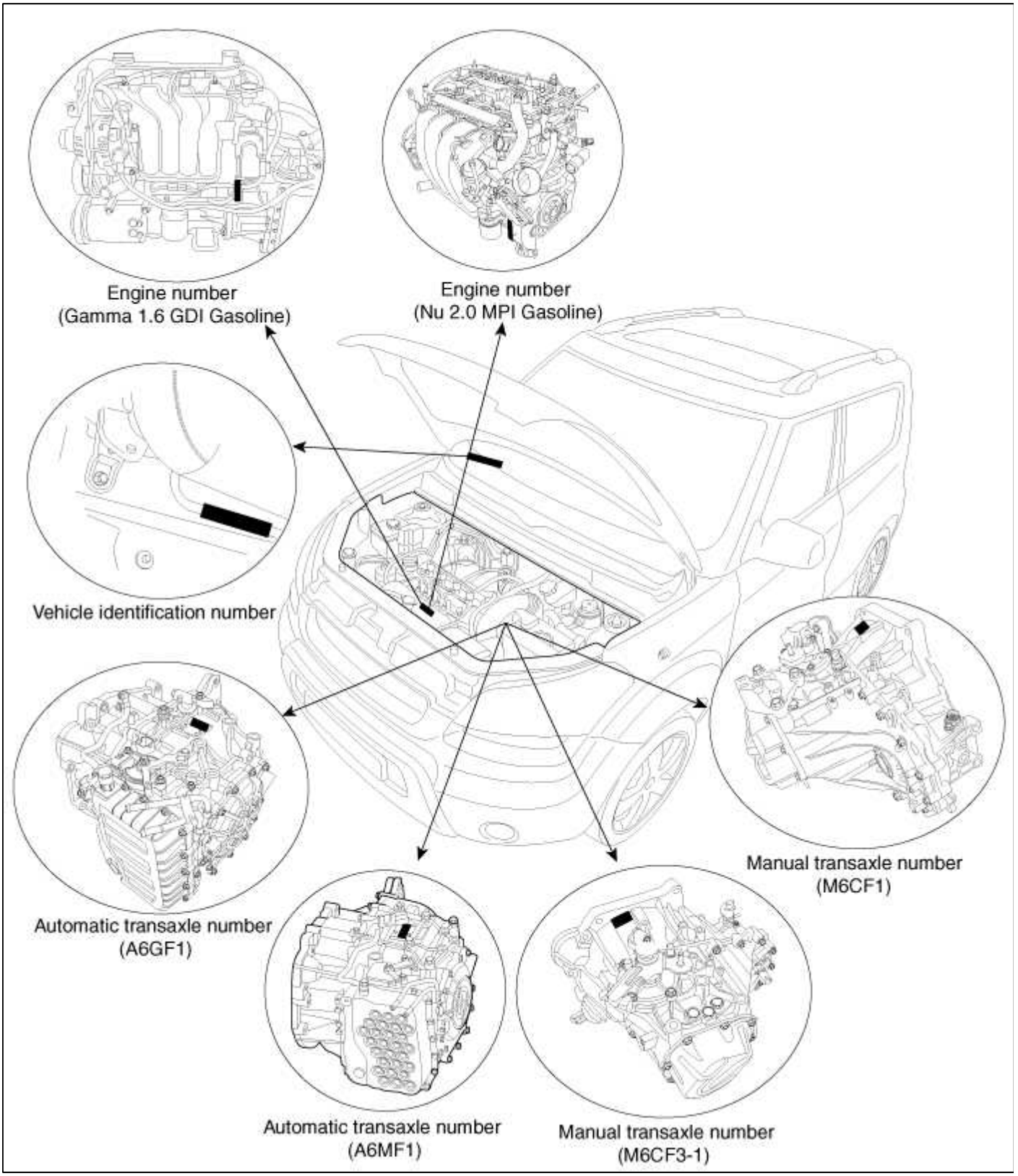
SOUL(AM) > 2012 > G 1.6 GDI > General Information

General Information > General Information > General Information

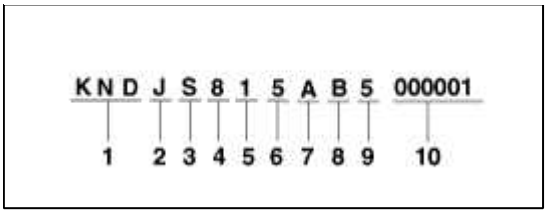
Identification Number Locations



Identification Number Description

Vehicle Identification Number

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1. World Manufacturer Identifier (WMI)
   - KNA : Passenger vehicle, MPV(Multipurpose Passenger Vehicle)/SUV(Sports Utility Vehicle)/RV(Recreational Vehicle)
   - KNC : Commercial vehicle (Van)
   - KND: MPV/SUV/RV (For U.S.A, Canada, Mexico)
   - KNH: Van

2. Vehicle line
   - J : SOUL

3. Model & Series
   - S : Low grade (L)
   - T : Middle-Low grade (GL)
   - U : Middle grade (GLS, JSL, TAX)
   - V : Middle-High grade (HGS)
   - W : High grade (TOP)

4. Body/Cabin type, Gross Vehicle Weight Rating
   KNA
   - 1 : Limousine
   - 2 : Sedan - 2 door
   - 3 : Sedan - 3 door
   - 4 : Sedan - 4 door
   - 5 : Sedan - 5 door
   - 6 : Coupe
   - 7 : Convertible
   - 8 : Wagon
   - 9 : Commercial Van
   - 0 : Pick-Up

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

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

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- D : Super Cabin Class-F 4×4 / Box Class-F 4×4

KND

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

KNH

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

5. Restraint system, Brake system

KNA, KND

Except U.S.A, Canada, Mexico

- 0 : Both side - None
- 1 : Both side - Active belt
- 2 : Both side - Passive belt

For U.S.A, Canada, Mexico

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

KNC, KNH

Except U.S.A, Canada, Mexico

- 7 : Hydraulic brake system
- 8 : Pneumatic brake system
- 9 : Mixed brake system

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

6. Engine type
   - 5 : Gasoline engine 1.6 (Gamma GDI)
   - 6 : Gasoline engine 2.0 (Nu MPI)

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

   For U.S.A, Canada, Mexico, Gulf Cooperation Council, China, Yemen
   - Check digit : 0 ~ 9, ×

8. Model year
   - B : 2011, C : 2012, D : 2013, E : 2014...

9. Plant of production
   - 6 : Sohari (Korea)
   - 5 : Hwasung (Korea)
   - 7 : Kwangju (Korea)
   - T : Seosan (Korea)

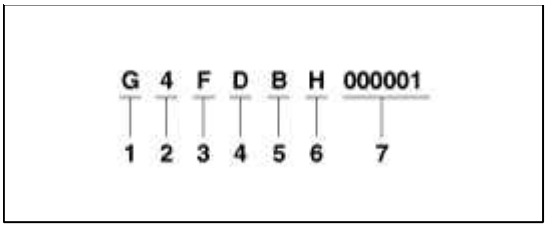
10. Vehicle production sequence number
    - 000001 ~ 999999

Paint Code

Code	Color
9H	Black Soul
1D, UD	Clear White
3D, A3D	Bright Silver
IM	Titanium Silver
I2	Moonlight Blue
1E	Tomato Red
I7	Green Tea Latte
A1, A1W	Vanilla Shake
BD5	Olive Green
DT9	Saddle Brown
ASE	Misty Green

Engine Number

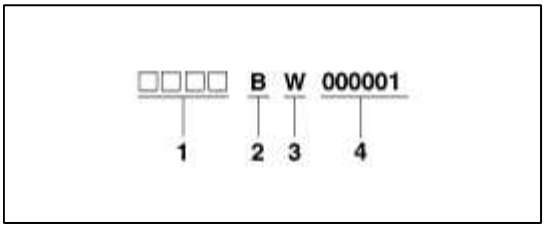
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1. Engine fuel
   - G : Gasoline
2. Engine range
   - 4 : 4 cycle 4 cylinder
3. Engine development order and capacity
   - F : Gamma engine
   - N : Nu engine
4. Engine Capacity
   - D : 1591cc (Gamma GDI)
   - A : 1999cc (Nu MPI)
5. Production year
   - B : 2011, C : 2012, D : 2013, E : 2014 …
6. Plant of production
   - A : Asan (Korea)
   - B : Beijing (China)
   - H : Hwasung (Korea)
   - K : Montgomery (U.S.A)
   - M : Chennai (India)
   - P : Poseung (Korea)
   - S : Sohari (Korea)
   - T : Izmit (Turkey)
   - U : Ulsan (Korea)
   - W : Shandong (China)
   - Z : Zilina (Slovakia)
   - 1 : Yancheng (China)
7. Engine production sequence number
   - 000001 ~ 999999

Transaxle Number

Manual (M6CF1)



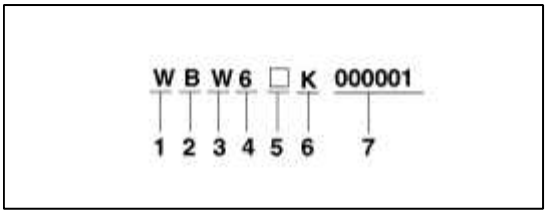
1. Assembly code of plant
2. Production year
   - B : 2011, C : 2012, D : 2013, E : 2014 …

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3. Plant of production
   - W : Hwasung (Korea)
   - J : Ostrava (Czech)

4. Transaxle production sequence number
   - 000001~999999

Manual (M6CF3-1)



1. Model
   - W : M6CF3-1

2. Production year
   - B : 2011, C : 2012, D : 2013, E : 2014 …

3. Plant of production
   - W : Hwasung (Korea)
   - J : Ostrava (Czech)

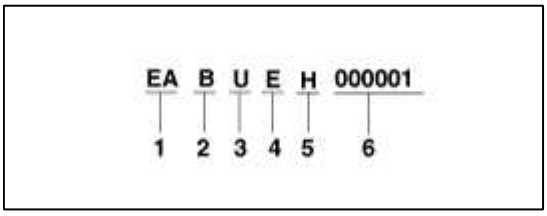
4. Speed

5. Reserve

6. Final gear ratio
   - K : 4.333 (Nu)

7. Transaxle production sequence number
   - 000001 ~ 999999

Automatic



1. Model
   - EA : A6MF1
   - NA : A6GF1

2. Production year
   - B : 2011, C : 2012, D : 2013, E : 2014 …

3. Final gear ratio
   - T : 3.367 (Nu 15, 16 inch tire)
   - U : 3.510 (Nu 18 inch tire)
   - S : 3.796 (Gamma)

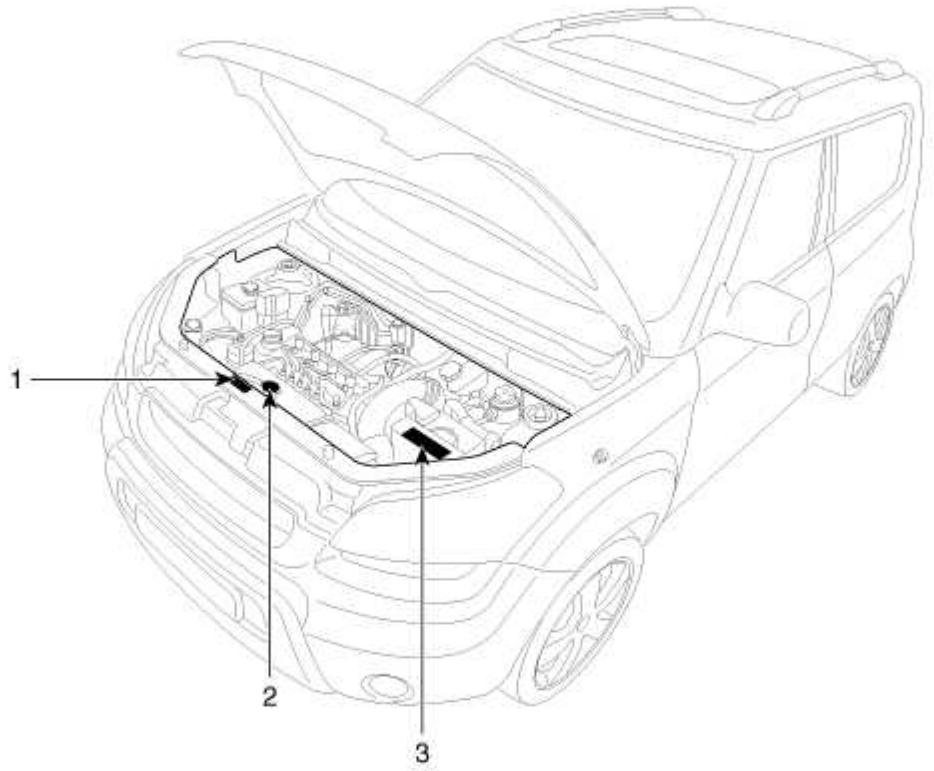
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4. Detailed classification
   - F : Nu 2.0 MPI (15, 16 inch tire)
   - G : Nu 2.0 MPI-ISG (15, 16 inch tire)
   - E : Nu 2.0 MPI (18 inch tire)
   - F : Nu 2.0 MPI-ISG (18 inch tire)
   - C : Gamma 1.6 GDI
   - F : Gamma 1.6 GDI-ISG

5. Plant classification
   - H : Hwasung (Korea)
   - U : Ulsan - Plant 1 (Korea)
   - S : Ulsan - Plant 2 (Korea)
   - 2 : Powertech - Pant 2 (Korea)
   - 4 : Powertech - Pant 4 (Korea)
   - A : Powertech (U.S.A)
   - C : Powertech (China)

6. Transaxle production sequence number
   - 000001 ~ 999999

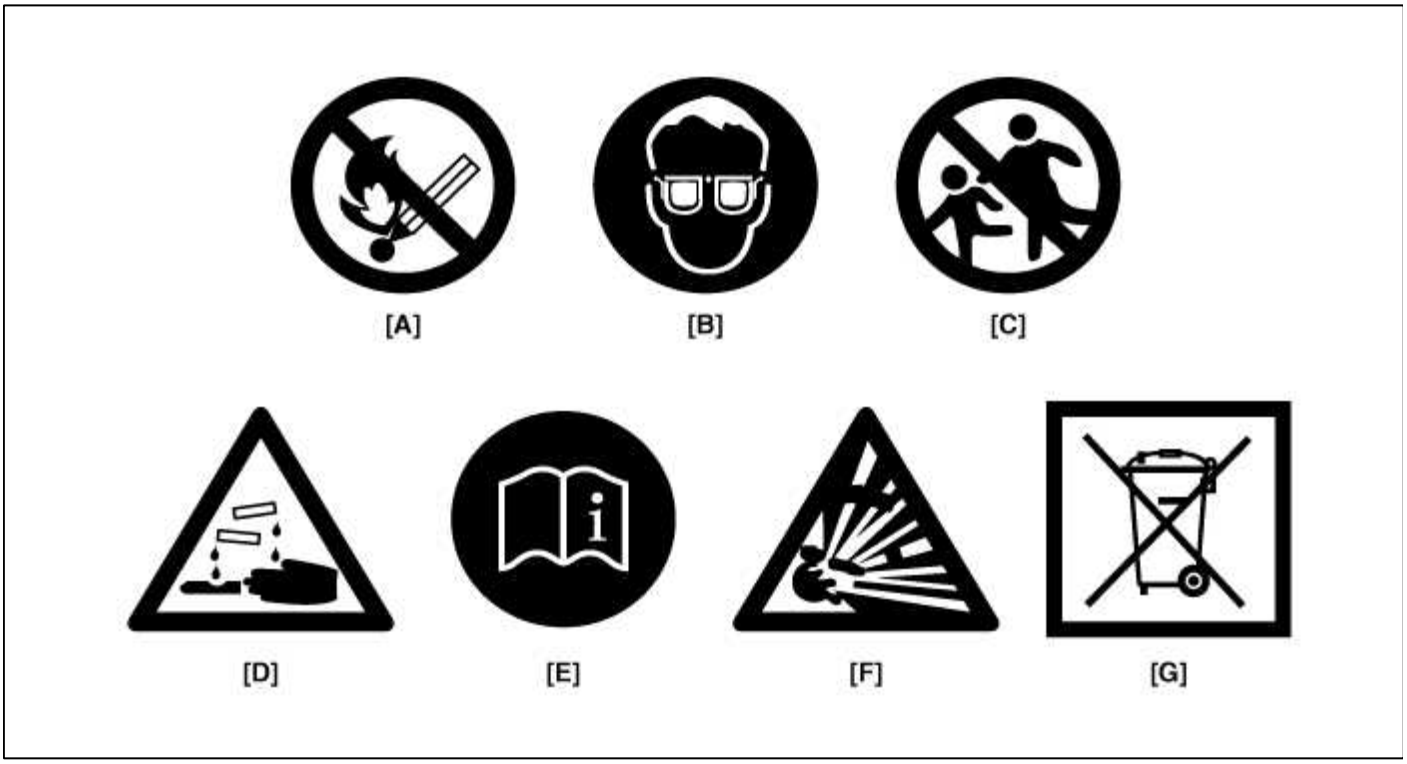
Warning / Caution Label Locations



1. Fan caution 2. Radiator cap caution	3. Battery caution

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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.

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

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

Handling And Storage The Battery

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

NOTE

After reconnecting or recharging a discharged battery, the ESC 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 ESC OFF indicator may turn OFF.
If the ESC 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.

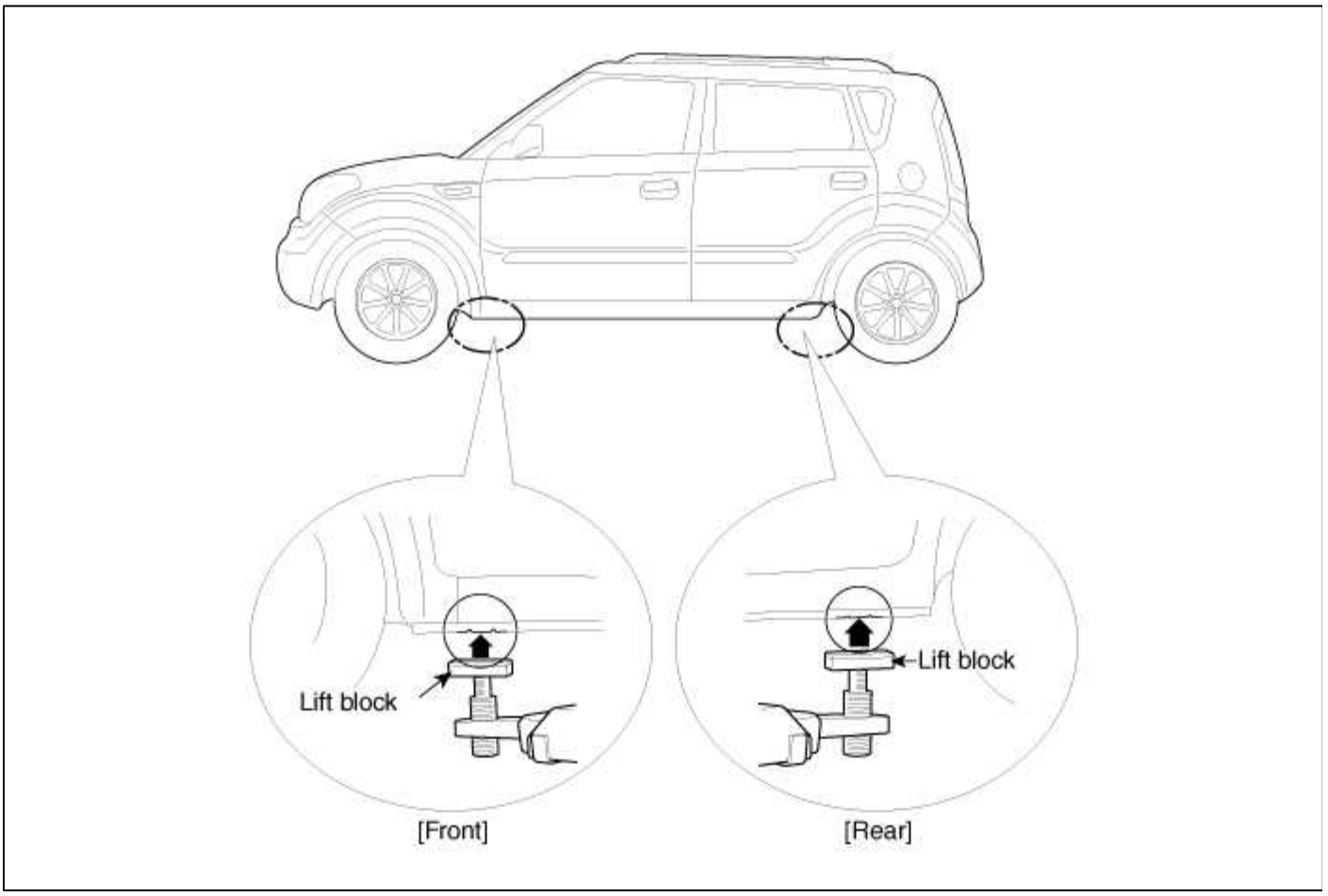
NOTE

- 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.

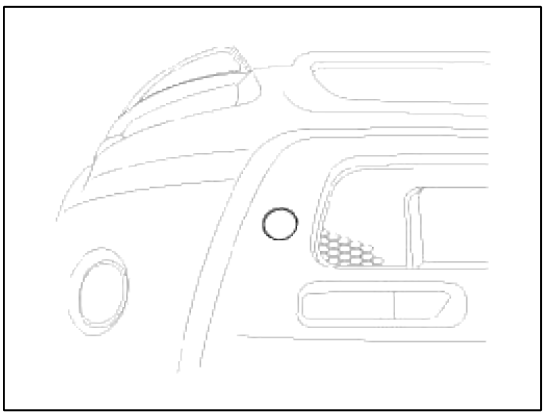
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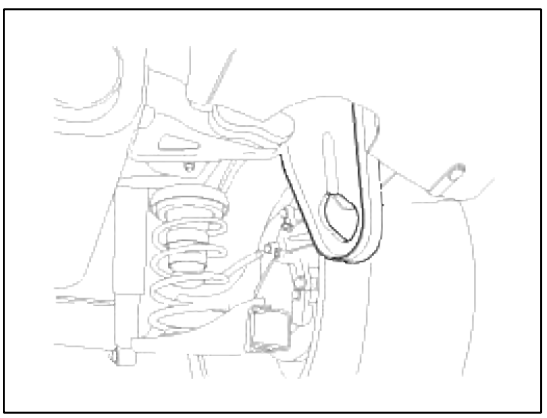
3. Raise the hoist to full height to inspect the lift points for secure support.



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

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There are three popular methods of towing a vehicle :

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

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

Manual Transaxle

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

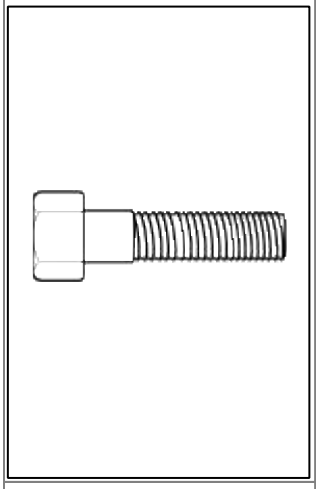
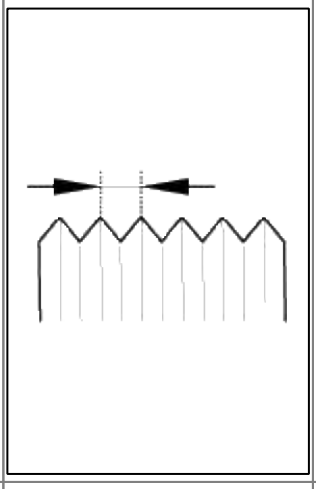
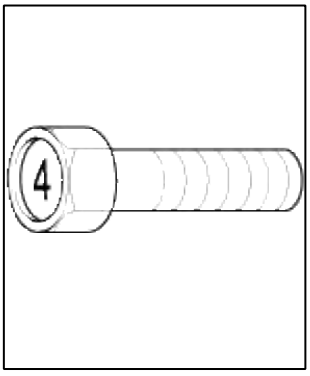
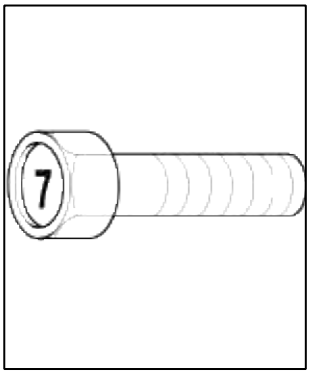
Automatic Transaxle

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

CAUTION

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

Tightening Torque Table Of Standard Parts

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

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M10	1.25	25 ~ 30 (250 ~ 300, 18 ~ 22)	30 ~ 50 (300 ~ 500, 22 ~ 36)
M12	1.25	35 ~ 45 (350 ~ 450, 25 ~ 33)	60 ~ 80 (600 ~ 800, 43 ~ 58)
M14	1.5	75 ~ 85 (750 ~ 850, 54 ~ 61)	120 ~ 140 (1,200 ~ 1,400, 85 ~ 100)
M16	1.5	110 ~ 130 (1,100 ~ 1,300, 80 ~ 94)	180 ~ 210 (1,800 ~ 2,100, 130 ~ 150)
M18	1.5	160 ~ 180 (1,600 ~ 1,800, 116 ~ 130)	260 ~ 300 (2,600 ~ 3,000, 190 ~ 215)
M20	1.5	220 ~ 250 (2,200 ~ 2,500, 160 ~ 180)	360 ~ 420 (3,600 ~ 4,200, 260 ~ 300)
M22	1.5	290 ~ 330 (2,900 ~ 3,300, 210 ~ 240)	480 ~ 550 (4,800 ~ 5,500, 350 ~ 400)
M24	1.5	360 ~ 420 (3,600 ~ 4,200, 260 ~ 300)	610 ~ 700 (6,100 ~ 7,000, 440 ~ 505)

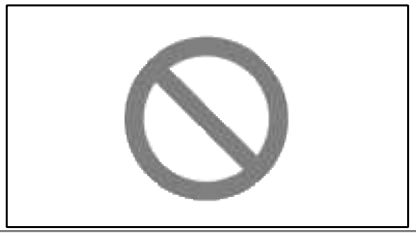
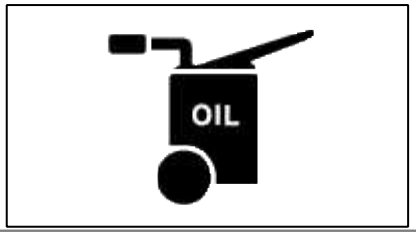
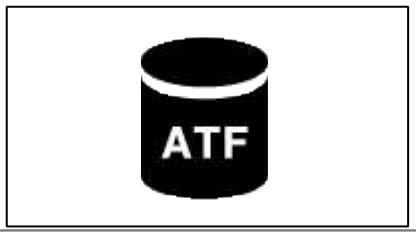
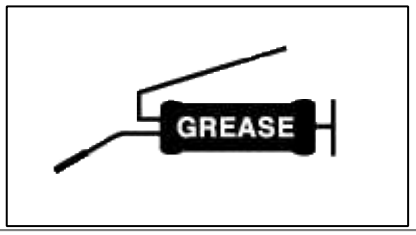
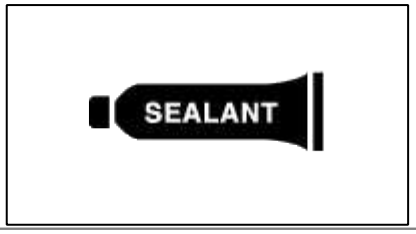
NOTE

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

Meaning Of Symbols

There are five primary symbols used to complement illustrations. These symbols indicate the part to apply such materials during service.

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Symbol	Meaning
	Do not reuse the part. Replace a new one.
	Apply engine oil or transmission oil to the part.
	Apply automatic transmission fluid (ATF) to the part.
	Apply grease to the part.
	Apply sealant to the part.

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.

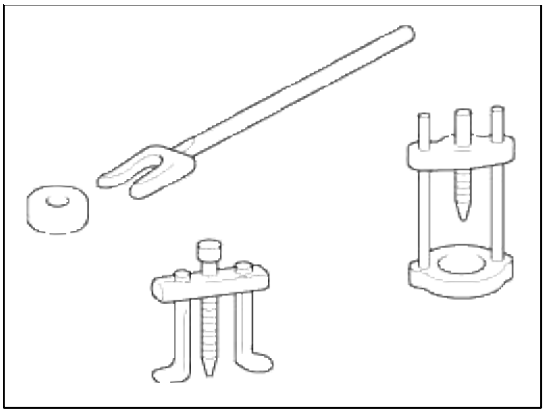
Preparation Of Tools And Mesuring Equipment

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

Special Tools

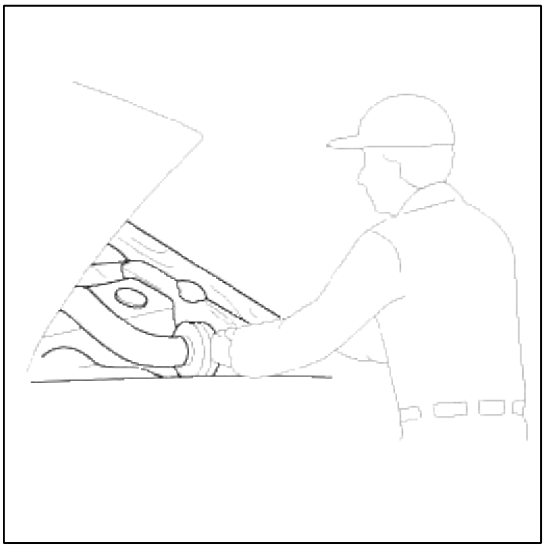
Use special tools when they are required.

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Removal Of Parts

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



Disassembly

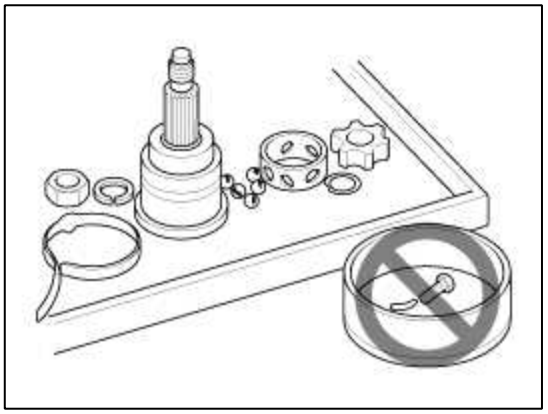
If the disassembly procedure is complex, requiring many parts to be disassembled, all parts should be disassembled in a way that will not affect their performance or external appearance.

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

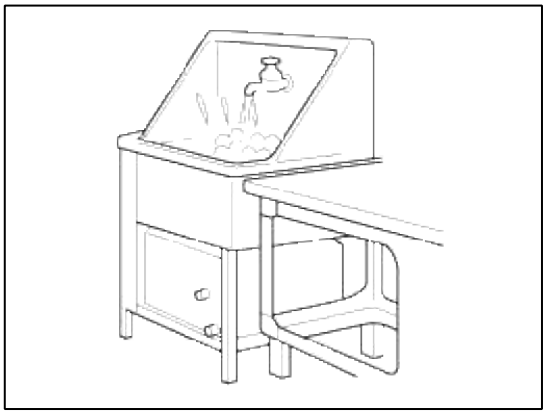


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2. **Arrangement of parts**
   All disassembled parts should be carefully arranged for effective reassembly.
   Be sure to separate and correctly identify the parts to be replaced from those that will be used again.



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



Parts
When replacing parts, use KIA genuine parts.

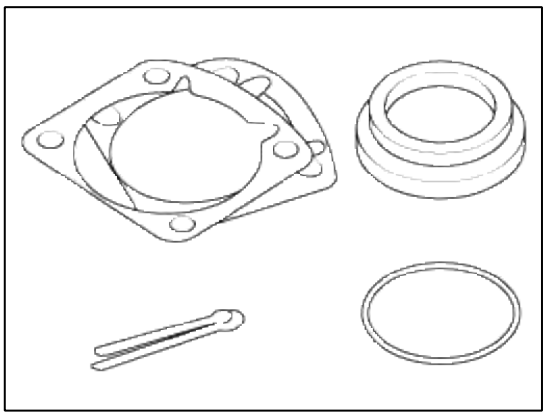


Replacement
Standard values, such as torques and certain adjustments, must be strictly observed in the reassembly of all parts.
If removed, the following parts should always be replaced with new ones.

1. Oil seals
2. Gaskets

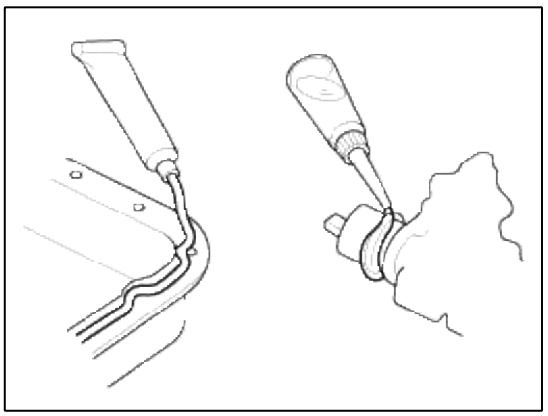
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3. O-rings
4. Lock washers
5. Cotter pins (split pins)
6. Plastic nuts



Depending on their location.

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



Adjustment

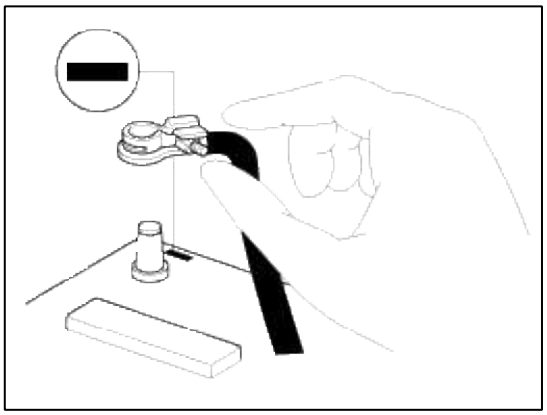
Use gauges and testers to adjust correctly the parts to standard values correctly.

Electrical System

1. Be sure to disconnect the battery cable from the negative (-) terminal of the battery.
2. Never pull on the wires when disconnecting connectors.
3. Locking connectors will click when the connector is secure.

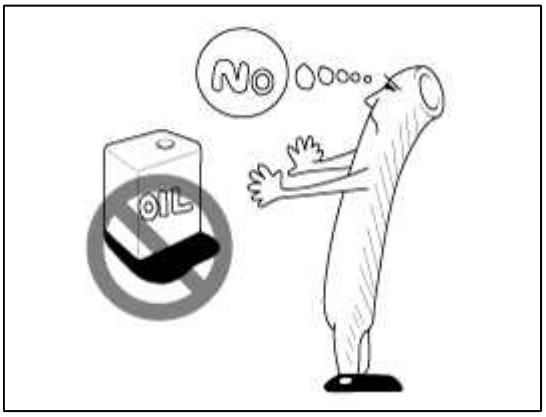
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4. Handle sensors and relays carefully. Be careful not to drop them against other parts.



Ruber Parts And Tubes

Always prevent gasoline or from touching rubber parts or tubing.

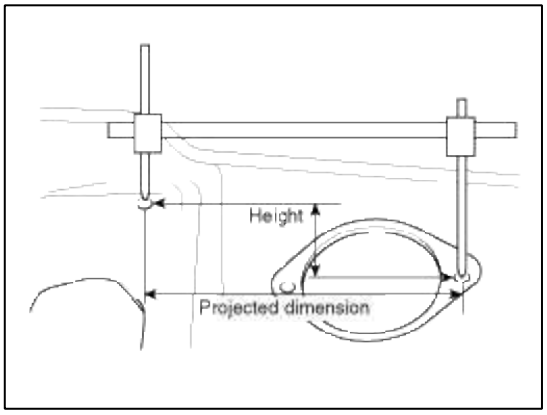


Measuring Body Dimensiongs

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

Dimensions Projected

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

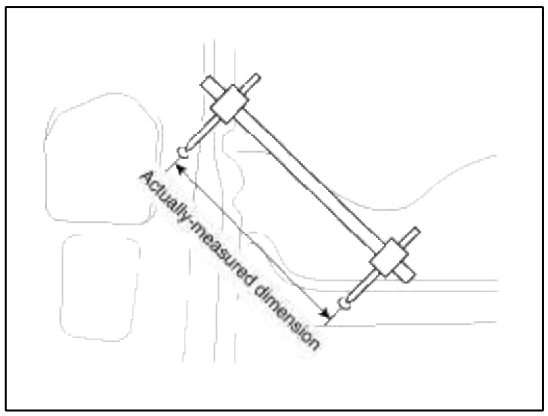


Measuring Actual Dimensions

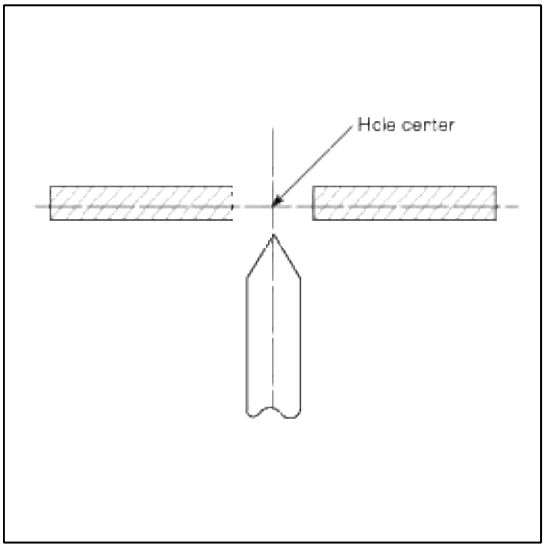
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1. These dimensions indicate the actual linear distance between measurement points, and are used as the reference dimensions when a tracking gauge is used for measurement.
2. First adjust both probes to the same length (A=A') before measurement.

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



Measurement Point
Measurements should be taken at the center of the hole.



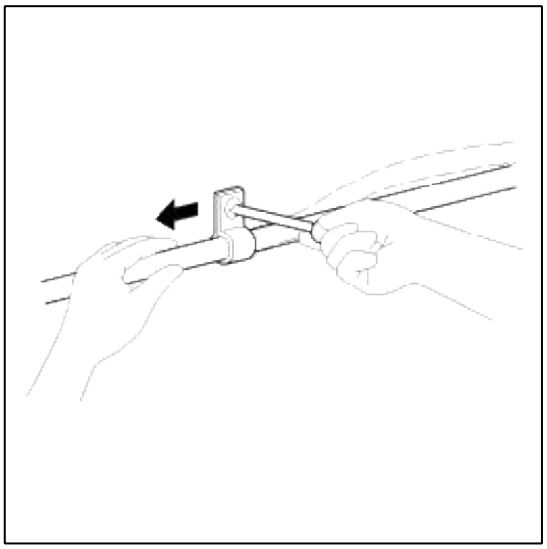
Checking Cables And Wires

1. Check the terminal for tightness.
2. Check terminals and wires for corrosion from battery electrolyte, etc.
3. Check terminals and wires for open circuits.
4. Check wire insulation and coating for damage, cracks and degrading.
5. Check the conductive parts of terminals for contact with other metallic parts (vehicle body and other parts).
6. Check grounded parts to verify that there is complete continuity between their attaching bolt(s) and the vehicle's body.
7. Check for incorrect wiring.
8. Check that the wiring is so clamped to the prevent contact with sharp corners of the vehicle body, etc. or hot parts (exhaust manifold, etc.)

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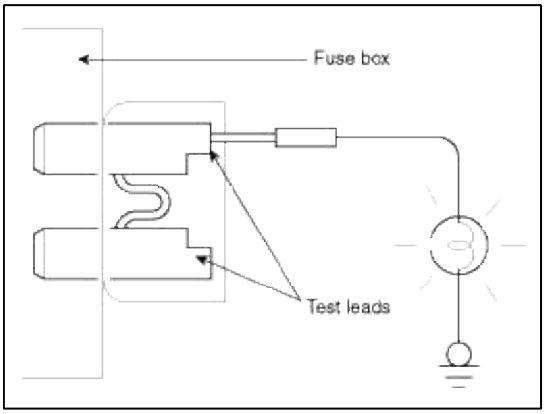
9. Check that the wiring is clamped firmly to provide enough clearance from the fan pulley, fan belt and other rotating or moving parts.

10. Check that the wiring has a little space so that it can vibrate between fixed and moving parts such as the vehicle body and the engine.



Check Fuses

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

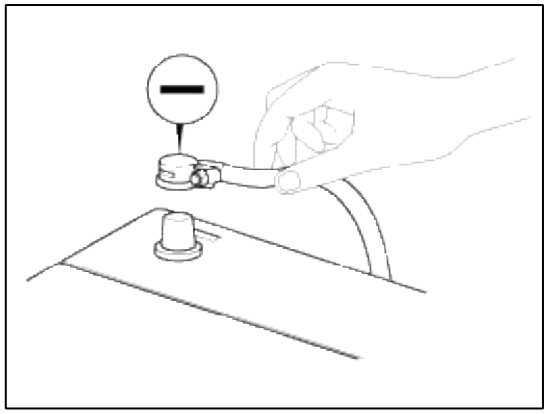


Serivicing The Electrical System

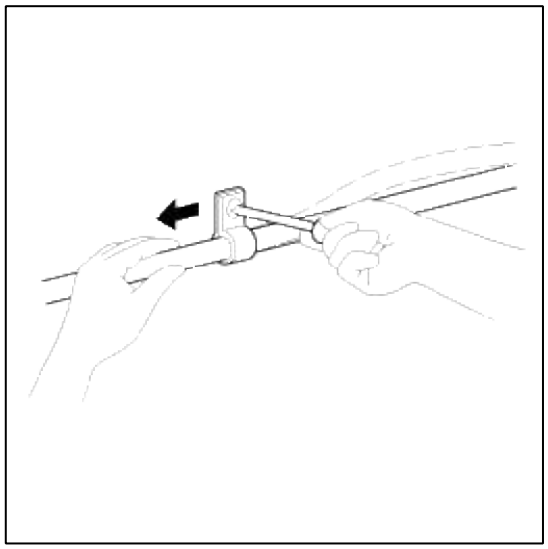
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1. Prior to servicing the electrical system, be sure to turn off the ignition switch and disconnect the battery ground cable.

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

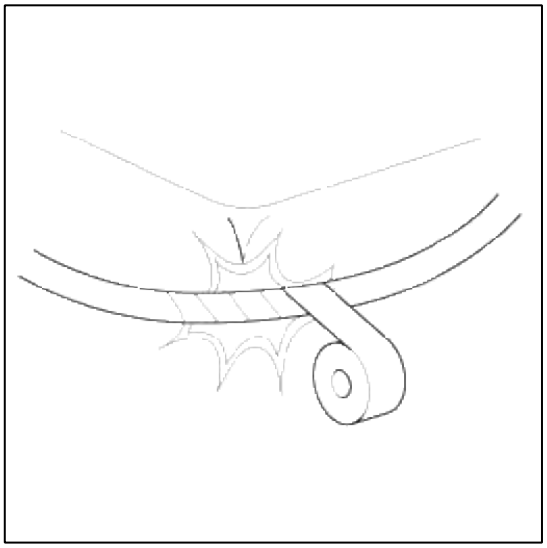


2. Attach the wiring harnesses with clamps so that there is no slack. However, for any harness which passes the engine or other vibrating parts of the vehicle, allow some slack within a range that does not allow the engine vibrations to cause the harness to come into contact with any of the surrounding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

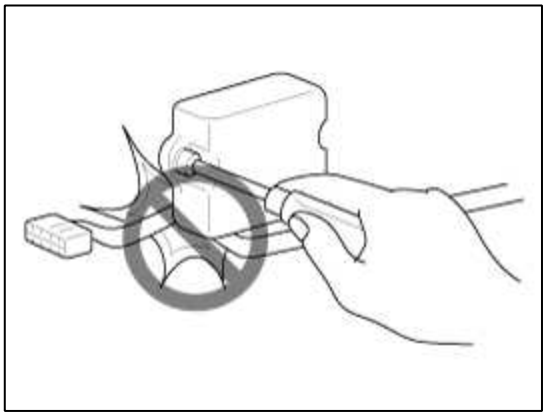


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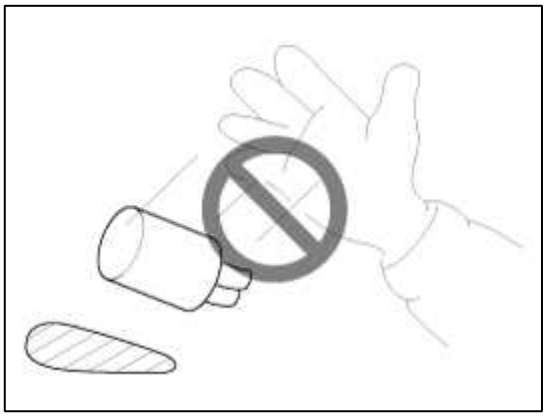
3. If any section of a wiring harness interferes with the edge of a parts, or a corner, wrap the section of the harness with tape or something similar in order to protect if from damage.



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

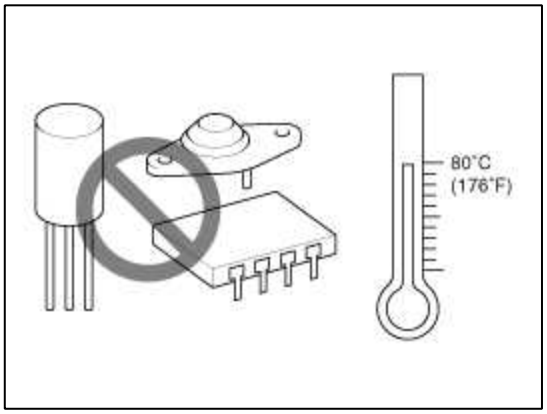


5. Never throw relays, sensors or electrical parts, or expose them to strong shock.

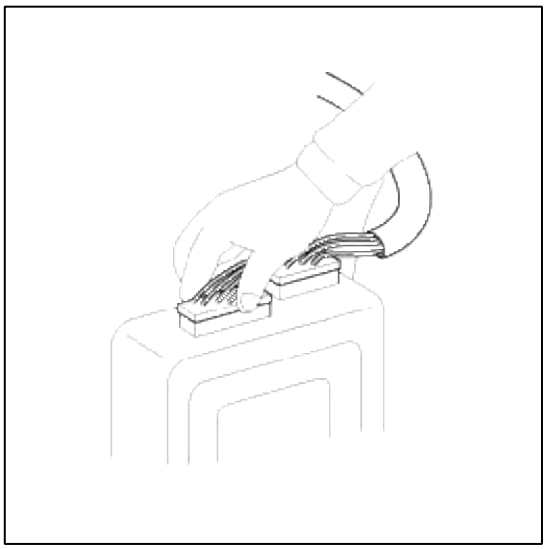


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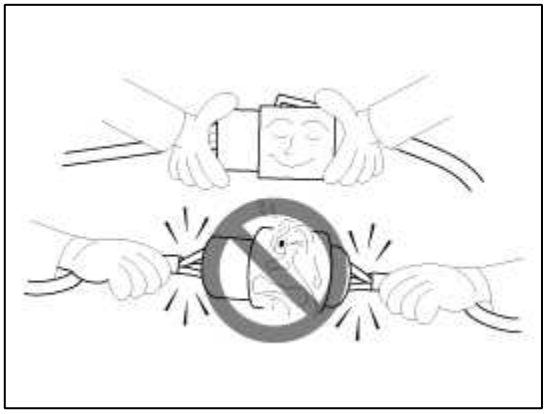
6. The electronic parts used in the computer, relays, etc. are readily damaged by heat. If there is a need for service operations that may cause the temperature to exceed 80°C (176°F), remove the electronic parts before hand.



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

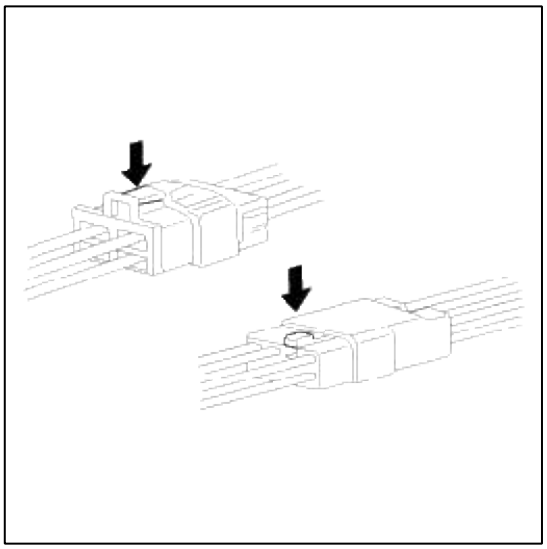


8. When disconnecting a connector, be sure to grip only the connector, not the wires.

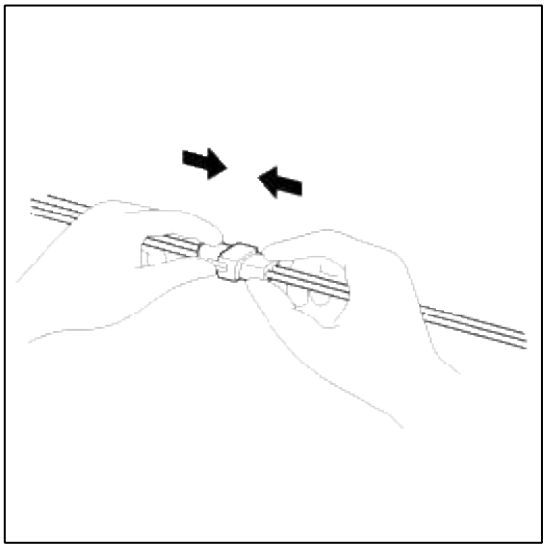


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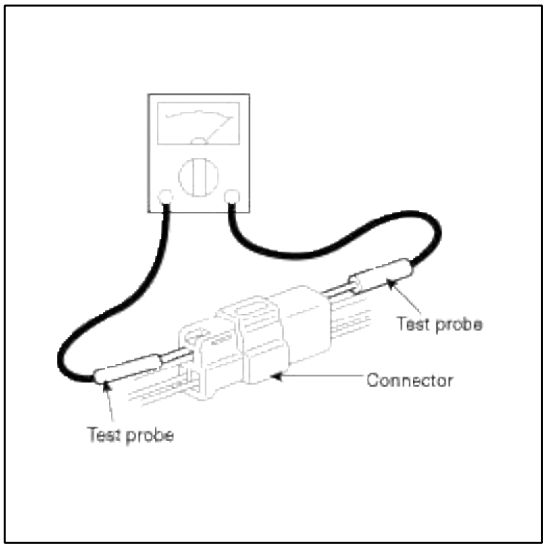
9. Disconnect connector which have catches by pressing in the direction of the arrows shown the illustration.



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.



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

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

Precautions For Catalytic Converter

CAUTION

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

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

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SOUL(AM) > 2012 > G 1.6 GDI > Engine Mechanical System

Engine Mechanical System > General Information > Specifications

Specifications

Description		Specifications	Limit
General			
Type		In-line, DOHC	
Number of cylinders		4	
Bore		77mm (3.0315in)	
Stroke		85.44mm (3.3638in)	
Total displacement		1,591 cc (97.09 cu.in)	
Compression ratio		11.0 : 1	
Firing order		1-3-4-2	
Valve timing			
Intake valve	Opens	ATDC 8°/BTDC 42°	
	Closes	ABDC 69°/ABDC 19°	
Exhaust valve	Opens	BBDC 50°/BBDC 10°	
	Closes	ATDC 5°/ATDC 45°	
Cylinder head			
Flatness of gasket surface		Less than 0.05mm (0.0020in) for total area Less than 0.02mm (0.0008in) for a section of 100mm (3.9370in) X 100mm (3.9370in)	
Camshaft			
Cam height	Intake	44.15mm (1.7382in)	
	Exhaust	43.55mm (1.7146in)	
Journal outer diameter (Intake, Exhaust)		22.964 ~ 22.980mm (0.9041 ~ 0.9047in)	
Camshaft cap oil clearance		0.027 ~ 0.058mm (0.0011 ~ 0.0023in)	0.1mm (0.0039in)
End play		0.10 ~ 0.20mm (0.0039 ~ 0.0079in)	
Valve			
Valve length	Intake	93.15mm (3.6673in)	
	Exhaust	92.60mm (3.6457in)	
Stem outer diameter	Intake	5.465 ~ 5.480mm (0.2152 ~ 0.2157in)	
	Exhaust	5.458 ~ 5.470mm (0.2149 ~ 0.2154in)	
Face angle		45.25° ~ 45.75°	
Thickness of valve head (margin)	Intake	1.10mm (0.0433in)	0.8mm (0.0315in)
	Exhaust	1.26mm (0.0496in)	1.0mm (0.0394in)
Valve stem to valve guide clearance	Intake	0.020 ~ 0.047mm (0.0008 ~ 0.0019in)	0.10mm (0.0039in)
	Exhaust	0.030 ~ 0.054mm (0.0012 ~ 0.0021in)	0.15mm (0.0059in)
Valve guide			
Length	Intake	40.3 ~ 40.7mm (1.5866 ~ 1.6024in)	
	Exhaust	40.3 ~ 40.7mm (1.5866 ~ 1.6024in)	
Valve spring			

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Free length		45.1mm (1.7756in)	
Out of squareness		Less than 1.5°	
Cylinder block			
Cylinder bore		77.00 ~ 77.03mm (3.0315 ~ 3.0327in)	
Flatness of gasket surface		Less than 0.05mm (0.0020in) for total area Less than 0.02mm (0.0008in) for a section of 100mm (3.9370in) X 100mm (3.9370in)	
Piston			
Piston outer diameter		76.97 ~ 77.00mm (3.0303 ~ 3.0315in)	
Piston to cylinder clearance		0.020 ~ 0.040mm (0.0008 ~ 0.0016in)	
Ring groove width	No. 1 ring groove	1.23 ~ 1.25mm (0.0484 ~ 0.0492in)	1.26mm (0.0496in)
	No. 2 ring groove	1.23 ~ 1.25mm (0.0484 ~ 0.0492in)	1.26mm (0.0496in)
	Oil ring groove	2.01 ~ 2.03mm (0.0791 ~ 0.0799in)	2.05mm (0.0807in)
Piston ring			
Side clearance	No.1 ring	0.04 ~ 0.08mm (0.0016 ~ 0.0031in)	0.1 mm (0.0039in)
	No.2 ring	0.04 ~ 0.08mm (0.0016 ~ 0.0031in)	0.1 mm (0.0039in)
	Oil ring	0.02 ~ 0.06mm (0.0008 ~ 0.0024in)	0.2 mm (0.0079in)
End gap	No. 1 ring	0.14 ~ 0.28mm (0.0055 ~ 0.0110in)	0.30mm (0.0118in)
	No. 2 ring	0.30 ~ 0.45mm (0.0118 ~ 0.0177in)	0.50mm (0.0197in)
	Oil ring	0.20 ~ 0.40mm (0.0079 ~ 0.0157in)	0.80mm (0.0315in)
Piston pin			
Piston pin outer diameter		18.001 ~ 18.006mm (0.7087 ~ 0.7089in)	
Piston pin hole inner diameter		18.016 ~ 18.021mm (0.7093 ~ 0.7095in)	
Piston pin hole clearance		0.010 ~ 0.020mm (0.0004 ~ 0.0008in)	
Connecting rod small end hole inner diameter		17.974 ~ 17.985mm (0.7076 ~ 0.7081in)	
Piston pin press-in load		500~1,500 kg (1,102 ~ 3,306 lb)	
Connecting rod			
Connecting rod big end inner diameter		45.000 ~ 45.018mm (1.7717 ~ 1.7724in)	
Connecting rod bearing oil clearance		0.032 ~ 0.052mm (0.0013 ~ 0.0020in)	0.060mm (0.0024in)
Side clearance		0.10 ~ 0.25mm (0.0039 ~ 0.0098in)	0.35m (0.0138in)
Crankshaft			
Main bearing oil clearance	No. 1, 2, 3, 4, 5	0.021 ~ 0.042mm (0.0008 ~ 0.0017in)	0.05mm (0.0020in)
End play		0.05 ~ 0.25mm (0.0020 ~ 0.0098in)	0.3mm (0.0118in)
Engine oil			
Oil quantity	Total	3.7L (3.91US qt, 3.25lmp qt)	When replacing a short engine or a block assembly
	Oil pan	3.0L (3.17US qt, 2.64lmp qt)	
	Drain and refill	3.3L (3.49US qt, 2.90lmp qt)	Including oil filter
Oil grade	Recommendation	API SM ILSAC GF-4 or above ACEA A5 or above	API SL/ILSAC GF-3/ACEA A3 class oil can be used if the recommended oil is not available.

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	SAE viscosity grade	Recommended SAE viscosity number	Refer to the "Lubrication System"
Oil pressure (at 1000rpm)		100kPa (1.0kg/cm², 14.5psi) or above	Oil temperature in oil pan : 110±2°C (230± 36°F)
Cooling system			
Cooling method		Forced circulation with cooling fan	
Coolant quantity		MT : 5.0L (1.32 U.S.gal., 5.28 U,S,qt., 4.40lmp.qt) AT : 5.2L (1.37 U.S.gal., 5.49 U,S,qt., 4.57lmp.qt)	
Thermostat	Type	Wax pellet type	
	Opening temperature	82 ± 1.5°C (179.6 ± 2.7°F)	
	Full opening temperature	95°C (203°F)	
Radiator cap	Main valve opening pressure	93.16 ~ 122.58kpa (0.95 ~ 1.25kgf/cm², 13.51 ~ 17.78psi)	
	Vacuum valve opening pressure	MAX. 6.86 kpa(0.07kgf/cm², 1.00 psi)	
Water temperature sensor			
Type		Thermister type	
Resistance	20°C (68°F)	2.45±0.14 kΩ	
	80°C (176°F)	0.3222 kΩ	

Tightening Torques

Item	Quantity	N.m	kgf.m	lb-ft
Engine mounting				
Engine mounting bracket to body fixing bolt	2	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0
Engine mounting bracket to body fixing nut	1	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0
Engine mounting support bracket to engine mounting insulator fixing nut	1	78.4 ~ 98.0	8.0 ~ 10.0	57.9 ~ 72.3
Engine mounting support bracket to engine support bracket fixing bolt	1	58.8 ~ 73.5	6.0 ~ 7.5	43.4 ~ 54.2
Engine mounting support bracket to engine support bracket fixing nut	2	58.8 ~ 73.5	6.0 ~ 7.5	43.4 ~ 54.2
Transaxle mounting bracket to body fixing bolt	2	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0
Transaxle mounting bracket to body fixing nut	1	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0
Transaxle mounting insulator to transaxle mounting support bracket fixing bolt	2	88.3 ~ 107.9	9.0 ~ 11.0	65.1 ~ 79.6
Roll rod bracket to sub frame fixing bolt	2	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0
Roll rod insulator to roll rod mounting support bracket fixing nut	1	107.9 ~ 127.5	11.0 ~ 13.0	79.6 ~ 94.0
Timing system				
Timing chain and oil pump assembly cover bolt (M6×20)	10	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain and oil pump assembly cover bolt (M6×38)	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7

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Timing chain and oil pump assembly cover bolt (M6×70)	1	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain and oil pump assembly cover bolt (M8×22)	3	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Idler pulley assembly bolt	1	42.2 ~ 53.9	4.3 ~ 5.5	31.1 ~ 39.8
Timing chain tensioner arm bolt	1	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain guide bolt	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Crankshaft pulley bolt	1	127.5 ~ 137.3	13.0 ~ 14.0	94.0 ~ 101.3
Timing chain tensioner bolt	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Cylinder head				
Ignition coil bolt	4	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
High pressure fuel pipe nut	2	25.5 ~ 31.4	2.6 ~ 3.2	18.8 ~ 23.1
High pressure fuel pump bolt	2	12.7 ~ 14.7	1.3 ~ 1.5	9.4 ~ 10.8
Cylinder head cover bolt	19	[3.9~5.9] + [7.8~9.8]	[0.4~0.6] + [0.8~1.0]	[2.9~4.3] + [5.8~7.2]
Camshaft bearing cap bolt (M6)	18	[5.9] + [11.8~13.7]	[0.6] + [1.2~1.4]	[4.3] + [8.7~10.1]
Camshaft bearing cap bolt (M8)	4	[9.8] + [18.6~22.6]	[1.0] + [1.9~2.3]	[7.2] + [13.7~16.6]
Cylinder head bolt	10	[29.4] + [90°] + [90°]	[3.0] + [90°] + [90°]	[21.7] + [90°] + [90°]
Cylinder block				
Engine support bracket bolt	4	29.4 ~ 41.2	3.0 ~ 4.2	21.7 ~ 30.4
Ladder frame bolt	13	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Connecting rod cap bolt	8	[17.7~21.6] + [88~92°]	[1.8~2.2] + [88~92°]	[13.0~15.9] + [88~92°]
Crankshaft main bearing cap bolt	10	[19.6] + [90°]	[2.0] + [90°]	[14.5] + [90°]
Flywheel bolts (M/T)	6	71.6 ~ 75.5	7.3 ~ 7.7	52.8 ~ 55.7
Drive plate bolts (A/T)	6	71.6 ~ 75.5	7.3 ~ 7.7	52.8 ~ 55.7
Lubrication system				
Oil filter	1	11.8 ~ 15.7	1.2 ~ 1.6	8.7 ~ 11.6
Oil pan bolt	11	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Oil pan drain plug	1	34.3 ~ 44.1	3.5 ~ 4.5	25.3 ~ 32.5
Oil screen bolt	2	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Oil pressure switch	1	7.8 ~ 11.8	0.8 ~ 1.2	5.8 ~ 8.7
Oil level gauge assembly mounting bolt	1	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Cooling system				
Water pump pulley bolt	4	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Water pump bolt	5	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Water temperature control assembly mounting bolt	3	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Water inlet fitting nut	2	18.6 ~ 23.5	1.9~ 2.4	13.7 ~ 17.4
Heater pipe mounting bolt (M6)	1	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Heater pipe mounting nut	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Heater pipe mounting bolt (M8)	1	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4

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Engine coolant temperature sensor (ECTS)	1	29.4 ~ 39.2	3.0 ~ 4.0	21.7 ~ 28.9
Intake and exhaust system				
Air intake hose clamp bolt	2	2.9 ~ 4.9	0.3 ~ 0.5	2.2 ~ 3.6
Air cleaner asembly bolt	2	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Electronic throttle control (ETC) module bolt	4	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Intake manifold nut	2	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Intake manifold bolt	3	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Exhaust manifold heat protector bolt	3	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Exhaust manifold stay bolt	3	39.2 ~ 49.0	4.0 ~ 5.0	28.9 ~ 36.2
Exhaust manifold nut	9	29.4 ~ 41.2	3.0 ~ 4.2	21.7 ~ 30.4
Oxygen sensor (Front/Rear)	2	39.2 ~ 49.0	4.0 ~ 5.0	28.9 ~ 36.2
Catalytic converter / muffler nut	6	39.2 ~ 58.8	4.0 ~ 6.0	28.9 ~ 43.4

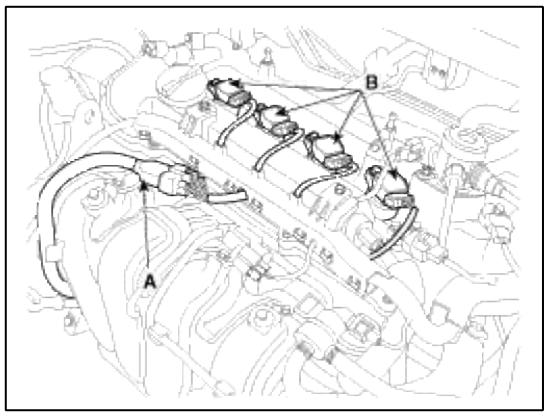
Engine Mechanical System > General Information > Repair procedures

Compression Pressure Inspection

NOTE

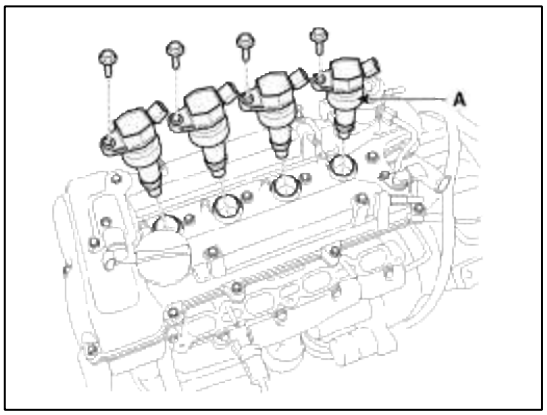
If there is lack of power, excessive oil consumption or poor fuel economy, measure the compression pressure.

1. Make sure the oil in the crankcase is of the correct viscosity and at the correct level and that the battery is correctly charged. Operate the vehicle until the engine is at normal operating temperature. Turn the ignition switch to the OFF position.
2. Remove the engine cover.
3. Disconnect the injector extension connector (A) and the ignition coil connectors (B).



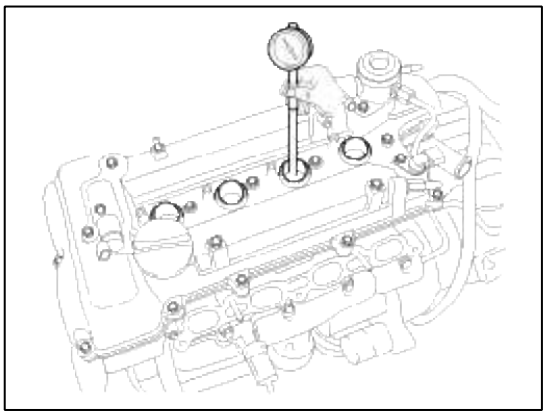
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4. Remove the ignition coils (A).



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

6. Check the cylinder compression pressure.
   (1) Insert a compression gauge into the spark plug hole.



   (2) Set the throttle plate in the wide-open position.

   (3) While cranking the engine, measure the compression pressure.

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

   (4) Repeat step 1) through 3) for each cylinder.

> NOTE
>
> This measurement must be done in as short time as possible.

Compression pressure
Standard : 1225.83kPa (12.5kg/cm², 177.79psi) (200~250 rpm)
Minimum : 1078.73kPa (11.0kg/cm², 156.46psi)
Difference between each cylinder :
98kPa (1.0kg/cm², 14psi) or less

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

7. Install the spark plugs.

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

8. Install the ignition coil.

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

9. Connect the injector extension connector and the ignition coil connectors.

10. Install the engine cover.

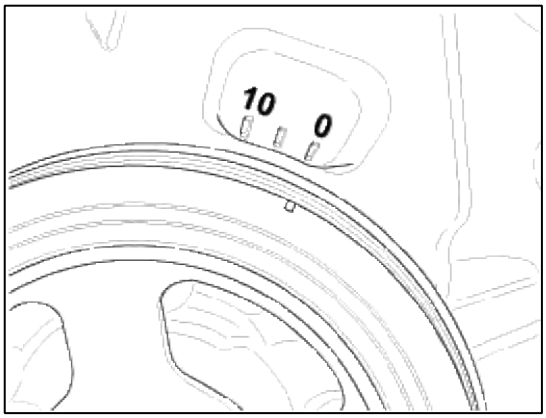
Valve Clearance Inspection And Adjustment

NOTE

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

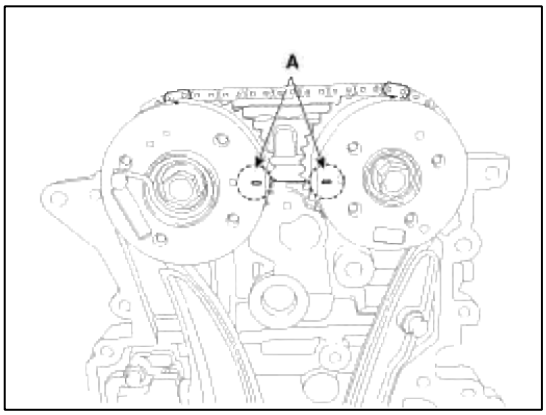
1. Remove the cylinder head cover. (Refer to Timing system)

2. Set No.1 cylinder to TDC/compression.
(1) Turn the crankshaft pulley and align its groove with the timing mark of the timing chain cover.



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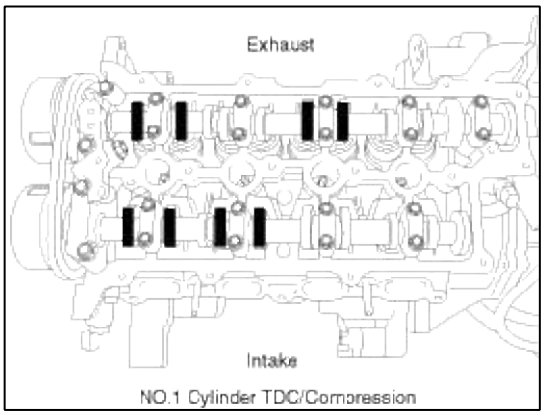
(2) Check that the marks of the intake and exhaust CVVT sprockets are in straight line on the cylinder head surface as shown in the illustration. If not, turn the crankshaft one revolution (360°).



3. Inspect the valve clearance.

(1) Check only the intake valves of the 1st and 2nd cylinders and exhaust valves of the 1st and 3rd cylinders for their clearance.

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



B. Record the out-of-specification valve clearance measurements. They will be used later to determine the required tappet for adjusting.

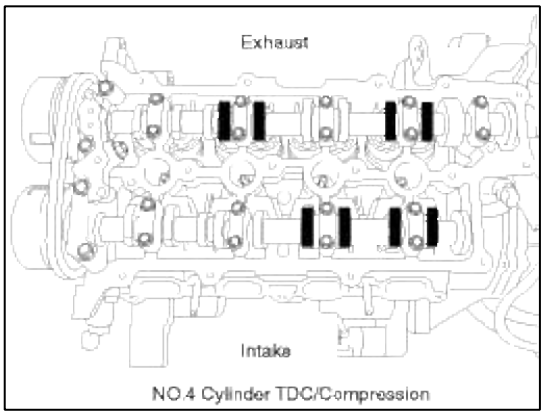
Valve clearance specification (Engine coolant temperature : 20°C [68°F])
Limit
Intake : 0.17 ~ 0.23mm (0.0067 ~ 0.0091in.)
Exhaust : 0.22 ~ 0.28mm (0.0087 ~ 0.0110in.)

---

(2) Turn the crankshaft pulley one revolution (clockwise 360°) and align its groove with timing mark of the timing chain cover.

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(3) Check the intake valves of the 3rd and 4th cylinders and exhaust valves of the 2nd and 4th cylinders for their clearance.

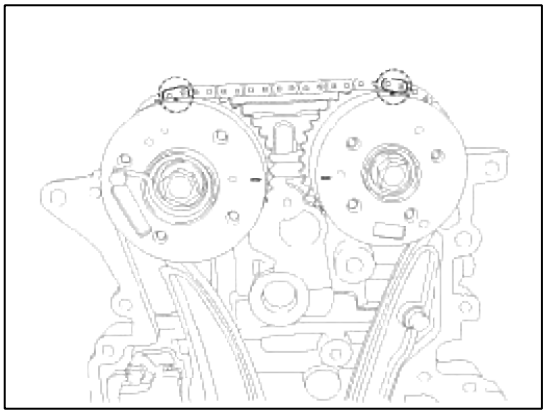


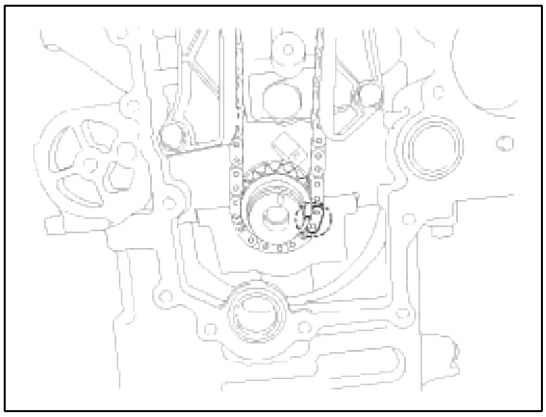
4. Adjust the intake and exhaust valve clearance.

(1) Set the No.1 cylinder to the TDC/compression position.

(2) Remove the timing chain. (Refer to Timing system)

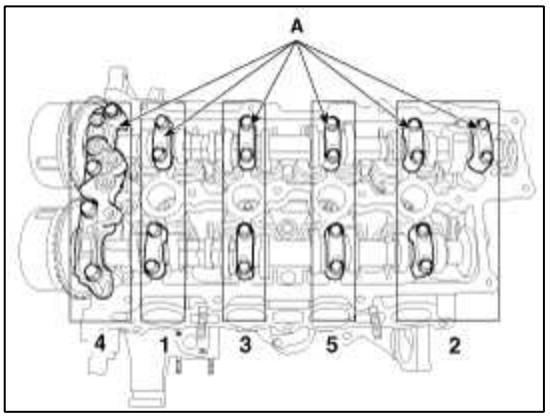
> **CAUTION**
>
> Put paint marks on the timing chain links (2 places) that meet with the timing marks of the intake and exhaust CVVT sprockets.





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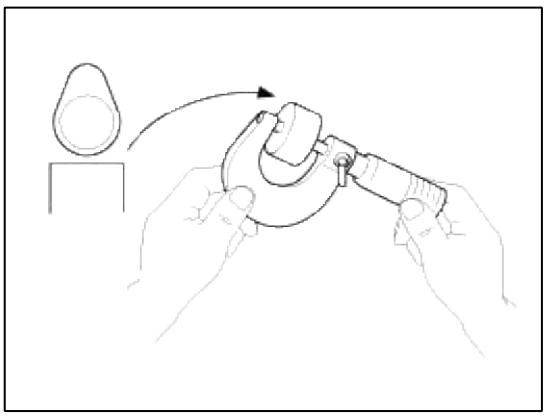
(3) Remove the camshaft bearing caps (A) with the order below.



(4) Remove the intake camshaft assembly.

(5) Remove the exhaust camshaft assembly.

(6) Measure the thickness of the removed tappet using a micrometer.



(7) Calculate the thickness of a new tappet so that the valve clearance comes within the specificified value.

Valve clearance (Engine coolant temperature : 20°C)
T : Thickness of removed tappet
A : Measured valve clearance
N : Thickness of new tappet
Intake : N = T + [A - 0.20mm(0.0079in.)]
Exhaust : N = T + [A - 0.25mm (0.0098in.)]

(8) Select a new tappet with a thickness as close as possible to the calculated value.

NOTE

Shims are available in 41 size increments of 0.015mm (0.0006in.) from 3.00mm (0.118in.) to 3.690mm (0.1417in.)

(9) Place a new tappet on the cylinder head.

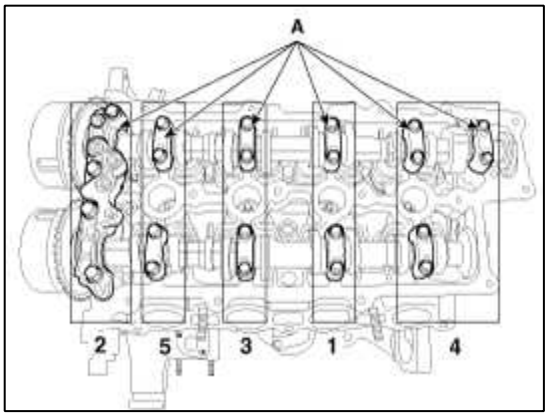
(10) Install the exhaust camshaft assembly.

(11) Install the intake camshaft assembly.

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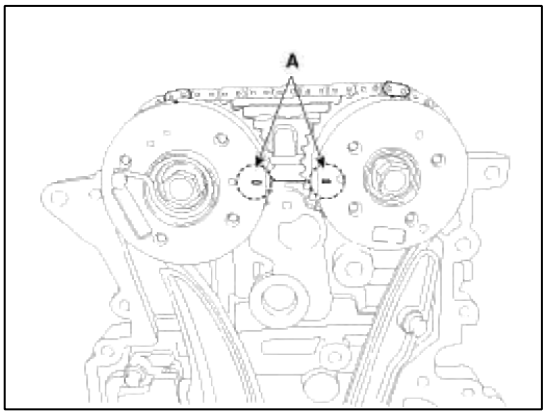
(12) Install the camshaft bearing caps with the order below.

Tightening torque :
1st step
M6 bolt :
5.9 N.m (0.6 kgf.m, 4.3 lb-ft)
M8 bolt :
9.8 N.m (1.0 kgf.m, 7.2 lb-ft)
2nd step
M6 bolts :
11.8 ~ 13.7N.m (1.2 ~ 1.4kgf.m, 8.7 ~ 10.1lb-ft)
M8 bolts :
18.6 ~ 22.6N.m (1.9 ~ 2.3kgf.m, 13.7 ~ 16.6lb-ft)



(13) Install the timing chain. (Refer to Timing system)

(14) Turn the crankshaft two turns in the operating direction(clockwise) and check that the marks of the intake and exhaust CVVT sprockets are in straight line on the cylinder head surface.



(15) Recheck the valve clearance.

Valve clearance (Engine coolant temperature : 20°C)
[Specification]
Intake : 0.17 ~ 0.23mm (0.0067 ~ 0.0091in.)
Exhaust : 0.22 ~ 0.28mm (0.0087 ~ 0.0110in.)

Engine Mechanical System > General Information > Troubleshooting

Troubleshooting

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Symptom	Suspect area	Remedy
Engine misfire with abnormal internal lower engine noises.	Loose or improperly installed engine flywheel.	Repair or replace the flywheel as required.
	Worn piston rings. (Oil consumption may or may not cause the engine to misfire.)	Inspect the cylinder for a loss of compression . Repair or replace as required.
	Worn crankshaft thrust bearings.	Replace the crankshaft and bearings as required.
Engine misfire with abnormal valve train noise.	Stuck valves. (Carbon buildup on the valve stem can cause the valve not to close properly.)	Repair or replace as required.
	Excessive worn or mis-aligned timing chain.	Replace the timing chain and sprocket as required.
	Worn camshaft lobes.	Replace the camshaft and MLA.
Engine misfire with coolant consumption.	• Faulty cylinder head gasket and/or cracking or other damage to the cylinder head and engine block cooling system. • Coolant consumption may or may not cause the engine to overheat.	• Inspect the cylinder head and engine block for damage to the coolant passages and/or a faulty head gasket. • Repair or replace as required.
Engine misfire with excessive oil consumption.	Worn valves, valve guides and/or valve stem oil seals.	Repair or replace as required.
	Worn piston rings. (Oil consumption may or may not cause the engine to misfire)	Inspection the cylinder for a loss of compression. Repair or replace as required.
Engine noise on start-up, but only lasting a few seconds.	Incorrect oil viscosity.	Drain the oil. Install the correct viscosity oil.
	Worn crankshaft thrust bearing.	Inspect the thrust bearing and crankshaft. Repair or replace as required.
Upper engine noise, regardless of engine speed.	Low oil pressure.	Repair or replace as required.
	Broken valve spring.	Replace the valve spring.
	Worn or dirty valve lifters.	Replace the valve lifters.
	Stretched or broken timing chain and/or damaged sprocket teeth.	Replace the timing chain and sprockets.
	Worn timing chain tensioner, if applicable.	Replace the timing chain tensioner as required.
	Worn camshaft lobes.	Inspect the camshaft lobes. Replace the camshaft and valve lifters as required.
	Worn valve guides or valve stems.	Inspect the valves and valve guides, then repair as required.
	Stuck valves. (Carbon on the valve stem or valve seat may cause the valve to stay open.)	Inspect the valves and valve guides, then repair as required.
Lower engine noise, regardless of engine speed.	Low oil pressure.	Repair or replace damaged components as required.
	Loose or damaged flywheel.	Repair or replace the flywheel.

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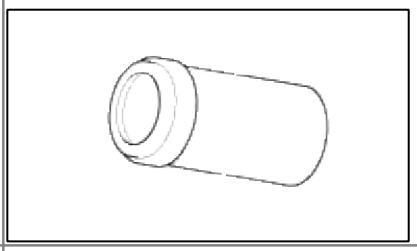
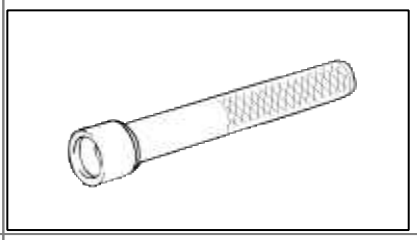
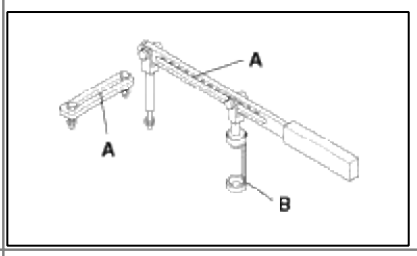
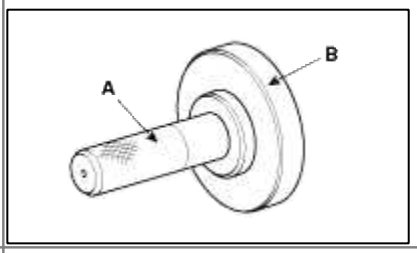
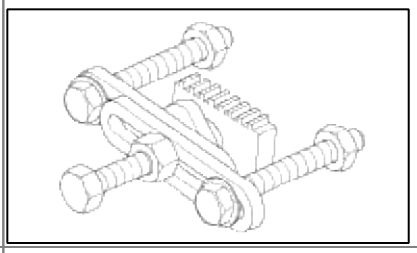
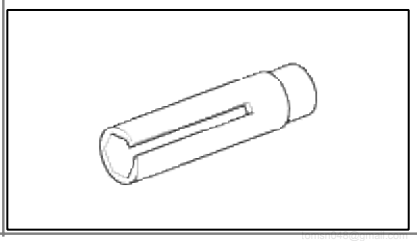
	Damaged oil pan, contacting the oil pump screen.	Inspect the oil pan. Inspect the oil pump screen. Repair or replace as required.
	Oil pump screen loose, damaged or restricted.	Inspect the oil pump screen. Repair or replace as required.
	Excessive piston-to-cylinder bore clearance.	Inspect the piston and cylinder bore. Repair as required.
	Excessive piston pin-to-bore clearance.	Inspect the piston, piston pin and the connecting rod. Repair or replace as required.
	Excessive connecting rod bearing clearance.	Inspect the following components and repair as required. • The connecting rod bearings. • The connecting rods. • The crankshaft. • The crankshaft journal.
	Excessive crankshaft bearing clearance.	Inspect the following components and repair as required. • The crankshaft bearings. • The crankshaft journals.
	Incorrect piston, piston pin and connecting rod installation.	Verify the piston pins and connecting rods are installed correctly. Repair as required.
Engine noise under load.	Low oil pressure.	Repair or replace as required.
	Excessive connecting rod bearing clearance.	Inspect the following components and repair as required. • The connecting rod bearings. • The connecting rods. • The crankshaft.
	Excessive crankshaft bearing clearance.	Inspect the following components and repair as required. • The crankshaft bearings. • The crankshaft journals. • The cylinder block crankshaft bearing bore.
Engine will not crank. (crankshaft will not rotate)	Hydraulically locked cylinder. • Coolant/antifreeze in cylinder. • Oil in cylinder. • Fuel in cylinder.	Remove spark plugs and check for fluid. Inspect for broken head gasket. Inspect for cracked engine block or cylinder head. Inspect for a sticking fuel injector and/or leaking fuel regulator.
	Broken timing chain and/or timing chain gears.	Inspect timing chain and gears. Repair as required.
	Foreign material in cylinder. • Broken valve. • Piston material. • Foreign material.	Inspect cylinder for damaged components and/or foreign materials. Repair or replace as required.

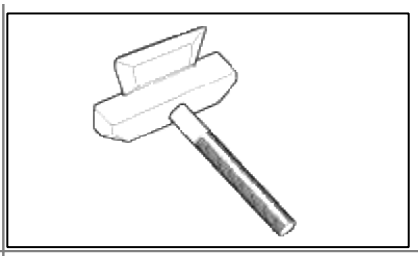
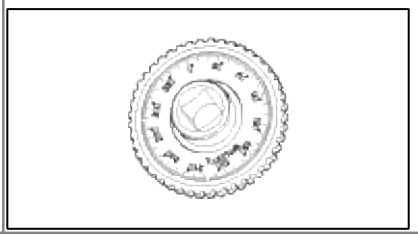
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	Seized crankshaft or connecting rod bearings.	Inspect crankshaft and connecting rod bearing. Repair or replace as required.
	Bent or broken connecting rod.	Inspect connecting rods. Repair or replace as required.
	Broken crankshaft.	Inspect crankshaft. Repair or replace as required.

Engine Mechanical System > General Information > Special Service Tools

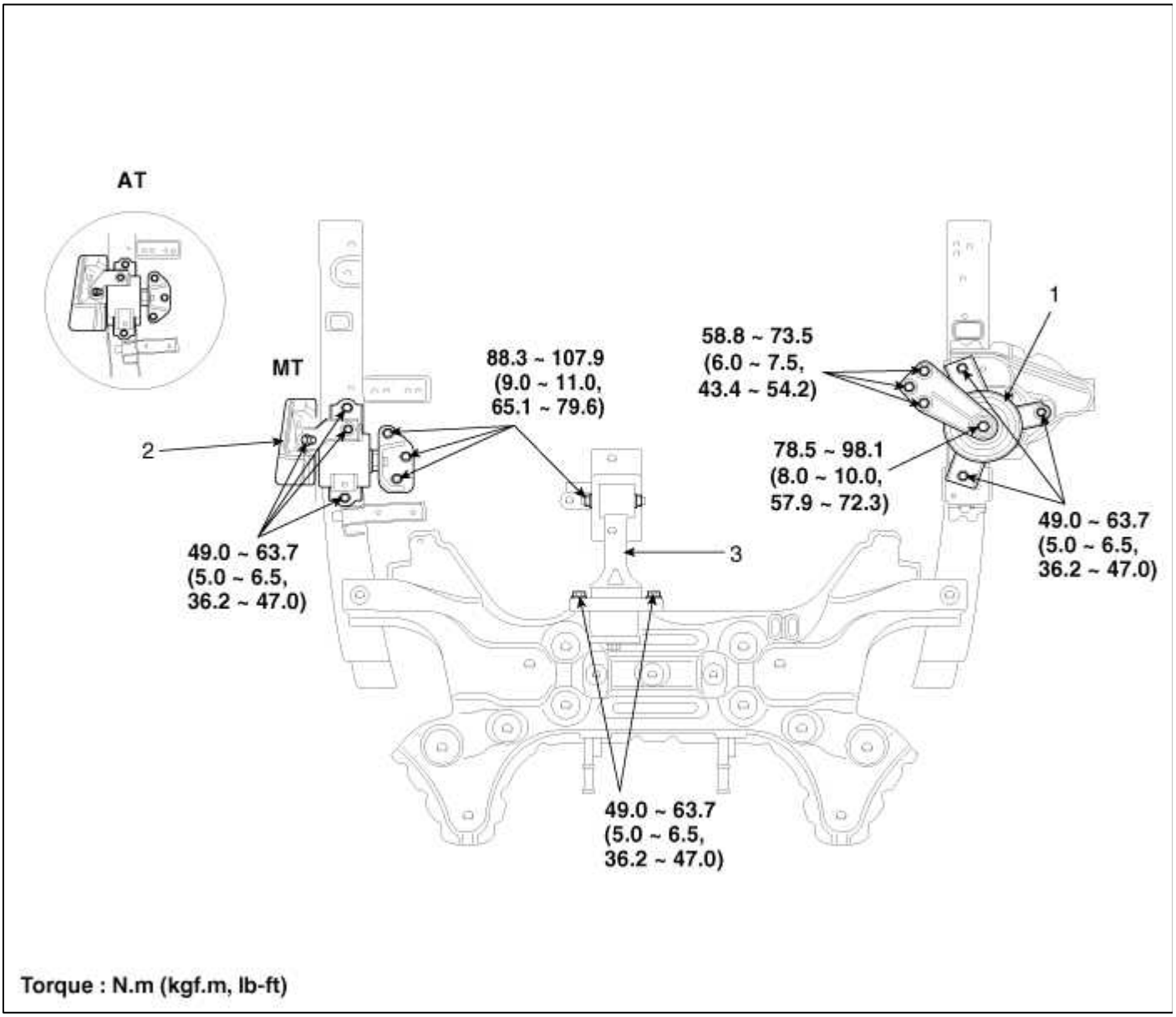
Special Service Tools

Tool (Number and name)	Illustration	Use
Crankshaft front oil seal installer (09455-21200)		Installation of the front oil seal
Valve stem oil seal installer (09222-2B100)		Installation of the valve stem oil seal
Valve spring compressor and holder A : (09222-3K000) B : (09222-3K100)		Removal and installation of the intake or exhaust valve
Crankshaft rear oil seal installer A : (09231-H1100) B : (09231-2B200)		Installation of the crankshaft rear oil seal
Ring gear stoppper (09231-2B100)		Installation of crankshaft pulley bolt
Engine coolant temperature sensor socket wrench (09221-25100)		Removal and installation of engine coolant sensor

Oil pan remover (09215-3C000)		Removal of oil pan
Torque angle adapter (09221-4A000)		Installation of bolts & nuts needing an angular method

Engine Mechanical System > Engine And Transaxle Assembly > Engine Mounting > Components and Components Location

Components



1. Transaxle mounting bracket	3. Engine mounting bracket
2. Roll rod bracket	4. Engine mounting support bracket

Engine Mechanical System > Engine And Transaxle Assembly > Engine And Transaxle Assembly > Repair procedures

Removal

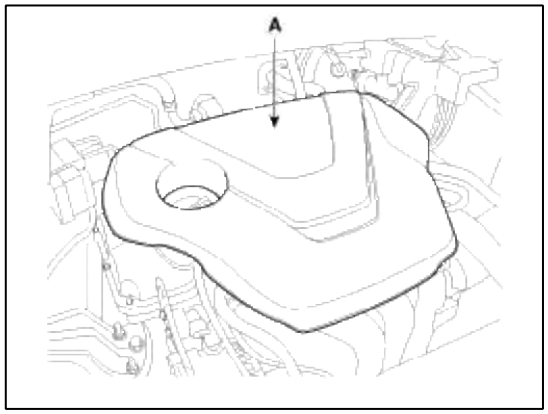
CAUTION

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

NOTE

- Mark all wiring and hoses to avoid misconnection.
- To release the fuel system pressure before removing the engine assembly, start the engine with the fuel pump relay removed. And then turn off the ignition switch after engine stops.

1. Remove the engine cover (A).



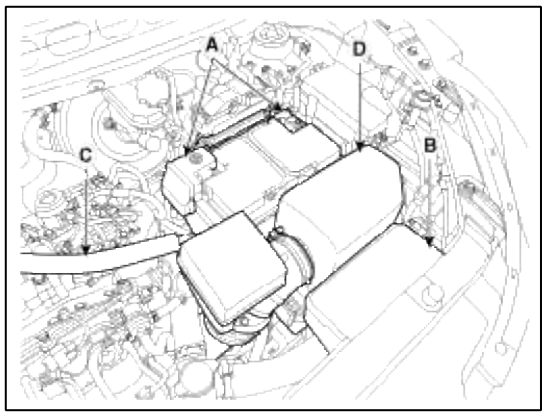
2. Disconnect the battery terminals (A). Disconnect the negative terminal first.

Tightening torque
(+) terminal :
7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)
(-) terminal (without battery sensor):
7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)
(-) terminal (with battery sensor):
4.0 ~ 6.0N.m (0.4 ~ 0.6kgf.m, 3.0 ~ 4.4lb-ft)

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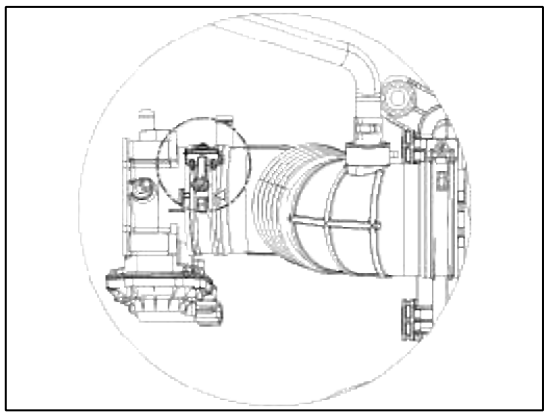
3. Remove the air cleaner assembly.
   (1) Remove the air duct (B).
   (2) Disconnect the breather hose (C).
   (3) Disconnect the air intake hose and then remove the air cleaner assembly (D).

Tightening torque
Hose clamp bolt:
2.9 ~ 4.9N.m (0.3 ~ 0.5kgf.m, 2.2 ~ 3.6lb-ft)
Air cleaner assembly bolts:
7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)

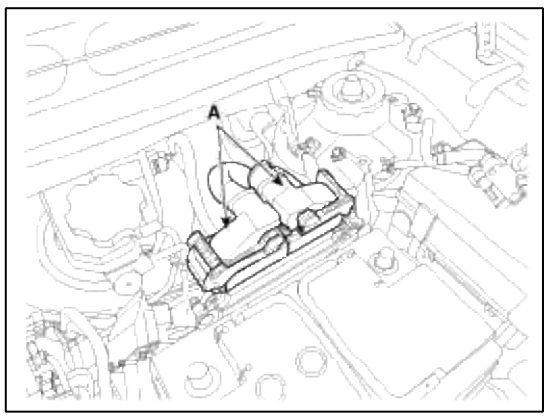


NOTE

- Install the air intake hose while the plate of the hose clamp must be in line with the stopper of the hose.
- Install the air intake hose while the groove of hose must be matched to the protrusion of the throttle body.



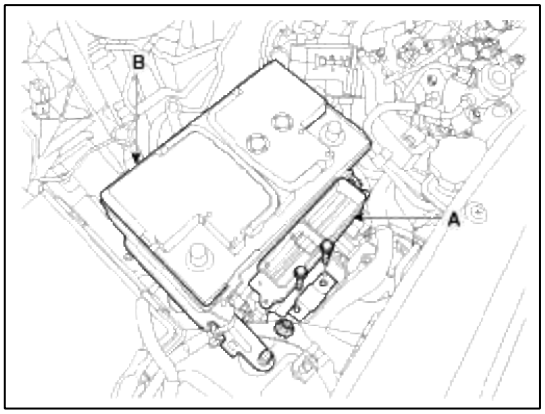
4. Disconnect the ECM connector (A).



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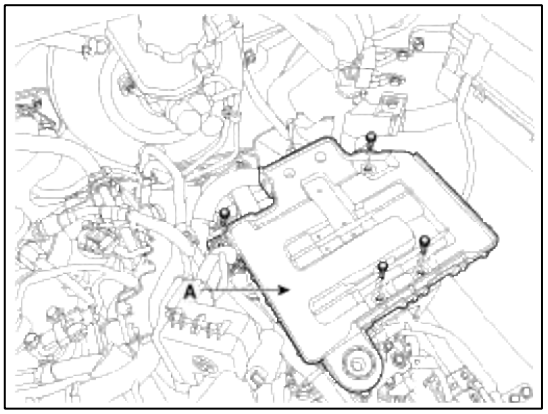
5. Remove the ECM (A) and then remove the battery (B).

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



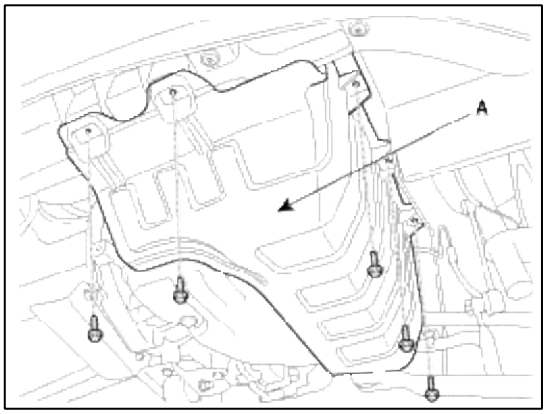
6. Remove the battery tray (A).

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

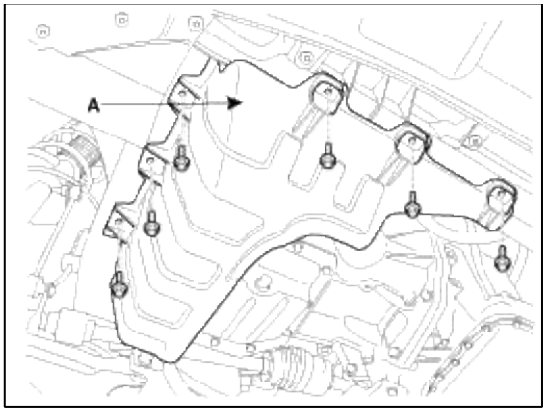


7. Remove the under cover (A).

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

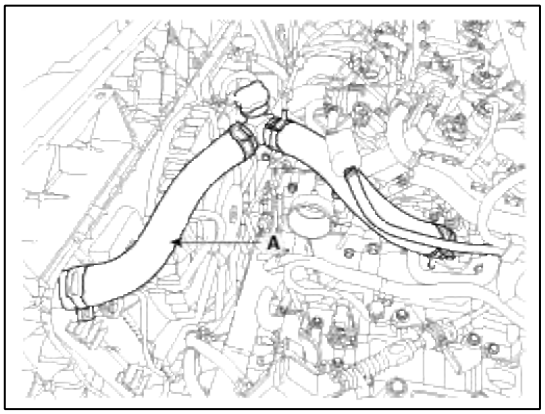


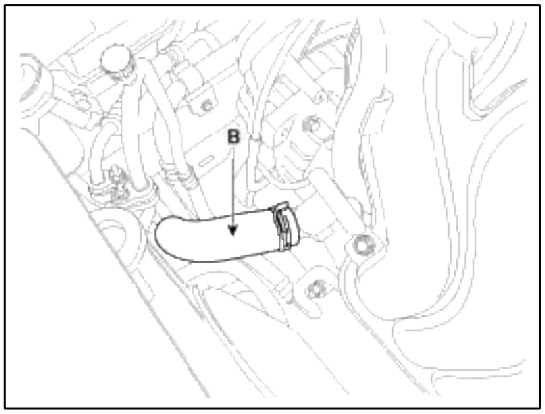
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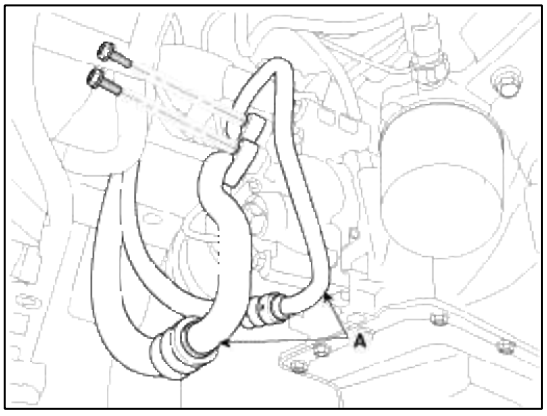
8. Loosen the drain plug, and drain the engine coolant. Remove the radiator cap to drain with speed. (Refer to Cooling system in this group)

9. Disconnect the radiator upper hose (A) and lower hose (B).



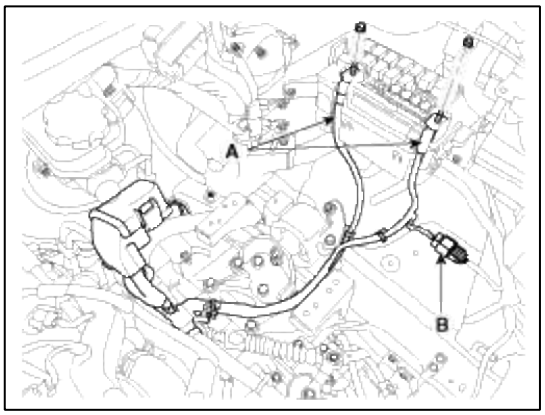


10. Recover the refrigerant and then remove the high pressure pipe and low pressure pipe (A). (Refer to Air conditioning system in HA Group.)

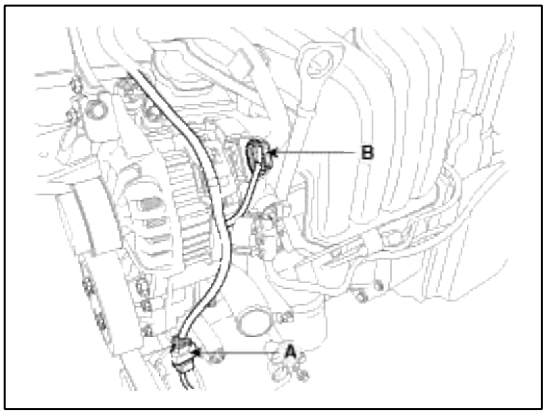


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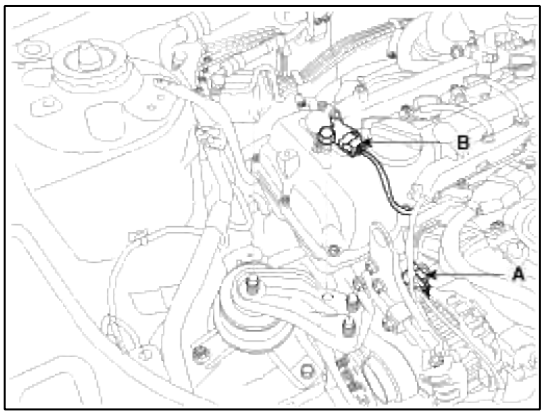
11. Disconnect the (+) cable (A), connector (B) from the fuse/relay box.



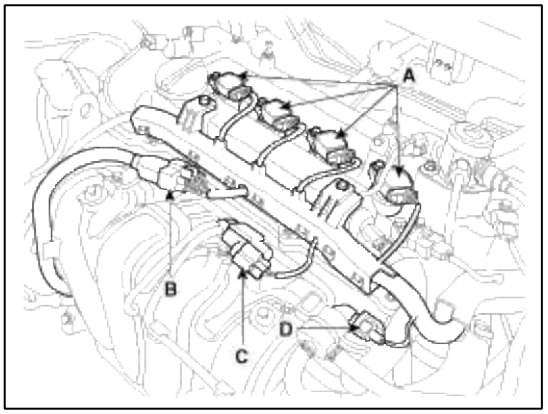
12. Disconnect the wiring connectors and harness clamps, and remove the wiring and protectors from the cylinder head and intake manifold.
    (1) The A/C compressor switch connector (A) and the alternator connector (B)



    (2) The intake OCV (Oil control valve) connector (A) and the exhaust OCV (Oil control valve) connector (B)

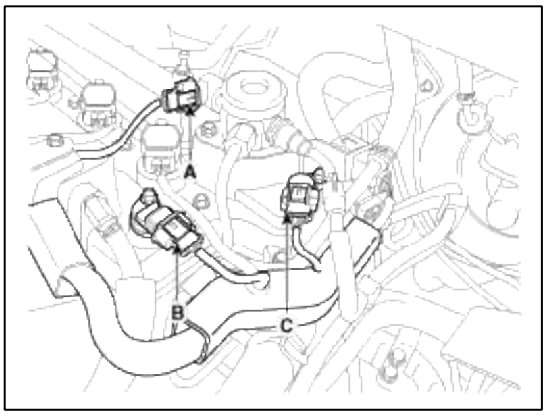


    (3) The ignition coil connectors (A), the injector extension connector (B), the VIS (Variable intake system) connector (C) and the PCSV (Purge control solenoid valve) connector (D)

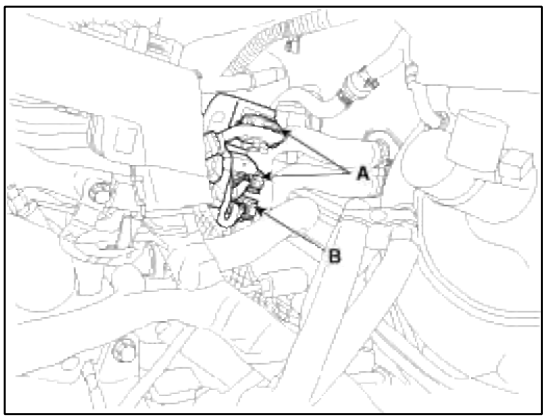


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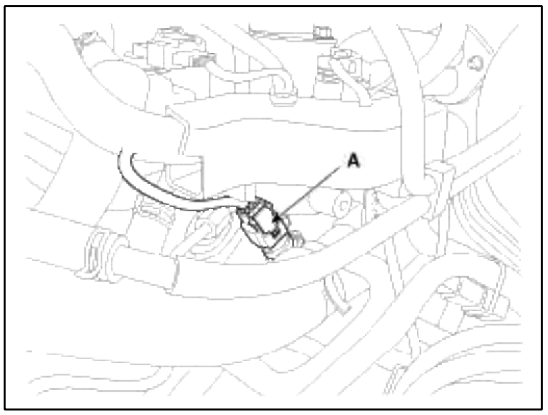
(4) The FPCV (Fuel pressure control valve) connector (A), the intake CMPS (Camshaft position sensor) connector (B) and the exhaust CMPS (Camshaft position sensor) connector (C)



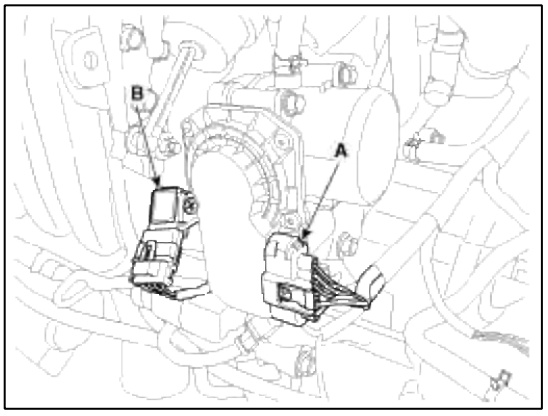
(5) The oxygen sensor connectors (A) and the condenser connector (B)



(6) The ECTS (Engine coolant temperature sensor) connector (A)

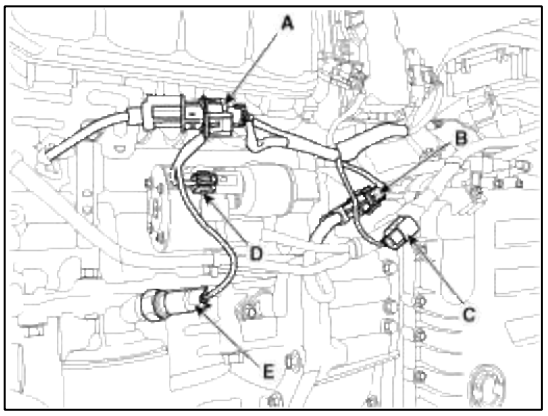


(7) The ETC (Electronic throttle control) connector (A) and the MAPS (Manifold absolute pressure sensor) & IATS (Intake air temperature sensor) connector (B)



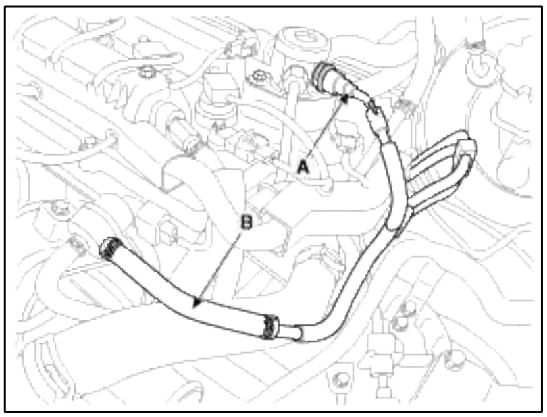
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(8) The knock sensor connector (A), the CKPS (Crankshaft position sensor) connector (B), the front connector (C), the starter connector (D) and the oil pressure connector (E)

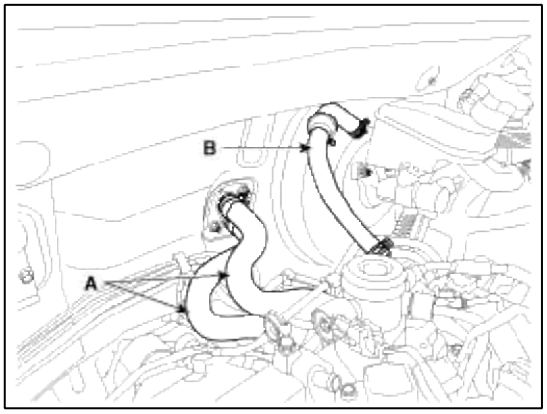


13. Remove the transaxle wire harness connectors and control cable from the transaxle. (Refer to AT or MT group).

14. Disconnect the fuel hose (A) and the PCSV (Purge control solenoid valve) hose (B).



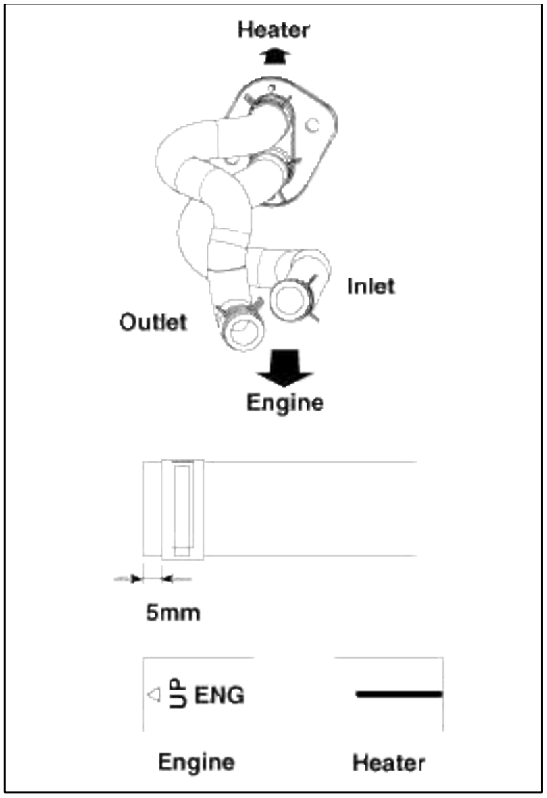
15. Disconnect the brake booster vacuum hose (A) and the heater hose (B).



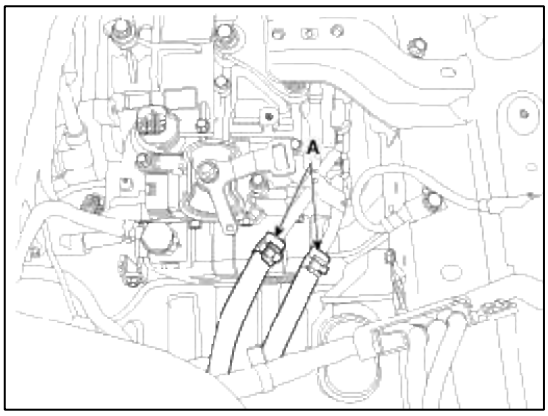
NOTE

Install the heater hoses as shown illustrations.

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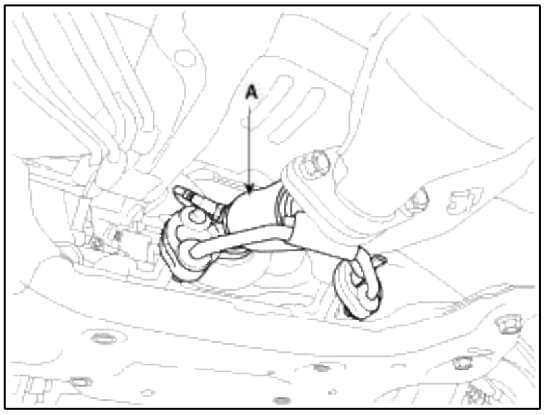


16. Disconnect the ATF cooler hoses (A). (Refer to AT group)



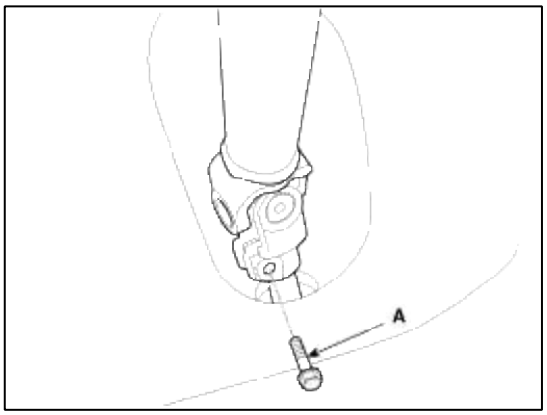
17. Remove the front muffler (A) after removing the rear oxygen sensor connector from the bracket.

Tightening torque:
39.2 ~ 58.8 N.m (4.0 ~ 6.0 kgf.m, 28.9 ~ 43.4 lb-ft)

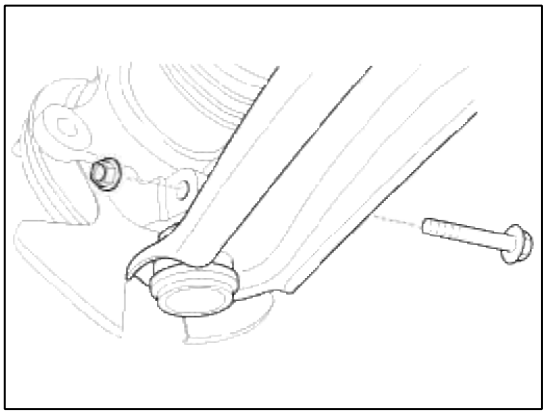


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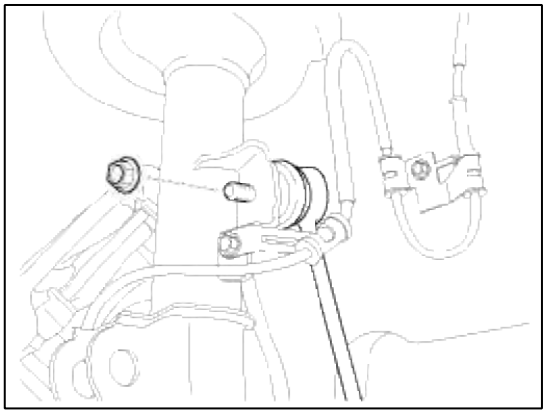
18. Remove the steering u-joint mounting bolt (A). (Refer to ST group)



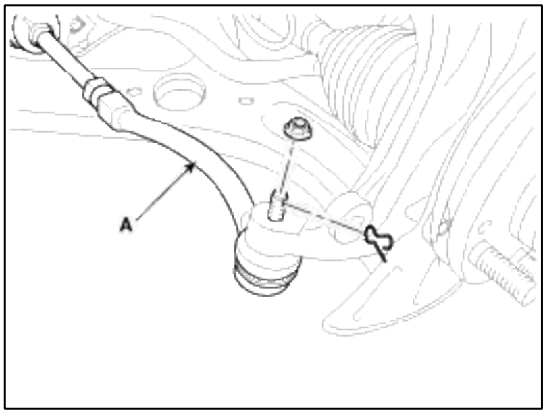
19. Remove the front wheels. (Refer to SS group)
20. Remove the lower arms. (Refer to SS group)



21. Remove the stabilizer bar links. (Refer to SS group)



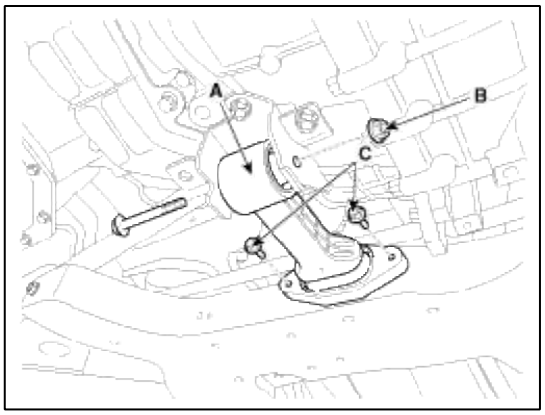
22. Remove the tie rod ends (A). (Refer to ST group)



23. Disconnect the drive shafts from the axle hubs. (Refer to DS group)

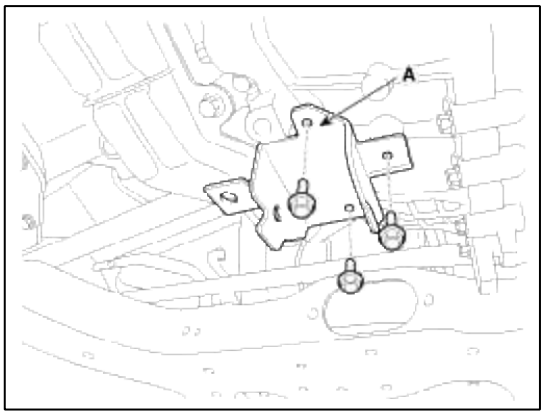
24. Remove the roll rod bracket (A).

Tightening torque
Nut (B) :
107.9 ~ 127.5 N.m (11.0 ~ 13.0 kgf.m, 79.6 ~ 94.0 lb-ft)
Bolt (C) :
49.0 ~ 63.7 N.m (5.0 ~ 6.5 kgf.m, 36.2 ~ 47.0 lb-ft)



25. Remove the roll rod mounting support bracket (A).

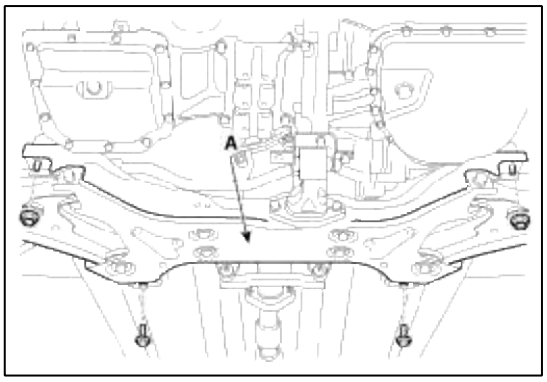
Tightening torque:
49.0 ~ 68.6 N.m (5.0 ~ 7.0 kgf.m, 36.2 ~ 50.6 lb-ft)



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26. Support the sub frame (A) with a floor jack, and then remove the sub frame mounting bolts and nuts. (Refer to SS group)

Tightening torque
Sub frame mounting bolts & nuts :
156.9 ~ 176.5 N.m (16.0 ~ 18.0 kgf.m, 115.7 ~ 130.2 lb-ft)

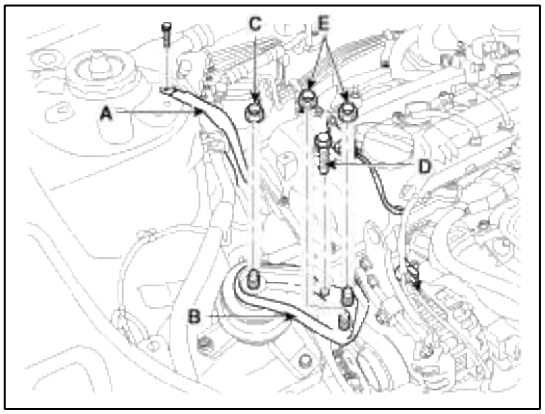


NOTE

- After removing the sub frame mounting bolts and nuts, the engine and transaxle assembly may fall downward. Securely support the assemblies with floor jack.
- Verify that the hoses and connectors are disconnected before removing the engine and transaxle assembly.

27. Disconnect the ground line (A) and then remove the engine mounting support bracket (B).

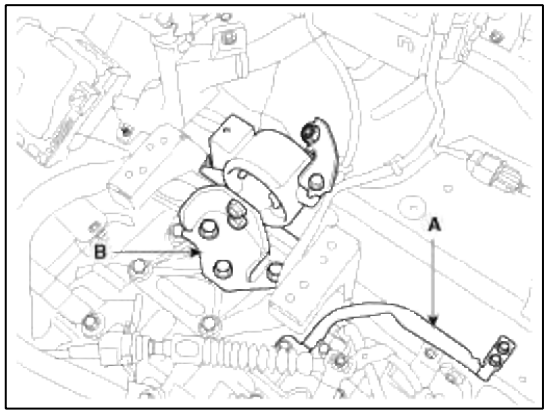
Tightening torque
Ground line bolt :
10.8 ~ 13.7 N.m (1.1 ~ 1.4 kgf.m, 8.0 ~ 10.1 lb-ft)
Nut (C) :
78.5 ~ 98.1N.m (8.0 ~ 10.0kgf.m, 57.9 ~ 72.3lb-ft)
Bolt (D) and nuts (E) :
58.8 ~ 73.5N.m (6.0 ~ 7.5kgf.m, 43.4 ~ 54.2lb-ft)



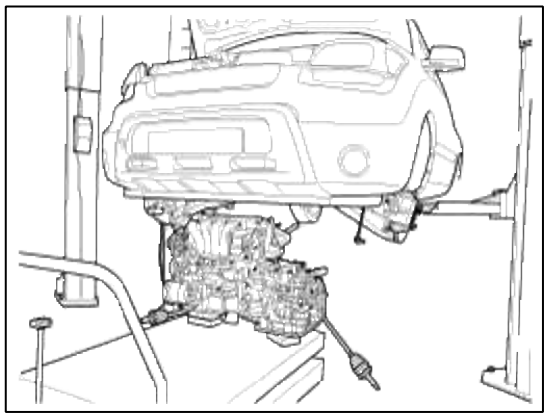
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28. Disconnect the ground line (A), and then remove the transaxle mounting bracket bolts (B).

Tightening torque:
88.3 ~ 107.9 N.m (9.0 ~ 11.0 kgf.m, 65.1 ~ 79.6 lb-ft)



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



CAUTION

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

Installation

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

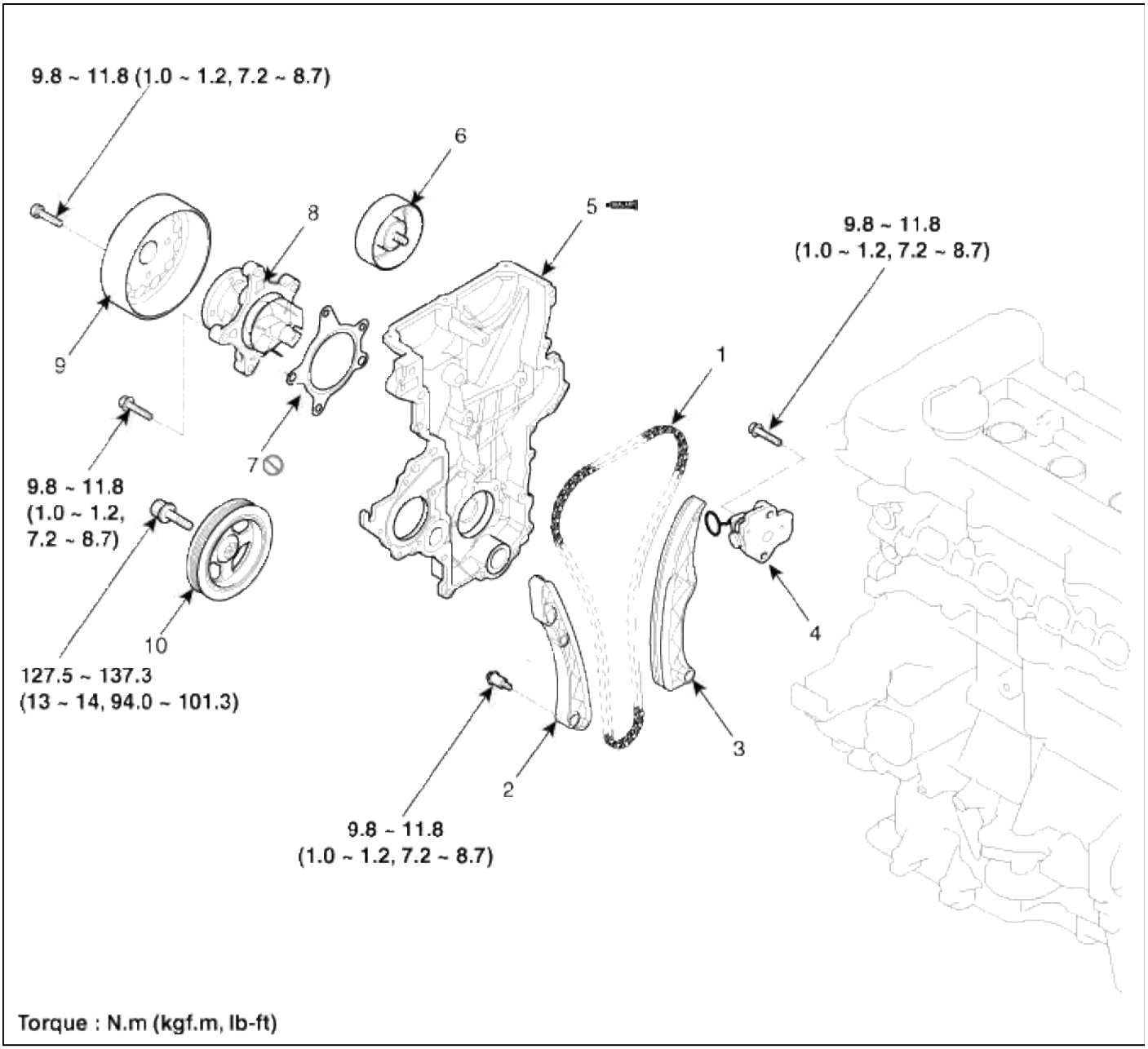
- Adjust a shift cable.
- Refill engine with engine oil.
- Refill a transaxle with fluid.
- Refill power steering fluid.
- Refill a radiator and a reservoir tank with engine coolant.
- Clean battery posts and cable terminals and assemble.
- Inspect for fuel leakage.
- After assemble the fuel line, turn on the ignition switch (do not operate the starter) so that the fuel pump runs for approximately two seconds and fuel line pressurizes.
- Repeat this operation two or three times, then check for fuel leakage at any point in the fuel line.
- Bleed air from the cooling system.

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- Start engine and let it run until it warms up. (until the radiator fan operates 3 or 4 times.)
- Turn Off the engine. Check the level in the radiator, add coolant if needed. This will allow trapped air to be removed from the cooling system.
- Put radiator cap on tightly, then run the engine again and check for leaks.

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

Components



1. Timing chain	6. Drive belt idler
2. Timing chain guide	7. Water pump gasket
3. Timing chain arm	8. Water pump
4. Timing chain auto tensionr	9. Water pump pulley
5. Timing chain cover	10. Crank shaft pulley

Engine Mechanical System > Timing System > Timing Chain > Repair procedures

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Removal

Engine removal is not required for this procedure.

CAUTION

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

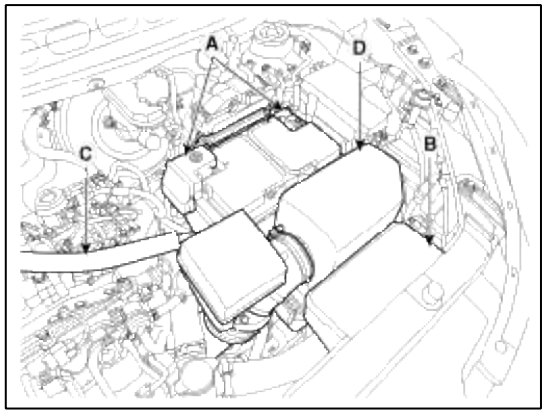
NOTE

Mark all wiring and hoses to avoid misconnection.

WARNING

In case of removing the high pressure fuel pump, high pressure fuel pipe, delivery pipe, and injector, there may be injury caused by leakage of the high pressure fuel. So don't do any repair work right after engine stops.

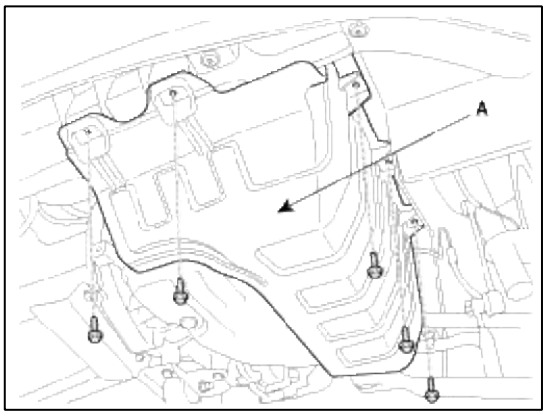
1. Remove the engine cover.
2. Disconnect the battery negative terminal (A).
3. Remove the air cleaner assembly.
   (1) Remove the air duct (B).
   (2) Disconnect the breather hose (C).
   (3) Disconnect the air intake hose and then remove the air cleaner assembly (D).

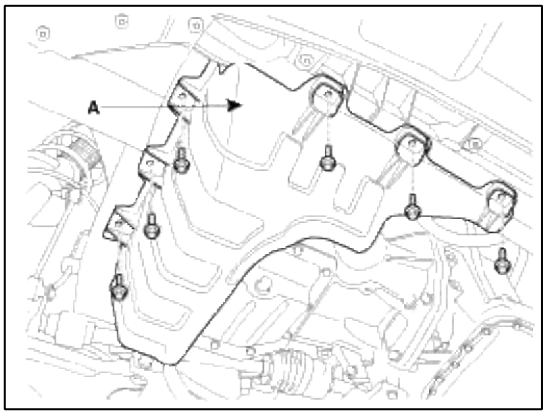


4. Remove the RH front wheel.

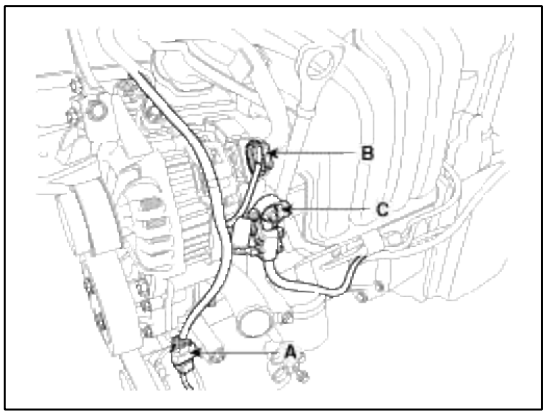
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5. Remove the under covers (A).

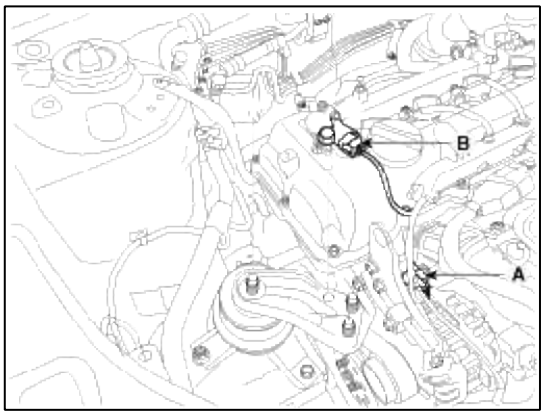




6. Disconnect the A/C compressor switch connector (A), the alternator connector (B) and the cable from the alternator “B” terminal (C).

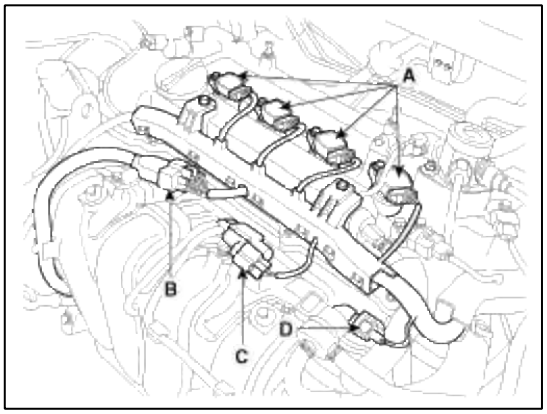


7. Disconnect the intake OCV (Oil control valve) connector (A) and the exhaust OCV (Oil control valve) connector (B).

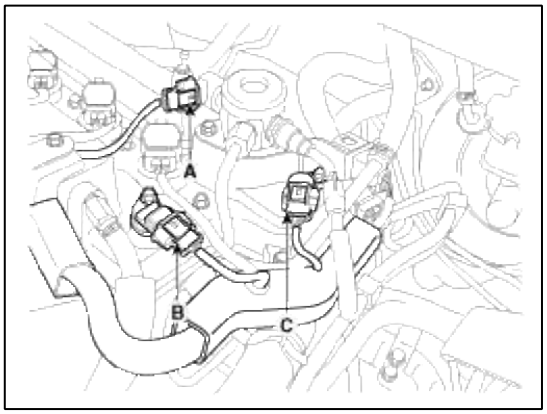


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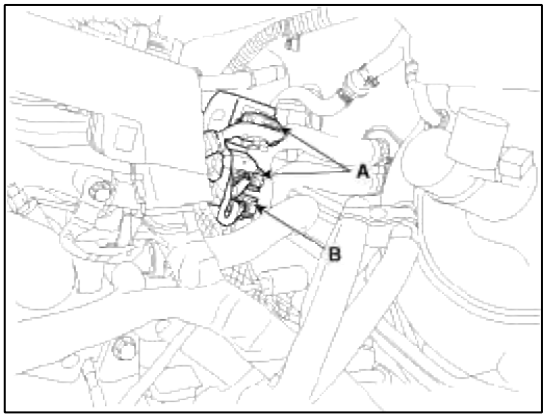
8. Disconnect the ignition coil connectors (A), the injector extension connector (B), the VIS (Variable intake system) connector (C) and the PCSV (Purge control solenoid valve) connector (D).



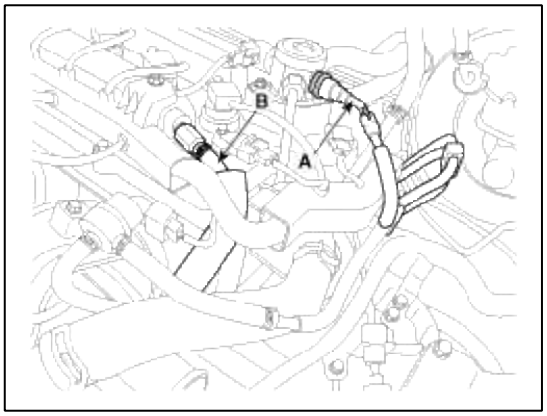
9. Disconnect the FPCV (Fuel pressure control valve) connector (A), the intake CMPS (Camshaft position sensor) connector (B) and the exhaust CMPS (Camshaft position sensor) connector (C).



10. Disconnect the oxygen sensor connectors (A) and the condenser connector (B).

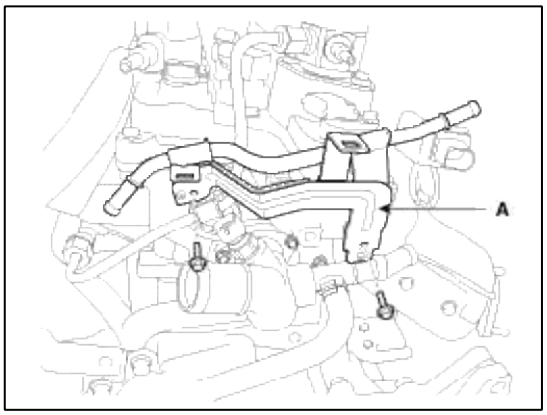


11. Disconnect the fuel hose (A) and the PCV (Positive crankcase ventilation) hose (B).

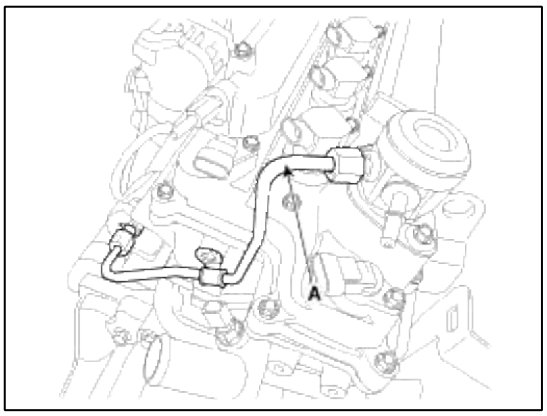


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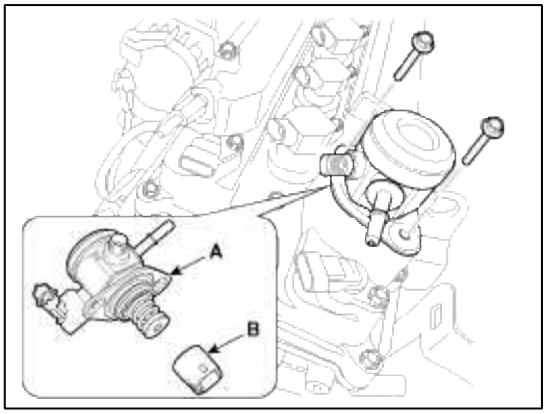
12. Remove the vacuum pipe assembly (A).



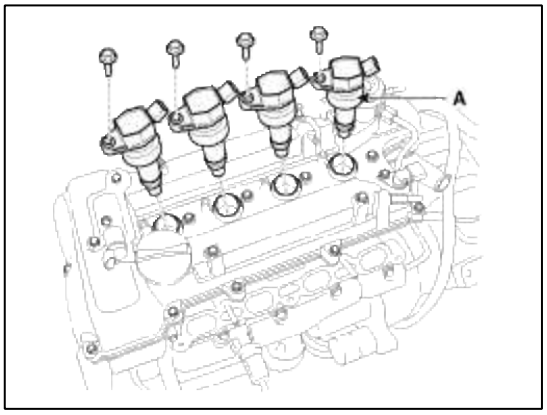
13. Remove the high pressure pipe (A). (Refer to FL group)



14. Remove the high pressure fuel pump (A) and the roller tappet (B). (Refer to FL group)

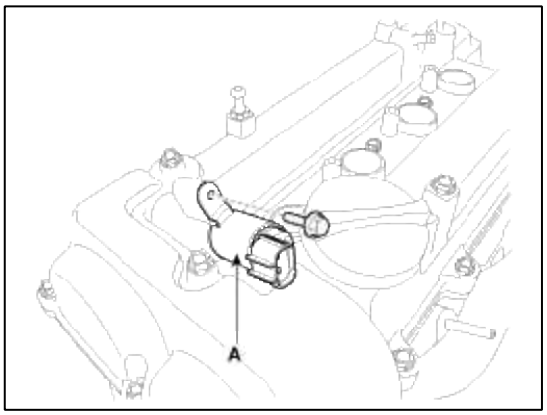


15. Remove the ignition coils (A).

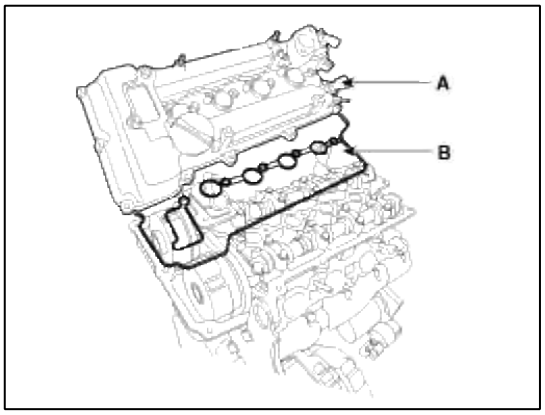


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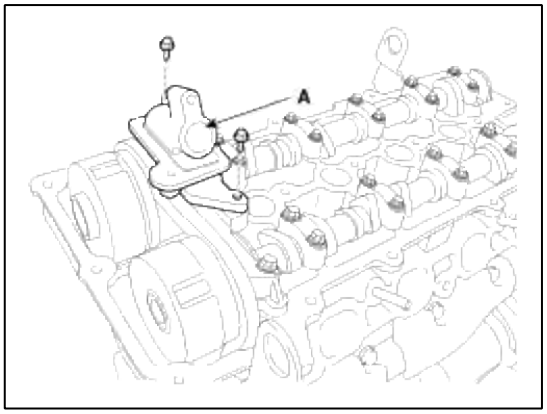
16. Remove the exhaust OCV (Oil control valve) (B).



17. Remove the cylinder head cover (A) with gaskets (B).

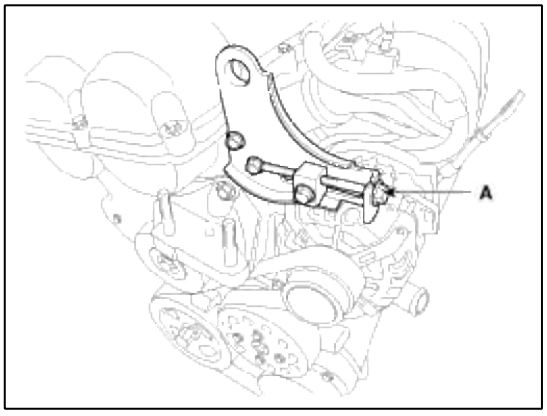


18. Remove the exhaust OCV (Oil control valve) adapter (A).



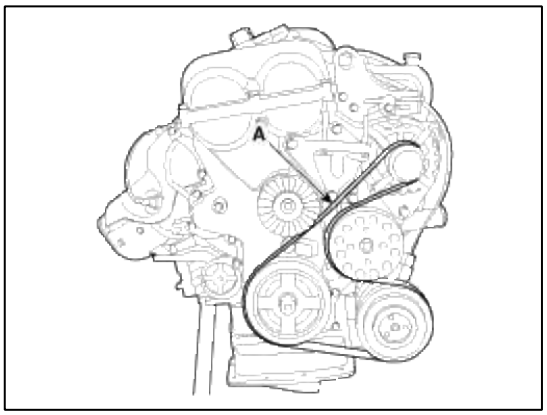
19. Loosen the water pump pulley bolt and the drive idler mounting bolt.

20. Loosen the alternator tension adjusting bolt (A) to loosen tension.

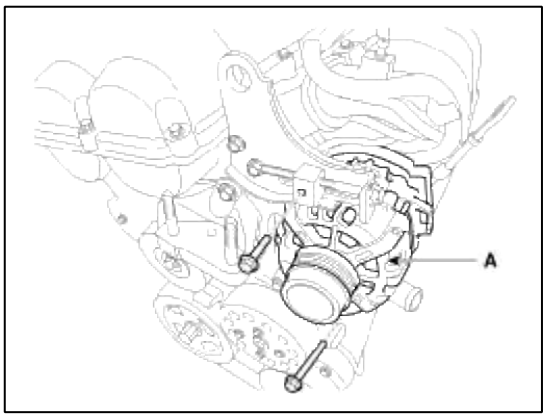


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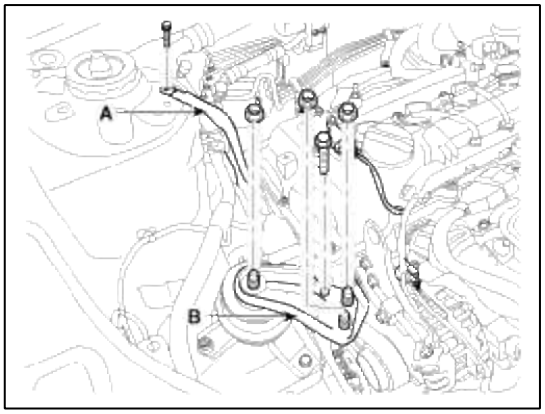
21. Remove the alternator drive belt (A).



22. Remove the alternator (A). (Refer to Altemator in EE Group).



23. Disconnect the ground line (A) and then remove the engine mounting support bracket (B).



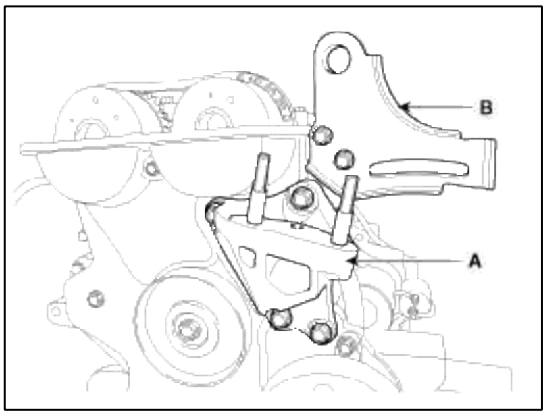
NOTE

Support the engine with a jack not to be tilted.

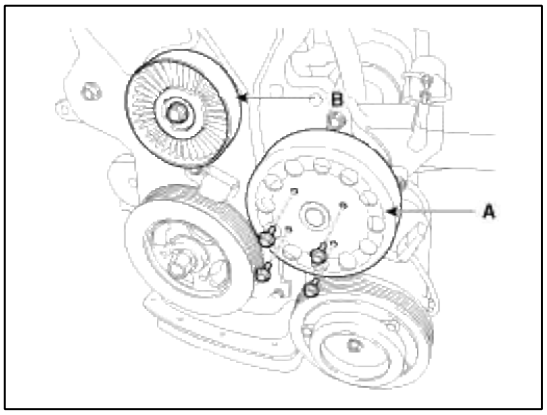
24. Remove the alternator bracket (B).

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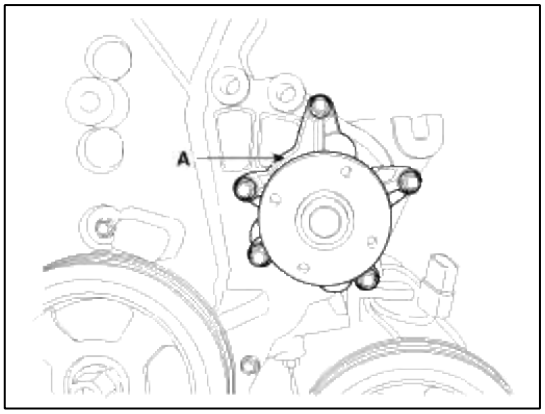
25. Remove the engine support bracket (A).



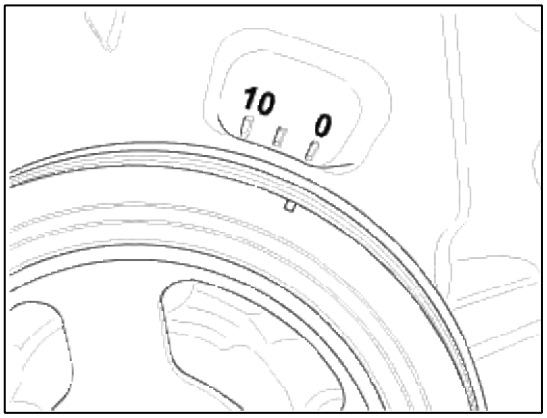
26. Remove the water pump pulley (A) and the drive belt idler (B).



27. Remove the water pump (A).

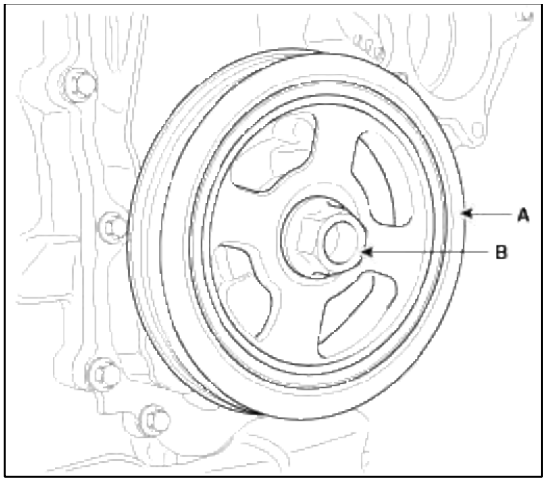


28. Turn the crankshaft pulley clockwise, and align its groove with the timing mark of the timing chain cover.



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

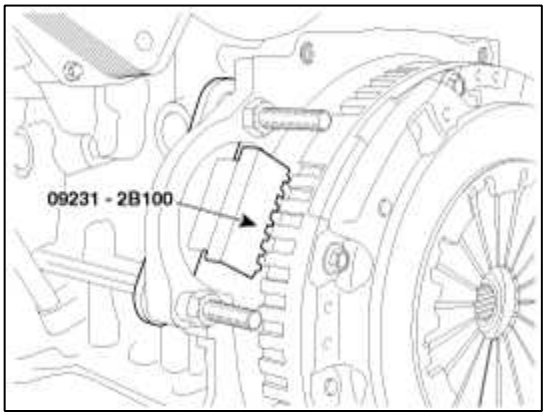
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NOTE

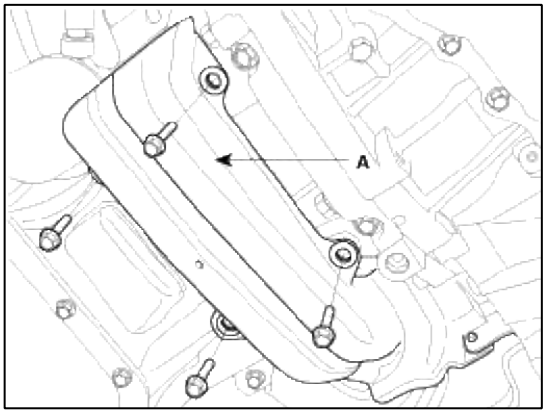
There are two methods to hold the ring gear when installing or removing the crankshaft damper pulley.

- Install the SST (09231-2B100) to hold the ring gear after removing the starter.

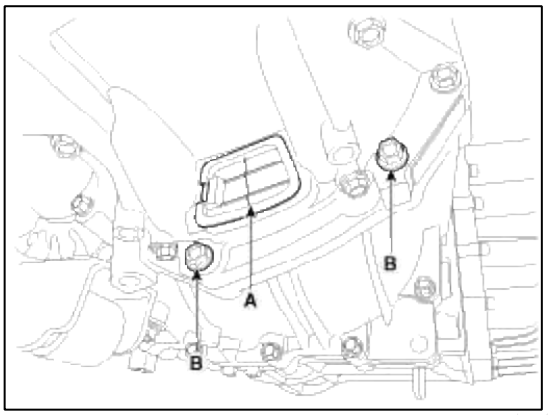


- Install the SST (09231-3D100) to hold the ring gear after removing the dust cover.

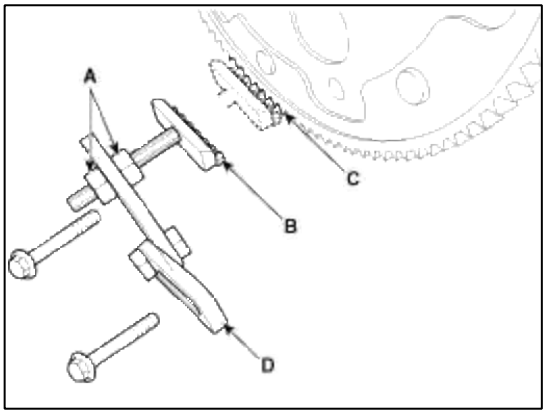
1. Remove the bracket (A).



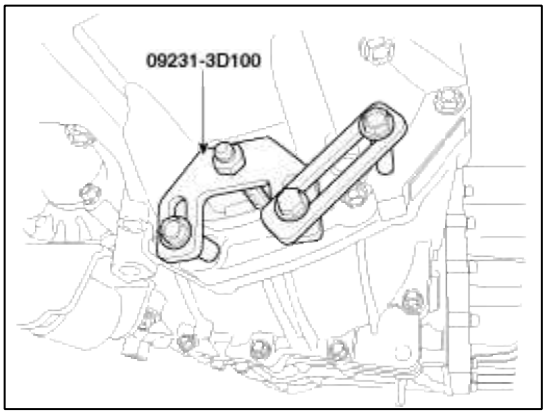
2. Remove the dust cover (A) and unfasten the transaxle mounting bolt (B).



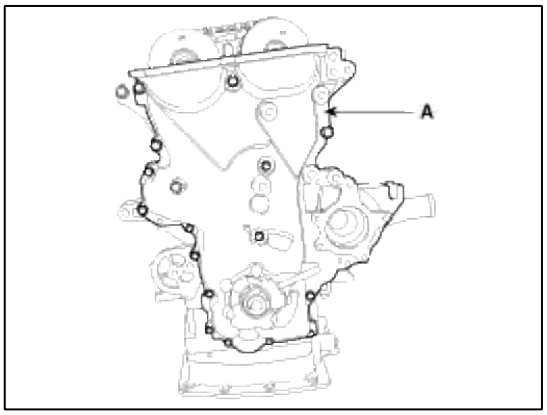
3. Adjust the length of the holder nuts (A) so that the front plate of the holder (B) puts in the ring gear (C) teeth.
4. Adjust the angle of the links (D), and fasten the bolt 70mm(2.7559in) in the original mounted hole.



5. Tighten the bolts and nuts of the holder and links securely.



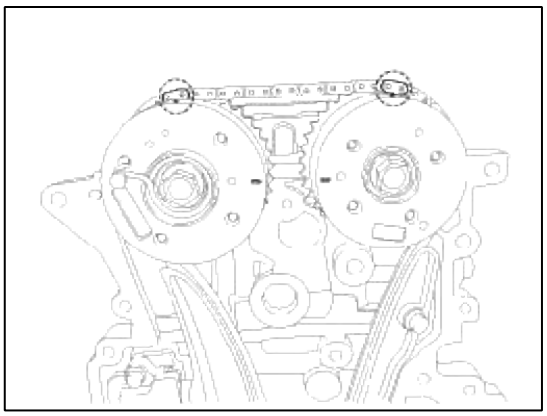
30. Remove the timing chain cover (A).

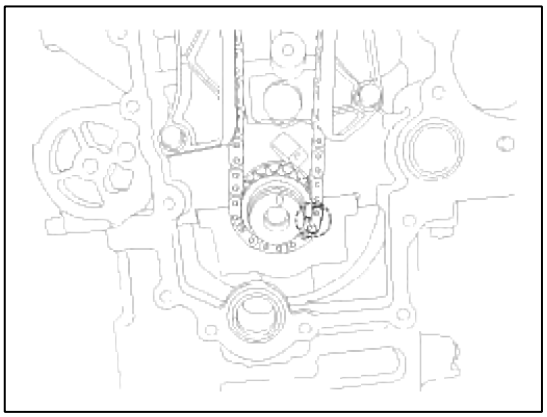


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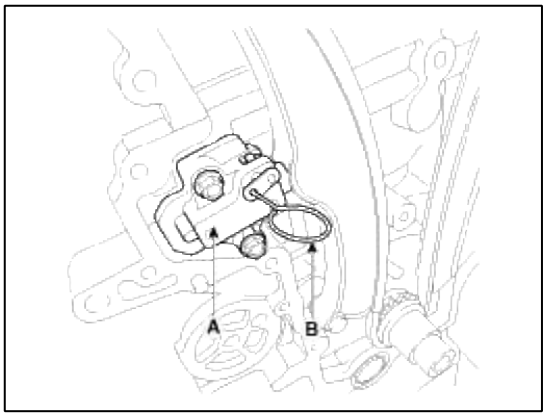
31. Align the timing marks of the CVVT sprockets with the upper surface of the cylinder head to make No.1 cylinder be positioned at TDC.
    (1) Check the dowel pin of the crankshaft for facing upside of the engine at this monent.

> CAUTION
>
> Put paint marks on the timing chain links(3 places) that meet with the timing marks of the CVVT sprockets(In, Ex : 2) and the CVVT sprocket.





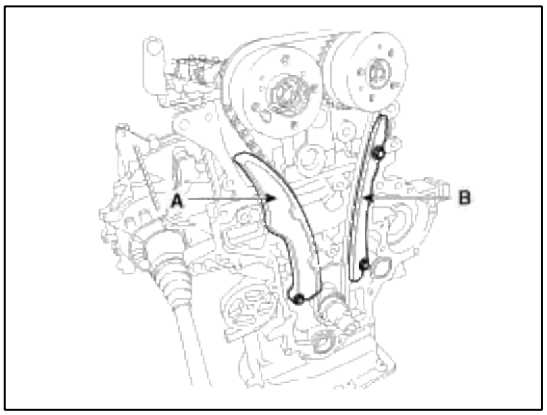
32. Remove the hydraulic tensioner (A).



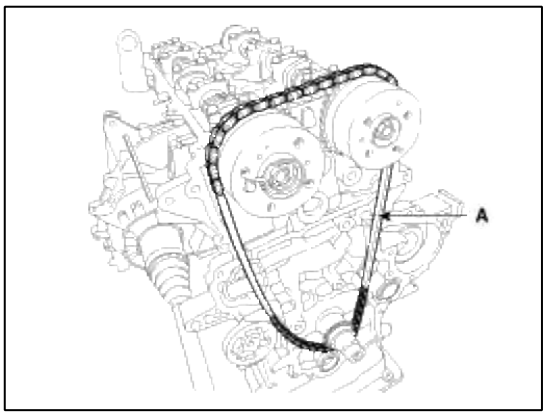
> CAUTION
>
> Before removing the tensioner, fix the piston of the tensioner with a pin through the hole(B) at compressed position.

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33. Remove the timing chain tensioner arm (A) and guide (B).



34. Remove the timing chain (A).



Inspection

Sprockets, Hydraulic Tensioner, Chain Guide, Tensioner Arm

1. Check the CVVT sprocket, crankshaft sprocket teeth for abnormal wear, cracks or damage. Replace if necessary.
2. Check a contact surface of the chain tensioner arm and guide for abnormal wear, cracks or damage. Replace if necessary.
3. Check the hydraulic tensioner for its piston stroke and ratchet operation. Replace if necessary.

Belt, Idler, Pulley

1. Check the idler for excessive oil leakage, abnormal rotation or vibration. Replace if necessary.
2. Check belt for maintenance and abnormal wear of V-ribbed part. Replace if necessary.
3. Check the pulleys for vibration in rotation, oil or dust deposit of V-ribbed part. Replace if necessary.

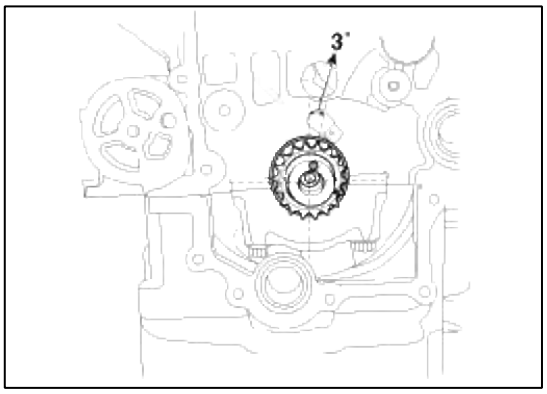
NOTE

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

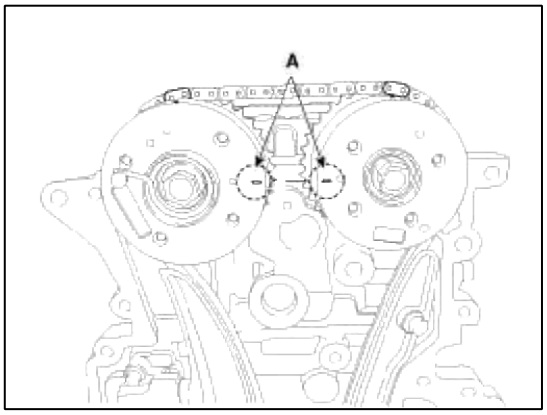
Installation

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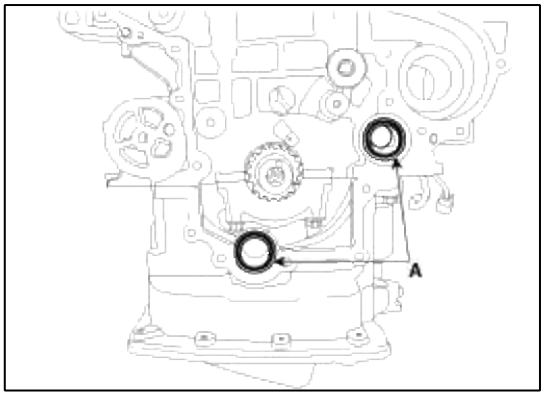
1. Dowel pin of crankshaft should be positioned at 3° in relation to vertical center line.



2. Align the TDC marks (A) of the CVVT sprockets with the upper surface of the cylinder head to make No.1 cylinder be positioned at TDC.



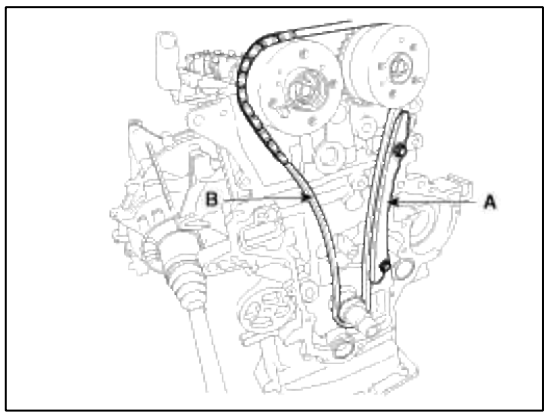
3. Install the new O-rings (A).



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4. Install the timing chain guide (A) and the timing chain (B).

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

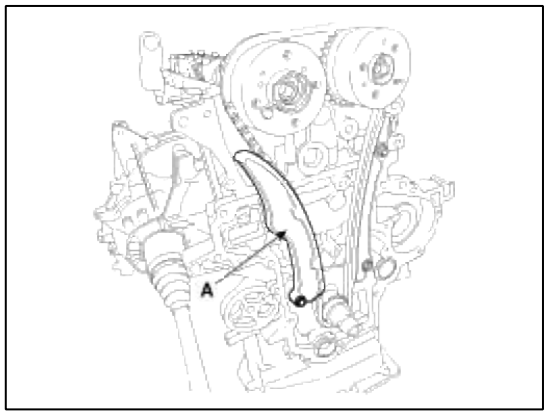


NOTE

When installing a timing chain, align the timing marks on the sprockets with paint marks of the chain.
Order : Crankshaft sprocket → Timing chain guide → Intake CVVT sprocket → Exhaust CVVT sprocket.

5. Install the chain tensioner arm (A).

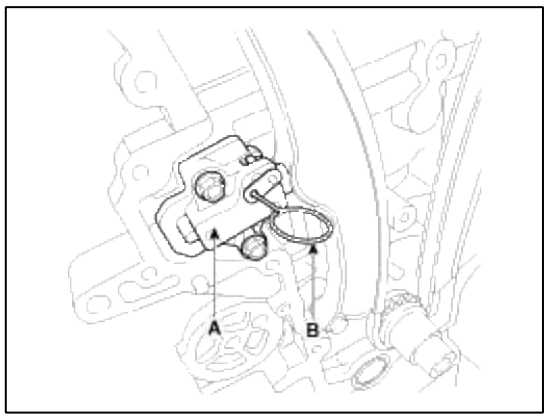
Tightening torque :
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)



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6. Install the hydraulic tensioner (A) and remove the pin (B).

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



NOTE

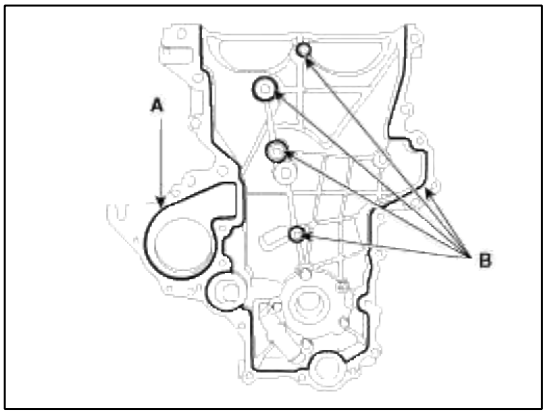
Recheck the top dead center (TDC) marks on the crankshaft and camshaft.

7. Install the timing chain cover.
   (1) Before installing, remove the hardened sealant from the cylinder block and ladder frame surface.
   (2) Apply the liquid gasket(TB 1217H or LOCTITE 5900H) on the surface between the cylinder head and the cylinder block.

Width : 3 ~ 5mm (0.1181~0.1969in.)

   (3) Apply the liquid gasket, THREE BOND 1282B or THREE BOND 1216E on the water pump contact parts (A) of the timing chain cover and THREE BOND 1217H or LOCTITE 5900H on the rest parts (B). Reassemble the cover within 5 minutes.

Width : 3.5 ~ 4.5 mm (0.1378 ~ 0.1772 in.)



CAUTION

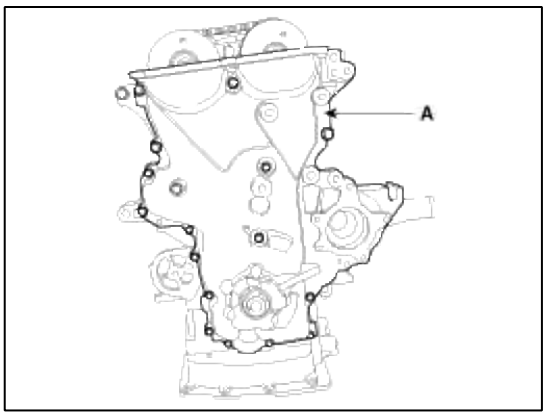
Remove oil or dust on the surface surely.

   (4) Align the dowel pin of the cylinder block and the holes of the oil pump.

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(5) Tighten the bolts to install the timing chain cover (A).

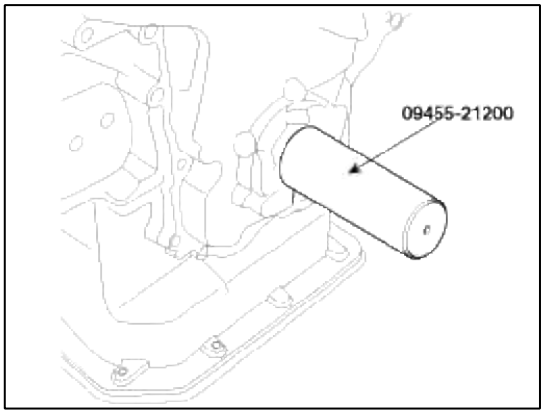
Tightening torque :
M8 bolts :
18.6 ~ 23.5 N.m (1.9 ~ 2.4 kgf.m, 13.7 ~ 17.4 lb-ft)
M6 bolts :
9.8 ~ 11.8 Nm (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)



CAUTION

After the installation, do not crank engine or apply pressure on the cover for half an hour.

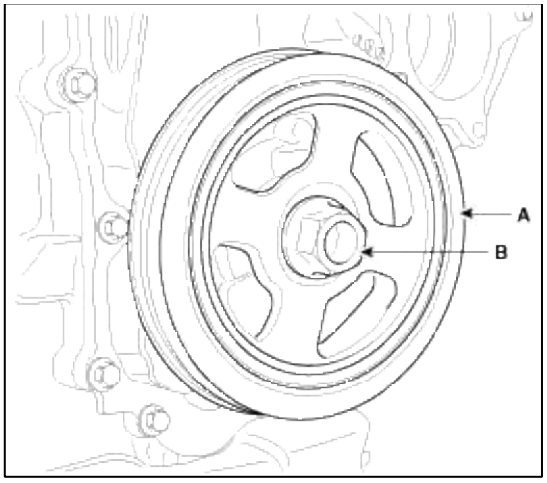
8. Using the SST(09455-21200), reassemble the timing chain cover oil seal.



9. Install the crankshaft pulley (A).

Tightening torque :
127.5 ~ 137.3 N.m (13.0 ~ 14.0 kgf.m, 94.0 ~ 101.3 lb-ft)

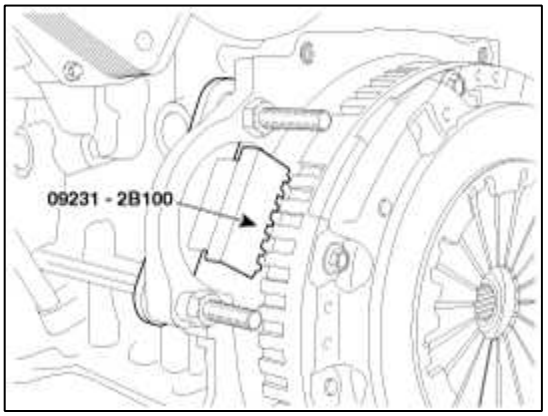
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NOTE

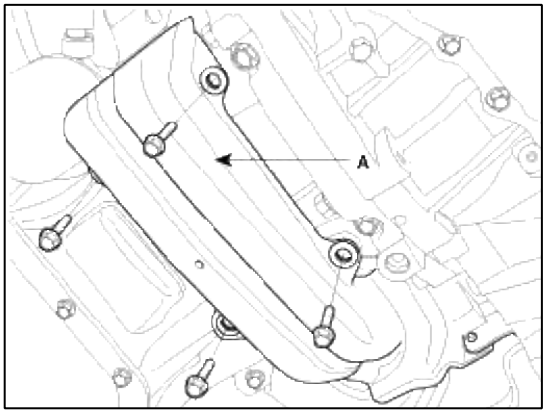
There are two methods to hold the ring gear when installing or removing the crankshaft damper pulley.

- Install the SST (09231-2B100) to hold the ring gear after removing the starter.

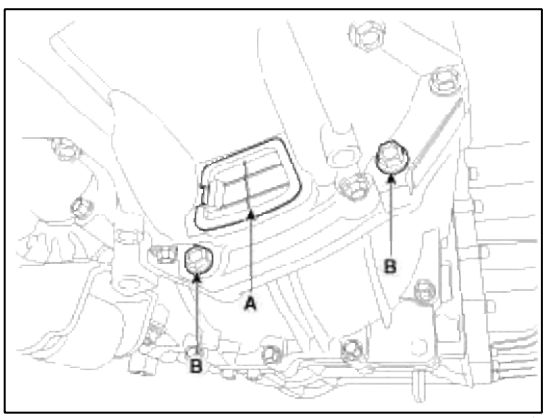


- Install the SST (09231-3D100) to hold the ring gear after removing the dust cover.

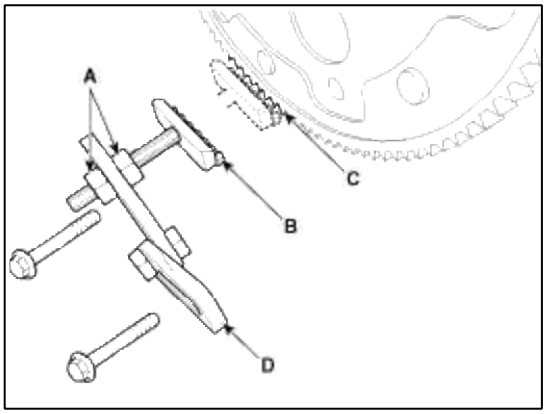
1. Remove the bracket (A).



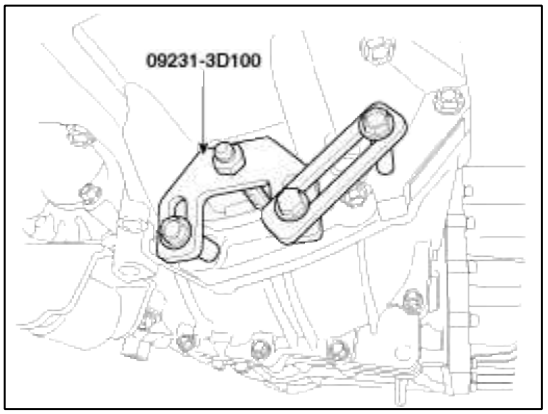
2. Remove the dust cover (A) and unfasten the transaxle mounting bolt (B).



3. Adjust the length of the holder nuts (A) so that the front plate of the holder (B) puts in the ring gear (C) teeth.
4. Adjust the angle of the links (D), and fasten the bolt 70mm(2.7559in) in the original mounted hole.

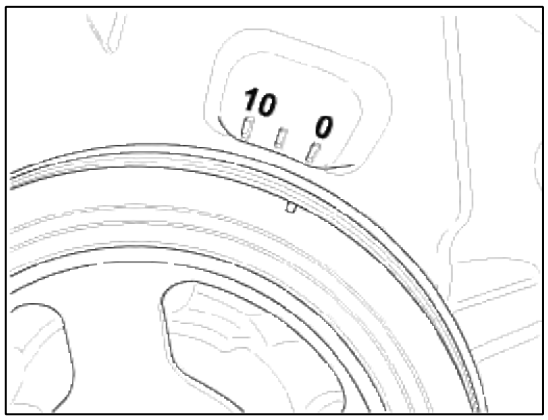


5. Tighten the bolts and nuts of the holder and links securely.



NOTE

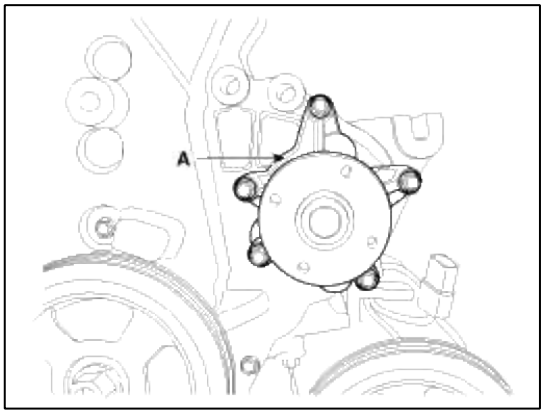
When installing the pulley, the groove on the pulley should be positioned outside.



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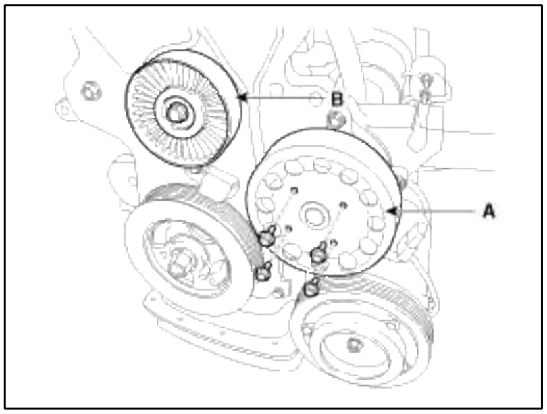
10. Install the water pump (A) with a gasket.

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



11. Install the water pump pulley (A) and the drive belt idler (B).

Tightening torque :
A: 9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)
B: 42.2 ~ 53.9 N.m (4.3 ~ 5.5 kgf.m, 31.1 ~ 39.8 lb-ft)



CAUTION

Tighten the bolts diagonally.

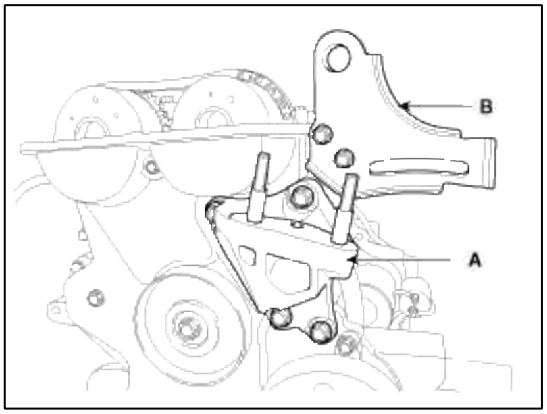
12. Install the engine support bracket (A).

Tightening torque :
29.4 ~ 41.2 N.m (3.0 ~ 4.2 kgf.m, 21.7 ~ 30.4 lb-ft)

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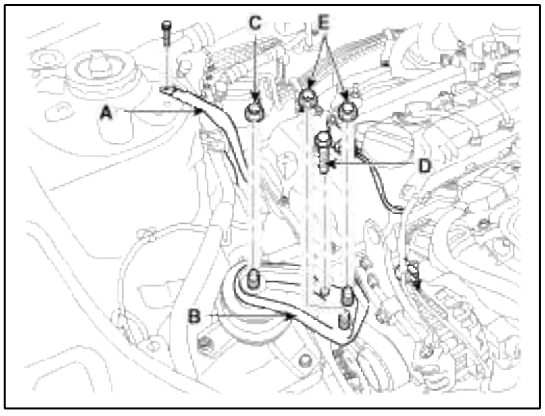
13. Install the alternator bracket (B).

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



14. Install the engine mounting support bracket (B) and then connect the ground line (A).

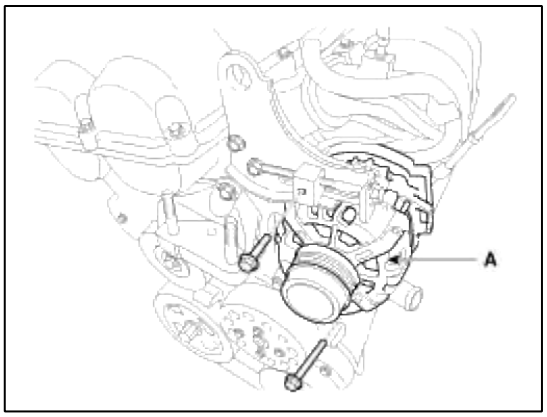
Tightening torque
Ground line bolt :
10.8 ~ 13.7 N.m (1.1 ~ 1.4 kgf.m, 8.0 ~ 10.1 lb-ft)
Nut (C) :
78.4 ~ 98.0N.m (8.0 ~ 10.0kgf.m, 57.8 ~ 72.3lb-ft)
Bolt (D) and nuts (E) :
58.8 ~ 73.5N.m (6.0 ~ 7.5kgf.m, 43.4 ~ 54.2lb-ft)



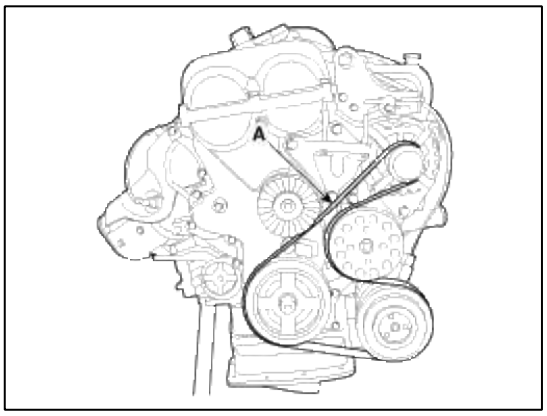
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15. Install the alternator (A).

Tightening torque :
M8 bolt :
19.6 ~ 26.5 N.m (2.0 ~ 2.7 kgf.m, 14.5 ~ 19.5 lb-ft)
M10 bolt :
29.4 ~ 41.2 N.m (3.0 ~ 4.2 kgf.m, 21.7 ~ 30.4 lb-ft)



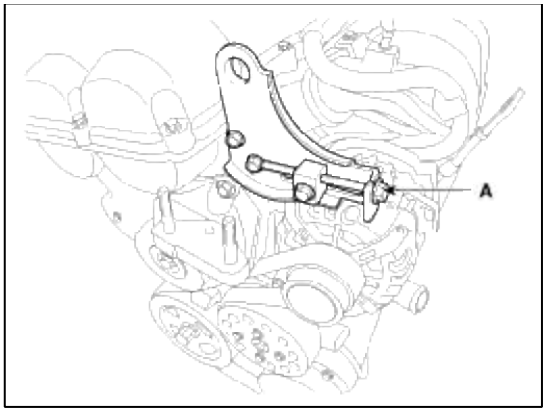
16. Install the drive belt (A).



17. Adjust tension by tightening the alternator tension adjust bolt (A).(Refer to Charging system in EE Group).

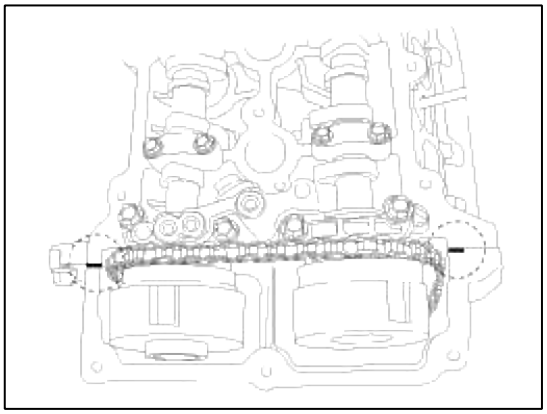
Tension
[With OAD]
New belt :637.4 ~ 735.5N (65 ~ 75kg, 143.3 ~ 165.3lb)
Used belt :490.3 ~ 588.4N (50 ~ 60kg, 110.2 ~ 132.3lb)
[Without OAD]
New belt: 882.6 ~ 980.7N (90 ~ 100kg, 198.4 ~ 220.5lb)
Used belt: 637.4 ~ 735.5N (65 ~ 75kg, 143.3 ~ 165.3lb)

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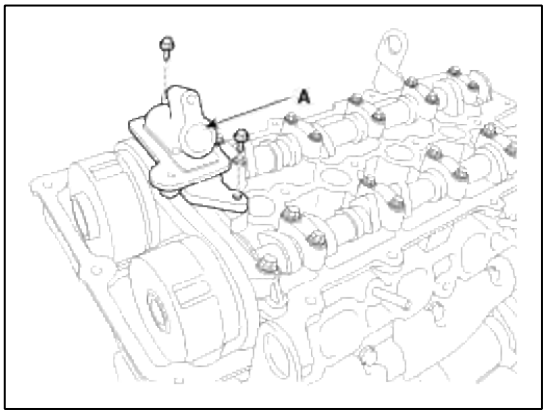
18. Before installing the cylinder head cover, remove oil, dust or hardened sealant from the timing chain cover and the cylinder head upper surface.
19. After applying the liquid gasket, THREE BOND 1217H or LOCTITE 5900H on the cylinder head cover, reassemble the cover within five minutes.

Width : 2.0 ~ 2.5mm(0.0787~0.0984in.)



20. Install the OCV (Oil Control Valve) adapter (A).

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

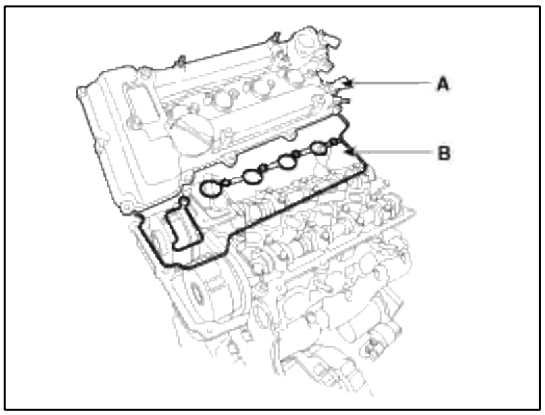


CAUTION

- Keep the OCV adapter clean.
- Make sure the O-rings on the front bearing cap are installed.

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21. Install the cylinder head cover (A) with a new gasket (B).

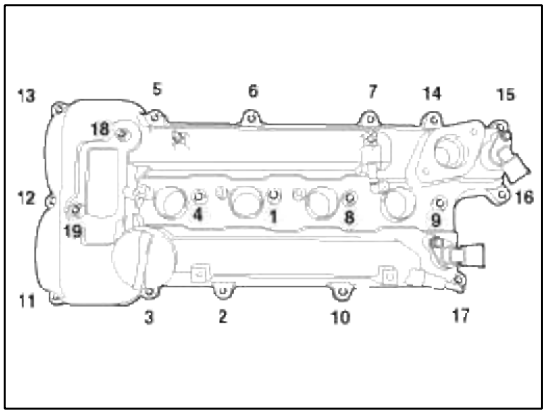


CAUTION

Do not reuse the disassembled gasket.

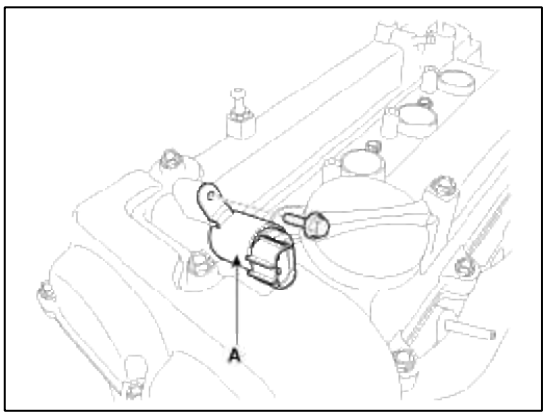
22. Tighten the cylinder head cover bolts with the order and steps.

Tightening torque :
1st step: 3.9 ~ 5.9 N.m (0.4 ~ 0.6 kgf.m, 2.9 ~ 4.3 lb-ft)
2nd step: 7.8 ~ 9.8 N.m (0.8 ~ 1.0 kgf.m, 5.8 ~ 7.2 lb-ft)



23. Install the exhaust OCV (Oil Control Valve) (A).

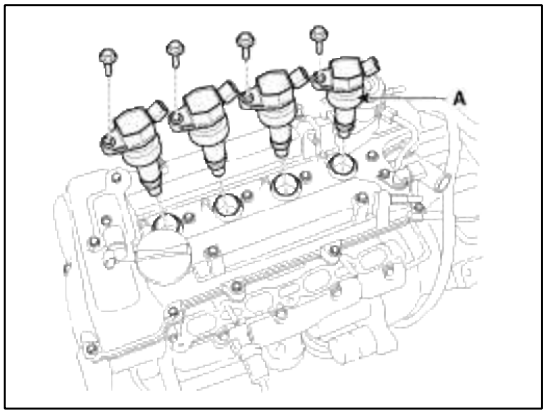
Tightening torque :
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)



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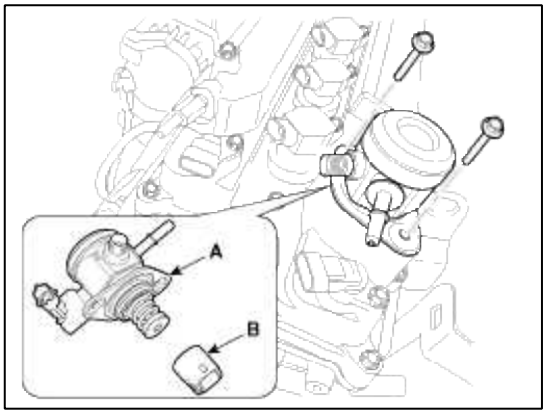
24. Install the ignition coils (A).

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



25. Install the high pressure fuel pump (A) and the roller tappet (B). (Refer to FL group)

Tightening torque :
12.7 ~ 14.7N.m (1.3 ~ 1.5kgf.m, 9.4 ~ 10.8lb-ft)



CAUTION

Before installing the high pressure fuel pump, position the roller tappet in the lowest position (BDC) by rotating the crankshaft. Otherwise the installation bolts may be broken because of tension of the pump spring.

NOTE

Do not use already used bolt again.

NOTE

When tightening the installation bolts of the high pressure fuel pump, tighten in turn the bolts in small step (0.5 turns) after tightening them with hand-screwed torque.

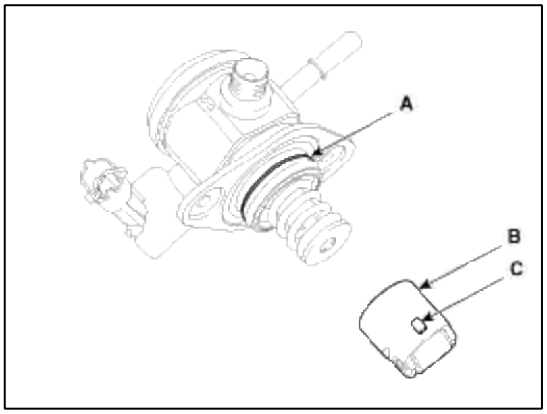
CAUTION

Note that internal damage may occur when the component is dropped. In this case, use it after inspecting.

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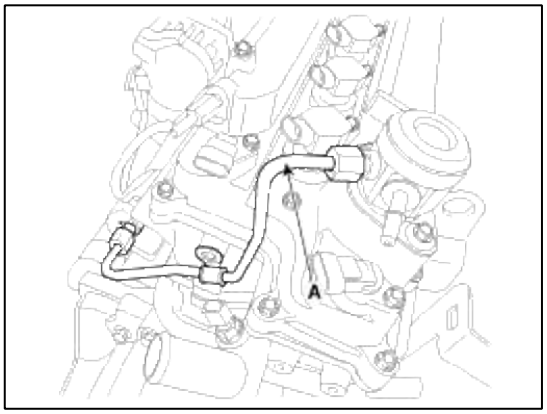
CAUTION

Apply engine oil to the O-ring (A) of the high pressure fuel pump, the roller tappet (B), and the protrusion (C). Also apply engine oil to the groove where the protrusion is installed.



26. Install the high pressure pipe (A). (Refer to FL group)

Tightening torque :
25.5 ~ 31.4N.m (2.6 ~ 3.2kgf.m, 18.8 ~ 23.1lb-ft)

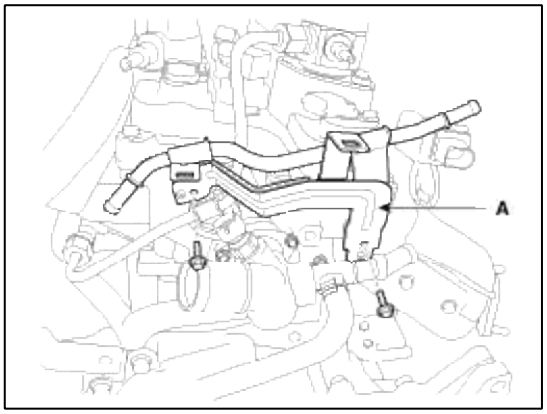


CAUTION

Do not reuse the high pressure pipe.

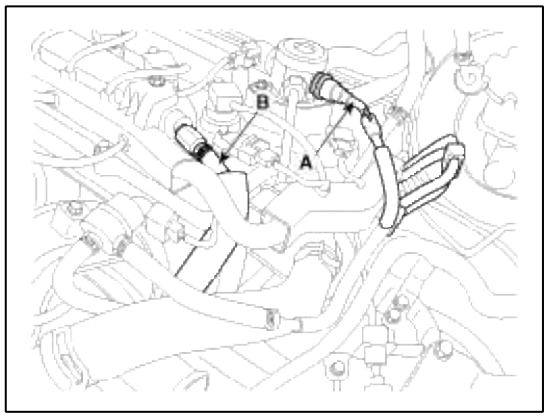
27. Install the vacuum pipe assembly (A).

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

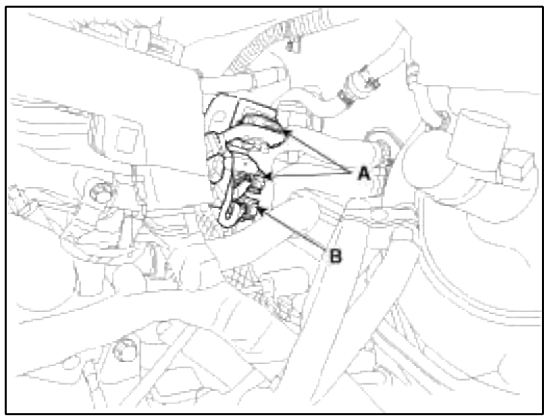


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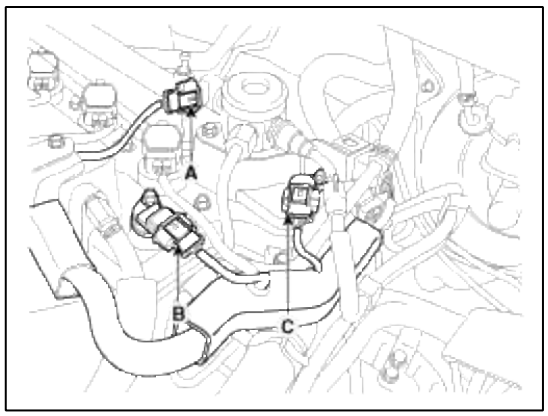
28. Connect the fuel hose (A) and the PCSV (Purge control solenoid valve) hose (B).



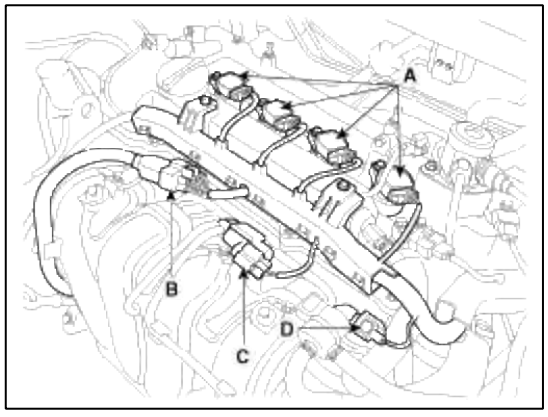
29. Connect the oxygen sensor connectors (A) and the condenser connector (B).



30. Connect the FPCV (Fuel pressure control valve) connector (A), the intake CMPS (Camshaft position sensor) connector (B) and the exhaust CMPS (Camshaft position sensor) connector (C).

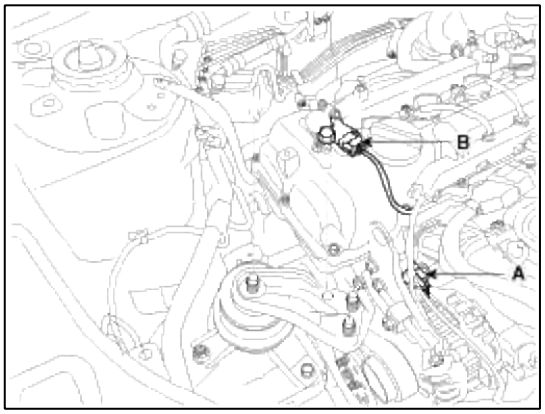


31. Connect the ignition coil connectors (A), the injector extension connector (B), the VIS (Variable intake system) connector (C) and the PCSV (Purge control solenoid valve) connector (D).



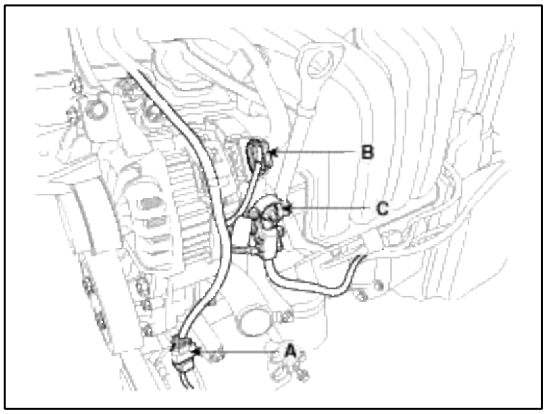
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32. Connect the intake OCV (Oil control valve) connector (A) and the exhaust OCV (Oil control valve) connector (B).



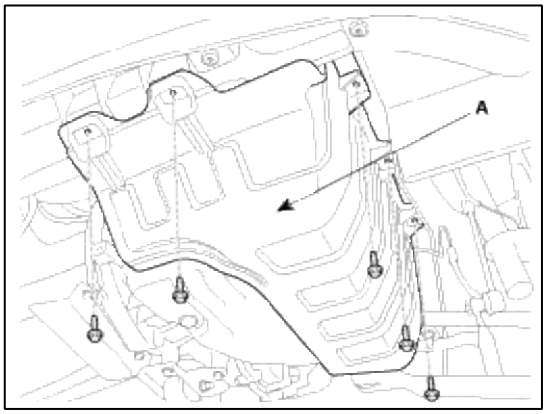
33. Connect the A/C compressor switch connector (A), the alternator connector (B) and the cable from the alternator “B” terminal (C).

Tightening torque :
9.8 ~ 14.7N.m (1.0 ~ 1.5kgf.m, 7.2 ~ 10.8lb-ft)

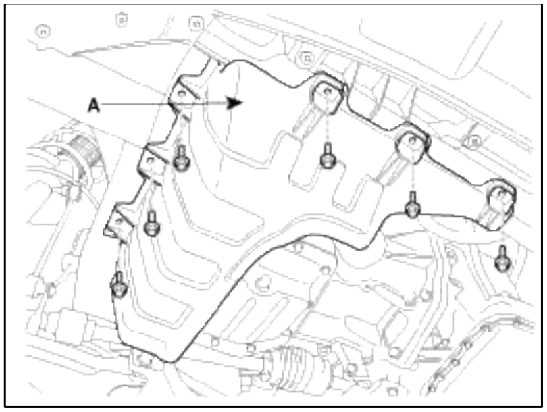


34. Install the under covers (A).

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



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35. Install the RH front wheel.

36. Install the air cleaner assembly.
    (1) Install the air cleaner assembly (D) and then connect the air intake hose.

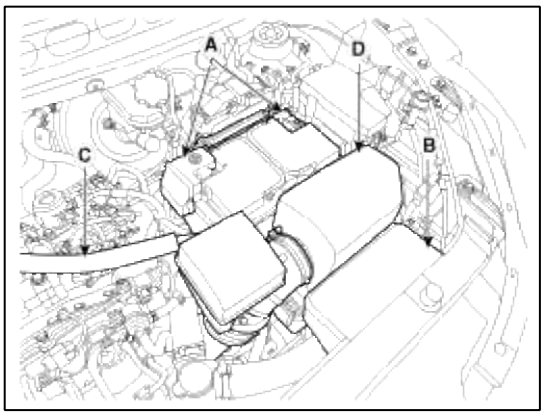
Tightening torque
Hose clamp bolt :
2.9 ~ 4.9N.m (0.3 ~ 0.5kgf.m, 2.2 ~ 3.6lb-ft)
Air cleaner assembly bolts :
7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)

    (2) Connect the breather hose (C).

    (3) Install the air duct (B).

    (4) Connect the battery negative terminal (A).

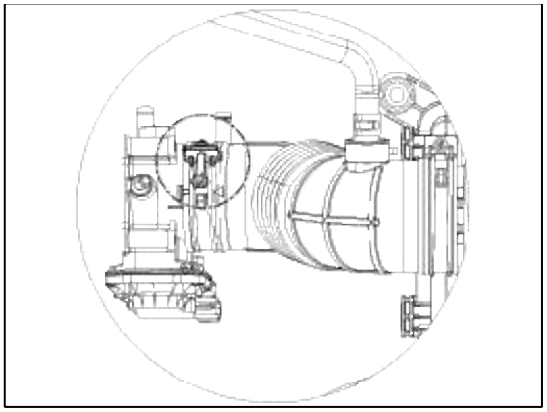
Tightening torque :
Without battery sensor :
7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)
With battery sensor :
4.0 ~ 6.0N.m (0.4 ~ 0.6kgf.m, 3.0 ~ 4.4lb-ft)



NOTE

- Install the air intake hose while the plate of the hose clamp must be in line with the stopper of the hose.
- Install the air intake hose while the groove of hose must be matched to the protrusion of the throttle body.

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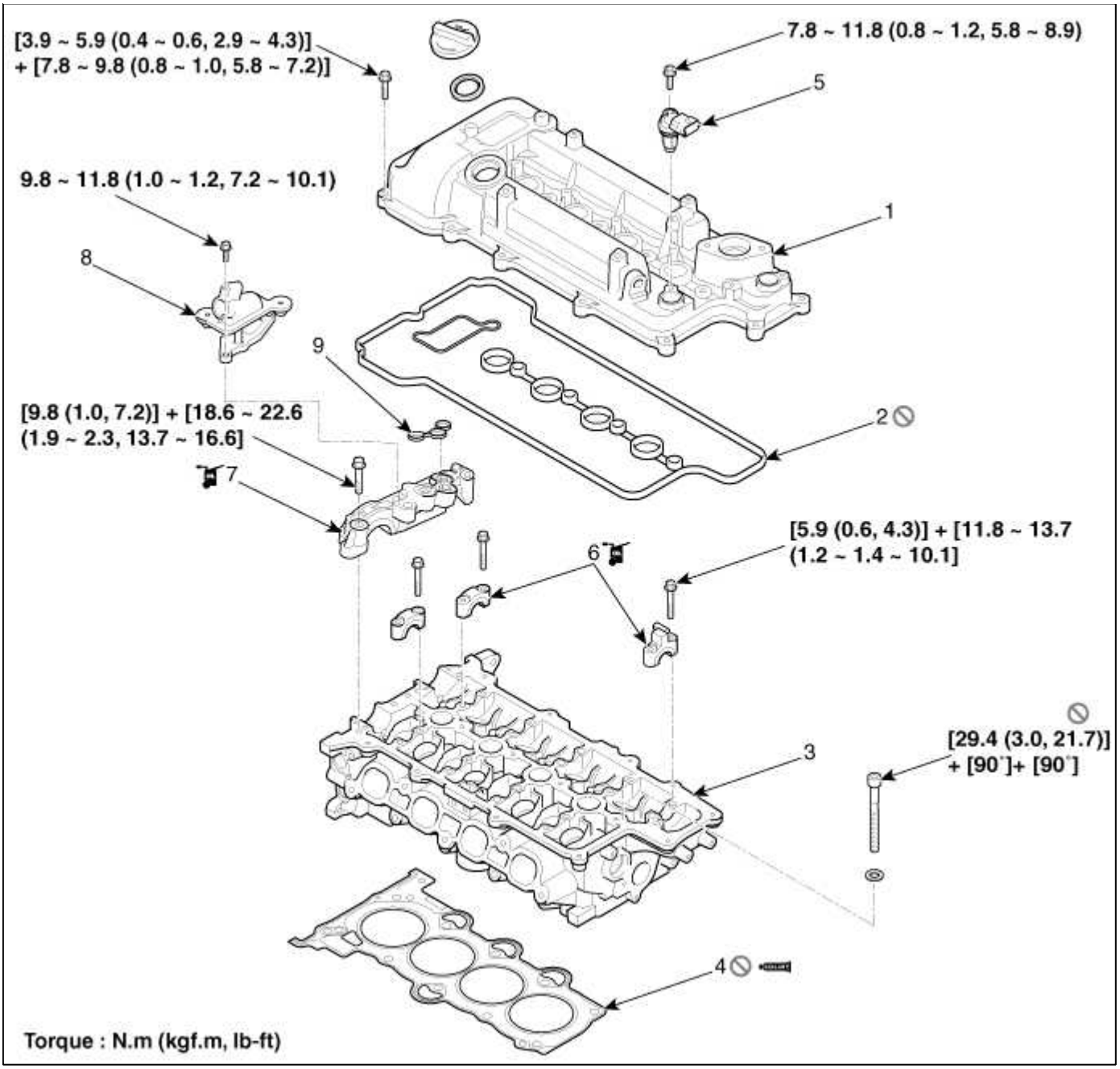
37. Install the engine cover.

> CAUTION
>
> Make sure the engine cover is installed before driving.

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

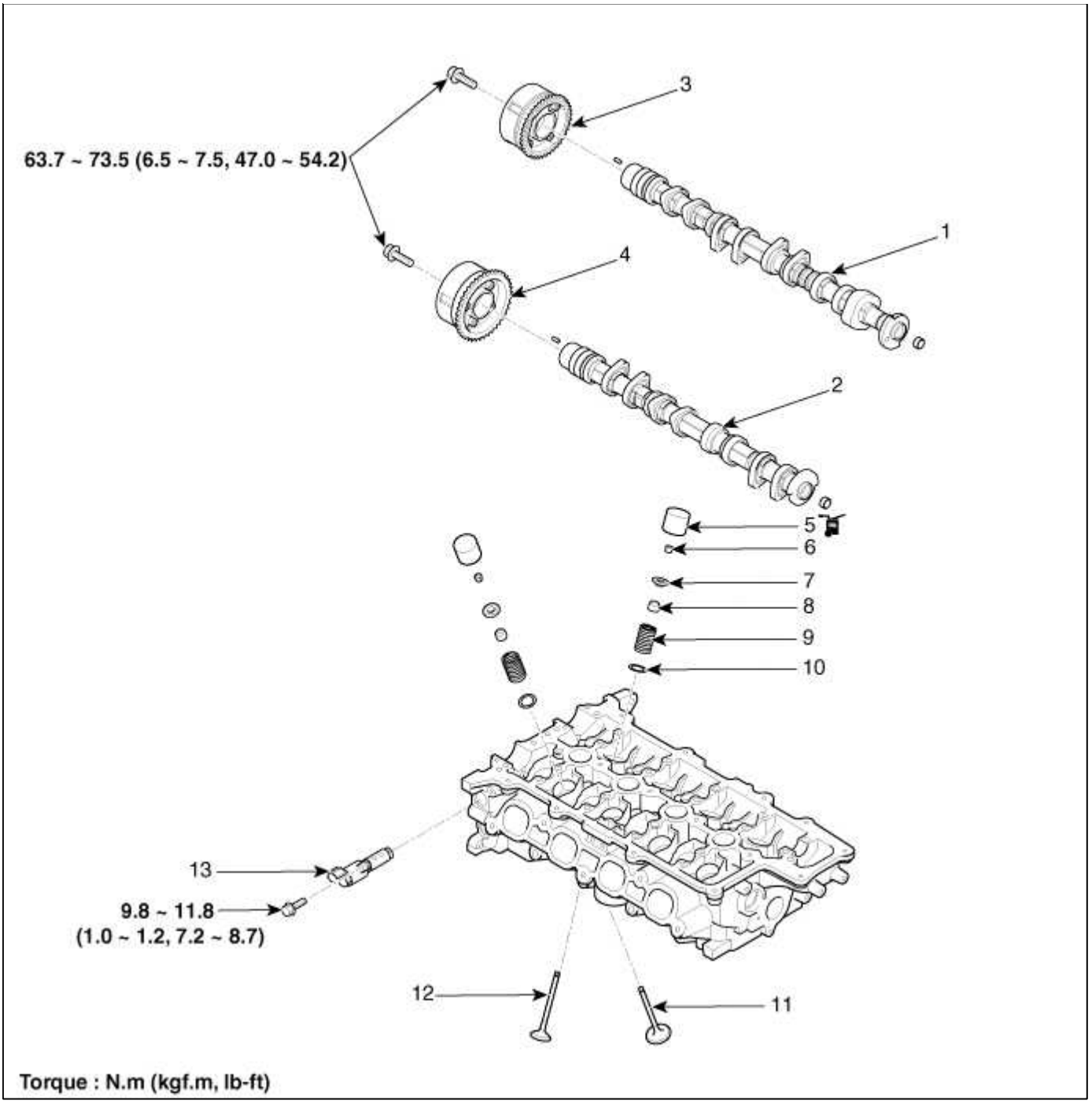
Components

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1. Cylinder head cover	6. Camshaft bearing cap
2. Cylinder head cover gasket	7. Camshaft front bearing cap
3. Cylinder head assembly	8. OCV (Oil Control Valve) adapter
4. Cylinder head gasket	9. O-ring
5. Camshaft position sensor	

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1. Exhaust camshaft	8. Valve stem seal
2. Intake camshaft	9. Valve spring
3. Exhaust CVVT assembly	10. Valve spring seat
4. Intake CVVT assembly	11. Intake valve
5. Mechanical Lash Adjuster (MLA)	12. Exhaust valve
6. Retainer lock	13. Oil Control Valve (OCV)
7. Retainer	

Engine Mechanical System > Cylinder Head Assembly > Cylinder Head > Repair procedures

Removal

Engine removal is not required for this procedure.

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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.

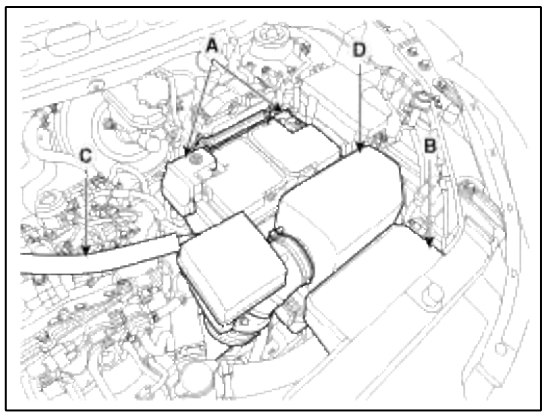
NOTE

Mark all wiring and hoses to avoid misconnection.

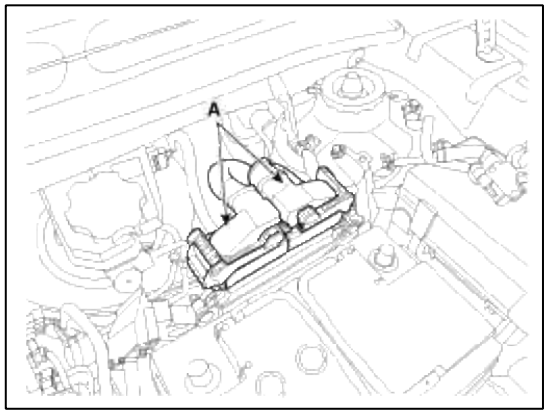
WARNING

In case of removing the high pressure fuel pump, high pressure fuel pipe, delivery pipe, and injector, there may be injury caused by leakage of the high pressure fuel. So don't do any repair work right after engine stops.

1. Remove the engine cover.
2. Disconnect the battery terminals (A).
3. Remove the air cleaner assembly.
   (1) Remove the air duct (B)
   (2) Disconnect the breather hose (C) and the air intake hose
   (3) Remove the air cleaner assembly (D)

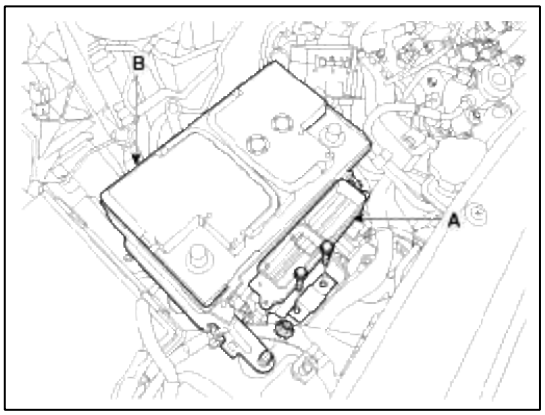


4. Disconnect the ECM connector (A).

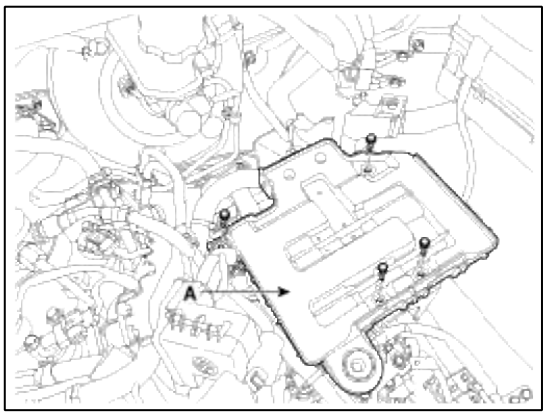


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5. Remove the ECM (A) and then remove the battery (B).

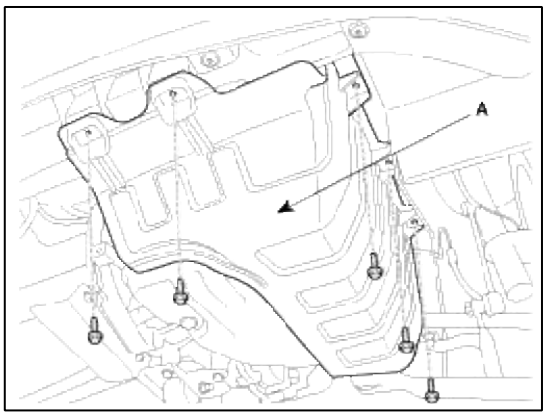


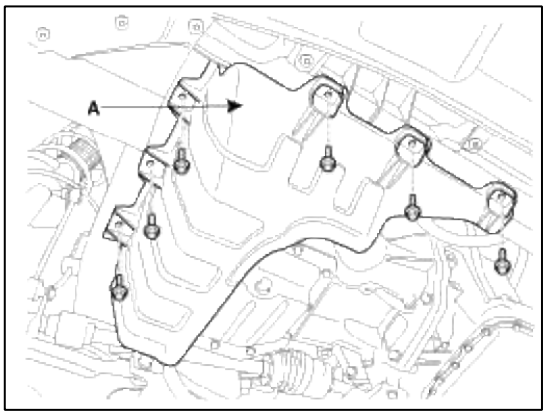
6. Remove the battery tray (A).



7. Remove the RH front wheel.

8. Remove the under covers (A).

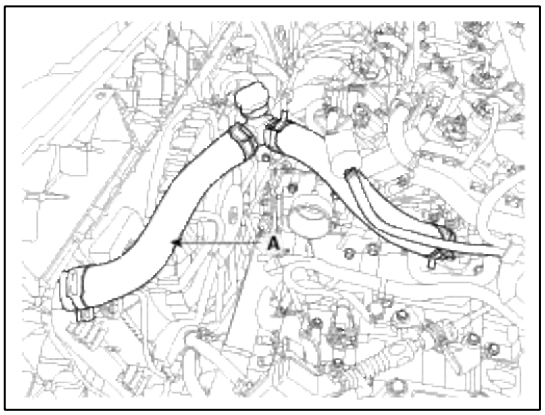


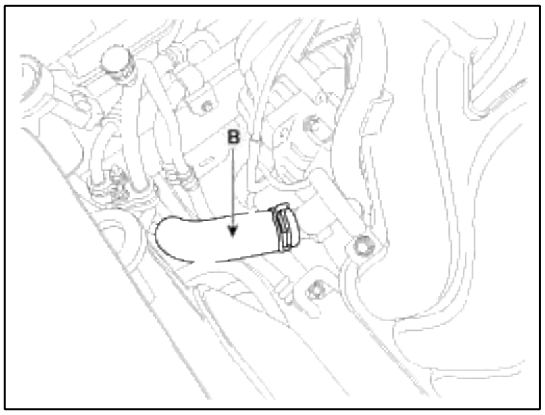


9. Loosen the drain plug, and drain the engine coolant. Remove the radiator cap to help drain the coolant faster. (Refer to Cooling system in this group)

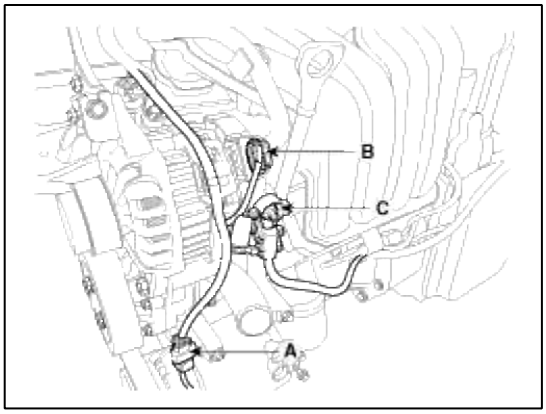
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10. Disconnect the radiator upper hose (A) and lower hose (B).

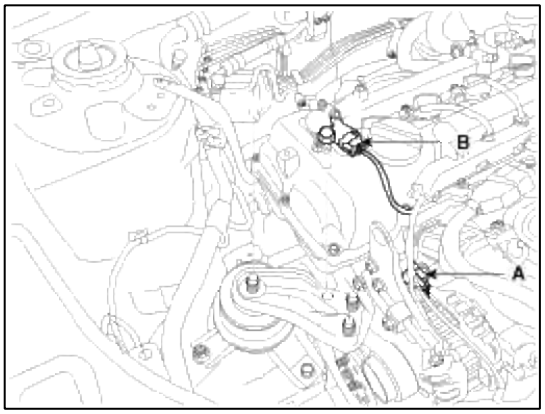




11. Disconnect the wiring connectors and harness clamps, and remove the wiring and protectors from the cylinder head and intake manifold.
    (1) The A/C compressor switch connector (A), the alternator connector (B) and the cable from the alternator "B" terminal (C)

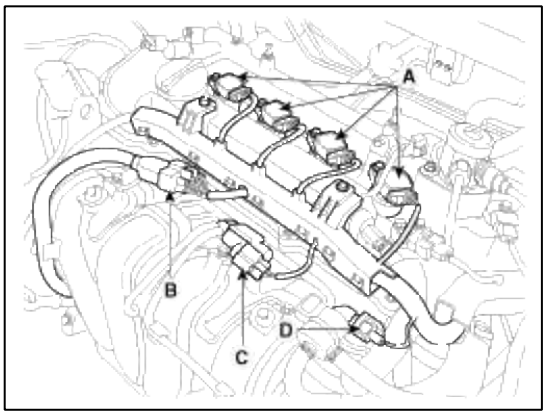


    (2) The intake OCV (Oil control valve) connector (A) and the exhaust OCV (Oil control valve) connector (B)

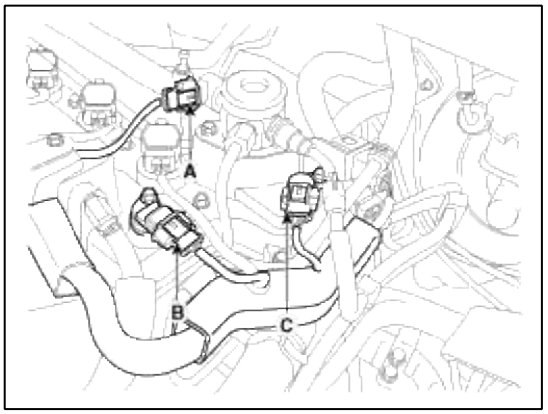


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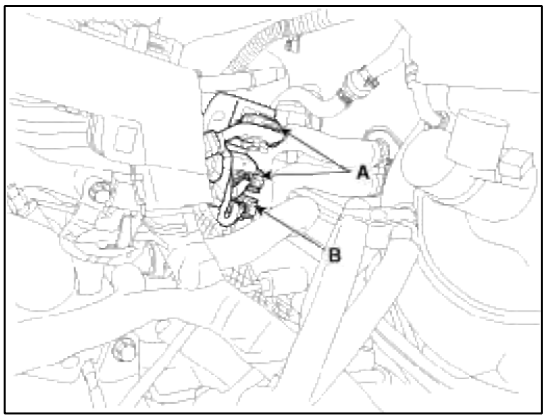
(3) The ignition coil connectors (A), the injector extension connector (B), the VIS (Variable intake system) connector (C) and the PCSV (Purge control solenoid valve) connector (D)



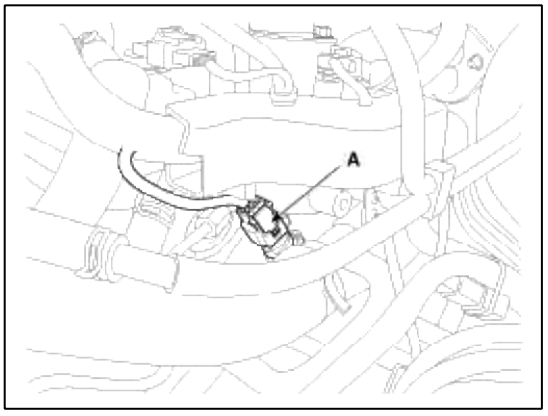
(4) The FPCV (Fuel pressure control valve) connector (A), the intake CMPS (Camshaft position sensor) connector (B) and the exhaust CMPS (Camshaft position sensor) connector (C)



(5) Disconnect the oxygen sensor connectors (A) and the condenser connector (B)

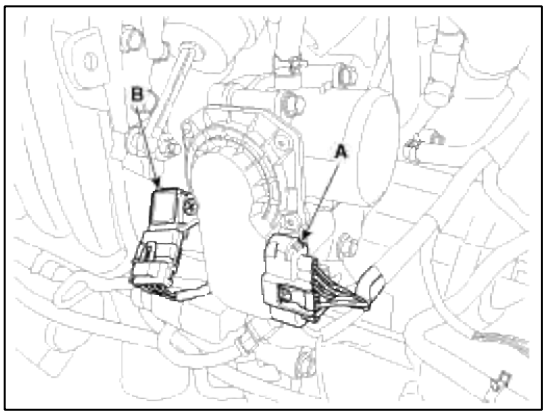


(6) The ECTS (Engine coolant temperature sensor) connector (A) and the ground line (B)

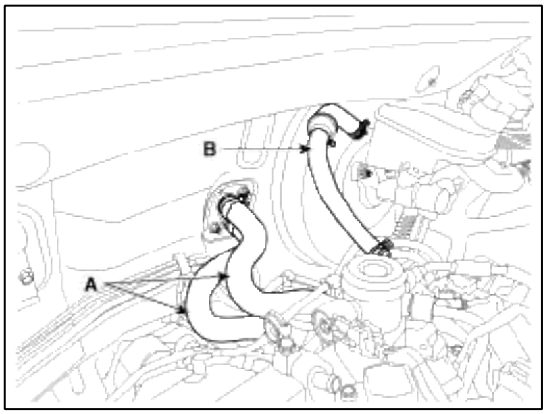


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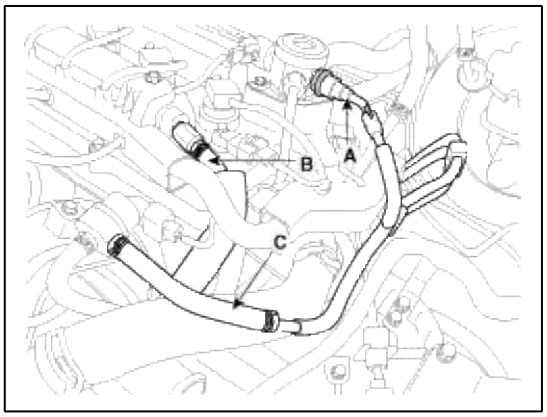
(7) The ETC (Electronic throttle control) connector (A) and the MAPS (Manifold absolute pressure sensor) & IATS (Intake air temperature sensor) connector (B)



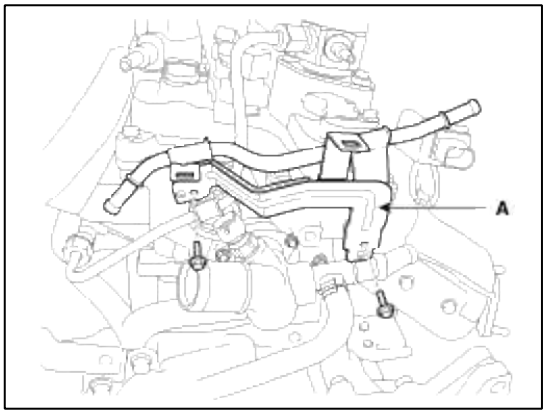
12. Disconnect the brake booster vacuum hose (B) and heater hose (A).



13. Disconnect the fuel hose (A), the PCV (Positive crankcase ventilation) hose (B) and the PCSV (Purge control solenoid valve) hose (C).

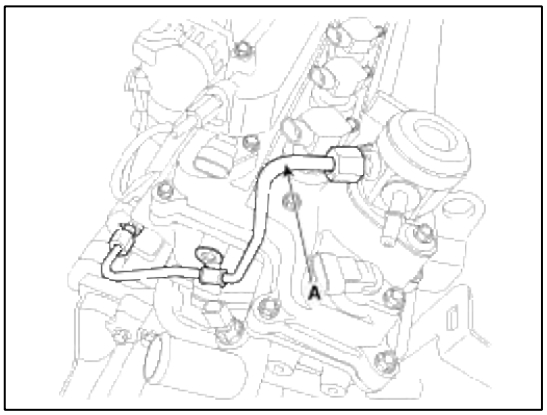


14. Remove the vacuum pipe assembly (A).

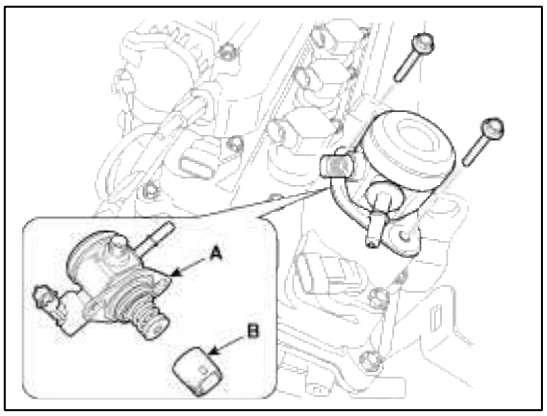


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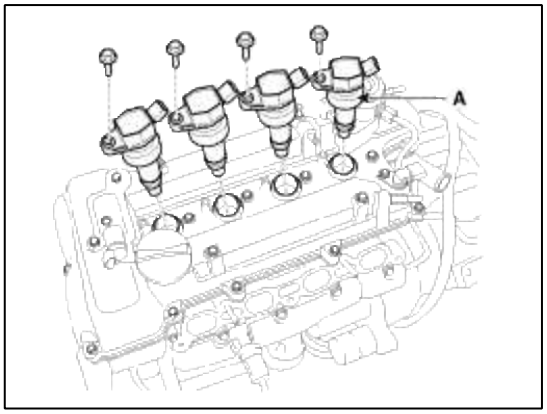
15. Remove the high pressure pipe (A). (Refer to FL group)



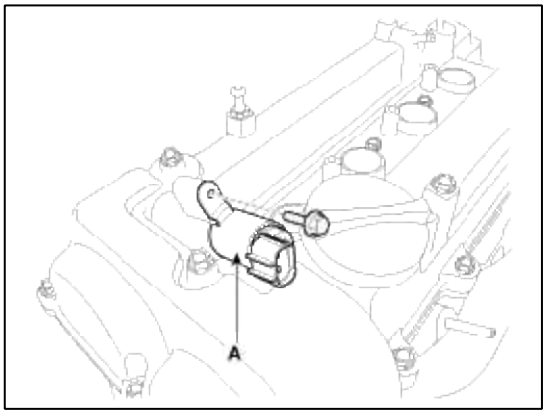
16. Remove the high pressure fuel pump (A) and the roller tappet (B). (Refer to FL group)



17. Remove the ignition coils (A).

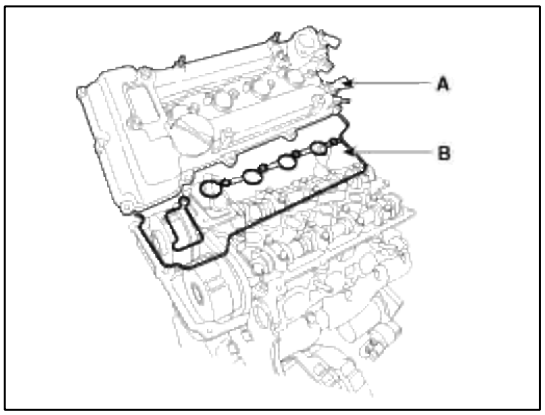


18. Remove the exhaust OCV (Oil control valve) (B).

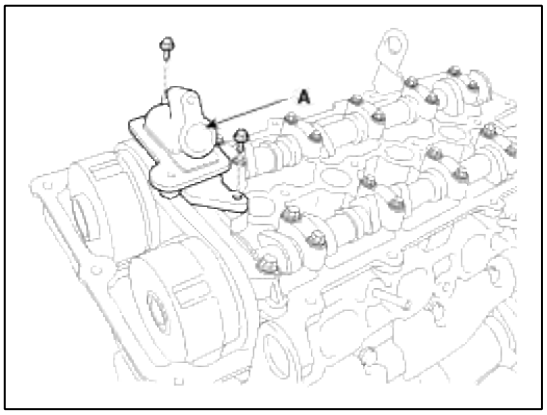


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19. Remove the cylinder head cover (A) with gaskets (B).



20. Remove the exhaust OCV (Oil control valve) adapter (A).

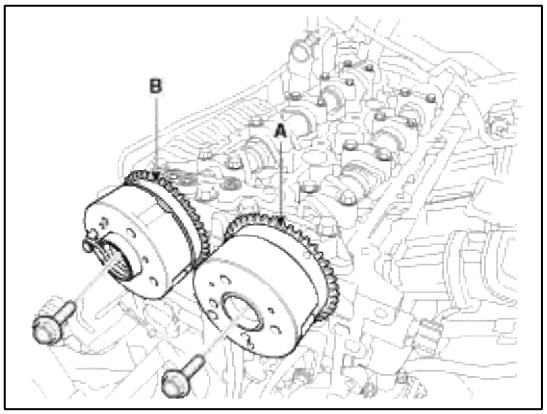


21. Remove the timing chain.
(Refer to Timing system in this group)

22. Remove the exhaust manifold assembly. (Refer to Intake and exhaust system in this group)

23. Remove the intake manifold module assembly. (Refer to Intake and exhaust system in this group)

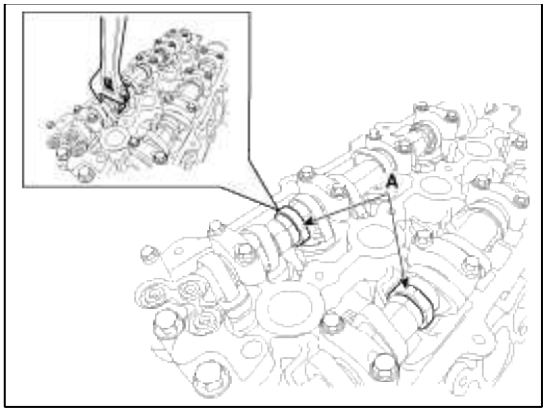
24. Remove the intake CVVT assembly (A) and exhaust CVVT assembly (B).



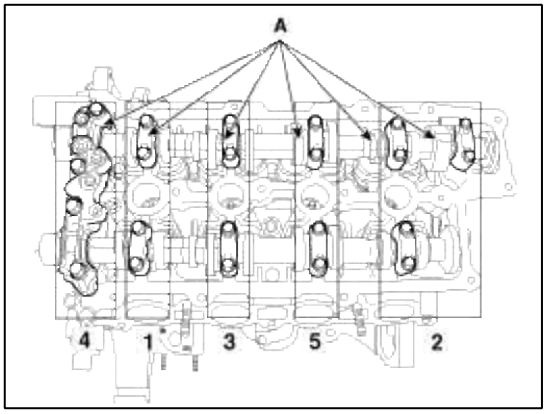
NOTE

When removing the CVVT assembly bolt, prevent the camshaft from rotating by using a wrench at position (A).

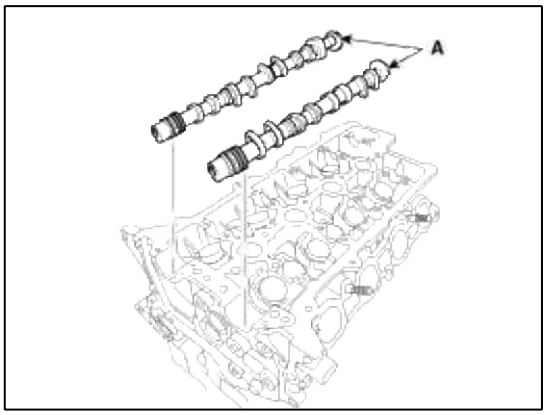
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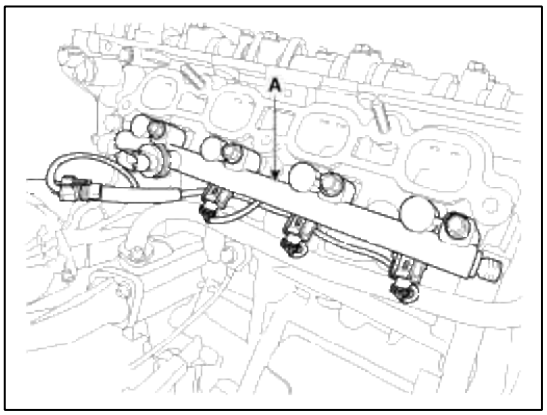
25. Remove the camshaft bearing caps (A) with the order below.



26. Remove the camshafts (A).

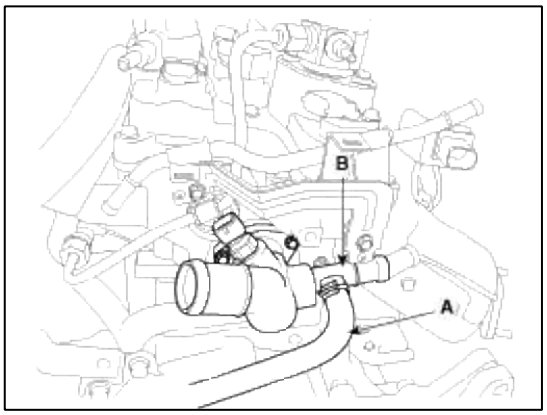


27. Remove the injector & rail assembly (A). (Refer to FL group)

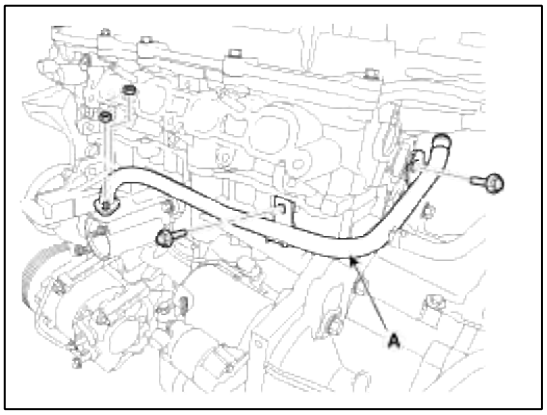


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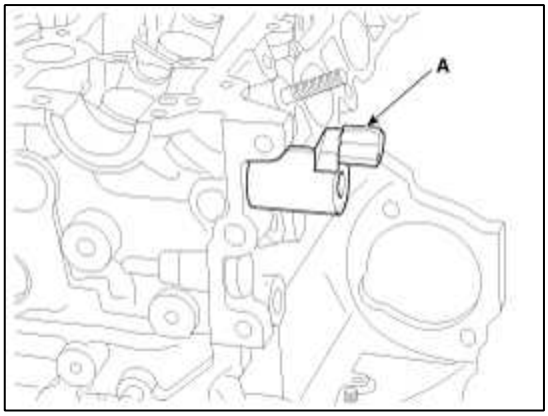
28. Remove the water temperature control assembly (B) after disconnecting the throttle body cooling hose (A).



29. Remove the heater pipe (A).

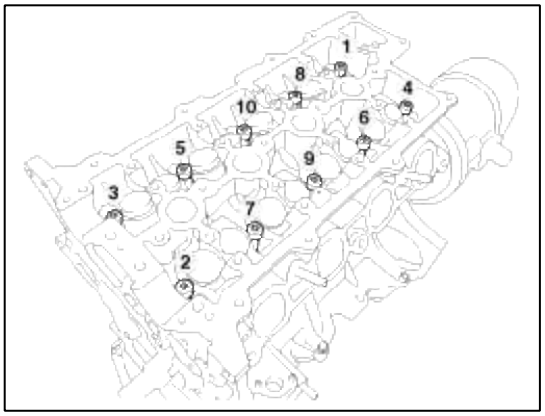


30. Remove the intake OCV (Oil Control Valve) (A).



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31. Remove the cylinder head bolts, then remove the cylinder head.
    (1) Uniformly loosen and remove the 10 cylinder head bolts, in several passes, in the sequence shown.



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

    (2) Lift the cylinder head from the cylinder block and put the cylinder head on wooden blocks.

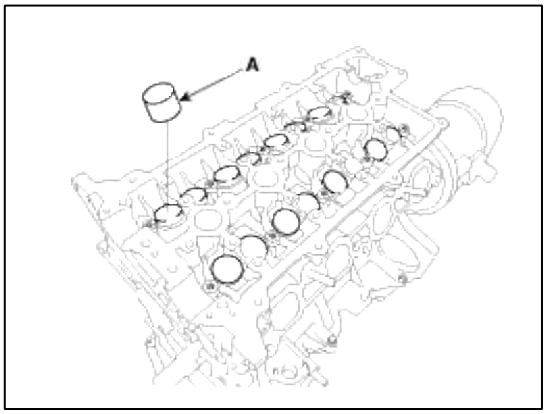
> CAUTION
>
> Be careful not to damage the contact surfaces of the cylinder head and cylinder block.

Disassembly

> NOTE
>
> Identify MLA(Mechanical lash adjuster), valves, valve springs as they are removed so that each item can be reinstalled in its original position.

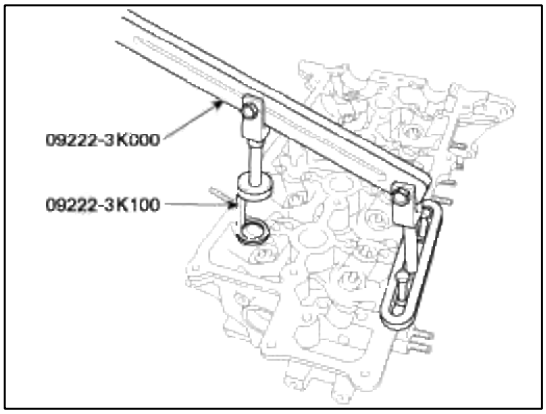
1. Remove the MLAs (A).

> CAUTION
>
> When removing MLAs, mark all the MLAs for their rearrangement.



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2. Remove the valves.
   (1) Using the SST (09222 - 3K000, 09222 - 3K100), compress the valve spring and remove the retainer lock.



   (2) Remove the spring retainer.
   (3) Remove the valve spring.
   (4) Remove the valve.
   (5) Remove the valve stem seal.
   (6) Using a magnetic pickup tool, remove the spring seat.

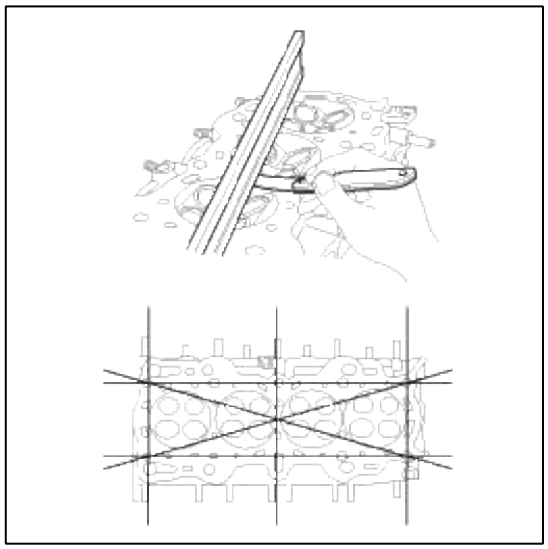
> CAUTION
>
> Do not reuse the valve stem seals.

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 0.05mm (0.0020in) for total area
Less than 0.02mm (0.0008in) for a section of 100mm (3.9370in) X 100mm (3.9370in)



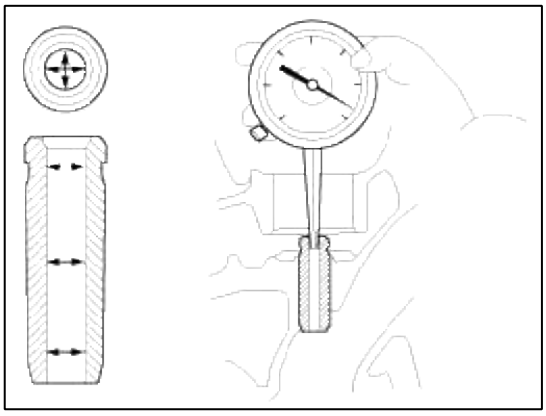
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2. Inspect for cracks.
   Check the combustion chamber, intake ports, exhaust ports and cylinder block surface for cracks. If cracked, replace the cylinder head.

Valve And Valve Spring

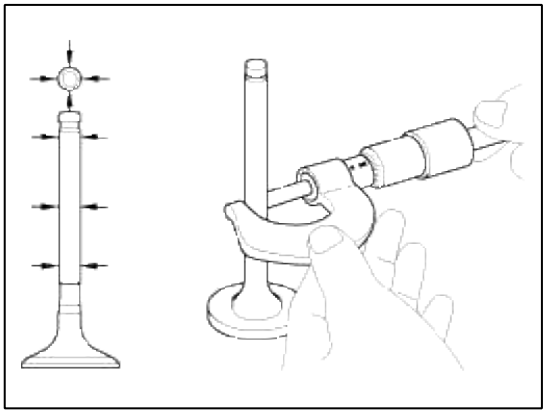
1. Inspect the valve stems and valve guides.
   (1) Using a caliper gauge, measure the inner diameter of valve guide.

Valve guide inner diameter :
5.500 ~ 5.512mm (0.2165 ~ 0.2170in)



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

Valve stem outer diameter
Intake : 5.465 ~ 5.480mm (0.2152 ~ 0.2157in)
Exhaust : 5.458 ~ 5.470mm (0.2149 ~ 0.2154in)



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

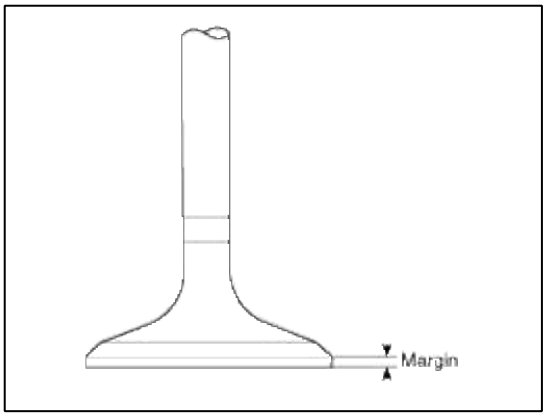
Valve stem- to-guide clearance
Intake : 0.020 ~ 0.047mm (0.0008 ~ 0.0019in)
Exhaust : 0.030 ~ 0.054mm (0.0012 ~ 0.0021in)

If the clearance is greater than specification, replace the valve or the cylinder head.

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

Margin
Standard
Intake : 1.10mm (0.0433in)
Exhaust : 1.26mm (0.0496in)



   (4) Check the length of valve.

Valve length
Standard
Intake : 93.15mm (3.6673 in)
Exhaust : 92.60mm (3.6457 in)

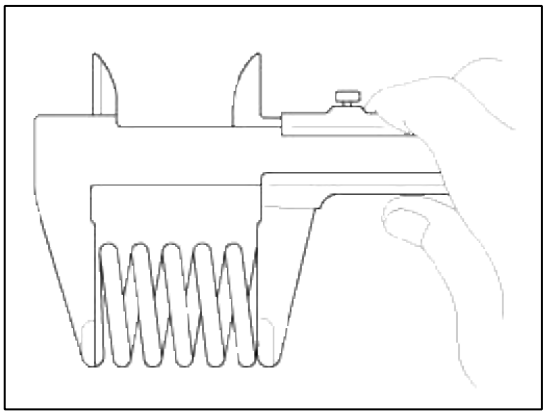
   (5) Check the surface of valve stem tip for wear.
   If the valve stem tip is worn, replace the valve.

3. Inspect the valve seats.
   (1) Check the valve seat for evidence of overheating and improper contact with the valve face. If the valve seat is worn, replace the cylinder head.
   (2) Check the valve guide for wear. If the valve guide is worn, replace the cylinder head.

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4. Inspect the valve springs.
   (1) Using a steel square, measure the out-of-square of valve spring.
   (2) Using a vernier calipers, measure the free length of valve spring.

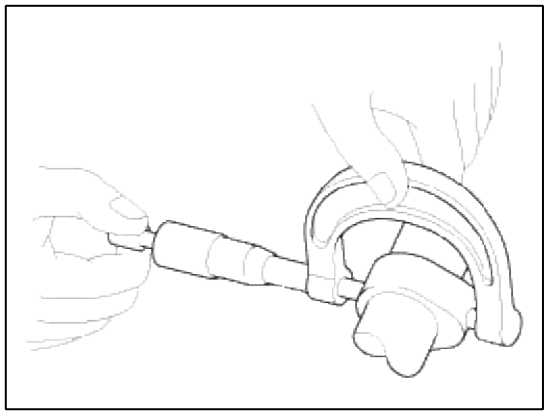
Valve spring
Standard
Free height : 45.1mm (1.7756in)
Out of square : Less than 1.5°



Camshaft

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

Cam height
Intake : 44.15mm (1.7382in)
Exhaust : 43.55mm (1.7146in)



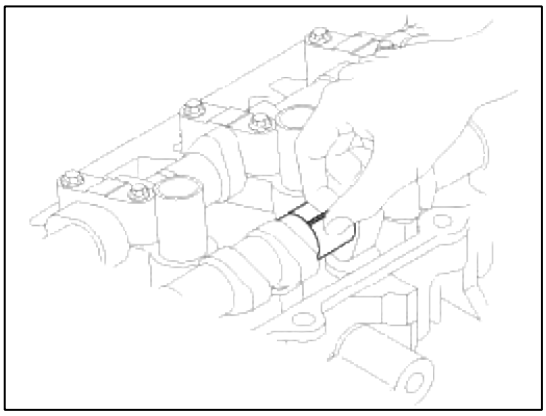
If the cam lobe height is less than specified, replace the camshaft.

2. Check the cranshaft journal for wear.
   If the journal is worn excessively, replace the camshaft.

3. Inspect the camshaft journal clearance.
   (1) Clean the bearing caps and camshaft journals.
   (2) Place the camshafts on the cylinder head.

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(3) Lay a strip of plastigage across each of the camshaft journal.



(4) Install the bearing caps and tighten the bolts with specified torque.

Tightening torque :
1st step
M6 bolt :
5.9 N.m (0.6 kgf.m, 4.3 lb-ft)
M8 bolt :
9.8 N.m (1.0 kgf.m, 7.2 lb-ft)
2nd step
M6 bolts :
11.8 ~ 13.7N.m (1.2 ~ 1.4kgf.m, 8.7 ~ 10.1lb-ft)
M8 bolts :
18.6 ~ 22.6N.m (1.9 ~ 2.3kgf.m, 13.7 ~ 16.6lb-ft)

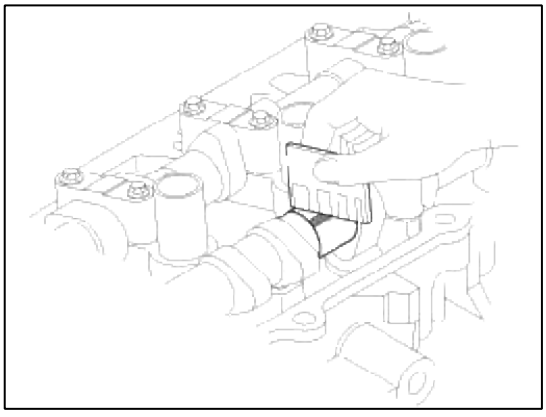
CAUTION

Do not turn the camshaft.

(5) Remove the bearing caps.

(6) Measure the plastigage at its widest point.

Bearing oil clearance
Standard : 0.027 ~ 0.058mm (0.0011 ~ 0.0023in)
Limit : 0.1mm (0.0039in)

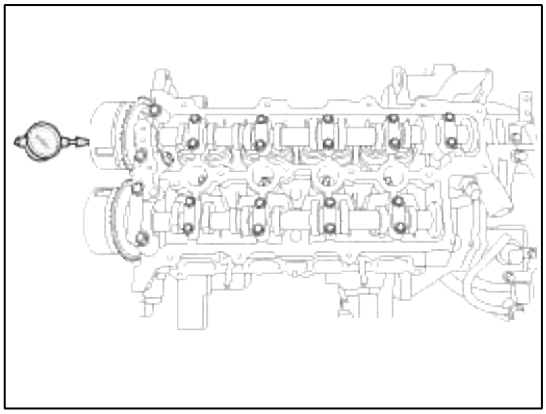


If the oil clearance is greater than specified, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.

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4. Inspect the camshaft end play.
   (1) Install the camshafts.
   (2) Using a dial indicator, measure the end play while moving the camshaft back and forth.

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

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

Continuous Variable Valve Timing (CVVT) Assembly

1. Inspect the Continuous variable valve timing (CVVT) assembly.
   (1) Fix the Continuous variable valve timing (CVVT) with its camshaft in a vice.
   (2) Check that the CVVT assembly will not turn. If it is not turned, it is in normal condition.
   (3) Apply vinyl tape to all the parts except the one hole.
   (4) Using an air gun, apply the pressure, 147.10kpa (1.5kg/cm², 21.33psi) in the hole. This makes the lock pin in maximum retarded state released.

   NOTE

   - Wrap around it with a shop rag, because the oil can splash out.
   - After releasing the pin, you can turn the CVVT assembly for advance by hand.
   - If there was too much air leakage, the pin can not be released.

   (5) Under the condition of 3), turn the CVVT assembly to the advance angle side with your hand.
   Depending on the air pressure, the CVVT assembly will turn to the advance side.
   Also, if the air pressure that was applied was insufficient because of the air leakage from the port, the lock pin may not release properly.
   (6) Except the position where the lock pin meets at the maximum delay angle, let the CVVT assembly turn back and forth and check the movable range and that there is no interference.

   Standard : Movable smoothly in the range about 25°

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

Reassembly

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NOTE

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

1. Install the valves.
   (1) Install the spring seats.
   (2) Using the SST (09222 - 2B100), push in a new oil seal.

   NOTE

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

   CAUTION

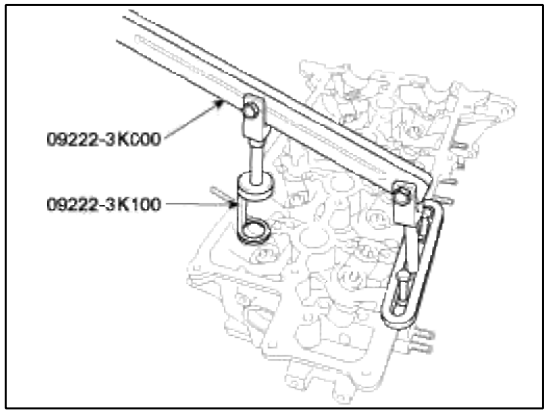
   Intake valve stem seals are different from exhaust ones in type. Do not reassembly ones in the other's places.

   (3) Install the valve, valve spring and spring retainer, after applying engine oil at the end of each valve.

   NOTE

   When installing valve springs, the enamel coated side should face the valve spring retainer.

2. Using the SST(09222 - 3K000, 09222 - 3K100), compress the spring and install the retainer locks.
   After installing the valves, ensure that the retainer locks are correctly in place before releasing the valve spring compressor.



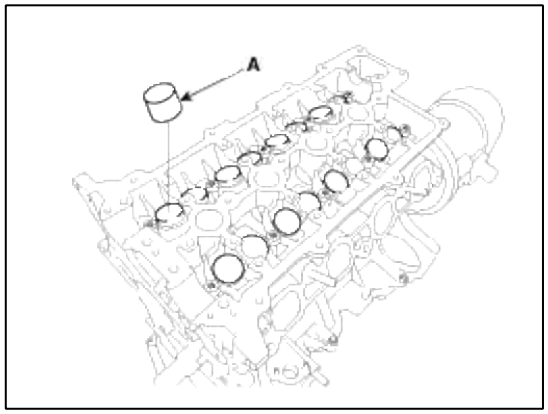
   CAUTION

   When installing the SST, use the torque, 1.2kgf.m or less.

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

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4. Install the MLA(Mechanical lash adjuster)s.
   Check that the MLA (A) rotates smoothly by hand.



NOTE

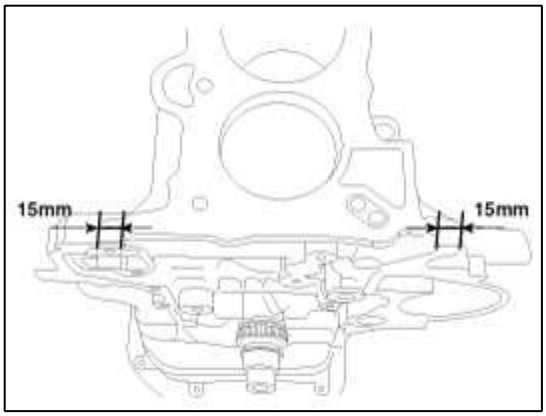
All the MLAs should be installed in its original position.

Installation

NOTE

- Thoroughly clean all parts to be assembled.
- Always use a new cylinder head and manifold gasket.
- Always use a new cylinder head bolt.
- The cylinder head gasket is a metal gasket. Take care not to bend it.
- Rotate the crankshaft, set the No.1 piston at TDC.

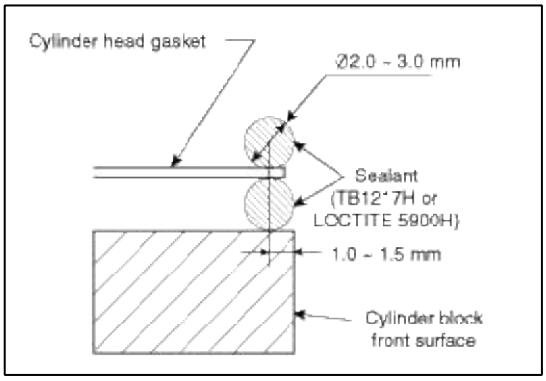
1. Install the cylinder head assembly.
   (1) Before installing, remove the hardened sealant from the cylinder block and cylinder head surface.
   (2) Before installing the cylinder head gasket, apply sealant on the upper surface of the cylinder block and reassemble the gasket within five minutes.



NOTE

Refer to the illustration for applying sealant.

Width : 2.0 ~ 3.0mm(0.0787~0.1181in.)
Position : 1.0 ~ 1.5mm(0.0394~0.0591in.)
Specification : TB 1217H or LOCTITE 5900H

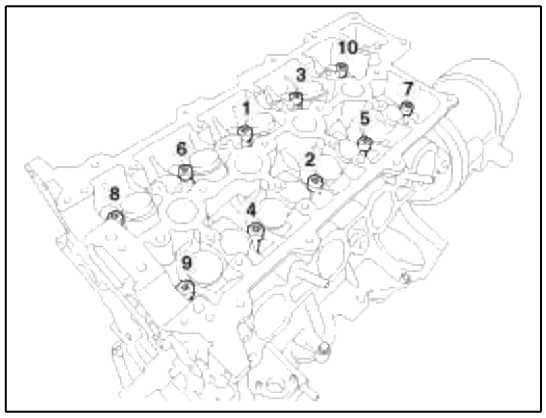


(3) After installing the cylinder head gasket on the cylinder block, apply sealant on the upper surface of the cylinder head gasket and reassemble in five minutes.

2. Place the cylinder head carefully not to damage the gasket.

3. Install the cylinder head bolts with washers.
   (1) Tighten the 10 cylinder head bolts, in several passes, in the sequence shown.

Tightening torque :
29.4Nm (3.0kgf.m, 21.7lb-ft) + 90° + 90°

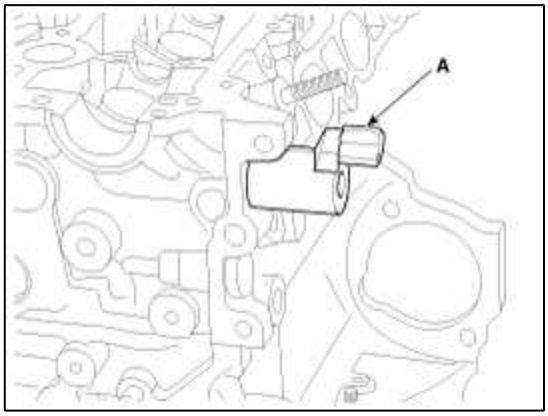


CAUTION

Always use new cylinder head bolts.

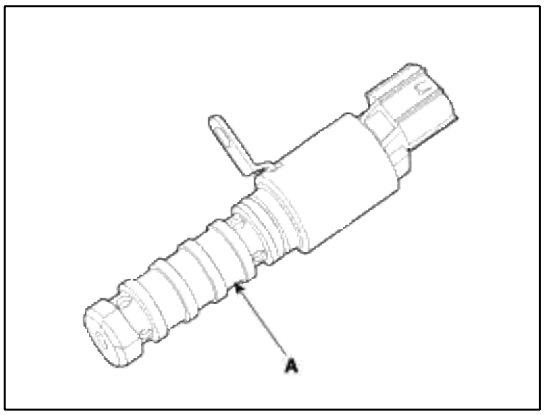
4. Install the oil control valve (OCV) (A).

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



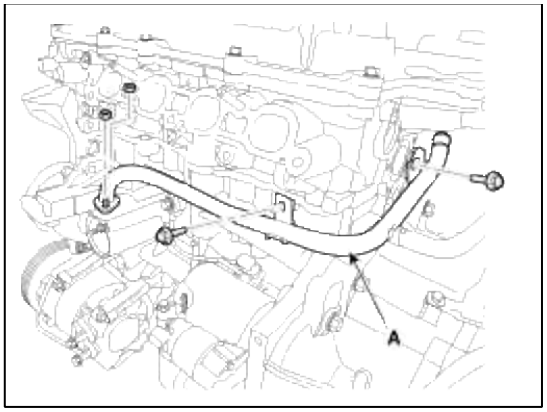
CAUTION

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



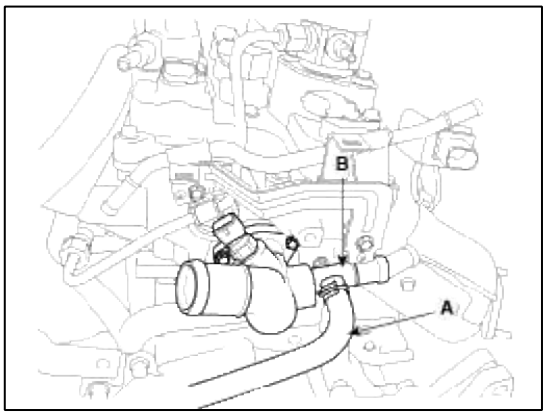
5. Install the heater pipe (A).

Tightening torque
M6 bolt and nuts :
9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)
M8 bolts :
18.6 ~ 23.5N.m (1.9 ~ 2.4kgf.m, 13.7 ~ 17.4lb-ft)



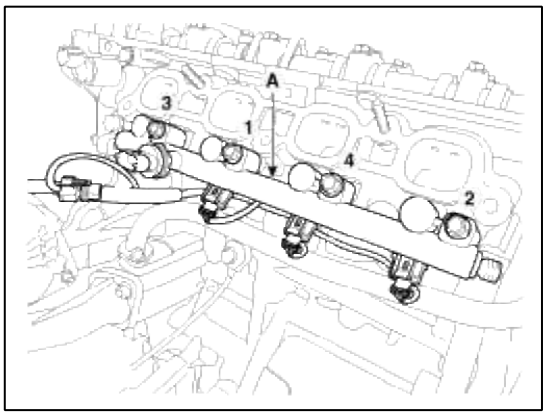
6. Install the water temperature control assembly (A) after connecting the throttle body cooling hose (A).

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



7. Install the injector & rail assembly (A).

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

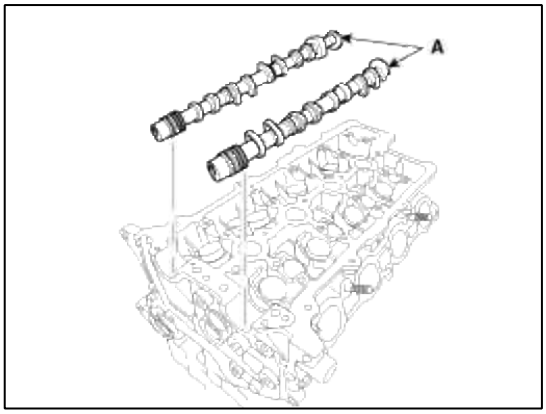


8. Install the intake and exhaust manifold.
(Refer to Intake and Exhaust system in this group)

9. Install the camshafts (A).
   (1) Before installing, apply engine oil on journals.

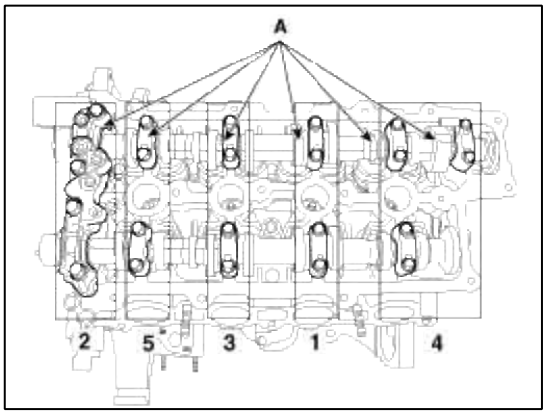
> CAUTION
>
> Do not make oil flow down to the front side of the cylinder head.

   (2) After installing, check the valve clearance.



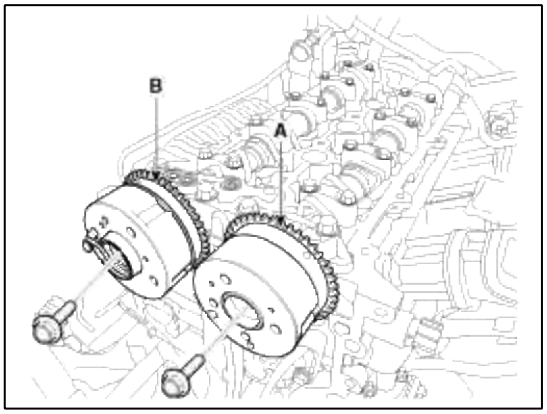
10. Install the camshaft bearing caps with the order below.

Tightening torque
1st step
M6 bolt :
5.9 N.m (0.6 kgf.m, 4.3 lb-ft)
M8 bolt :
9.8 N.m (1.0 kgf.m, 7.2 lb-ft)
2nd step
M6 bolts :
11.8 ~ 13.7N.m (1.2 ~ 1.4kgf.m, 8.7 ~ 10.1lb-ft)
M8 bolts :
18.6 ~ 22.6N.m (1.9 ~ 2.3kgf.m, 13.7 ~ 16.6lb-ft)



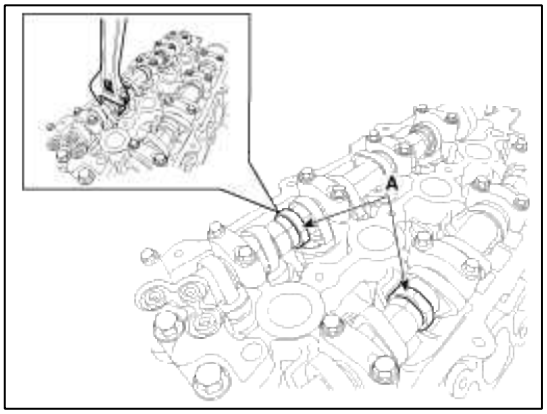
11. Install the intake CVVT assembly (A) and exhaust CVVT assembly (B).

Tightening torque :
63.7 ~ 73.5N.m (6.5 ~ 7.5kgf.m, 47.0 ~ 54.2lb-ft)



NOTE

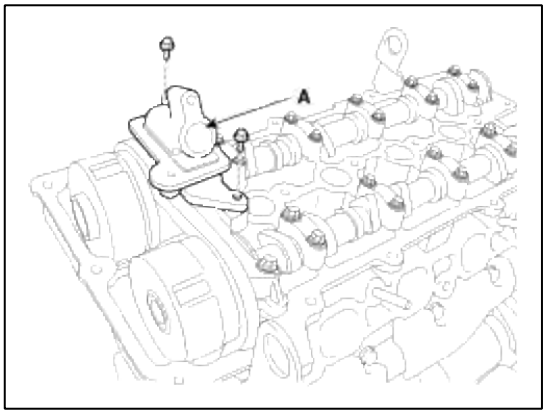
When installing the CVVT assembly bolt, prevent the camshaft from rotating by using a wrench at position (A).



12. Install the timing chain.
(Refer to Timing system in this group)

13. Install the OCV (Oil Control Valve) adapter (A).

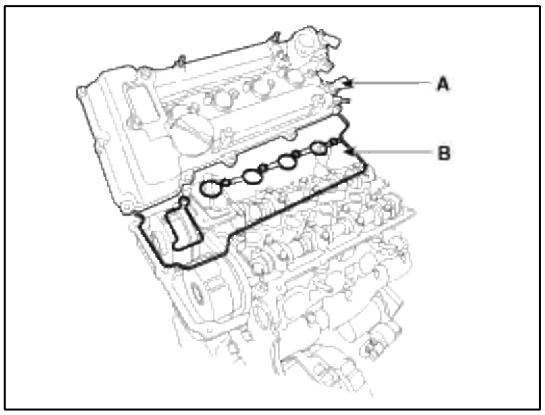
Tightening torque :
9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)



CAUTION

- Keep the OCV adapter clean.
- Make sure the O-rings on the front bearing cap are installed.

14. Install the cylinder head cover (A) with a new gasket (B).

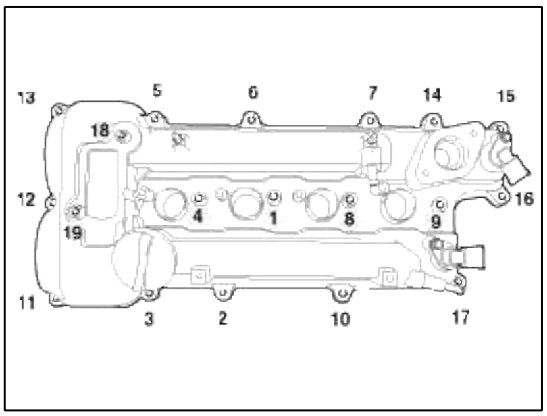


CAUTION

Do not reuse the disassembled gasket.

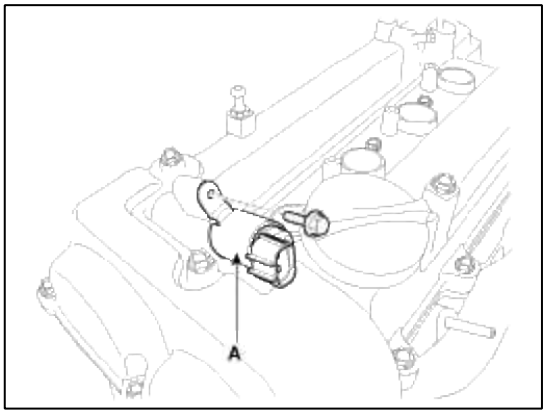
15. Tighten the cylinder head cover bolts (A) with the order and steps.

Tightening torque :
1st step: 3.9 ~ 5.9 N.m (0.4 ~ 0.6 kgf.m, 2.9 ~ 4.3 lb-ft)
2nd step: 7.8 ~ 9.8 N.m (0.8 ~ 1.0 kgf.m, 5.8 ~ 7.2 lb-ft)



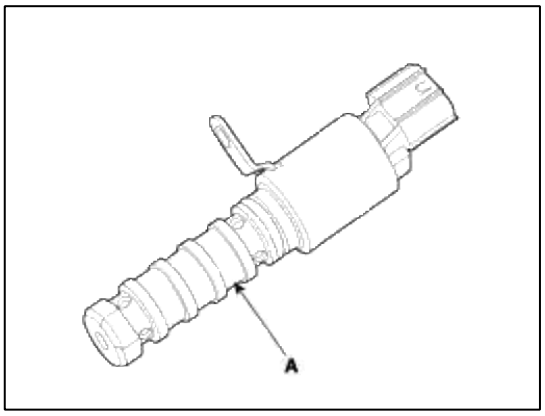
16. Install the exhaust OCV (Oil control valve) (A).

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



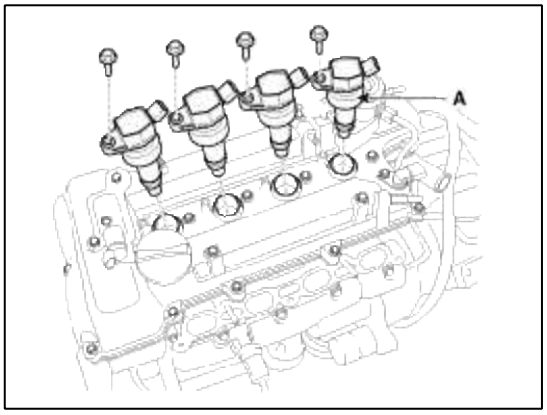
CAUTION

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



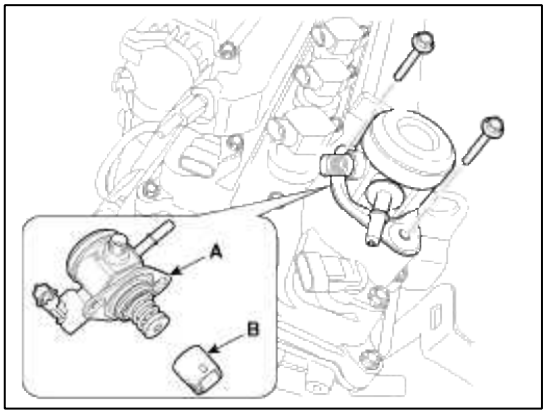
17. Install the ignition coils (A).

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



18. Install the high pressure fuel pump (A) and the roller tappet (B). (Refer to FL group)

Tightening torque :
12.7 ~ 14.7N.m (1.3 ~ 1.5kgf.m, 9.4 ~ 10.8lb-ft)



CAUTION

Before installing the high pressure fuel pump, position the roller tappet in the lowest position (BDC) by rotating the crankshaft. Otherwise the installation bolts may be broken because of tension of the pump spring.

NOTE

Do not use already used bolt again.

NOTE

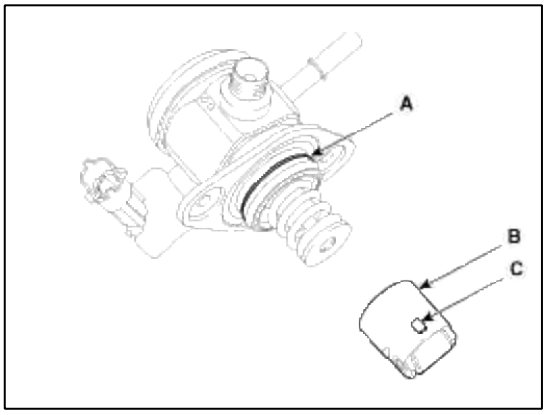
When tightening the installation bolts of the high pressure fuel pump, tighten in turn the bolts in small step (0.5 turns) after tightening them with hand-screwed torque.

CAUTION

Note that internal damage may occur when the component is dropped. In this case, use it after inspecting.

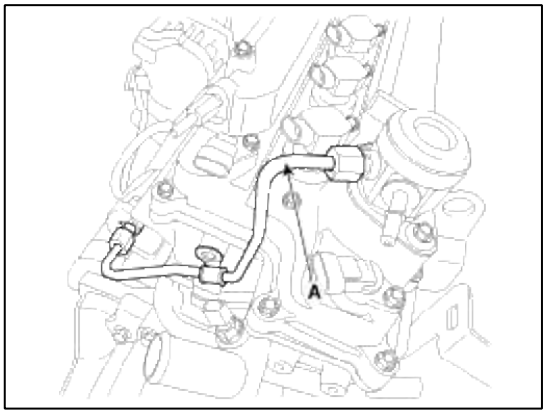
CAUTION

Apply engine oil to the O-ring (A) of the high pressure fuel pump, the roller tappet (B), and the protrusion (C). Also apply engine oil to the groove where the protrusion is installed.



19. Install the high pressure pipe (A). (Refer to FL group)

Tightening torque :
25.5 ~ 31.4N.m (2.6 ~ 3.2kgf.m, 18.8 ~ 23.1lb-ft)

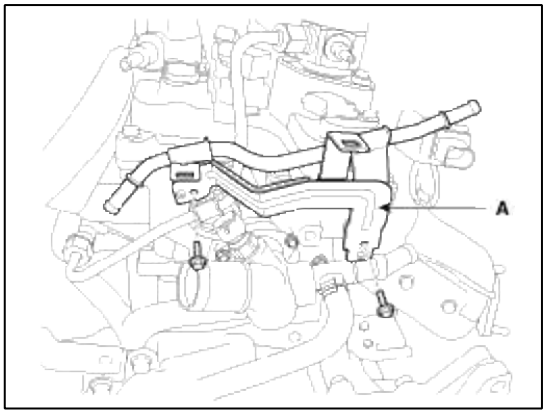


CAUTION

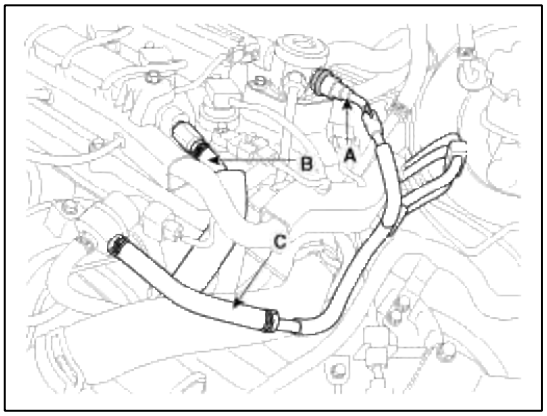
Do not reuse the high pressure pipe.

20. Install the vacuum pipe assembly (A).

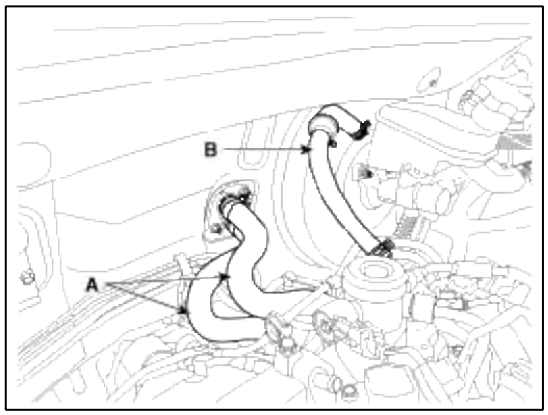
Tightening torque :
9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)



21. Connect the fuel hose (A), the PCV (Positive crankcase ventilation) hose (B) and the PCSV (Purge control solenoid valve) hose (C).

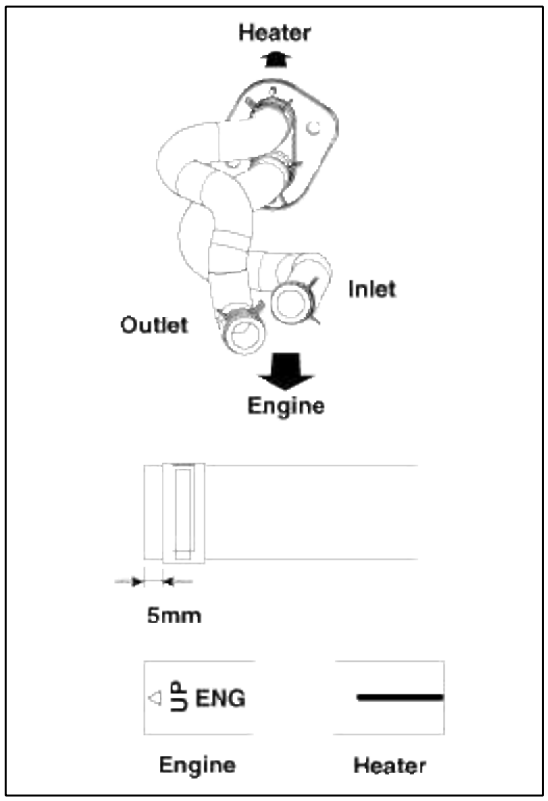


22. Connect the brake booster vacuum hose (B) and heater hose (A).



NOTE

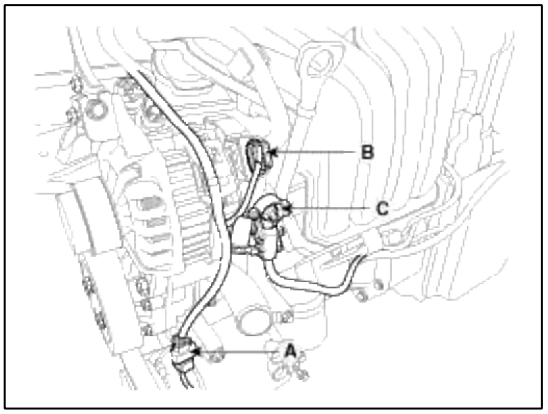
Install the heater hoses as shown illustrations.



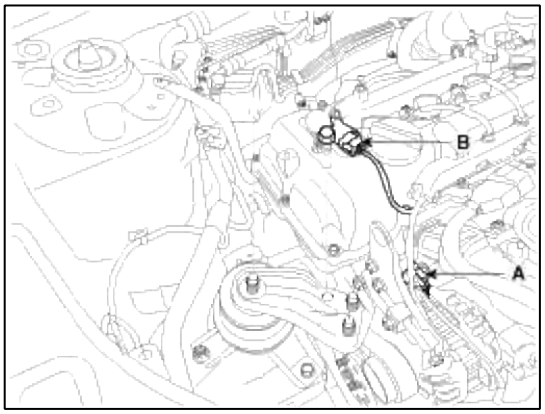
23. Connect the wiring connectors and harness clamps, and remove the wiring and protectors from the cylinder head and intake manifold.

(1) The A/C compressor switch connector (A), the alternator connector (B) and the cable from the alternator "B" terminal (C)

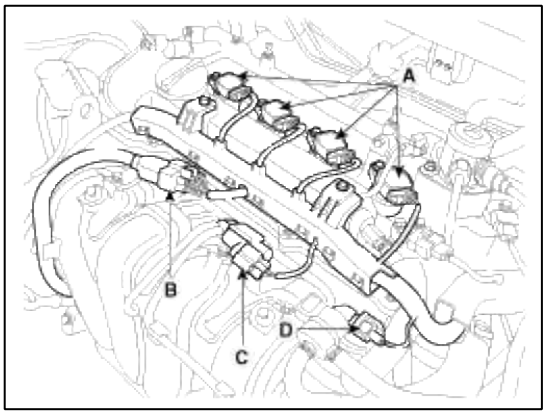
Tightening torque :
9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)



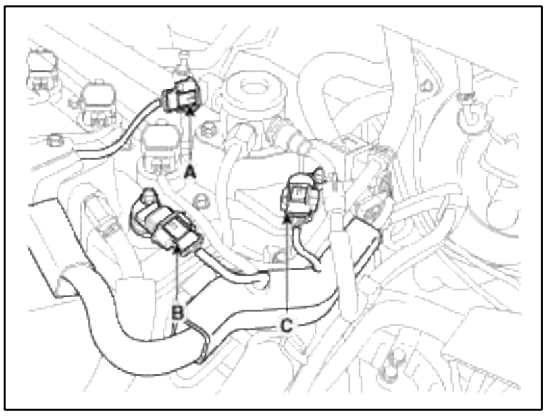
(2) The intake OCV (Oil control valve) connector (A) and the exhaust OCV (Oil control valve) connector (B)



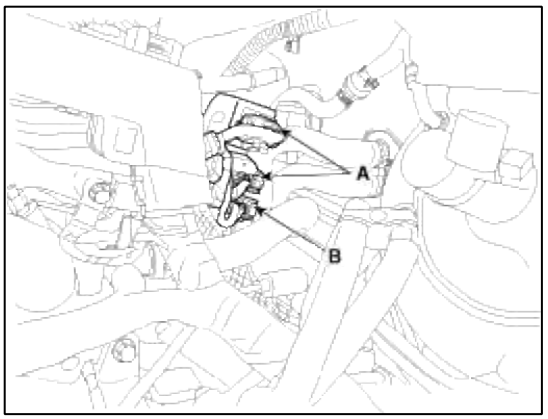
(3) The ignition coil connectors (A), the injector extension connector (B), the VIS (Variable intake system) connector (C) and the PCSV (Purge control solenoid valve) connector (D)



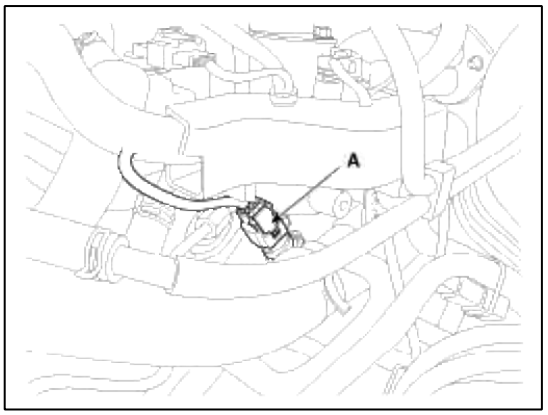
(4) The FPCV (Fuel pressure control valve) connector (A), the intake CMPS (Camshaft position sensor) connector (B) and the exhaust CMPS (Camshaft position sensor) connector (C)



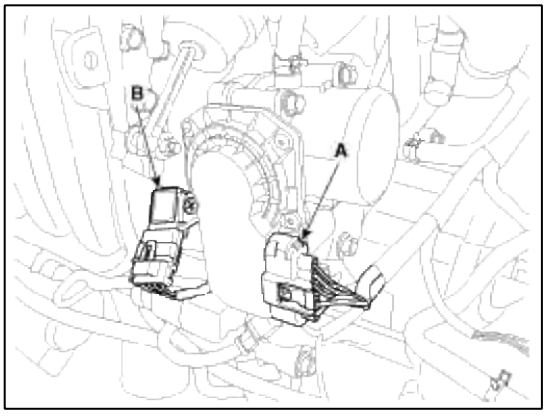
(5) The oxygen sensor connectors (A) and the condenser connector (B).



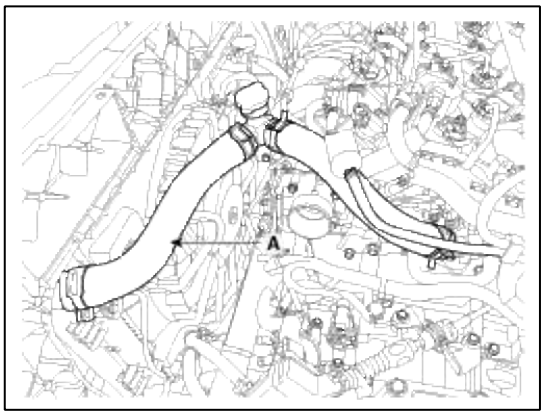
(6) The ECTS (Engine coolant temperature sensor) connector (A) and the ground line

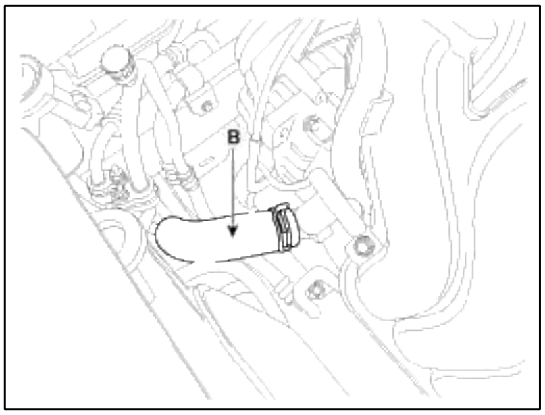


(7) The ETC (Electronic throttle control) connector (A) and the MAPS (Manifold absolute pressure sensor) & IATS (Intake air temperature sensor) connector (B)



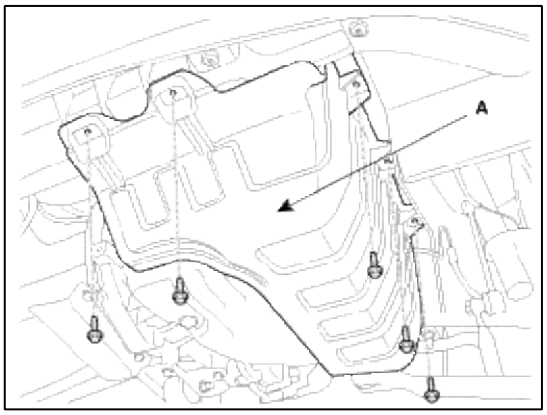
24. Connect the radiator upper hose (A) and lower hose (B).

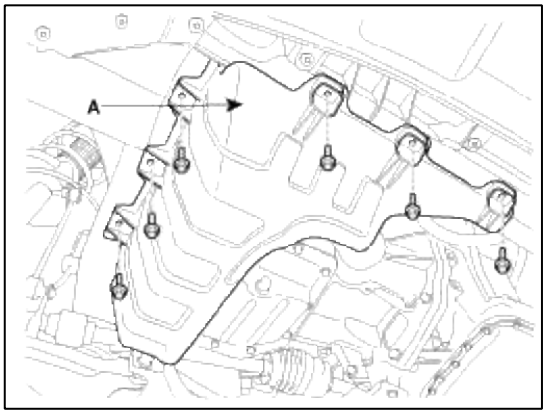




25. Install the under covers (A).

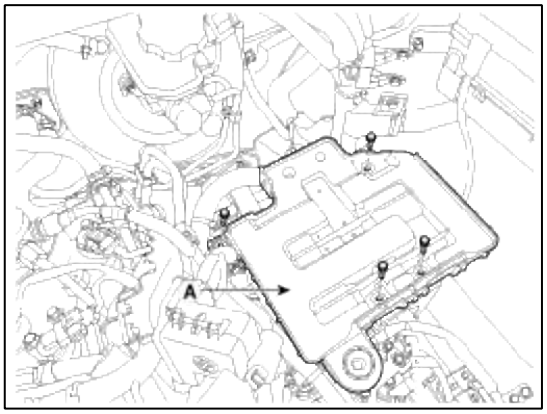
Tightening torque :
6.9 ~ 10.8 N.m (0.7 ~ 1.1 kgf.m, 5.1 ~ 8.0 lb-ft)





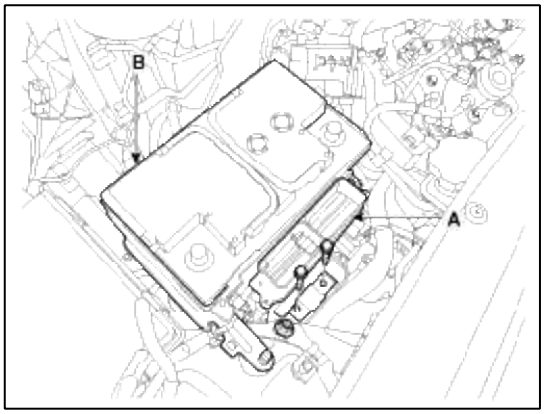
26. Install the battery tray (A).

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

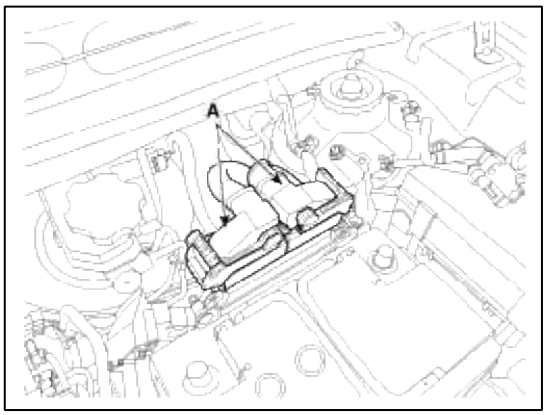


27. Install the battery (B) and then install the ECM (A).

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



28. Connect the ECM connector (A).



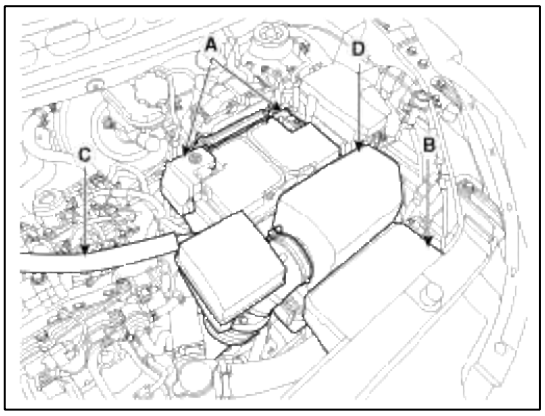
29. Install the RH front wheel.

30. Install the air cleaner assembly.
    (1) Install the air cleaner assembly (D) and the air intake hose.

Tightening torque
Hose clamp bolt :
2.9 ~ 4.9N.m (0.3 ~ 0.5kgf.m, 2.2 ~ 3.6lb-ft)
Air cleaner assembly bolts :
7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)

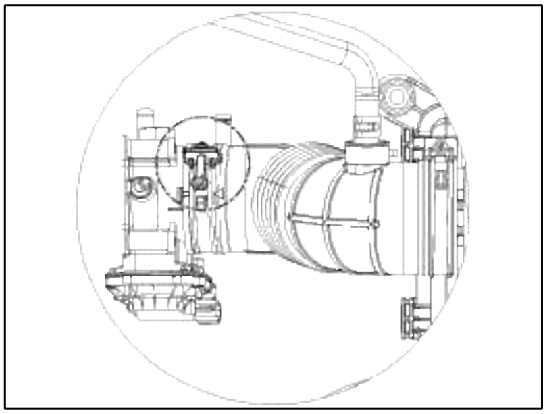
    (2) Connect the breather hose (C).
    (3) Install the air duct (B).
    (4) Connect the battery negative terminals (A).

Tightening torque
(+) terminal :
7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)
(-) terminal (without battery sensor) :
7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)
(-) terminal (with battery sensor) :
4.0 ~ 6.0N.m (0.4 ~ 0.6kgf.m, 3.0 ~ 4.4lb-ft)



NOTE

- Install the air intake hose while the plate of the hose clamp must be in line with the stopper of the hose.
- Install the air intake hose while the groove of hose must be matched to the protrusion of the throttle body.



31. Install the engine cover.

CAUTION

Install the engine cover.

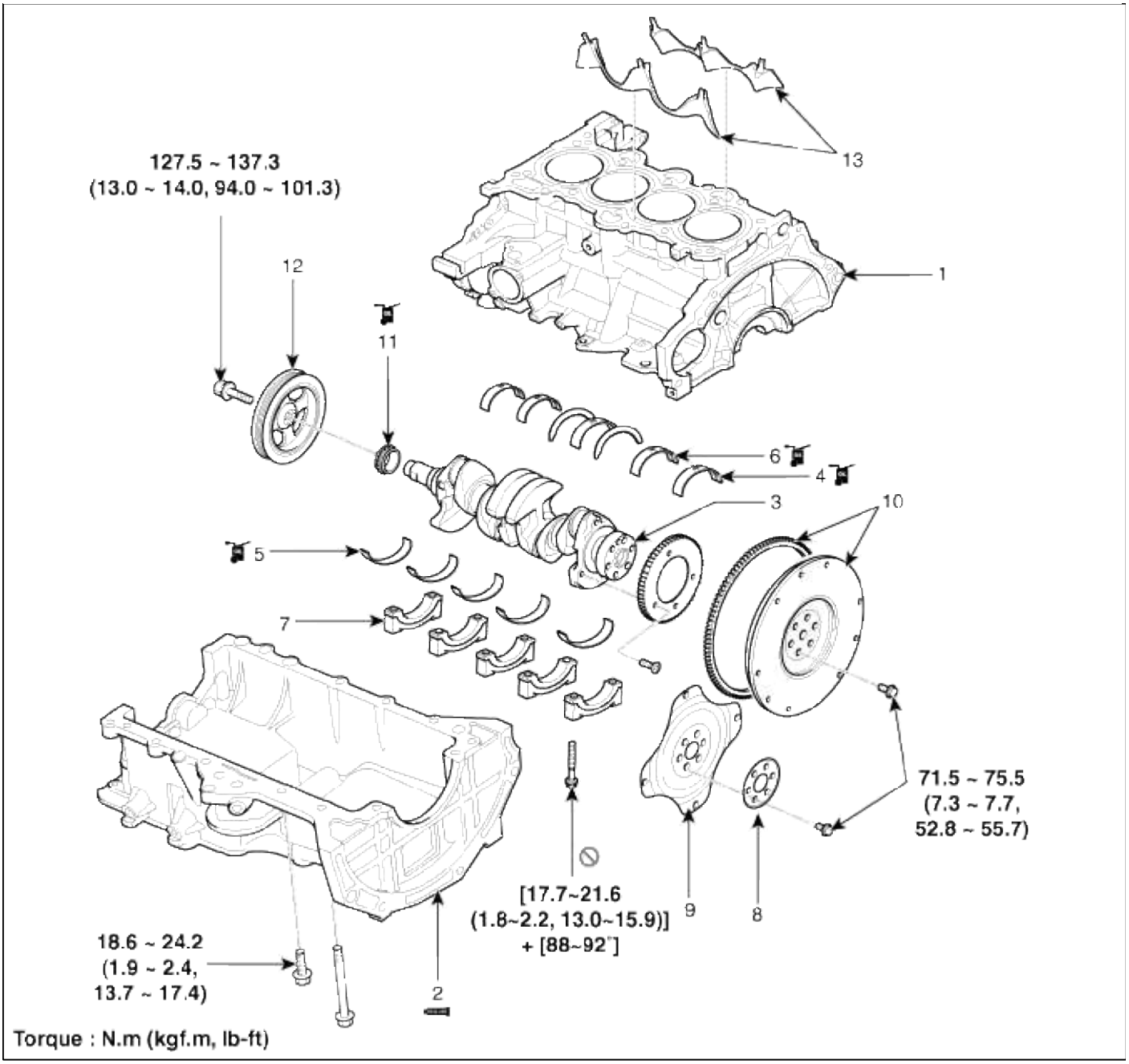
NOTE

Perform the following :

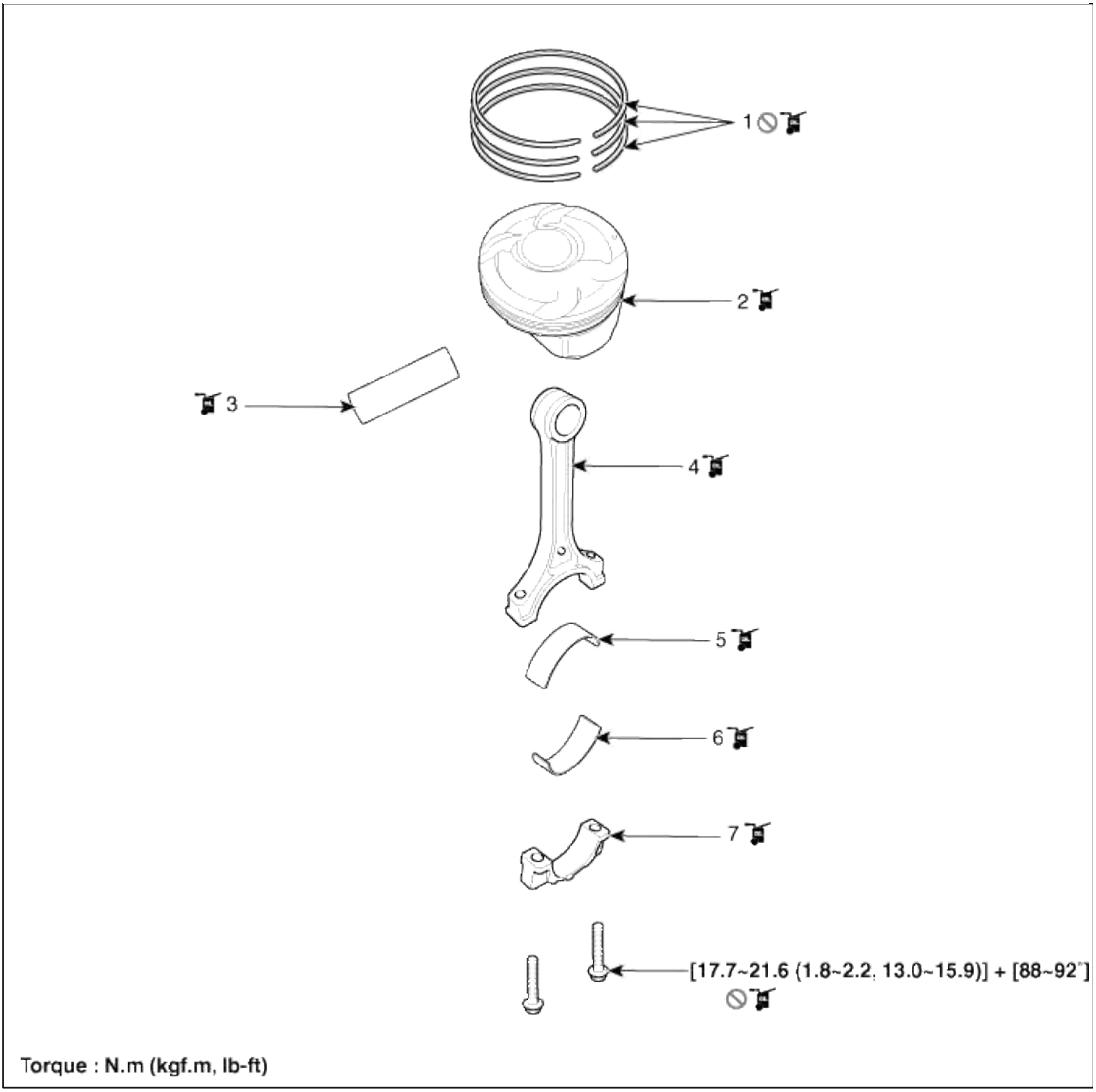
- Adjust a shift cable.
- Refill engine with engine oil.
- Refill a transaxle with fluid.
- Refill a radiator and a reservoir tank with engine coolant.
- Clean battery posts and cable terminals and assemble.
- Inspect for fuel leakage.
  - After assemble the fuel line, turn on the ignition switch (do not operate the starter) so that the fuel pump runs for approximately two seconds and fuel line pressurizes.
  - Repeat this operation two or three times, then check for fuel leakage at any point in the fuel line.
- Bleed air from the cooling system.
  - Start engine and let it run until it warms up. (until the radiator fan operates 3 or 4 times.)
  - Turn Off the engine. Check the level in the radiator, add coolant if needed. This will allow trapped air to be removed from the cooling system.
  - Put radiator cap on tightly, then run the engine again and check for leaks.

Engine Mechanical System > Cylinder Block > Cylinder Block > Components and Components Location

Components



1. Cylinder block	5. Crankshaft lower bearing	9. Drive plate
2. Ladder frame	6. Thrust bearing	10. Fly wheel
3. Crankshaft	7. Main bearing cap	11. Crankshaft sproket
4. Crankshaft upper bearing	8. Adapter plate	12. Crankshaft pulley
		13. Water jacket insert



1. Piston ring 2. Piston 3. Piston pin 4. Connecting rod	5. Connecting rod upper bearing 6. Connecting rod lower bearing 7. Connecting rod bearing cap

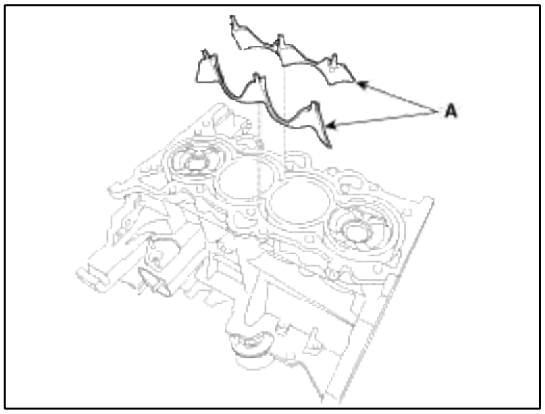
Engine Mechanical System > Cylinder Block > Cylinder Block > Repair procedures

Disassembly

Engine removal is required for this procedure. (Refer to Engine and transaxle assembly removal in this group)

1. M/T : Remove the fly wheel.
2. A/T : Remove the drive plate.
3. Install the engine to engine stand for disassembly.

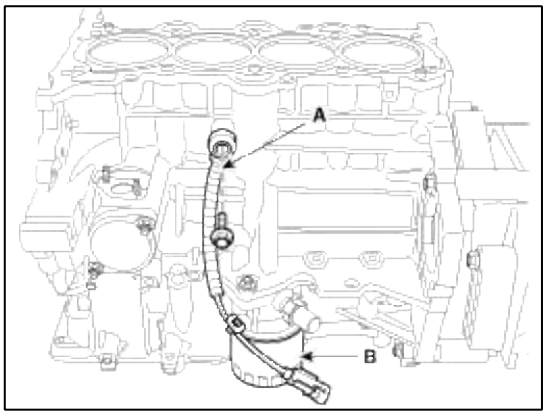
4. Remove the timing chain. (Refer to Timing chain in this group)
5. Remove the cylinder head. (Refer to Cylinder head in this group)
6. Remove the water jacket insert (A).



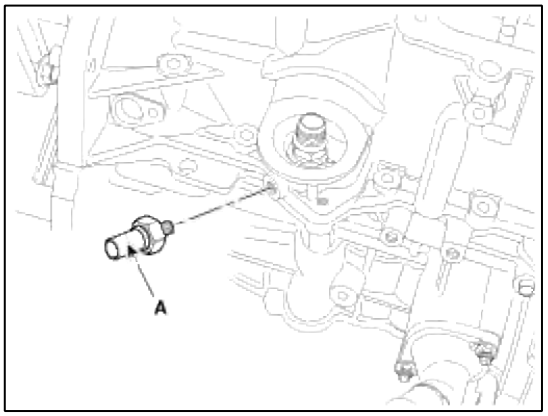
CAUTION

Be careful not to deform or damage it when removing.

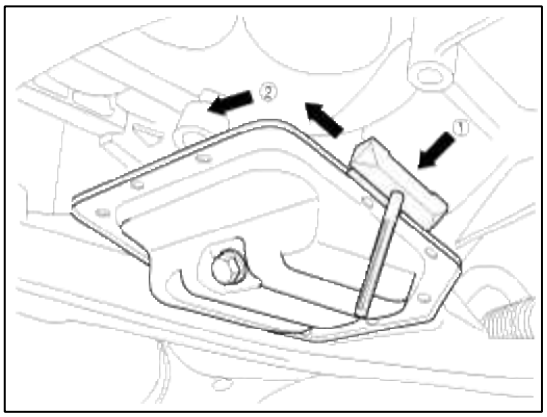
7. Remove the oil level gauge tube.
8. Remove the knock sensor (A) and the oil filter (B).



9. Remove the oil pressure switch (A).



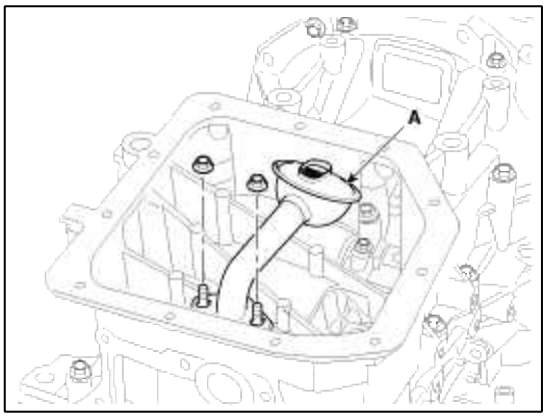
10. Using the SST (09215-3C000), remove the oil pan (A).



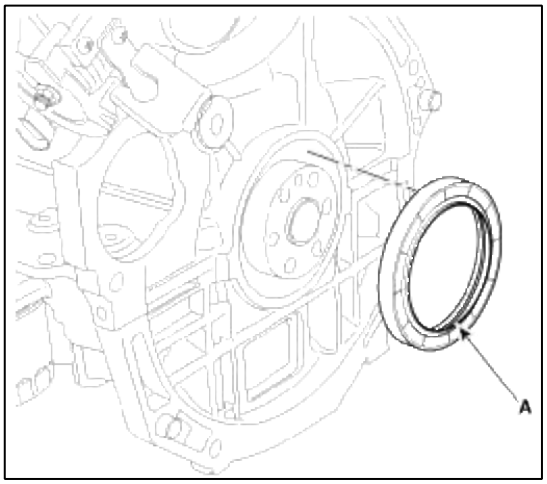
CAUTION

- Insert the SST between the oil pan and the ladder frame by tapping it with a plastic hammer in the direction of ① arrow.
- After tapping the SST with a plastic hammer along the direction of ② arrow around more than 2/3 edge of the oil pan, remove it from the ladder frame.
- Do not turn over the SST abruptly without tapping. It is result in damage of the SST.

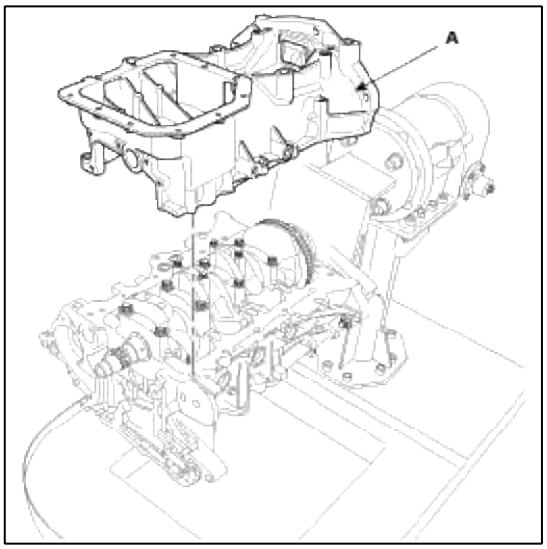
11. Remove the oil screen (A).



12. Remove the rear oil seal (A).



13. Remove the ladder frame (A).



14. Check the connecting rod end play.

15. Remove the connecting rod caps and check oil clearance.

16. Remove the piston and connecting rod assemblies.
    (1) Using a ridge reamer, remove all the carbon from the top of the cylinder.
    (2) Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.

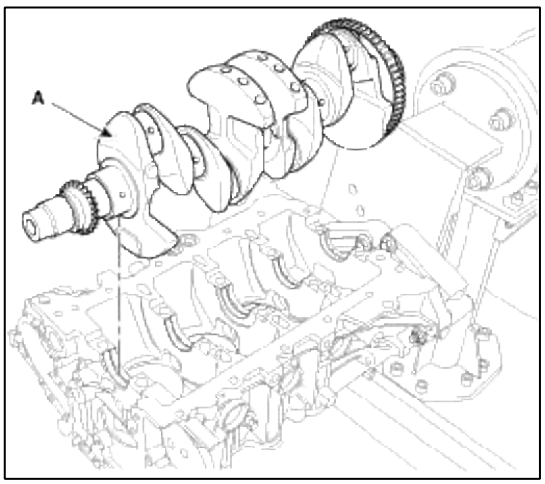
> NOTE
>
> • Keep the bearings, connecting rod and cap together.
> • Arrange the piston and connecting rod assemblies in the correct order.

17. Remove the 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 thrust bearings in the correct order.



20. Check fit between piston and piston pin.
    Try to move the piston back and forth on the piston pin.
    If any movement is felt, replace the piston and pin as a set.

21. Remove the piston rings.
    (1) Using a piston ring expander, remove the 2 compression rings.
    (2) Remove the 2 side rails and coil spring.

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

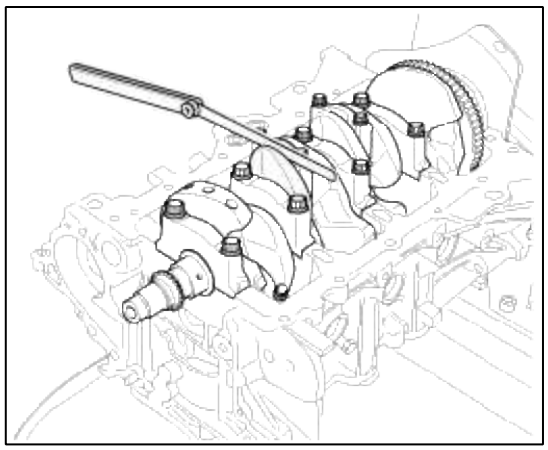
22. Remove the connecting rod from the piston.
    Using a press, remove the piston pin from piston.
    (Press-in load : 500 ~ 1,500kg(1,102 ~ 3,306lb))

Inspection

Connecting Rod And Crankshaft

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

End play
Standard : 0.10 ~ 0.25mm (0.0039 ~ 0.0098in)
Maximum : 0.35mm (0.0138in)



A. If out-of-tolerance, install a new connecting rod.
B. If still out-of-tolerance, replace the crankshaft.

2. Check the connecting rod bearing oil clearance.
   (1) Check the match marks on the connecting rod and cap are aligned to ensure correct reassembly.
   (2) Remove the 2 connecting rod cap bolts.
   (3) Remove the connecting rod cap and lower bearing.
   (4) Clean the crankshaft pin journal and bearing.
   (5) Place a plastigage across the crankshaft pin journal.

(6) Reinstall the lower bearing and cap, and tighten the bolts. Do not reuse the bolts.

Tightening torque :
17.7 ~ 21.6N.m (1.8 ~ 2.2kgf.m, 13.0 ~ 15.9lb-ft) + 88 ~ 92°

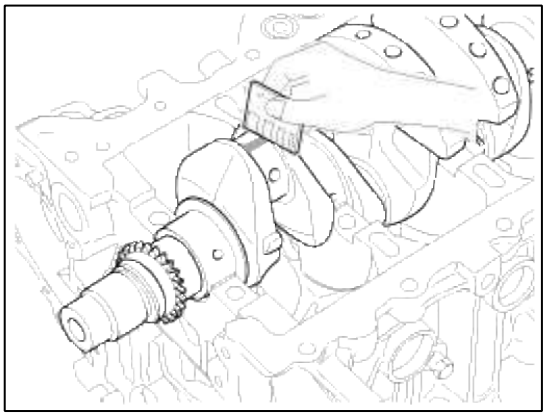
NOTE

Do not turn the crankshaft.

(7) Remove the 2 bolts, connecting rod cap and lower bearing .

(8) Measure the plastigage at its widest point.

Standard oil clearance
0.032 ~ 0.052mm (0.0013 ~ 0.0020in)



(9) If the measurement from the plastigage is too wide or too narrow, remove the upper and lower bearing and then install a new bearings with the same color mark.
Recheck the oil clearance.

CAUTION

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

(10) If the plastigage shows the clearance is still incorrect, try the next larger or smaller bearing.
Recheck the oil clearance.

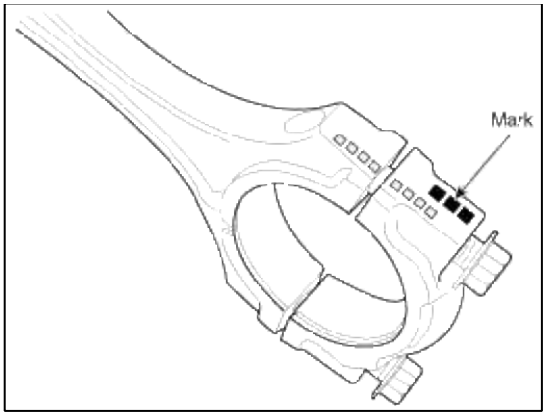
NOTE

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

CAUTION

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

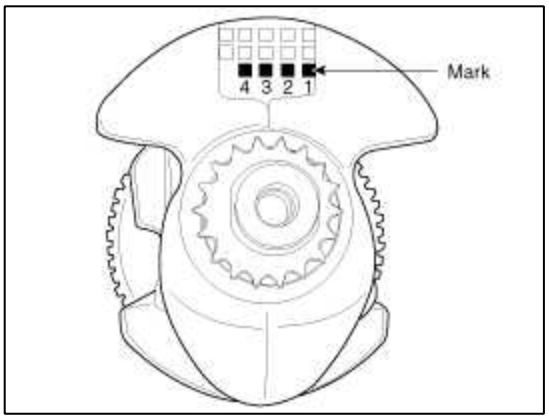
Connecting Rod Mark Location



Discrimination Of Connecting Rod

Mark	Connecting rod big-end inner diameter
A, 0	45.000 ~ 45.006mm (1.7717 ~ 1.7719in)
B, 00	45.006 ~ 45.012mm (1.7719 ~ 1.7721in)
C, 000	45.012 ~ 45.018mm (1.7721 ~ 1.7724in)

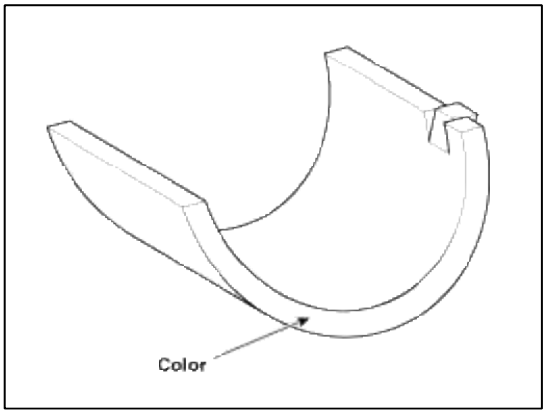
Crankshaft Pin Diameter Mark Location



Discrimination Of Crankshaft Pin Diameter

Mark	Crankshaft pin outer diameter
1	41.972 ~ 41.966mm (1.6524 ~ 1.6522in)
2	41.966 ~ 41.960mm (1.6522 ~ 1.6520in)
3	41.960 ~ 41.954mm (1.6520 ~ 1.6517in)

Connecting Rod Bearing Color Location



Discrimination Of Connecting Rod Bearing

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

(11) Select the bearing by using selection table.

Connecting Rod Bearing Selection Table

		Connecting rod mark		
		A, 0	B, 00	C, 000
Crank shaft pin journal mark	1	E (Red)	D (Green)	C (None)
	2	D (Green)	C (None)	B (Black)
	3	C (None)	B (Black)	A (Blue)

3. Check the connecting rods.
   (1) When reinstalling, make sure that cylinder numbers put on the connecting rod and cap at disassembly match. When a new connecting rod is installed, make sure that the notches for holding the bearing in place are on the same side.
   (2) Replace the connecting rod if it is damaged on the thrust faces at either end. Also if step wear or a severely rough surface of the inside diameter of the small end is apparent, the rod must be replaced as well.
   (3) Using a connecting rod aligning tool, check the rod for bend and twist. If the measured value is close to the repair limit, correct the rod by a press. Any connecting rod that has been severely bent or distorted should be replaced.

Allowable bend of connecting rod :
0.05mm / 100mm (0.0020in / 3.94in) or less
Allowable twist of connecting rod :
0.10mm / 100mm (0.0039in / 3.94in) or less

NOTE

When the connecting rods installed without bearings, there should be no difference on side surface.

4. Check the crankshaft bearing oil clearance.
   (1) To check main bearing-to-journal oil clearance, remove the main bearing caps and lower bearings.
   (2) Clean each main journal and lower bearing with a clean shop towel.
   (3) Place one strip of plastigage across each main journal.

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

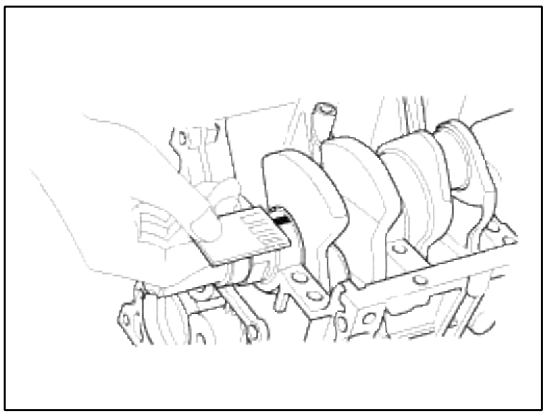
Tightening torque :
17.7~21.6Nm (1.8~2.2kgf.m, 13.0~15.9lb-ft) + 88~92°

NOTE

Do not turn the crankshaft.

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

Standard oil clearance :
No.1, 2, 3, 4, 5 : 0.021 ~ 0.042mm (0.0008 ~ 0.0017in)



(6) If the plastigage measures too wide or too narrow, remove the upper and lower bearing and then install a new bearings with the same color mark. (Refer to crankshaft main bearing selection table in this Group).
Recheck the oil clearance.

CAUTION

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

(7) If the plastigage shows the clearance is still incorrect, try the next larger or smaller bearing. (Refer to crankshaft main bearing selection table in this Group).
Recheck the oil clearance.

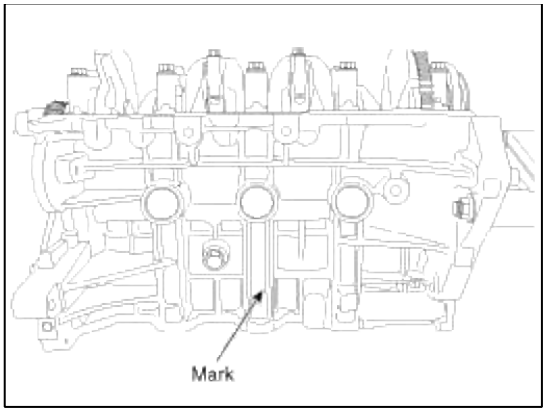
NOTE

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

CAUTION

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

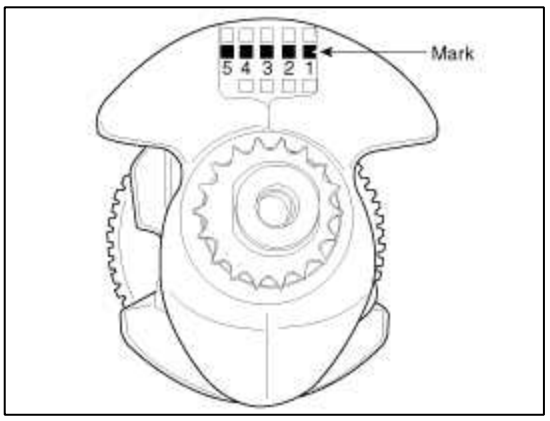
Cylinder block crankshaft journal bore mark location
Letters have been stamped on the side surface of the block as a mark for the size of each of the 5 main journal bores.
Use them, and the numbers or letters stamped on the crank (marks for main journal size), to choose the correct bearings.



Discrimination Of Cylinder Block Crankshaft Journal Bore

Mark	Cylinder block crankshaft journal bore inner diameter
A	52.000 ~ 52.006mm (2.0472 ~ 2.0475in)
B	52.006 ~ 52.012mm (2.0475 ~ 2.0477in)
C	52.012 ~ 52.018mm (2.0477 ~ 2.0479in)

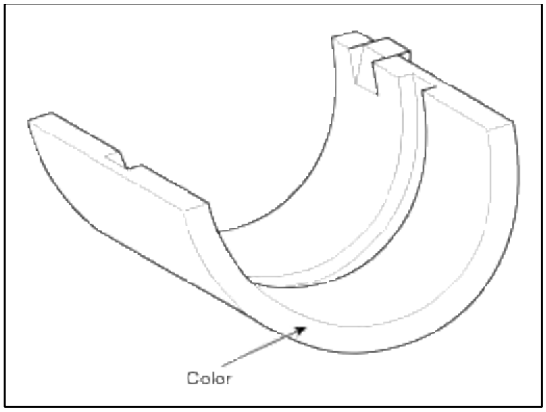
Crankshaft Main Journal Mark Location



Discrimination Of Crankshaft Main Journal

Mark	Crankshaft main journal outer diameter
1	47.960 ~ 47.954mm (1.8882 ~ 1.8879in)
2	47.954 ~ 47.948mm (1.8879 ~ 1.8877in)
3	47.948 ~ 47.942mm (1.8877 ~ 1.8875in)

Crankshaft Main Bearing Color Location



Discrimination Of Crankshaft Main Bearing

Mark	Color	Crankshaft main bearing thickness
		No.1, 2, 3, 4, 5
A	Blue	2.026 ~ 2.029mm (0.0798 ~ 0.0799in)
B	Black	2.023 ~ 2.026mm (0.0796 ~ 0.0798in)
C	None	2.020 ~ 2.023mm (0.0795 ~ 0.0796in)
D	Green	2.017 ~ 2.020mm (0.0794 ~ 0.0795in)
E	Red	2.014 ~ 2.017mm (0.0793 ~ 0.0794in)

(8) Select the bearing by using selection table.

Crankshaft Main Bearing Selection Table

		Cylinder block crankshaft journal bore mark		
		A	B	C
Crank shaft main journal mark	1	E (Red)	D (Green)	C (None)
	2	D (Green)	C (None)	B (Black)
	3	C (None)	B (Black)	A (Blue)

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

End play
Standard: 0.05 ~ 0.25mm (0.0020 ~ 0.0098in)
Limit : 0.30mm (0.0118in)

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

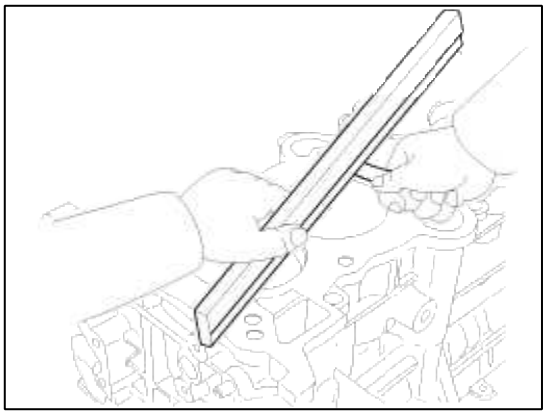
Cylinder Block

1. Remove the gasket material.
   Using a gasket scraper, remove all the gasket material from the top surface of the cylinder block.

2. Clean the cylinder block
   Using a soft brush and solvent, thoroughly clean the cylinder block.

3. Inspect the top surface of cylinder block for flatness.
   Using a precision straight edge and feeler gauge, measure the surface contacting the cylinder head gasket for warpage.

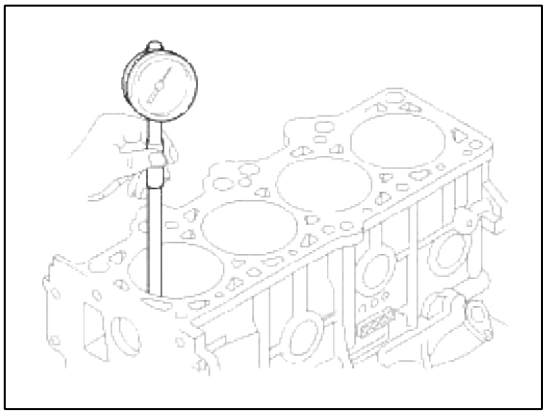
Flatness of cylinder block gasket surface
Standard :
Less than 0.05mm (0.0020in) for total area
Less than 0.02mm (0.0008in) for a section of 100mm (3.9370in) X 100mm (3.9370in)



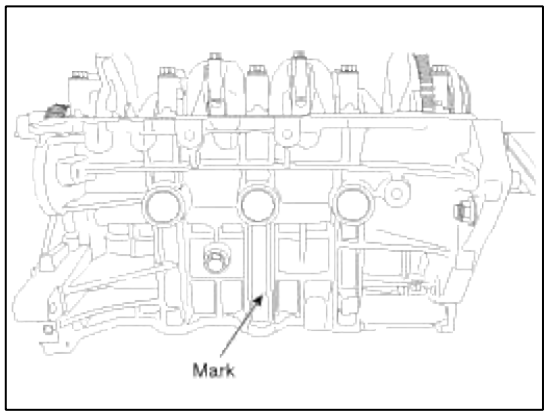
4. Inspect the cylinder bore.
   Visually check the cylinder for vertical scratchs.
   If deep scratchs are present, replace the cylinder block.

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

Standard diameter :
77.00 ~ 77.03mm (3.0315 ~ 3.0327in)



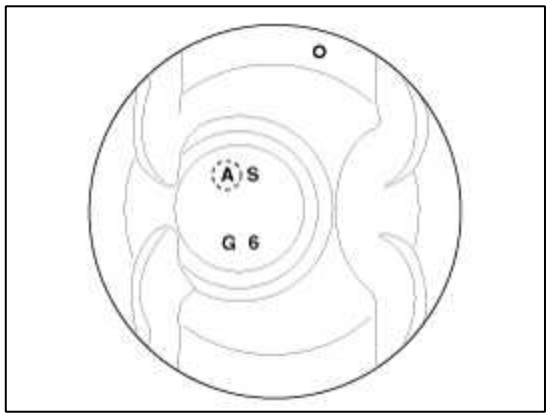
6. Check the cylinder bore size code on the cylinder block side surface.



Discrimination Of Cylinder Bore Size

Mark	Cylinder bore inner diameter
A	77.00 ~ 77.01mm (3.0315 ~ 3.0319in)
B	77.01 ~ 77.02mm (3.0319 ~ 3.0323in)
C	77.02 ~ 77.03mm (3.0323 ~ 3.0327in)

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



A : Grade
S : ISG type
G : Gasoline engine
6 : 1.6L

Discrimination Of Piston Outer Diameter

Mark	Piston outer diameter
A	76.97 ~ 76.98mm (3.0303 ~ 3.0307in)
B	76.98 ~ 76.99mm (3.0307 ~ 3.0311in)
C	76.99 ~ 77.00mm (3.0311 ~ 3.0315in)

8. Select the piston related to cylinder bore class.

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

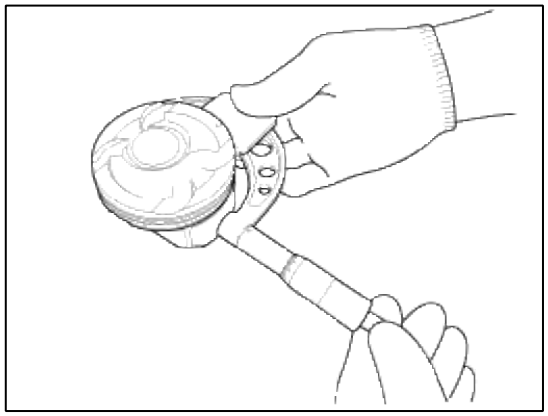
1. Clean the piston.
   (1) Using a gasket scraper, remove the carbon from the piston top.
   (2) Using a groove cleaning tool or broken ring, clean the piston ring grooves.
   (3) Using solvent and a brush, thoroughly clean the piston.

   NOTE

   Do not use a wire brush.

2. The standard measurement of the piston outside diameter is taken 12mm(0.4724in) from bottom land of the piston.

   Standard diameter :
   76.97 ~ 77.00mm (3.0303 ~ 3.0315in)

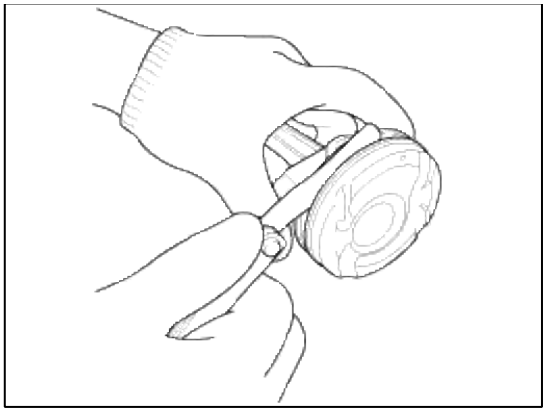


3. Calculate the difference between the cylinder bore inner diameter and the piston outer diameter.

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

4. Inspect the piston ring side clearance.
   Using a feeler gauge, measure the clearance between new piston ring and the wall of ring groove.

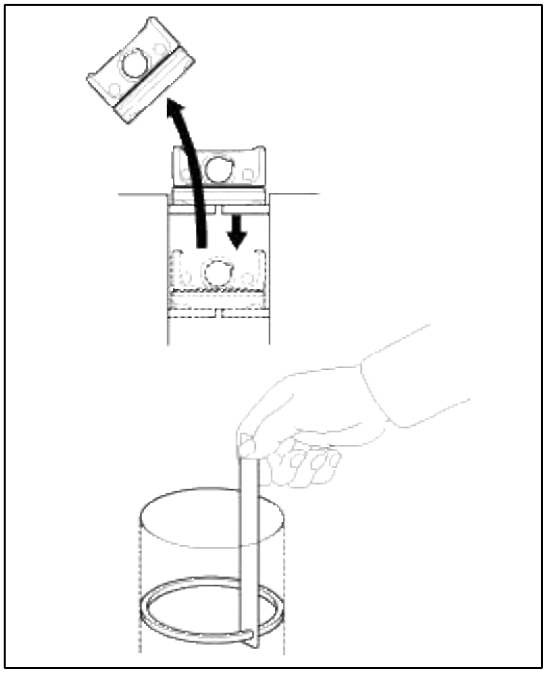
   Piston ring side clearance
   No.1 ring : 0.04 ~ 0.08mm (0.0016 ~ 0.0031in)
   No.2 ring : 0.04 ~ 0.08mm (0.0016 ~ 0.0031in)
   Oil ring : 0.02 ~ 0.06mm (0.0008 ~ 0.0024in)
   Limit
   No.1 ring : 0.1mm (0.0039in)
   No.2 ring : 0.1mm (0.0039in)
   Oil ring : 0.2mm (0.0079in)



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

5. Inspect the piston ring end gap.
   To measure the piston ring end gap, insert a piston ring into the cylinder bore. Position the ring at right angles to the cylinder wall by gently pressing it down with a piston. Measure the gap with a feeler gauge. If the gap exceeds the service limit, replace the piston rings. If the gap is too large, recheck the cylinder bore inner diameter. If the bore is over the service limit, the cylinder block must be rebored.

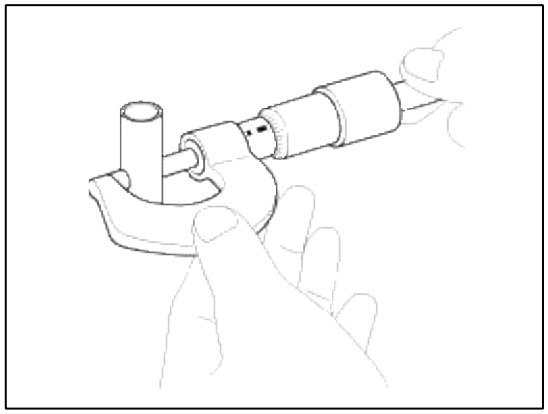
Piston ring end gap
Standard
No.1 ring : 0.14 ~ 0.28mm (0.0079 ~ 0.0138in)
No.2 ring : 0.30 ~ 0.45mm (0.0118 ~ 0.0177in)
Oil ring : 0.20 ~ 0.40mm(0.0079 ~ 0.0157in)
Limit
No.1 ring : 0.3mm(0.0118in)
No.2 ring : 0.5mm(0.0197in)
Oil ring : 0.8mm(0.0315in)



Piston Pins

1. Measure the outer diameter of piston pin

Piston pin diameter :
18.001 ~ 18.006mm (0.7087 ~ 0.7089in)



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

Piston pin-to-piston clearance :
0.010 ~ 0.020mm (0.0004 ~ 0.0008in)

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

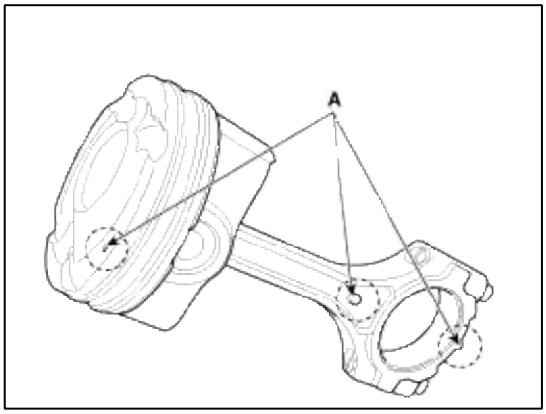
Piston pin-to-connecting rod interference :
-0.032 ~ -0.016mm (-0.0013 ~ -0.0006in)

Reassembly

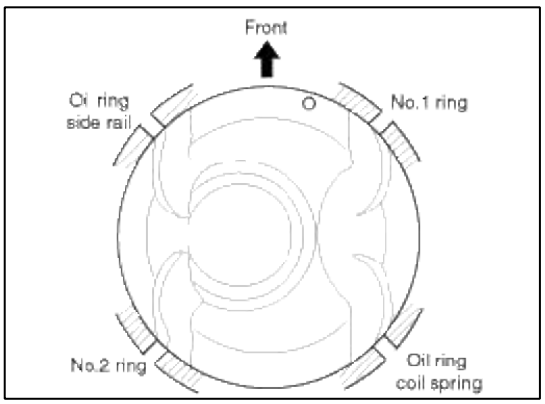
NOTE

- Thoroughly clean all parts to assembled.
- Before installing the parts, apply fresh engine oil to all sliding and rotating surfaces.
- Replace all gaskets, O-rings and oil seals with new parts.

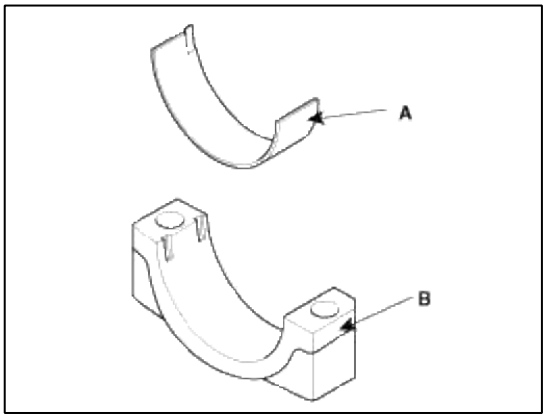
1. Assemble the piston and connecting rod.
   (1) Use a hydraulic press for installation
   (2) The piston front mark (A) and the connecting rod front mark (A) must face the timing chain side of the engine.



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



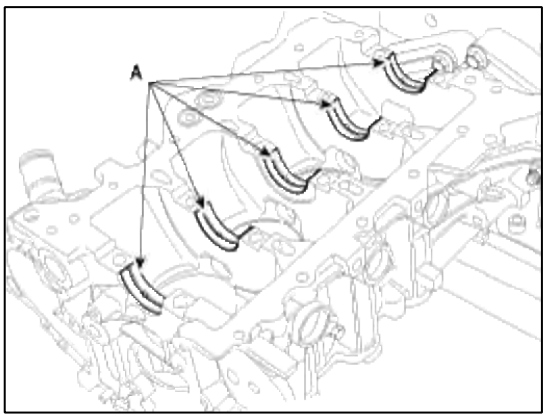
3. Install the connecting rod bearings.
   (1) Align the bearing (A) claw with the groove of the connecting rod or connecting rod cap (B).
   (2) Install the bearings (A) in the connecting rod and connecting rod cap (B).



4. Install the crankshaft main bearings.

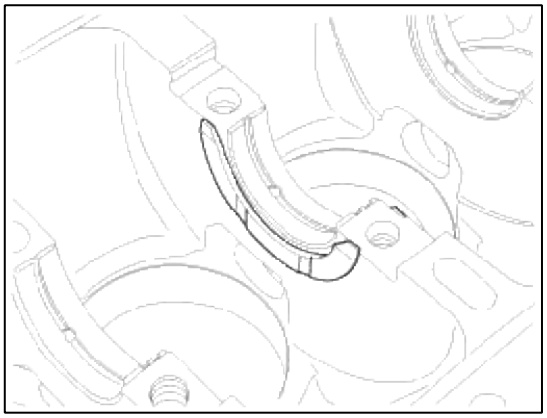
> NOTE
>
> Upper bearings have an oil groove of oil holes ; Lower bearings do not.

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



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

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



6. Place the crankshaft on the cylinder block.

7. Place the main bearing caps on the cylinder block.

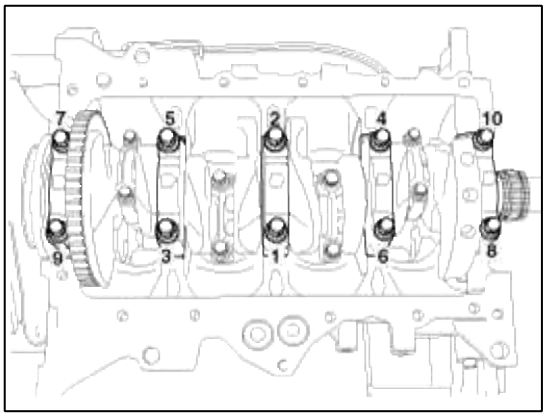
8. Install the main bearing cap bolts.

> NOTE
>
> The main bearing cap bolts are tightened in 2 progressive steps.
> If any of the bearing cap bolts in broken or deformed, replace it.

(1) Apply a light coat of engine oil on the threads and under the bearing cap bolts.

(2) Install and uniformly tighten the 10 bearing cap bolts, in several passes, in the sequence shown.

Tightening torque :
17.7~21.6Nm (1.8~2.2kgf.m, 13.0~15.9lb-ft) + 88~92°



> CAUTION
>
> Do not reuse the main bearing cap bolts.

(3) Check that the crankshaft turns smoothly.

9. Check the crankshaft end play.

10. Install the piston and connecting rod assemblies.

> NOTE
>
> Before installing the piston, apply a coat of engine oil to the ring grooves and cylinder bores.

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

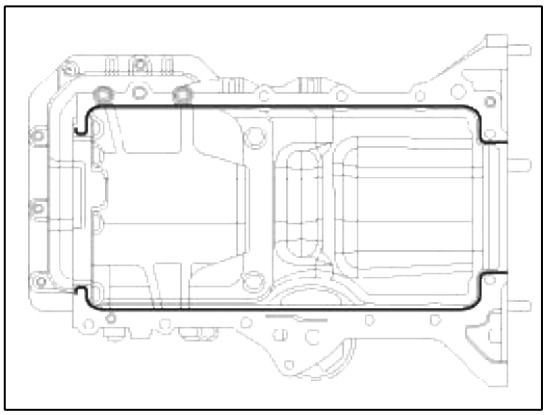
(2) Stop after the ring compressor pops free, and check the connecting rod-to-crank journal alignment before pushing the piston into place.

(3) Install the rod caps with bearings, and tighten the bolts.

Tightening torque :
17.7~21.8Nm (1.8~2.2kgf.m, 13.0~15.9lb-ft) + 88~92°

> CAUTION
>
> Do not reuse the connecting rod cap bolts.

11. Apply the sealant on the ladder frame.

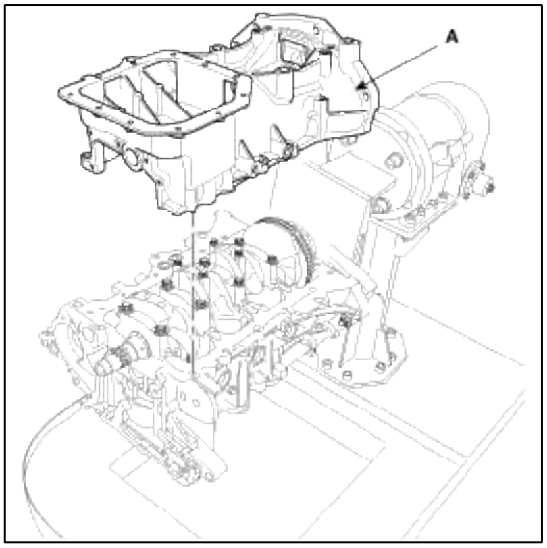


NOTE

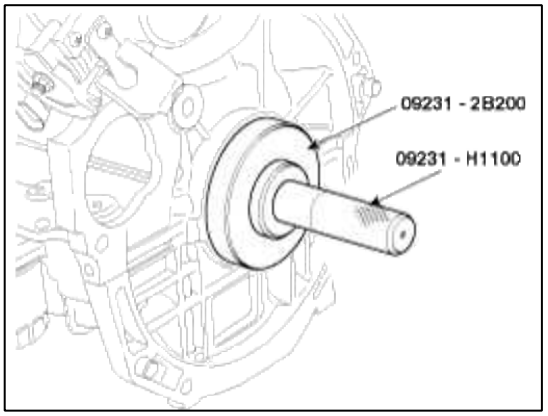
- Apply the sealant, THREE-BOND 1217H or LOCTITE 5900H on the ladder frame rail portion and install it with in five minutes.
  If when sealant is applied to cylinder block bottom position, sealant position to be same with positon that is applied to ladder frame rail position.
- Apply sealant along the inner line of the bolt holes.

12. Install the ladder frame (A).

Tightening torque :
18.6 ~ 24.2N.m (1.9 ~ 2.4kgf.m, 13.7 ~ 17.4lb-ft)

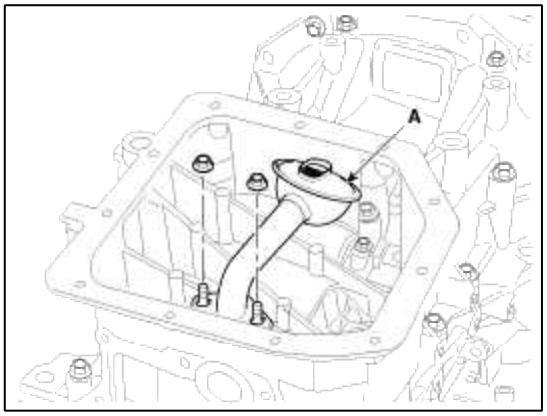


13. Install the rear oil seal.
    (1) Apply engine oil to a new oil seal lip.
    (2) Using the SST(09231-H1100, 09231-2B200) and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.



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

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



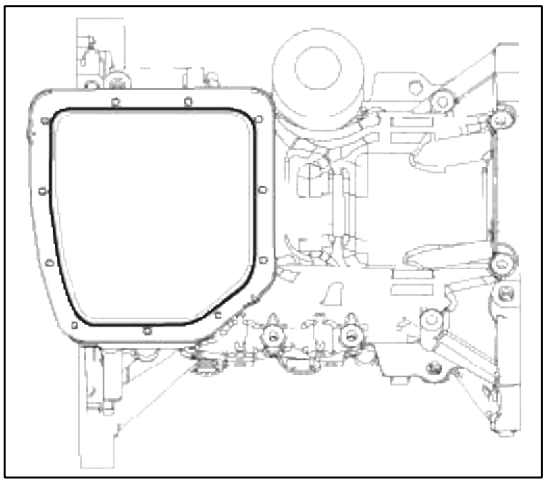
15. Install the oil pan.
    (1) Using a razor blade and gasket scraper, remove all the old packing material from the gasket surfaces.

NOTE

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

(2) Apply liquid gasket with the width of Ø3mm, starting 1mm-away position from the inner rounding of the oil pan rail.

Liquid gasket : TB 1217H or LOCTITE 5900H

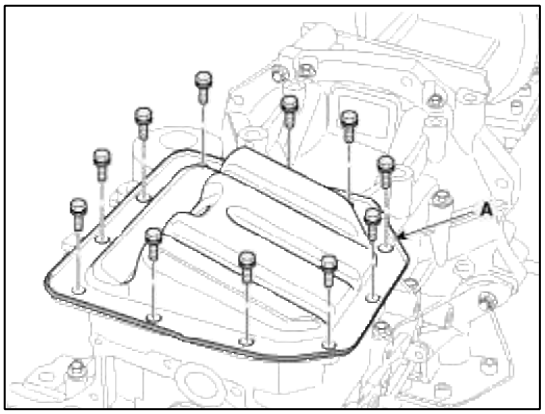


NOTE

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

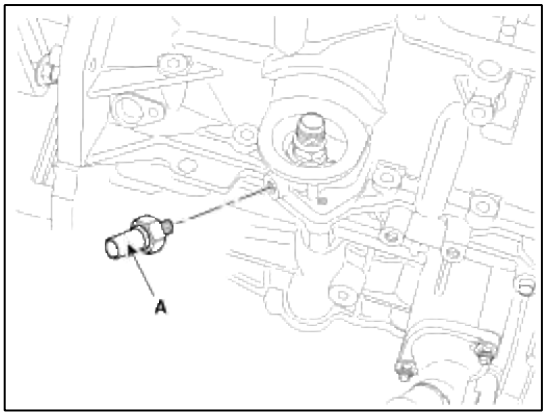
(3) Install the oil pan (A) with the bolts.
Uniformly tighten the bolts in several passes.

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



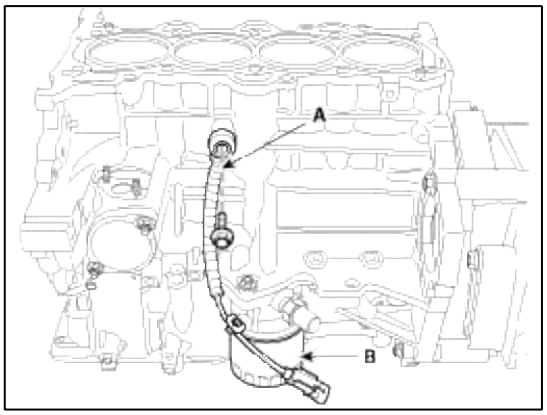
16. Install the oil pressure switch.
    (1) Apply adhesive to 2 or 3 threads.
    (2) Install the oil pressure switch (A).

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



17. Install the knock sensor (A) and the oil filter (B).

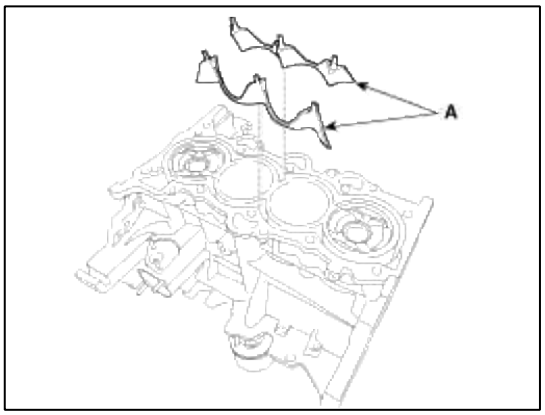
Tightening torque :
16.7 ~ 26.5N.m (1.7 ~ 2.7kgf.m, 12.3 ~ 19.5lb-ft)



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

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

19. Install the water jacket insert (A).

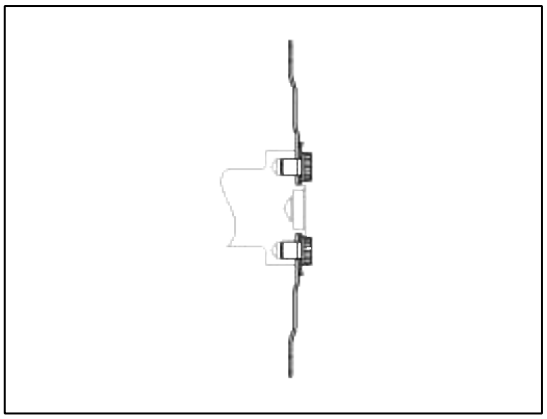


CAUTION

Maximum height of installed water jacket insert must be below top surface of cylinder block.

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

Tightening torque :
71.6 ~ 75.5N.m (7.3 ~ 7.7kgf.m, 52.8 ~ 55.7lb-ft)



24. M/T :install the fly wheel.

Tightening torque :
71.6 ~ 75.5N.m (7.3 ~ 7.7kgf.m, 52.8 ~ 55.7lb-ft)

25. Install the engine. (Refer to Engine and transaxle assembly in this group)

Engine Mechanical System > Cooling System > Coolant > Repair procedures

Refilling And Bleeding

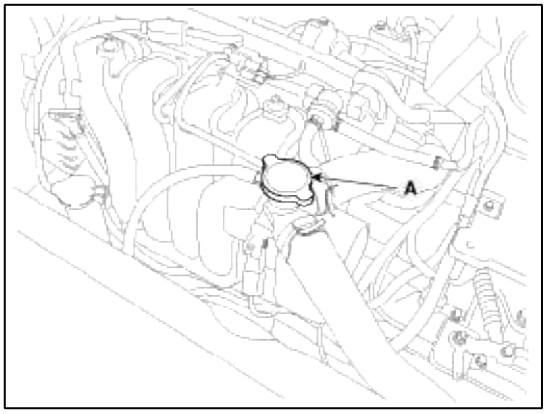
WARNING

Never remove the radiator cap when the engine is hot. Serious scalding could be caused by hot fluid under high pressure escaping from the radiator.

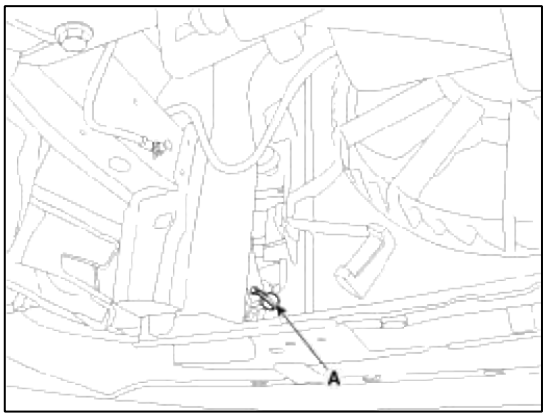
CAUTION

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

1. Make sure the engine and radiator are cool to the touch.
2. Remove radiator cap (A).



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



4. Tighten the radiator drain plug securely.
5. After draining engine coolant in the reservoir tank, clean the tank.
6. Fill the radiator with water through the radiator cap and tighten the cap.

NOTE

To most effectively bleed the air, pour the water slowly and press on the upper/lower radiator hoses.

7. Start the engine and allow to come to normal operating temperature. Wait for the cooling fans to turn on several times. Accelerate the engine to aid in purging trapped air. Shut engine off.
8. Wait until the engine is cool.
9. Repeat steps 1 to 8 until the drained water runs clear.

10. Fill fluid mixture with coolant and water (55~60%) (except for North America, Europe and China : 45~50%) slowly through the radiator cap. Push the upper/lower hoses of the radiator so as bleed air easily.

> NOTE
>
> - Use only genuine antifreeze/coolant.
> - For best corrosion protection, the coolant concentration must be maintained year-round at 55% (except for North America, Europe and China : 45%) minimum.
>   Coolant concentrations less than 55% (except for North America, Europe and China : 45%) 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 antirust products; they may not be compatible with the coolant.

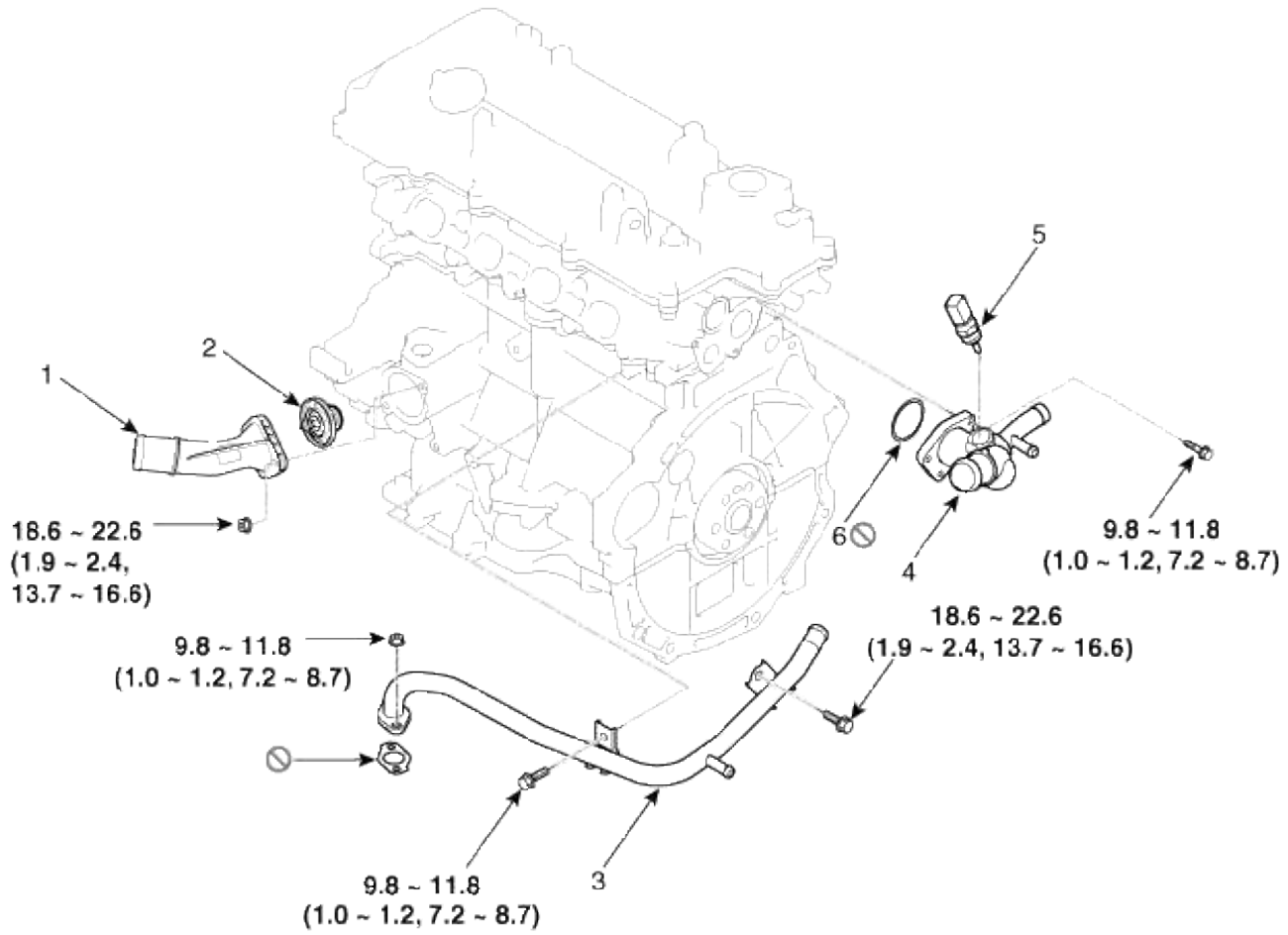
11. Start the engine and run until coolant circulates.
    When the cooling fan operates and coolant circulates, refill coolant through the radiator cap.
12. Repeat 11 until the cooling fan 3 ~ 5 times and bleed air sufficiently out of the cooling system.
13. Install the radiator cap and fill the reservoir tank to the "MAX" (or "F") line with coolant.
14. Run the vehicle under idle until the cooling fan operates 2 ~ 3 times.
15. Stop the engine and wait coolant gets cool.
16. Repeat 10 to 15 until the coolant level doesn't fall any more, bleed air out of the cooling system.

> NOTE
>
> It takes time to bleed out all the air in the cooling system. Refill coolant when coolant gets cool completely, when recheck the coolant level in the reservoir tank for 2~3 days after replacing coolant.

Coolant capacity :
MT : 5.0L (1.32 U.S.gal., 5.28 U,S,qt., 4.40lmp.qt)
AT : 5.2L (1.37 U.S.gal., 5.49 U,S,qt., 4.57lmp.qt)

Engine Mechanical System > Cooling System > Thermostat > Components and Components Location

Components



1. Water inlet fitting	4. Water temp control assembly
2. Thermostat	5. Water temperature sensor
3. Heater pipe	6. Gasket

Engine Mechanical System > Cooling System > Thermostat > Repair procedures

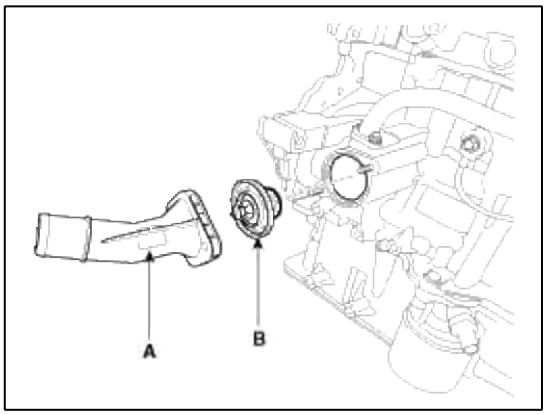
Removal

NOTE

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

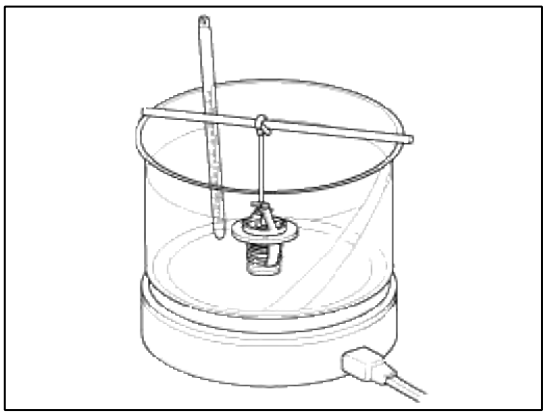
1. Drain engine coolant so that its level would be under the thermostat height.
2. Remove the radiator lower hose.

3. Remove the water inlet fitting (A) and thermostat (B).



Inspection

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



2. Check the valve opening temperature.

Valve opening temperature : 82±1.5°C (179.6±2.7°F)
Full opening temperature : 95°C (203°F)

If the valve opening temperature is not as specified, replace the thermostat.

3. Check the valve lift.

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

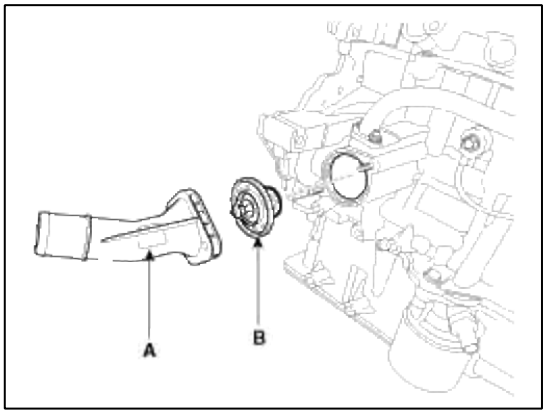
If the valve lift is not as specified, replace the thermostat.

Installation

1. Place the thermostat in the block.
   Install the thermostat (B) with the jiggle valve upward.

2. Install the water inlet fitting (A).

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



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

Engine Mechanical System > Cooling System > Thermostat > Troubleshooting

Troubleshooting

Symptoms		Possible Causes		Remedy
Coolant leakage	• From the thermostat gasket	Check the mounting bolts	• Check the torque of the mounting bolts	• Retighten the bolts and check leakage again.
		Check the gasket for damage	• Check gasket or seal for damage	• Replace gaskets and reuse the thermostat.
Cooled excessively	• Low heater performance (cool air blowed-out) • Temperature gauge 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 • Temperature gauge indicates 'HI'	Visually check after removing the radiator cap.	• Insufficient coolant or leakage. Be careful when removing a radiator cap of the overheated vehicle. • Check air in cooling system.	• After refilling coolant, recheck. • Check the cylinder head gaskets for damage and the tightening torque of the mounting bolts.
		GDS check&Starting engine	• Check DTCs • Check the fan motor performance as temperature varies. • Check if the fan clutch slips. • Check the water pump adherence or impeller damaged.	• Check the engine coolant sensor, wiring and connectors. • Check the fan motor, the relay and the connector. • Replace the fan clutch, if it doesn't work properly. • Replace the water pump, if it doesn't work properly.
		Immerse the thermostat in boiling water and inspection.	• After removing the thermostat, check it works properly. Check the thermostat opens at the valve opening temperature.	• Replace the thermostat, if it doesn't work properly.

Engine Mechanical System > Cooling System > Water pump > Repair procedures

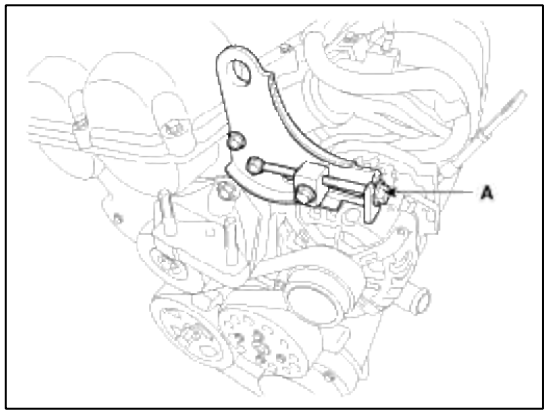
Removal and Installation

Water Pump

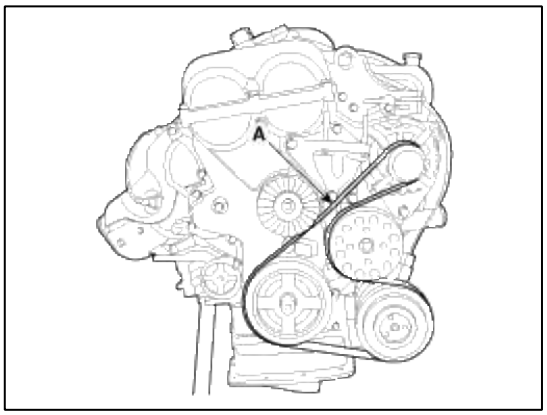
1. Drain engine coolant.

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

2. Loosen the alternator tension adjusting bolt (A) to loosen tension.

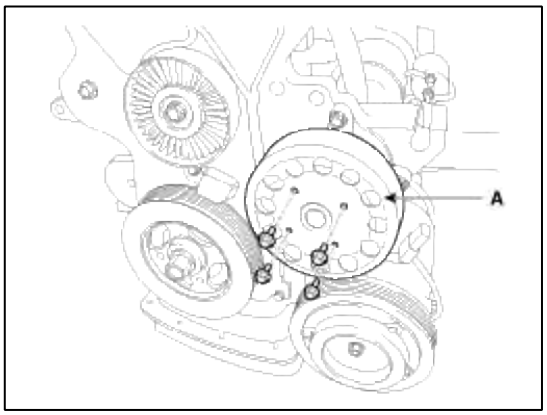


3. Remove the drive belt (A).



4. Remove the water pump pulley (A).

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

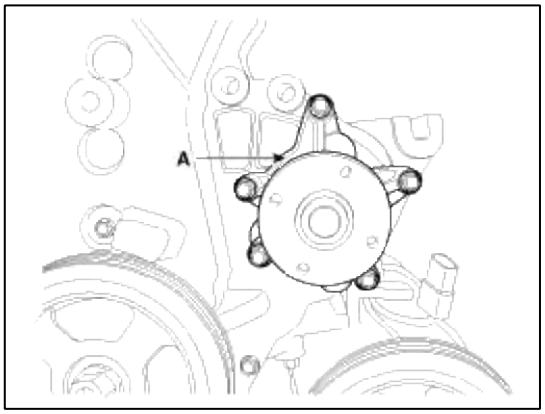


CAUTION

Tighten the bolts diagonally when installing.

5. Remove the water pump (A).

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



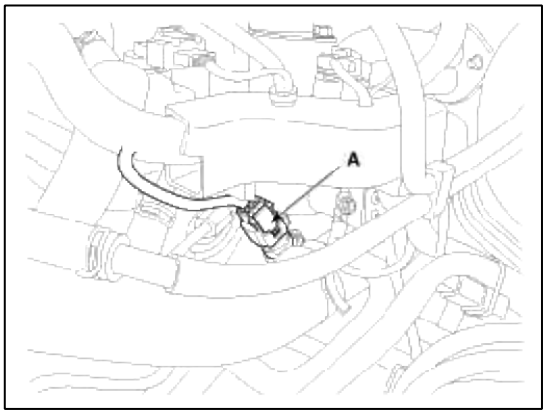
NOTE

Install the water pump with a new gasket.

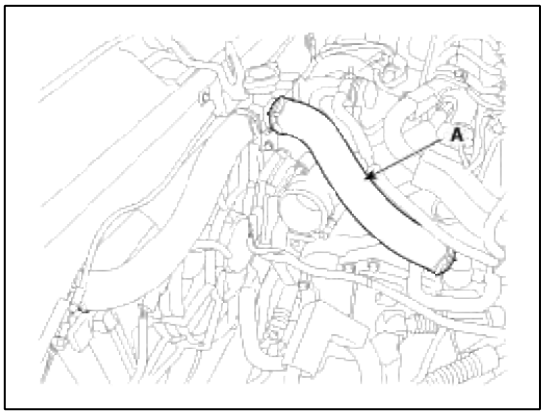
6. To install, reverse the removal orders.
7. Fill with engine coolant.
8. Start engine and check for leaks.
9. Recheck engine coolant level.

Water Temperature Control Assembly

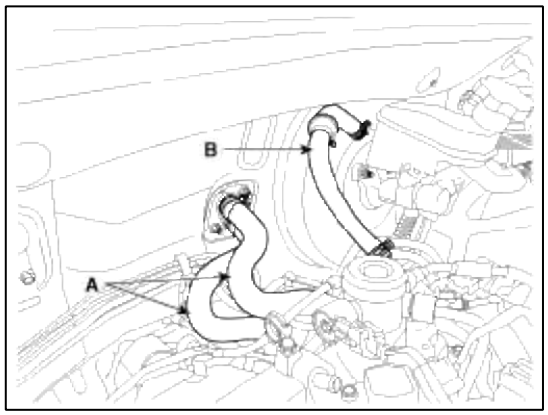
1. Drain engine coolant.
2. Disconnect the battery negative terminal.
3. Remove the air duct and air cleaner assembly. (Refer to Engine and transaxle assembly)
4. Disconnect the engine coolant temperature sensor connector (A).



5. Disconnect the radiator upper hose (A).

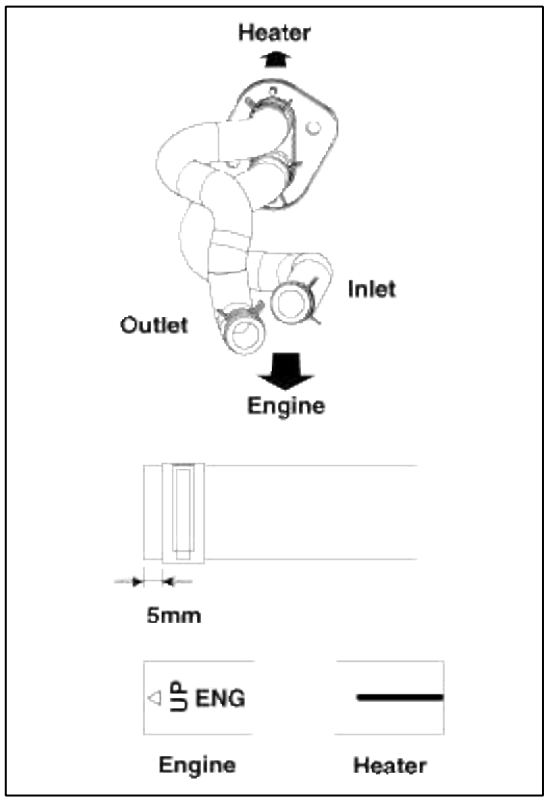


6. Disconnect the heater hoses (A).



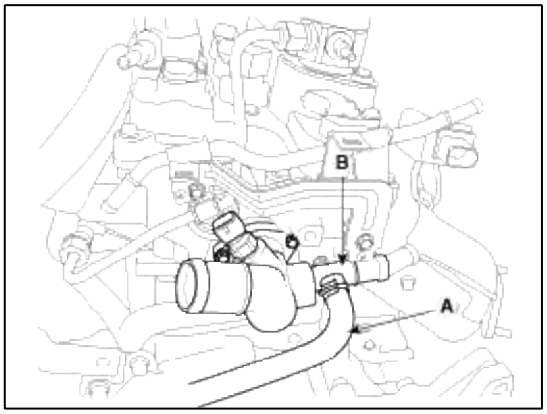
NOTE

Install the heater hoses as shown illustrations.



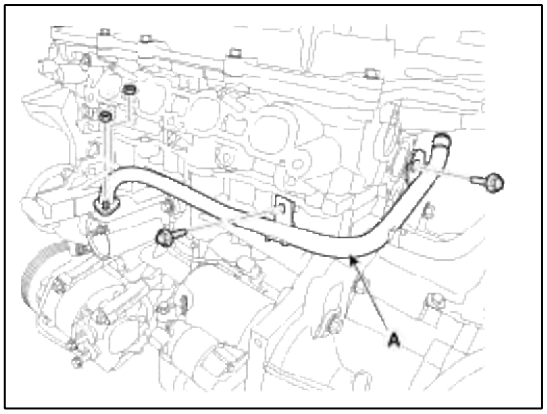
7. Remove the water temperature control assembly (B) after disconnecting the throttle body cooling hose (A).

Tightening torque :
9.8 ~ 11.7N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)



8. Remove the intake manifold. (Refer to Intake and exhaust system)
9. Remove the heater pipe (A).

Tightening torque
M6 bolt and nuts :
9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)
M8 bolt :
18.6 ~ 23.5N.m (1.9 ~ 2.4kgf.m, 13.7 ~ 17.4lb-ft)



10. To install, reverse the removal orders.

CAUTION

Clean the surface of the water temperature control assembly before installing.

Inspection

1. Check each part for cracks, damage or wear, and replace the coolant pump assembly if necessary.
2. Check the bearing for damage, abnormal noise and sluggish rotation, and replace the coolant pump assembly if necessary.

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

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

Engine Mechanical System > Cooling System > Water pump > Troubleshooting

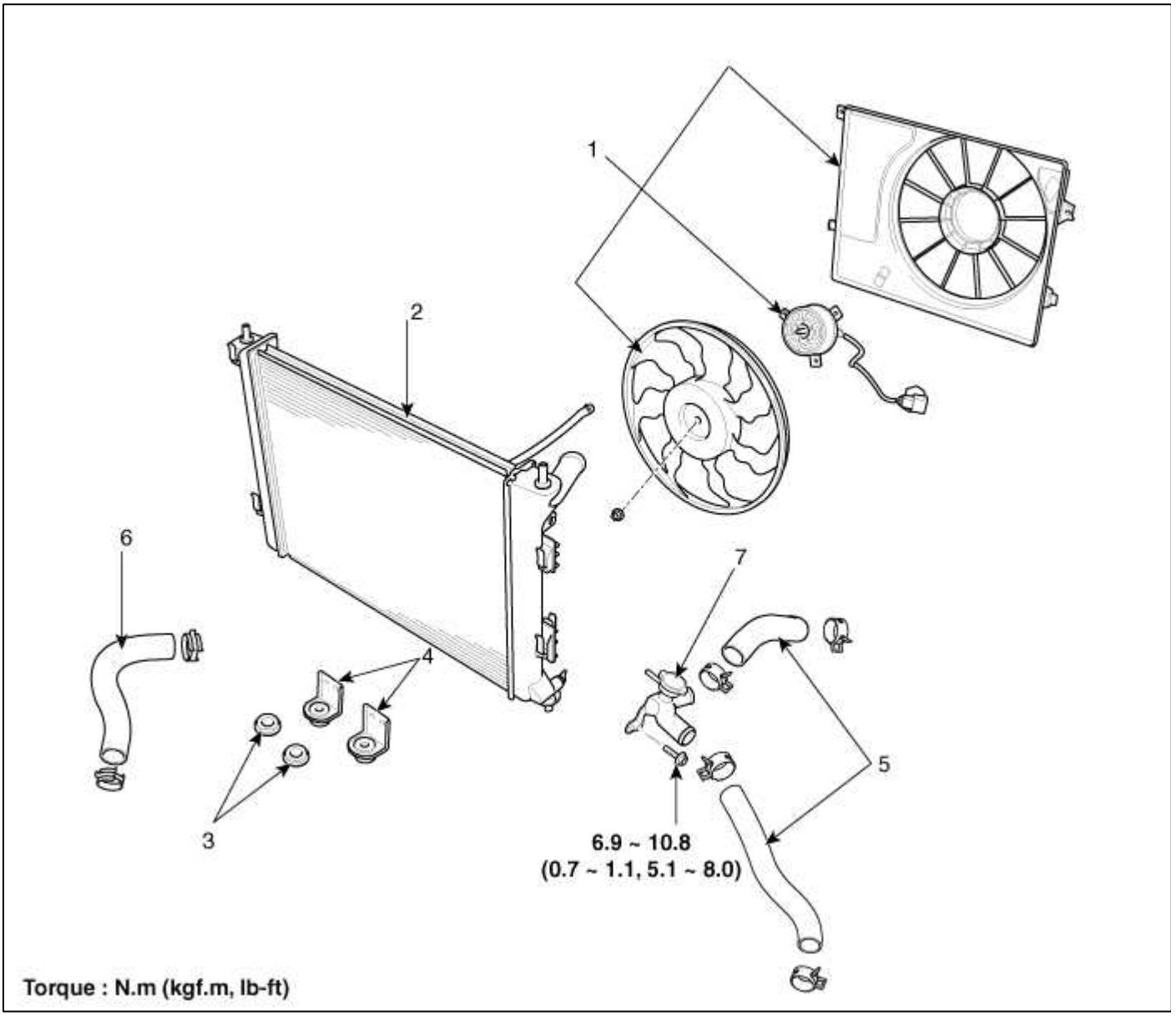
Troubleshooting

Water Pump

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

Engine Mechanical System > Cooling System > Radiator > Components and Components Location

Components



1. Cooling fan & reservoir tank assembly	5. Radiator upper hose
2. Radiator lower hose	6. Radiator lower hose
3. Mounting insulator	7. Filler neck
4. Radiator mounting bracket	

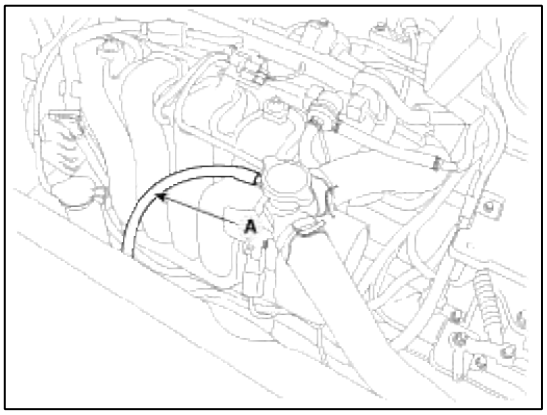
Engine Mechanical System > Cooling System > Radiator > Repair procedures

Removal and Installation

1. Disconnect the battery negative terminal.

Tightening torque
(-) terminal (without battery sensor):
7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)
(-) terminal (with battery sensor):
4.0 ~ 6.0N.m (0.4 ~ 0.6kgf.m, 3.0 ~ 4.4lb-ft)

2. Remove the air cleaner assembly. (Refer to Intake and exhaust system in this group)
3. Remove the front bumper. (Refer to BD group-front bumper)
4. Disconnect the over flow hose (A).

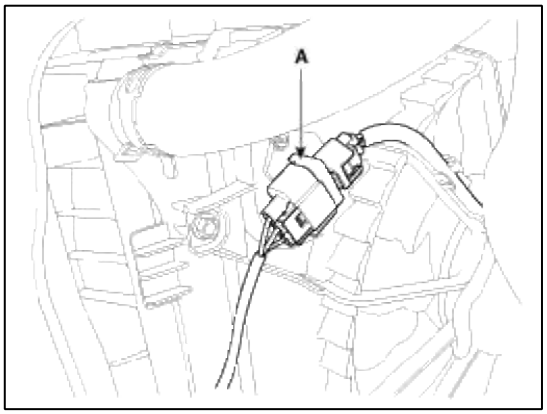


5. Loosen the drain plug and drain the coolant. Open the radiator cap to make rapid draining.

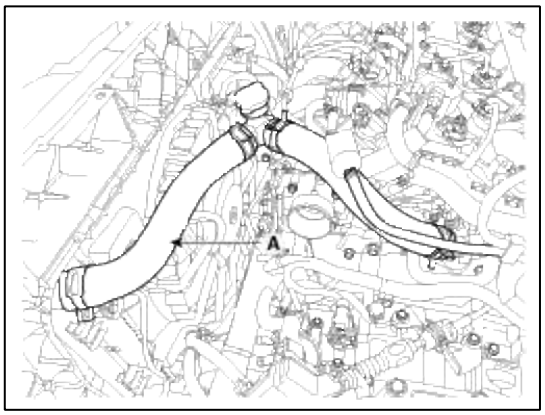
WARNING

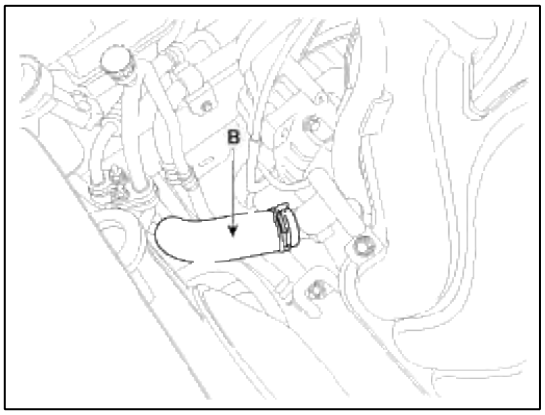
Never remove the radiator cap when the engine is hot. Serious scalding could be caused by hot fluid under high pressure escaping from the radiator.

6. Disconnect the fan motor connector (A).

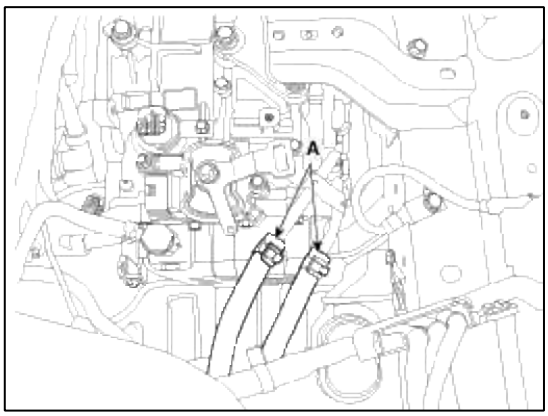


7. Remove the radiator upper hose (A) and lower hose (B).

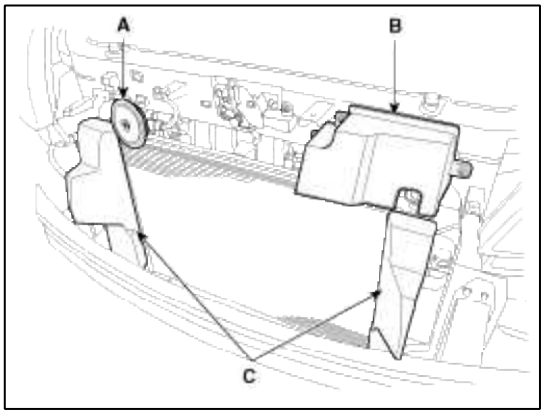




8. Disconnect the ATF cooler hose (A).

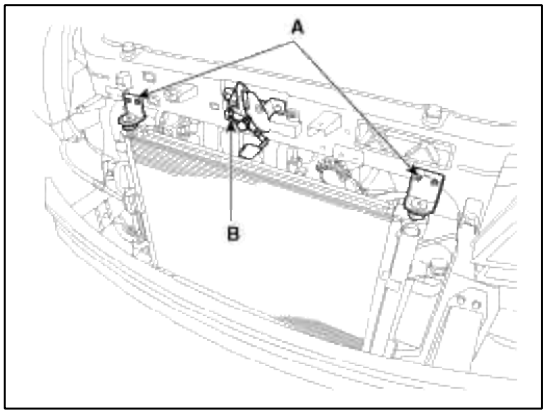


9. Remove the horn (A), intake shield cover (B), air guard (C).

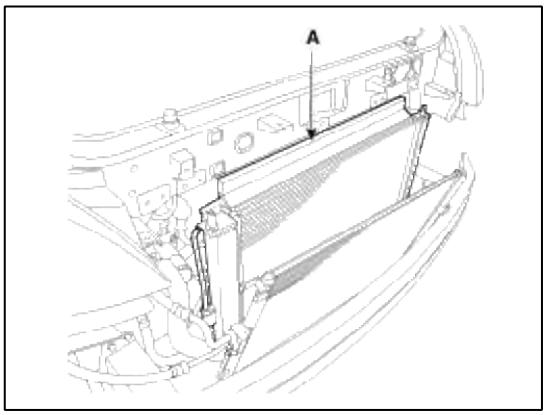


10. Remove the radiator upper mounting bracket (A), hood latch (B).

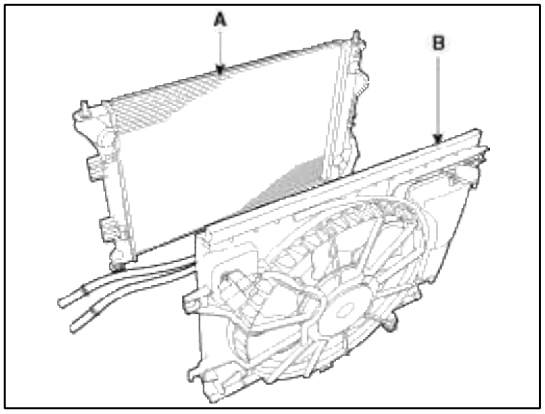
Tightening torque :
6.9 ~ 10.8N.m (0.7 ~ 1.1kgf.m, 5.1 ~ 8.0lb-ft)



11. Remove the A/C condenser from the radiator assembly and then lift up the radiator assembly (A).



12. Remove the cooling fan (B) from the radiator (A).



13. Installation is reverse order of removal.

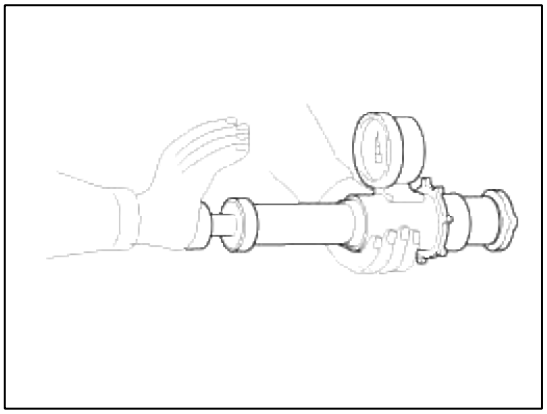
NOTE

- Bleed air from the cooling system.
- Start engine and let it run until it warms up. (Until the radiator fan operates 3 or 4 times.)
- Turn off engine. Check the coolant level and add coolant if needed. This will allow trapped air to be removed from the cooling system.
- Put the radiator cap on tightly, then run engine again and check for leaks.

Inspection

Radiator Cap Testing

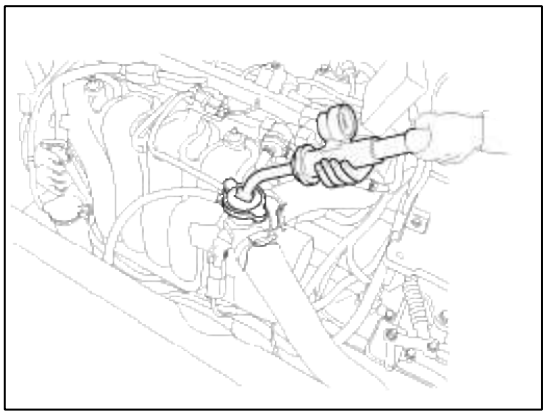
1. Remove the radiator cap, wet its seal with engine coolant, then install it to pressure tester.



2. Apply a pressure of 93 ~ 123kPa (0.95 ~ 1.25kgf/cm², 14 ~ 19psi).
3. Check for a drop in pressure.
4. If the pressure drops, replace the cap.

Radiator Leakage Test

1. Wait until engine is cool, then carefully remove the radiator cap and fill the radiator with engine coolant, then install a pressure tester on it.



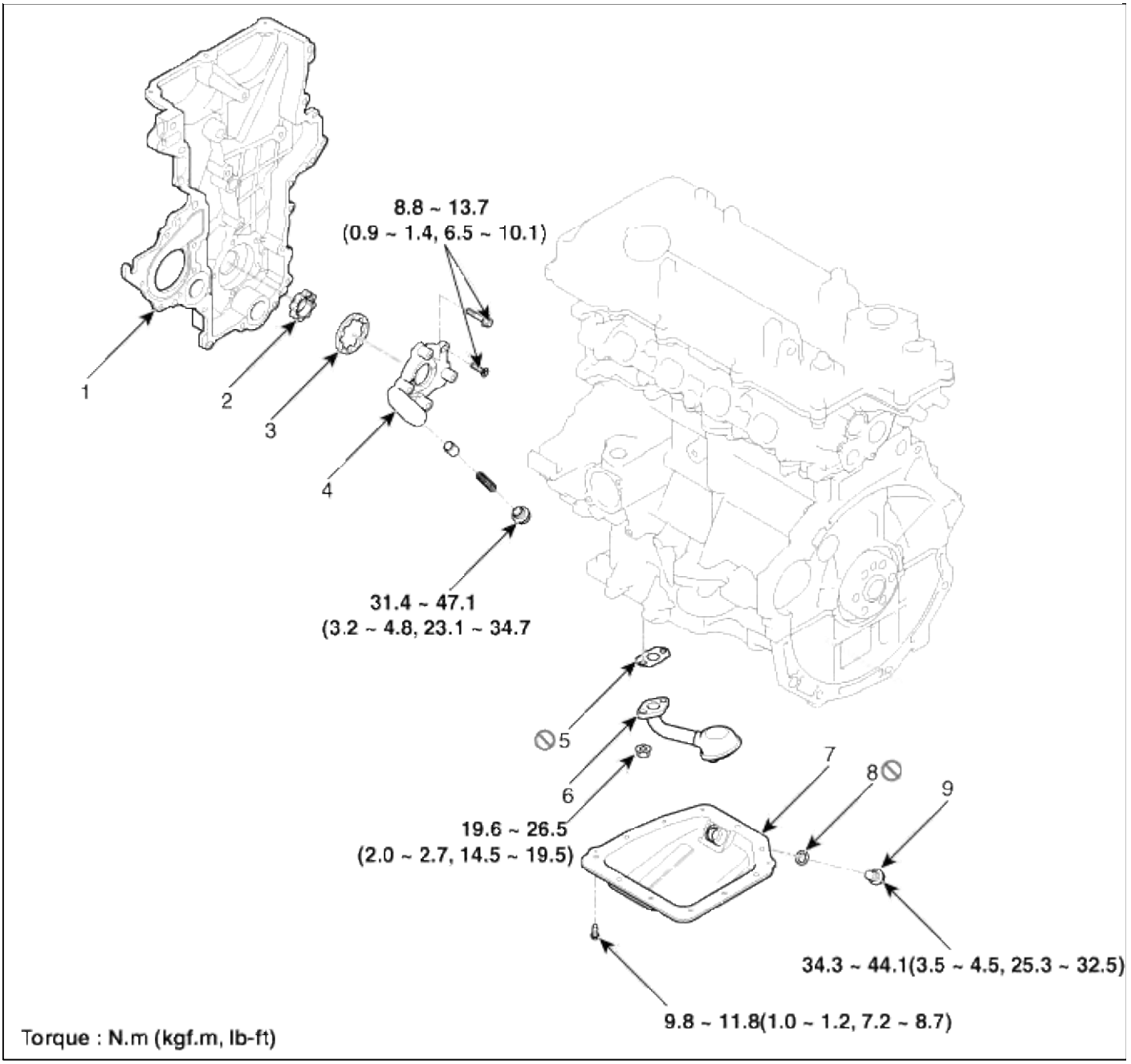
2. Apply a pressure of 93 ~ 123kPa (0.95 ~ 1.25kgf/cm², 14 ~ 19psi).
3. Inspect for engine coolant leaks and a drop in pressure.
4. If the pressure drops, check hoses, the radiator and the water pump for leakage. If there is no leakage, inspect the heater core, the cylinder block and the cylinder head.
5. Remove the tester and reinstall the radiator cap.

NOTE

Check for engine oil in coolant and/or coolant in engine oil.

Engine Mechanical System > Lubrication System > Oil Pump > Components and Components Location

Components



1. Timing chain cover	6. Oil screen
2. Inner roter	7. Oil pan
3. Outer roter	8. Drain plug gasket
4. Pump cover	9. Oil drain plug
5. Gasket	

Engine Mechanical System > Lubrication System > Engine Oil > Repair procedures

Oil And Filter Replacement

CAUTION

- Prolonged and repeated contact with mineral oil will result in the removal of natural fats from the skin, leading to dryness, irritation and dermatitis. In addition, used engine oil contains potentially harmful contaminants which may cause skin cancer.
- Exercise caution in order to minimize the length and frequency of contact of your skin to used oil. Wear protective clothing and gloves. Wash your skin thoroughly with soap and water, or use water-less hand cleaner, to remove any used engine oil. Do not use gasoline, thinners, or solvents.
- In order to preserve the environment, used oil and used oil filter must be disposed of only at designated disposal sites.

1. Drain the engine oil.
   (1) Remove the oil filler cap.
   (2) Remove the oil drain plug, and drain the oil into a container.

2. Replace the oil filter.
   (1) Remove the oil filter.
   (2) Check and clean the oil filter installation surface.
   (3) Check the part number of the new oil filter is as same as old one.
   (4) Apply clean engine oil to the gasket of a new oil filter.
   (5) Lightly screw the oil filter into place, and tighten it until the gasket contacts the seat.
   (6) Tighten it with the torque below.

   Tightening torque :
   11.8 ~ 15.7N.m (1.2 ~ 1.6kgf.m, 8.7 ~ 11.6lb-ft)

3. Refill with engine oil.
   (1) Clean and install the oil drain plug with a new gasket.

   Tightening torque :
   34.3 ~ 44.1N.m (3.5 ~ 4.5kgf.m, 25.3 ~ 32.5lb-ft)

   (2) Fill with fresh engine oil.

   Capacity
   Total : 3.7L (3.91US qt, 3.25lmp qt)
   Oil pan : 3.0L (3.17US qt, 2.64lmp qt)
   Drain and refill in cluding oil filter :
   3.3 L (3.49US qt, 2.90lmp qt)

   (3) Install the oil filler cap.

4. Start engine and check for oil leaks.

5. Recheck the engine oil level.

Inspection

Engine Oil

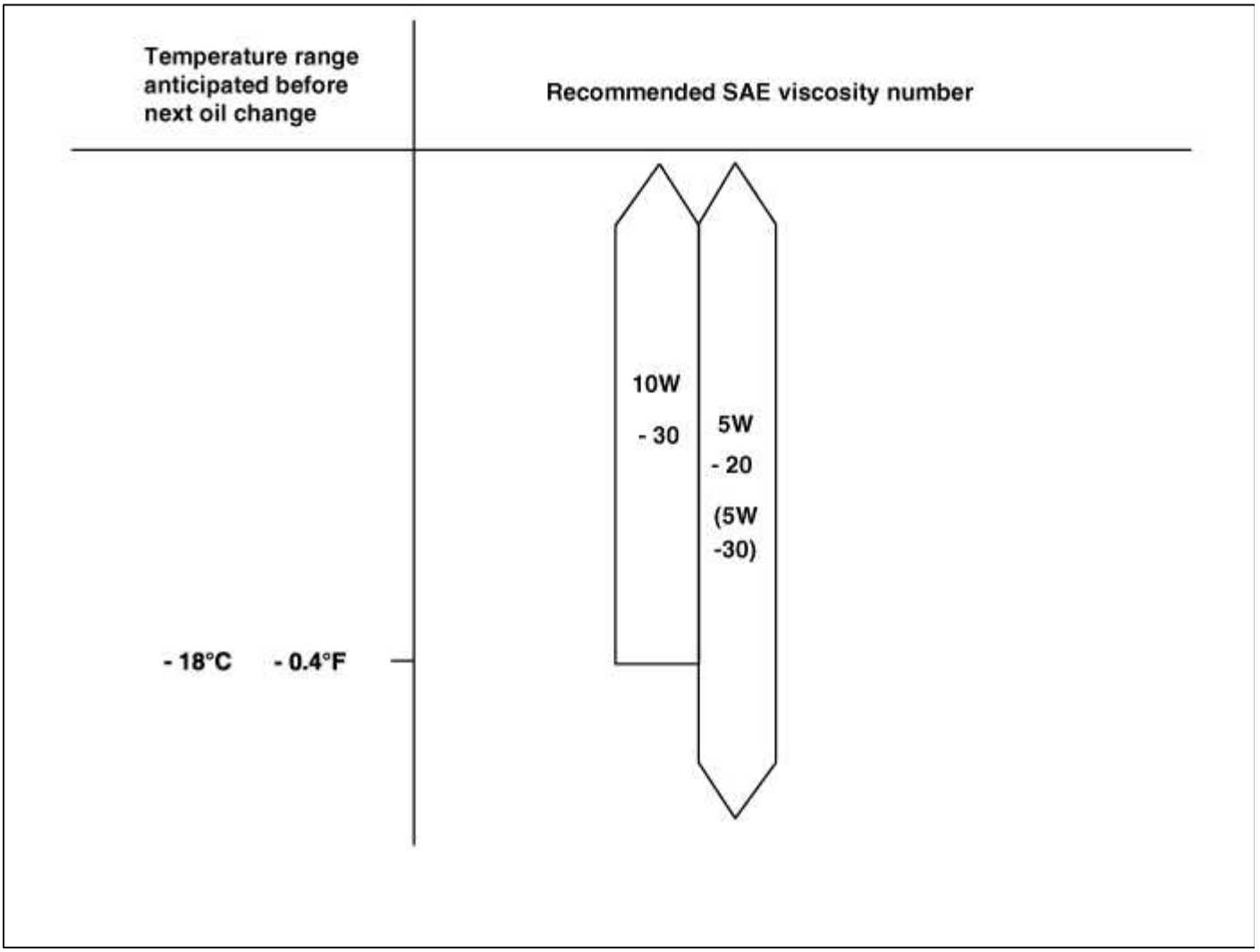
1. Check the engine oil quality.
   Check the oil deterioration, entry of water, discoloring of thinning.
   If the quality is visibly poor, replace the oil.

2. Check the engine oil level.
   After warning up the engine and then 5 minutes after the engine stop, oil level should be between the "L" and "F" marks in the dipstick.
   If low, check for leakage and add oil up to the "F" mark.

> NOTE
>
> Do not fill with engine oil above the "F" mark.

Selection Of Engine Oil

Recommendation of oil classification :
API SM, ILSAC GF-4, ACEA A5 (API SL/ILSAC GF-3/ACEA A3 class oil can be used if the recommended oil is not available)



NOTE

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

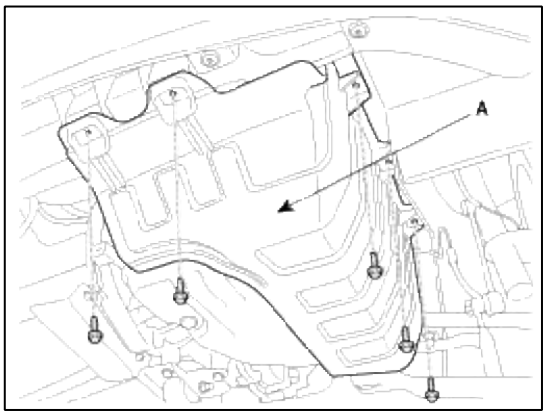
1. Satisfy the requirement of the ACEA, API or ILSAC classification.
2. Have proper SAE grade number for expected ambient temperature range.
3. Lubricants that do not have both an SAE grade number and ACEA, API or ILSAC service classification on the container should not be used.

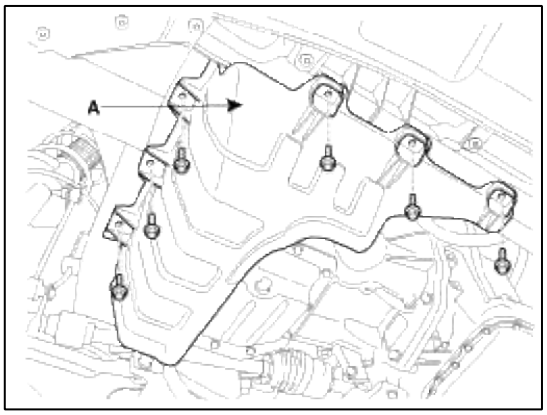
Engine Mechanical System > Lubrication System > Oil Pan > Repair procedures

Removal

1. Remove the under covers (A).

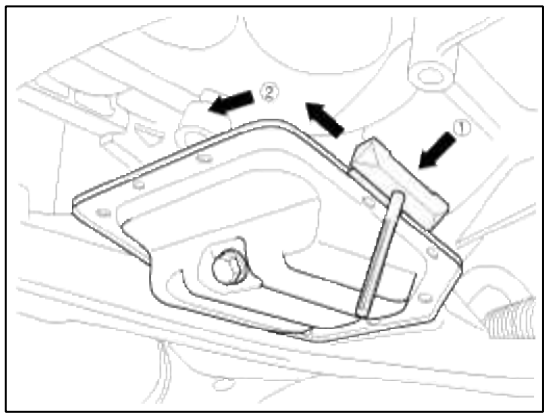
Tightening torque:
6.9 ~ 10.8 N.m (0.7 ~ 1.1 kgf.m, 5.1 ~ 8.0 lb-ft)





2. Drain engine oil.

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



CAUTION

- Insert the SST between the oil pan and the ladder frame by tapping it with a plastic hammer in the direction of ① arrow.
- After tapping the SST with a plastic hammer along the direction of ② arrow around more than 2/3 edge of the oil pan, remove it from the ladder frame.
- Do not turn over the SST abruptly without tapping. It be result in damage of the SST.

Installation

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

NOTE

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

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

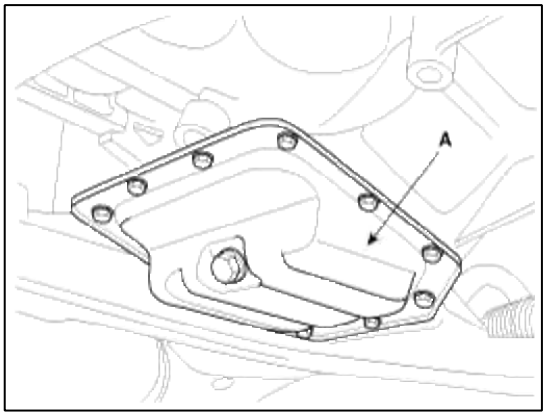
Liquid gasket : TB 1217H or LOCTITE 5900H

NOTE

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

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

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

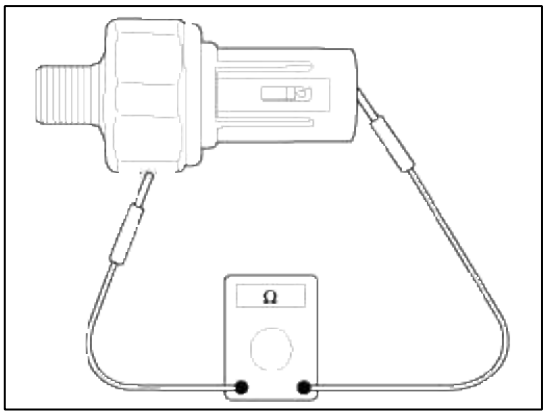


2. Refill engine oil.

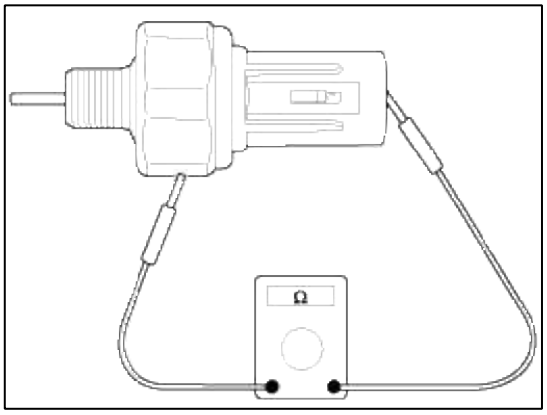
Engine Mechanical System > Lubrication System > Oil Pressure Switch > Repair procedures

Inspection

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



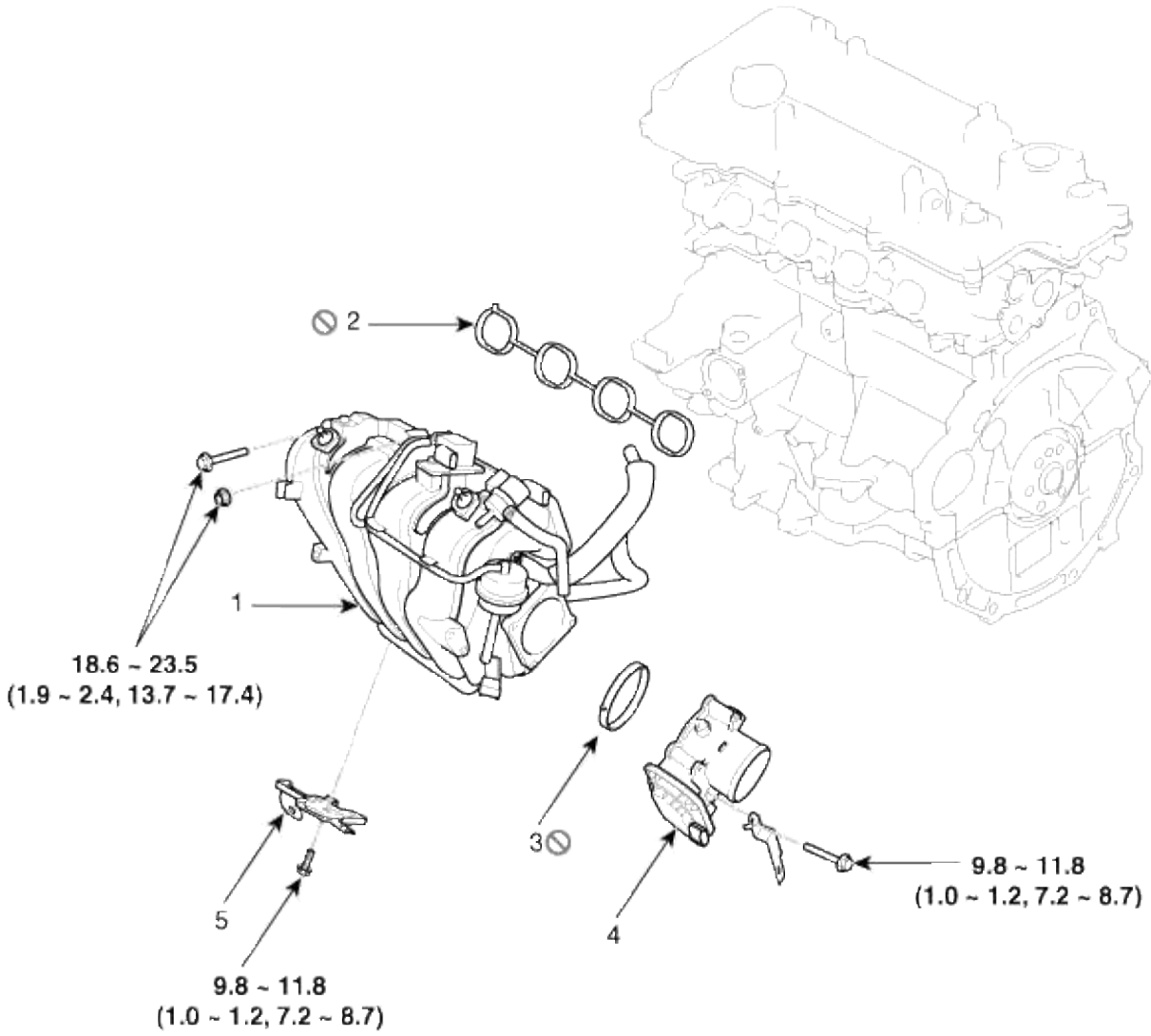
2. Check the continuity between the terminal and the body when the fine wire is pushed. If there is continuity even when the fine wire is pushed, replace the switch.



3. If there is no continuity when a 49.0kpa (0.5kg/cm², 7.1psi) is applied through the oil hole, the switch is operating properly.
   Check for air leakage. If air leaks, the diaphragm is broken. Replace it.

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

Components



1. Intake manifold 2. Intake manifold gasket 3. Electronic throttle body gasket	4. Electronic throttle body 5. Bracket

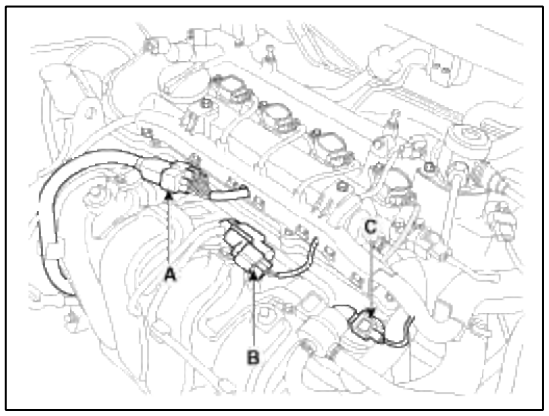
Engine Mechanical System > Intake And Exhaust System > Intake Manifold > Repair procedures

Removal and Installation

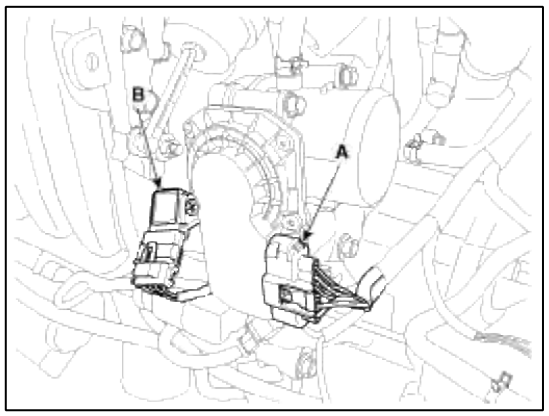
1. Remove the engine cover.
2. Disconnect the battery negative terminal.

Tightening torque :
Without battery sensor :
7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)
With battery sensor :
4.0 ~ 6.0N.m (0.4 ~ 0.6kgf.m, 3.0 ~ 4.4lb-ft)

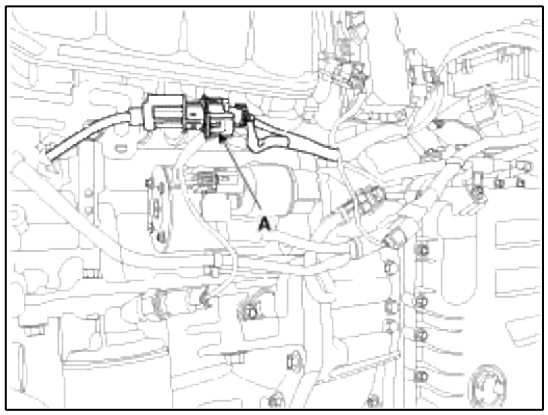
3. Remove the air duct and the air cleaner assembly.
(Refer to Engine and transaxle assembly)
4. Disconnect the injector extension connector (A), the VIS (Variable intake system) connector (B) and the PCSV (Purge control solenoid valve) connector (C).



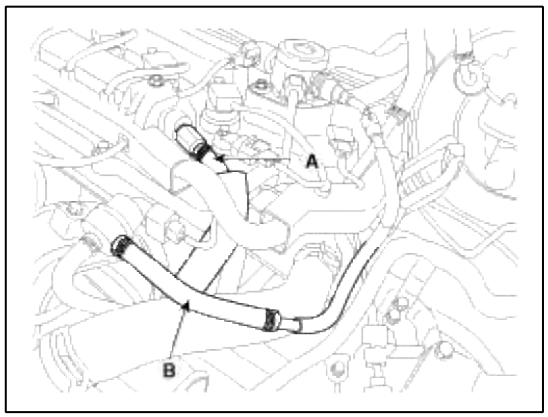
5. Disconnect the ETC (Electronic throttle control) connector (A) and the MAPS (Manifold absolute pressure sensor) & IATS (Intake air temperature sensor) connector (B).



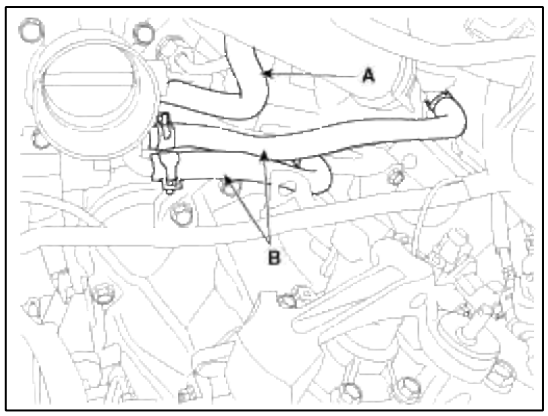
6. Disconnect the knock sensor connector (A).



7. Disconnect the PCV (Positive crankcase ventilation) hose (A) and the PCSV (Purge control solenoid valve) hose (B).

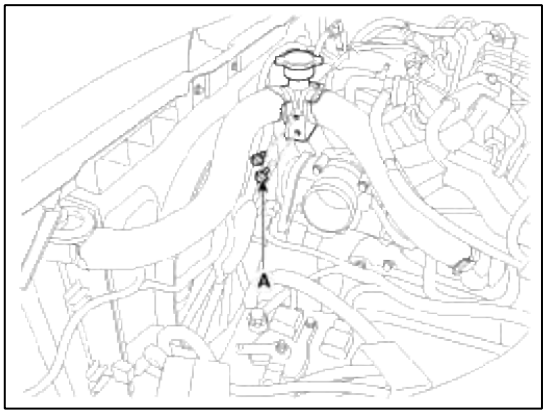


8. Disconnect the vacuum hose (A) and the throttle body coolant hoses (B).



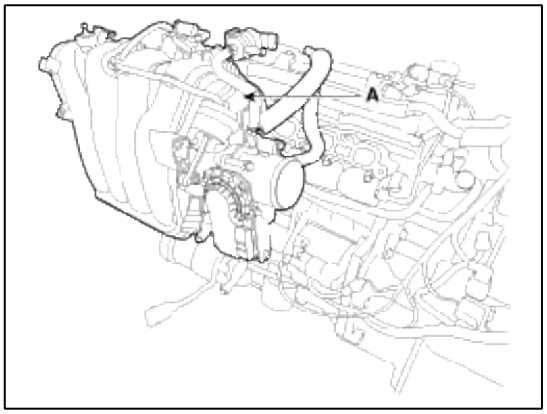
9. Unfasten the filler neck assembly mounting bolts (A).

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



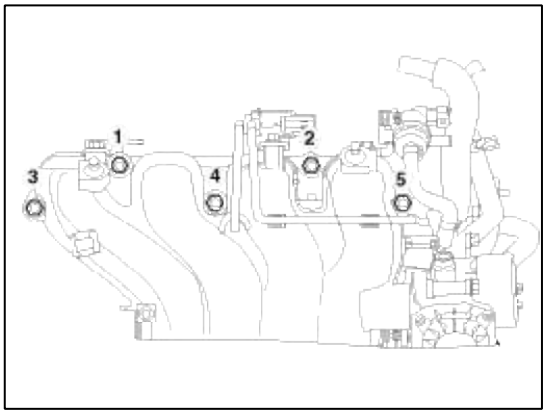
10. Remove the intake manifold (A) with the gasket (B).

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



NOTE

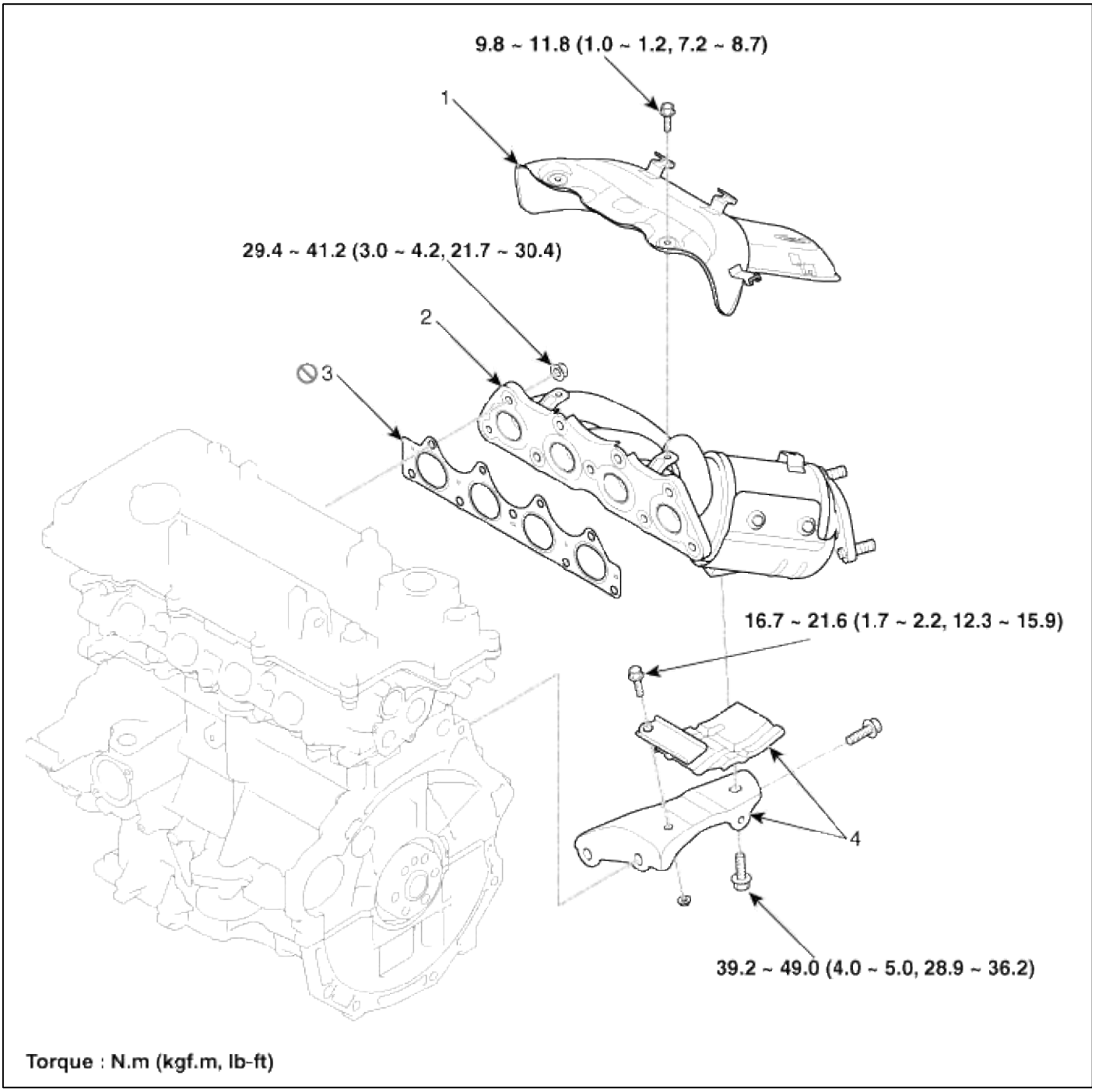
When installing, replace with new gaskets.
When installing the intake manifold, tighten the bolts and nuts with pre-torque first, and then tighten the bolts and nuts with specified torque in the sequence shown.



11. Installation is reverse order of removal.

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

Components



1. Heat protector	3. Exhaust manifold gasket
2. Exhaust manifold	4. Exhaust manifold stay

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

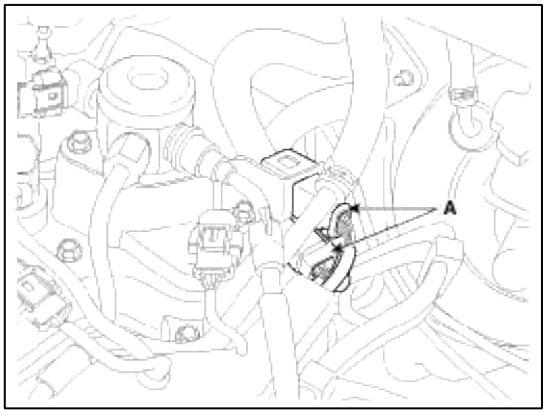
Removal and Installation

1. Remove the engine cover.

2. Disconnect the battery negative terminal.

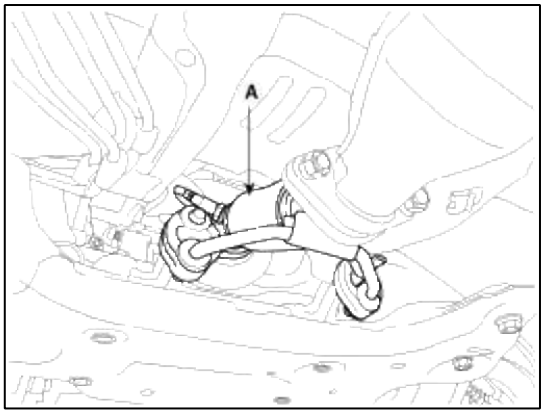
Tightening torque :
Without battery sensor :
7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)
With battery sensor :
4.0 ~ 6.0N.m (0.4 ~ 0.6kgf.m, 3.0 ~ 4.4lb-ft)

3. Disconnect the front and rear oxygen sensor connectors (A).



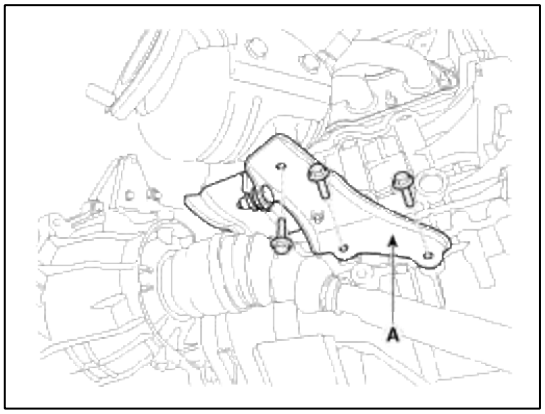
4. Remove the front muffler (A).

Tightening torque:
39.2 ~ 58.8 N.m (4.0 ~ 6.0 kgf.m, 28.9 ~ 43.4 lb-ft)



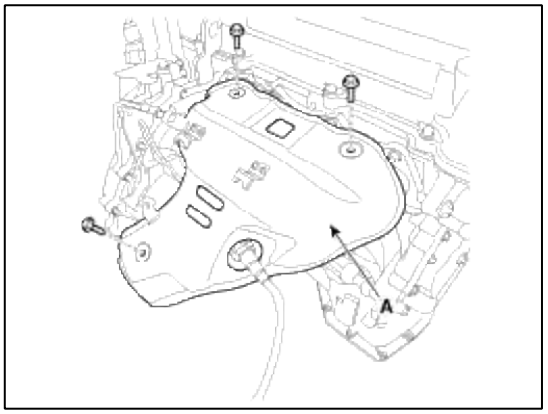
5. Remove the exhaust manifold stay (A).

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



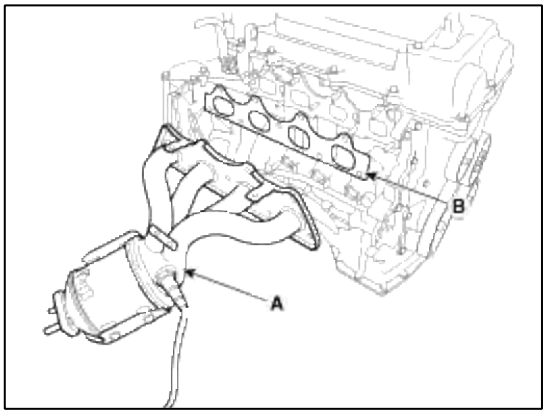
6. Remove the heat protector (A).

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



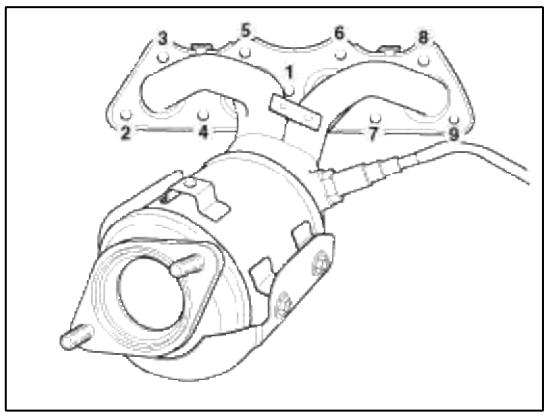
7. Remove the exhaust manifold (A).

Tightening torque:
29.4 ~ 41.2N.m (3.0 ~ 4.2kgf.m, 21.7 ~ 30.4lb-ft)



NOTE

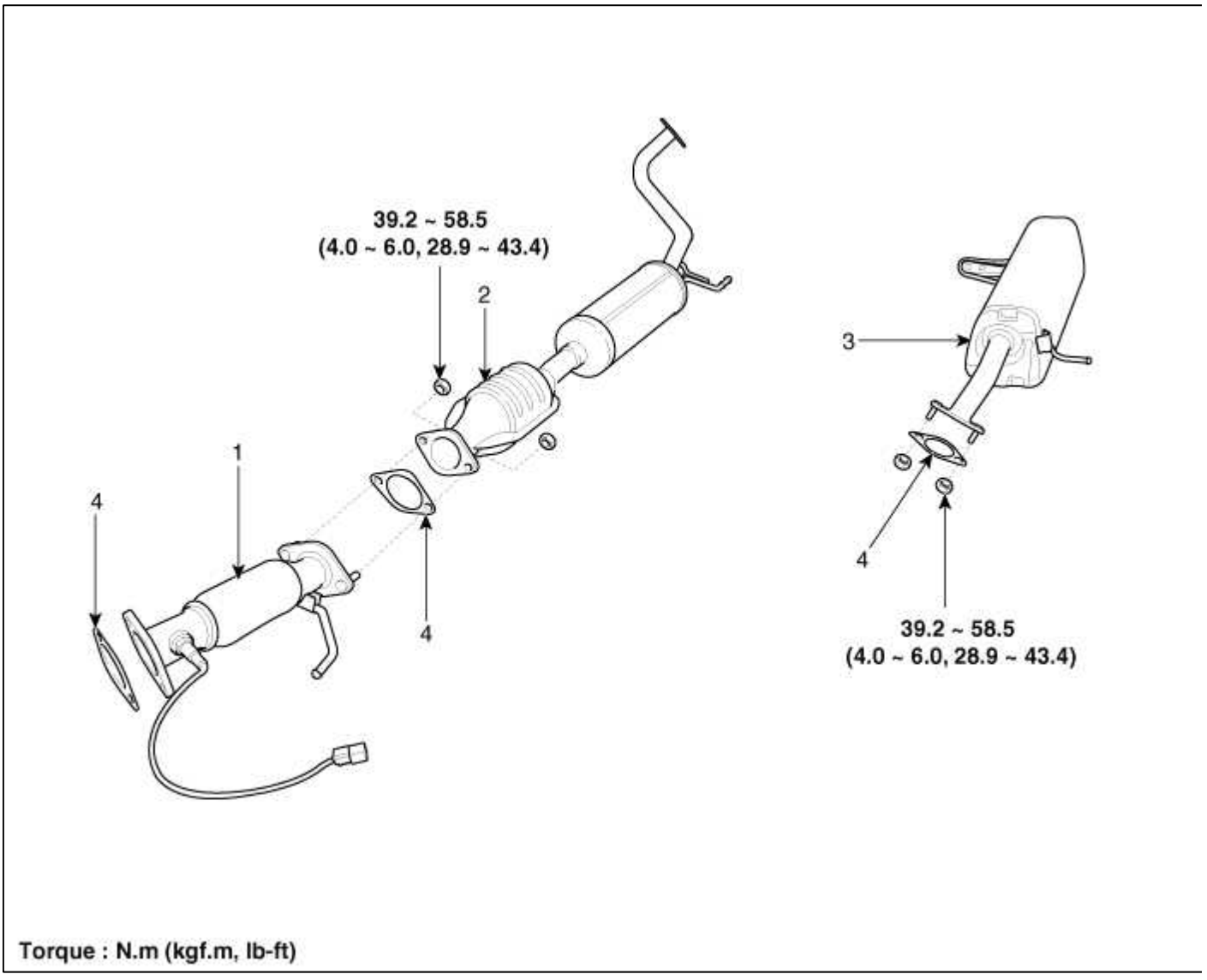
When installing, replace with a new gasket.
When installing the intake manifold, tighten the nuts with pre-torque first, and then tighten the nuts with specified torque in the sequence shown.



8. Installation is reverse order of removal.

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

Components



1. Front muffler 2. Catalytic converter & center muffler assembly	3. Main muffler 4. Gasket

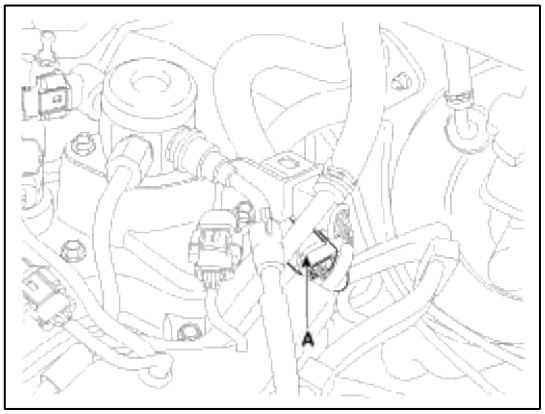
Engine Mechanical System > Intake And Exhaust System > Muffler > Repair procedures

Removal and Installation

1. Disconnect the battery negative terminal.

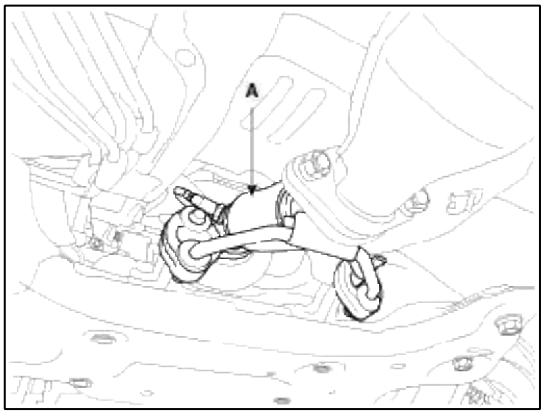
Tightening torque
Without battery sensor :
7.8 ~ 9.8 N.m (0.8 ~ 1.0 kgf.m, 5.8 ~ 7.2 lb-ft)
With battery sensor :
4.0 ~ 6.0 N.m (0.4 ~ 0.6 kgf.m, 3.0 ~ 4.4 lb-ft)

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



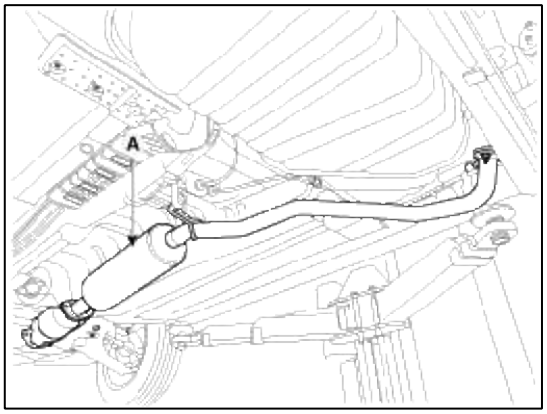
3. Remove the front muffler (A).

Tightening torque:
39.2 ~ 58.8 N.m (4.0 ~ 6.0 kgf.m, 28.9 ~ 43.4 lb-ft)

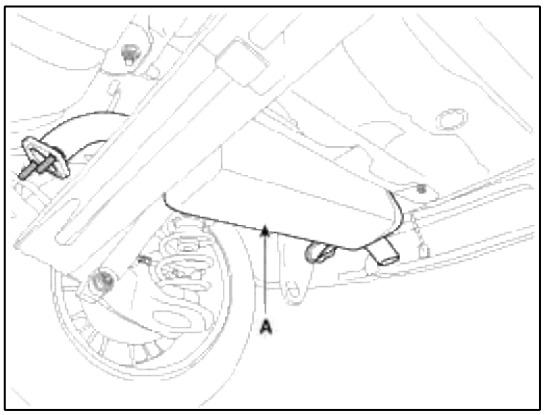


4. Remove the center muffler (A).

Tightening torque:
39.2 ~ 58.8 N.m (4.0 ~ 6.0 kgf.m, 28.9 ~ 43.4 lb-ft)



5. Remove the main muffler (A).



6. Installation is the reverse order of removal.

NOTE

When installing, replace with new gaskets.

SOUL(AM) > 2012 > G 1.6 GDI > Engine Electrical System

Engine Electrical System > General Information > Specifications

Specifications

Ignition System

Items			Specification
Ignition coil	Primary resistance		0.75 ± 15% (Ω)
	Secondary resistance		5.9 (kΩ)
Spark plugs	GDI	Type	SILZKR6B10
		Gap	0.9 ~ 1.0 mm (0.0433 ~ 0.0394 in.)

Starting System

Items			Specification	
			Non-ISG	ISG
Starter	Rated voltage		12 V, 0.9kW	12 V, 1.3kW
	No. of pinion teeth		8	9
	No-load characteristics	Voltage	11.5V	12V
		Ampere	60A, MAX	95A, MAX
		Speed	5,500rpm, MIN	3,500rpm, MIN

Charging System

Items			Specifications	
Alternator (AMS)	Rate voltage		13.5V, 110A	
	Speed in use		1,000 ~ 18,000 rpm	
	Voltage regulator		IC regulator built-in type	
	Regulator setting voltage	External mode	ECU control	
		Internal mode	14.55 ± 0.3V	
	Temperature compensation	External mode	ECU control	
		Internal mode	-3.5 ± 2mV / °C	
Alternator (Non-AMS)	Rate voltage		13.5V, 90A	
	Speed in use		1,000 ~ 18,000rpm	
	Voltage regulator		IC regulator built-in type	
	Regulator setting voltage		14.55±0.2V	
	Temperature compensation		-7 ± 3mV / °C	
Items			Non-ISG	ISG
Battery	Type		36-20GL	56-28GL(AGM)
	Cold cranking amperage [at -18°C(-0.4°F)]		410 A	760 A
	Reserve capacity		80 min	120 min
	Specific gravity [at 25°C(77°F)]		1.280 ± 0.01	1.310 ± 0.01

CAUTION

- COLD CRANKING AMPERAGE is the amperage a battery can deliver for 30 seconds and maintain a terminal voltage of 7.2V or greater at a specified temperature.
- RESERVE CAPACITY RATING is amount of time a battery can deliver 25A and maintain a minimum terminal voltage of 10.5V at 26.7°C(80.1°F).

NOTE

- Battery type notation : MF 48 - 23 G L
  (① ② ③ ④ ⑤)

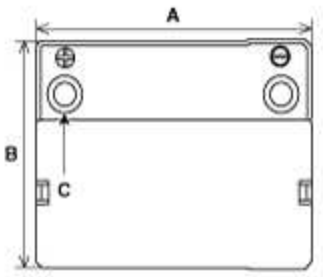
① : Battery type
- MF : Maintenance Free

② : Battery capacity (5HR)
- 48 : 48AH

③ : Battery length (A)
- 23 : 230mm (9.06in)

④ : Battery width (B)
- A : 127mm (5.00in)
- B : 129mm (5.08in)
- C : 132mm (5.20in)
- D : 135mm (5.31in)
- E : 154mm (6.06in)
- F : 173mm (6.81in)
- G : 175mm (6.89in)
- H : 176mm (6.93in) or above

⑤ : Terminal location (C)
- L : Positive terminal is left
- R : Positive terminal is right



Engine Electrical System > General Information > Troubleshooting

Troubleshooting

Ignition System

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

Charging System

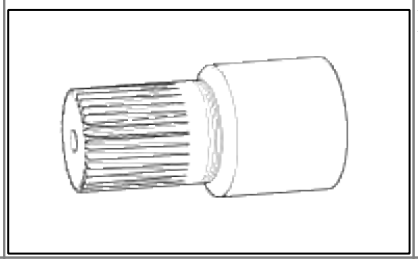
Symptom	Suspect area	Remedy
Charging warning indicator does not light with ignition switch "ON" and engine off.	Fuse blown	Check fuses
	Light burned out	Replace light
	Wiring connection loose	Tighten loose connection
	Electronic voltage regulator	Disconnect the voltage regulator to see if light turns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

Starting System

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

Engine Electrical System > General Information > Special Service Tools

Special Service Tools

Tool (Number and name)	Illustration	Use
Alternator pulley remover wrench (09373-27000)		Removal and installation of alternator pulley

Engine Electrical System > Ignition System > Description and Operation

Description

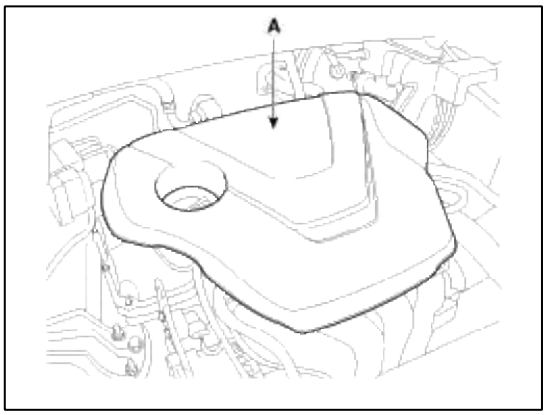
Ignition timing is controlled by the electronic control ignition timing system. The standard reference ignition timing data for the engine operating conditions are preprogrammed in the memory of the ECM (Engine Control Module). The engine operating conditions (speed, load, warm-up condition, etc.) are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

Engine Electrical System > Ignition System > Repair procedures

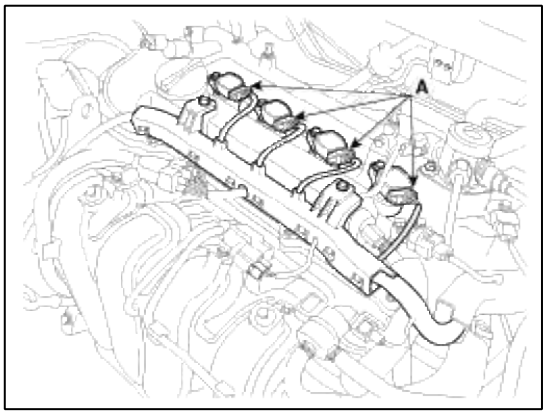
On-vehicle Inspection

Spark Test

1. Remove the engine cover (A).

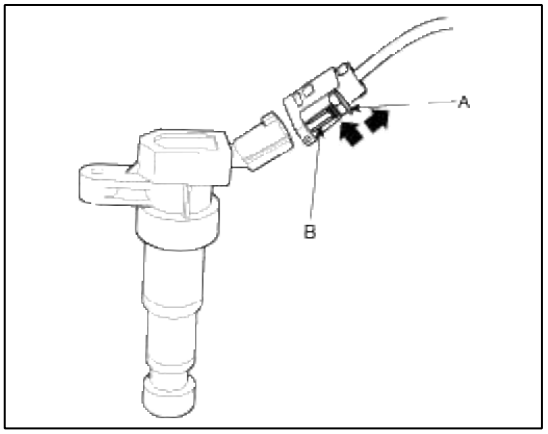


2. Disconnect the ignition coil connectors (A).

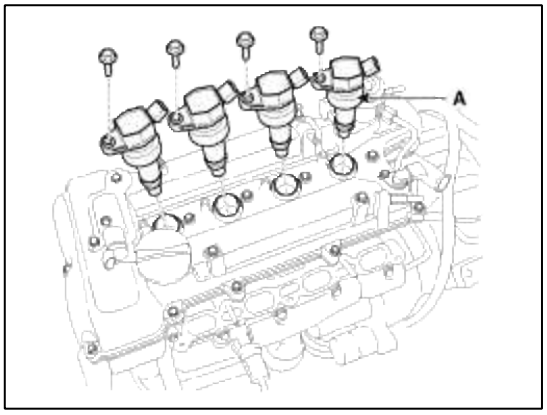


NOTE

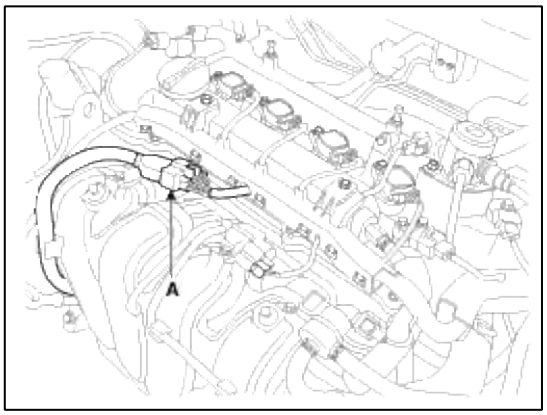
When removing the ignition coil connector, pull the lock pin (A) and push the clip (B).



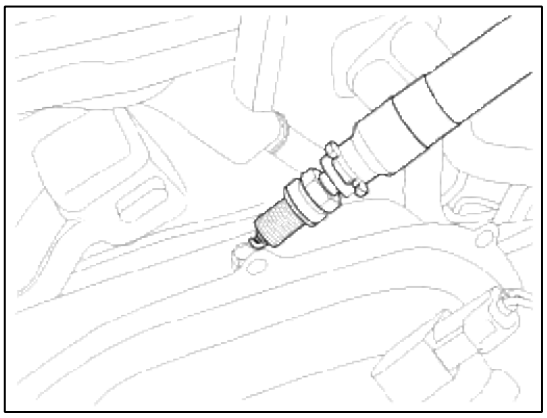
3. Remove the ignition coils (A).



4. Disconnect the injector connector or extension connector (A).



5. Using a spark plug socket, remove the spark plug.
6. Install the spark plug to the ignition coil.
7. Ground the spark plug to the engine.



8. Check if spark occurs while engine is being cranked.

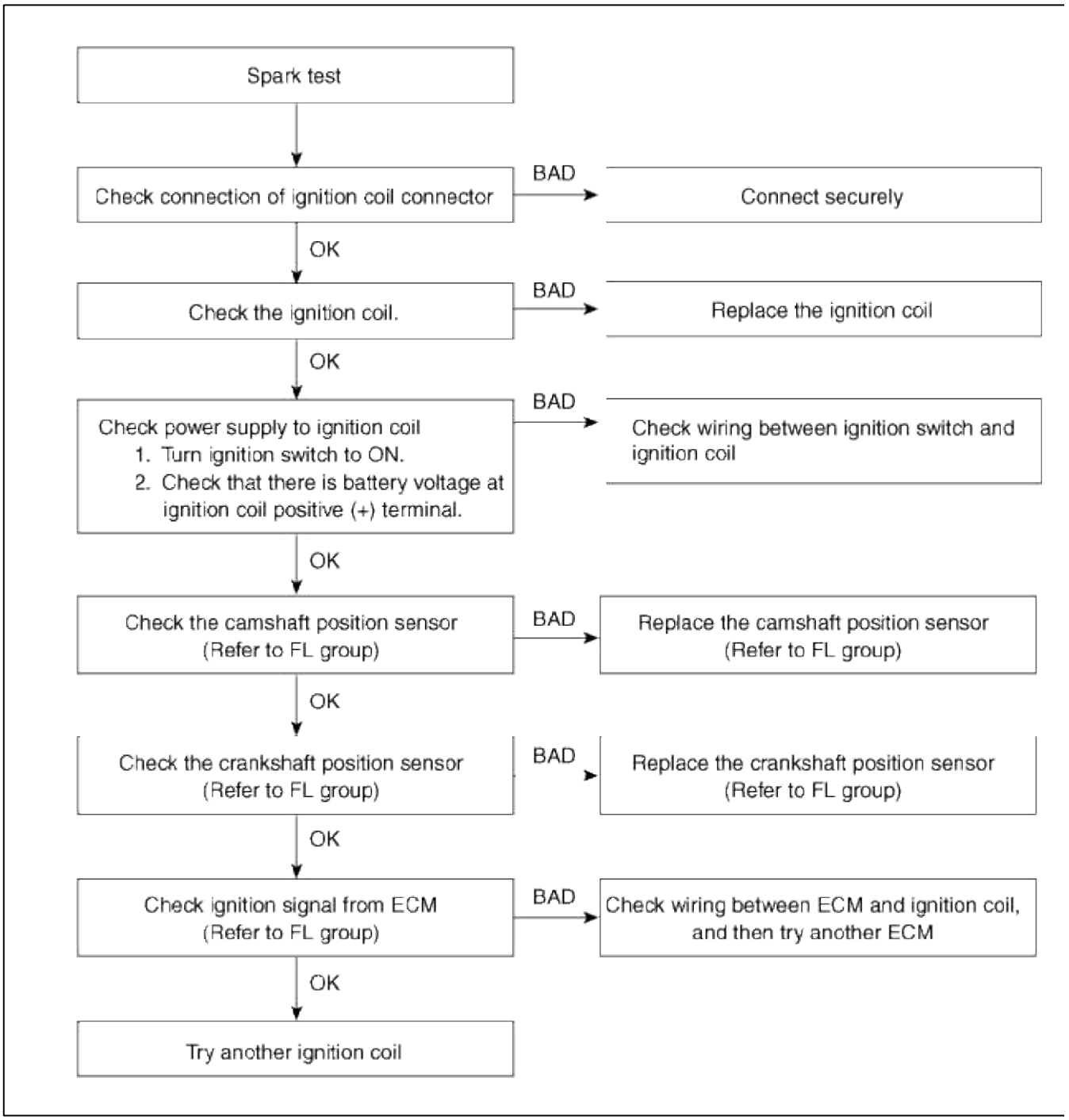
> NOTE
>
> To prevent fuel being injected from injectors while the engine is being cranked, disconnect the fuel pump connector.
> Crank the engine for no more than 5 ~ 10 seconds.

9. Inspect all the spark plugs.
10. Using a spark plug socket, install the spark plug.
11. Install the ignition coil.

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

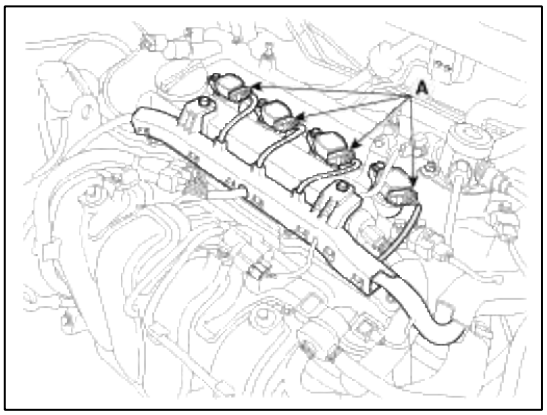
> NOTE
>
> When inserting ignition coil into the cylinder head cover for spark plug to be inserting ignition coil, the sealing cap of ignition coil must be mated totally with inner side of cylinder head.

12. Reconnect the ignition coil connectors.



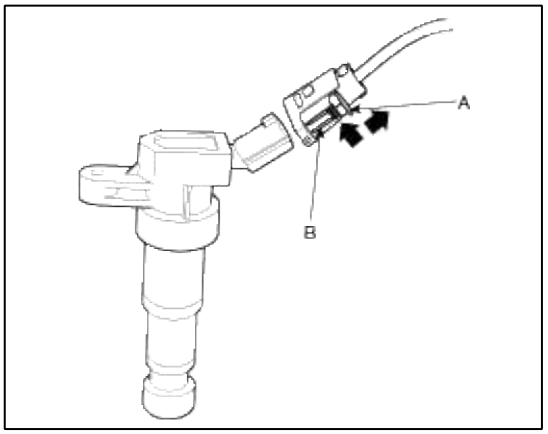
Inspect Spark Plug

1. Disconnect the ignition coil connectors (A).



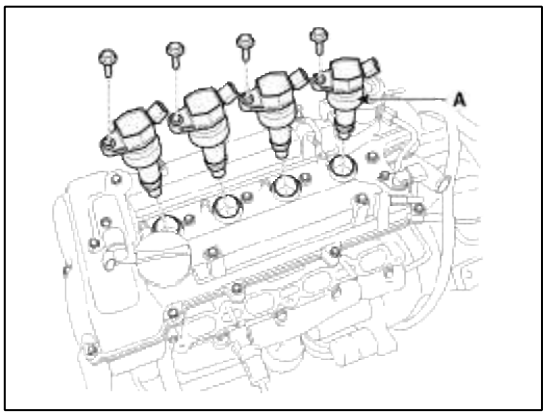
NOTE

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



2. Remove the ignition coils (A).

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

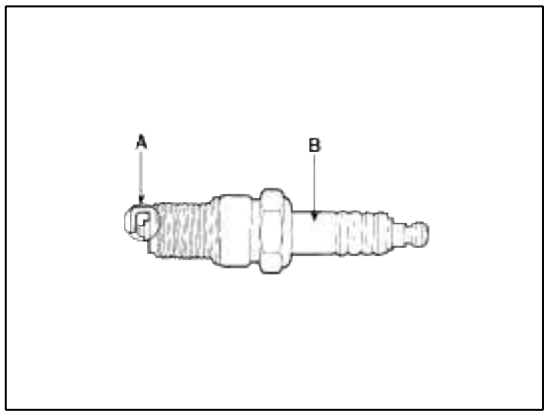


3. Using a spark plug socket, remove the spark plug.

CAUTION

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

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

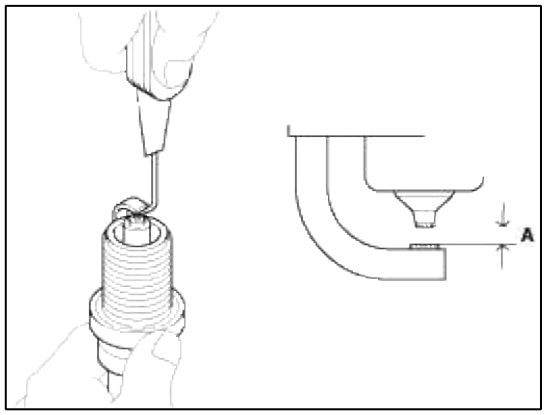


Inspection Of Electrodes

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

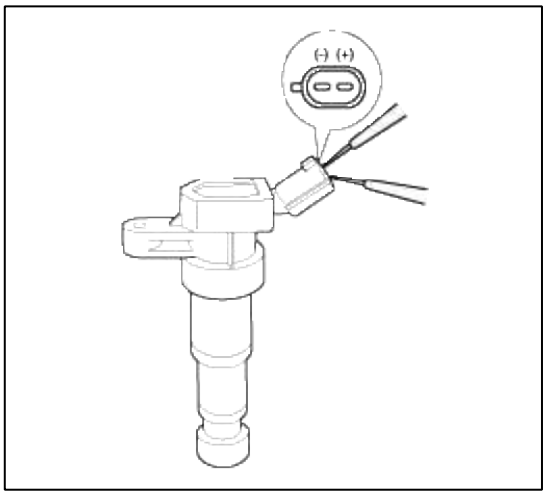
5. Check the electrode gap (A).

Standard
GDI : 0.9 ~ 1.0 mm (0.0354 ~ 0.0394 in.)
MPI (Unleaded):
1.0 ~ 1.1 mm (0.0394 ~ 0.0433 in.)
MPI (Leaded) :
0.8 ~ 0.9 mm (0.0314 ~ 0.0354 in.)



Inspect Ignition Coil

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



Standard value : 0.75Ω ± 15%

Engine Electrical System > Charging System > Description and Operation

Description

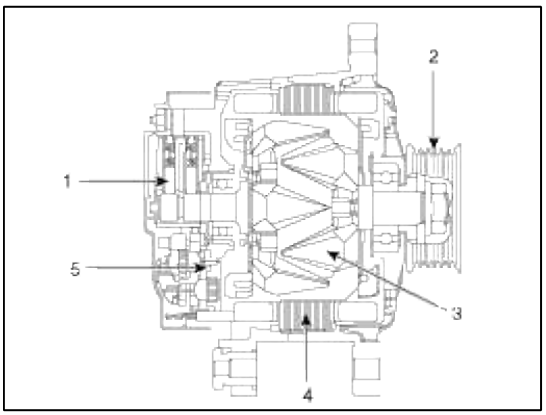
The charging system includes a battery, an alternator with a built-in regulator, and the charging indicator light and wire.

The Alternator has built-in diodes, each rectifying AC current to DC current.

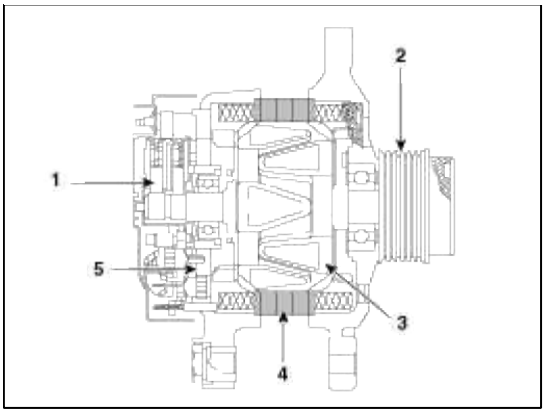
DC current appears at alternator "B" terminal. The charging voltage of this alternator is regulated by the battery voltage detection system (or ECM - with AMS).

The main components of the alternator are the rotor, stator, rectifier, capacitor, brushes, bearings and V-ribbed belt pulley (or OAD : Overrunning Alternator Decoupler). The brush holder contains a built-in electronic voltage regulator.

[Without OAD]



[With OAD]



1. Brush
2. Drive belt pulley
3. Rotor
4. Stator
5. Rectifier

Alternator Management System (AMS)
Alternator management system controls the charging voltage set point in order to improve fuel economy, manage alternator load under various operating conditions, keep the battery charged, and protect the battery from over-charging. ECM controls generating voltage by duty cycle (charging control, discharging control, normal control) based on the battery conditions and vehicle operating conditions.
The system lowers the charging rate when accelerating. Lowering the charging rate will allow more engine power for accelerating.
The system increases the charging rate when decelerating. The system uses the unused power of the decelerating engine and increases the charging rate.

Engine Electrical System > Charging System > Repair procedures

On-vehicle Inspection

CAUTION

- Check that the battery cables are connected to the correct terminals.
- Disconnect the battery cables when the battery is given a quick charge.
- Never disconnect the battery while the engine is running.

Check Battery Voltage

1. If 20 minutes have not passed since the engine was stopped, turn the ignition switch ON and turn on the electrical system (headlamp, blower motor, rear defogger etc.) for 60 seconds to remove the surface charge.
2. Turn the ignition switch OFF and turn off the electrical systems.
3. Measure the battery voltage between the negative (-) and positive (+) terminals of the battery.

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

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

Check The Battery Terminals And Fuses

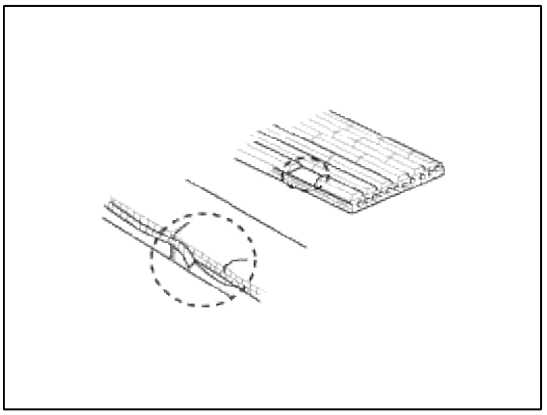
1. Check that the battery terminals are not loose or corroded.

2. Check the fuses for continuity.

Inspect Drive Belt
Visually check the belt for excessive wear, frayed cords etc.
If any defect has been found, replace the drive belt.

NOTE

Cracks on the rib side of a belt are considered acceptable. If the belt has chunks missing from the ribs, it should be replaced.



Drive belt tension measurement and adjustment

Belt tension measurement

Measure the belt tension using a mechanical tension gauge or a sonic tension meter.

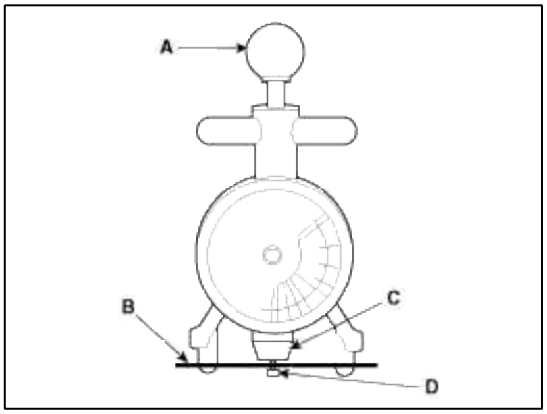
Tension
[Without OAD]
New belt: 882.6 ~ 980.7N (90 ~ 100kg, 198.4 ~ 220.5lb)
Used belt: 637.4 ~ 735.5N (65 ~ 75kg, 143.3 ~ 165.3lb)
[With OAD]
New belt: 686.5 ~ 784.5N (70 ~ 80kg, 154.3 ~ 176.4lb)
Used belt: 490.3 ~ 588.4N (50 ~ 60kg, 110.2 ~ 132.3lb)

CAUTION

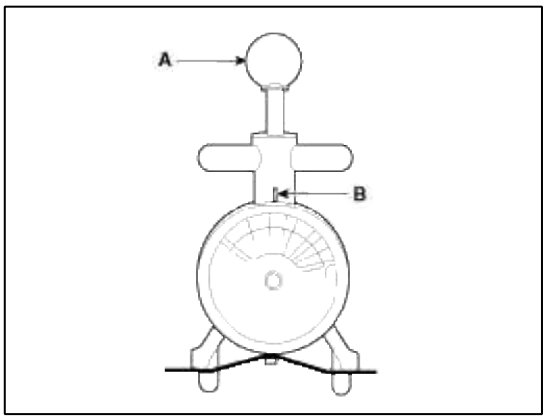
- If the engine has run for 5 minutes or more, the belt tension must be adjusted as a used belt.
- When installing the V-ribbed belt, all grooves on the pulley should be covered with belt ribs.
- A loose belt causes slip noise.
- Too tight belt cause bearing of alternator and water pump to damage.

Using a mechanical tension gauge (BT-33-73F, BTG-2 type)

1. While pressing the handle (A) of the gauge, insert the belt (B) between pulley and pulley (or idler) into the gap between spindle (C) and hook (D).



2. After releasing the handle (A), read a value on the dial pointed by the indicator (B).



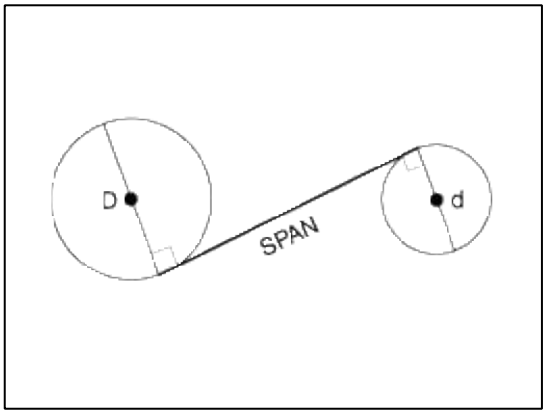
Using a sonic tension meter (U-505/507 type)

1. Input the belt specifications into the tension meter.

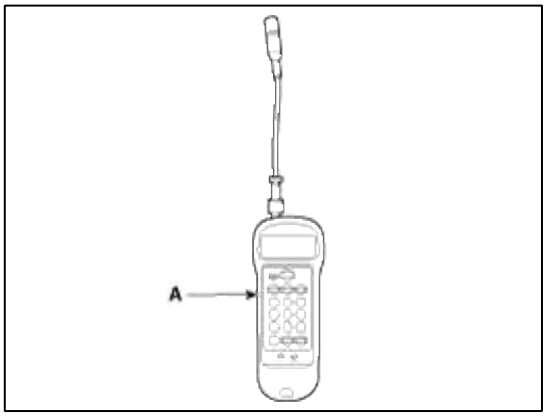
Belt type	Location of measurement	Input data		
		M (Mass, g/m.rib)	W (Width, rib)	S (Span, mm)
With A/C	Crankshaft pulley to A/C compressor pulley	013.4	006.0	178.9
Without A/C	Idler to alternator pulley	013.4	006.0	Actual measurement value

NOTE

Measurement of S (Span) : Caculate average value after measuring the distance 3~4 times.

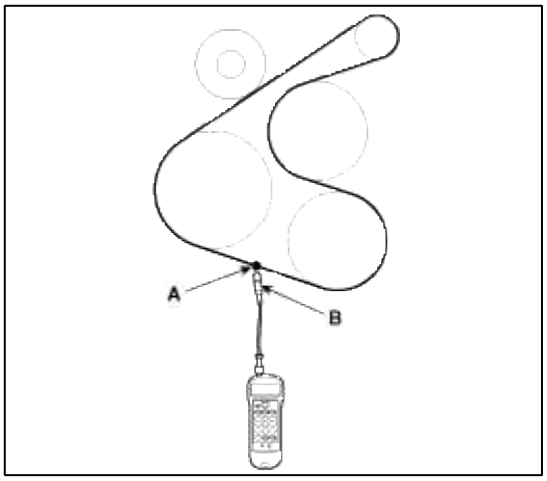


D : Idler
d : Alternator pulley

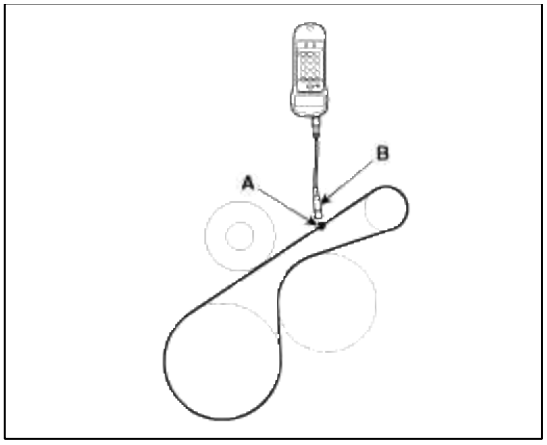


2. Locate the micro phone (B) close to the center of belt span (A) and bounce the belt by finger 2~3 times. Read a value on the display.

[With A/C]

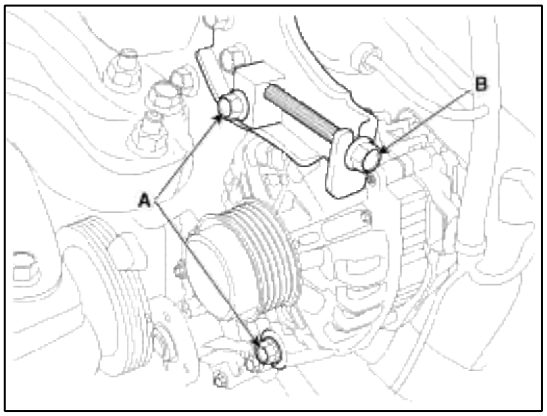


[Without A/C]



If adjustment is necessary:

1. Loosen the mounting bolts (A).
2. Tighten the adjusting bolt(B) clockwise in loose tension ; loosen the bolt counterclockwise in high tension.



3. Recheck tension of the belt.
4. After adjusting tension, tighten the through bolts.

Tightening torque
12mm (0.47in) bolt :
19.6 ~ 26.5 Nm (2.0 ~ 2.7 kgf.m, 14.5 ~ 19.5 Ib-ft)
14mm (0.55in) bolt :
29.4 ~ 41.2 Nm (3.0 ~ 4.2 kgf.m, 21.7 ~ 30.4 Ib-ft)

Visually Check Alternator Wiring And Listen For Abnormal Noises

1. Check that the wiring is in good condition.
2. Check that there is no abnormal noise from the alternator while the engine is running.

Check Discharge Warning Light Circuit

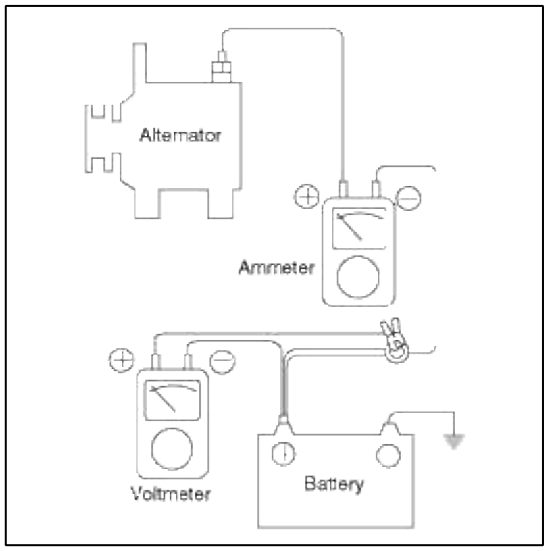
1. Warm up the engine and then turn it off.
2. Turn off all accessories.
3. Turn the ignition switch "ON". Check that the discharge warning light is lit.
4. Start the engine. Check that the light is lit.
   If the light does not go off as specified, troubleshoot the discharge light circuit.

Voltage Drop Test Of Alternator Output Wire

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

Preparation

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



Test

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

Result

1. The voltmeter may indicate the standard value.

   Standard value: 0.2V max

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

Output Current Test

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

Preparation

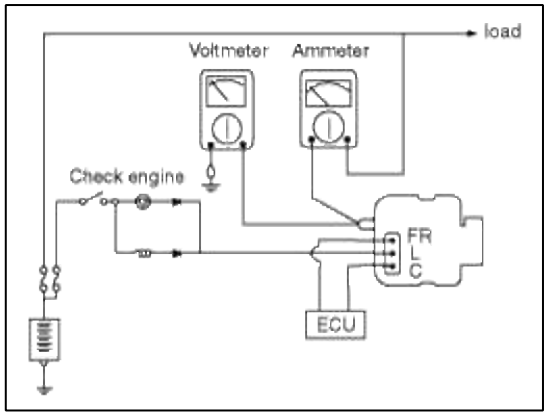
1. Prior to the test, check the following items and correct as necessary.
   Check the battery installed in the vehicle to ensure that it is in good condition. The battery checking method is described in the section "Battery".
   The battery that is used to test the output current should be one that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

   NOTE

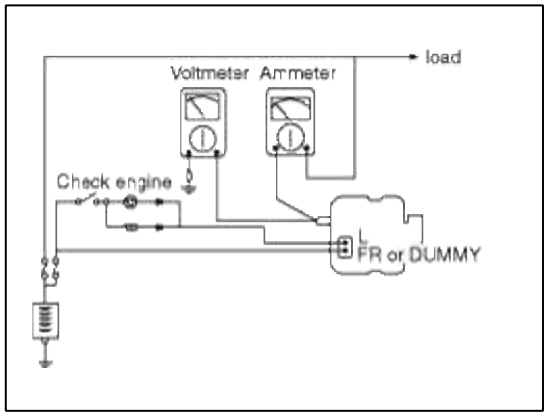
   Tighten each connection securely, as a heavy current will flow. Do not rely on clips.

6. Connect a voltmeter (0 to 20V) between the "B" terminal and ground. Connect the (+) lead wire to the alternator "B" terminal and (-) lead wire to a good ground.
7. Attach an engine tachometer and connect the battery ground cable.
8. Leave the engine hood open.

[AMS]



[Non-AMS]



Test

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

NOTE

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

Result

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

Limit value : 60% of the voltage rate

NOTE

- The output current value changes with the electrical load and the temperature of the alternator itself. Due to temperature the maximum output current may not be obtained. If such is the case, keep the headlamps on to increase the electrical load.
  The nominal output current may not be obtained if the temperature of the alternator itself or ambient temperature is too high.
  In such a case, reduce the temperature before testing again.

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

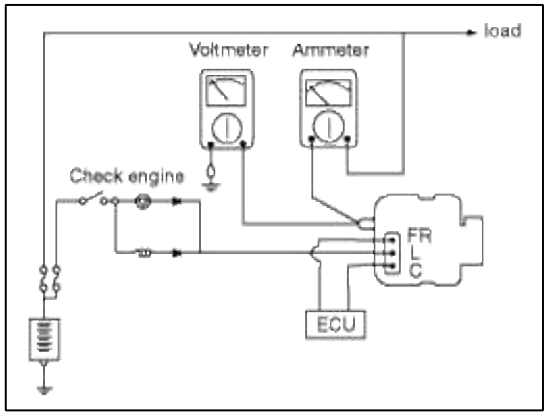
Regulated Voltage Test
The purpose of this test is to check that the electronic voltage regulator controls voltage correctly.

Preparation

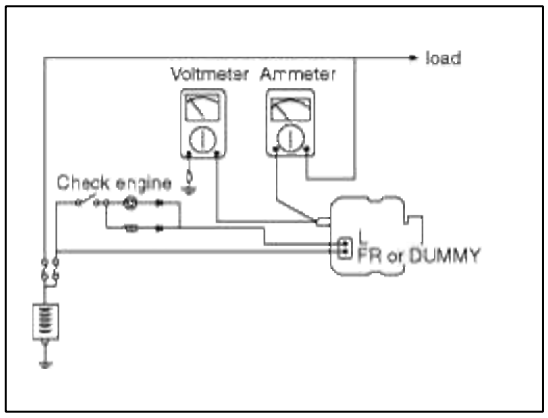
1. Prior to the test, check the following items and correct if necessary.
   Check that the battery installed on the vehicle is fully charged. The battery checking method is described in the section "Battery".
   Check the alternator drive belt tension. The belt tension check method is described in the section "Inspect drive belt".
2. Turn ignition switch to "OFF".
3. Disconnect the battery ground cable.

4. Connect a digital voltmeter between the "B" terminal of the alternator and ground. Connect the (+) lead of the voltmeter to the "B" terminal of the alternator. Connect the (-) lead to good ground or the battery (-) terminal.
5. Disconnect the alternator output wire from the alternator "B" terminal.
6. Connect a DC ammeter (0 to 150A) in series between the "B" terminal and the disconnected output wire. Connect the (-) lead wire of the ammeter to the disconnected output wire.
7. Attach the engine tachometer and connect the battery ground cable.

[AMS]



[Non-AMS]



Test

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

   Voltage: Battery voltage

   If it reads 0V, there is an open circuit in the wire between the alternator "B" terminal and the battery and the battery (-) terminal.
2. Start the engine. Keep all lights and accessories off.
3. Run the engine at a speed of about 2,500 rpm and read the voltmeter when the alternator output current drops to 10A or less

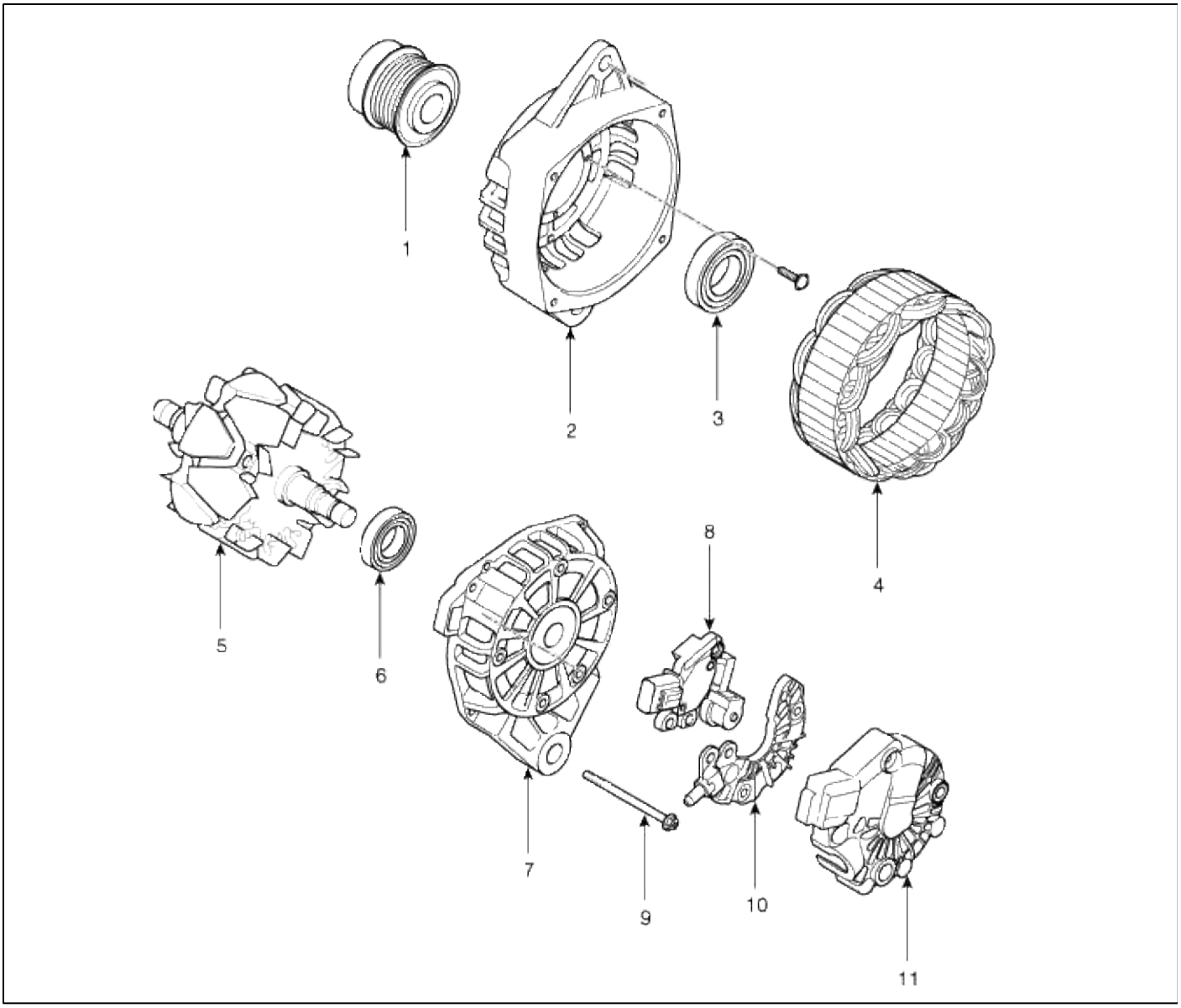
Result

1. If the voltmeter reading dosen't agree with the standard value, the voltage requlator or the alternator is 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 and ammeter and the engine tachometer.
5. Connect the alternator output wire to the alternator "B" terminal.
6. Connect the battery ground cable.

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

Components



1. OAD (Overrunning Alternator Decoupler) pully	6. Rear bearing
2. Front housing	7. Rear housing
3. Front bearing	8. Regulator assembly
4. Stator	9. Through bolt
5. Rotor	10. Rectifier assembly
	11. Rear cover

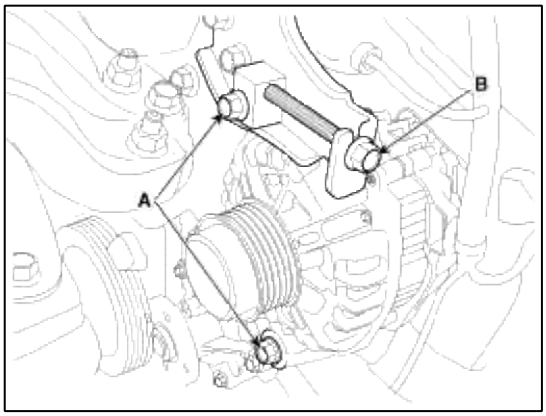
Engine Electrical System > Charging System > Alternator > Repair procedures

Removal and installation

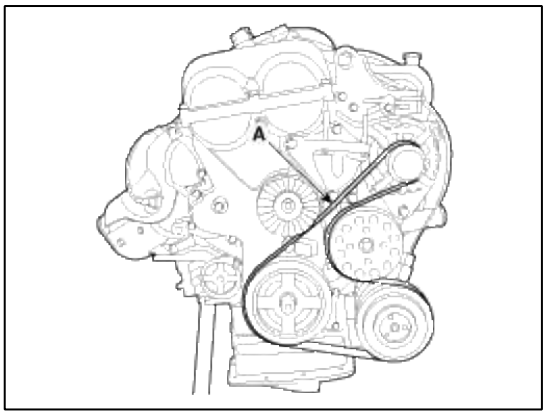
1. Disconnect the battery negative terminal first, then the positive terminal.

Tightening torque
(+) terminal :
7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)
(-) terminal (without battery sensor):
7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)
(-) terminal (with battery sensor):
4.0 ~ 6.0N.m (0.4 ~ 0.6kgf.m, 3.0 ~ 4.4lb-ft)

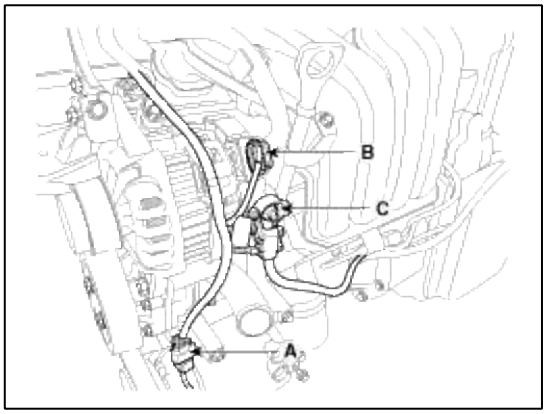
2. Remove the drive belt.
   (1) Loosen the through bolt (A).
   (2) Loosen the tension by turning the tension adjusting bolt (B).



   (3) Remove the drive belt (A).

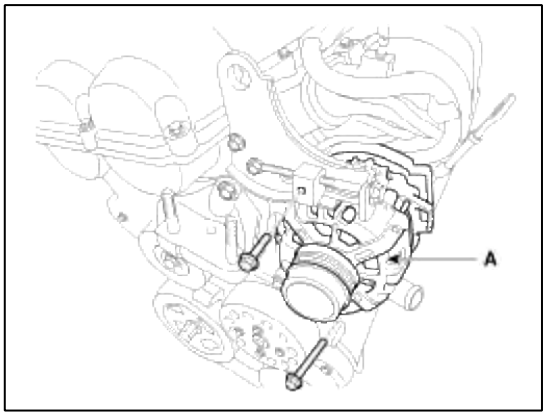


3. Disconnect the A/C compressor switch connector (A), the alternator connector (B) and the cable from the alternator "B" terminal (C).



4. Remove the alternator (A).

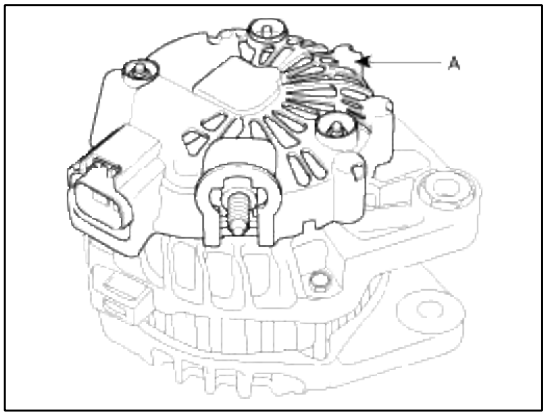
Tightening torque :
19.6~26.5 Nm (2.0~2.7 kgf.m, 14.5~19.5 Ib-ft)-12mm bolt
29.4~41.2 Nm (3.0~4.2 kgf.m, 21.7~30.4 Ib-ft)-14mm bolt



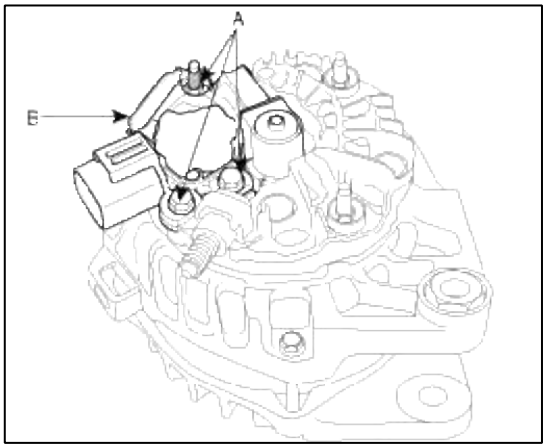
5. Installation is the reverse order of removal.
6. Adjust the alternator belt tension after installation.

Disassembly

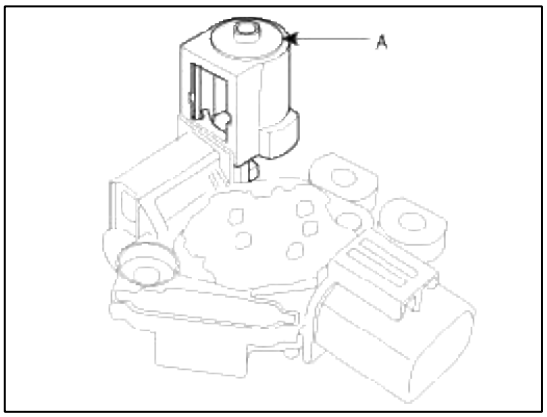
1. Remove the alternator cover(A).



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



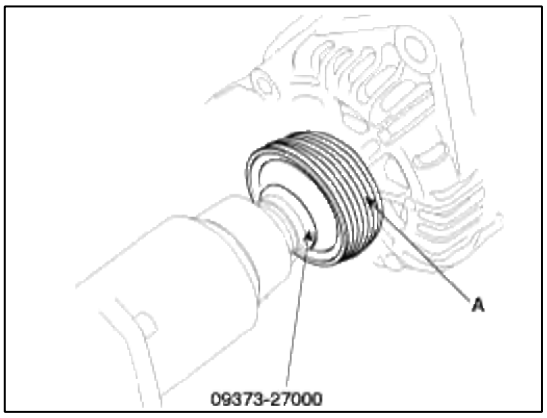
3. Remove the slip ring guide(A).



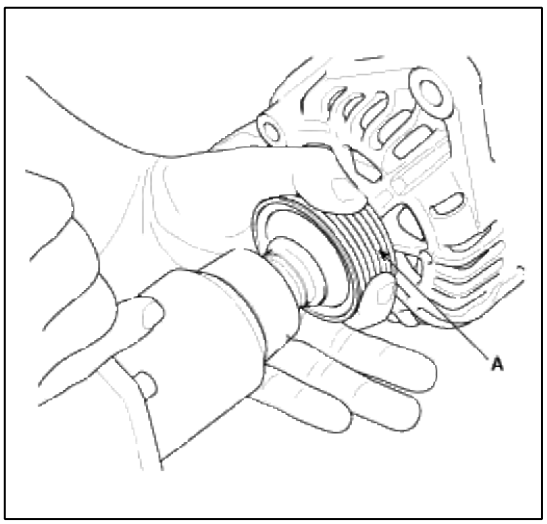
4. Remove the OAD (Overrunning Alternator Decoupler) cap. (With OAD)

> NOTE
>
> When installing, replace with new OAD cap.

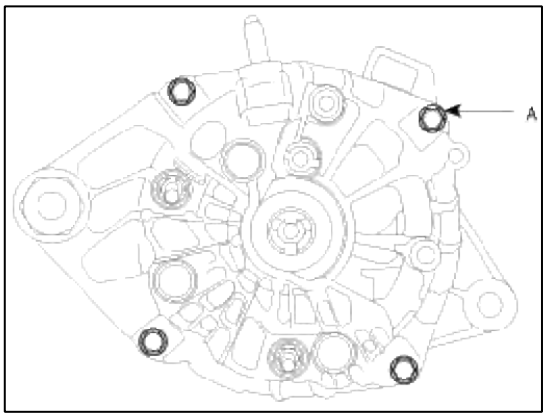
5. Remove the OAD (Overrunning Alternator Decoupler) pulley (A) using the special tool. (With OAD)



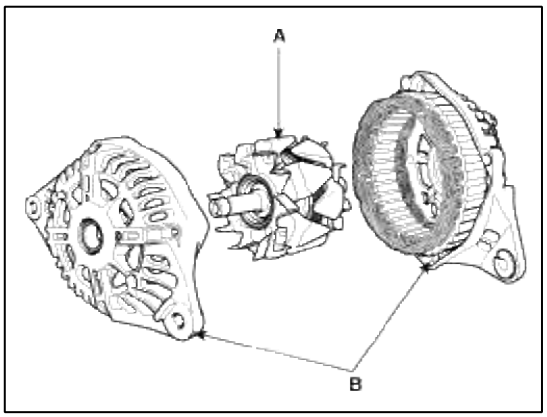
6. Remove the nut and pulley(A). (Without OAD)



7. Loosen the 4 through bolts(A).



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

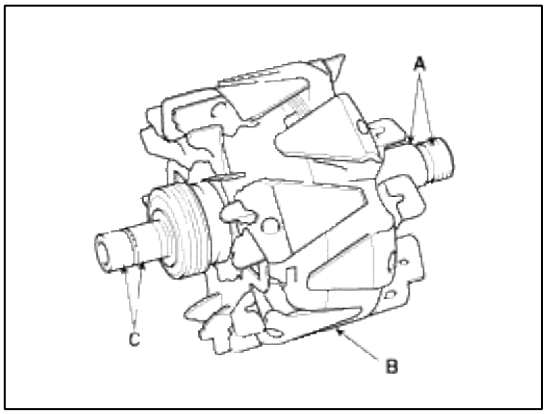


9. Reassembly is the reverse of disassembly.

Inspection

Inspect Rotor

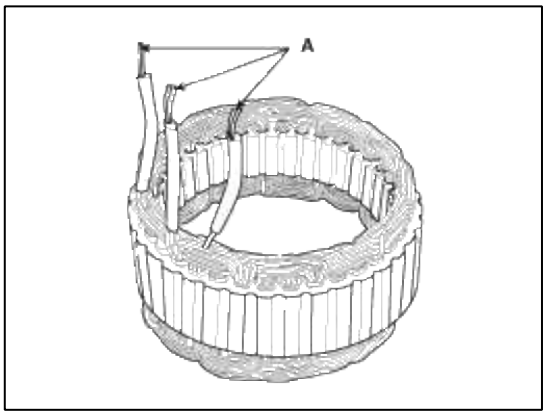
1. Check that there is continuity between the slip rings (C).
2. Check that there is no continuity between the slip rings and the rotor (B) or rotor shaft (A).



3. If the rotor fails either continuity check, replace the alternator.

Inspect Stator

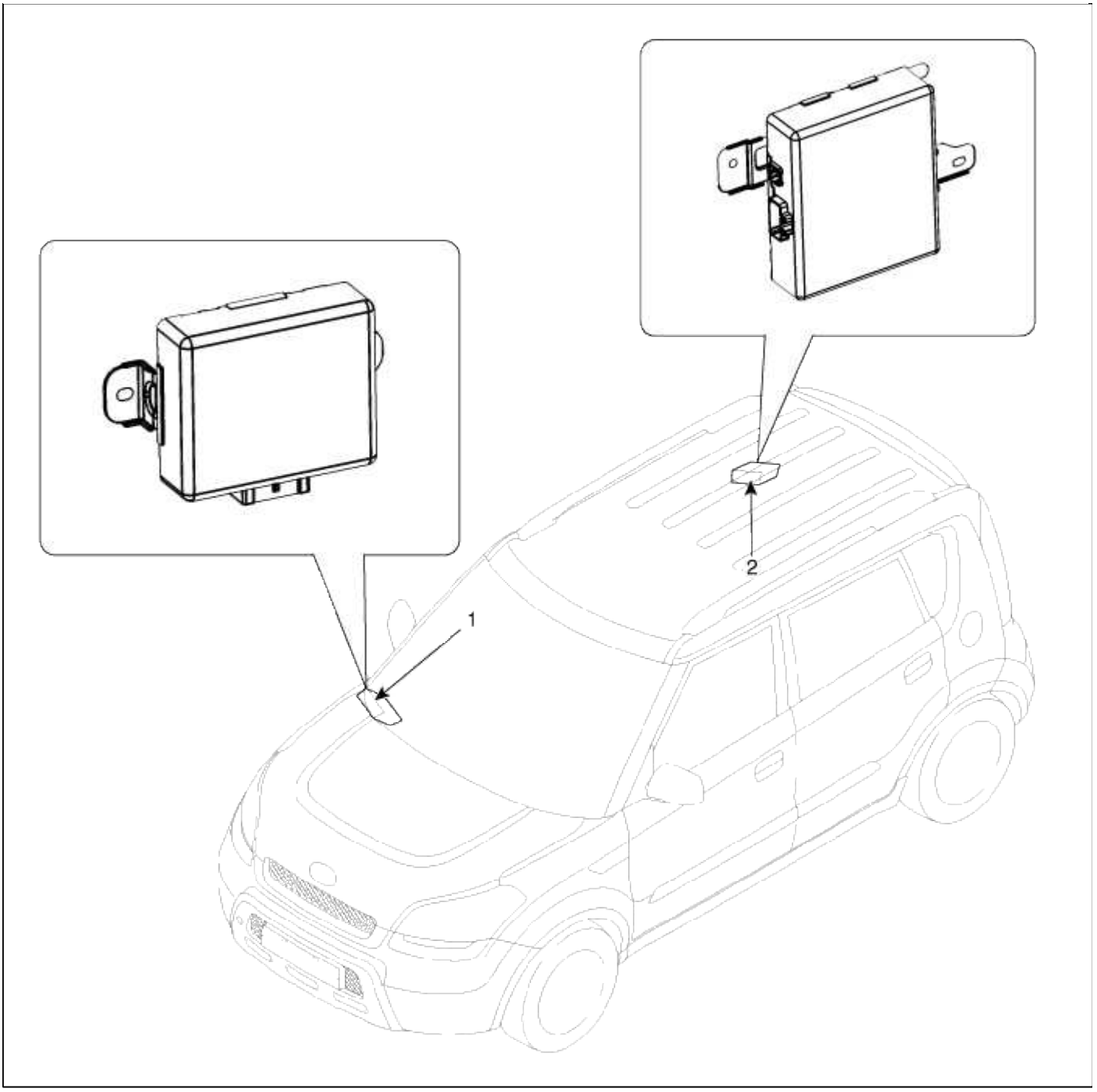
1. Check that there is continuity between each pair of leads (A).



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

Engine Electrical System > Charging System > DC DC converter > Components and Components Location

Component Location

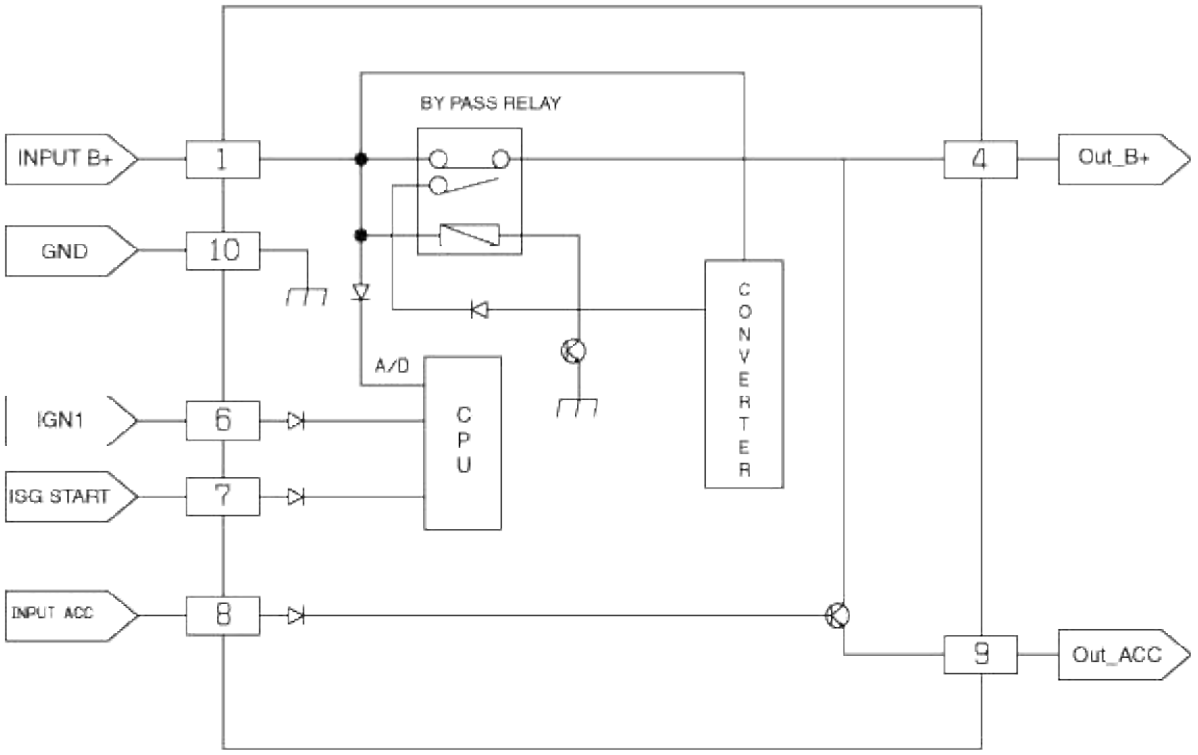


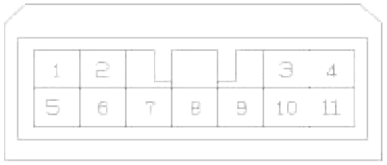
1. DC/DC converter (200W)	2. DC/DC converter (400W)

Engine Electrical System > Charging System > DC DC converter > Schematic Diagrams

Circuit Diagram

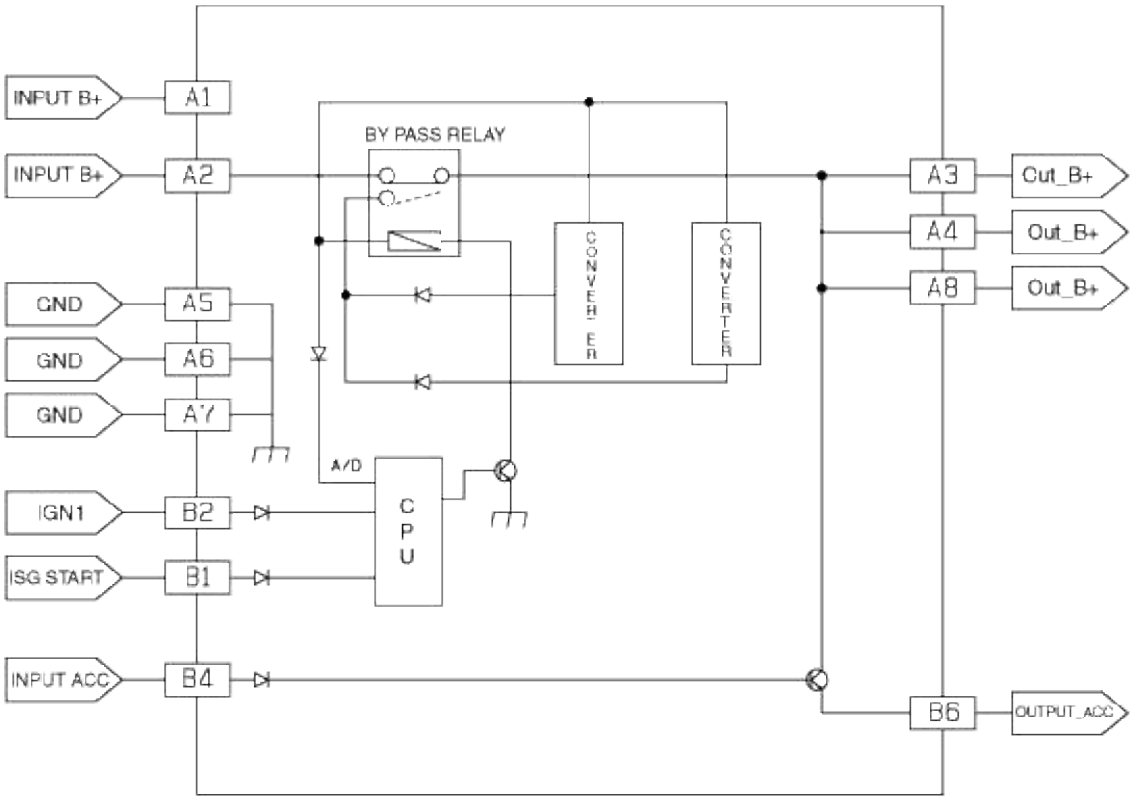
[200W]

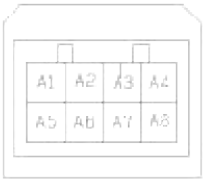




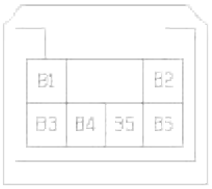
PIN NO.	DESCRIPTION
1	INPUT B+
2	-
3	-
4	OUTPUT B+
5	-
6	IGN1
7	ISG START
8	INPUT_ACC
9	OUTPUT_ACC
10	GND
11	-

[400W]





PIN NO.	DESCRIPTION
A1	INPUT B+
A2	INPUT B+
A3	OUTPUT B+
A4	OUTPUT B+
A5	GND
A6	GND
A7	GND
A8	OUTPUT B+



PIN NO.	DESCRIPTION
B1	ISG START
B2	ING1
B3	NC
B4	INPUT ACC
B5	NC
B6	OUTPUT_ACC

NOTE

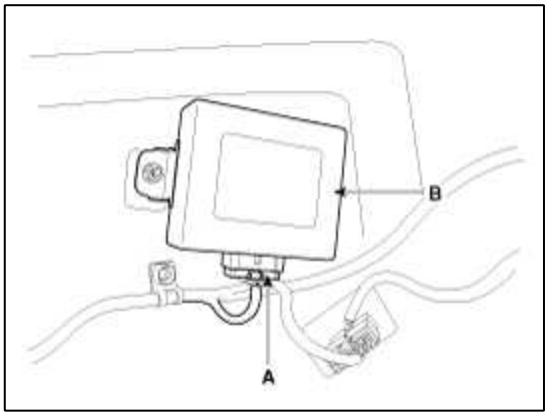
In case of IGN 2 with connecting battery, input the signal 'ISG Start' then BY PASS RELAY will be ON, after boosting voltage (12±0.6V) of low battery, if the battery voltage is over 12±0.5V then BY PASS RELAY will be OFF.
In the ISG mode, if the power of an audio system turns OFF by drawdown while "Auto Starting" or "Idle Starting" function operates, replace the DC/DC converter.

Engine Electrical System > Charging System > DC DC converter > Repair procedures

Replacement

[200W]

1. Disconnect the battery negative terminal.
2. Remove the glove box housing. (Refer to BD group - "Interior")
3. Disconnect the DC/DC converter connector (A) and then remove the DC/DC converter (B).

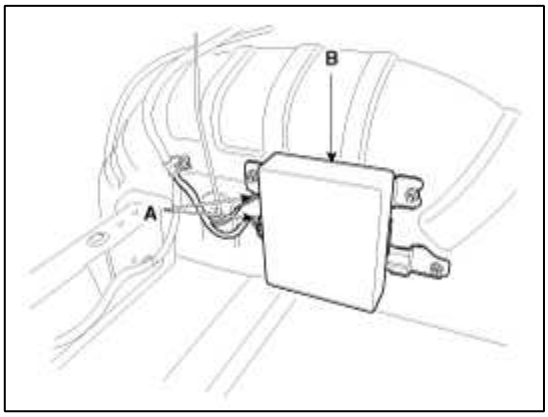


4. Installation is reverse order of removal.

> NOTE
>
> After disconnecting then reconnecting the battery negative cable, the ISG function dose not operates until the system is stabilized, about 4 hours.

[400W]

1. Disconnect the battery negative terminal.
2. Remove the rear seat. (Refer to BD group - "Seat")
3. Remove the luggage side trim. (Refer to BD group - "Interior")
4. Disconnect the DC/DC converter connector (A) and then remove the DC/DC converter (B).



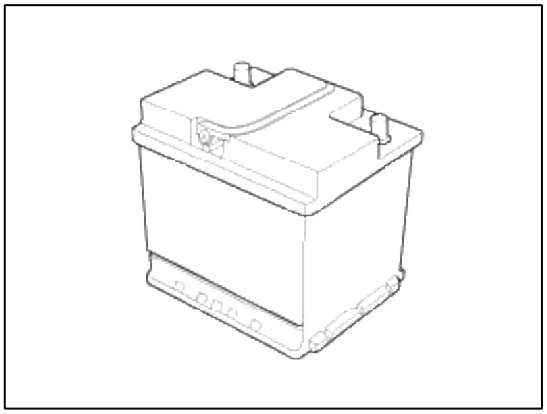
5. Installation is reverse order of removal.

> NOTE
>
> After disconnecting then reconnecting the battery negative cable, the ISG function dose not operates until the system is stabilized, about 4 hours.

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

Description

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



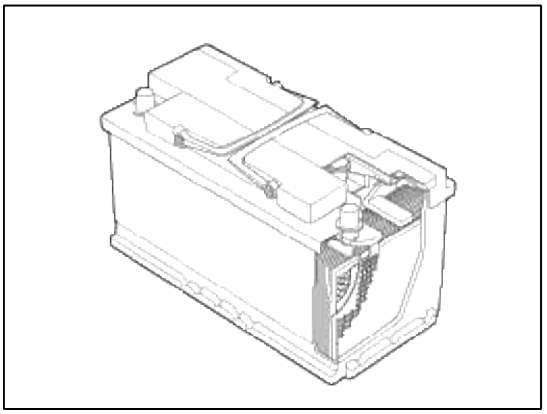
NOTE

After disconnecting then reconnecting the batterynegative cable, reset some parts that require thereset procedures. (Refer to BE group . GeneralInformation)

[ISG Type]

AGM battery is used for especially heavy load on the vehicle network depending on equipment and requirements. AGM stands for Absorbent Glass Material Battery; that is absorbent glass fibre fleece. AGM batteries are fitted in models with electrical loads/consumers which have a high energy demand.
The constantly increasing energy demand of modern vehicle electrical systems calls for ever more powerful battery solutions.
The power consumption is considerable even when the vehicle is parked.
The somewhat higher price compared with a battery of similar size is fully balanced by the following benefits:

- Significantly longer service life
- Increased starting reliability at low temperatures
- 100 % freedom from maintenance
- Low risk in event of an accident (reduced risk to the environment)



Recharging [ISG Type]

Check the battery condition

The battery condition cannot be determined solely on the basis of the battery charge state. If there is a suspicion of a damaged battery, check the battery condition whit battery tester and investigate the cause by means of the test module. With a low battery charge state, recharge the battery.

Recharging the AGM battery

The battery may be charged using the battery chargers at a constant charge voltage of 14.8V.
If possible, the battery temperature during charging should be between 20°C and 30°C.
Only chargers with voltage clamping (IU or WU curve) may be used or chargers with IUoU curve which have a trickle.

IU or WU charging technique
Optimized charging voltage for IU or WU: 14.7V (at 20°C ~ 30°C) about 24 hours
Min. charging voltage at 20°C: 14.4V
Max. charging voltage at 20°C: 14.8V
10% of capacity is recommended as charging current (e.g. 60Ah : 10 = 6,0A charging current).

WARNING

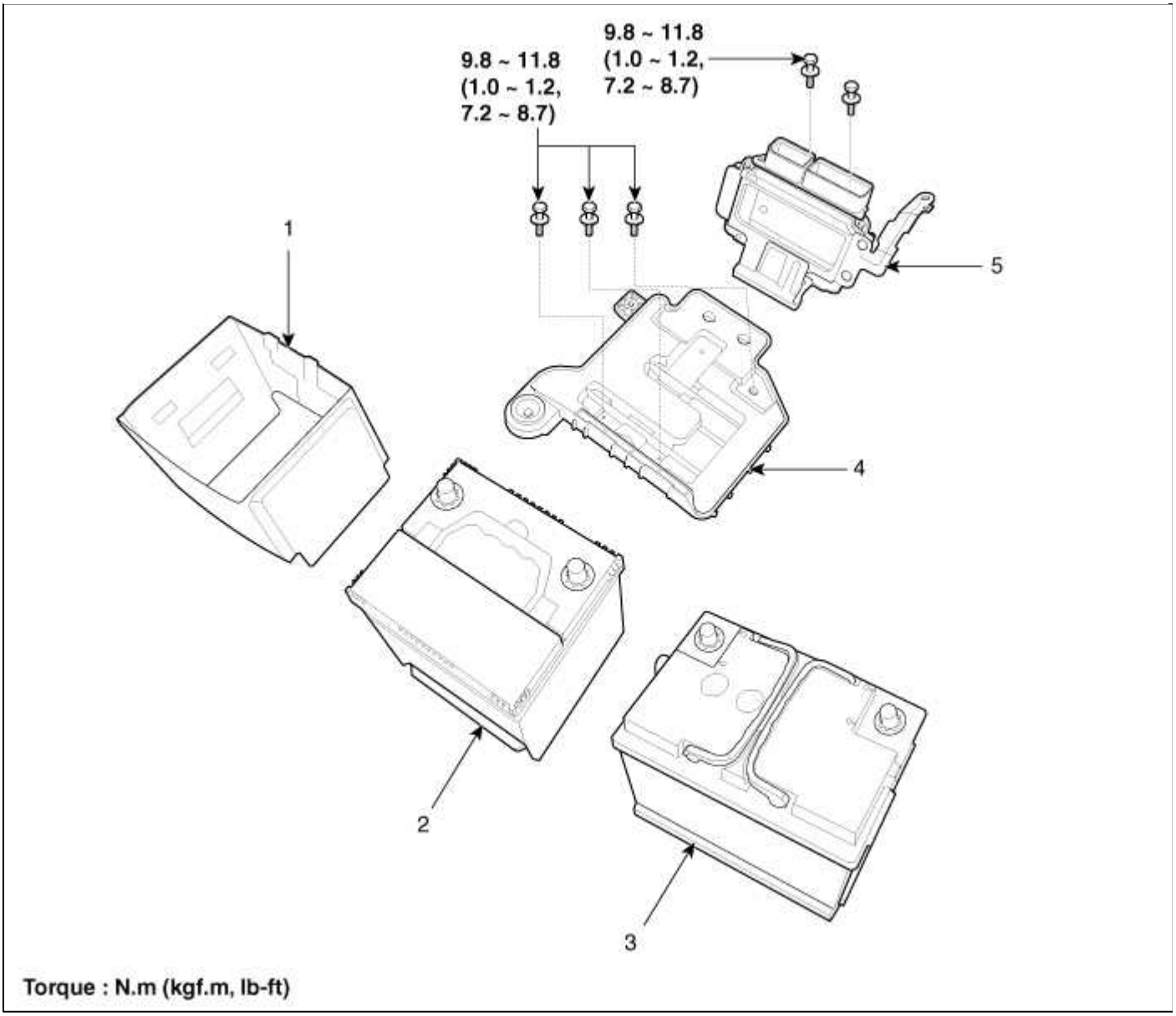
Do not charge the AGM battery with>15.2V. No quick-charging routines.

CAUTION

If the battery is charged directly at the battery terminals on vehicles with battery sensor, misinterpretations of battery condition and under certain circumstances also unwanted Check Control messages or fault memory entire can occur.
If the battery is charged directly at the battery (+),(-) terminals on vehicles with battery sensor, please battery sensor be re-installed and re-calibration.

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

Components



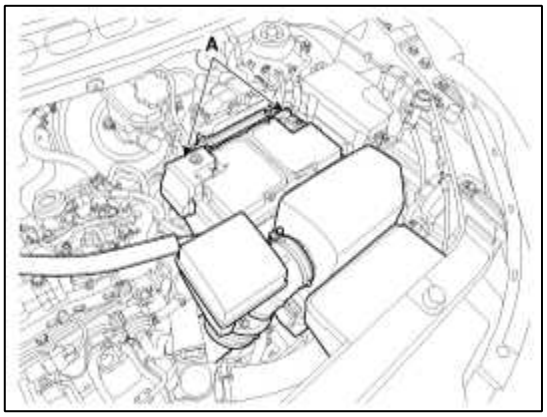
1. Battery insulation pad 2. Battery (NON-ISG) 3. Battery (ISG)	4. Battery mounting bracket 5. ECM & bracket assembly

Engine Electrical System > Charging System > Battery > Repair procedures

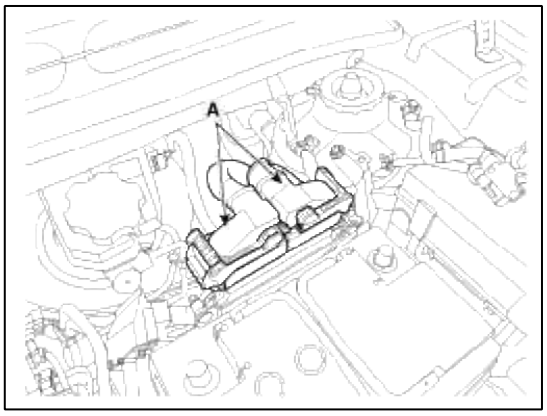
Removal and Installation

1. Remove the battery.
   (1) Disconnect the battery terminals (A).

Tightening torque
(+) terminal :
7.8 ~ 9.8 N.m (0.8 ~ 1.0 kgf.m, 5.8 ~ 7.2 lb-ft)
(-) terminal (without battery sensor) :
7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)
(-) terminal (with battery sensor) :
4.0 ~ 6.0N.m (0.4 ~ 0.6kgf.m, 3.0 ~ 4.4lb-ft)

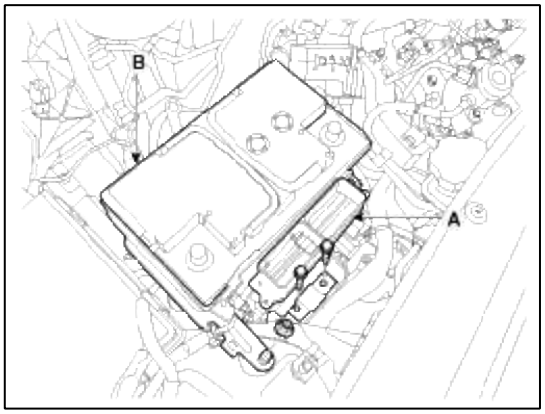


2. Remove the air duct and air cleaner assembly. (Refer to EM group).
3. Remove the battery insulation pad.
4. Disconnect the ECM connector (A).



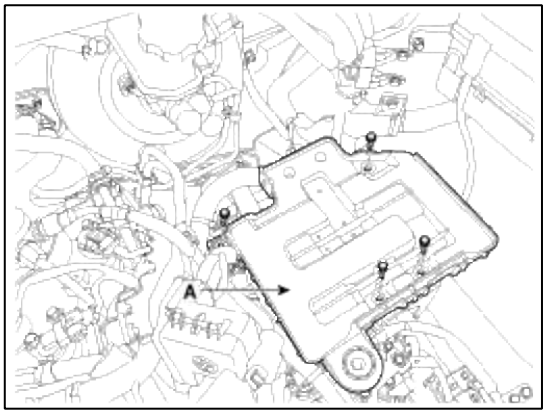
5. Remove the ECM (A) and then disconnect the battery tray (B).

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



6. Remove the battery tray (A).

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



7. Installation is the reverse order of removal.

CAUTION

When installing the battery, fix the mounting bracket on the tray correctly.

CAUTION

- ISG (Idle stop & go) system equipped vehicle always use the AGM battery only. If flooded battery has installed, this can potentially lead to engine electrical trouble or ISG system error.
- Replace same capacity of the AGM battery.

NOTE

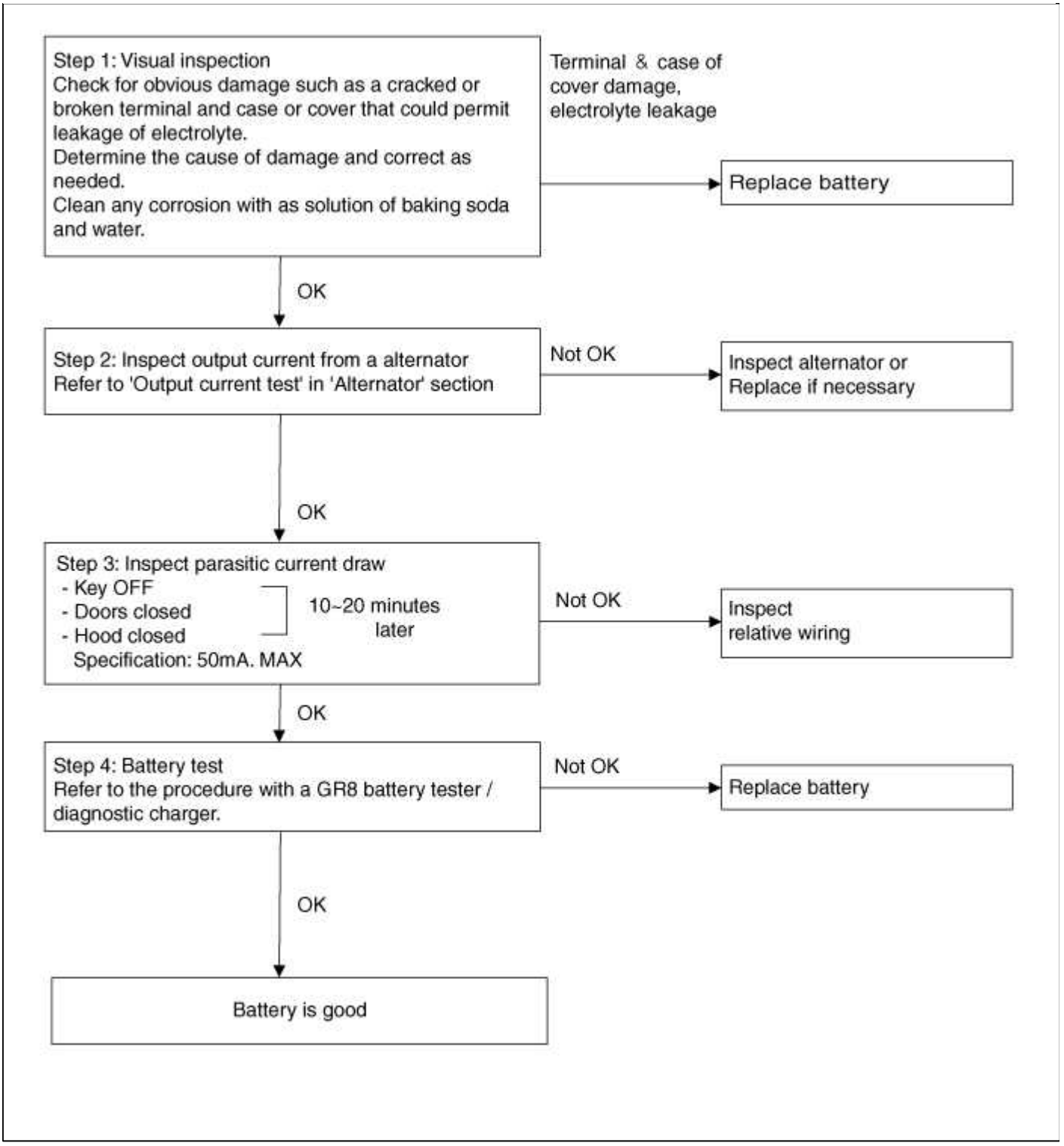
Ensure the AGM battery is placed correctly on the battery tray.
In all cases, an AGM battery must be installed and the battery sensor calibrated for the ISG system to function.
After the battery has been changed or disconnected, the battery sensor must be recalibrated. After connecting the battery, start the engine at least once.
Then park the car for at least 4 hours with the ignition off in the ignition switch OFF door closed, hood switch off state.
After the 4 hours, the engine should be started two times.
At this time the battery sensor will be recalibrated. (Refer to "Battery sensor recalibration procedure" in FL group.)
But first 25 times, the ISG function can operates regardless of ISG system stability for ISG function operating check.

WARNING

Do not open the AGM battery.
The AGM battery must not be opened under any circumstances as the introduction of oxygen from the air will cause the battery to lose its chemical equilibrium and rendered non-operational.

Inspection

Battery Diagnostic Flow



Vehicle parasitic current inspection

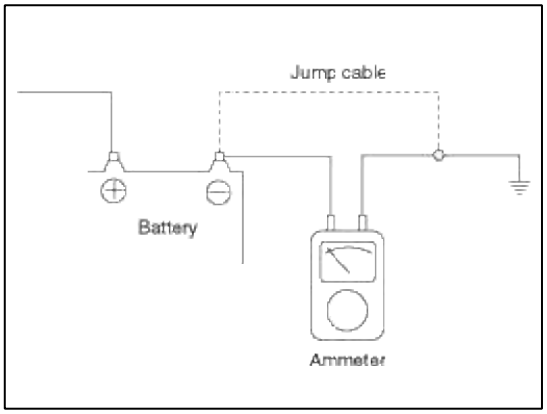
1. Turn all the electric devices OFF, and then turn the ignition switch OFF.
2. Close all doors except the engine hood, and then lock all doors.
   (1) Disconnect the hood switch connector.
   (2) Close the trunk lid.
   (3) Close the doors or remove the door switches.

3. Wait a few minutes until the vehicle's electrical systems go to sleep mode.

> NOTE
>
> For an accurate measurement of a vehicle parasitic current, all electrical systems should go to sleep mode. (It takes at least one hour or at most one day.) However, an approximate vehicle parasitic current can be measured after 10~20 minutes.

4. Connect an ammeter in series between the battery (-) terminal and the ground cable, and then disconnect the clamp from the battery (-) terminal slowly.

> CAUTION
>
> Be careful that the lead wires of an ammeter do not come off from the battery (-) terminal and the ground cable to prevent the battery from being reset. In case the battery is reset, connect the battery cable again, and then start the engine or turn the ignition switch ON for more than 10 sec. Repeat the procedure from No. 1.
> To prevent the battery from being reset during the inspection,
> 1) Connect a jump cable between the battery (-) terminal and the ground cable.
> 2) Disconnect the ground cable from the battery (-) terminal.
> 3) Connect an ammeter between the battery (-) terminal and the ground cable.
> 4) After disconnecting the jump cable, read the current value of the ammeter.



5. Read the current value of the ammeter.
   A. If the parasitic current is over the limit value, search for abnormal circuit by removing a fuse one by one and checking the parasitic current.
   B. Reconnect the suspected parasitic current draw circuit fuse only and search for suspected unit by removing a component connected with the circuit one by one until the parasitic draw drops below limit value.

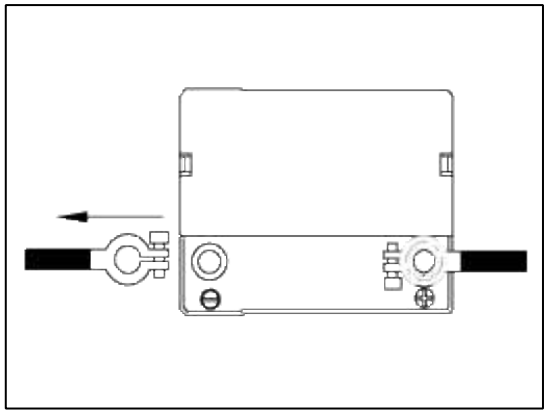
Limit value (after 10~20 min.) : Below 50mA

Cleaning

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

3. Remove the battery from the vehicle.

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



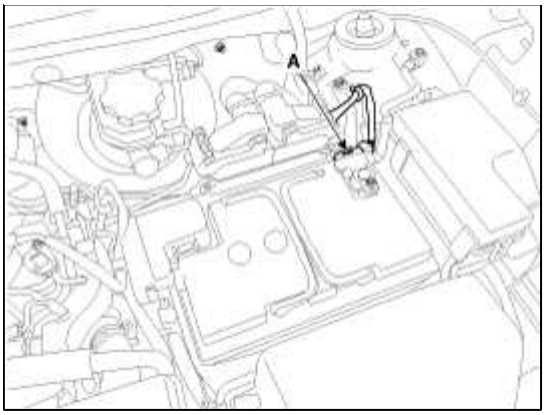
4. Inspect the battery tray for damage caused by the loss of electrolyte. If acid damage is present, it will be necessary to clean the area with a solution of clean warm water and baking soda. Scrub the area with a stiff brush and wipe off with a cloth moistened with baking soda and water.
5. Clean the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

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

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

Description

Vehicles have many control units that use more electricity. These units control their own system based on information from diverse sensors. It is important to have a stable power supply as there diverse sensors giving a variety of information. Battery sensor (A) is mounted on battery (-) terminal. It transmits battery voltage, current, temperature information to ECM. ECM controls generating voltage by duty cycle based on these signals.



CAUTION

When battery sensor signal fault occurs, inspect the vehicle parasitic draw in advance after inspecting the sensor because the sensor will behave abnormally when the parasitic draw is more than 100mA. (Refer to vehicle parasitic current inspection)

NOTE

It takes a few hours for a new battery sensor to detect the battery state correctly.
Perform the following process after replacing the battery sensor.

1. Ignition switch ON/OFF.
2. Park the vehicle about 4 hours.
3. After 4 hours later, check that the SOC (State of charge) of battery is displayed on GDS properly.
4. After engine start ON/OFF 2 times or more, check the SOF (State of function) of battery using GDS.

CAUTION

For the vehicle equipped with a battery sensor, be careful not to damage the battery sensor when the battery is replaced or recharged.

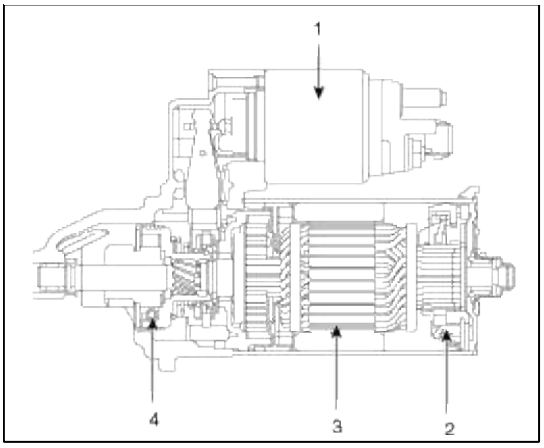
- When replacing the battery, it should be same one (type, capacity and brand) that is originally installed on your vehicle. If a battery of a different type is replaced, the battery sensor may recognize the battery to be abnormal.
- When installing the ground cable on the negative post of battery, tighten the clamp with specified torque of 4.0~6.0N.m (0.4~0.6kgf.m, 3.0~4.4lb-ft). An excessive tightening torque can damage the PCB internal circuit and the battery terminal.
- When recharging the battery, ground the negative terminal of the booster battery to the vehicle body.

Engine Electrical System > Starting System > Description and Operation

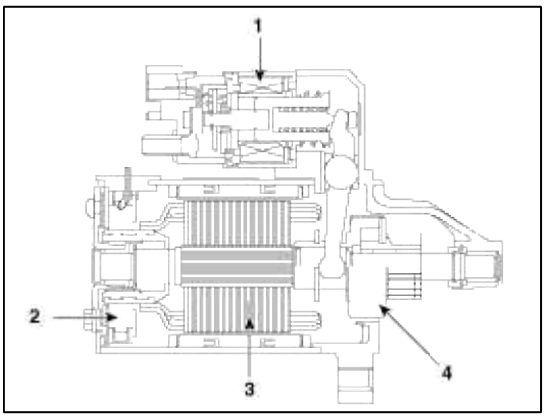
Description

The starting system includes the battery, starter, solenoid switch, ignition switch, inhibitor switch (A/T), ignition lock switch, connection wires and the battery cable.
When the ignition key is turned to the start position, current flows and energizes the starter motor's solenoid coil.
The solenoid plunger and clutch shift lever are activated, and the clutch pinion engages the ring gear.
The contacts close and the starter motor cranks. In order to prevent damage caused by excessive rotation of the starter armature when the engine starts, the clutch pinion gear overruns.

[ISG Type]



[Non-ISG Type]



1. Solenoid
2. Brush
3. Armature
4. Overrun clutch

[ISG Type]
In conjunction with the ISG function, the starter motor must do a great deal more work. The starter motor is therefore configured for a significantly higher number of start cycles. The components of the starter motor have been adapted to the higher requirements.

NOTE

There are two kinds of starter, ISG type starter and the other.
When replace the starter, confirm that the part number and connector shape.

CAUTION

ISG (Idle stop & go) system equipped vehicle always use the ISG type starter only. If the other starter has installed, this can potentially lead to engine electrical trouble or ISG system error.

WARNING

Do not disassemble the ISG type starter.
If the starter troubles occur, replace the starter.

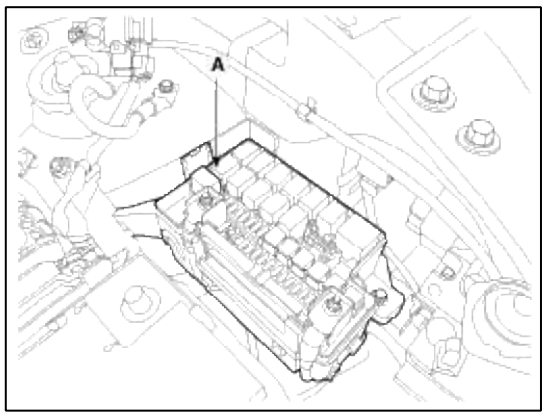
Engine Electrical System > Starting System > Repair procedures

Troubleshooting Starter Circuit

NOTE

The battery must be in good condition and fully charged.

1. Remove the fuel pump relay (A) from the fuse box.



2. With the shift lever in N or P (A/T) or clutch pedal pressed (M/T), turn the ignition switch to "START".
   If the starter normally cranks the engine, starting system is OK. If the starter will not crank the engine at all, go to next step.
   If it won't disengage from the ring gear when you release key, check for the following until you find the cause.
   A. Solenoid plunger and switch malfunction.
   B. Dirty pinion gear or damaged overrunning clutch.

3. Check the battery condition. Check electrical connections at the battery, battery negative cable connected to the body, engine ground cables, and the starter for looseness and corrosion. Then try starting the engine again.
   If the starter cranks the engine normally, repairing the loose connection repaired the problem. The starting system is now OK.
   If the starter still does not crank the engine, go to next step.

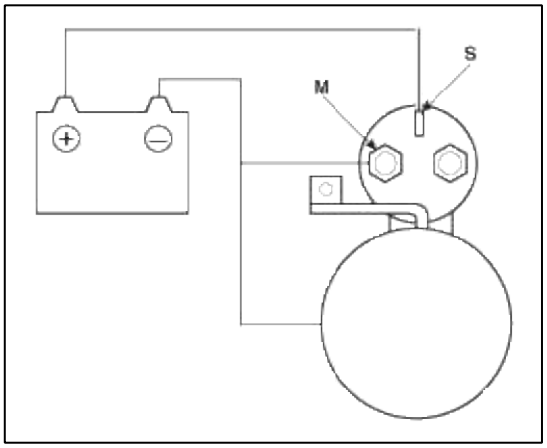
4. Disconnect the connector from the S-terminal of solenoid. Connect a jumper wire from the B-terminal of solenoid to the S-terminal of solenoid.
   If the starter cranks the engine, go to next step.
   If the starter still does not crank the engine, remove the starter, and repair or replace as necessary.

5. Check the following items in the order listed until you find the open circuit.
   A. Check the wire and connectors between the driver's under-dash fuse/relay box and the ignition switch, and between the driver's under-dash fuse/relay box and the starter.
   B. Check the ignition switch (Refer to ignition system in BE Group).
   C. Check the transaxle range switch connector or ignition lock switch connector.
   D. Inspect the starter relay.

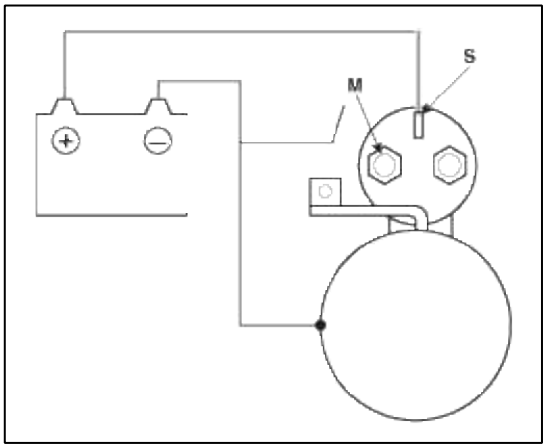
Starter Solenoid Test

1. Disconnect the field coil wire from the M-terminal of solenoid switch.

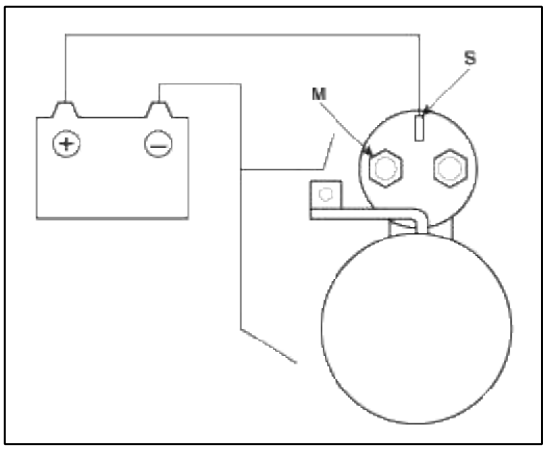
2. Connect the battery as shown. If the starter pinion pops out (engages), it is working properly. To avoid damaging the starter, do not leave the battery connected for more than 10 seconds.



3. Disconnect the battery from the M terminal.
   If the pinion does not retract, the hold-in coil is working properly. To avoid damaging the starter, do not leave the battery connected for more than 10 seconds.



4. Disconnect the battery also from the body. If the pinion retracts immediately, it is working properly. To avoid damaging the starter, do not leave the battery connected for more than 10 seconds.

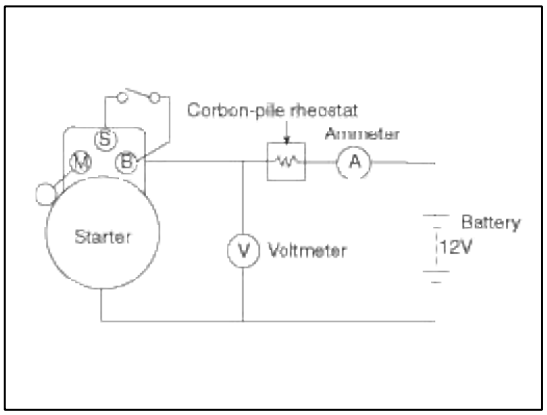


Free Running Test

1. Place the starter motor in a vise equipped with soft jaws and connect a fully-charged 12-volt battery to starter motor as follows.

2. Connect a test ammeter (150-ampere scale) and carbon pile rheostats as shown in the illustration.

3. Connect a voltmeter (15-volt scale) across starter motor.

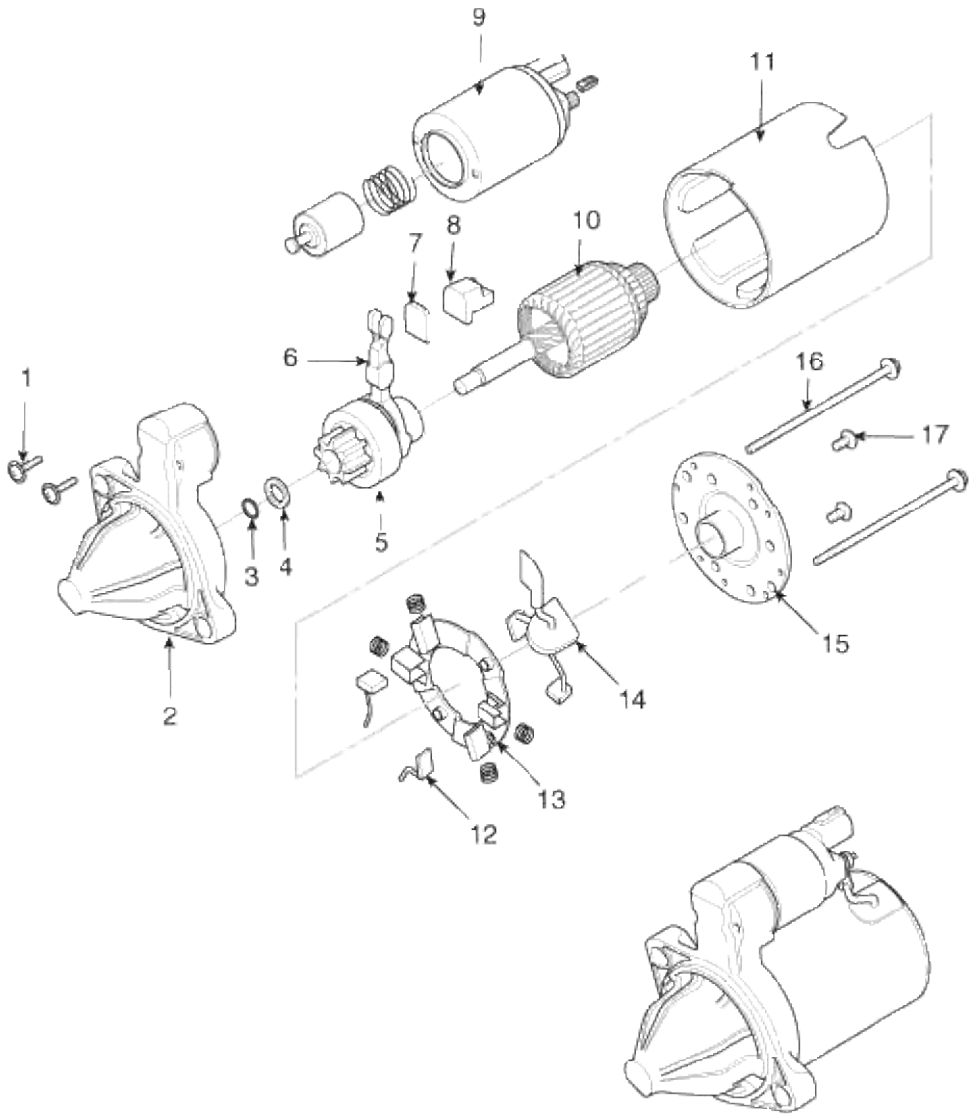


4. Rotate carbon pile to the off position.
5. Connect the battery cable from battery's negative post to the starter motor body.
6. Adjust until battery voltage shown on the voltmeter reads 11.5volts.
7. Confirm that the maximum amperage is within the specifications and that the starter motor turns smoothly and freely.

Max. Current :
Non-ISG : 60A
ISG :95A
Min. Speed :
Non-ISG : 5,500rpm
ISG : 3,500rpm

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

Components



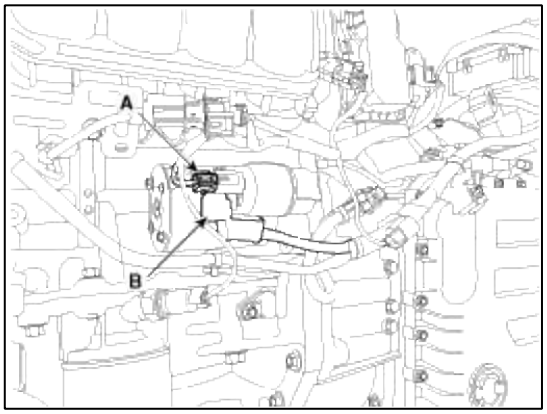
1. Screw	10. Armature
2. Front bracket	11. Yoke assembly
3. Stop ring	12. Brush (-)
4. Stopper	13. Brush holder
5. Overrun clutch	14. Brush (+)
6. Lever	15. Rear bracket
7. Lever plate	16. Through bolts
8. Lever packing	17. Screw
9. Magnet switch	

Engine Electrical System > Starting System > Starter > Repair procedures

Removal and Installation

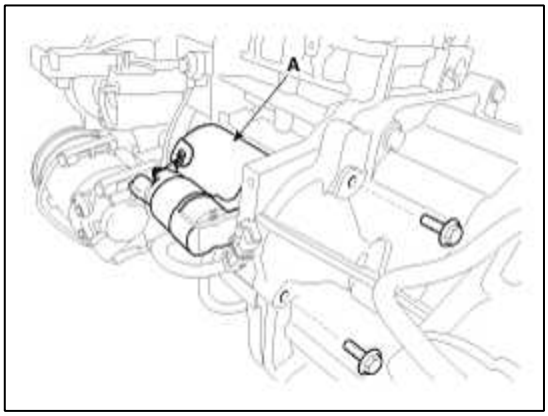
1. Disconnect the battery negative terminal.
2. Remove the air duct and air cleaner assembly. (Refer to EM group)

3. Disconnect the starter cable (B) from the B terminal on the solenoid then disconnect the connector (A) from the S terminal.



4. Remove the 2 bolts holding the starter, then remove the starter (A).

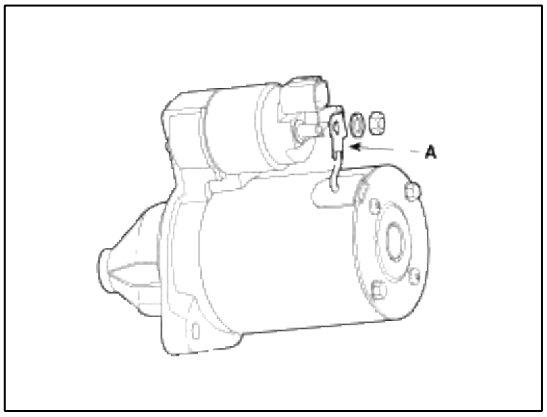
Tighting torque :
42.2 ~ 53.9 Nm (4.3 ~ 5.5 kgf.m, 31.1 ~ 39.8 lb-ft)



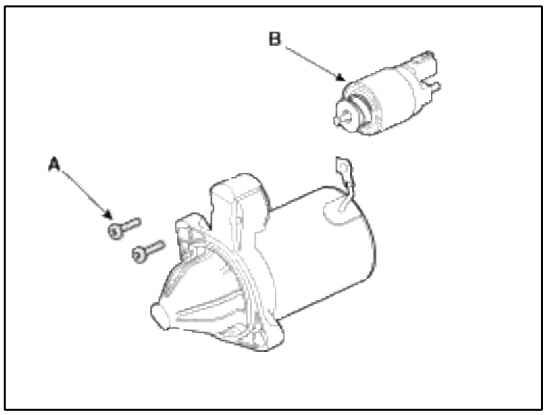
5. Installation is the reverse of removal.

Disassembly

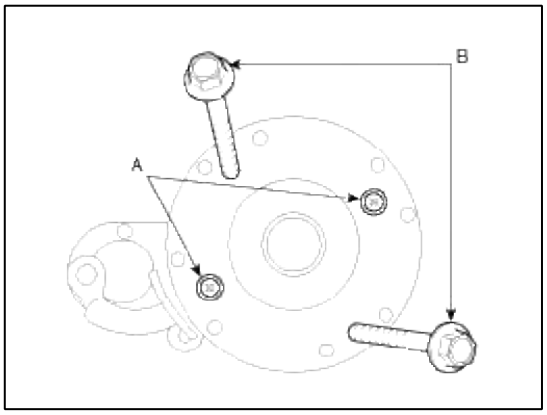
1. Disconnect the M-terminal (A) on the magnet switch assembly (B).



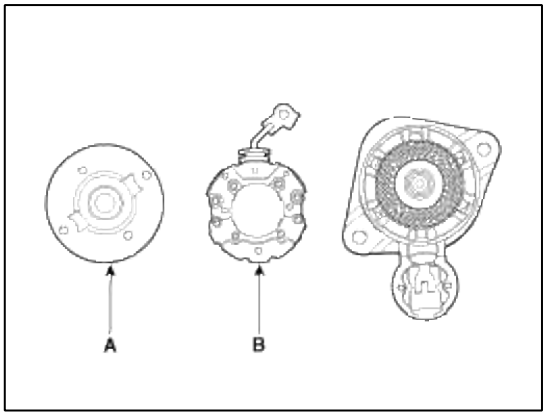
2. After loosening the 2 screws (A), detach the magnet switch assembly (B).



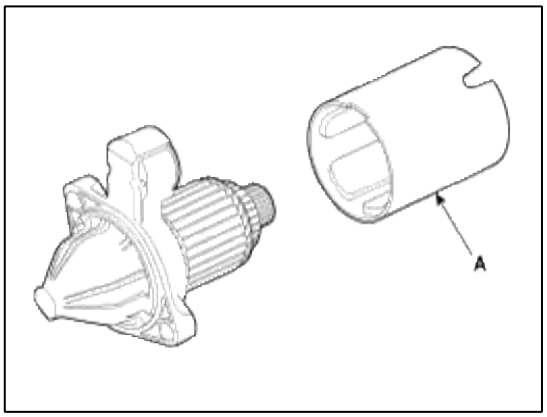
3. Loosen the brush holder mounting screw (A) and through bolts (B).



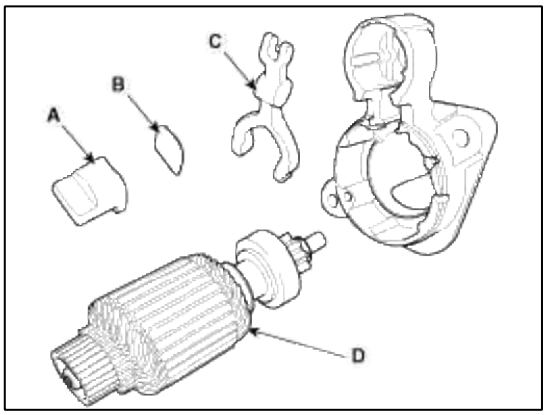
4. Remove the rear bracket (A) and brush holder assembly (B).



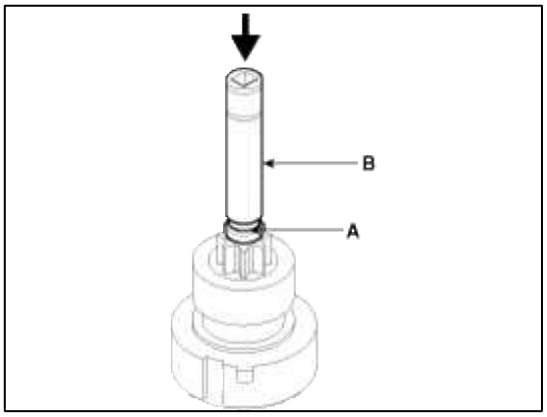
5. Remove the yoke (A).



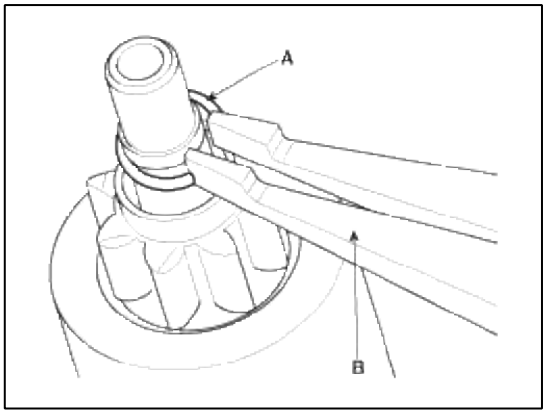
6. Remove the packing (A), lever plate (B), lever (C) and the armature (D).



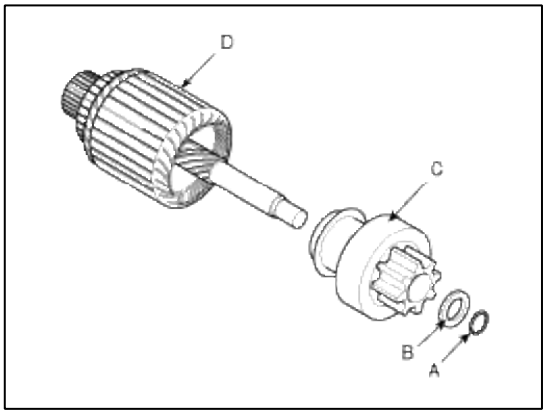
7. Press the stopper (A) using a socket (B).



8. Remove the stop ring (A) using stop ring pliers (B).



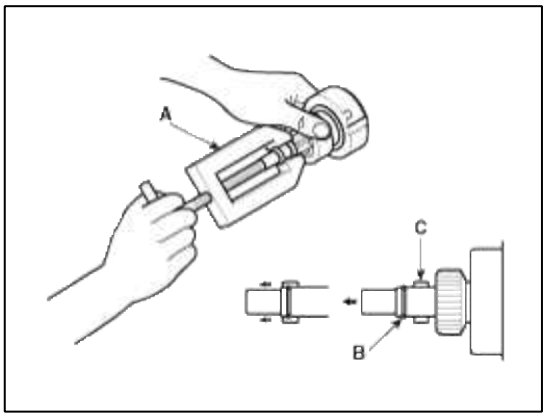
9. Remove the stop ring (B), stopper (A), overrunning clutch (C) and armature (D).



10. Reassembly is the reverse of disassembly.

NOTE

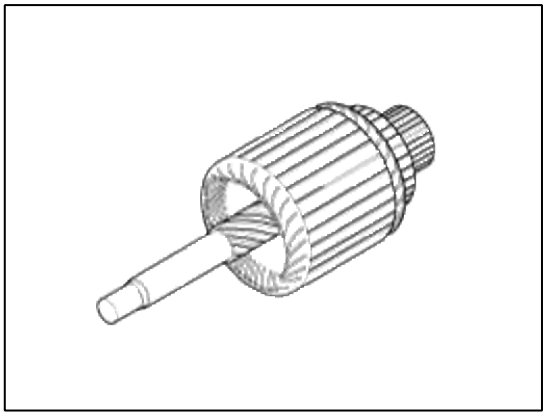
Using a suitable pulling tool (A), pull the overrunning clutch stopper (C) over the stop ring (B).



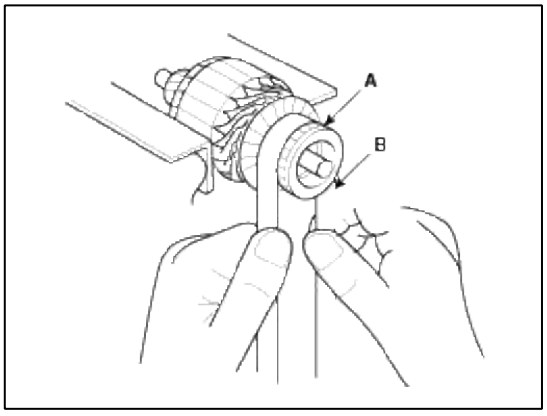
Inspection

Armature Inspection And Test

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

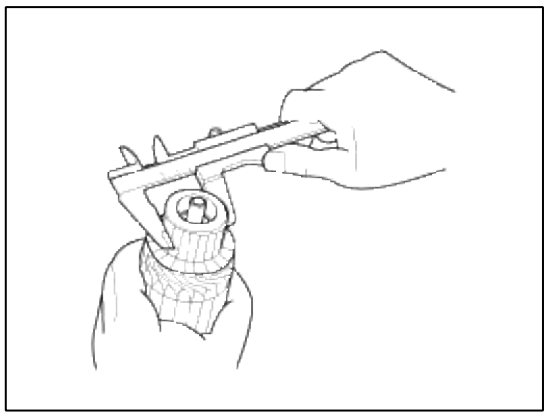


4. Check the commutator (A) surface. If the surface is dirty or burnt, resurface with emery cloth or a lathe within the following specifications, or recondition with #500 or #600 sandpaper (B).



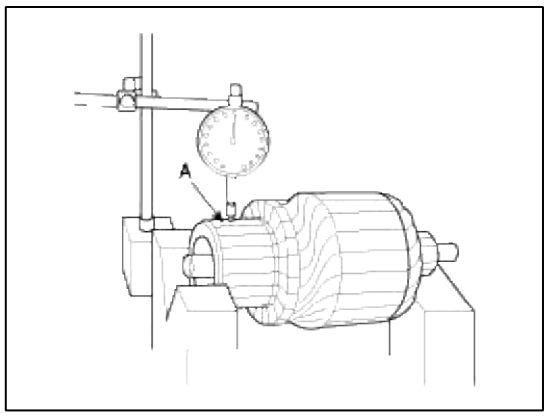
5. Check the commutator diameter. If the diameter is below the service limit, replace the armature.

Commutator diameter
Standard (New) : 29.4 mm (1.1575 in)
Service limit : 28.8 mm (1.1339 in)



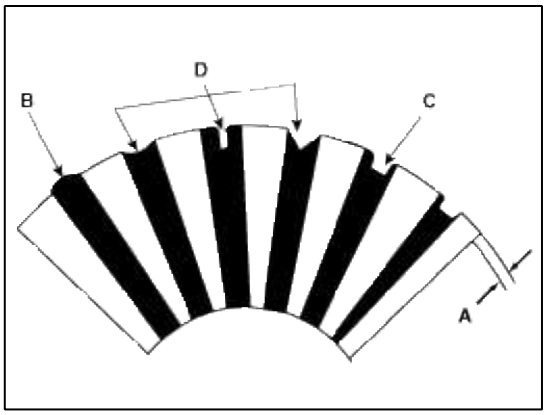
6. Measure the commutator (A) runout.
   A. If the commutator runout is within the service limit, check the commutator for carbon dust or brass chips between the segments.
   B. If the commutator run out is not within the service limit, replace the armature.

Commutator runout
Standard (New) : 0.05mm (0.0020in.) max
Service limit : 0.08mm (0.0031in.) max

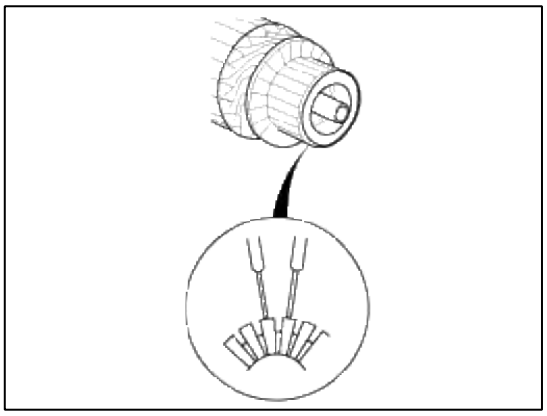


7. Check the mica depth (A). If the mica is too high (B), undercut the mica with a hacksaw blade to the proper depth. Cut away all the mica (C) between the commutator segments. The undercut should not be too shallow, too narrow, or v-shaped (D).

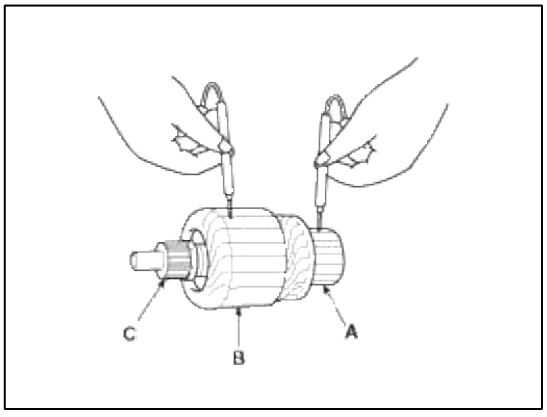
Commutator mica depth
Standard (New) : 0.5mm (0.0197in.)
Limit : 0.2mm (0.0079 in.)



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

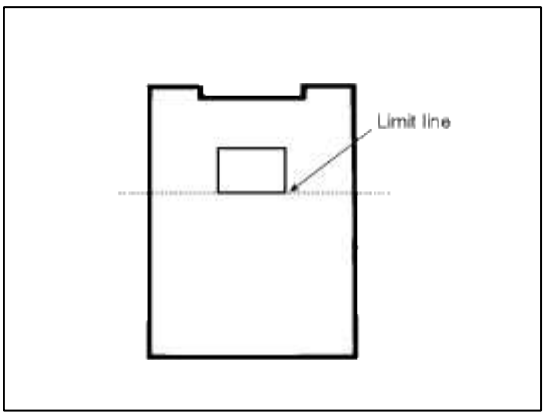


9. Check with an ohmmeter that no continuity exists between the commutator (A) and armature coil core (B), and between the commutator and armature shaft (C). If continuity exists, replace the armature.



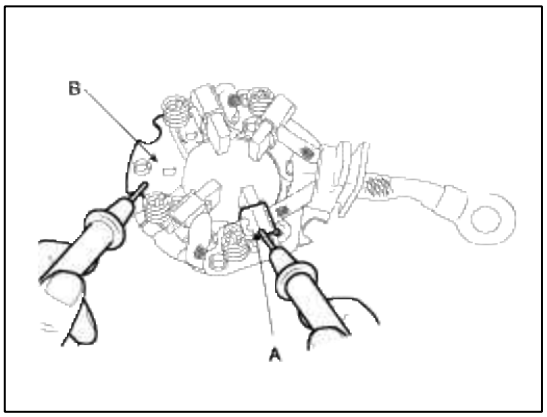
Inspect Starter Brush
Brushes that are worm out, or oil-soaked, should be replaced.

Bruch length
Standard : 12.3 mm (0.4843 in)
Service limit : 5.5 mm (0.2165 in)

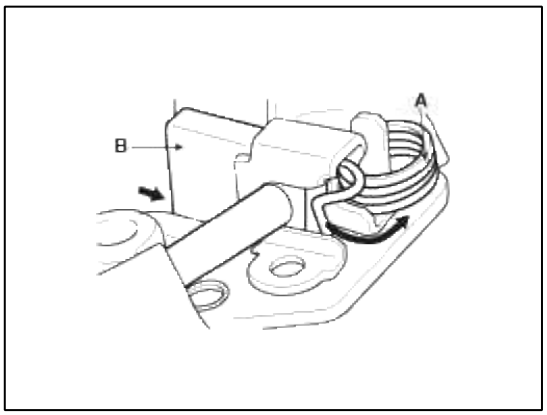


Starter Brush Holder Test

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



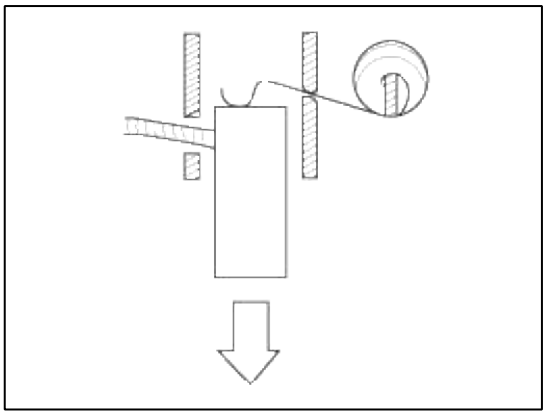
2. Pry back each brush spring (A) with a screwdriver, then position the brush (B) about halfway out of its holder, and release the spring to hold it there.



3. Install the armature in the housing, and install the brush holder. Next, pry back each brush spring again, and push the brush down until it seats against the commutator, then release the spring against the end of the brush.

NOTE

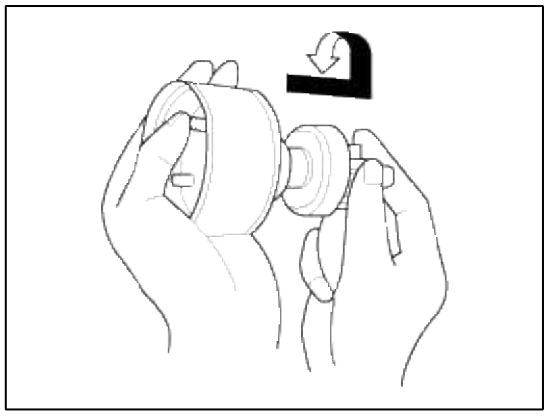
To seat new brushes, slip a strip of #500 or #600 sandpaper, with the grit side up, between the commutator and each brush, and smoothly rotate the armature. The contact surface of the brushes will be sanded to the same contour as the commutator.



Overrunning Clutch

1. Slide the overrunning clutch along the shaft.
   Replace it if does not slide smoothly.

2. Rotate the overrunning clutch both ways.
   Does it lock in one direction and rotate smoothly in reverse? If it does not lock in either direction or it locks in both directions, replace it.



3. If the starter drive gear is worn or damaged, replace the overrunning clutch assembly. (the gear is not available separately).
   Check the condition of the flywheel or torque converter ring gear if the starter drive gear teeth are damaged.

Cleaning

1. Do not immerse parts in cleaning solvent. Immersing the yoke assembly and/or armature will damage the insulation. Wipe these parts with a cloth only.

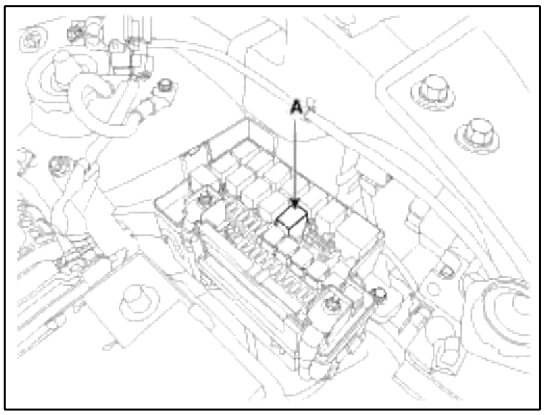
2. Do not immerse the drive unit in cleaning solvent. The overrun clutch is pre-lubricated at the factory and solvent will wash lubrication from the clutch.

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

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

Inspection

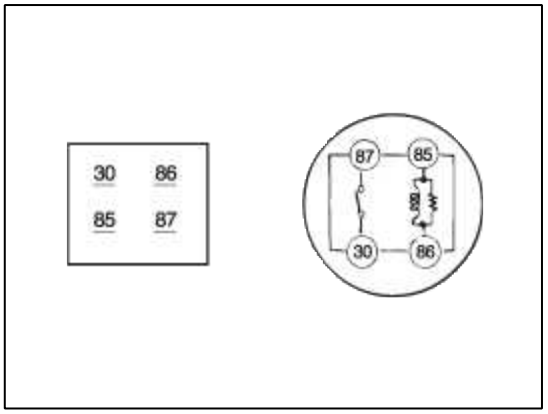
1. Remove the fuse box cover.
2. Remove the starter relay (A).



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

Terminal	Continuity
30 - 87	NO
85 - 86	YES

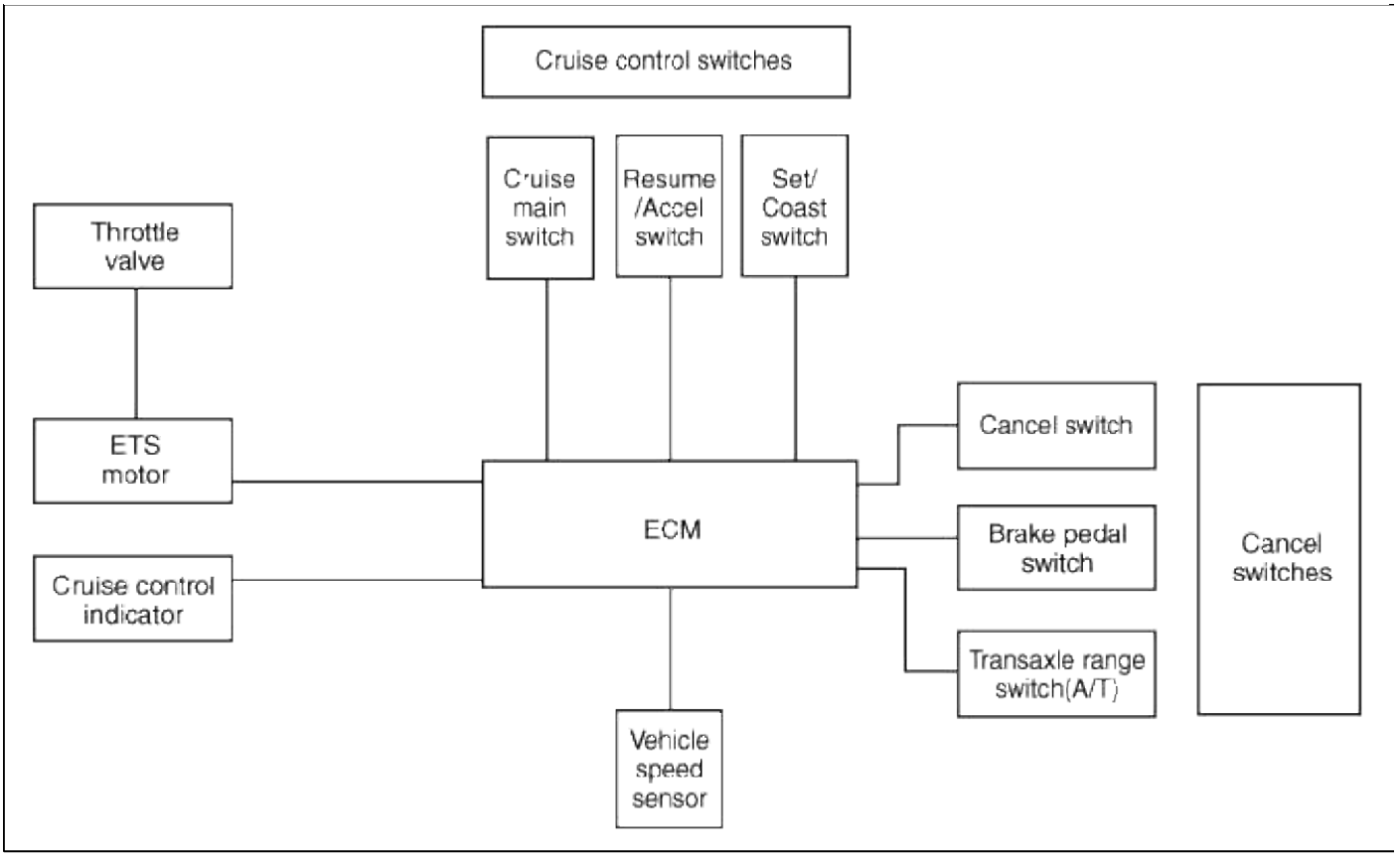
4. Apply 12V to terminal 85 and ground to terminal 86.
   Check for continuity between terminals 30 and 87.



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

Engine Electrical System > Cruise Control System > Schematic Diagrams

System Block Diagram



Component Parts And Function Outline

Component part		Function
Vehicle-speed sensor		Converts vehicle speed to pulse.
ECM		Receives signals from sensor and control switches.
Cruise control indicator		Illuminate when CRUISE main switch is ON (Built into cluster)
Cruise Control switches	ON/OFF switch	Switch for automatic speed control power supply.
	Resume/Accel switch	Controls automatic speed control functions by Resume/Accel switch (Set/Coast switch)
	Set/Coast switch	
Cancel switches	Cancel switch	Sends cancel signals to ECM.
	Brake-pedal switch	
	Transaxle range switch (A/T)	
ETS motor		Regulates the throttle valve to the set opening by ECM.

* ETS : Electronic Throttle System

Engine Electrical System > Cruise Control System > Description and Operation

Cruise Control

The cruise control system is engaged by the cruise "ON/OFF" main switch located on right of steering wheel column. The system has the capability to cruise, coast, accelerate and resume speed.
It also has a safety interrupt, engaged upon depressing brake or shifting select lever.
The ECM is the control module for this system. The main components of cruise control system are mode control switches, transmission range switch, brake switch, vehicle speed sensor, ECM and ETS motor that connect throttle body.
The ECM contains a low speed limit which will prevent system engagement below a minimum speed of 40km/h (25mph).

The operation of the controller is controlled by mode control switches located on steering wheel.
Transmission range switch and brake switch are provided to disengage the cruise control system. The switches are on brake pedal bracket and transmission. When the brake pedal is depressed or select lever shifted, the cruise control system is electrically disengaged and the throttle is returned to the idle position.

Cruise main switch (ON/OFF)

The cruise control system is engaged by pressing the cruise "ON/OFF" main switch. Pressing the cruise "ON/OFF" main switch again releases throttle, clears cruise memory speed, and puts vehicle in a non-cruise mode.

Set/Coast switch (SET/–)

The "SET/–" switch located on right of steering wheel column has two functions.
The set function - Push the "SET/–" switch and release it at the desired speed. The SET indicator light in the instrument cluster will illuminate. Release the accelerator pedal. The desired speed will automatically be maintained.
The coast function - Push the "SET/–" switch and hold it when the cruise control is on. The vehicle will gradually slow down. Release the switch at the desired speed. The desired speed will be maintained.
Push the "SET/–" switch and release it quickly. The cruising speed will decrease by 2.0km/h (1.2mph) or 1.6km/h (1.0mph).

Resume/Accel switch (RES/+)

The "RES/+" switch located on right of steering wheel column has two functions.
The resume function - If any method other than the cruise “ON/OFF” main switch was used to cancel cruising speed temporarily and the system is still activated, the most recent set speed will automatically resume when the "RES/+" switch is pushed. It will not resume, however, if the vehicle speed has dropped below approximately 40km/h (25mph).
The accel function - Push the "RES/+" switch and hold it when the cruise control is on. The vehicle will gradually accelerate. Release the switch at the desired speed. The desired speed will be maintained.
Push the "RES/+" switch and release it quickly. The cruising speed will increase by 2.0km/h (1.2mph) or 1.6km/h (1.0mph).

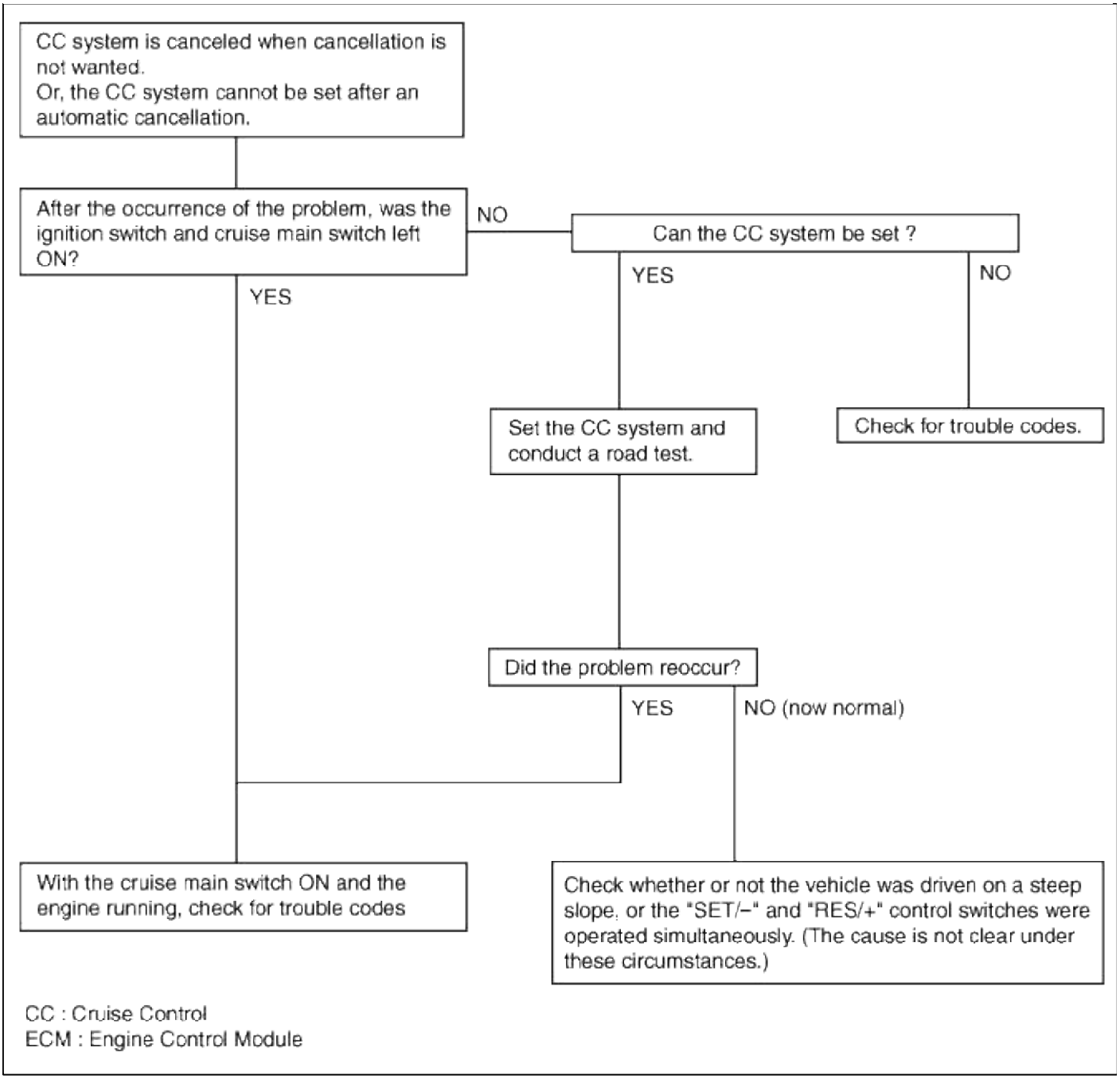
Cancel switch (CANCEL)

The cruise control system is temporarily disengaged by pushing the "CANCEL" switch.
Cruise speed canceled by this switch can be recovered by pushing the "RES/+" switch.

Engine Electrical System > Cruise Control System > Troubleshooting

Trouble Symptom Charts

Trouble Symptom 1



Trouble Symptom 2

Trouble symptom	Probable cause	Remedy
The set vehicle speed varies greatly upward or downward	Malfunction of the vehicle speed sensor circuit	Repair the vehicle speed sensor system, or replace the part
"Surging" (repeated alternating acceleration and deceleration) occurs after setting	Malfunction of ECM	Check input and output signals at ECM

Trouble Symptom 3

Trouble symptom	Probable cause	Remedy
The CC system is not canceled when the brake pedal is depressed	Damaged or disconnected wiring of the brake pedal switch	Repair the harness or replace the brake pedal switch
	Malfunction of the ECM signals	Check input and output signals at ECM

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 inhibitor switch
	Improper adjustment of inhibitor switch	
	Malfunction of the ECM signals	Check input and output signals at ECM

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
	Malfunction of the ECM signals	Check input and output signals at ECM

Trouble Symptom 6

Trouble symptom	Probable cause	Remedy
Cannot accelerate or resume speed by using the "RES/+" switch	Damaged or disconnected wiring, or short circuit, or "RES/+" switch input circuit	Repair the harness or replace the "RES/+" switch
	Malfunction of the ECM signals	Check input and output signals at ECM

Trouble Symptom 7

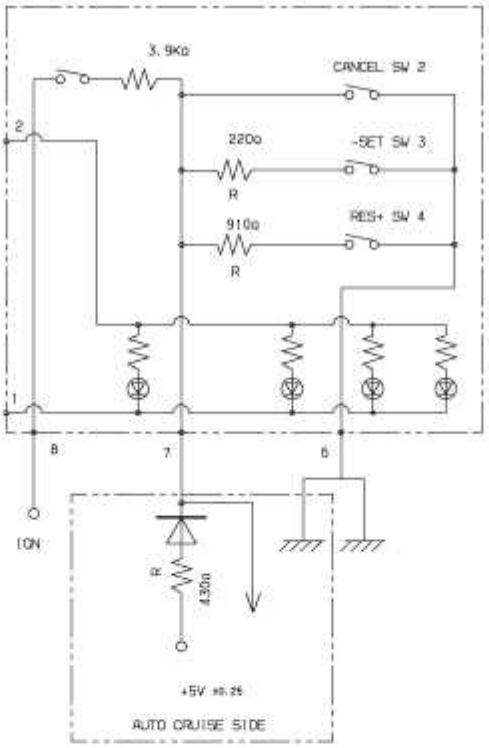
Trouble symptom	Probable cause	Remedy
CC system can be set while driving at a vehicle speed of less than 40km/h (25mph), or there is no automatic cancellation at that speed	Malfunction of the vehicle-speed sensor circuit	Repair the vehicle speed sensor system, or replace the part
	Malfunction of the ECM signals	Check input and output signals at ECM

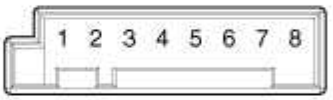
Trouble Symptom 8

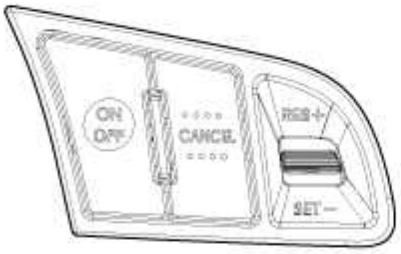
Trouble symptom	Probable cause	Remedy
The cruise main switch indicator lamp does not illuminate (But CC system is normal)	Damaged or disconnected bulb of cruise main switch indicator lamp	Repair the harness or replace the part.
	Harness damaged or disconnected	

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

Circuit Diagram







[Cruise control switch]

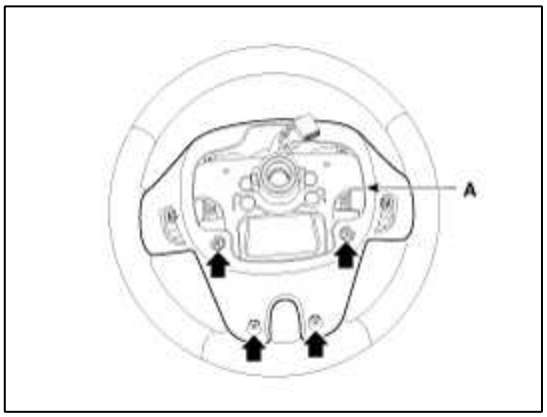
PIN	Connector
1	ILL (-)
2	ILL (+)
3	-
4	-
5	-
6	ACC (-)
7	ACC (+)
8	ACC ON/OFF

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

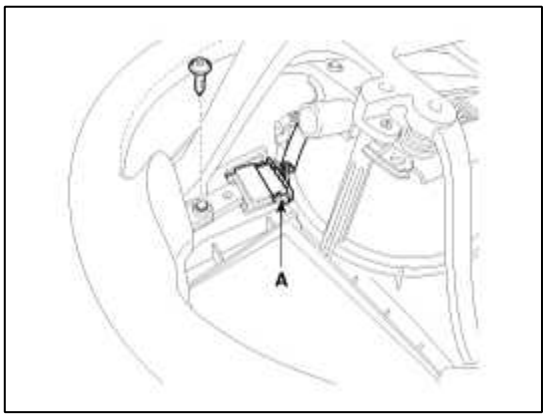
Removal and Installation

1. Disconnect the battery negative terminal.
2. Remove the driver airbag module. (Refer to the RT group - "Airbag module")
3. Remove the steering wheel. (Refer to the ST group - "Steering column and shaft")

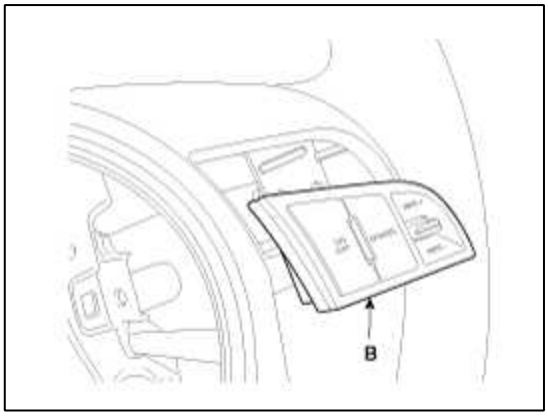
4. Remove the steering wheel cover (A) after loosening the screws.



5. Disconnect the audio switch connector (A) and then loosen the mounting screw.



6. Remove the cruise control switch (A).



NOTE

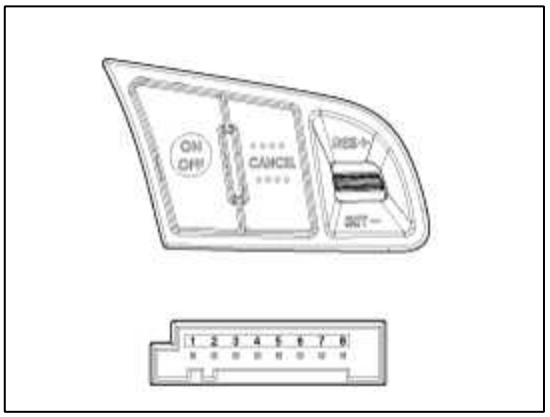
Be careful not to damage the hook when removing the switch.

7. Installation is reverse order of removal.

Inspection

Measuring Resistance

1. Disconnect the cruise control switch connector from the control switch.



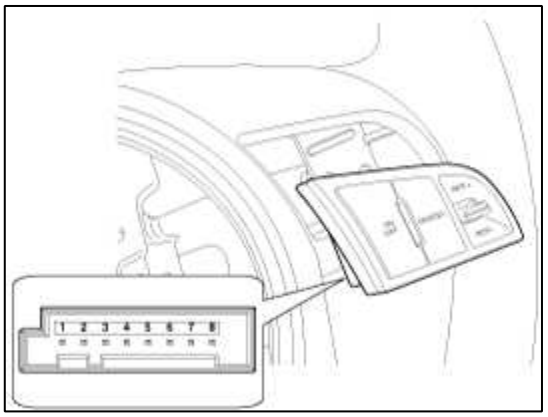
2. Measure resistance between terminals on the control switch when each function switch is ON (switch is depressed).

Function switch	Terminal	Resistance
CANCEL	6 - 7	0Ω
SET	6 - 7	220Ω ± 10%
RESUME	6 - 7	910Ω ± 10%
ON/OFF	7 - 8	3.9KΩ ± 10%

3. If not within specification, replace switch.

Measuring Voltage

1. Connect the cruise control switch connector to the control switch.



2. Measure voltage between terminals on the harness side connector when each function switch is ON (switch is depressed).

Function switch	Terminal	Voltage
CANCEL	6 - 7	0V ± 0.22V
SET	6 - 7	1.5V ± 0.22V
RESUME	6 - 7	3.0V ± 0.22V
ON/OFF	7 - 8	-

3. If not within specification, replace switch.

SOUL(AM) > 2012 > G 1.6 GDI > Fuel System

Fuel System > General Information > Specifications

Specifications

Fuel Delivery System

Items	Specification	
Fuel Tank	Capacity	48 lit. (12.7 U.S.gal., 50.7 U.S.qt., 42.2 Imp.qt.)
Fuel Filter	Type	Paper type
Fuel Pressure	Low Pressure Fuel Line	480 ~ 520 kPa (4.89 ~ 5.30 kgf/cm², 69.6 ~ 75.4 psi)
	High Pressure Fuel Line	5.0 ~ 12.0 MPa (51.0 ~ 122.4 kgf/cm², 725.2 ~ 1740.5 psi)
Fuel Pump	Type	Electrical, in-tank type
	Driven by	Electric motor
High Pressure Fuel Pump	Type	Mechanical type
	Driven by	Camshaft

Sensors

Manifold Absolute Pressure Sensor (MAPS)

Type: Piezo-resistive pressure sensor type

Specification

Pressure [kPa (kgf/cm², psi)]	Output Voltage (V)
20.0 (0.20, 2.9)	0.79
46.7 (0.47, 6.77)	1.84
101.3 (1.03, 14.7)	4.0

Intake Air Temperature Sensor (IATS)

Type: Thermistor type

Specification

Temperature		Resistance (kΩ)
°C	°F	
-40	-40	40.93 ~ 48.35
-20	-4	13.89 ~ 16.03
0	32	5.38 ~ 6.09
10	50	3.48 ~ 3.90
20	68	2.31 ~ 2.57
40	104	1.08 ~ 1.21
50	122	1.56 ~ 1.74
60	140	0.54 ~ 0.62
80	176	0.29 ~ 0.34

Engine Coolant Temperature Sensor (ECTS)

Type: Thermistor type

Specification

Temperature		Resistance (kΩ)
°C	°F	
-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) [integrated into ETC module]
Type: Hall IC Non-contact sensor type
Specification

Throttle angle(°)	Output Voltage (V)	
	TPS1	TPS2
0	0.5	4.5
10	0.96	4.05
20	1.41	3.59
30	1.87	3.14
40	2.32	2.68
50	2.78	2.23
60	3.23	1.77
70	3.69	1.32
80	4.14	0.86
90	4.6	0.41
98	4.65	0.35
C.T (0)	0.5	4.5
W.O.T (86)	4.41	0.59

Crankshaft Position Sensor (CKPS) [Without ISG]
Type: Magnetic field sensitive Type
Specification

Item	Specification
Coil Resistance (Ω)	774 ~ 946 [20°C (68°F)]

Crankshaft Position Sensor (CKPS) [With ISG]
Type: Hall effect type
Camshaft Position Sensor (CMPS)
Type: Hall effect type
Knock Sensor (KS)
Type: Piezo-electricity type
Specification

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

Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 1]
Type: Zirconia (ZrO2) [Linear] Type
Specification

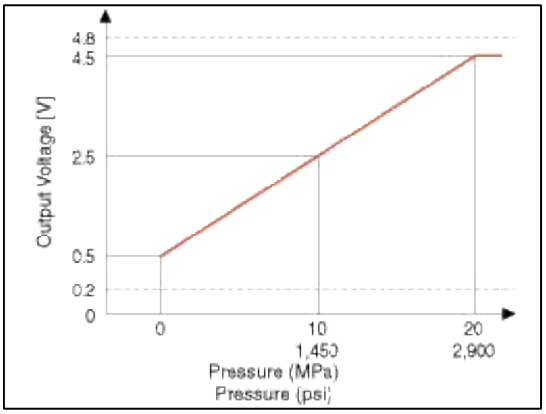
Item	Specification
Heater Resistance (Ω)	2.4 ~ 4.0 [20°C(69.8°F)]

Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2]
Type: Zirconia (ZrO2) [Binary] 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 [21°C(69.8°F)]

Rail Pressure Sensor (RPS)
Type: Piezo-electricity type
Specification



Accelerator Position Sensor (APS)
Type: Variable resistor type
Specification

Accelerator Position	Output Voltage (V)	
	APS1	APS2
C.T	0.7 ~ 0.8	0.275 ~ 0.475
W.O.T	3.8 ~ 4.4	1.75 ~ 2.35

Fuel Tank Pressure Sensor (FTPS)
Type: Piezo - Resistivity type
Specification

Pressure [kPa (kgf/cm², in H2O)]	Output Voltage (V)
-6.67 (-0.068, -26.8)	0.5
0	2.5
+6.67 (0.068, 26.8)	4.5

Actuators

Injector

Specification

Item	Specification
Coil Resistance (Ω)	1.5 [20°C(68°F)]

ETC Motor [integrated into ETC Module]

Specification

Item	Specification
Coil Resistance (Ω)	0.3 ~ 100 [20°C(68°F)]

Purge Control Solenoid Valve (PCSV)

Specification

Item	Specification
Coil Resistance (Ω)	22.0 ~ 26.0 [20°C(68°F)]

CVVT Oil Control Valve (OCV)

Specification

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

Variable Intake Solenoid (VIS) Valve

Specification

Item	Specification
Coil Resistance (Ω)	30.0 ~ 35.0 [20°C(68°F)]

Fuel Pressure control Valve

Specification

Item	Specification
Coil Resistance (Ω)	0.5 [20°C(68°F)]

Ignition Coil

Type: Stick type

Specification

Item	Specification
Primary Coil Resistance (Ω)	0.75 ± 15 [20°C(68°F)]
Secendary Coil Resistance (kΩ)	5.9 [20°C(68°F)]

Canister Close Valve (CCV)

Specification

Item	Specification
Coil Resistance (Ω)	15.5 ~ 18.5 (20°C)

Service Standard

Item		Specification	
Ignition Timing (°)		BTDC 3 ± 10	
Idle Speed (rpm)	A/C OFF	Neutral, N, P-range	630 ± 100
		D-range	630 ± 100
	A/C ON	Neutral, N, P-range	700 ± 100
		D-range	700 ± 100

Tightening Torques

Engine Control System

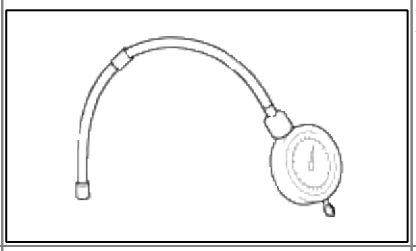
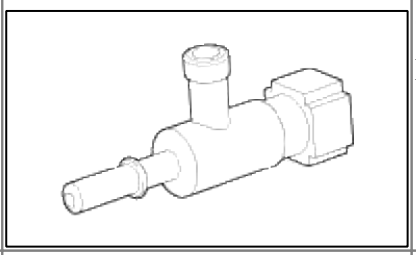
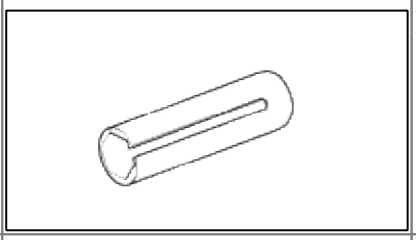
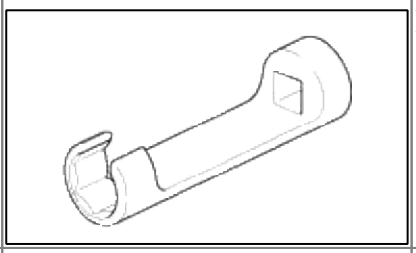
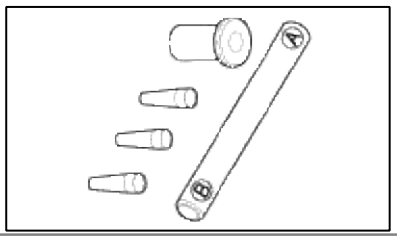
Item	kgf.m	N.m	lb-ft
ECM installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
ECM bracket installation bolt	2.0 ~ 3.0	19.6 ~ 29.4	14.5 ~ 21.7
ECM bracket installation nut	0.8 ~ 1.2	7.8 ~ 11.8	5.8 ~ 8.7
Manifold absolute pressure sensor installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
Engine Coolant Temperature Sensor installation	3.0 ~ 4.0	29.4 ~ 39.2	21.7 ~ 28.9
Crankshaft position sensor installation bolt	0.8 ~ 1.2	7.8 ~ 11.8	5.8 ~ 8.7
Camshaft position sensor (Bank 1 / Intake) installation bolt	0.8 ~ 1.2	7.8 ~ 11.8	5.8 ~ 8.7
Camshaft position sensor (Bank 1 / Exhaust) installation bolt	0.8 ~ 1.2	7.8 ~ 11.8	5.8 ~ 8.7
Knock sensor installation bolt	1.9 ~ 2.5	18.6 ~ 24.5	13.7 ~ 18.1
Heated oxygen sensor (Bank 1 / sensor 1) installation	4.0 ~ 5.0	39.2 ~ 49.1	28.9 ~ 36.2
Heated oxygen sensor (Bank 1 / sensor 2) installation	4.0 ~ 5.0	39.2 ~ 49.1	28.9 ~ 36.2
Rail pressure sensor installation	3.0 ~ 3.5	29.4 ~ 34.3	21.7 ~ 25.3
Electronic throttle body installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
Purge control solenoid valve bracket installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
CVVT oil control valve (Bank 1 / Intake) installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
CVVT oil control valve (Bank 1 / Exhaust) installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
Canister close valve installation bolt	0.4 ~ 0.6	3.9 ~ 5.9	2.9 ~ 4.3
Ignition coil installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7

Fuel Delivery System

Item	kgf.m	N.m	lb-ft
Fuel tank installation nut	4.0 ~ 5.5	39.2 ~ 54.0	28.9 ~ 39.8
Fuel pump plate cover installation bolt	0.2 ~ 0.3	2.0 ~ 2.9	1.4 ~ 2.2
Filler-neck assembly bracket installation bolt	0.4 ~ 0.6	3.9 ~ 5.9	2.9 ~ 4.3
Filler-neck assembly installation screw	0.6 ~ 0.7	5.6 ~ 6.9	4.3 ~ 5.1
Accelerator pedal module installation nut	1.7 ~ 2.6	16.7 ~ 25.5	12.3 ~ 18.8
Delivery pipe installation bolt	1.9 ~ 2.4	18.6 ~ 23.5	13.7 ~ 17.4
High pressure fuel pump installation bolt	1.3 ~ 1.5	12.8 ~ 14.7	9.4 ~ 10.9
High pressure fuel pipe installation nut	2.7 ~ 3.3	26.5 ~ 32.4	19.5 ~ 23.9
High pressure fuel pipe function block installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7

Fuel System > General Information > Special Service Tools

Special Service Tools

Item	Illustration	Application
Fuel Pressure Gauge (09353-24100)		Measuring the fuel line pressure
Fuel Pressure Gauge Adapter (09353-02100)		Connection between the high pressure fuel pump and the fuel feed line
Heated Oxygen Sensor Socket Wrench (09392-2H100)		Removal and installation of the heated oxygen sensor
Torque Wrench Socket (09314-3Q100) or (09314-27130) (19mm)		Removal and installation of the high pressure fuel pipe
Injector Combustion Seal Guide & Sizing tool (09353-2B000)		Installation of the injector combustion seal

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 the GDS 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	DPF (Diesel Engine)	☐ With DPF ☐ Without DPF

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.

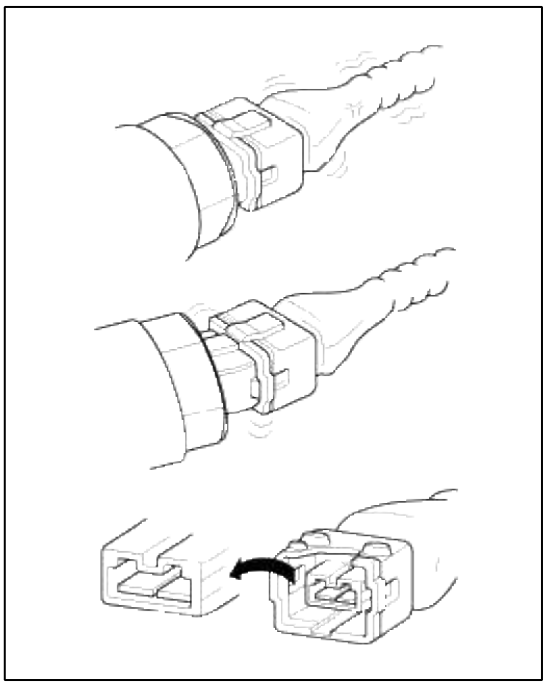
NOTE

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.

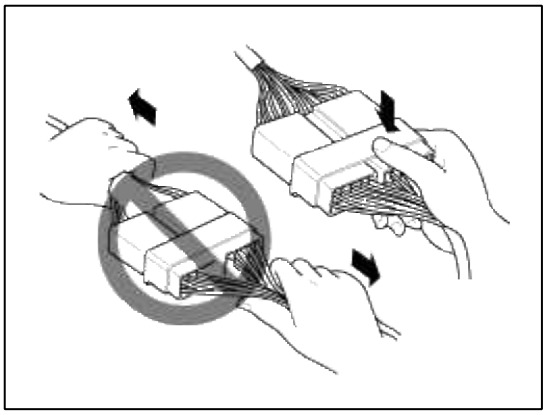
● Simulating Electrical Load

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

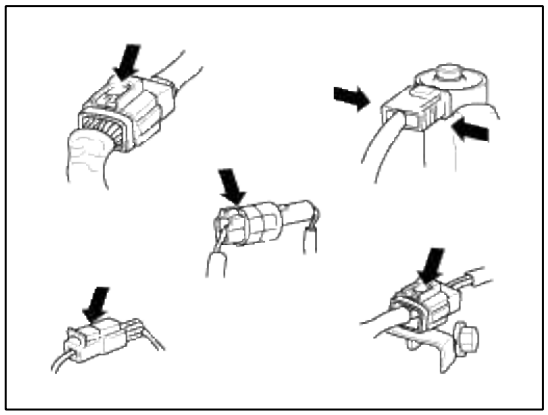
Connector Inspection Procedure

1. Handling of Connector

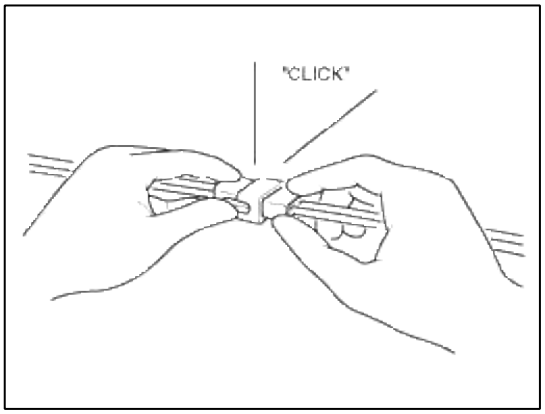
A. Never pull on the wiring harness when disconnecting connectors.



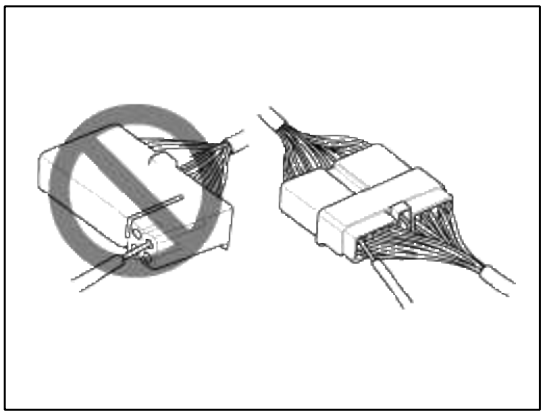
B. When removing the connector with a lock, press or pull locking lever.



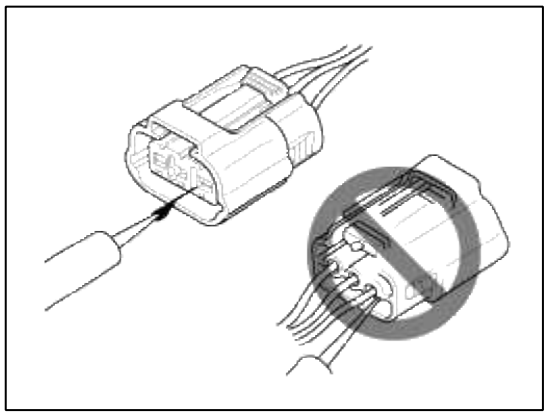
C. Listen for a click when locking connectors. This sound indicates that they are securely locked.



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.

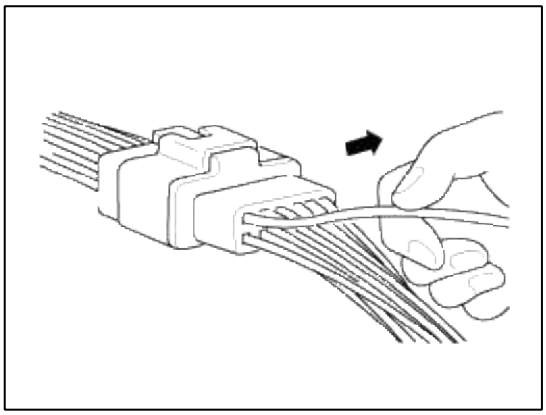
2. Checking Point for Connector

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

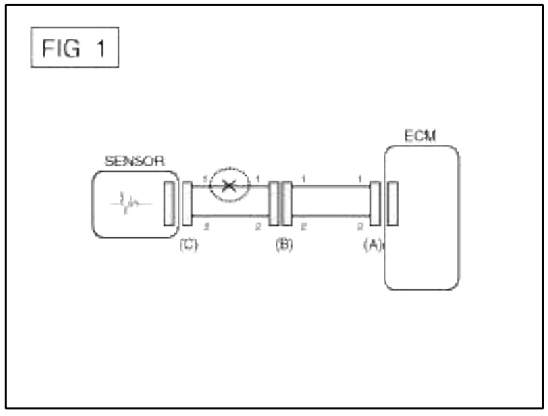
1. Before removing the wire harness, check the wire harness position and crimping in order to restore it correctly.
2. Check whether the wire harness is twisted, pulled or loosened.
3. Check whether the temperature of the wire harness is abnormally high.
4. Check whether the wire harness is rotating, 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.

FIG 1



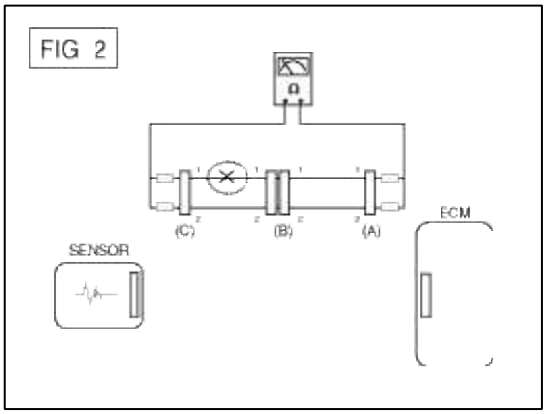
2. Continuity Check Method

NOTE

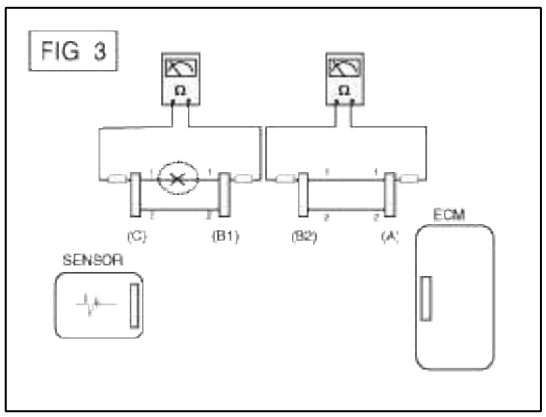
When measuring for resistance, lightly shake the wire harness above and below or from side to side.

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

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

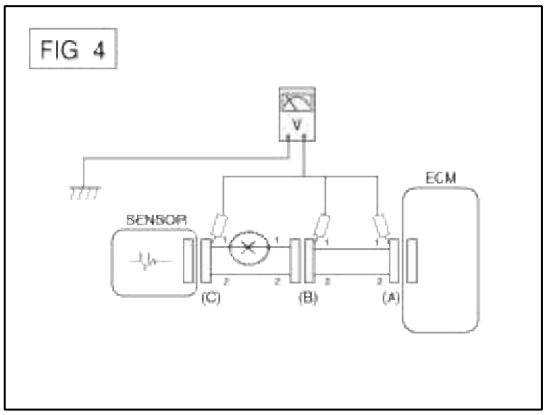


B. Disconnect connector (B), and measure for resistance between connector (C) and (B1) and between (B2) and (A) as shown in [FIG. 3].
In this case the measured resistance between connector (C) and (B1) is higher than 1MΩ and the open circuit is between terminal 1 of connector (C) and terminal 1 of connector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



3. Voltage Check Method
   A. With each connector still connected, measure the voltage between the chassis ground and terminal 1 of each connectors (A), (B) and (C) as shown in [FIG. 4].
   The measured voltage of each connector is 5V, 5V and 0V respectively. So the open circuit is between connector (C) and (B).

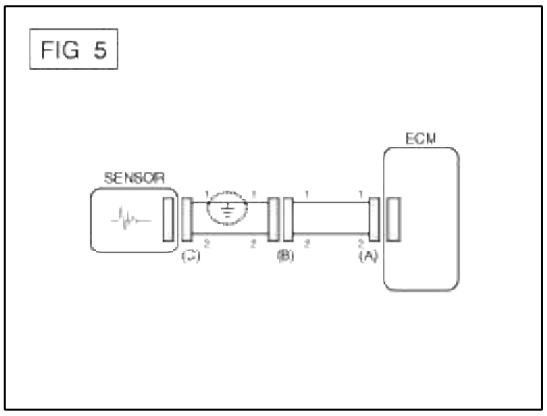
FIG 4



● 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



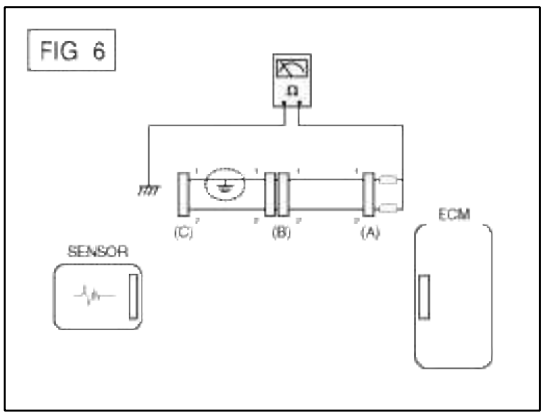
2. Continuity Check Method (with Chassis Ground)

NOTE

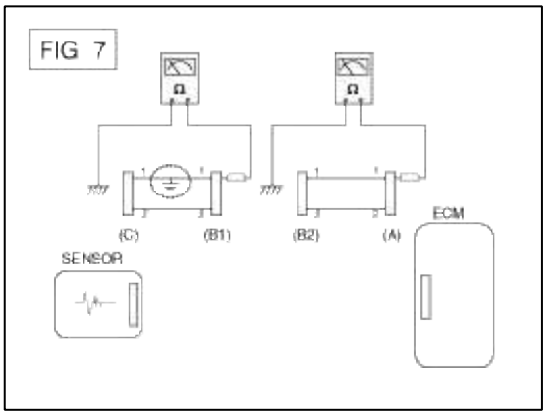
Lightly shake the wire harness above and below, or from side to side when measuring the resistance.

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

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



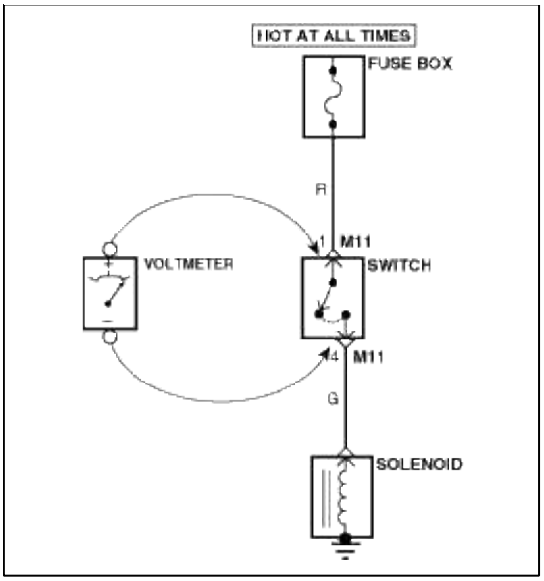
B. Disconnect connector (B), and measure the resistance between connector (A) and chassis ground, and between (B1) and chassis ground as shown in [FIG. 7].
The measured resistance between connector (B1) and chassis ground is 1Ω or less. The short to ground circuit is between terminal 1 of connector (C)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



● Testing For Voltage Drop

This test checks for voltage drop along a wire, or through a connection orswitch.

1) Connect the positive lead of a voltmeter to the end of the wire (or to the side of the connector or switch) closest to the battery.
2) Connect the negative lead to the other end of the wire. (or the other side of the connector or switch)
3) Operate the circuit.
4) The voltmeter will show the difference in voltage between the two points. A difference, or drop of more than 0.1 volts (50mV in 5V circuits), may indicate a problem. Check the circuit for loose or dirty connections.



Symptom Troubleshooting Guide Chart

Main symptom	Diagnostic procedure	Also check for
Unable to start (Engine does not turn over)	1. Test the battery 2. Test the starter 3. Inhibitor switch (A/T) or clutch start switch (M/T)	
Unable to start (Incomplete combustion)	1. Test the battery 2. Check the fuel pressure 3. Check the ignition circuit 4. Troubleshooting the immobilizer system (In case of immobilizer lamp flashing)	• DTC • Low compression • Intake air leaks • Slipped or broken timing belt • Contaminated fuel
Difficult to start	1. Test the battery 2. Check the fuel pressure 3. Check the ECTS 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 ECTS 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 ECTS and Circuit (Check DTC)	• DTC • Low compression • Intake air leaks

	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)	• Contaminated fuel • Weak ignition spark
Knocking	1. Check the fuel pressure 2. Inspect the engine coolant 3. Inspect the radiator and the electric cooling fan 4. Check the spark plugs	• DTC • Contaminated fuel
Poor fuel economy	1. Check customer's driving habitsIs · A/C on full time or the defroster mode on? · Are tires at correct pressure? · Is excessively heavy load being carried? · Is acceleration too much, too often? 2. Check the fuel pressure 3. Check the injector 4. Test the exhaust system for a possible restriction 5. Check the ECTS and circuit	• DTC • Low compression • Intake air leaks • Contaminated fuel • Weak ignition spark
Hard to refuel (Overflow during refueling)	1. Test the canister close valve 2. Inspect the fuel filler hose/pipe · Pinched, kinked or blocked? · Filler hose is torn 3. Inspect the fuel tank vapor vent hose between the canister and fuel tank air filter 4. Check the 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, Exhaust 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.

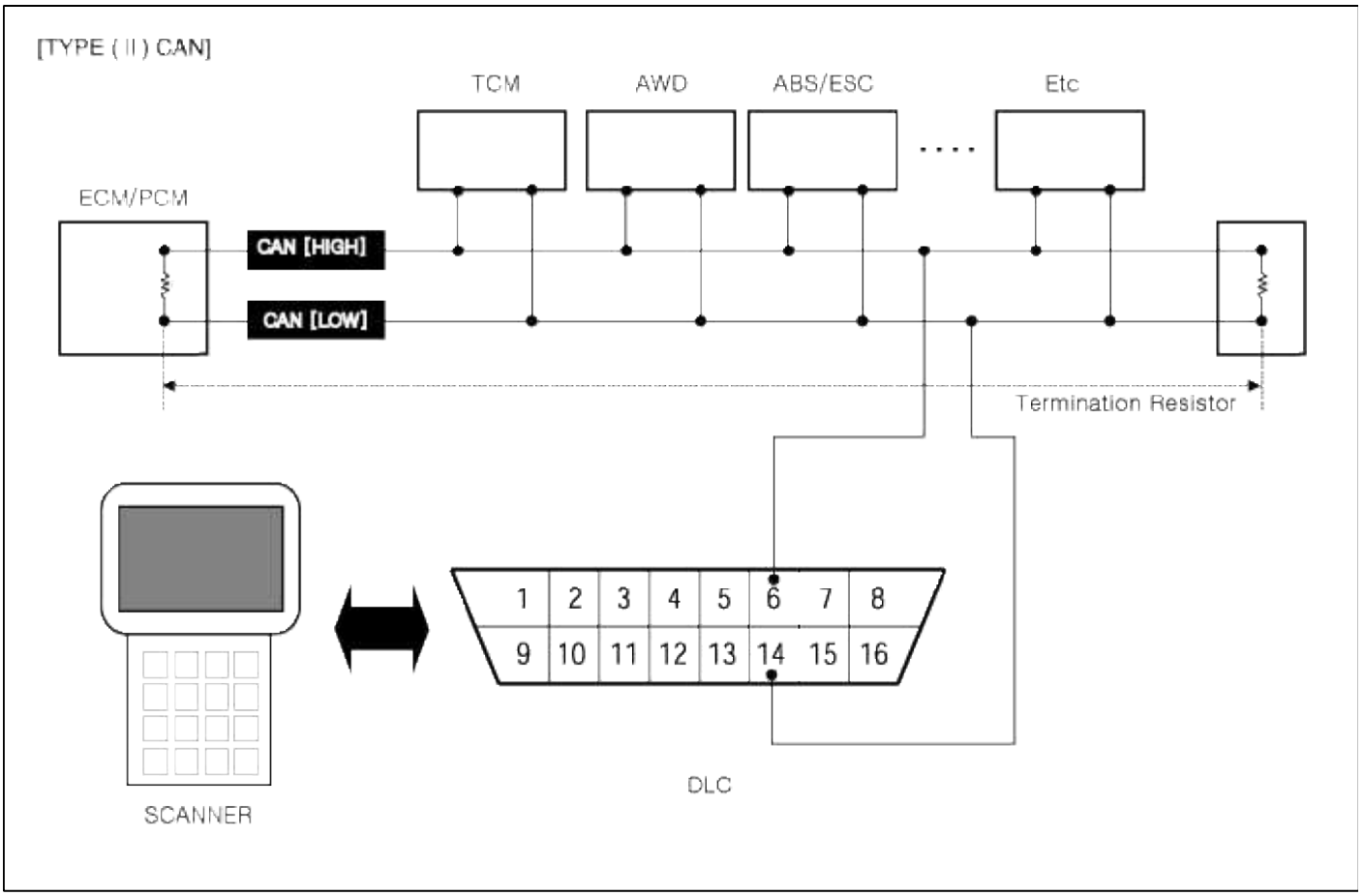
The OBD-II system meets government regulations by monitoring the emission control system. When a system or component exceeds emission threshold or a component operates outside tolerance, a DTC will be stored and the MIL illuminated.

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.

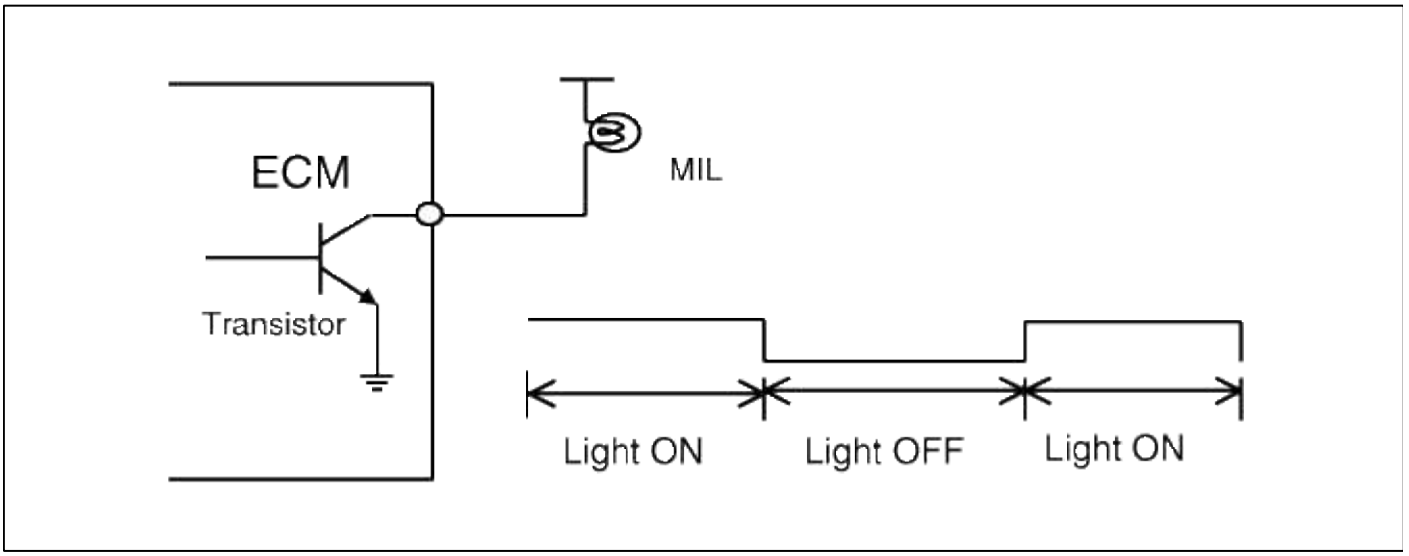
Freeze frame data describes stored engine conditions, such as state of the engine, state of fuel control, spark, RPM, load and warm status at the point the first fault is detected. Previously stored conditions will be replaced only if a fuel or misfire fault is detected. This data is accessible with 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) Drive cycle

A Drive Cycle is when a vehicle is operation (following an engine-off period) for a 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.

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 Cycle is when a vehicle is driven under the conditions for one or more of the monitors is completed. After repairing the vehicle for an emission related fault, dirving the vehicle under the conditions to run the monitor for the system is concidered a Trip.

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

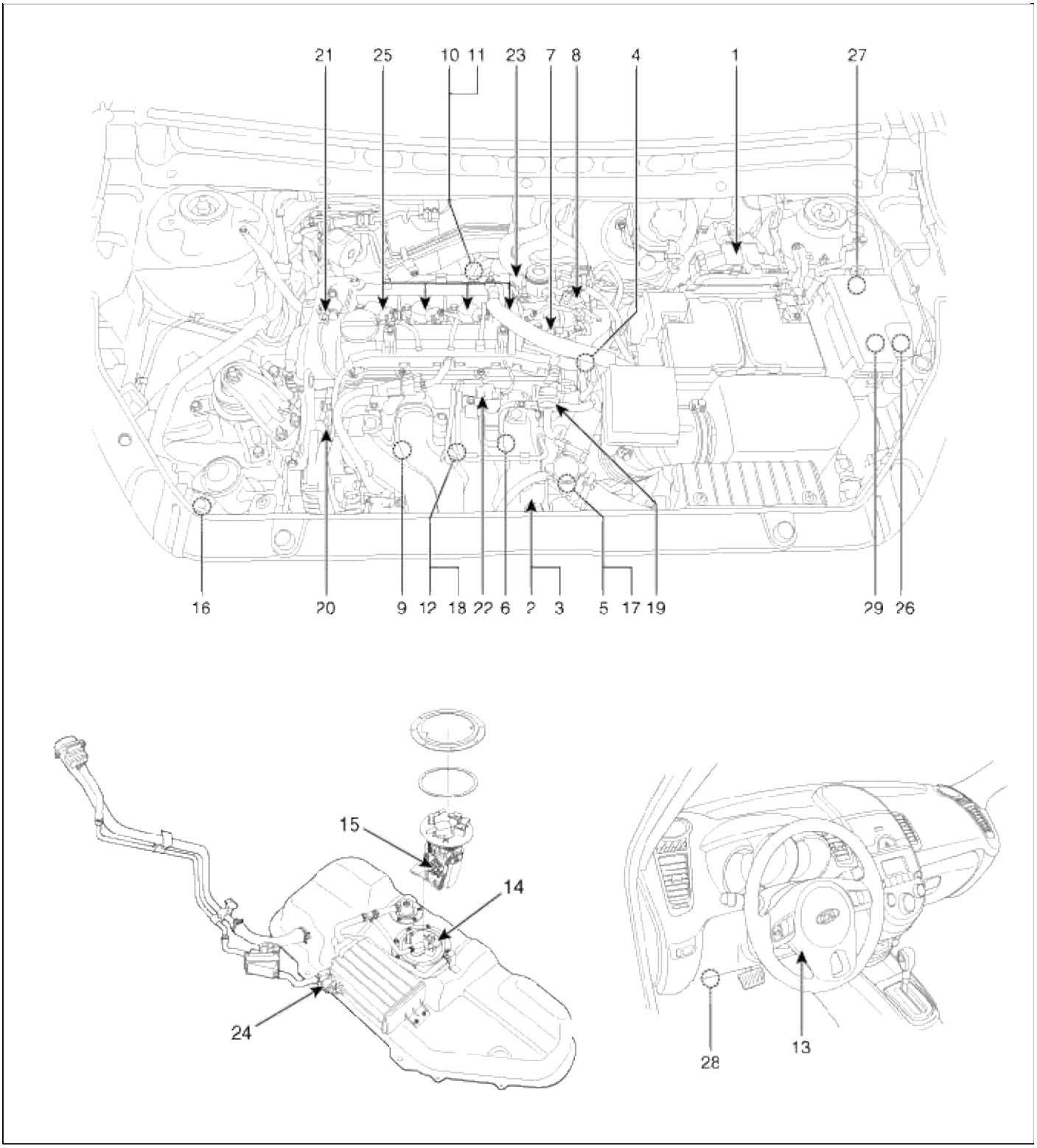
The A/C system monitoring is a self-test strategy within the ECM or PCM that monitors malfunction of all A/C system components at A/C ON.
8) Comprehensive components monitoring

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

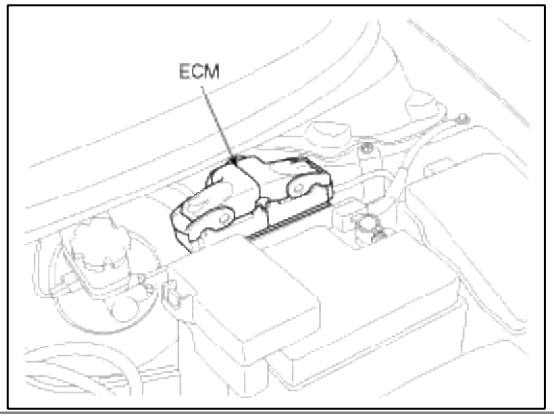
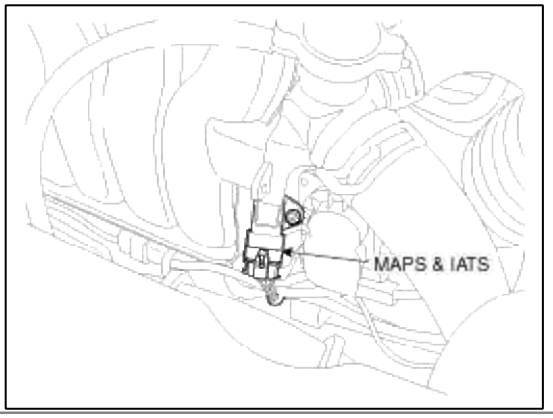
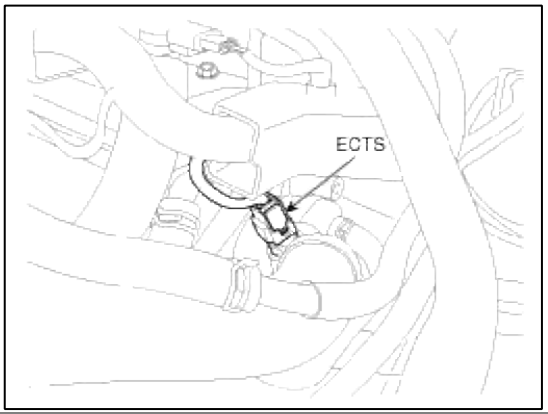
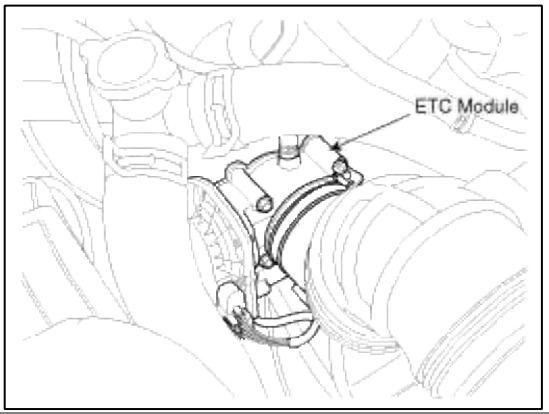
Requirement:
If a vehicle incorporates an engine control strategy that alters off idle fuel and/or spark control when the A/C system is on, the OBD II system shall monitor all electronic air conditioning system components for malfunctions that cause the system to fail to invoke the alternate control 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.

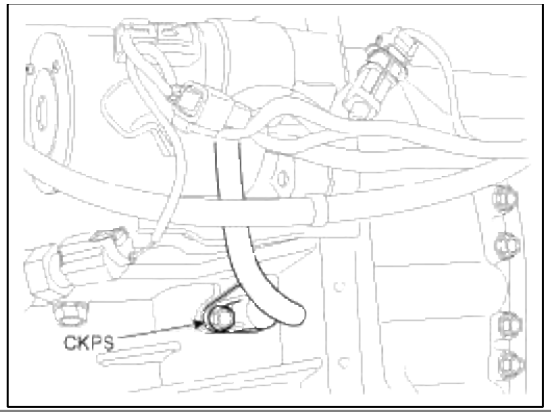
Fuel System > Engine Control System > Components and Components Location

Components Location

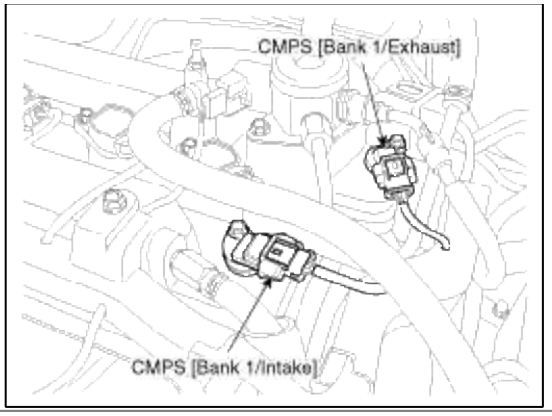

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1. Engine Control Module (ECM) 2. Manifold Absolute Pressure Sensor (MAPS) 3. Intake Air Temperature Sensor (IATS) 4. Engine Coolant Temperature Sensor (ECTS) 5. Throttle Position Sensor (TPS) [integrated into ETC Module] 6. Crankshaft Position Sensor (CKPS) 7. Camshaft Position Sensor (CMPS) [Bank 1 / Intake] 8. Camshaft Position Sensor (CMPS) [Bank 1 / Exhaust] 9. Knock Sensor (KS) 10. Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 1] 11. Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2] 12. Rail Pressure Sensor (RPS) 13. Accelerator Position Sensor (APS) 14. Fuel Tank Pressure Sensor (FTPS) 15. Fuel Level Sender (FLS)	16. A/C Pressure Transducer (APT) 17. ETC Motor [integrated into ETC Module] 18. Injector 19. Purge Control Solenoid Valve (PCSV) 20. CVVT Oil Control Valve (OCV) [Bank 1 / Intake] 21. CVVT Oil Control Valve (OCV) [Bank 1 / Exhaust] 22. Variable Intake Solenoid (VIS) Valve 23. Fuel Pressure Control Valve (FPCV) 24. Canister Close Valve (CCV) 25. Ignition Coil 26. Main Relay 27. Fuel Pump Relay 28. Data Link Connector (DLC) [16-Pin] 29. Multi-Purpose Check Connector [20-Pin]

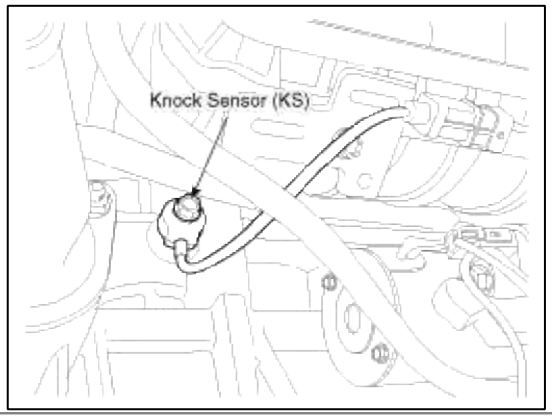
1. Engine Control Module (ECM)	2. Manifold Absolute Pressure Sensor (MAPS) 3. Intake Air Temperature Sensor (IATS)
	
4. Engine Coolant Temperature Sensor (ECTS)	5. Throttle Position Sensor (TPS) 17. ETC Motor
	
6. Crankshaft Position Sensor (CKPS)	7. Camshaft Position Sensor (CMPS) [Bank 1 / Intake] 8. Camshaft Position Sensor (CMPS) [Bank 1 / Exhaust]



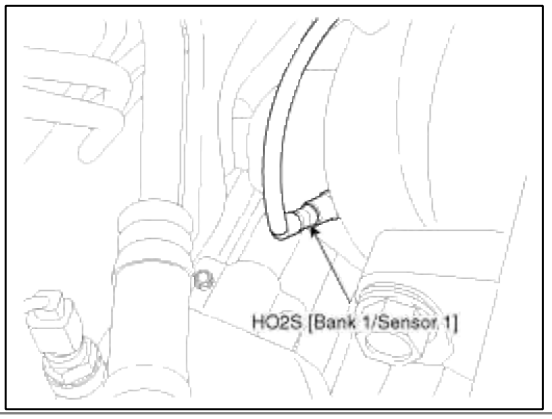
9. Knock Sensor (KS)



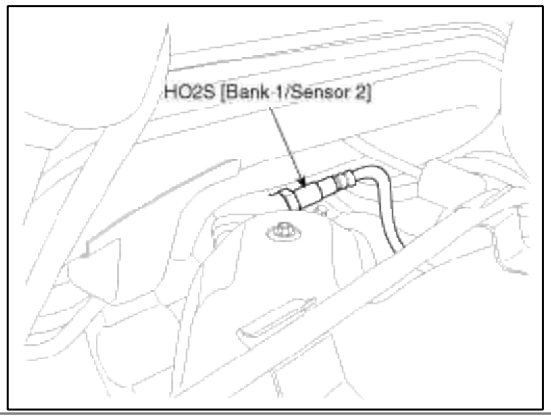
10. Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 1]



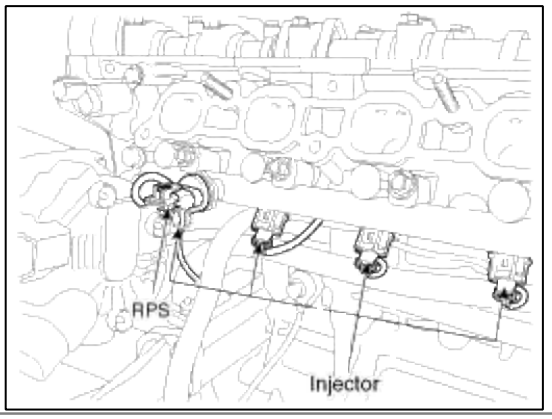
11. Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2]



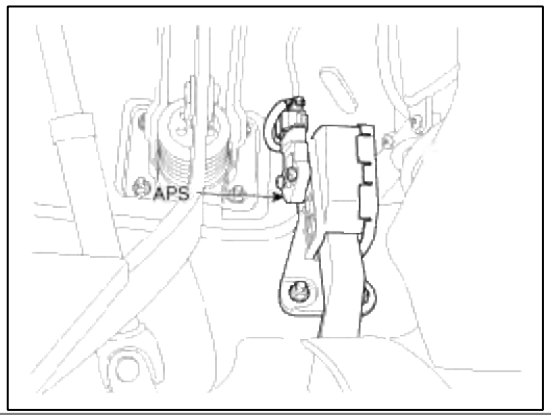
12. Rail Pressure Sensor (RPS)
18. Injector



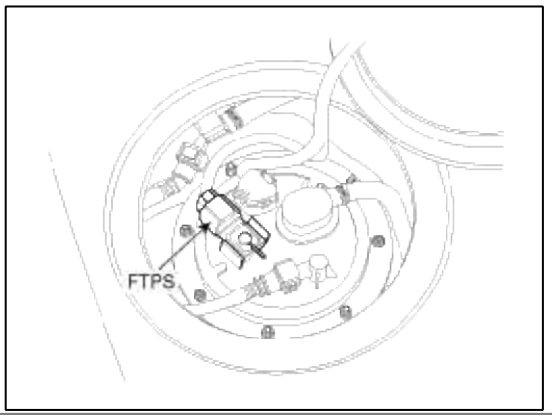
13. Accelerator Position Sensor (APS)



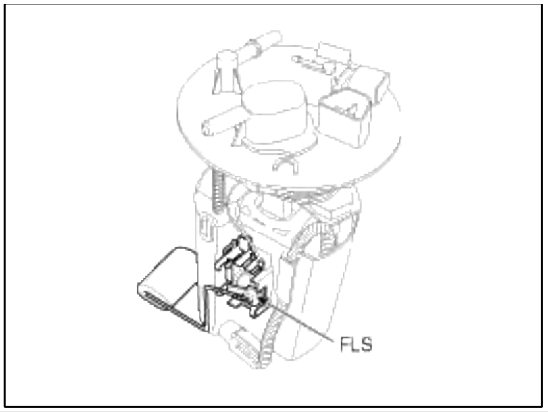
14. Fuel Tank Pressure Sensor (FTPS)



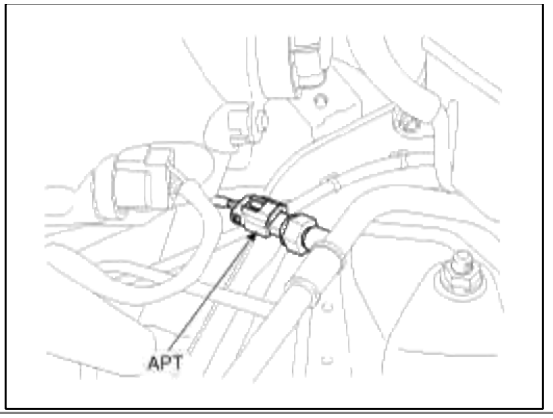
15. Fuel Level Sender (FLS)



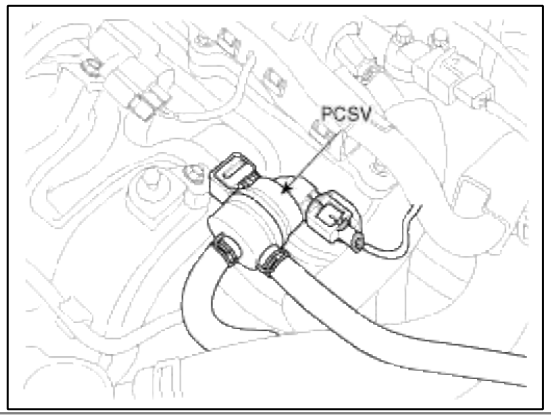
16. A/C Pressure Transducer (APT)



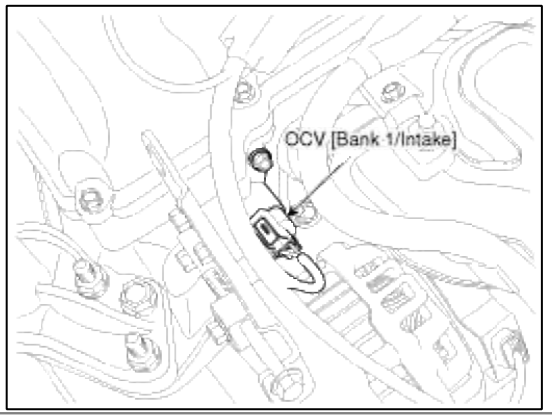
19. Purge Control Solenoid Valve (PCSV)



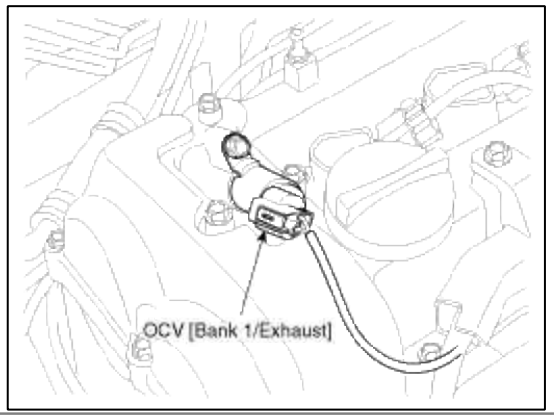
20. CVVT Oil Control Valve (OCV) [Bank 1 / Intake]



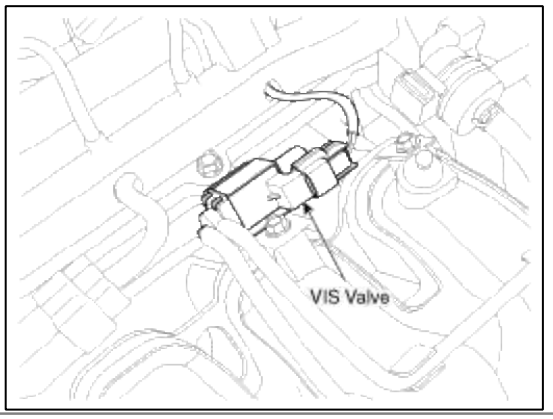
21. CVVT Oil Control Valve (OCV) [Bank 1 / Exhaust]



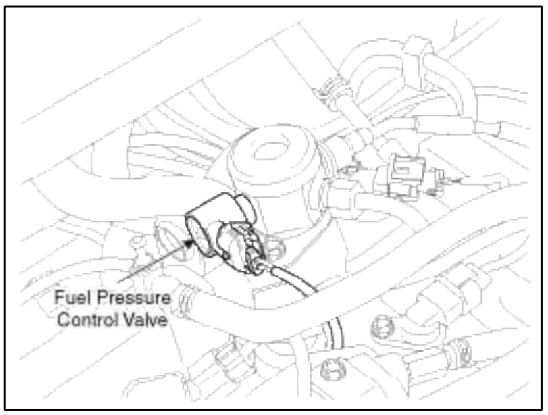
22. Variable Intake Solenoid (VIS) Valve



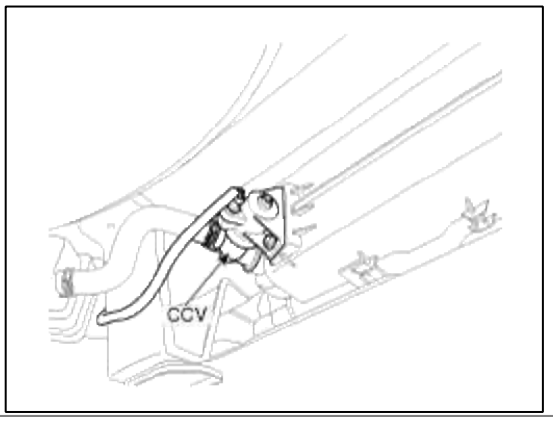
23. Fuel Pressure Control Valve (FPCV)



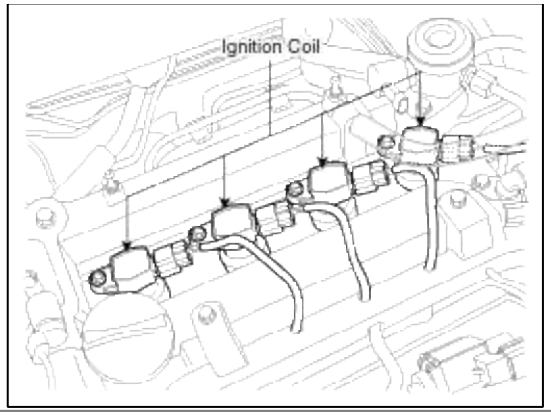
24. Canister Close Valve (CCV)

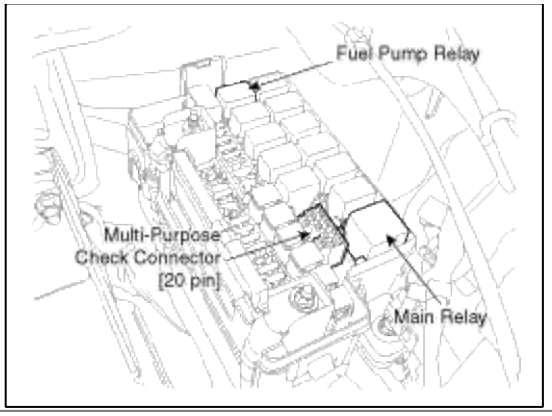


25. Ignition Coil

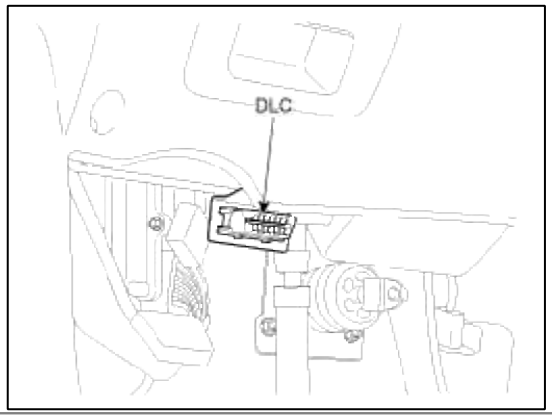


26. Main Relay
27. Fuel Pump Relay
29. Multi-Purpose Check Connector [20-Pin]



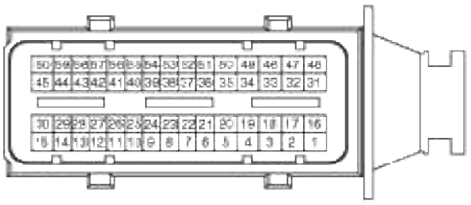


28. Data Link Connector (DLC) [16-Pin]



Fuel System > Engine Control System > Engine Control Module (ECM) > Schematic Diagrams

ECM Terminal And Input/Output signal [M/T]



Connector [EGGM-A]



Connector [EGGM-K]

ECM Terminal Function (M/T)

Connector [EGGM-A]

Pin No.	Description	Connected to
1	Injector (Cylinder #3) [High] control output	Injector (Cylinder #3)
2	Injector (Cylinder #4) [High] control output	Injector (Cylinder #4)
3	Injector (Cylinder #2) [Low] control output	Injector (Cylinder #2)
4	-	
5	Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 1] heater control output	Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 1]
6	-	
7	Supply power (+5V)	Cruise control switch
8	-	
9	-	

10	-	
11	-	
12	Immobilizer indication lamp control output	Cluster
13	-	
14	Cooling fan relay [High] control output	Cooling fan relay [High]
15	CVVT Oil Control Valve (OCV) [Bank 1/Exhaust] control output	CVVT Oil Control Valve (OCV) [Bank 1/Exhaust]
16	Injector (Cylinder #2) [High] control output	Injector (Cylinder #2)
17	Injector (Cylinder #1) [High] control output	Injector (Cylinder #1)
18	Injector (Cylinder #3) [Low] control output	Injector (Cylinder #3)
19	-	
20	Heated Oxygen Sensor (HO2S) [Bank 1/Sensor2] heater control output	Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2]
21	-	
22	-	
23	Engine Coolant Temperature Sensor (ECTS) signal input	Engine Coolant Temperature Sensor (ECTS)
24	Sensor ground	Engine Coolant Temperature Sensor (ECTS)
25	-	
26	Fuel Tank Pressure Sensor (FTPS) signal input	Fuel Tank Pressure Sensor (FTPS)
27	Fuel pump relay control output (Without Immobilizer)	Fuel pump relay
	Canister Close Valve (CCV) control output (With Immobilizer)	Canister Close Valve (CCV)
28	-	
29	A/C compressor relay control output	A/C compressor relay
30	-	
31	Ignition coil (Cylinder #3) control output	Ignition coil (Cylinder #3)
32	Ignition coil (Cylinder #1) control output	Ignition coil (Cylinder #1)
33	Injector (Cylinder #1) [Low] control output	Injector (Cylinder #1)
34	Fuel Pressure Control Valve (FPCV) [High] control output	Fuel Pressure Control Valve (FPCV)
35	ETC motor [-] control output	ETC motor
36	-	
37	Knock Sensor (KS) signal input	Knock Sensor (KS)
38	Sensor ground	Knock Sensor (KS)
39	-	
40	Brake Light switch signal input	Brake switch
41	-	
42	-	
43	-	
44	-	
45	CVVT Oil Control Valve (OCV) [Bank 1/Intake] control output	CVVT Oil Control Valve (OCV) [Bank 1/Intake]
46	Ignition coil (Cylinder #4) control output	Ignition coil (Cylinder #4)
47	Ignition coil (Cylinder #2) control output	Ignition coil (Cylinder #2)

48	Injector (Cylinder #4) [Low] control output	Injector (Cylinder #4)
49	Fuel Pressure Control Valve (FPCV) [Low] control output	Fuel Pressure Control Valve (FPCV)
50	ETC motor [+] control output	ETC motor
51	-	
52	-	
53	Brake Test switch signal input	Brake switch
54	-	
55	Clutch switch signal input	Clutch switch
56	Electric load signal input [Defrost]	Alternator
57	Alternator COM signal output	Alternator
58	-	
59	Cooling fan relay [Low] control output	Cooling fan relay
60	Variable Intake Solenoid (VIS) valve control output	Variable Intake Solenoid (VIS) valve

Connector [EGGM-K]

Pin No.	Description	Connected to
1	ECM ground	Chassis ground
2	ECM ground	Chassis ground
3	ECM ground	Chassis ground
4	Battery power (B+)	Main relay
5	Battery power (B+)	Battery
6	Battery power (B+)	Battery
7	Battery power (B+)	Main relay
8	Sensor ground	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2]
9	Accelerator Position Sensor (APS) 1 signal input	Accelerator Position Sensor (APS) 1
10	Sensor ground	Accelerator Position Sensor (APS) 2
11	-	
12	Sensor ground	Fuel Tank Pressure Sensor (FTPS)
13	-	
14	Throttle Position Sensor (TPS) 1 signal input	Throttle Position Sensor (TPS) 1
15	-	
16	-	
17	Fuel Level signal input	Fuel Level Sender (FLS)
18	Sensor power (+5V)	Accelerator Position Sensor (APS) 2
19	-	
20	Sensor power (+5V)	Rail Pressure Sensor (RPS)
		A/C Pressure Transducer (APT)
21	-	
22	-	
23	-	
24	Alternator PWM signal output	Alternator
25	-	

26	-	
27	-	
28	-	
29	Ignition switch signal input	
30	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2] signal input	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2]
31	Accelerator Position Sensor (APS) 2 signal input	Accelerator Position Sensor (APS) 2
32	Sensor ground	Accelerator Position Sensor (APS) 1
33	-	
34	-	
35	Sensor ground	Throttle Position Sensor (TPS)
36	Throttle Position Sensor (TPS) 2 signal input	Throttle Position Sensor (TPS) 2
37	-	
38	-	
39	Sensor power (+5V)	Throttle Position Sensor (TPS) 1,2
40	Sensor power (+5V)	Accelerator Position Sensor (APS) 1
41	Sensor power (+5V)	Manifold Absolute Pressure Sensor (MAPS)
		Fuel Tank Pressure Sensor (FTPS)
42	Sensor power (+5V)	Camshaft Position Sensor (CMPS) [Bank 1 / Intake]
		Camshaft Position Sensor (CMPS) [Bank 1 / Exhaust]
43	-	
44	-	
45	A/C Pressure Transducer (APT) signal input	A/C Pressure Transducer (APT)
46	Vehicle speed signal input	Vehicle Speed Sensor
47	-	
48	-	
49	-	
50	-	
51	-	
52	VS-/IP- (Common Ground for VS, IP)	Heated Oxygen Sensor [Bank 1/Sensor 1]
53	Rc/Rp (Pump Cell Voltage)	Heated Oxygen Sensor [Bank 1/Sensor 1]
54	-	
55	-	
56	Ground	Cruise Control Switch
57	-	
58	Rail Pressure Sensor (RPS) signal input	Rail Pressure Sensor (RPS)
59	Cruise Control Switch signal input	Cruise Control Switch
60	Start signal input	PDM module
61	-	
62	-	
63	CAN [Low]	Other control module, Data Link Connector (DLC), Multi-Purpose Check Connector
64	Sensor ground	Camshaft Position Sensor (CMPS) [Bank 1 / Exhaust]

65	Camshaft Position Sensor (CMPS) [Bank 1 / Exhaust] signal input	Camshaft Position Sensor (CMPS) [Bank 1 / Exhaust]
66	-	
67	Crankshaft Position Sensor (CKPS) [B] signal input	Crankshaft Position Sensor (CKPS)
68	-	
69	-	
70	-	
71	-	
72	Purge Control Solenoid Valve (PCSV) control output	Purge Control Solenoid Valve (PCSV)
73	-	
74	VS+ (NERNST Cell Voltage)	Heated Oxygen Sensor [Bank 1/Sensor 1]
75	Rc (Compensative Resistance)	Heated Oxygen Sensor [Bank 1/Sensor 1]
76	Sensor ground	Rail Pressure Sensor (RPS)
77	Sensor ground	A/C Pressure Transducer (APT)
78	Sensor ground	Manifold Absolute Pressure Sensor (MAPS)
79	Intake Temperature Sensor (IATS) signal input	Intake Temperature Sensor (IATS)
80	Manifold Absolute Pressure Sensor (MAPS) signal input	Manifold Absolute Pressure Sensor (MAPS)
81	-	
82	-	
83	Immobilizer communication line	Smart Key Control Module [With Button Engine Start System]
		Immobilizer Control Module [Without Button Engine Start System]
84	-	
85	CAN [High]	Other control module, Data Link Connector (DLC), Multi-Purpose Check Connector
86	Sensor ground	Camshaft Position Sensor (CMPS) [Bank 1 / Intake]
87	Camshaft Position Sensor (CMPS) [Bank 1 / Intake] signal input	Camshaft Position Sensor (CMPS) [Bank 1 / Intake]
88	-	
89	Crankshaft Position Sensor (CKPS) [A] signal input	Crankshaft Position Sensor (CKPS)
90	Canister Close Valve (CCV) control output (Without Immobilizer)	Canister Close Valve (CCV)
	Fuel pump relay control output (With Immobilizer)	Fuel pump relay
91	-	
92	-	
93	Main relay control output	Main relay
94	Start relay (Low) control output	Start relay

ECM Terminal Input/Output Signal (M/T)

Connector [EGGM-AG]

Pin No.	Description	Condition	Type	Level
1	Injector (Cylinder #3) [High] control output	Relay ON/OFF	DC voltage	71V
2	Injector (Cylinder #4) [High] control output	Relay ON/OFF	DC voltage	71V
3	Injector (Cylinder #2) [Low] control output	Relay OFF	DC voltage	71V
		Relay ON		Max. 1.0V
4	-			
5	Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 1] heater control output	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 1.65V
6	-			
7	Supply power (+5V)			
8	-			
9	-			
10	-			
11	-			
12	-			
13	Immobilizer indication lamp control output			
14	Cooling fan relay [High] control output	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 1.76V
15	CVVT Oil Control Valve (OCV) [Bank 1/Exhaust] control output	Idle	Pulse	High: Battery voltage
				Low: Max. 1.65V
16	Injector (Cylinder #2) [High] control output	Relay ON/OFF	DC voltage	71V
17	Injector (Cylinder #1) [High] control output	Relay ON/OFF	DC voltage	71V
18	Injector (Cylinder #3) [Low] control output	Relay OFF	DC voltage	71V
		Relay ON		Max. 1.0V
19	-			
20	Heated Oxygen Sensor (HO2S) [Bank 1/Sensor2] heater control output	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 1.65V
21	-			
22	-			
23	Engine Coolant Temperature Sensor (ECTS) signal input	Idle	Analog	0.270 ~ 4.77V
24	Sensor ground	Idle	DC voltage	Max. 50mV
25	-			
26	Fuel Tank Pressure Sensor (FTPS) signal input	Idle	Analog	0.3343 ~ 0.4667V
27	Canister Close Valve (CCV) control output (With Immobilizer)	Active	DC voltage	Battery voltage
		Inactive		Max. 1.76V
	Fuel pump relay control output (Without Immobilizer)	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 1.44V
28	-			

29	A/C compressor relay control output	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 1.0V
30	-			
31	Ignition coil (Cylinder #3) control output	Idle	Pulse	1st voltage: 370 ~ 430V
				ON voltage: Max. 2.2V
32	Ignition coil (Cylinder #1) control output	Idle	Pulse	1st voltage: 370 ~ 430V
				ON voltage: Max. 2.2V
33	Injector (Cylinder #1) [Low] control output	Relay OFF	DC voltage	71V
		Relay ON		Max. 1.0V
34	Fuel Pressure Control Valve (FPCV) [High] control output	Relay ON/OFF	DC voltage	16V
35	ETC motor [-] control output	Idle	Pulse	High: Battery voltage
				Low: Max. 1.0V
36	-			
37	Knock Sensor (KS) signal input	Knocking	Variable	
		Normal	Frequency	
38	Sensor ground	Knocking	Variable	
		Normal	Frequency	
39	-			
40	Brake Light switch signal input	ON	DC voltage	Battery voltage
		OFF		Max. 2.25V
41	-			
42	-			
43	-			
44	-			
45	CVVT Oil Control Valve (OCV) [Bank 1/Intake] control output	Idle	Pulse	High: Battery voltage
				Low: Max. 1.65V
46	Ignition coil (Cylinder #4) control output	Idle	Pulse	1st voltage: 370 ~ 430V
				ON voltage: Max. 2.2V
47	Ignition coil (Cylinder #2) control output	Idle	Pulse	1st voltage: 370 ~ 430V
				ON voltage: Max. 2.2V
48	Injector (Cylinder #4) [Low] control output	Relay OFF	DC voltage	71V
		Relay ON		Max. 1.0V
49	Fuel Pressure Control Valve (FPCV) [Low] control output	Relay OFF	DC voltage	16V
		Relay ON		Max. 1.0V
50	ETC motor [+] control output	Idle	Pulse	High: Battery voltage
				Low: Max. 1.0V

51	-			
52	-			
53	Brake Test switch signal input	ON	DC voltage	Battery voltage
		OFF		Max. 2.25V
54	-			
55	Clutch switch signal input			
56	Electric load signal input [Defrost]	ON	DC voltage	Battery voltage
		OFF		Max. 2.25V
57	Alternator COM signal output	Idle	Pulse	High: Battery voltage
				Low: Max. 0.6V
58	-			
59	Cooling fan relay [Low] control output	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 1.76V
60	Variable Intake Solenoid (VIS) valve control output	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 1.65V

Connector [EGGM-K]

Pin No.	Description	Condition	Type	Level
1	ECM ground	Idle	DC voltage	Max. 50mV
2	ECM ground	Idle	DC voltage	Max. 50mV
3	ECM ground	Idle	DC voltage	Max. 50mV
4	Battery power (B+)	IG OFF	DC voltage	Max. 1.0V
		IG ON		Battery voltage
5	Battery power (B+)	IG OFF	DC voltage	Max. 1.0V
		IG ON		Battery voltage
6	Battery power (B+)	IG OFF	DC voltage	Max. 1.0V
		IG ON		Battery voltage
7	Battery power (B+)	IG OFF	DC voltage	Max. 1.0V
		IG ON		Battery voltage
8	Sensor ground	Idle	DC voltage	Max. 50mV
9	Accelerator Position Sensor (APS) 1 signal input	Idle	Analog	0.674 ~ 4.379 V
10	Sensor ground	Idle	DC voltage	Max. 50mV
11	-			
12	Sensor ground	Idle	DC voltage	Max. 50mV
13	-			
14	Throttle Position Sensor (TPS) 1 signal input	Idle	Analog	0.33 ~ 4.72 V
15	-			
16	-			

17	Fuel Level signal input	Idle	Analog	0.193 ~ 4.0V
18	Sensor power (+5V)	IG OFF	DC voltage	Max. 0.5V
		IG ON		4.9 ~ 5.1V
19	-			
20	Sensor power (+5V)	IG OFF	DC voltage	Max. 0.5V
		IG ON		4.9 ~ 5.1V
21	-			
22	-			
23	Neutral switch signal input			
24	Alternator PWM signal output	Idle	Pulse	High: Battery voltage
				Low: Max. 1.5V
25	-			
26	-			
27	Auto Stop Lamp output			
28	-			
29	Ignition switch signal input	IG OFF	DC voltage	Max. 1.0V
		IG ON		Battery voltage
30	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2] signal input	Engine	Analog	Rich: 0.6 ~ 1.0V
		Running		Lean: Max. 0.4V
31	Accelerator Position Sensor (APS) 2 signal input	Idle	Analog	0.261 ~ 2.204 V
32	Sensor ground	Idle	DC voltage	Max. 50mV
33	-			
34	-			
35	Sensor ground	Idle	DC voltage	Max. 50mV
36	Throttle Position Sensor (TPS) 2 signal input	Idle	Analog	0.55 ~ 4.37 V
37	-			
38				
39	Sensor power (+5V)	IG OFF	DC voltage	Max. 0.5V
		IG ON		4.9 ~ 5.1V
40	Sensor power (+5V)	IG OFF	DC voltage	Max. 0.5V
		IG ON		4.9 ~ 5.1V
41	Sensor power (+5V)	IG OFF	DC voltage	Max. 0.5V
		IG ON		4.9 ~ 5.1V
42	Sensor power (+5V)	IG OFF	DC voltage	Max. 0.5V
		IG ON		4.9 ~ 5.1V
43	-			
44	-			
45	A/C Pressure Transducer (APT) signal input	A/C ON	Analog	0.348 ~ 4.63 V
46	Vehicle speed signal input	Idle	Pulse	High: Min. 5.4V
				Low: Max. 2.25V
47	-			
48	-			

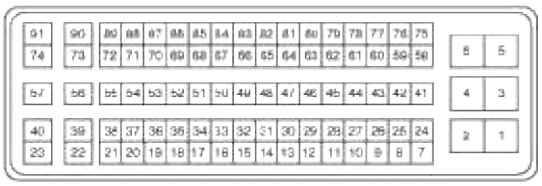
49	-			
50	-			
51	-			
52	VS-/IP- (Common Ground for VS, IP)	Idle	DC voltage	Max. 50mV
53	Rc/Rp (Pump Cell Voltage)	Idle	Analog	0 ~ 5.1V
54	-			
55	-			
56	Ground			
57	-			
58	Rail Pressure Sensor (RPS) signal input	Idle	Analog	0.43 ~ 3.46V
59	Cruise Control Switch signal input			
60	Start signal input	ON	DC voltage	Battery voltage
		OFF		Max. 2V
61	-			
62	-			
63	CAN [Low]	RECESSIVE	Pulse	2.0 ~ 3.0V
		DOMINANT		0.5 ~ 2.25V
64	Sensor ground	Idle	DC voltage	Max. 50mV
65	Camshaft Position Sensor (CMPS) [Bank 1 / Exhaust] signal input	Idle	Pulse	High: min. 4.8V
				Low: Max. 0.6V
66	-			
67	Crankshaft Position Sensor (CKPS) [B] signal input	Idle	Pulse	Vp_p: Min. 1.0V
68	-			
69	-			
70	-			
71	-			
72	Purge Control Solenoid Valve (PCSV) control output	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 1.76V
73	-			
74	VS+ (NERNST Cell Voltage)	Idle	Analog	0 ~ 5.1V
75	Rc (Compensative Resistance)	Idle	Analog	0 ~ 5.1V
76	Sensor ground	Idle	DC voltage	-
77	Sensor ground	Idle	DC voltage	Max. 50mV
78	Sensor ground	Idle	DC voltage	Max. 50mV
79	Intake Temperature Sensor (IATS) signal input	Idle	Analog	0.209 ~ 4.756V
80	Manifold Absolute Pressure Sensor (MAPS) signal input	Idle	Analog	0.6683 ~ 4.346V
81	-			
82	-			

83	Immobilizer communication line	When transmitting	Pulse	High: Min. 8.4V(at 14V) Low: Max. 6.44V(at 14V)
84	-			
85	CAN [High]	RECESSIVE	Pulse	2.0 ~ 3.0V
		DOMINANT		2.75 ~ 4.5V
86	Sensor ground	Idle	DC voltage	Max. 50mV
87	Camshaft Position Sensor (CMPS) [Bank 1 / Intake] signal input	Idle	Pulse	High: min. 4.8V Low: Max. 0.6V
88	-			
89	Crankshaft Position Sensor (CKPS) [A] signal input	Idle	Pulse	Vp_p: Min. 1.0V
90	Canister Close Valve (CCV) control output (Without Immobilizer)	Active	DC voltage	Battery voltage
		Inactive		Max. 1.76V
	Fuel pump relay control output (With Immobilizer)	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 1.44V
91	-			
92	-			
93	Main relay control output	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 1.7V
94	Start relay control output	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 2.64V

ECM Terminal And Input/Output signal [A/T]



Connector [EGGA-AG]



Connector [EGGA-KG]

ECM Terminal Function (A/T)

Connector [EGGA-A]

Pin No.	Description	Connected to
1	Injector (Cylinder #1) [High] control output	Injector (Cylinder #1)
2	Injector (Cylinder #4) [High] control output	Injector (Cylinder #4)
3	Injector (Cylinder #2) [High] control output	Injector (Cylinder #2)
4	Injector (Cylinder #3) [High] control output	Injector (Cylinder #3)
5	-	
6	-	
7	Purge Control Solenoid Valve (PCSV) control output	Purge Control Solenoid Valve (PCSV)
8	Start relay control output	Start relay

9	-	
10	Power supply (+5V)	Cruise Control Switch
11	Sensor power (+5V)	Manifold Absolute Pressure Sensor (MAPS)
		Fuel Tank Pressure Sensor (FTPS)
12	Throttle Position Sensor (TPS) 1 signal input	Throttle Position Sensor (TPS) 1
13	Sensor ground	Engine Coolant Temperature Sensor (ECTS)
14	-	
15	Sensor power (+5V)	Accelerator Position Sensor (APS) 2
16	-	
17	-	
18	Sensor power (+5V)	Throttle Position Sensor (TPS) 1,2
19	Sensor power (+5V)	Accelerator Position Sensor (APS) 1
20	Ground	Cruise control switch
21	-	
22	-	
23	-	
24	Heated Oxygen Sensor [Bank 1/Sensor 1] heater control output	Heated Oxygen Sensor [Bank 1/Sensor 1]
25	Heated Oxygen Sensor [Bank 1/Sensor 2] heater control output	Heated Oxygen Sensor [Bank 1/Sensor 2]
26	-	
27	-	
28	-	
29	-	
30	A/C pressure switch signal input	A/C pressure switch
31	A/C switch signal input	A/C switch
32	Sensor ground	Throttle Position Sensor (TPS) 1,2
33	-	
34	Throttle Position Sensor (TPS) 2 signal input	Throttle Position Sensor (TPS) 2
35	-	
36	-	
37	-	
38	-	
39	-	
40	-	
41	Sensor ground	Heated Oxygen Sensor [Bank 1/Sensor 2]
42	-	
43	-	
44	-	
45	-	
46	-	
47	-	
48	-	
49	-	

50	-	
51	Alternator PWM signal output	Alternator
52	-	
53	Brake switch signal input	Brake switch
54	Accelerator Position Sensor (APS) 1 signal input	Accelerator Position Sensor (APS) 1
55	-	
56	Accelerator Position Sensor (APS) 2 signal input	Accelerator Position Sensor (APS) 2
57	-	
58	-	
59	-	
60	Sensor ground	Knock Sensor (KS)
61	Knock Sensor (KS) signal input	Knock Sensor (KS)
62	Sensor ground	Accelerator Position Sensor (APS) 1
63	Sensor ground	Accelerator Position Sensor (APS) 2
64	Injector (Cylinder #1) [Low] control output	Injector (Cylinder #1)
65	Injector (Cylinder #4) [Low] control output	Injector (Cylinder #4)
66	Injector (Cylinder #2) [Low] control output	Injector (Cylinder #2)
67	Injector (Cylinder #3) [Low] control output	Injector (Cylinder #3)
68	-	
69	-	
70	-	
71	-	
72	-	
73	-	
74	-	
75	-	
76	-	
77	Fuel Tank Pressure Sensor (FTPS) signal input	Fuel Tank Pressure Sensor (FTPS)
78	Fuel Level Sender (FLS) signal input	Fuel Level Sender (FLS)
79	Cruise control switch signal	Cruise control switch
80	-	
81	-	
82	Engine Coolant Temperature Sensor (ECTS) signal input	Engine Coolant Temperature Sensor (ECTS)
83	VS-/IP- (Common Ground for VS, IP)	Heated Oxygen Sensor [Bank 1/Sensor 1]
84	VS+ (NERNST Cell Voltage)	Heated Oxygen Sensor [Bank 1/Sensor 1]
85	Fuel Pressure Control Valve (FPCV) [Low] control output	Fuel Pressure Control Valve (FPCV)
86	Fuel Pressure Control Valve (FPCV) [High] control output	Fuel Pressure Control Valve (FPCV)
87	-	
88	-	
89	-	
90	-	
91	-	
92	-	

93	-	
94	-	
95	-	
96	-	
97	-	
98	-	
99	-	
100	-	
101	-	
102	-	
103	Heated Oxygen Sensor [Bank 1/Sensor 2] signal input	Heated Oxygen Sensor [Bank 1/Sensor 2]
104	Rc/Rp (Pump Cell Voltage)	Heated Oxygen Sensor [Bank 1/Sensor 1]
105	Rc (Compensative Resistance)	Heated Oxygen Sensor [Bank 1/Sensor 1]

Connector [EGGA-K]

Pin No.	Description	Connected to
1	ECM ground	Chassis ground
2	ECM ground	Chassis ground
3	Battery power (B+)	Ignition switch
4	ECM ground	Chassis ground
5	Battery power (B+)	Ignition switch
6	Battery power (B+)	Main relay
7	Sensor ground	Camshaft Position Sensor (CMPS) [Bank 1 / Exhaust]
8	Sensor ground	Manifold Absolute Pressure Sensor (MAPS)
9	-	
10	Sensor ground	Rail Pressure Sensor (RPS)
11	-	
12	-	
13	Sensor power (+5V)	Camshaft Position Sensor (CMPS) [Bank 1 / Intake]
		Camshaft Position Sensor (CMPS) [Bank 1 / Exhaust]
14	-	
15	Sensor power (+5V)	Rail Pressure Sensor (RPS)
		A/C Pressure Transducer (APT)
16	Alternator COM signal output	Alternator
17	-	
18	-	
19	-	
20	Cooling fan relay [Low] control output	Cooling fan relay
21	-	
22	ETC motor [-] control output	ETC motor
23	ETC motor [+] control output	ETC motor
24	Brake booster vacuum pressure sensor signal input	Brake booster vacuum pressure sensor (BBVPS)

25	Sensor ground	A/C Pressure Transducer (APT)
26	Manifold Absolute Pressure Sensor (MAPS) signal input	Manifold Absolute Pressure Sensor (MAPS)
27	Rail Pressure Sensor (RPS) signal input	Rail Pressure Sensor (RPS)
28	Intake Air Temperature Sensor (IATS) signal input	Intake Air Temperature Sensor (IATS)
29	Electric load signal input [Defrost]	Alternator
30	Electric load signal input [Head lamp switch]	Alternator
31	ISG OFF switch input	ISG OFF switch
32	-	
33	-	
34	-	
35	ISG inhibitor lamp control output	ISG inhibitor lamp
36	Cooling fan relay [High] control output	Cooling fan relay
37	Canister Close Valve (CCV) control output (Without Immobilizer)	Canister Close Valve (CCV)
	Fuel pump relay control output (With Immobilizer)	Fuel pump relay
38	-	
39	CVVT Oil Control Valve (OCV) [Bank 1/Exhaust] control output	CVVT Oil Control Valve (OCV) [Bank 1/Exhaust]
40	Ignition coil (Cylinder #2) control output	Ignition coil (Cylinder #2)
41	-	
42	Sensor ground	Fuel Tank Pressure Sensor (FTPS)
43	Sensor ground	Brake Booster Vacuum Pressure Sensor (BBVPS)
44	A/C Pressure Transducer (APT) signal input	A/C Pressure Transducer (APT)
45	-	
46	Brake Light switch signal input	Brake switch
47	Camshaft Position Sensor (CMPS) [Bank 1 / Exhaust] signal input	Camshaft Position Sensor (CMPS) [Bank 1 / Exhaust]
48	-	
49	Wiper switch signal input	Wiper switch
50	Main relay control output	Main relay
51	Fuel pump relay control output (Without Immobilizer)	Fuel pump relay
	Canister Close Valve (CCV) control output (With Immobilizer)	Canister Close Valve (CCV)
52	-	
53	-	
54	Immobilizer indication lamp control output	Immobilizer indication lamp
55	-	
56	CVVT Oil Control Valve (OCV) [Bank 1/Intake] control output	CVVT Oil Control Valve (OCV) [Bank 1/Intake]
57	Ignition coil (Cylinder #1) control output	Ignition coil (Cylinder #1)
58	-	

59	-	
60	CAN [High]	Other control module, Data Link Connector (DLC), Multi-Purpose Check Connector
61	Immobilizer communication line	Smart Key Control Module [With Button Engine Start System]
		Immobilizer Control Module [Without Button Engine Start System]
62	LIN communication signal input	Battery sensor
63	Engine rpm signal	Cluster
64	Vehicle speed signal input	Vehicle Speed Sensor
65	-	
66	Camshaft Position Sensor (CMPS) [Bank 1 / Intake] signal input	Camshaft Position Sensor (CMPS) [Bank 1 / Intake]
67	Start signal input	PDM module
68	Ignition switch signal input	Ignition switch
69	-	
70	-	
71	Start relay control output	Start relay
72	-	
73	-	
74	Ignition coil (Cylinder #4) control output	Ignition coil (Cylinder #4)
75	Battery power (B+)	Main relay
76	-	
77	CAN [Low]	Other control module, Data Link Connector (DLC), Multi-Purpose Check Connector
78	Sensor ground	Crankshaft Position Sensor (CKPS)
79	Crankshaft Position Sensor (CKPS) [A] signal input	Crankshaft Position Sensor (CKPS)
80	Sensor ground	Camshaft Position Sensor (CMPS) [Bank 1 / Intake]
81	-	
82	-	
83	A/C compressor relay control output	A/C compressor relay
84	-	
85	Variable Intake Solenoid (VIS) Valve control output	Variable Intake Solenoid (VIS) Valve
86	-	
87	-	
88	-	
89	-	
90	-	
91	Ignition coil (Cylinder #3) control output	Ignition coil (Cylinder #3)

ECM Terminal Input/Output Signal (A/T)

Connector [EGGA-A]

Pin No.	Description	Condition	Type	Level
1	Injector (Cylinder #1) [High] control output	Relay ON/OFF	DC voltage	71V
2	Injector (Cylinder #4) [High] control output	Relay ON/OFF	DC voltage	71V
3	Injector (Cylinder #2) [High] control output	Relay ON/OFF	DC voltage	71V
4	Injector (Cylinder #3) [High] control output	Relay ON/OFF	DC voltage	71V
5	-			
6	-			
7	Purge Control Solenoid Valve (PCSV) control output	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 1.76V
8	Start relay control output	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 2.64V
9	-			
10	Power supply (+5V)	IG OFF	DC voltage	Max. 0.5V
		IG ON		4.9 ~ 5.1V
11	Sensor power (+5V)	IG OFF	DC voltage	Max. 0.5V
		IG ON		4.9 ~ 5.1V
12	Throttle Position Sensor (TPS) 1 signal input	Idle	Analog	0.33 ~ 4.72 V
13	Sensor ground	Idle	DC voltage	Max. 50mV
14	-			
15	Sensor power (+5V)	IG OFF	DC voltage	Max. 0.5V
		IG ON		4.9 ~ 5.1V
16	-			
17	-			
18	Sensor power (+5V)	IG OFF	DC voltage	Max. 0.5V
		IG ON		4.9 ~ 5.1V
19	Sensor power (+5V)	IG OFF	DC voltage	Max. 0.5V
		IG ON		4.9 ~ 5.1V
20	Ground	Idle	DC voltage	Max. 50mV
21	-			
22	-			
23	-			
24	Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 1] heater control output	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 1.65V
25	Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2] heater control output	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 1.65V
26	-			
27	-			
28	-			

29	-			
30	A/C pressure switch signal input	ON	DC voltage	Battery voltage
		OFF		Max. 2V
31	A/C switch signal input	ON	DC voltage	Battery voltage
		OFF		Max. 2V
32	Sensor ground	Idle	DC voltage	Max. 50mV
33	-			
34	Throttle Position Sensor (TPS) 2 signal input	Idle	Analog	0.55 ~ 4.37 V
35	-			
36	-			
37	-			
38	-			
39	-			
40	-			
41	Sensor ground	Idle	DC voltage	Max. 50mV
42	-			
43	-			
44	-			
45	-			
46	-			
47	-			
48	-			
49	-			
50	-			
51	Alternator PWM signal output	Idle	Pulse	High: Battery voltage
				Low: Max. 1.5V
52	-			
53	Brake switch signal input	ON	DC voltage	Battery voltage
		OFF		Max. 2.25V
54	Accelerator Position Sensor (APS) 1 signal input	Idle	Analog	0.674 ~ 4.379 V
55	-			
56	Accelerator Position Sensor (APS) 2 signal input	Idle	Analog	0.261 ~ 2.204 V
57	-			
58	-			
59	-			
60	Sensor ground	Knocking	Variable	
		Normal	Frequency	
61	Knock Sensor (KS) signal input	Knocking	Variable	
		Normal	Frequency	
62	Sensor ground	Idle	DC voltage	Max. 50mV

63	Sensor ground	Idle	DC voltage	Max. 50mV
64	Injector (Cylinder #1) [Low] control output	Relay OFF	DC voltage	71V
		Relay ON		Max. 1.0V
65	Injector (Cylinder #4) [Low] control output	Relay OFF	DC voltage	71V
		Relay ON		Max. 1.0V
66	Injector (Cylinder #2) [Low] control output	Relay OFF	DC voltage	71V
		Relay ON		Max. 1.0V
67	Injector (Cylinder #3) [Low] control output	Relay OFF	DC voltage	71V
		Relay ON		Max. 1.0V
68	-			
69	-			
70	-			
71	-			
72	-			
73	-			
74	-			
75	-			
76	-			
77	Fuel Tank Pressure Sensor (FTPS) signal input	Idle	Analog	0.3343 ~ 0.4667V
78	Fuel Level signal input	Idle	Analog	0.193 ~ 4.0V
79	Cruise control switch signal			
80	-			
81	-			
82	Engine Coolant Temperature Sensor (ECTS) signal input	Idle	Analog	0.270 ~ 4.77V
83	VS-/IP- (Common Ground for VS, IP)	Idle	DC voltage	Max. 50mV
84	VS+ (NERNST Cell Voltage)	Idle	Analog	0 ~ 5.1V
85	Fuel Pressure Control Valve (FPCV) [Low] control output	Relay OFF	DC voltage	16V
		Relay ON		Max. 1.0V
86	Fuel Pressure Control Valve (FPCV) [High] control output	Relay ON/OFF	DC voltage	16V
87	-			
88	-			
89	-			
90	-			
91	-			
92	-			
93	-			
94	-			
95	-			
96	-			
97	-			
98	-			

99	-			
100	-			
101	-			
102	-			
103	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2] signal input	Engine	Analog	Rich: 0.6 ~ 1.0V
		Running		Lean: Max. 0.4V
104	Rc/Rp (Pump Cell Voltage)	Idle	Analog	0 ~ 5.1V
105	Rc (Compensative Resistance)	Idle	Analog	0 ~ 5.1V

Connector [EGGA-K]

Pin No.	Description	Condition	Type	Level
1	ECM ground	Idle	DC voltage	Max. 50mV
2	ECM ground	Idle	DC voltage	Max. 50mV
3	Battery power (B+)	IG OFF	DC voltage	Max. 1.0V
		IG ON		Battery voltage
4	ECM ground	Idle	DC voltage	Max. 50mV
5	Battery power (B+)	IG OFF	DC voltage	Max. 1.0V
		IG ON		Battery voltage
6	Battery power (B+)	IG OFF	DC voltage	Max. 1.0V
		IG ON		Battery voltage
7	Sensor ground	Idle	DC voltage	Max. 50mV
8	Sensor ground	Idle	DC voltage	Max. 50mV
9	-			
10	Sensor ground	Idle	DC voltage	Max. 50mV
11	-			
12	-			
13	Sensor power (+5V)	IG OFF	DC voltage	Max. 0.5V
		IG ON		4.9 ~ 5.1V
14	-			
15	Sensor power (+5V)	IG OFF	DC voltage	Max. 0.5V
		IG ON		4.9 ~ 5.1V
16	Alternator COM signal output	Idle	Pulse	High: Battery voltage
				Low: Max. 0.6V
17	-			
18	-			
19	-			
20	Cooling fan relay [Low] control output	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 1.76V

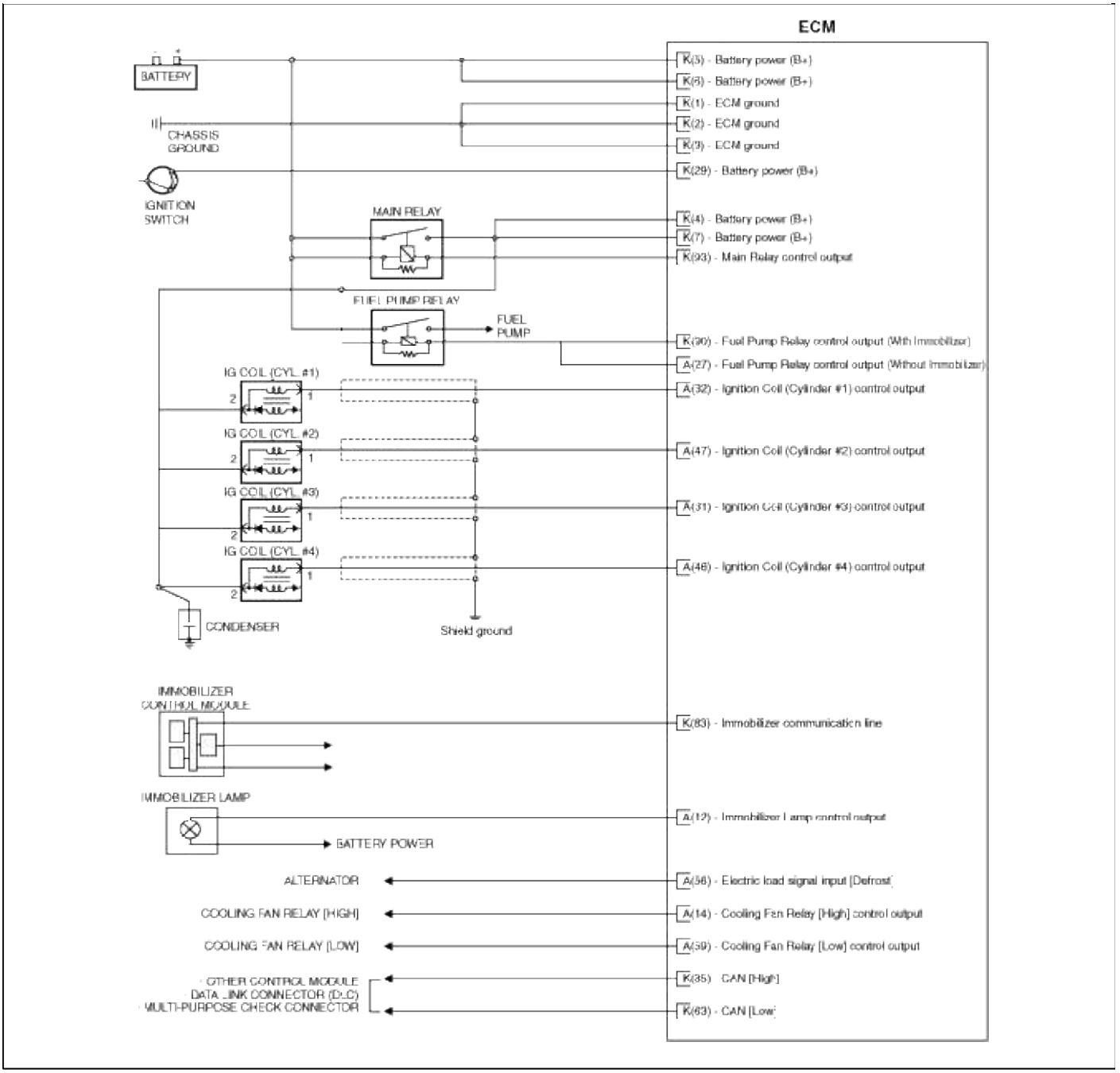
21	-			
22	ETC motor [-] control output	Idle	Pulse	High: Battery voltage
				Low: Max. 1.0V
23	ETC motor [+] control output	Idle	Pulse	High: Battery voltage
				Low: Max. 1.0V
24	Brake Booster Vacuum Pressure Sensor signal input			
25	Sensor ground	Idle	DC voltage	Max. 50mV
26	Manifold Absolute Pressure Sensor (MAPS) signal input	Idle	Analog	0.6683 ~ 4.346V
27	Rail Pressure Sensor (RPS) signal input	Idle	Analog	0.43 ~ 3.46V
28	Intake Temperature Sensor (IATS) signal input	Idle	Analog	0.209 ~ 4.756V
29	Electric load signal input [Defrost]	ON	DC voltage	Battery voltage
		OFF		Max. 2.25V
30	Electric load signal input [Head lamp switch]	ON	DC voltage	Max. 2.25V
		OFF		Battery voltage
31	ISG OFF switch input			
32	-			
33	-			
34	-			
35	ISG inhibitor lamp control output			
36	Cooling fan relay [High] control output	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 1.76V
37	Canister Close Valve (CCV) control output (Without Immobilizer)	Active	DC voltage	Battery voltage
		Inactive		Max. 1.76V
	Fuel pump relay control output (With Immobilizer)	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 1.44V
38	-			
39	CVVT Oil Control Valve (OCV) [Bank 1/Exhaust] control output	Idle	Pulse	High: Battery voltage
				Low: Max. 1.65V
40	Ignition coil (Cylinder #2) control output	Idle	Pulse	1st voltage: 370 ~ 430V
				ON voltage: Max. 2.2V
41	-			
42	Sensor ground	Idle	DC voltage	Max. 50mV
43	Sensor ground	Idle	DC voltage	Max. 50mV
44	A/C Pressure Transducer (APT) signal input	A/C ON	Analog	0.348 ~ 4.63 V
45	-			
46	Brake Light switch signal input	ON	DC voltage	Battery voltage
		OFF		Max. 2.25V
47	Camshaft Position Sensor (CMPS) [Bank 1 / Exhaust] signal input	Idle	Pulse	High: min. 4.8V
				Low: Max. 0.6V

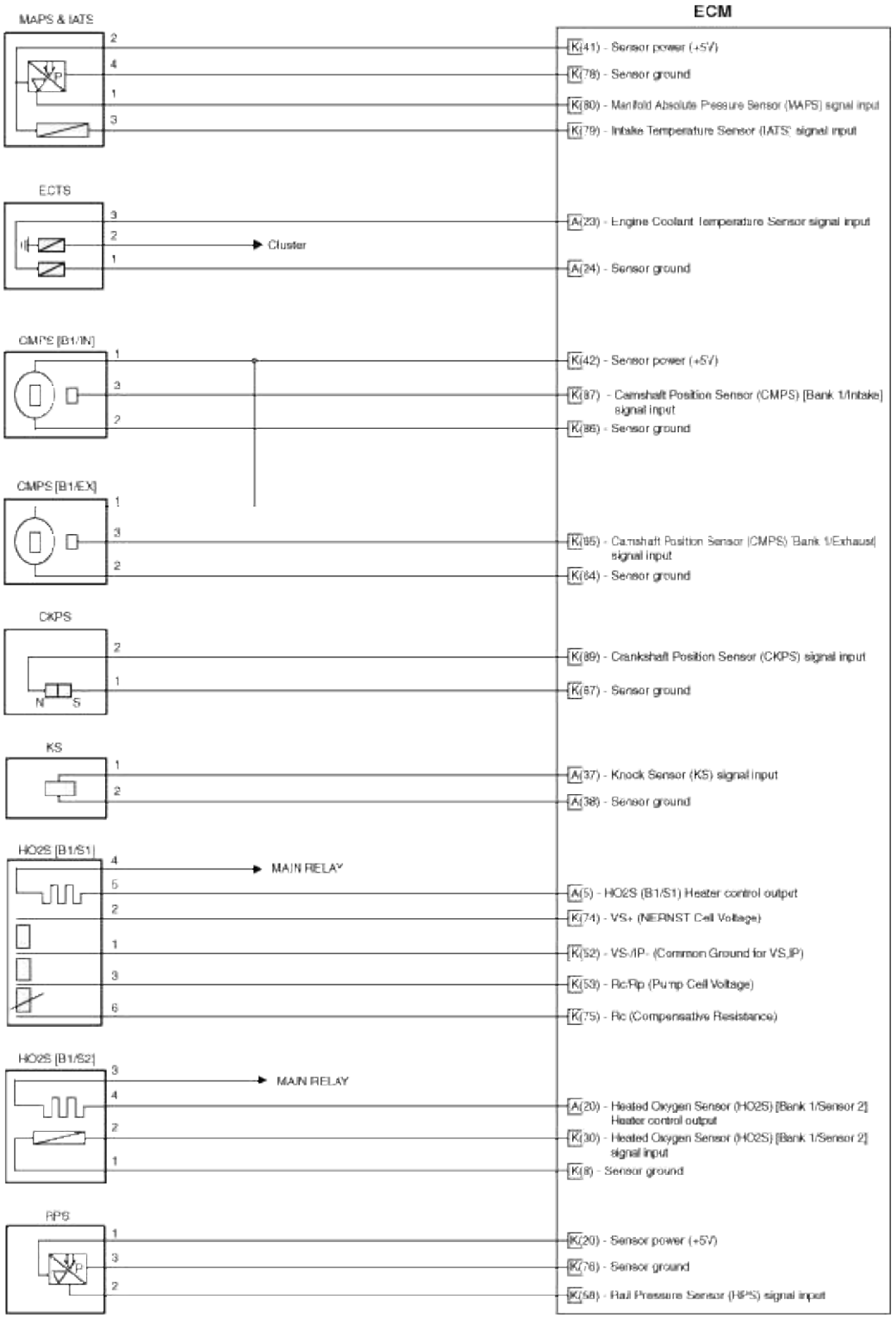
48	-			
49	Wiper switch signal input	ON	DC voltage	Battery voltage
		OFF		Max. 2V
50	Main relay control output	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 1.7V
51	Canister Close Valve (CCV) control output (With Immobilizer)	Active	DC voltage	Battery voltage
		Inactive		Max. 1.76V
	Fuel pump relay control output (Without Immobilizer)	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 1.44V
52	-			
53	-			
54	Malfunction Indiation Lamp (MIL) control			
55	-			
56	CVVT Oil Control Valve (OCV) [Bank 1/Intake] control output	Idle	Pulse	High: Battery voltage
				Low: Max. 1.65V
57	Ignition coil (Cylinder #1) control output	Idle	Pulse	1st voltage: 370 ~ 430V
				ON voltage: Max. 2.2V
58	-			
59	-			
60	CAN [High]	RECESSIVE	Pulse	2.0 ~ 3.0V
		DOMINANT		2.75 ~ 4.5V
61	Immobilizer communication line	When transmitting	Pulse	High: Min. 8.4V(at 14V)
				Low: Max. 6.44V(at 14V)
62	LIN communication signal input	RECESSIVE	Pulse	max 5.6V (at 14V)
		DOMINANT		min 8.4V (at 14V)
63	Engine rpm signal			
64	Vehicle speed signal input	Idle	Pulse	High: Min. 5.4V
				Low: Max. 2.25V
65	-			
66	Camshaft Position Sensor (CMPS) [Bank 1 / Intake] signal input	Idle	Pulse	High: min. 4.8V
				Low: Max. 0.6V
67	Start signal input	ON	DC voltage	Battery voltage
		OFF		Max. 2V
68	Ignition switch signal input	IG OFF	DC voltage	Max. 1.0V
		IG ON		Battery voltage
69	-			
70	-			
71	Start relay control output	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 2.64V
72	-			

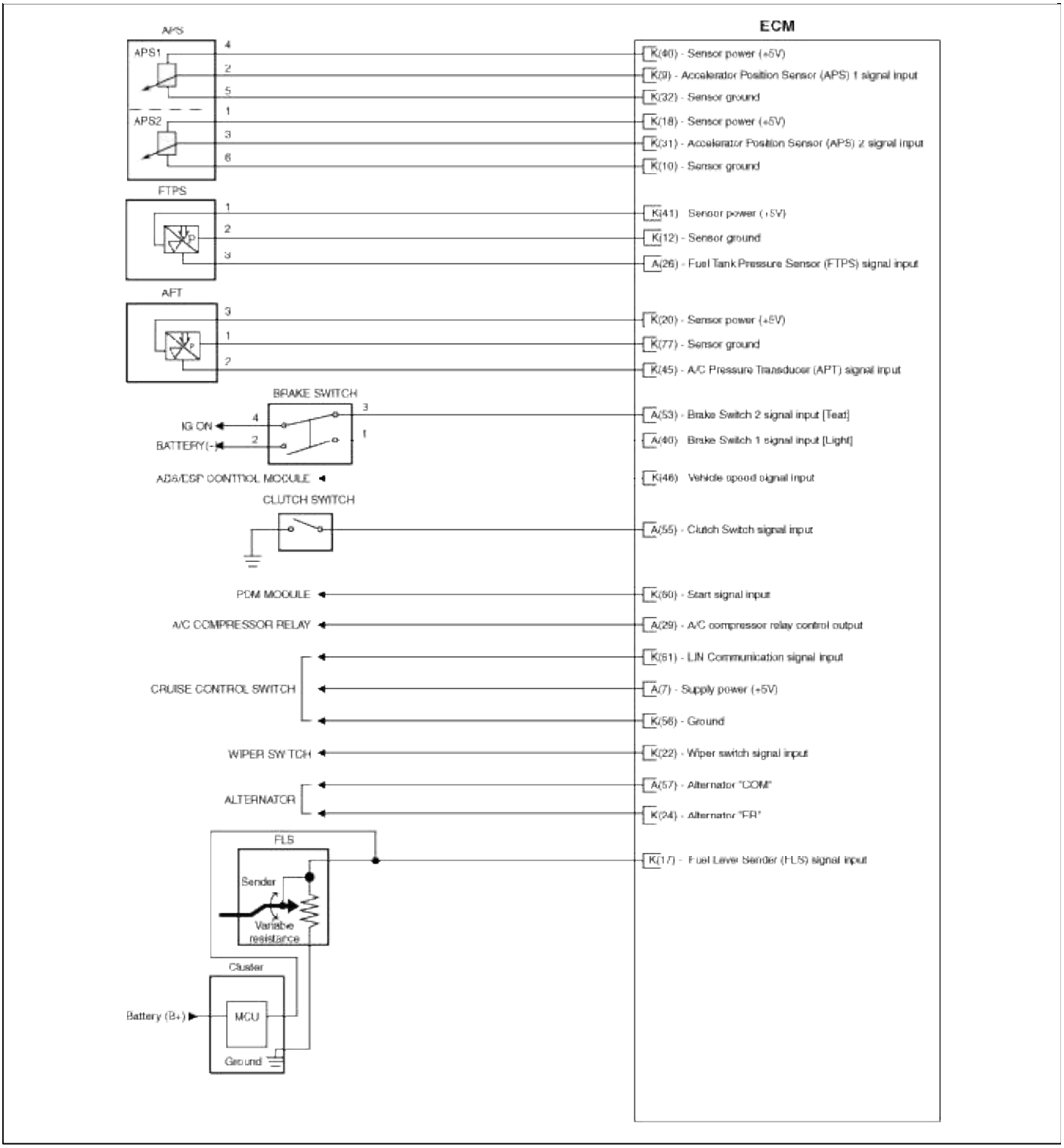
73	-			
74	Ignition coil (Cylinder #4) control output	Idle	Pulse	1st voltage: 370 ~ 430V ON voltage: Max. 2.2V
75	Battery power (B+)	IG OFF	DC voltage	Max. 1.0V
		IG ON		Battery voltage
76	-			
77	CAN [Low]	RECESSIVE	Pulse	2.0 ~ 3.0V
		DOMINANT		0.5 ~ 2.25V
78	Sensor ground	Idle	DC voltage	Max. 50mV
79	Crankshaft Position Sensor (CKPS) [A] signal input	Idle	Pulse	Vp_p: Min. 1.0V
80	Sensor ground	Idle	DC voltage	Max. 50mV
81	-			
82	-			
83	A/C compressor relay control output	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 1.0V
84	-			
85	Variable Intake Solenoid (VIS) valve control output	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 1.65V
86	-			
87	-			
88	-			
89	-			
90	-			
91	Ignition coil (Cylinder #3) control output	Idle	Pulse	1st voltage: 370 ~ 430V ON voltage: Max. 2.2V

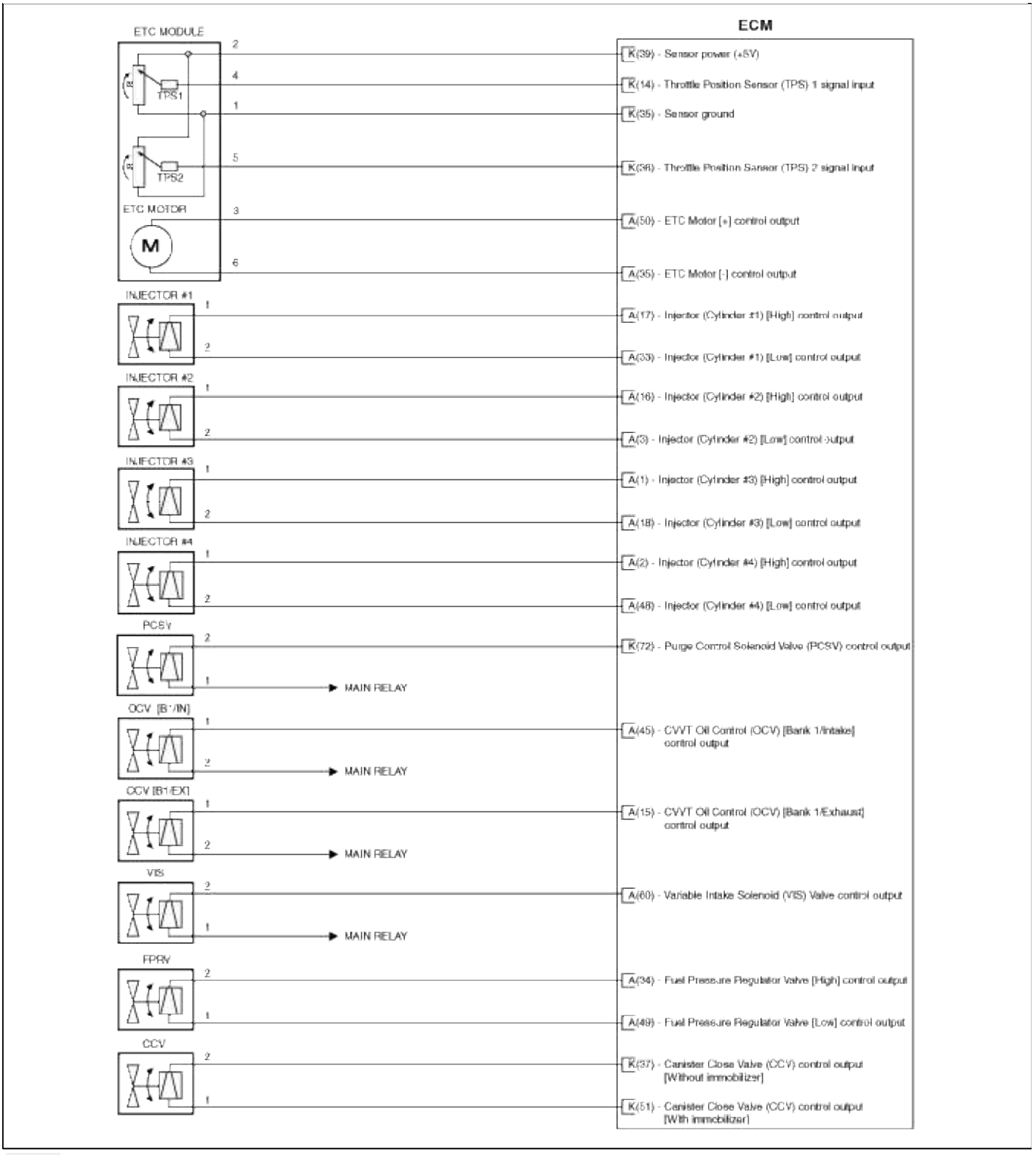
Circuit Diagram

(M/T)

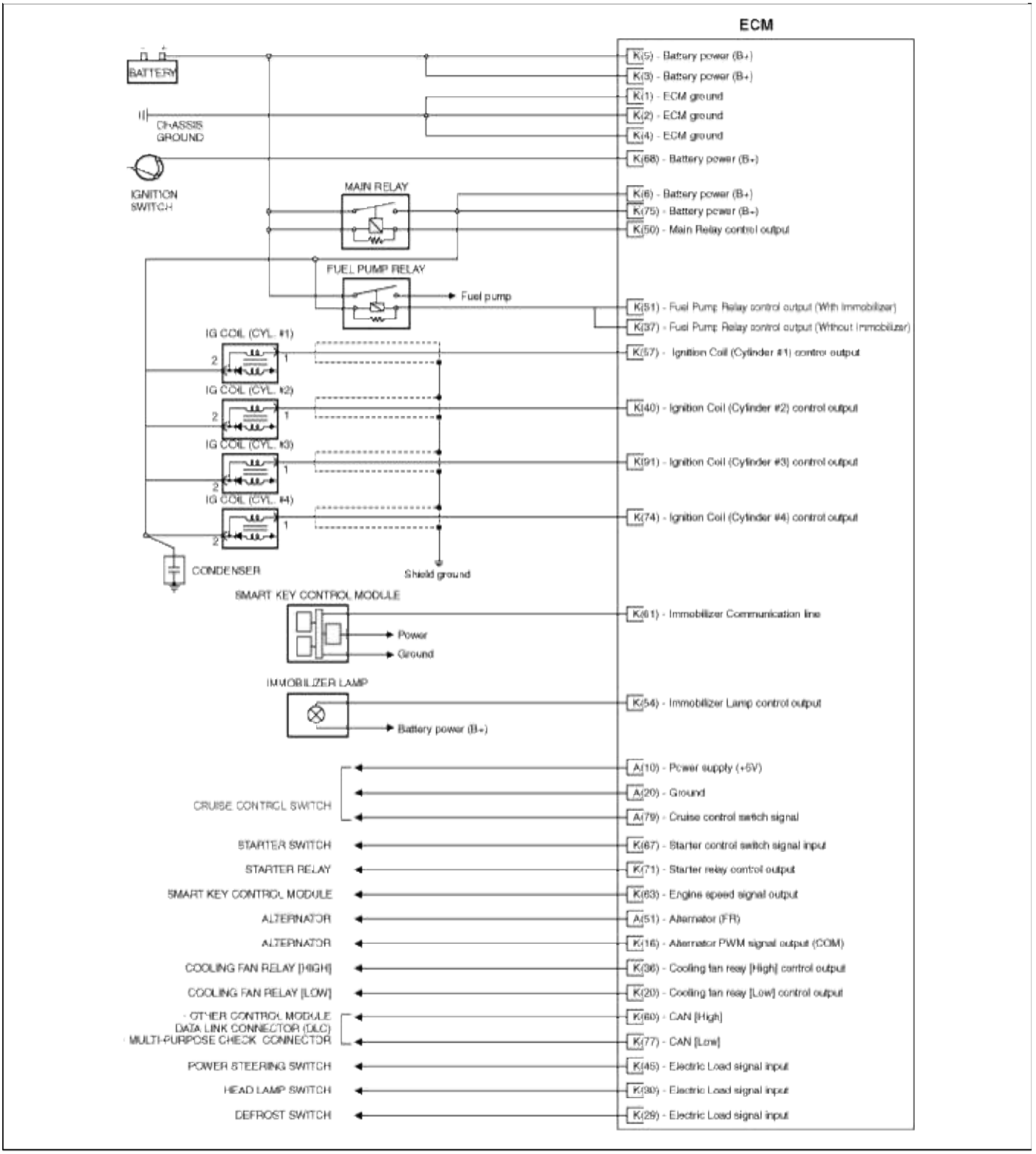

ECM
BATTERY
CHASSIS GROUND
IGNITION SWITCH
MAIN RELAY
FUEL PUMP RELAY
FUEL PUMP
IG COIL (CYL. #1)
IG COIL (CYL. #2)
IG COIL (CYL. #3)
IG COIL (CYL. #4)
CONDENSER
Shield ground
IMMOBILIZER CONTROL MODULE
IMMOBILIZER LAMP
BATTERY POWER
ALTERNATOR
COOLING FAN RELAY [HIGH]
COOLING FAN RELAY [LOW]
OTHER CONTROL MODULE
DATA LINK CONNECTOR (DLC)
MULTI-PURPOSE CHECK CONNECTOR
K(3) - Battery power (B+)
K(5) - Battery power (B+)
K(1) - ECM ground
K(2) - ECM ground
K(9) - ECM ground
K(29) - Battery power (B+)
K(4) - Battery power (B+)
K(7) - Battery power (B+)
K(93) - Main Relay control output
K(90) - Fuel Pump Relay control output (With Immobilizer)
A(27) - Fuel Pump Relay control output (Without Immobilizer)
A(32) - Ignition Coil (Cylinder #1) control output
A(47) - Ignition Coil (Cylinder #2) control output
A(31) - Ignition Coil (Cylinder #3) control output
A(48) - Ignition Coil (Cylinder #4) control output
K(83) - Immobilizer communication line
A(12) - Immobilizer Lamp control output
A(56) - Electric load signal input [Defrost]
A(14) - Cooling Fan Relay [High] control output
A(39) - Cooling Fan Relay [Low] control output
K(35) - CAN [High]
K(63) - CAN [Low]

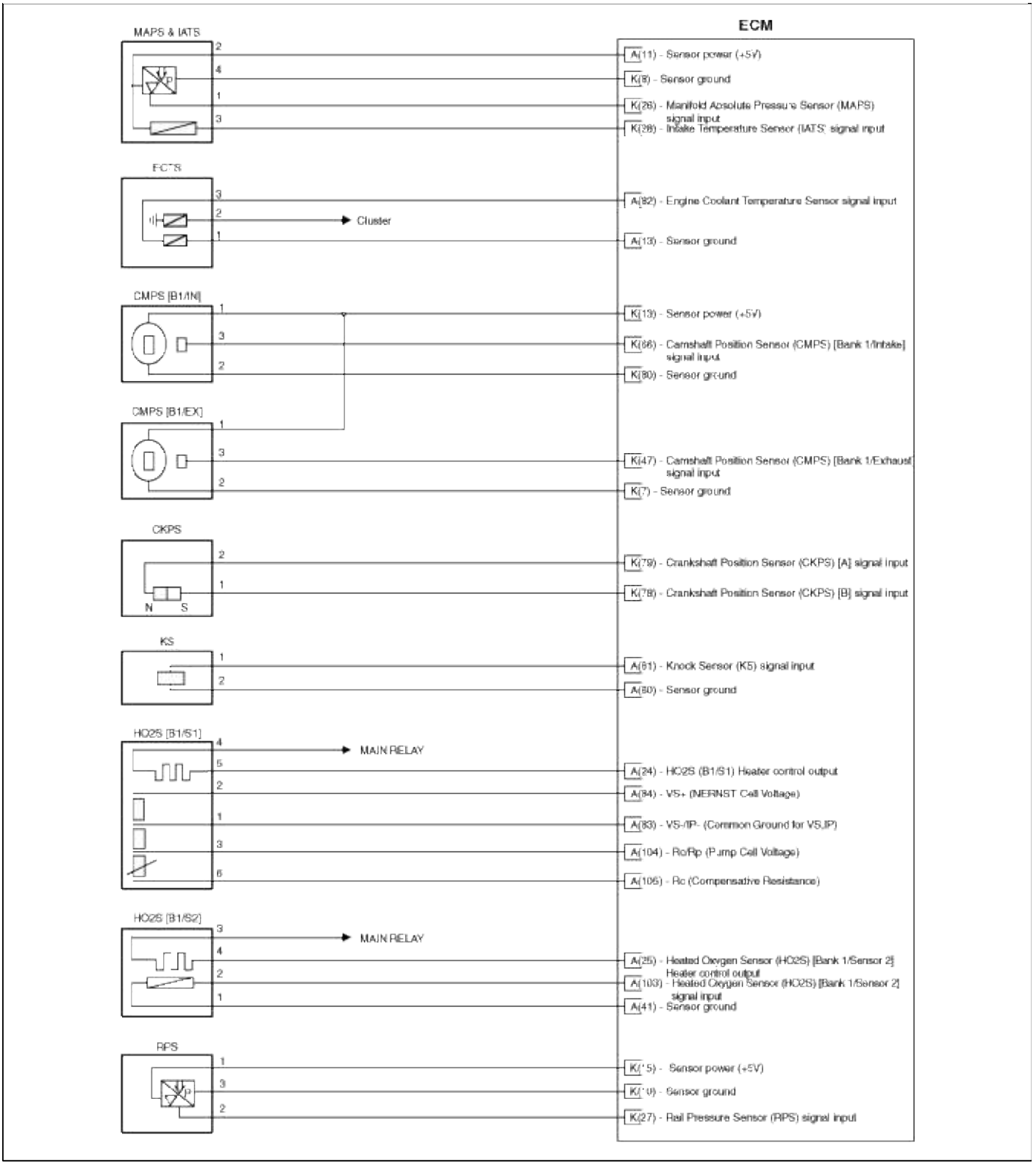

ECM
MAPS & IATS
2
4
1
3
K(41) - Sensor power (+5V)
K(78) - Sensor ground
K(80) - Manifold Absolute Pressure Sensor (MAPS) signal input
K(79) - Intake Temperature Sensor (IATS) signal input
ECTS
3
2
1
Cluster
A(23) - Engine Coolant Temperature Sensor signal input
A(24) - Sensor ground
CMPS [B1/IN]
1
3
2
K(42) - Sensor power (+5V)
K(87) - Camshaft Position Sensor (CMPS) [Bank 1/Intake] signal input
K(86) - Sensor ground
CMPS [B1/EX]
1
3
2
K(85) - Camshaft Position Sensor (CMPS) [Bank 1/Exhaust] signal input
K(84) - Sensor ground
CKPS
2
1
N
S
K(89) - Crankshaft Position Sensor (CKPS) signal input
K(67) - Sensor ground
KS
1
2
A(37) - Knock Sensor (KS) signal input
A(38) - Sensor ground
HO2S [B1/S1]
4
5
2
1
3
6
MAIN RELAY
A(5) - HO2S (B1/S1) Heater control output
K(74) - VS+ (NERNST Cell Voltage)
K(52) - VS-/IP- (Common Ground for VS,IP)
K(53) - Ric/Rp (Pump Cell Voltage)
K(75) - Ric (Compensative Resistance)
HO2S [B1/S2]
3
4
2
1
MAIN RELAY
A(20) - Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2] Heater control output
K(30) - Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2] signal input
K(8) - Sensor ground
RPS
1
3
2
K(20) - Sensor power (+5V)
K(76) - Sensor ground
K(58) - Rail Pressure Sensor (RPS) signal input

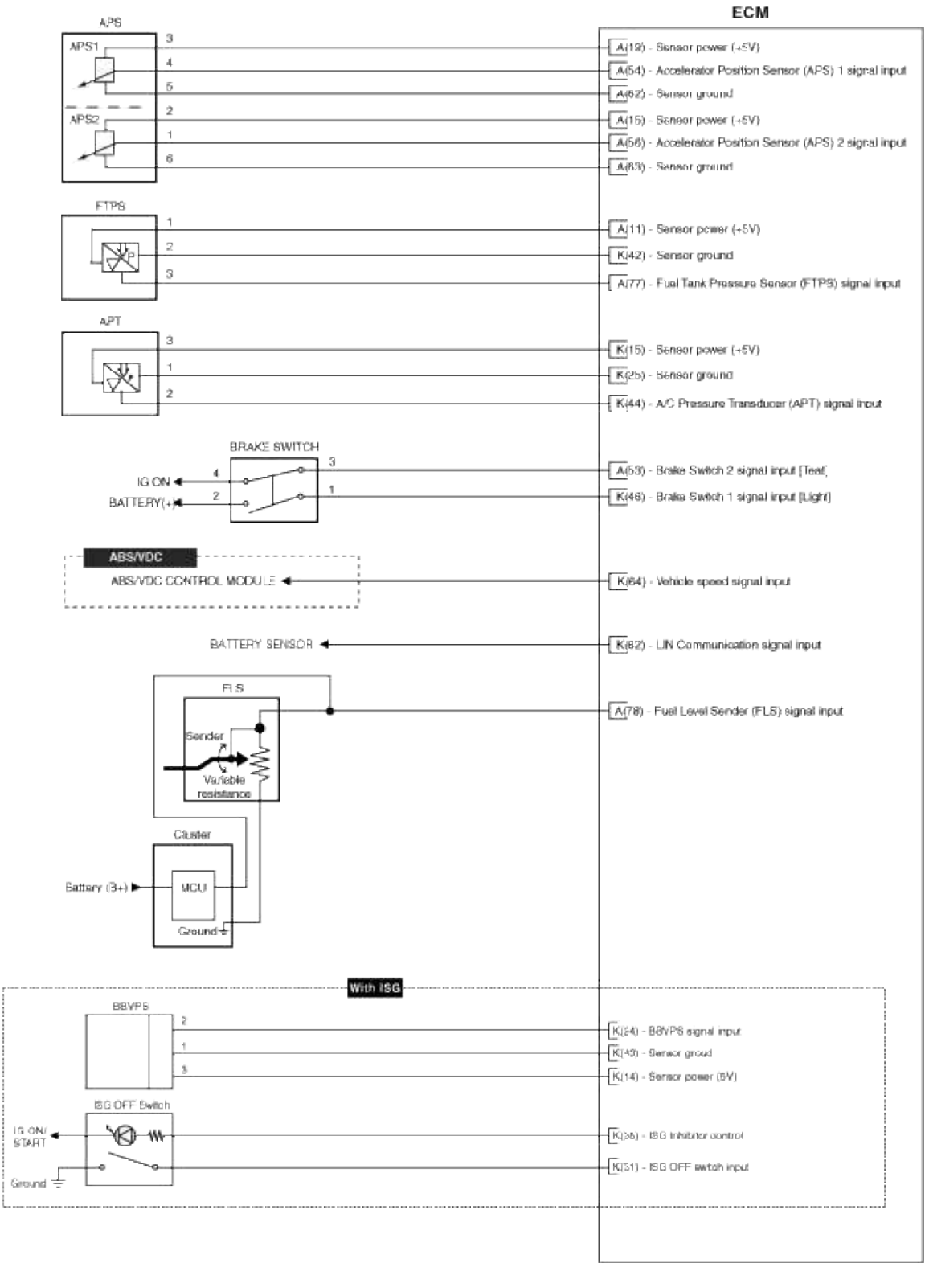

APS
APS1
APS2
4
2
5
1
3
6
FTPS
1
2
3
AFT
3
1
2
BRAKE SWITCH
IG ON
BATTERY(+)
4
2
3
1
ADS/ESP CONTTROL MODULE
CLUTCH SWITCH
PDM MODULE
A/C COMPRESSOR RELAY
CRUISE CONTROL SWITCH
WIPER SWITCH
ALTERNATOR
FLS
Sender
Variable resistance
Cluster
Battery (B+)
MCU
Ground
ECM
K(40) - Sensor power (+5V)
K(9) - Accelerator Position Sensor (APS) 1 signal input
K(32) - Sensor ground
K(18) - Sensor power (+5V)
K(31) - Accelerator Position Sensor (APS) 2 signal input
K(10) - Sensor ground
K(41) - Sensor power (+5V)
K(12) - Sensor ground
A(26) - Fuel Tank Pressure Sensor (FTPS) signal input
K(20) - Sensor power (+5V)
K(77) - Sensor ground
K(45) - A/C Pressure Transducer (APT) signal input
A(53) - Brake Switch 2 signal input [Test]
A(40) - Brake Switch 1 signal input [Light]
K(46) - Vehicle speed signal input
A(55) - Clutch Switch signal input
K(60) - Start signal input
A(29) - A/C compressor relay control output
K(61) - LIN Communication signal input
A(7) - Supply power (+5V)
K(56) - Ground
K(22) - Wiper switch signal input
A(57) - Alternator "COM"
K(24) - Alternator "FR"
K(17) - Fuel Level Sender (FLS) signal input

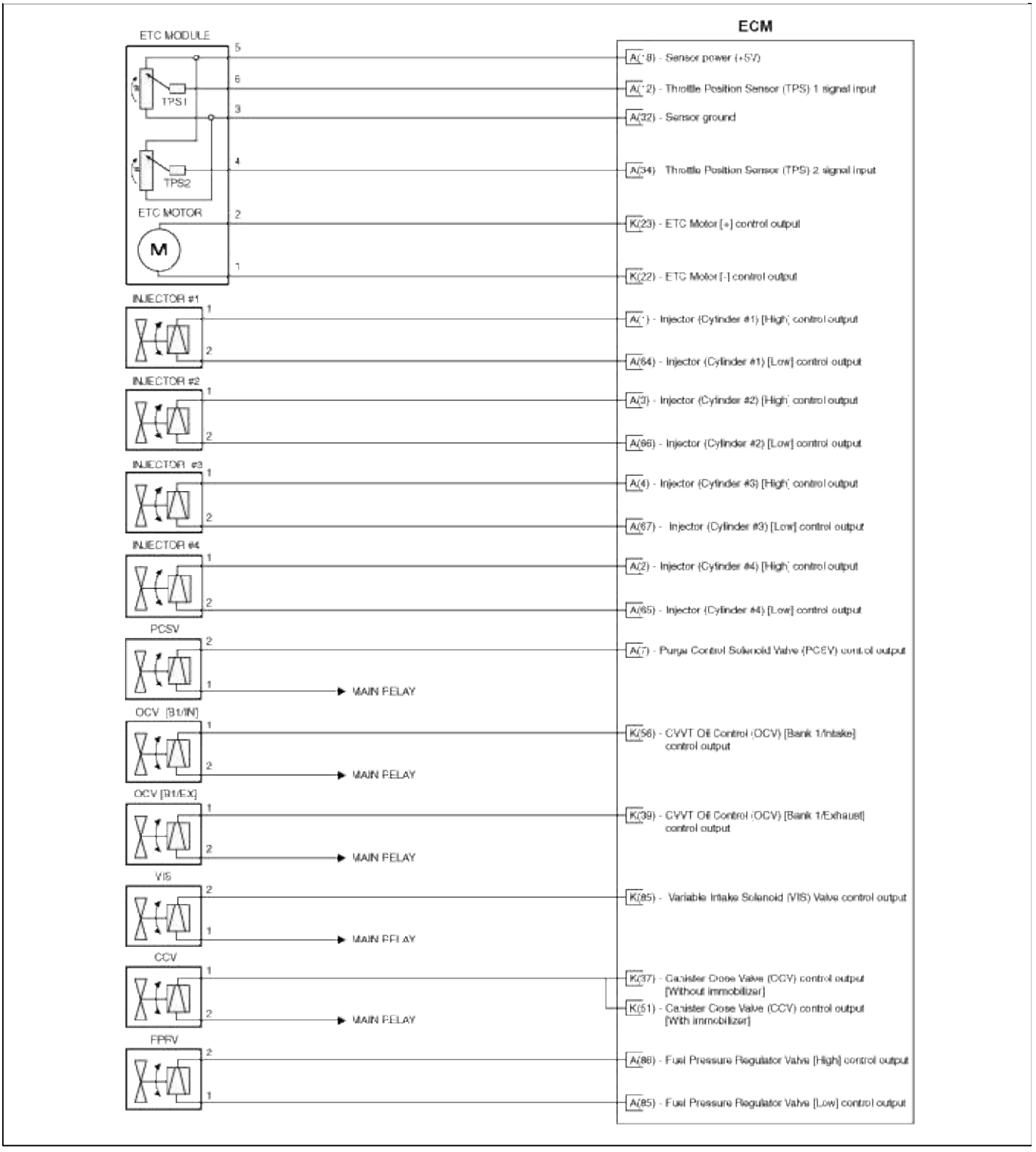

ECM
ETC MODULE
TPS1
TPS2
ETC MOTOR
M
INJECTOR #1
INJECTOR #2
INJECTOR #3
INJECTOR #4
PCSV
OCV [B1/IN]
OCV [B1/EX]
VIS
FPRV
CCV
MAIN RELAY
K(39) - Sensor power (+5V)
K(14) - Throttle Position Sensor (TPS) 1 signal input
K(35) - Sensor ground
K(36) - Throttle Position Sensor (TPS) 2 signal input
A(50) - ETC Motor [+] control output
A(35) - ETC Motor [-] control output
A(17) - Injector (Cylinder #1) [High] control output
A(33) - Injector (Cylinder #1) [Low] control output
A(16) - Injector (Cylinder #2) [High] control output
A(3) - Injector (Cylinder #2) [Low] control output
A(1) - Injector (Cylinder #3) [High] control output
A(18) - Injector (Cylinder #3) [Low] control output
A(2) - Injector (Cylinder #4) [High] control output
A(48) - Injector (Cylinder #4) [Low] control output
K(72) - Purge Control Solenoid Valve (PCSV) control output
A(45) - CVVT Oil Control (OCV) [Bank 1/Intake] control output
A(15) - CVVT Oil Control (OCV) [Bank 1/Exhaust] control output
A(60) - Variable Intake Solenoid (VIS) Valve control output
A(34) - Fuel Pressure Regulator Valve [High] control output
A(49) - Fuel Pressure Regulator Valve [Low] control output
K(37) - Canister Close Valve (CCV) control output [Without immobilizer]
K(51) - Canister Close Valve (CCV) control output [With immobilizer]

(A/T)


ECM
BATTERY
CHASSIS GROUND
IGNITION SWITCH
MAIN RELAY
FUEL PUMP RELAY
Fuel pump
IG COIL (CYL. #1)
IG COIL (CYL. #2)
IG COIL (CYL. #3)
IG COIL (CYL. #4)
CONDENSER
Shield ground
SMART KEY CONTROL MODULE
Power
Ground
IMMOBILIZER LAMP
Battery power (B+)
CRUISE CONTROL SWITCH
STARTER SWITCH
STARTER RELAY
SMART KEY CONTROL MODULE
ALTERNATOR
ALTERNATOR
COOLING FAN RELAY [HIGH]
COOLING FAN RELAY [LOW]
OTHER CONTROL MODULE
DATA LINK CONNECTOR (DLC)
MULTI-PURPOSE CHECK CONNECTOR
POWER STEERING SWITCH
HEAD LAMP SWITCH
DEFROST SWITCH
K(5) - Battery power (B+)
K(3) - Battery power (B+)
K(1) - ECM ground
K(2) - ECM ground
K(4) - ECM ground
K(68) - Battery power (B+)
K(6) - Battery power (B+)
K(75) - Battery power (B+)
K(50) - Main Relay control output
K(51) - Fuel Pump Relay control output (With Immobilizer)
K(37) - Fuel Pump Relay control output (Without Immobilizer)
K(57) - Ignition Coil (Cylinder #1) control output
K(40) - Ignition Coil (Cylinder #2) control output
K(91) - Ignition Coil (Cylinder #3) control output
K(74) - Ignition Coil (Cylinder #4) control output
K(61) - Immobilizer Communication line
K(54) - Immobilizer Lamp control output
A(10) - Power supply (+5V)
A(20) - Ground
A(79) - Cruise control switch signal
K(67) - Starter control switch signal input
K(71) - Starter relay control output
K(63) - Engine speed signal output
A(51) - Alternator (FR)
K(16) - Alternator PWM signal output (COM)
K(36) - Cooling fan relay [High] control output
K(20) - Cooling fan relay [Low] control output
K(60) - CAN [High]
K(77) - CAN [Low]
K(45) - Electric Load signal input
K(30) - Electric Load signal input
K(29) - Electric Load signal input


ECM
MAPS & IATS
2
4
1
3
A(11) - Sensor power (+5V)
K(8) - Sensor ground
K(26) - Manifold Absolute Pressure Sensor (MAPS) signal input
K(28) - Intake Temperature Sensor (IATS) signal input
ECTS
3
2
1
Cluster
A(82) - Engine Coolant Temperature Sensor signal input
A(13) - Sensor ground
CMPS [B1/IN]
1
3
2
K(13) - Sensor power (+5V)
K(66) - Camshaft Position Sensor (CMPS) [Bank 1/Intake] signal input
K(80) - Sensor ground
CMPS [B1/EX]
1
3
2
K(47) - Camshaft Position Sensor (CMPS) [Bank 1/Exhaust] signal input
K(7) - Sensor ground
CKPS
2
1
N
S
K(79) - Crankshaft Position Sensor (CKPS) [A] signal input
K(78) - Crankshaft Position Sensor (CKPS) [B] signal input
KS
1
2
A(61) - Knock Sensor (KS) signal input
A(80) - Sensor ground
HO2S [B1/S1]
4
5
2
1
3
6
MAIN RELAY
A(24) - HO2S (B1/S1) Heater control output
A(84) - VS+ (NERNST Cell Voltage)
A(83) - VS-/IP- (Common Ground for VS,IP)
A(104) - Ro/Rp (Pump Cell Voltage)
A(106) - Rc (Compensative Resistance)
HO2S [B1/S2]
3
4
2
1
MAIN RELAY
A(25) - Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2] Heater control output
A(103) - Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2] signal input
A(41) - Sensor ground
RPS
1
3
2
K(15) - Sensor power (+5V)
K(10) - Sensor ground
K(27) - Rail Pressure Sensor (RPS) signal input


ECM
APS
APS1
APS2
3
4
5
2
1
6
A(19) - Sensor power (+5V)
A(54) - Accelerator Position Sensor (APS) 1 signal input
A(62) - Sensor ground
A(15) - Sensor power (+5V)
A(56) - Accelerator Position Sensor (APS) 2 signal input
A(63) - Sensor ground
FTPS
1
2
3
A(11) - Sensor power (+5V)
K(42) - Sensor ground
A(77) - Fuel Tank Pressure Sensor (FTPS) signal input
APT
3
1
2
K(15) - Sensor power (+5V)
K(25) - Sensor ground
K(44) - A/C Pressure Transducer (APT) signal input
BRAKE SWITCH
IG ON
BATTERY(+)
4
2
3
1
A(53) - Brake Switch 2 signal input [Test]
K(48) - Brake Switch 1 signal input [Light]
ABS/VDC
ABS/VDC CONTROL MODULE
K(64) - Vehicle speed signal input
BATTERY SENSOR
K(82) - LIN Communication signal input
FLS
Sender
Variable resistance
A(78) - Fuel Level Sender (FLS) signal input
Cluster
Battery (B+)
MCU
Ground
With ISG
BBVPS
2
1
3
K(24) - BBVPS signal input
K(43) - Sensor ground
K(14) - Sensor power (5V)
ISG OFF Switch
IG ON/ START
Ground
K(26) - ISG inhibitor control
K(31) - ISG OFF switch input



Fuel System > Engine Control System > Engine Control Module (ECM) > Repair procedures

Removal

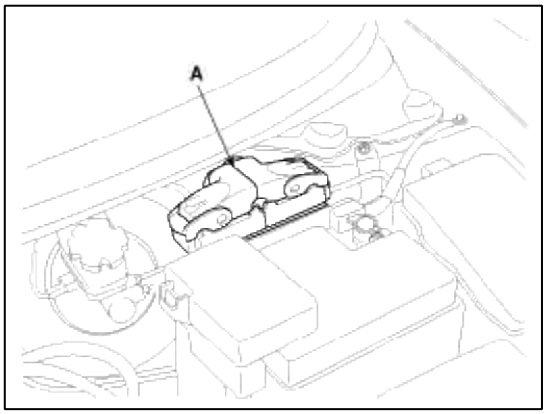
NOTE

When replacing the ECM, the vehicle equipped with immobilizer must be performed the procedure as below.
[In the case of installing used ECM]
1. Perform "Neutral mode" procedure with GDS. (Refer to "Immobilizer" in BE group)
2. Insert the key and turn it to the IGN ON and OFF position.

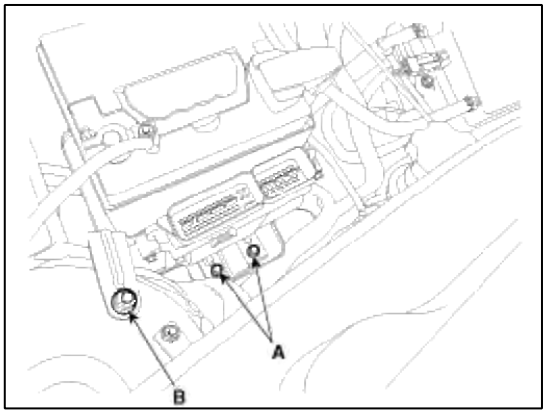
Then the ECM key register process is completed automatically.
[In the case of installing new ECM]
- Insert the key and turn it to the IGN ON and OFF position.

Then the ECM key register process is completed automatically.

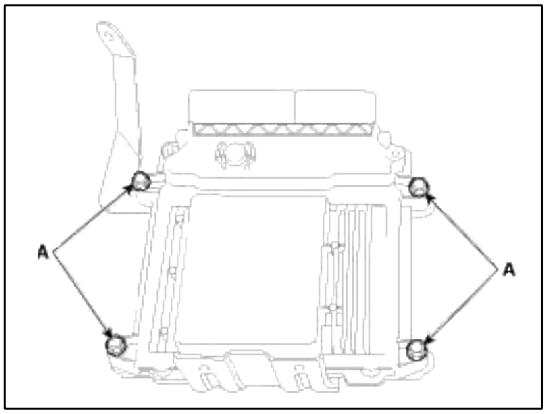
1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Disconnect the ECM Connector (A).



3. Remove the battery (Refer to "Charging System" in EM group).
4. Remove the mounting bolts (A) and nut (B), and then remove the ECM bracket assembly.



5. Remove the ECM after removing the nuts (A) from the bracket.



Installation

NOTE

When replacing the ECM, the vehicle equipped with immobilizer must be performed the procedure as below.
[In the case of installing used ECM]
1. Perform "Neutral mode" procedure with GDS. (Refer to "Immobilizer" in BE group)
2. Insert the key and turn it to the IGN ON and OFF position.

Then the ECM key register process is completed automatically.
[In the case of installing new ECM]
- Insert the key and turn it to the IGN ON and OFF position.

Then the ECM key register process is completed automatically.

1. Installation is reverse of removal.

ECM installation bolt:
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)
ECM bracket installation bolt:
19.6 ~ 29.4 N.m (2.0 ~ 3.0 kgf.m, 14.5 ~ 21.7 lb-ft)
ECM bracket installation nut:
7.8 ~ 11.8 N.m (0.8 ~ 1.2 kgf.m, 5.8 ~ 8.7 lb-ft)

ECM Problem Inspection Procedure

1. TEST ECM GROUND CIRCUIT: Measure 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: Below 1Ω

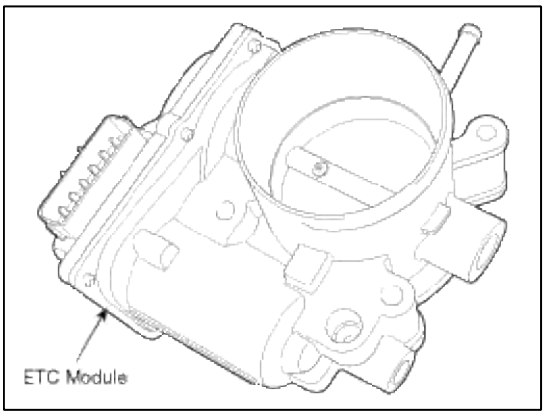
2. TEST ECM CONNECTOR: Disconnect the ECM connector and visually check the ground terminals on ECM side and harness side for bent pins or poor contact pressure. If the problem is found, repair it.
3. If problem is not found in Step 1 and 2, the ECM could be faulty. If so, make sure there were no DTC's before swapping the ECM with a new one, and then check the vehicle again. If DTC's were found, examine this first before swapping 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 Inspection Procedure” in Basic Inspection Procedure).

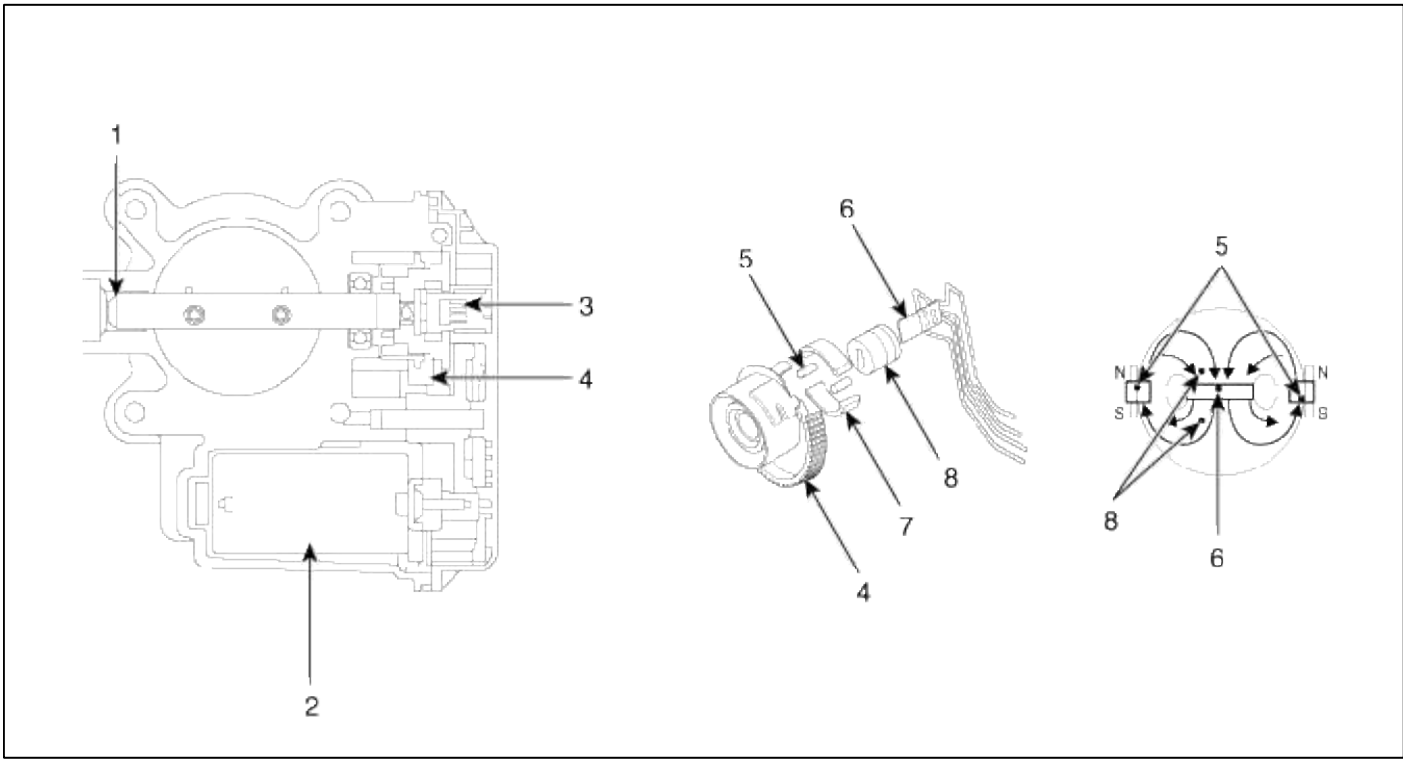
Fuel System > Engine Control System > ETC (Electronic Throttle Control) System > Description and Operation

Description

The Electronic Throttle Control (ETC) System consists of a throttle body with an integrated control motor and throttle position sensor (TPS). Instead of the traditional throttle cable, an Accelerator Position Sensor (APS) is used to receive driver input. The ECM uses the APS signal to calculate the target throttle angle; the position of the throttle is then adjusted via ECM control of the ETC motor. The TPS signal is used to provide feedback regarding throttle position to the ECM. Using ETC, precise control over throttle position is possible; the need for external cruise

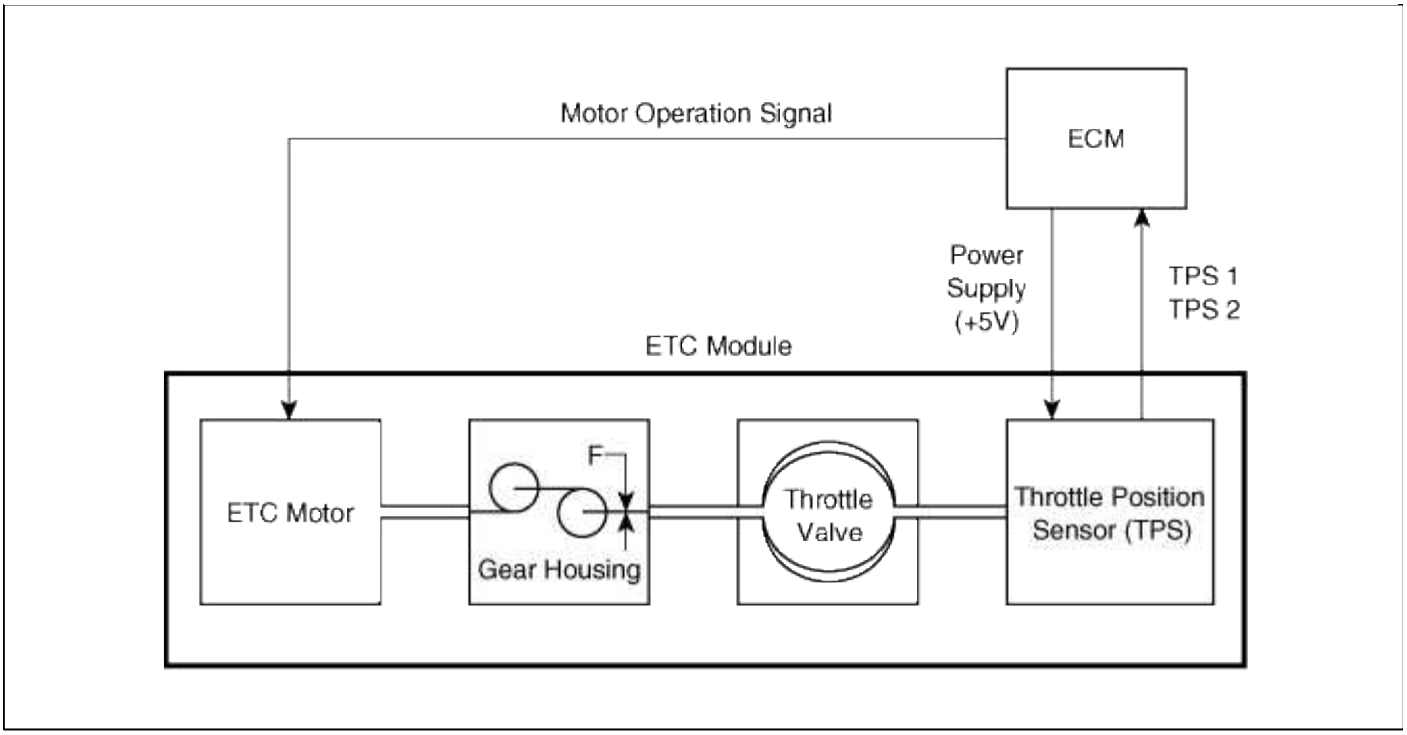
control modules/cables is eliminated.





1. Dry bearing	5. Magnet
2. DC motor	6. Hall IC
3. Non-contact hall sensor	7. Yoke
4. Gear	8. Stator

Schematic Diagram



Fuel System > Engine Control System > ETC (Electronic Throttle Control) System > Troubleshooting

Fail-Safe Mode

Item	Fail-Safe	
ETC Motor	Throttle valve stuck at 7°	
TPS	TPS 1 fault	ECM looks at TPS2
	TPS 2 fault	ECM looks at TPS1
	TPS 1,2 fault	Throttle valve stuck at 7°
APS	APS 1 fault	ECM looks at APS 2
	APS 2 fault	ECM looks at APS 1
	APS 1,2 fault	Engine idle state

NOTE

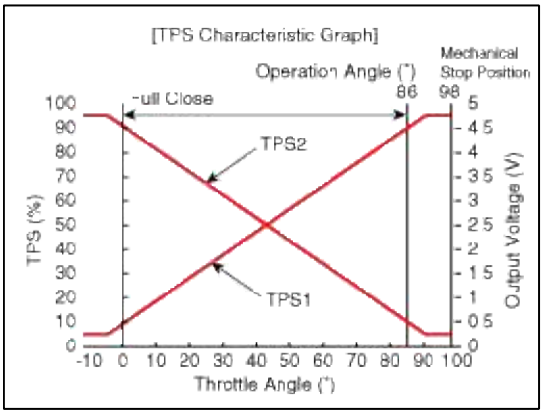
When throttle value is stuck at 7°, engine speed is limited at below 1,500rpm and vehicle speed at maximum 40 ~ 50 km/h (25 ~ 31 mph)

Fuel System > Engine Control System > ETC (Electronic Throttle Control) System > Specifications

Specification

[Throttle Position Sensor (TPS)]

Throttle angle(°)	Output Voltage (V)	
	TPS1	TPS2
0	0.5	4.5
10	0.96	4.05
20	1.41	3.59
30	1.87	3.14
40	2.32	2.68
50	2.78	2.23
60	3.23	1.77
70	3.69	1.32
80	4.14	0.86
90	4.6	0.41
98	4.65	0.35
C.T (0)	0.5	4.5
W.O.T (86)	4.41	0.59



[ETC Motor]

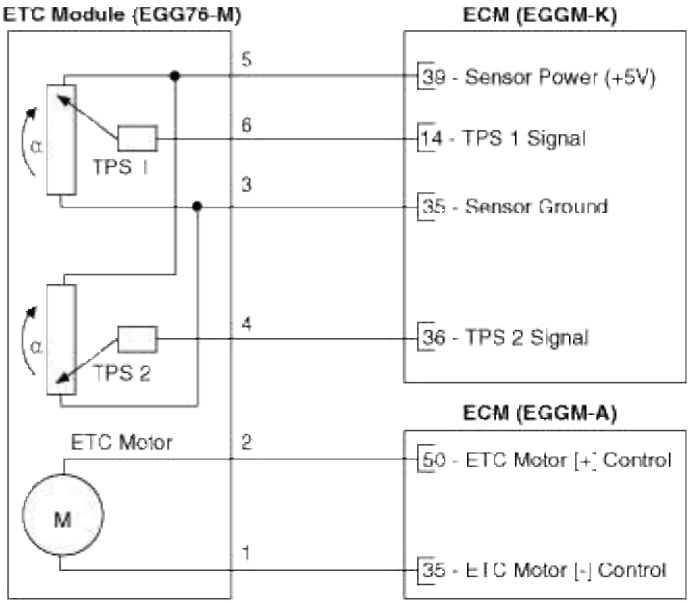
Item	Specification
Coil Resistance (Ω)	0.3 ~100 [20°C(68°F)]

Fuel System > Engine Control System > ETC (Electronic Throttle Control) System > Schematic Diagrams

Circuit Diagram

(M/T)

[Circuit Diagram]



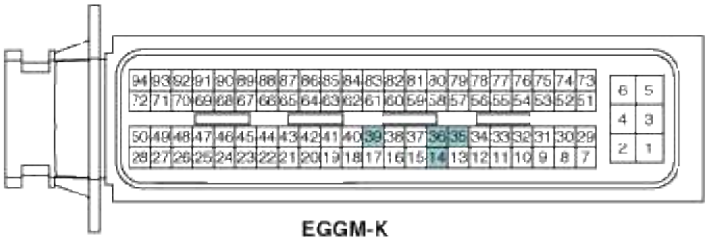
[Connection Information]

Terminal	Connected to	Function
1	ECM EGGM-A (35)	ETC Motor [-] Control
2	ECM EGGM-A (50)	ETC Motor [+] Control
3	ECM EGGM-K (35)	Sensor Ground
4	ECM EGGM-K (36)	TPS 2 Signal
5	ECM EGGM-K (39)	Sensor Power (+5V)
6	ECM EGGM-K (14)	TPS 1 Signal

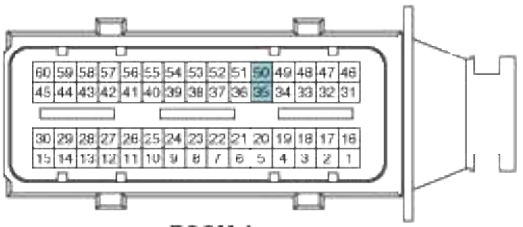
[Harness Connector]



EGG76-M
ETC Module



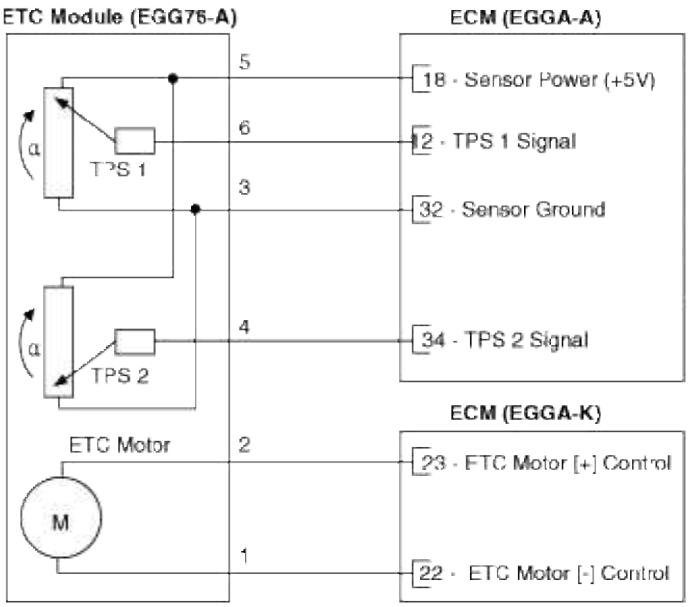
EGGM-K



EGGM-A
ECM

(A/T)

[Circuit Diagram]



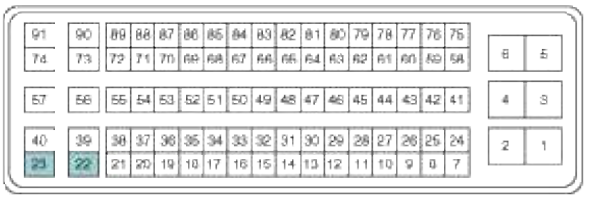
[Connection Information]

Terminal	Connected to	Function
1	ECM EGGA-K (22)	ETC Motor [-] Control
2	ECM EGGA-K (23)	ETC Motor [+] Control
3	ECM EGGA-A (32)	Sensor Ground
4	ECM EGGA-A (34)	TPS 2 Signal
5	ECM EGGA-A (18)	Sensor Power (+5V)
6	ECM EGGA-A (12)	TPS 1 Signal

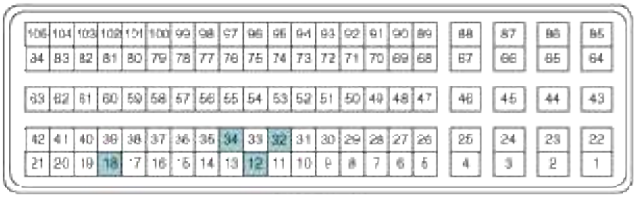
[Harness Connector]



EGG76-A
ETC Module



EGGA-K



EGGA-A
ECM

Fuel System > Engine Control System > ETC (Electronic Throttle Control) System > Repair procedures

Inspection

Throttle Position Sensor (TPS)

1. Connect the GDS on the Data Link Connector (DLC).
2. Start the engine and measure the output voltage of TPS 1 and 2 at C.T. and W.O.T.

Specification: Refer to “Specification”

ETC Motor

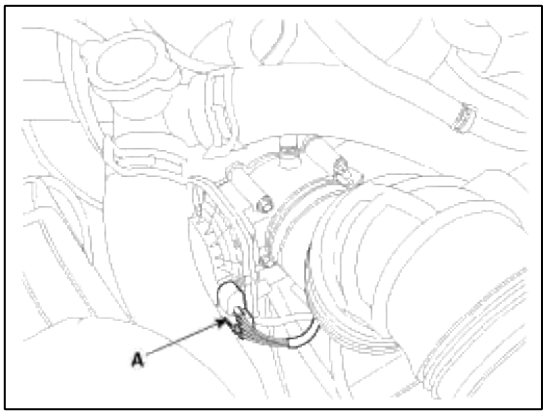
1. Turn the ignition switch OFF.
2. Disconnect the ETC module connector.
3. Measure resistance between the ETC module terminals 1 and 2.

4. Check that the resistance is within the specification.

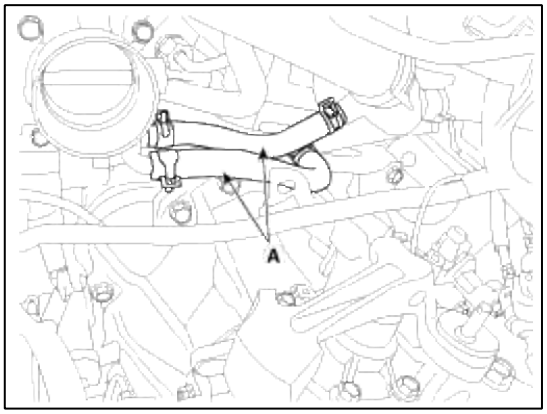
Specification: Refer to “Specification”

Removal

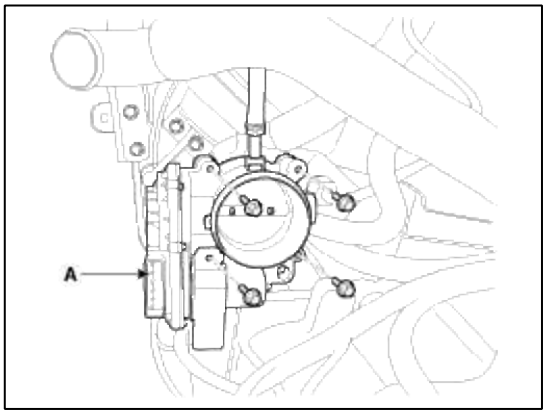
1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Remove the resonator and the air intake hose (Refer to “Intake And Exhaust System” in EM group).
3. Disconnect the ETC module connector (A).



4. Disconnect the coolant hoses (A).



5. Remove the installation bolts, and then remove the ETC module (A) from the engine.



Installation

CAUTION

- Install the component with the specified torques.
- Note that internal damage may occur when the component is dropped. If the component has been dropped, inspect before installing.

NOTE

When cleaning the throttle body, clean the valve and carbon at the bore with the cloth wetted by cleaner.

CAUTION

Do not spray the engine cleaner on the throttle body.

CAUTION

Be careful that fingers or cloth are not caught in the valve.
When installing the throttle body, be careful not to get foreign material into the throttle body.

1. Installation is reverse of removal.

Electronic throttle body Installation bolt:
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)

Adjustment

ETC module learning procedure

When installing new ETC module or re-installing it, ETC module learning procedure must be performed.

1. Hold the ignition key or the start button at the IG ON position during 5 seconds.
2. Turn ignition swich OFF and then start the engine.

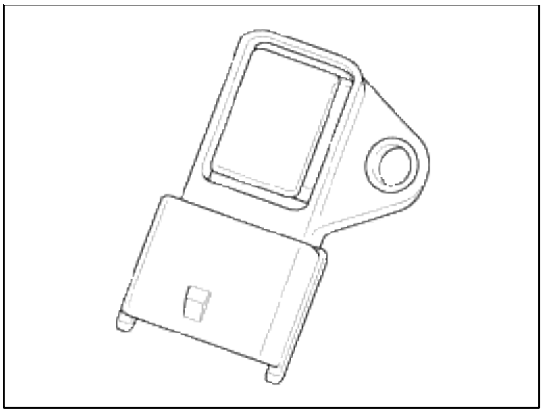
CAUTION

DTC codes (P0638, P2110) might be displayed if ETC module learning procedure does not performed after replacing ETC module.

Fuel System > Engine Control System > Manifold Absolute Pressure Sensor (MAPS) > Description and Operation

Description

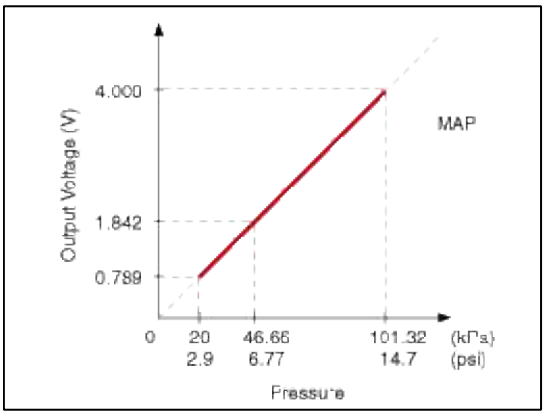
Manifold Absolute Pressure Sensor (MAPS) is a speed-density type sensor and is installed on the surge tank. It senses absolute pressure of the surge tank and transfers the analog signal proportional to the pressure to the ECM. By using this signal, the ECM calculates the intake air quantity and engine 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

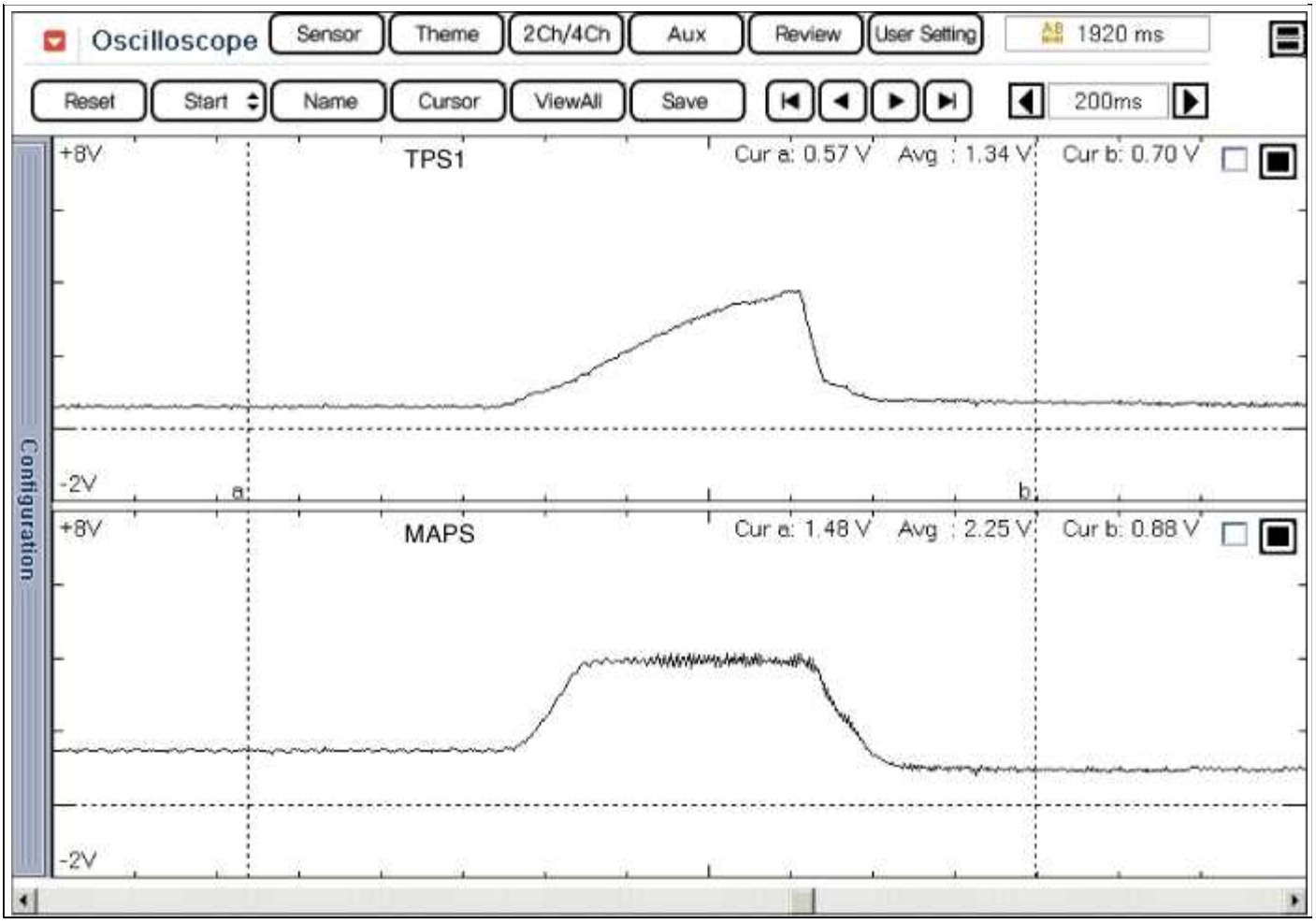
Specification

Pressure [kPa (kgf/cm², psi)]	Output Voltage (V)
20.0 (0.20, 2.9)	0.79
46.7 (0.47, 6.77)	1.84
101.3 (1.03, 14.7)	4.0



Fuel System > Engine Control System > Manifold Absolute Pressure Sensor (MAPS) > Troubleshooting

Signal Waveform

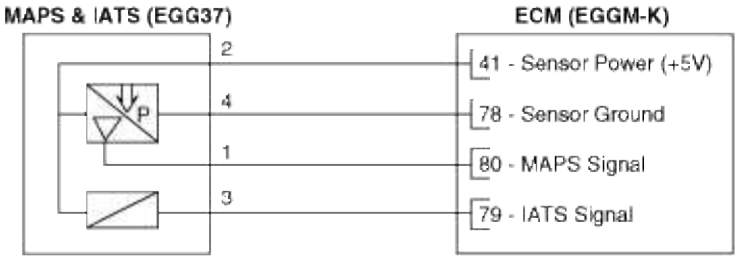


Fuel System > Engine Control System > Manifold Absolute Pressure Sensor (MAPS) > Schematic Diagrams

Circuit Diagram

(M/T)

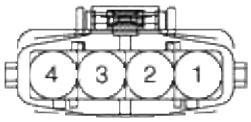
[Circuit Diagram]



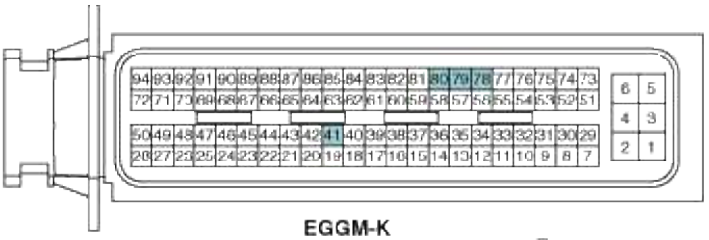
[Connection Information]

Terminal	Connected to	Function
1	ECM EGGM-K (80)	MAPS Signal
2	ECM EGGM-K (41)	Sensor Power (+5V)
3	ECM EGGM-K (79)	IATS Signal
4	ECM EGGM-K (78)	Sensor Ground

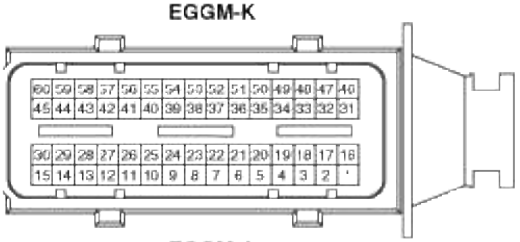
[Harness Connector]



EGG37
MAPS & IATS



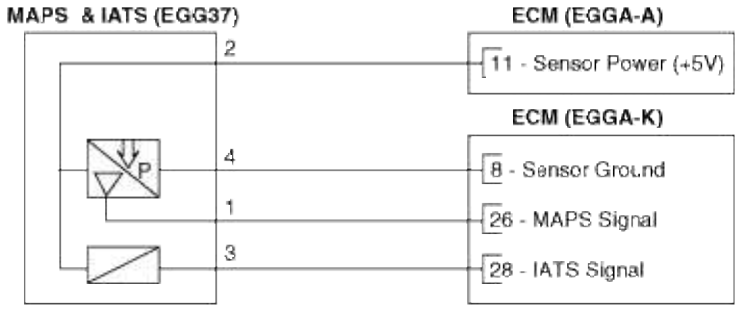
EGGM-K



EGGM-A
ECM

(A/T)

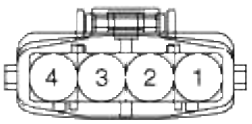
[Circuit Diagram]



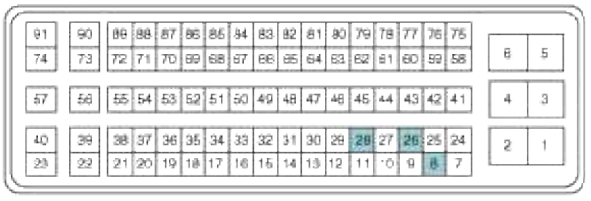
[Connection Information]

Terminal	Connected to	Function
1	ECM EGGA-K (26)	MAPS Signal
2	ECM EGGA-A (11)	Sensor Power (+5V)
3	ECM EGGA-K (28)	IATS Signal
4	ECM EGGA-K (8)	Sensor Ground

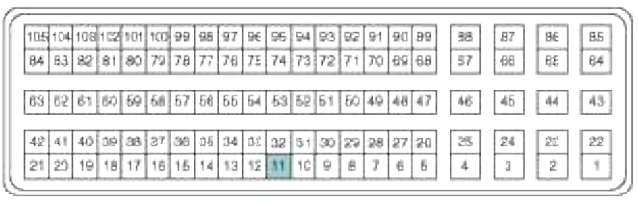
[Harness Connector]



EGG37
MAPS & IATS



EGGA-K



EGGA-A
ECM

Fuel System > Engine Control System > Manifold Absolute Pressure Sensor (MAPS) > Repair procedures

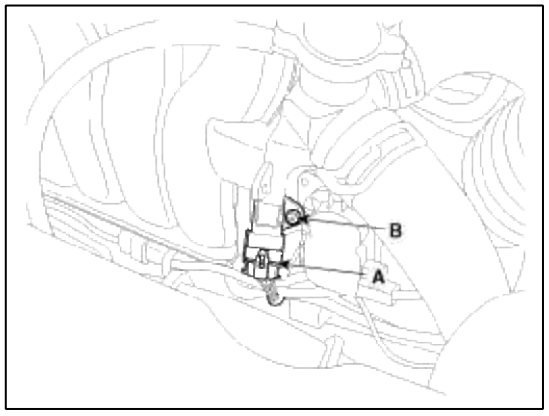
Inspection

1. Connect the GDS on the Data Link Connector (DLC).
2. Measure the output voltage of the MAPS at idle and IG ON.

Specification: Refer to "Specification"

Removal

1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Disconnect the manifold absolute pressure sensor connector (A).
3. Remove the installation bolt (B), and then remove the sensor from the surge tank.



Installation

CAUTION

- Install the component with the specified torques.
- Note that internal damage may occur when the component is dropped. If the component has been dropped, inspect before installing.

CAUTION

- Insert the sensor in the installation hole and be careful not to damage.

1. Installation is reverse of removal.

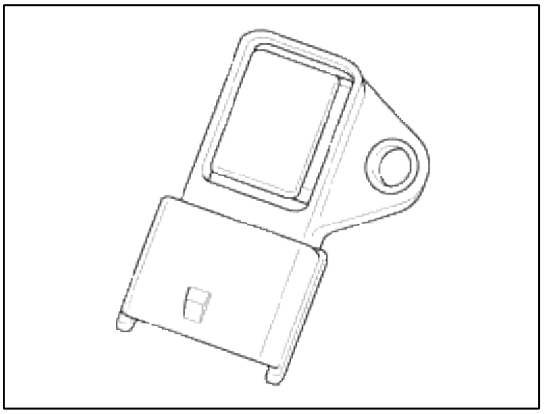
Manifold absolute pressure sensor installation bolt:
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)

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) Thermister and it's resistance changes in reverse proportion to the temperature.



Fuel System > Engine Control System > Intake Air Temperature Sensor (IATS) > Specifications

Specification

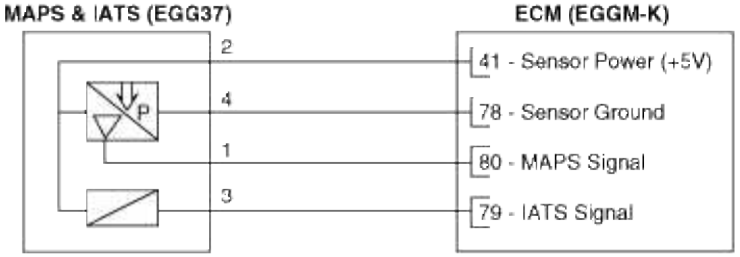
Temperature		Resistance (kΩ)
°C	°F	
-40	-40	40.93 ~ 48.35
-20	-4	13.89 ~ 16.03
0	32	5.38 ~ 6.09
10	50	3.48 ~ 3.90
20	68	2.31 ~ 2.57
40	104	1.08 ~ 1.21
50	122	1.56 ~ 1.74
60	140	0.54 ~ 0.62
80	176	0.29 ~ 0.34

Fuel System > Engine Control System > Intake Air Temperature Sensor (IATS) > Schematic Diagrams

Circuit Diagram

(M/T)

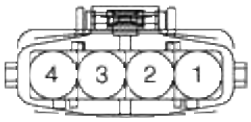
[Circuit Diagram]



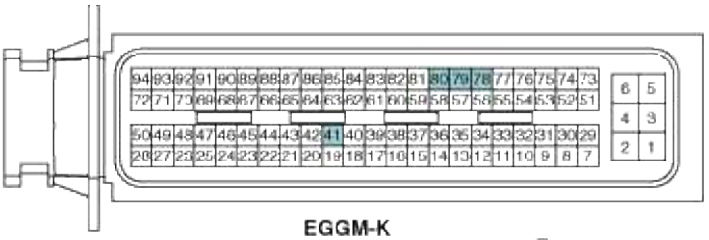
[Connection Information]

Terminal	Connected to	Function
1	ECM EGGM-K (80)	MAPS Signal
2	ECM EGGM-K (41)	Sensor Power (+5V)
3	ECM EGGM-K (79)	IATS Signal
4	ECM EGGM-K (78)	Sensor Ground

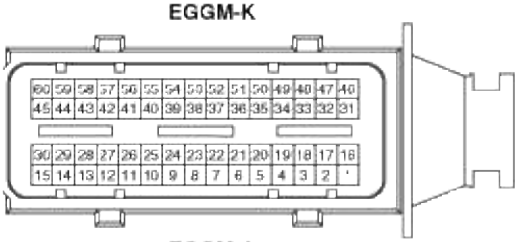
[Harness Connector]



EGG37
MAPS & IATS



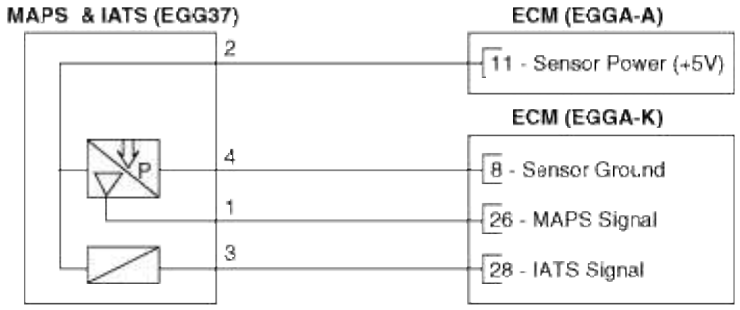
EGGM-K



EGGM-A
ECM

(A/T)

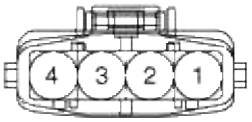
[Circuit Diagram]



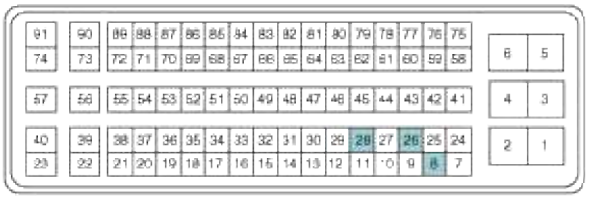
[Connection Information]

Terminal	Connected to	Function
1	ECM EGGA-K (26)	MAPS Signal
2	ECM EGGA-A (11)	Sensor Power (+5V)
3	ECM EGGA-K (28)	IATS Signal
4	ECM EGGA-K (8)	Sensor Ground

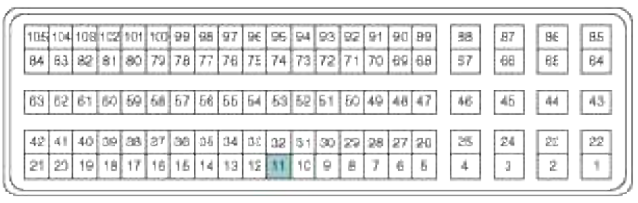
[Harness Connector]



EGG37
MAPS & IATS



EGGA-K



EGGA-A
ECM

Fuel System > Engine Control System > Intake Air Temperature Sensor (IATS) > Repair procedures

Inspection

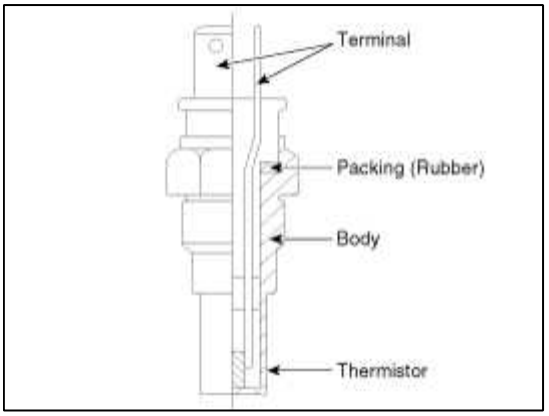
1. Turn the ignition switch OFF.
2. Disconnect the IATS connector.
3. Measure resistance between the IATS terminals 3 and 4.
4. Check that the resistance is within the specification.

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 that changes resistance 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

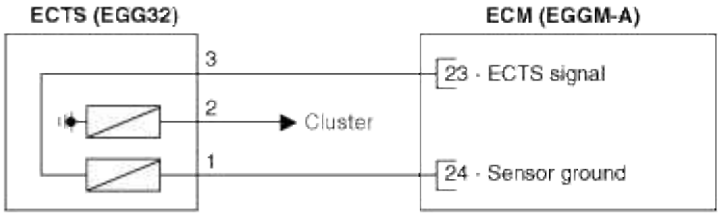
Temperature		Resistance (kΩ)
°C	°F	
-40	-40	48.14
-20	-4	14.13 ~ 16.83
0	32	5.79
20	68	2.31 ~ 2.59
40	104	1.15
60	140	0.59
80	176	0.32

Fuel System > Engine Control System > Engine Coolant Temperature Sensor (ECTS) > Schematic Diagrams

Circuit Diagram

(M/T)

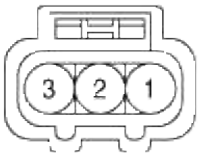
[Circuit Diagram]



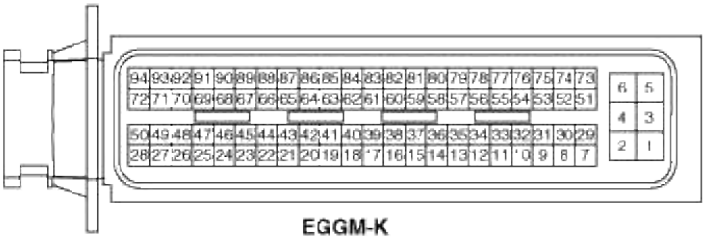
[Connection Information]

Terminal	Connected to	Function
1	ECM EGGM-A (24)	Sensor ground
2	Cluster	-
3	ECM EGGM-A (23)	ECTS signal

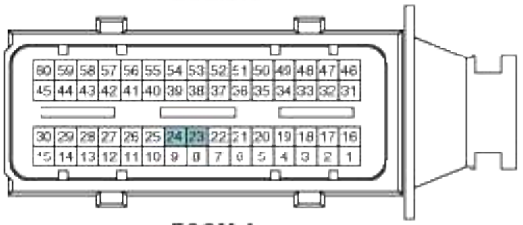
[Harness Connector]



EGG32
ECTS



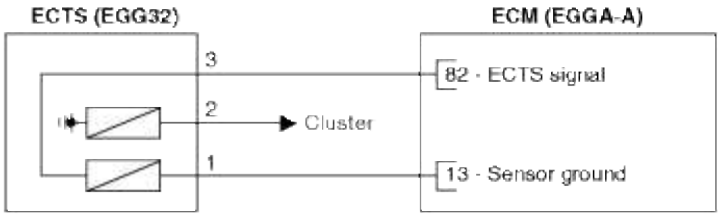
EGGM-K



EGGM-A
ECM

(A/T)

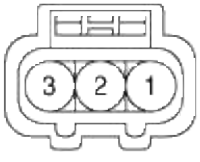
[Circuit Diagram]



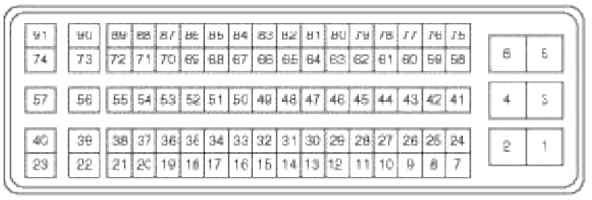
[Connection Information]

Terminal	Connected to	Function
1	ECM EGGA-A (13)	Sensor ground
2	Cluster	-
3	ECM EGGA-A (82)	ECTS signal

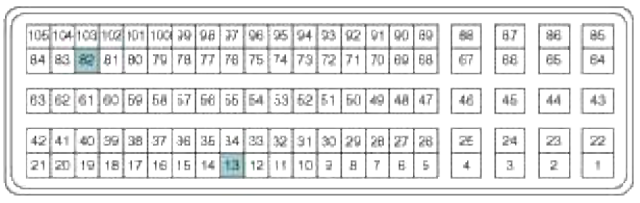
[Harness Connector]



EGG32
ECTS



EGGA-K



EGGA-A

ECM

Fuel System > Engine Control System > Engine Coolant Temperature Sensor (ECTS) > Repair procedures

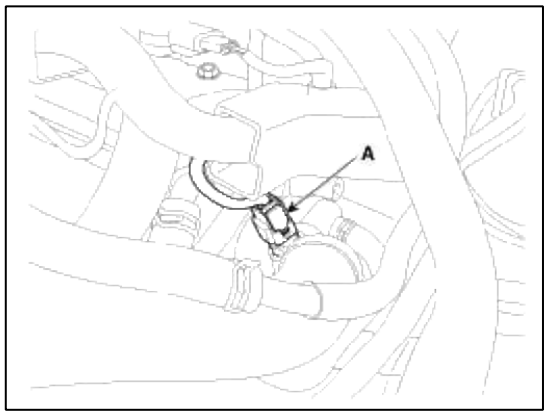
Inspection

1. Turn the ignition switch OFF.
2. Remove the ECTS (Refer to "Removal").
3. After immersing the thermistor of the sensor into engine coolant, measure resistance between the ECTS terminals 3 and 4.
4. Check that the resistance is within the specification.

Specification: Refer to “Specification”

Removal

1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Disconnect the engine coolant temperature sensor connector (A).



3. Supplement the engine coolant (Refer to “Cooling System” in EM group).

Installation

CAUTION

- Install the component with the specified torques.
- Note that internal damage may occur when the component is dropped. If the component has been dropped, inspect before installing.

CAUTION

- Apply the engine coolant to the O-ring.

CAUTION

- Insert the sensor in the installation hole and be careful not to damage.

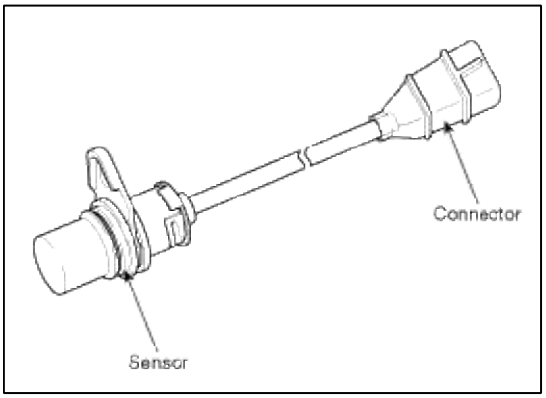
1. Installation is reverse of removal.

Engine Coolant Temperature Sensor installation :
29.4 ~ 39.2 N.m (3.0 ~ 4.0 kgf.m, 21.7 ~ 28.9 lb-ft)

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 in ladder frame and generates alternating current by magnetic flux field which is made by the sensor and the target wheel when the engine rotates. The target wheel consists of 58 slots and 2 missing slots on 360 CA (Crank Angle).



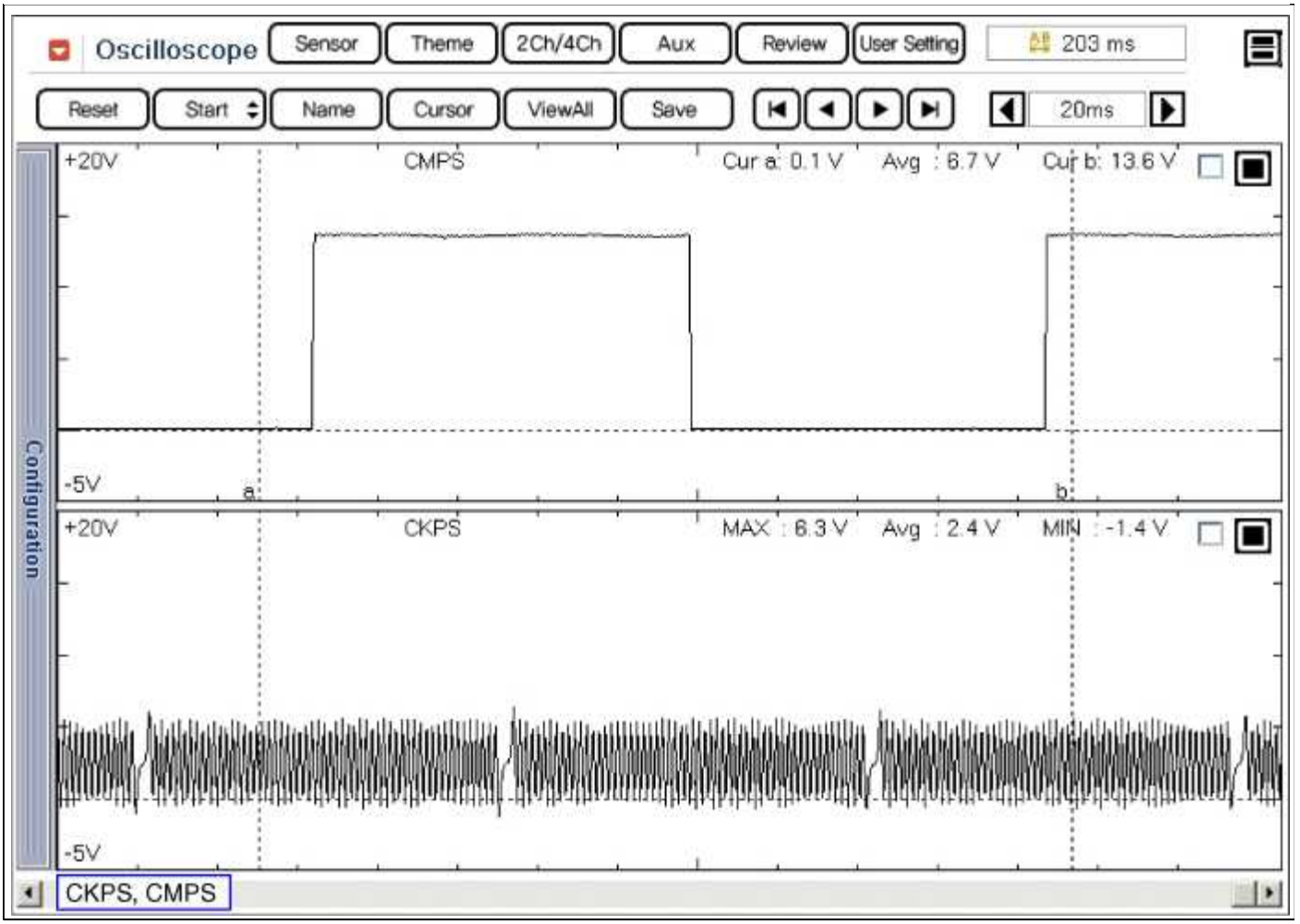
Fuel System > Engine Control System > Crankshaft Position Sensor (CKPS) > Specifications

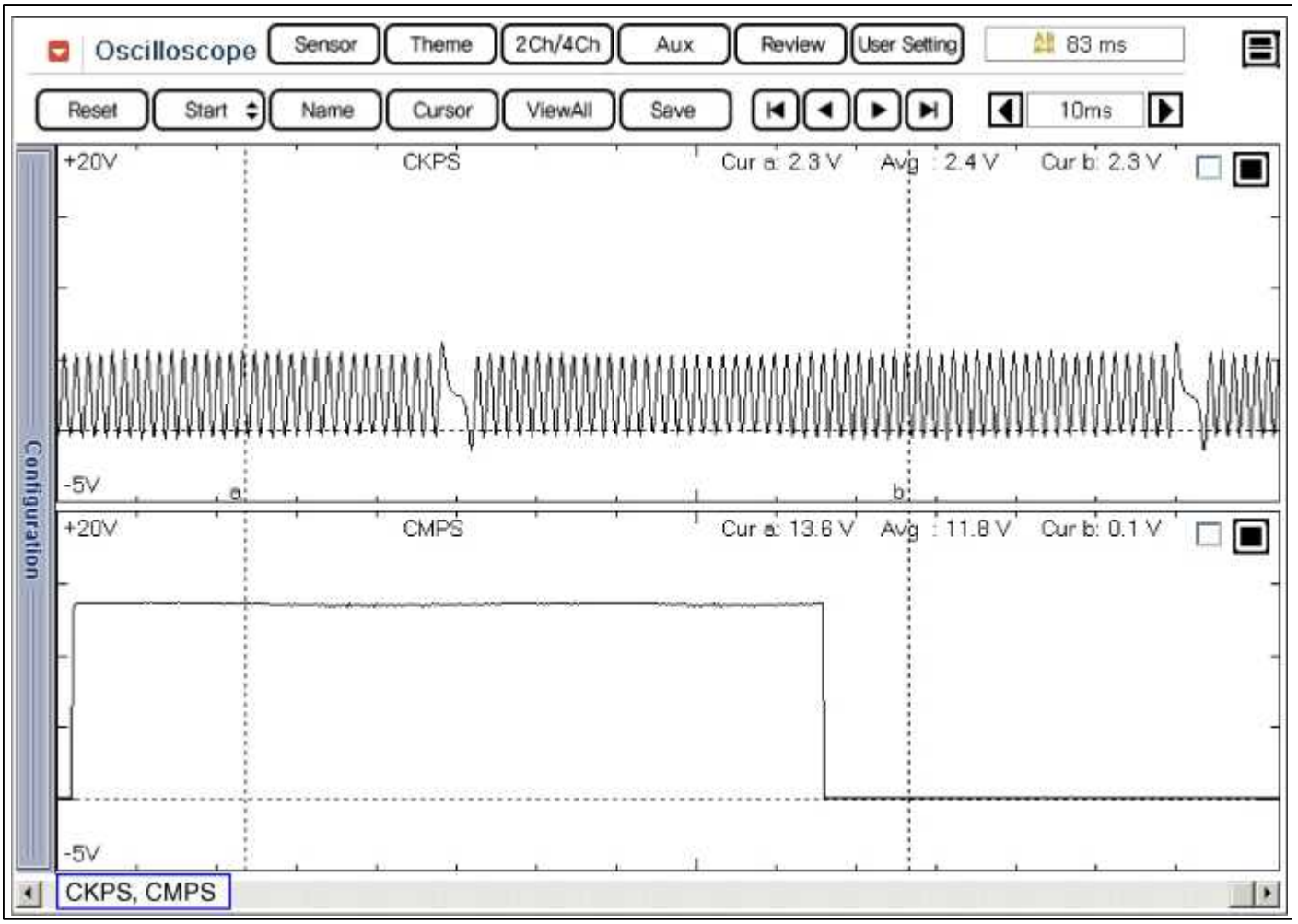
Specification

Item	Specification
Coil Resistance (Ω)	774 ~ 946 [20°C (68°F)]

Fuel System > Engine Control System > Crankshaft Position Sensor (CKPS) > Troubleshooting

Waveform





This example shows a typical Crankshaft Position Sensor(CkPS) and Camshaft Position Sensor(CMPS) waveform

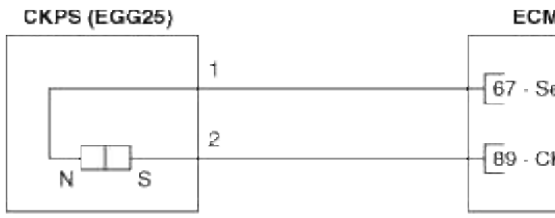
at idle.The PCM controls the injection and ignition timing by using these signals.
Generally CkPS signal is used to detect the piston's position and CMPS signal is used to detect the Top Dead Center of each cylinder.

Fuel System > Engine Control System > Crankshaft Position Sensor (CKPS) > Schematic Diagrams

Circuit Diagram

(M/T)

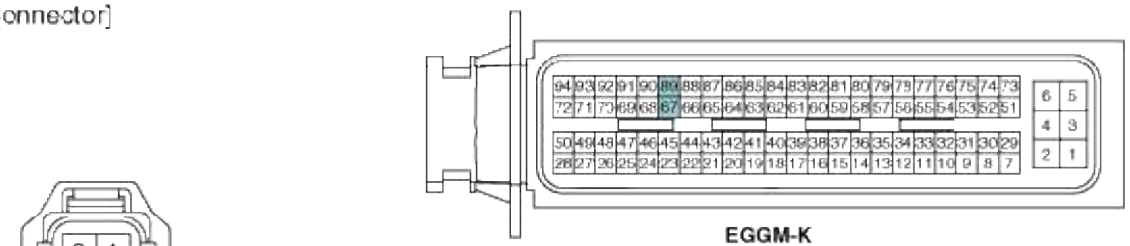
[Circuit Diagram]



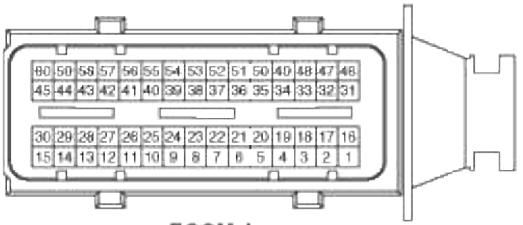
[Conection Information]

Terminal	Conected to	Function
1	ECM EGGM-K (67)	Sensor ground
2	ECM EGGM-K (89)	CKPS Signal

[Harness Connector]

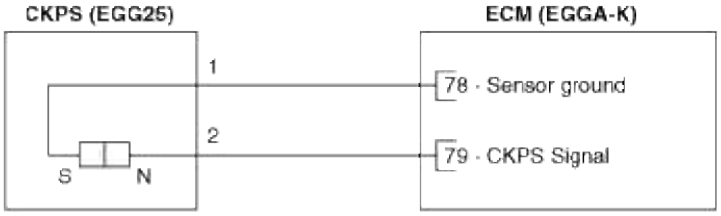






(A/T)

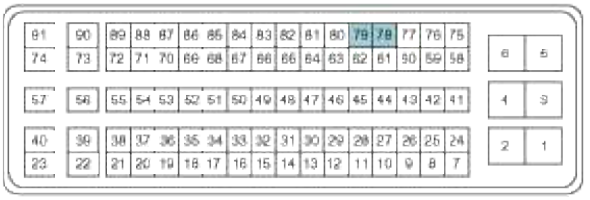
[Circuit Diagram]



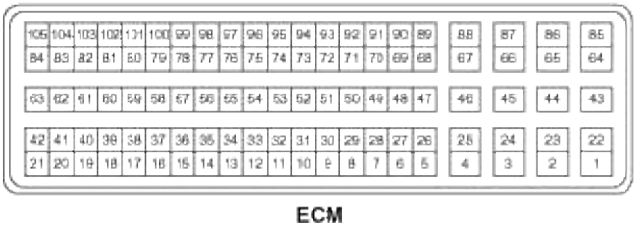
[Conection Information]

Terminal	Conected to	Function
1	ECM EGGA-K (78)	Sensor ground
2	ECM EGGA-K (79)	CKPS Signal

[Harness Connector]







Fuel System > Engine Control System > Crankshaft Position Sensor (CKPS) > Repair procedures

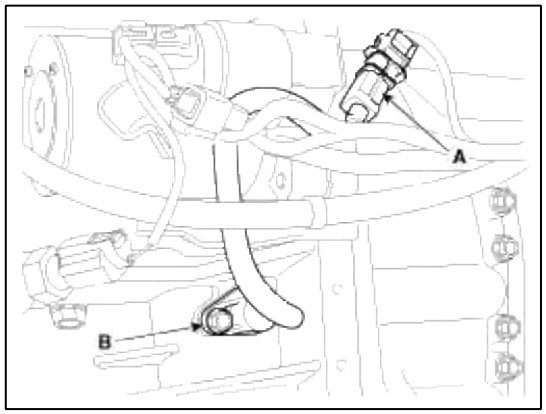
Inspection

1. Check signal waveform of CKPS and CMPS using a GDS.

Specification: Refer to “Waveform”

Removal

1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Disconnect the crankshaft position sensor connector (A) and remove the sensor (B) after removing the installation bolt.



Installation

CAUTION

- Install the component with the specified torques.
- Note that internal damage may occur when the component is dropped. If the component has been dropped, inspect before installing.

CAUTION

- Apply the engine oil to the O-ring.

CAUTION

- Insert the sensor in the installation hole and be careful not to damage.

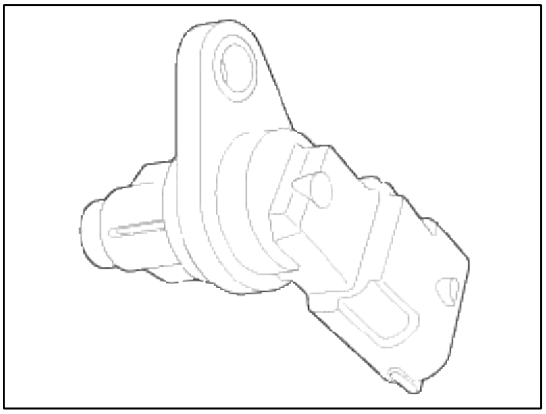
1. Installation is reverse of removal.

Crankshaft position sensor installation bolt:
7.8 ~ 11.8 N.m (0.8 ~ 1.2 kgf.m, 5.8 ~ 8.7 lb-ft)

Fuel System > Engine Control System > Camshaft Position Sensor (CMPS) > Description and Operation

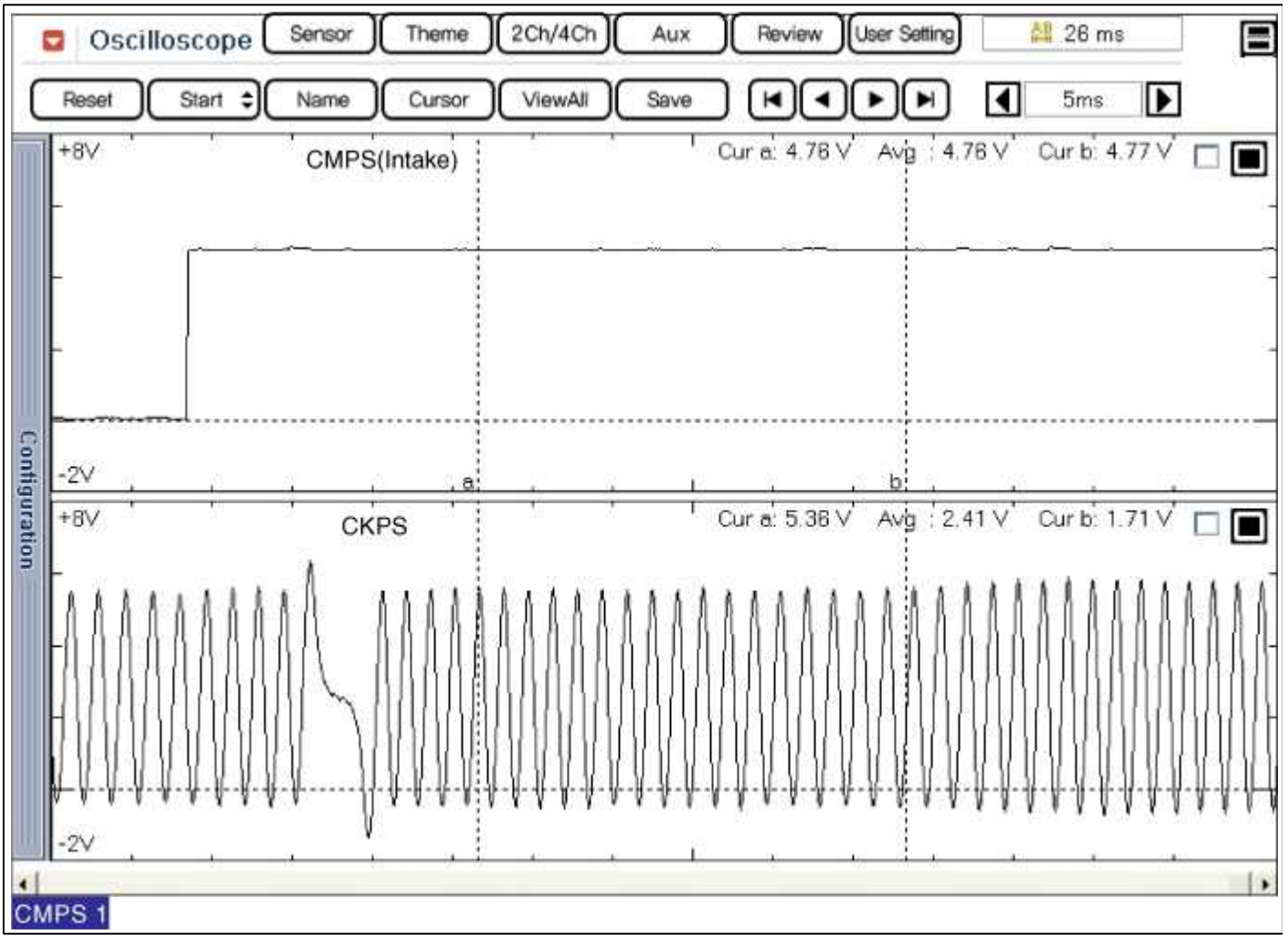
Description

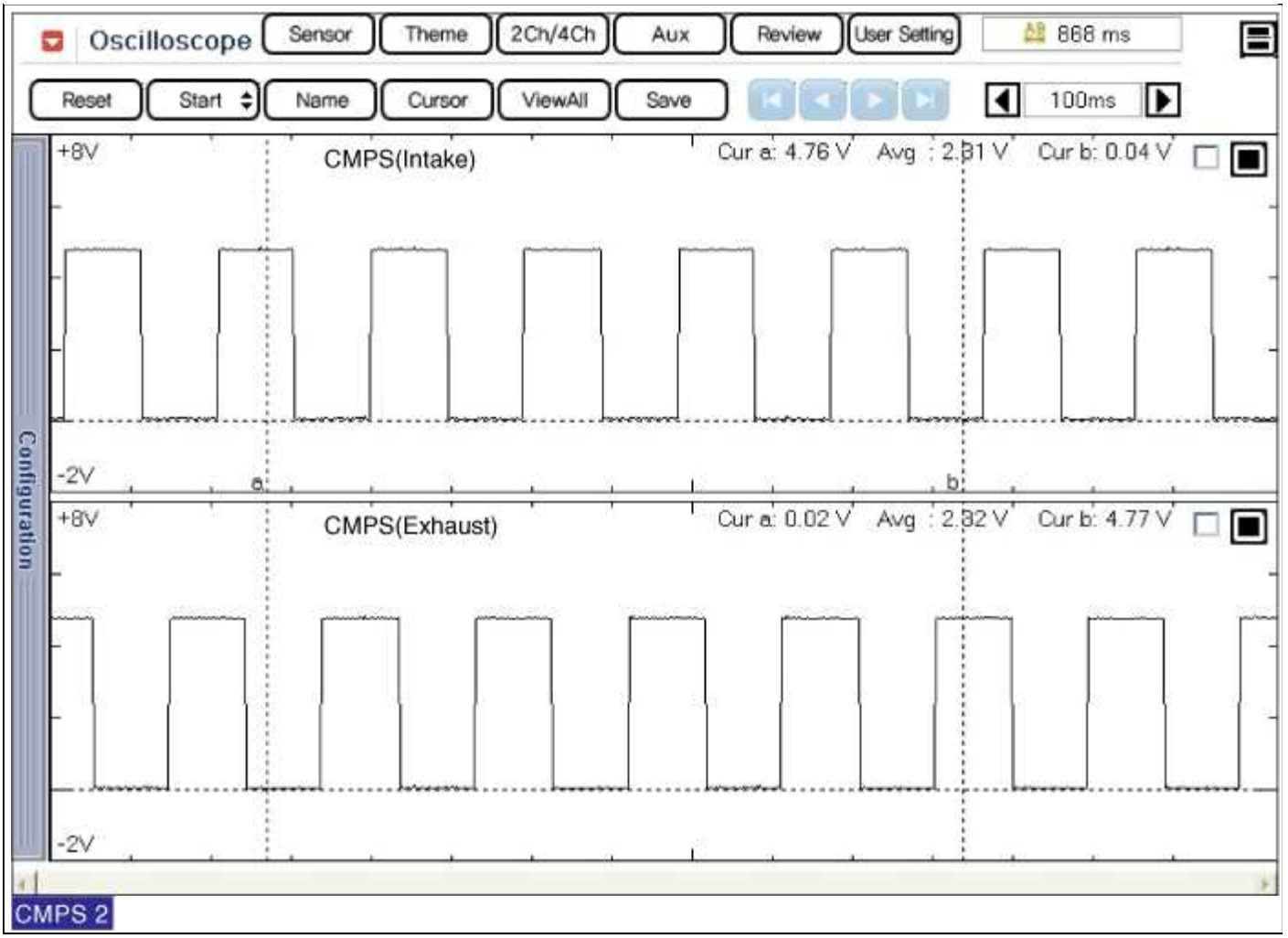
Camshaft Position Sensor (CMPS) is a hall sensor and detects the camshaft position by using a hall element.
It is related with Crankshaft Position Sensor (CKPS) and detects the piston position of each cylinder which the CKPS can't detect.
The CMPS is installed on engine head cover and uses a target wheel installed on the camshaft. The Cam Position sensor is a hall-effect type sensor. As the target wheel passes the Hall sensor, the magnetic field changes in the sensor. The sensor then switches a signal which creates a square wave.



Fuel System > Engine Control System > Camshaft Position Sensor (CMPS) > Troubleshooting

Wave Form



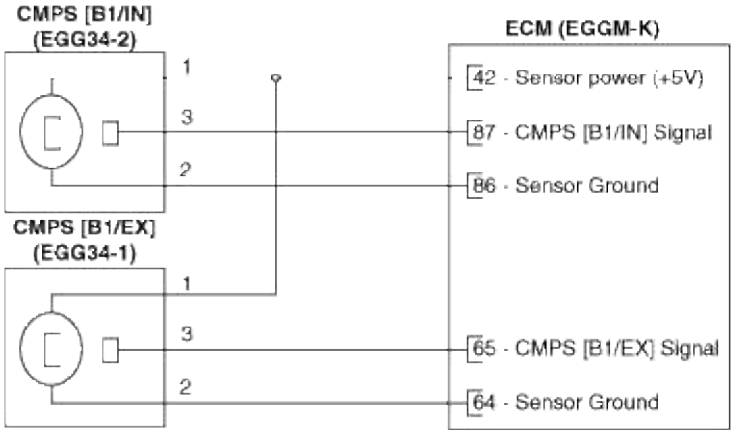


Fuel System > Engine Control System > Camshaft Position Sensor (CMPS) > Schematic Diagrams

Circuit Diagram

(M/T)

[Circuit Diagram]



[Connection Information]

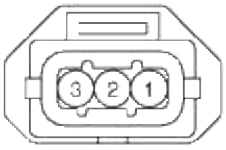
CMPS [B1/IN] (EGG34-2)

Terminal	Connected to	Function
1	Main Relay	Battery Power (B+)
2	ECM EGGM-K (86)	Sensor Ground
3	ECM EGGM-K (87)	CMPS [B1/IN] Signal

CMPS [B1/EX] (EGG34-1)

Terminal	Connected to	Function
1	Main Relay	Battery Power (B+)
2	ECM EGGM-K (64)	Sensor Ground
3	ECM EGGM-K (65)	CMPS [B1/EX] Signal

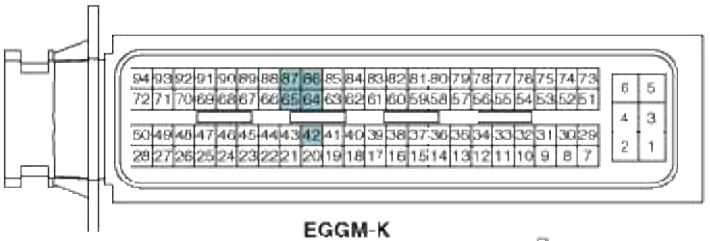
[Harness Connector]



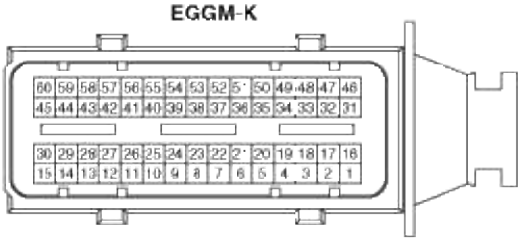
EGG34-2
CMPS [B1/IN]



EGG34-1
CMPS [B1/EX]



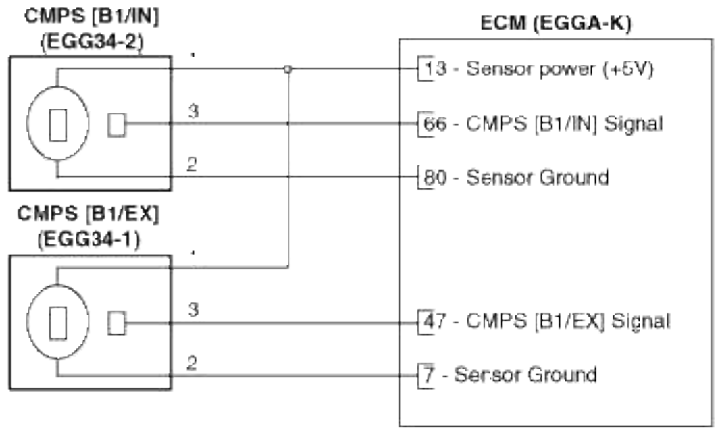
EGGM-K



EGGM-A
ECM

(A/T)

[Circuit Diagram]



[Connection Information]

CMPS [B1/IN] (EGG34-2)

Terminal	Connected to	Function
1	Main Relay	Battery Power (B+)
2	ECM EGGA-K (80)	Sensor Ground
3	ECM EGGA-K (66)	CMPS [B1/IN] Signal

CMPS [B1/EX] (EGG34-1)

Terminal	Connected to	Function
1	Main Relay	Battery Power (B+)
2	ECM EGGA-K (7)	Sensor Ground
3	ECM EGGA-K (47)	CMPS [B1/EX] Signal

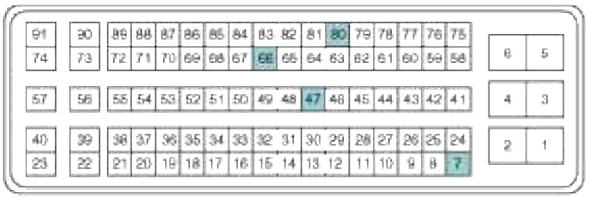
[Harness Connector]



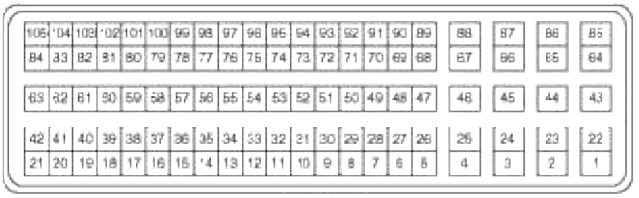
EGG34-2
CMPS [B1/IN]



EGG34-1
CMPS [B1/EX]



EGGA-K



EGGA-A
ECM

Fuel System > Engine Control System > Camshaft Position Sensor (CMPS) > Repair procedures

Inspection

1. Check the signal waveform of the CMPS and CKPS using the GDS.

Specification: Refer to “Wave Form”

Removal

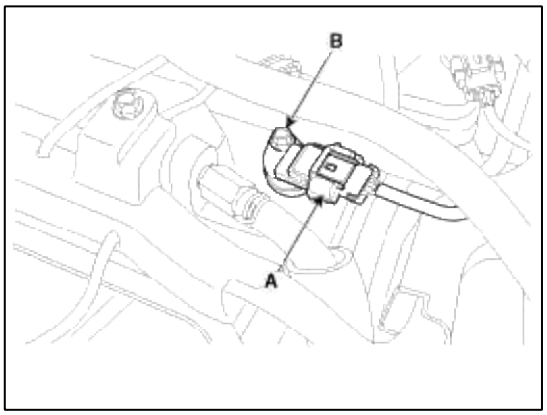
WARNING

- DON’T remove the camshaft position sensor while the engine is running or right after engine is turned off. The part and engine oil is hot and can cause burns.

[Bank 1 / Intake]

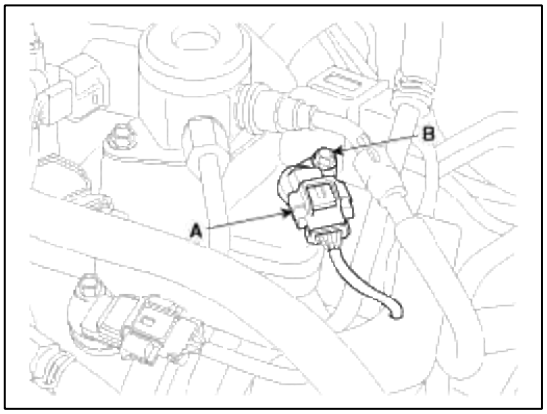
1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Disconnect the camshaft position sensor connector (A).

3. Remove the installation bolt (B), and then remove the sensor.



[Bank 1 / Exhaust]

1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Disconnect the camshaft position sensor connector (A).
3. Remove the hanger and the protector.
4. Remove the installation bolt (B), and then remove the sensor.



Installation

CAUTION

- Install the component with the specified torques.
- Note that internal damage may occur when the component is dropped. If the component has been dropped, inspect before installing.

CAUTION

- Apply the engine oil to the O-ring.

CAUTION

- Insert the sensor in the installation hole and be careful not to damage.

CAUTION

- Be careful not to damage the sensor housing and the connector.
- Be careful not to damage the O-ring.

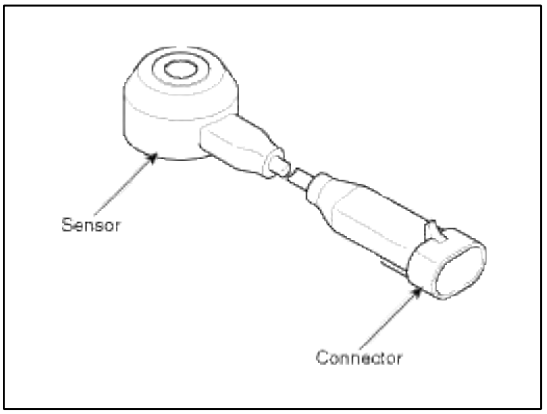
1. Installation is reverse of removal.

Camshaft position sensor installation bolt:
7.8 ~ 11.8 N.m (0.8 ~ 1.2 kgf.m, 5.8 ~ 8.7 lb-ft)

Fuel System > Engine Control System > Knock Sensor (KS) > Description and Operation

Description

Knocking is a phenomenon characterized by undesirable vibration and noise and can cause engine damage. Knock Sensor (KS) is installed on the cylinder block and senses engine knocking.
When knocking occurs, the vibration from the cylinder block is applied as pressure to the piezoelectric element. When a knock occurs, the sensor produces voltage signal. The ECM retards the ignition timing when knocking occurs. 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

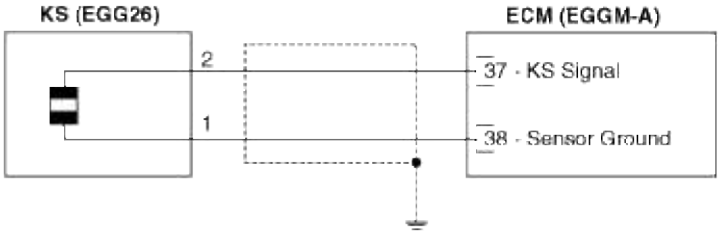
Item	Specification
Capacitance (pF)	950 ~ 1,350
Resistance (MΩ)	4.87

Fuel System > Engine Control System > Knock Sensor (KS) > Schematic Diagrams

Circuit Diagram

(M/T)

[Circuit Diagram]



[Connection Information]

Terminal	Connected to	Function
1	ECM EGGM-A (38)	Sensor Ground
2	ECM EGGM-A (37)	KS Signal

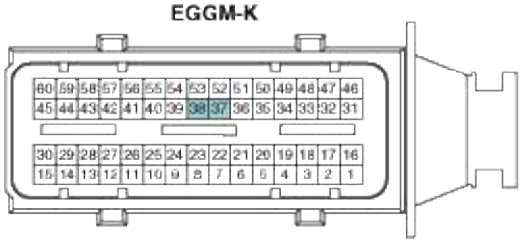
[Harness Connector]



EGG26
Knock Sensor



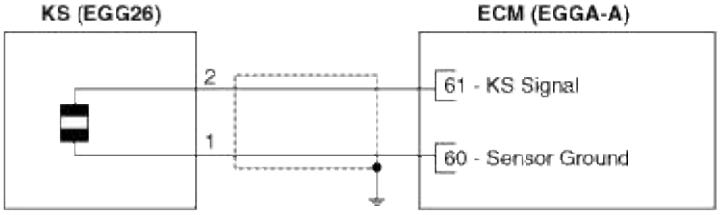
EGGM-K



EGGM-A
ECM

(A/T)

[Circuit Diagram]



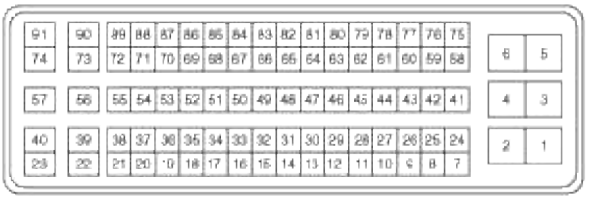
[Connection Information]

Terminal	Connected to	Function
1	ECM EGGA-A (60)	Sensor Ground
2	ECM EGGA-A (61)	KS Signal

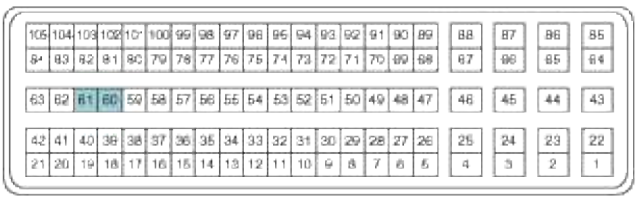
[Harness Connector]



EGG26
Knock Sensor



EGGA-K



EGGA-A

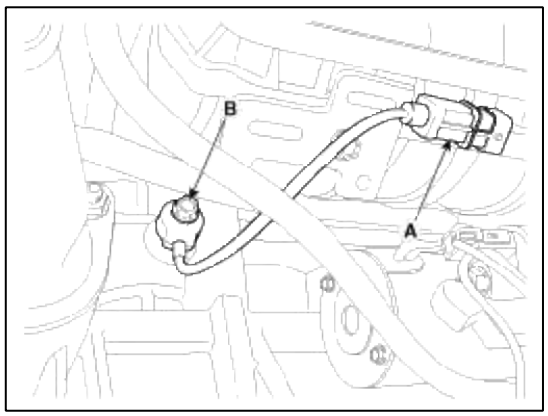
ECM

Fuel System > Engine Control System > Knock Sensor (KS) > Repair procedures

Removal

1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Remove the intake manifold (Refer to “Intake And Exhaust System” in EM group).

3. Disconnect the injector connector (A).
4. Remove the installation bolt (B), and then remove the sensor from the cylinder block.



Installation

CAUTION

- Install the component with the specified torques.
- Note that internal damage may occur when the component is dropped. If the component has been dropped, inspect before installing.

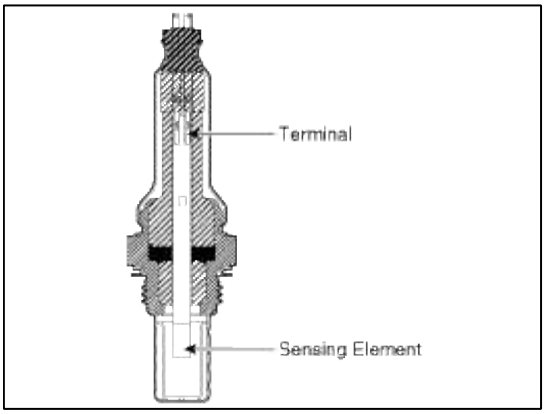
1. Installation is reverse of removal.

Knock sensor installation bolt:
18.6 ~ 24.5 N.m (1.9 ~ 2.5 kgf.m, 13.7 ~ 18.1 lb-ft)

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 both upstream and downstream of the Manifold Catalytic Converter. The sensor output voltage varies in accordance with the air/fuel ratio.
The sensor must be hot in order to operate normally. To keep it hot, the sensor has a heater which is controlled by the ECM via a duty cycle signal. When the exhaust gas temperature is lower than the specified value, the heater warms the sensor tip.



Fuel System > Engine Control System > Heated Oxygen Sensor (HO2S) > Specifications

Specification

HO2S [Bank 1/Sensor 1]

Item	Specification
Heater Resistance (Ω)	2.4 ~ 4.0 [20°C(68°F)]

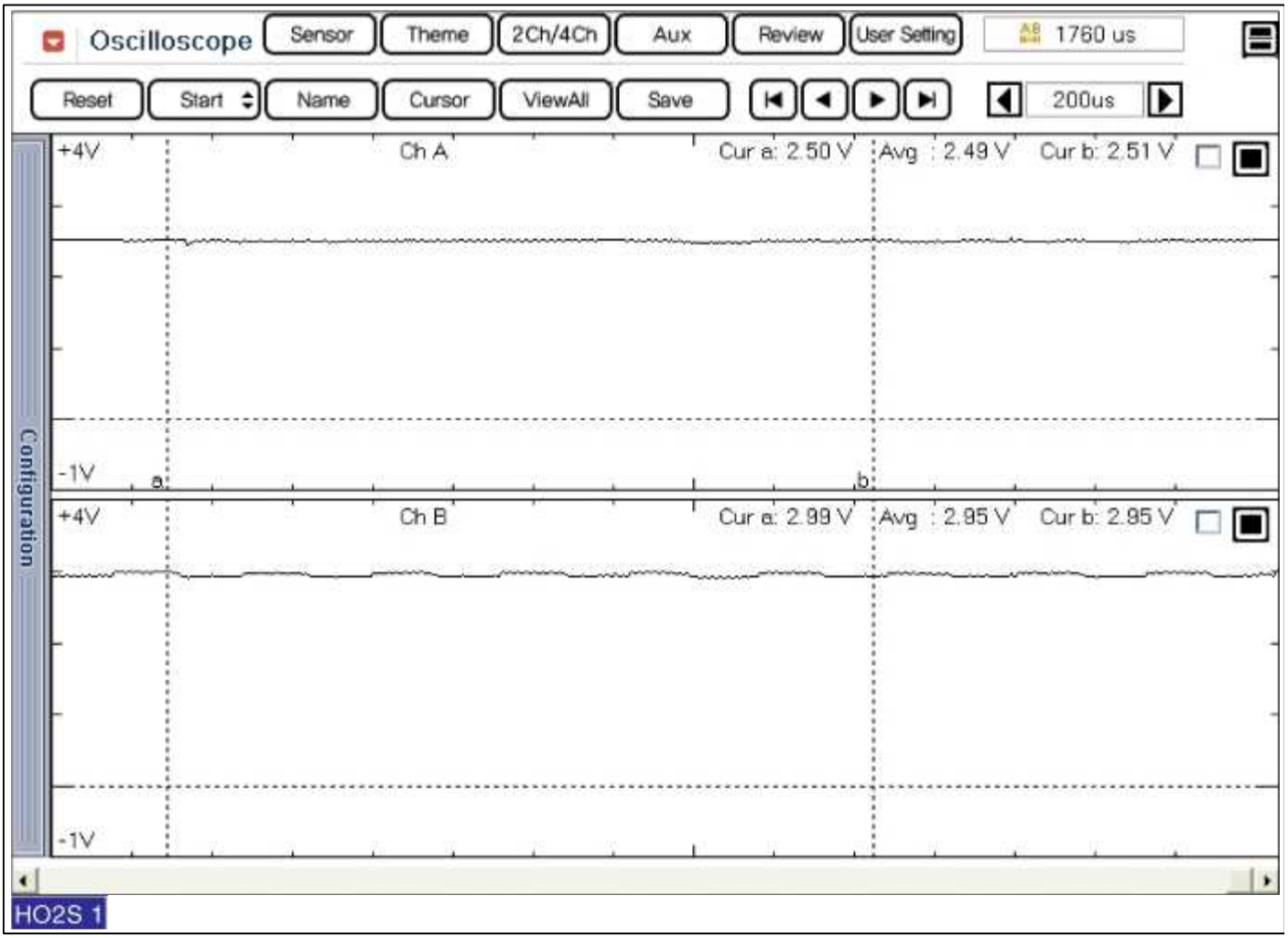
HO2S [Bank 1/Sensor 2]

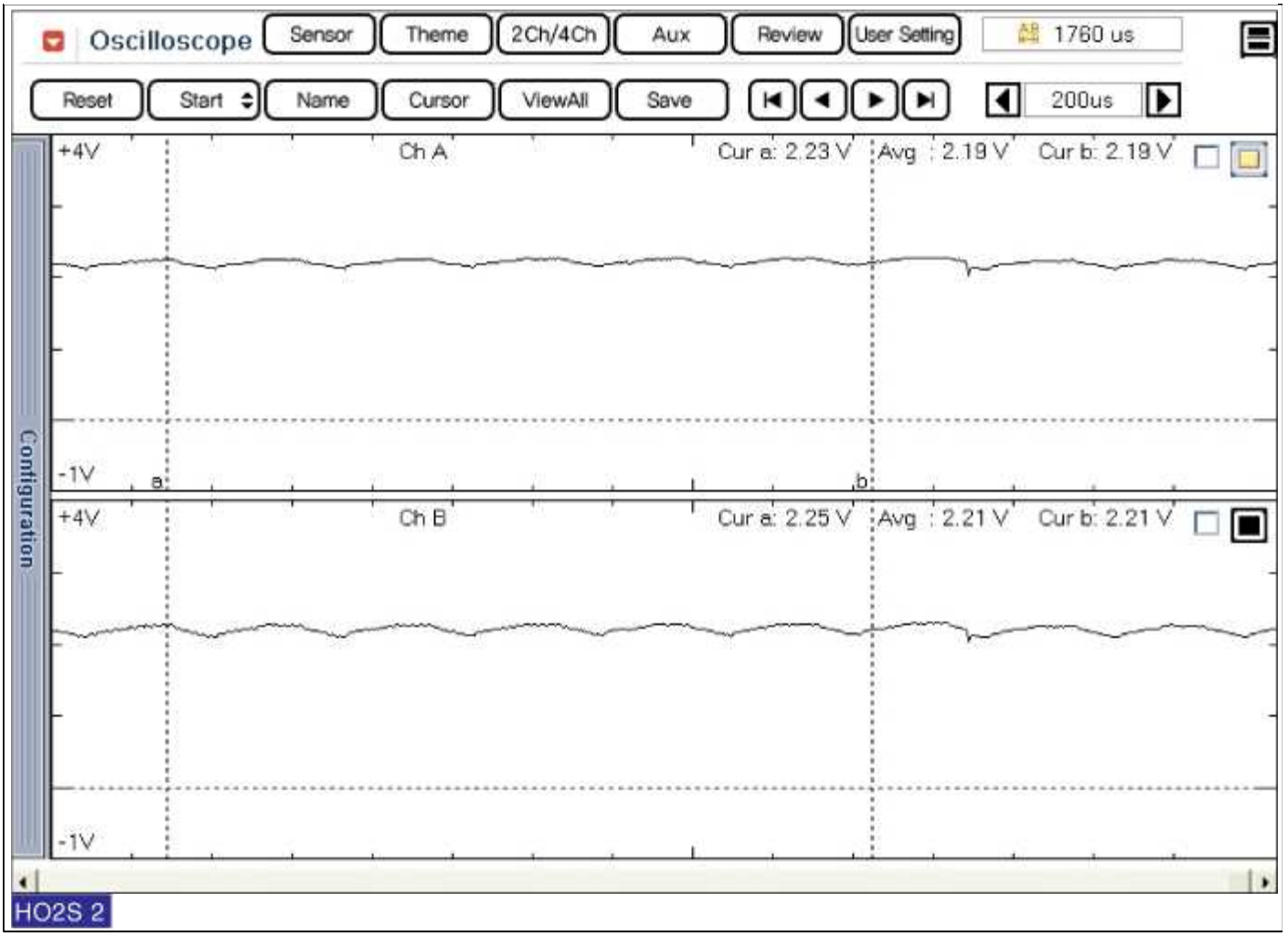
A/F Ratio (λ)	Output Voltage(V)
RICH	0.6 ~ 1.0
LEAN	0 ~ 0.4

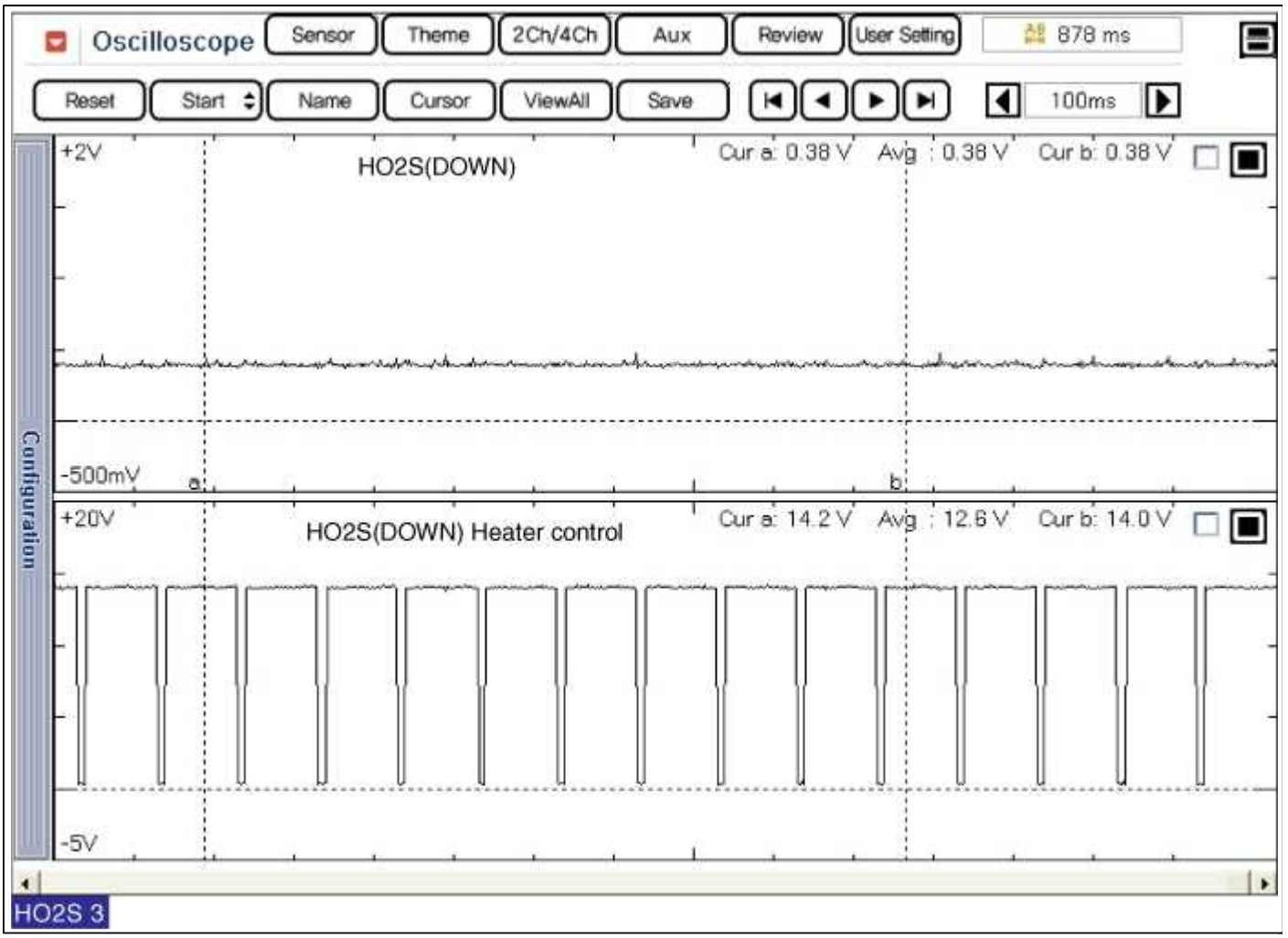
Item	Specification
Heater Resistance (Ω)	Approx. 9.0 [21°C(69.8°F)]

Fuel System > Engine Control System > Heated Oxygen Sensor (HO2S) > Troubleshooting

Signal Waveform




Oscilloscope
Sensor
Theme
2Ch/4Ch
Aux
Review
User Setting
1760 us
Reset
Start
Name
Cursor
ViewAll
Save
200us
Configuration
+4V
Ch A
Cur a: 2.23 V
Avg : 2.19 V
Cur b: 2.19 V
-1V
a
b
+4V
Ch B
Cur a: 2.25 V
Avg : 2.21 V
Cur b: 2.21 V
-1V
HO2S 2

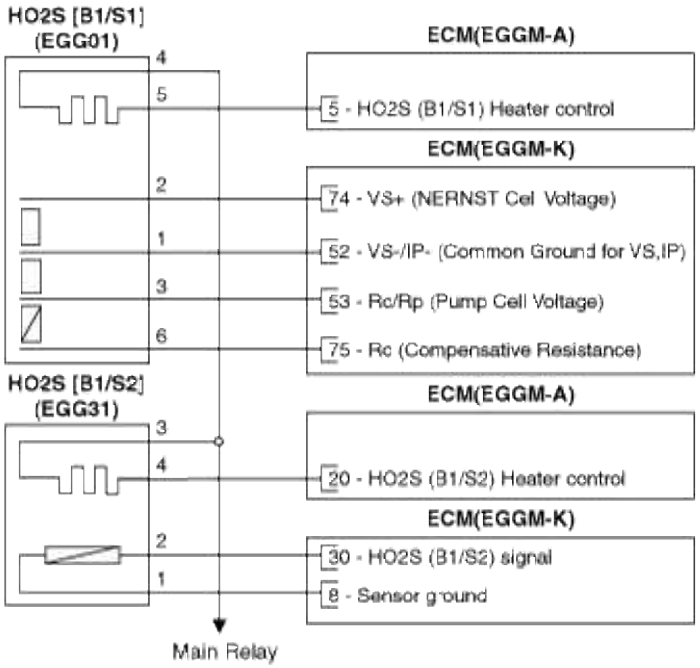

Oscilloscope
Sensor
Theme
2Ch/4Ch
Aux
Review
User Setting
878 ms
Reset
Start
Name
Cursor
ViewAll
Save
100ms
Configuration
+2V
HO2S(DOWN)
Cur a: 0.38 V
Avg : 0.38 V
Cur b: 0.38 V
-500mV
a
b
+20V
HO2S(DOWN) Heater control
Cur a: 14.2 V
Avg : 12.6 V
Cur b: 14.0 V
-5V
HO2S 3

Fuel System > Engine Control System > Heated Oxygen Sensor (HO2S) > Schematic Diagrams

Circuit Diagram

(M/T)

[Circuit Diagram]



[Connection Information]

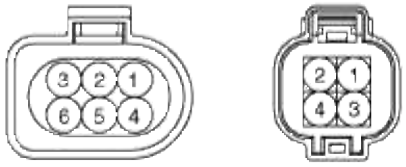
HO2S [B1/S1] (EGG01)

Terminal	Connected to	Function
1	ECM EGGM-K (52)	VS-/IP- (Common Ground for VS,IP)
2	ECM EGGM-K (74)	VS+ (NERNST Cell Voltage)
3	ECM EGGM-K (53)	Rc/Rp (Pump Cell Voltage)
4	Main Relay	Power Supply (B+)
5	ECM EGGM-A (5)	Heater control
6	ECM EGGM-K (75)	Rc (Compensative Resistance)

HO2S [B1/S2] (EGG31)

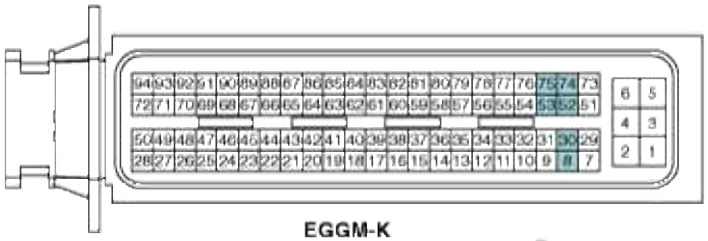
Terminal	Connected to	Function
1	ECM EGGM-K (8)	Sensor Ground
2	ECM EGGM-K (30)	HO2S (B1/S2) Signal
3	Main Relay	Power Supply (B+)
4	ECM EGGM-A (20)	Heater control

[Harness Connector]

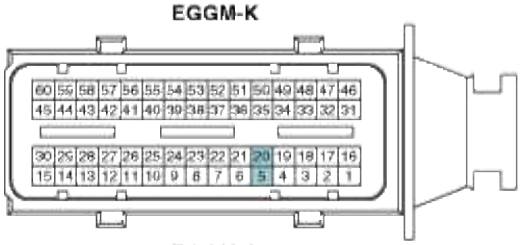


EGG01
HO2S [B1/S1]

EGG31
HO2S [B1/S2]



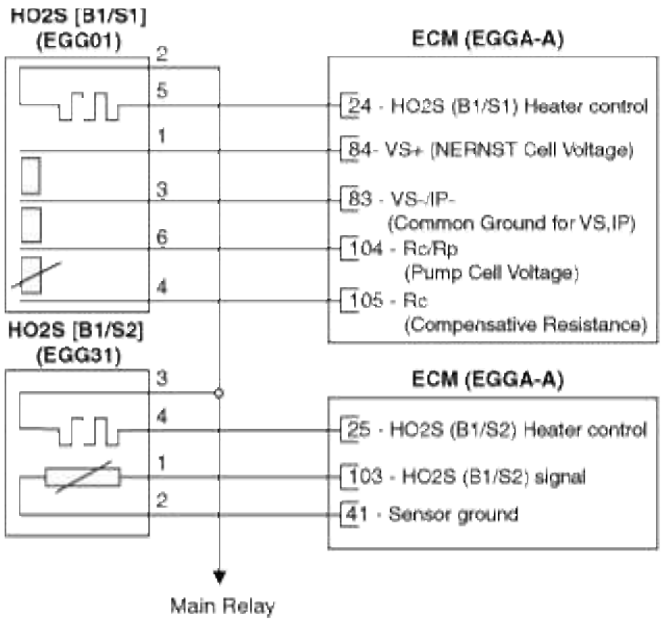
EGGM-K



EGGM-A
ECM

(A/T)

[Circuit Diagram]



[Connection Information]

HO2S [B1/S1](EGG01)

Terminal	Connected to	Function
1	ECM EGGA-A (84)	VS+ (NERNST Cell Voltage)
2	Main Relay	Power Supply (B+)
3	ECM EGGA-A (83)	VS-/IP- (Common Ground for VS,IP)
4	ECM EGGA-A (105)	Rc (Compensative Resistance)
5	ECM EGGA-A (24)	HO2S (B1/S1) Heater control
6	ECM EGGA-A (104)	Rc/Rp (Pump Cell Voltage)

HO2S [B1/S2] (EGG31)

Terminal	Connected to	Function
1	ECM EGGA-A (103)	HO2S (B1/S2) signal
2	ECM EGGA-A (41)	Sensor Ground
3	Main Relay	Power Supply (B+)
4	ECM EGGA-A (25)	HO2S (B1/S2) Heater control

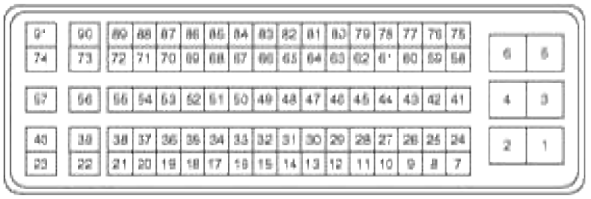
[Harness Connector]



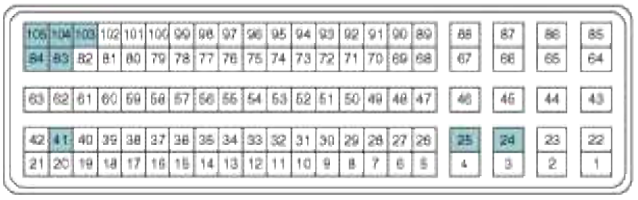
EGG01
HO2S [B1/S1]



EGG31
HO2S [B1/S2]



EGGA-K



EGGA-A
ECM

Fuel System > Engine Control System > Heated Oxygen Sensor (HO2S) > Repair procedures

Inspection

1. Turn the ignition switch OFF.
2. Disconnect the HO2S connector.
3. Measure resistance between the HO2S terminals 4 and 5 [B1/S1].
4. Measure resistance between the HO2S terminals 3 and 4 [B1/S2].
5. Check that the resistance is within the specification.

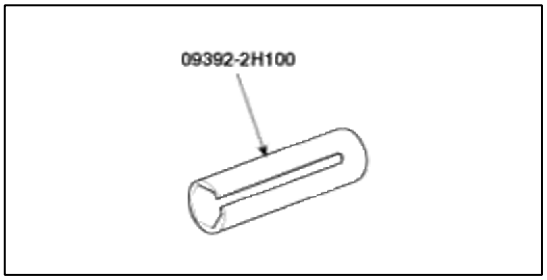
Specification: Refer to “Specification”

Removal

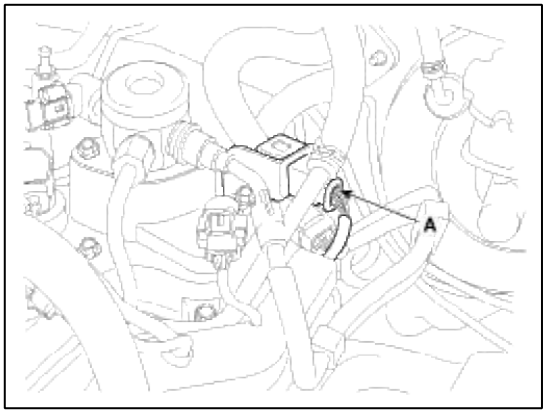
1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Disconnect the connector (A), and then remove the sensor (B).

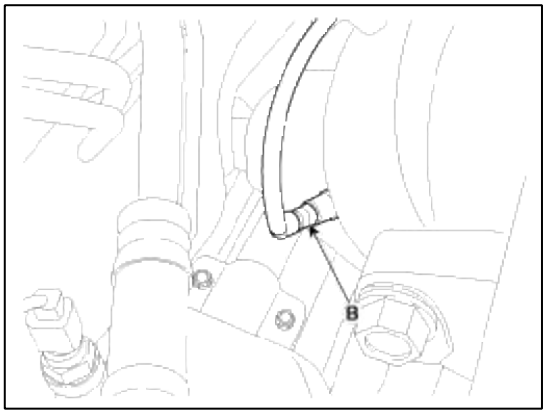
NOTE

Note that the SST (Part No.: 09392-2H100) is useful when removing the heated oxygen sensor.

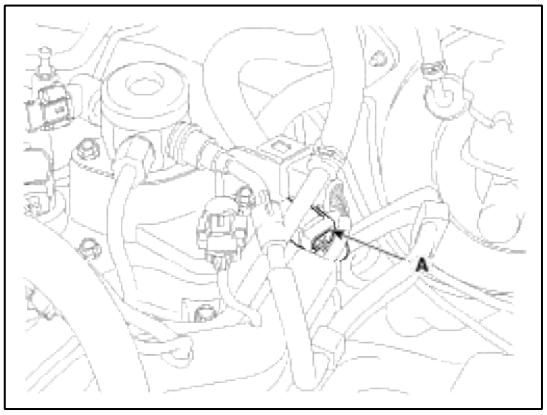


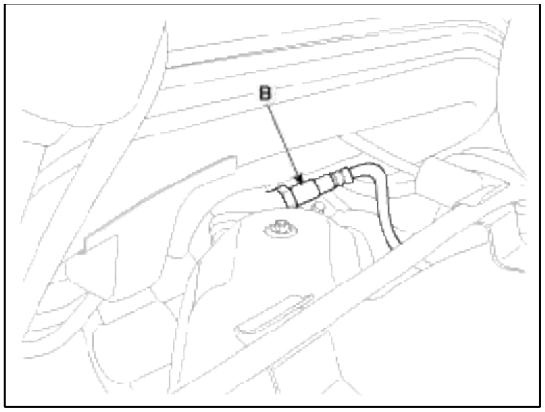
[Bank 1 / Sensor 1]





[Bank 1 / Sensor 2]





Installation

CAUTION

- Install the component with the specified torques.
- Note that internal damage may occur when the component is dropped. If the component has been dropped, inspect before installing.

CAUTION

- DON'T use a cleaner, spray, or grease to sensing element and connector of the sensor because oil component in them may malfunction the sensor performance.
- Sensor and its wiring may be damaged in case of contacting with the exhaust system (Exhaust Manifold, Catalytic Converter, and so on).

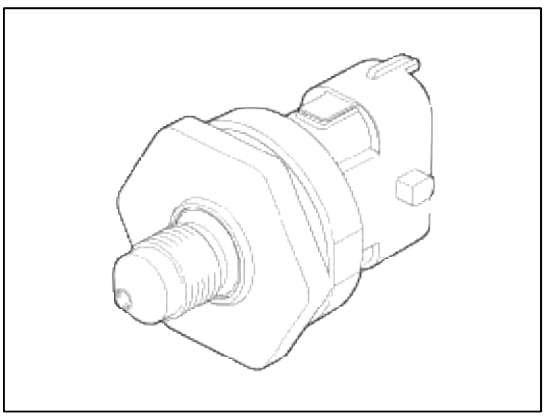
1. Installation is reverse of removal.

Heated oxygen sensor installation:
39.2 ~ 49.1 N.m (4.0 ~ 5.0 kgf.m, 28.9 ~ 36.2 lb-ft)

Fuel System > Engine Control System > Rail Pressure Sensor (RPS) > Description and Operation

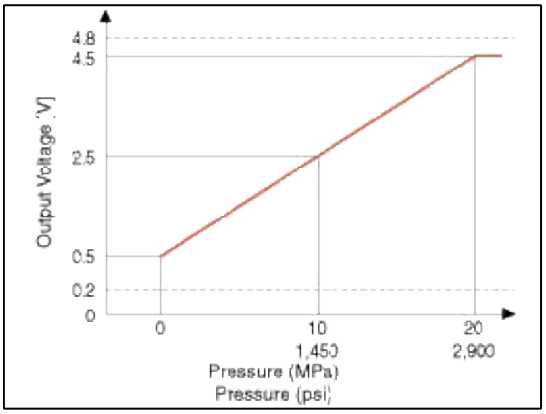
Description

Rail Pressure Sensor (RPS) is installed on the delivery pipe and measures the instantaneous fuel pressure in the delivery pipe. The sensing element (Semiconductor element) built in the sensor converts the pressure to voltage signal. By using this signal, the ECM can control correct injection amount and timing and adjusts the fuel pressure with the fuel pressure regulator valve if the target pressure and the actual pressure calculated by the RPS output signal are different.



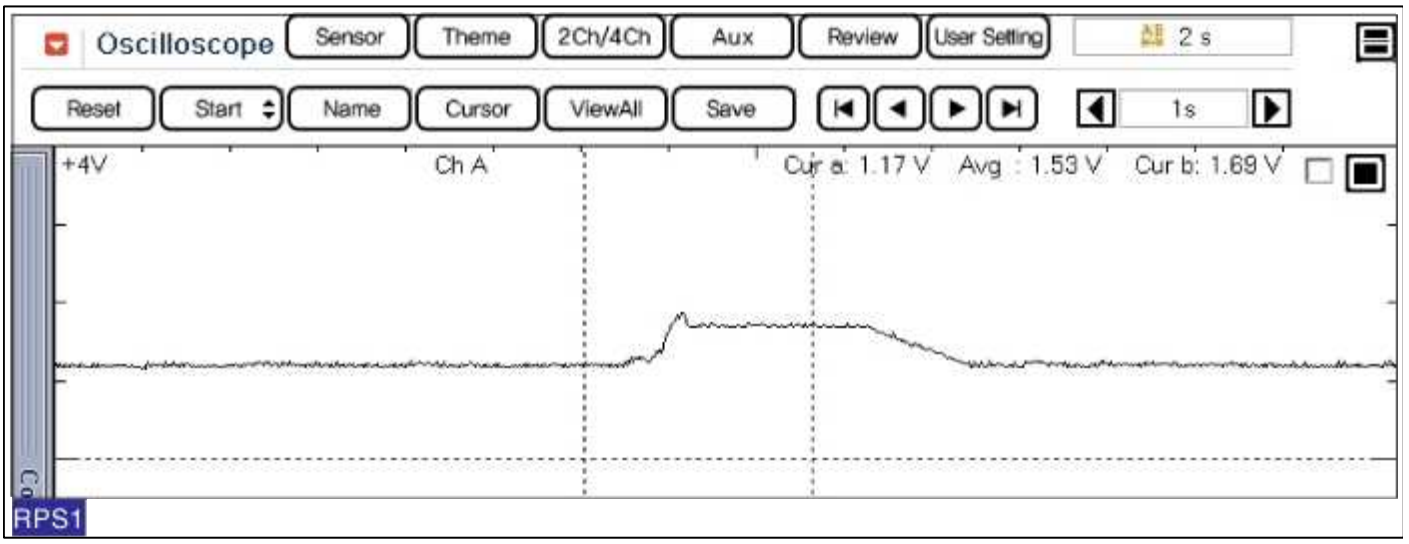
Fuel System > Engine Control System > Rail Pressure Sensor (RPS) > Specifications

Specification



Fuel System > Engine Control System > Rail Pressure Sensor (RPS) > Troubleshooting

Signal Waveform

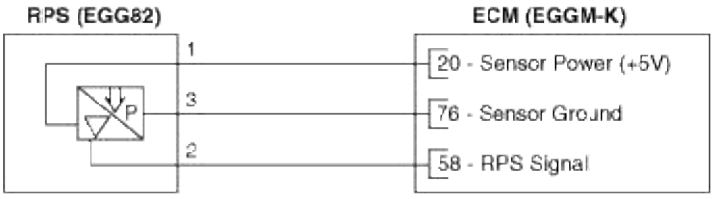


Fuel System > Engine Control System > Rail Pressure Sensor (RPS) > Schematic Diagrams

Circuit Diagram

(M/T)

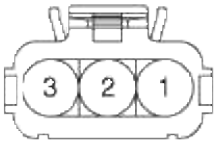
[Circuit Diagram]



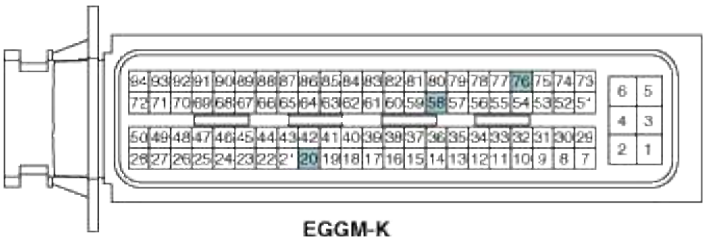
[Connection Information]

Terminal	Connected to	Function
1	ECM EGGM-K (20)	Sensor Power (+5V)
2	ECM EGGM-K (58)	RPS Signal
3	ECM EGGM-K (76)	Sensor Ground

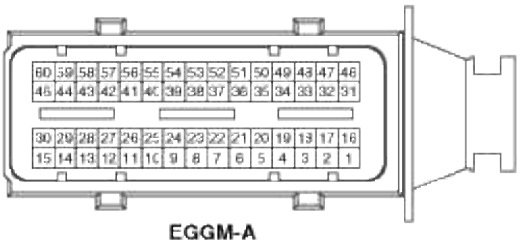
[Harness Connector]



EGG82
RPS



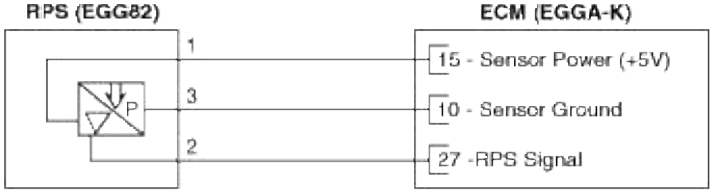
EGGM-K



EGGM-A
ECM

(A/T)

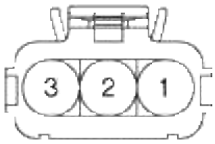
[Circuit Diagram]



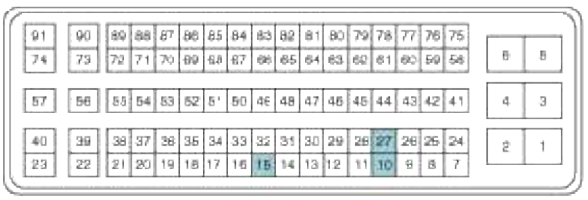
[Connection Information]

Terminal	Connected to	Function
1	ECM EGGA-K (15)	Sensor Power (+5V)
2	ECM EGGA-K (27)	RPS Signal
3	ECM EGGA-K (10)	Sensor Ground

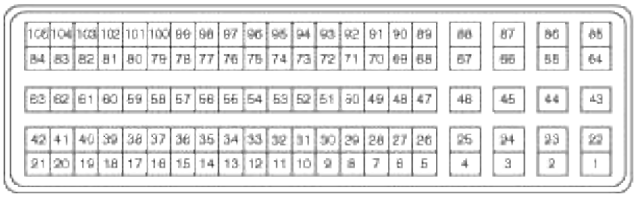
[Harness Connector]



EGG82
RPS



EGGA-K



EGGA-A
ECM

Fuel System > Engine Control System > Rail Pressure Sensor (RPS) > Repair procedures

Inspection

1. Connect the GDS on the Data Link Connector (DLC).

2. Measure the output voltage of the RPS at idle and various engine speed.

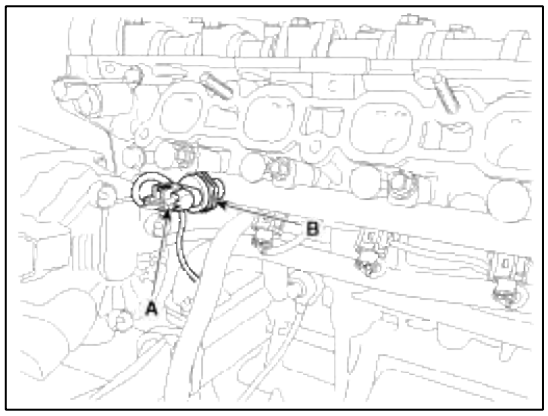
Condition	Output Voltage (V)
Idle	Approx. 1.2
1,500 rpm	2.2 ~ 2.5
6,300 rpm	Approx. 3.0

Removal

1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Release the residual pressure in fuel line (Refer to “Release Residual Pressure in Fuel Line” in this group).

> CAUTION
>
> When removing the fuel pump relay, a Diagnostic Trouble Code (DTC) may occur. Delete the code with the GDS after completion of “Release Residual Pressure in Fuel Line” work.

3. Remove the intake manifold (Refer to “Intake And Exhaust System” in EM group).
4. Disconnect the rail pressure sensor connector (A), and then remove the sensor (B) from the delivery pipe.



Installation

CAUTION

- Install the component with the specified torques.
- Note that internal damage may occur when the component is dropped. If the component has been dropped, inspect before installing.

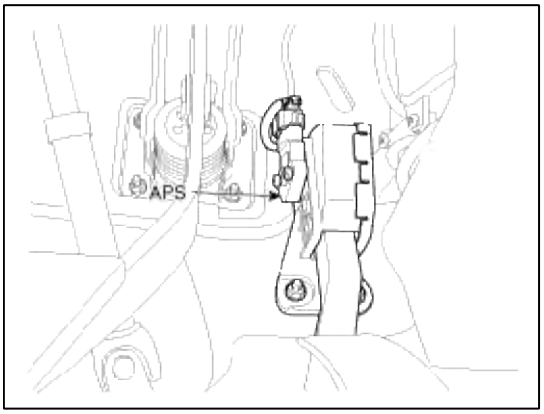
1. Installation is reverse of removal.

Rail Pressure Sensor Installation:
29.4 ~ 34.3 N.m (3.0 ~ 3.5 kgf.m, 21.7 ~ 25.3 lb-ft)

Fuel System > Engine Control System > Accelerator Position Sensor (APS) > Description and Operation

Description

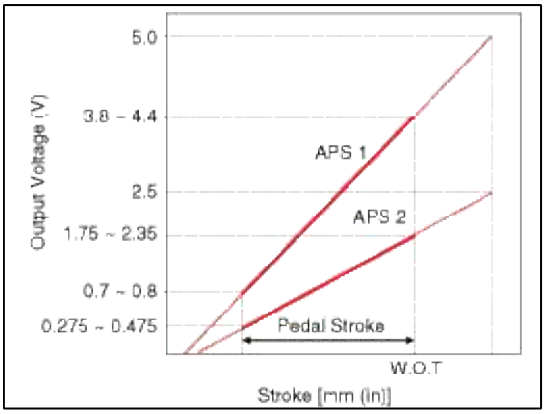
Accelerator Position Sensor (APS) is installed on the accelerator pedal module and detects the rotation angle of the accelerator pedal. The APS is one of the most important sensors in engine control system, so it consists of the two sensors which adapt individual sensor power and ground line. The second sensor monitors the first sensor and its output voltage is half of the first one. If the ratio of the sensor 1 and 2 is out of the range (approximately 1/2), the diagnostic system judges that it is abnormal.



Fuel System > Engine Control System > Accelerator Position Sensor (APS) > Specifications

Specification

Accelerator Position	Output Voltage (V)	
	APS1	APS2
C.T	0.7 ~ 0.8	0.275 ~ 0.475
W.O.T	3.8 ~ 4.4	1.75 ~ 2.35

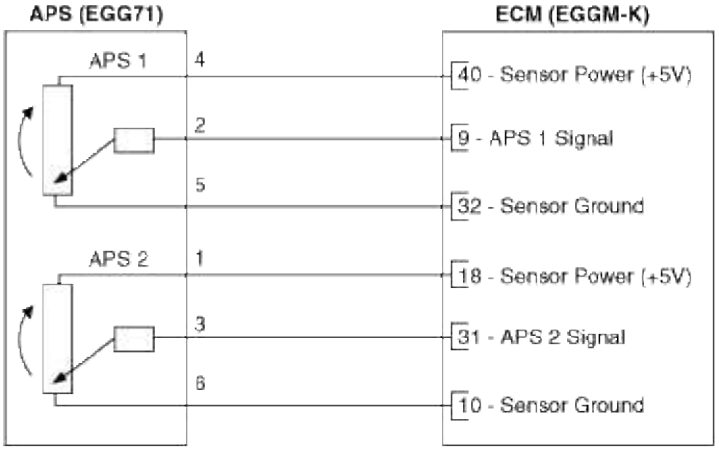


Fuel System > Engine Control System > Accelerator Position Sensor (APS) > Schematic Diagrams

Circuit Diagram

(M/T)

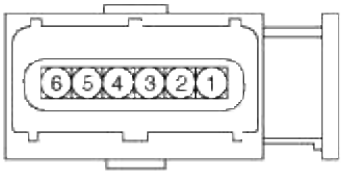
[Circuit Diagram]



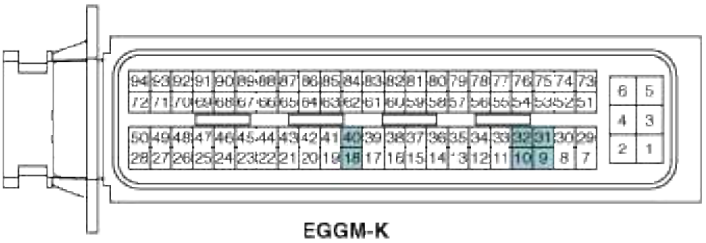
[Connection Information]

Terminal	Connected to	Function
1	ECM EGGM-K (18)	APS 2 Sensor Power (+5V)
2	ECM EGGM-K (9)	APS 1 Signal
3	ECM EGGM-K (31)	APS 2 Signal
4	ECM EGGM-K (40)	APS 1 Sensor Power (+5V)
5	ECM EGGM-K (32)	APS 1 Sensor Ground
6	ECM EGGM-K (10)	APS 2 Sensor Ground

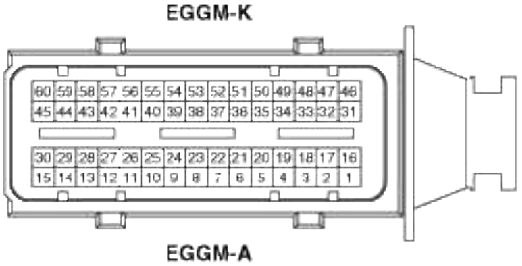
[Harness Connector]



EGG71
APS



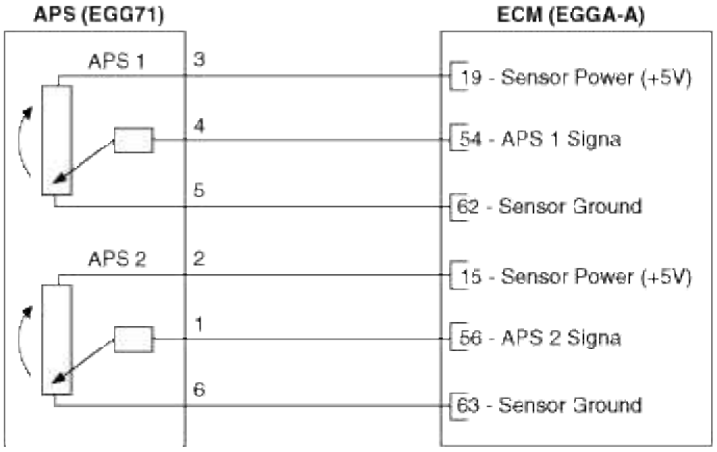
EGGM-K



EGGM-A
ECM

(A/T)

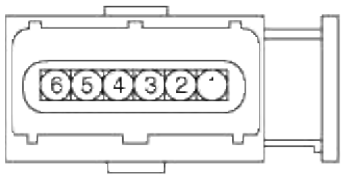
[Circuit Diagram]



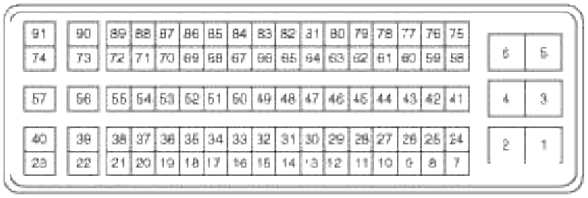
[Connection Information]

Terminal	Connected to	Function
1	ECM EGGA-A (56)	APS 2 Signal
2	ECM EGGA-A (15)	APS 2 Sensor Power (+5V)
3	ECM EGGA-A (19)	APS 1 Sensor Power (+5V)
4	ECM EGGA-A (54)	APS 1 Signal
5	ECM EGGA-A (62)	APS 1 Sensor Ground
6	ECM EGGA-A (63)	APS 2 Sensor Ground

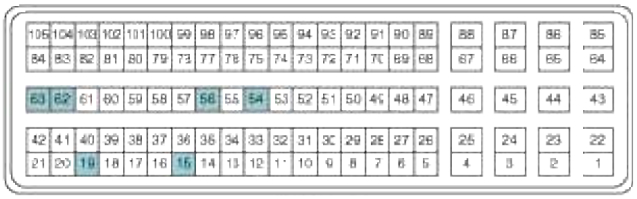
[Harness Connector]



EGG71
APS



EGGA-K



EGGA-A
ECM

Fuel System > Engine Control System > Accelerator Position Sensor (APS) > Repair procedures

Inspection

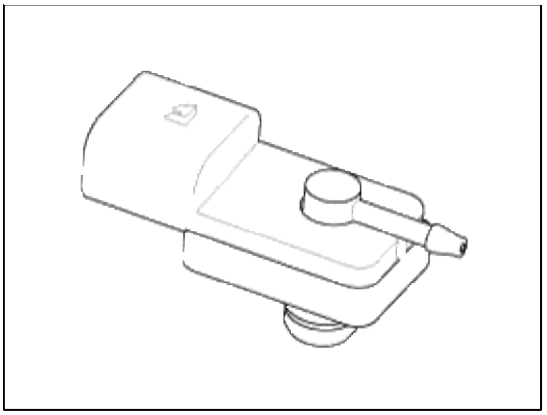
1. Connect the GDS on the Data Link Connector (DLC).
2. Turn the ignition switch ON.
3. Measure the output voltage of the APS 1 and 2 at C.T and W.O.T.

Specification: Refer to “Specification”

Fuel System > Engine Control System > Fuel Tank Pressure Sensor (FTPS) > Description and Operation

Description

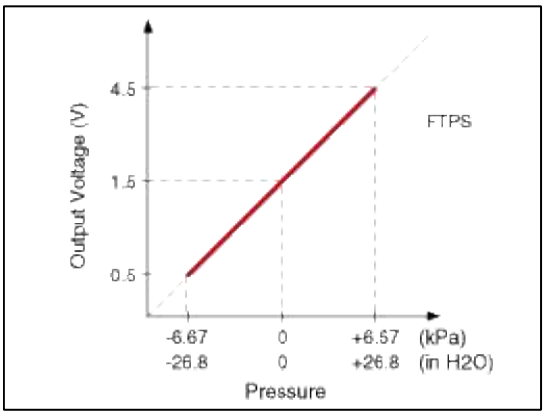
Fuel Tank Pressure Sensor (FTPS) is a component of the evaporative emission control system and is installed on the fuel tank, the fuel pump, or the canister. It checks the purge control solenoid valve operation and detects a leakage of the system.



Fuel System > Engine Control System > Fuel Tank Pressure Sensor (FTPS) > Specifications

Specification

Pressure [kPa (kgf/cm², in H2O)	Output Voltage (V)
-6.67 (-0.068, -26.8)	0.5
0	2.5
+6.67 (0.068, 26.8)	4.5

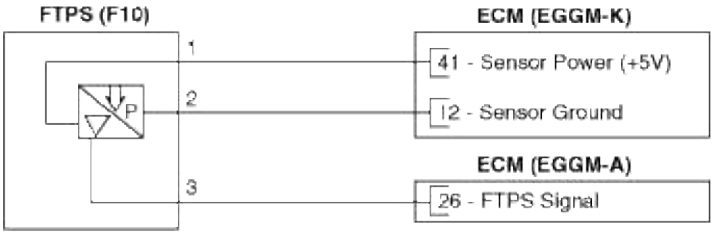


Fuel System > Engine Control System > Fuel Tank Pressure Sensor (FTPS) > Schematic Diagrams

Circuit Diagram

(M/T)

[Circuit Diagram]



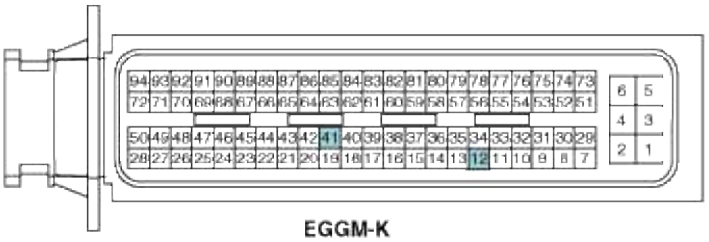
[Connection Information]

Terminal	Connected to	Function
1	ECM EGGM-K (41)	Sensor Power (+5V)
2	ECM EGGM-K (12)	Sensor Ground
3	ECM EGGM-A (26)	FTPS Signal

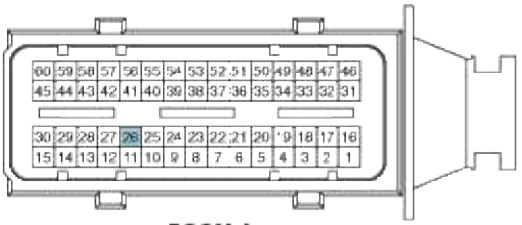
[Harness Connector]



F10
FTPS



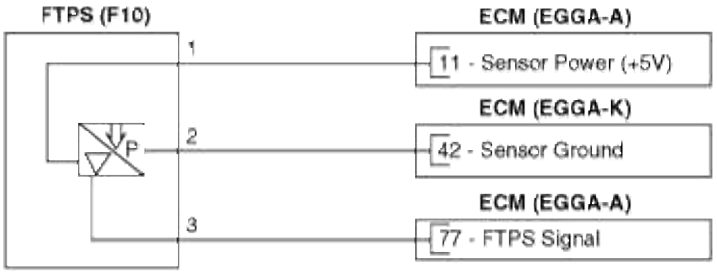
EGGM-K



EGGM-A
ECM

(A/T)

[Circuit Diagram]



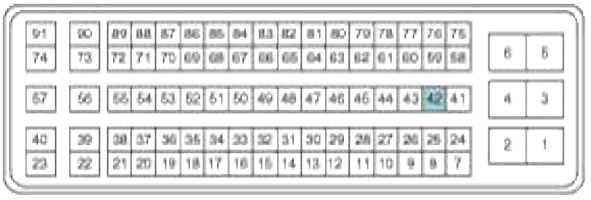
[Connection Information]

Terminal	Connected to	Function
1	ECM EGGA-A (11)	Sensor Power (+5V)
2	ECM EGGA-K (42)	Sensor Ground
3	ECM EGGA-A (77)	FTPS Signal

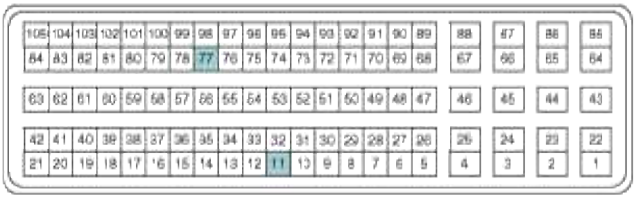
[Harness Connector]



F10
FTPS



EGGA-K



EGGA-A
ECM

Fuel System > Engine Control System > Fuel Tank Pressure Sensor (FTPS) > Repair procedures

Inspection

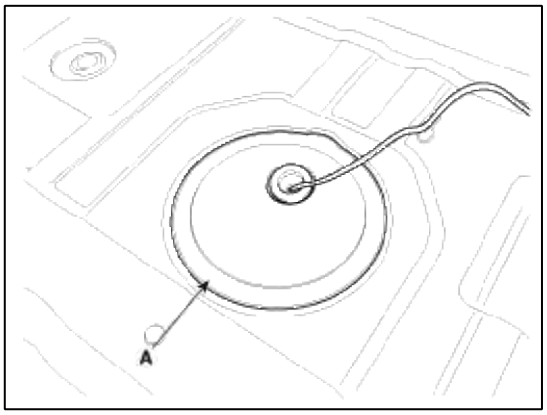
1. Connect the GDS on the Data Link Connector (DLC).

2. Measure the output voltage of the FTPS.

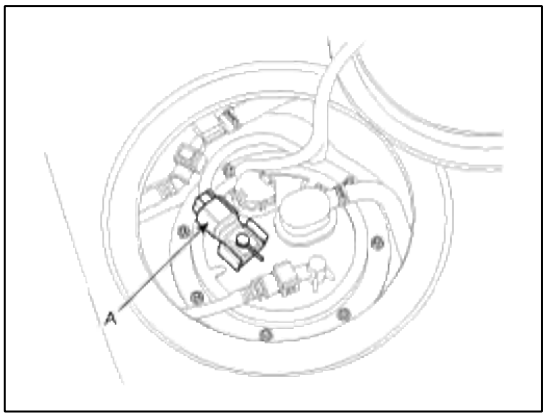
Specification: Refer to "Specification"

Removal

1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Remove the rear seat (Refer to "Seat" in BD group).
3. Remove the fuel pump service cover (A).



4. Disconnect the fuel tank pressure sensor connector.
5. Remove the fuel tank pressure sensor (A) after releasing the hooks vertically.



Installation

CAUTION

- Install the component with the specified torques.
- Note that internal damage may occur when the component is dropped. In this case, use it after inspecting.

CAUTION

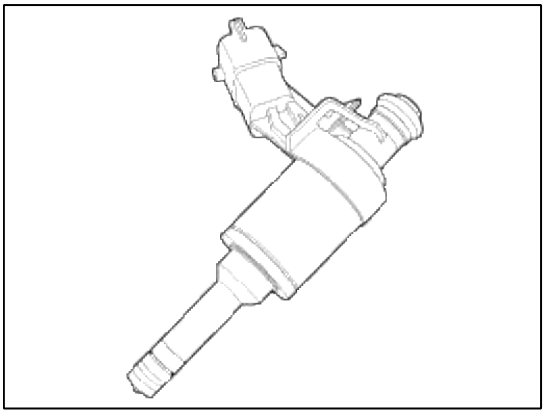
- Insert the sensor in the installation hole and be careful not to damage when installation.

1. Installation is reverse of removal.

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, and then settle at system voltage.



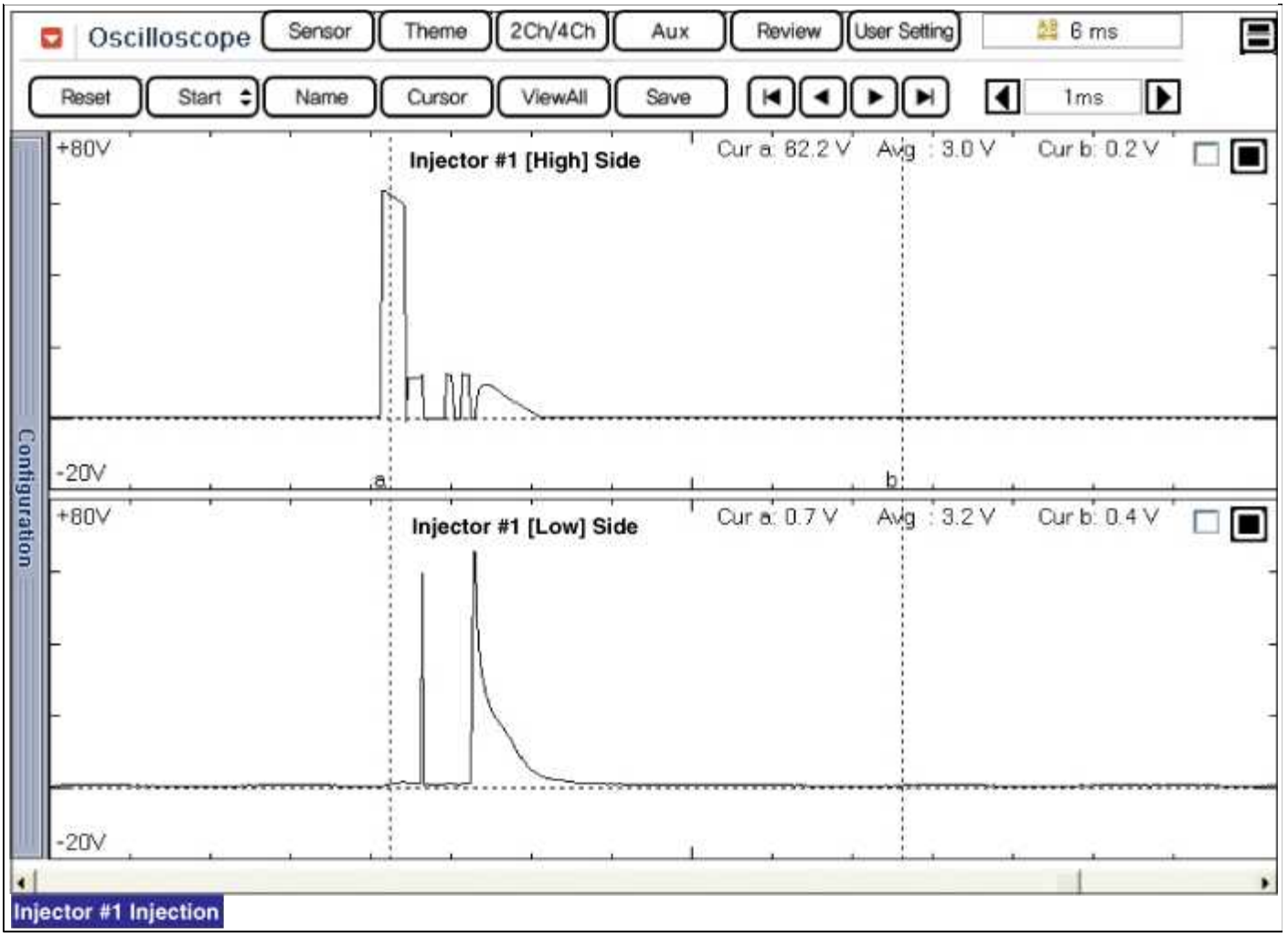
Fuel System > Engine Control System > Injector > Specifications

Specification

Item	Specification
Coil Resistance (Ω)	1.5 [20°C(68°F)]

Fuel System > Engine Control System > Injector > Troubleshooting

Signal Waveform

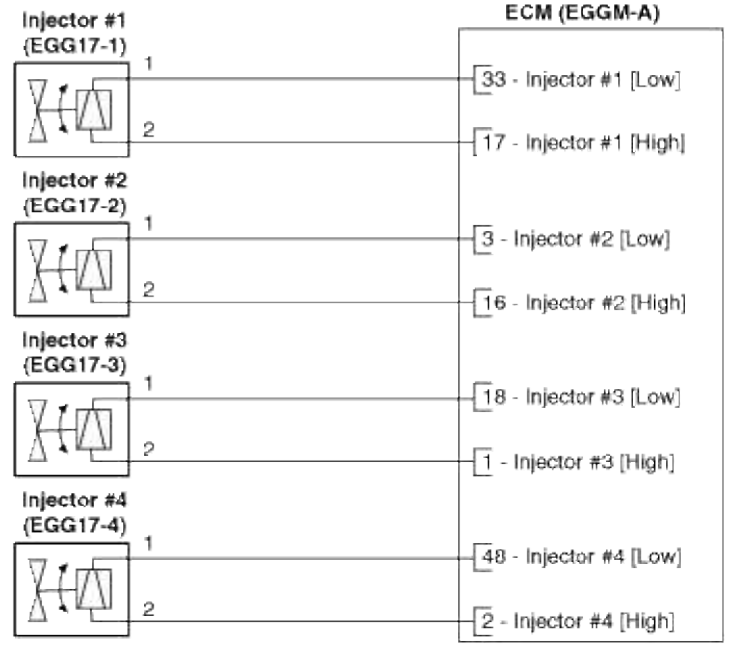


Fuel System > Engine Control System > Injector > Schematic Diagrams

Circuit Diagram

(M/T)

[Circuit Diagram]



[Connection Information]

Injector #1 (EGG17-1)

Terminal	Connected to	Function
1	ECM EGGM-A (33)	Injector #1 [Low] Control
2	ECM EGGM-A (17)	Injector #1 [High] Control

Injector #2 (EGG17-2)

Terminal	Connected to	Function
1	ECM EGGM-A (3)	Injector #2 [Low] Control
2	ECM EGGM-A (16)	Injector #2 [High] Control

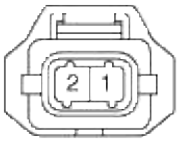
Injector #3 (EGG17-3)

Terminal	Connected to	Function
1	ECM EGGM-A (18)	Injector #3 [Low] Control
2	ECM EGGM-A (1)	Injector #3 [High] Control

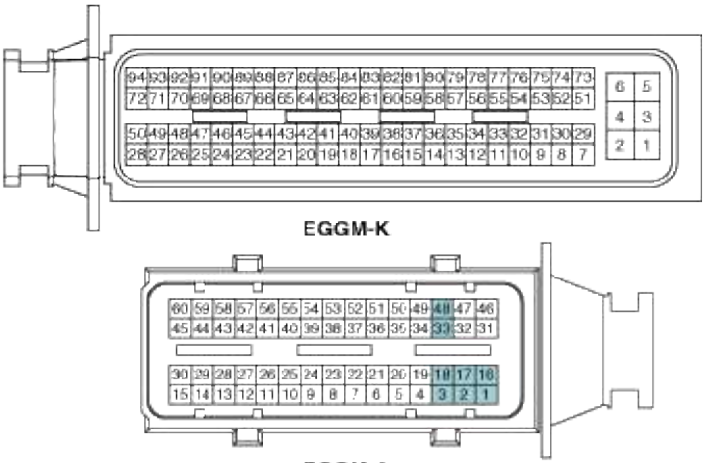
Injector #4 (EGG17-4)

Terminal	Connected to	Function
1	ECM EGGM-A (48)	Injector #4 [Low] Control
2	ECM EGGM-A (2)	Injector #4 [High] Control

[Harness Connector]



EGG17-1,2,3,4
Injector #1,2,3,4

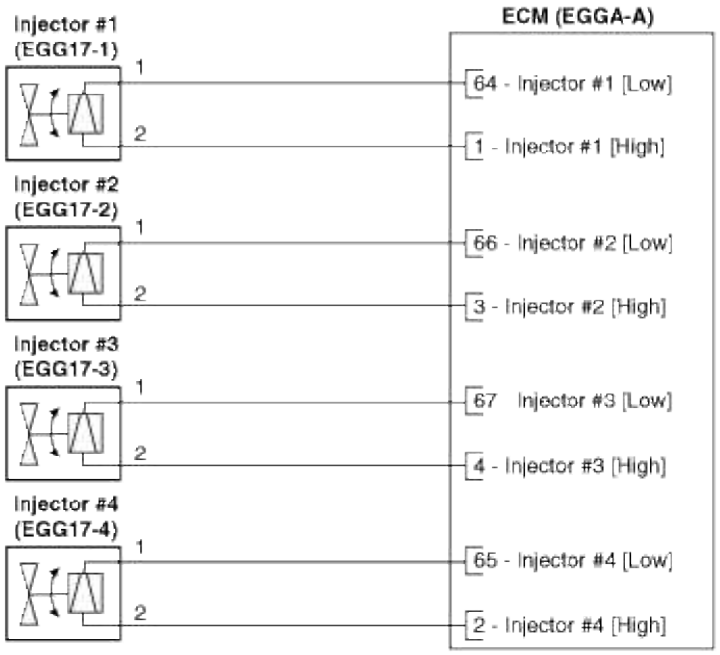


EGGM-K

EGGM-A
ECM

(A/T)

[Circuit Diagram]



[Connection Information]

Injector #1 (EGG17-1)

Terminal	Connected to	Function
1	ECM EGGA-A (64)	Injector #1 [Low] Control
2	ECM EGGA-A (1)	Injector #1 [High] Control

Injector #2 (EGG17-2)

Terminal	Connected to	Function
1	ECM EGGA-A (66)	Injector #2 [Low] Control
2	ECM EGGA-A (3)	Injector #2 [High] Control

Injector #3 (EGG17-3)

Terminal	Connected to	Function
1	ECM EGGA-A (67)	Injector #3 [Low] Control
2	ECM EGGA-A (4)	Injector #3 [High] Control

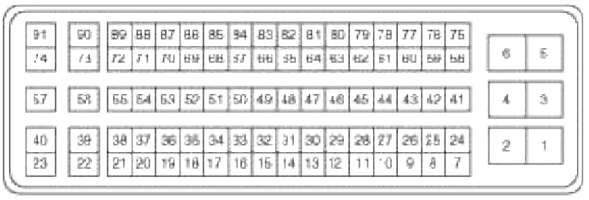
Injector #4 (EGG17-4)

Terminal	Connected to	Function
1	ECM EGGA-A (65)	Injector #4 [Low] Control
2	ECM EGGA-A (2)	Injector #4 [High] Control

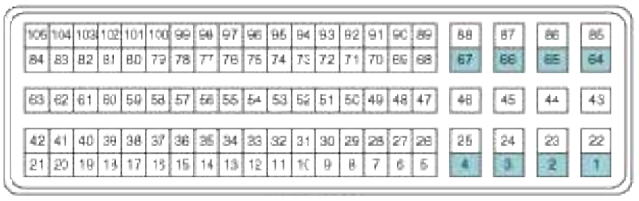
[Harness Connector]



EGG17-1,2,3,4
Injector #1,2,3,4



EGGA-K



EGGA-A
ECM

Fuel System > Engine Control System > Injector > Repair procedures

Inspection

1. Turn the ignition switch OFF.
2. Disconnect the injector connector.
3. Measure resistance between the injector terminals 1 and 2.
4. Check that the resistance is within the specification.

Specification: Refer to “Specification”

Removal

WARNING

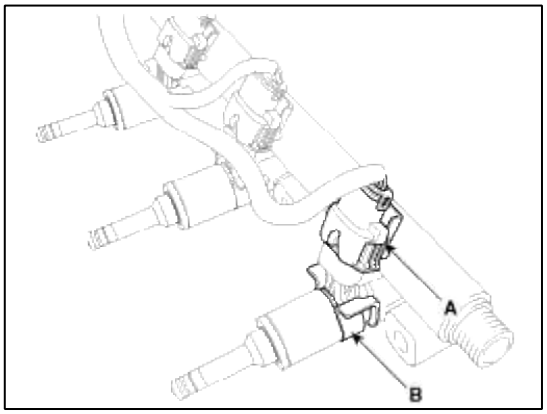
In case of removing the high pressure fuel pump, high pressure fuel pipe, delivery pipe, and injector, there may be injury caused by leakage of the high pressure fuel. Before repairing the high pressure system, be sure to release the residual pressure in fuel line as step 2 in below procedure.

1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Release the residual pressure in fuel line (Refer to “Release Residual Pressure in Fuel Line” in this group).

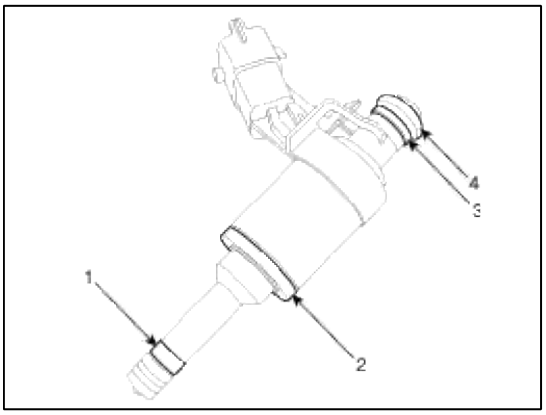
CAUTION

When removing the fuel pump relay, a Diagnostic Trouble Code (DTC) may occur. Delete the code with the GDS after completion of “Release Residual Pressure in Fuel Line” work.

3. Remove the delivery pipe & injector assembly (Refer to "Delivery Pipe" in this group).
4. Remove the connector (A) and the fixing clip (B), and then separate the injector from the delivery pipe.



Installation



1. Combustion seal
2. Rubber washer
3. Support disc
4. O-ring

CAUTION

- Do not reuse the used injector fixing clip.

CAUTION

- Install the component with the specified torques.
- Note that internal damage may occur when the component is dropped. If the component has been dropped, inspect before installing.

CAUTION

- Apply engine oil to the injector O-ring.
- Do not reuse the used injector O-ring.

CAUTION

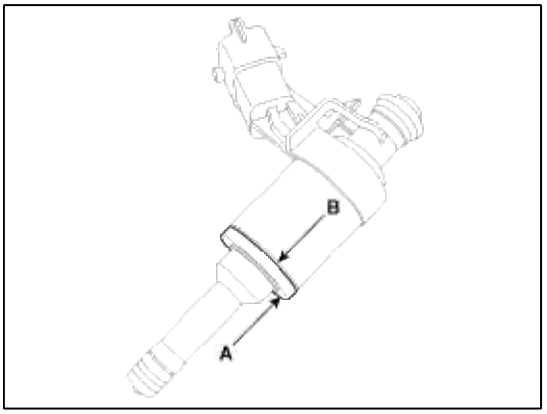
- Do not reuse the used bolt.

CAUTION

- When inserting the injector, be careful not to damage the injector tip.

CAUTION

- Do not reuse the support disc.
- Do not reuse the injector rubber washer.
- When replacing the rubber washer, the steal plate (A) part should be faced the cylinder installation part and the rubber plate (B) part should be faced the injector body part.



CAUTION

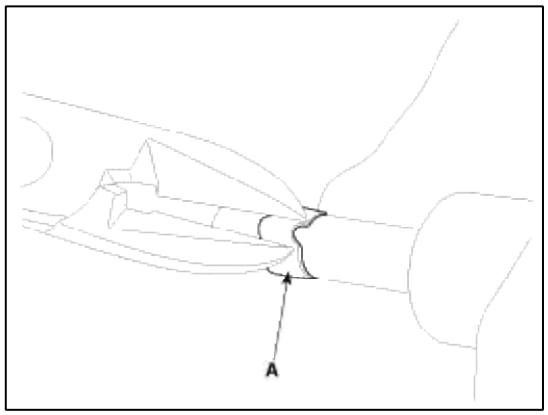
- Do not reuse the combustion seal.

1. Installation is reverse of removal.

Replacement

The injector combustion seal should be replaced new one to prevent leakage after removing the injector.

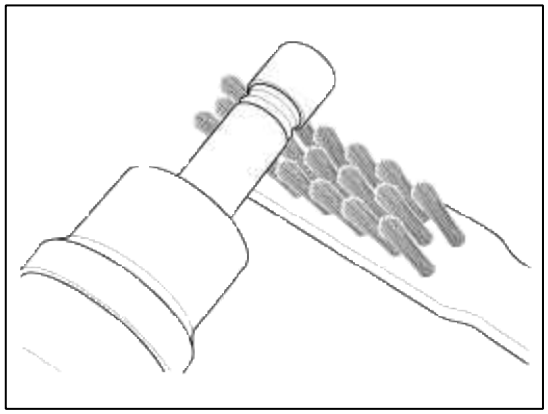
1. Remove the combustion seal (A) with a wire cutter.



CAUTION

Grip the sealing ring carefully, pull it to form a small loop and then cut it.
Be careful not to damage the surface of the valve sleeve with the wire cutter.

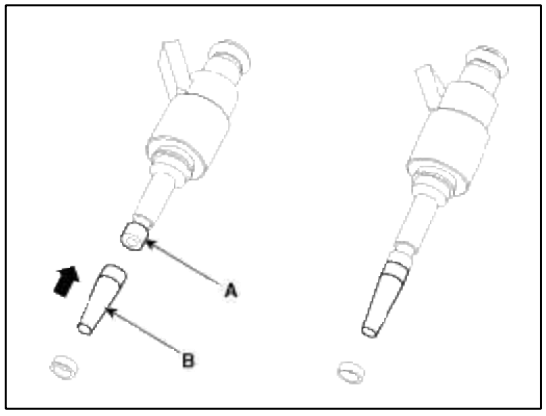
2. Before the assembly of the sealing ring the groove must be cleaned using a clean cloth.
   Any coking of the injector sealing surface must be carefully removed with a brass-wire brush.

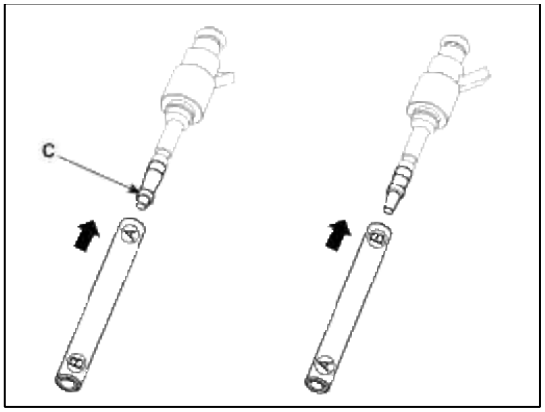


CAUTION

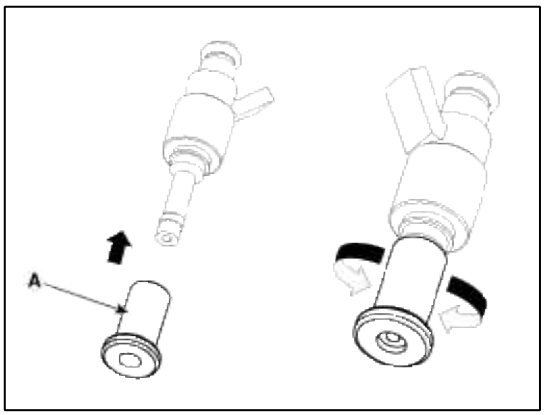
The surfaces of the new sealing ring must be clean and free of grease.

3. Place the seal installing guide (B) (SST No.: 09353-2B000) on the tip of the injector not to damage the injector tip (A).
   Push the sealing ring (C) with thumb and index finger over the conical assembly tool until it snaps into the groove.
   The complete assembly must not take longer than 2 to 3 seconds.





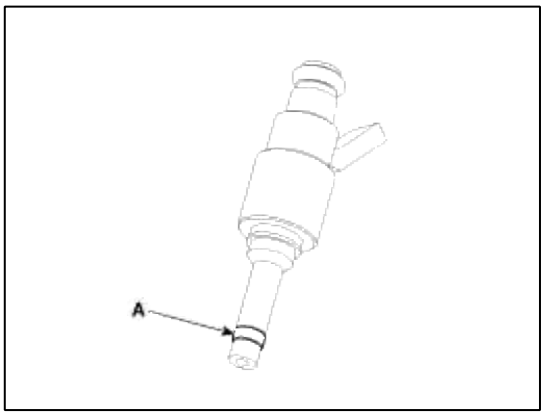
4. To size the sealing ring the injector is first introduced into the sizing tool (A) (SST No.: 09353-2B000) and then pressed and at the same time rotated 180° into the sizing tool.



5. Pull the injector out of the sizing tool by turning it in the reverse direction to that used for the press-in process.

> CAUTION
>
> Check that the seal ring has not been damaged during assembly to the injector and that no circumferential scratches are present.
> Do not reuse the combustion seal.
> The seal must be completely free of grease and oil.

6. Check the combustion seal (A) installation.

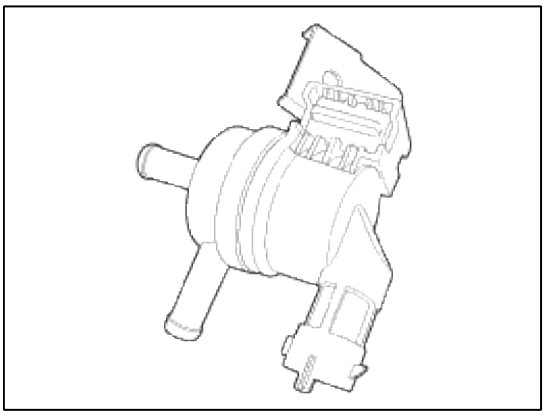


Fuel System > Engine Control System > Purge Control Solenoid Valve (PCSV) > Description and Operation

Description

Purge Control Solenoid Valve (PCSV) is installed on the surge tank and controls the passage between the canister and the intake manifold. It is a solenoid valve and is open when the ECM grounds the valve control line. When the

passage is open (PCSV ON), fuel vapor stored in the canister is transferred to the intake manifold.



Fuel System > Engine Control System > Purge Control Solenoid Valve (PCSV) > Specifications

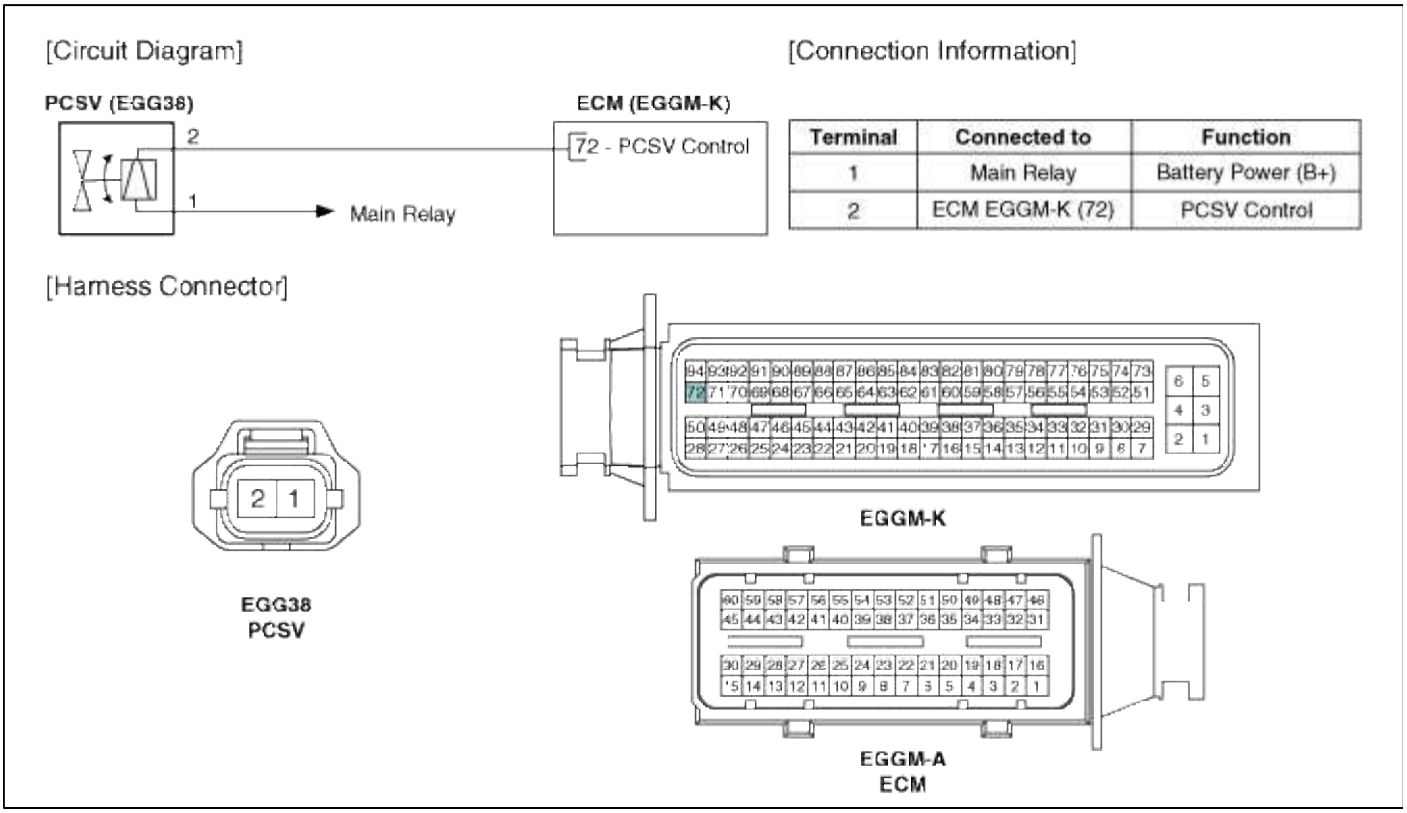
Specification

Item	Specification
Coil Resistance (Ω)	22.0 ~ 26.0 [20°C(68°F)]

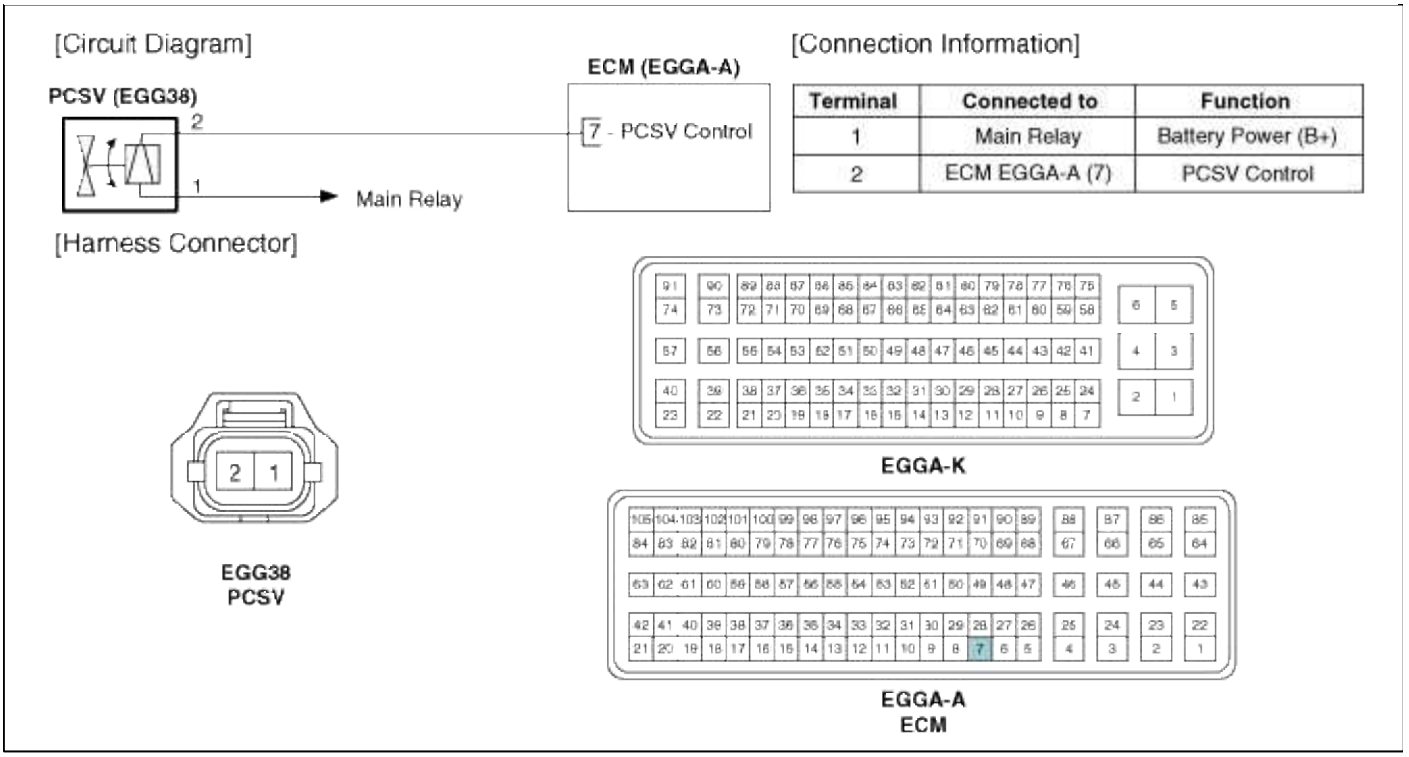
Fuel System > Engine Control System > Purge Control Solenoid Valve (PCSV) > Schematic Diagrams

Circuit Diagram

(M/T)



(A/T)



[Connection Information]

Terminal	Connected to	Function
1	Main Relay	Battery Power (B+)
2	ECM EGGA-A (7)	PCSV Control

Fuel System > Engine Control System > Purge Control Solenoid Valve (PCSV) > Repair procedures

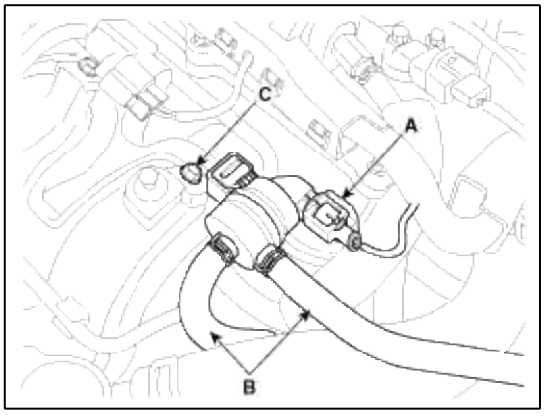
Inspection

1. Turn the ignition switch OFF.
2. Disconnect the PCSV connector.
3. Measure resistance between the PCSV terminals 1 and 2.
4. Check that the resistance is within the specification.

Specification: Refer to “Specification”

Removal

1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Disconnect the purge control solenoid valve connector (A).
3. Disconnect the vapor hoses (B) from the purge control solenoid valve.
4. Remove the valve after removing the bolt (C).



Installation

CAUTION

- Install the component with the specified torques.
- Note that internal damage may occur when the component is dropped. If the component has been dropped, inspect before installing.

CAUTION

- Use care to keep foreign material out of the valve.

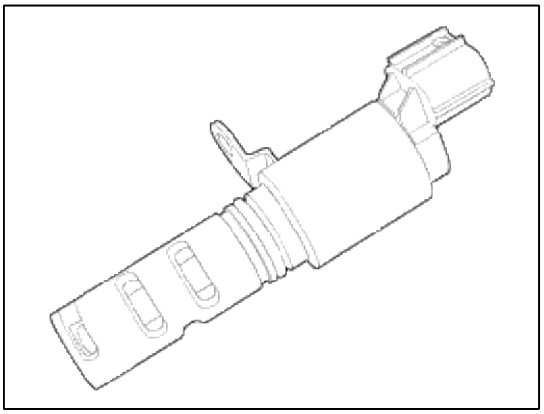
1. Installation is reverse of removal.

Purge control solenoid valve bracket installation bolt: 9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)

Fuel System > Engine Control System > CVVT Oil Control Valve (OCV) > Description and Operation

Description

Continuous Variable Valve Timing (CVVT) system advances or retards the valve timing of the intake and exhaust valve in accordance with the ECM control signal which is calculated by the engine speed and load.
By controlling CVVT, the valve over-lap or under-lap occurs, which makes better fuel economy and reduces exhaust gases (NOx, HC) and improves engine performance through reduction of pumping loss, internal EGR effect, improvement of combustion stability, improvement of volumetric efficiency, and increase of expansion work.
This system consist of
-the CVVT Oil Control Valve (OCV) which supplies the engine oil to the cam phaser or cuts the engine oil from the cam phaser in accordance with the ECM PWM (Pulse With Modulation) control signal,
- the CVVT Oil Temperature Sensor (OTS) which measures the engine oil temperature,
-and the Cam Phaser which varies the cam phase by using the hydraulic force of the engine oil.
The engine oil getting out of the CVVT oil control valve varies the cam phase in the direction (Intake Advance/Exhaust Retard) or opposite direction (Intake Retard/Exhaust Advance) of the engine rotation by rotating the rotor connected with the camshaft inside the cam phaser.



Fuel System > Engine Control System > CVVT Oil Control Valve (OCV) > Specifications

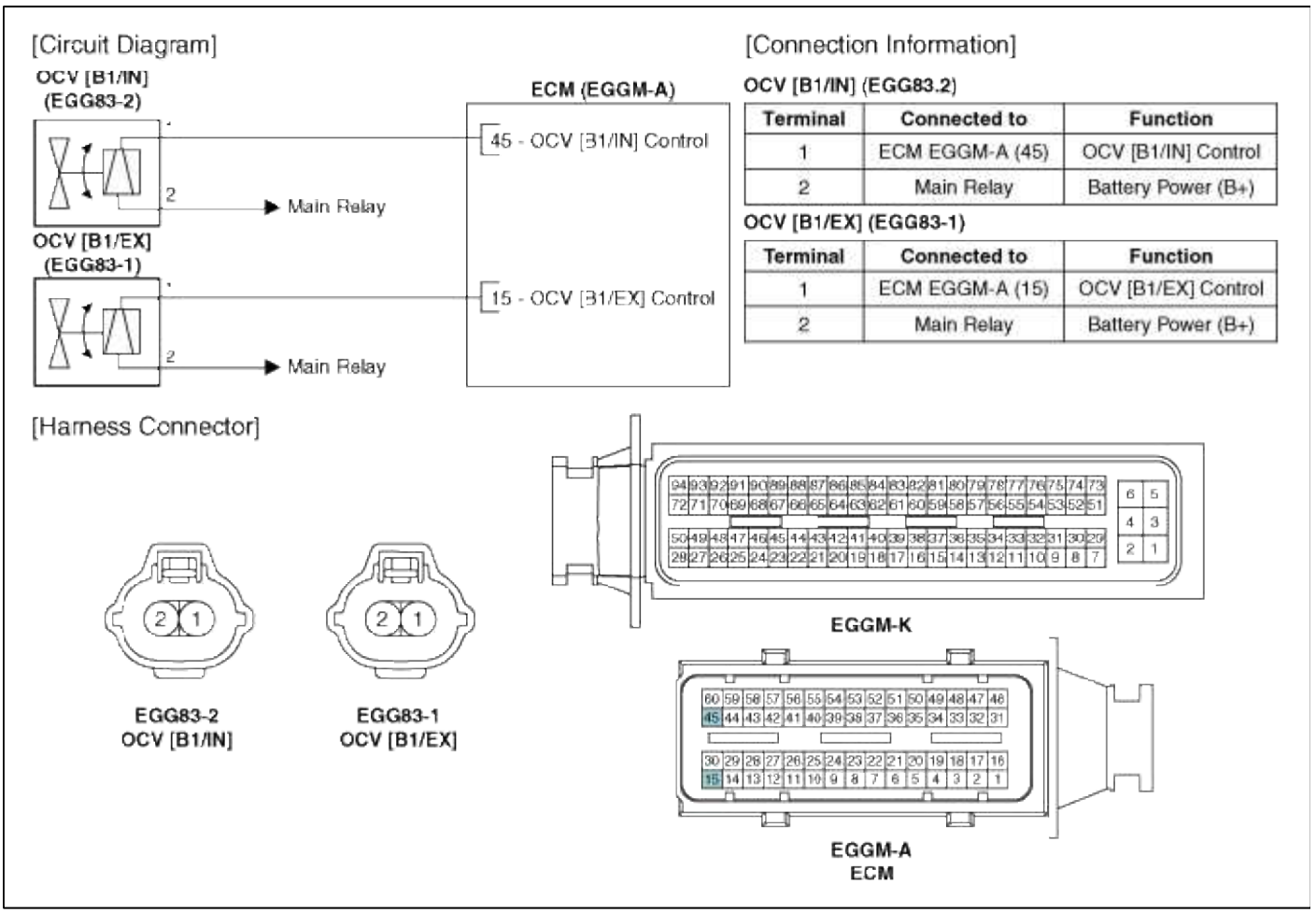
Specification

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

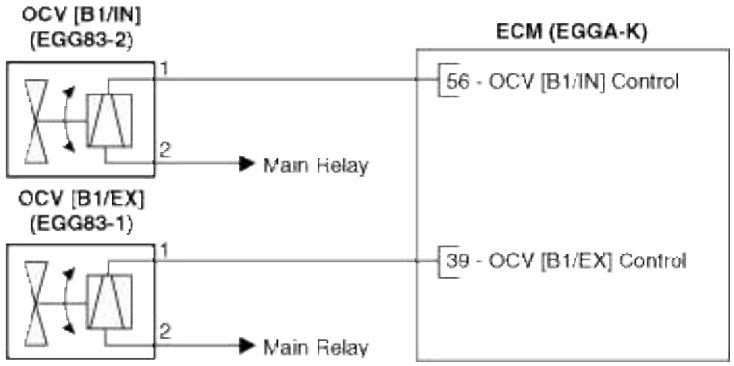
Circuit Diagram

(M/T)



(A/T)

[Circuit Diagram]



[Connection Information]

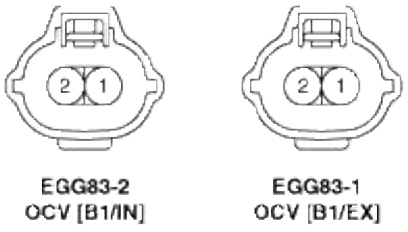
OCV [B1/IN] (EGG83-2)

Terminal	Connected to	Function
1	ECM EGGA-K (56)	OCV [B1/IN] Control
2	Main Relay	Battery Power (B+)

OCV [B1/EX] (EGG83-1)

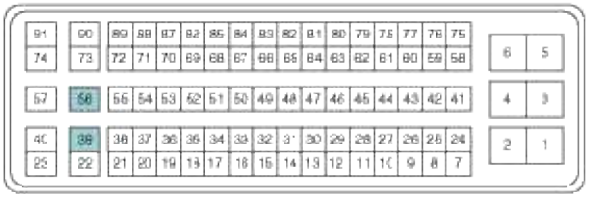
Terminal	Connected to	Function
1	ECM EGGA-K (39)	OCV [B1/EX] Control
2	Main Relay	Battery Power (B+)

[Harness Connector]

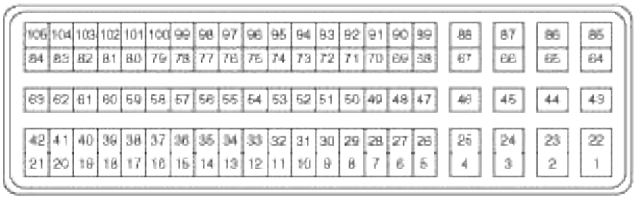


EGG83-2
OCV [B1/IN]

EGG83-1
OCV [B1/EX]



EGGA-K



EGGA-A
ECM

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.

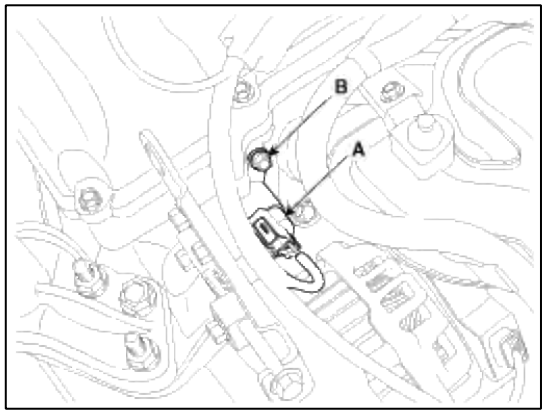
Specification: Refer to “Specification”

Removal

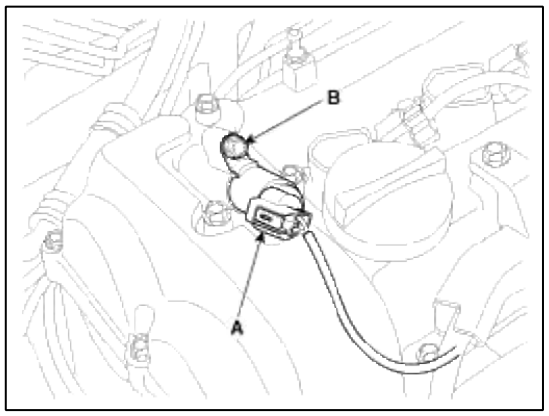
1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Disconnect the CVVT oil control valve connector (A).

3. Remove the installation bolt (B), and then remove the valve from the engine.

[Bank 1 / Intake]



[Bank 1 / Exhaust]



Installation

CAUTION

- Install the component with the specified torques.
- Note that internal damage may occur when the component is dropped. If the component has been dropped, inspect before installing.

CAUTION

- Apply engine oil to the valve O-ring.

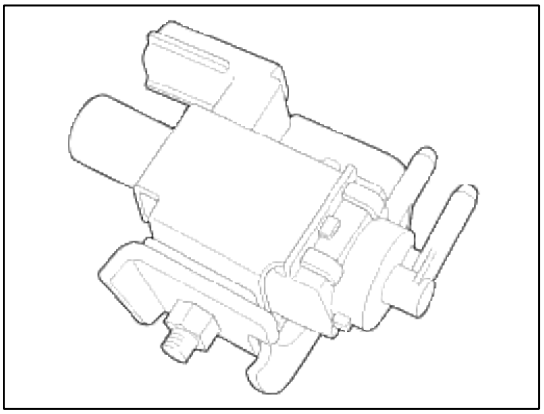
1. Installation is reverse of removal.

CVVT oil control valve installation bolt:
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)

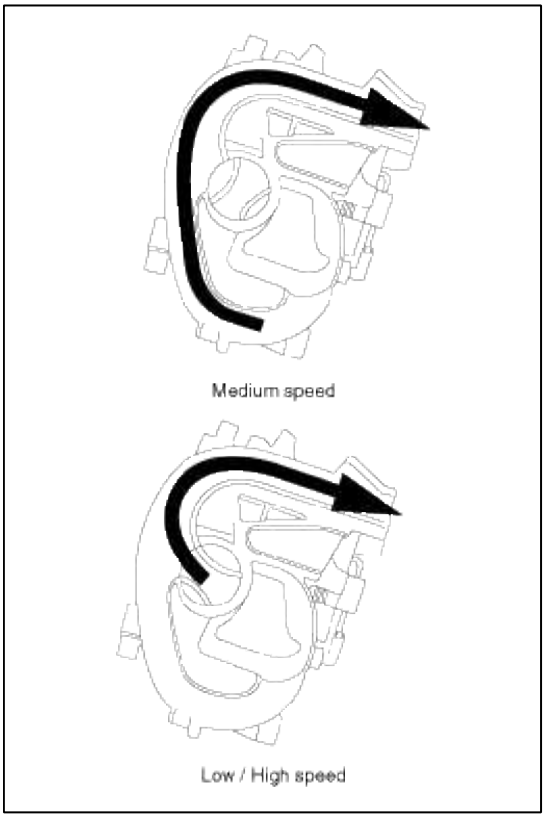
Fuel System > Engine Control System > Variable Intake Solenoid (VIS) Valve > Description and Operation

Description

Variable Intake manifold Solenoid (VIS) valve is installed on the intake manifold. The VIS valve controls the vacuum modulator which activates a valve in the intake manifold. The ECM opens or closes this valve according to engine condition (Refer to below table).



Engine condition	VIS valve	Operation
Medium speed	Closed	Increasing engine performance in low engine speed by reducing intake interference among cylinders
Low / High speed	Open	Minimizing intake resistance by shortening intake manifold length and increasing area of air entrance



Fuel System > Engine Control System > Variable Intake Solenoid (VIS) Valve > Specifications

Specification

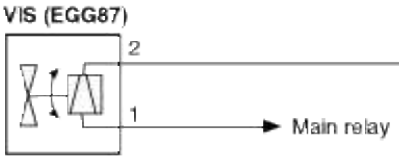
Item	Specification
Coil resistance (Ω)	30.0 ~ 35.0 [20°C(68°F)]

Fuel System > Engine Control System > Variable Intake Solenoid (VIS) Valve > Schematic Diagrams

Circuit Diagram

(M/T)

[Circuit Diagram]



[Connection Information]

Terminal	Connected to	Function
1	Main relay	Power supply (B+)
2	ECM EGGM-A (60)	VIS valve control

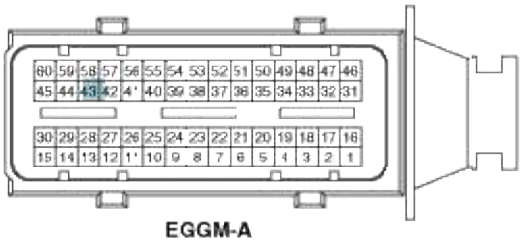
[Harness Connector]



EGG87
VIS Valve



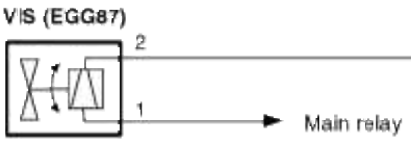
EGGM-K



EGGM-A
ECM

(A/T)

[Circuit Diagram]



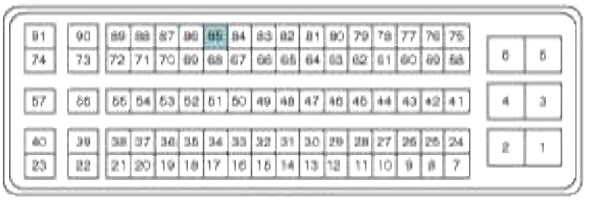
[Connection Information]

Terminal	Connected to	Function
1	Main relay	Power supply (B+)
2	ECM EGGA-K (85)	VIS valve control

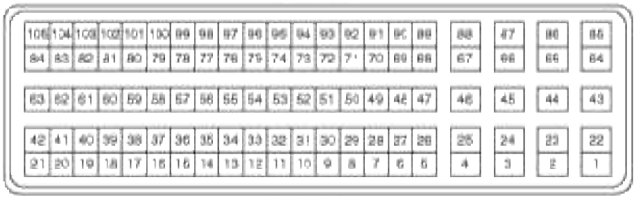
[Harness Connector]



EGG87
VIS Valve



EGGA-K



EGGA-A
ECM

Fuel System > Engine Control System > Variable Intake Solenoid (VIS) Valve > Repair procedures

Inspection

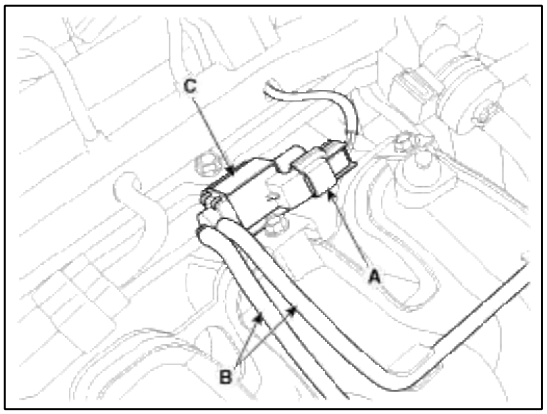
1. Turn the ignition switch OFF.
2. Disconnect the VIS valve connector.

3. Measure resistance between VIS valve terminals 1 and 2.

Specification: Refer to "Specification"

Removal

1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Disconnect the variable intake solenoid valve connector (A).
3. Disconnect the vacuum hoses (B) from the valve.
4. Remove the installation bolt, and then remove the valve (C) from the surge tank.



Installation

CAUTION

- Install the component with the specified torques.
- Note that internal damage may occur when the component is dropped. If the component has been dropped, inspect before installing.

CAUTION

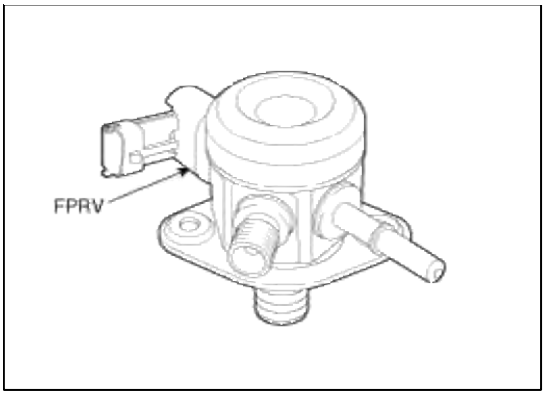
- Use care to keep foreign material out of the valve.

1. Installation is reverse of removal.

Fuel System > Engine Control System > Fuel Pressure Control Valve > Description and Operation

Description

Fuel Pressure Regulator Valve is installed on the high pressure fuel pump and controls fuel flow flowing into the injectors in accordance with the ECM signal calculated based on various engine condition.



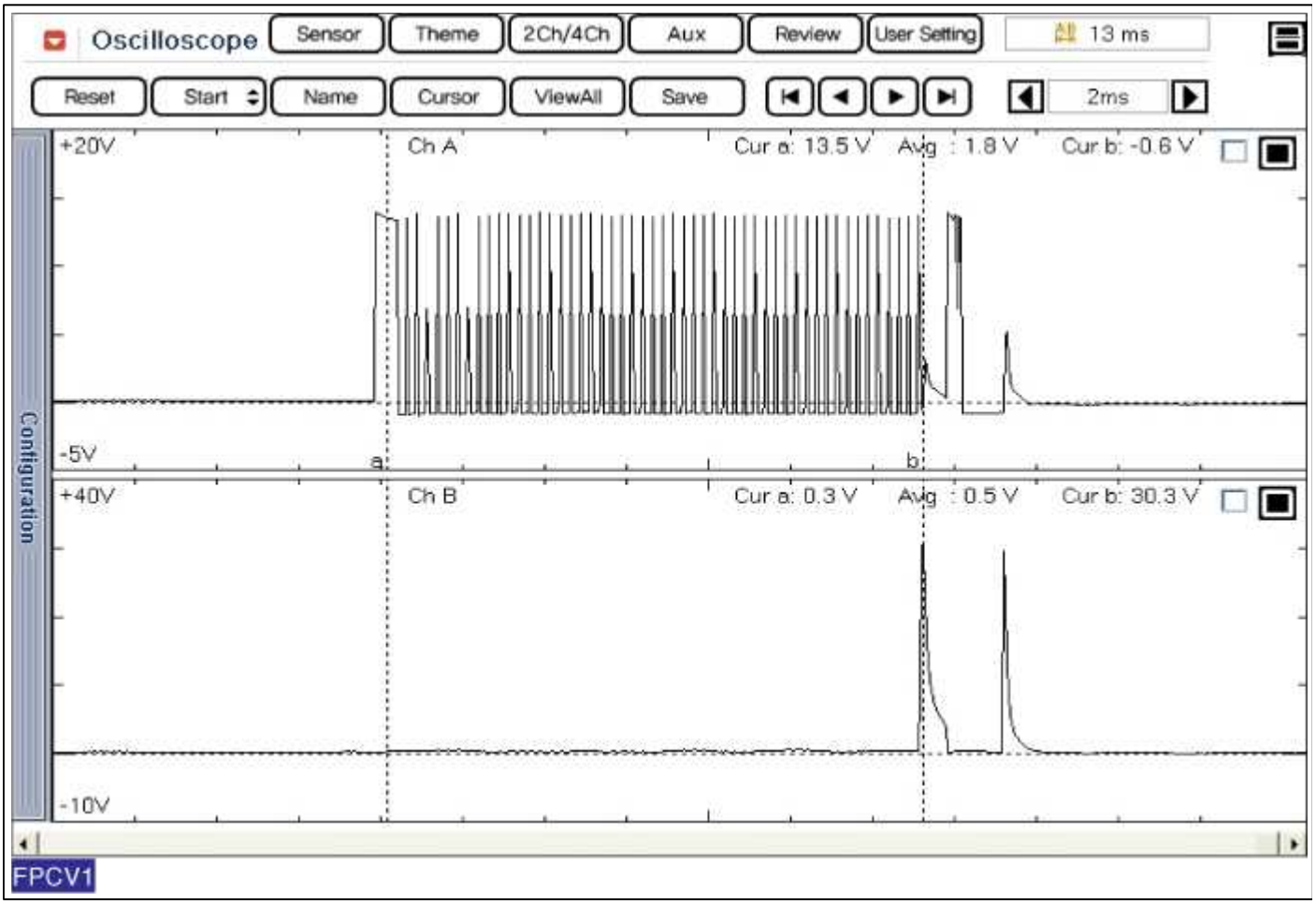
Fuel System > Engine Control System > Fuel Pressure Control Valve > Specifications

Specification

Item	Specification
Coil Resistance (Ω)	0.5 [20°C(68°F)

Fuel System > Engine Control System > Fuel Pressure Control Valve > Troubleshooting

Signal Waveform



Fuel System > Engine Control System > Fuel Pressure Control Valve > Schematic Diagrams

Circuit Diagram

(M/T)

[Circuit Diagram]



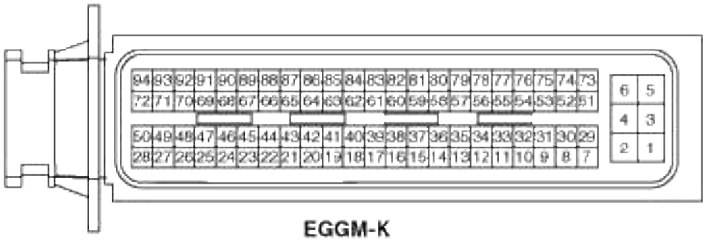
[Connection Information]

Terminal	Connected to	Function
1	ECM EGGM-A (49)	FPRV [Low]
2	ECM EGGM-A (34)	FPRV [High]

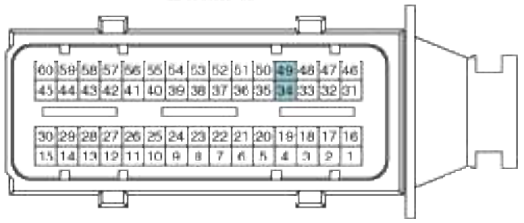
[Harness Connector]



EGG77
FPCV



EGGM-K



EGGM-A
ECM

(A/T)

[Circuit Diagram]



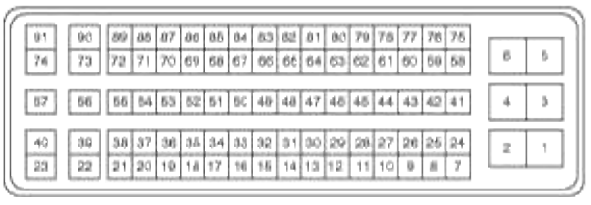
[Connection Information]

Terminal	Connected to	Function
1	ECM EGGA-A (85)	FPRV [Low]
2	ECM EGGA-A (86)	FPRV [High]

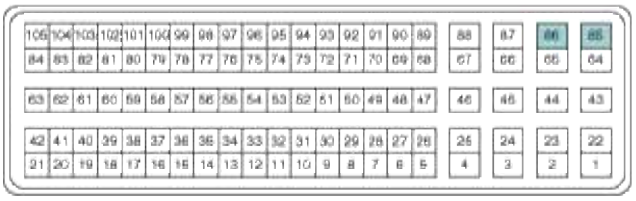
[Harness Connector]



EGG77
FPCV



EGGA-K



EGGA-A
ECM

Fuel System > Engine Control System > Fuel Pressure Control Valve > Repair procedures

Inspection

1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Disconnect the fuel pressure regulator valve connector.
3. Measure resistance between the fuel pressure regulator valve terminals 1 and 2.

4. Check that the resistance is within the specification.

Specification: Refer to “Specification”

Removal

Refer to "High pressure fuel pump removal" in this group.

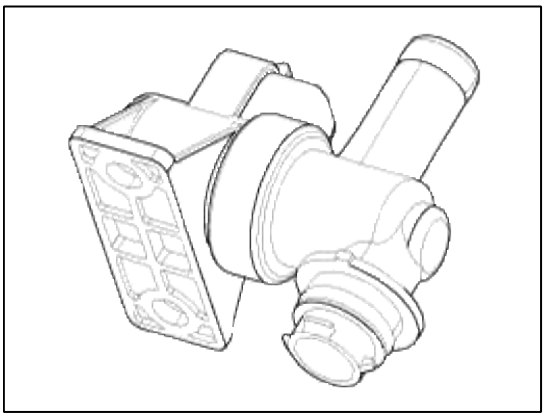
Installation

Refer to "High pressure fuel pump installation" in this group.

Fuel System > Engine Control System > Canister Close Valve (CCV) > Description and Operation

Description

Canister Close Valve (CCV) is normally open and is installed on the canister ventilation line. It seals evaporative emission control system by shutting the canister from the atmosphere during EVAP leak detection process.



Fuel System > Engine Control System > Canister Close Valve (CCV) > Specifications

Specification

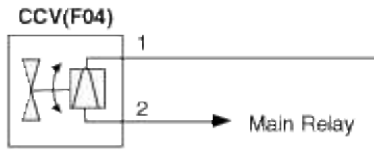
Item	Specification
Coil Resistance (Ω)	15.5 ~ 18.5 [20°C(68°F)

Fuel System > Engine Control System > Canister Close Valve (CCV) > Schematic Diagrams

Circuit Diagram

(M/T)

[Circuit Diagram]



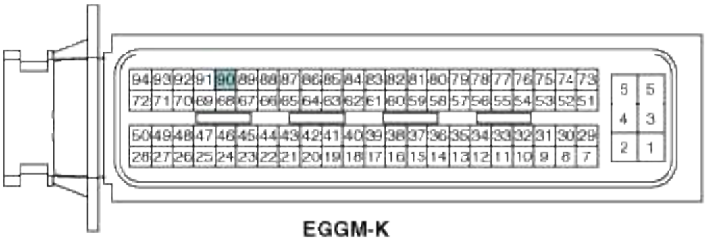
• [ ] : With immobilizer

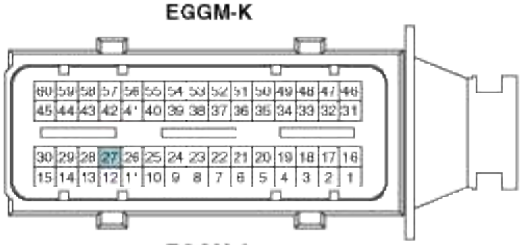
[Connection Information]

Terminal	Connected to	Function
1	ECM EGGM-A(27) [K(90)]	CCV Control
2	Main Relay	Battery Power (B+)

[Harness Connector]

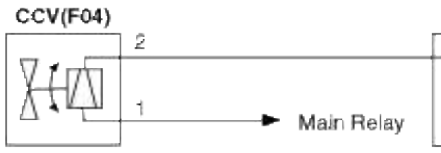






(A/T)

[Circuit Diagram]

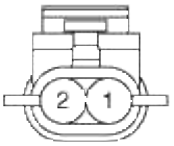


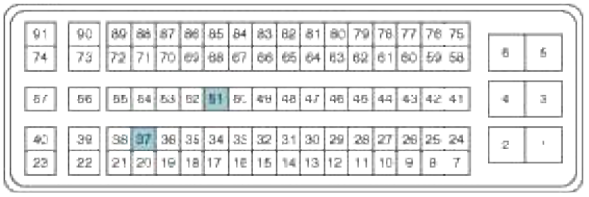
• [ ] : With immobilizer

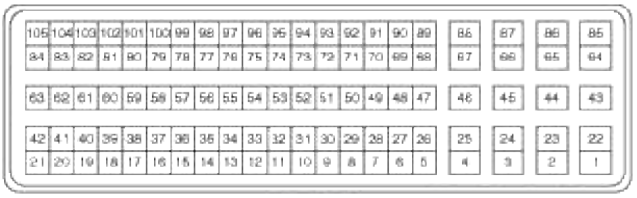
[Connection Information]

Terminal	Connected to	Function
1	Main Relay	Battery Power (B+)
2	ECM EGGA-K (37) [51]	CCV Control

[Harness Connector]







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 1 and 2.

4. Check that the resistance is within the specification.

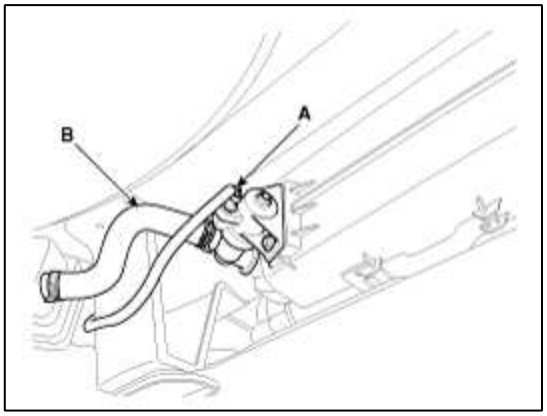
Specification: Refer to "Specification"

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

Removal

1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Lift the vehicle.
3. Disconnect the canister close valve connector (A).
4. Disconnect the ventilation hose (B) from the canister close valve.
5. Remove the canister close valve after removing the bolts.



Installation

CAUTION

- Install the component with the specified torques.
- Note that internal damage may occur when the component is dropped. In this case, use it after inspecting.

1. Installation is reverse of removal.

Canister close valve installation bolt:
3.9 ~ 5.9 N.m (0.4 ~ 0.6 kgf.m, 2.9 ~ 4.3 lb-ft)

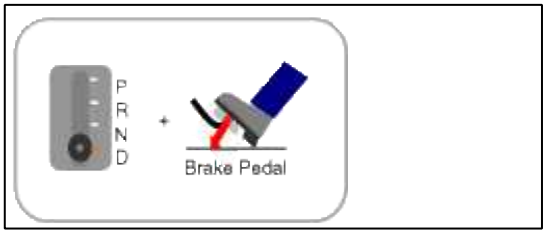
Fuel System > ISG (Idle Stop & Go) System > Description and Operation

Description

Idle Stop & Go (ISG) function automatically switches off the engine when the car is at a standstill if the and starts it again as soon as the brake pedal is released. This not only reduces fuel consumption, it also lowers emissions. Idle Stop & Go (ISG) function also has a built-in sensitivity to driving safety and comfort.
The engine is not switched off if certain conditions relating to safety and comfort have not been fulfilled (For example, when the engine oil is still cold, when the battery is running low or when the outside temperature is below 3°C). It can be deactivated by pressing the ISG OFF switch on the crash pad lower panel.
Sample scenario: switching off the engine at a standstill at a red traffic light or in stop-and-go traffic.

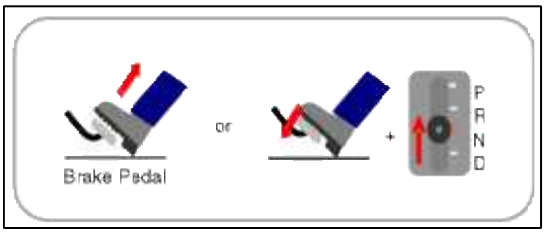
How to use:

1. Engine Auto-Stop: D-range + brake pedal is pressed.

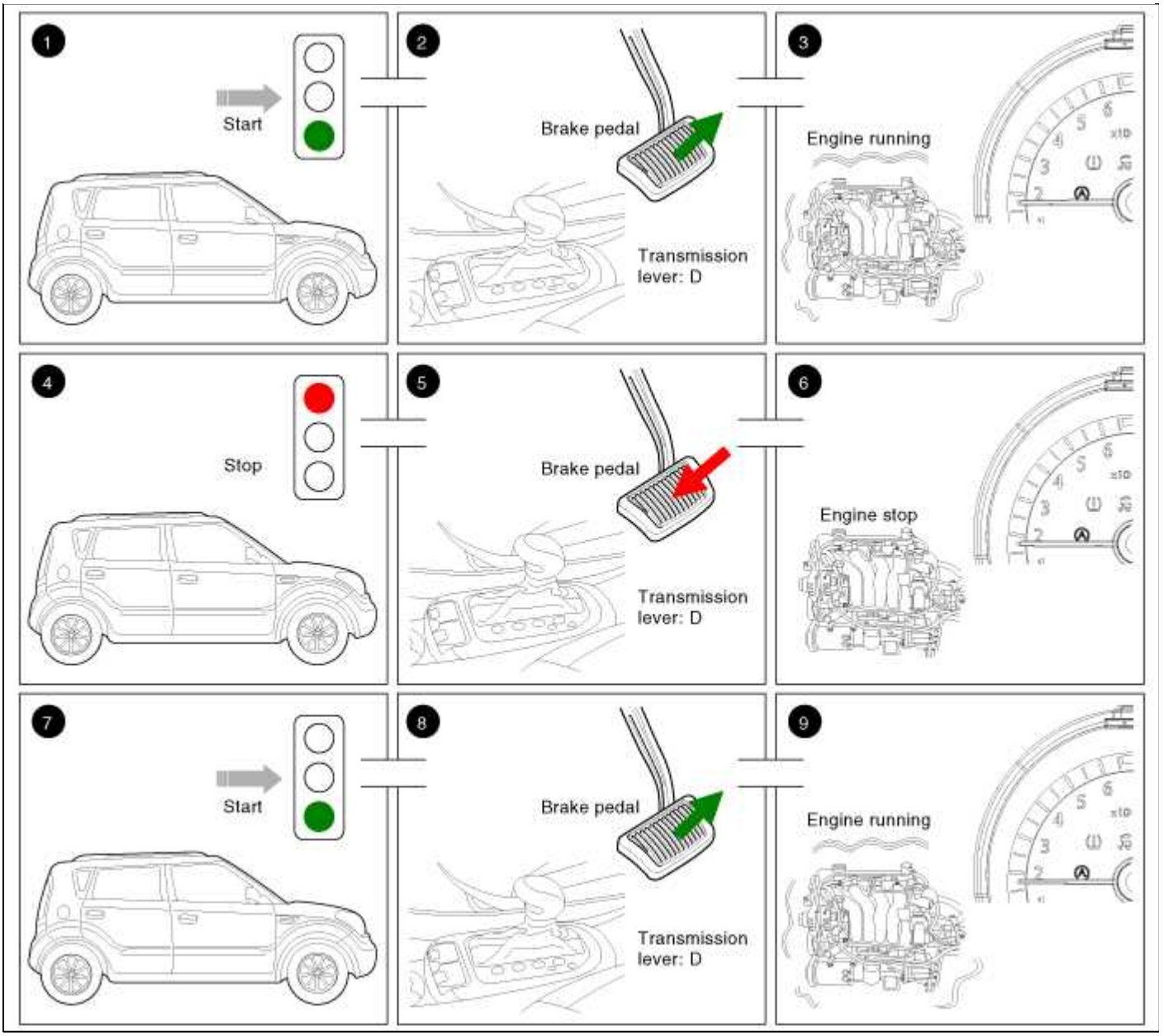


2. Engine Auto-Start:

- Brake pedal is released.
- N-range + brake pedal is pressed.



Operation



1. Vehicle moving.
2. The transmission lever position is D-range. The brake pedal is released.
3. The engine is running. (Vehicle moving).
4. The driver brakes until the vehicle comes to a standstill.
5. The transmission lever position is D-range. The brake pedal is pressed
6. The engine stops. The symbol "AUTO STOP" lights up in the instrument cluster.
7. The driver wants to continue the journey.
8. The transmission lever position is D-range. The brake pedal is released.
9. The engine is running again. The symbol goes out.

Operation Condition for the ISG function

1. Auto stop or Auto start condition (If all of the below condition are satisfied)

Items		State	Remark
Driving conditions	ISG OFF Switch	off	
	Switch (seat/door/hood)	Closed	
	Lever position	D or N range	Prohibit operation on gear 'P, R'
	Brake pedal	Pressed	Auto Stop
		Released	Auto Start
	Vehicle speed	Vehicle speed = 0 Mph	After driving higher than 8kph (5 Mph)
	Air conditioning system	Ambient temperature is between -2 ~ 35 °C (28.4 ~ 95 °F)	
	Engine Coolant Temperature (ECT)	Over 78 °C (172.4 °F)	
	Brake Pressure	Below -35kpa	
Battery conditions	SOC	Over 77%	To protect Battery
	Temperature	2 ~ 55 °C (35.6 ~ 131 °F)	
Steering wheel	Operating angle	Below 180°	
Parking condition	Slope	Up hill <12%, Down hill < 8%	
ISG related part error		Sensor Error	Brake Booster Pressure Sensor
			Brake Master Cylinder Pressure
			Sensor, Brake Pedal Sensor,
			APS, Battery Sensor
		Related System Error	TM Electronic Auxiliary Pump
			ESC System Defect Mode
			CAN Communication Error
			Engine Limp Home Mode

2. Forced re-start conditions (If any of the below condition is not satisfied)

Component	Conditions	State	Remark
Conditions for safety	Low pressure for braking system	Over -35kpa	
	Low battery voltage	Below 12.1V for 180 sec	
	Active defroster of front glass	On	
	When inertial speed reach 1Mph with (down hill)	Over 1Mph (Kph)	Inertial Speed
	Open the door or unfasten driver's seat belt	Open	Brake Pedal Pressed
	Elapsed much of stop time		
	On the steep slope way		
Conditions for convenience	Turn on the air-conditioner or max blower speed or bad performance of air conditioning and heating		
	Active 'ISG OFF' button		
Sign of forced auto re-start	Blinking of lamp for 5 second and indicating on cluster		

3. Restriction conditions for Auto-Stop operation

To protect system and safety auto-stop system is restricted below the conditions

Large steering angle when car is stop
Low brake operating pressure
Turn on the air conditioner with max blower
When battery Condition is poor (low SOC)
Active defroster of front or rear glass
Unfasten driver's seat belt or open the door and hood
On the steep slope way
With ISG system errors, and other diagnosis

4. Restriction condition for auto Re-Start operation

Open hood (have to restart by key for repairman's safety)

5. Restriction condition for OBD Check & Emission control

Auto Stop system will be limited	During Canister purge monitoring
	During OBD check
To restrict continuous Cranking (for Emission Control)	Start Motor can operate for two seconds at the longest (just once)

CAUTION

The ISG system is strongly networked with the power management. In the event of battery replacement, disconnection of the battery terminal or after changing the engine management system, the reference data regarding the battery charge state and battery condition can be lost.
They are only available again a closed-circuit current measurement of approximate 4 hours in which the vehicle may not be wakened. In this time, the ISG system is inactive.

CAUTION

ISG system deactivation by fault.

- Fault in communication line (LIN/CAN)
  Fault Electric oil pump
  Fault ESC System
  Fault Limp home mode
- Fault brake booster vacuum pressure sensor
  Fault Brake master cylinder pressure sensor
  Fault Brake pedal switch
  Fault Battery sensor

When the ISG related sensors or system error occurs, the ISG OFF switch lights up. Especially when the battery sensor is replaced or reinstalled, the vehicle must be placed in the ignition switch OFF for about 4 hours for recalibration.
The ISG function is operated about 4 hours later normally. But in the case of first 25 times, the ISG function can be operated regardless of recalibration.
If the ISG function is not operated after 4 hours, perform recalibration procedure again.
(Refer to "Battery sensor recalibration procedure.")

WARNING

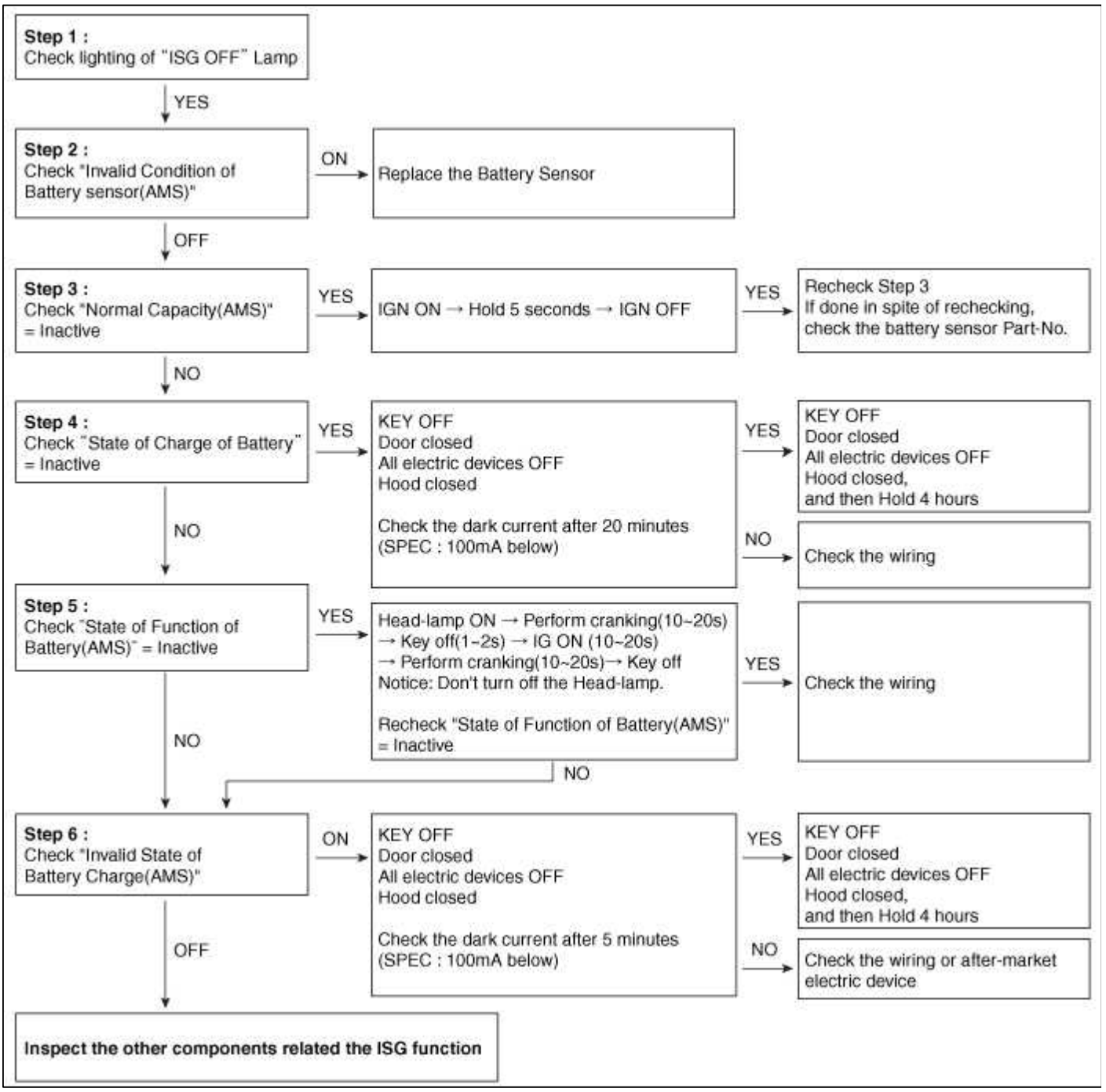
When the engine is in Idle stop mode, it's possible to restart the engine without the driver taking any action. Before leaving the car or doing anything in the engine room area, stop the engine by turning the ignition key to the LOCK position or removing it.

Fuel System > ISG (Idle Stop & Go) System > Troubleshooting

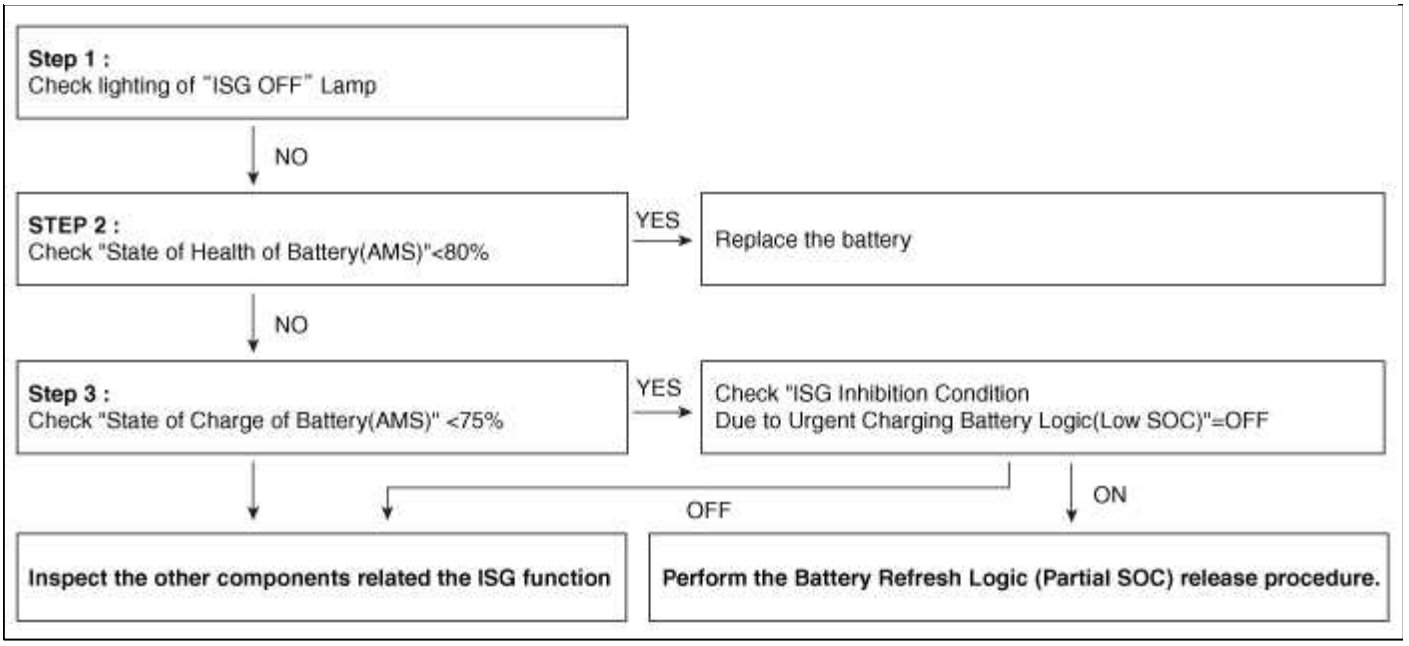
Troubleshooting

If ISG function is not operated, check the related DTC codes. (Refer to DTC guide.)
If the ISG function is not operated in spite of no DTC, inspect the ISG system as below.
The GDS tool shows the current data about the ISG function for inspection.

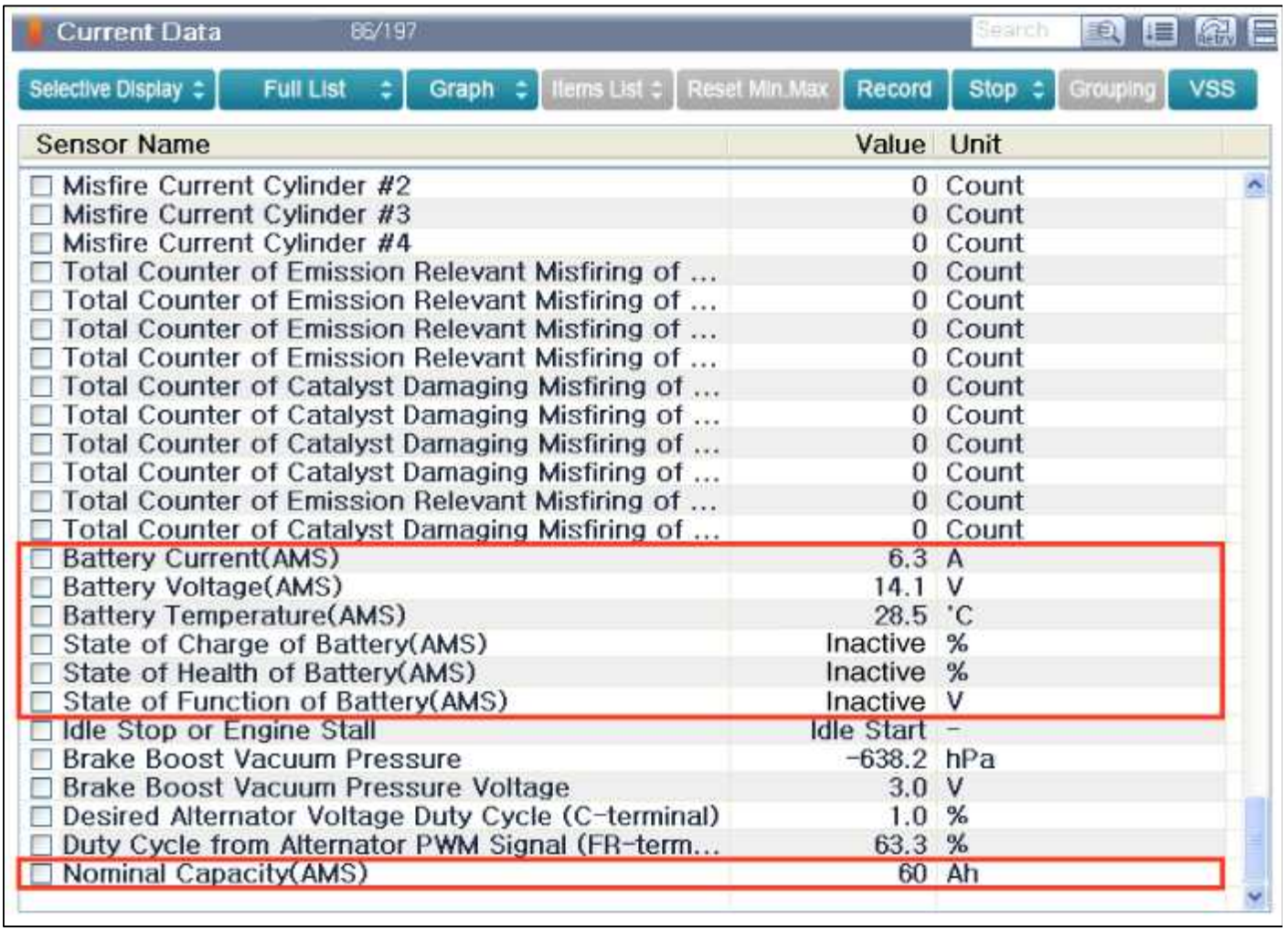
[Battery sensor and calibration value inspection]



[Battery status inspection]



Current Data



Sensor Name	Value	Unit
Misfire Current Cylinder #2	0	Count
Misfire Current Cylinder #3	0	Count
Misfire Current Cylinder #4	0	Count
Total Counter of Emission Relevant Misfiring of ...	0	Count
Total Counter of Emission Relevant Misfiring of ...	0	Count
Total Counter of Emission Relevant Misfiring of ...	0	Count
Total Counter of Emission Relevant Misfiring of ...	0	Count
Total Counter of Catalyst Damaging Misfiring of ...	0	Count
Total Counter of Catalyst Damaging Misfiring of ...	0	Count
Total Counter of Catalyst Damaging Misfiring of ...	0	Count
Total Counter of Catalyst Damaging Misfiring of ...	0	Count
Total Counter of Emission Relevant Misfiring of ...	0	Count
Total Counter of Catalyst Damaging Misfiring of ...	0	Count
Battery Current(AMS)	6.3	A
Battery Voltage(AMS)	14.1	V
Battery Temperature(AMS)	28.5	°C
State of Charge of Battery(AMS)	Inactive	%
State of Health of Battery(AMS)	Inactive	%
State of Function of Battery(AMS)	Inactive	V
Idle Stop or Engine Stall	Idle Start	-
Brake Boost Vacuum Pressure	-638.2	hPa
Brake Boost Vacuum Pressure Voltage	3.0	V
Desired Alternator Voltage Duty Cycle (C-terminal)	1.0	%
Duty Cycle from Alternator PWM Signal (FR-term...	63.3	%
Nominal Capacity(AMS)	60	Ah



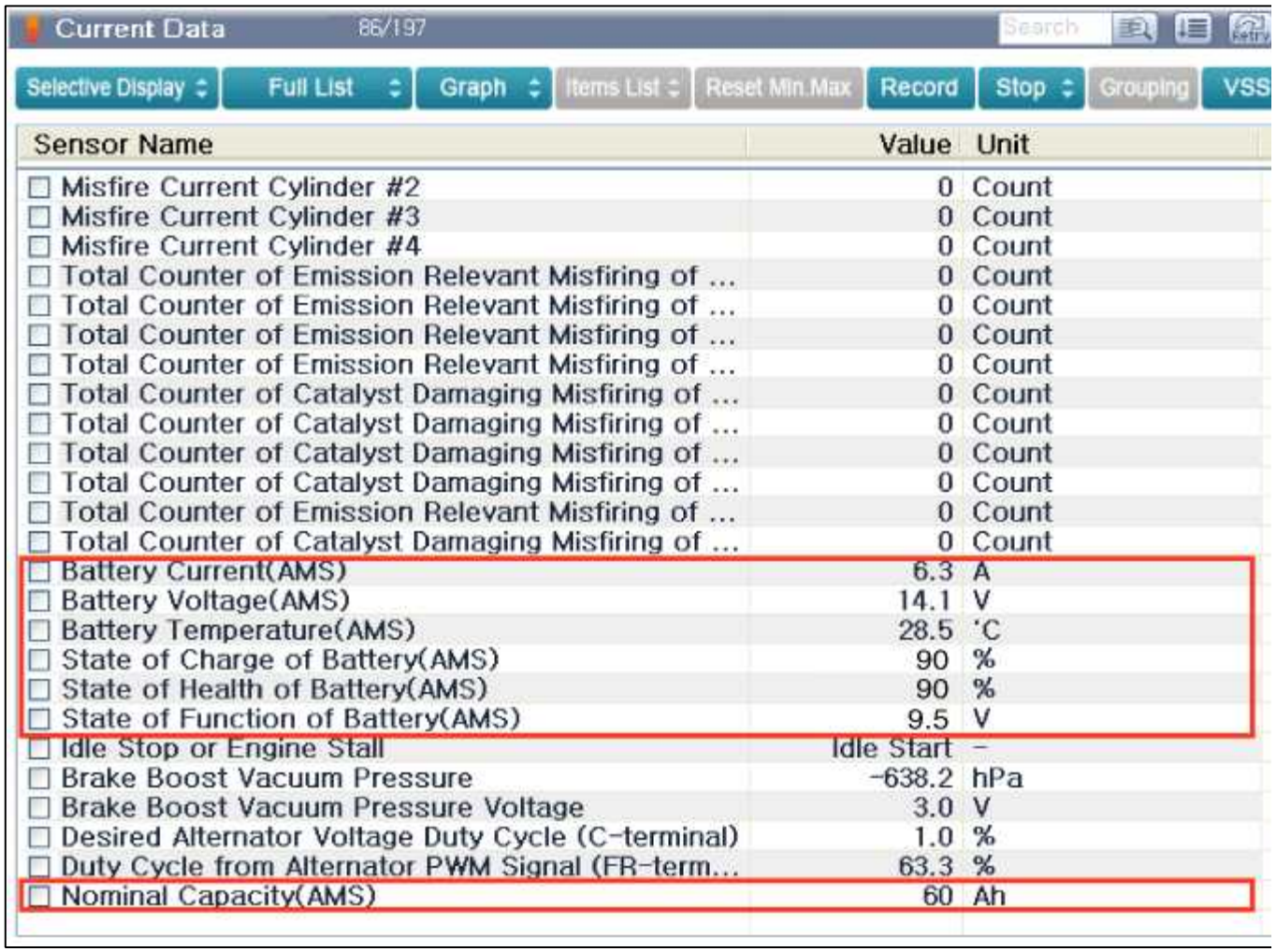
Fuel System > ISG (Idle Stop & Go) System > Repair procedures

Battery Sensor Recalibration Procedure

If disconnecting the negative (-) battery cable from the battery during repair work for the vehicle equipped with ISG function, Battery sensor recalibration procedure should be performed after finishing the repair work.

1. Turn the Iginition switch ON and OFF.
2. Park the vehicle about 4 hours under below states.
   A. Park the vehicle about 4 hours under below states.
   B. Closing the hood, trunk, and all doors.
3. After 4 hours later, check whether the current datas are displayed normally or not using GDS.
   A. Nominal capacity(AMS) = 60Ah
   B. State of Charge of Battery(AMS) = (0~100%)
   C. State of Health of Battery(AMS) = (0~100%)

4. After cranking the engine 2 times or more, check "State of Function of Battery(AMS) =(0~12V)".



Sensor Name	Value	Unit
Misfire Current Cylinder #2	0	Count
Misfire Current Cylinder #3	0	Count
Misfire Current Cylinder #4	0	Count
Total Counter of Emission Relevant Misfiring of ...	0	Count
Total Counter of Emission Relevant Misfiring of ...	0	Count
Total Counter of Emission Relevant Misfiring of ...	0	Count
Total Counter of Emission Relevant Misfiring of ...	0	Count
Total Counter of Catalyst Damaging Misfiring of ...	0	Count
Total Counter of Catalyst Damaging Misfiring of ...	0	Count
Total Counter of Catalyst Damaging Misfiring of ...	0	Count
Total Counter of Catalyst Damaging Misfiring of ...	0	Count
Total Counter of Emission Relevant Misfiring of ...	0	Count
Total Counter of Catalyst Damaging Misfiring of ...	0	Count
Battery Current(AMS)	6.3	A
Battery Voltage(AMS)	14.1	V
Battery Temperature(AMS)	28.5	'C
State of Charge of Battery(AMS)	90	%
State of Health of Battery(AMS)	90	%
State of Function of Battery(AMS)	9.5	V
Idle Stop or Engine Stall	Idle Start	-
Brake Boost Vacuum Pressure	-638.2	hPa
Brake Boost Vacuum Pressure Voltage	3.0	V
Desired Alternator Voltage Duty Cycle (C-terminal)	1.0	%
Duty Cycle from Alternator PWM Signal (FR-term...	63.3	%
Nominal Capacity(AMS)	60	Ah

Battery Refresh Logic (Partial SOC) Release Procedure

If "ISG Inhibition Condition Due to Urgent Charging Battery Logic(Low SOC)" is ON in the current data as below, battery refresh logic release procedure should be performed.

There are 2 methods to release the battery refresh logic.

Method 1) Chrge the battery more than 95% SOC.

Method 2) Drive the vehicle until total driving time is more than 2 hours.

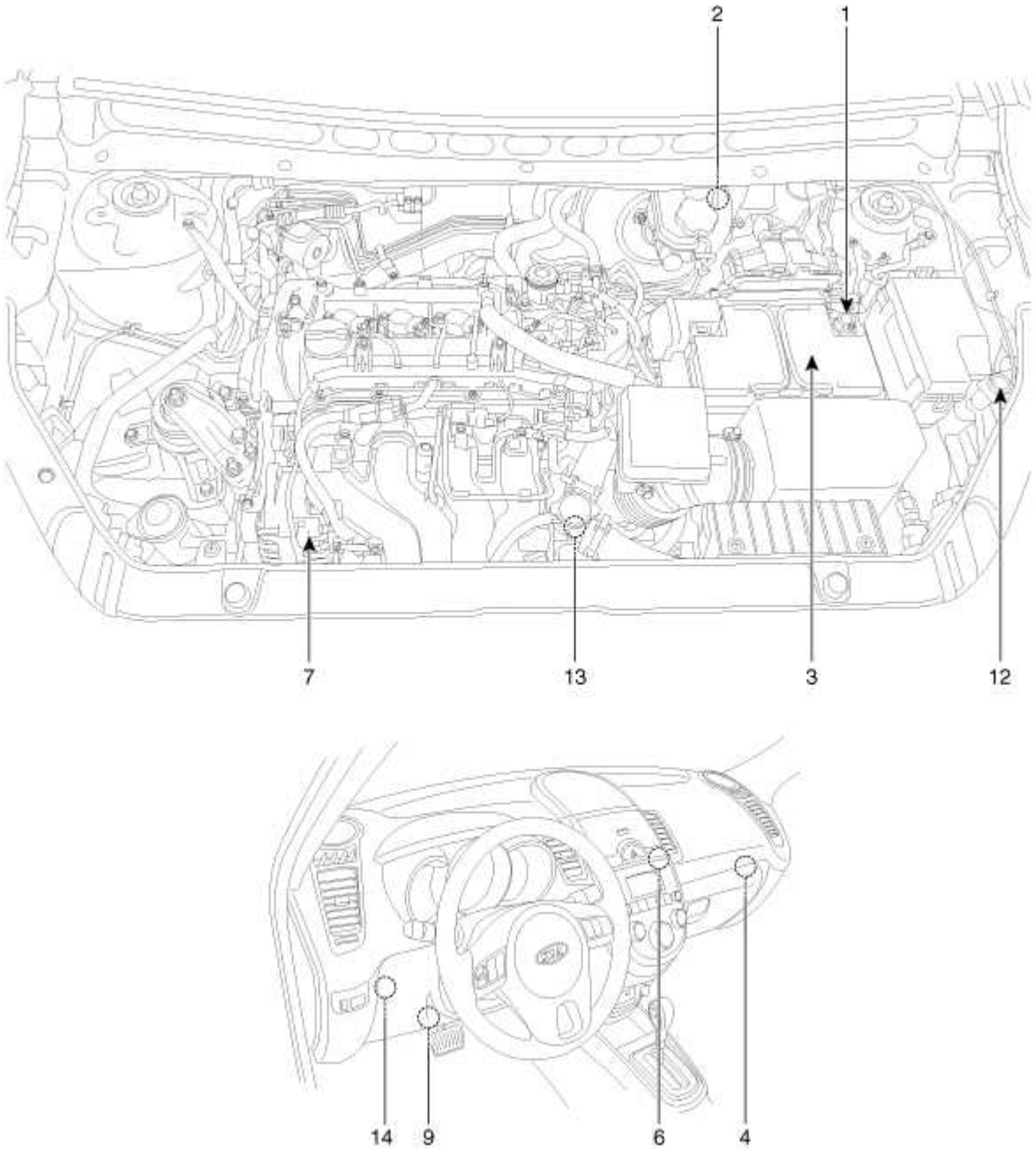
1. Perform one of two methods.

2. Check "ISG Inhibition Condition Due to Urgent Charging Battery Logic(Low SOC)" is OFF using GDS.



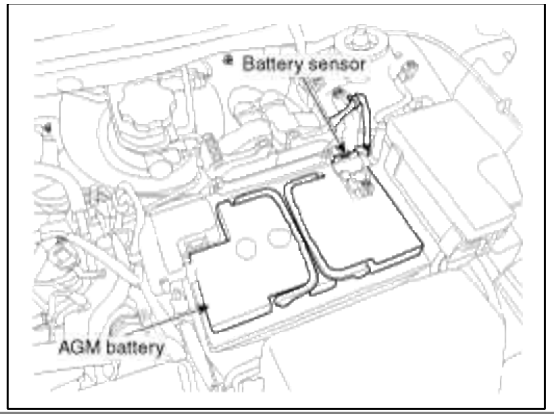
Fuel System > ISG (Idle Stop & Go) System > Components and Components Location

Components Location

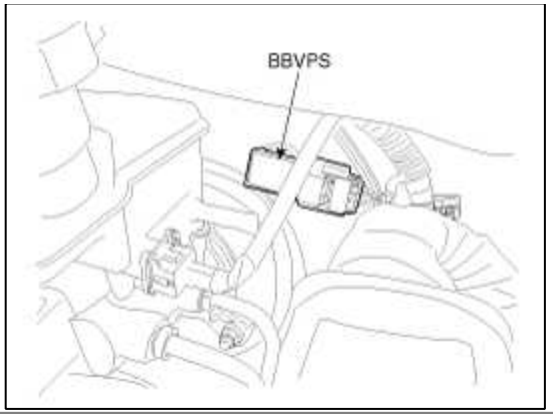


1. Battery sensor	8. Starter
2. Brake Booster Vacuum Pressure Sensor (BBVPS)	9. Brake switch
3. AGM battery	10. Door switch
4. DC/ DC Converter (LDC) [200W]	11. Seat belt switch
5. DC/ DC Converter (LDC) [400W]	12. Hood switch
6. ISG OFF Switch	13. Electric Oil Pump (EOP)
7. Alternator	14. Oil Pump Unit (OPU)

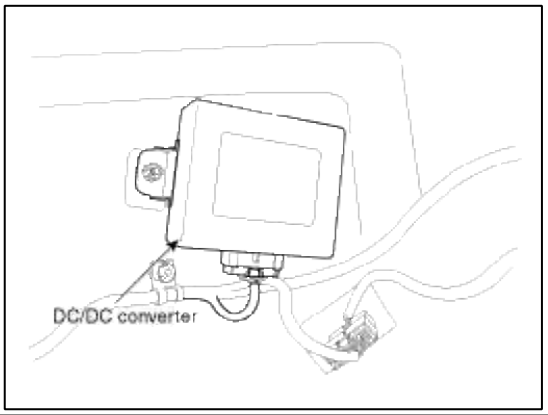
1. Battery sensor 3. AGM battery	2. Brake Booster Vacuum Pressure Sensor (BBVPS)



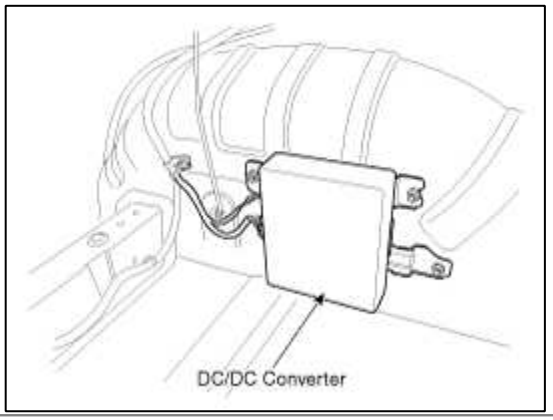
4. DC/ DC Converter (LDC)



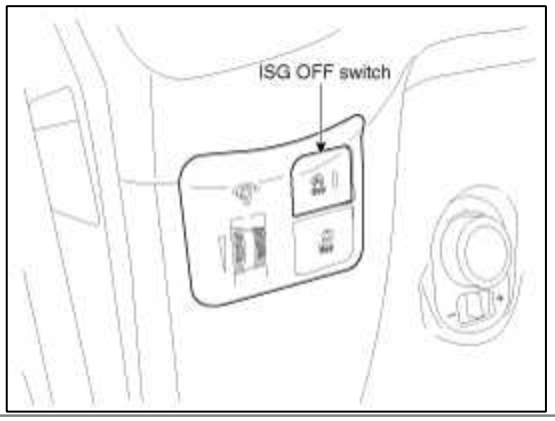
5. DC/DC Converter (LDC) [400W]



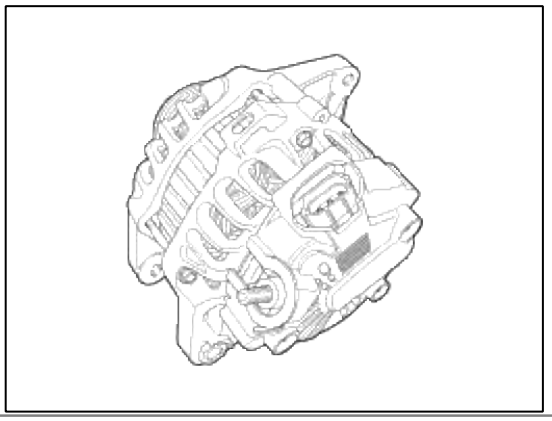
6. ISG OFF Switch



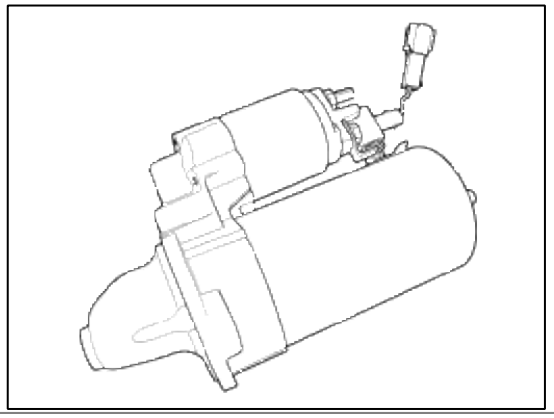
7. Alternator



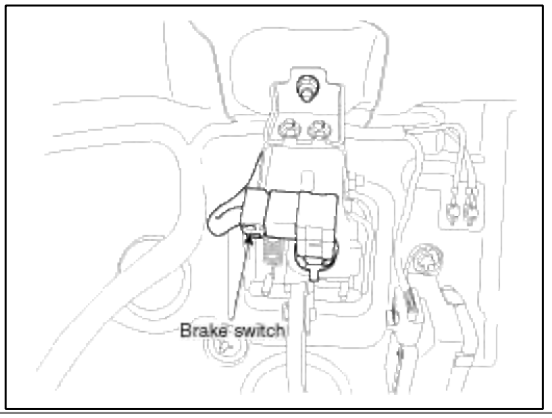
8. Starter



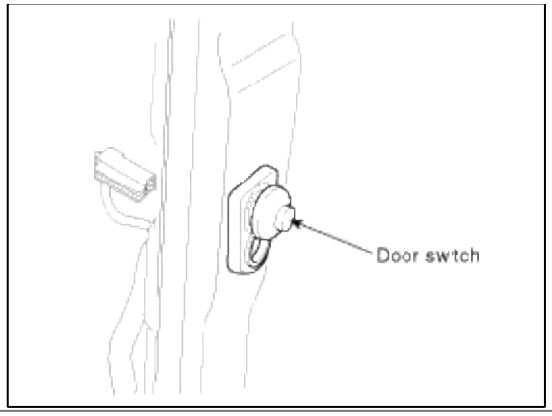
9. Brake switch

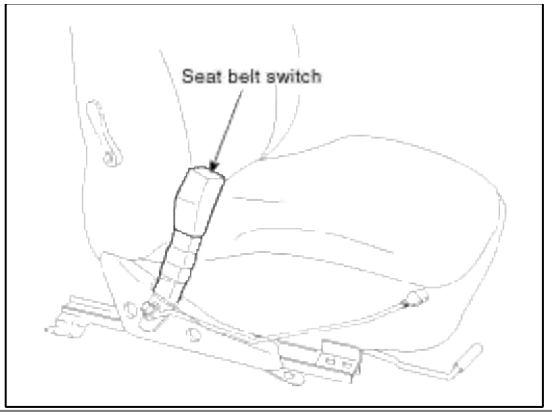


10. Door switch



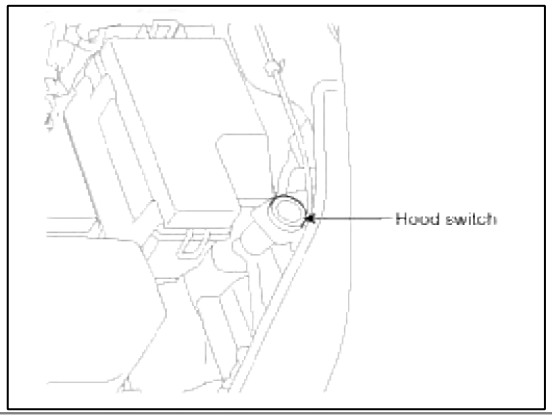
11. Seat belt switch

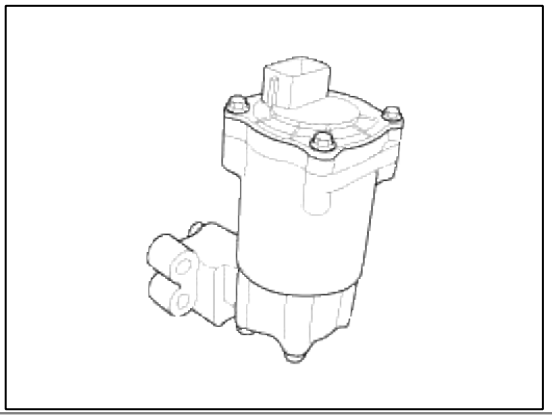




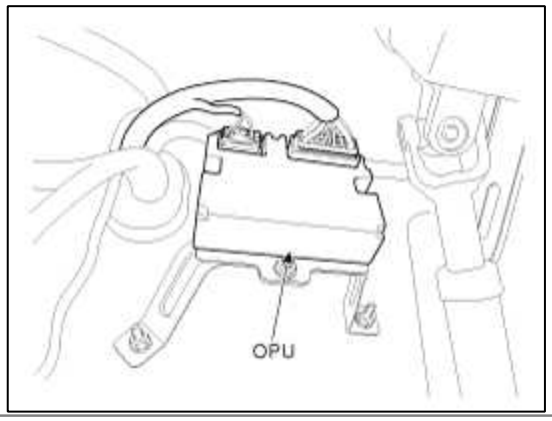
12. Hood switch

13. Electric Oil Pump (EOP)





14. Oil Pump Unit (OPU)

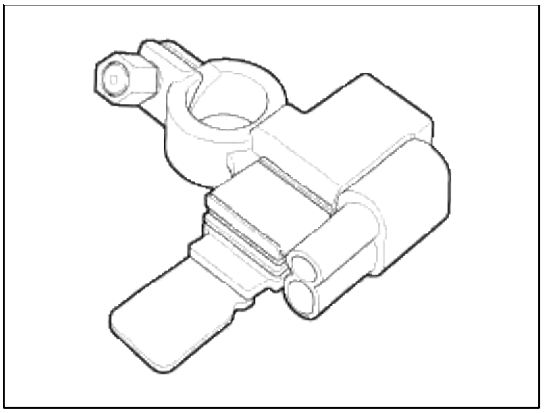


Fuel System > ISG (Idle Stop & Go) System > Battery Sensor > Description and Operation

Description

The battery sensor perceives battery status.
Battery status is a major influencing factor on the ISG function.
The aim is to enable a reliable start of the combustion engine after a defined parking period from the perspective of the vehicle energy system.The Battery sensor monitors the following data:

- Battery charge condition
- Battery temperature
- Voltage dip on engine start



CAUTION

When battery sensor signal fault occurs, inspect the vehicle parasitic draw in advance after inspecting the sensor because the sensor will behave abnormally when the parasitic draw is more than 100mA. (Refer to vehicle parasitic current inspection)

NOTE

It takes a few hours for a new battery sensor to detect the battery state correctly.
Perform the following process after replacing the battery sensor. (Refer to "Battery sensor recalibration procedure" in FL group)

1. Ignition switch ON/OFF.
2. Park the vehicle about 4 hours.
3. After 4 hours later, check that the SOC (State of charge) of battery is displayed on GDS properly.
4. After engine start ON/OFF 2 times or more, check the SOF (State of function) of battery using GDS.

CAUTION

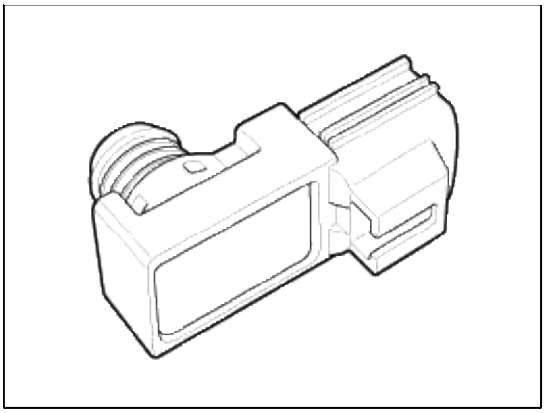
For the vehicle equipped with a battery sensor, be careful not to damage the battery sensor when the battery is replaced or recharged.

- When replacing the battery, it should be same one (type, capacity and brand) that is originally installed on your vehicle. If a battery of a different type is replaced, the battery sensor may recognize the battery to be abnormal.
- When installing the ground cable on the negative post of battery, tighten the clamp with specified torque of 3.9~5.9N.m (0.4~0.6kgf.m, 3.0~4.4lb-ft). An excessive tightening torque can damage the PCB internal circuit of battery sensor or the negative post of battery.
- When recharging the battery, ground the negative terminal of the booster battery to the vehicle body.

Fuel System > ISG (Idle Stop & Go) System > Brake Booster Vacuum Pressure Sensor > Description and Operation

Description

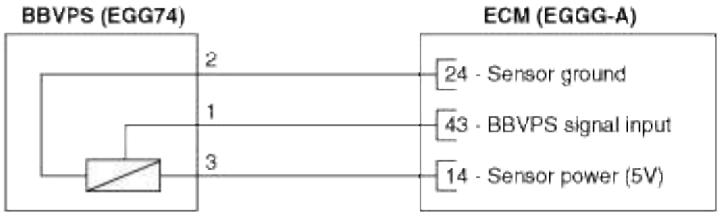
In order to ensure adequate brake power assistance in every situation, the brake booster is equipped with a partial vacuum sensor. The brake booster vacuum pressure sensor is located beside the brake booster.



Fuel System > ISG (Idle Stop & Go) System > Brake Booster Vacuum Pressure Sensor > Schematic Diagrams

Circuit Diagram

[Circuit Diagram]



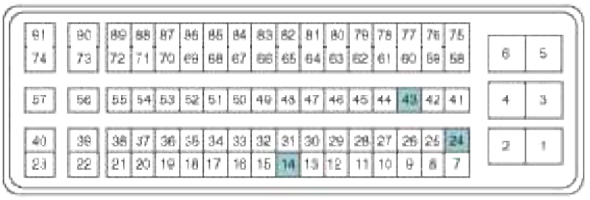
[Connection Information]

Terminal	Connected to	Function
1	ECM EGGG-A (43)	BBVPS signal input
2	ECM EGGG-A (24)	Sensor ground
3	ECM EGGG-A (14)	Sensor power (5V)

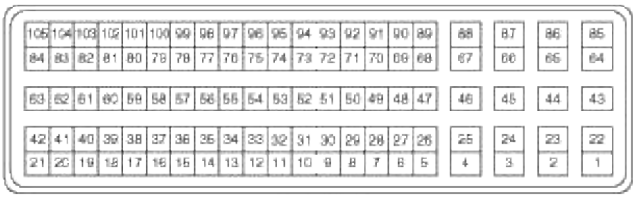
[Harness Connector]



EGG74
BBVPS



EGGG-A



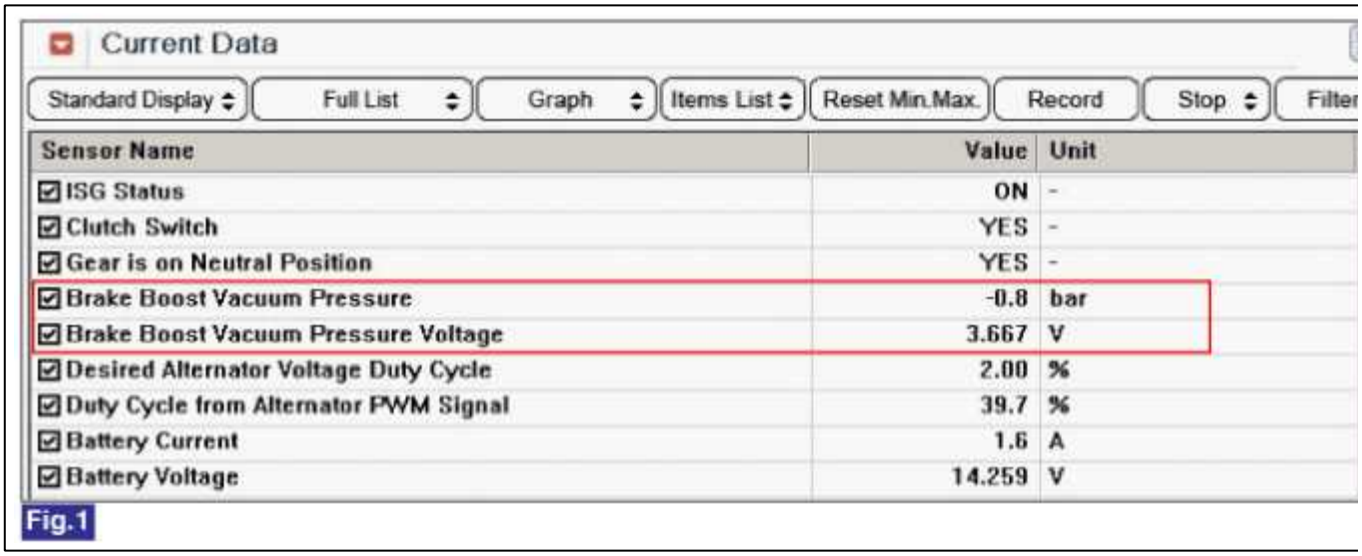
EGGG-A
ECM

Fuel System > ISG (Idle Stop & Go) System > Brake Booster Vacuum Pressure Sensor > Repair procedures

Inspection

1. Check installation status of BBVPS and Vacuum hose or damage of vacuum hose.
2. Connect GDS to DLC (Data Link Cable).
3. Warm up the engine to normal operating temperature.

4. Monitor "BBVPS" parameter on GDS.



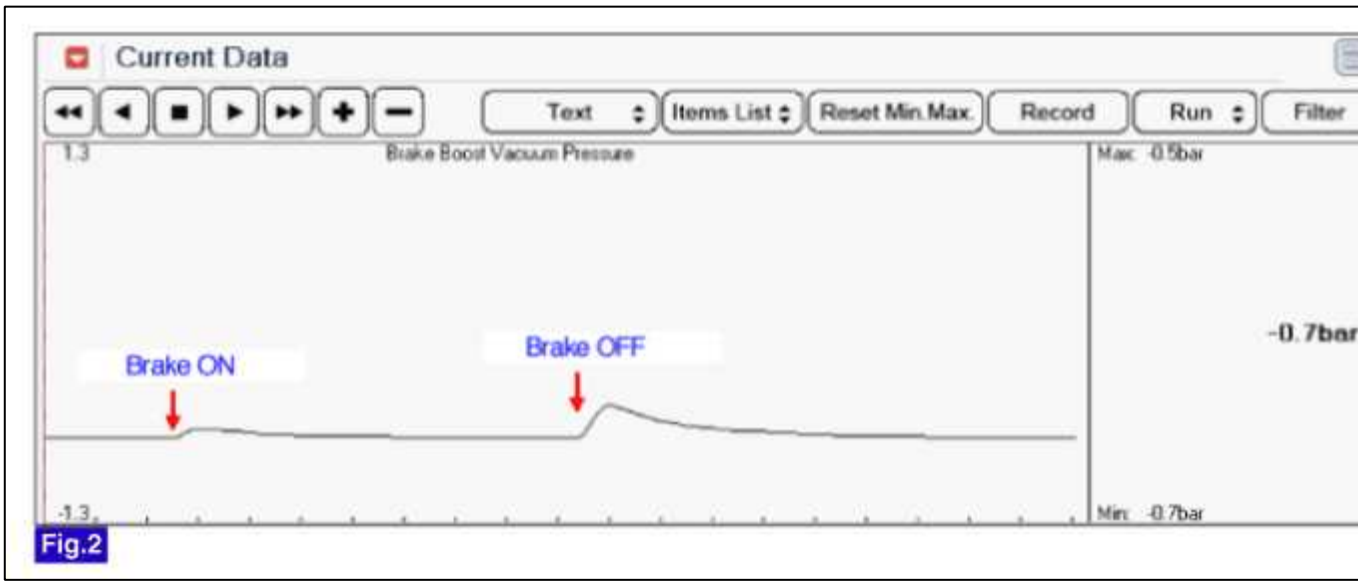


Fig.1) Idle Status
Fig.2) Brake pressure signal

NOTE

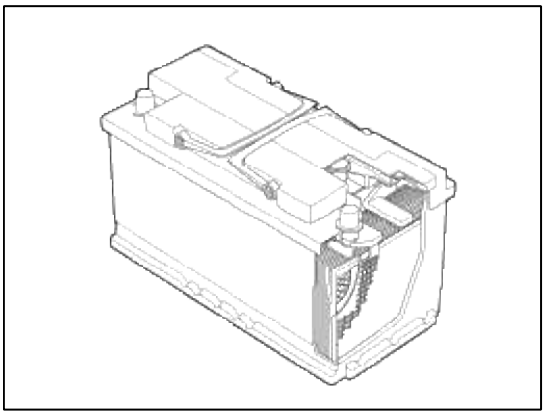
With a brake partial vacuum that is too low, the ISG function also starts without activity on the part of the driver.
Insufficient brake partial vacuum can lead to safety risks during braking manoeuvres, when rolling on an incline
To prevent this, the engine is started.
(Refer to “DTC P0557, P0558” in DTC manual)

Fuel System > ISG (Idle Stop & Go) System > AGM Battery > Description and Operation

Description

AGM battery is used for especially heavy load on the vehicle network depending on equipment and requirements.
AGM stands for Absorbent Glass Material Battery; that is absorbent glass fibre fleece. AGM batteries are fitted in models with electrical loads/consumers which have a high energy demand.
The constantly increasing energy demand of modern vehicle electrical systems calls for ever more powerful battery solutions.
The power consumption is considerable even when the vehicle is parked.
The somewhat higher price compared with a battery of similar size is fully balanced by the following benefits:

- Significantly longer service life
- Increased starting reliability at low temperatures
- 100 % freedom from maintenance
- Low risk in event of an accident (reduced risk to the environment)



Recharging [ISG Type]

Check the battery condition

The battery condition cannot be determined solely on the basis of the battery charge state. If there is a suspicion of a damaged battery, check the battery condition whit battery tester and investigate the cause by means of the test module. With a low battery charge state, recharge the battery.

Recharging the AGM battery

The battery may be charged using the battery chargers at a constant charge voltage of 14.8V.
If possible, the battery temperature during charging should be between 20°C and 30°C.
Only chargers with voltage clamping (IU or WU curve) may be used or chargers with IUoU curve which have a trickle.

IU or WU charging technique
Optimized charging voltage for IU or WU: 14.7V (at 20°C ~ 30°C) about 24 hours
Min. charging voltage at 20°C: 14.4V
Max. charging voltage at 20°C: 14.8V
10% of capacity is recommended as charging current (e.g. 60Ah : 10 = 6,0A charging current).

WARNING

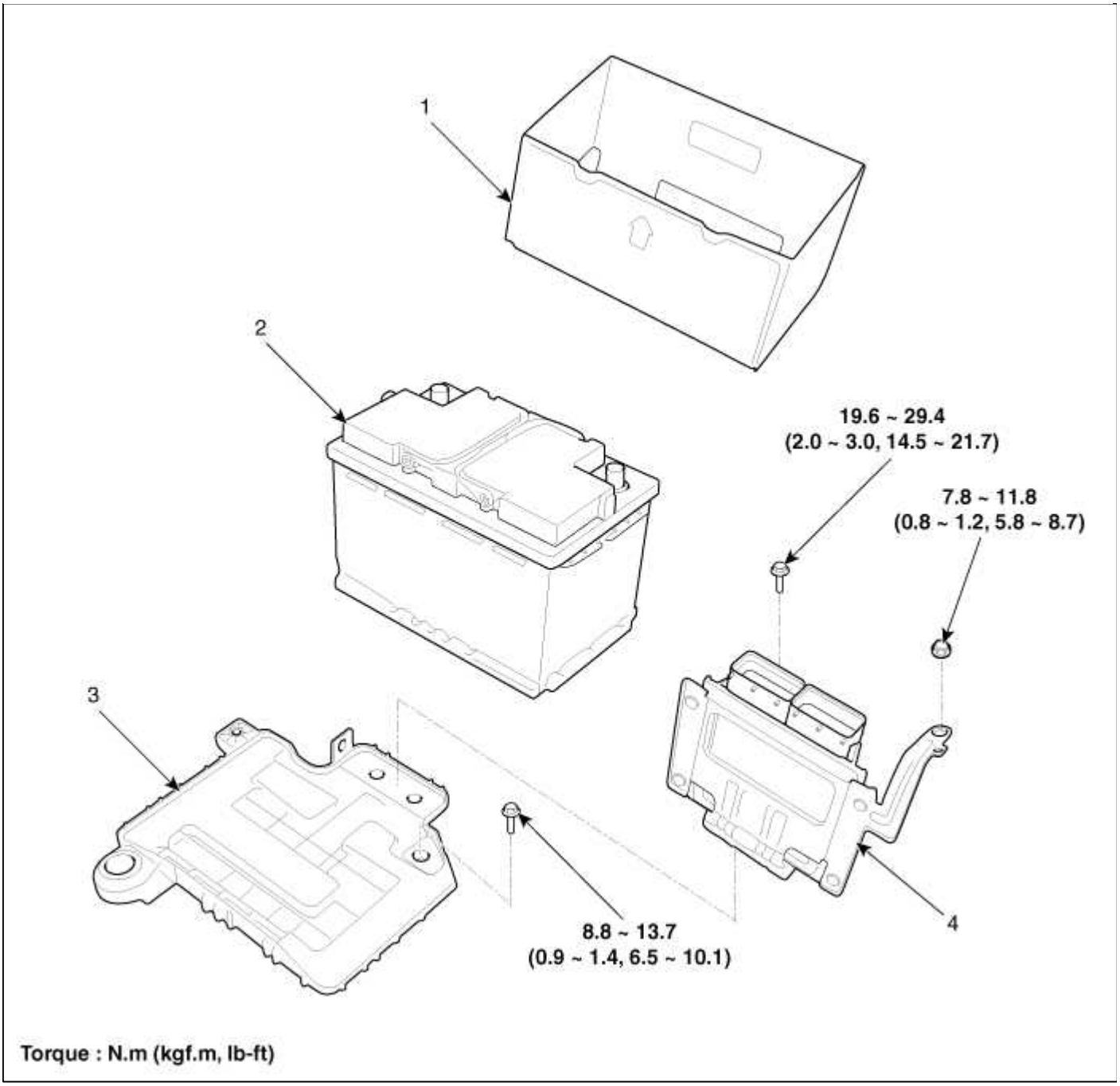
Do not charge the AGM battery with>15.2V. No quick-charging routines.

CAUTION

If the battery is charged directly at the battery terminals on vehicles with battery sensor, misinterpretations of battery condition and under certain circumstances also unwanted Check Control messages or fault memory entire can occur.
If the battery is charged directly at the battery (+),(-) terminals on vehicles with battery sensor, the battery sensor should be re-installed and then, battery sensor recalibration procedure should be performed.

Fuel System > ISG (Idle Stop & Go) System > AGM Battery > Components and Components Location

Components



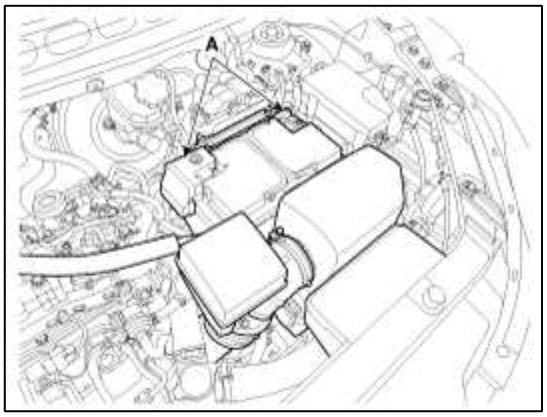
1. Battery insulation pad 2. Battery 3. Battery tray	4. ECM & bracket assembly 5. Battery mounting bracket

Fuel System > ISG (Idle Stop & Go) System > AGM Battery > Repair procedures

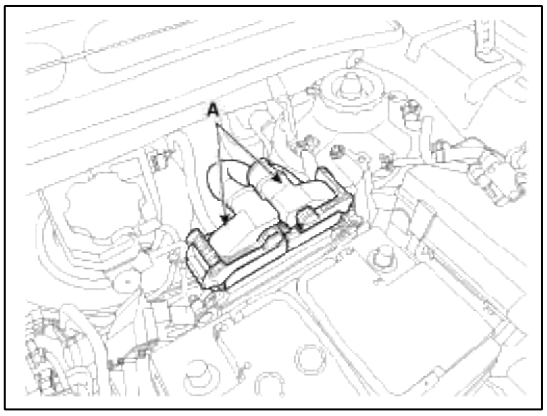
Removal and Installation

1. Remove the battery.
   (1) Disconnect the battery terminals (A).

Tightening torque
(+) terminal :
7.8 ~ 9.8 N.m (0.8 ~ 1.0 kgf.m, 5.8 ~ 7.2 lb-ft)
(-) terminal (without battery sensor) :
7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)
(-) terminal (with battery sensor) :
4.0 ~ 6.0N.m (0.4 ~ 0.6kgf.m, 3.0 ~ 4.4lb-ft)

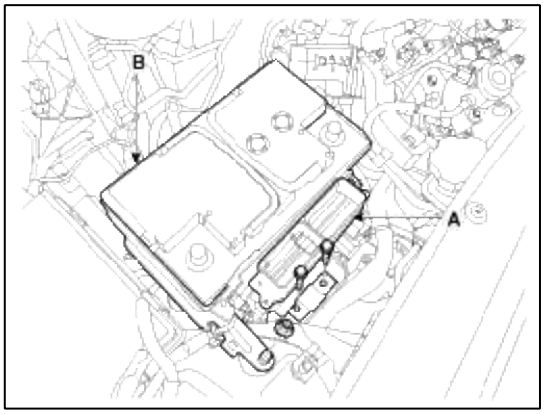


2. Remove the air duct and air cleaner assembly. (Refer to EM group).
3. Remove the battery insulation pad.
4. Disconnect the ECM connector (A).



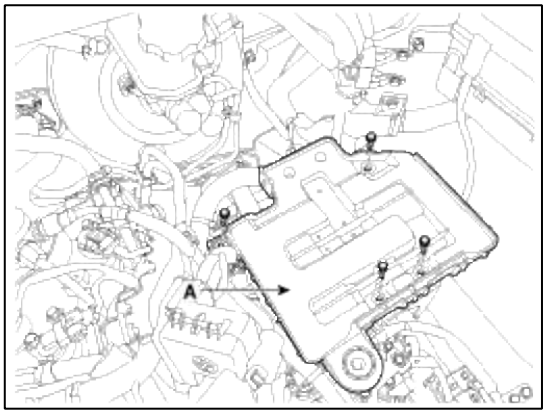
5. Remove the ECM (A) and then disconnect the battery tray (B).

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



6. Remove the battery tray (A).

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



7. Installation is the reverse order of removal.

CAUTION

When installing the battery, fix the mounting bracket on the tray correctly.

CAUTION

- ISG (Idle stop & go) system equipped vehicle always use the AGM battery only. If flooded battery has installed, this can potentially lead to engine electrical trouble or ISG system error.
- Replace same capacity of the AGM battery.

NOTE

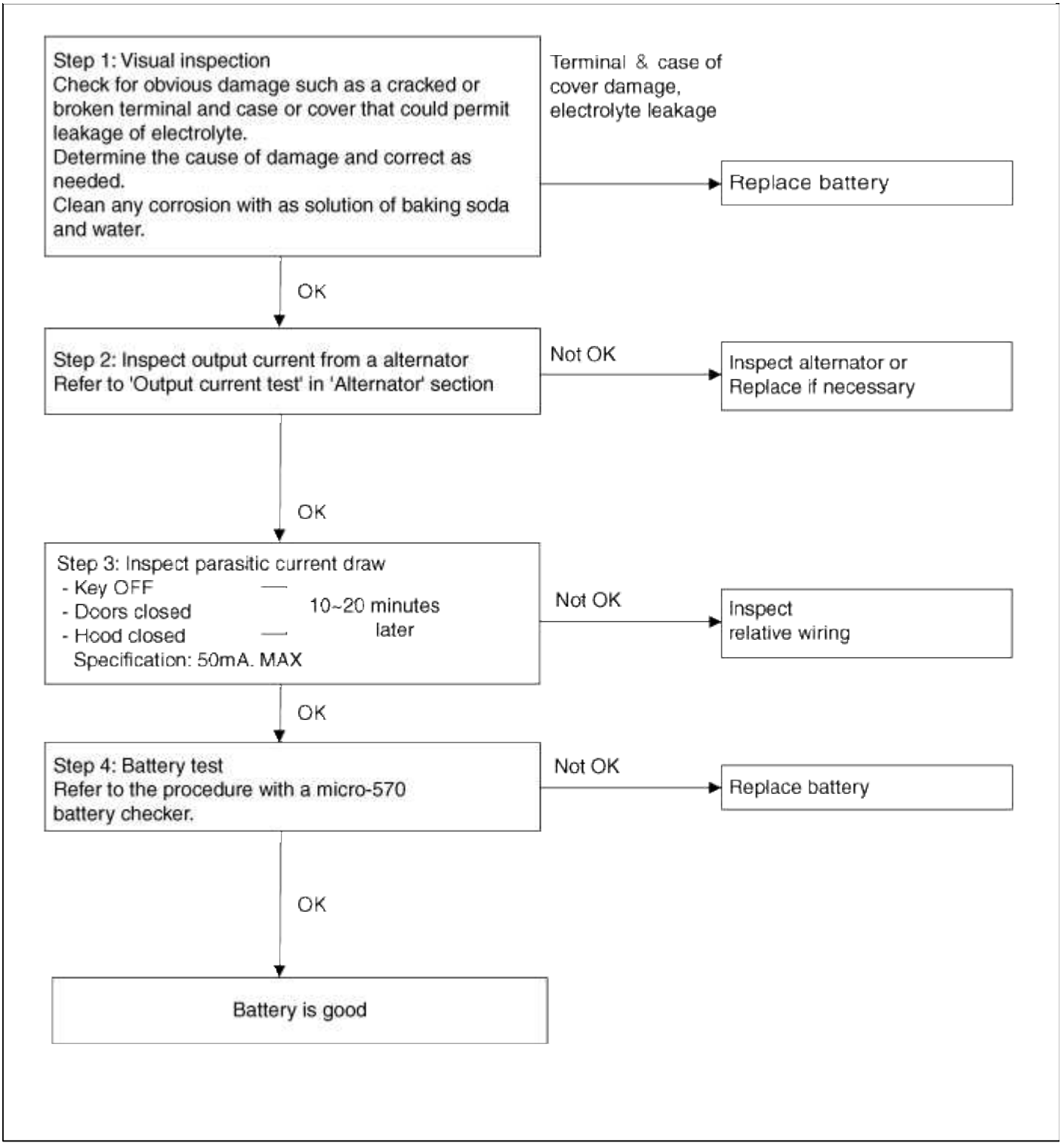
Ensure the AGM battery is placed correctly on the battery tray.
In all cases, an AGM battery must be installed and the battery sensor calibrated for the ISG system to function.
After the battery has been changed or disconnected, the battery sensor must be recalibrated. After connecting the battery, start the engine at least once.
Then park the car for at least 4 hours with the ignition off in the ignition switch OFF door closed, hood switch off state.
After the 4 hours, the engine should be started two times.
At this time the battery sensor will be recalibrated. (Refer to "Battery sensor recalibration procedure" in FL group.)
But first 25 times, the ISG function can operates regardless of ISG system stability for ISG function operating check.

WARNING

Do not open the AGM battery.
The AGM battery must not be opened under any circumstances as the introduction of oxygen from the air will cause the battery to lose its chemical equilibrium and rendered non-operational.

Inspection

Battery Diagnostic Flow



Vehicle parasitic current inspection

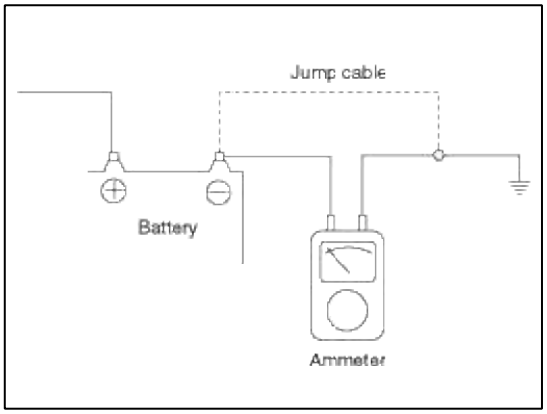
1. Turn all the electric devices OFF, and then turn the ignition switch OFF.
2. Close all doors except the engine hood, and then lock all doors.
   (1) Disconnect the hood switch connector.
   (2) Close the trunk lid.
   (3) Close the doors or remove the door switches.

3. Wait a few minutes until the vehicle's electrical systems go to sleep mode.

> NOTE
>
> For an accurate measurement of a vehicle parasitic current, all electrical systems should go to sleep mode. (It takes at least one hour or at most one day.) However, an approximate vehicle parasitic current can be measured after 10~20 minutes.

4. Connect an ammeter in series between the battery (-) terminal and the ground cable, and then disconnect the clamp from the battery (-) terminal slowly.

> CAUTION
>
> Be careful that the lead wires of an ammeter do not come off from the battery (-) terminal and the ground cable to prevent the battery from being reset. In case the battery is reset, connect the battery cable again, and then start the engine or turn the ignition switch ON for more than 10 sec. Repeat the procedure from No. 1.
> To prevent the battery from being reset during the inspection,
> 1) Connect a jump cable between the battery (-) terminal and the ground cable.
> 2) Disconnect the ground cable from the battery (-) terminal.
> 3) Connect an ammeter between the battery (-) terminal and the ground cable.
> 4) After disconnecting the jump cable, read the current value of the ammeter.



5. Read the current value of the ammeter.
   A. If the parasitic current is over the limit value, search for abnormal circuit by removing a fuse one by one and checking the parasitic current.
   B. Reconnect the suspected parasitic current draw circuit fuse only and search for suspected unit by removing a component connected with the circuit one by one until the parasitic draw drops below limit value.

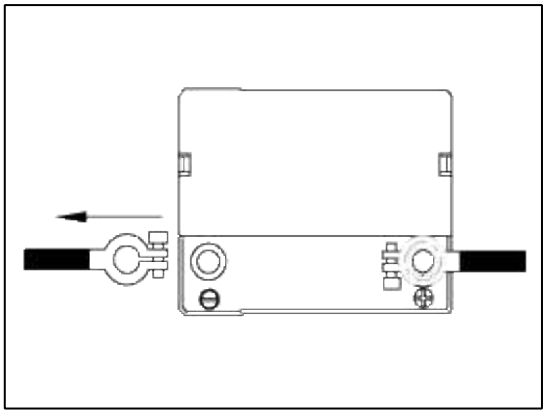
Limit value (after 10~20 min.): Below 50 mA

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 from battery.

Fuel System > ISG (Idle Stop & Go) System > DC/DC Converter > Description and Operation

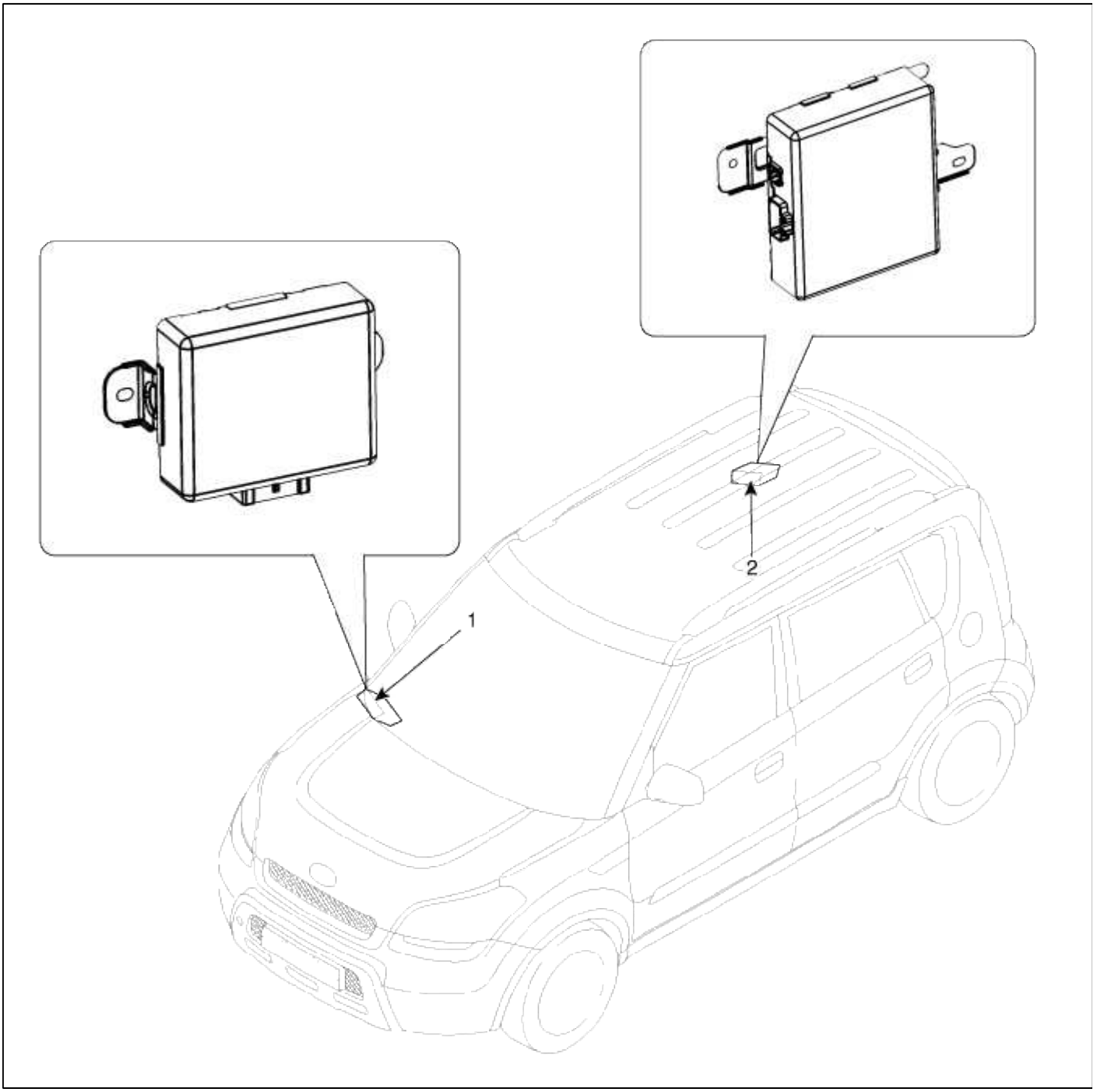
Description

Due to the considerably more frequent occurrence of starting operations, the electrical load that occurs often leads to voltage dips in the vehicle network. In order to stabilize the power supply for certain voltage-sensitive electrical components, a DC/DC converter is used in conjunction with the ISG function.
The DC DC converter supplies the relay with a voltage that also remains constant during the starting operation.

The DC/DC converter is fitted at the behind of the glove box and luggage side trim RH.
Via the test leads for input voltage and the start relay , the electronics decide whether the power is supplied to the output via the bypass or the DC/DC converter.
In the bypass mode, the on-board supply voltage is not fed across the DC/DC converter, rather is transferred directly to the outputs. In the booster phase, the vehicle voltage is adapted.

Fuel System > ISG (Idle Stop & Go) System > DC/DC Converter > Components and Components Location

Component Location

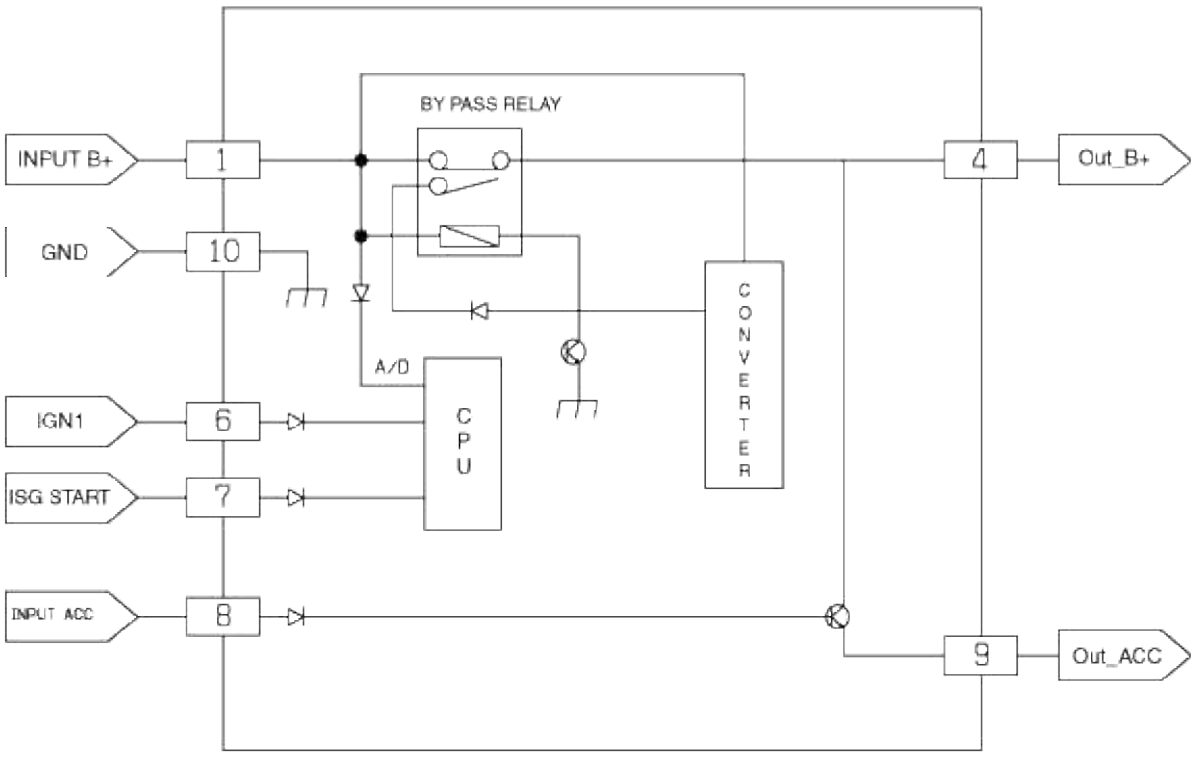


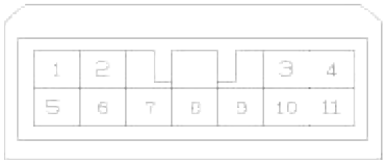
1. DC/DC Converter (200W)
2. DC/DC Converter (400W)

Fuel System > ISG (Idle Stop & Go) System > DC/DC Converter > Schematic Diagrams

Circuit Diagram

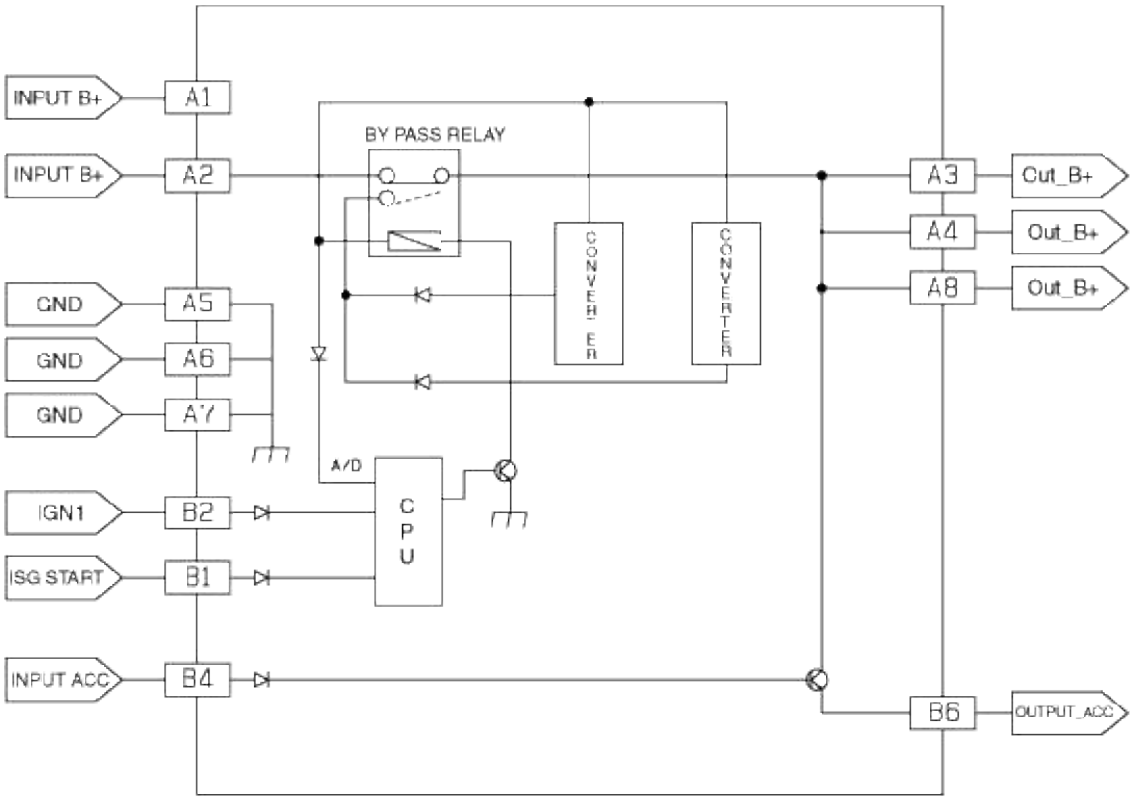
[200W]

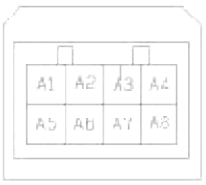




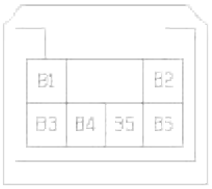
PIN NO.	DESCRIPTION
1	INPUT B+
2	-
3	-
4	OUTPUT B+
5	-
6	IGN1
7	ISG START
8	INPUT_ACC
9	OUTPUT_ACC
10	GND
11	-

[400W]





PIN NO.	DESCRIPTION
A1	INPUT B+
A2	INPUT B+
A3	OUTPUT B+
A4	OUTPUT B+
A5	GND
A6	GND
A7	GND
A8	OUTPUT B+



PIN NO.	DESCRIPTION
B1	ISG START
B2	ING1
B3	NC
B4	INPUT ACC
B5	NC
B6	OUTPUT_ACC

NOTE

In the ISG mode, if the power of an audio system turnsOFF by drawdown while “Auto Starting” or “Idle Starting”function operates, replace the DC/DC converter.

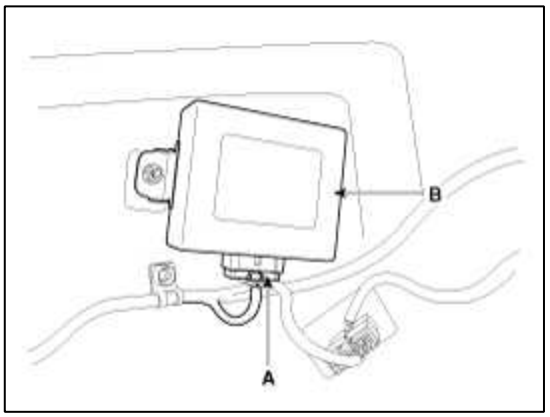
Fuel System > ISG (Idle Stop & Go) System > DC/DC Converter > Repair procedures

Removal

[200W]

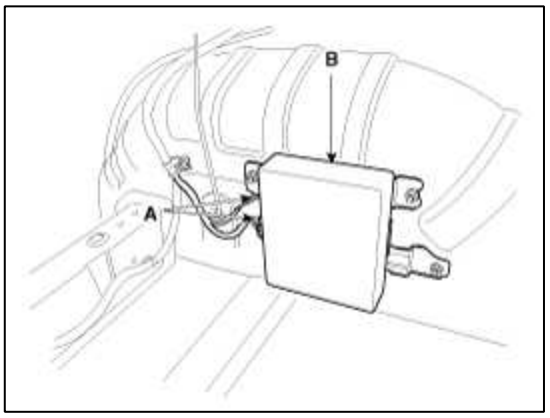
1. Disconnect the battery negative terminal.
2. Remove the glove box housing. (Refer to BD group)

3. Disconnect the connector (A) and then remove the DC/DC converter (B).



[400W]

1. Disconnect the battery negative terminal.
2. Remove the rear seat (Refer to "Seat & Rear Seat" in BD group).
3. Remove the luggage side trim RH (Refer to "Interior" in BD group).
4. Disconnect the connector (A) and then remove the DC/DC converter (B).



NOTE

After disconnecting then reconnecting the battery negative cable, the ISG function dose not operates until the system is stabilized, about 4 hours.

Installation

1. Installation is reverse of removal.

Fuel System > ISG (Idle Stop & Go) System > ISG OFF Switch > Description and Operation

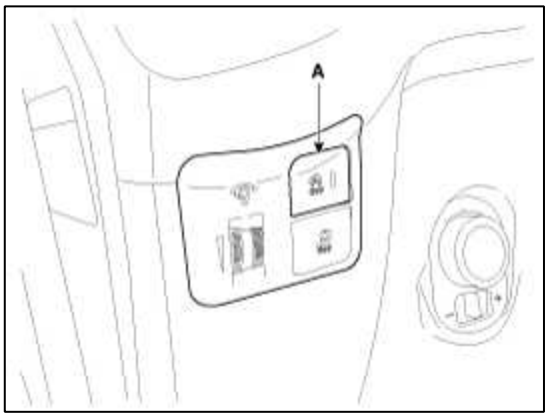
Description

The ISG OFF switch on the crash pad lower panel can be used to deactivate the ISG function.

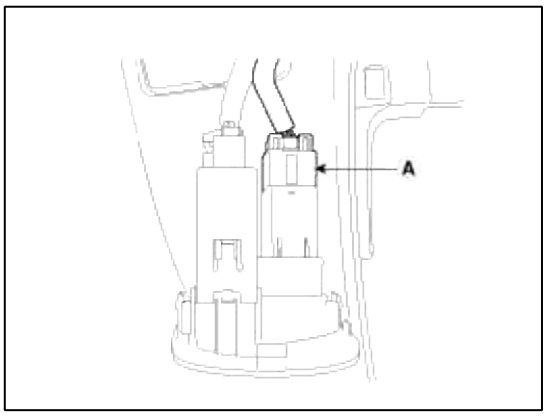
Fuel System > ISG (Idle Stop & Go) System > ISG OFF Switch > Repair procedures

Inspection

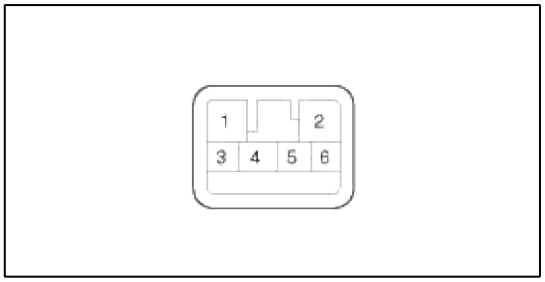
1. Remove the crash pad side switch assembly (A) from the switch panel on the crach pad of the driver's side.

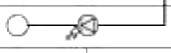


2. Disconnect the ISG OFF switch connector (A).



3. Check the continuity between the switch 2 and 3 terminals as the ISG OFF switch is engaged.



Position / Terminal	ON	OFF	Remark
3			Indicator
5			Indicator
4			Switch
1			Switch

Fuel System > ISG (Idle Stop & Go) System > Alternator > Description and Operation

Description

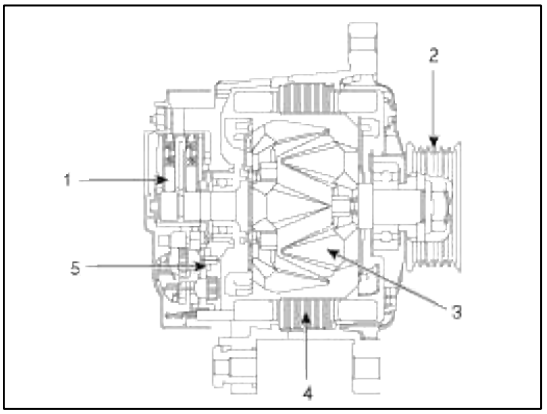
The charging system included a battery, an alternator with a built-in regulator, and the charging indicator light and wire.

The Alternator has eight built-in diodes, each rectifying AC current to DC current.

Therefore, DC current appears at alternator "B" terminal.

In addition, the charging voltage of this alternator is regulated by the battery voltage detection system.

The alternator is regulated by the battery voltage detection system. The main components of the alternator are the rotor, stator, rectifier, capacitor brushes, bearings and OAD (Overrunning Alternator Decoupler) pulley. The brush holder contains a built-in electronic voltage regulator.



1. Brush
2. OAD (Overrunning Alternator Decoupler) pulley
3. Rotor
4. Ststor
5. Rectifier

Alternator Management System
Alternator management system controls the charging voltage set point in order to improve fuel economy, manage alternator load under various operating conditions, keep the battery charged, and protect the battery from over-charging. ECM controls generating voltage by duty cycle (charging control, discharging control, normal control) based on the battery conditions and vehicle operating conditions.
The system conducts discharging control when accelerating a vehicle. Vehicle reduces an alternator load and consumes an electric power form a battery.
The system conducts charging control when decelerating a vehicle. Vehicle increases an alternator load and charges a battery.

Fuel System > ISG (Idle Stop & Go) System > Alternator > Specifications

Specification

Items			Specification
ISG Alternator	Rated voltage		13.5V, 110A
	Speed in use		1,000 ~ 18,000rpm
	Voltage regulator		IC Regulator built-in type
	Regulator setting voltage	External mode	ECU control
		Internal mode	14.55 ± 0.3V
	Temperature compensation	External mode	ECU control
		Internal mode	-3.5 ± 2mV / °C

Fuel System > ISG (Idle Stop & Go) System > Alternator > Repair procedures

On-vehicle Inpection

CAUTION

- Check that the battery cables are connected to the correct terminals.
- Disconnect the battery cables when the battery is given a quick charge.
- Never disconnect the battery while the engine is running.

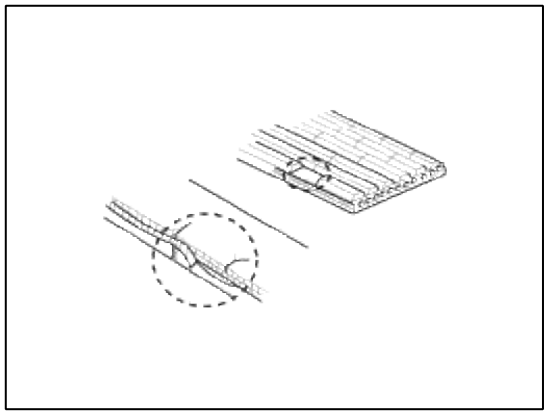
Check The Battery Terminals And Fuses

1. Check that the battery terminals are not loose or corroded.
2. Check the fuses for continuity.

Inspect Drive Belt

1. Visually check the belt for excessive wear, frayed cords etc.
   If any defect has been found, replace the drive belt.

> NOTE
>
> Cracks on the rib side of a belt are considered acceptable. If the belt has chunks missing from the ribs, it should be replaced.



Drive belt tension measurement and adjustment

Belt tension measurement

Measure the belt tension using a mechanical tension gauge or a sonic tension meter.

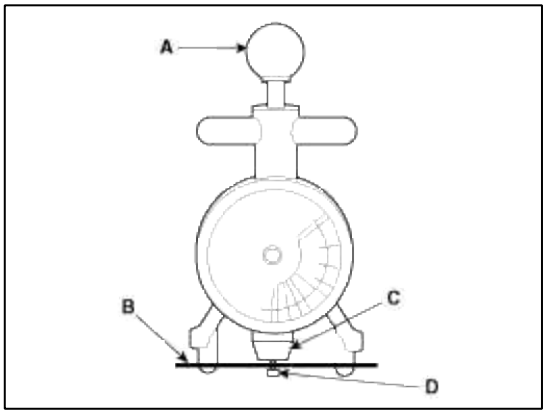
Tension
New belt: 637.4 ~ 735.5N (65 ~ 75kg, 143.3 ~ 165.3lb)
Used belt: 490.3 ~ 588.4N (50 ~ 60kg, 110.2 ~ 132.3lb)

CAUTION

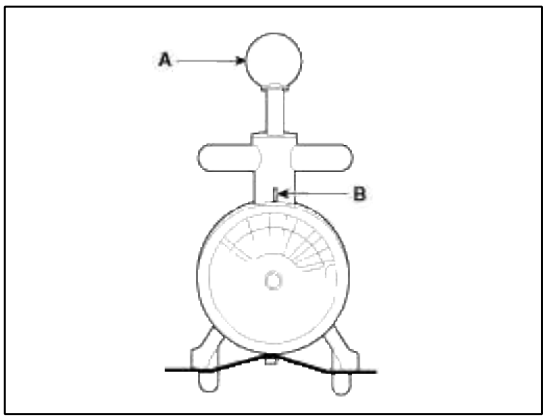
- If the engine has run for 5 minutes or more, the belt tension must be adjusted as a used belt.
- When installing the V-ribbed belt, all grooves on the pulley should be covered with belt ribs.
- A loose belt causes slip noise.
- Too tight belt cause bearing of alternator and water pump to damage.

Using a mechanical tension gauge (BT-33-73F, BTG-2 type)

1. While pressing the handle (A) of the gauge, insert the belt (B) between pulley and pulley (or idler) into the gap between spindle (C) and hook (D).



2. After releasing the handle (A), read a value on the dial pointed by the indicator (B).



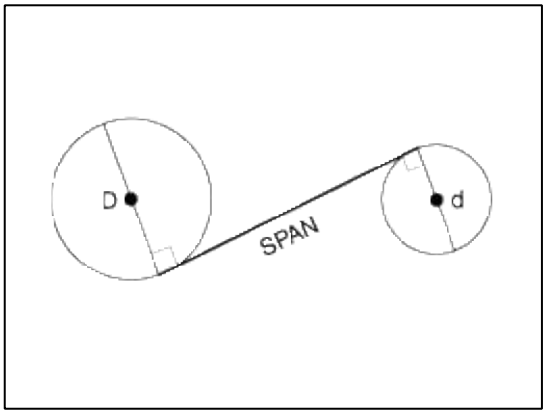
Using a sonic tension meter (U-505/507 type)

1. Input the belt specifications into the tension meter.

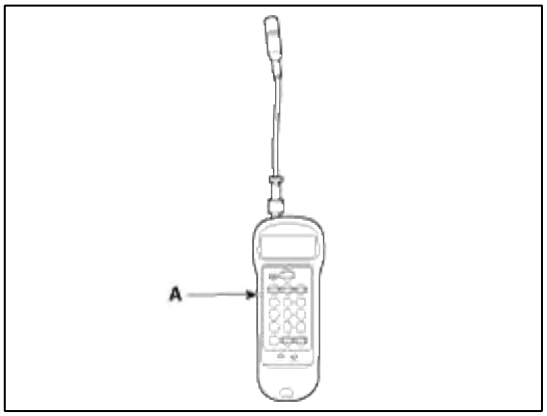
Belt type	Location of measurement	Input data		
		M (Mass, g/m.rib)	W (Width, rib)	S (Span, mm)
With A/C	Crankshaft pulley to A/C compressor pulley	013.4	006.0	178.9
Without A/C	Idler to alternator pulley	013.4	006.0	Actual measurement value

NOTE

Measurement of S (Span) : Caculate average value after measuring the distance 3~4 times.

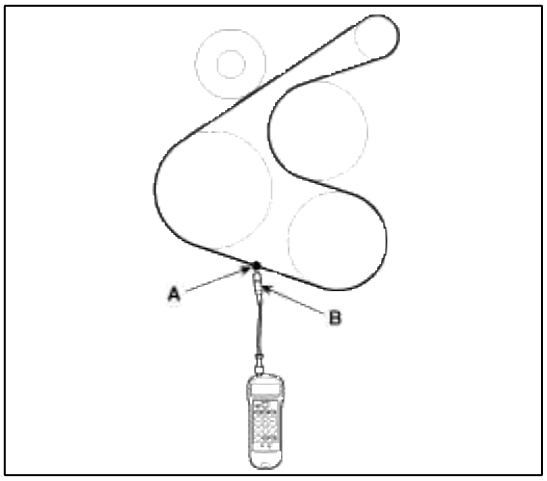


D : Idler
d : Alternator pulley

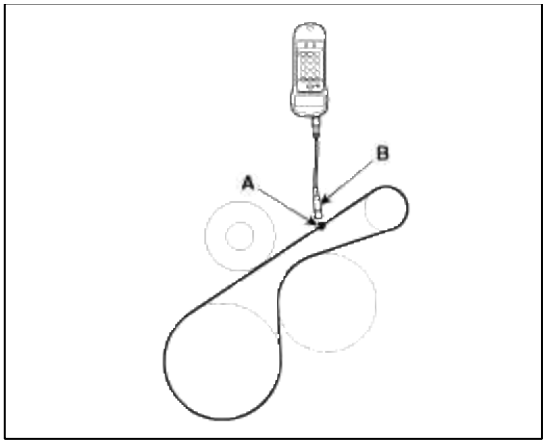


2. Locate the micro phone (B) close to the center of belt span (A) and bounce the belt by finger 2~3 times. Read a value on the display.

[With A/C]

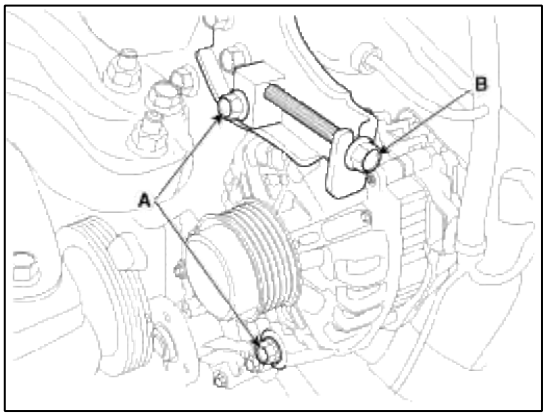


[Without A/C]



If adjustment is necessary :

1. Loosen the mounting bolts (A).
2. Tighten the adjusting bolt(B) clockwise in loose tension ; loosen the bolt counterclockwise in high tension.



3. Recheck tension of the belt.
4. After adjusting tension, tighten the through bolts.

Tightening torque
12mm (0.47in) bolt : 19.6 ~ 26.5 Nm (2.0 ~ 2.7 kgf.m, 14.5 ~ 19.5 Ib-ft)
14mm (0.55in) bolt : 29.4 ~ 41.2 Nm (3.0 ~ 4.2 kgf.m, 21.7 ~ 30.4 Ib-ft)

Visually Check Alternator Wiring And Listen For Abnormal Noises

1. Check that the wiring is in good condition.
2. Check that there is no abnormal noise from the alternator while the engine is running.

Check Discharge Warning Light Circuit

1. Warm up the engine and then turn it off.
2. Turn off all accessories.
3. Turn the ignition switch "ON". Check that the discharge warning light is lit.
4. Start the engine. Check that the light is lit.
   If the light does not go off as specified, troubleshoot the discharge light circuit.

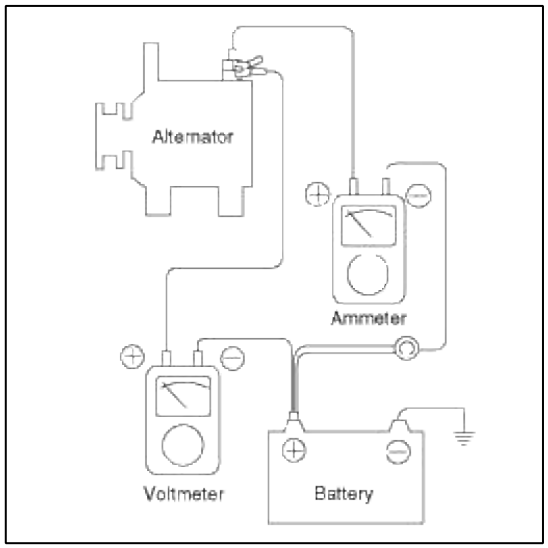
Inspect Charging System

Voltage Drop Test Of Alternator Output Wire

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

Preparation

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



Test

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

Result

1. The voltmeter may indicate the standard value.

   Standard value : 0.2V max

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

Output Current Test

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

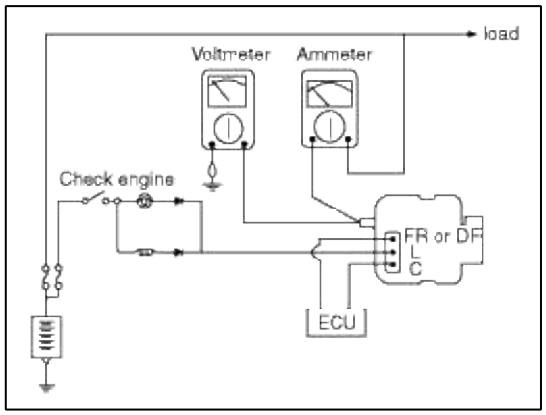
Preparation

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

   NOTE

   Tighten each connection securely, as a heavy current will flow. Do not rely on clips.

6. Connect a voltmeter (0 to 20V) between the "B" terminal and ground. Connect the (+) lead wire to the alternator "B" terminal and (-) lead wire to a good ground.
7. Attach an engine tachometer and connect the battery ground cable.
8. Leave the engine hood open.



Test

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

   NOTE

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

Result

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

   Limit value : 60% of the voltage rate

   NOTE

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

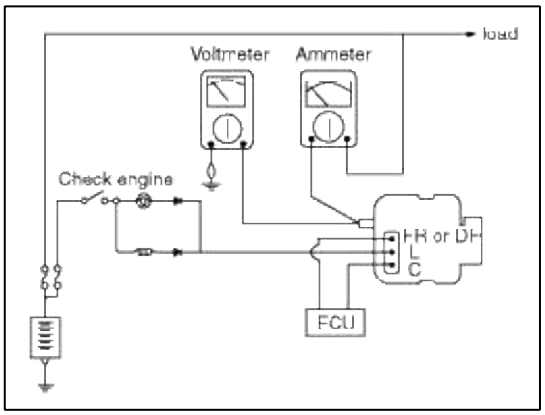
2. Upon completion of the output current test, lower the engine speed to idle and turn off the ignition switch.
3. Disconnect the battery ground cable.
4. Remove the ammeter and voltmeter and the engine tachometer.
5. Connect the alternator output wire to the alternator "B" terminal.
6. Connect the battery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

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

Preparation

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

7. Attach the engine tachometer and connect the battery ground cable.



Test

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

   Voltage: Battery voltage

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

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

Result

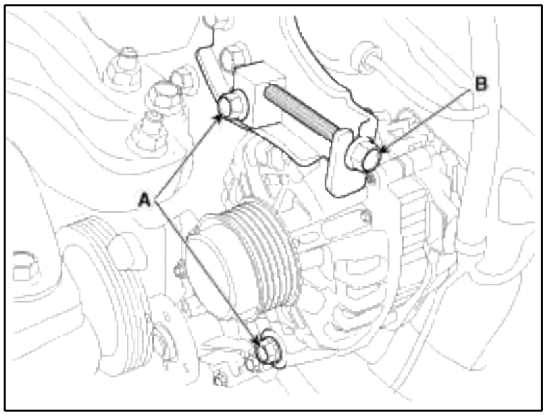
1. If the voltmeter reading dosen't agree with the standard value, the voltage regulator or the alternator is faulty.
2. Upon completion of the test, reduce the engine speed to idle, and turn off the ignition switch.
3. Disconnect the battery ground cable.
4. Remove the voltmeter and ammeter and the engine tachometer.
5. Connect the alternator output wire to the alternator "B" terminal.
6. Connect the battery ground cable.

Removal and Installation

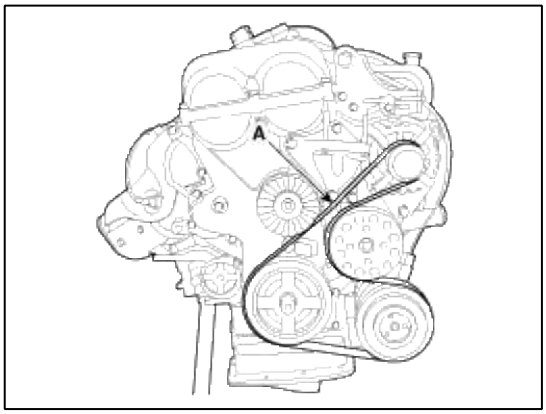
1. Disconnect the battery negative terminal first, then the positive terminal.

   Tightening torque
   (+) terminal :
   7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)
   (-) terminal (without battery sensor):
   7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)
   (-) terminal (with battery sensor):
   4.0 ~ 6.0N.m (0.4 ~ 0.6kgf.m, 3.0 ~ 4.4lb-ft)

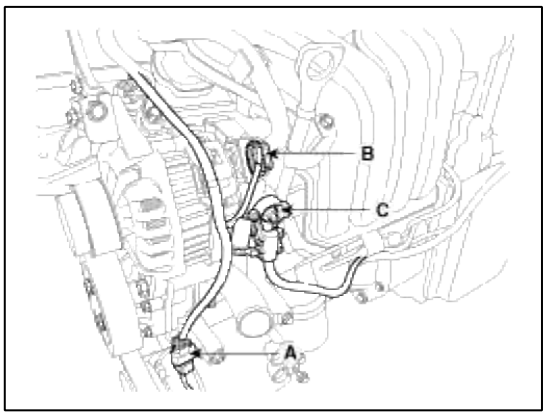
2. Remove the drive belt.
   (1) Loosen the through bolt (A).
   (2) Loosen the tension by turning the tension adjusting bolt (B).



   (3) Remove the drive belt (A).

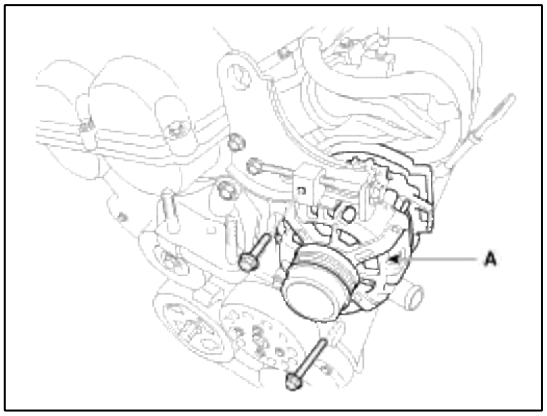


3. Disconnect the A/C compressor switch connector (A), the alternator connector (B) and the cable from the alternator "B" terminal (C).



4. Remove the alternator (A).

Tightening torque :
19.6~26.5 Nm (2.0~2.7 kgf.m, 14.5~19.5 Ib-ft)-12mm bolt
29.4~41.2 Nm (3.0~4.2 kgf.m, 21.7~30.4 Ib-ft)-14mm bolt



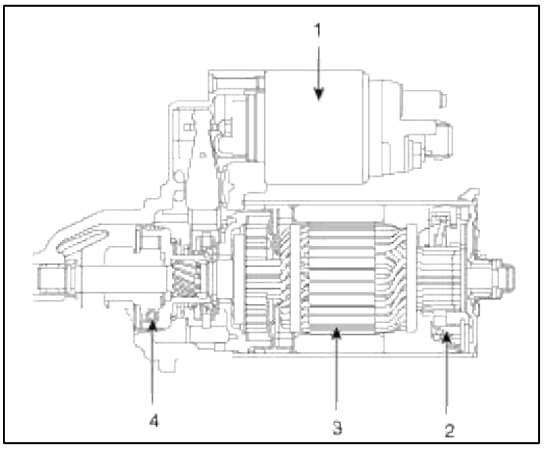
5. Installation is the reverse order of removal.

6. Adjust the alternator belt tension after installation.

Fuel System > ISG (Idle Stop & Go) System > Starter > Description and Operation

Description

The starting system includes the battery, starter, solenoid switch, inhibitor switch (A/T), ignition switch, ignition lock switch, connection wires and the battery cable.
When the ignition key is turned to the start position, current flows and energizes the starter motor's solenoid coil. The solenoid plunger and clutch shift lever are activated, and the clutch pinion engages the ring gear.
The contacts close and the starter motor cranks. In order to prevent damage caused by excessive rotation of the starter armature when the engine starts, the clutch pinion gear overruns.



In conjunction with the ISG function, the starter motor must do a great deal more work. The starter motor is therefore configured for a significantly higher number of start cycles. The components of the starter motor have been adapted to the higher requirements.

NOTE

There are two kinds of starter, ISG type starter and the other.
When replace the starter, confirm that the part number and connector shape.

CAUTION

ISG (Idle stop & go) system equipped vehicle always use the ISG type starter only. If the other starter has installed, this can potentially lead to engine electrical trouble or ISG system error.

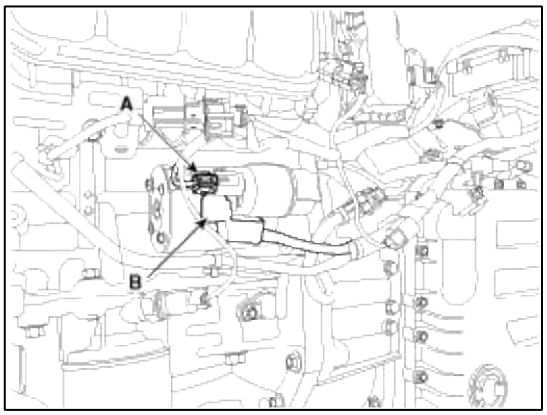
WARNING

Do not disassemble the ISG type starter.
If the starter troubles occur, replace the starter.

Fuel System > ISG (Idle Stop & Go) System > Starter > Repair procedures

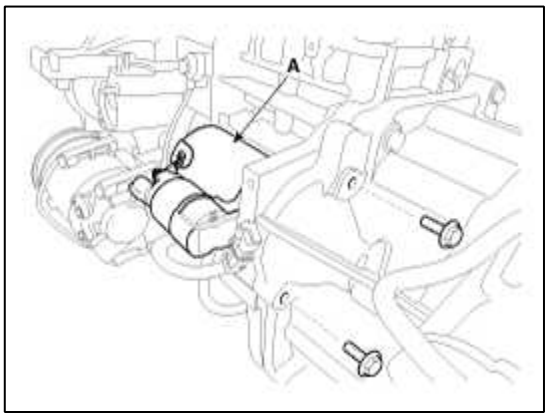
Removal and Installation

1. Disconnect the battery negative terminal.
2. Remove the air duct and air cleaner assembly. (Refer to EM group)
3. Disconnect the starter cable (B) from the B terminal on the solenoid then disconnect the connector (A) from the S terminal.



4. Remove the 2 bolts holding the starter, then remove the starter (A).

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



5. Installation is the reverse of removal.

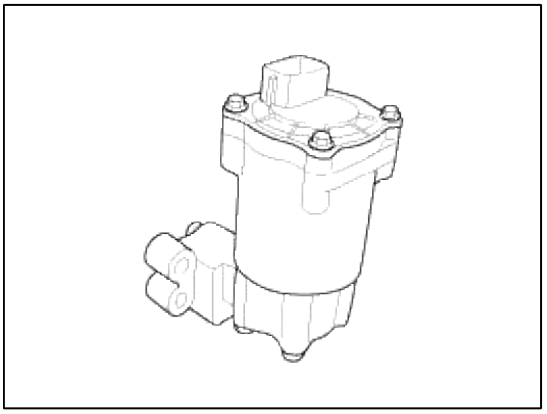
Fuel System > ISG (Idle Stop & Go) System > Electric Oil Pump > Description and Operation

Description

This transaxle has a standard Mechanical Oil Pump (MOP) linked to the input shaft to generates oil pressure when input shaft rotates.

But, this transaxle equipped with ISG system also has an Electric Oil Pump (EOP). Because the ISG system features Auto-Stop which starts and stops the engine as needed. The Auto-Stop feature prevents the Mechanical Oil Pump (MOP) from operating and building enough pressure for the transaxle to operate. When the vehicle comes to a stop with the engine off, Mechanical Oil Pump (MOP) cannot generate sufficient oil pressure during the initial startup or during low speed driving.

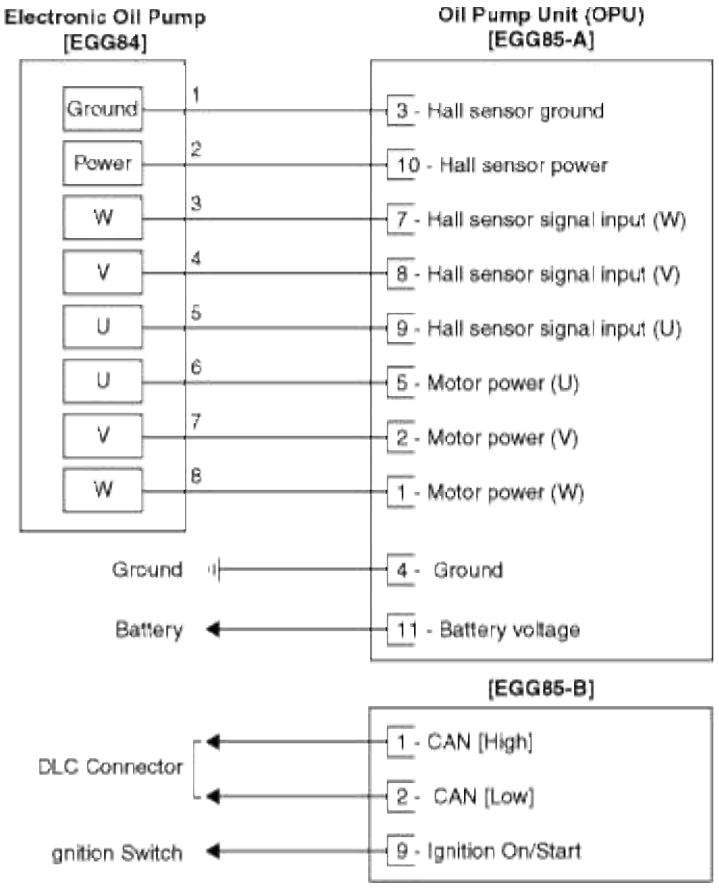
For these reasons, the Electric Oil Pump (EOP) takes on this role as an additional device that can generate the required oil pressure when the vehicle comes to a stop or during low speed driving. The Electric Oil Pump (EOP) supplies oil pressure to the Under Drive Brake (UD/B).



Fuel System > ISG (Idle Stop & Go) System > Electric Oil Pump > Schematic Diagrams

Circuit Diagram

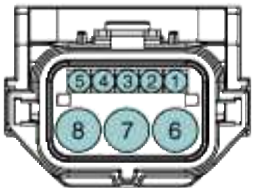
[Circuit Diagram]



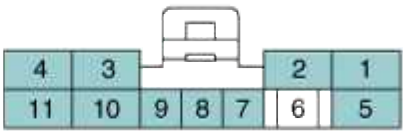
[Connection Information]

Termianl	Connected to	Function
1	OPI EGG85-A (3)	Hal sensor ground
2	OPI EGG85-A (10)	Hall sensor power
3	OPI EGG85-A (7)	Hall sensor signal input (W)
4	OPI EGG85-A (8)	Hall sensor signal input (V)
5	OPI EGG85-A (9)	Hall sensor signal input (U)
6	OPI EGG85-A (5)	Motor power (U)
7	OPI EGG85-A (2)	Motor power (V)
8	OPI EGG85-A (1)	Motor power (W)

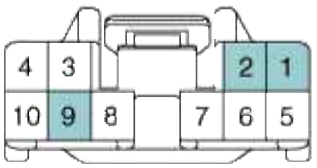
[Harness Connector]



EGG84
Electronic Oil Pump



EGG85-A



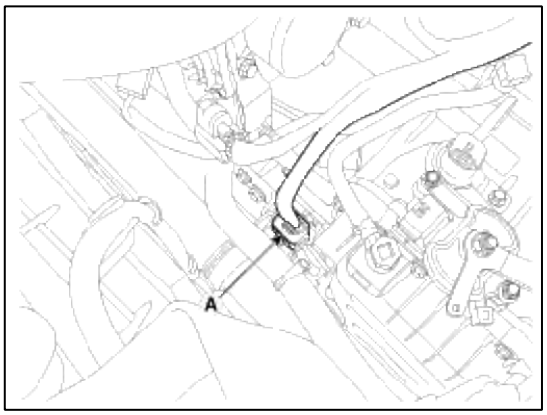
EGG85-B
OPU

Fuel System > ISG (Idle Stop & Go) System > Electric Oil Pump > Repair procedures

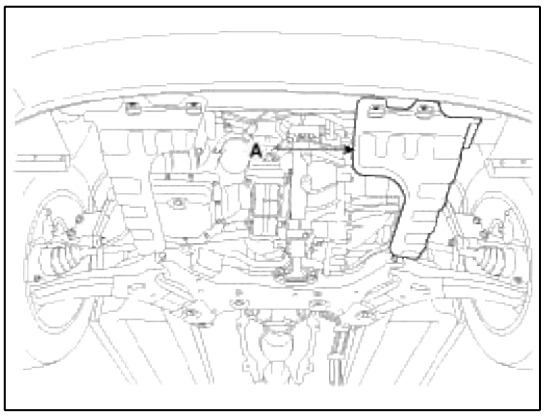
Removal

1. Disconnect the negative (-) battery terminal.

2. Disconnect the Electric Oil Pump (EOP) connector (A).

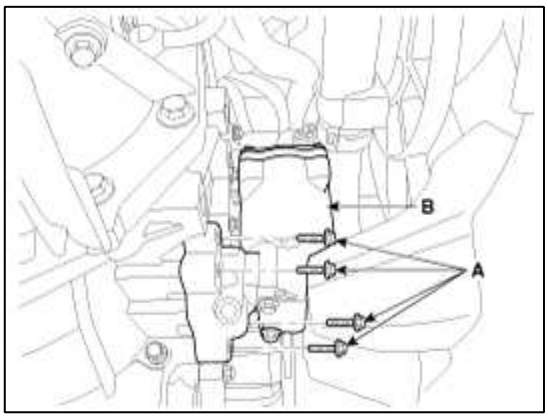


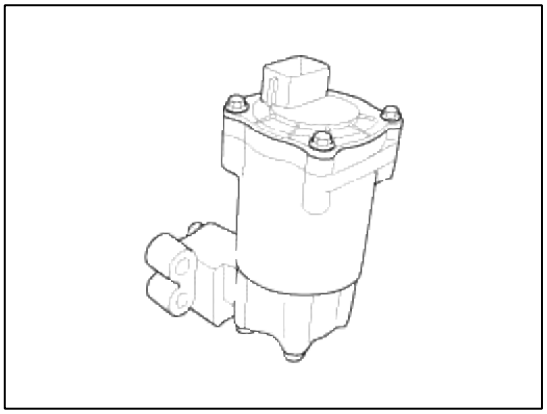
3. Remove the under cover (A) after lifting the vehicle with lift.



4. Remove the Electric Oil Pump (B) after removing the bolts (A-4ea).

Tightening torque:
19.6 ~ 25.5 N.m (2.0 ~ 2.6 kgf.m, 14.4 ~ 18.8 lb-ft)





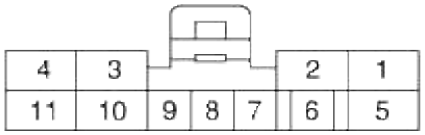
Installation

1. Installation is the reverse of removal.

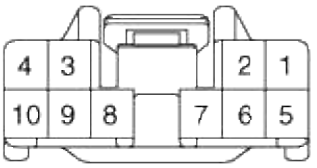
> NOTE
>
> If ATF is spilled, add ATF fluid as the amount of ATF flow.

Fuel System > ISG (Idle Stop & Go) System > Oil Pump Unit (OPU) > Schematic Diagrams

Oil Pump Unit (OPU) Connector



[EGG85-A]



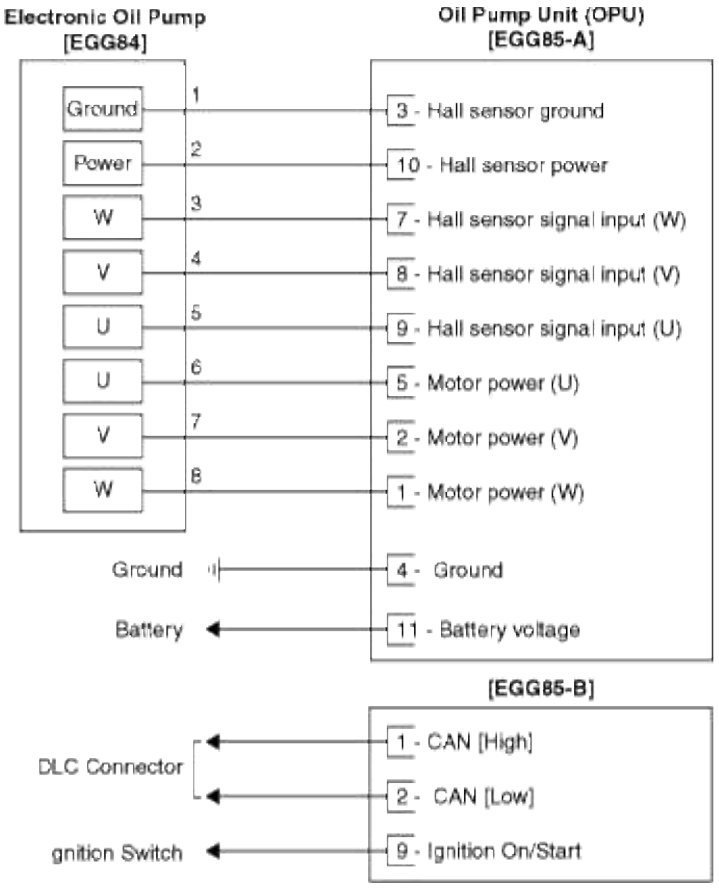
[EGG85-B]

Opu Connector Terminal Function

EGGG114-A		EGGG114-B	
Pin No.	**Description**	**Pin No.**	**Description**
1	Motor power(W)	1	CAN communication (High)
2	Motor power(V)	2	CAN communication (Low)
3	Hall sensor(Ground)	3	-
4	Ground	4	-
5	Motor power(U)	5	-
6	Shield ground	6	-
7	Hall sensor signal input (W)	7	-
8	Hall sensor signal input (V)	8	-
9	Hall sensor signal input (U)	9	Ignition ON / Start
10	Hall sensor power	10	-
11	Battery voltage		

Circuit diagram

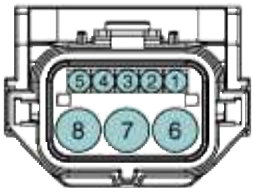
[Circuit Diagram]



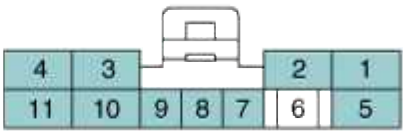
[Connection Information]

Termianl	Connected to	Function
1	OPI EGG85-A (3)	Hal sensor ground
2	OPI EGG85-A (10)	Hall sensor power
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5	OPI EGG85-A (9)	Hall sensor signal input (U)
6	OPI EGG85-A (5)	Motor power (U)
7	OPI EGG85-A (2)	Motor power (V)
8	OPI EGG85-A (1)	Motor power (W)

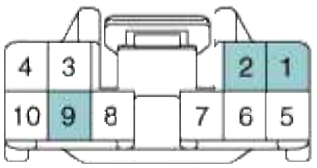
[Harness Connector]



EGG84
Electronic Oil Pump



EGG85-A



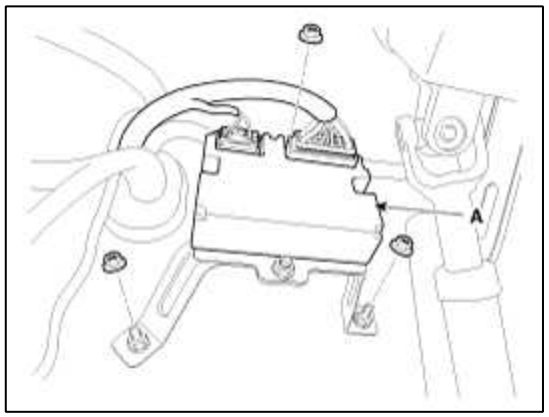
EGG85-B
OPU

Fuel System > ISG (Idle Stop & Go) System > Oil Pump Unit (OPU) > Repair procedures

Removal

1. Remove the negative (-) battery terminal.
2. Remove the crash pad lower panel. (Refer to “Crash pad” in BD group.)
3. Remove the oil pump unit connector to the left side of the brake pedal.

4. Remove the oil pump unit (A) after removing the nuts (3ea).



Installation

1. Installation is the reverse of removal.

Inspection

OPU Problem Inspection Procedure

1. TEST OPU GROUND CIRCUIT: Measure resistance between OPU and chassis ground using the backside of OPU harness connector as OPU side check point. If the problem is found, repair it.

   Specification: Below 1Ω

2. TEST OPU CONNECTOR: Disconnect the OPU connector and visually check the ground terminals on OPU 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 OPU could be faulty. If so, make sure there were no DTC's before swapping the OPU with a new one, and then check the vehicle again. If DTC's were found, examine this first before swapping OPU.
4. RE-TEST THE ORIGINAL OPU: Install the original OPU (may be broken) into a known-good vehicle and check the vehicle. If the problem occurs again, replace the original OPU with a new one. If problem does not occur, this is intermittent problem (Refer to “Intermittent Problem Inspection Procedure” in Basic Inspection Procedure

   NOTE

   Refer to DTC manual code “P1775, P1777” to inspect oil pump unit.

Fuel System > ISG (Idle Stop & Go) System > Brake Switch > Description and Operation

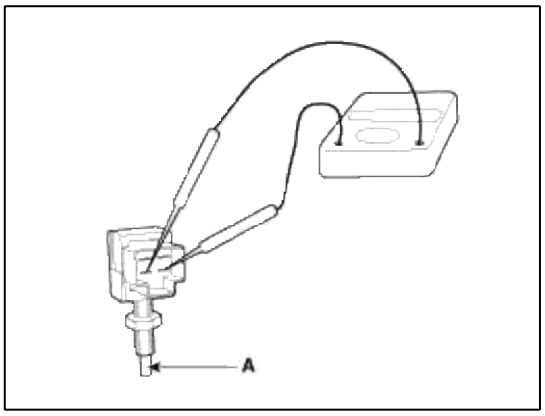
Description

The present brake switch is used as an input variable for the ISG function to detect bracke operation.

Fuel System > ISG (Idle Stop & Go) System > Brake Switch > Repair procedures

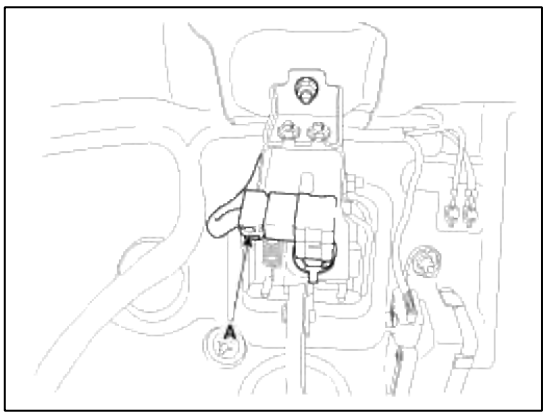
Inspection

1. Connect a circuit tester to the connector of stop lamp switch, and check whether or not there is continuity when the plunger of the stop lamp switch is pushed in and when it is released.
2. The stop lamp switch is in good condition if there is no continuity when plunger (A) is pushed.



Removal

1. Turn ignition switch OFF.
2. Remove the crash pad lower panel. (Refer to the Body group-"crash pad")
3. Disconnect the stop lamp switch connector (A).



Installation

1. Install is reverse of removal.

Fuel System > ISG (Idle Stop & Go) System > Door Switch > Description and Operation

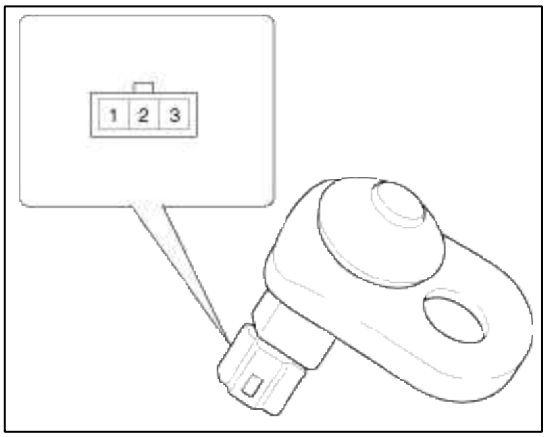
Description

Via the seat belt/Door switch, the ISG function can detect that the driver has fastened the seat belt/door. If the driver has not fastened the seat belt/door, the ISG function reacts as follows. If the seat belt or door is opened, the engine must not be started or stopped by the ISG function for safety reasons.

Fuel System > ISG (Idle Stop & Go) System > Door Switch > Repair procedures

Inspection

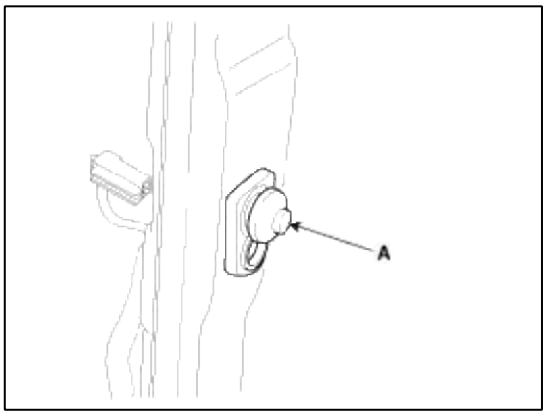
1. Remove the door switch and check for continuity between the terminals.



Terminal / Position	1	2	GND
Free(Door open)	○	○	○
Push(Door close)			

Removal

1. Remove the door switch (A) after loosening the bolt.



Installation

1. Install is reverse of removal.

Fuel System > ISG (Idle Stop & Go) System > Seat Belt Switch > Description and Operation

Description

Via the seat belt/Door switch, the ISG function can detect that the driver has fastened the seat belt/door. If the driver has not fastened the seat belt/door, the ISG function reacts as follows. If the seat belt or door is opened, the engine must not be started or stopped by the ISG function for safety reasons.

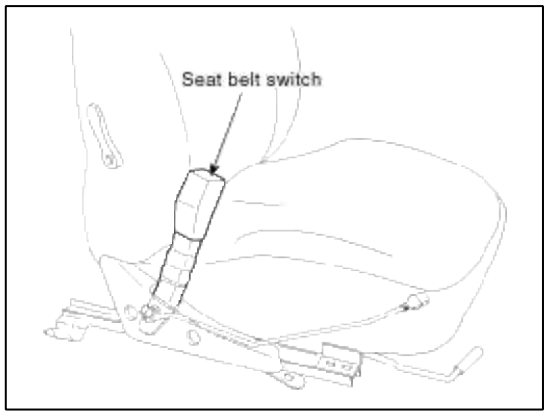
Fuel System > ISG (Idle Stop & Go) System > Seat Belt Switch > Repair procedures

Inspection

1. Remove the connector from the switch.

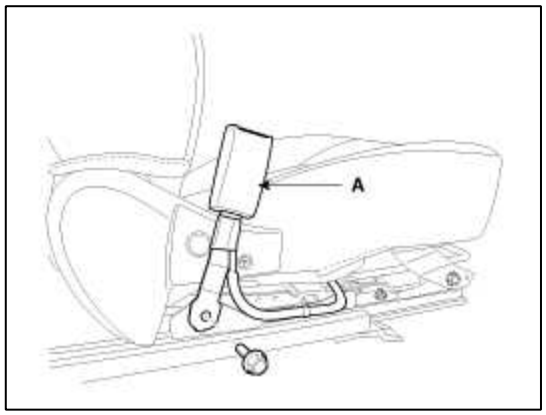
2. Check for continuity between terminals.

Seat belt condition	Continuity
Fastened	Non-conductive (∞Ω)
Not fastened	Conductive (Ω)



Removal

1. Remove the front seat.
2. After loosening the mounting bolt, then remove the front seat belt buckle (A).



Installation

1. Install is reverse of removal.

Tightening Torque :
39.2 ~ 54.0N.m (4.0 ~ 5.5kgf.m, 28.9 ~ 39.8lb-ft)

Fuel System > ISG (Idle Stop & Go) System > Hood switch > Description and Operation

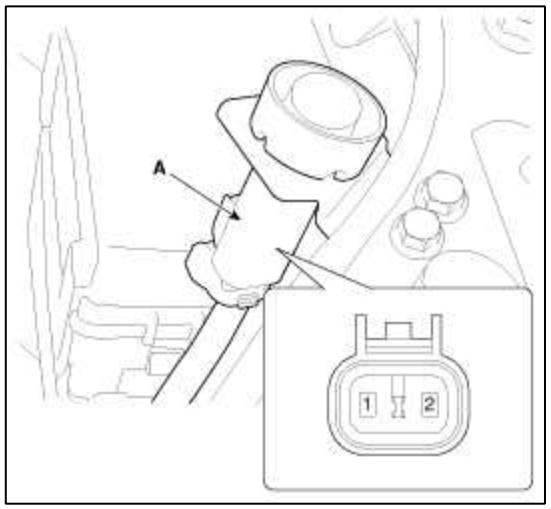
Description

The hood switch is included as the influencing factors in the calculation of the ISG function. If the hood is open, the engine must not be started or stopped by the ISG function for safety reasons.

Fuel System > ISG (Idle Stop & Go) System > Hood switch > Repair procedures

Inspection

1. Disconnect the hood switch connector (A).

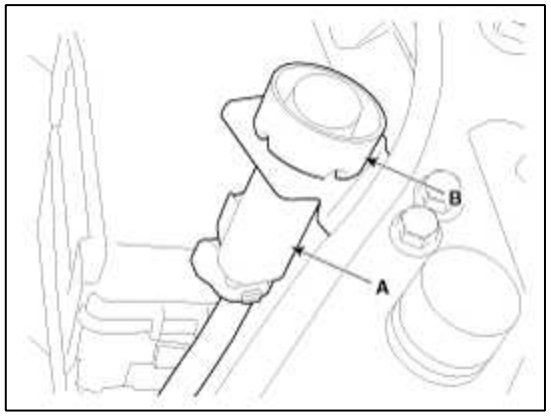


2. Check for continuity between terminals

Terminal / Position	1	2
Hood open (Free)	○	○
Hood close (Push)		

Removal

1. After loosening the mounting bolts and connector (A), then remove the hood switch (B).

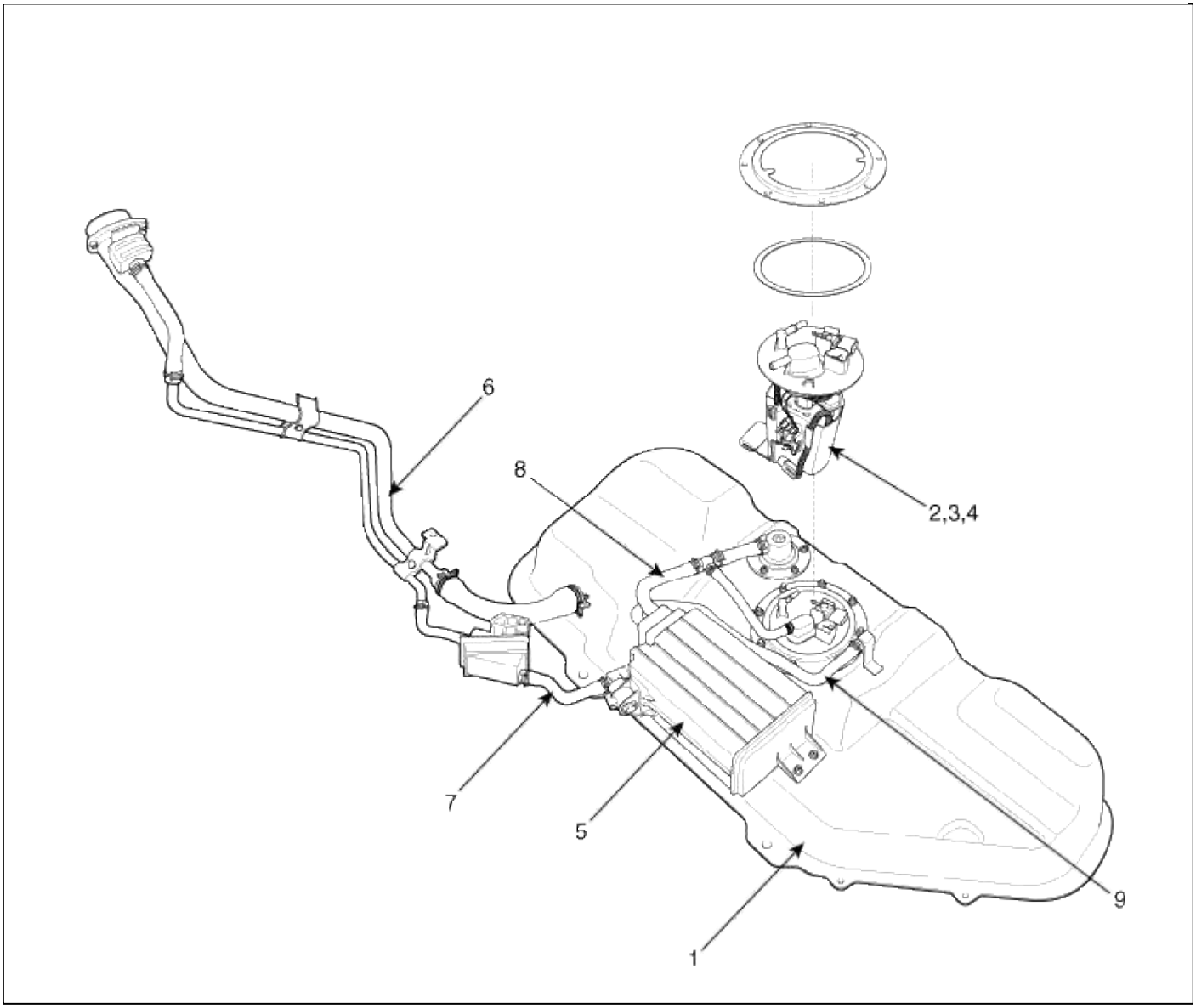


Installation

1. Install is reverse of removal.

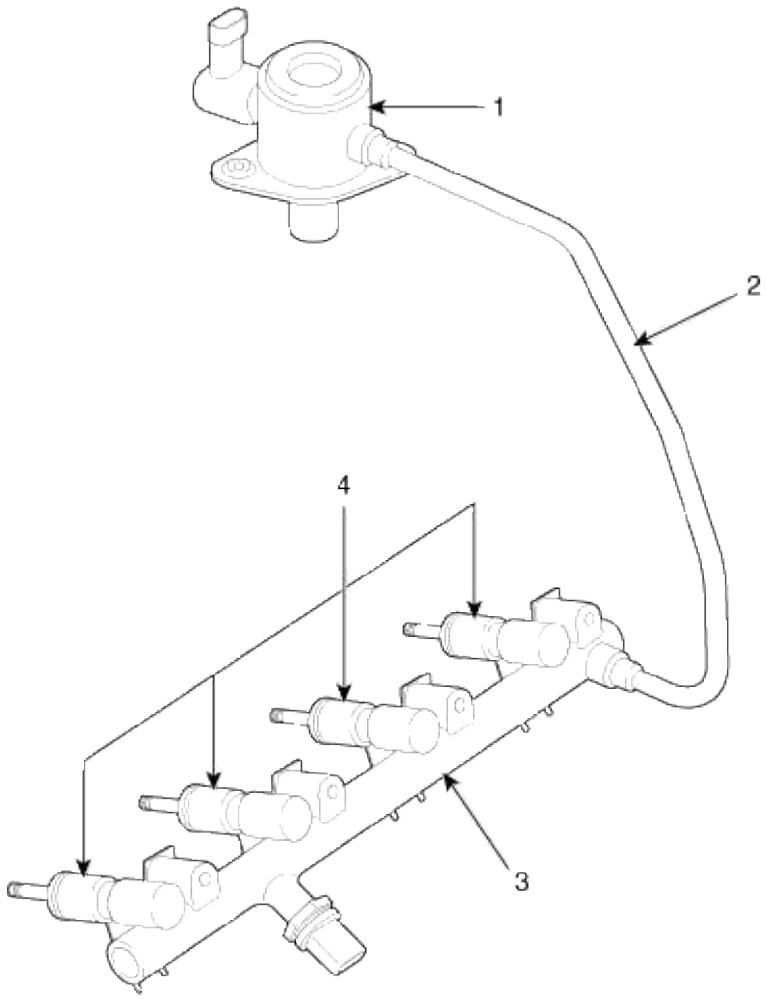
Fuel System > Fuel Delivery System > Components and Components Location

Components Location



1. Fuel Tank	6. Fuel Filler Hose Pipe
2. Fuel Pump	7. Ventilation Hose
3. Fuel Filter	8. Vapor Tube
4. Fuel Pressure Regulator	9. Fuel Pump Plate Cover
5. Canister	

[High Pressure Fuel Line]



1. High Pressure Fuel Pump 2. High Pressure Fuel Pipe	3. Delivery Pipe 4. Injector

WARNING

In case of removing the high pressure fuel pump, high pressure fuel pipe, delivery pipe, and injector, there may be injury caused by leakage of the high pressure fuel. Before repairing the high pressure system, be sure to release the residual pressure in fuel line as step 2 in below procedure.

Fuel System > Fuel Delivery System > Repair procedures

Fuel Pressure Test

1. Release the residual pressure in fuel line (Refer to “Release Residual Pressure in Fuel Line” in this group).

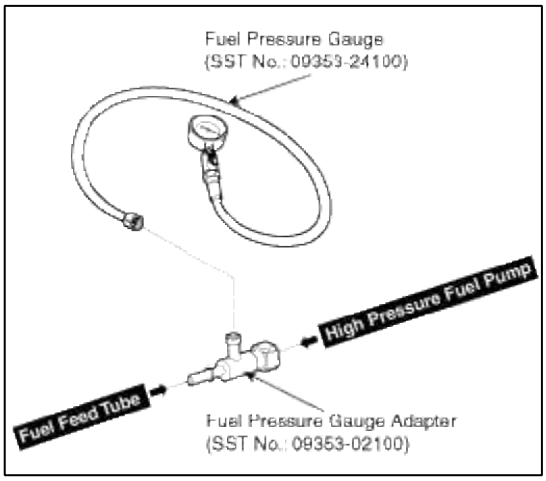
CAUTION

When removing the fuel pump relay, a Diagnostic Trouble Code (DTC) may occur. Delete the code with the GDS after completion of “Release Residual Pressure in Fuel Line” work.

2. Install the Special Service Tool (SST).
   (1) Disconnect the fuel feed tube from the delivery pipe.

> **CAUTION**
>
> There may be some residual pressure even after “Release Residual Pressure in Fuel Line” work, so cover the hose connection with a shop towel to prevent residual fuel from spilling out before disconnecting any fuel connection.

   (2) Install the special service tool for measuring the fuel pressure in between the fuel feed tube and the fuel delivery pipe (Refer to the figure below).



3. Inspect fuel leakage on connections among the fuel feed tube, the delivery pipe, and the SST components with IG ON.

4. Measure Fuel Pressure.
   (1) Start the engine and measure the fuel pressure at idle.

Fuel Pressure:
429 ~ 469 kPa (4.38 ~ 4.79 kgf/cm², 62.3 ~ 68.1 psi)

> **NOTE**
>
> If the fuel pressure differs from the standard value, repair or replace the related part (Refer to the table below).

Fuel Pressure	Cause	Related Part
Too Low	Fuel filter clogged	Fuel Filter
	Fuel leakage	Fuel Pressure Regulator
Too High	Fuel pressure regulator valve stuck	Fuel Pressure Regulator

(2) Stop the engine, and then check for the change in the fuel pressure gauge reading.

Standard Value: The gauge reading should hold for about 5 minutes after the engine stops

NOTE

If the gauge reading should not be held, repair or replace the related part (Refer to the table below).

Fuel Pressure (After Engine Stops)	Cause	Related Part
Fuel Pressure Drops Slowly	Leakage on injector	Injector
Fuel Pressure Drops Immediately	Check valve of fuel pump stuck open	Fuel Pump

(3) Turn the ignition switch OFF.

5. Release the residual pressure in fuel line (Refer to “Release Residual Pressure in Fuel Line”).
6. Test End
   (1) Remove the Special Service Tool (SST) from the fuel feed tube and the delivery pipe.
   (2) Connect the fuel feed tube and the delivery pipe.

Release Residual Pressure in Fuel Line

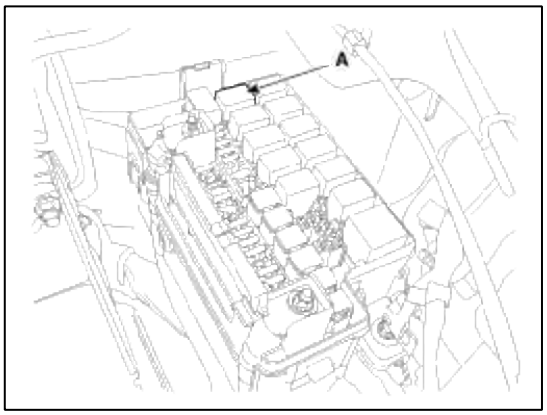
CAUTION

Whenever the high pressure fuel pump, fuel pipe, delivery pipe, or injector is removed immediately after shutting off the engine, an injury may ve caused by the release of highly pressurized fuel. Release the residual pressure in the high pressure fuel line by referring to the "Residual fuel pressure release procedure" below before removing any high pressure fuel system components.

NOTE

Wear safety glasses and fuel resistant gloves.

1. Turn the ignition off and disconnect the battery negative cable.
2. Remove the fuel pump relay (A).



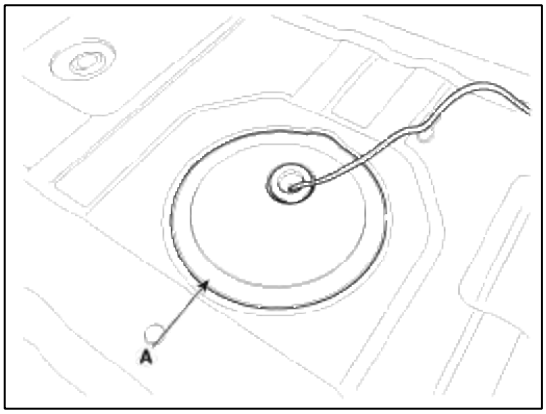
3. Reconnect the battery negative cable.

4. Run the engine for about 1 minute to lower the pressure in the low pressure line.
5. Turn the engine off.
6. Disconnect the low pressure fuel line quick connector at the High Pressure Pump. Use rags to cover opening and catch spills while removing the fuel line.
7. Start the engine and let it idle until the engine stops. At this point the pressure should be under 30 psi.
8. Proceed with the service or repair. Use rags to cover opening and catch spills when opening up the high pressure system.
9. Reinstall / re-connect all components in reverse order of removal. Start engine and confirm proper operation, and make sure there are no fuel leaks.
10. After completing, clear DTC(s) using GDS scan tool (the procedure described above will cause DTC to set).

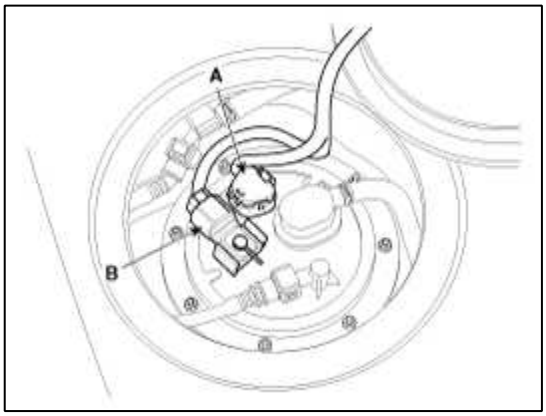
Fuel System > Fuel Delivery System > Fuel Tank > Repair procedures

Removal

1. Preparation
   (1) Remove the rear seat cushion (Refer to "Seat" in BD group).
   (2) Open the service cover (A).

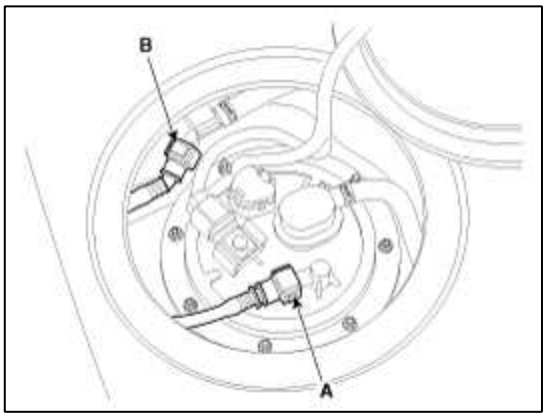


   (3) Disconnect the fuel pump connector (A) and the fuel tank pressure sensor connector (B).

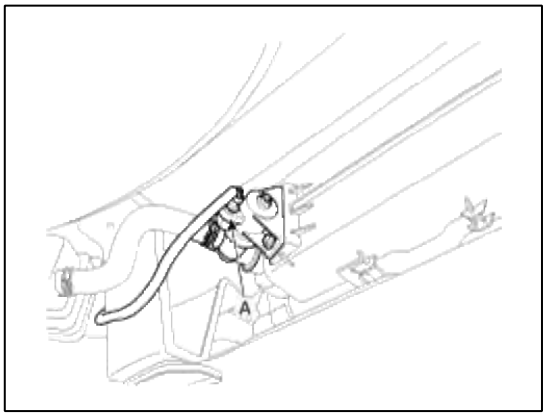


   (4) Start the engine and wait until the fuel engine has stalled.
   (5) After engine stalls, turn the ignition switch to OFF position.

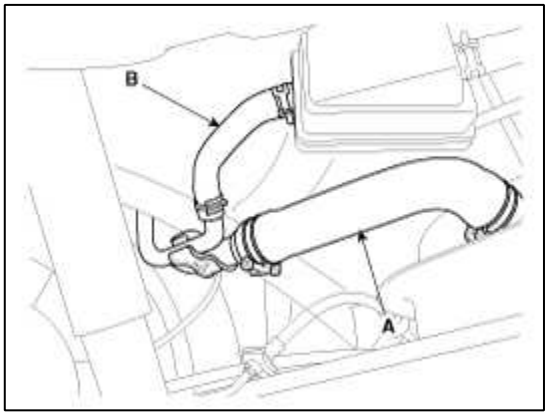
2. Disconnect the fuel feed quick-connector (A) and the vapor tube quick-connector (B).



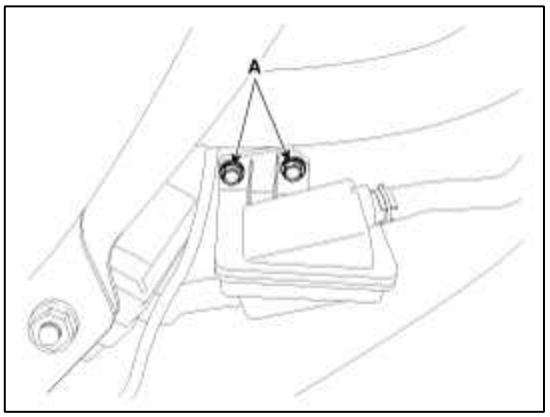
3. Lift the vehicle and support the fuel tank with a jack.
4. Disconnect the canister close valve connector (A).



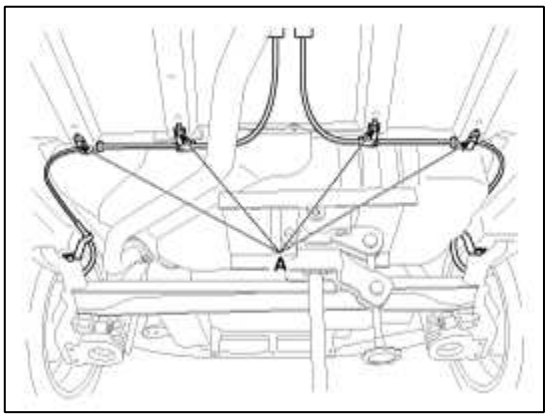
5. Remove the center muffler (Refer to "Intake And Exhaust System" in EM group).
6. Disconnect the fuel filler hose (A) and the ventilation hose (B).



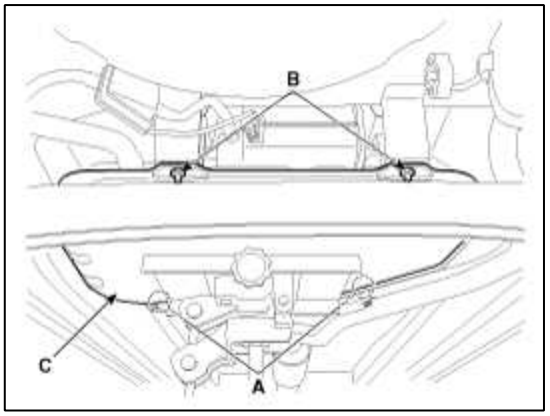
7. Remove the fuel tank air filter installation bolt (A).



8. Remove the brake line bracket mounting bolt (A).



9. Remove the fuel tank mounting bolts (A) and nuts (B), and then remove the fuel tank (C).



Installation

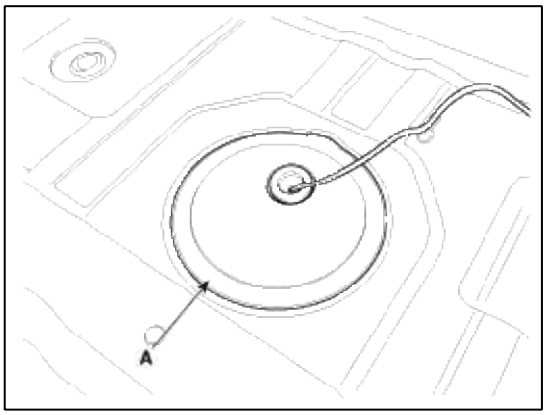
Installation is reverse of removal.

Fuel tank installation bolt:
39.2 ~ 53.9 N.m (4.0 ~ 5.5 kgf.m, 28.9 ~ 39.8 lb-ft)
Fuel tank installation nut:
39.2 ~ 53.9 N.m (4.0 ~ 5.5 kgf.m, 28.9 ~ 39.8 lb-ft)
Fuel tank air filter installation bolt:
3.9 ~ 5.9 N.m (0.4 ~ 0.6 kgf.m, 2.9 ~ 4.3 lb-ft)

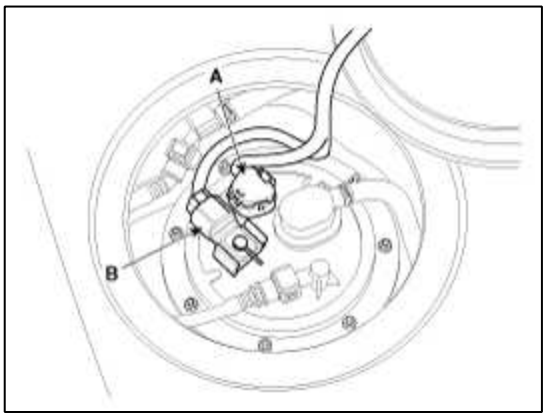
Fuel System > Fuel Delivery System > Fuel Pump > Repair procedures

Removal

1. Preparation
   (1) Remove the rear seat cushion (Refer to "Seat" in BD group).
   (2) Open the service cover (A).

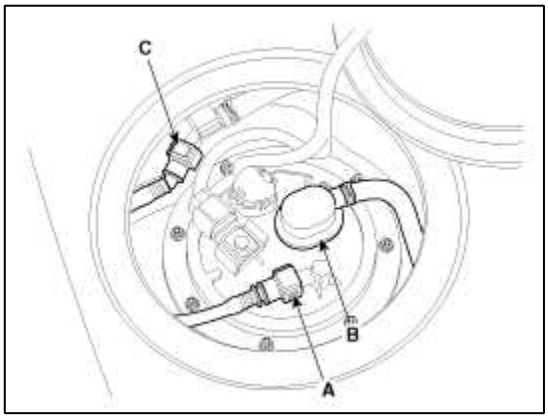


   (3) Disconnect the fuel pump connector (A) and the fuel tank pressure sensor connector (B).

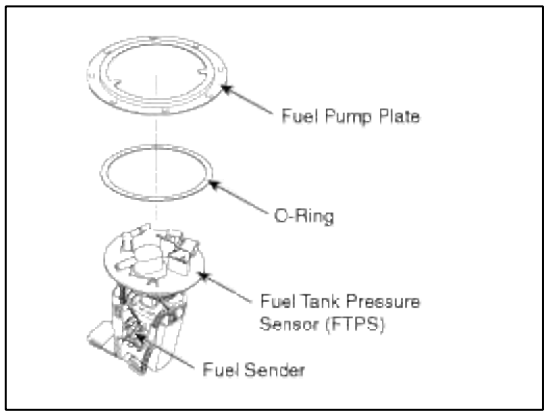


   (4) Start the engine and wait until fuel in fuel line is exhausted.
   (5) After engine stalls, turn the ignition switch to OFF position.

2. Disconnect the fuel feed tube quick-connector (A), the vapor hose (B) and the vapor tube quick-connector (C).



3. Remove the fuel pump installation nuts and remove the fuel pump assembly.



Installation

Installation is reverse of removal.

Fuel pump installation nut:
2.0 ~ 2.9 N.m (0.2 ~ 0.3 kgf.m, 1.4 ~ 2.2 lb-ft)

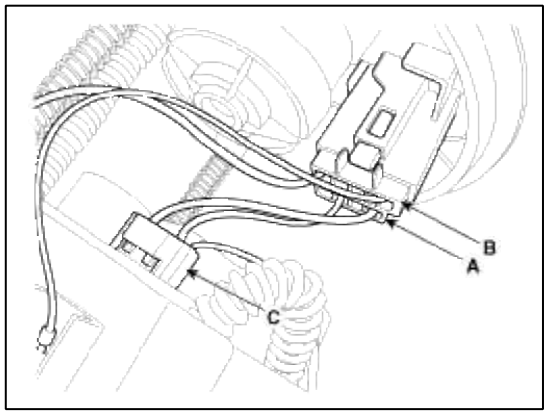
CAUTION

When installing the fuel pump module, be careful not to get the seal-ring entangled.

Fuel System > Fuel Delivery System > Fuel Filter > Repair procedures

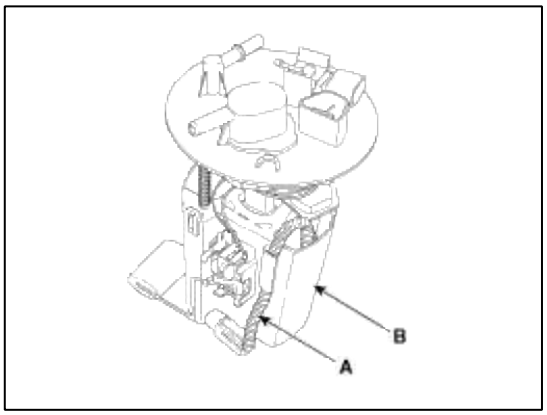
Replacement

1. Remove the fuel pump (Refer to “Fuel Pump” in this group).
2. Disconnect the electric pump wiring connector (A) and the fuel sender wiring connector (B).
3. Disconnect the electric pump wiring connector (C) from the pump.

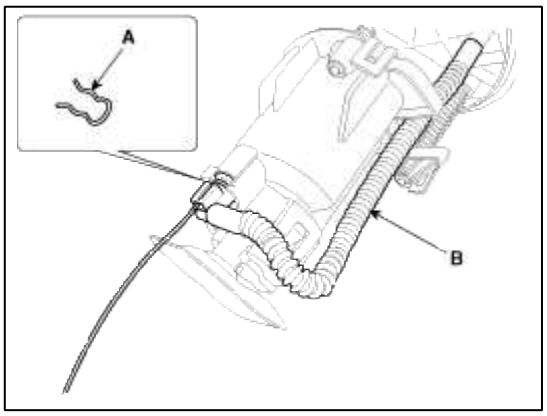


4. Disconnect the fuel tube (A).

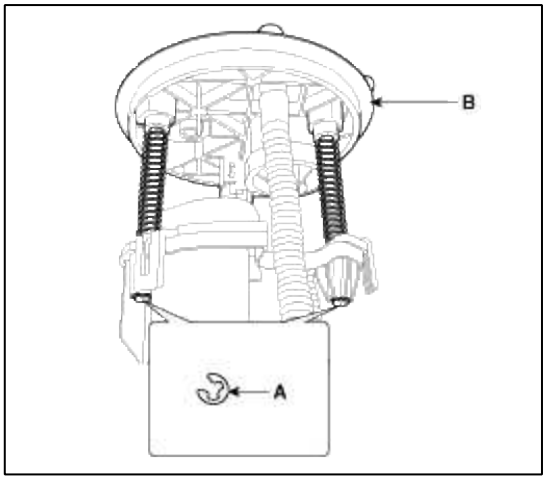
5. Remove the reservior-cup (B) after releasing the fixing hooks.



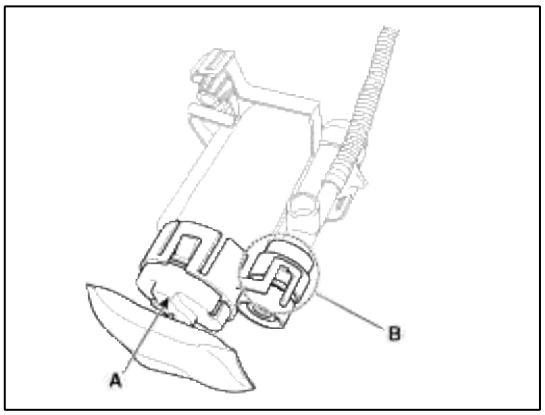
6. Disconnect the fuel tube (B) after removing the fixing clip (A).

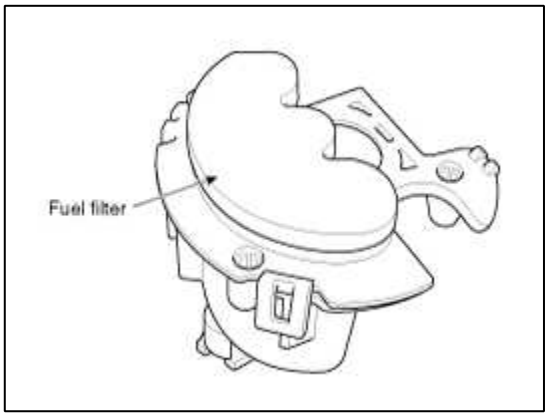


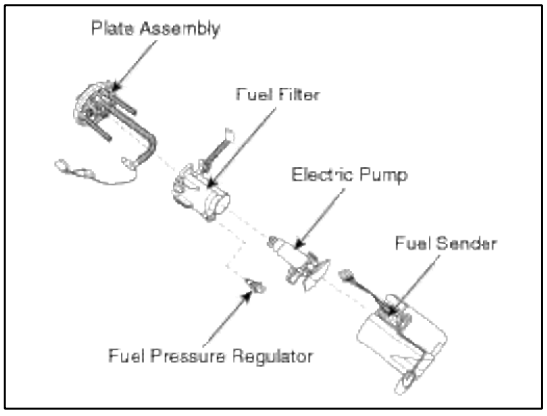
7. Remove the plate assembly (B) after removing the cushion pipe fixing clip (A).



8. Remove the pump & pre-filter assembly (A) and the fuel pressure regulator (A) from the fuel filter.



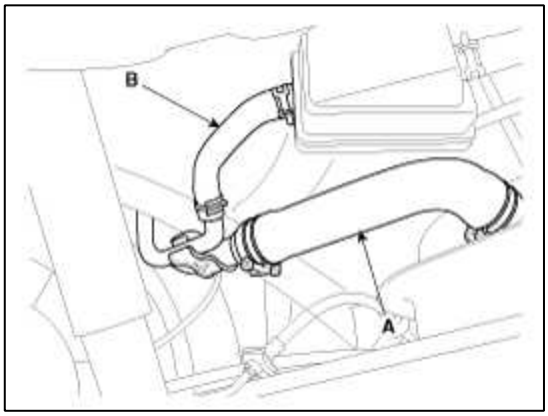




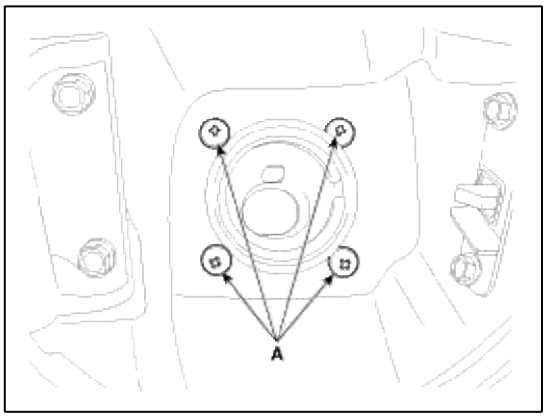
Fuel System > Fuel Delivery System > Filler-Neck Assembly > Repair procedures

Removal

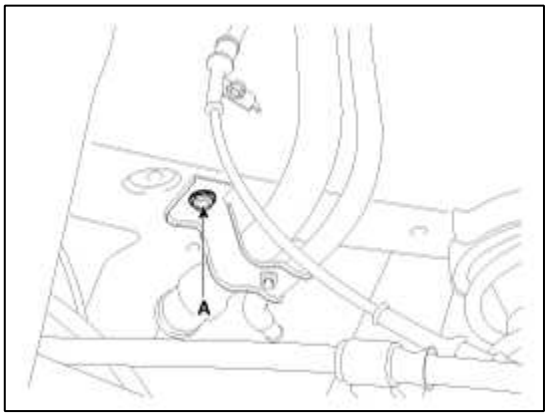
1. Disconnect the fuel filler hose (A) and the ventilation hose (B) from the fuel tank air filter.



2. Open the fuel filler door and unfasten the filler-neck assembly mounting screws (A).



3. Remove the rear-LH wheel, tire, and the inner wheel house.
4. Remove the bracket mounting bolt (A) and remove the filler-neck assembly.



Installation

1. Installation is reverse of removal.

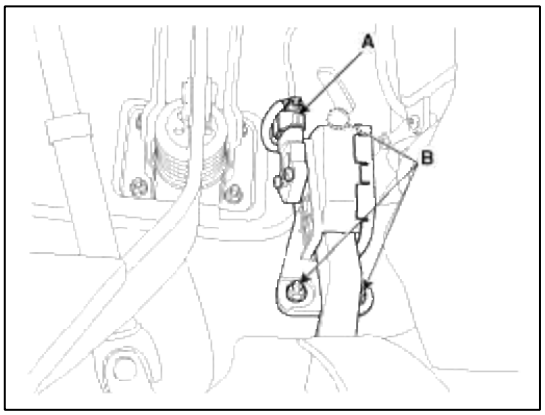
Filler-neck assembly installation bolt:
3.9 ~ 5.9 N.m (0.4 ~ 0.6 kgf.m, 2.9 ~ 4.3 lb-ft)
Filler-neck assembly installation screw:
5.6 ~ 6.9 N.m (0.6 ~ 0.7 kgf.m, 4.3 ~ 5.1 lb-ft)

Fuel System > Fuel Delivery System > Accelerator Pedal > Repair procedures

Removal

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

3. Remove the installation nuts (B), and then remove the accelerator pedal module.



Installation

1. Installation is reverse of removal.

Accelerator pedal module installation nut:
16.7 ~ 25.5 N.m (1.7 ~ 2.6 kgf.m, 12.3 ~ 18.8 lb-ft)

Fuel System > Fuel Delivery System > Delivery Pipe > Repair procedures

Removal

WARNING

In case of removing the high pressure fuel pump, high pressure fuel pipe, delivery pipe, and injector, there may be injury caused by leakage of the high pressure fuel. Before repairing the high pressure system, be sure to release the residual pressure in fuel line as step 2 in below procedure.

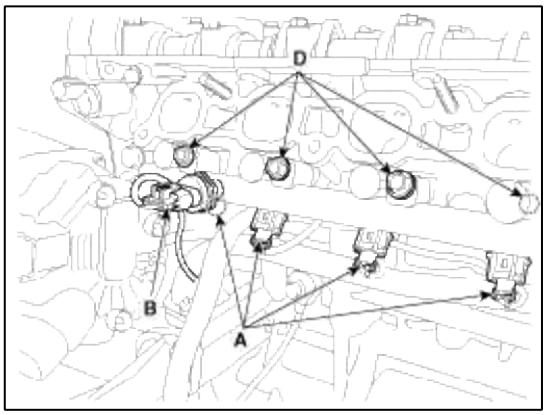
1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Release the residual pressure in fuel line (Refer to “Release Residual Pressure in Fuel Line” in this group).

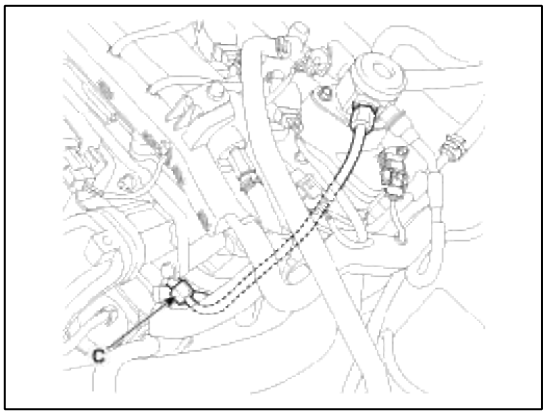
CAUTION

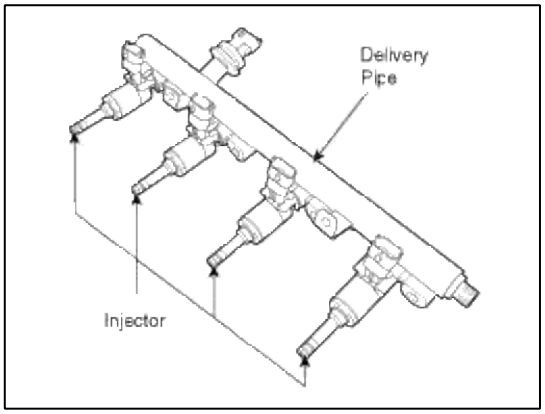
When removing the fuel pump relay, a Diagnostic Trouble Code (DTC) may occur. Delete the code with the GDS after completion of “Release Residual Pressure in Fuel Line” work.

3. Remove the intake manifold (Refer to "Intake And Exhaust System" in EM group).
4. Disconnect the injector connectors (A) and the rail pressure sensor connector (B).
5. Remove the high pressure fuel pipe (C).
6. Remove the engine oil gauge.

7. Remove the installation bolt (D), and then remove the delivery pipe and injector assembly from the engine.







Installation

CAUTION

- Do not use already used injector fixing clip again.

CAUTION

Do not reuse the support disc.
Do not reuse the injector rubber washer.
Do not reuse the combustion seal.

CAUTION

- Install the component with the specified torques.
- Note that internal damage may occur when the component is dropped. In this case, use it after inspecting.

CAUTION

- Apply engine oil to the injector O-ring.
- Do not use already used injector O-ring again.

CAUTION

- Do not use already used bolt again.

CAUTION

- When insert the injector, be careful not to damage the injector tip.

1. Installation is reverse of removal.

Delivery pipe installation bolt:
18.6 ~ 23.5 N.m (1.9 ~ 2.4 kgf.m, 13.7 ~ 17.4 lb-ft)
High pressure fuel pipe installation nut:
26.5 ~ 32.4 N.m (2.7 ~ 3.3 kgf.m, 19.5 ~ 23.9 lb-ft)

Fuel System > Fuel Delivery System > High Pressure Fuel Pump > Repair procedures

Removal

WARNING

In case of removing the high pressure fuel pump, high pressure fuel pipe, delivery pipe, and injector, there may be injury caused by leakage of the high pressure fuel. Before repairing the high pressure system, be sure to release the residual pressure in fuel line as step 2 in below procedure.

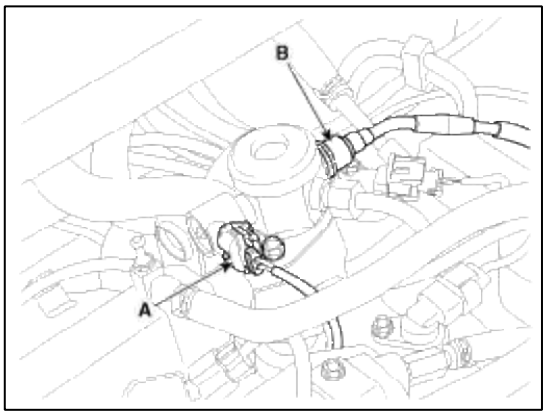
1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Release the residual pressure in fuel line (Refer to “Release Residual Pressure in Fuel Line” in this group).

CAUTION

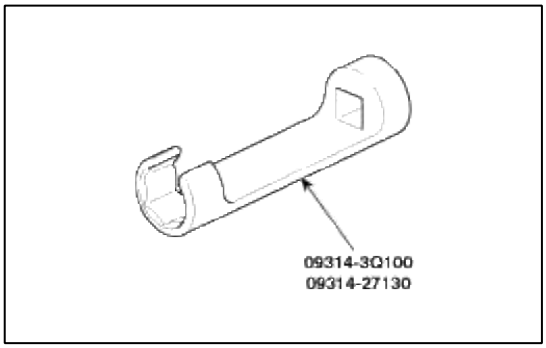
When removing the fuel pump relay, a Diagnostic Trouble Code (DTC) may occur.
Delete the code with the GDS after completion of “Release Residual Pressure in Fuel Line” work.

3. Remove the air cleaner and the air intake hose (Refer to “Intake And Exhaust System” in EM group).
4. Disconnect the fuel pressure regulator valve connector (A).

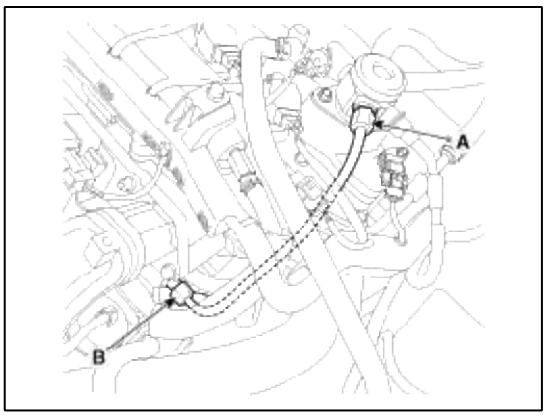
5. Disconnect the fuel feed tube quick-connector (B).



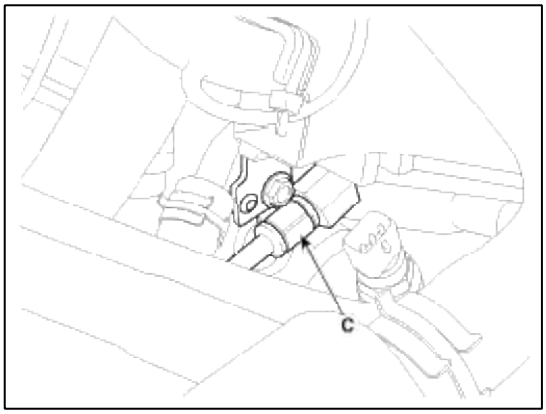
6. Remove the high pressure fuel pipe.
   (1) Remove the installation nut (A) from the high pressure fuel pump with the special service tool [SST No.: 09314-3Q100 or 09314-27130]



   (2) Remove the installation nut (B) from the delivery pipe with the special service tool [SST No.: 09314-3Q100 or 09314-27130]



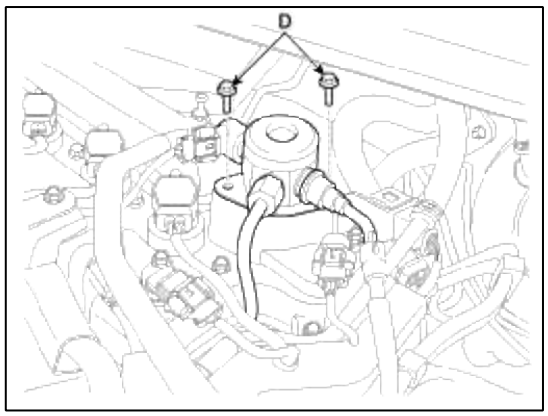
   (3) Disconnect the engine coolant temperature sensor connector.
   (4) Remove the function block (C), and then remove the high pressure fuel pipe.



7. Remove the installation bolts (D), and then remove the high pressure fuel pump from the cylinder head assembly.

CAUTION

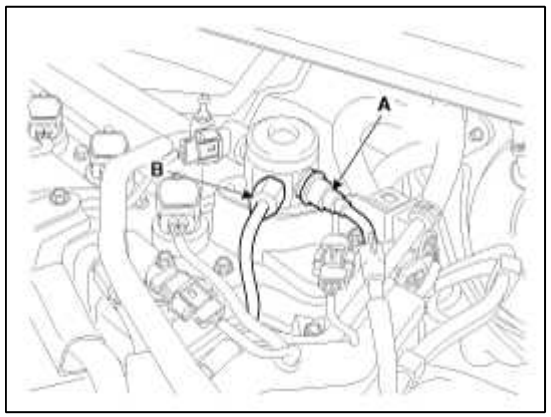
Unscrew in turn the two bolts in small step (0.5 turns). In case of fully unscrewing one of the two bolts with the other bolt installed, the housing surface of the cylinder head may be broken because of tension of the pump spring.



Installation

WARNING

- Be sure to check the low pressure fuel hose quick-connector (A) is completely connected to the high pressure fuel pump until a confirmation 'click' sound is heard.
- Be sure to re-check the low pressure fuel hose is completely connected to the high pressure fuel pump by pulling it after connecting.
- Be sure to install the high pressure fuel pipe (B) with the specified torques.
- Because fuel leak may cause fire, securely Inspect leakage of all fuel line connection parts at engine start condition.



CAUTION

- Before installing the high pressure fuel pump, position the roller tappet in the lowest position by rotating the crankshaft. Otherwise the installation bolts may be broken because of tension of the pump spring.

CAUTION

- Be careful to be free from foreign materials when assembling.

CAUTION

- Do not reuse the used bolt.

CAUTION

- Do not reuse the used high pressure fuel pipe.

CAUTION

- When tightening the installation bolts of the high pressure fuel pump, tighten in turn the bolts in small step (0.5 turns) after tightening them with hand-screwed torque.

CAUTION

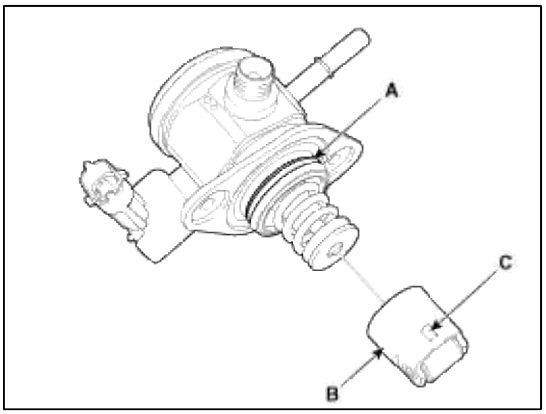
- Install the component with the specified torques.
- First hand-tighten the fasteners fully until they are not fastened any more in orderto have them inserted in place and then completely tighten to the specified torque using a torque wrench.
  If not tightening the bolts or nuts in a straight line with the mating bolt holes or fittings, it may cause a fuelleak due to broken threads.

CAUTION

- Note that internal damage may occur when the component is dropped. In this case, use it after inspecting.

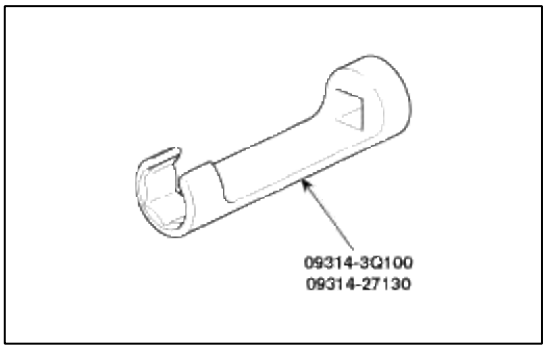
CAUTION

- Apply engine oil to the O-ring (A) of the high pressure fuel pump, the roller tappet (B), and the protrusion (C). Also apply engine oil to the groove on the location where the protrusion (C) is installed.



1. Installation is reverse of removal.

> NOTE
>
> Use the special service tool [SST No.: 09314-3Q100 or 09314-27130] to install the high pressure fuel pipe.



High pressure fuel pump installation bolt:
12.8 ~ 14.7 N.m (1.3 ~ 1.5 kgf.m, 9.4 ~ 10.9 lb-ft)
High pressure fuel pipe installation nut:
26.5 ~ 32.4 N.m (2.7 ~ 3.3 kgf.m, 19.5 ~ 23.9 lb-ft)
High pressure fuel pipe function block installation bolt: 9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)

SOUL(AM) > 2012 > G 1.6 GDI > Clutch System

Clutch System > General Information > Specifications

Specifications

Items		Specifications
Clutch operation method		Hydraulic type
Clutch cover	Type	Diaphragm spring strap
Clutch disc Type	Type	Single dry with diaphragm
	Faling diameter (Outer × inner)	Gasoline 1.6 : Ø210 × Ø145mm (Ø8.2677 × Ø5.7087 in.)
		Gasoline 2.0 : Ø235 × Ø155mm (Ø9.2520 × Ø6.1024 in.)
Clutch release cylinder	Inner diameter	20.64 mm (0.8126 in.)
Clutch master cylinder	Inner diameter	15.87 mm (0.6248 in.)

Service Standard

Item	Specification
Clutch disc thickness [When free]	8.3 ± 0.3 mm (0.3268 ± 0.0118 in.)
Clutch pedal height [With carpet]	178.8 mm (7.0394 in.)
Clutch pedal free play	6 ~ 13 mm (0.2362 ~ 0.5118 in.)
Clutch pedal stroke	Gasoline 1.6 : 135 ± 3mm (5.3150 ± 0.1181 in.)
	Gasoline 2.0 : 145 ± 3mm (5.7087 ± 0.1181 in.)
Clutch disc rivet depth	1.1 mm (0.0433 in.)

Tightening Torques

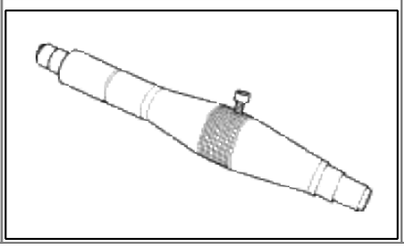
Item	N.m	kgf.m	lb-ft
Clutch pedal mounting nuts	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Clutch release cylinder mounting nuts	14.7 ~ 21.6	1.5 ~ 2.2	10.8 ~ 15.9
Clutch release cylinder union bolt	24.5 ~ 34.3	2.5 ~ 3.5	18.1 ~ 25.3
Clutch release cylinder bleed plug	6.8 ~ 9.8	0.7 ~ 1.0	5.0 ~ 7.2
Clutch cover mounting bolt (Gasoline 2.0, Diesel 1.6)	11.8 ~ 14.7	1.2 ~ 1.5	8.7 ~ 10.8
Clutch cover mounting bolt (Gasoline 1.6)	14.7 ~ 21.6	1.5 ~ 2.2	10.8 ~ 15.9

Lubricants

Items	Specified lubricants	Quantity
Input shaft spline	CASMOLY L9508	0.2g
Clutch release cylinder assembly	Brake fluid DOT 3 or DOT	As required
Clutch pedal shaft and bushings	Chassis grease SAE J310a, NLGI No.1	

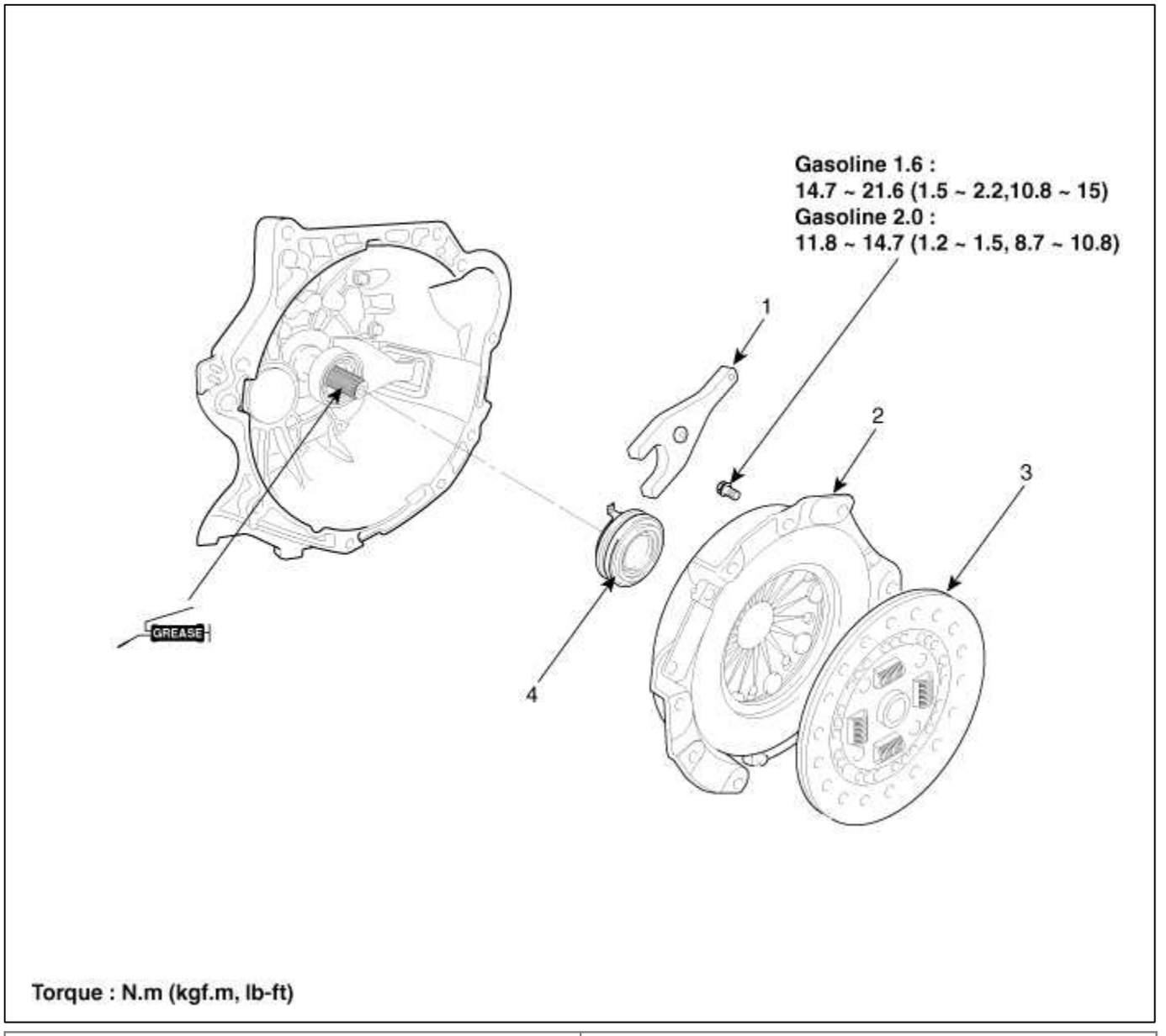
Clutch System > General Information > Special Service Tools

Special Service Tools

Tool (Number and name)	Illustration	Use
09411-1P000 Clutch disc guide		Installation of the clutch disc.

Clutch System > Clutch System > Clutch Cover And Disc > Components and Components Location

Components



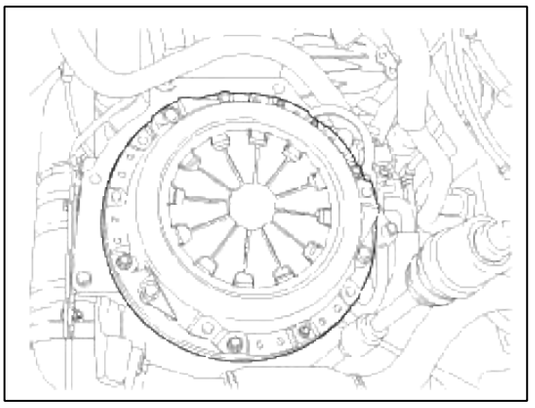
1. Clutch release fork	3. Clutch disk assembly
2. Clutch cover assembly	4. Clutch release bearing

Clutch System > Clutch System > Clutch Cover And Disc > Repair procedures

Removal

1. Remove the transaxle assembly.
   (Refer to "Manual transaxle system" in MT group)

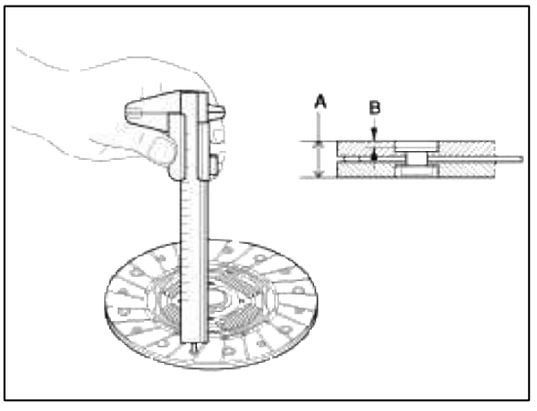
2. Remove the clutch cover bolts. Be careful not to be bent ortwist bolts. Loosen bolts in diagonal directions.



Inspection

1. Inspect diaphragm spring wear which is in contact with a concentric slave cylinder bearing.
2. Check the clutch cover and disc surface for wear or cracks.
3. Check the clutch disc lining for slipping or oil marks.
4. Measure the depth from a clutch lining surface to a rivet. If the measured value is less than the specification below, replace it.

Standard value
Clutch disc thickness(A)[when free] :
8.3 ± 0.3 mm (0.3268 ± 0.0118 in.)
Clutch disc rivet depth(B) : 1.1 mm (0.0433 in.)



Installation

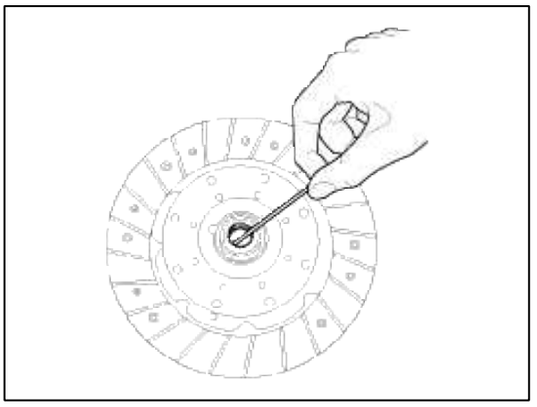
NOTE

If reinstalling used cover, the cover should be installed with its clutch disc as a set.

1. Apply grease on a disc spline part and transmission input shaft spline part as required.

CAUTION

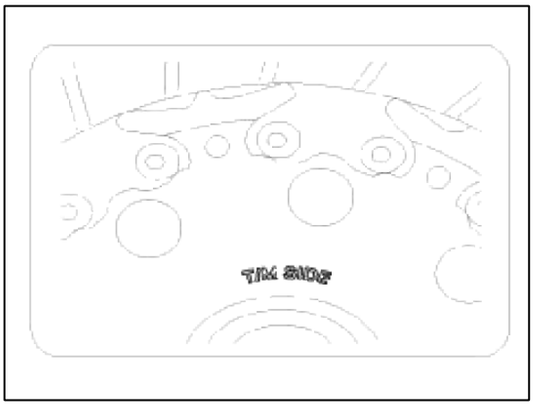
* Possible problems when not following
  - When not applying: Excessive wear of splines and bad clutch operation can occur.
  - When excessively applying: Grease can be scattered bycentrifugal force which can conteminate the clutch disc.
    This can cause a loss of friction force causing a slip.



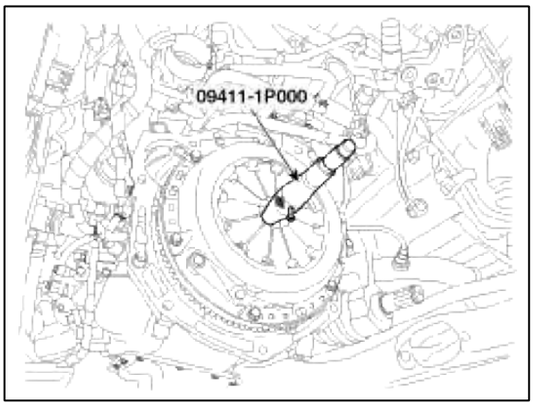
2. The 'T/M SIDE' marked surface should face the transmission.

CAUTION

* Possible problems when the disc is installed in the opposite direction.
  • Transaxle shift errror or a strangesound can occur due to clutch separation.



3. Install the clutch disc and the cover with SST (A: 09411-1P000).

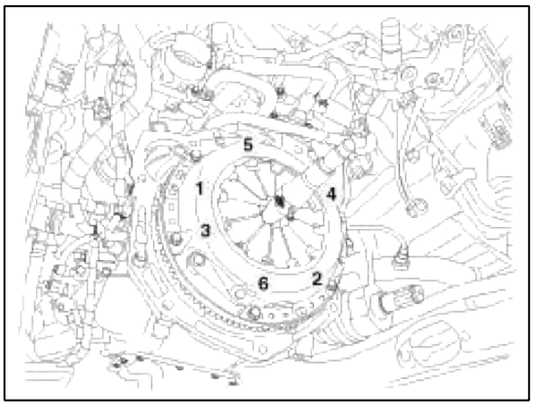


4. Install the clutch cover bolts. Not to be bent or twisted, Tighten them in diagonal directions.

Tightening torque:
Gasoline 1.6 :
14.7 ~ 21.6 N.m (1.5 ~ 2.2 kgf.m, 10.8 ~ 15.9 lb-ft)
Gasoline 2.0, Diesel 1.6 :
11.8 ~ 14.7 N.m (1.2 ~ 1.5 kgf.m, 8.7 ~ 10.8 lb-ft)

CAUTION

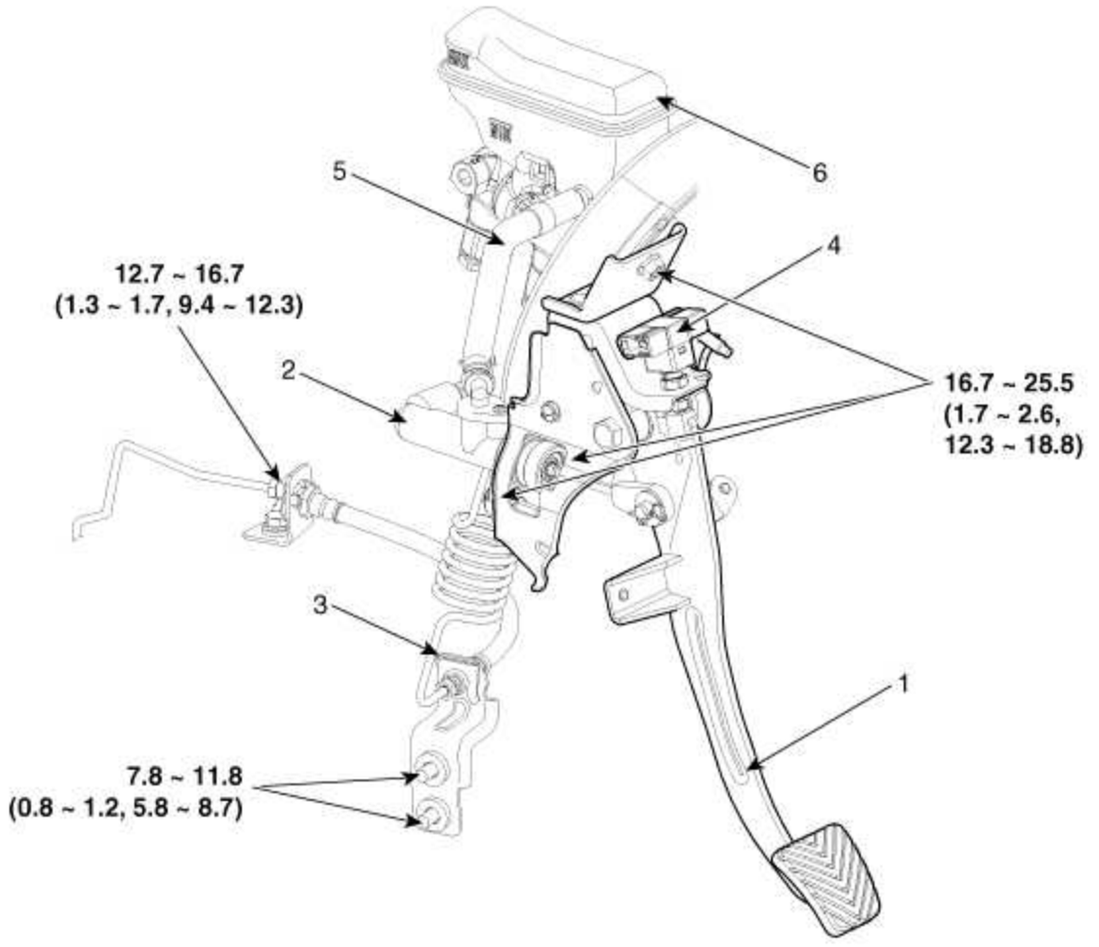
- Loosely tighten every clutch cover bolts, then torque to specifications in a diagonal direction. This can prevent twisting, vibration of the cover, and the lifting of the pressure plate.
- Install the all the components with the specified torques. If not, the clutch torque transmission may have concerns or the mounting bolt can loosen.



5. Install the transaxle assembly.
(Refer to "Manual transaxle system" in MT group.)

Clutch System > Clutch System > Clutch Pedal > Components and Components Location

Components



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

1. Clutch pedal assembly	4. Ignition lock switch
2. Clutch master cylinder	5. Reverse hose
3. Clutch tube	6. Reverse tank

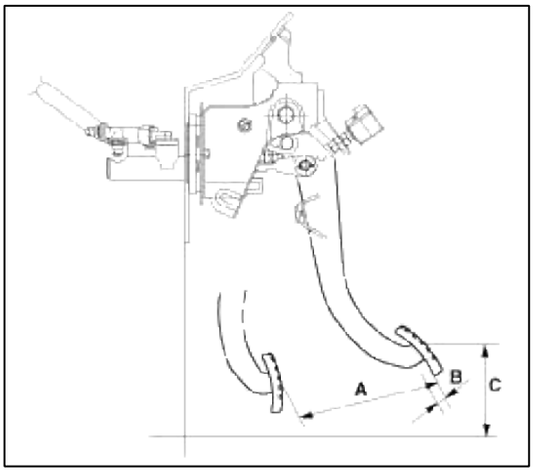
Clutch System > Clutch System > Clutch Pedal > Repair procedures

Inspection

Clutch Pedal Inspection

1. Measure the clutch pedal height (from the face of the pedal pad to the floor board) and the clutch pedal clevis pin play (measured at the face of the pedal pad.)

Standard value:
Stroke (A):
Gasoline 2.0, Diesel 1.6 :
145 ± 3 mm (5.7087 ± 0.1181 in.)
Gasoline 1.6 :
135 ± 3 mm (5.3150 ± 0.1181 in.)
Free play (B): 6 ~ 13 mm (0.2362 ~ 0.5118 in.)
Height (C): 189.1 mm (7.4449 in.)



Ignition Lock Switch Inspection

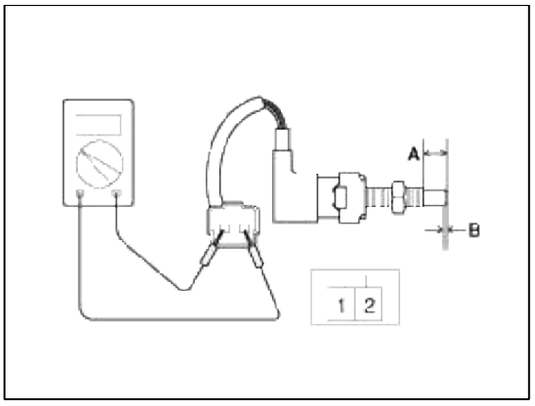
1. Disconnect 2P-connector from a ignition lock switch.
2. Disconnect the ignition lock switch.
   (if you can install a tester with the switch fixed, this step can be omissible)
3. Check for continuity between terminals. (refer to the table below)

NOTE

- If there is difference between what tested and the table above, replace the ignition lock switch with a new one.

Pedal position	Clutch switch	Ignition lock switch
Released	Pressed (Continuity)	Released (Open)
Fully pressed	Released (Open)	Pressed (Continuity)

Standard value :
Full stroke (A): 12.0 ± 0.3mm (0.4724 ± 0.0118 in.)
ON-OFF point (B): 2.0 ± 0.3mm (0.0787 ± 0.0118 in)

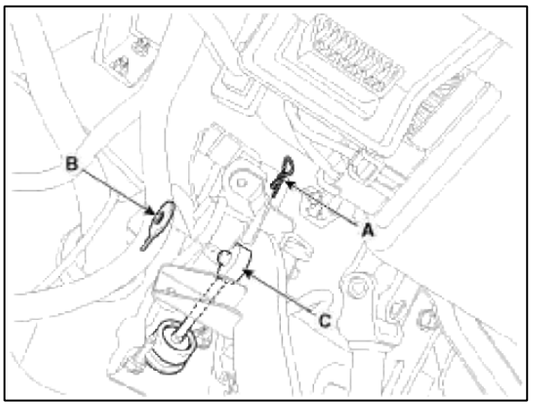


Removal

CAUTION

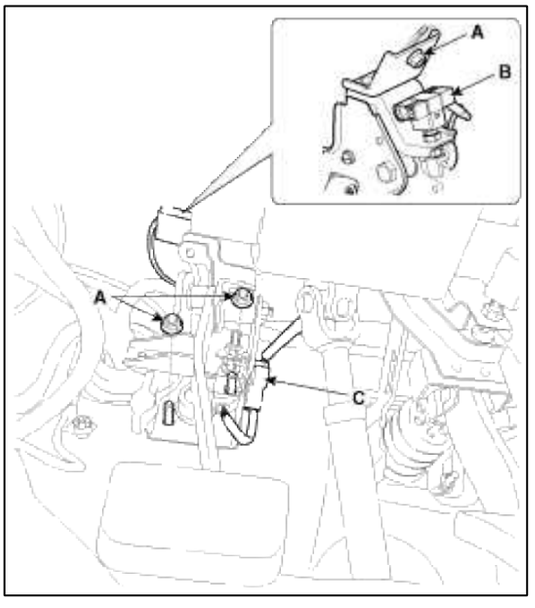
- Do not spill brake fluid on the vehicle; it may damage the paint if brake fluid does contact the paint, wash it off immediately with water.

1. Disconnect the push rod (C) from the clutch pedal by removing the snap pin (A) and washer (B).



2. Disconnect the ignition lock switch connector (C) and clutch switch connector (B).
3. Remove the clutch pedal mounting nuts (A-3ea).

Tightening torque:
(A) 16.7 ~ 25.5 N.m (1.7 ~ 2.6 kgf.m, 12.3 ~ 18.8 lb-ft)



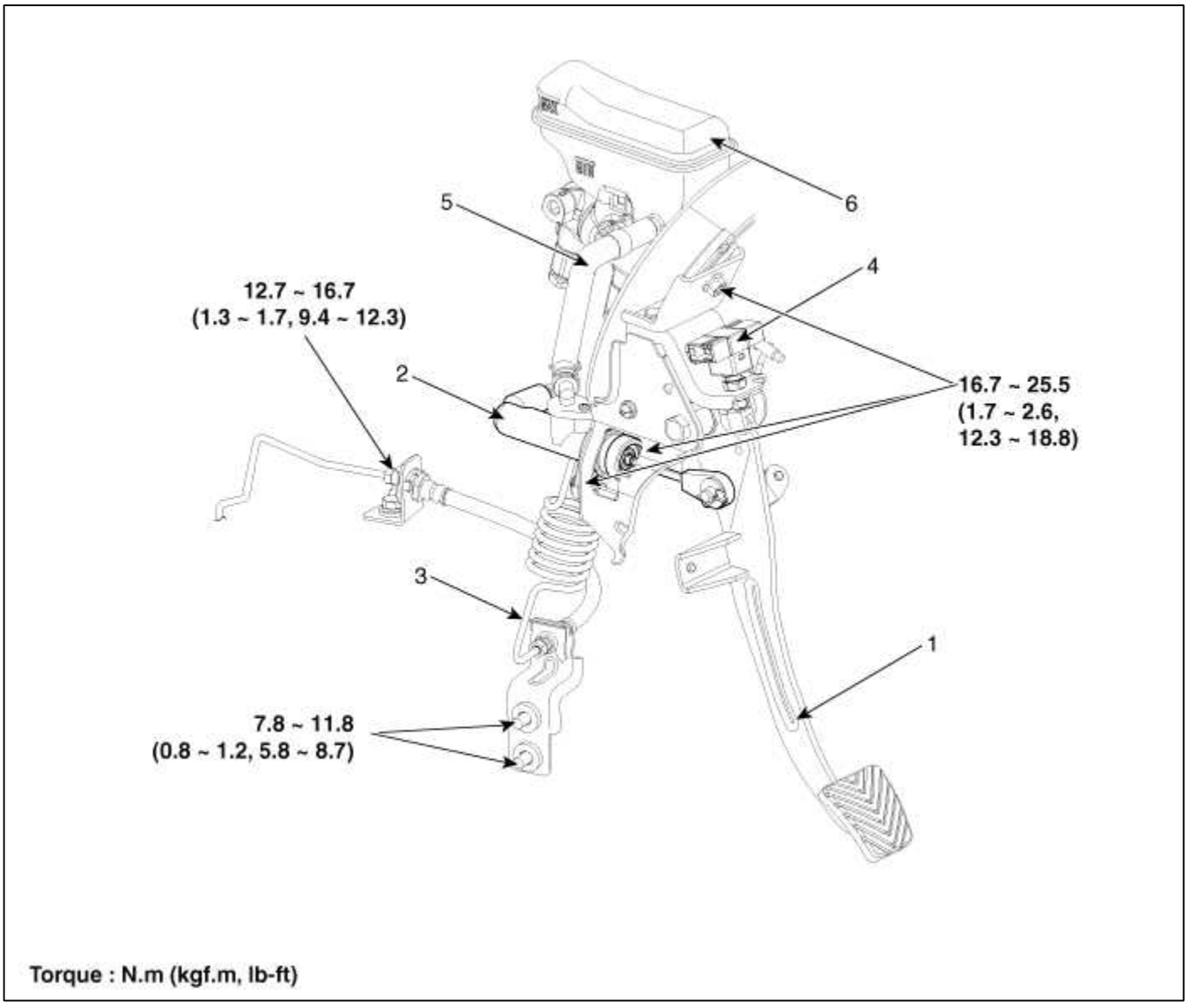
4. Remove the clutch pedal.

Installation

1. Installation is in reverse order of removal.

Clutch System > Clutch System > Clutch Master Cylinder > Components and Components Location

Components



1. Clutch pedal assembly	4. Ignition lock switch
2. Clutch master cylinder	5. Reverse hose
3. Clutch tube	6. Reverse tank

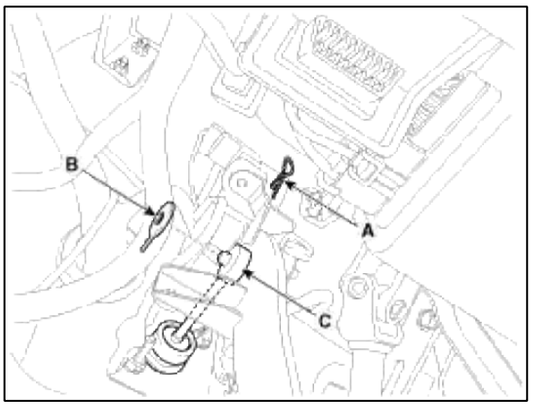
Clutch System > Clutch System > Clutch Master Cylinder > Repair procedures

Removal

CAUTION

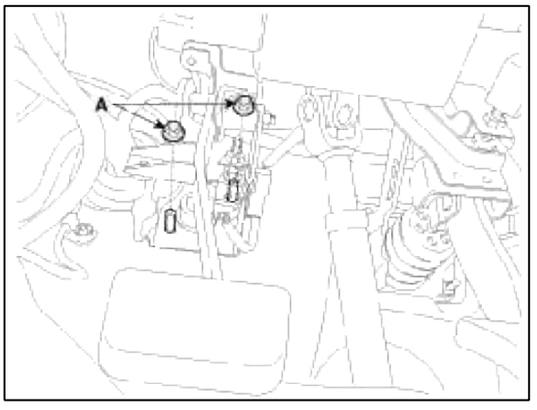
- Do not spill brake fluid on the vehicle; it may damage the paint if brake fluid does contact the paint, wash it off immediately with water.

1. Disconnect the push rod from the master cylinder by removing the snap pin (A) and washer (B).

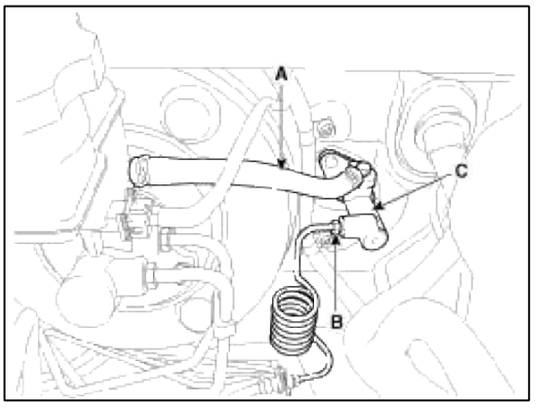


2. Remove the master cylinder mounting nuts (A-2ea).

Tightening torque:
(A) 16.7 ~ 25.5 N.m (1.7 ~ 2.6 kgf.m, 12.3 ~ 18.8 lb-ft)



3. Remove the battery and ECM.
(Refer to "Charging system system" in EE group)
4. Disconnect the clutch tube (B) and reservoir hose (A) from the clutch master cylinder (C).
5. Remove the clutch master cylinder assembly (C).



Installation

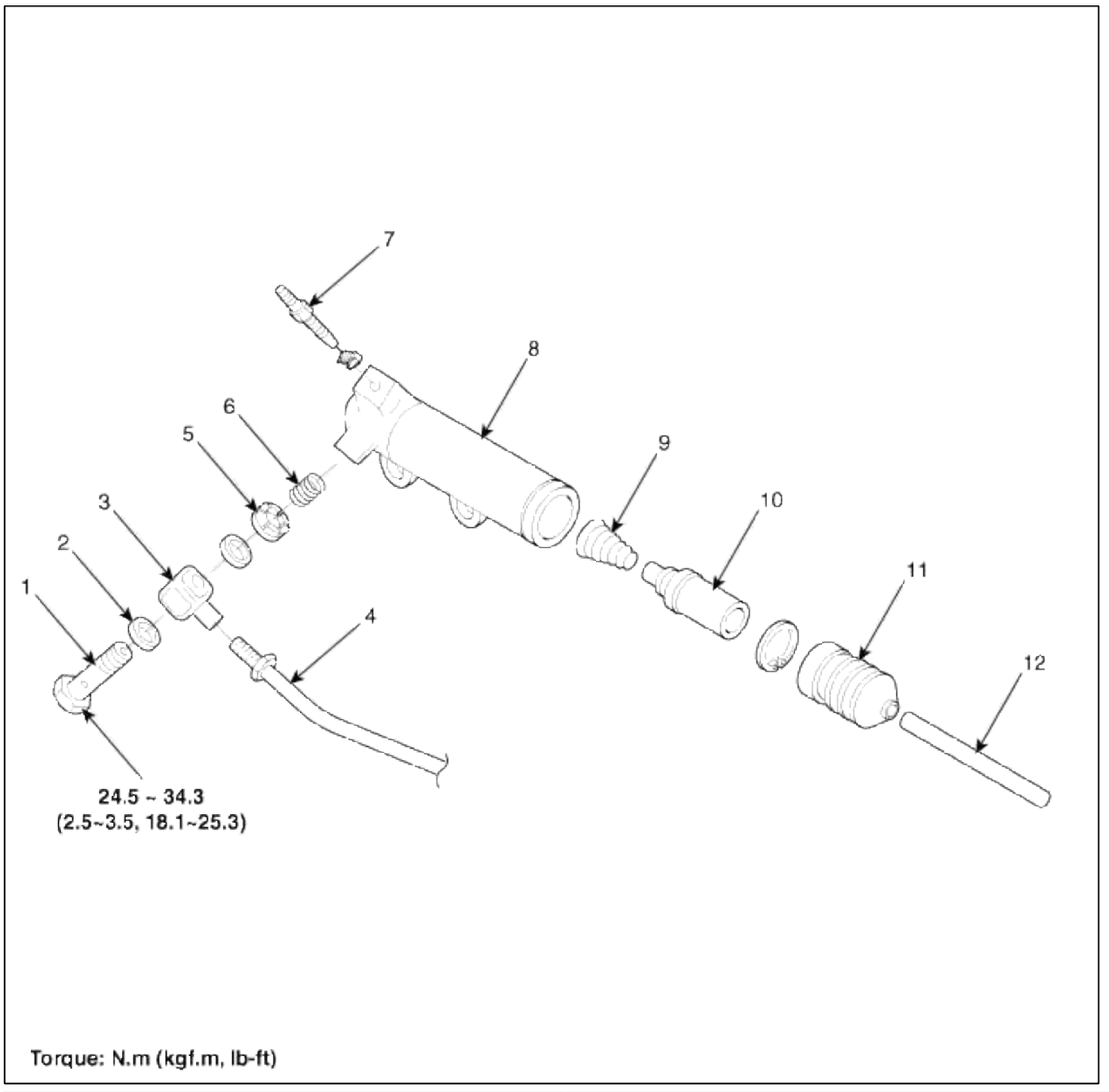
1. Installation is the reverse of removal.

NOTE

- Perform bleeding air procedure in clutch release cylinder after pouring the brake fluid.
(Refer to "clutch release cylinder" in CH group.)

Clutch System > Clutch System > Clutch Release Cylinder > Components and Components Location

Components

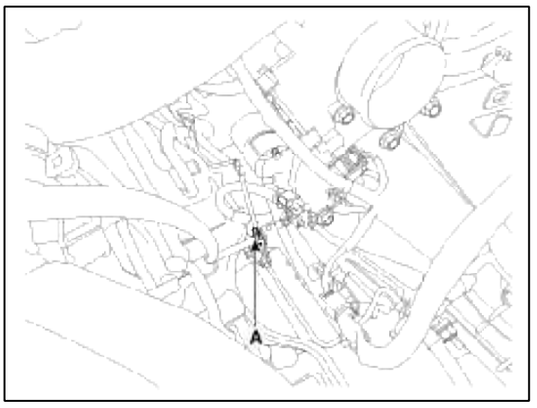


1. Union bolt	7. Bleeder screw
2. Gasket	8. Release cylinder
3. Tube joint	9. Return spring
4. Clutch tube	10. Piston
5. Valve plate	11. Boot
6. Valve spring	12. Push rod

Clutch System > Clutch System > Clutch Release Cylinder > Repair procedures

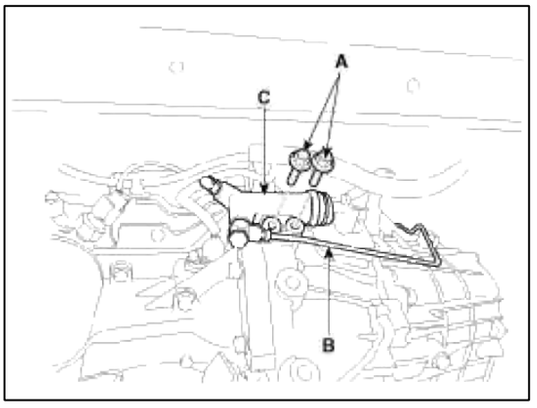
Removal

1. Drain the brake fluid through the bleed plug (A).



2. Remove the clutch release cylinder assembly (C) after removing thd tube (B) and nuts (A-2ea).

Tightening torque:
14.7 ~ 21.6 N.m (1.5 ~ 2.2 kgf.m, 10.9 ~ 15.9 lb-ft)



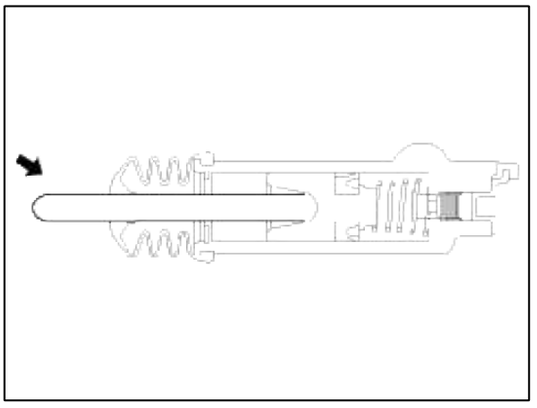
Installation

1. Installation is the reverse of removal.

CAUTION

- Coat the clutch clevis push rod specified grease.

Specified grease: CASMOLY L9508



Adjustment

Clutch Release Cylinder Air Bleeding Procedure

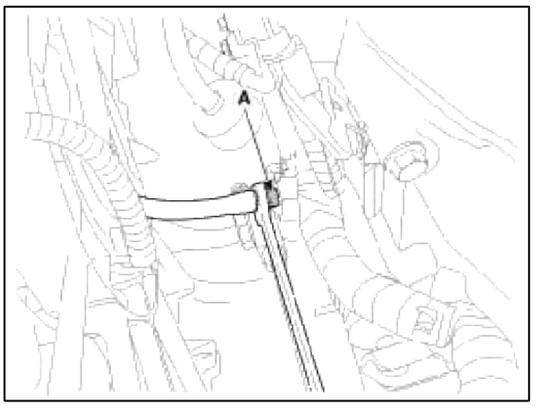
CAUTION

- Use the specified fluid. Avoid mixing different brands of fluid.

Specified fluid: SAE J1703 (DOT 3 or DOT 4)

1. After disconnecting a cap from the clutch release cylinder air bleeder, insert a vinyl hose in the plug.
2. Loosening the plug screw, press and release the clutch pedal about 10 times.
3. Tighten the plug (A) during the clutch pedal pressed. Afterwards, raise the pedal with a hand.
4. After pressing the clutch pedal 3 times more, loosen the plug (A) and retighten it with the pedal pressed. Raise it again, then.
5. Repeat the step 4 two or three times. (until there is no bubble in the fluid)

Tightening torque:
6.8 ~ 9.8 N.m (0.7 ~ 1.0 kgf.m, 5.0 ~ 7.2 lb-ft)



6. Refill the clutch master cylinder with the specified fluid.

SOUL(AM) > 2012 > G 1.6 GDI > Manual Transaxle System

Manual Transaxle System > General Information > Specifications

Specifications

Transaxle type		M6CF1
Engine type		Gasoline 1.6 MPI/GDI
Gear ratio	1st	3.615
	2nd	1.955
	3rd	1.286
	4th	0.971
	5th	0.839
	6th	0.727
	Reverse	3.700
Final gear ratio		4.267

Tightening Torques

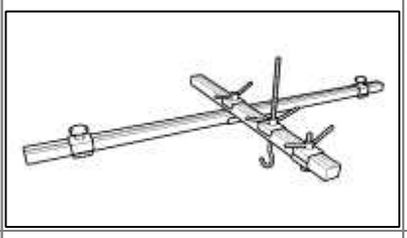
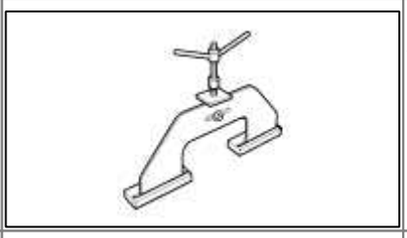
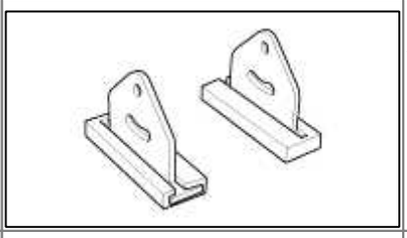
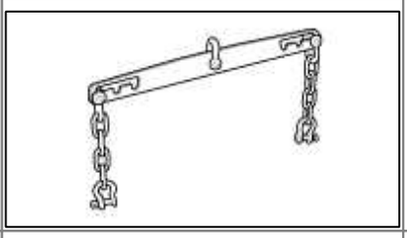
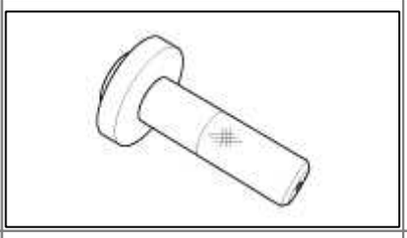
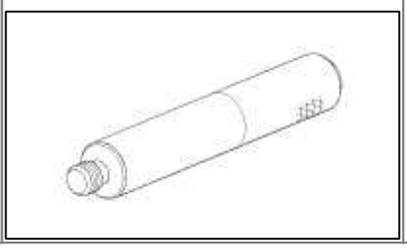
Items	N.m	kgf.m	lb-ft
Oil drain plug	58.9 ~ 78.5	6.0 ~ 8.0	43.4 ~ 57.8
Oil filler plug	58.9 ~ 78.5	6.0 ~ 8.0	43.4 ~ 57.8
Shift lever assembly bolt	8.8 ~ 13.7	0.9 ~ 1.4	6.5 ~ 10.1
Back up lamp switch	29.4 ~ 34.3	3.0 ~ 3.5	21.7 ~ 25.3
Transaxle support bracket bolt	88.3 ~ 107.9	9.0 ~ 11.0	65.1 ~ 79.6
Roll rod bracket bolt	49.0 ~ 68.6	5.0 ~ 7.0	36.2 ~ 50.6
	107.9 ~ 127.5	11.0 ~ 13.0	79.6 ~ 94.1
Start motor installation bolt	42.2 ~ 53.9	4.3 ~ 5.5	31.1 ~ 39.8
Transaxle upper mounting bolt (TM=>ENG)	42.2 ~ 53.9	4.3 ~ 5.5	31.1 ~ 39.8
Transaxle lower mounting bolt (ENG=>TM)	42.2 ~ 48.1	4.3 ~ 4.9	31.1 ~ 35.4
	42.2 ~ 53.9	4.3 ~ 5.5	31.1 ~ 39.8

Lubricants

Items	Recommnend lubricant	Quantity
Transaxle gear oil	SAE 75W/85 API GL-4 TGO-7(MS517-14)	1.8L (0.48 U.S.gal., 1.90 U.S. qt., 1.58 lmp.qt.)
Air breather	MS721-38	As requried
Transaxle housing	MS721-40 or MS721-38	As requried
Surface of release fork and bearing	Grease (CASMOLY L9508)	As requried

Manual Transaxle System > General Information > Special Service Tools

Special Service Tools

Tools (Number and name)	Illustration	Use
09200-38001 / 3N000 Engine support fixture (Beam)		Removal and installation of the transaxle. Use this adapter (SST No. : 09200-4X000) with the supporter (SST No. : 09200-2S100, 2S200). Permit operating with 09200-38001.
09200-2S100 Engine support fixture (Supporter)		Removal and installation of the transaxle. Use this beam (SST No. : 09200-38001/3N000) with the supporter (SST No. : 09200-2S200) and adapter (SST No. : 09200-4X000).
09200-2S200 Engine support fixture (Supporter)		Removal and installation of the transaxle. Use this beam (SST No. : 09200-38001/3N000) with the adapter (SST No. : 09200-4X000) and supporter (SST No. : 09200-2S100).
09200-4X000 Engine support fixture (Adapter)		Installation of transaxle case oil seal. [Using with handle (SST No.:09231-H1100)]
09431-26100 Oil seal installer		Installation of transaxle case oil seal. [Using with handle (SST No.:09231-H1100)]
09231-H1100 Bar		Installation of transaxle case oil seal. [Using with oil seal installer (SST No.:09452-26100)]

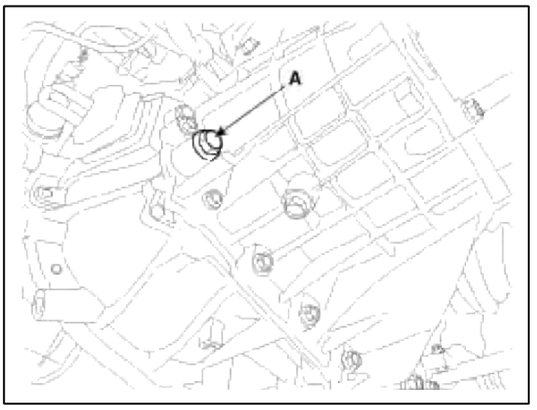
Manual Transaxle System > Manual Transaxle System > Repair procedures

Inspection

Manual Transaxle Oil Inspection

1. Park the vehicle on a level ground and stop the engine.

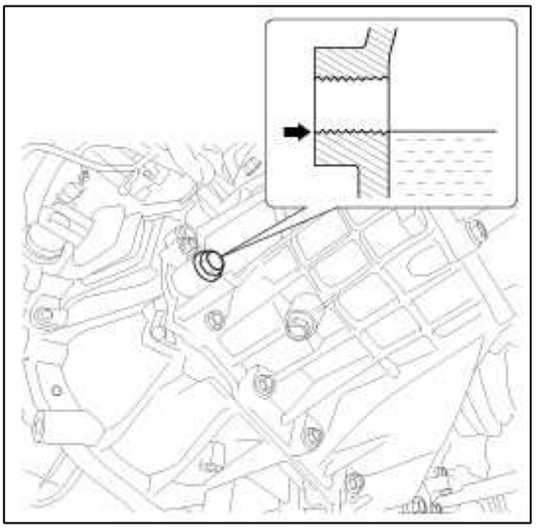
2. Retighten the oil filler plug (A) with a new washer.



3. Check level with finger.

NOTE

- Oil level must be up to fill the hole, if not, add oil until it runs over.

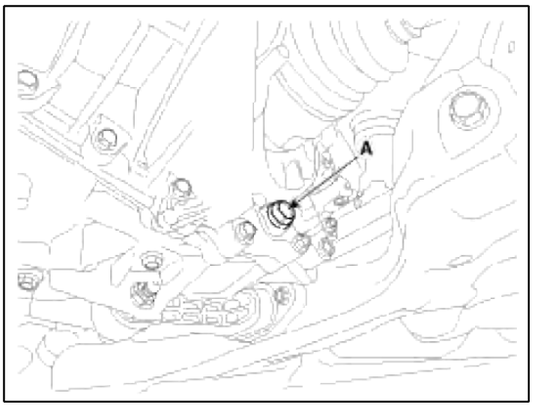


4. Install the filler plug with a new gasket.

Tightening torque:
58.9 ~ 78.5 N.m (6.0 ~ 8.0 kgf.m, 43.4 ~ 57.8 lb-ft)

Manual Transaxle Oil Replacement

1. Park the vehicle on a level ground and stop the engine.
2. Drain the manual transaxle oil after loosening the drain plug (A).



3. Install the drain plug with a new gasket.

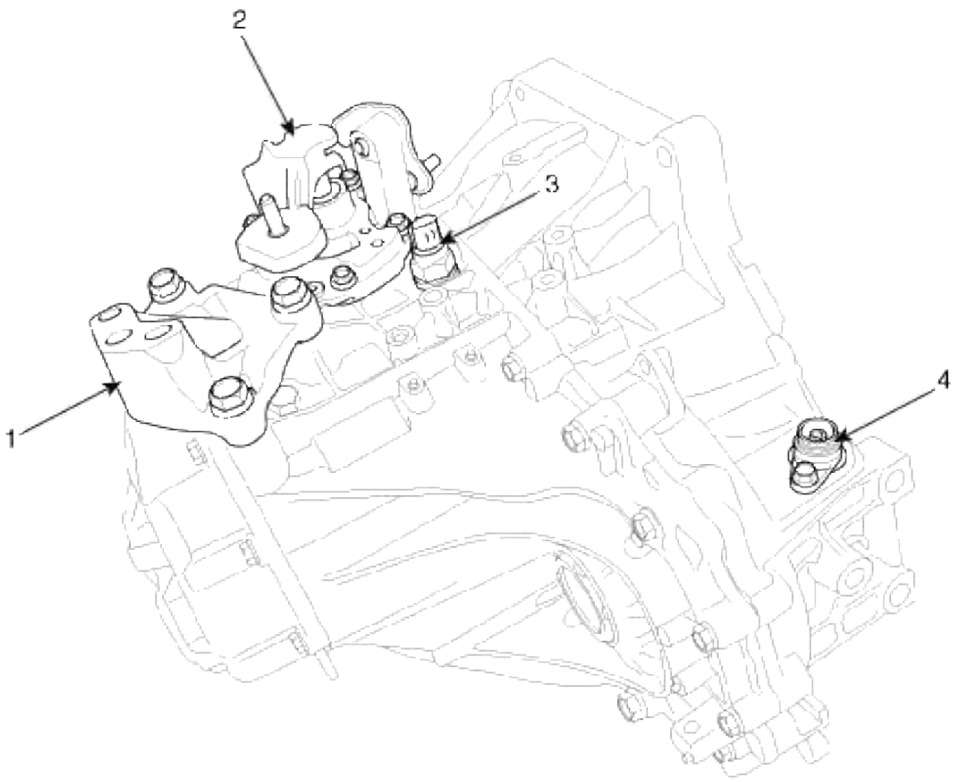
Tightening torque:
58.9 ~ 78.5 N.m (6.0 ~ 8.0 kgf.m, 43.4 ~ 57.9 lb-ft)

4. Add new oil through the filler plug hole and, fill it just below the plug opening.

Standard oil: SAE 75W/85, API GL-4
Oil capacity: 1.8L (0.48 U.S.gal., 1.90 U.S. qt., 1.58 lmp.qt.)

Manual Transaxle System > Manual Transaxle System > Manual Transaxle > Components and Components Location

Components

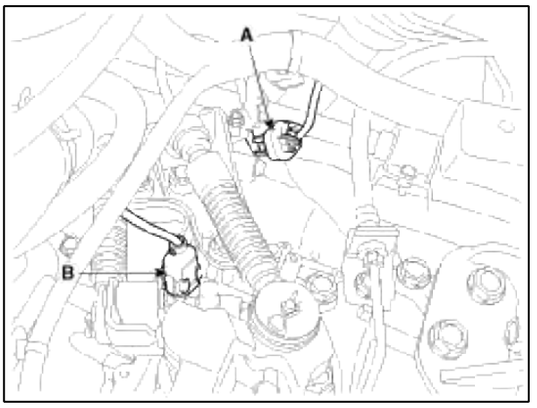


1. Manual transaxle support mounting bracket	3. Back-up lamp switch
2. Control complete shaft	4. Speed sensor

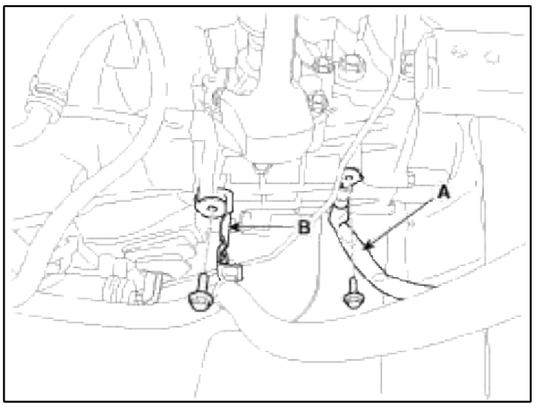
Manual Transaxle System > Manual Transaxle System > Manual Transaxle > Repair procedures

Removal

1. Remove the following items;
   A. Engine cover. (Refer to "Intake and Exhaust system" in EM group.)
   B. Air cleaner assembly and air duct. (Refer to "Intake and Exhaust system" in EM group.)
   C. Battery and battery tray.
      (Refer to "Charging system" in EE group.)
   D. ECM.
      (Refer to "Engine Control System" in FL group.)
2. Disconnect the speed sensor connector (A).
3. Disconnect the back up lamp switch connector (B).

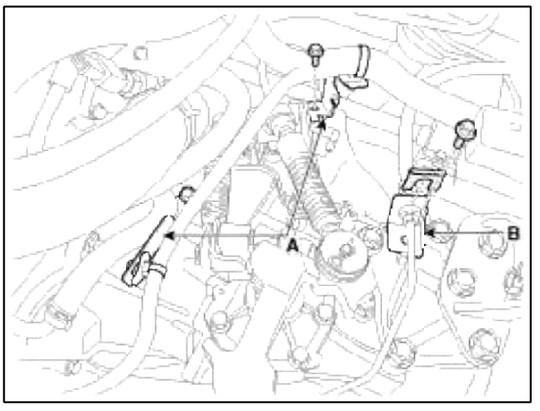


4. Remove the ground (A) and bracket (B).

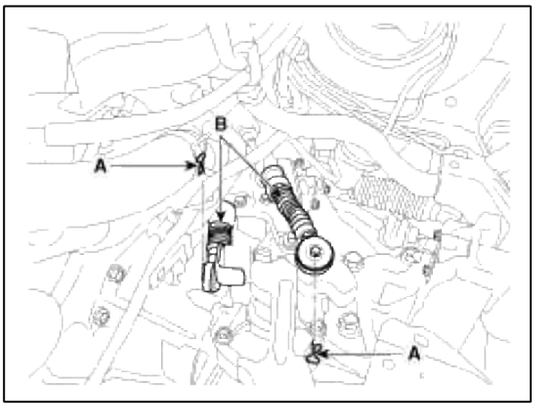


5. Remove the clutch tube bracket bolt (B) and wire bracket (A).

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

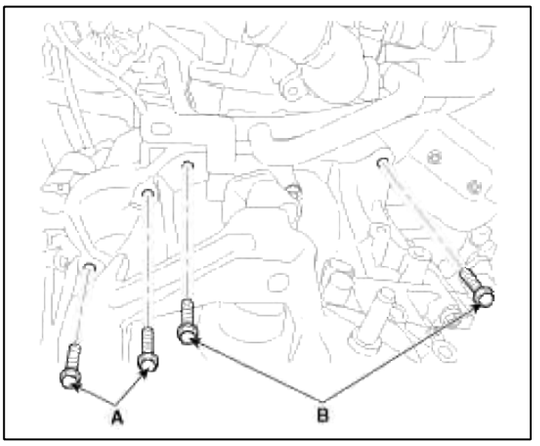


6. Disconnect the select or shift cable assembly (B) after removing the pin (A).

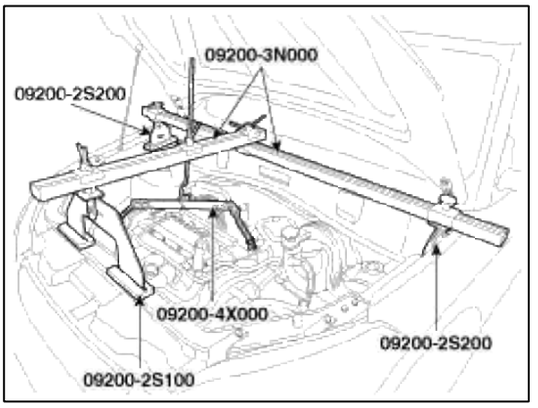


7. Remove the transaxle upper mounting bolt (B-2ea) and the start motor mounting bolt (A-2ea).

Tightening torque:
(A,B) 42.2 ~ 54.0 N.m (4.3 ~ 5.5 kgf.m, 31.1 ~ 39.8 lb-ft)

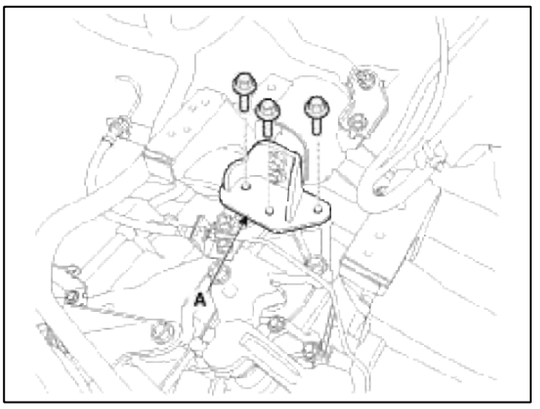


8. Using the SST (support SST No. : 09200-2S000, beam SST No. : 09200-38001, adapter SST No. : 09200-4X000), hold the engine and transaxle assembly safely.



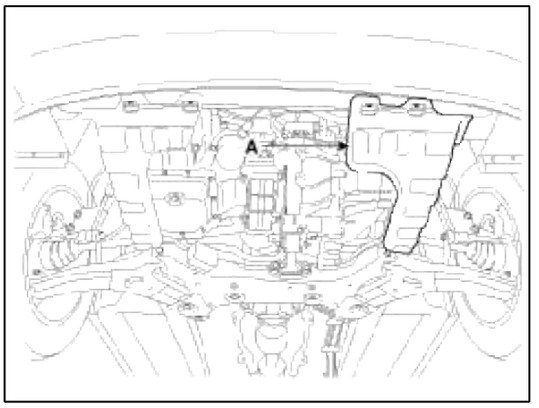
9. Remove the transaxle support mounting bracket bolts (A-2ea).

Tightening torque:
88.3 ~ 107.9 N.m (9.0 ~ 11.0 kgf.m, 65.1 ~ 79.6 lb-ft)



10. Remove the under cover (A).

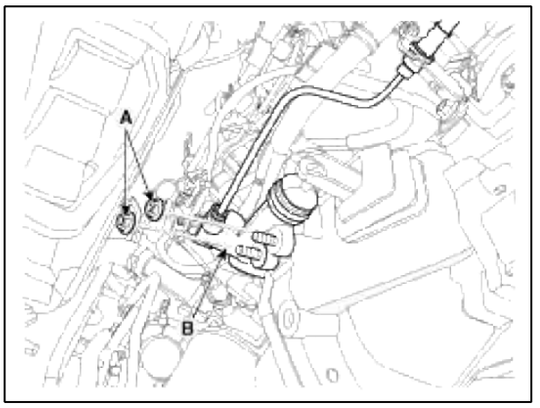
Tightening torque:
6.9 ~ 10.8 N.m (0.7 ~ 1.1 kgf.m, 5.1 ~ 8.0 lb-ft)



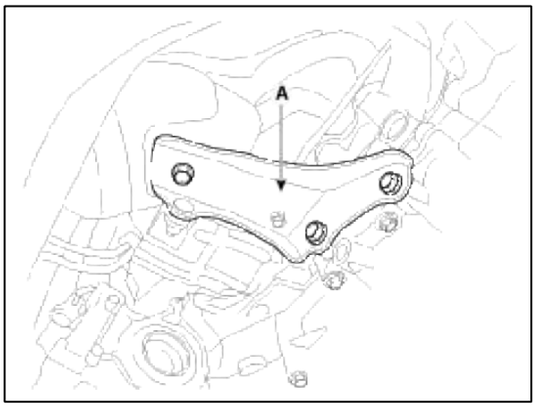
11. Remove the drive shaft assembly.
(Refer to "Drive shaft assembly" in DS group.)

12. Remove the clutch release cylinder assembly (B) after removing the nuts (A-2ea).

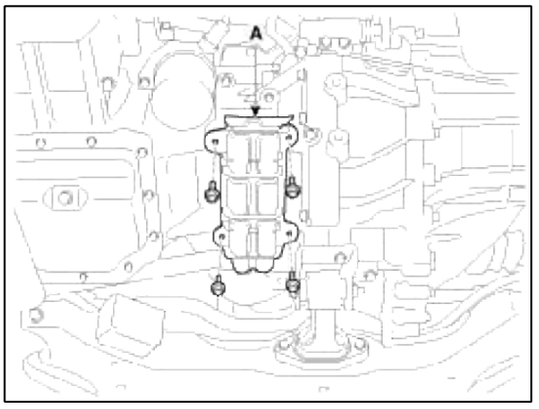
Tightening torque:
14.7 ~ 21.6 N.m (1.5 ~ 2.2 kgf.m, 10.8 ~ 15.9 lb-ft)



13. Remove the drive shaft cover (A).

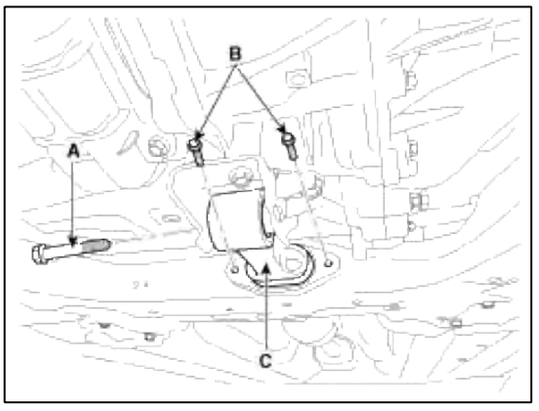


14. Remove the bracket (A).



15. Remove the roll rod bracket (C) after removing bolt (A,B).

Tightening torque:
(A) 49.0 ~ 68.6 N.m (5.0 ~ 7.0 kgf.m, 36.2 ~ 50.6 lb-ft)
(B) 107.9 ~ 127.5 N.m (11.0 ~ 13.0 kgf.m, 79.6 ~ 94.1 lb-ft)

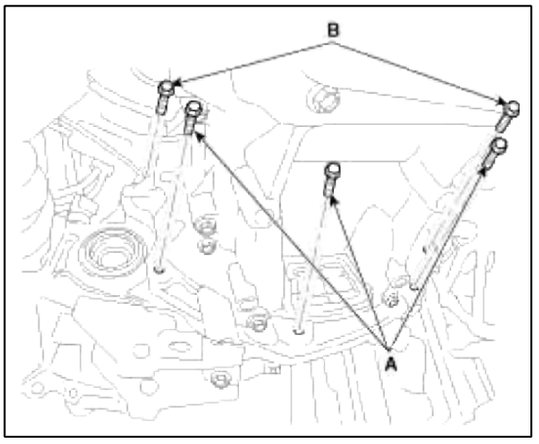


16. Remove the mounting bolts (A-4ea, B-2ea) of lower part of the transaxle, and the left side cover and remove the transaxle assembly by supporting it with a jack.

CAUTION

- Be careful not to damage other system or parts near by when removing the engine and transaxle assembly.

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



Installation

CAUTION

If the oil seal on the transaxle case side is damaged and fluid is leaking, replace the oil seal with a new unit. When installing the new oil seal, use the specialized tool (oil seal installer, 09431-26100).

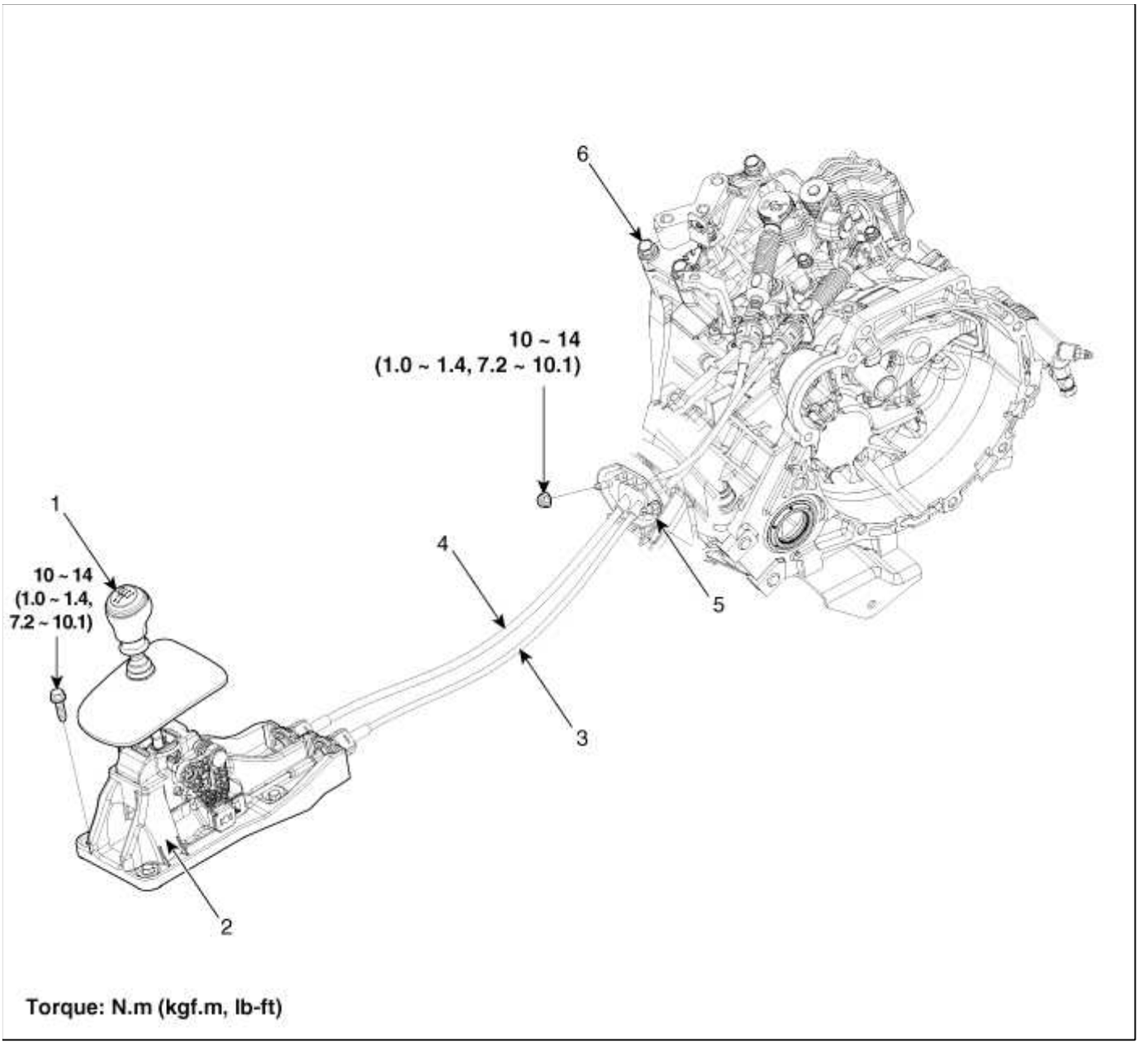
1. Installation is the reverse of removal.

NOTE

- Adding Manual transaxle fluid.
  (Refer to "Manual transaxle system" in this group.)

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

Components

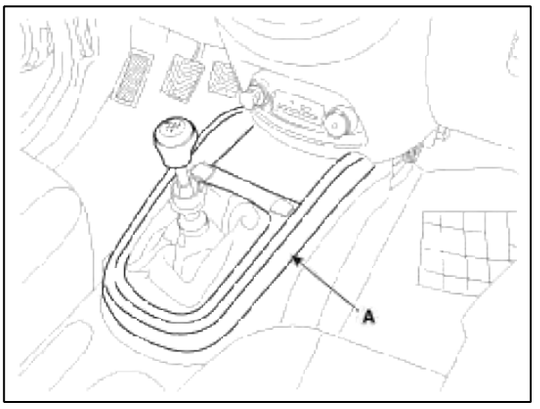


1. Shift lever knob	4. Shift cable assembly
2. Shift lever assembly	5. Retainer
3. Select cable assembly	6. Manual transaxle assembly

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

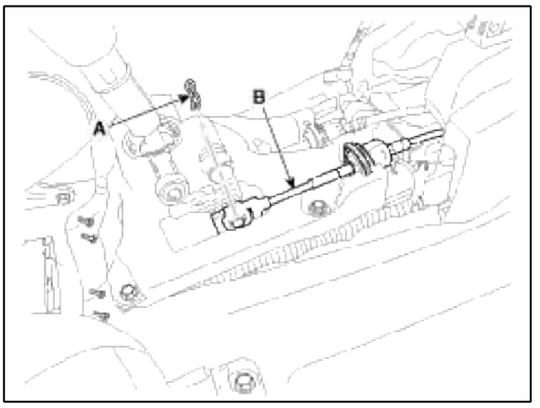
Removal

1. Remove the cover (A).

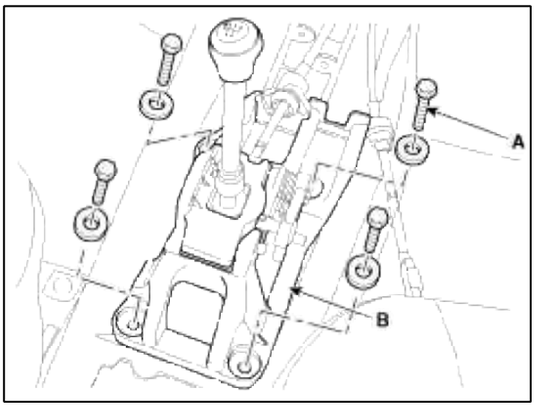


2. Remove the center console assembly.
   (Refer to "Interior" in BD group.)

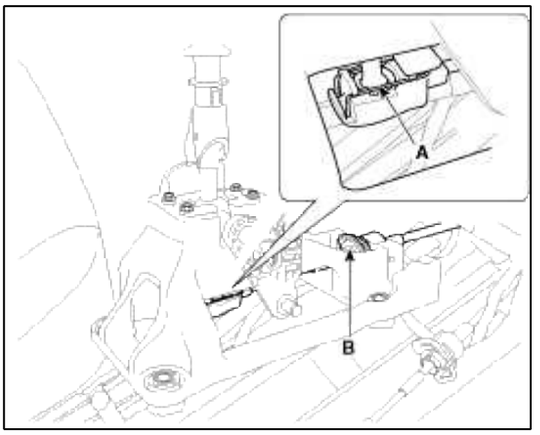
3. Remove the select cable (B) by removing the snap pin (A).

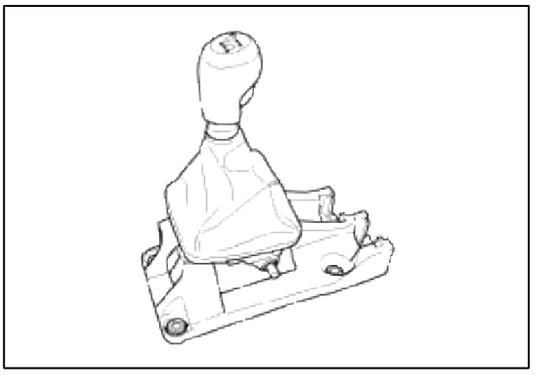


4. Remove the shift lever assembly (B) by removing the bolts (A-4ea).



5. Remove the shift cable (B) from the shift lever assembly by removing the clip (A).

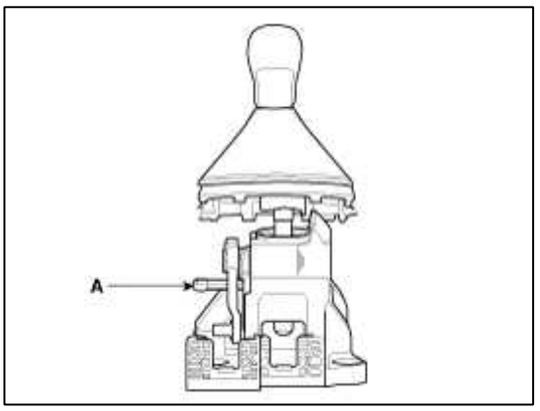




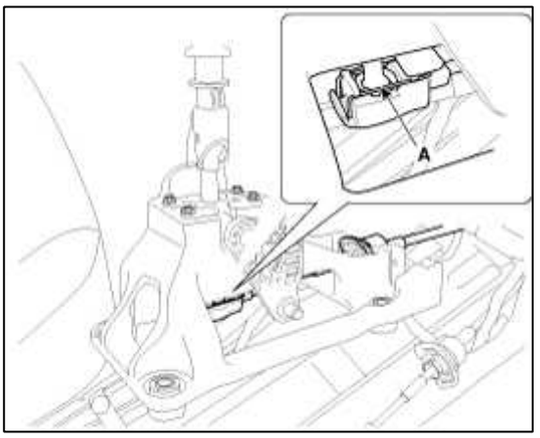
Installation

CAUTION

- Make sure vehicle does not roll before setting room side shift lever and T/M side manual control lever to "N" position.
- Intall the "N" position pin (A).

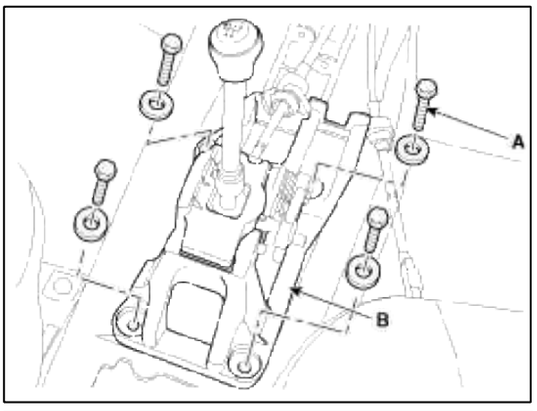


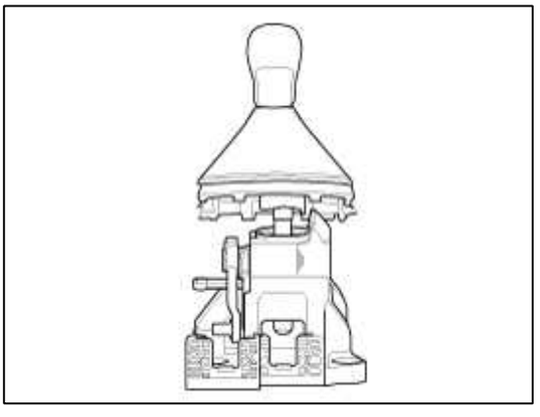
1. Install the shift cable (A).



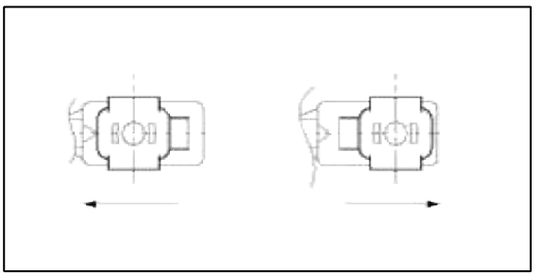
2. Install the shift lever assembly (B) by tightening the bolts (A-4ea).

Tightening torque:
9.8 ~ 13.7 N.m (1.0 ~ 1.4 kgf.m, 7.2 ~ 10.1 lb-ft)

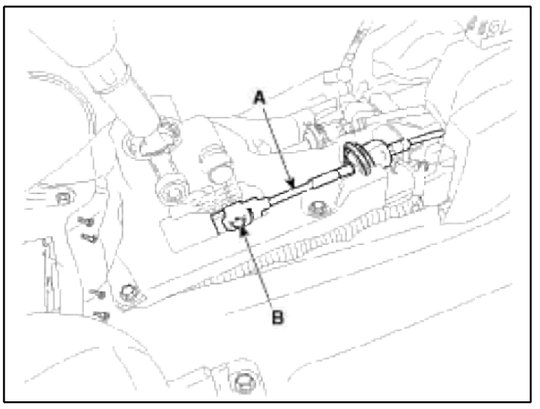




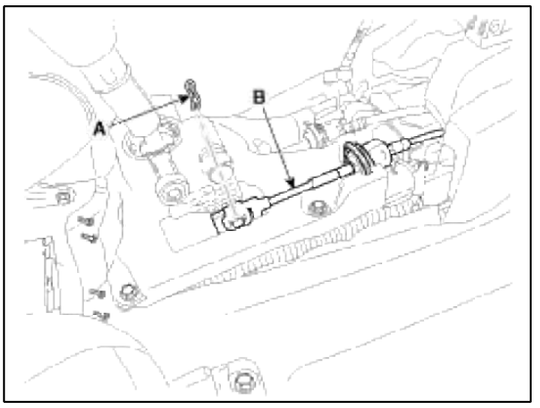
3. Shift the shift lever to 3rd gear.
4. Re-adjust select cable.



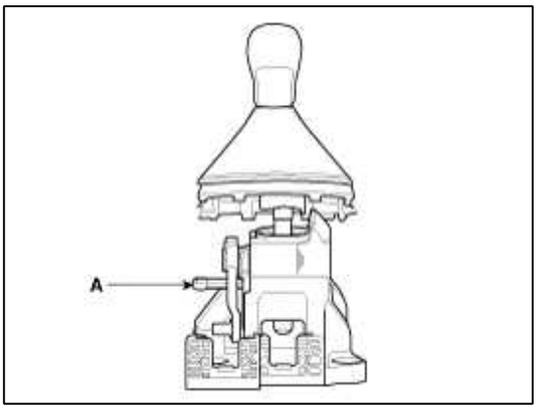
5. Insert the select cable (A) to the shift lever assembly pin (B).



6. After shifting 2nd gear, checking the left select gab about 1.1mm (if not, loop no.3 ~ 6).
7. Install the snap pin (A).



8. Remove the "N" position pin (A) after after assembling select cable. (Resuse)

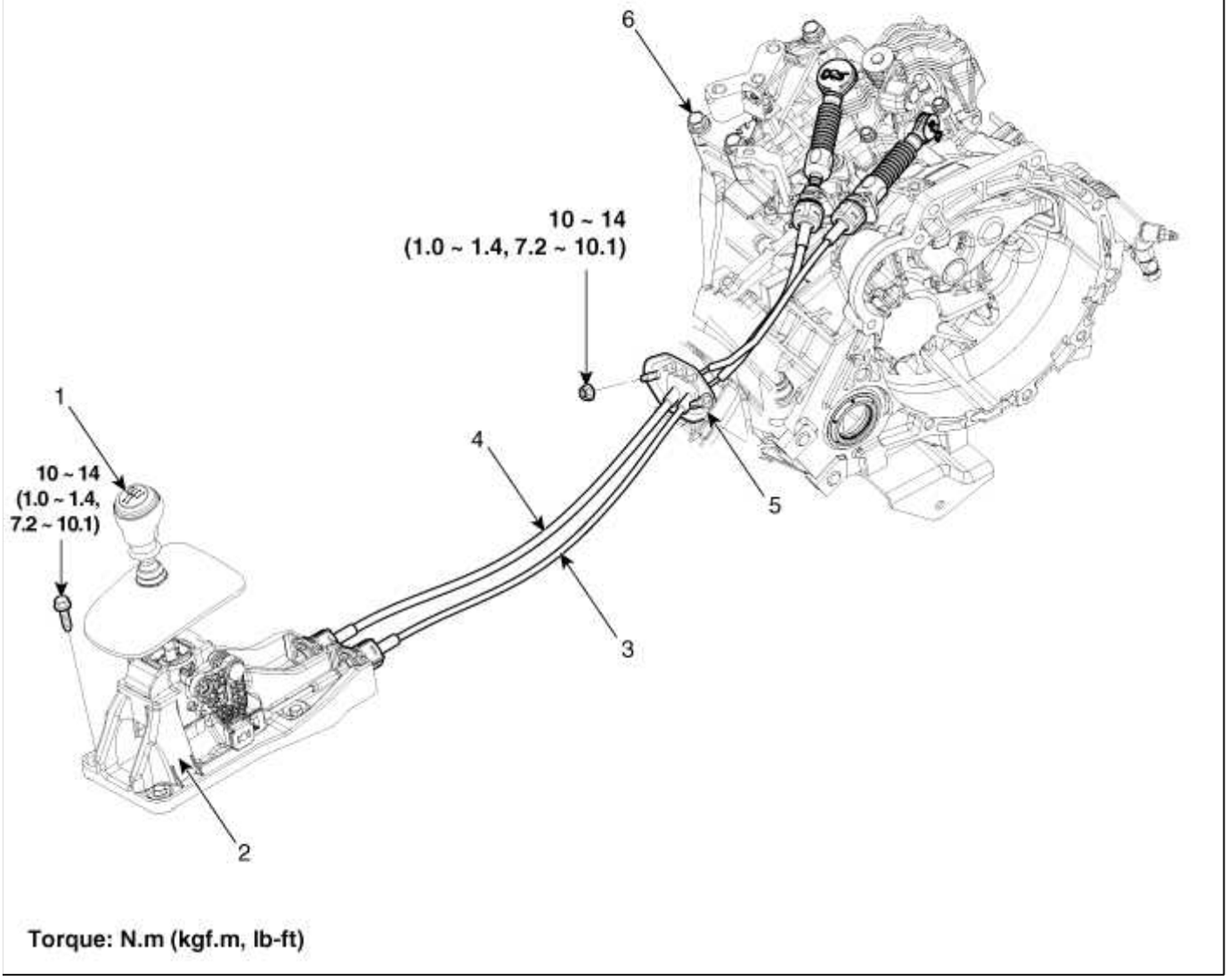


NOTE

1. Operating lever of body side, check secure operation of lever of T/M side after assembly.
2. When lever is engaged to "R", check the position of "skirt".
3. When lever is shifted to each position, if stop occur between two position, re-adjust select cable.

Manual Transaxle System > Manual Transaxle Control System > Control Cable > Components and Components Location

Components



1. Shift lever knob	4. Shift cable assembly
2. Shift lever assembly	5. Retainer
3. Select cable assembly	6. Manual transaxle assembly

Manual Transaxle System > Manual Transaxle Control System > Control Cable > Repair procedures

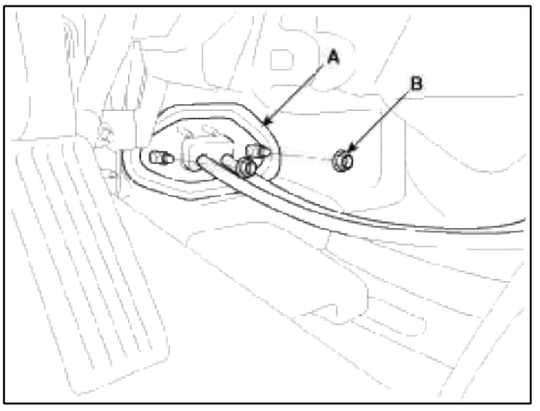
Inspection

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.

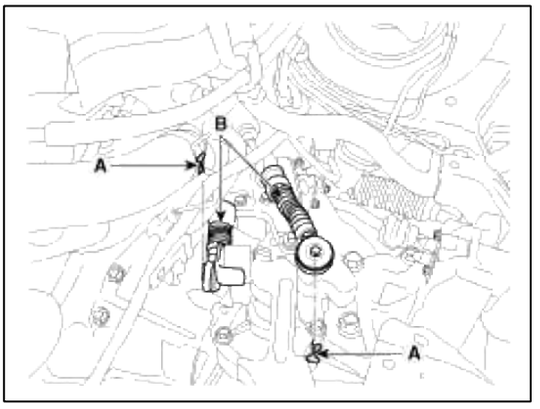
Reomval

1. Remove the shift lever assembly.
   (Refer to "Manual Transaxle Control System "Shift Lever" in this group)

2. Remove the retainer (A) and nuts (B-2ea).



3. Remove the pin (A) and then remove the shift cable & select cable (B).



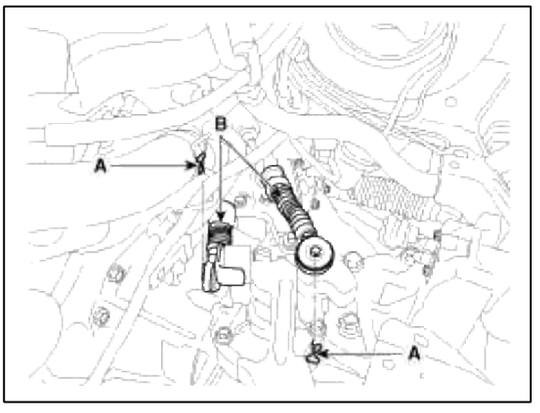
4. Remove the shift cable and select cable at cabin room.

Installation

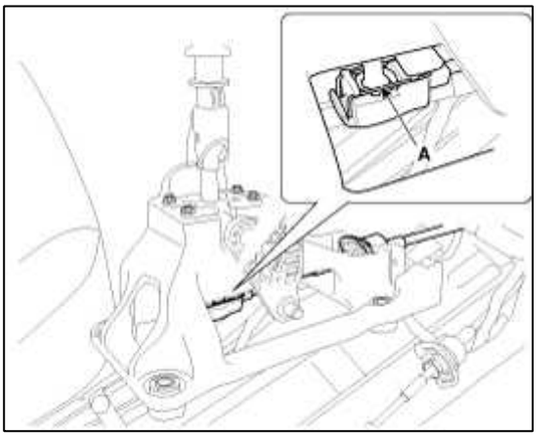
CAUTION

Set room side lever and T/M side lever to "N" position.

1. Install the shift cable & select cable (B) and pin (A).

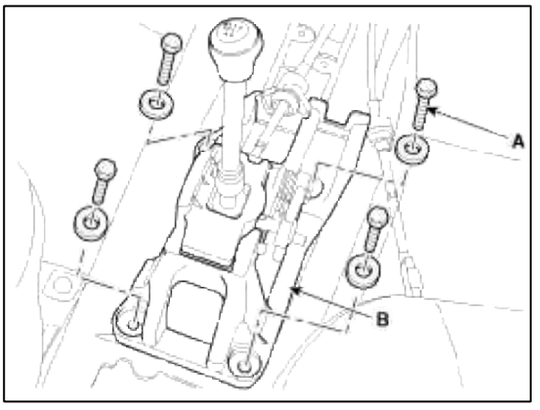


2. Install the shift cable (A).



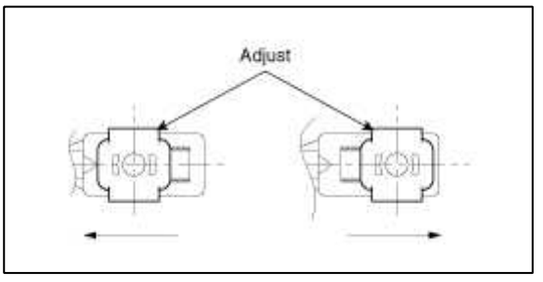
3. Install the shift lever assembly (B) by tightening the bolts (A-4ea).

Tightening torque:
9.8 ~ 13.7 N.m (1.0 ~ 1.4 kgf.m, 7.2 ~ 10.1 lb-ft)

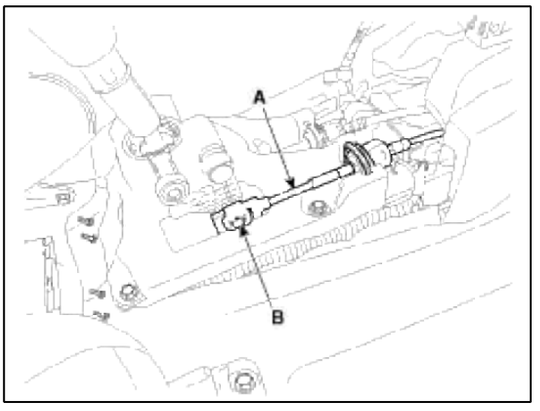


4. Shift the shift lever to 3rd gear.

5. Re-adjust select cable.

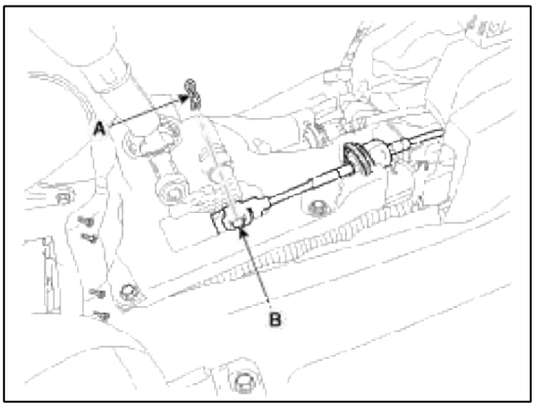


6. Insert the select cable (A) to the shift lever assembly pin (B).

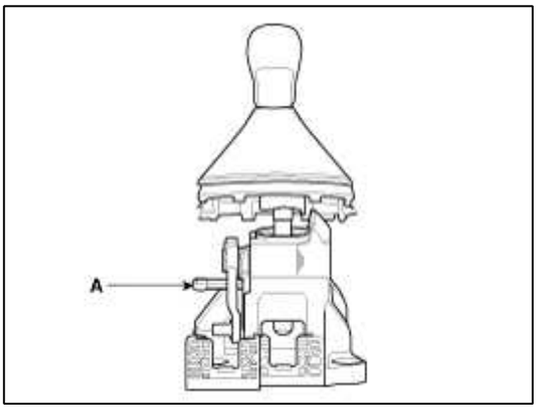


7. After shifting 2nd gear, checking the left select gab about 1.1mm (if not, loop no.3 ~ 6).

8. Install the snap pin (A) to the shift lever assembly pin (B).



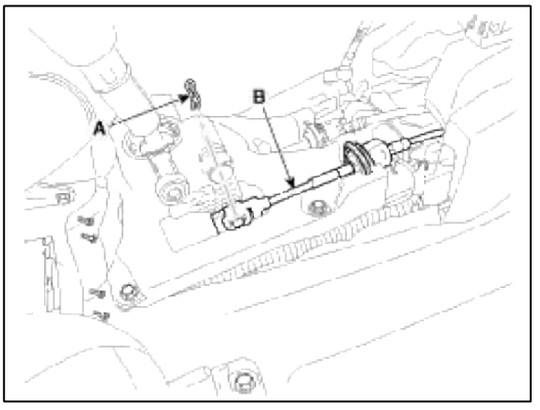
9. Remove the "N" position pin (A) after after assembling select cable. (Resuse)



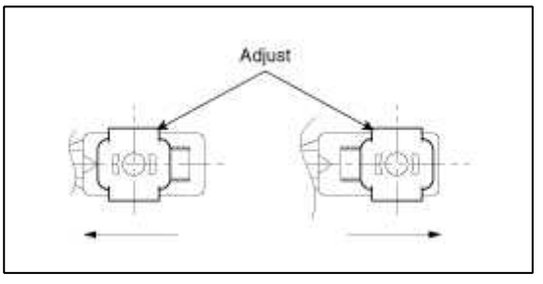
Adjustment

Select cable re-adjustment

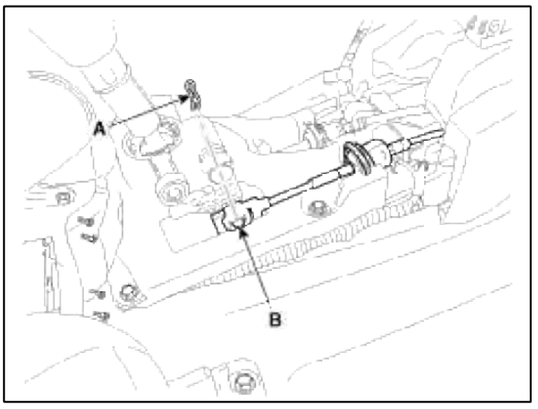
1. In neutural position, remove the snap pin (A) and select cable (B) from shift lever pin.



2. Shift the shift lever to 3rd gear.
3. Depress the select adjust and then re-adjust select cable.



4. In neutural position, insert on free load and press the adjust and then install the snap pin (A) from shift lever pin (B).



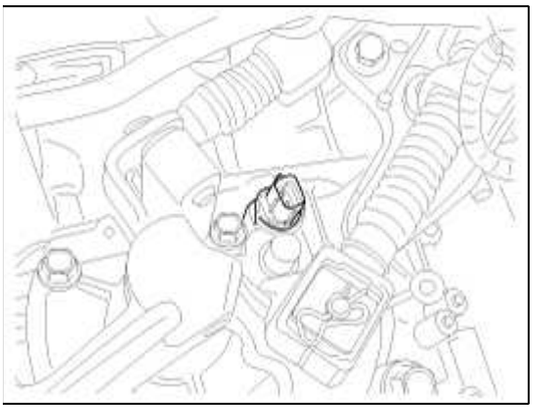
NOTE

- After shifting 2nd gear, checking the left select cable gab about 1.1mm. (if not, loop no.1 ~ 4)
- Check the select cable for proper operation.
- Check the shift cable for proper operation.

Manual Transaxle System > Manual Transaxle Control System > Back-up Lamp Switch > Description and Operation

Description

Back up lamp switch is pushed by the reverse lug sliding when select arm, and switches the back up lamp.



Manual Transaxle System > Manual Transaxle Control System > Back-up Lamp Switch > Specifications

Specifications

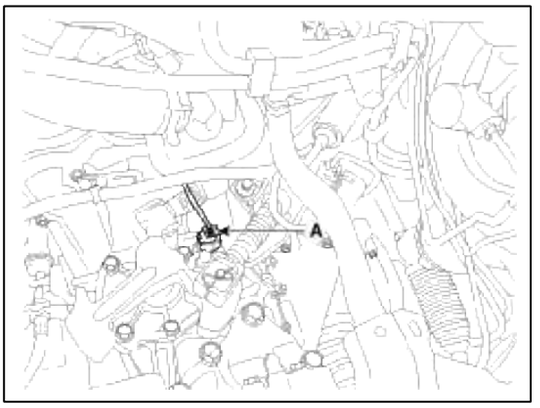
Specification

Working voltage	DC 10~15V
Operating force	3.0kg Max
Voltage drop	-0.4V
Working temperature	-30°C ~ 100°C [-30°F ~ 212°F]

Manual Transaxle System > Manual Transaxle Control System > Back-up Lamp Switch > Repair procedures

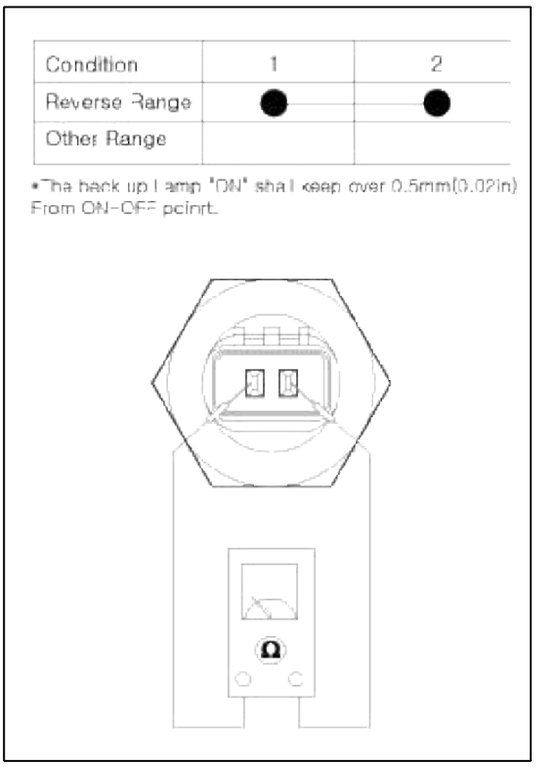
Inspection

1. Disconnect the back up lamp switch connector (A).



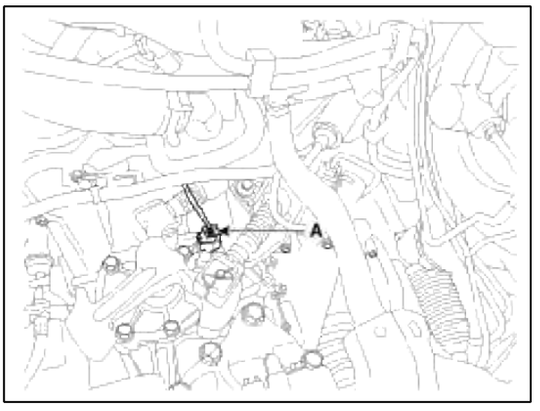
2. Check the continuity between no. 1 and 2 terminals of backup lamp switch. When the shift lever is in reverse, there should be continuity.

3. If necessary, repair or replace the backup lamp switch.

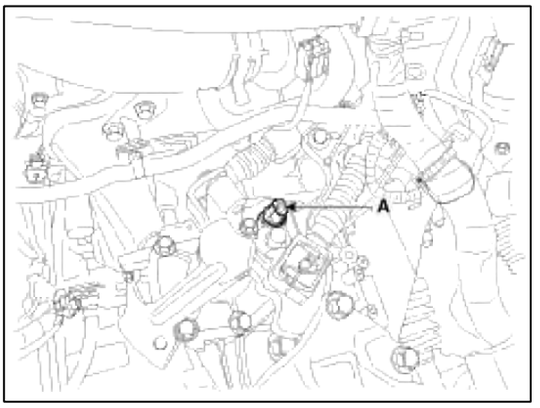


Replacement

1. Disconnect the back up lamp switch connector (A).



2. Remove the back up lamp switch (A).



3. Replace a new one and install the back up lamp switch.

Tightening torque:
29.4 ~ 34.3 N.m (3.0 ~ 3.5 kgf.m, 21.7 ~ 25.3 lb-ft)

SOUL(AM) > 2012 > G 1.6 GDI > Driveshaft and axle

Driveshaft and axle > General Information > Specifications

Specification

Engine	T/M	Joint type		Max. permissible angle	
		Outer	Inner	Outer	Inner
Gasoline 1.6 GDI	M/T	BJ#87	TJ#87	46.5°	21°
	A/T	BJ#82	BJ#82	46.5°	21°
Gasoline 2.0 MPI	M/T	BJ#87	BJ#87	46.5°	21°
	A/T	BJ#87	BJ#87	46.5°	21°

Tightening Torque

Item	Nm	Kgf.m	lb-ft
Hub nuts	88.3 ~ 107.9	9.0 ~ 11.0	65.1 ~ 79.6
Driveshaft lock nut	240.3 ~ 269.7	24.5 ~27.5	177.2 ~ 198.9
Strut assembly to knuckle	98.1 ~ 117.7	10.0 ~12.0	72.3 ~ 86.8
Lower arm to knuckle	58.8 ~ 70.6	6.0 ~ 7.2	43.4 ~ 52.1
Tie rod end castle nut	23.5 ~ 33.3	2.4 ~ 3.4	17.4 ~ 24.6
Front caliper to knuckle	63.7 ~ 73.5	6.5 ~ 7.5	47.0 ~ 54.2
Rear caliper to carrier	63.7 ~ 73.5	6.5 ~ 7.5	47.0 ~ 54.2
Rear carrier to torsion axle	68.6 ~ 88.3	7.0 ~ 9.0	50.6 ~ 65.1

CAUTION

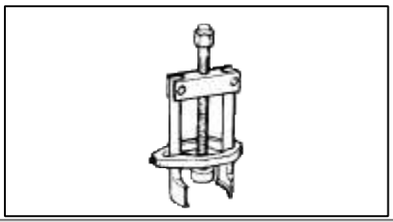
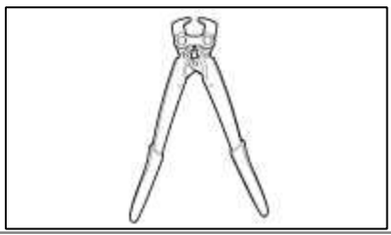
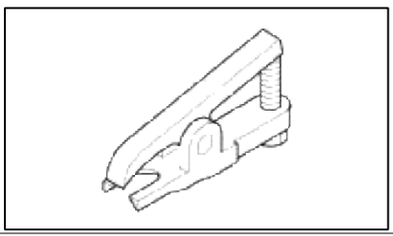
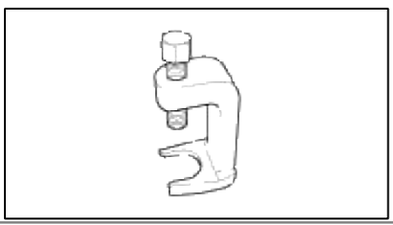
Replace self-locking nuts with new ones after removal.

Lubricants

Engine	TM	Lubricants		Quantity	
		Outer	Inner	Outer	Inner (LH / RH)
Gasoline 1.6 GDI	M/T	GRB006	SH06-VX21	100±10g	LH :135±10g / RH : 130±10g
	A/T	GRB006	SH06-VX21	80±10g	LH :130±10g / RH : 115±10g
Gasoline 2.0	M/T	GRB006	SH06-VX21	100±10g	LH :135±10g / RH : 130±10g
	A/T	GRB006	SH06-VX21	100±10g	LH :135±10g / RH : 130±10g

Driveshaft and axle > General Information > Special Service Tools

Special Service Tools

Tool(Number and Name)	Illustration	Use
09495-33000 Puller		Removal of spider assembly from a drive shaft.
09495-3K000 Band installer		Installation of ear type boot band
09568-34000 Ball joint remover		Removal of the rear upper arm ball joint
09568-2J100 Ball joint puller		Remover of ball joint

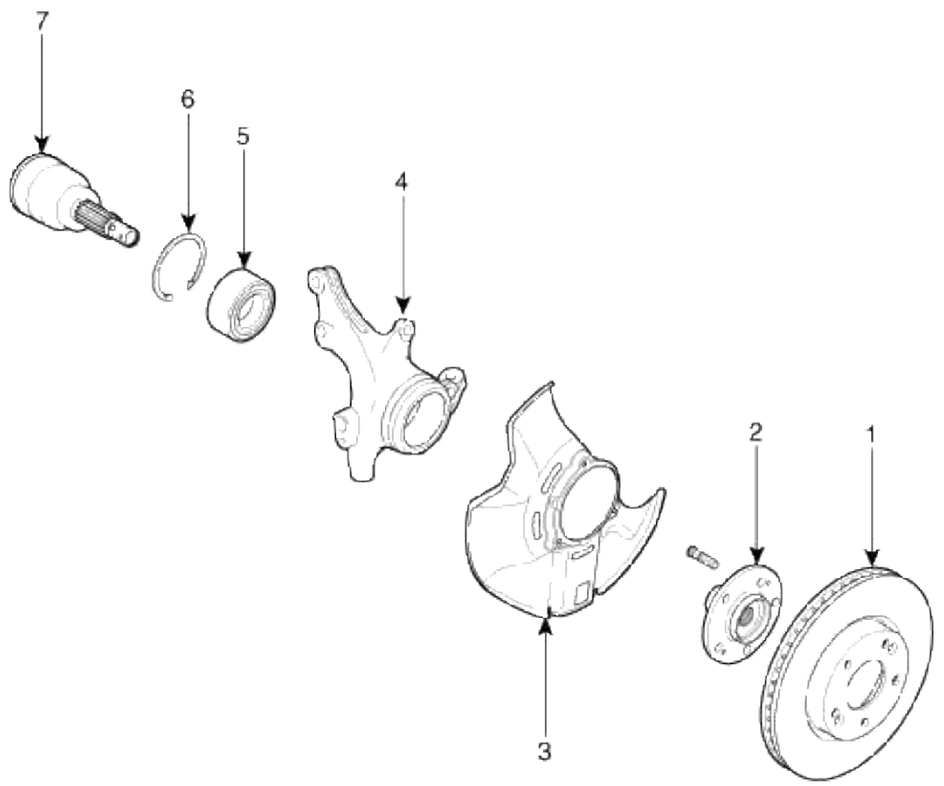
Driveshaft and axle > General Information > Troubleshooting

Troubleshooting

Trouble Symptom	Probable cause	Remedy
Vehicle pulls to one side	Scoring of driveshaft ball joint	Replace
	Wear, rattle or scoring of wheel bearing	Replace
	Defective front suspension and steering	Adjustment or Replace
Vibartion	Wear, damage or bending of driveshaft	Replace
	Driveshaft rattle and hub serration	Replace
	Wear, rattle or scratching of wheel bearing	Replace
Shimmy	Defective wheel balance	Adjustment or Replace
	Defective front suspension and steering	Adjustment or Replace
Excessive noise	Wear, damage or bending of driveshaft	Replace
	Rattle of driveshaft and worn hub splines	Replace
	Wear, rattle or scoring of wheel bearing	Replace
	Loose hub nut	Adjustment or Replace
	Defective front suspension and steering	Adjustment or Replace

Driveshaft and axle > Front Axle Assembly > Front Hub / Knuckle > Components and Components Location

Components



1. Brake disc	5. Wheel bearing
2. Hub	6. Snap ring
3. Dust cover	7. Driver shaft
4. Knuckle	

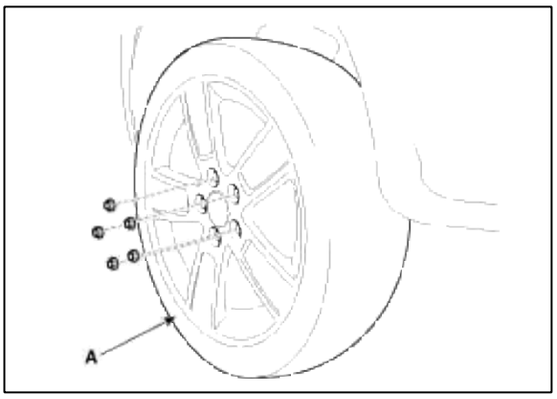
Driveshaft and axle > Front Axle Assembly > Front Hub / Knuckle > Repair procedures

Replacement

1. Loosen the wheel nuts slightly.
   Raise the vehicle, and make sure it is securely supported.

2. Remove the front wheel and tire (A) from front hub .

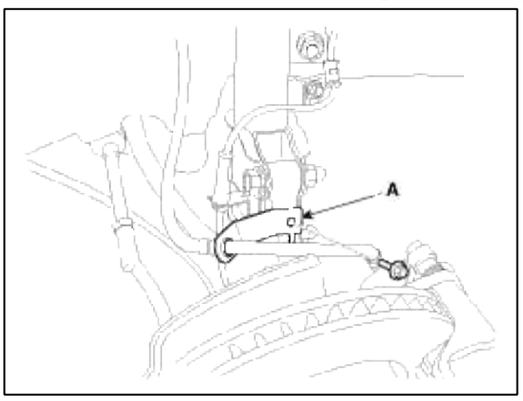
Tightening torque:
88.3 ~ 107.9 N.m (9.0 ~ 11.0 kgf.m, 65.1 ~ 79.6 lb-ft)



CAUTION

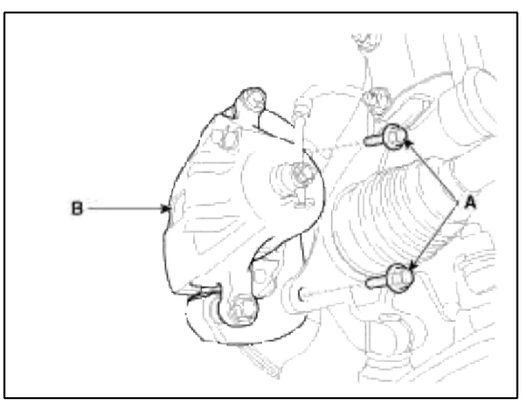
Be careful not to damage to the hub bolts when removing the front wheel and tire (A).

3. Remove the brake hose mounting bracket (A).



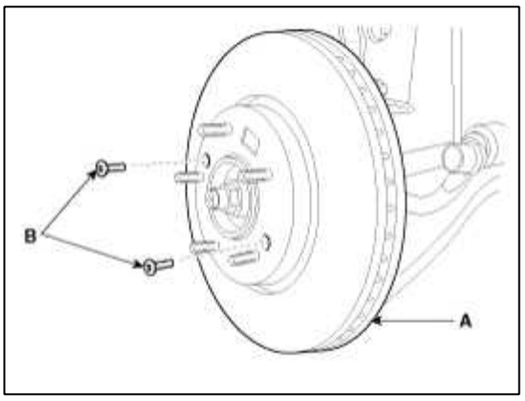
4. Remove the brake caliper mounting bolts (A), and then place the brake caliper assembly (B) with wire.

Tightening torque:
88.3 ~ 107.9 N.m (9.0 ~ 11.0 kgf.m, 65.1 ~ 79.6 lb-ft)



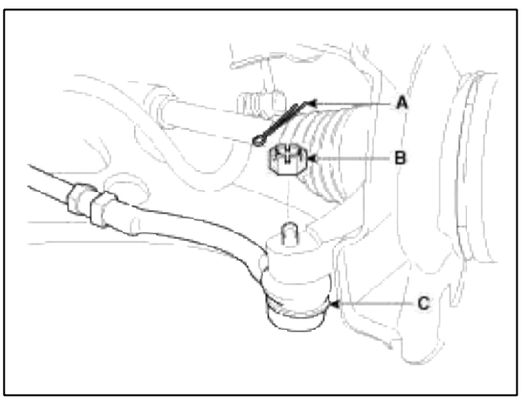
5. Loosen the front brake disc mount screw (B) and then remove the front brake disc (A).

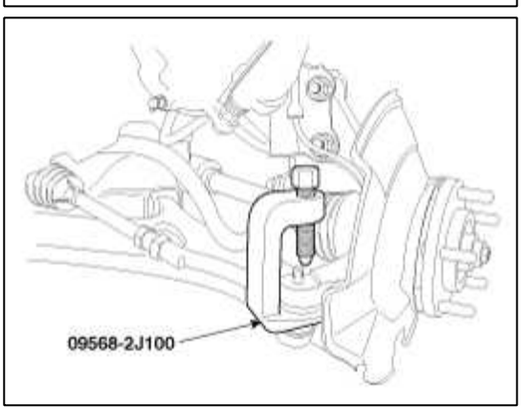
Tightening torque:
4.9 ~ 5.9 N.m (0.5 ~ 0.6 kgf.m, 3.6 ~ 4.3 lb-ft)



6. Remove the tie rod end ball joint from the knuckle.
   (1) Remove the split pin (A).
   (2) Remove the castle nut (B).
   (3) Disconnect the ball joint (C) from knuckle using the special tool (09568-2J100).

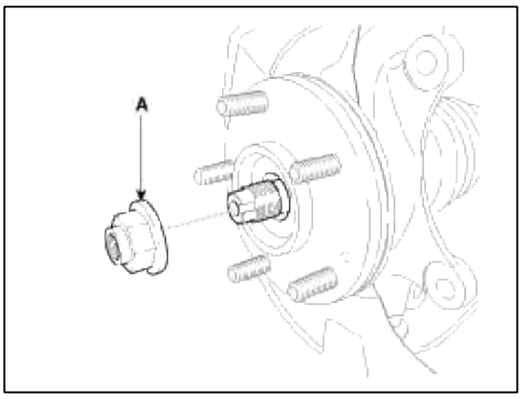
Tightening torque:
23.5 ~ 33.3 N.m (2.4 ~ 3.4 kgf.m, 17.4 ~ 24.6 lb-ft)





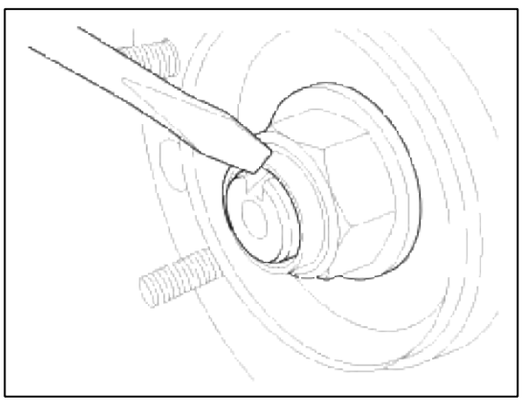
7. Remove driveshaft nut (A) from the front hub under applying the break.

Tightening torque:
240.3 ~ 269.7 N.m (24.5 ~ 27.5 Kgf.m, 177.2 ~ 197.9 lb-ft)



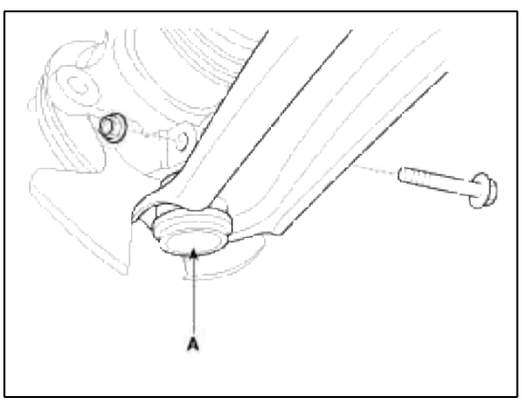
CAUTION

- The driveshaft lock nut should be replaced with new ones.
- After installation driveshaft lock nut, stake the lock nut using a chisel and hammer as shown in the illustration below.

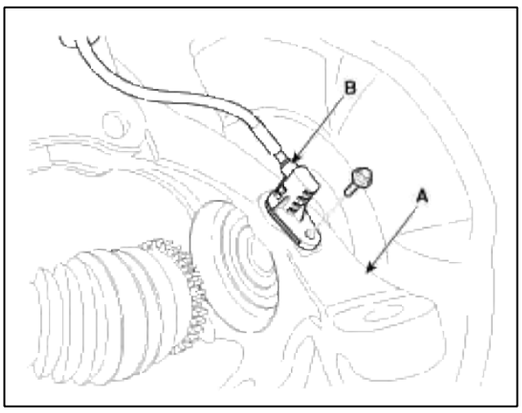


8. Remove the lower arm (A) from the knuckle.

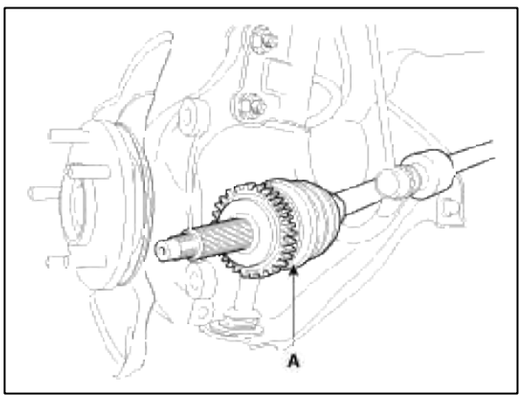
Tightening torque:
58.9 ~ 70.6 N.m (6.0 ~ 7.2 kgf.m, 43.4 ~ 52.1 lb-ft)



9. Loosen the mount bolt and then remove the wheel speed sensor (B) from knuckle (A).

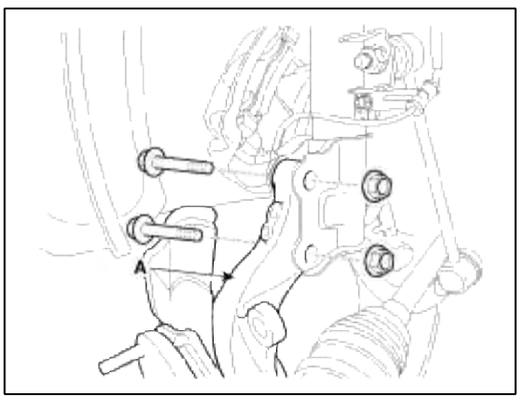


10. Disconnect the driveshaft (A) from the front hub assembly..

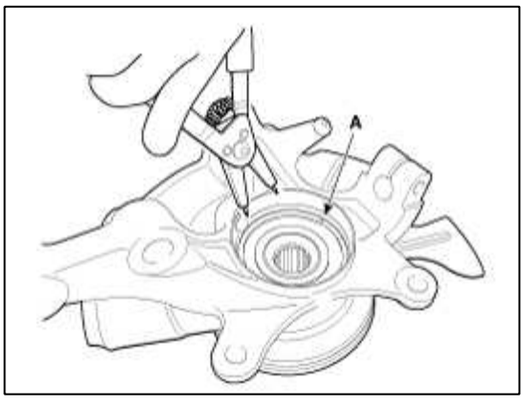


11. Loosen the strut mount bolts and then remove the knuckle assembly (A).

Tightening torque:
98.1 ~ 117.7 N.m (10.0 ~ 12.0 kgf.m, 72.4 ~ 86.8 lb-ft)



12. Remove the snap ring (A).



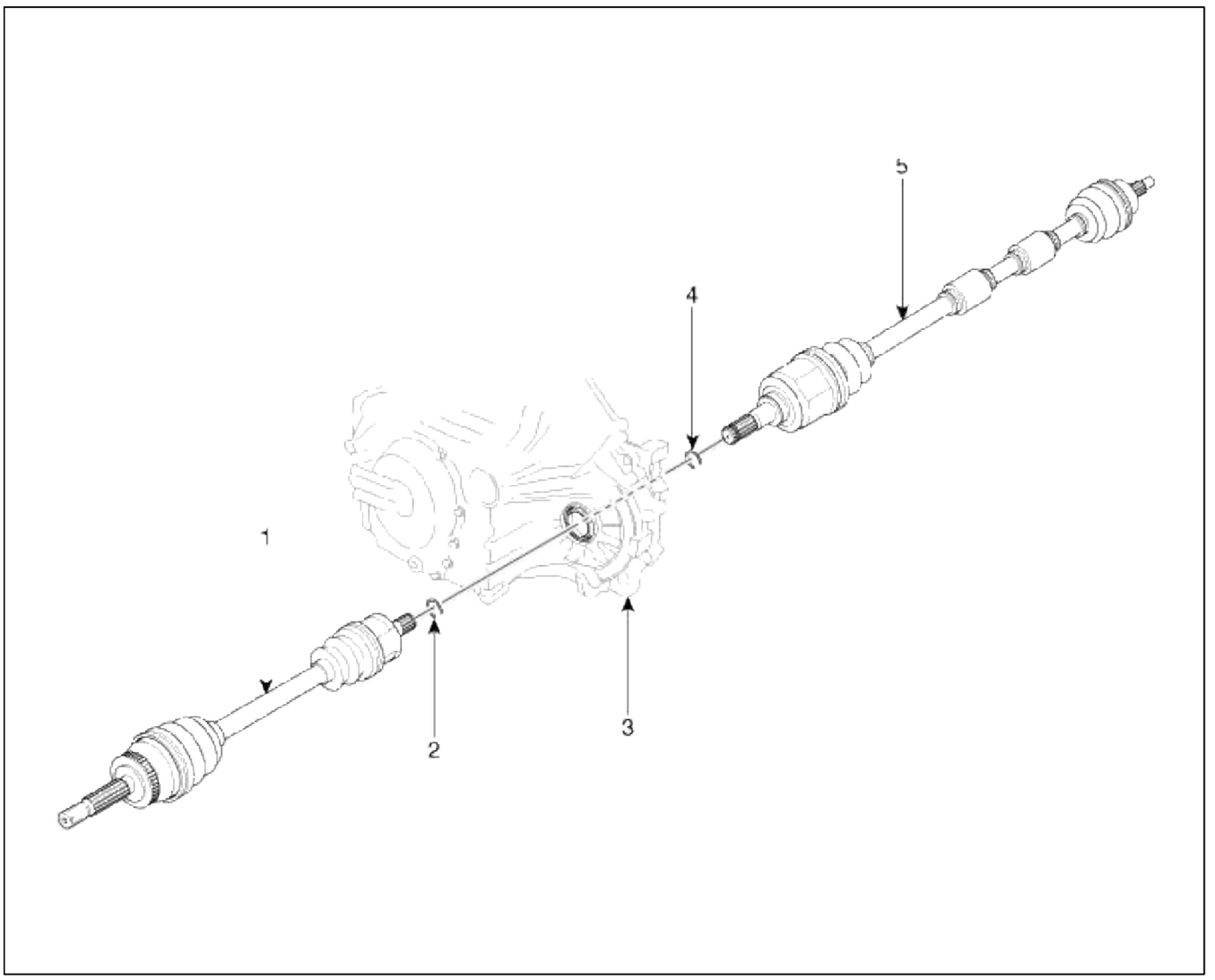
13. Install in the reverse order of removal.

Inspection

1. Check the hub for cracks and the splines for wear.
2. Check the brake disc for scoring and damage.
3. Check the knuckle for cracks
4. Check the bearing for cracks or damage.

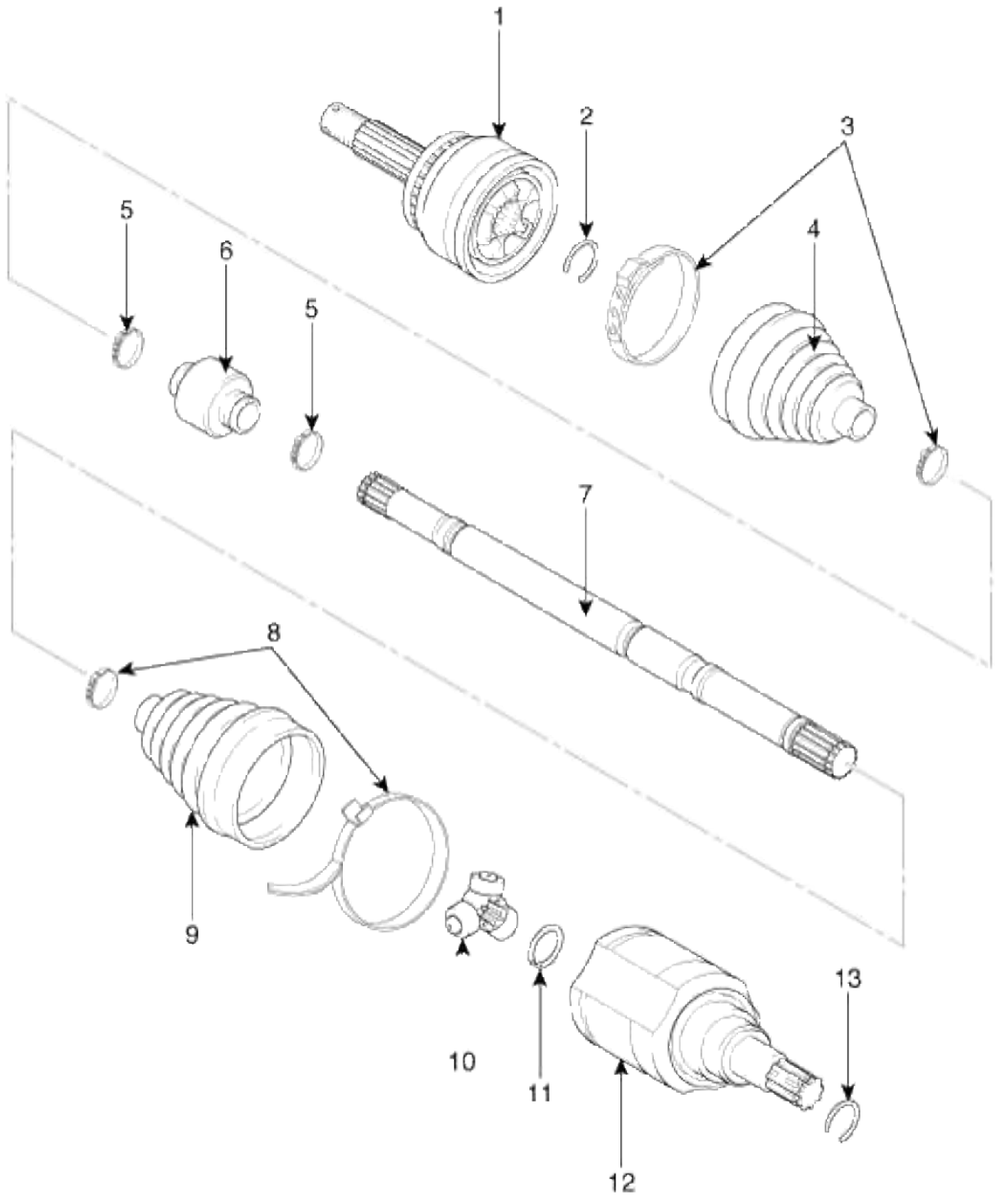
Driveshaft and axle > Driveshaft Assembly > Front Driveshaft > Components and Components Location

Component location



1. Driveshaft(LH) 2. Circlip 3. Transaxle	4. Circlip 5. Driveshaft(RH)

Components



1. BJ boot assembly	5. Dynamic damper bend	9. TJ boot	13. Snap ring
2. BJ circlip	6. Dynamic damper	10. Spider assembly	
3. BJ boot bend	7. Shaft	11. Snap ring	
4. BJ boot	8. TJ boot band	12. TJ case	

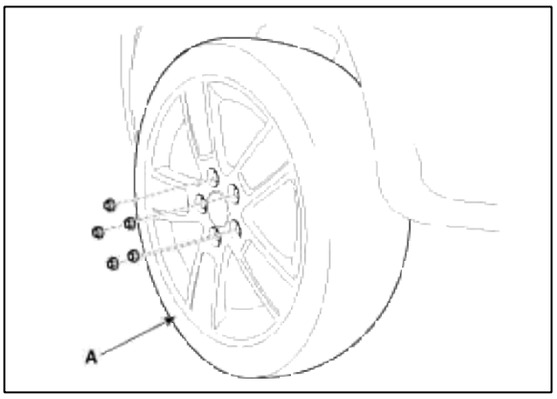
Driveshaft and axle > Driveshaft Assembly > Front Driveshaft > Repair procedures

Replacement

1. Loosen the wheel nuts slightly.
   Raise the vehicle, and make sure it is securely supported.

2. Remove the front wheel and tire (A) from front hub .

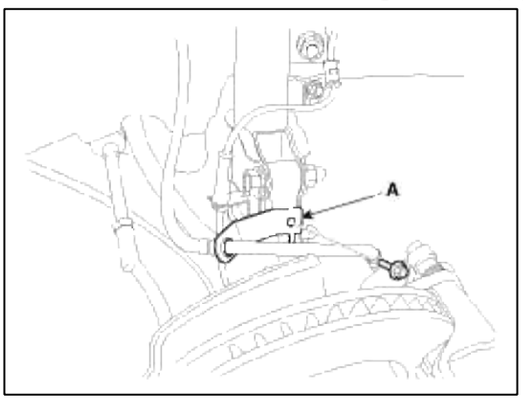
Tightening torque:
88.3 ~ 107.9 N.m (9.0 ~ 11.0 kgf.m, 65.1 ~ 79.6 lb-ft)



CAUTION

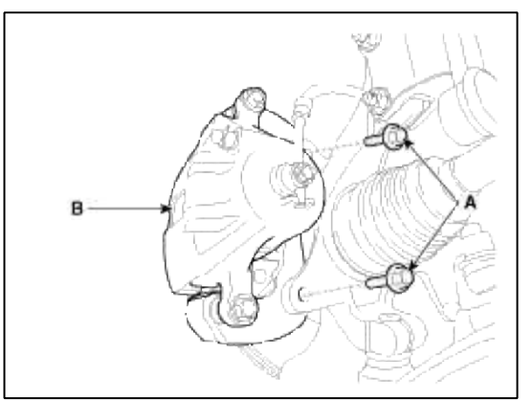
Be careful not to damage to the hub bolts when removing the front wheel and tire (A).

3. Remove the brake hose mounting bracket (A).

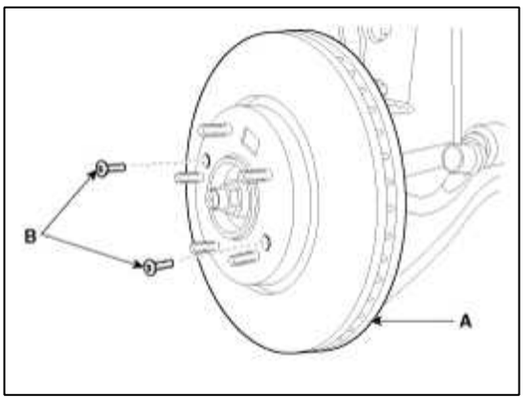


4. Remove the brake caliper mounting bolts (A), and then place the brake caliper assembly (B) with wire.

Tightening torque :
88.3 ~ 107.9 N.m (9.0 ~ 11.0 kgf.m, 65.1 ~ 79.6 lb-ft)

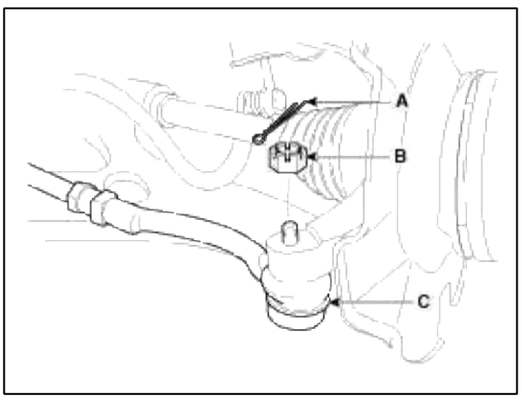


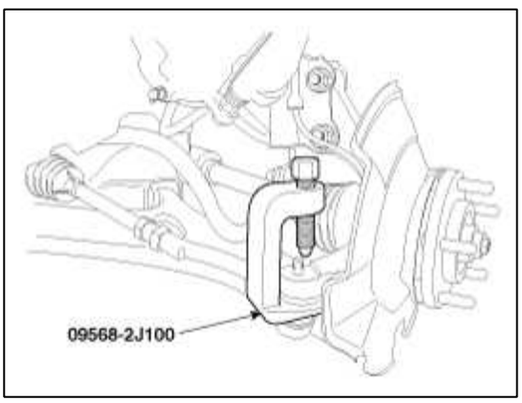
5. Loosen the front brake disc mount screw (B) and then remove the front brake disc (A).



6. Remove the tie rod end ball joint from the knuckle.
   (1) Remove the split pin (A).
   (2) Remove the castle nut (B).
   (3) Disconnect the ball joint (C) from knuckle using the special tool (09568-2J100).

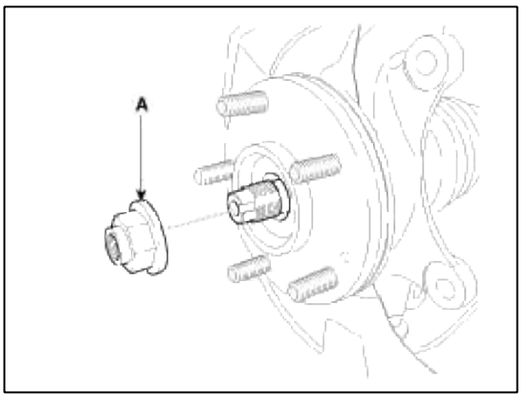
Tightening torque:
23.5 ~ 33.3 N.m (2.4 ~ 3.4 Kgf.m, 17.4 ~ 24.6 lb-ft)





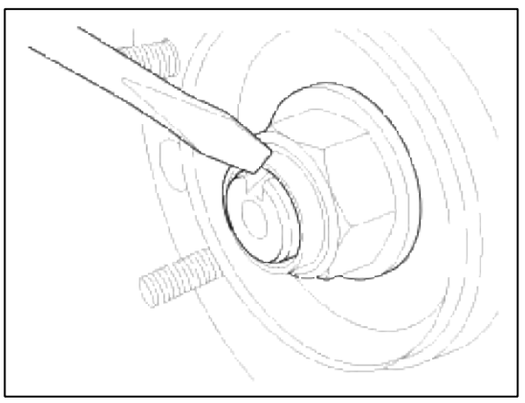
7. Remove driveshaft nut (A) from the front hub under applying the break.

Tightening torque:
240.3 ~ 269.7 N.m (24.5 ~ 27.5 Kgf.m, 177.2 ~ 197.9 lb-ft)



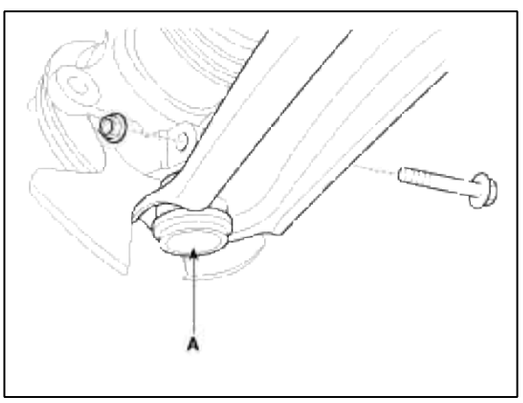
CAUTION

- The driveshaft lock nut should be replaced with new ones.
- After installation driveshaft lock nut, stake the lock nut using a chisel and hammer as shown in the illustration below.

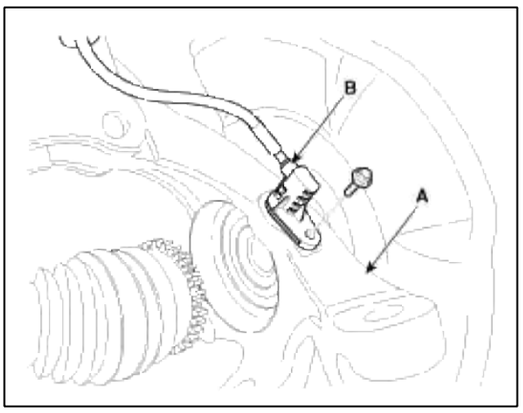


8. Remove the lower arm (A) from the knuckle.

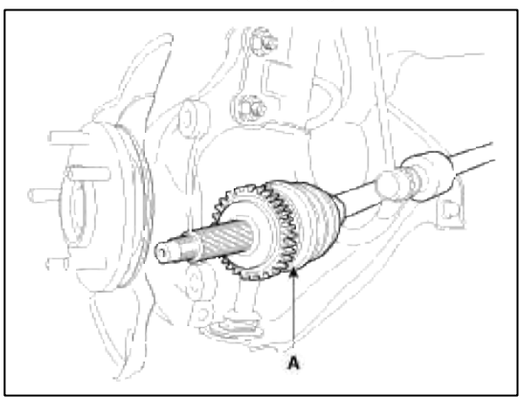
Tightening torque:
60 ~ 72 N.m (6 ~ 7.2 Kgf.m, 43 ~ 52 lb-ft)



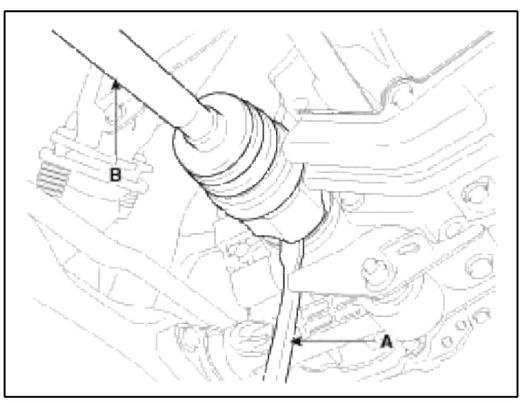
9. Loosen the mount bolt and then remove the wheel speed sensor (B) from knuckle (A).



10. Disconnect the driveshaft (A) from the front hub assembly..



11. Insert a pry bar (A) between the transaxle case and joint case, and separate the drive shaft (B) from the transaxle case.



12. Install in the reverse order of removal.

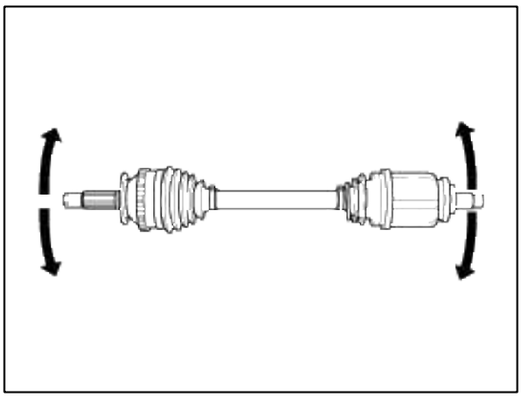
CAUTION

- Use a pry bar(A) being careful not to damage the transaxle and joint.
- Do not insert the pry bar(A) too deep, as this may cause damage to the oil seal.
- Do not pull the driveshaft by excessive force it may cause components inside the joint kit to dislodge resulting in a torn boot or a damaged bearing.
- Plug the hole of the transaxle case with the oil seal cap to prevent contamination.
- Support the driveshaft properly.
- Replace the retainer ring whenever the driveshaft is removed from the transaxle case.

Inspection

1. Check the driveshaft boots for damage and deterioration.
2. Check the driveshaft spline for wear or damage.
3. Check that there is no water or foreign material in the joint.

4. Check the spider assembly for roller rotation, wear or corrosion.
5. Check the groove inside the joint case for wear or corrosion.
6. Check the dynamic damper for damage or cracks.

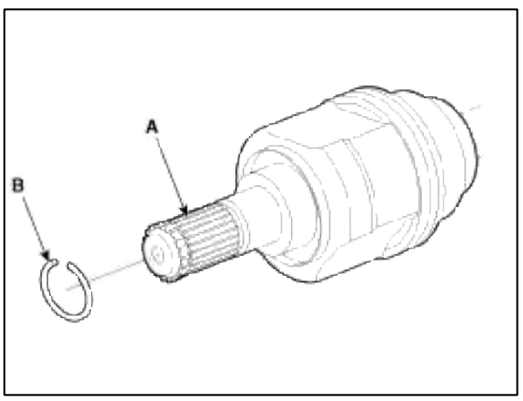


Disassembly

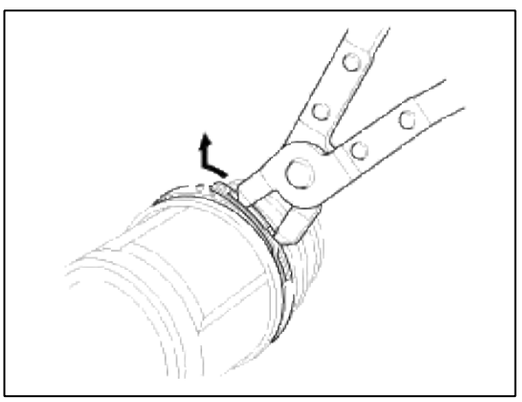
CAUTION

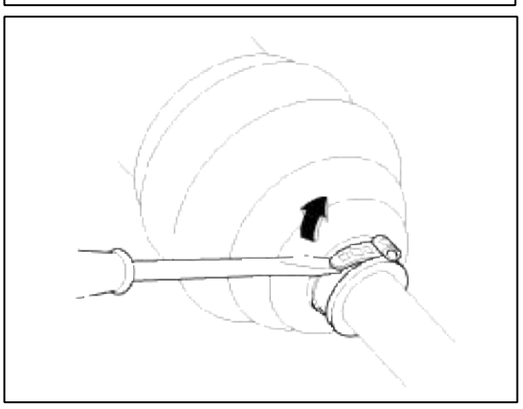
- Do not disassemble the BJ assembly.
- Special grease must be applied to the driveshaft joint. Do not substitute with another type of grease.
- The boot band should be replaced with a new one.

1. Remove the circlip (B) from the driveshaft spline (A).

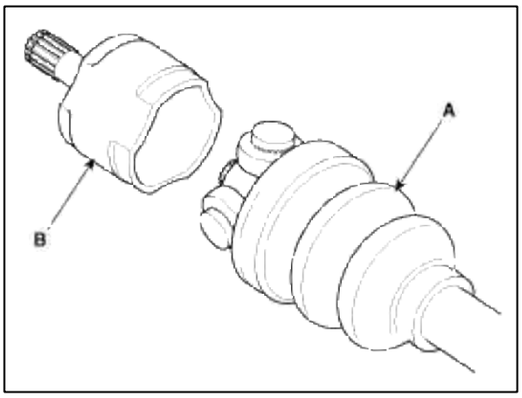


2. Remove both boot bands from the transaxle side joint(TJ) case.



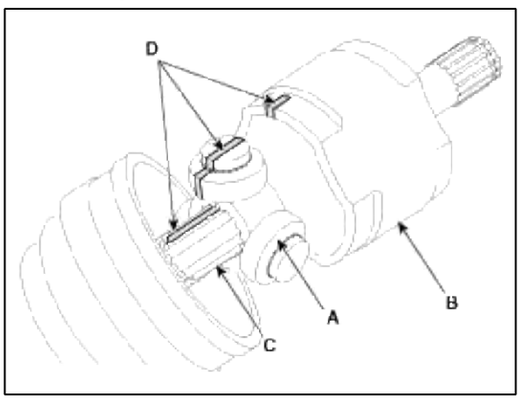


3. Pull out the boot from transaxle side joint case (B).
4. While dividing joint(TJ) boot (A) of the transaxle side, wipe the grease in TJ case (B) and collect them respectively.

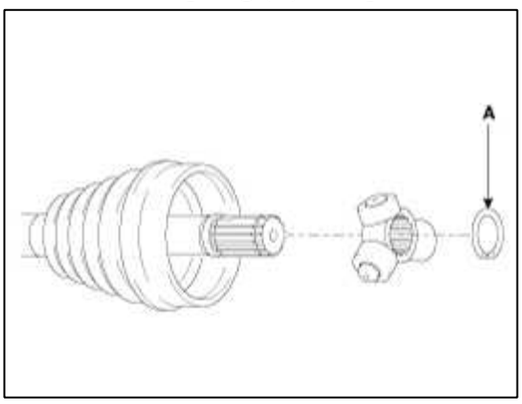


CAUTION

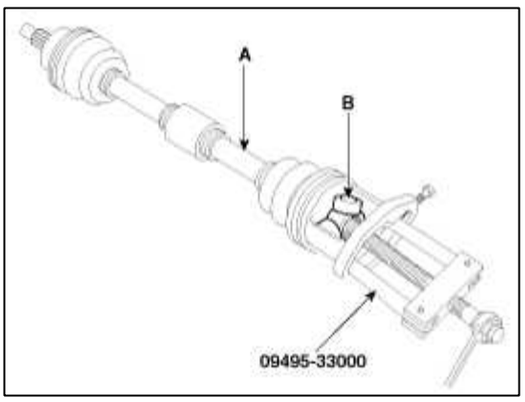
Make alignment marks on spider roller assembly (A), joint case (B), and shaft spline (C) to aid reassembly.



5. Remove the snap ring (A) and spider roller assembly (B) from the shaft.



6. Remove the spider assembly (B) from the driveshaft (A) using the special tool (09495-33000).

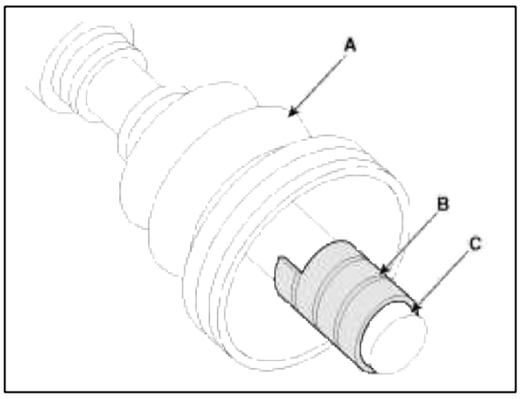


7. Clean the spider assembly.

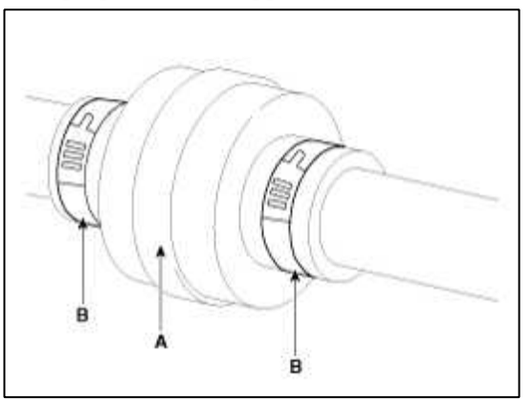
8. Remove the boot (A) of the transaxle side joint(TJ).

CAUTION

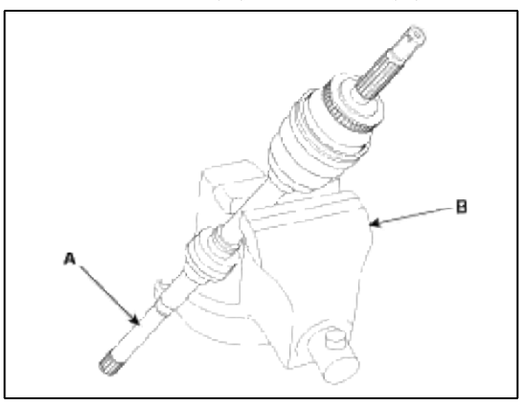
For reusing the boot (A), wrap tape (B) around the driveshaft splines (C) to protect the boot (A).



9. Using a plier or flat-tipped (-) screwdriver, remove the both side of clamp (B) of the dynamic damper (A).

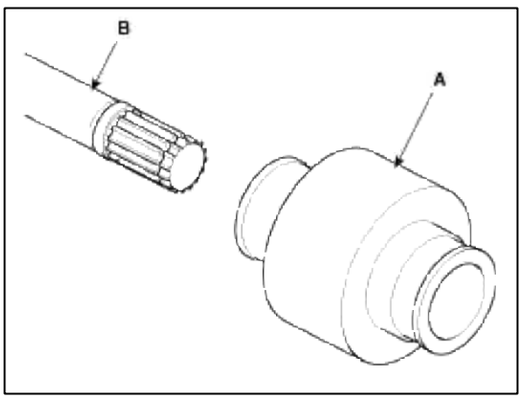


10. Fix the driveshaft (A) with a vice (B) as illustrated.



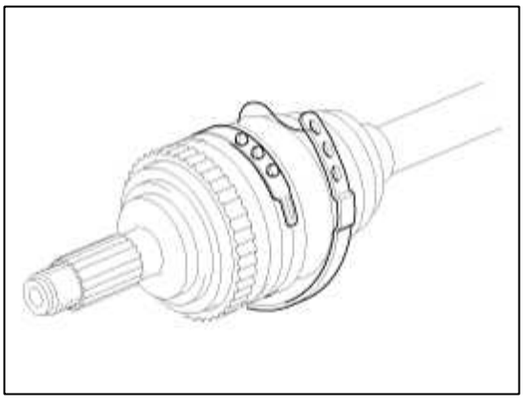
11. Apply soap powder on the shaft to prevent being damaged between the shaft spline and the dynamic damper when the dynamic damper is removed.

12. Saperate the dynamic damper (A) from the shaft (B) carefully.

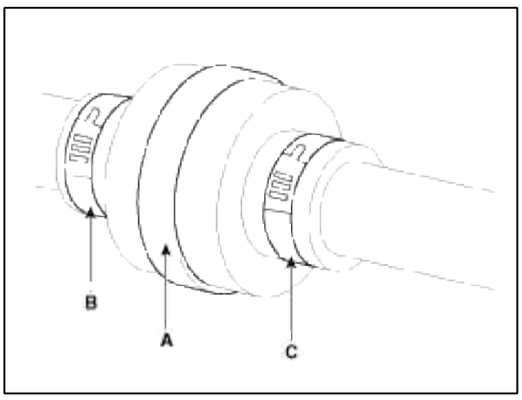


Reassembly

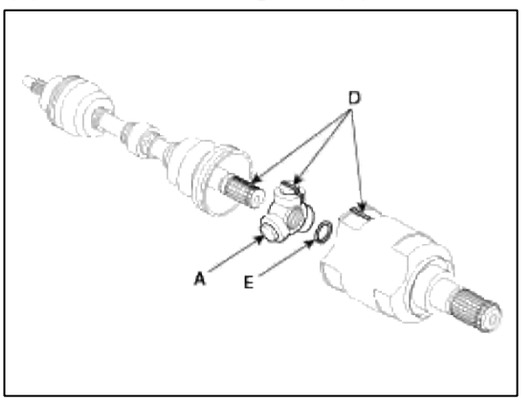
1. Wrap tape around the driveshaft spline(TJ) to prevent damage to the boots.
2. Apply grease to the joint boot on the side of the wheel and install the boot.
3. Install the clamp.

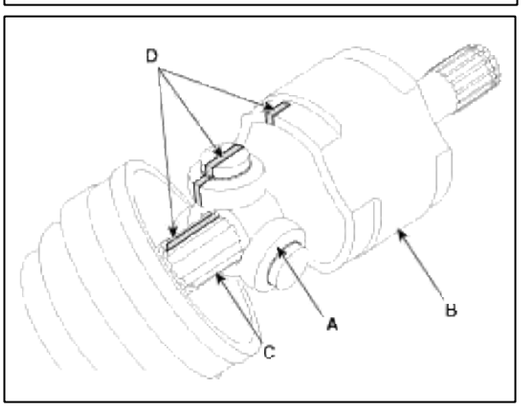


4. To install the dynamic damper(A), keep the shaft(B) in a straight line and assemble the dynamic damper with the bands(C).



5. Assemble the transaxle side joint boot and bands.
6. Using the alignment marks (D) made during disassembly as a guide, install the spider assembly (A) and snap ring (B) on the driveshaft splines (C).

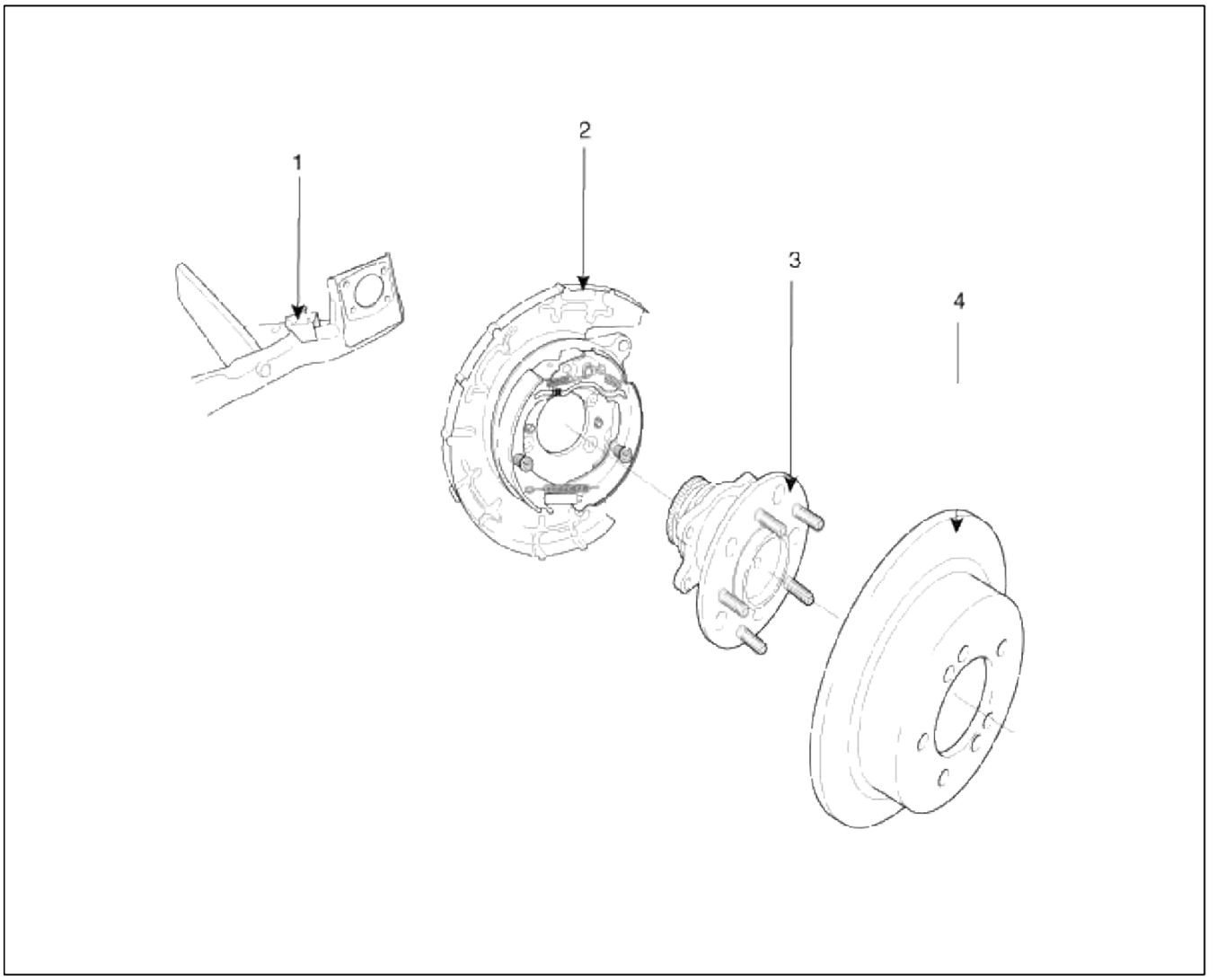




7. Add specified grease to the joint boot as much as it was wiped away at inspection.
8. Install the both boot band.

Driveshaft and axle > Rear Axle Assembly > Rear Hub - Carrier > Components and Components Location

Components



1. Rear torsion beam assembly	3. Rear wheel hub assembly
2. Rear drum brake assembly	4. Rear brake disc

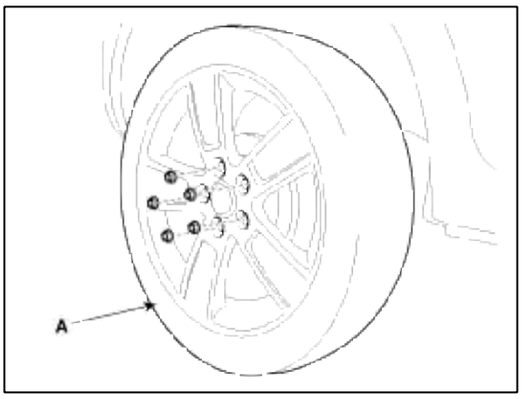
Driveshaft and axle > Rear Axle Assembly > Rear Hub - Carrier > Repair procedures

Replacement

1. Loosen the wheel nuts slightly.
   Raise the vehicle, and make sure it is securely supported.

2. Remove the rear wheel and tire(A) from rear hub .

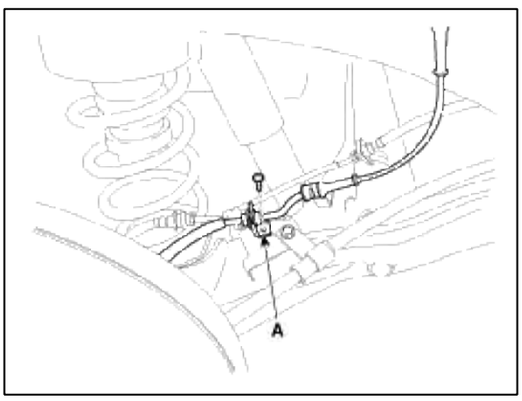
Tightening torque:
88.3 ~ 107.9 N.m (9.0 ~ 11.0 kgf.m, 65.1 ~ 79.6 lb-ft)



CAUTION

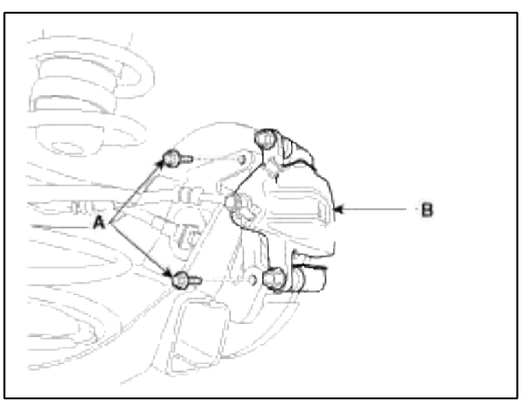
Be careful not to damage to the hub bolts (C) when removing the rear wheel and tire (A).

3. Loosen the mount bolt and then remove the brake mount bracket(A).

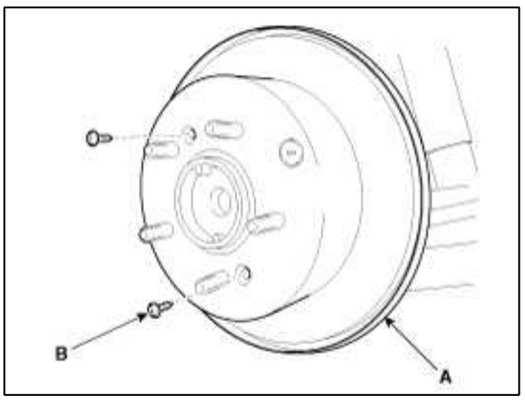


4. Remove the brake caliper mounting bolts (A), and then place the brake caliper assembly (B) with wire as shown in the illustration.

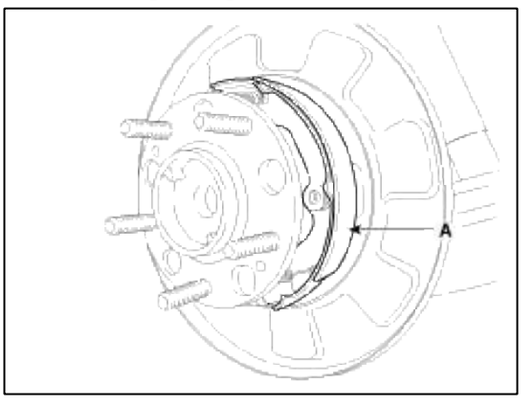
Tightening torque:
63.7 ~ 73.5 N.m (6.5 ~ 7.5 Kgf.m, 47.0 ~ 54.2 lb-ft)



5. Remove the rear brake disc assembly (A) after loosen the screw (B).

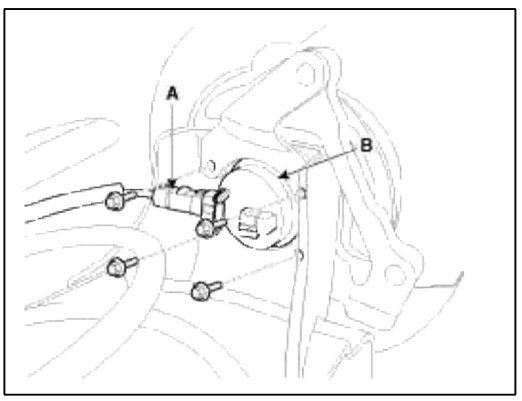


6. Remove the parking brake cable and brake lining (A). (Refer to "Rear bracke" in BR group.)



7. Disconnect the wheel speed sensor connector (A) and then remove the hub bearing (B).

Tightening torque:
68.7 ~ 88.3 N.m (7.0 ~ 9.0 kgf.m, 50.6 ~ 65.1 lb-ft)



8. Install in the reverse order of removal.

Inspection

1. Check the hub for cracks and the splines for wear.
2. Check the brake disc for scoring and damage.
3. Check the rear axle carrier for cracks
4. Check the bearing for cracks or damage.

SOUL(AM) > 2012 > G 1.6 GDI > Suspension System

Suspension System > General Information > Specifications

Specifications

Front Suspension

Item			Specification
Suspension type			MacPherson Strut
Shock absorber	Type		Gas
Coil spring	Free Height [I.D. color]	Gasoline 1.6 GDI	306.1mm (Pink – Green)
		Gasoline 2.0 MPI	322.0mm (Pink – Yellow)

Rear Suspension

Item			Specification
Suspension type			Torsion Beam Axle
Shock absorber	Type		Gas
Coil spring	Free Height [I.D. color]	Gasoline 1.6 GDI	301.3mm (Blue -1)
		Gasoline 2.0 MPI	290.3mm (Yellow – White)

Wheel & Tire

Item		Specification
Wheel	Aluminum	6.5J x 16
		7.5J x 18
	Steel	6.0J x 15
Tire		195/65 R15
		205/55 R16
		235/45 R18
Tire pressure		2.3kg/cm² (33psi)
Front / Rear PCD (Pitch Circle Diameter)		Ø114.3

Wheel Alignment

Item		Specification	
		Front	Rear
Toe-in	Total	-0.2°~0.2°	0.4°±0.2°
	Individual	-0.1°~0.1°	0.2°±0.1°
Camber		-0.5°±0.5°	-1.3°±30°
Caster		3.4°±0.5°	-
King-pin		14.53°±0.5°	-

Tightening Torques

Front Suspension

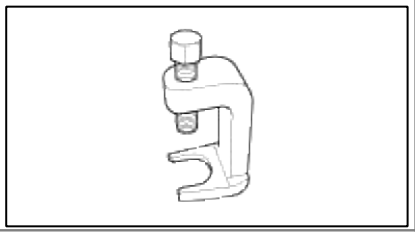
Item	Tightening torque		
	Nm	Kgf.m	lb-ft
Hub nuts	88.3 ~ 107.9	9.0 ~ 11.0	65.1 ~ 79.6
Lower arm to sub frame	156.9 ~ 176.5	16.0 ~ 18.0	115.7 ~ 130.2
Tie rod end castle nut	23.5 ~ 33.3	2.4 ~ 3.4	17.4 ~ 24.6
Steering gear box to sub frame	58.8 ~ 78.5	6.0 ~ 8.0	43.4 ~ 57.9
Stabilizer bar to stabilizer link	98.1 ~ 117.7	10.0 ~ 12.0	72.3 ~ 86.8
Stabilizer bar to sub frame	44.1 ~ 53.9	4.5 ~ 5.5	32.5 ~ 39.8
Stabilizer bar to front strut assembly	98.1 ~ 117.7	10.0 ~ 12.0	72.3 ~ 86.8
Front strut assembly to front axle	137.3 ~ 156.9	14.0 ~ 16.0	101.3 ~ 115.7

Rear Suspension

Item	Tightening torque		
	Nm	Kgf.m	lb-ft
Hub nuts	88.3 ~ 107.9	9.0 ~ 11.0	65.1 ~ 79.6
Shock absorber to body	117.7 ~ 137.3	12.0 ~14.0	86.8 ~ 101.3
Shock absorber to torsion beam axle	117.7 ~ 137.3	12.0 ~14.0	86.8 ~ 101.3
Torsion beam axle to body	117.7 ~ 137.3	12.0 ~14.0	86.8 ~ 101.3

Suspension System > General Information > Special Service Tools

Special Service Tools

Tool (Number and Name)	Illustration	Use
09546-26000 Strut spring compressor		Compression of coli spring
09568-2J100 Ball joint puller		Remover of ball joint

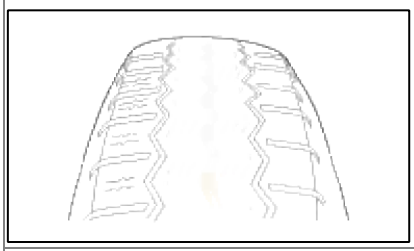
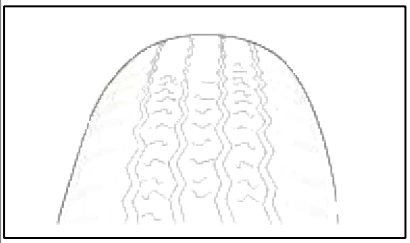
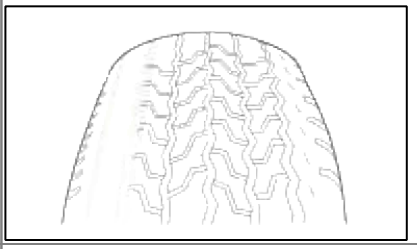
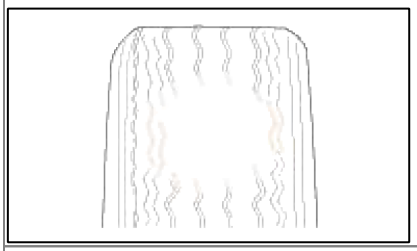
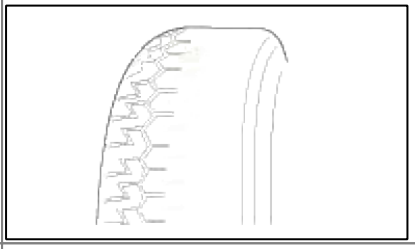
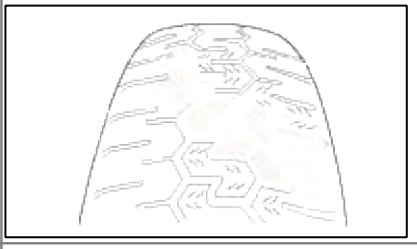
Suspension System > General Information > Troubleshooting

Troubleshooting

Symptom	Possible cause	Remedy
Hard steering	Improper front wheel alignment Excessive turning resistance of lower arm ball joint Low tire pressure No power assist	Correct Replace Adjust Repair and replace
Poor return of steering wheel to center	Improper front wheel alignment	Correct
Poor or rough ride	Improper front wheel alignment Malfunctioning shock absorber Broken or worn stabilizer Broken or worn coil spring Worn lower arm bushing	Correct Repair or replace Replace Replace Replace the lower arm assembly
Abnormal tire wear	Improper front wheel alignment Improper tire pressure Malfunctioning shock absorber	Correct Adjust Replace
Wandering	Improper front wheel alignment Poor turning resistance of lower arm ball joint Loose or worn lower arm bushing	Correct Repair Retighten or replace
Vehicle pulls to one side	Improper front wheel alignment Excessive turning resistance of lower arm ball joint Broken or worn coil spring Bent lower arm	Correct Replace Replace Repair
Steering wheel shimmy	Improper front wheel alignment Poor turning resistance of lower arm ball joint Broken or worn stabilizer Worn lower arm bushing Malfunctioning shock absorber Broken or worn coil spring	Correct Replace Replace Replace Replace Replace
Bottoming	Broken or worn coil spring Malfunctioning shock absorber	Replace Replace

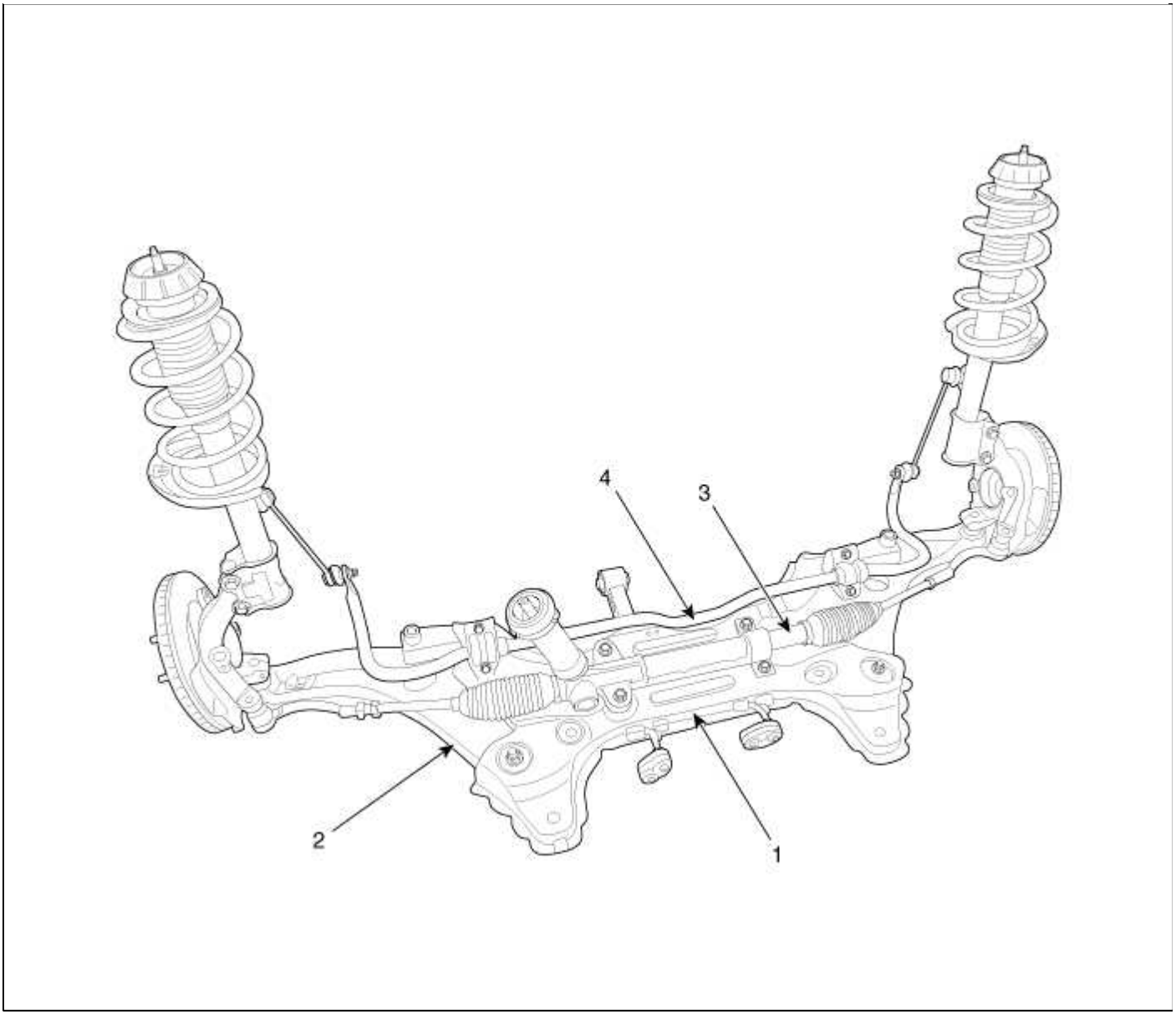
Wheel /tire noise, vibration and harshness concerns are directly related to vehicle speed and are not generally affected by acceleration, coasting or decelerating. Also, out-of-balance wheel and tires can vibrate at more than one speed. A vibration that is affected by the engine rpm, or is eliminated by placing the transmission in Neutral is not related to the tire and wheel. As a general rule, tire and wheel vibrations felt in the steering wheel are related to the front tire and wheel assemblies. Vibrations felt in the seat or floor are related to the rear tire and wheel assemblies. This can initially isolate a concern to the front or rear.

Careful attention must be paid to the tire and wheels. There are several symptoms that can be caused by damaged or worn tire and wheels. Perform a careful visual inspection of the tires and wheel assemblies. Spin the tires slowly and watch for signs of lateral or radial runout. Refer to the tire wear chart to determine the tire wear conditions and actions

Wheel and tire diagnosis		
Rapid wear at the center	Rapid wear at both shoulders	Wear at one shoulder
		
• Center-tread down to fabric due to excessive over inflated tires • Lack of rotation • Excessive toe on drive wheels • Heavy acceleration on drive	• Under-inflated tires • Worn suspension components • Excessive cornering speeds • Lack of rotation	• Toe adjustment out of specification • Camber out of specification • Damaged strut • Damaged lower arm
Partial wear	Feathered edge	Wear pattern
		
• Caused by irregular burrs on brake drums	• Toe adjustment out of specification • Damaged or worn tie rods • Damaged knuckle	• Excessive toe on non-drive wheels • Lack of rotation

Suspension System > Front Suspension System > Components and Components Location

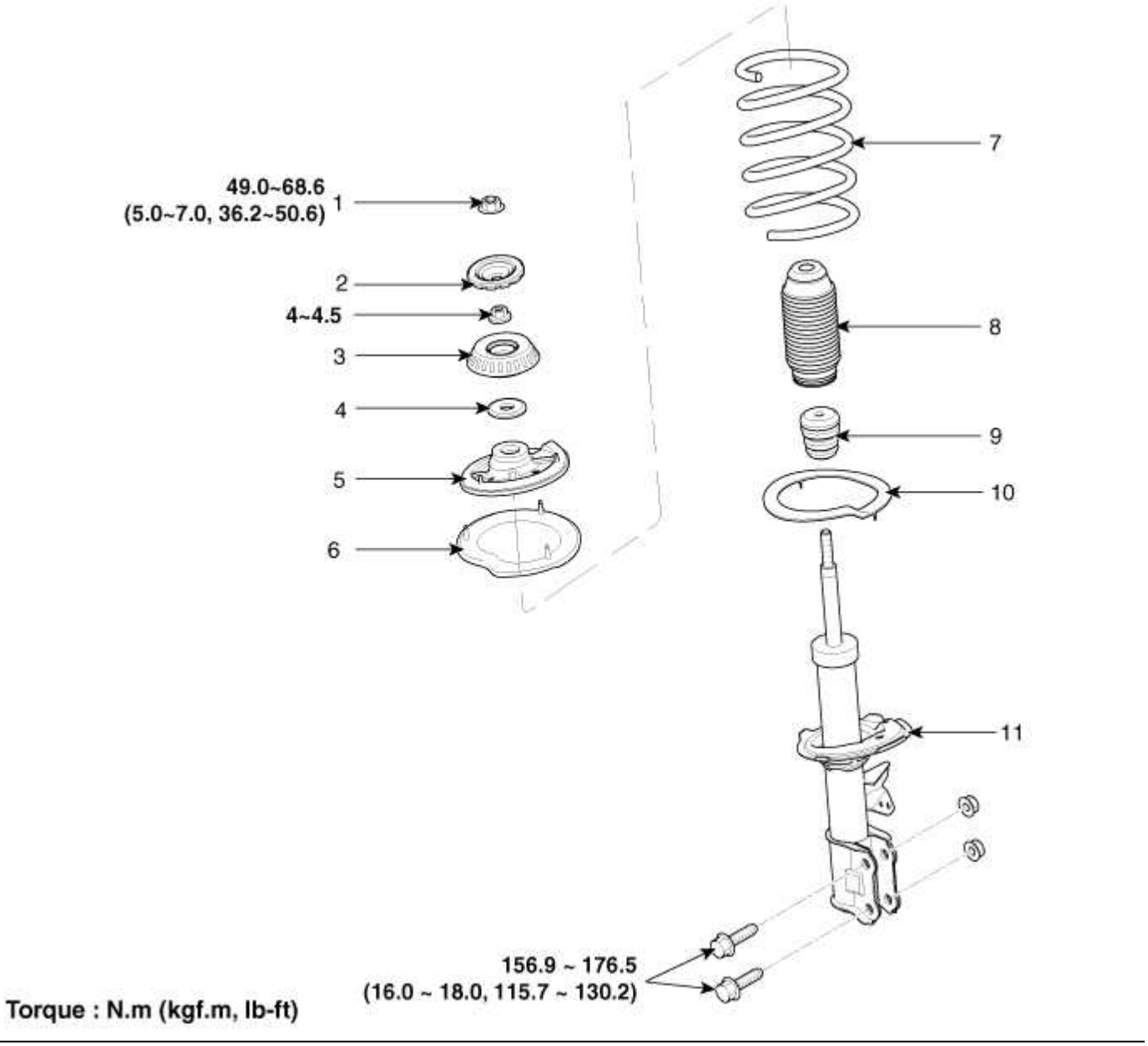
Components



1. Sub frame 2. Lower Arm	3. Steering gear box 4. Stabilizer Bar

Suspension System > Front Suspension System > Front Strut Assembly > Components and Components Location

Components



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. Strut assembly

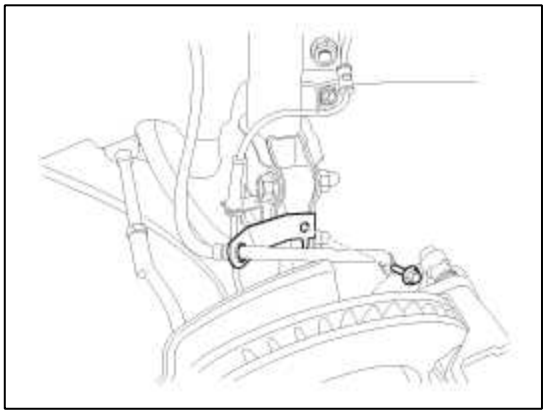
Suspension System > Front Suspension System > Front Strut Assembly > Repair procedures

Replacement

1. Remove the front wheel & tire.

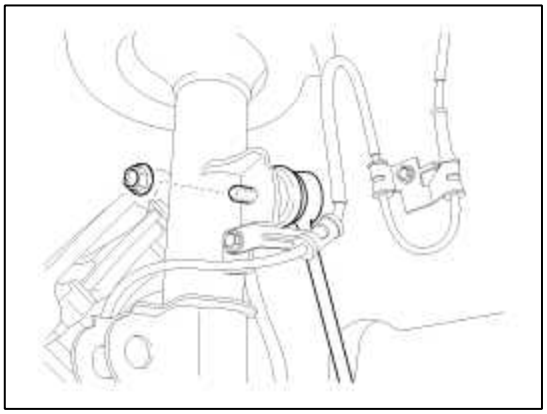
Tightening torque :
90 ~ 110 N.m (9.0 ~ 11.0 kgf.m, 65 ~ 80 lb-ft)

2. Remove the brake hose and the wheel speed sensor bracket from the front strut assembly by loosening the mounting bolts.



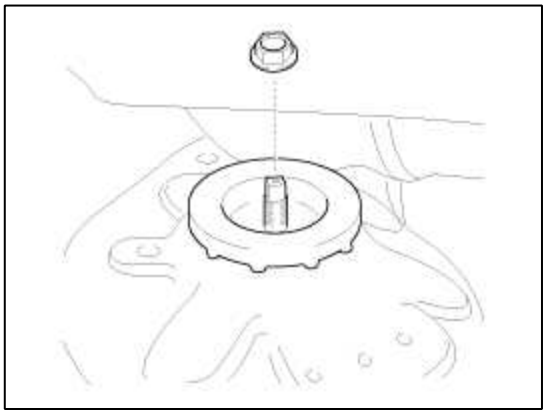
3. Disconnect the stabilizer link with the front strut assembly after loosening the nut.

Tightening torque :
98.1 ~ 117.7 N.m (10.0 ~ 12.0 kgf.m, 72.3 ~ 86.8 lb-ft)



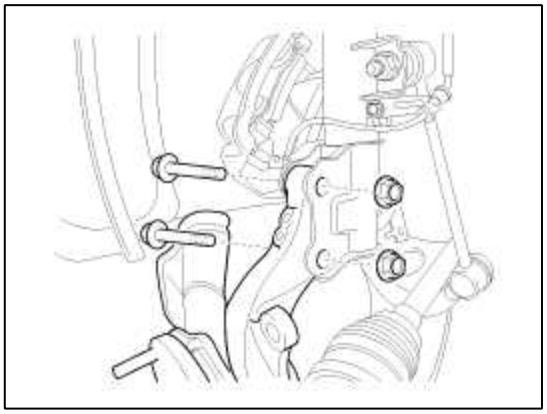
4. Loosen the strut mounting nuts.

Tightening torque :
44.1 ~ 58.8 N.m (4.5 ~ 6.0 kgf.m, 32.5 ~ 43.4 lb-ft)



5. Disconnect the front strut assembly with the knuckle by loosening the bolt & nut.

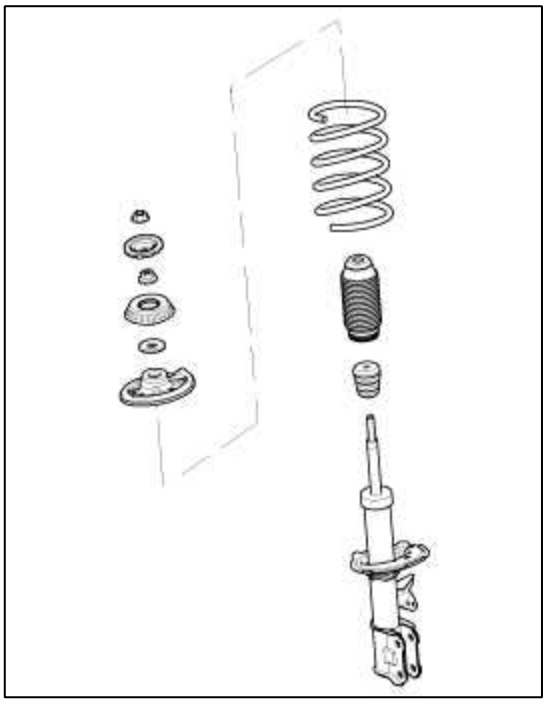
Tightening torque :
156.9 ~ 176.5 N.m (16.0 ~ 18.0 kgf.m, 115.7 ~ 130.2 lb-ft)



6. Installation is the reverse of removal.

Disassembly

1. Using the special tool (09546-26000), compress the coil spring (A) until there is only a little tension of the spring on the strut.

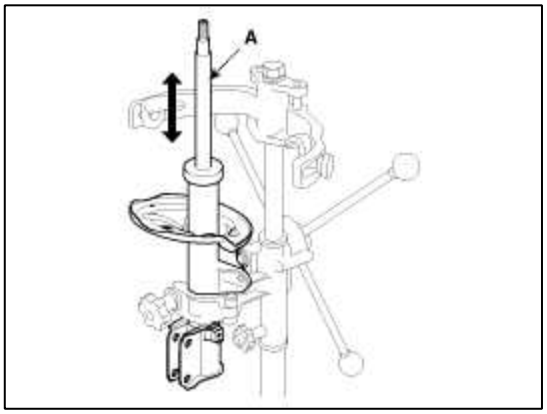


2. Remove the self-locking nut (C) from the strut assembly (B).
3. Remove the insulator, spring seat, coil spring and dust cover from the strut assembly.

Inspection

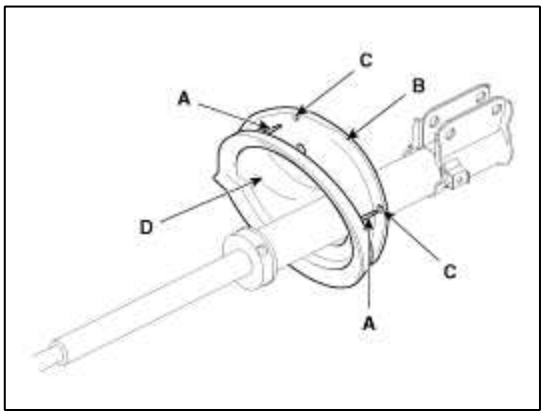
1. Check the strut insulator bearing for wear or damage.
2. Check rubber parts for damage or deterioration.

3. Compress and extend the piston rod (A) and check that there is no abnormal resistance or unusual sound during operation.



Reassembly

1. Install the spring lower pad (D) so that the protrusions (A) fit in the holes (C) in the spring lower seat (B).

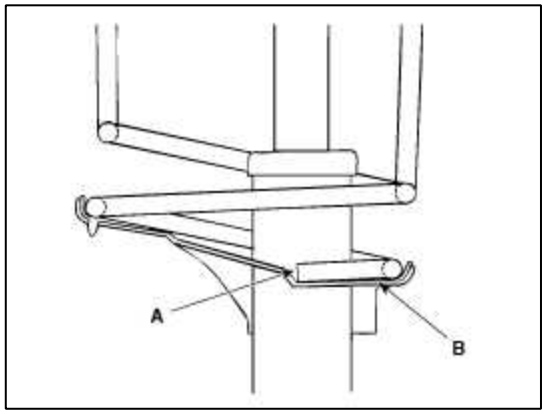


2. Compress coil spring using special tool (09546-26000).
   Install compressed coil spring into shock absorber.

> NOTE
>
> 1) Indicated two identification color marks on the coil spring one follows model option (see page SS-2) the other follows load classification according to the below.
>   Pay attention to distiuguish between the two marks and then install them.
> 2) Install the coil spring wth the idemtification mark directed toward the knuckle.

3. After fully extending the piston rod, install the spring upper seat and insulator assembly.

4. After seating the upper and lower ends of the coil spring (A) in the upper and lower spring seat grooves (B) correctly, tighten new self-locking nut temporarily.



5. Remove the special tool (09546-26000).
6. Tighten the self-locking nut to the specified torque.

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

Suspension System > Front Suspension System > Front Lower Arm > Repair procedures

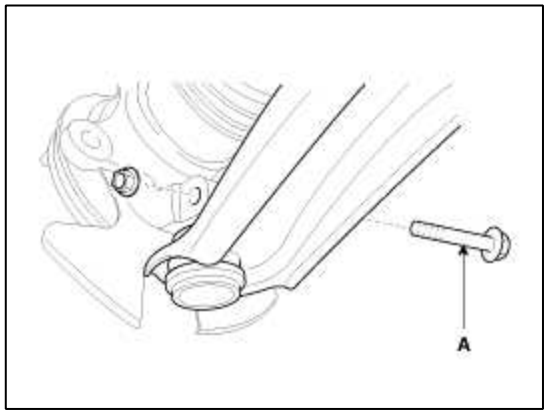
Replacement

1. Remove the front wheel & tire.

Tightening torque :
98.3 ~ 107.9 N.m (9.0 ~ 11.0 kgf.m, 65.1 ~ 79.6 lb-ft)

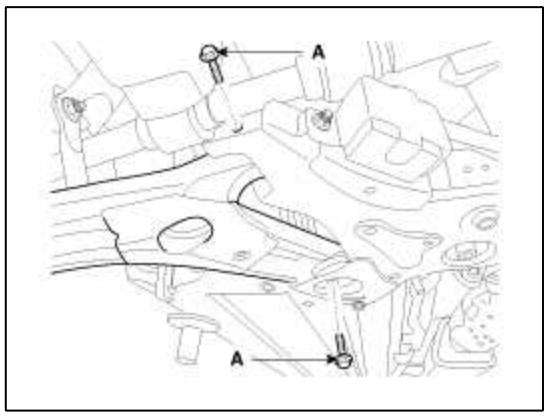
2. Remove the lower arm ball joint mounting bolts (A).

Tightening torque :
58.8 ~ 70.6 N.m (6.0 ~ 7.2 kgf.m, 43.4 ~ 52.1 lb-ft)



3. Remove the lower arm mounting bolts (A,B).

Tightening torque
(A,B) : 156.9 ~ 176.5 N.m (16.0 ~ 18.0 kgf.m, 115.7 ~ 130.2 lb-ft)



4. Installation is the reverse of removal.

Inspection

1. Check the bushing for wear and deterioration.
2. Check the lower arm for deformation.
3. Check the all bolts and nuts.

Suspension System > Front Suspension System > Front Stabilizer Bar > Repair procedures

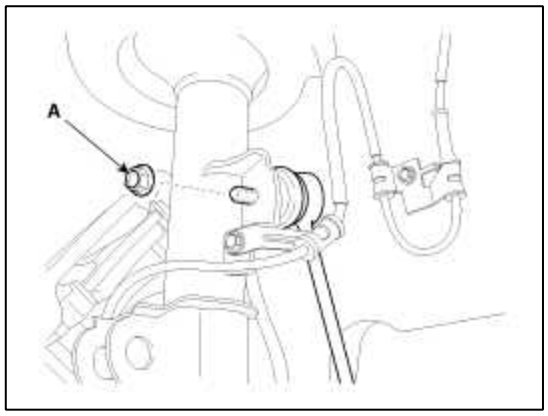
Replacement

1. Remove the front wheel & tire.

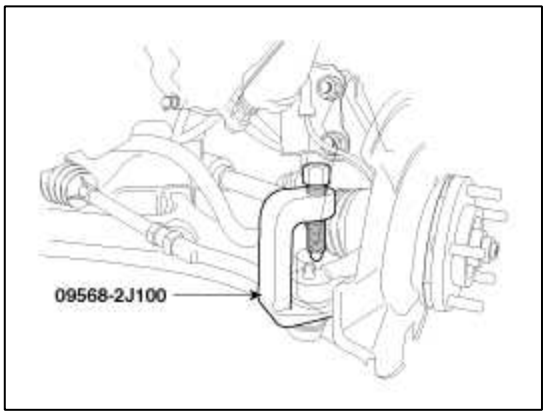
Tightening torque :
88.3 ~ 107.9 N.m (9.0 ~ 11.0 kgf.m, 65.1 ~ 79.6 lb-ft)

2. Disconnect the stabilizer link with the front strut assembly after loosening the nut (A).

Tightening torque :
98.1 ~ 117.7 N.m (10.0 ~ 12.0 kgf.m, 72.3 ~ 86.8 lb-ft)

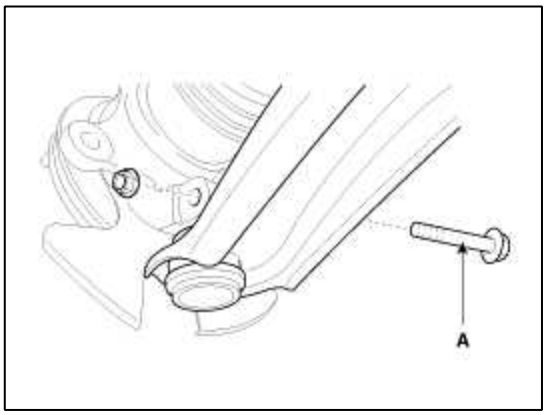


3. Disconnect the tie-rod end with the knuckle using a SST (09568-2J100).



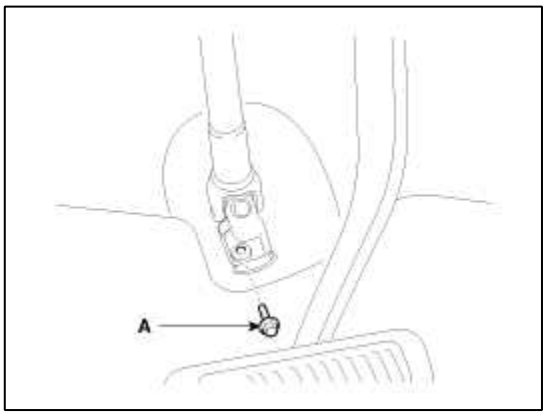
4. Remove the two bolts (A) for lower arm ball joint.

Tightening torque :
58.8 ~ 70.6 N.m (6.0 ~ 7.2 kgf.m, 43.4 ~ 52.1 lb-ft)



5. Loosen the bolt (A) and then disconnect the universal joint assembly from the pinion of the steering gear box.

Tightening torque :
29.4 ~ 34.3 N.m (3.0 ~ 3.5 kgf.m, 21.7 ~ 25.3 lb-ft)

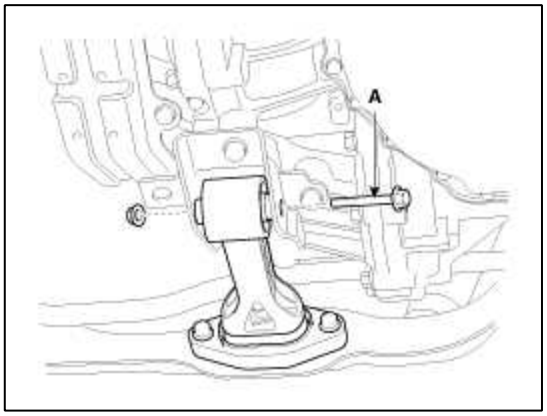


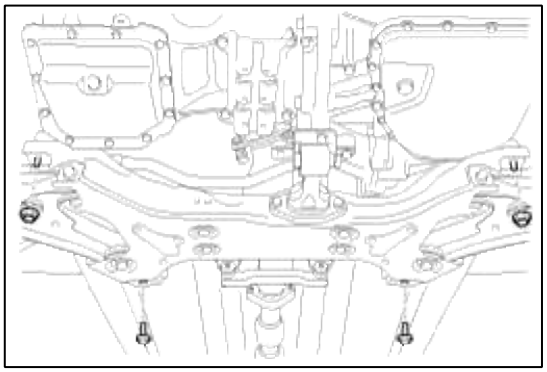
CAUTION

Keep the neutral-range to prevent the damage of the clock spring inner cable when you handlethe steering wheel.

6. Remove the cross member from the body by loosening the mounting bolts and nuts.

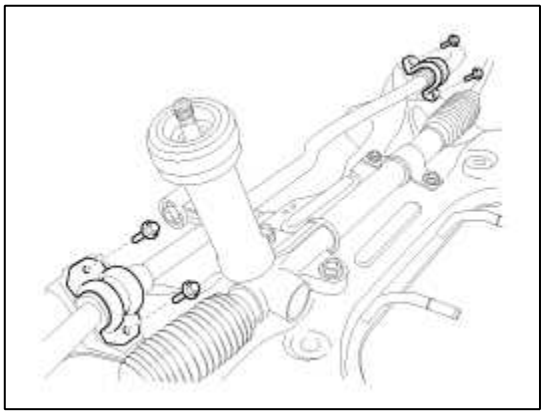
Tightening torque :
107.9 ~ 127.5 N.m (11.0 ~ 13.0 kgf.m, 79.6 ~ 94.0 lb-ft)



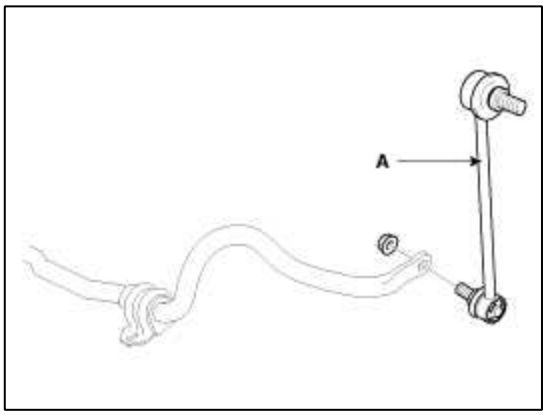


7. Remove the stabilizer from the cross member by loosening the bracket mounting bolts.

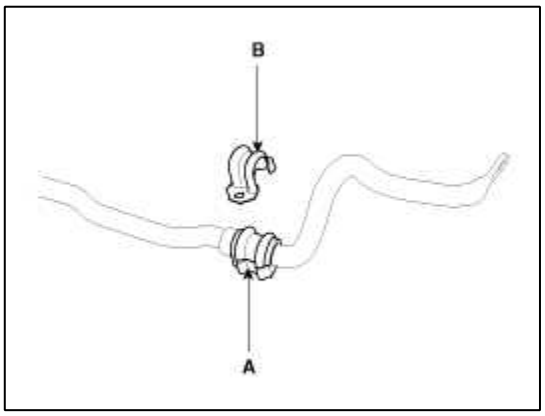
Tightening torque :
44.1 ~ 53.9 N.m (4.5 ~ 5.5 kgf.m, 32.5 ~ 39.8 lb-ft)



8. Disconnect the stabilizer link (A) with the stabilizer bar by loosening the nut.



9. Remove the bushing (A) and the bracket (B) from the stabilizer bar.



10. Installation is the reverse of removal.

Inspection

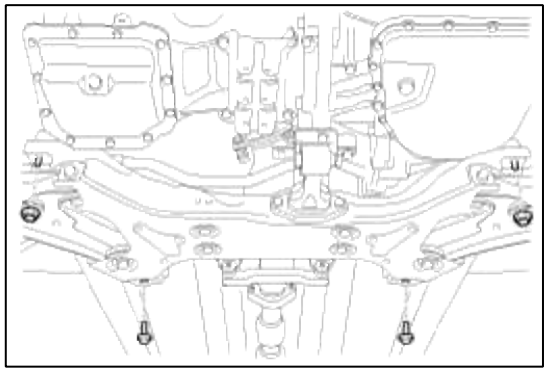
1. Check the bushing for wear and deterioration
2. Check the front stabilizer bar for deformation.
3. Check the front stabilizer link ball joint for damage.

Suspension System > Front Suspension System > Sub Frame > Repair procedures

Replacement

1. Remove the sub frame. (Refer to front stabilizer)

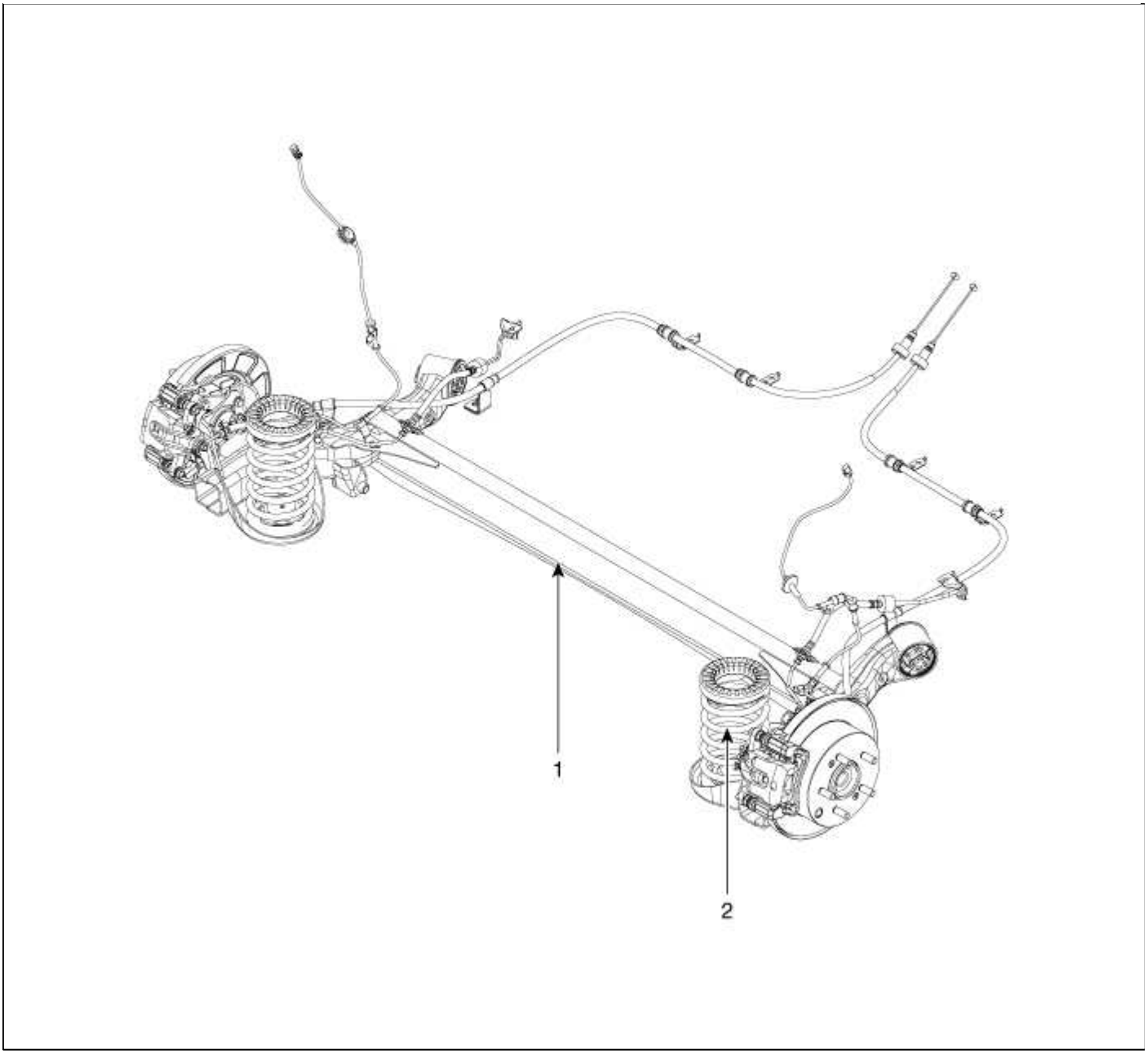
Tightening torque :
156.9 ~ 176.5 N.m (16.0 ~ 18.0 kgf.m, 115.7 ~ 130.2 lb-ft)



2. Remove the front lower arm.
3. Remove the front strut assembly.
4. Remove the front stabilizer.
5. Remove the steering gear box.
6. Installation is the reverse of removal.

Suspension System > Rear Suspension System > Components and Components Location

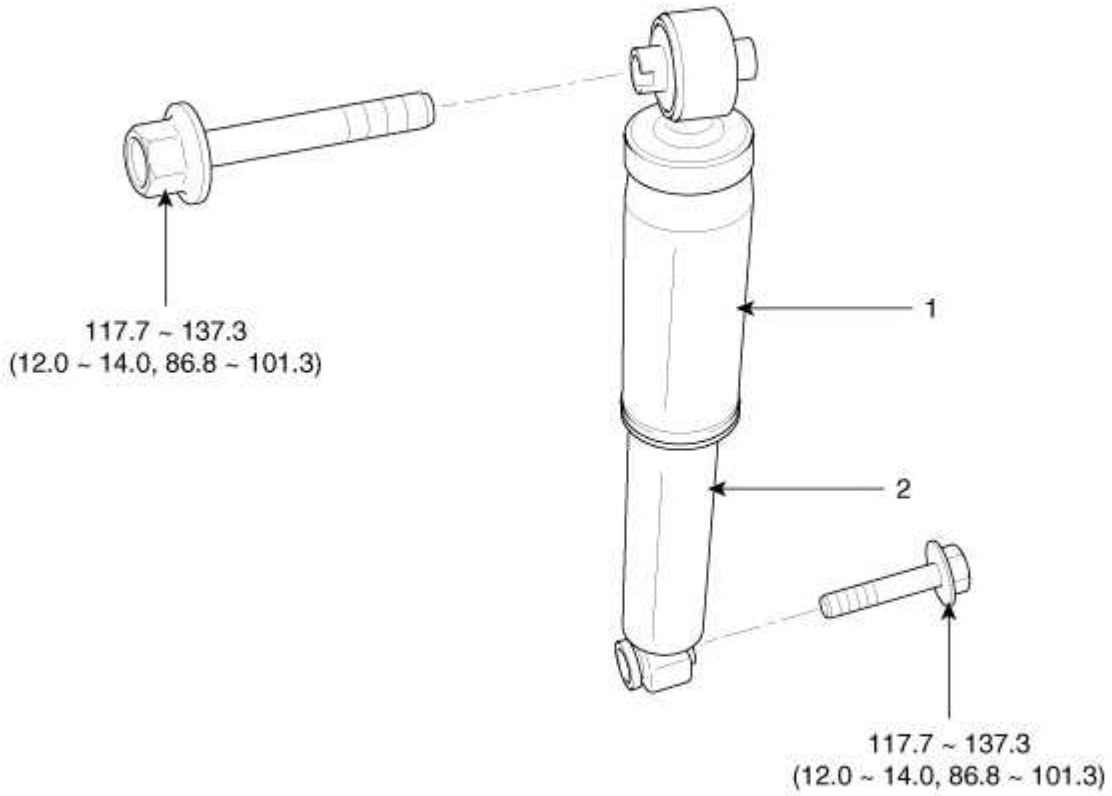
Components



1. Torsion beam axle
2. Coil spring assembly

Suspension System > Rear Suspension System > Rear Shock Absorber > Components and Components Location

Components



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

1. Dust cover
2. Shock absorber

Suspension System > Rear Suspension System > Rear Shock Absorber > Repair procedures

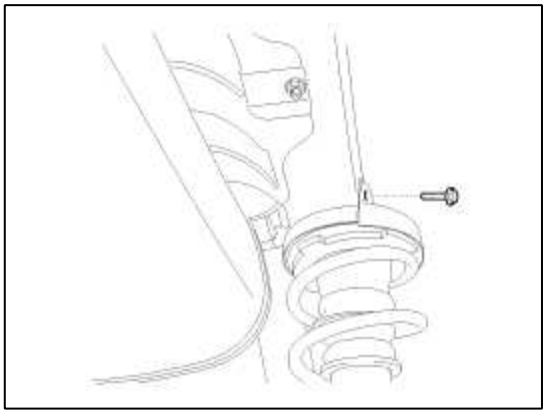
Replacement

1. Remove the rear wheel & tire.

Tightening torque :
88.3 ~ 107.9 N.m (9.0 ~ 11.0 kgf.m, 65.1 ~ 79.6 lb-ft)

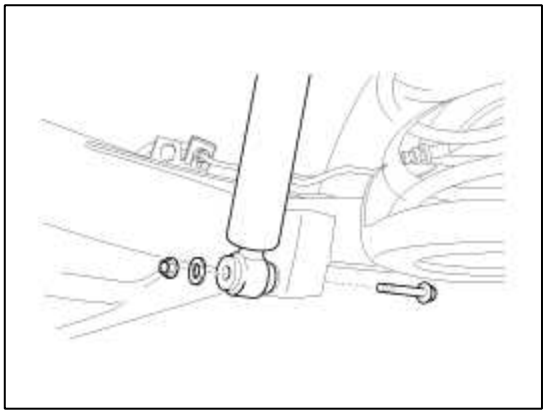
2. Remove the rear shock absorber from the frame by loosening the bolt.

Tightening torque :
117.7 ~ 137.2 N.m (12.0 ~ 14.0 kgf.m, 86.8 ~ 101.3 lb-ft)



3. Remove the rear shock absorber from the torsion beam axle by loosening the nut.

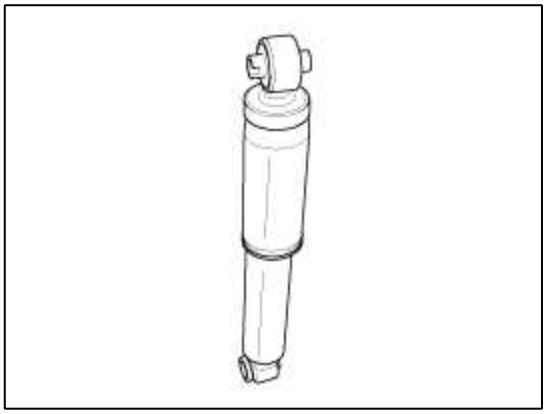
Tightening torque :
117.7 ~ 137.2 N.m (12.0 ~ 14.0 kgf.m, 86.8 ~ 101.3 lb-ft)



4. Installation is the reverse of removal.

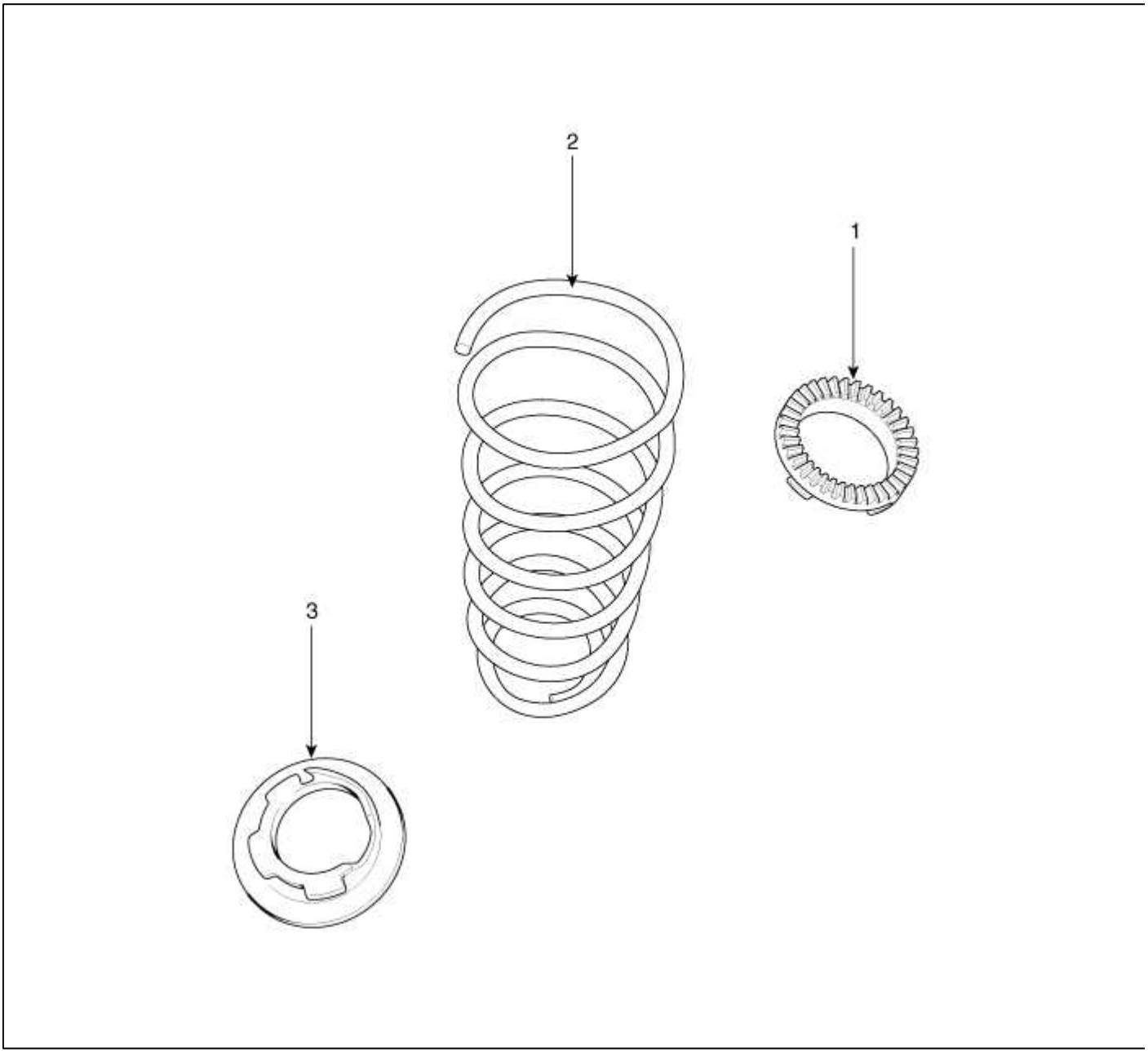
Inspection

1. Check the components for damage or deformation.
2. Compress and extend the piston and check that there is no abnormal resistance or unusual sound during operation.



Suspension System > Rear Suspension System > Rear Coil Spring > Components and Components Location

Components



1. Spring upper pad
2. Spring
3. Spring lower pad

Suspension System > Rear Suspension System > Rear Coil Spring > Repair procedures

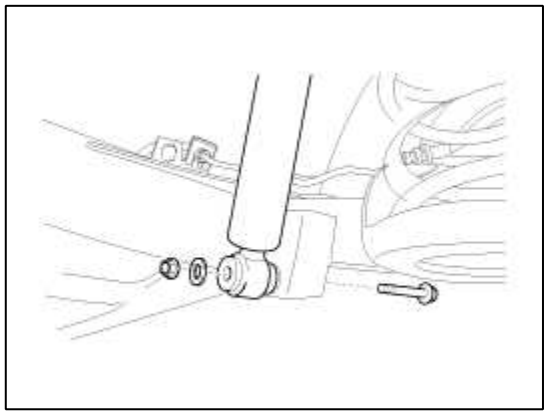
Replacement

1. Remove the rear wheel & tire.

Tightening torque :
88.3 ~ 107.9 N.m (9.0 ~ 11.0 kgf.m, 65.1 ~ 79.6 lb-ft)

2. Remove the rear shock absorber from the torsion beam axle by loosening the nut.

Tightening torque :
117.7 ~ 137.3 N.m (12.0 ~ 14.0 kgf.m, 86.8 ~ 101.3 lb-ft)



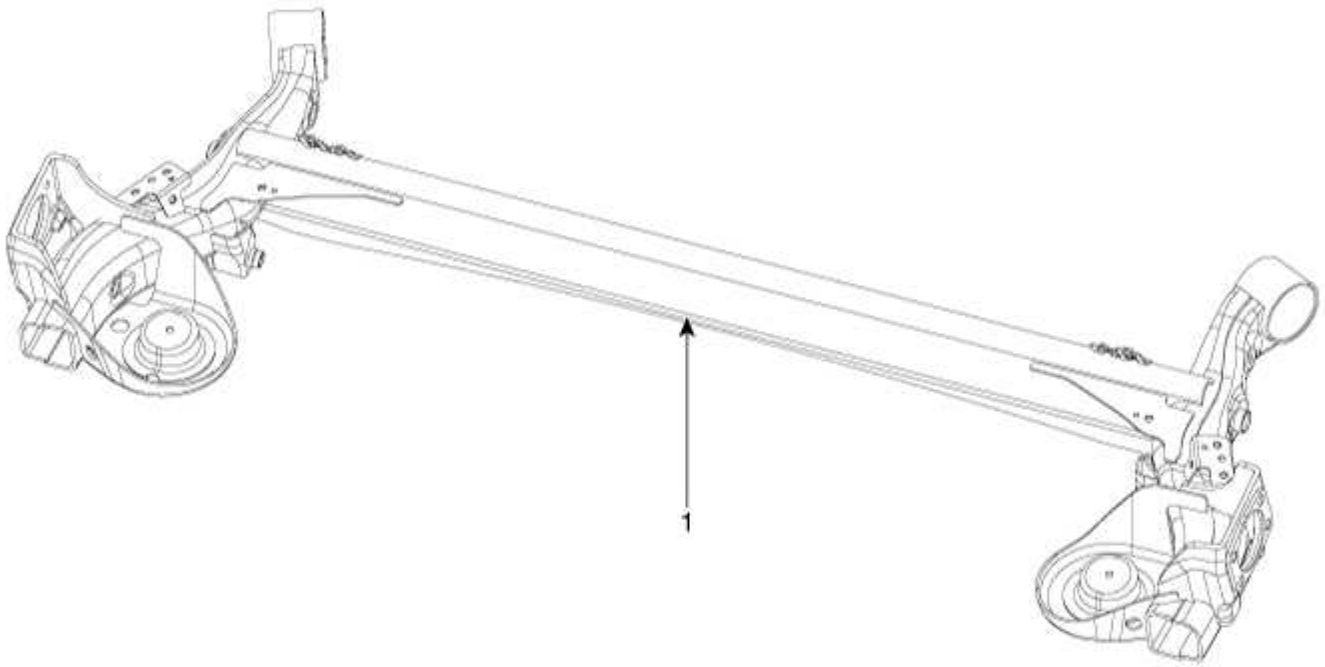
3. Installation is the reverse of removal.

Inspection

1. Check the coil spring for crack and deformation.
2. Check the coil spring pad for damage and deformation.

Suspension System > Rear Suspension System > Rear torsion beam axle > Components and Components Location

Components



1. Rear torsion beam axle

Suspension System > Rear Suspension System > Rear torsion beam axle > Repair procedures

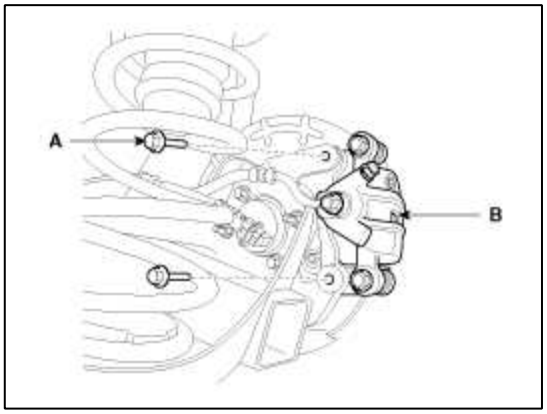
Replacement

1. Remove the rear wheel & tire.

Tightening torque :
88.3 ~ 107.9 N.m (9.0 ~ 11.0 kgf.m, 65.1 ~ 79.6 lb-ft)

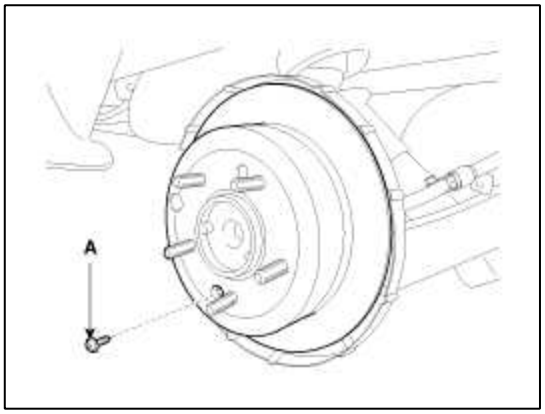
2. Remove the brake caliper assembly (B) from the torsion beam axle by loosening the bolts (A).

Tightening torque :
63.7 ~ 73.5 N.m (6.5 ~ 7.5 kgf.m, 47.0 ~ 54.2 lb-ft)



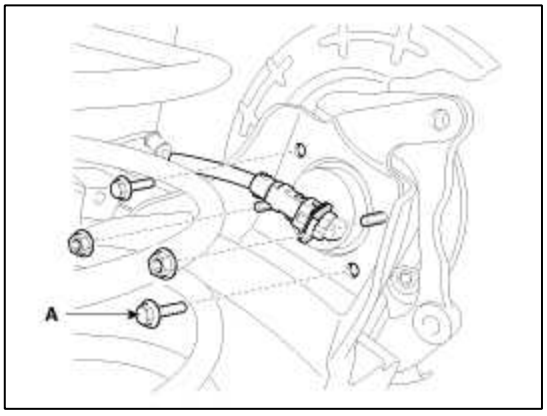
3. Loosen the screw (A).

Tightening torque :
4.9 ~ 5.9 N.m (0.5 ~ 0.6 kgf.m, 3.6 ~ 4.3 lb-ft)

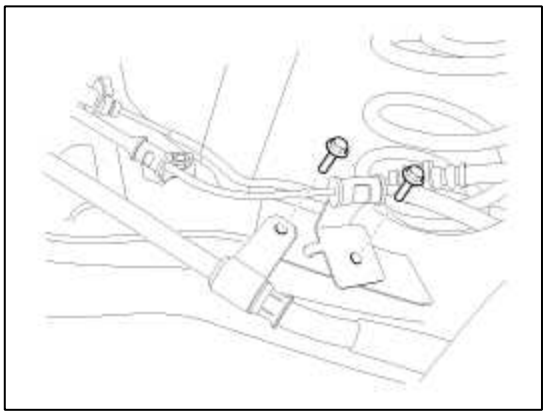


4. Remove the wheel speed sensor cable and the loosening the mounting bolts.

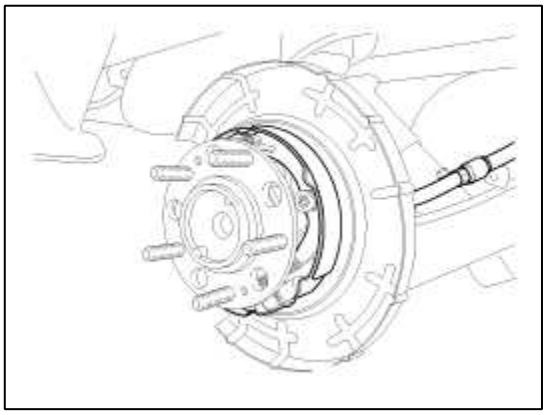
Tightening torque :
58.8 ~ 68.6 N.m (6.0 ~ 7.0 kgf.m, 43.4 ~ 50.6 lb-ft)



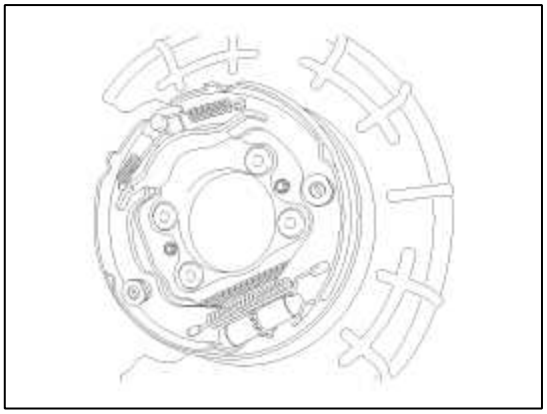
5. Remove the wheel speed sensor cable and parking break cable mounting bracket bolts.



6. Remove the rear hub unit bearing.

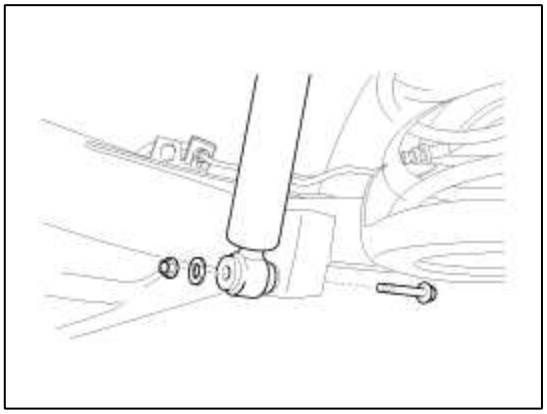


7. Remove the parking brake cable.



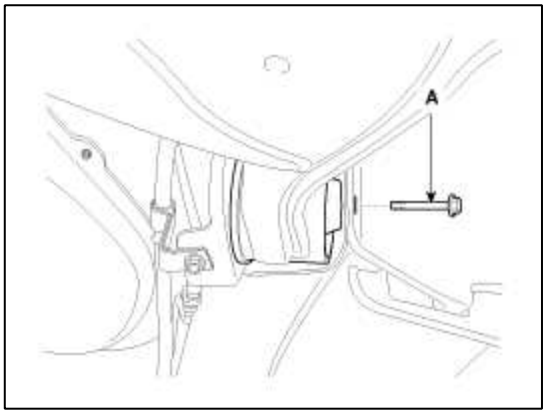
8. Remove the rear shock absorber from the torsion beam axle by loosening the nut.

Tightening torque :
117.7 ~ 137.3 N.m (12.0 ~ 14.0 kgf.m, 86.8 ~ 101.3 lb-ft)



9. Remove the torsion axle from the body loosening the bolts.

Tightening torque :
117.7 ~ 137.3 N.m (12.0 ~ 14.0 kgf.m, 86.8 ~ 101.3 lb-ft)



10. Installation is the reverse of removal.

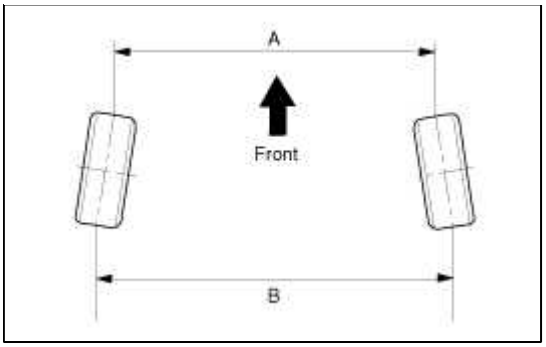
Suspension System > Tires/Wheels > Alignment > Repair procedures

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

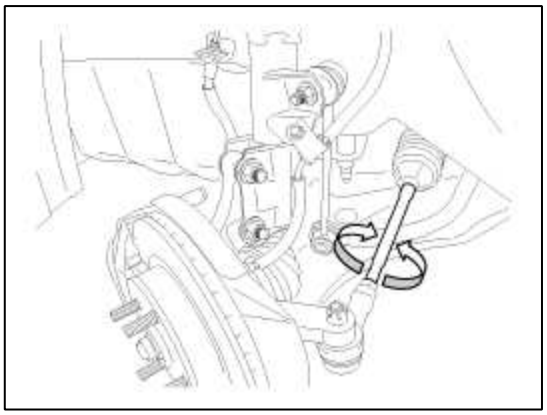


B - A > 0: Toe in (+)
B - A < 0: Toe out (-)

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
Total :-0.2°~0.2°
Individual : -0.1°~0.1°



4. When completing the toe adjustment, install the bellows clip and tighten the tie rod end lock nut to specified torque.

Tightening torque :
49.0 ~ 53.9N.m (5.0 ~ 5.5kgf.m, 36.2 ~ 39.8lb-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 : -0.5°±0.5°

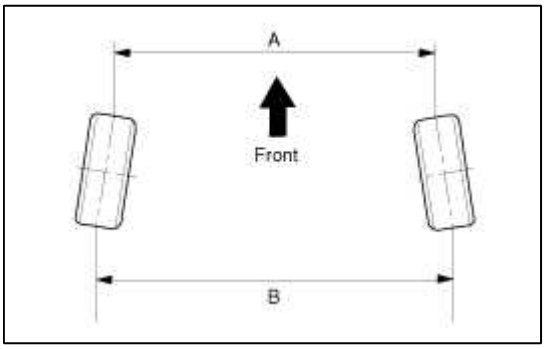
Caster angle : 3.4°±0.5°

Rear Wheel Alignment

CAUTION

When using a commercially available computerized wheel alignment equipment to inspect the rear wheel alignment, always position the vehicle on a level surface.
Prior to inspection, make sure that the rear suspension system is in normal operating condition and that the tires are inflated to the specified pressure.

Toe



B - A > 0: Toe in (+)
B - A < 0: Toe out (-)

Toe is pre-set at the factory, so it does not need to be adjusted. If the toe is not within the standard value, replace or repair the damaged parts and then inspect again.

Toe
Total : 0.4°±0.2°
Individual : 0.2°±0.1°

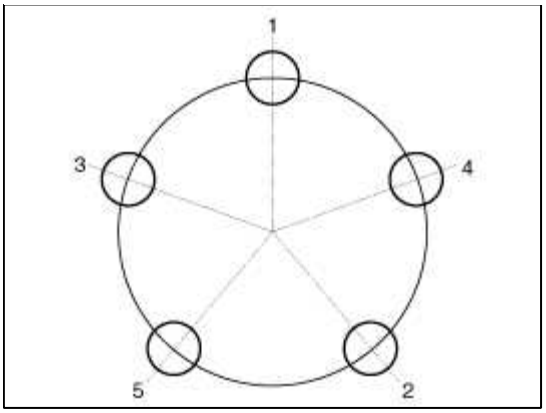
Camber
Camber is pre-set at the factory, so it does not need to be adjusted. If the camber is not within the standard value, replace or repair the damaged parts and then inspect again.

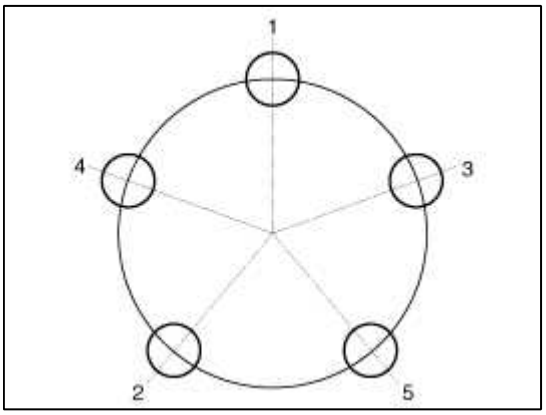
Camber : -1.30°±30°

Suspension System > Tires/Wheels > Wheel > Repair procedures

Hub Nut Tightening Sequence
Tighten the hub nuts as follows.

Tightening torque :
88.3 ~ 107.9N.m (9.0 ~ 11.0kgf.m, 65.1 ~ 79.6lb-ft)





CAUTION

When using an impact gun, final tightening torque should be checked using a torque wrench.

Suspension System > Tires/Wheels > Tire > Repair procedures

Tire Wear

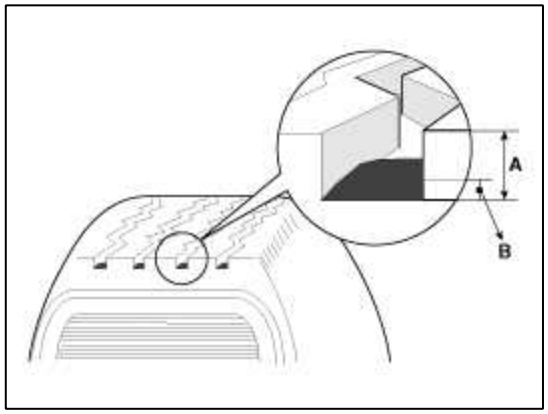
1. Measure the tread depth of the tires.

Tread depth [limit] : 1.6 mm (0.0630 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.

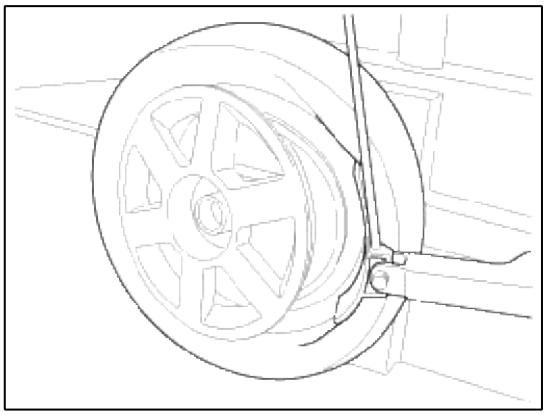


Removal

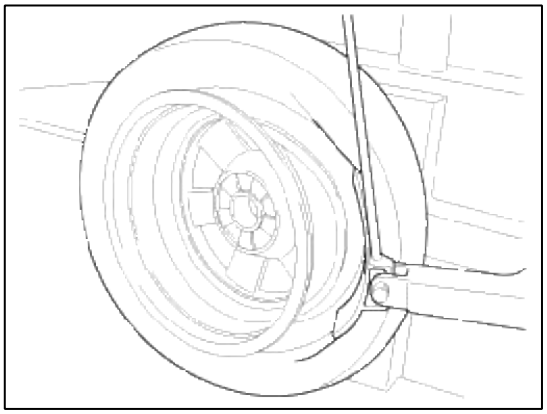
CAUTION

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.

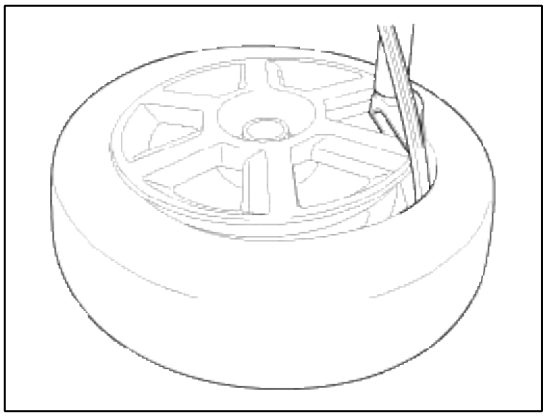
1. Take off the first side of the tire. The tool should not be used near the valve (no less than 30 cm).



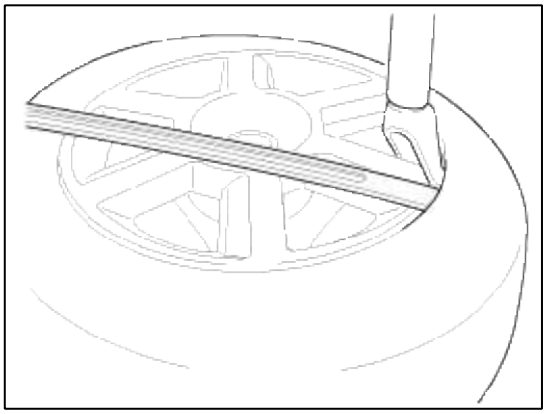
2. Take off the second side of the tire. The tool should not be used near the valve (No less than 30 cm).



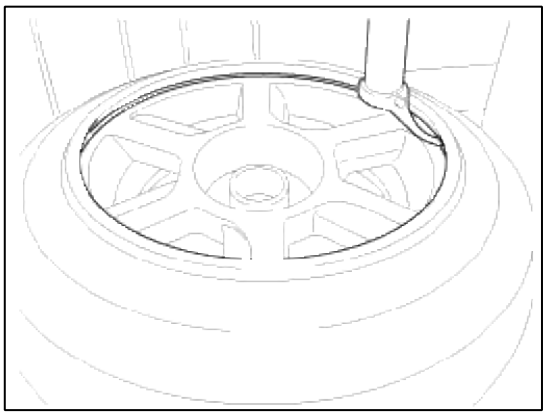
3. Dismount the first side of the tire: Place the shoe of the tool between 5 and 15 cm away from the sensor and use the tire lever as shown in the picture.



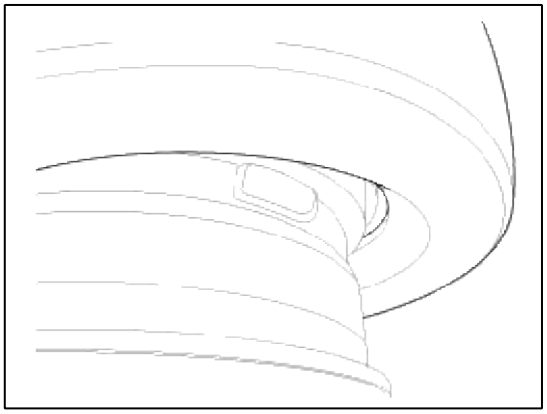
4. By using the tire lever, extract the external side wall of the tire and engage on the shoe of the machine. The lever and the tire must not come into contact with the sensor. Then remove the lever.



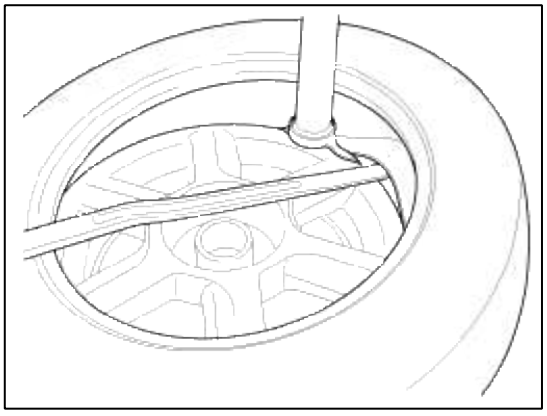
5. The wheel rotation allows the complete extraction of the first side of tire.



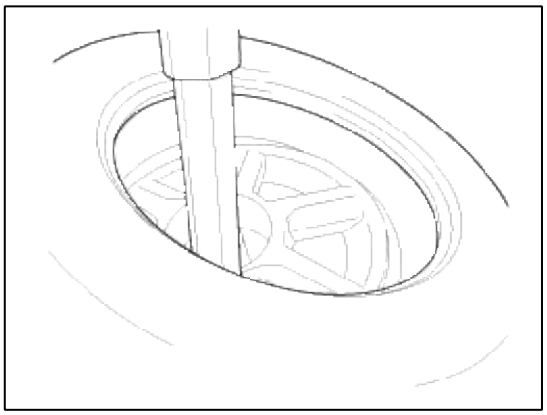
6. Raise the tire to prepare the introduction of the tire lever to aid extraction of the second side wall, the same recommendations as for the first side wall will apply.



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.

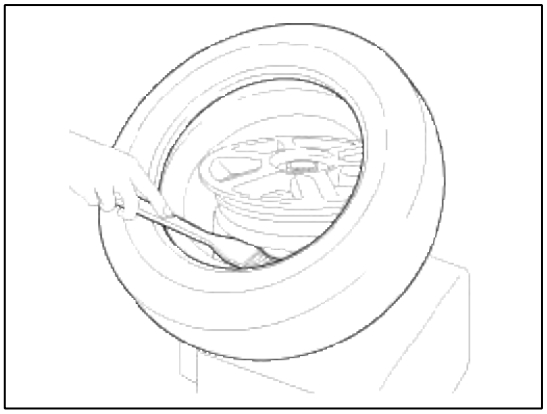


Installation

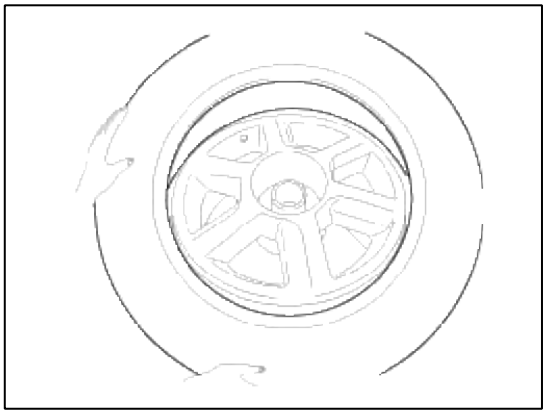
CAUTION

- 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.

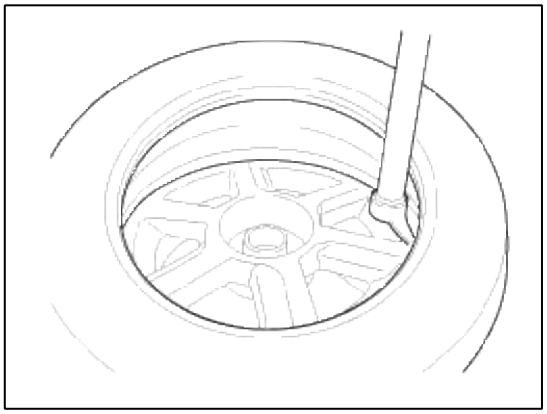
1. Prepare the tire and fix the rim as usual.



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).

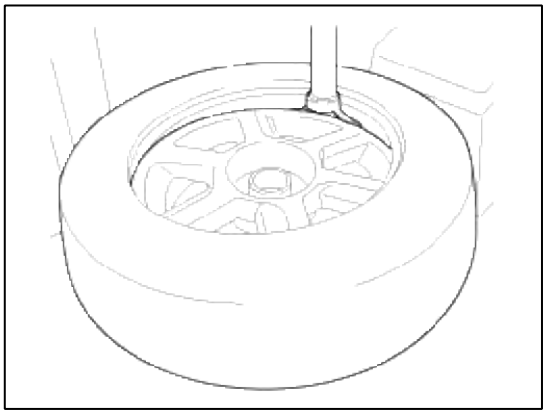


3. Engage the shoe and make sure that 20cm is maintained between the cross point and the valve. The arrow shows the direction of rotation of the wheel.

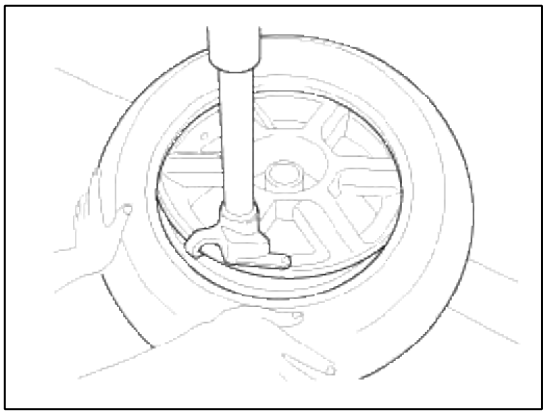


4. Turn the wheel in order to engage all the first side of the tire.

> NOTE
>
> The standard shoes can pass over the sensor without damaging it.

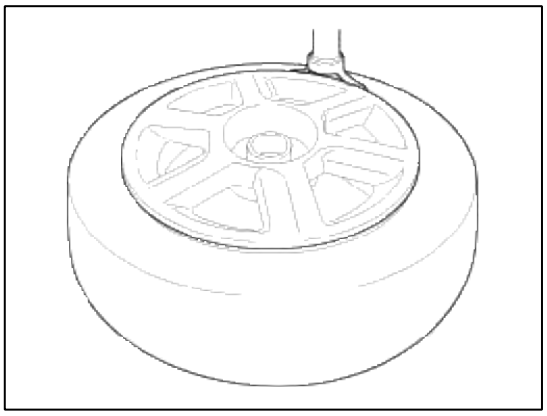


5. Put the second side of the tire in position, so that the cross point of the belt with the rim is approximately 20 cm away from the valve (see the picture). The curved arrow shows the direction of rotation of the wheel.



6. Turn the wheel in order to engage all of the second side of the tire.

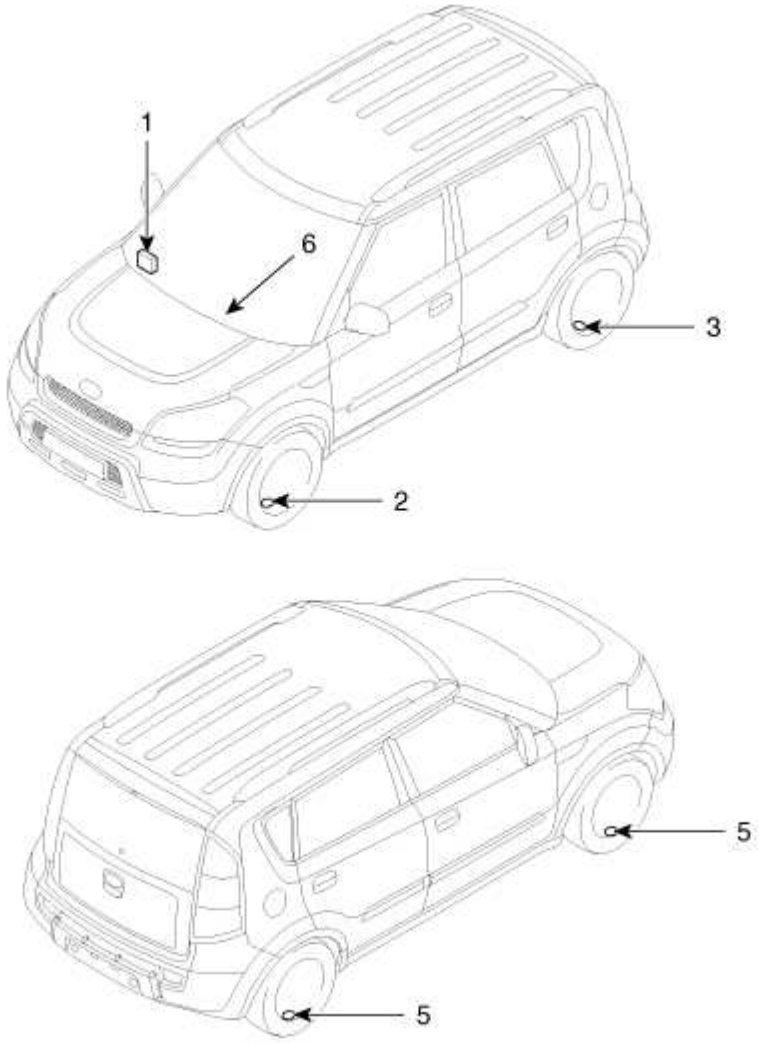
> NOTE
>
> The standard shoes can pass over the sensor without damaging it.



7. Perform the Register Sensor procedure. (Refer to Register Sensor.)

Suspension System > Tire Pressure Monitoring System > Components and Components Location

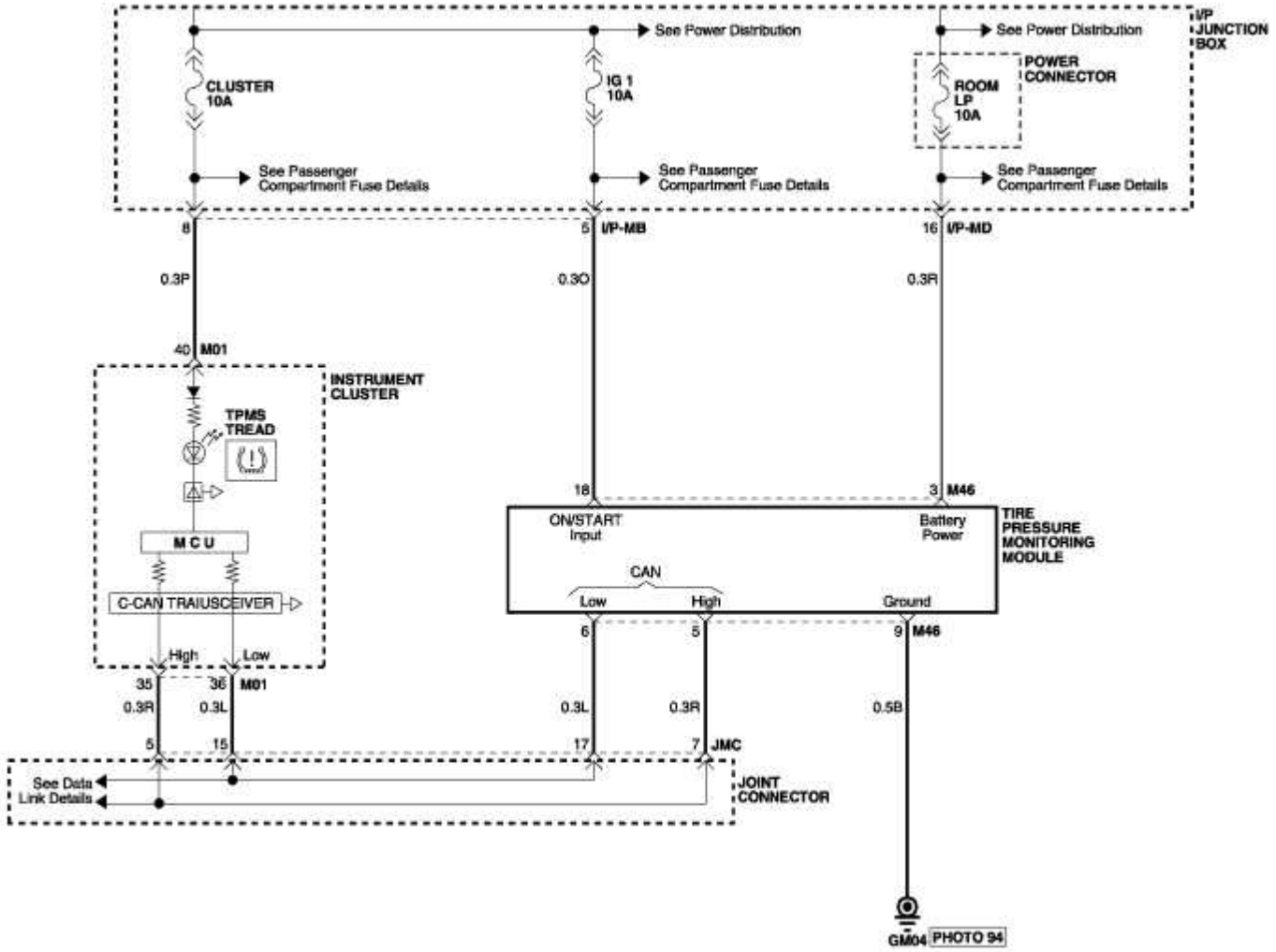
Components



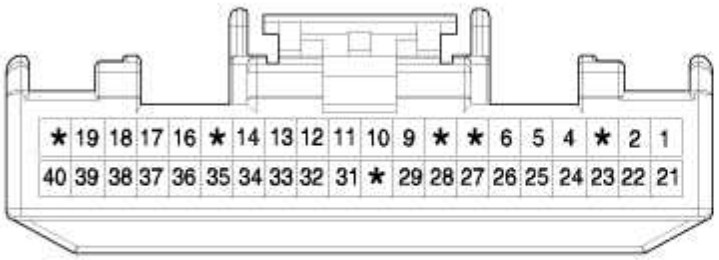
1. TPMS Receiver	4. TPMS Sensor (FR)
2. TPMS Sensor (FL)	5. TPMS Sensor (RR)
3. TPMS Sensor (RL)	6. Tread Lamp

Suspension System > Tire Pressure Monitoring System > Schematic Diagrams

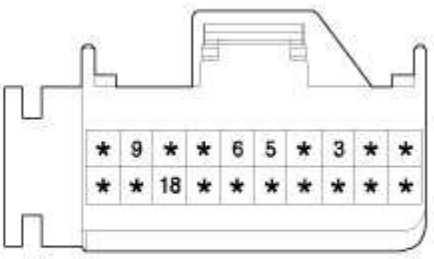
Circuit Diagram



Hamess Connector



[M01]



[M45]

TPMS Terminal Function

[M01]

Pin No.	Discription	Connected to
35	C-CAN Traiusceiver_High	CAN_High
36	C-CAN Traiusceiver_Low	CAN_Low
40	TPMS_Tread	Wake_up and cluster state

[M45]

Pin No.	Discription	Connected to
1	-	-
2	-	-
3	Battery power_ECU	Battery Interface_VBAT
4	-	-
5	CAN_High	CAN_High
6	CAN_Low	CAN_Low
7	-	-
8	-	-
9	Ground_ECU	Battery Interface_GND
10	-	-
11	-	-
12	-	-
13	-	-
14	-	-
15	-	-
16	-	-
17	-	-
18	Ignition_ON	Wake_up and ignition state
19	-	-
20	-	-

Suspension System > Tire Pressure Monitoring System > Description and Operation

Description

TREAD Lamp

- Tire Under Inflation / Leak Warning.



1. Turn on condition
   A. When tire pressure is below allowed threshold
   B. When rapid leak is detected by the sensor.
   C. Indicates that tire needs to be re-inflated to placard pressure / repaired.

2. Turn off condition
   A. Under-inflation ; When tire pressure is above (warning threshold + hysteresis).
   B. Rapid Leak ; When tire pressure is above (leak warning threshold).

DTC Warning

1. Turn on condition
   A. When the system detects a fault that is external to the receiver/ sensor.
   B. When the system detects a receiver fault.
   C. When the system detects a sensor fault.

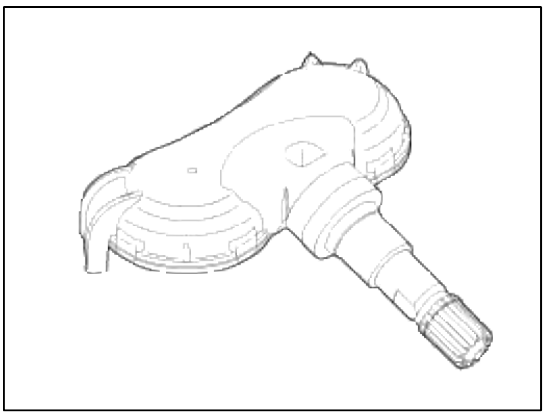
2. Turn off condition
   A. If the fault is considered as 'critical', then the lamp is held on throughout the current Ignition cycle (even if the DTC has been demoted). This is because it is important to bring the problem to the drivers attention. On the following Ignition cycle, the demotion conditions will be re-checked. If the demotion conditions occur, the lamp will be turned off. It will be held on until DTC demotion checking is completed.
   B. 'Non critical' faults are those that can occur temporarily e.g. vehicle battery under voltage. The lamp is therefore turned off when the DTC demotion condition occurs.

System Fault

1. General Function
   A. The system monitors a number of inputs across time in order to determine that a fault exists.
   B. Faults are prioritized according to which has the most likely cause.
   C. Maximum fault store is equal to 15.
   D. Certain faults are not covered through DTC. The main ones are:
      1) Sensor thermal shutdown (over 257°F/125°C).
      2) Ignition Line stuck ; requires observation of lamps at Ignition ON to diagnose.

Suspension System > Tire Pressure Monitoring System > TPMS Sensor > Description and Operation

Description



1. Mode
   (1) Configuration State
      A. All sensors should be in the Low Line (Base) state.
      B. In Low Line (Base) configuration, sensor transmissions occur every 3 minutes 20 seconds (nominal) and pressure is measured every 20 seconds.
   (2) Normal Fixed Base State
      A. Sensor transmissions continue at the Low Line (Base) configuration defined rates until the state is either changed by LF command or by the sensor detecting a condition that requires a temporary change to another state.
      B. The LF command to this state must contain the sensors ID.
   (3) Storage Auto State:
      A. This state is a Low current consumption state.
      B. Sensors are in this state when they first arrive at the dealership (either on the vehicle or as replacement spares).
      C. In this state, the sensor does not measure pressure / temperature / battery level.
      D. The sensor will not transmit in this state unless requested to do so by the initiate command.
   (4) Alert State:
      A. The sensor automatically enters this state if the measured temperature exceeds 230 °F(110 °C) and over temperature shutdown is likely.
      B. In this state, pressure is measured every 4 seconds and RF data transmitted every 4 seconds.
      C. The state lasts for 1 minute if it is pressure triggered.
      D. This state is alse entered when a 3 psi change in pressure from the last RF transmission occurs.

NOTE

Sensor mode is used to configure sensor between high line and low line system. TPMS sensor for UB should be set to low line.

Suspension System > Tire Pressure Monitoring System > TPMS Sensor > Repair procedures

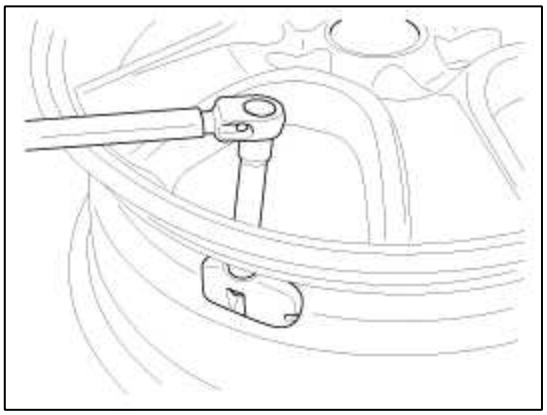
Removal

CAUTION

Handle the sensor with care.

1. Remove the tire. (Refer to "Tire Removal")

2. Remove the valve nut.



CAUTION

The valve nut should not be re-used.

3. Discard the valve assembly.

Replacement

Repair tire after using the Tire Mobility Kit (TMK)

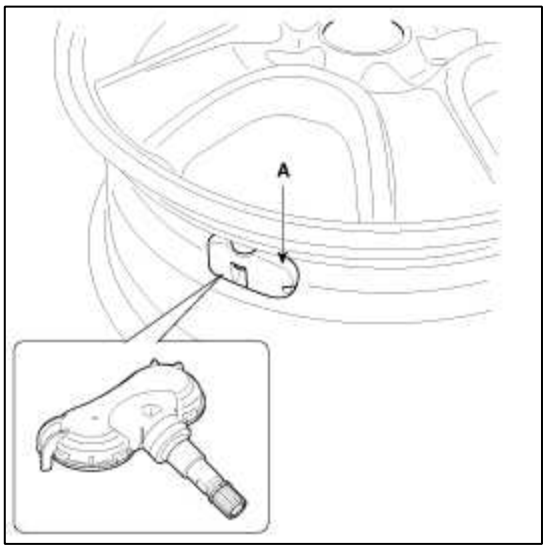
When the TPMS warning lamp OFF

1. Remove the TMK repaired tire, wheel and TPMS sensor.
   (Refer to "Tire removal")

2. Remove the sealant on the wheel and TPMS sensor (A) completely.

CAUTION

- Clean the sealant on the housing and sensing hole of TPMS sensor with clean cloth, gauze or air inhalers.
- To prevent the sensor and circuit board damage, do not use the pointed instrument and give a lot of impact.



3. Install the TPMS sensor to the new tire.

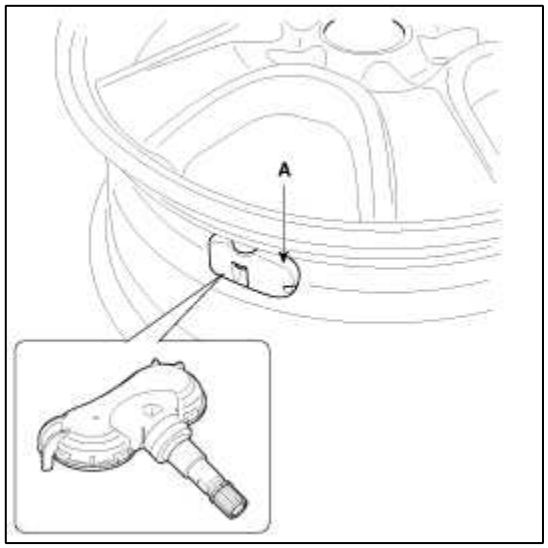
4. Check that the normal operation of TPMS system.

When the TPMS warning lamp ON

1. Remove the TMK repaired tire, wheel and TPMS sensor.
   (Refer to "Tire removal")
2. Remove the sealant on the wheel and TPMS sensor (A) completely.

CAUTION

- Clean the sealant on the housing and sensing hole of TPMS sensor with clean cloth, gauze or air inhalers.
- To prevent the sensor and circuit board damage, do not use the pointed instrument and give a lot of impact.



3. Install the TPMS sensor to the new tire.
4. Check the tire pressure using the electrical tire pressure gauge.
5. Check the tire pressure of TPMS sensor using the GDS
6. If the difference between two checked pressures in the above is not more than 2 psi, TPMS sensor is normal. Reinstall it to new tire.
7. If the difference between two checked pressures in the above is more than 2 psi, TPMS sensor is abnormal. Install new TPMS sensor to new tire.
8. Check that the normal operation of TPMS system.

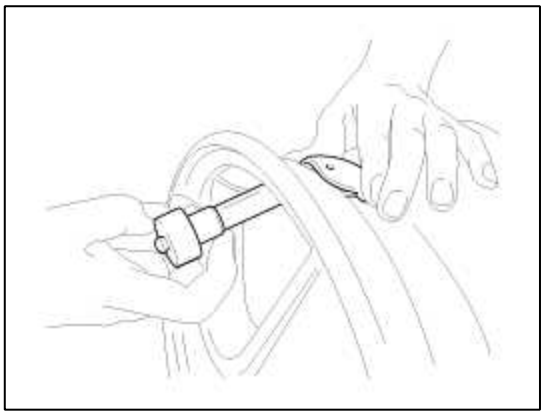
Installation

Sensor Fit

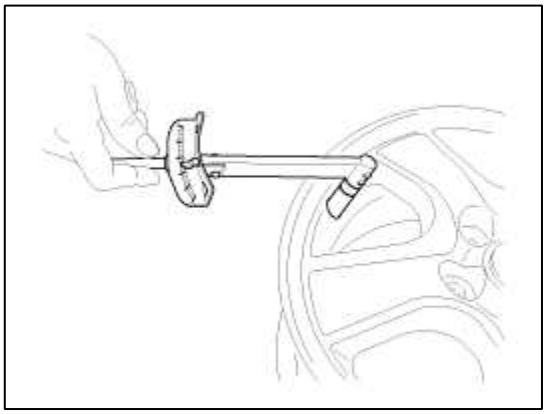
CAUTION

- Handle the sensor with care.
- Avoid lubricant contact.
- Ensure that the wheel to be fitted is designed for sensor mount. There should normally be a mark to indicate this.
- Ensure that the valve hole and mating face of the wheel are clean.

1. Slide the sensor-valve unit through the valve hole of the rim. Hold the sensor against the rim and the rubber grommet against the sealing surface.
2. Insert the nut over the valve stem and then tighten the nut.



3. Continue to tightening the nut until contact with the rim and then tighten to 3.5 ~ 4.5Nm.



CAUTION

- Tighten slowly with quarter turn steps until the final torque is reached.
- Do not exceed allowed torque.
- Do not use electric or pneumatic tools.

4. Check that the sensor is firmly attached to the rim.

CAUTION

Risk of damage during the tire installation/ removal if the sensor is not firmly attached to the rim.

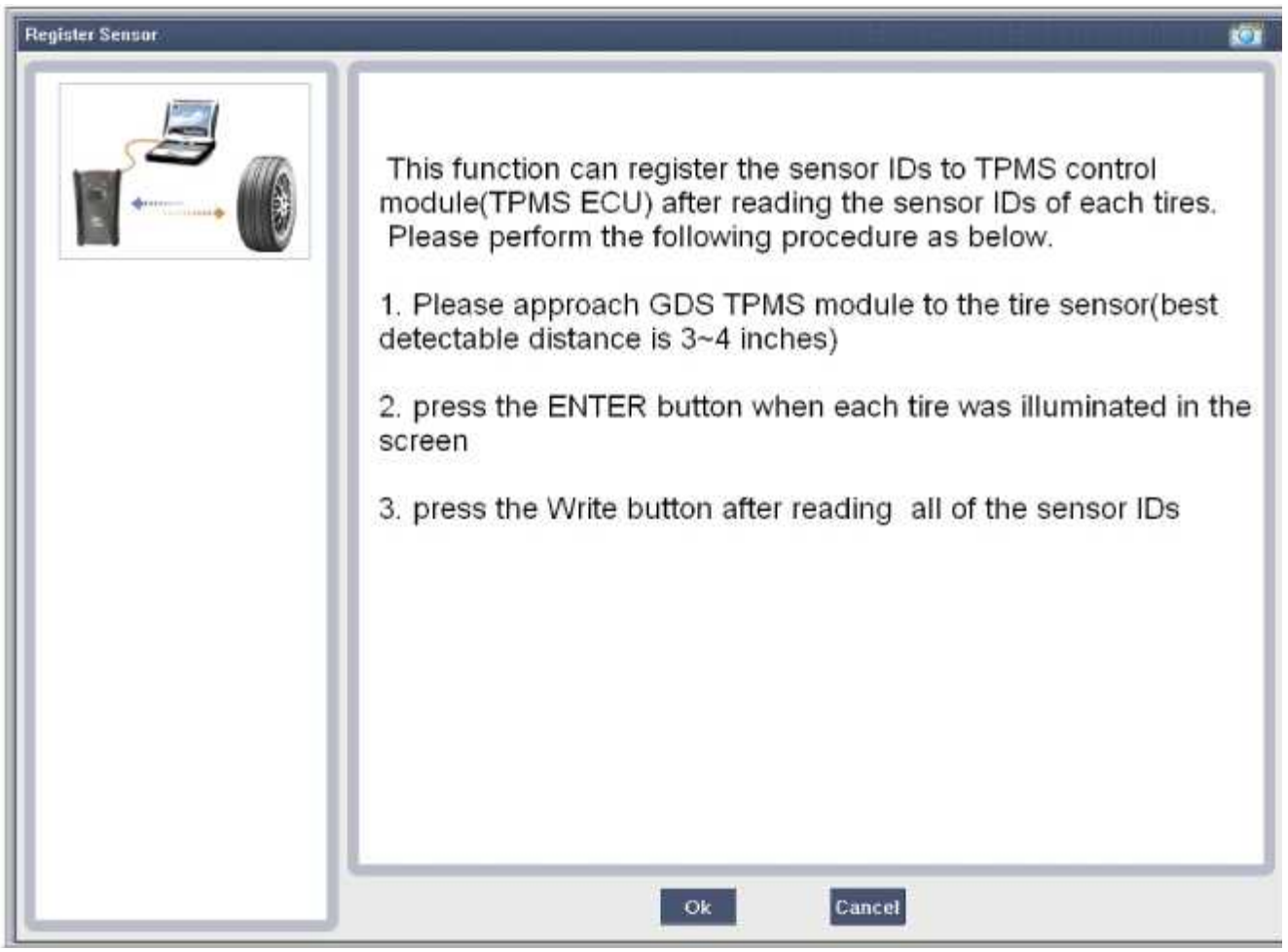
5. Carry out inflation / pressure correction and then fit valve cap.

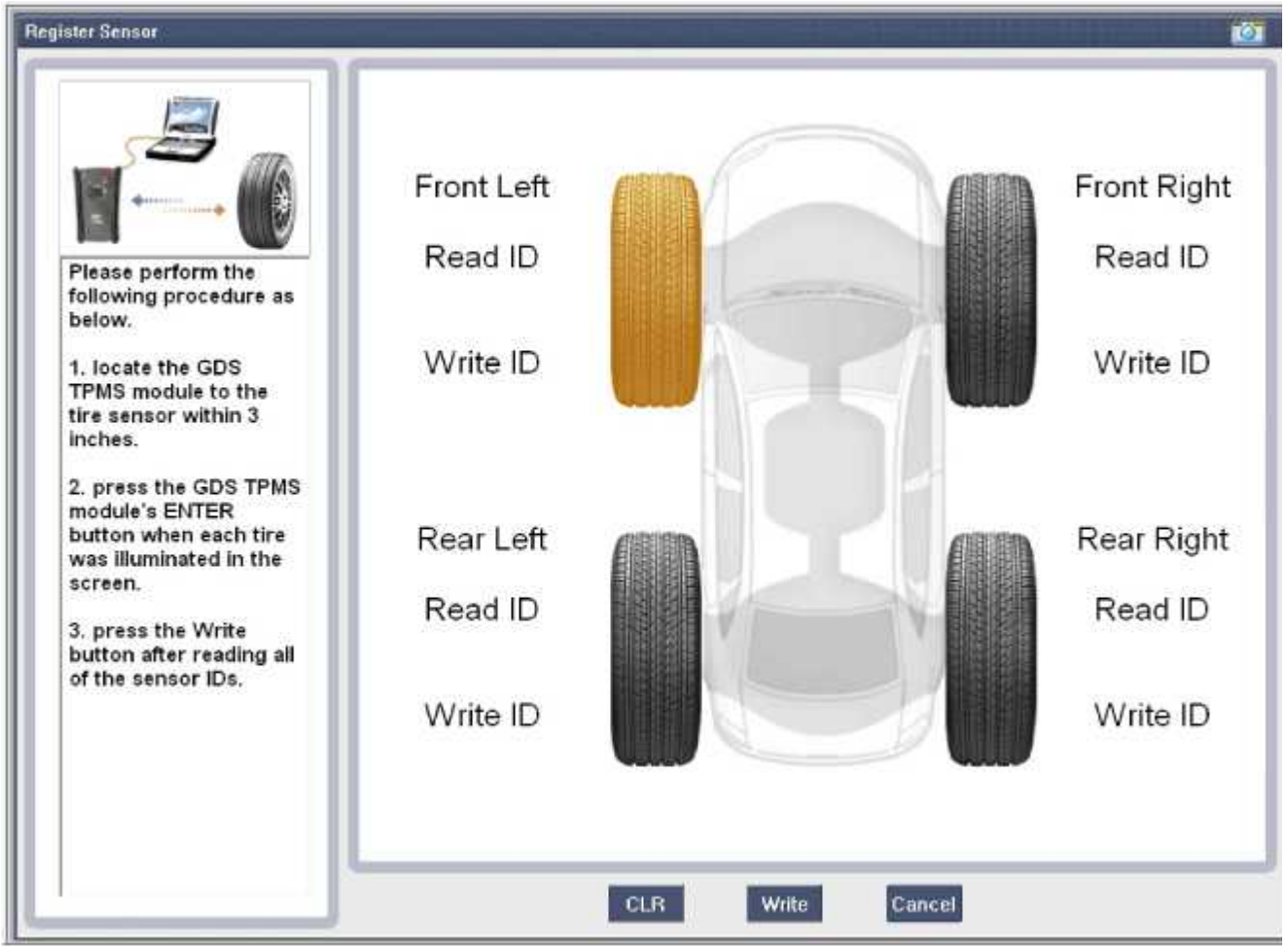
CAUTION

Change the newly installed sensor mode to Normal Fixed Base(Low Line) with the 'GDS'.
Mode (Status / option) of the sensor installed to the vehicle should be Normal Fixed Base (Low).

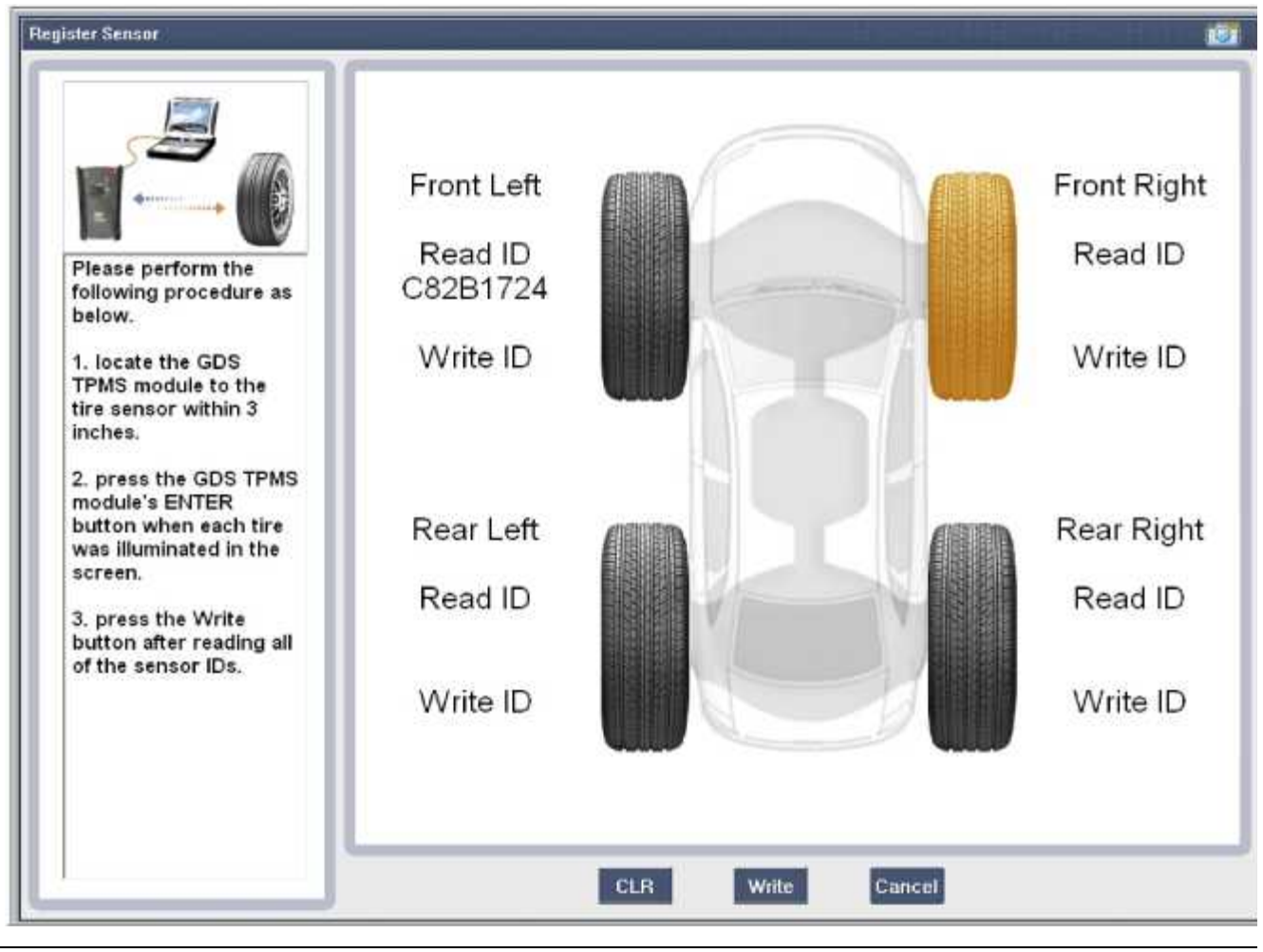
6. Install the tire. (Refer to "Tire Installation")

Sensor ID Writing (Wireless)

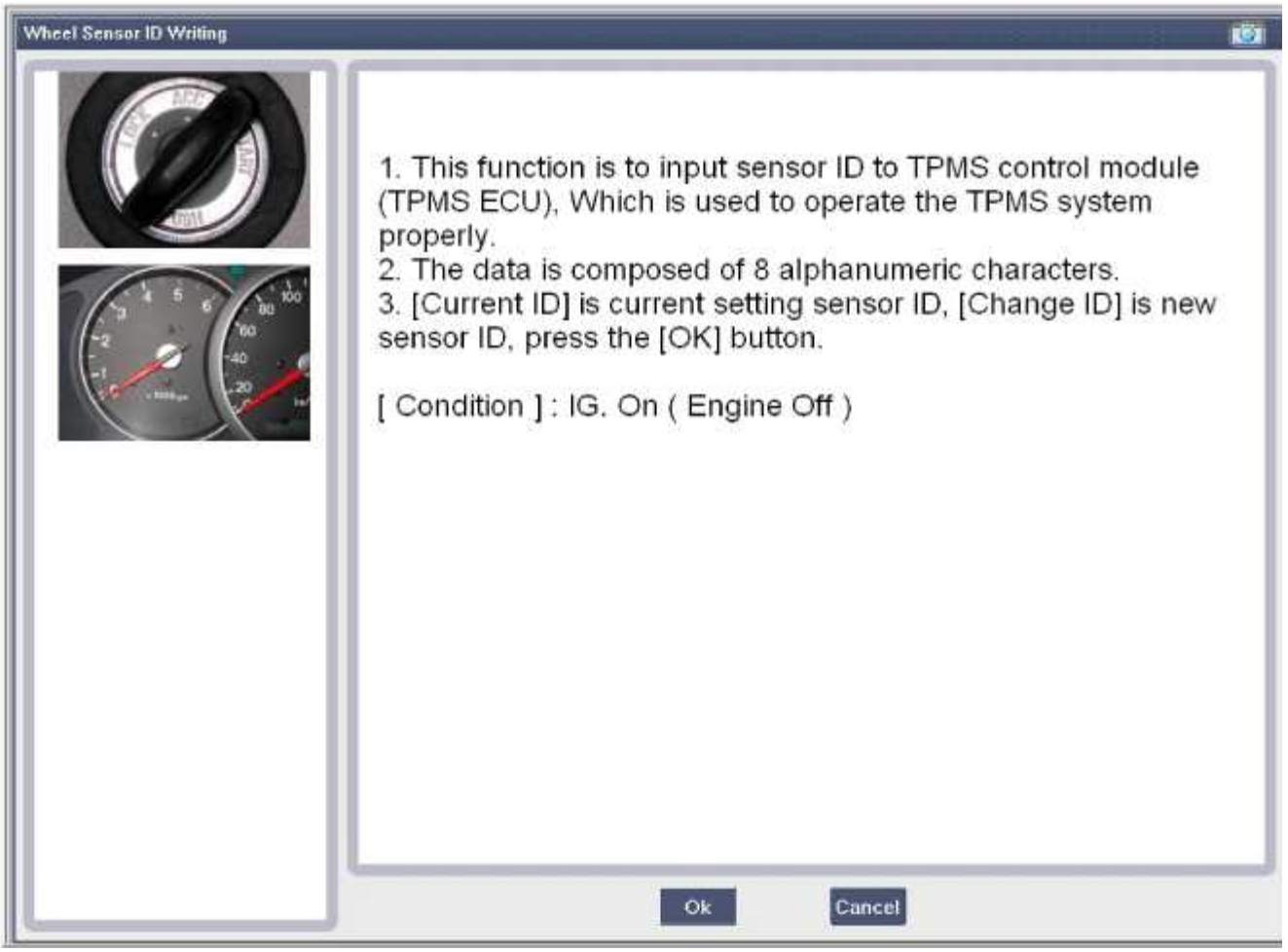

Register Sensor
This function can register the sensor IDs to TPMS control module(TPMS ECU) after reading the sensor IDs of each tires. Please perform the following procedure as below.
1. Please approach GDS TPMS module to the tire sensor(best detectable distance is 3~4 inches)
2. press the ENTER button when each tire was illuminated in the screen
3. press the Write button after reading all of the sensor IDs
Ok
Cancel

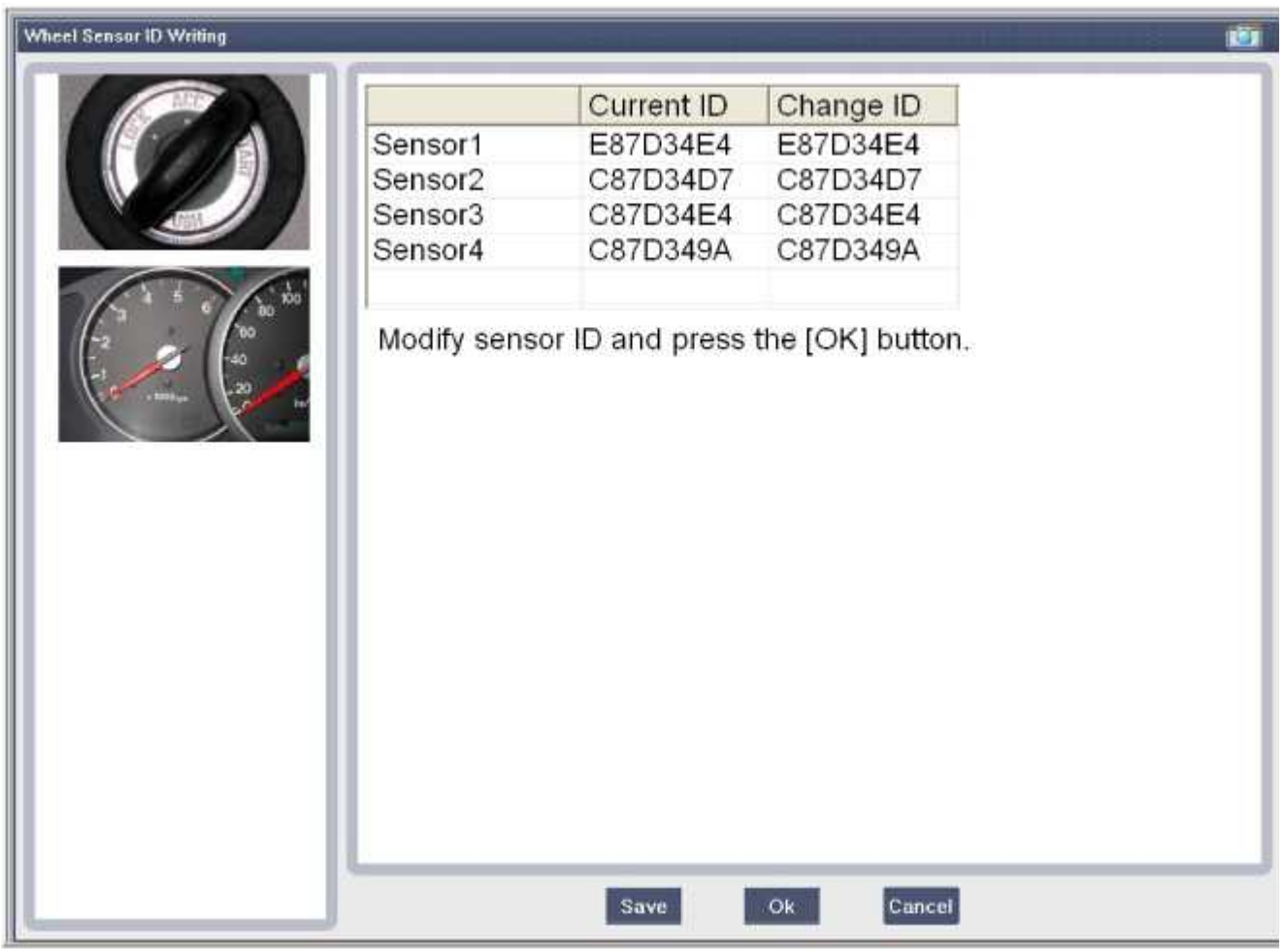

Register Sensor
Please perform the following procedure as below.
1. locate the GDS TPMS module to the tire sensor within 3 inches.
2. press the GDS TPMS module's ENTER button when each tire was illuminated in the screen.
3. press the Write button after reading all of the sensor IDs.
Front Left
Read ID
Write ID
Front Right
Read ID
Write ID
Rear Left
Read ID
Write ID
Rear Right
Read ID
Write ID
CLR
Write
Cancel

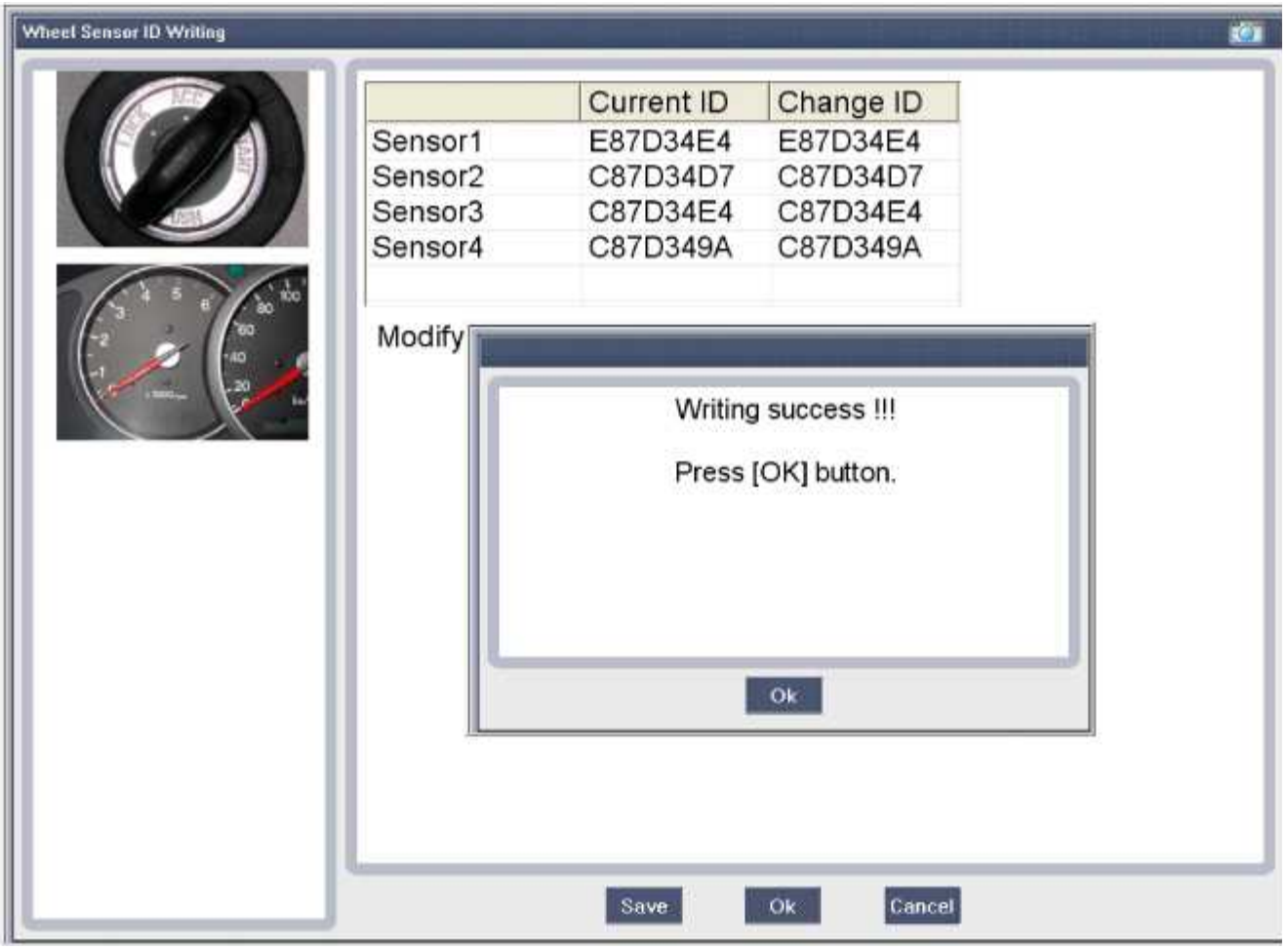

Register Sensor
Please perform the following procedure as below.
1. locate the GDS TPMS module to the tire sensor within 3 inches.
2. press the GDS TPMS module's ENTER button when each tire was illuminated in the screen.
3. press the Write button after reading all of the sensor IDs.
Front Left
Read ID
Write ID
Front Right
Read ID
Write ID
GDS TPMS
It takes Max. 30 Sec. Please, wait.....
Cancel
Rear Right
Read ID
Write ID
Write ID
CLR
Write
Cancel



Sensor ID Writing

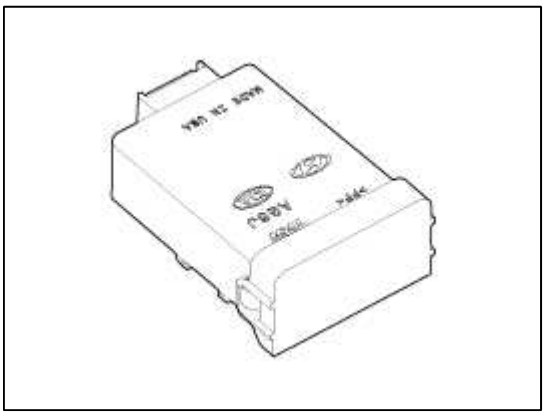

Wheel Sensor ID Writing
1. This function is to input sensor ID to TPMS control module (TPMS ECU), Which is used to operate the TPMS system properly.
2. The data is composed of 8 alphanumeric characters.
3. [Current ID] is current setting sensor ID, [Change ID] is new sensor ID, press the [OK] button.
[Condition] : IG. On (Engine Off)
Ok
Cancel


Wheel Sensor ID Writing
Current ID
Change ID
Sensor1 E87D34E4 E87D34E4
Sensor2 C87D34D7 C87D34D7
Sensor3 C87D34E4 C87D34E4
Sensor4 C87D349A C87D349A
Modify sensor ID and press the [OK] button.
Save
Ok
Cancel



Suspension System > Tire Pressure Monitoring System > TPMS Receiver > Description and Operation

Description



1. **Mode**
   (1) Virgin State
      A. The receiver as a sole part is shipped in this state. Replacement parts should therefore arrive in this state.
      B. In this state, there is no sensor monitoring and no DTC monitoring.
      C. The state indicates that platform specific parameters must be written to the receiver and that sensors are un-learned.
   (2) Normal State
      A. In order for tire inflation state and DTC monitoring to occur, the receiver must be in this state.
      B. In this state, automatic sensor learning is enabled.
   (3) Test State
      A. This state is only used in manufacturing plant to check RF transmission between sensor and receiver.

2. **Overview**
   A. Receives RF data from sensor.
   B. Uses sensor data to decide whether to turn on TREAD Lamp.
   C. Learn TPM sensor for under inflation monitoring automatically.
   D. Uses sensor information, distance travelled, background noise levels, Auto-learn status, short / open circuit output status, vehicle battery level, internal receiver states to determine if there is a system or a vehicle fault.

Operation

1. General Function
   A. Auto-learn takes place only once per Ignition cycle.
   B. On successful completion, 4 road wheel sensor ID's are latched into memory for monitoring.
   C. Until Auto-learn completes, previously learned sensors are monitored for under inflation / leak warnings.

2. General Conditions to Learn New Sensors:
   A. Receiver must determine that it is confident that sensor is not temporary:
      1) Uses vehicle speed.
      2) Uses confidence reduction of previously learned sensors.
   B. Typical time at driving continuously over 12.4 mph(20 kph) to learn a new sensor is up to 20 minutes.

3. General Conditions to Un-Learn a sensor that is removed:
   A. It takes less than 20 minutes at 12.4 ~ 18.6 mph(20 ~ 30kph).
   B. Confidence reduction is dependent on time which vehicle is driven at speed greater than or equal to 12.4 mph(20 kph).

Suspension System > Tire Pressure Monitoring System > TPMS Receiver > Repair procedures

Replacement

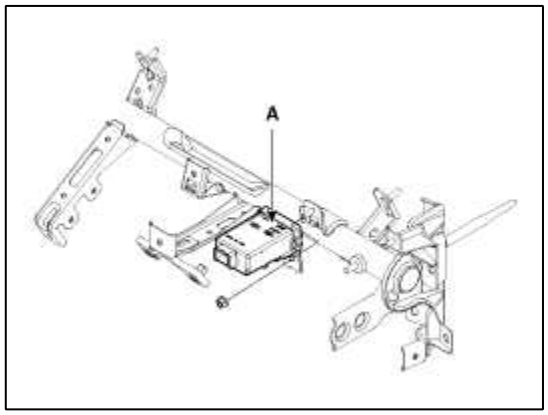
NOTE

When the receiver first arrives for replacement:
1) It will be in Virgin State.
2) It will not be configured for any specific platform.
3) It will not have any sensor ID's memorized.

CAUTION

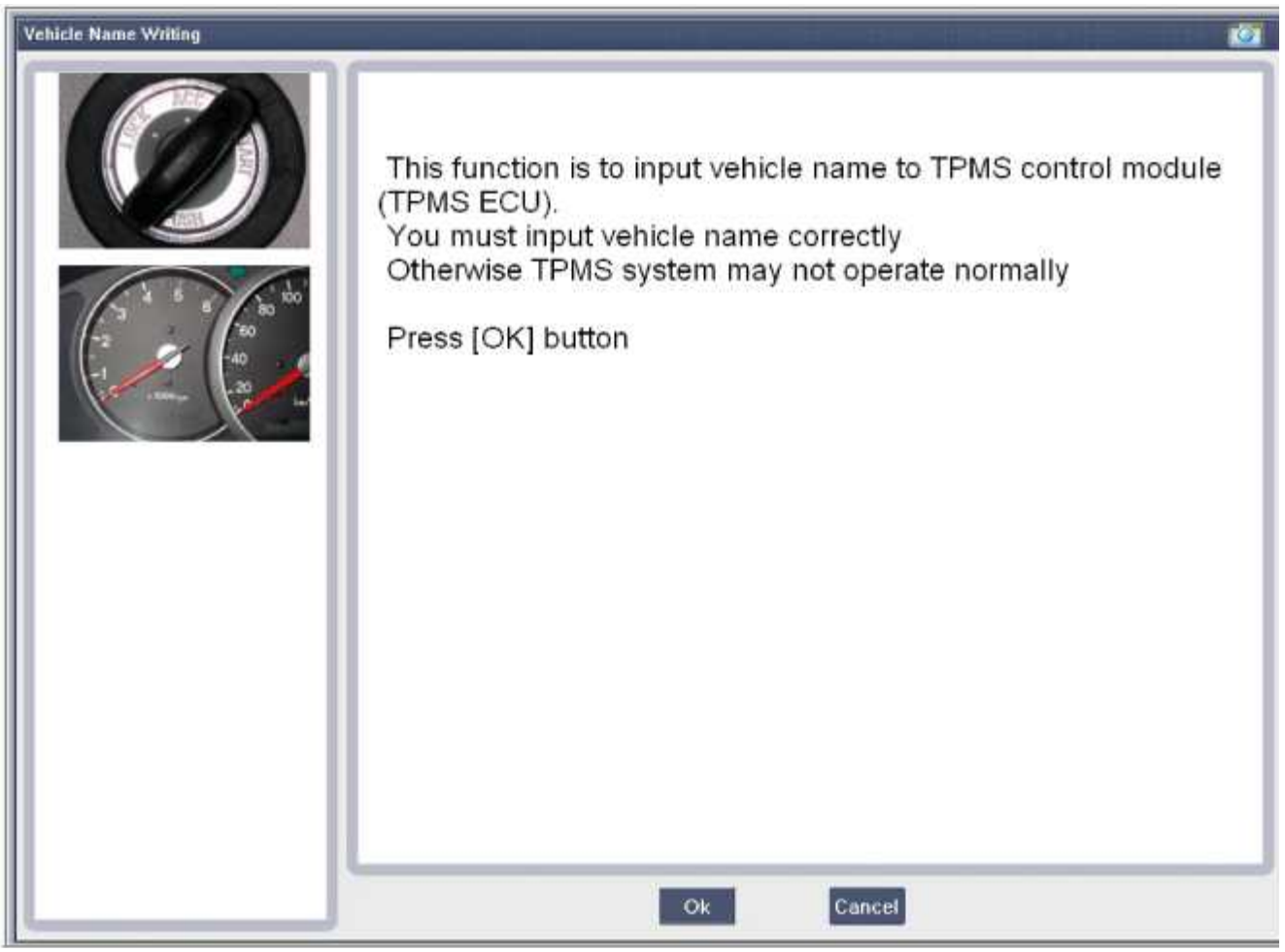
It is important to make sure that the correct receiver is used to replace the faulty part i.e. it must be Low Line and not High Line in order to have the correct inflation warning thresholds set.

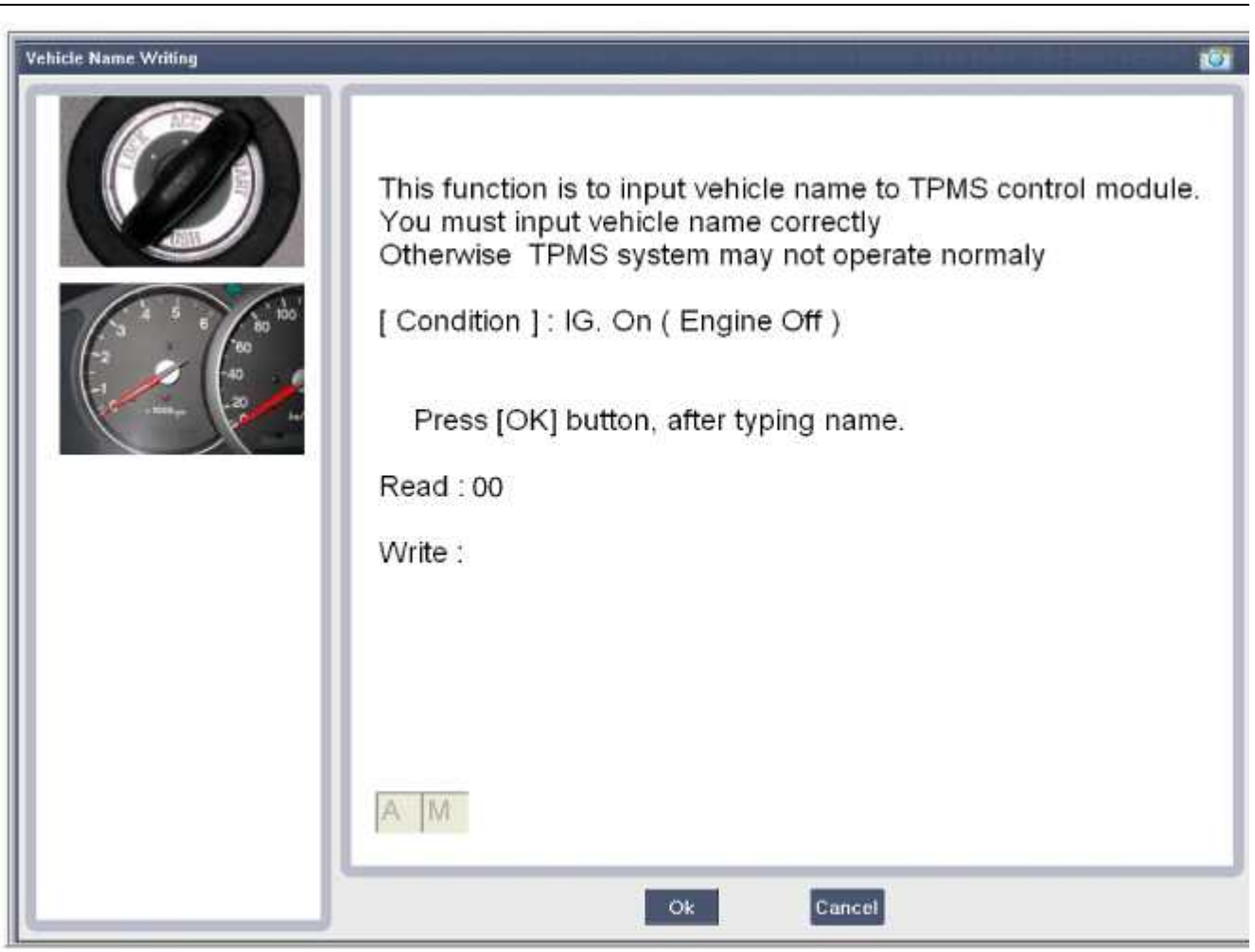
1. Disconnect vehicle battery.
2. Remove the glove box.
   (Refer to BD group - "Crash Pad")
3. Remove the receiver (A) and fit bracket assembly to new part.

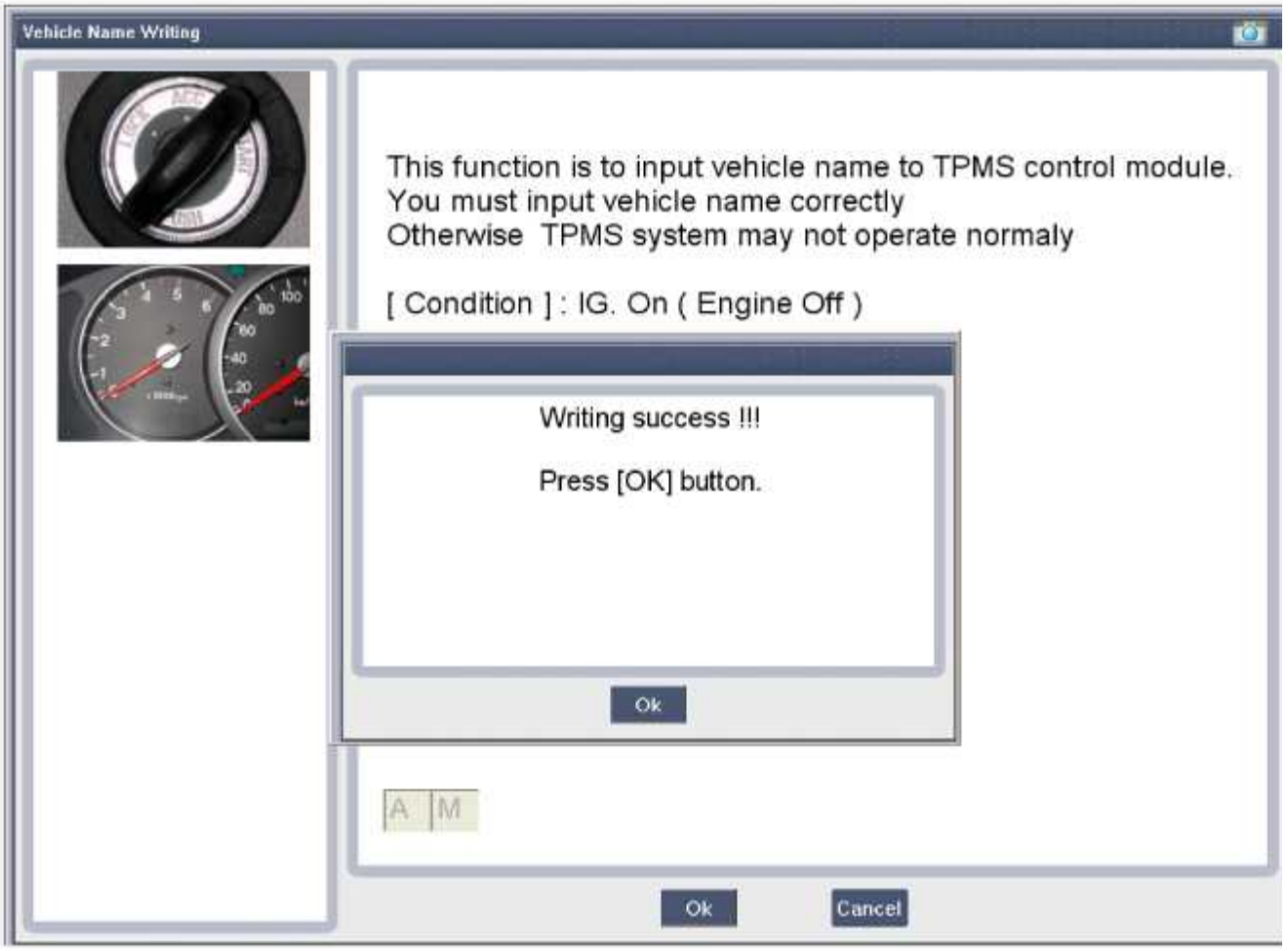


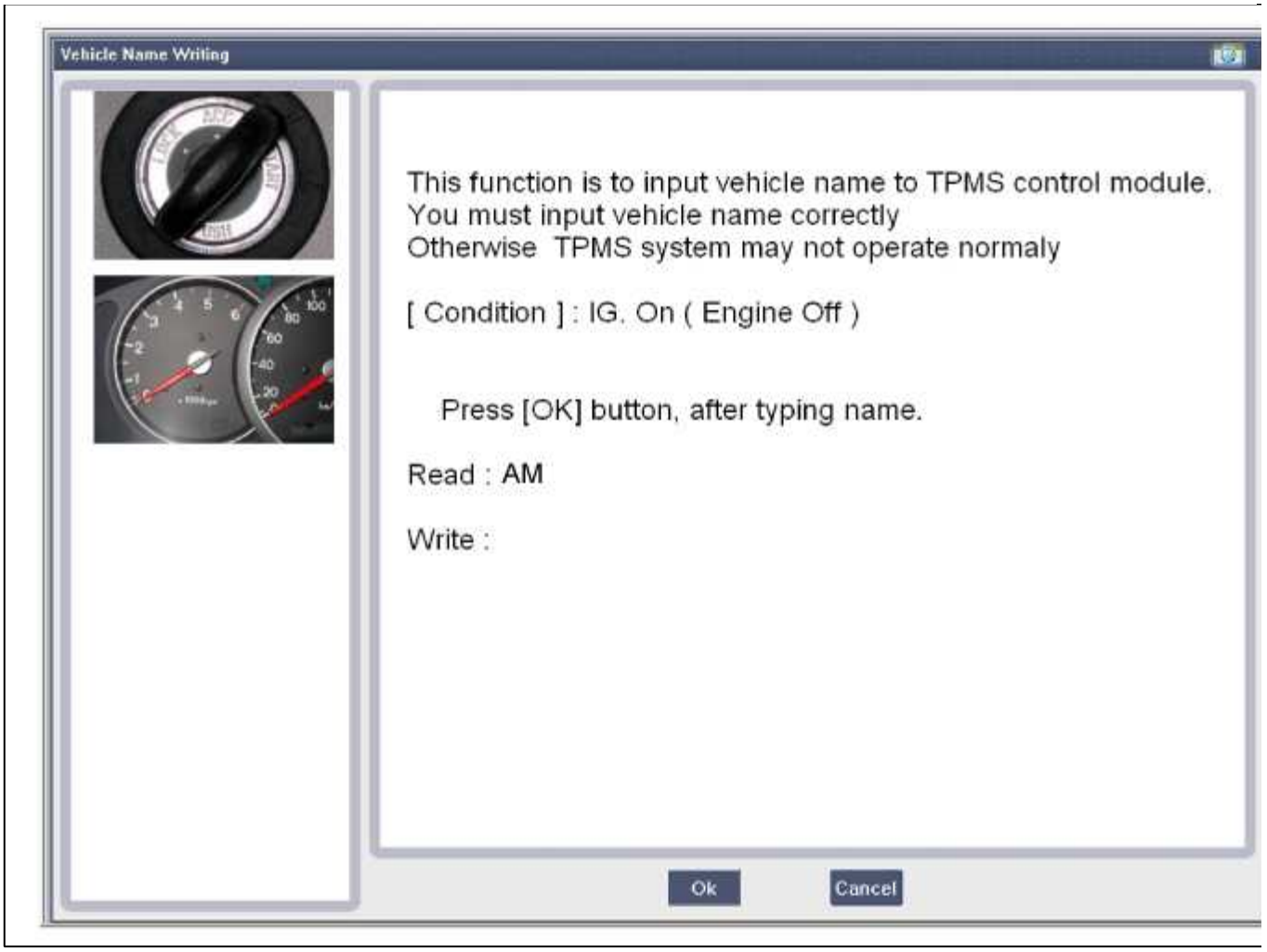
4. Secure new part to vehicle and fit connector.
5. Re-connect battery and turn Ignition on.
6. Check that TREAD Lamp flash rate matches Virgin State indication.

   Vechicle Name Writing

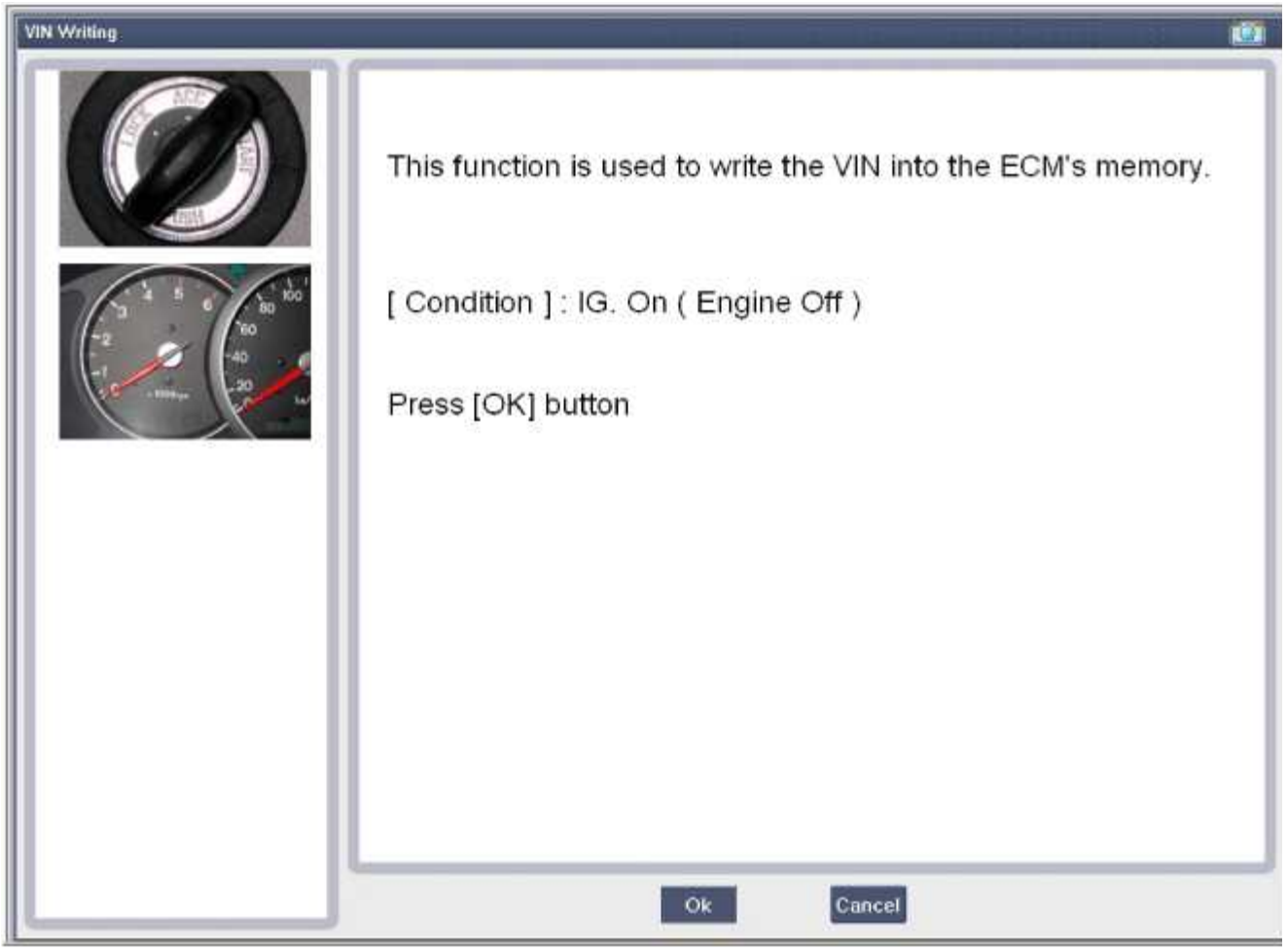

Vehicle Name Writing
This function is to input vehicle name to TPMS control module (TPMS ECU).
You must input vehicle name correctly
Otherwise TPMS system may not operate normally
Press [OK] button
Ok
Cancel

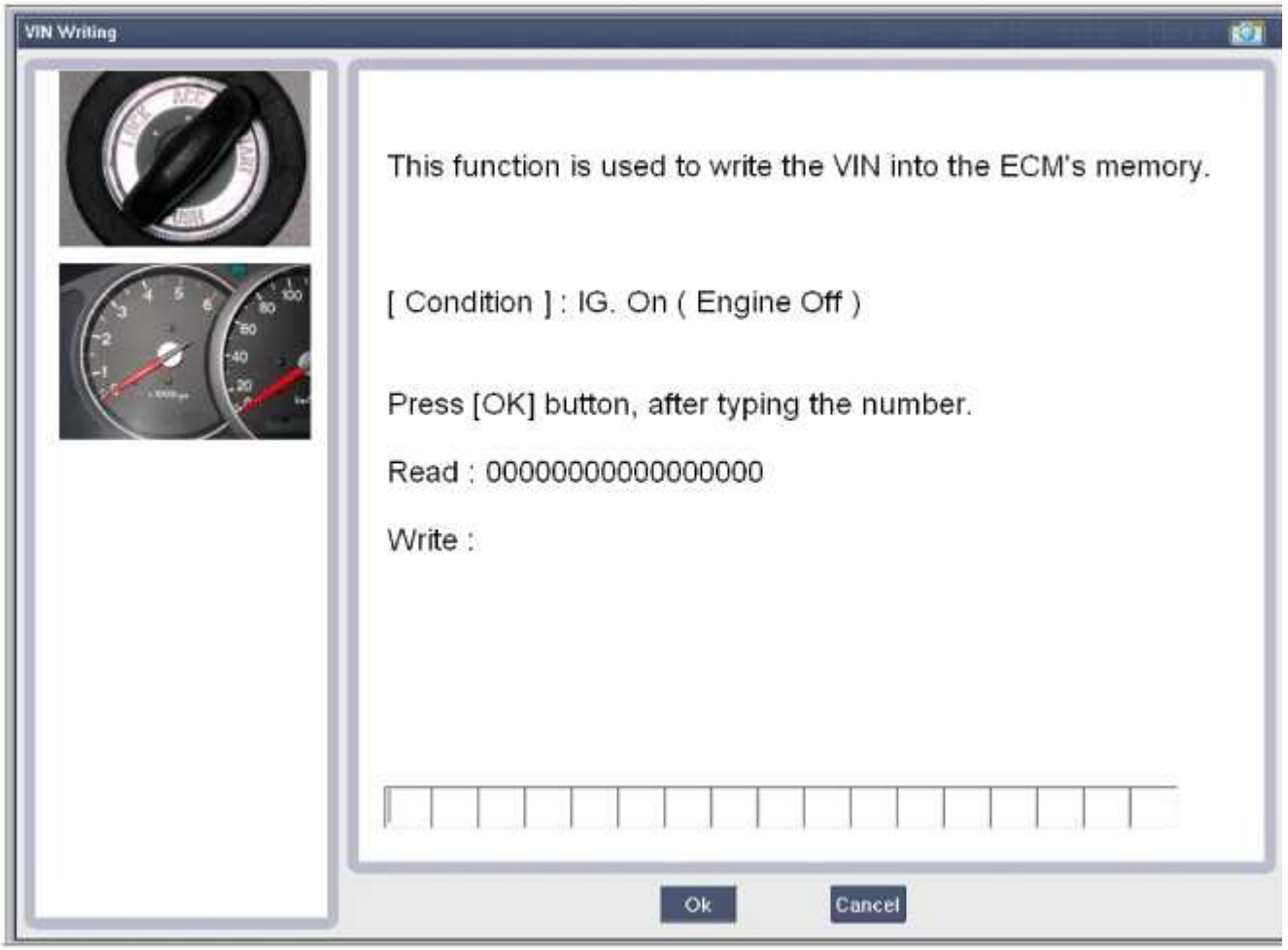

Vehicle Name Writing
This function is to input vehicle name to TPMS control module.
You must input vehicle name correctly
Otherwise TPMS system may not operate normaly
[Condition] : IG. On (Engine Off)
Press [OK] button, after typing name.
Read : 00
Write :
A M
Ok
Cancel

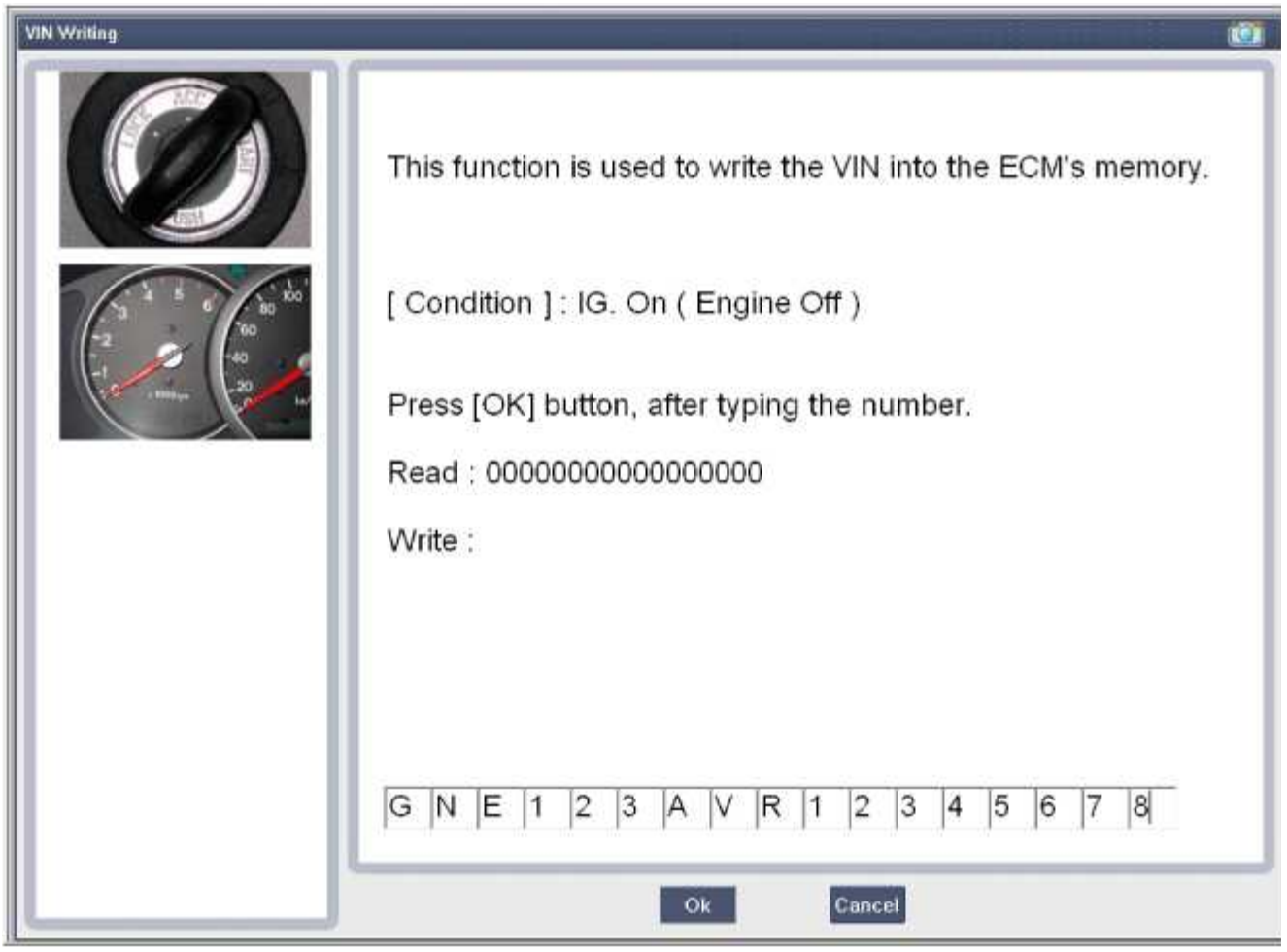

Vehicle Name Writing
This function is to input vehicle name to TPMS control module.
You must input vehicle name correctly
Otherwise TPMS system may not operate normaly
[Condition] : IG. On (Engine Off)
Writing success !!!
Press [OK] button.
Ok
A
M
Ok
Cancel

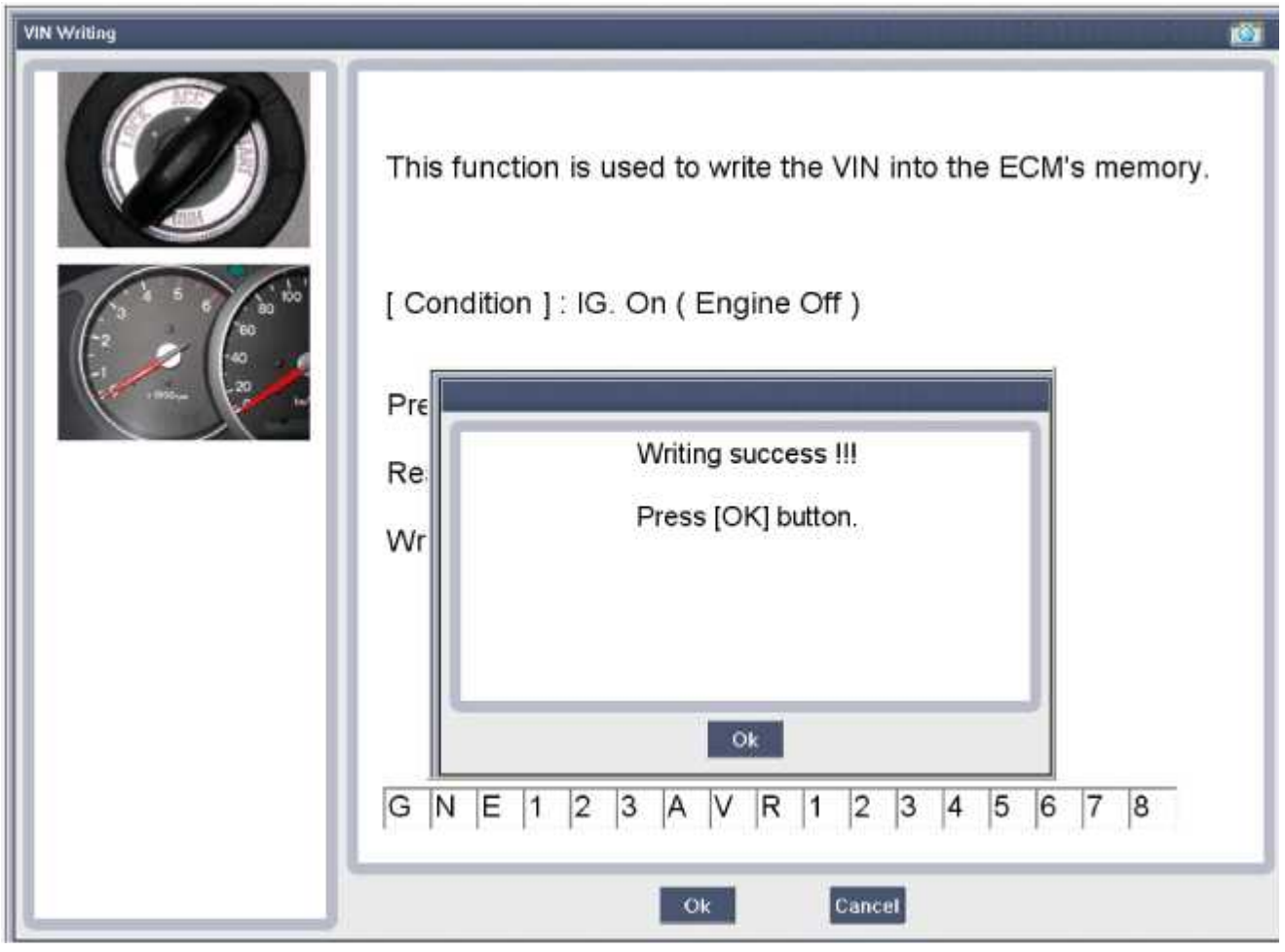

Vehicle Name Writing
This function is to input vehicle name to TPMS control module.
You must input vehicle name correctly
Otherwise TPMS system may not operate normaly
[Condition] : IG. On (Engine Off)
Press [OK] button, after typing name.
Read : AM
Write :
Ok
Cancel

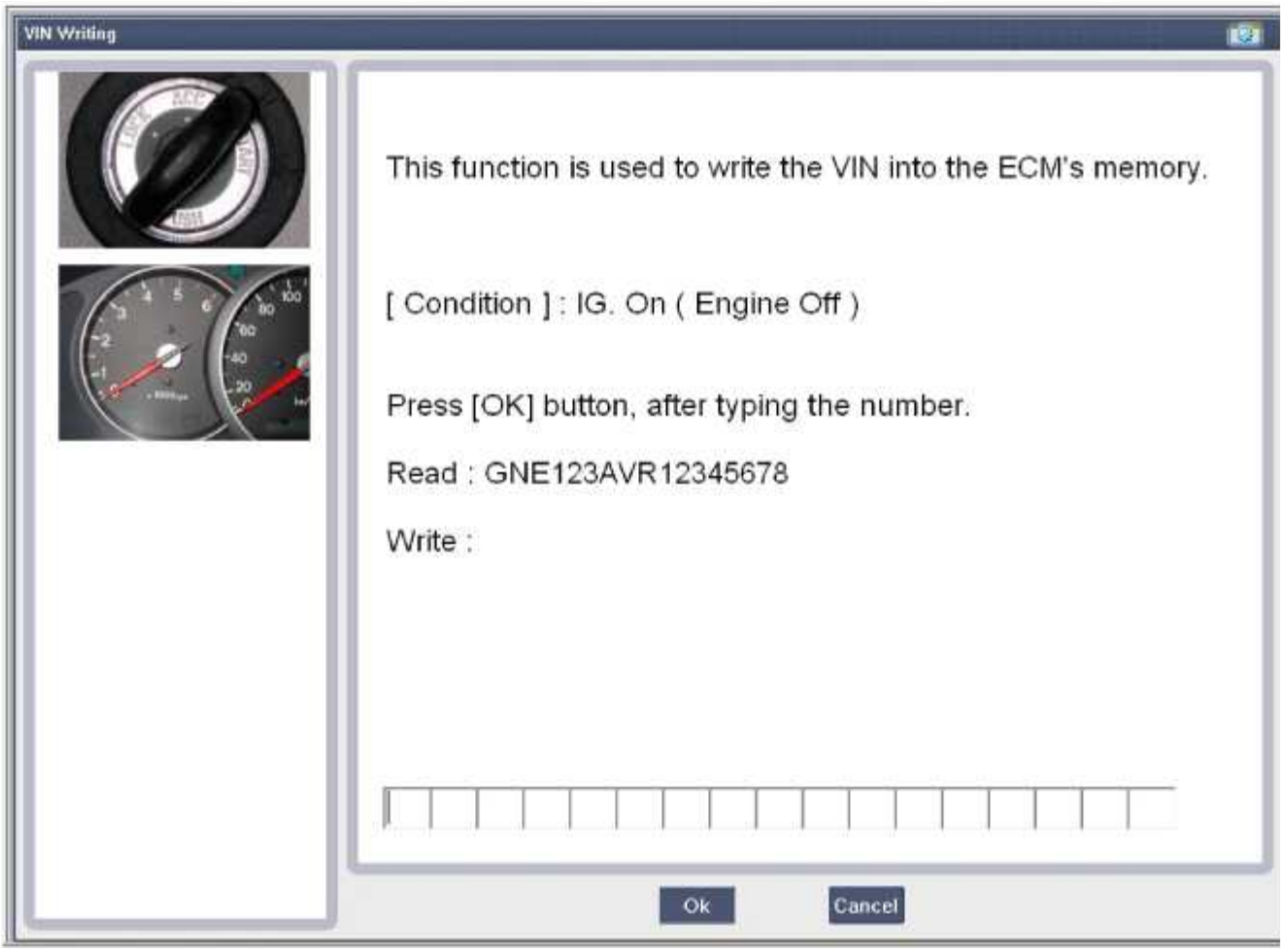
VIN Writing


VIN Writing
This function is used to write the VIN into the ECM's memory.
[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.
[Condition] : IG. On (Engine Off)
Press [OK] button, after typing the number.
Read : 00000000000000000
Write :
Ok
Cancel


VIN Writing
This function is used to write the VIN into the ECM's memory.
[Condition] : IG. On (Engine Off)
Press [OK] button, after typing the number.
Read : 00000000000000000
Write :
G N E 1 2 3 A V R 1 2 3 4 5 6 7 8
Ok
Cancel


VIN Writing
This function is used to write the VIN into the ECM's memory.
[Condition] : IG. On (Engine Off)
Writing success !!!
Press [OK] button.
Ok
G N E 1 2 3 A V R 1 2 3 4 5 6 7 8
Ok
Cancel


VIN Writing
This function is used to write the VIN into the ECM's memory.
[Condition] : IG. On (Engine Off)
Press [OK] button, after typing the number.
Read : GNE123AVR12345678
Write :
Ok
Cancel

SOUL(AM) > 2012 > G 1.6 GDI > Steering System

Steering System > General Information > Specifications

Specifications

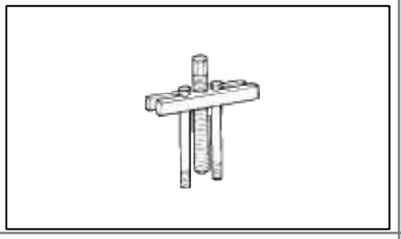
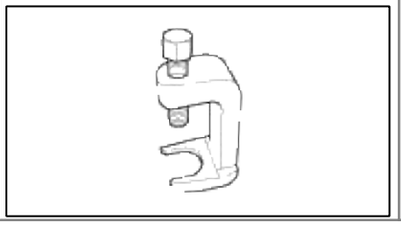
Item		Specification
Type		Electronic Power Steering System
Steering gear	Type	Rack & Pinion
	Rack stroke	140±1mm (5.5118 ± 0.0394)
Steering angle (Max.)	Inner	38.35° ± 2°
	Outer	30.81°

Tightening Torques

Item	Tightening torque		
	N.m	Kgf.m	lb-ft
Hub nuts	88.3 ~ 107.9	9.0 ~ 11.0	65.1 ~ 79.6
Steering column mounting bolts and nuts	12.7 ~ 17.7	1.3 ~ 1.8	9.4 ~ 13.0
Bolt connecting universal joint to pinion	29.4 ~ 34.3	3.0 ~ 3.5	21.7 ~ 25.3
Tie rod end castle nut	23.5 ~ 33.3	2.4 ~ 3.4	17.4 ~ 24.6
Steering gear box mounting bolts	58.8 ~ 78.5	6.0 ~ 8.0	43.4 ~ 57.9
Steering wheel lock nut	39.2 ~ 49.0	4.0 ~ 5.0	28.9 ~ 36.2

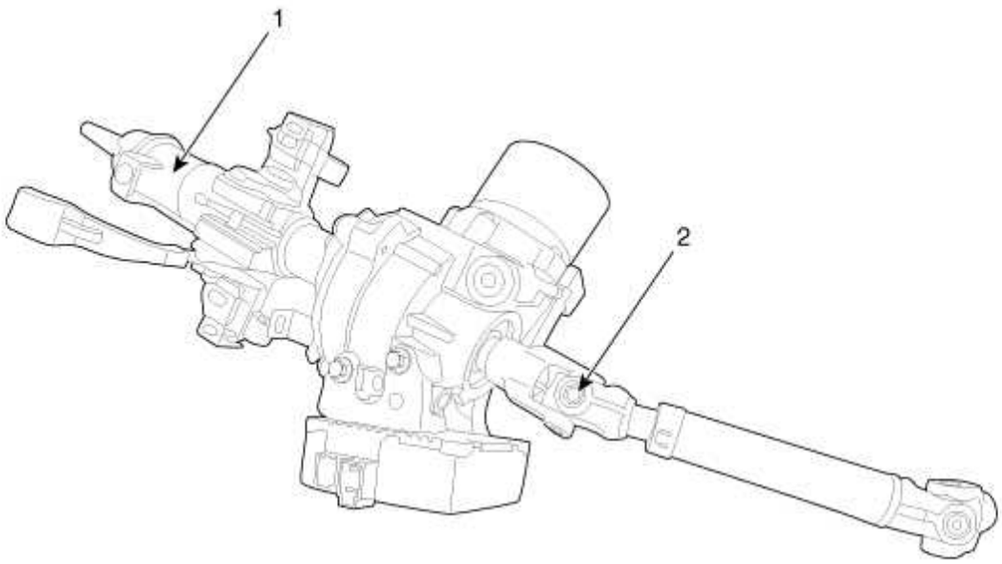
Steering System > General Information > Special Service Tools

Special Service Tools

Tool (Number and Name)	Illustration	Use
09561-11001 Steering wheel puller		Removal of steering wheel
09568-2J100 Ball joint puller		Separation of tie-rod end ball joint

Steering System > Electric Power Steering > Components and Components Location

Components



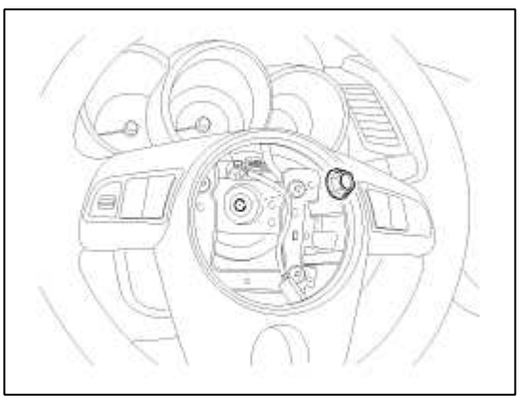
1. Steering Column & EPS unit assembly	2. Universal joint assembly

Steering System > Electric Power Steering > EPS Control Unit > Repair procedures

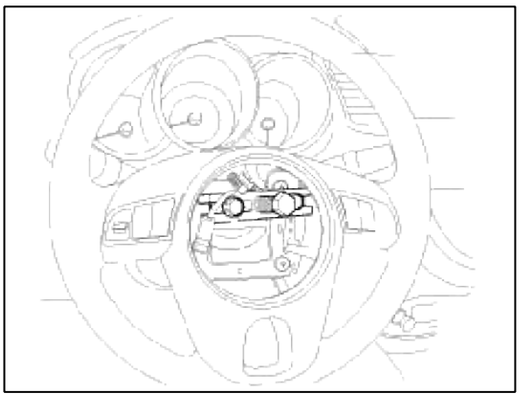
Replacement

1. Disconnect the battery negative cable from the battery and then wait for at least 30 seconds.
2. Turn the steering wheel so that the front wheels can face straight ahead.
3. Remove the airbag module. (Refer to RT group)
4. Loosen the steering wheel lock nut.

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



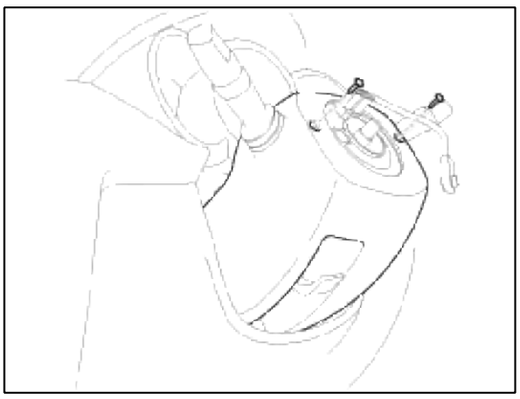
5. Remove the steering wheel from the steering column shaft by using a SST (09561-11001).



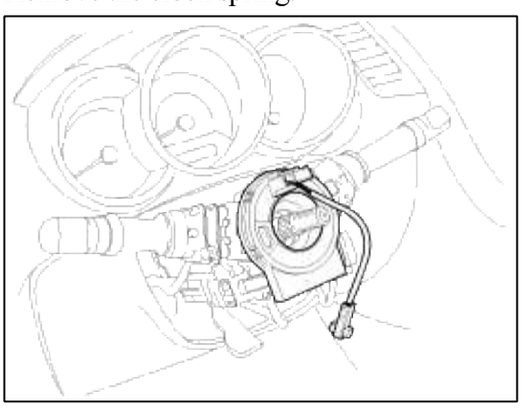
CAUTION

Do not hammer on the steering wheel to remove it; it may damage the steering column.

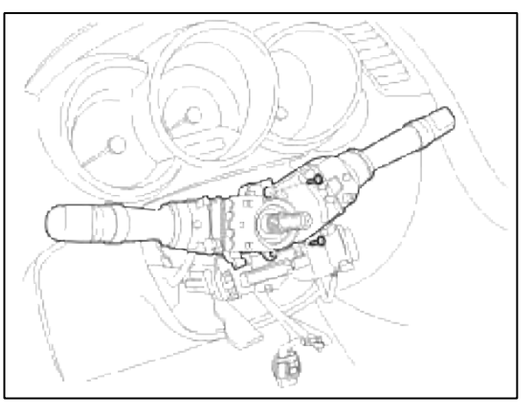
6. Remove the steering column upper and lower shroud.



7. Remove the clock spring.



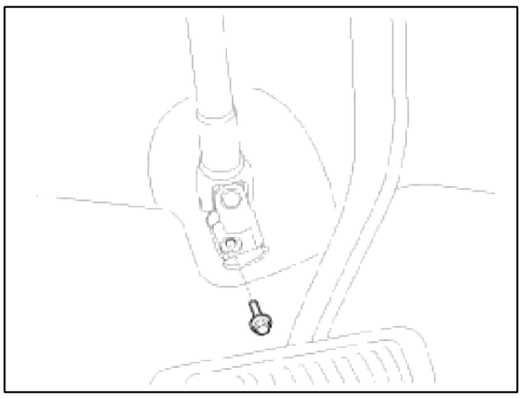
8. Loosen the screw and then remove the multifunction switches.



9. Remove the lower crash pad. (Refer to BD group)

10. Loosen the bolt and then disconnect the universal joint assembly from the pinion of the steering gear box.

Tightening torque :
29.4 ~ 34.3 N.m (3.0 ~ 3.5 kgf.m, 21.7 ~ 25.3 lb-ft)



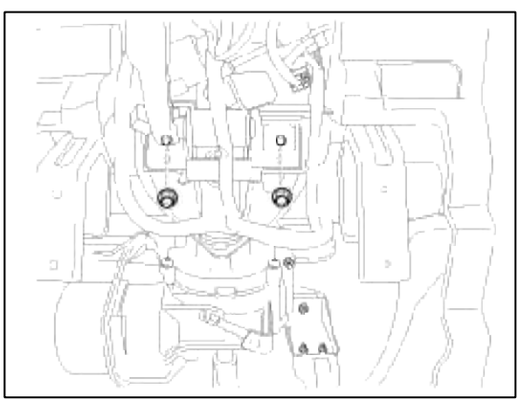
CAUTION

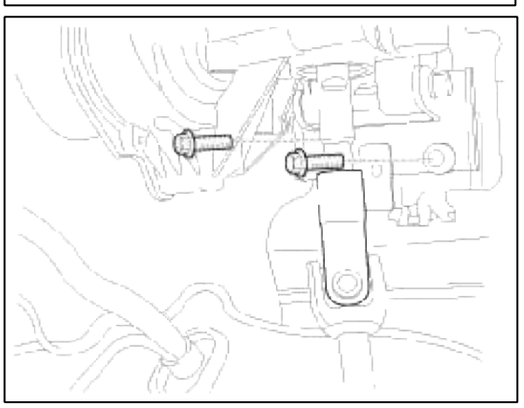
Keep the neutral-range to prevent the damage of the clock spring inner cable when you handlethe steering wheel.

11. Disconnect all connectors connected the steering column.

12. Remove the steering column & EPS unit assembly by loosening the mounting bolts and nuts.

Tightening torque :
12.7 ~ 17.7 N.m (1.3 ~ 1.8 kgf.m, 9.4 ~ 13.0 lb-ft)





13. Installation is the reverse of the removal.

CAUTION

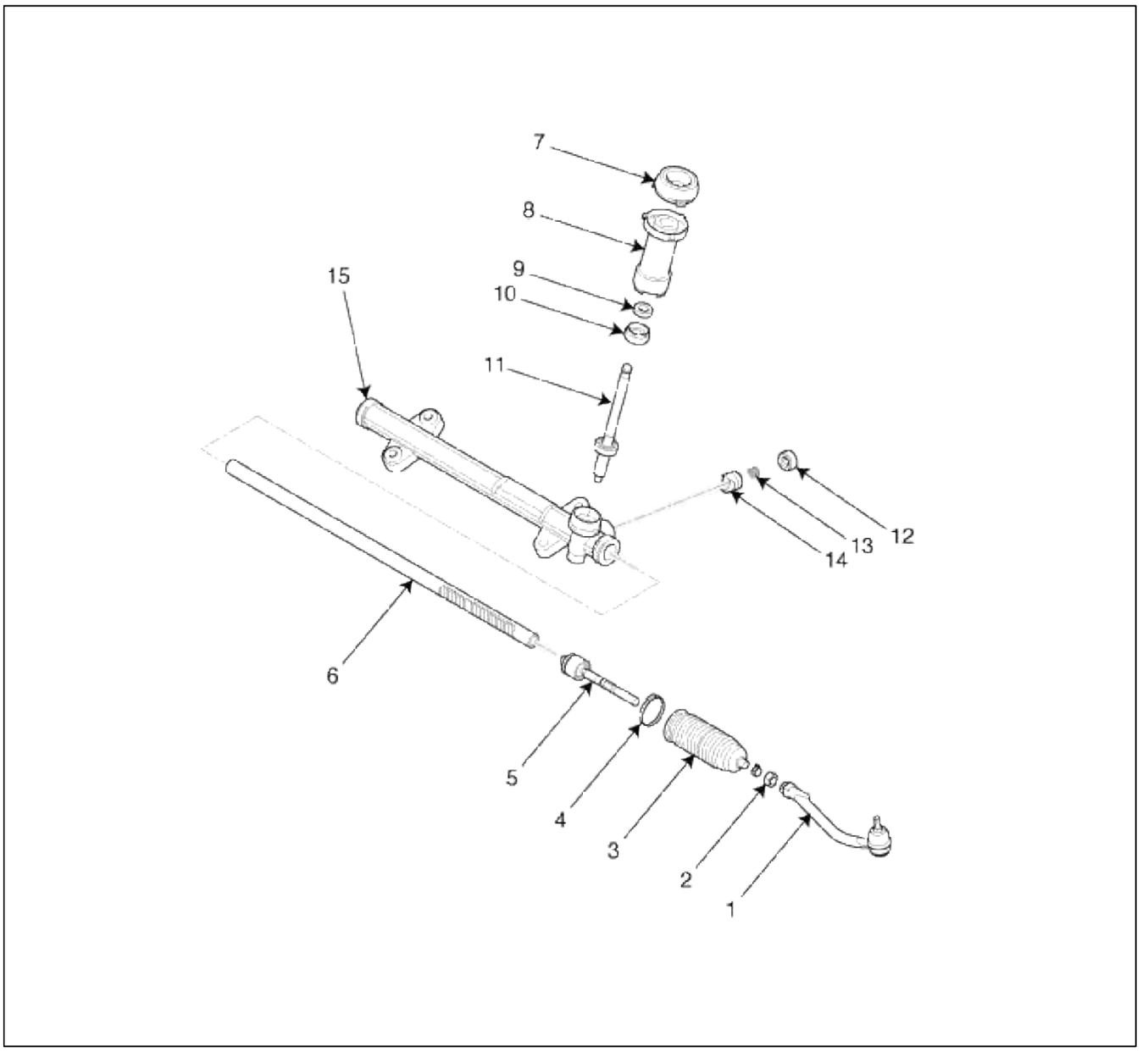
When installing the clock spring, refer the RT group to prevent the damage of clock spring inner cable.

Inspection

1. Check the steering column for damage and deformation.
2. Check the steering column for damage and deformation.
3. Check the join bearing for damage and wear.
4. Check the tilt bracket for damage and cracks.
5. Check the key lock assembly for proper operation and replace it if necessary.

Steering System > Electric Power Steering > Steering Gear box > Components and Components Location

Components



1. Tie rod end	6. Rack bar	11. Pinion assembly
2. Lock nut	7. Dust packing	12. Yoke plug
3. Bellows	8. Dust cap	13. Yoke spring
4. Bellows band	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

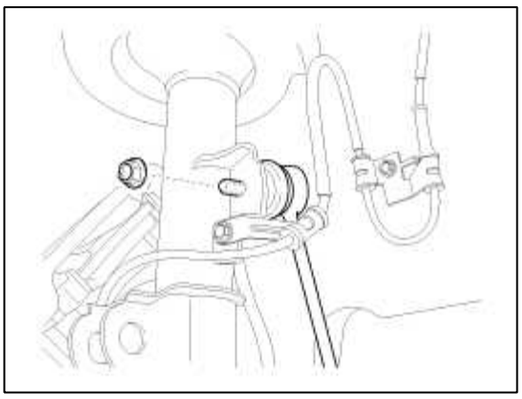
Replacement

1. Remove the front wheel & tire.

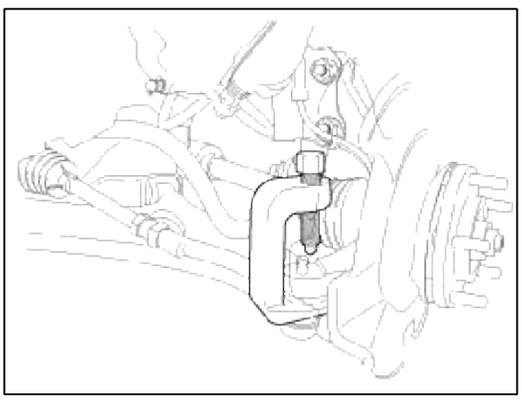
Tightening torque :
88.3 ~ 107.9 N.m (9.0 ~ 11.0 kgf.m, 65.1 ~ 79.6 lb-ft)

2. Disconnect the stabilizer link with the front strut assembly after loosening the nut.

Tightening torque :
98.1 ~ 117.7 N.m (10.0 ~ 12.0 kgf.m, 72.3 ~ 86.8 lb-ft)

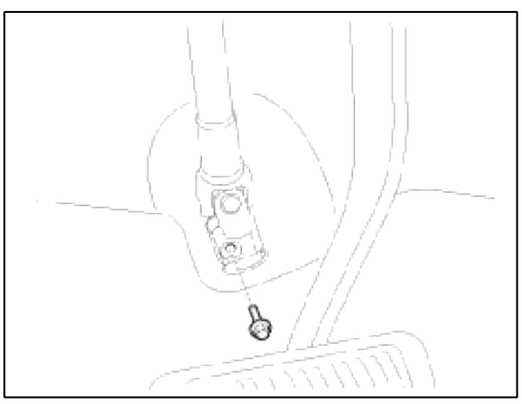


3. Disconnect the tie-rod end with the knuckle using a SST (09568-2J100).



4. Loosen the bolt and then disconnect the universal joint assembly from the pinion of the steering gear box.

Tightening torque :
29.4 ~ 34.3 N.m (3.0 ~ 3.5 kgf.m, 21.7 ~ 25.3 lb-ft)

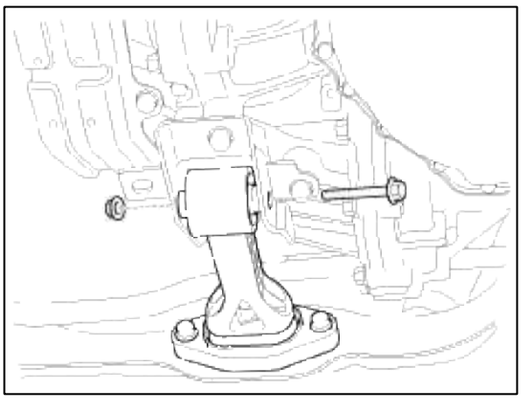


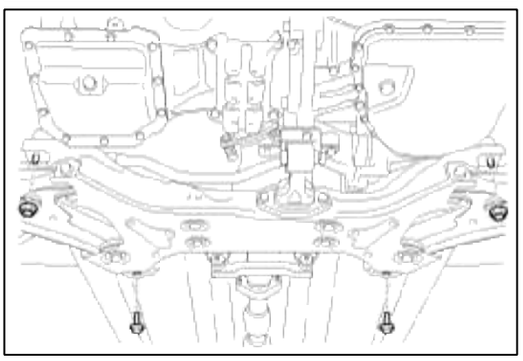
CAUTION

Keep the neutral-range to prevent the damage of the clock spring inner cable when you handlethe steering wheel.

5. Remove the cross member from the body by loosening the mounting bolts and nuts.

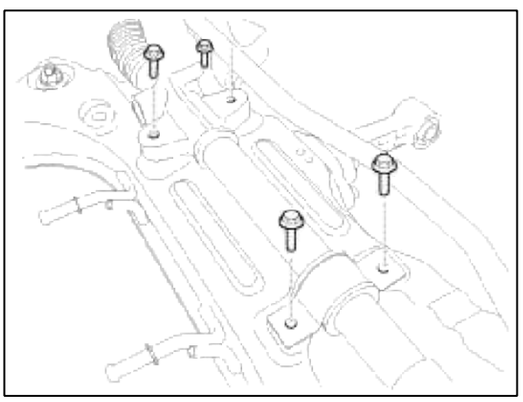
Tightening torque :
107.9 ~ 127.5 N.m (11.0 ~ 13.0 kgf.m, 79.6 ~ 94.0 lb-ft)





6. Remove steering gearbox from the cross member by loosening the bracket mounting bolts

Tightening torque :
58.8 ~ 78.5 N.m (6.0 ~ 8.0 kgf.m, 43.4 ~ 57.9 lb-ft)



7. Installation is the reverse of the removal.

SOUL(AM) > 2012 > G 1.6 GDI > Restraint

Restraint > General Information > General Information

General

The supplemental restraint system (SRS) is designed to supplement the seat belt to help reduce the risk or severity of injury to the driver and passenger by activating and deploying the driver, passenger, side airbag and belt pretensioner in certain frontal or side collisions.
The SRS (Airbag) consists of ; a driver side airbag module located in the center of the steering wheel, which contains the folded cushion and an inflator unit ; a passenger side airbag module located in the passenger side crash pad contains the folded cushion assembled with inflator unit ; side airbag modules located in the front seat contain the folded cushion and an inflator unit ; curtain airbag modules located inside of the headliner which contains folded cushions and inflator units. The impact sensing function of the SRSCM is carried out by electronic accelerometer that continuously measure the vehicle's acceleration and delivers a corresponding signal through amplifying and filtering circuitry to the microprocessor.

SRSCM (SRS Control Module)
SRSCM will detect front impact with front impact sensor, and side impact with side impact sensor, and determine airbag module deployment.

1. DC/DC converter: DC/DC converter in power supply unit includes up/down transformer converter, and provide ignition voltage for 2 front airbag ignition circuits and the internal operation voltage of the SRSCM. If the internal operation voltage is below critical value setting, it will perform resetting.
2. Back up power supply: SRSCM has separate back up power supply, that will supply deployment energy instantly in low voltage condition or upon power failure by front crash.
3. Self diagnosis: SRSCM will constantly monitor current SRS operation status and detect system failure while vehicle power supply is on, system failure may be checked with trouble codes using scan tool. (Hi- Scan)
4. Airbag warning lamp on: Upon detecting error, the module will transmit signal to SRSCM indicator lamp located at cluster. MIL lamp will indicate driver SRS error. Upon ignition key on, SRS lamp will turn on for about six seconds.
5. Trouble code registration: Upon error occurrence in system, SRSCM will store DTC corresponding to the error. DTC can be cleared only by Hi-Scan. However, if an internal fault code is logged or if a crash is recorded the fault clearing should not happen.
6. Self diagnostic connector: Data stored in SRSCM memory will be output to Hi-Scan or other external output devices through connector located below driver side crash pad.
7. Once airbag is deployed, SRSCM should not be used again but replaced.

Restraint > General Information > Specifications

Specification

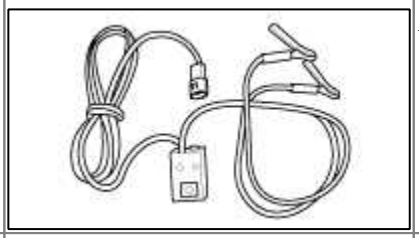
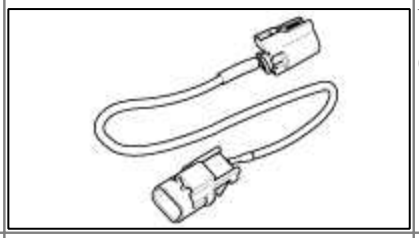
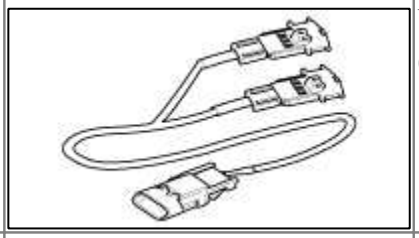
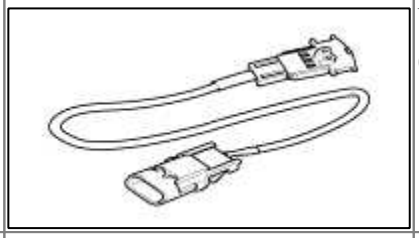
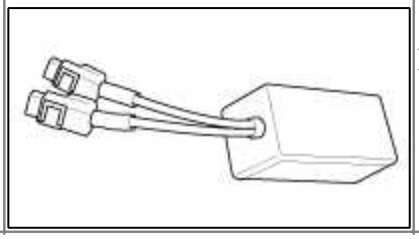
Item	Resistance (Ω)
Driver Airbag (DAB)	1.6 ~ 6.0
Passenger Airbag (PAB)	1.6 ~ 6.0
Side Airbag (SAB)	1.6 ~ 6.0
Curtain Airbag (CAB)	1.6 ~ 6.0
Seat Belt Pretensioner (BPT)	1.6 ~ 6.0

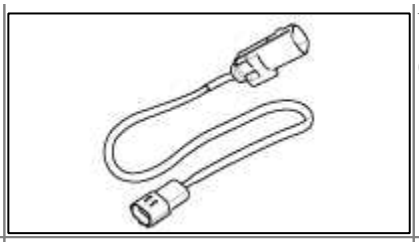
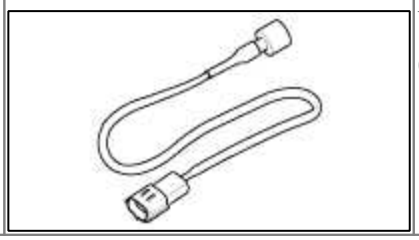
Tightening Torques

Item	Nm	kgf.m	lb-ft
Driver Airbag (DAB)	7.8 ~ 10.8	0.8 ~ 1.1	5.8 ~ 8.0
Passenger Airbag (PAB)	7.8 ~ 8.8	0.8 ~ 0.9	5.8 ~ 6.5
Curtain Airbag (CAB)	10.8 ~ 14.7	1.1 ~ 1.5	8.0 ~ 10.8
Side Airbag (SAB)	5.9 ~ 7.8	0.6 ~ 0.8	4.3 ~ 5.8
SRSCM	7.8 ~ 9.8	0.8 ~ 1.0	5.7 ~ 7.3
Front Impact Sensor (FIS) Mounting nut	7.8 ~ 9.8	0.8 ~ 1.0	5.7 ~ 7.3
Pressure Side Impact Sensor (PSIS) Mounting Screw	1.1 ~ 1.3	0.11 ~ 0.13	0.81 ~ 0.96
Side Impact Sensor (SIS) Mounting Bolt	7.8 ~ 9.8	0.8 ~ 1.0	5.7 ~ 7.3

Restraint > General Information > Special Service Tools

Special Service Tools

Tool(Number and Name)	Illustration	Use
Deployment tool 0957A-34100A		Airbag deployment tool
Deployment adapter 0957A-3F100		Use with deployment tool. (SAB)
Deployment adapter 0957A-38510		Use with deployment tool. (DAB, PAB)
Deployment adapter 0957A-38500		Use with deployment tool. (CAB, BPT, APT)
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, APT)

DAB : Driver Airbag
PAB : Passenger Airbag
SAB : Side Airbag
CAB : Curtain Airbag
BPT : Seat Belt Pretensioner
APT : Anchor Pretensioner

Restraint > General Information > General Safety Information and Caution

Precautions

General Precautions

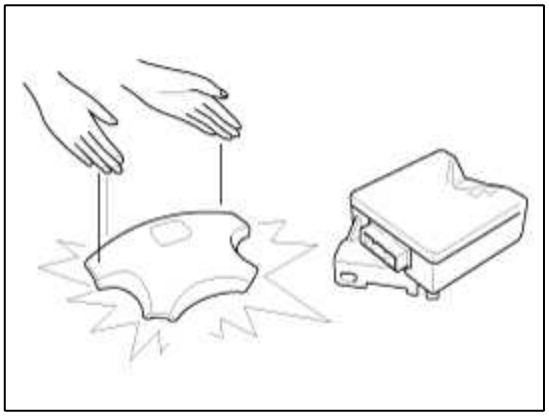
Please read the following precautions carefully before performing the airbag system service.
Observe the instructions described in this manual, or the airbags could accidentally deploy and cause damage or injuries.

- Except when performing electrical inspections, always turn the ignition switch OFF and disconnect the negative cable from the battery, and wait at least three minutes before beginning work.

NOTE

The contents in the memory are not erased even if the ignition switch is turned OFF or the battery cables are disconnected from the battery.

- Use the replacement parts which are manufactured to the same standards as the original parts and quality. Do not install used SRS parts from another vehicle. Use only new parts when making SRS repairs.
- Carefully inspect any SRS part before you install it. Do not install any part that shows signs of being dropped or improperly handled, such as dents, cracks or deformation.



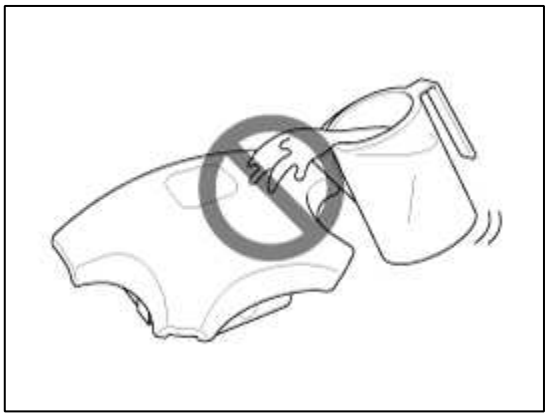
- Before removing any of the SRS parts (including the disconnection of the connectors), always disconnect the SRS connector.

Airbag Handling and Storage

Do not disassemble the airbags; it has no serviceable parts. Once an airbag has been deployed, it cannot be repaired or reused.

For temporary storage of the air bag during service, please observe the following precautions.

- Store the removed airbag with the pad surface up.
- Keep free from any oil, grease, detergent, or water to prevent damage to the airbag assembly.

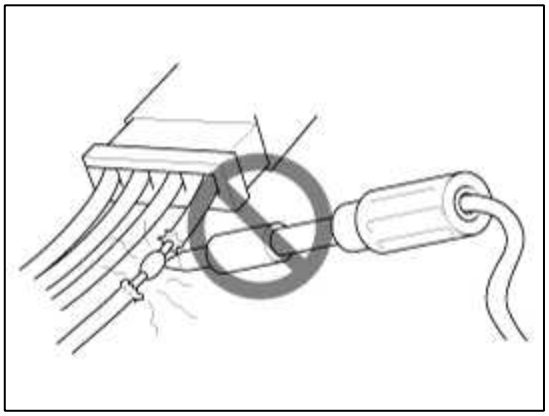


- Store the removed airbag on secure, flat surface away from any high heat source (exceeding 85 C/185 F).
- Never perform electrical inspections to the airbags, such as measuring resistance.
- Do not position yourself in front of the airbag assembly during removal, inspection, or replacement.
- Refer to the scrapping procedures for disposal of the damaged airbag.
- Be careful not to bump or impact the SRS unit or the side impact sensors or front impact sensors whenever the ignition switch is ON, wait at least three minutes after the ignition switch is turned OFF before begin work.
- During installation or replacement, be careful not to bump (by impact wrench, hammer, etc.) the area around the SRS unit and the side impact sensor and the front impact sensors. The airbags could accidentally deploy and cause damage or injury.
- Replace the front airbag module, SRSCM, FIS when deploying the front airbag. Replace the airbag wiring when the airbag wiring get damaged. Replace the side airbag module, the curtain airbag module, SRSCM, SIS when deploying the side airbag. Replace the airbag when the airbag wiring get damaged.
- After a collision in which the airbags or the side air bags did not deploy, inspect for any damage or any deformation on the SRS unit and the side impact sensors. If there is any damage, replace the SRS unit, the front impact sensor and/or the side impact sensors.
- Do not disassemble the SRS unit, the front impact sensor or the side impact sensors.
- Turn the ignition switch OFF, disconnect the battery negative cable and wait at least three minutes before beginning installation or replacement of the SRS unit.
- Be sure the SRS unit, the front impact sensor and side impact sensors are installed securely with the mounting bolts.
- Do not spill water or oil on the SRS unit, or the front impact sensor or the side impact sensors and keep them away from dust.
- Store the SRS unit, the front impact sensor and the side impact sensors in a cool (15 ~ 25 C/ 59 ~ 77 F) and dry (30 ~ 80% relative humidity, no moisture) area.

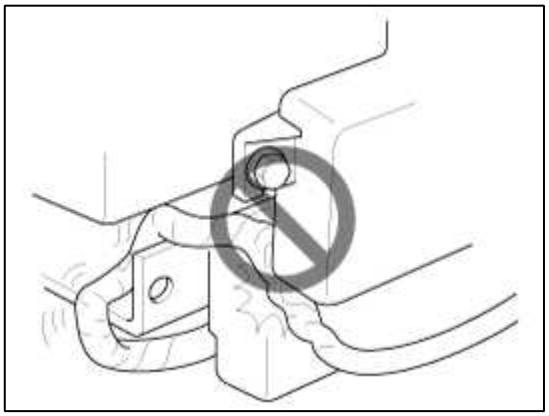
Wiring Precautions

SRS wiring can be identified by special yellow outer covering. Observe the instructions described in this section.

- Never attempt to modify, splice, or repair SRS wiring. If there is an open or damage in SRS wiring, replace the harness.



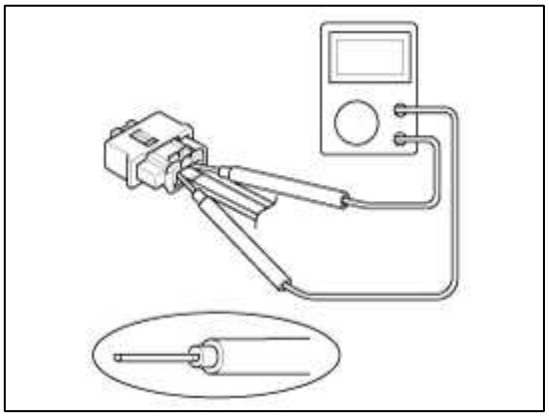
- Be sure to install the harness wires so that they are not pinched, or interfere with other parts.



- Make sure all SRS ground locations are clean, and grounds are securely fastened for optimum metal-to-metal contact. Poor grounding can cause intermittent problems that are difficult to diagnose.

Precautions for Electrical Inspections

- When using electrical test equipment, insert the probe of the tester into the wire side of the connector.
  Do not insert the probe of the tester into the terminal side of the connector, and do not tamper with the connector.



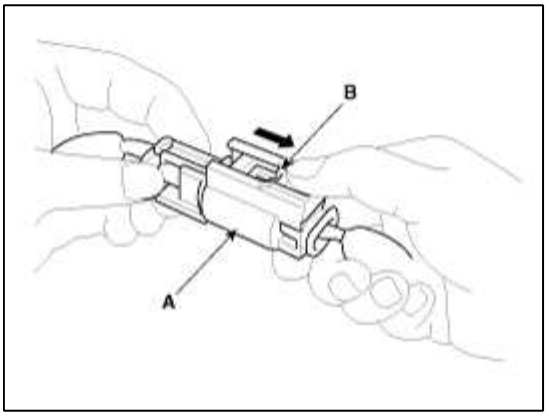
- Use a u-shaped probe. Do not insert the probe forcibly.
- Use specified service connectors for troubleshooting.
  Using improper tools could cause an error in inspection due to poor metal contact.

Spring-laded Lock Connector
Some SRS system connectors have a spring-loaded lock.

Airbag Connector

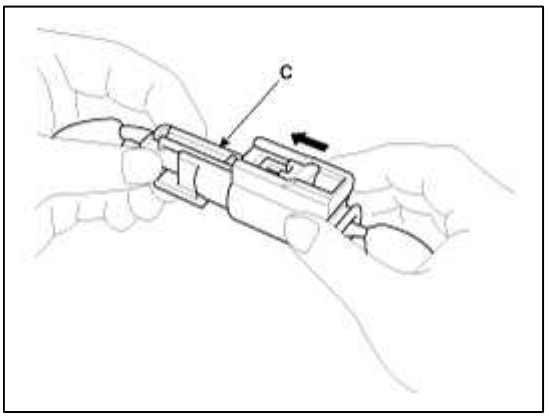
Disconnecting

To release the lock, pull the spring-loaded sleeve (A) and he slider (B), while holding the opposite half of the connector.
Pull the connector halves apart. Be sure to pull on the sleeve and not on the connector half.



Connecting

Hold both connector halves and press firmly until the projection(C) of the sleeve-side connector clicks to lock.



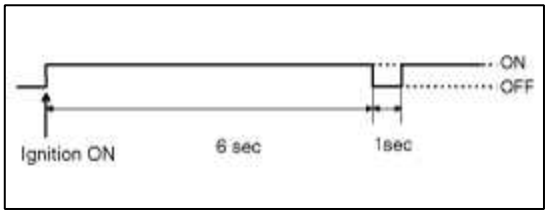
Restraint > General Information > Description and Operation

Warning Lamp Activation

Warning lamp behavior after ignition ON

As soon as the operating voltage is applied to the SRSCM ignition input, the SRSCM activates the warning lamp for a bulb check.
The lamp shall turn on for 6 seconds during the initialization phase and be turned off afterward.
However, in order to indicate the driver, the warning lamp shall turn on for 6 seconds and off for one second then on continuously after the operating voltage is applied if any active fault exists.
If the variant coding is not performed, the airbag warning lamp is periodically blinking (ON: 0.5sec., OFF: 0.5sec.).
If the variant coding is normally performed, the airbag warning lamp normally operates.

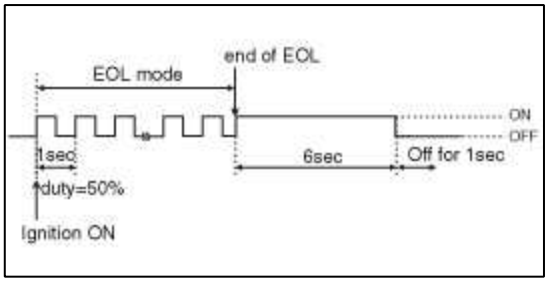
1. Active fault or historical fault counter is greater or equal to 10



2. Normal or historical fault counter is less than 10.



3. SRSCM Variant Coding not performed.



SRSCM Independent warning lamp activation

There are certain fault conditions in which the SRSCM cannot function and thus cannot control the operation of the standard warning lamp. In these cases, the standard warning lamp is directly activated by appropriate circuitry that operates independently of the SRSCM. These cases are:

1. Loss of battery supply to the SRSCM : warning lamp turned on continuously.
2. Loss of internal operating voltage : warning lamp turned on continuously.
3. Loss of Microprocessor operation : warning lamp turned on continuously.
4. SRSCM not connected : warning lamp turned on continuously through the shorting bar.

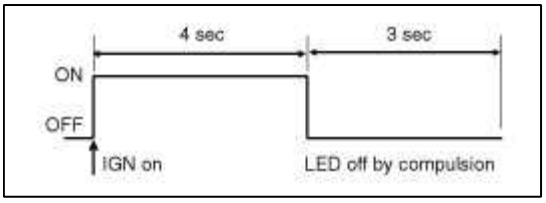
Telltale Lamp Activation

The Telltale Lamp indicates the Passenger Airbag(PAB) enabled and disabled status based on occupant status of passenger seat. If the passenger seat is empty or occupied with infant or child restraint system with 1 year old child, the Passenger Airbag is disabled and the Telltale Lamp is turned ON to inform the driver that the PAB is disabled. As soon as operating voltage is applied to the SRSCM ignition input, the SRSCM activates telltale lamp turn. Occupant status information and telltale ststus are as below table.

Occupant Status	Telltale Lamp	PAB
Empty	ON	Disabled
Infant or Child restraint system with 1 year old	ON	Disabled
Adult or Child age 12 and over*1	OFF	Enabled
Defect	OFF	Enabled

*1) When a smaller child than the same agesits in the front passenger seat, the system may recognize him/her as an infant depending on his/her physique or posture.

After ignition on, telltale lamp will turn on for 4 seconds and turn off for 3 seconds during the initialization phase and be turned off afterward until receipt of first valid suppression message from OCS system.



Restraint > General Information > Repair procedures

Component Replacement after Deployment

NOTE

Before doing any SRS repairs, use the GDS to check for DTCs. Refer to the Diagnostic Trouble Code list for repairing of the related DTCs.

When the front airbag(s) deployed after a collision, replace the following items.

- SRSCM
- Deployed airbag(s)
- Seat belt pretensioner(s)
- Front impact sensors
- SRS wiring harnesses
- Inspect the clock spring for heat damage.
  If any damage found, replace the clock spring.

When the side/curtain airbag(s) deployed after a collision, replace the following items.

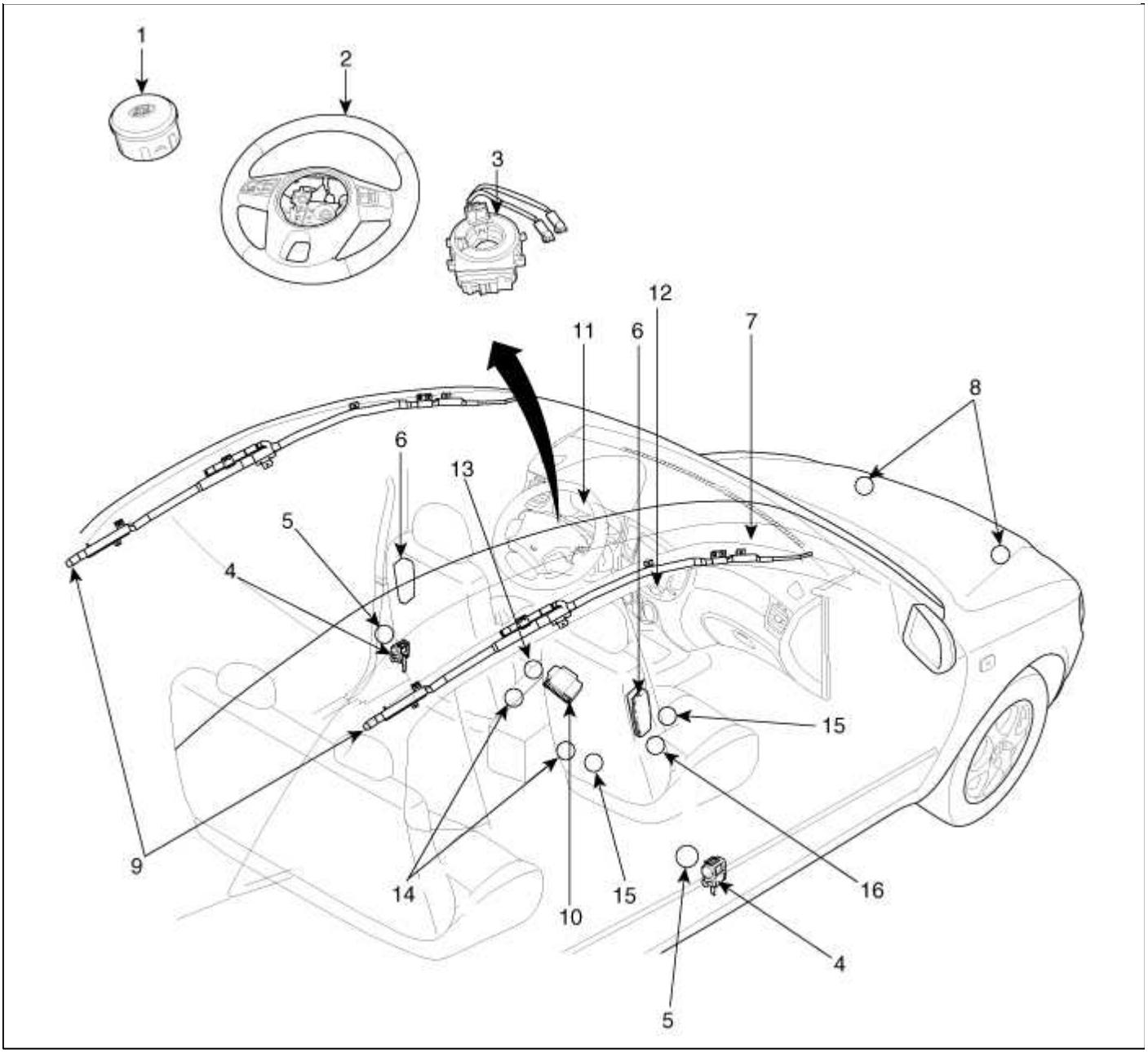
- SRSCM
- Deployed airbag(s)
- Side impact sensor(s) for the deployed side(s)
- SRS wiring harnesses

After the vehicle is completely repaired, confirm the SRS airbag system is OK.

- Turn the ignition switch ON, the SRS indicator should come on for about 6 seconds and then go off.

Restraint > General Information > Components and Components Location

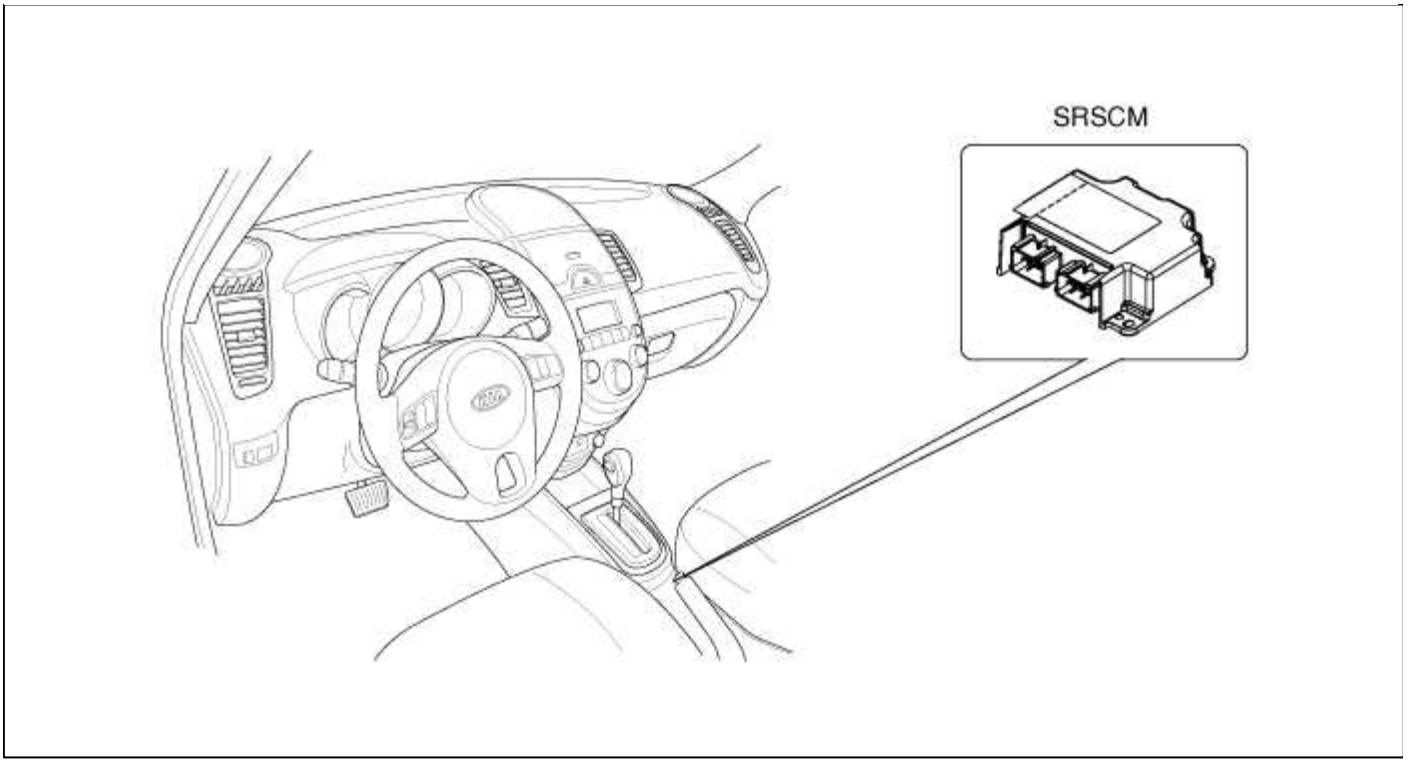
Components



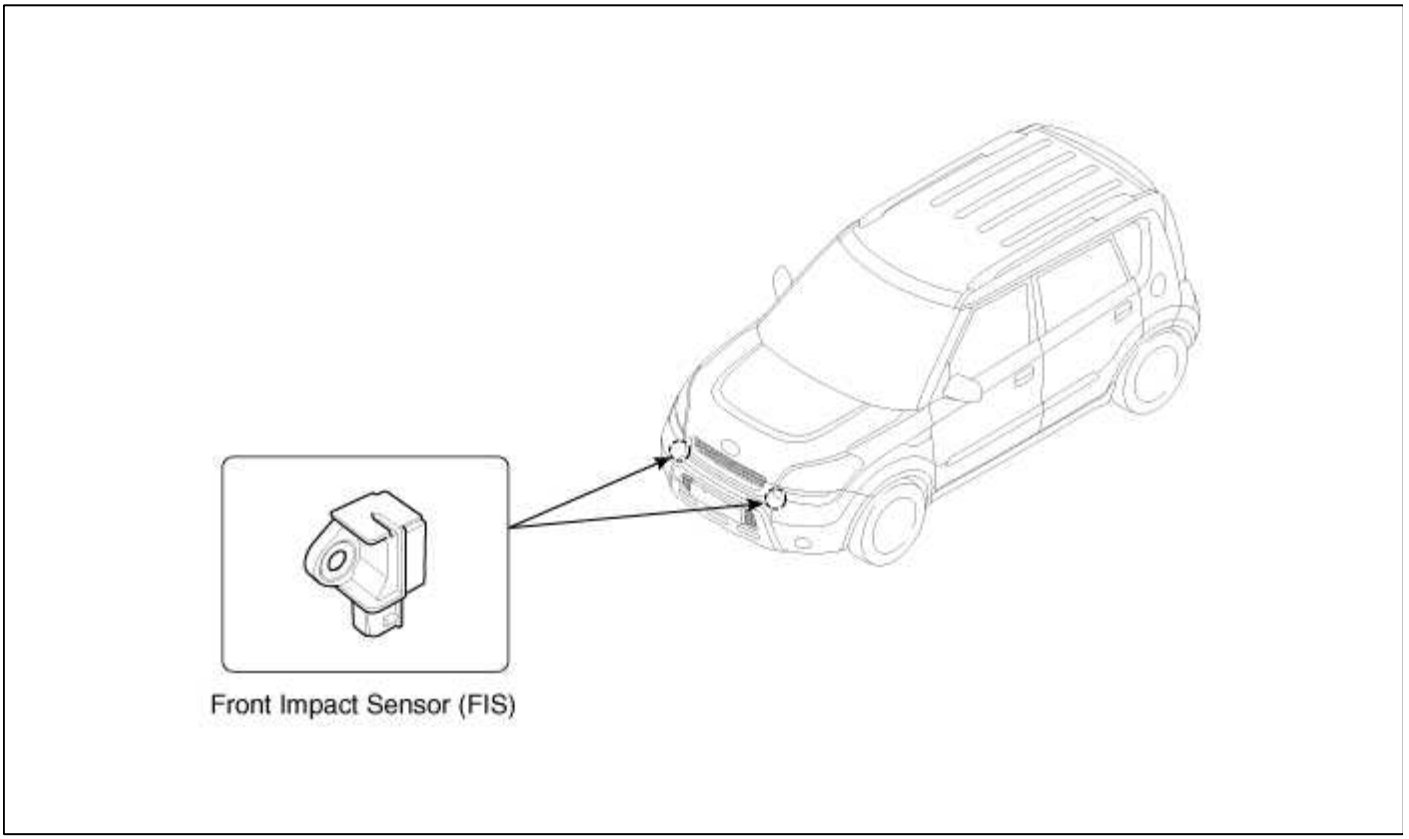
1. Driver Airbag (DAB)	9. Curtain Airbag (CAB)
2. Steering Wheel	10. Supplemental Restraint System Control Module(SRSCM)
3. Clock Spring	11. Airbag Warning Lamp
4. Seat Belt Pretensioner (BPT)	12. Telltale Lamp
5. Side Impact Sensor (SIS)	13. Seat Track Position Sensor(STPS)
6. Side Airbag (SAB)	14. Seat Belt Buckle Switch
7. Passenger Airbag (PAB)	15. Weight Sensor
8. Front Impact Sensor (FIS)	16. Weight Classification System(WCS) Module

Components Location

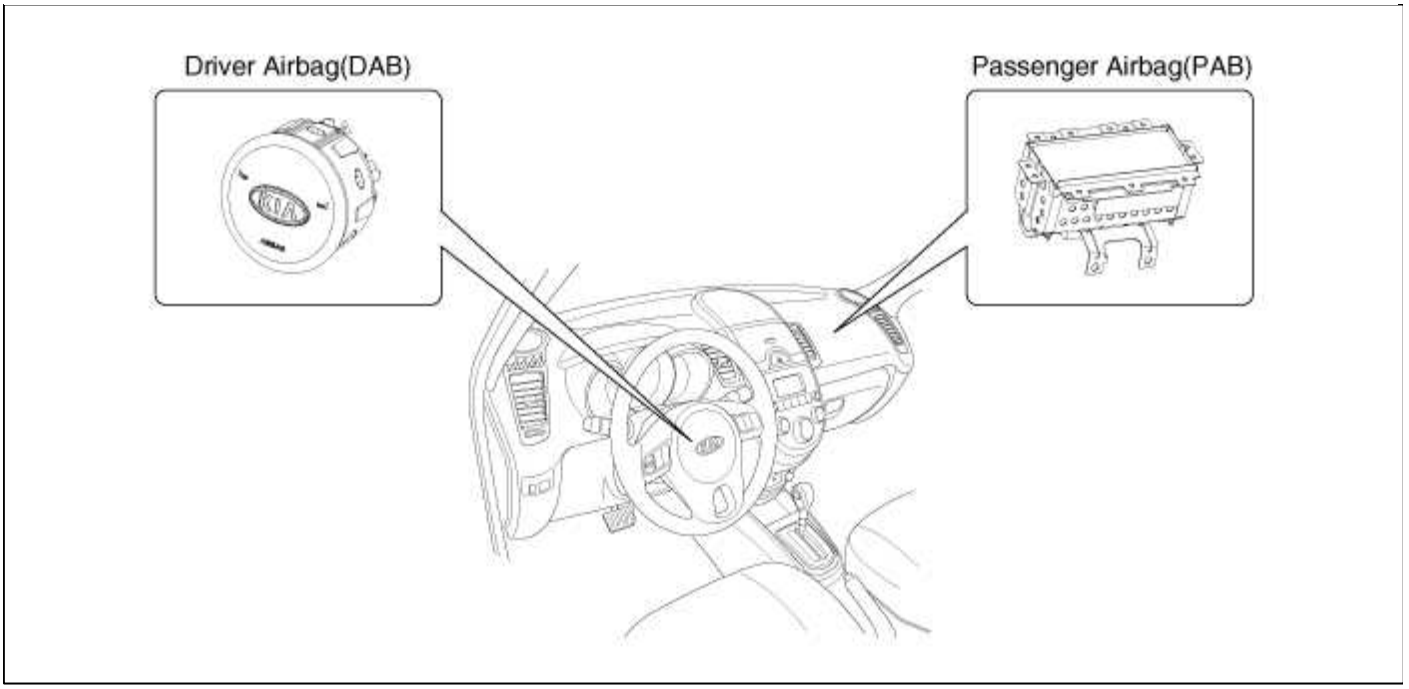
Supplemental Restraint System Control Module (SRSCM)



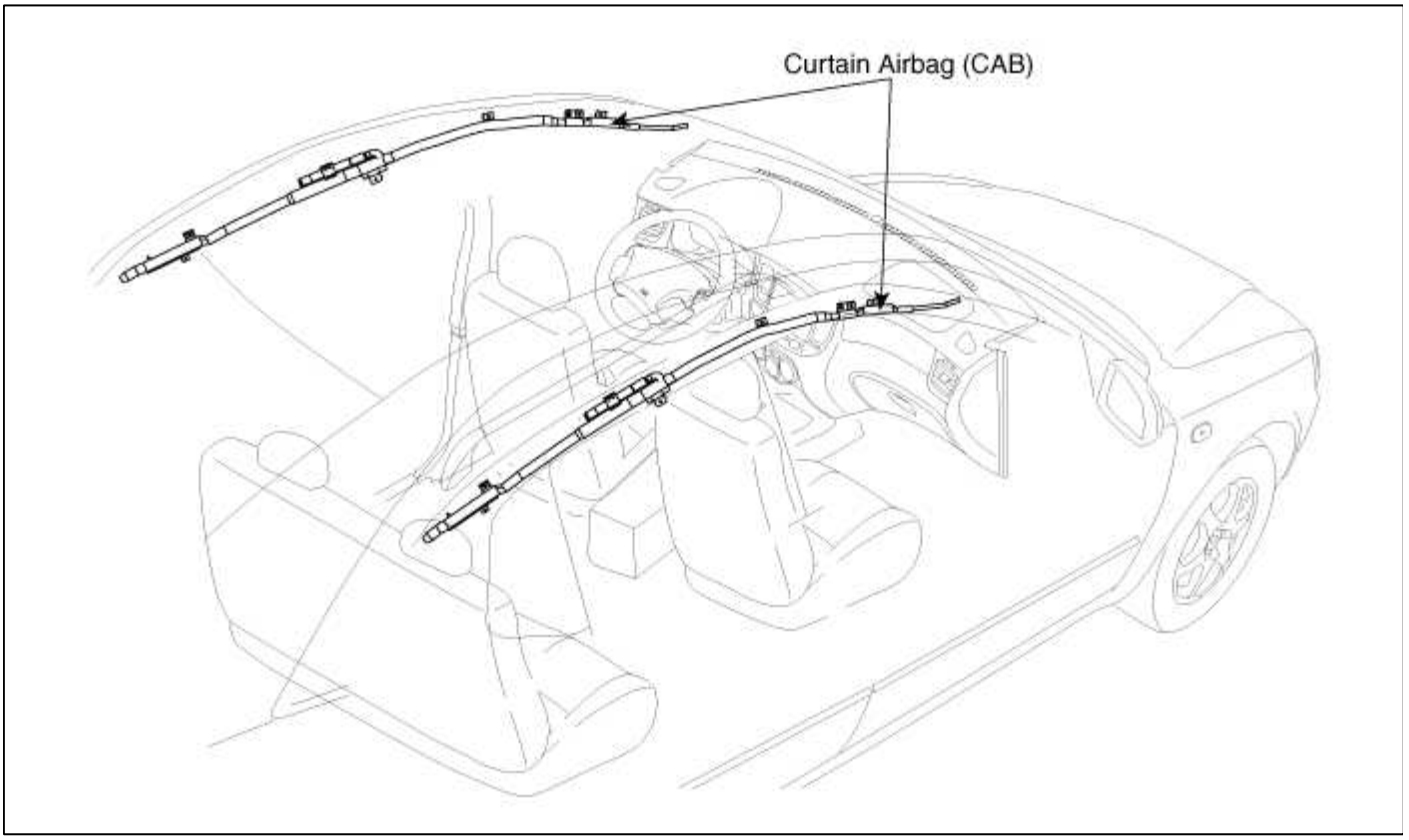
Front Impact Sensor (FIS)



Driver Airbag (DAB) / Passenger Airbag (PAB)



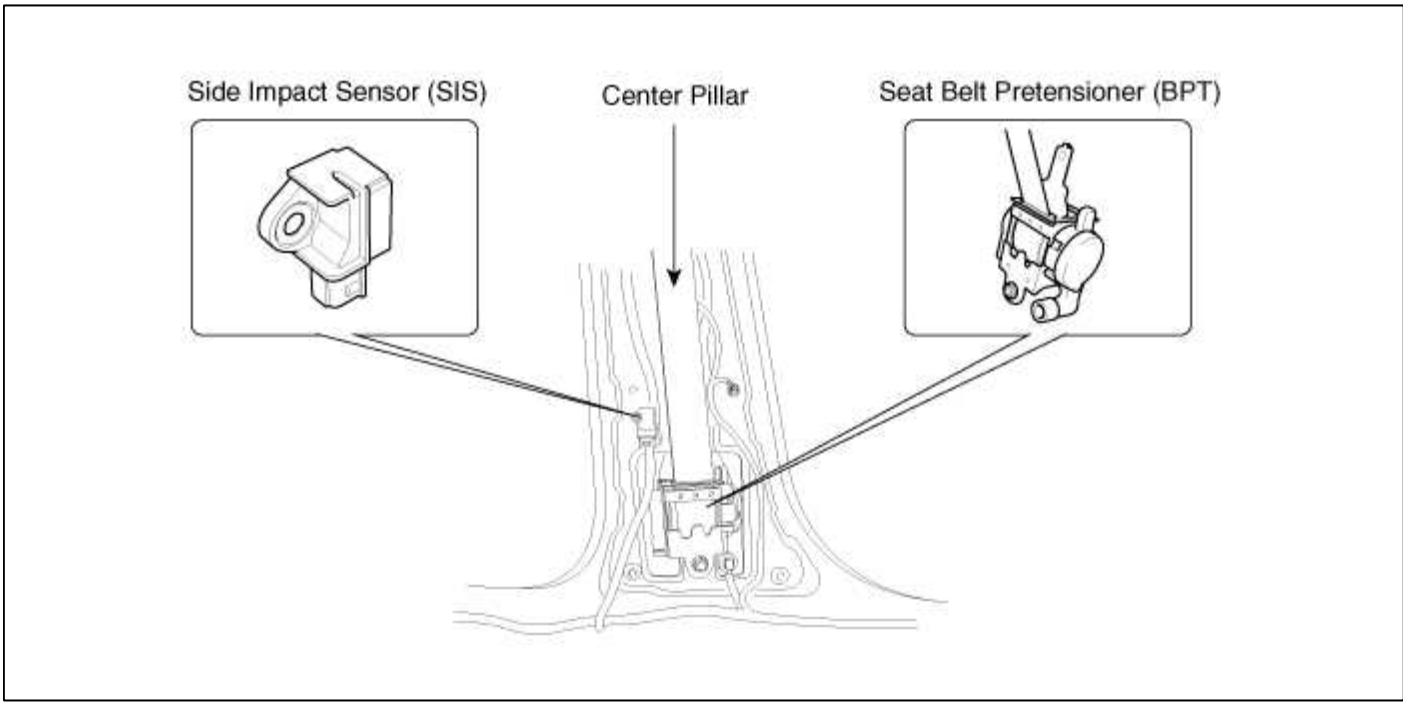
Curtain Airbag (CAB)



Side Airbag (SAB)



Seat Belt Pretensioner (BPT)/Side Impact Sensor (SIS)



Restraint > SRSCM > SRS Control Module (SRSCM) > Description and Operation

Description

The primary purpose of the SRSCM (Supplemental Restraints System Control Module) is to discriminate between an event that warrants restraint system deployment and an event that does not. The SRSCM must decide whether to deploy the restraint system or not. After determining that pretensioners and/or airbag deployment is required, the SRSCM must supply sufficient power to the pretensioners and airbag igniters to initiate deployment.

The SRSCM determines that an impact may require deployment of the pretensioners and airbags from data obtained from impact sensors and other components in conjunction with a safing function.

The SRSCM will not be ready to detect a crash or to activate the restraint system devices until the signals in the SRSCM circuitry stabilize.

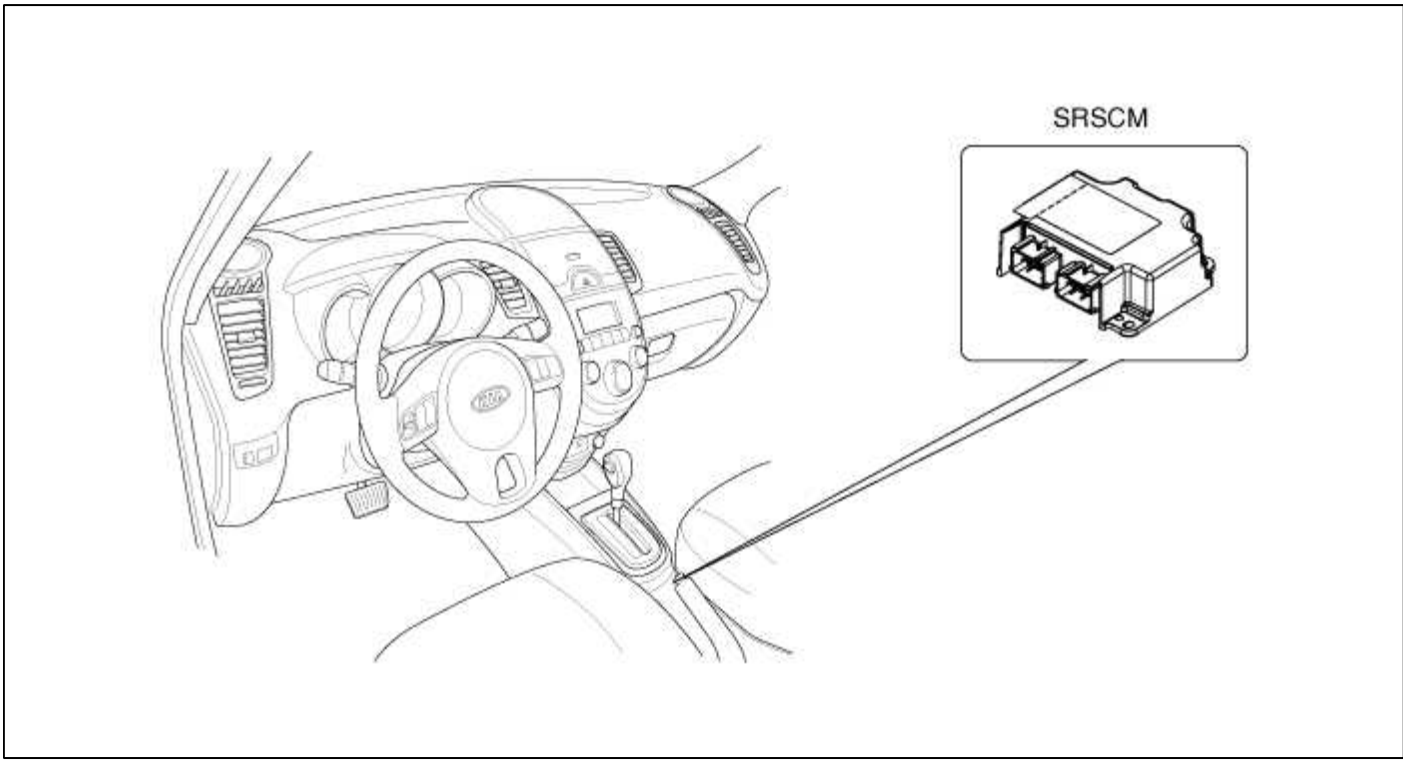
It is possible that the SRSCM could activate the safety restraint devices in approximately 7 seconds but is guaranteed to fully function after prove-out is completed.

The SRSCM must perform a diagnostic routine and light a system readiness indicator at key-on. The system must

perform a continuous diagnostic routine and provide fault annunciation through a warning lamp indicator in the event of fault detection. A serial diagnostic communication interface will be used to facilitate servicing of the restraint control system.

Restraint > SRSCM > SRS Control Module (SRSCM) > Components and Components Location

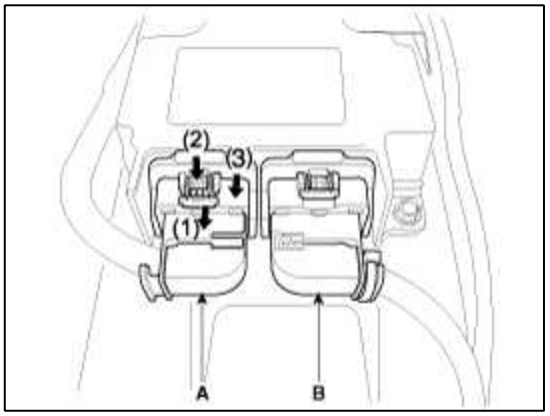
Components



Restraint > SRSCM > SRS Control Module (SRSCM) > Repair procedures

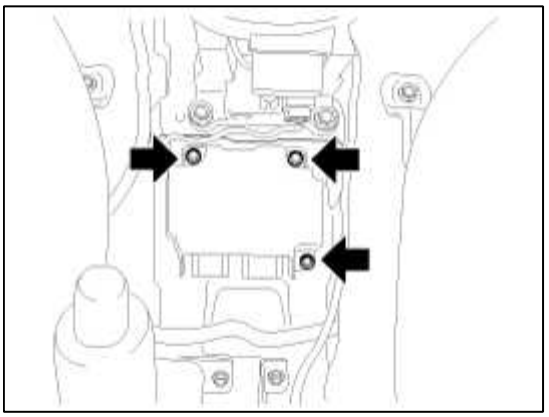
Removal

1. Remove the ignition key from the vehicle.
2. Disconnect the battery negative cable and wait for at least three minutes before beginning work.
3. Disconnect the DAB, PAB, SAB, CAB and BPT connectors.
4. Remove the floor console. (Refer to the Body group - console)
5. Pull the lock (1) forward. Pull the lever (3) after pressing the lever lock (2). Disconnect the airbag system control module (SRSCM) connector (A) and (B).



6. Disconnect the SRSCM harness connector(A) and (B) from the SRSCM.

7. Remove the SRSCM mounting bolts(3EA) from the SRSCM, then remove the SRSCM.



Installation

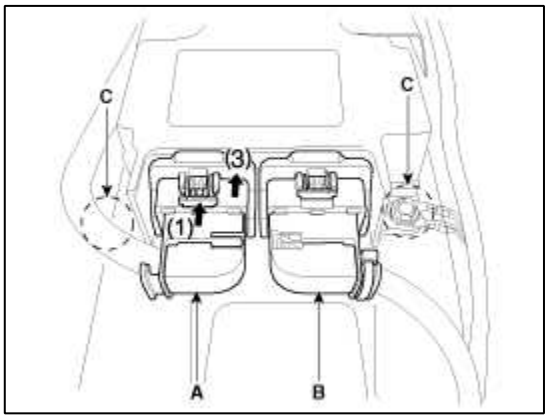
1. Remove the ignition key from the vehicle.
2. Disconnect the battery negative cable and wait for at least three minutes before beginning work.
3. Install the SRSCM with the SRSCM mounting bolts.

Tightening torque (SRSCM Mounting Bolt)
: 7.8 ~ 9.8 Nm (0.8 ~ 1.0 kgf.m, 5.7 ~ 7.3 lb.ft)

NOTE

Use new mounting bolts when replacing the SRSCM after a collision.

4. Connect the SRSCM connector (A) and (B) by pushing the lever (3) and lock (1) completely.



NOTE

When installing the airbag wiring harness, ground points(C) must be installed.

5. Install the floor console. (Refer to the Body group - console)
6. Connect the DAB, PAB, SAB, CAB and BPT connectors.
7. Reconnect the battery negative cable.

8. After installing the SRSCM, confirm proper system operation:
   A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

Variant coding

After replacing the SRSCM with a new one, MUST perform the “Variant Coding” procedure.

NOTE

1. On SRSCM variant coding mode, the airbag warning lamp is periodically blinking (ON: 0.5sec., OFF: 0.5sec.) until the coding is normally completed.
2. If the variant coding is failed, DTC B1762 (ACU Coding Error) will be displayed and the warning lamp will be turned on.
   In this case, perform the variant coding procedure again after confirming the cause in “DTC Fault State Information”.
   Variant Coding can be performed up to 255 times, but if the number of coding work exceeds 255 times, DTC B1683 (Exceed Maximum coding Number) will be displayed and SRSCM must be replaced.
3. If the battery voltage is low (less than 9V) before performing the Variant Coding, DTC B1762 will be displayed only. In this case, charge the battery before anything else, and then perform the variant coding procedure.
   Because, although Variant Coding is normally performed, DTC B1762 and low battery are displayed.

Variant coding Procedure

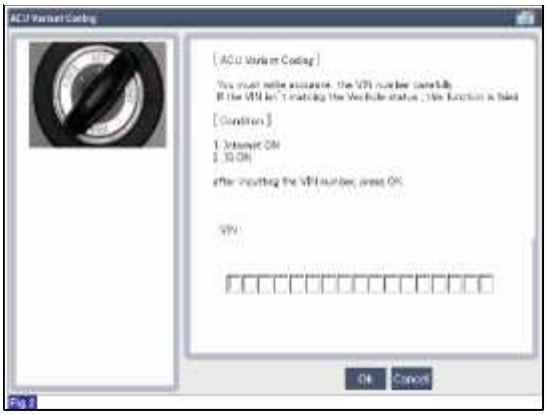
■ On-Line type on GDS

1. Ignition "OFF", connect scantool.
2. Ignition "ON" & Engine "OFF" select vehicle name and airbag system.
3. Select Variant coding mode.
4. Follow steps on the screen as below.

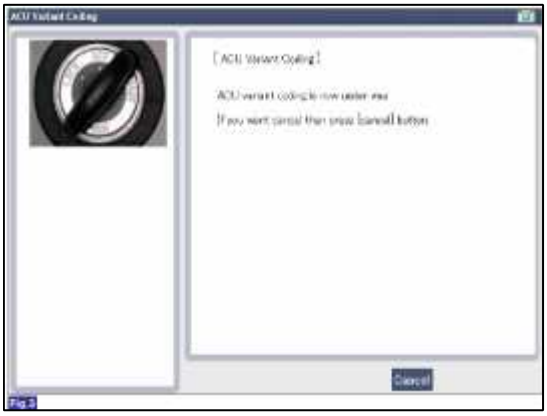
1) Initial ACU Variant Coding screen



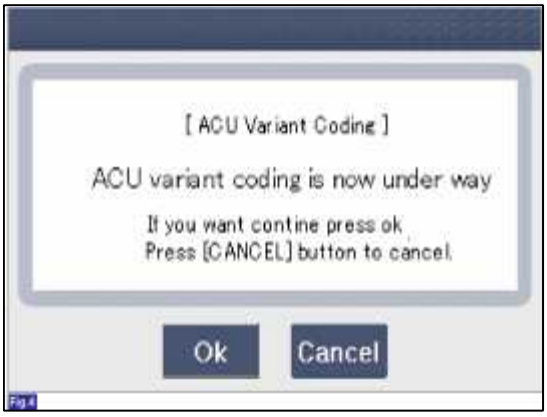
2) VIN Code entering screen



3) Variant coding's proceeding screen-1



4) Variant coding's proceeding screen-2



5) Variant coding is completed



NOTE

1) Screen of Retrying the Variant coding after finishing variant coding

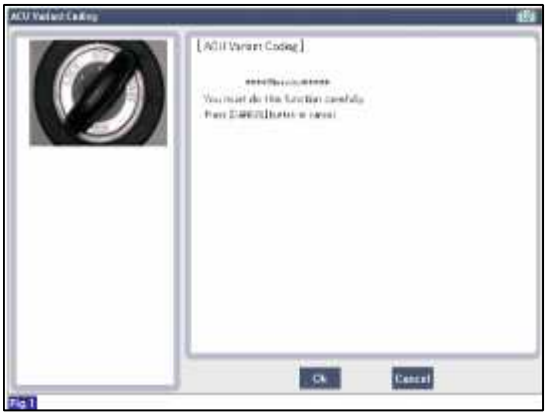


2) Screen of communication failure



■ Off-line type on GDS (This can be used when not connecting to internet)

1) Initial ACU Variant Coding screen



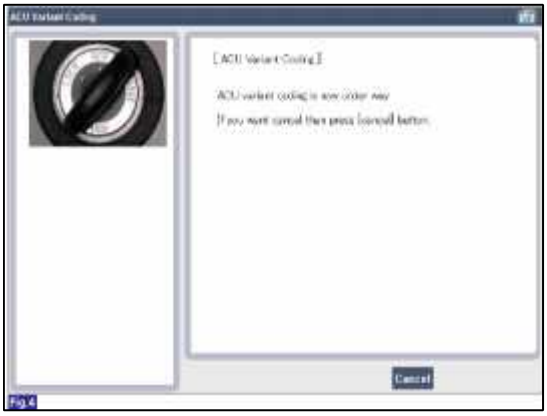
2) ACU CODING Code entering screen



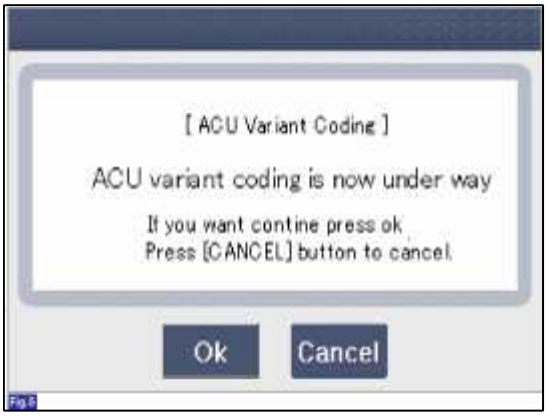
3) Screen of rechecking ACU CODING code's entering



4) Variant coding's proceeding screen-1



5) Variant coding's proceeding screen-2



6) Variant coding is completed



NOTE

1) Screen of Retrying the Variant coding after finishing variant coding



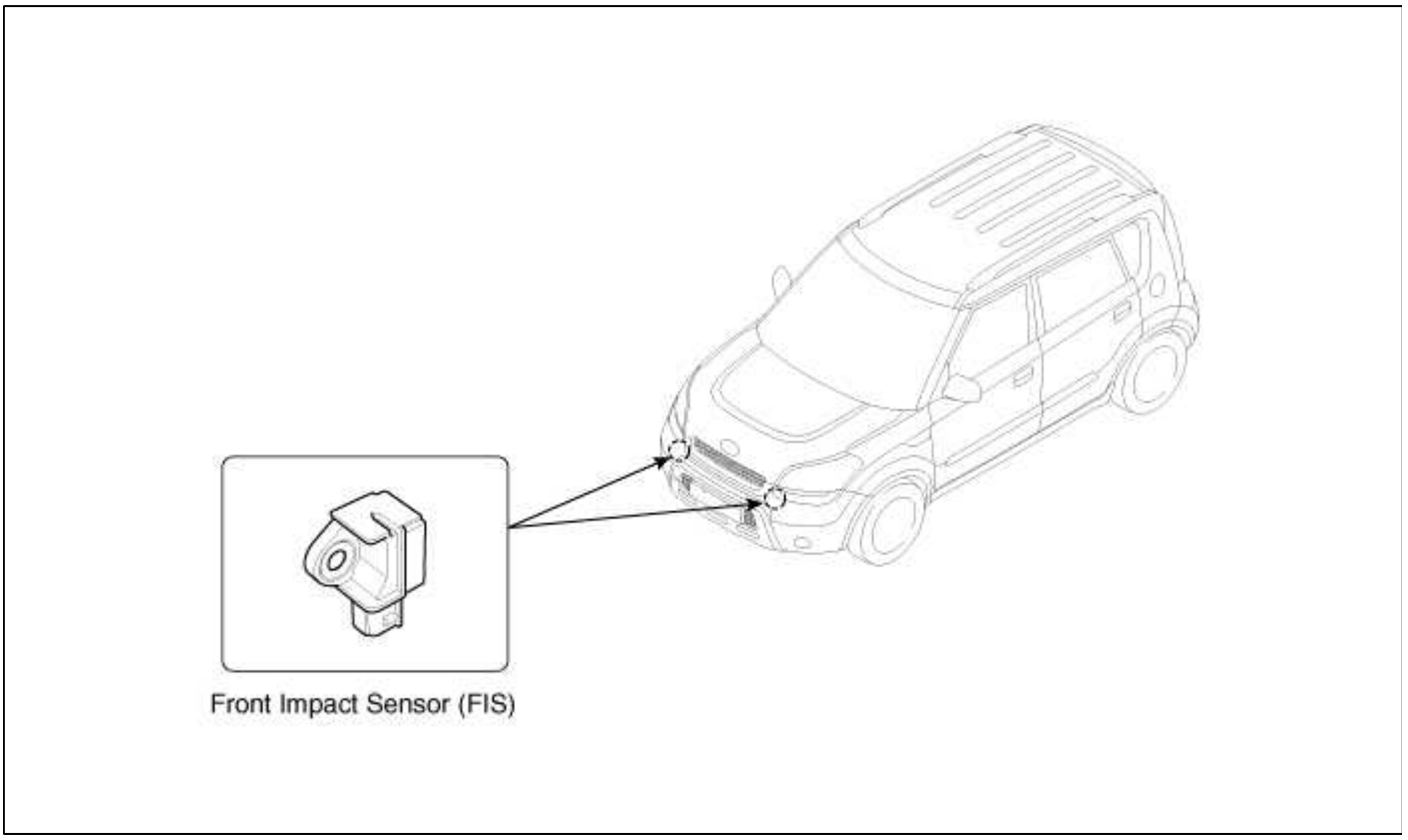
Restraint > SRSCM > Front Impact Sensor (FIS) > Description and Operation

Description

The Front Impact Sensor (FIS) is installed in the Front End Module (FEM). They are remote sensors that detect acceleration due to a collision at its mounting location. The primary purpose of the Front Impact Sensor (FIS) is to provide an indication of a collision. The Front Impact Sensor (FIS) sends acceleration data to the SRSCM.

Restraint > SRSCM > Front Impact Sensor (FIS) > Components and Components Location

Components



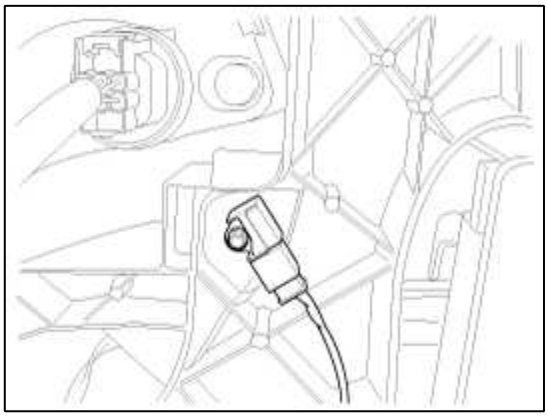
Restraint > SRSCM > Front Impact Sensor (FIS) > Repair procedures

Removal

CAUTION

- Removal of the airbag must be performed according to the precautions/ procedures described previously.
- Before disconnecting the front impact sensor connector, disconnect the front airbag connector(s).
- Do not turn the ignition switch ON and do not connect the battery cable while replacing the front impact sensor.

1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
2. Disconnect the Front Impact Sensor connector.
3. Remove the Front Impact Sensor mounting bolt.



4. Remove the Front Impact Sensor.

Installation

CAUTION

- Do not turn the ignition switch ON and do not contact the battery cable while replacing the front impact sensor.

1. Install the new Front Impact Sensor.
2. Tighten the Front Impact Sensor mounting bolt.

Tightening torque
: 7.8 ~ 9.8 Nm (0.8 ~ 1.0 kgf.m, 5.7 ~ 7.3 lb.ft)

3. Connect the Front Impact Sensor connector.
4. Reconnect the battery negative cable.
5. After installing the Front Impact Sensor, confirm proper system operation:
   A. Turn the ignition switch ON the SRS indicator light should be turned on for about six seconds and then go off.

Restraint > SRSCM > Side Impact Sensor (SIS) > Description and Operation

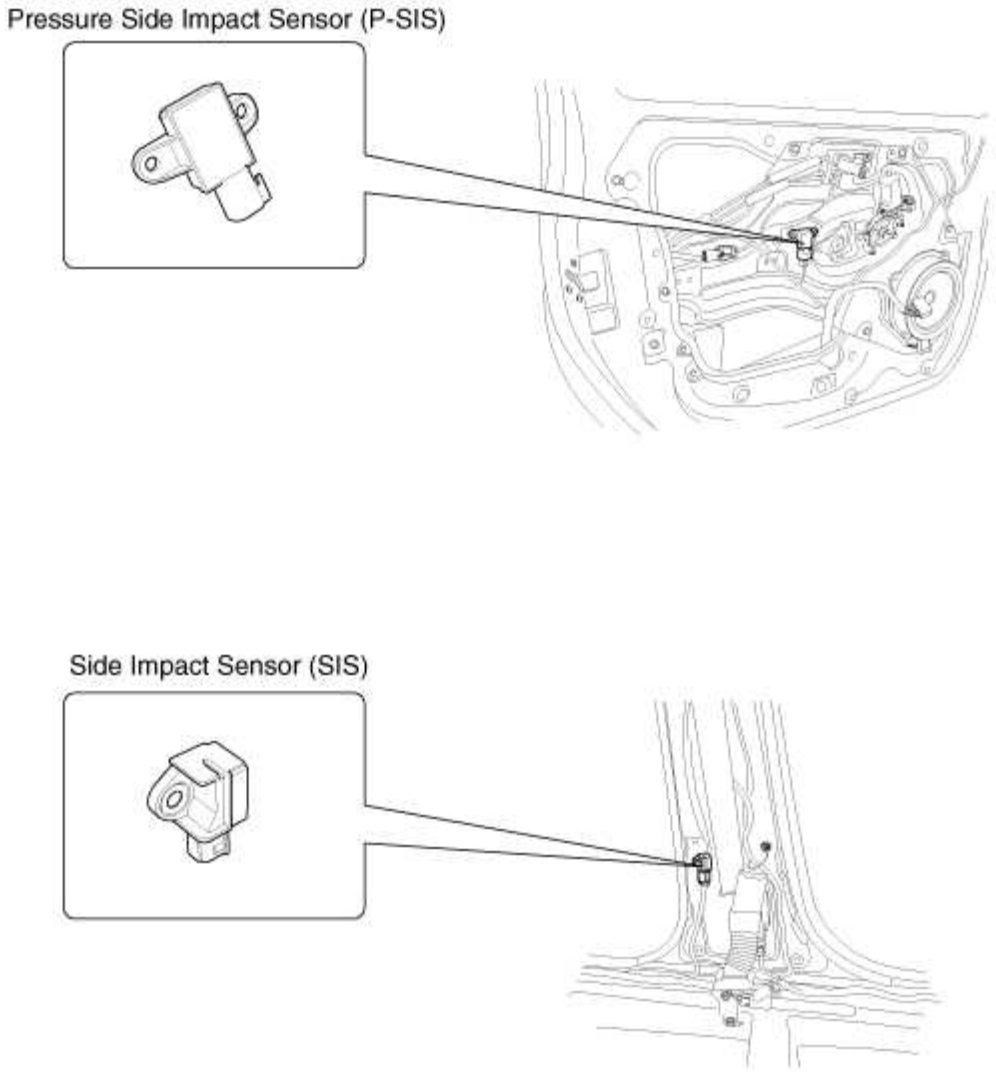
Description

Side Impact Sensor (SIS) system consists of two P-SIS which are installed at each center of the front door module (LH and RH) and two SIS which are installed at each center pillar nearby (LH and RH).

Side Pressure Sensor is also called P-SIS because it detects pressure due to collision at its mounting location.
Side Impact Sensor is also called A-SIS because it detects acceleration.
SRSCM decides deployment of the airbag and the time of deployment through the collision signal of the SIS when the collision occurred.

Restraint > SRSCM > Side Impact Sensor (SIS) > Components and Components Location

Components



Restraint > SRSCM > Side Impact Sensor (SIS) > Repair procedures

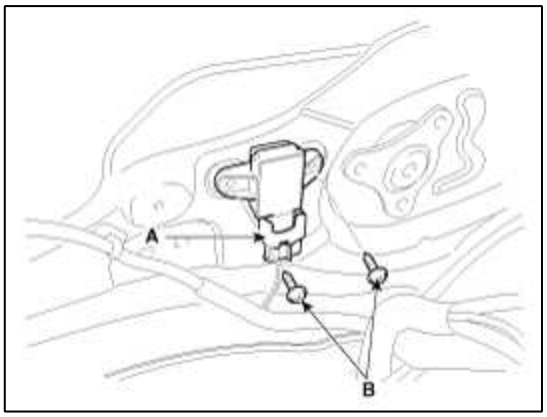
Removal

Pressure Side Impact Sensor

CAUTION

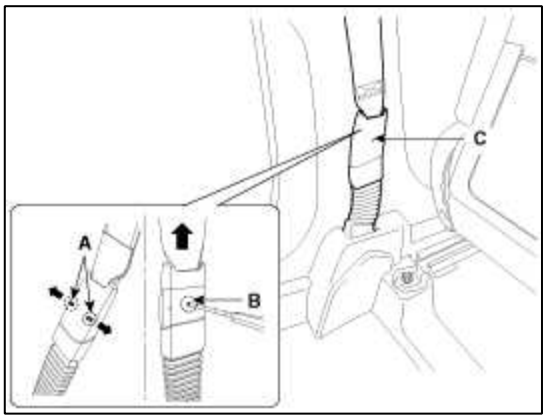
- Removal of the airbag must be performed according to the precautions/procedures described previously.
- Before disconnecting the side impact sensor connector(s), disconnect the side airbag connector(s).
- Do not turn the ignition switch ON and do not connect the battery cable while replacing the side impact sensor.

1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
2. Remove the front door trim.
   (Refer to the Body group - "Front door")
3. Disconnect the pressure side impact sensor connector (A) and remove the pressure side impact sensor mounting screws (B).



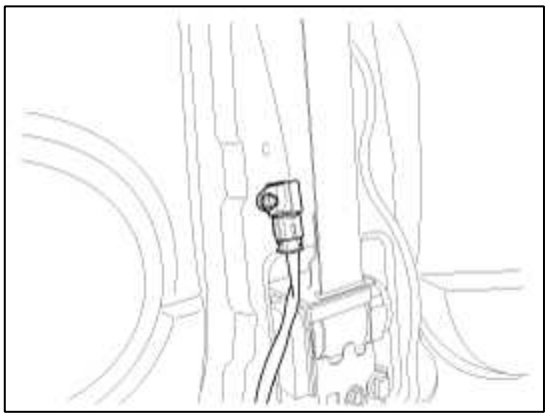
Side Impact Sensor

1. Disconnect the battery negative cable and wait for at least three minutes before beginning work.
2. To remove the seat belt anchor pretensioner, keep on pushing the lock pin (A) as arrow direction. And then remove the seat belt after pushing the lock pin (B).



3. Remove the door scuff trim.
   (Refer to the Body group - "Interior trim")
4. Remove the center pillar trim.
   (Refer to the Body group - "Interior trim")
5. Disconnect the side impact sensor connector.

6. Loosen the side impact sensor mounting bolt and remove the side impact sensor.



Installation

Pressure Side Impact Sensor

1. Install the new pressure side impact sensor with the screws then connect the pressure side impact sensor connector.

Tightening torque :
1.1 ~ 1.3 N.m (0.11 ~ 0.13 kgf.m, 0.81 ~ 0.96 lb-ft)

CAUTION

- Use the specified screws.

2. Install the front door trim.
(Refer to the Body group - "Front door)"
3. Reconnect the battery negative cable.
4. After installing the pressure 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.

CAUTION

- You must comply with the specified tightening torques with the tool specified because Pressure – Side Impact Sensors (P-SIS) may be broken or POP-NUT may be rotated.
- Problems may occur in the durability of P-SIS or the impact sensing performance may depreciate if POP-NUT is rotated.
- The door module must not be modified because SRSCM judges an impact through the pressure sensor in the door module.

Side Impact Sensor

CAUTION

- Do not turn the ignition switch ON and do not connect the battery cable while replacing the side impact sensor.

1. Install the new side impact sensor with the bolt then connect the side impact sensor connector.

Tightening torque:
7.8 ~ 9.8 N.m (0.8 ~ 1.0 kgf.m, 5.7 ~ 7.3 lb-ft)

2. Install the center pillar trim.
(Refer to the Body group - "Interior tirm")
3. Install the door scuff trim.
(Refer to the Body group - "Interior tirm")
4. Insert the seat belt to the anchor pretensioner.

NOTE

Make sure the lock pin is connected in properly.

5. Reconnect the battery negative cable.
6. After installing the Side Impact Sensor, confirm proper system operation:
   A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

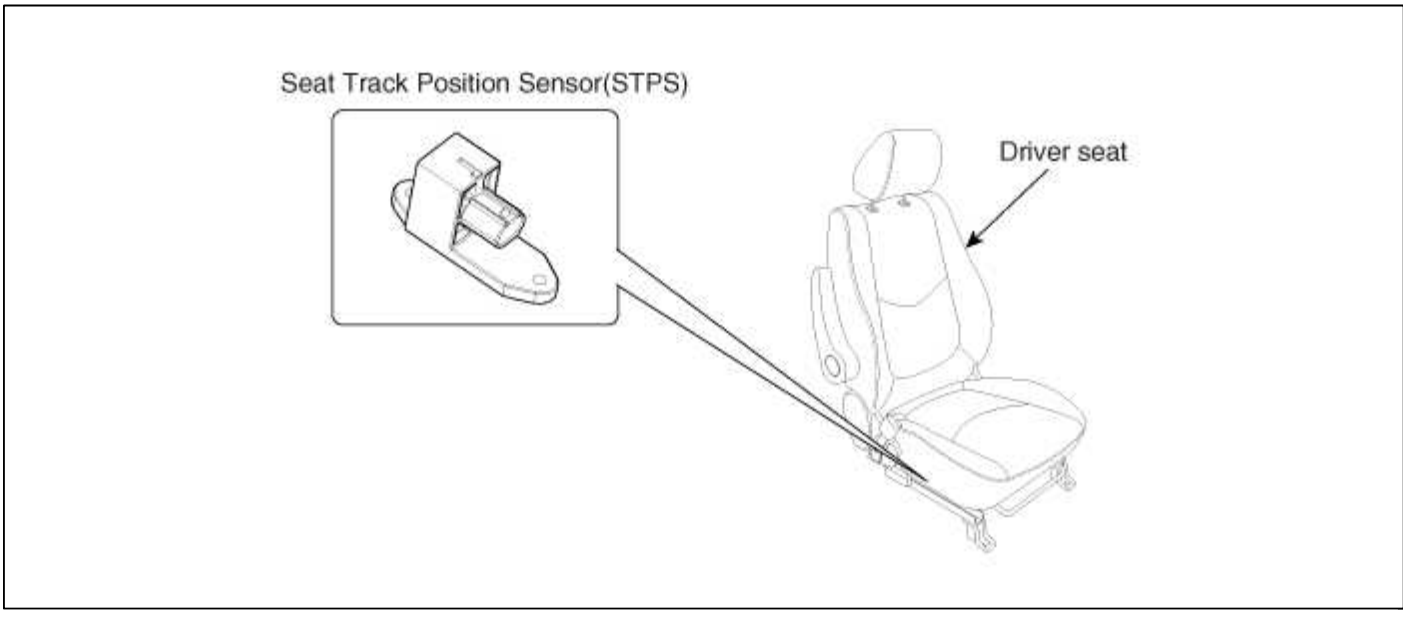
Restraint > SRSCM > Seat Track Position Sensor (STPS) > Description and Operation

Description

The STPS operates via a non-contacting magnetic proximity sensing device combined with a simple electronic circuit resulting in the ability of producing two separate and distinct logic level signals.
The STPS output signal is altered by the proximity of a separate ferro-magnetic shunt, which is linked via the seat track. The logic signal produced is the result of the proximity device being activated or deactivated.
When the seat is in the forward position zone of the track, the sensor gives a low current (prohibit) signal. When the seat is in the rear positon zone of the track, it gives a high current (enable) signal.

Restraint > SRSCM > Seat Track Position Sensor (STPS) > Components and Components Location

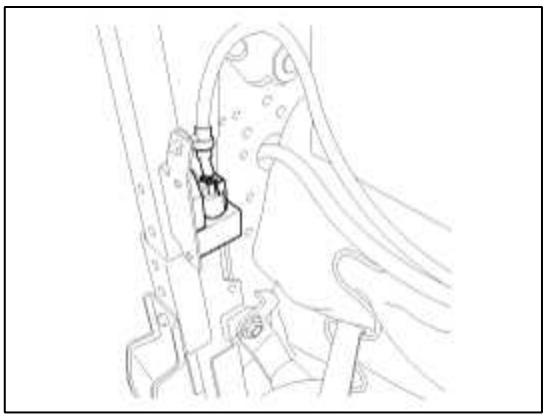
Components



Restraint > SRSCM > Seat Track Position Sensor (STPS) > Repair procedures

Removal

1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
2. Remove the front seat assembly. (Refer to BD group)
3. Loosen the two STPS screws, then remove the STPS after disconnecting the STPS connector.



Installation

CAUTION

Be sure to install the harness wires not to be pinched or interfered with other parts.

1. Remove the ignition key from the vehicle.
2. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
3. Install the STPS with two screws.
4. Install the front seat assembly. (Refer to BD group)
5. Reconnect the battery negative cable.
6. After installing the Seat Track Position Sensor, confirm proper system operation:
   Turn the ignition switch ON, the SRS indicator should be turned on for about six seconds and then go off.

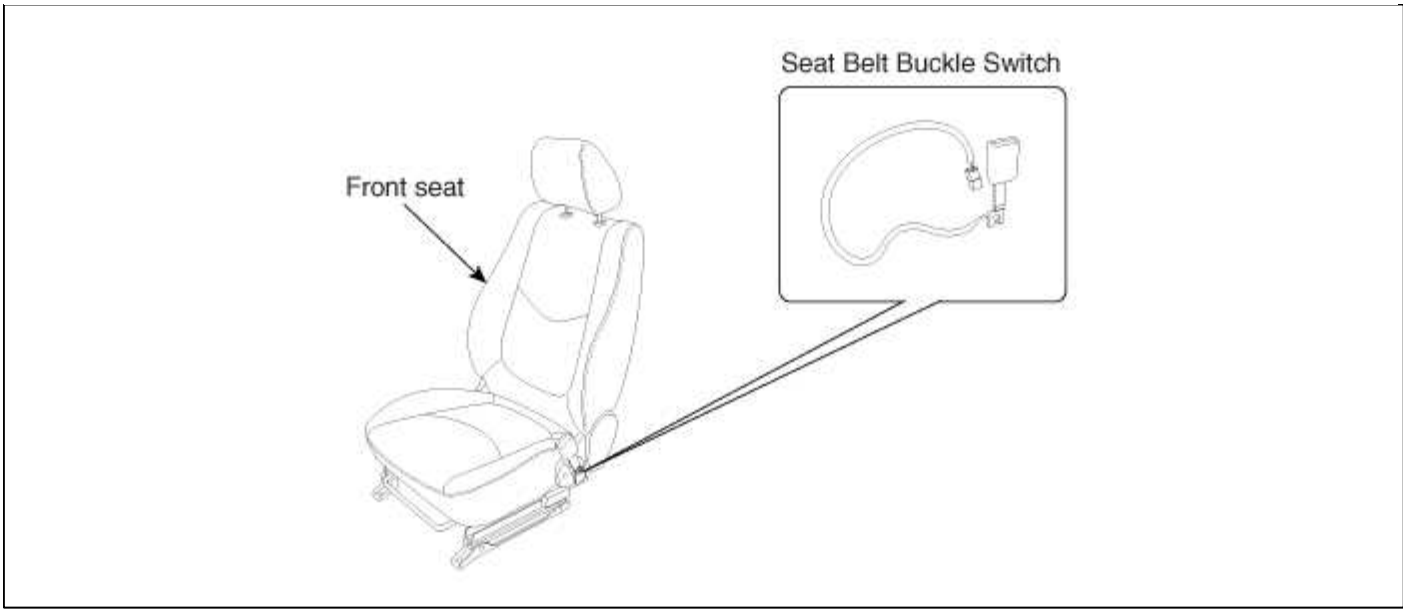
Restraint > SRSCM > Seat Belt Buckle Switch (BS) > Description and Operation

Description

The SRSCM shall monitor the status of the driver and front passenger seat belt buckle. The SRSCM provides one pin each for the driver and front passenger seat belt buckle status input. The seat belt buckle circuit operates from internal boost voltage supplied by the SRSCM, and uses chassis ground for the signal return. The buckle status shall modify the SRSCM deployment. If the buckle status is unbuckled, the corresponding pretensioner will be deactivated.

Restraint > SRSCM > Seat Belt Buckle Switch (BS) > Components and Components Location

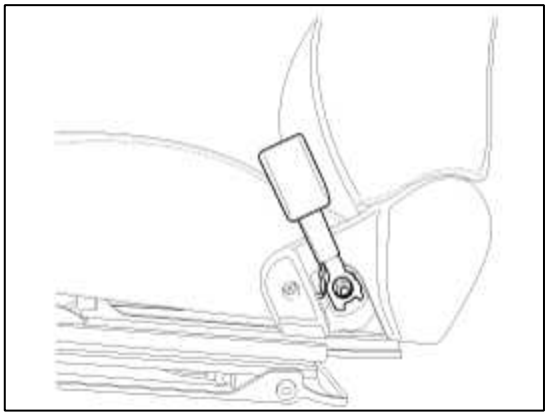
Components



Restraint > SRSCM > Seat Belt Buckle Switch (BS) > Repair procedures

Removal

1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
2. Remove the front seat assembly. (Refer to the Body group - Seat)
3. Loosen the seat belt buckle mounting bolt and remove the seat belt buckle switch.



Installation

CAUTION

Be sure to install the harness wires not to be pinched or interfered with other parts.

1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
2. Remove the ignition key from the vehicle.
3. Install the seat belt buckle switch.

Tightening Torque
: 39.2 ~53.9 Nm (4.0 ~ 5.5 kgf.m, 28.9 ~ 39.8 lb.ft)

4. Install the front seat assembly. (Refer to the Body group - Seat)

5. Reconnect the battery negative cable.
6. After installing the Seat Belt Buckle Switch, confirm proper system operation:
   A. Turn the ignition switch ON, the SRS indicator should be turned on for about six seconds and then go off.

Restraint > SRSCM > Occupant Classification Sensor (OCS) > Description and Operation

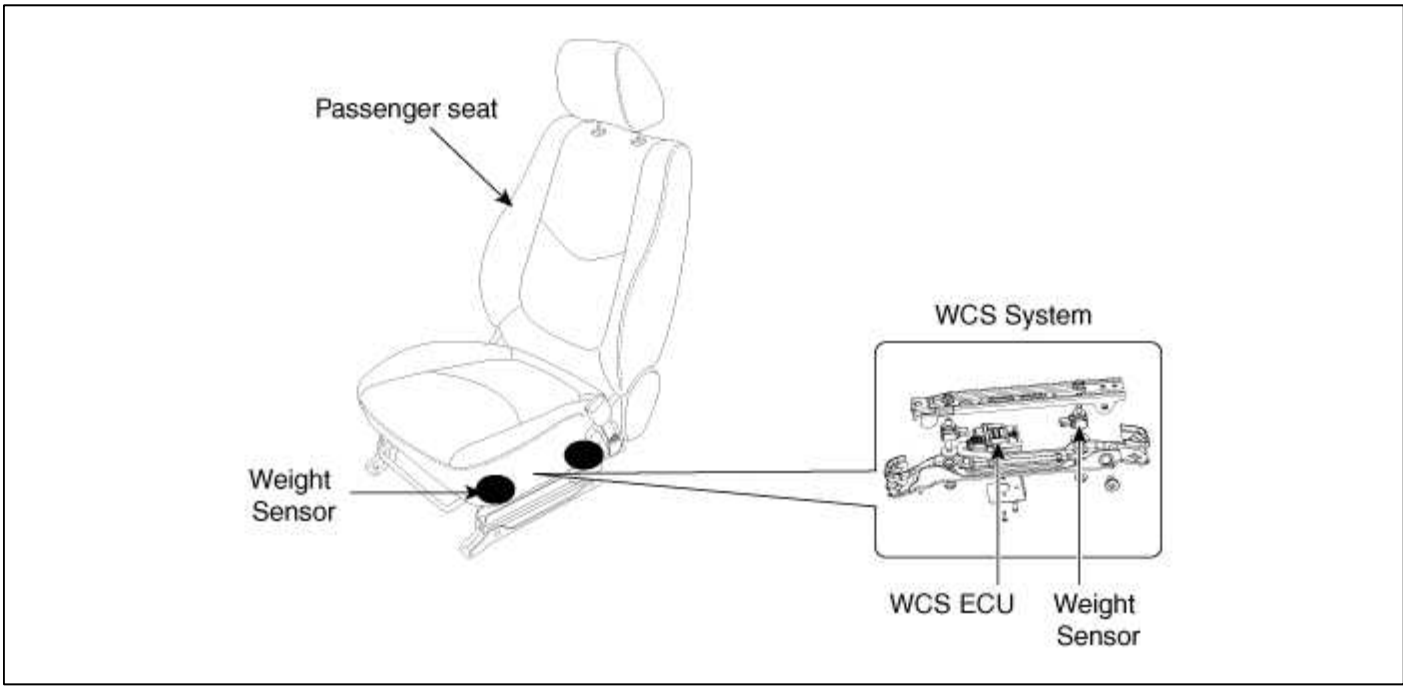
Description

In contrast to the initial one-stage airbag systems, newer restraint systems involve complex logic to select, or alternatively suppress, various levels of safety system deployment. Inherent to an Advanced Restraint System is the ability to discern information regarding passenger occupancy. It is intended that these inputs be provided through the WCS.

The object of such safety system is to reduce the risk and level of injuries by automatically adapting the airbag(s) and seat belt pretensioner to the driving status of the vehicle, its occupants, and the crash severity. The current WCS covered in this specification continually senses and classifies the front passenger side seat. The Occupant Classification System described in this section is Weight Classification System(WCS) of strain gauge type. It consist of 2 weight sensors and ECU which is classifying weight of occupant. It is installed on the seat track assembly.

Restraint > SRSCM > Occupant Classification Sensor (OCS) > Components and Components Location

Components



Restraint > SRSCM > Occupant Classification Sensor (OCS) > Repair procedures

Removal

1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
2. Remove the front passenger seat assembly.
   (Refer to the Body group - Seat)
3. Remove the ODS assembly.
   (Refer to the Body group - Seat)

Installation

NOTE

ODS(Occupant Detection System) is utilizing a robust weight measuring technology. Thus, if any of the following conditions occur, WCS reset and accuracy check should be performed.

- The occupant classification ECU or any of the sensors is replaced.
- The vehicle is brought to the repair shop due to an accident or a crash even though the severity seems to be minor.
- The telltale lamp is not illuminated when the passenger seat is not occupied.
- The telltale lamp is delayed more than 10 seconds to be turned off when an adult passenger seats in.
- The passenger seat is removed from the vehicle and reassembled.
- Any accessories (side table, seatback table and seat cover, etc) are replaced or installed.

1. Install the ODS in the front passenger seat assembly.
   (Refer to the Body group - Seat)
2. Install the front passenger seat assembly. (Refer to the Body group - Seat)
3. Reconnect the battery negative cable.
4. After installing ODS, perform the WCS reset and accuracy check with the scantool.

NOTE

Check that seat is not occupied and empty before performing the operation. Make sure that the back pocket is empty. In order to perform the accuracy check, the command zero operation should be finished normally. Make sure the procedure be finished normally.

(1) Adjust the seat position according to the table below.

Item	Remark
Seat track position	Rearmost position
Seat recliner angle	Normal (upright)
Head rest position	Lowest position
Lifter position	Lowest position

Make sure seat belt not to be buckled, and the belt tension be normal.

(2) Connect the scantool connector to the data link connector located under the crash pad.

(3) Turn the ignition switch on and power on the scantool.

(4) Perform the WCS reset by using the scantool.
[System selection screen]
Vehicle Selection_Airbag_Weight Classification System_WCS RESET_ENTER
(then, Completed is displayed)

(5) Perform the accuracy check by using the scantool.
[System selection screen]
Vehicle Selection_Airbag_Weight Classification System_WCS RESET_ESC

(6) Confirm the measured weight is within the standard value. And then press "ESC".

specification : -2.0kg ~ 2.0kg (-4.4lb ~ 4.4lb)

(7) Place a 37kg (81.57lb) weight on the passenger front seat.

(8) Confirm that the result of accuracy check is within the standard value.

specification : 31kg ~ 43kg (68.34lb ~ 94.79lb)

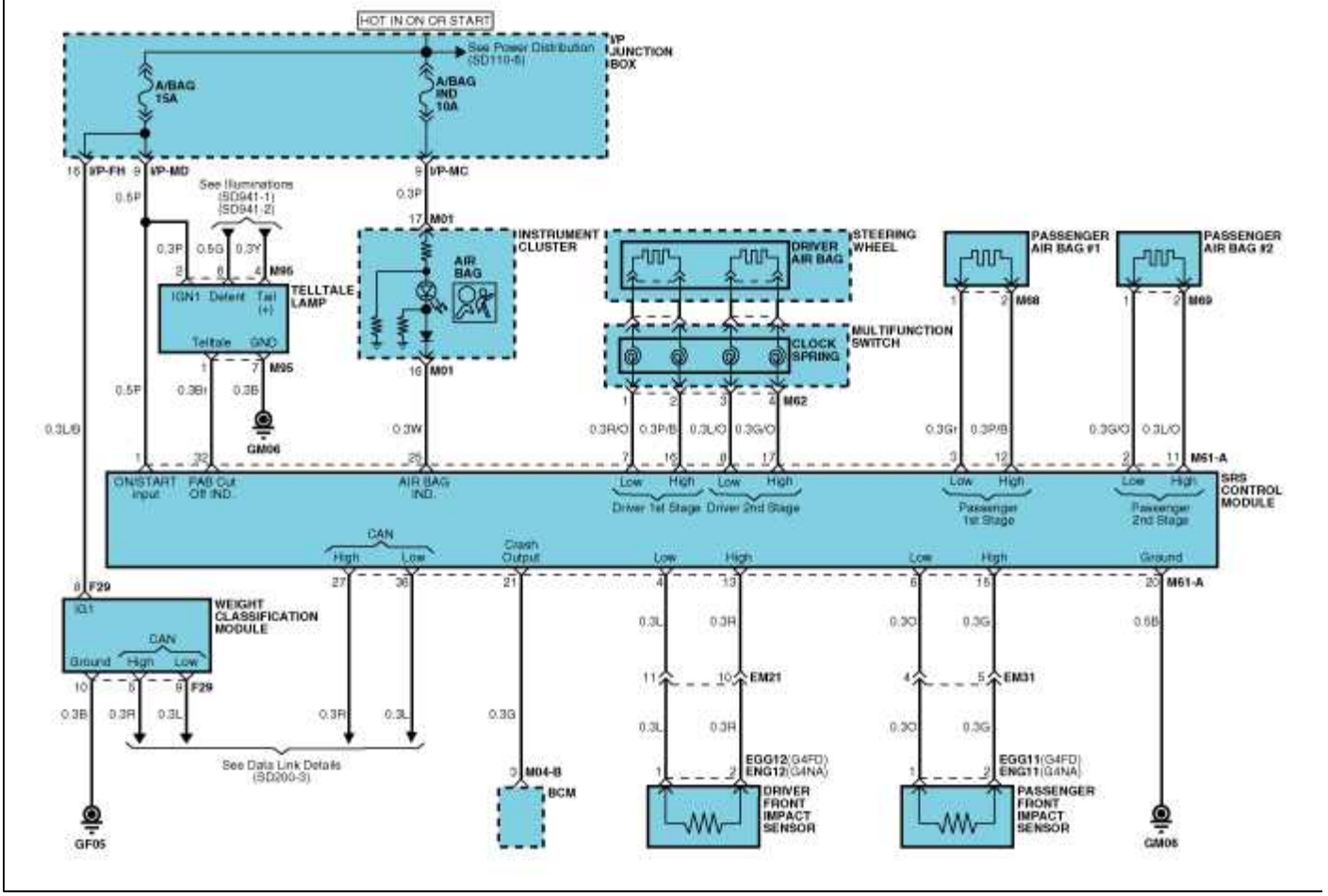
NOTE

- When performing the accuracy check, use a solid metal weight and place it at the center of the seat. If the weight made from liquid is used or the weight slides, the check result may not accurate, and could result in unwanted fail
- When the measured weight deviates from the standard value, check again all the fastening bolts are tightened properly. And make sure there is no interference. During the tightening, be careful not to deform the seat rail or seat structure. If the accuracy check is still not inside the standard value, replace the seat leg assembly.
- When WCS reset operation not finished normally, replace the seat leg assembly.

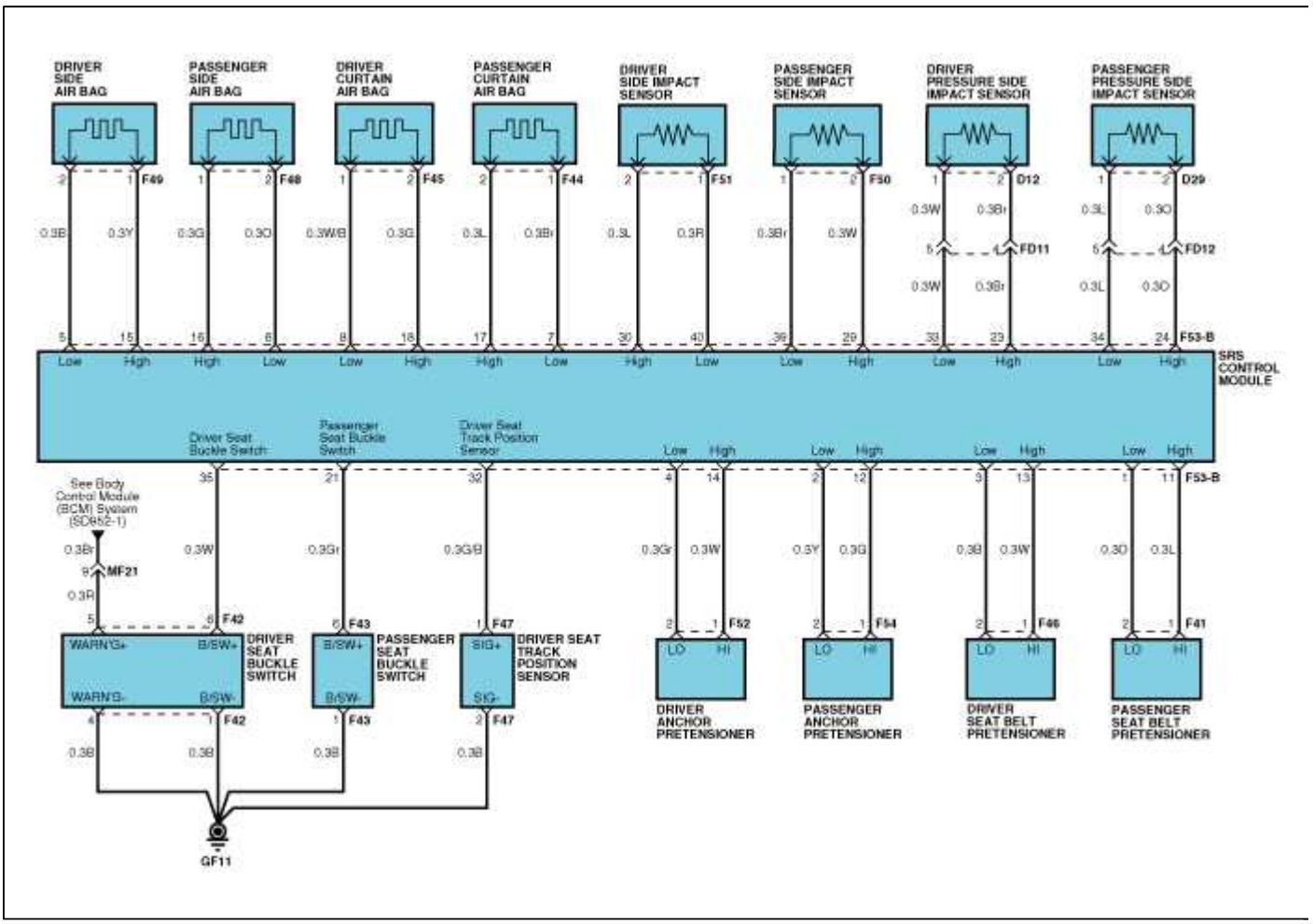
5. After installing the ODS, confirm proper system operation:
   A. Turn the ignition switch ON, the SRS indicator should be turned on for about six seconds and then go off.
   B. Telltale lamp will turn on for 4 seconds and be turned off for 3 seconds. After the 7 seconds, it shall remain off if the ODS does not require suppression and the passenger airbag is enabled.

Restraint > SRSCM > Schematic Diagrams

Circuit Diagram (1)

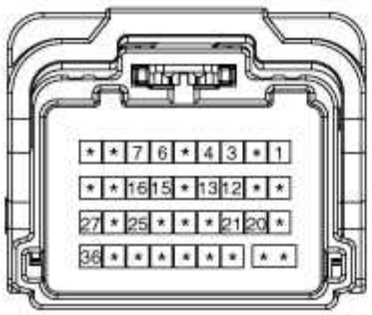


Circuit Diagram (2)

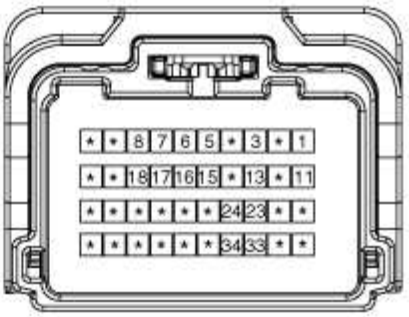


SRSCM Connector Terminal

Harness Connector



Connector A



Connector B

Pin	Function (Connector A)	Pin	Function (Connector B)
1	Ignition	1	Passenger Seat Belt Pretensioner Low
2	(2nd stage) Passenger Airbag Low	2	Passenger Anchor Pretensioner Low
3	(1st stage) Passenger Airbag Low	3	Driver Seat Belt Pretensioner Low
4	Driver Front Impact Sensor Low	4	Driver Anchor Pretensioner Low
5	-	5	Driver Side Airbag Low
6	Passenger Front Impact Sensor Low	6	Passenger Side Airbag Low
7	(1st stage) Driver Airbag Low	7	Passenger Curtain Airbag Low
8	(2nd stage) Dirver Airbag Low	8	Driver Curtain Airbag Low
9	-	9	-
10	-	10	-
11	(2nd stage) Passeng Airbag High	11	Passenger Seat Belt Pretensioner High
12	(1st stage) Passenger Airbag High	12	Passenger Anchor Pretensioner High
13	Driver Front Impact Sensor High	13	Driver Seat Belt Pretensioner High
14	-	14	Driver Anchor Pretensioner High
15	Passenger Front Impact Sensor High	15	Driver Side Airbag High
16	(1st stage) Driver Airbag High	16	Passenger Side Airbag High
17	(2nd stage) Driver Airbag High	17	Passenger Curtain Airbag High
18	-	18	Driver Curtain Airbag High
19	-	19	-
20	Ground	20	-
21	Crash Output	21	Passenger Seat Belt Buckle Switch
22	-	22	-
23	-	23	Driver Side Impact Sensor High
24	-	24	Passenger Side Impact Sensor High
25	Airbag Warning Lamp	25	-
26	-	26	-
27	CAN-High	27	-
28	Short Bar	28	-
29	Short Bar	29	Passenger Pressure Side Impact Sensor High
30	-	30	Driver Pressure Side Impact Sensor High

31	-	31	-
32	Telltale Warning Lamp	32	Driver Seat Track-Position Sensor
33		33	Driver Side Impact Sensor Low
34	-	34	Passenger Side Impact Sensor Low
35	-	35	Driver Seat Belt Buckle Switch
36	CAN-Low	36	-
		37	-
		38	-
		39	Passenger Pressure Side Impact Sensor Low
		40	Driver Pressure Side Impact Sensor Low

Restraint > Airbag Module > Driver Airbag (DAB) Module and Clock Spring > Description and Operation

Description

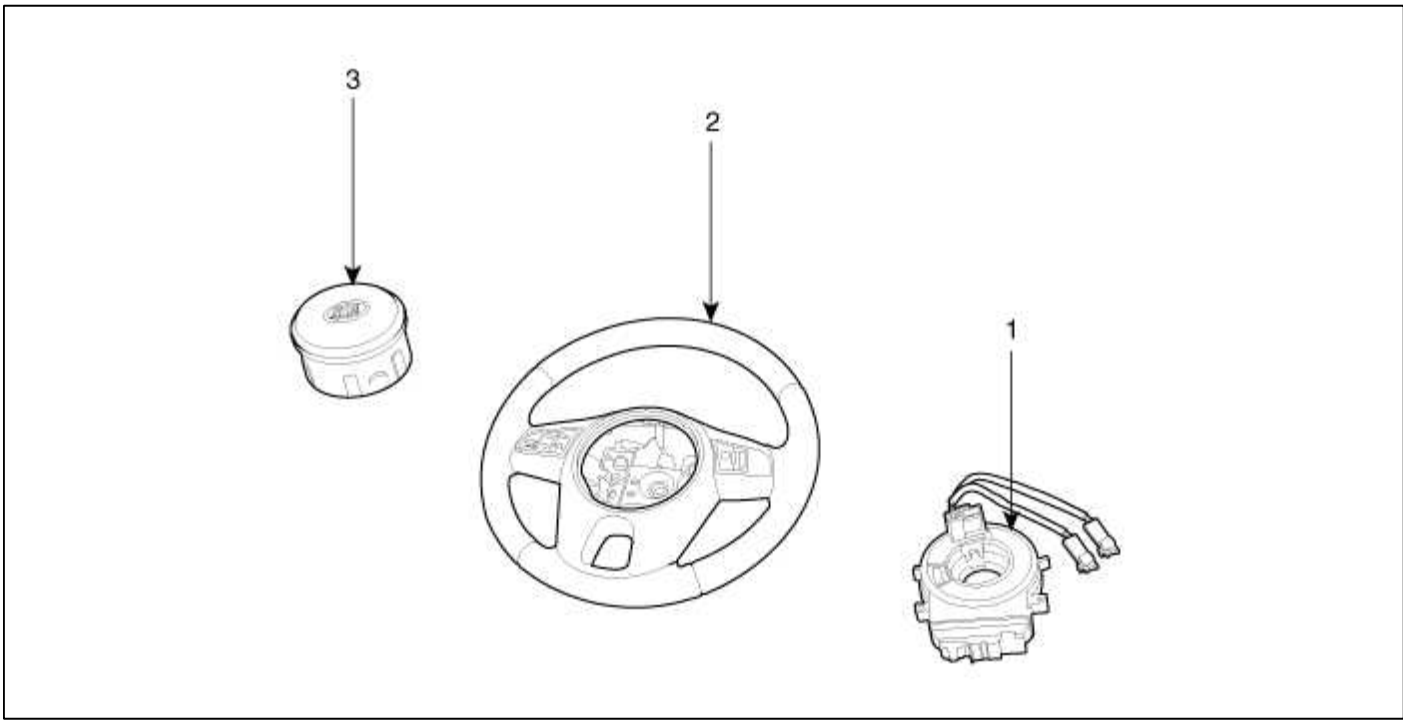
Driver Airbag (DAB) is installed in steering wheel and electrically connected to SRSCM via clock spring. It protects the driver from danger by deploying a bag when frontal crash occurs. The SRSCM determines deployment of Driver Airbag (DAB).

CAUTION

Never attempt to measure the circuit resistance of the airbag module (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment will result in serious personal injury.

Restraint > Airbag Module > Driver Airbag (DAB) Module and Clock Spring > Components and Components Location

Components

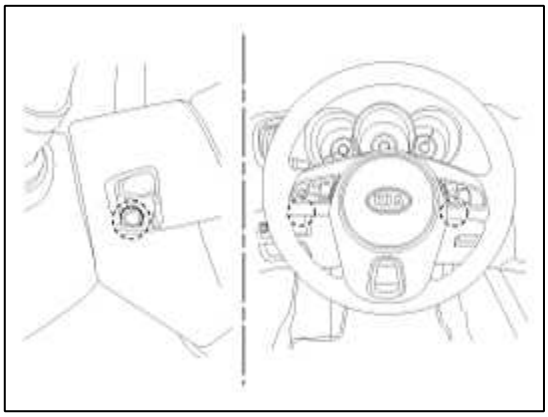


1. Driver Airbag (DAB) 2. Steering Wheel	3. Clock Spring

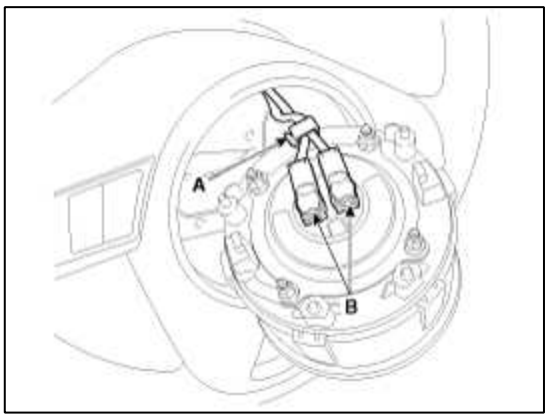
Restraint > Airbag Module > Driver Airbag (DAB) Module and Clock Spring > Repair procedures

Removal

1. Disconnect the battery negative cable and wait for at least three minutes before beginning work.
2. Remove the steering wheel low cover cap.
3. Remove the driver airbag module mounting bolts(2EA).



4. Remove the wiring fixing clip(A) and disconnect airbag module connector (B).

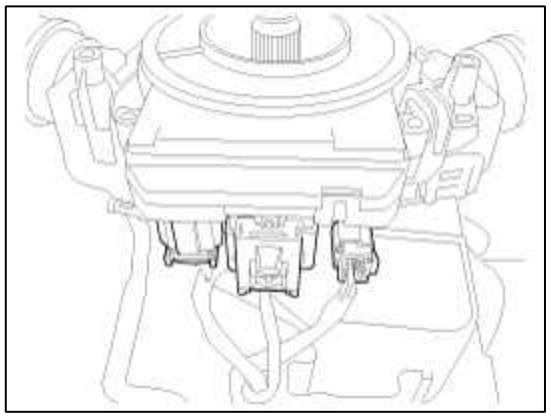


5. Disconnect the horn connector.
6. Separate the airbag module from the steering wheel.

> CAUTION
>
> The removed airbag module should be stored in aclean, dry place with the pad cover face up.

7. Remove the steering wheel and steering wheel column cover. (Refer to the Steering System group- Steering Column and Shaft)

8. Disconnect the clock spring and horn connector, then remove the clock spring.



Inspection

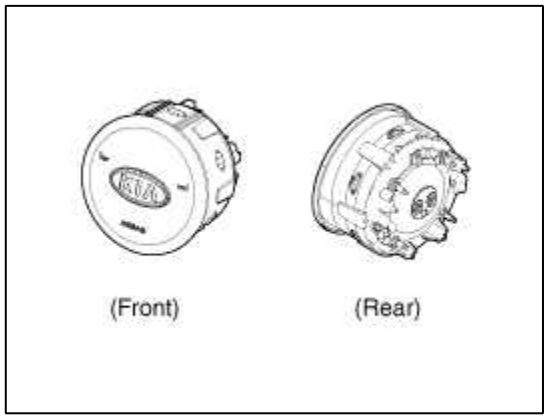
Driver Airbag (DAB)

If any improper parts are found during the following inspection, replace the airbag module with a new one.

CAUTION

Never attempt to measure the circuit resistance of the airbag module (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment will result in serious personal injury.

1. Check pad cover for dents, cracks or deformities.
2. Check the airbag module for denting, cracking or deformation.
3. Check hooks and connectors for damage, terminals for deformities, and harness for binds.
4. Check airbag inflator case for dents, cracks or deformities.

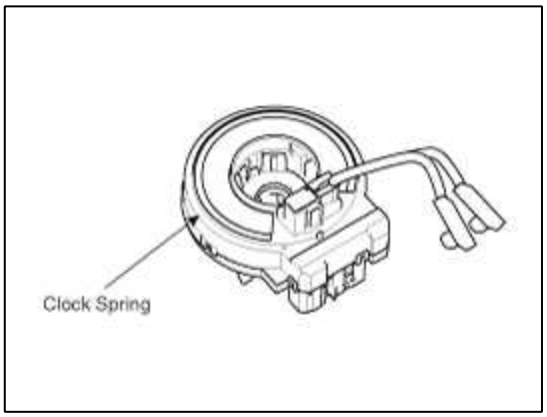


5. Install the airbag module to the steering wheel to check for fit or alignment with the wheel.

Clock Spring

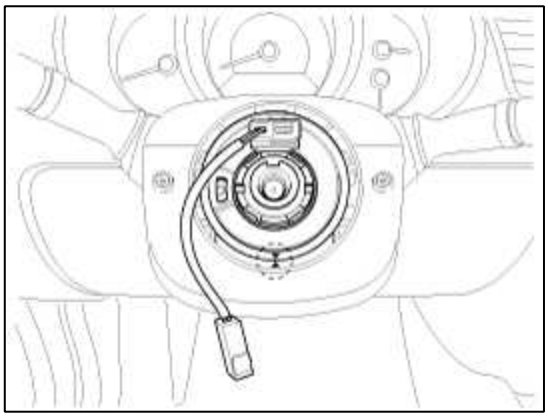
1. If, as a result of the following checks, even one abnormal point is discovered, replace the clock spring with a new one.

2. Check connectors and protective tube for damage, and terminals for deformities.



Installation

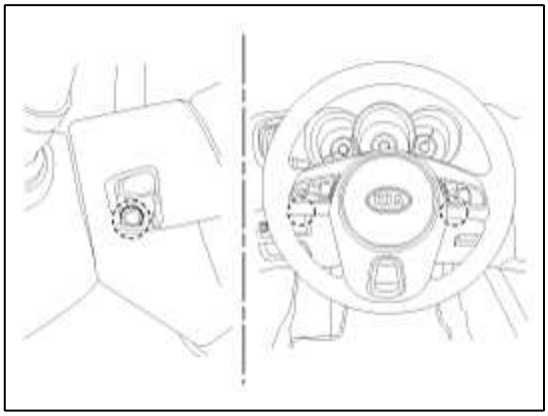
1. Remove the ignition key from the vehicle.
2. Disconnect the battery negative cable from battery and wait for at least three minutes before beginning work.
3. Connect the clock spring harness connector and horn harness connector to the clock spring.
4. Set the center position by getting marks between the clock spring and the cover into line. Make an array the mark ( ) by turning the clock spring clockwise to the stop and then 2 revolutions counterclockwise.



5. Install the steering wheel column cover and the steering wheel. (Refer to the Steering System group- Steering Column and Shaft)
6. Connect the Driver Airbag (DAB) module connector and horn connector, and then install the Driver Airbag (DAB) module on the steering wheel.

7. Secure the Driver Airbag (DAB) with the new mounting bolts.

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



8. Connect the battery negative cable.
9. After installing the airbag, confirm proper system operation:
   A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.
   B. Make sure horn button works.

Restraint > Airbag Module > Passenger Airbag (PAB) Module > Description and Operation

Description

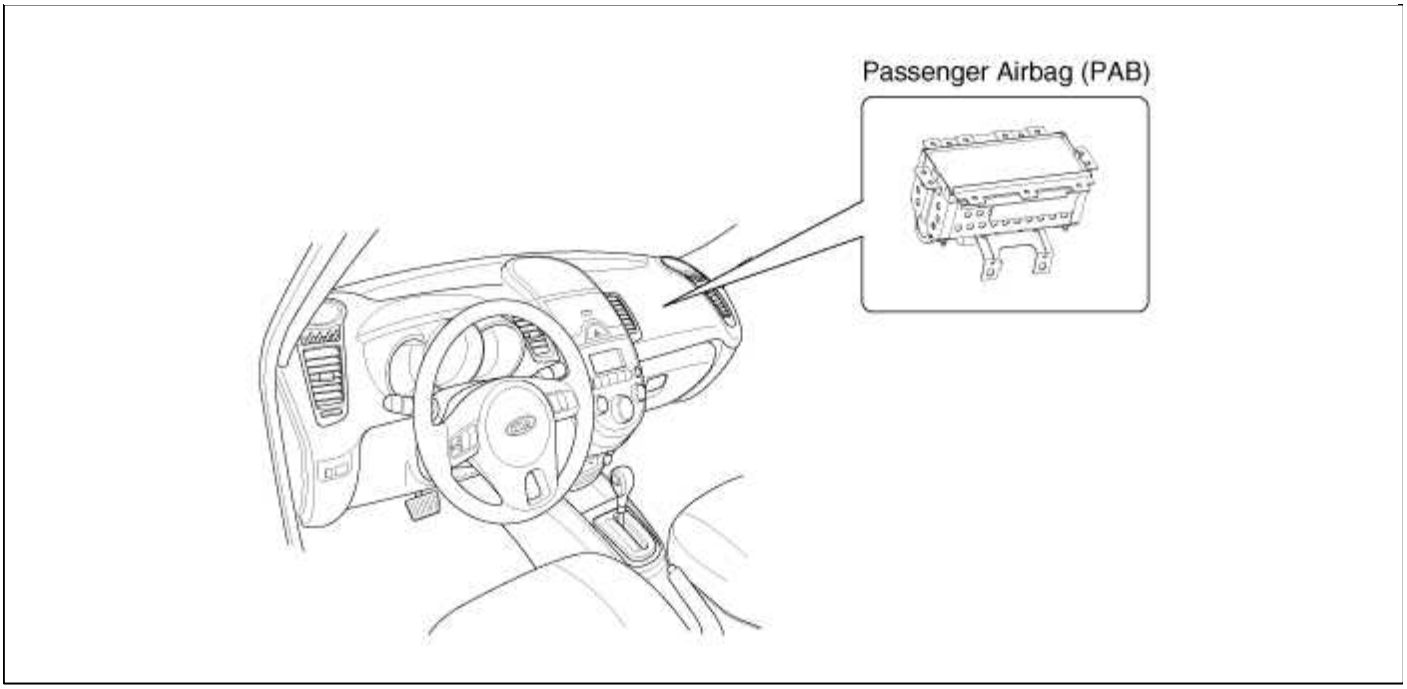
The passenger Airbag (PAB) is installed inside the crash pad and protects the front passenger in the event of a frontal crash. The SRSCM determines if and when to deploy the PAB.

CAUTION

Never attempt to measure the circuit resistance of the airbag module (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment will result in serious personal injury.

Restraint > Airbag Module > Passenger Airbag (PAB) Module > Components and Components Location

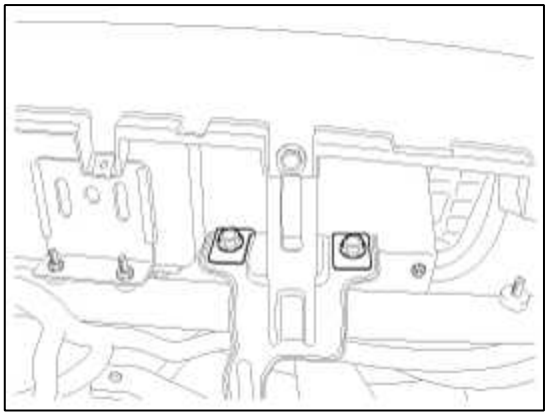
Components



Restraint > Airbag Module > Passenger Airbag (PAB) Module > Repair procedures

Removal

1. Disconnect the battery negative cable and wait for at least three minutes before beginning work.
2. Remove the glove box and glove box housing. (Refer to the Body group- crash pad).
3. Disconnect the passenger airbag connector and remove the passenger airbag mounting bolt.

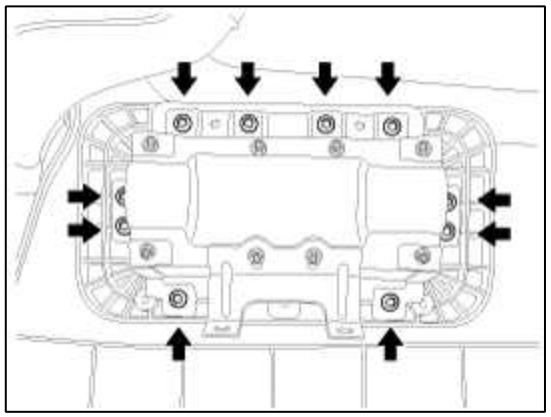


4. Remove the crash pad. (Refer to the Body group- crash pad).

> NOTE
>
> Replace the crash pad which is damaged while PAB is deployed.

5. Remove the heater duct from the Crash pad.

6. Remove the mounting screws(10EA) from the Crash pad. Then remove the passenger airbag.



CAUTION

The removed airbag module should be stored in a clean, dry place with the airbag cushion up.

Installation

1. Remove the ignition key from the vehicle.
2. Disconnect the battery negative cable from battery and wait for at least three minutes before beginning work.
3. Place a Passenger airbag on the Crash pad and tighten the Passenger airbag mounting screws.
4. Install the heater duct to the Crash pad.
5. Install the Crash pad. (Refer to the Body group- crash pad)
6. Tighten the PAB mounting bolt.

Tightening torque
: 7.8 ~ 8.8 Nm (0.8 ~ 0.9 kgf.m , 5.8 ~ 6.5 lb.ft)

7. Connect the Passenger Airbag (PAB) harness connector to the SRS main harness connector.
8. Reinstall the glove box housing and glove box. (Refer to the Body group- crash pad)
9. Reconnect the battery negative cable.
10. After installing the Passenger Airbag (PAB), confirm proper system operation:
    A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

Restraint > Airbag Module > Side Airbag (SAB) Module > Description and Operation

Description

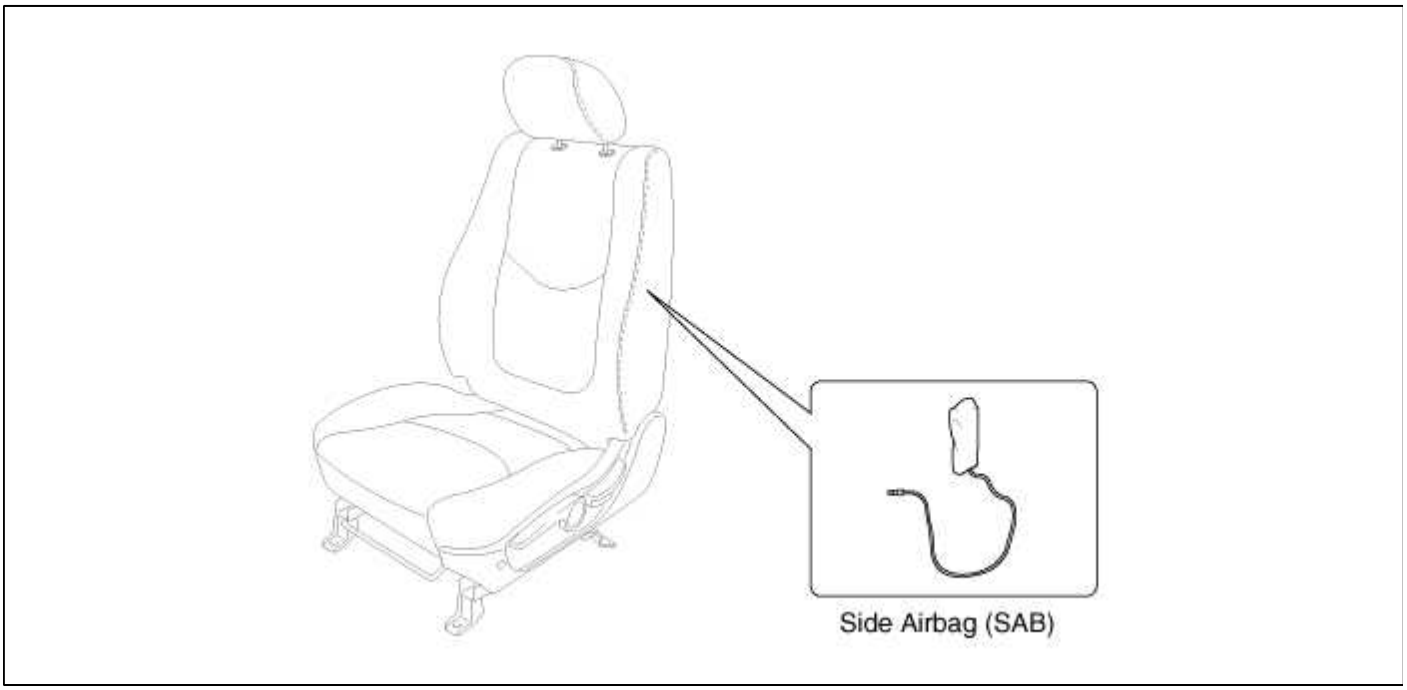
The Side Airbags (SAB) are installed inside the front seat and protect the driver and front passenger from danger when side crash occurs. The SRSCM determines deployment of side airbag by using Side Impact Sensor (SIS) signal.

CAUTION

Never attempt to measure the circuit resistance of the airbag module (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment will result in serious personal injury.

Restraint > Airbag Module > Side Airbag (SAB) Module > Components and Components Location

Components



Restraint > Airbag Module > Side Airbag (SAB) Module > Repair procedures

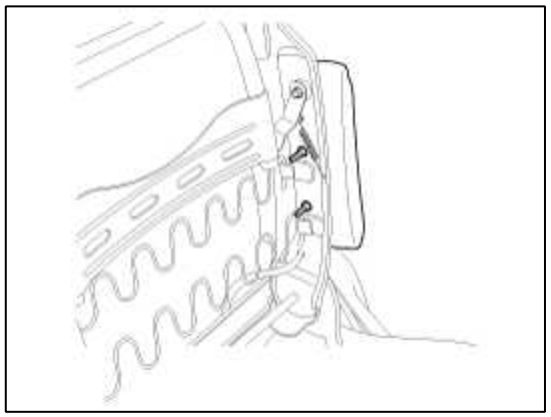
Removal

1. Disconnect the battery negative cable and wait for at least 3 minutes before beginning work.
2. Remove the front seat assembly. (Refer to the Body group- Seat)
3. Remove the seat back cover. (Refer to the Body group- Seat)

NOTE

When the front side airbag deployed after a collision, replace the seat back as an assembly.

4. Loosen the SAB mounting nuts and remove the SAB module.



WARNING

The removed airbag module should be stored in a clean and dry place with the cushion side up.

Installation

CAUTION

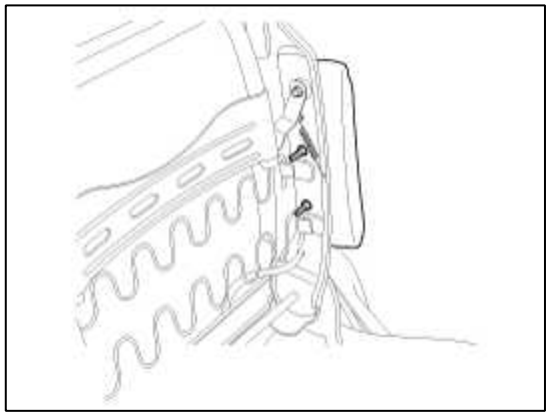
Be sure to install the harness wires not to be pinched or interfered with other parts.

NOTE

- Do not open the lid of the side airbag cover.
- Use a new mounting nuts when you replace a side airbag.
- Make sure that the airbag assembly cover is installed properly. Improper installation may prevent the proper deployment.

1. Remove the ignition key from the vehicle.
2. Disconnect the battery negative cable and wait for at least three minutes.
3. Place a Side Airbag (SAB) on the side airbag frame and tighten the side airbag mounting nuts (2EA).

Tightening torque
: 5.9 ~ 7.8 Nm (0.6 ~ 0.8 kgf.m , 4.3 ~ 5.8 lb.ft)



4. Install the new seat back cover. (Refer to the Body group- Seat)

5. Install the front seat assembly, and then connect the Side Airbag (SAB) harness connector.
6. Recline and slide the front seat forward fully, make sure the harness wires are not pinched of interfering with other parts.
7. Reconnect the battery negative cable.
8. After installing the Side Airbag (SAB), confirm proper system operation:
   A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

Restraint > Airbag Module > Curtain Airbag (CAB) Module > Description and Operation

Description

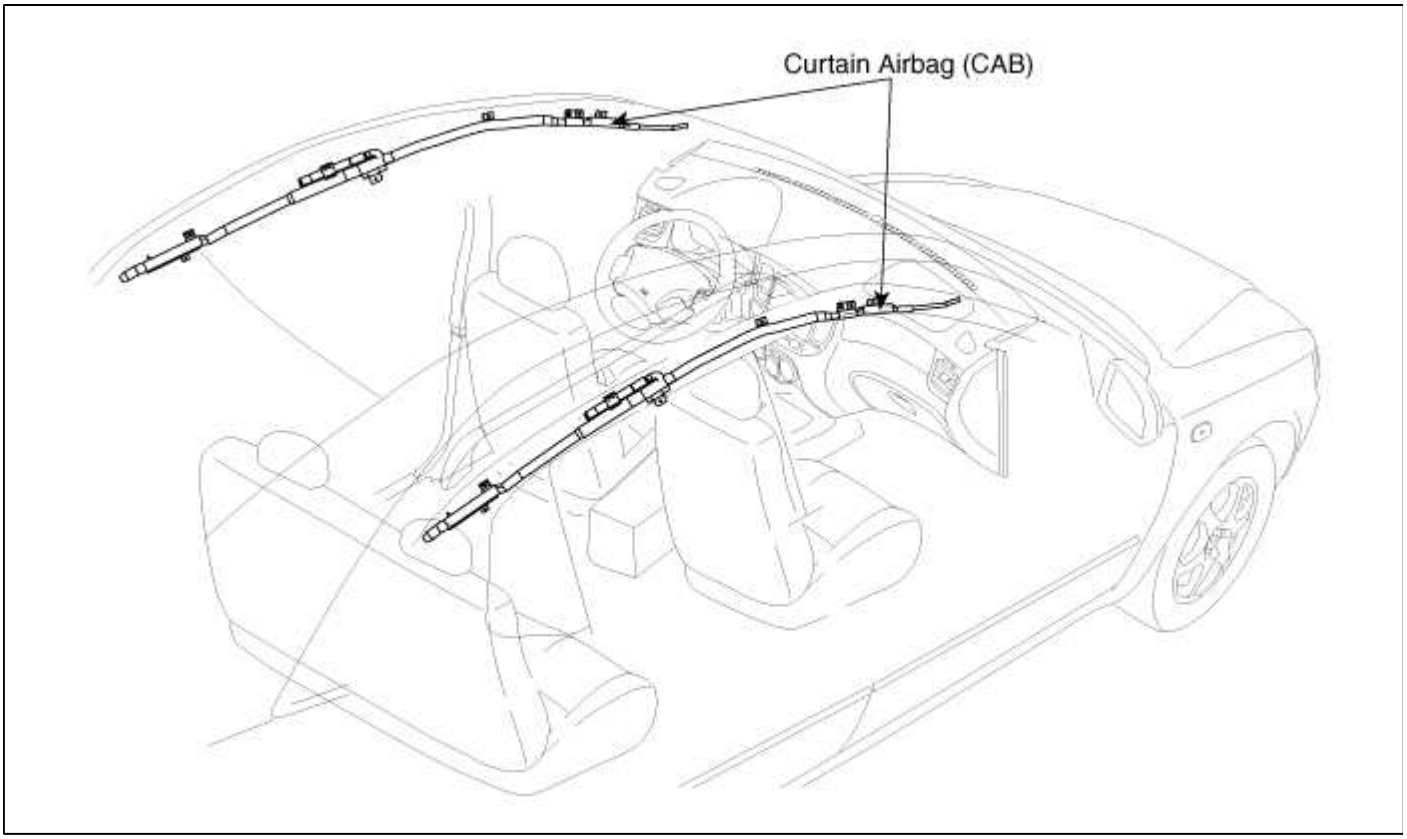
Curtain airbags are installed inside the headliner (LH and RH) and protect the driver and passenger from danger when side crash occurs. The SRSCM determines deployment of curtain airbag by using side impact sensor (SIS) signal.

CAUTION

Never attempt to measure the circuit resistance of the airbag module even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment will result in serious personal injury.

Restraint > Airbag Module > Curtain Airbag (CAB) Module > Components and Components Location

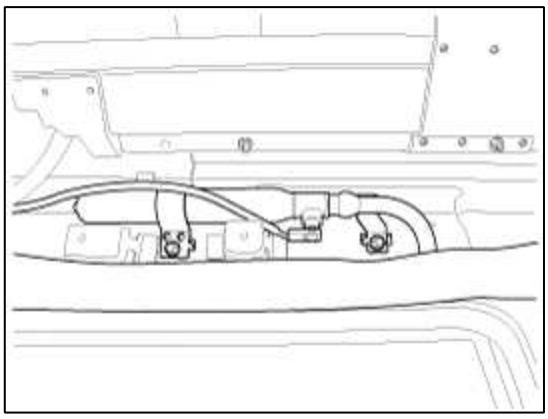
Components



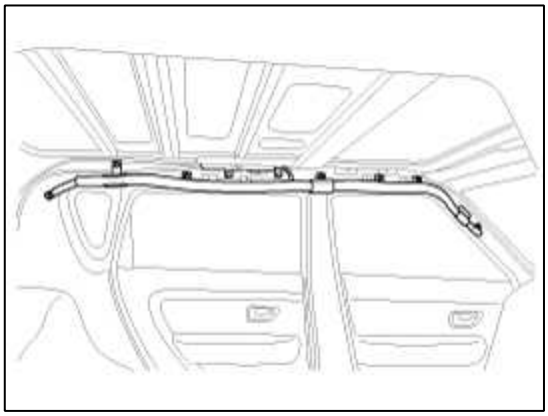
Restraint > Airbag Module > Curtain Airbag (CAB) Module > Repair procedures

Removal

1. Disconnect the battery negative cable and wait for at least 3 minutes before beginning work.
2. Remove the Interior trim. (Refer to the Body group - Interior trim)
3. Remove the headlining (Refer to the Body group - Roof trim)
4. Disconnect the Curtain Airbag harness connector.



5. After loosening the mounting bolts and nuts remove the curtain airbag.



Installation

1. Remove the ignition key from the vehicle.
2. Disconnect the battery negative cable and wait for at least three minutes.
3. Tighten the Curtain Airbag (CAB) mounting bolts.

Tightening torque
: 10.8 ~ 14.7 Nm (1.1 ~ 1.5 kgf.m, 8.0 ~ 10.8 lb.ft)

CAUTION

- Never twist the airbag module when installing it. If the module is twisted, airbag module may operate abnormally.

4. Connect the CAB connector.
5. Install the headlining. (Refer to the Body group - Roof trim)
6. Install the Interior trim. (Refer to the Body group - Interior trim)

7. Reconnect the battery negative cable.
8. After installing the Curtain Airbag (CAB), confirm proper system operation:
   A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

Restraint > Airbag Module > Airbag Module Disposal > Description and Operation

Airbag Disposal

Special tool required

Deployment tool 0957A-34100A

Before scrapping any airbags or side airbags (including those in a whole vehicle to be scrapped), the airbags or side airbags must be deployed. If the vehicle is still within the warranty period, before deploying the airbags or side airbags, the Technical Manager must give approval and/or special instruction. Only after the airbags or side airbags have been deployed (as the result of vehicle collision, for example), can they be scrapped. If the airbags or side airbags appear intact (not deployed), treat them with extreme caution. Follow this procedure.

Deploying airbags in the vehicle

If an SRS equipped vehicle is to be entirely scrapped, its airbags or side airbags should be deployed while still in the vehicle. The airbags or side airbags should not be considered as salvageable parts and should never be installed in another vehicle.

1. Turn the ignition switch OFF, and disconnect the battery negative cable and wait at least three minutes.
2. Confirm that each airbag or side airbag is securely mounted.
3. Confirm that the special tool is functioning properly by following the check procedure.
   (1) Driver's Airbag :
      A. Remove the driver's airbag and install the SST (0957A-38500).
      B. Install the driver's airbag on the steering wheel.
   (2) Front Passenger's Airbag :
      A. Remove the glove box, and then disconnect the 2P connector between the front passenger's airbag and SRS main harness.
      B. Install the SST(0957A-38500).
   (3) Side Airbag :
      A. Disconnect the 2P connector between the side airbag and side wire harness.
      B. Install the SST (0957A-3F100).
   (4) Curtain Airbag :
      A. Disconnect the 2P connector between the curtain airbag and wire harness.
      B. Install the SST (0957A-38500).
   (5) Seat Belt Pretensioner :
      A. Disconnect the 2P connector from the seat belt pretensioner.
      B. Install the SST (0957A-38500).
4. Place the deployment tool at least thirty feet (10meters) away from the airbag.
5. Connect a 12 volt battery to the tool.
6. Push the tool's deployment switch. The airbag should deploy (deployment is both highly audible and visible: a loud noise and rapid inflation of the bag, followed by slow deflection)

7. Dispose of the complete airbag. No part of it can be reused. Place it in a sturdy plastic bag and seal it securely.

Deploying the airbag out of the vehicle
If an intact airbag has been removed from a scrapped vehicle, or has been found defective or damage during transit, storage or service, it should be deployed as follows:

1. Confirm that the special is functioning properly by following the check procedure on this page.
2. Position the airbag face up, outdoors on flat ground at least thirty feet (10meters) from any obstacles or people.

Disposal Of Damaged Airbag

1. If installed in a vehicle, follow the removal procedure of driver's airbag front passenger's and side airbag.
2. In all cases, make a short circuit by twisting together the two airbag inflator wires.
3. Package the airbag in exactly the same packing that the new replacement part come in.

Restraint > Seat Belt Pretensioner > Seat Belt Pretensioner (BPT) > Description and Operation

Description

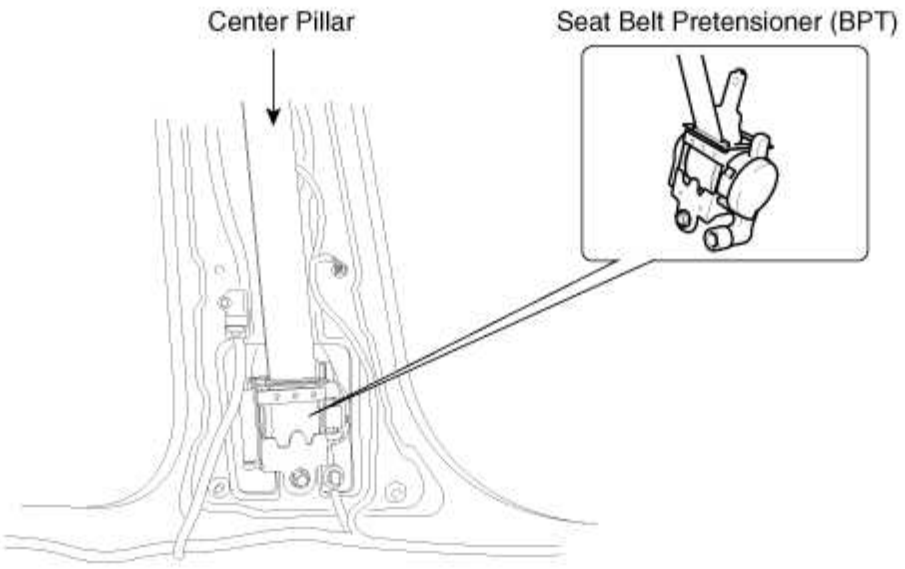
The Seat Belt Pretensioners (BPT) are installed inside Center Pillar (LH & RH). When a vehicle crashes with a certain degree of frontal impact, the pretensioner seat belt helps to reduce the severity of injury to the front seat occupants by retracting the seat belt webbing. This prevents the front occupants from thrusting forward and hitting the steering wheel or the instrument panel when the vehicle crashes.

CAUTION

Never attempt to measure the circuit resistance of the Seat Belt Pretensioner (BPT) even if you are using the specified tester. If the circuit resistance is measured with a tester, the pretensioner will be ignited accidentally. This will result in serious personal injury.

Restraint > Seat Belt Pretensioner > Seat Belt Pretensioner (BPT) > Components and Components Location

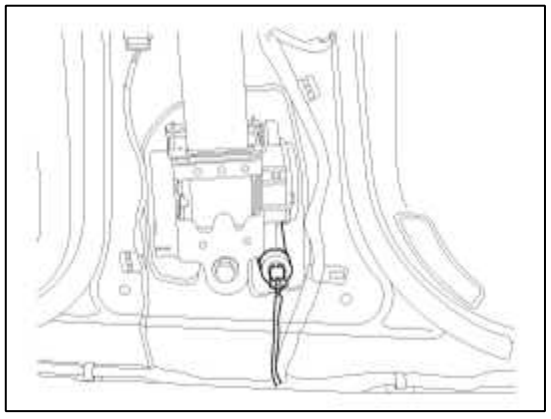
Components



Restraint > Seat Belt Pretensioner > Seat Belt Pretensioner (BPT) > Repair procedures

Removal

1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
2. Remove the lower anchor bolt. (Except Anchor Pretensioner)
3. Remove the following parts. (Refer to the Body group - Interior trim)
   A. Door scuff trim
   B. Center pillar trim
4. Remove the upper anchor bolt.
5. Disconnect the Seat Belt Pretensioner connector.



6. Loosen the Seat Belt Pretensioner mounting bolt and remove the Seat Belt Pretensioner.

Installation

1. Remove the ignition key from the vehicle.
2. Disconnect the battery negative cable and wait for at least three minutes.
3. Install the Seat Belt Pretensioner (BPT) with a bolt.

4. Connect the Seat Belt Pretensioner (BPT) connector.

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

5. Install the upper anchor bolts.

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

6. Install the following parts. (Refer to the Body group- Interior trim)
   A. Center pillar trim
   B. Door scuff trim
7. Install the lower anchor bolts.

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

8. Reconnect the battery negative cable.
9. After installing the Seat Belt Pretensioner (BPT), confirm proper system operation:
   A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

Restraint > Seat Belt Pretensioner > Anchor Pretensioner (APT) > Description and Operation

Description

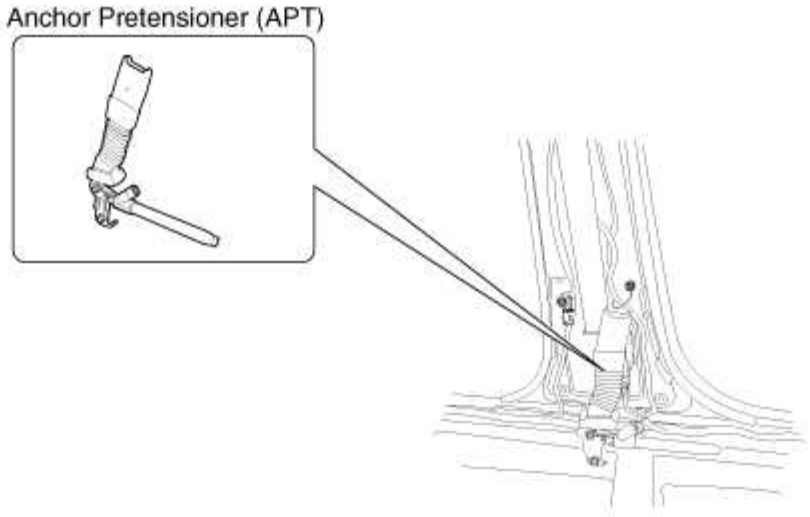
Front seat belt anchor pretensioner operates as well as belt pretensioner at the same time If it gets into its deploy condition after a collision. It is located at near anchor on front seat and it is an equipment to make up for the existing short stroke. Front seat belt anchor pretensioner is supported by two cables and it is an auxiliary equipment to prevent the driver and passenger from breaking away doubly as seat belt is being pulled toward anchor side after a collision.

CAUTION

Never measure resistance of anchor pretensioner directly, current of measuring device may cause unexpected airbag deploy.

Restraint > Seat Belt Pretensioner > Anchor Pretensioner (APT) > Components and Components Location

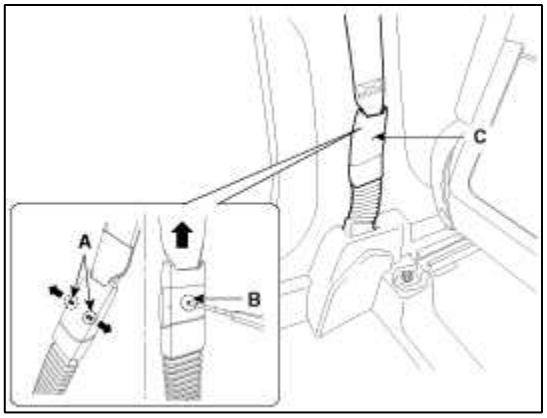
Components



Restraint > Seat Belt Pretensioner > Anchor Pretensioner (APT) > Repair procedures

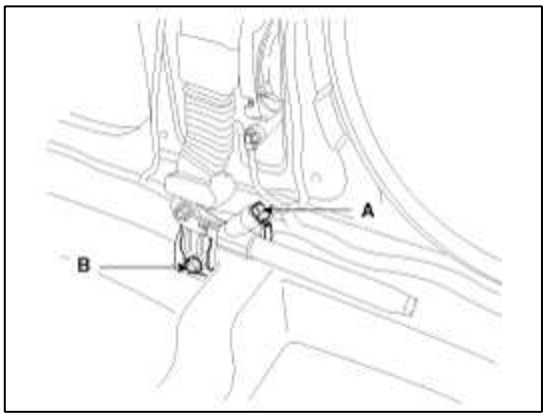
Removal

1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
2. To remove the seat belt anchor pretensioner (C), keep on pushing the lock pin (A) as arrow direction. And then remove the seat belt after pushing the lock pin (B).



3. Remove the door scuff trim.
   (Refer to the Body group - "Interior trim")
4. Remove the center pillar trim.
   (Refer to the Body group - "Interior trim")

5. Disconnect the anchor pretensioner connector (A).



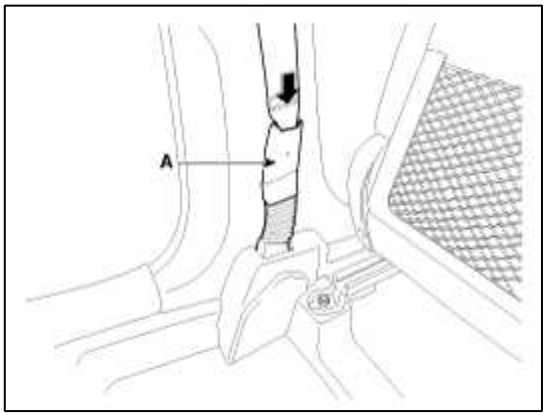
6. Loosen the anchor pretensioner mounting bolt (B) and remove the anchor pretensioner.

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 anchor pretensioner with a bolt.

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

4. Connect the anchor pretensioner connector.
5. Install the center pillar trim.
   (Refer to the Body group - "Interior trim")
6. Install the door scuff trim.
   (Refer to the Body group - "Interior trim")
7. Insert the seat belt to the anchor pretensioner (A).



NOTE

Make sure the lock pin is connected in properly.

8. Reconnect the battery negative cable.

9. After installing the anchor pretensioner, confirm proper system operation:
   A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

SOUL(AM) > 2012 > G 1.6 GDI > Brake System

Brake System > General Information > Specifications

Specifications

Item	Specification
Master cylinder	
Type	Tandem type
Piston stroke	45 mm (1.77 in)
Fluid level warning sensor	Provided
Brake booster	
Type	Vacuum
Boosting ratio	9 : 1
Front brake (Disc)	Floating type with ventilated disc
Type	280 mm (11.02 in)
Disc O.D.	172 mm (6.77 in)
Disc I.D.	26 mm (1.02 in)
Disc thickness	11 mm (0.43 in)
Pad thickness	Single piston
Cylinder I.D.	Ø57.0 mm (2.24 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.	Ø30.0 mm (1.22 in)
Rear brake (Drum)	
Type	Leading trailing
Drum I.D.	Ø203.2 mm (8.00 in)
Brake lining thickness	5.14 mm (0.20 in)
Clearance adjustment	Automatic
Parking brake (Disc type)	
Actuation	DIH (Drum in hat)
Type	Lever
Drum I.D.	168 mm(6.61 in)

NOTE

O.D. : Outer Diameter
I.D : Inner Diameter

Specification (ESC)

Part	Item	Standard value	Remark
HECU	System	4 Channel 4 Sensor (Solenoid)	Total control (ABS, EBD, TCS, ESC)
	Type	Motor, valve relay intergrated type	
	Operating Voltage	10 ~ 16V	
	Operating Temperature	-40 ~ 120°C(-40 ~ 248°F)	
	Motor power	270W	
Active Wheel speed sensor	Supply voltage	DC 4.5 ~ 20V	
	Output current low	5.9 ~ 8.4mA	
	Output current high	11.8~ 16.8mA	
	Output range	1 ~ 2500Hz	
	Tone wheel	47 teeth	
	Air gap	Front : 0.5 ~ 1.5 mm Rear : 0.5 mm	
Yaw rate& Lateral G sensor (CAN TYPE)	Operating Voltage	10 V ~ 16V	
	Current Consumption	Max. 150mA	
	Yaw rate sensor measurement range	-75 ~ 75°/sec	
	Lateral G sensor measurement range	-1.5 ~ 1.5gN	

Service Standard

Item	Standard value
Brake pedal height	194 mm (7.64 in)
Brake pedal stroke	135 mm (5.31 in)
Stop lamp switch outer case to pedal stopper clearance	1 ~ 2 mm (0.039 ~ 0.047 in)
Brake pedal free play	3 ~ 8 mm (0.08 ~ 0.20 in)
Booster push rod to master cylinder piston clearance	0.6 ~ 1.4 mm (at 500 mmHg vacuum)
Parking brake lever stroke when lever assembly is pulled with 196N (20Kg, 44lb force)	5 ~ 7 clicks
Front disc brake pad thickness	11 mm (0.43 in.)
Front disc thickness	26 mm (1.02 in)
Rear disc brake pad thickness	10 mm (0.35 in)
Rear disc brake disc thickness	10 mm (0.39 in)
Rear brake lining thickness	Disc Brake : 2.6 mm (0.10 in) Drum Brake : 5.14 mm (0.20 in)

Tightening Torques

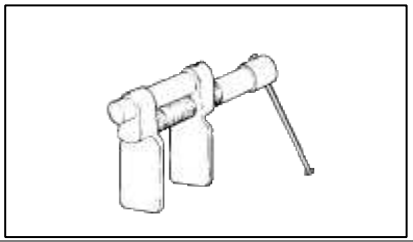
Item	N.m	kgf.m	lb-ft
Master cylinder to booster mounting nut	12.7 ~ 16.7	1.3 ~ 1.7	9.4 ~ 12.3
Brake booster mounting nut	16.7 ~ 25.5	1.7 ~ 2.6	12.3 ~ 18.8
Bleeder screw	6.9 ~ 12.7	0.7 ~ 1.3	5.1 ~ 9.4
Brake tube to HECU-CBS/ABS	12.7 ~ 16.7	1.3 ~ 1.7	9.4 ~ 12.3
Brake tube to HECU-ESC	18.6 ~ 22.6	1.9 ~ 2.3	13.7 ~ 16.6
Caliper guide rod bolt	21.6 ~ 31.4	2.2 ~ 3.2	15.9 ~ 23.1
Caliper mounting bolt (Front)	78.5 ~ 98.1	8.0 ~ 10.0	57.9 ~ 72.3
Caliper mounting bolt (Rear)	63.7 ~ 73.6	6.5 ~ 7.5	47.0 ~ 54.3
Brake hose to caliper	24.5 ~ 29.4	2.5 ~ 3.0	18.1 ~ 21.7
Brake pedal member assembly bracket mounting nut	16.7 ~ 25.5	1.7 ~ 2.6	12.3 ~ 18.8
Brake pedal member assembly bracket mounting bolt	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Stop lamp switch mounting nut	11.8 ~ 14.7	1.2 ~ 1.5	8.7 ~ 10.8
Wheel speed sensor mounting bolt	6.9 ~ 10.8	0.7 ~ 1.1	5.1 ~ 8.0
HECU mounting bracket bolt	16.7 ~ 25.5	1.7 ~ 2.6	12.3 ~ 18.8
HECU bracket mounting nut	10.8 ~ 13.7	1.1 ~ 1.4	8.0 ~ 10.1
Yaw rate & Lateral G sensor mounting bolt	7.8 ~ 10.8	0.8 ~ 1.1	5.8 ~ 8.0

Lubricant

Item	Recommended lubricant	Quantity
Brake fluid	DOT 3 or DOT 4	As required
Brake pedal bushing and brake pedal bolt	Chassis grease	As required
Parking brake shoe and backing plate contact surfaces	Bearing grease	As required
Caliper guide rod bolt and boot	AI-11P grease	Front : 1.2 ~ 1.7g Rear : 0.8 ~ 1.3g

Brake System > General Information > Special Service Tools

Special Service Tools

Tool (Number and Name)	Illustration	Use
09581 - 11000 Piston expander		Pushing back of the front disc and rear disc brake piston

Brake System > General Information > Troubleshooting

Troubleshooting

Problem Symptoms Table

Use the table below to help you find the cause of the problem. The numbers indicate the priority of the possible

cause of the problem. Check each part in order. If necessary, replace these parts.

Symptom	Suspect Area	Remedy
Lower pedal or spongy pedal	1. Brake system (Fluid leaks) 2. Brake system (Air in) 3. Piston seals (Worn or damaged) 4. Master cylinder (Faulty)	Repair Air bleeding Replace Replace
Brake drag	1. Brake pedal free play (Minimum) 2. Parking brake lever travel (Out of adjustment) 3. Parking brake wire (Sticking) 4. Pad or lining (Cracked or distorted) 5. Piston (Stuck) 6. Piston (Frozen) 7. Return spring (Faulty) 8. Booster system (Vacuum leaks) 9. Master cylinder (Faulty)	Adjust Adjust Repair Replace Replace Replace Replace Replace Replace
Brake pull	1. Piston (sticking) 2. Pad or lining (Oily) 3. Piston (Frozen) 4. Disc (Scored) 5. Pad or lining (Cracked or distorted)	Replace Replace Replace Replace Replace
Hard pedal but brake inefficient	1. Brake system (Fluid leaks) 2. Brake system (Air in) 3. Pad or lining (Worn) 4. Pad or lining (Cracked or distorted) 5. Pad or lining (Oily) 6. Pad or lining (Glazed) 7. Disc (Scored) 8. Booster system (Vacuum leaks)	Repair Air bleeding Replace Replace Replace Replace Replace Replace
Noise from brake	1. Pad or lining (Cracked or distorted) 2. Installation bolt (Loosen) 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, pulsation	1. Disc (Excessive thickness variation) 2. Disc (Faulty run-out) 3. Disc (Uneven worn or crack) 4. Pad or lining (Uneven worn and contact) 5. Caliper (Faulty pad sliding)	Replace Replace Replace Replace Replace
Brake chatter	Brake chatter is usually caused by loose or worn components, or glazed or burnt linings. Rotors with hard spots can also contribute to	

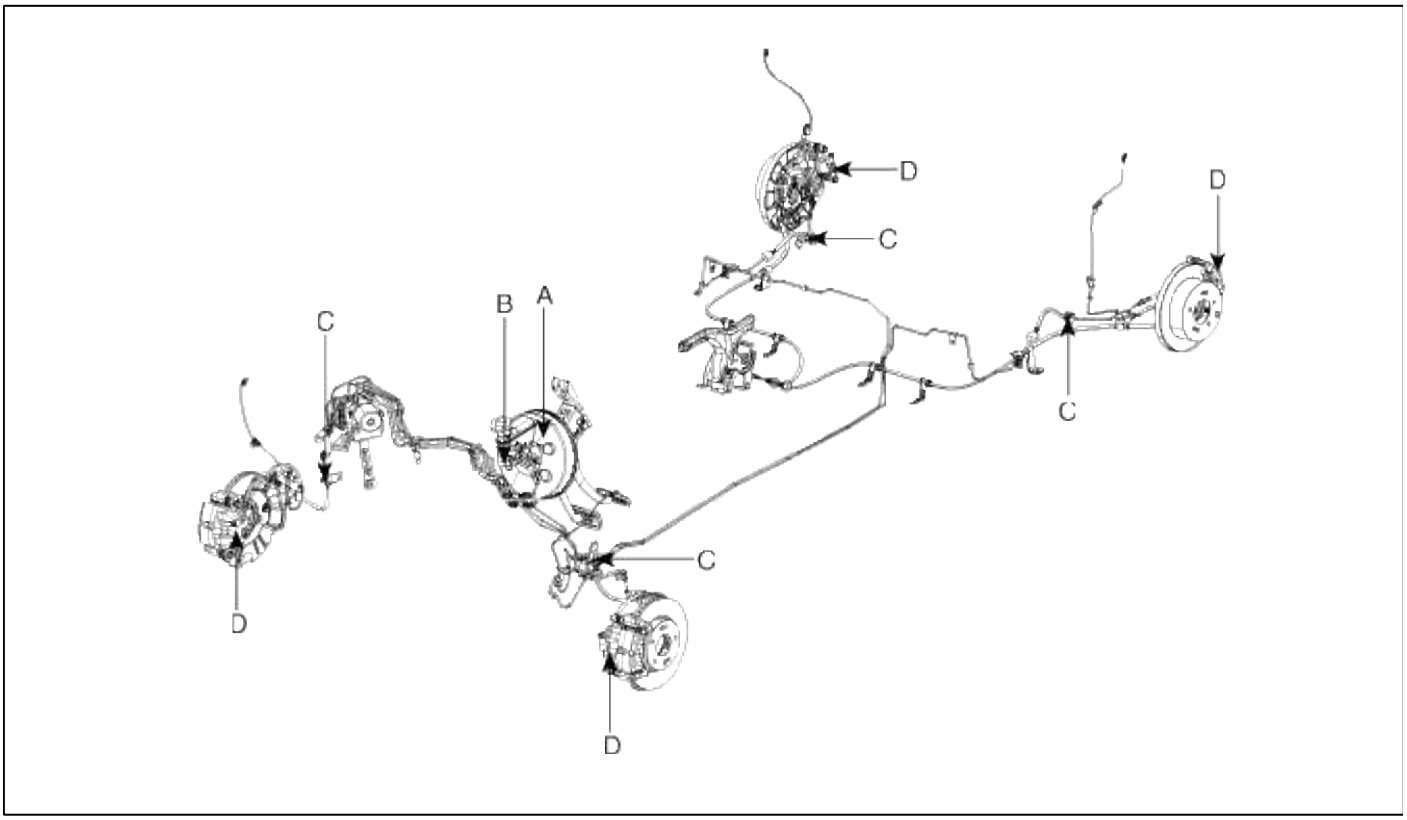
	brake chatter. Additional causes of chatter are out-of-tolerance rotors, brake lining not securely attached to the shoes, loose wheel bearings and contaminated brake lining.	

Brake System > Brake System > Repair procedures

Operation and Leakage Check

Check all of the following items

Component	Procedure
Brake Booster (A)	Check brake operation by applying the brakes during a test drive. If the brakes do not work properly, check the brake booster(Refer to "Brake Booster Operating Test" in this group). Replace the brake booster as an assembly if it does not work properly or if there are signs of leakage.
Piston cup and pressure cup inspection (B)	• Check brake operation by applying the brakes. Look for damage or signs of fluid leakage. Replace the master cylinder as an assembly if the pedal does not work properly or if there is damage or signs of fluid leakage. • Check for a difference in brake pedal stroke between quick and slow brake applications. Replace the master cylinder if there is a difference in pedal stroke.
Brake hoses (C)	Look for damage or signs of fluid leakage. Replace the brake hose with a new one if it is damaged or leaking.
Caliper piston seal and piston boots (D)	Check brake operation by applying the brakes. Look for damage or signs of fluid leakage. If the pedal does not work properly, the brakes drag, or there is damage or signs of fluid leakage, disassemble and inspect the brake caliper. Replace the boots and seals with new ones whenever the brake caliper is disassembled.



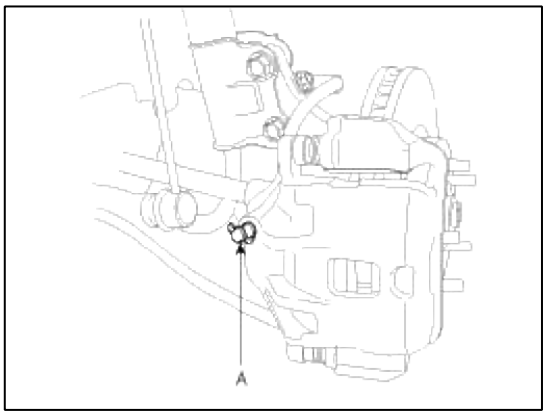
Brake System Bleeding

CAUTION

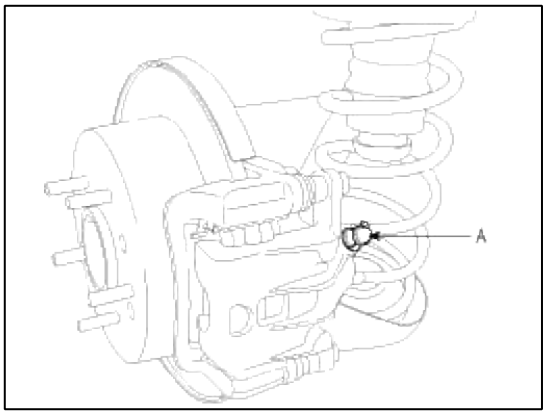
- Do not reuse the drained fluid.
- Always use genuine DOT3/DOT4 brake Fluid.
  Using a non-genuine DOT3/DOT4 brake fluid can cause corrosion and decrease the life of the system.
- Make sure no dirt or other foreign matter is allowed to contaminate the brake fluid.
- Do not spill brake fluid on the vehicle, it may damage the paint; if brake fluid does contact the paint, wash it off immediately with water.
- The reservoir on the master cylinder must be at the MAX (upper) level mark at the start of bleeding procedure and checked after bleeding each brake caliper. Add fluid as required.

1. Make sure the brake fluid in the reservoir is at the MAX(upper) level line.
2. Have someone slowly pump the brake pedal several times, and then apply pressure.
3. Loosen the right-rear brake bleed screw (A) to allow air to escape from the system. Then tighten the bleed screw securely.

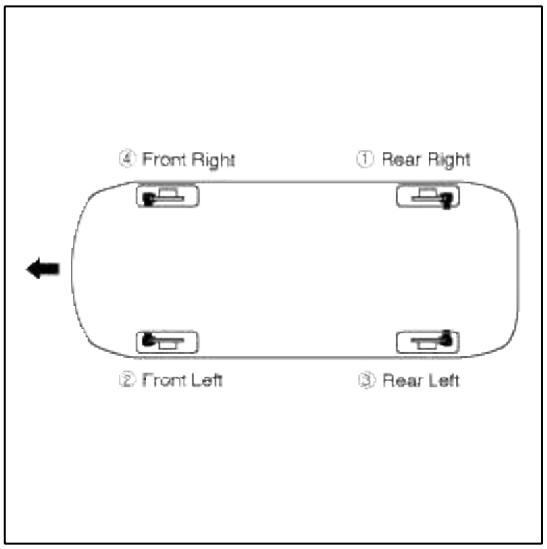
   Front



   Rear



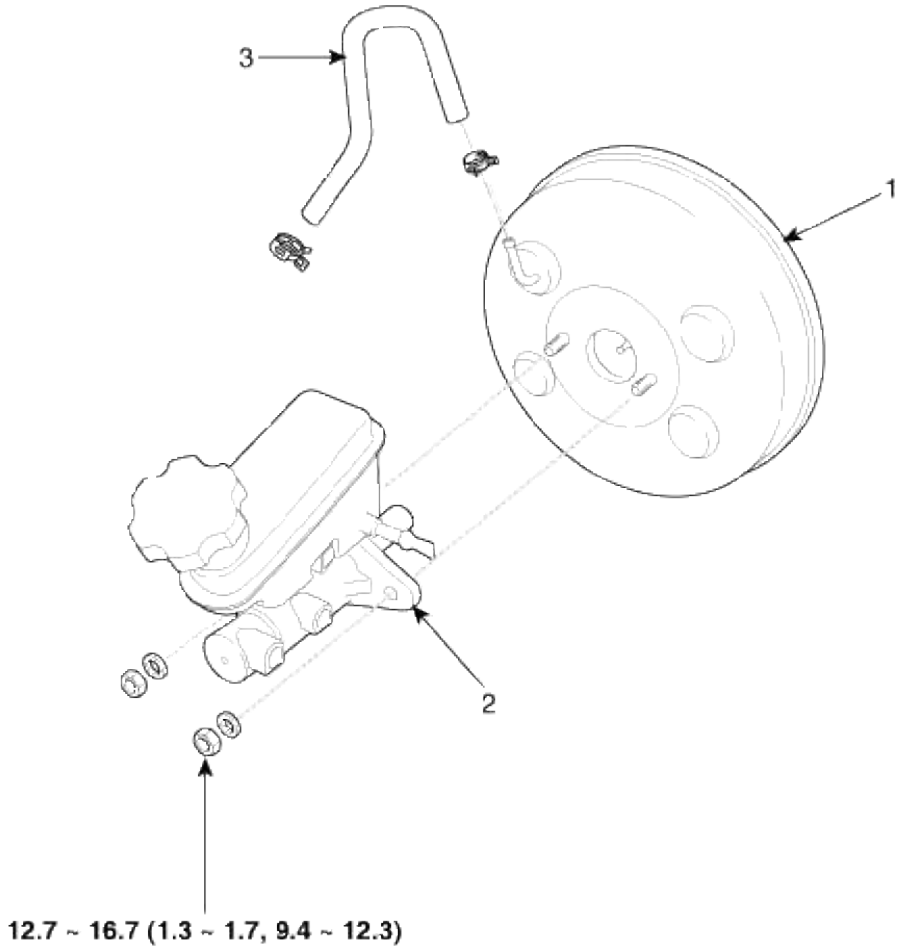
4. Repeat the procedure for wheel in the sequence shown below until air bubbles no longer appear in the fluid.



5. Refill the master cylinder reservoir to MAX(upper) level line.

Brake System > Brake System > Brake Booster > Components and Components Location

Components



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

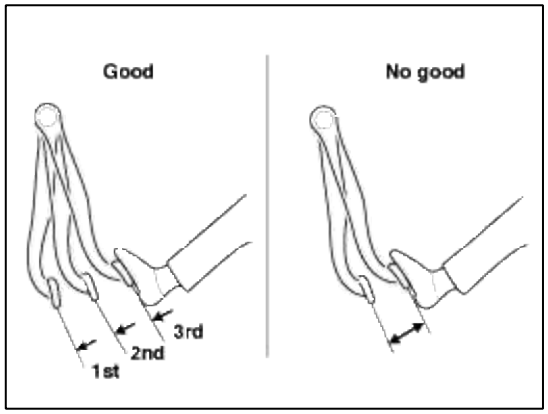
1. Brake booster
2. Master cylinder assembly
3. Vacuum hose

Brake System > Brake System > Brake Booster > Repair procedures

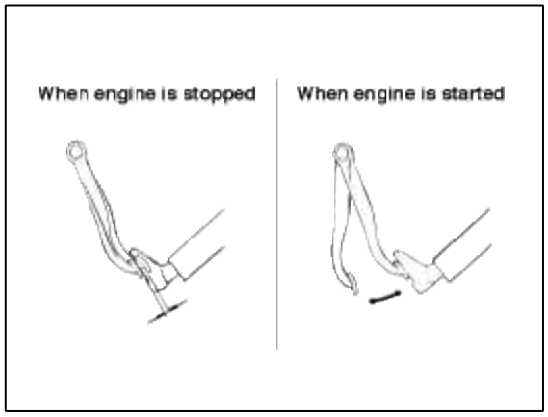
Brake Booster Operating Test

For simple checking of the brake booster operation, carry out the following tests.

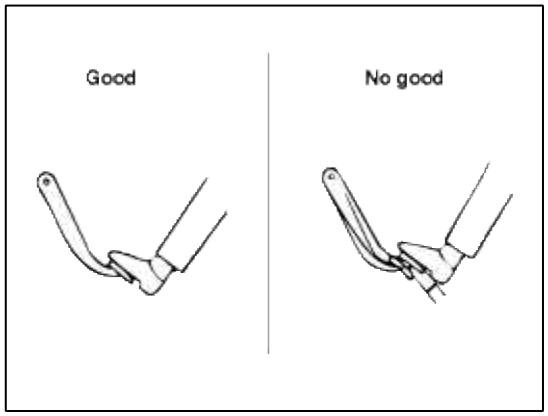
1. Run the engine for one or two minutes, and then stop it. If the pedal depresses fully the first time but gradually becomes higher when depressed succeeding times, the booster is operating properly, if the pedal height remains unchanged, the booster is inoperative.



2. With the engine stopped, step on the brake pedal several times.
   Then step on the brake pedal and start the engine. If the pedal moves downward slightly, the booster is in good condition. If there is no change, the booster is inoperative.



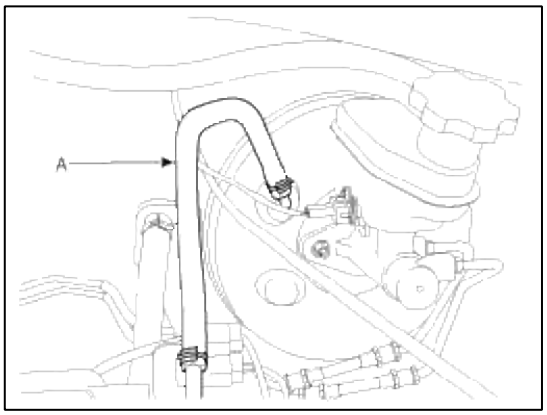
3. With the engine running, step on the brake pedal and then stop the engine.
   Hold the pedal depressed for 30 seconds. If the pedal height does not change, the booster is in good condition, if the pedal rises, the booster is inoperative.
   If the above three tests are okay, the booster performance can be determined as good.
   Even if one of the above three tests is not okay, check the check valve, vacuum hose and booster for malfunction.



Removal

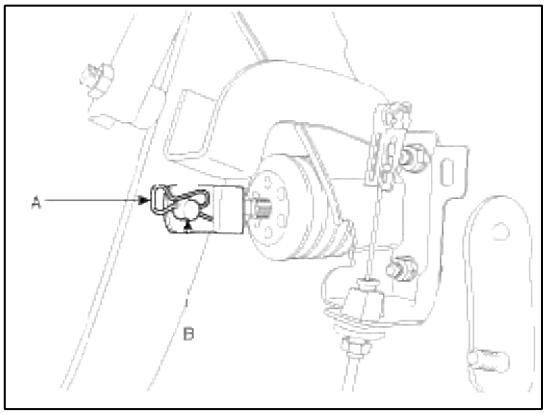
1. Turn ignition switch OFF and disconnect the negative (-) battery cable.

2. Disconnect the vacuum hose (A) from the brake booster.



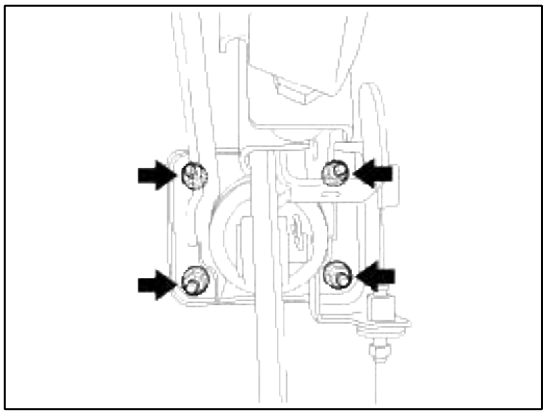
3. Remove the master cylinder. (Refer to Master cylinder)

4. Remove the snap pin (A) and clevis pin (B).

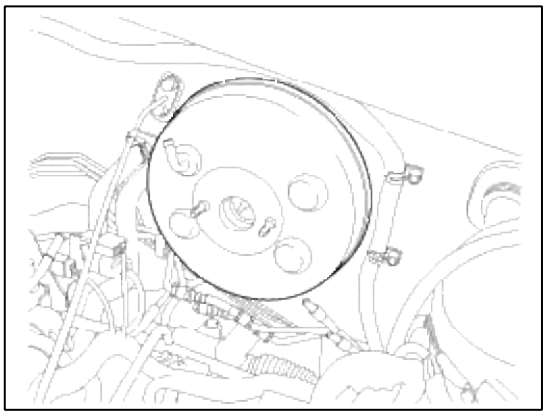


5. Remove the mounting nuts.

Tightening torque :
16.7 ~ 25.5N.m (1.7 ~ 2.6kgf.m, 12.3 ~ 18.8lb-ft)



6. Remove the brake booster.



Inspection

1. Inspect the check valve in the vacuum hose.

> CAUTION
>
> Do not remove the check valve from the vacuum hose.

2. Check the boot for damage.

Installation

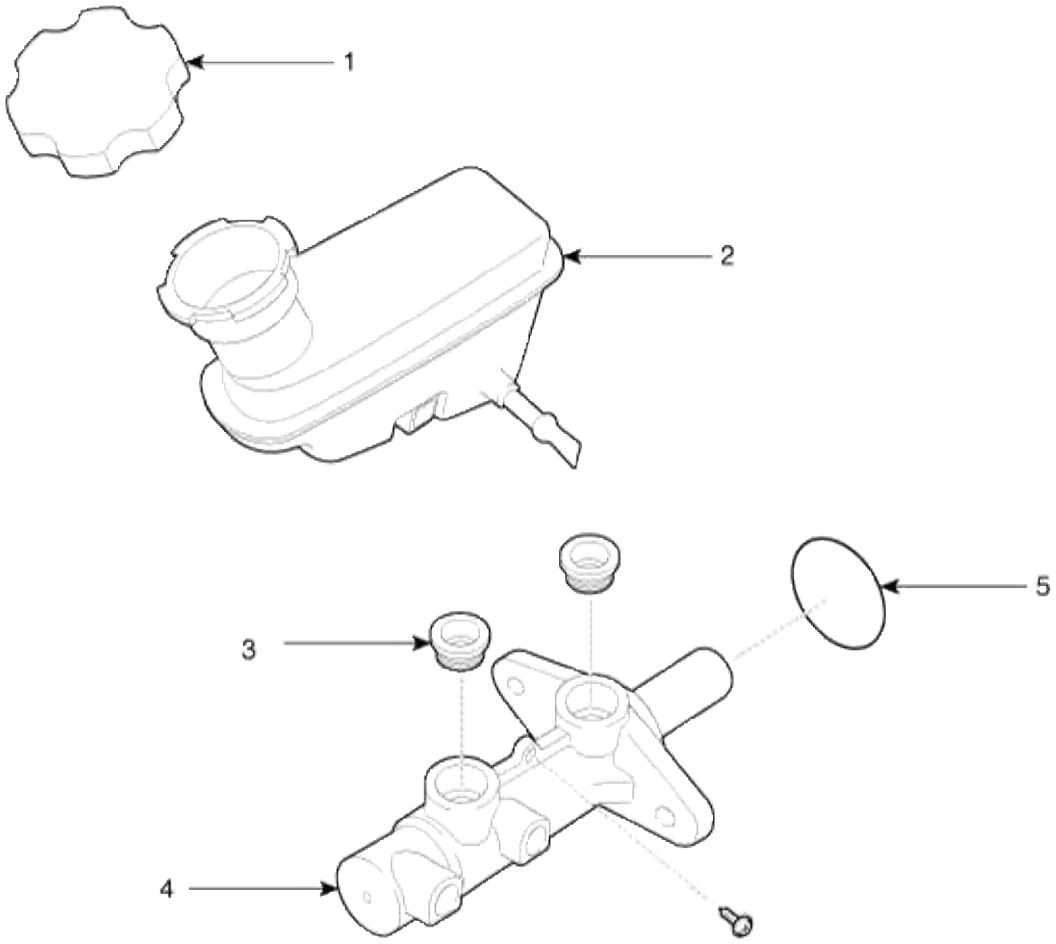
1. Installation is the reverse of removal.

> CAUTION
>
> • Before installing the pin, apply the grease to the joint pin.
> • Use a new snap pin whenever installing.

2. After installing, bleed the brake system. (Refer to Brake system bleeding)
3. Adjust the brake pedal height and free play.
   (Refer to Brake pedal height and free play adjustment)

Brake System > Brake System > Master Cylinder > Components and Components Location

Components



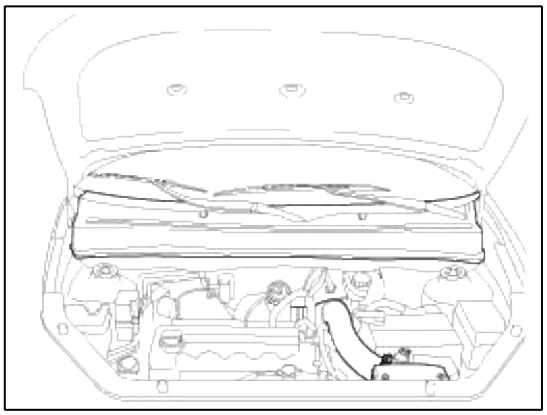
1. Reservoir cap 2. Reservoir 3. Grommet	4. Master cylinder body 5. O-Ring

Brake System > Brake System > Master Cylinder > Repair procedures

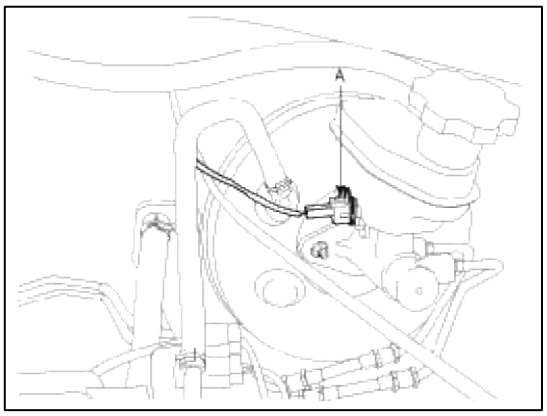
Removal

1. Turn ignition switch OFF and disconnect the negative (-) battery cable.

2. Remove the cowl top cover. (Refer to the Body group-Cowl top Cover)



3. Disconnect the brake fluid level switch connector (A) from the reservoir.

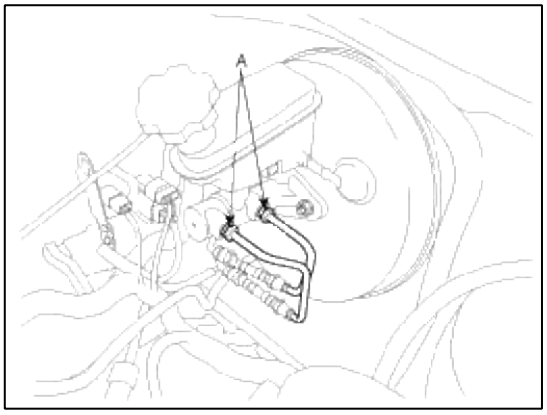


4. Remove the brake fluid from the master cylinder reservoir with a syringe.

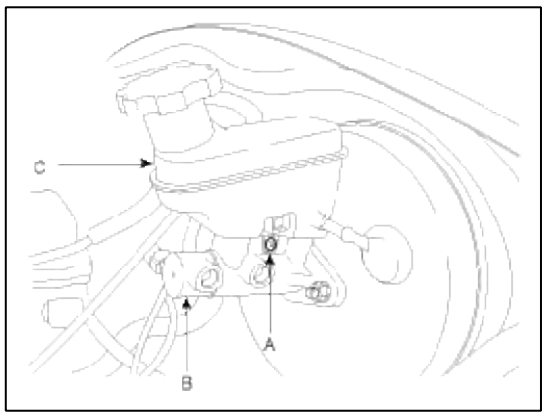
> CAUTION
>
> - Be sure to completely remove foreign substances from around brake fluid reservoir and cap before opening the reservoir cap. If not, it may cause contamination of brake fluid and deterioration in braking performance.
> - Do not spill brake fluid on the vehicle, it may damage the paint; if brake fluid does contact the paint, wash it off immediately with water.

5. Disconnect the brake tube (A) from the master cylinder by loosening the tube flare nut.

Tightening torque :
CBS/ABS : 12.7 ~ 16.7N.m (1.3 ~ 1.7kgf.m , 9.4 ~ 12.3lb-ft)
ESC : 18.6 ~ 22.6N.m (1.9 ~ 2.3kgf.m, 13.7 ~ 16.6lb-ft)

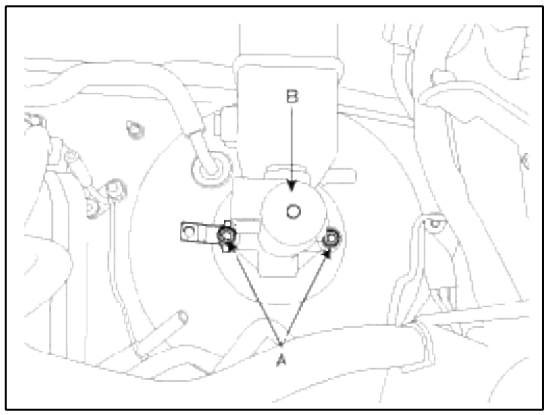


6. Remove the clutch hose. (MT Only)
7. Remove the reservoir (C) from the master cylinder (B), after removing mounting screw (A).



8. Remove the two grommets.
9. Remove the master cylinder (B) from the brake booster after loosening the mounting nuts (A).

Tightening torque :
12.7 ~ 16.7N.m (1.3 ~ 1.7kgf.m, 9.4 ~ 12.3lb-ft)

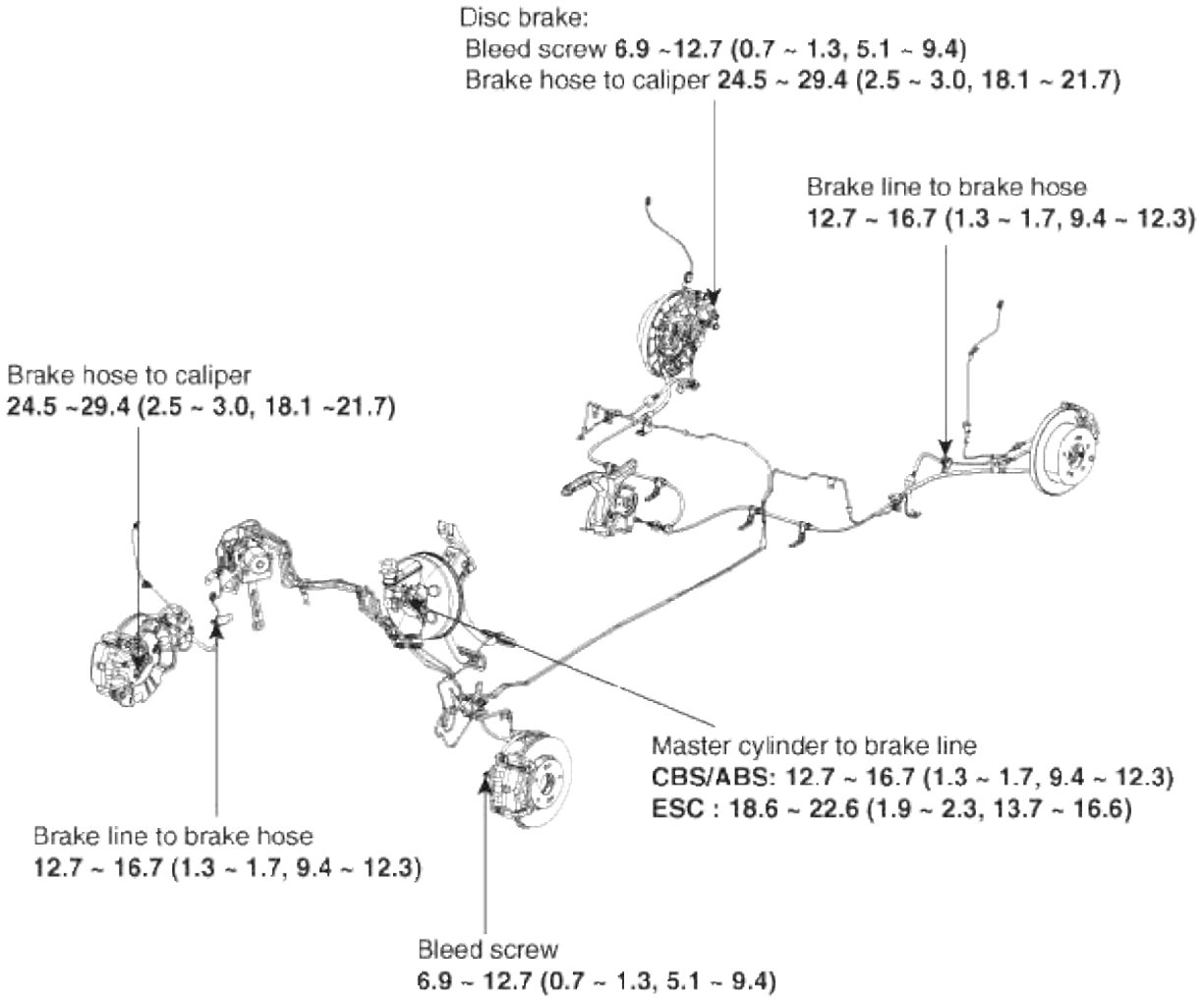


Installation

1. Installation is the reverse of removal.
2. After installation, bleed the brake system. (Refer to Brake system bleeding)

Brake System > Brake System > Brake Line > Components and Components Location

Components



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

WARNING

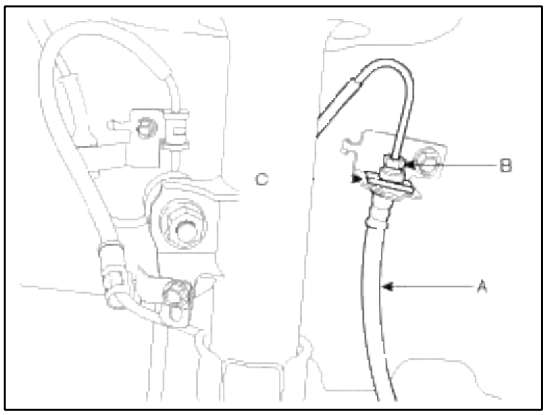
When installing brake hose, be sure to comply with the torque specification to prevent twisted hose.

Brake System > Brake System > Brake Line > Repair procedures

Removal

1. Remove the wheel & tire.

2. Remove the brake hose clip (C).



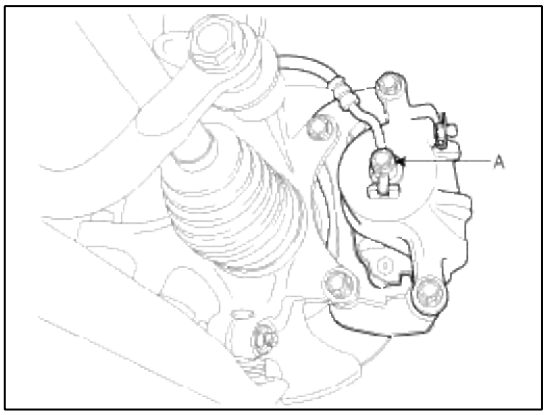
3. Disconnect the brake tube by loosening the tube flare nut (B).

Tightening torque :
12.7 ~ 16.7N.m (1.3 ~ 1.7kgf.m, 9.4 ~ 12.3lb-ft)

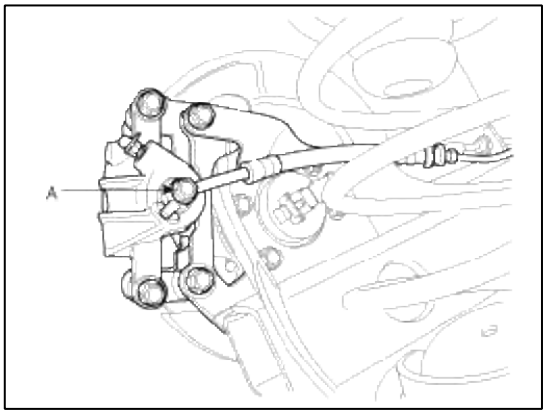
4. Disconnect the brake hose from the brake caliper by loosening the bolt (A).

Tightening torque :
24.5 ~ 29.4N.m (2.5 ~ 3.0kgf.m, 18.1 ~ 21.7lb-ft)

Front



Rear



Inspection

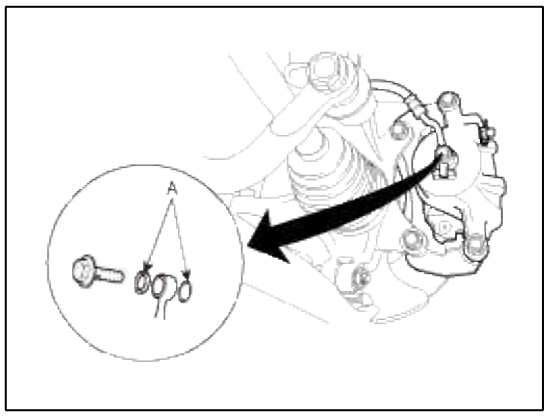
1. Check the brake tubes for cracks, crimps and corrosion.

2. Check the brake hoses for cracks, damage and fluid leakage.
3. Check the brake tube flare nuts for damage and fluid leakage.
4. Check the brake hose mounting bracket for crack or deformation.

Installation

1. Installation is the reverse of removal.

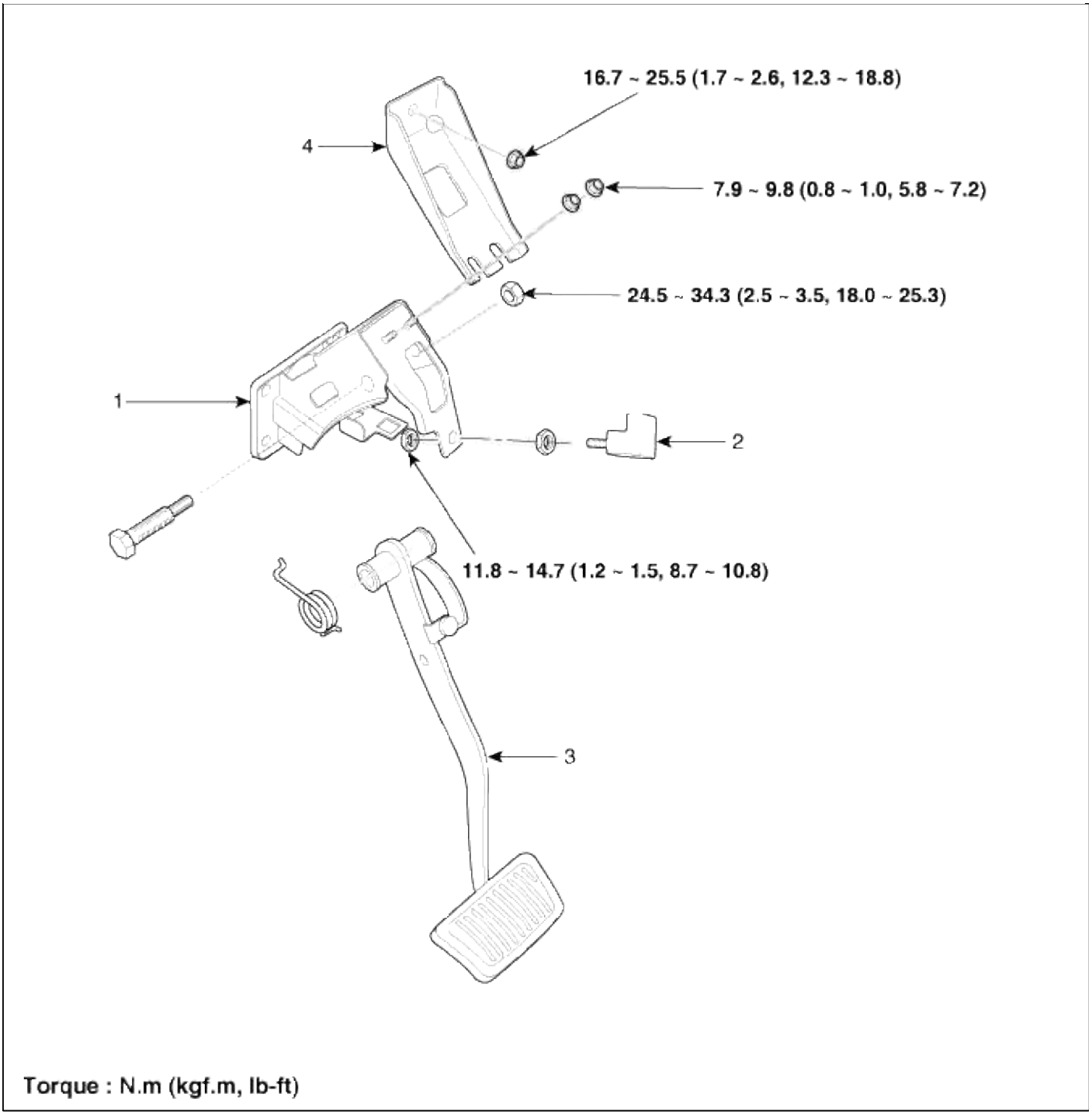
> CAUTION
>
> Use a new washer(A) whenever installing.



2. After installation, bleed the brake system. (Refer to Brake system bleeding)
3. Inspect for brake fluid leaks.

Brake System > Brake System > Brake Pedal > Components and Components Location

Components



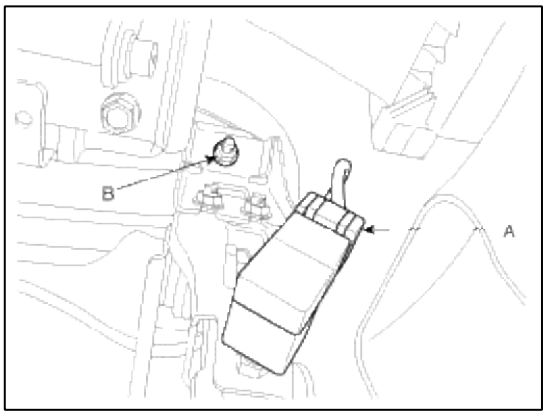
1. Brake pedal member assembly	3. Brake pedal
2. Stop lamp switch	4. Mounting bracket

Brake System > Brake System > Brake Pedal > Repair procedures

Removal

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

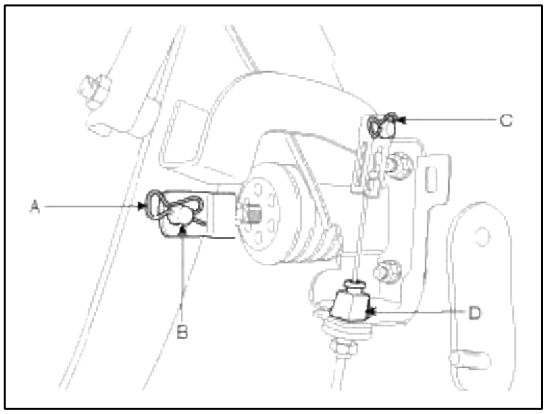
2. Disconnect the stop lamp switch connector (A).



3. Remove the mounting bracket bolt (B).

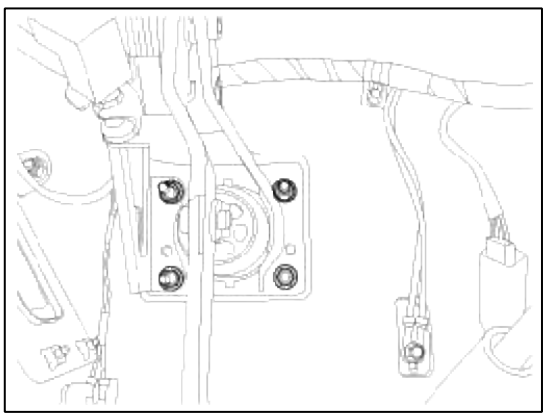
Tightening torque :
16.7 ~ 25.5N.m (1.7 ~ 2.6kgf.m, 12.3 ~ 18.8lb-ft)

4. Remove the snap pin (A) and clevis pin (B).



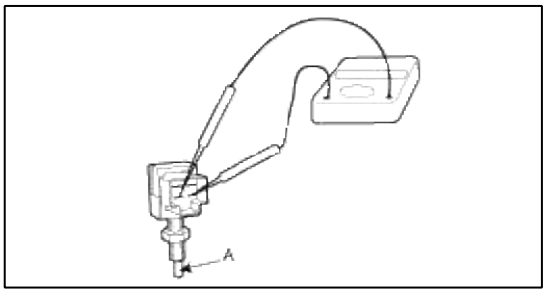
5. Remove the shift lock cable after removing the snap pin (C) and the clip (D).
6. Remove the brake pedal member assembly mounting nuts and then remove the brake pedal assembly.

Tightening torque :
16.7 ~ 25.5N.m (1.7 ~ 2.6kgf.m, 12.3 ~ 18.8lb-ft)



Inspection

1. Check the bushing for wear.
2. Check the brake pedal for bending or twisting.
3. Check the brake pedal return spring for damage.
4. Check the stop lamp switch.
   (1) Connect a circuit tester to the connector of stop lamp switch, and check whether or not there is continuity when the plunger of the stop lamp switch is pushed in and when it is released.
   (2) The stop lamp switch is in good condition if there is no continuity when plunger(A) is pushed.



Installation

1. Installation is the reverse of removal.

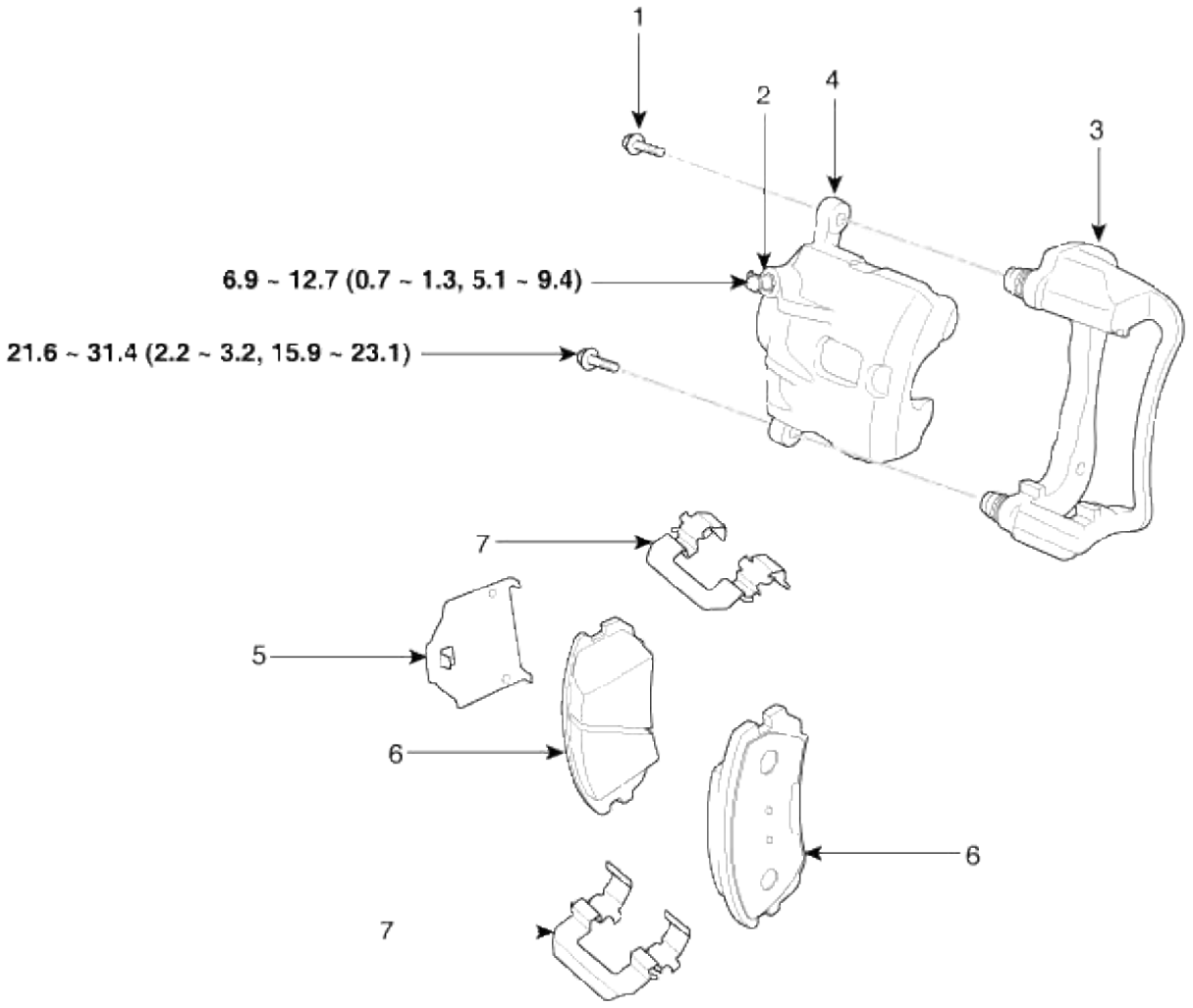
CAUTION

- Before installing the pin, apply the grease to the clevis pin.
- Use a new snap pin whenever installing.

2. Check the brake pedal operation.

Brake System > Brake System > Front Disc Brake > Components and Components Location

Components



1. Guide rod bolt 2. Bleed screw 3. Caliper bracket 4. Caliper body	5. Inner pad shim 6. Brake pad 7. Pad retainer

Brake System > Brake System > Front Disc Brake > Repair procedures

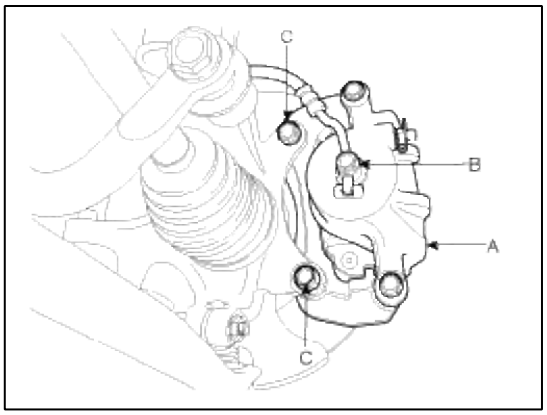
Removal

1. Remove the front wheel & tire.

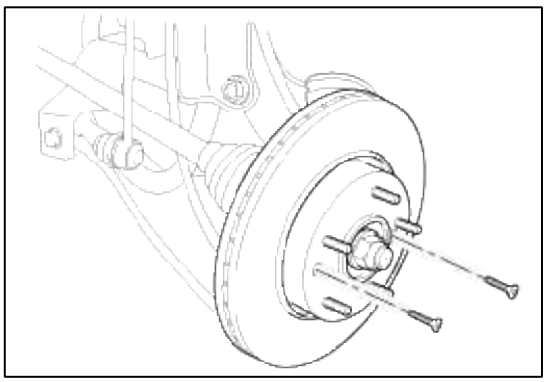
Tightening torque :
88.3 ~ 107.9N.m (9.0 ~ 11.0kgf.m, 65.1 ~ 79.6lb-ft)

2. Loosen the hose eye-bolt (B) and caliper mounting bolts (C), then remove the front caliper assembly (A).

Tightening torque
Brake hose to caliper(B):
24.5 ~ 29.4N.m (2.5 ~ 3.0kgf.m, 18.1 ~ 21.7lb-ft)
Caliper assembly to knuckle(C):
78.5 ~ 98.1N.m (8.0 ~ 10.0kgf.m, 57.9 ~ 72.3lb-ft)



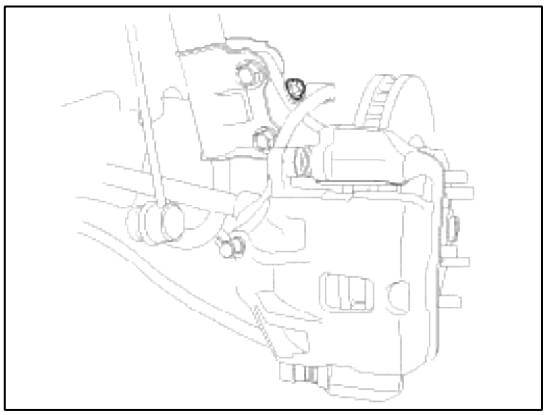
3. Remove the front brake disc by loosening the screws.



Replacement

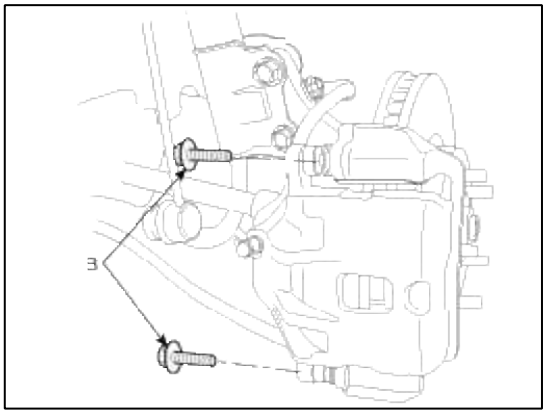
Front Brake Pads

1. Remove the brake hose mounting bracket knuckle mounting part.

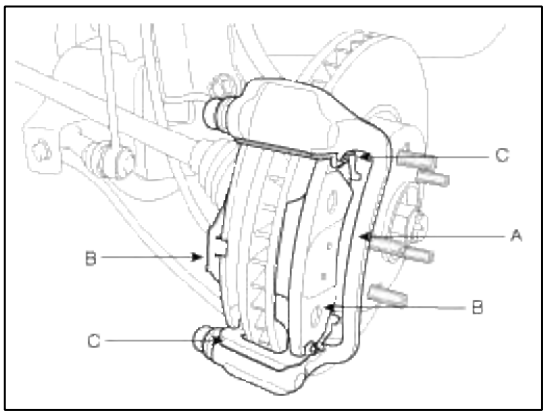


2. Loosen the guide rod bolt (B) and pivot the caliper up out of the way.

Tightening torque :
21.6 ~ 31.4N.m (2.2 ~ 3.2kgf.m, 15.9 ~ 23.1lb-ft)



3. Replace pad shim (B), pad retainers (C) and brake pads (B) in the caliper bracket (A).



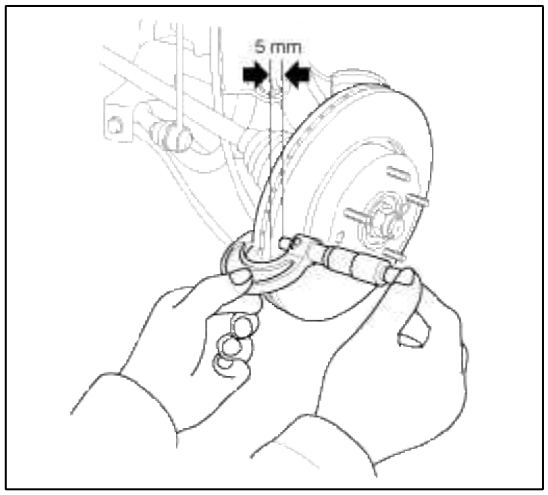
Inspection

Front Brake Disc Thickness Check

1. Check the brake pads for wear and fade.
2. Check the brake disc for damage and cracks.

3. Remove all rust and contamination from the surface, and measure the disc thickness at 8 points, at least, of same distance (5mm) from the brake disc outer circle.

Brake disc thickness
Standard: 26mm (1.02in)
Service limit: 24.4mm (0.96in)
Deviation: Less than 0.005mm (0.0002in)



4. If wear exceeds the limit, replace the discs and pad assembly left and right of the vehicle.

Front Brake Pad Check

1. Check the pad wear. Measure the pad thickness and replace it, if it is less than the specified value.

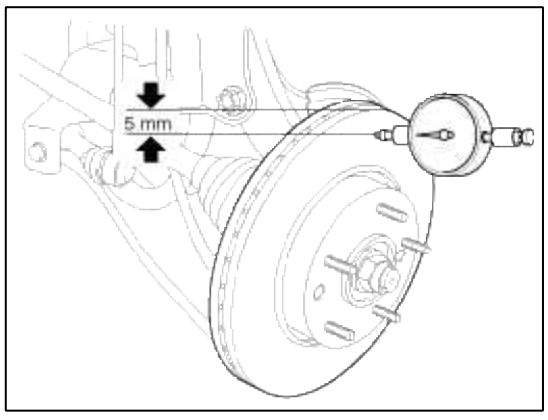
Pad thickness
Standard value : 11mm (0.43in)
Service limit : 2.0mm (0.0787in)

2. Check that grease is applied, to sliding contact points and the pad and backing metal for damage.

Front Brake Disc Runout Check

1. Place a dial gauge about 5mm (0.2 in.) from the outer circumference of the brake disc, and measure the runout of the disc.

Brake disc runout
Limit : 0.025mm (0.00098in.) or less (new one)



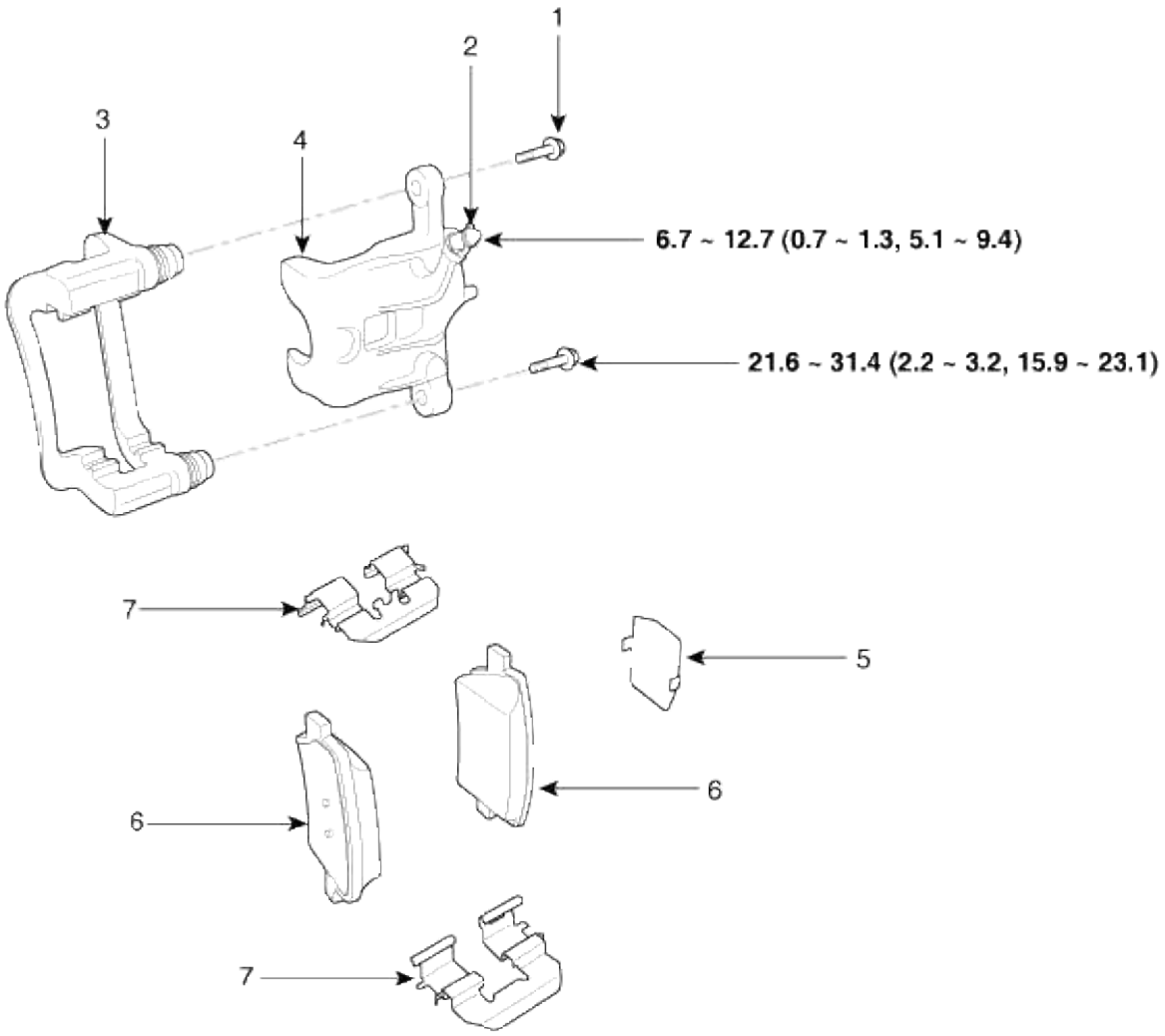
2. If the runout of the brake disc exceeds the limit specification, replace the disc, and then measure the run out again.
3. If the replacement brake disc runout exceeds the limit specification rotate the 180° and check again.
4. If the runout cannot be corrected by changing the position of the brake disc, replace the brake disc.

Installation

1. Installation is the reverse of removal.
2. Use a SST (09581-11000) when installing the brake caliper assembly.
3. After installation, bleed the brake system. (Refer to Brake system bleeding)

Brake System > Brake System > Rear Disc Brake > Components and Components Location

Components



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

1. Guide rod bolt 2. Bleed screw 3. Caliper bracket 4. Caliper body	5. Inner pad shim 6. Brake pad 7. Pad retainer

Brake System > Brake System > Rear Disc Brake > Repair procedures

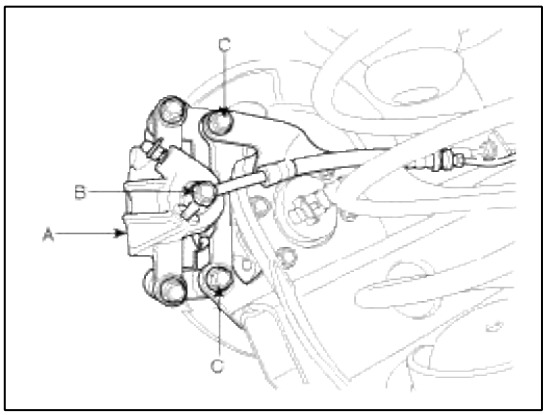
Removal

1. Remove the rear wheel & tire.

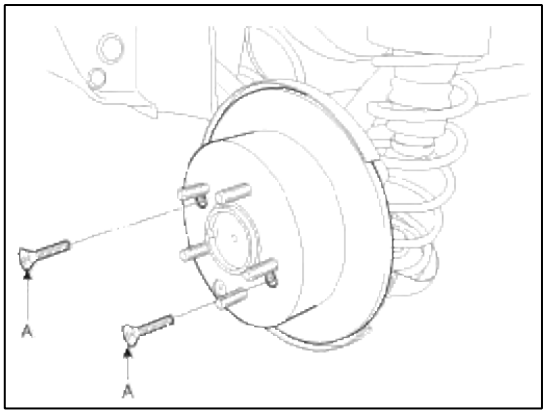
Tightening torque :
88.3 ~ 107.9N.m (9.0 ~ 11.0kgf.m, 65.1 ~ 79.6lb-ft)

2. Loosen the hose eye-bolt (B) and caliper mounting bolts (C), then remove the rear caliper assembly (A).

Tightening torque
Brake hose to caliper(B):
24.5 ~ 29.4N.m (2.5 ~ 3.0kgf.m, 18.1 ~ 21.7lb-ft)
Caliper assembly to carrier(C):
63.7 ~ 73.6N.m (6.5 ~ 7.5kgf.m, 47.0 ~ 54.3lb-ft)



3. Remove the rear brake disc by loosening the screws (A).

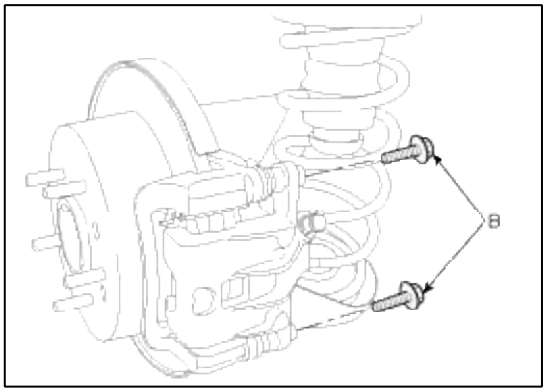


Replacement

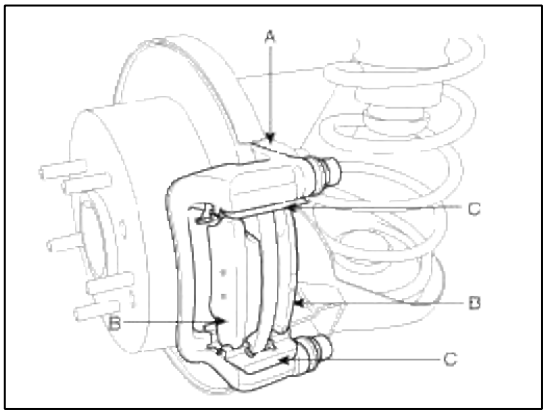
Rear Brake Pads

1. Loosen the guide rod bolt (B) and pivot the caliper up out of the way.

Tightening torque :
21.6 ~ 31.4N.m (2.2 ~ 3.2kgf.m, 15.9 ~ 23.1lb-ft)



2. Replace pad shim, pad retainers (C) and brake pads (B) in the caliper bracket (A).



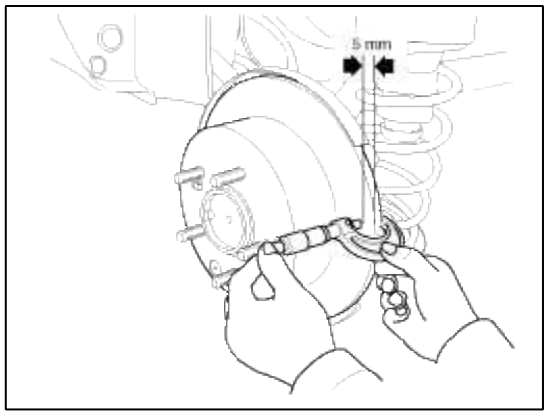
Inspection

Rear Brake Disc Thickness Check

1. Check the brake pads for wear and fade.
2. Check the brake disc for damage and cracks.

3. Remove all rust and contamination from the surface, and measure the disc thickness at 8 points, at least, of same distance (5mm) from the brake disc outer circle.

Brake disc thickness
Standard: 10mm (0.39in)
Service limit: 8.4mm (0.33in)
Deviation: less than 0.01mm (0.00039in)



4. If wear exceeds the limit, replace the discs and pad assembly left and right of the vehicle.

Rear Brake Pad Check

1. Check the pad wear. Measure the pad thickness and replace it, if it is less than the specified value.

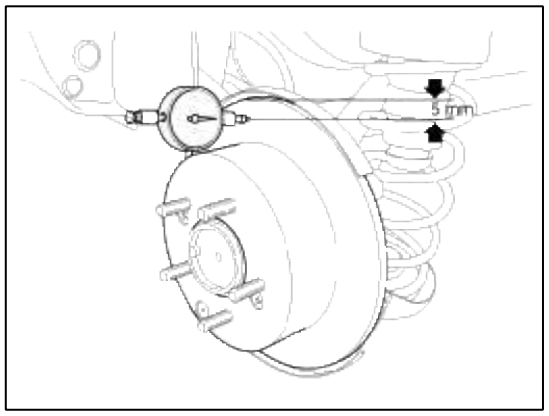
Pad thickness
Standard value: 10mm (0.39 n)
Service limit: 2.0 mm (0.0787 in)

2. Check that grease is applied, to sliding contact points and the pad and backing metal for damage.

Rear Brake Disc Runout Check

1. Place a dial gauge about 5mm (0.2 in.) from the outer circumference of the brake disc, and measure the runout of the disc.

Brake disc runout
Limit: 0.05mm (0.00197in.) or less (new one)



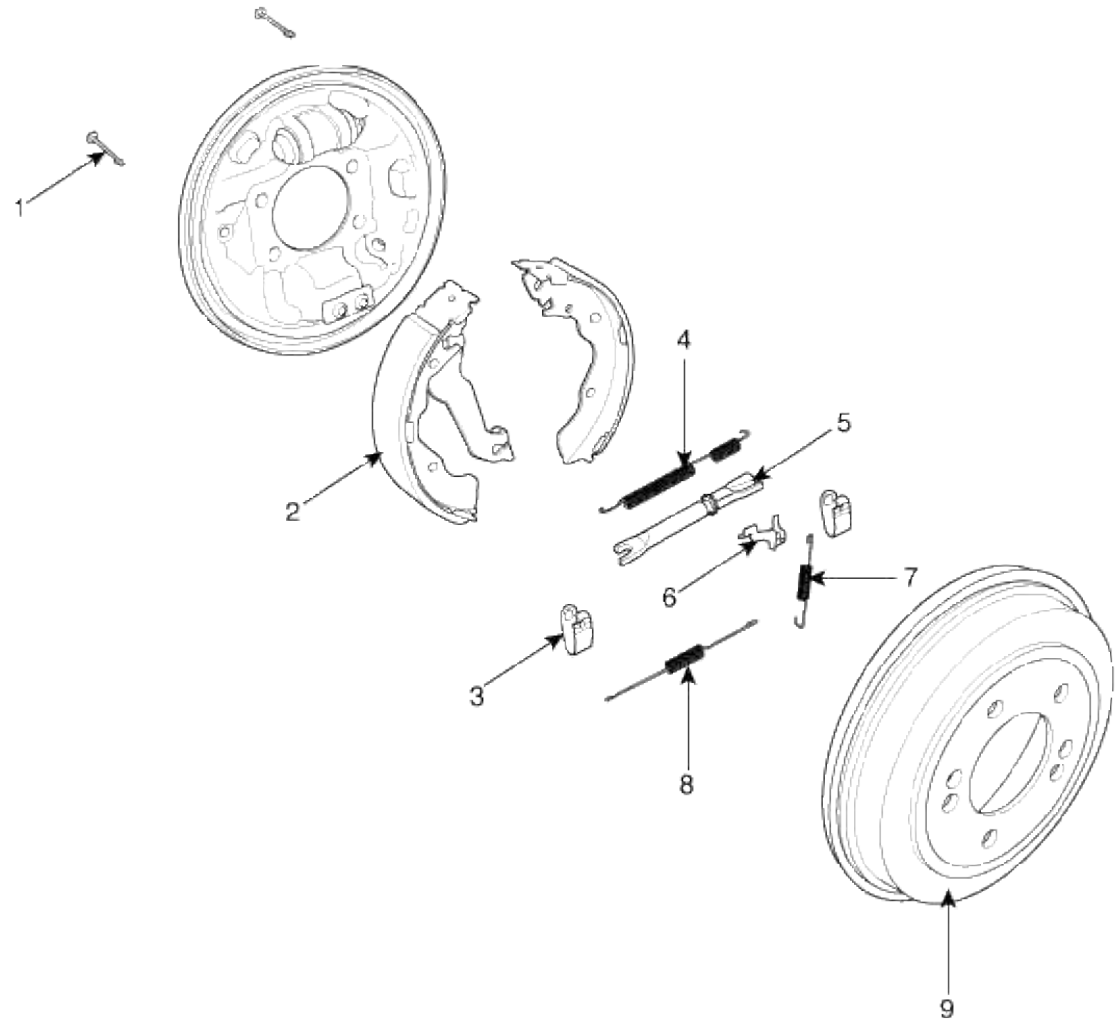
2. If the runout of the brake disc exceeds the limit specification, replace the disc, and then measure the runout again.
3. If the replacement brake disc runout exceed the limit specification rotate the 180° and check again.
4. If the runout cannot be corrected by changing the position of the brake disc, replace the brake disc.

Installation

1. Installation is the reverse of removal.
2. Use a SST (09581-11000) when installing the brake caliper assembly.
3. After installation, bleed the brake system. (Refer to Brake system bleeding)

Brake System > Brake System > Rear Drum Brake > Components and Components Location

Components



1. Shoe hold down pin	6. Adjusting lever
2. Shoe	7. Adjusting lever spring
3. Shoe hold spring	8. Lower return spring
4. Upper return spring	9. Brake drum
5. Shoe adjuster	

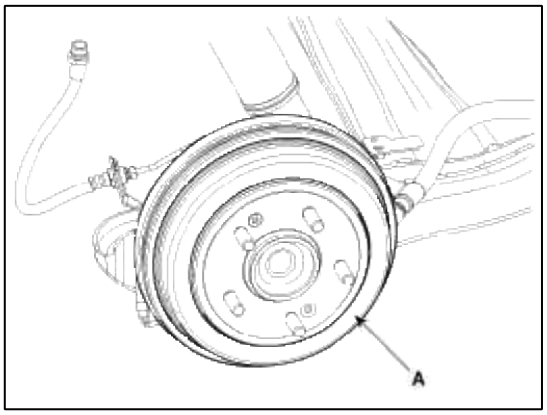
Brake System > Brake System > Rear Drum Brake > Repair procedures

Removal

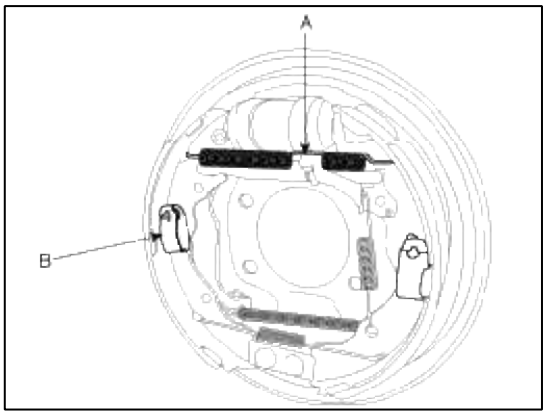
CAUTION

- Frequent inhalation of brake pad dust, regardless of material composition, could be hazardous to your health.
- Avoid breathing dust particles.
- Never use an air hose or brush to clean brake assemblies.

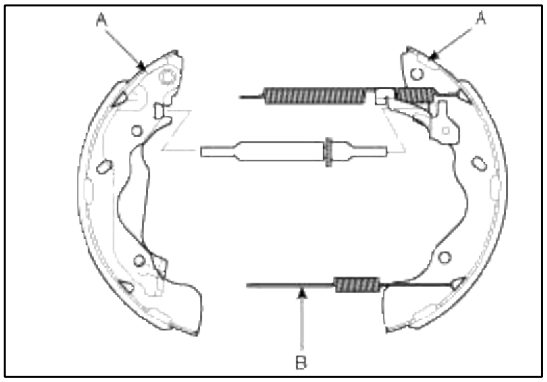
1. Release the parking brake.
2. Remove the rear tire and wheel.
3. Remove the rear brake drum (A).



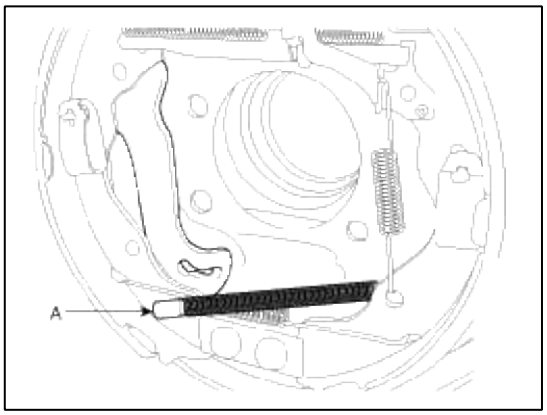
4. Remove the shoe hold spring and shoe hold pin (B).
5. Remove the upper return spring (A).



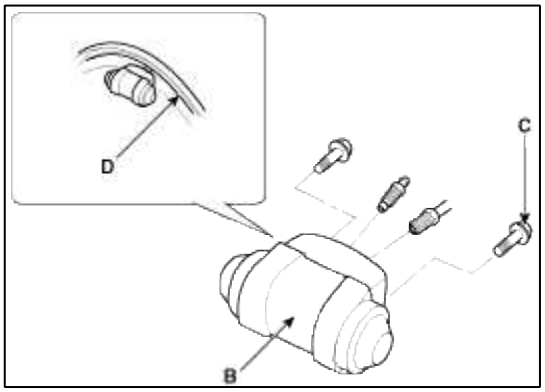
6. Lower the brake shoe assembly (A), and remove the lower return spring (B). Make sure not to damage the dust cover on the wheel cylinder.



7. Remove the parking brake cable (A) from the brake assembly.



8. Remove the brake shoe assembly.
9. Disconnect brake tubes (A) from the wheel cylinder (B).
10. Remove the bolt (C) and the wheel cylinder (B) from the backing plate (D).

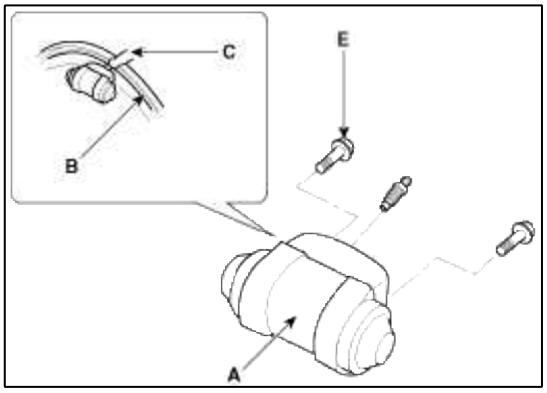


Installation

NOTE

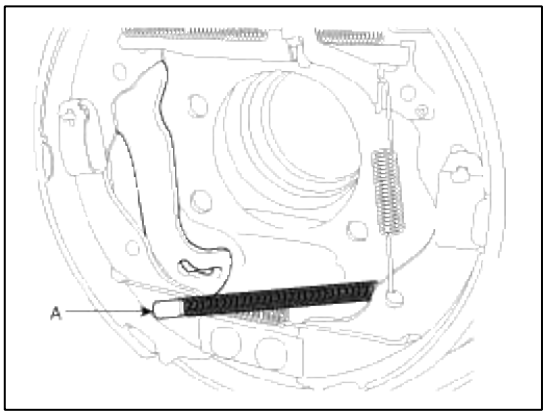
- Do not spill brake fluid on the vehicle: it may damage the paint; if brake fluid does contact the paint. Wash it off immediately with water.
- To prevent spills, cover the hose joints with rags or shop towels.
- Use only a genuine wheel cylinder special bolt.

1. Apply sealant (C) between the wheel cylinder (A) and backing plate (B), and install the wheel cylinder.

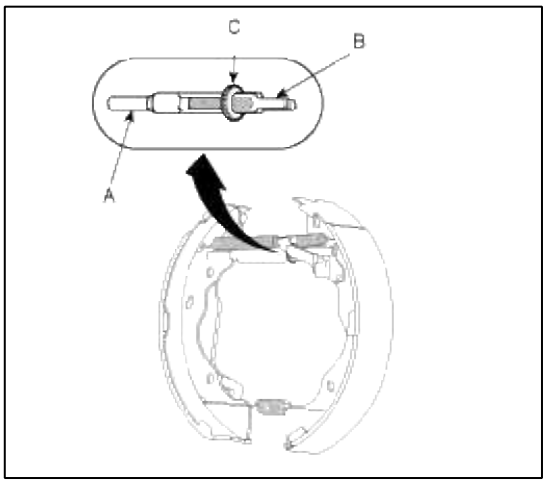


2. Connect the brake tubes (D) to the wheel cylinder.

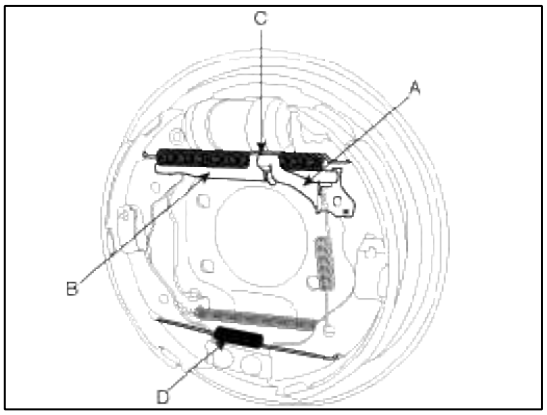
3. Connect the parking brake cable (A) to the brake assembly.



4. Clean the threaded portions of adjuster sleeve (A) and push rod female (B). Coat the threads of the adjuster assembly with grease. To shorten the clevises, turn the adjuster bolt (C).



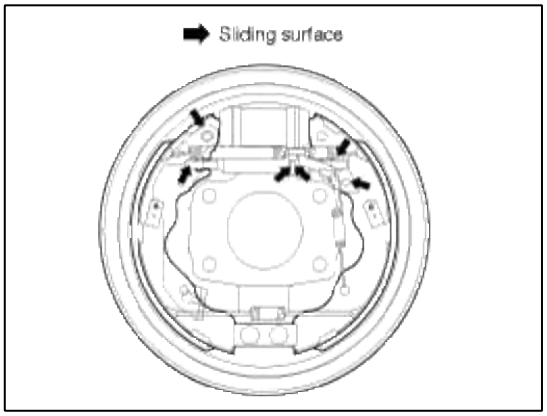
5. Hook the shoe adjuster lever (A), then install it to the brake shoe.



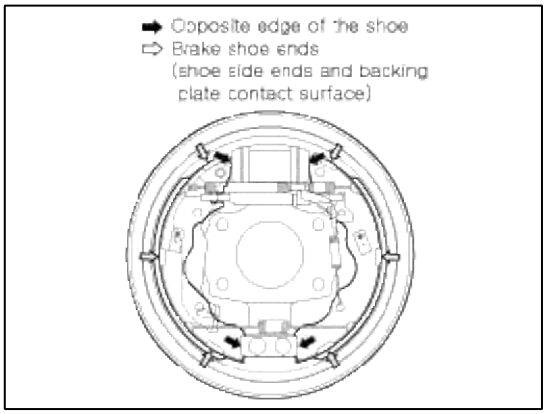
6. Install the adjuster assembly (B) and upper return spring (C) as right direction. Be careful not to damage the wheel cylinder dust covers.

7. Install the lower return spring (D).

8. Apply brake cylinder grease or equivalent rubber grease to the sliding surfaces shown. Don't get grease on the brake linings.

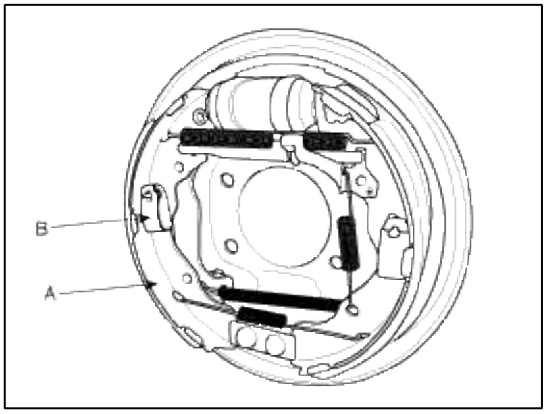


9. Apply brake cylinder grease or equivalent rubber grease to the brake shoe ends and opposite edges of the shoes shown. Don't get grease on the brake linings.

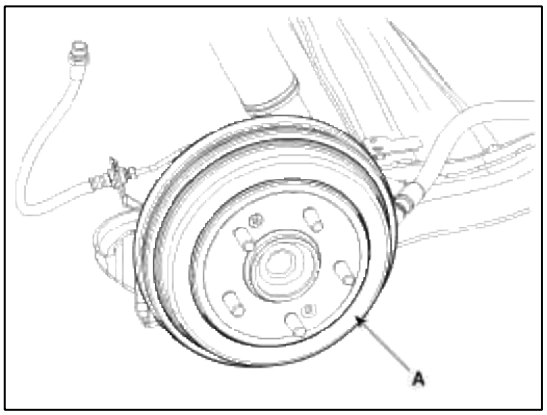


10. Install the brake shoes (A) onto the backing plate. Be careful not to damage the wheel cylinder dust covers.

11. Install the shoe hold down pins (B) and the shoe hold down springs.



12. Install the rear brake drum (A).



13. If the wheel cylinder has been removed, bleed the brake system.
14. Depress the brake pedal several times to set the self-adjusting brake.
15. Adjust the parking brake.

Inspection

CAUTION

- Frequent inhalation of brake pad dust, regardless of material composition, could be hazardous to your health.
- Avoid breathing dust particles.
- Never use an air hose or brush to clean brake assemblies.

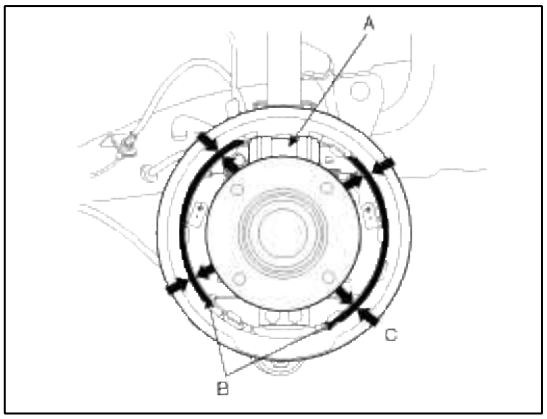
NOTE

- Contaminated brake linings or drums reduce stopping ability.
- Block the front wheels before jacking up the rear of the vehicle.

1. Raise the rear of the vehicle, and make sure it is securely supported.
2. Release the parking brake, and remove the rear brake drum.
3. Check the wheel cylinder (A) for leakage.
4. Check the brake linings (B) for cracking, glazing, wear, and contamination.

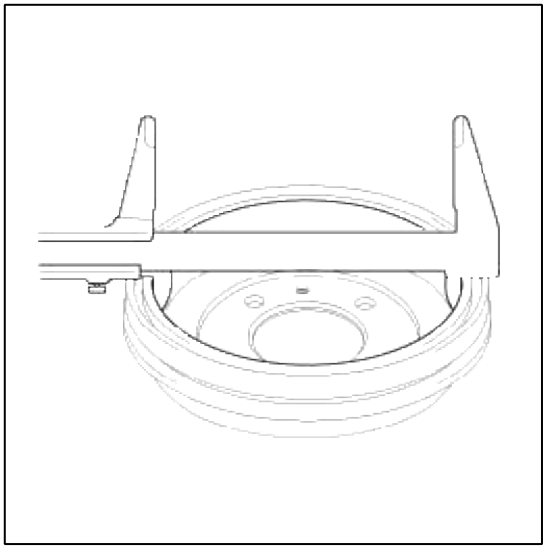
5. Measure the brake lining thickness (C).
   Measurement does not include brake shoe thickness.

Brake lining thickness
Standard : 5.14mm (0.202in)
Service limit : 1.0mm (0.039in)



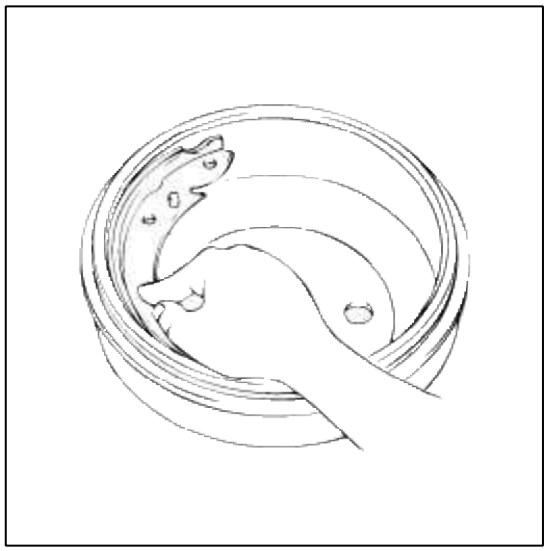
6. If the brake lining thickness is less than the service limit, replace the brake shoes as a set.
7. Check the bearings in the hub unit for smooth operation. If it requires servicing, replace it.
8. Measure the inside diameter of the brake drum with inside vernier calipers.

Drum inside diameter
Standard : 203.2mm (8.0in)
Service limit : 205.2mm (8.08in)
Drum roundness
Service limit : 0.06mm (0.00236in)



9. If the inside diameter of the brake drum is more than the service limit, replace the brake drum.
10. Check the brake drum for scoring, grooves, and cracks.

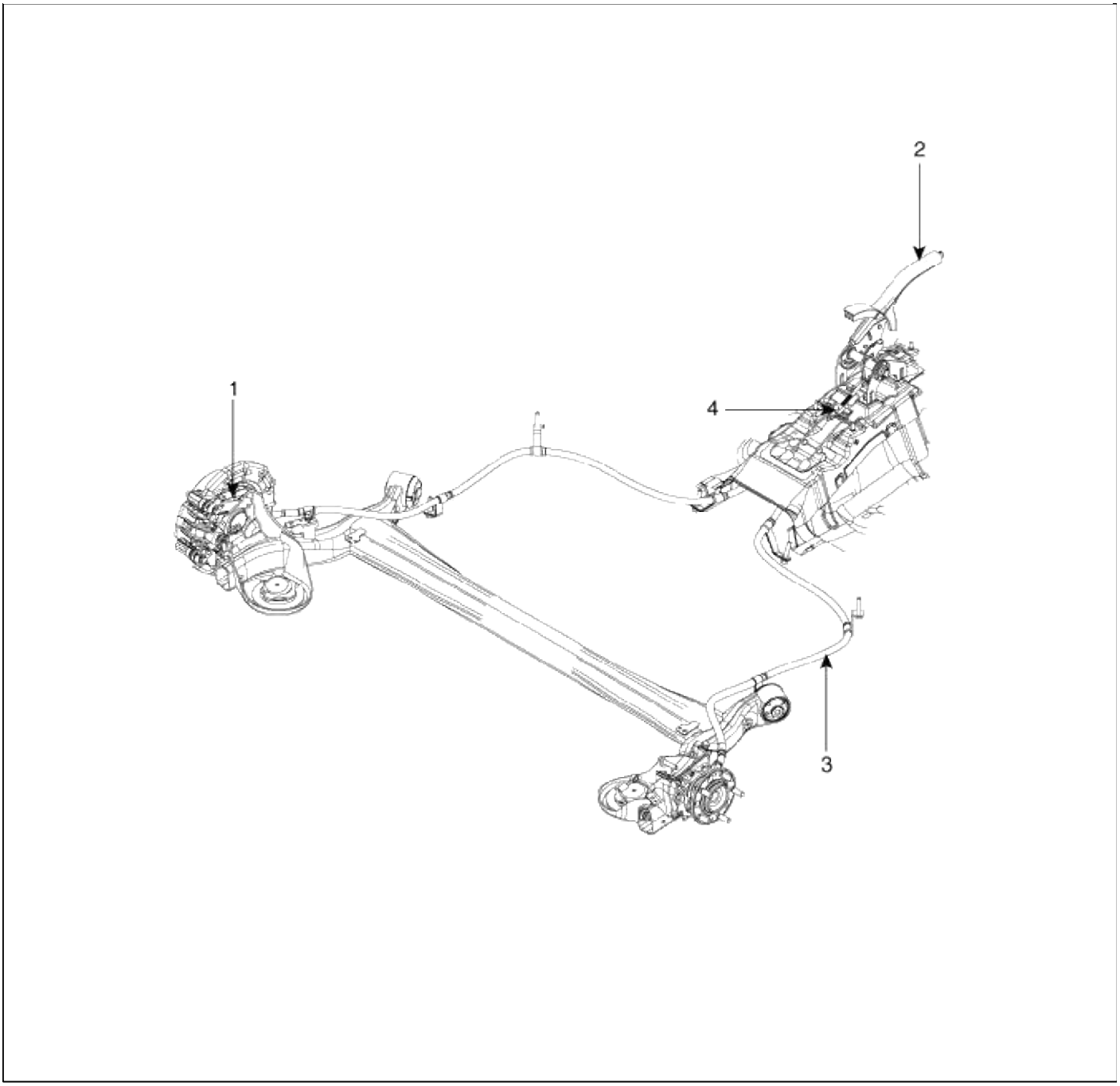
11. Inspect the brake lining and drum for proper contact.



12. Inspect the wheel cylinder outside for excessive wear and damage.
13. Inspect the backing plate for wear or damage.

Brake System > Parking Brake System > Parking Brake Assembly > Components and Components Location

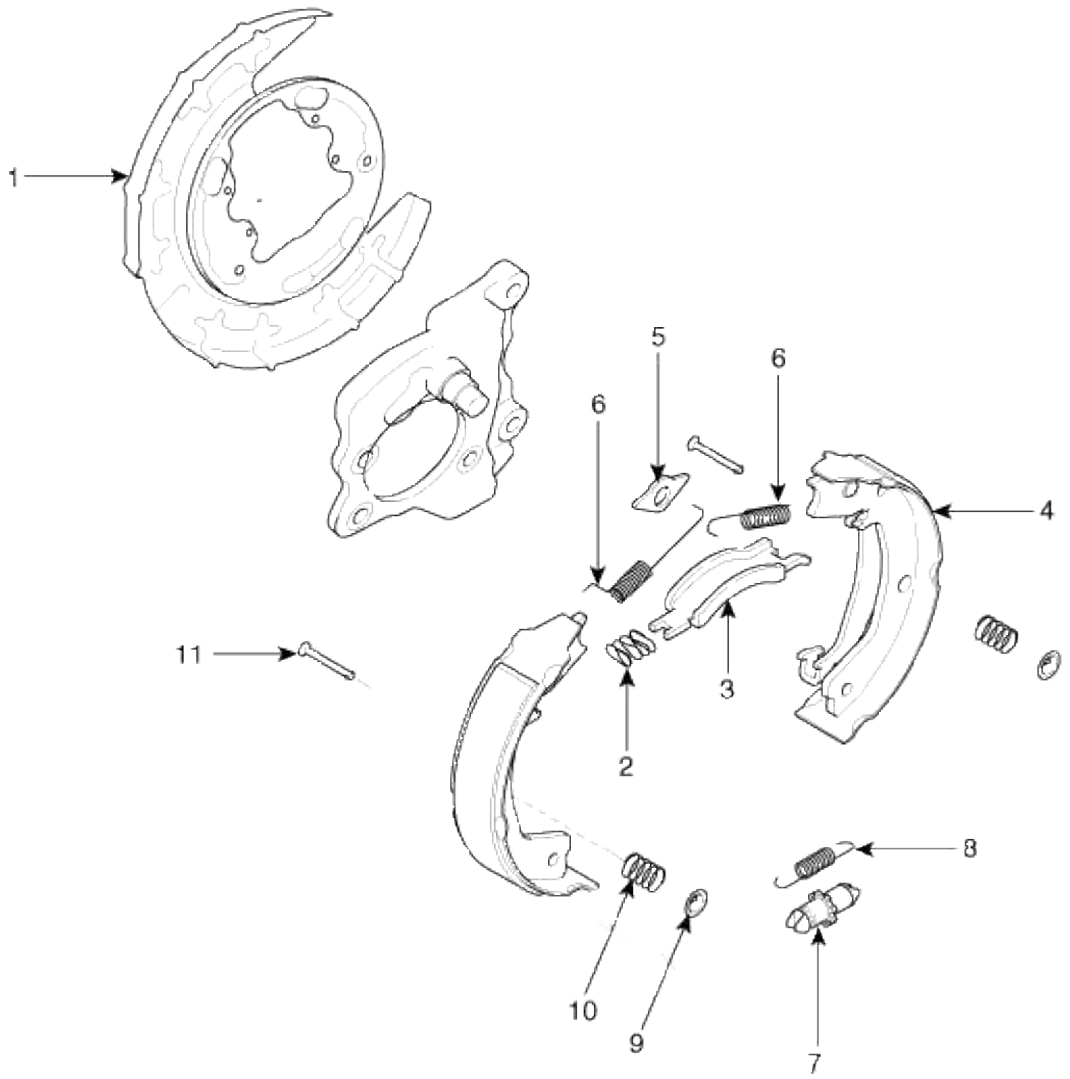
Component Location



1. Parking brake 2. Parking brake lever	3. Parking brake cable 4. Equalizer assembly

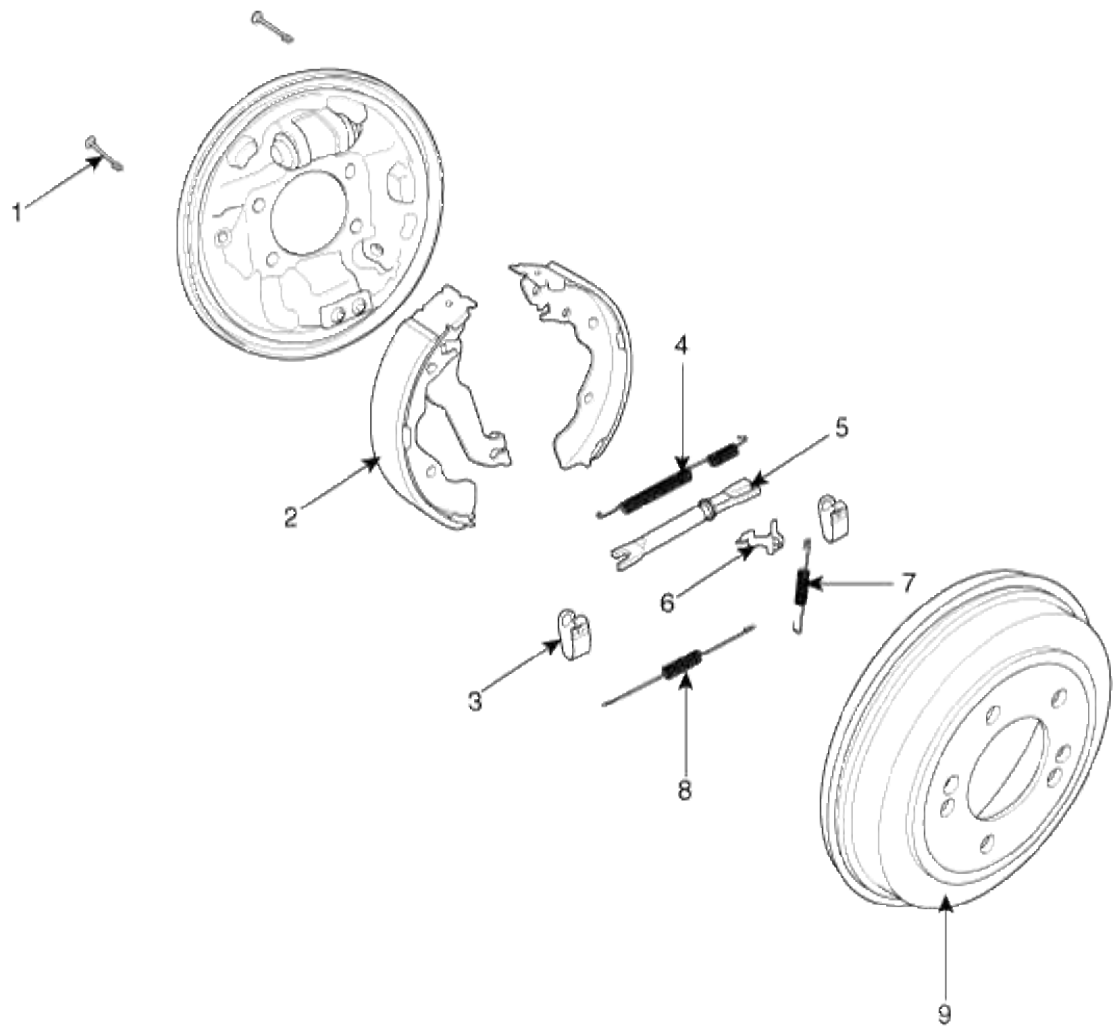
Component

Disc Brake Type



1. Back plate	6. Return spring
2. Strut spring	7. Adjuster
3. strut	8. Return spring
4. Shoe & lining	9. Cup washer
5. Shoe guie	10. Shoe hold down spring

Drum Brake Type



1. Shoe hold down pin	6. Adjusting lever
2. Shoe	7. Adjusting lever spring
3. Shoe hold spring	8. Lower return spring
4. Upper return spring	9. Brake drum
5. Shoe adjuster	

Brake System > Parking Brake System > Parking Brake Assembly > Repair procedures

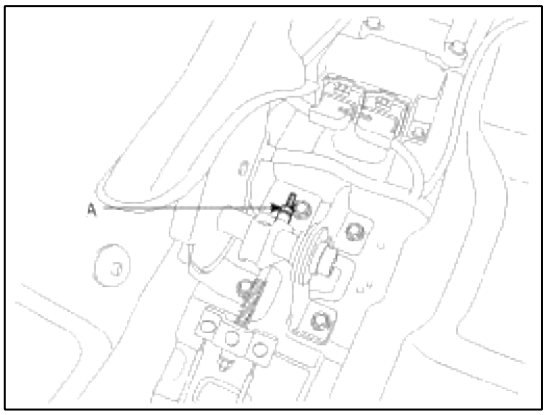
Removal

Parking Brake Lever

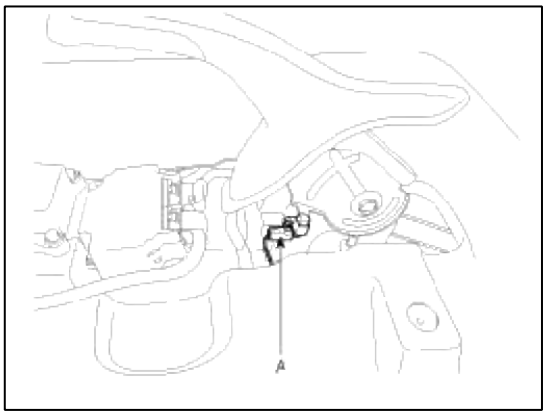
NOTE

The parking brake cables must not be bent or distorted. This will lead to stiff operation and premature failure.

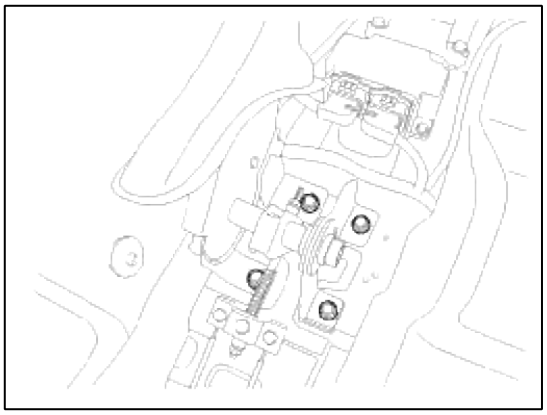
1. Remove the floor console. (Refer to Body group. -"Floor console")
2. Loosen the adjusting nut (A) and the parking brake cables.



3. Disconnect the connector (A) of parking brake switch.



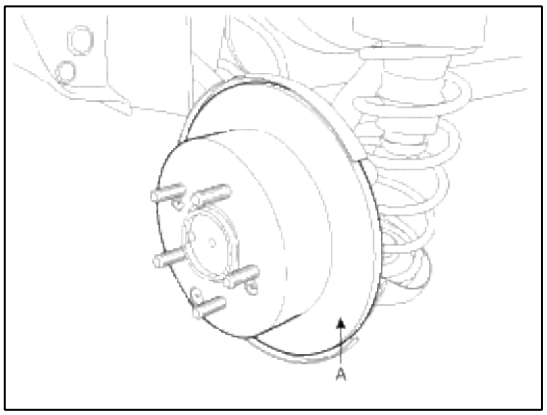
4. Remove the parking brake lever assembly after removing the 4 bolts shown.



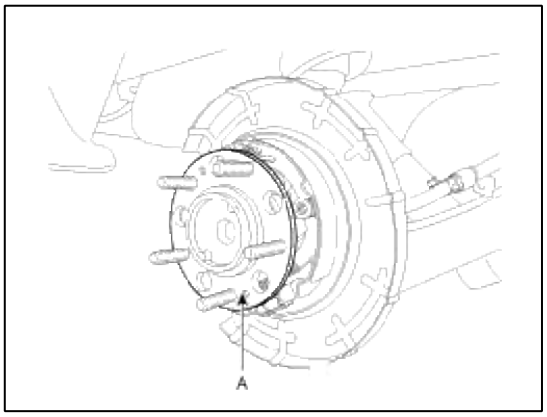
Parking Brake Shoe (Disc Brake Type)

1. Raise the vehicle, and make sure it is securely supported.
2. Remove the rear tire and wheel, then remove the brake caliper. (Refer to "Rear disc brake removal")

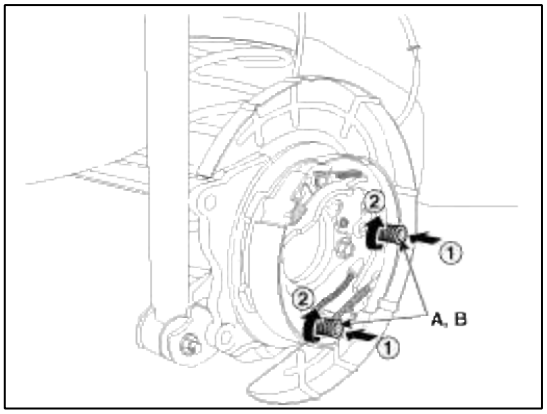
3. Remove the brake Disc (A).



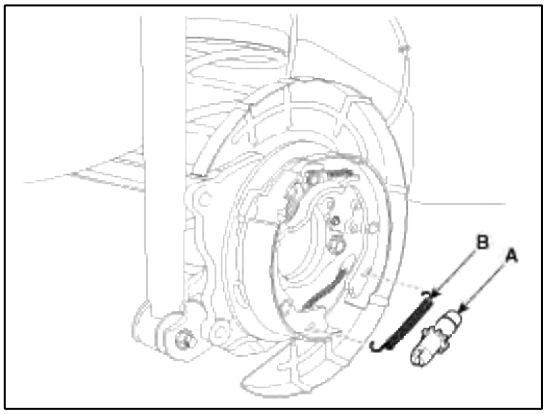
4. Remove the rear hub unit bearing (A).



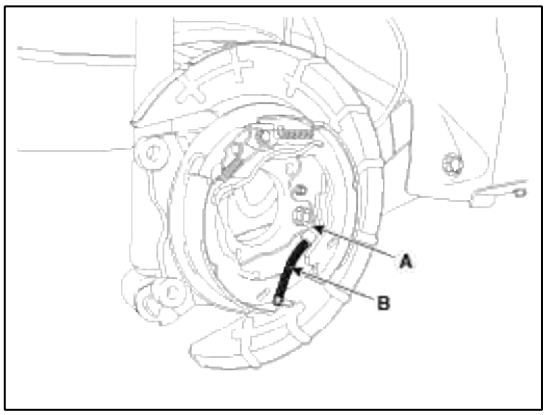
5. Remove the shoe hold down pin (A) and the spring (B) by pushing the retainer spring and turning the pin.



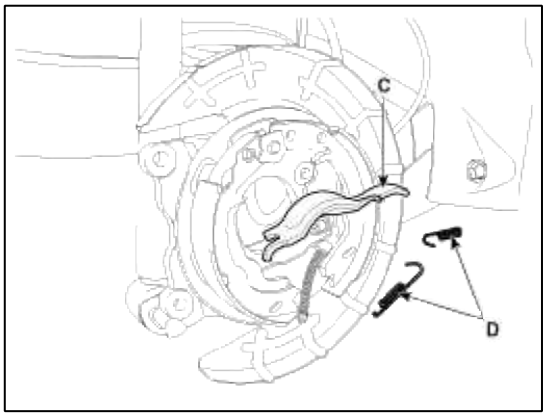
6. Remove the adjuster assembly (A) and the return spring (B).



7. Remove the parking brake cable (B) from the brake shoe (A).

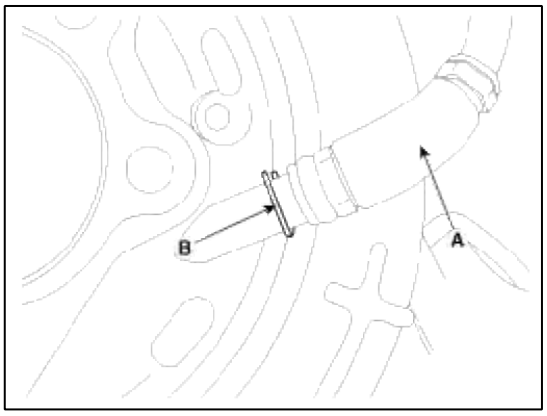


8. Remove the strut (C) and the strut spring (D).



9. Remove the brake shoe.

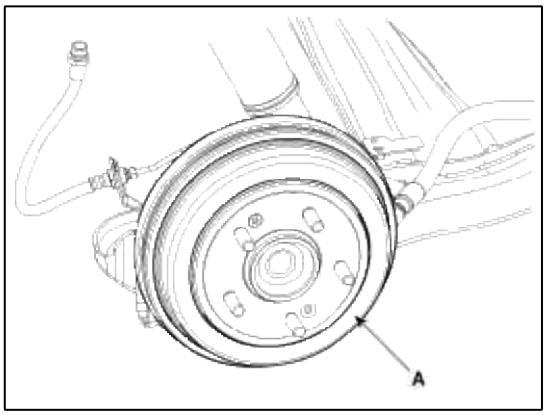
10. Remove the parking brake cable retaining (B), from the parking brake cable (A).



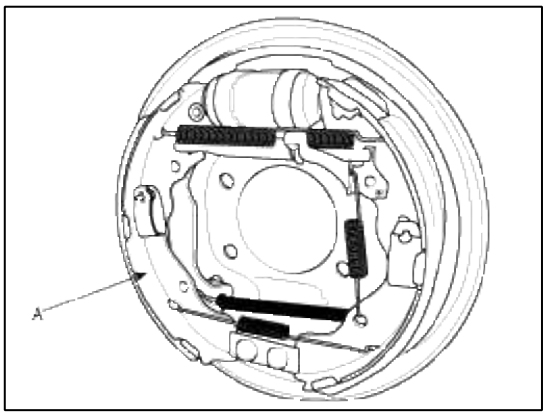
Parking Brake Shoe (Drum Brake Type)

1. Raise the vehicle, and make sure it is securely supported.

2. Remove the rear tire and wheel, then remove the brake drum (A).



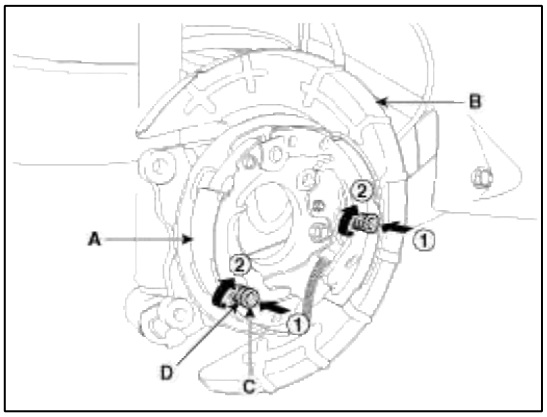
3. Remove the brake shoe (A). (Refer to "Rear drum brake removal")



Installation

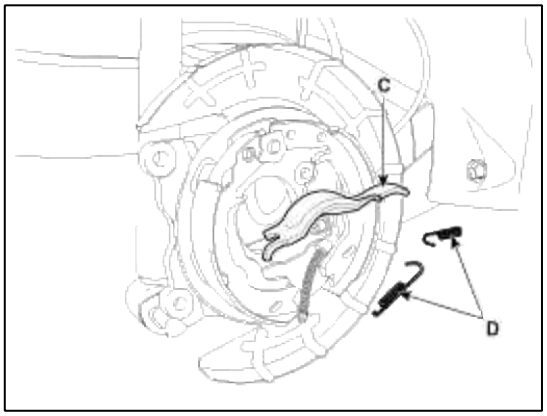
Parking Brake Shoe (Disc Brake Type)

1. Install the brake shoe(A) to the back plate(B).

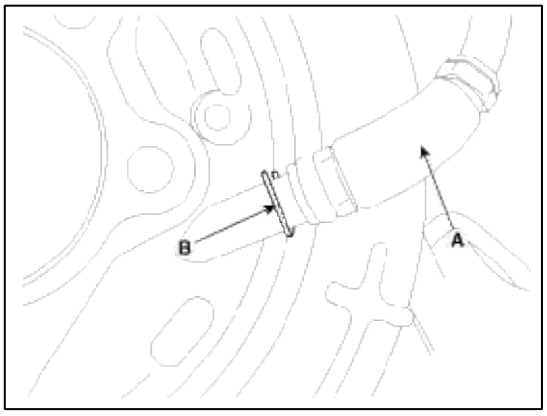


2. Install the shoe hold down pin(C) and the spring(D) by pushing the retainer spring (D) and turning the pins.

3. After installing the strut (A) and upper return spring (B), install the adjuster assembly (C) and the lower return spring (D).

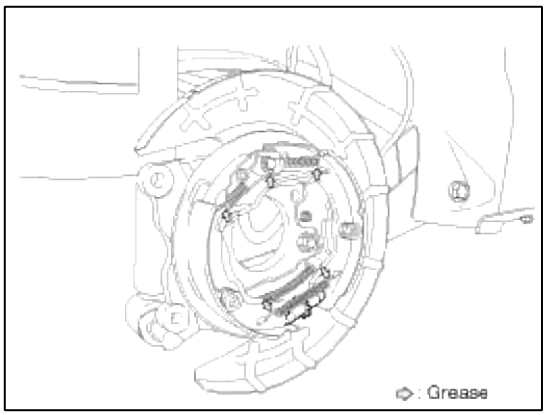


4. Install the parking brake cable (A), then install the retaining (B).

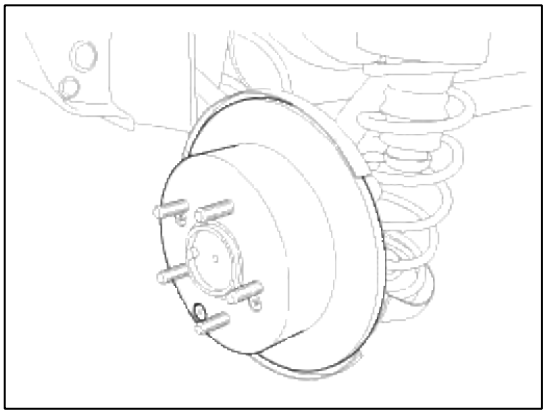


5. Apply a coating of the specified grease to each sliding parts of parking brake as shown.

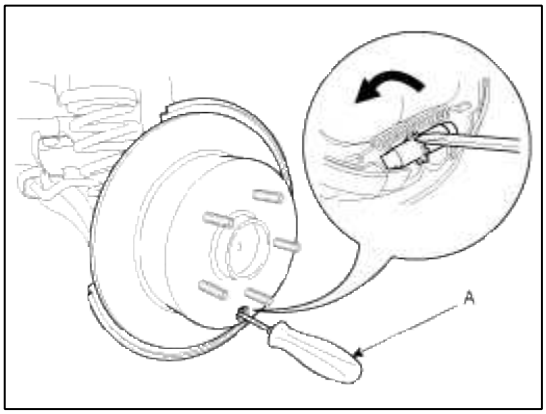
Specified grease :
Multi purpose grease SAE J310, NLGI No.2



6. Install the rear brake disc, then adjust the rear brake shoe clearance.
   (1) Remove the plug from the disc.



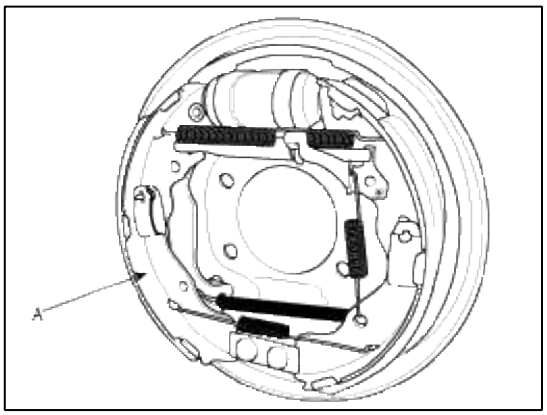
   (2) Rotate the toothed wheel of adjuster by a screw driver until the disc is not moving, and then return it by 3 ~ 5 notches in the opposite direction.



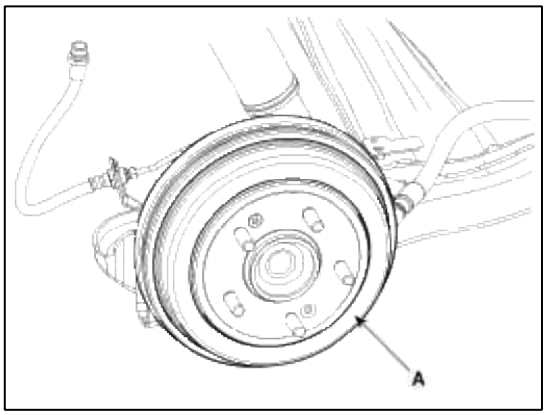
7. Install the brake caliper. (Refer to "Rear brake installation")
8. Install the tire and wheel.
9. Adjust the parking brake lever.

Parking Brake Shoe (Drum Brake Type)

1. Install the brake shoe (A). (Refer to "Rear drum brake installation")



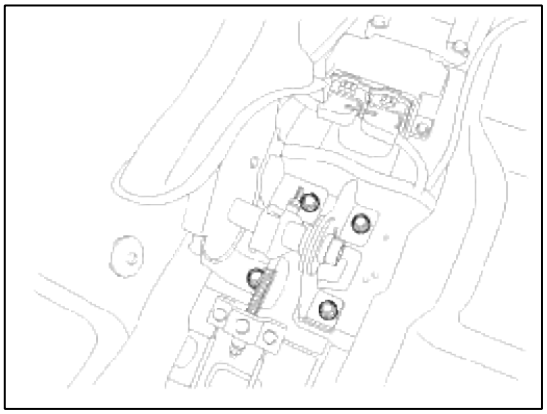
2. Install the brake drum (A).



3. Depress the brake pedal several times to set the self-adjusting brake.
4. Adjust the parking brake lever.

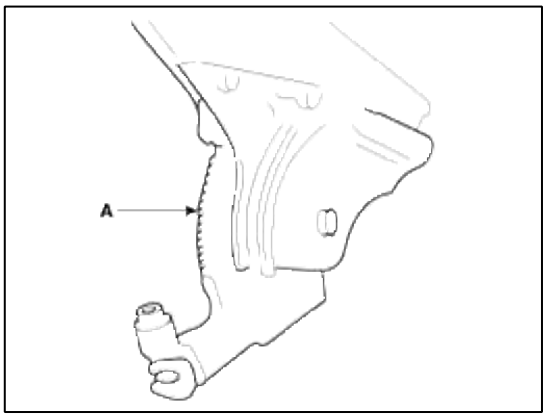
Parking Brake Lever

1. Install the parking brake lever assembly, then tighten the mounting bolts.



2. Apply a coating of the specified grease to each sliding parts (A) of the ratchet plate or the ratchet pawl.

Specified grease :
Multi purpose grease SAE J310, NLGI No.2

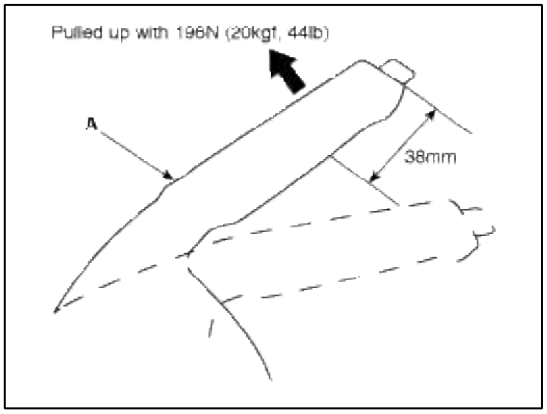


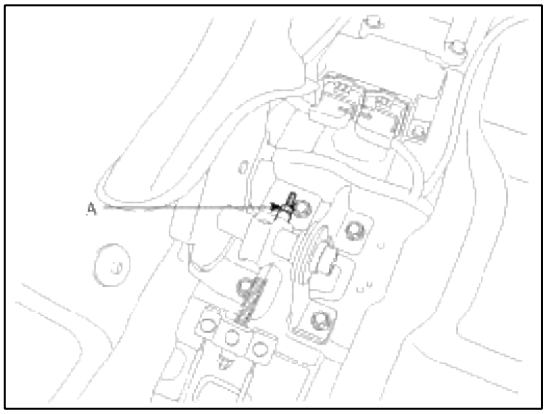
3. Install the parking brake cable adjuster, then adjust the parking brake lever stroke by turning adjusting nut (A).

Parking brake lever stroke :
5 ~ 7 cliks (Pull the lever with 20kg)

NOTE

After repairing the parking brake shoe, adjust the brake shoe clearance, and then adjust the parking brake lever stroke. (Refer to "Parking brake shoe installation")

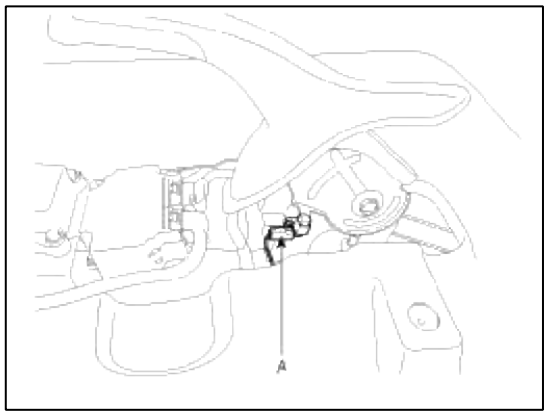




4. Release the parking brake lever fully, and check that parking brakes do not drag when the rear wheels are turned. Readjust if necessary.

5. Make sure that the parking brakes are fully applied when the parking brake lever is pulled up fully.

6. Reconnect the connector (A) of parking brake switch.



NOTE

Inspect the continuity of parking brake switch.

When the brake lever is pulled : continuity
When the brake lever is released : no continuity

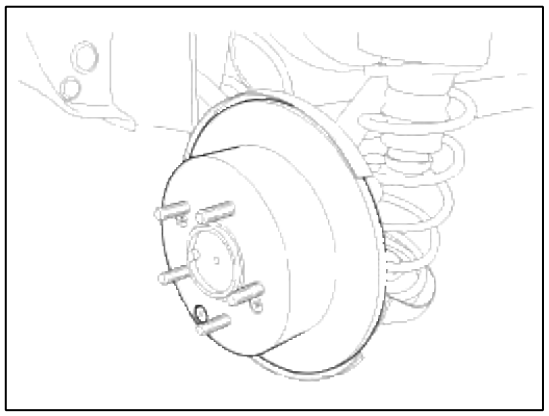
7. Install the floor console. (Refer to Body group - "Floor console")

Adjustment

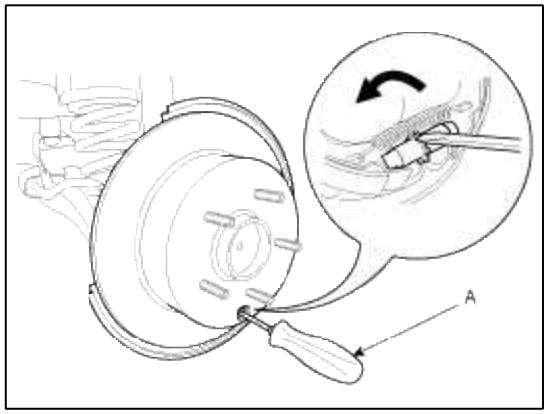
Parking Brake Shoe Clearance Adjustment

Disc Brake Type

1. Raise the vehicle, and make sure it is securely supported.
2. Remove the rear tire and wheel.
3. Remove the plug from the disc.



4. Rotate the toothed wheel of adjuster by a screw driver until the disc is not moving, and then return it by 3~5 notches in the opposite direction.



Parking Brake Shoe Clearance Adjustment

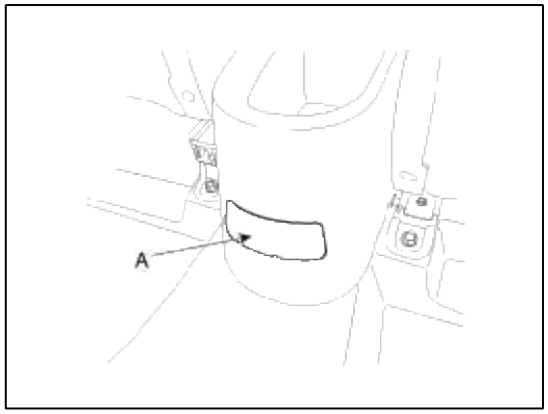
Drum Brake Type

1. Depress the brake pedal several times to set the self-adjusting brake.

> NOTE
>
> For Drum Brake type, shoe clearance is automatically adjusted by the adjuster and adjusting lever.

Parking Brake Lever Stroke Adjustment

1. Raise the vehicle, and make sure it is securely supported.
2. Remove the floor console rear cover(A).

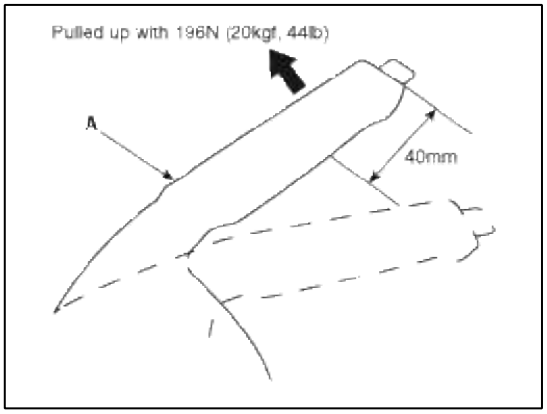


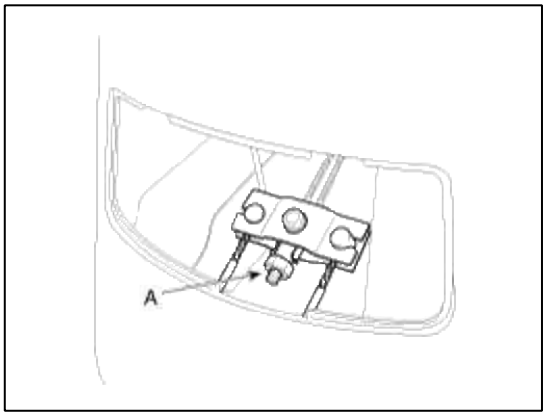
3. Adjust the parking brake lever stroke by turning adjusting nut (A).

Parking brake lever stroke :
5~7 cliks (Pull the lever with 20kg)

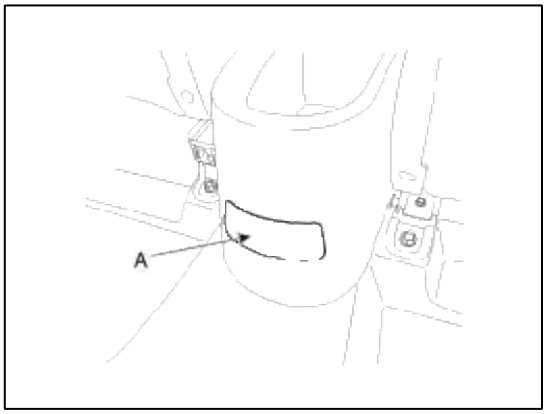
NOTE

After repairing the parking brake shoe, adjust the brake shoe clearance, and then adjust the parking brake lever stroke. (Refer to "Parking brake shoe installation")



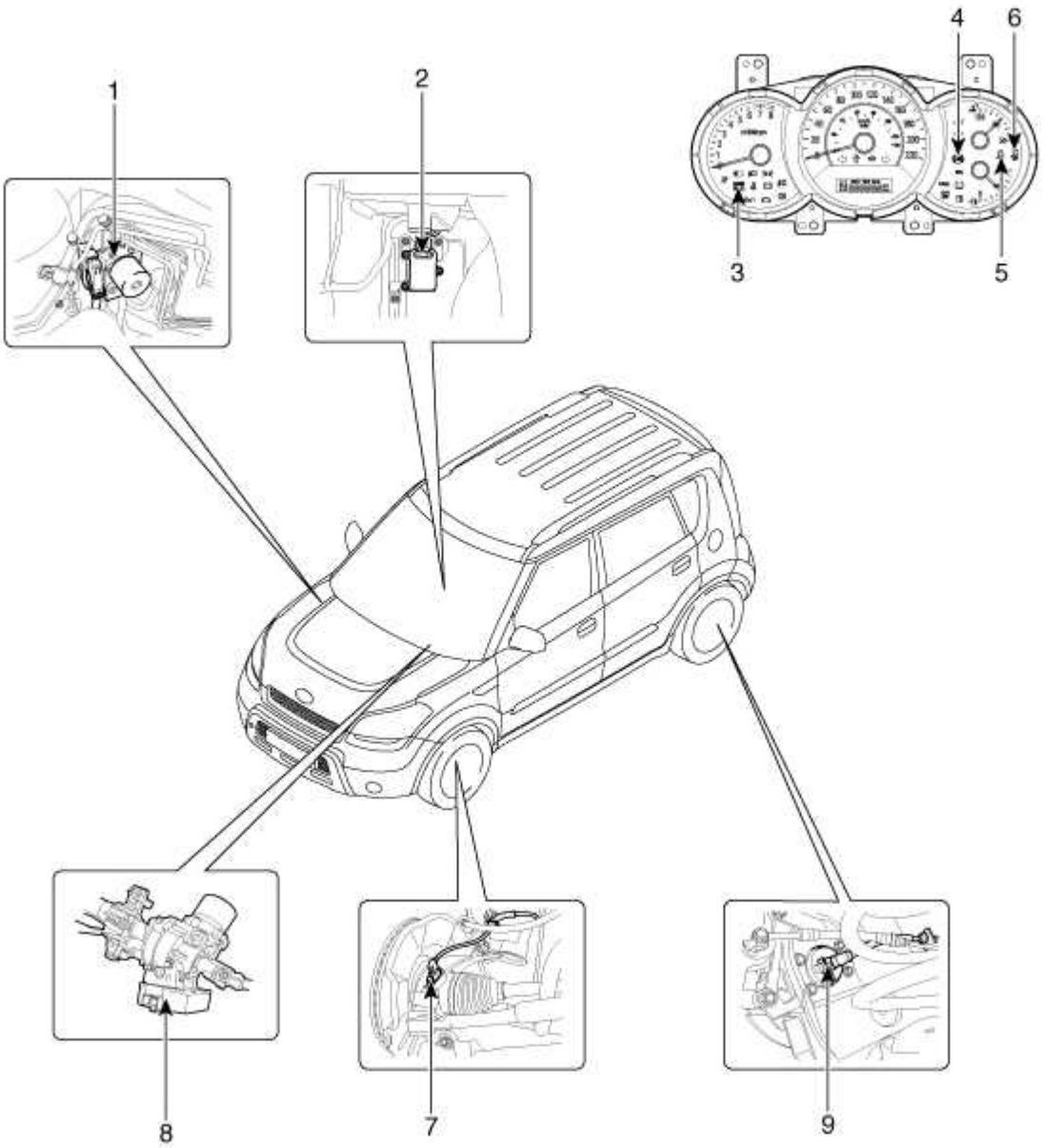


4. Release the parking brake lever fully, and check that parking brakes do not drag when the rear wheels are turned. Readjust if necessary.
5. Make sure that the parking brakes are fully applied when the parking brake lever is pulled up fully.
6. Install the floor console rear cover(A).



Brake System > ESC(Electronic Stability Control) System > Components and Components Location

Components



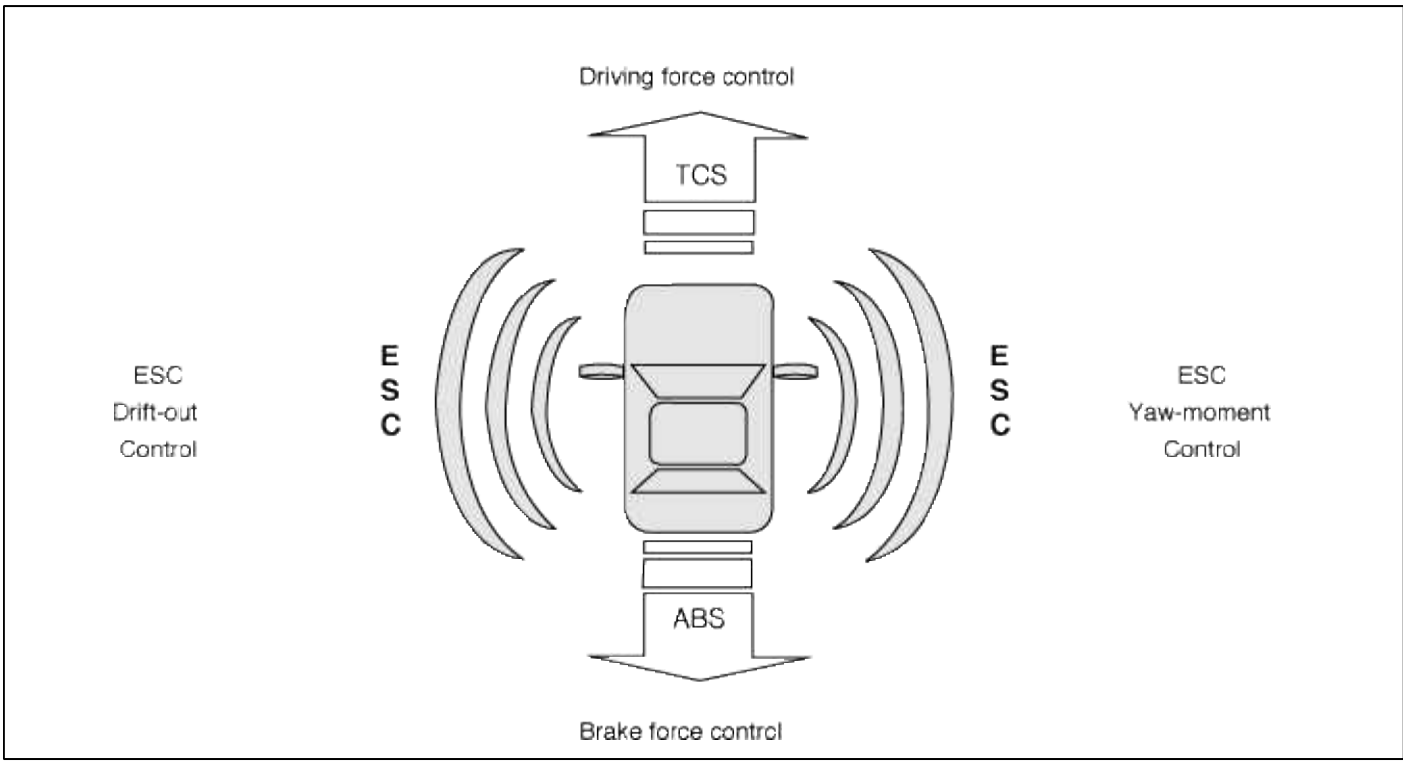
1. HECU module	6. ESC OFF lamp
2. Yaw rate & Lateral G sensor	7. Front wheel speed sensor
3. Parking brake/EBD warning lamp	8. Steering angle sensor
4. ABS warning lamp	9. Rear wheel speed sensor
5. ESC function / warning lamp	

Brake System > ESC(Electronic Stability Control) System > Description and Operation

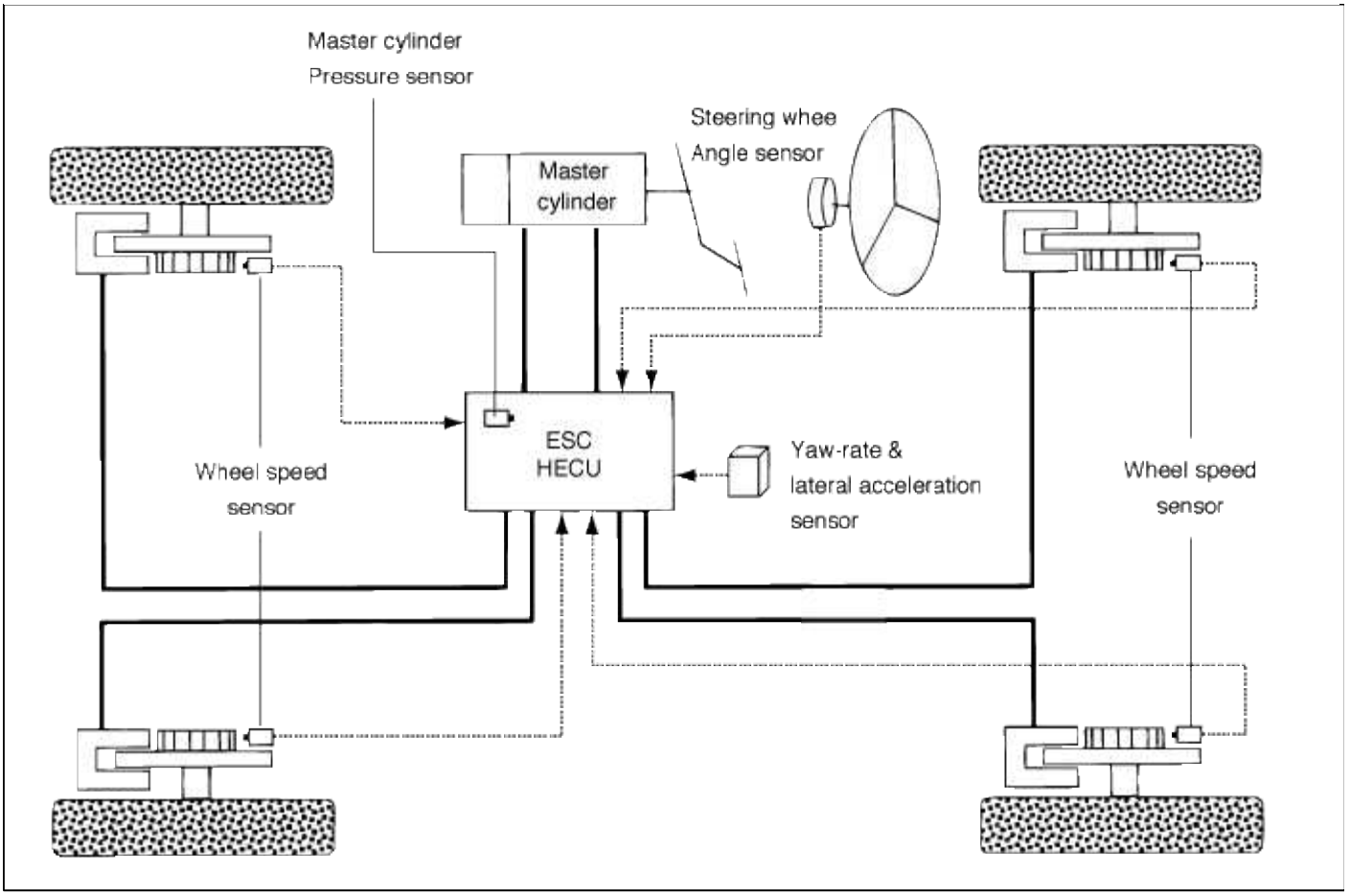
Description of ESC

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.
ESC adds a further function known as Active Yaw Control (AYC) to the ABS, TCS, EBD and EDC functions. Whereas the ABS/TCS function controls wheel slip during braking and acceleration and, thus, mainly intervenes in

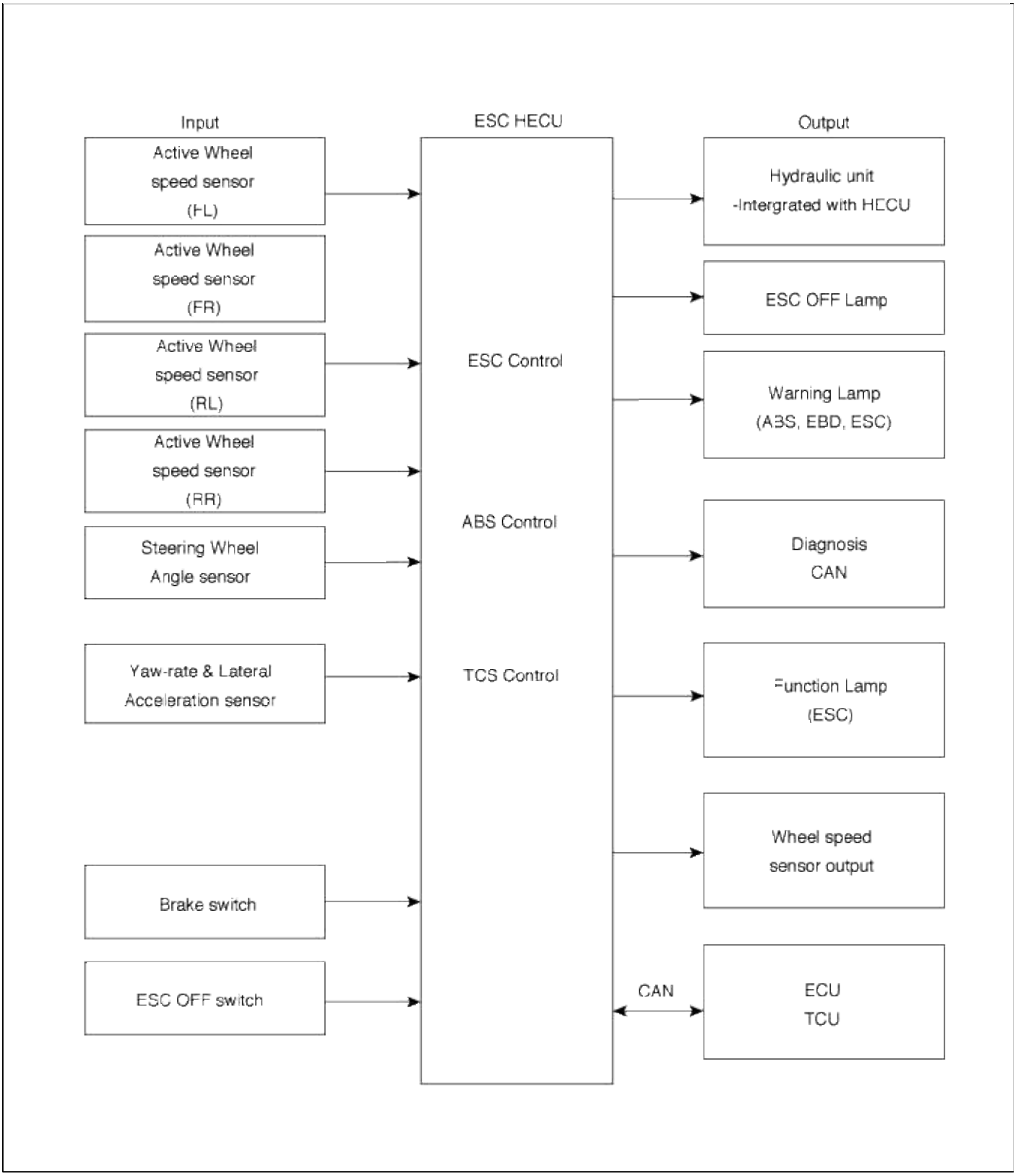
the longitudinal dynamics of the vehicle, active yaw control stabilizes the vehicle about its vertical axis.
This is achieved by wheel individual brake intervention and adaptation of the momentary engine torque with no need for any action to be taken by the driver.
ESC essentially consists of three assemblies : the sensors, the electronic control unit and the actuators.
The stability control feature works under all driving and operating conditions. Under certain driving conditions, the ABS/TCS function can be activated simultaneously with the ESC function in response to a command by the driver.
In the event of a failure of the stability control function, the basic safety function, ABS, is still maintained.



Description of ESC control
ESC system includes ABS/EBD, TCS and AYC function.
ABS/EBD function : The ECU changes the active sensor signal (current shift) coming from the four wheel sensors to the square wave.By using the input of above signals, the ECU calculates the vehicle speed and the acceleration & deceleration of the four wheels.And, the ECU judges whether the ABS/EBD should be actuated or not.
TCS function prevents the wheel slip of drive direction by adding the brake pressure and engine torque reduction via CAN communication.TCS function uses the wheel speed sensor signal to determine the wheel slip as far as ABS function.
AYC function prevents unstable maneuver of the vehicle. To determine the vehicle maneuver, AYC function uses the maneuver sensor signals(Yaw Rate Sensor, Lateral Acceleration Sensor, Steering Wheel Angle Sensor).If vehicle maneuver is unstable (Over Steer or Under Steer), AYC function applies the brake pressure on certain wheel, and send engine torque reduction signal by CAN.
After the key-on, the ECU continually diagnoses the system failure. (self-diagnosis)If the system failure is detected, the ECU informs driver of the system failure through the BRAKE/ABS/ESC warning lamp. (fail-safe warning)

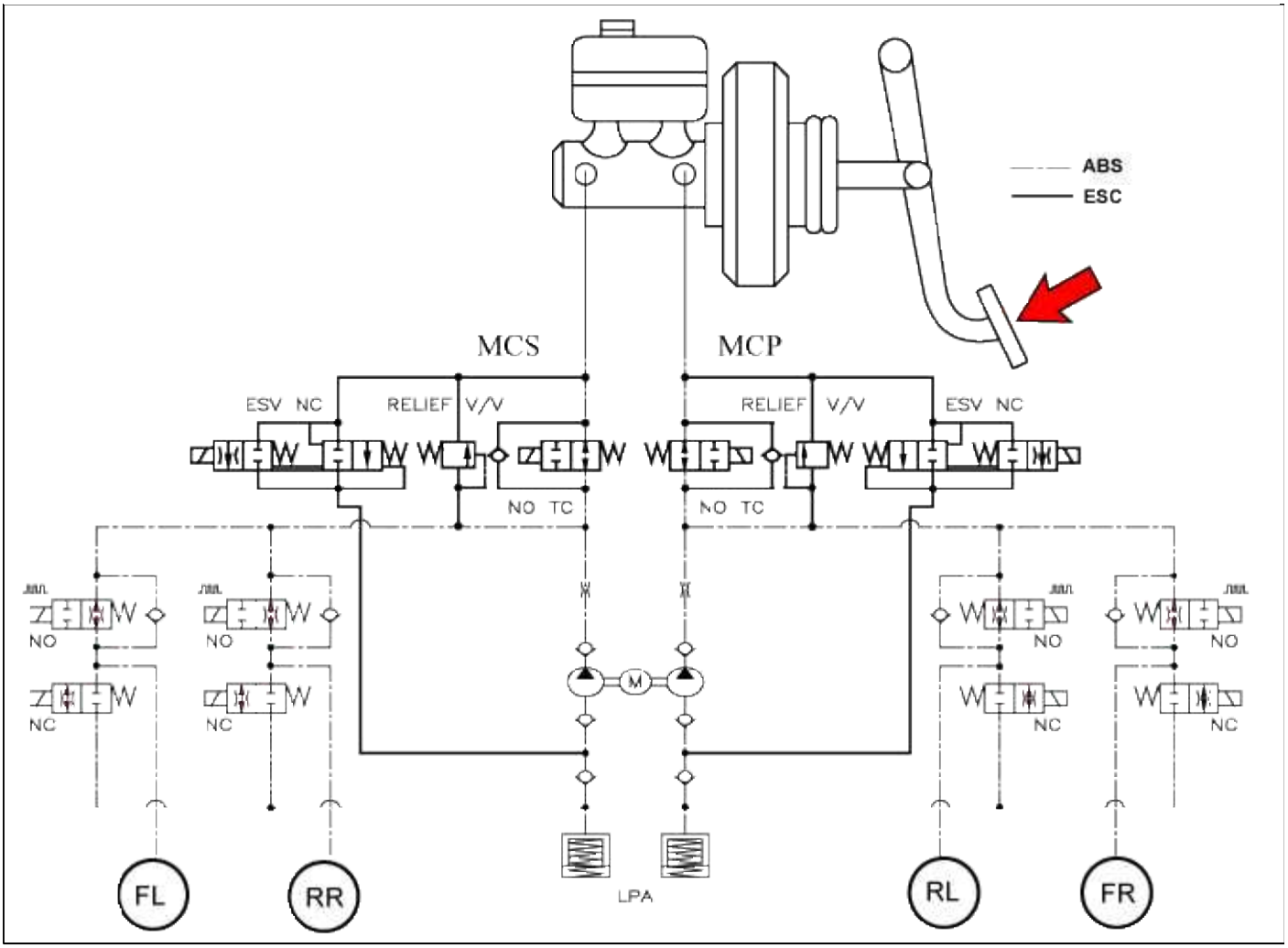


Input and output diagram



ESC Operation mode

ESC Hydraulic system diagram

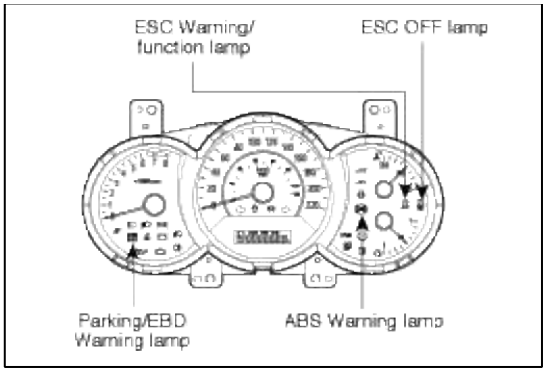


1. ESC Non-operation : Normal braking.

Solenoid valve	Continuity	Valve	Motor pump	TC Valve
IN (NO)	OFF	OPEN	OFF	OFF
OUT (NC)	OFF	CLOSE		

2. ESC operation

Solenoid valve		Continuity	Valve	Motor pump	TC Valve
Understeering (Only inside of rear wheel)	IN(NO)	OFF	OPEN	ON	ON
	OUT(NC)	OFF	CLOSE		
Oversteering (Only outside of front wheel)	IN(NO)	OFF	OPEN		
	OUT(NC)	OFF	CLOSE		



ABS Warning lamp
The active ABS warning lamp indicates the self-test and failure status of the ABS .The ABS warning lamp shall be on:

- During the initialization phase after IGN ON. (continuously 3 seconds).
- In the event of inhibition of ABS functions by failure.
- During diagnostic mode.
- When the ECU Connector is seperated from ECU.
- Cluster lamp is ON when communication is impossible when CAN module.

EBD/Parking brake warning lamp
The active EBD warning lamp indicates the self-test and failure status of the EBD. However, in case the Parking Brake Switch is turned on, the EBD warning lamp is always turned on regardless of EBD functions. The EBD warning lamp shall be on:

- During the initialization phase after IGN ON. (continuously 3 seconds).
- When the Parking Brake Switch is ON or brake fluid level is low.
- When the EBD function is out of order .
- During diagnostic mode.
- When the ECU Connector is seperated from ECU.
- Cluster lamp is ON when communication is impossible when CAN module.

ESC Warning lamp (ESC system)
The ESC warning lamp indicates the self-test and failure status of the ESC.
The ESC warning lamp is turned on under the following conditions :

- During the initialization phase after IGN ON. (continuously 3 seconds).
- In the event of inhibition of ESC functions by failure.
- During diagnostic mode.

ESC Function lamp (ESC system)
The ESC function lamp indicates the self-test and operating status of the ESC.
The ESC Function lamp operates under the following conditions :

- During the initialization phase after IGN ON. (continuously 3 seconds).
- When the ESC control is operating. (Blinking - 2Hz)

ESC OFF lamp (ESC System)

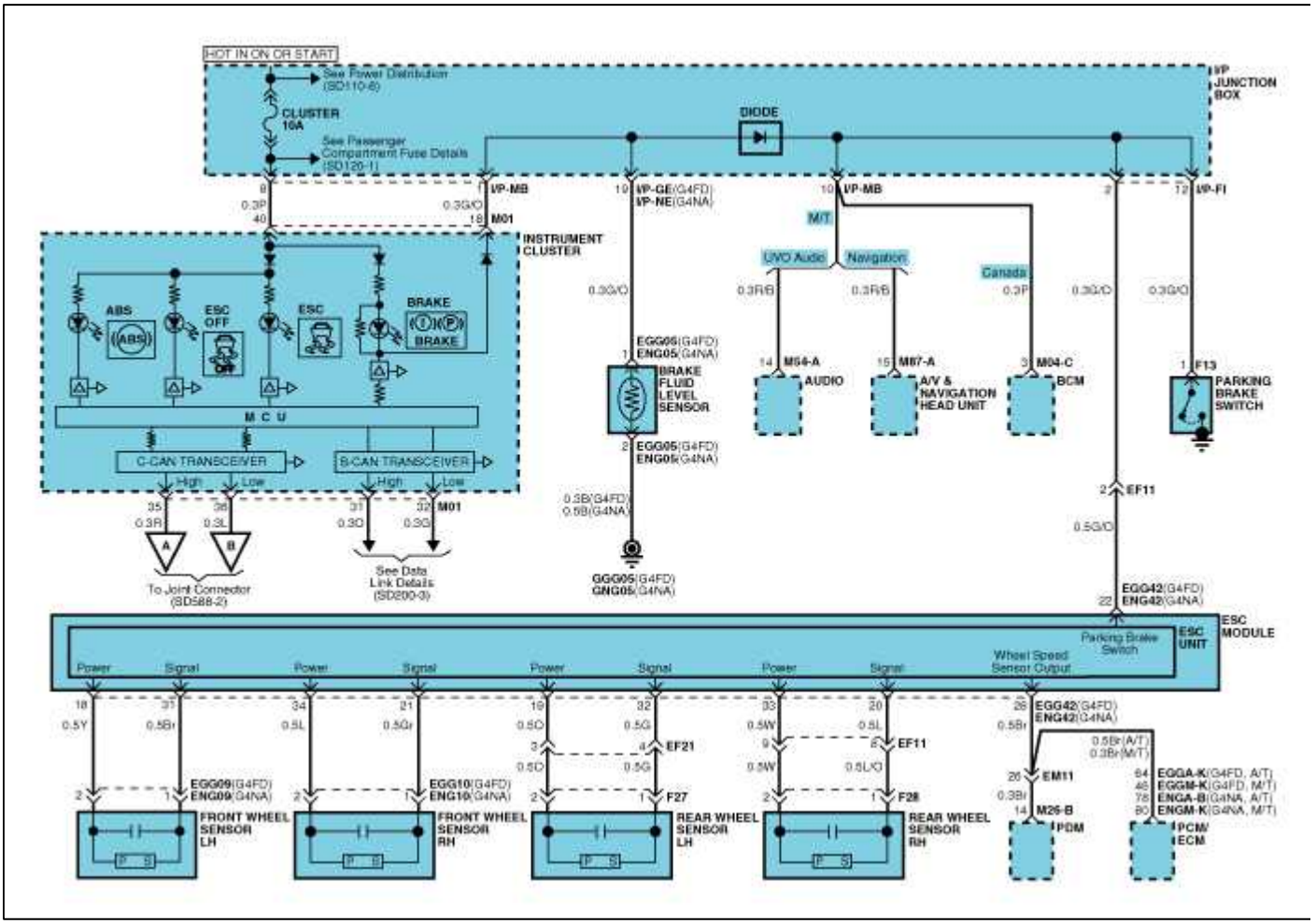
- When the driver truns off the ESC function with the on/off switch.

ESC OFF switch (ESC system)
The ESC On/Off Switch shall be used to toggle the ESC function between On/Off states based upon driver input.

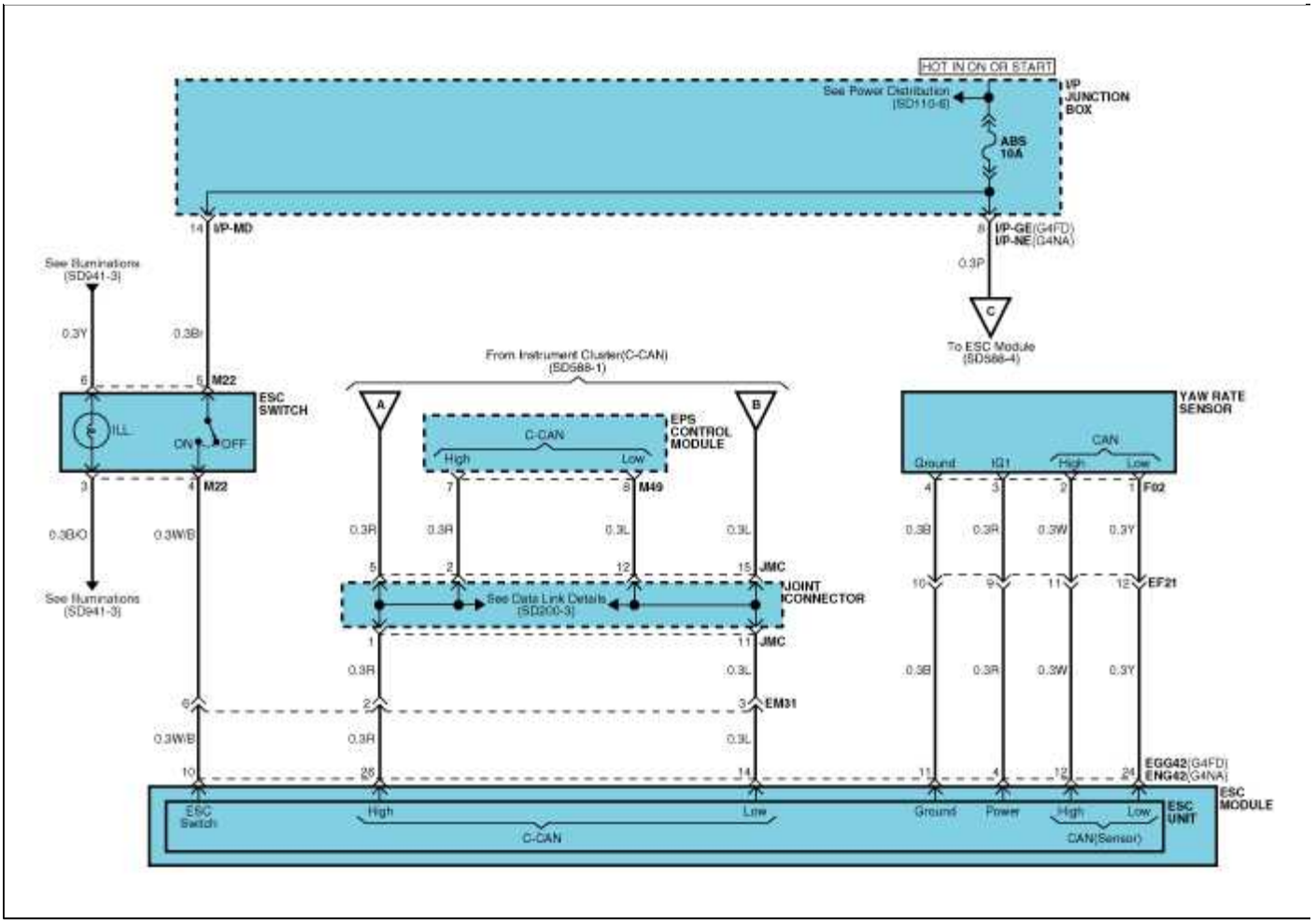
The On/Off switch shall be a normally open, momentary contact switch.Closed contacts switch the circuit to ignition. Initial status of the ESC function is on and switch toggle the state.

Brake System > ESC(Electronic Stability Control) System > Schematic Diagrams

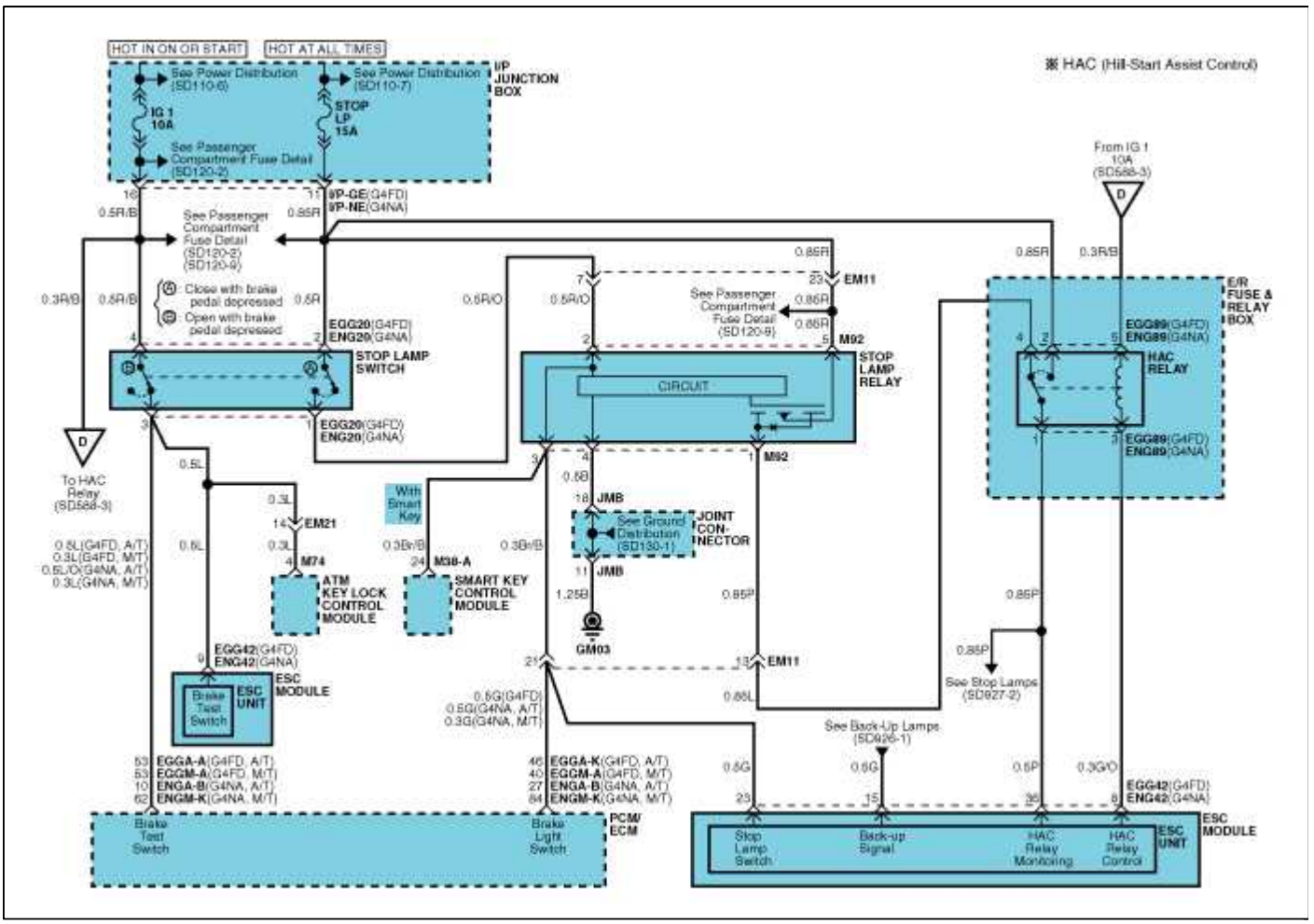
Circuit Diagram - ESC (1)



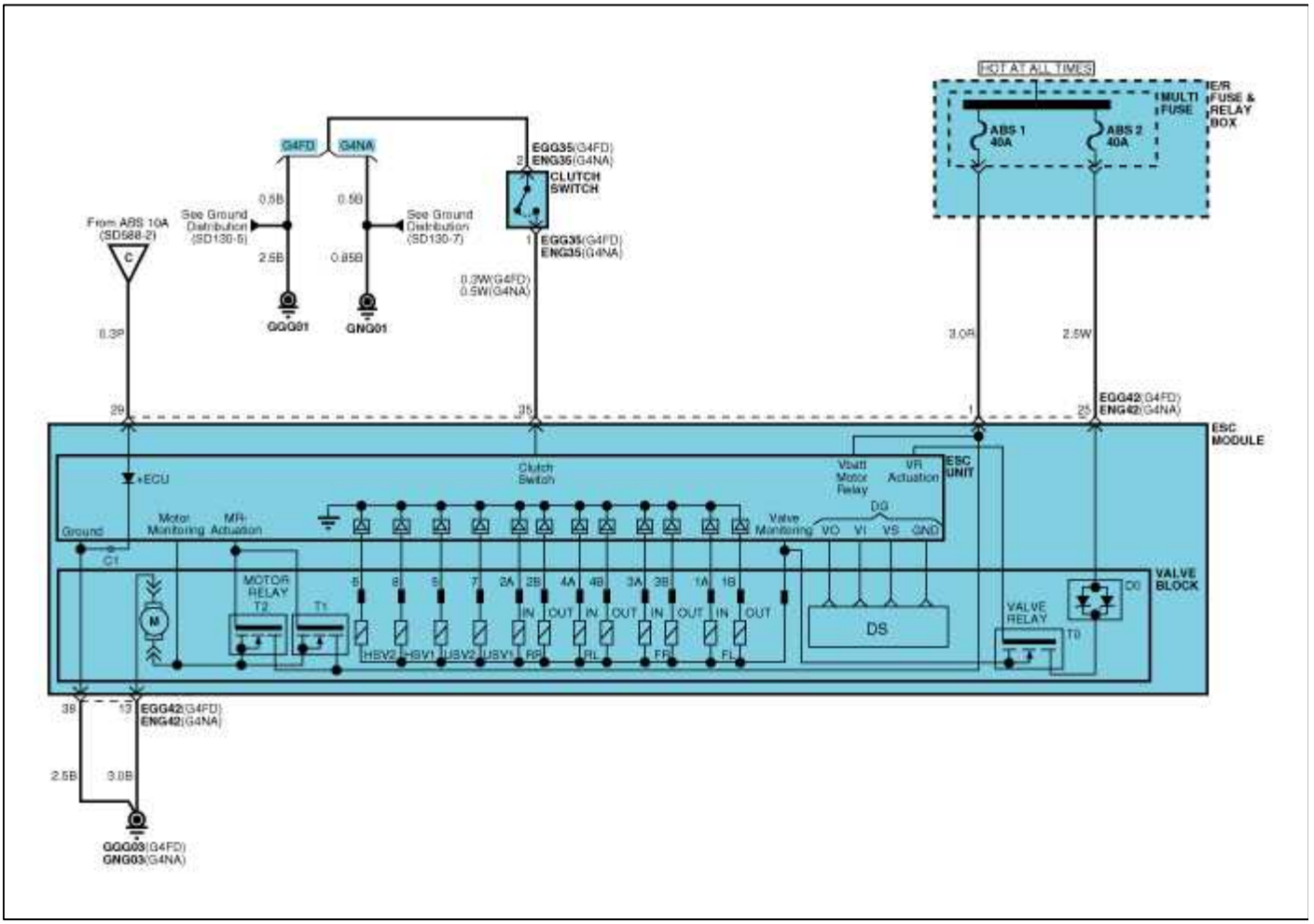
Circuit Diagram - ESC (2)



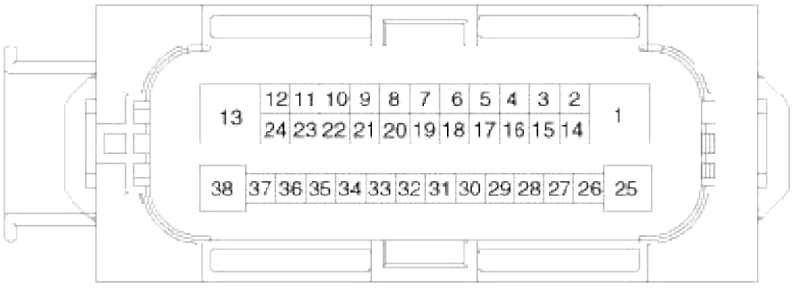
Circuit Diagram - ESC (3)



Circuit Diagram - ESC (4)



ESC Connector Input/Output



Connector Terminal		Specification
No	Description	
29	IGNITION1(+)	High level of wake up voltage :4.5V < V < 16.0V Low level of wake up voltage : V < 2.4V Nominal current : I < 50mA
25	POS. BATTERY 1.(SOLENOID)	Over voltage range : 17.0 ± 0.5V Operating voltage range : 10.0 ± 0.5V < V < 16.0 ± 0.5V Low voltage range : 7.0 ± 0.5V < V < 9.5 ± 0.5V Nominal current : I < 40A Max. leakage current : I < 0.25mA

1	POS. BATTERY 2.(MOTOR)	Operating voltage range: 10.0 ± 0.5V < V < 16.0 ± 0.5V Peak current : I < 110A Nominal current : I < 40A Max. leakage current : I < 0.25mA
38	GROUND	Rated current : I <550mA Nominal current: I < 40A
13	PUMP MOTOR GROUND	Peak current : I < 110A Nominal current : I < 40A
4	SENSOR POWER	Max voltage : V_BAT1-0.8V Max current Capability : I < 250mA
11	SENSOR GROUND	Rated current : I <250mA
18	SENSOR FRONT LEFT POWER	Output voltage : V_BAT1-0.6V ~ V_BAT1-1.1V Output current : Max. 30mA
34	SENSOR FRONT RIGHT POWER	
19	SENSOR REAR LEFT POWER	
33	SENSOR REAR RIGHT POWER	
31	SENSOR FRONT LEFT SIGNAL	Input current LOW : 5.9 ~ 8.4mA Input current HIGH :11.8 ~ 16.8mA Frequency range :1 ~ 2,500Hz Input duty : 50 ± 10%
21	SENSOR FRONT RIGHT SIGNAL	
32	SENSOR REAR LEFT SIGNAL	
20	SENSOR REAR RIGHT SIGNAL	
23	BRAKE LIGHT SWITCH	Input voltage (Low) : V < 2V Input voltage (High) : V > 6V Max. input current:I < 3mA (@12.8V)
10	ESC ON/OFF SWITCH	
9	BRAKE SWITCH	
15	BACK-UP LAMP SWITCH	
22	PARKING BRAKE SWITCH	Input voltage (Low) : V < 2V Input voltage (High) : V > 6V Max input current : I < 5mA (@12.8V)
35	CLUTCH SWITCH	
28	SENSOR FRONT RIGHT OUTPUT	External pull up resistance :1 KΩ < R Output duty :50 ± 20%
14	CAN BUS LINE(LOW)	Max. input current : I < 10mA
26	CAN BUS LINE(HIGH)	
12	CAN SENSOR LINE (HIGH)	
24	CAN SENSOR LINE (LOW)	
8	HAC RELAY DRIVE	Max. input current : I < 180mA Max. output low voltage : V < 1.2V
36	HAC RELAY STATE MONITORING	Input voltage (Low) : V < 2V Input voltage (High) : V > 6V Max. Input current : I < 10mA (@12.8V)

Brake System > ESC(Electronic Stability Control) System > Troubleshooting

Failure Diagnosis

1. In principle, ESC and TCS controls are prohibited in case of ABS failure.
2. When ESC or TCS fails, only the failed system control is prohibited.
3. However, when the solenoid valve relay should be turned off in case of ESC failure, refer to the ABS fail-safe.

4. Information on ABS fail-safe is identical to the fail-safe in systems where ESC is not installed.

Memory of Fail Code

1. It keeps the code as far as the backup lamp power is connected. (O)
2. It keeps the code as far as the HCU power is on. (X)

Failure Checkup

1. Initial checkup is performed immediately after the HECU power on.
2. Valve relay checkup is performed immediately after the IG2 ON.
3. It executes the checkup all the time while the IG2 power is on.

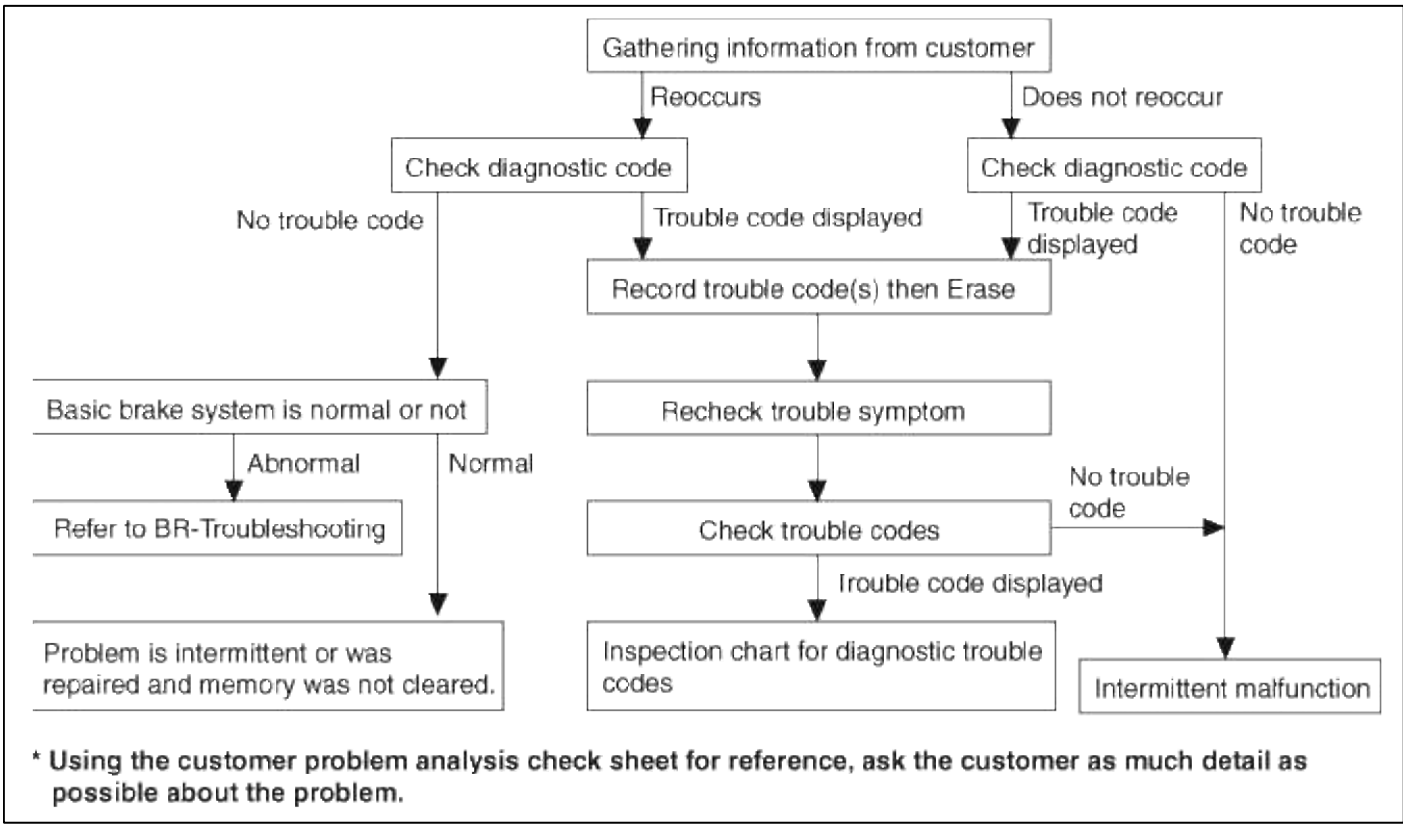
Countermeasures In Fail

1. Turn the system down and perform the following actions and wait for HECU power OFF.
2. Turn the valve relay off.
3. Stop the control during the operation and do not execute any until the normal condition recovers.

Warning Lamp ON

1. ESC warning lamp turn on for 3sec after IGN ON.
2. ESC function lamp blinks when ESC Act.
3. ESC OFF lamp turn on in case of
   A. ESC Switch OFF
   B. 3sec after IGN ON

Standard Flow of Diagnostic Troubleshooting



Notes with regard to diagnosis

The condition listed in the following table are not abnormal.

Condition	Explanation
System check sound	When starting the engine, a thudding sound can sometimes be heard coming from inside the engine compartment. This is because the system operation check is being performed.
ABS operation sound	1. Sound of the motor inside the ABS hydraulic unit operation (whine). 2. Sound is generated along with vibration of the brake pedal (scraping). 3. When ABS operates, sound is generated from the vehicle chassis due to repeated brake application and release (Thump : suspension; squeak: tires)
ABS operation (Long braking distance)	For road surfaces such as snow-covered and gravel roads, the braking distance for vehicles with ABS can sometimes be longer than that for other vehicles. Accordingly, advise the customer to drive safely on such roads by lowering the vehicle speed.
Diagnosis detection conditions can vary depending on the diagnosis code. When checking the trouble symptom after the diagnosis code has been erased, ensure that the requirements listed in "Comment" are met.	

ABS Check sheet

ABS Check Sheet

Inspector's Name

Customer's Name		**License No.**	
		License Year	/ /
		VIN.	
Date Vehicle Brought In	/ /	**Odometer**	Km Miles

Date the Problem First Occurred	/ /
Frequency of Occurence of Problem	☐ Continuous ☐ Intermittent (times a day)

Symptoms	☐ ABS does not operate.		
	☐ ABS does not operate efficiently.	☐ Intermittent (	times a day)
	ABS Warning Light Abnormal	☐ Remains ON	☐ Does not light up

Diagnostic Trouble Code Check	**1st Time**	☐ Normal Code	☐ Malfunction Code (Code)
	2nd Time	☐ Normal Code	☐ Malfunction Code (Code)

Problem symptoms table

Symptom	Suspect Area
ABS does not operate.	Only when 1.~4. are all normal and the problem is still occurring, replace the HECU. 1. Check the DTC reconfirming that the normal code is output. 2. Power source circuit. 3. Speed sensor circuit. 4. Check the hydraulic circuit for leakage.
ABS does not operate intermittently.	Only when 1.~4. are all normal and the problem is still occurring, replace the ABS actuator assembly. 1. Check the DTC reconfirming that the normal code is output. 2. Wheel speed sensor circuit. 3. Stop lamp switch circuit. 4. Check the hydraulic circuit for leakage.
Communication with GDS is not possible. (Communication with any system is not possible)	1. Power source circuit 2. CAN line
Communication with GDS is not possible. (Communication with ABS only is not possible)	1. Power source circuit 2. CAN line 3. HECU
When ignition key is turned ON (engine OFF), the ABS warning lamp does not light up.	1. ABS warning lamp circuit 2. HECU
Even after the engine is started, the ABS warning lamp remains ON.	1. ABS warning lamp circuit 2. HECU

CAUTION

During ABS operation, the brake pedal may vibrate or may not be able to be depressed. Such phenomena are due to intermittent changes in hydraulic pressure inside the brake line to prevent the wheels from locking and is not an abnormality.

ABS Does Not Operate.

Detecting condition

Trouble Symptoms	Possible Cause
Brake operation varies depending on driving conditions and road surface conditions, so diagnosis can be difficult. However if a DTC is displayed, check the following probable cause. When the problem is still occurring, replace the ABS control module.	- Faulty power source circuit - Faulty wheel speed sensor circuit - Faulty hydraulic circuit for leakage - Faulty HECU

Inspection procedures

DTC Inspection

1. Connect the GDS with the data link connector and turn the ignition switch ON.

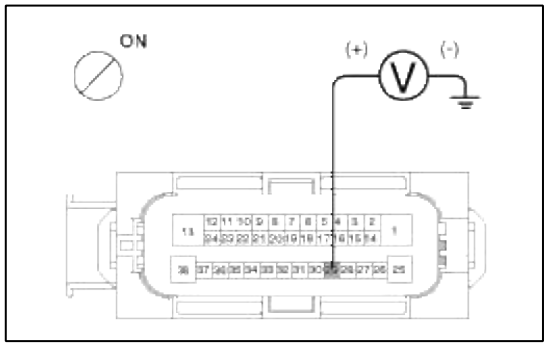
2. Verify that the normal code is output.
3. Is the normal code output?

NO	Check the power source circuit.
YES	Erase the DTC and recheck using GDS.

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 29 of the ABS control module harness side connector and body ground.

Specification: approximately B+

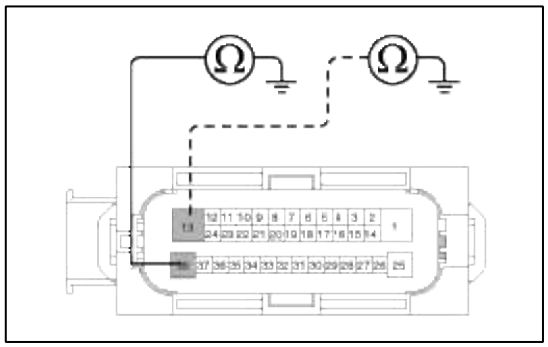


3. Is the voltage within specification?

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 13, 38 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 it normal?

YES	Check the hydraulic circuit for leakage.
NO	Repair or replace the wheel speed sensor.

Check the hydraulic circuit for leakage

1. Refer to the hydraulic lines.
2. Inspect leakage of the hydraulic lines.
3. Is it normal?

YES	The problem is still occurring, replace the ABS control module.
NO	Repair the hydraulic lines for leakage.

ABS Does Not Operate (Intermittently).

Detecting condition

Trouble Symptoms	Possible Cause
Brake operation varies depending on driving conditions and road surface conditions, so diagnosis can be difficult. However if a DTC is displayed, check the following probable cause. When the problem is still occurring, replace the ABS control module.	- Faulty power source circuit - Faulty wheel speed sensor circuit - Faulty hydraulic circuit for leakage - Faulty HECU

Inspection procedures

DTC Inspection

1. Connect the GDS with the data link connector and turn the ignition switch ON.
2. Verify that the normal code is output.
3. Is the normal code output?

NO	Check the wheel speed sensor circuit.
YES	Erase the DTC and recheck using GDS.

Check the wheel speed sensor circuit

1. Refer to the DTC troubleshooting procedures.

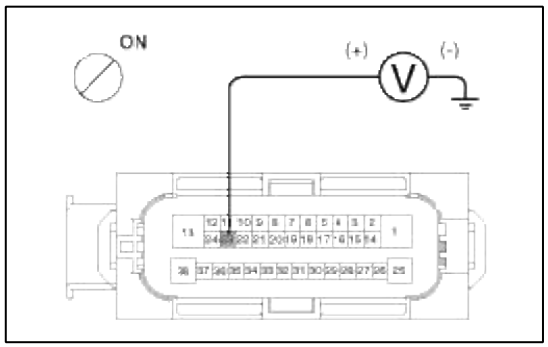
2. Is it normal?

YES	Check the stop lamp switch circuit.
NO	Repair or replace the wheel speed sensor.

Check the stop lamp switch circuit

1. Check that stop lamp lights up when brake pedal is depressed and turns off when brake pedal is released.
2. Measure the voltage between terminal 23 of the ABS control module harness side connector and body ground when brake pedal is depressed.

Specification : approximately B+



3. Is the voltage within specification?

YES	Check the hydraulic circuit for leakage.
NO	Repair the stop lamp switch. Repair an open in the wire between the ABS control module and the stop lamp switch.

Check the hydraulic circuit for leakage

1. Refer to the hydraulic lines.
2. Inspection leakage of the hydraulic lines.
3. Is it normal?

YES	The problem is still occurring, replace the ABS control module.
NO	Repair the hydraulic lines for leakage.

Communication with GDS is not possible.
(Communication with any system is not possible)

Detecting condition

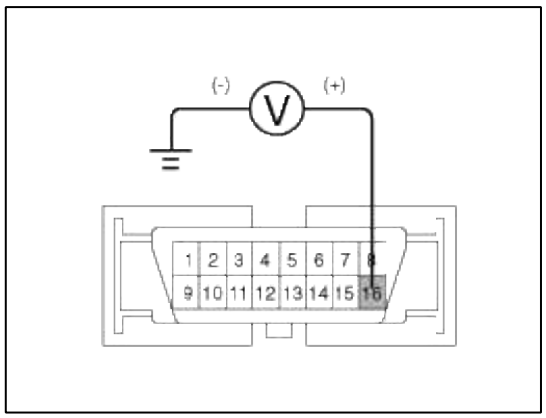
Trouble Symptoms	Possible Cause
Possible defect in the power supply system (including ground) for the diagnosis line.	- An open in the wire - Poor ground - Faulty power source circuit

Inspection procedures

Check The Power Supply Circuit For The Diagnosis

1. Measure the voltage between terminal 16 of the data link connector and body ground.

Specification : approximately B+

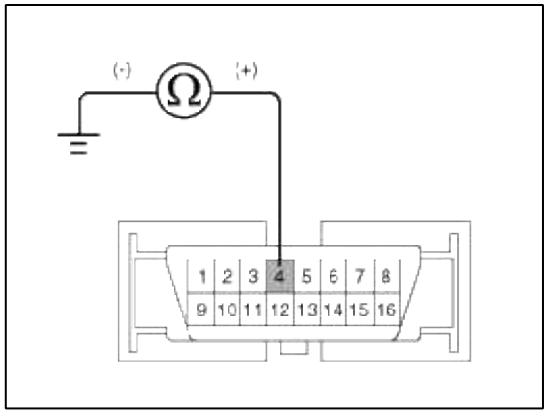


2. Is voltage within specification?

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. Check for continuity between terminal 4 of the data link connector and body ground.



2. Is there continuity?

NO	Repair an open in the wire between terminal 4 of the data link connector and ground point.

Communication with GDS is not possible.
(Communication with ABS only is not possible)

Detecting condition

Trouble Symptoms	Possible Cause
When communication with GDS is not possible, the cause may be probably an open in the HECU power circuit or an open in the diagnosis output circuit.	- An open in the wire - Faulty HECU - Faulty power source circuit

Inspection procedures

Check for Continuity in the Diagnosis Line

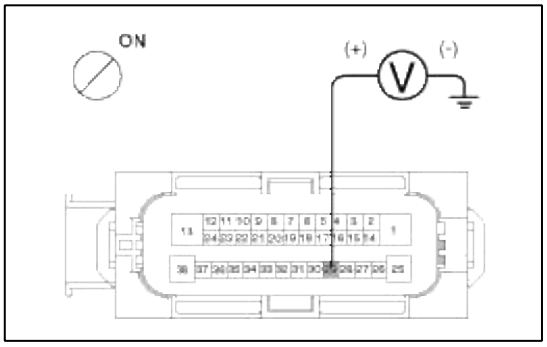
1. Disconnect the connector from the ABS control module.
2. Check for continuity between terminals 30 of the ABS control module connector and 8 of the data link connector.
3. Is there continuity?

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 29 of the ABS control module harness side connector and body ground.

Specification : approximately B+

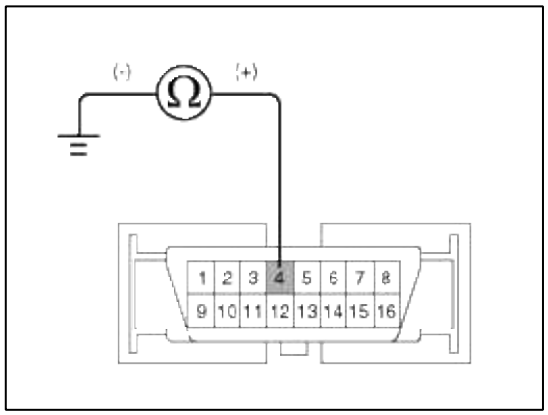


3. Is voltage within specification?

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 4 of the data link connector and ground point.



YES	Replace the ABS control module and recheck.
NO	Repair an open in the wire or poor ground.

When Ignition Key Is Turned ON (engine OFF), The ABS Warning Lamp Does Not Light Up.

Detecting condition

Trouble Symptoms	Possible Cause
When current flows in the HECU the ABS warning lamp turns from ON to OFF as the initial check. Therefore if the lamp does not light up, the cause may be an open in the lamp power supply circuit, a blown bulb, an open in the both circuits between the ABS warning lamp and the HECU, and the faulty HECU.	- Faulty ABS warning lamp bulb - Blown fuse is related to ABS in the engine compartment junction block - Faulty ABS warning lamp module - Faulty HECU

Inspection procedures

Problem verification

1. Disconnect the connector from the ABS control module and turn the ignition switch ON.
2. Does the ABS warning lamp light up?

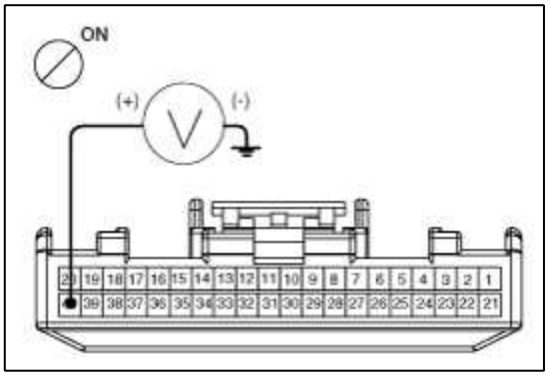
YES	Inspect again after replacing the ABS HECU.
NO	Check the power source for the ABS warning lamp.

Check the power source for the ABS warning lamp

1. Disconnect the instrument cluster connector (M01) and turn the ignition switch ON.

2. Measure the voltage between terminal (M01) 40 of the cluster harness side connector and body ground.

Specification : approximately B+



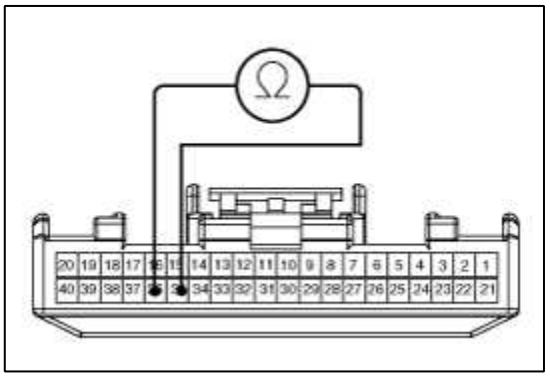
3. Is voltage within specification?

YES	Check the CAN circuit resistance for ABS warning lamp.
NO	Check for blown fuse.

Check the CAN circuit resistance for ABS warning lamp

1. Turn the ignition switch OFF. Disconnect the instrument cluster connector (M01).
2. Measure the resistance between terminal (M01) 35 and 36 of the cluster harness side connector.

Specification : 60Ω



3. Is resistance within specification?

YES	Repair ABS warning lamp bulb or instrument cluster assembly.
NO	Check the CAN circuit wiring for ABS warning lamp.

Check the CAN circuit wiring for ABS warning lamp

1. Turn the ignition switch OFF. Disconnect the instrument cluster connector (M01) and ABS HECU connector.

2. Check for continuity between terminal (M01) 35 of the cluster harness side connector and terminal 26 of ABS HECU harness side.
   Check for continuity between terminal (M01) 36 of the cluster harness side connector and terminal 14 of ABS HECU harness side.

   Specification : Below 1Ω

3. Is resistance within specification?

YES	Repair short circuit wiring between terminal 26, 14 of ABS HECU harness connector and ABS warning lamp module.
NO	Repair open circuit wiring between terminal 26, 14 of ABS HECU harness connector and ABS warning lamp module.

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 and at the same time prohibits ABS control. The HECU then records a DTC in memory. If the ABS warning lamp remains ON, even after the problem with the DTC is repaired and cleared, then the cause may be an open or short in the ABS warning lamp circuit.	- An open in the wire - Faulty instrument cluster assembly - Faulty ABS warning lamp module - Faulty HECU

Inspection procedures

Check DTC Output

1. Connect the GDS to the 16P data link connector located behind the driver's side kick panel.
2. Check the DTC output using GDS.
3. Is DTC output?

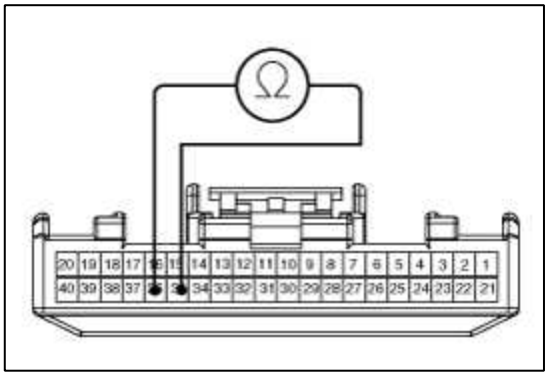
YES	Perform the DTC troubleshooting procedure (Refer to DTC troubleshooting).
NO	Check the CAN circuit resistance for ABS warning lamp.

Check the CAN circuit resistance for ABS warning lamp

1. Turn the ignition OFF. Disconnect the instrument cluster connector (M01).

2. Measure the resistance between terminal (M01) 35 and 36 of the cluster harness side connector.

Specification : 60Ω



3. Is resistance within specification?

YES	Repair ABS warning lamp bulb or instrument cluster assembly.
NO	Check the CAN circuit wiring for ABS warning lamp.

Check the CAN circuit wiring for ABS warning lamp

1. Turn the ignition switch OFF. Disconnect the instrument cluster connector (M01) and ABS HECU connector.
2. Check for continuity between terminal (M01) 35 of the cluster harness side connector and terminal 26 of ABS HECU harness side.
   Check for continuity between terminal (M01) 36 of the cluster harness side connector and terminal 14 of ABS HECU harness side.

Specification : Below 1Ω

3. Is there continuity?

YES	Repair short circuit wiring between terminal 26, 14 of ABS HECU harness connector and ABS warning lamp module.If no trouble in wiring, inspect again after replacing the ABS HECU.
NO	Repair short circuit wiring between terminal 26, 14 of ABS HECU harness connector and ABS warning lamp module.If no trouble in wiring, inspect again after replacing the ABS HECU.

Bleeding of Brake System

This procedure should be followed to ensure adequate bleeding of air and filling of the ABS unit, brake lines and master cylinder with brake fluid.

1. Remove the reservoir cap and fill the brake reservoir with brake fluid.

> CAUTION
>
> If there is any brake fluid on any painted surface, wash it off immediately.

> NOTE
>
> When pressure bleeding, do not depress the brake pedal.
> Recommended fluid..... DOT3 or DOT4

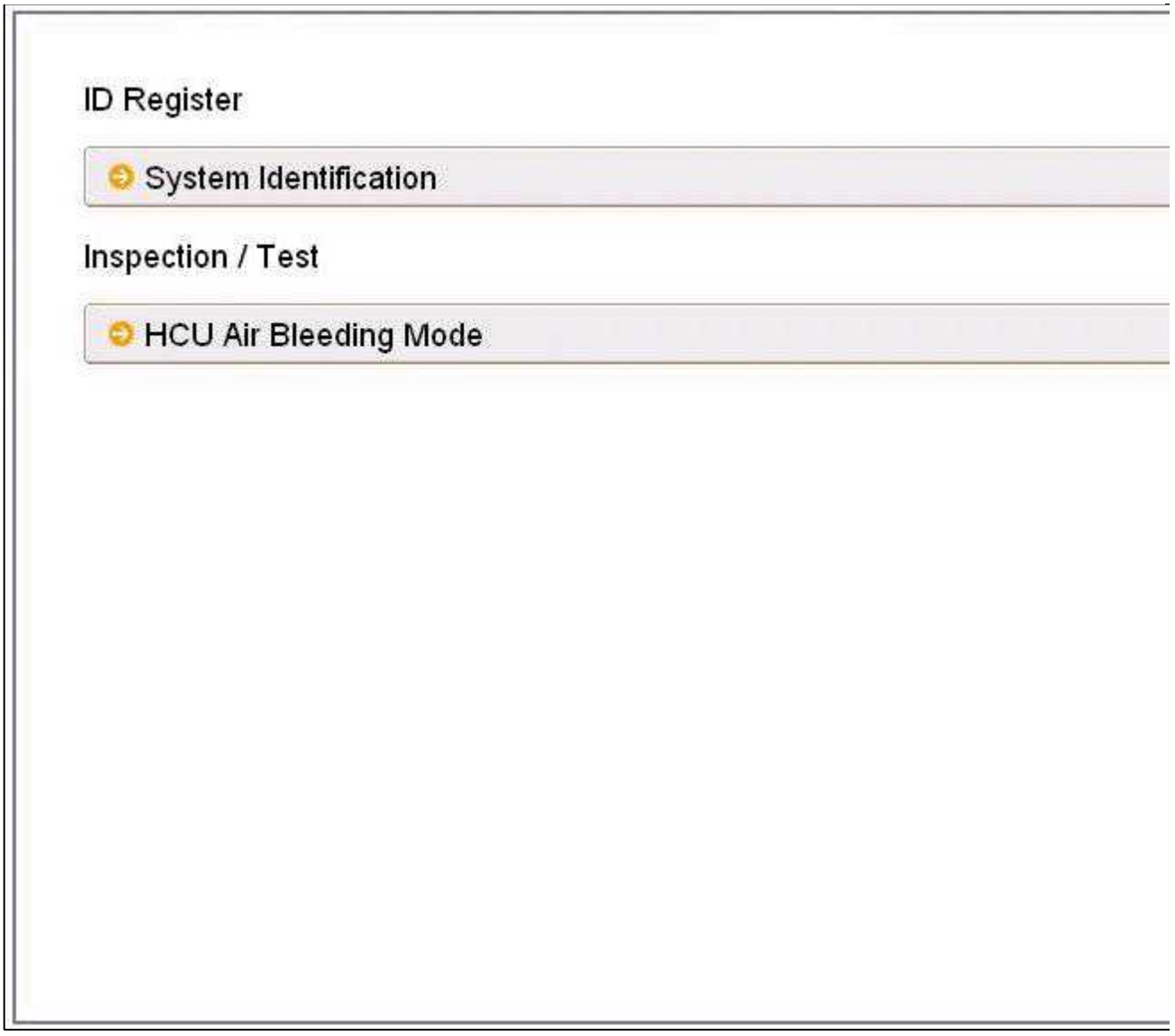
2. Connect a clear plastic tube to the wheel cylinder bleeder plug and insert the other end of the tube into a half filled clear plastic bottle.
3. Connect the GDS to the data link connector located underneath the dash panel.
4. Select and operate according to the instructions on the GDS screen.

> CAUTION
>
> You must obey the maximum operating time of the ABS motor with the GDS to prevent the motor pump from

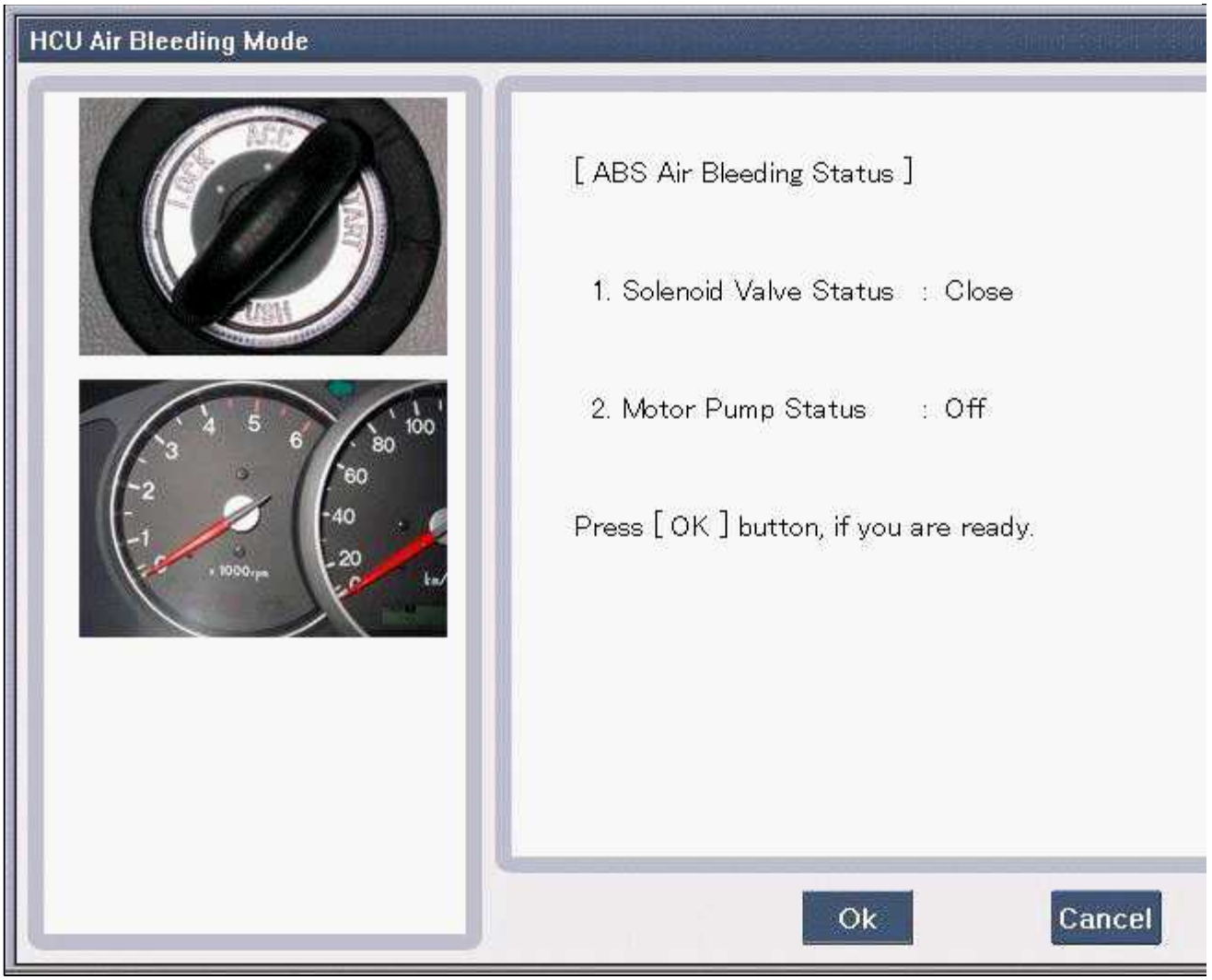
(1) Select vehicle name.

(2) Select Anti-Lock Brake system.

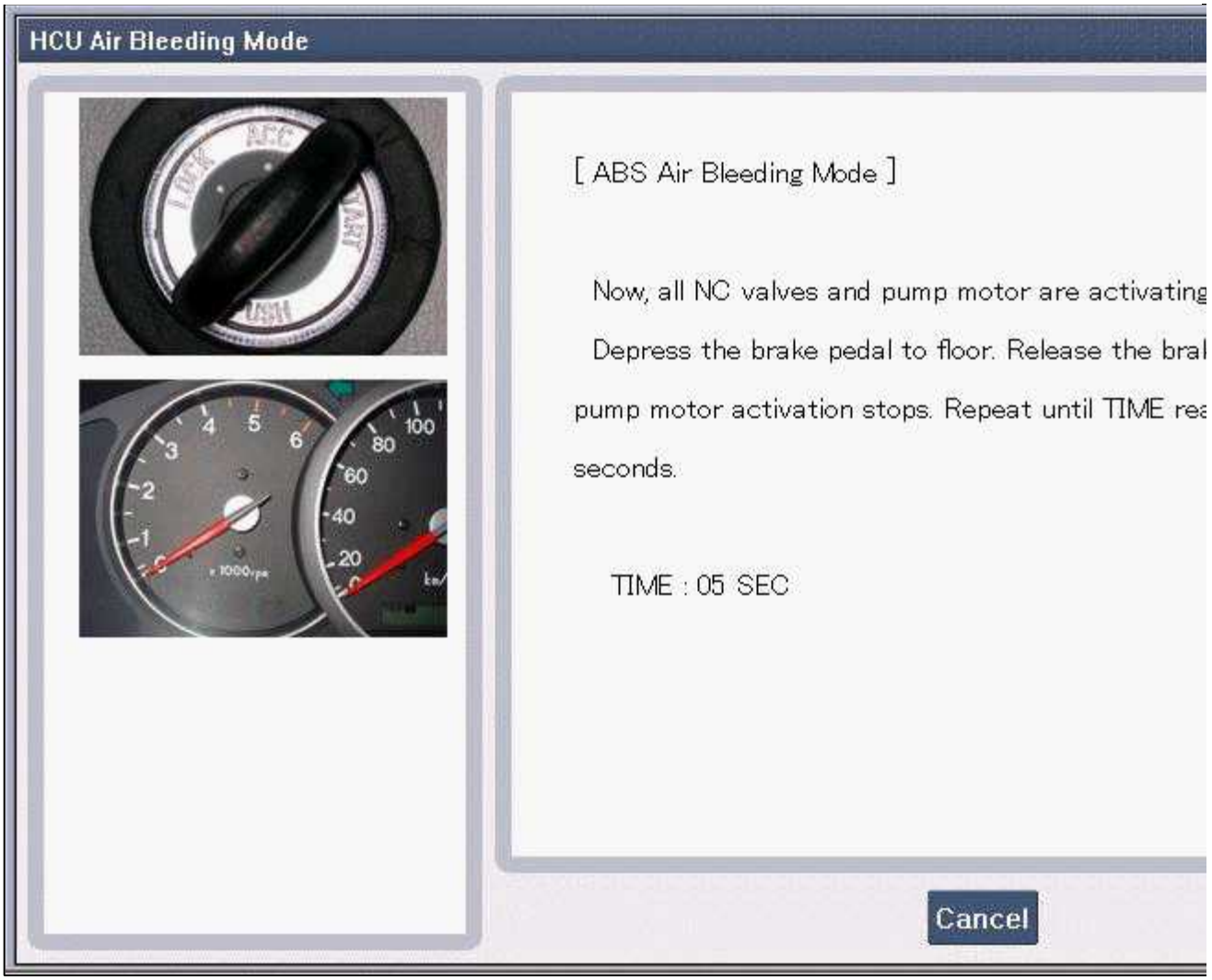
(3) Select HCU air bleeding mode.



(4) Press "OK" to operate motor pump and solenoid valve.



(5) Wait 60 sec. before operating the air bleeding. (If not, you may damage the motor.)

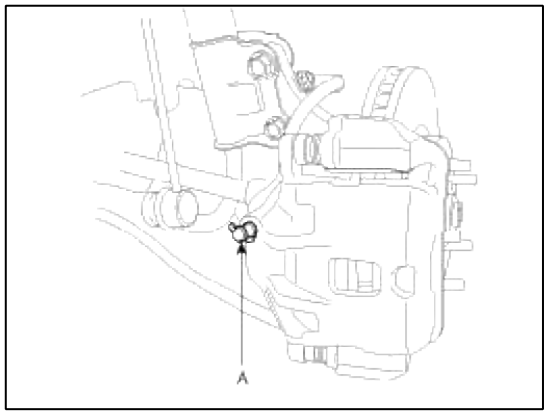


(6) Perform the air bleeding.

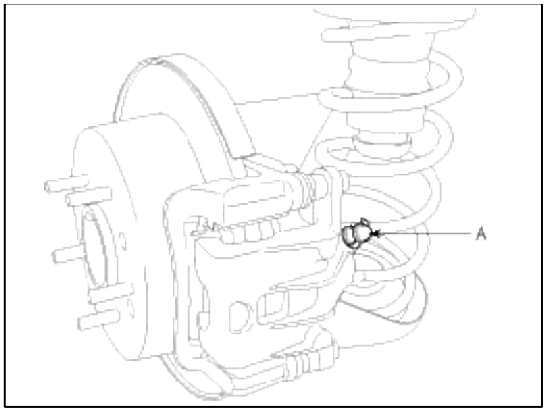


5. Pump the brake pedal several times, and then loosen the bleeder screw until fluid starts to run out without bubbles. Then close the bleeder screw(A).

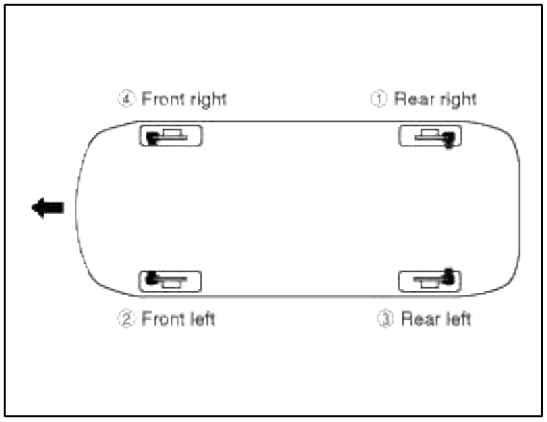
Front



Rear



6. Repeat step 5 until there are no more bubbles in the fluid for each wheel.



7. Tighten the bleeder screw.

Bleed screw tightening torque:
6.9 ~ 12.7N.m (0.7 ~ 1.3kgf.m, 5.1 ~ 9.4lb-ft)

Brake System > ESC(Electronic Stability Control) System > EBD(Electronic Brake-force Distribution) > Description and Operation

EBD (Electronic brake-force distribution) Operation

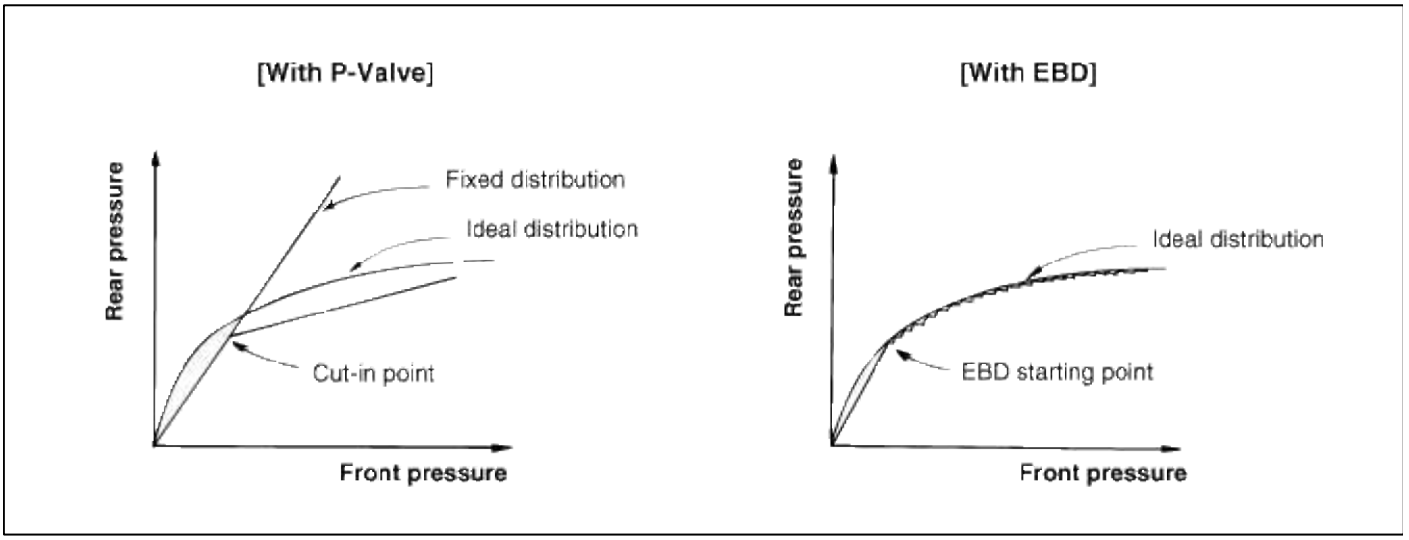
The EBD system (Electronic Brake force Distribution) as a sub-system of the ABS system is to control the Maximum braking effectiveness by the rear wheels.
It further utilizes the efficiency of highly developed ABS equipment by controlling the slip of the rear wheels in the partial braking range.
The brake force is moved even closer to the optimum and controlled electronically, thus dispensing with the need for the proportioning valve.
The proportioning valve, because of a mechanical device, has limitations to achieve an ideal brake force distribution tothe rear wheels as well as to carry out the flexible brake force distribution proportioning to the vehicle load or weight increasing. And in the event of malfunctioning, driver cannot notice whether it fails or not.
EBD controlled by the ABS Control Module, calculates the slip ratio of each wheel at all times and controls the brake pressure of the rear wheels not to exceed that of the front wheels.
If the EBD fails, the EBD warning lamp (Parking brake lamp) lights up.

Advantages

- Function improvement of the base-brake system.
- Compensation for the different friction coefficients.
- Elimination of the proportioning valve.

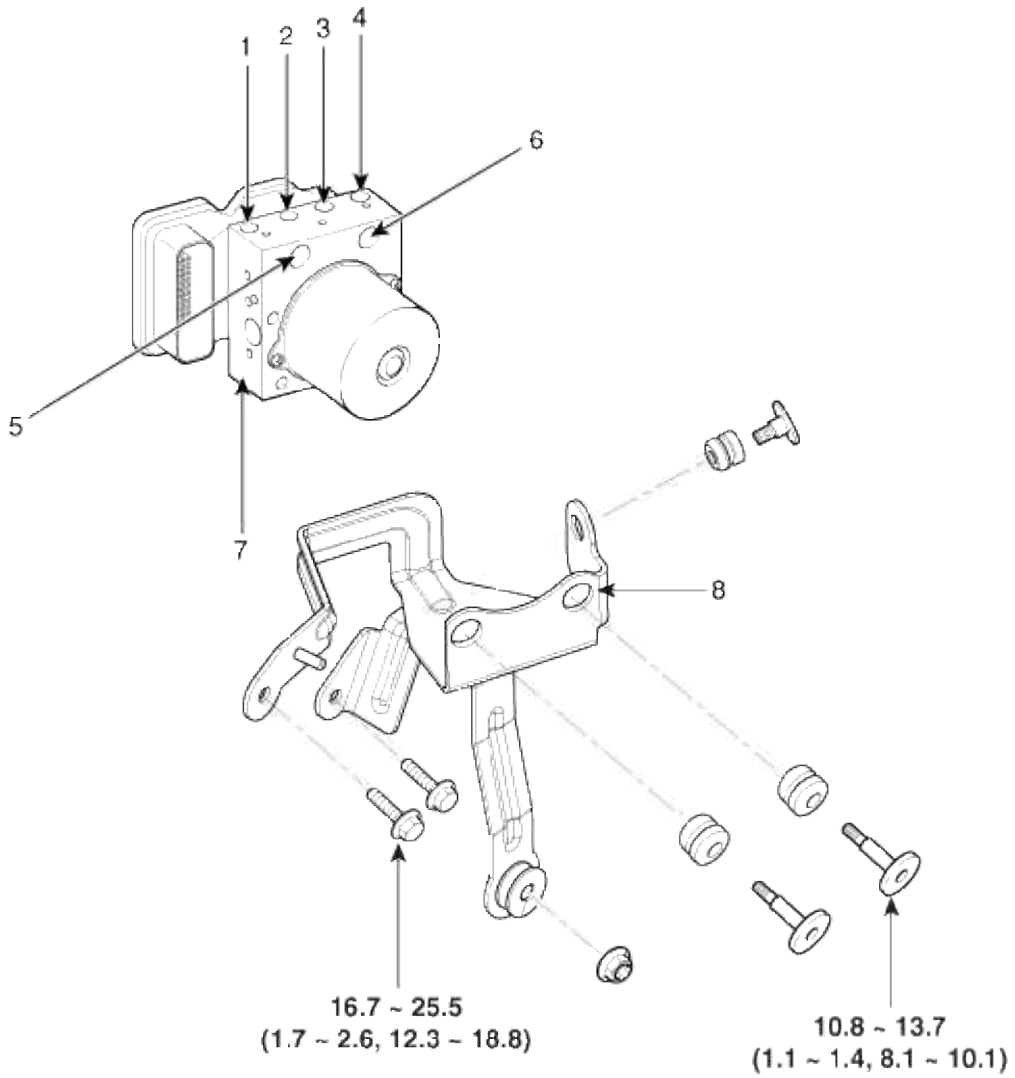
- Failure recognition by the warning lamp.

Comparison between proportioning valve and EBD



Brake System > ESC(Electronic Stability Control) System > ESC Control Module > Components and Components Location

Components



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

1. Front-left tube	5. MC2
2. Rear -right tube	6. MC1
3. Rear-left tube	7. ESC control module (HECU)
4. Front-right tube	8. Bracket

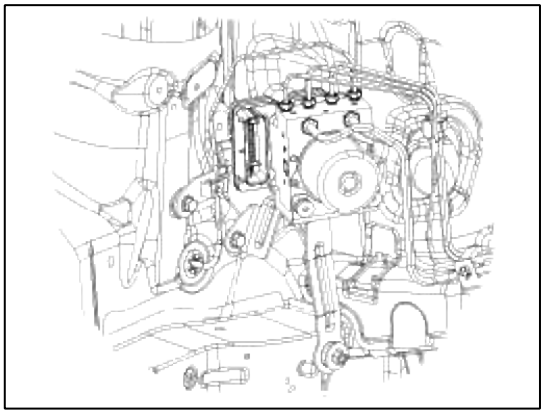
Brake System > ESC(Electronic Stability Control) System > ESC Control Module > Repair procedures

Removal

1. Turn the ignition switch OFF and disconnect the negative (-) battery cable.
2. Pull up the lock of the ABS control unit connector, then disconnect the connector.

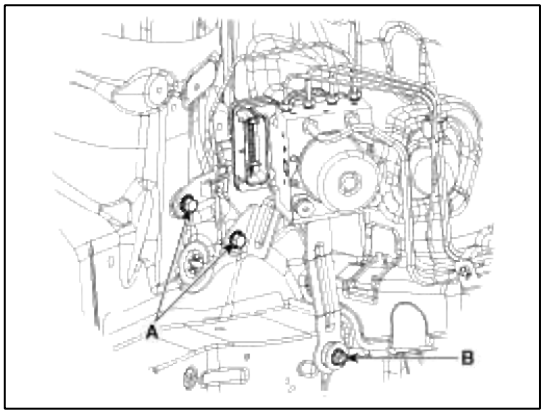
3. Disconnect the brake tubes from the HECU by unlocking the nuts counterclockwise with a spanner.

Tightening torque:
18.6 ~ 22.6 N.m (1.9 ~ 2.3 kgf.m, 13.7 ~ 16.6 lb-ft)



4. Loosen the HECU bracket bolts and nut, then remove HECU and bracket.

Tightening torque:
16.7 ~ 25.5 N.m (1.7 ~ 2.6 kgf.m, 12.3 ~ 18.8 lb-ft)



CAUTION

1. Never attempt to disassemble the HECU.
2. The HECU must be transported and stored in.
3. Never shock to the HECU.

5. Remove the bolts, then remove the bracket from HECU.

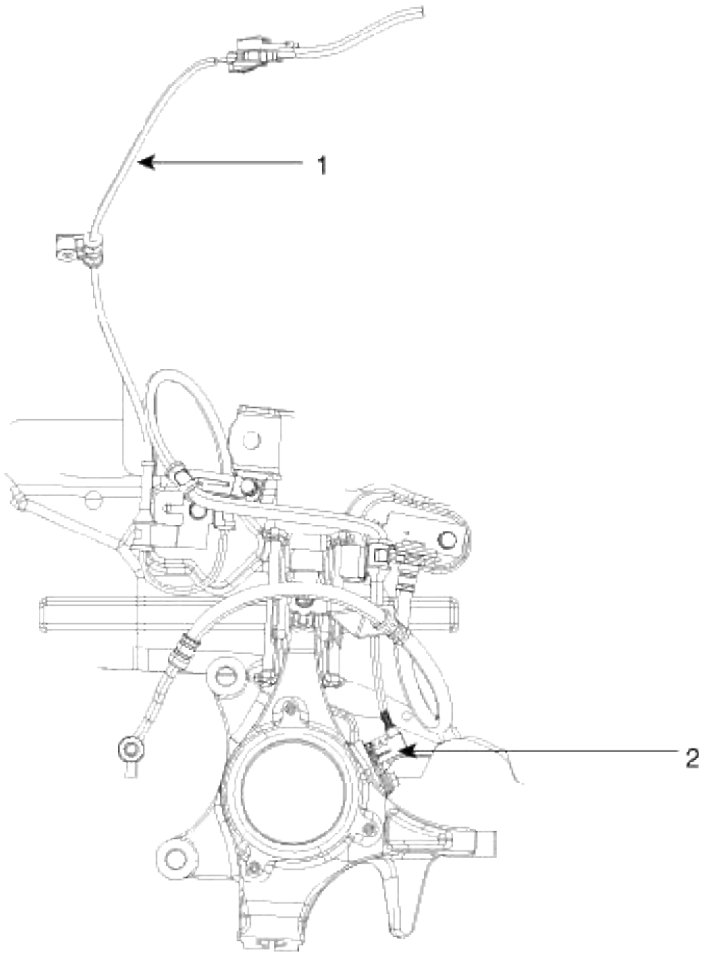
Tightening torque:
10.8 ~ 13.7 N.m (1.1 ~ 1.4 kgf.m, 8.0 ~ 10.1 lb-ft)

Installation

1. Installation is the reverse of removal.
2. Tighten the HECU mounting bolts and nuts to the specified torque.

Brake System > ESC(Electronic Stability Control) System > Front Wheel Speed Sensor > Components and Components Location

Components



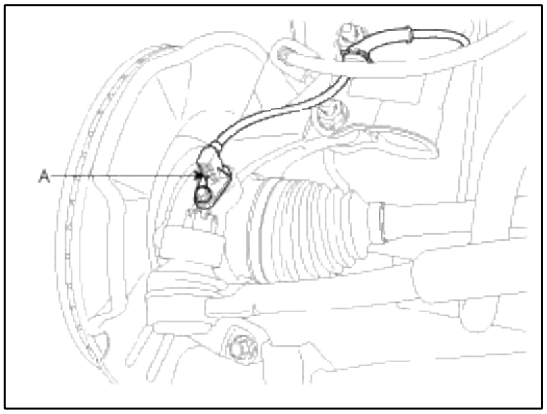
1. Front wheel speed sensor cable
2. Front wheel speed sensor

Brake System > ESC(Electronic Stability Control) System > Front Wheel Speed Sensor > Repair procedures

Removal

1. Remove the front wheel speed sensor mounting bolt (A).

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



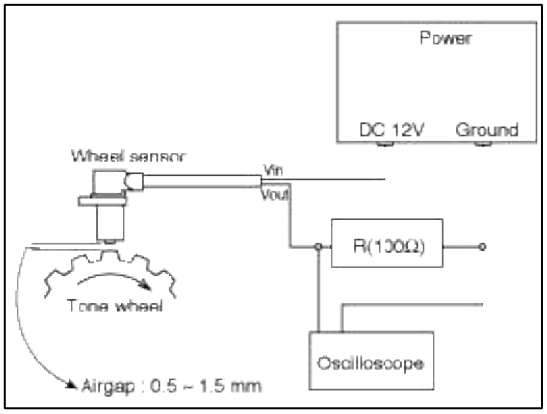
2. Remove the front wheel guard.
3. Disconnect the front wheel speed sensor connector. And remove the front wheel speed sensor.
4. Installation is the reverse of removal.

Inspection

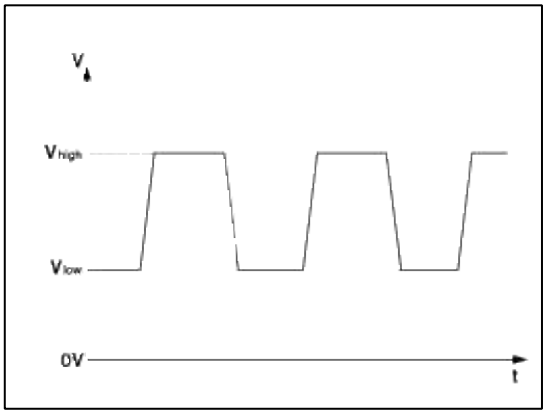
1. Measure the output voltage between the terminal of the wheel speed sensor and the body ground.

CAUTION

In order to protect the wheel speed sensor, when measuring output voltage, a 100 Ω resister must be used as shown.



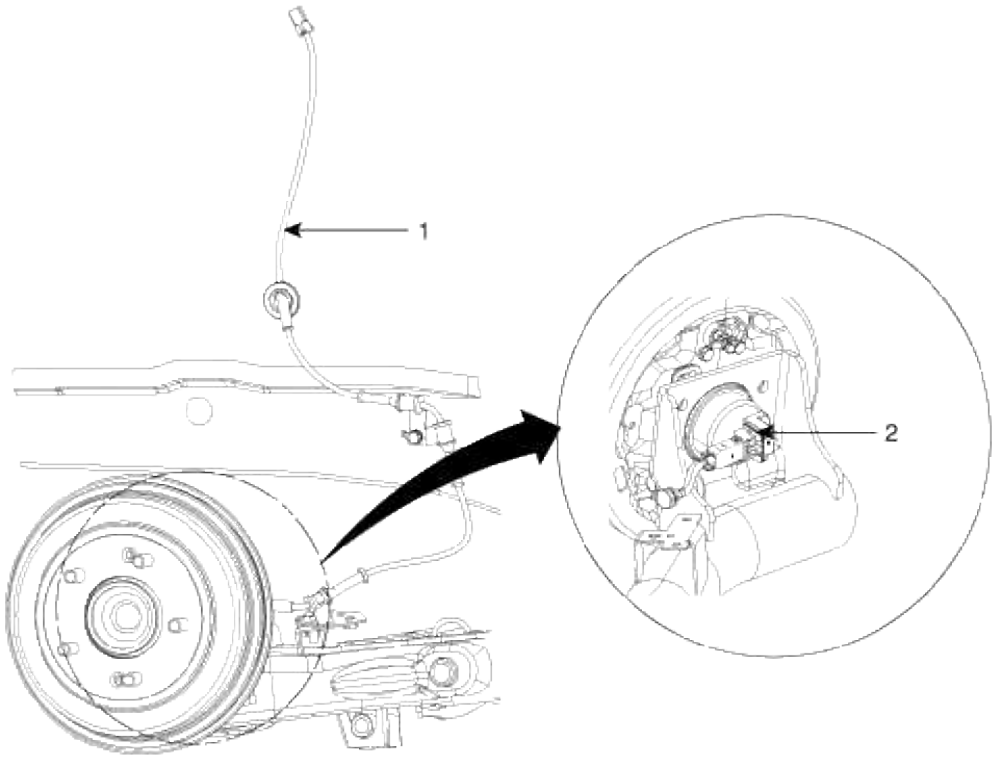
2. Compare the change of the output voltage of the wheel speed sensor to the normal change of the output voltage as shown below.



V_low : 0.59V ~ 0.84V
V_high : 1.18V ~ 1.68V
Frequency range : 1 ~ 2,500Hz

Brake System > ESC(Electronic Stability Control) System > Rear Wheel Speed Sensor > Components and Components Location

Components

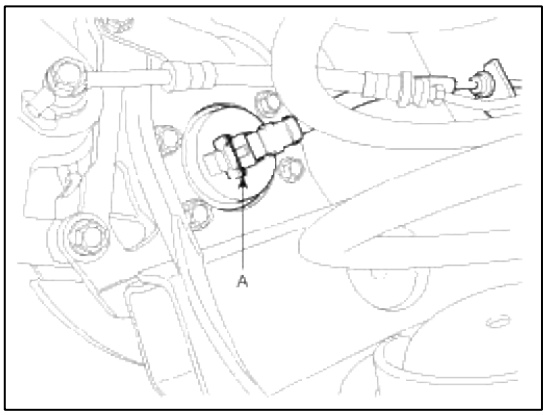


1. Rear wheel speed sensor cable
2. Rear wheel speed sensor

Brake System > ESC(Electronic Stability Control) System > Rear Wheel Speed Sensor > Repair procedures

Removal

1. Remove the connector after(A) removing the rear wheel speed sensor clip.

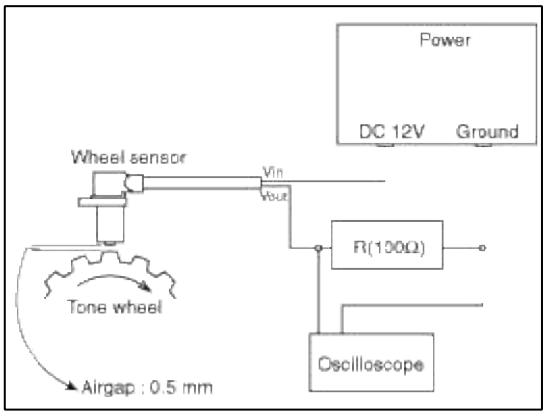


2. Remove the rear wheel speed sensor. (Refer to Driveshaft and axle group - Rear axle assembly)
3. Installation is the reverse of removal.

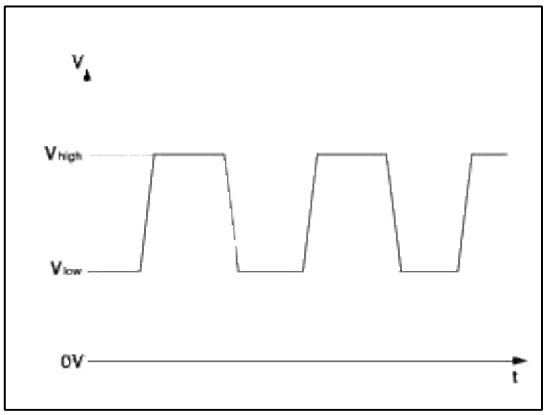
Inspection

1. Measure the output voltage between the terminal of the wheel speed sensor and the body ground.

> **CAUTION**
>
> In order to protect the wheel speed sensor, when measuring output voltage, a 100 Ω resister must be used as shown.



2. Compare the change of the output voltage of the wheel speed sensor to the normal change of the output voltage as shown below.

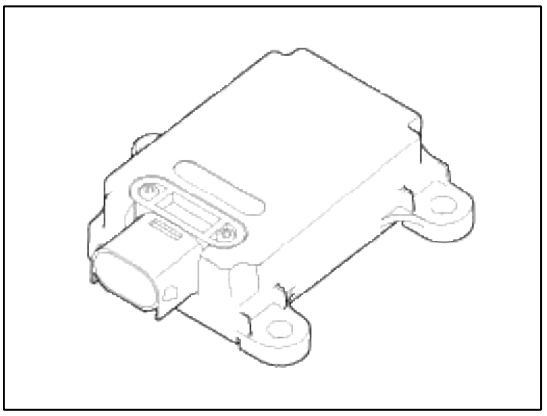


V_low : 0.59V ~ 0.84V
V_high : 1.18V ~ 1.68V
Frequency range : 1 ~ 2,500Hz

Brake System > ESC(Electronic Stability Control) System > Yaw-rate and Lateral G Sensor > Description and Operation

Description

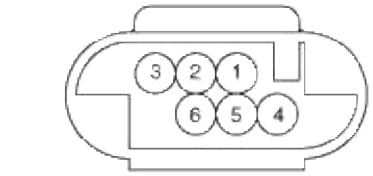
When the vehicle is turning with respect to a vertical axis the yaw rate sensor detects the yaw rate electronically by the vibration change of plate fork inside the yaw rate sensor.
If yaw velocity reaches the specific velocity after it detects the vehicle' yawing, the ESC control is reactivated.
The later G sensor senses vehicle's lateral G. A small element inside the sensor is attached to a deflectable lever arm by later G.
Direction and magnitude of lateral G loaded to vehicle can be known with electrostatic capacity changing according to lateral G.
It interchanges signals with HECU through extra CAN line which only used for communication between HECU and sensor.



Specifications

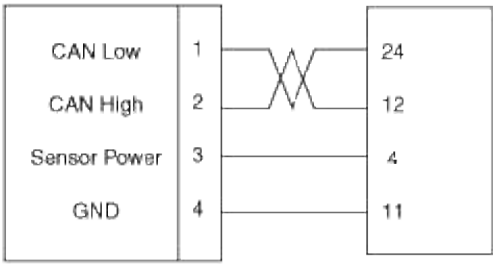
Description		Specification	Remarks
Operating voltage		10 ~ 16V	
Output signal		CAN Interface	
Operating temperature		-40 ~ 85°C(-40 ~ 185°F)	
Yaw-rate sensor	Measurement range	-75 ~ 75°/sec	
	Frequency response	18 ~ 22Hz	
Lateral G sensor	Measurement range	-1.5 ~ 1.5g	
	Frequency response	50Hz±60%	

External Diagram



(Yaw-rate & Lateral & Longtudinal G sensor's)

[Harness Connector]

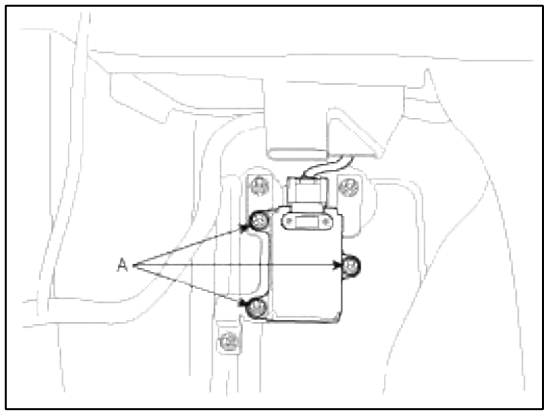


Brake System > ESC(Electronic Stability Control) System > Yaw-rate and Lateral G Sensor > Repair procedures

Removal

1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Remove the passenger seat assembly.
   (Refer to the Body group - "Seat")
3. Clear away the floor mat.
4. Disconnect the yaw rate & lateral G sensor connector.
5. Remove the mounting bolts (A).

Tightening torque:
7.9 ~ 10.8N.m (0.8 ~ 1.1kgf.m, 5.8 ~ 8.0Ib-ft)



6. Installation is the reverse of removal.

Brake System > ESC(Electronic Stability Control) System > ESC OFF Switch > Description and Operation

Description

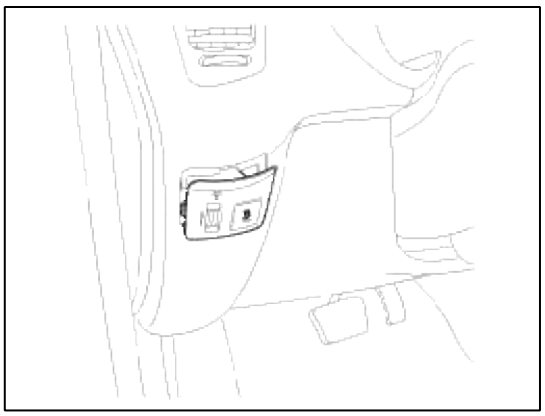
1. The ESC OFF switch is for the user to turn off the ESC system.

2. The ESC OFF lamp is on when ESC OFF switch is engaged.

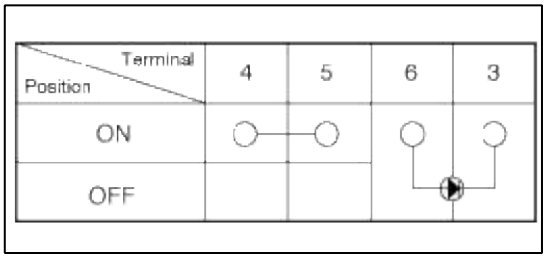
Brake System > ESC(Electronic Stability Control) System > ESC OFF Switch > Repair procedures

Inspection

1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Remove the lower crash pad switch assembly by using the scraper and then disconnect the connectors.



3. Check the continuity between the switch terminals as the ESC OFF switch is engaged.



Brake System > ESC(Electronic Stability Control) System > Steering Wheel Angle Sensor > Description and Operation

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.
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 be inspected. They must be replaced. (Refer to “ST (Steering system) Gr.”)

SOUL(AM) > 2012 > G 1.6 GDI > Body (Interior and Exterior)

Body (Interior and Exterior) > General Information > Specifications

Specifications

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

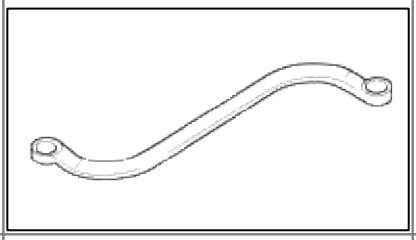
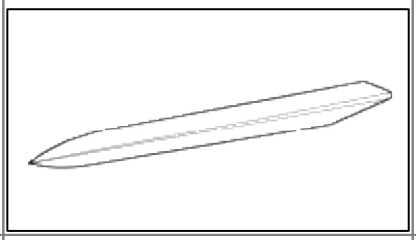
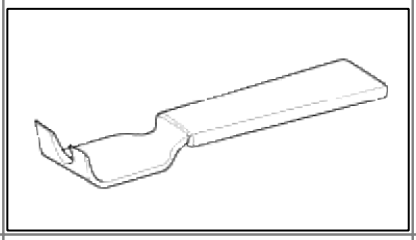
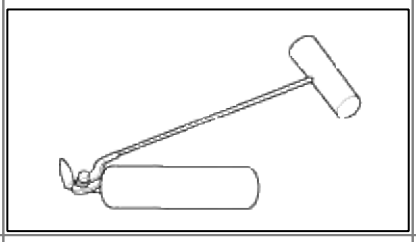
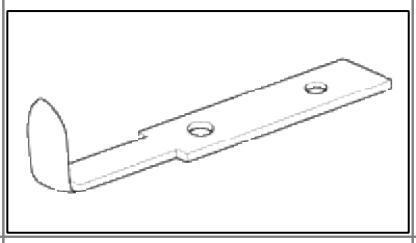
Tightening Torques

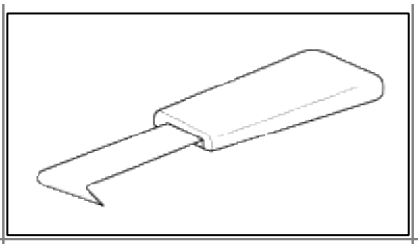
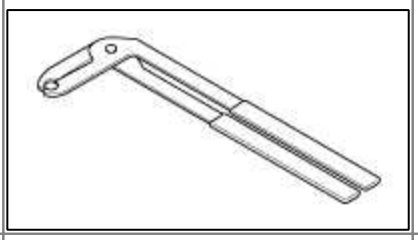
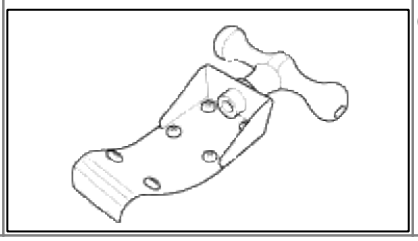
Items		N.m	Kgf.m	lb-ft
Front and rear doors	Door hinge to body	34.3 ~ 41.2	3.5 ~ 4.2	25.3~ 30.4
	Door hinge to door	21.6 ~ 26.5	2.2 ~ 2.7	15.9 ~ 19.5
	Door checker to door	6.9 ~ 10.8	0.7 ~ 1.1	5.1 ~ 8.0
	Door checker to body	16.7 ~ 21.6	1.7 ~ 2.2	12.3 ~ 15.9
	Door glass mounting bolt	7.8 ~ 11.8	0.8 ~ 1.2	5.8 ~ 8.7
	Outside handle base mounting bolt	0.7 ~ 0.5	0.07 ~ 0.1	1.0 ~ 0.7
	Latch mounting bolts	6.9 ~ 10.8	0.7 ~ 1.1	5.1 ~ 8.0
	Door module mounting bolts	7.8 ~ 11.8	0.8 ~ 1.2	5.8 ~ 8.7
	Door striker mounting bolts	16.7 ~ 21.6	1.7 ~ 2.2	12.3 ~ 15.9
Tail gate	Tail gate hinge to body	21.6 ~ 26.5	2.2 ~ 2.7	15.9 ~ 19.5
	Tail gate hinge to trunk lid	21.6 ~ 26.5	2.2 ~ 2.7	15.9 ~ 19.5
	Tail gate latch mounting bolts	6.9 ~ 10.8	0.7 ~ 1.1	5.1 ~ 8.0
	Tail gate striker mounting bolts	21.6 ~ 26.5	2.2 ~ 2.7	15.9 ~ 19.5
Hood	Hood hinge to body	21.6 ~ 26.5	2.2 ~ 2.7	15.9 ~ 19.5
	Hood hinge to hood	21.6 ~ 26.5	2.2 ~ 2.7	15.9 ~ 19.5
	Hood latch to body	6.9 ~ 10.8	0.7 ~ 1.1	5.1 ~ 8.0
Seat	Front seat mounting bolts	39.2 ~ 58.8	4.0 ~ 6.0	28.9 ~ 43.4
	Front seat frame mounting bolts	39.2 ~ 58.8	4.0 ~ 6.0	28.9 ~ 43.4
	Rear seat mounting bolts	16.7 ~ 25.5	1.7 ~ 2.6	12.3 ~ 18.8
	Rear seat latch mounting bolts	19.6 ~ 29.4	2.0 ~ 3.0	14.5 ~ 21.7
Seat belt	Height adjuster mounting bolts	39.2 ~ 53.9	4.0 ~ 5.5	28.9 ~ 39.8
	Front seat belt upper anchor mounting bolt	39.2 ~ 53.9	4.0 ~ 5.5	28.9 ~ 39.8
	Anchor pretensioner mounting bolt	39.2 ~ 53.9	4.0 ~ 5.5	28.9 ~ 39.8
	Front seat belt retractor mounting bolt	39.2 ~ 53.9	4.0 ~ 5.5	28.9 ~ 39.8
	Rear seat belt lower anchor mounting bolt	39.2 ~ 53.9	4.0 ~ 5.5	28.9 ~ 39.8

	Rear seat belt retractor mounting bolt	39.2 ~ 53.9	4.0 ~ 5.5	28.9 ~ 39.8
	Rear center seat belt mounting bolt	39.2 ~ 53.9	4.0 ~ 5.5	28.9 ~ 39.8
	Seat belt buckle mounting bolt	39.2 ~ 53.9	4.0 ~ 5.5	28.9 ~ 39.8
Wiper arm	Wiper arm mounting nuts	22.6 ~ 26.5	2.3 ~ 2.7	16.6 ~ 19.5
Outside rearview mirror	Outside rearview mirror mounting nuts	6.9 ~ 10.8	0.7 ~ 1.1	5.1 ~ 8.0
Sunroof	Sunroof mounting bolts	7.8 ~ 11.8	0.8 ~ 1.2	5.8 ~ 8.7
	Sunroof mounting nuts	3.9 ~ 5.9	0.4 ~ 0.6	2.9 ~ 4.3

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

Special Service Tools

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

Windshield molding remover		
09880-4F000 Hog ring clip installer		Hog ring clip installation
09840-1E100 Center fascia remover		Center fascia removal

Body (Interior and Exterior) > General Information > Troubleshooting

Troubleshooting

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

closed is not an unusual noise		retighten motor
	Worn out or damaged motor pinion bearing	Replace motor assembly
	Worn out or deformed drive cable	Replace
Door glass fails to operate up and down	Incorrect window glass installation	Adjust position
	Damaged or faulty regulator arm or regulator	Correct or replace
Door does not open or close completely	Incorrect door installation	Adjust position
	Defective door check assembly	Correct or replace
	Door hinge requires grease	Apply grease
Hood does not open or close completely	Striker and latch not properly aligned	Adjust
	Incorrectly installed hood	Adjust
	Incorrect hood bumper height	Adjust
Water leak through windshield end rear window	Defective seal	Fill with sealant
	Defective flange	Correct

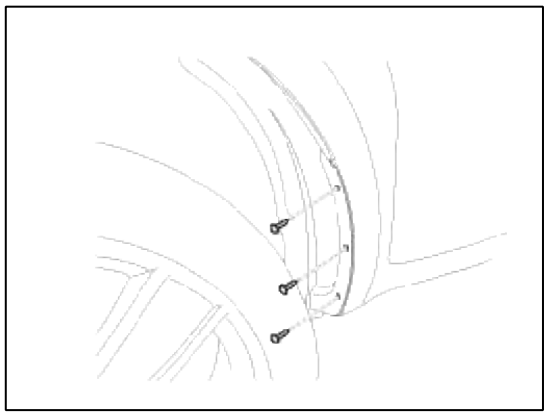
Body (Interior and Exterior) > Exterior > Fender > Repair procedures

Replacement

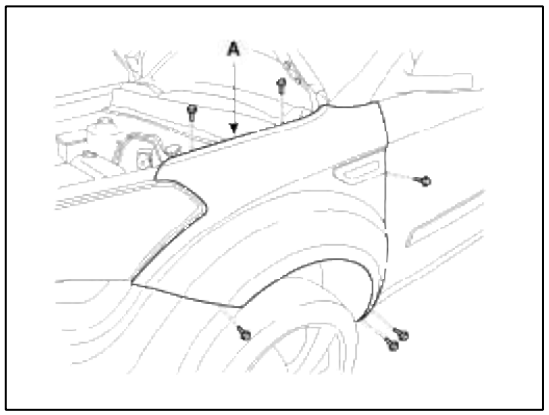
NOTE

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

1. Remove the front bumper.
   (Refer to the BD group - "Front Bumper")
2. Remove the head lamps.
   (Refer to the BE group - "Head Lamps")
3. Loose the mud guard mounting screws.



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



5. Installation is the reverse of removal.

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

Replacement

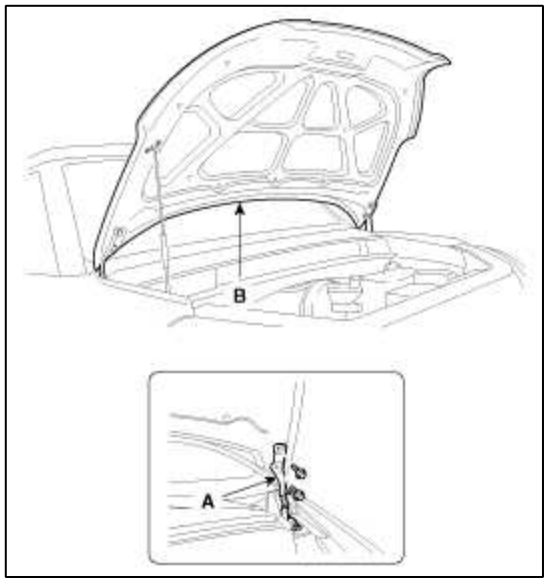
Hood Assembly Replacement

NOTE

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

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

Tightening torque :
21.6~26.5N.m (2.2~2.7kgf.m, 15.9~19.5 lb-ft)



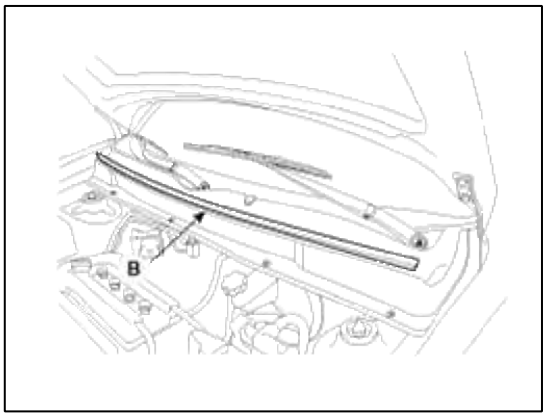
2. Installation is the reverse of removal.

NOTE

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

Hood Weatherstrip Replacement

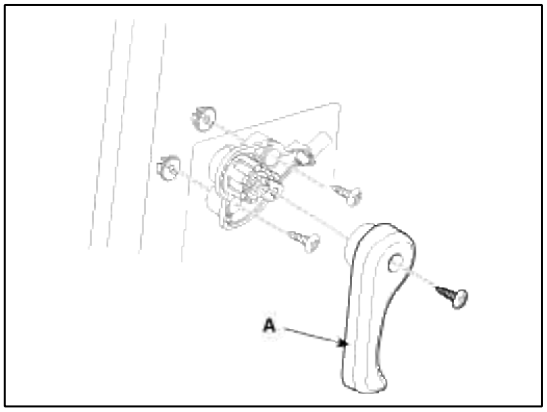
1. Remove the hood weatherstrip (B).



2. Installation is the reverse of removal.

Hood Release Handle Replacement

1. Remove the cowl side trim.
   (Refer to the BD group - "Interior Trim")
2. After loosening the mounting screw, then remove the hood release handle (A).



3. Installation is the reverse of removal.

NOTE

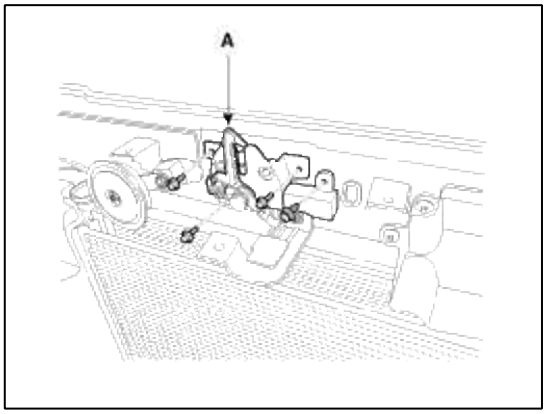
- Make sure the hood latch cable is connected properly.
- Make sure the hood locks securely.

Hood Latch Replacement

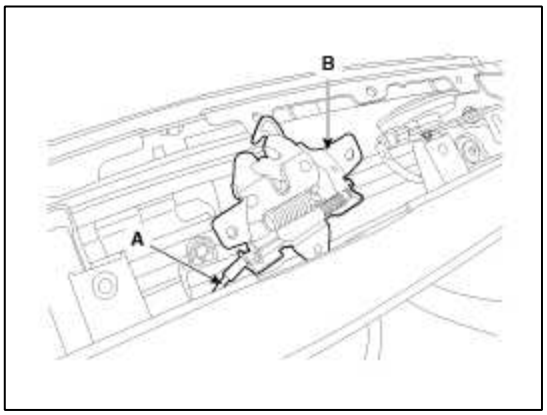
1. Remove the radiator upper cover.
   (Refer to the BD group - "Front Bumper")

2. After loosening the mounting bolts and clip, then remove the hood latch (A).

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



3. Disconnect the hood latch cable (A) and remove the hood latch (B).



4. Installation is the reverse of removal.

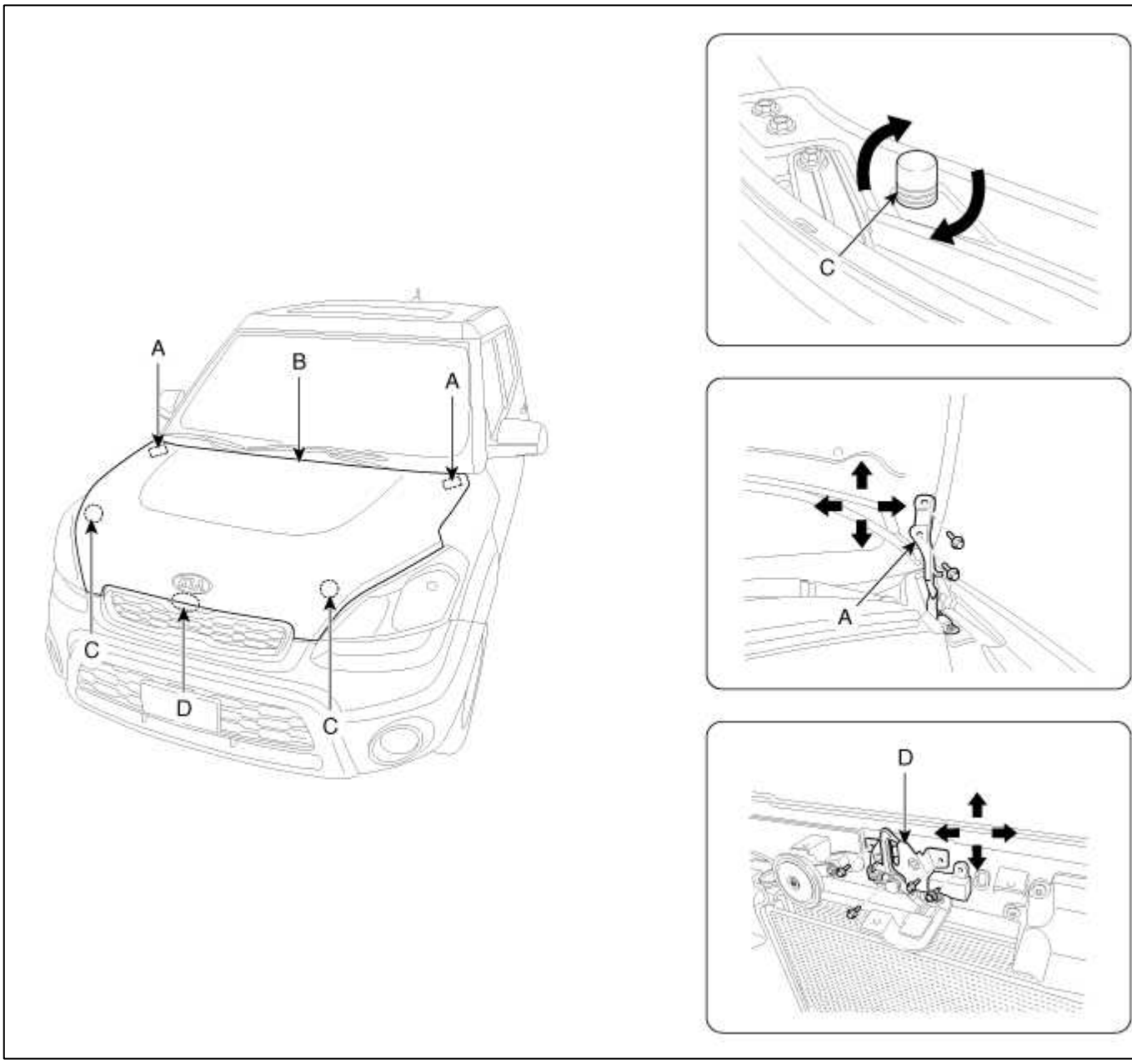
NOTE

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

Adjustment

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

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



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

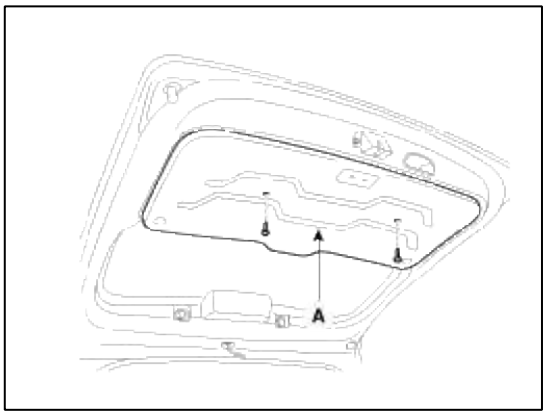
Replacement

Tailgate Trim Replacement

NOTE

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

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

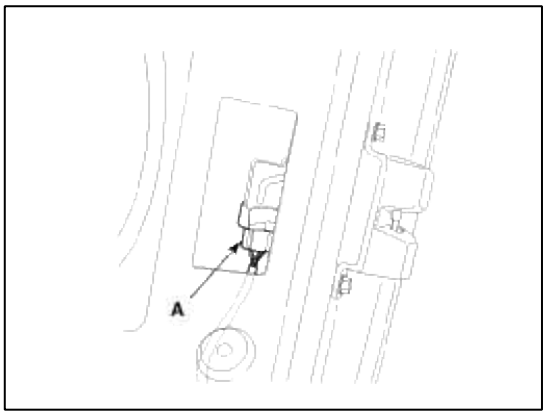


2. Installation is the reverse of removal.

> NOTE
>
> • Replace and damaged clips.

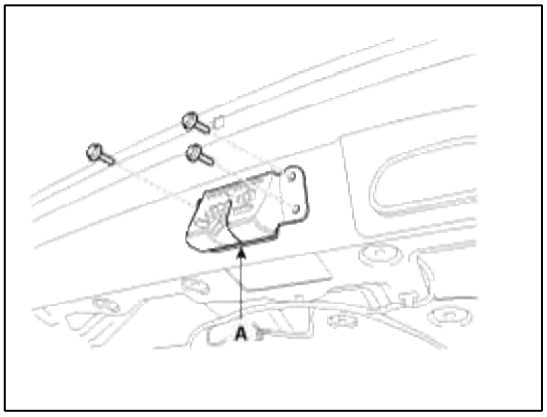
Latch Assembly Replacement

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



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

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



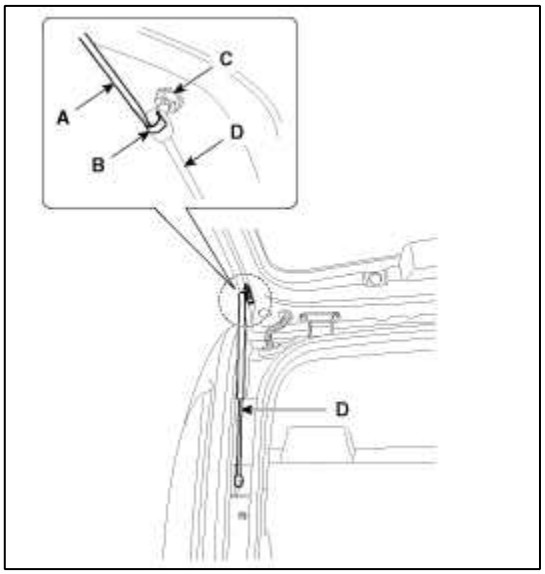
4. Installation is the reverse of removal.

NOTE

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

Tailgate Lifter Replacement

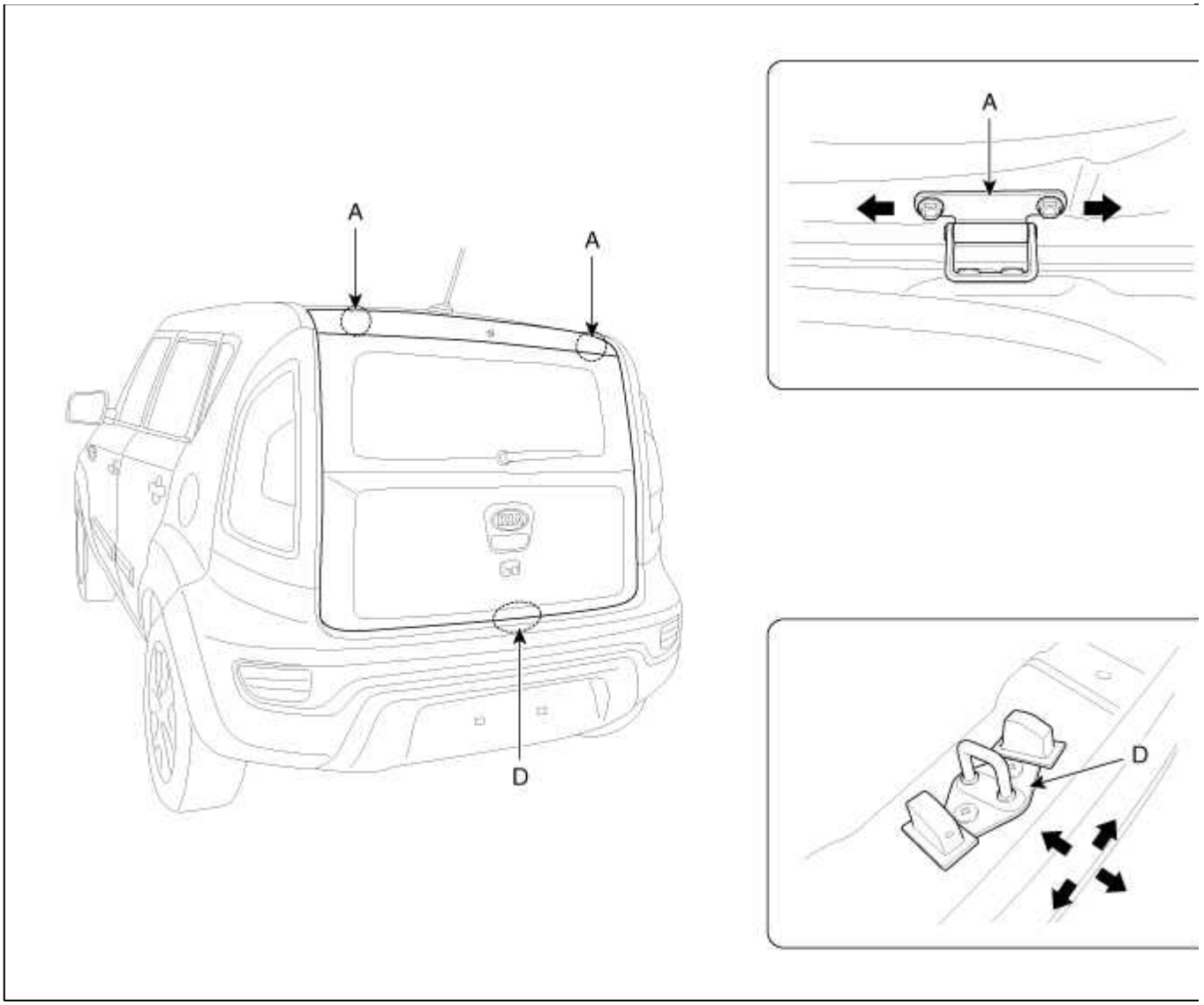
1. Using a screwdriver (A), lift up slightly the socket clips (B) of both ends on the lifer (D), and then remove the lifter from the bracket (C).



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

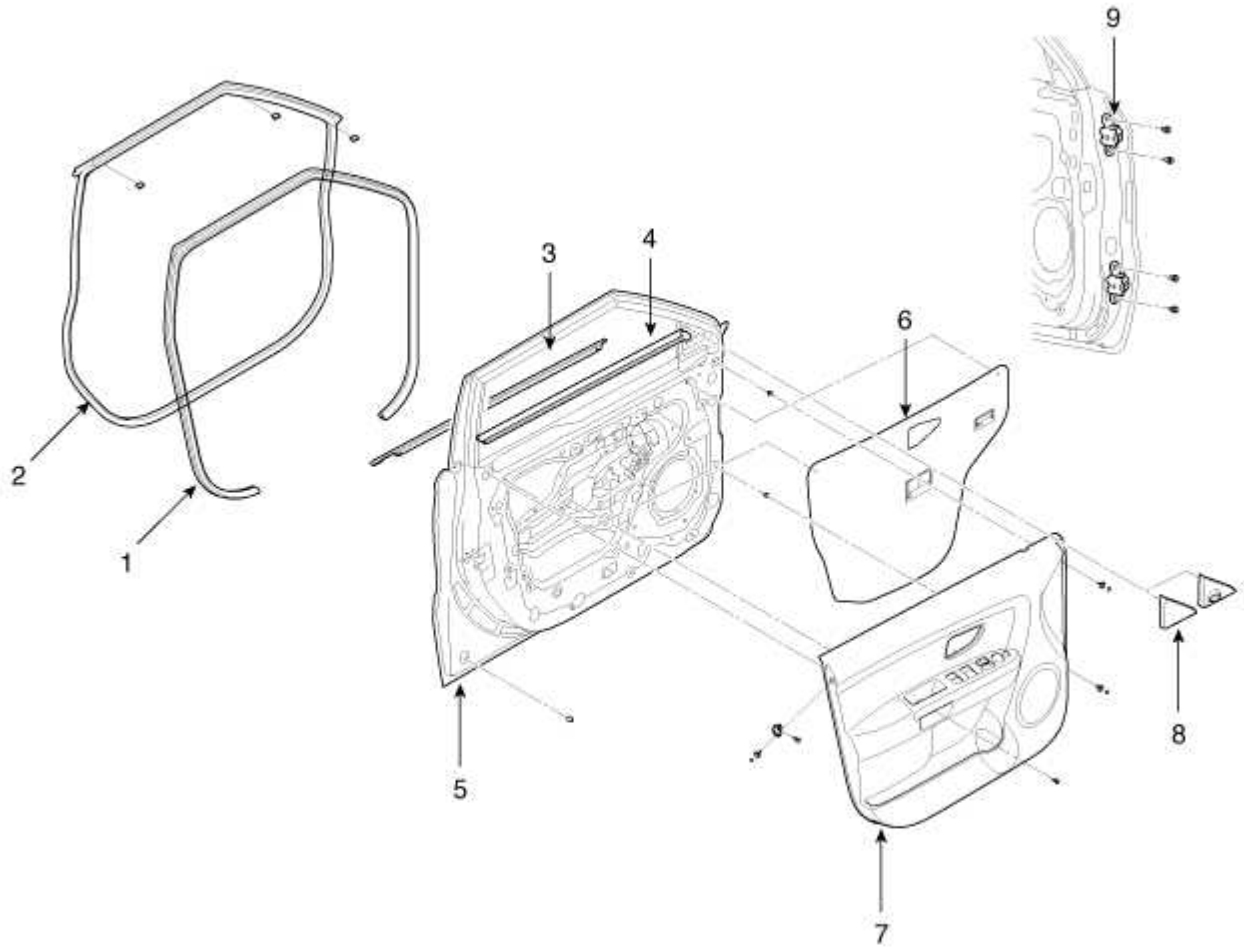
Adjustment

1. After loosening the tailgate hinge (A) mounting bolt, adjust the tailgate by moving it up or down, or right or left.
2. Adjust the tailgate fit by turning the tailgate over slam bumper and side bumper.
3. Adjust the striker (D) by moving it up or down, or right or left.

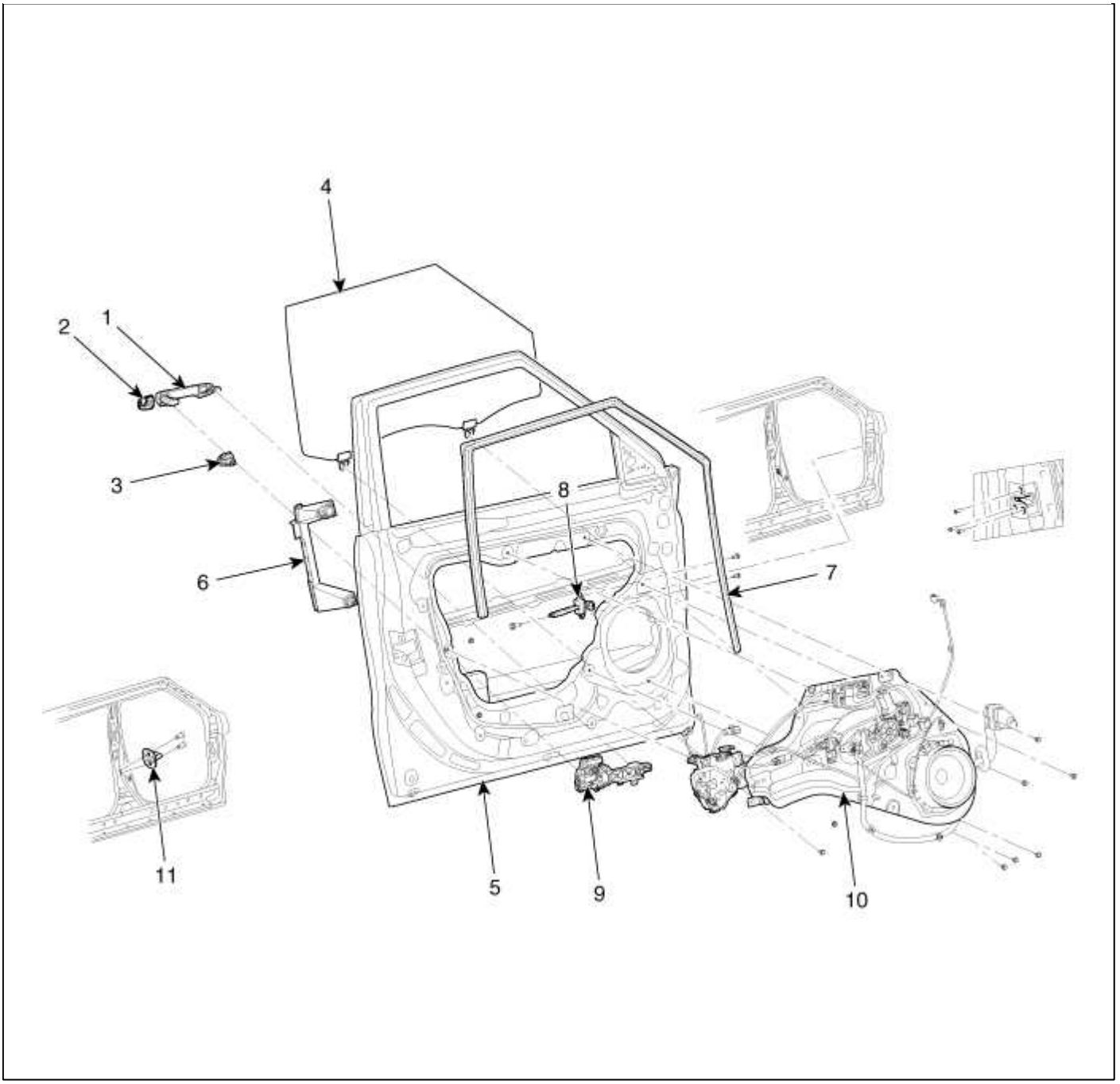


Body (Interior and Exterior) > Exterior > Front Door > Components and Components Location

Components



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



1. Front door outside handle	7. Front door window glass run
2. Front door outside handle cover	8. Front door checker
3. Door lock assembly	9. Front door outside handle base
4. Front door glass	10. Front door module
5. Front door panel	11. Door striker
6. Front door channel	

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

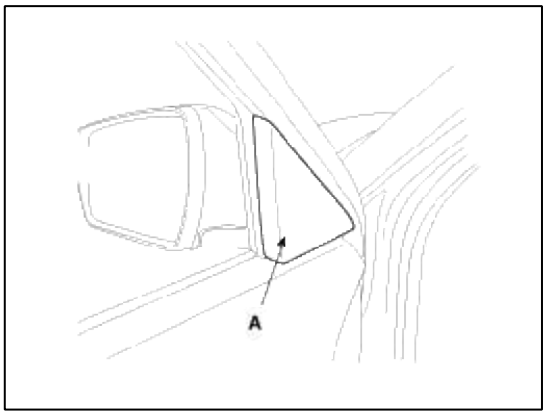
Replacements

Door Trim Replacement

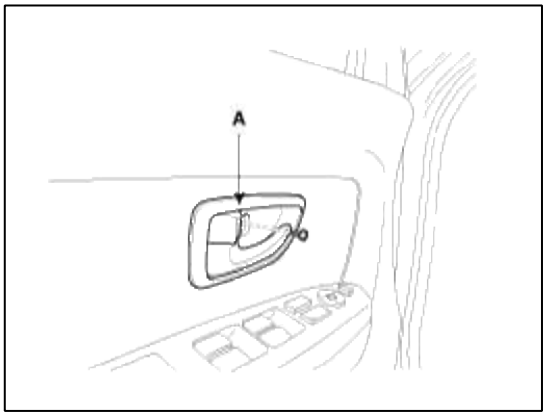
NOTE

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

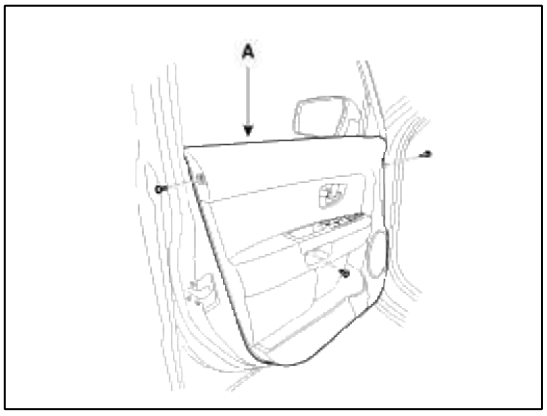
1. Remove the quadrant inner cover (A).



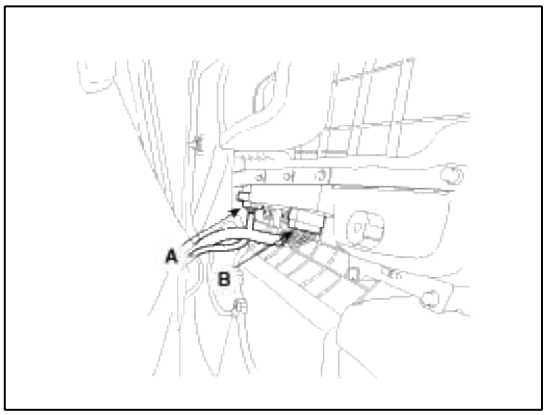
2. After loosening the mounting screw, then remove the inside handle cover (A).



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



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



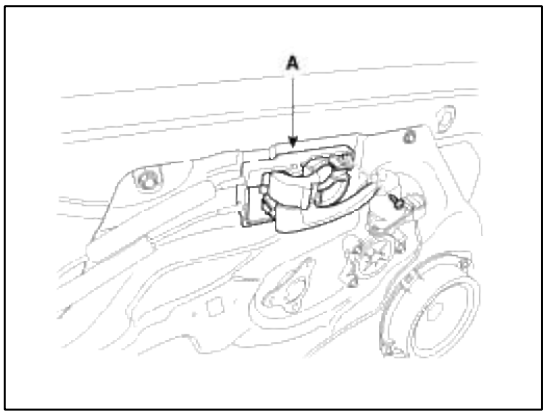
6. Installation is the reverse of removal.

NOTE

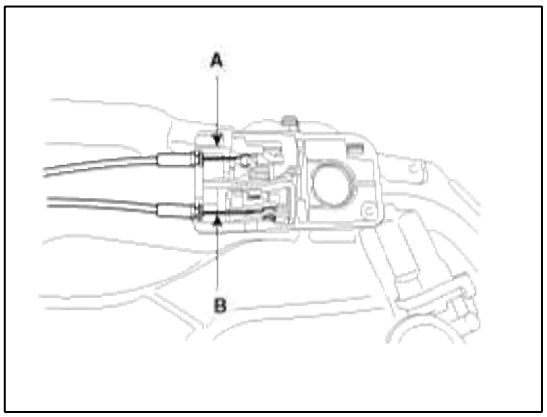
- Make sure of connectors is plugged in properly and each rod is connected securely.
- Make sure the door lock and opens properly.

Inside Handle Replacement

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



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



4. Installation is the reverse of removal.

NOTE

- Make sure the door locks and opens properly.

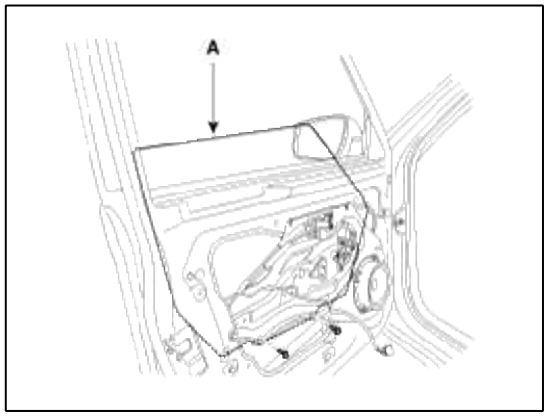
Glass Replacement

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

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

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

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

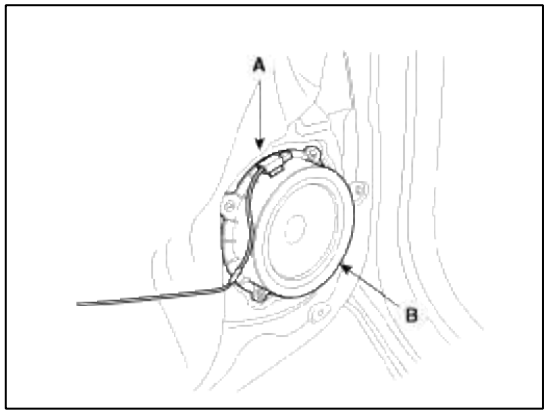


4. Installation is the reverse of removal.

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

Speaker Replacement

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



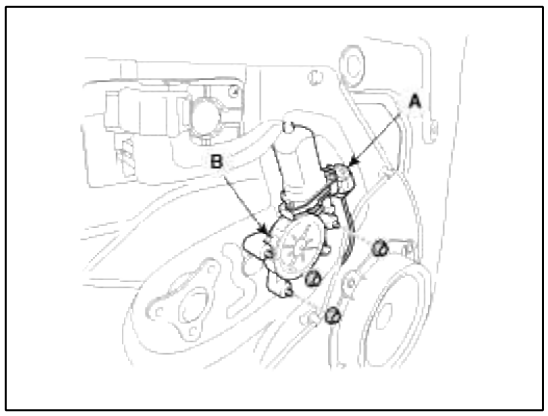
4. Installation is the reverse of removal.

NOTE

- Use sheet metal screws to secure the speaker.

Power Window Motor Replacement

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



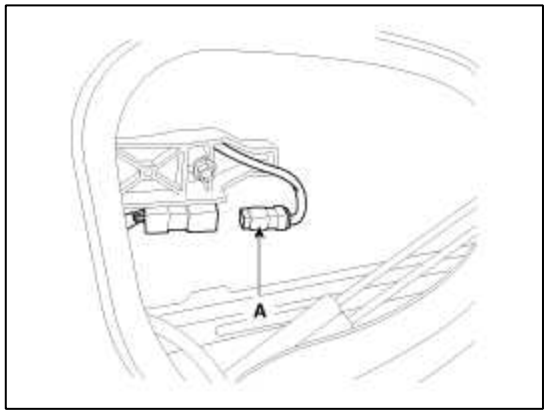
4. Installation is the reverse of removal.

NOTE

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

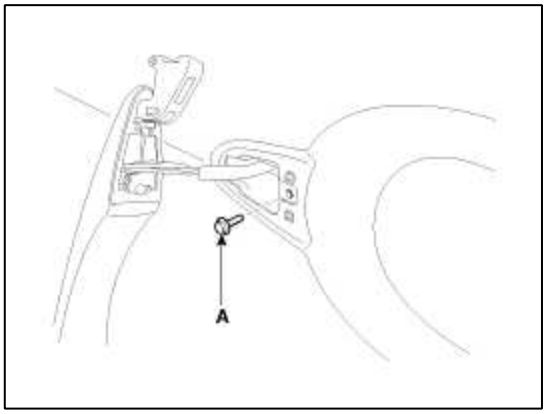
Door Module Assembly Replacement

1. Remove the following parts.
   A. Door trim
   B. Door screen
   C. Window glass
   D. Outside handle
2. Disconnect the outside handle connector (A).

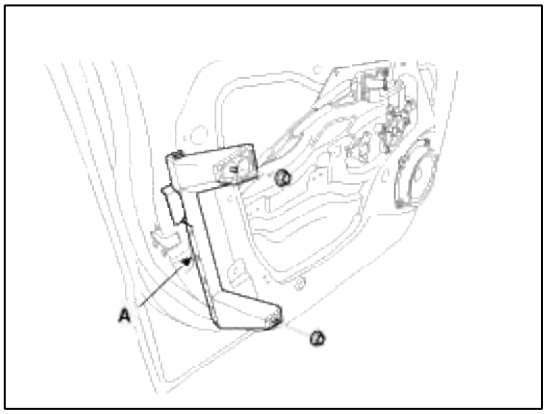


3. Loosen the mounting bolt (A).

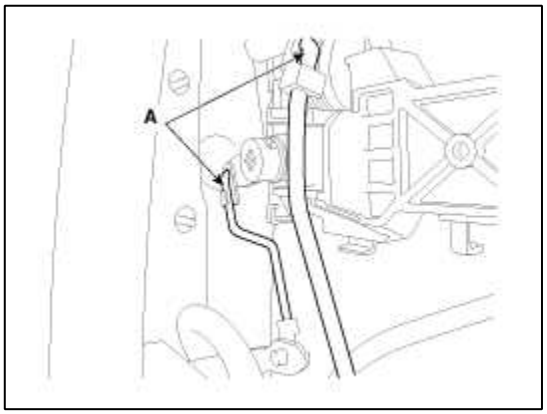
Tightening torque :
0.7~0.5N.m (0.07~0.1kgf.m, 1.0~0.7 lb-ft)



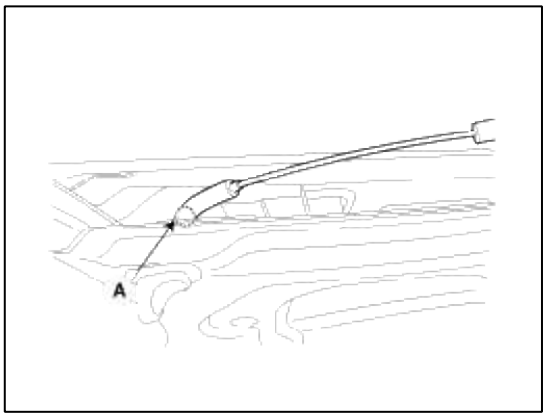
4. Loosen the rear channel mounting nuts.
5. After disconnecting the glass molding, remove the rear channel (A).



6. Disconnect the rod (A).

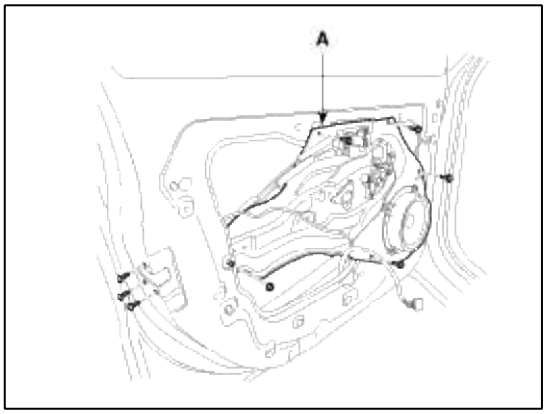


7. Disconnect the clip (A).



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

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



11. Installation is the reverse of removal.

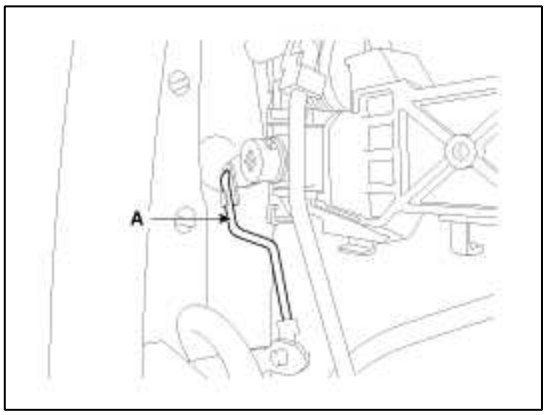
NOTE

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

Out Side Handle Replacement

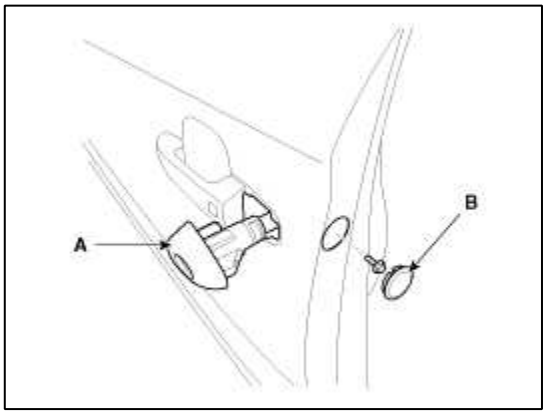
1. Remove the door trim.
2. Remove the door screen.

3. Disconnect the outside handle rod (A).

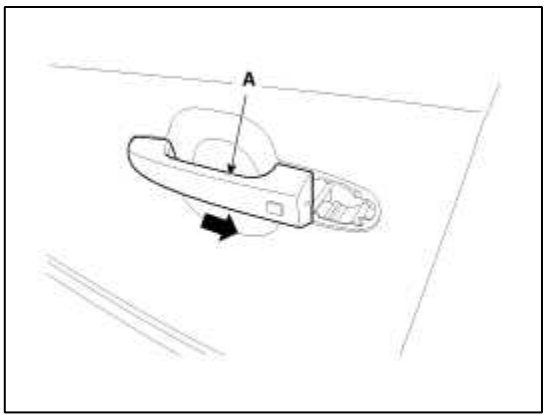


4. Remove the hole plug (B).

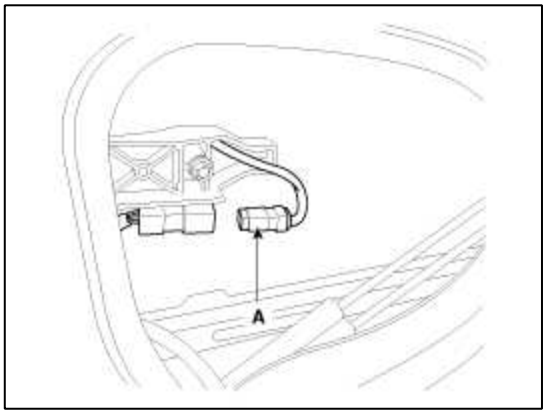
5. After loosening the mounting bolt, then remove the outside handle cover (A).



6. Remove the outside handle (A) by sliding it rearward.



7. Disconnect the outside handle connector (A).



8. Installation is the reverse of removal.

NOTE

• Make sure the door lock and open properly.

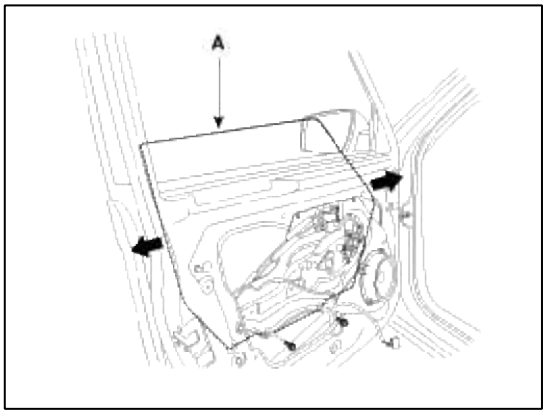
Adjustment

Glass Adjustment

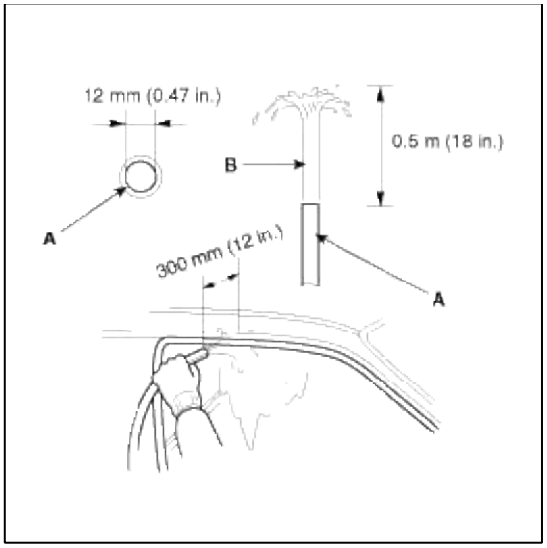
NOTE

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

1. Remove the following parts:
   A. Quadrant inner cover
   B. Door trim
   C. Door screen
2. Carefully move the glass (A) until the glass mounting bolts are visible, then loosen them.



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

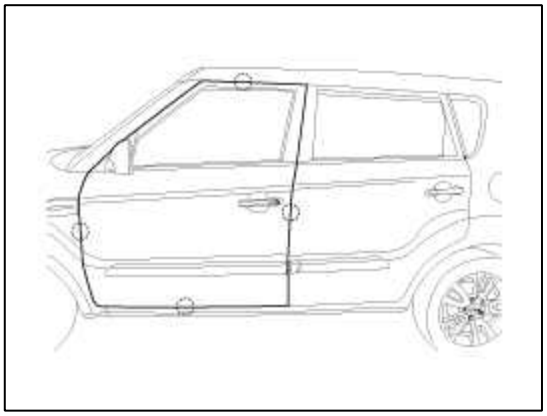


Door Position Adjustment

NOTE

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

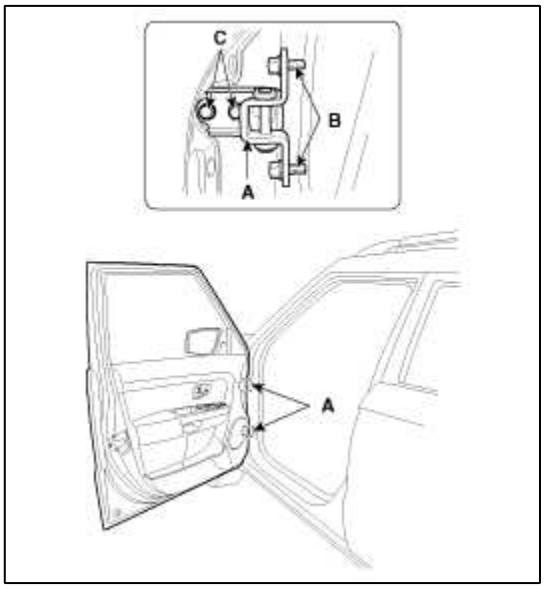
1. Check that the door and body edges are parallel.



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

3. Adjust at the hinges (A) :
   A. Loosen the door mounting bolts slightly, and move the door in or out until it aligns flush with the body.
   B. Loosen the hinge mounting bolts slightly, and move the door backward or forward, up or down as necessary to equalize the gaps.
   C. Place a shop towel on the jack to prevent damage to the door when adjusting the door.

Tightening torque :
(B) : 21.6~26.5N.m (2.2~2.7kgf.m, 15.9~19.5 lb-ft)
(C) : 34.3~41.2N.m (3.5~4.2kgf.m, 25.3~30.4 lb-ft)

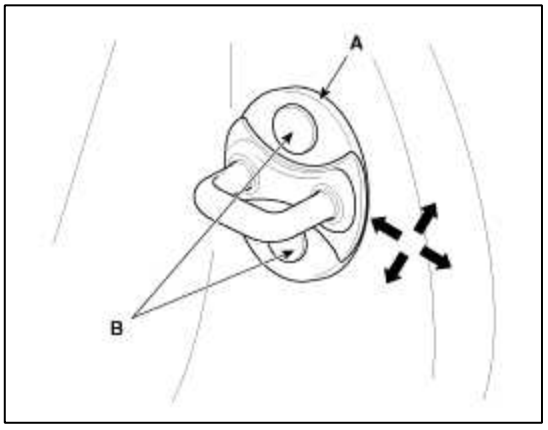


4. Grease the pivot portions of the hinges indicated.
5. Check for water leaks.

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

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

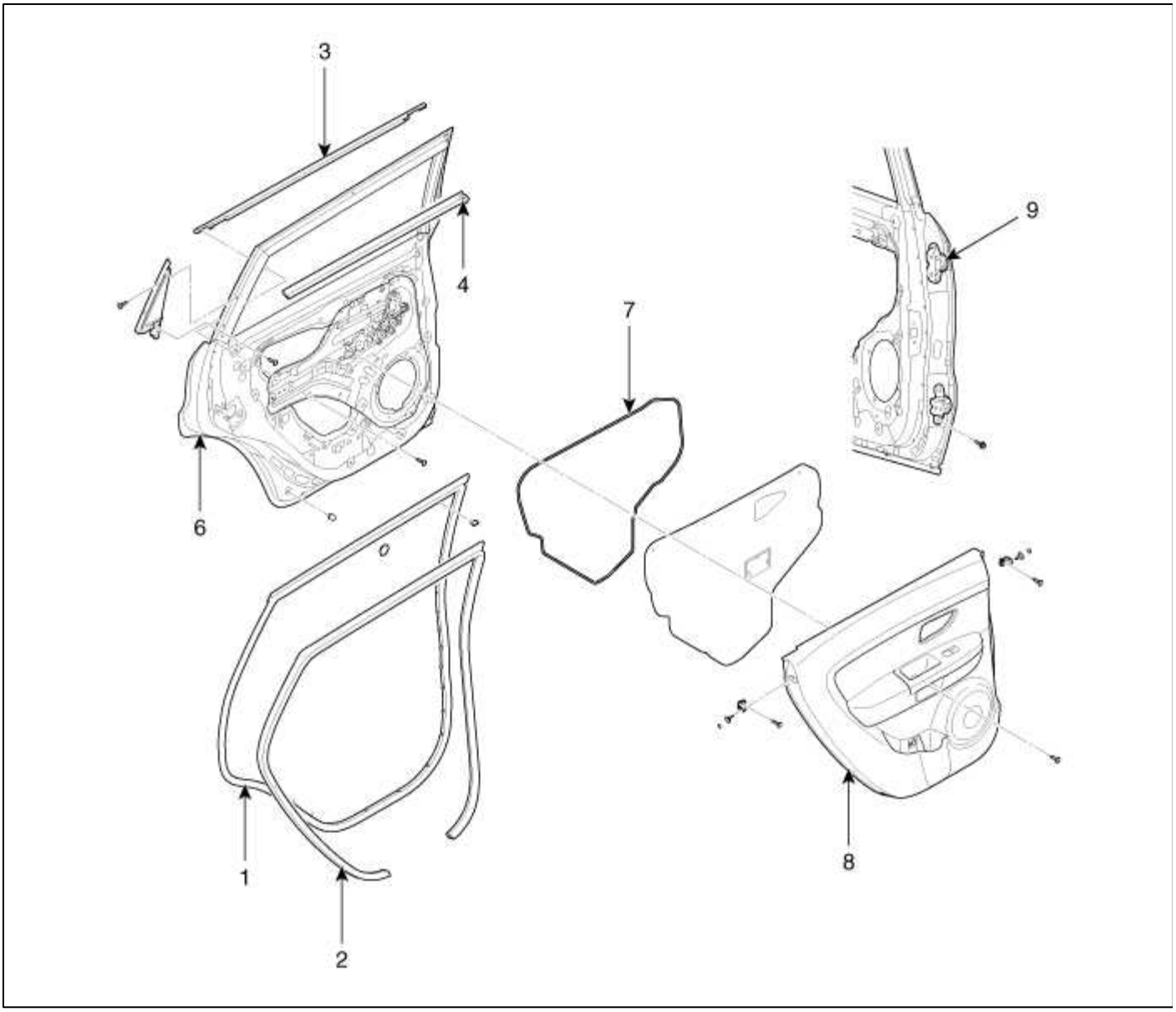
Tightening torque :
(B) 16.7~21.6N.m (1.7~2.2kgf.m, 12.3~15.9 lb-ft)



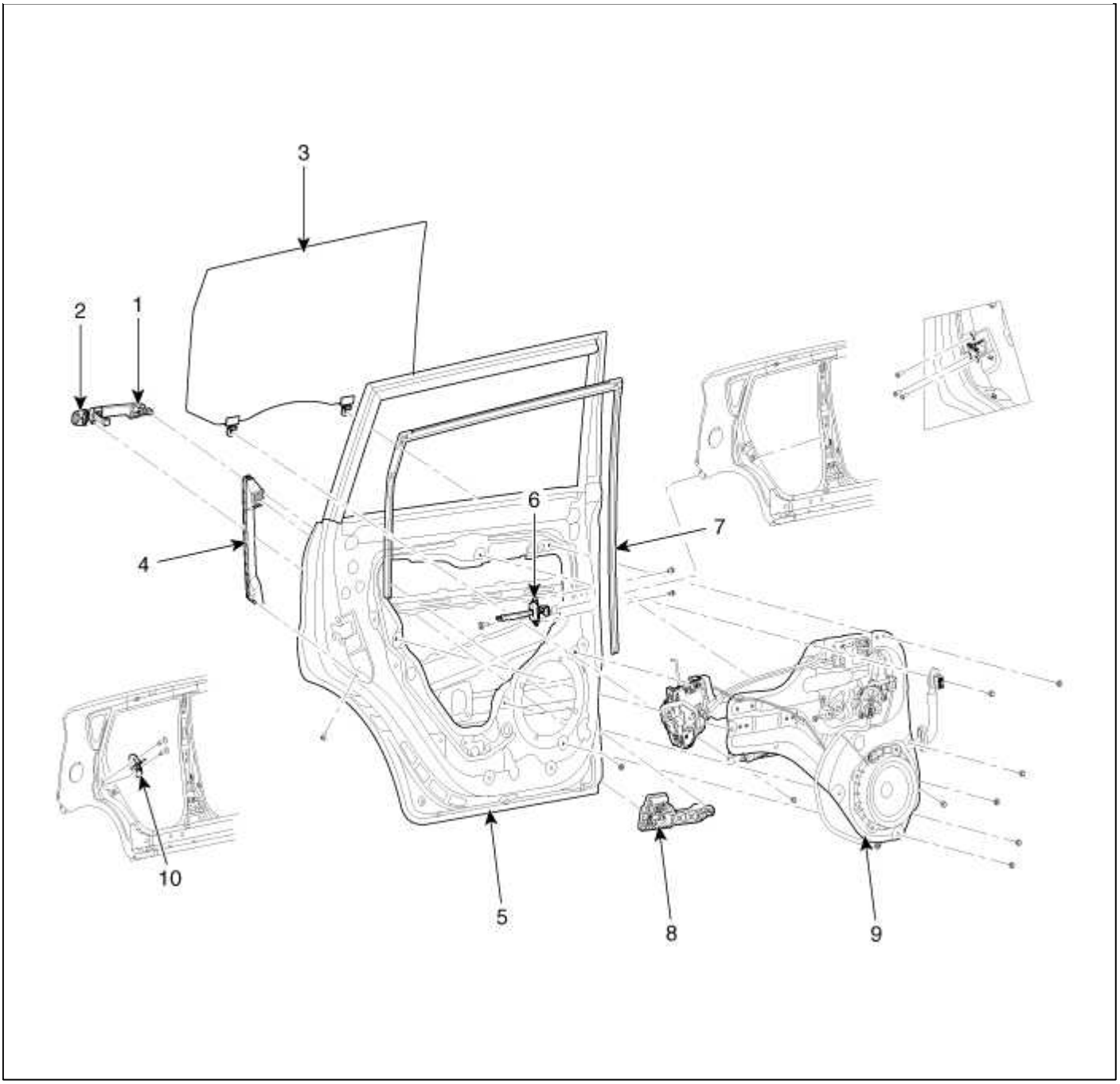
2. Tap on the striker with a plastic hammer to adjust the striker. The striker will not move much, but will give some adjustment.
3. Hold the outer handle out, and push the door against the body to be sure the striker allows a flush fit. If the door latches properly, tighten the screws and recheck.

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

Components



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



1. Rear door outside handle	6. Rear door checker
2. Rear door outside handle cover	7. Rear door window glass run
3. Rear door glass	8. Rear door outside handle base
4. Rear door channel	9. Rear door module
5. Rear door panel	10. Door striker

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

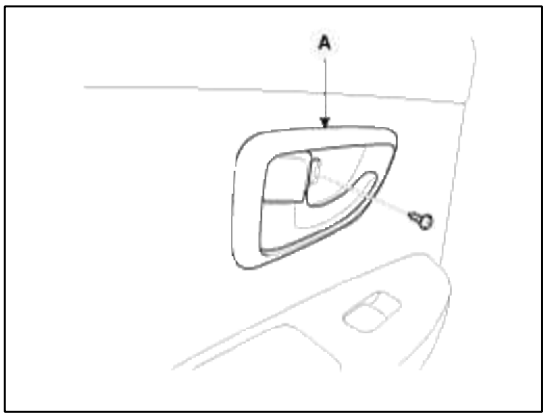
Replacement

Door Trim Replacement

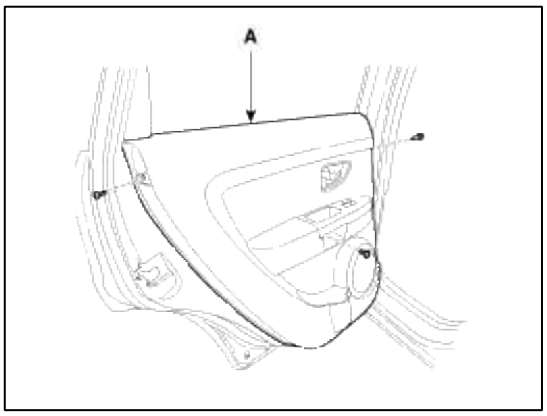
NOTE

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

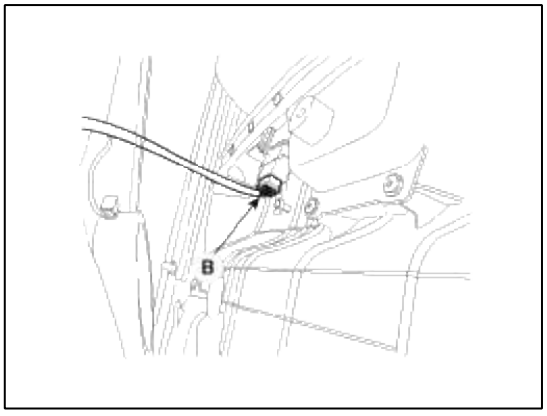
1. After loosening the mounting screw, then remove the inside handle cover (A).



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



3. Disconnect the connector (B).



4. Installation is the reverse of removal.

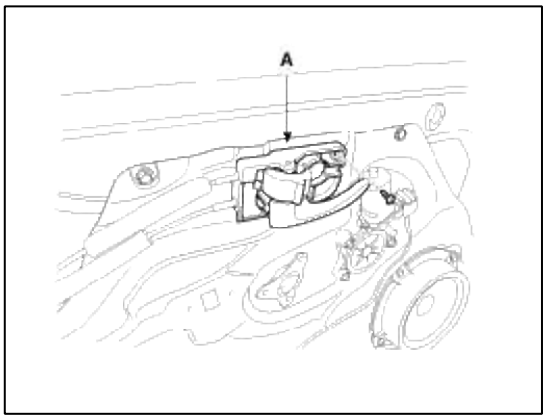
NOTE

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

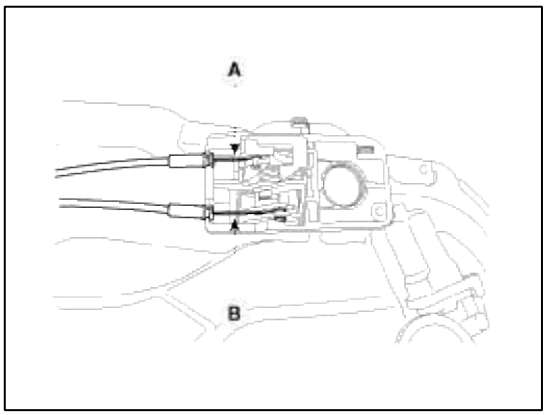
Inside Handle Replacement

1. Remove the door trim.

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



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



4. Installation is the reverse of removal.

NOTE

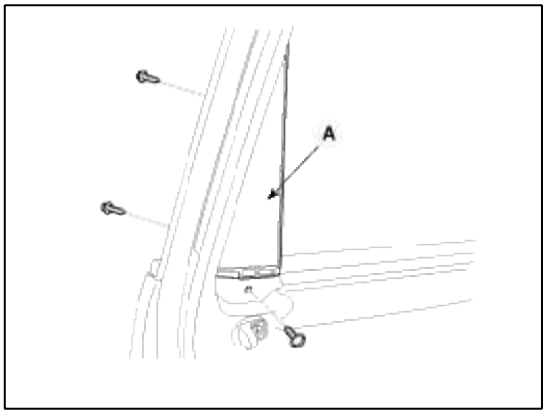
- Make sure the door locks and opens properly.

Glass Replacement

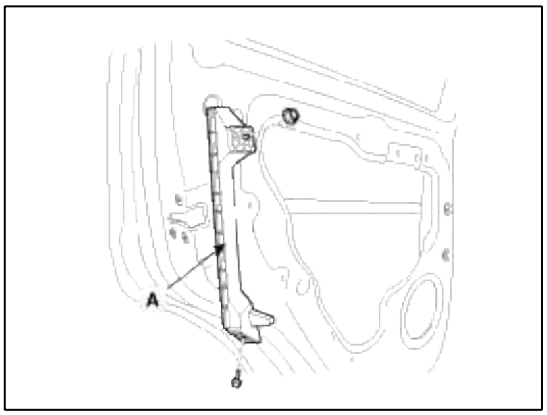
NOTE

- Put on gloves to protect your hands.

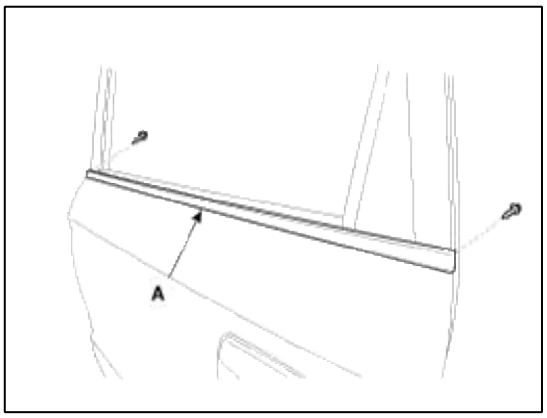
1. Remove the door trim.
2. Remove the door screen.
3. After loosening the mounting screws, then remove the delta cover (A).



4. After loosening the mounting bolt and nut, then remove the rear channel (A).



5. After loosening the mounting screws, then remove the door belt weatherstrip (A).

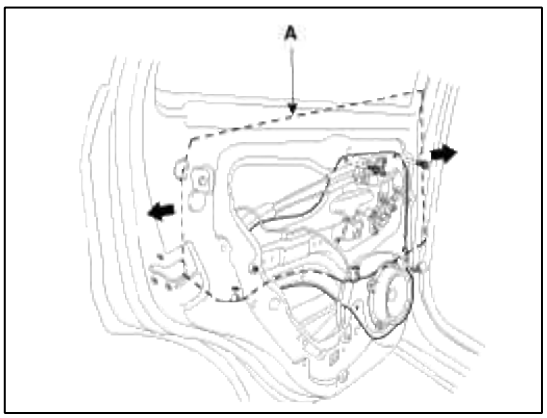


6. Carefully move the glass (A) until you can see the bolts, then loosen them. Separate the glass from the glass run and carefully pull the glass out through the window slot.

CAUTION

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

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



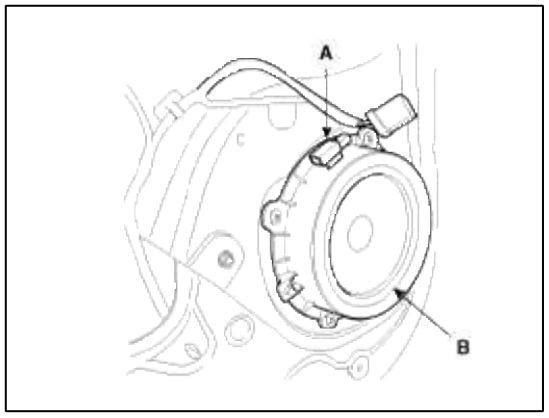
7. Installation is the reverse of removal.

NOTE

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

Speaker Replacement

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



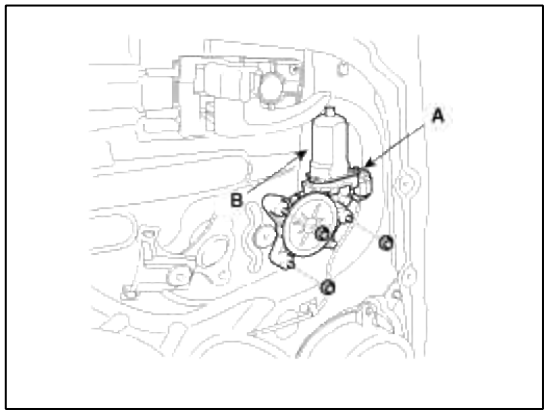
4. Installation is the reverse of removal.

NOTE

- Use sheet metal screws to secure the speaker.

Power Window Motor Replacement

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



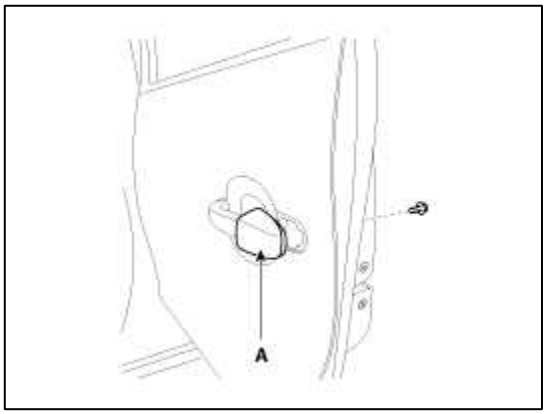
4. Installation is the reverse of removal.

NOTE

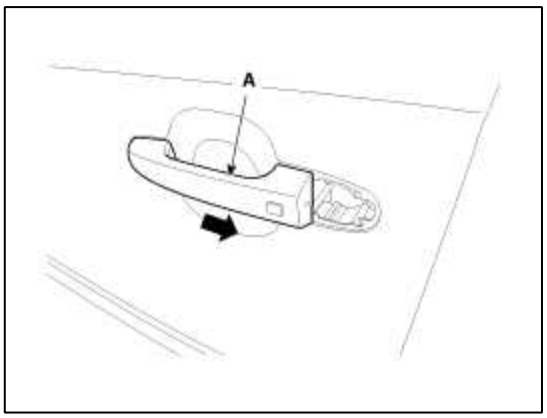
- The area of rotational parts and springs should be applied with sufficient grease.
- Roll the glass up down to see if it move freely without binding.

Out Side Handle Replacement

1. Remove the door trim.
2. Remove the door screen.
3. After loosening the mouting bolt, then remove the outside handle cover (A).



4. Remove the outside handle (A) by sliding it rearward.



5. Installation is the reverse of removal.

NOTE

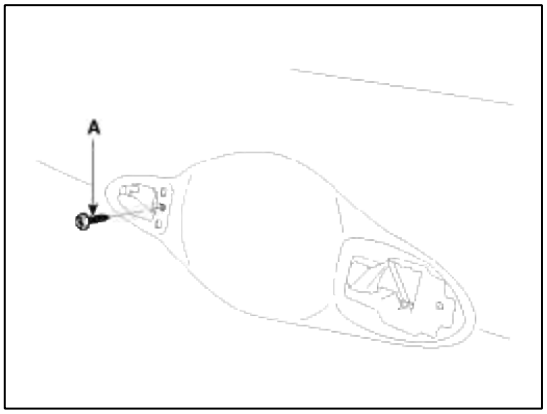
- Make sure door lock operates and door open/closes properly.

Module Assembly Replacement

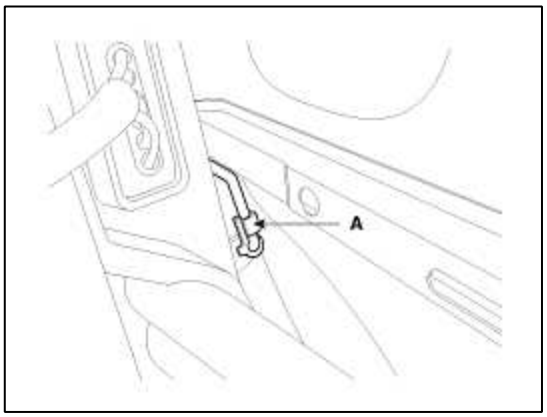
1. Remove the following parts.
   A. Door trim.
   B. Door screen.
   C. Window Glass.
   D. Outside handle

2. Loosen the mounting screw (A).

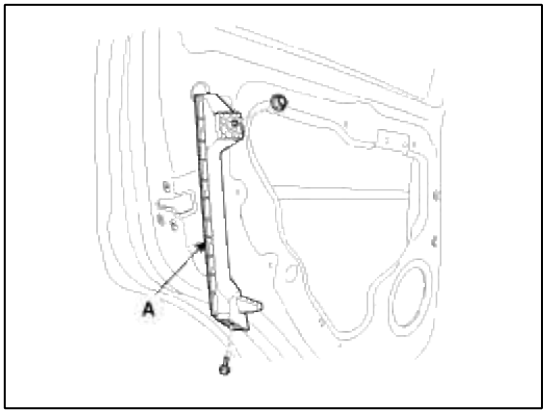
Tightening torque :
0.7~0.5N.m (0.07~0.1kgf.m, 1.0~0.7 lb-ft)



3. Disconnect the rod (A).



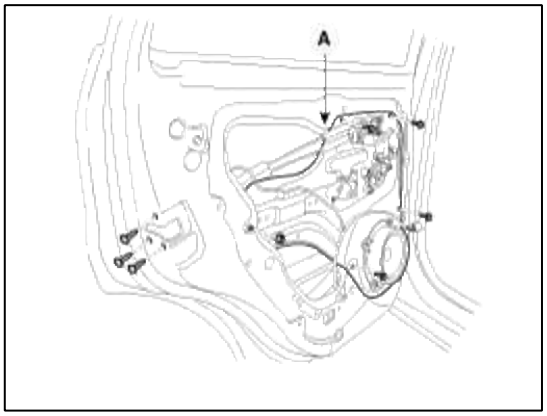
4. After loosening the mouting bolt and nut, then remove the rear channel (A).



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

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

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



7. Installation is the reverse of removal.

NOTE

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

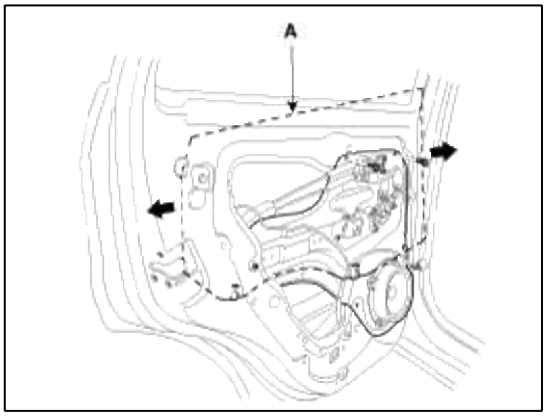
Adjustment

Glass Adjustment

NOTE

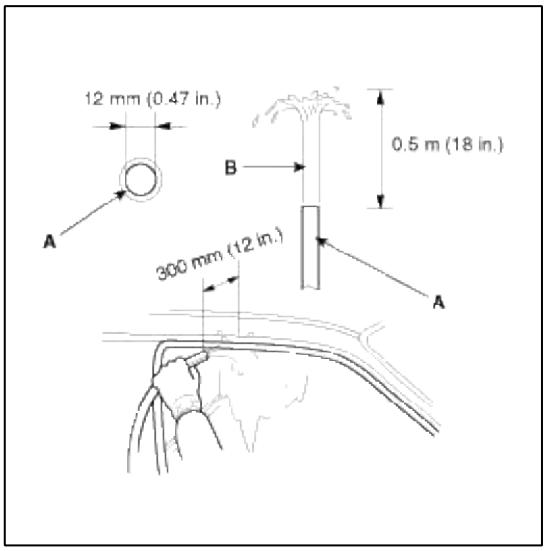
- Check the glass run channel for damage or deterioration, and replace them necessary.

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



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

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

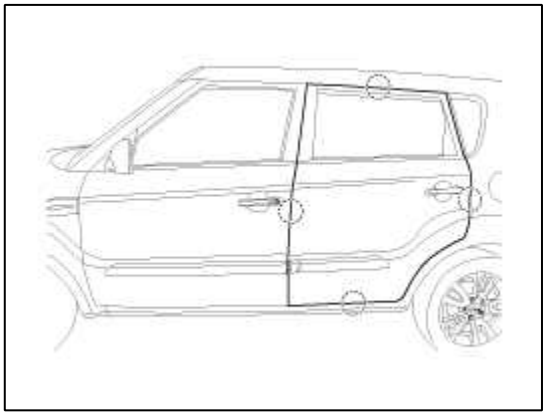


Door Position Adjustment

NOTE

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

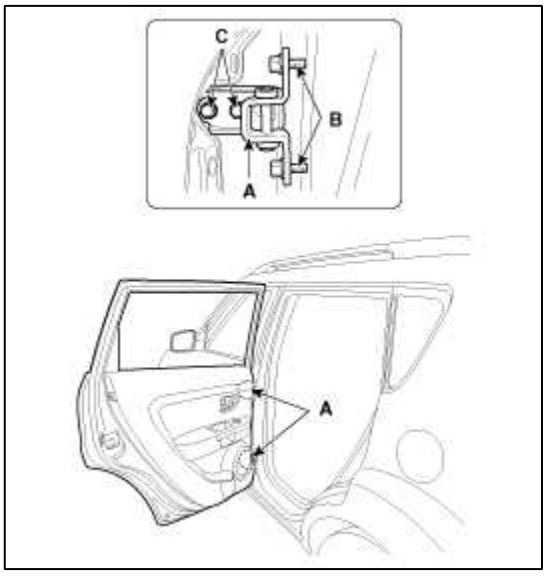
1. Check that the door and body edges are parallel.



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

3. Adjust at the hinges (A) :
   A. Loosen the door mounting bolts slightly, and move the door in or out until it aligns flush with the body.
   B. Loosen the hinge mounting bolts slightly, and move the door backward or forward, up or down as necessary to equalize the gaps.
   C. Place a shop towel on the jack to prevent damage to the door when adjusting the door.

Tightening torque :
(B) : 21.6~26.5N.m (2.2~2.7kgf.m, 15.9~19.5 lb-ft)
(C) : 34.3~41.2N.m (3.5~4.2kgf.m, 25.3~30.4 lb-ft)

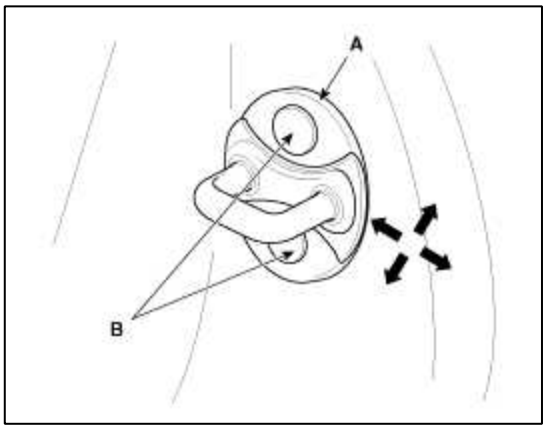


4. Grease the pivot portions of the hinges indicated.
5. Check for water leaks.

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

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

Tightening torque :
(B) 16.7~21.6N.m (1.7~2.2kgf.m, 12.3~15.9 lb-ft)



2. Tap on the striker with a plastic hammer to adjust the striker. The striker will not move much, but will give some adjustment.

3. Hold the outer handle out, and push the door against the body to be sure the striker allows a flush fit. If the door latches properly, tighten the screws and recheck.

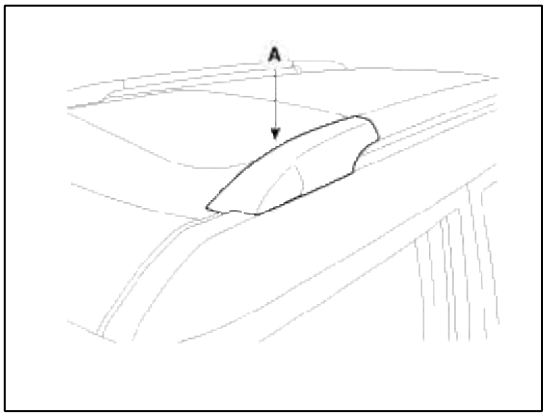
Body (Interior and Exterior) > Exterior > Body Side Moldings > Repair procedures

Replacement

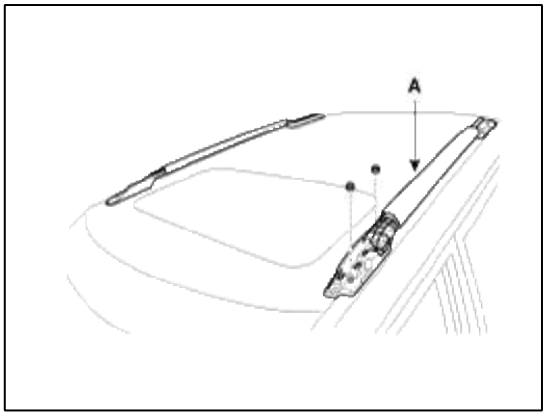
Roof Rack Replacement

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

1. Remove the roof rack cover (A).



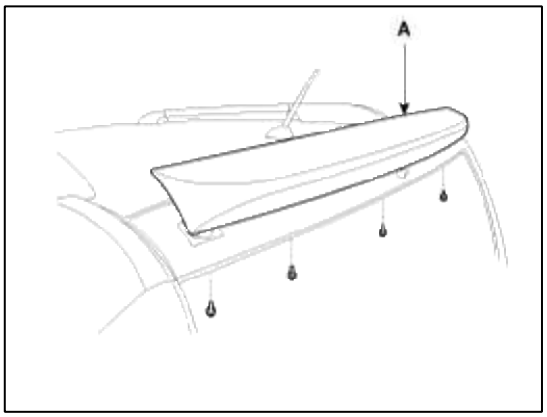
2. After loosening the mounting nuts, then remove the roof rack (A).



3. Installation is the reverse of removal.

Spolier Replacement

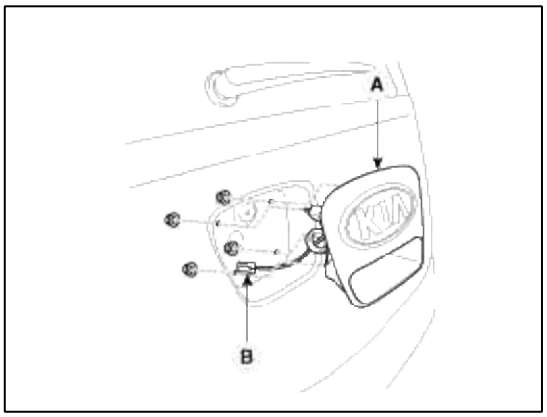
1. After loosening the mounting nuts, then remove the spolier (A).



2. Installation is the reverse of removal.

Tailgate Handle Replacement

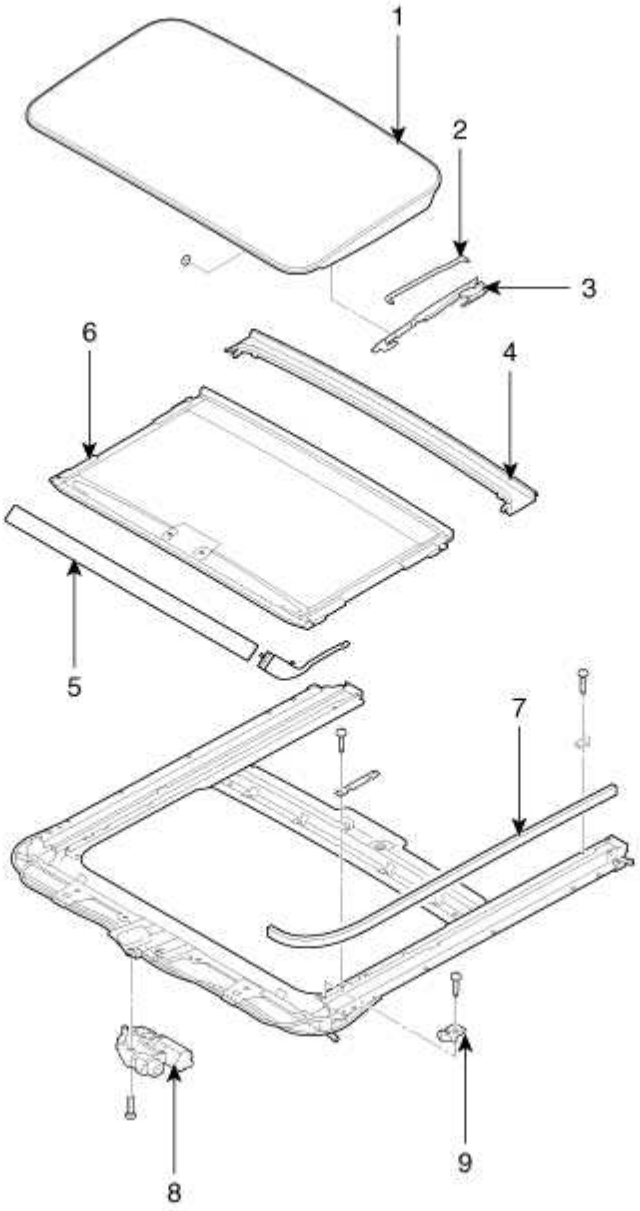
1. Remove the tailgate trim.
   (Refer to the BD group - "Tail Gate")
2. After loosening the mounting nuts, then remove the tailgate handle (A).
3. Disconnect the connector (B).



4. Installation is the reverse of removal.

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

Components



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

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

Replacements

Glass Replacement

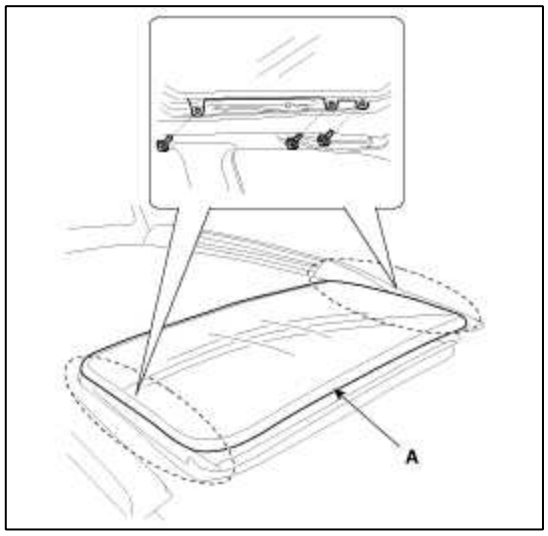
NOTE

- Put on glove to protect your hands.

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

NOTE

• Do not damage the roof panel.



2. Installation is the reverse of removal.

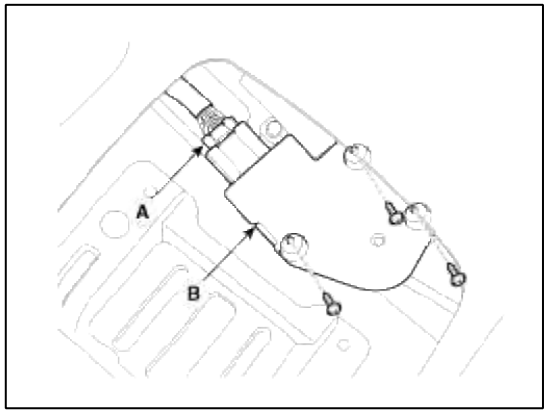
Motor Replacement

1. Remove the over head console.
(Refer to the BD group - "Roof Trim")

NOTE

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

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



3. Installation is the reverse of removal.

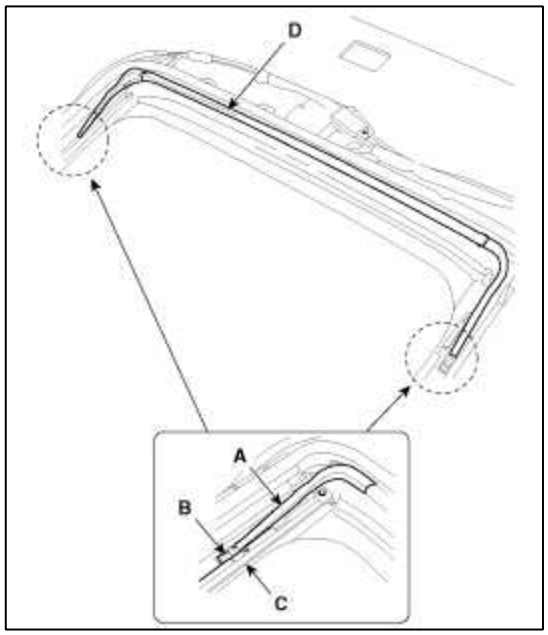
NOTE

• Make sure to initialize the motor.

Deflector Replacement

1. Open the glass fully.

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

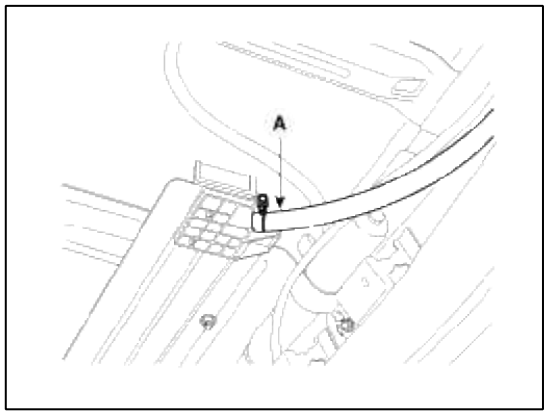


3. Installation is the reverse of removal.

Sunroof Assembly Replacement

1. Remove the follwing parts :
   A. Interior Trim
      (Refer to the BD group - "Interior Trim")
   B. Roof Trim
      (Refer to the BD group - "Roof Trim")
   C. Sunroof glass

2. Disconnect the drain tubes (A).

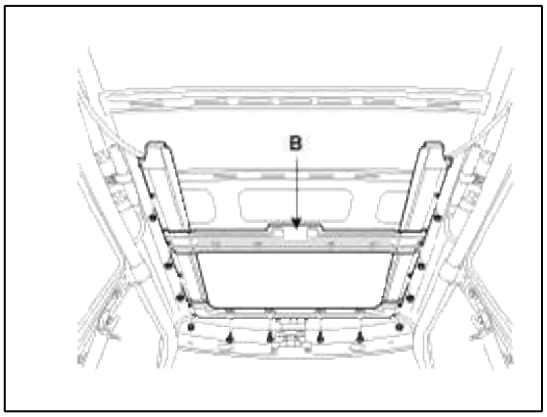


3. After loosening the mounding bolts and nuts, remove the sunroof assembly (B).

NOTE

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

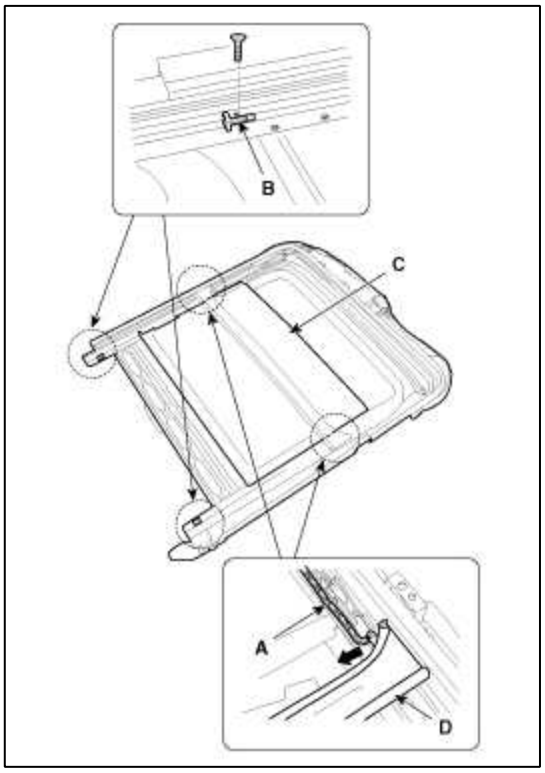
Tightening torque :
Bolts : 7.8~11.8N.m (0.8~1.2kgf.m, 5.8~8.7 lb-ft)
Nuts : 3.9~5.9N.m (0.4~0.6kgf.m, 2.9~4.3 lb-ft)



4. Installation is the reverse of removal.

Sunshade And Drip Rail Replacement

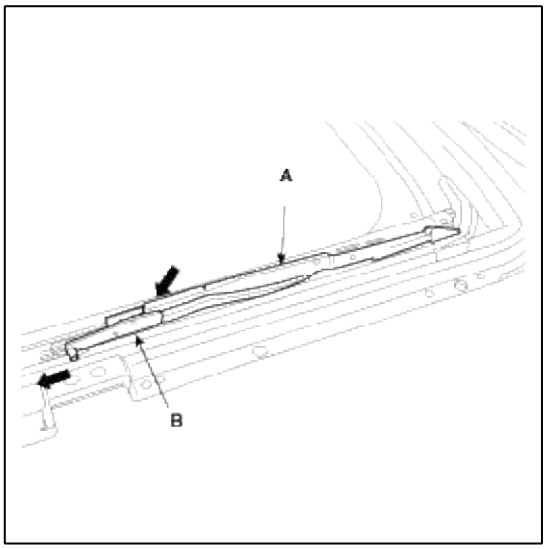
1. Remove the sunroof assembly.
2. Remove the drip link (A) and sunshade stopper (B).
3. Remove the sunshade (C) and drip rail (D).



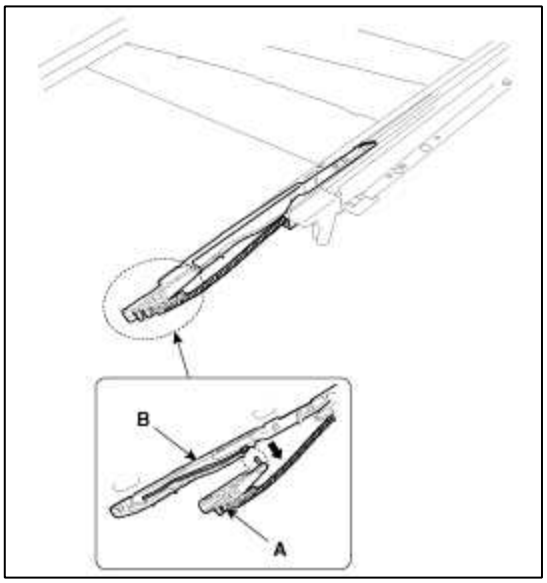
4. Installation is the reverse of removal.

Guide Assembly Replacement

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



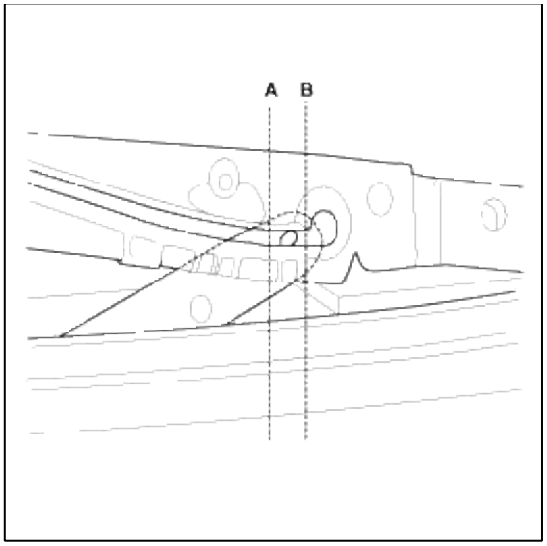
3. Remove the guide (A) and slide (B).



4. Installation is the reverse of removal.

NOTE

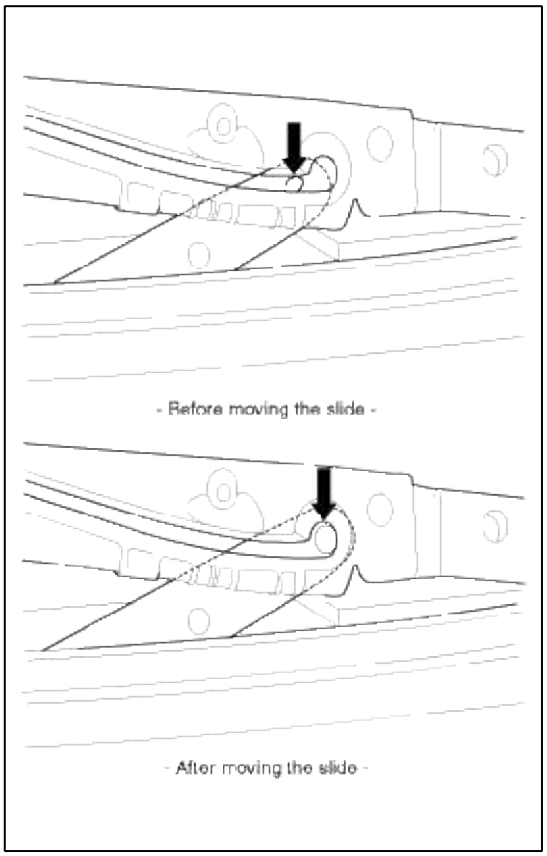
- Make sure to align the slide with the center of“A” and “B”
- Make sure to initialize the motor.



Adjustment

How To Initialize

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



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

When To Initialize The Motor

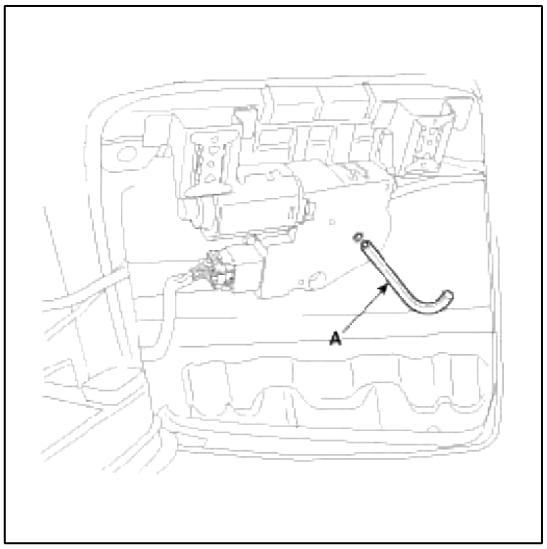
1. First operation the vehicle after manufacture it.
2. Initial value is erased or damaged because of short power electric discharge during operation
3. After using the manual handle.

Operating The Sunroof Emergency Handle

1. Use the sunroof emergency handle to close or open the sunroof manually if the sunroof cannot be closed electronically due to motor or controller electrical malfunction.
   A. To close the sunroof before driving a vehicle in a rainy day or on the highway if the sunroof cannot be closed due to failure of the sunroof motor or controller.
2. Operating method
   A. Remove the overhead console
   B. Push the emergency handle up into the hexagonal drive (A) of the sunroof motor. You must push hard enough to disengage the motor clutch; otherwise the emergency handle will slip due to incomplete fit in the motor.
   C. Carefully turn the emergency handle clockwise to close the sunroof.
   D. After closing the sunroof, wiggle the handle back and forth as you remove the tool from the motor, to ensure the motor clutch reengages.
   E. A 5mm hex socket may be used in place of the emergency handle, with a" Speeder" type handle.

CAUTION

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



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

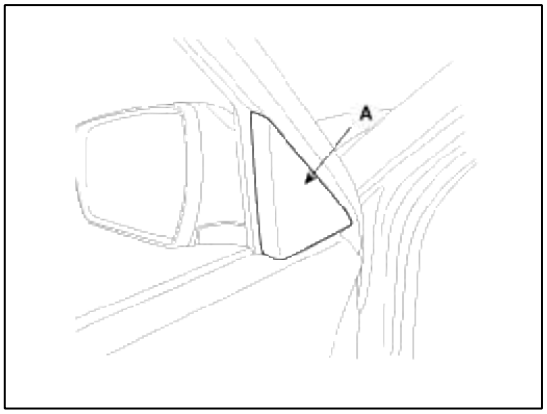
Replacement

Outside Rear View Mirror Relplacement

NOTE

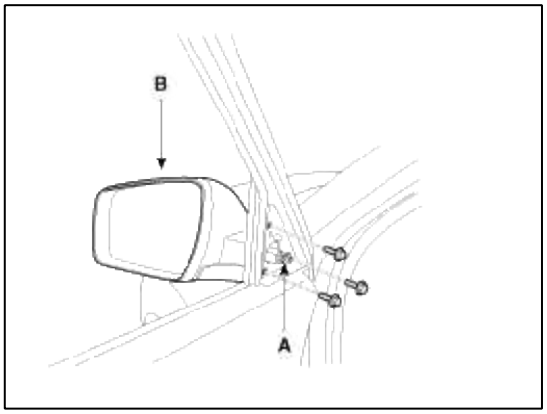
- When prying with a flat-up screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.

1. Remove the quadrant inner cover (A).



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

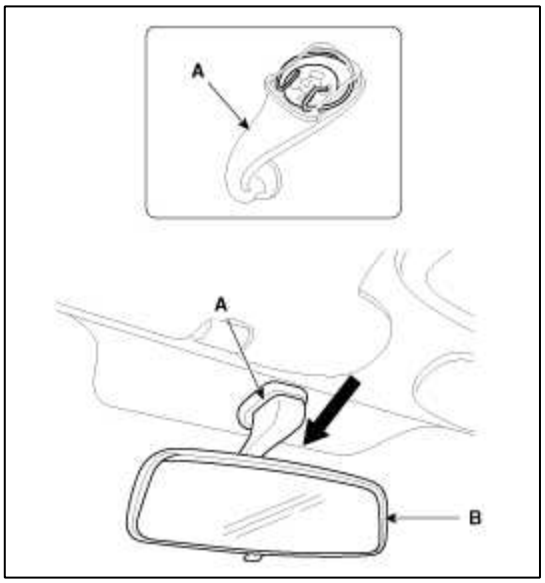
Tightening torque :
6.9~10.8N.m (0.7~1.1kgf.m, 5.1~8.0 lb-ft)



3. Installation is the reverse of removal.

Inside Rear View Mirror Replacement

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



2. Installation is the reverse of removal.

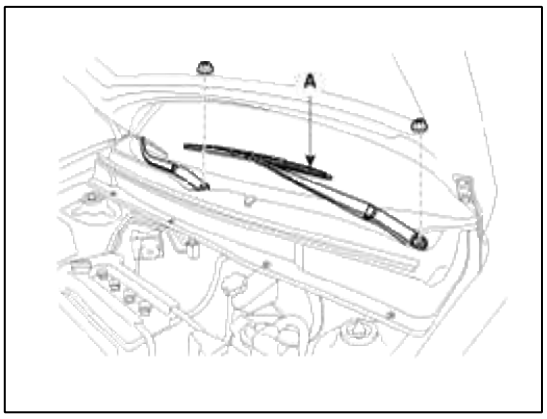
Body (Interior and Exterior) > Exterior > Cowl Top Cover > Repair procedures

Replacement

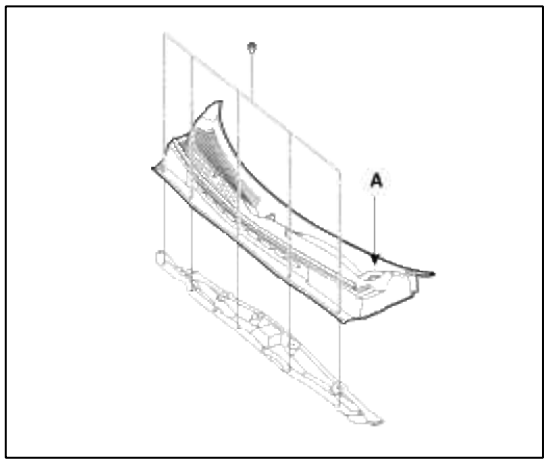
Cowl Top Cover Replacement

1. Remove the caps and remove the nuts, then remove the wiper arm (A).

Tightening torque :
22.6~26.5N.m (2.3~2.7kgf.m, 16.6~19.5 lb-ft)



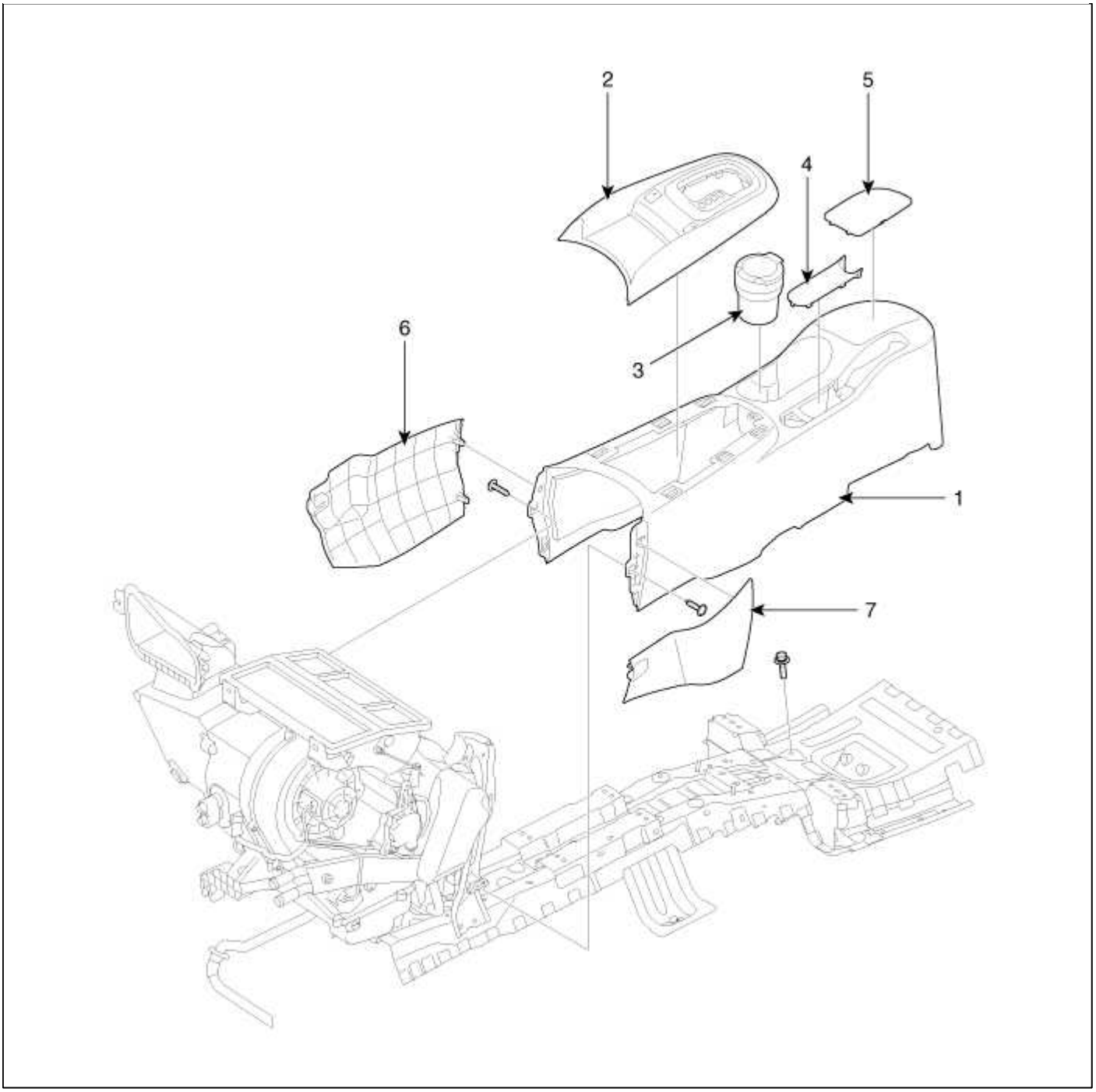
2. Detach the clips, then remove the cowl top cover (A).



3. Installation is the reverse of removal.

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

Components



1. Floor console assembly	5. Hole cap
2. Console upper cover	6. Console side cover [RH]
3. Ash tray	7. Console side cover [LH]
4. Parking brake cover	

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

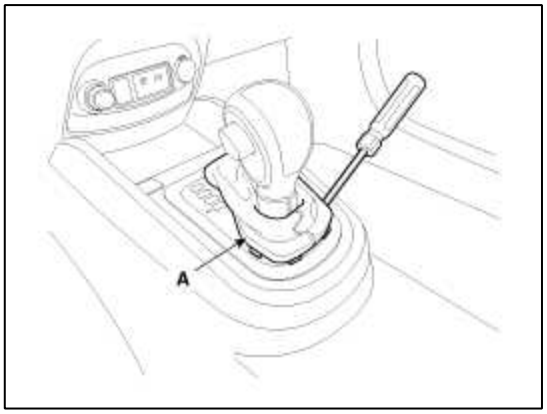
Replacement

Floor Console Replacement

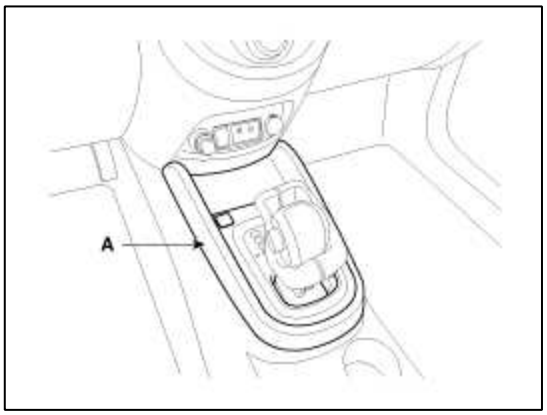
NOTE

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

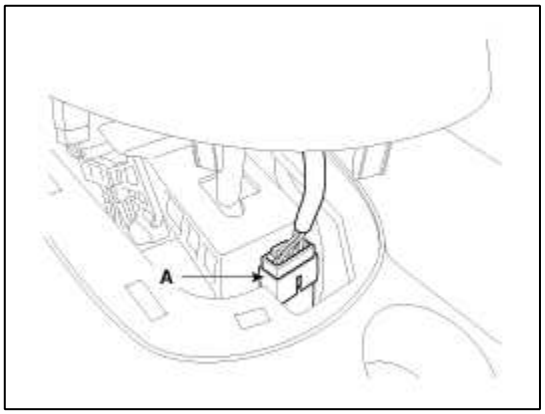
1. Using a screwdriver or remover, disconnect the gear boots (A).

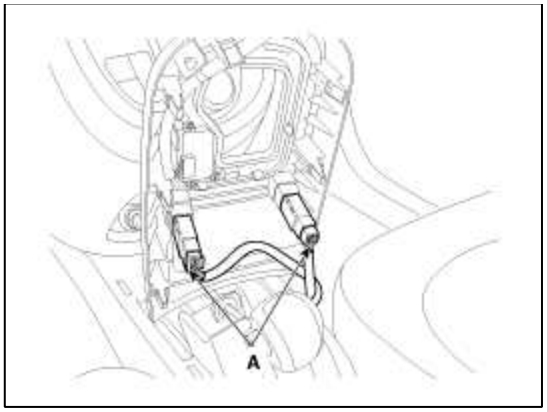


2. Using a screwdriver or remover, remove the console upper cover (A).

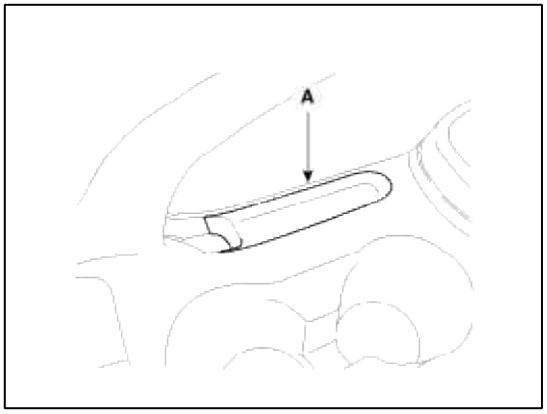


3. Disconnect the connectors (A).

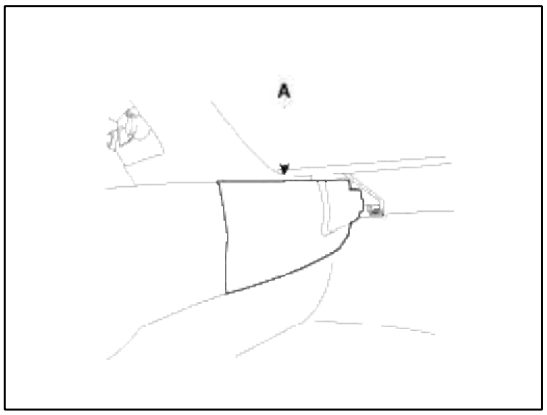




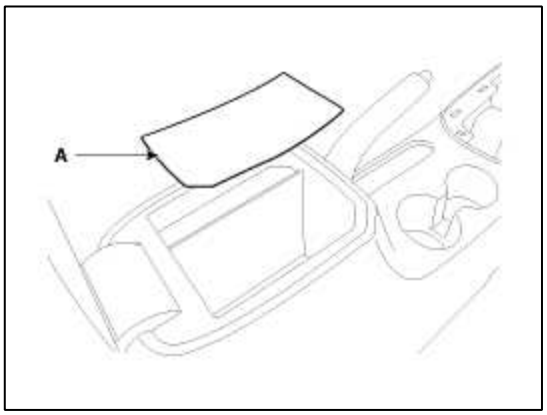
4. Remove the parking brake cover (A).



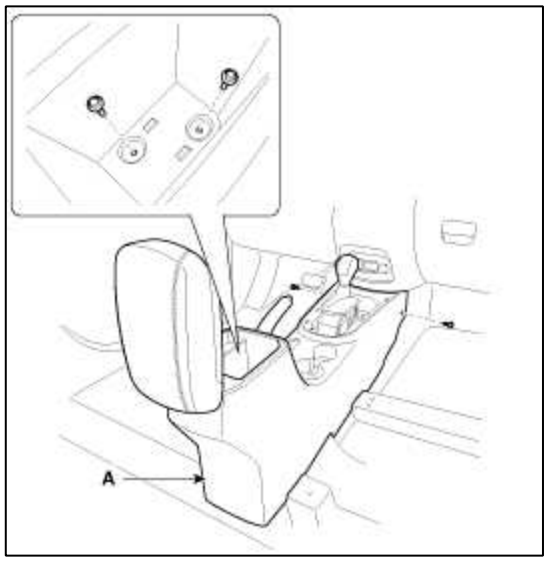
5. Remove the console side cover (A).



6. Remove the console tray mat (A).



7. After loosening the console mounting screws and bolts, remove the floor console assembly (A).



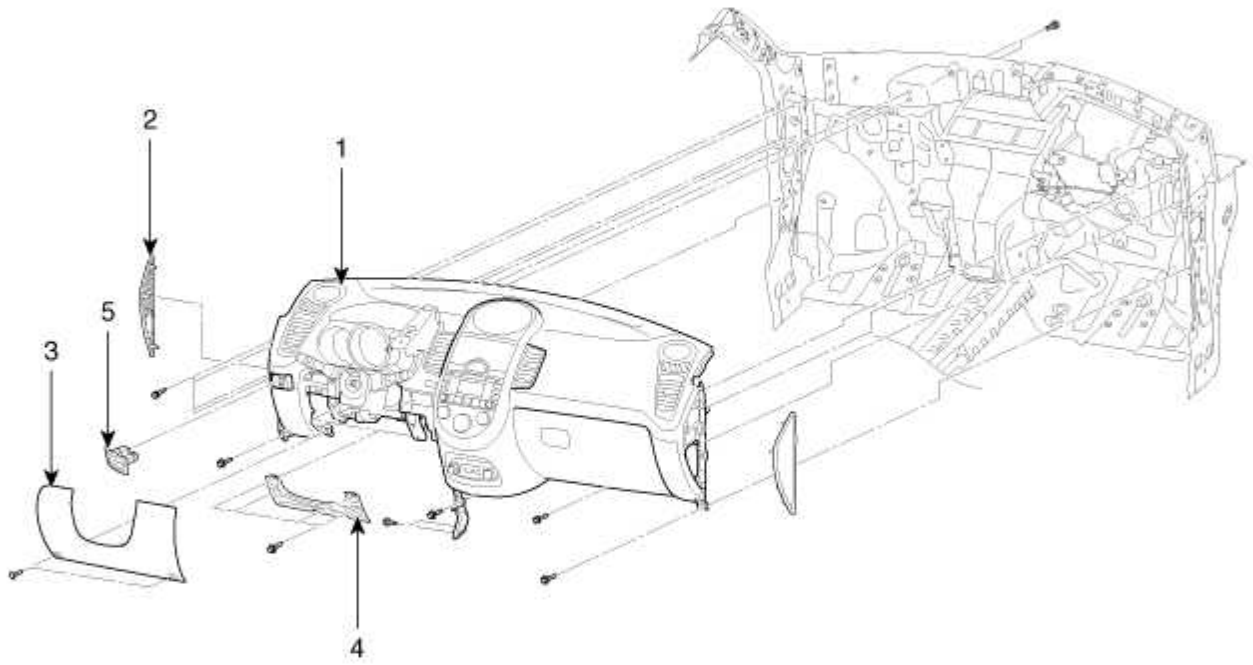
8. Installation is the reverse of removal.

NOTE

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

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

Components



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

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

Replacement

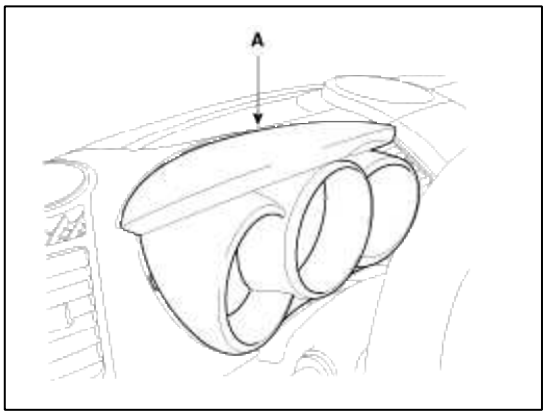
Cluster Fascia Replacement

NOTE

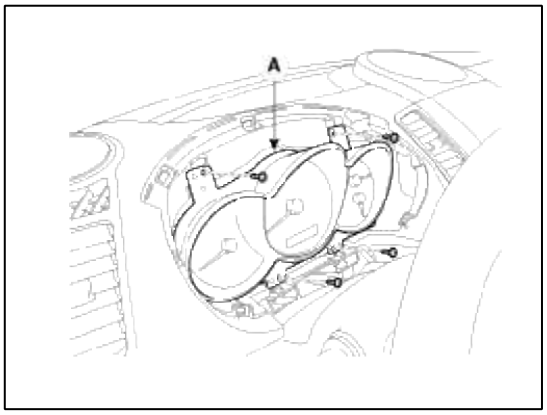
- When prying with a flat-up screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.

1. Tilt the steering column down.

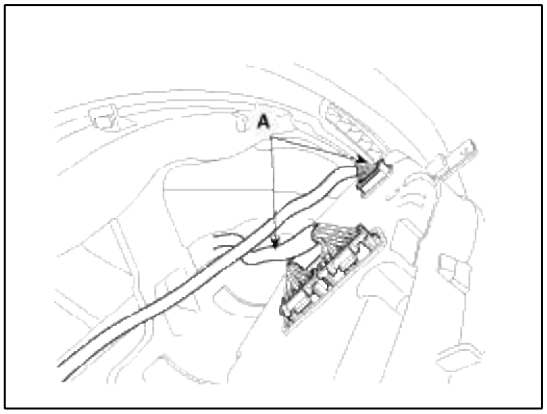
2. Remove the cluster fascia panel (A).



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



4. Disconnect the connector (A).



5. Installation is the reverse of removal.

NOTE

- Make sure the connector is plugged in properly.

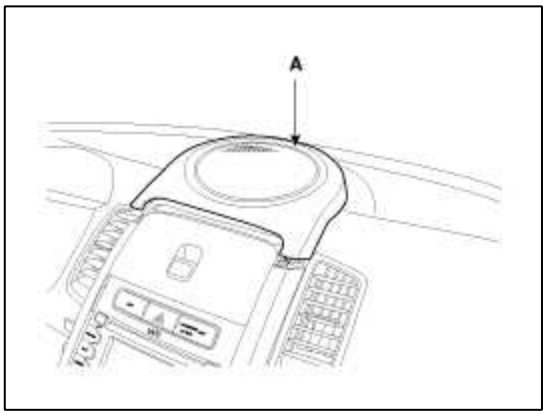
Center Fascia Panel Replacement

[Manual Type]

CAUTION

- A plastic trim tool is recommended, but if prying with a screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.

1. Using a screwdriver or remover, remove the center speaker grill (A).

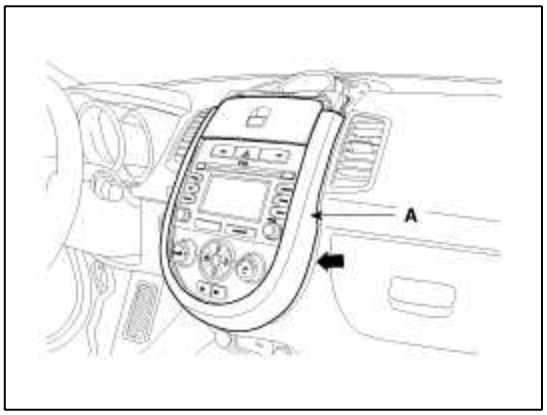


2. Put the SST (09840-1E100) into the space between the center fascia panel (A) and crash pad.

NOTE

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

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



4. Installation is the reverse of removal.

NOTE

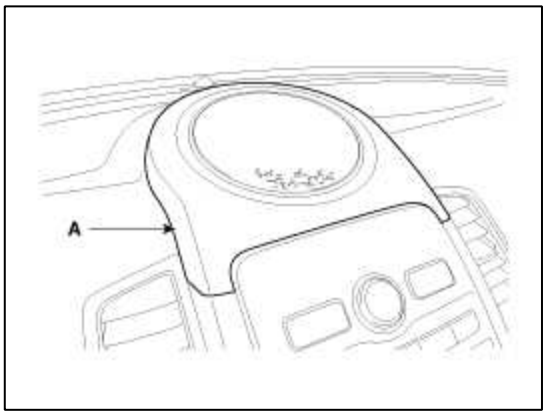
- Replace any damaged clips.

[Navigation Type]

CAUTION

- A plastic trim tool is recommended, but if prying with a screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.

1. Using a screwdriver or remover, remove the center speaker grill (A).

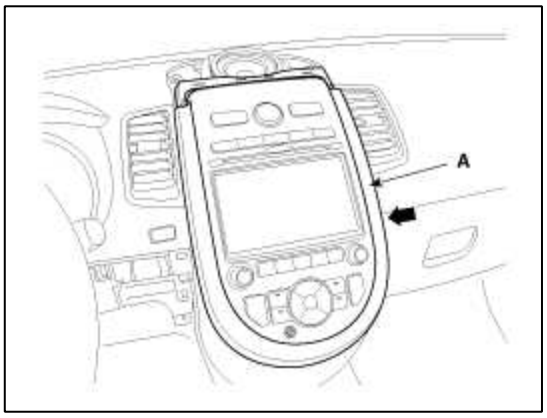


2. Put the SST (09840-1E100) into the space between the center fascia panel (A) and crash pad.

NOTE

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

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



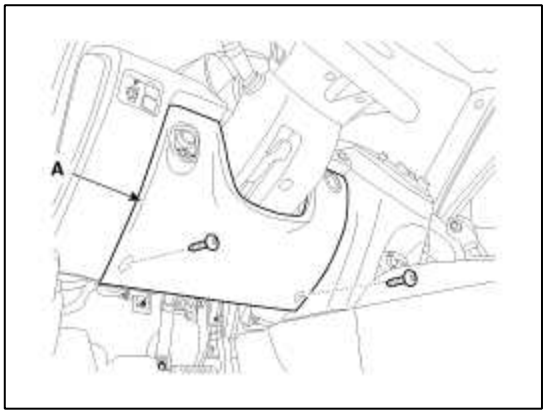
4. Installation is the reverse of removal.

NOTE

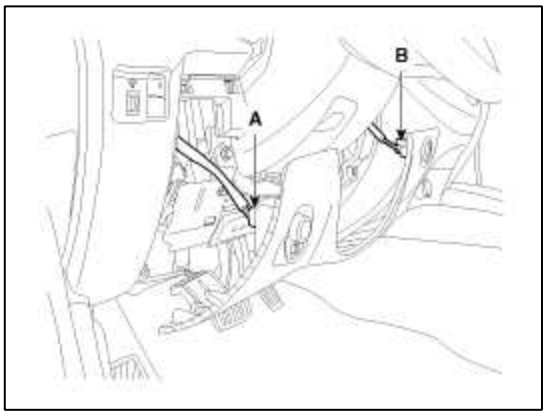
- Replace any damaged clips.

Lower Panel Replacement

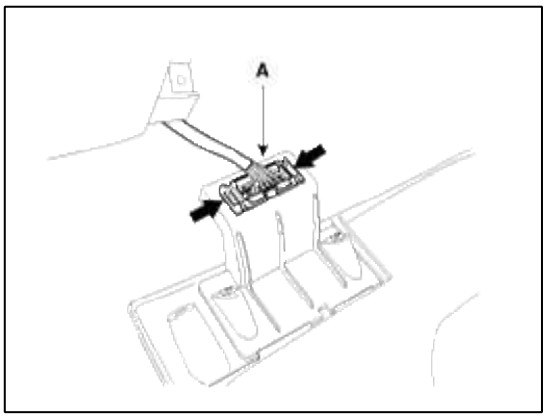
1. After loosening the crash pad lower panel mounting screws, remove the lower panel (A).



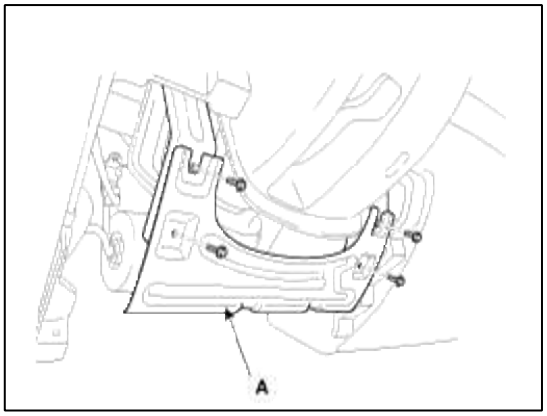
2. Disconnect the speaker lamp switch connector (A) and start/stop button connector (B).



3. Disconnect the connector (A).



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



5. Installation is the reverse of removal.

NOTE

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

Audio Assembly Replacement

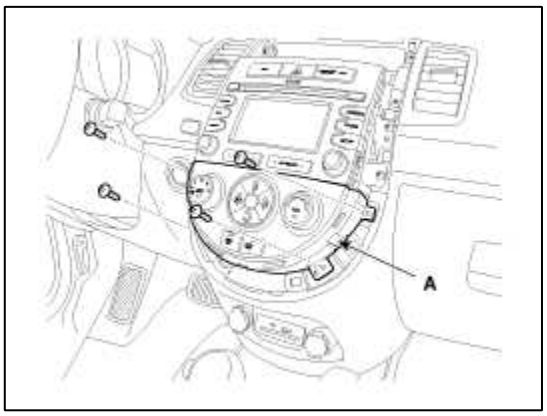
[Manual Type]

CAUTION

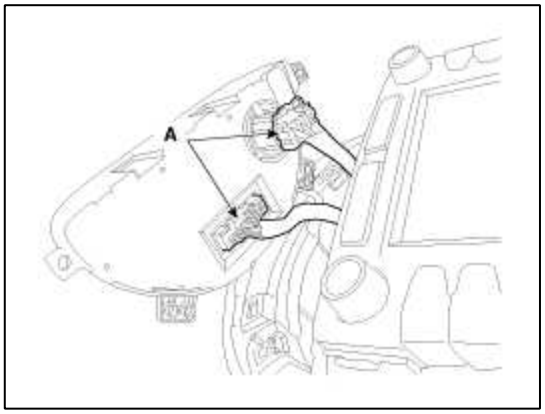
- A plastic trim tool is recommended, but if prying with a screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.

1. Remove the following items :
   A. Center speaker grill
   B. Center fascia panel

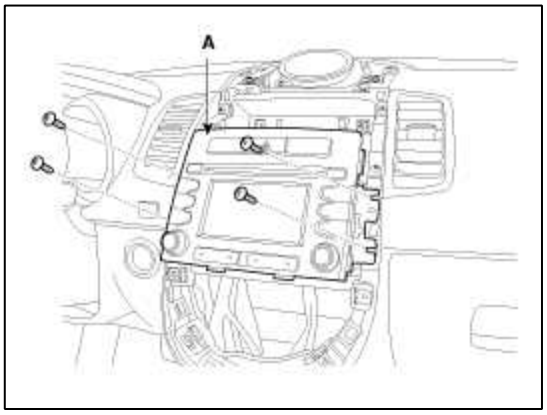
2. After loosening the mounting screws, then remove the heater control unit (A).



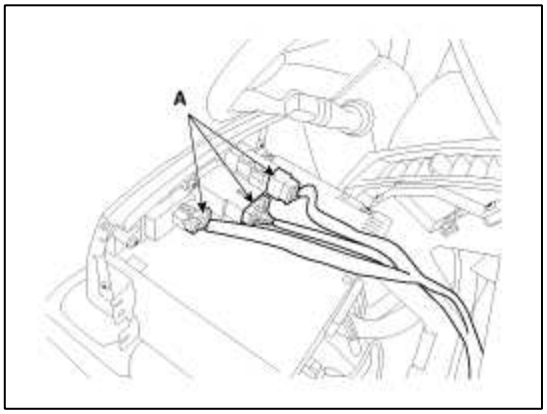
3. Disconnect the connectors (A).



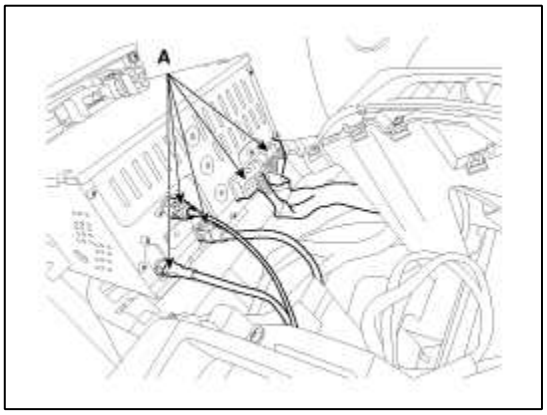
4. After loosening the mounting screws, then remove the audio assembly (A).



5. Disconnect the connectors (A).
[Upper]



[Lower]



6. Installation is the reverse of removal.

NOTE

- Make sure the connectors are connected in properly.
- Replace any damaged clips.

[Navigation Type]

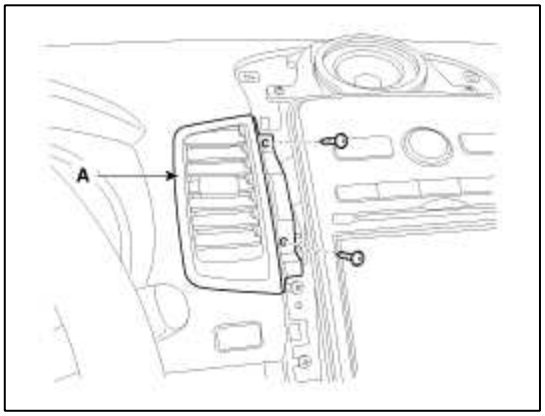
CAUTION

- A plastic trim tool is recommended, but if prying with a screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.

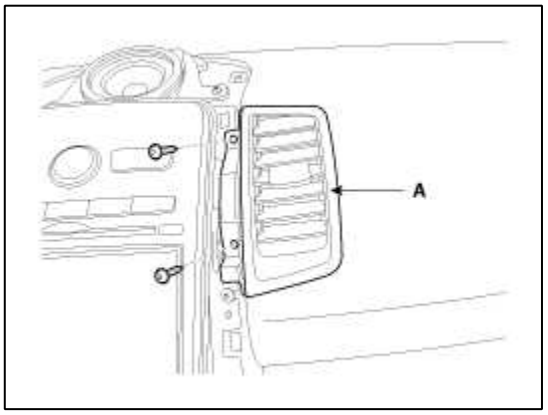
1. Remove the following items:
   A. Center speaker grill
   B. Center fascia panel

2. After loosening the mounting screws, then remove the center air vent (A).

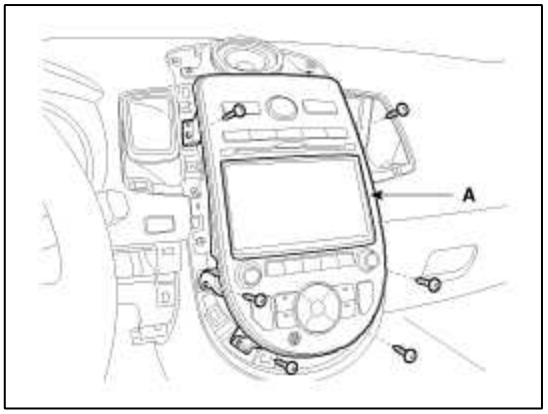
[LH]



[RH]

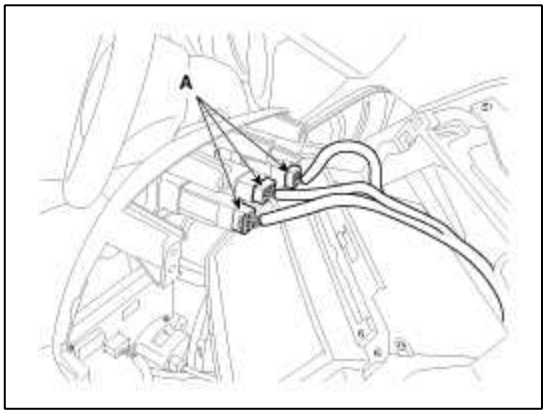


3. After loosening the mounting screws, then remove the heater control unit panel (A).

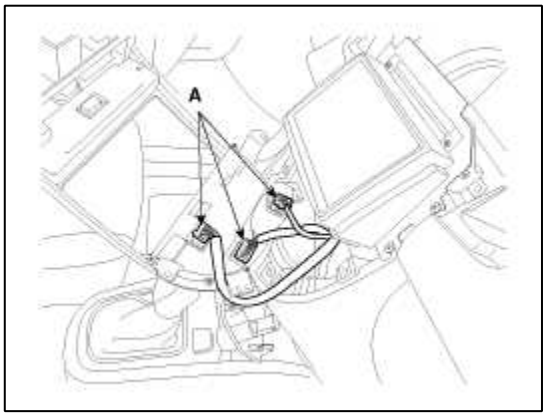


4. Disconnect the connectors (A).

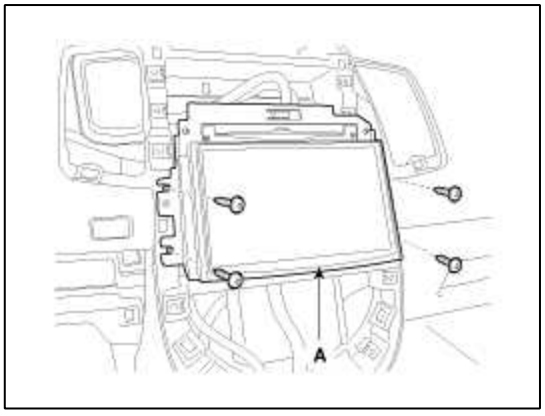
[Upper]



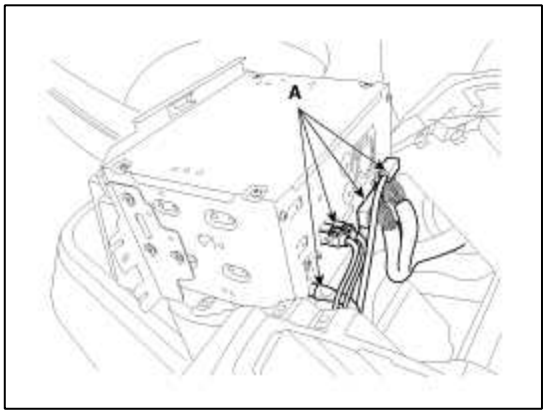
[Lower]



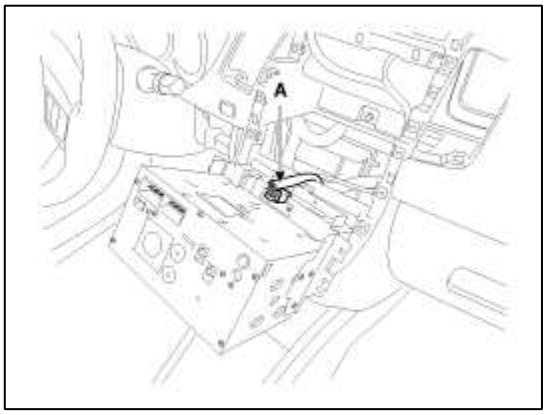
5. After loosening the mounting screws, then remove the navigation assembly (A).



6. Disconnect the connectors (A).
[Upper]



[Lower]



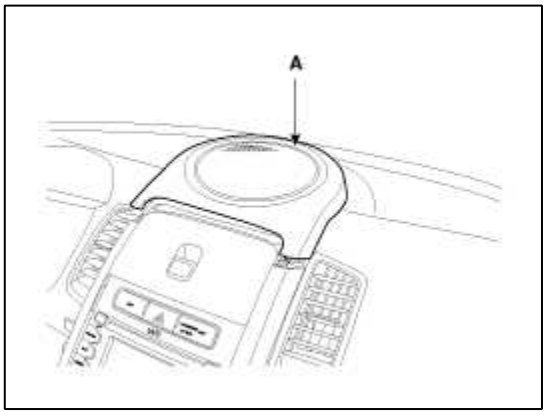
7. Installation is the reverse of removal.

NOTE

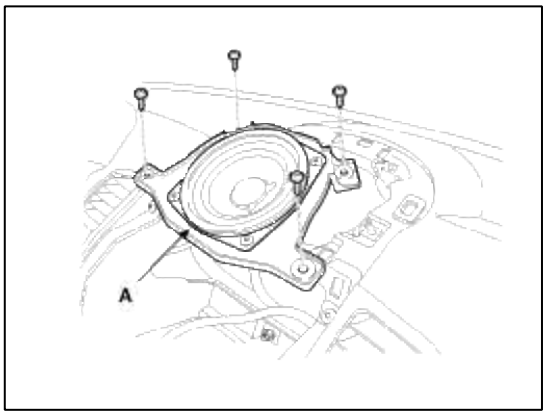
- Make sure the connectors are connected in properly.
- Replace any damaged clips.

Center Speaker Replacement

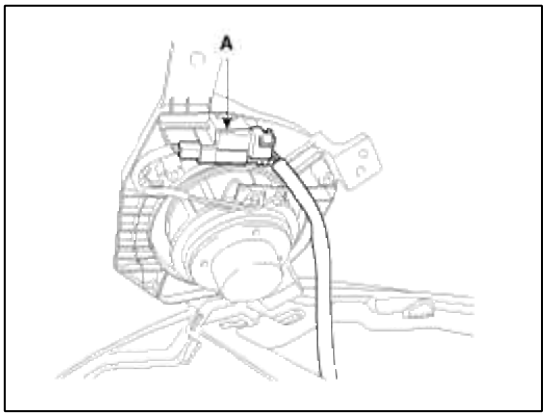
1. Using a screwdriver or remover, remove the center speaker grill (A).



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



3. Disconnect the speaker connector (A).



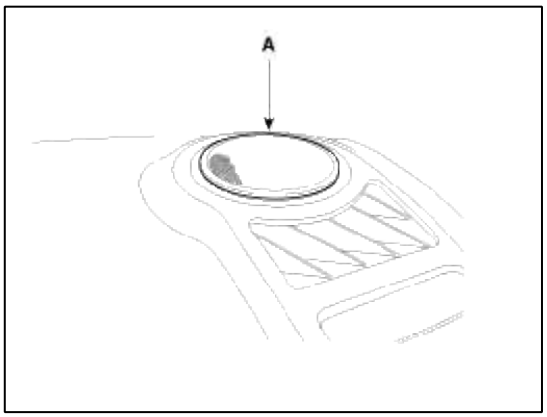
4. Installation is the reverse of removal.

NOTE

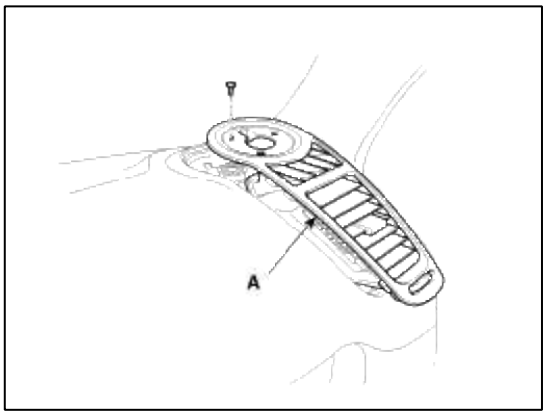
- Make sure the connector is plugged in properly.

Twitter Speaker Replacement

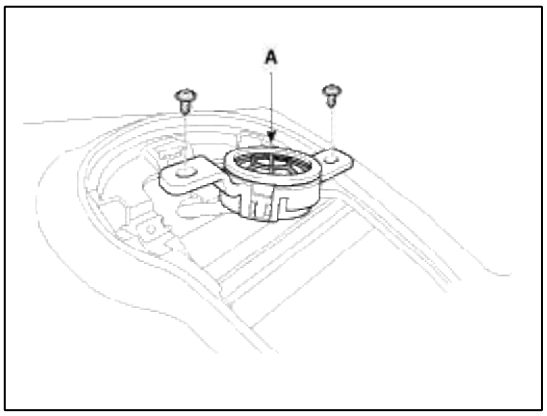
1. Remove the twitter speaker grill (A).



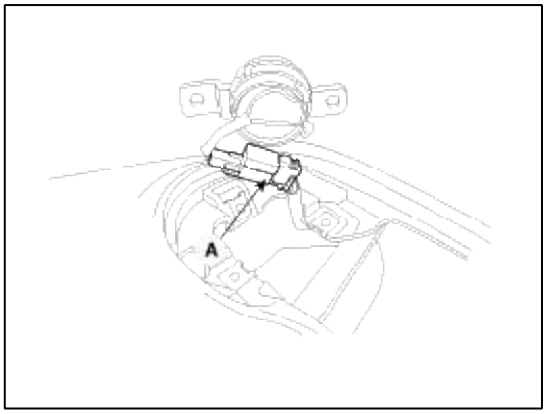
2. After loosening the mounting screws, then remove the side air vent (A).



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



4. Disconnect the twitter speaker connector (A).



5. Installation is the reverse of removal.

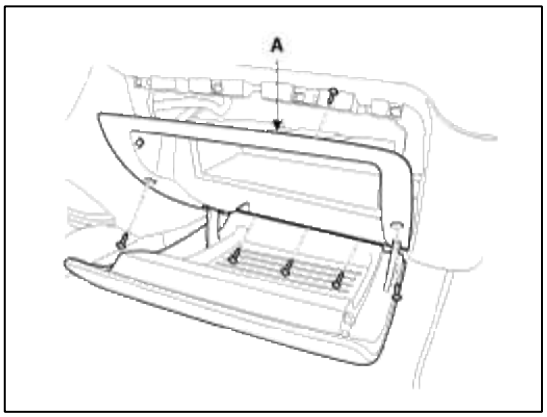
NOTE

- Make sure the connector is plugged in properly.

Glove Box Replacement

1. Open the glove box.

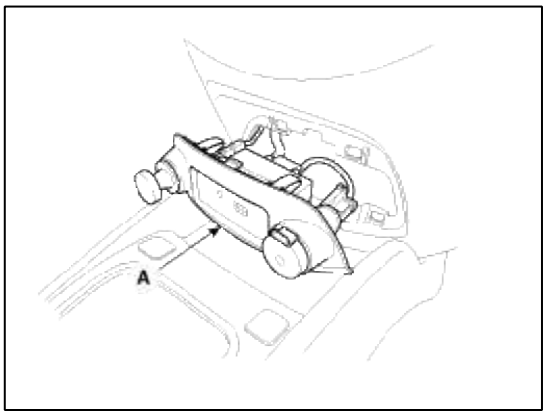
2. After loosening the mounting screws, remove the glove (A).



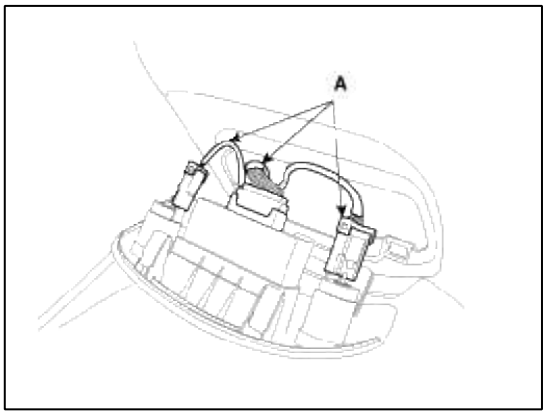
3. Installation is the reverse of removal.

Lower Tray Replacement

1. Remove the lower tray (A).



2. Disconnect the connector (A).



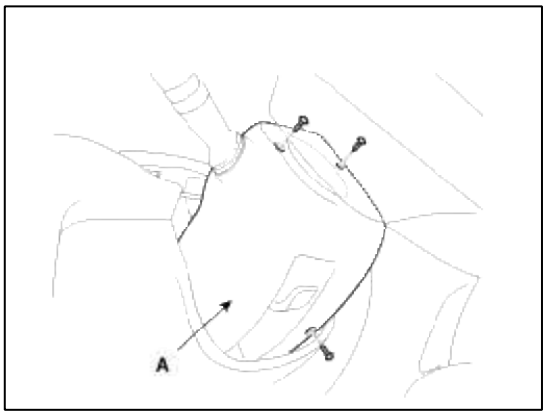
3. Installation is the reverse of removal.

NOTE

- Make sure the connector is plugged in properly.

Shroud Replacement

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



2. Installation is the reverse of removal.

Crash Pad Replacement

NOTE

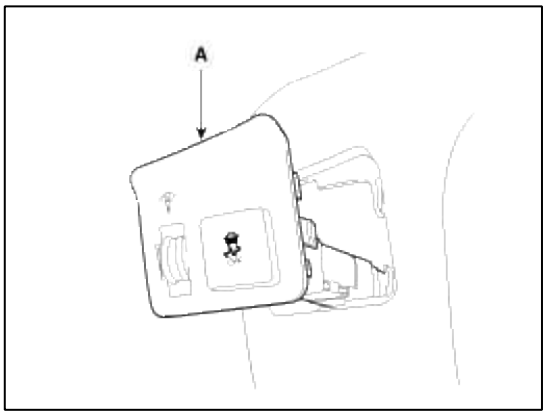
- When prying with a flat-up screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.

1. Remove the following items :
   A. Front seat
      (Refer to the BD group – “Front Seat”)
   B. Front pillar trim
      (Refer to the BD group – “Interior Trim”)
   C. Floor console assembly
      (Refer to the BD group – “Console”)
   D. Front door scuff trim
      (Refer to the BD group – “Interior Trim”)
   E. Cowl side trim
      (Refer to the BD group – “Interior Trim”)
   F. Crash pad side cover
   G. Crash pad lower panel
   H. Cluster fascia panel & Cluster assembly
   I. Center fascia panel
   J. Heater control unit
   K. Audio assembly
   L. Glove box

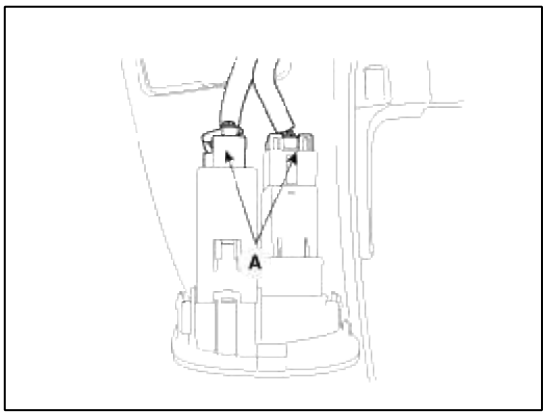
2. Disconnect the steering column connectors.
   (Refer to the ST group - "Steering Column and Shaft")

3. Down the steering column after loosening the mounting bolts.
   (Refer to the ST group - "Steering Column and Shaft")

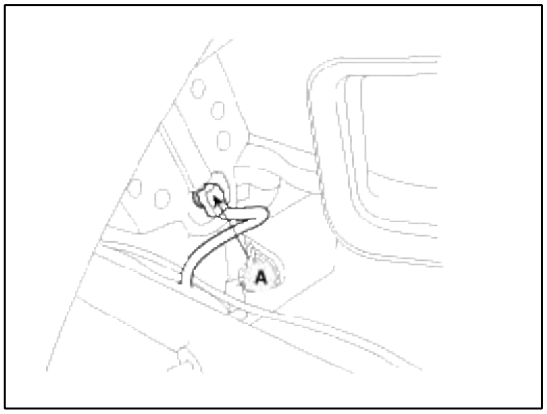
4. Remove the switch assembly (A).



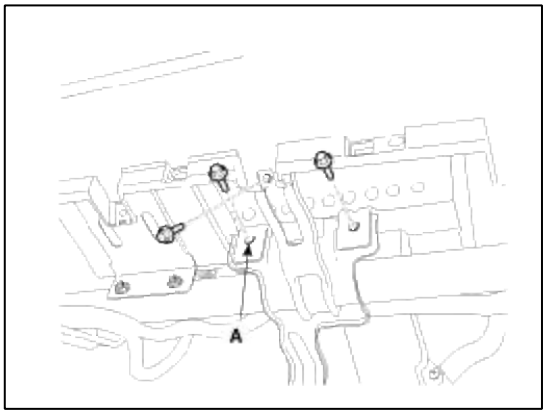
5. Disconnect the connector (A).



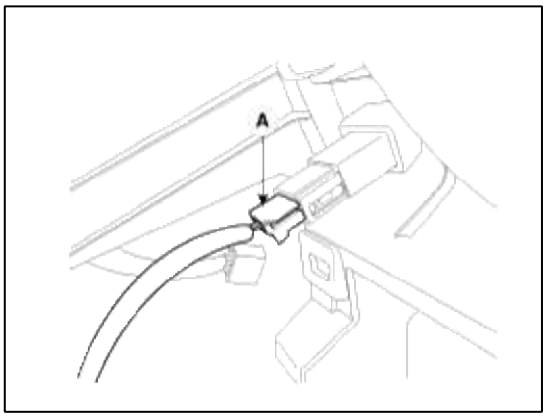
6. Disconnect the passenger`s air bag connector (A).



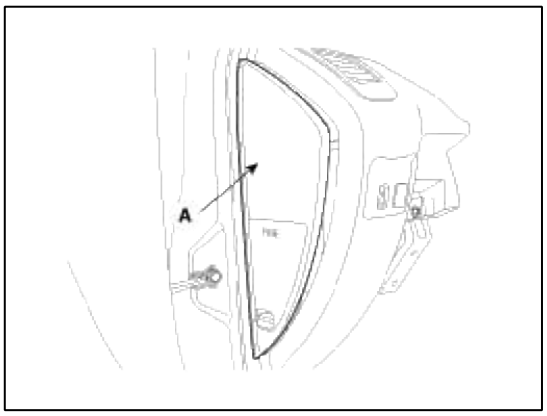
7. Remove the passenger’s air bag mounting bolt (A).



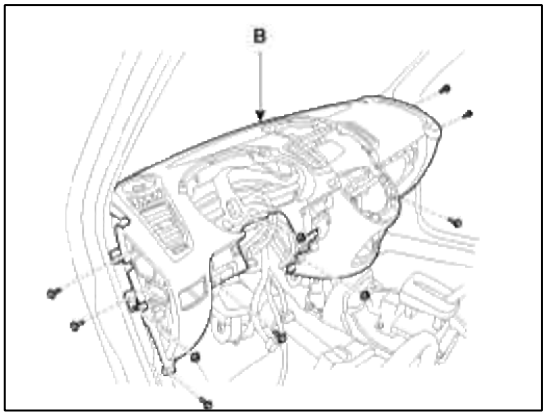
8. Disconnect the connector (A).



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



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



11. Installation is the reverse of removal.

NOTE

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

Cowl Cross Bar Replacement

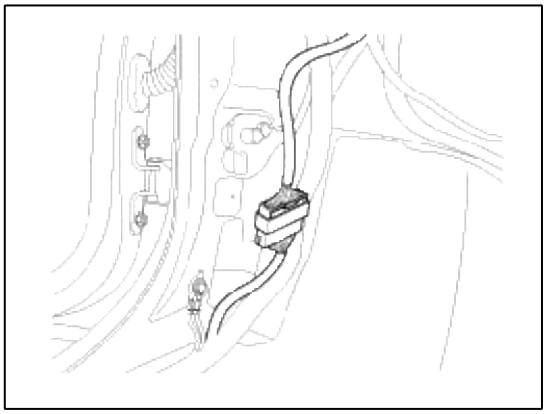
NOTE

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

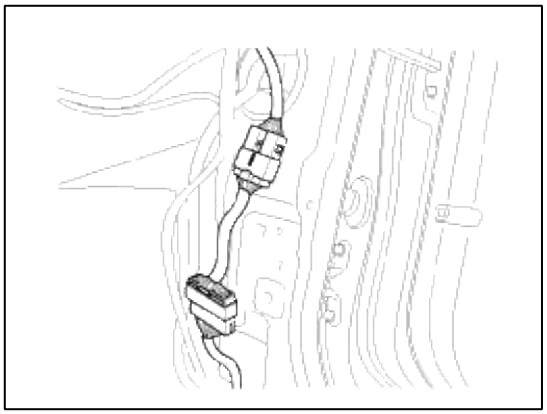
1. Remove the following items :
   A. Front seat
      (Refer to the BD group – “Front Seat”)
   B. Floor console assembly
      (Refer to the BD group – “Console”)
   C. Cowl top cover
      (Refer to the BD group - "Cowl Top Cover")
   D. Main crash pad

2. Disconnect the blower unit connectors.
   (Refer to the HA group - "Air conditioning system, Heater, Blower")

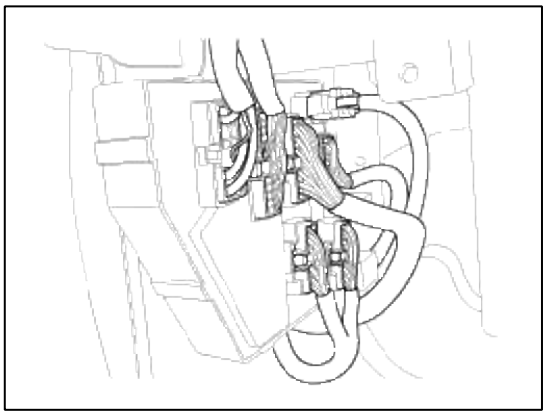
3. Disconnect the driver’s connectors.



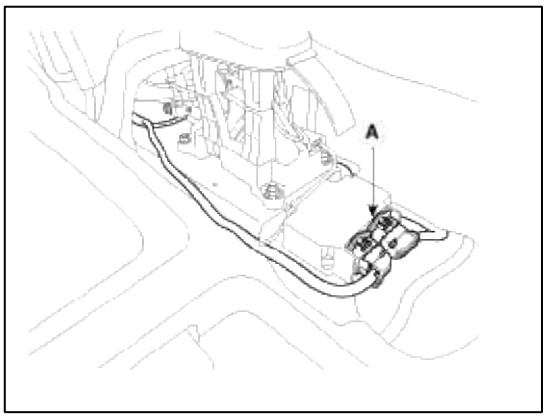
4. Disconnect the passenger’s connectors.



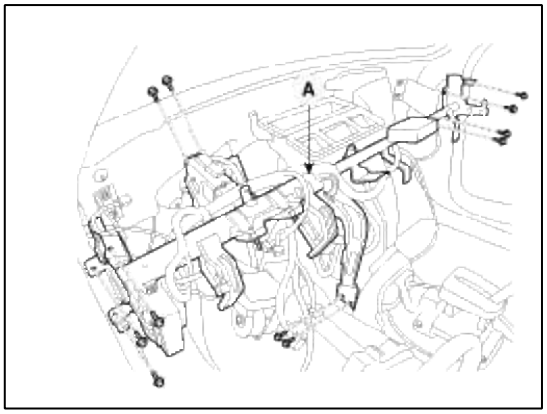
5. Disconnect the connectors.



6. Disconnect the air bag connector (A).



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



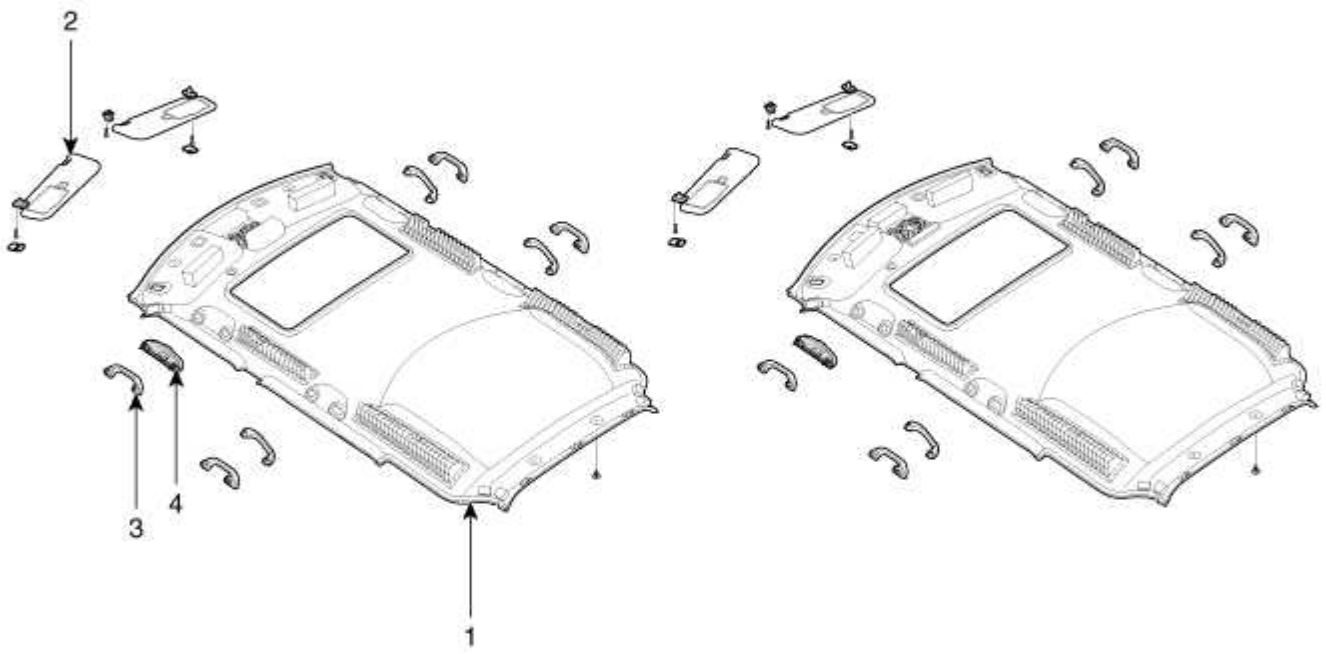
8. Installation is the reverse of removal.

NOTE

- Make sure the connector is plugged in properly.

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

Components



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

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

Replacement

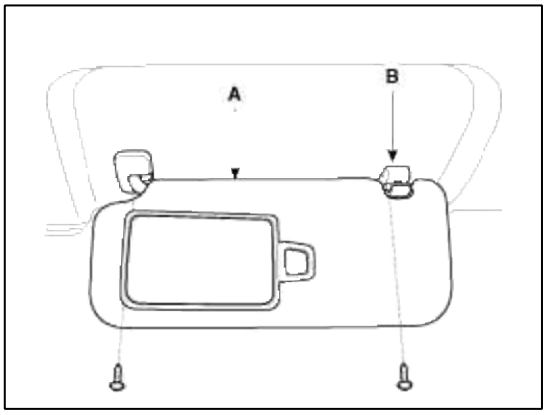
Sunvisor Replacement

NOTE

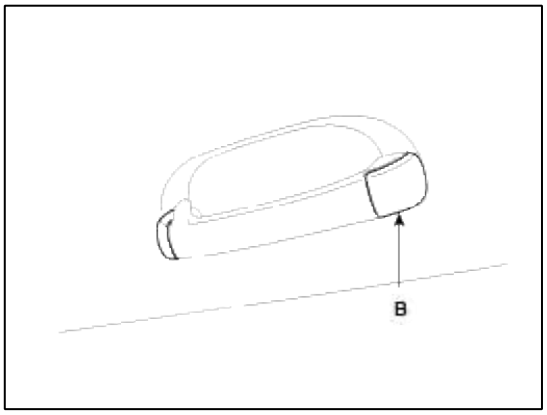
- When prying with a flat-tip screwdriver, wrap it with protective tape to prevent damage.
- Put on gloves to protect your hands.

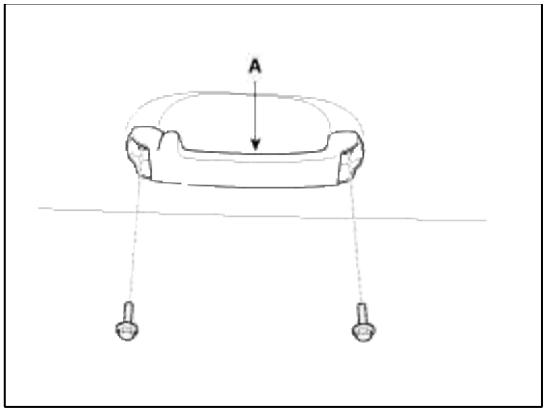
1. Remove the following items :
   A. Front seat
      (Refer to the BD group - "Front Seat")
   B. Rear seat
      (Refer to the BD group - "Rear Seat")
   C. Front pillar trim
      (Refer to the BD group - " Interior Trim")
   D. Front door scuff trim & Rear door scuff trim
      (Refer to the BD group - " Interior Trim")
   E. Center pillar lower trim & Center pillar upper trim
      (Refer to the BD group - " Interior Trim")
   F. Luggage side trim
      (Refer to the BD group - " Interior Trim")
   G. Rear pillar trim
      (Refer to the BD group - " Interior Trim")

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

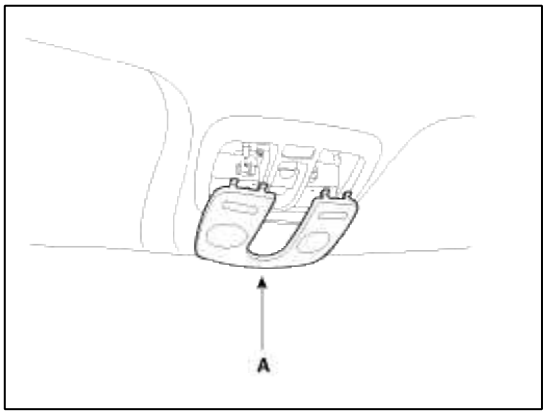


3. Remove the assist handle
   A. Remove the covers (B), and remove the screws, then remove the assist handle (A).

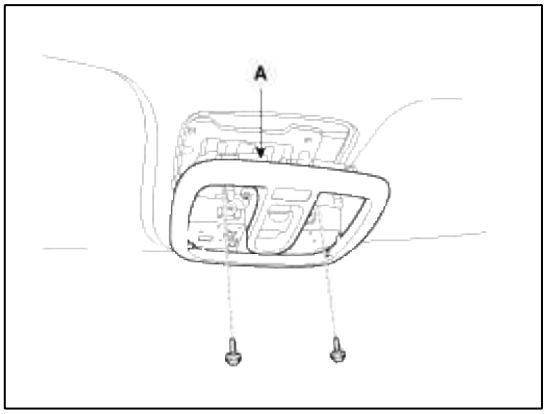




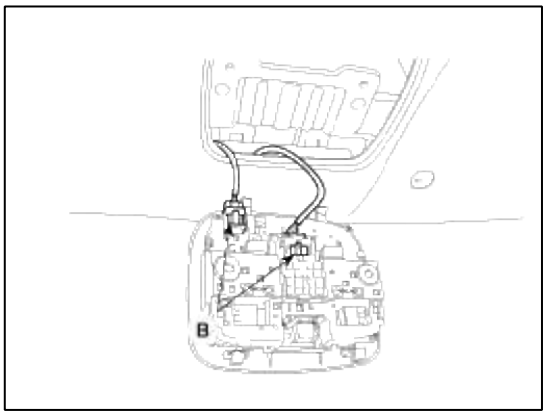
4. Remove the overhead console.
   A. Remove the cover (A).



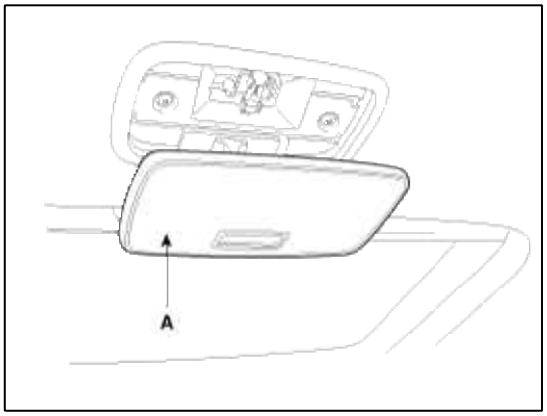
   B. After loosening the overhead console mounting screws, remove the overhead console lamp (A).



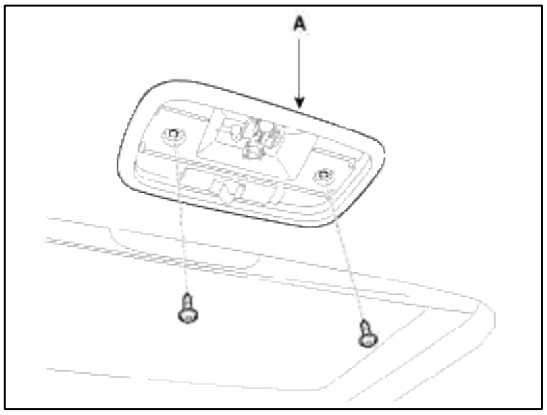
   C. Disconnect the connector (B).



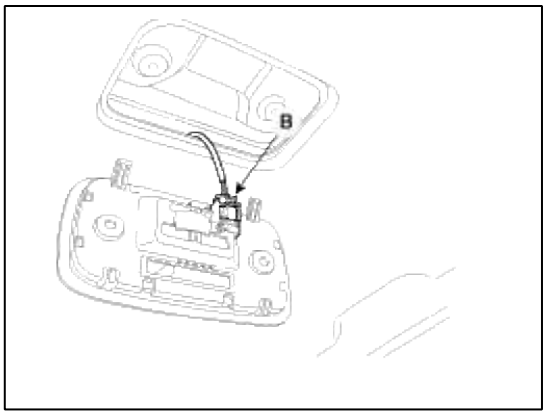
5. Remove the room lamp.
   A. Remove the room lamp cover (A).



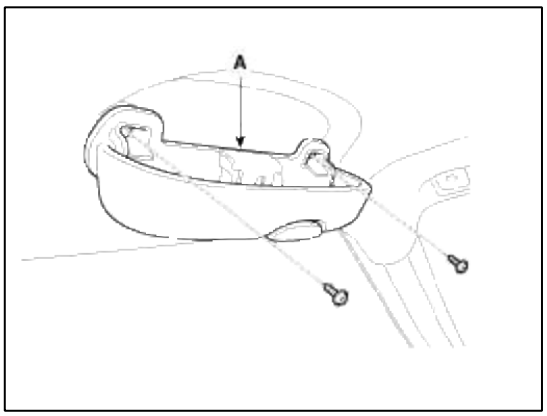
   B. Remove the screws.
   C. Pull out the room lamp (A).



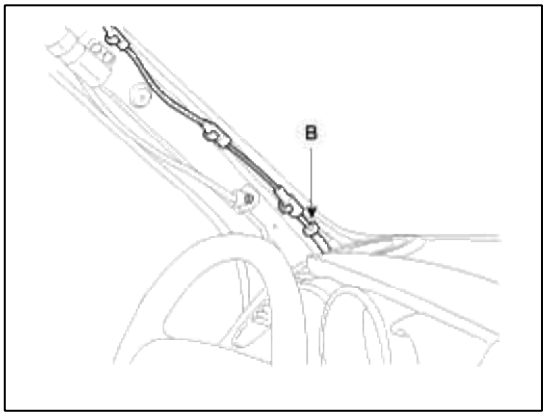
   D. Disconnect the connector (B).



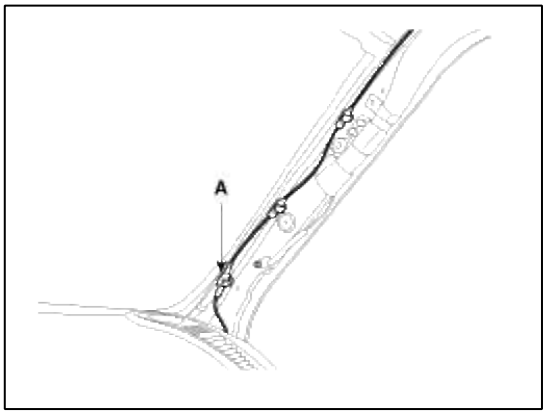
6. After loosening the mounting screws, remove the sunglass case (A).



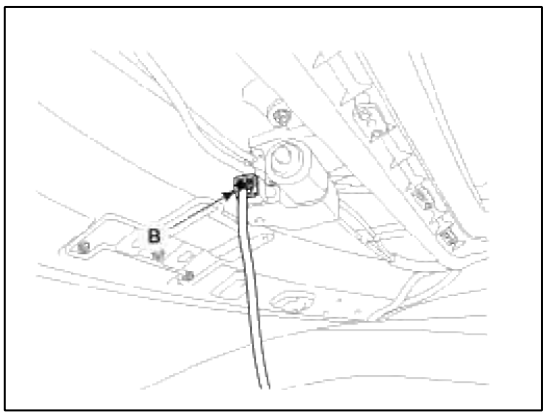
7. Disconnect the connector (B).
[Driver's]



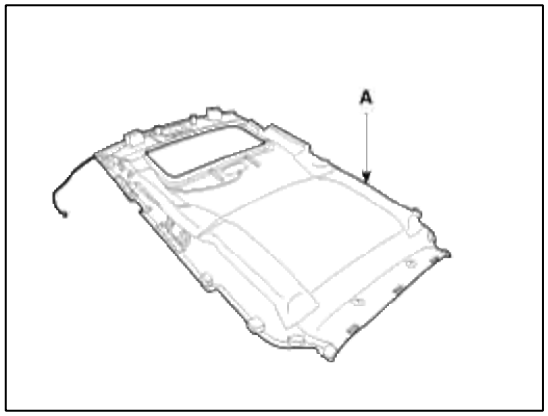
8. Disconnect the connector (A).
[Passenger's]



9. Disconnect the sunroof motor connector (B).



10. Remove the roof trim (A).



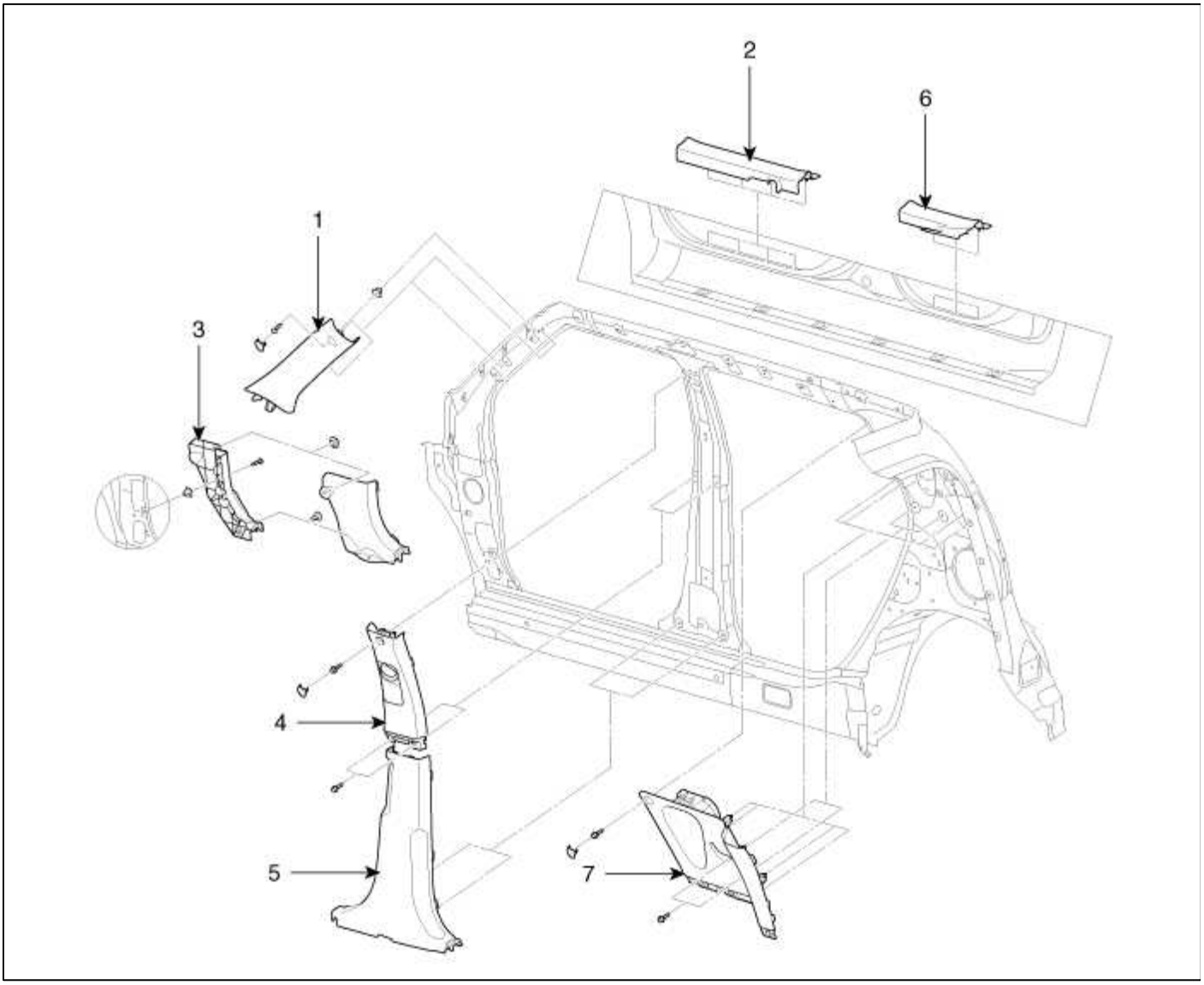
11. Installation is the reverse of removal.

NOTE

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

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

Components



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

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

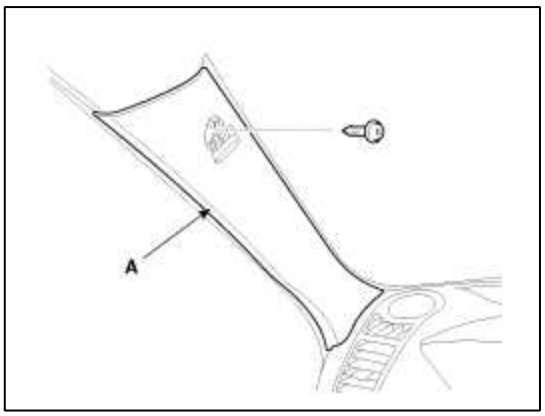
Replacement

Front Pillar Trim Replacement

NOTE

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

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



2. Installation is the reverse of removal.

NOTE

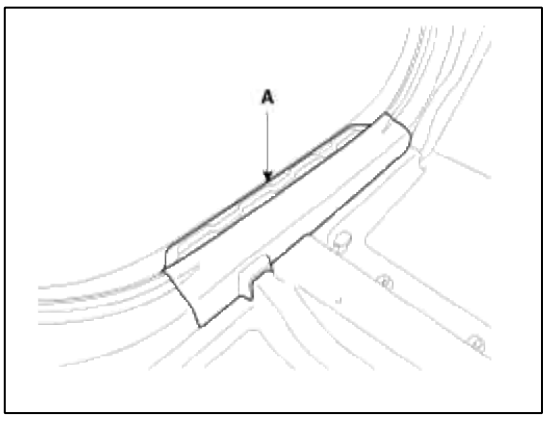
- Replace any damage clips.

Door Scuff Trim Replacement

NOTE

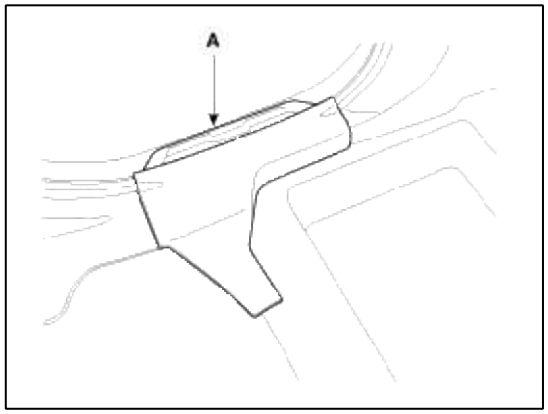
- Put on gloves to protect your hands.
- When prying with a flat-tip screwdriver, wrap it with protective tape to prevent damage.
- Take care not to bend or scratch the trim and panels.

1. Using a screwdrier or remover, remove the front door scuff trim (A).
[Front]



2. Remove the rear seat cushion.
(Refer to the BD group - "Rear Seat")

3. Using a screwdrier or remover, remove the rear door scuff trim (A).
[Rear]



4. Installation is the reverse of removal.

NOTE

- Replace any damage clips.

Center Piller Trim Replacement

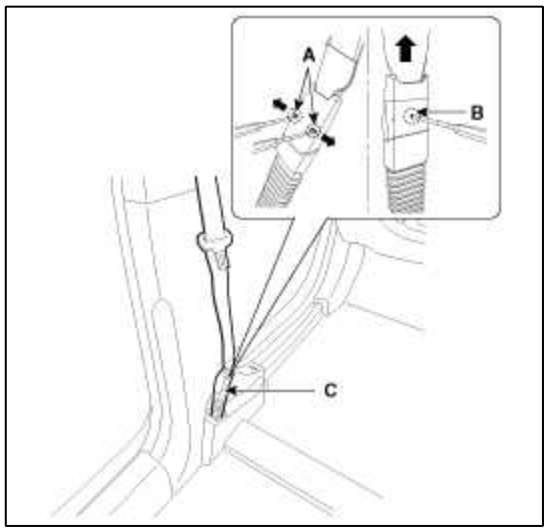
NOTE

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

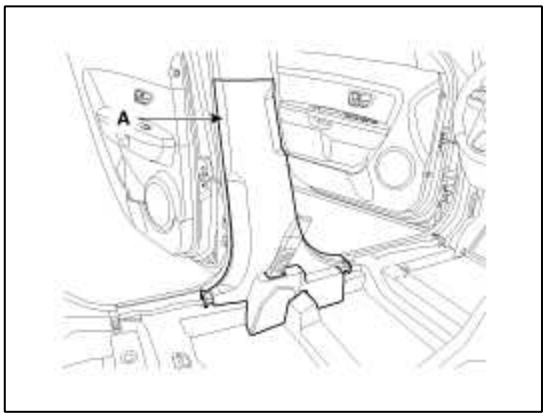
1. Remove the following items :
A. Front door scuff trim & Rear door scuff trim

2. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.

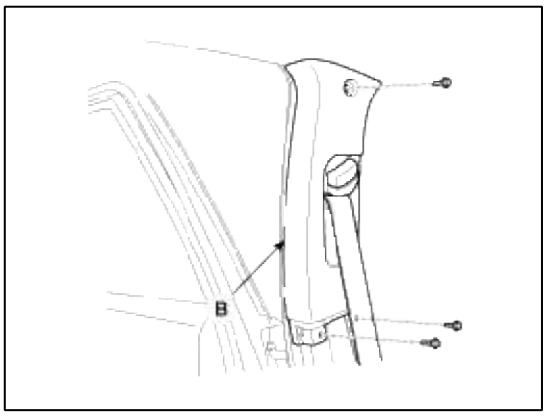
3. To remove the seat belt anchor pretensioner (C), keep on pushing the lock pins (A) as arrow direction. And then remove the seat belt after pushing the lock pin (B).



4. Using a screwdriver or remover, remove the center pillar lower trim (A).



5. After loosening the mounting bolts, then remove the center pillar upper trim (B).



6. Installation is the reverse of removal.

NOTE

- Replace any damage clips.

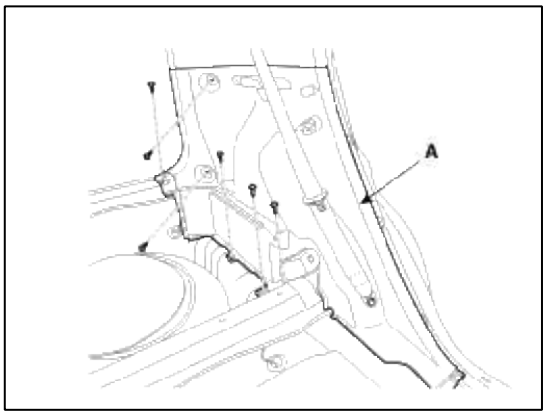
Rear Pillar Trim Replacement

NOTE

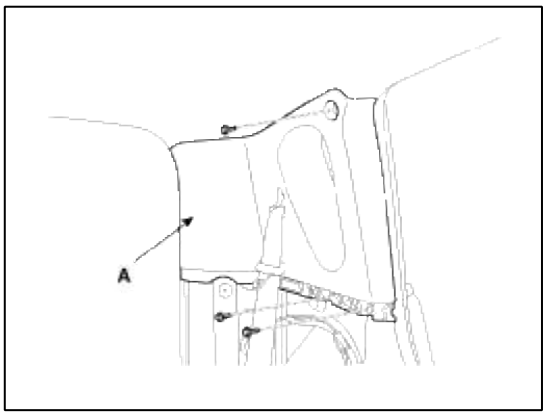
- Put on gloves to protect your hands.
- When prying with a flat-tip screwdriver, wrap it with protective tape to prevent damage.
- Take care not to bend or scratch the trim and panels.

1. Remove the following items :
   A. Rear seat assembly
      (Refer to the BD group - "Rear Seat")
   B. Rear door scuff trim
   C. Transverse trim

2. After loosening the mounting screws, then remove the luggage side trim (A).



3. After loosening the mounting screws, then remove the rear pillar trim (A).



4. Installation is the reverse of removal.

NOTE

- Replace any damage clips.

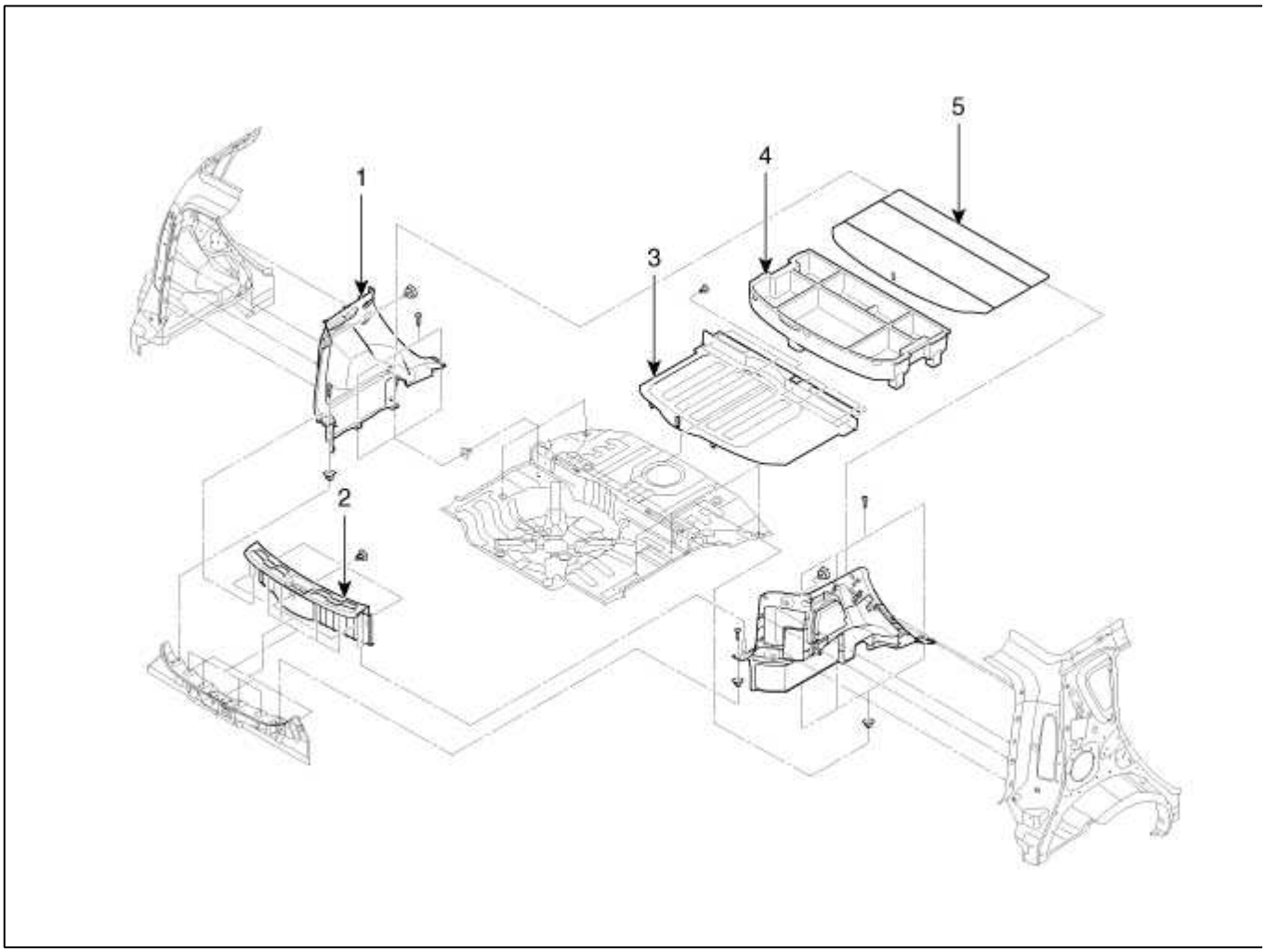
Luggage Side Trim Replacement

NOTE

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

1. Remove the rear seat.
   (Refer to the BD group - "Rear Seat")
2. Remove the rear door scuff trim.
3. Remove the transverse trim.
4. After loosening the mounting screws, remove the luggage side trim.

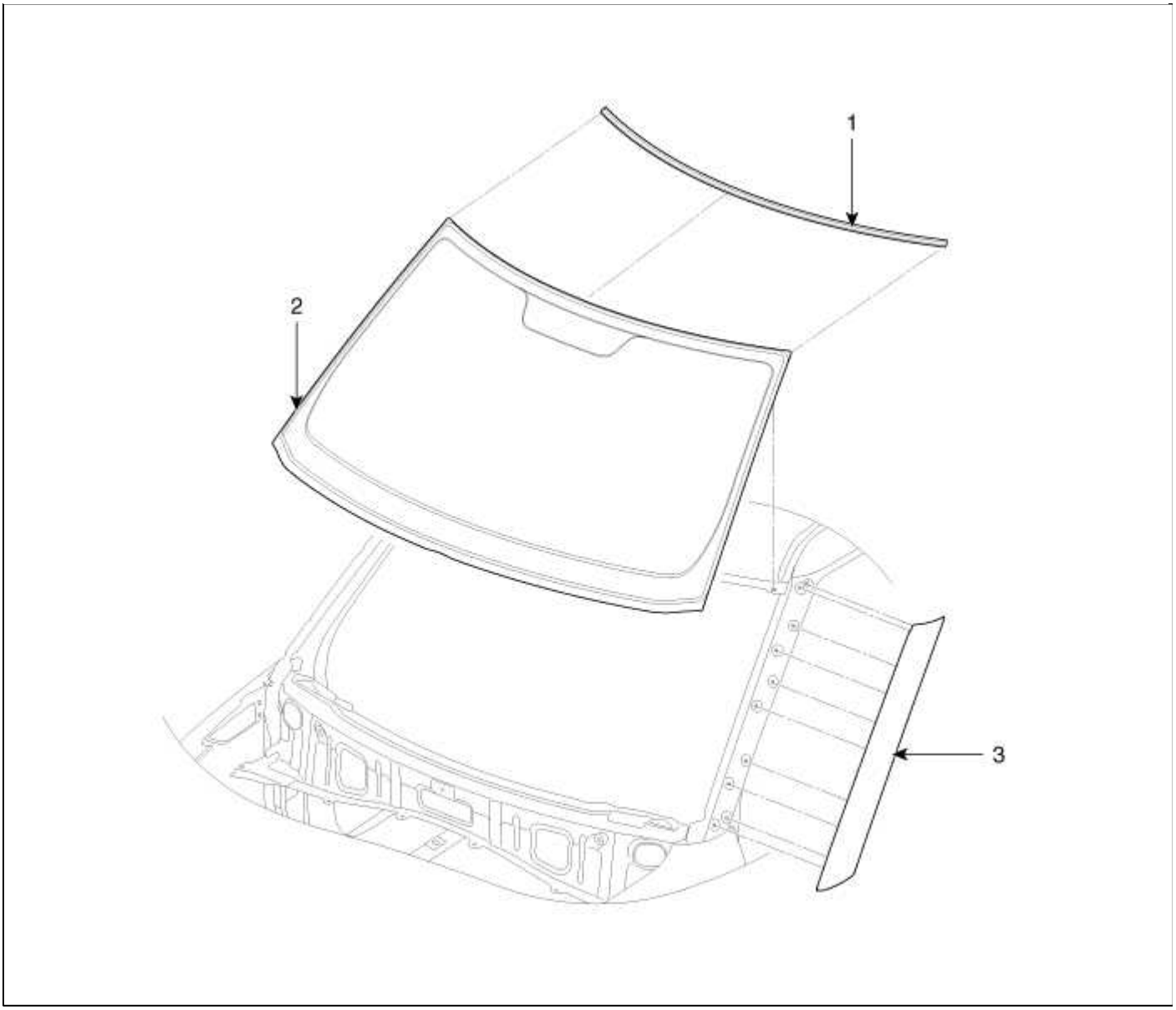
5. Installation is the reverse of removal.



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

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

Components



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

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

Replacement

Removal

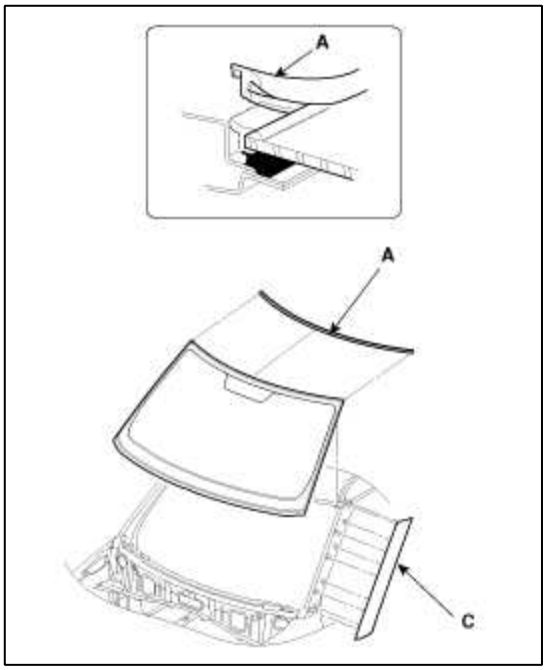
NOTE

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

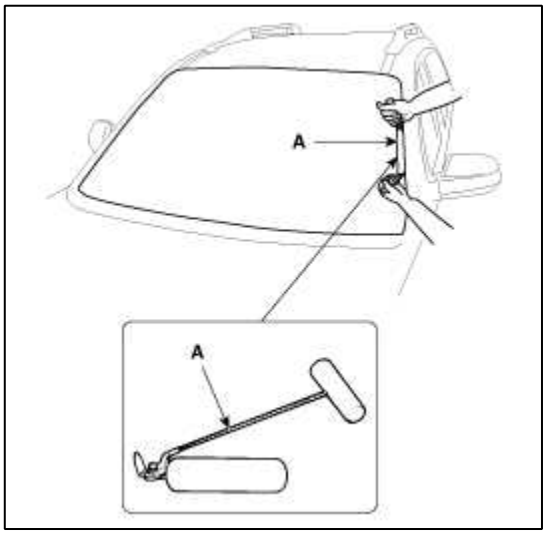
1. Remove the following items :
   A. Front pillar trim
      (Refer to the BD group - "Interior Trim")
   B. Inside rearview mirror
      (Refer to the BD group – “Mirror”)
   C. Wiper arm
      (Refer to the BD group – “Cowl Top Cover”)
   D. Cowl top cover
      (Refer to the BD group – “Cowl Top Cover”)

2. Remove the front pillar garnish (C).

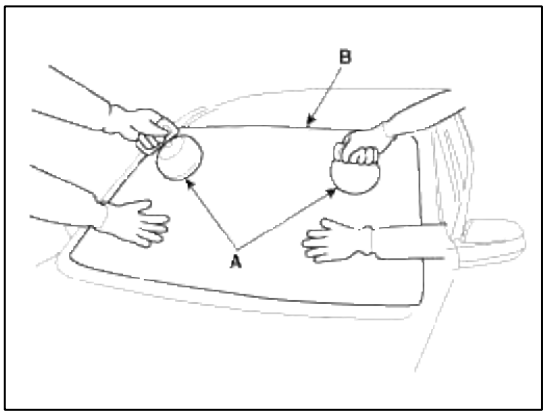
3. Remove the windshield glass upper molding (A).Remove the spacer.



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

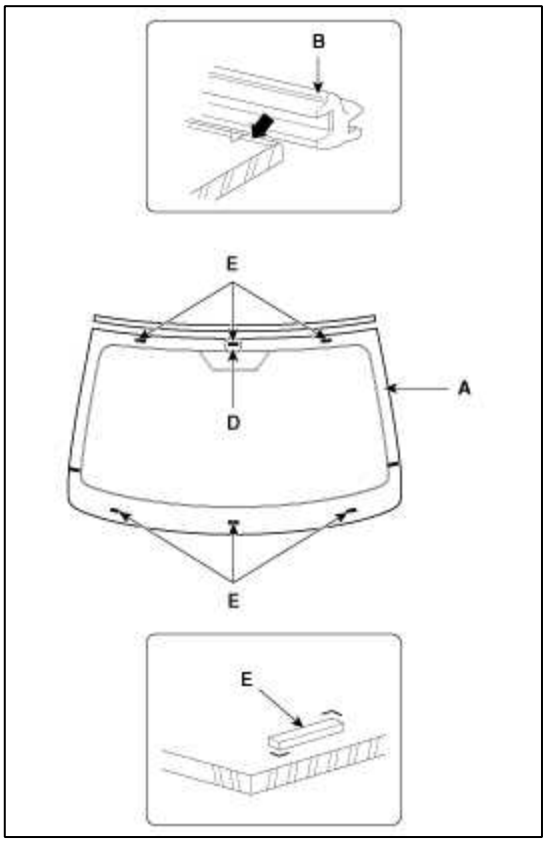


5. Remove the windshield (B) carefully using the glass holder (A).



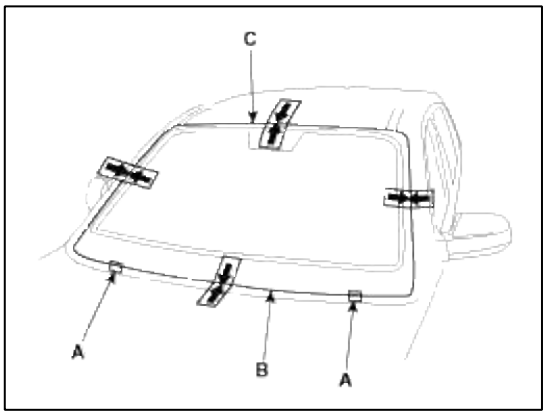
Installtion

1. With a scraper, scrape the old adhesive smooth to a thickness of about 2mm (0.08 in.) on the bonding surface around the entire windshield opening flange:
   A. Do not scrape down to the painted surface of the body; damaged paint will interfere with proper bonding.
   B. Remove the rubber dam and fastereners from the body.
   C. Mask off surrounding surfaces before painting.
2. Clean the bonding surface with a sponge dampened in alcohol. After cleaning, keep oil, grease and water from getting on the clean surface.
3. Install the winshield (A) upper molding (B) and fasteners (E).

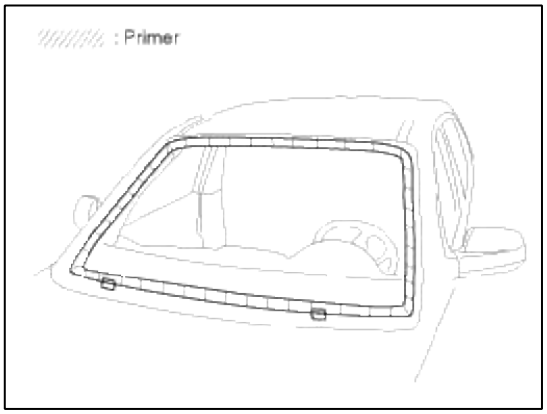


4. Install the spacer (A) install the windshield glass (B) temporarily with marking sure to position them on the center, and then place the alignment mark (C).

5. Remove the windshield.



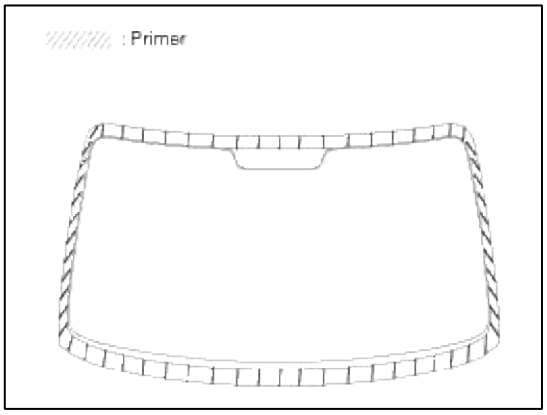
6. With a sponge, apply a light coat of body primer to the original adhesive remaining around the windshield opening flange. Let the body primer dry for at least 10 minutes.
   A. Do not apply glass primer to the body, and be careful not to mix up glass and body primer sponges.
   B. Never touch the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



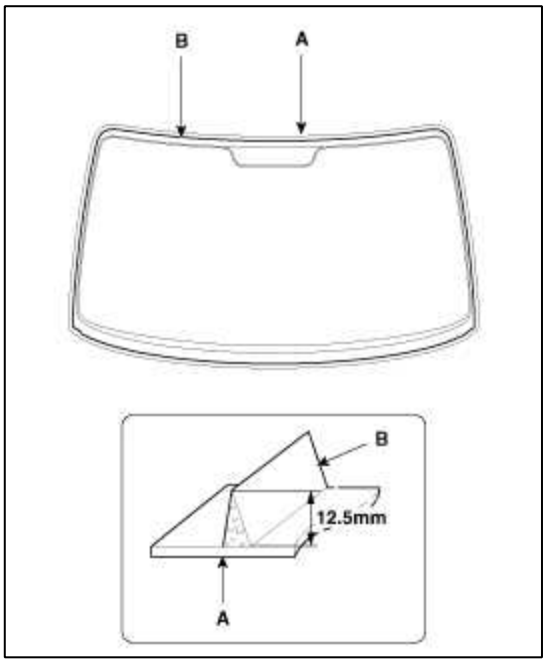
7. Apply a light coat of glass primer to the outside of the fasteners.

NOTE

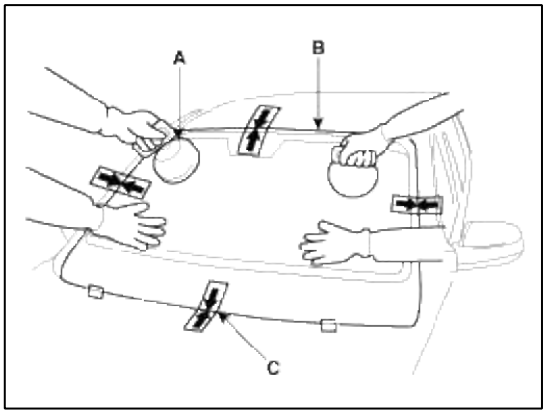
- Never touch the primed surface with your hand. If you do, the adhesive may not bond to the glass properly, causing a leak after the windshield glass is installed.
- Do not apply body primer to the glass.
- Keep water, dust, and abrasive materials away from the primer.



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



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



10. Scrape or wipe the excess adhesive off with a putty knife or towel. To remove adhesive from a painted surface or the windshield, wipe with a soft shop towel dampened with alcohol.

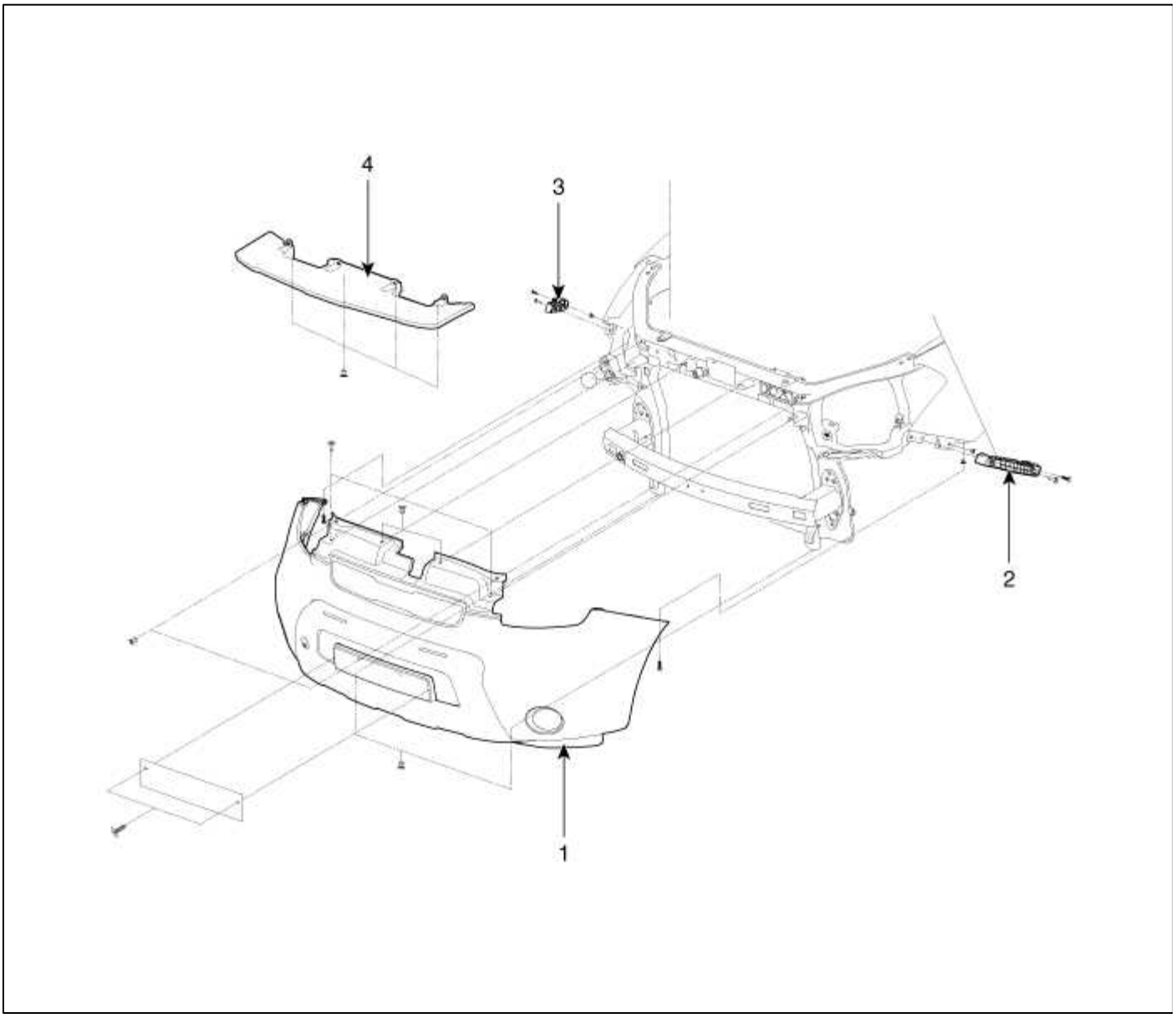
11. Let the adhesive dry for at least one hour, then spray water over the windshield and check for leaks. Make leaking areas, and let the windshield dry, then seal with sealant:
    A. Let the vehicle stand for at least four hours after windshield installation. If the vehicle has to be used within the first four, it must be driven slowly.
    B. Keep the windshield dry for the first hour after installation.

12. Reinstall all remaining removed parts. Install the rearview mirror after the adhesive has dried thoroughly. Advise the customer not to do the following things for two the three days:
    A. Slam the door with all the windows rolled up.
    B. Twist the body excessively (such as when going in and out of driveways at an angle or driving over rough, uneven roads)

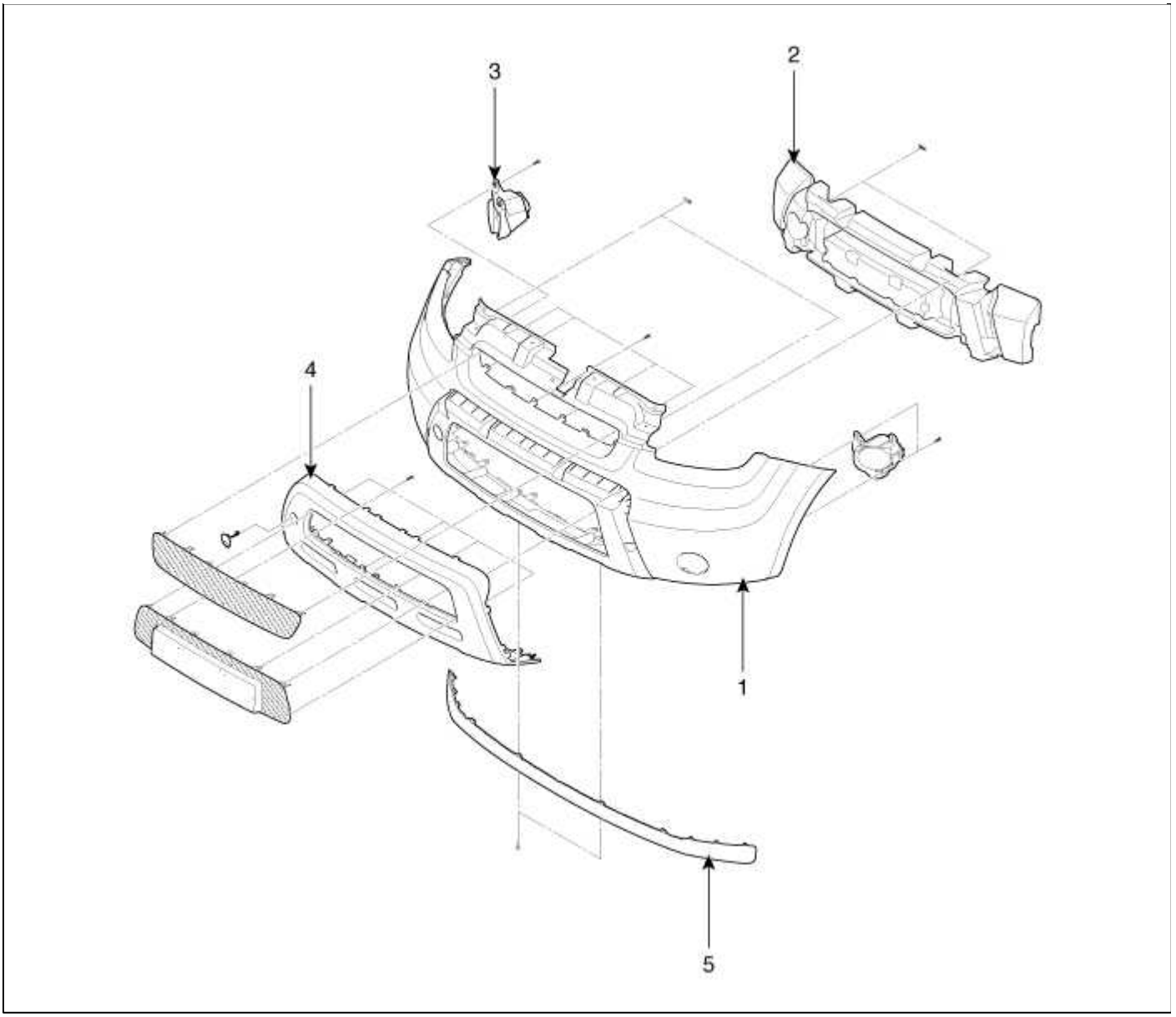
13. Installation the following items :
    A. Cowl top cover
       (Refer to the BD group – “Cowl Top Cover”)
    B. Wiper arm
       (Refer to the BD group – “Cowl Top Cover”)
    C. Inside rearview mirror
       (Refer to the BD group – “Mirror”)
    D. Front pillar trim
       (Refer to the BD group - "Interior Trim")

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

Components



1. Front bumper cover	3. Front bumper side bracket [RH]
2. Front bumper side bracket [LH]	4.Front bumper lower stiffener



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

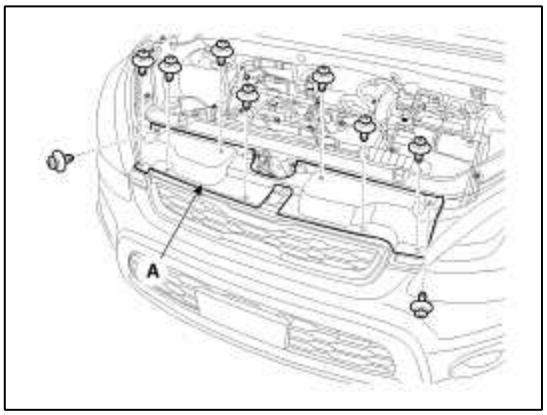
Body (Interior and Exterior) > Bumper > Front Bumper > Repair procedures

Replacement

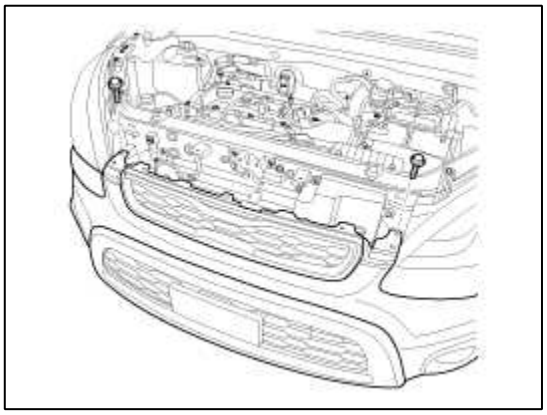
NOTE

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

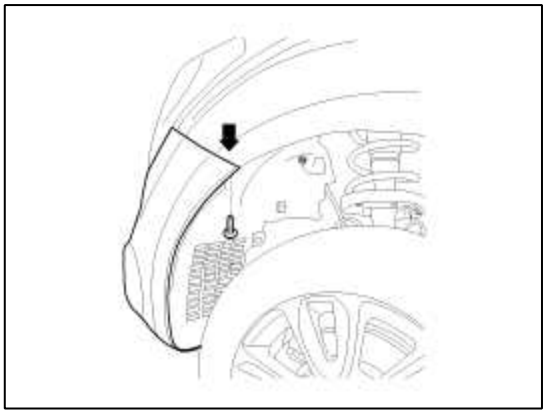
1. After loosening the mounting clips, then remove the radiator grille upper cover (A).



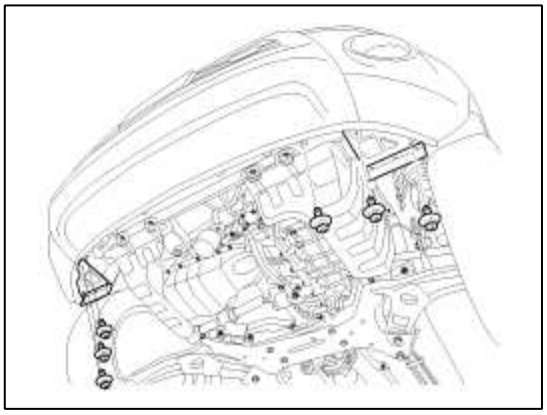
2. Loosen the mounting bolts.



3. After loosening the front bumper side's mounting screw, then disconnect the side's.

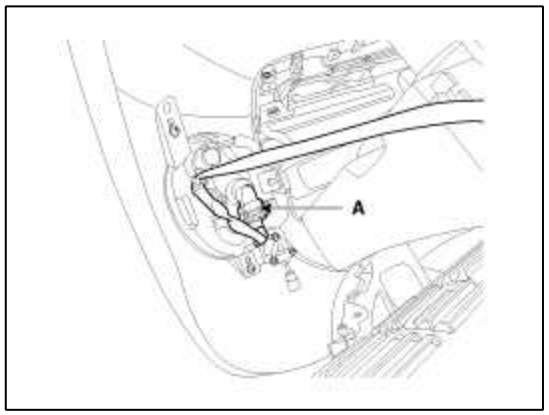


4. Remove the front bumper lower mounting clips.



5. Disconnect the fog lamp connector (A).

6. Remove the front bumper cover.



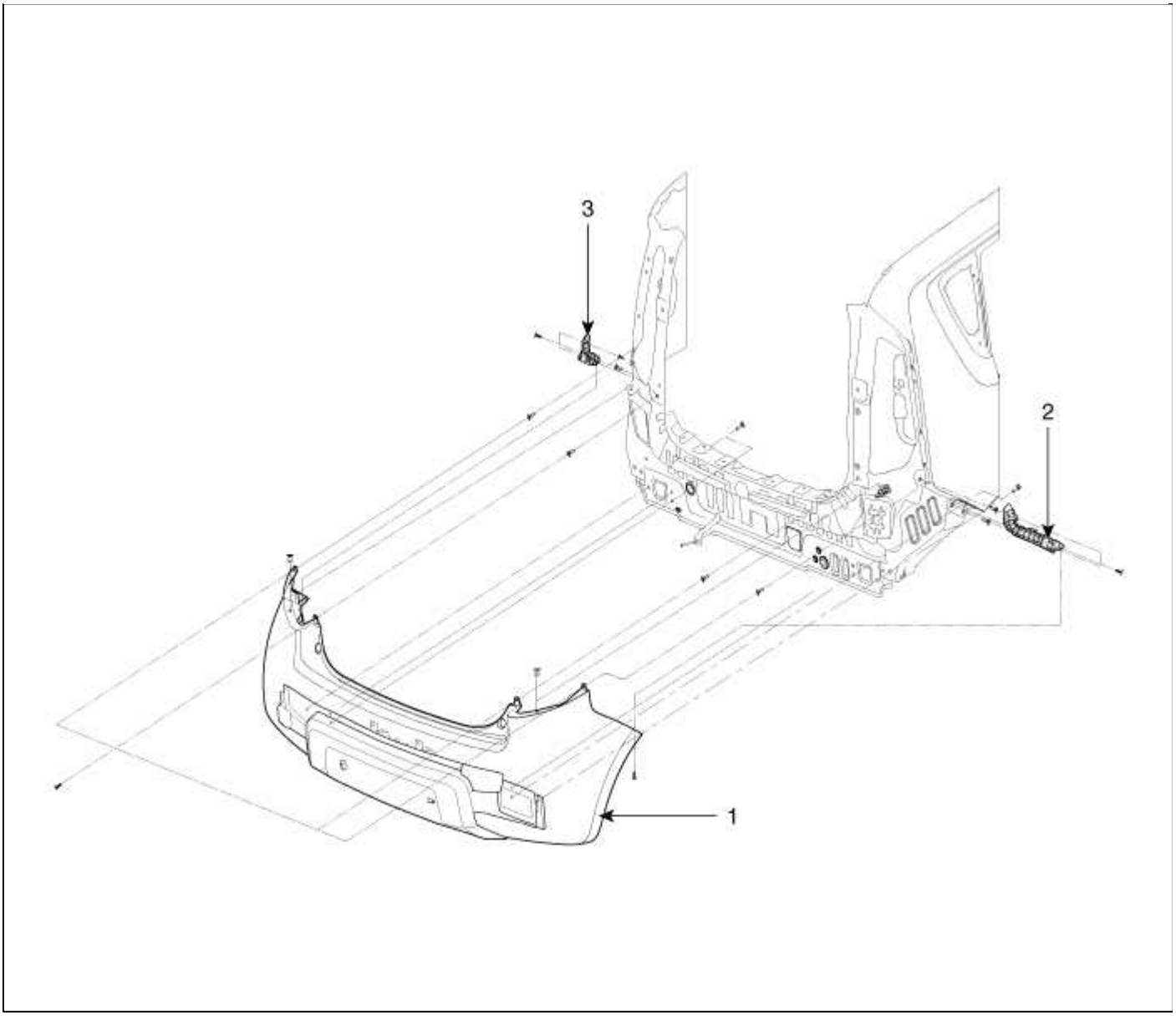
7. Installation is the reverse of removal.

NOTE

- Make sure the connectors are connected in properly.
- Replace any damaged clips.

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

Components



1. Rear bumper cover 2. Rear bumper side bracket [RH]	3. Rear bumper side bracket [LH]

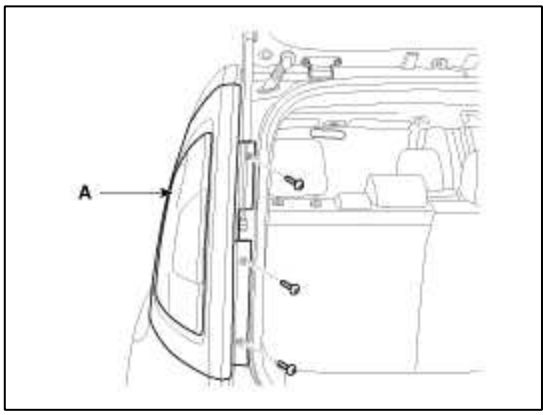
Body (Interior and Exterior) > Bumper > Rear Bumper > Repair procedures

Replacement

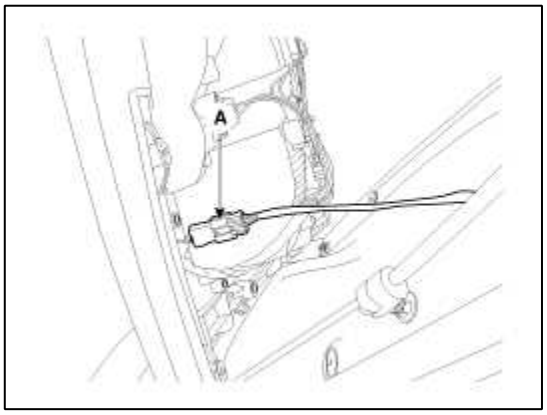
NOTE

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

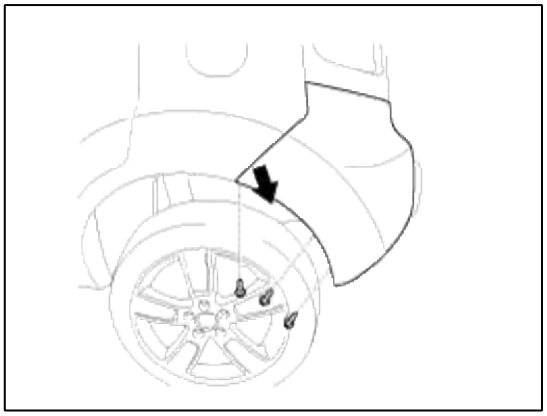
1. After loosening the mounting screws, then remove the rear combination lamp (A).



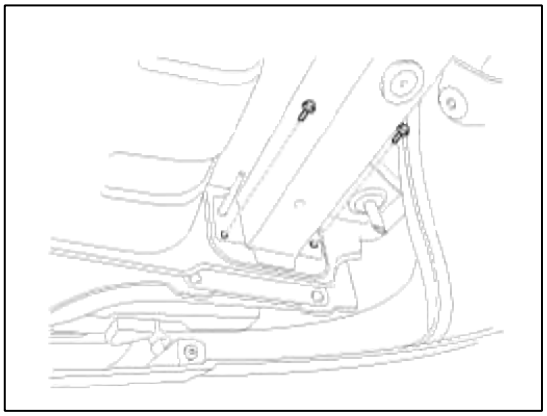
2. Disconnect the rear combination lamp connector (A).



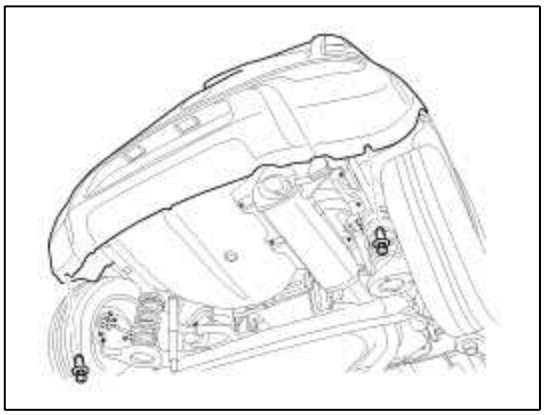
3. After loosening the rear bumper side's mounting screws, then disconnect the side's.



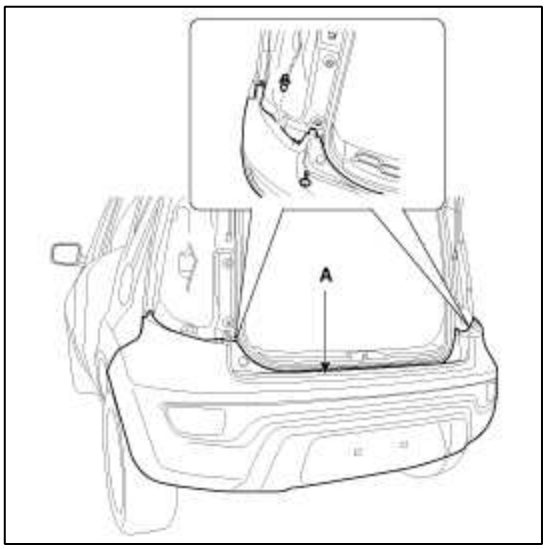
4. Loosen the rear bumper lower mounting bolts.



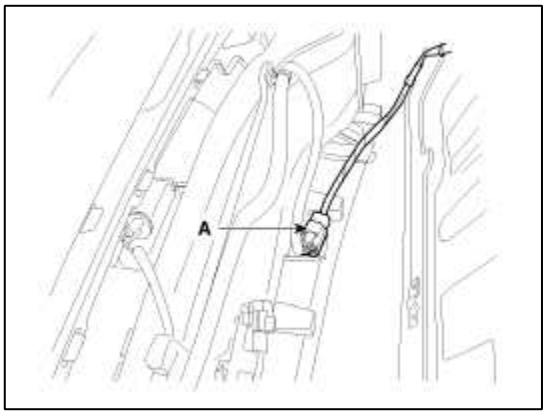
5. Loosen the rear bumper lower mounting clips.



6. Loosen the rear bumper side mounting screw and clip.



7. Push the lock pin, disconnect the rear bumper main connector (A).
8. Remove the rear bumper cover.



9. Installation is the reverse of removal.

NOTE

- Make sure the connectors are connected in properly.
- Replace any damaged clips.

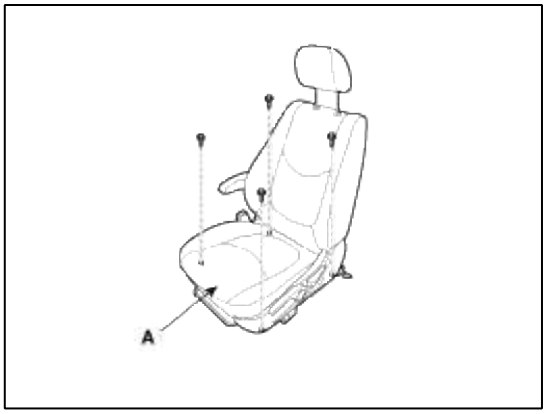
Body (Interior and Exterior) > Seat & Power Seat > Front Seat > Repair procedures

Replacement

Seat assembly replacement

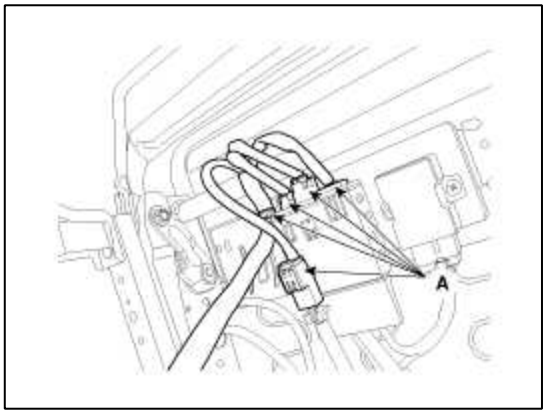
1. After loosening the seat assembly mounting bolts, remove the seat assembly (A).

Tightening torque :
39.2~58.8N.m (4.0~6.0kgf.m, 28.9~43.4 lb-ft)

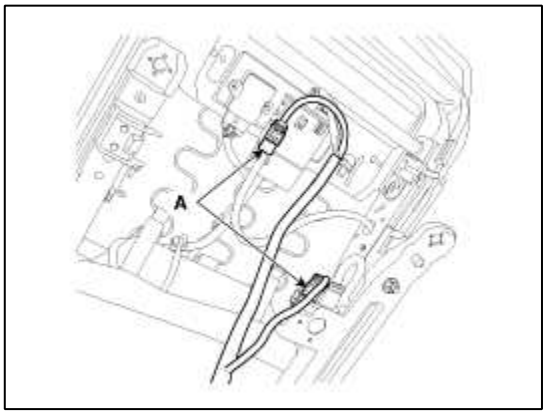


2. Disconnect the connectors (A), and remove the seat assembly.

[Driver's]



[Passenger's]



3. Installation is reverse of removal.

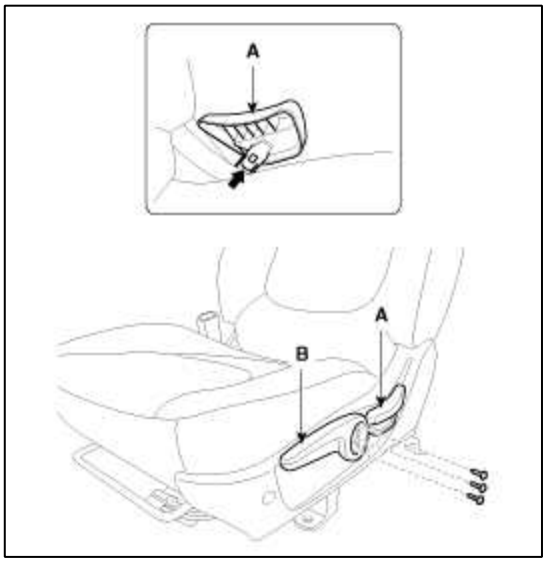
CAUTION

SEAT MOUNTING BOLT INSTALLATION PROCEDURE (manual seat only)

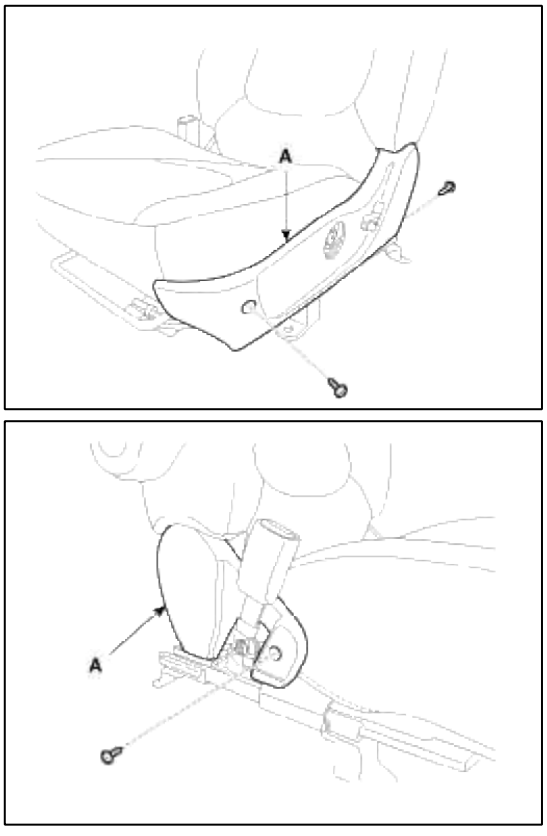
- Set the into the most rearward position. check then each slide is locked, and then tighten the front mounting bolt temporarily.
- Set the seat into most forward position. check that each slide is locked, and then tighten the rear mounting bolt completely.
- Set the seat into the most rearward position. check the front mounting bolt completely.
- Check that the seat operates to and fro smoothy and the locking portion locks properly.

Recliner Cover Replacement

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



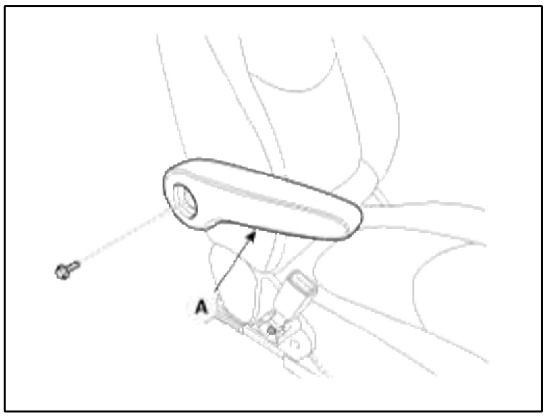
2. Loosen the recliner mounting screw and clip, remove the recliner cover (A).



3. Installation is the reverse of removal.

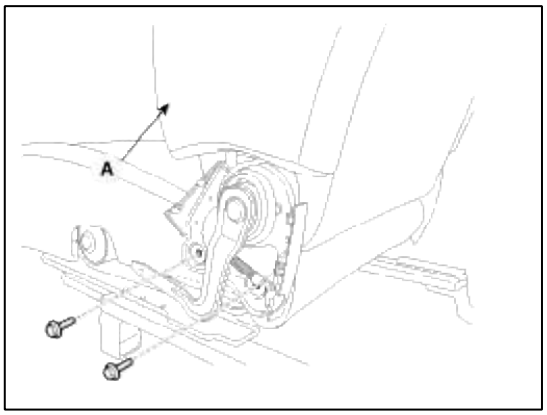
Seat Back Cover Replacement

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

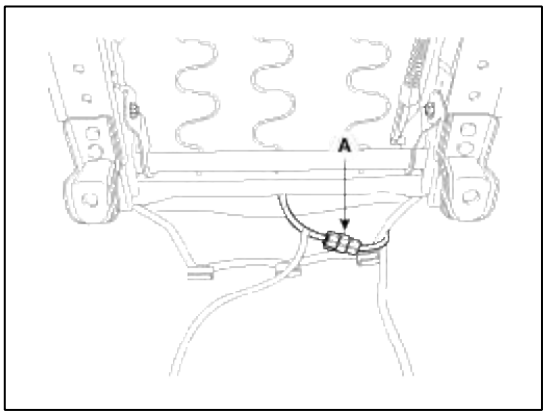


4. After loosening the mounting bolts, then remove the seat back assembly (A).

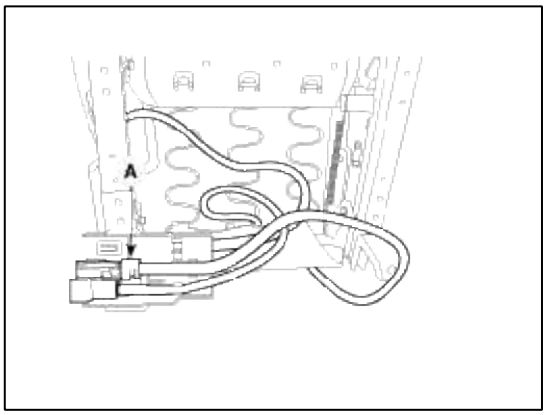
Tightening torque :
39.2~58.8N.m (4.0~6.0kgf.m, 28.9~43.4 lb-ft)



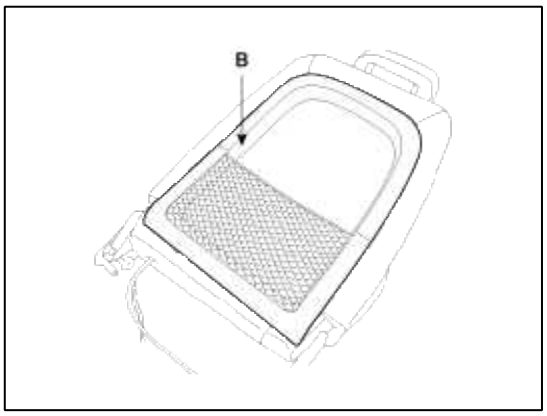
5. Disconnect the connector (A).



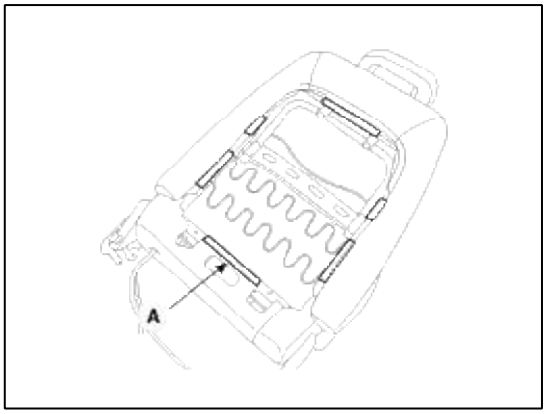
6. Disconnect the air bag wiring (A).



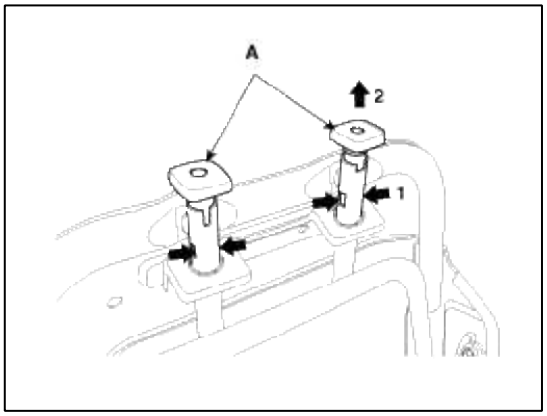
7. Remove the seat back panel (B).



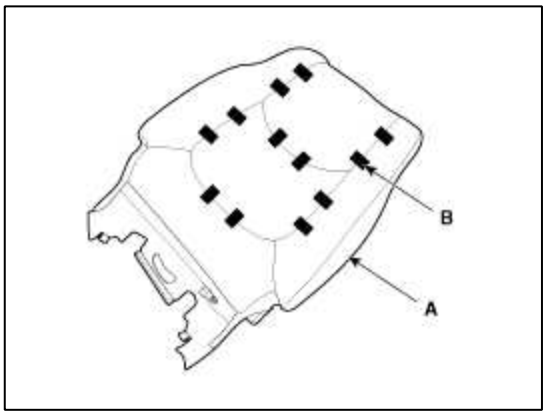
8. Disconnect the protector (A) from the back frame.



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



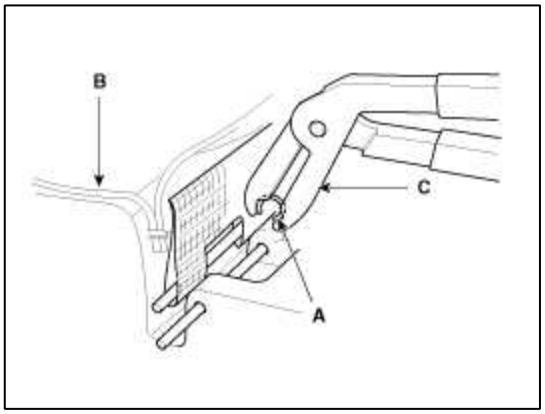
10. After removing the hog-ring clips (B) on the front of seat back and remove the seat back cover (A).



11. Installation is the reverse of removal.

NOTE

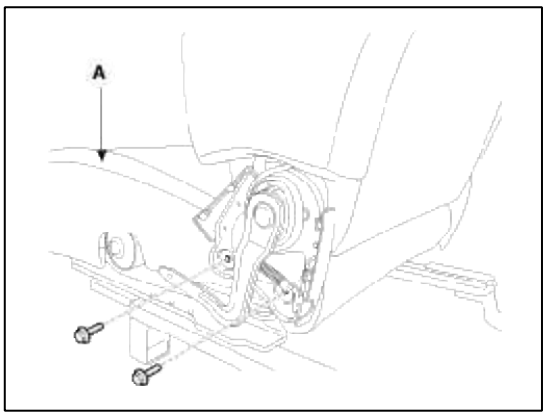
- To prevent wrinkles, make sure the material is stretched evenly over the cover (B) before securing the hog-ring clips (A).
- Replace the hog-ring clips with new ones using special tool [C (09880-4F000)].



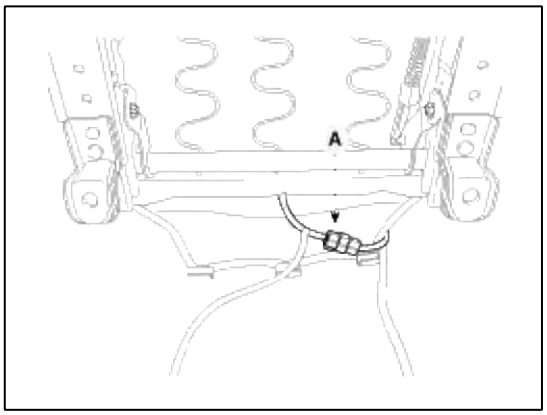
Seat Cushion Cover Replacement

1. Remove front seat assembly.
2. Remove the recliner cover.
3. After loosening the mounting bolts, then remove the seat cushion assembly (A).

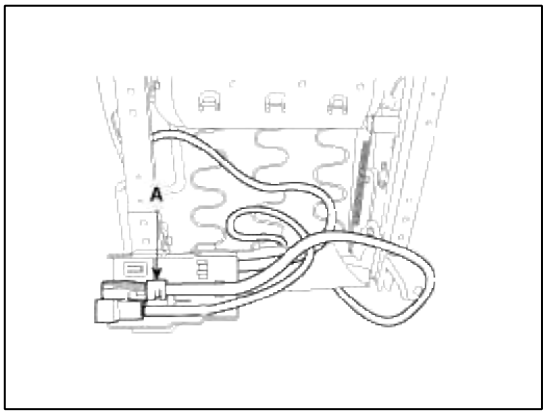
Tightening torque :
39.2~58.8N.m (4.0~6.0kgf.m, 28.9~43.4 lb-ft)



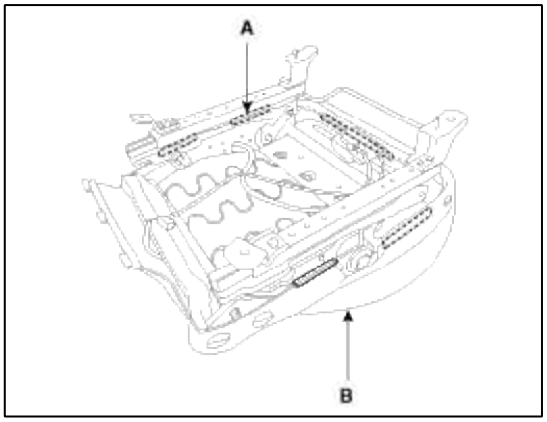
4. Disconnect the heater connector (A).



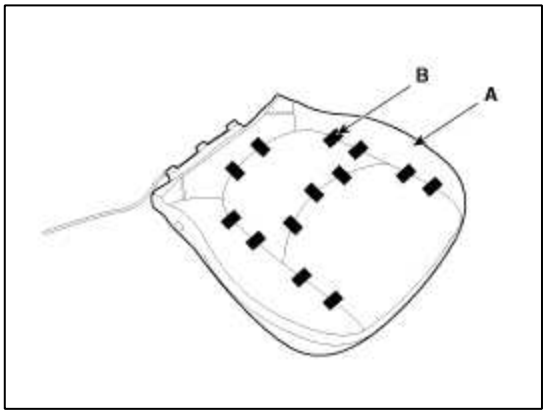
5. Disconnect the air bag wiring (A).



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



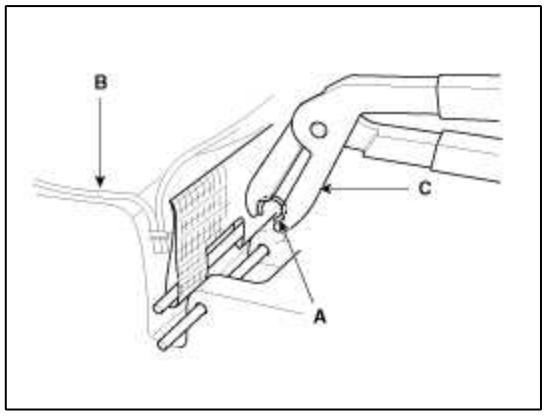
7. After removing the hog-ring clips (B) on the front of seat cushion and remove the seat cushion cover (A).



8. Installation is the reverse of removal.

NOTE

- To prevent wrinkles, make sure the material is stretched evenly over the cover (B) before securing the hog-ring clips (A).
- Replace the hog-ring clips with new ones using special tool [C (09880-4F000)].



Seat Frame Replacement

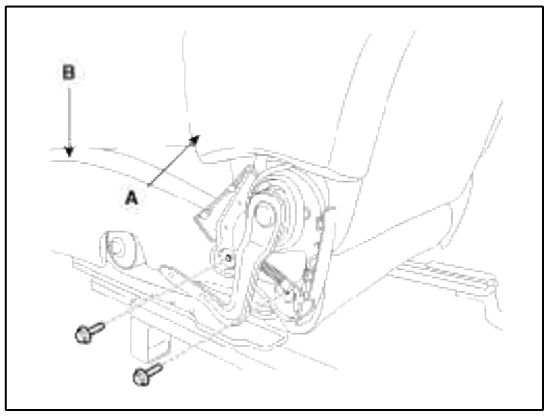
1. Remove the following items :
   A. Front seat assembly
   B. Recliner cover.

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

NOTE

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

Tightening torque :
39.2~58.8N.m (4.0~6.0kgf.m, 28.9~43.4 lb-ft)



3. Remove the seat back cover.

4. Remove the seat cushion cover.

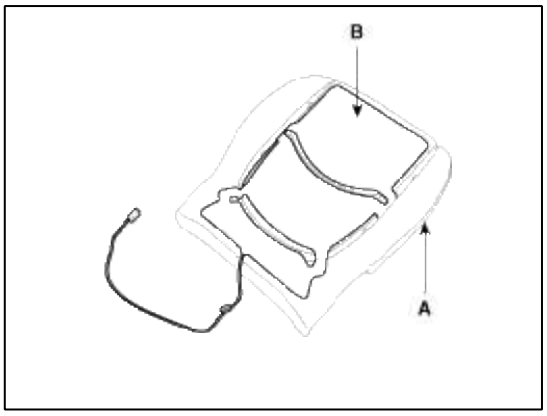
5. Installation is the reverse of removal.

Seat Cushion Heater Replacement

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

CAUTION

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



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

CAUTION

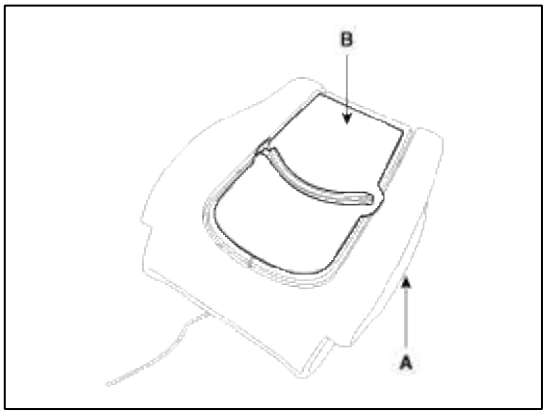
- Be sure to match the heater with main appearance.

Seat Back Heater Replacement

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

CAUTION

- Take care not to damage the slave pad.



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

> CAUTION
>
> • Be sure to match the heater with main appearance.

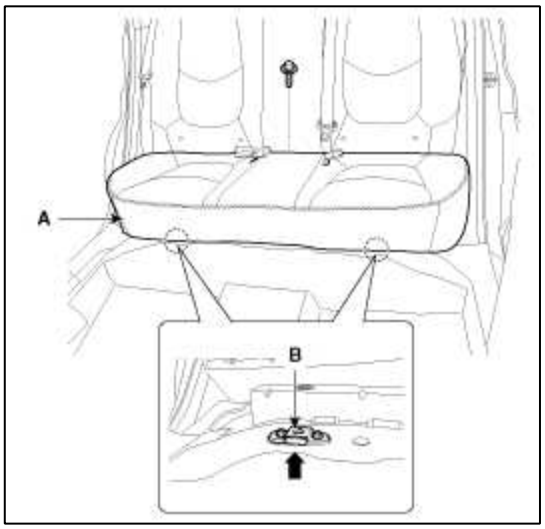
Body (Interior and Exterior) > Seat & Power Seat > Rear Seat > Repair procedures

Replacement

Rear Seat Assembly Replacement

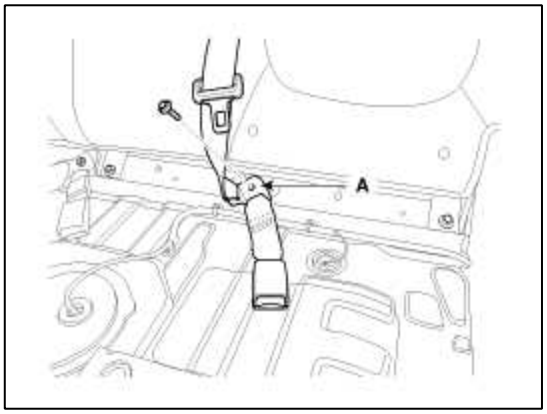
1. Loosen the mounting bolt.
2. Push the lock pin (B), remove the rear seat cushion (A).

Tightening torque :
16.7 ~ 25.5 N.m (1.7 ~ 2.6 kgf.m, 12.3 ~ 18.8 lb-ft)



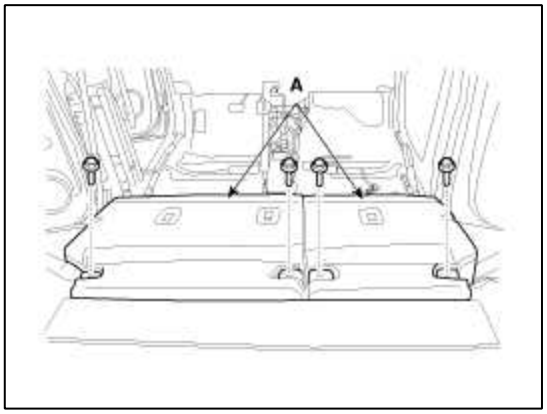
3. After loosening the mounting bolt, then remove the center rear seat belt lower anchor (A).

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



4. After loosening the mounting bolts, then remove the rear seat back (A).

Tightening torque :
16.7 ~ 25.5 N.m (1.7 ~ 2.6 kgf.m, 12.3 ~ 18.8 lb-ft)



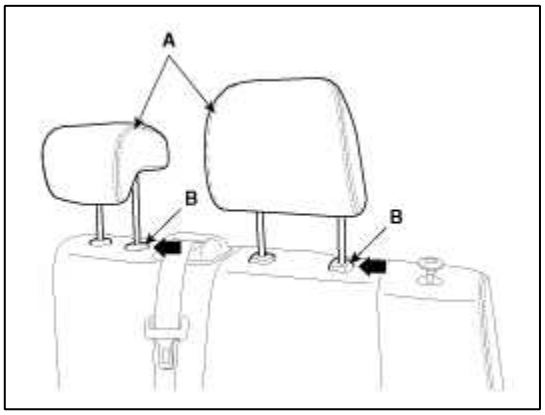
5. Installation is the reverse of removal.

Rear Seat Back Cover Replacement [LH]

CAUTION

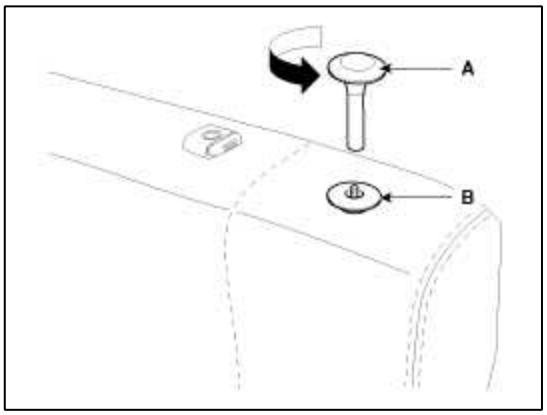
- When prying with a flat-tip screwdriver, wrap it with protective tape, and apply protective tape around the related parts your hands.
- Put on gloves to protect your hands.

1. Remove the following items first :
   A. Rear seat back assembly [LH]
2. Push the lock pin (B), remove the headrest (A).

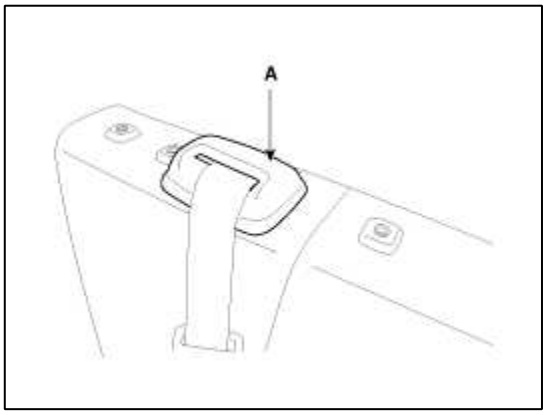


3. Remove the rear seat folding knob (A) after turning in the counter clock-wise direction.

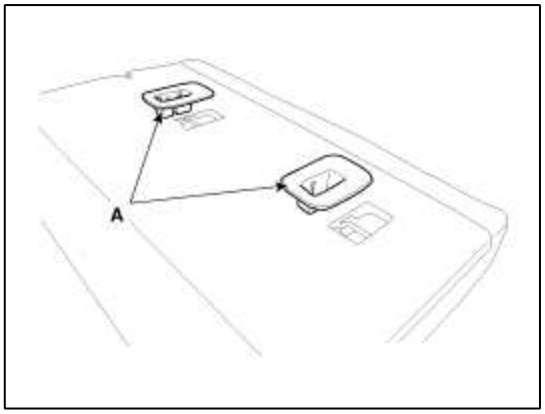
4. Remove the rear back bezel (B).



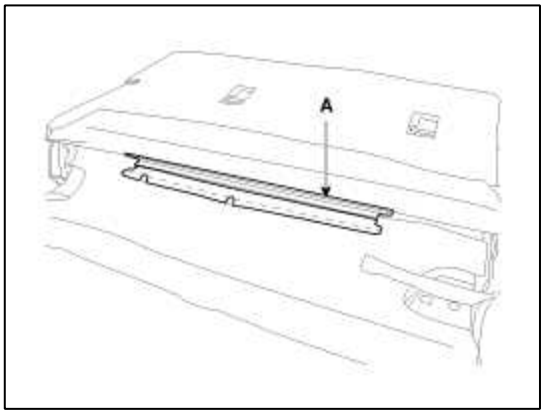
5. Using a screwdriver or remover, remove the center seat belt cover (A).



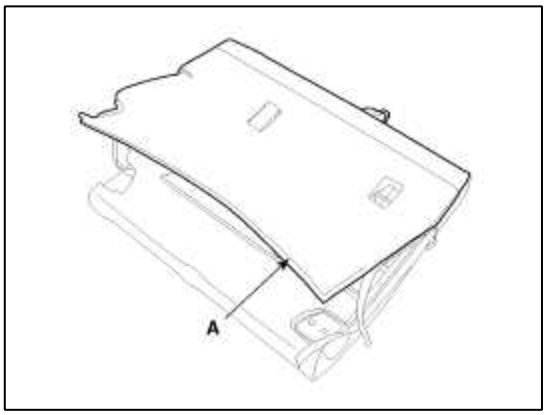
6. Using a screwdriver or remover, remove the tether anchor garnish (A).



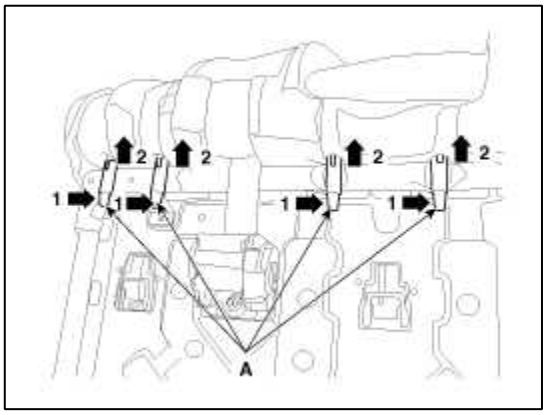
7. Remove the rear seat back lower mounting protector (A).



8. Zip off the rear seat back cover (A), and then full it up.

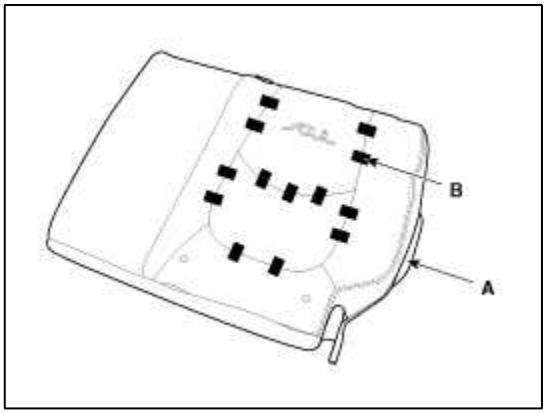


9. Pull out the headrest guides (A) while pinching the end of the guides, and remove them.



10. Remove the rear seat back cover from the rear seat back frame.

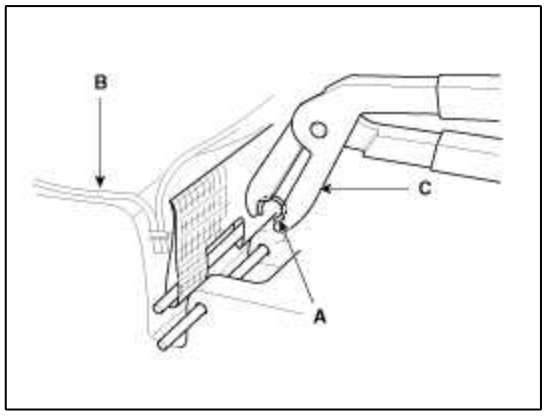
11. After removing the hog-ring clips (B) on the rear of seat back and remove the rear seat back cover (A).



12. Installation is the reverse of removal.

NOTE

- To prevent wrinkles, make sure the material is stretched evenly over the cover (B) before securing the hog-ring clips (A).
- Replace the hog ring clips with new ones using special tool [C (09880-4F000)].



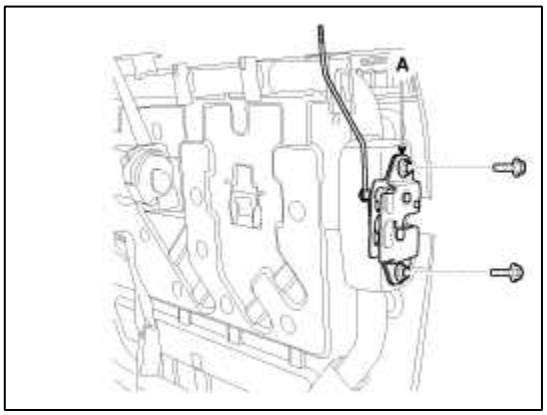
Rear Seat Latch Replacement [LH]

CAUTION

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

1. Remove the following items first :
   A. Rear seat back assembly [LH]
   B. Rear seat back cover [LH]
2. After loosening the mounting bolts, then remove the rear seat latch assembly (A).

Tightening torque :
19.6 ~ 29.4 N.m (2.0 ~ 3.0 kgf.m, 14.5 ~ 21.7 lb-ft)



3. Installation is the reverse of removal.

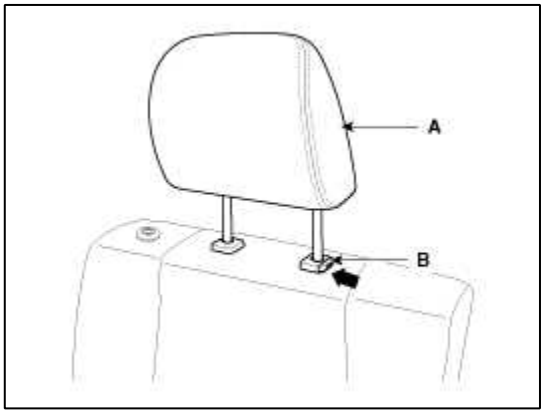
Rear Seat Back Cover Replacement [RH]

CAUTION

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

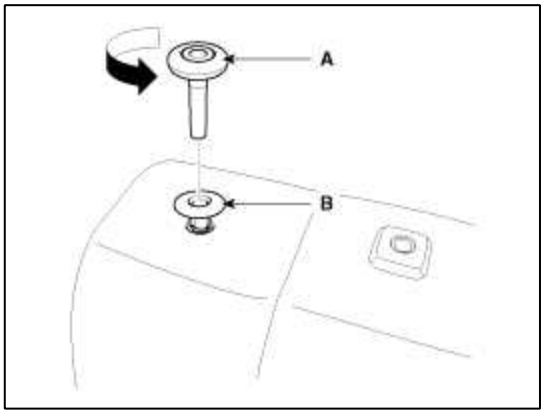
1. Remove the following items first :
   A. Rear seat back assembly [RH]

2. Push the lock pin (B), remove the headrest (A).

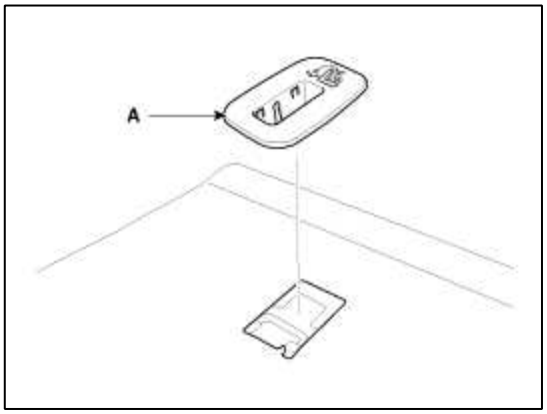


3. Remove the rear seat folding knob (A) after turning in the counter clock-wise direction.

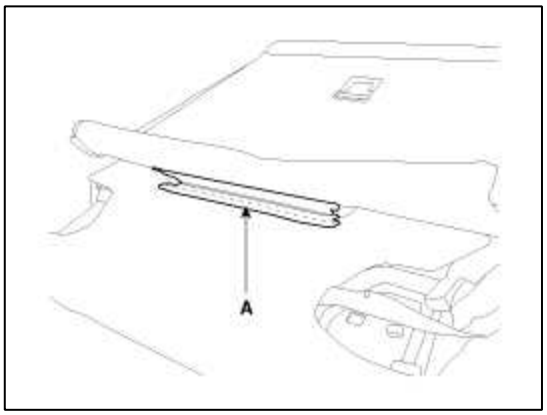
4. Remove the rear back bezel (B).



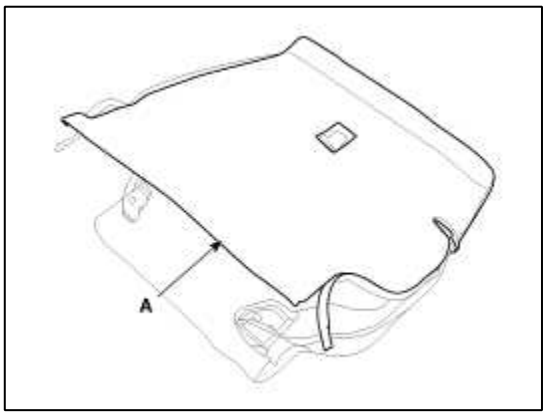
5. Using a screwdriver or remover, remove the tether anchor garnish (A).



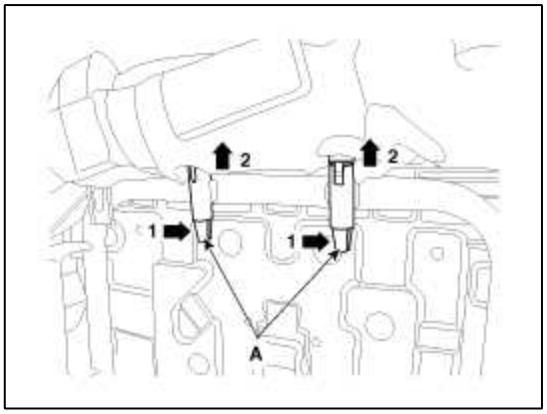
6. Remove the rear seat back lower mounting protector (A).



7. Zip off the rear seat back cover (A), and then full it up.

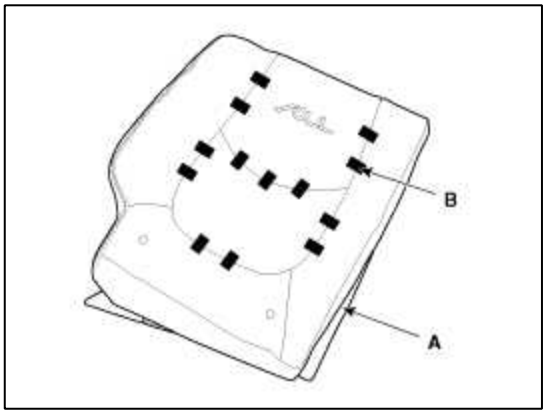


8. Pull out the headrest guides (A) while pinching the end of the guides, and remove them.



9. Remove the rear seat back cover from the rear seat back frame.

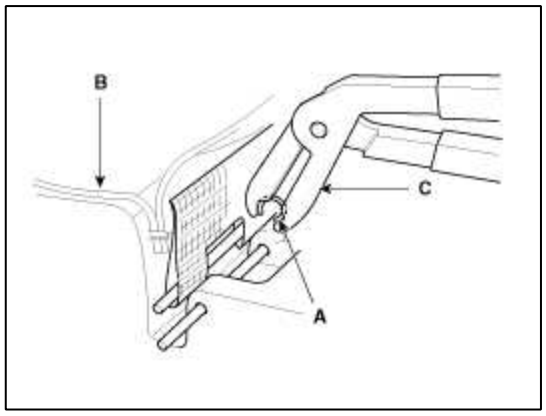
10. After removing the hog-ring clips (B) on the rear of seat back and remove the rear seat back cover (A).



11. Installation is the reverse of removal.

NOTE

- To prevent wrinkles, make sure the material is stretched evenly over the cover (B) before securing the hog-ring clips (A).
- Replace the hog ring clips with new ones using special tool [C (09880-4F000)].



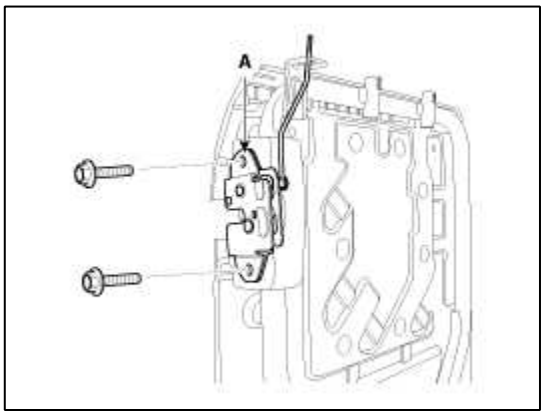
Rear Seat Latch Replacement [RH]

CAUTION

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

1. Remove the following items first :
   A. Rear seat back assembly [RH]
   B. Rear seat back cover [RH]
2. After loosening the mounting bolts, then remove the rear seat latch assembly (A).

Tightening torque :
19.6 ~ 29.4 N.m (2.0 ~ 3.0 kgf.m, 14.5 ~ 21.7 lb-ft)



3. Installation is the reverse of removal.

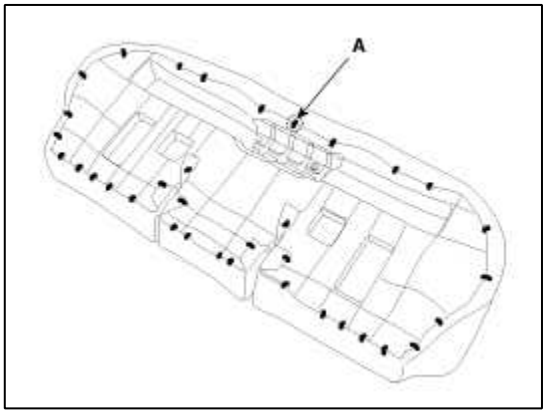
Rear Seat Cushion Cover Replacement

CAUTION

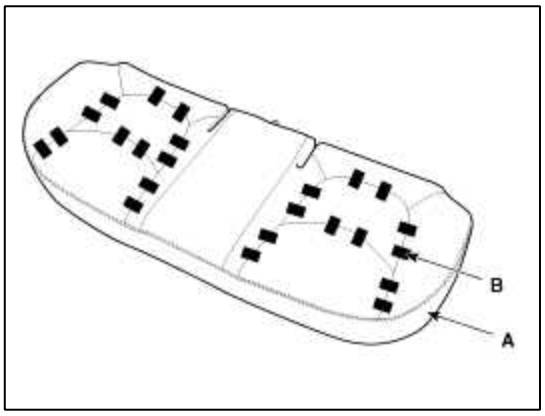
- When prying with a flat-tip screwdriver, wrap it with protective tape, and apply protective tape around the related parts your hands.
- Put on gloves to protect your hands.

1. Remove the following items first :
   A. Rear seat cushion assembly

2. Remove the hog-ring clips (A).



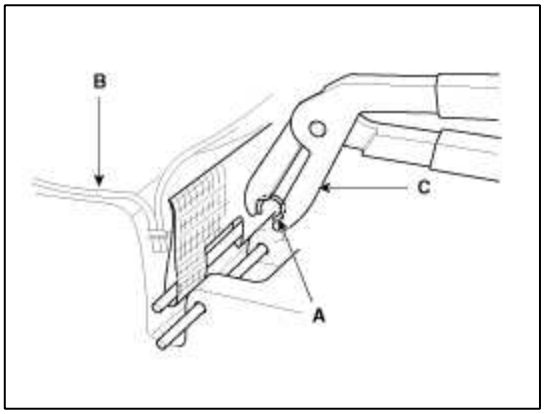
3. After removing the hog-ring clips (B) on the rear of seat cushion and remove the rear seat cushion cover (A).



4. Installation is the reverse of removal.

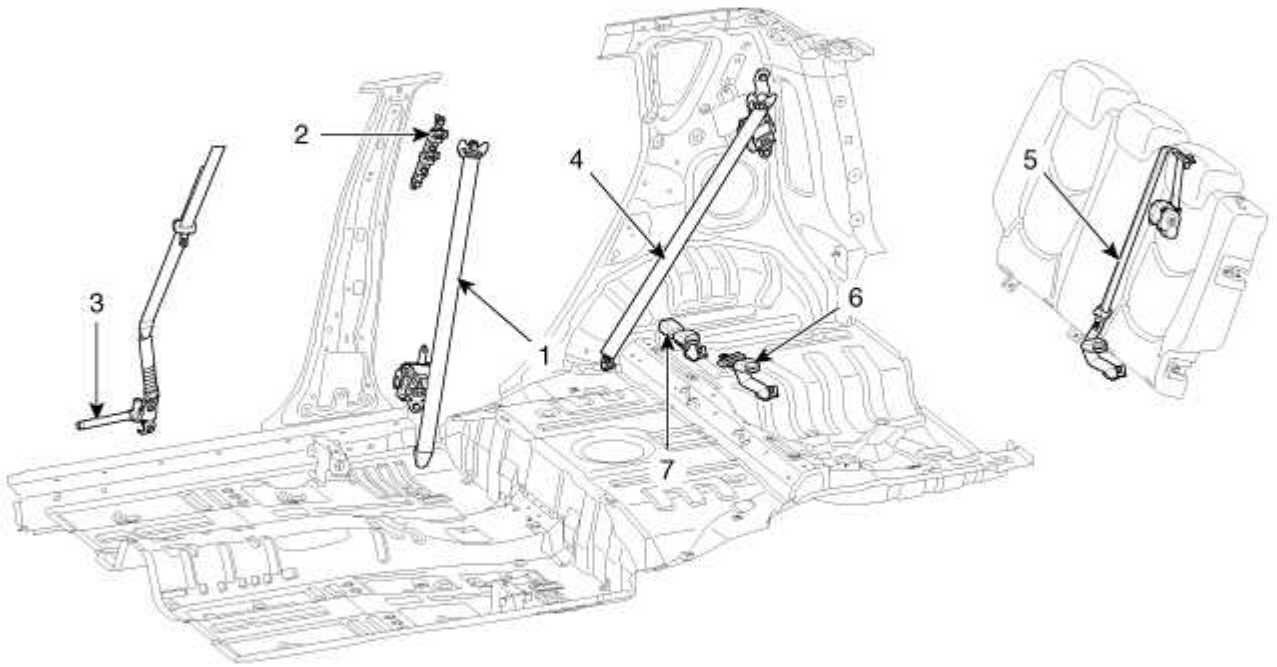
NOTE

- To prevent wrinkles, make sure the material is stretched evenly over the cover (B) before securing the hog-ring clips (A).
- Replace the hog ring clips with new ones using special tool [C (09880-4F000)].



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

Components



1. Front seat belt 2. Height adjuster 3. Front seat belt anchor pretensioner 4. Rear seat belt	5. Center rear seat belt 6. Rear seat belt buckle [LH] 7. Rear seat belt buckle [RH]

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

Replacement

Front Seat Belt Replacement

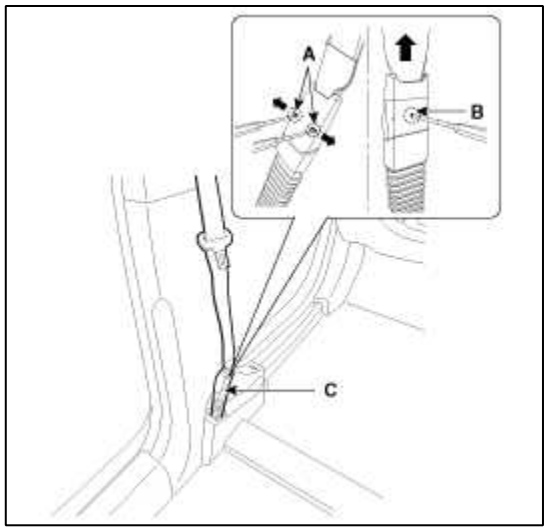
CAUTION

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

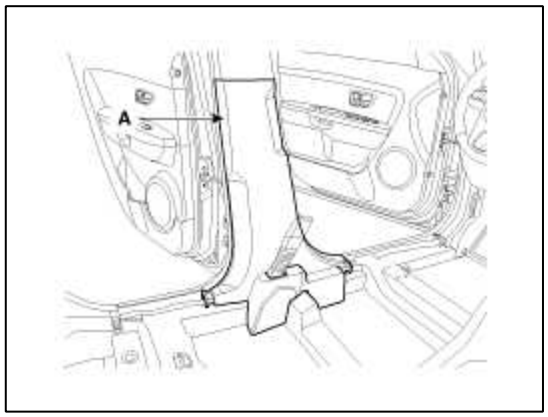
1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.

2. Remove the following items fist :
   A. Front seat assembly.
      (Refer to the BD group - "Front Seat")
   B. Front door scuff trim & Rear door scuff trim.
      (Refer to the BD group - "Interior Trim")

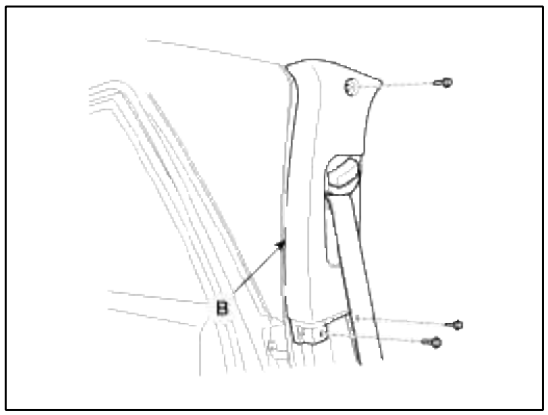
3. To remove the seat belt anchor pretensioner (C), keep on pushing the lock pins (A) as arrow direction. And then remove the seat belt after pushing the lock pin (B).



4. Using a screwdriver or remover, remove the center pillar lower trim (A).



5. After loosening the mounting bolts, then remove the center pillar upper trim (B).

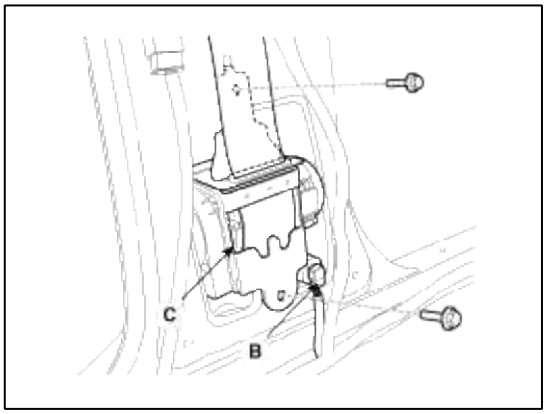


6. After loosening the mounting bolt, then remove the front seat belt upper anchor (A).

Tightening torque :
39.2 ~ 53.9 N.m (4.0 ~ 5.5 kgf.m, 28.8 ~ 39.8 lb-ft)



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



8. Installation is the reverse of removal.

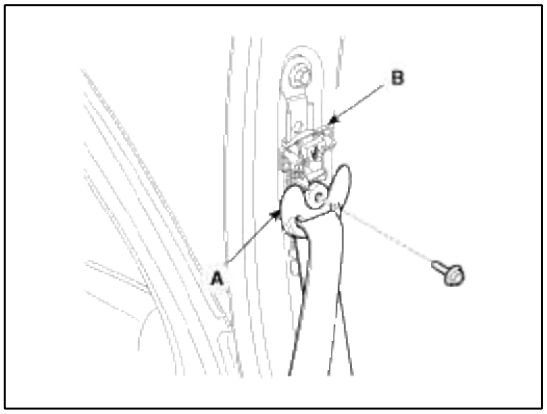
Hight adjuster replacement

1. Remove the following items first :
   A. Front seat assembly
      (Refer to the BD group – “Front Seat”)
   B. Front door scuff trim & Rear door scuff trim
      (Refer to the BD group - "Interior Trim")
   C. Front seat belt lower anchor
   D. Center pillar lower trim
      (Refer to the BD group - "Interior Trim")
   E. Center pillar upper trim
      (Refer to the BD group - "Interior Trim")

2. After loosening the mounting bolt, then remove the front seat belt upper anchor (A).

3. After loosening the mounting bolt, then remove the height adjustor (B).

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

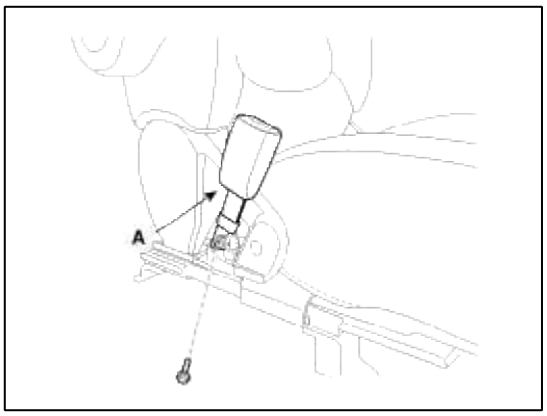


4. Installation is the reverse of removal.

Front Seat Belt Buckle Replacement

1. Remove the following items first.
   A. Front seat assembly.
      (Refer to the BD group – "Front Seat")
2. Remove the wire harness of buckle from seat.
3. After loosening the mounting bolt, then remove the seat belt buckle (A).

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



4. Installation is the reverse of removal.

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

Replacement

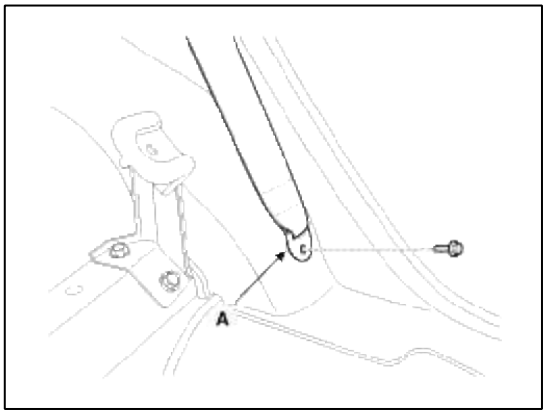
Seat belt relacement

CAUTION

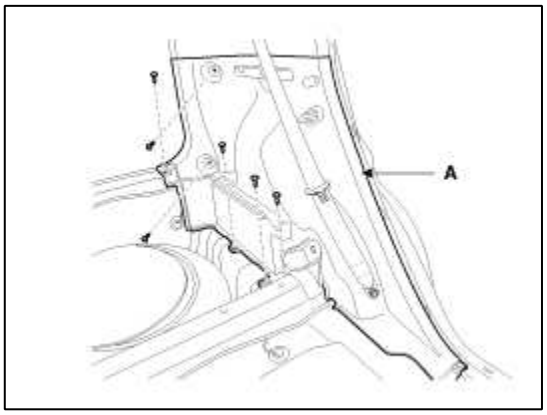
- When installing the belt, make sure not to damaged the pretensioner.

1. Remove the following items first :
   A. Rear seat assembly
      (Refer to the BD group - "Rear Seat")
   B. Rear door scuff trim
      (Refer to the BD group - "Interior Trim")
   C. Transverse trim
      (Refer to the BD group - "Interior Trim")
2. After loosening the mounting bolt, then remove the rear seat belt lower anchor (A).

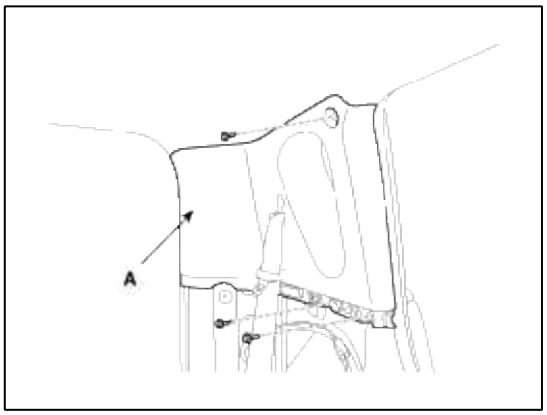
Tightening torque :
39.2~53.9 N.m (4.0~5.5kgf.m, 28.9~39.8lb-ft)



3. After loosening the mounting screws, then remove the luggage side trim (A).

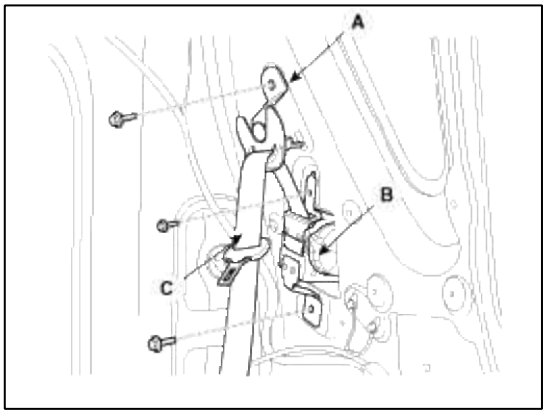


4. After loosening the mounting bolts, then remove the rear pillar trim (A).



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

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



7. Installation is the reverse of removal.

Center Rear Seat Belt Replacement

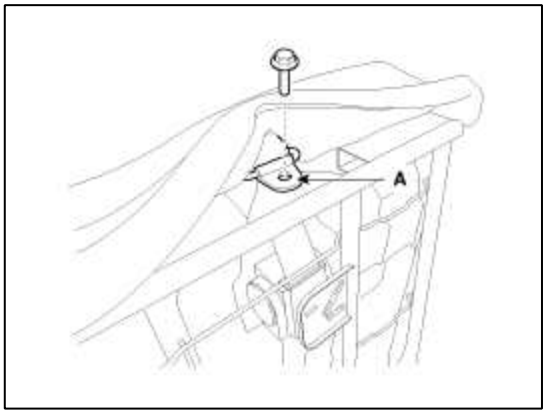
CAUTION

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

1. Remove the following items first :
   A. Rear seat back assembly [LH]
      (Refer to the BD group - "Rear Seat")
   B. Rear seat back cover [LH]
      (Refer to the BD group - "Rear Seat")

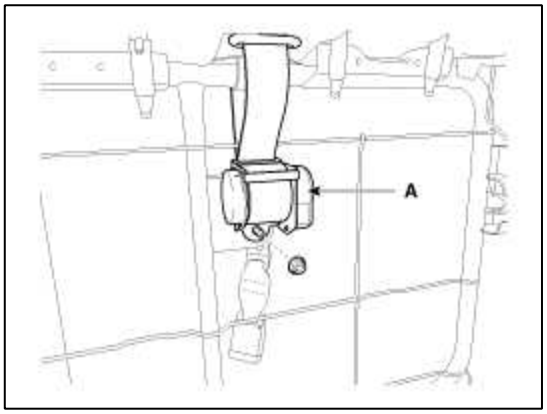
2. After loosening the mounting bolt, then remove the seat belt center upper anchor (A).

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



3. After loosening the mounting nut, then remove the seat belt center retrator (A).

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



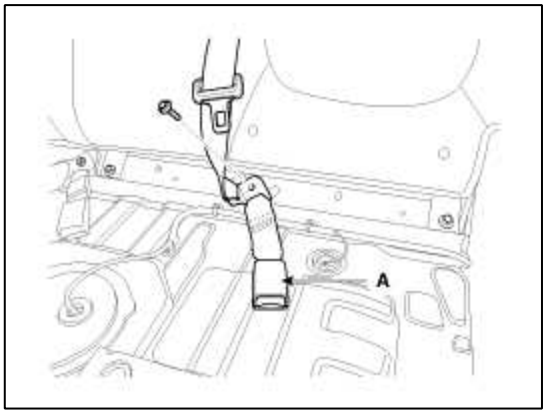
4. Installation is the reverse of removal.

Rear Seat Belt Buckle Replacement

1. Remove the following items first :
   A. Rear seat cushion assembly
      (Refer to the BD group - "Rear Seat")

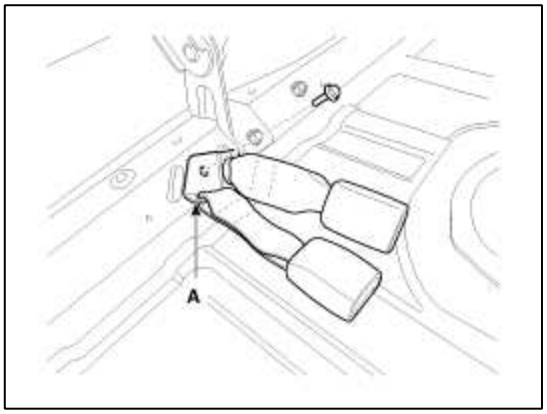
2. After loosening the mounting bolt, then remove the seat belt buckle (A).
[LH]

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



[RH]

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



3. Installation is the reverse of removal.

SOUL(AM) > 2012 > G 1.6 GDI > Body Electrical System

Body Electrical System > General Information > General Information

General Troubleshooting Information

Before Troubleshooting

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

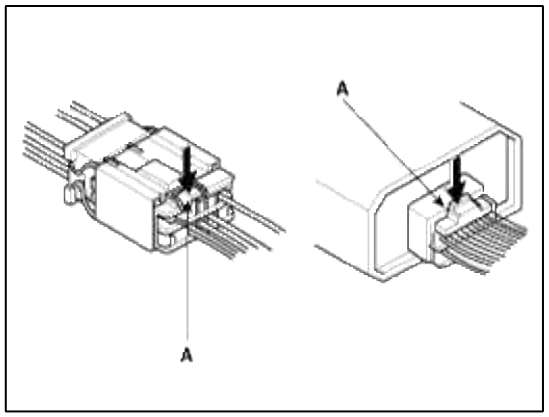
   NOTE

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

3. Check the alternator belt tension.

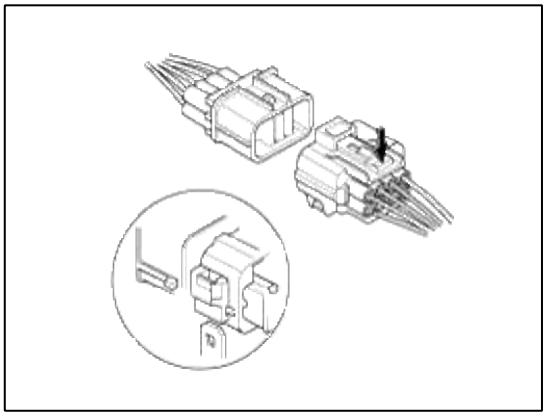
Handling Connectors

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

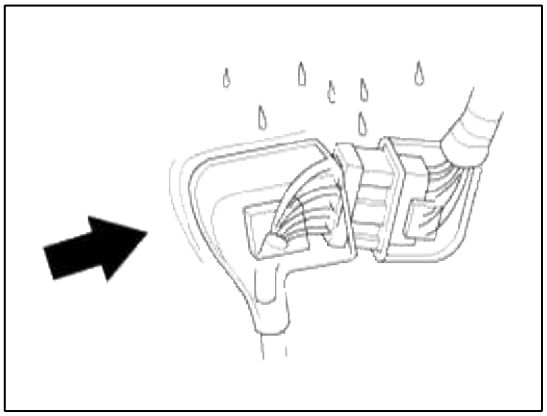


4. Some connectors have a clip on their side used to attach them to a mount bracket on the body or on another component. This clip has a pull type lock.

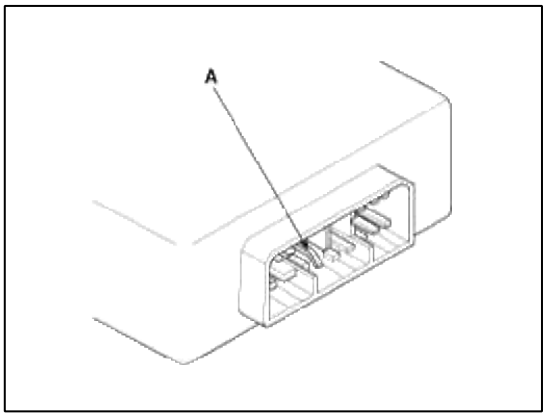
5. Some mounted connectors cannot be disconnected unless you first release the lock and remove the connector from its mount bracket (A).



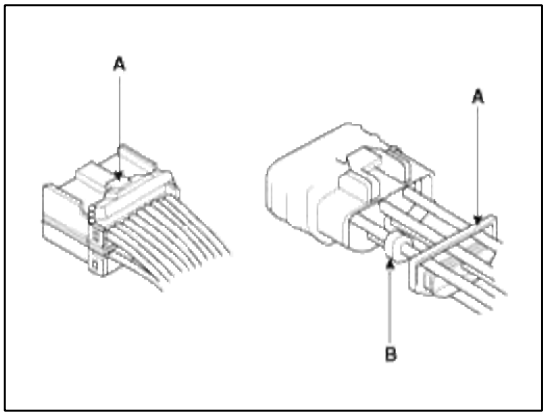
6. Never try to disconnect connectors by pulling on their wires; pull on the connector halves instead.
7. Always reinstall plastic covers.



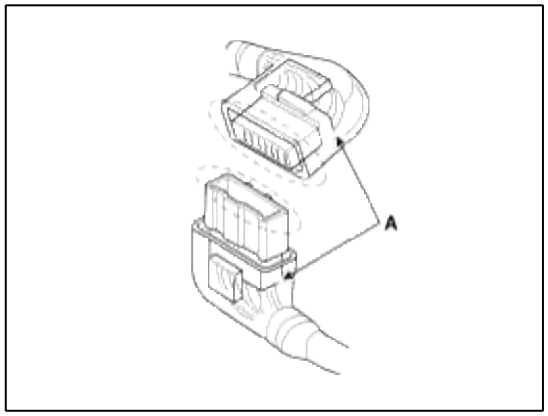
8. Before connecting connectors, make sure the terminals (A) are in place and not bent.



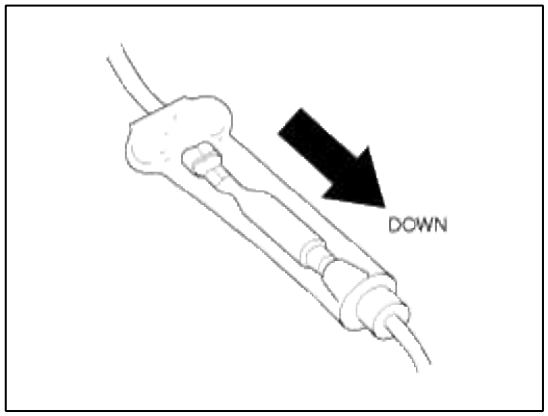
9. Check for loose retainer (A) and rubber seals (B).



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

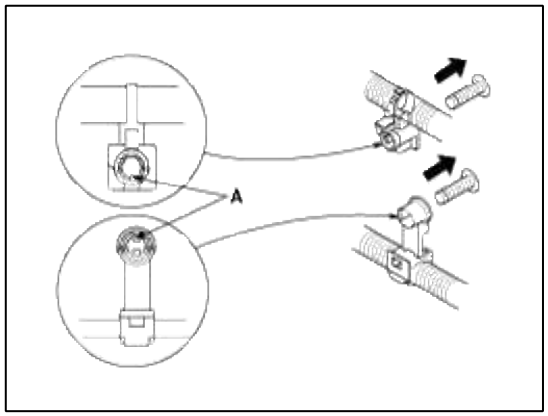


11. Insert the connector all the way and make sure it is securely locked.
12. Position wires so that the open end of the cover faces down.

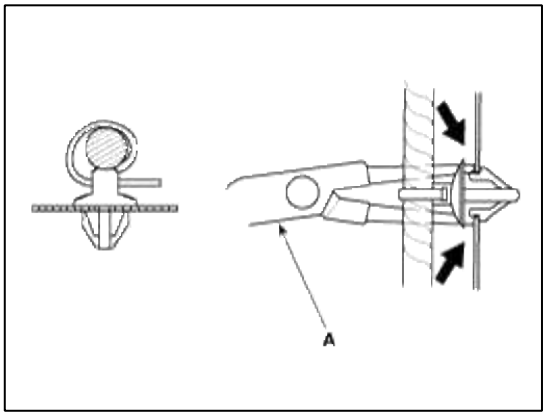


Handling Wires And Harnesses

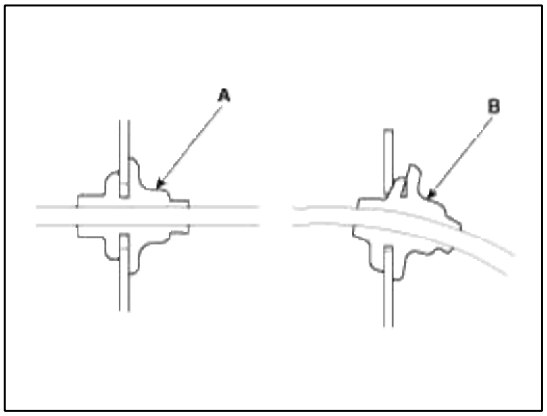
1. Secure wires and wire harnesses to the frame with their respective wire ties at the designated locations.
2. Remove clips carefully; don't damage their locks (A).



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

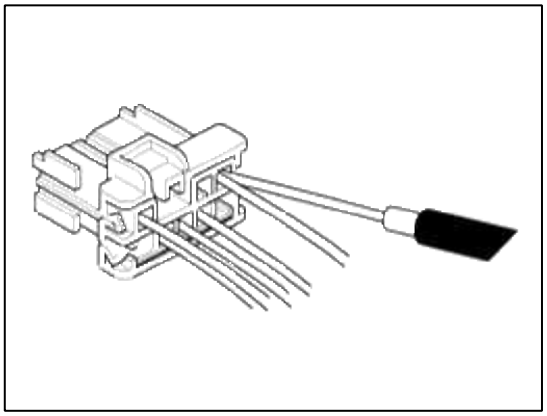


4. After installing harness clips, make sure the harness doesn't interfere with any moving parts.
5. Keep wire harnesses away from exhaust pipes and other hot parts, from sharp edges of brackets and holes, and from exposed screws and bolts.
6. Seat grommets in their grooves properly (A). Do not leave grommets distorted (B).

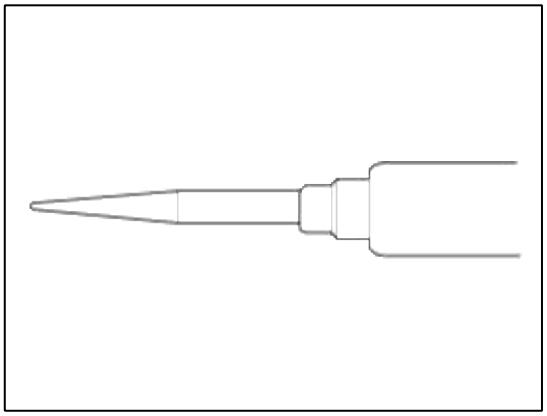


Testing And Repairs

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



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



Five-step Troubleshooting

1. Verify the complaint
   Turn on all the components in the problem circuit to verify the customer complaint. Note the symptoms. Do not begin disassembly or testing until you have narrowed down the problem area.

2. Analyze the schematic
   Look up the schematic for the problem circuit.
   Determine how the circuit is supposed to work by tracing the current paths from the power feed through the circuit components to ground. If several circuits fail at the same time, the fuse or ground is a likely cause.
   Based on the symptoms and your understanding of the circuit operation, identify one or more possible causes of the problem.

3. Isolate the problem by testing the circuit.
   Make circuit tests to check the diagnosis you made in step 2. Keep in mind that a logical, simple procedure is the key to efficient troubleshooting.
   Test for the most likely cause of failure first. Try to make tests at points that are easily accessible.

4. Fix the problem
   Once the specific problem is identified, make the repair. Be sure to use proper tools and safe procedures.

5. Make sure the circuit works
   Turn on all components in the repaired circuit in all modes to make sure you've fixed the entire problem. If the problem was a blown fuse, be sure to test all of the circuits on the fuse. Make sure no new problems turn up and the original problem does not recur.

Battery Reset

Description

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

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

Body Electrical System > Audio > Specifications

Specification

Audio

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

Speaker

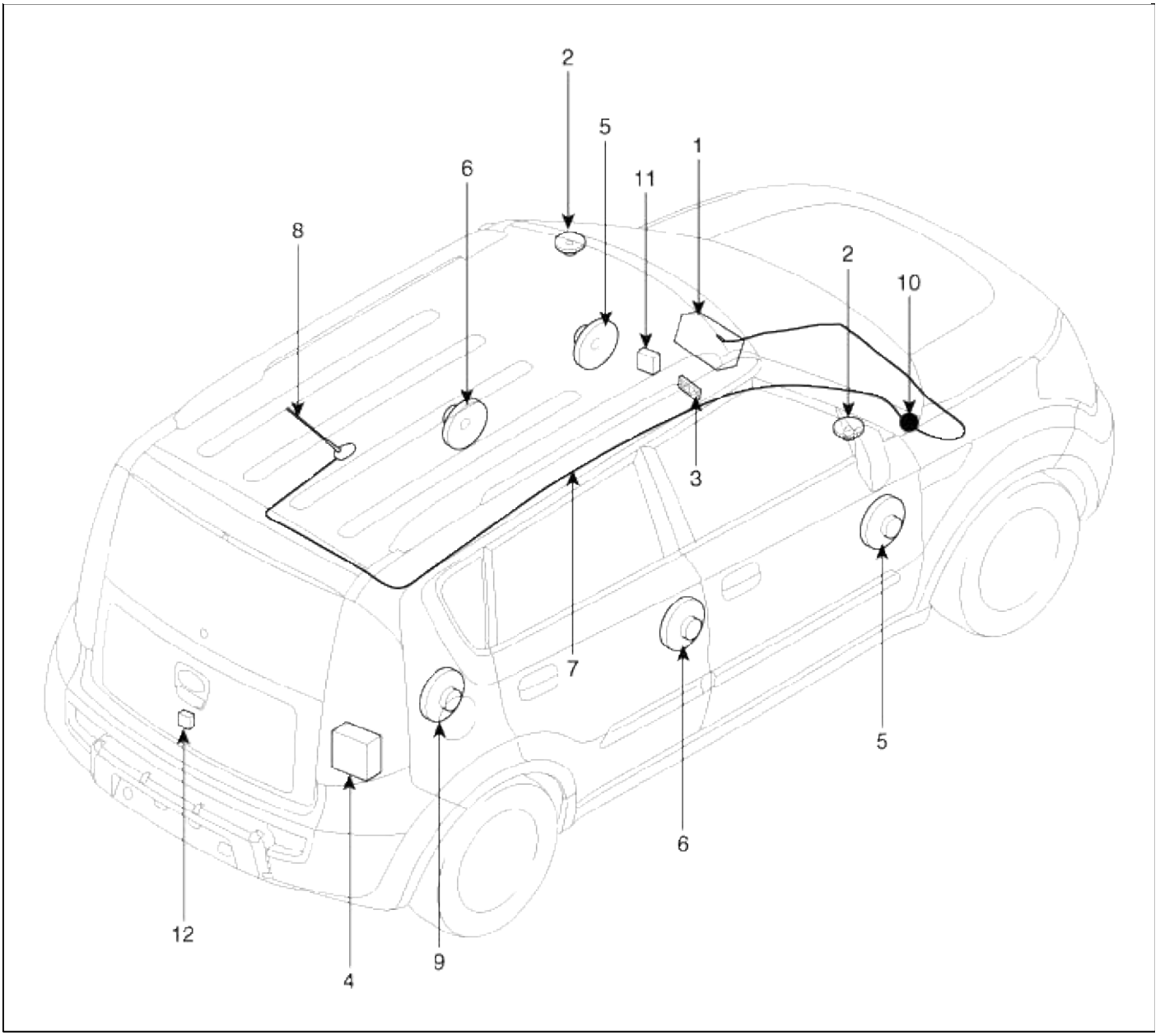
Item		Specification
Input Power (W)	Front	20 (Max. 40)
	Rear	20 (Max. 40)
	Tweeter	20 (Max. 40)
	Center	20 (Max. 40)
	Woofer	20 (Max. 40)
Speaker Impedance (Ω)	Front	4.0 ± 0.6, 2.0 ± 0.3 (External Amp)
	Rear	4.0 ± 0.6, 2.0 ± 0.3 (External Amp)
	Tweeter	4.0 ± 0.6
	Center	2.0 ± 0.3
	Woofer	2.0 ± 0.3
Speaker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

External Amplifier

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

Body Electrical System > Audio > Components and Components Location

Component Location



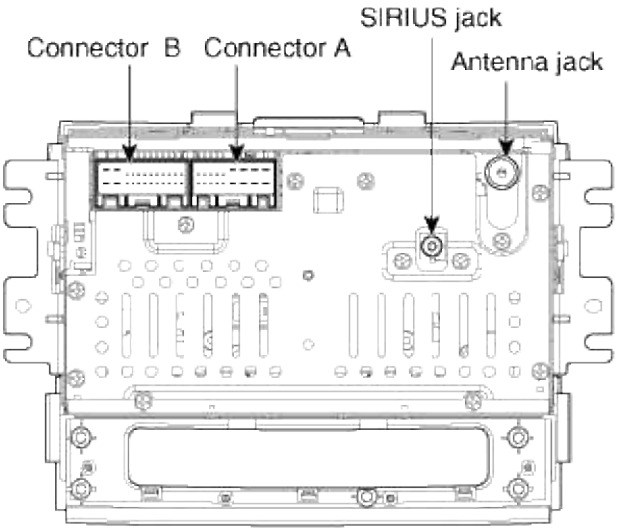
1. Audio unit	7. Antenna feeder cable
2. Tweeter speaker	8. Roof antenna
3. AUX Jack / USB Port	9. Woofer speaker
4. External amplifier	10. Antenna cable connector
5. Front door speaker	11. Advanced lighting speaker unit
6. Rear door speaker	12. Back view camera

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

Components

[RADIO/CD/MP3]





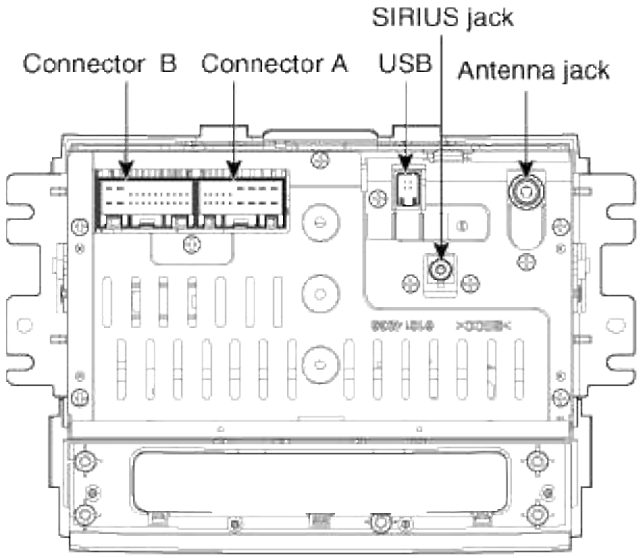


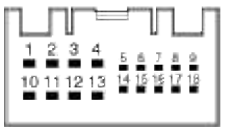
Terminal specification (PA710S)

Pin NO	Comments	Remarks	Output voltage (V)
A1	Loudspeaker Rear Left+	Needed connection to the car	Analog output
A2	Loudspeaker Front Left+	Needed connection to the car	Analog output
A3	Loudspeaker Front Right+	Needed connection to the car	Analog output
A4	Loudspeaker Rear Right+	Needed connection to the car	Analog output
A8	Rheostat from vehicle +		
A10	Loudspeaker Rear Left-	Needed connection to the car	Analog output
A11	Loudspeaker Front Left-	Needed connection to the car	Analog output
A12	Loudspeaker Front Right-	Needed connection to the car	Analog output
A13	Loudspeaker Rear Right-	Needed connection to the car	Analog output
A17	Rheostat from vehicle -		
A18	Remote supply for motorised antenna	Acc on	9V ~ 18V
B4	Steering Wheel Remote Control	Steering Wheel switch pushed	0.5V ~ 3V
B6	USB D+	USB device is inserted	3.2V ~ 3.45
B7	USB /iPod power	USB/iPod device is inserted	4.9V ~ 5.1V
B8	AUX Right Sound Signal	External Auxiliary device is Audio playing (At time of Aux jack use)	A waveform synchronized with sound is output
B9	AUX Reference Ground	Always	Below 1 ohm
B10	Bluetooth MIC+	Input the Voice Signal via MIC	A waveform synchronized with Voice data via MIC
B11	Accessory	Engine switch on(ACC)	11 ~ 14 V
B12	Battery	Always	11 ~ 14 V
B16	Speed Sensor Signal	Engine switch on(IGN), car is moved slowly	Approx. 5V Level Pulse Generation
B17	Steering Wheel Remote Control Gnd	Always	Below 1 ohm
B18	USB data line	USB device is inserted	3.2V ~ 3.45
B19	iPod detection line	iPod device is inserted	GND
B20	AUX Signal Input Detect	Auxiliary device is inserted	0V(Low) → 5V(High)
B21	AUX Left Sound Signal	External Auxiliary device is Audio playing (At time of Aux jack use)	A waveform synchronized with sound is output
B22	Bluetooth MIC-	Input the Voice Signal via MIC	A waveform synchronized with Voice data via MIC
B24	Ground	Always	Below 1 ohm

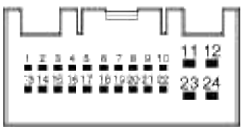
[Bristol]







Connector A



Connector B



No.	USB connector
1	USB 5V
2	USB D(-)
3	USB D(+)
4	USB GND

Terminal specification (UVO)

Pin NO	Comments	Remarks	Output voltage (V)
A5	SPDIF_GND	Needed connection to the car	Digital Audio Output
A6	SPDIF_DN	Needed connection to the car	Digital Audio Output
A8	Rheostat from vehicle +		
A17	Rheostat from vehicle -		
A18	Remote supply for motorised antenna	Acc on	9V ~ 18V
B1	CAN_HIGH	Needed connection to the car	Communication with external amp
B4	Steering Wheel Remote Control	Steering Wheel switch pushed	0.5V ~ 3V
B6	Rear View Camera Video Signal	Gearbox is in R-position	A wavefor synchronized with video
B7	Rear View Camera Power Supply	Gearbox is in R-position	3.2V ~ 3.45
B8	AUX Right Sound Signal	External Auxiliary device is Audio playing (At time of Aux jack use)	A waveform synchronized with sound is output
B9	AUX Reference Ground	Always	Below 1 ohm
B10	Bluetooth MIC+	Input the Voice Signal via MIC	A waveform synchronized with Voice data via MIC
B11	Accessory	Engine switch on(ACC)	11 ~ 14 V
B12	Battery	Always	11 ~ 14 V
B13	CAN_LOW	Needed connection to the car	Communication with external amp
B15	Auto Light Signal	Needed connection to the car	
B16	Speed Sensor Signal	Engine switch on(IGN), car is moved slowly	Approx. 5V Level Pulse Generation
B17	Steering Wheel Remote Control Gnd	Always	Below 1 ohm
B18	Rear View Camera Video GND	Gearbox is in R-position	A wavefor synchronized with video
B19	R-Position	Needed connection to the car	Gearbox is in R-position
B20	AUX Signal Input Detect	Auxiliary device is inserted	0V(Low) → 5V(High)
B21	AUX Left Sound Signal	External Auxiliary device is Audio playing (At time of Aux jack use)	A waveform synchronized with sound is output
B22	Bluetooth MIC-	Input the Voice Signal via MIC	A waveform synchronized with Voice data via MIC
B23	Rear View Camera Power GND	Always	Below 1 ohm
B24	Ground	Always	Below 1 ohm

Body Electrical System > Audio > Audio Unit > Description and Operation

Description

Introduction to CD

- If the temperature inside the car is too high, open the car windows for ventilation before using your car audio.

- It is illegal to copy and use MP3/WMA/ AAC/WAVE files without permission. Use CDs that are created only by lawful means.
- Do not apply volatile agents such as benzene and thinner, normal cleaners and magnetic sprays made for analogue disc onto CDs.
- To prevent the disc surface from getting damaged. Hold and carry CDs by the edges or the edges of the center hole only.
- Clean the disc surface with a piece of soft cloth before playback (wipe it from the center to the outside edge).
- Do not damage the disc surface or attach pieces of sticky tape or paper onto it.
- Make sure on undesirable matter other than CDs are inserted into the CD player (Do not insert more than one CD at a time).
- Keep CDs in their cases after use to protect them from scratches or dirt.
- Depending on the type of CD-R/CD-RW CDs, certain CDs may not operate normally according to manufacturing companies or making and recording methods. In such circumstances, if you still continue to use those CDs, they may cause the malfunction of your car audio system.

NOTE

Playing an Incompatible Copy-Protected Audio CD
Some copy protected CDs, which do not comply with the international audio CD standards (Red Book), may not play on your car audio. Please note that if you try to play copy protected CDs and the CD player does not perform correctly the CDs maybe defective, not the CD player.

Introduction to USB

CAUTION

- To use an external USB device, make sure the device is not connected when starting up the vehicle. Connect the device after starting up.
- If you start the engine when the USB device is connected, it may damage the USB device. (USB flashdrives are very sensitive to electric shock.)
- If the engine is started up or turned off while the external USB device is connected, the external USB device may not work.
- It may not play non-authentic MP3 or WMA files.

1. It can only play MP3 files with the compression rate between 8Kbps~320Kbps.
2. It can only play WMA music files with the compression rate between 8Kbps~320Kbps.

- Take precautions for static electricity when connecting or disconnecting the external USB device.
- An encrypted MP3 PLAYER is not recognizable.
- Depending on the condition of the external USB device, the connected external USB device can be unrecognizable.
- When the formatted byte/sector setting of External USB device is not either 512BYTE or 2048BYTE, then the device will not be recognized.
- Use only a USB device formatted to FAT 12/16/32.
- USB devices without USB I/F authentication may not be recognizable.
- Make sure the USB connection terminal does not come in contact with the human body or other objects.
- If you repeatedly connect or disconnect the USB device in a short period of time, it may break the device.
- You may hear a strange noise when connecting or disconnecting a USB device.

- If you disconnect the external USB device during playback in USB mode, the external USB device can be damaged or may malfunction. Therefore, disconnect the external USB device when the audio is turned off or in another mode. (e.g, Radio, XM or CD)
- Depending on the type and capacity of the external USB device or the type of the files stored in the device, there is a difference in the time taken for recognition of the device.
- Do not use the USB device for purposes other than playing music files.
- Use of USB accessories such as rechargers or heaters using USB I/F may lower performance or cause trouble.
- If you use devices such as a USB hub purchased separately, the vehicle's audio system may not recognize the USB device. In that case, connect the USB device directly to the multimedia terminal of the vehicle.
- If the USB device is divided by logical drives, only the music files on the highest-priority drive are recognized by car audio.
- Devices such as MP3 Player/ Cellular phone/Digital camera can be unrecognizable by standard USB I/F can be unrecognizable.
- Some non-standard USB devices
  (METAL COVER TYPE USB) can be unrecognizable.
- Some USB flash memory readers (such as CF, SD, microSD, etc.) or external-HDD type devices can be unrecognizable.
- Music files protected by DRM (DIGITAL RIGHTS MANAGEMENT) are not recognizable.
- The data in the USB memory may be lost while using this audio. Always back up important data on a personal storage device.
- Please avoid using USB memory products which can be used as key chains or cellular phone accessories as they could cause damage to the USB jack. Please make certain only to use plug type connector products as shown below.

Introduction to iPod

NOTE

- Some iPod models might not support the communication protocol and the files will not be played.
  Supported iPod models:

- iPod Mini
- iPod 4th(Photo) ~ 6th(Classic) generation
- iPod Nano 1st~4th generation
- iPod Touch 1st~2nd generation

- The order of search or playback of songs in the iPod can be different from the order searched in the audio system.
- If the iPod disabled due to its own malfunction, reset the iPod. (Reset: Refer to iPod manual)
- An iPod may not operate normally on low battery.
- Some iPod devices, such as the iPhone, can be connected through the Bluetooth® interface. The device must have audio Bluetooth® capability (such as for stereo headphone Bluetooth®). The device can play, but it will not be controlled by the audio system.

CAUTION

- The Hyundai iPod Power Cable is needed in order to operate iPod with the audio buttons on the audio system. The USB cable provided by Apple may cause malfunction and should not be used for Hyundai vehicles.
  The Hyundai iPod Power Cable may be purchased through your Hyundai Dealership.
- When connecting iPod with the iPod Power Cable, insert the connector to the multimedia socket completely. If not inserted completely, communications between iPod and audio may be interrupted.
- When adjusting the sound effects of the iPod and the audio system, the sound effects of both devices will overlap and might reduce or distort the quality of the sound.
- Deactivate (turn off) the equalizer function of an iPod when adjusting the audio system's volume, and turn off the equalizer of the audio system when using the equalizer of an iPod.
- When the iPod cable is connected, the system can be switched to AUX mode even without iPod device and may cause noise. Disconnect the iPod cable when you are not using the iPod device.
- When not using iPod with car audio, detach the iPod cable from iPod. Otherwise, iPod may remain in accessory mode, and may not work properly.

Introduction to Bluetooth

■ What is Bluetooth®?

Bluetooth® is a wireless technology that allows multiple devices to be connected in a short range, low-powered devices like hands-free, stereo headset, wireless remocon, etc. For more information, visit the Bluetooth® website at www.Bluetooth.com

■ General Features

- This audio system supports Bluetooth® hands-free and stereo-headset features.
- HANDS-FREE feature: Making or receiving calls wirelessly through voice recognition.
- STEREO-HEADSET feature: Playing music from cellular phones (that supports A2DP feature) wirelessly.
- Voice recognition engine of the Bluetooth® system supports 3 types of languages:
- English
- US Spanish
- Canadian French

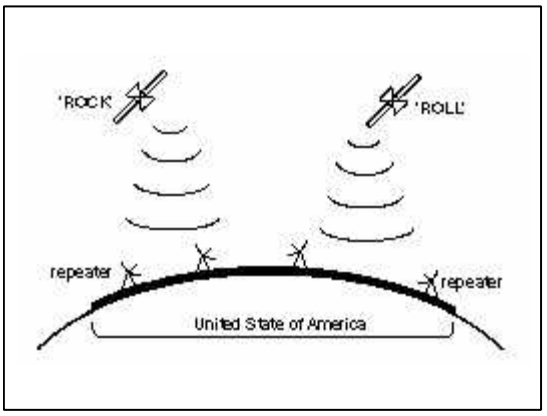
NOTE

- The phone must be paired to the system before using Bluetooth® features.
- Only one selected (linked) cellular phone can be used with the system at a time.
- Some phones are not fully compatible with this system.

Introduction to XM radio

XM-Radio is a Satellite Based Radio Broadcast System that operates around 2.3 GHz from two 15,000 watts satellites; one named "ROCK," at 115 Degrees West, the other named "ROLL" at 85.0 Degrees West. Or another way of saying, the satellites are positioned over the East and West Coasts of US. The service covers only US.
Due to the limitations of satellite transmission, the signal is not able to penetrate buildings, so it cannot effectively cover dense urban areas. The terrestrial repeater network extends SDARS coverage and allows providers to reach the greatest number of subscribers and provide quality coverage. The repeaters receive the XM signal directly from the satellites and then re-transmit it to XM radios anywhere.
XM provides digitalized radio programs in terms of channels. Each channel is a program that the user can tune to. A category is a group of channels. Examples of categories are classical, news and sports.
XM is a paid service. Users have to make a subscription to XM before they can enjoy the programs. However,

XM does give some free-to-air channels. The users can listen to one of them without making any subscription.



Introduction to HD Radio

This audio system is able to receive standard analog FM/AM radio broadcasting as well as digital HD Radio FM/AM broadcasting.

HD Radio technology provides digital and analog reception using existing FM and AM broadcasting frequencies. Currently, radio stations broadcasting an HD Radio signal are operating in a hybrid mode of both, analog and digital, in order to reach both receivers. In both modes, analog and digital, the broadcasted program contents is the same(except of multicasting, see below).

Eventually, as analog receivers are replaced by digital ones, radio stations may be able to turn off their analog broadcasting and use only the digital one.

Multicasting

HD Radio FM stations are able to broadcast multiple digital program streams(channels) over a single FM frequency. For example, a HD Radio FM station can run a main channel of music and a sub channel of news(or even two different music channels) at one frequency. But only the program content of the main channel is also broadcasted analog.

HD Radio signal delay

"To overcome the delay that digital systems inherently produce, HD Radio technology first uses the audio signal of the analog broadcasting when you tune to an AM station or to the main channel of a FM station. After that, the system will blend from analog to digital signal.Normally, this blending is very smooth. If you experience a skip in program content of several seconds, the radio station has not implemented HD Radio broadcasting correctly. This is not a problem with your audio system.Due to the fact that sub channels are only broadcasting digital, blending from analog to digital signal is not possible if you tune to a sub channel. In this case playback of the sub channel starts after several seconds, this is a normal function."

Automatic switching between digital and analog broadcasting

"If the reception of the digital signal is lost, the system switches automatically to the analog signal. As soon as the digital signal is available again it will switch back. Due to the fact that sub channels are only broadcasted digital, first the system mutes playback if you have tuned to a sub channel and the digital signal is lost.Additionally, the main line shows the message No HD signal in place of station name.Second, after 1 minute with the digital signal lost, the system will automatically tune to the analog signal of the corresponding frequency."

Text based information

HD Radio stations are able to broadcast text based informations, e.g. station name, song title and artist name. The Driver Information System is able to display these informations.

Itroduction to UVO System

Description

Kia UVO is all about letting you see more, do more and connect more.

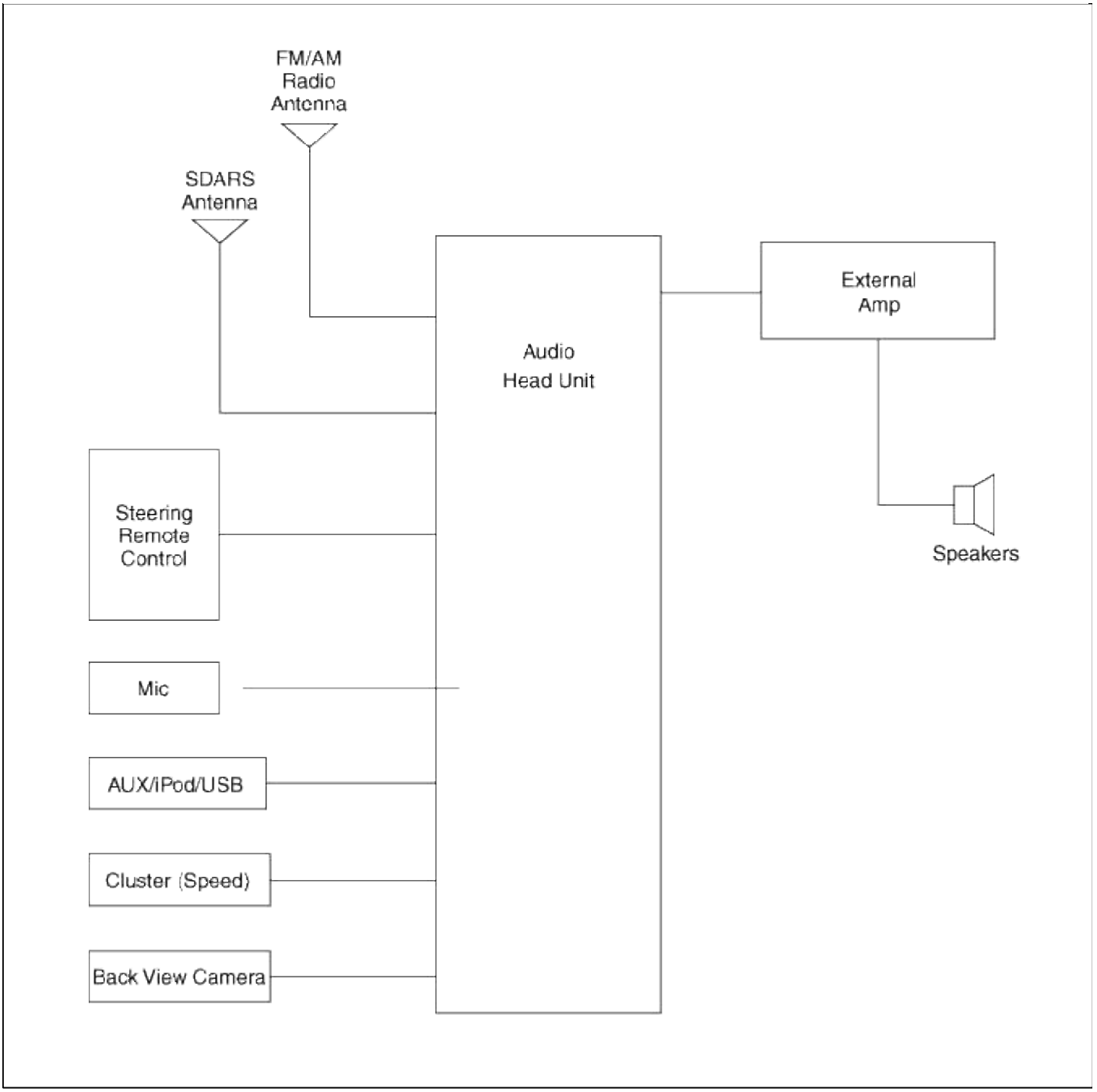
With Microsoft's advanced voice-recognition technology, you get hands-free access to your music and Bluetooth®-enabled phone.

Function

1. Color Touch Screen
   The simple, intuitive menus on UVO's vivid color LCD touch screen make operation easy.
2. Advanced Voice Control
   Microsoft speech technology can learn multiple users' speaking patterns, and responds quickly to long phrases.
3. Easy Feature Updates
   With its flexible Windows® Embedded Automotive platform, the UVO system is incredibly easy to update.
4. HD Radio™ Technology
   UVO offers available HD Radio™ Technology - the digital evolution of AM and FM radio.
5. Rear-Camera Display
   Whenever you shift into reverse, UVO's rear-camera display lets you see behind your vehicle.
6. Digital Jukebox
   UVO's in-dash hard drive is large enough to hold up to 700 megabytes of music.

Body Electrical System > Audio > Audio Unit > Schematic Diagrams

System Block Diagram



Body Electrical System > Audio > Audio Unit > Repair procedures

Removal

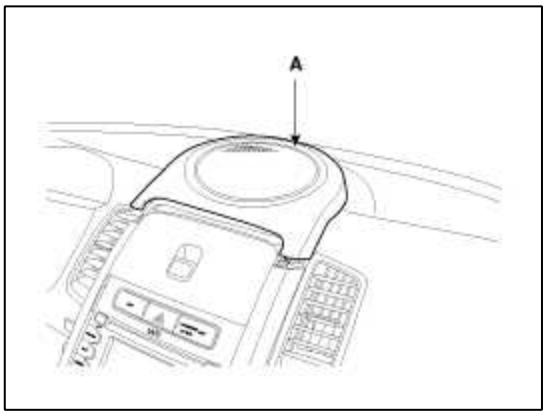
Center Fascia Panel Replacement

1. Disconnect the negative (-) battery terminal.

CAUTION

- A plastic trim tool is recommended, but if prying with a screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.

2. Using a screwdriver or remover, remove the center speaker grill (A).

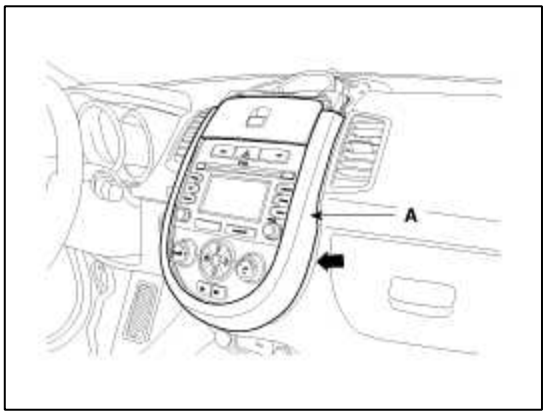


3. Put the SST (09840-1E100) into the space between the center fascia panel (A) and crash pad.

NOTE

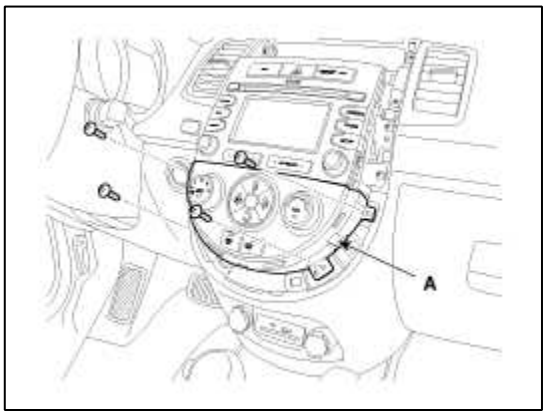
- Be care not to damage the center facia and crash pad.
- Put the SST into the area as indicated by the arrows.
- To prevent the scratch, apply protective tapes to the center fascia panel and its related parts.

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

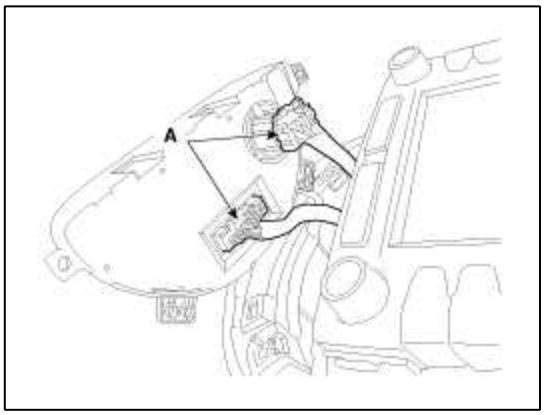


Audio Assembly Replacement

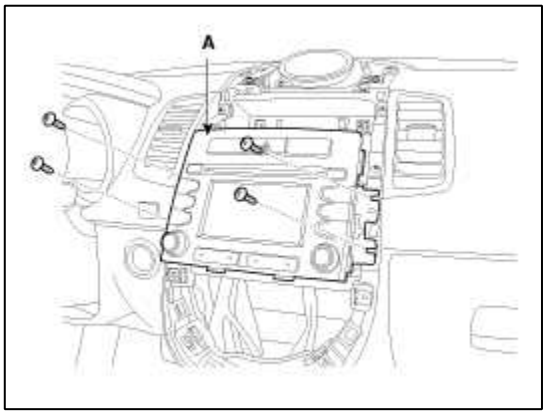
1. After loosening the mounting screws, then remove the heater control unit (A).



2. Disconnect the connectors (A).

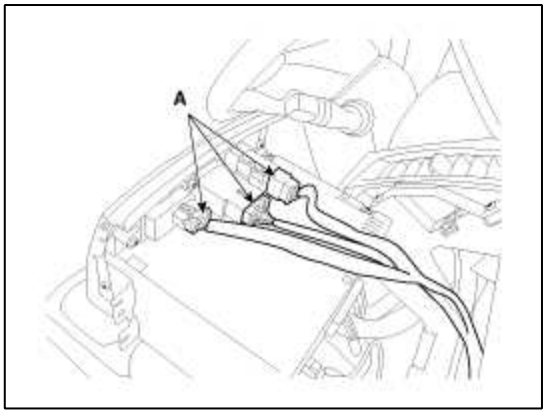


3. After loosening the mounting screws, then remove the audio assembly (A).

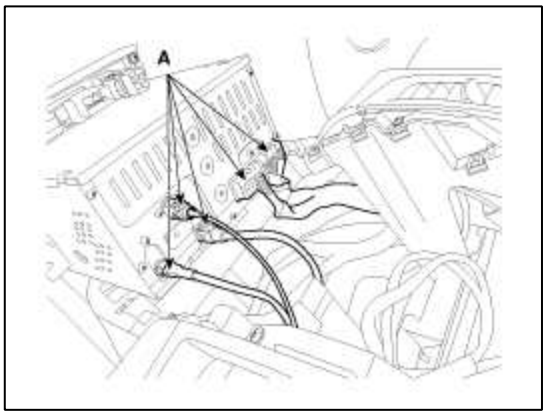


4. Disconnect the connectors (A).

[Upper]

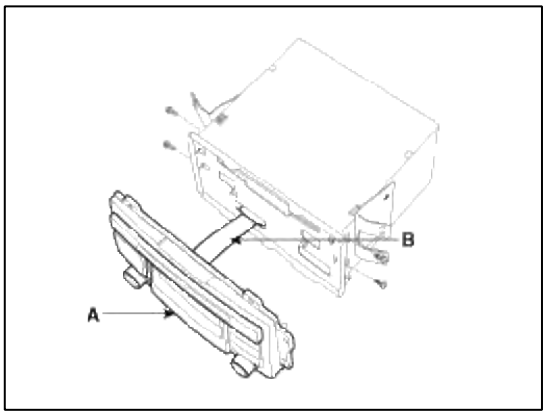


[Lower]

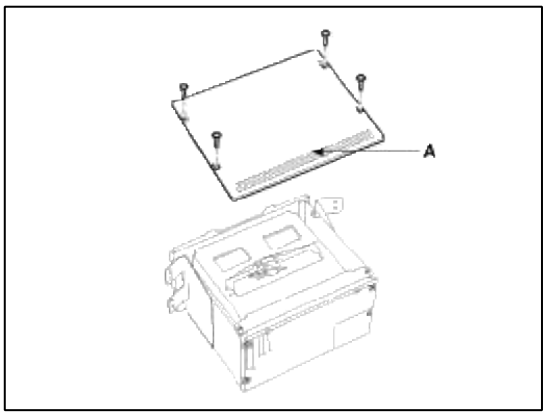


Disassembly

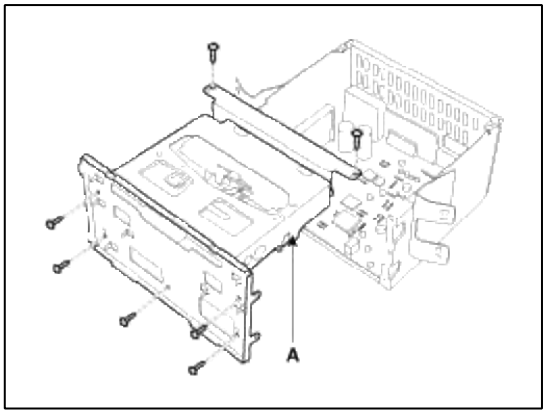
1. Disassemble the front panel(A) then disconnect the connector(B) between the unit and front panel.



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



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



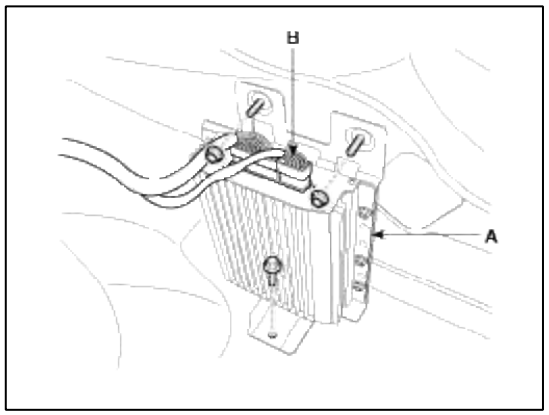
Reassembly

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

External Amplifier

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

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



Installation

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

NOTE

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

External Amplifier

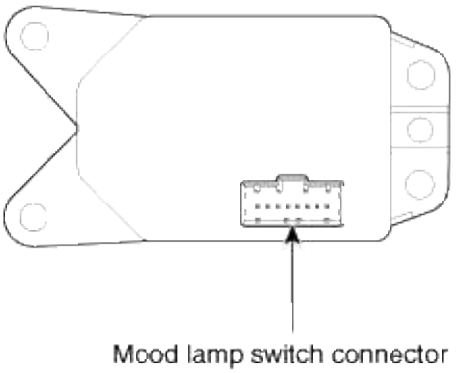
1. Install the external amplifier and connect the external amplifier connector.
2. Install the right side trunk trim.

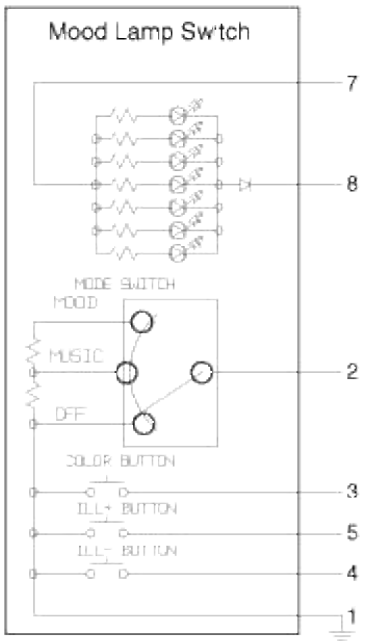
Body Electrical System > Audio > Speakers > Components and Components Location

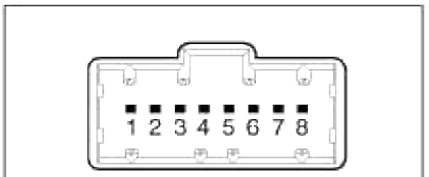
Components

[Mood Lamp Switch]



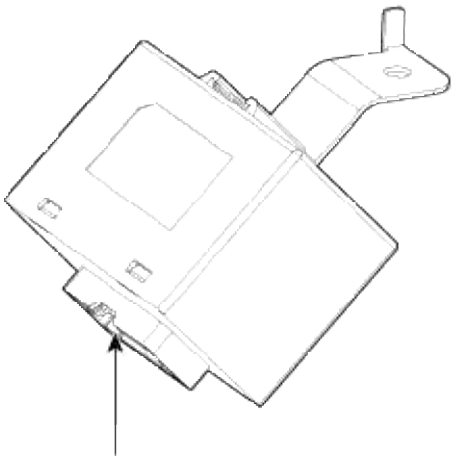


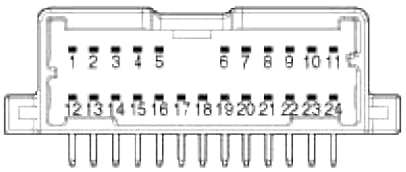




No.	Description
1	GND
2	Mode select
3	Color select
4	Illumination select (-)
5	Illumination select (+)
6	-
7	Tail lamp (+)
8	Tail lamp (-)

[Mood Lamp Unit]



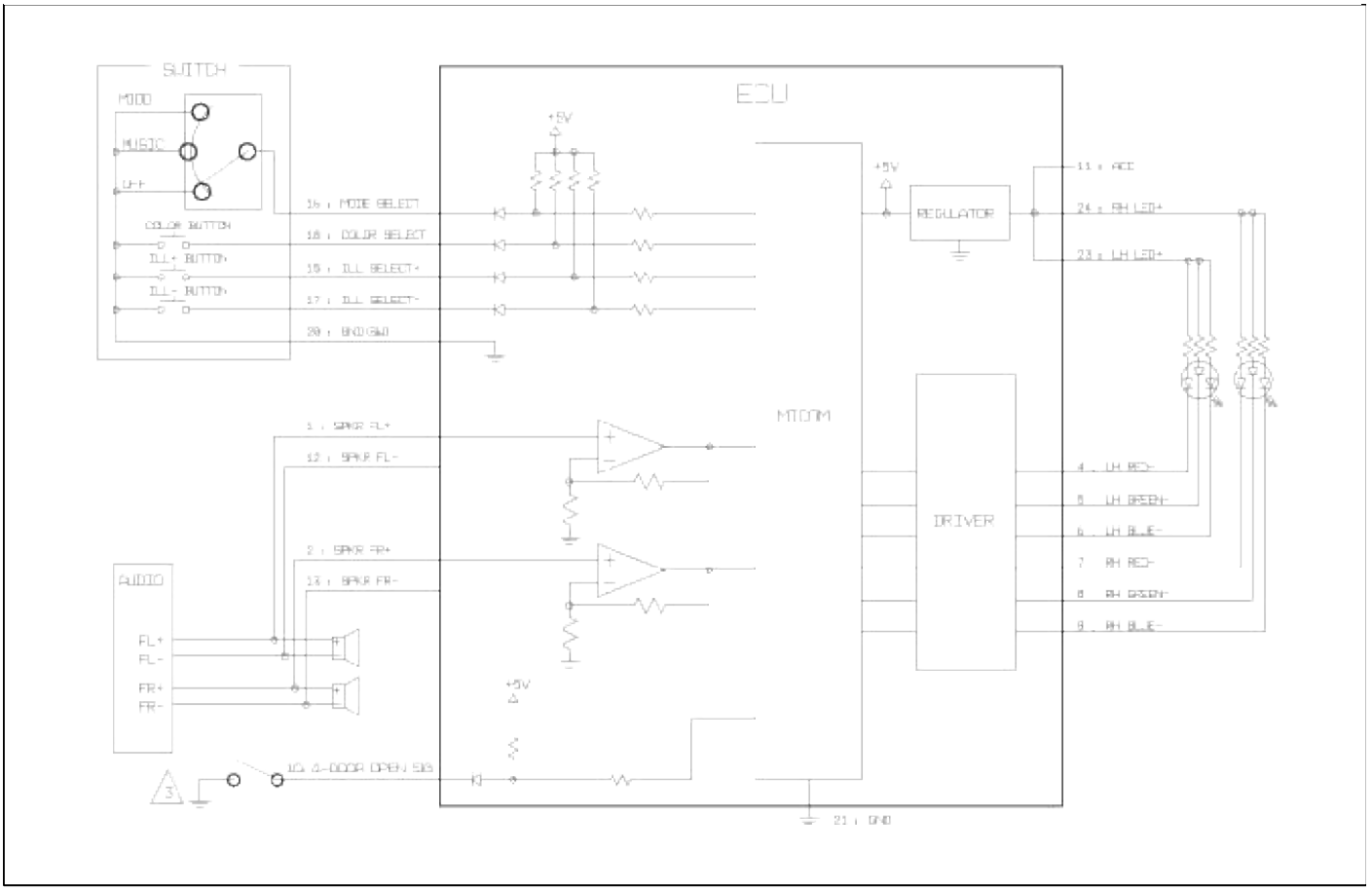


No.	Description	No.	Description
1	Speaker FL+	13	Speaker FR-
2	Speaker FR+	14	-
3	Remote Ext. AMP	15	Illumination select+
4	RED (LH)	16	Mood select
5	GREEN (LH)	17	Illumination se ect1
6	BLUE (LH)	18	Color select
7	RED (RH)	19	-
8	GREEN (RH)	20	GND (switch)
9	BLUE (RH)	21	GND
10	4 door oepn	22	-
11	ACC	23	LH LED +
12	Speaker FL-	24	RH LED +

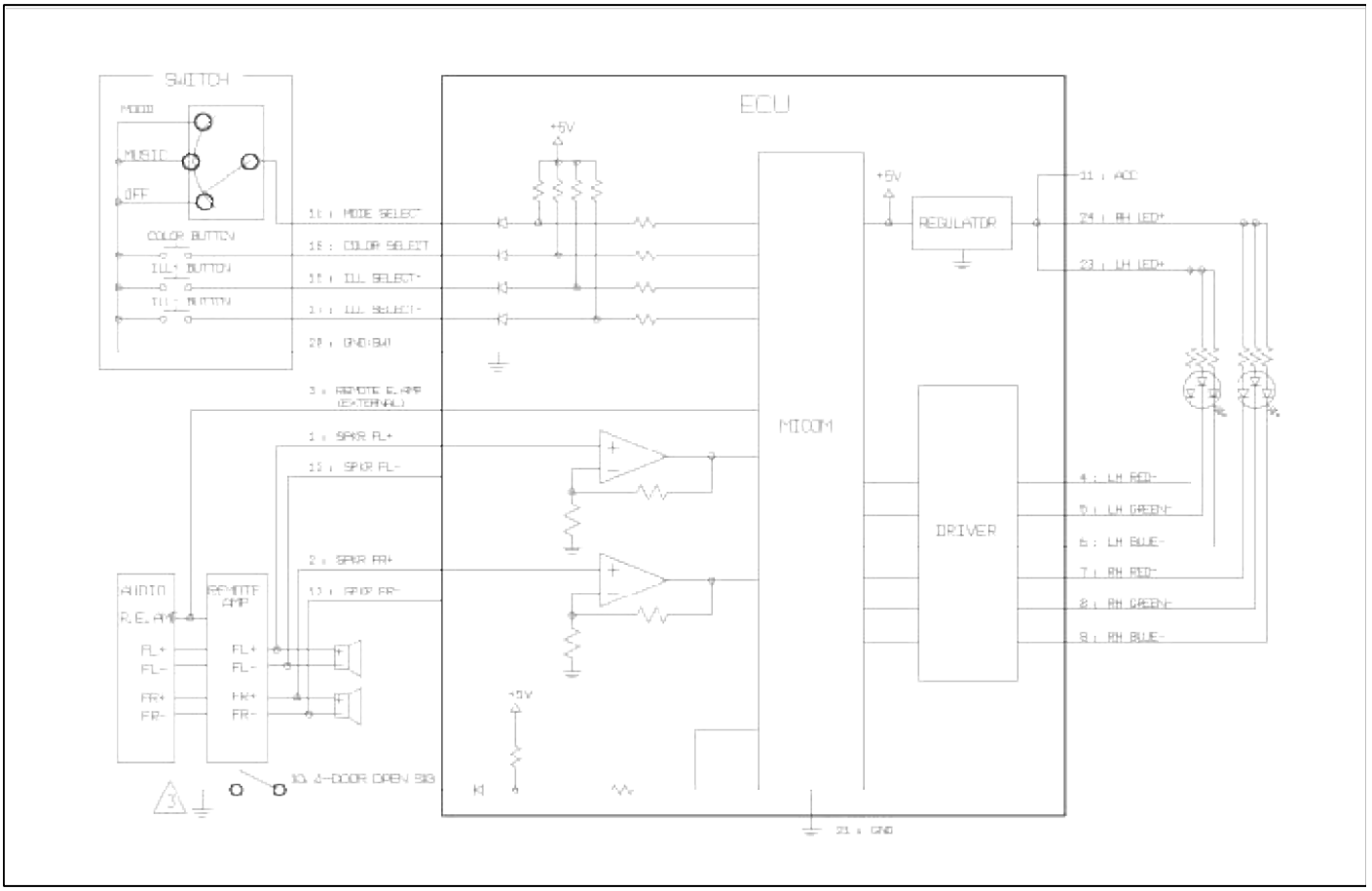
Body Electrical System > Audio > Speakers > Schematic Diagrams

Circuit diagram

[Mood lamp unit- Internal AMP]



[Mood lamp unit- External AMP]



Body Electrical System > Audio > Speakers > Description and Operation

Description

Advanced lighting speaker

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

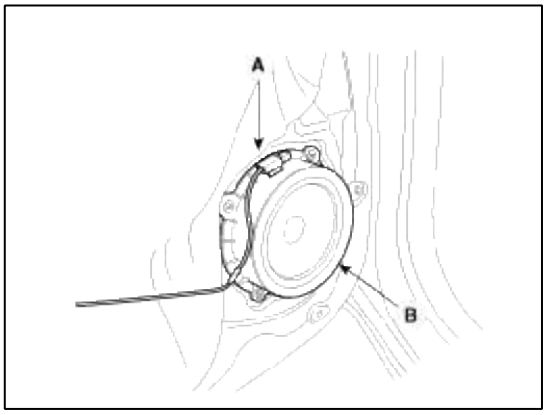
- ON : The light turns on.
- MOOD : The light shade changes automatically at regular interval.
- MUSIC : The light blinks or changes shade according to the sound of audio.
- OFF : The light turns off.
- +/- : When the lights are on, push the illumination button to adjust the light intensity.

Body Electrical System > Audio > Speakers > Repair procedures

Removal

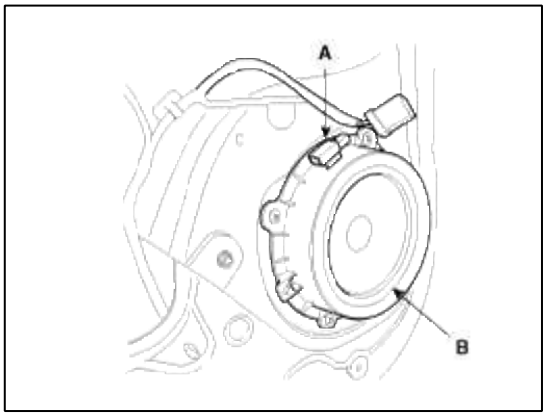
Front Speaker

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



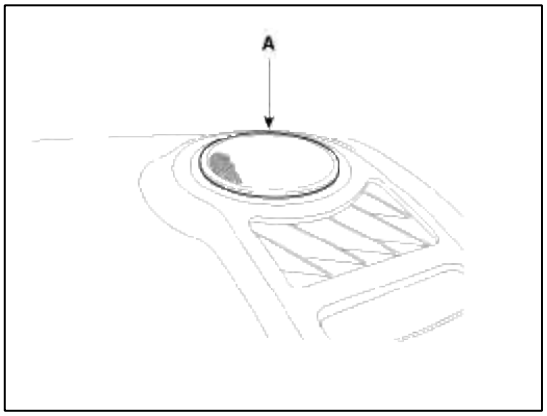
Rear Speaker

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

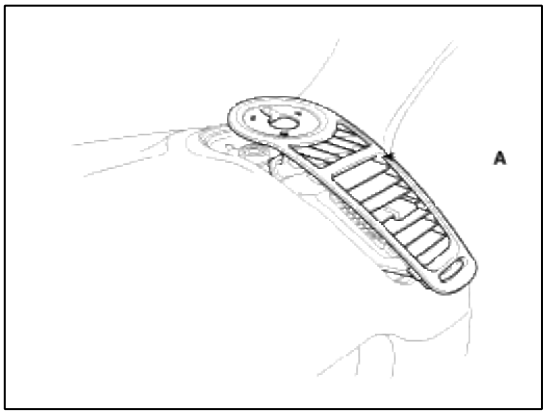


Tweeter Speaker

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



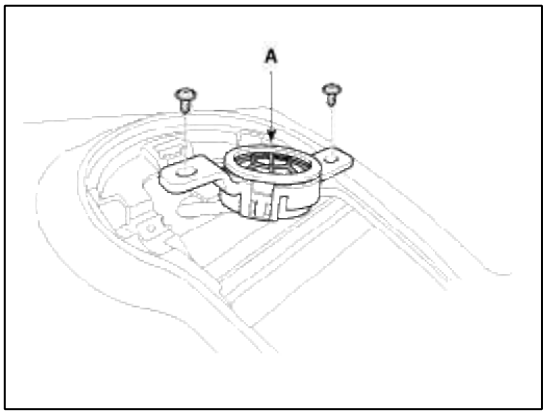
2. Remove the tweeter speaker cover (A).

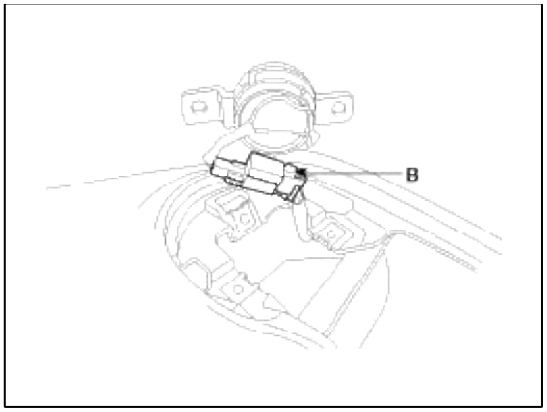


NOTE

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

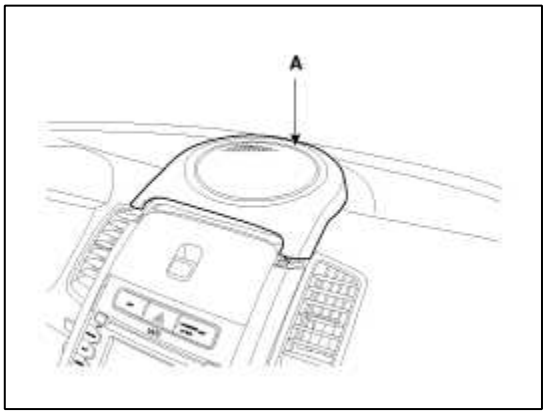
3. Remove the tweeter speaker (A) after removing the screw (2EA) and connector (B).



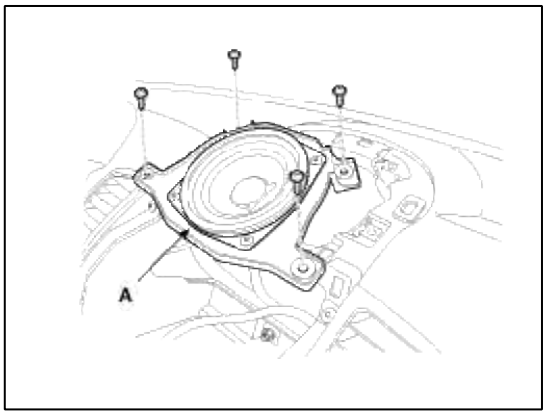


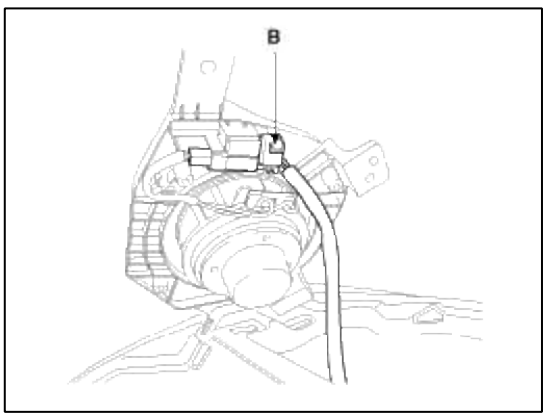
Center Speaker

1. Disconnect the negative (-) battery terminal.
2. Using a screwdriver or remover, remove the center speaker grill (A).



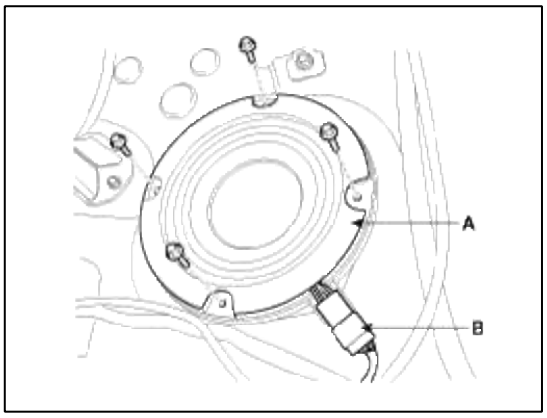
3. Remove the center speaker (A) after removing the screws (4EA) and connector (B).





Woofer Speaker

1. Remove the right luggage side trim and disconnecting the connector.
   (Refer to the Body group - Interior trim)
2. Remove the woofer speaker (A) after removing the screws (4EA) and connector (B).



Installation

Front Speaker

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

Rear Speaker

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

Tweeter Speaker

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

Center Speaker

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

Woofer Speaker

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

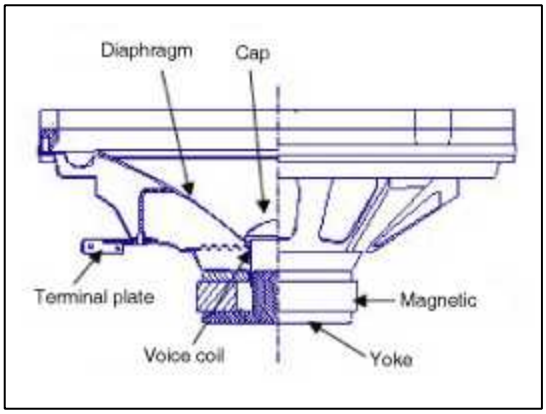
Inspection

Speaker

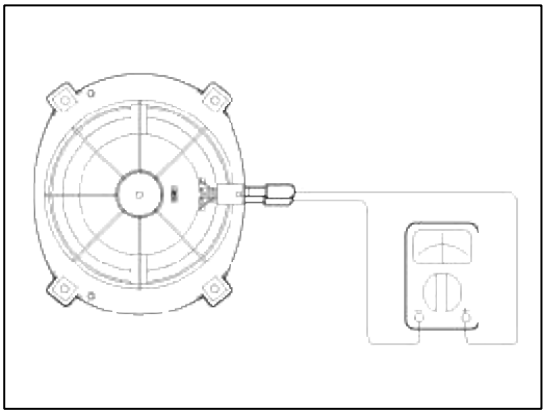
1. Troubleshooting for Speaker

(1) Basic inspection of speaker

Inspect the sound from speaker. Make sure the electrical connector is connected and the speaker mounting screws are tight to remove vibration.



(2) Case Troubleshooting

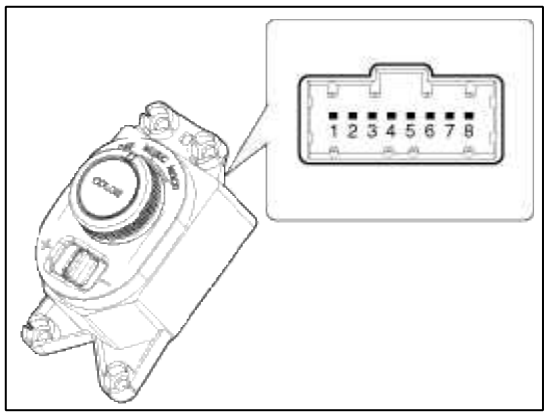
No.	Case	Inspection/Remedy
1	Trembling sound	1. Before replacing the speaker, inspect that the mounting screw is installed normally. 2. After re-installing the speaker, verify that no trembling sound is heard. 3. When hearing a trembling sound again, replace the speaker with new one.
2	Noise	1. Check if the wiring connector is connected normally. If not, reconnect the wiring connector. 2. In case of radio static, check if there is a noise from cassette. 3. When a noise is heard when using the radio and cassette, replace the speaker with new one. NOTE If there is static only when using the radio, poor radio reception may be the cause. The speakers would not be the cause.
3	Poor working	Inspection of the wiring connection between the audio unit and the speaker 1. Before replacing the speaker, inspect the wiring connection between the audio unit and the speaker. 2. Check the supplying power to the speaker and the resistance, then inspect the sound quality. ■ Specified impedance : 4±0.6Ω  3. If the speaker works poorly, replace it with new one.

CAUTION

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

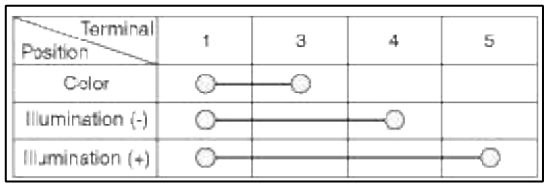
Mood lamp switch

1. Check the mood lamp switch (A) for voltage between connector terminals in each switch position.



Switch	Connector terminal	Voltage
Mood	1-2	2.5 ± 0.5 V
Music	1-2	4.0 V (or above)
OFF	1-2	1.5 V (or below)

2. Check for continuity between the terminals.



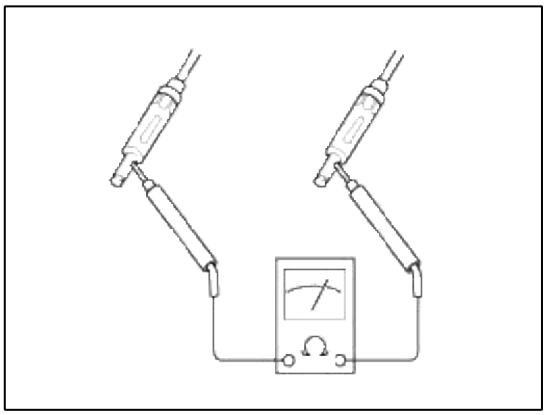
Body Electrical System > Audio > Antenna > Repair procedures

Inspection

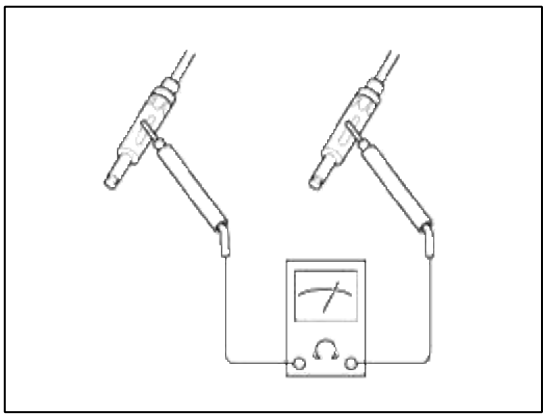
Antenna Cable

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

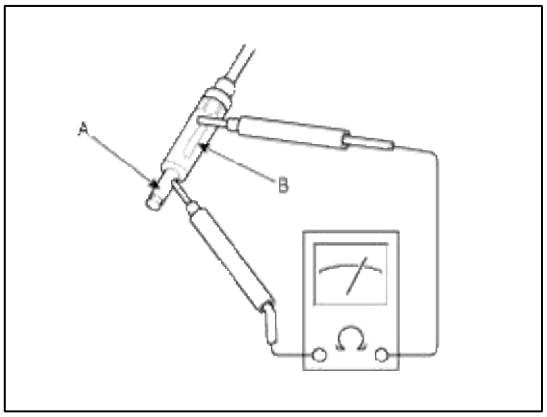
2. Check for continuity between the center poles of antenna cable. There sould be continuity.



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



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

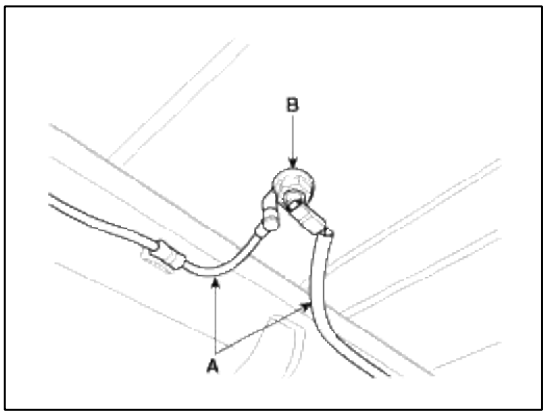


6. If there is continuity, replace the antenna cable.

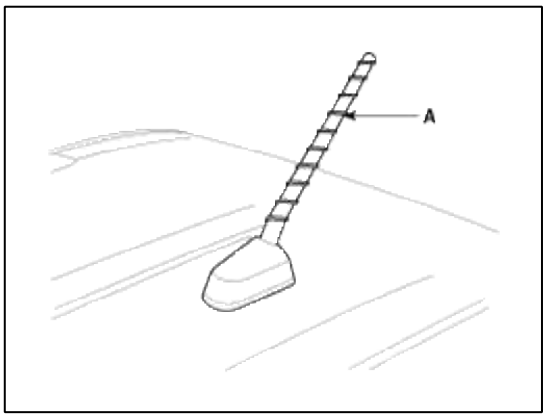
Removal

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

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



3. Remove the roof antenna(A).



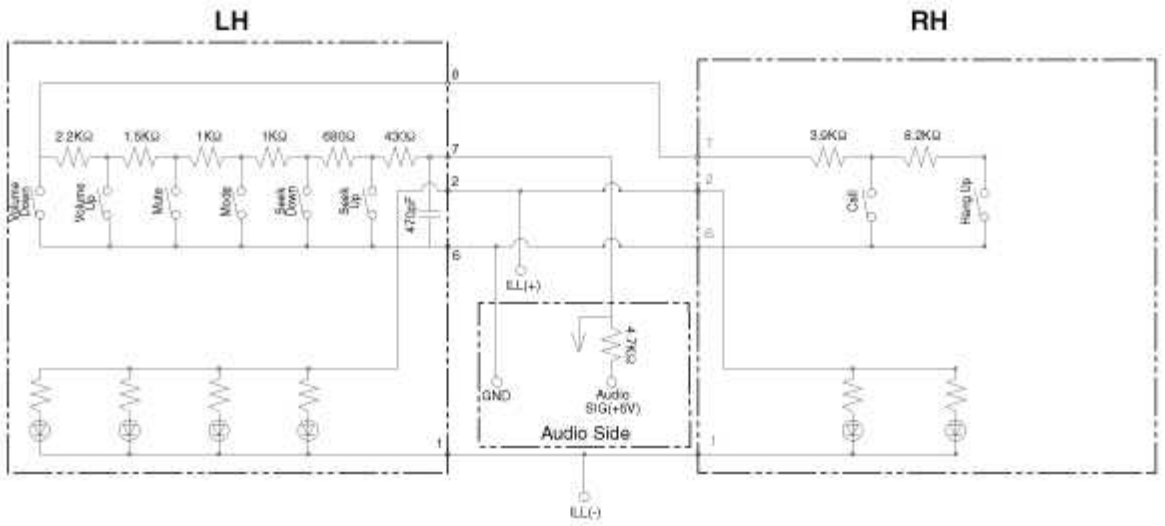
Installation

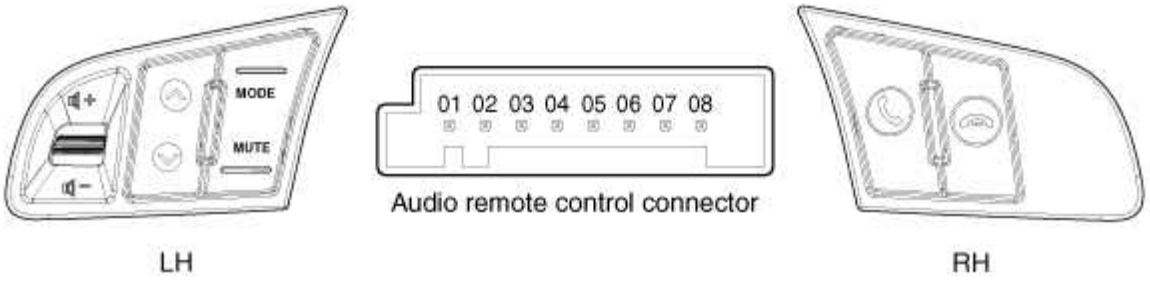
1. Connect the roof antenna cables and connectors.
2. Install the rear roof trim.

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

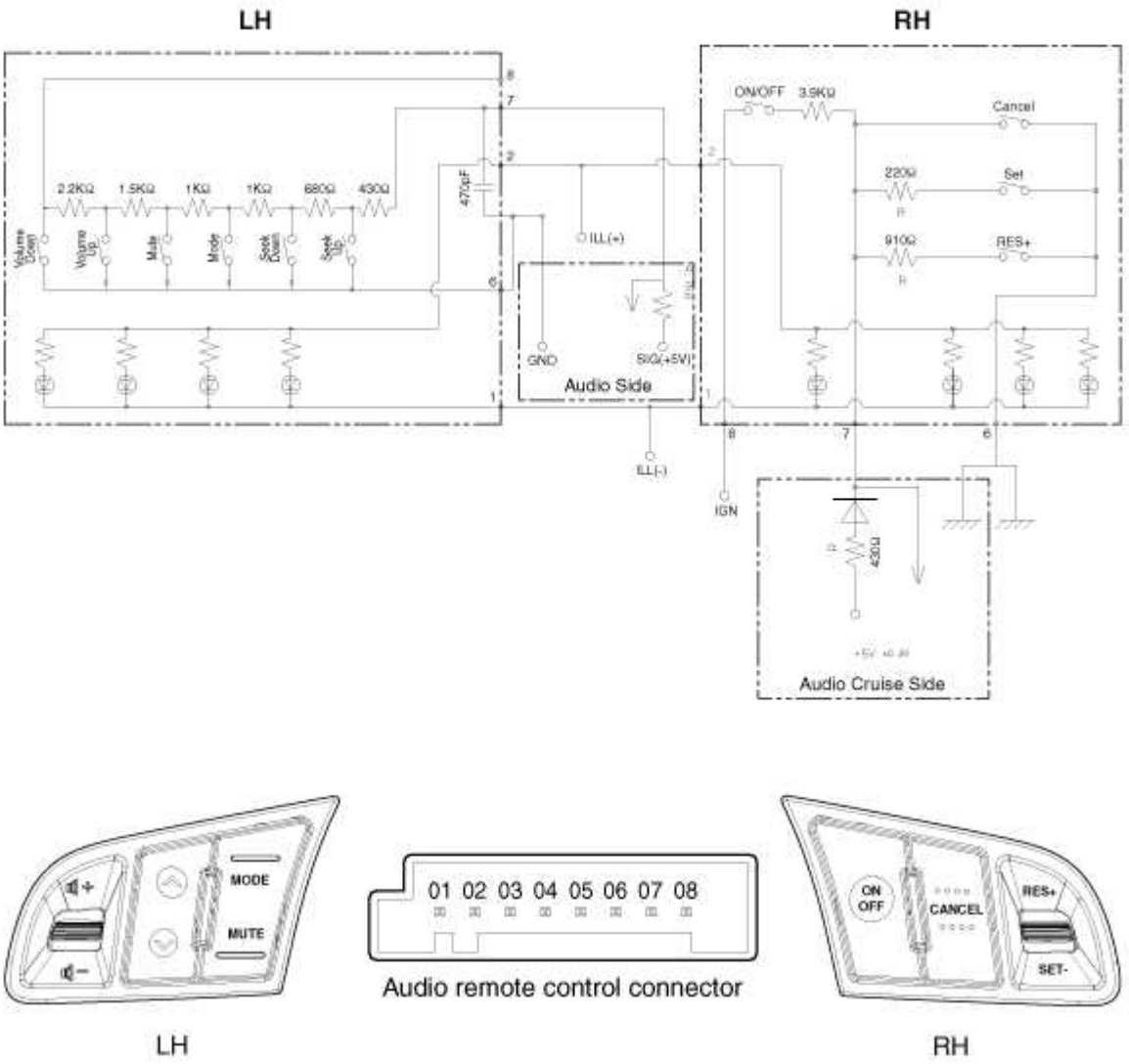
Circuit Diagram

[Audio + Hands free]





[Audio + Cruise]

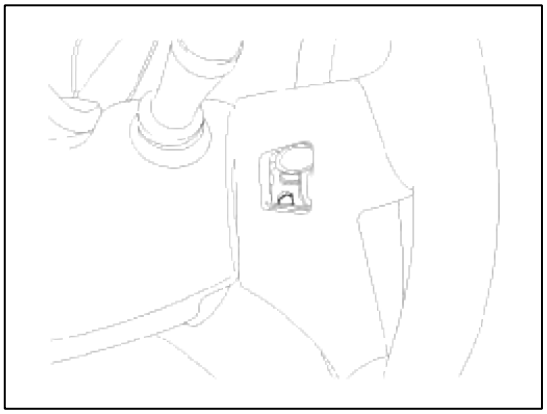


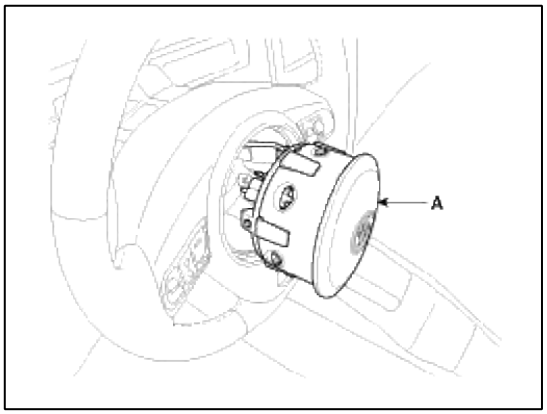
Body Electrical System > Audio > Audio Remote control > Repair procedures

Removal

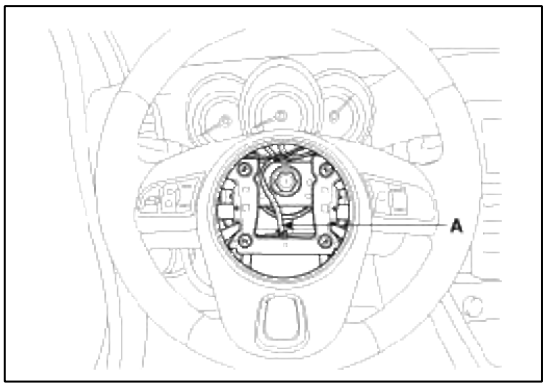
1. Disconnect the negative (-) battery terminal.

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

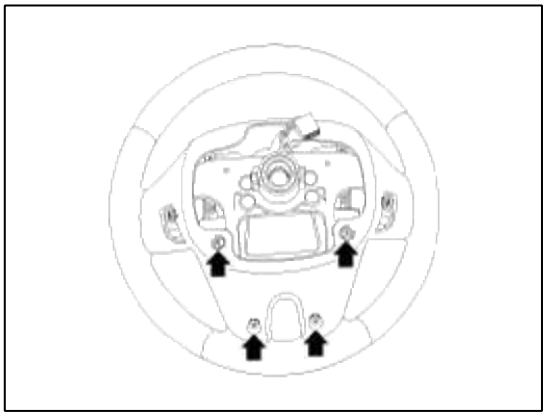




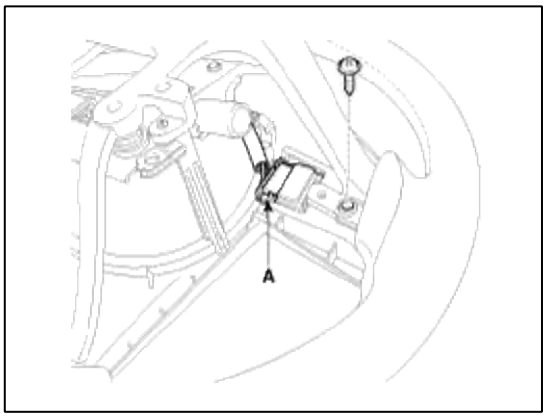
3. Remove the steering wheel after loosening the nut and disconnecting the connector (A).



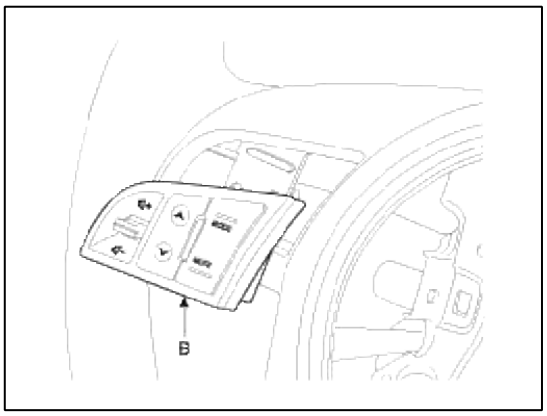
4. Loosen the screws (4EA) on the opposite side of the steering wheel.



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



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

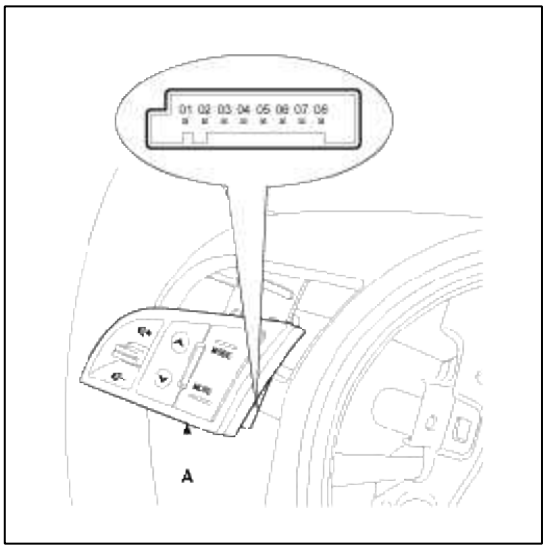


Installation

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

Inspection

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

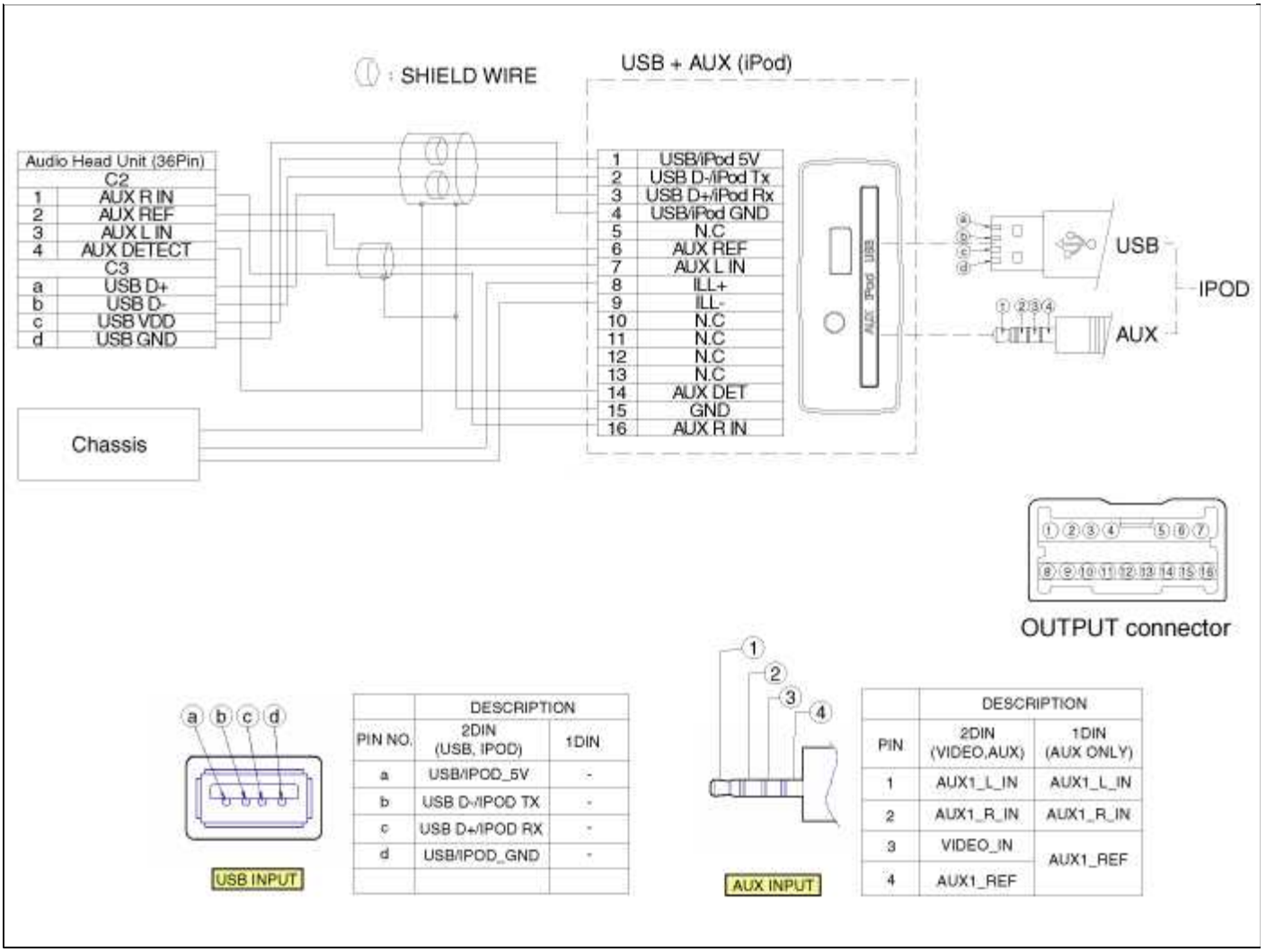


[Audio System]

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

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

Circuit Diagram

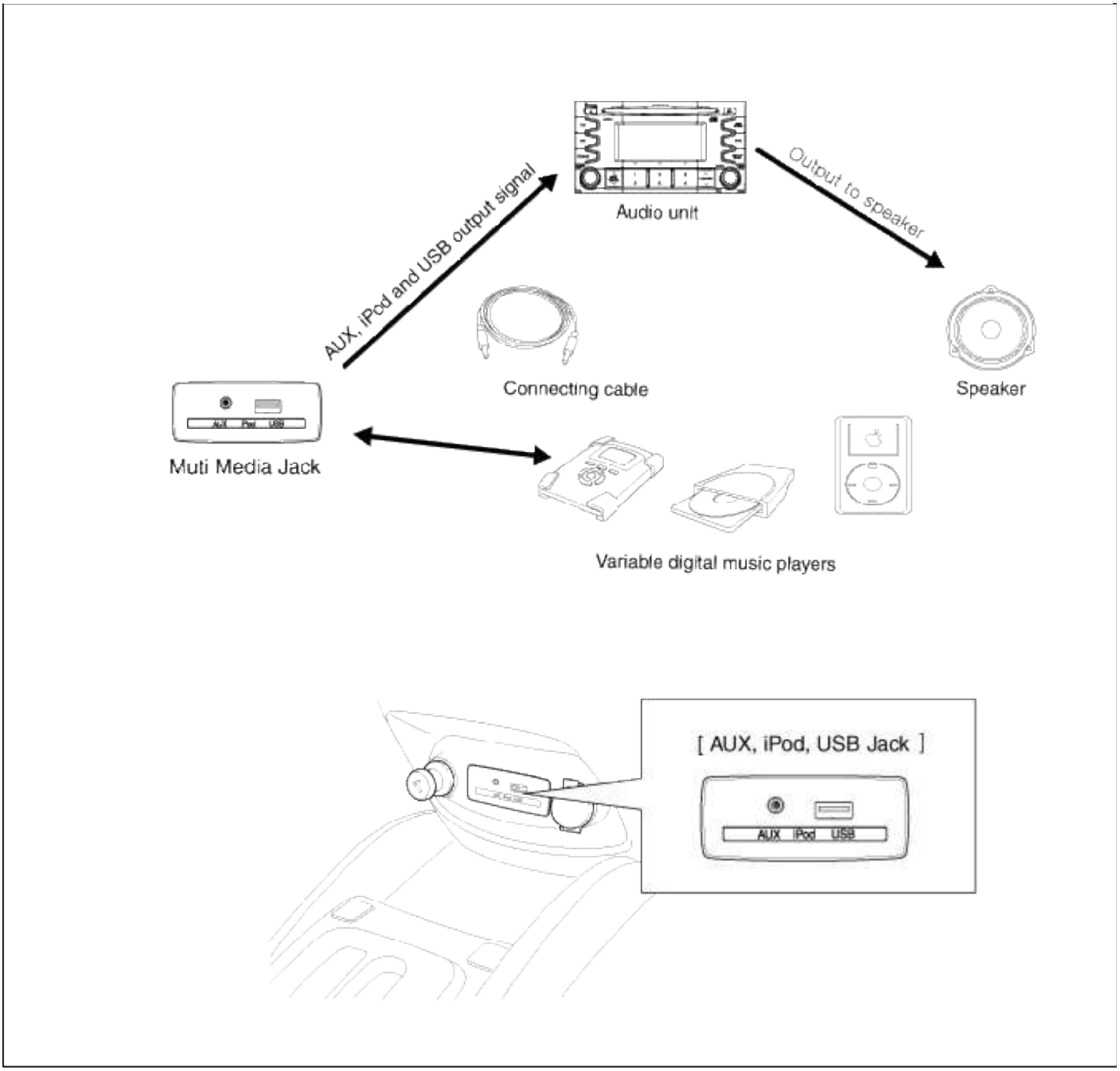


Body Electrical System > Audio > AUX(Auxiliary) jack > Description and Operation

Description

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

In case of distortions from media connected to the AUX source, the audio unit may not be defect but the output level of the used media does not match the specification of the AUX input.

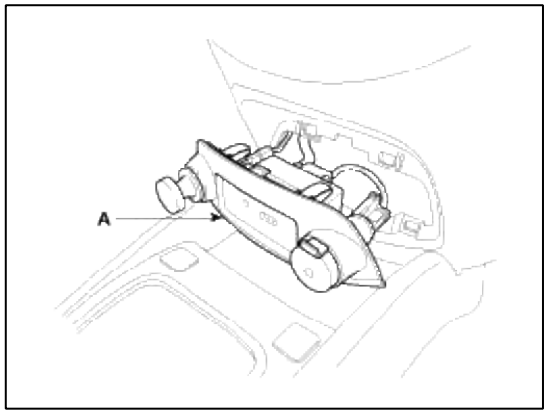


Body Electrical System > Audio > AUX(Auxiliary) jack > Repair procedures

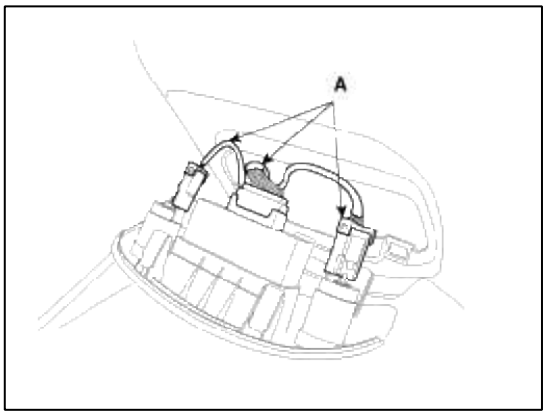
Removal

Multi Media Jack

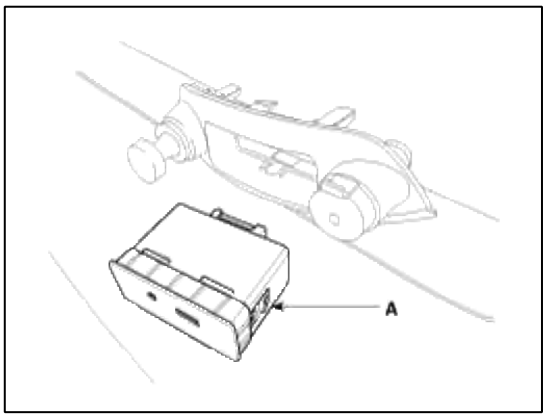
1. Remove the multi media jack assembly from main creah pad (A) by using the trim remover tool.



2. Disconnect the jack assembly connector(A)



3. Remove the Multi Media Jack (A).



Installation

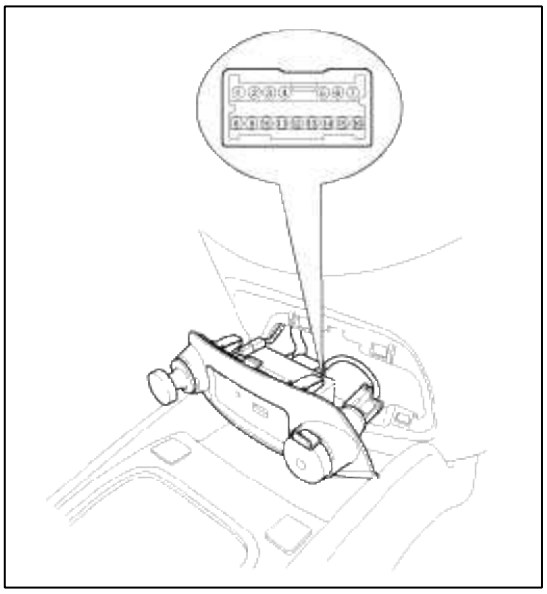
Multi Media Jack

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

Inspection

1. Disconnect the negative(-) battery terminal.

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



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

Standard value : 5V

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

Standard value : 5V

Body Electrical System > Audio > Troubleshooting

Troubleshooting

Symptom	Suspected area	Repairment
Pressing power switch does not turn on system	Audio head unit power source circuit	R-1
	LCD module	R-1
Panel switch does not function	Steering pad switch circuit	R-3
	Audio head unit front pcb ass'y	R-1
	Audio head unit power source circuit	R-1
No sound can be heard from speakers	Audio head unit power source circuit	R-1
	EXT. AMP I/F (For UVO)	R-4 R-6 R-8
	EXT. AMP power source (For UVO)	R-5
	Speaker ↔ H/U wiring	R-11
	Speaker input Waveform	R-12
Noise occurs	Proceed to "noise occurs"	R-14
Radio broadcast cannot be received <poor reception>	Proceed to "radio broadcast cannot be received (poor reception)"	R-13

Disc cannot be inserted or is ejected right after insertion	Audio head unit power source circuit	R-1
	Proceed to "Disc cannot be inserted or is ejected right after insertion"	R-19
Disc cannot be ejected.	Audio head unit power source circuit	R-1
CD sound skips	CD player	R-20
Illumination for radio receiver does not come on whth light control switch on.	Illumination circuit	R-15
	Audio head unit display	R-15
	Audio head unit power source circuit	R-1
Display does not dim with light control switch turned on	Illumination circuit	R-16
Power does not turn off	Audio head unit	R-1
Bluetooth voice recognition faulty	Audio head unit	R-1
	Mic input	R-17
USB I/F error	Audio head unit	R-1
	Usb device faulty	R-18
	Multimedia terminal connection	R-17
iPod I/F error	Audio head unit	R-1
	Ipod faulty	R-18
	Multimedia terminal connection	R-17
AUX connection error	Audio head unit	R-1
	Multimedia terminal connection	R-17

R-1 : Replace the audio head unit

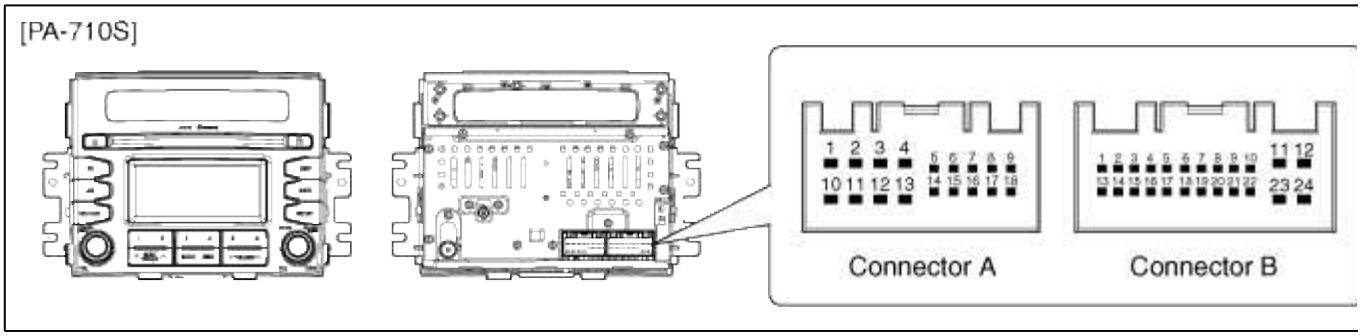
1. Check the same problems after replaceing the audio head unit

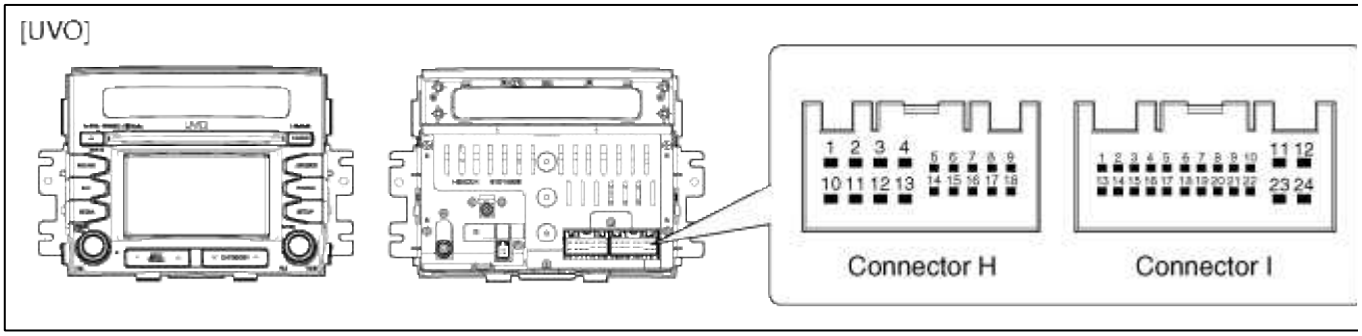
OK	If Audio is normal operating, replace the audio head unit
NG	Check the vehicle wiring. (Refer to removal procedure. R-2)

R-2 : Check the power connection of audio head unit.

1. Remove the audio head unit.

2. Check the specified condition of terminal.





OK	

Tester Connection	Condition	Specified Condition
CON-B11/I11 ↔ GND	Always	9~12 V
CON-B12/I12 ↔ GND	Always	9~12 V
CON-B24/I24 ↔ GND	Always	Below 1Ω

NG	Check again after repairing or replacing the Cable harness or Connector.

R-3 : Check the steering wheel remote control

1. Check the steering wheel remote control connector specification (Refer to "Audio remote control - inspection")

OK	Replace the audio head unit. (Refer to R-1)
NG	Replace the steering wheel remote control switch.

R-4 : Replace the external amplifier

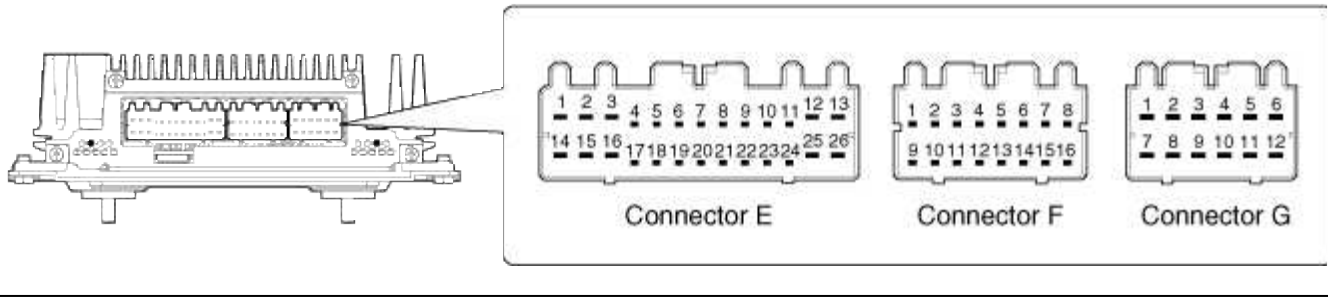
1. Check the same problems after replaceing the external amplifier

OK	If Audio is normal operating, replace the external amplifier
NG	Check the connectors of external amplifier power and interface (Refer to R-5,R-6 and R-8)

R-5 : Check the external amplifier power cable

1. Remove the external amplifier

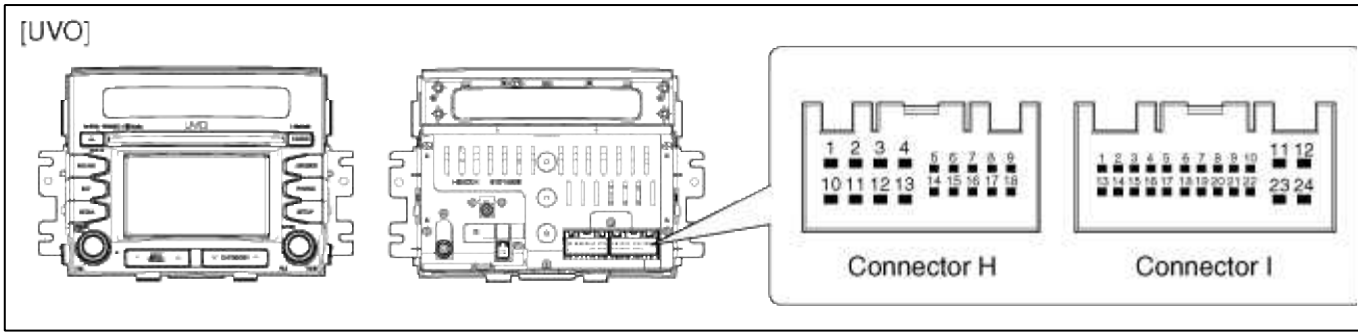
2. Check the specified condition of terminal.

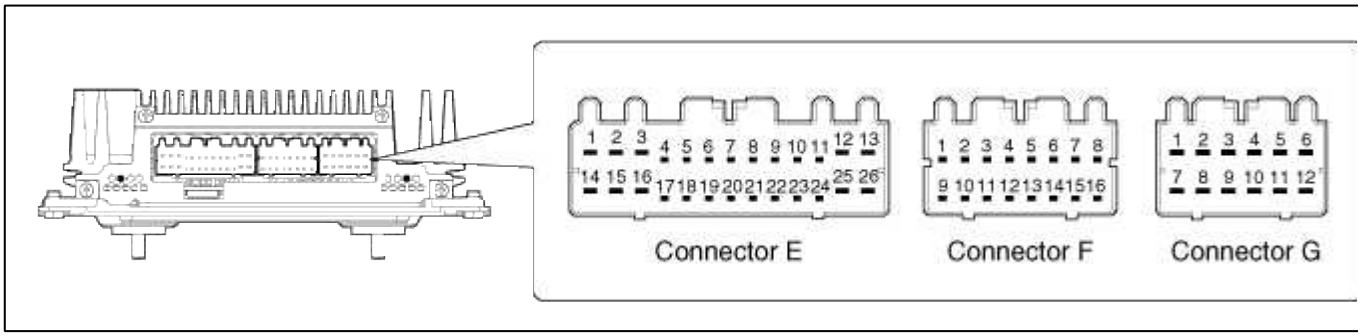


OK	**Tester Connection**	**Condition**	**Specified Condition**
	CON-E1 ↔ GND	Always	9~12 V
	CON-E7 ↔ GND	Always	9~12 V
	CON-E15 ↔ GND	Always	Below 1Ω
NG	Check again after repairing or replacing the Cable harness or Connector.		

R-6 : Check the external amplifier CAN interface

1. Remove the audio head Unit.
2. Remove the external amplifier
3. Check the specified condition of terminal.





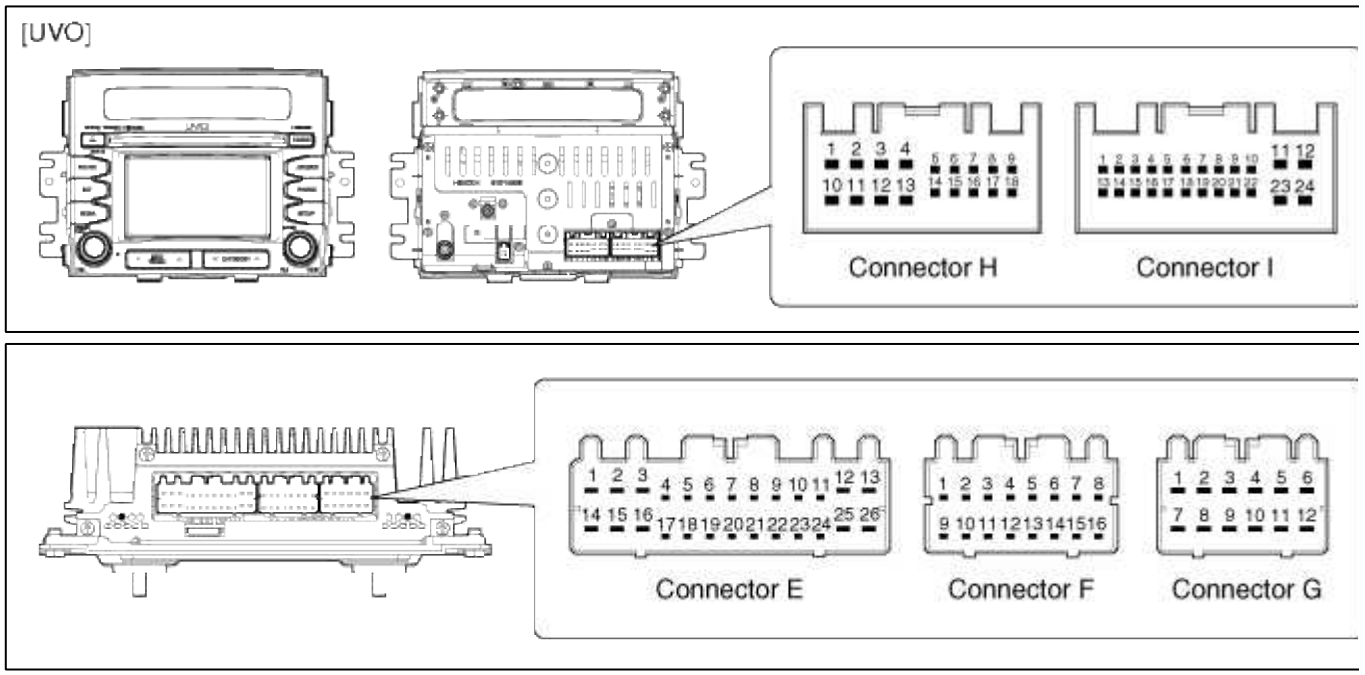
OK

Tester Connection	Condition	Specified Condition
CON-I1 ↔ CON-E5	Always	Below 1Ω
CON-I1 ↔ GND CON-E5 ↔ GND	Always	OPEN
CON-I13 ↔ CON-E6	Always	Below 1Ω
CON-I13 ↔ GND CON-E6 ↔ GND	Always	OPEN

NG	Check again after repairing or replacing the Cable harness or Connector.

R-8 : Check the external amplifier S/PDIF connection

1. Remove the audio head unit.
2. Remove the external amplifier
3. Check the specified condition of terminal.



OK

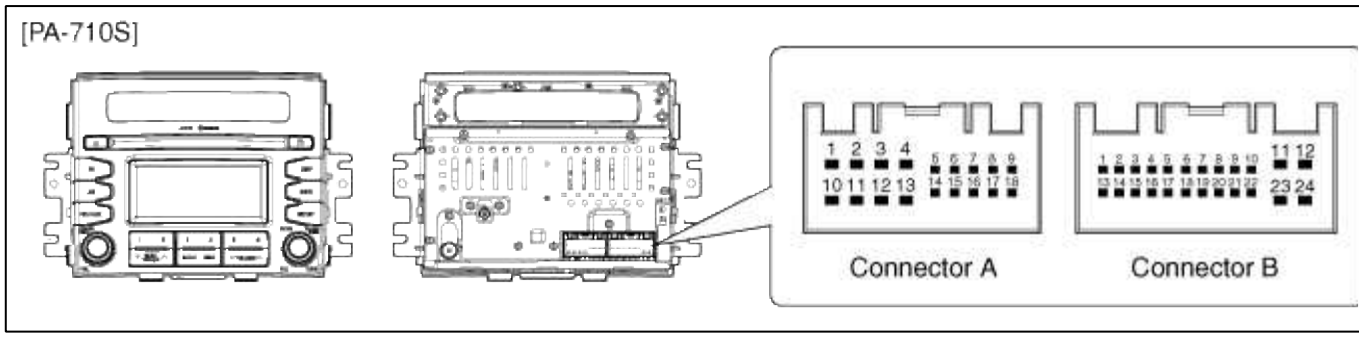
Tester Connection	Condition	Specified Condition
CON-H6 ↔ CON-E19	Always	Below 1Ω
CON-H6 ↔ GND CON-E19↔ GND	Always	OPEN
CON-H15 ↔ CON-E18	Always	Below 1Ω
CON-H15 ↔ GND CON-E18 ↔ GND	Always	OPEN

NG	Check again after repairing or replacing the Cable harness or Connector.

R-11 : Check the wiring harness and connector

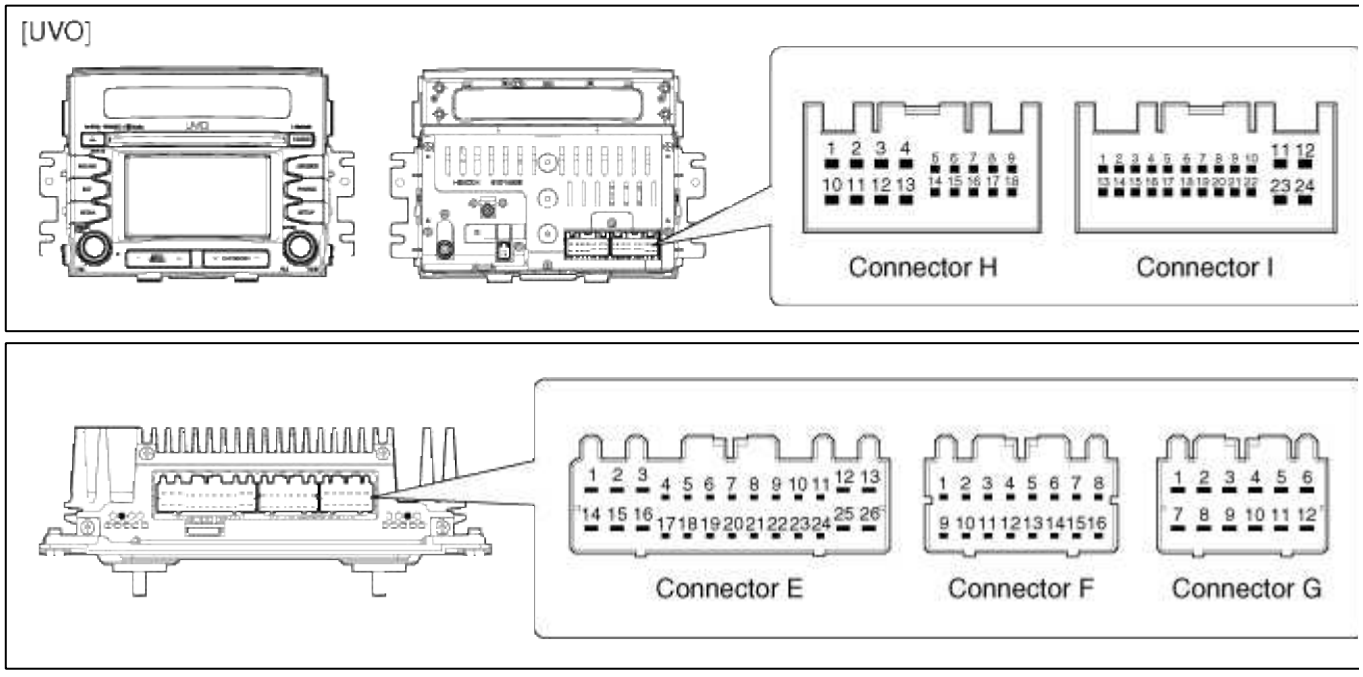
1. Remove the audio head unit
2. Remove the external amplifier (For UVO)

OK	FOR PA-710S



Tester Connection	Condition	Specified Condition
CON-A1 ↔ RL SPK +	Always	Below 1Ω
CON-A10 ↔RL SPK -	Always	Below 1Ω
CON-A2 ↔ FL SPK +	Always	Below 1Ω
CON-A11 ↔ FL SPK -	Always	Below 1Ω
CONA3 ↔ FR SPK +	Always	Below 1Ω
CON-A12 ↔ FR SPK -	Always	Below 1Ω
CON-A4 ↔ RR SPK +	Always	Below 1Ω
CON-A13 ↔ RR SPK -	Always	Below 1Ω
CON-A1, 2, 3, 4, 10, 11, 12, 13 ↔ GND	Always	OPEN

OK	FOR UVO



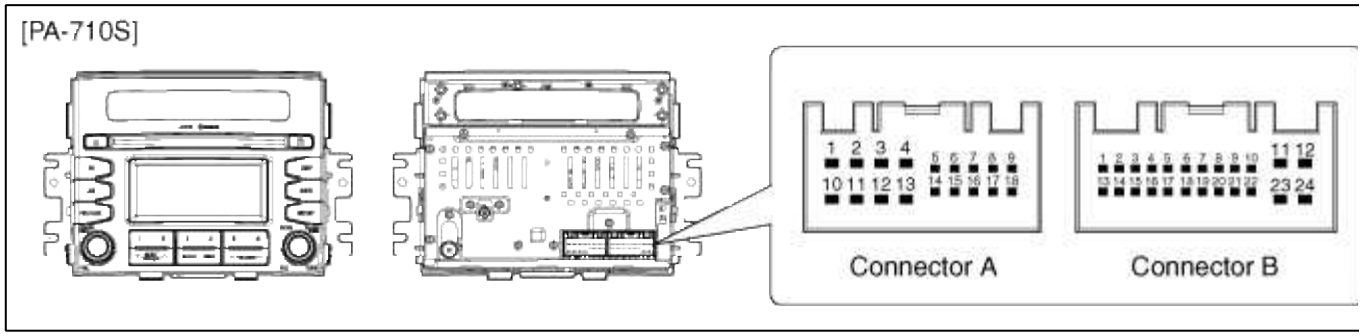
Tester Connection	Condition	Specified Condition
CON-E12 ↔ SUB WOOFER2 +	Always	Below 1Ω
CON-E25 ↔ SUB WOOFER2 -	Always	Below 1Ω
CON-E13 ↔ SUB WOOFER1 +	Always	Below 1Ω
CON-E26 ↔ SUB WOOFER1 -	Always	Below 1Ω
CON-F7 ↔ CENTER SPK +	Always	Below 1Ω
CON-F14 ↔ CENTER SPK -	Always	Below 1Ω
CON-G1 ↔ RR DOOR SPK +	Always	Below 1Ω
CON-G7 ↔ RR DOOR SPK -	Always	Below 1Ω
CON-G2 ↔ RL DOOR SPK +	Always	Below 1Ω
CON-G8 ↔ RL DOORSPK -	Always	Below 1Ω
CON-G3 ↔ FR SPK +	Always	Below 1Ω
CON-G9 ↔ FR SPK -	Always	Below 1Ω
CON-G4 ↔ FL SPK +	Always	Below 1Ω
CON-G10 ↔ FL SPK -	Always	Below 1Ω
CON-G5 ↔ FR DOOR SPK +	Always	Below 1Ω
CON-G11 ↔ FR DOOR SPK -	Always	Below 1Ω
CON-G6 ↔ FL DOOR SPK +	Always	Below 1Ω
CON-G12 ↔ FL DOOR SPK -	Always	Below 1Ω
CON-E12, 13, 25, 26/ F7, 14/ G1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 ↔ GND	Always	OPEN

NG	Check again after repairing or replacing the Cable harness or Connector.

R-12 : Check the wiring harness and connector

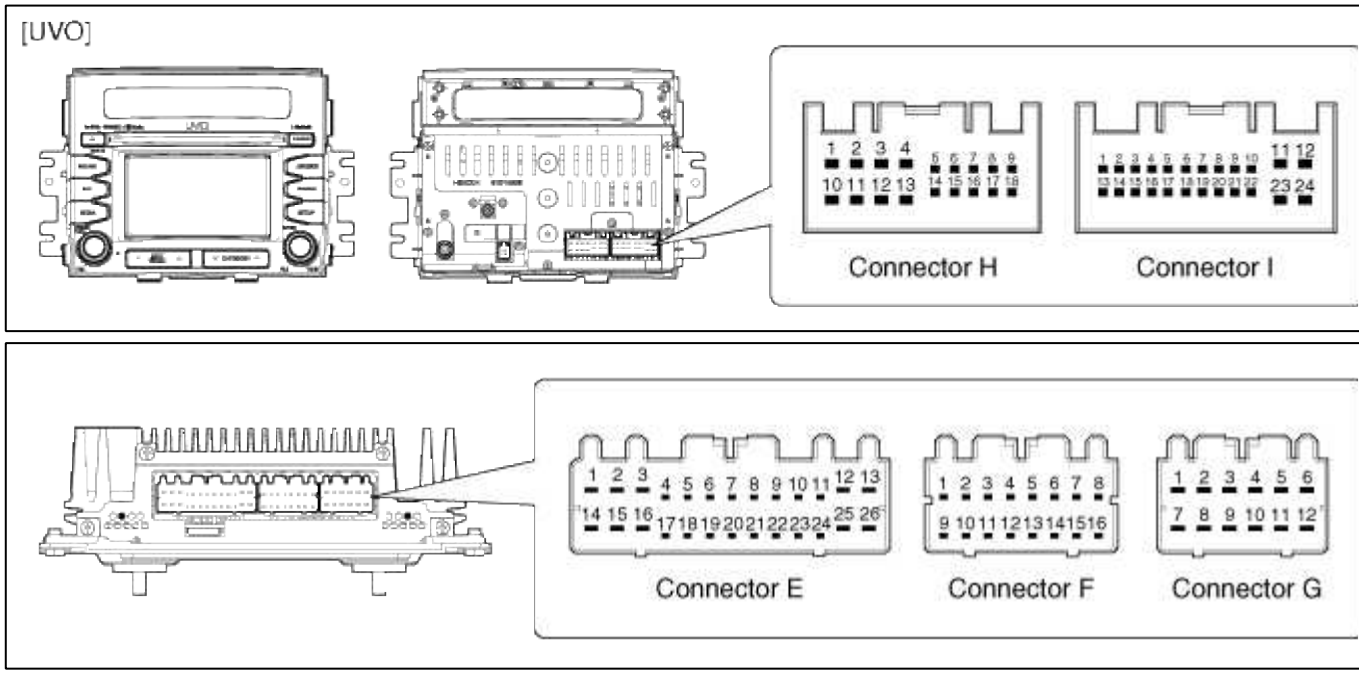
1. Remove the audio head unit
2. Remove the external amplifier (For UVO)
3. Check the output of audio head unit and external amplifier using the oscilloscope

OK	FOR PA-710S



Tester Connection	Condition	Specified Condition
CON-A1 ↔ GND	Audio sound is being produced	A waveform synchronized with sound is output
CON-A10 ↔ GND	Audio sound is being produced	A waveform synchronized with sound is output
CON-A2 ↔ GND	Audio sound is being produced	A waveform synchronized with sound is output
CON-A11 ↔ GND	Audio sound is being produced	A waveform synchronized with sound is output
CON-A3 ↔ GND	Audio sound is being produced	A waveform synchronized with sound is output
CON-A12 ↔ GND	Audio sound is being produced	A waveform synchronized with sound is output
CON-A4 ↔ GND	Audio sound is being produced	A waveform synchronized with sound is output
CON-A13 ↔ GND	Audio sound is being produced	A waveform synchronized with sound is output

OK	FOR UVO



Tester Connection	Condition	Specified Condition
CON-E12 ↔ GND	Audio sound is being produced	A waveform synchronized with sound is output
CON-E25 ↔ GND	Audio sound is being produced	A waveform synchronized with sound is output
CON-E13 ↔ GND	Audio sound is being produced	A waveform synchronized with sound is output
CON-E26 ↔ GND	Audio sound is being produced	A waveform synchronized with sound is output
CON-F7 ↔ GND	Audio sound is being produced	A waveform synchronized with sound is output
CON-F14 ↔ GND	Audio sound is being produced	A waveform synchronized with sound is output
CON-G1 ↔ GND	Audio sound is being produced	A waveform synchronized with sound is output
CON-G7 ↔ GND	Audio sound is being produced	A waveform synchronized with sound is output
CON-G2 ↔ GND	Audio sound is being produced	A waveform synchronized with sound is output
CON-G8 ↔ GND	Audio sound is being produced	A waveform synchronized with sound is output
CON-G3 ↔ GND	Audio sound is being produced	A waveform synchronized with sound is output
CON-G9 ↔ GND	Audio sound is being produced	A waveform synchronized with sound is output

CON-G4 ↔ GND	Audio sound is being produced	A waveform synchronized with sound is output
CON-G10 ↔ GND	Audio sound is being produced	A waveform synchronized with sound is output
CON-G5 ↔ GND	Audio sound is being produced	A waveform synchronized with sound is output
CON-G11 ↔ GND	Audio sound is being produced	A waveform synchronized with sound is output
CON-G6 ↔ GND	Audio sound is being produced	A waveform synchronized with sound is output
CON-G12 ↔ GND	Audio sound is being produced	A waveform synchronized with sound is output

NG	Check again after repairing or replacing the Cable harness or Connector.

R-13 : Radio Broadcast cannot be Received (Bad reception)

1. Check the radio broadcast reception after replacing the audio head unit

OK	If Audio is normal operating, replace the audio head unit

NG	Go to step 2

2. Check the antenna jack

NG	Check again the radio broadcast reception after connecting the antenna jack

OK	Go to step 3

3. Check the feeder cable connection (Refer to "Antenna - Antenna cable")

NG	Check again after repairing or replacing the antenna feeder cable.

OK	Go to step 4

4. Check again the radio broadcast reception after replacing the external amplifier

OK	If Audio is normal operating, replace the external amplifier

NG	Go to step 5

5. Check and repair the glass antenna. (Refer to "Antenna - Glass antenna test")

R-14 : Check that speakers are installed tightly.

NG	Install the speakers tightly.

OK	Go to step 1

1. Noise source description

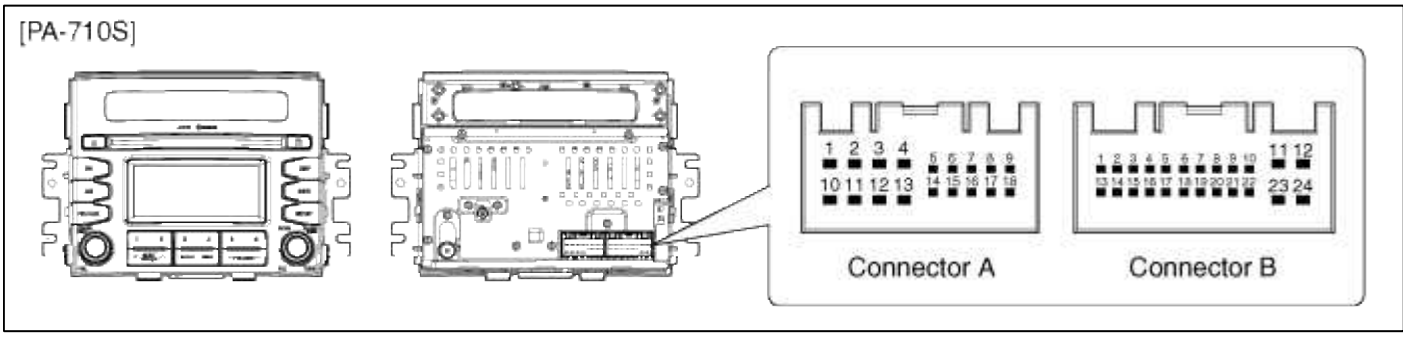
Condition in Which Noise Occurs	Noise Type
Depressing accelerator pedal increases noise, and stopping engine stops noise immediately	Generator nosie
When A/C or heater is operating	Blower motor noise
• When rapidly accelerating on unpaved road • When engine switch is turned on (IG)	Fuel pump noise
• When horn switch is pressed and released • When horn switch is pressed and held down	Horn noise
Running engine causes soft noise, and stopping engine stops noise immediately	Ignition noise
Noise occurs synchronously with turn signal flash	Flasher noise
Noise occurs during window washer operation	Washer noise
Running engine causes noise, but stopping engine does not stop noise	Engine coolant temperature sensor noise
When wiper is operating	Wiper noise
When brake pedal is depressed	Stop light switch noise
Other	Static electricity on vehicle

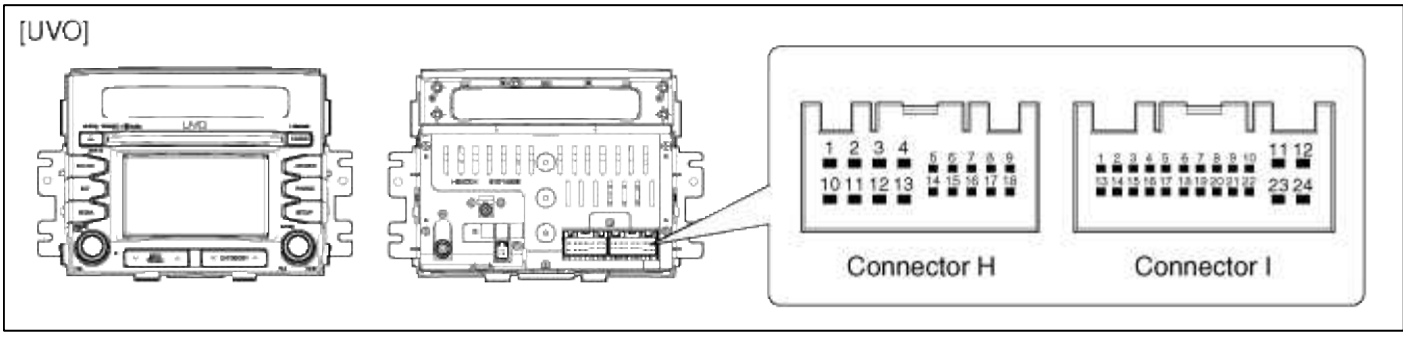
OK	Check the noise source

NG	Check again after replacing the audio head unit

2. Repair or replace the noise source

R-15 : Check again after replacing the audio head unit





OK	Remove the audio head unit

NG	Go to step 1

1. Check the input signal of Illumination (+)
   FOR PA-710S, UVO

Tester Connection	Condition	Specified Condition
CON-A8/H8 ↔ GND	Always	9~16 V
CON-C4 ↔ GND	Always	Below 1Ω

NG	Check the vehicle wiring

OK	Go to step 2

2. Check the illumination (-) input signal using the oscilloscope
   FOR PA-710S, UVO

Tester Connection	Condition	Specified Condition
CON-A17/H17 ↔ GND	Always	Check the PWM waveform

NG	Check the vehicle wiring and cluster PWM output.

OK	Go to step 3

3. Check the vehicle illumination control unit.

R-16 : Test after replacing the audio head unit

OK	Replace the audio head unit

NG	Go to step 1

1. Check the illumination (-) input signal using the oscilloscope
   FOR PA-710S & UVO

Tester Connection	Condition	Specified Condition
CON-A17/H17 ↔ GND	Always	Check the PWM waveform

Is PWM output waveform changed according to vehicle illumination control ?

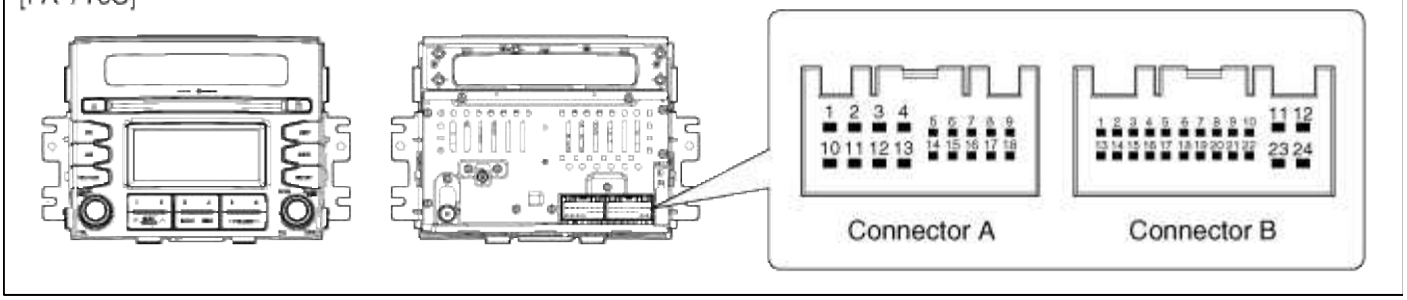
NG	Check the vehicle wiring and cluster PWM output module.

OK	Go to step 2

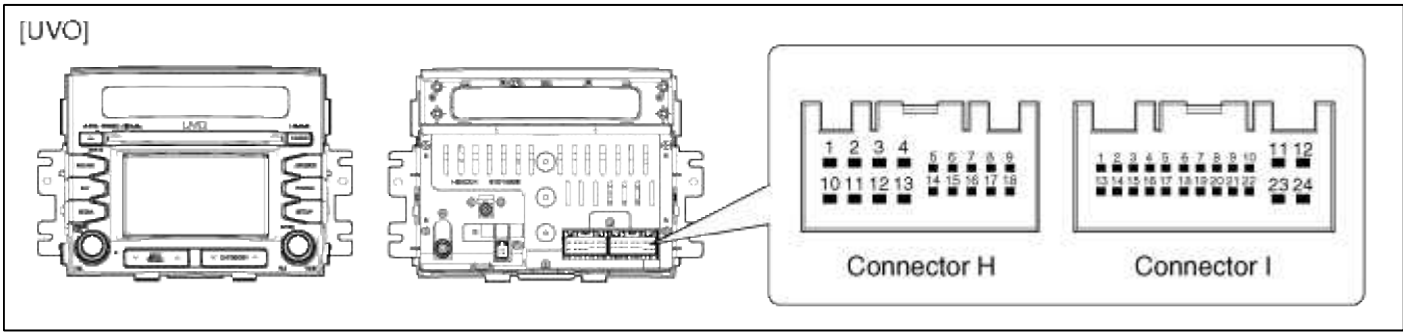
2. Check the vehicle illumination control unit.

R-17 : Check the mic input condition.

[PA-710S]



[UVO]



Tester Connection	Condition	Specified Condition
CON-B10/I10 ↔ MIC+	Always	Below 1Ω
CON-B22/I22 ↔ MIC-	Always	Below 1Ω
CON-B22/I22↔ GND	Always	OPEN

NG	Check the vehicle wiring and B/T mic

OK	Go to step 1

1. Test again after replacing the B/T mic

R-18 : Test after replacing the audio head unit

OK	Replace the audio head unit

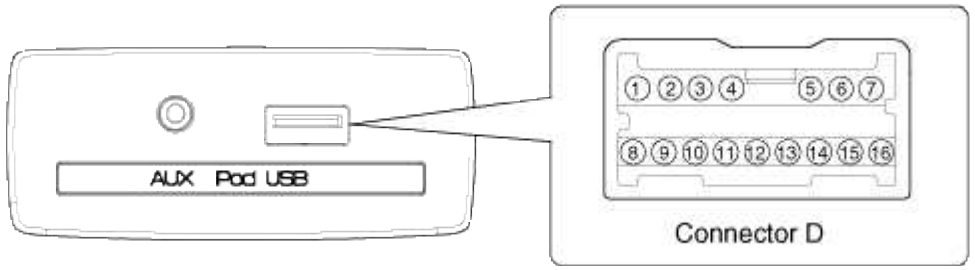
NG	Go to step 1

1. Test after replacing the multimedia jack.

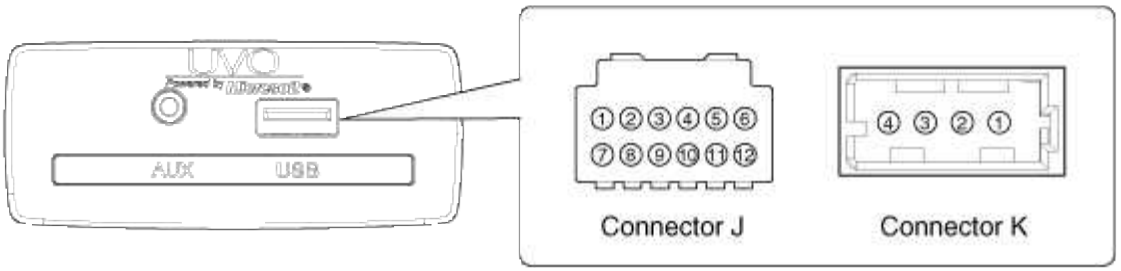
OK	Replace the multimedia jack .

NG	Go to step 2

2. Check the multimedia jack connector.



Tester Connection	Condition	Specified Condition
CON-B6 ↔ CON-D3	Always	Below 1Ω
CON-B18 ↔ CON-D2	Always	Below 1Ω
CON-B7↔ CON-D1	Always	Below 1Ω
CON-B8↔ COND16	Always	Below 1Ω
CON-B9↔ CON-D6	Always	Below 1Ω
CON-B20↔ CON-D14	Always	Below 1Ω
CON-B21↔ CON-D7	Always	Below 1Ω
CON-B6, 18, 7, 8, 20, 21 ↔ GND	Always	OPEN



Tester Connection	Condition	Specified Condition
CON-B21 ↔ CON-J1	Always	Below 1Ω
CON-B8 ↔ CON-J2	Always	Below 1Ω
CON-B20 ↔ CON-J3	Always	Below 1Ω
CON-B9 ↔ CON-J7	Always	Below 1Ω
USB-1 ↔ CON-K4	Always	Below 1Ω
USB-2 ↔ CON-K3	Always	Below 1Ω
USB-3 ↔ CON-K2	Always	Below 1Ω
USB-4 ↔ CON-K1	Always	Below 1Ω
CON-B/8,9,20,21↔USB-/1,2,3,4	Always	OPEN

NG	Check the vehicle wiring

OK	Go to step 3

3. Check again after replacing the external input device with another one.

R-19 : Disc cannot be inserted or ejected right after insertion

1. Is the ignition key at ACC or ON?

OK	Go to step 2

NG	Turn the key to ON

2. Power ON reset. Disconnect the 2 audio fuses, wait 5minutes with ignition switch off. And then insert both fuse. Then turn the ignition key ON. Is CD ejected?

OK	Loock for foreign matters in CD player. Such as paper lables, coins etc.

NG	Go to step 3

3. If CD does not ejected, don't try removing it. The player may be damaged. Please replace the CD player.

R-20 : Sound sometimes skips when parking

1. Is CD face scratched or dirty?

OK	CD is defective, or clean CD

NG	Go to step 2

2. Does it play properly if CD is replaced with an existing proper CD?

OK	Replace CD

NG	Repair or replace CD player

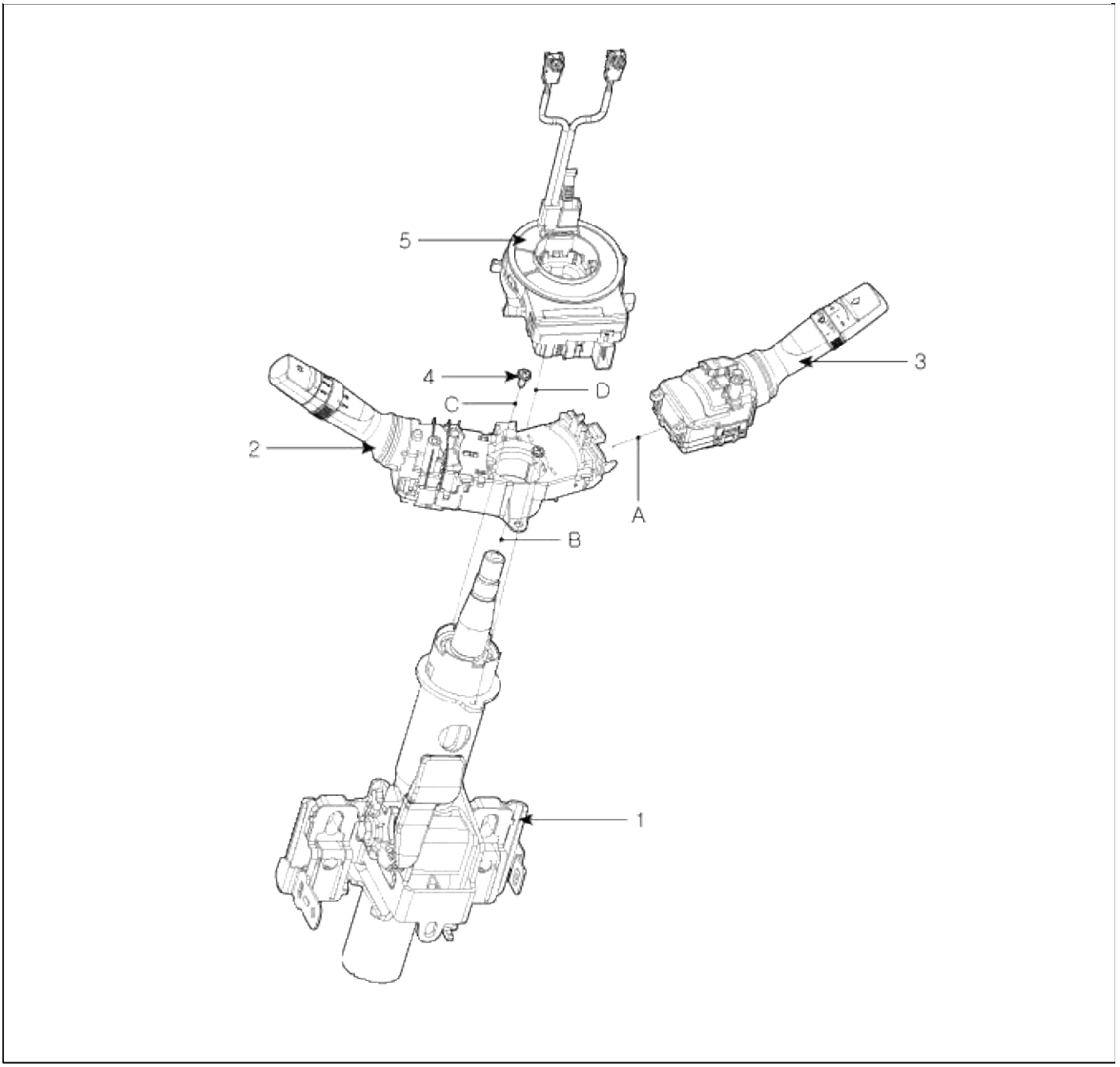
Body Electrical System > Multifunction switch > Specifications

Specifications

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

Body Electrical System > Multifunction switch > Components and Components Location

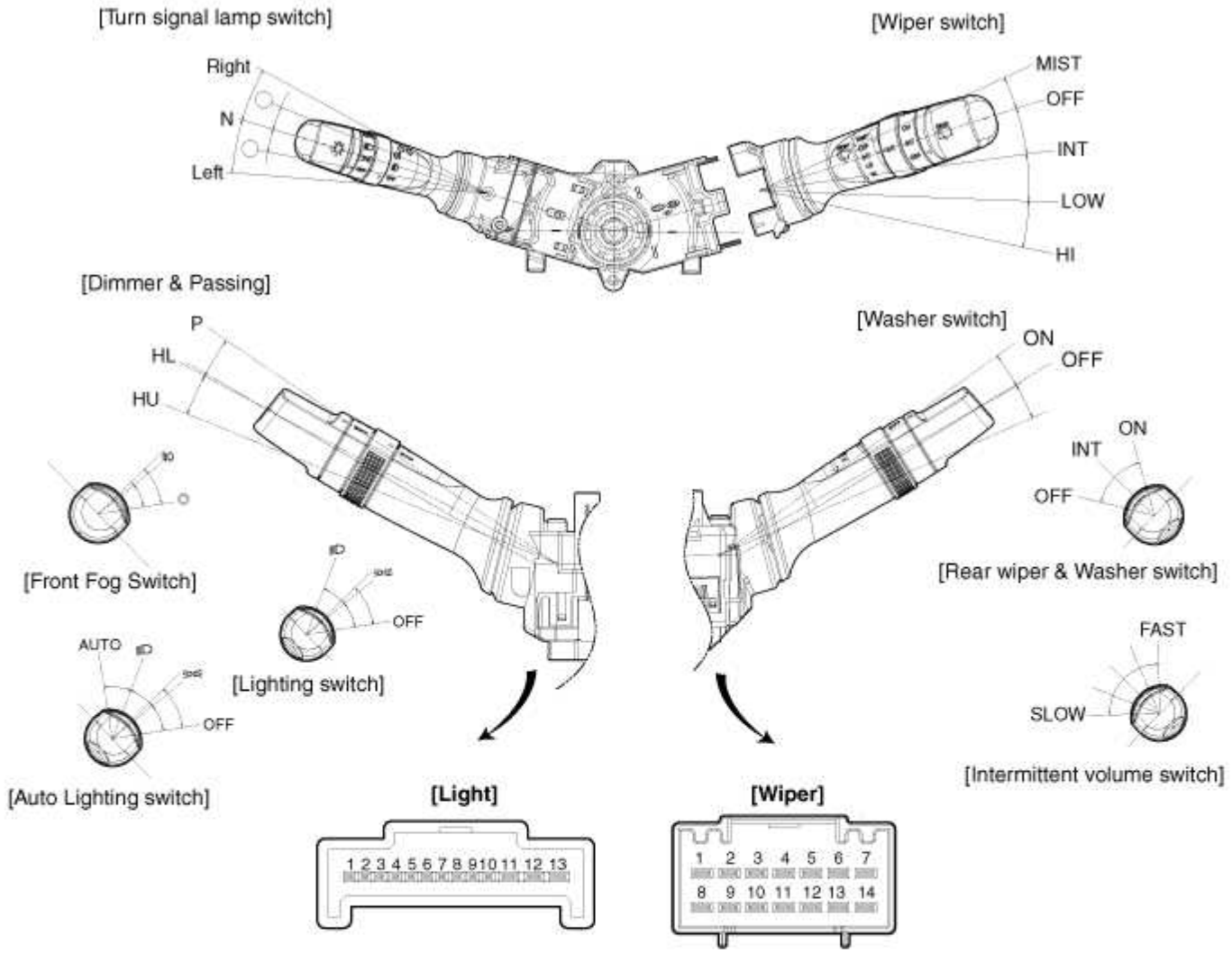
Component (1)



<Installation order : A→B→C→D>

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

Component (2)



Circuit connection

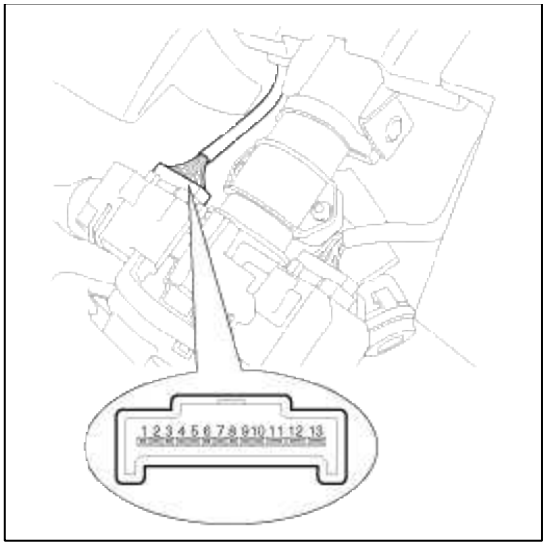
Connector Name	Terminal No.	Description	Connector Name	Terminal No.	Description
Light	1	Tail lamp switch	Wiper	1	Mist switch
	2	Lighting switch ground		2	Wiper parking
	3	Auto light switch		3	Wiper Low speed
	4	Head lamp switch		4	Intermittent volume base
	5	Fog switch base		5	Intermittent time base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

Body Electrical System > Multifunction switch > Repair procedures

Inspection

Lighting Switch Inspection

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



Lighting Switch (Auto Light)

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

Lighting Switch

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

Dimmer And Passing Switch

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

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

Turn Signal Switch

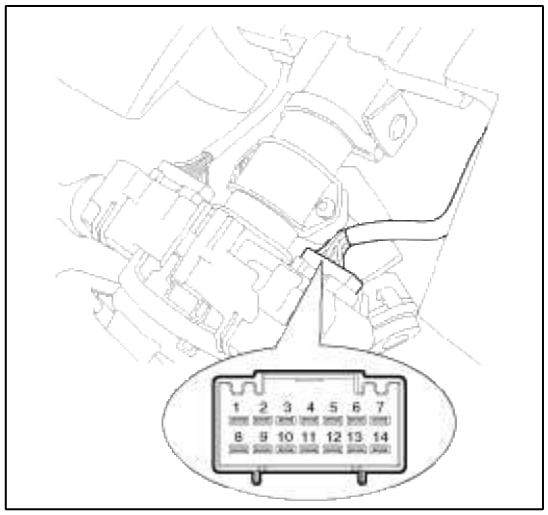
Terminal / Hazard switch / Turn signal switch		13	11	12
OFF	L		○	○
	N			
	R	○	—	○

Front Fog Lamp

Terminal / Position	5	6
OFF		
ON	○	○

Wiper And Washer Switch Inspection

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



Wiper Switch

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

Washer Switch

Terminal / Position	11	10
OFF		
ON	○	○

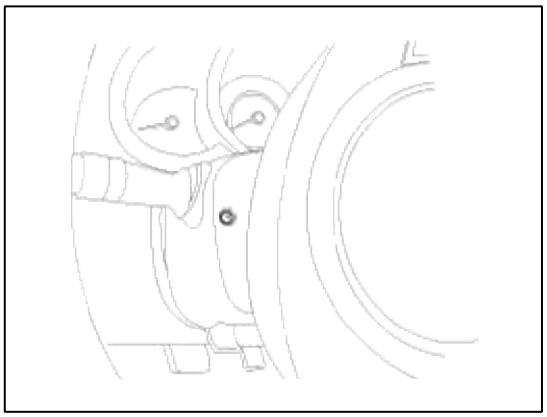
Rear Wiper & Washer Switch

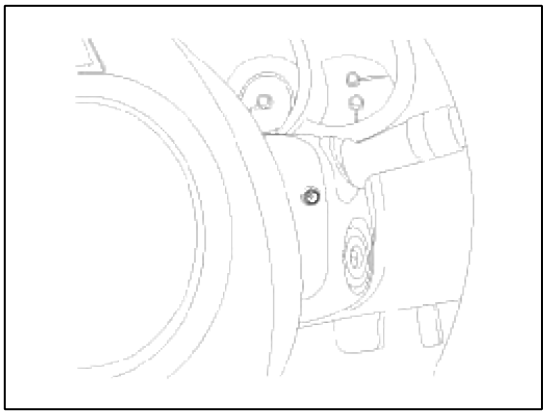
Terminal / Position	12	7	6	13
WIPER(ON)	○		○	
INT	○	○		
OFF				
WASHER(ON)	○			○

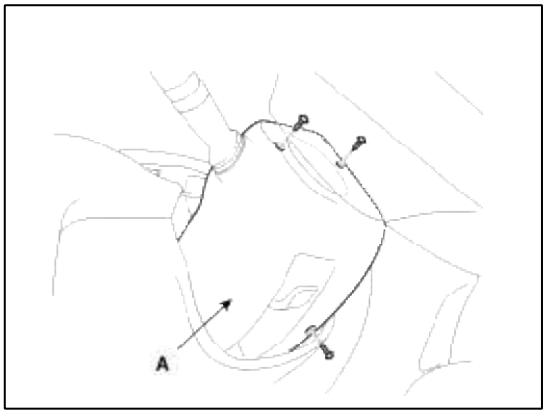
Removal

1. Disconnect the negative (-) battery terminal.

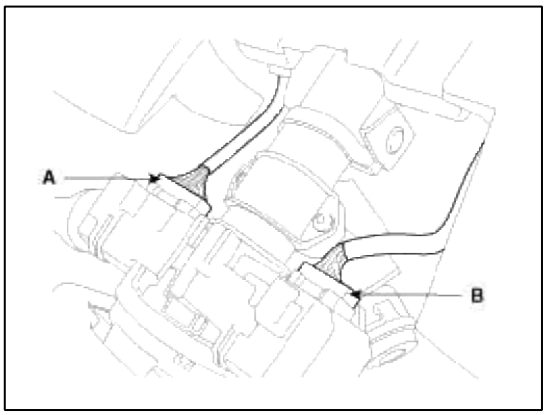
2. Remove the steering column upper and lower shrouds (A) after removing 3 screws.





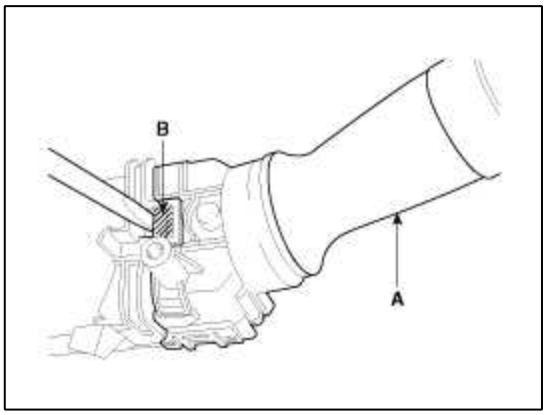


3. Disconnect the light switch connector (A) and the wiper switch connector (B).

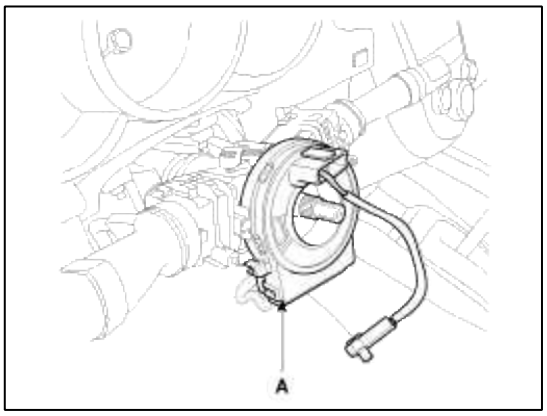


4. Remove the wiper switch (A) by pushing the lock pin (B).

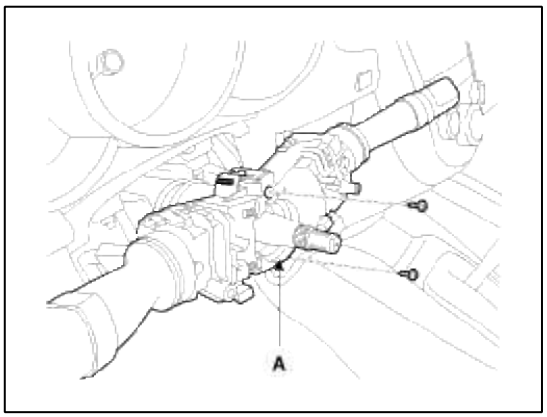
> NOTE
>
> when removing the wiper & washer switch only, release the lock of wiper switch without removing the steering wheel.



5. Remove the clock spring(A).



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

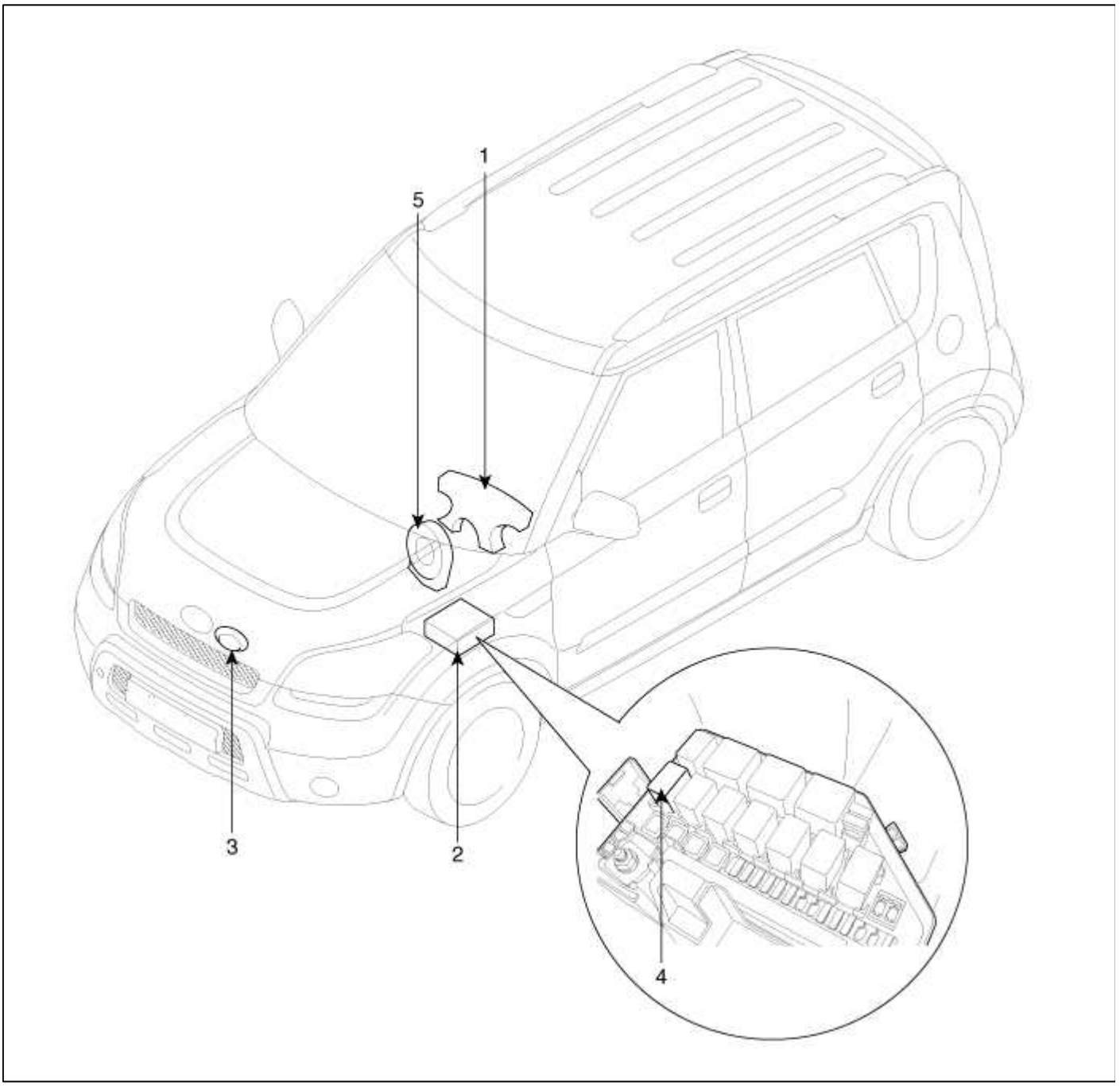


Installation

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

Body Electrical System > Horn > Components and Components Location

Component Location



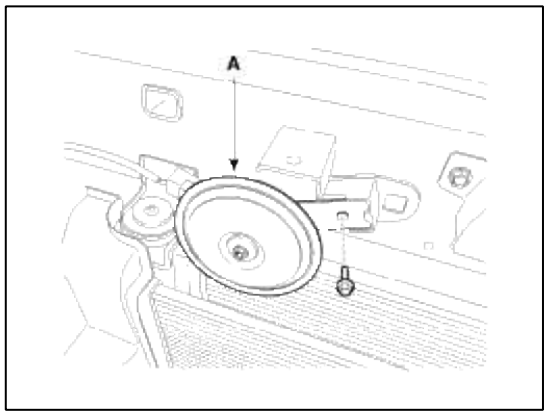
1. Horn switch 2. Relay box (Engine room compartment) 3. Horn (High pitch - Single)	4. Horn relay 5. Clock spring

Body Electrical System > Horn > Repair procedures

Removal

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

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



Installation

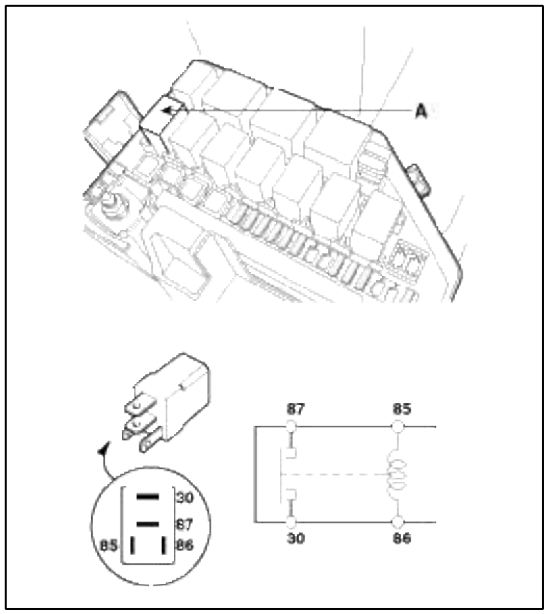
1. Install the horns after connecting the horn connectors.
2. Install the front bumper.
   (Refer to the Body group - "Front bumper")

Inspection

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

Horn Relay Inspection

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



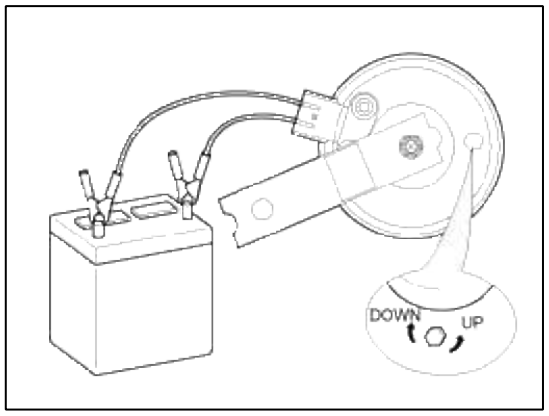
Terminal / Power	30	87	85	86
Disconnected			○	○
Connected	○	○	⊖	⊕

Adjustment

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

NOTE

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



Body Electrical System > Smart key System > Specifications

Specification

IPM (Smart Key Unit)

Items	Specification
Rated voltage	DC 12V
Operating voltage	DC 9 ~ 16V
Operating temperature	-30°C ~ 75°C (-22°F ~ 167°F)
Load	Max. 2mA

RF Receiver

Items	Specification
Frequency	433 MHz
Antenna type	FSK (Frequency Shift Keying)

Smart Key FOB

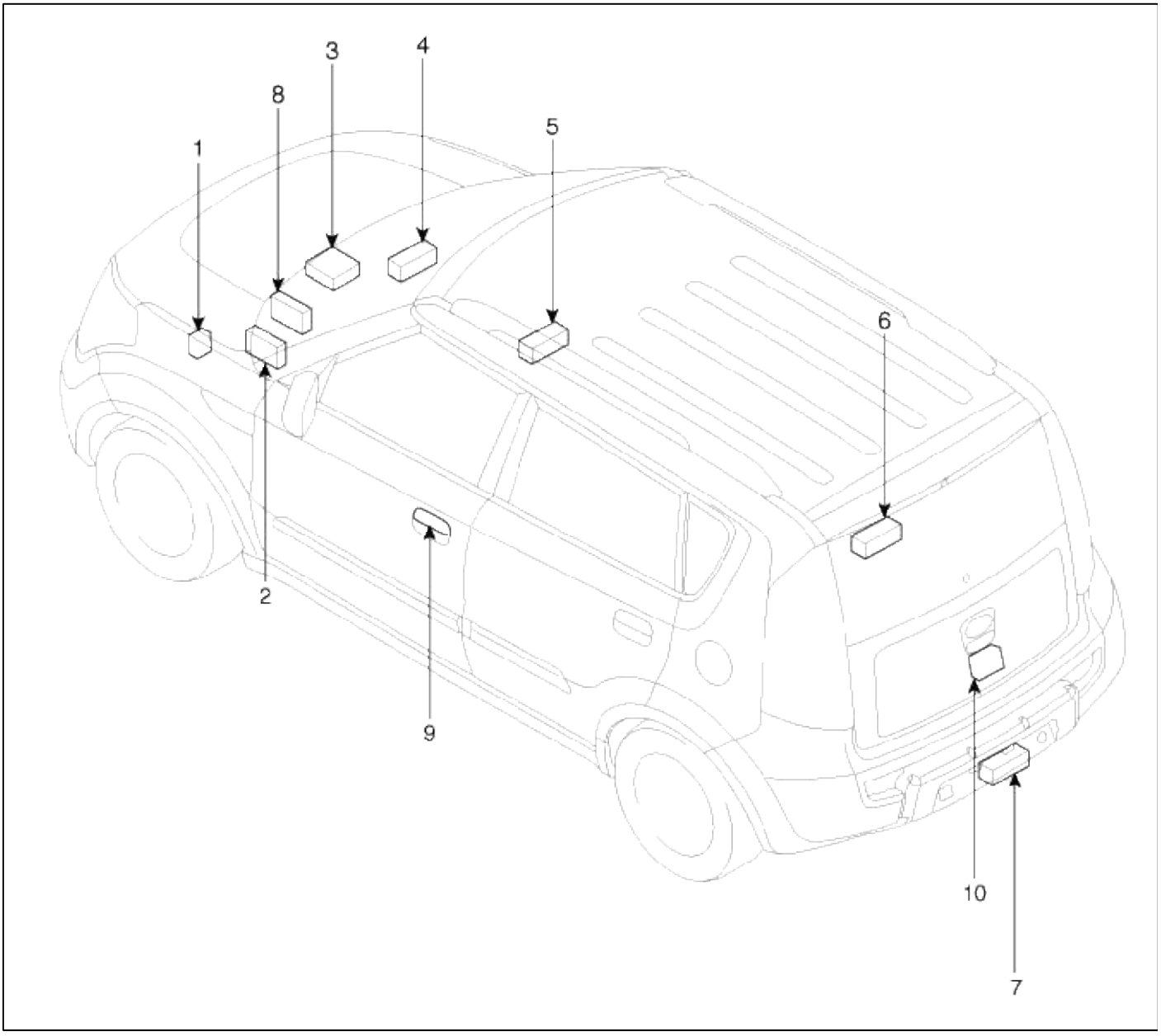
Items	Specification
Battery	Lithium battery 3V 1EA
Distance	10m
Battery life	More than 2years
Push buttons	Door lock / unlock / Tailgate / Panic
Frequency(Rx)	125 kHz
Frequency(Tx)	433 MHz
Numbers	2EA

Antenna

Items	Specification
Rated voltage	DC 12V
Operating voltage	DC 9 ~ 16V
Operating temperature	-30°C ~ 75°C (-22°F ~ 167°F)
Frequency	125kHz
Numbers	Interior(3EA), Door(2EA), Bumper(1EA)

Body Electrical System > Smart key System > Components and Components Location

Component Location



1. Buzzer	6. Interior antenna 3
2. RF receiver	7. Bumper antenna
3. Smart key unit	8. PDM(Power Distrubution Module)
4. Interior antenna 1	9. Door outside handle
5. Interior antenna 2	10. Tailgate switch

Body Electrical System > Smart key System > Description and Operation

Description

The SMART KEY system is a system that allows the user to access and operate a vehicle in a very convenient way. To access the vehicle, no traditional key or remote control unit is needed.
The user carries a SMART KEY FOB which does not require any conscious actions by the user (e.g. operate a RKE button). The SMART KEY system is triggered by pressing a push button in the door handle.
After being triggered the vehicle sends out a request in a limited range. If the SMART KEY FOB receives this request, it automatically sends a response to the vehicle. Then the system decides whether to perform a particular action (unlocking, locking…) or remain inactive.
The System offers the following features :

- passive unlock via door driver side and passenger side
- passive locking via door driver side and passenger side
- passive start
- passive access trunk/tailgate via the tailgate switch at the trunk
- passive locking via tailgate
- max. 2 FOBs can be handled by the system
- immobilizer backup antenna driver integrated into FOB-HOLDER for TP authentication (i.e. limp home mode)
- communication with engine management system
- communication with SRX
- LF-RF communication

1. Passive unlock
   The system allows the user to access (unlock) the vehicle without performing any actions with the SMART KEY FOB. This feature could be different depending on platform as follows:
   A. Pressing Push button in door handle

2. Passive locking
   The system allows the user to lock the vehicle by pushing a button on door handle with the SMART KEY FOB.

3. Button start
   The system allows the user to switch the power modes (Off, Accessory, Ignition), as well as to start and stop the vehicle's engine without performing any actions with the SMART KEY FOB. See Button Engine Start system specification.

4. LIMP HOME Mode
   Additionally, the system offers so called "limp home mode", which is the user can operate all vehicle functions by inserting the key into the FOB HOLDER.

Smart Key ECU (SMK ECU)
The SMK ECU manages all functions related to "Passive Unlock", "Passive Lock" and "Passive Authorization for Engine Start Operation".
It reads the inputs (Push button in door handle, Start Stop Button (SSB), PARK position Switch), controls the outputs (e.g. exterior and interior antennas), and communicates via the CAN/LIN (depends on the vehicle) as well as a single line interface to further devices of the car.
It reads the inputs (Push button in door handle, Start Stop Button (SSB), PARK position Switch), controls the outputs (e.g. exterior and interior antennas), and communicates via the CAN as well as a single line interface to further devices of the car.
For communication with the SMART KEY FOB, SMK ECU generates a request (challenge) as an encoded and

modulated 125 kHz signal at the inductive antenna outputs and receives the SMART KEY FOB’s response via the external RF receiver.
The main functional blocks of the SMK ECU are:

- Power supply
- Microcontroller with FLASH Memory
- Single Line Interface to SRX
- Single Line Interface to EMS
- Input stage
- LF antenna amplifier/driver
- CAN communication with BCM
- LIN communication with other unit (depending on platform)

The LF antenna amplifier/driver generates a 125 kHz sinusoidal carrier signal which is distributed to the different antennas.

Smart Key FOB
The system supports up to 2 SMART KEY FOBs.
The main functions of the SMART KEY FOB are:

- Passive functionality: receives LF-challenge and sends automatically RF response.
- Classic RKE function by action up to 6 push buttons.
- Transponder-functionality in case of a flat battery or a disturbed communication.
- LED for operation feedback and battery monitoring.

NOTE

The FOB's LED indicator may continue to light even with a low transmitter battery.
If the performance or range of the FOB is less than expected, check the transmitter battery.

Antennas

1. Emitting LF Antennas:
   Inductive antennas in and at the vehicle are used to transform the current, driven by the SMK ECU antenna driver, into a 125 kHz magnetic field, which is the carrier for the SMART KEY challenge.
   Three antennas cover the vehicle’s exterior: two antennas in the Door Handles (DS and PS) cover the area around the doors; one antenna in the rear bumper covers the area around the trunk/tailgate.
   Up to three antennas cover the vehicle’s interior and the trunk interior: two in the passenger compartment and one in the trunk.

2. Bidirectional Immobilizer Antenna (for Limp Home):
   The Immobilizer Backup Antenna is used for sending and receiving data: it emits a magnetic field (125 - 135 kHz challenge) and receives changes in the field strength (response of Transponder).

3. External Receiver
   The SMART KEY FOB’s response is received via the external RF receiver, which is connected to the SMK ECU via a serial communication Line.
   The SMK ECU provides a connector pin for the serial communication Line.

Door Handle
The front door handles of the two doors (driver door / passenger door) are equipped with emitting LF-antennas to emit the 125 kHz signals. The front door handles are also equipped with a push button.

Push Button

The push button in door handle serves as a trigger to indicate the user's intent to unlock or lock the vehicle.
The push buttons are installed at front doors, integrated into the door handles.
Another button is installed at the tailgate.

Operation

Passive Functions
The system allows the user to access the vehicle without having to perform any actions (e.g. RKE button pressing) with the SMART KEY FOB. It is sufficient that a valid SMART KEY FOB is located within a defined and limited range with respect to the vehicle. So the system is capable of detecting and authenticating a SMART KEY FOB in the ranges as specified below.

Operating Range

The SMART KEY FOB receives and interprets a challenge sent from the vehicle via the exterior antennas in a free space range of min. 0.7m measured around the exterior antennas which are integrated in the door handles; refer to the below given picture. The trunk access range is also min. 0.7m measured from the antenna position.
The SMART KEY FOB receives and interprets a challenge sent from the vehicle via the exterior antennas in a free space range of min. 0.7m measured around the exterior antennas which are integrated in the door handles.

Passive Access (Passive Entry)
Pressing one of the push buttons in the door handles when all doors locked indicates the operator's intent to access the vehicle and thus triggers the system for unlock

Passive Locking (Exit)
Pressing one of the push buttons in the door handles when one of the following condition is fulfilled:

- at least one door is unlocked and two_steps timer is not running or
- two_steps timer is running and one of the push button except Front Left side is triggered

indicates the operator's intent to lock the vehicle and thus triggers the system for a lock.

Passive Open Tailgate
Pressing the Tailgate Lid Switch when tailgate is closed indicates the operator's intent to open the tailgate and thus triggers the system. Subsequently, the SMK ECU sends a LF-challenge to the SMART KEY FOB via the exterior bumper antenna. The SMART KEY FOB answers with a RF-response. If the received response matches the expected answer, SMK ECU sends a "tailgate open" message via the CAN network.

Passive Trunk Warning
Whenever the trunk is closed, SMK ECU uses a suitable search strategy to avoid trunk buzzer warning by a FOB outside the vehicle. Then SMK searches for a SMART KEY FOB in the interior of the trunk. If a valid SMART KEY FOB is found in the trunk, the SMK ECU activates SMK external buzzer (TBD) to inform the user that the trunk has been closed with a fob inside the trunk.
SMK will send the trunk open command to BCM for trunk reopening if Trunk reopening bit is set(BK). For this functionality, a "valid" SMART KEY FOB means any SMART KEY FOB that belongs to the vehicle, even if it's DEACTIVATED.

NOTE

- A blind spot in the trunk similar to any RF disturbance may lead to no trunk warning. Due to the penetration of the bumper antenna into the trunk area the lid may open without an Identification Device outside.
- A blind spot in the trunk similar to any RF disturbance may lead to no trunk warning

Smart Key Reminder 1

1. Preconditions:
   All terminals OFF & at least one door open & locking status is not locked checked by SMK periodically every 100ms, as long as CAN/LIN active.

2. Event:
   At least 1 door knob status changed from unlock to lock.

3. SMK actions:
   A. IF NO FOB-IN ACTIVE
      SMK performs a search for the fobs in the interior of the vehicle.The same LF-strategy has to be used as it is defined for the ID out warning (registering only, no authentication)
   B. IF FOB-IN ACTIVE
      SMK sends request toward PDM to search valid TP
   If no FOB or no TP has been found, no action is required.
   If any valid FOB or valid TP has been found, SMK unlocks the vehicle by sending a CAN Key Reminder unlock message with the FOB number.
   If any valid FOB has been found, SMK unlocks the vehicle by sending a CAN/LIN Key Reminder unlock message with the FOB number.

Smart Key Reminder 2

1. Preconditions:
   All terminals OFF & any door (including tail gate) open & no FOB-IN & no locking status (checked by SMK periodically every 100ms, as long as CAN/LIN active)

2. Vehicle action:
   Closing last door or tail gate with knobs locked state, or with a locking in progress

3. SMK actions:
   Before elapsing 500ms after the closing if all doors are locked then:
   A. IF NO FOB-IN ACTIVE
      SMK performs a search for the fobs in the interior of the vehicle.
      The same LF-strategy has to be used as it is defined for the ID out warning (registering only, no authentication)
   B. IF FOB-IN ACTIVE
      SMK sends request toward PDM to search valid TP
   If no FOB has been found, no action is required.
   If any valid FOB or valid TP has been found, SMK sends unlock command via CAN and activates ext. buzzer warning.
   If any valid FOB has been found, SMK sends unlock command via CAN/LIN and activates ext. buzzer warning.

Smart Key Door Lock Warning

Door Lock Warning 1

1. Preconditions:
   While (at least one door knob is unlocked) & (ACC ON or IGN ON) & (No FOB-IN) :
   A. (All doors are closed) & (tailgate closed)

2. Event:
   A. User presses the push button in door handle or tailgate

3. SMK actions:
   SMK performs a search for the FOBs outside of the vehicle; the same LF-strategy has to be used as it is defined for "Scenario Access with I/O Distinction".

Door Lock Warning 2

1. Preconditions:
   Same as passive locking precondition but with at least one door open.

2. Event:
   User presses the door handle Push button .

3. SMK actions:
   SMK performs a search for the FOBs outside of the vehicle; the same LF-strategy has to be used as it is defined for "Scenario Access with I/O Distinction".
   If no FOB has been found, no action is required.
   If the preconditions are no longer valid during buzzer active time (3 seconds), the SMK ECU stops the buzzer immediately.

Door Lock Warning 3

1. Preconditions:
   Same as passive locking precondition

2. User action:
   A. User presses the door handle Push button

3. SMK ECU actions:
   A. If ATWS(Anti Theft Warning System) is in DISARM status, SMK ECU performs a search for the fob inside of the vehicle (use "Door Lock Warning 3" scenario)

If no FOB has been found, the passive locking is performed.
If any valid FOB has been found, SMK ECU activates the external buzzer.
If the activity timer elapsed or ACC ON or IGN1 ON or NOT All door closed or FOB-IN, the SMK ECU stops the buzzer immediately.
After searching of inside fob, SMK ECU also performs a search for FOBs outside of the vehicle.

Smart Key Lamp Warning

1. SMK actions:
   As long as the preconditions are valid, the SMK ECU performs a periodical search for the FOBs in the interior of the vehicle; the same LF-strategy has to be used as it is defined for the ID out warning (registering only, no authentication); periodical means, the search is done every 3 seconds.
   If no FOB has been found, the SMK ECU starts Key out indicator lamp activation as all preconditions are valid and will perform another search 3 seconds later.

If any valid FOB has been found, the SMK ECU stops the Key out indicator lamp and will (if one door is open) perform another search 3 seconds later; if no door is open then it’s only at the next When the preconditions are still valid, the search resumes by opening of one door.

Failsafe Functions (Backup For Limp Home)
In case of a discharged battery of the SMART KEY FOB or disturbed transmission, the following functions are available:

- Unlocking / locking of doors or trunk (or tailgate depending of the vehicle configuration): use of mechanical key

User Information Functions

ID OUT Warning

1. Preconditions:
   A. (ACC or IGN1) & (any door open or tailgate open)
2. Event:
   The last opened door is closed
3. SMK action:
   SMK searches for a SMART KEY FOB in the interior.
   A. If no valid SMART KEY FOB is found, the SMK activates external buzzer and also sends ID OUT WNG via CAN (exterior buzzer warning and internal buzzer warning).
   B. If a door is opened and closed again during terminals on and inside valid FOB, SMK re-enables the authentication and stops the warning. If the terminal is in ACC, SMK shall turn on immobilizer lamp.

NOTE

If there is a LF error (LF overheating or LF antenna failure), the system will have the same behavior as it is with no FOB found.

Immobilizer Lamp
Removing the PIF from the MSL and reinserting the PIF and pushing the MSL Knob will switch the lamp on again.

FOB Battery Low Voltage Detection
To detect FOB low battery condition, certain battery voltage measurement and low voltage detection strategy are implemented into FOB. The measurement of the battery voltage will be done if FOB button is pressed or if a LF measurement command is received.
If the FOB has detected a low battery voltage, the LED will not be switched on at button press.

Learning Description
In this chapter, the learning procedure for SMK, PDM and FOBs is described.
For the learning of the SMK, PDM and FOBs, it's necessary to have a connection to the diagnostic tool.

Learning MODE
Whatever the mode, the learning procedures are managed by the SMK.
Prior to start learning service, FOB-In signal must be active and the vehicle secrect code (called as PIN code) should be known.

Teaching MODE
This mode is used by the dealers in order to replace SMK and/or PDM and/or the set of keys, or to register additional keys for an existing system. That means the system already has been learnt with certain PIN Code. The PIN Code is fixed for the life time of the vehicle, therefore the same PIN Code must be used in this mode. Otherwise learning will be failed

Teaching MODE Procedure Description (Step By Step)
Objective: Key teaching procedure at service station
Initial state:

- SMK replacement: SMK is not learnt, PDM and SMART FOB are already learnt with same PIN code
- PDM replacement: PDM is not learnt, SMK and SMART FOB are already learnt with same PIN code
- Additional or new keys teaching: SMK and PDM are already learnt with same PIN code

Smart key teaching

Insert smart key #1 to key holder
↓
SMK start to learn
↓
Input the PIN code
↓
PDM start to learn
↓
Smart key #1 learnt
↓
SMK/PDM learnt
↓
Pull out smart key #1
↓
Insert smart key #2 to holder
↓
Smart key #2 learnt

- Smart key system is learnt **transponder and smart key** by once at same time.

<Smart key neutralization mode>

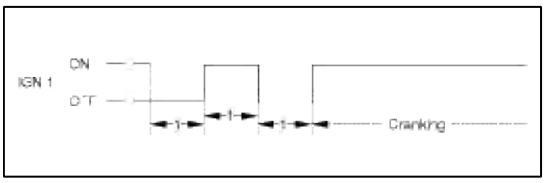
- Neutralization mode is for replacing Smart key unit, PDM ECM easily.
- It is possible that smart key is learnt again, after neutralizing Smart key system.
- Virgin start (twice ignition) is impossible in neutralized condition

<Lock by timer>

- If PIN code is inputted over 3 times, it is impossible to learnt and neutralization during 1 hour.

Starting After Replacing (Virgin Start)
Starting is possible by following process after replacing new smart key unit , PDM or FOB key.

- It is for starting at virgin condition
- All related parts are virgin condition (Smart key, IPM, PDM)
- When virgin smart key is inserted in smart key holder, possible to start, IG ON and ACC position
- Press brake pedal in P or N range
- After inserting virgin smart key to holder, push start button once.



Body Electrical System > Smart key System > Repair procedures

Inspection

Self Diagnosis With GDS
Smart key system defects can be diagnose with the GDS quickly. GDS can operates actuator forcefully, input/output value monitoring and self diagnosis.
The following three features will be major problem in SMART KEY system.

1. Problem in SMART KEY unit input.
2. Problem in SMART KEY unit.
3. Problem in SMART KEY unit output.

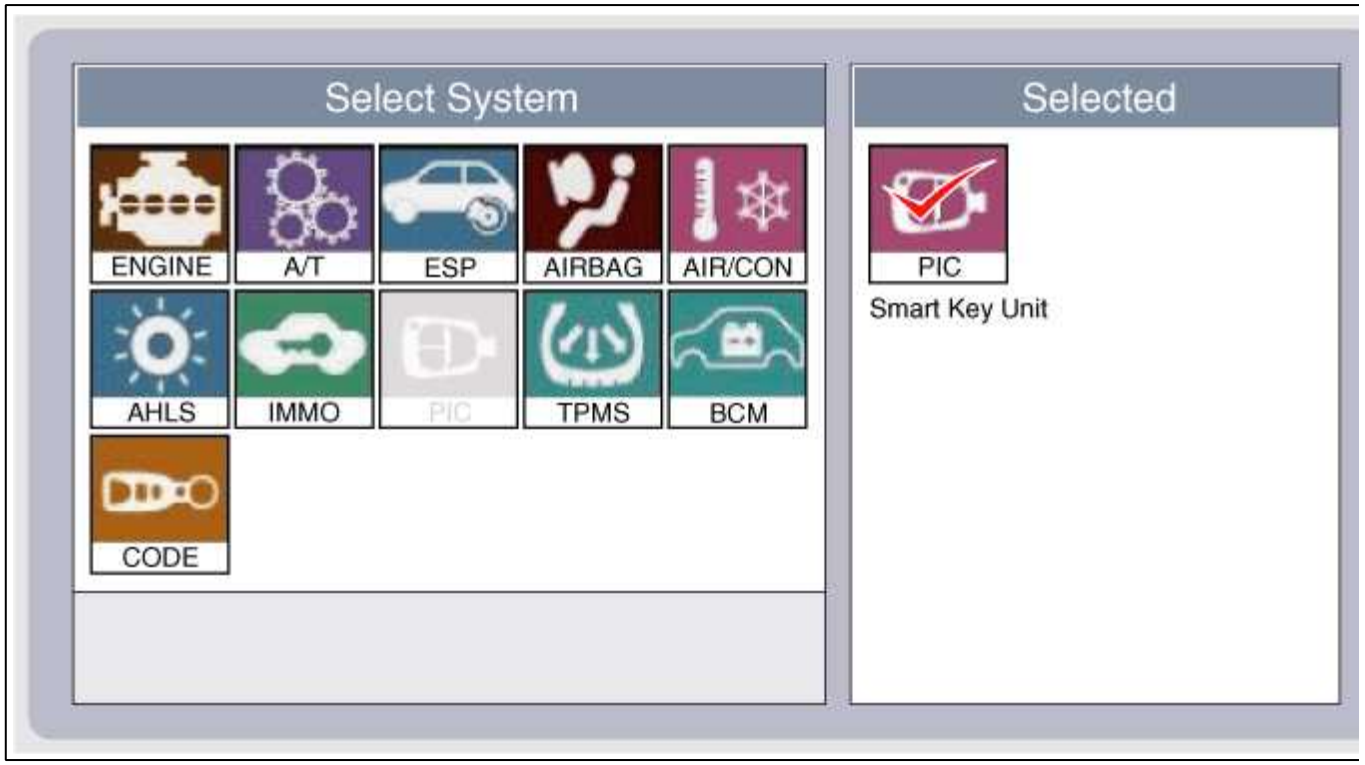
So the following three diagnosis operates will be the major problem solution process.

1. SMART KEY unit Input problem : switch diagnosis
2. SMART KEY unit problem : communication diagnosis

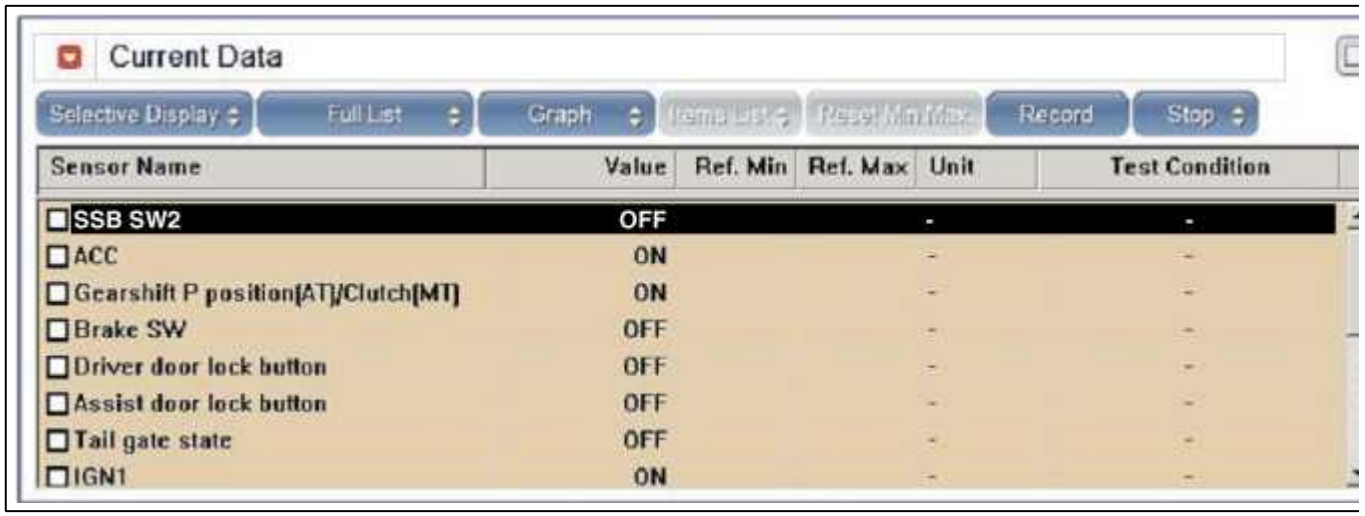
3. SMART KEY unit Output problem : antenna and switch output diagnosis

Switch Diagnosis

1. Connect the cable of GDS to the data link connector in driver side crash pad lower panel, turn the power on GDS.
2. Select the vehicle model and then SMART KEY system.



3. Select the "SMART KEY unit".
4. After IG ON, select the "Current data".



5. You can see the situation of each switch on scanner after connecting the "current data" process.

Display	Description
FL Toggle switch	ON : Push button is ON in the driver door handle.
FR Toggle switch	ON : Push button is ON in the assist door handle.
Tailgate switch	ON : Tailgate button is ON.
Gear P Position	ON : Shift lever is P position.
IGN 1	ON : IGN switch is IG position.
ACC	ON : IGN switch is ACC position.
Push Knob switch	ON : Push knob switch is ON.
External Buzzer	ON : Buzzer is ON.

Communication Diagnosis With GDS (Self Diagnosis)

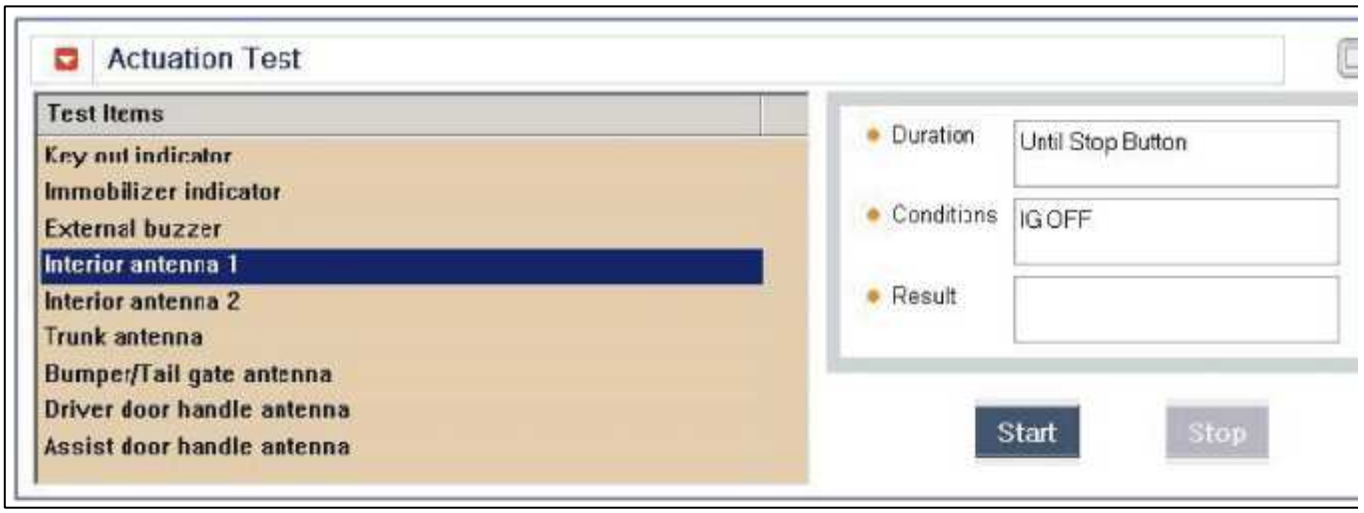
1. Communication diagnosis checks that the each linked components operates normal.
2. Connect the cable of GDS to the data link connector in driver side crash pad lower panel.
3. After IG ON, select the "DTC".



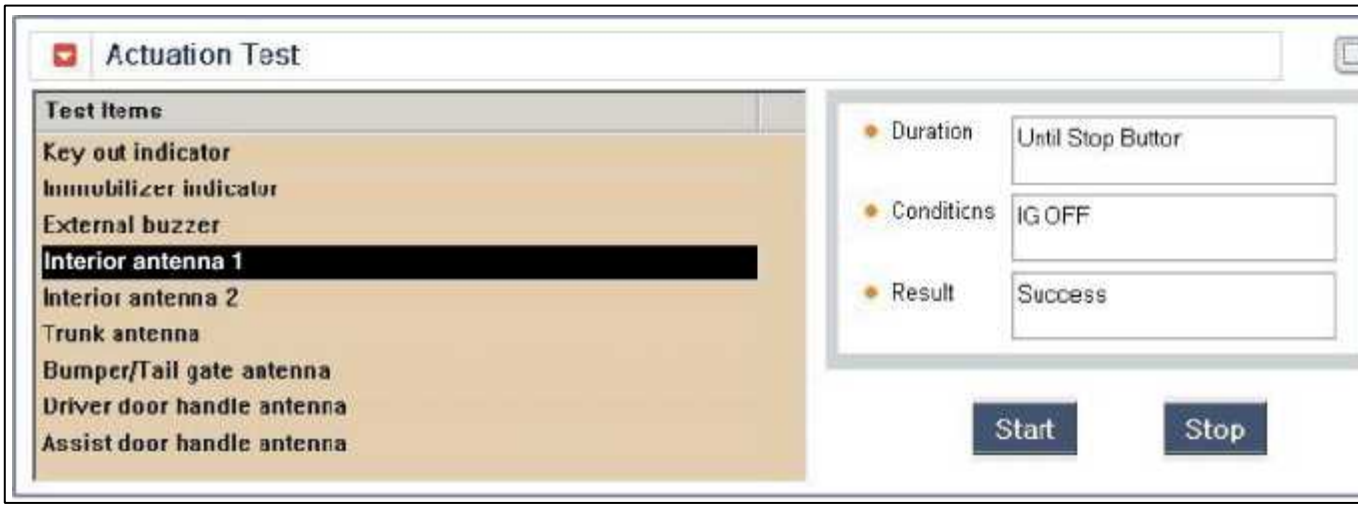
Antenna Actuation Diagnosis

1. Connect the cable of GDS to the data link connector in driver side crash pad lower panel.

2. After IG ON, select the "ACTUATION TEST".



3. Set the smart key near the related antenna and operate it with a GDS.

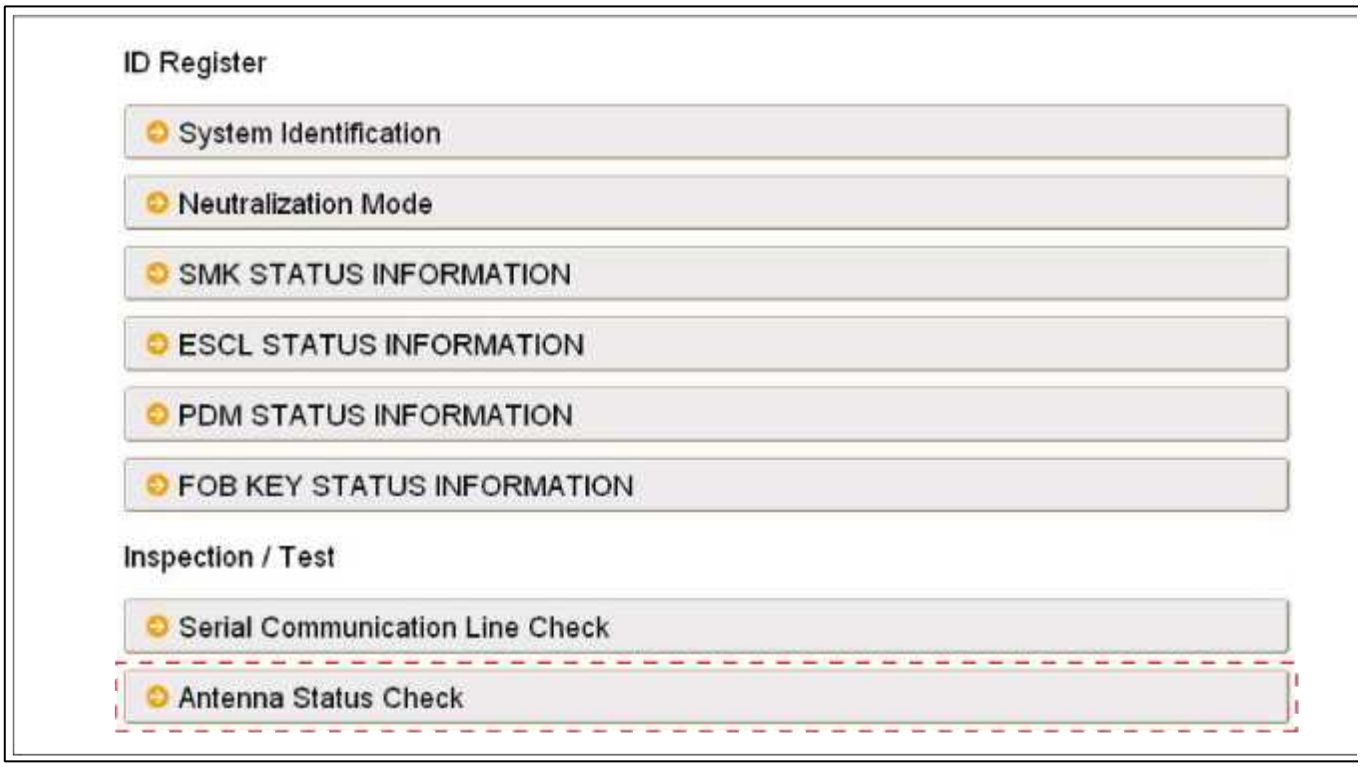


4. If the LED of smart key is blinking, the smart key is normal.
5. If the LED of smart key is not blinking, check the voltage of smart key battery.
6. Antenna actuation
   A. INTERIOR Antenna 1
   B. INTERIOR Antenna 2
   C. INTERIOR Antenna 3
   D. BUMPER Antenna
   E. DRV_DR Antenna
   F. AST_DR Antenna

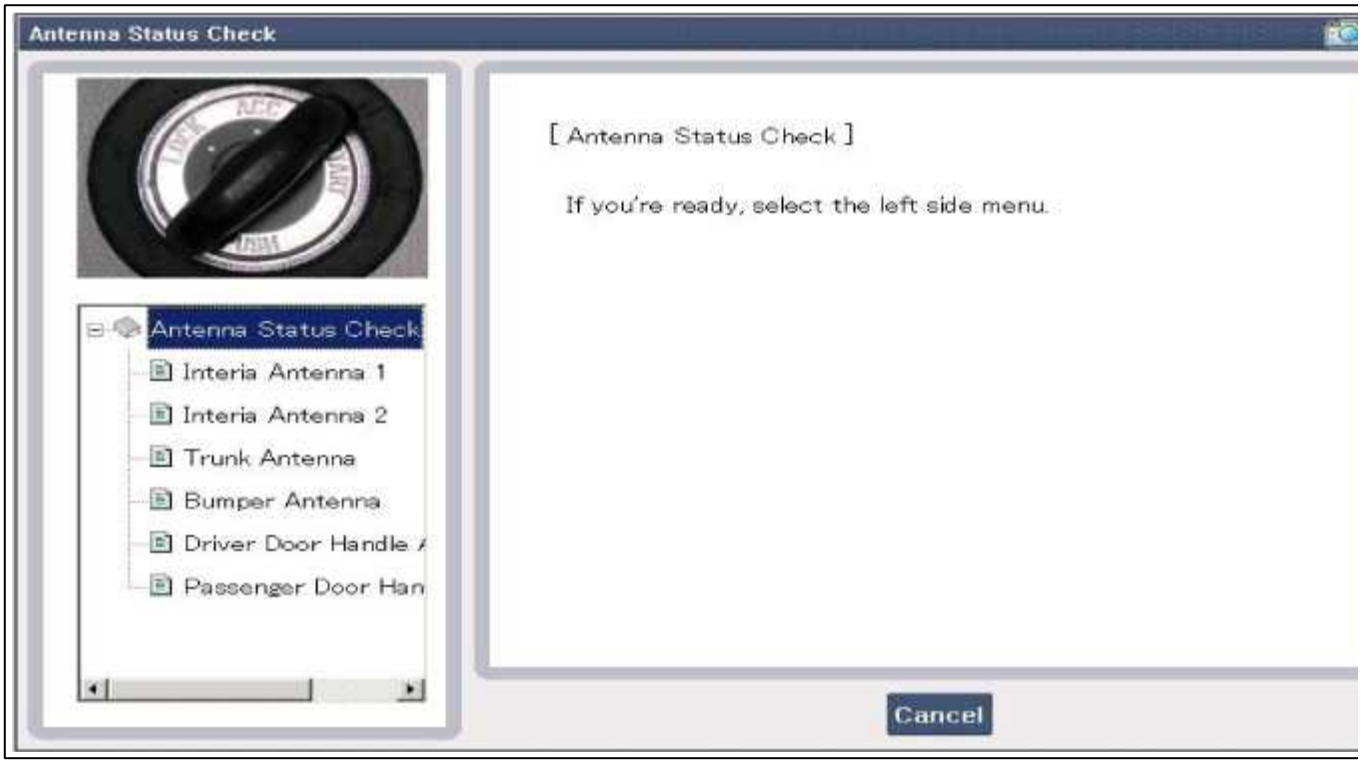
Antenna Status Check

1. Connect the cable of GDS to the data link connector in driver side crash pad lower panel.

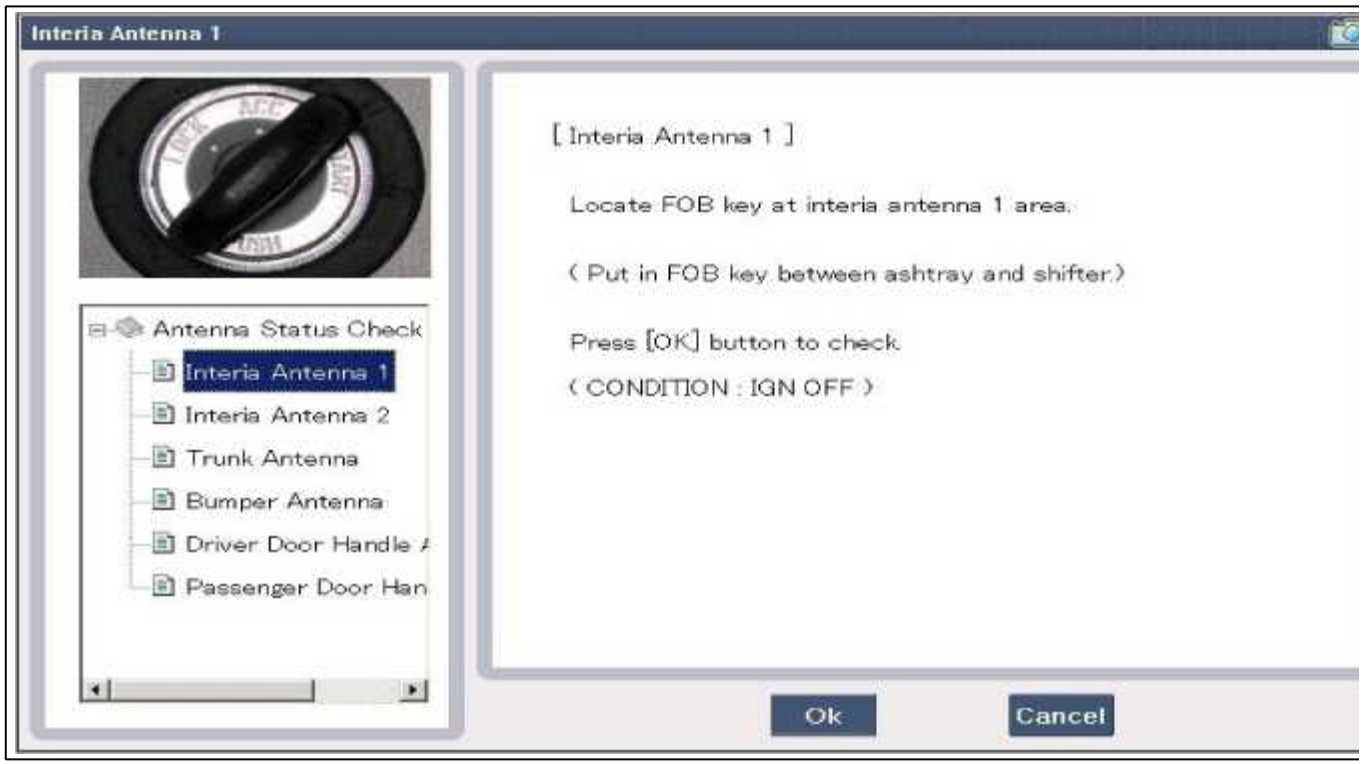
2. Select the "Antenna Status Check".



3. After IG ON, select the "Antenna Status Check".



4. Set the smart key near the related antenna and operate it with a GDS.



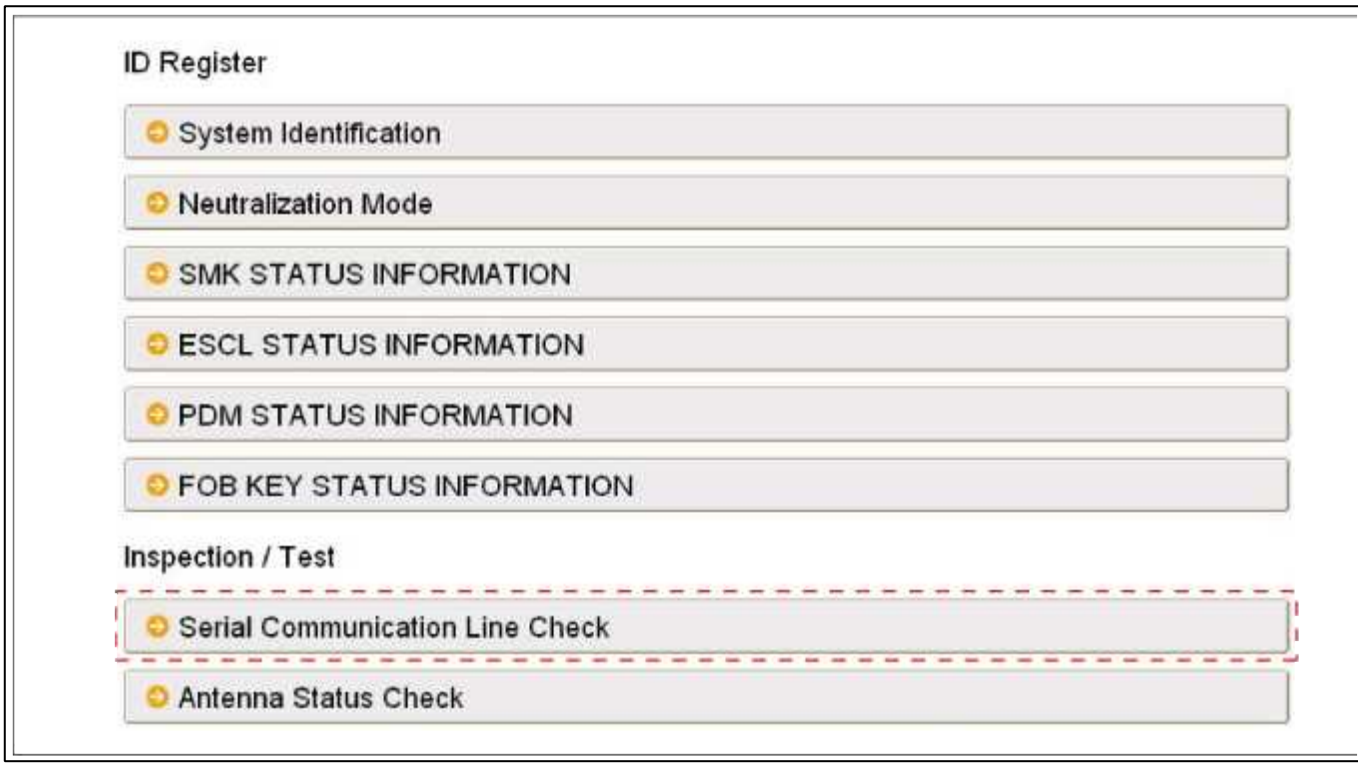


5. If the smart key runs normal , the related antenna, smart key(transmission, reception) and exterior receiver are normal.

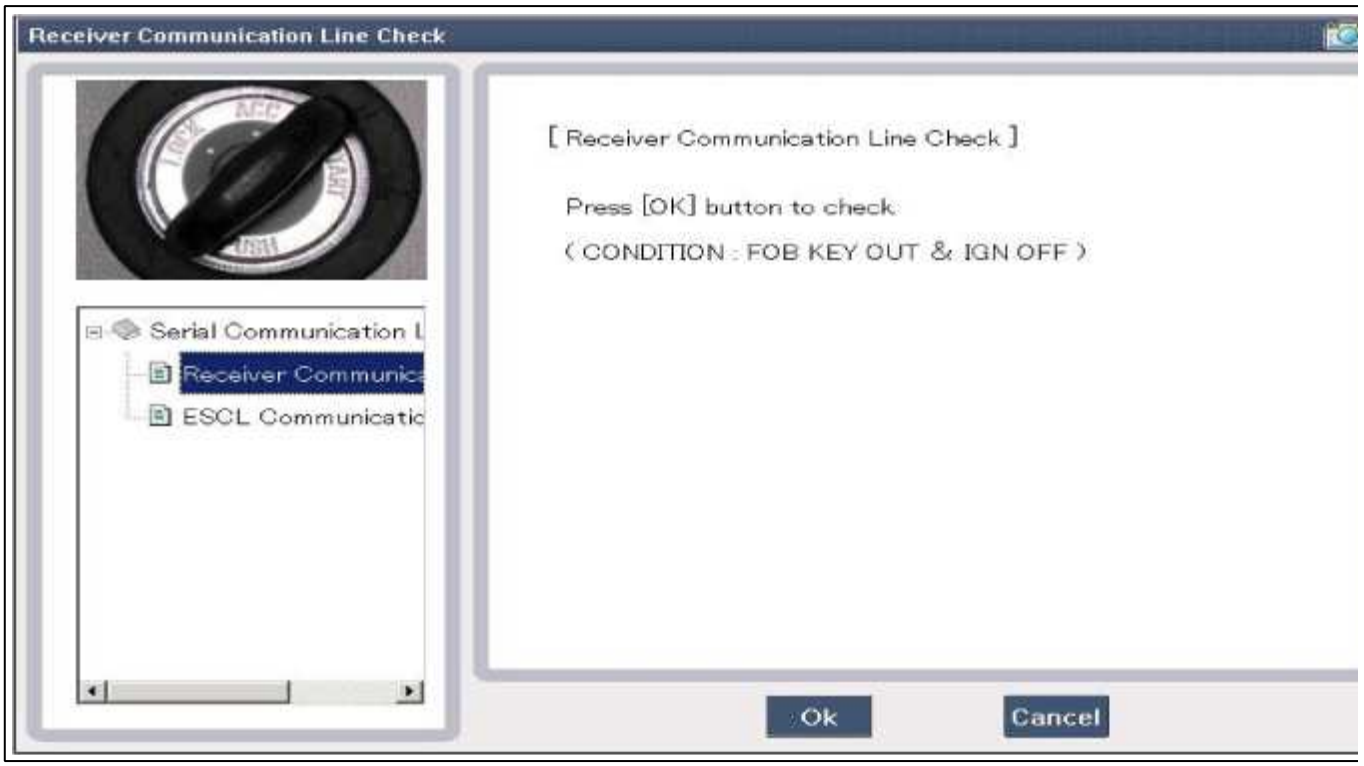
6. Antenna status
   A. INTERIOR Antenna 1
   B. INTERIOR Antenna 2
   C. INTERIOR Antenna 3
   D. BUMPER Antenna
   E. DRV_DR Antenna
   F. AST_DR Antenna

Serial Communication Status Check

1. Connect the cable of GDS to the data link connector in driver side crash pad lower panel.
2. Select the "Serial Communication Line Check".



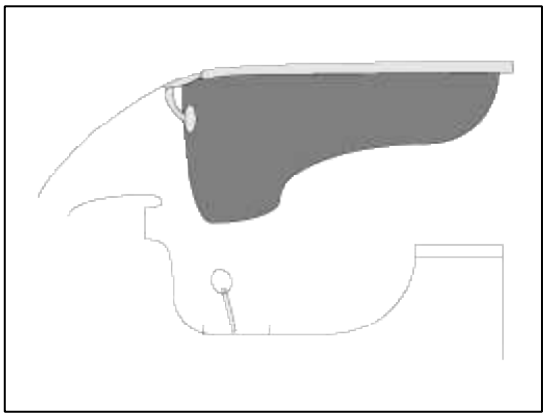
3. After IG ON, select the "Receiver Communication Line Check".



4. Check the serial communication line with a GDS.
5. If the smart key runs normal, the communication of smart key unit and exterior receiver are normal.
6. If the smart key runs abnormal, check the following items.
   A. Disconnection or no response of the exterior receiver communication line.
   B. The exterior receiver communication line disconnection and ground connection.

Interior Antenna Actuation Check

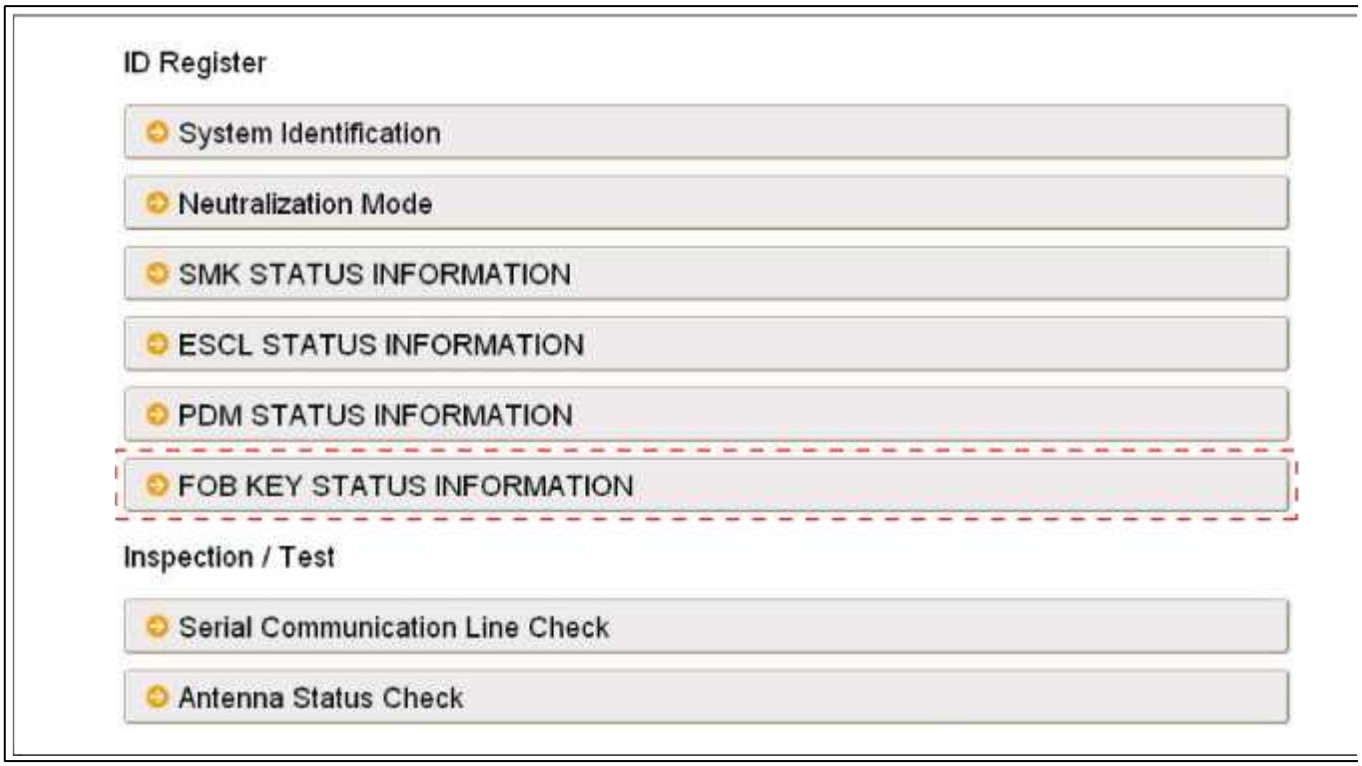
1. Set the smart key in the following shade area and check the IG ON.



2. If the ignition is ON, the antenna runs normal.
3. Check the interior antenna ignition mode.
4. Set the smart key in the following shade area and actuate the antenna. Check the LED of smart key is blinking.
5. If the LED of smart key is not blinking, check the antenna in shade area.

FOB Status Check

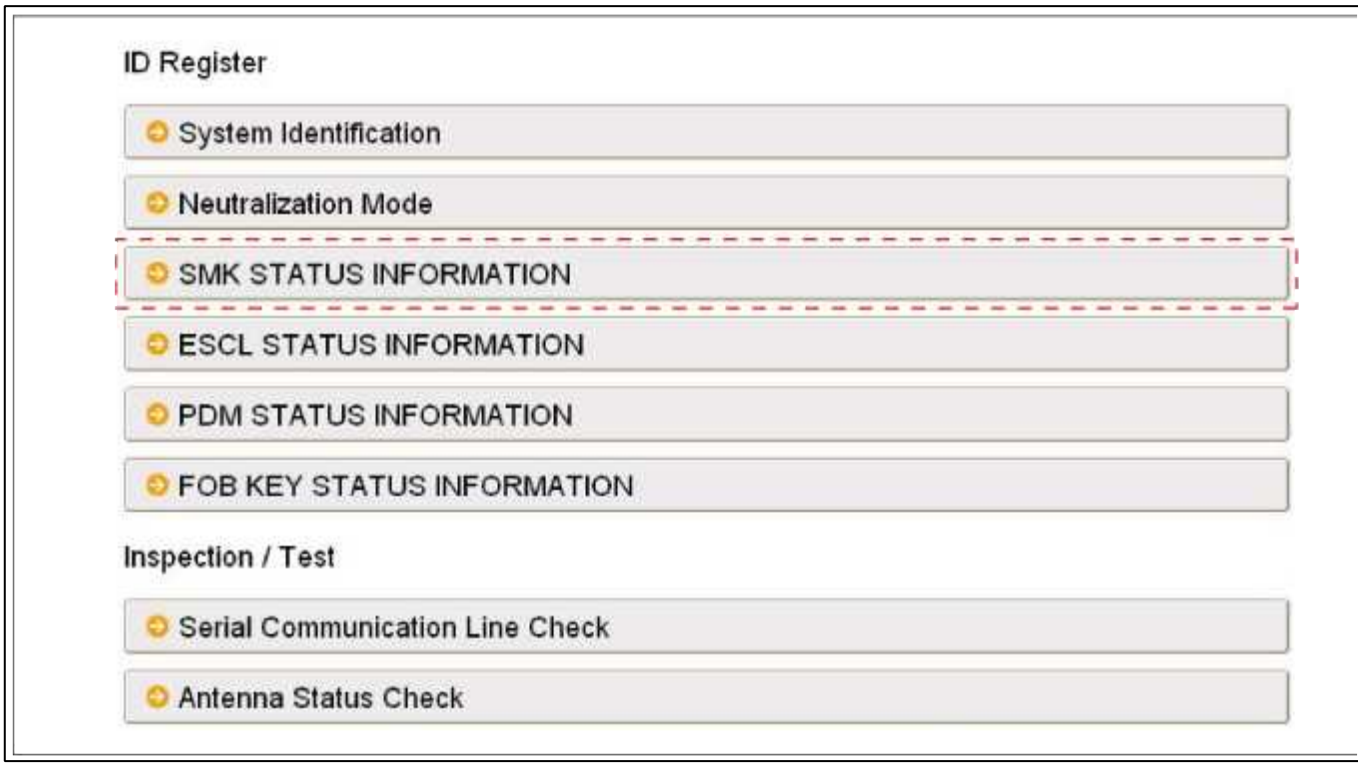
1. Connect the cable of GDS to the data link connector in driver side crash pad lower panel.
2. After IG ON, select the "FOB KEY STATUS INFO".

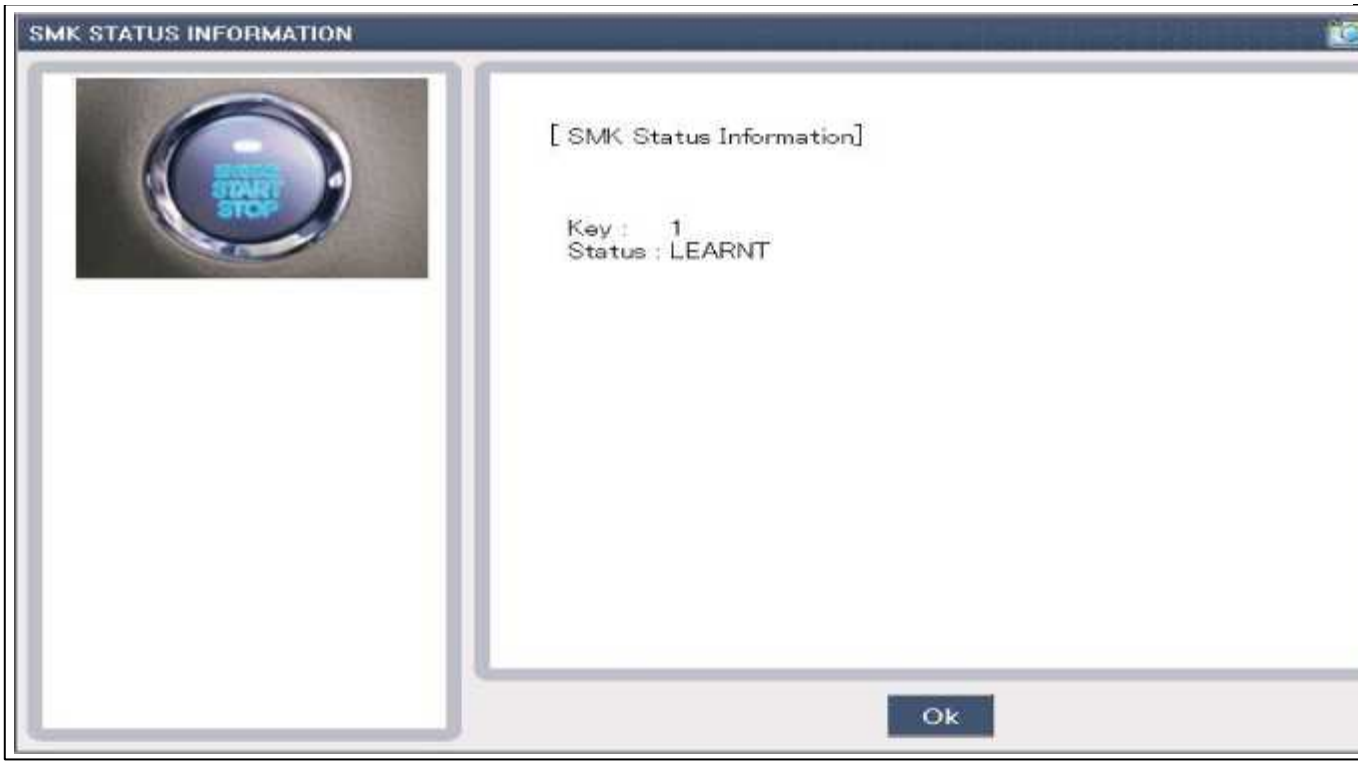




Smart Key Status Check

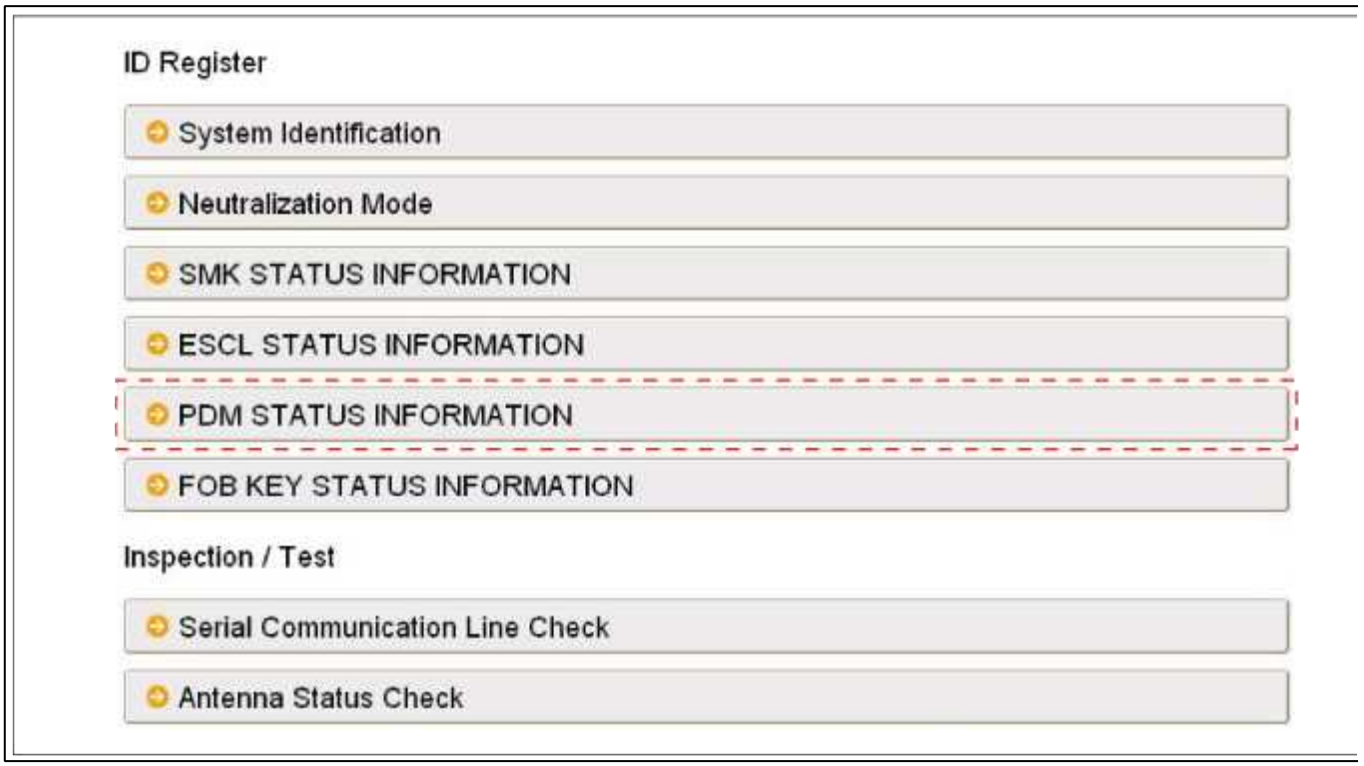
1. Connect the cable of GDS to the data link connector in driver side crash pad lower panel.
2. After IG ON, select the "SMK STATUS INFO".

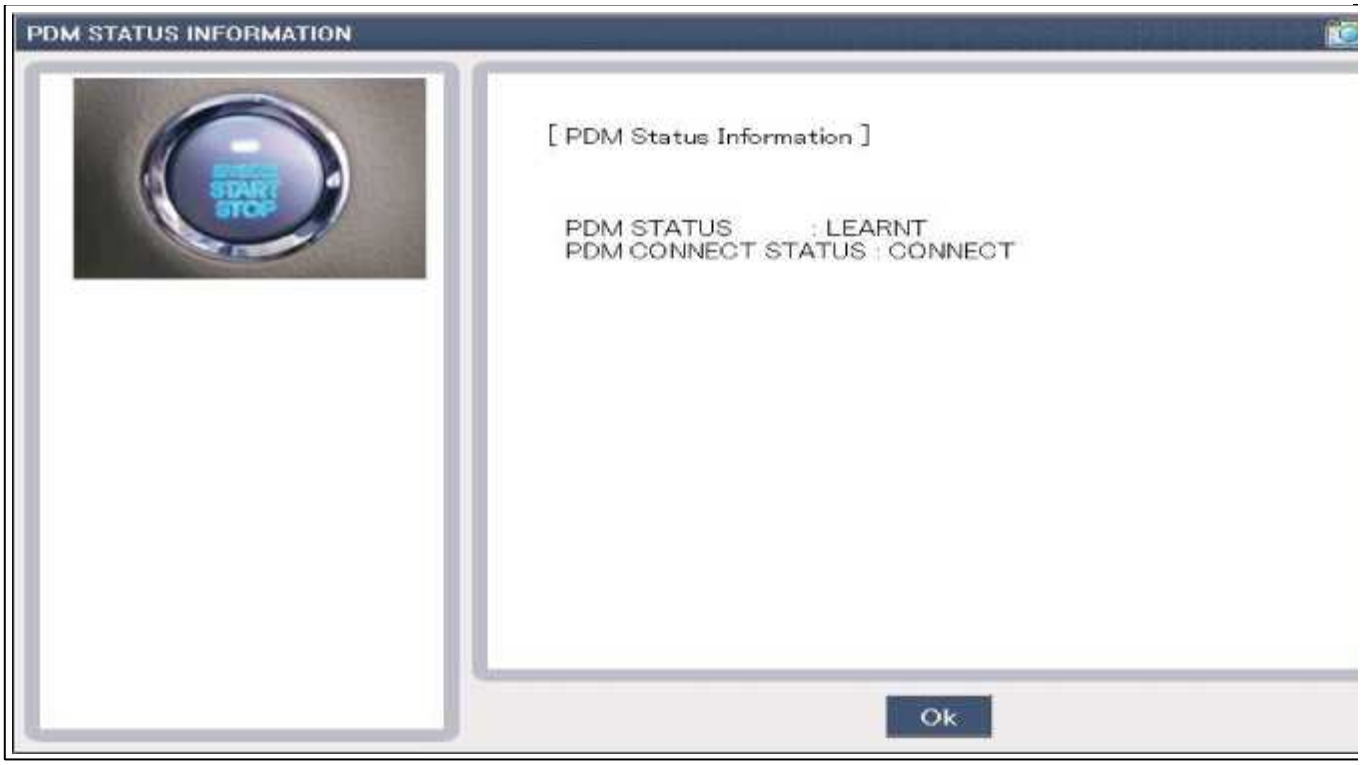




PDM Status Check

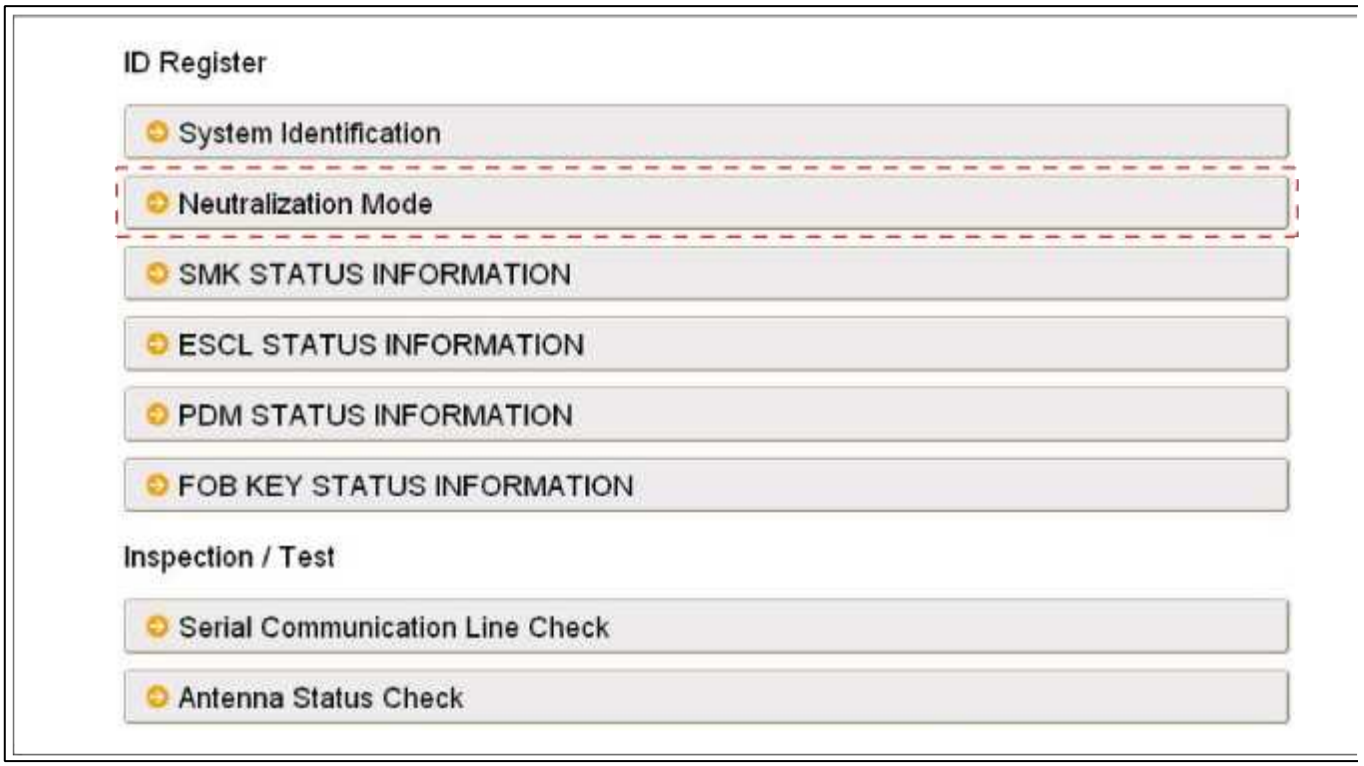
1. Connect the cable of GDS to the data link connector in driver side crash pad lower panel.
2. After IG ON, select the "PDM STATUS INFO".

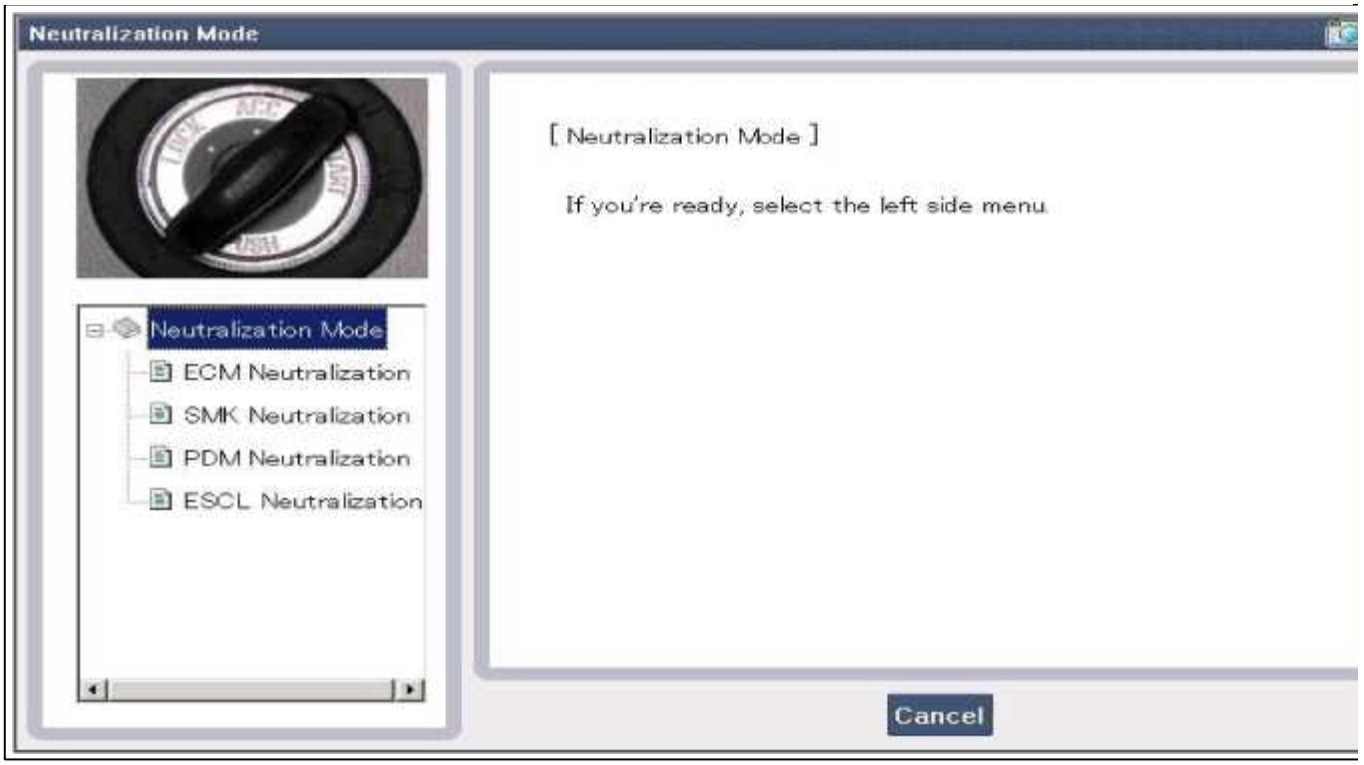


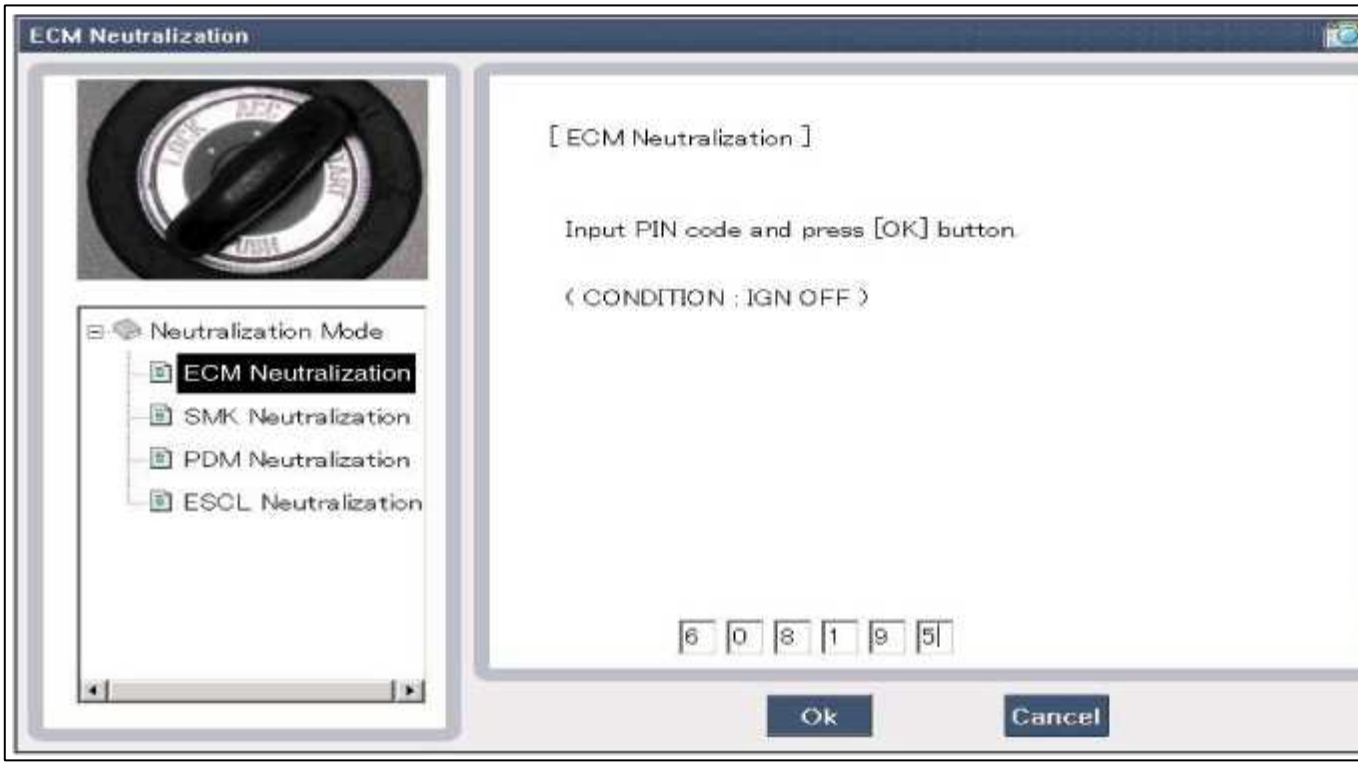


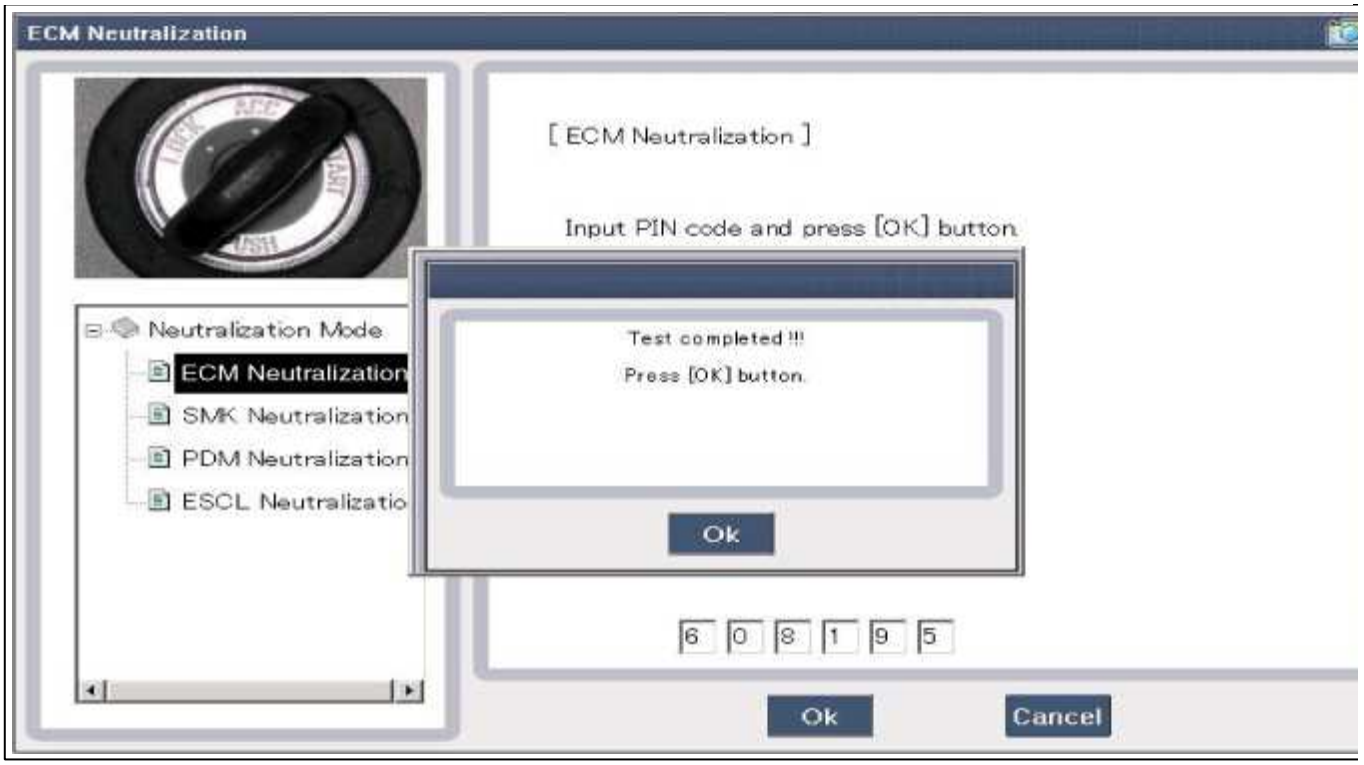
Neutralization Status Check

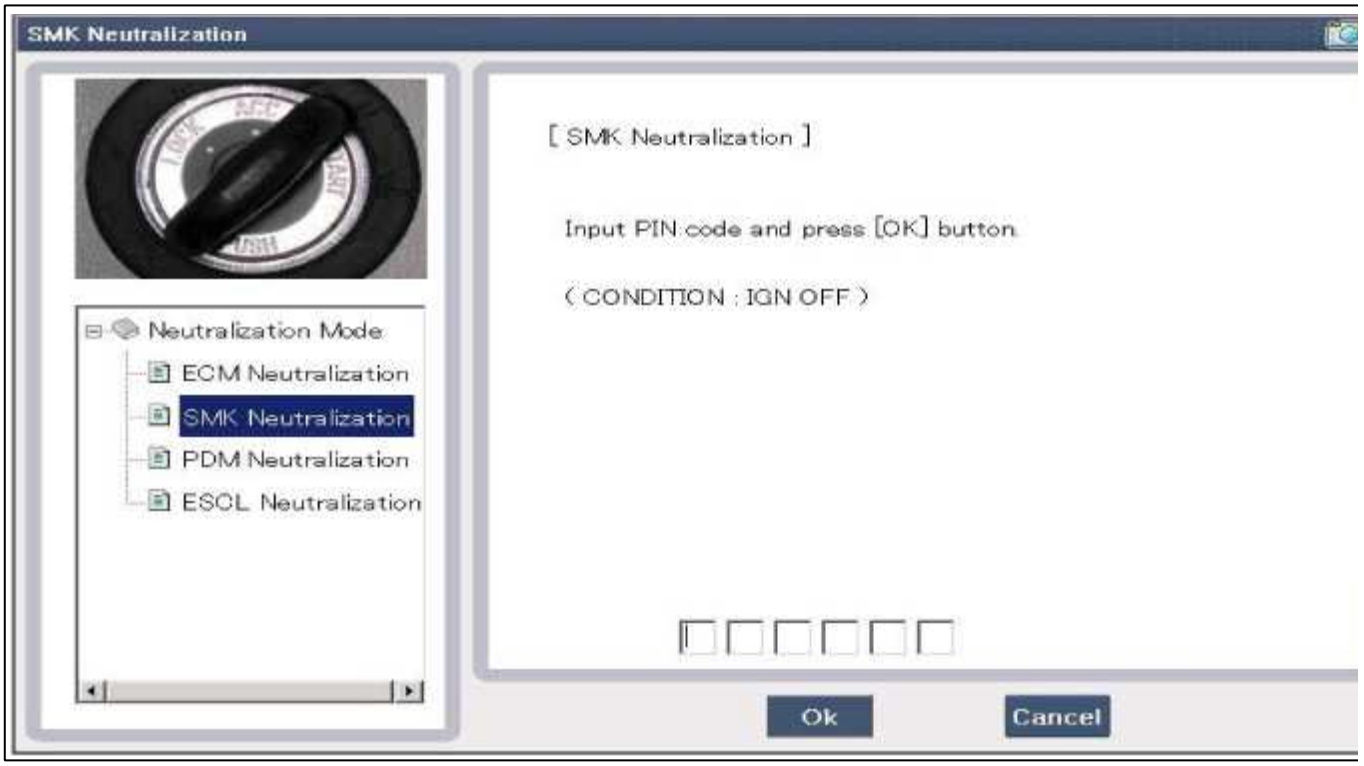
1. Connect the cable of GDS to the data link connector in driver side crash pad lower panel.
2. After IG ON, select the "Neutralization mode".

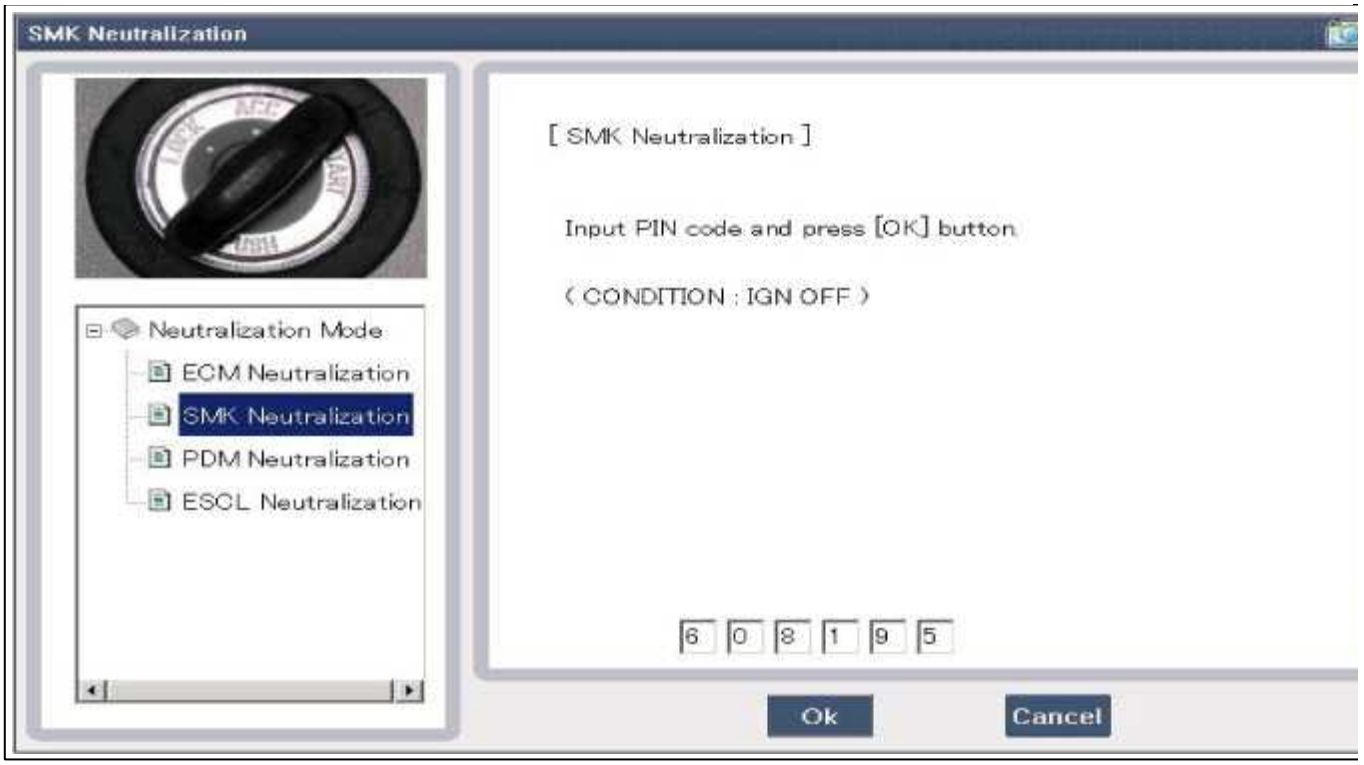


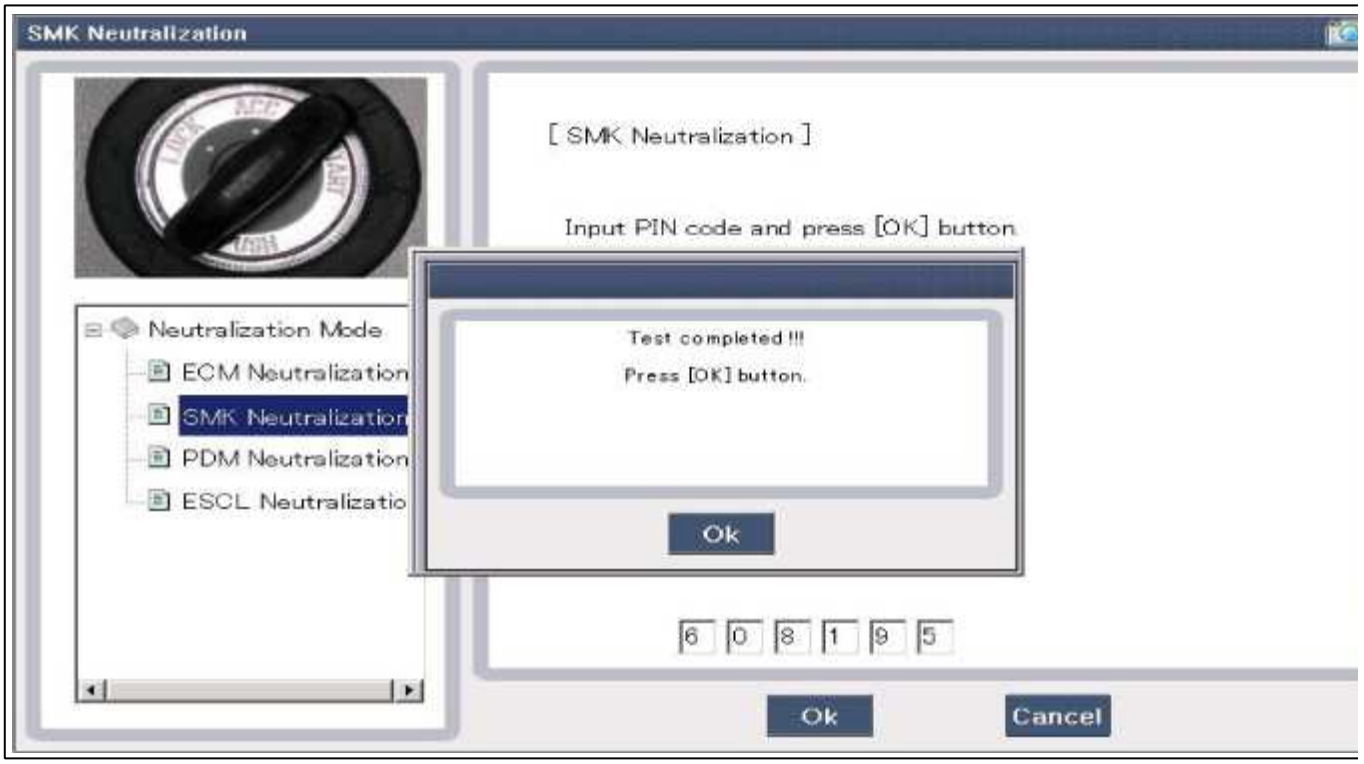

Neutralization Mode
Neutralization Mode
ECM Neutralization
SMK Neutralization
PDM Neutralization
ESCL Neutralization
[Neutralization Mode]
If you're ready, select the left side menu.
Cancel


ECM Neutralization
Neutralization Mode
ECM Neutralization
SMK Neutralization
PDM Neutralization
ESCL Neutralization
[ECM Neutralization]
Input PIN code and press [OK] button.
(CONDITION : IGN OFF)
6 0 8 1 9 5
Ok
Cancel

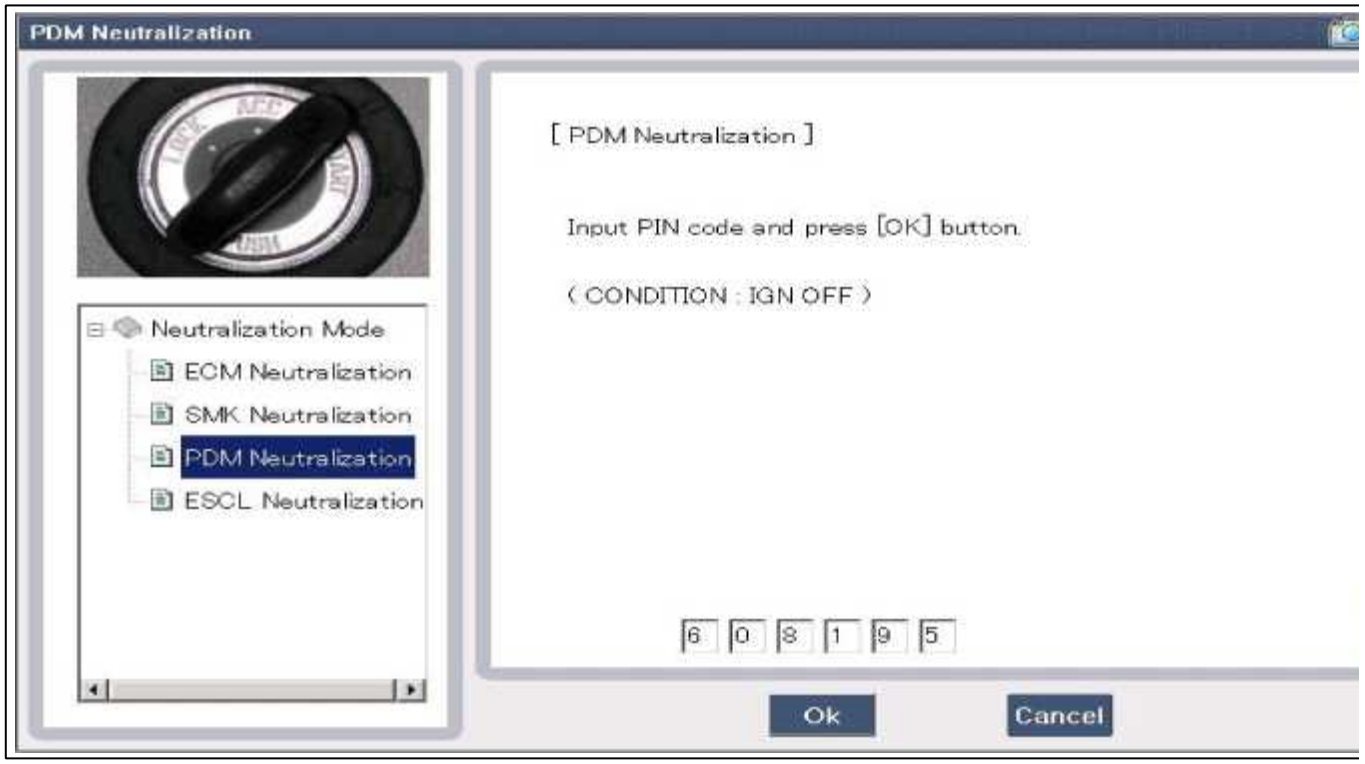

ECM Neutralization
[ECM Neutralization]
Input PIN code and press [OK] button.
Neutralization Mode
ECM Neutralization
SMK Neutralization
PDM Neutralization
ESCL Neutralizatio
Test completed !!!
Press [OK] button.
Ok
6 0 8 1 9 5
Ok
Cancel

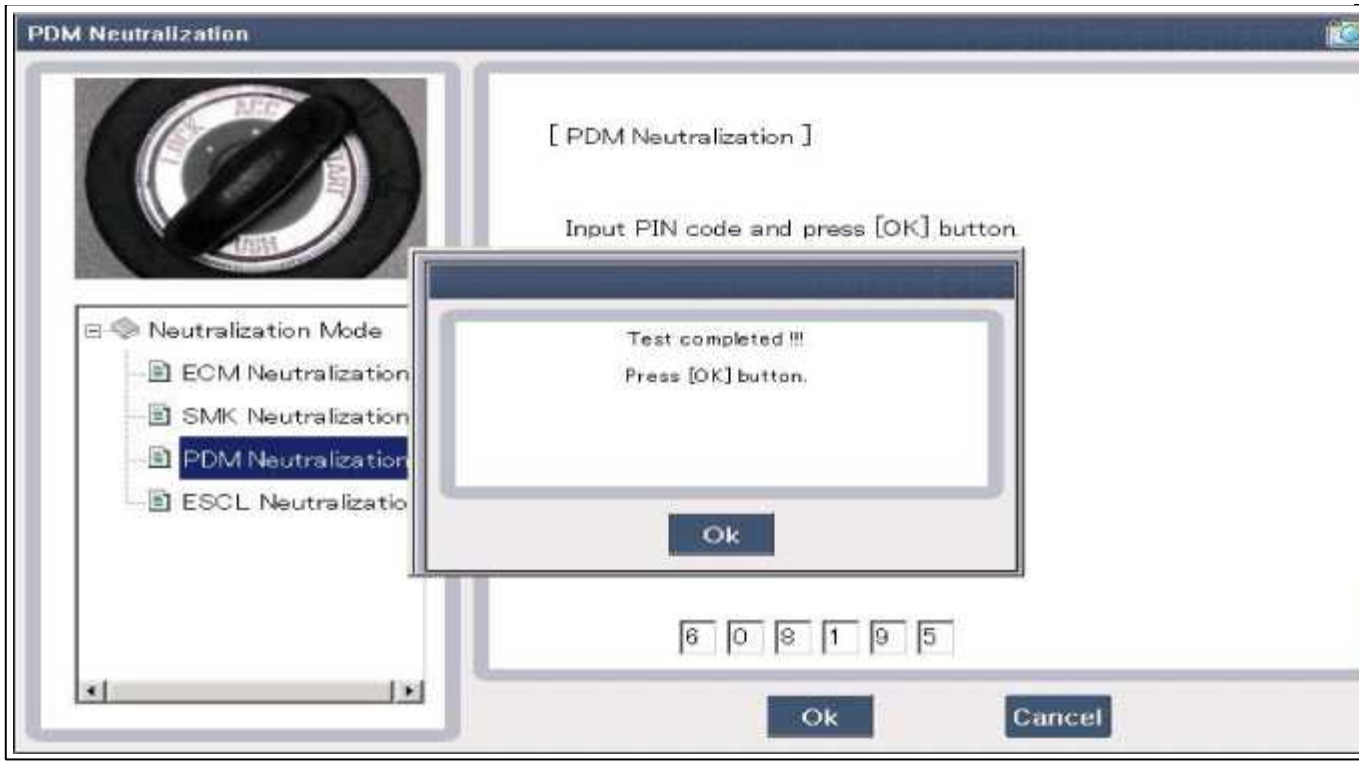

SMK Neutralization
[SMK Neutralization]
Input PIN code and press [OK] button.
(CONDITION : IGN OFF)
Neutralization Mode
ECM Neutralization
SMK Neutralization
PDM Neutralization
ESCL Neutralization
Ok
Cancel


SMK Neutralization
Neutralization Mode
ECM Neutralization
SMK Neutralization
PDM Neutralization
ESCL Neutralization
[SMK Neutralization]
Input PIN code and press [OK] button.
(CONDITION : IGN OFF)
6 0 8 1 9 5
Ok
Cancel

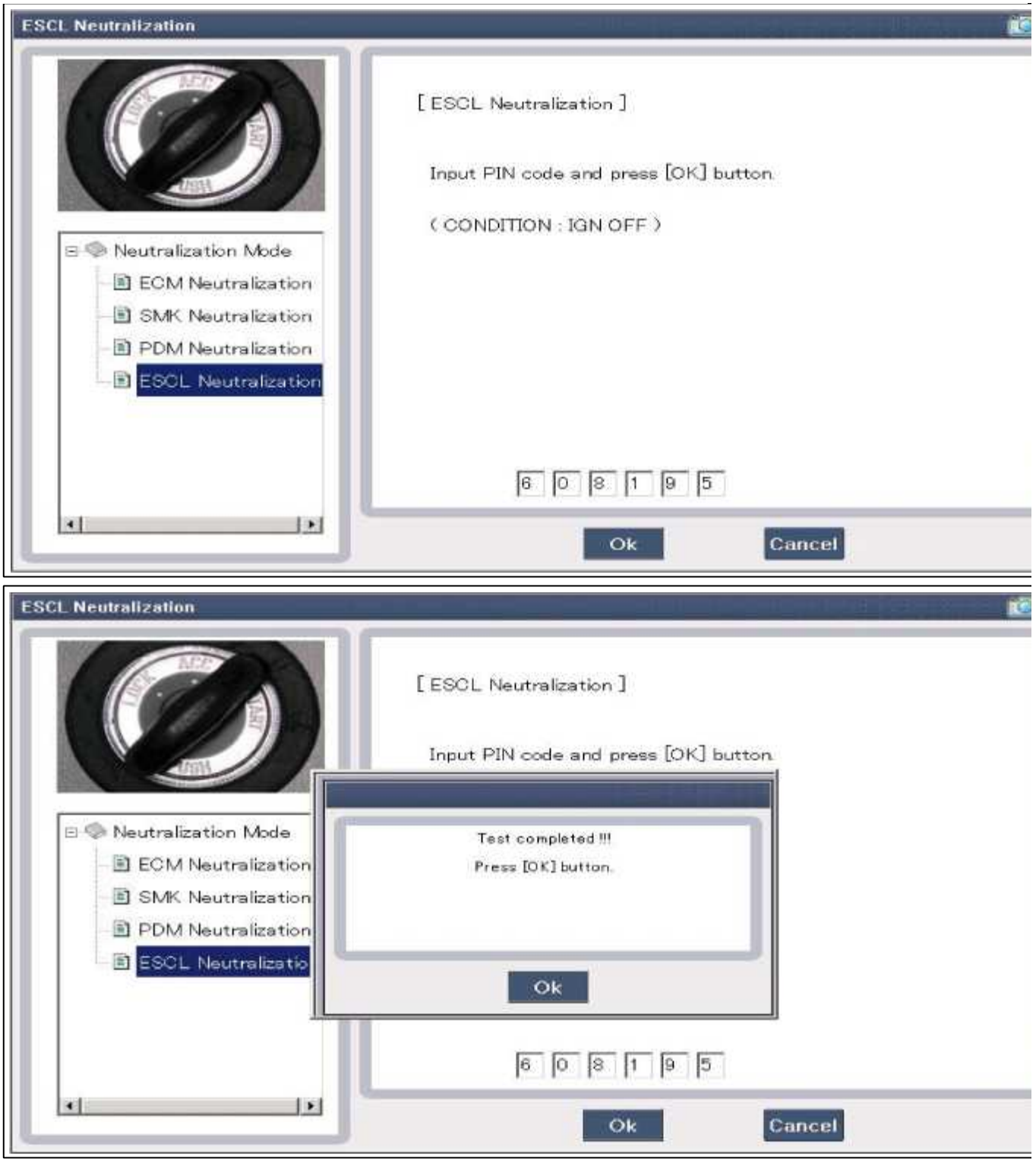

SMK Neutralization
Neutralization Mode
ECM Neutralization
SMK Neutralization
PDM Neutralization
ESCL Neutralizatio
[SMK Neutralization]
Input PIN code and press [OK] button.
Test completed !!!
Press [OK] button.
Ok
6 0 8 1 9 5
Ok
Cancel


PDM Neutralization
Neutralization Mode
ECM Neutralization
SMK Neutralization
PDM Neutralization
ESCL Neutralization
[PDM Neutralization]
Input PIN code and press [OK] button.
(CONDITION : IGN OFF)
Ok
Cancel


PDM Neutralization
Neutralization Mode
ECM Neutralization
SMK Neutralization
PDM Neutralization
ESCL Neutralization
[PDM Neutralization]
Input PIN code and press [OK] button.
(CONDITION : IGN OFF)
6 0 8 1 9 5
Ok
Cancel


PDM Neutralization
[PDM Neutralization]
Input PIN code and press [OK] button.
Neutralization Mode
ECM Neutralization
SMK Neutralization
PDM Neutralization
ESCL Neutralizatio
Test completed !!!
Press [OK] button.
Ok
6 0 8 1 9 5
Ok
Cancel


ESCL Neutralization
[ESCL Neutralization]
Input PIN code and press [OK] button.
(CONDITION : IGN OFF)
Neutralization Mode
ECM Neutralization
SMK Neutralization
PDM Neutralization
ESCL Neutralization
Ok
Cancel

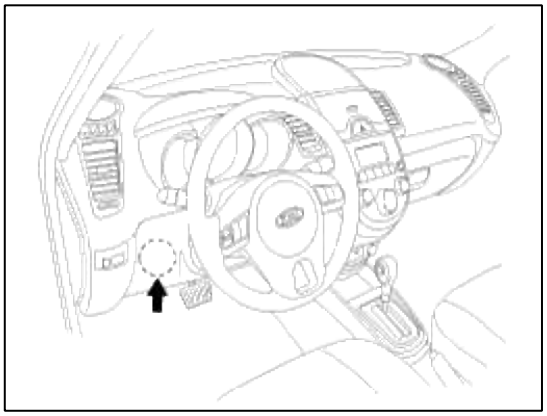


Body Electrical System > Smart key System > Smart key > Repair procedures

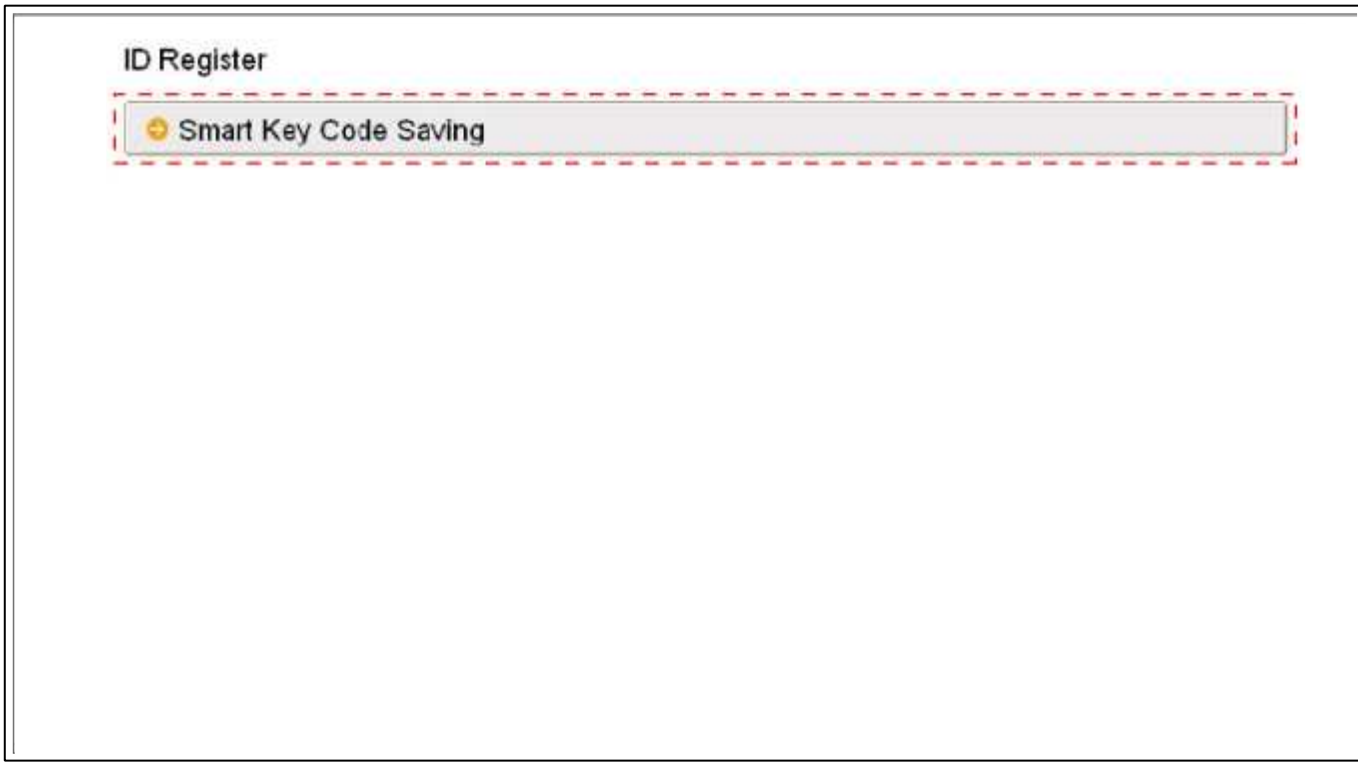
Smart Key

Smart Key Code Saving

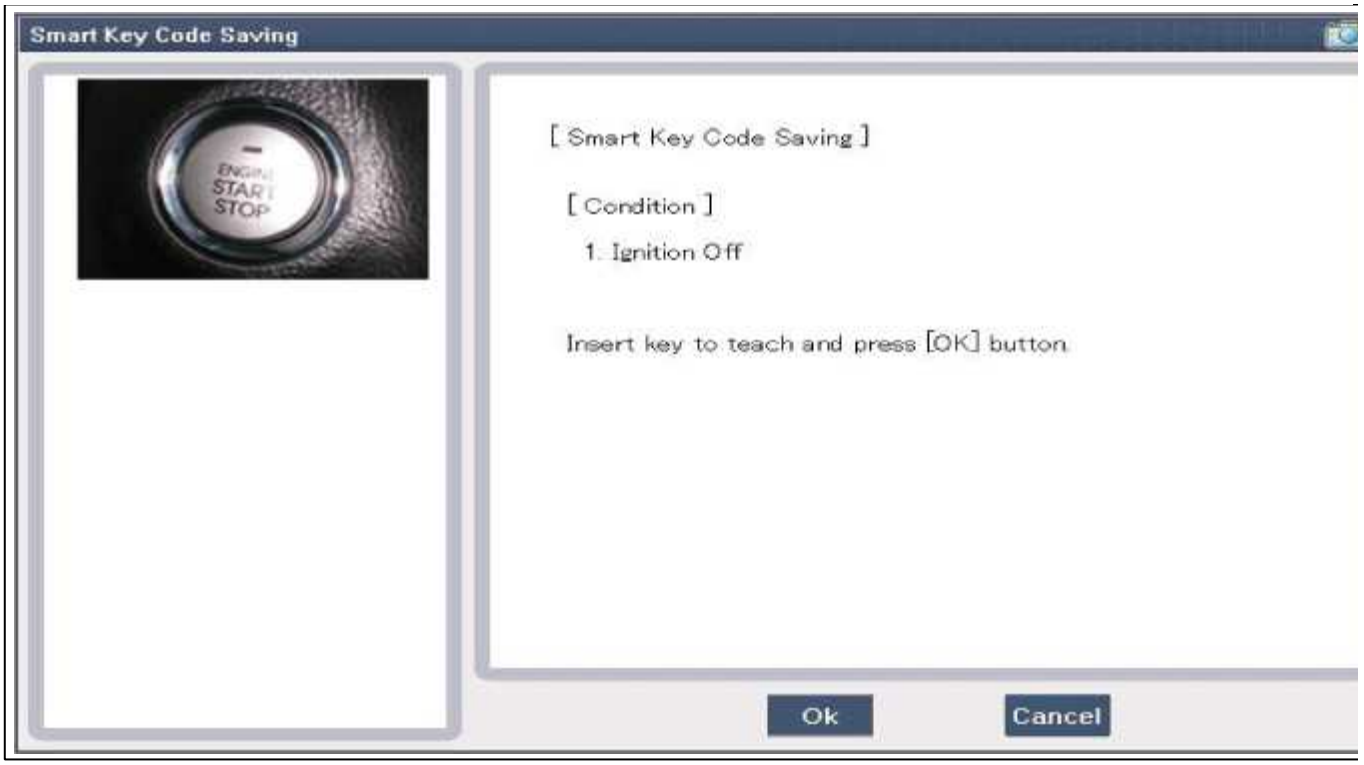
1. Connect the DLC cable of GDS to the data link connector in driver side crash pad lower panel, turn the power on GDS.



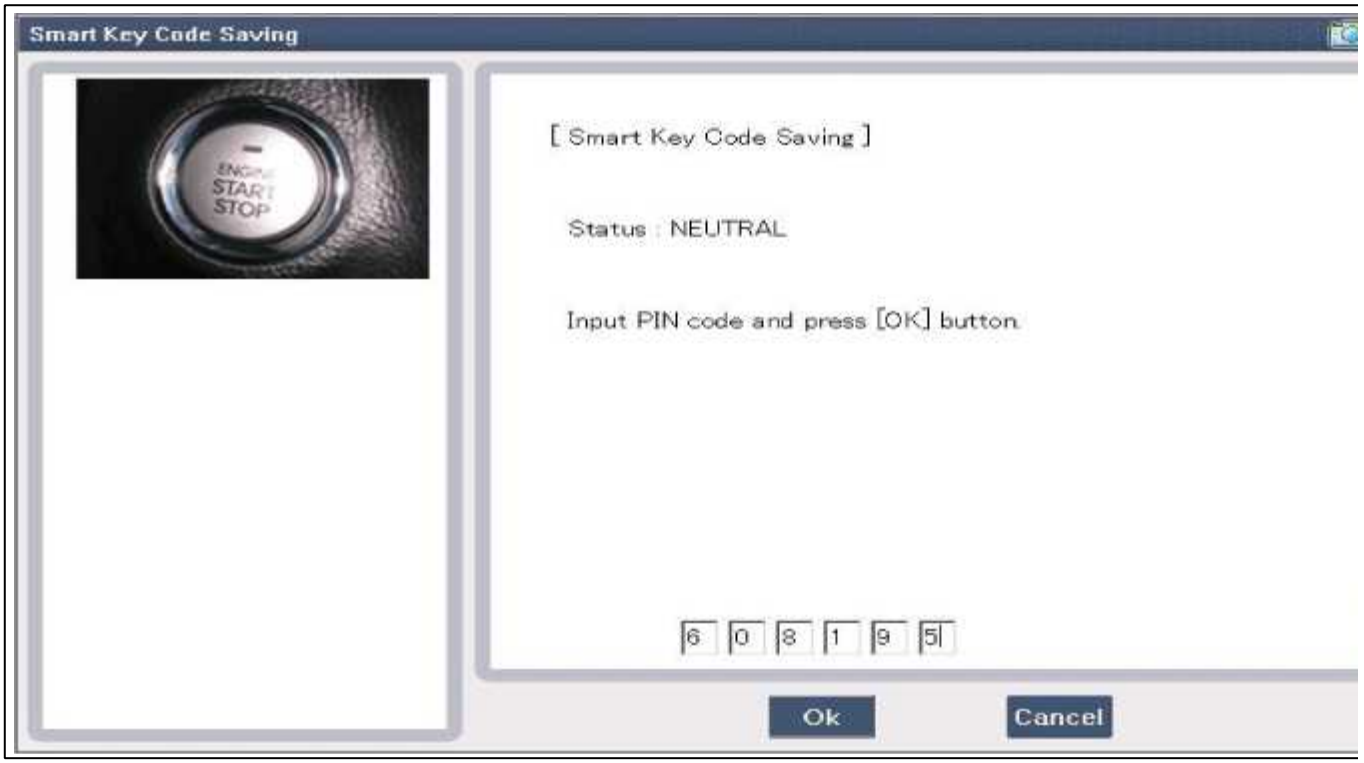
2. Select the vehicle model and then do "Smart key code saving".

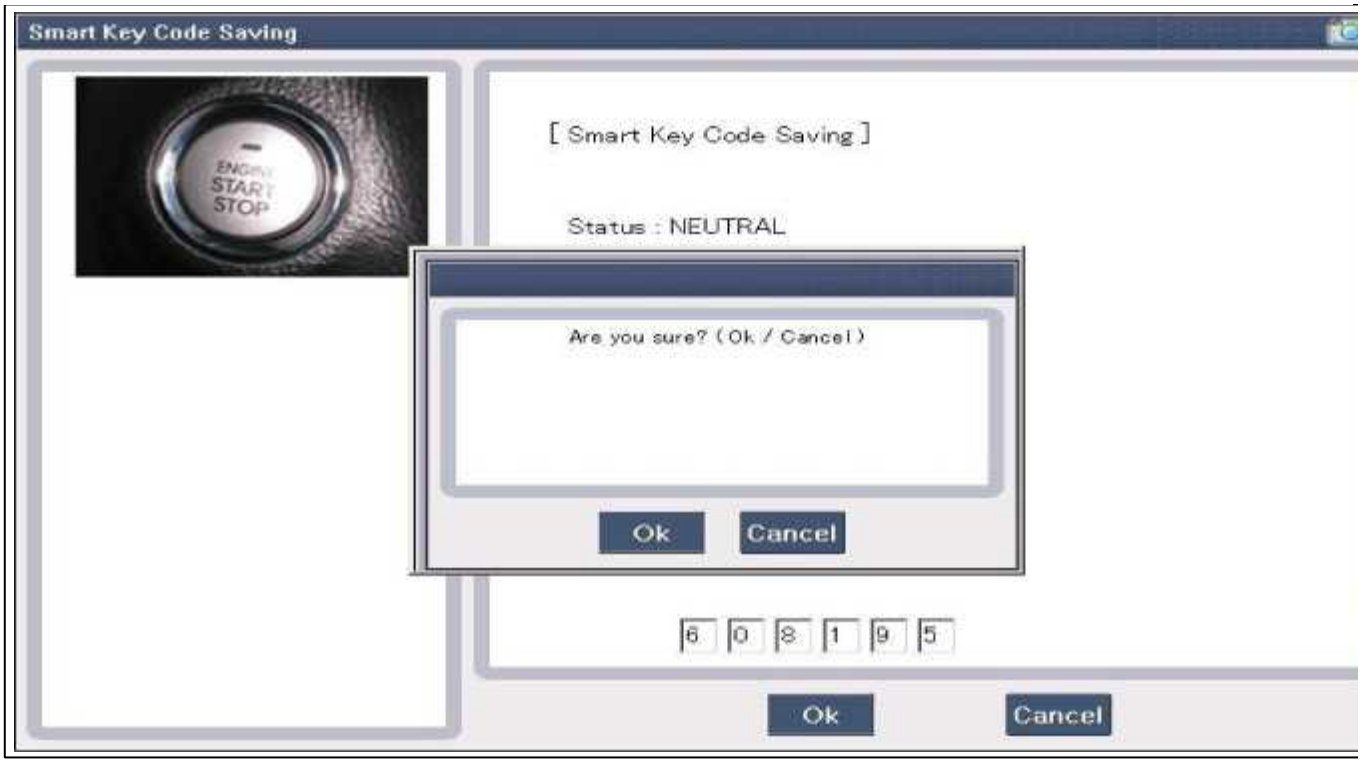


3. After selecting "Smart key teaching" menu, push "Enter" key, then the screen will be shown as below.

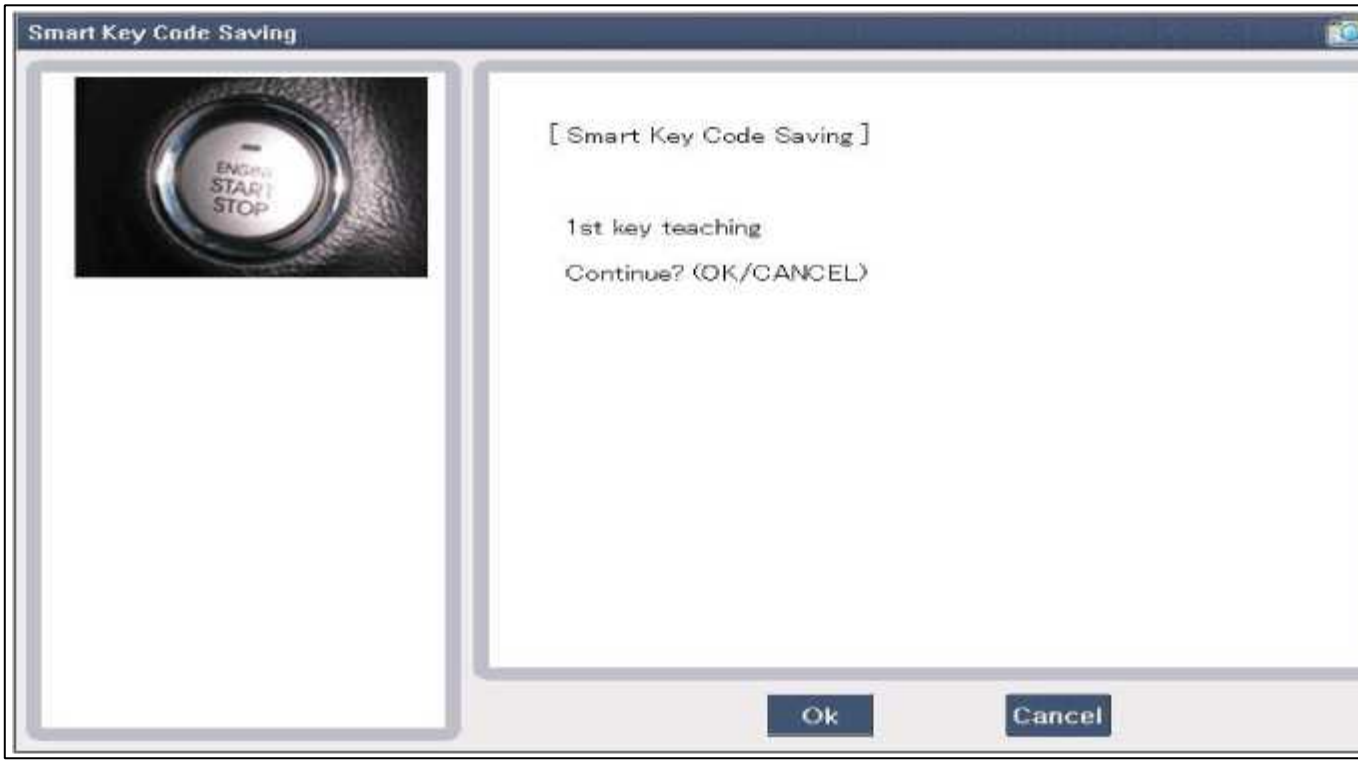


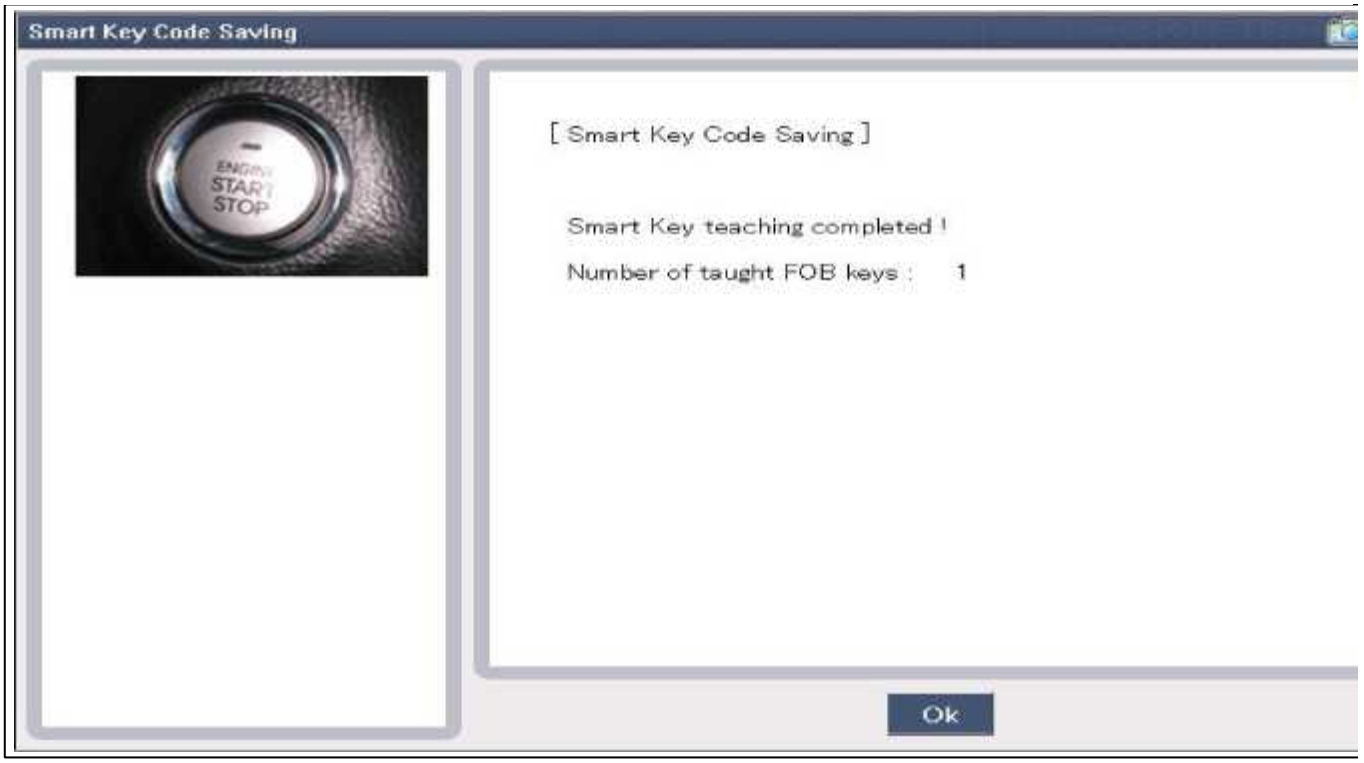
4. After inserting the teaching key, push "ENTER" key.
5. Input the "Pin code" for first key teaching.



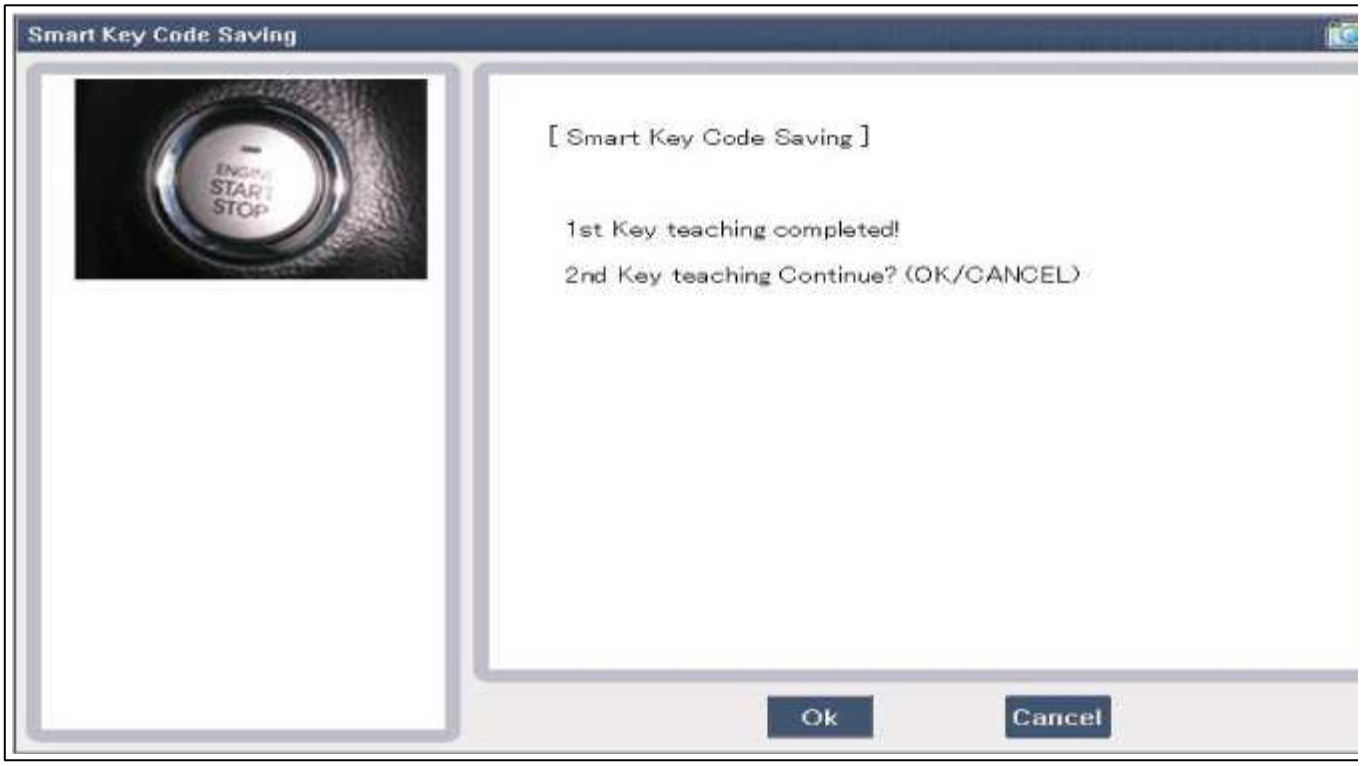


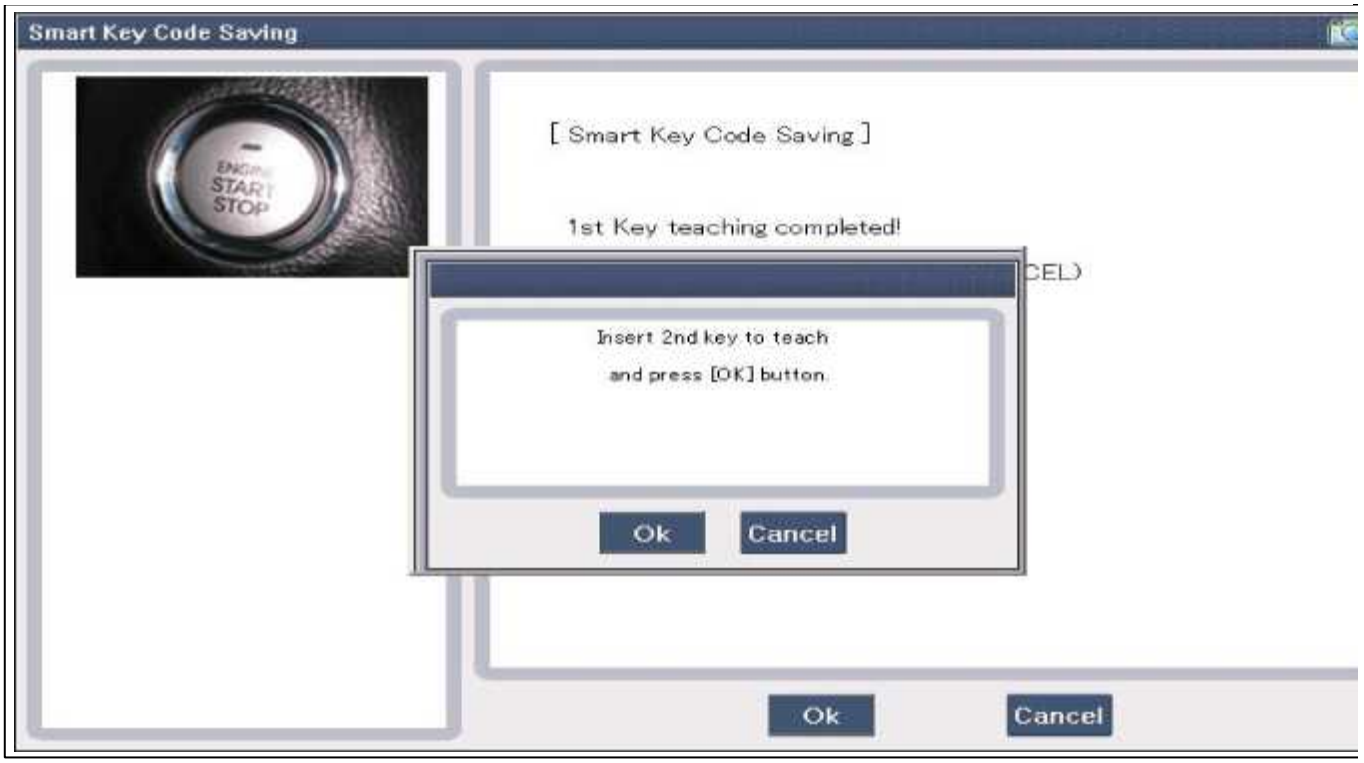
6. Confirm the message "First key teaching completed".



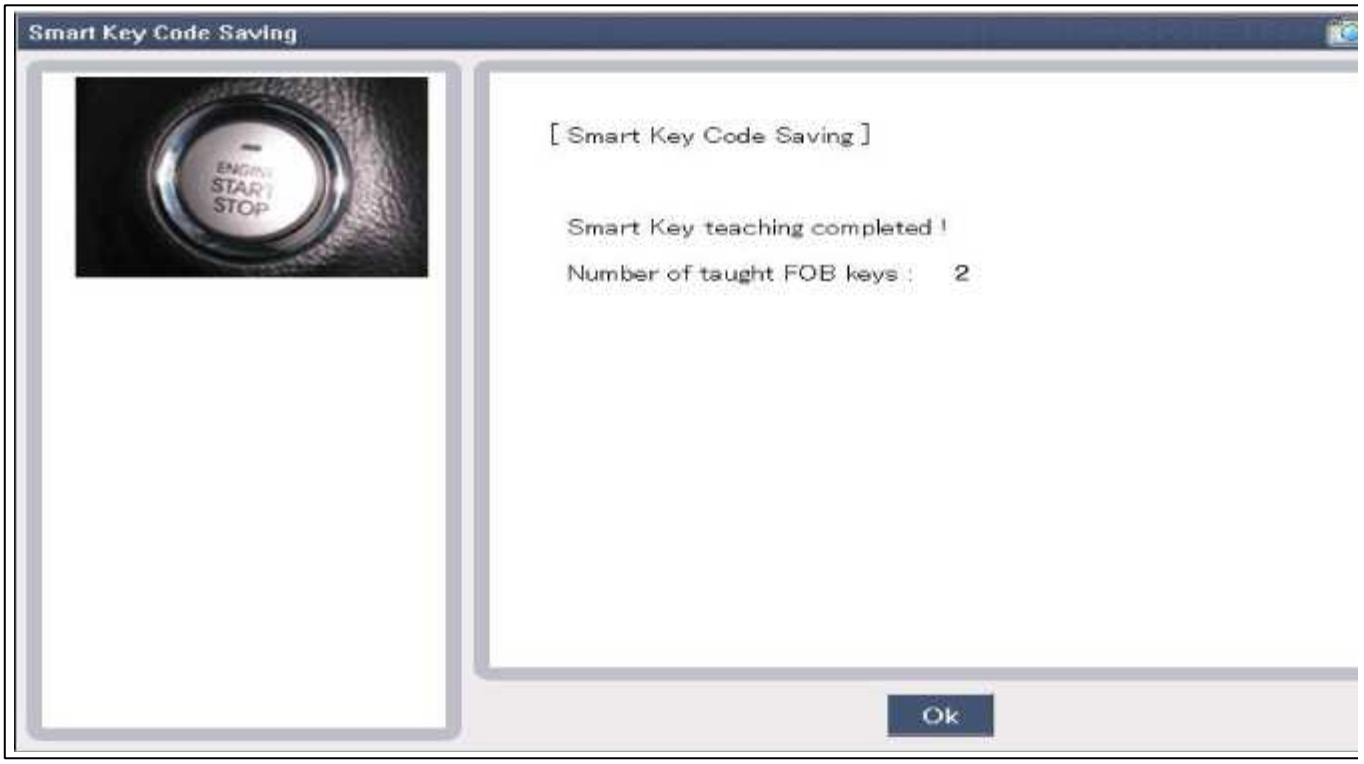


7. Input the "Pin code" for second key teaching.





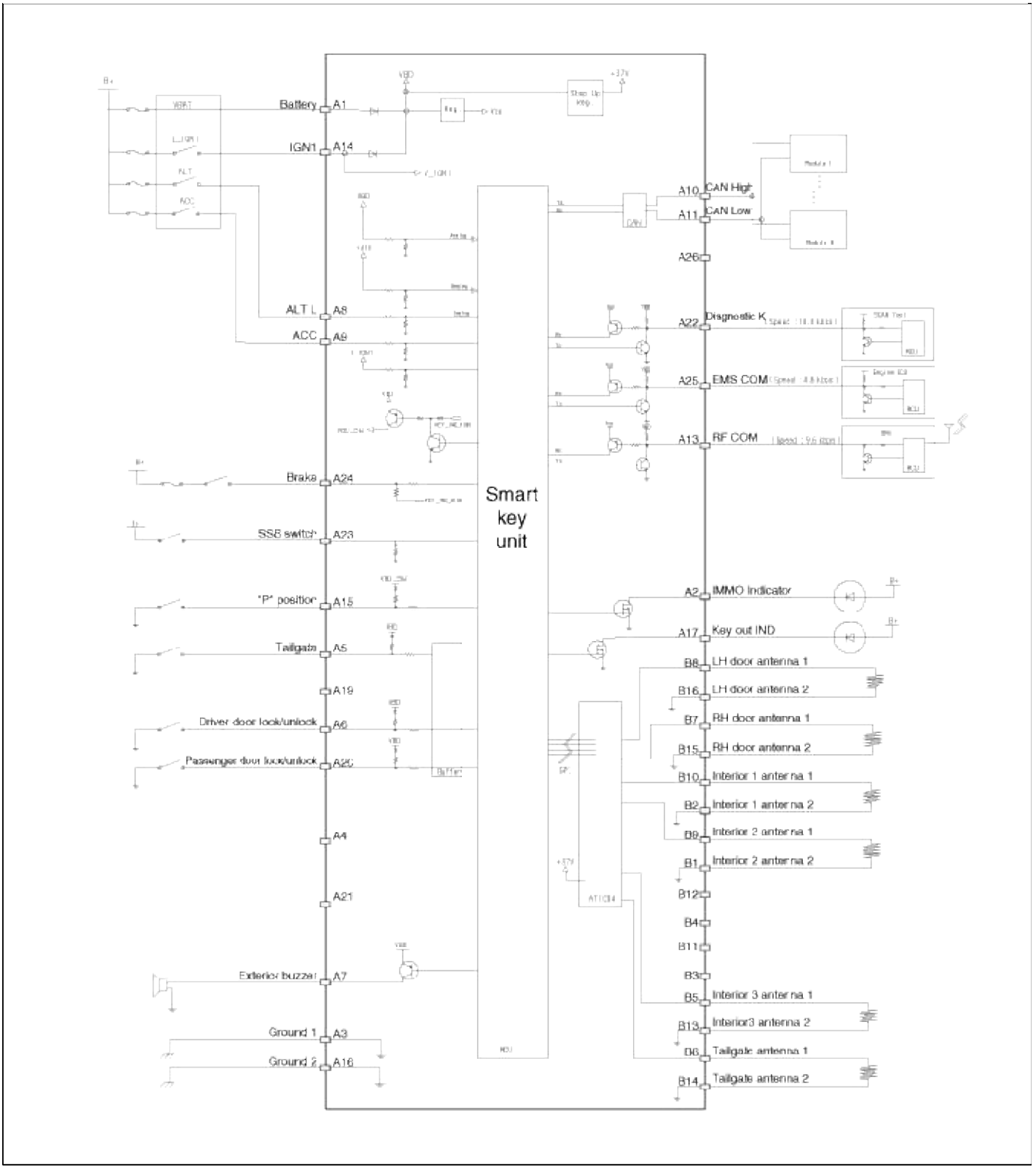
8. Confirm the message "Second key teaching completed".



9. Then the screen will be shown as below when key teaching process is completed.

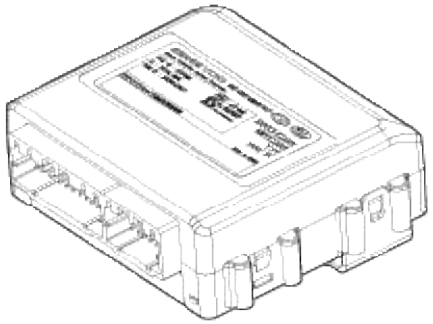
Body Electrical System > Smart key System > Smart key unit > Schematic Diagrams

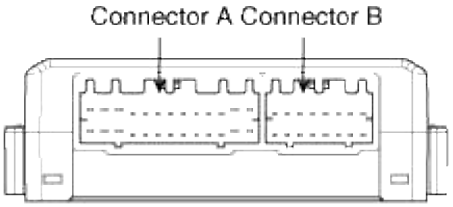
Circuit Diagram

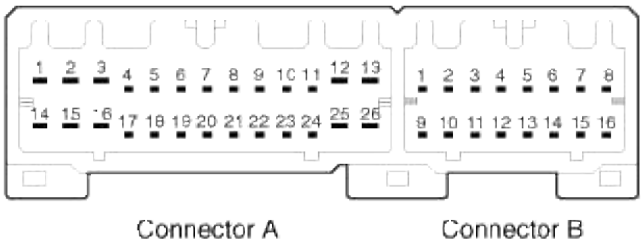


Body Electrical System > Smart key System > Smart key unit > Components and Components Location

Components







Connector Pin Information

Pin	Connector A	Pin	Connector B
1	BAT	1	Interior 2 antenna 2
2	IMMO Indicator	2	Interior 1 antenna 2
3	GND 1	3	-
4	-	4	
5	Tailgate	5	Interior 3 antenna 1
6	Front left door lock / unlock	6	Tailgate antenna 1
7	Buzzer	7	RH door antenna 1
8	ALT L	8	LH door antenna 1
9	ACC	9	Interior 2 antenna 1
10	CAN high	10	Interior 1 antenna 1
11	CAN low	11	-
12	-	12	
13	RF COM	13	Interior 3 antenna 2
14	IGN 1	14	Tailgate antenna 2

15	P position	15	RH door antenna 2
16	GND 2	16	LH door antenna 2
17	Key out IND		
18	-		
19	Push Knob		
20	Front right door lock / unlock		
21	-		
22	Diagnosis		
23	SSB switch 2		
24	Brake		
25	EMS COM		
26	LIN COM		

Body Electrical System > Smart key System > Smart key unit > Repair procedures

Inspection

Smart Key Unit

- Refer to the BE group - inspection / self diagnosis with scan tool.

Smart Key Switch

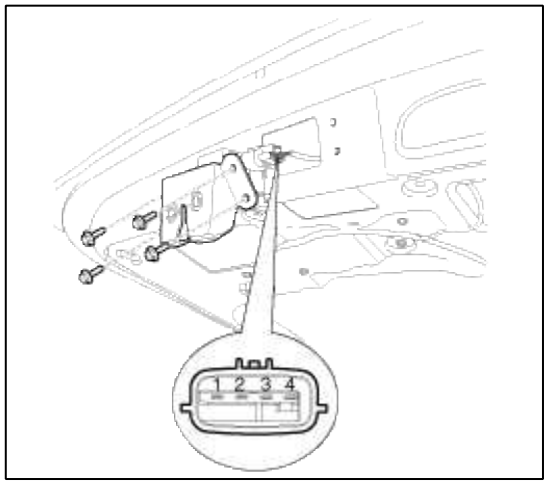
- Refer to the BE group - inspection / self diagnosis with scan tool.

Antenna

- Refer to the BE group - inspection / self diagnosis with scan tool.

Tailgate Open Switch

1. Remove the trunk trim.
   (Refer to BD group - "Trunk trim")
2. Check for continuity between the tailgate switch terminals.



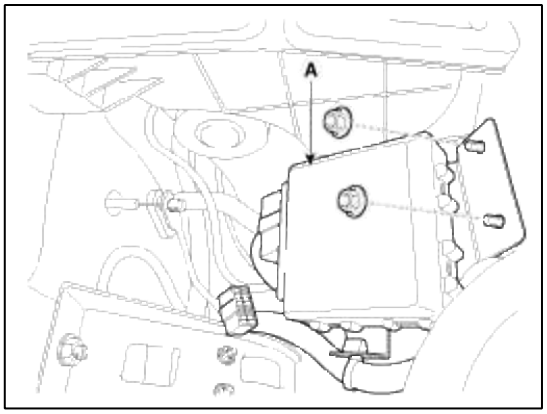
3. If continuity is not specified, inspect the switch

Terminal / Position	1	2
Unlock	○	○
Lock		

Removal

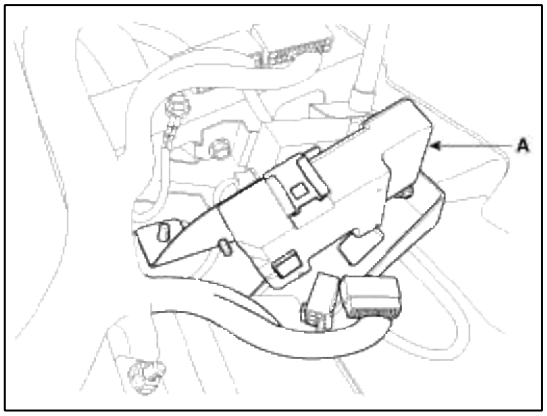
Smart Key Unit

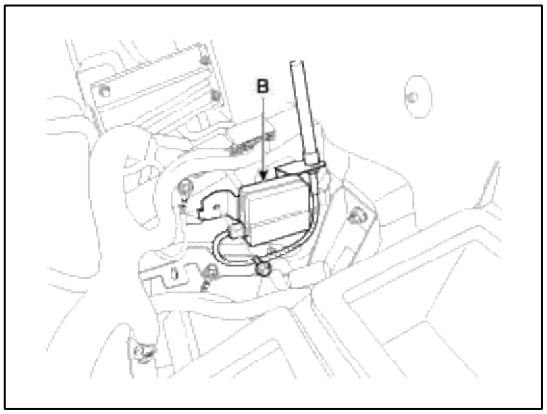
1. Disconnect the negative(-) battery terminal.
2. Remove the crash pad.(Refer to the BD group - "Crash pad")
3. Disconnect the connector. Remove the smart key unit(A) after loosening 2 nuts.



RF Receiver

1. Disconnect the negative(-) battery terminal.
2. Remove the crash pad.(Refer to the BD group - "Crash pad")
3. Remove the PDM unit(A). Then remove the RF receiver(B) after loosening a bolt.

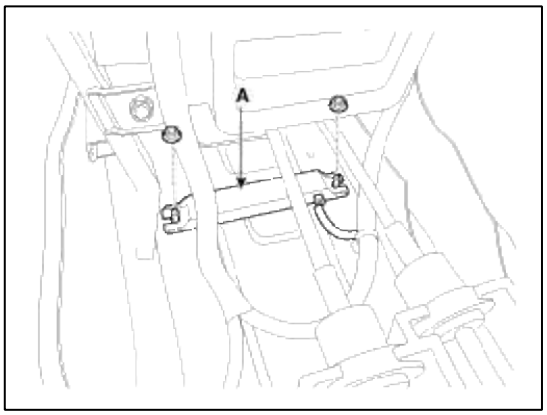




Interior 1 Antenna

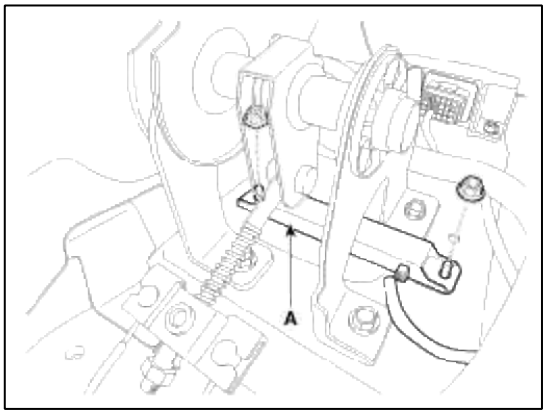
1. Disconnect the negative(-) battery terminal.
2. Remove the console assembly.(Refer to the BD group - "Console")

3. Disconnect the connector. Remove the interior 1 antenna(A) after loosening 2 nuts.



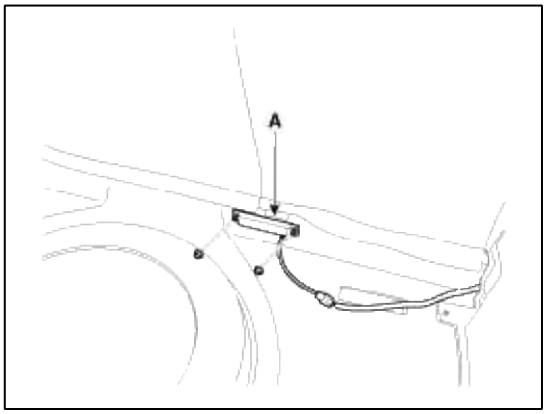
Interior 2 Antenna

1. Disconnect the negative(-) battery terminal.
2. Remove the console assembly.(Refer to the BD group - "Console")
3. Disconnect the connector. Remove the interior 2 antenna(A) after loosening 2 nuts.



Interior 3 Antenna

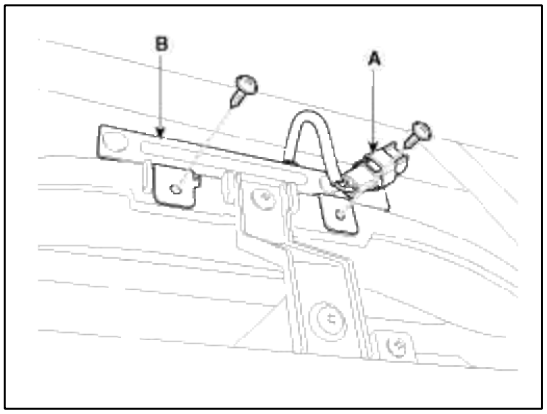
1. Disconnect the negative(-) battery terminal.
2. Remove the floor box and cover after opening the tailgate.
3. Disconnect the connector. Remove the interior 3 antenna(A) after loosening 2 nuts.



Exterior Bumper Antenna

1. Disconnect the negative(-) battery terminal.
2. Raise the vehicle with a lift.

3. Disconnect the connector(A). Remove the exterior bumper antenna(B) in the center of rear bumper after loosening 2 screws.

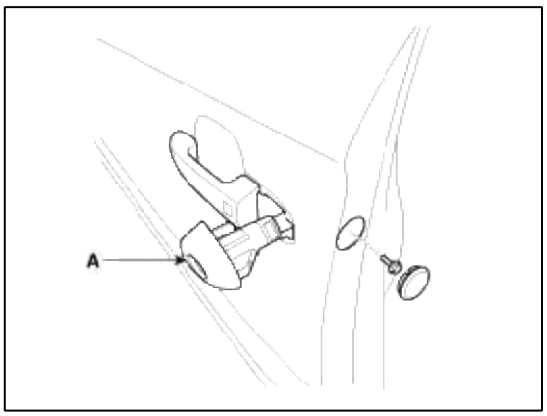


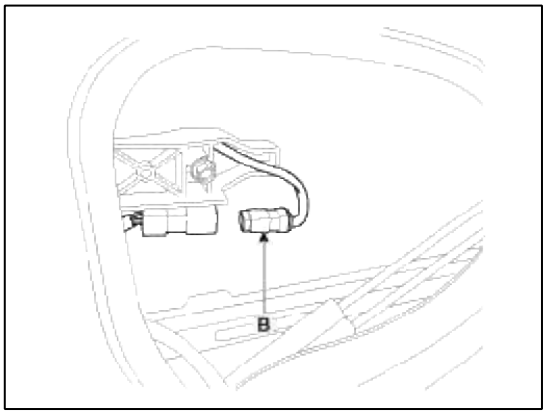
Buzzer

1. Disconnect the negative(-) battery terminal.
2. Remove the buzzer installed on the side rail panel.

Door Outside Handle

1. Disconnect the negative(-) battery terminal.
2. Remove the door outside handle mounting bolt.
3. Disconnect the connector(B) and remove the door outside handle(A).(Refer to the BD group - "Front Door")

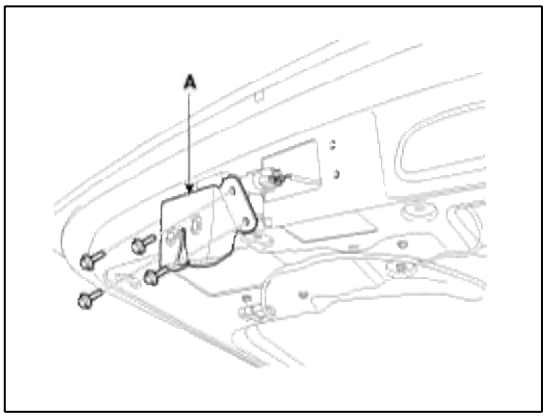




Tailgate Switch

1. Disconnect the negative(-) battery terminal.
2. Remove the tailgate trim.(Refer to the BD group - "Tailgate")

3. Remove the tailgate open switch(A).



Installation

Smart Key Unit

1. Install the smart key unit.
2. Install the smart key unit mounting nuts and connector.
3. Install the crash pad.
4. Install the negative (-) battery terminal and check the smart key system.

RF Receiver

1. Install the RF receiver.
2. Install the crash pad.
3. Install the negative (-) battery terminal and check the smart key system.

Interior 1 Antenna

1. Install the interior 1 antenna.
2. Install the floor console.
3. Install the negative (-) battery terminal and check the smart key system.

Interior 2 Antenna

1. Install the interior 2 antenna.
2. Install the floor console.
3. Install the negative (-) battery terminal and check the smart key system.

Interior 3 Antenna

1. Install the interior 3 antenna.
2. Install the floor box and cover.
3. Install the negative (-) battery terminal and check the smart key system.

Exterior Bumper Antenna

1. Install the exterior bumper antenna.

2. Install the negative (-) battery terminal and check the smart key system.

Buzzer

1. Install the buzzer.
2. Install the negative (-) battery terminal and check the smart key system.

Door Outside Handle

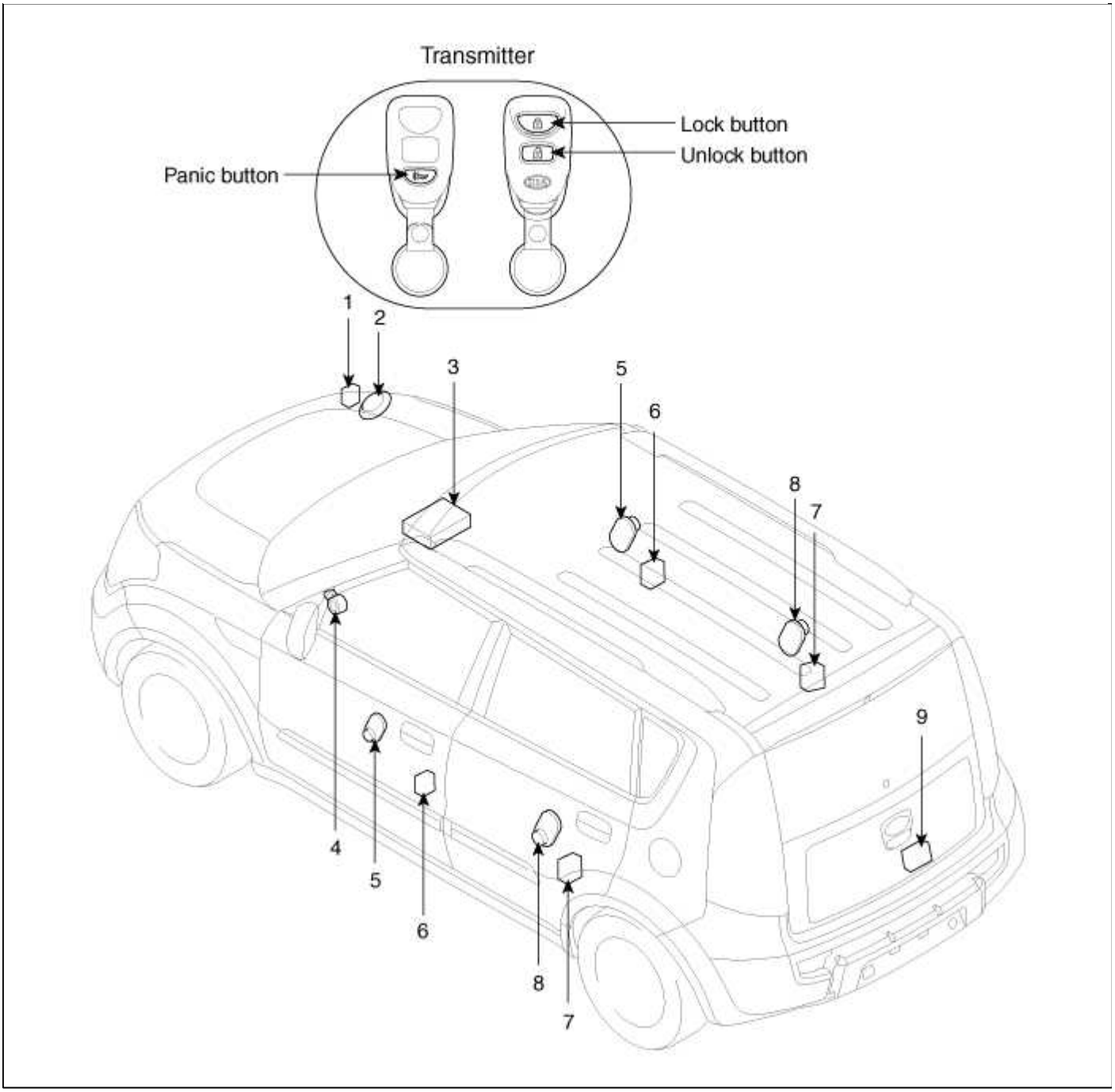
1. Install the outside handle.
2. Install the door trim.
3. Install the negative (-) battery terminal and check the smart key system.

Tailgate Switch

1. Install the tailgate switch.
2. Install the tailgate trim.
3. Install the negative (-) battery terminal and check the smart key system.

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 motor
4. Key warning switch	9. Tailgate actuator & switch
5. Front door motor	

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

Description

Keyless Entry System

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

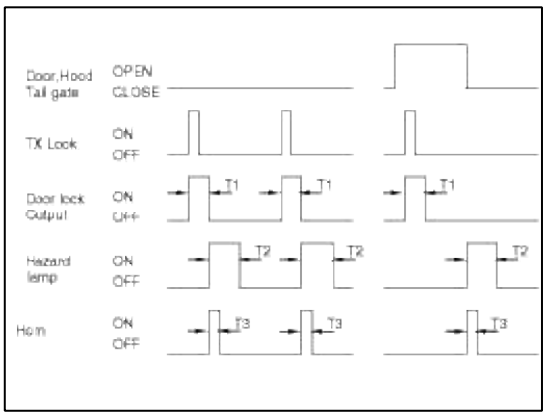
The room lamp, if its switch is in the center position, will come on when you press the UNLOCK button. If you do not open a door, the light will go off in about 30 seconds, the doors will automatically relock, and the burglar alarm system will rearm. If you relock the doors with the remote transmitter within 30 seconds, the light will go off

immediately.
You cannot lock or unlock the doors with the remote transmitter if the key is in the ignition switch.
The system will signal you when the doors lock and unlock by flashing the hazard lamp once when they lock and closed, and twice when they unlock.

Function

Remote keyless entry

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



T1 : 0.5 ± 0.1sec, T2 : 1.0 ± 0.2sec
T3 : 50.0 ± 5msec

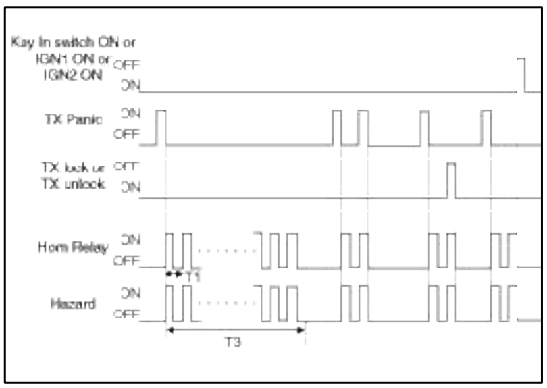
Panic alarm

This is a function of PANIC ALARM in vehicles using Horn Relay and Hazard Relay.
On condition of Key In Switch = OFF, IGN1 = OFF, IGN2 = OFF, SMK(RKE PAINC) operation is started when inputting PANIC of TX and stopped on condition of situations below.

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

9. When Driver Door Key Lock SWITCH ON

10. When Assist Door Key Lock SWITCH ON



T1 : 0.9 ± 0.1sec, T2 : 27 ± 3sec

Transmitter(TX) Spec

1. Transmission Distance : 30m or more from outside of the car

2. Registration procedure of the transmitter
   (1) In registration mode, it shall be possible to register up to Max 4EA.
   (2) At re-registration, data are registered newly after deleting the previous TX DATA

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

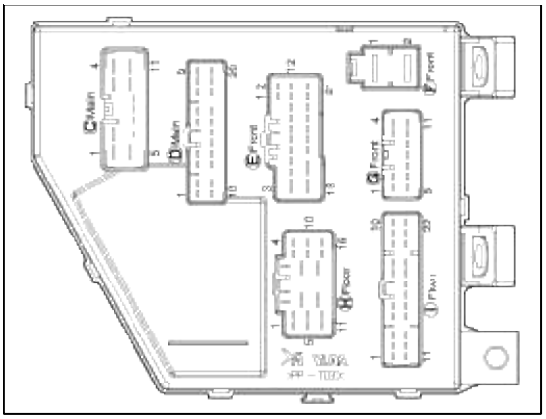
   (3) For the registration procedures by using Hi-scan tool, refer to "TRANSMITTER CODE REGISTRATION".

3. Transmitter signal & Receiver Spec
   (1) Transmission signal
      A. Transmit relevant transmission DATA (Transmission frame) twice by pushing TX switch.
      B. Only LOCK signal is output when pushing TX LOCK switch and UNLOCK switch at the same time.

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

Inspection

Door Lock Relay

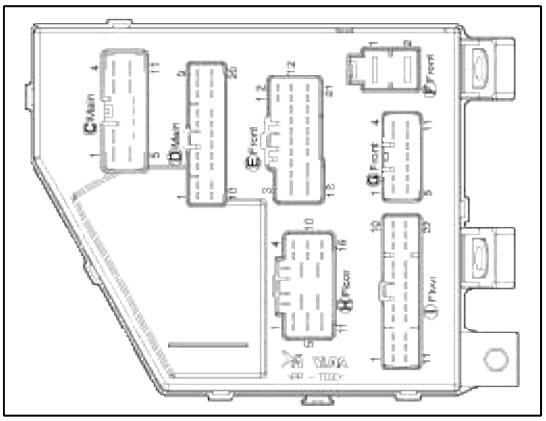


Terminal / Power	F-1	H-6	F-1	H-3
Disconnected			○	○
Connected	○	○	⊖	⊕

Check for continuity between the terminals.

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

Door Unlock Relay



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

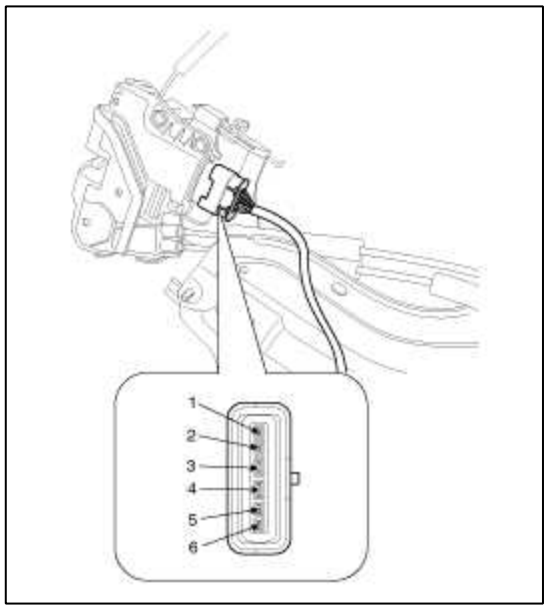
Check for continuity between the terminals.

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

Front Door Lock Actuator

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

3. Disconnect the connectors from the actuator.

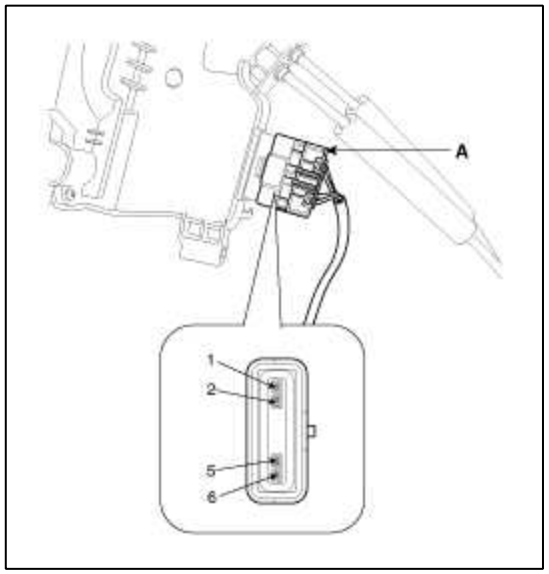


4. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

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

Rear Door Lock Actuator

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



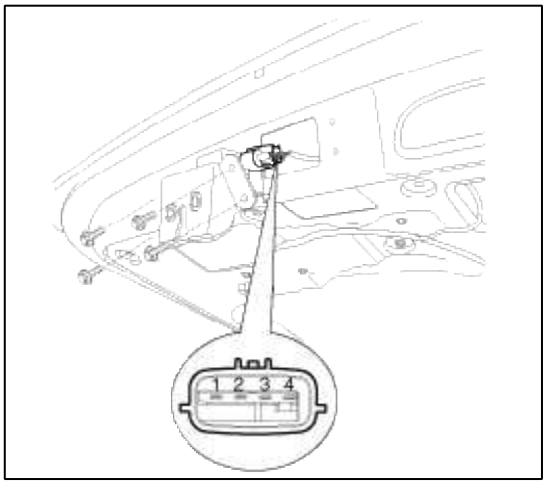
4. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

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

Tailgate Lock Actuator Inspection

1. Remove the tailgate trim.
   (Refer to the Body group - "Tail gate")

2. Disconnect the 4P connector from the actuator.



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

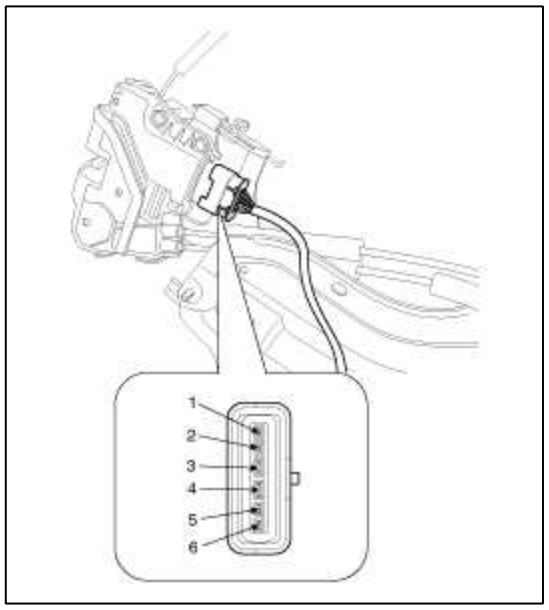
Position \ Terminal	3	4
Unlock	⊕	⊖

Front Door Lock Switch

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

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

3. Disconnect the connectors from the actuator.



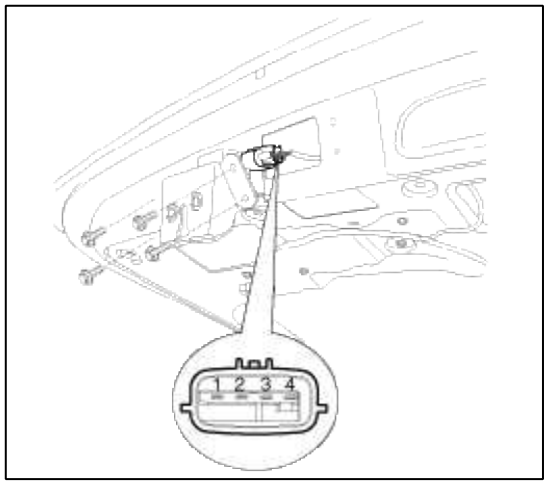
4. Check for continuity between the terminals in each switch position when inserting the key into the door according to the table.

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

Tailgate Switch

1. Remove the tailgate trim.
   (Refer to the Body group - "Tail gate")

2. Disconnect the 4P connector from the actuator.

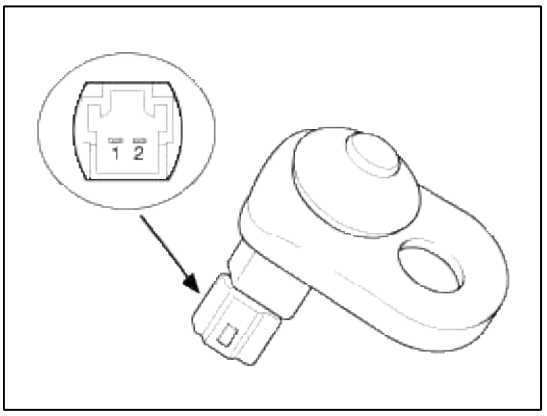


3. Check for continuity between the terminals in each switch position according to the table.

Position \ Terminal	1	2
Lock		
Unlock	○	○

Door Switch

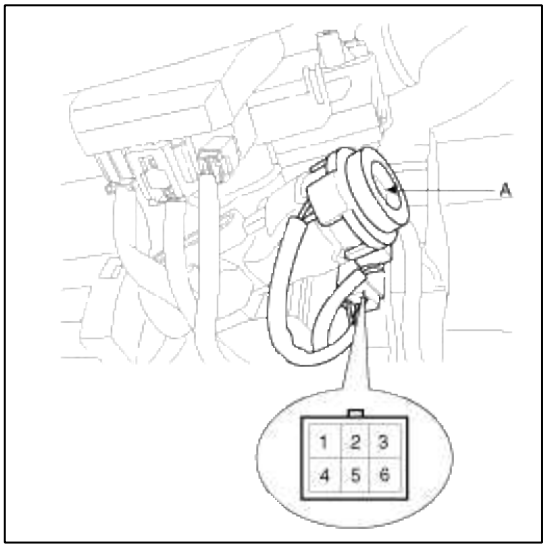
Remove the door switch and check for continuity between the terminals.



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

Key In Switch

1. Remove the crash pad lower panel.
   (Refer to Body group - "Crash pad")
2. Disconnect the 6P connector from the key warning switch.



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

Key position \ Terminal	5	6
Insert	○	○
Removal		

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

Specifications

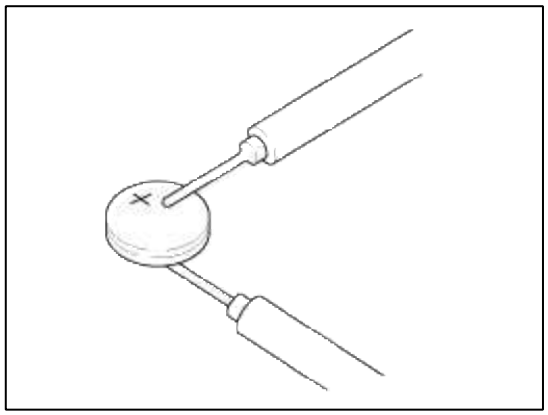
Item	Specification
Rated voltage	DC 3V
Service voltage range	DC 2.5V ~ 3.2V
Temperature range	-4°F ~ 140°F (-20°C ~ +60°C)
Modulation method	FSK
Keyless entry transmitterPower source	CR2032 (Lithium 3V battery, 1EA)
Transmissible distance	30m or more
Life of battery	2 years or more (at 20 times per day)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

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

Inspection

1. Check that the red light flickers when the door lock or unlock button is pressed on the transmitter.
2. Remove the battery and check voltage if the red light doesn't flicker.

Standard voltage : 3V

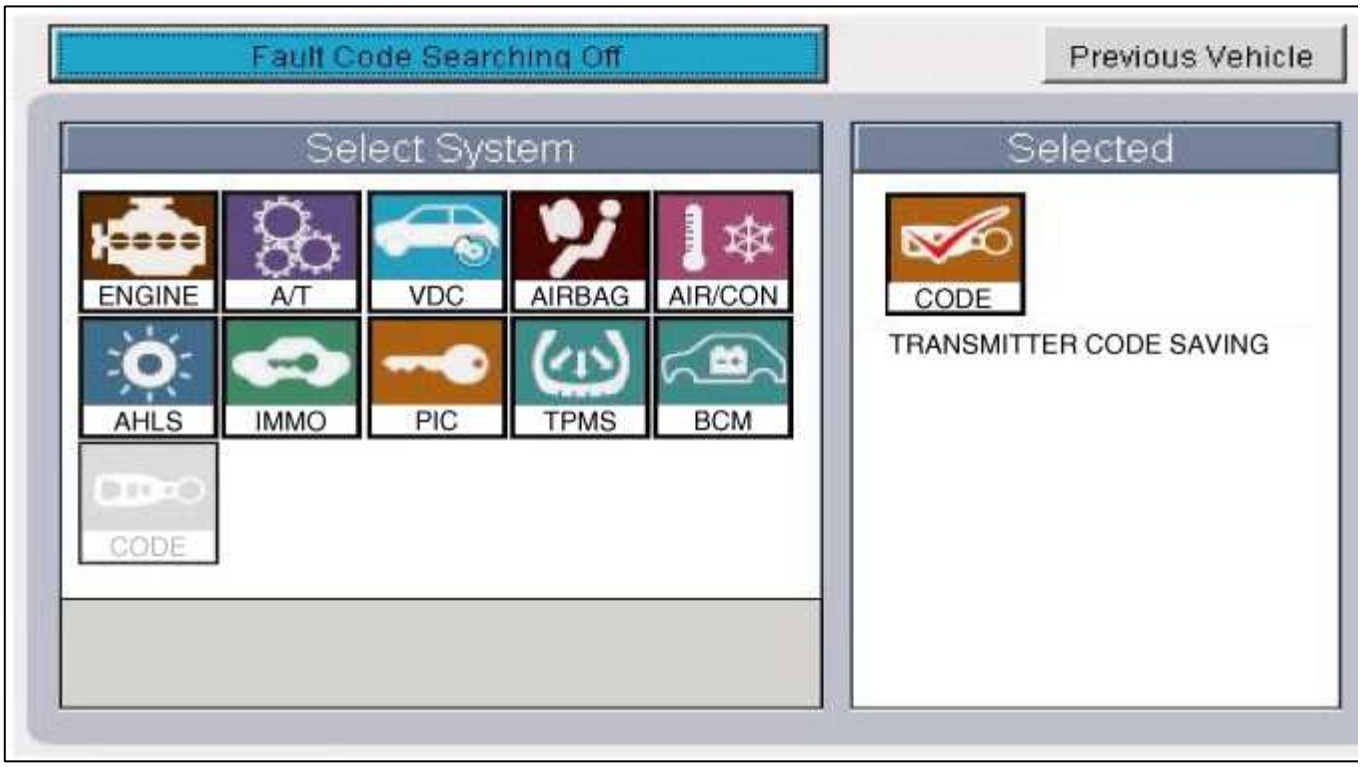


3. Replace the transmitter battery with a new one, if voltage is below 3V then try to lock and unlock the doors with the transmitter by pressing the lock or unlock button five or six times.
4. If the doors lock and unlock, the transmitter is O.K, but if the doors don't lock and unlock, register the transmitter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

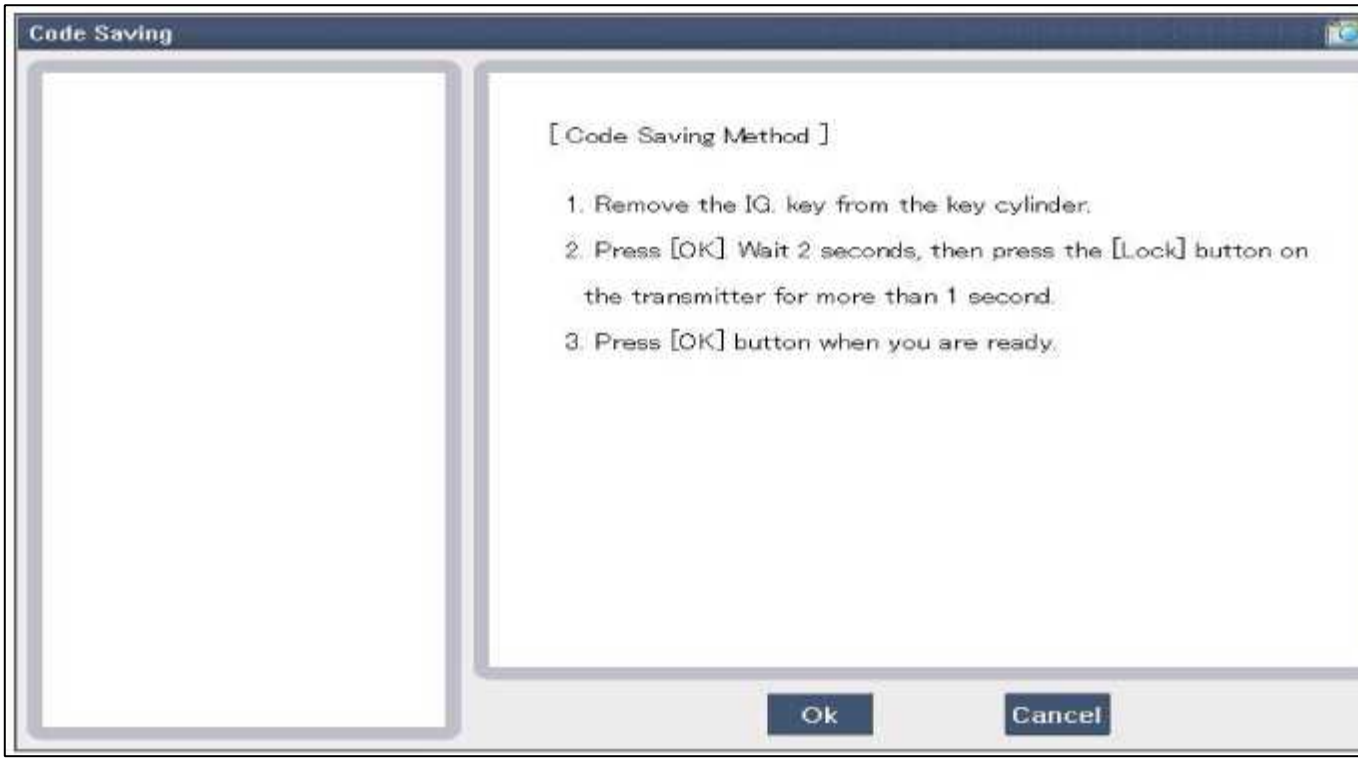
Transmitter Code Registration (Using GDS)

1. Connect the DLC cable of GDS to the data link connector (16 pins) in driver side crash pad lower panel, turn the GDS ON.

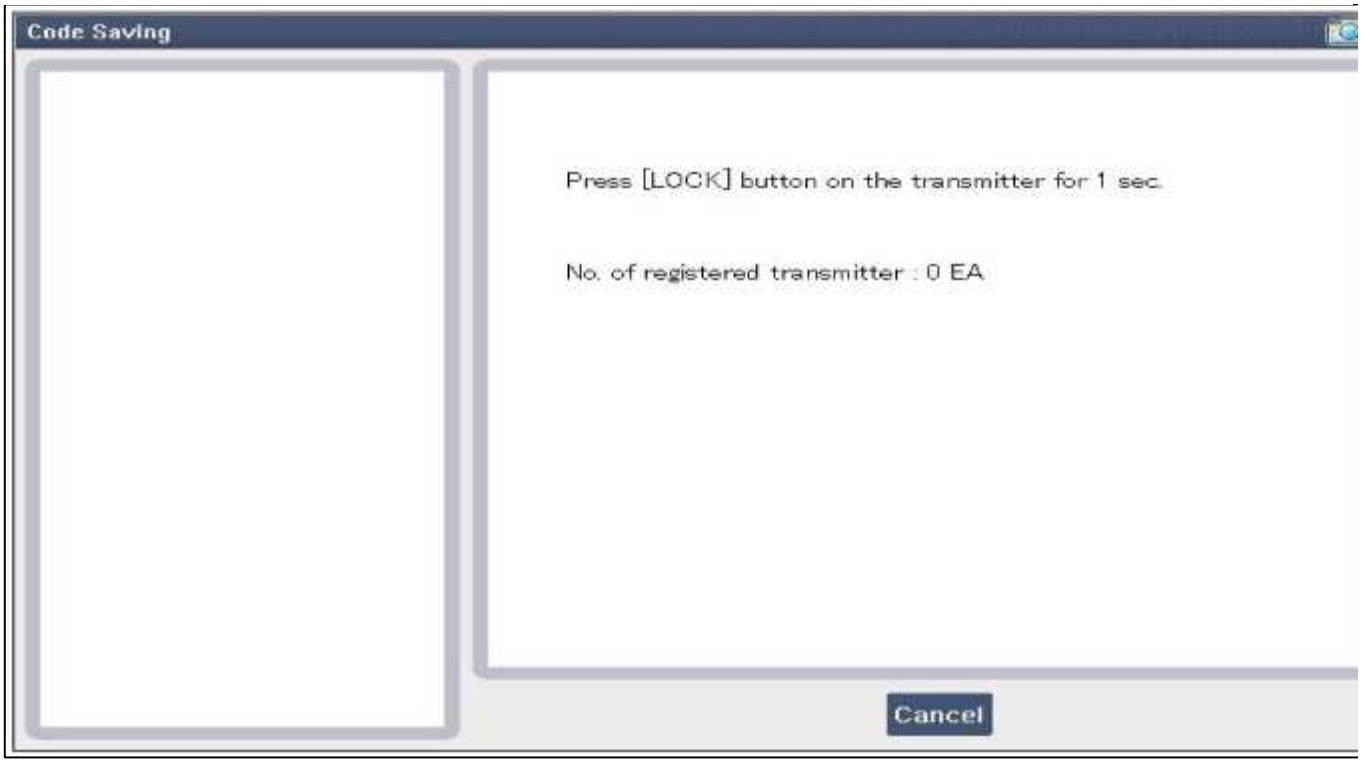
2. Select the vehicle model and then do "CODE SAVING".

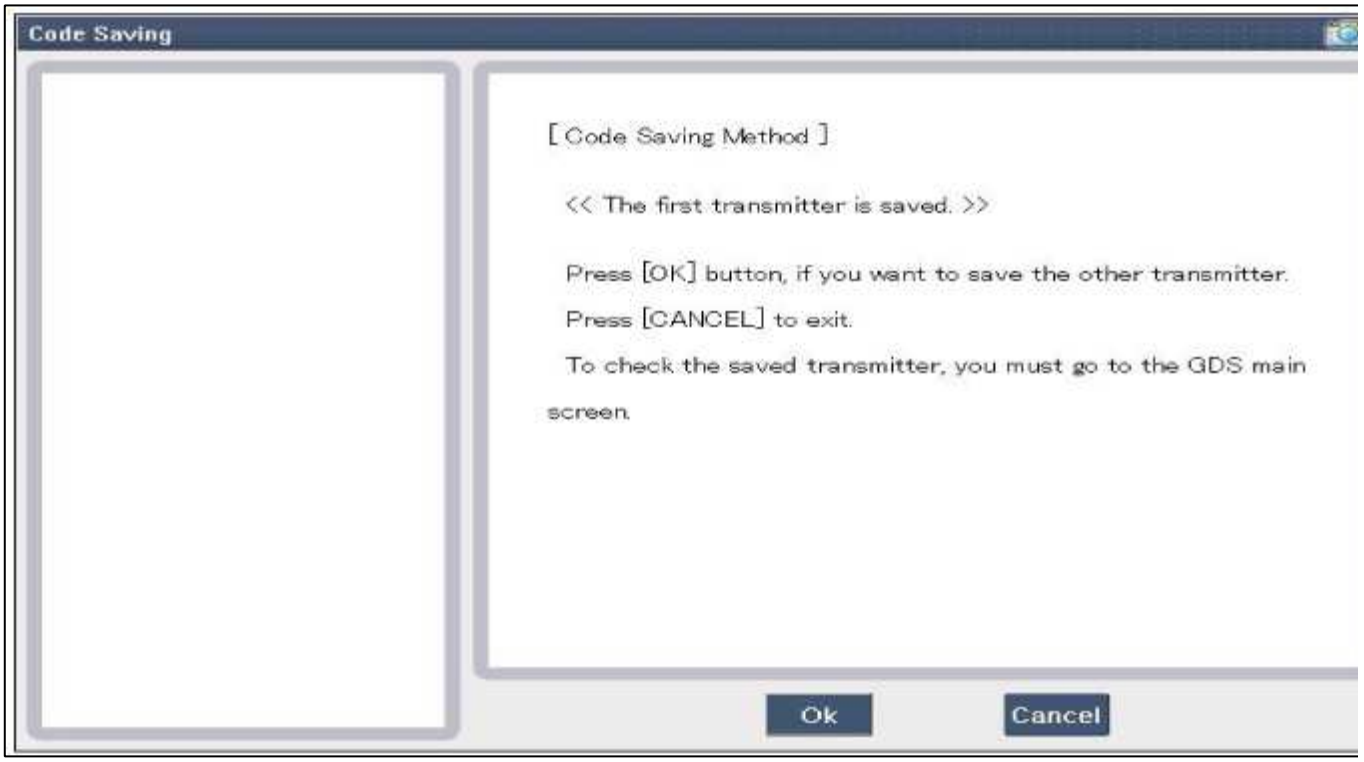


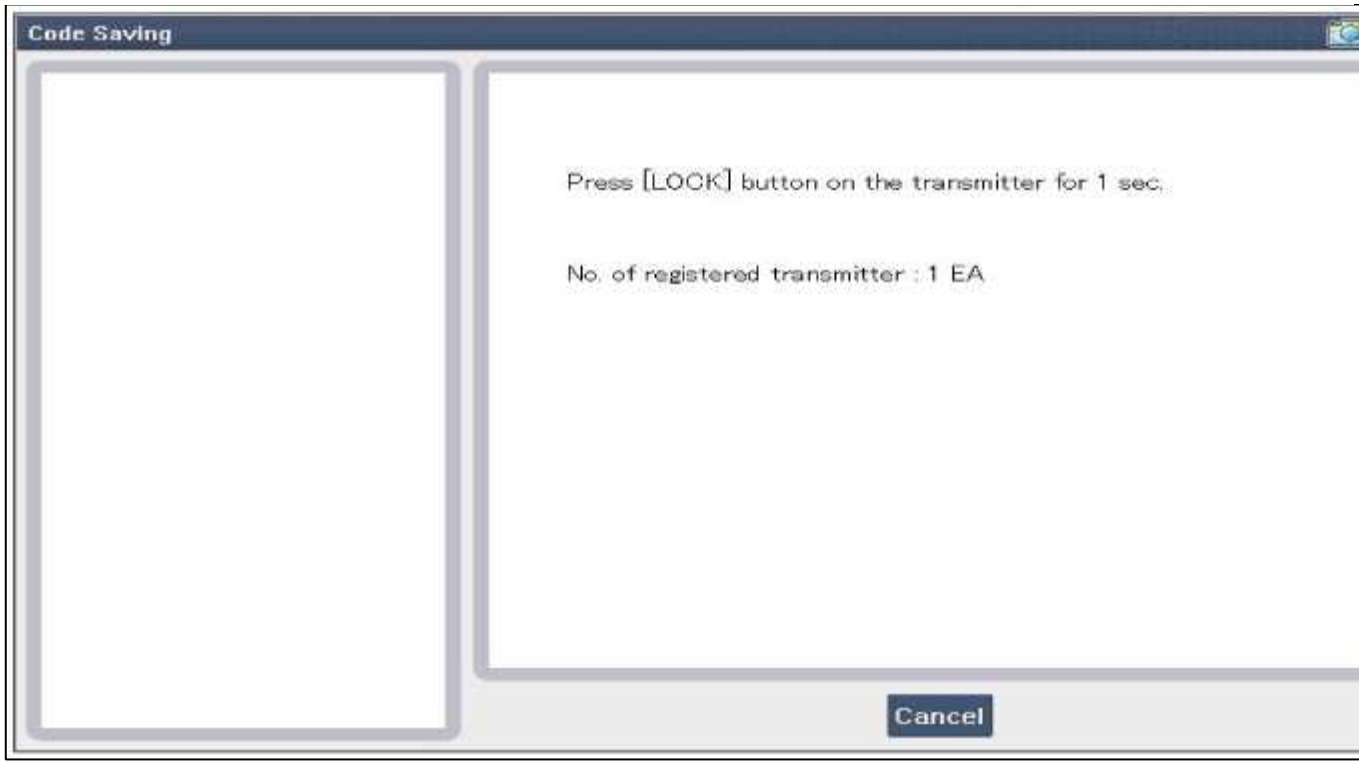
3. After selecting "CODE SAVING" menu, button "OK" key, then the screen will be shown as below.

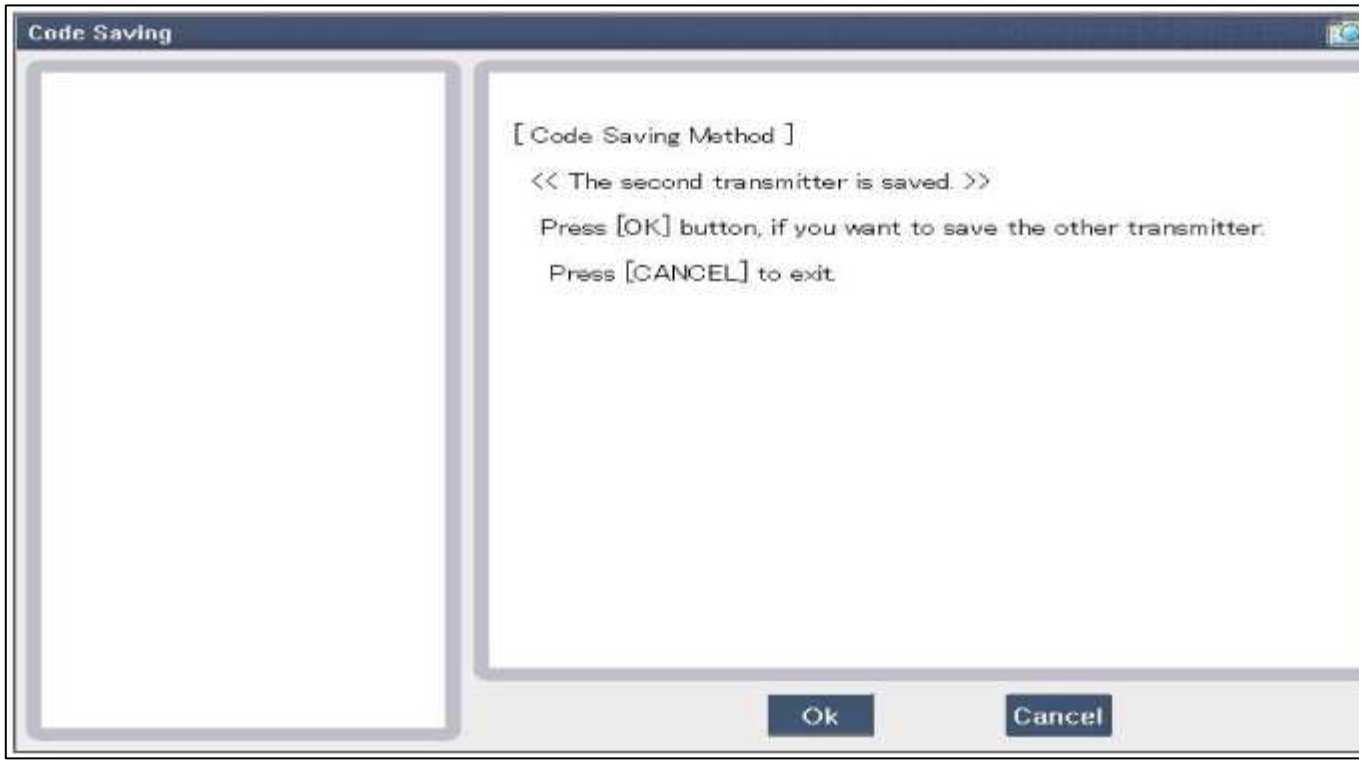


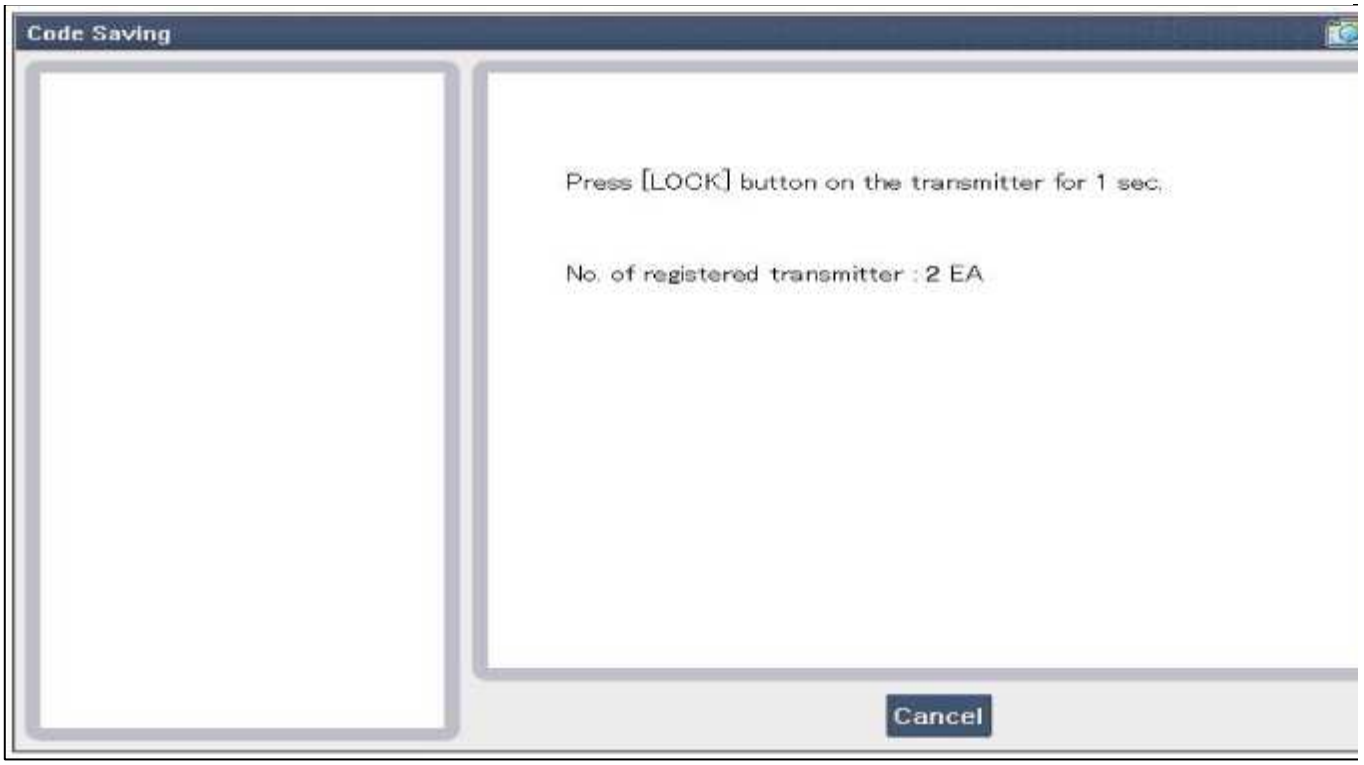
4. After removing the ignition key from key cylinder, push "OK" key to proceed to the next mode for code saving. Follow steps 1 to 4 and then code saving is completed.

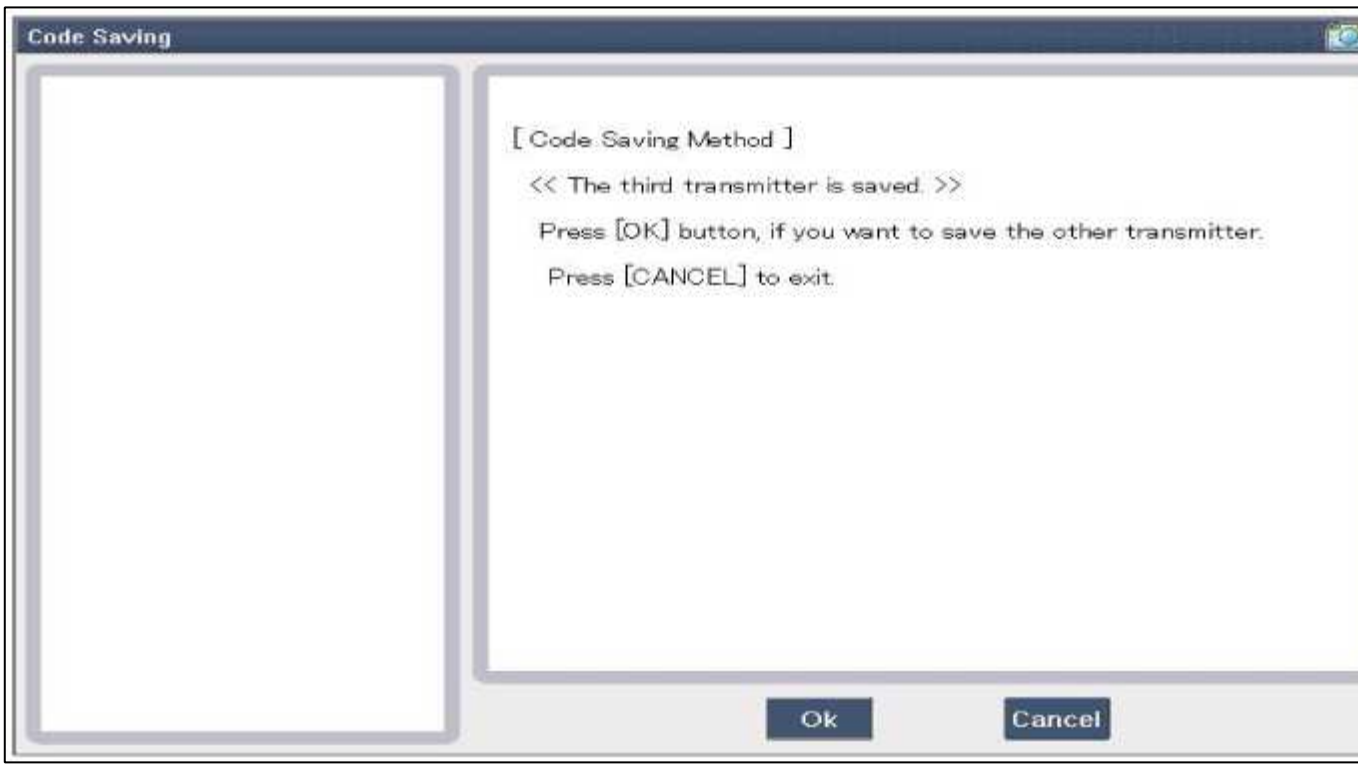

Code Saving
Press [LOCK] button on the transmitter for 1 sec.
No. of registered transmitter : 0 EA
Cancel

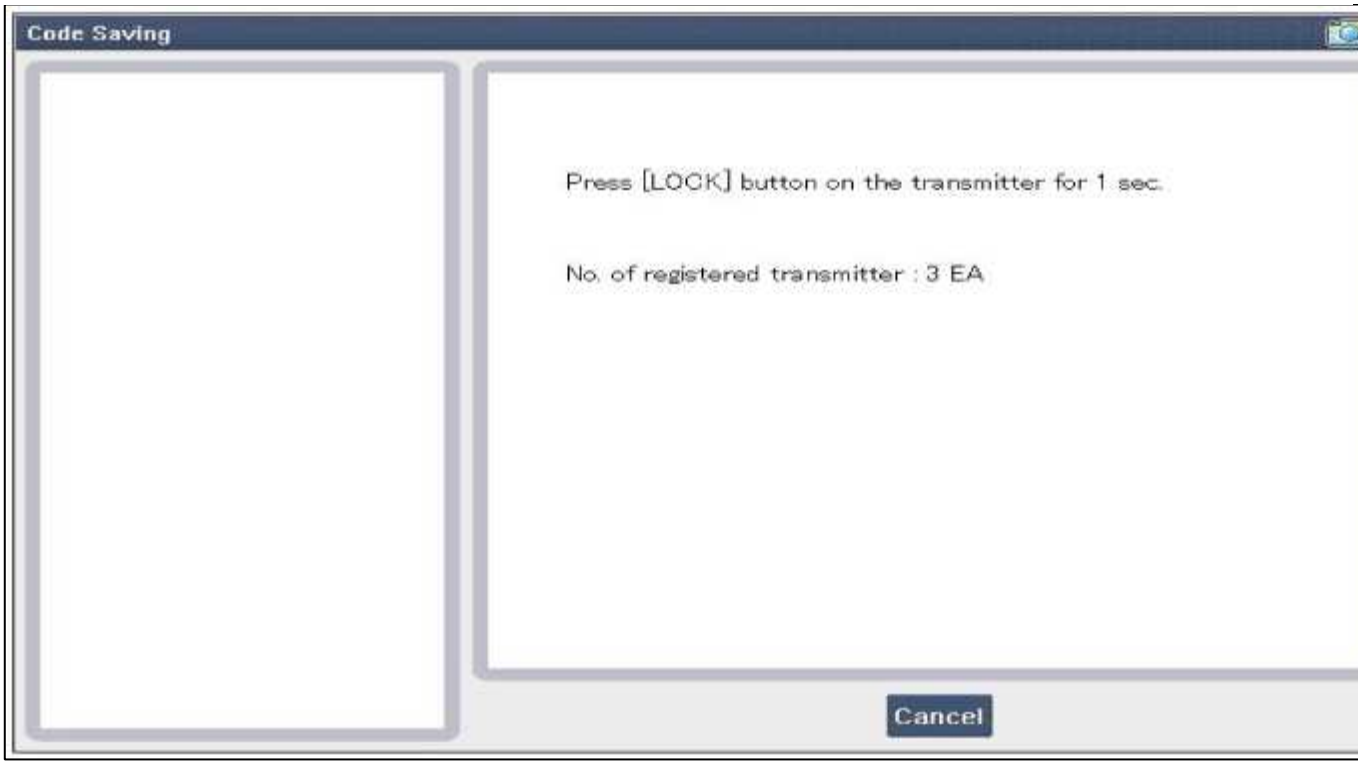

Code Saving
[Code Saving Method]
<< The first transmitter is saved. >>
Press [OK] button, if you want to save the other transmitter.
Press [CANCEL] to exit.
To check the saved transmitter, you must go to the GDS main screen.
Ok
Cancel

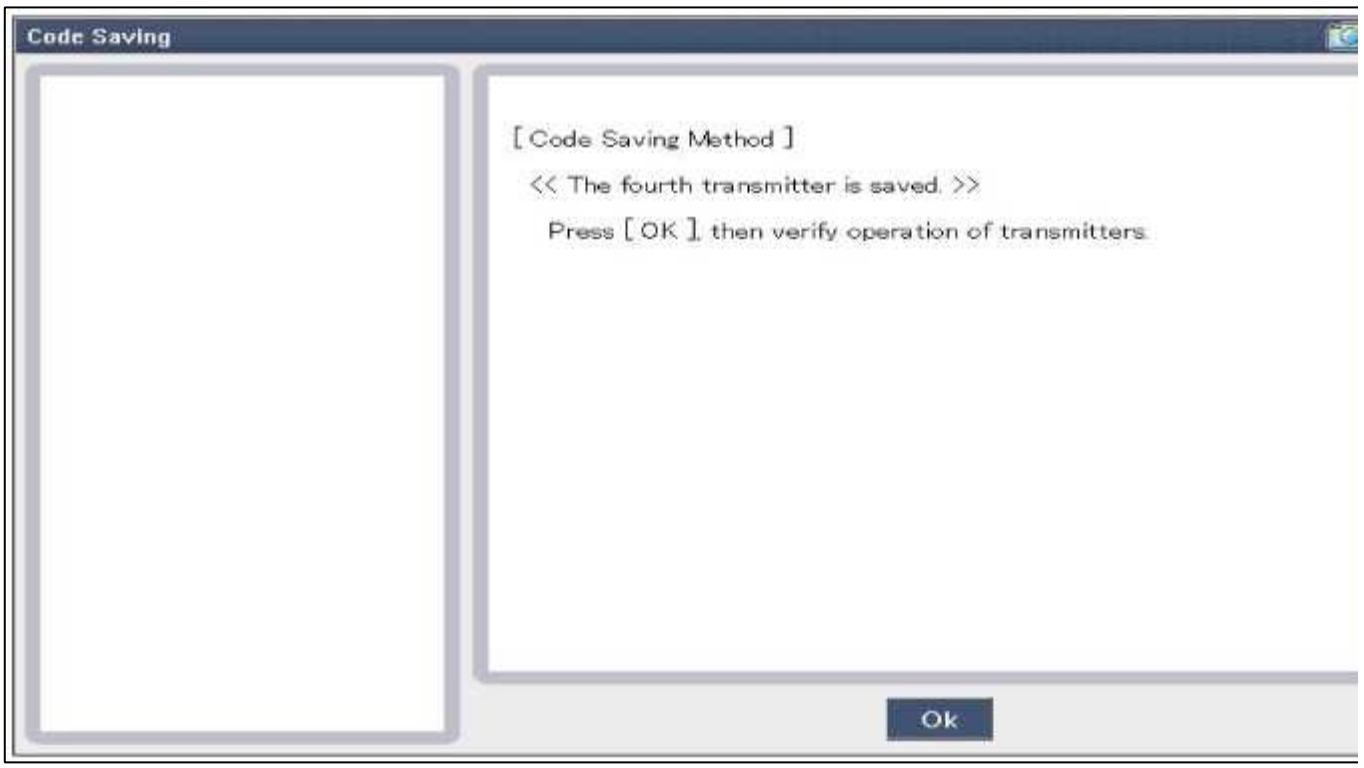

Code Saving
Press [LOCK] button on the transmitter for 1 sec.
No. of registered transmitter : 1 EA
Cancel

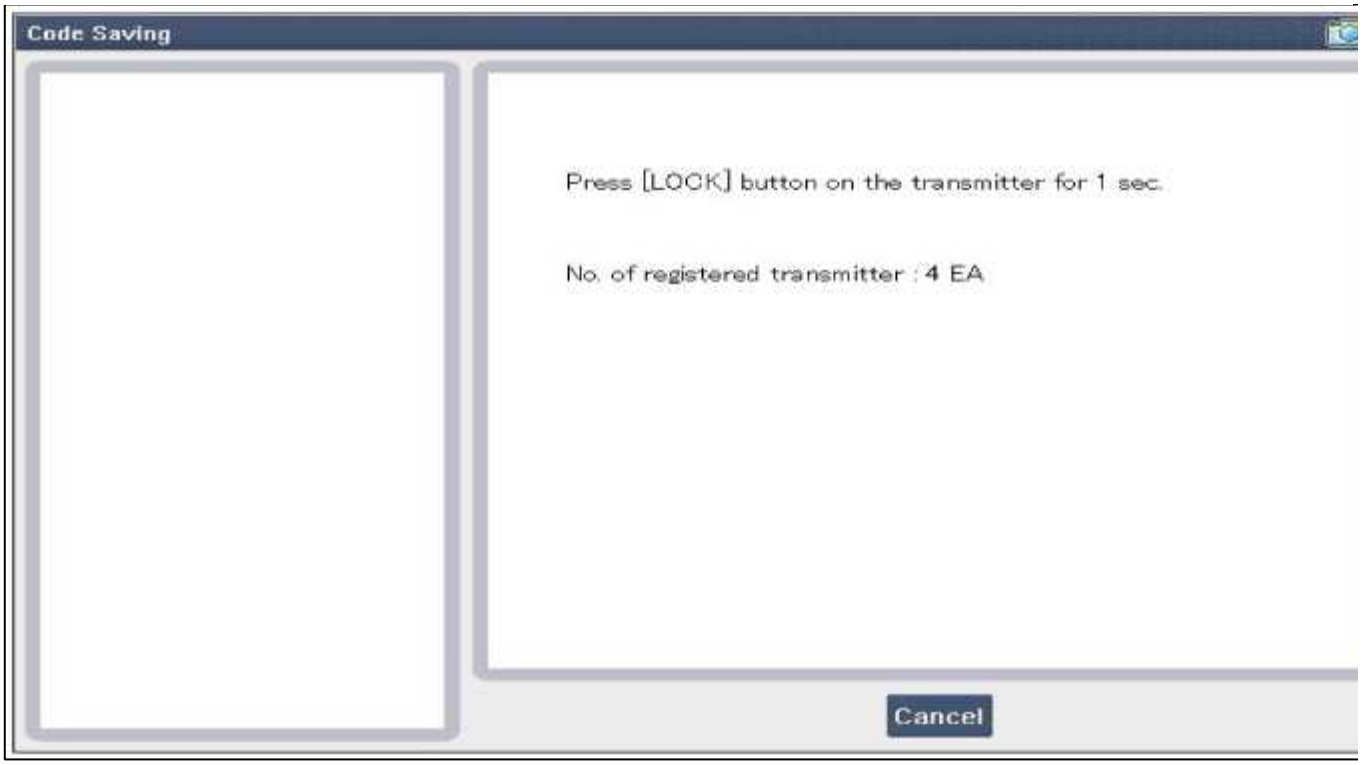

Code Saving
[Code Saving Method]
<< The second transmitter is saved. >>
Press [OK] button, if you want to save the other transmitter.
Press [CANCEL] to exit.
Ok
Cancel


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


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


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


Code Saving
[Code Saving Method]
<< The fourth transmitter is saved. >>
Press [OK], then verify operation of transmitters.
Ok



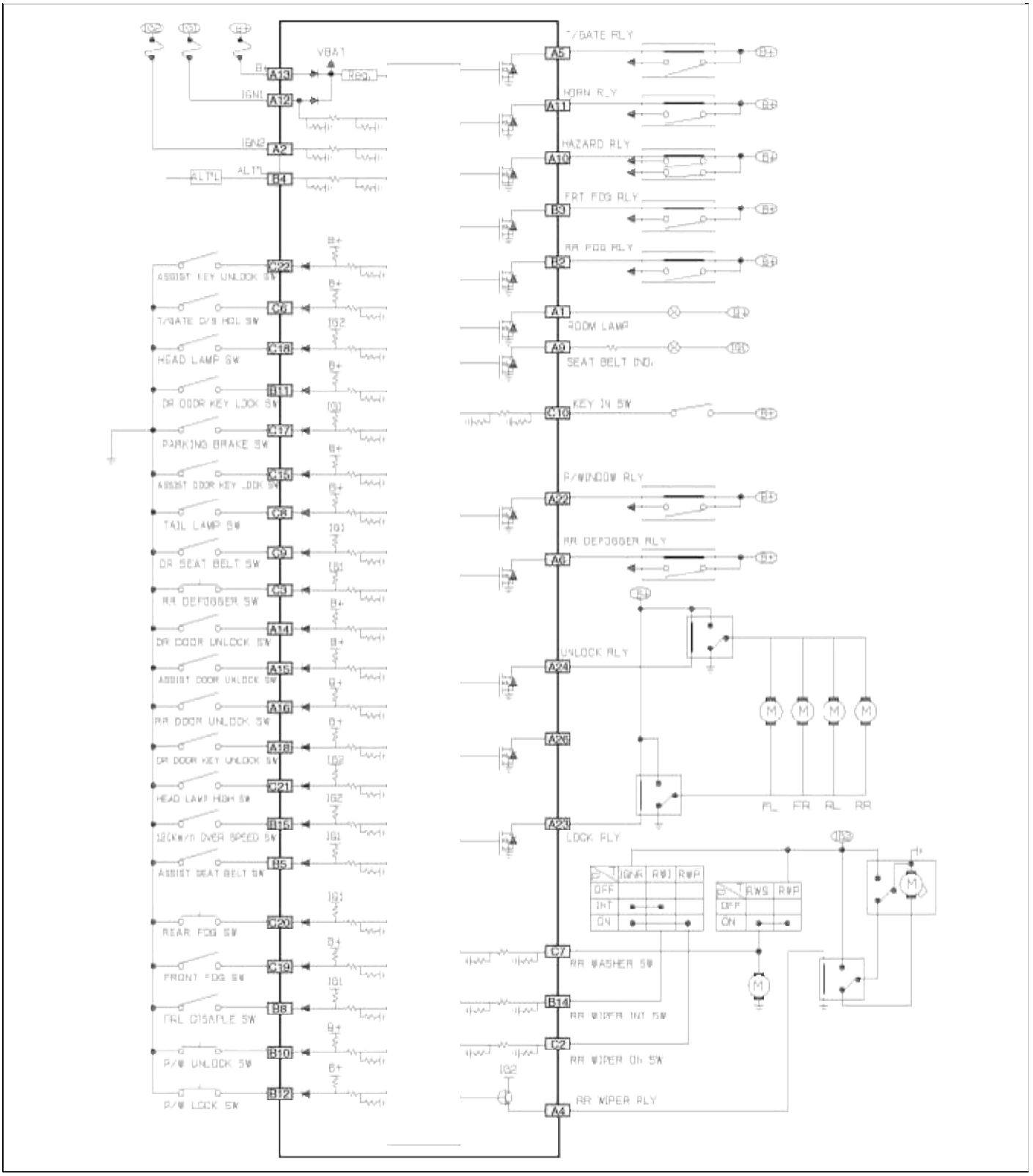
Body Electrical System > BCM (Body Control Module) > Body Control Module (BCM) > Specifications

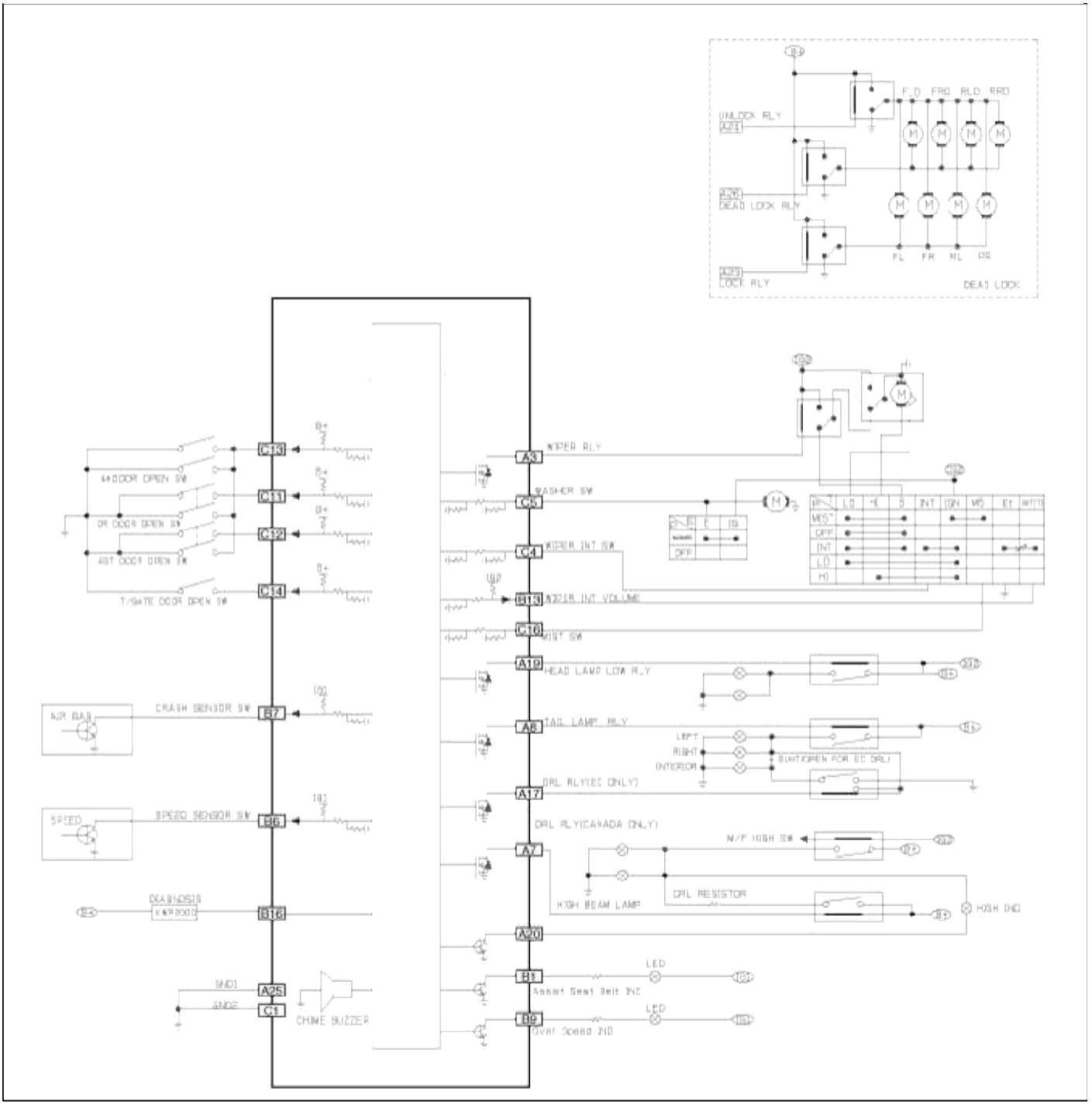
Specifications

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

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

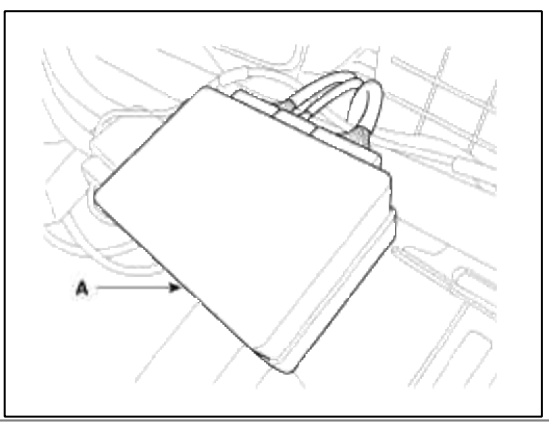
Circuit Diagram


VBAT
IGN1
IGN2
ALT'L
T/GATE RLY
HORN R_Y
HAZARD RLY
FRT FOG RLY
RR FOG RLY
ROOM LAMP
SEAT BELT IND.
KEY IN SW
P/WINDOW RLY
RR DEFOGGER RLY
UNLOCK RLY
LOCK RLY
RR WASHER SW
RR WIPER INT SW
RR WIPER ON SW
RR WIPER RLY
ASSIST KEY UNLOCK SW
T/GATE O/S HDL SW
HEAD LAMP SW
DR DOOR KEY LOCK SW
PARKING BRAKE SW
ASSIST DOOR KEY LOCK SW
TAIL LAMP SW
DR SEAT BELT SW
RR DEFOGGER SW
DR DOOR UNLOCK SW
ASSIST DOOR UNLOCK SW
RR DOOR UNLOCK SW
DR DOOR KEY UNLOCK SW
HEAD LAMP HIGH SW
120Km/h OVER SPEED SW
ASSIST SEAT BELT SW
REAR FOG SW
FRONT FOG SW
P/W UNLOCK SW
P/W LOCK SW
FL
FR
RL
RR



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

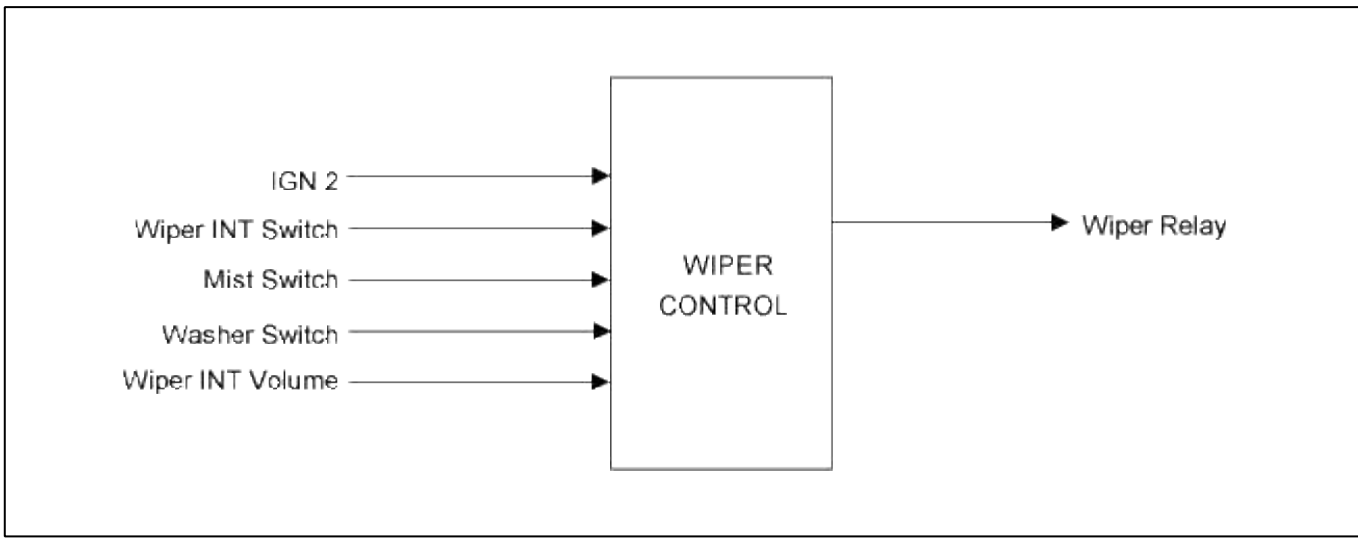
Description

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

Function

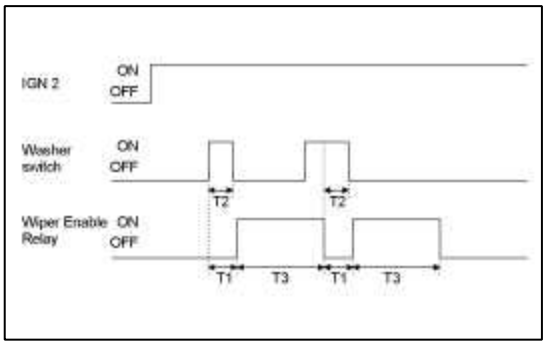
Wiper Control

1. Wiper Data Flow



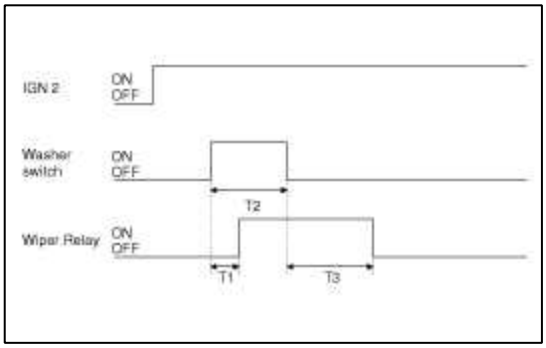
2. Washer Interlocking Wiper

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



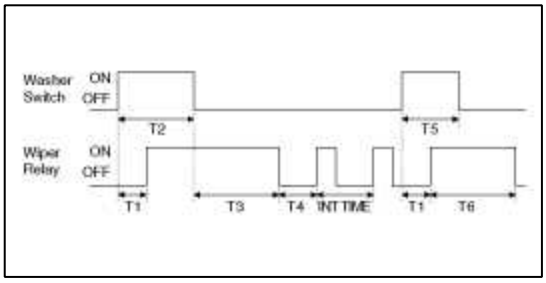
T1 : 0.3±0.03sec, T2 : 0.06~0.2sec, T3 : 0.7±0.1sec, T2 is less than 0.06sec : T3=0

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



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

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

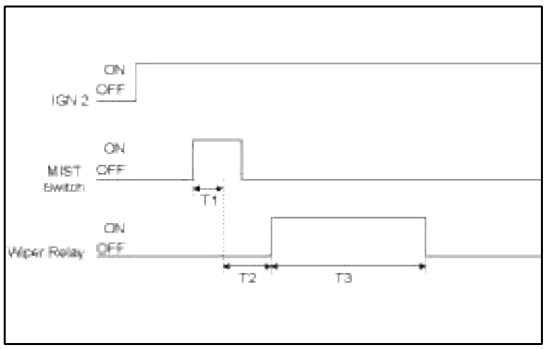


T1 : 0.3 ± 0.03s, T2 : more than 0.2s,
T3 : 2.5 ~ 3.8s, T4 : INT TIME - 0.7s,
T5 : 0.06 ~ 0.2s, T6 : 0.7 ± 0.1s

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

3. Mist Interlocking Wiper

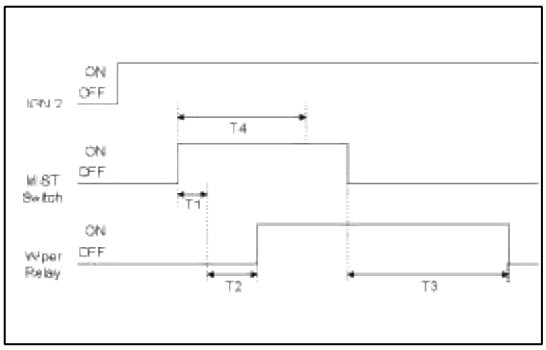
(1) Turn the output of Wiper Relay for 700ms when Mist switch ON at the status of IGN2 ON.



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

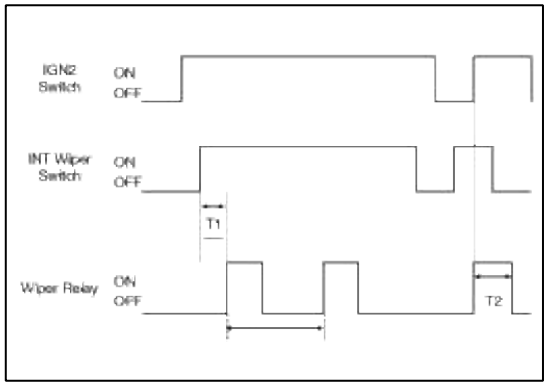
(2) If the input of Mist switch is continuous (for more than 700ms), keep the condition of Wiper Relay is ON and if Mist switch is turned OFF turn the output of Wiper Relay for 700ms from that point.

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



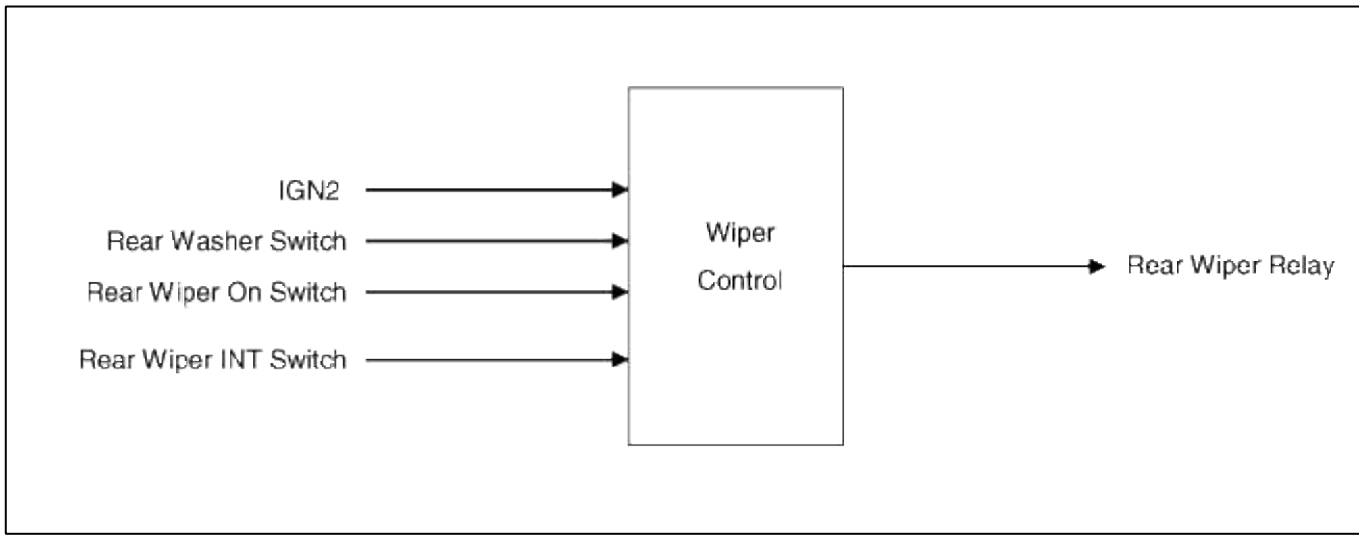
T1 : Min 60 ms, T2 : Max 100ms,
T3 : 700 ± 100ms, T4 : 700ms

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

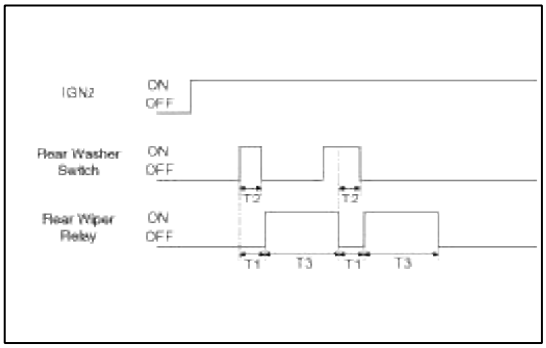


   T1 : 0.3sec MAX, T2 : 0.7 ± 1SEC
   T3 : T2 + pause time

5. Rear Wiper Control

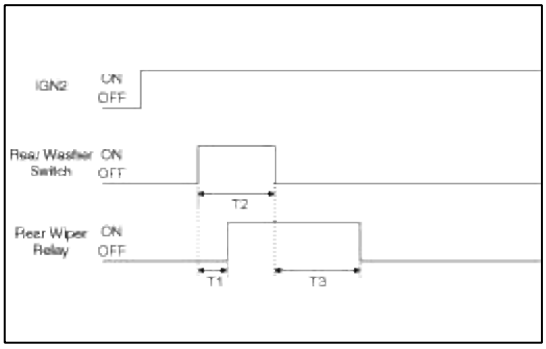


6. Rear Washer Inter Locking Rear Wiper
   (1) Rear Wiper Realy is turned ON after T1 When Rear Washer switch is turned ON at the status of IGN2 ON. If input of Rear Washer switch is less than 0.2sec and more than 0.06sec, Rear Wiper Realy is turned OFF after T3. Ignore the input of Rear Washer switch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



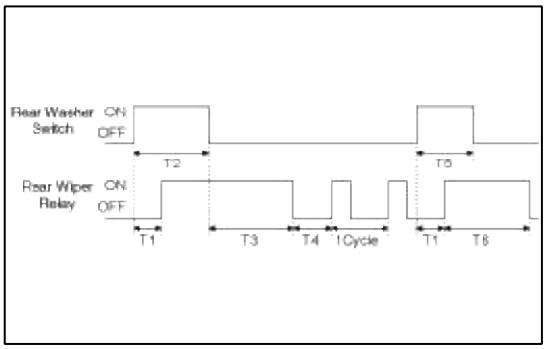
   T1 : 0.3 ± 0.03sec, T2 : 0.06 ~ 0.2sec
   T3 : 0.7 ± 0.1sec, T2 is less than 0.06sec : T3=0

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



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

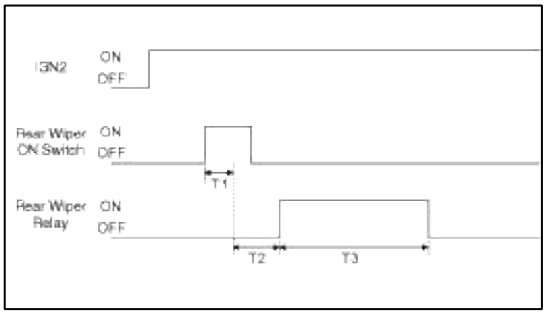
(3) If the input of Rear Washer switch is more than 0.2sec operating Rear Wiper INT, output of Rear Washer interlocking Rear Wiper is turned ON. If the input of Rear Washer is less than 0.2sec, turn the output of Rear Washer interlocking Rear Wiper once.



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

7. Rear Wiper ON

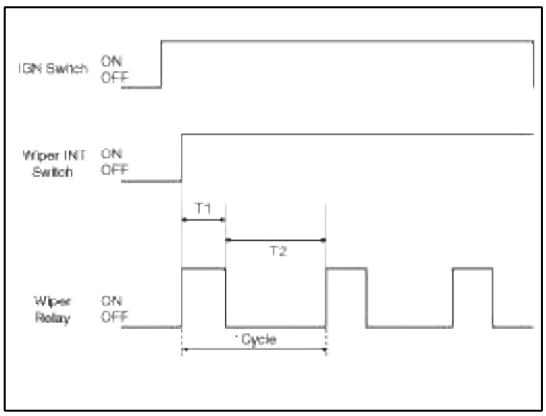
(1) IF Rear Wiper ON switch is ON at the status of IGN2 ON, the output of Rear Wiper Relay is turned ON for 700ms.



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

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

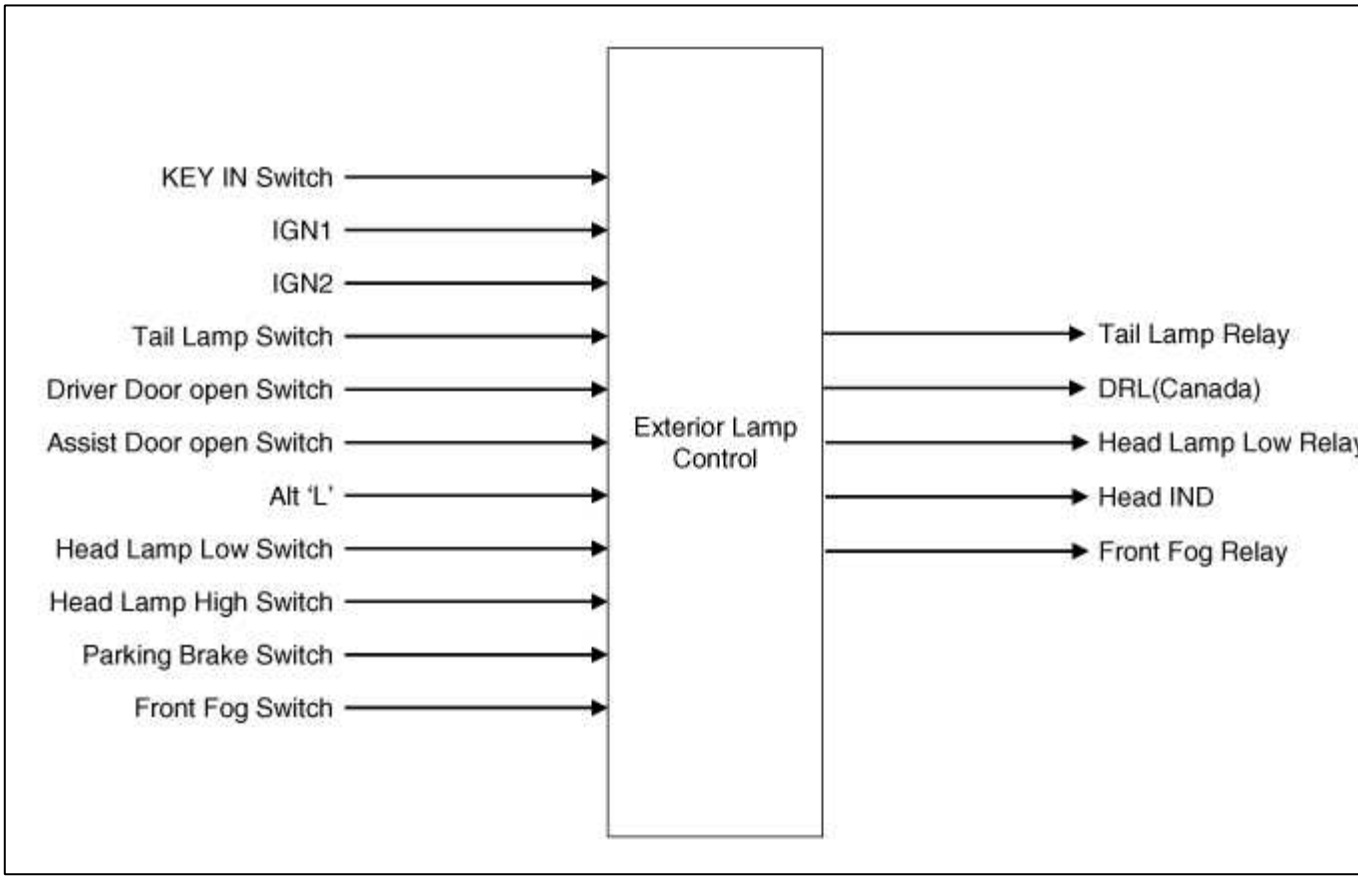
8. Rear Wiper INT
   (1) If Rear Wiper INT switch is turned ON, Rear Wiper Relay is operated in a cycle (0.7sec ON & 6sec OFF).



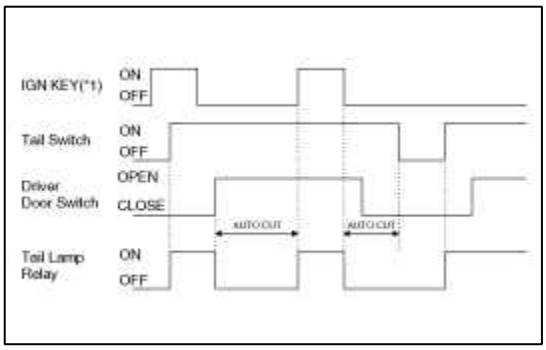
T1 = 0.7s ± 0.1s, T2=6s ± 0.6s

Lamp Control

1. Exterior Lamp Control Data Flow

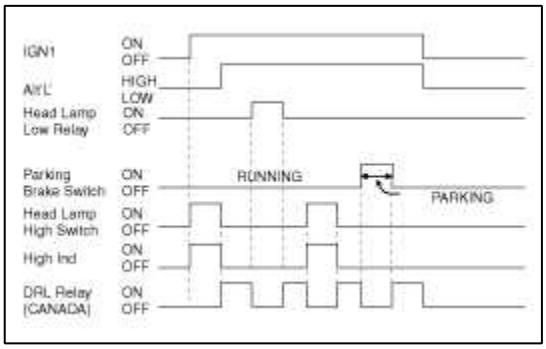


2. Tail Lamp Auto Cut
   (1) Turn IGN KEY OFF when turning Tail Lamp switch ON after turning IGN KEY ON and turn Tail Lamp Relay OFF(automatic blackout) when Driver Door open switch is opened.
   (2) Also, Tail Lamp Relay OFF(automatic blackout) even though IGN KEY is turned OFF after opening Driver Door open switch at the condition that IGN KEY is ON..
   (3) When turning Tail Lamp switch ON again form OFF after the automatic blackout, Tail Lamp Relay will be turned ON and AUTO CUT function will be cancelled.
   (4) When turning IGN KEY ON after the automatic blackout, Tail Lamp Relay will be turned ON and AUTO CUT function will be cancelled.
   (5) AUTO CUT will be kept when removing or installing B+ at the status of AUTO CUT.
   (6) Tail Lamp Relay will be kept turning OFF though Driver Door open switch is closed from opened at the status of AUTO CUT.

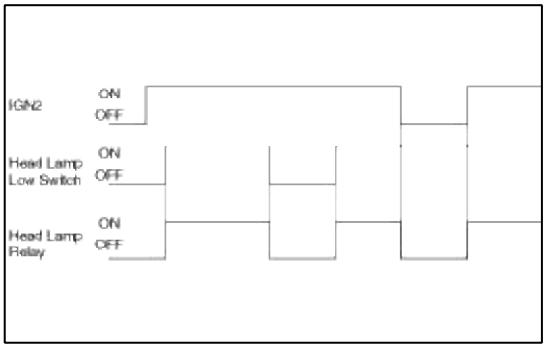


*1 IGN KEY ON : (Push Knob SW or Key In SW ON or IGN 1 ON or IGN 2 ON)
IGN KEY ON : (Push Knob SW and Key In SW OFF and IGN 1 OFF and IGN 2 OFF)

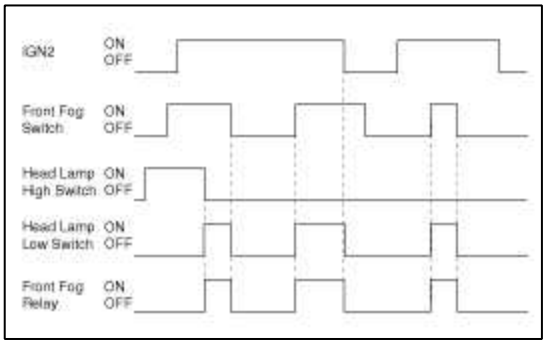
3. Daytime Running Lamps
   (1) If Alt 'L'is High, DRL control put in operation.
   (2) If Head Lamp Low Relay is turned ON or Head Lamp High Switch is turned ON during DRL control operating, DRL control is cancelled.



4. Head Lamp Low
   (1) If Head Lamp switch is turned ON at the status of IGN2 ON, output of Head Lamp Low Relay is turned ON.
   (2) If IGN2 is turned OFF or Head Lamp switch is turn OFF, output of Head Lamp Low Relay is turned OFF.

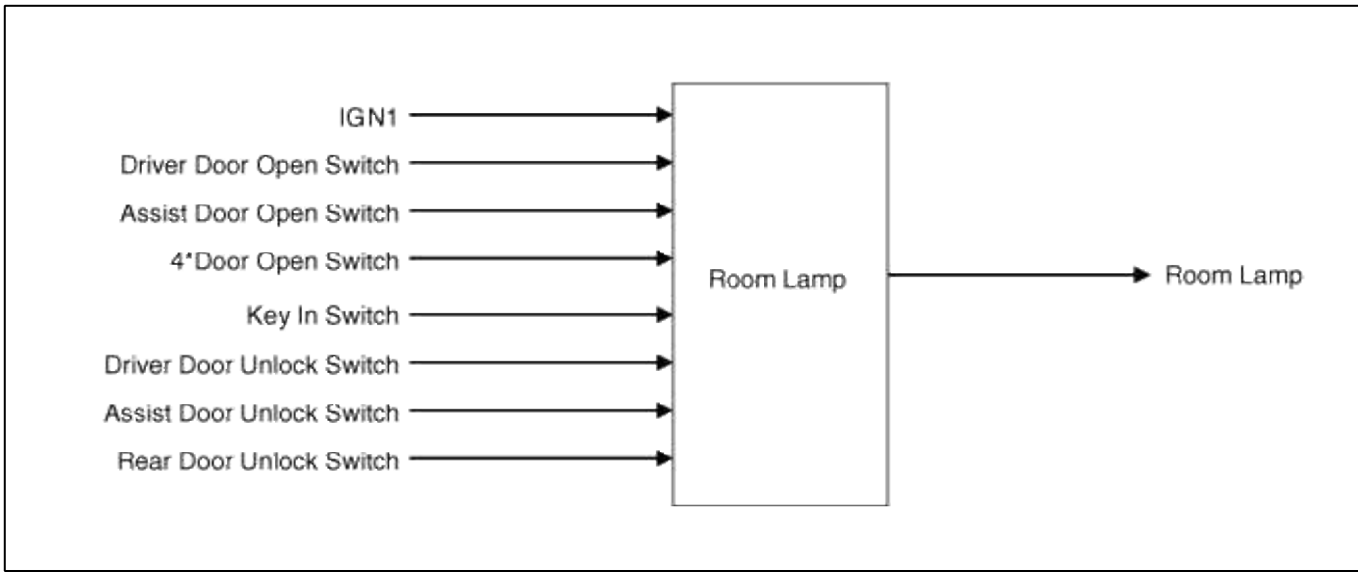


5. Front Fog Lamp
   (1) If IGN2 ON, Head Lamp Low Relay ON, Head Lamp High Switch OFF and Front Fog Switch ON, turn Front Fog Relay ON.
   (2) Turn Front Fog Relay OFF excluding this condition.



Interior Room Lamp

1. Interrior Room Lamp Data Flow



2. Decayed Room Lamp & Keyless Unlock Timer
   When removing or installing the Battery
   (1) Start Room Lamp on the state of 20min, if the DOOR is OPENED.
   (2) Start Room Lamp when it is OFF if the DOOR is CLOSED.

3. Room Lamp Off

(1) Condition 1

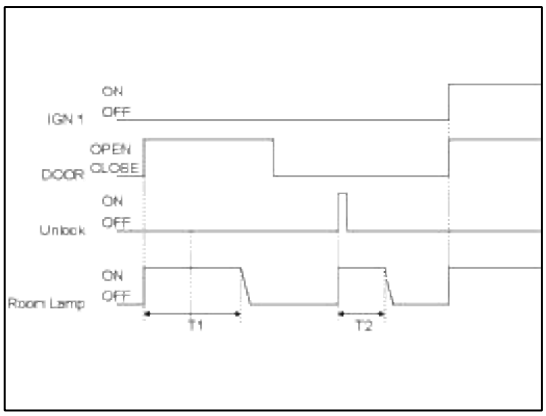
State	Description
Initial condition	Room Lamp OFF and DOOR CLOSE
Event	UNLOCK by TX(Transmitter) or key In ON → OFF
Action	Room Lamp ON for 30± 3 sec.

(2) Condition 2

State	Description
Initial condition	Room Lamp OFF
Event	Any DOOR OPEN for over 0.1 sec. when ALL DOORS are closed
Action	ROOM LAMP ON for 20 min

(3) Condition 3

State	Description
Initial condition	Room Lamp OFF and IGN1 OFF
Event	IGN1 ON and DOOR OPEN for over 0.1 sec.
Action	ROOM LAMP ON



T1 : 20 ± 1min, T2 :30 ± 3sec

4. Room Lamp On for 30s

(1) Condition 1

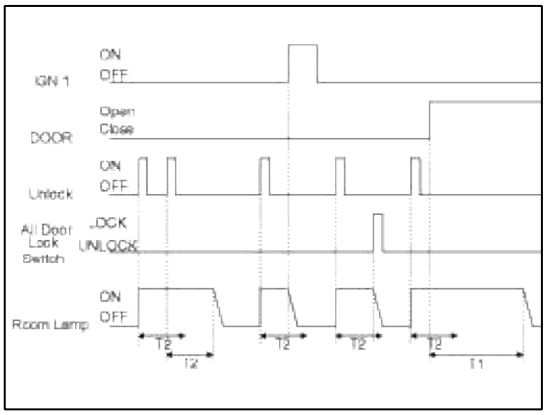
State	Description
Initial condition	ROOM LAMP ON for 30s and IGN1 OFF
Event	DOOR OPEN for over 0.1 sec. when ALL DOORS are closed.
Action	ROOM LAMP ON for 20min

(2) Condition 2

State	Description
Initial condition	ROOM LAMP ON for 30s and IGN1 OFF
Event	UNLOCK by TX
Action	ROOM LAMP ON for 30s

(3) Condition 3

State	Description
Initial condition	ROOM LAMP ON for 30s and IGN1 OFF
Event	IGN1=ON, or after 30sec, or ALL DOOR UNLOCK → LOCKED or TX LOCK & ALL DOORS CLOSED & ALL DOOR LOCKED
Action	The state go to ROOM LAMP DECAYING state Room Lamp decaying for 2 ± 0.2 sec and OFF



T1 : 20 ± 1min, T2 : 30 ± 3sec

5. Room Lamp On for 20min

(1) Condition 1

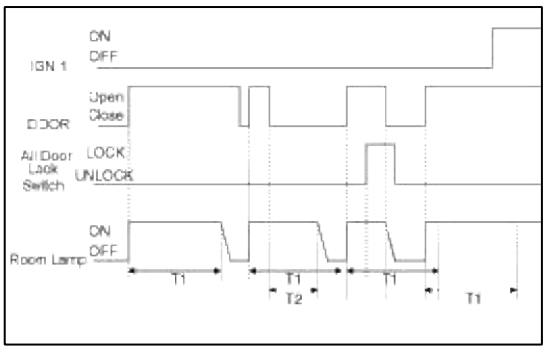
State	Description
Initial condition	Room Lamp ON for 20min and IGN1 OFF
Event	IGN1 ON
Action	ROOM LAMP ON

(2) Condition 2

State	Description
Initial condition	Room Lamp ON for 20min and IGN1 OFF
Event	DOOR CLOSE and ALL DOOR LOCK Or after 20min
Action	ROOM LAMP DECAYING for 2 ± 0.2 sec and OFF

(3) Condition 3

State	Description
Initial condition	ROOM LAMP ON for 20min and IGN1 OFF
Event	DOOR CLOSE
Action	ROOM LAMP ON for 30s



T1 :20 ± 1min, T2 : 30 ± 3sec

6. Room Lamp Decaying

(1) Condition 1

State	Description
Initial condition	ROOM LAMP DECAYING and IGN1 OFF
Event	DOOR OPEN for over 0.1 sec. when All doors are closed
Action	ROOM LAMP ON for 20min

(2) Condition 2

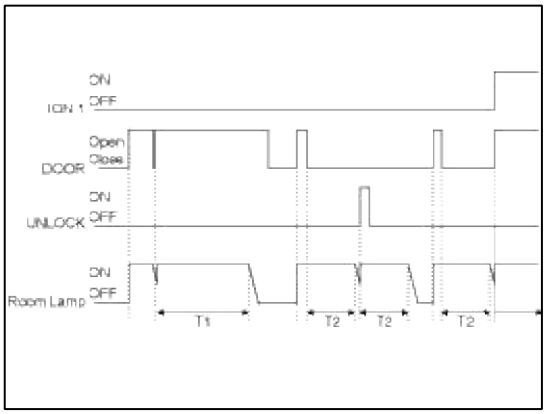
State	Description
Initial condition	ROOM LAMP DECAYING and IGN1 OFF and DOOR CLOSE
Event	UNLOCK by TX
Action	ROOM LAMP ON for 30s

(3) Condition 3

State	Description
Initial condition	ROOM LAMP DECAYING
Event	After decaying
Action	ROOM LAMP OFF

(4) Condition 4

State	Description
Initial condition	ROOM LAMP DECAYING
Event	IGN1 ON and DOOR OPEN for 0.1 sec.
Action	ROOM LAMP ON



T1 : 20 ± 1min, T2 : 30 ± 3sec.

7. Room Lamp On

(1) Condition 1

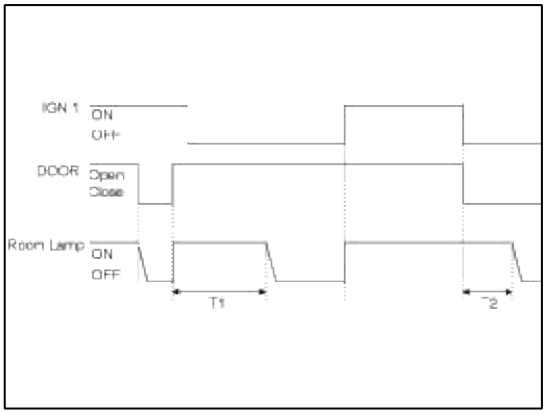
State	Description
Initial condition	Room Lamp ON and IGN1 ON and DOOR OPEN
Event	DOOR CLOSE
Action	ROOM LAMP DECAYING for 2 ± 0.2 sec. and OFF

(2) Condition 2

State	Description
Initial condition	Room Lamp ON and IGN1 ON and DOOR OPEN
Event	IGN1 OFF
Action	ROOM LAMP ON for 20min

(3) Condition 3

State	Description
Initial condition	Room Lamp ON and IGN1 ON and DOOR OPEN
Event	DOOR CLOSE and IGN1 OFF
Action	ROOM LAMP ON for 30s



T1 : 20 ± 1min, T2 : 30 ±3sec

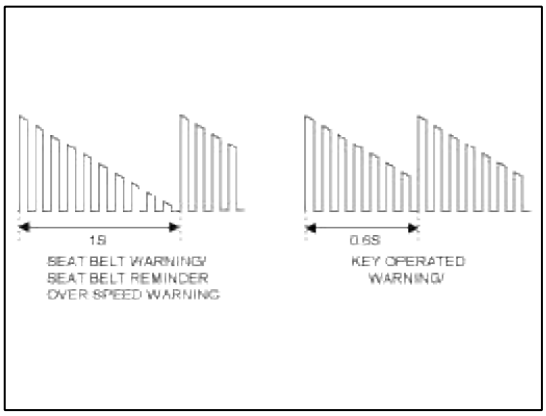
NOTE

1. ROOM LAMP should not be flickered when turning IGN1 ON.
2. Exposure for the ROOM LAMP should be more than 32 steps.

8. Buzzer Control

(1) SPECIFICATION of BUZZER SOUND

	Frequency	Frequency DUTY	Cycle	Sound pressure	Remark
SEAT BELT WARNING/ SEAT BELT REMINDER OVER SPEED WARNING	800Hz	50%	1.0s	70±10dB	Decreasing sound
KEY OPERATED WARNING	800Hz	50%	0.6s	70±10dB	Decreasing sound



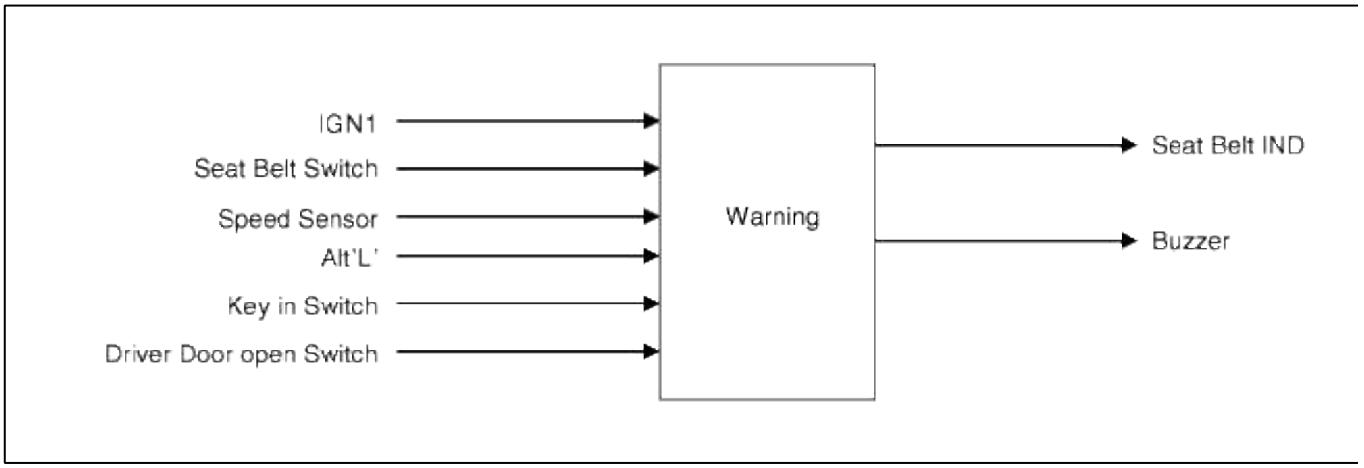
(2) Priority :
S/BELT WARNING/SEAT BELT REMINDER > OVER SPEED WARNING > KEY OPERATED WARNING

(3) Keep the output up to the OFF cycle when turning the output OFF.

(4) Measurement distance for sound pressure: 1.0 m

Warning Control

1. Warning Control Data Flow



2. Seat Belt Warning Timer

(1) From State IGN1 Off (Default State)

State	Description
Initial condition	IGN1 OFF
Event	Driver side seat belt is belted and IGN1 ON
Action	- Start Bulb check 6 seconds driver indicator blinking - The automaton state is changed to IGN1 ON DRIVER BELTED

State	Description
Initial condition	IGN1 OFF
Event	Driver side seat belt is unbelted and IGN1 ON
Action	- Start Bulb check 6 seconds driver indicator blinking - Start Bulb check 6 seconds buzzer warning - If ALT L=ON then start ALT L 6s indicator blinking & ALT L 6s buzzer - The automaton state is changed to IGN1 ON DRIVER UNBELTED

(2) From State IGN1 On Driver Belted

State	Description
Initial condition	IGN1 ON DRIVER BELTED
Event	IGN1 OFF
Action	- Stop Bulb check 6 seconds driver indicator blinking - Stop ALT L 6 seconds driver indicator blinking - The automaton state is changed to IGN1 OFF

State	Description
Initial condition	IGN1 ON DRIVER BELTED
Event	Driver side seat belt is unbelted
Action	- Start Normal 6 seconds driver indicator blinking - Start Normal 6 seconds buzzer warning - The automaton state is changed to IGN1 ON DRIVER UNBELTED

State	Description
Initial condition	IGN1 ON DRIVER BELTED
Event	ALT L 0 → 1
Action	- Start ALT L 6 seconds driver indicator blinking

(3) From State IGN1 On Driver Unbelted

State	Description
Initial condition	IGN1 ON DRIVER UNBELTED
Event	IGN1 OFF
Action	- Stop Bulb check 6 seconds driver indicator blinking - Stop Normal 6 seconds driver indicator blinking - Stop ALT L 6 seconds driver indicator blinking - Stop ALT L 6 seconds buzzer warning - The automaton state is changed to IGN1 OFF

State	Description
Initial condition	IGN1 ON DRIVER UNBELTED
Event	Driver side seat belt is belted
Action	- Stop Normal 6 seconds driver indicator blinking - Stop ALL 6 seconds buzzer warning - The automaton state is changed to IGN1 ON DRIVER BELTED

State	Description
Initial condition	IGN1 ON DRIVER UNBELTED
Event	Vehicle Speed ≥ 10km/h
Action	- Start buzzer and driver indicator Pattern (10 times (6sec ON/24sec OFF) + 6sec ON) - The automaton state is changed to PATTERN

State	Description
Initial condition	IGN1 ON DRIVER UNBELTED
Event	ALT'L 0 → 1
Action	- Start ALT L 6seconds driver indicator blinking & ALT L 6seconds buzzer warning

(4) From State Pattern

State	Description
Initial condition	PATTERN
Event	IGN1 OFF
Action	- Stop Buzzer and driver indicator Pattern - Stop ALL 6s driver indicator blinking - Stop ALL 6s buzzer warning - The automaton state is changed to IGN1 OFF

State	Description
Initial condition	PATTERN
Event	Driver side seat belt is belted
Action	- Stop Buzzer and driver indicator Pattern - Stop Normal 6s driver indicator blinking - Stop ALL 6s buzzer warning - The automaton state is changed to IGN1 ON DRIVER BELTED

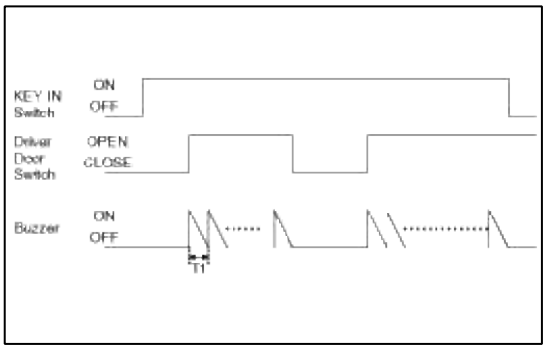
State	Description
Initial condition	PATTERN
Event	Vehicle Speed ≤ 5km/h
Action	- Stop Buzzer and driver indicator Pattern - If 6s buzzer period, after 6s warning stop Pattern - The automaton state is changed to IGN1 ON DRIVER UNBELTED

3. Key Operated Warning

(1) When Driver Door Switch is ON at the status of KEY IN ON, Buzzer will be outputted per 0.6sec continuously.

(2) If KEY IN turns OFF or Driver Door Switch is CLOSED during Buzzer output, the output will turn OFF.

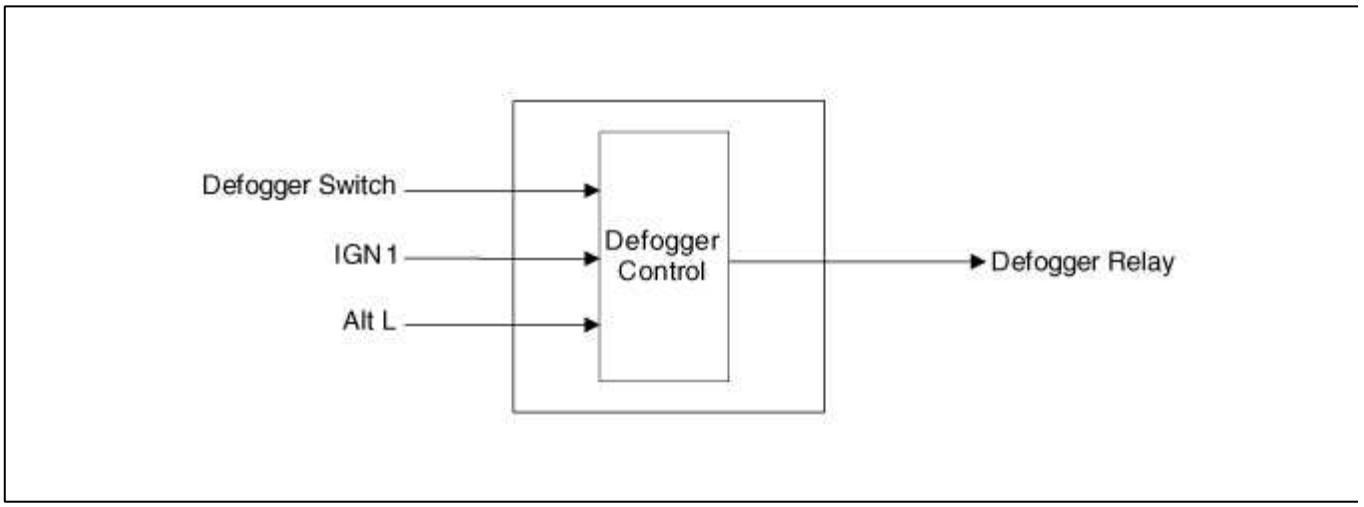
(3) When IGN1 turns ON while outputting, the output will be stopped.



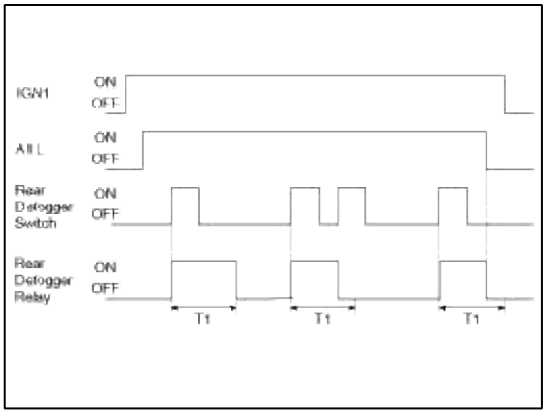
T1 : 0.6 ± 0.1sec

Rear Defogger Timer Control

1. Rear Defogger Control Data Flow

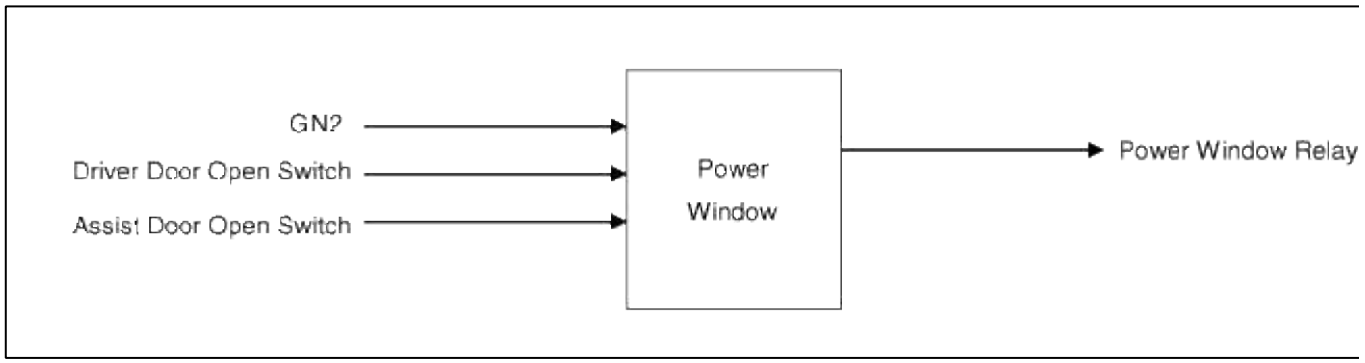


2. Rear Defogger Timer
   (1) With the Enging Running (charging voltage at Alt 'L' terminal, 12v at IGN1) and the Rear Defogger turned on, the Rear Defogger relay will stay ON for 20min.
   (2) If Rear Defogger switch turns ON again while Rear Defogger relay output is ON, turn Rear Defogger relay output OFF.
   (3) The Defogger will turn OFF if there is no charging voltage at Alt 'L' or there is not 12v at ING1 even though the Rear Defogger relay output is ON.
   (4) If Alt'L' is over 10 Volts Engine is RUNNING (Alt'L' ON) and if Alt'L' is less than 5 Volts ENGINE is STOPPED (Alt'L' OFF). Also, AltL is between 5 and 10 Volts, keep the previous condition.
   (5) Rear Defogger relay should not be outputted when turning Alt'L' ON while Rear Defogger switch is pressed.



T1 : 20 ± 1min

3. Power Window Timer

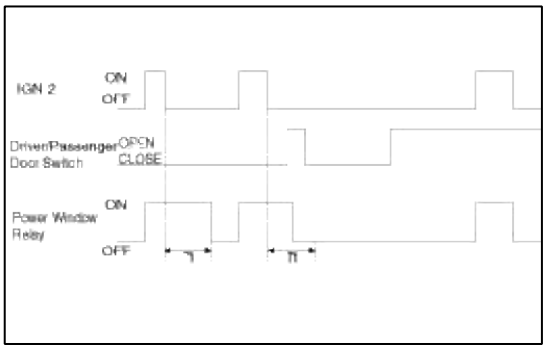


(1) Turn Power window Relay output ON when turning IGN2 ON.

(2) Turn Power window Relay output OFF after keeping Power window Relay output for 30sec when IGN2 is OFF.

(3) Turn Power window Relay OFF immediately when opening Driver Door Switch or Passenger Door Switch within the condition (2) above.

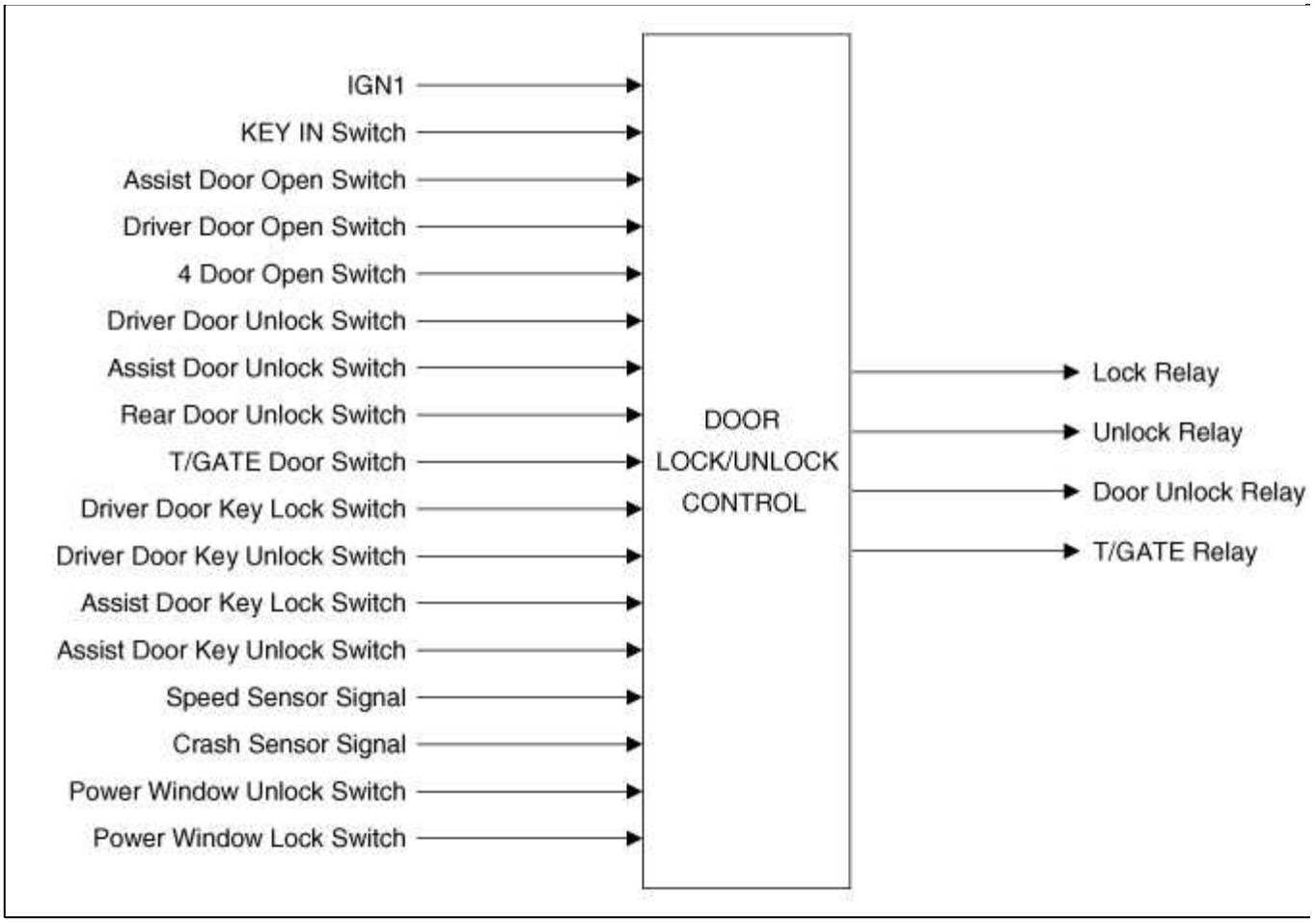
(4) Turn Power window Relay output OFF when IGN2 is OFF while Driver Door Switch or Passenger Door Switch is open.



T1 : 30 ± 3sec

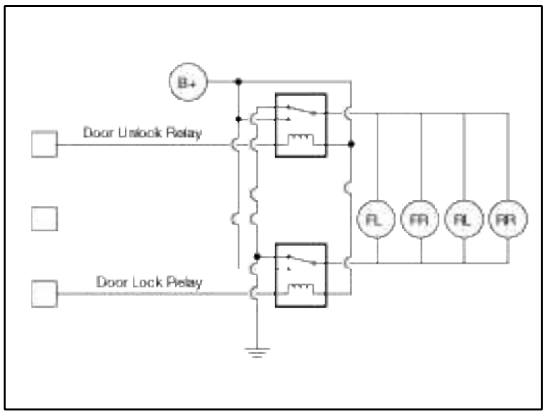
Door Lock/unlock Control

1. Door Lock/unlock Control Data Flow



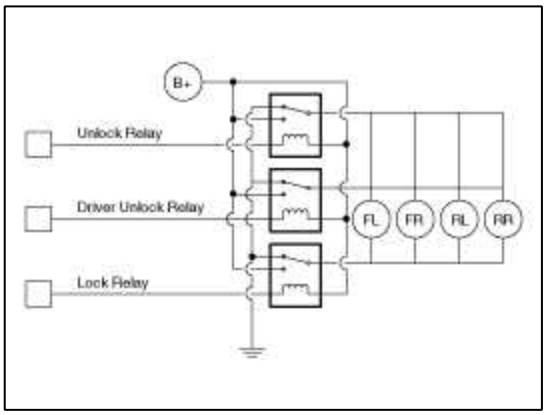
2. Door Lock/unlock Relay Control

(1) NON-APPLICABLE SPEC FOR 2-TURN



Mode	Unlock Relay	Driver Door Unlock Relay	Lock Relay
CENTRAL LOCK	OFF	NC	ON
CENTRAL UNLOCK	ON	NC	OFF

(2) 2-Turn Unlock Spec (For North America)



Mode	Unlock Relay	Driver Unlock Relay	Lock Relay
CENTRAL LOCK	OFF	OFF	ON
CENTRAL UNLOCK	ON	ON	OFF
DRIVER UNLOCK	OFF	ON	OFF

(3) Turn the present output OFF immediately when reciprocal output is requested while outputting and start outputting reciprocally in 100ms. However, output the last request if there is request for output during the delay of 100ms.

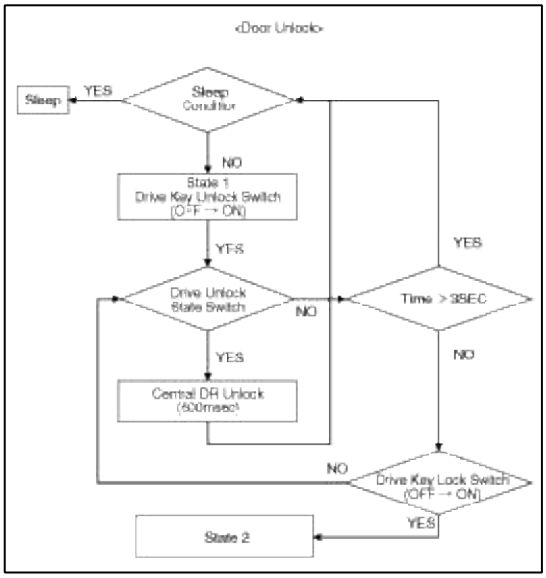
(4) Execute LOCK output and ignore UNLOCK output when the condition for LOCK and UNLOCK is occurred at the same time.

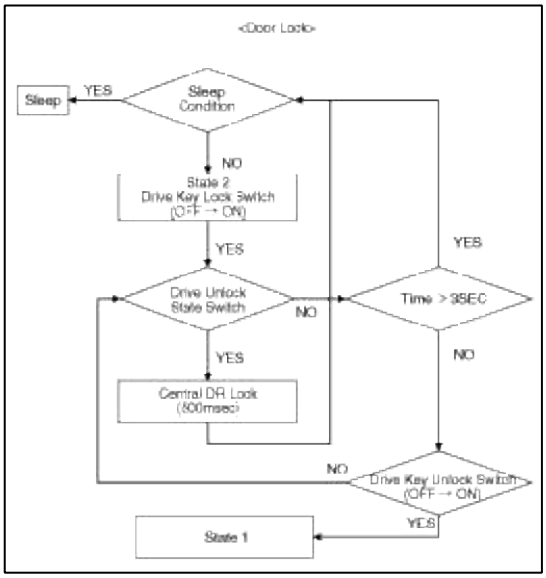
(5) Execute Driver Door Unlock output by the Unlock Relay output when Unlock Relay is requested during Driver Unlock Relay output.(For North America)

3. Door Key Lock/unlock

(1) In case of DOOR KEY LOCK (UNLOCK) signal of driver's seat, handle as KEY LOCK (UNLOCK) of driver's seat is inputted if the knob in the driver's seat is LOCKED (UNLOCKED) after checking it for 3s.

(2) In case of DOOR KEY LOCK (UNLOCK) signal of the passenger seat, handle as KEY LOCK (UNLOCK) of the passenger seat is inputted if the knob in the passenger seat is LOCKED (UNLOCKED) after checking it for 3s.





4. Central Door Lock/unlock

(1) If Driver Door Key Lock Switch or Passenger Door Key Lock Switch turns ON, turn Door Lock Relay output ON during T1. But prohibit the output when KEY IN ON and IGN1 are ON.

(2) When Driver Door Key Unlock and Passenger Door Key Unlock turn ON, turn Door Unlock Relay and Driver Door Unlock Relay output ON during T1.

(3) Turn CENTRAL LOCK *1) ON during T1 when receiving TX LOCK signal.
But ignore LOCK input when Driver Door SW or Passenger Door SW is ON.

(4) Turn CENTRAL UNLOCK *2) ON during T1 when receiving TX UNLOCK signal.

(5) LOCK/UNLOCK by SAFETY KNOB is not interlock (Mechanical operation).

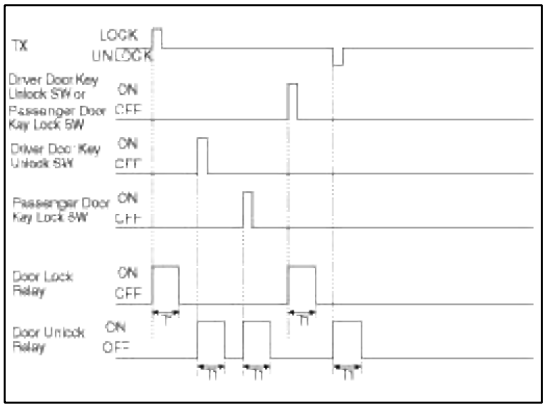
(6) Malfunction should be free when joining BATTERY (Also malfunction should be free at the location of Key In Switch ON).

(7) Input which is less than 60msec should not be received (KEY LOCK/UNLOCK Switch).

(8) Do not execute the output of DOOR LOCK (UNLOCK) by KNOB change.

(9) If Power Window Lock Switch is ON, turn Lock Relay output ON for T1. (NORTH AMERICA)

(10) If Power window Lock Switch is ON, turn CENTRAL UNLOCK output ON for T1. (NORTH AMERICA) But, inhibit operating by Power window Unlock Switch at Lock state by TX.
*1) CENTRAL LOCK : Refer to control mode for each Spec.
*2) CENTRAL LOCK : Refer to control mode for each Spec.



T1 : 0.5 ± 0.1sec

5. 2-Turn Unlock

(1) If Driver Door Key Unlock Switch turns OFF from ON within T1 after Driver Door Key Unlock Switch turns ON from OFF(Driver Door Unlock Switch becomes UNLOCKED mechanically and does not output BCM.), turn Driver Unlock Relay, Unlcok Relay(Central Unlock) output ON duting T2.

(2) If TX UNLOCK is received within T1 after Driver Door Key Unlock Switch turns ON from OFF (Driver Door Unlcok Switch becomes UNLOCKED mechanically and does not output BCM.), turn Driver Unlock Relay and Unlock Relay(Central Unlock) output ON during T2.

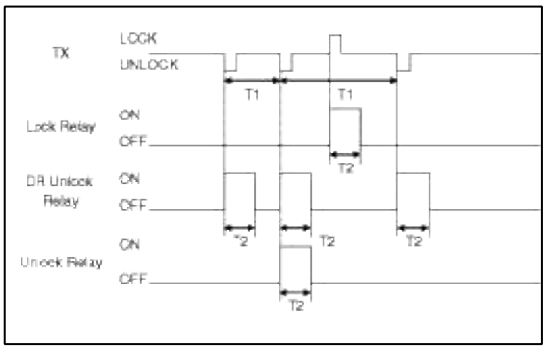
(3) Turn Driver Unlock Relay output ON during T2 when receiving TX UNLOCK signal. However, turn Driver Unlock Relay, Unlock Relay (Central Unlock) output duting T2 if TX UNLOCK is received within T1.

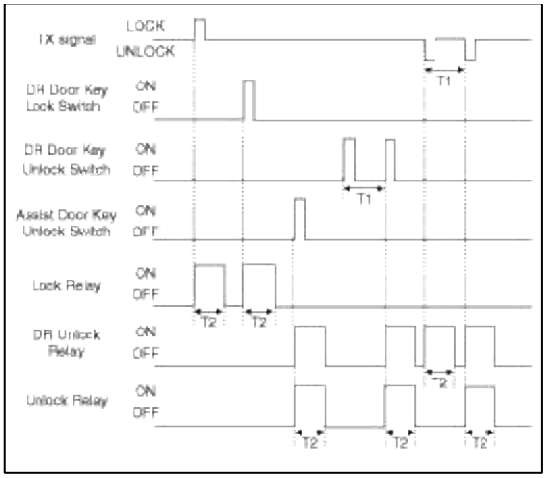
(4) Also, turn Driver Unlock Relay, Unlock Relay (Central Unlock) ON during T2 in case that Driver Door Key Unlock Switch turns ON from OFF within T1 after receiving TX UNLOCK.

(5) Regard as the same TX even though different signal which is registered within T1 is received.

(6) If turn Lock Relay output ON by TX Lock or Driver/Assist Key lock Switch, T1 is initialized.

(7) Assist Key Unlock Switch turns ON from OFF, turn Driver Unlock Relay and Unlock Relay (Central Unlock) output ON during T2.

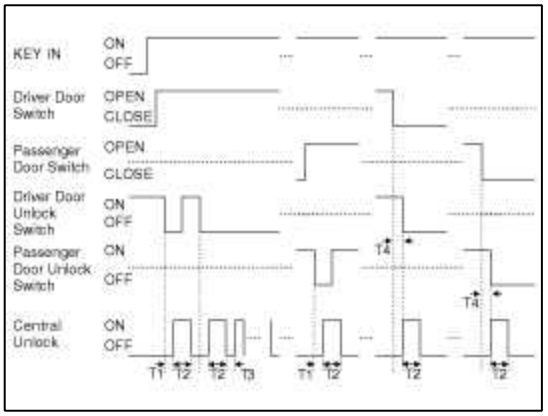




T1 : 4 ± 1sec, T2 : 0.5 ± 0.1sec

6. IGN Key Reminder
   (1) This function will not be operated if the speed of cars exceeds 3km/h.
   (2) Perform Unlock Relay output for 1s after 0.5s when the condition becomes to be KEY IN = ON& Driver Door open Switch = OPEN & Driver Door Unlock Switch = LOCK(Regions for North America).
   (3) Perform Driver Unlock Relay output for 1s after 0.5s when the condition becomes to be KEY IN = ON & Driver Door open Switch = OPEN & Driver Door Unlock Switch = LOCK.(Spec for North America ONLY)
   (4) Perform Unlock Relay output for 1s in 0.5s when the condition becomes to be KEY IN = ON & Assist Door Open Switch =OPEN & Assist Door Unlock Switch = LOCK.
   (5) Output CENTRAL UNLOCK for 1s in 0.5s based on (4) if (1), (3) and (4) are satisfied.
   (6) Output UNLOCK up to 3 times(excluding output for 1s) if LOCK condition is maintained though UNLOCK output is performed for 1s by (2), (3), (4)(cycle for 1s: 0.5s ON/OFF).
   (7) Try UNLOCK once when DOOR is CLOSED while keeping LOCK condition after performing (6).
   (8) Output Driver Unlock Relay once only for 1s when Driver Door open Switch is closed within 0.5s since Driver Door Unlock Switch is changed from UNLOCK to LOCK during KEY IN = ON(North America SPEC ONLY).
   (9) Output CENTRAL UNLOCK once only for 1s when Assist Door Open Switch is closed within 0.5s since Assist Door Unlock Switch is changed from UNLOCK to LOCK during KEY IN = ON.
   (10) Output Driver Unlock Relay for 1s when Driver Door Unlock Switch becomes LOCK from UNLOCK within 0.5s since Driver Door open Switch is changed from OPEN to CLOSE during KEY IN = ON(North America SPEC ONLY)
   (11) Output CENTRAL UNLOCK once only for 1s if Assist Door Unlock Switch becomes to be LOCK from UNLOCK within 0.5s since Assist Door Open Switch is changed from OPEN to CLOSE during KEY IN = ON.
   (12) Jugde if RETRY output is performed or not at the point of the beginnig of RETRY output(in 1.5s from the initial UNLOCK output).

(13) Output UNLOCK though the condition is not kept for 0.5sec after realizing that of UNLOCK. But, do not output UNLOCK in case that KEY IN is OFF at the point of 0.5s passed after realizing the condition by the change of UNLOCK → LOCK in Driver Door Unlock Switch or Assist Door Unlock Switch.



T1, T3 : 0.5 ± 0.1sec, T2 : 1 ± 0.1sec,
T4 : 0.5sec Max
** KEY IN ON : Key In ON or IGN1 ON or IGN2 ON
KEY IN OFF : Key In OFF and IGN1 OFF and IGN2 OFF

7. Crash Door Unlock

(1) Always perform CENTRAL UNLOCK output whenever Crash Sensor signal is inputted(Duty 20%±10%) while IGN1 is ON. (But ignore Sensor input during 5sec output.)

(2) Jugde Sensor Fail if Crash Sensor signal is more than T3, Crash Door Unlock is not operated.

(3) Keep CENTRAL UNLOCK output fot the time left though IGN1 turns OFF from ON while outputting CENTRAL UNLOCK.

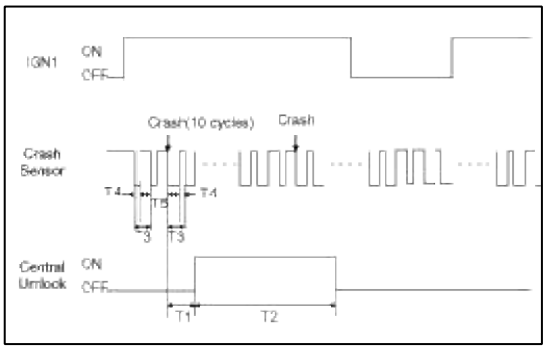
(4) Do not output CENTRAL UNLOCK if IGN1 switch turns ON from OFF after Crash Sensor signal is already inputted..

(5) Output CENTRAL UNLOCK during T3 Driver Door Unlock switch or Assist Door Unlock switch or Rear Door Unlock switch turns to LOCK from UNLOCK after outputting CENTRAL UNLOCK.

(6) Do not perform AUTO DOOR LOCK function at the condition of CRASH UNLOCK.

(7) CRASH DOOR UNLOCK function has priority to LOCK/UNLOCK control by other functions.

(8) Ignore the request for LOCK/UNLOCK by other functions while or after outputting CRASH DOOR UNLOCK. But, control LOCK/UNLOCK by other functions if IGN1 switch becomes OFF.



T1 : Min 40ms, T2 : 5 ± 0.5s,
T3 : 20 ± 2ms, T4 : 16 ± 2ms,
T5 : 4 ± 2ms

Tailgate Release Control

1. Permission Mode State

State	Description
Initial condition	No permission state
Event	DR Door Unlock switch ON
Action	The state goes to permission state

State	Description
Initial condition	30s permission state
Event	DR Door Unlock switch ON
Action	The state goes to permission state

State	Description
Initial condition	Permission state
Event	When vehicle speed is under 5km/h, T/Gate switch ON
Action	Tail Gate Relay ON for 0.5sec The state goes to permission state

2. No Permission State

State	Description
Initial condition	30s Permission state
Event	T/GATE TIMER IS EXPIRED or LOCK command by RKE & Driver Lock state or T/gate open to close
Action	The state goes to NO permission state

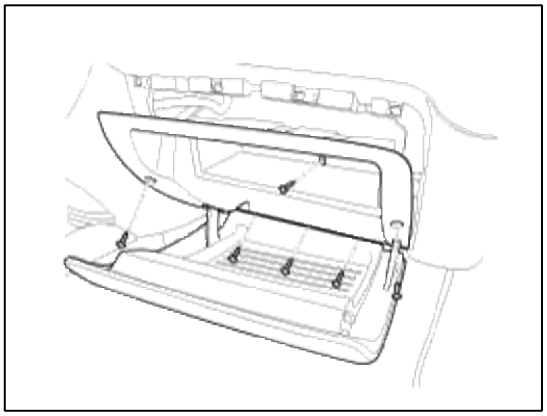
State	Description
Initial condition	Permission state
Event	DR Door Unlock switch OFF
Action	The state goes to NO permission state

Body Electrical System > BCM (Body Control Module) > Body Control Module (BCM) > Repair procedures

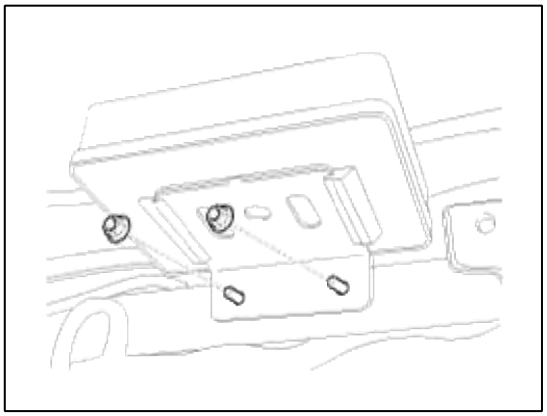
Removal

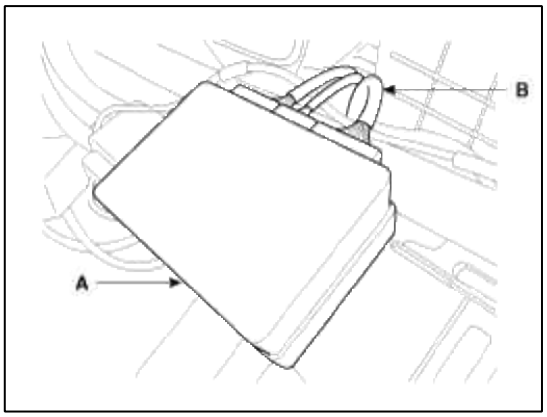
1. Disconnect the negative (-) battery terminal.

2. Remove the glove box.
   (Refer to the Body group - "Crash pad")



3. Remove the BCM (A) after removing the connector (B) and nuts (2EA).



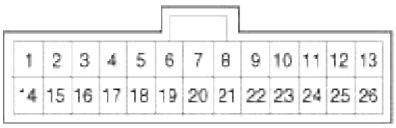


Installation

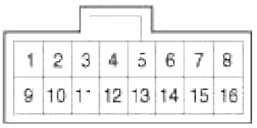
1. Install the BCM after connecting the connector.
2. Install the glove box.

Inspection

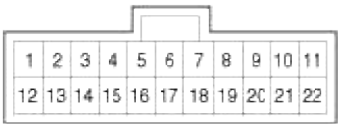
BCM Connectors



Connector A



Connector B



Connector C

PIN NO.	Connector A	Connector B	Connector C
1	Room lamp	Assist seat belt IND	GND 2
2	IG 2	-	Rear wiper ON switch
3	Wiper relay	Front fog relay	Rear defogger switch
4	Rear wiper relay	ALT L	Wiper INT switch
5	T/Gate relay	Assist seat belt switch	Washer switch
6	Rear defogger relay	Speed sensor	T/Gate outside handle switch
7	DRL relay (Canada)	Crash sensor	Rear washer switch
8	Tail lamp relay	DRL disable switch	Tail lamp switch
9	Seat belt indicator	-	Seat belt switch
10	Hazard relay	Power window unlock switch	Key in switch
11	Horn relay	Driver door key lock switch	Driver door open switch
12	IG 1	Power window lock switch	Assist door open switch
13	B +	Wiper INT volume	4 door open switch
14	Driver door unlock switch	Rear wiper INT switch	Tail Gate door switch
15	Assist door unlock switch	-	Assist door key lock switch
16	Rear door unlock switch	Diagnosis	MIST switch
17	-		Parking brake switch
18	Driver door key unlock switch		Head lamp switch
19	Head lamp low relay		Front fog switch
20	High indicator		Rear fog switch
21	-		Head lamp high switch
22	Power window relay		Assist key unlock switch
23	Lock relay		
24	Unlock relay		
25	GND 1		
26	Driver unlock relay		

BCM Logic Output

PIN Name	Capacity	Availability in Power
Horn relay	DC 12V 200mA(indective load)	B+
Hazard relay	DC 12V 200mA(indective load)	B+
Room lamp	DC 12V 30W LAMP	B+
Defogger relay	DC 12V 200mA(indective load)	B+
Unlock relay	DC 12V 200mA(indective load)	B+
Lock relay	DC 12V 200mA(indective load)	B+
Dead lock relay/ Drive door unlock relay	DC 12V 200mA(indective load)	B+
Power window relay	DC 12V 200mA(indective load)	B+
Front fog relay	DC 12V 200mA(indective load)	B+
Tail lamp relay	DC 12V 200mA(indective load)	B+
Head lamp relay	DC 12V 200mA(indective load)	IG2
Wiper realy	DC 12V 200mA(indective load)	IG2
Seat belt indicator lamp	DC 12V 1.2W(LED)	IG1
Assist seat belt indicator lamp	DC 12V 1.2W(LED)	IG1
K line communication		B+
Internal chime buzzer		B+
Tail gate relay	DC 12V 200mA(indective load)	B+
Over speed indicator lamp	DC 12V 1.2W(LED)	IG1
DRL (Canada) relay	DC 12V 200mA(indective load)	B+
Rear wiper relay	DC 12V 200mA(indective load)	IG2

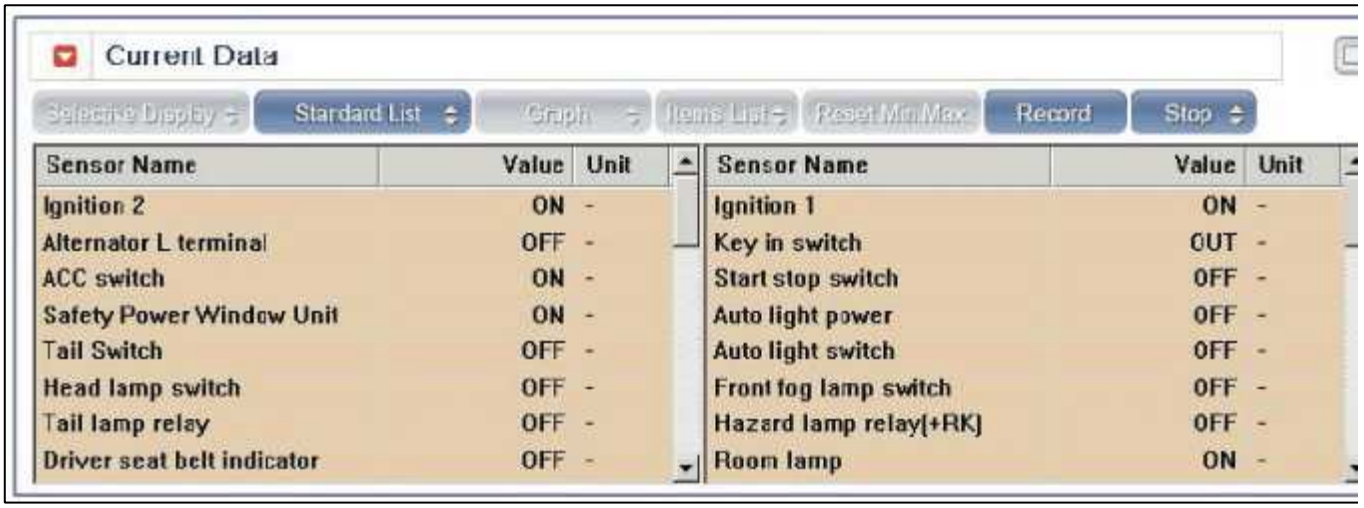
Trouble Diagnostics When Using Diagnosis Tool

1. The body control system can be diagnosed by using the GDS.
   The BCM communicates with the GDS which then displays inputs and outputs along with codes.

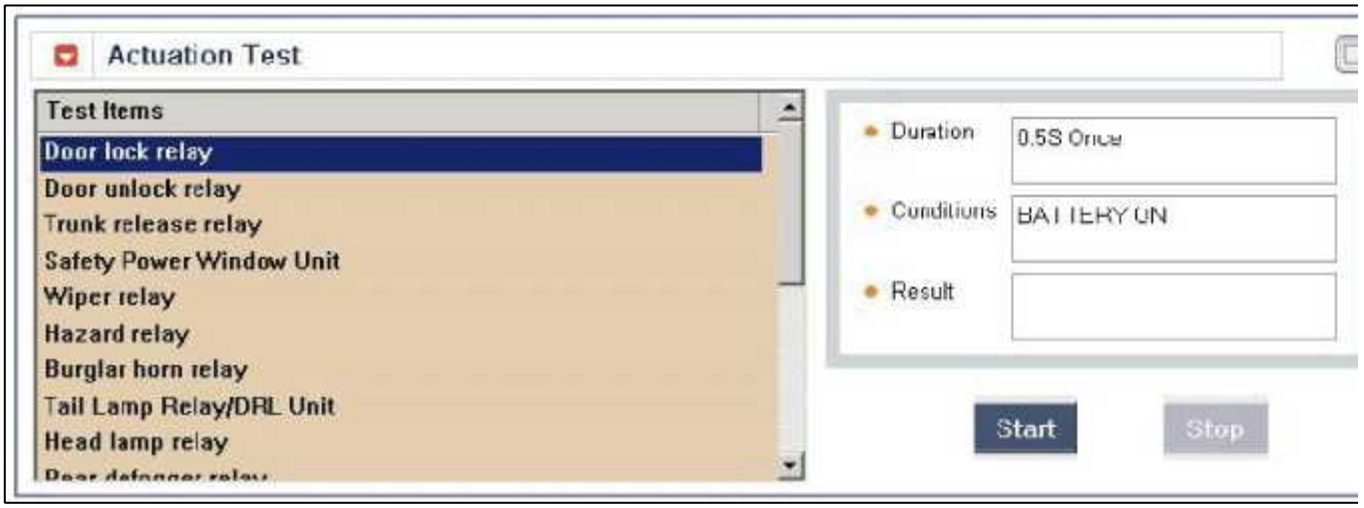
2. To diagnose the BCM function, select the menu of model and body control module.

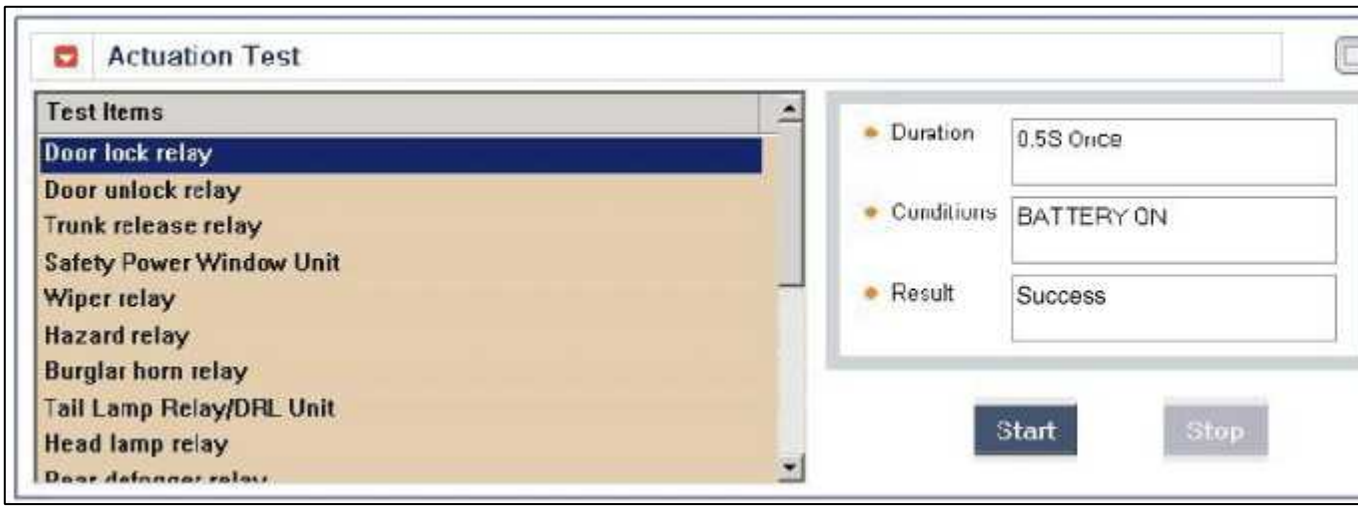


3. To consult the present input/out value of BCM, "Current DATA". It provides information of BCM input/output conditions of power supply, turn signal/brake lamp, headlamp, door locks, outside mirror, wiper, auto-light and transmitters etc.



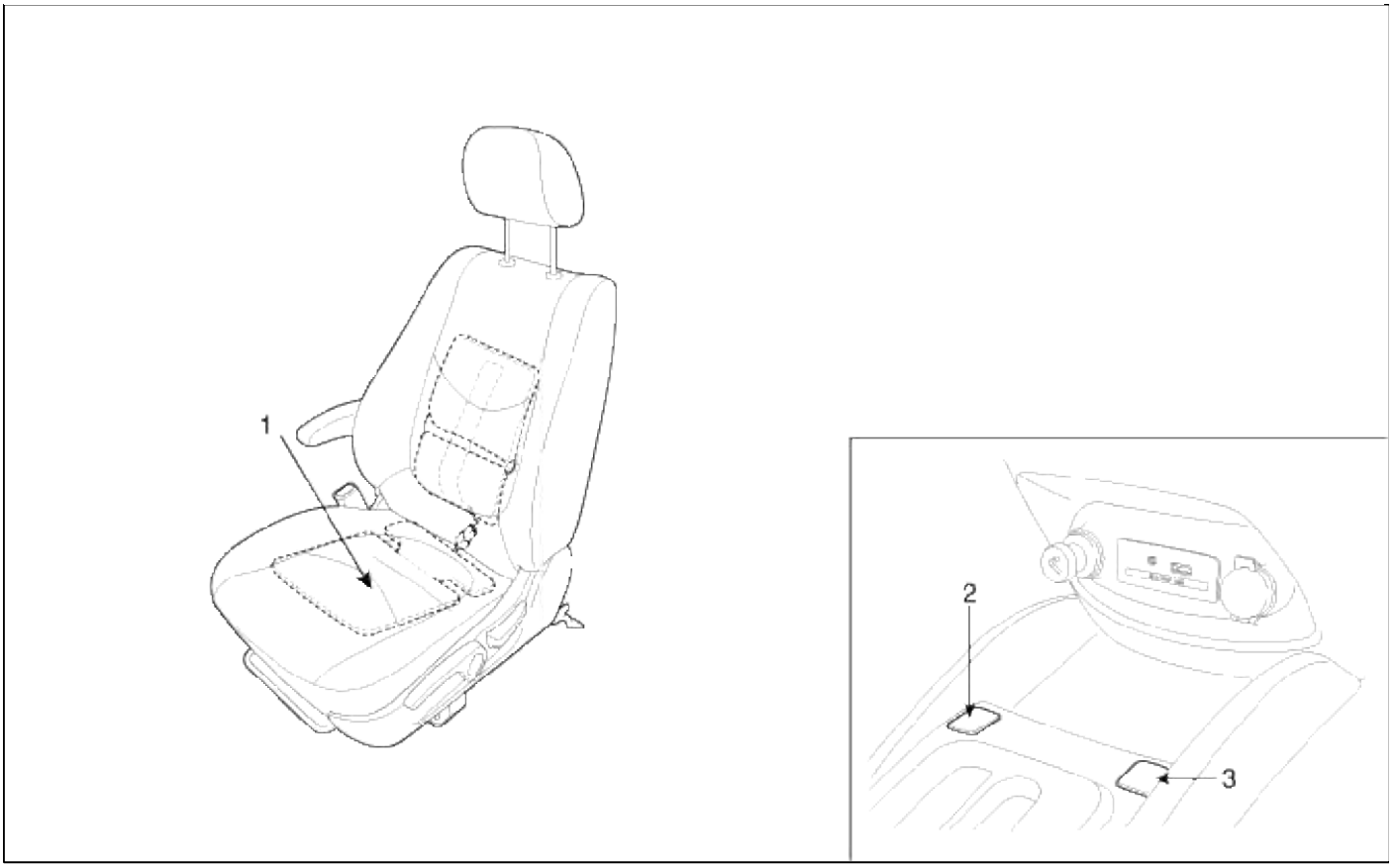
4. To perform functional test on BCM outputs, select "ACTUATION TEST"





Body Electrical System > Seat Electrical > Components and Components Location

Component Location



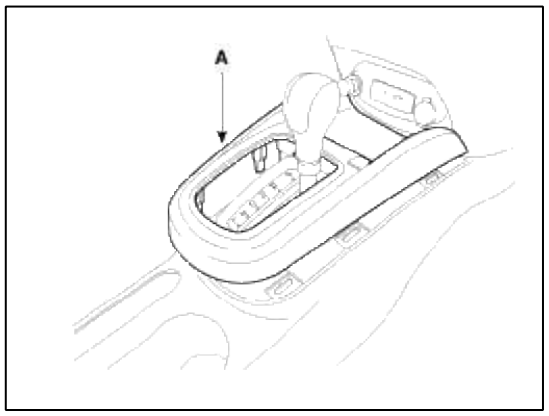
1. Seat warmer 2. Seat warmer switch (LH)	3. Seat warmer switch (RH)

Body Electrical System > Seat Electrical > Seat Heater Switch > Repair procedures

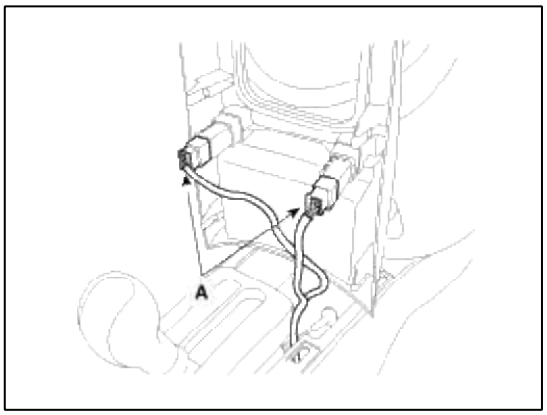
Inspection

Front Seat Warmer Switch

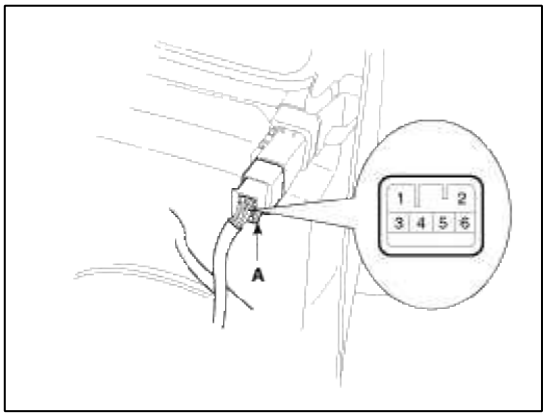
1. Disconnect the negative (-) battery terminal.
2. Remove the floor console upper cover(A).
   (Refer to the Body group - "Console")



3. Disconnect the seat heater switch connectors.



4. Check for continuity between the terminals (A) in each switch position according to the table.

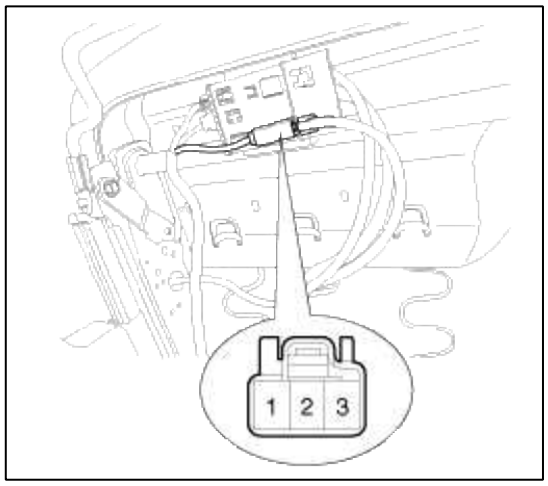


Position / Terminal	ON	OFF	REMARK
1			
3			IND+
4			
5			IND-
6			ILL+
2			ILL-

Body Electrical System > Seat Electrical > Seat Heater > Repair procedures

Inspection

1. Check for continuity and measure the resistance between No.1 terminal and No.3 terminal of connector.



Standard value
Leather seat : 2.4Ω ± 10% / set
Fabric seat : 3.24Ω ± 10% / set

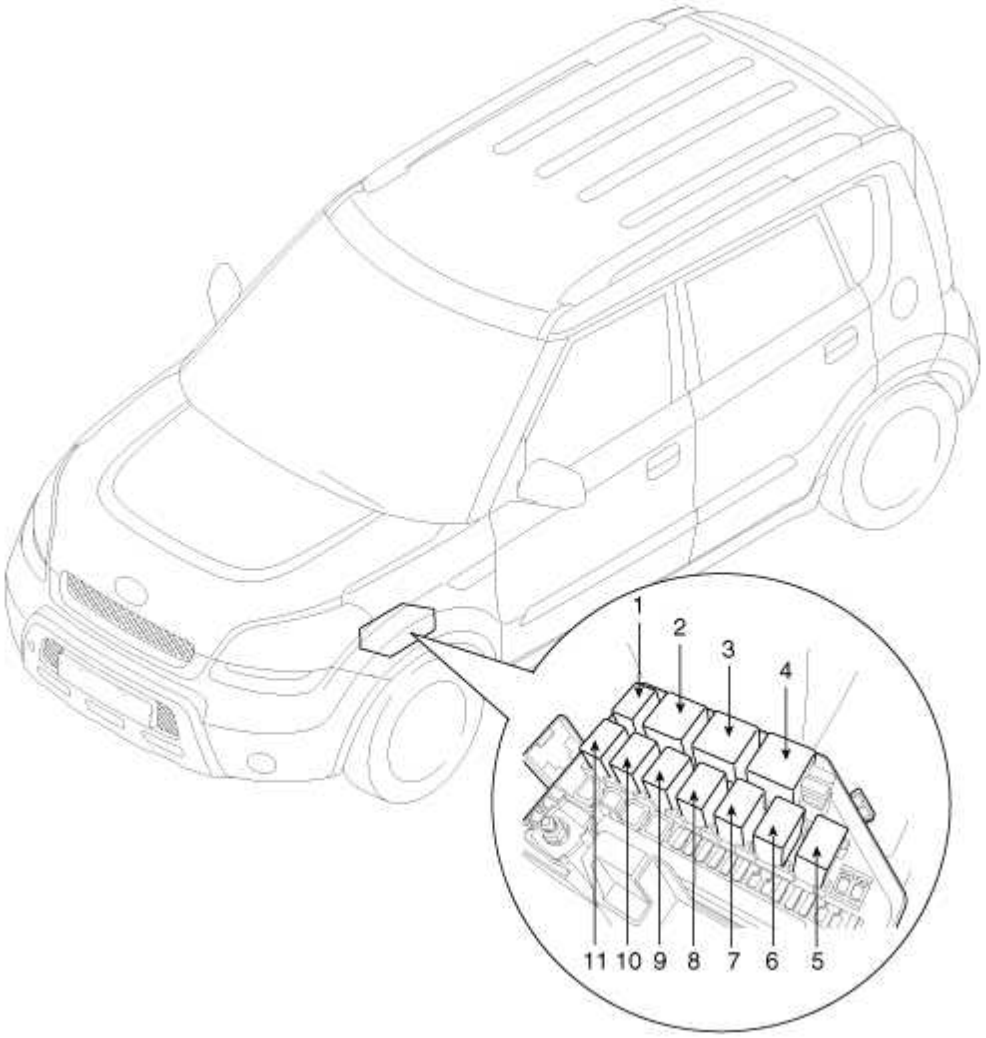
2. Operate the seat warmer after connecting the connectors, and then check the thermostat by measuring the temperature of seat surface.

Standard value
ON : 34 ± 5°C (93.2 ± 9°F)
OFF : 43 ± 4°C (109.4 ± 7°F)

Body Electrical System > Fuses And Relays > Components and Components Location

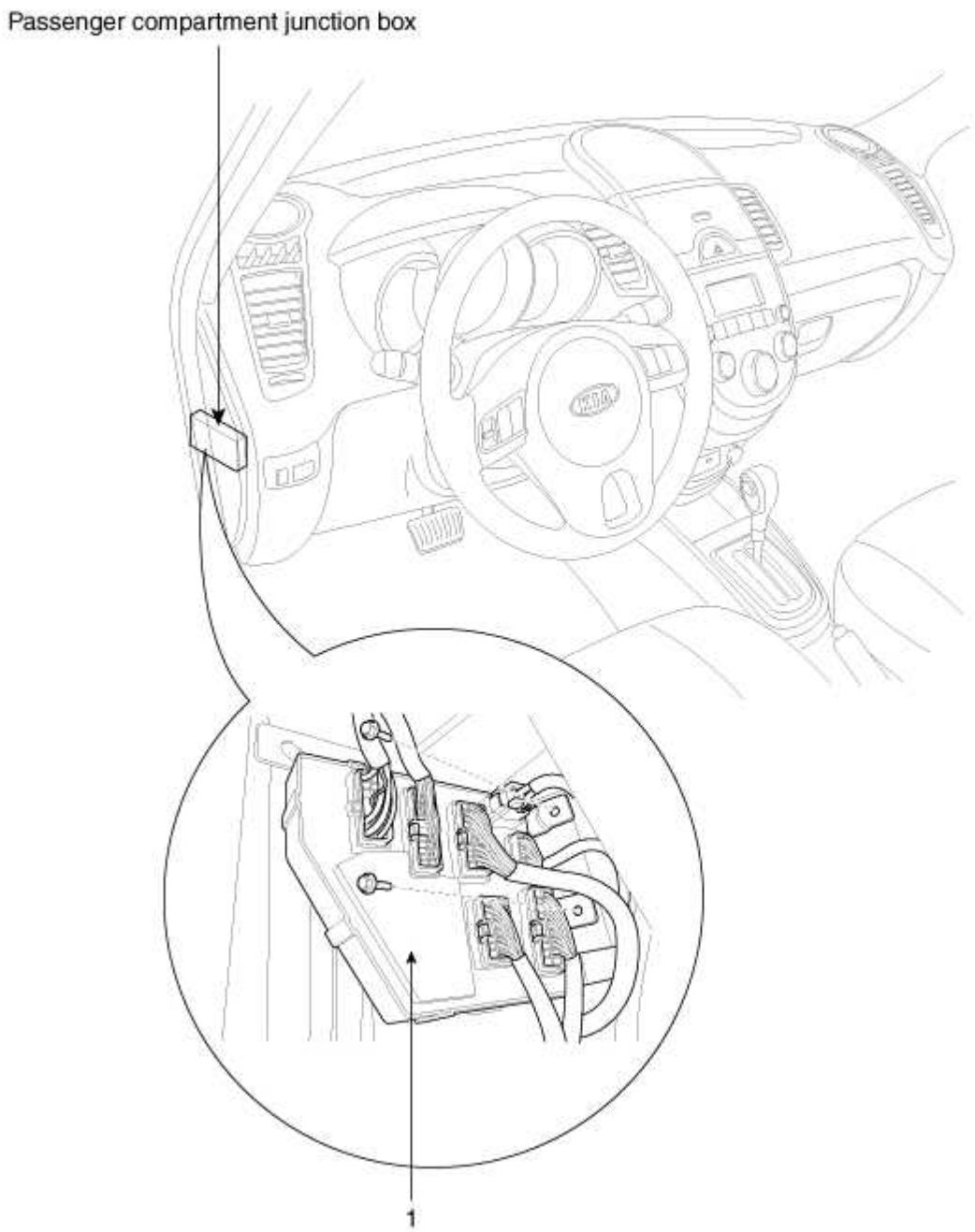
Component Location

[Engine room relay box]



1. Wiper relay (Front)	7. Head lamp relay (High)
2. Blower relay	8. Head lamp relay (Low)
3. Fuel pump relay	9. Start relay
4. Main relay	10. A/C relay
5. Condenser fan relay (High)	11. Horn relay
6. Condenser fan relay (Low)	

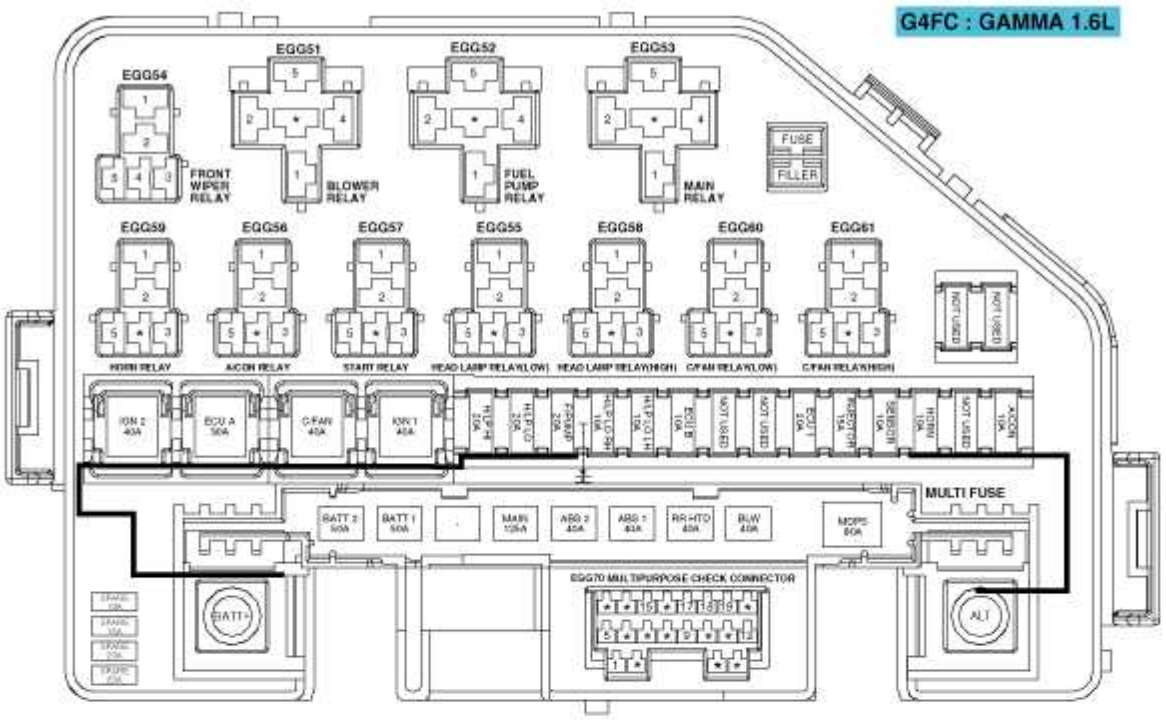
[Passenger compartment relay]



1. Tail lamp relay, Power window relay, Rear heater relay, Door unlock relay, Door lock relay, Hazard relay, Rear wiper relay, Front fog relay, Tailgate relay, DRL relay

Body Electrical System > Fuses And Relays > Relay Box (Engine Compartment) > Components and Components Location

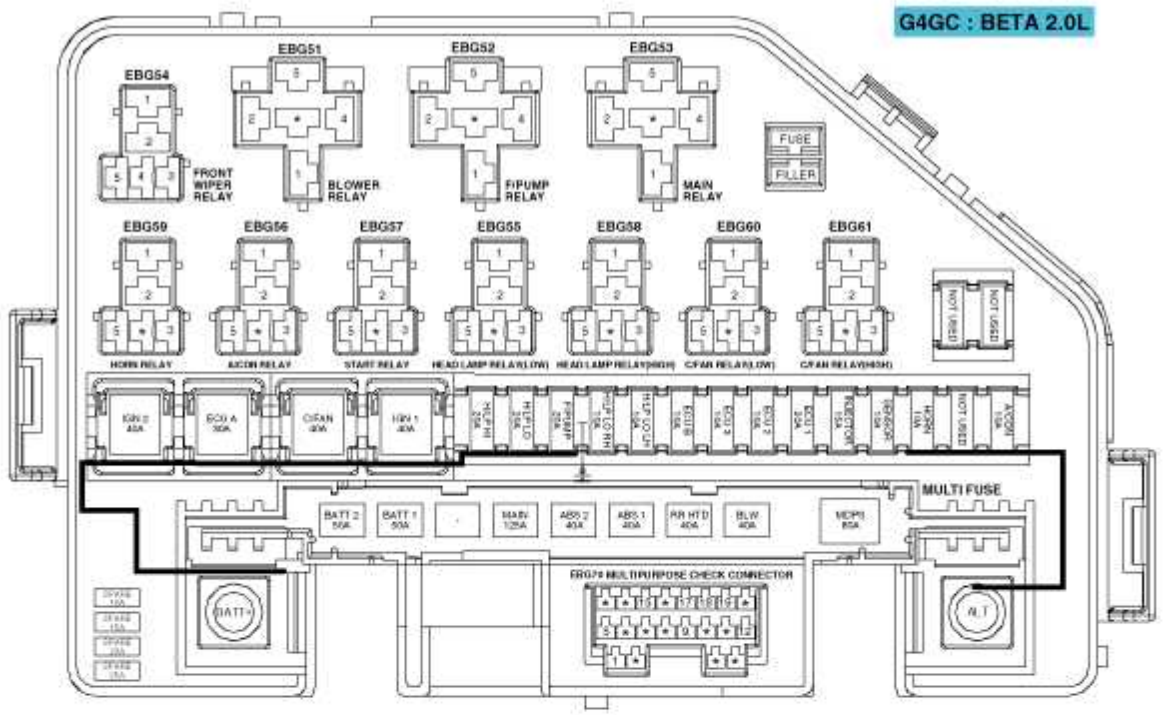
Component Location



E/R FUSE & RELAY BOX

Description		(A)	Circuit Protected
MULTI FUSE	BATT 2	50A	I/P Junction Box (Relay - Tail Lamp, Fuse - TAIL LH 10A, TAIL RH 10A, S/ROOF 20A, STOP LP 15A, DR LOCK 20A AMP 25A, T/GATE OPEN 15A, (FOG LP(FR)) 15A, (FOG LP(RR)) 10A, Power Connector - MEMORY 10A, AUDIO 15A)
	BATT 1	50A	I/P Junction Box (Relay - Power Window, Fuse - P/WDW LH 25A, P/WDW RH 25A, F/MIRROR 10A, HAZARD LP 15A)
	MAIN	125A	Generator, Fuse (ABS 2 40A, ABS 1 40A, RR HTD 40A, BLW 40A, MDPS 80A, A/CON 10A)
	ABS 2	40A	ABS Control Module, ESC Control Module
	ABS 1	40A	ABS Control Module, ESC Control Module
	RR HTD	40A	I/P Junction Box (Rear Defogger Relay)
	BLW	40A	Blower Relay
	MDPS	80A	-
FUSE	IGN 2	40A	Ignition Switch, Start Relay
	ECU A	30A	Main Relay, ECU B 10A
	C/FAN	40A	C/Fan Relay (High), C/Fan Relay (Low)
	IGN 1	40A	Ignition Switch
	H/LP HI	20A	Head Lamp Relay (High)
	H/LP LO	20A	Head Lamp Relay (Low)
	F/PUMP	20A	Fuel Pump Relay
	H/LP LO RH	10A	Head Lamp RH
	H/LP LO LH	10A	Head Lamp LH, Instrument Cluster (Low Beam IND.)
	ECU B	10A	ECM, PCM
	ECU 1	20A	ECM, PCM
	INJECTOR	15A	Injector #1 ~ #4, Idle Speed Control Actuator, Immobilizer Module, Canister Close Valve
	SENSOR	10A	A/Con Relay, C/Fan Relay (High/Low), Camshaft Position Sensor, Canister Purge Solenoid Valve, Oil Control Valve Oxygen Sensor Up/Down, Stop Lamp Switch
	HORN	10A	Horn Relay
	A/CON	10A	A/Con Relay

※USE THE DESIGNATED FUSE ONLY



E/R FUSE & RELAY BOX

Description		(A)	Circuit Protected
MULTI FUSE	BATT 2	50A	I/P Junction Box (Relay - Tail Lamp, Fuse - TAIL LH 10A, TAIL RH 10A, S/ROOF 20A, STOP LP 15A, DR LOCK 20A, AMP 25A, T/GATE OPEN 15A, (FOG LP(FR)) 15A, (FOG LP(RR)) 10A, Power Connector - MEMORY 10A, AUDIO 15A)
	BATT 1	50A	I/P Junction Box (Relay - Power Window, Fuse - P/WDW LH 25A, P/WDW RH 25A, F/MIRROR 10A, HAZARD LP 15A)
	MAIN	125A	Generator, Fuse (ABS 2 40A, ABS 1 40A, RR HTD 40A, BLW 40A, MDPS 80A, A/CON 10A)
	ABS 2	40A	ABS Control Module, ESC Control Module
	ABS 1	40A	ABS Control Module, ESC Control Module
	RR HTD	40A	I/P Junction Box (Rear Defogger Relay)
	BLW	40A	Blower Relay
	MDPS	80A	EPS Control Module
FUSE	IGN 2	40A	Ignition Switch, Start Relay
	ECU A	30A	Main Relay, ECU B 10A
	C/FAN	40A	C/Fan Relay (High), C/Fan Relay (Low)
	IGN 1	40A	Ignition Switch
	H/LP HI	20A	Head Lamp Relay (High)
	H/LP LO	20A	Head Lamp Relay (Low)
	F/PUMP	20A	F/Pump Relay
	H/LP LO RH	10A	Head Lamp RH
	H/LP LO LH	10A	Head Lamp LH, Instrument Cluster (Low Beam IND.)
	ECU B	10A	PCM
	ECU 3	10A	-
	ECU 2	10A	-
	ECU 1	20A	PCM, Ignition Coil
	INJECTOR	15A	Immobilizer Module, Idle Speed Control Actuator, Injector #1-4, Canister Close Valve
	SENSOR	10A	Camshaft Position Sensor, Oil Control Valve, Oxygen Sensor(Up/Down), Canister Purge Solenoid Valve, Stop Lamp Switch A/Con Relay, C/Fan Relay (High/Low), Crankshaft Position Sensor
	HORN	10A	Horn Relay
	A/CON	10A	A/Con Relay

※USE THE DESIGNATED FUSE ONLY

Body Electrical System > Fuses And Relays > Relay Box (Engine Compartment) > Repair procedures

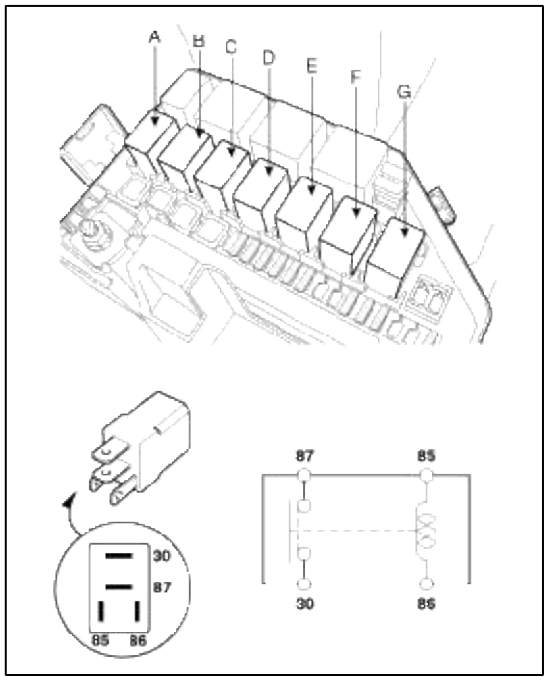
Inspection

1. Disconnect the negative (-) battery terminal.
2. Pull out the relay from the engine compartment relay box.

Power Relay (Type A)
Check for continuity between the terminals.
A : Horn relay

B : A/C relay
C : Start relay
D : Head lamp relay (Low)
E : Head lamp relay (High)
F : Condenser pan relay (Low)
G : Condenser pan relay (High)

1. There should be continuity between the No.30 and No.87 terminals when power and ground are connected to the No.85 and No.86 terminals.
2. There should be no continuity between the No.30 and No.87 terminals when power is disconnected.

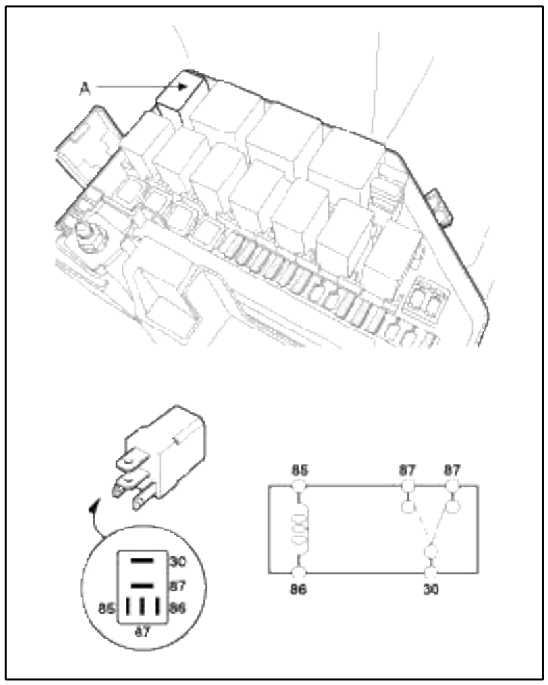


Terminal / Power	30	87	85	86
Disconnected			○ -	○
Connected	○—○		⊖—⊕	

Power Relay (Type B)
Check for continuity between the terminals.
A : Wiper relay

1. There should be continuity between the No.30 and No.87 terminals when power and ground are connected to the No.85 and No.86 terminals.

2. There should be continuity between the No.30 and No.87 terminals when power is disconnected.

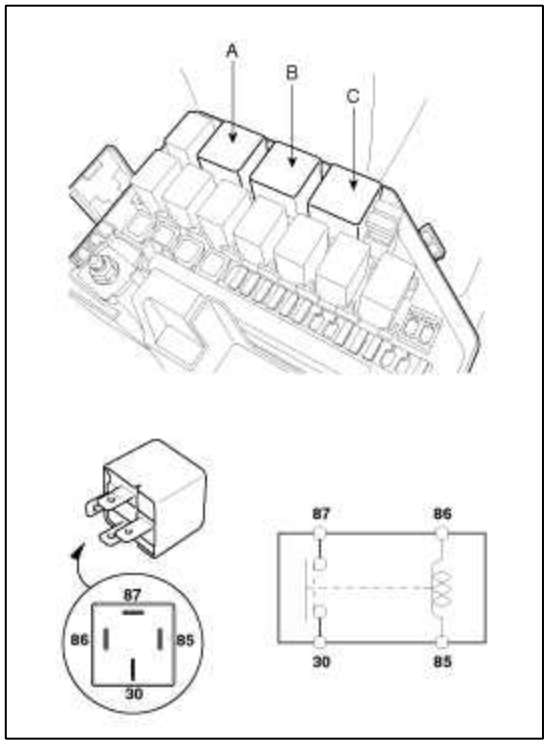


Terminal / Power	85	86	30	87	87
Disconnected			○	○	○
Connected	⊖	⊕	○	○	

Power Relay (Type C)
Check for continuity between the terminals.
A : Blower relay
B : Fuel pump realy
C : Main relay

1. There should be continuity between the No.30 and No.87 terminals when power and ground are connected to the No.85 and No.86 terminals.

2. There should be no continuity between the No.30 and No.87 terminals when power is disconnected.

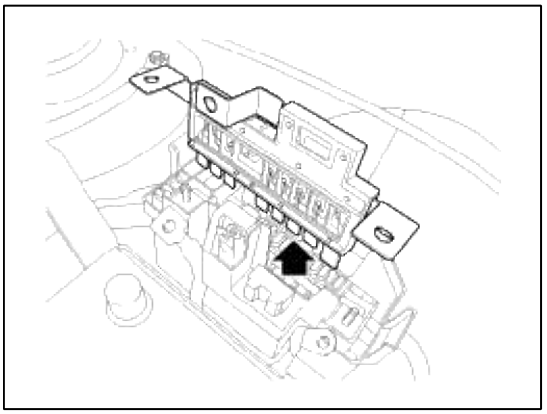


Terminal / Power	86	85	87	30
Disconnected	○	○		
Connected	⊖	⊕	○	○

Fuse

1. Be sure there is no play in the fuse holders, and that the fuses are held securely.
2. Are the fuse capacities for each circuit correct?
3. Are there any blown fuses?
   If a fuse is to be replaced, be sure to use a new fuse of the same capacity. Always determine why the fuse blew first and completely eliminate the problem before installing a new fuse.

Multi Fuse

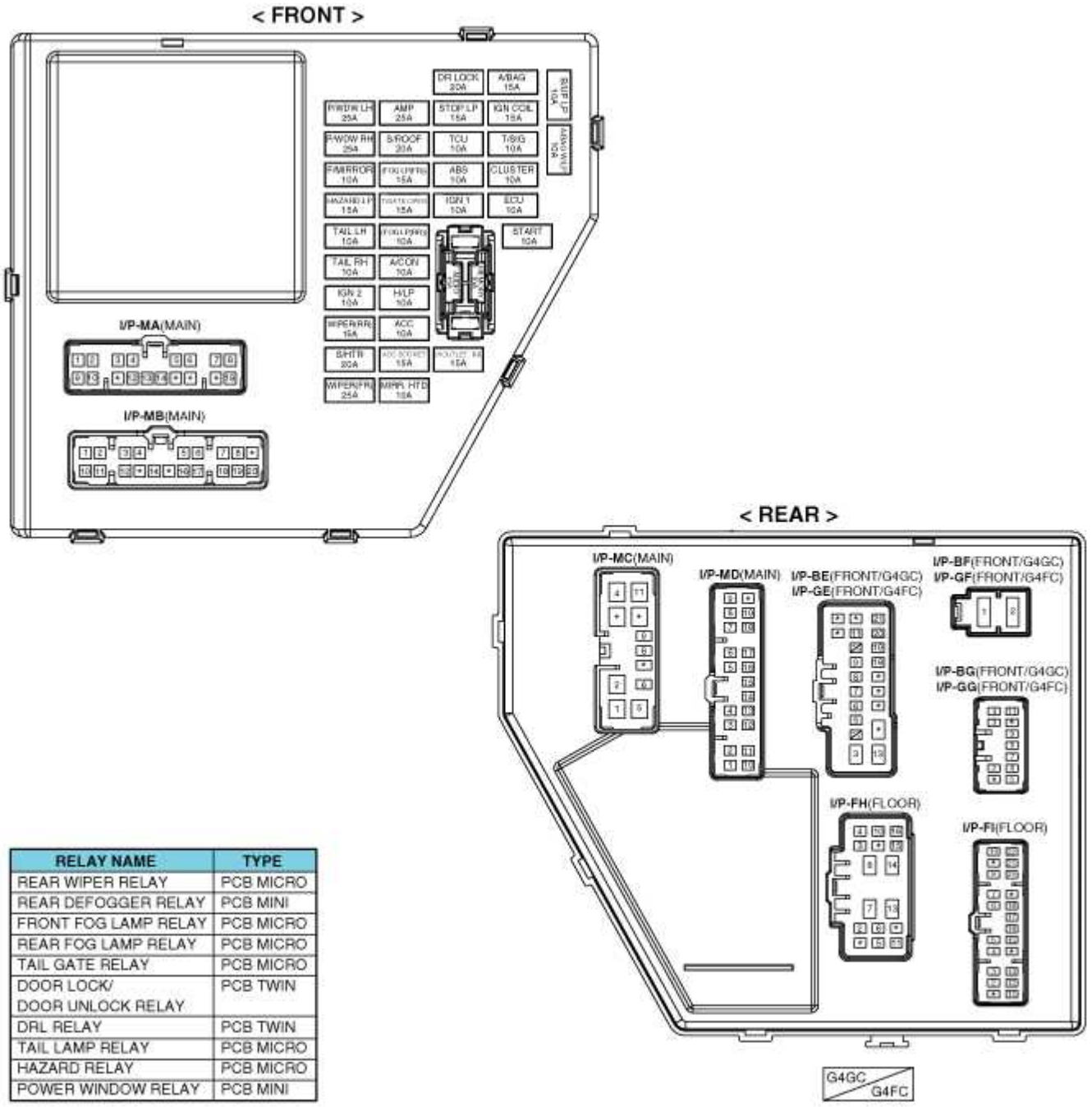


CAUTION

- Multi fuse is needed to replace in the mass when it damaged only one fuse.
- When replace the multi fuse, refer to the "Engine compartment - component location" diagram exactly.
- Use the multi fuse capacities for each circuit correctly.

Body Electrical System > Fuses And Relays > Relay Box (Passenger Compartment) > Components and Components Location

Component Location



RELAY NAME	TYPE
REAR WIPER RELAY	PCB MICRO
REAR DEFOGGER RELAY	PCB MINI
FRONT FOG LAMP RELAY	PCB MICRO
REAR FOG LAMP RELAY	PCB MICRO
TAIL GATE RELAY	PCB MICRO
DOOR LOCK/ DOOR UNLOCK RELAY	PCB TWIN
DRL RELAY	PCB TWIN
TAIL LAMP RELAY	PCB MICRO
HAZARD RELAY	PCB MICRO
POWER WINDOW RELAY	PCB MINI

※ USE THE DESIGNATED FUSE & RELAY ONLY

CIRCUIT

Description		(A)	Circuit Protected
P/WDW LH		25A	Power Window Main Switch, Rear Power Window Switch LH
P/WDW RH		25A	Power Window Main Switch, Passenger Power Window Switch, Rear Power Window Switch RH
F/MIRROR		10A	Data Link Connector
HAZARD LP		15A	Hazard Relay, Hazard Switch
TAIL LH		10A	Rear Combination Lamp LH, Head Lamp LH, License Lamp
TAIL RH		10A	Rear Combination Lamp RH, Head Lamp RH, Rheostat Detent, AUX & USB Jack, Hazard Switch, ESC Switch Instrument Cluster (ILL.), Instrument Cluster (IND.), Mood Lamp Switch, Power Window Main Switch, Audio Driver/Passenger Seat Warmer Switch, Shift Lever Switch, A/C Control Module, Multifunction Switch (Remocon)
IGN 2		10A	BCM, Electro Chromic Mirror, Sunroof Control Module
WIPER(RR)		15A	Rear Wiper Relay, Rear Wiper Motor, Multifunction Switch (Wiper)
S/HTR		20A	Driver/Passenger Seat Warmer Switch
WIPER(FR)		25A	E/R Fuse & Relay Box (Front Wiper Relay), Front Wiper Motor, Multifunction Switch (Wiper)
AMP		25A	AMP
S/ROOF		20A	Sunroof Control Module
(FOG LP(FR))		15A	Front Fog Lamp Relay
T/GATE OPEN		15A	Tail Gate Relay, DRL Relay
(FOG LP(RR))		10A	Rear Fog Lamp Relay
A/CON		10A	A/C Control Module, E/R Fuse & Relay Box (Head Lamp Relay (High), Blower Relay
H/LP		10A	E/R Fuse & Relay Box (Head Lamp Relay (Low))
ACC		10A	Audio, Mood Lamp Switch, Power Outside Mirror Switch
ACC SOCKET		15A	Cigarette Lighter, Front Power Outlet
MIRR. HTD		10A	ECM/PCM (G4FC), Driver/Passenger Power Outside Mirror Motor, A/C Control Module
DR LOCK		20A	Door Lock Relay, Door Unlock Relay, 2 Turn Unlock Relay
STOP LP		15A	Stop Lamp Switch, E/R Fuse & Relay Box (Multipurpose Check Connector)
TCU		10A	Vehicle Speed Sensor (M/T), Pulse Generator 'A', Pulse Generator 'B', PCM, Shift Lever Switch
ABS		10A	ABS Control Module, ESC Control Module, ESC Switch, Steering Angle Sensor E/R Fuse & Relay Box (Multipurpose Check Connector)
IGN 1		10A	Tire Pressure Monitoring Module, Multifunction Switch (Remocon), Audio
POWER CONNECTOR	AUDIO	15A	Audio
	MEMORY	10A	BCM, Instrument Cluster (IND.), A/C Control Module, Tire Pressure Monitoring Module, Door Warning Switch Overhead Console Assembly (Map Lamp), Center Room Lamp, Luggage Lamp

CIRCUIT

Description	(A)	Circuit Protected
P/OUTLET. RR	15A	Rear Power Outlet
A/BAG	15A	SRS Control Module, Weight Classification Module
IGN COIL	15A	Condenser, Ignition Coil #1 – #4
T/SIG	10A	Hazard Switch
CLUSTER	10A	BCM, Instrument Cluster (IND.), A/C Control Module
ECU	10A	ECM, PCM
START	10A	E/R Fuse & Relay Box (Start Relay)
B/UP LP	10A	Back-up Lamp Switch (M/T), Transaxle Range Switch (A/T), Cruise Control Module
A/BAG W/LP	10A	Instrument Cluster (Air Bag IND.)

※ USE THE DESIGNATED FUSE ONLY

Body Electrical System > Fuses And Relays > Relay Box (Passenger Compartment) > Repair procedures

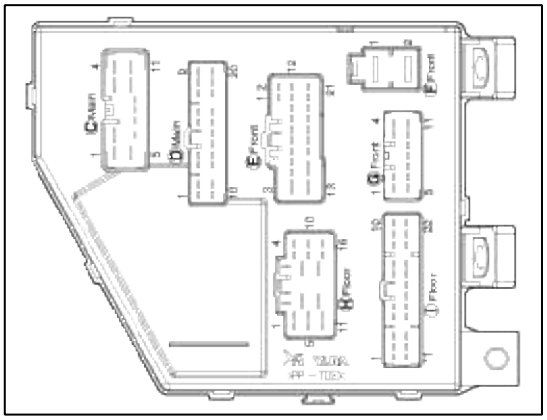
Inspection

Fuse

1. Be sure there is no play in the fuse holders, and that the fuses are held securely.
2. Are the fuse capacities for each circuit correct?
3. Are there any blown fuses?
   If a fuse is to be replaced, be sure to use a new fuse of the same capacity. Always determine why the fuse blew first and completely eliminate the problem before installing a new fuse.

Passenger Compartment Relay

1. Disconnect the negative(-) battery terminal.
2. Remove the crash pad lower panel.
   (Refer to the Body group - "Crash pad")
3. Remove the junction box.



Power Window
Check for continuity between the terminals.

1. There should be continuity between the No.2 terminal in the I/P-F and the No.8 or 14 terminal in the I/P-H when power and ground are connected to the No.2 terminal in the I/P-F and the No.9 terminal in the I/P-A.
2. There should be no continuity between the No.2 terminal in the I/P-F and the No.8 or 14 terminal in the I/P-H when power is disconnected.

Tail Lamp
Check for continuity between the terminals.

1. There should be continuity between the No.1 terminal in the I/P-F and the No.17(LH) or 16(RH) terminal in the I/P-I when power and ground are connected to the No.1 terminal in the I/P-F and the No.18 terminal in the I/P-A.
2. There should be no continuity between the No.1 terminal in the I/P-F and the No.17(LH) or 16(RH) terminal in the I/P-I when power is disconnected.

Tailgate Lid Open
Check for continuity between the terminals.

1. There should be continuity between the No.1 terminal in the I/P-F and the No.16 terminal in the I/P-I when power and ground are connected to the No.14 terminal in the I/P-A and the No.1 terminal in the I/P-F.
2. There should be no continuity between the No.1 terminal in the I/P-F and the No.16 terminal in the I/P-I when power is disconnected.

Rear Heater
Check for continuity between the terminals.

1. There should be continuity between the No.13 terminal in the I/P-E and the No.7 terminal in the I/P-H when power and ground are connected to the No.13 terminal in the I/P-E and the No.11 terminal in the I/P-D.
2. There should be no continuity between the No.13 terminal in the I/P-E and the No.7 terminal in the I/P-H when power is disconnected.

Rear Wiper
Check for continuity between the terminals.

1. There should be continuity between the No.1 terminals in the I/P-C and No.20 terminals in the I/P-I when power and ground are connected to the No.1 terminals in the I/P-A and No.2 terminals in the I/P-A.
2. There should be no continuity between the No.1 terminals in the I/P-C and No.20 terminals in the I/P-I when power is disconnected.

Hazard Lamp
Check for continuity between the terminals.

1. There should be continuity between the No.2 terminals in the I/P-F and No.5 or 6 terminals in the I/P-A when power and ground are connected to the No.2 terminals in the I/P-F and No.4 terminals in the I/P-A.
2. There should be no continuity between the No.2 terminals in the I/P-F and No.5 or 6 terminals in the I/P-A when power is disconnected.

Front Fog
Check for continuity between the terminals.

1. There should be continuity between the No.1 terminals in the I/P-F and No.11 terminals in the I/P-G when power and ground are connected to the No.1 terminals in the I/P-F and No.3 terminals in the I/P-A.
2. There should be no continuity between the No.1 terminals in the I/P-F and No.11 terminals in the I/P-G when power is disconnected.

Door Lock
Check for continuity between the terminals.

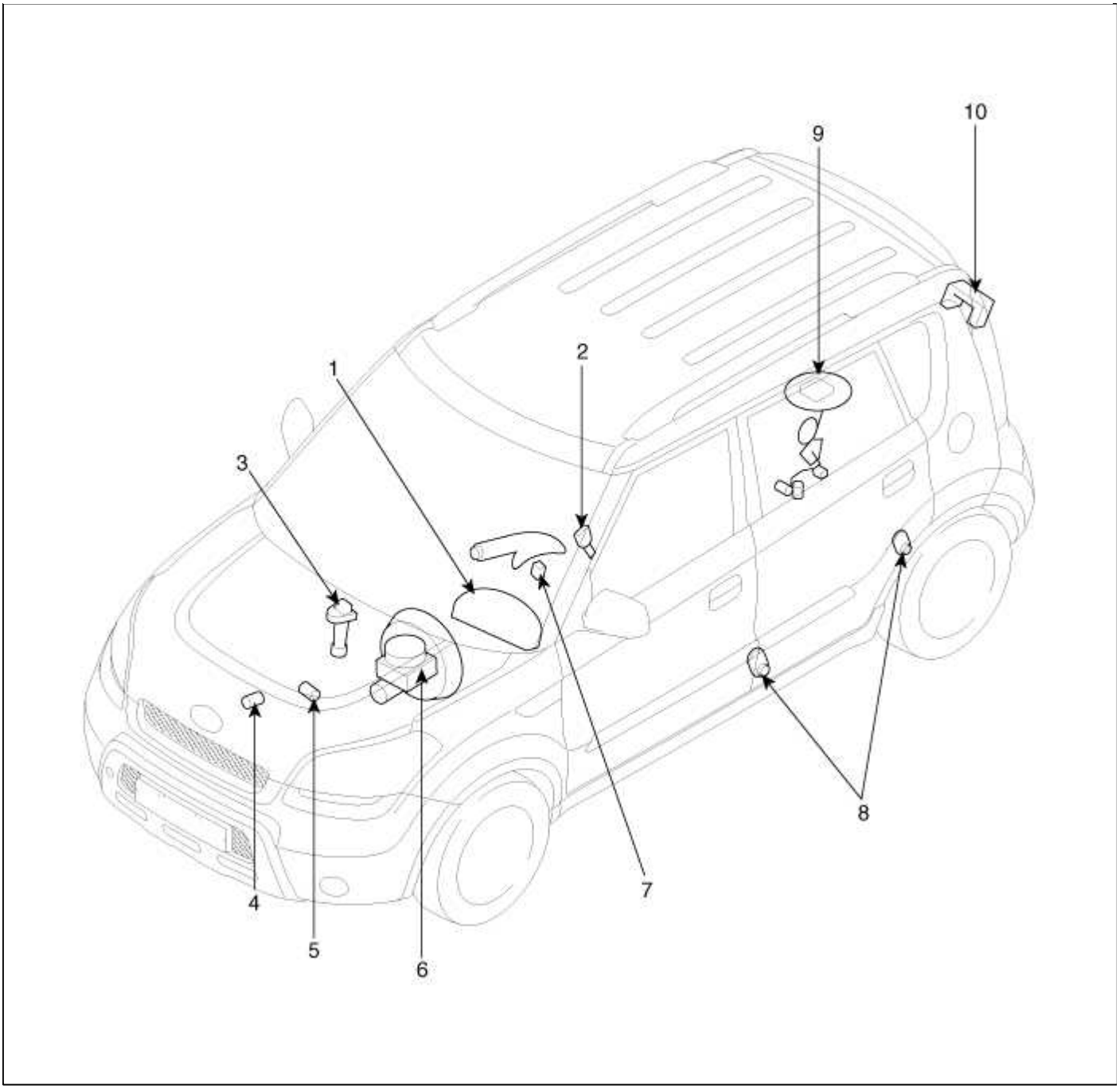
1. There should be continuity between the No.1 terminals in the I/P-F and No.6 terminals in the I/P-H when power and ground are connected to the No.1 terminals in the I/P-F and No.3 terminals in the I/P-H.
2. There should be no continuity between the No.1 terminals in the I/P-F and No.6 terminals in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

Door Unlock
Check for continuity between the terminals.

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

Body Electrical System > Indicators And Gauges > Components and Components Location

Component Location

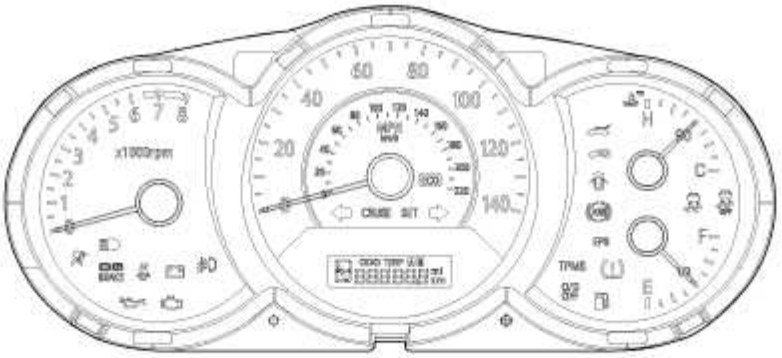


1. Cluster assembly	6. Brake fluid level warning switch
2. Seat belt switch	7. Parking brake switch
3. Vehicle speed sensor	8. Door switch
4. Engine coolant temperature sender	9. Fuel gauge sender
5. Oil pressure switch	10. Tailgate switch

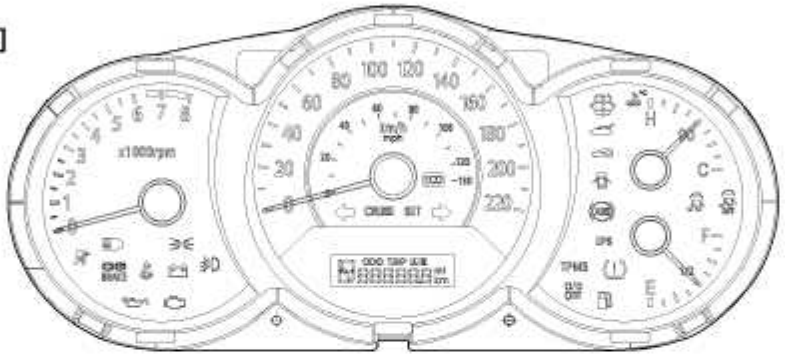
Body Electrical System > Indicators And Gauges > Instrument Cluster > Components and Components Location

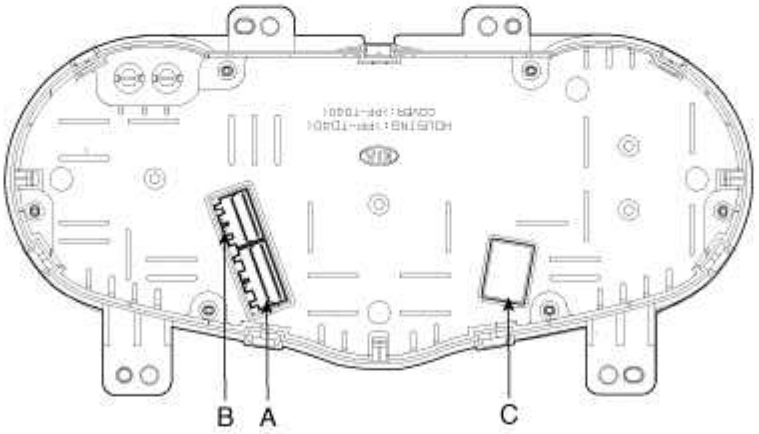
Components

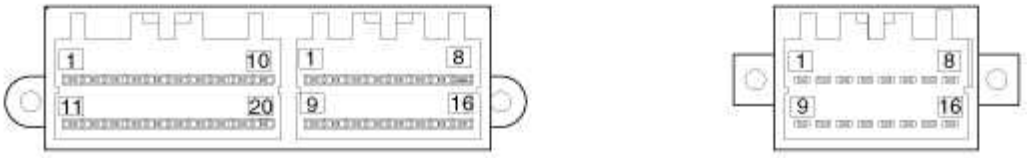
[USA]



[Canada]







Connector A Connector B Connector C

Instrument Cluster

Pin No	Connector A	Connector B	Connector C
1	Detent	Power GND	O/D OFF
2	ILL+	-	TPMS Diagnosis
3	Battery charge	-	TPMS TREAD
4	Oil pressure	Head lamp (Low)	EPS
5	Check engine	Tail lamp ON	Washer Low
6	P brake	Seat belt	Immobilizer
7	Airbag input -	Front fog	Trunk open
8	Airbag supply +	-	Door open
9	High beam input +	Cruise	P
10	High beam GND	Turn signal L	R
11	ILL-	Fuel -	PWM
12	Diagnosis	Signal GND	D
13	Tachometer	CAN high	N
14	Speed	CAN low	ABS/EBD
15	Reset/ mode	Battery	ESC OFF
16	Fuel gage	IGN 1	ESC
17	Temperature gage		
18	Over speed		
19	Turn signal R		
20	Set(Cruise)		

Body Electrical System > Indicators And Gauges > Instrument Cluster > Description and Operation - Revised

ECO driving system

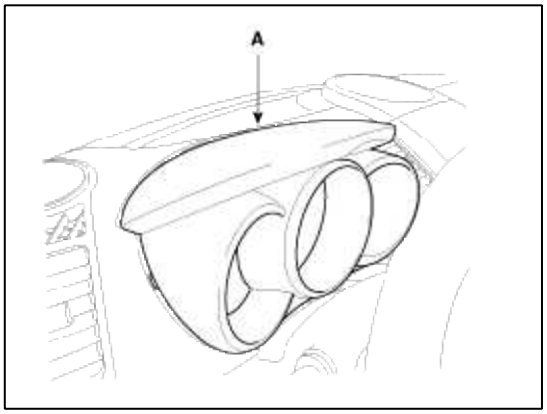
This system is designed to encourage eco-driving by providing real-time feedback to the driver.
The ECO indicator light assists you to drive in the most economical way.
The green indicator comes on when you drive with high fuel efficiency.
The fuel efficiency depends on driver's driving habit and road condition.
The system stops operation when the transaxle is in the P,R,N position or sports mode, or instantaneous fuel consumption mode is selected.

Body Electrical System > Indicators And Gauges > Instrument Cluster > Repair procedures

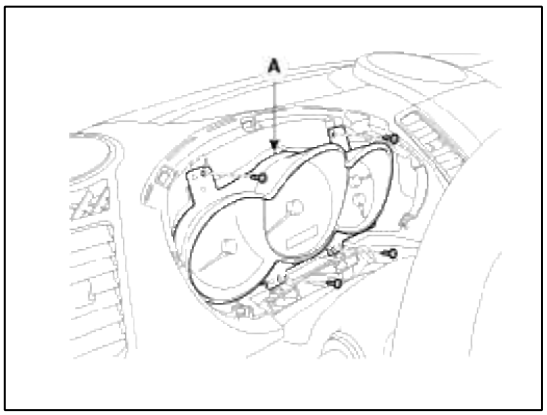
Removal

1. Disconnect the negative (-) battery terminal.

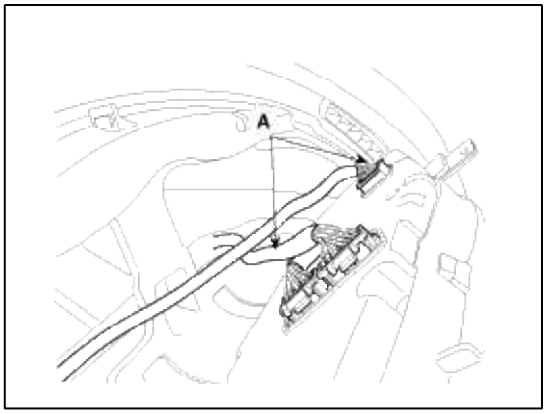
2. Remove the cluster fascia panel (A).
   (Refer to the Body group - "Crash pad")



3. Remove the cluster fascia (A) from the housing after removing 4 screws.



4. Disconnect the cluster fascia connecters(A) and then remove the cluster.



Installation

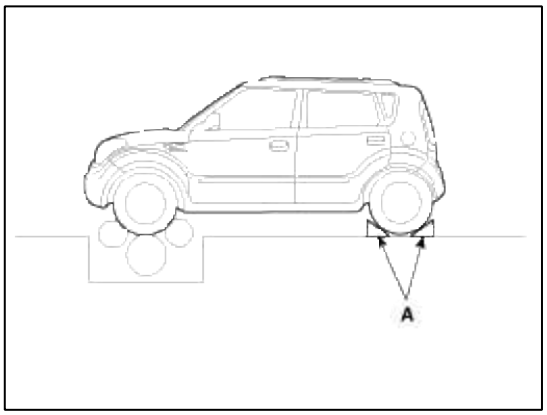
1. Connect the cluster connector.
2. Install the cluster assembly.
3. Install the center facia panel.

Inspection

Speedometer

1. Adjust the pressure of the tires to the specified level.

2. Drive the vehicle onto a speedometer tester. Use wheel chocks(A) as appropriate.



3. Check if the speedometer indicator range is within the standard values.

CAUTION

Do not operate the clutch suddenly or increase/ decrease speed rapidly while testing.

NOTE

Tire wear and tire over or under inflation will increase the indication error.

[km/h - Canada]

Velocity (km/h)	20	40	60	80	100
Tolerance (km/h)	+1.8 +0.5	+2.5 +1.0	+3.1 +1.5	+4.2 +2.0	+5.3 +2.5
Velocity (km/h)	120	140	160	180	200
Tolerance (km/h)	+6.3 +3.0	+7.4 +3.5	+8.5 +4.0	+9.5 +4.5	+10.5 +5.0

[MPH - USA]

Velocity (MPH)	10	20	40	60
Tolerance (MPH)	+1.0 +0.3	+1.5 +0.5	+2.1 +1.0	+3.2 +1.5
Velocity (MPH)	80	100	120	-
Tolerance (MPH)	+4.3 +2.0	+5.4 +2.5	+6.4 +3.0	-

Tachometer

1. Connect the scan tool to the diagnostic link connector or install a tachometer.

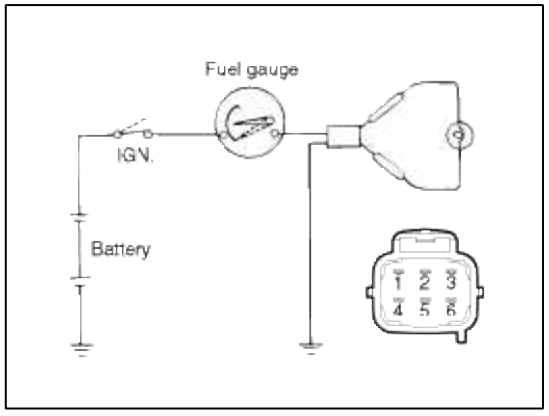
2. With the engine started, compare the readings of the tester with that of the tachometer. Replace the tachometer if the tolerance is exceeded.

> CAUTION
>
> 1) Reversing the connections of the tachometer will damage the transistor and diodes inside.
> 2) When removing or installing the tachometer, be careful not to drop it or subject it to severe shock.

Revolution (rpm)	1,000	2,000	3,000	4,000
Tolerance (rpm)	±100	±125	±150	±150
Revolution (rpm)	5,000	6,000	7,000	8,000
Tolerance (rpm)	±150	±180	±210	±230

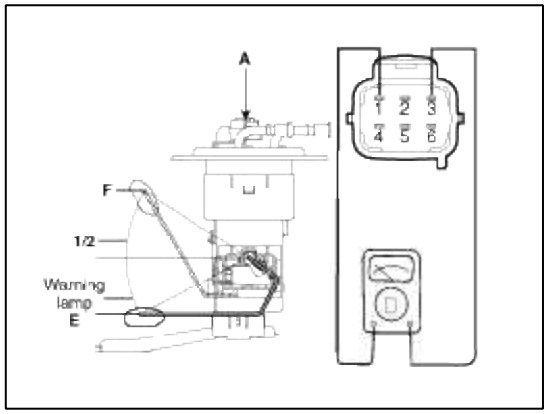
Fuel Gauge

1. Disconnect the fuel sender connector from the fuel sender.
2. Connect a 3.4 watt, 12V test bulb to terminals 1 and 3 on the wire harness side connector.
3. Turn the ignition switch to the ON, and then check that the bulb lights up and the fuel gauge needle moves to full.



Fuel Gauge Sender

1. Using an ohmmeter, measure the resistance between terminals 1 and 3 of sender connector (A) at each float level.



2. Also check that the resistance changes smoothly when the float is moved from "E" to "F".

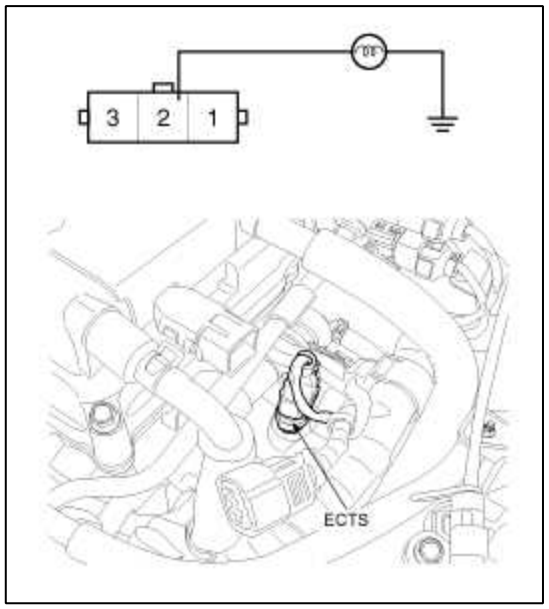
Position	Resistance(Ω)
E	184 ± 1Ω
Warning lamp	170 ± 1Ω
1/2	66.2 ± 1Ω
Sender (F)	15 ± 1Ω

3. If the height resistance is unsatisfied, replace the fuel sender as an assembly.

> CAUTION
>
> After completing this test, wipe the sender dry and reinstall it in the fuel tank.

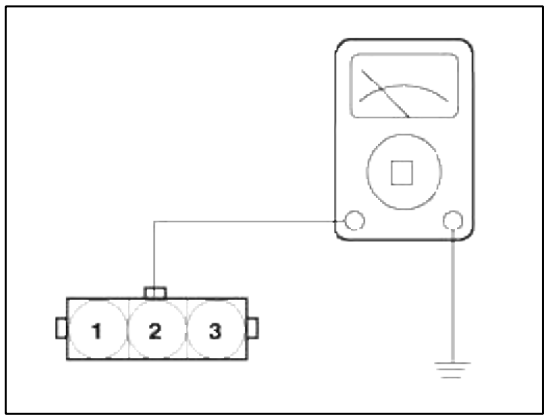
Engine Coolant Temperature Gauge

1. Disconnect the wiring connector (A) from the engine coolant temperature sender in the engine compartment.
2. Connect a 12V, 3.4 wattages test bulb between the harness side connector 2 terminal and ground.
3. Turn the ignition switch ON.
4. Verify that the test bulb flashes and that the indicator moves to HOT position.
   If operation is not as specified, replace the cluster (Engine coolant temperature gauge). Then recheck the system.



Engine Coolant Temperature Sender

1. Using an ohmmeter, measure the resistance between the terminal 2 and ground.

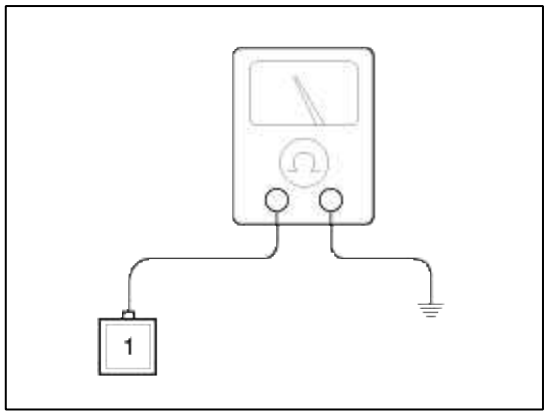


2. If the resistance value is not as shown in the table, replace the temperature sender.

Temp °F(°C)	140 (60)	185 (85)	230 (110)	257 (125)
Resistance (Ω)	161	58	26	17

Oil Pressure Switch

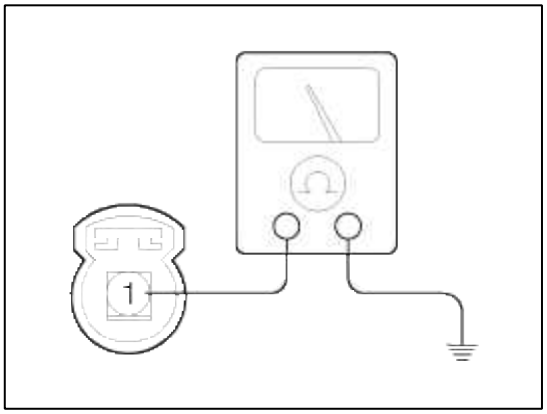
1. Check that there is continuity between the oil pressure switch terminal and ground with the engine off.
2. Check that there is no continuity between the terminal and ground with the engine running.
3. If operation is not as specified, replace the switch.



Oil Pressure Warning Lamp

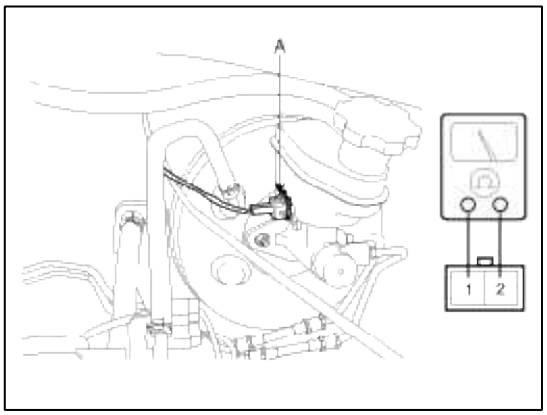
1. Disconnect the connector from the warning switch and ground the terminal on the wire harness side connector.

2. Turn the ignition switch ON. Check that the warning lamp lights up. If the warning lamp doesn't light, test the bulb or inspect the wire harness.



Brake Fluid Level Warning Switch

1. Remove the connector (A) from the switch located at the brake fluid reservoir.
2. Verify that continuity exists between switch terminals 1 and 2 while pressing the switch (float) down with a rod.



Brake Fluid Level Warning Lamp

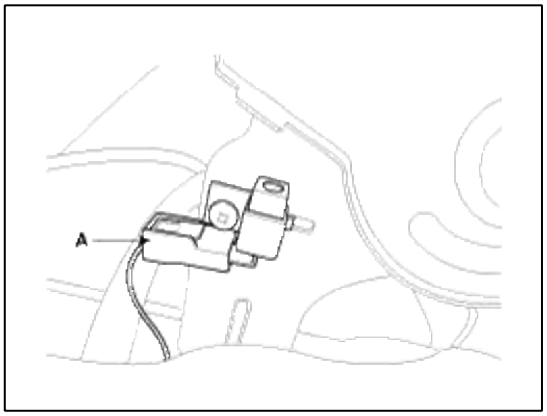
1. Ignition "ON".
2. Release the parking brake.
3. Remove the connector from the brake fluid level warning switch.
4. Ground the connector at the harness side.
5. Verify that the warning lamp lights.

Parking Brake Switch

The parking brake switch is a pull type. It is located at the side of the parking brake lever.

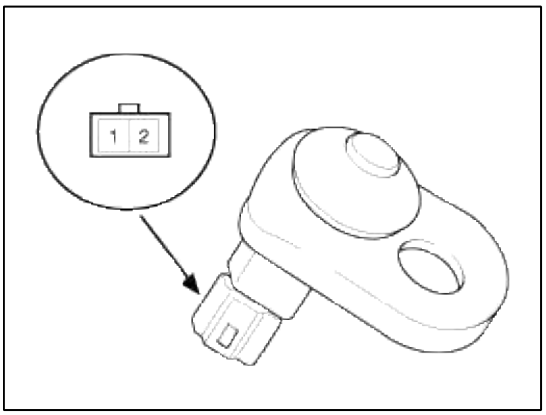
1. Check that there is continuity between the terminal and switch body with the switch (A) ON.

2. Check that there is no continuity between the terminal and switch body with the switch OFF.
   If continuity is not as specified, replace the switch or inspect its ground connection.



Door Switch

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

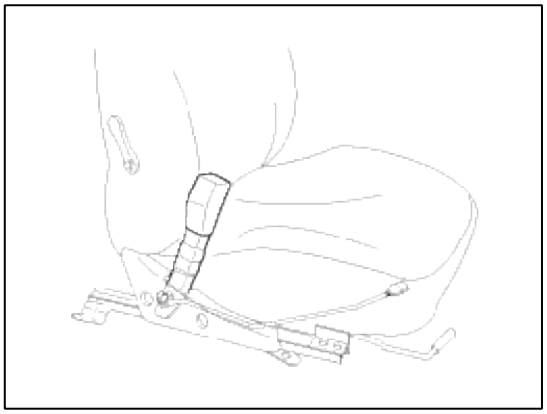


Position \ Terminal	1	2	Body (Ground)
Free(Door open)	○	○	○
Push(Door close)			

Seat Belt Switch

1. Remove the connector from the switch.
2. Check for continuity between terminals.

Seat belt condition	Continuity
Fastened	Non-conductive (∞Ω)
Not fastened	Conductive (Ω)



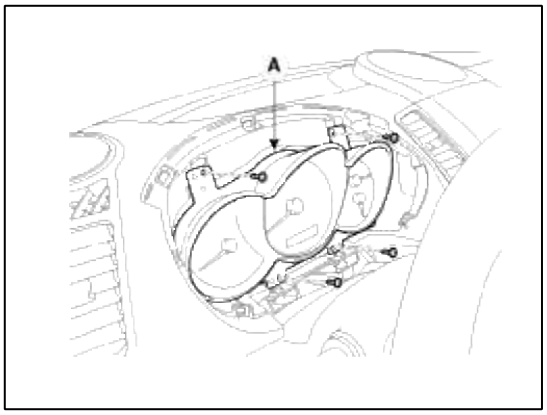
Seat Belt Warning Lamp

With the ignition switch turned ON, verify that the lamp glows.

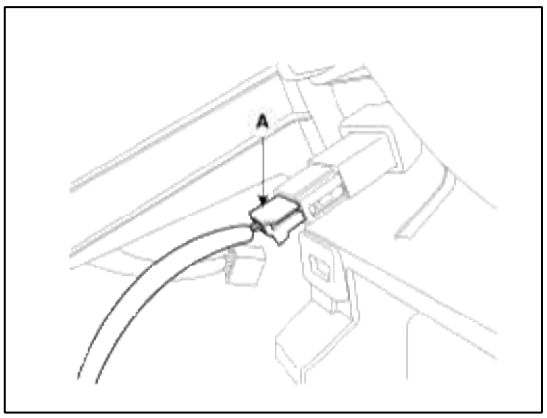
Seat belt condition	Warning lamp
Fastened	OFF
Not fastened	ON

Trip Switch

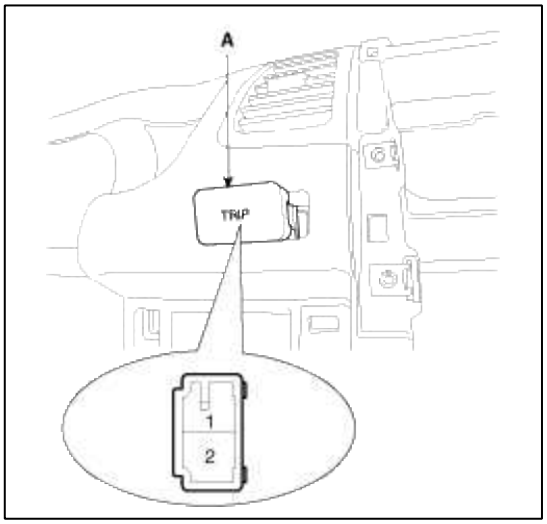
1. Disconnect the negative (-) battery terminal.
2. Remove the cluster (A).
   (Refer to the Body group - " Crash pad")



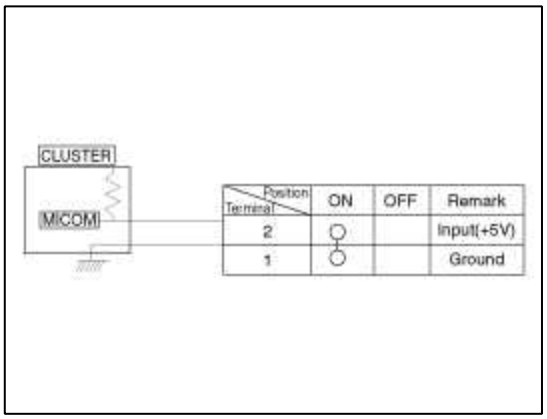
3. Remove the trip switch connector (A) from the main crash pad.



4. Remove the trip switch (A).



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



Body Electrical System > Indicators And Gauges > Troubleshooting

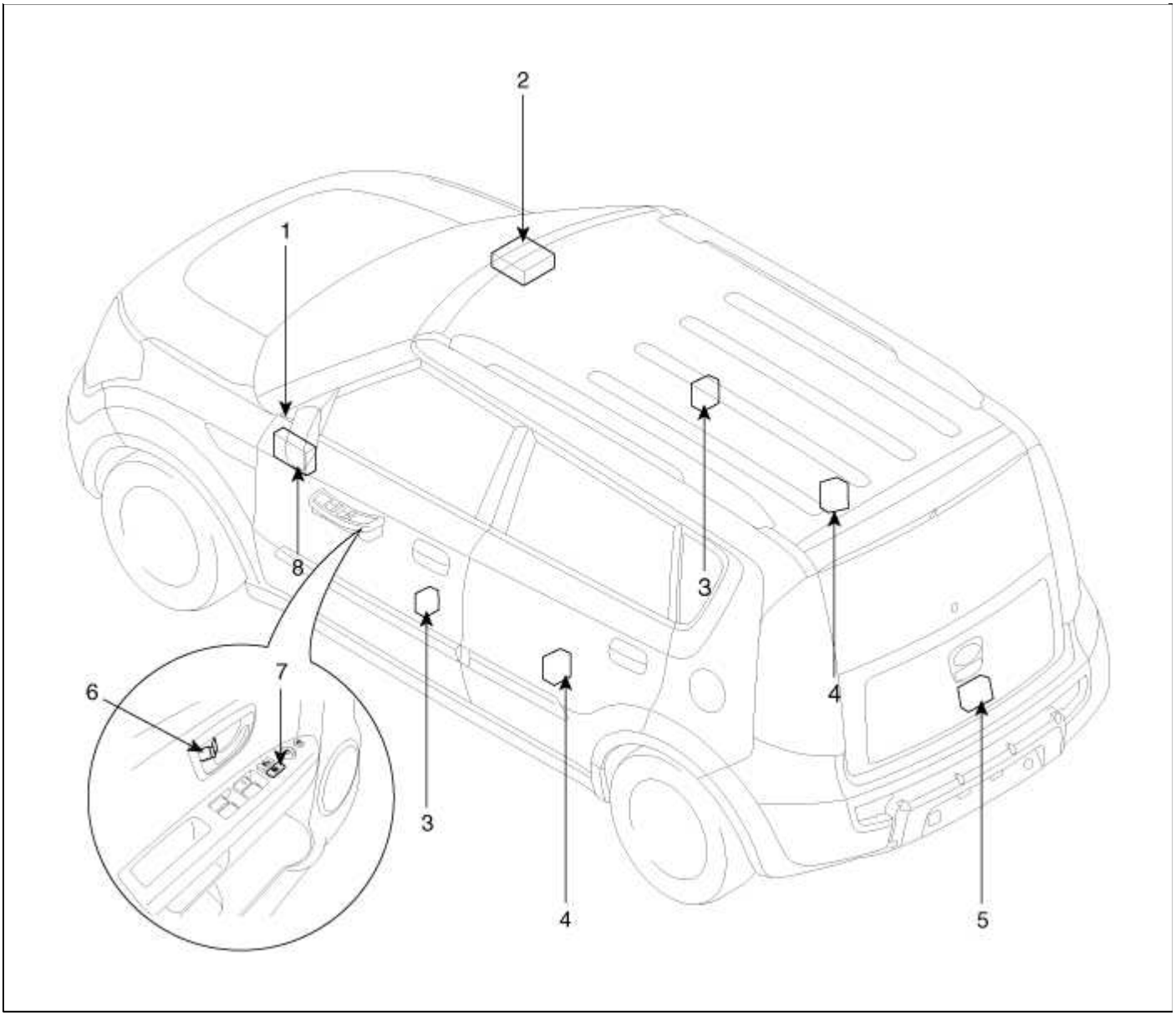
Troubleshooting

Symptom	Possible cause	Remedy
Speedometer does not operate	Cluster fuse (10A) blown	Check for short and replace fuse
	Speedometer faulty	Check speedometer
	Vehicle speed sensor faulty	Check vehicle speed sensor
	Wiring or ground faulty	Repair if necessary
Tachometer does not operate	Cluster fuse (10A) blown	Check for short and replace fuse
	Tachometer faulty	Check tachometer
	Wiring or ground faulty	Repair if necessary
Fuel gauge does not operate	Cluster fuse (10A) blown	Check for short and replace fuse
	Fuel gauge faulty	Check gauge
	Fuel sender faulty	Check fuel sender
	Wiring or ground faulty	Repair if necessary
Low fuel warning lamp does not light up	Cluster fuse (10A) blown	Check for short and replace fuse
	Bulb burned out	Replace bulb
	Fuel sender faulty	Check fuel sender
	Wiring or ground faulty	Repair if necessary
Water temperature gauge does not operate	Cluster fuse (10A) blown	Check for short and replace fuse
	Water temperature gauge faulty	Check gauge
	Water temperature sender faulty	Check sender
	Wiring or ground faulty	Repair if necessary
Oil pressure warning lamp does not light up	Cluster fuse (10A) blown	Check for short and replace fuse
	Bulb burned out	Replace bulb
	Oil pressure switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary

Parking brake warning lamp does not light up	Cluster fuse (10A) blown	Check for short and replace fuse
	Bulb burned out	Replace bulb
	Brake fluid level warning switch faulty	Check switch
	Parking brake switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Open door warning lamp and tailgate warning lamp do not light up	Memory fuse (15A) blown	Check for short and replace fuse
	Bulb burned out	Replace bulb
	Door switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Seat belt warning lamp does not light up	Cluster fuse (10A) blown	Check for short and replace fuse
	Bulb burned out	Replace bulb
	Seat belt switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary

Body Electrical System > Power Door Locks > Components and Components Location

Component Location



1. Passenger compartment junction box (Door lock/unlock relay)	5. Tailgate actuator & switch
2. Body control module (BCM)	6. Door lock knob
3. Front door lock actuator & switch	7. Door lock switch
4. Rear door lock actuator & switch	8. Passenger compartment junction box (Tailgate relay)

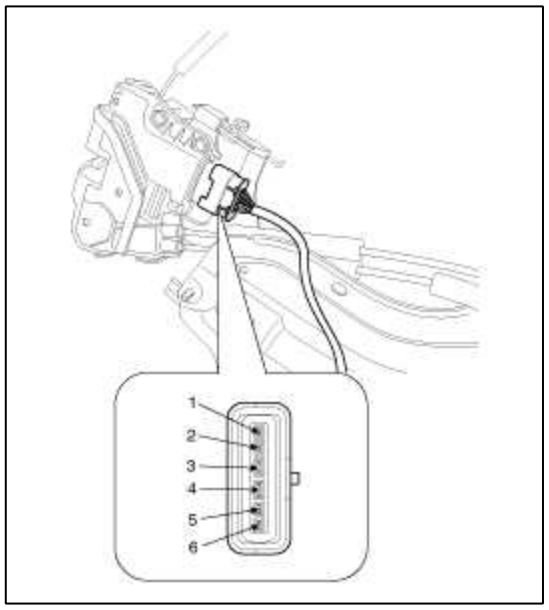
Body Electrical System > Power Door Locks > Power Door Lock Actuators > Repair procedures

Inspection

Front Door Lock Actuator

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

3. Disconnect the connectors from the actuator.

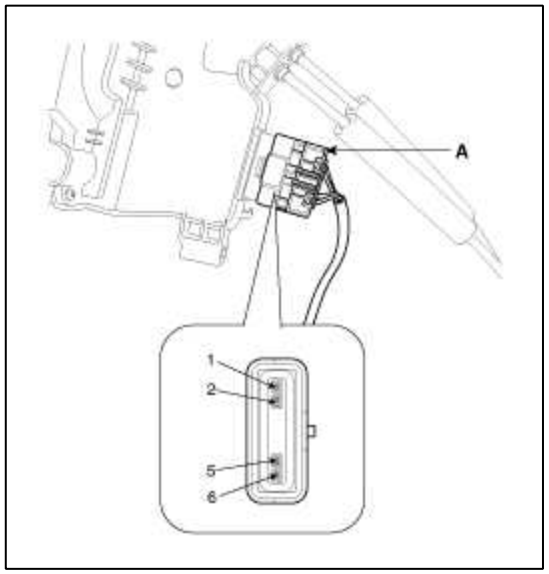


4. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

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

Rear Door Lock Actuator

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



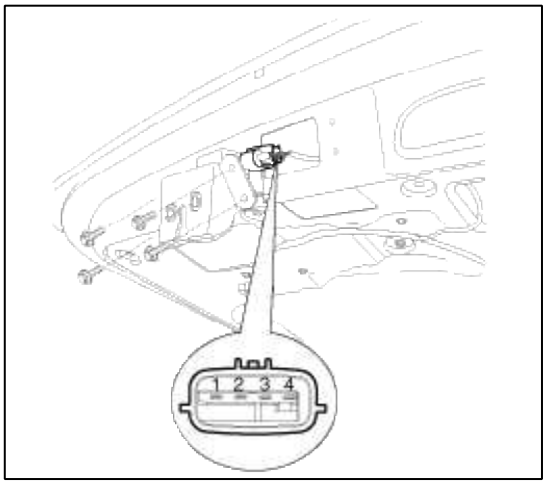
4. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

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

Tailgate Lock Actuator Inspection

1. Remove the tailgate trim.
   (Refer to the Body group - "Tail gate")

2. Disconnect the 4P connector from the actuator.



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

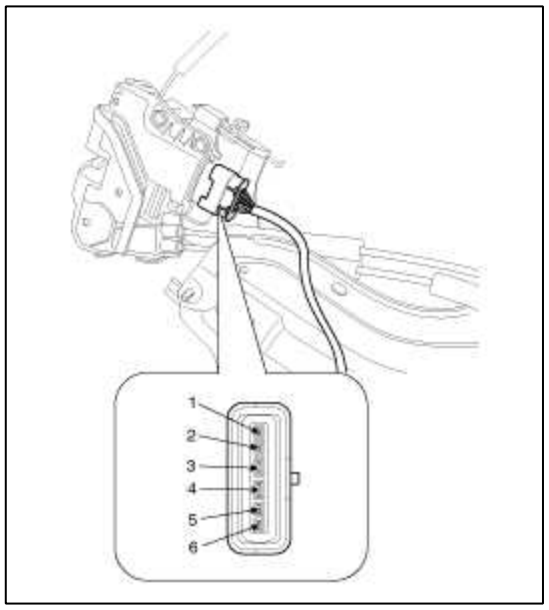
Position \ Terminal	3	4
Unlock	⊕	⊖

Front Door Lock Switch

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

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

3. Disconnect the connectors from the actuator.



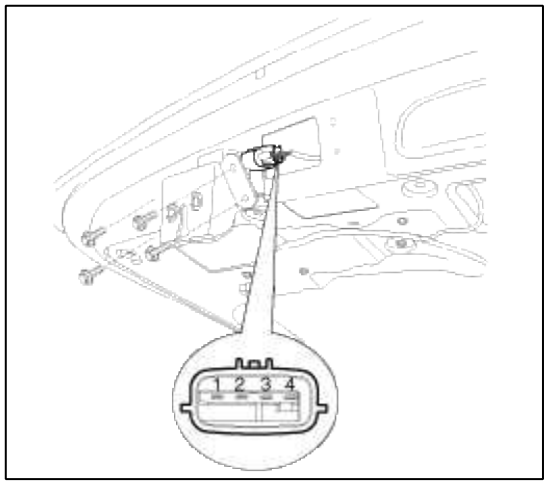
4. Check for continuity between the terminals in each switch position when inserting the key into the door according to the table.

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

Tailgate Switch

1. Remove the tailgate trim.
   (Refer to the Body group - "Tail gate")

2. Disconnect the 4P connector from the actuator.



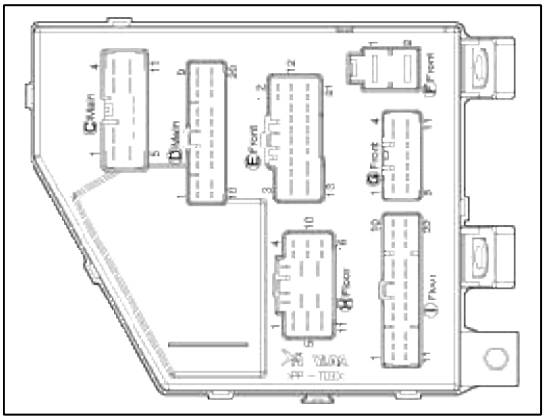
3. Check for continuity between the terminals in each switch position according to the table.

Position \ Terminal	1	2
Lock		
Unlock	○	○

Body Electrical System > Power Door Locks > Power Door Lock Relay > Repair procedures

Inspection

Door Lock Relay



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

Check for continuity between the terminals.

1. Disconnect the negative (-) battery terminal.
2. Remove the passenger compartment junction box.
3. Check for continuity between the terminals.
4. There should be continuity between the No.1 terminals in the I/P-F and No.6 terminals in the I/P-H when power and ground are connected to the No.1 terminals in the I/P-F and No.3 terminals in the I/P-H.
5. There should be no continuity between the No.1 terminals in the I/P-F and No.6 terminals in the I/P-H when power is disconnected.

Door Unlock Relay

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

Check for continuity between the terminals.

1. Disconnect the negative (-) battery terminal.
2. Remove the passenger compartment junction box.
3. Check for continuity between the terminals.
4. There should be continuity between the No.1 terminals in the I/P-F and No.5 terminals in the I/P-H when power and ground are connected to the No.1 terminals in the I/P-F and No.9 terminals in the I/P-H.
5. There should be no continuity between the No.1 terminals in the I/P-F and No.5 terminals in the I/P-H when power is disconnected.

Tailgate Open

1. Disconnect the negative (-) battery terminal.

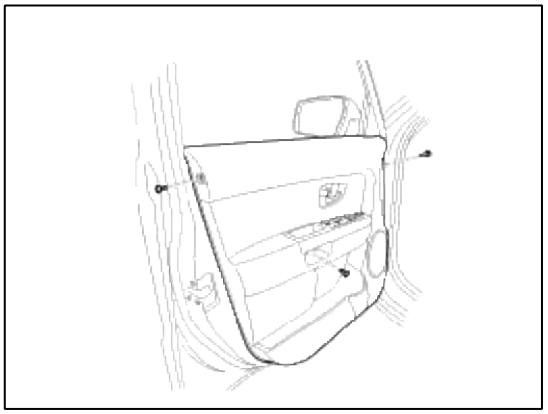
2. Remove the passenger compartment junction box.
3. Check for continuity between the terminals.
4. There should be continuity between the No.1 terminal in the I/P-F and the No.16 terminal in the I/P-I when power and ground are connected to the No.14 terminal in the I/P-A and the No.1 terminal in the I/P-F.
5. There should be no continuity between the No.1 terminal in the I/P-F and the No.16 terminal in the I/P-I when power is disconnected.

Body Electrical System > Power Door Locks > Power Door Lock Switch > Repair procedures

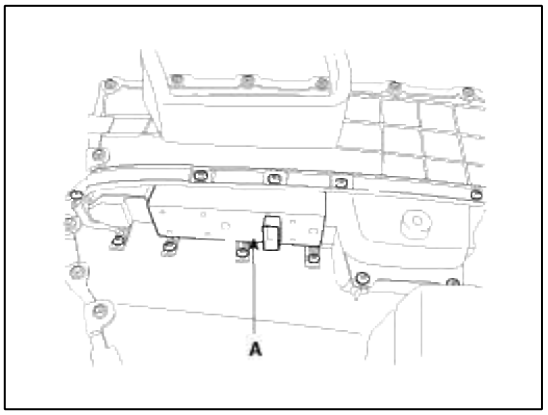
Inspection

Driver Door Lock Switch

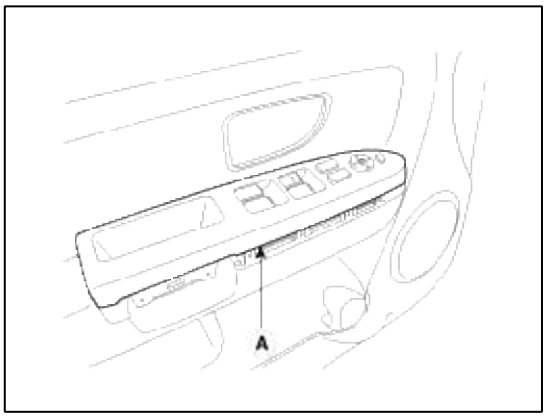
1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim and power window switch.
   (Refer to the Body group - "Front door")



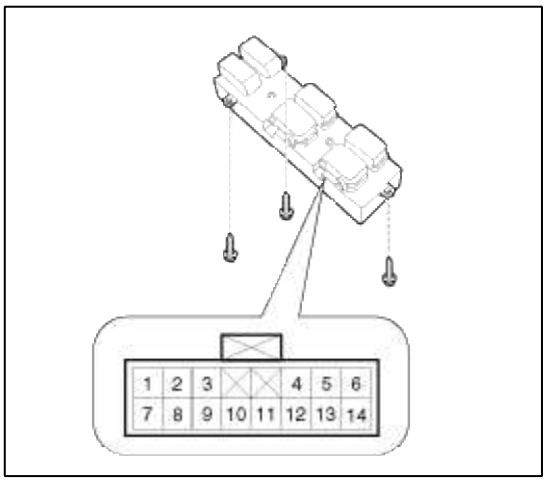
3. Remove the screws from the switch module (A).



4. Remove the power door switch module (A).



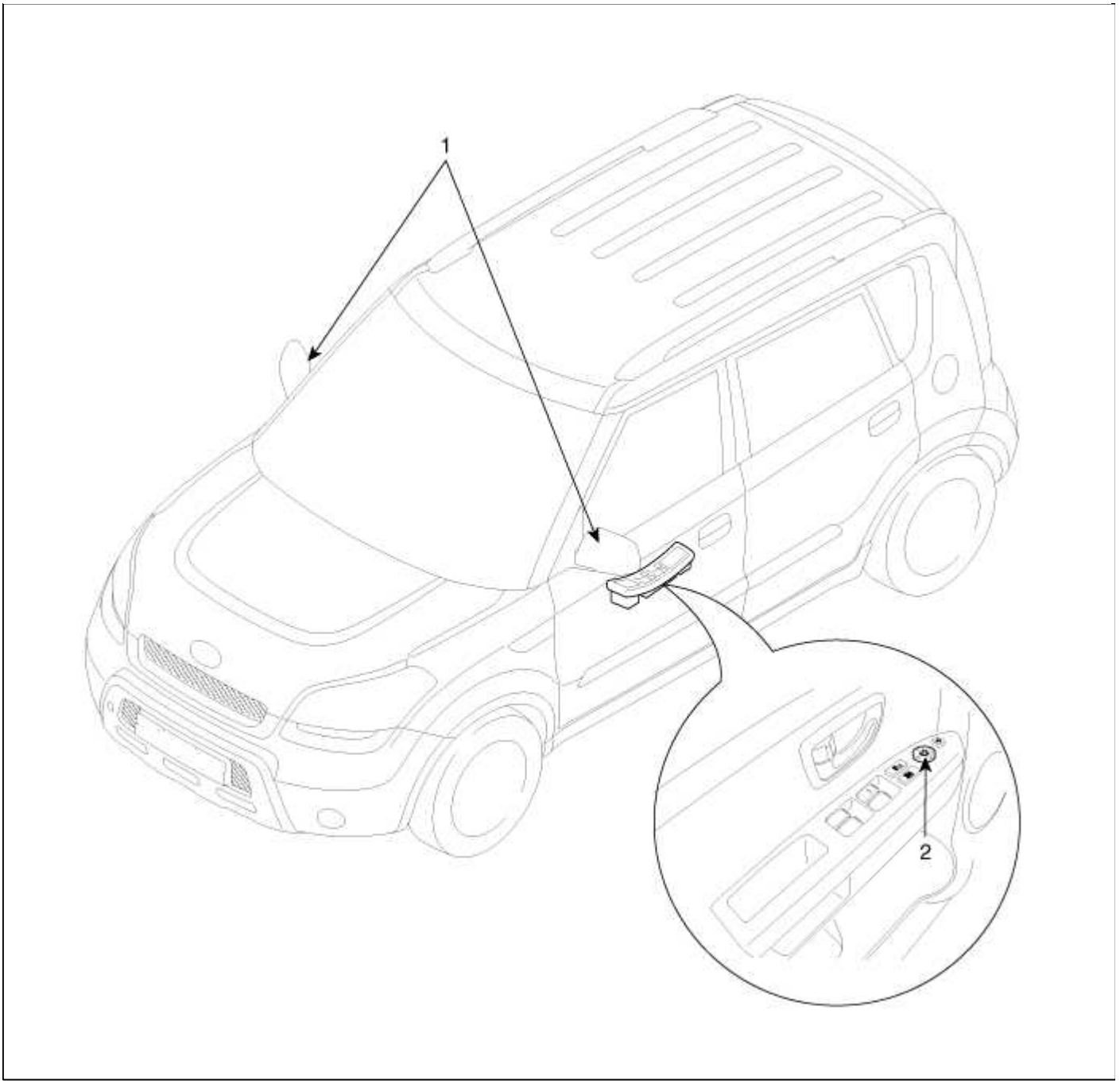
5. Check for continuity between the terminals in each switch position according to the table.



Terminal / Position	4	10	11
LOCK		○—○	
UNLOCK	○—○		

Body Electrical System > Power Door Mirrors > Components and Components Location

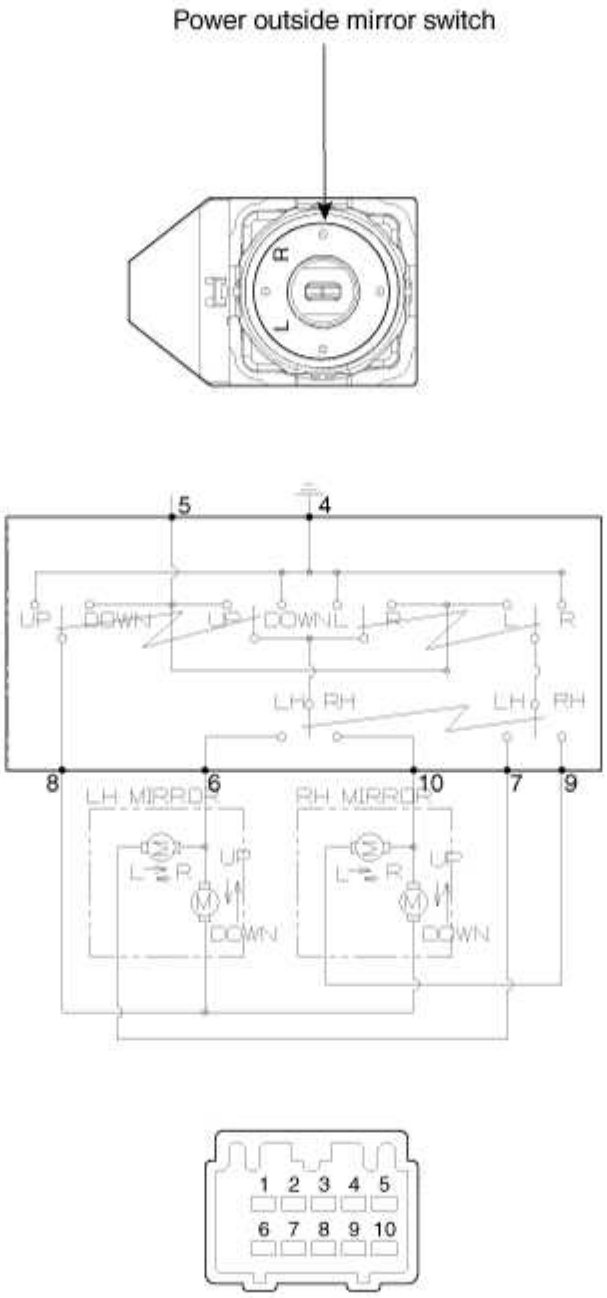
Component Location



1. Power door mirror	2. Power door mirror switch

Body Electrical System > Power Door Mirrors > Power Out Side Mirror Switch > Components and Components Location

Components

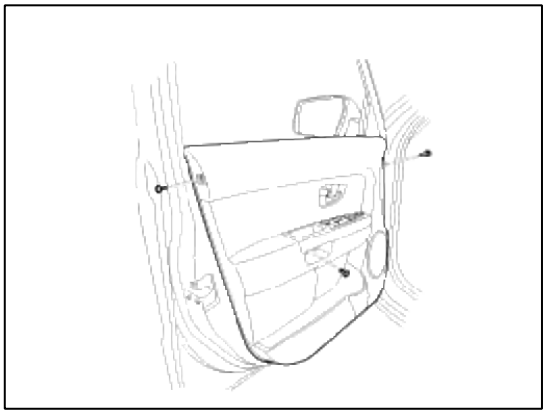


Body Electrical System > Power Door Mirrors > Power Out Side Mirror Switch > Repair procedures

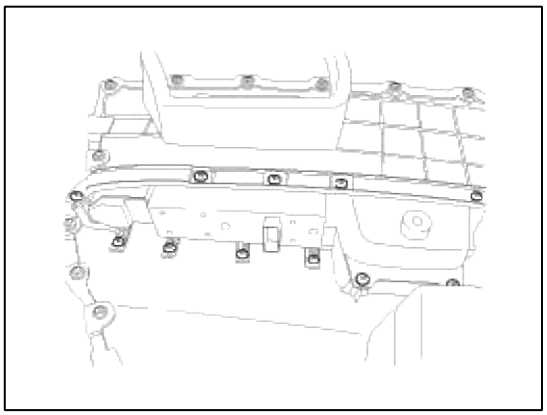
Inspection

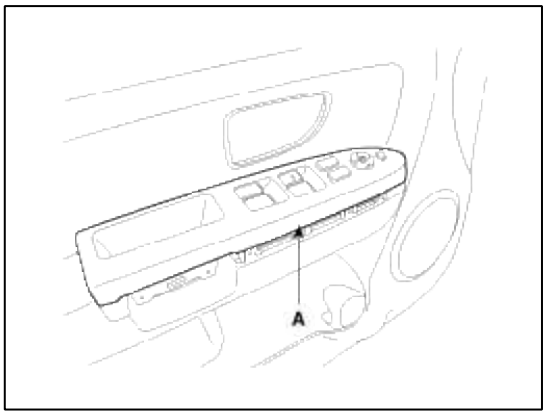
1. Disconnect the negative (-) battery terminal.

2. Remove the front door trim and power window switch module.
   (Refer to the Body group - "Front door")

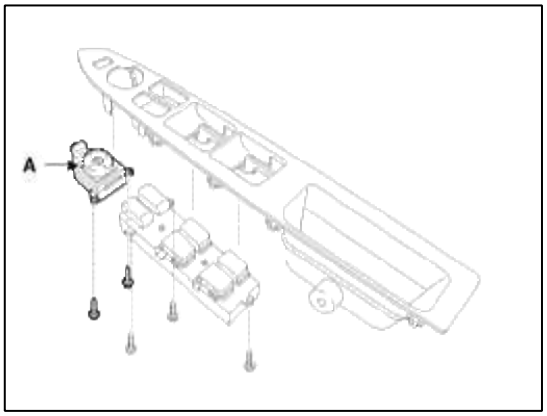


3. Remove the power door switch module (A) after removing the screws.



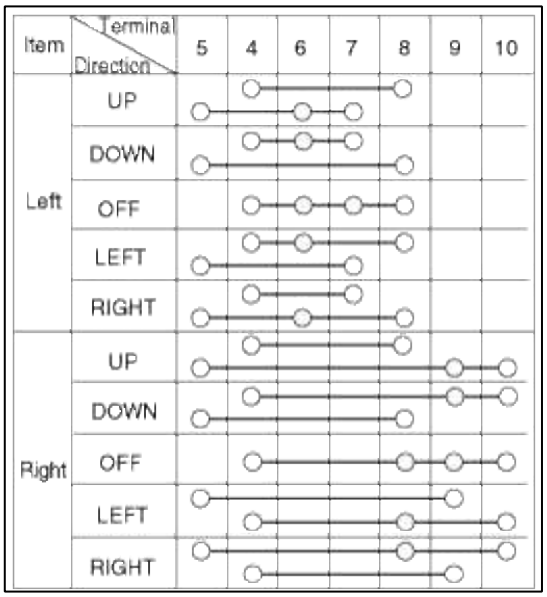


4. Remove the power door mirror switch (A).



5. Check for the continuity between terminals of power door mirror switch according to the table.

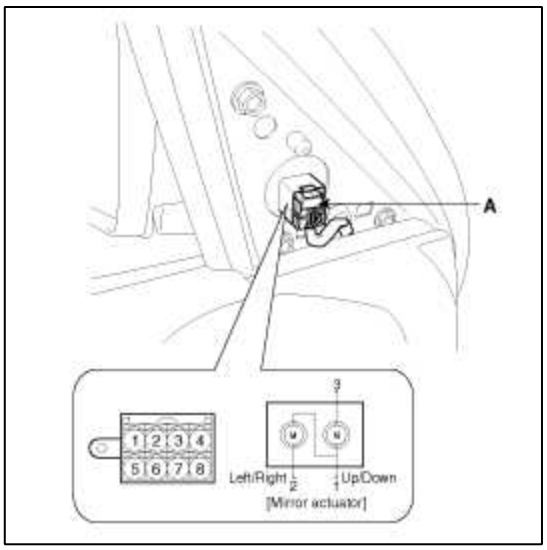
6. Check for continuity between the terminals in each switch position according to the table.

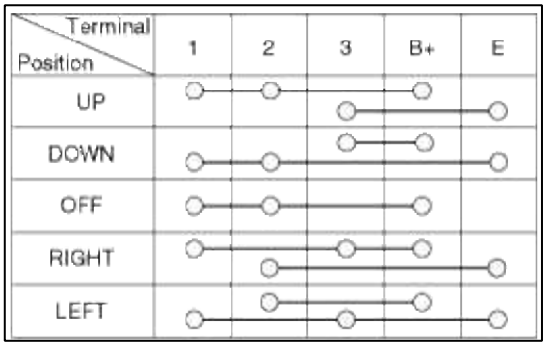


Body Electrical System > Power Door Mirrors > Power Door Mirror Actuator > Repair procedures

Inspection

1. Remove the front door quadrant inner cover. Take care not to damage fixing clips.
   (Refer to the Body group - "Front door")
2. Disconnect the power door mirror connector (A) from the harness.
3. Apply battery voltage to each terminal as shown in the table and verify that the mirror operates properly.



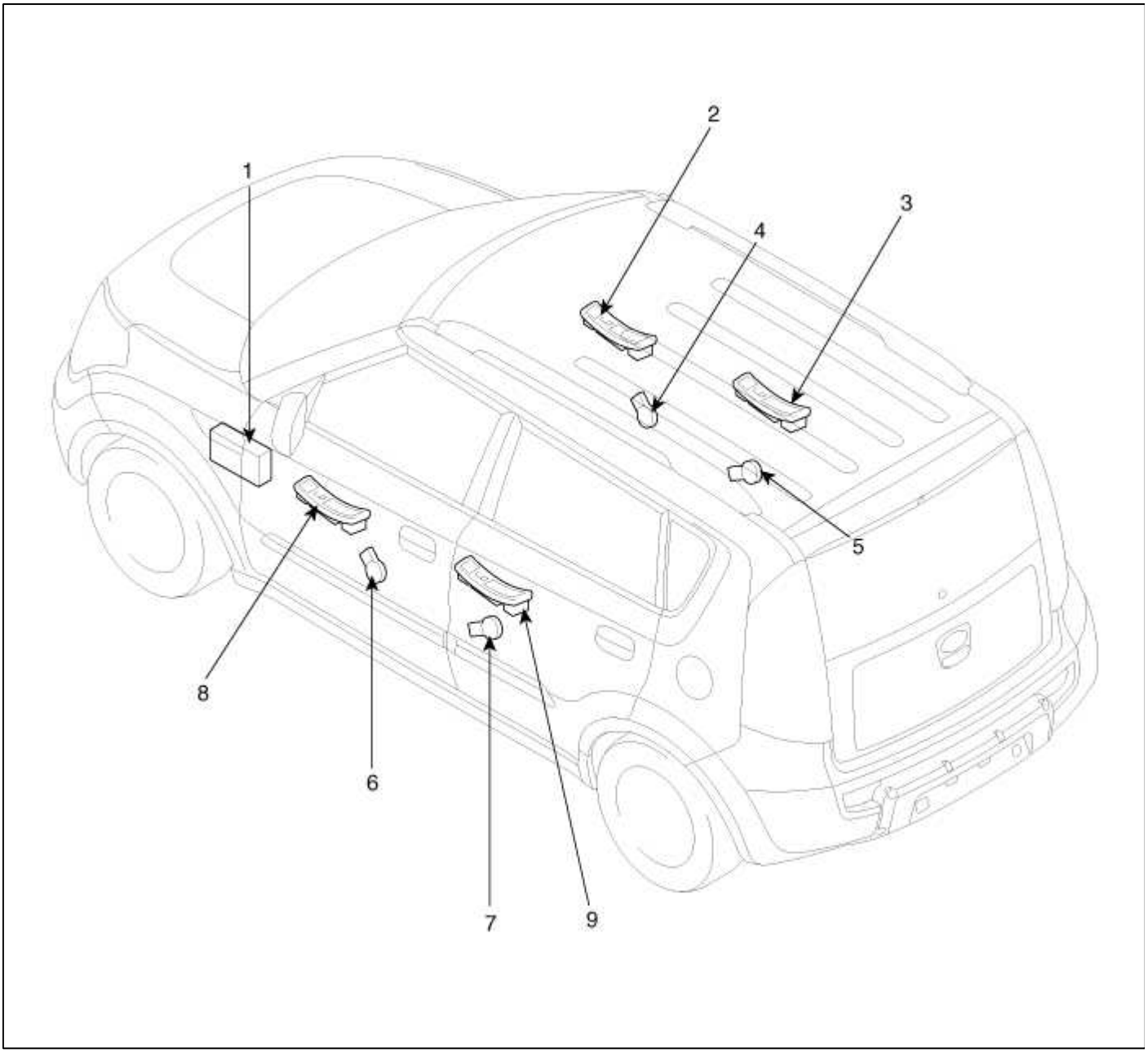


Mirror Heater

Terminal / Position	7	8
Heater	○	○

Body Electrical System > Power Windows > Components and Components Location

Component Location



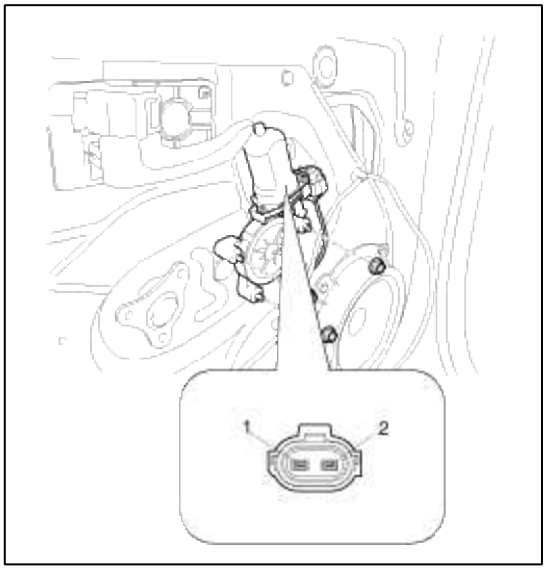
1. Instrument panel junction box (Power window relay)	6. Front window motor
2. Passenger window switch	7. Rear window motor
3. Rear window switch	8. Driver power window main switch
4. Front window motor	9. Rear window switch
5. Rear window motor	

Body Electrical System > Power Windows > Power Window Motor > Repair procedures

Inspection

Front Power Window Motor

1. Remove (-) negative battery terminal.
2. Remove the front door trim.
   (Refer to the Body group - "Front door")
3. Disconnect the connector from the motor.



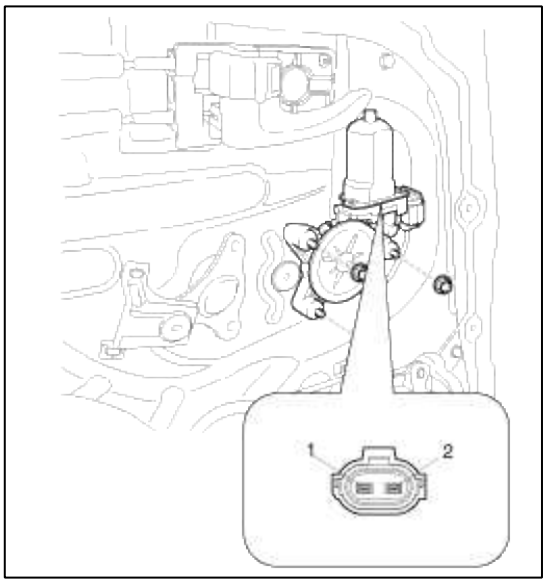
4. Connect the motor terminals directly to a 12 volt battery and check that the motor operates smoothly. Next, reverse the polarity and check that the motor operates smoothly in the reverse direction. If the operation is abnormal, replace the motor.

Position \ Terminal			1	2
Left	UP	Clockwise	⊕	⊖
	DOWN	Counter-clockwise	⊖	⊕
Right	DOWN	Clockwise	⊖	⊕
	UP	Counter-clockwise	⊕	⊖

Rear Power Window Motor

1. Remove (-) negative battery terminal.
2. Remove the rear door trim.
   (Refer to the Body group - "Rear door")

3. Disconnect the connector from the motor.



4. Connect the motor terminals directly to a 12 volt battery and check that the motor operates smoothly. Next, reverse the polarity and check that the motor operates smoothly in the reverse direction. If the operation is abnormal, replace the motor.

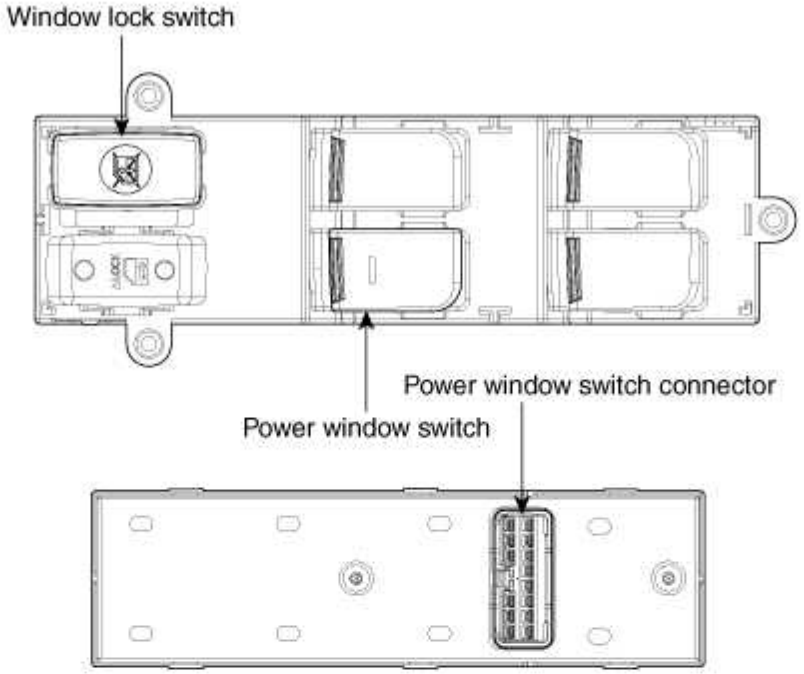
Position		Terminal	1	2
Left	DOWN	Clockwise	⊕	⊖
	UP	Counter-clockwise	⊖	⊕
Right	UP	Clockwise	⊖	⊕
	DOWN	Counter-clockwise	⊕	⊖

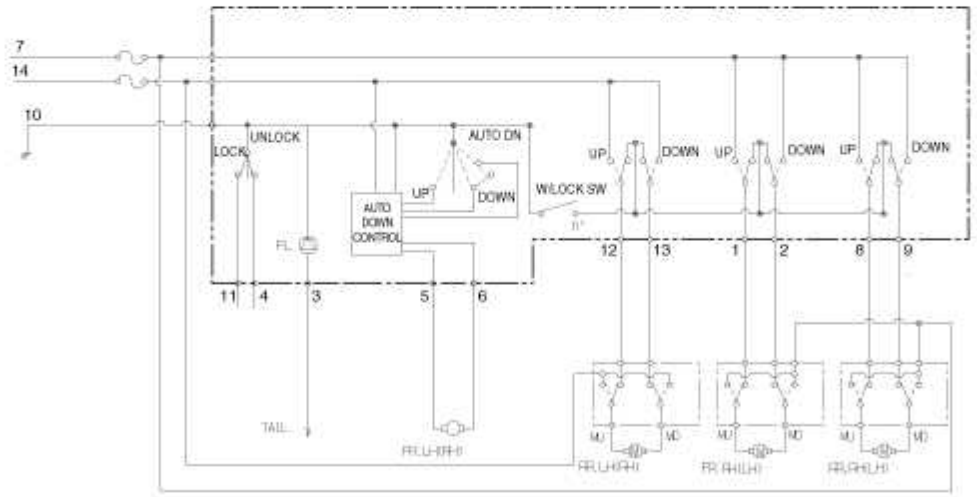
Body Electrical System > Power Windows > Power Window Switch > Components and Components Location

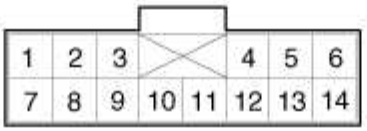
Components

Power Window Main Switch

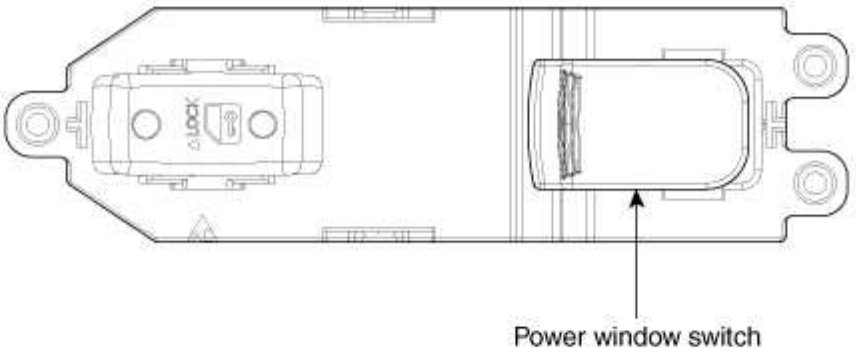
[Driver Power Window]



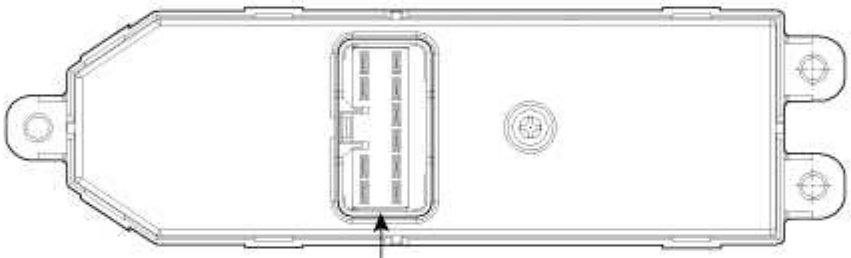




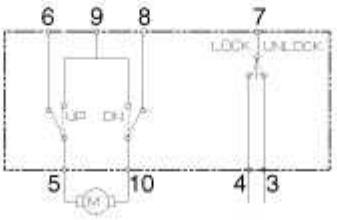
[Assist Power Window Switch]



Power window switch

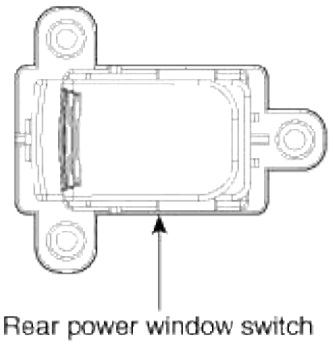


Assist power window switch connector

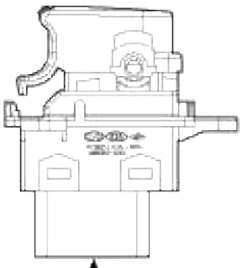


1	2			3	4
5	6	7	8	9	10

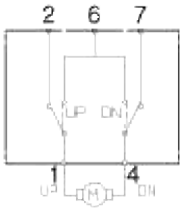
Rear Power Window Switch



Rear power window switch



Rear power window switch connector





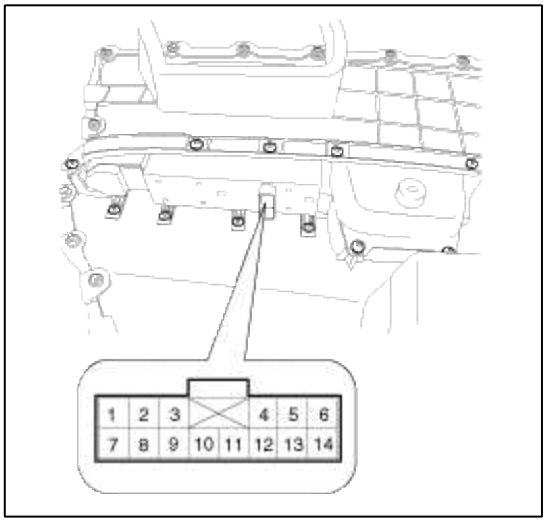
Body Electrical System > Power Windows > Power Window Switch > Repair procedures

Inspection

Power Window Main Switch Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim.
   (Refer to the Body group - "Front door")
3. Disconnect the connector from the switch.

4. Check for continuity between the terminals in each switch position according to the table. If the continuity condition is not normal, replace the switch.



[Auto Down]

Position \ Terminal	11	10	4
Lock	○	○	
Unlock		○	○

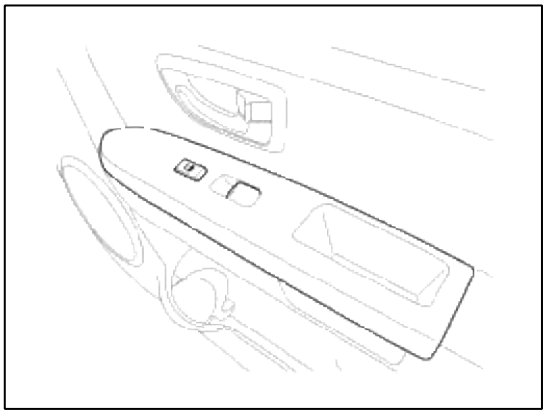
[Auto Down Power Window]

Position \ Terminal	Front left				Front right			
	5	6	10	14	1	2	7	10
UP	○	○	○		○	○		
OFF	○	○	○		○	○		○
DOWN	○		○	○	○		○	○

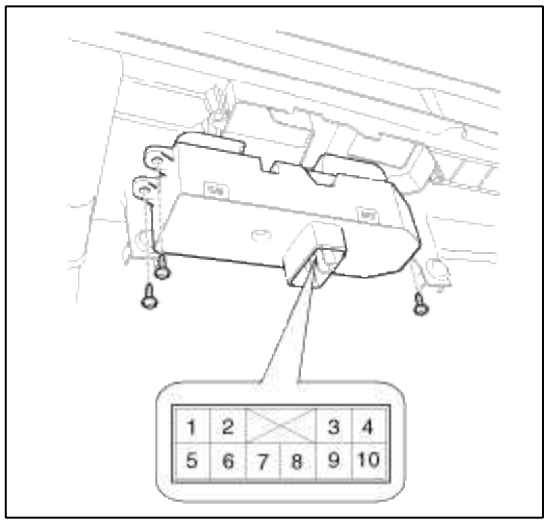
Position \ Terminal	Rear left				Rear right			
	10	12	13	14	7	8	9	10
UP	○	○	○		○	○	○	
OFF	○	○	○			○	○	○
DOWN	○	○	○	○	○		○	○

Passenger Power Window Switch Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim and power window switch module.
   (Refer to the Body group - "Front door")

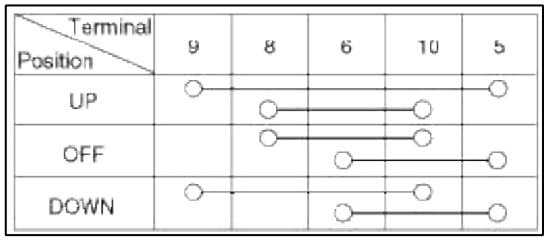


3. Disconnect the connector from the switch.



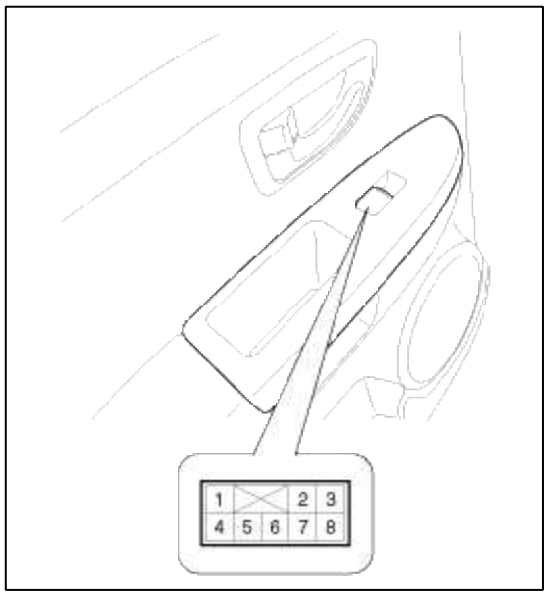
4. Check for continuity between the terminals in each switch position according to the table. If the continuity condition is not normal, replace the switch.

[Manual Power Window]



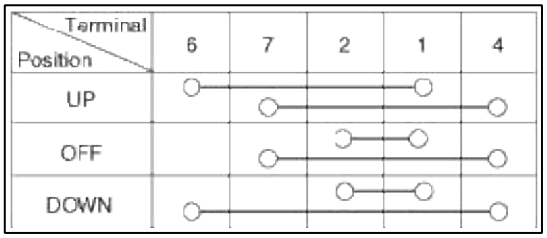
Rear Power Window Switch Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the rear door trim.
(Refer to the Body group - "Rear door")
3. Disconnect the 8P connector from the switch.



4. Check for continuity between the terminals in each switch position according to the table. If the continuity condition is not normal, replace the switch.

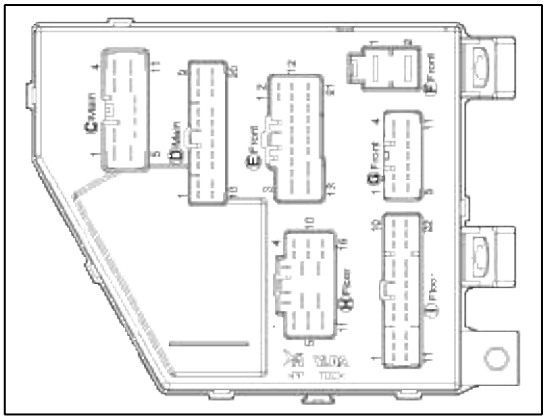
   [Manual Power Window]



Body Electrical System > Power Windows > Power Window Relay > Repair procedures

Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad lower panel.
   (Refer to Body group - "Crash pad")
3. Remove the junction box.
4. Check for continuity between the terminals.
5. There should be continuity between the No.2 in the I/P-F and No.8 or 14 terminal in the I/P-H when power and ground are connected to the No.2 terminal in the I/P-F and No.9 terminal in the I/P-A.
6. There should be no continuity between the No.2 terminal in the I/P-F and No.8 or 14 terminal in the I/P-H when power is disconnected.

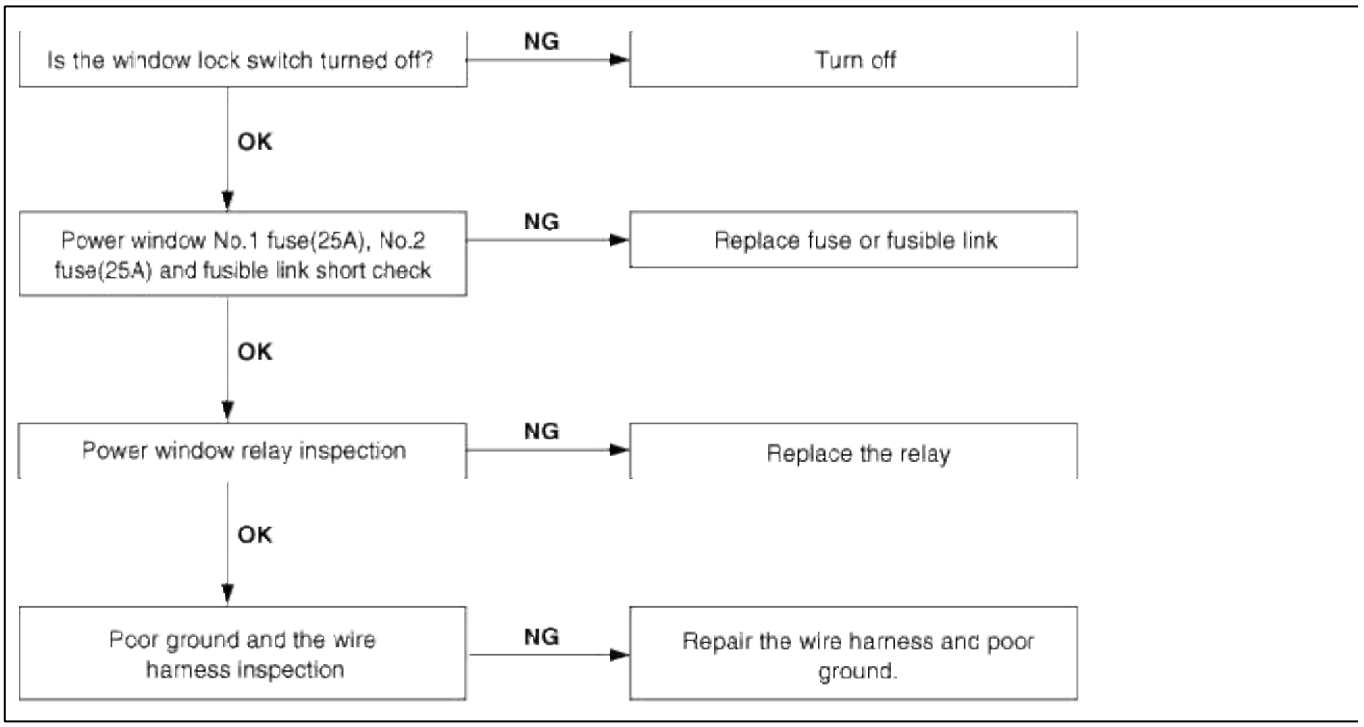


Terminal / Power	I/P-F (2)	I/P-H (8 or 14)	I/P-F (2)	I/P-A (9)
Disconnected			○	○
Connected	○	○	⊕	⊖

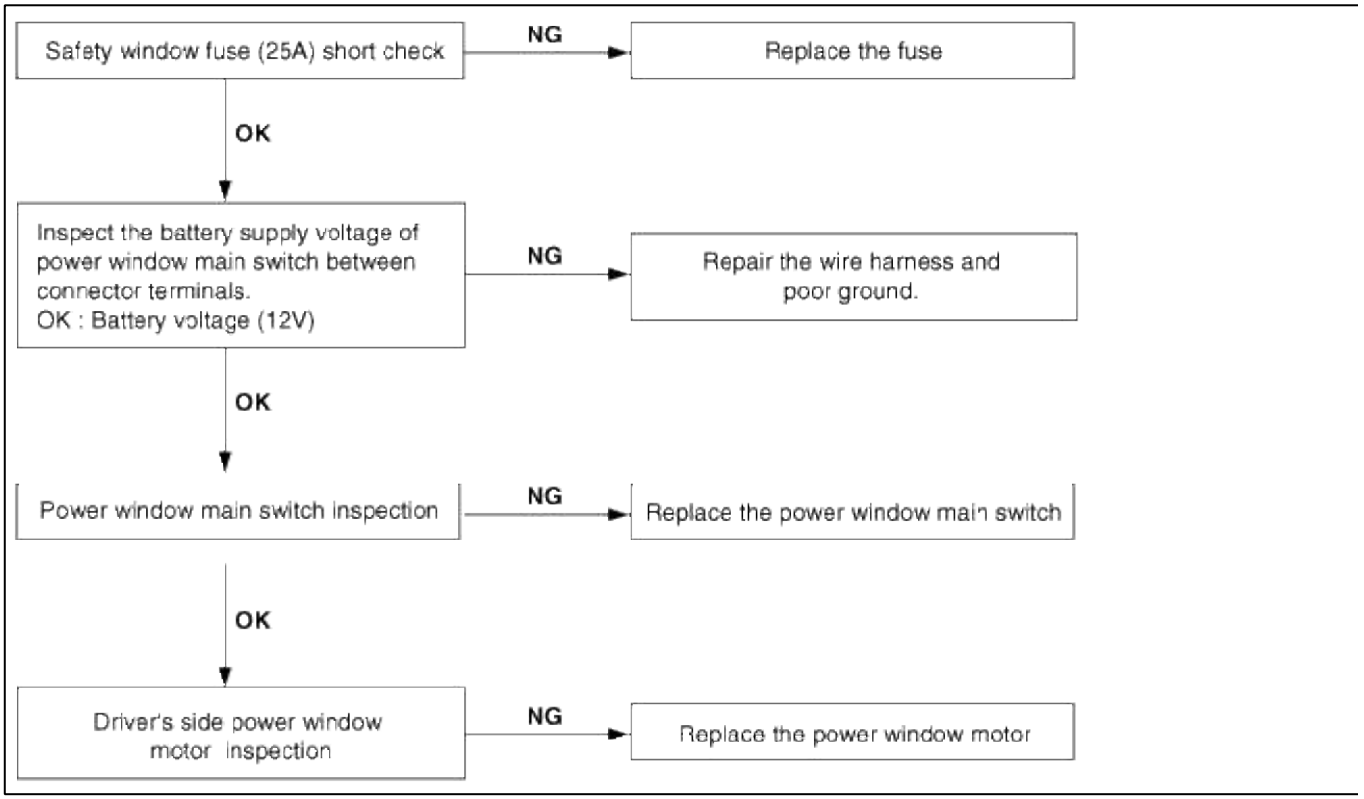
Body Electrical System > Power Windows > Troubleshooting

Troubleshooting

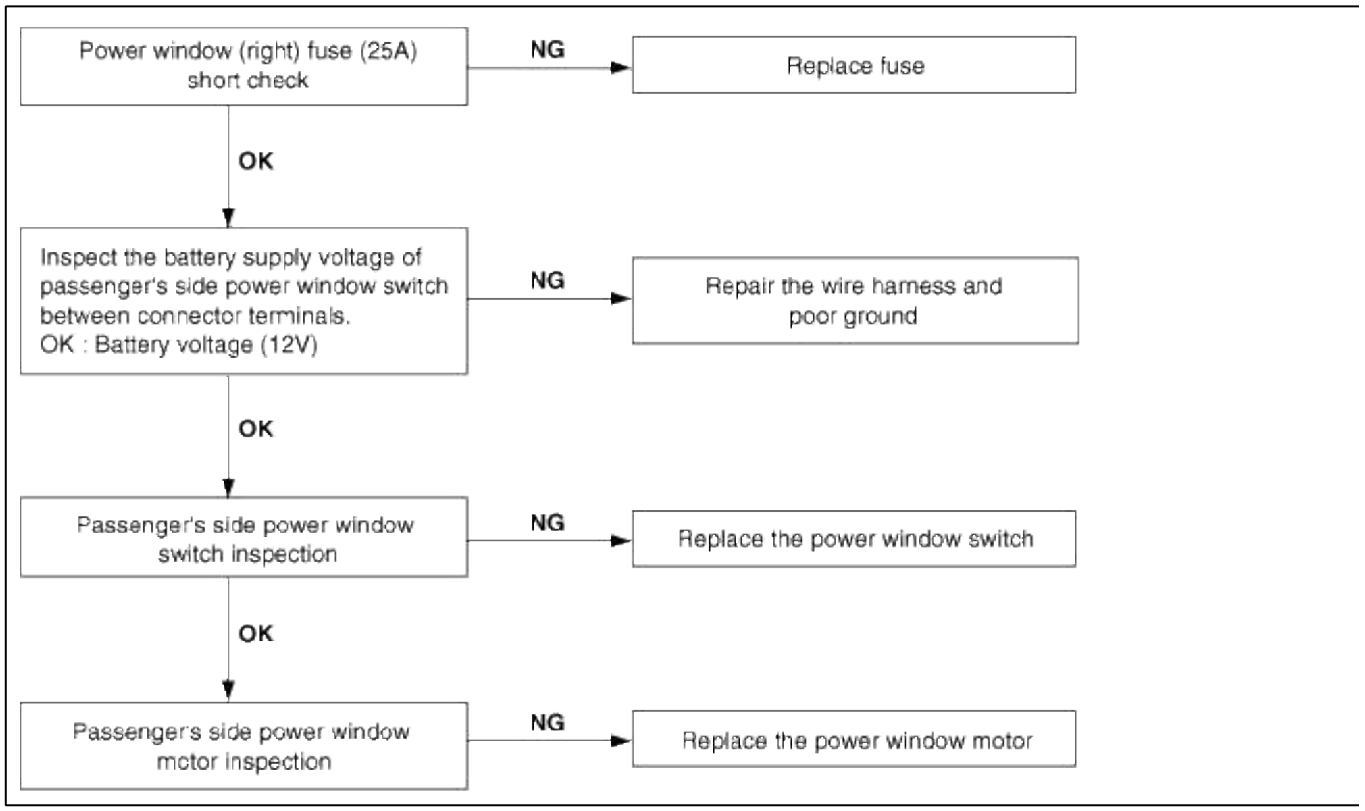
1. No windows operate from the main switch on the driver's door.



2. Driver's side window does not operate.

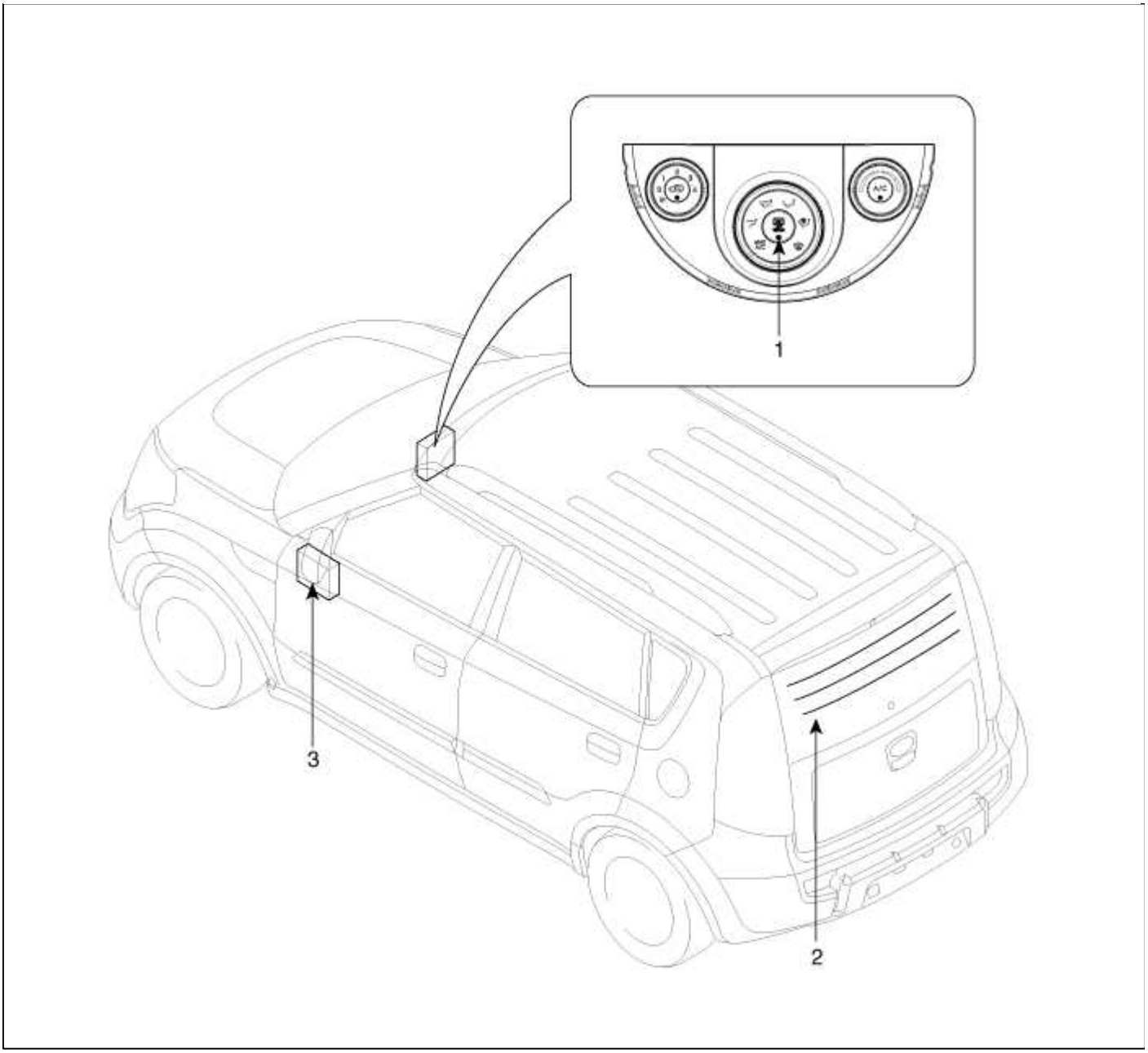


3. Passenger's side window does not operate.



Body Electrical System > Rear Glass Defogger > Components and Components Location

Component Location



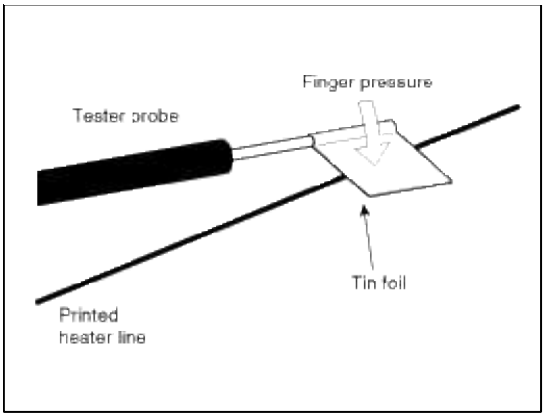
1. Rear window defogger switch 2. Rear window defogger	3. Passenger compartment junction box

Body Electrical System > Rear Glass Defogger > Rear Glass Defogger Printed Heater > Repair procedures

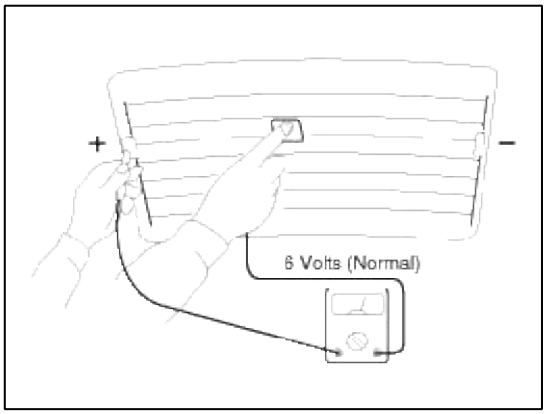
Inspection

CAUTION

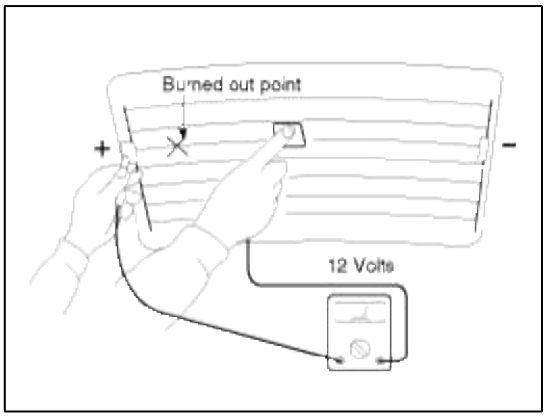
Wrap tin foil around the end of the voltmeter test lead to prevent damaging the heater line. Apply finger pressure on the tin foil, moving the tin foil along the grid line to check for open circuits.



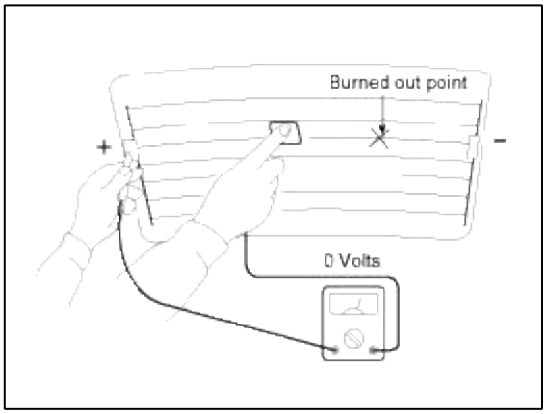
1. Turn on the defogger switch and use a voltmeter to measure the voltage of each heater line at the glass center point. If a voltage of approximately 6V is indicated by the voltmeter, the heater line of the rear window is considered satisfactory.



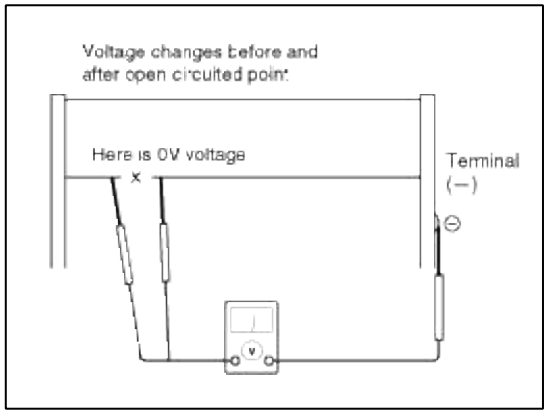
2. If a heater line is burned out between the center point and (+) terminal, the voltmeter will indicate 12V.



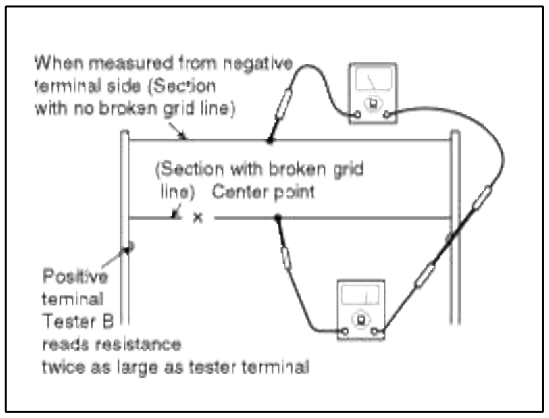
3. If a heater line is burned out between the center point and (-) terminal, the voltmeter will indicate 0V.



4. To check for open circuits, slowly move the test lead in the direction that the open circuit seems to exist. Try to find a point where a voltage is generated or changes to 0V. The point where the voltage has changed is the open-circuit point.



5. Use an ohmmeter to measure the resistance of each heater line between a terminal and the center of a grid line, and between the same terminal and the center of one adjacent heater line. The section with a broken heater line will have a resistance twice as that in other sections. In the affected section, move the test lead to a position where the resistance sharply changes.

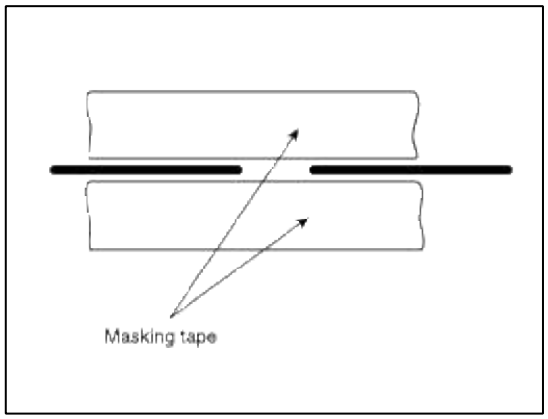


Repair Of Broken Heater Line

Prepare the following items :

1. Conductive paint.
2. Paint thinner.
3. Masking tape.
4. Silicone remover.

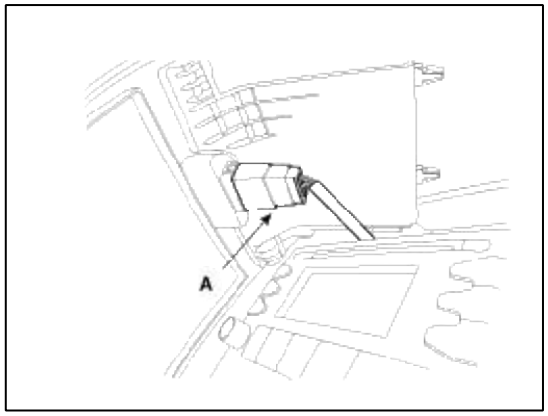
5. Using a thin brush :
   Wipe the glass adjacent to the broken heater line, clean with silicone remover and attach the masking tape as shown. Shake the conductive paint container well, and apply three coats with a brush at intervals of about 15 minutes apart. Remove the tape and allow sufficient time for drying before applying power. For a better finish, scrape away excess deposits with a knife after the paint has completely dried. (Allow 24 hours).



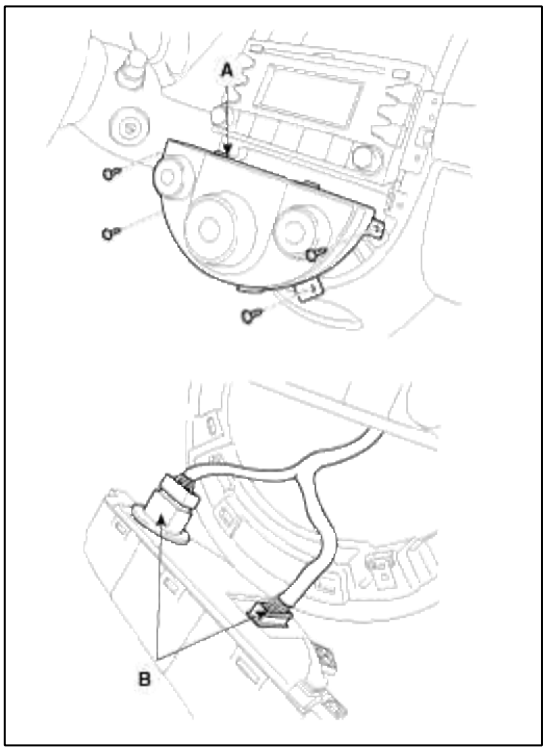
Body Electrical System > Rear Glass Defogger > Rear Glass Defogger Switch > Repair procedures

Inspection

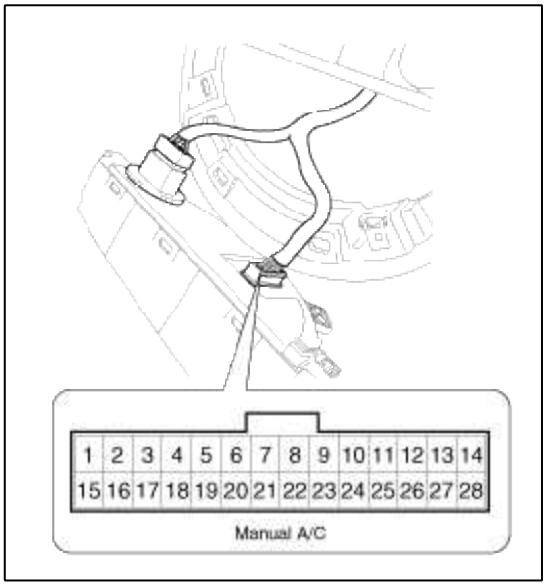
1. Disconnect the negative (-) battery terminal.
2. Remove the center facia panel after removing upper tray. Take care not to damage fixing clips.
   (Refer to the Body group - "Crash pad")
3. Disconnect hazard lamp connector (A).



4. Remove the heater control unit (A) after removing the screws (4EA) and connector (B).



5. Using an ohmmeter, inspect the continuity between the terminals after removing controller.

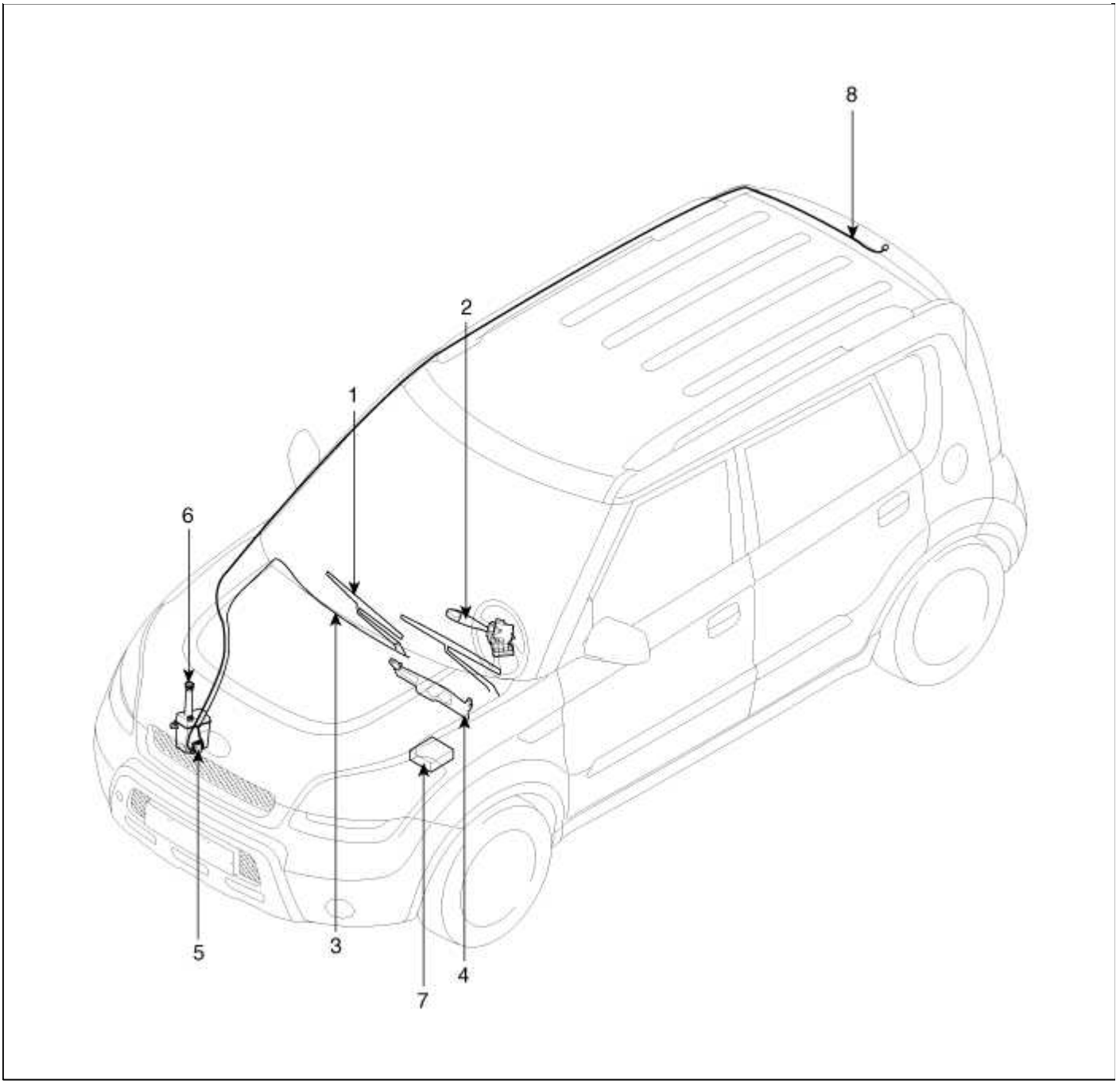


[Manual A/C]

Terminal / Position	25	GND
ON(PUSH)	○	○
OFF(FREE)		

Body Electrical System > Windshield Wiper/Washer > Components and Components Location

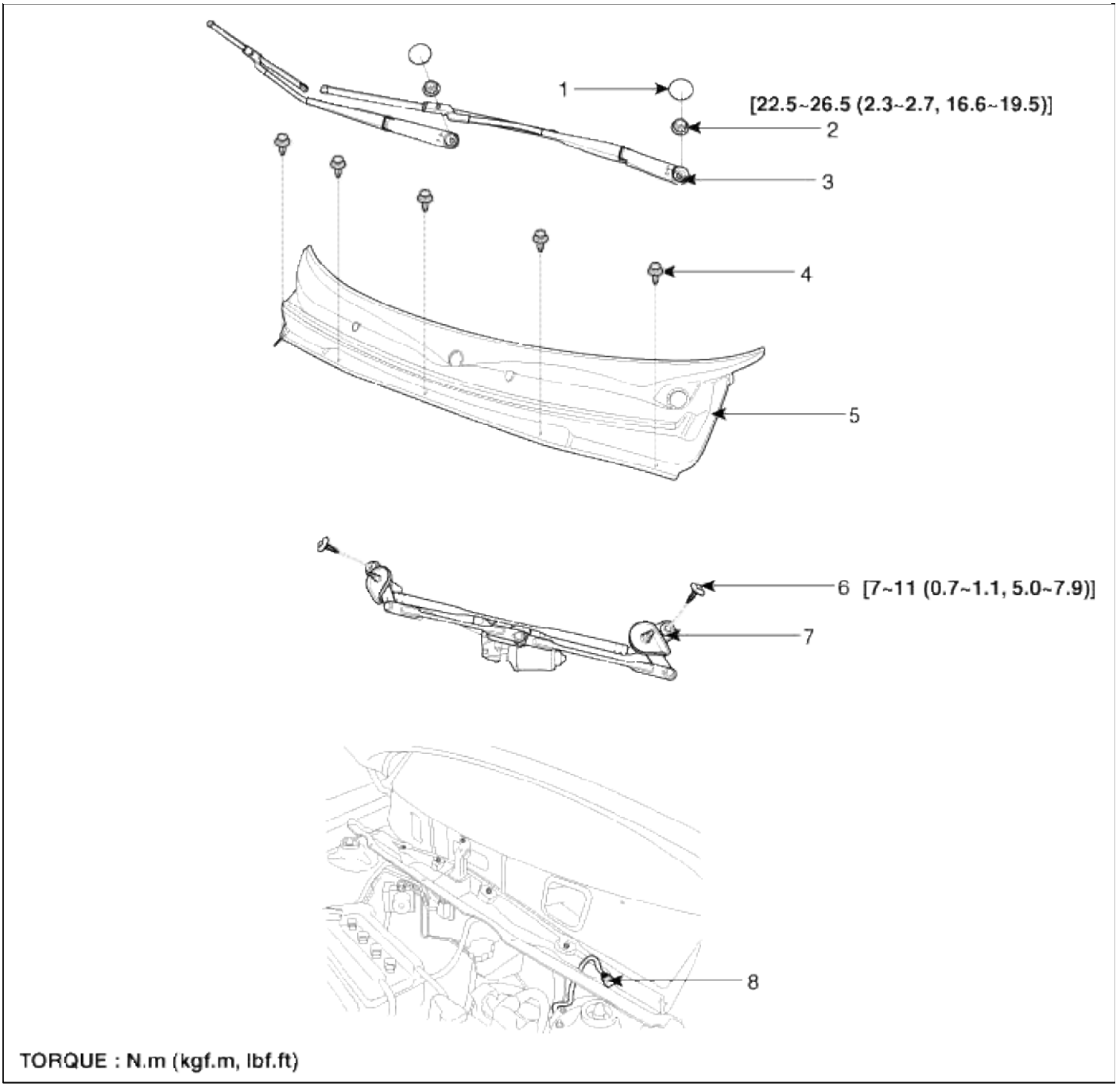
Component Location



1. Windshield wiper arm & blade	5. Washer motor
2. Wiper & washer switch	6. Washer reservoir
3. Windshield washer hose	7. Wiper relay (Engine room relay box)
4. Windshield wiper motor & linkage	8. Rear washer hose

Body Electrical System > Windshield Wiper/Washer > Windshield Wiper-Washer Switch > Components and Components Location

Component Location



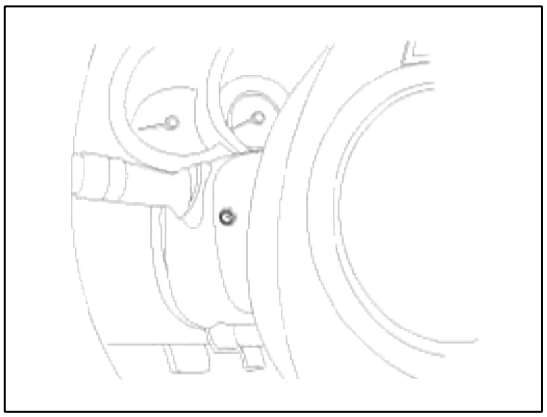
1. Cap	5. Cowl top cover
2. Nut	6. Bolt
3. Wiper arm & blade	7. Wiper motor & linkage assembly
4. Retainer	8. Wiper motor connector

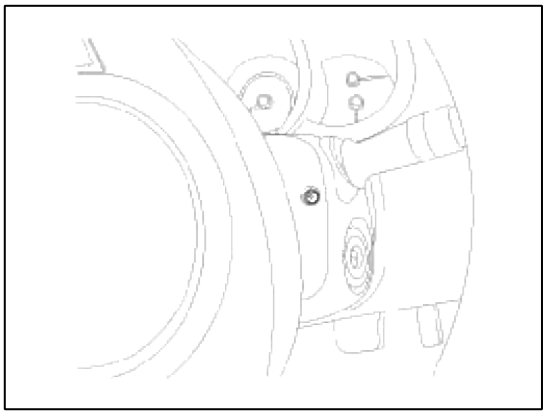
Body Electrical System > Windshield Wiper/Washer > Windshield Wiper-Washer Switch > Repair procedures

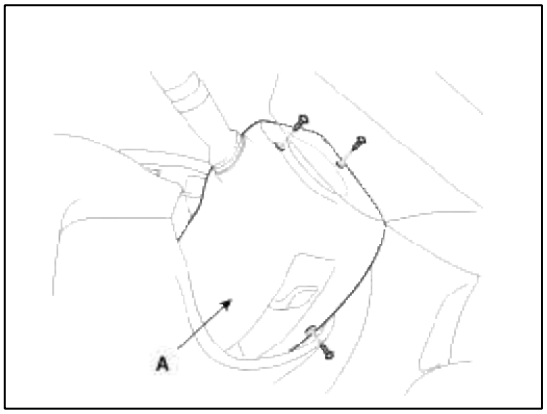
Removal

1. Disconnect the negative (-) battery terminal.

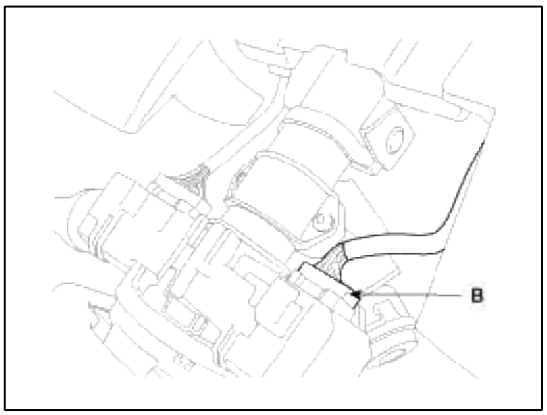
2. Remove the steering column upper and lower shrouds (A) after loosening 3 screws.

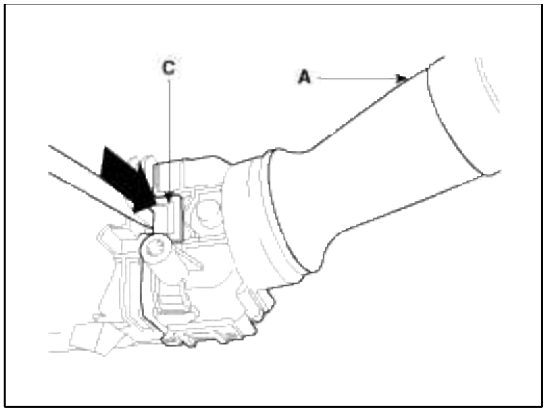






3. Remove the wiper switch (A) after disconnecting the connector(B) with pushing the lock pin (C).



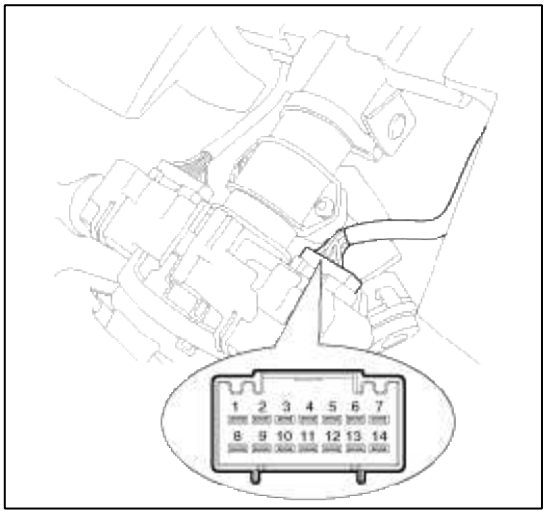


Installation

1. Install the windshield wiper switch.
2. Connect the wiper switch connector.
3. Install the steering column upper and lower shrouds.

Inspection

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



Wiper Switch

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

Washer Switch

Terminal / Position	11	10
OFF		
ON	○	○

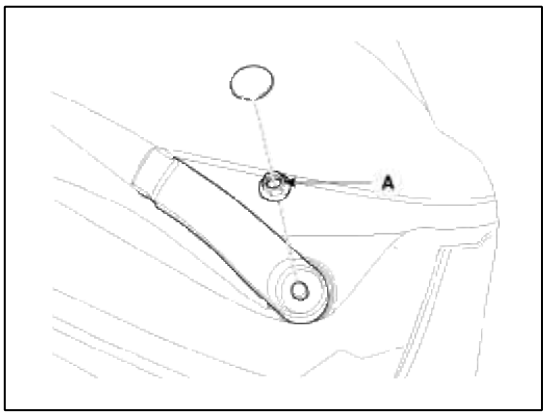
Rear Wiper & Washer Switch

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

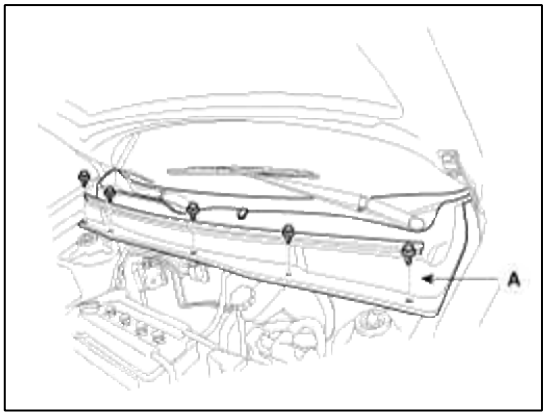
Body Electrical System > Windshield Wiper/Washer > Front Wiper Motor > Repair procedures

Removal

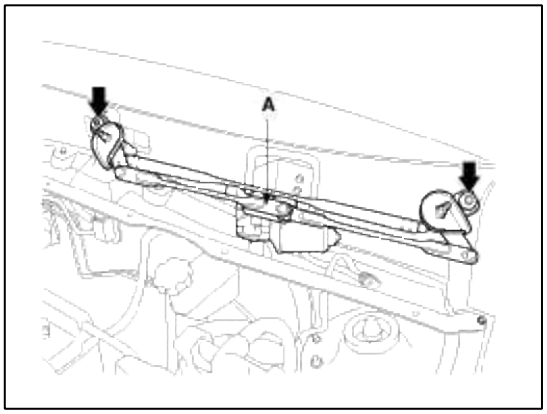
1. Remove the windshield wiper arm and blade after removing a nut (A).

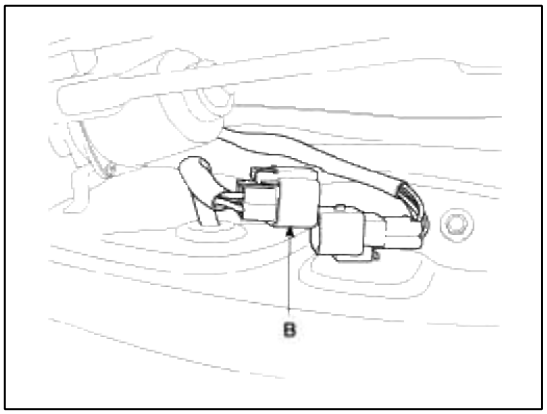


2. Remove the weather strip and the cowl top cover (A) after removing 5 retainers.



3. Remove the windshield wiper motor and linkage assembly(A) after removing 2 bolts. Disconnect the wiper motor connector (B) from the wiper motor & linkage assembly.





Installation

1. Install the wiper motor and linkage assembly and then connect the wiper motor connector.

   TORQUE : 7-11Nm (0.7-1.1, kgf.m, 5.0-7.9 lbf.ft)

2. Install the cowl top cover.
3. Install the windshield wiper arm and blade.

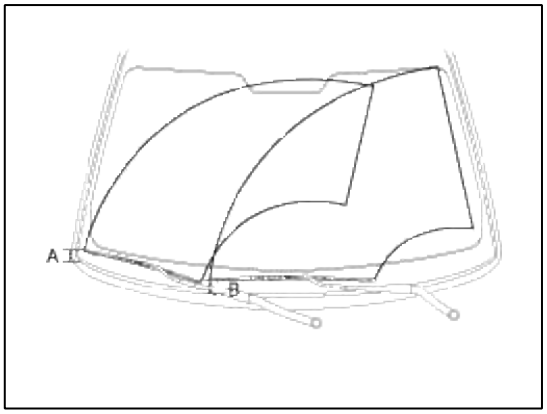
   TORQUE : 22.5~26.5 Nm (2.3~2.7 kgf.m, 16.6~19.5 lbf.ft)

NOTE

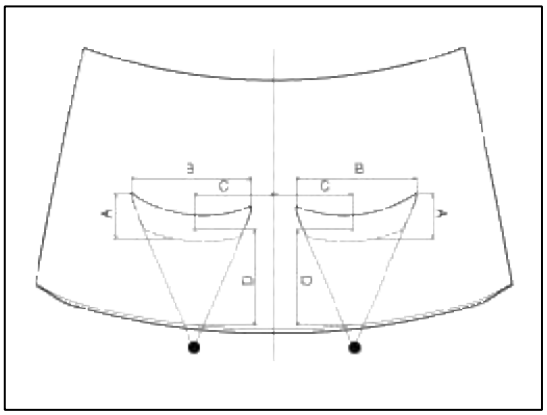
- The windshield wiper motor must be cycled to make sure that it is in the park position. If necessary, adjust the wiper arm and blade.

4. Install the wiper arm and blade to the specified position.

Specified position	A	B
Distance [in (mm)]	1.57~1.77 (40~45)	1.18~1.37 (30~35)



5. Set the cowl top cover on the specified spray position.

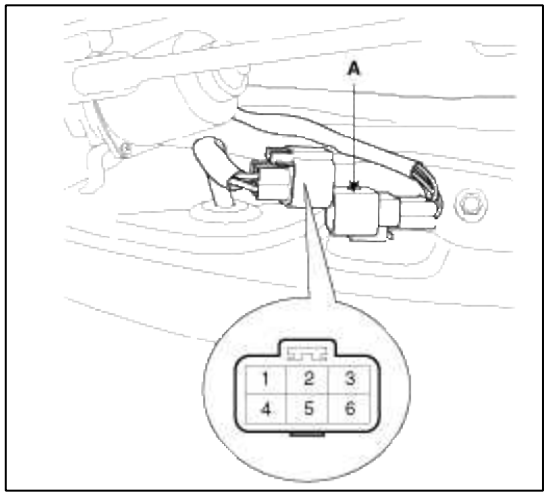


Specified position	Distance (mm)	Distance (in)
A	111~171	4.37~6.73
B	326~426	12.8~16.7
C	246	9.68
D	310	12.2

Inspection

Speed Operation Check

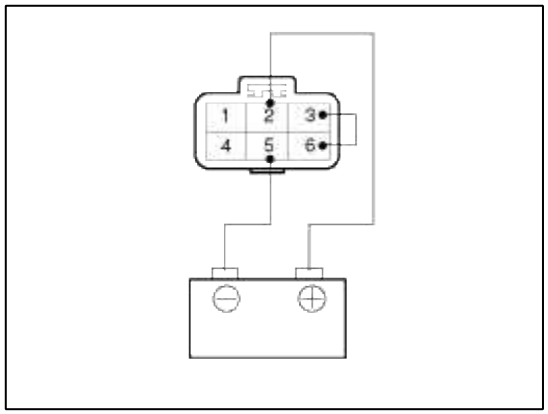
1. Remove the connector(A) from the wiper motor.
   (1. Blank, 2. Battery+, 3. Parking, 4. High, 5. GND, 6. Low)



2. Attach the positive (+) lead from the battery to terminal 2 and the negative (-) lead to terminal 6.
3. Check that the motor operates at low speed.
4. Connect the positive (+) lead from the battery to terminal 2 and the negative (-) lead to terminal 4.
5. Check that the motor operates at high speed.

Automatic Stop Operation Check

1. Operate the motor at low speed using the stalk control.
2. Stop the motor operation anywhere except at the off position by disconnecting terminal 4.
3. Connect terminals 3 and 6.
4. Connect the positive (+) lead from the battery to terminal 2 and the negative (-) lead to terminal 5.
5. Check that the motor stops running at the off position.



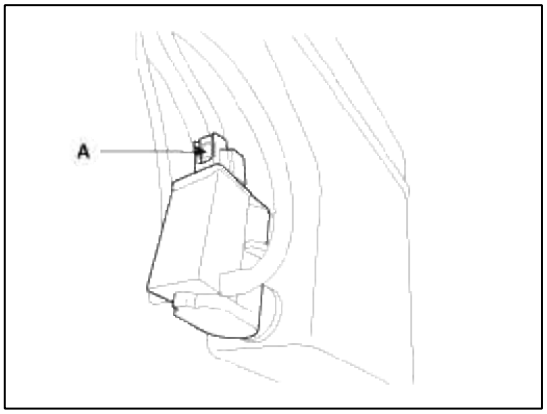
Body Electrical System > Windshield Wiper/Washer > Front Washer Motor > Repair procedures

Removal

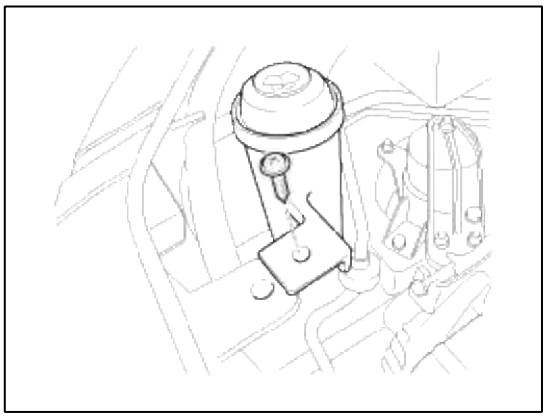
CAUTION

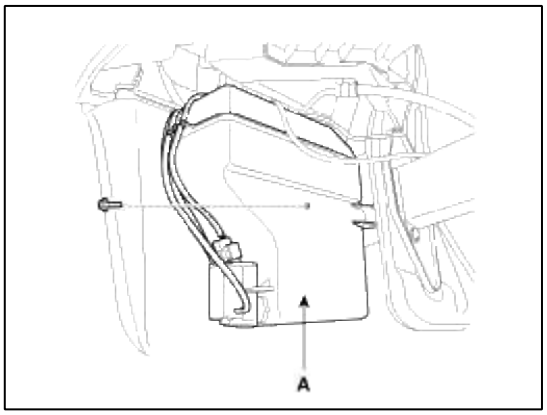
- When servicing the washer pump, be careful not to damage the washer pump seal.
- Do not operate the washer pump before filling the washer reservoir.
  Failure to do so could result in premature pump failure.

1. Disconnect the negative (-) battery terminal.
2. Remove the front bumper cover.
   (Refer to Body group - Front bumper)
3. Remove the washer hose and the washer motor connector (A).



4. Remove the washer reservoir (A) after removing bolts.





Installation

1. Install the washer reservoir.

> NOTE
>
> Before installing the pump motor, check the filter for foreign material or contamination. if necessary, clean the filter into the pump motor.

2. Install the washer motor and connect the washer hose, the motor and level sensor connector.
3. Install the front bumper cover.

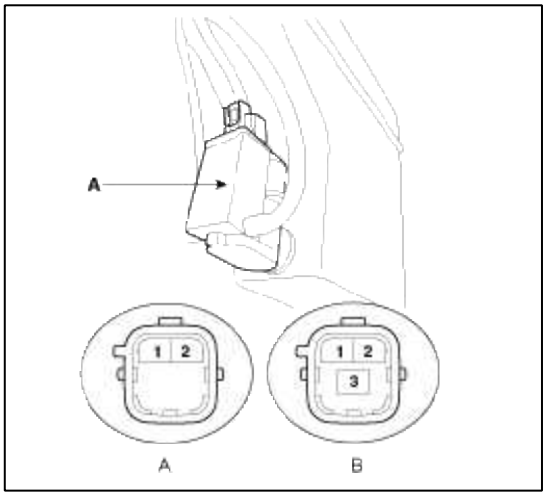
Inspection

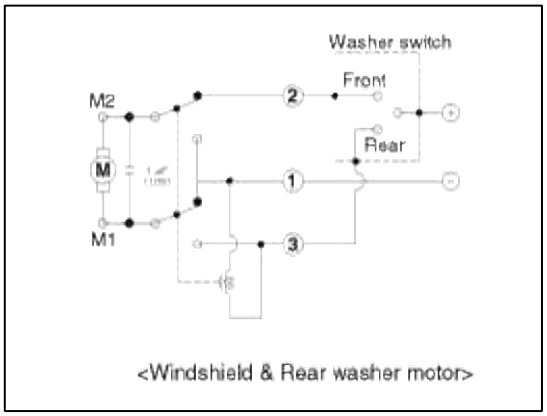
1. With the washer motor connected to the reservoir tank, fill the reservoir tank with water.

> NOTE
>
> Before filling the reservoir tank with water, check the filter for foreign material or contamination. if necessary, clean the filter.

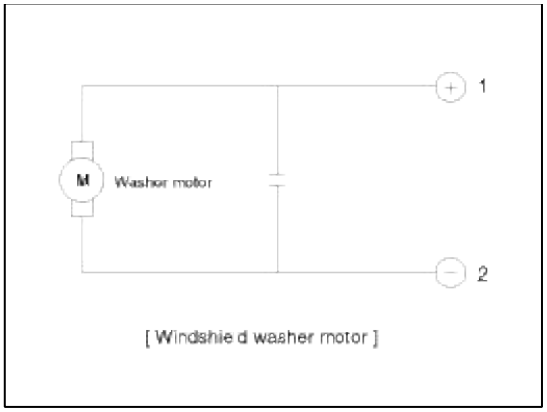
2. Connect positive (+) battery cables to terminal 1 and negative (-) battery cables to terminal 2 respectively.
3. Check that the motor operates normally and the washer motor runs and water sprays from the front nozzles.
4. If they are abnormal, replace the washer motor (A).

Pin	Front washer (A)	Front & Rear washer (B)
1	Windshield washer (+)	Windshield washer (+)
2	Ground	Ground
3	-	Rear washer (+)





<Windshield & Rear washer motor>

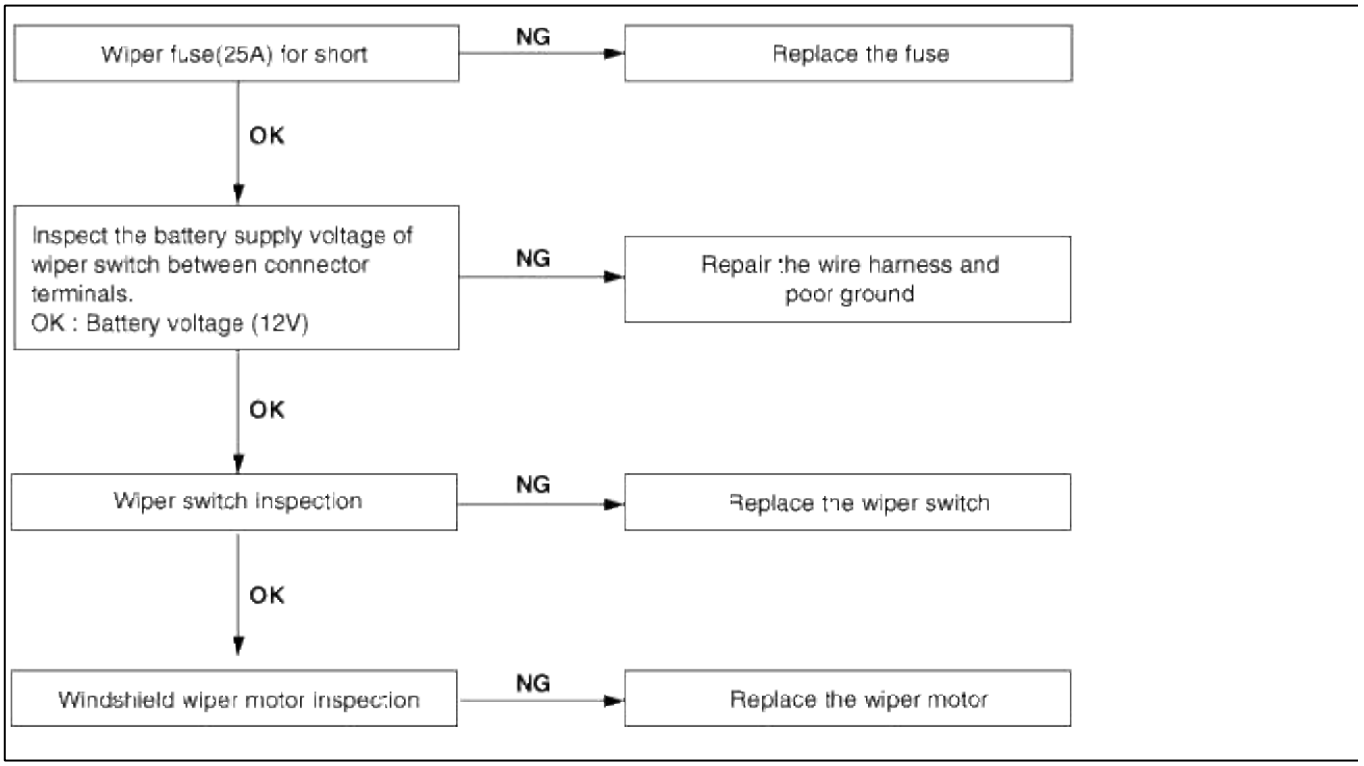


[Windshie d washer motor]

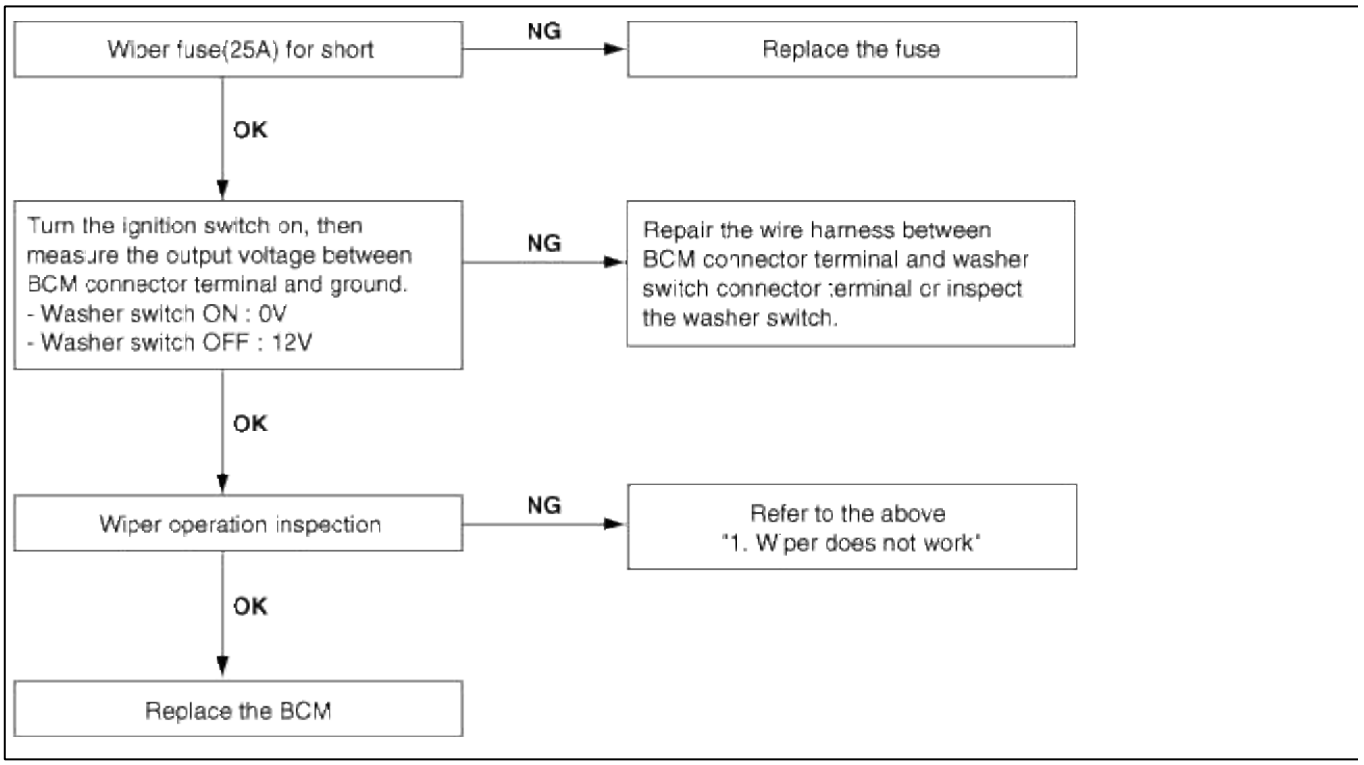
Body Electrical System > Windshield Wiper/Washer > Troubleshooting

Troubleshooting

1. Wiper low and wiper high do not work.

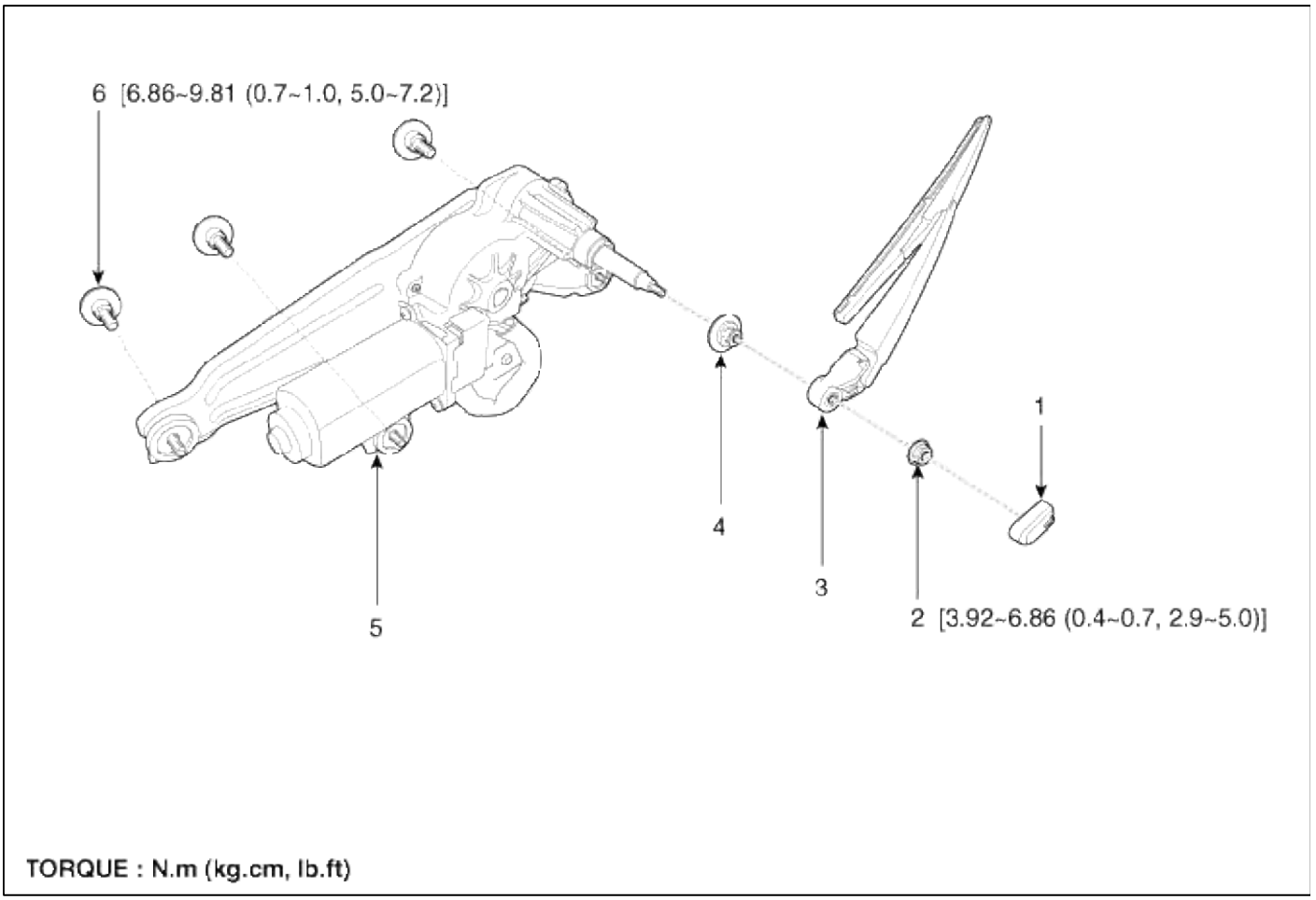


2. When washer switch is on, wiper does not work.



Body Electrical System > Rear Wiper/Washer > Components and Components Location

Component Location

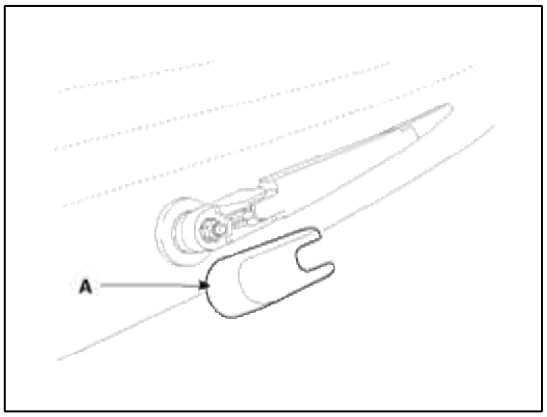


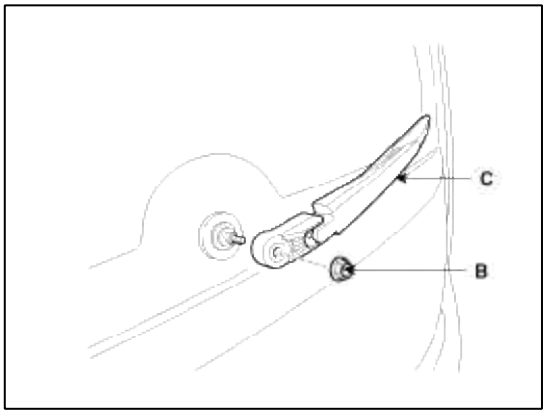
1. Head cap 2. Nut 3. Rear wiper arm & Blade	4. Packing (rubber) 5. Rear wiper motor assembly 6. Bolt

Body Electrical System > Rear Wiper/Washer > Rear Wiper Motor > Repair procedures

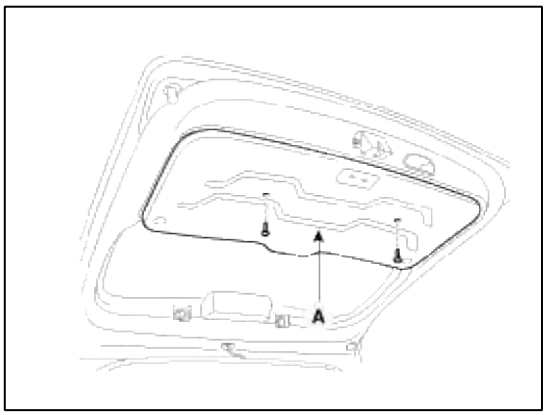
Removal

1. Detach the wiper cap (A), then remove the rear wiper arm (C) after removing a nut (B).

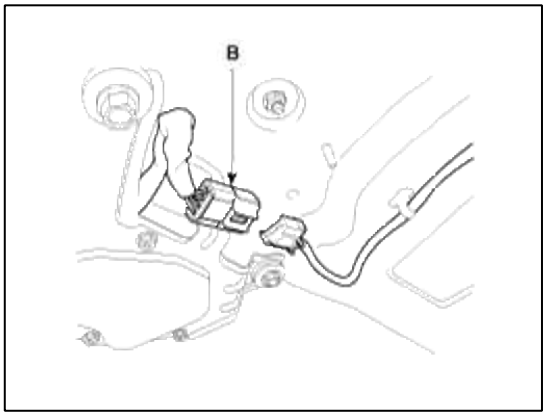


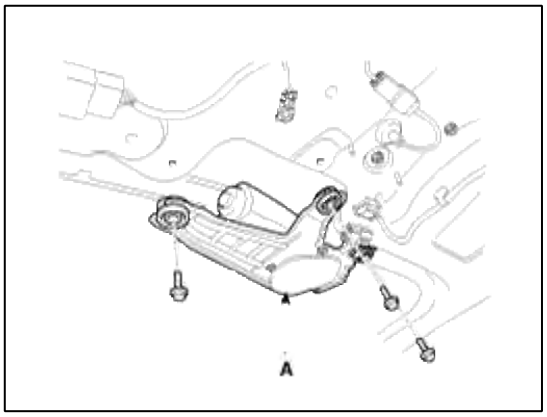


2. Open the tailgate then remove the tailgate trim.

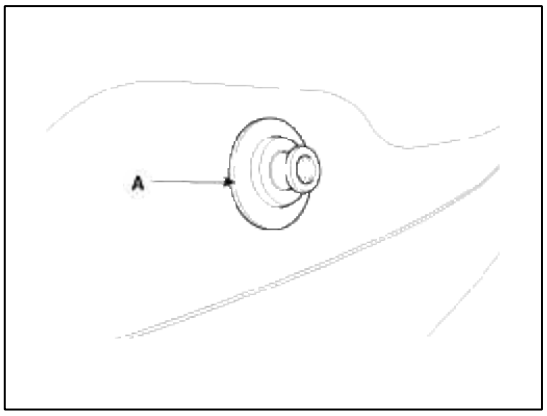


3. Disconnect the rear wiper motor connector (4P) (B) then remove the rear wiper motor (A) after removing 3 bolts.





4. Remove the rubber packing (A).



Installation

1. Install the rubber packing.
2. Install the rear wiper motor assembly.

Tightening torque :
6.86 ~ 9.81N.m (0.7 ~ 1.0kgf.m, 5.0 ~ 7.2lb-ft)

3. Intall the tailgate trim.

4. Install the rear wiper arm and rear wiper arm cap.

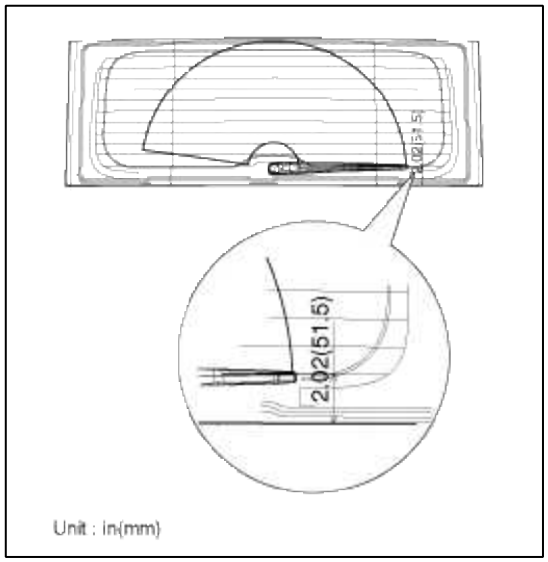
Tightening torque :
3.92 ~ 6.86N.m (0.4 ~ 0.7kgf.m, 2.9 ~ 5.0lb-ft)

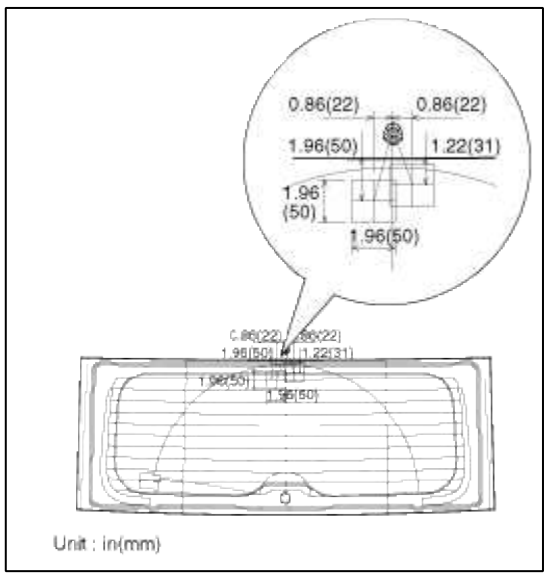
NOTE

Before installation, be sure that the rear wiper motor is in the park position.
Turn the wiper switch ON and OFF to allow the rear wiper motor to cycle and stop in the park position.

5. Set the rear wiper blade and to the lowest defogger heat line and tailgate glass.

6. Set the rear washer nozzle on the specified spray position.





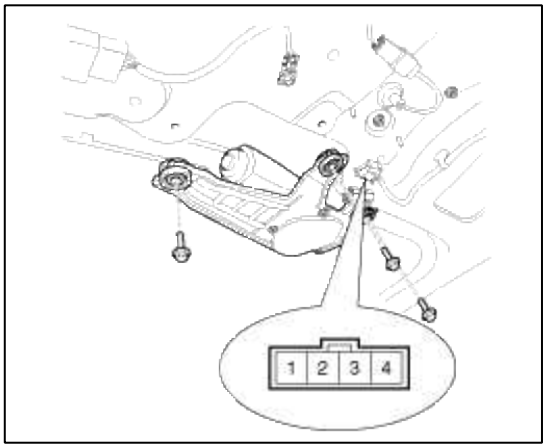
Inspection

Rear Wiper Motor

1. Remove the 4P connector from the rear wiper motor.

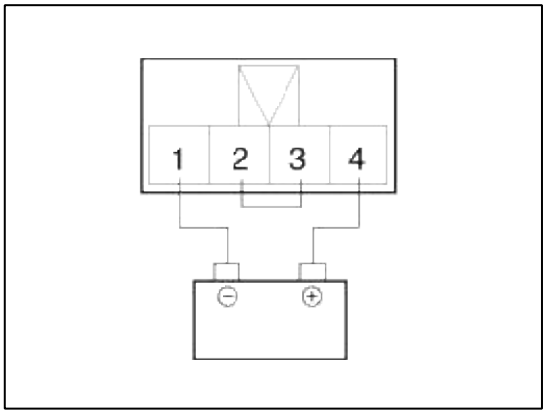
2. Connect battery positive (+) and negative (-) cables to terminals 4 and 1 respectively.

3. Check that the motor operates normally. Replace the motor if it operates abnormally.
   (1. B+, 2. Parking, 3. Switch , 4. GND)



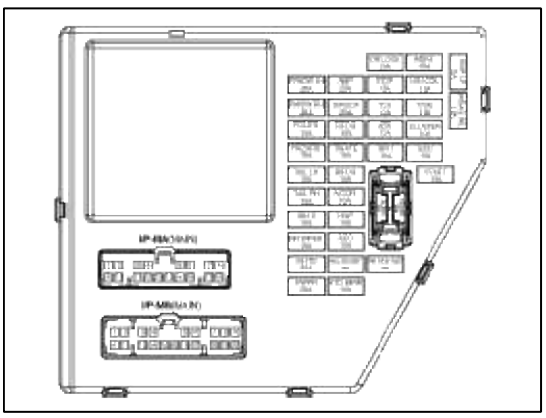
Automatic Stop Operation Check

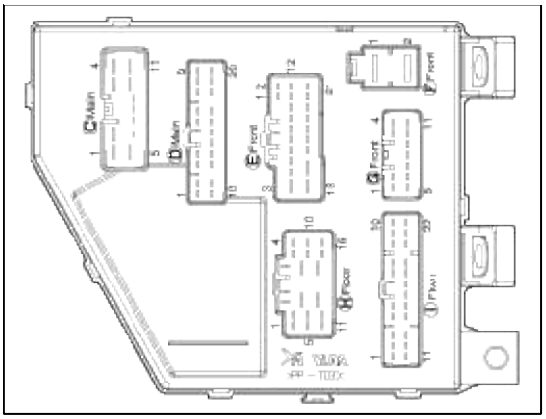
1. Operate the motor at low speed using the stalk control.
2. Stop the motor operation anywhere except at the off position by disconnecting terminal 2.
3. Connect terminals 2 and 3.
4. Connect the positive (+) lead from the battery to terminal 4 and the negative (-) lead to terminal 1.
5. Check that the motor stops running at the off position.



Body Electrical System > Rear Wiper/Washer > Rear Wiper Relay > Repair procedures

Inspection





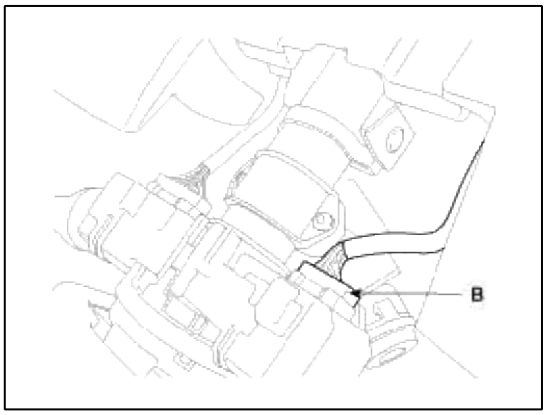
Check for continuity between the terminals.

1. Disconnect the negative (-) battery terminal.
2. Remove the passenger compartment junction box.
3. Check for continuity between the terminals.
4. There should be continuity between the No.1 terminals in the I/P-C and No.20 terminals in the I/P-I when power and ground are connected to the No.1 terminals in the I/P-A and No.2 terminals in the I/P-A.
5. There should be no continuity between the No.1 terminals in the I/P-C and No.20 terminals in the I/P-I when power is disconnected.

Body Electrical System > Rear Wiper/Washer > Rear Washer Switch > Repair procedures

Inspection

1. With the rear wiper & washer switch in each position, make sure that continuity exists between the terminals below. If continuity is not as specified, replace the multifunction switch.



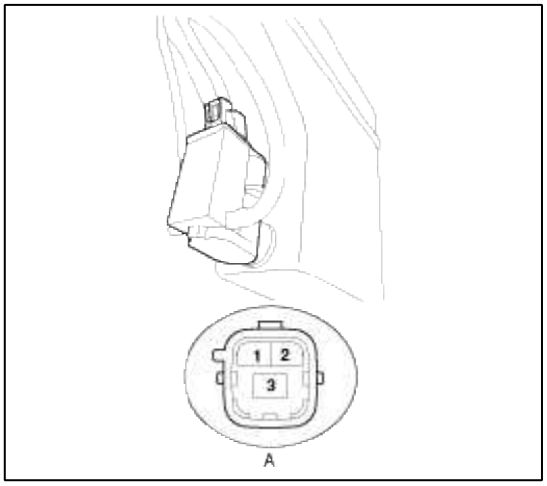
Rear Wiper & Washer Switch

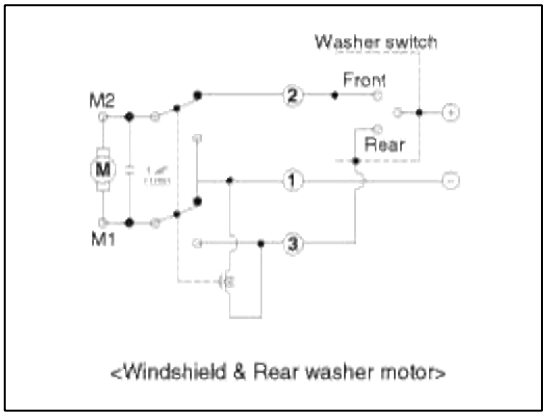
Terminal / Position	12	7	6	13
WIPER(ON)	○		○	
INT	○	○		
OFF				
WASHER(ON)	○			○

Body Electrical System > Rear Wiper/Washer > Rear Washer Motor > Repair procedures

Inspection

1. With the washer motor connected to the reservoir tank, fill the reservoir tank with water.
2. Remove the front bumper cover. (Refer to the Body group- Front bumper)
3. Connect positive (+) and negative (-) battery cables to terminals 3 and 1 respectively to see that the washer motor runs and water is pumped.
4. Check that the motor operates normally.
   Replace the motor if it operates abnormally.
   A : Front & rear washer
   1. Windshield washer (+), 2. Ground, 3. Rear washer (+)



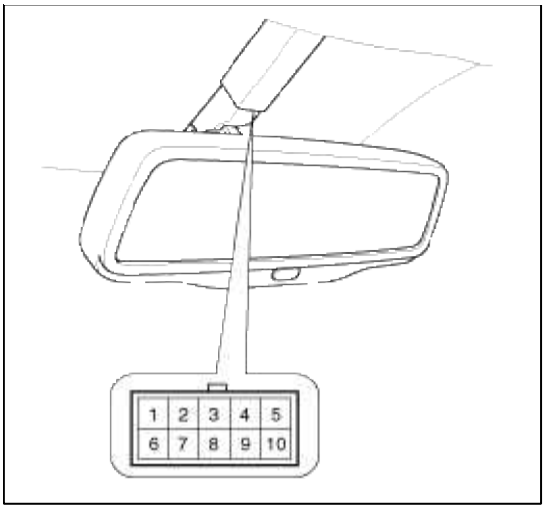


<Windshield & Rear washer motor>

Body Electrical System > Electro chromic Inside Rear View Mirror > Description and Operation

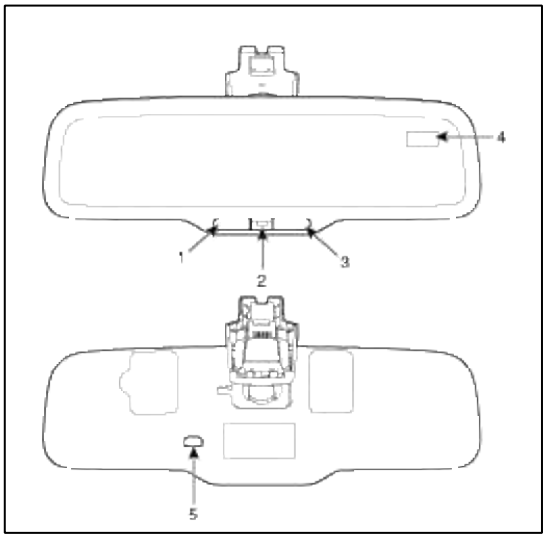
Description

The ECM (Electro Chromic inside rear view Mirror) is for dimming the reflecting light from a vehicle behind at night, in order the user not to be dazzled by the light. The front looking sensor detects brightness of the surroundings, while the rearward looking sensor the strength of the reflecting light so that adjusts the reflexibility of the mirror in the range of 10~70%. But, when the reverse gear is engaged, it stops functioning.



Pin NO.	Description
1	Camera power (-)
2	ECM (+)
3	Camera power (+)
4	Video signal (-)
5	Video signal (+)
6	-
7	ECM (-)
8	GND
9	R range signal
10	IGN power (+12V)

1. The front looking sensor sees if the brightness of the surroundings is low enough for the mirror to operate its function.
2. The rearward looking sensor detects glaring of the reflecting light from a vehicle behind.
3. The ECM is darkened to the level as determined by the rearward looking sensor. When the glaring is no longer detected, the mirror stops functioning.
   (1. Mirror button2. Rearward looking sensor3. Compass button4. Direction indicator5. Front looking sensor)

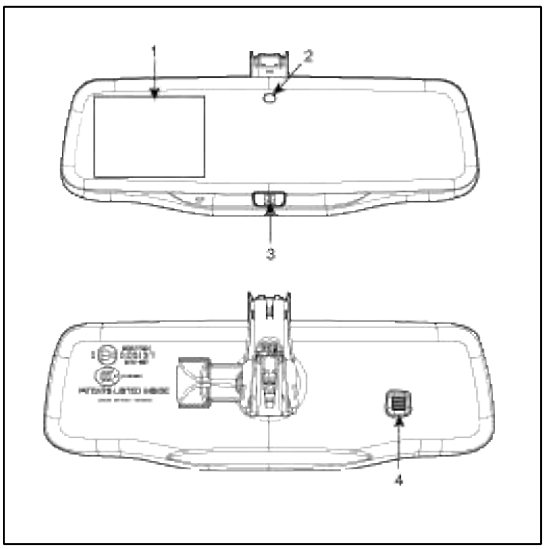


Reverse Display Room Mirror

Description

The back view camera system, located on the tailgate, provides a video image (which appears in the rear view mirror) of the area behind the vehicle. It adds assistance to the driver while reversing or reverse parking the vehicle. To use the back view camera system, place the transmission in R (Reverse); an image will display on the left portion of the rear view mirror. The area displayed on the screen may vary according to the vehicle orientation and/or road condition.

1. Rear camera display
2. Rearward sensor
3. Power button
4. Forward sensor



Use the side mirrors and back view mirror to get better coverage on both sides and rear of the vehicle. When shifting out of reverse and into any other gear, the image will remain on for a few seconds before it shuts off to assist in parking or trailer hookup.

The camera lens for the back view camera system is located on the tailgate, near the tailgate handle. Keep the lens clean so the video image remains clear and undistorted. Clean the lens with a soft, lint-free cloth and non-abrasive cleaner.

NOTE

If the back view camera system image is not clear or seems distorted, it may be covered with water droplets, snow, mud or any other substance. If this occurs, clean the camera lens before using the reverse camera system.

WARNING

The back view camera system is a reverse aid supplement device that still requires the driver to use it in conjunction with the back view mirror and the side mirrors for maximum coverage.

WARNING

Objects that are close to either corner of the bumper or under the bumper, might not be seen on the screen due to the limited coverage of the back view camera system.

WARNING

Backup as slow as possible since higher speeds might limit your reaction time to stop the vehicle.

WARNING

Do not use the back view camera system with the tailgate open.

If the back end of the vehicle is hit or damaged, then check with your authorized dealer to have your rear video system checked for proper coverage and operation.

Nighttime and dark area use

At night time or in dark areas, the back view camera system relies on the reverse lamp lighting to produce an image. Therefore it is necessary that both reverse lamps are operating in order to get a clear image in the dark. If either of the lamps are not operating, stop using the back view camera system, at least in the dark, until the lamp(s) are replaced and functioning.

Automatic-dimming Function

To protect your vision during nighttime driving, your mirror will automatically dim upon detecting glare from the vehicles traveling behind you. The auto-dimming function can be controlled by the Dimming ON/OFF Button :

1. Pressing and holding the Feature Control button for more than 3 but less than 6 seconds turns the auto-dimming function OFF which is indicated by the green Status Indicator LED turning off.
2. Pressing and holding the Feature Control button again for more than 3 but less than 6 seconds turns the auto-dimming function ON which is indicated by the green Status Indicator LED turning on.

NOTE

The mirror defaults to the "ON" position each time the vehicle is started.

Body Electrical System > Electro chromic Inside Rear View Mirror > Repair procedures

Inspection

Check it by the procedure below to see if the function of the ECM is normal.

1. Turn the ignition key to the "ON" position.
2. Cover the forward looking sensor to stop functioning.
3. Head a light to the rearward looking sensor.
4. The ECM should be darkened as soon as the rearward looking sensor detects the light.

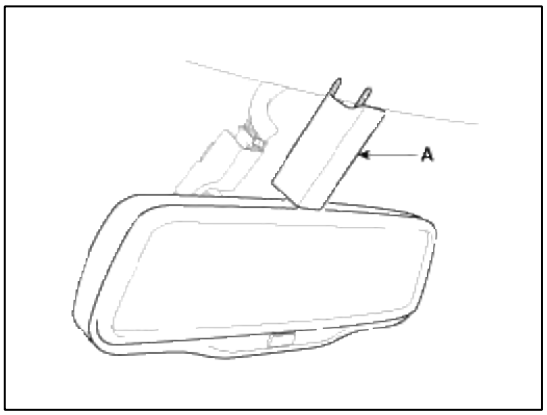
NOTE

If this test is performed in daytime, the ECM may be darkened as soon as the forward looking sensor is covered.

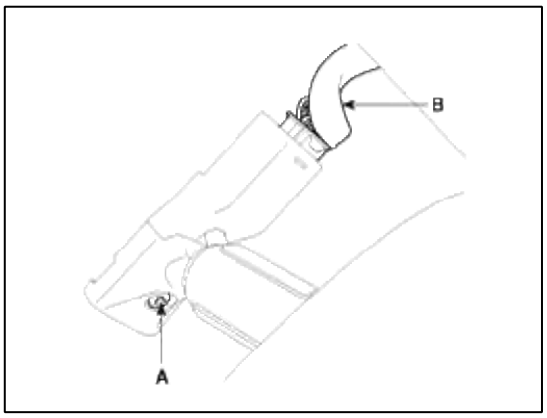
5. When the reverse gear is engaged, the ECM should not be darkened.
   When heading lights to both the forward looking and rearward looking sensors, the ECM should not be darkened.

Removal

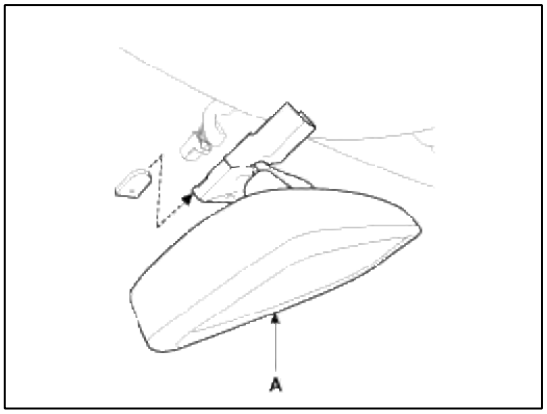
1. Remove the mirror wire cover(A).



2. Disconnect the inside rear view mirror connector(B) and screw (A).



3. Remove the inside rear view mirror pulling it upside carefully.

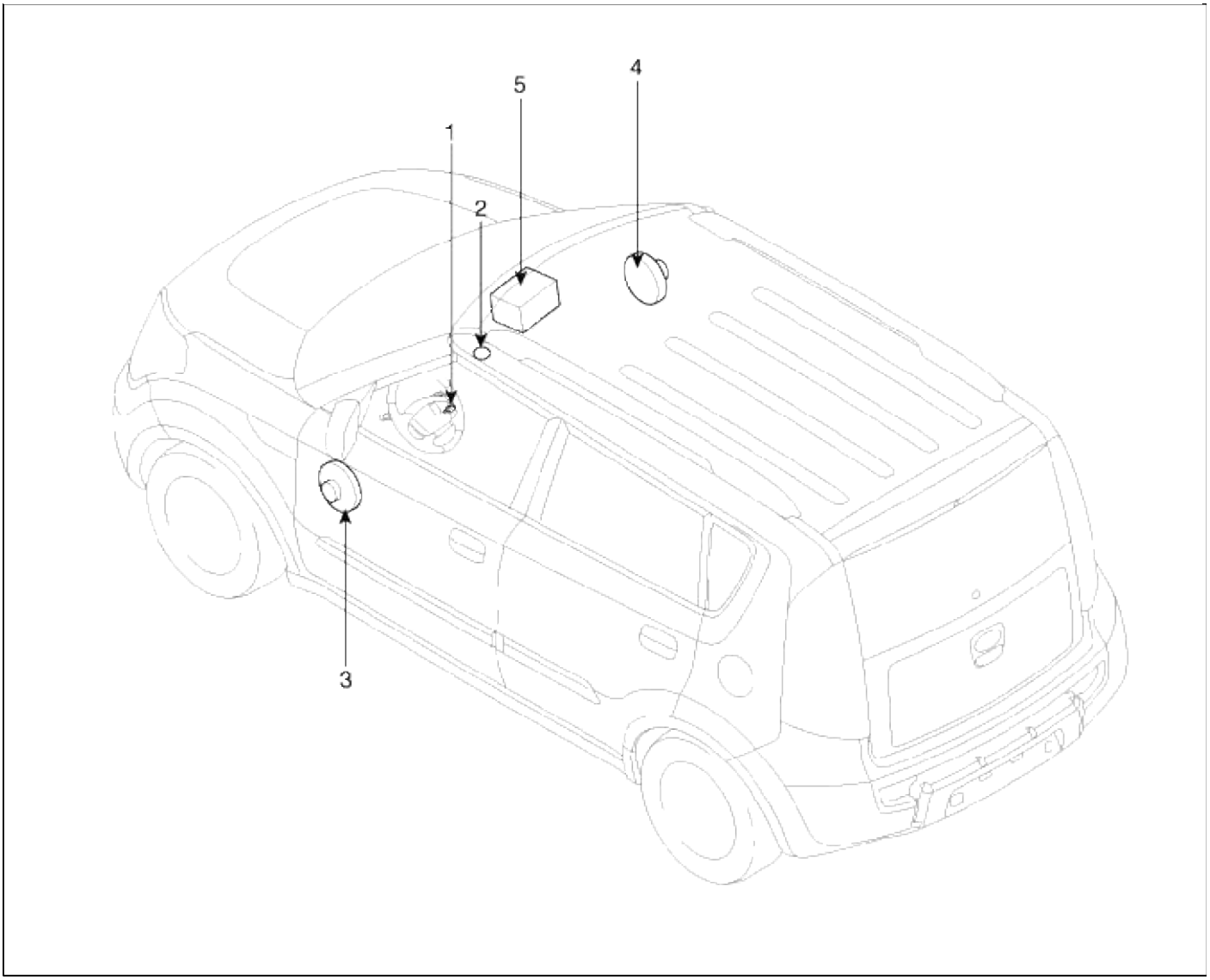


Installation

1. Install the inside rear view mirror.
2. Connect the inside rear view mirror connector.
3. Install the mirror wire cover.

Body Electrical System > Hands Free System > Components and Components Location

Components



1. Hands free call switch 2. Mic 3. Front left speaker	4. Front right speaker 5. Audio head unit (hands free control)

There is no hands free jack. This system supports Bluetooth(wireless system).

Body Electrical System > Hands Free System > Description and Operation

Function

General Feature

- This system supports Bluetooth, a wireless system that allows you to make or receive calls without taking your hands from the steering wheel and without using cables to connect the phone and system.

- The phone must be paired to the system before using the hands-free feature.
  Only one linked cellular phone can be used with the system at a time. The system is available in English, US Spanish, or Canadian French languages.

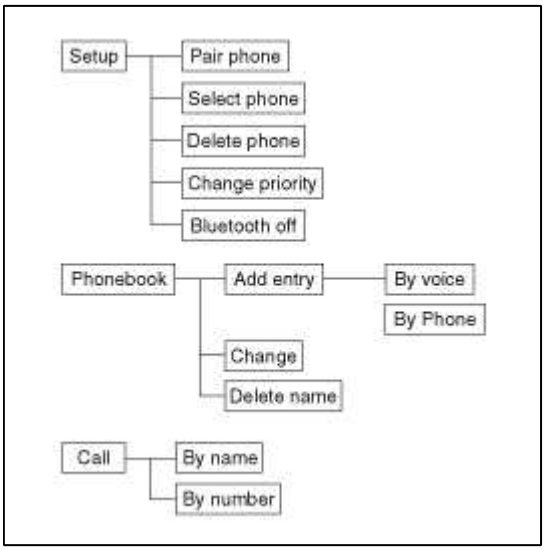
> CAUTION
>
> If the vehicle is moving do not use a cellular phone or connect the Bluetooth phone.

> NOTE
>
> Some Bluetooth devices do not offer a perfect compatibility with this system.

Voice Recognition Activation

- The voice recognition engine containedin the Bluetooth System can be activatedin the following conditions:
  - Button Activation
  The voice recognition system will beactive when the button is pressed and after the sound of a Beep.
  - Active Listening
  The voice recognition system will beactive for a period of time when the Voice Recognition system has askedfor a customer response.
- The system can recognize single digits from zero to nine while number greaterthan ten will not be recognized.
- If the command is not recognized, the system will announce "Pardon" or Noinput voice signal from microphone. (Noresponse)
- The system shall cancel voice recogntionmode in following cases : When pressing the button and saying cancel following the beep. When not making a call and pressing the button. When voice recognition has failed 3 consecutive times.
- At any time if you say "help", the system will announce what commands are available.

Menu tree



Phone Setup

Pairing phone

To use the hands-free system, you need to register your phone in the system. Up to 5 phones can be registered in the system.

1. Press the button.
2. Say "Set Up".

3. Say "Pair Phone".
4. Say "Yes".
5. Say the name of the contact.
6. Say "Yes".
7. The Pairing procedure of the cellularphone varies according to each cellularphone.

> NOTE
>
> The system may not function in the following cases:
> If 5 phones have already been registered.If the system cannot communicate with the phone.

To connect phone

The registered phones can be selected. When the system connects to Bluetooth, the phone previously used is automatically selected. Select a different phone if necessary. Only the selected phone can be used with the hands-free system.

1. Press the button.
2. Say "Set Up".
3. Say "Select Phone".
4. Say the name of the contact or the number of the contact.
5. Say "Yes".

> NOTE
>
> The system may not function in the following cases:
> If the phone is not found.
> If the system does not recognize the voice command.

Deleting phone

The registered phones can be deleted.

1. Press the button.
2. Say "Set Up".
3. Say "Delete Phone".
4. Say the name of the contact, the number of the contact or "Delete all phone".
5. Say "Yes".

Receiving a phone call
When receiving a phone call, a ring toneis audible and the system changes into telephone mode.
When receiving a phone call, the phone number and the message "Incoming" will be displayed.

- Do either one of the following:
  Press the send switch to take the call. Press the end switch to refuse the call.
- To adjust the ring volume, push "+" or "-" on the steering volume controls.
  Volume adjustment cannot be madeusing the audio system.

- To transfer a call to the phone:
  The received call can be transferred from the hands-free system to the cellularphone that is connected to Bluetooth.
  For details, please refer to you user's manual for the cellular phone or go to the Key matrix in this manual (next page).

Talking on the phone
When talking on the phone, the display will differ depending on whether or not the vehicle is in motion.
Number and "active call" is displayed.
When the call is finished, press the end switch.

NOTE

In the following situations, your voice may not reach the other party:

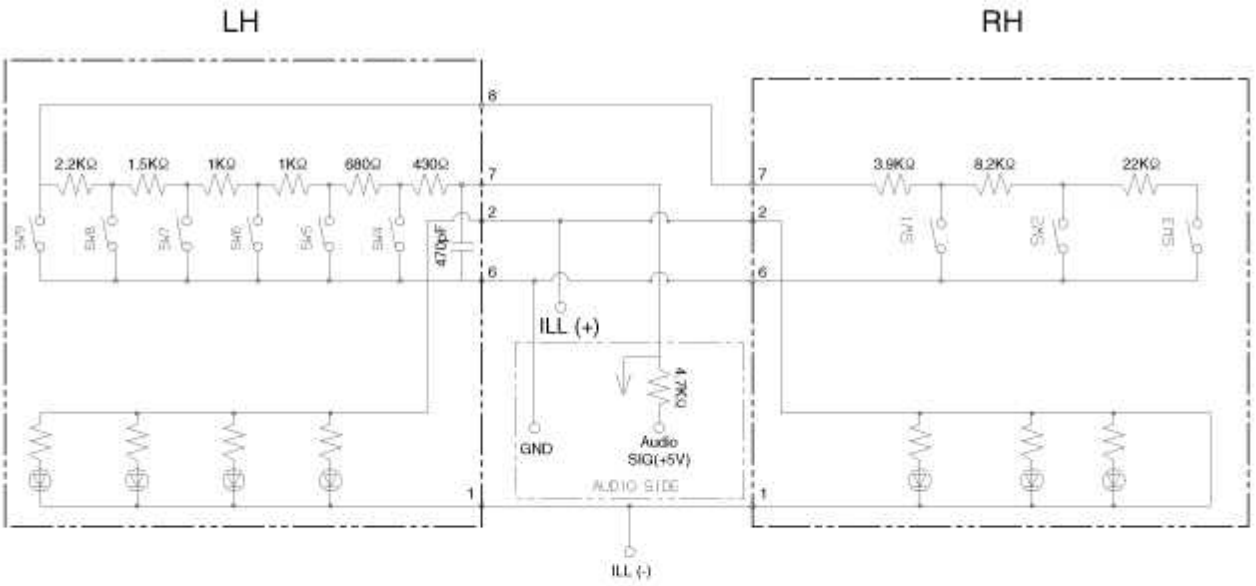
1. Talk alternately with the other partyon the phone. If you talk at the sametime, the voice may not reach eachother parties. (This is not a malfunction.)(It is not a malfunction.)
2. Keep the volume of receiving voice to a low level. Otherwise, high volumes may result in an echo. When you talk on the phone, speak clearly towards the microphone.
3. When driving on a rough road.
4. When driving at high speeds.
5. When the window is open.
6. When the air conditioning vents are facing the microphone.
7. When the sound of the air conditioning fan is loud.

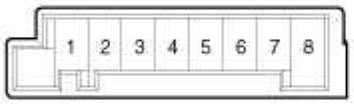
Key matrix

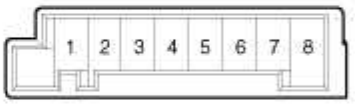
No.	KEY		Class							
			Paired H/P Empty	Disconnected	Connected		Incoming Call	Outgoing Call	Active Call	Active Call
					Normal mode	BT SETUP menu				
1		SHORT	Not Paired	Not Connecting	-	-		-	2nd call 1st Call:waiting 2nd Call:active	2nd Call 2nd Call:waiting 1st Call:active
		LONG	-	-	-	-	-	-	Transfer call:secret call	
2		SHORT	VR MODE Cancel	VR MODE Cancel	VR MODE Cancel	VR MODE Cancel	Reject Call	End Call	End Call	End Call
		LONG [10sec]	-	-	Speaker Adaptation (Only English)	Speaker Adaptation (Only English)	-	-	-	-
3		SHORT	Active	Active	Active	Active	-	-	-	-
		LONG [10sec]	Change language	Change language	Change language	Change language	-	-	-	-

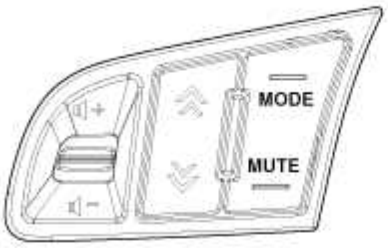
Circuit Diagram

[Audio + Bluetooth hands free]

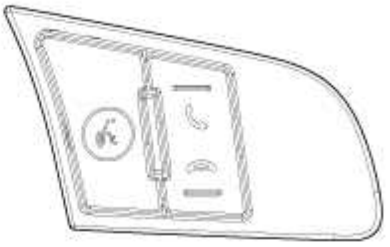






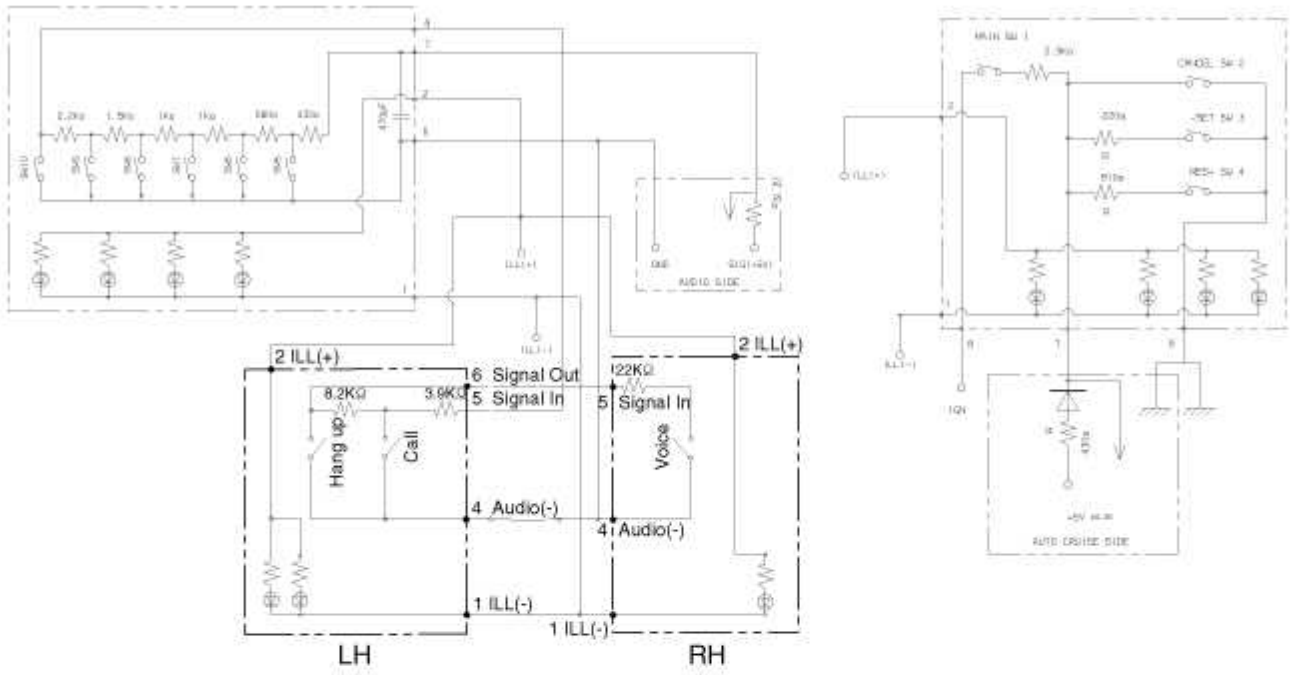


[LH]



[RH]

[Audio + Cruise + Bluetooth hands free]

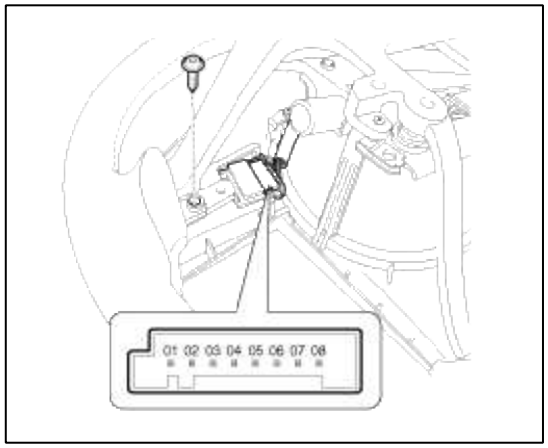




Body Electrical System > Hands Free System > Hands Free Switch > Repair procedures

Inspection

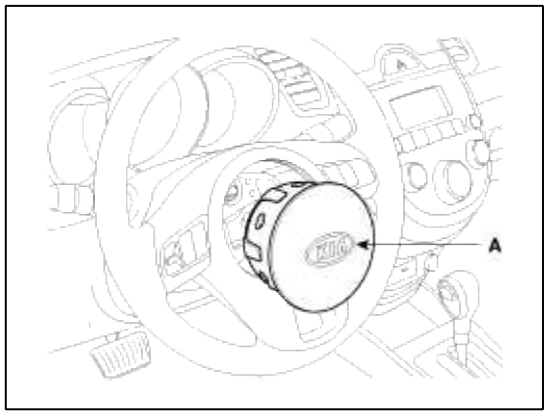
1. Check the hands free remote control switch for resistance between No.3 and No.4 terminals in each switch position.



Switch	Connector terminal	Resistance (±5%)
HANG UP	6 - 7 (RH)	18.91 kΩ
CALL	6 - 7 (RH)	10.71 kΩ
VOICE Recognition	6 - 7 (RH)	40.91 kΩ

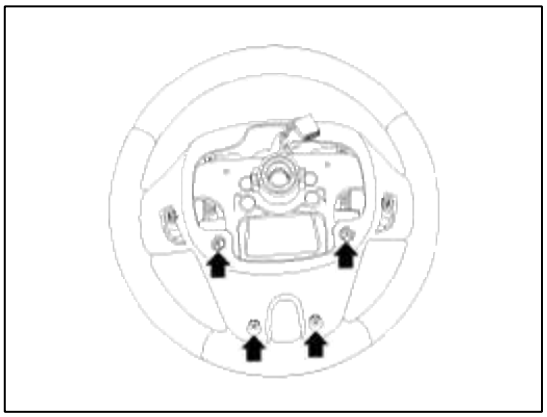
Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the driver airbag module(A).
   (Refer to the airbag group)

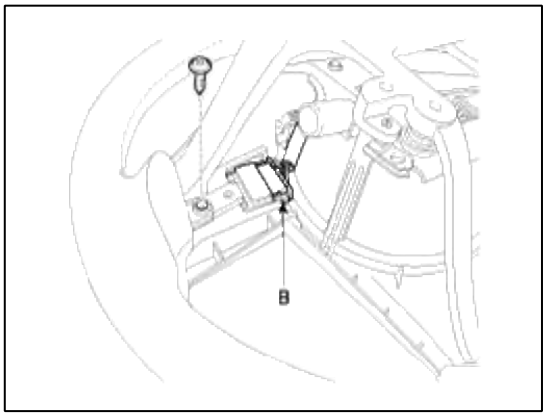


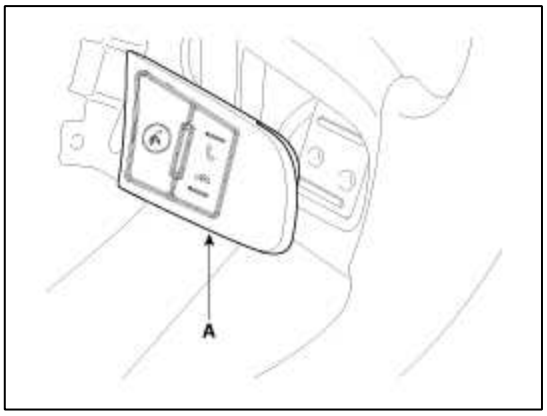
3. Remove the steering wheel.
   (Refer to ST group - "Steering column & shaft")

4. Remove the steering wheel cover after loosening the 4 screws.



5. Remove the hands free remote control switch(A) after removing the steering wheel remote control switch connector(B) and 2 screws.





Installation

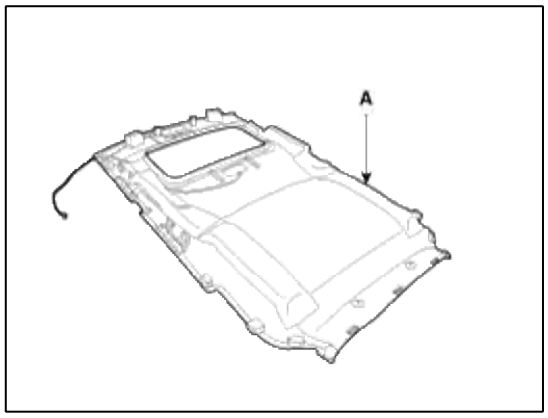
1. Reassemble the steering wheel remote control switch after connecting the connector.
2. Reassemble the steering wheel.
3. Reassemble the driver airbag module.

> NOTE
>
> Make sure the hands free remote control switch and the airbag module connectors are plugged in properly.

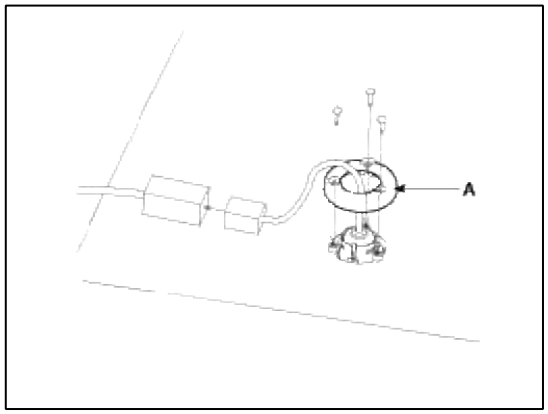
Body Electrical System > Hands Free System > Hands Free Mic > Repair procedures

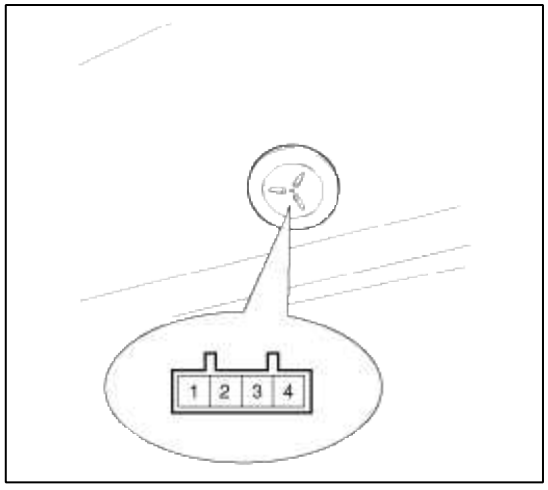
Inspection

1. Disconnect the negative(-) battery terminal.
2. Remove the roof trim(A).
   (Refer to the Body group - "Roof trim")

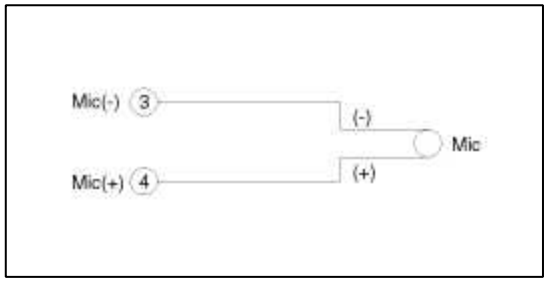


3. Remove the hands free mic(A) after loosening the connector and screw(3EA) from loof top.





4. Check the continuity of Mic between terminals.



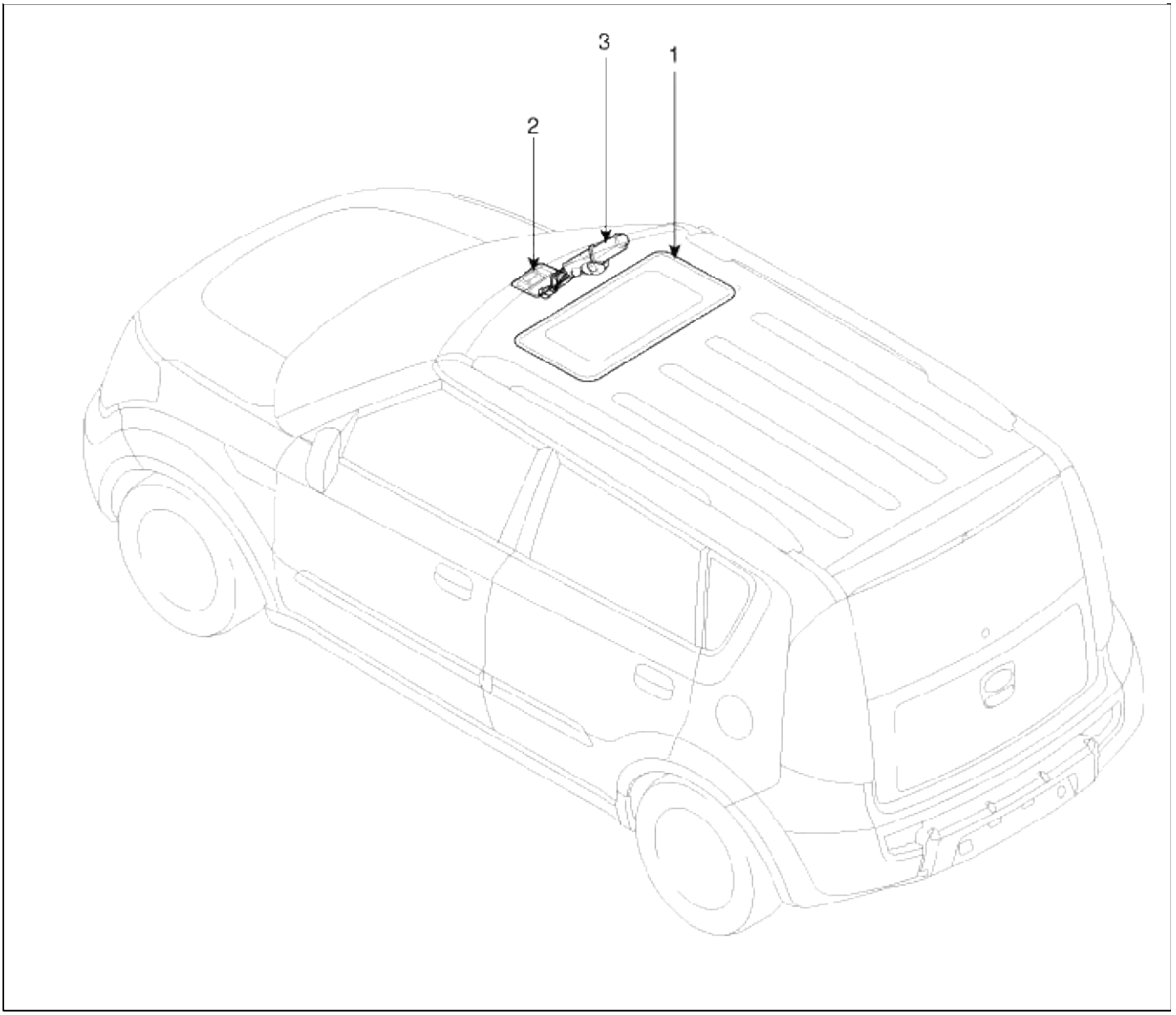
Body Electrical System > Hands Free System > Troubleshooting

Troubleshooting

Problem	Possible cause	Solution
Not pairing	Bluetooth device of Car is not discoverable mode	Enter Bluetooth pairing (searching) mode
	User's phone is Bluetooth off mode	User's phone set Bluetooth on
	Making an attempt pairing others bluetooth system	Check Bluetooth device name and address (12 word) to attempt paring Ex) 000B24FFF123
	Pass key error	Input the passkey displayed on the audio screen into the phone.
	5 phones have already been registered.	Delete paired phone list
	Bluetooth system cannot communicate with the phone.	Refer to IOP sheet IOP : Inter-operability
Not connection	User's phone or Bluetooth device of Car dose not register Bluetooth device to connect	Retry pairing
	Bluetooth system cannot communicate with the phone.	Waiting 1minute then Retry connection or phone power off/on. Refer to IOP sheet
Not redial	User phone system issue	Push the 2 times Send button
Not accept call	User phone system issue	Refer to IOP sheet
Not dialing	User's phone playing other menu (internet, mp3, game, etc..)	Stop other menu then set normal mode
	Bluetooth system cannot communicate with the phone	Refer to IOP sheet

Body Electrical System > Sun Roof > Components and Components Location

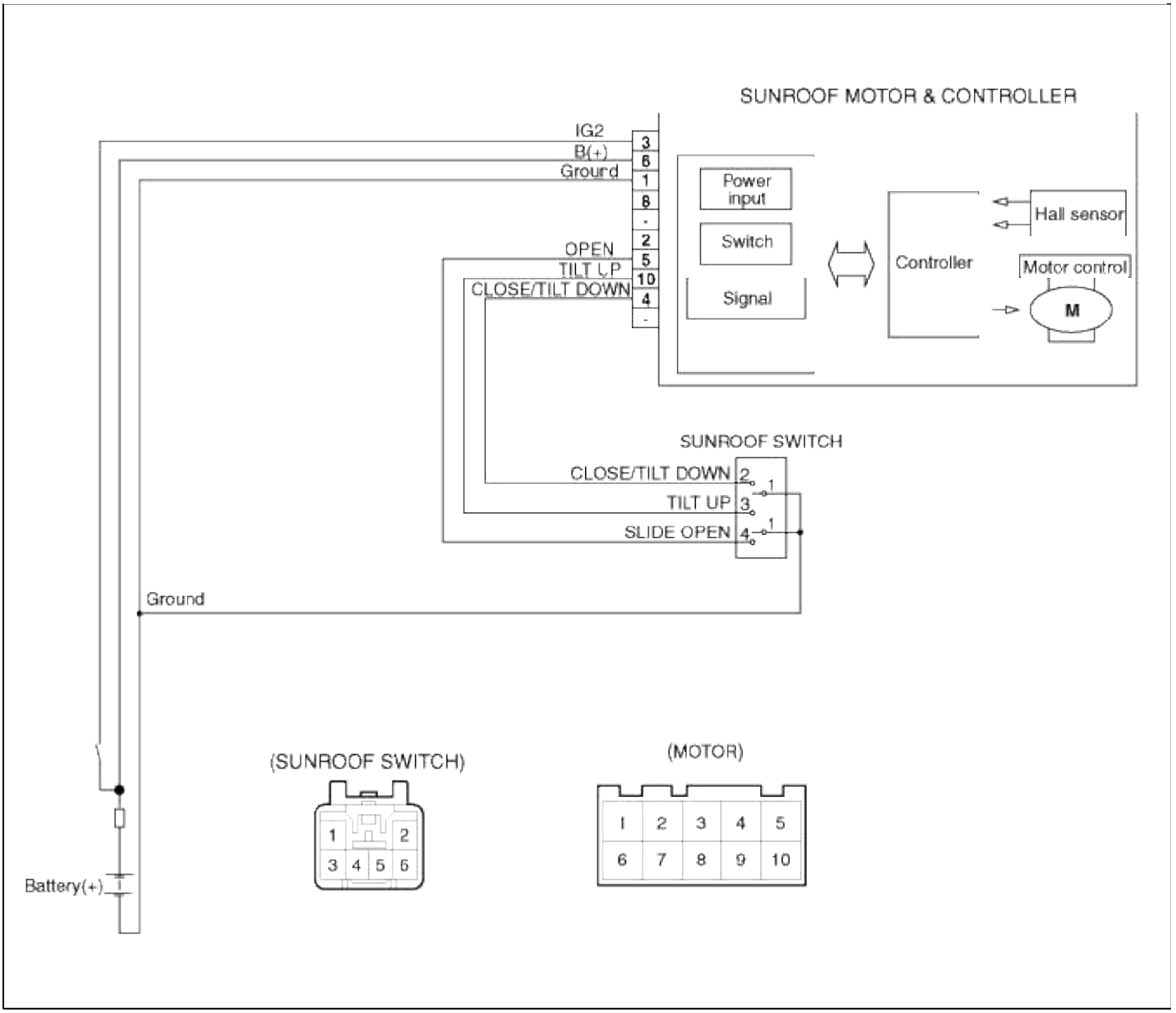
Component Location



1. Sunroof 2. Sunroof switch	3. Sunroof motor & controller

Body Electrical System > Sun Roof > Schematic Diagrams

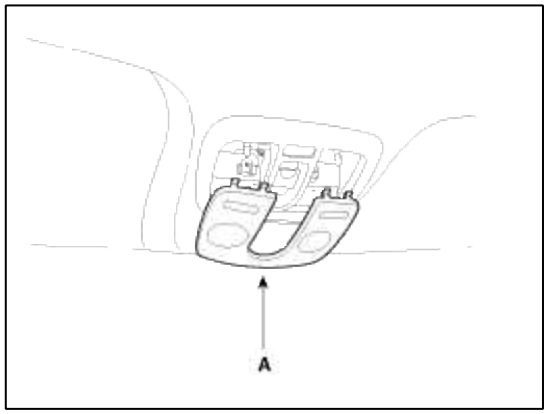
Circuit Diagram



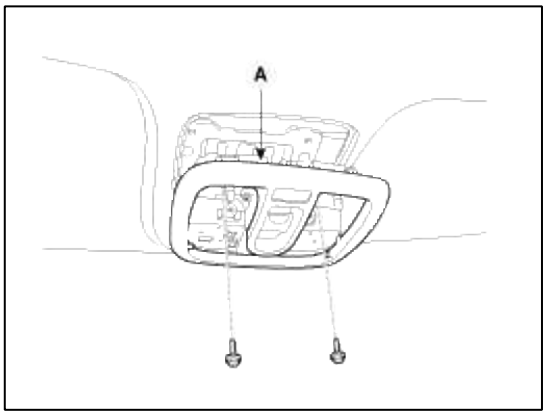
Body Electrical System > Sun Roof > Sunroof Switch > Repair procedures

Inspection

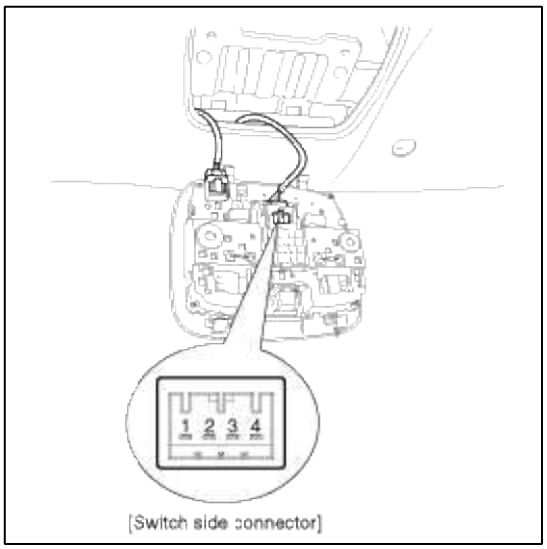
1. Disconnect the negative (-) battery terminal.
2. Detach the lamp lens (A) from the overhead console lamp with a flat-tip screwdriver.



3. Remove the over head console lamp (A) after removing the screws (2EA).



4. Check for continuity between the terminals. If the continuity is not as specified, replace the sunroof switch.



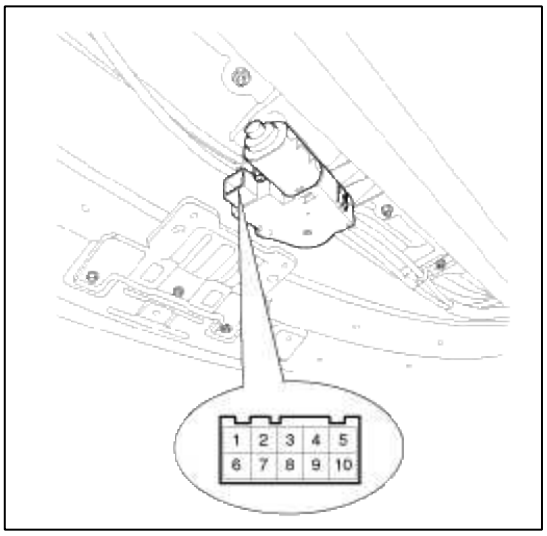
Position \ Terminal	1	2	4	3
TILT UP	○			○
CLOSE/ TILT DOWN	○		○	
SLIDE OPEN	○	○		

Body Electrical System > Sun Roof > Sunroof Motor > Repair procedures

Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the overhead console and roof trim.
   (Refer to the Body group - "Roof trim")

3. Remove the sunroof motor after removing the screws (3EA) and connector (10P).



4. Ground the terminals as below table, and check that the sunroof unit operates as below table.

Position \ Terminal	3	4	5	10
TILT UP	⊖			⊖
SLIDE CLOSE/DOWN	⊕	⊖		
SLIDE OPEN	⊖		⊖	

5. Make these input tests at the connector
   if any test indicates a problem, find and correct the cause, then recheck the system.
   If all the input tests prove OK, the sunroof motor must be faulty; replace it.

Terminal	Test condition	Test : Desired result
3	IG2 ON	Check for voltage to ground : There should be battery voltage
1	Under all conditions	Check for continuity to ground : There should be continuity.
6	Under all conditions	Check for voltage to ground : There should be battery voltage.

Resetting The Sunroof

Whenever the vehicle battery is disconnected or discharged, or you use the emergency handle to operate the sunroof, you have to reset your sunroof system as follows :

1. Turn the ignition key to the ON position.

2. According to the position of the sunroof, do as follows.
   (1) In case that the sunroof has closed completely or been tilted :
   Press the TILT button until the sunroof has tilted upward completely.
   (2) In case that the sunroof has slide-opened :
   Press and hold the CLOSE button for more than 5 seconds until the sunroof has closed completely.
   Press and hold the CLOSE button for more than 5 seconds after the sunroof has closed completely. Press the TILT button until the sunroof has tilted upward completely.

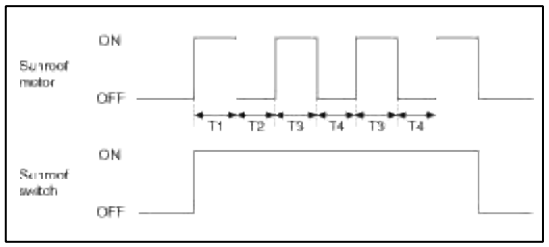
3. Release the TILT button.

4. Press and hold the TILT button once again until the sunroof has returned to the original position of TILT after it is raised a little higher than the maximum TILT position.
   When this is complete, the sunroof system is reset.

Protecting Motor From Overheating

In order to protect the sunroof motor from overheating from continuous motor operation, the sunroof ECU controls the Run-time and Cool-time of the motor as follows:

1. The Sunroof ECU detects the Run- time of motor
2. Motor can be operated continuously for the 1st run-time(120 ± 10sec.).
3. The continuous operation of motor stops after the 1st Run-time(120 ± 10sec.).
4. Then Motor is not operated for the 1st Cool-time(18 ± 2sec.).
5. Motor is operated for the 2nd Run-time(10 ± 2sec.) at the continued motor operation after 1st Cool-time(18 ± 2sec.)
6. The continuous operation of motor stops operating after the 2nd Run-time(10 ± 2sec.)
7. Motor is not operated for the 2nd Cool-time(18 ± 2sec.).
8. Motor repeats the 2nd run-time and 2nd cool-time at the continued motor operation.
   A. In case that motor is not operated continuously, the run-time is increased.
   B. The Run-Time of motor is initialized to "0" if the battery or fuse is reconnected after being disconnected, discharged or blown.



T1 : 120 ± 10 sec., T2 : 18 ± 2 sec.,
T3 : 10 ± 2 sec., T4 : 18 ± 2 sec.

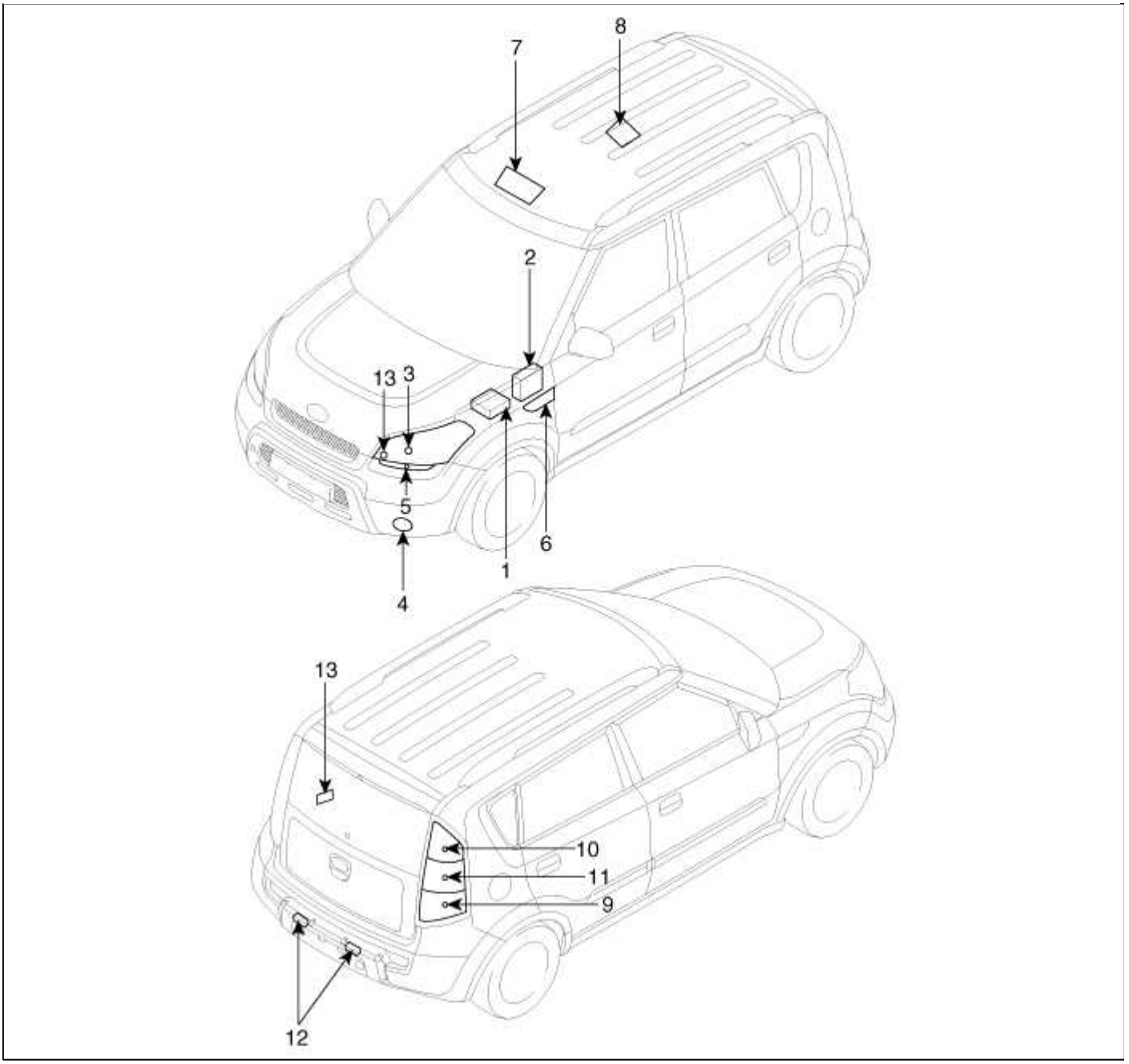
Body Electrical System > Lighting System > Specifications

Specification

Items	Bulb Wattage (W)
Head lamp (High/Low)	60/55
Front turn signal lamp	27
Front fog lamp	35
Position lamp	5
Rear stop/tail lamp	27/8
Back up lamp	16
Rear turn signal lamp	27
License plate lamp	5
Side marker	5
Room lamp	10
Overhead console lamp	10
High mounted stop lamp	5
Luggage room lamp	5
Turn signal lamp - Outside mirror	5

Body Electrical System > Lighting System > Components and Components Location

Component Location



1. Engine room junction box (Head lamp Low/High, Fog lamp relay) 2. Passenger compartment junction box (Tail lamp relay,Hazard relay) 3. Head lamp (Low/High) 4. Front fog lamp 5. Front turn signal lamp 6. Side marker	7. Over head lamp 8. Room lamp(Center) 9. Tail/Stop lamp 10. Rear turn signal lamp 11. Back up lamp 12. License plate lamp 13. Luggage room lamp

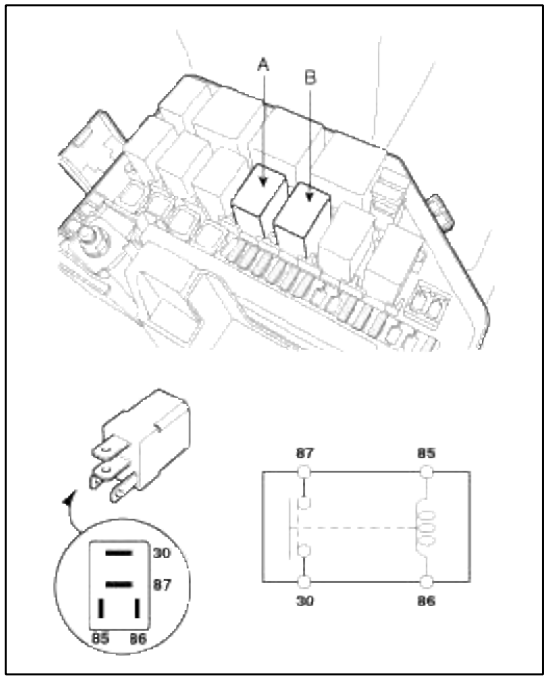
Body Electrical System > Lighting System > Head Lamps > Repair procedures

Inspection

Head Lamp Relay / Front Lamp Relay

1. Disconnect the negative(-) battery terminal.

2. Pull out the relay from the engine compartment relay box.
   A : Head lamp(Low) relay
   B : Head lamp (High) relay



3. Check for continuity between terminals. There should be continuity between the No.87 and No.30 terminals when power and ground are connected to the No.86 and No.85 terminals.

4. There should be no continuity between the No.87 and No.30 terminals when power is disconnected.

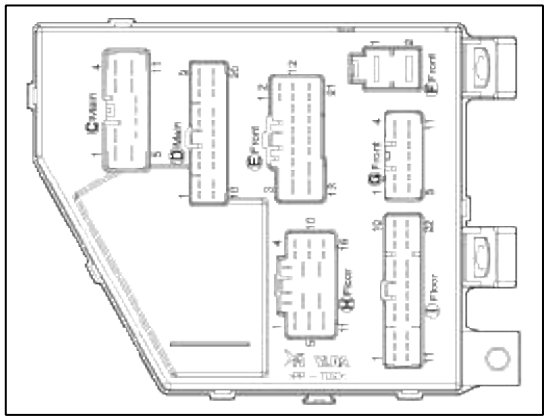
Terminal / Power	30	87	85	86
Disconnected			○	○
Connected	○	○	⊖	⊕

Tail Lamp

1. Disconnect the negative(-) battery terminal.

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

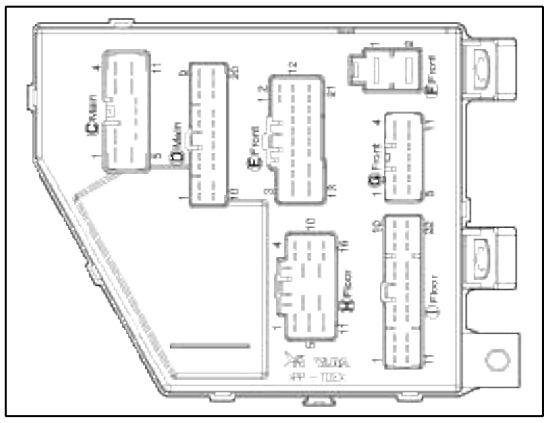
3. Remove the junction box.



4. Check for continuity between the terminals.
   (1) There should be continuity between the No.1 terminal in the I/P-F and the No.17(LH) or 16(RH) terminal in the I/P-I when power and ground are connected to the No.1 terminal in the I/P-F and the No.18 terminal in the I/P-A.
   (2) There should be no continuity between the No.1 terminal in the I/P-F and the No.17(LH) or 16(RH) terminal in the I/P-I when power is disconnected.

Front Fog Lamp

1. Disconnect the negative(-) battery terminal.
2. Remove the crash pad lower panel.
   (Refer to the Body group - "Crash pad")
3. Remove the junction box.



4. Check for continuity between the terminals.
   (1) There should be continuity between the No.1 terminals in the I/P-F and No.11 terminals in the I/P-G when power and ground are connected to the No.1 terminals in the I/P-F and No.3 terminals in the I/P-A.
   (2) There should be no continuity between the No.1 terminals in the I/P-F and No.11 terminals in the I/P-G when power is disconnected.

Adjustment

Head Lamp Aiming Instructions

CAUTION

Head lamps become very hot during use; do not touch them or any attaching hardware immediately after they have been turned off.

The head lamps should be aimed with the proper beam-setting equipment, and in accordance with the equipment manufacturer's instructions.

NOTE

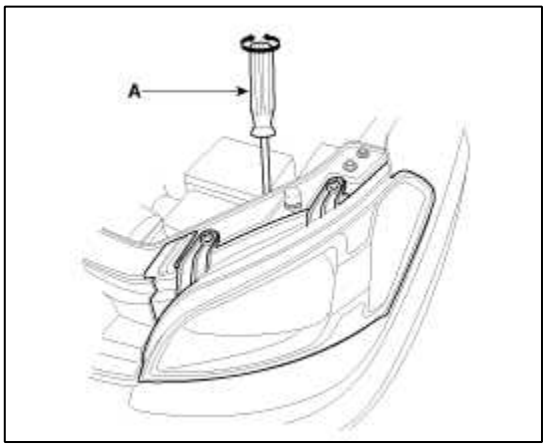
If there are any regulations pertinent to the aiming of head lamps in the area where the vehicle is to be used, adjust so as to meet those requirements.

Alternately turn the adjusting gear to adjust the head lamp aiming. If beam-setting equipment is not available, proceed as follows :

1. Inflate the tires to the specified pressure and remove any loads from the vehicle except the driver, spare tire and tools.

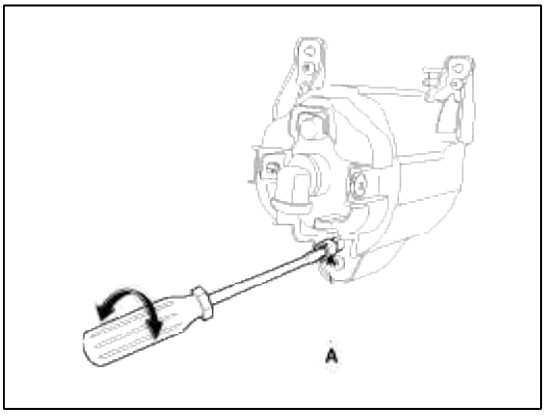
2. The vehicle should be placed on a flat floor.
3. Draw vertical lines (Vertical lines passing through respective head lamp centers) and a horizontal line (Horizontal line passing through center of head lamps) on the screen.
4. With the head lamp and battery in normal condition, aim the head lamps so the brightest portion falls on the horizontal and vertical lines.
   Make vertical(A) adjustments to the lower beam using the adjusting wheel.

Condition	Aiming Direction
	A
Turning Clockwise	UP
Turning Counter clockwise	DOWN

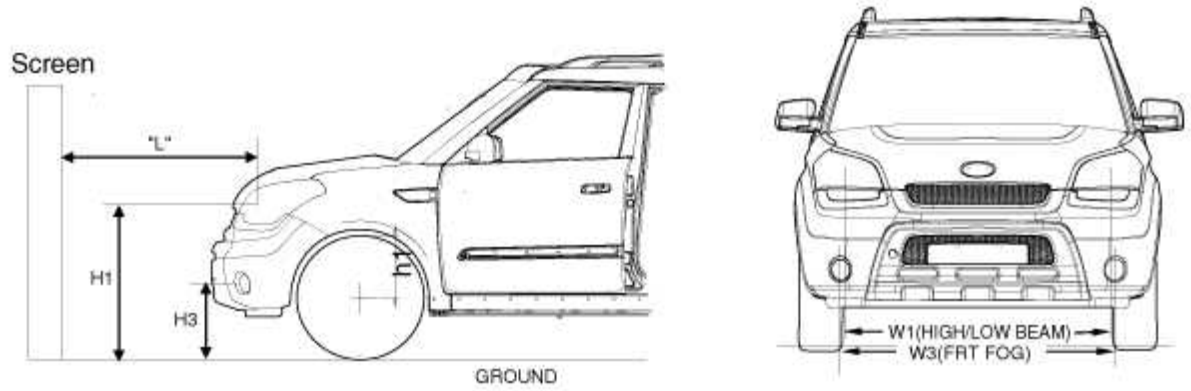


Front Fog Lamp Aiming
The front fog lamps should be aimed as the same manner of the head lamps aiming.
With the front fog lamps and battery normal condition, aim the front fog lamps by turning the adjusting gear (A).

Condition	Aiming Direction
Turning Clockwise	DOWN
Turning Counter clockwise	UP



Head Lamp And Fog Lamp Aiming Point

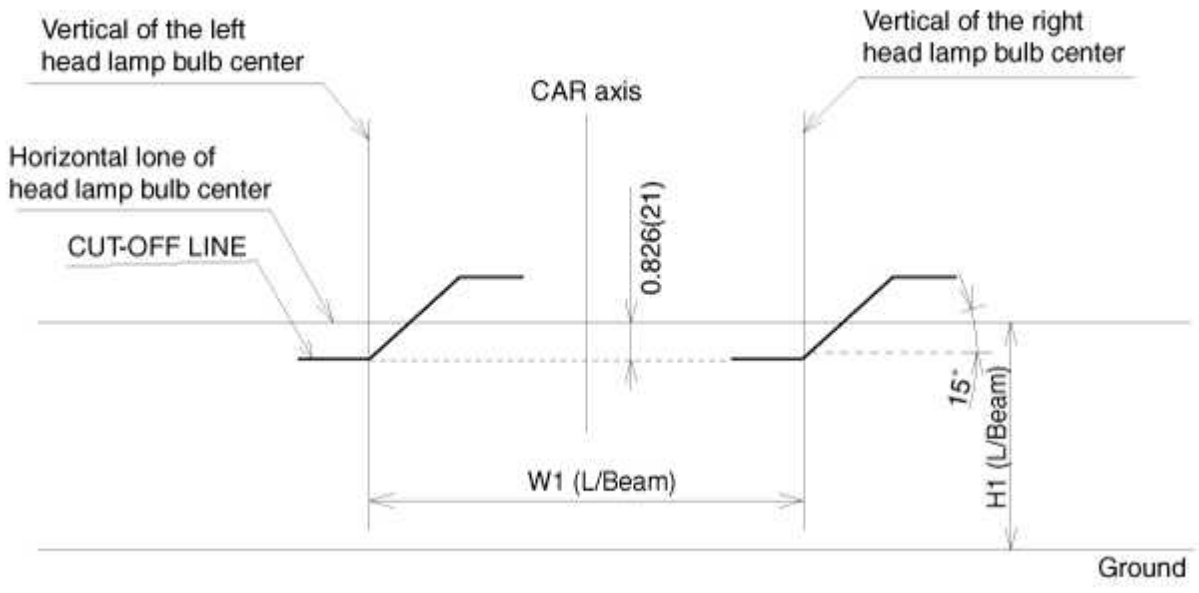


H1 : Height between the head lamp bulb center and ground (Low/High beam)
H3 : Height between the fog lamp bulb center and ground
W1 : Distance between the two head lamp bulbs centers (Low/High beam)
W3 : Distance between the two fog lamp bulbs centers
L : Distance between the head lamp bulb center and screen
h1 : Ride height

Unit : in (mm)

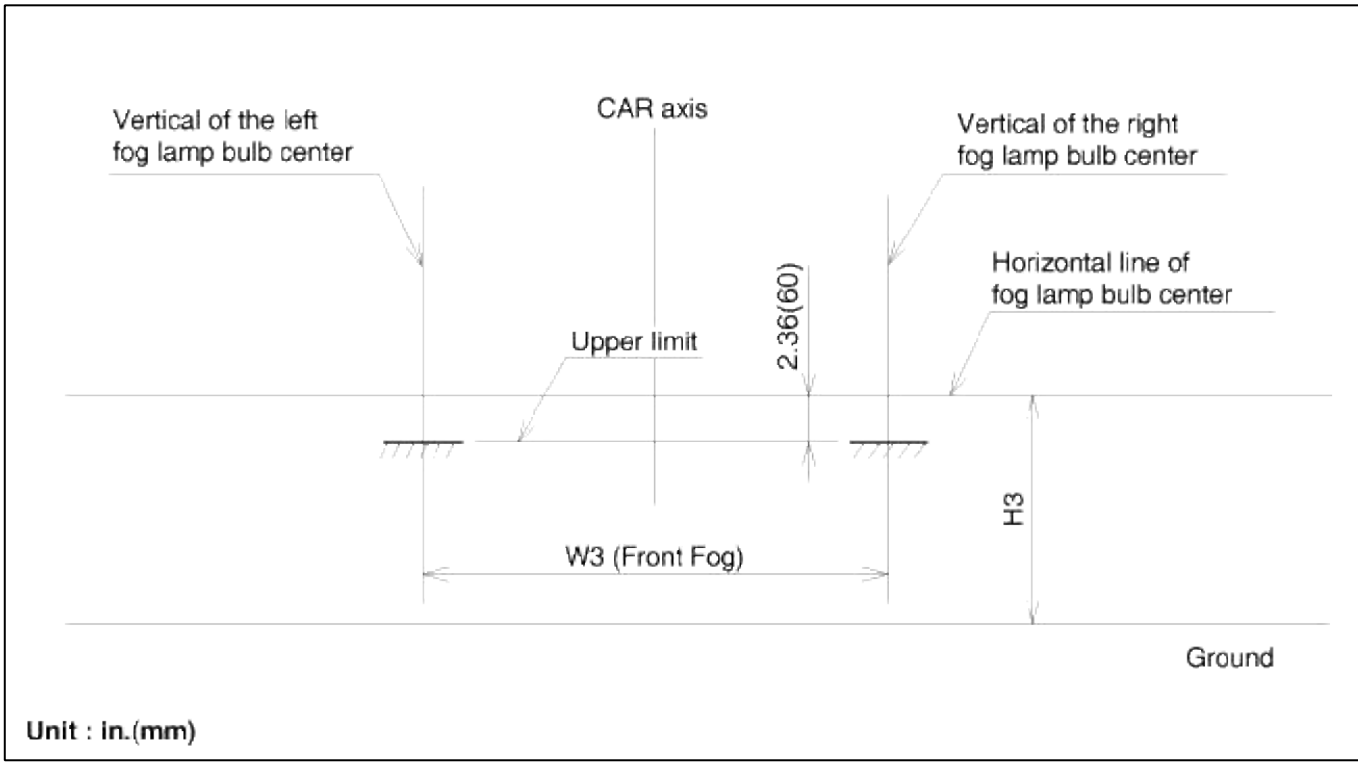
Vehicle condition	H1	H3	W1	W3	L
Without driver	33.4(849)	15.1(383)	47.8(1214)	52.6(1338)	118.1(3000)
With driver	33.2(843)	14.8(377)			

1. Turn the low beam on with driver.
   The cut-off line should be projected in the allowable range shown in the picture.
   In case of equipping with the manual leveling device, set the leveling device switch on the "O" position.



Unit : in.(mm)

2. Turn the front fog lamp on with driver.
   The cut-off line should be projected in the allowable range shown in the picture.



Removal

CAUTION

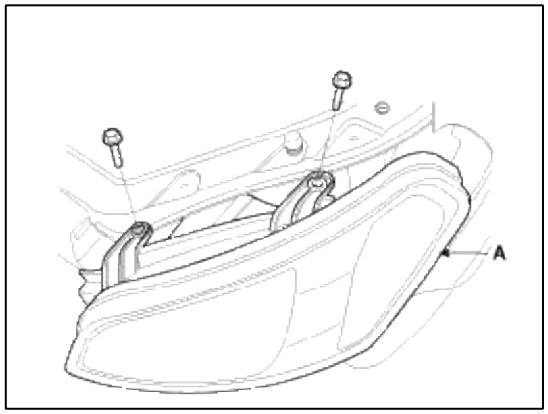
Head lamps become very hot during use; do not touch them or any attaching hardware immediately after they have been turned off.

NOTE

The headlamp bulb should not be removed from the headlamp assembly until just before a new bulb is installed.
Removing bulb for an extended period of time may affect headlamp bulb performance.
Contaminants may enter the headlamp assembly where they can settle on the lens and reflector.
Never turn on the head lamps with the bulb removed from the headlamp assembly.

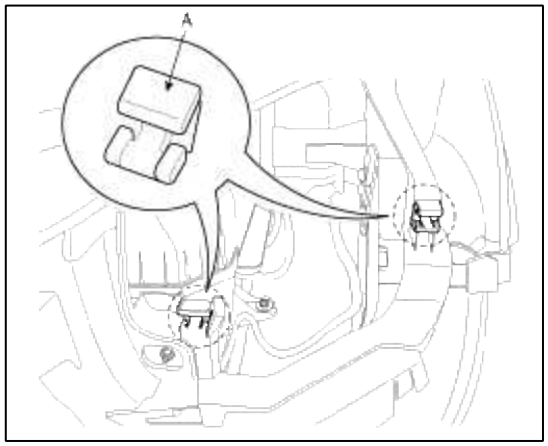
1. Disconnect the negative (-) battery terminal.
2. Remove the front bumper. (Refer to the Body group - "Front bumper")

3. Loosen the mounting bolts (2EA) of head lamp. Remove the head lamp assembly (A) after disconnecting the lamp connectors.

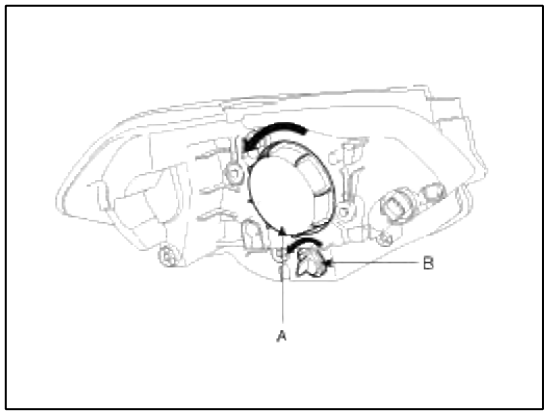


NOTE

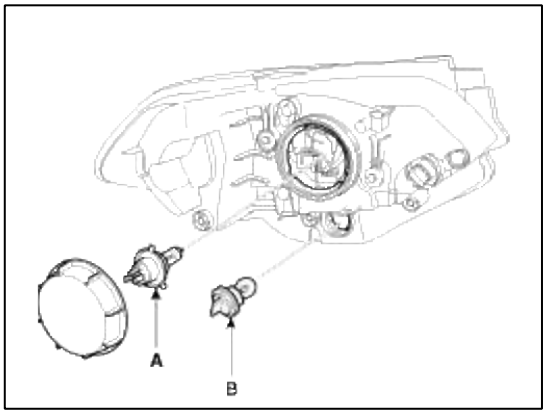
Take care that retaining clip (A) is not to be damaged.



4. Remove the bulb caps from the head lamp assembly after turning in the counter clock-wise direction.
   A : Head lamp low/high bulb
   B : Turn signal bulb cab



5. Remove the head lamp bulbs after releasing the lock of the set spring.
   A : Head lamp low/high bulb, B : Turn signal bulb



Installation

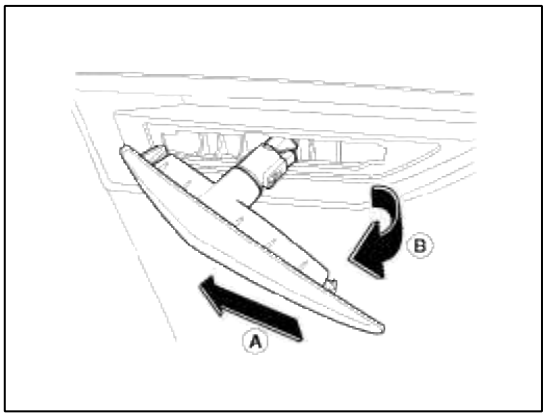
1. Install the head lamp bulbs.
2. Install the head lamp bulb caps.
3. Install the head lamp assembly after connecting the lamp connector.

Body Electrical System > Lighting System > Turn Signal Lamp > Repair procedures

Removal

Side marker

1. Disconnect the negative (-) battery terminal.
2. Push the side marker lamp assembly in the direction of (A) and then pull it in the direction of (B).



CAUTION

Be careful not to damage the fixing clip.

3. Replace the lamp bulb.

Installation

Side marker

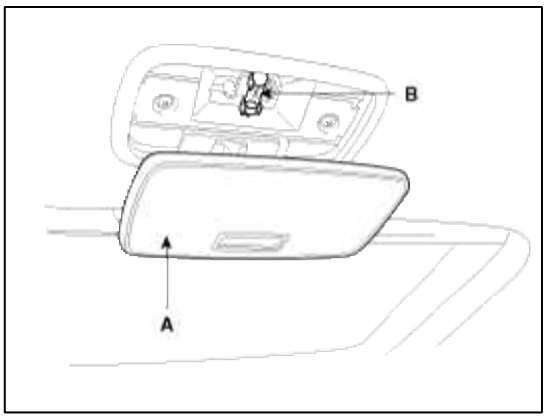
1. Install the lamp bulb.

2. Install the the side marker lamp assembly.

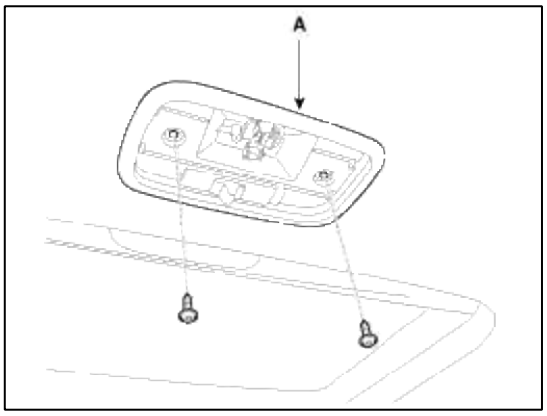
Body Electrical System > Lighting System > Room Lamp > Repair procedures

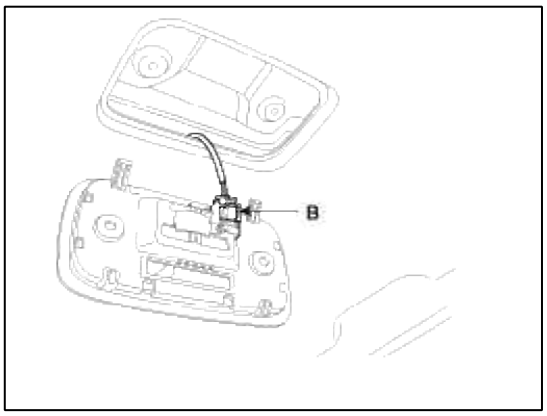
Removal

1. Disconnect the negative (-) battery terminal.
2. Detach the lamp lens (A) from the room lamp with a flat-tip screwdriver then remove the bulb (B).



3. Loosen the fixing screw (2EA) and disconnect the 3P connector(B). And then remove the room lamp assembly (A).



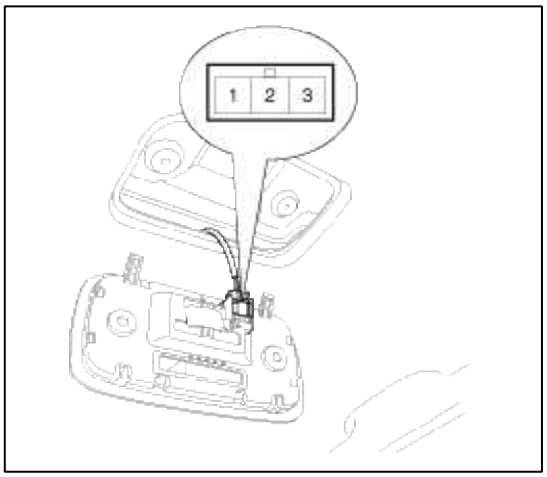


Installation

1. Install the room lamp assembly after connecting the lamp connector.
2. Install the lamp lens after assembling the bulb.

Inspection

1. Remove the room lamp assembly then check for continuity between terminals.

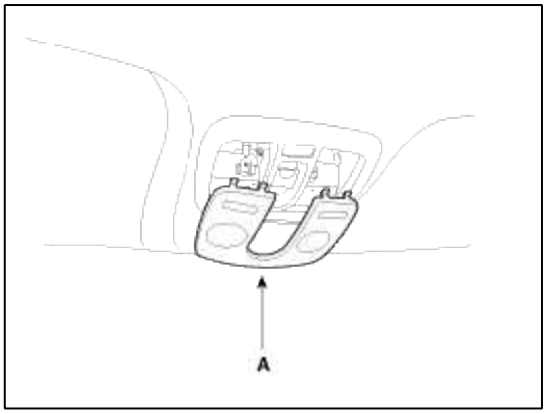


Terminal / Position	1	3	2
DOOR		○—(M)—○	
ON	○—(M)—○		
OFF			

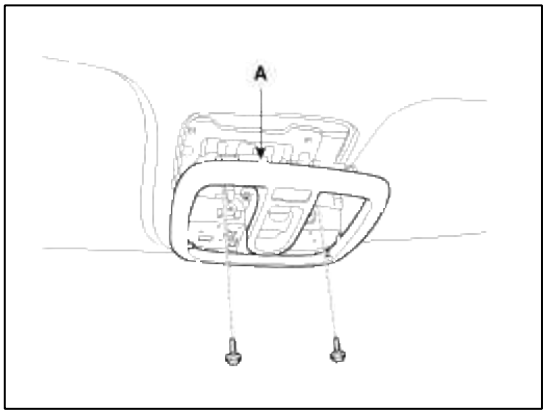
Body Electrical System > Lighting System > Overhead Console Lamp > Repair procedures

Removal

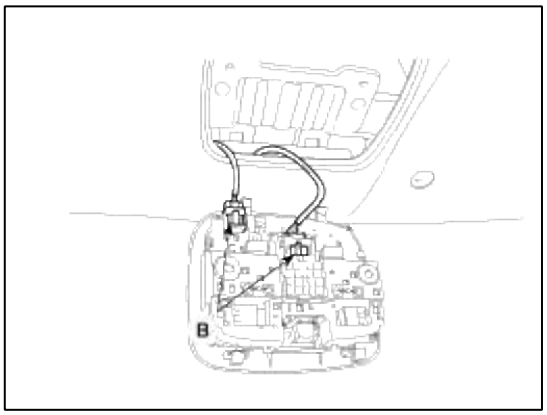
1. Disconnect the negative (-) battery terminal.
2. Detach the lamp lens (A) from the room lamp with a flat-tip screwdriver.

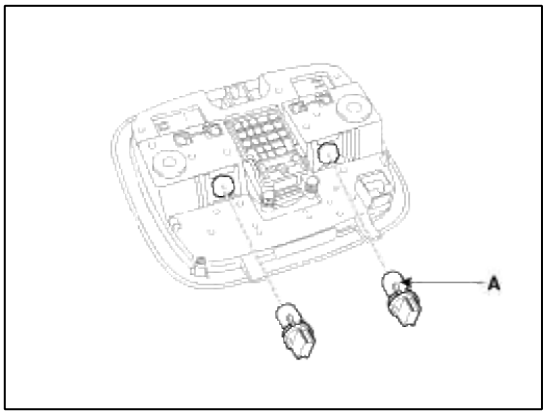


3. Loosen the fixing screw (2EA) and remove the overhead console lamp (A).



4. Disconnect the sunroof switch and lamp connector (B) and then remove the overhead console lamp (A).



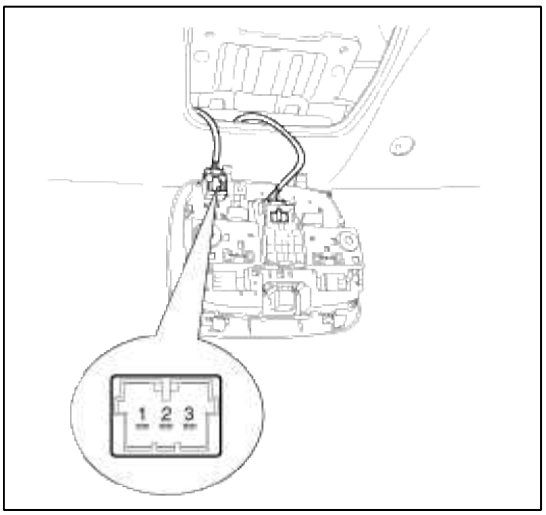


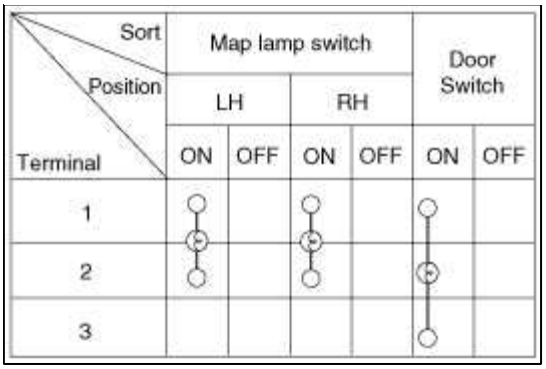
Installation

1. Install the overhead console lamp after connecting the sunroof switch and lamp connector.
2. Install the lens after tightening 2 screws.

Inspection

Remove the overhead console lamp assembly then check for continuity between terminals. If the continuity is not as specified, replace the map lamp switch.



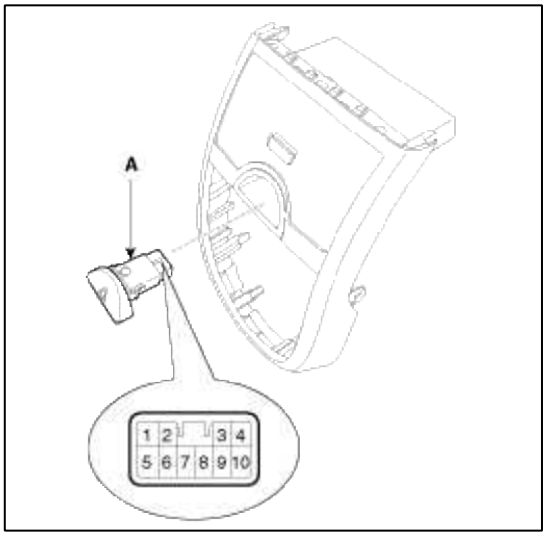


Body Electrical System > Lighting System > Hazard Lamp Switch > Repair procedures

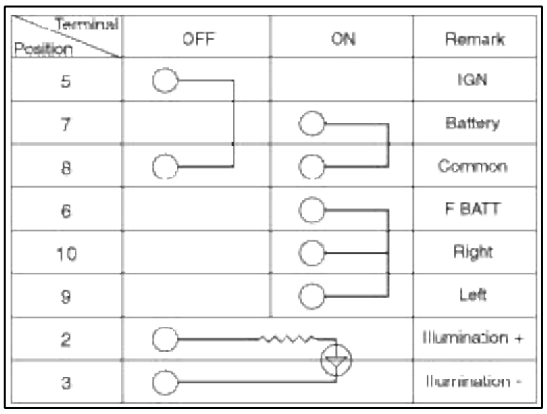
Inspection

Hazard Lamp Switch

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad center facia panel.
   (Refer to the Body group - "Crash pad")
3. Disconnect the hazard lamp switch connector (A).



4. Operate the switch and check for continuity between terminals with an ohmmeter.

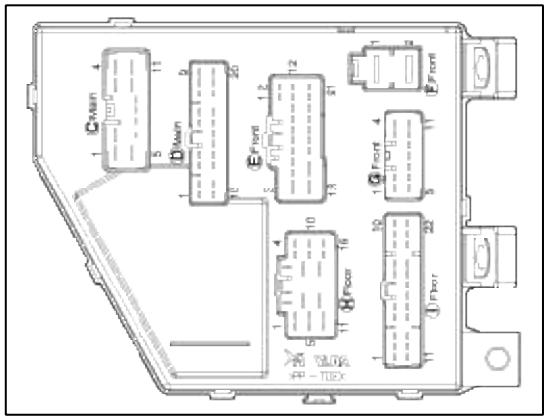


Hazard Lamp Relay

Check for continuity between the terminals.

1. There should be continuity between the No.2 terminals in the I/P-F and No.5 or 6 terminals in the I/P-A when power and ground are connected to the No.2 terminals in the I/P-F and No.4 terminals in the I/P-A.

2. There should be no continuity between the No.2 terminals in the I/P-F and No.5 or 6 terminals in the I/P-A when power is disconnected.

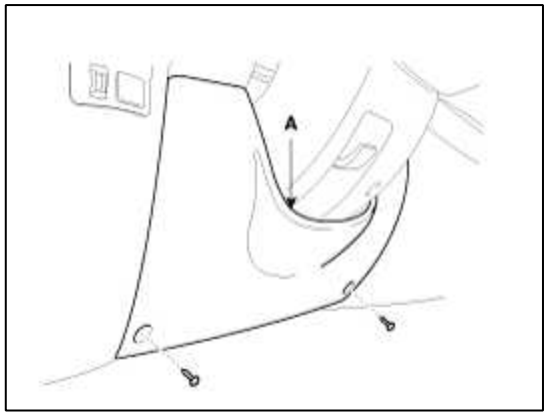


Terminal / Position	I/P-F (2)	/P-A (5 or 6)	I/P-F (2)	I/P-A (4)
Power off			○	○
Power on	○	○	⊖	⊕

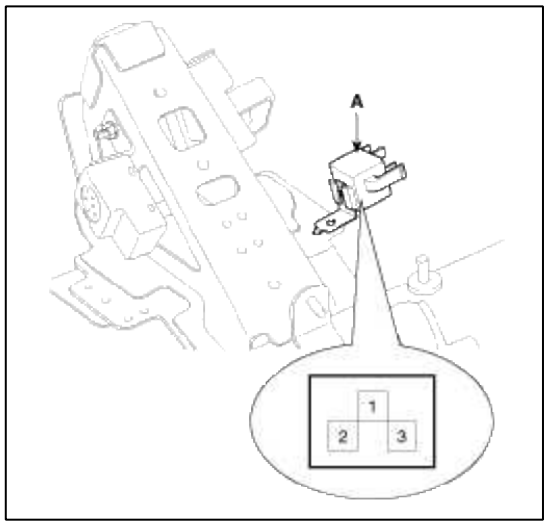
Body Electrical System > Lighting System > Flasher Unit > Repair procedures

Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the main crash pad (A).
   (Refer to Body group - "Main crash pad")



3. Remove the flasher unit (A).



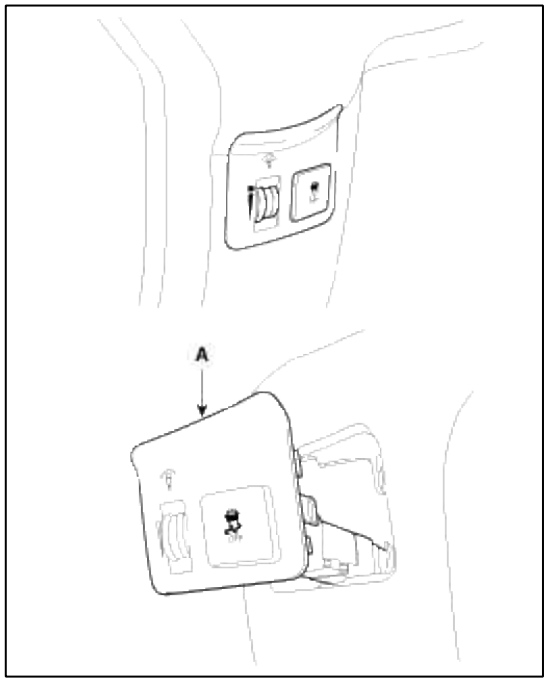
4. Connect the positive (+) lead from the battery to terminal 2 and the negative (-) lead to terminal 3.
5. Connect the two turn signal lamps in parallel to terminals 1 and 3. Check that the bulbs turn on and off.

> NOTE
>
> The turn signal lamps should flash 60 to 120 times per minute. If one of the front or rear turn signal lamps has an open circuit, the number of flashes will be more than 120 per minute. If operation is not as specified, replace the flash unit.

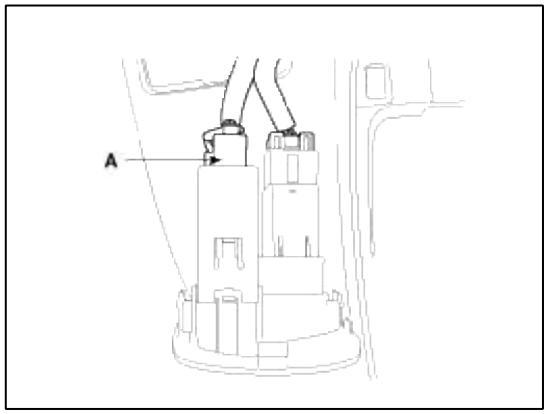
Body Electrical System > Lighting System > Rheostat > Repair procedures

Inspection

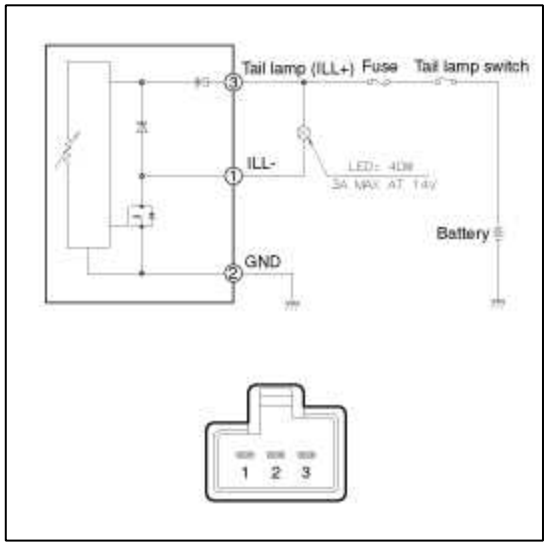
1. Disconnect the negative (-) battery terminal.
2. Remove the lower side crash pad switch assembly (A) by using the trim remover tool. (Refer to the group - "Main crash pad")



3. Disconnect the rheostat switch connector (A).



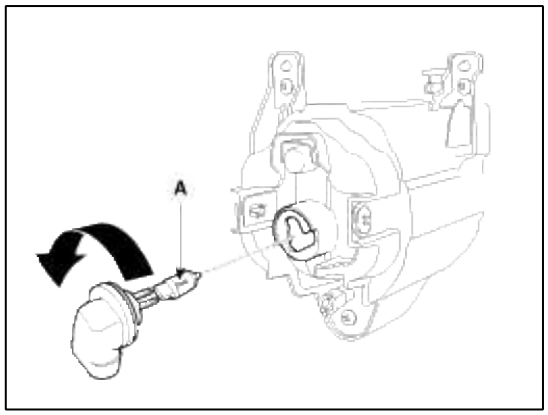
4. Check for intensity of new rheostat switch. If the light intensity of the lamps changes smoothly without any flickering when the rheostat is turned, it can be assumed that the rheostat is normal.



Body Electrical System > Lighting System > Front Fog Lamps > Repair procedures

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the front bumper.
   (Refer to the Body group - "Bumper")
3. Remove the front fog lamp bulb (A) turning in the counter clock-wise direction.



Installation

1. Install the front fog lamp bulb.
2. Connect the front fog lamp connector.
3. Install the front side cover.

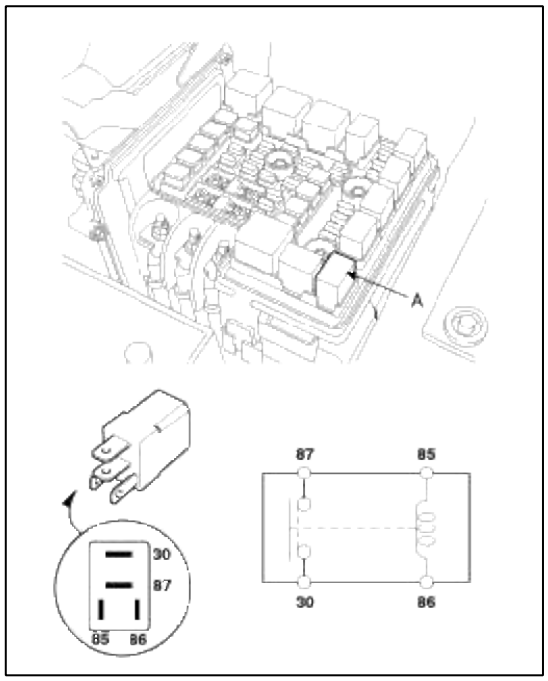
Inspection

Front Fog Lamp Relay

1. Disconnect the negative(-) battery terminal.
2. Pull out the front fog lamp relay(A) from the engine compartment relay box.

3. Check for continuity between terminals. There should be continuity between the No.87 and No.30 terminals when power and ground are connected to the No.85 and No.86 terminals.

4. There should be no continuity between the No.87 and No.30 terminals when power is disconnected.



Terminal / Power	F-1	G-11	A-3	F-1
Disconnected			○	○
Connected	○	○	⊖	⊕

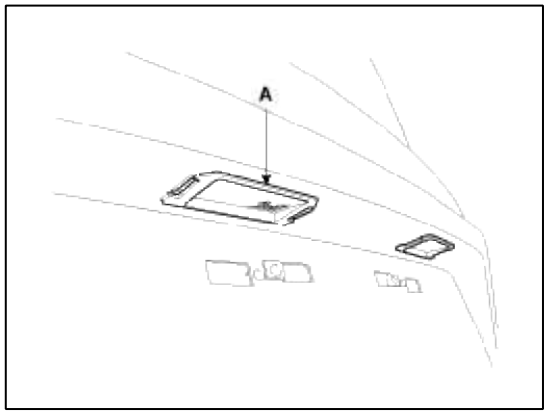
Body Electrical System > Lighting System > License Lamps > Repair procedures

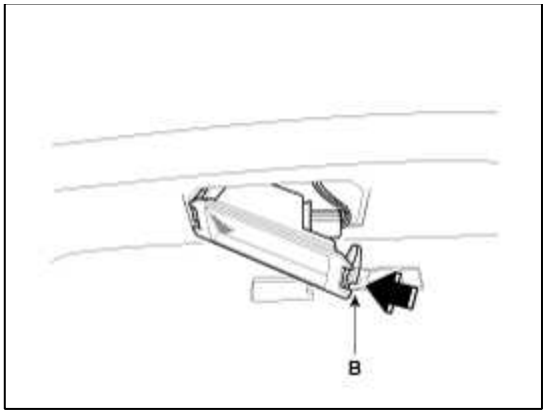
Removal

License Lamp

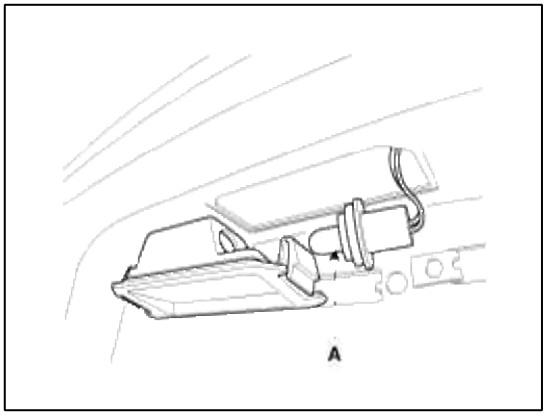
1. Disconnect the negative (-) battery terminal.

2. Remove the license lamp lens(A) by pushing the clip(B).



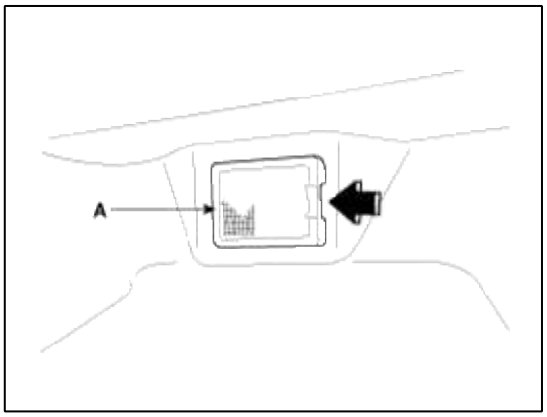


3. Replace the bulb (A).

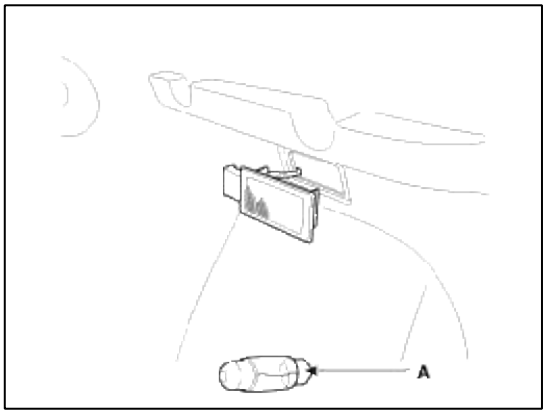


Luggage Room Lamp

1. Disconnect the negative(-) battery terminal.
2. Remove the luggage room lamp lens(A) from the luggage side trim.



3. Remove the bulb(A).



Installation

License Lamp

1. Install the bulb.
2. Install the license lamp lens.

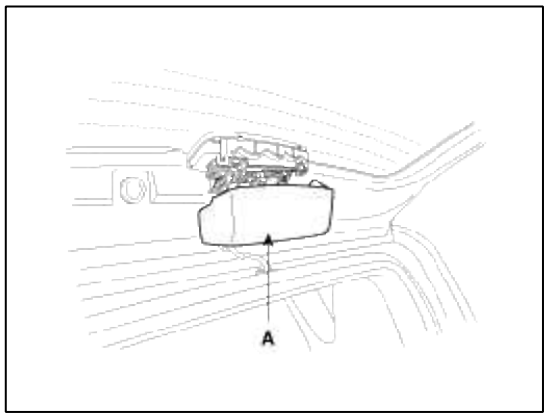
Luggage Room Lamp

1. Install the bulb.
2. Install the luggage room lamp lens.

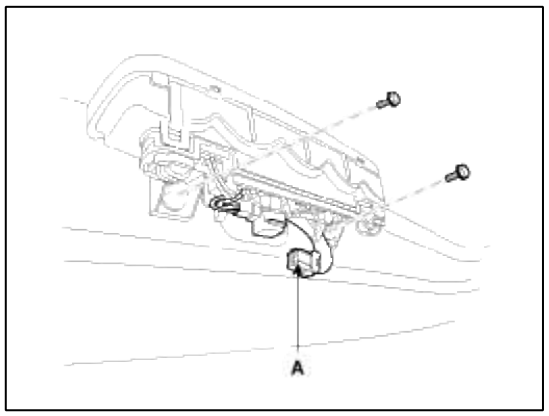
Body Electrical System > Lighting System > High Mounted stop lamp > Repair procedures

Removal

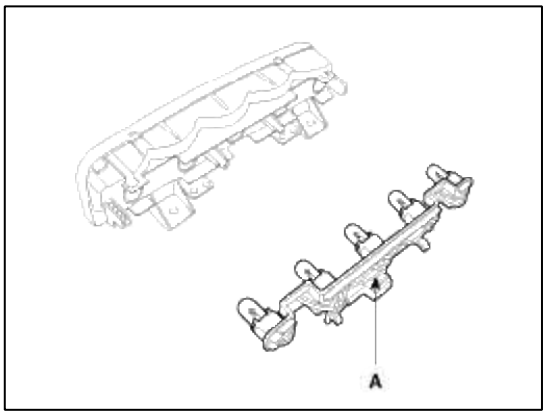
1. Disconnect the negative(-) battery terminal.
2. Remove the high mounted stop lamp cover (A).



3. Remove the connector (A) and bolts.



4. Replace the bulbs (A).



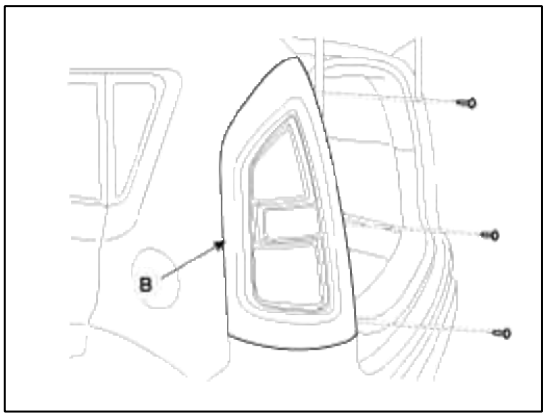
Installation

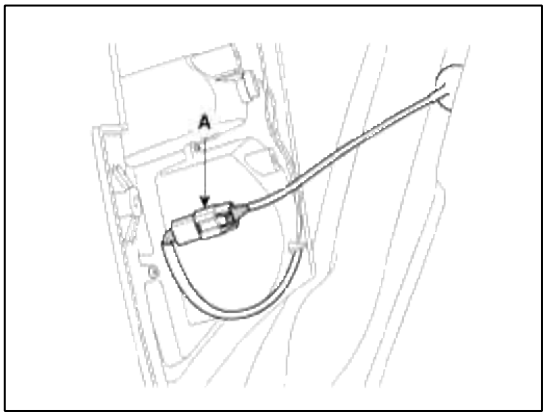
1. Install the high mounted stop lamp and connector.
2. Install the high mounted stop lamp cover.

Body Electrical System > Lighting System > Rear combination lamp > Repair procedures

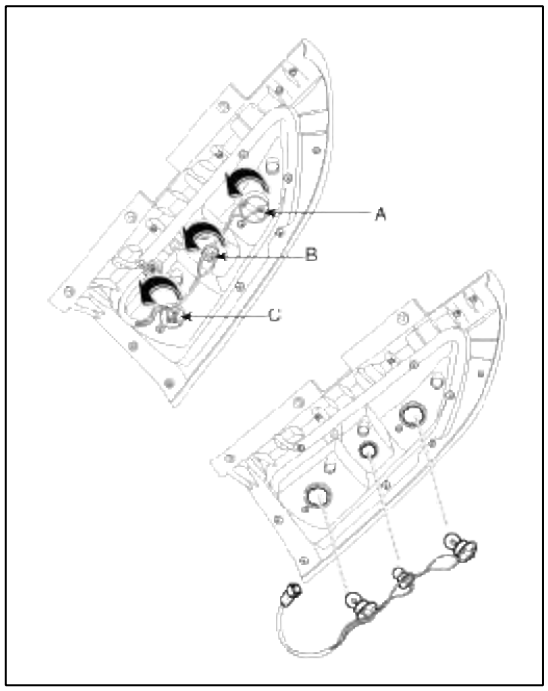
Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the rear combination lamp assembly (B) after removing connector (A) and screw (3EA).





3. Replace the lamp bulbs after turning in the counter clock-wise direction.
   A: Turn signal lamp
   B: Back up lamp
   C: Tail / Stop lamp



Installation

1. Connect the lamp connector after assembling the bulb.
2. Install the rear combination lamp assembly.

Body Electrical System > Lighting System > Troubleshooting

Troubleshooting

Symptom	Possible cause	Remedy
One lamp does not light (all exterior)	Bulb burned out	Replace bulb
	Socket, wiring or ground faulty	Repair if necessary
Head lamps do not light	Bulb burned out	Replace bulb
	Head lamp fuse (LOW:10A, HIGH:20A) blown	Check for short and replace fuse
	Head lamp fuse (10A) blown	Check for short and replace fuse
	Head lamp relay faulty	Check relay
	Lighting switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Tail lamps and license plate lamps do not light	Bulb burned out	Replace bulb
	Tail lamp fuse (10A) blown	Check for short and replace fuse
	Tail lamp relay faulty	Check relay
	Lighting switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary

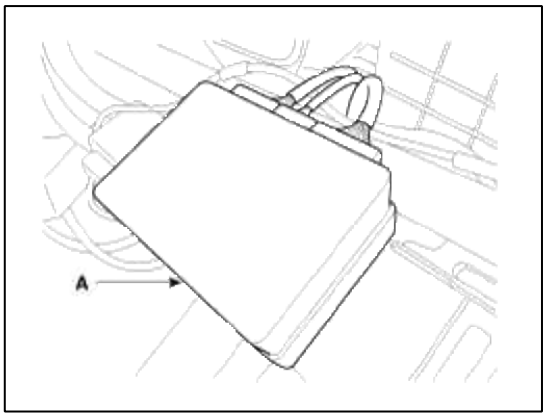
Stop lamps do not light	Bulb burned out	Replace bulb
	Stop lamp fuse (15A) blown	Check for short and replace fuse
	Stop lamp switch faulty	Adjust or replace switch
	Wiring or ground faulty	Repair if necessary
Stop lamps do not turn off	Stop lamp switch faulty	Repair or replace switch
Instrument lamps do not light (Tail lamps light)	Rheostat faulty	Check rheostat
	Wiring or ground faulty	Repair if necessary
Turn signal lamp does not flash on one side	Bulb burned out	Replace bulb
	Turn signal switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Turn signal lamps do not light	Bulb burned out	Replace bulb
	Turn signal lamp fuse (10A) blown	Check for short and replace fuse
	Flasher unit faulty	Check flasher unit
	Turn signal switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Hazard warning lamps do not light	Bulb burned out	Replace bulb
	Hazard warning lamp fuse (15A) blown	Check for short and replace fuse
	Flasher unit faulty	Check flasher unit
	Hazard switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Flasher rate too slow or too fast	Lamps' wattages are smaller or larger than specified	Replace lamps
	Flasher unit faulty	Check flasher unit
Back up lamps do not light	Bulb burned out	Replace bulb
	Back up lamp fuse (10A) blown	Check for short and replace fuse
	Back up lamp switch (M/T) faulty	Check switch
	Transaxle range switch (A/T) faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Room lamp does not light	Bulb burned out	Replace bulb
	Room lamp fuse (15A) blown	Check for short and replace fuse
	Room lamp switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Front fog lamps do not light	Bulb burned out	Replace bulb
	Front fog lamp fuse (15A) blown	Check for short and replace fuse
	Front fog lamp relay faulty	Check relay
	Front fog lamp switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Rear fog lamps do not light	Bulb burned out	Replace bulb

	Rear fog lamp fuse (10A) blown	Check for short and replace fuse
	Rear fog lamp fuse (10A) blown	Check for short and replace fuse
	Rear fog lamp switch faulty	Check switch
	Rear fog lamp relay faulty	Check relay
	Wiring or ground faulty	Repair if necessary
Room lamp does not light	Bulb burned out	Replace bulb
	Room lamp fuse (10A) blown	Check for short and replace fuse
	Map lamp switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Tailgate room lamp does not light	Bulb burned out	Replace bulb
	Room lamp fuse (10A) blown	Check for short and replace fuse
	Tailgate room lamp switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary

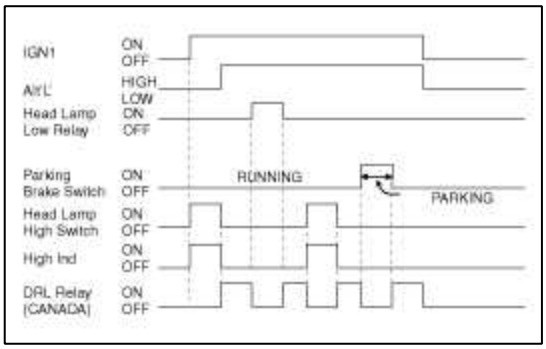
Body Electrical System > Daytime Running Lights > DRL Control Module > Repair procedures

Inspection

1. The daytime running unit is integrated in the BCM (A).



2. Check that the light operate according to the following timing chart.
   (1) If Alt 'L'is High, DRL control put in operation.
   (2) If Head Lamp Low Relay is turned ON or Head Lamp High Switch is turned ON during DRL control operating, DRL control is cancelled.

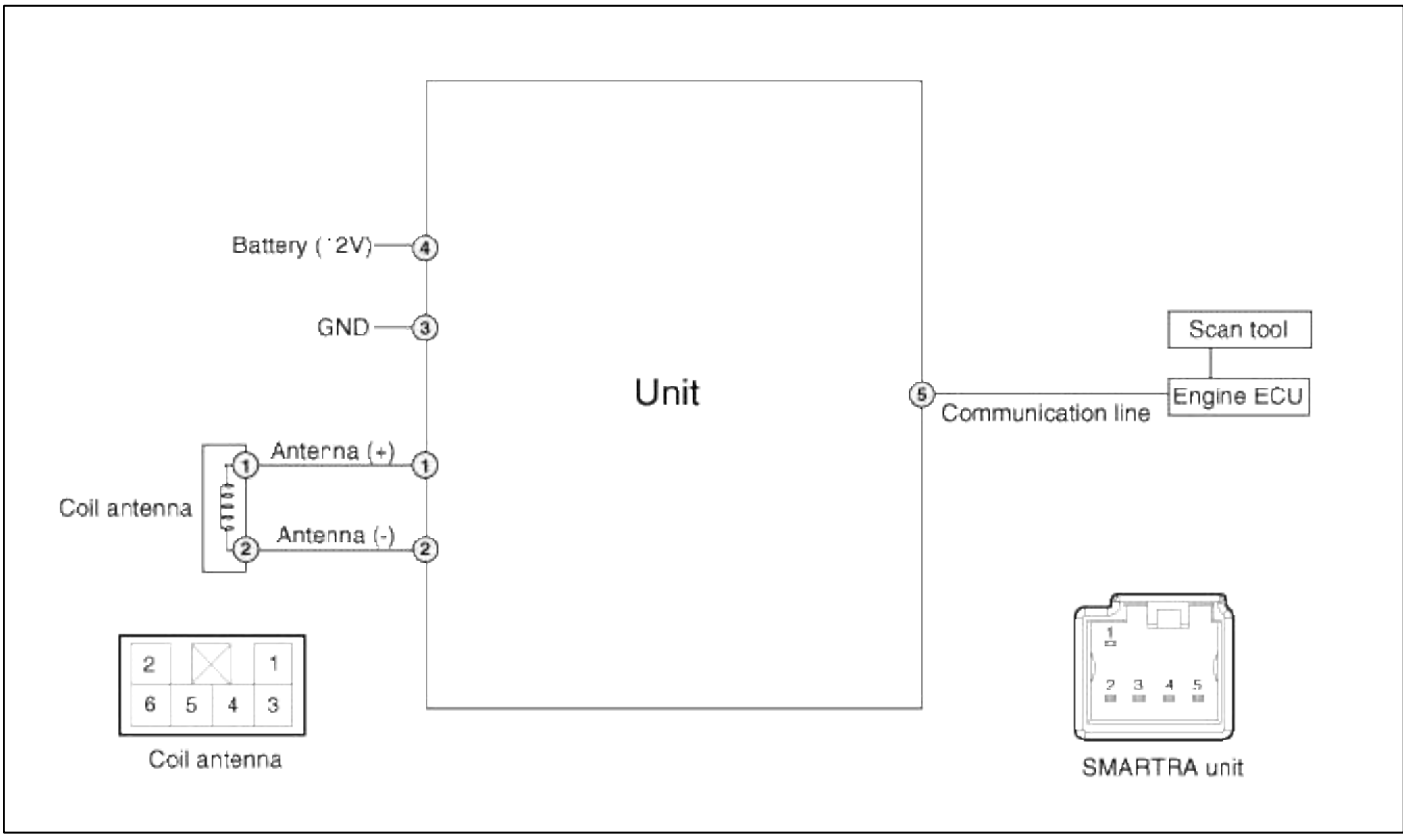


3. If the daytime running light is not operated well, Inspect the connector and terminals to be sure they are all making good contact.
   If the terminals are bent, loose or corroded, repair them as necessary, and recheck the system.
   If the terminals look OK, go to step 4.

4. Make these input tests at the connector by using ETM.
   If any test indicates a problem, find and correct the cause, then recheck the system.
   If all the input tests prove OK, the I/P (Instrument panel) junction box must be faulty; replace it.

Body Electrical System > Immobilizer System > Schematic Diagrams

Circuit Diagram

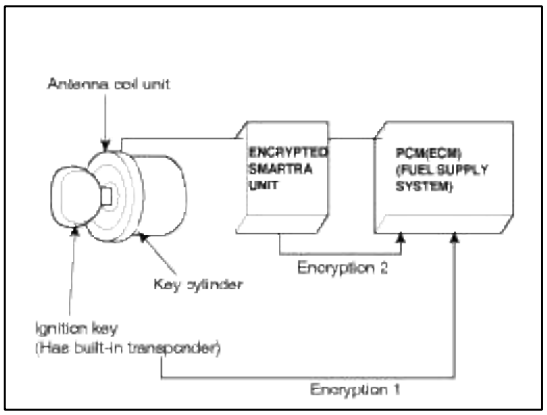


Body Electrical System > Immobilizer System > Description and Operation

Description

The immobilizer system will disable the vehicle unless the proper ignition key is used, in addition to the currently available anti-theft systems such as car alarms, the immobilizer system aims to drastically reduce the rate of auto theft.

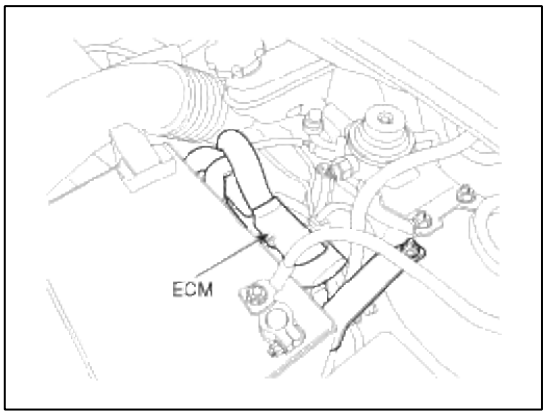
1. Encrypted SMARTRA type immobilizer
   A. The SMARTRA system consists of a passive challenge - response (mutual authentication)transponder located in the ignition key, an antenna coil, an encoded SMARTRA unit, an indicator light and the PCM(ECM).
   B. The SMARTRA communicates to the PCM(ECM) (Engine Control Module) via a dedicated communications line. Since the vehicle engine management system is able to control engine mobilization, it is the most suitable unit to control the SMARTRA.
   C. When the key is inserted in the ignition and turned to the ON position, the antenna coil sends power to the transponder in the ignition key. The transponder then sends a coded signal back through the SMARTRA unit to the PCM(ECM).
   D. If the proper key has been used, the PCM(ECM) will energize the fuel supply system. The immobilizer indicator light in the cluster will simultaneously come on for more than five seconds, indicating that the SMARTRA unit has recognized the code sent by the transponder.
   E. If the wrong key has been used and the code was not received or recognized by the PCM(ECM) the indicator light will continue blinking for about five seconds until the ignition switch is turned OFF.
   F. If it is necessary to rewrite the PCM(ECM) to learn a new key, the dealer needs the customer's vehicle, all its keys and the Hi-scan (pro) equipped with an immobilizer program card. Any key that is not learned during rewriting will no longer start the engine.
   G. The immobilizer system can store up to eight key codes.
   H. If the customer has lost his key, and cannot start the engine, contact Hyundai motor service station.



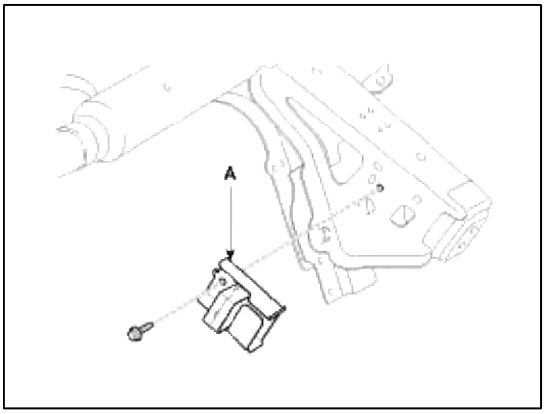
Components Operations

PCM (Power Train Control Module)

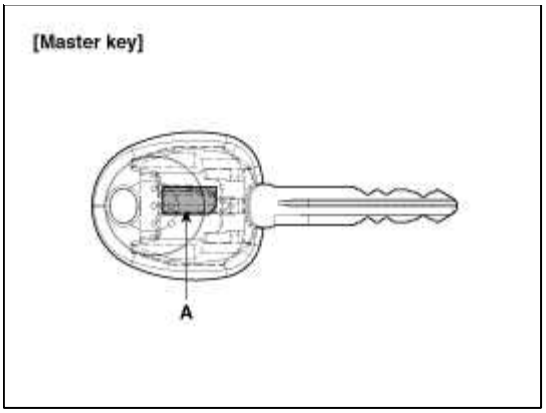
1. The PCM(ECM) (A) carries out a check of the ignition key using a special encryption algorithm, which is programmed into the transponder as well as the PCM(ECM) simultaneously. Only if the results are equal, the engine can be started. The data of all transponders, which are valid for the vehicle, are stored in the PCM(ECM).
   ERN (Encrypted Randorn Number) value between EMS and encrypted smartra unit is checked and the validity of coded key is decided by EMS.



ENCRYPTED SMARTRA unit (A)
The SMARTRA carries out communication with the built-in transponder in the ignition key. This wireless communication runs on RF (Radio frequency of 125 kHz). The SMARTRA is mounted behind of the crash pad close to center cross bar.
The RF signal from the transponder, received by the antenna coil, is converted into messages for serial communication by the SMARTRA device. And, the received messages from the PCM(ECM) are converted into an RF signal, which is transmitted to the transponder by the antenna.
The SMARTRA does not carry out the validity check of the transponder or the calculation of encryption algorithm. This device is only an advanced interface, which converts the RF data flow of the transponder into serial communication to the PCM(ECM) and vice versa.

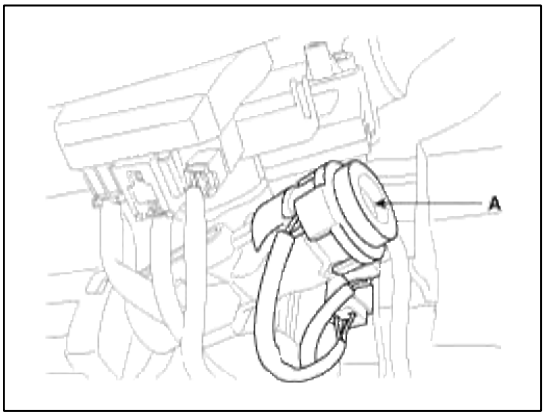


TRANSPONDER (Built-in keys)
The transponder (A) has an advanced encryption algorithm. During the key teaching procedure, the transponder will be programmed with vehicle specific data. The vehicle specific data are written into the transponder memory. The write procedure is once only; therefore, the contents of the transponder can never be modified or changed.



Antenna coil
The antenna coil (A) has the following functions.

- The antenna coil supplies energy to the transponder.
- The antenna coil receives signal from the transponder.
- The antenna coil sends transponder signal to the SMARTRA.
  It is located directly in front of the steering handle lock.



Body Electrical System > Immobilizer System > Repair procedures

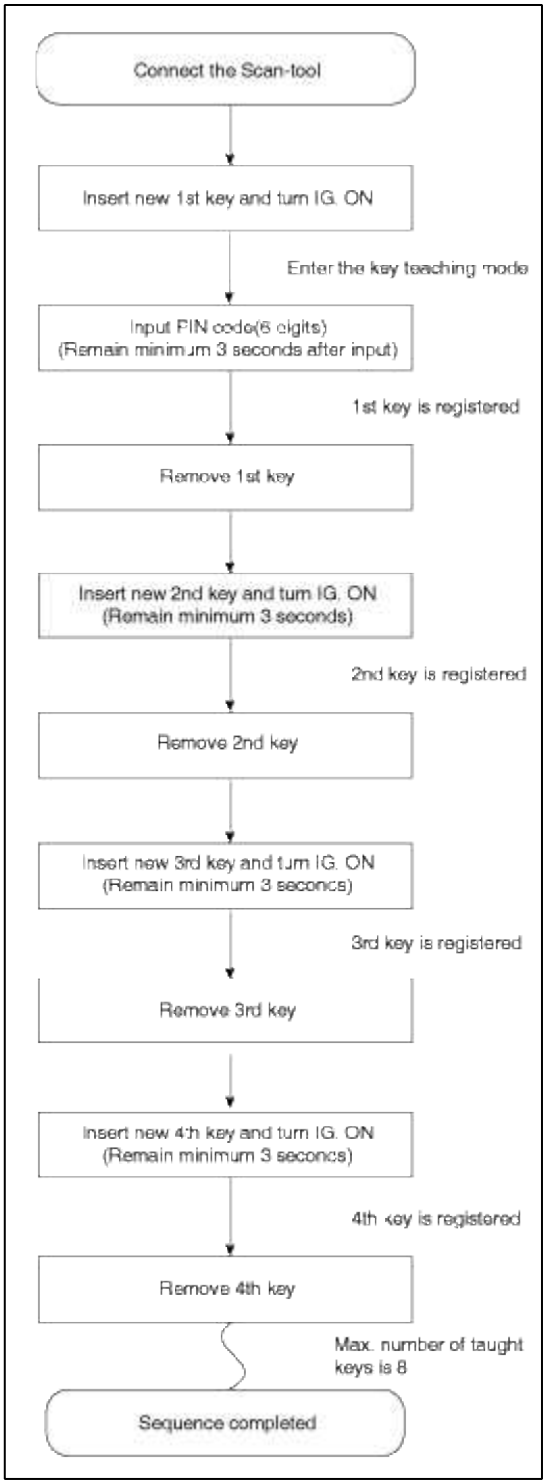
Teaching Procedures

1. Key Teaching Procedure
   Key teaching must be done after replacing a defective PCM(ECM) or when providing additional keys to the vehi
   owner.
   The procedure starts with an PCM(ECM) request for vehicle specific data (PIN code: 6digits) from the tester. Tl
   "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 p
   If incorrect vehicle specific data have been sent to the PCM(ECM) three times, the PCM(ECM) will reject the re
   of key teaching for one hour. This time cannot be reduced by disconnecting the battery or any other manipulation.
   reconnecting the battery, the timer starts again for one hour.
   The key teaching is done by ignition on with the key and additional tester commands. The PCM(ECM) stores the
   relevant data in the EEPROM and in the transponder. Then the PCM(ECM) runs the authentication required for
   confirmation of the teaching process. The successful programming is then confirmed by a message to the tester.
   If the key is already known to the PCM(ECM) from a previous teaching, the authentication will be accepted and
   EEPROM data are updated. There is no changed transponder content (this is impossible for a learnt transponder
   The attempt to repeatedly teach a key, which has been taught already during the same teaching cycle, is recognize
   the PCM(ECM). This rejects the key and a message is sent to the tester.
   The PCM(ECM) rejects invalid keys, which are presented for teaching. A message is sent to the tester. The key
   invalid due to faults in the transponder or other reasons, which result from unsuccessful programming of data. If th
   PCM(ECM) detects different authenticators of a transponder and an PCM(ECM), the key is considered to be in

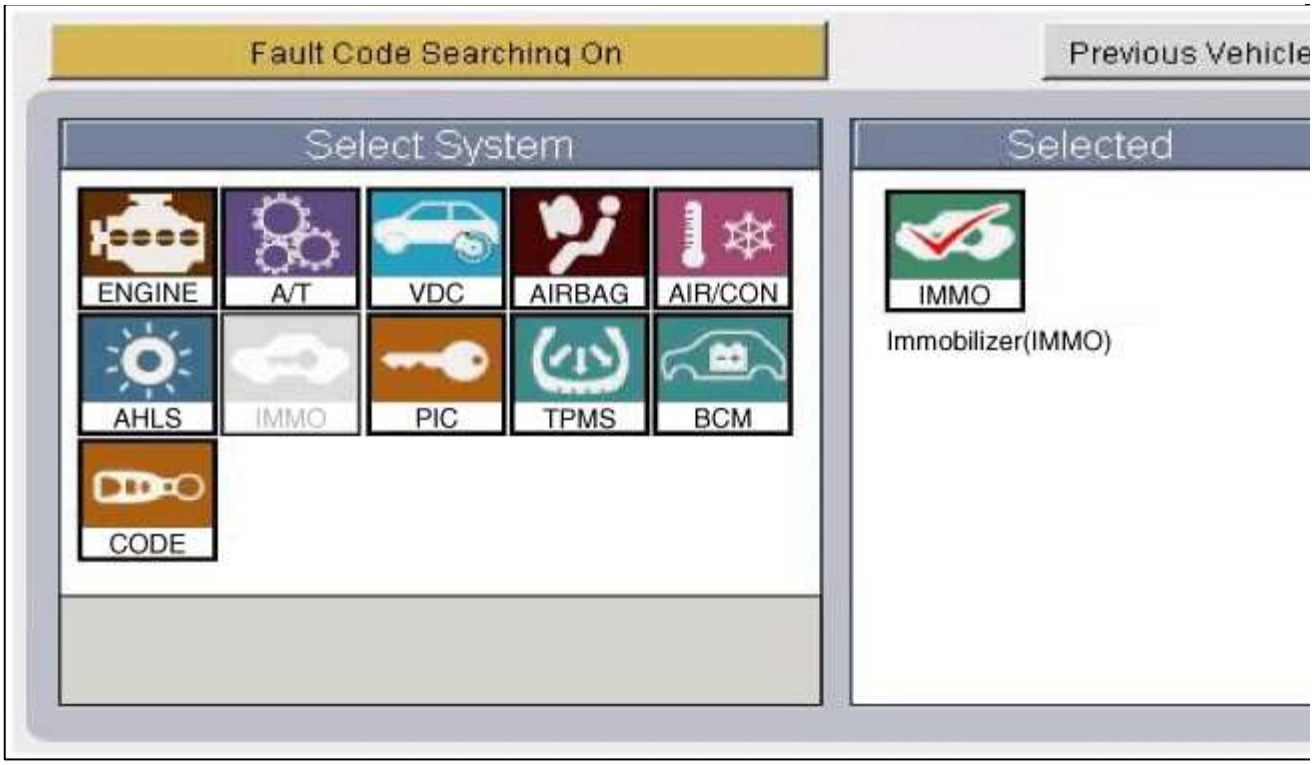
The maximum number of taught keys is 8
If an error occurs during the Immobilizer Service Menu, the PCM(ECM) status remains unchanged and a specific code is stored.
If the PCM(ECM) status and the key status do not match for teaching of keys, the tester procedure will be stopp a specific fault code will be stored at PCM(ECM).

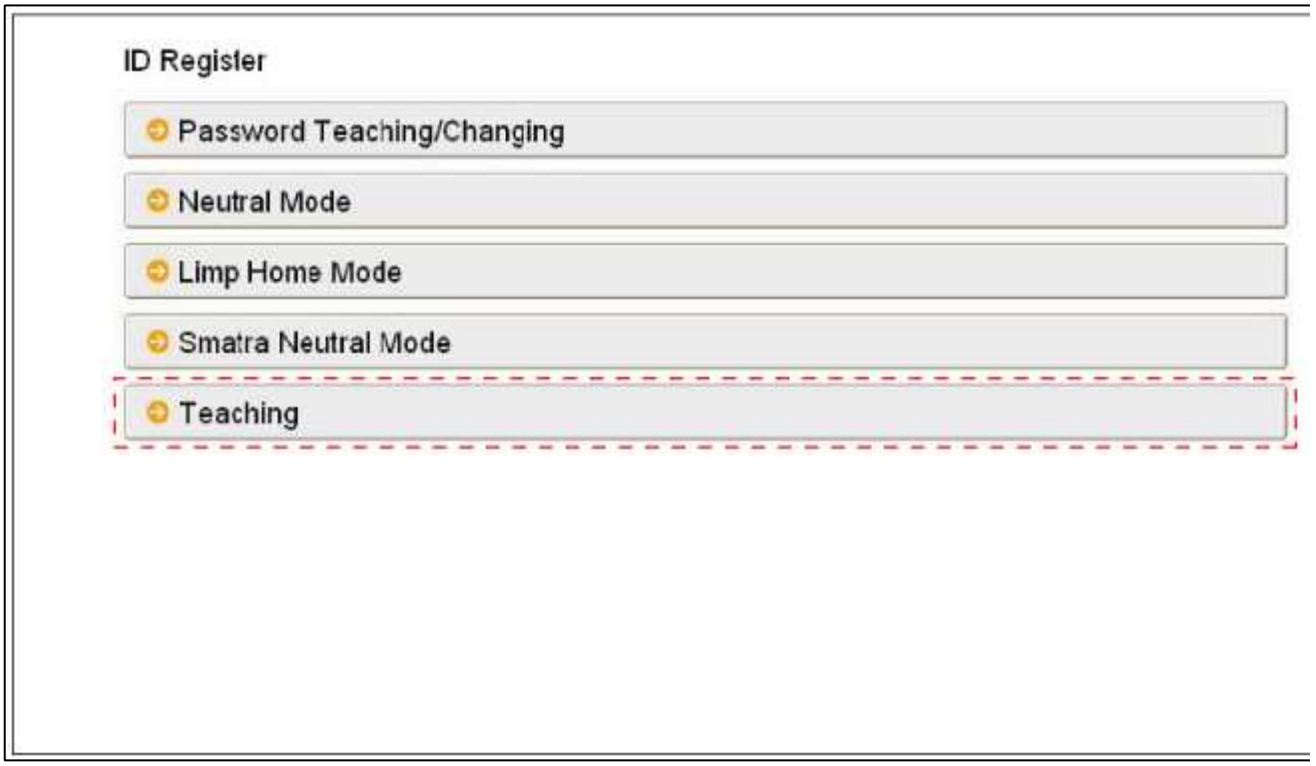
NOTE

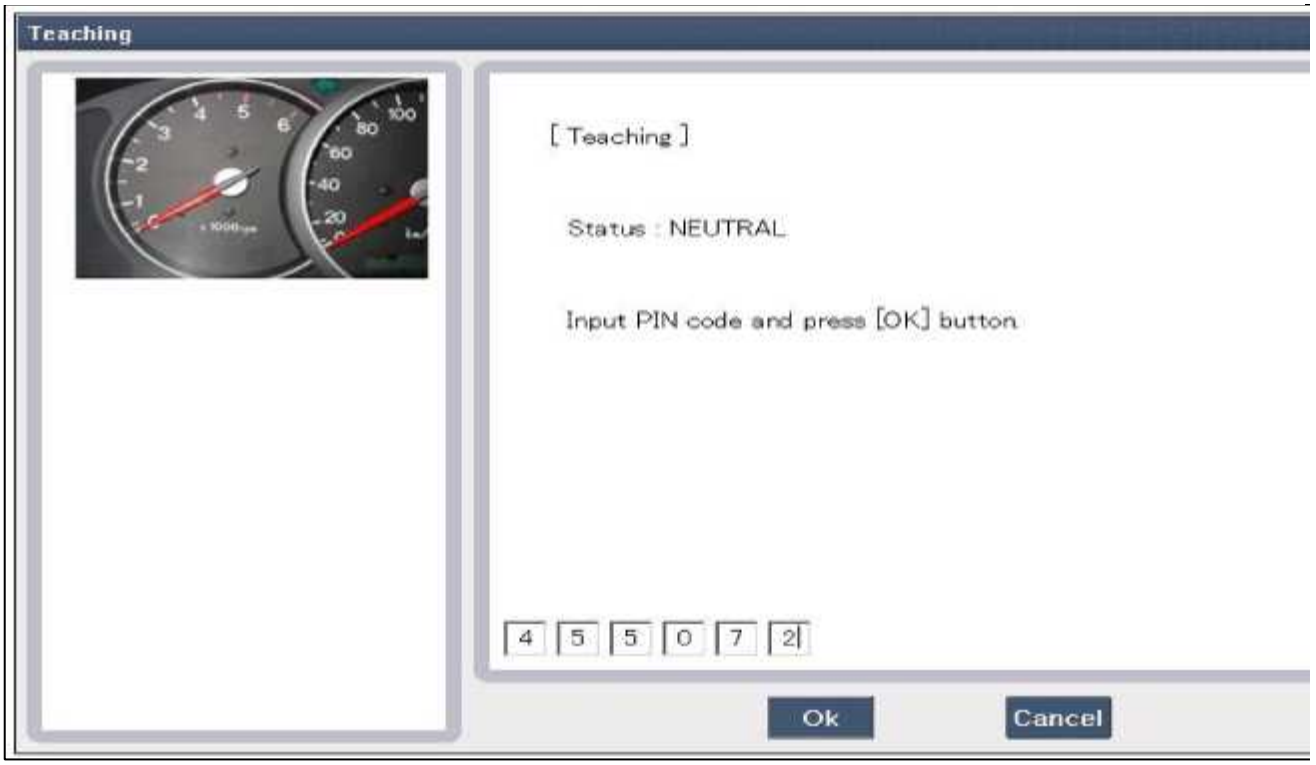
When teaching the 1st key, Smartra regists at the same time.

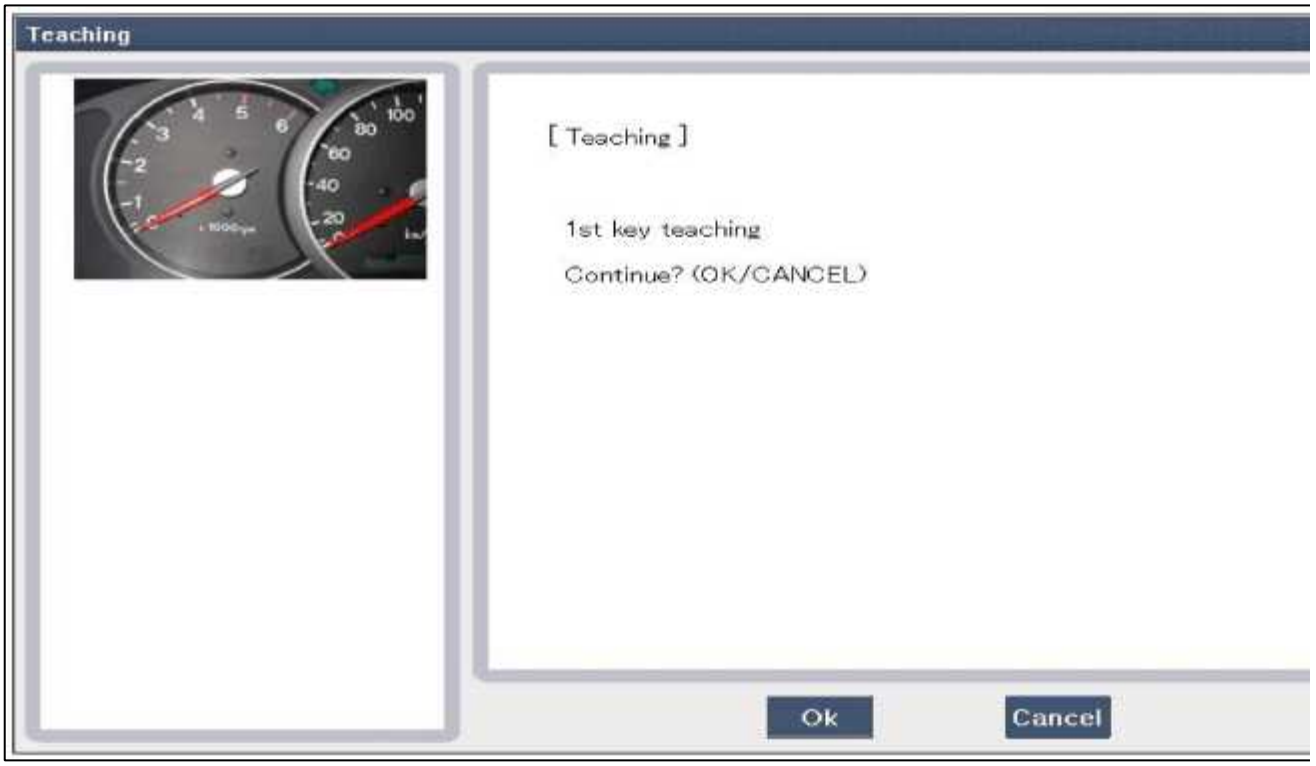


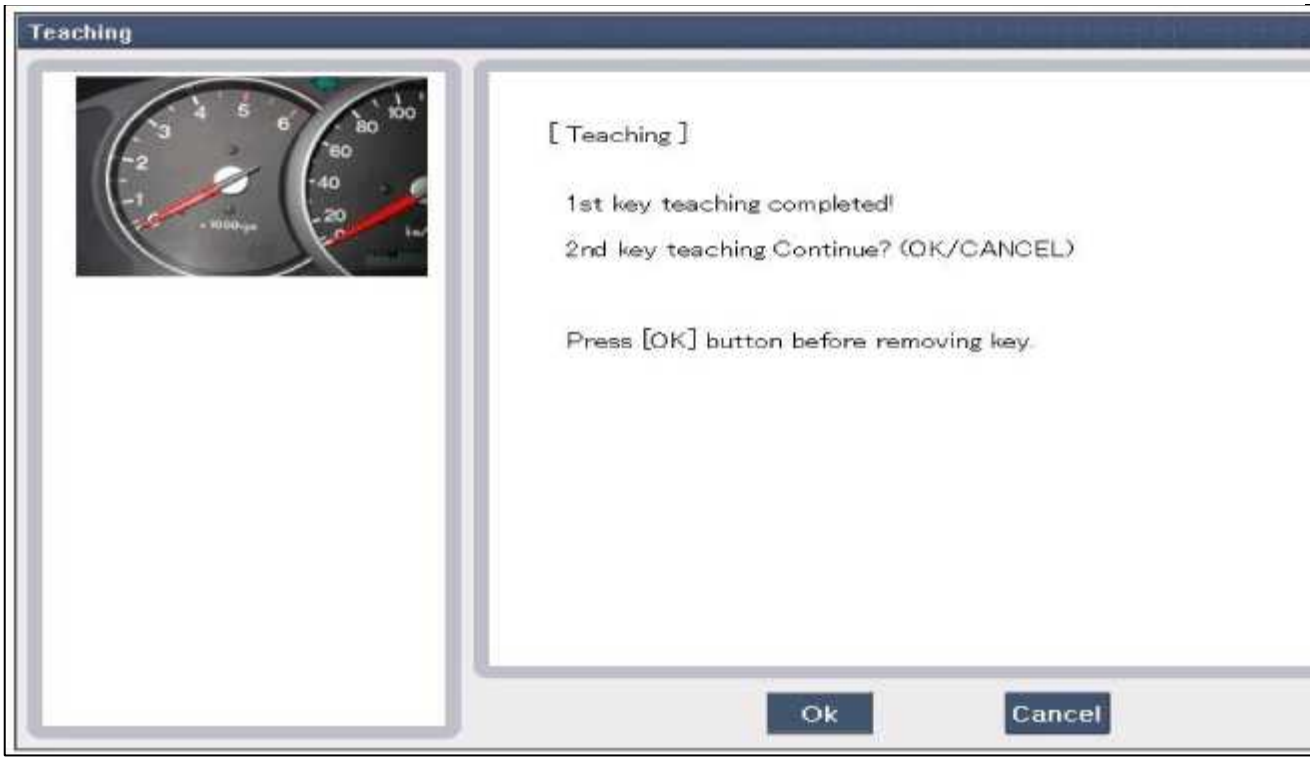
(1) PCM(ECM) learnt status.

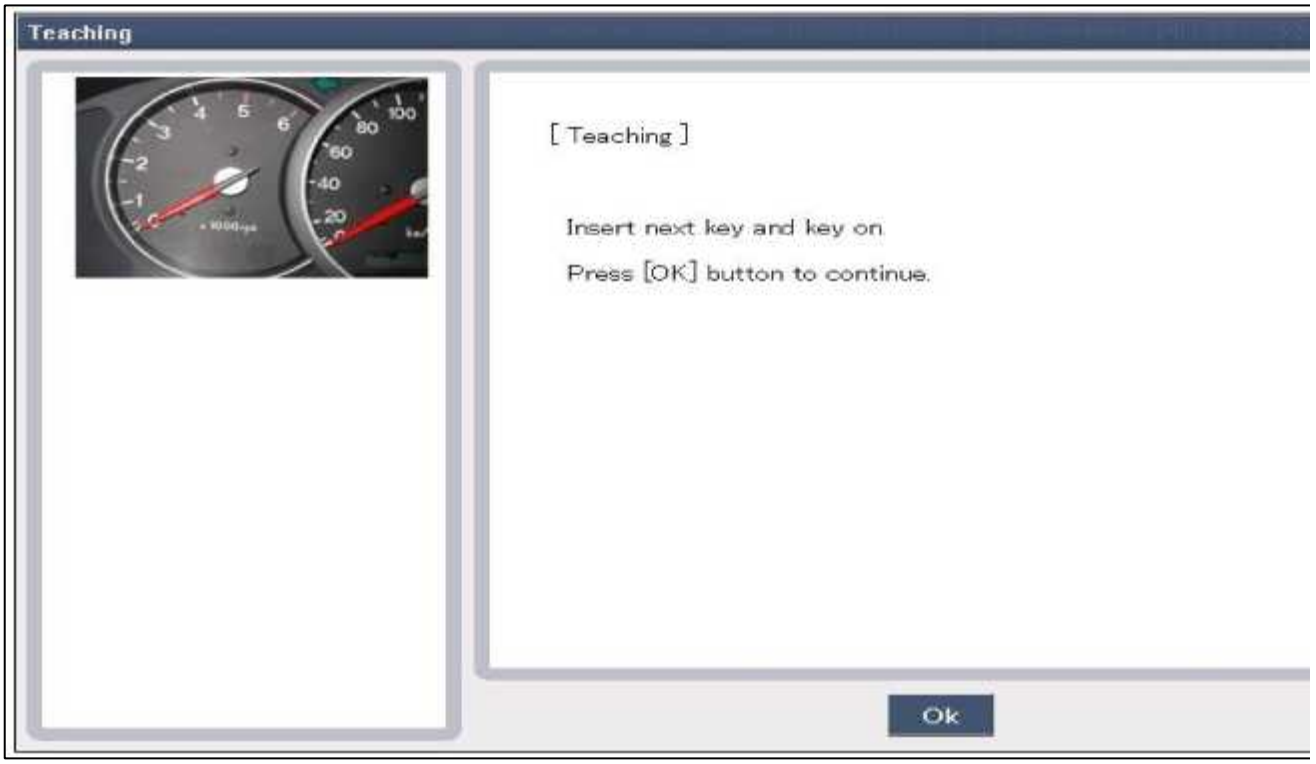

Fault Code Searching On
Previous Vehicle
Select System
ENGINE
A/T
VDC
AIRBAG
AIR/CON
AHLS
IMMO
PIC
TPMS
BCM
CODE
Selected
IMMO
Immobilizer(IMMO)

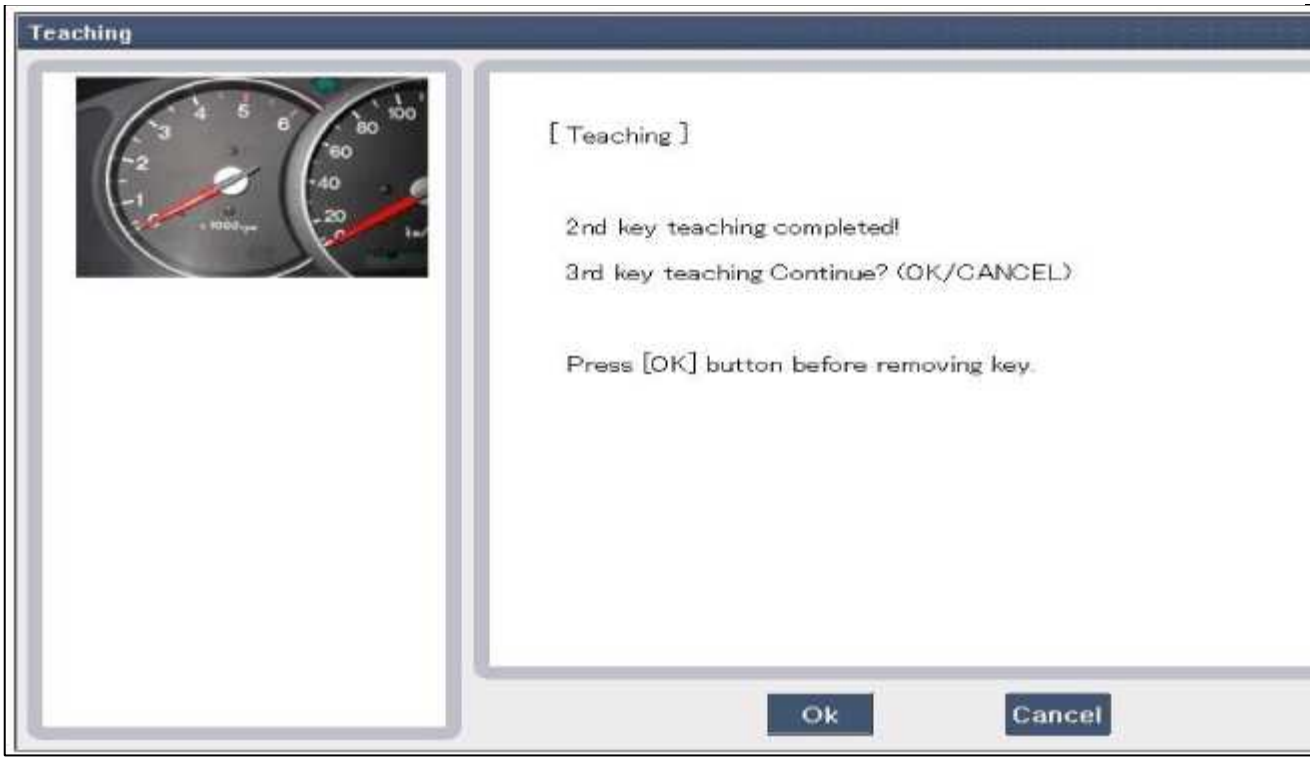

ID Register
Password Teaching/Changing
Neutral Mode
Limp Home Mode
Smatra Neutral Mode
Teaching

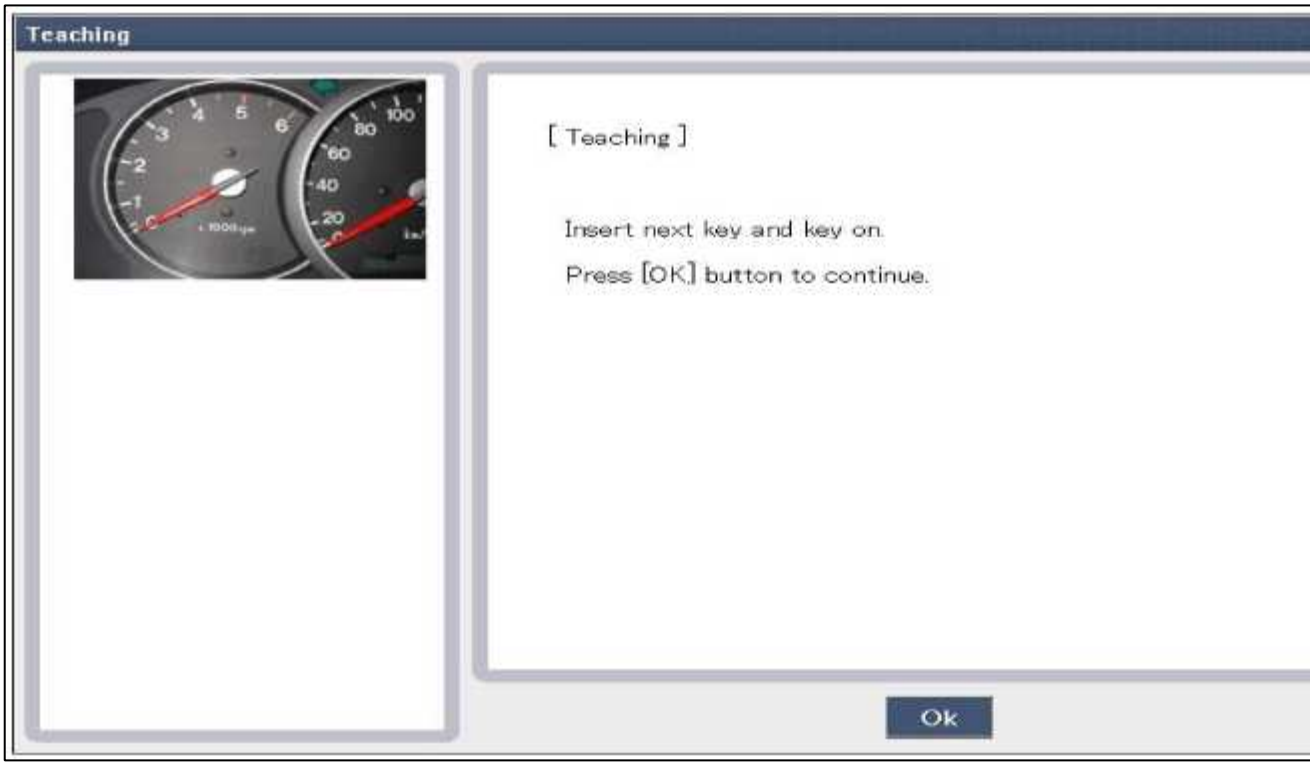

Teaching
[Teaching]
Status : NEUTRAL
Input PIN code and press [OK] button
4 5 5 0 7 2
Ok
Cancel

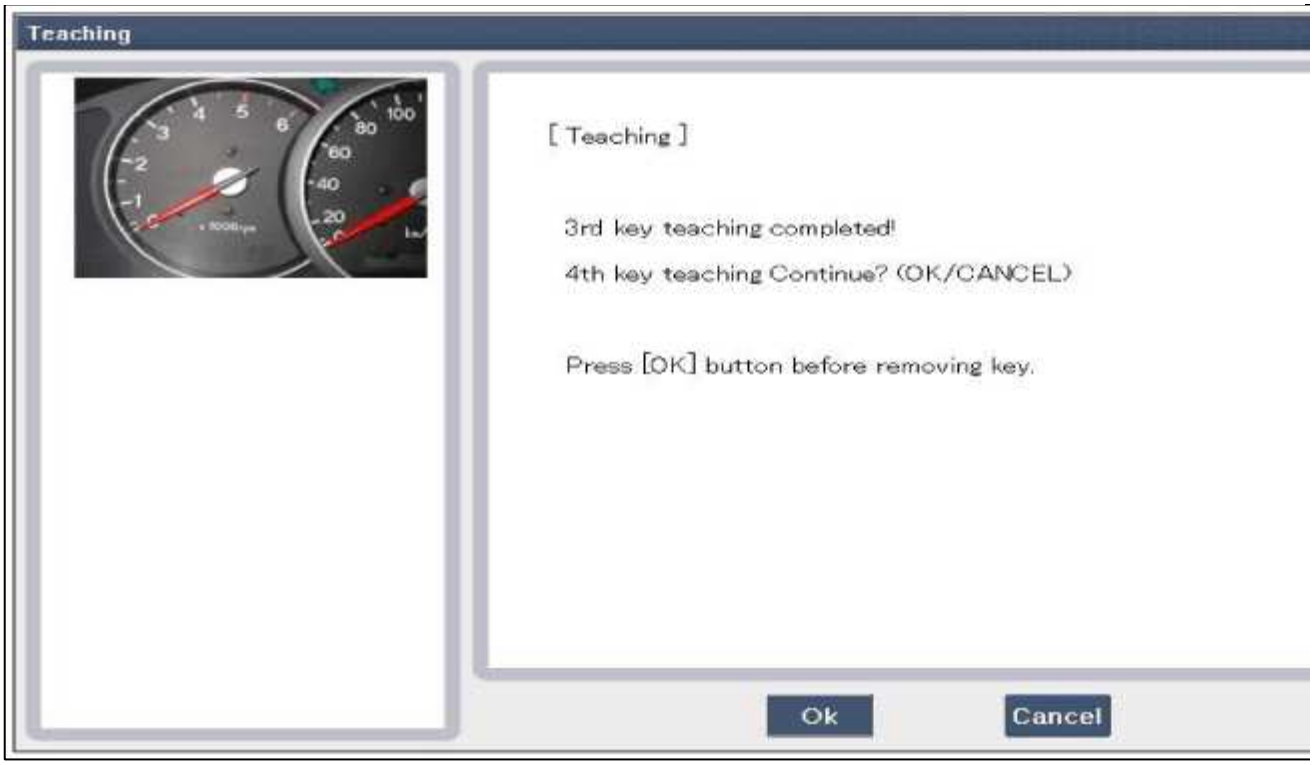

Teaching
[Teaching]
1st key teaching
Continue? (OK/CANCEL)
Ok
Cancel

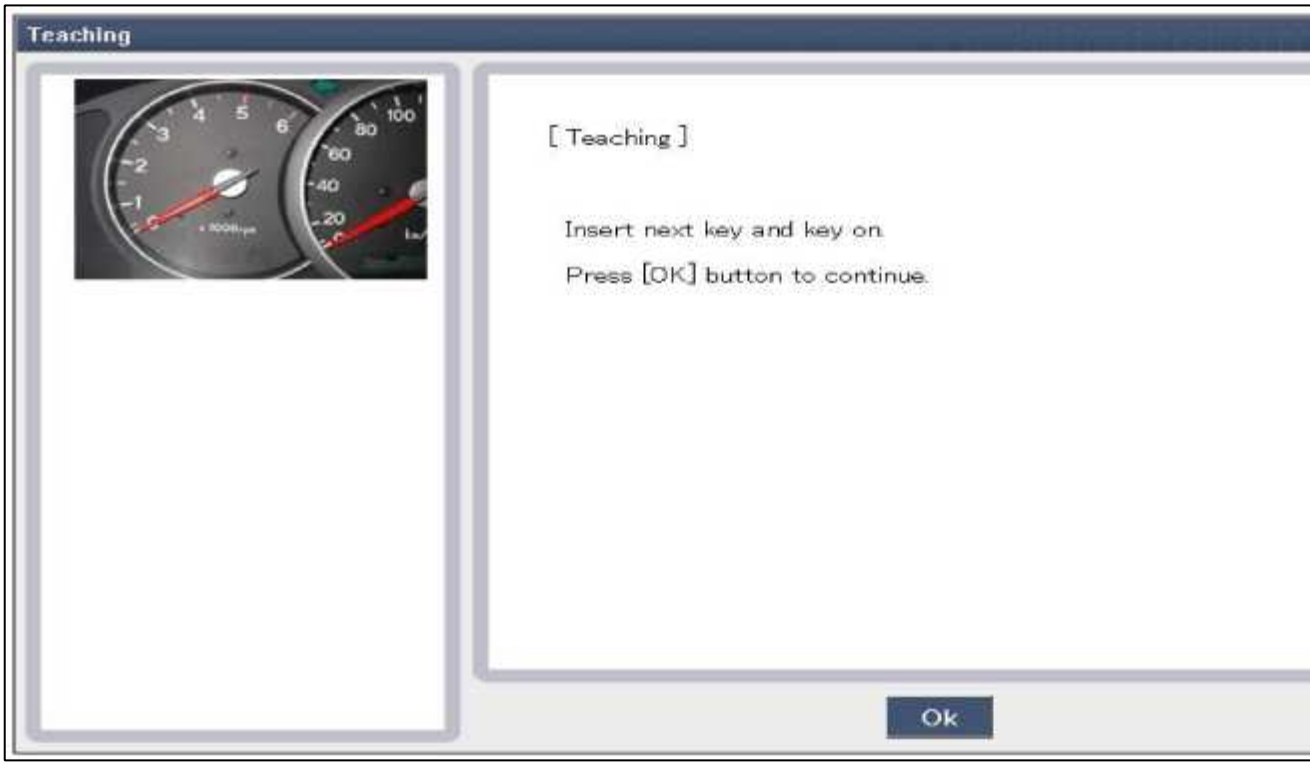

Teaching
[Teaching]
1st key teaching completed!
2nd key teaching Continue? (OK/CANCEL)
Press [OK] button before removing key.
Ok
Cancel

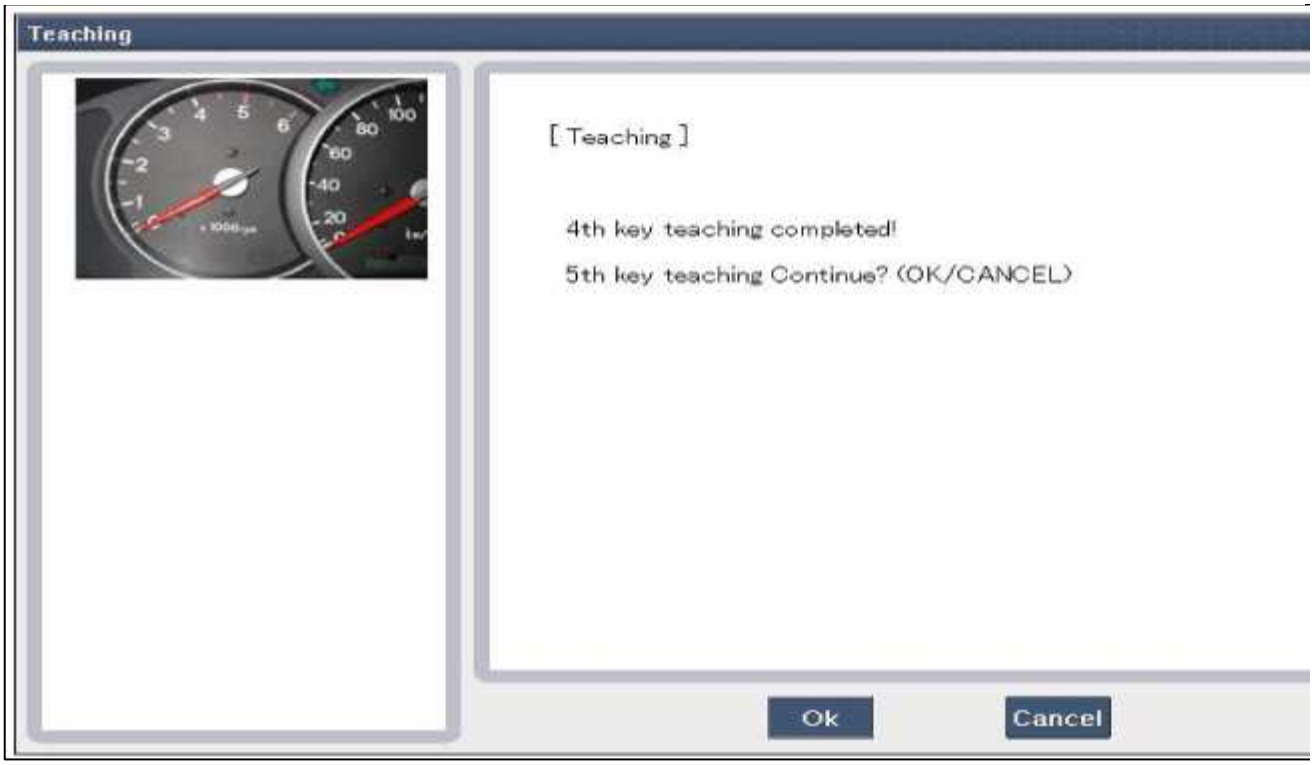

Teaching
[Teaching]
Insert next key and key on.
Press [OK] button to continue.
Ok


Teaching
[Teaching]
2nd key teaching completed!
3rd key teaching Continue? (OK/CANCEL)
Press [OK] button before removing key.
Ok
Cancel


Teaching
[Teaching]
Insert next key and key on.
Press [OK] button to continue.
Ok


Teaching
[Teaching]
3rd key teaching completed!
4th key teaching Continue? (OK/CANCEL)
Press [OK] button before removing key.
Ok
Cancel


Teaching
[Teaching]
Insert next key and key on.
Press [OK] button to continue.
Ok



(2) PCM(ECM) virgin status.
After replacing new "PCM(ECM)" scan tool displays that PCM(ECM) is virgin status in Key Teaching mode
"VIRGIN" status means that PCM(ECM) has not matched any PIN code before.

Password Teaching/changing

1. User Password Teaching Procedure
   The user password for limp home is taught at the service station. The owner of the vehicle can select a number with four digits.
   The user password teaching is only accepted by a "learnt" PCM(ECM). Before first teaching of user password to an PCM(ECM), the status of the password is "virgin" No limp home function is possible.
   The teaching is started by ignition on, with a valid key(learnt key) and sending the user password by tester.
   After successful teaching, the status of the user password changes from "virgin" to "learnt"
   The learnt user password can also be changed. This can be done if the user password status is "learnt" and the tester sends authorization of access, either the old user password or the vehicle specific data. After correct authorization, the PCM(ECM) requests the new user password. The status remains "learnt" and the new user password will be valid for the next limp home mode.
   If wrong user passwords or wrong vehicle specific data have been sent to the PCM(ECM) three times continuously or intermittently, the PCM(ECM) will reject the request to change the password for one hour. This time cannot be reduced by disconnecting the battery or any other actions. After reconnecting the battery, the timer starts again for one hour.

2. User password teaching

ID Register

- Password Teaching/Changing
- Neutral Mode
- Limp Home Mode
- Smatra Neutral Mode
- Teaching

Password Teaching/Changing

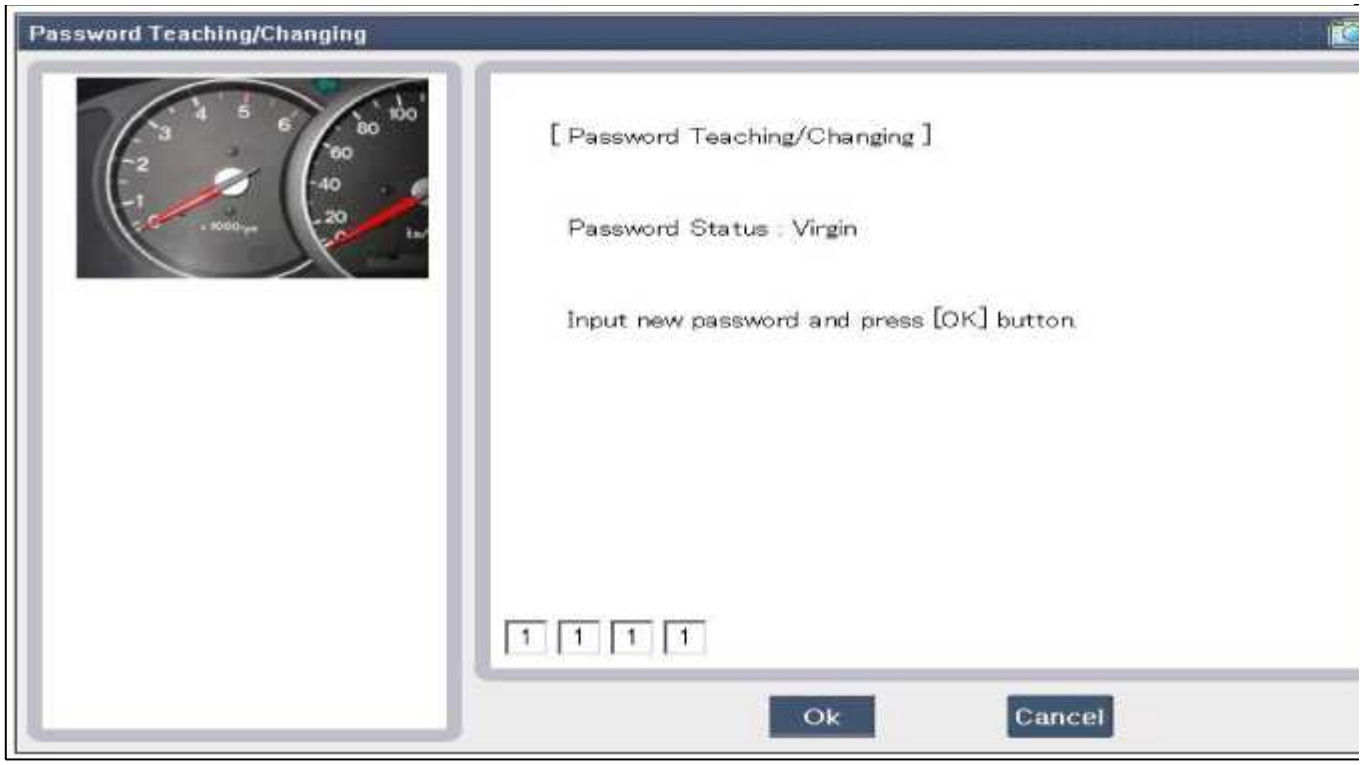


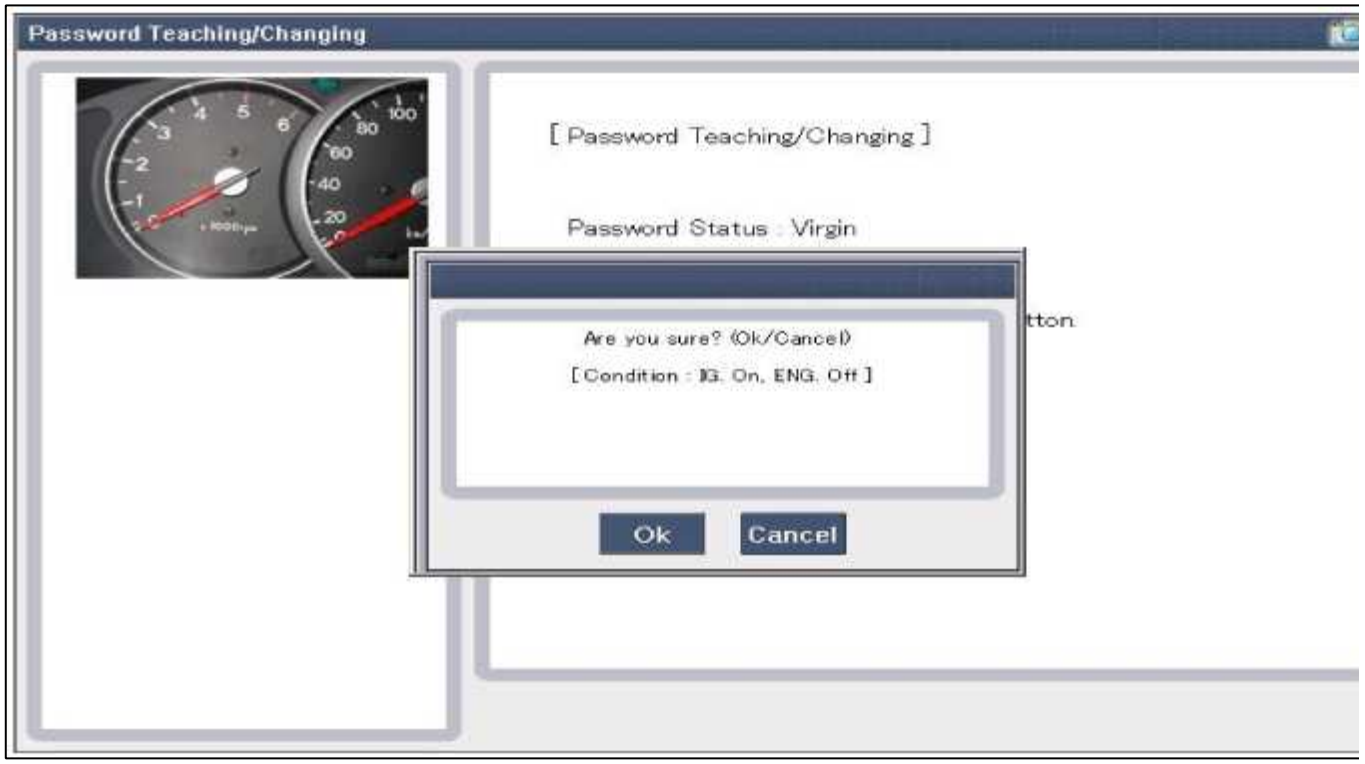
[Password Teaching/Changing]

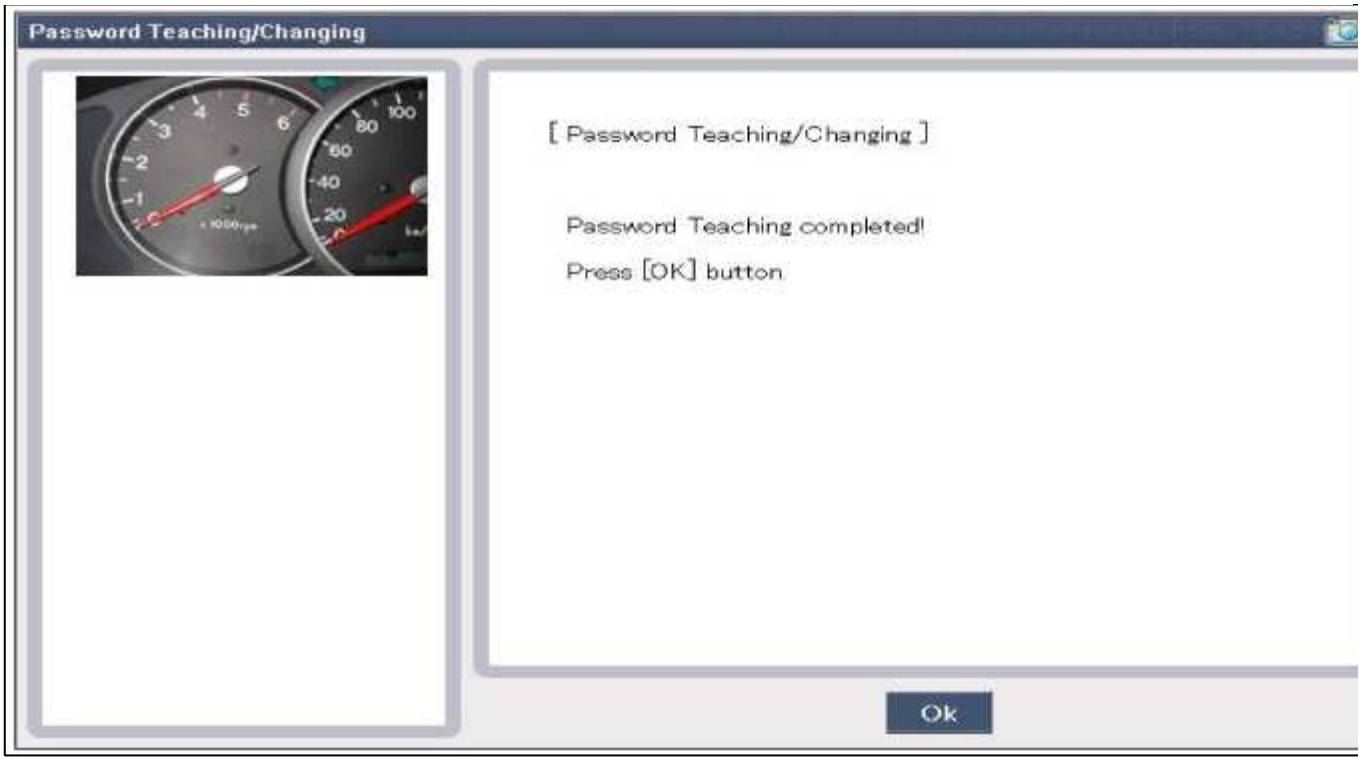
Password Status : Virgin

Input new password and press [OK] button.

Ok Cancel

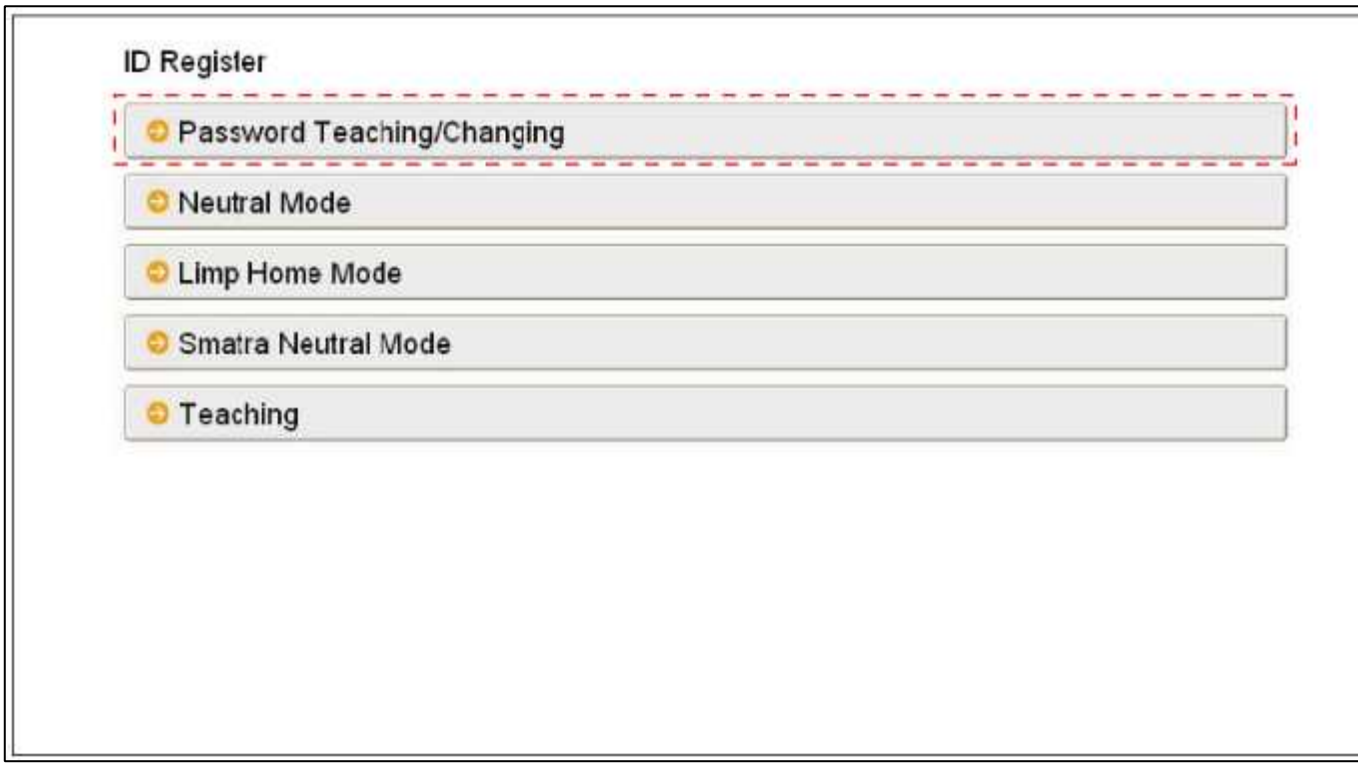

Password Teaching/Changing
[Password Teaching/Changing]
Password Status : Virgin
Input new password and press [OK] button.
1 1 1 1
Ok
Cancel

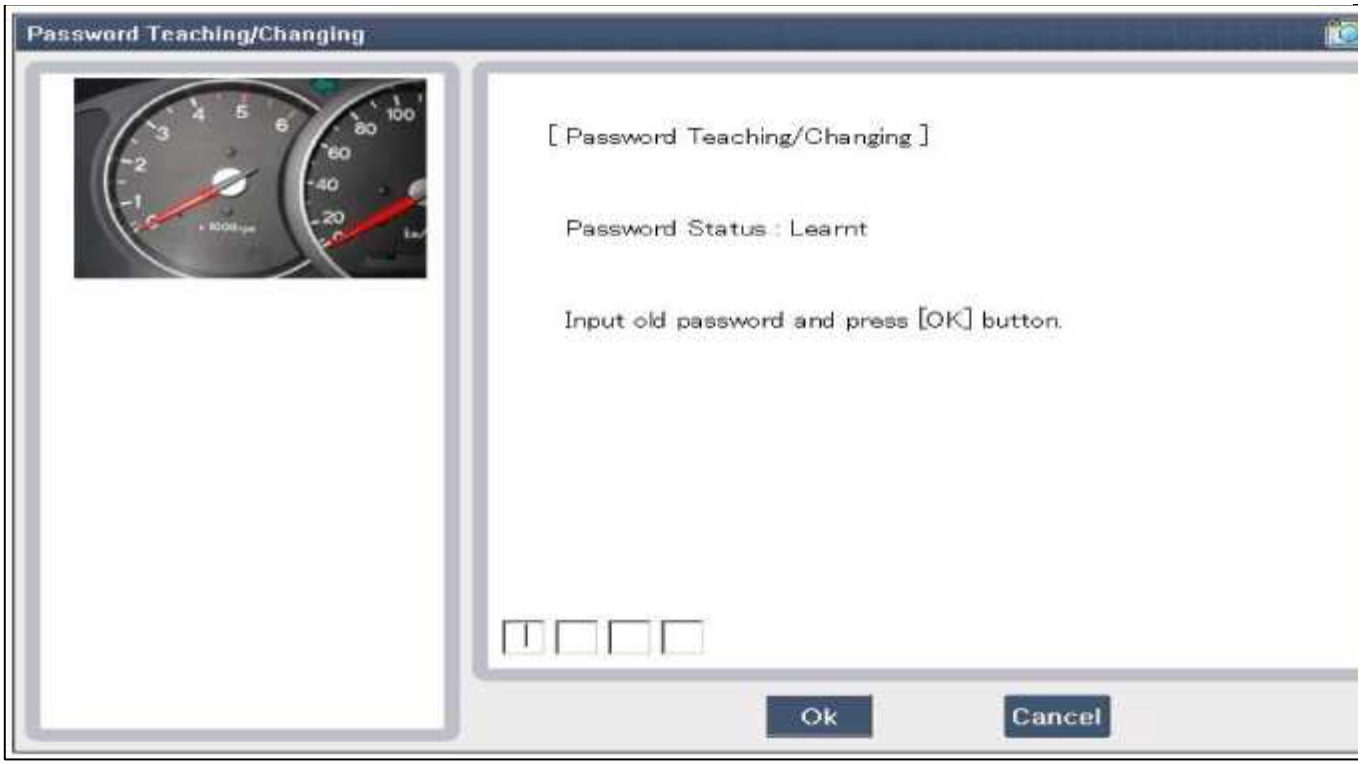

Password Teaching/Changing
[Password Teaching/Changing]
Password Status : Virgin
Are you sure? (Ok/Cancel)
[Condition : IG. On, ENG. Off]
Ok
Cancel

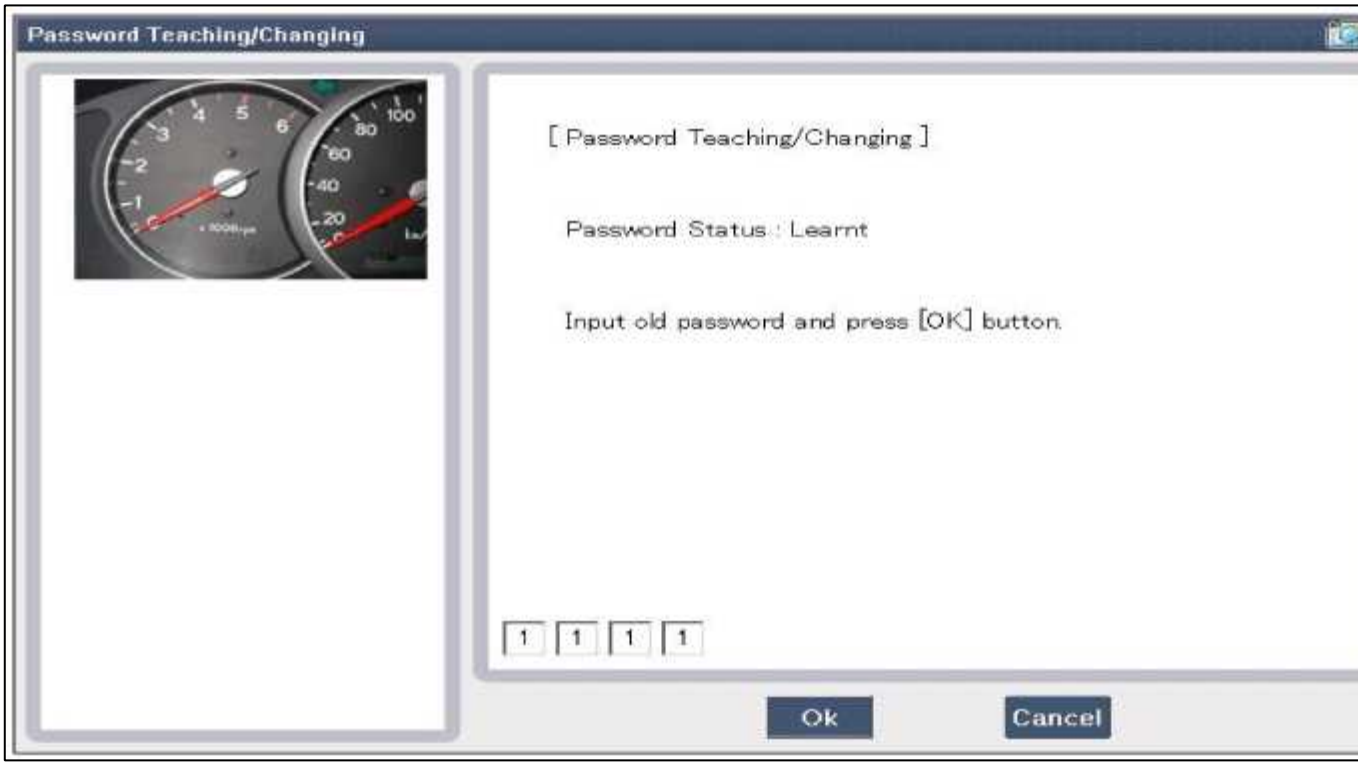


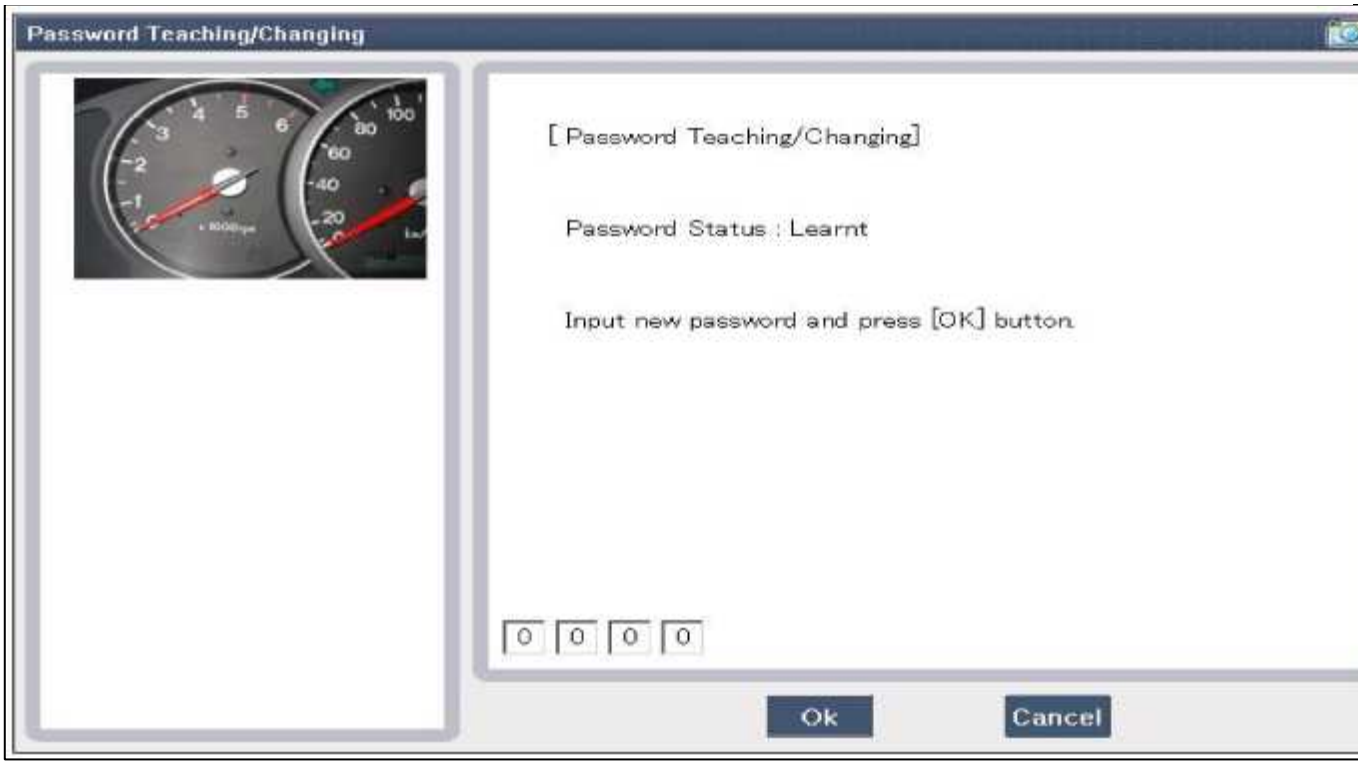
In case of putting wrong password, retry from first step after 10 seconds.

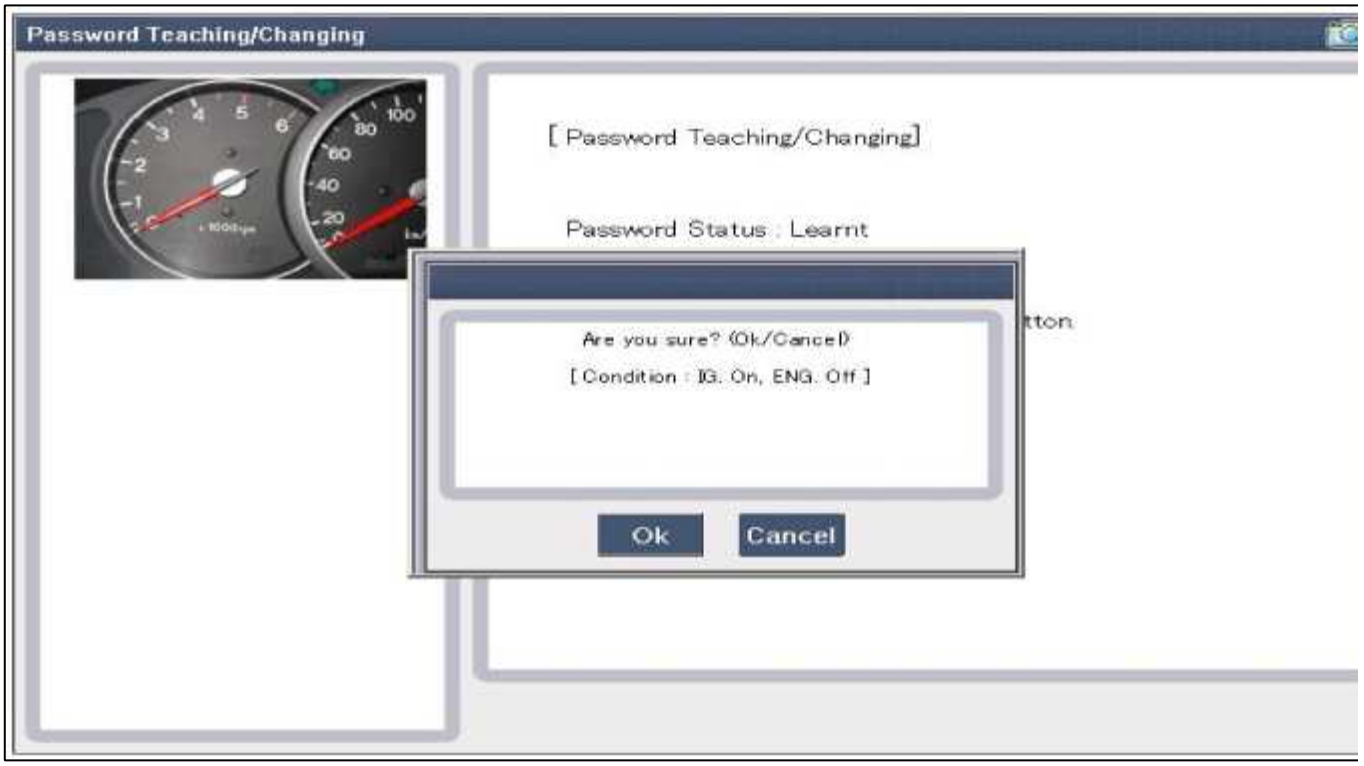
3. User password changing

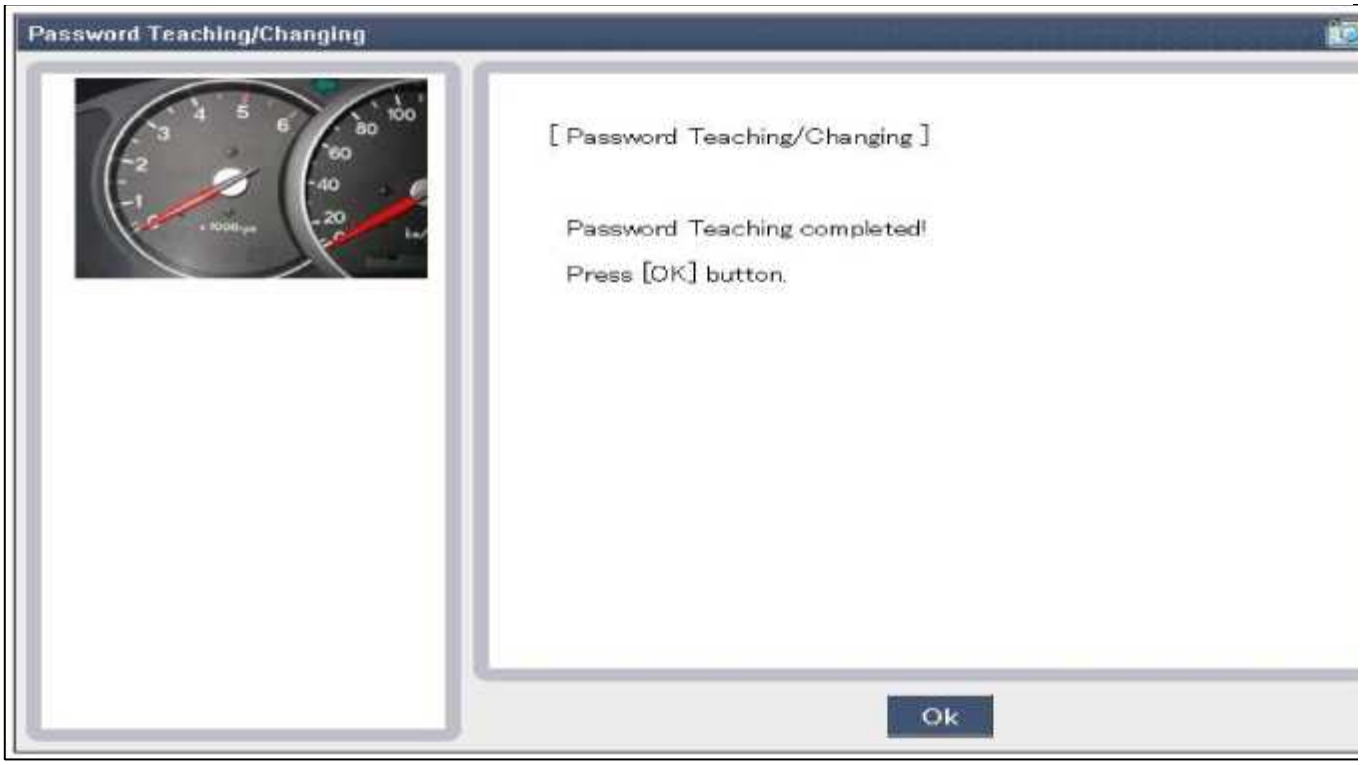



Password Teaching/Changing
[Password Teaching/Changing]
Password Status : Learnt
Input old password and press [OK] button.
Ok
Cancel


Password Teaching/Changing
[Password Teaching/Changing]
Password Status : Learnt
Input old password and press [OK] button.
1 1 1 1
Ok
Cancel

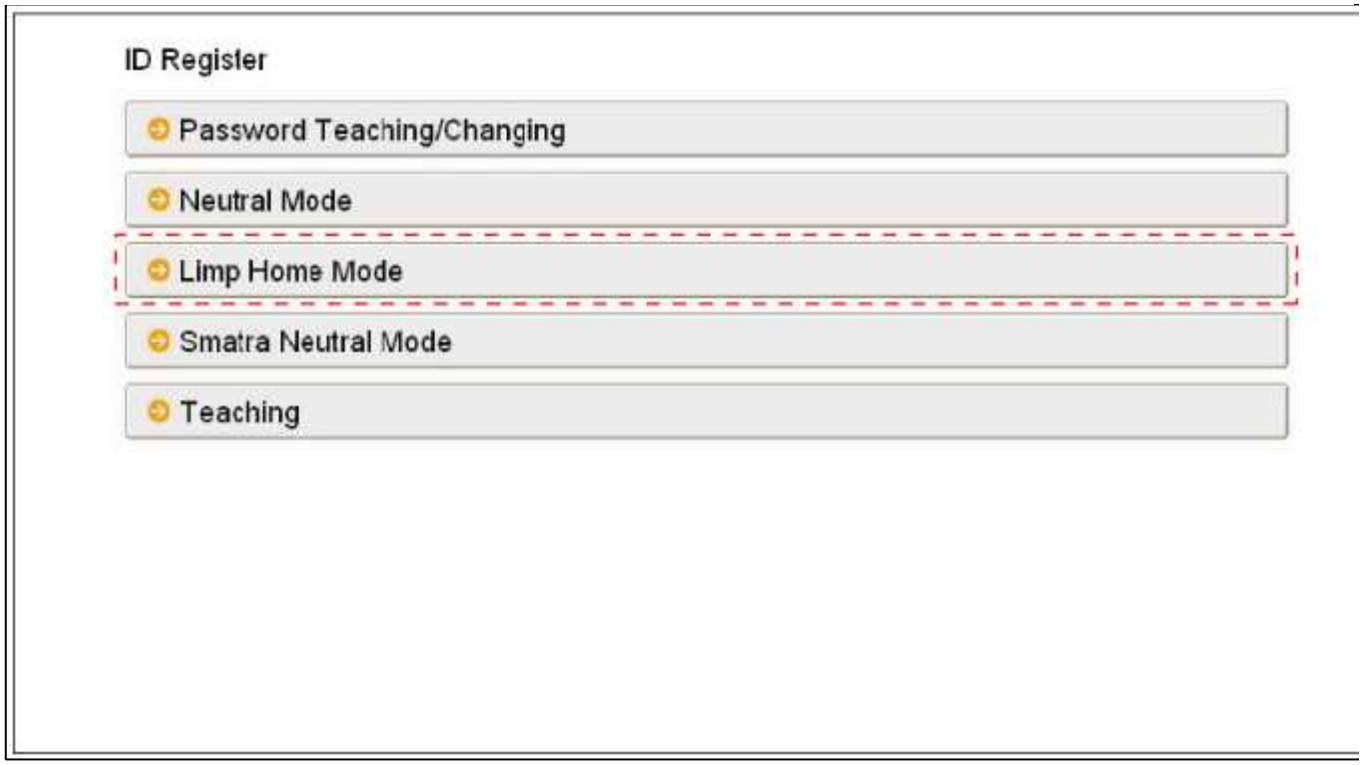

Password Teaching/Changing
[Password Teaching/Changing]
Password Status : Learnt
Input new password and press [OK] button.
0 0 0 0
Ok
Cancel

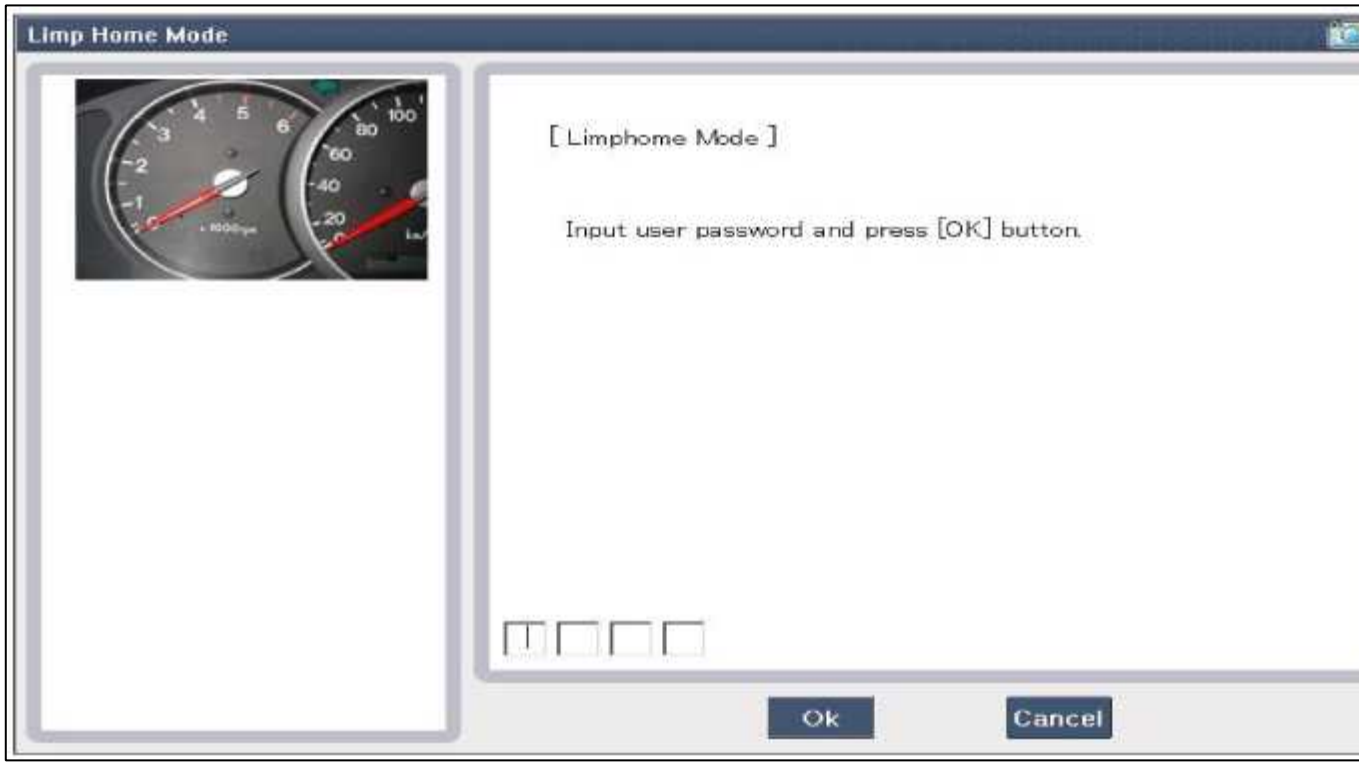

Password Teaching/Changing
[Password Teaching/Changing]
Password Status : Learnt
Are you sure? (Ok/Cancel)
[Condition : IG. On, ENG. Off]
Ok
Cancel

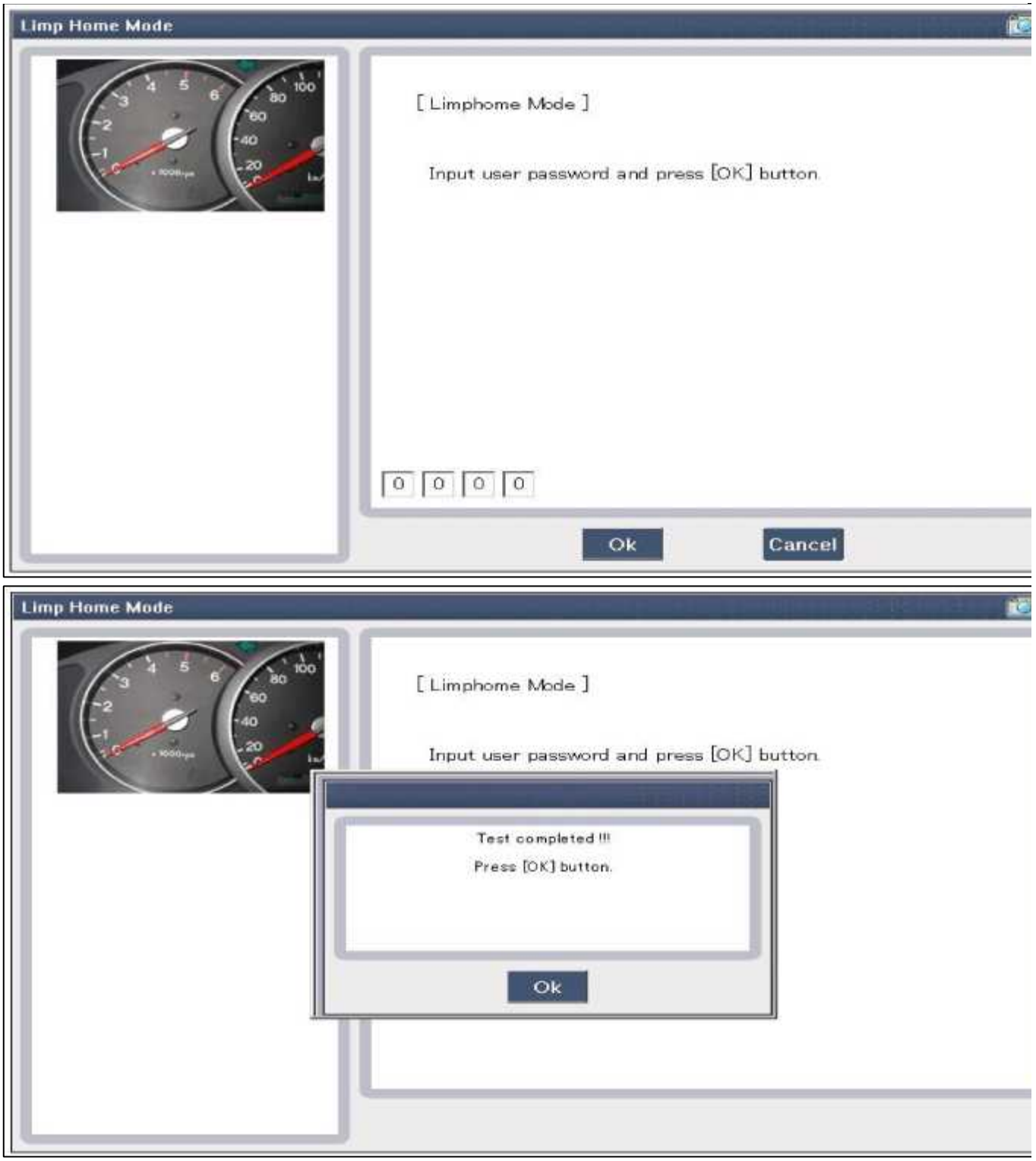


Limp Home Function

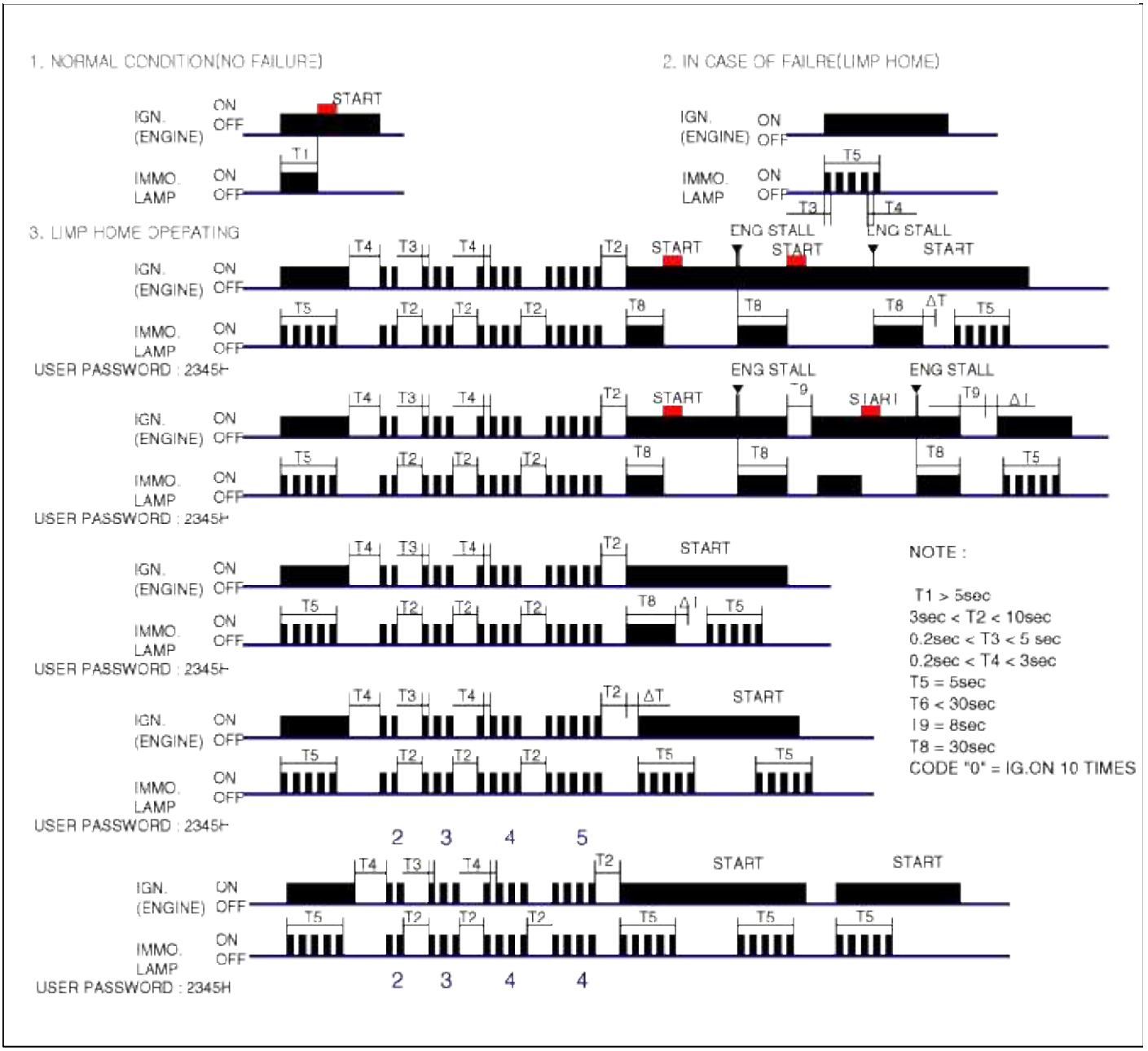
1. Limp Home By Tester
   If the PCM(ECM) detects the fault of the SMARTRA or transponder, the PCM(ECM) will allow limp home function of the immobilizer. Limp home is only possible if the user password (4 digits) has been given to the PCM(ECM) before. This password can be selected by the vehicle owner and is programmed at the service static 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 corr 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. Disconnect the battery or any other action cannot reduce this time. After connecting the battery to the PCM(ECM), the timer starts again for one hour.


ID Register
Password Teaching/Changing
Neutral Mode
Limp Home Mode
Smatra Neutral Mode
Teaching


Limp Home Mode
[Limphome Mode]
Input user password and press [OK] button.
Ok
Cancel



2. Limp Home By Ignition Key
   The limp home can be activated also by the ignition key. The user password can be input to the PCM(ECM) by a special sequence of ignition on/off.
   Only if the PCM(ECM) is in status "learnt" and the user password status is "learnt" and the user password is correct, the PCM(ECM) will be unlocked for a period of time (30 sec.). The engine can be started during this time. After the time has elapsed, engine start is not possible. After a new password has been input, the timer (30 sec.) will start again.
   After ignition off, the PCM(ECM) is locked if the timer has elapsed 8 seconds. For the next start, the input of the user password is requested again.



Replacement

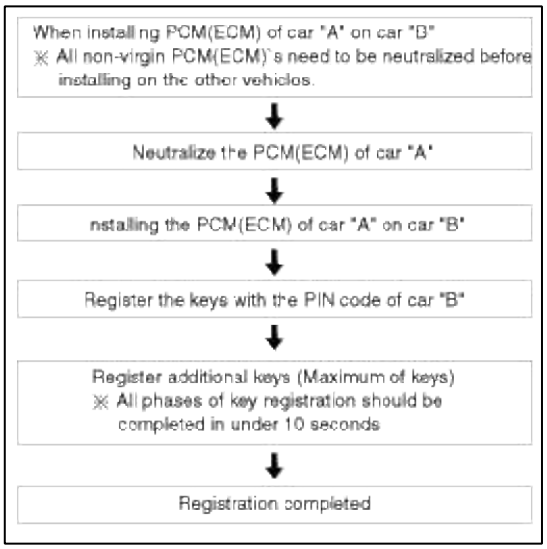
Problems And Replacement Parts:

Problem	Part set	Scan tool required?
All keys have been lost	Blank key (4)	YES
Antenna coil unit does not work	Antenna coil unit	NO
ECM does not work	PCM(ECM)	YES
Ignition switch does not work	Ignition switch with Antenna coil unit	YES
Unidentified vehicle specific data occurs	Key, PCM(ECM)	YES
SMARTRA unit does not work	SMARTRA unit	YES

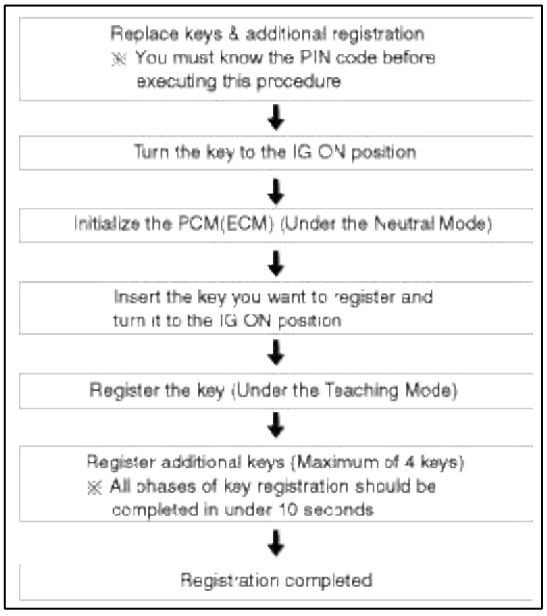
Replacement Of Ecm And Smartra

In case of a defective ECM, the unit has to be replaced with a "virgin" or "neutral" ECM. All keys have to be taught to the new ECM. Keys, which are not taught to the ECM, are invalid for the new ECM (Refer to key teaching procedure). The vehicle specific data have to be left unchanged due to the unique programming of transponder.
In case of a defective SMARTRA, it needs teaching the smartra. A new SMARTRA device replaces the old one and smartra need teaching.

1. Things to remember before a replacement (PCM(ECM))



2. Things to remember before a replacement (Keys & Additional registration)



NOTE

1. When there is only one key registered and you wish to register another key, you need to re-register the key which was already registered.
2. When the key #1 is registered and master key #2 is not registered, Put the key #1 in the IG/ON or the start position and remove it. The engine can be started with the unregistered key #2.
   (Note that key #2 must be used within 10 seconds of removing key #1)
3. When the key #1 is registered and key #2 is not registered, put the unregistered master key #2 in the IG/ON or the start position.
   The engine cannot be started even with the registered key #1.
4. When you inspect the immobilizer system, refer to the above paragraphs 1, 2 and 3.
   Always remember the 10 seconds zone.
5. If the pin code & password are entered incorrectly on three consecutive inputs, the system will be locked for one hour.
6. Be cautious not to overlap the transponder areas.
7. Problems can occur at key registration or vehicle starting if the transponders should overlap.

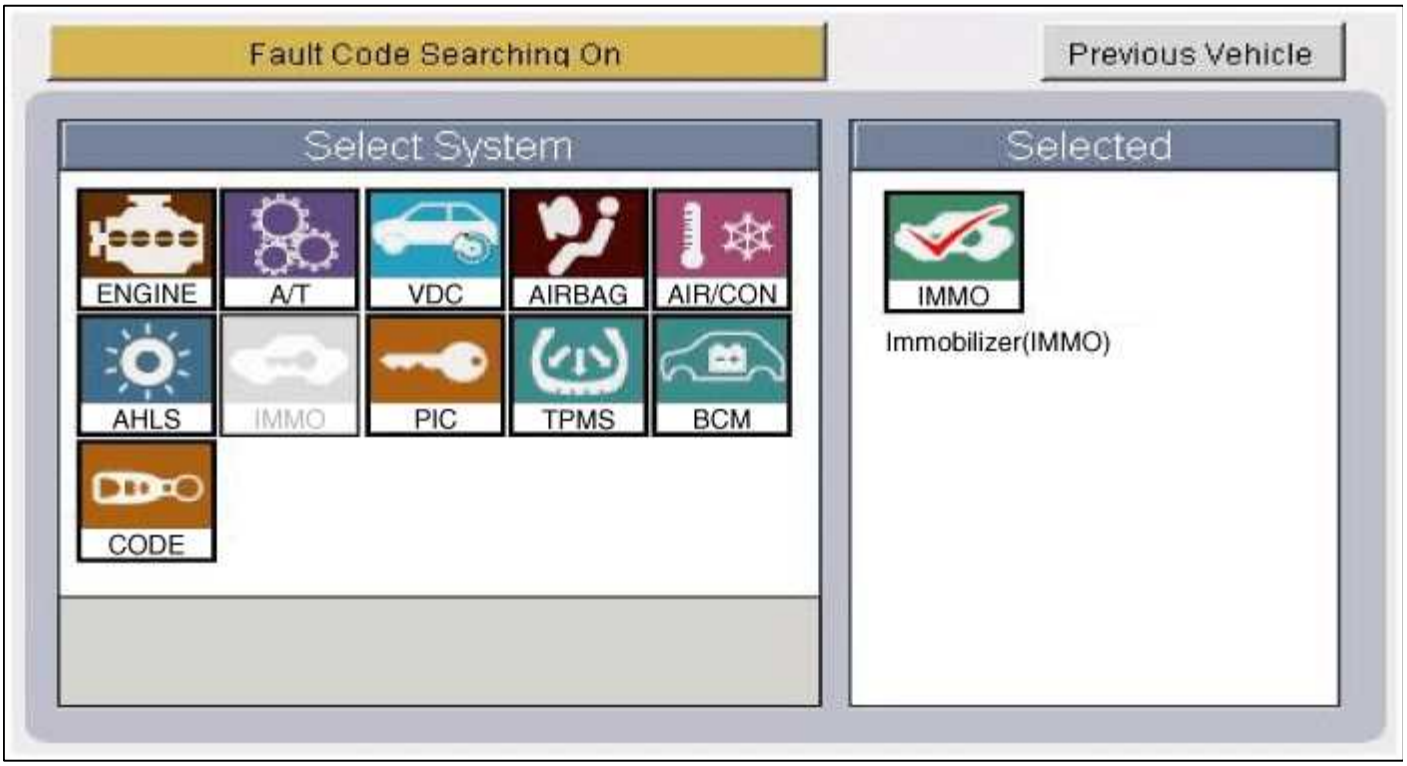
Neutralizing Of ECM

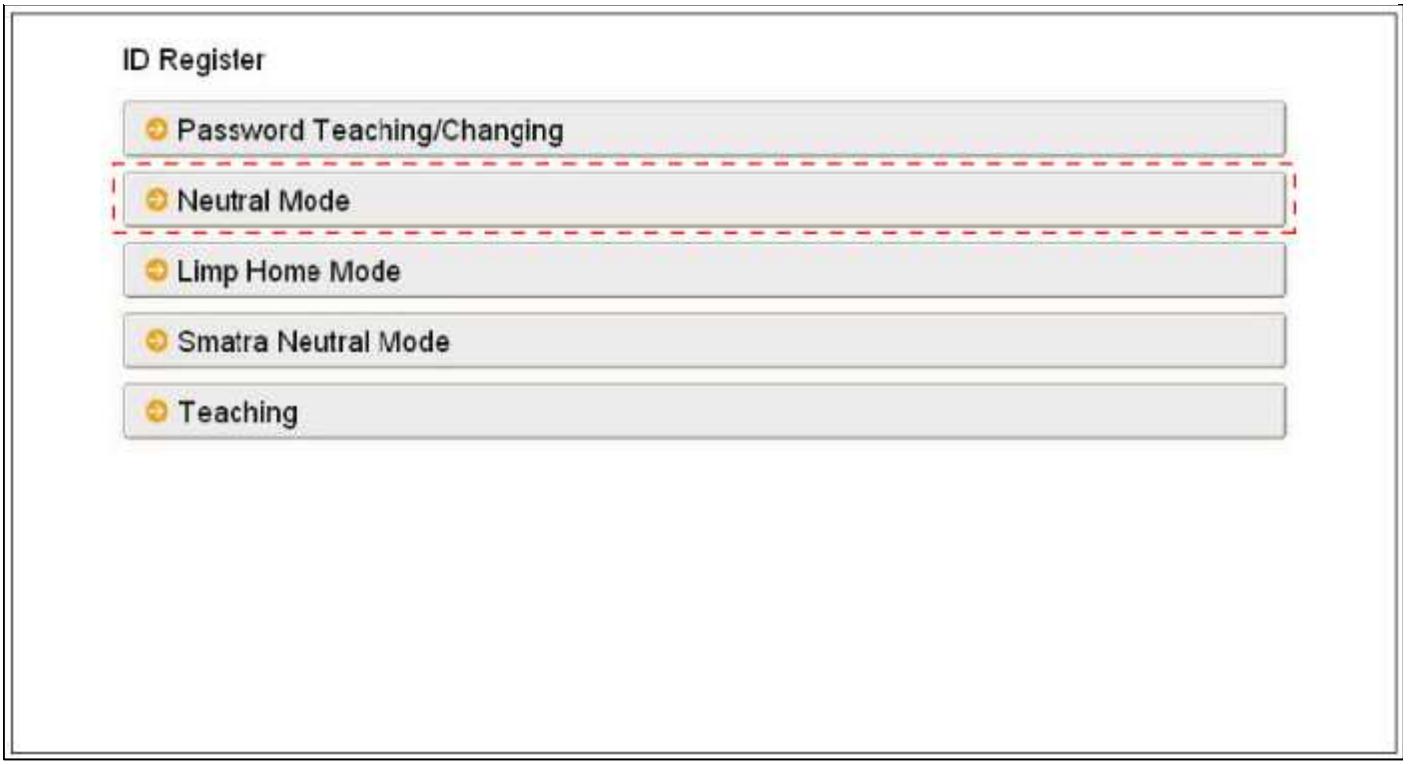
The PCM(ECM) can be set to the "neutral" status by a tester.
A valid ignition key is inserted and after ignition on is recorded, the PCM(ECM) requests the vehicle specific data from the tester. The communication messages are described at "Neutral Mode" After successfully receiving the data, the PCM(ECM) is neutralized.
The ECM remains locked. Neither the limp home mode nor the "twice ignition on" function, is accepted by the PCM(ECM).
The teaching of keys follows the procedure described for the virgin PCM(ECM). The vehicle specific data have to be unchanged due to the unique programming of the transponder. If data should be changed, new keys with a virgin transponder are requested.
This function is for neutralizing the PCM(ECM) and Key. Ex) when lost key, Neutralize the PCM(ECM) then teach keys.
(Refer to the Things to do when Key & PIN Code the PCM(ECM) can be set to the "neutral" status by a scanner.
If wrong vehicle specific data have been sent to SMATRA three times continuously or intermittently, the SMATRA will reject the request to enter neutral mode for one hour. Disconnecting the battery or other manipulation cannot reduce this time. After connecting the battery the timer starts again for one hour.

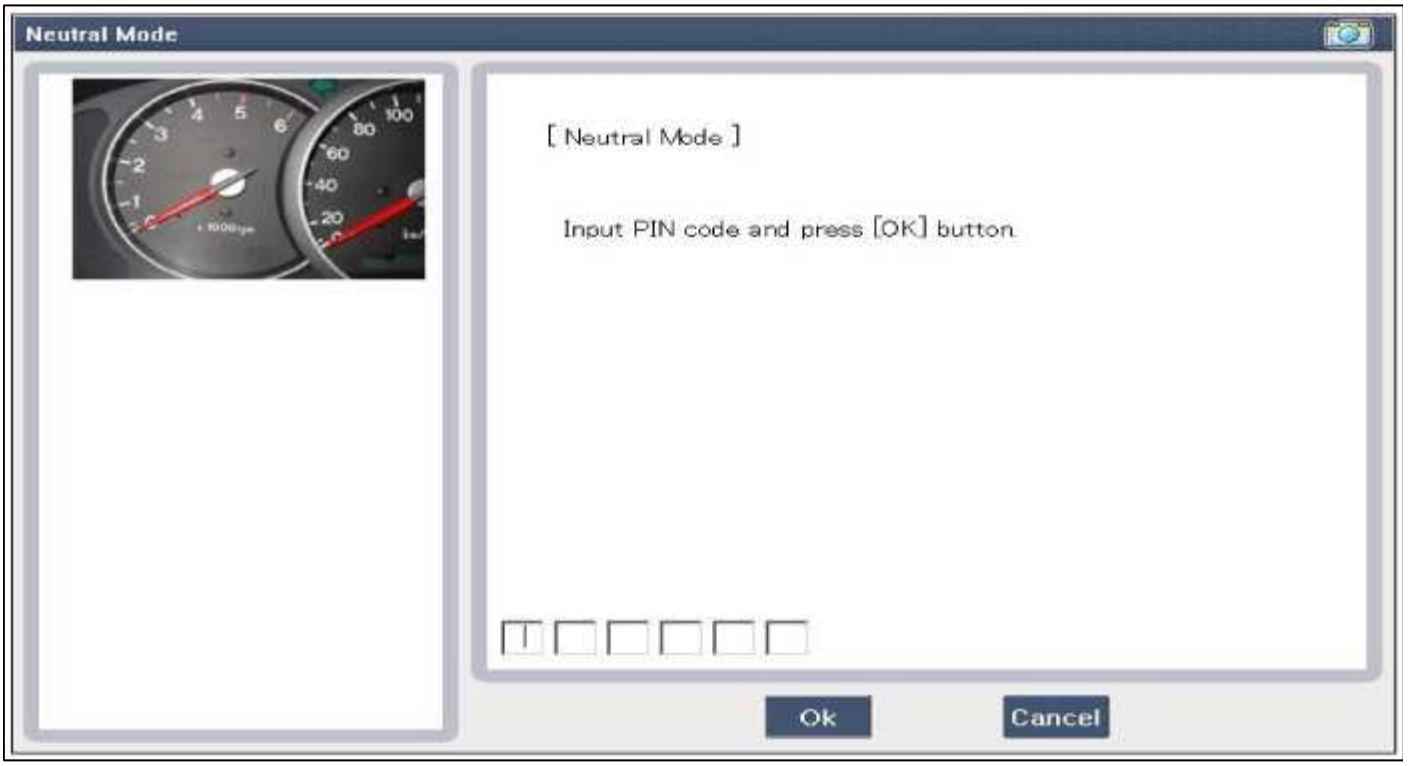
NOTE

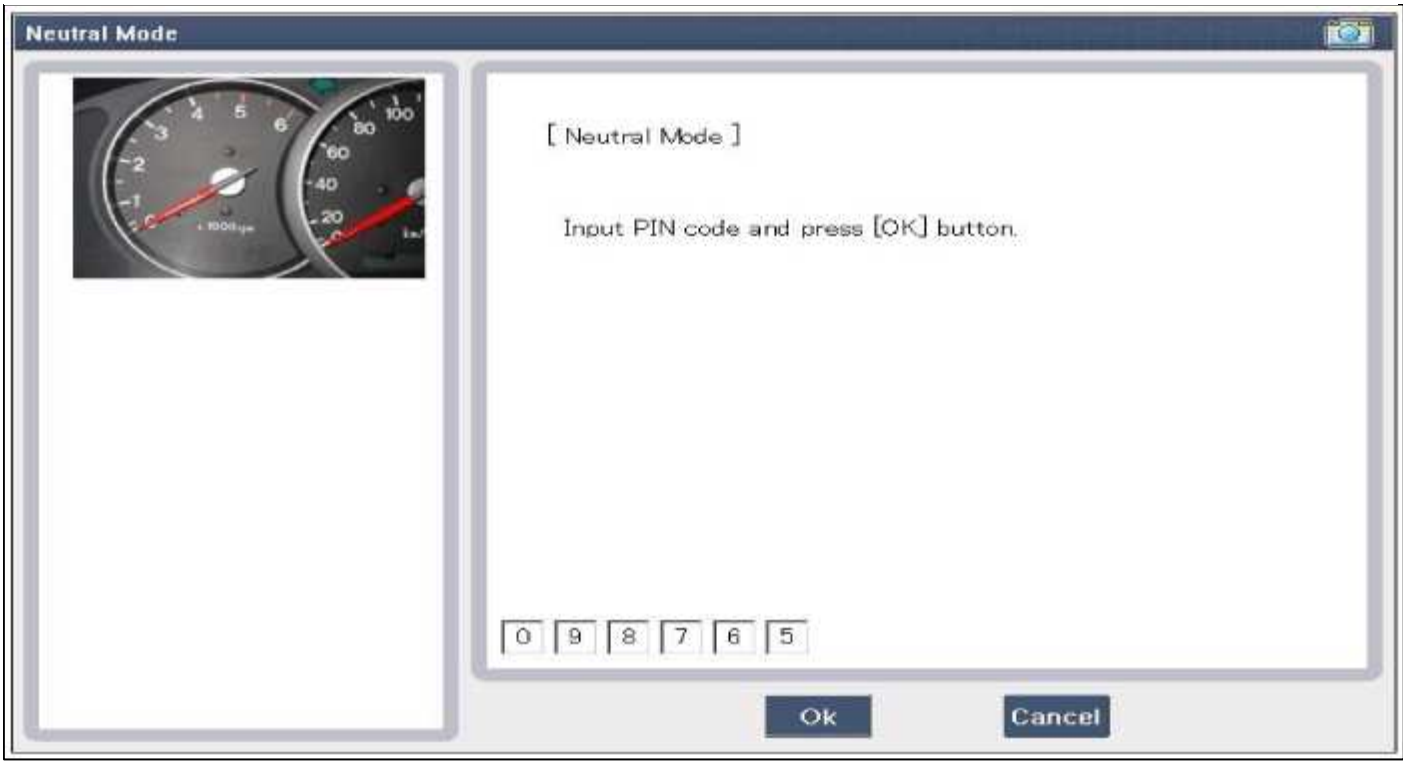
- Neutralizing setting condition
  - In case of PCM(ECM) status "Learnt" regardless of user password "Virgin or Learnt"
  - Input correct PIN code by scanner.
  - Neutralizing meaning .
    : PIN code (6) & user password (4) deletion.
    : Locking of ECM (except key teaching permission)
- Neutralizing meaning:
  - PIN Code(6) & User P/Word(4) deletion
  - Locking of EMS(except Key Learning permission)

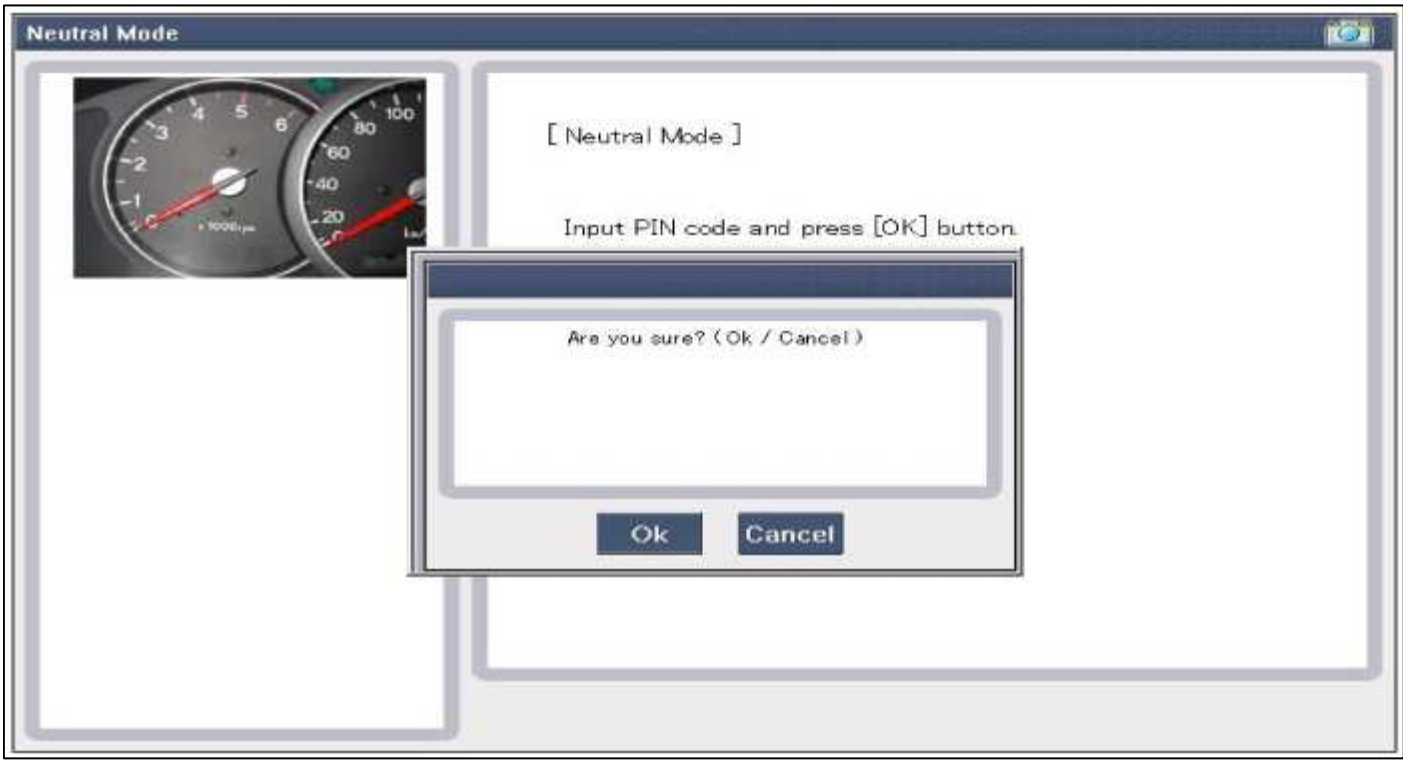
Function / EMS	Engine Running			Learning	
	Learnt Key	Limp home	Twice Ignition	Key	User Password
Neutral	No	No	No	Yes	No

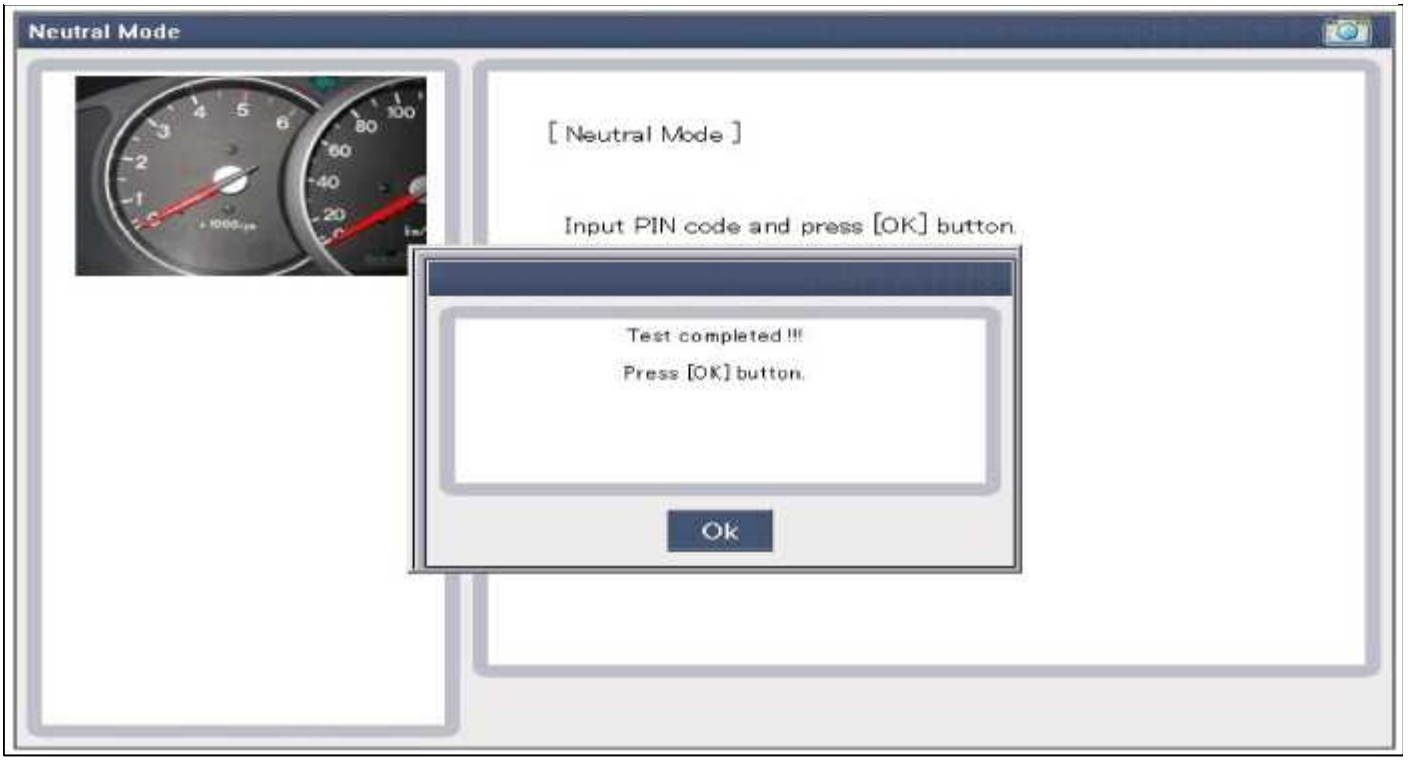


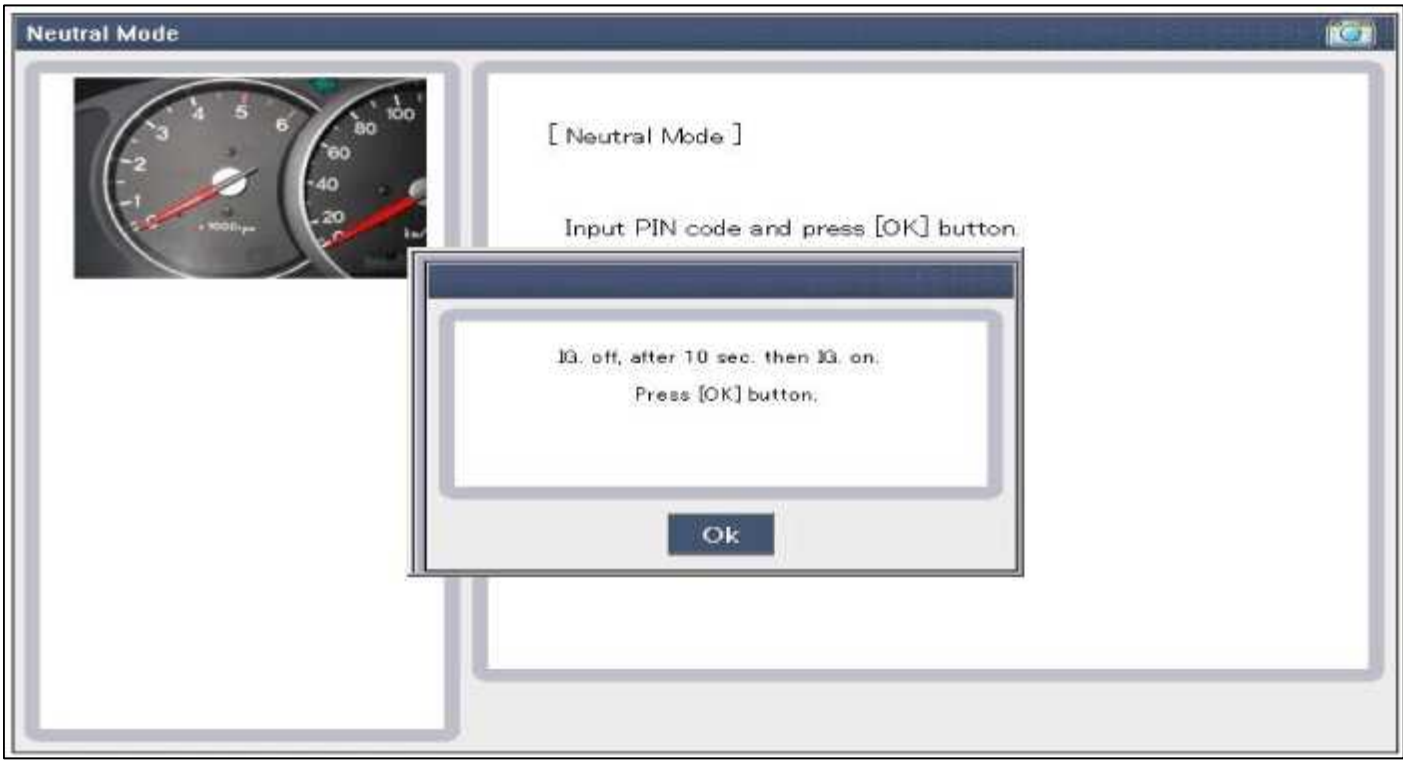

ID Register
Password Teaching/Changing
Neutral Mode
Limp Home Mode
Smatra Neutral Mode
Teaching

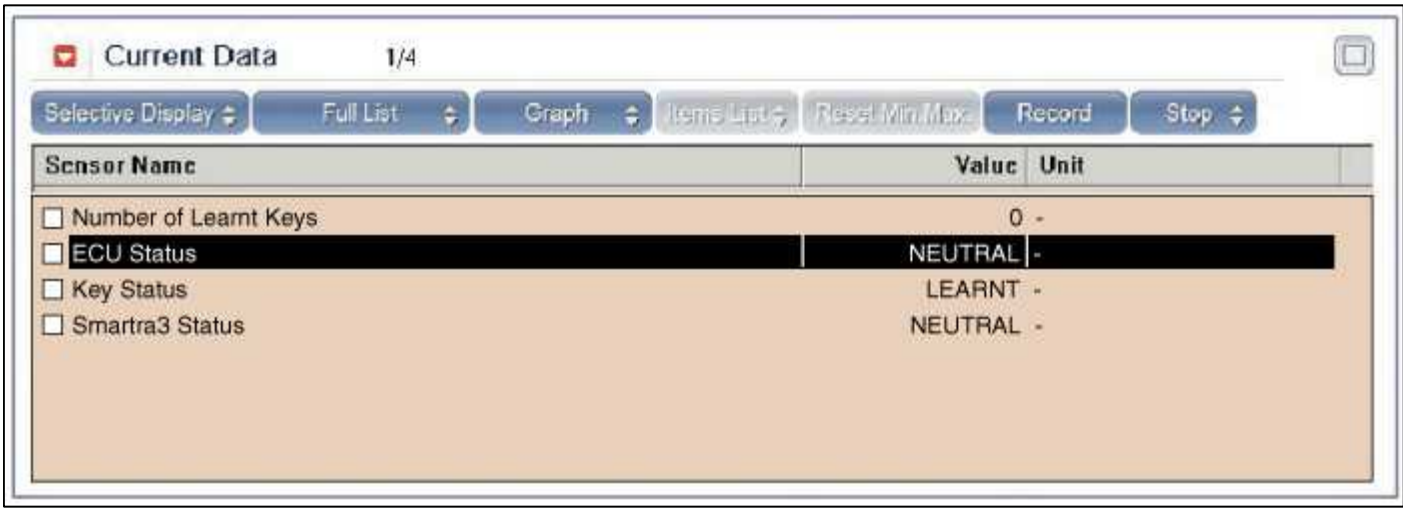

Neutral Mode
[Neutral Mode]
Input PIN code and press [OK] button
Ok
Cancel


Neutral Mode
[Neutral Mode]
Input PIN code and press [OK] button.
0 9 8 7 6 5
Ok
Cancel


Neutral Mode
[Neutral Mode]
Input PIN code and press [OK] button.
Are you sure? (Ok / Cancel)
Ok
Cancel


Neutral Mode
[Neutral Mode]
Input PIN code and press [OK] button.
Test completed !!!
Press [OK] button.
Ok


Neutral Mode
[Neutral Mode]
Input PIN code and press [OK] button.
IG. off, after 10 sec. then IG. on.
Press [OK] button.
Ok


Current Data
1/4
Selective Display
Full List
Graph
Items List
Reset Min Max
Record
Stop
Sensor Name
Value
Unit
Number of Learnt Keys
0
-
ECU Status
NEUTRAL
-
Key Status
LEARNT
-
Smartra3 Status
NEUTRAL
-

Neutralizing Of SMARTRA

The EMS can be set to the status "neutral" by tester

Ignition key (regardless of key status) is inserted and after IGN ON. If receiving the correct vehicle password from GST, SMARTRA can be neutralized. The neutralization of SMARTRA is possible if DPN is same as the value inputted by GST.

In case that the SMARTRA status is neutral, the EMS keeps the lock state. And the start is not possible by "twice ignition".

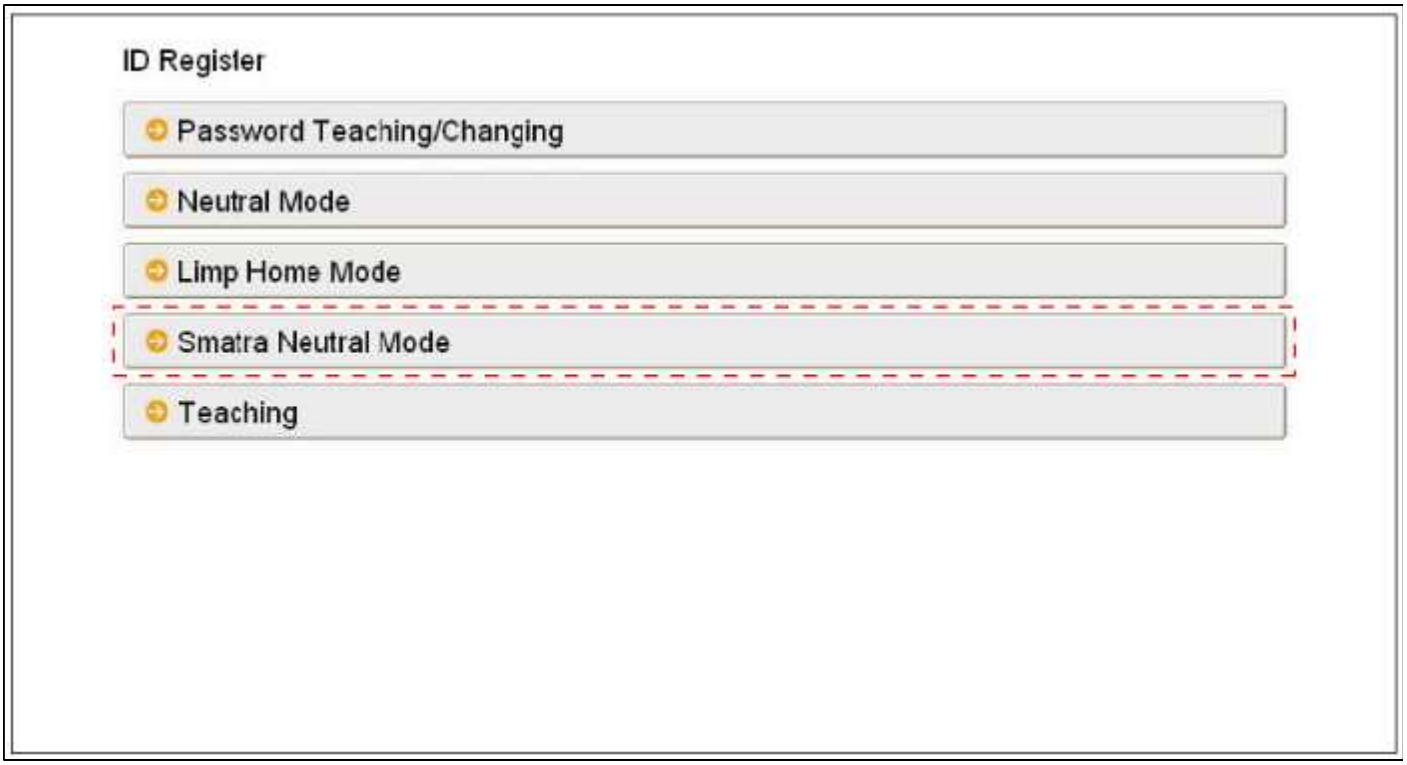
In case of changing the vehicle password, new virgin transponder must be only used. And in case of virgin key, after Learning the key of vehicle password, it can be used.

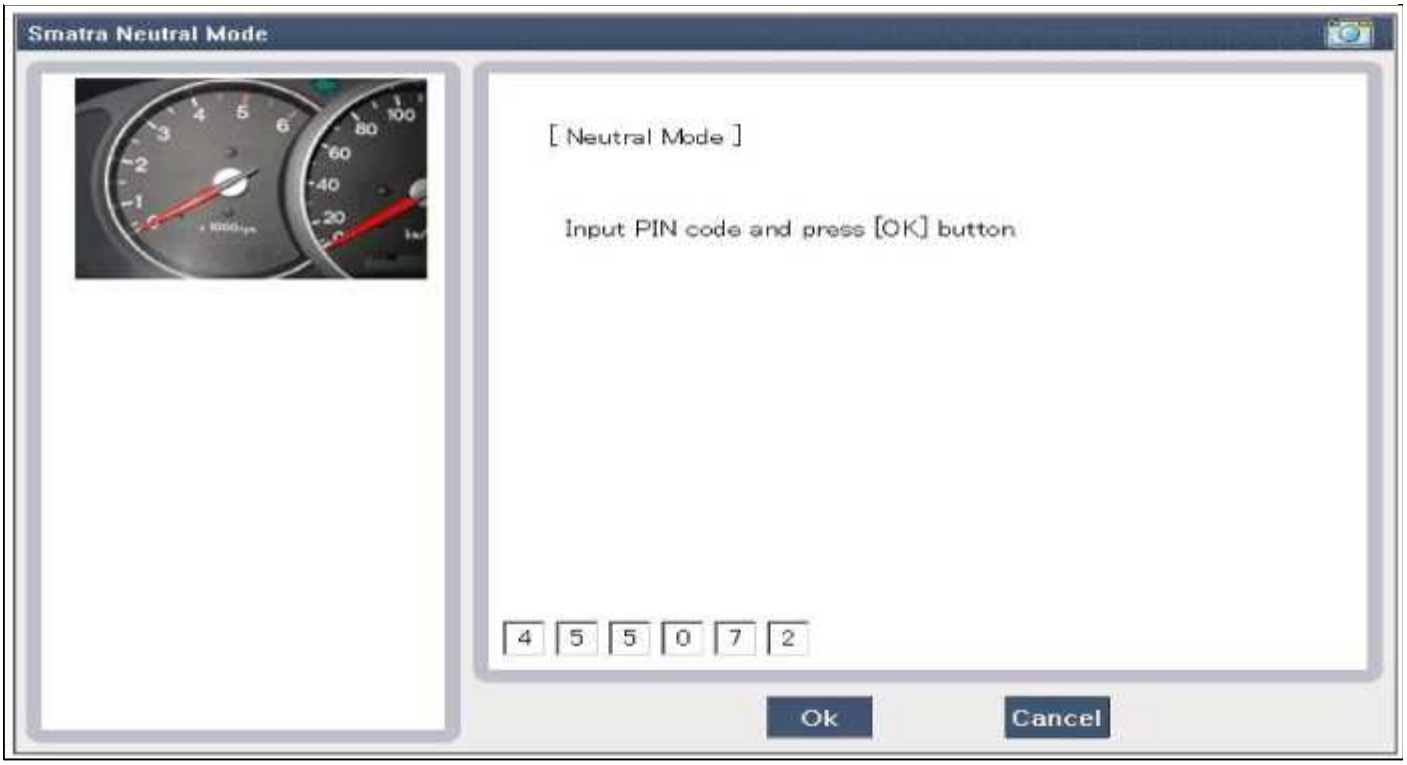
If wrong vehicle specific data have been sent to SMATRA three times continuously or intermittently, the SMATRA will reject the request to enter neutral mode for one hour. Disconnecting the battery or other manipulation cannot reduce this time. After connecting the battery the timer starts again for one hour.

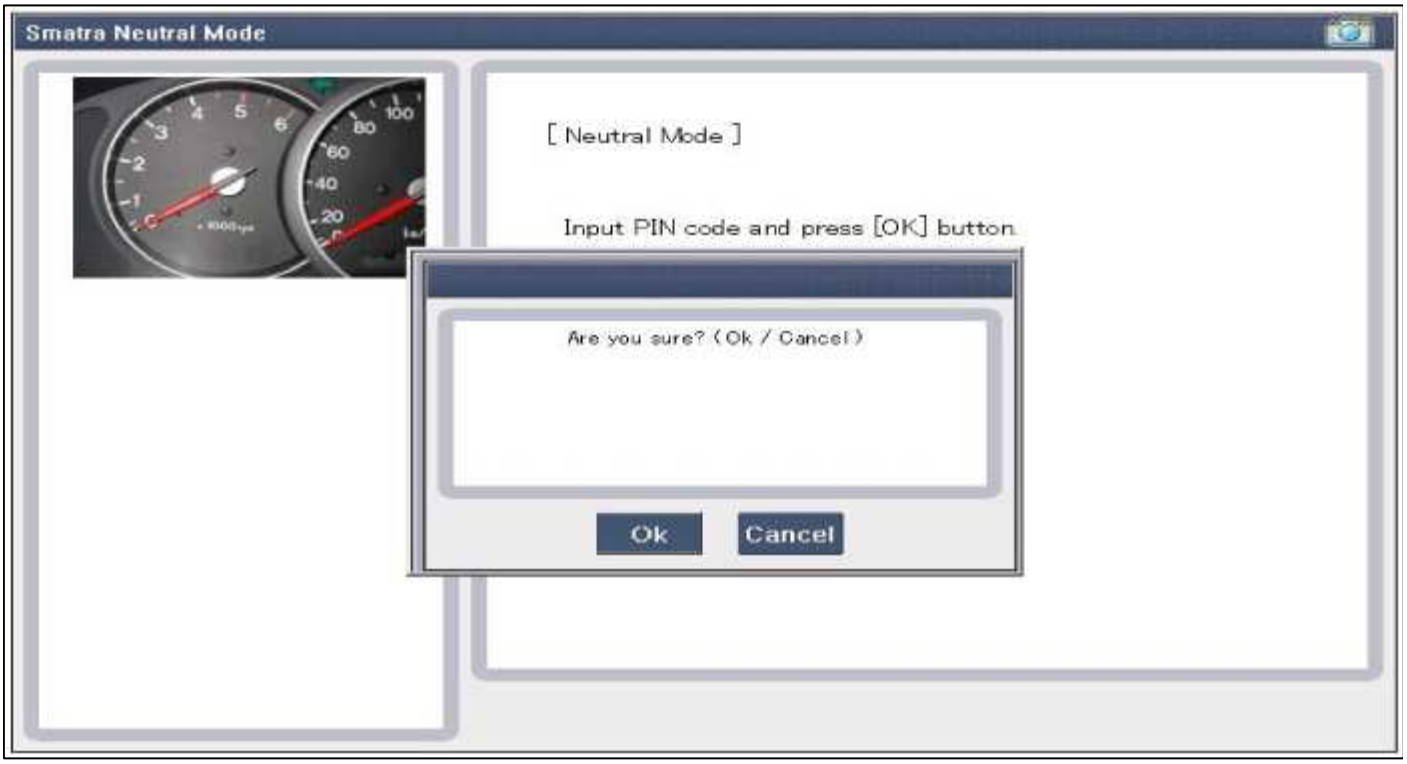
NOTE

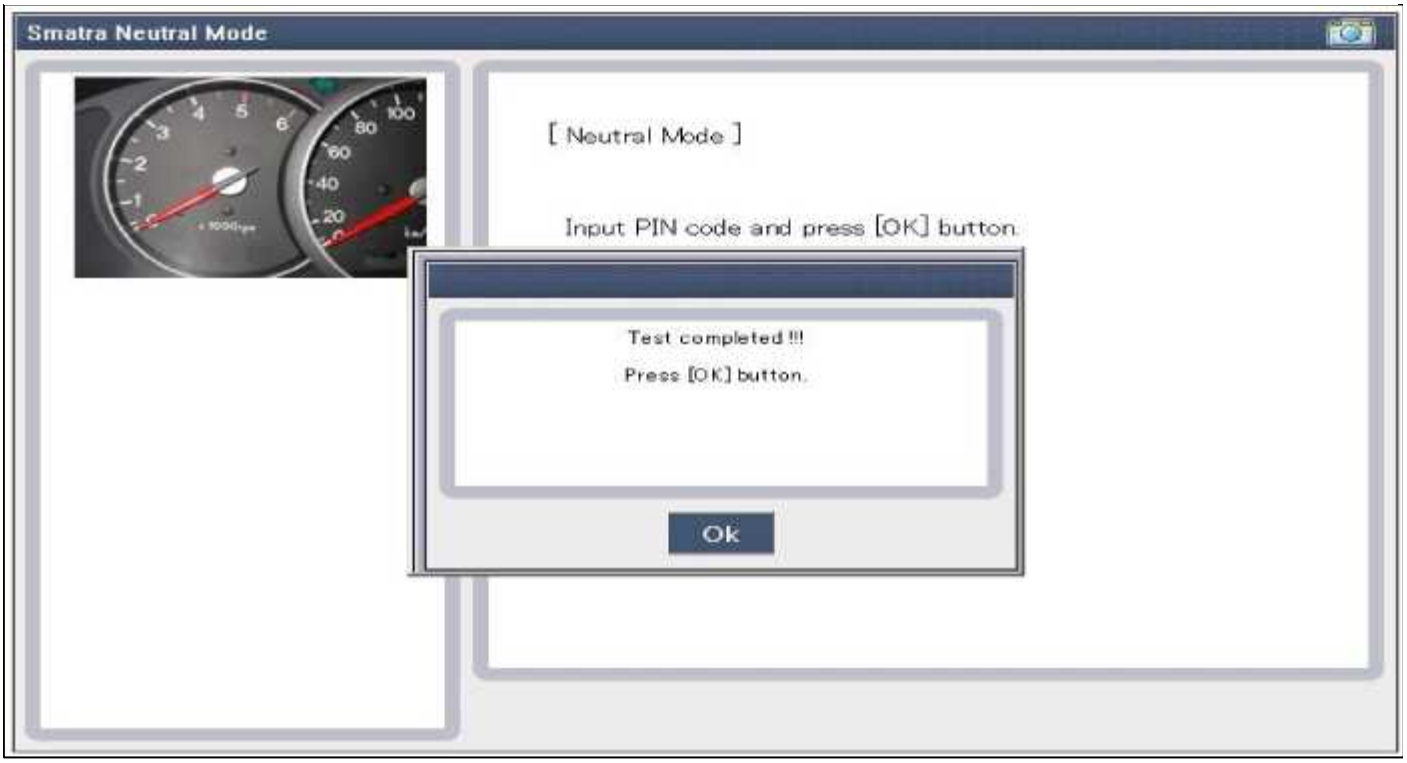
- Neutralizing Setting condition :
  - In case of "SMARTRA status", "Learnt"
  - Input correct Pin code by tester
- Neutralizing meaning :
  - Vehicle password(DPN Code) & SEK Code deletion.
  - Permission of New DPN Learning.

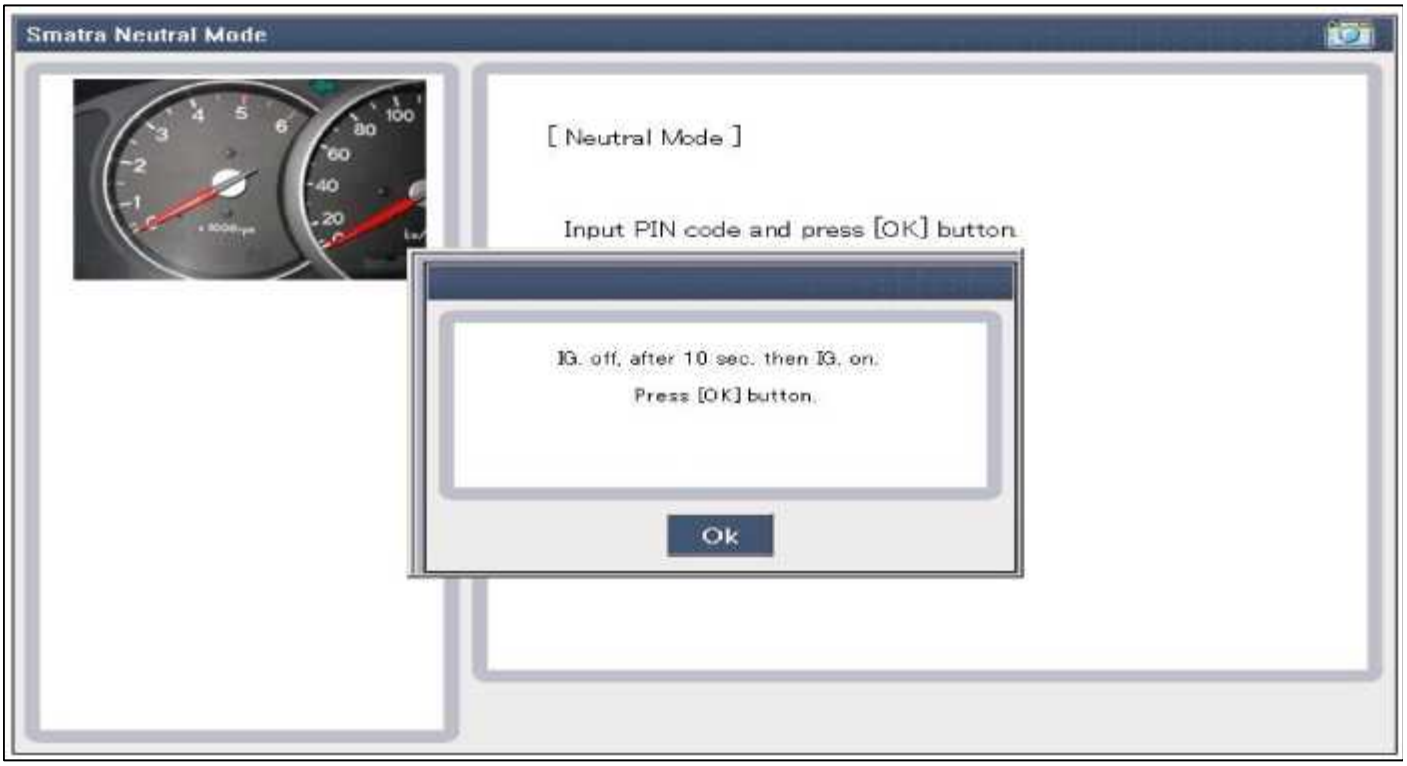
Function / SMARTRA	Engine Running			Learning	
	Learnt Key	Limp home	Twice Ignition	Key	User Password
Neutral	No	Yes (EMS learnt)	No	Yes	No

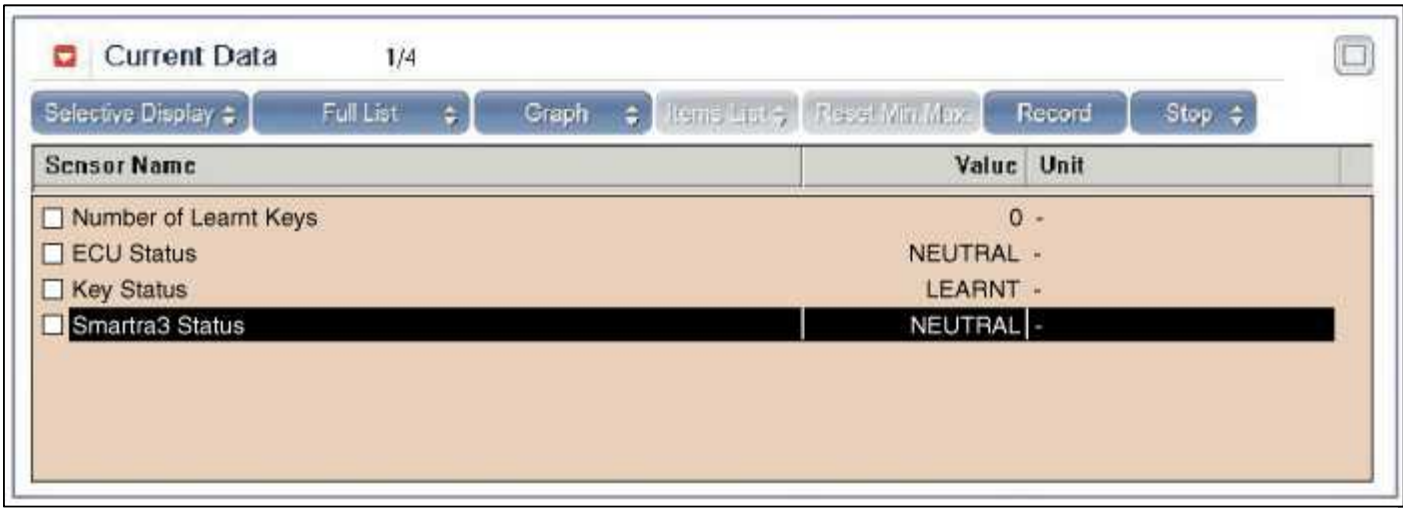



Smatra Neutral Mode
[Neutral Mode]
Input PIN code and press [OK] button
4 5 5 0 7 2
Ok
Cancel


Smatra Neutral Mode
[Neutral Mode]
Input PIN code and press [OK] button
Are you sure? (Ok / Cancel)
Ok
Cancel


Smatra Neutral Mode
[Neutral Mode]
Input PIN code and press [OK] button.
Test completed !!!
Press [OK] button.
Ok


Smatra Neutral Mode
[Neutral Mode]
Input PIN code and press [OK] button.
IG. off, after 10 sec. then IG. on.
Press [OK] button.
Ok


Current Data 1/4
Selective Display
Full List
Graph
Items List
Reset Min Max
Record
Stop
Sensor Name
Value
Unit
Number of Learnt Keys 0 -
ECU Status NEUTRAL -
Key Status LEARNT -
Smartra3 Status NEUTRAL -

Body Electrical System > Immobilizer System > Troubleshooting

Diagnosis Of Immobilizer Faults

- Communication between the ECM and the SMARTRA.
- Function of the SMARTRA and the transponder.
- Data (stored in the ECM related to the immobilizer function.

The following table shows the assignment of immobilizer related faults to each type:

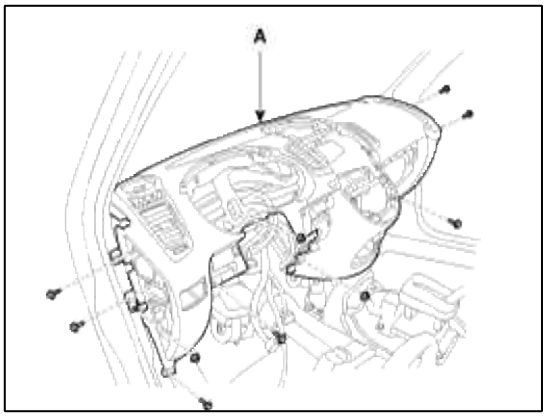
Immobilizer Related Faults	Fault types	Diagnostic codes
PCM(ECM) fault	1. Non-Immobilizer-EMS connected to an Immobilizer	P1610
Transponder key fault	1. Transponder not in password mode 2. Transponder transport data has been changed.	P1674 (Transponder status error)
Transponder key fault	1. Transponder programming error	P1675 (Transponder programming error)
SMARTRA fault	1. Invalid message from SMARTRA to PCM(ECM)	P1676 (SMARTRA message error)
SMARTRA fault	1. Virgin SMARTRA at learnt EMS 2. Neutral SMARTRA at learnt EMS 3. Incorrect the Authentication of EMS and SMARTRA 4. Locking of SMARTRA	P169A (SMARTRA Authentication fail)
SMARTRA fault	1. No response from SMARTRA 2. Antenna coil error 3. Communication line error (Open/Short etc.) 4. Invalid message from SMARTRA to PCM(ECM)	P1690 (SMARTRA no response)
Antenna coil fault	1. Antenna coil open/short circuit	P1691 (Antenna coil error)
Immobilizer indicator lamp fault	1. Immobilizer indicator lamp error (Cluster)	P1692 (Immobilizer lamp error)
Transponder key fault	1. Corrupted data from transponder 2. More than one transponder in the magnetic field (Antenna coil) 3. No transponder (Key without transponder) in the magnetic field (Antenna coil)	P1693 (Transponder no response error/invalid response)
PCM(ECM) fault	1. Request from PCM(ECM) is invalid (Protocol layer violation- Invalid request, check sum error etc.)	P1694 (PCM(ECM) message error)
PCM(ECM) internal permanent memory (EEPROM) fault	1. PCM(ECM) internal permanent memory (EEPROM) fault 2. Invalid write operation to permanent memory (EEPROM)	P1695 (PCM(ECM) memory error)
Invalid key fault	1. Virgin transponder at PCM(ECM) status "Learnt" Learnt (Invalid) Transponder at PCM(ECM) status "Learnt"(Authentication fail)	P1696 (Authentication fail)

Hi-Scan fault	1. Hi-Scan message error	P1697
Locked by timer	1. Exceeding the maximum limit of Twice IGN ON (32 times)	P1699 (Twice IG ON over trial)

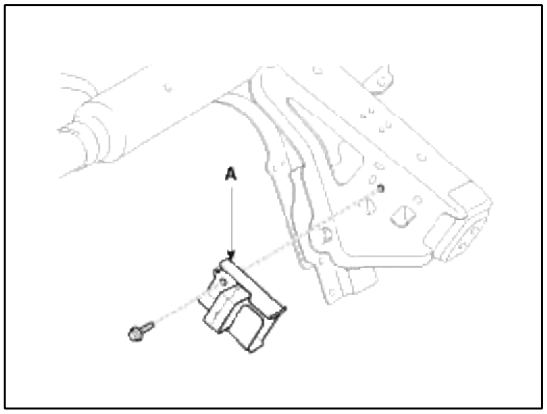
Body Electrical System > Immobilizer System > Immobilizer Control Unit > Repair procedures

Removal

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



3. Disconnect the 5P connector of the SMARTRA unit and then remove the SMARTRA unit (A) after loosening a nut.



Installation

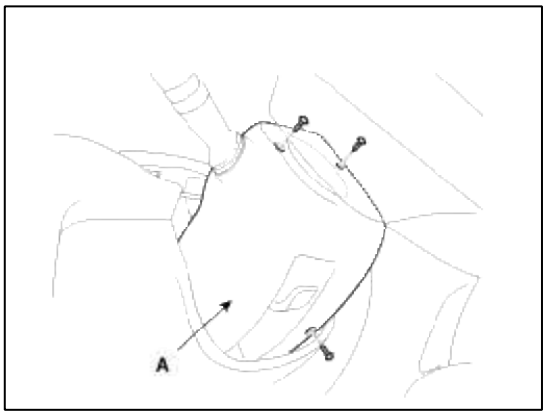
1. Install the immobilizer control unit after connecting the unit connector.
2. Install the crash pad.

Body Electrical System > Immobilizer System > Antenna Coil > Repair procedures

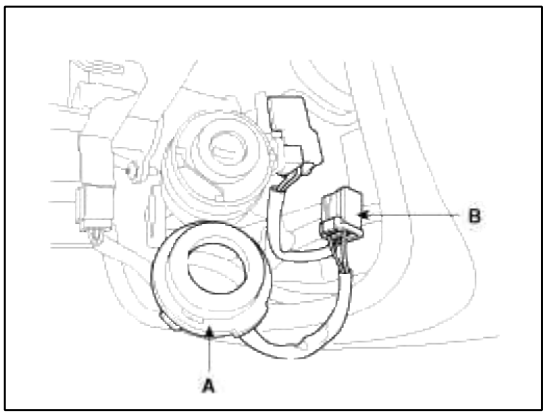
Removal

1. Disconnect the negative (-) battery terminal.

2. Remove the steering column upper and lower shrouds (A).



3. Disconnect the 6P connector (B) of the coil antenna and then remove the coil antenna (A) after loosening the screw.



Installation

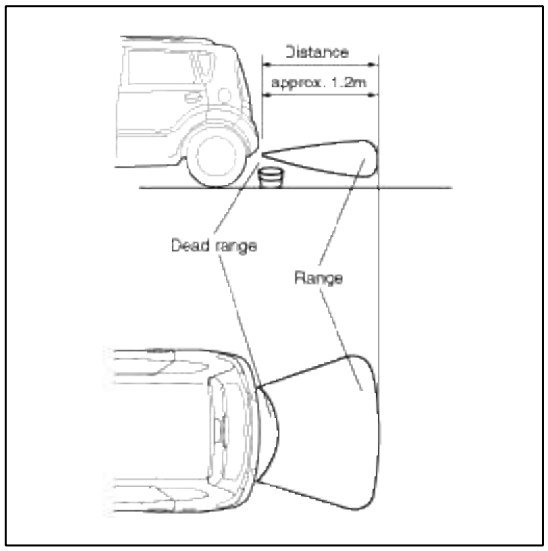
1. Install the coil antenna and connect the 6P connector.
2. Install the steering column upper and lower shrouds.

Body Electrical System > Rear Parking Assist System > General Safety Information and Caution

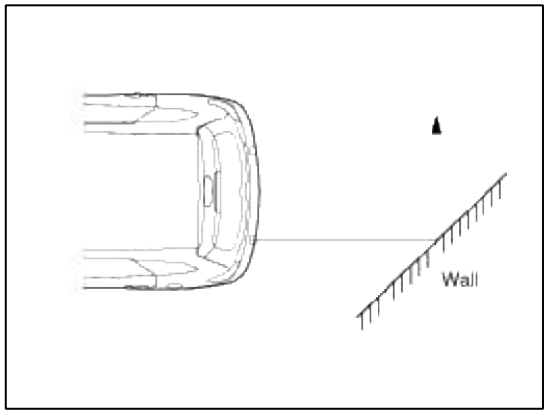
Warning

1. Range detected by back sensors is limited.
   Watch back before reversing.
2. There is a blind spot below the bumper. Low objects (for example boundary barrier) may be detected from minimum 1.5m away unable to detect at nearer.

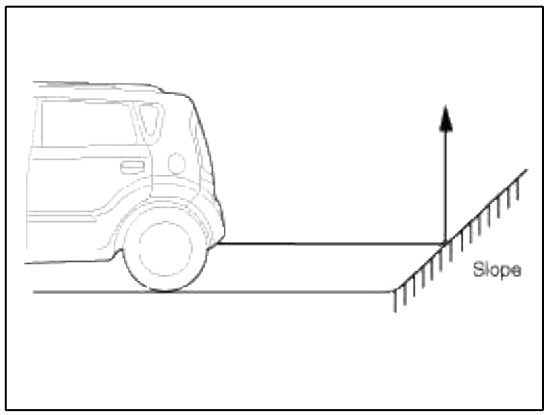
3. Besides there are some materials unable to be detected even in detection range as follows.
   (1) Needles, ropes, rods, or other thin objects.
   (2) Cotton, snow and other material absorbing ultrasonic wave(for example, fire extinguisher device covered with snow)



4. Reversing toward the sloped walls.



5. Reversing toward the sloped terrain.



6. False alarm may operate in the following condition: irregular road surface, gravel road, sloped road and grass. Upon alarm generation by grass the alarm may be generated by rock behind grass. Be sure to check for the safety.
   Ultrasonic sensor cannot discriminate among glass, stake, and rock.

7. Sensors may not operate correctly in the below conditions.
   Ensure sensors clean from mud or dirt.
   (1) When spraying the bumper, the sensor opening is covered with something in order not to be contaminated. If sensor opening is contaminated with mud, snow, or dirt, detection range will be reduced and alarm may not be generated under the crash condition. Dirt accumulated on the sensor opening shall be removed with water.
   Do not wipe or scrape sensor with a rod or a hard object.
   (2) If the sensor is frozen, alarm may not operate until sensor thaws.
   (3) If a vehicle stays under extremely hot or cold environment, the detection range may be reduced. It will be restored at the normal temperature.
   (4) When heavy cargo is loaded in tailgate, it changes the vehicle balance, which reduces the detection range.
   (5) When other vehicle's horn, motor cycle engine noise, or other ultra-sonic wave sources are near.
   (6) Under heavy rain.
   (7) When reversing towards a vertical wall and the gap between the vehicle and the wall is 15cm. (Alarm may sound despite of no barrier)
   (8) If radio antenna is installed at the rear.
   (9) If the vehicle rear wiring is re-routed or electrical component is added at the rear part.
   (10) Vehicle balance is changed due to the replacement of the rear spring.
   (11) The unit will operate normally when the vehicle speed is 5km/h or less. Above the speed, the unit may not operate normally.

8. Check the rear bumper for installation condition and deformation. If installed improperly or the sensor orientation is deviated, it may cause malfunction.

9. Be careful not to apply shock during sensor installation on the transmission or reception unit.

10. When adding electrical devices or modifying harness at the rear body of the vehicle, ensure not the change the transmission and reception unit wiring. Tagging the transmission side and reception side, it may cause malfunction.

11. High power radio transmitter (above 10W) may cause malfunction. Do not install it on the vehicle.

12. Be careful that heating or sharp objects shall not touch ultrasonic sensor surface.
    Besides do not cover the sensor opening or press the sensor.

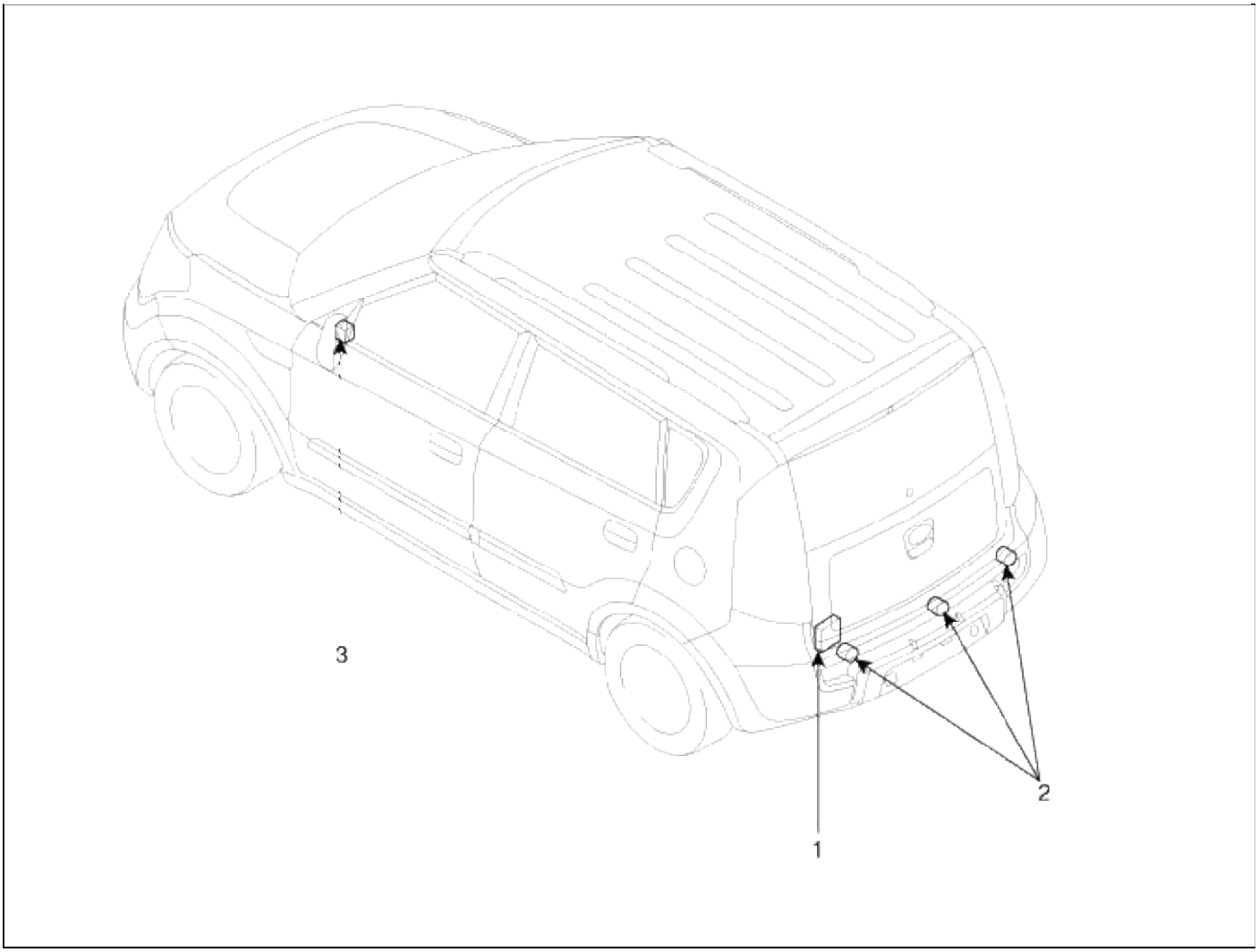
Body Electrical System > Rear Parking Assist System > Specifications

Specification

Item		Specification
Rear parking assist system control unit	Voltage rating	DC 12V
	Operation voltage	DC 9 ~ 16 V
	Operation temperature	-30°C ~ + 80°C
	Operation current	MAX 600 mA
	Operation frequency	40 ± 5 KHz
	Detective method	Direct and indirect detection
Ultrasonic sensor	Voltage rating	DC 8 V
	Detecting range	40 cm ~ 120 cm
	Operation voltage	DC 9 ~ 16 V
	Operation current	MAX 20 mA
	Operation temperature	-30°C ~ + 80°C
	Beam width	Horizontal : 100±5°(70cm), Vertical : 50±5°(50cm)
	Number of sensors	4 (Right, center, Left)
Piezo buzzer	Voltage rating	DC 12 V
	Operation voltage	DC 9 ~ 16 V
	Operation temperature	-30°C ~ + 80°C
	Operation current	MAX 60 mA
	Sound, tone	Oscillation frequency : 2.2±0.5 KHz
		Sound level : MIN 70 dB (DC 13V /m)

Body Electrical System > Rear Parking Assist System > Components and Components Location

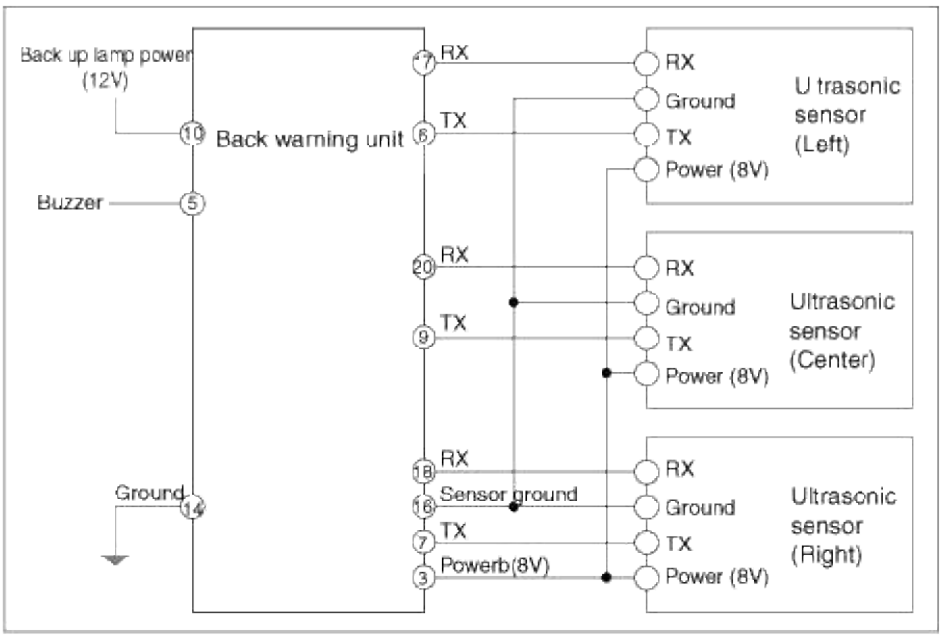
Component Location

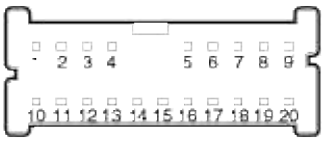


1. Rear parking assist system control unit 2. Ultrasonic sensor	3. Buzzer

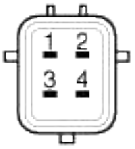
Body Electrical System > Rear Parking Assist System > Schematic Diagrams

Circuit Diagram





(Rear parking assist system control unit connector)



(Ultrasonic sensor connector)

Pin configuration

Pin No.	Signal	Test : Desired result
3	Sensor power	8V (While operating)
5	Buzzer	0V (While operating)
6	TX - Sensor(Left)	0~3V voltage change (Inspect waveform)
7	TX - Sensor(Right)	0~3V voltage change (Inspect waveform)
9	TX - Sensor(Center)	0~3V voltage change (Inspect waveform)
10	Back up lamp power	12V (While shifting to "R")
14	Ground	0V
16	Sensor ground	0V
17	RX - Sensor(Left)	0~1V voltage change (Inspect waveform)
18	RX - Sensor(Right)	0~1V voltage change (Inspect waveform)
20	RX - Sensor(Center)	0~1V voltage change (Inspect waveform)

PIN NO	SIGNAL
1	TX
2	8V
3	GND
4	RX

Body Electrical System > Rear Parking Assist System > Description and Operation

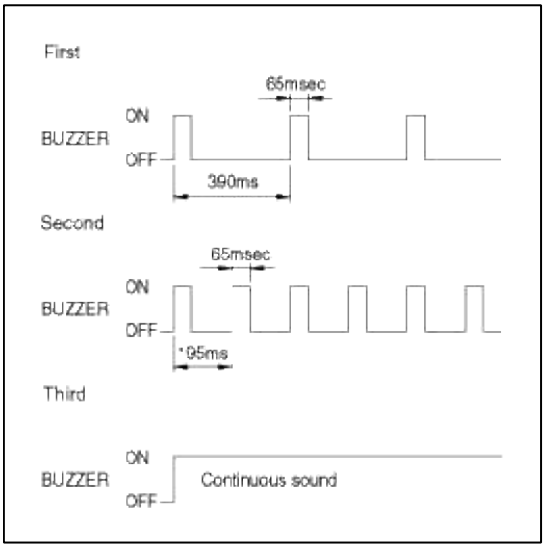
Description

When reversing, the driver is not easy to find objects in the blind spots and to determine the distance from the object. In order to provide the driver safety and convenience, rear parking assist system will operate upon shifting to "R" Ultrasonic sensor will emit ultrasonic wave rearward and detect the reflected wave. Control unit will calculate distance to the object using the sensor signal input and output buzzer alarm in three steps (first, second and third alarm).

Alarm Range

Upon detecting an object at each range out of 3 ranges as stated below within the operation range, it will generate alarm.

First alarm : Object comes near to the sensor located at the rear of vehicle, within 81-120cm ± 15cm
Second alarm : Object comes near to the sensor located at the rear of vehicle, within 41-80cm ± 10cm
Third alarm : Object comes near to the sensor located at the rear of vehicle, within 40cm ± 10cm



NOTE

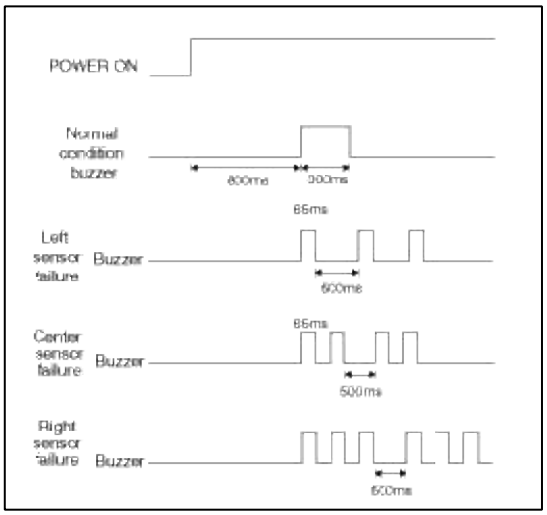
1. Time tolerance of the above waveform : Time ± 10%
2. At nearer distance than 40cm, detection may not occur.
3. Alarm will be generated with vehicle reversing speed 10km/h or less.
   For moving target, maximum operation speed shall be target approach speed of 10km/h.
4. When the vehicle or the target is moving, sequential alarm generation or effective alarm may be failed.
5. Misalarm may occur in the following conditions.
   - Irregular road surface, gravel road, reversing toward grass.
   - Horn, motor cycle engine noise, large vehicle air brake, or other object generating ultrasonic wave is near.
   - When a wireless transmitter is used near to the sensor.
   - Dirt on the sensor.
   - Sequential alarm may not occur due to the reversing speed or the target shape.

Body Electrical System > Rear Parking Assist System > Troubleshooting

Diagnosis

1. Operate with ignition switch on and shift the lever to position "R"
2. Then it checks the system condition.
   If no trouble, it generates buzzer alarm sound for 0.3 seconds after 0.8 seconds from power approval. In case of system failure, then it indicates the failed point as follows.
   A. Left sensor failure : beep-beep-beep
   B. Center sensor failure : beep beep-beep beep-beep beep
   C. Right sensor failure: beep beep beep-beep beep beep-beep beep beep
3. Alarm is generated 3 times sequentially.

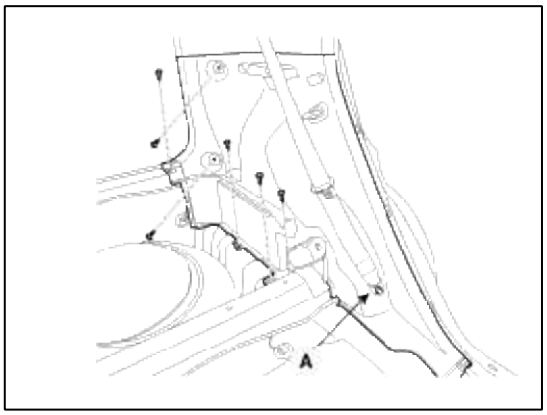
4. Effective operation range is 10km/h or less for the vehicle speed.



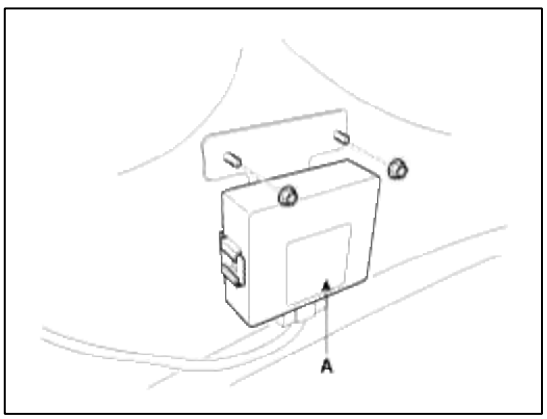
Body Electrical System > Rear Parking Assist System > Rear Parking Assist System Control Unit > Repair procedures

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the left side trim(A) of the trunk room.
   (Refer to the Body group - "Interior trim")



3. Loosen a mounting nut and disconnect the connector.
4. Remove the rear parking assist system control unit (A).



Installation

1. Install the rear parking assist system control unit.
2. Install the left side trim.

Body Electrical System > Rear Parking Assist System > Parking Assist Sensor > Description and Operation

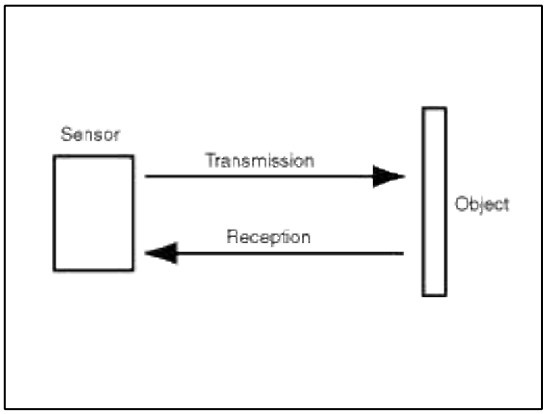
Operation Principle

The sensor emits ultrasonic wave to the objects, and it measures the time until reflected wave returns, and calculates the distance to the object.

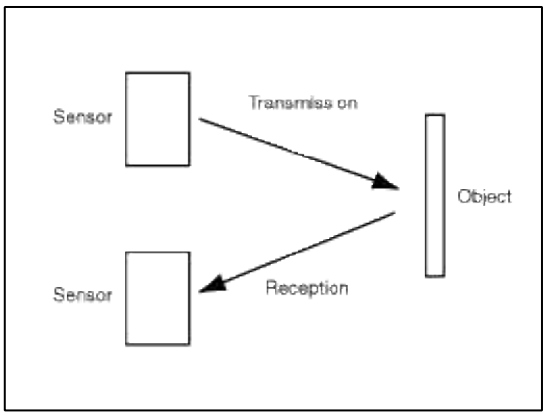
Distance Detection Type

Direct detection type and indirect detection type are used together for improving effectiveness of the detection.

1. Direct detection type: One sensor transmits and receives signals to measure the distance.



2. Indirect detection type: One sensor transmits signals and the other sensor receives the signals to measure the distance.



Measurement Principle

Rear parking assist system is a complementary device for reversing. Rear parking assist system detects objects behind vehicle and provides the driver with buzzer alarm finding objects in a certain area, using ultrasonic wave propagation speed and time.

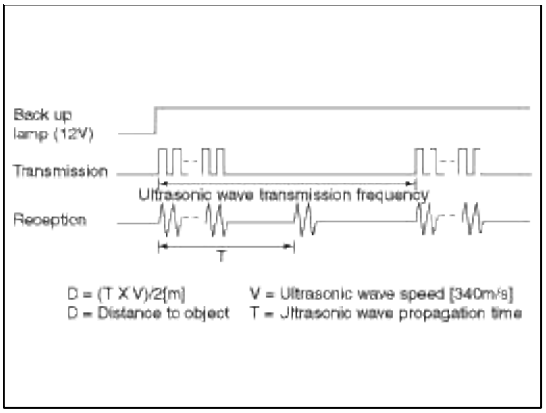
The propagation speed formula of ultrasonic wave in air is following :

$v=331.5 + 0.6t$ (m/s)

v=ultrasonic wave propagation speed

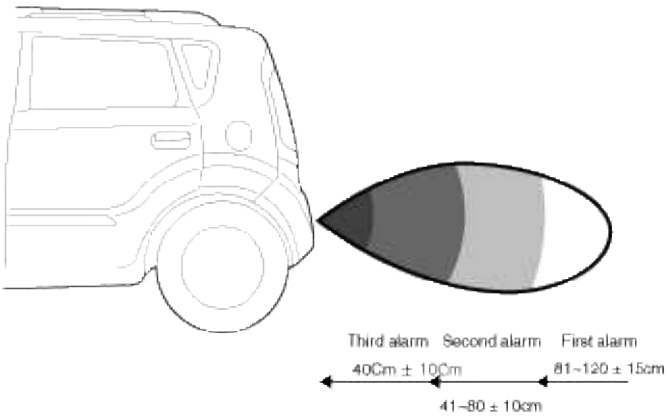
t=ambient temperature

The basic principle of distance measurement using ultrasonic wave is :



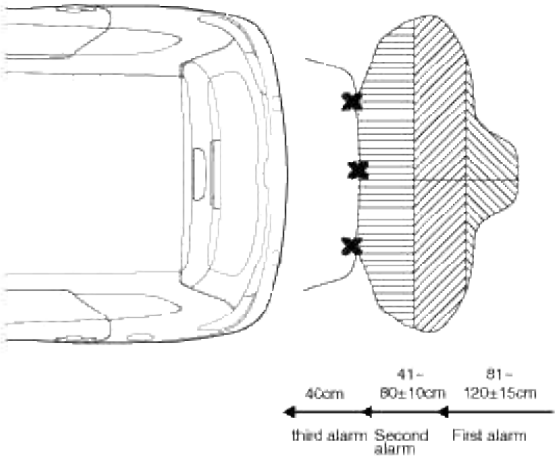
Sensor Detection Range

[Vertical range]



1. Distance tolerance(Messured at the front of sensor)
   81~120cm : ±15cm
   41~80cm : ±10cm
   40cm : ±10Cm
2. Detection tolerance
   At 40cm :45° ± 15°
   At 80cm : 30° ± 15°
   At 120cm : 20° ± 15°
3. At nearer distance than 40cm detection may occur
4. Measurement condition : Room temperature (20℃), 140mm diameter, 1m length rod.

[Horizontal range]



1. Distance tolerance(Messured at the front of sensor)
   81~120cm : ±15cm
   41~80cm : ±10cm
   40cm : ±10cm
2. Detection tolerance
   At 80cm : 90° + 20°
   At 120cm : 10° + 20°
3. At nearer distance than 40Cm detection may occur.
4. Measurement condition : Room temperature (20℃), 140mm diameter, 1m length rod.

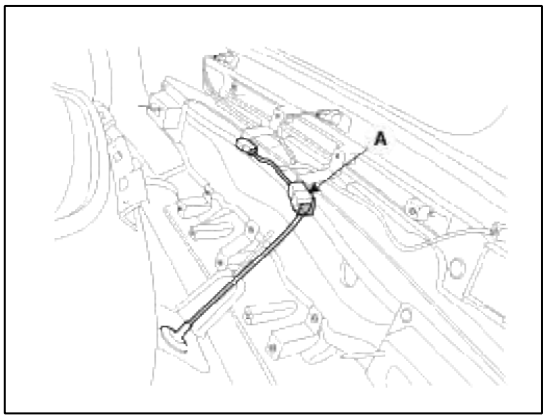
NOTE

1. 14cm (dia.) plastic rod is used for the test target.
2. The test result may differ by a different target object.
3. Detection range may be reduced by dirt accumulated on sensor, and extremely hot or cold weather.
4. The following object may not be detected.
   - Sharp object or thin object like rope.
   - Cotton sponge, snow or other materials absorbing sonic wave.
   - Smaller objects than 14cm (dia.), 1m length.

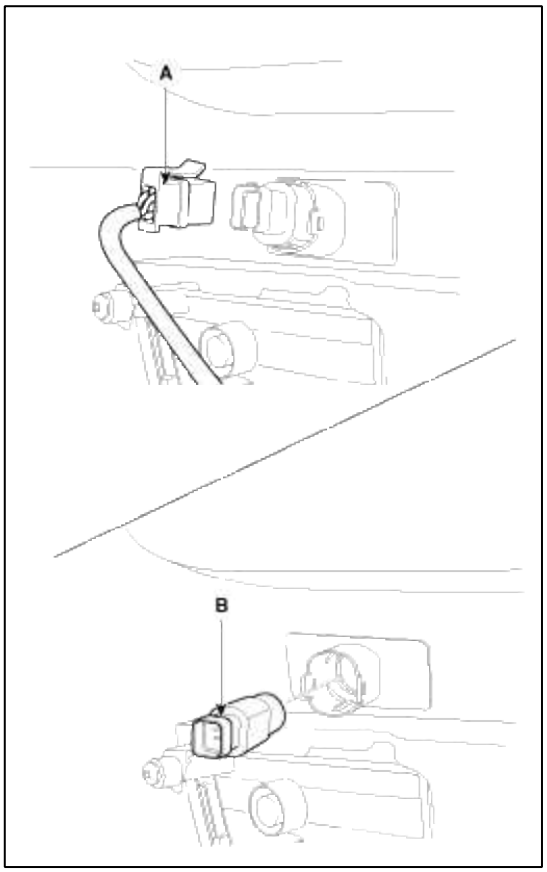
Body Electrical System > Rear Parking Assist System > Parking Assist Sensor > Repair procedures

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the rear bumper.
   (Refer to the Body group - "Rear bumper")
3. Disconnect the connectors (A) from the rear bumper.



4. Disconnect the sensor connector (A) at the inside of the rear bumper, and then remove the sensor (B) from the housing.



Installation

1. Connect the connector, and then install the sensor.
2. Install the rear bumper.

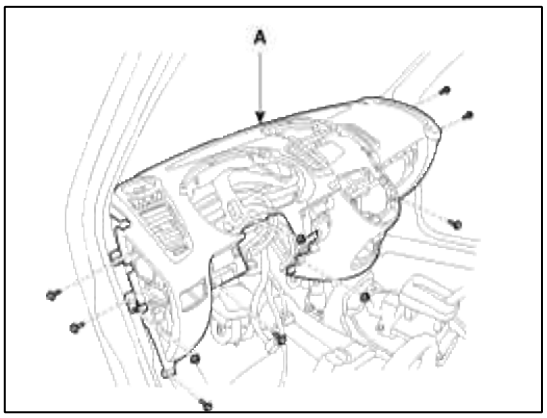
Body Electrical System > Rear Parking Assist System > Buzzer > Repair procedures

Inspection

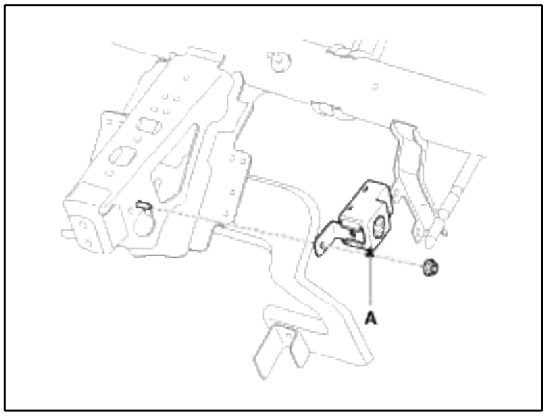
Test the buzzer by connecting battery voltage to the 1 terminal and ground the 2 terminal.
The buzzer should make a sound. If the buzzer fails to make a sound, replace it.

Removal

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



3. Remove the buzzer (A) after loosening the nut and disconnecting the 2P connector.

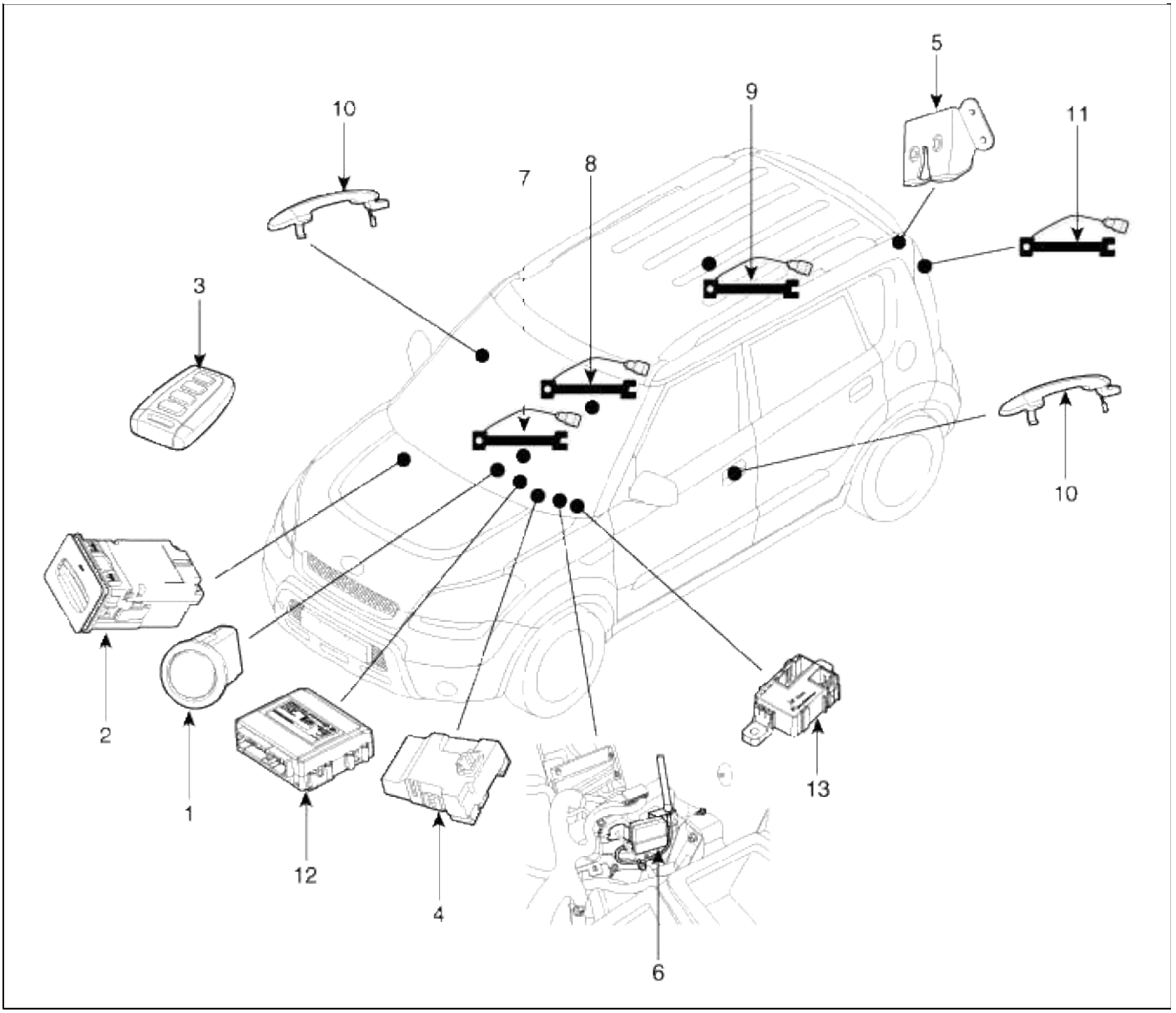


Installation

1. Connect the connector, and then install the buzzer.
2. Install the main crash pad.

Body Electrical System > Button Engine Start System > Components and Components Location

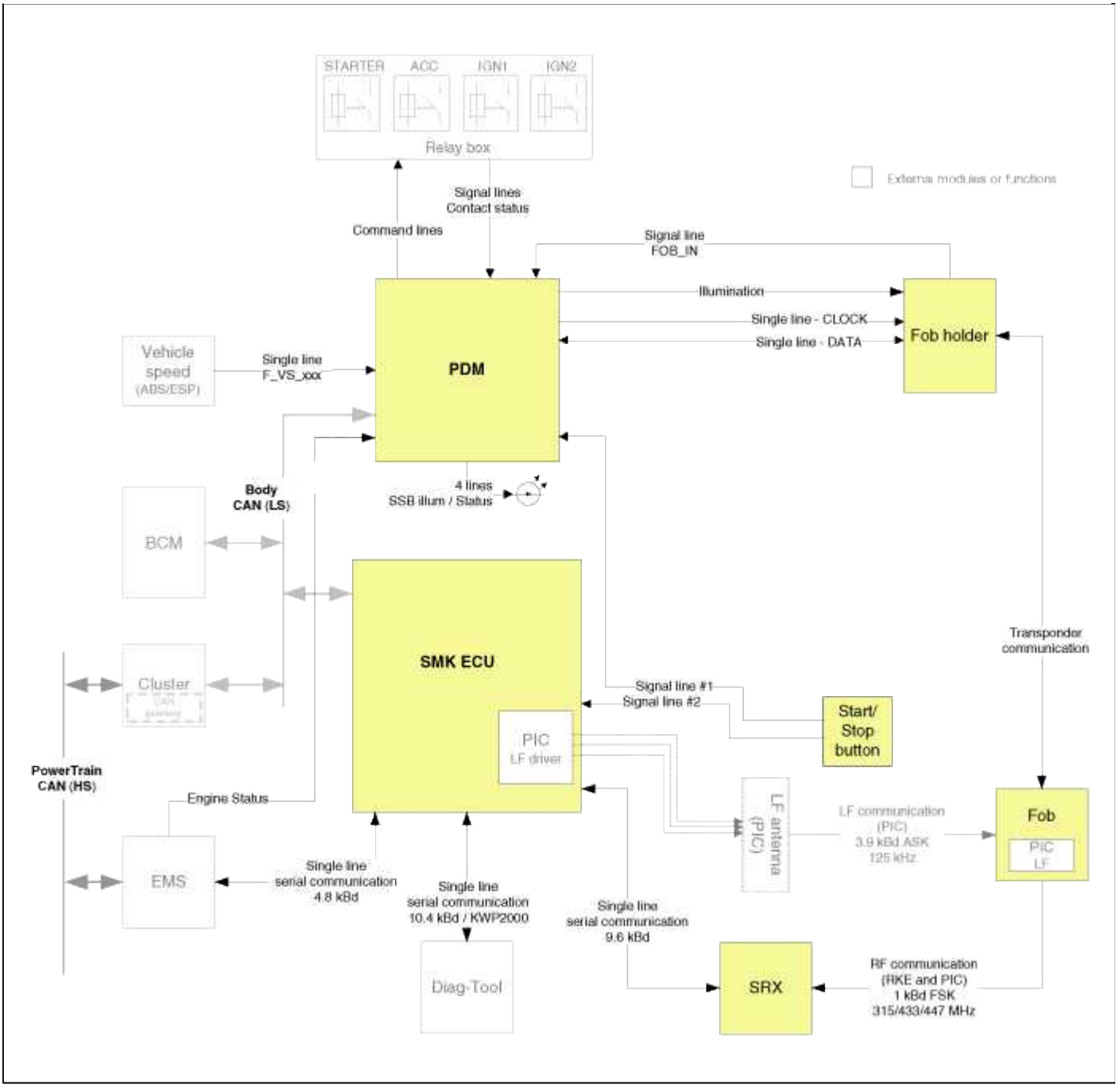
Component Location



1. Start Stop Button(SSB)	8. Interior antenna 2
2. FOB key holder	9. Interior antenna 3
3. FOB key	10. Door handle & door antenna
4. PDM(Power Distribution Module)	11. Bumper antenna
5. Trunk lid switch	12. Smart key unit
6. RF receiver	13. PDM relay box
7. Interior antenna 1	

Body Electrical System > Button Engine Start System > Schematic Diagrams

Circuit Diagram



Body Electrical System > Button Engine Start System > Description and Operation

Description

System Overview

The System offers the following features:

- Human machine interface through a 1-stage button, for terminal switching and engine start.
- Control of external relays for ACC / IGN1 / IGN2 terminal switching and STARTER, without use of mechanical ignition switch.
- Indication of vehicle status through LED or explicit messages on display.
- Immobilizer function by LF transponder communication between fob and fob holder.
- Redundant architecture for high system dependability .
- Interface with Low Speed CAN vehicle communication network.
- Interface with LIN vehicle communication network depending on platform .

The RKE and SMART KEY functions are not considered part of this Button Engine Start system and are specified in separated system.

System Main Function

- Switching of ACC / IGN1 / IGN2 terminals.
- Control of the STARTER relay BAT line (high side) based on communication with EMS ECU.
- Management of the Immobilizer function.
- Management of BES warning function.

Button Engine Start System

The Button Start System allows the driver to operate the vehicle by simply pressing a button (called as SSB) instead of using a standard mechanical key.

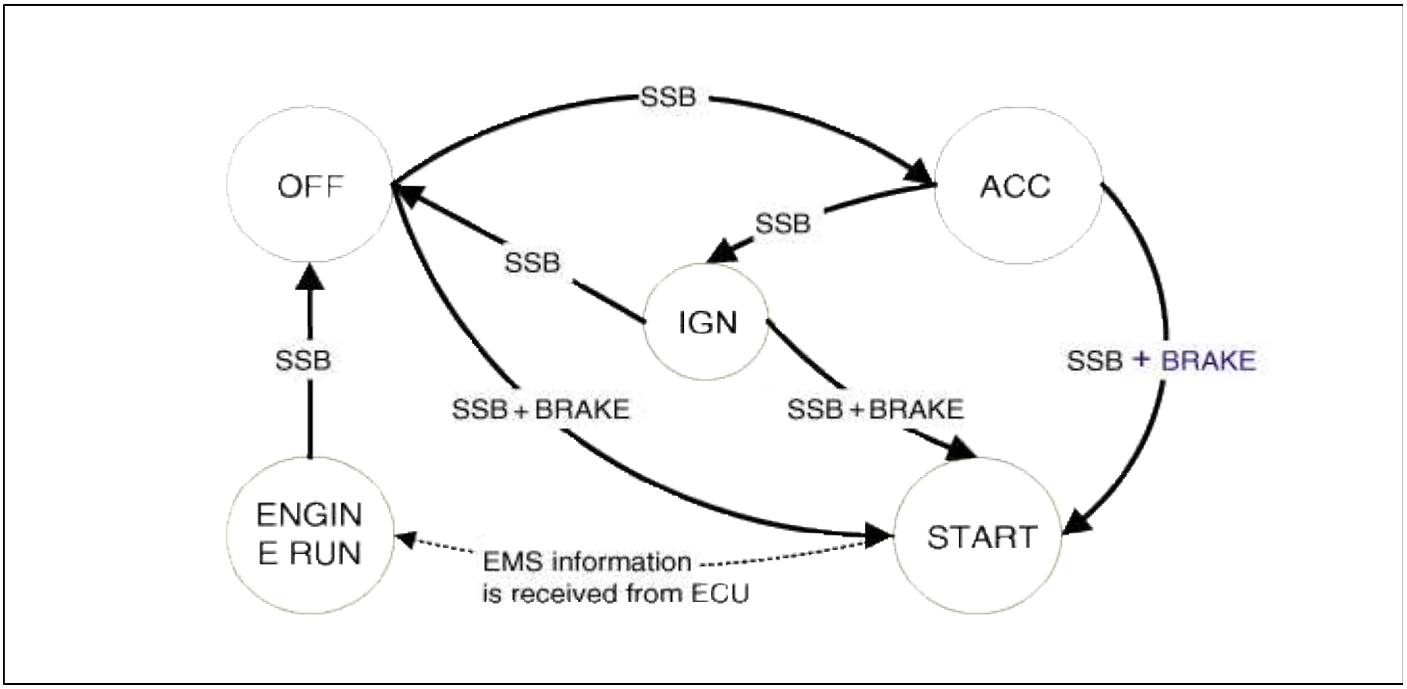
If the driver press the SSB while prerequisites on brakes, fob authentication and transmission status are satisfied, the BES System will proceed with the locking/unlocking of the steering column, the control of the terminal, and the cranking of the engine.

The driver can release the SSB as soon as this sequence initiated. After positive response from immobilizer interrogation, the system will activate the starter motor and communicate with the EMS to check the engine running status for starter release.

The driver will be able to stop the engine by a short push on the SSB if the vehicle is already in standstill. Emergency engine stop will be possible by a long press of the SSB or 3 consecutive presses in case the vehicle is in ENGINE RUNNING.

If the conditions for engine cranking are not satisfied while a push on the SSB is detected and a valid fob authenticated, the system will unlock the steering column and switch the terminals to IGN. Another push on the SSB will be necessary to start the engine.

In case of a vehicle equipped with SMART KEY system, fob authentication will not require any action from the driver. For limp home start or in case of vehicle without SMART KEY, the driver will have to insert the fob into the fob holder.



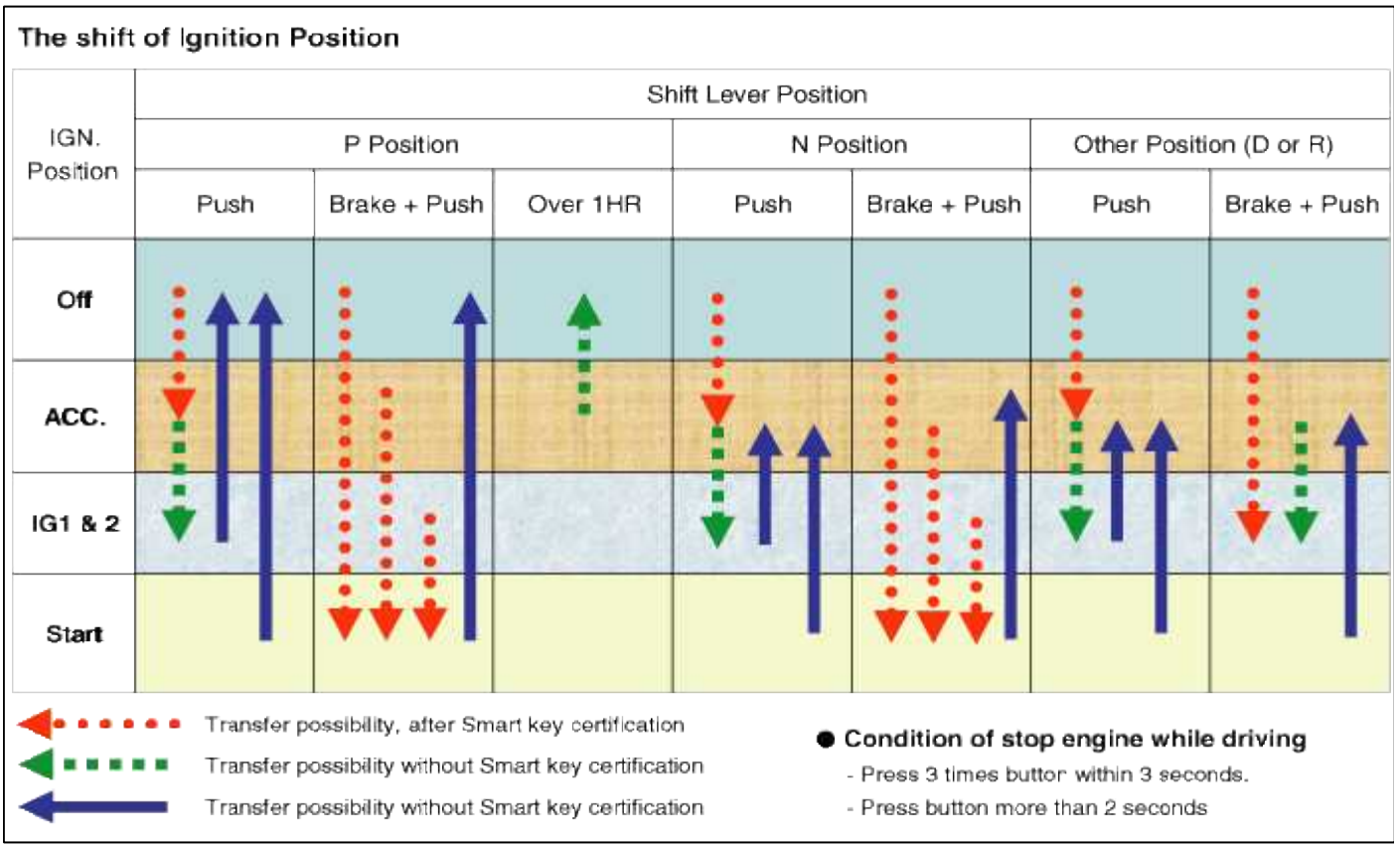
- Control Ignition and engine ON/OFF by Sending signal to IPM and PDM.
- Display status by LED Lamp ON/OFF. (Amber or Blue)

Indicator ON/OFF Condition At Ignition Key Off Condition

No.	Character lamp	Conditions
1	Indicator Lamp ON	Door open, Tail lamp ON, ACC, IG ON
2	Indicator Lamp 30sec ON → Lamp OFF	Door close, Tail lamp OFF, IG OFF
3	Indicator Lamp OFF	Remote LOCK, Passive LOCK
4	Rheostat at tail lamp ON (Illumination lamp)	

Indicator ON/OFF Condition According To Ignition Key's Position

No.	Ignition conditions	Start Button LED status
1	IG OFF	LED OFF
2	IG ACC	Amber color LED ON
3	IG ON (Engine OFF)	Blue color LED ON
4	Cranking	Maintain LED status before cranking
5	Engine running	LED OFF



Wireless Communication

Electromagnetic waves are used to exchange information between the vehicle and the FOB. Two types of RKE Key can supplement the BES system:

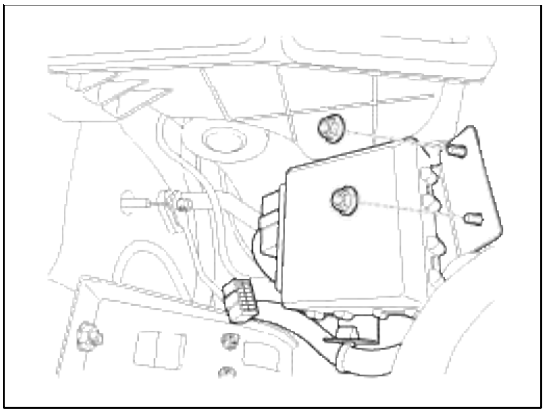
- Non-smart key RKE
- SMART KEY FOB

Currently the BES system comprises with SMART KEY FOB always.

The transmitter, receiver and antennas required for the communication between the fob and the vehicle will differ depending on functionalities and regional areas.

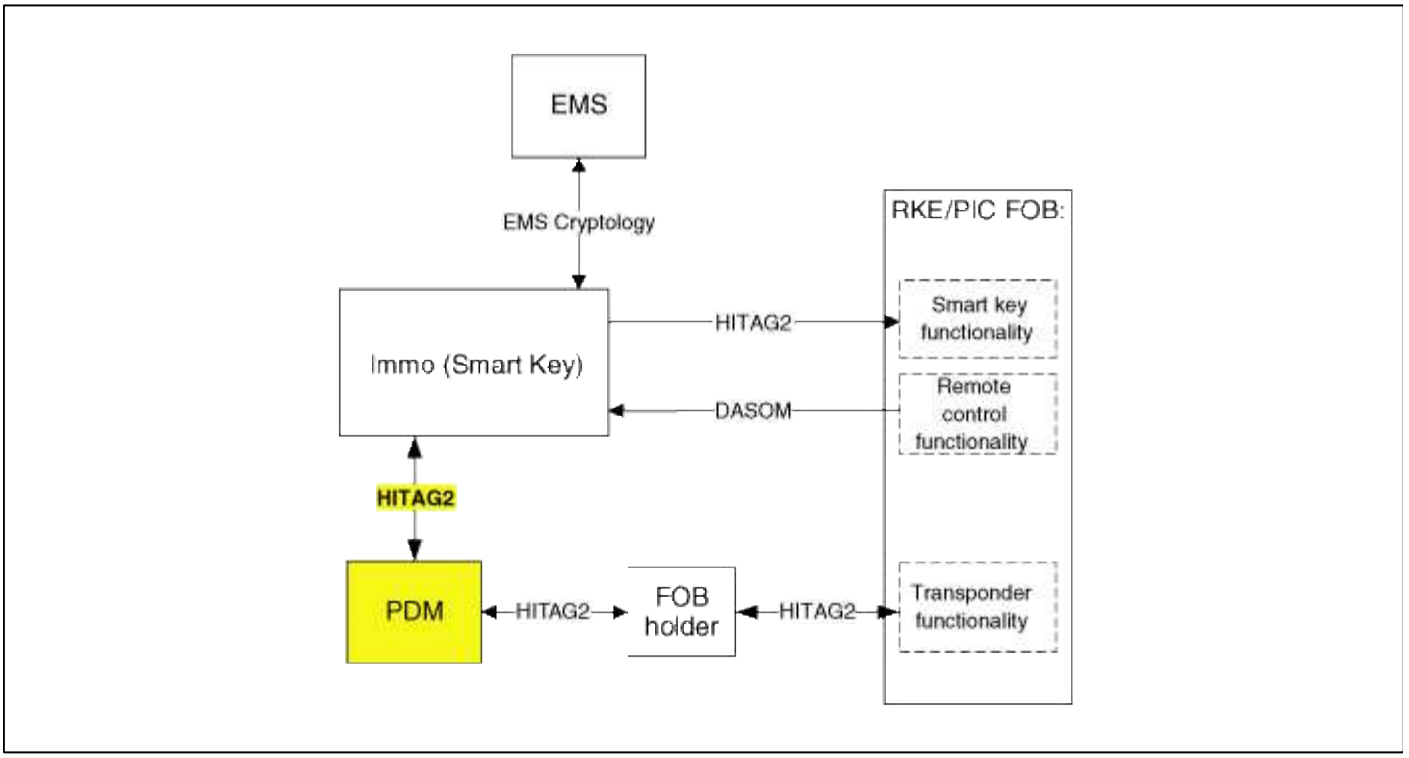
The RKE and SMART KEY functions are in separated documents. Refer to Smart key system for more detailed information about SMART KEY function.

Smart Key



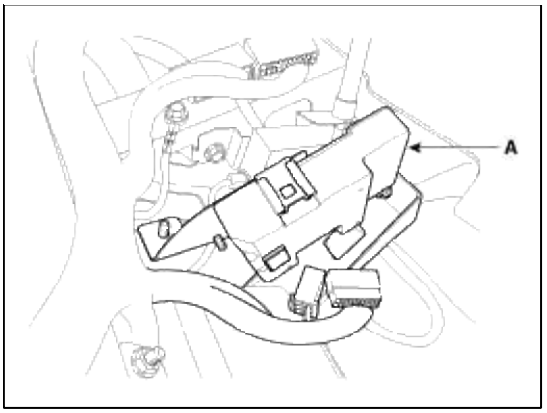
The SMK manages all function related to:

- "Start Stop Button (SSB) monitoring",
- "Immobilizer communication" (with Engine Management System unit for immobilizer release),
- "Authentication server" (Validity of Transponder and in case of Smart Key option Passive Fob authentication),
- "System consistency monitoring",
- "System diagnosis",
- Control of display message / warning buzzer .



The unit behaves as Master role in the whole system.
In case of SMART KEY application, for example “Passive Access”, “Passive Locking” and “Passive Authorization are Terminal switching Operations”.
It collects information about vehicle status from other modules (vehicle speed, alarm status, driver door open...), read the inputs (e.g. SSB, Lock Button and PARK position Switch), controls the outputs (e.g. exterior and interior antennas), and communicates with others devices via the CAN network as well as a single line interfaces.
The diagnosis and learning of the components of the BES System are also handled by the SMK.

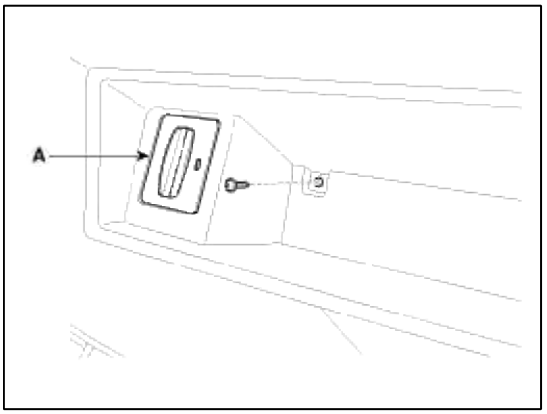
PDM



The PDM(A) manages the functions related to the "terminal control" by activating external relays for ACC, IGN1 and IGN2. This unit is also responsible for the control of the STARTER relay.
The PDM is also controlling the illumination of the SSB as well as the "system status indicator", which consists of 2 LEDs of different color. The illumination of the fob holder is also managed by the PDM.
The PDM reads the inputs (Engine fob_in, vehicle speed, relays contact status), controls the outputs (Engine relay output drivers), and communicates with others devices via the CAN.
In case, failure of one of the two controllers, the remaining controller shall disable the starter relay. The IGN1 and IGN2 terminals relays shall be maintained in the state memorized before the failure and the driver shall be able to switch those IGN terminals off by pressing the SSB with EMERGENCY_STOP pressing sequence. However, engine restart will not be allowed. The state of the ACC relay will depend on the type of failure.
The PDM is diagnosed through the SMK MUT service, using the CAN network.
The main functions of the PDM are:

- Control of Terminal relays
- Monitoring of the Vehicle speed received from sensor or ABS/ESC ECU.
- Control of SSB LEDs (illumination, clamp state) and FOB HOLDER illumination.
- Control of the base station located in fob holder through direct serial interface.
- System consistency monitoring to diagnose SMK failure and to switch to relevant limp home mode.
- Providing vehicle speed information

Fob Holder

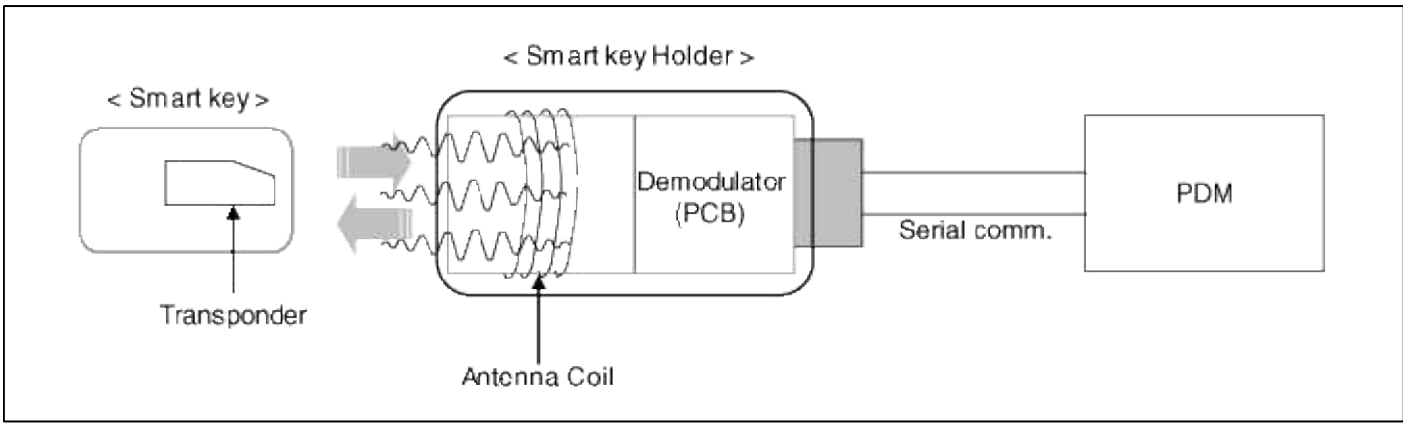


This unit is used for transponder authentication. In case of a vehicle equipped with Smart key, this transponder authentication is necessary in case of failure of the passive fob authentication (Engine loss of RF or LF link with the fob).
The Fob holder(A) module integrates a slot where to insert the fob. The fob is maintained in position with a push-push mechanical locking (not electrically driven) and a signal (FOB_IN) is sent back to the PDM as soon as its insertion is detected.
The power supply of the fob holder is active only if a communication is initiated by the PDM.
The insertion of the fob into the holder and the communication with the transponder should be possible regardless of the insertion direction of fob to the holder (buttons facing up or bottom).

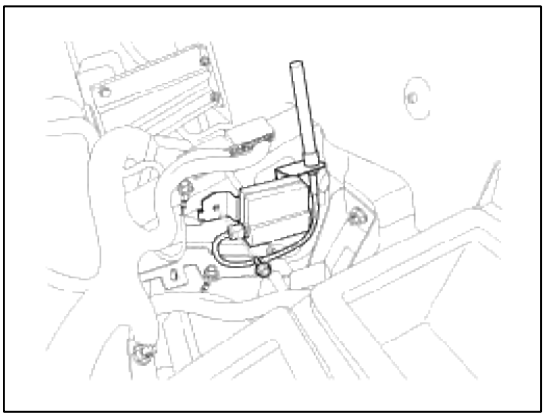
A lighting device is also integrated for illumination of the Fob Holder and it is driven directly by the PDM,
The main functions of the Fob holder are:

- Transponder base station
- Fob mechanical lock
- Illumination

Transponder



External Receiver(SRX)



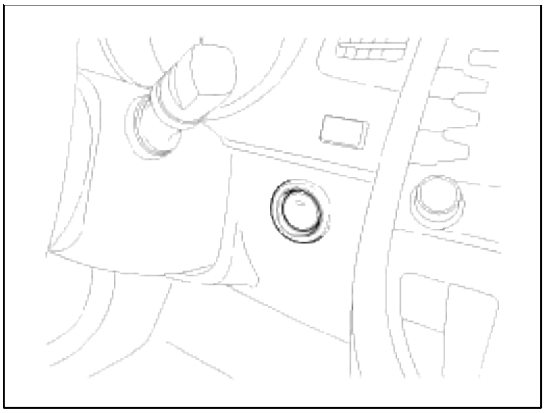
The data transmitted by the RKE or Smart key Fob is received by an external RF receiver called as SRX. This receiver will be same as that one for the SMK applications, with respect to electronics, housing, connector and software.
This receiver is connected to the SMK via a serial communication line.

Terminal And Starter Relays
Relays will be used to switch the terminals ACC / IGN1 / IGN2. Those normally-open relays will be driven by the PDM and located either in the passenger or engine compartment depending on the vehicle architecture.
Only one relay coil is connected to the terminal outputs of the PDM.
Those relays should integrate a resistor connected in parallel to the coil in order to reduce the transients during commutation.

Start/Stop Button(SSB)
A single stage push button is used for the driver to operate the vehicle. Pressing this button allows:

- To activate the power modes ‘Off’, ’Accessory’, ‘Ignition’ and 'Start' by switching the corresponding terminals
- To start the engine
- To stop the engine

The contact will be insured by a micro-switch and a backlighting is provided to highlight the marking of the button whenever necessary.
Two (2) LED colors are located in the center of the button to display of the status of the system. Another illumination LED is also integrated into the SSB for the lighting of the "Engine Start/Stop" characters.



BES System State Chart

System STATES in LEARNT MODE
In learnt mode, the BES System can be set in 6 different sates, depending on the status of the terminals and Engine status:

System State	Terminal Status	Engine status
1. OFF - Locked	OFF	Stopped
2. OFF - Unlocked	OFF	Stopped
3. ACC	ACC	Stopped
4. IGN	IGN1, IGN2, ACC	Stopped
5. Start	IGN1, Start	Cranking
6. IGN - Engine	IGN1, IGN2, ACC	Running (means "self-running")

Referring to the terminals, the system states described in the table above are same as those one found in a system based on a mechanical ignition switch. The one of distinction with Mechanical-Ignition-Switch based system is that the BES system allows specific transition from [OFF] to [START] without going through [ACC] and [IGN] states.

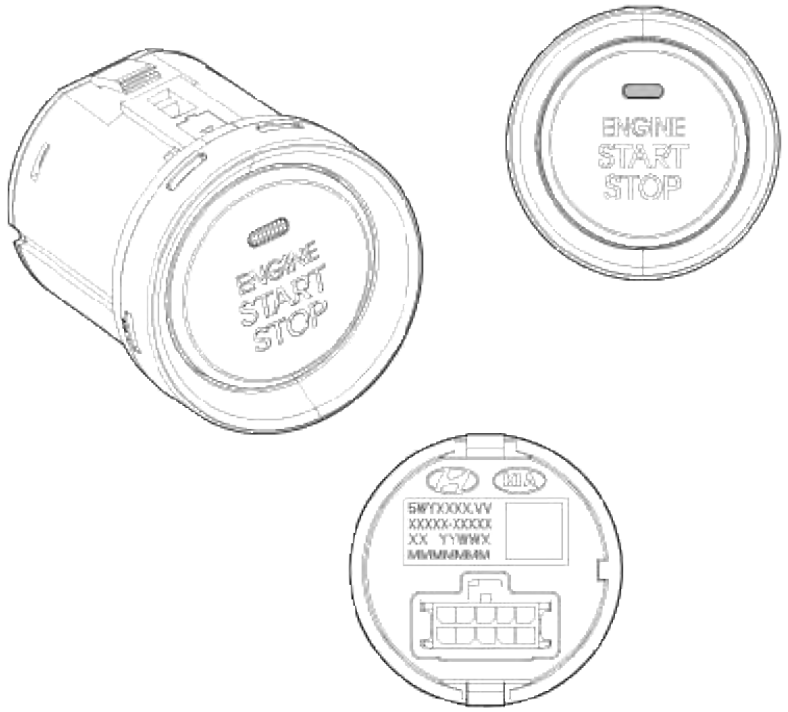
System STATES IN VIRGIN MODE
The BES System can be set in 5 different states (OFF LOCKED is not available in virgin mode), depending on the status of the terminals and Engine status:

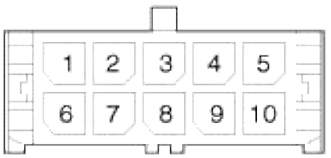
System State	Terminal Status	Engine status
1. OFF - UNLOCKED	OFF	Stopped
2. ACC	ACC	Stopped
3. IGN	IGN1, IGN2, ACC	Stopped
4. Start	IGN1, START with special pattern of activation	Cranking
5. IGN - Engine	IGN1, IGN2, ACC	Running (means "self-running")

Referring to the terminals, the system states described in the table above are same as those one found in a system based on a mechanical ignition switch. The one of distinction with Mechanical-Ignition-Switch based system is that the BES system allows specific transition from [OFF] to [START] without going through [ACC] and [IGN] states.

Body Electrical System > Button Engine Start System > Start/Stop Button > Components and Components Location

Component



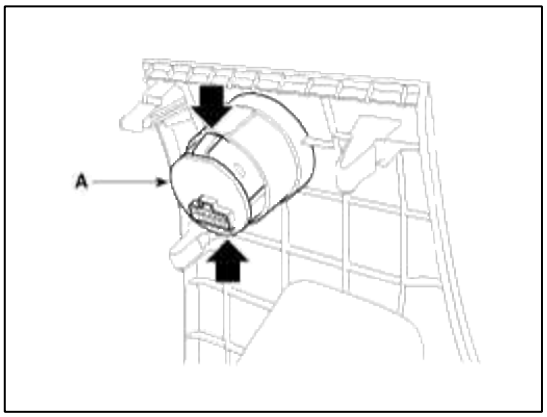
Connector (10 pins)			
Pin No.	Description	Pin No.	Description
1	Start/Stop button switch1(PDM)	6	Battery
2	Battery illumination	7	Start/Stop button switch2(IPM)
3	Start/Stop button LED Amber(PDM)	8	Start/Stop button LED Green(PDM)
4	Start/Stop button illum. GND	9	Rheostat
5	Start/Stop button illum. power (PDM)	10	-

Body Electrical System > Button Engine Start System > Start/Stop Button > Repair procedures

Removal

1. Disconnect the negative(-) battery terminal.
2. Remove the crash pad lower panel(Refer to BD group - "Crash Pad")

3. Remove the start/stop button(A) from the crash pad lower panel not to damage the fixing clip.

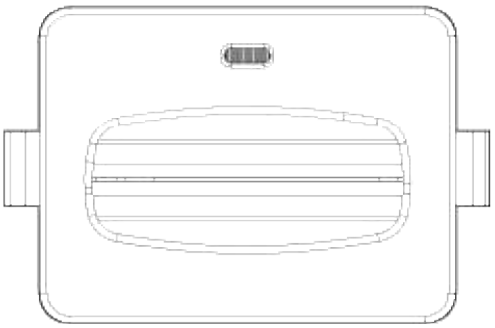


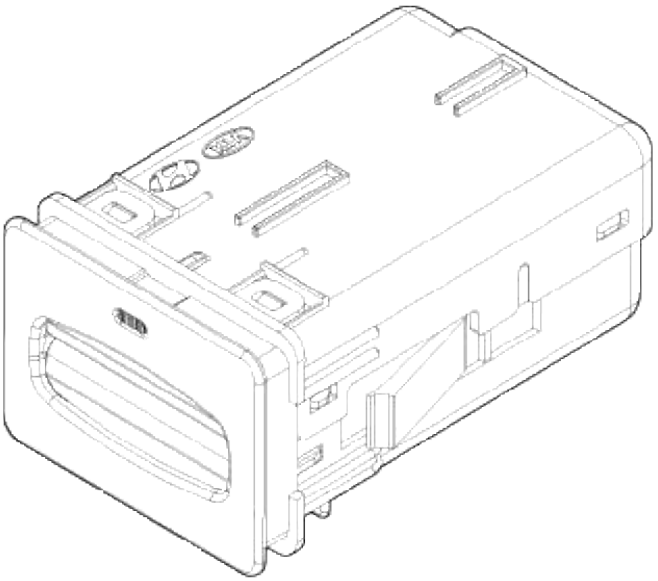
Installation

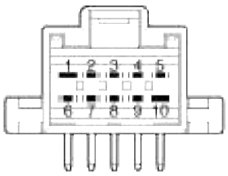
1. Install the start/stop button.
2. Install the crash pad lower panel.

Body Electrical System > Button Engine Start System > Fob Holder > Components and Components Location

Component





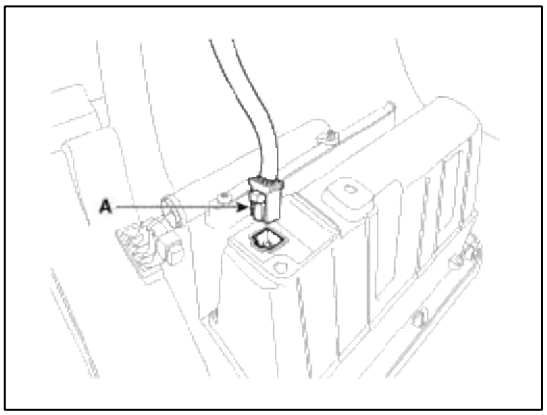
Connector (10 pins)			
Pin No.	Description	Pin No.	Description
1	-	6	Battery
2	Immobilizer clock	7	Immobilizer data
3	Holder illumination(PDM)	8	Illumination battery
4	-	9	Fob in (PDM)
5	GND	10	-

Body Electrical System > Button Engine Start System > Fob Holder > Repair procedures

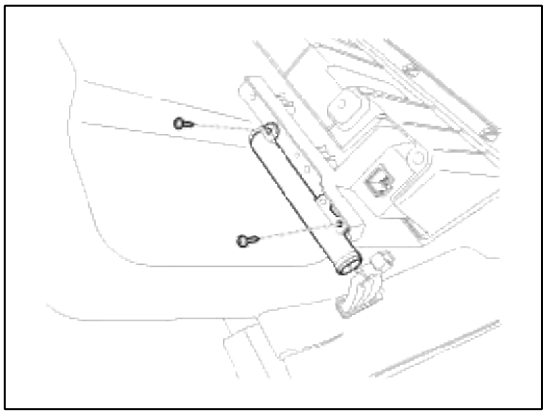
Removal

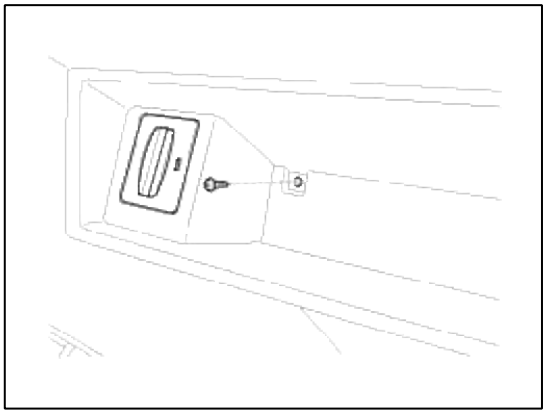
1. Disconnect the negative(-) battery terminal.

2. Remove the glove box and disconnect the FOB holder connector(A).

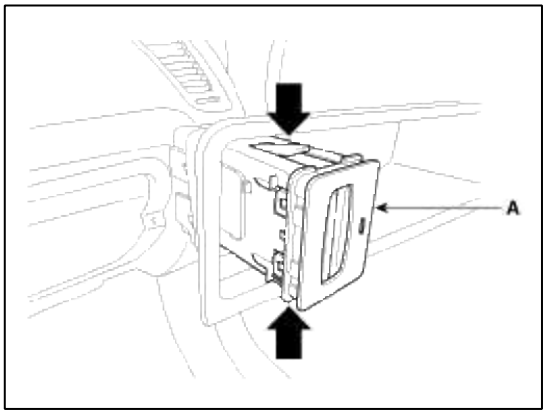


3. Loosen 3 screws.





4. Remove the FOB holder(A) from the glove box.



Installation

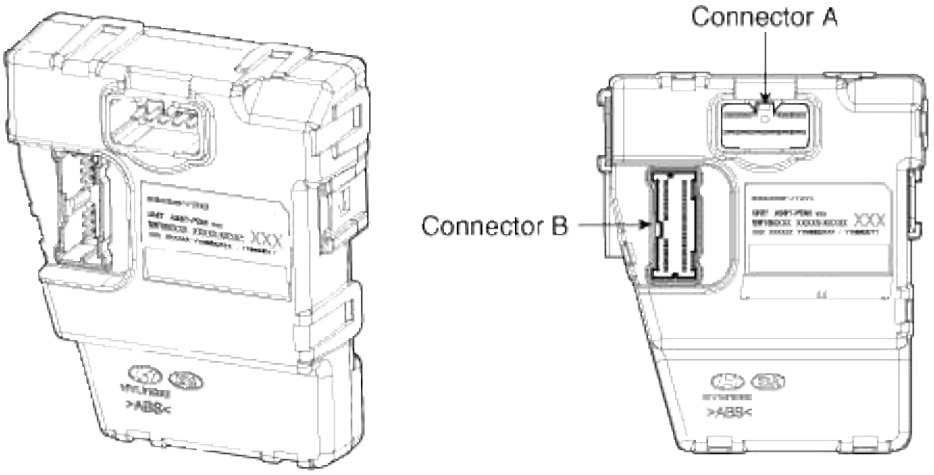
1. Install the FOB holder to the glove box.

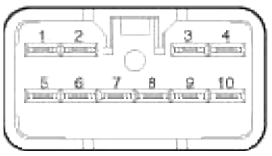
2. Install the glove box to the crash pad.

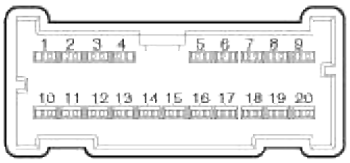
3. Connect the negative(-) battery terminal.

Body Electrical System > Button Engine Start System > PDM(Power Distribution Module) > Components and Components Location

Component



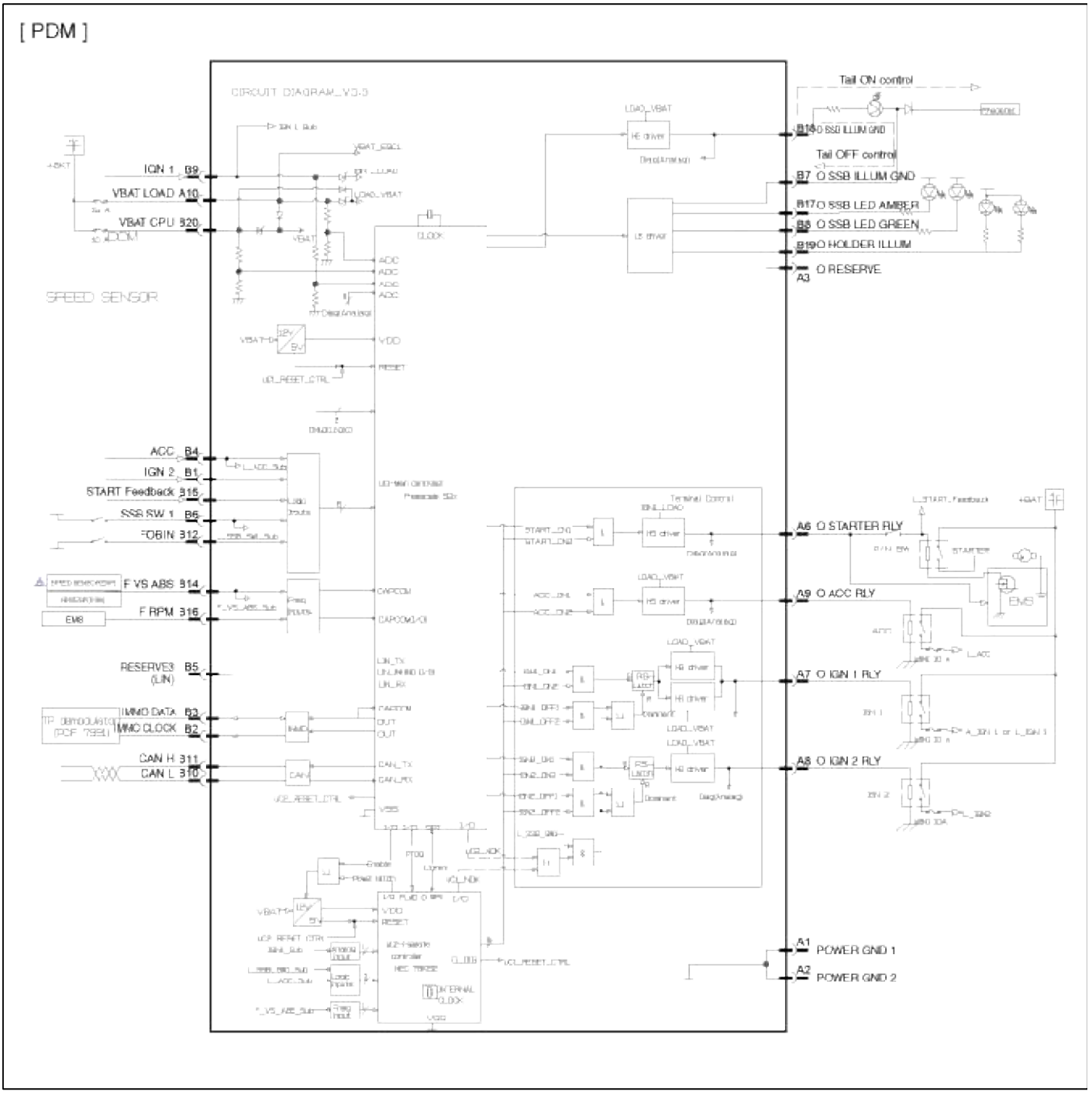




Pin No.	Connector A (10 pin)	Connector B (20 pin)
1	Power ground 1	IGN2
2	Power ground 2	Immobil zer clock
3	-	Immobilizer data
4	-	ACC
5	-	-
6	Starter relay	SSB switch1
7	IGN1 relay	SSB illumination ground
8	IGN2 relay	SSB LED green
9	ACC relay	IGN1
10	Battery load	CAN L
11		CAN H
12		Fob in
13		-
14		Vehicle speed
15		Start Feed back
16		RPM data (EMS)
17		SSB LED amber
18		SSB il umination power
19		Holder illumination
20		CPU battery

Body Electrical System > Button Engine Start System > PDM(Power Distribution Module) > Schematic Diagrams

System Circuit Diagram

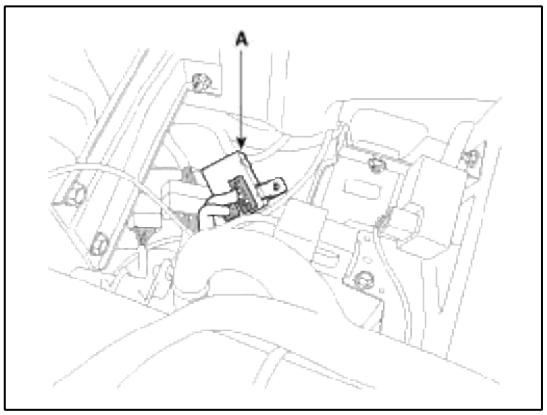


Body Electrical System > Button Engine Start System > PDM(Power Distribution Module) > Repair procedures

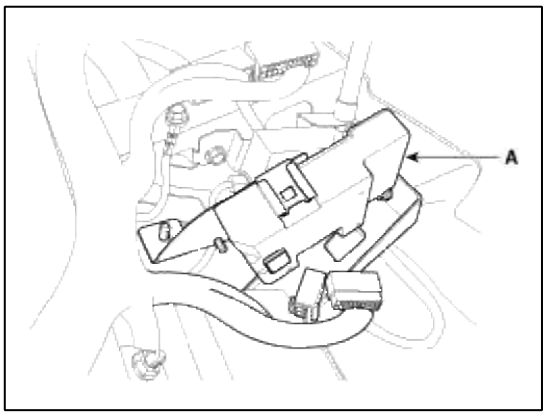
Removal

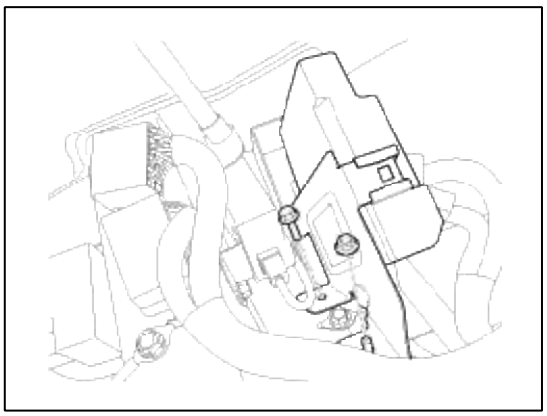
1. Disconnect the negative(-) battery terminal.
2. Remove the crash pad.(Refer to the BD group - "Crash Pad")

3. Remove the PDM relay(A).



4. Disconnect the PDM connector. Remove the PDM(A) after loosening a bolt and nut.





Installation

1. Install the PDM and the PDM relay. Connect the PDM connector.
2. Install the crash pad.
3. Connect the negative(-) battery terminal.

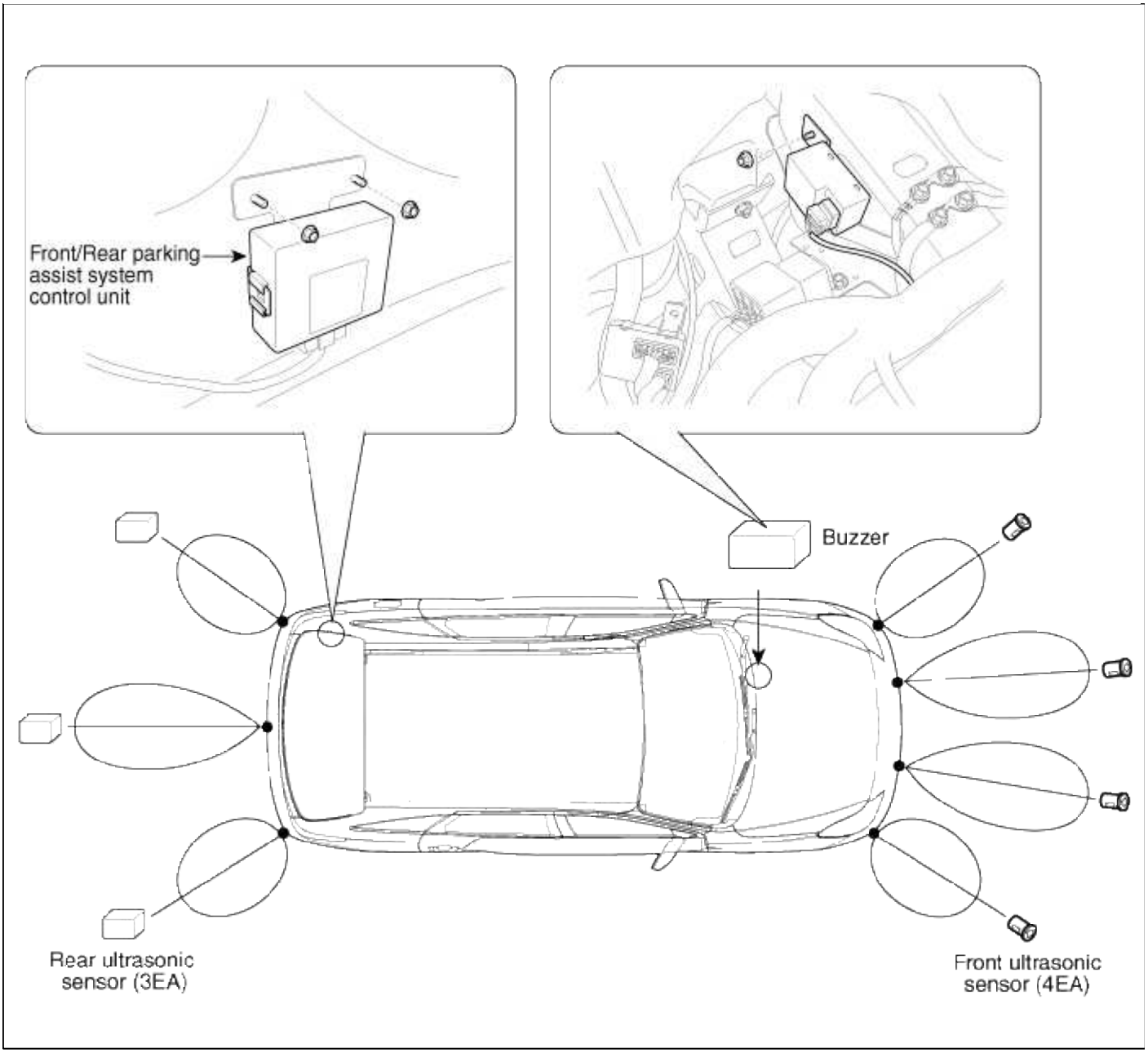
Body Electrical System > Front / Rear Parking Assist System > Front / Rear Parking Assist System Control Unit > Specifications

Specifications

Item		Specification
Rear parking assist system control unit	Voltage rating	DC 12V
	Operation voltage	DC 9 ~ 16 V
	Operation temperature	-30 ~ + 80°C (-22 ~ 176°F)
	Operation current	MAX 600 mA
	Operation frequency	40 ± 5 KHz
	Measuring range	30 ~ 100cm
Ultrasonic sensor	Insulation resistance	Min. 100MΩ
	Operation temperature	-30 ~ + 80°C (-22 ~ 176°F)
	Beam width	Horizontal : 110°, Vertical : 50°
	Operation frequency	40 ± 5 KHz
	Number of sensors	7 (front : 4, rear : 3)
Piezo buzzer	Voltage rating	DC 12 V
	Operation voltage	9 ~ 16 V
	Operation temperature	-30 ~ + 80°C (-22 ~ 176°F)
	Operation temperature	-40 ~ + 85°C (-40 ~ 185°F)
	Operation current	MAX 60 mA
	Sound, tone	Oscillation frequency : 2,200 ± 500 Hz
		Sound level : Min. 70 dB

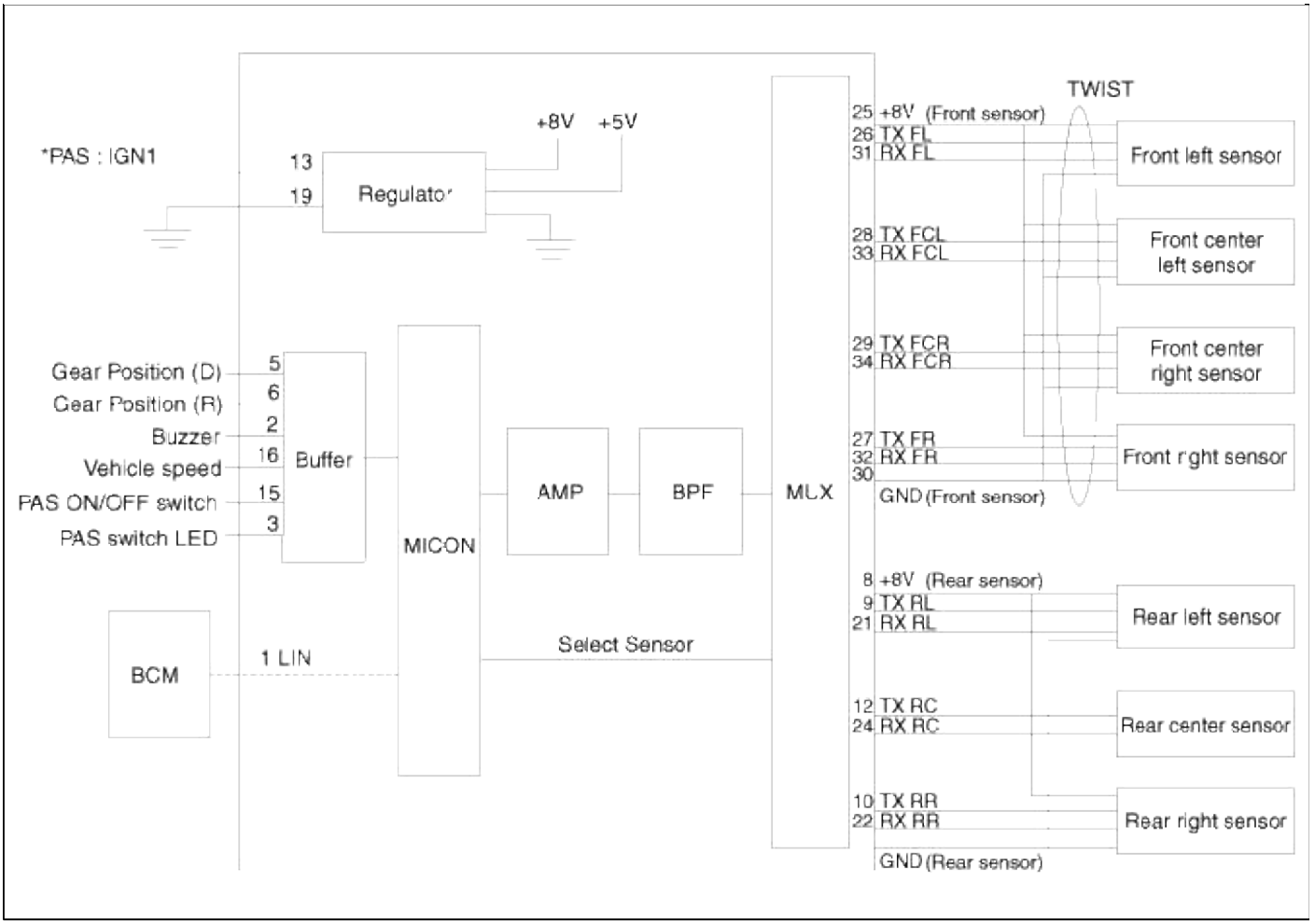
Body Electrical System > Front / Rear Parking Assist System > Front / Rear Parking Assist System Control Unit > Components and Components Location

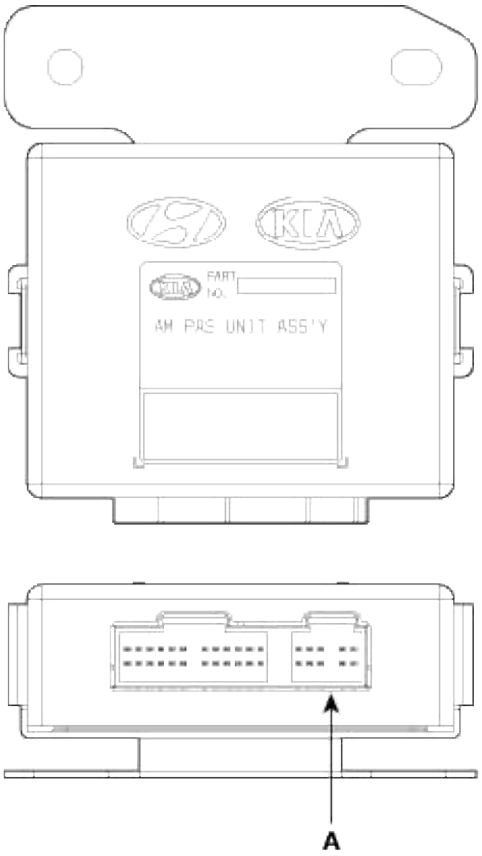
Component Location



Body Electrical System > Front / Rear Parking Assist System > Front / Rear Parking Assist System Control Unit > Schematic Diagrams

Circuit Diagram


*PAS : IGN1
13
19
Regulator
+8V
+5V
Gear Position (D)
Gear Position (R)
Buzzer
Vehicle speed
PAS ON/OFF switch
PAS switch LED
5
6
2
16
15
3
Buffer
MICON
AMP
BPF
MUX
BCM
1 LIN
Select Sensor
TWIST
25 +8V (Front sensor)
26 TX FL
31 RX FL
Front left sensor
28 TX FCL
33 RX FCL
Front center left sensor
29 TX FCR
34 RX FCR
Front center right sensor
27 TX FR
32 RX FR
30
Front right sensor
GND (Front sensor)
8 +8V (Rear sensor)
9 TX RL
21 RX RL
Rear left sensor
12 TX RC
24 RX RC
Rear center sensor
10 TX RR
22 RX RR
Rear right sensor
GND (Rear sensor)



36 Pin connector (A)			
No.	Description	No.	Description
1	LIN	19	Main ground
2	Buzzer	20	Rear sensor ground
3	PAS switch LED	21	RX RL sensor
4	-	22	RX RR sensor
5	Gear D	23	-
6	Gear R	24	RX RC sensor
7	-	25	+8V front sensor
8	+8V rear sensor	26	TX FL sensor
9	TX RL sensor	27	TX FR sensor
10	TX RR sensor	28	TX FCL sensor
11	-	29	TX FCR sensor
12	TX RC sensor	30	Front sensor ground
13	IGN1	31	RX FL sensor
14	-	32	RX FR sensor
15	PAS ON/OFF switch	33	RX FCL sensor
16	Vehicle speed signal	34	RX FCR sensor
17	-	35	-
18	-	36	-

Body Electrical System > Front / Rear Parking Assist System > Front / Rear Parking Assist System Control Unit > Description and Operation

Description

When reversing, the driver is not easy to find objects in the blind spots and to determine the distance from the object. In order to provide the driver safety and convenience, back warning system will operate upon shifting to "R" Ultrasonic sensor will emit ultrasonic wave rearward and detect the reflected wave. Control unit will calculate distance to the object using the sensor signal input and output buzzer alarm in three steps (first, second and third

alarm).

Functional Specification

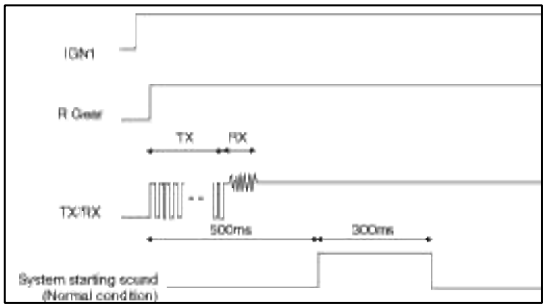
1. PAS(Parking Assist System) functional specification.
   (1) Use the IGN1 Power. (IGN1 ON action)
   (2) PAS SYSTEM is enabled when Moving forward is under the condition of PAS switch On and vehicle speed is under 10 KPH and backward is under 15KPH.
   (3) Front System is enabled when Gear is putting somewhere except for 'P' range position or Parking Brake is released.
   (4) Gear shifted to 'R', Rear PAS System will start.
      A. Front System makes Front 4 sensors (FL, FCL, FCR, FR) enabled.
      B. Rear System makes the Front 4 sensors (FL, FCL, FCR, FR) and Rear 3 sensors (RR, RC, RL) enabled.

2. System function flow.
   (1) Above 1), 2), 3) or 1), 2), 4) conditions, the system will start.
   (2) Front System has no initial starting sound when it starts and does an alarm system when it detects the obstacle according to distance.
   (3) When Rear System is in operation, initial starting sound is ringing 0.5 second just after R gear is shifted and conducts the alarm system by the distance.
   (4) Some of sensors have faults, Front system or Rear system sends a fault alarm sound and displays the sensors on the cluster.
   (5) Alarms of obstacle consists of 3 level 1, 2, 3 step and 1, 2 alarm sounds intermittently and 3 alarm sounds continuously But Front System does not have 1 step alarm, and in 2 step alarm it just turns on the INDICATOR in the cluster.
   (6) According to alarm level. Cluster controls turning the INDICATOR on that is in it.
   (7) PAS System is in operation under the condition of PAS switch ON, and PAS switch will keep its last status when IGN is OFF even.
   (8) PAS switch OFF will be released when the Gear is shifted to 'R' automatically. PAS switch is recover to OFF condition If PAS OFF released when applying 'R'Gear.
      A. IN PAS switch ON, INDICATOR that is in PAS switch turns on and PAS ECU controls the INDICATOR light.
      B. PAS switch Factory initial condition is ON.

PAS alarm method

Obstacle are detected by PAS, It alarms driver through the hearing and visual device.But, PAS ECU transmits alarm data to CLUSTER by LIN communication and cluster starts to show visual alarm through alarm data.

1. PAS alarm sound specification.
   In the state of IGN ON, and PAS or RPAS turn active, System will do work as below.



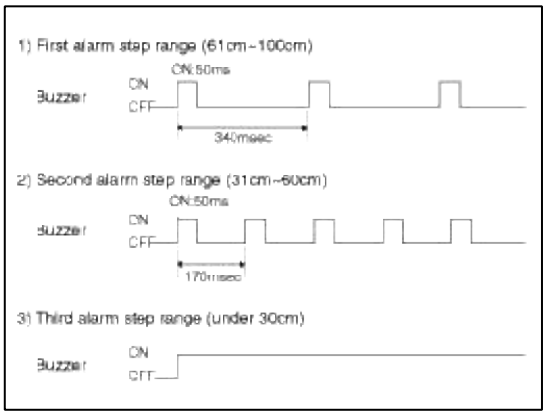
   If Front system and Rear system has common operational condition (3.1 reference), MICOM checks every sensor and if it finds no fault, after 500ms sends the initial starting Sound for 300mS (But, initial starting sound works not PPS but only under the RPAS systemBut, if it finds any defect, it sends fault sound and show fault sensor through INDICATOR.

   In Front system, initial starting sound doesn't work but in case PAS sensors have any fault sends fault sound and shows through INDICATOR under the PAS ON condition.

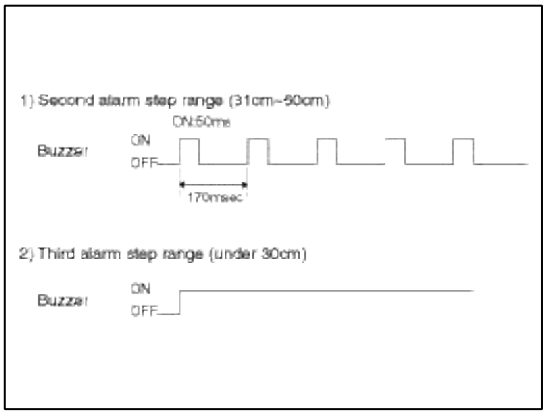
   Acceptable wave error range ±10%

2. Alarm sound output spec by the distance

   Rear buzzer alarm sound



   Front buzzer alarm sound

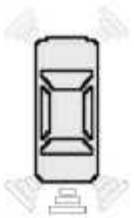
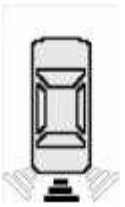
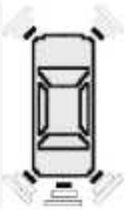


NOTE

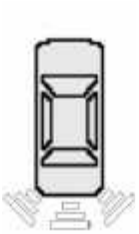
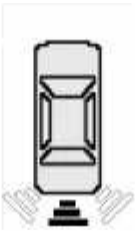
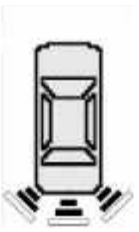
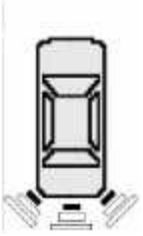
1. Acceptable wave error range: ±10%
2. Under 30Cmm area, alarm sound could not work.
3. By the Vehicle moving and target shape, distance alarms could not be in order.
4. Alarm sound comes from CLUSTER and period and alarm lasting time of alarm could be changed.

3. INDICATOR display method.
When the System starts, CLUSTER controls INDICATOR according to alarm data like below.If it finds any obstacle, lights immediately, and doesn't find anything, Front System do nothing but Rear System lights INDICATOR as a nothing alarm for 2 seconds after 'R'gear and turns off (If it senses obstacle and then has no obstacle, it lights INDICATOR as a nothing alarm and turns off)

PAS(Front, Rear alarm System) INDICATOR Display

Alarm Step	Nothing alarm	1 alarm(lighting) (61Cm ~ 100Cm)	2 alarm(lighting) (31Cm ~ 60Cm)	3 alarm(lighting) (under 30Cm)
INDICATOR display				

RPAS(Rear Parking Alarm System) INDICATOR Display

Alarm Step	Nothing alarm	1 alarm(lighting) (61Cm ~ 100Cm)	2 alarm(lighting) (31Cm ~ 60Cm)	3 alarm(lighting) (under 30Cm)
INDICATOR display				

NOTE

It displays the position of detected obstacle.Front sensor has no 1 step alarm display(sensing area under 60Cm)Front system has no alarm sound but only display in 2 step alarm.3 step alarm turns on/off 1 sec cycle(0.5sec ON, 0.5sec OFF)If Front system and Rear system release the operational condition, cluster stops the INDICATOR display and alarm sound immediately.(within 230ms)

INDICATOR light control

	Front PAS SYSTEM	Rear Front PAS SYSTEM
System starting(no obstacle)	NO INDICATOR	Display nothing alarm for 2 seconds
System starting (obstacle)	Turn INDICATOR on immediately by the distance	Turn INDICATOR on immediately by the distance
Alarm released	Display nothing alarm for 2 seconds	Display nothing alarm for 2 seconds
System operational released	Released immediately	Released immediately

When alarm is working on and released, or nothing alarm, if system operational condition released, display and alarm sound stop immediately.

In releasing alarm condition, INDICATOR lights turns off within 230ms.

4. PAS ECU and CLUSTER alarm data process.
   Cluster response the alarm data from PAS ECU and lights INDICATOR. If it needs alarm delay or INDICATOR light delay, it controls the alarm data as below.

Alarm data status	Data control	remark
1,2,3 level alarm data send	PAS ECU	Cluster response 1,2,3 level alarm data immediately from PAS ECU
After 'R'Gear, no alarm and after 1,2,3 level alarm , no alarm	CLUSTER	Cluster display nothing alarm for 2 seconds after sending 1,2,3 level alarm sound, if cluster get no alarm data from PAS ECU.
In obstacle gets far, alarm data delay	PAS ECU	PAS ECU has 1sec alarm delay when the obstacle gets far or alarm is released after entering the alarm process.

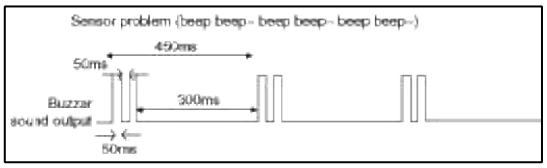
   But recognize R Gear starting point from the initial sound data that comes from PAS ECU.

5. Self diagnosis and fault alarm specification.
   System starts to fault alarm when it finds PAS sensor fault.
   PAS Sensor fault type is as below.
   A. Sensors fault.
   B. Sensor signal line OPEN of SHORT to GROUNDError diagnosis is performed by the error time and error type.
   Error diagnosis is performed by the error time and error type.

   1) Fault diagnosis by the fault time.
   A. On System starting → Display the INDICATOR after inform the fault sensor through the alarm sound(sensor circuto open or GROUND SHORT).
   B. On the normal operation, fault occurs (including the fault releasing and normal operation) → No fault alarm, just INDICATOR show the fault sensor.

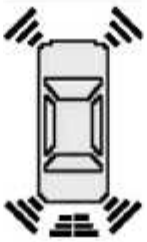
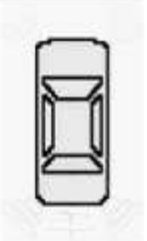
   2) Fault diagnosis by Fault type.
   A. Sensor fault (sensor circuit fault or sensor cell breakdown)→ INDICATOR displays that fault.
   B. Sensor WIRE fault (OPEN or GROUND SHORT)→ INDICATOR displays that fault.
   C. Sensor drive device of ECU fault→ INDICATOR display as if the sensor has a fault.

6. Sensor fault alarm sound output specification.
   In system initial starting, if it has fault sensor, it sounds as below.



   Acceptable wave error range: ±10%
   After sensor fault alarm sound are sent, the other sensors work normally.
   There is no fault alarm when the fault occurs during working normally.
   Alarm sound comes from CLUSTER and period and alarm lasting time of alarm could be changed (If it has any changes, cluster firm must notify Body Control Design team and Chassis Safety control team and MOBIS of changes)

7. Sensor fault display method.

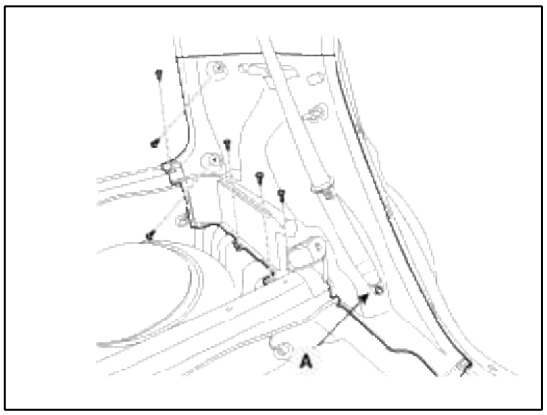
Alarm level	0.5sec lighting	0.5sec off
INDICATOR display		

Indicator lights only Fault sensor and when the sensor fault is released, faulty display will be disappeared.But, it is supposed to display the fault when it occurs on the work.

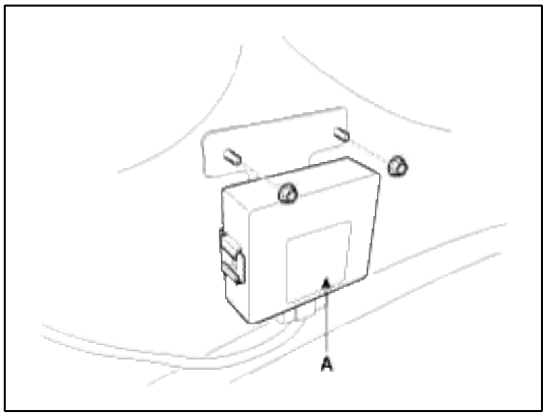
Body Electrical System > Front / Rear Parking Assist System > Front / Rear Parking Assist System Control Unit > Repair procedures

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the rear left luggage side trim (A) of the trunck.



3. Loosen the nut and disconnect the connector.
4. Remove the front/rear parking assist system control unit (A).

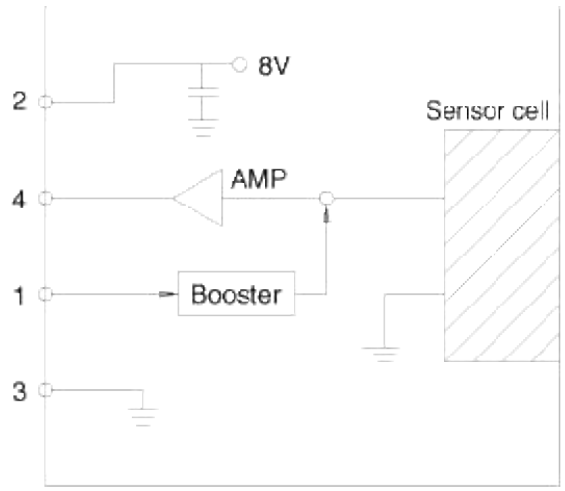


Installation

1. Install the front/rear parking assist system control unit.
2. Install the rear left luggage side trim.

Body Electrical System > Front / Rear Parking Assist System > Parking Assist Sensor > Schematic Diagrams

Circuit Diagram



[Sensor connector]



Pin number	Signal
1	TX
2	8V
3	Ground
4	RX

Body Electrical System > Front / Rear Parking Assist System > Parking Assist Sensor > Description and Operation

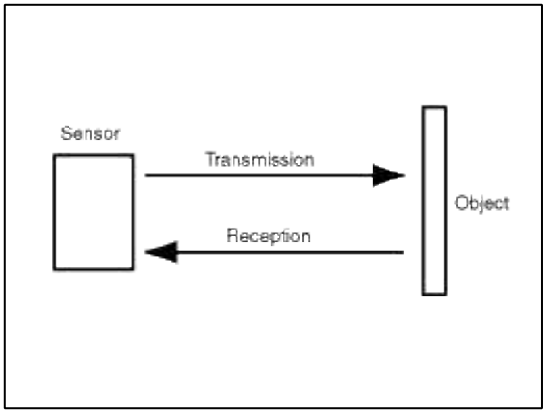
Operation

The sensor emits ultrasonic wave to the objects, and it measures the time until reflected wave returns, and calculates the distance to the object.

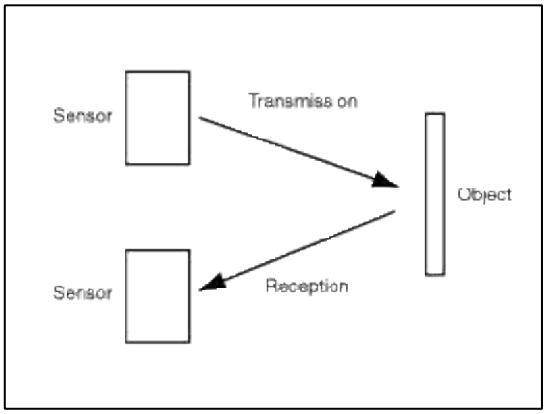
Distance Detection Type

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

Back warning system (BWS) is a complementary device for reversing. BWS detects objects behind vehicle and provides the driver with buzzer alarm finding objects in a certain area, using ultrasonic wave propagation speed and time.

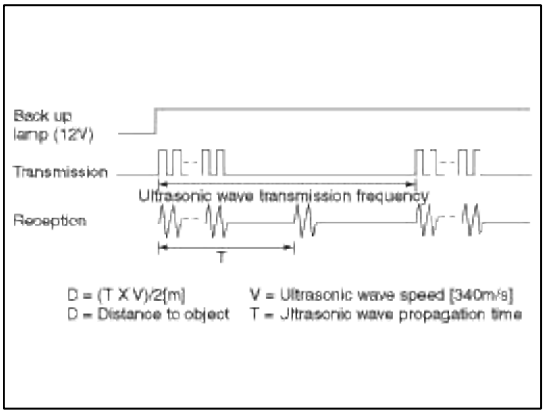
The propagation speed formula of ultrasonic wave in air is following :

v=331.5 + 0.6t (m/s)

v=ultrasonic wave propagation speed

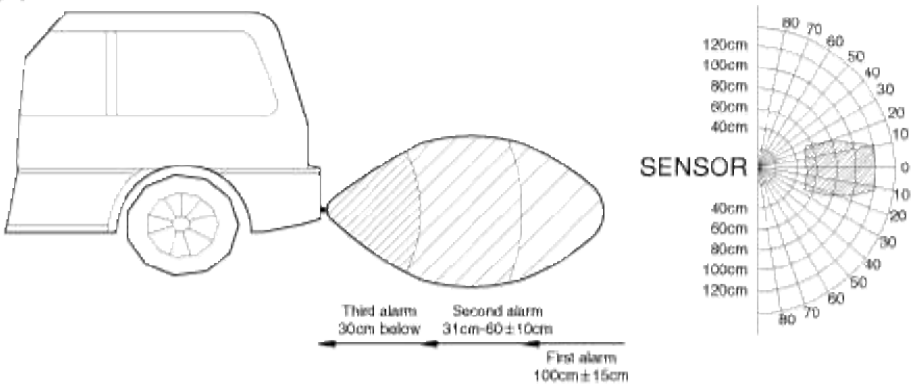
t=ambient temperature

The basic principle of distance measurement using ultrasonic wave is :



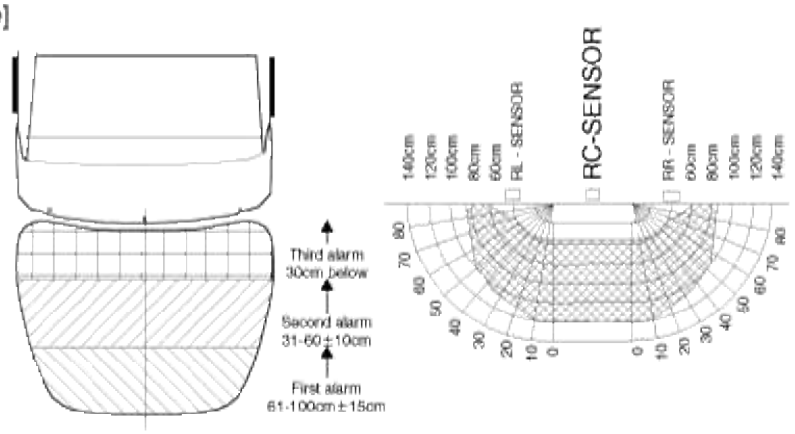
Sensor Detection Range

[Vertical range]



(1) Distance tolerance(Measured at the front of sensor)
61~100 cm(24~47.2 in) : ± 15 cm(5.9 in)
31~60 cm(12.2~23.6 in) : ± 10 cm(3.9 in)
30 cm(11.8 in) below : ± 10 cm(3.9 in)
(2) Detection tolerance
At 30cm(11.8 in) : 45° ± 20°
At 60cm(23.6 in) : 30° ± 20°
At 100cm(47.2 in) : 20° ± 20°
(3) At nearer distance than 30 cm detection may be not occurred.
(4) Measurement condition : Room temperature(20℃/68°F),
90 mm(3.5 in) diameter, 3m(9.8 ft) length rod.

[Horizontal range]



(1) Distance tolerance(Measured at the front of sensor)
61~100 cm(24~47.2 in) : ± 15 cm(5.9 in)
31~60 cm(12.2~23.6 in) : ± 10 cm(3.9 in)
30 cm(11.8 in) below : ± 10 cm(3.9 in)
(2) Detection tolerance
At 60cm(23.6 in) : 90° ± 20°
At 100cm(47.2 in) : 10° ± 20°
(3) At nearer distance than 30 cm detection may be not occurred.
(4) Measurement condition : Room temperature(20℃/68°F),
140 mm(5.5 in) diameter, 3m(9.8 ft) length rod.

NOTE

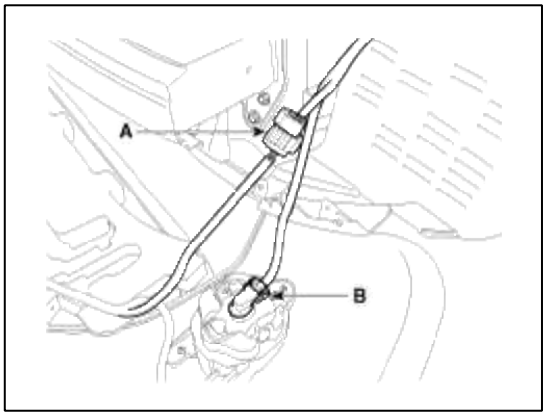
1. Plastic rod is used for the test target.
2. The test result may differ by a different target object.
3. Detection range may be reduced by dirt accumulated on sensor, and extremely hot or cold weather.
4. The following object may not be detected.
   - Sharp object or thin object like rope.
   - Cotton, sponge, snow or other materials absorbing sonic wave.
   - Smaller objects than 75mm(2.95 in) (Diameter), 1m(3.2 ft) length.

Body Electrical System > Front / Rear Parking Assist System > Parking Assist Sensor > Repair procedures

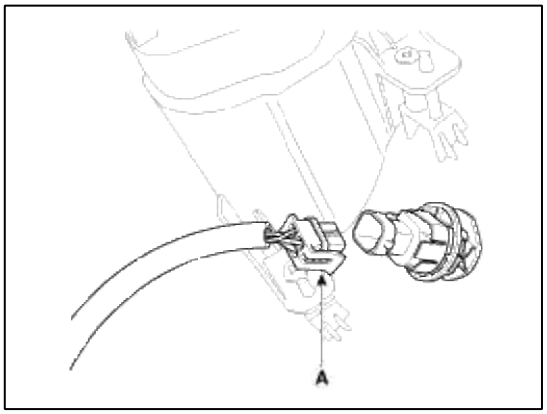
Removal

Front ultrasonic sensor

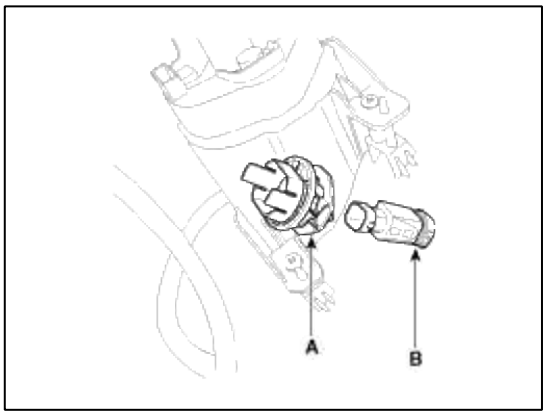
1. Disconnect the negative(-) battery terminal.
2. Remove the front bumper. (Refer to the BD group - "Front Bumper")
3. Disconnect the front ultrasonic sensor joint connector (A) and the fog lamp connector (B).



4. Disconnect the front ultrasonic sensor connector (A).

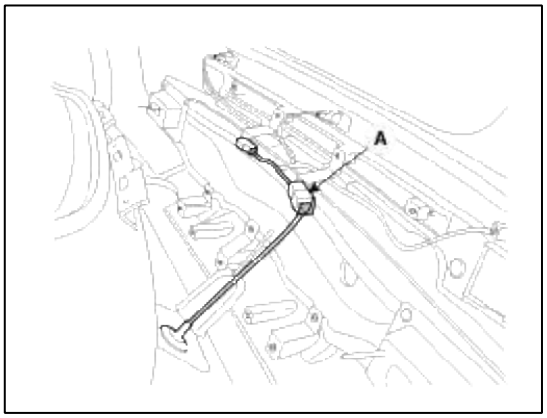


5. Remove the front ultrasonic sensor (B) after removing the front ultrasonic sensor housing cover (A).

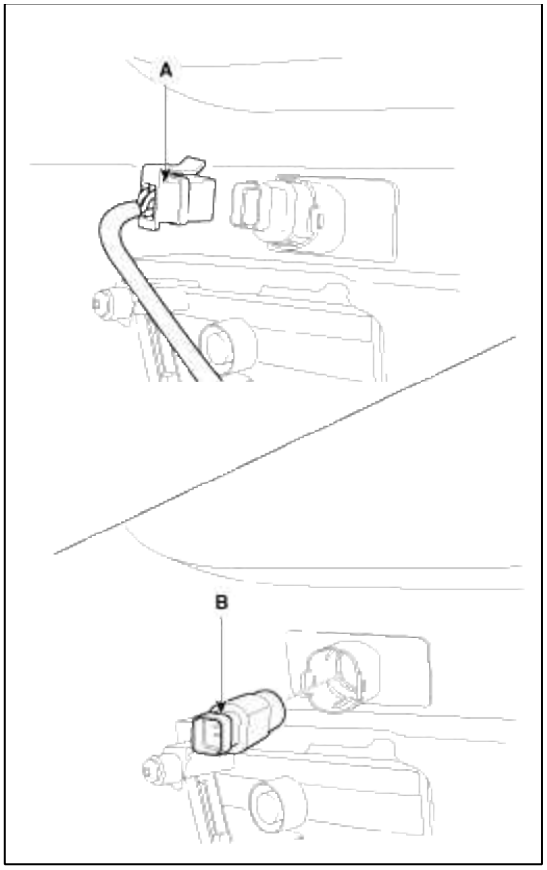


Rear ultrasonic sensor

1. Disconnect the negative(-) battery terminal.
2. Remove the rear bumper. (Refer to the BD group - "Rear Bumper")
3. Disconnect the connector (A) from the rear bumper.



4. Disconnect the sensor connector (A) at the inside of the rear bumper, and then remove the sensor (B) from the housing.



Installation

Front ultrasonic sensor

1. Connect the front ultrasonic sensor connector, and then install the sensor.
2. Install the front bumper.

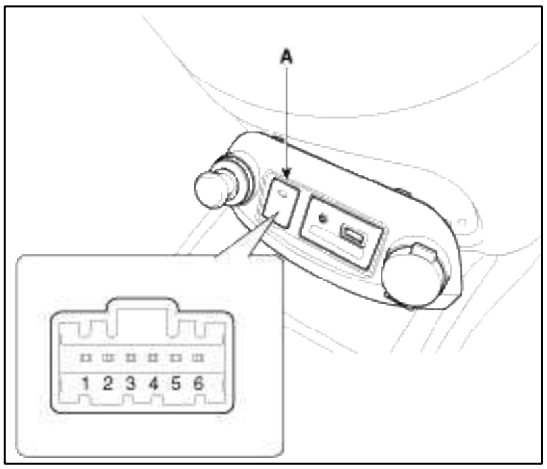
Rear ultrasonic sensor

1. Connect the rear ultrasonic sensor connector, and then install the sensor.
2. Install the rear bumper.

Body Electrical System > Front / Rear Parking Assist System > Front Rear Parking Assist System Switch > Repair procedures

Inspection

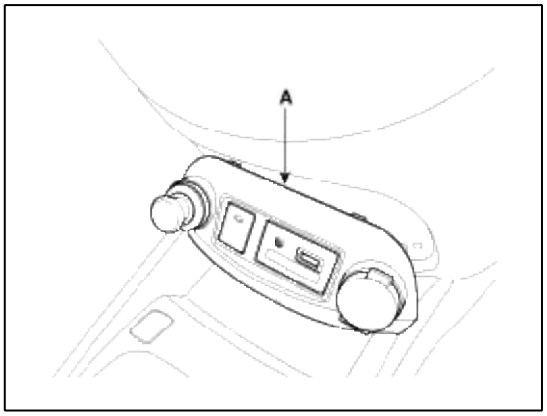
1. Check for continuity between the terminals. If continuity is not specified, replace the switch (A).



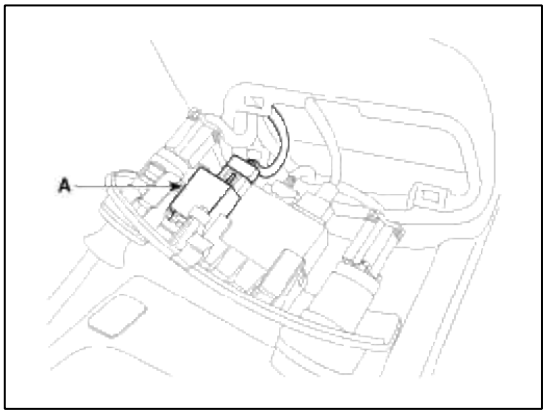
Position / Terminal	ON(Push)	OFF(Free)	
2			
5			
6			Indicator (-)
1			Indicator (+)
4			Illumination (-)
3			Illumination (+)

Removal

1. Remove the lower tray (A) from the crash pad by scraper.



2. Remove the PAS switch (A) after disconnecting the connector.



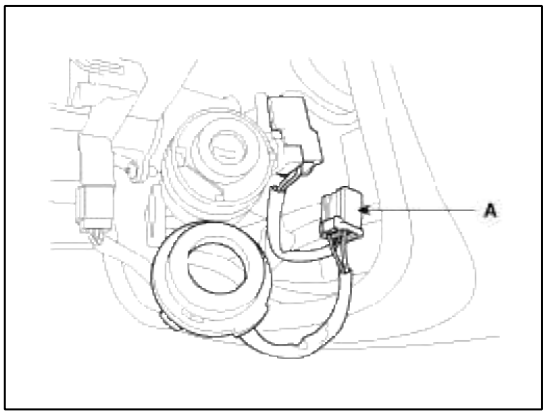
Installation

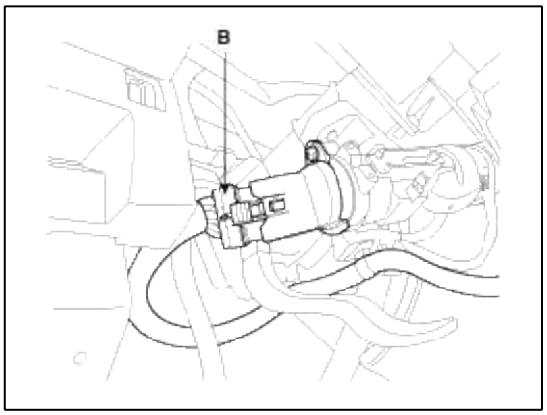
1. Install the connector and lower tray.
2. Install the (-) battery terminal.

Body Electrical System > Ignition Switch Assembly > Repair procedures

Inspection

1. Disconnect the ignition switch connector (B) and key warning switch connector (A) from under the steering column.





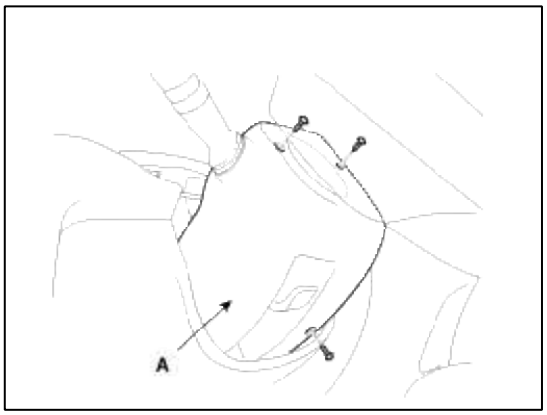
2. Check for continuity between the terminals.
3. If continuity is not specified, replace the switch.

TERMINAL / POSITION / KEY		IGNITION SWITCH (B)						STEERING		KEY WARNING SWITCH (A)		KEY HOLE ILLUMINATION(A)	
		2	4	6	5	3	1	TRAVEL	TRAVEL	5	6	3	4
LOCK	REMOVAL							LOCK					
	INSERT							LOCK	UNLOCK				
ACC		○—○						UNLOCK		○—○			
ON		○—○	—○	—○	○—○								
START		○—	—○	—○	○—	—○	—○						

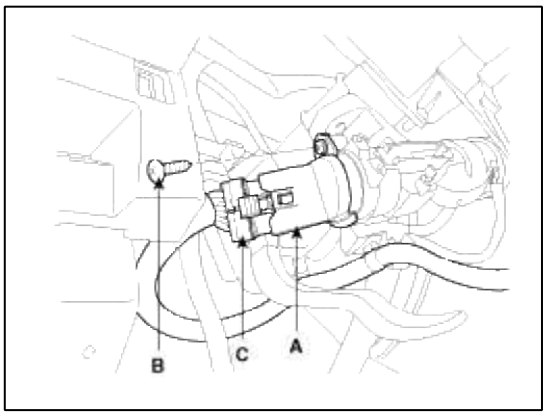
Removal

1. Disconnect the negative (-) battery terminal.

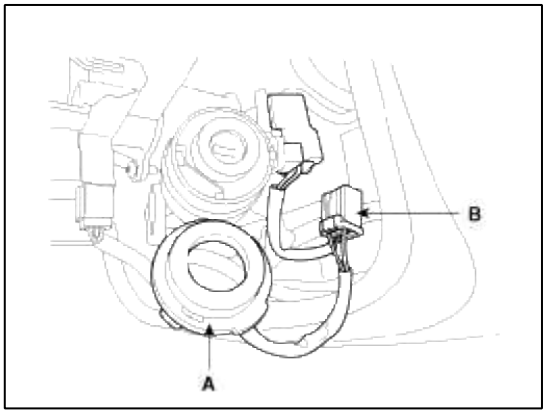
2. Remove the steering column upper and lower shrouds (A).



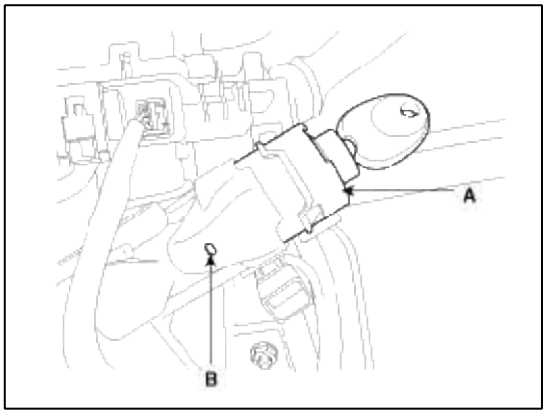
3. Remove the ignition switch (A) after loosening the screw (B) with IG ON and disconnecting the 6P connector (C).



4. Remove the door warning switch and key illumination lamp (A) after loosening the screw and disconnecting the 6P connector (B).



5. If it is necessary to remove the key lock cylinder (A), remove the interlock cable.And then remove the key lock cylinder after pushing lock pin (B) with key ACC.



Installation

1. Install the key lock cylinder.
2. Install the interlock cable.

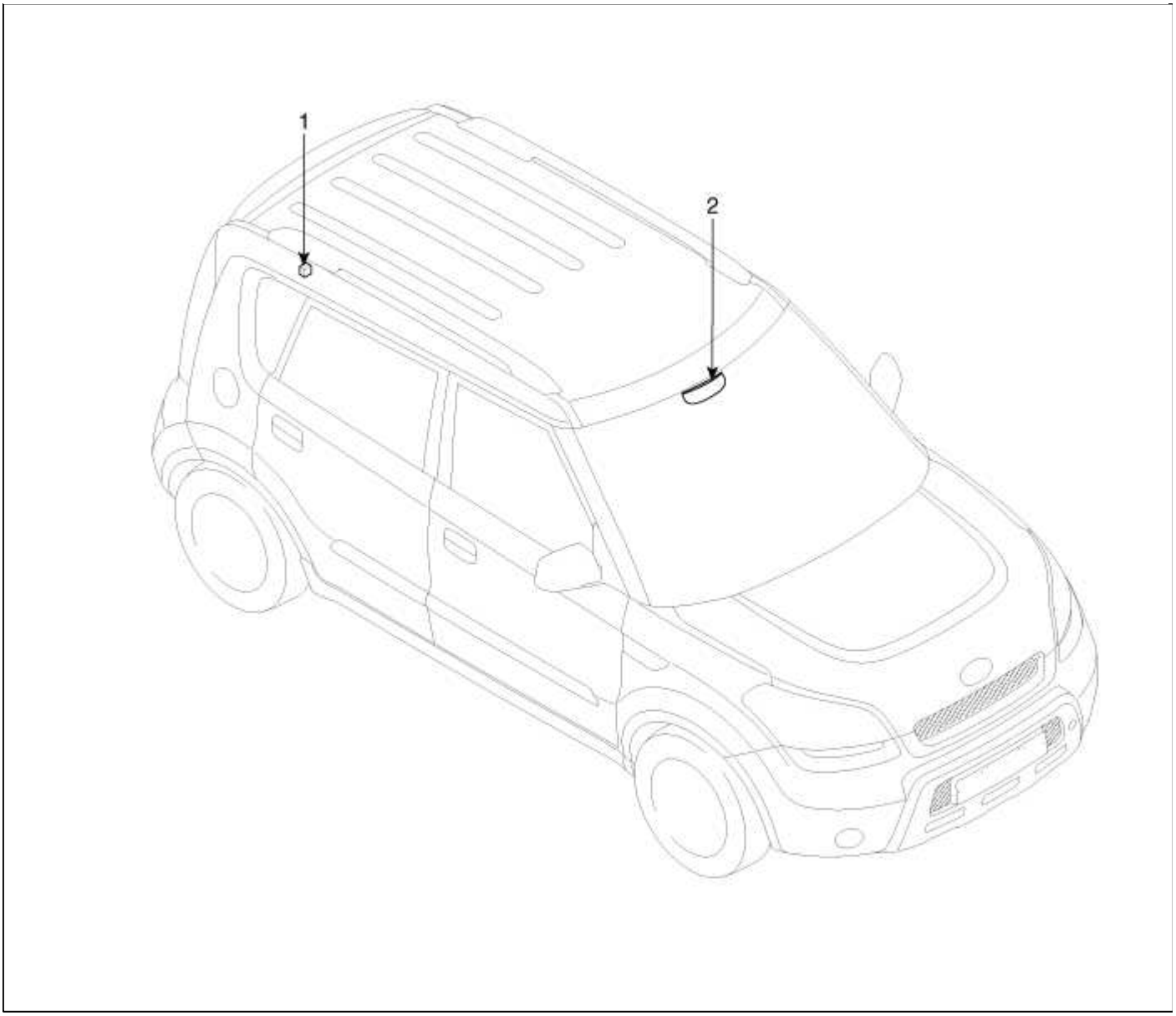
> NOTE
>
> Install procedure for interlock cable
> 1. After setting key interlock cable and IGN lock assembly, fix the key interlock cable with pre-assembled set screw.
> 2. Install interlock cable in position.
> 3. Turn the key "Lock" state, and check the A/T change lever P position.

> NOTE
>
> Check point of the key interlock system.
> 1. At "Lock" position, and brake pedal depressed, push button cannot be operated.
> 2. Key must not be turned to "Lock", except "P" position of A/T change lever.
> 3. At "P" position of A/T change lever, key must be turned to "Lock" smoothly.

3. Install the door warning switch and key illumination lamp.
4. Install the ignition switch.
5. Install the steering column shrouds.

Body Electrical System > Back View Camera System > Components and Components Location

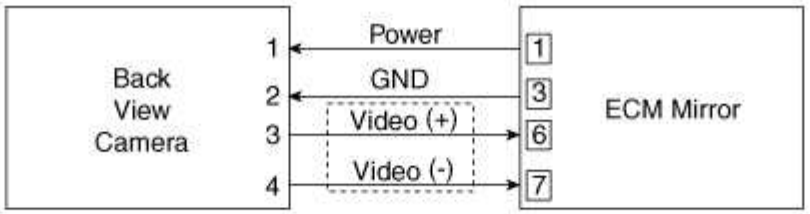
Component Location



1. Back view camera	2. ECM mirror

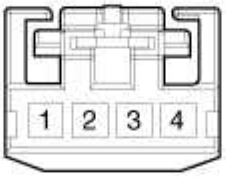
Body Electrical System > Back View Camera System > Schematic Diagrams

Circuit Diagram





Back view camera connector



Pin no.	Name
1	Video (-)
2	Video (+)
3	Ground
4	Power

Body Electrical System > Back View Camera System > Description and Operation

Description

Back view camera will activate when the backup light is ON with the ignition switch ON and the shift lever in the R position.
This system is a supplemental system that shows behind the vehicle through the AV monitor or ECM mirror while backing-up.

WARNING

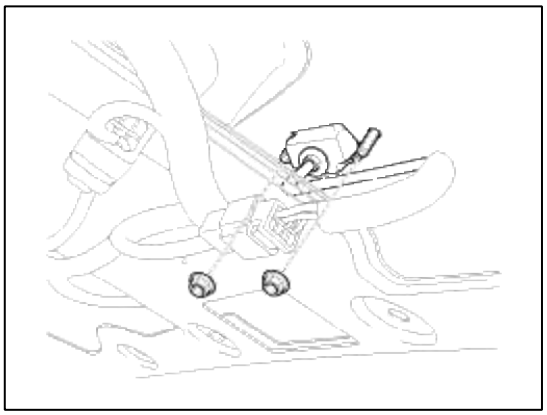
This system is a supplementary function only. It is the responsibility of the driver or always check the inside/ outside rearview mirror and the area behind the vehicle before and while backing up because there is a dead zone that can't see through the camera.

Body Electrical System > Back View Camera System > Repair procedures

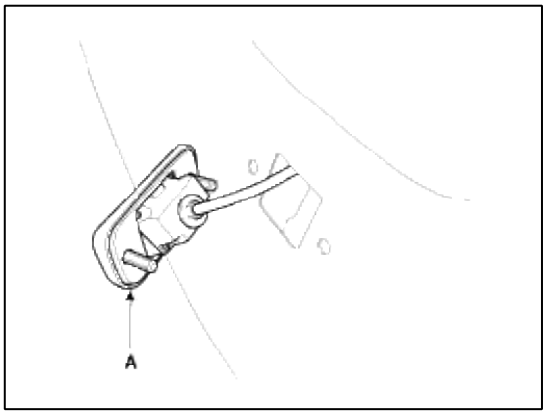
Removal

1. Remove the tailgate trim after removing the screws and clips.
   (Refer to the Body group - "Tailgate")

2. Remove the connector and nuts(2EA).



3. Remove the back view camera(A).



Installation

1. Install the back view camera.
2. Install the tailgate trim.

SOUL(AM) > 2012 > G 1.6 GDI > Heating,Ventilation, Air Conditioning

Heating,Ventilation, Air Conditioning > General Information > Specifications

Air conditioner

Item		Specification
Compressor	Type	VS12 (Variable Swash Plate Type)
	Oil type & Capacity	PAG OIL, 100 ± 5~10cc
	Pulley type	5PK-TYPE
	Displacement	126cc/rev
Condenser	Heat rejection	13,400 - 5% Min kal/hr
APT(A/C pressure transducer)	The method to measure the pressure	Voltage = 0.00878835 * Pressure + 0.37081095
Expansion valve	Type	Block
Refrigerant	Type	R-134a
	Capacity [g(oz.)]	550 ± 25 (19.4 ± 0.88)

Blower unit

Item		Specification
Fresh and recirculation	Operating method	Actuator
Blower	Type	Sirocco
	Speed step	0~4(Manual), Auto + 8speed(Auto)
	Speed control	Blower resistor(Manual), Power mosfet(Auto)
Air filter	Type	Particle filter

Heater and evaporator unit

Item		Specification
Heater	Type	Pin & Tube type
	Heating capacity	4,500 - 5% kal/hr
	Mode operating method	Actuator
	Temperature operating method	Actuator
Evaporator	Temperature control type	Evaporator temperature sensor
	A/C ON/OFF [°C(°F)]	ON : 2.1 ± 0.5 (37.4 ± 0.9), OFF: 0.6 ± 0.5 (33.8 ± 0.9)

Heating,Ventilation, Air Conditioning > General Information > Troubleshooting

Problem symptoms table

Before replacing or repairing air conditioning components, first determine if the malfunction is due to the refrigerant charge, air flow or compressor.

Use the table below to help you find the cause of the problem. The numbers indicate the priority of the likely cause of the problem. Check each part in order. If necessary, replace these parts.

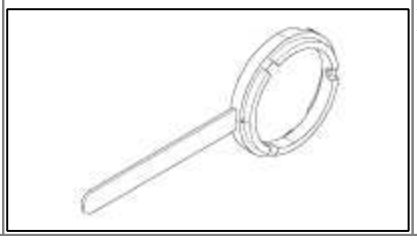
After correcting the malfunction, check the complete system to ensure that performance is satisfactory.

Standard:

Symptom	Suspect Area
No blower operation	1.Blower fuse 2.Blower relay 3.Blower motor 4.Power mosfet 5.Blower speed control switch 6.Wire harness
No air temperature control	1.Engine coolant capacity 2.Heater control assembly
No compressor operation	1.Refrigerant capacity 2.A/C Fuse 3.Magnetic clutch 4.Compressor 5.A/C pressure transducer 6.A/C switch 7.Evaporator temperature sensor 8.Wire harness
No cool air	1.Refrigerant capacity 2.Refrigerant pressure 3.Drive belt 4.Magnetic clutch 5.Compressor 6.A/C pressure transducer 7.Evaporator temperature sensor 8.A/C switch 9.Heater control assemblyWire harness
Insufficient cooling	1.Refrigerant capacity 2.Drive belt 3.Magnetic clutch 4.Compressor 5.Condenser 6.Expansion valve 7.Evaporator 8.Refrigerant lines 9.A/C pressure transducer 10.Heater control assembly
No engine idle-up when A/C switch ON	1.Engine ECM 2.Wire harness
No air inlet control	1. Heater control assembly
No mode control	1.Heater control assembly 2.Mode actuator
No cooling fan operation	1.Cooling fan fuse 2.Fan motor 3.Engine ECM 4.Wire harness

Heating,Ventilation, Air Conditioning > General Information > Special Service Tools

Special tools

Tool (Number and name)	Illustration	Use
09977-3R000 Disc & hub assembly bolt remover		Removal and installation of disc & hub assembly

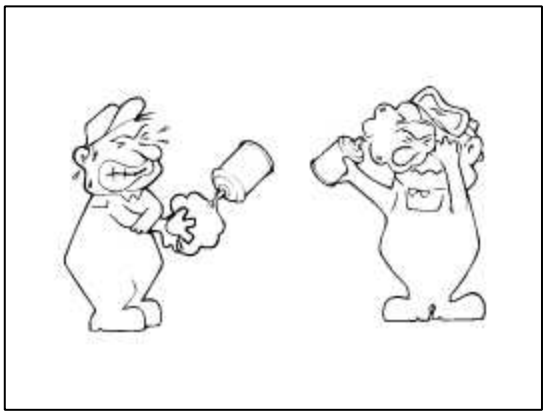
Heating,Ventilation, Air Conditioning > Air conditioning System > General Safety Information and Caution

Instructions

When Handling Refrigerant

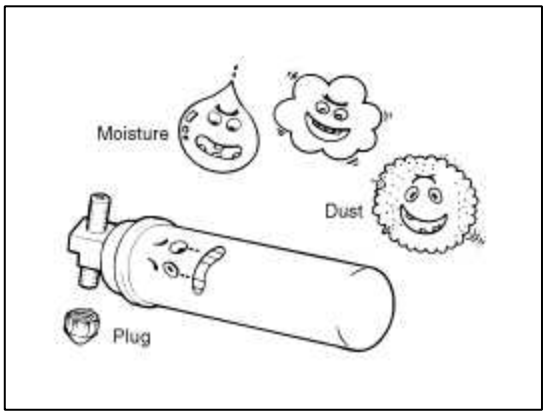
1. R-134a liquid refrigerant is highly volatile. A drop on the skin of your hand could result in localized frostbite. When handling the refrigerant, be sure to wear gloves.
2. It is standard practice to wear goggles or glasses to protect your eyes, and gloves to protect your hands. If the refrigerant splashes into your eyes, wash them with clean water immediately.
3. The R-134a container is highly pressurized. Never leave it in a hot place, and check storage temperature is below 52°C (126°F)
4. An electronic leak detector should be used to check the system for refrigerant leakage. Bear in mind that the R-134a, upon coming into contact with flame, produces phosgene, a highly toxic gas.
5. Use only recommended lubricant for R-134a systems. If lubricants other than the recommended one used, system failure may occur.
6. PAG lubricant absorbs moisture from the atmosphere at a rapid rate, therefore the following precautions must be observed:
   A. When removing refrigerant components from a vehicle, cap the components immediately to prevent entry of moisture.
   B. When installing refrigerant components to a vehicle, do not remove the cap until just before connecting the components.
   C. Complete the connection of all refrigerant tubes and hoses without delay to prevent the A/C system from taking on moisture.
   D. Use the recommended lubricant from a sealed container only.

7. If an accidental discharge in the system occurs, ventilate the work area before resum of service.



When replacing parts ON A/C system

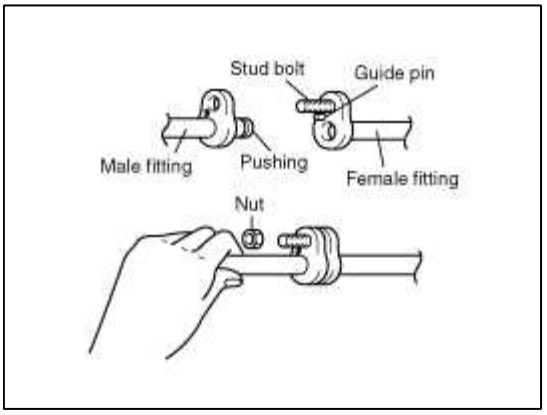
1. Never open or loosen a connection before discharging the system.
2. Seal the open fittings of components with a cap or plug immediately to prevent intrusion of moisture or dust.
3. Do not remove the sealing caps from a Replacement component until it is ready to be installed.
4. Before connecting an open fitting, always install a new sealing ring. Coat the fitting and seal with refrigerant oil before making the connection.



When Installing Connecting Parts

Flange with guide pin

Check the new O-ring for damage (use only the specified) and lubricate by using compressor oil. Tighten the nut to specified torque.



Size	Tightening torque [N.m (kg.m, lbf.ft)]	
	General bolt, nut	
	4T	7T
M6	5 - 6(0.5 - 0.6, 3.6 - 4.3)	9 - 11(0.9 - 1.1, 6.5 - 7.9)
M8	12 - 15(1.2 - 1.5, 8.7 - 10)	20 - 25(2.0 - 2.5, 14 - 18)
M10	25 - 30(2.5 - 3.0, 18 - 22)	45 - 50(4.5 - 5.0, 32 - 36)
Size	Flange bolt, nut	
	4T	7T
M6	5 - 7(0.5 - 0.7, 3.6 - 5.0)	8 - 12(0.8 - 1.2, 5.8 - 8.6)
M8	10 - 15(1.0 - 1.5, 7 - 10)	19 - 28(1.9 - 2.8, 14 - 20)
M10	21 - 31(2.1 - 3.1, 15 - 22)	39 - 60(3.9 - 6.0, 28 - 43)

NOTE

- T means tensile intensity, which is stamped on the head of bolt only numeral.

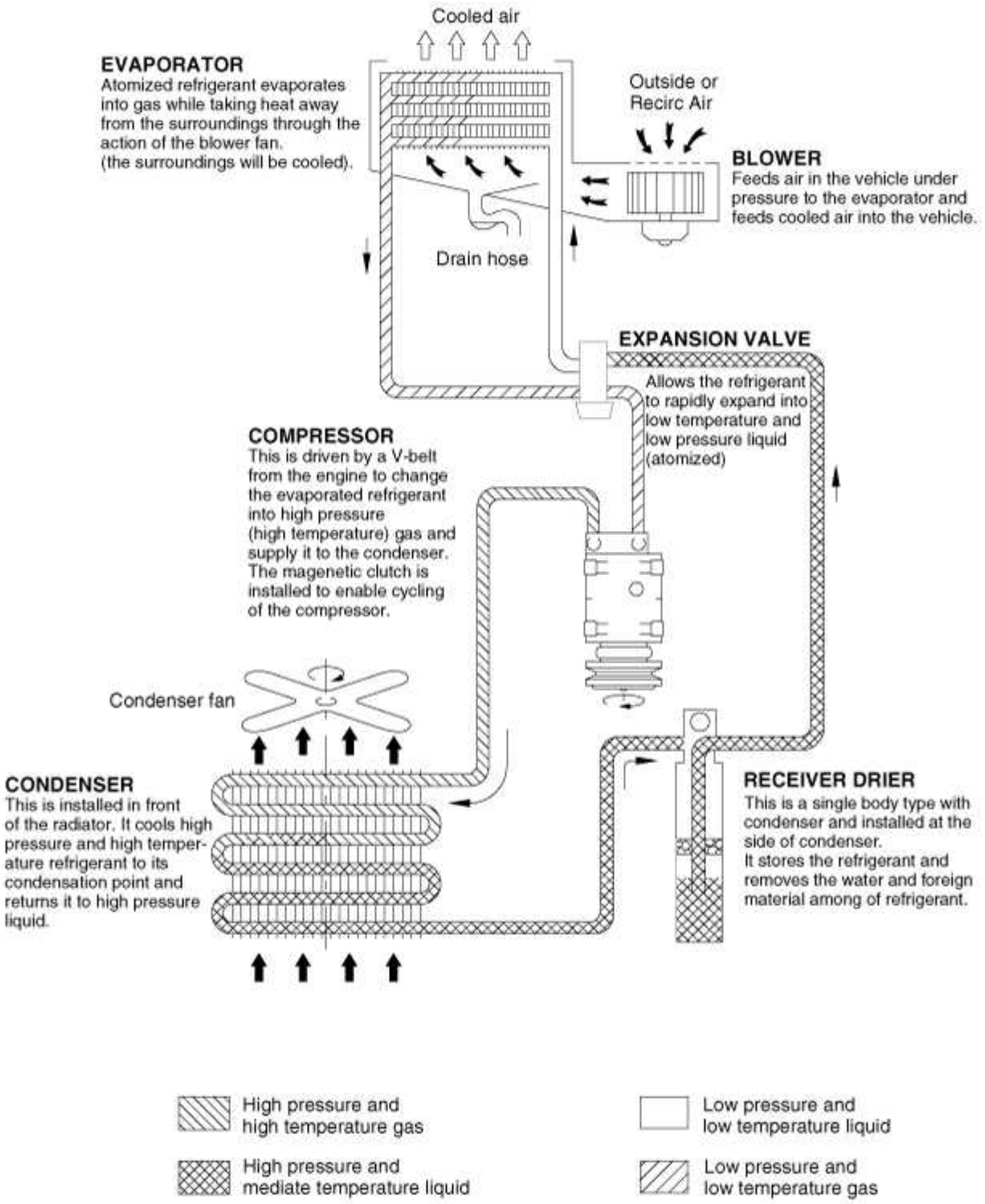
Handling tubing and fittings
The internal parts of the refrigeration system will remain in a state of chemical stability as long as pure moisture-free refrigerant and refrigerant oil are used. Abnormal amounts of dirt, moisture or air can upset the chemical stability and cause problems or serious damage.

The Following precautions must be observed

1. When it is necessary to open the refrigeration system, have everything you will need to service the system ready so the system will not be left open any longer than necessary.
2. Cap or plug all lines and fittings as soon as they are opened to prevent the entrance of dirt and moisture.
3. All lines and components in parts stock should be capped or sealed until they are ready to be used.
4. Never attempt to rebind formed lines to fit. Use the correct line for the installation you are servicing.
5. All tools, including the refrigerant dispensing manifold, the gauge set manifold and test hoses, should be kept clean and dry.

Heating,Ventilation, Air Conditioning > Air conditioning System > Description and Operation

Refrigeration cycle



Heating,Ventilation, Air Conditioning > Air conditioning System > Repair procedures

Refrigerant system service basics

Refrigerant recovery

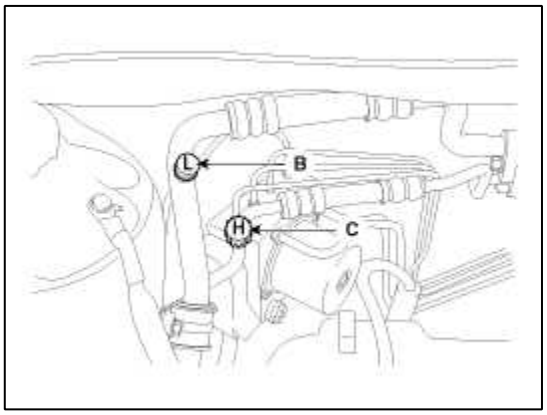
Use only service equipment that is U.L-listed and is certified to meet the requirements of SAE J2210 to remove HFC-134a(R-134a) from the air conditioning system.

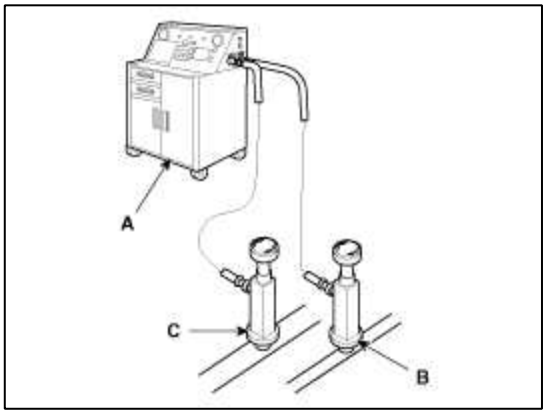
CAUTION

- Air conditioning refrigerant or lubricant vapor can irritate your eyes, nose, or throat.
- Be careful when connecting service equipment.
- Do not breathe refrigerant or vapor.

If accidental system discharge occurs, ventilate work area before resume of service.
Additional health and safety information may be obtained from the refrigerant and lubricant manufacturers.

1. Connect an R-134a refrigerant Recovery/Recycling/Charging System (A) to the high-pressure service port (B) and the low-pressure service port (C) as shown, following the equipment manufacturer's instructions.





2. Measure the amount of refrigerant oil removed from the A/C system after the recovery process is completed. Be sure to install the same amount of new refrigerant oil back into the A/C system before charging.

System evacuation
Use only service equipment that is U.L-listed and is certified to meet the requirements of SAE J2210 to remove HFC-134a(R-134a) from the air conditioning system.

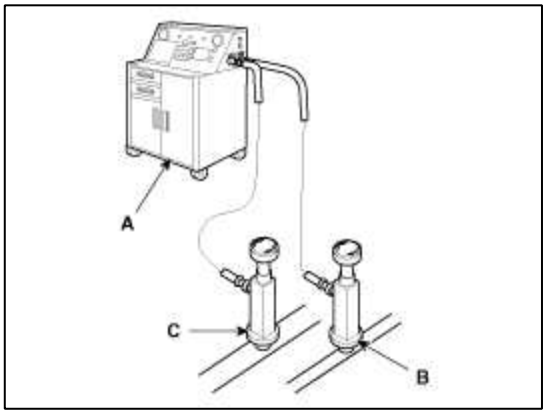
CAUTION

- Air conditioning refrigerant or lubricant vapor can irritate your eyes, nose, or throat.
- Be careful when connecting service equipment.
- Do not breathe refrigerant or vapor.

If accidental system discharge occurs, ventilate work area before resume of service.
Additional health and safety information may be obtained from the refrigerant and lubricant manufacturers.

1. When an A/C System has been opened to the atmosphere, such as during installation or repair, it must be evacuated using an R-134a refrigerant Recovery/Recycling/Charging System. (If the system has been open for several days, the receiver/dryer should be replaced, and the system should be evacuated for several hours.)

2. Connect an R-134a refrigerant Recovery/Recycling/Charging System (A) to the high-pressure service port (B) and the low-pressure service port (C) as shown, following the equipment manufacturer's instructions.



3. If the low-pressure does not reach more than 93.3 kPa (700 mmHg, 27.6 in.Hg) in 10 minutes, there is probably a leak in the system. Partially charge the system, and check for leaks (see Leak Test.).

4. Remove the low pressure valve from the low-pressure service port.

System charging

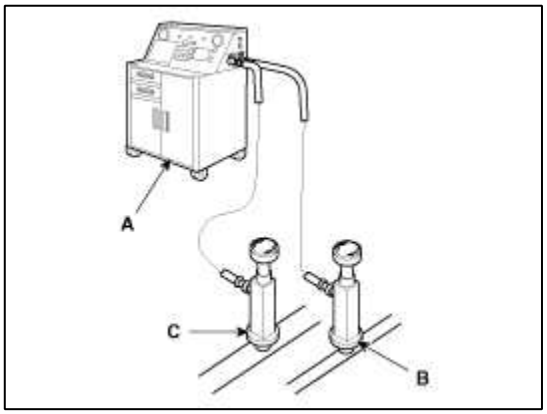
Use only service equipment that is U.L-listed and is certified to meet the requirements of SAE J2210 to remove HFC-134a(R-134a) from the air conditioning system.

CAUTION

- Air conditioning refrigerant or lubricant vapor can irritate your eyes, nose, or throat.
- Be careful when connecting service equipment.
- Do not breathe refrigerant or vapor.

If accidental system discharge occurs, ventilate work area before resume of service.
Additional health and safety information may be obtained from the refrigerant and lubricant manufacturers.

1. Connect an R-134a refrigerant Recovery/Recycling/Charging System (A) to the high-pressure service port (B) as shown, following the equipment manufacturer's instructions.



2. Add the same amount of new refrigerant oil to system that was removed during recovery. Use only specified refrigerant oil. Charge the system with 550±25g (19.4±0.88 oz.)of R-134a refrigerant. Do not overcharge the system the compressor will be damaged.

Refrigerant leak test

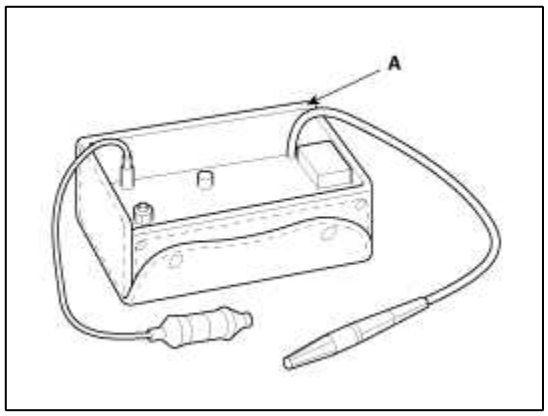
Always conduct a leak test with an electronic leak detector whenever leakage or refrigerant is suspected and when conducting service operations which are accompanied by disassembly or loosening or connection fittings.

NOTE

In order to use the leak detector properly, read the manual supplied by the manufacturer.

If a gas leak is detected, proceed as follows:

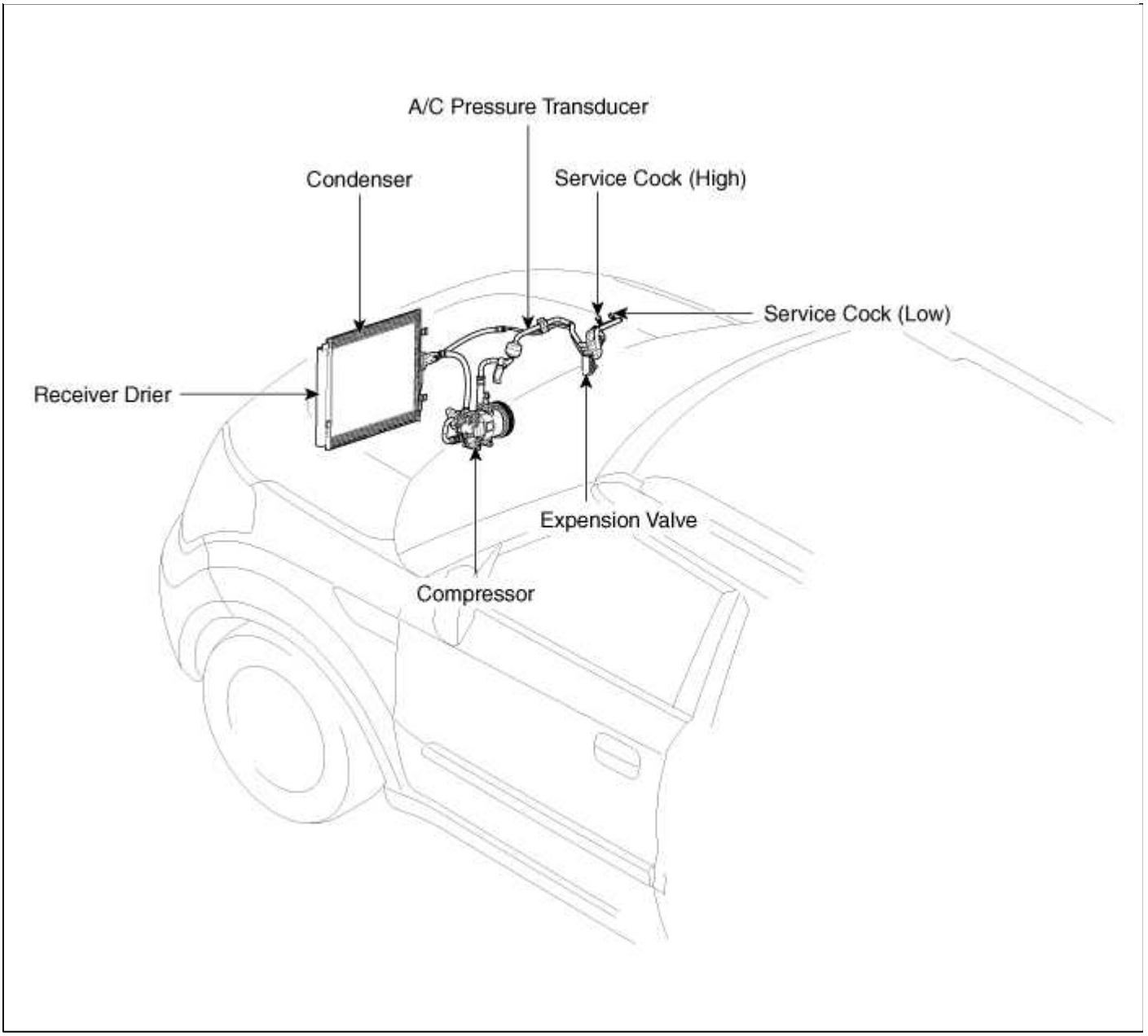
1. Check the torque on the connection fittings and, if too loose, tighten to the proper torque. Check for gas leakage with a leak detector (A).
2. If leakage continues even after the fitting has been tightened, discharge the refrigerant from the system, disconnect the fittings, and check their seating faces for damage. Always replace, even if the damage is slight.
3. Check the compressor oil and add oil if required.
4. Charge the system and recheck for gas leaks. If no leaks are found, evacuate and charge the system again.



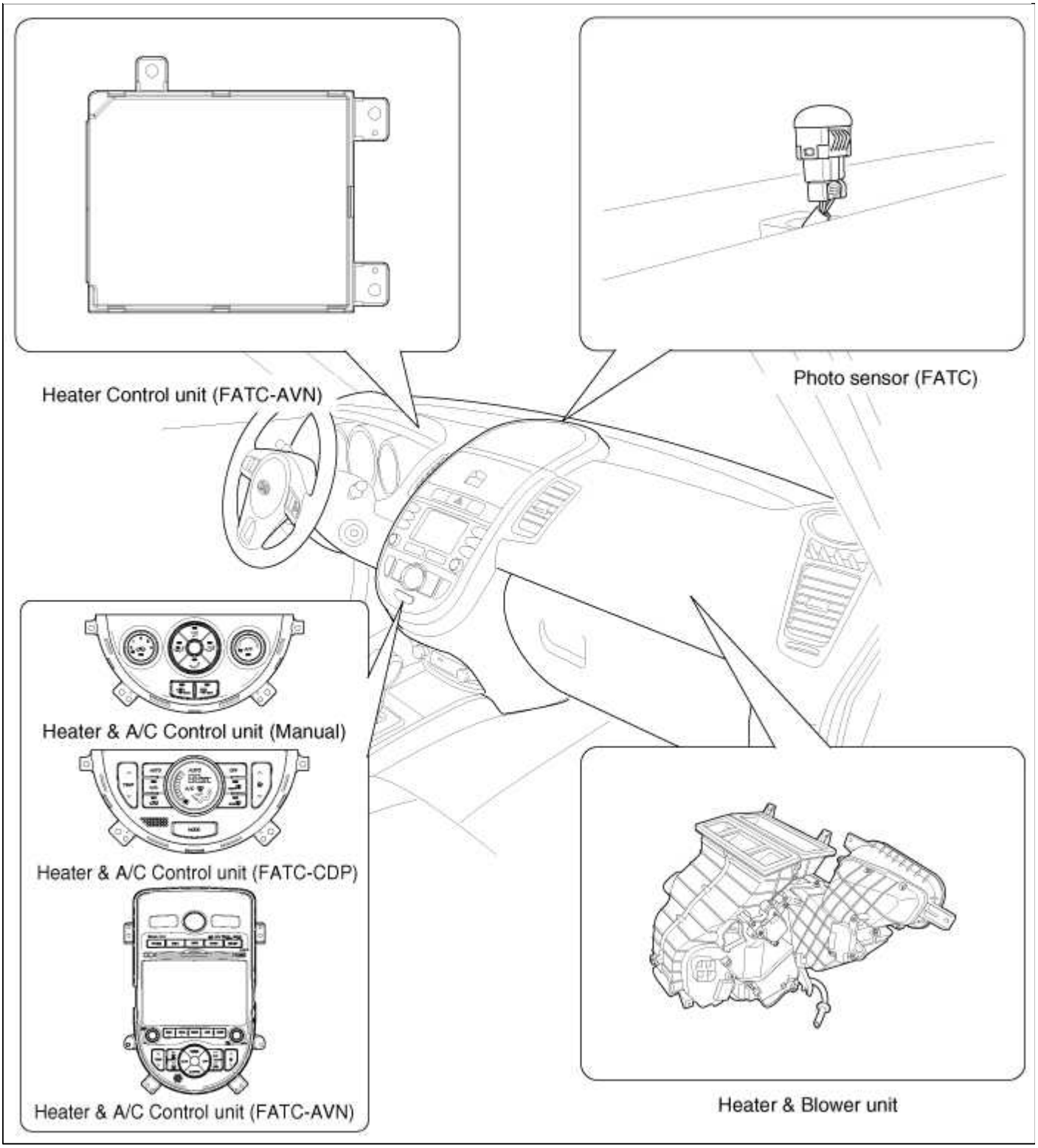
Heating,Ventilation, Air Conditioning > Air conditioning System > Components and Components Location

Component Locaiton Index

Engine room


A/C Pressure Transducer
Condenser
Service Cock (High)
Service Cock (Low)
Receiver Drier
Expension Valve
Compressor

Interior



Heating,Ventilation, Air Conditioning > Air conditioning System > Compressor oil > Repair procedures

Oil Specification

1. The HFC-134a system requires synthetic (PAG) compressor oil whereas the R-12 system requires mineral compressor oil. The two oils must never be mixed.
2. Compressor (PAG) oil varies according to compressor model. Be sure to use oil specified for the model of compressor.

Handling of Oil

1. The oil should be free from moisture, dust, metal powder, etc.

2. Do not mix with other oil.
3. The water content in the oil increases when exposed to the air. After use, seal oil from air immediately. (HFC-134a Compressor Oil absorbs moisture very easily.)
4. The compressor oil must be stored in steel containers, not in plastic containers.

Compressor oil check
The oil used to lubricate the compressor is circulating with the refrigerant.
Whenever replacing any component of the system or a large amount of gas leakage occurs, add oil to maintain the original amount of oil.

Oil total volume in system : 100±5~10cc (3.52±0.17~0.34 fl.oz)

Oil Return Operation
There is close affinity between the oil and the refrigerant.
During normal operation, part of the oil recirculates with the refrigerant in the system. When checking the amount of oil in the system, or replacing any component of the system, the compressor must be run in advance for oil return operation. The procedure is as follows:

1. Open all the doors and the engine hood.
2. Start the engine and air conditioning switch to "ON" and set the blower motor control knob at its highest position.
3. Run the compressor for more than 20 minutes between 800 and 1,000 rpm in order to operate the system.
4. Stop the engine.

Replacement of Component Parts
When replacing the system component parts, supply the following amount of oil to the component parts to be installed.

Component parts to be installed	Amount of Oil
Evaporator	50 cc (1.70 fl.oz)
Condenser	30 cc (1.02 fl.oz)
Receiver/dryer	30 cc (1.02 fl.oz)
Refrigerant line (One piece)	10 cc (0.34 fl.oz)

For compressor Replacement, subtract the volume of oil drained from the removed compressor from the specified volume, and drain the calculated volume of oil from the new compressor:
The specified volume - volume of removed compressor = volume to drain from the new compressor.

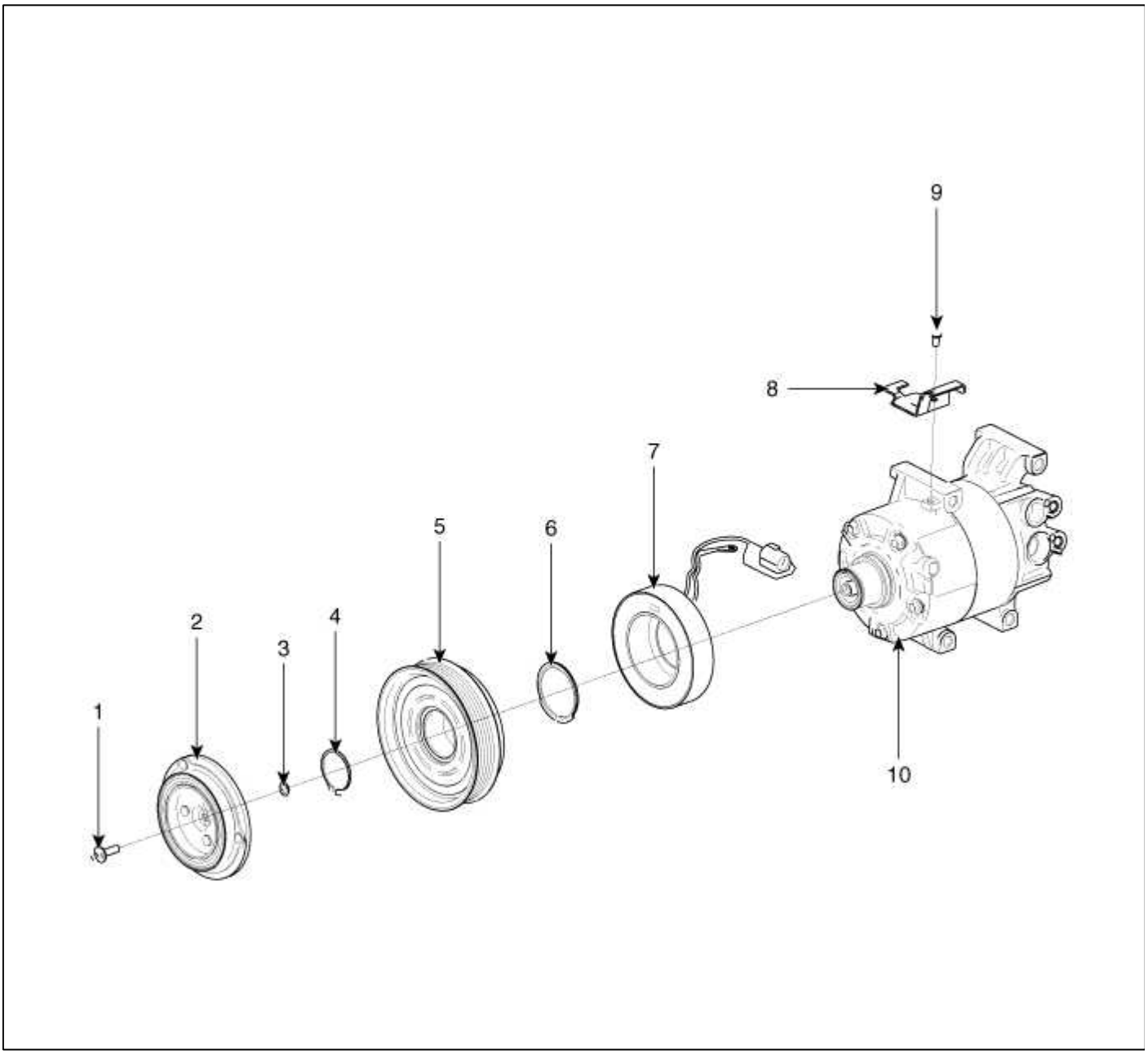
NOTE

- Even if no oil is drained from the removed compressor, don’t drain more than 50cc from new compressor.

Heating,Ventilation, Air Conditioning > Air conditioning System > Compressor > Components and Components Location

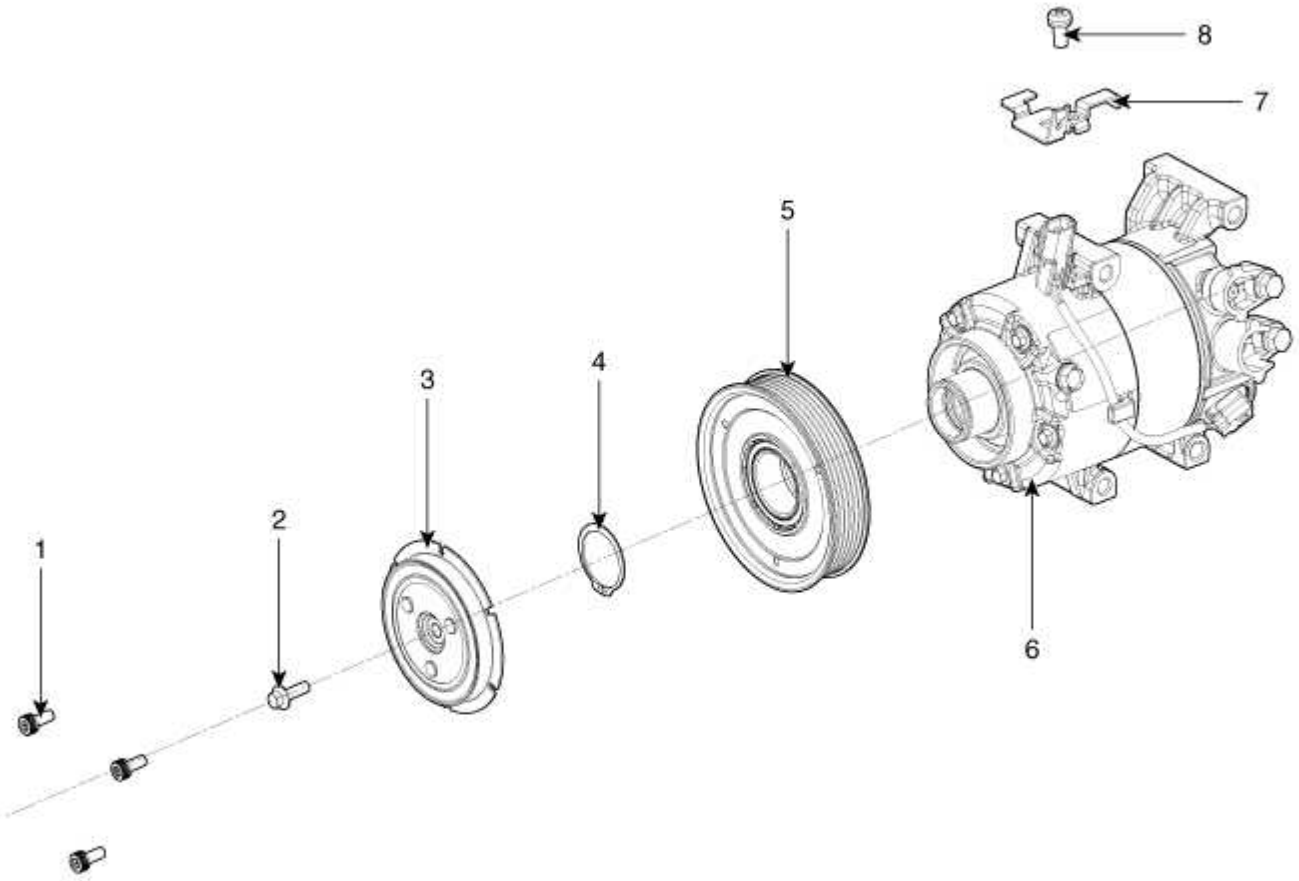
Components

Intermally Controlled Variable Swash Plate Type



1. Bolt	6. Retainer ring (Field coil)
2. Disc & hub assembly	7. Field coil
3. Shim	8. Connector bracket
4. Retainer ring (pulley)	9. Screw
5. Pulley	10. Compressor assembly

Externally Controlled Variable Swash Plate Type



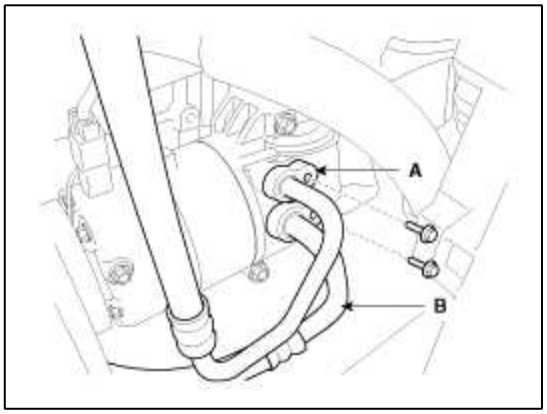
1. Hub bolt	5. Pulley
2. Center bolt	6. Compressor assembly
3. Disc & hub assembly	7. Connector bracket
4. Retainer ring	8. Screw

Heating,Ventilation, Air Conditioning > Air conditioning System > Compressor > Repair procedures

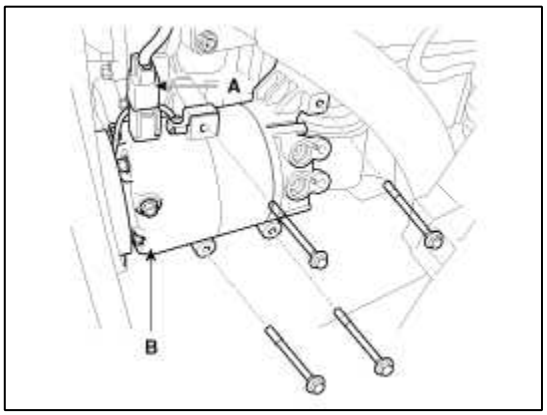
Removal

1. If the compressor is marginally operable, run the engine at idle speed, and let the air conditioning work for a few minutes, then shut the engine off.
2. Disconnect the negative cable from the battery.
3. Recover the refrigerant with a recovery/charging station.
4. Loosen the drive belt.

5. Remove the bolts, then disconnect the suction line (A) and discharge line (B) from the compressor. Plug or cap the lines immediately after disconnecting them to avoid moisture and dust contamination.



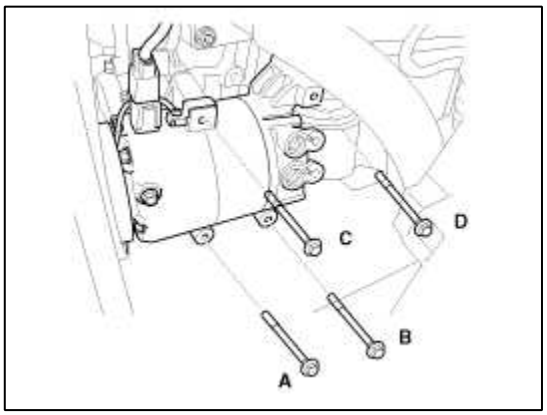
6. Disconnect the compressor clutch connector (A), and then remove 4 mounting bolts and the compressor (B).



Installation

1. Make sure of the length of compressor mounting bolts, and then tighten it A→B→C→D order.

TORQUE :
21.6~32.4N.m (2.2~3.3kgf.m, 15.9~23.9lbf.ft)

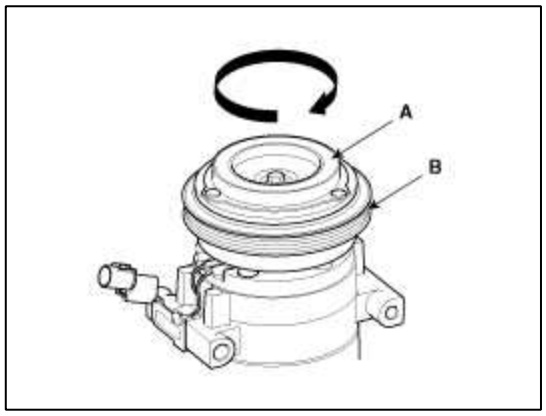


2. Install in the reverse order of removal, and note these items.
   A. If you're installing a new compressor, drain all the refrigerant oil from the removed compressor, and measure its volume, Subtract the volume of drained oil from 100cc(3.52 oz.) the result is the amount of oil you should drain from the new compressor (through the suction fitting).
   B. Replace the O-rings with new ones at each fitting, and apply a thin coat of refrigerant oil before installing them. Be sure to use the right O-rings for R-134a to avoid leakage.
   C. To avoid contamination, do not return the oil to the container once dispensed, and never mix it with other refrigerant oils.
   D. Immediately after using the oil, replace the cap on the container and seal it to avoid moisture absorption.
   E. Do not spill the refrigerant oil on the vehicle; it may damage the paint; if the refrigerant oil contacts the paint, wash it off immediately.
   F. Adjust the drive belt.
   G. Charge the system and test its performance.

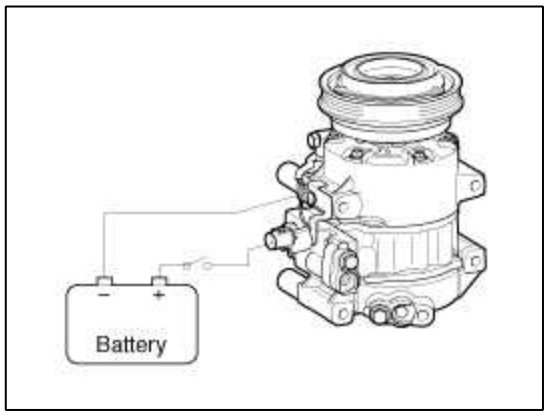
Inspection

1. Check the plated parts of the disc & hub assembly (A) for color changes, peeling or other damage. If there is damage, replace the clutch set.

2. Check the pulley (B) bearing play and drag by rotating the pulley by hand. Replace the clutch set with a new one if it is noisy or has excessive play/drag.



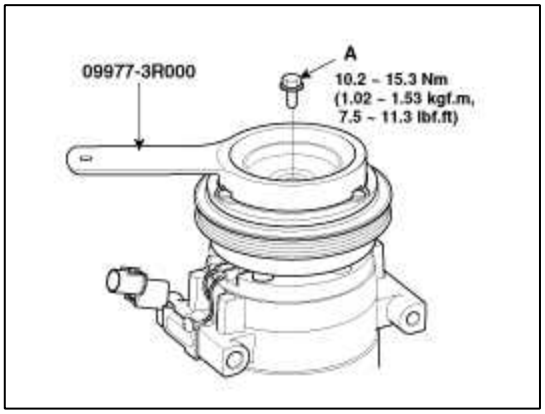
3. Check operation of the magnetic clutch.Connect the compressor side terminals to the battery (+) terminal and the ground battery (-) terminal to the compressor body.Check the magnetic clutch operating noise to determine the condition.



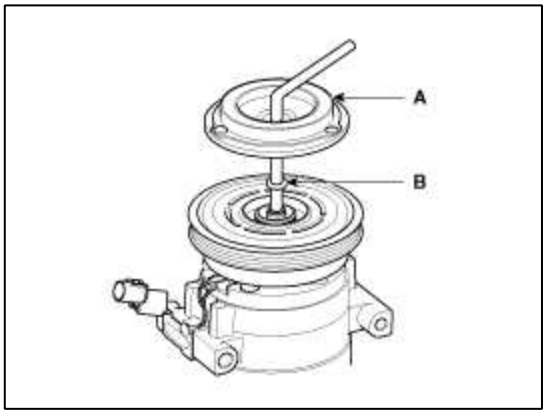
Disassembly

1. Remove the center bolt (A) while holding the disc & hub assembly with a commercially available disc & hub assembly bolt remover; Special tool number 09977-3R000.

TORQUE : 10~15N.m (1.02~1.53kgf.m, 7.37~11lbf.ft)



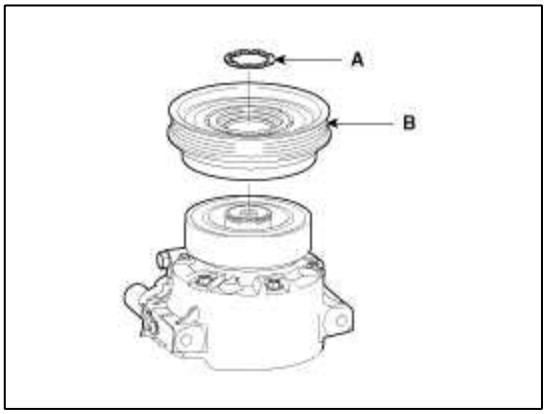
2. Remove the disc & hub assembly (A) and shim (gap washer) (B), taking care not to lose the shims. If the clutch needs adjustment, increase or decrease the number and thickness of shims as necessary, then reinstall the disc & hub assembly, and recheck its clearance.



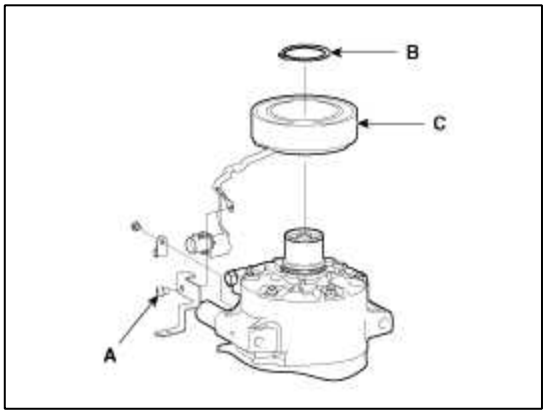
3. If you removal the field coil, remove retainer ring (A) with retainer ring pliers.

NOTE

- Be careful not to damage the pulley (B) and compressor during removal/installation.
- Once retainer ring (A) is removed, replace it with a new one.



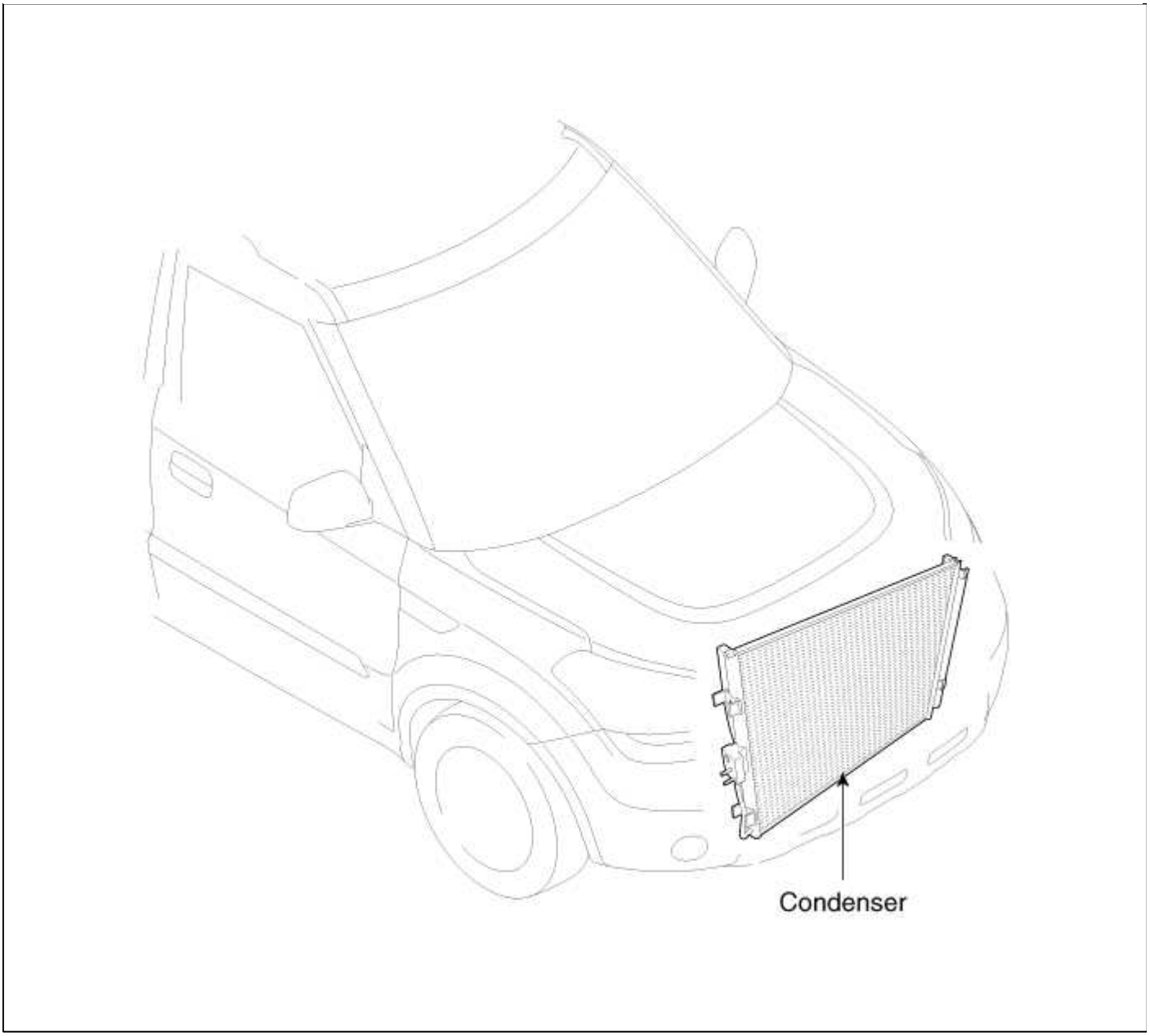
4. After loosening the screw (A), remove the retainer ring (B) and then remove the field coil (C). Be careful not to damage the coil and compressor.



5. Reassemble the compressor clutch in the reverse order of disassembly, and note these items :
   A. Clean the pulley and compressor sliding surfaces with non-petroleum solvent.
   B. Install new retainer rings, and make sure they are fully seated in the groove.
   C. Make sure that the pulley turns smoothly after its reassembled.

Heating,Ventilation, Air Conditioning > Air conditioning System > Condenser > Components and Components Location

Component location



Heating,Ventilation, Air Conditioning > Air conditioning System > Condenser > Repair procedures

Inspection

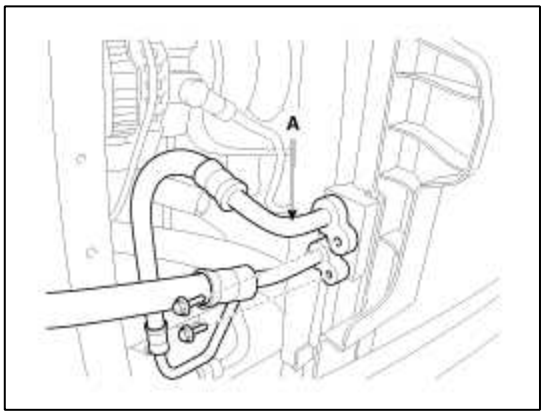
1. Check the condenser fins for clogging and damage. If clogged, clean them with water, and blow them with compressed air. If bent, gently bend them using a screwdriver or pliers.
2. Check the condenser connections for leakage, and repair or replace it, if required.

Replacement

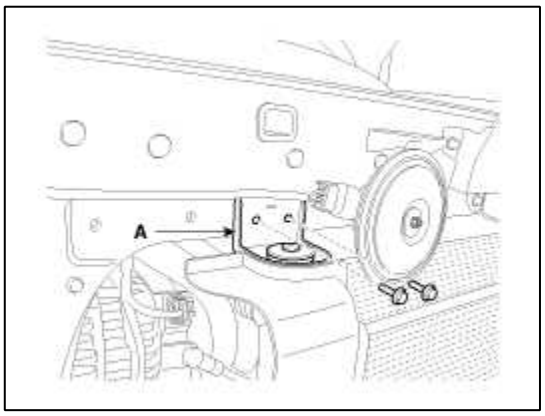
Condenser Assembly

1. Recover the refrigerant with a recovery/ recycling/ charging station .
2. Disconnect the negative (-) battery terminal.
3. Remove the front bumper. (Refer to BD group-front bumper)

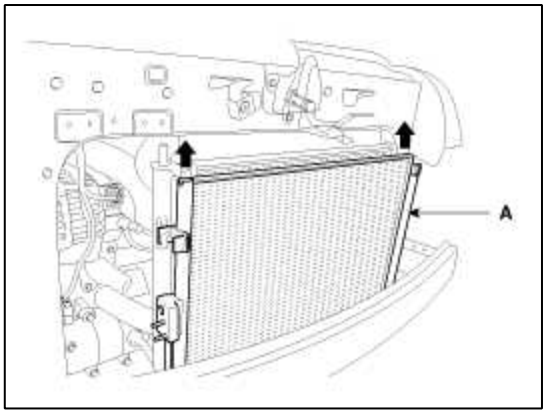
4. Disconnect the refrigerant line(A).



5. Remove the mount bumper(A).



6. Remove the condenser (A) by lifting it up. Be careful not to damage the radiator and condenser fins when removing the condenser.

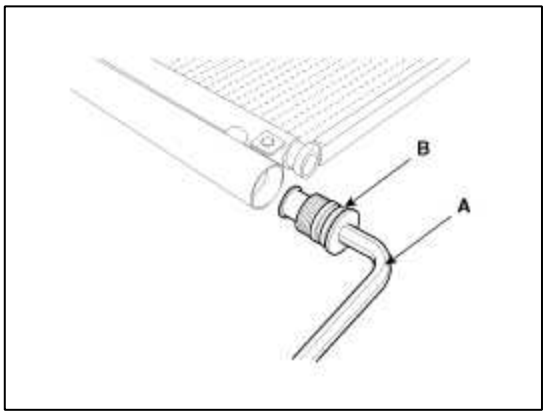


7. Install in the reverse order of removal, and note these items :
   A. If you're installing a new condenser, add refrigerant oil PAG OIL.
   B. Replace the O-rings with new ones at each fitting, and apply a thin coat of refrigerant oil before installing them. Be sure to use the right O-rings for R-134a to avoid leakage.
   C. Be careful not to damage the radiator and condenser fins when installing the condenser.
   D. Be sure to install the lower mount cushions of condenser securely into the holes.
   E. Charge the system, and test its performance.

Desiccant

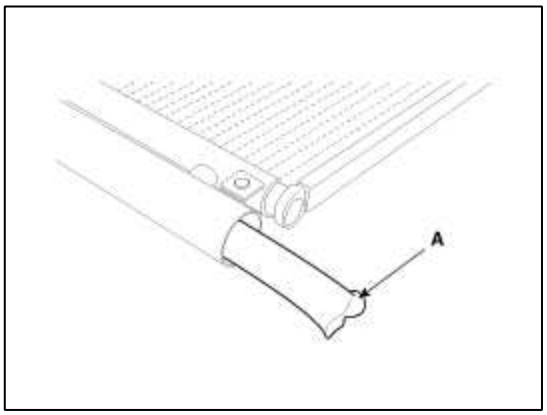
Replacement

1. Remove the condenser, and then remove the bottom cap (B) with L wrench (A) from the condenser.



TORQUE : 9.8~14.7N.m (1.0~1.5kgf.m, 7.2~10.8lb-ft)

2. Remove the desiccant (A) from condenser using a long nose plier. Check for crumbled desiccant and clogged bottom cap filter.



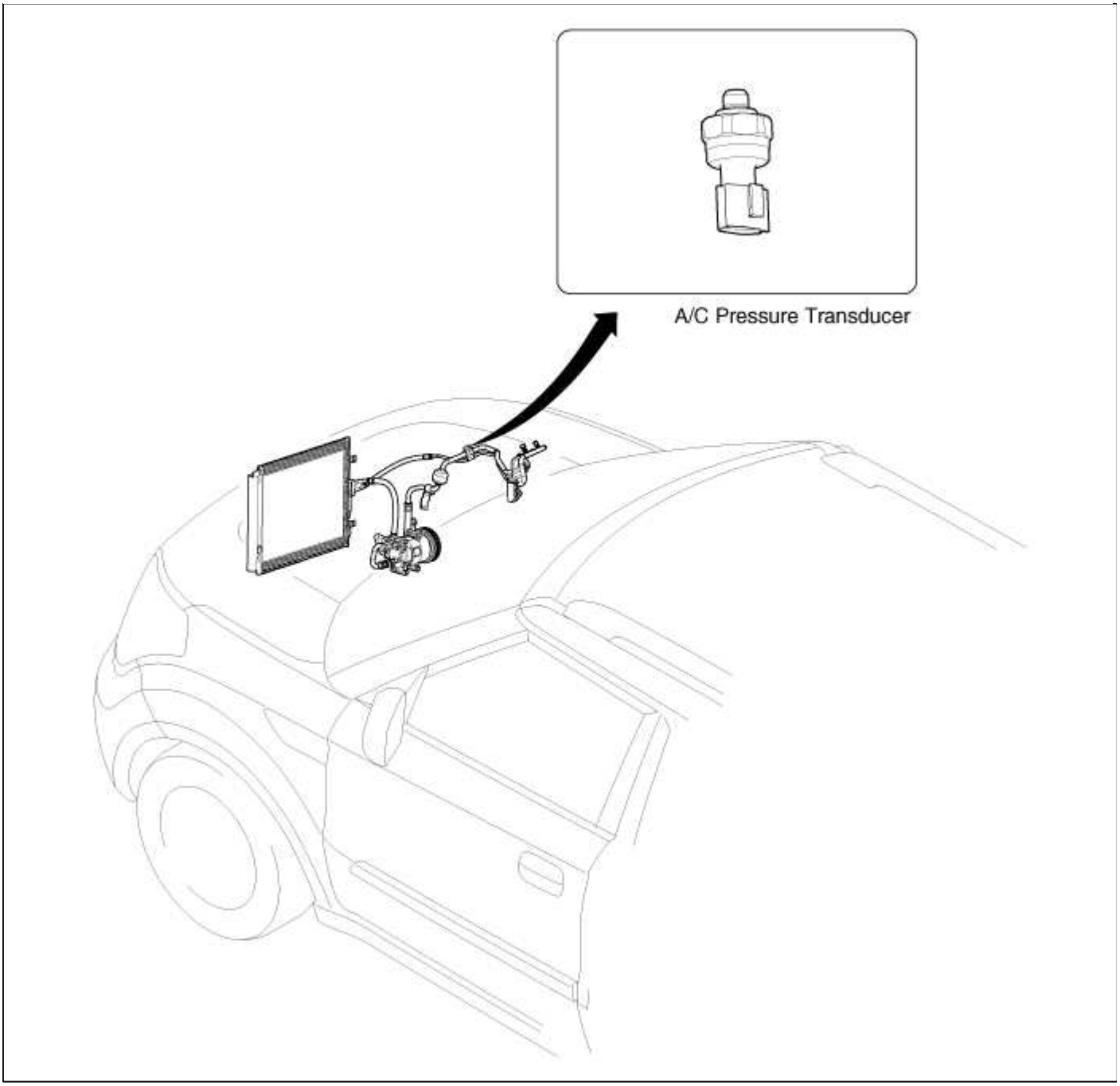
3. Apply air conditioning compressor oil along the O-rings and threads of the new bottom cap.
4. Insert the new desiccant into the receiver drier tank. The desiccant must be sealed in vacuum before it is exposed to air for use.
5. Install the new bottom cap to the condenser.

NOTE

- Always replace the desiccant and bottom cap at the same time.
- Replace the O-rings with new ones at each fitting, and apply a thin coat of refrigerant oil before installing them. Be sure to use the right O-rings for R-134a to avoid leakage.
- Be careful not to damage the radiator and condenser fins when installing the condenser.
- Be sure to install the lower mount cushions of condenser securely into the holes.
- Charge the system, and test its performance.

Heating,Ventilation, Air Conditioning > Air conditioning System > A/C pressure transducer > Components and Components Location

Component Location



Heating,Ventilation, Air Conditioning > Air conditioning System > A/C pressure transducer > Description and Operation

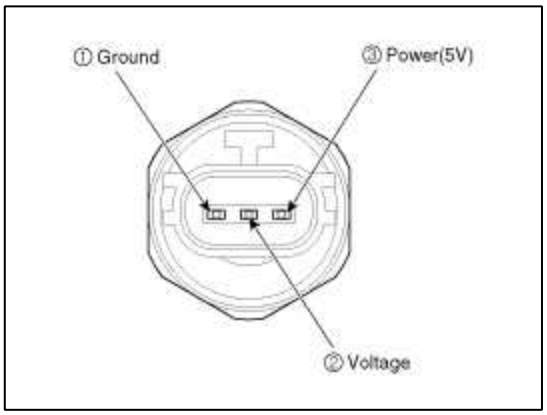
Description

A/C pressure transducer convert the pressure value of high pressure line into voltage value after measure. By converted voltage value, engine ECU controls cooling fan by operating high speed or low speed. Engine ECU stop the operation of compressor when the temperature of refrigerant line is too high or too low irregularly to optimize air conditioning system.

Heating,Ventilation, Air Conditioning > Air conditioning System > A/C pressure transducer > Repair procedures

Inspection

1. Measure the pressure of high pressure line by voltage output between NO.1 and NO.2 terminals



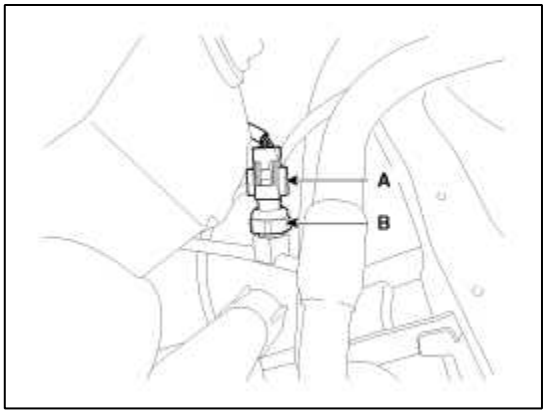
2. Inspect the voltage value whether it is sufficient to be regular value or not.

Voltage = 0.00878835 * Pressure + 0.37081095 [PSIA]

3. If the measured voltage value is not specification, replace the A/C pressure transducer.

Replacement

1. Disconnect the negative (-) battery terminal.
2. Recover the refrigerant with a recovery/charging station.
3. Disconnect A/C pressure transducer connector (3P) (A).
4. Remove the A/C pressure transducer(B).



CAUTION

- Take care that liquid & suction pipe are not bent.

5. Installation is the reverse order of removal.

TORQUE : 10~12N.m (1.0~1.2kgf.m, 7.4~8.8lbf.ft)

Heating,Ventilation, Air Conditioning > Air conditioning System > Evaporator temperature sensor > Description and Operation

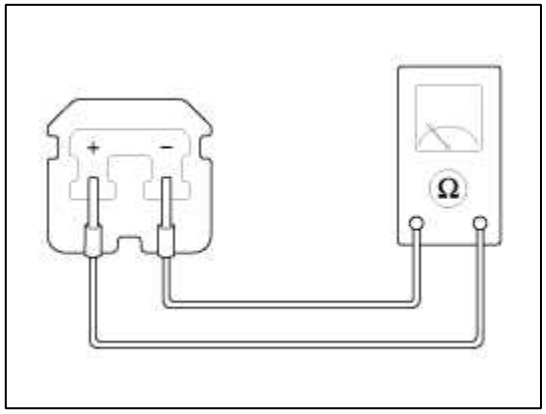
Description

The evaporator temperature sensor will detect the evaporator core temperature and interrupt compressor relay power in order to prevent evaporator freezing by excessive cooling.

Heating,Ventilation, Air Conditioning > Air conditioning System > Evaporator temperature sensor > Repair procedures

Inspection

1. Ignition "OFF"
2. Disconnect evaporator temperature sensor.
3. Using the multi-tester, Measure resistance between terminal "+" and "-" of evaporator temperature sensor.



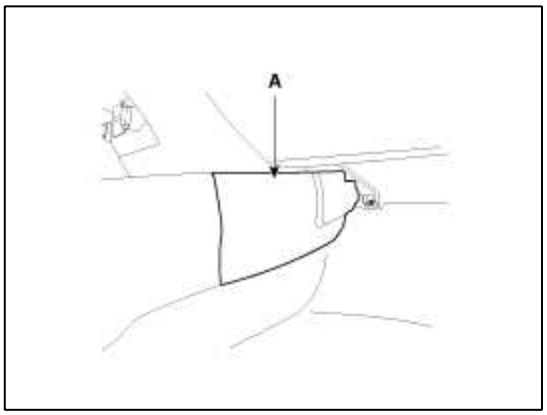
Specification

Coolant temperature [°C(°F)]	Resistance (kΩ)	Voltage (V)
-10(14)	43.35	2.96
0(32)	27.62	2.40
10(50)	18.07	1.88
20(68)	12.11	1.44
30(86)	8.30	1.08
40(104)	5.81	0.81
50(122)	4.15	0.61

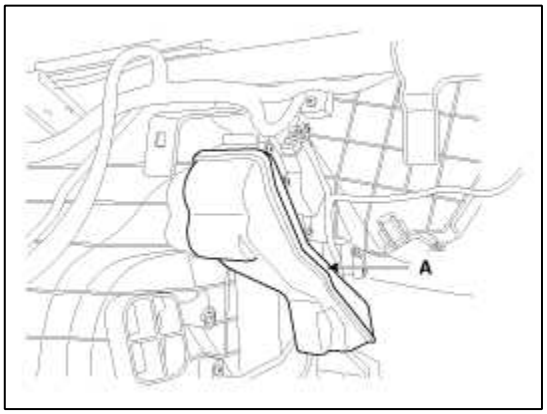
4. If the measured resistance is not specification, substitute with a known-good evaporator temperature sensor and check for proper operation.
5. If the problem is corrected, replace the evaporator temperature sensor.

Replacement

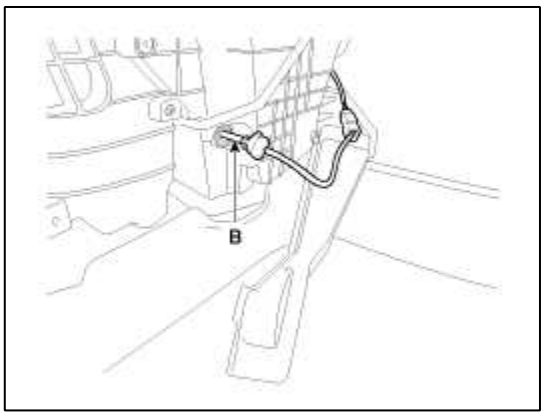
1. Remove the crash pad lower panel (A).



2. Remove the glove box. (Refer to BD group)
3. Remove the shower duct (A).



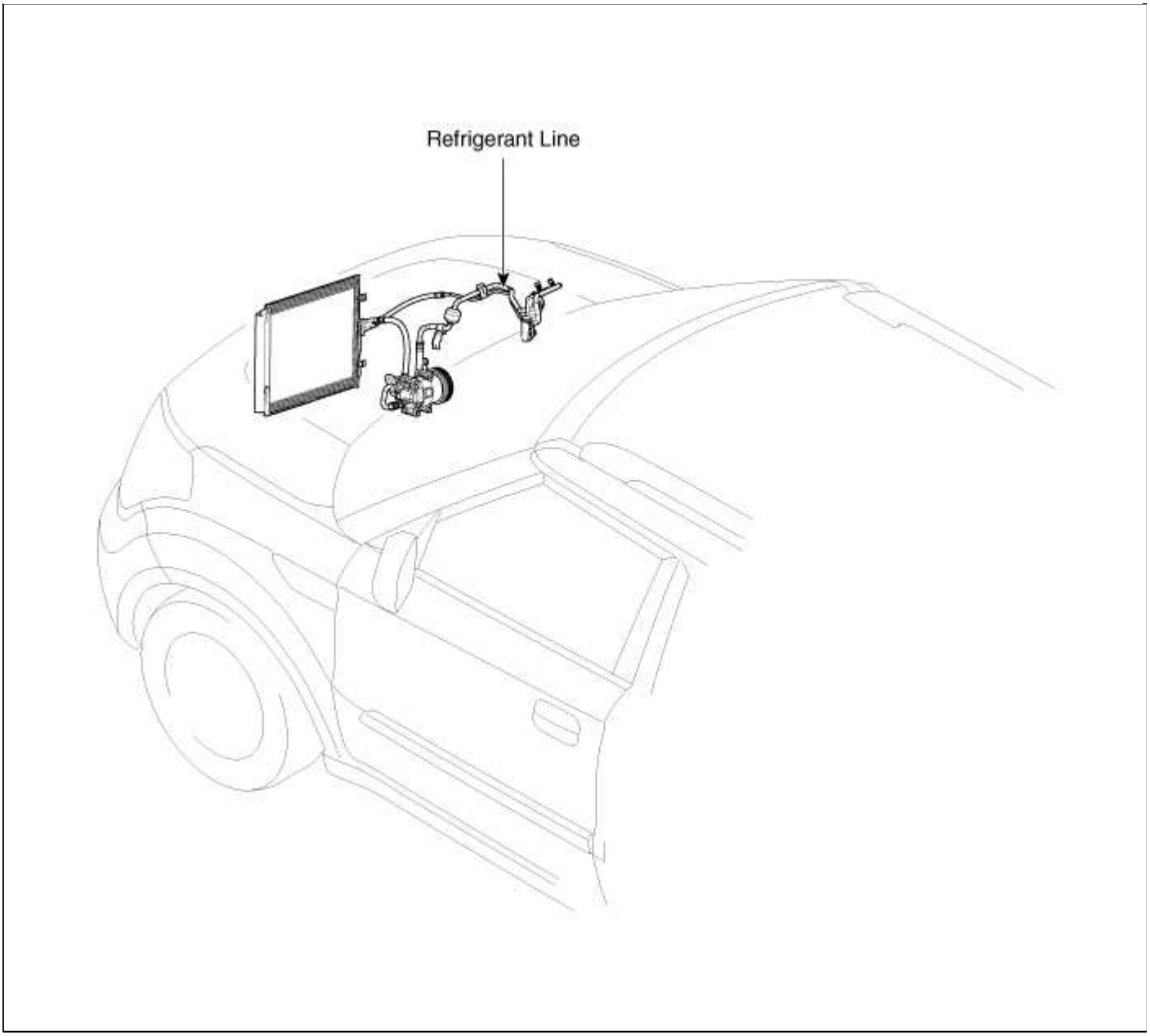
4. Remove the evaporator temperature sensor (B), by pulling it after rorating 90° in a counter clock wise direction.



5. Installation is the reverse order of removal

Heating,Ventilation, Air Conditioning > Air conditioning System > Refrigerant line > Components and Components Location

Component location



Heating,Ventilation, Air Conditioning > Air conditioning System > Refrigerant line > Repair procedures

Replacement

1. Discharge refrigerant from refrigeration system .
2. Replace faulty tube or hose.

CAUTION

- Cap the open fittings immediately to keep moisture or dirt out of the system.

3. Tighten joint of bolt or nut to specified torque

CAUTION

• Connections should not be torque tighter than the specified torque.

Part tightened	N.m	Kgf.m	lbf.ft
Condenser - Discharge hose	7.8 ~ 11.8	0.8 ~ 1.2	5.8 ~ 8.7
Condenser - Liquid tube			
Compressor - Discharge hose	8.8 ~ 27.5	0.9 ~ 2.8	6.5 ~ 20.3
Compressor - Suction hose			
Expansion valve - Evaporator	8.8 ~ 13.7	0.9 ~ 1.4	6.5 ~ 10.1

4. Evacuate air in refrigeration system and charge system with refrigerant.

Specified amount: 550 ± 25g (19.4 ± 0.88 oz.)

5. Inspect for leakage of refrigerant.
   Using a gas leak detector, check for leakage of refrigerant .

6. Inspect A/C operation.

Heating,Ventilation, Air Conditioning > Air conditioning System > In-car sensor > Description and Operation

Description

1. In-car air temperature sensor is located at the center fascia lower panel.
2. It senses the inside temperature, changes the resistance value, and enters the corresponding voltage into the automatic temperature control module.

Heating,Ventilation, Air Conditioning > Air conditioning System > In-car sensor > Repair procedures

Inspection

1. Ignition "ON"

2. Blow air with changing temperature to the in car sensor air inlet. Measure sensor resistance between "1" and "2" terminals.

Specification

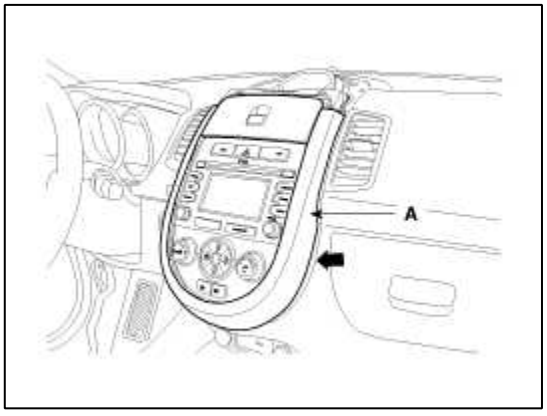
Temperature [°C(°F)]	Resistance between terminals 1and 2 (kΩ)
-30(33.8)	509.4 ± 4.1%
-15(5)	216.0 ± 3.2%
0 (32)	97.71± 2.4%
15(59)	47.13± 1.7%
25(77)	30.0± 1.2%
35(95)	19.59± 1.6%
50((122)	10.81± 2.2%
60(140)	7.463± 2.6%

NOTE

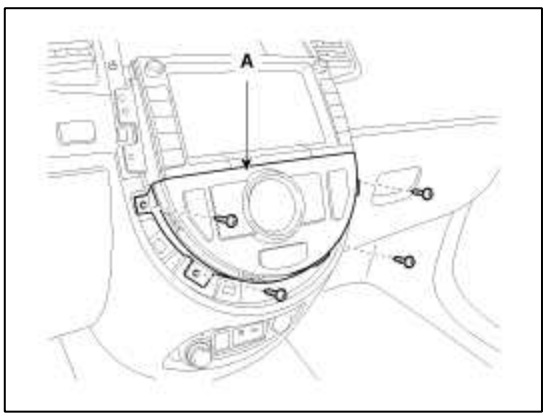
In car sensor is negative type therrmistor that resistance will rise with lower temperature, and reduce with higher temperature.

Replacement

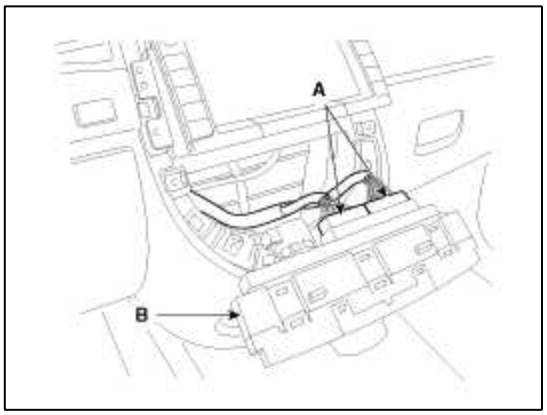
1. Disconnect the negative (-) battery terminal.
2. Remove the center speaker. (Refer to BE group)
3. Using screwdriver, remove the center fascia panel (A).



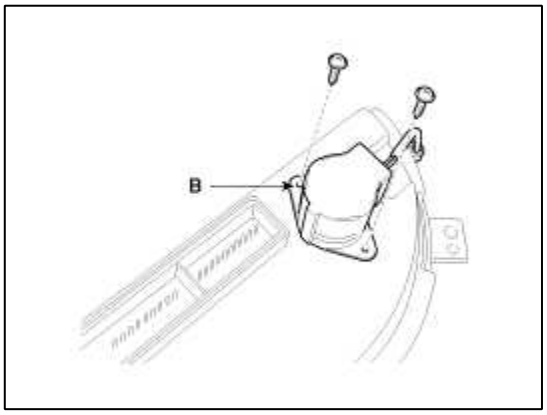
4. Remove the blower and A/C control panel (A) from center fascia.



5. Disconnect the connectors (A), then remove the blower and A/C control panel (B).



6. Loosen the mounting 2 screws and then remove the in-car sensor (B).



7. Installation is the reverse order of removal.

Heating,Ventilation, Air Conditioning > Air conditioning System > Photo sensor > Description and Operation

Description

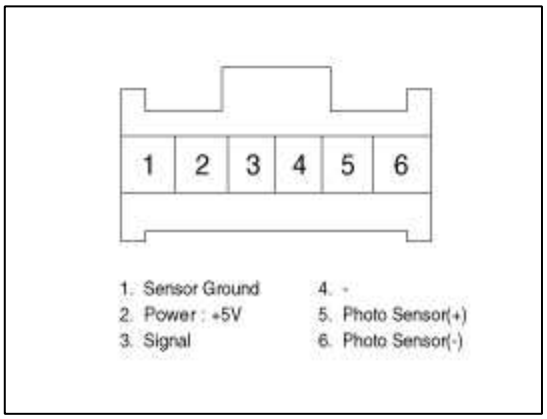
1. The photo sensor is located at the center of defrost nozzle.
2. The photo sensor contains a photovoltaic (sensitive to sunlight) diode. The solar radiation received by its light receiving portion, generates an electromotive force in proportion to the amount of radiation received which is transferred to the automatic temperature control module so that the solar radiation compensation will be performed.

Heating,Ventilation, Air Conditioning > Air conditioning System > Photo sensor > Repair procedures

Inspection

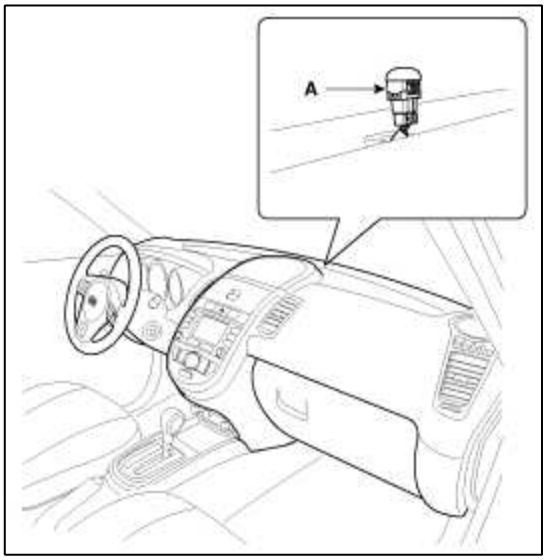
1. Ignition "ON"
2. Using the scan tool.
3. Emit intensive light toward photo sensor using a lamp, and check the output voltage change.

4. The voltage will rise with higher intensive light and reduce with lower intensive light.



Replacement

1. Disconnect the negative (-) battery terminal.
2. With the (-) driver, remove the photo sensor (A) from the center of defrost nozzle.



3. Install in the reverse order of removal.

Heating,Ventilation, Air Conditioning > Air conditioning System > Ambient sensor > Description and Operation

Description

1. The ambient temperature sensor is located at the front of the condenser and detects ambient air temperature. It is a negative type thermistor; resistance will increase with lower temperature, and decrease with higher temperatures.
2. The sensor output will be used for discharge temperature control, temperature regulation door control, blower motor level control, mix mode control and in-car humidity control.

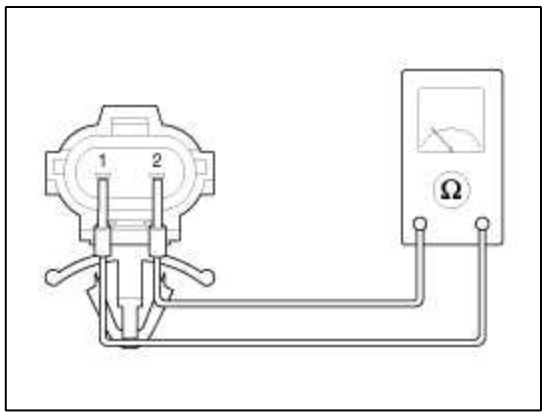
NOTE

If the ambient temperature is below 2.0°C (35.6°F), the A/C compressor will be stopped.
The compressor will be operated by manual operating.

Heating,Ventilation, Air Conditioning > Air conditioning System > Ambient sensor > Repair procedures

Inspection

1. Ignition "OFF"
2. Disconnect ambient temperature sensor.
3. Check the resistance of ambient temperature sensor between terminals 1 and 2 whether it is changed by changing of the ambient temperature.



1. Sensor Ground	2. Ambient Sensor Signal

Specification

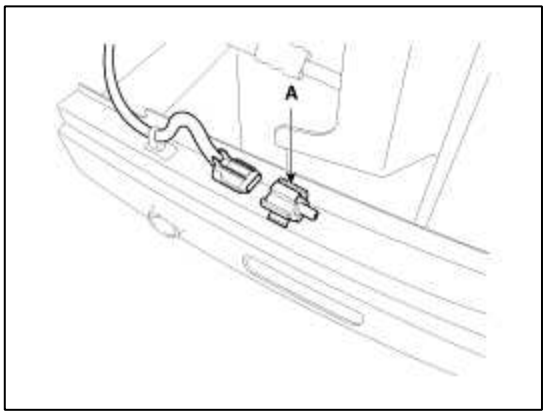
Ambient temperature [°C(°F)]	Resistance between terminals 1and 2 (kΩ)
-10(14)	163.131
0 (32)	96.892
10 (50)	59.365
20 (68)	37.147
25(77)	30.0
40(104)	16.032

4. If the measured resistance is not specification, substitute with a known-good ambient temperature sensor and check for proper operation.
5. If the problem is corrected, replace the ambient temperature sensor.

Replacement

1. Disconnect the negative (-) battery terminal.
2. Remove the front bumper.
   (Refer to BD group-Front bumper)

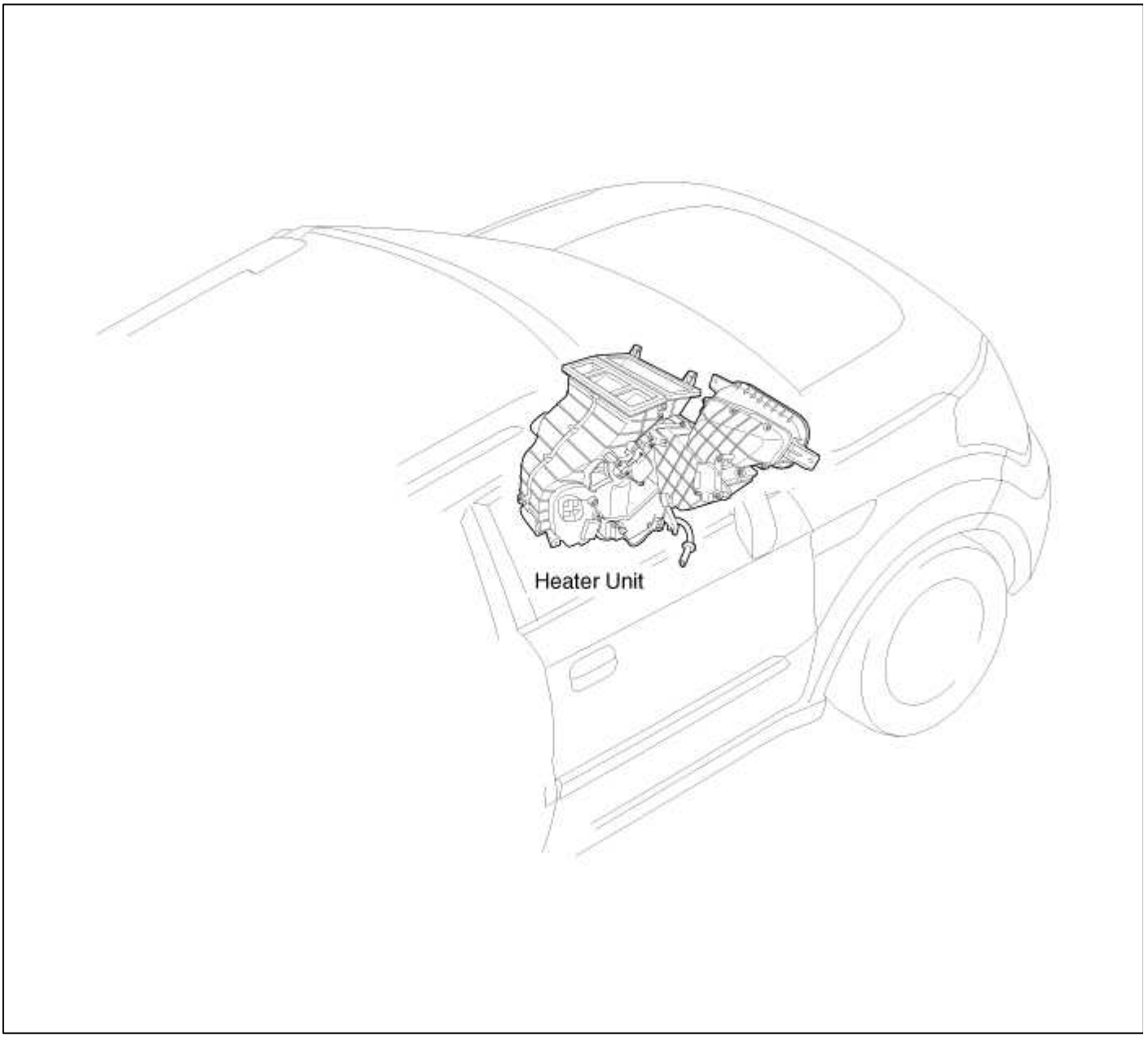
3. Disconnect the connector and then remove the ambient temperature sensor (A).



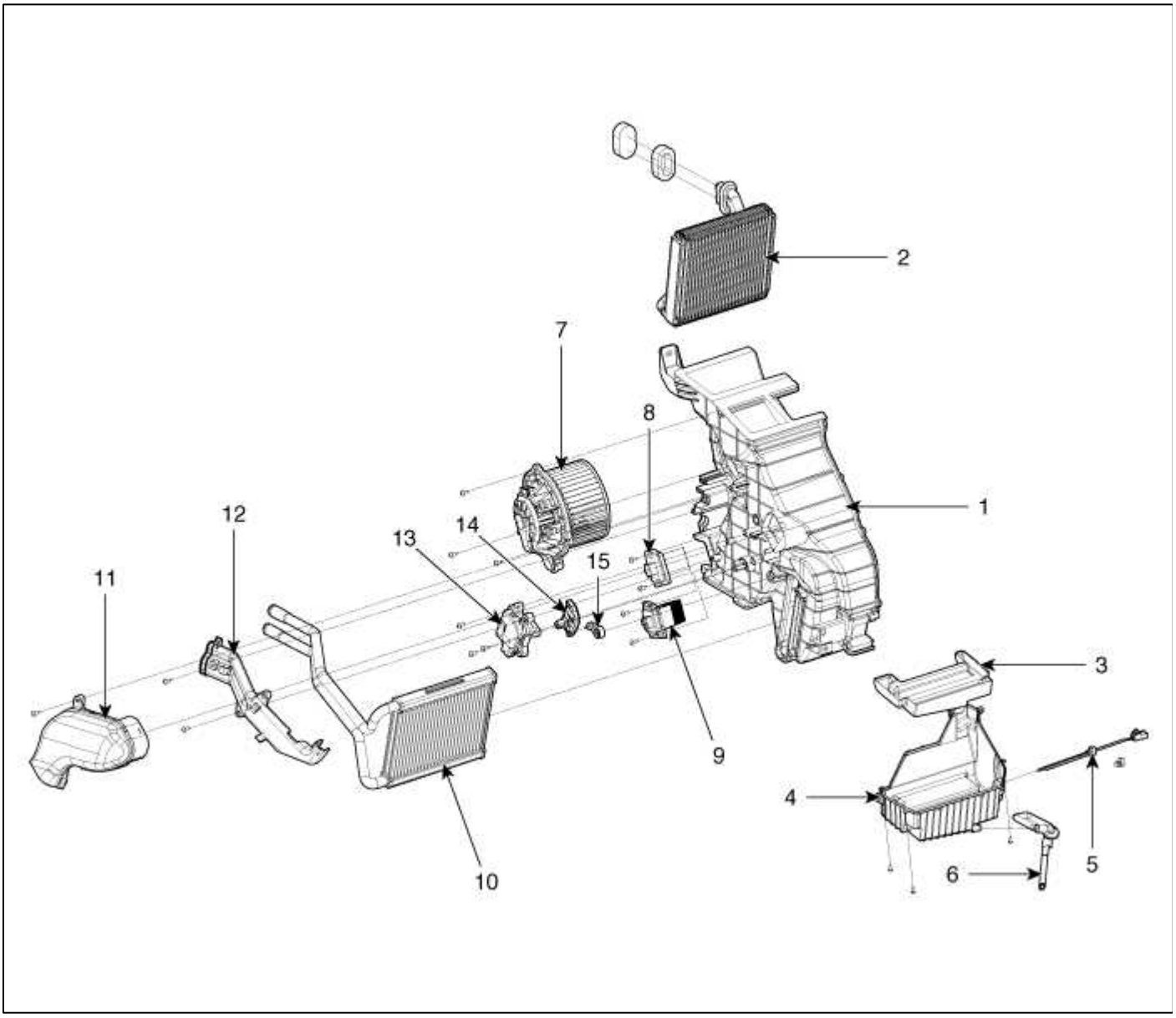
4. Installation is the reverse order of removal.

Heating,Ventilation, Air Conditioning > Heater > Heater Unit > Components and Components Location

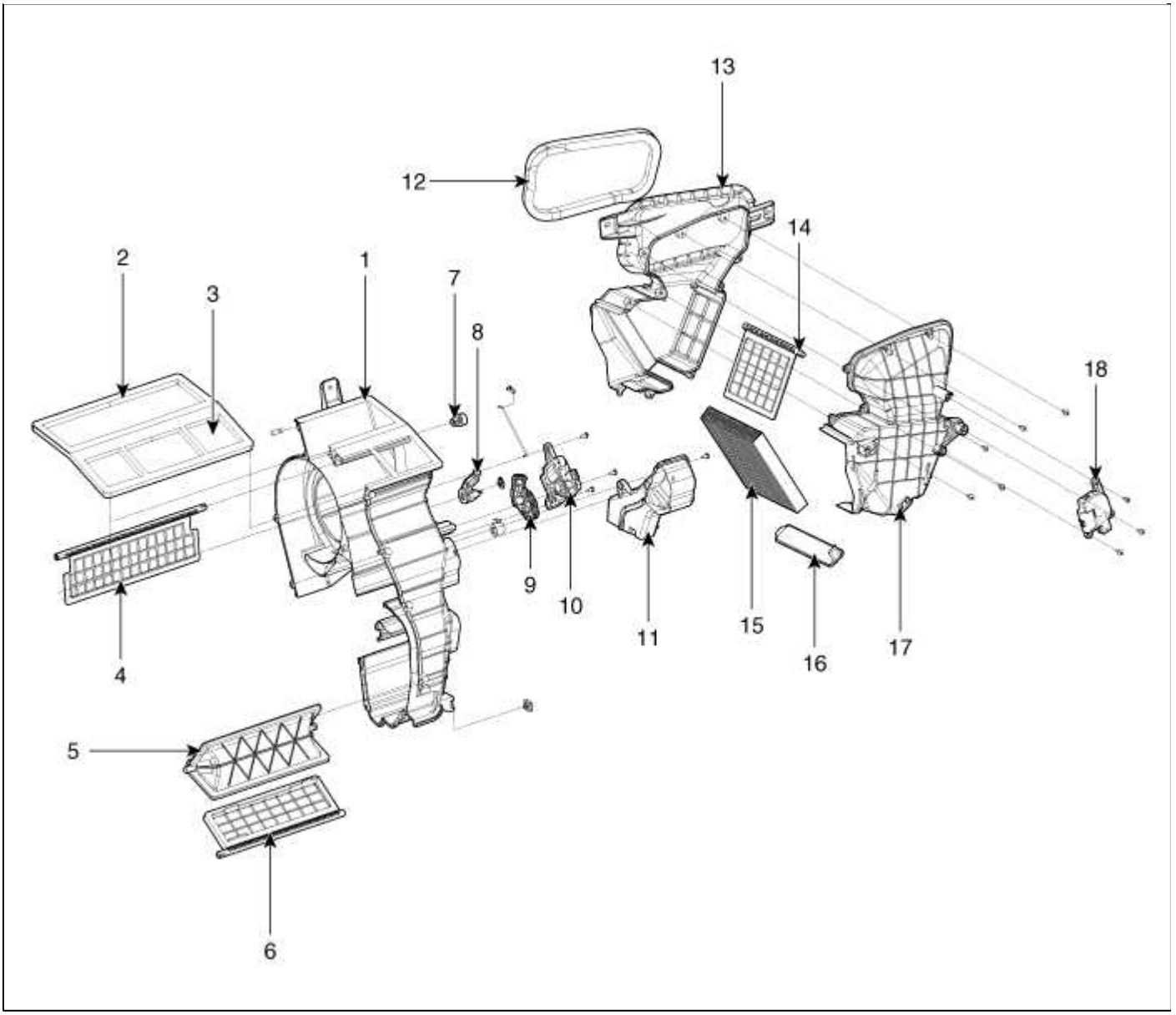
Component Location



Compoment



1. Heater case (LH)	6. Drain hose	11. Shower duct (LH)
2. Evaporator core	7. Blower motor	12. Heater core cover
3. Evaporator lower insulator	8. Power mosfet	13. Temp control actuator
4. Heater lower case	9. Blower resistor	14. Vent door lever
5. Evaporator temp sensor	10. Heater core	15. Temp door lever



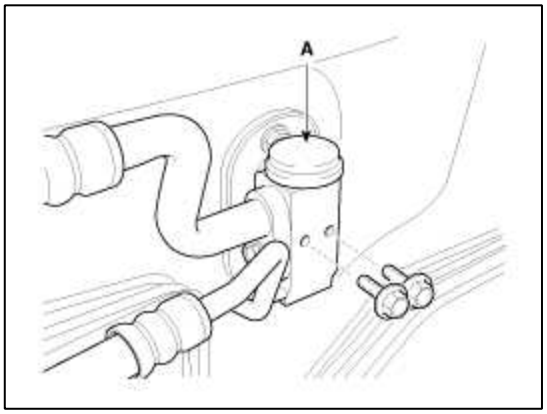
1. Heater case (RH)	6. Temp door	11. Shower duct (RH)	16. Air filter cover
2. Duct seal 1	7. Vent arm	12. Intake seal	17. Inlet duct case
3. Duct seal 2	8. Vent door lever	13. Inlet duct case	18. Intake actuator
4. Vent door	9. Mode cam	14. Inlet door	
5. Floor door	10. Mode actuator	15. Climate control air filter	

Heating,Ventilation, Air Conditioning > Heater > Heater Unit > Repair procedures

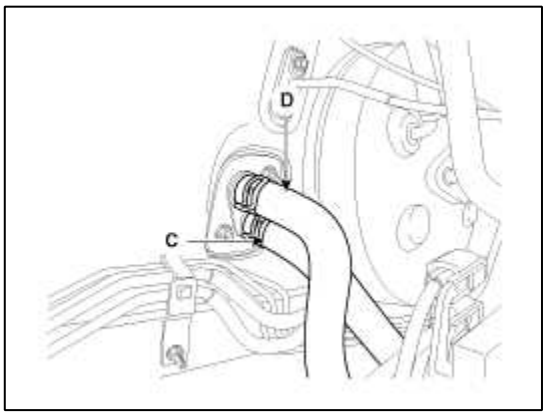
Replacement

1. Disconnect the negative (-) battery terminal.
2. Recover the refrigerant with a recovery/ recycling/ charging station.
3. When the engine is cool, drain the engine coolant from the radiator.

4. Remove the expansion valve (A) from the evaporator core.
   Plug or cap the lines immediately after disconnecting them to avoid moisture and dust contamination.



5. Disconnect the inlet (C) and outlet (D) heater hoses from the heater unit.



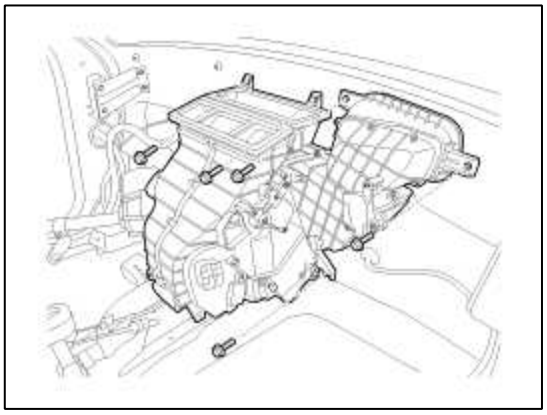
CAUTION

- Engine coolant will spill when the hoses are disconnected; drain it into a clean drip pan. Be sure not to let coolant spill on electrical parts or painted surfaces. If any coolant spills, rinse it off immediately.

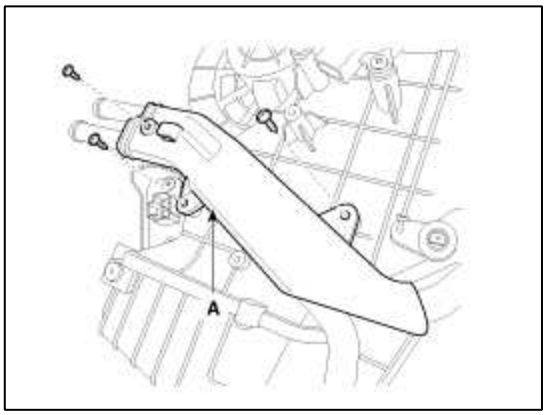
6. Remove the crash pad.
   (Refer to BD group-Crash pad)

7. Remove the cowl cross bar assembly.
   (Refer to BD group-Cross member)

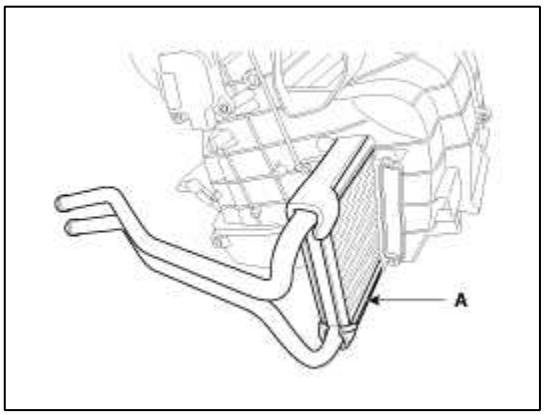
8. Remove the heater & blower unit (A) after loosening mounting bolts.



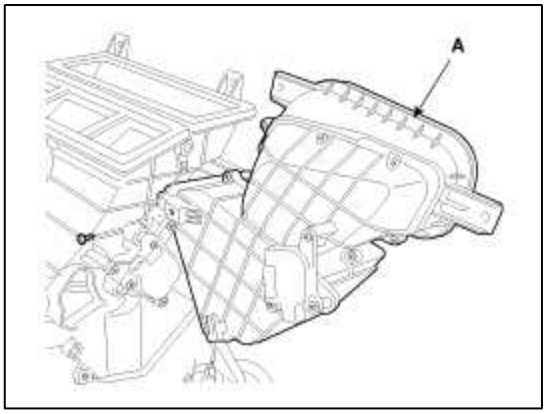
9. Remove the cover (A).



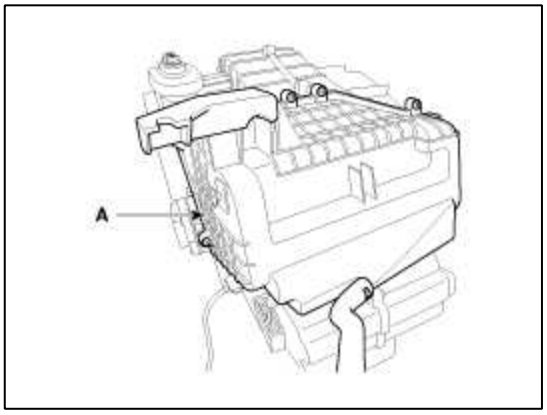
10. Be careful that the inlet and outlet pipe are not bent during heater core removal, and pull out the heater core (A).



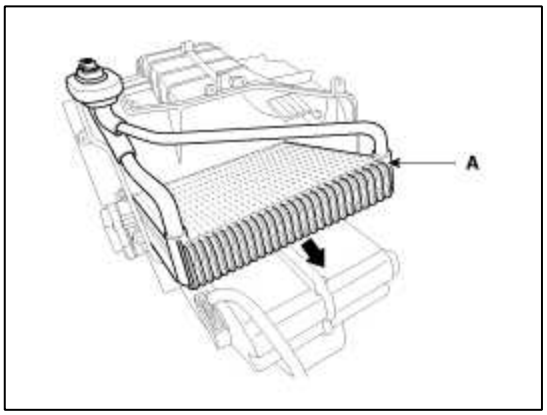
11. Remove the intake assembly (A).



12. Remove the heater unit lower case (A).



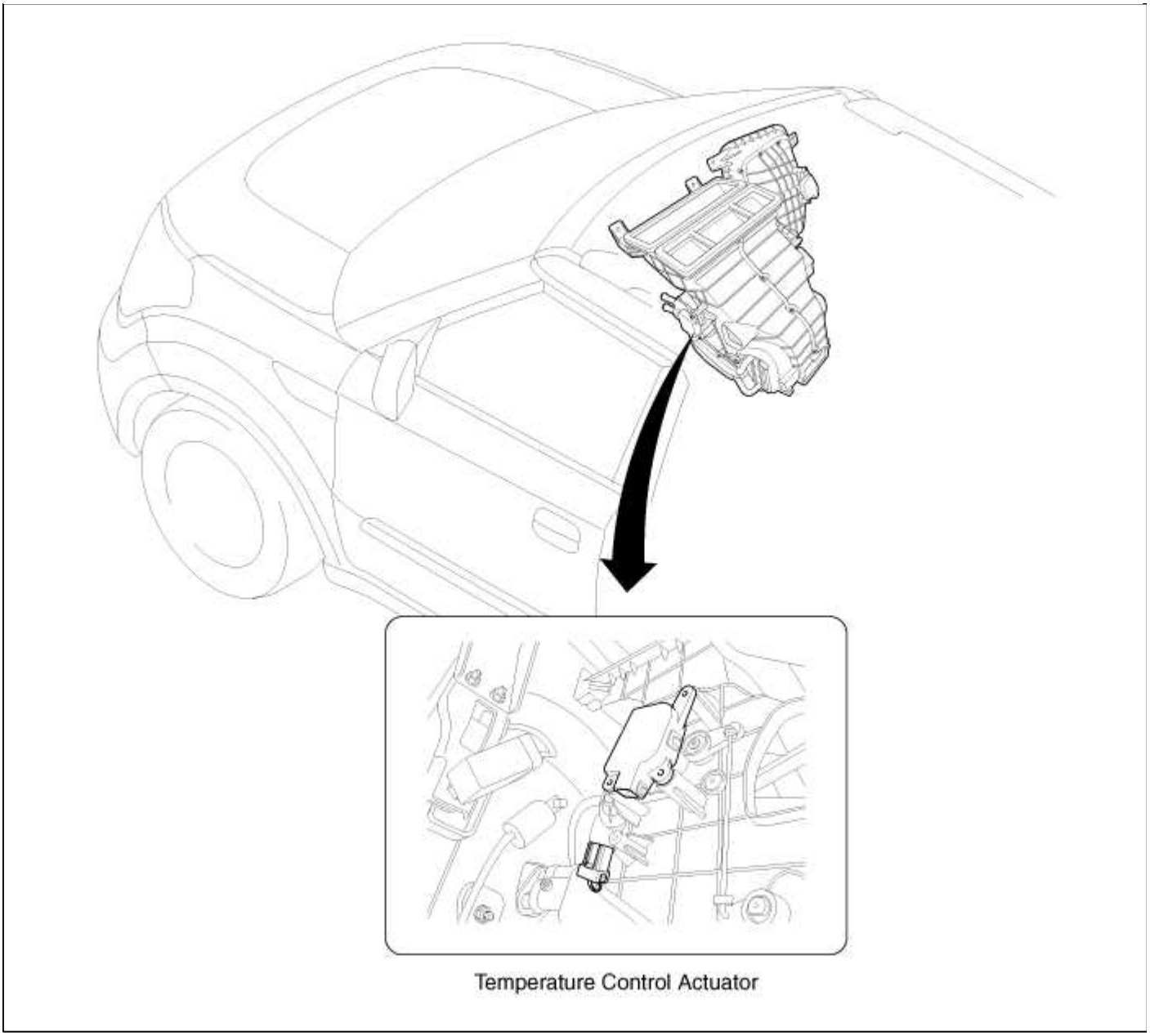
13. Remove the evaporator core (A).



14. Be careful that the inlet and outlet pipe are not bent during heater core removal, and pull out the heater core.
15. Install the heater core in the reverse order of removal.
16. Installation is the reverse order of removal, and note these items :
    A. If you're installing a new evaporator, add refrigerant oil (PAG OIL).
    B. Replace the O-rings with new ones at each fitting, and apply a thin coat of refrigerant oil before installing. Be sure to use the right O-rings for R-134a to avoid leakage.
    C. Immediately after using the oil, replace the cap on the container, and seal it to avoid moisture absorption.
    D. Do not spill the refrigerant oil on the vehicle ; it may damage paint ; if the refrigerant oil contacts the paint, wash off immediately.
    E. Apply sealant to the grommets.
    F. Make sure that there is no air leakage.
    G. Charge the system and test its performance.
    H. Do not interchange the inlet and outlet heater hoses and install the hose clamps securely.
    I. Refill the cooling system with engine coolant.

Heating,Ventilation, Air Conditioning > Heater > Temperature Control Actuator > Components and Components Location

Component Location



Temperature Control Actuator

Heating,Ventilation, Air Conditioning > Heater > Temperature Control Actuator > Description and Operation

Description

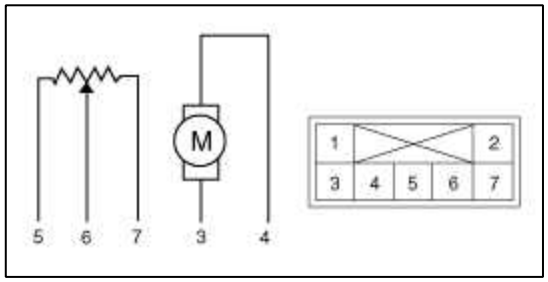
1. Heater unit includes mode control actuator and temperature control actuator.
2. Temperature control actuator is located at the heater unit. It regulates the temperature by the procedure as follows. Signal from control unit adjusts position of temperature door by operating temperature switch and then temperature will be regulated by the hot/cold air ratio decided by position of temperature door

Heating,Ventilation, Air Conditioning > Heater > Temperature Control Actuator > Repair procedures

Inspection

1. Ignition "OFF"
2. Disconnect the connector of temperature control actuator.

3. Verify that the temperature control actuator operates to the cool position when connecting 12V to the terminal 3 and grounding terminal 4.
   Verify that the temperature control actuator operates to the hot position when connecting in the reverse.



1. - 2. - 3. Cool Position 4. Hot Position	5. 5V (Vcc) 6. Feedback Signal 7. Sensor Ground

4. Check the voltage between terminals 6 and 7.
   Specification

Door position	Voltage (6-7)	Error detecting
Max. cooling	0.3 ± 0.15V	Low voltage :0.1V or less
Max. heating	4.7 ± 0.15V	High voltage :4.9V or more

   * It will feedback current position of actuator to controls.

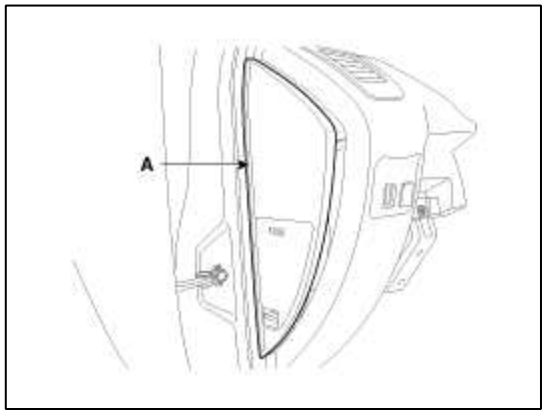
5. If the measured voltage is not specification, substitute with a known-good temperature control actuator and check for proper operation.

6. If the problem is corrected, replace the temperature control actuator.

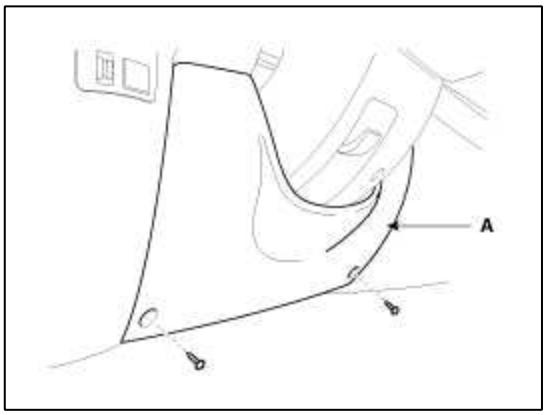
Replacement

1. Disconnect the negative (-) battery terminal.

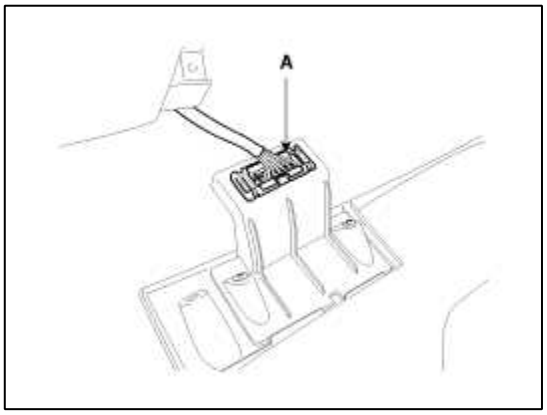
2. Remove the crash pad side cover (A).



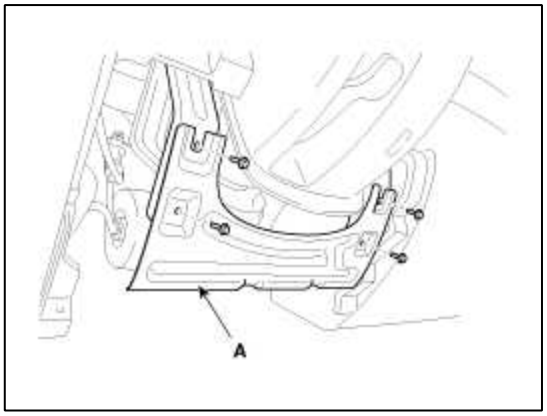
3. Loosen the mount screw and then remove the crashpad lower panel (A).



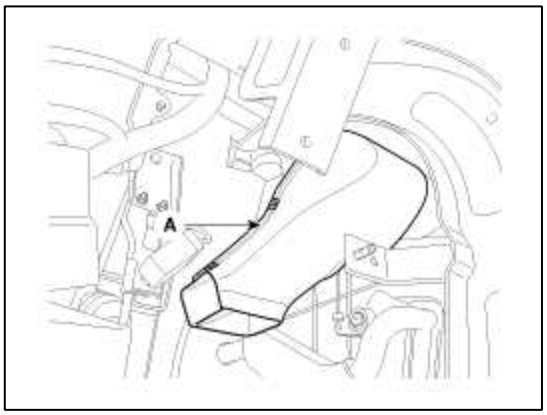
4. Disconnect the connector (A).



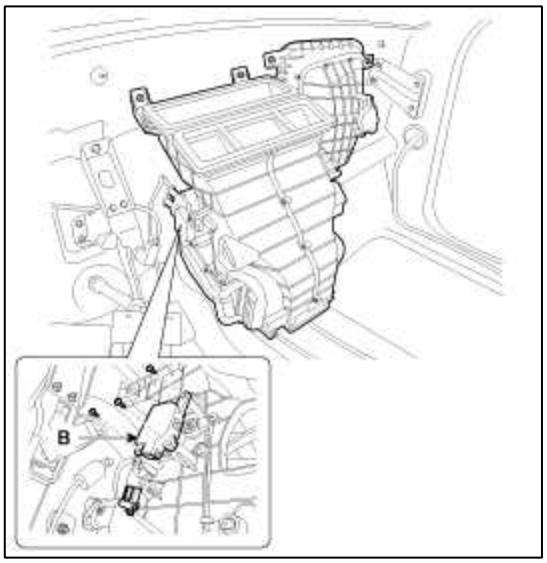
5. After loosening the mounting bolts, then the reinforcing panel (A).



6. Remove the shower duct (A).



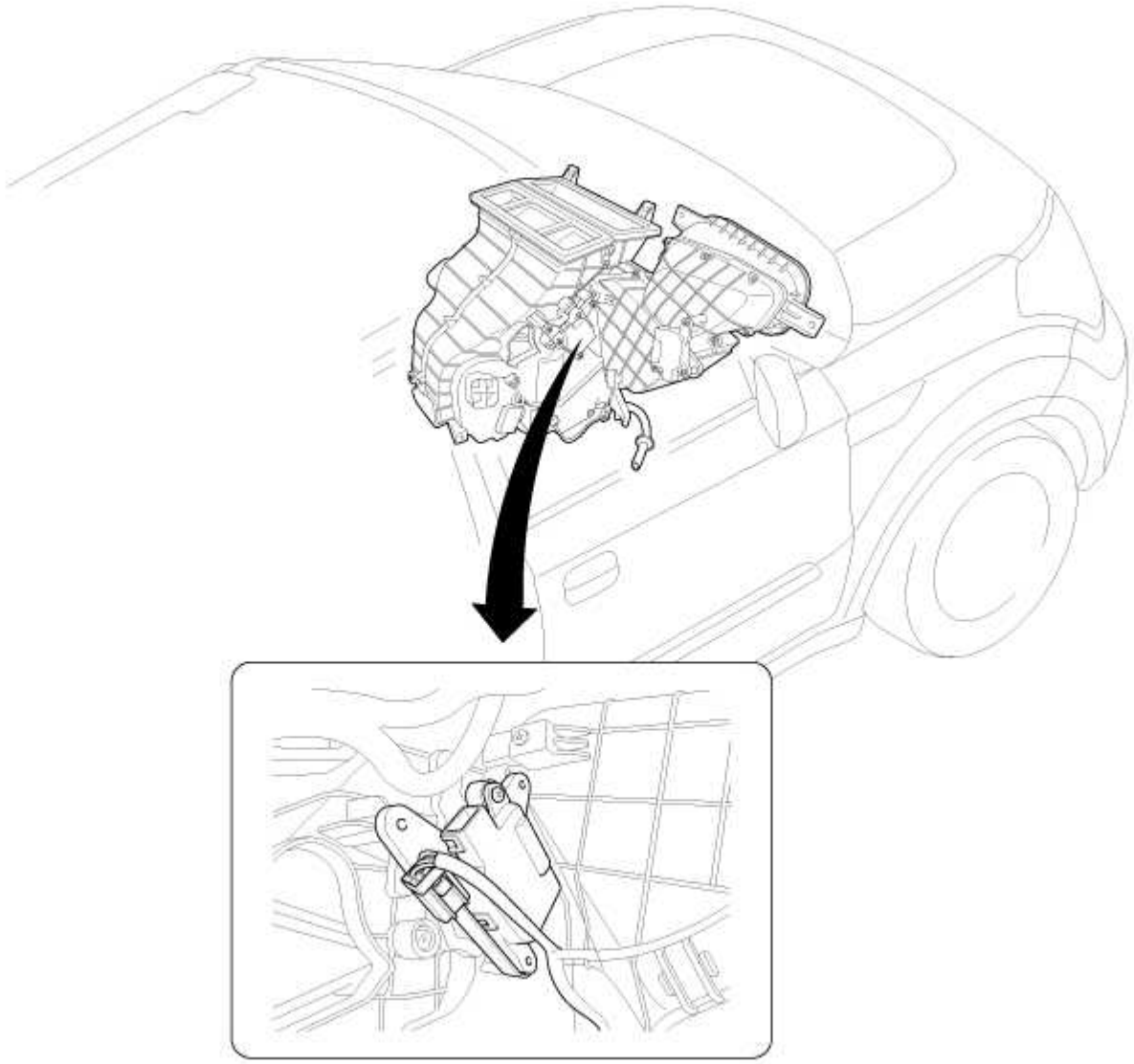
7. Loosen the mounting screw and then remove the temperature control actuator (B).



8. Installation is the reverse order of removal.

Heating,Ventilation, Air Conditioning > Heater > Mode Control Actuator > Components and Components Location

Component Location



Mode Control Actuator

Heating,Ventilation, Air Conditioning > Heater > Mode Control Actuator > Description and Operation

Description

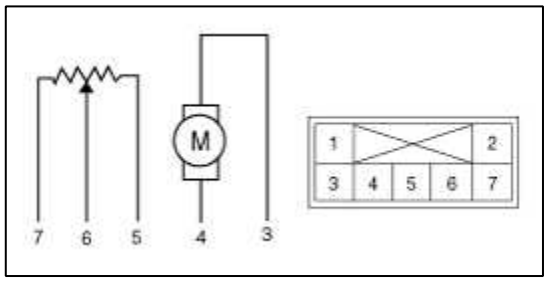
The mode control actuator is located at the heater unit.
It adjusts position of mode door by operating mode control actuator based on signal of A/C control unit. Pressing mode select switch makes the mode control actuator shift in order of vent→ B/L → floor → mix.

Heating,Ventilation, Air Conditioning > Heater > Mode Control Actuator > Repair procedures

Inspection

1. Ignition "OFF”
2. Disconnect the connector of mode control actuator.
3. Verify that the mode control actuator operates to the vent mode when connecting 12V to the terminal 3 and grounding terminal 4.

4. Verify that the mode control actuator operates to the defrost mode when connecting in the reverse.



1. - 2. - 3. Vent Mode 4. Defrost Mode	5. 5V (Vcc) 6. Feedback Signal 7. Sensor Ground

5. Check the voltage between terminals 6 and 7.

Door position	Voltage (6-7)	Error detecting
Vent	0.3 ± 0.15V	Low voltage :0.1V or less
Defrost	4.7 ± 0.15V	High voltage :4.9V or more

* It will feedback current position of actuator to controls.

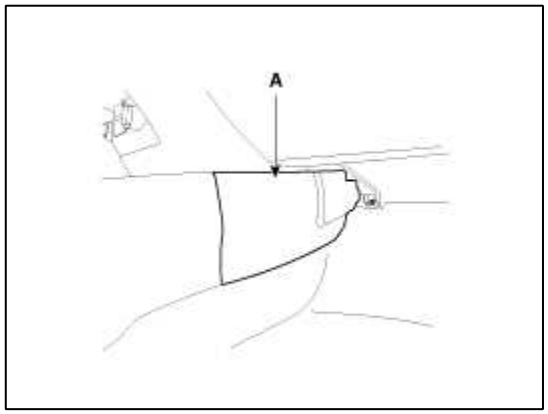
6. If the measured voltage is not specification, substitute with a known-good console temp control actuator and check for proper operation.

7. If the problem is corrected, replace the console temp control actuator.

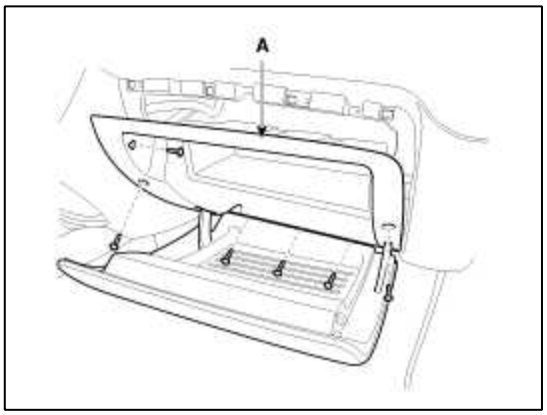
Replacement

1. Disconnect the negative (-) battery terminal.

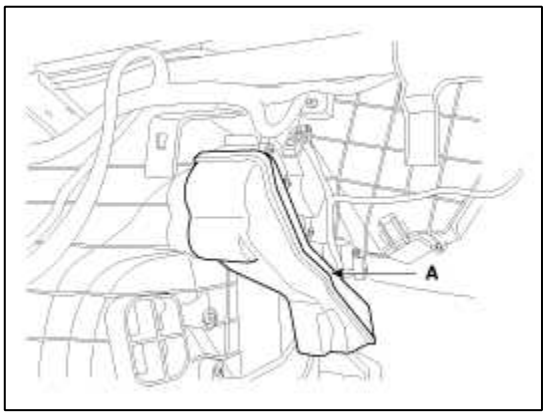
2. Remove the crash pad lower cover (A).



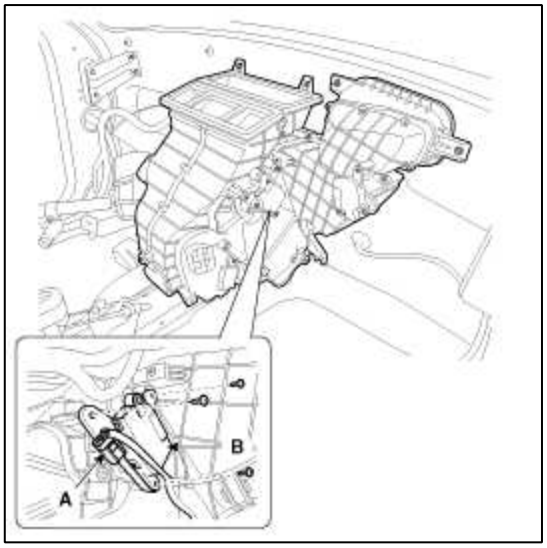
3. Loosen the mount screw and then remove the glove box (A).



4. Remove the shower duct (A).



5. Loosen the mounting screw and then remove the temperature control actuator (B).

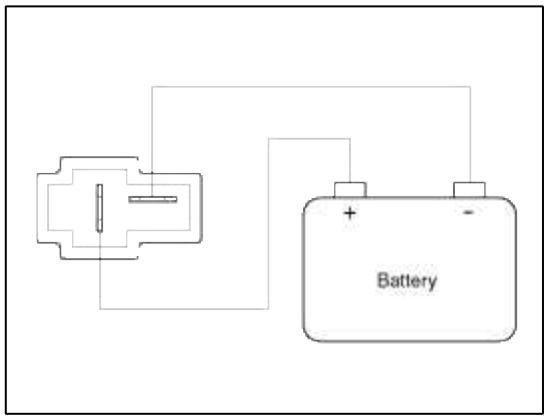


6. Installation is the reverse order of removal.

Heating,Ventilation, Air Conditioning > Blower > Blower Motor > Repair procedures

Inspection

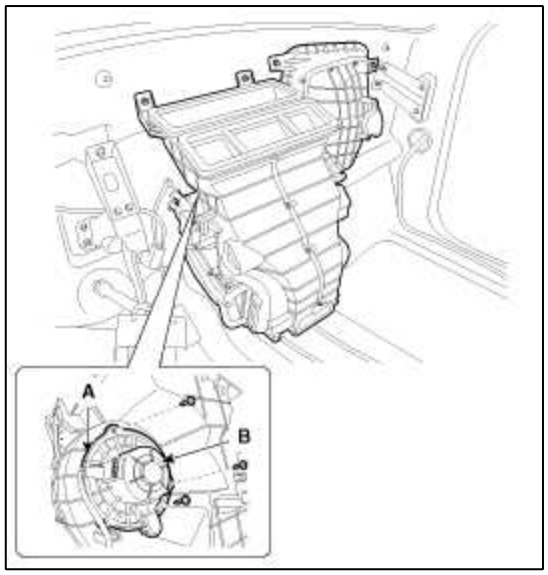
1. Connect the battery voltage and check the blower motor rotation.



2. If the blower motor voltage is not operated well, substitute with a known-good blower motor and check for proper operation.
3. If the problem is corrected, replace the blower motor.

Replacement

1. Disconnect the negative (-) battery terminal.
2. Remove the crashpad lower cover.
   Refer to BD group - "Crash Pad")
3. Disconnect the connector (A) of the blower motor.
4. Remove the blower motor (B) after loosening the mounting screws.



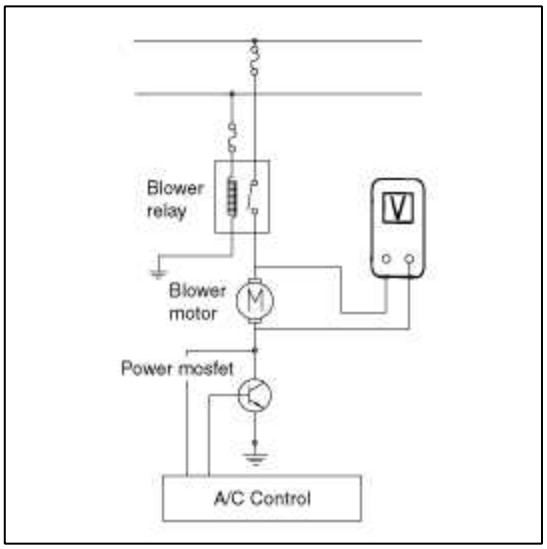
5. Installation is the reverse order of removal.

Heating,Ventilation, Air Conditioning > Blower > Power Mosfet > Repair procedures

Inspection

1. Ignition "ON"
2. Manually operate the control switch and measure the voltage of blower motor.

3. Select the control switch to raise voltage until high speed.



Specification

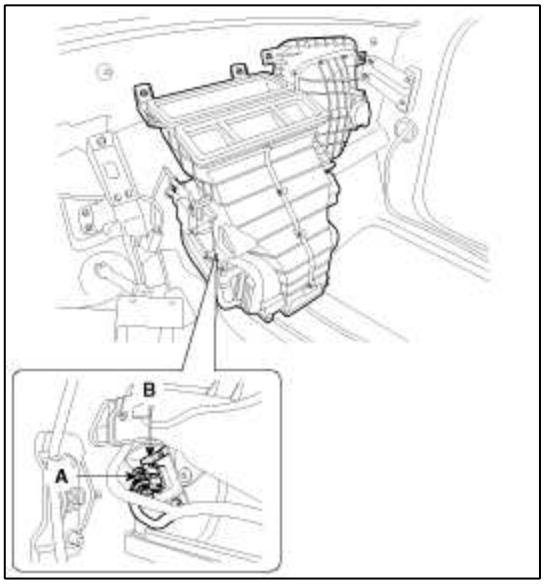
Fan	Motor Voltage
	Manual
First speed	3.8 ±0.5V
Second speed	5.0 ±0.5V
Third speed	6.2 ±0.5V
Fourth speed	7.4 ±0.5V
Fifth speed	8.6 ±0.5V
Sixth speed	9.8 ±0.5V
Seventh speed	11.0 ±0.5V
eighth speed	Battery

4. If the measured voltage is not specification, substitute with a known-good power mosfet and check for proper operation.
5. If the problem is corrected, replace the power mosfet.

Replacement

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad lower cover.
   (Refer to BD group - "Crash Pad")

3. Disconnect the power mosfet connector (A) and then remove the power mosfet (B) after loosening the mounting screws.

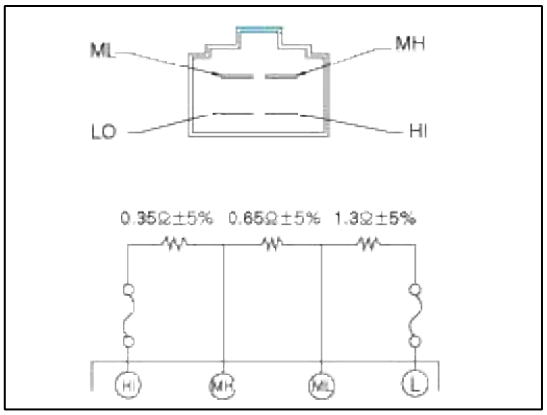


4. Installation is the reverse order of removal.

Heating,Ventilation, Air Conditioning > Blower > Blower Resistor > Repair procedures

Inspection

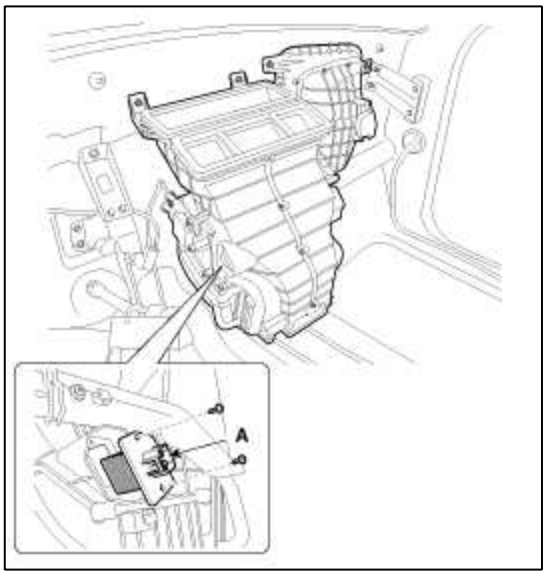
1. Measure terminal-to-terminal resistance of the blower resistor.
2. If measured resistance is not within specification, the blower resistor must be replaced. (After removing the resistor)



Replacement

1. Disconnect the negative (-) battery terminal.
2. Remove the crashpad lower pannel.(refer to BD group-crash pad)

3. Disconnect the connector and then remove the blower resistor (A).



4. Installation is the reverse order of removal.

Heating,Ventilation, Air Conditioning > Blower > Climate control air filtar > Description and Operation

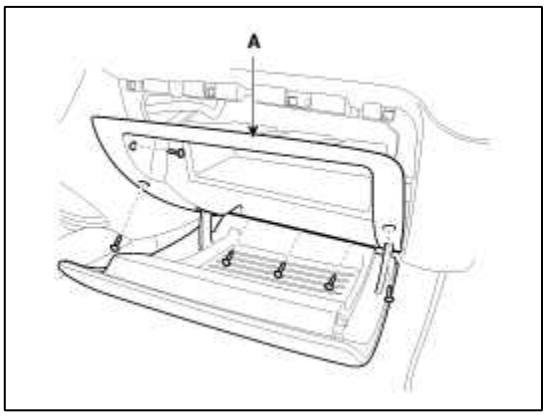
Description

This has particle filter which eliminates foreign materials and odor. The particle filter includes odor filter as well as conventional dust filter to ensure comfortable interior environment.

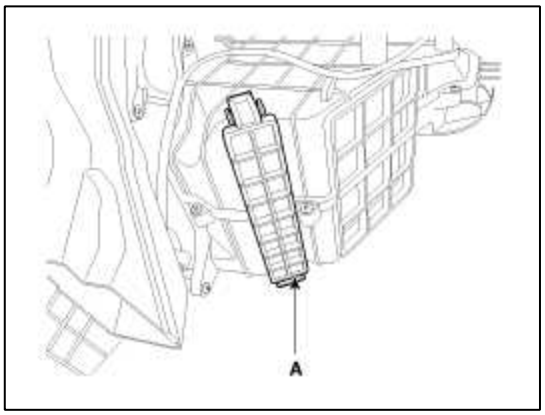
Heating,Ventilation, Air Conditioning > Blower > Climate control air filtar > Repair procedures

Replacement

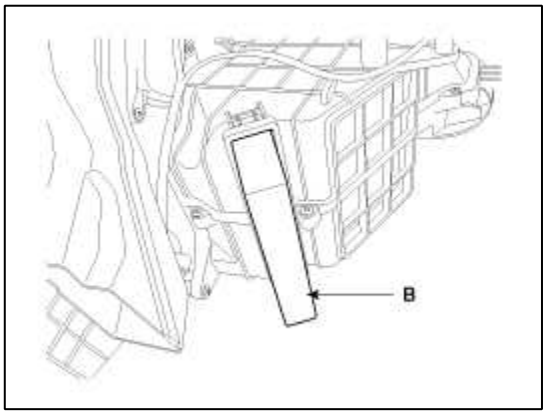
1. Loosen the mount screw and then remove the glove box (A).



2. Remove the filter cover (A) with pushing the knob.



3. Replace the air filter (B), install it after making sure of the direction of air filter.



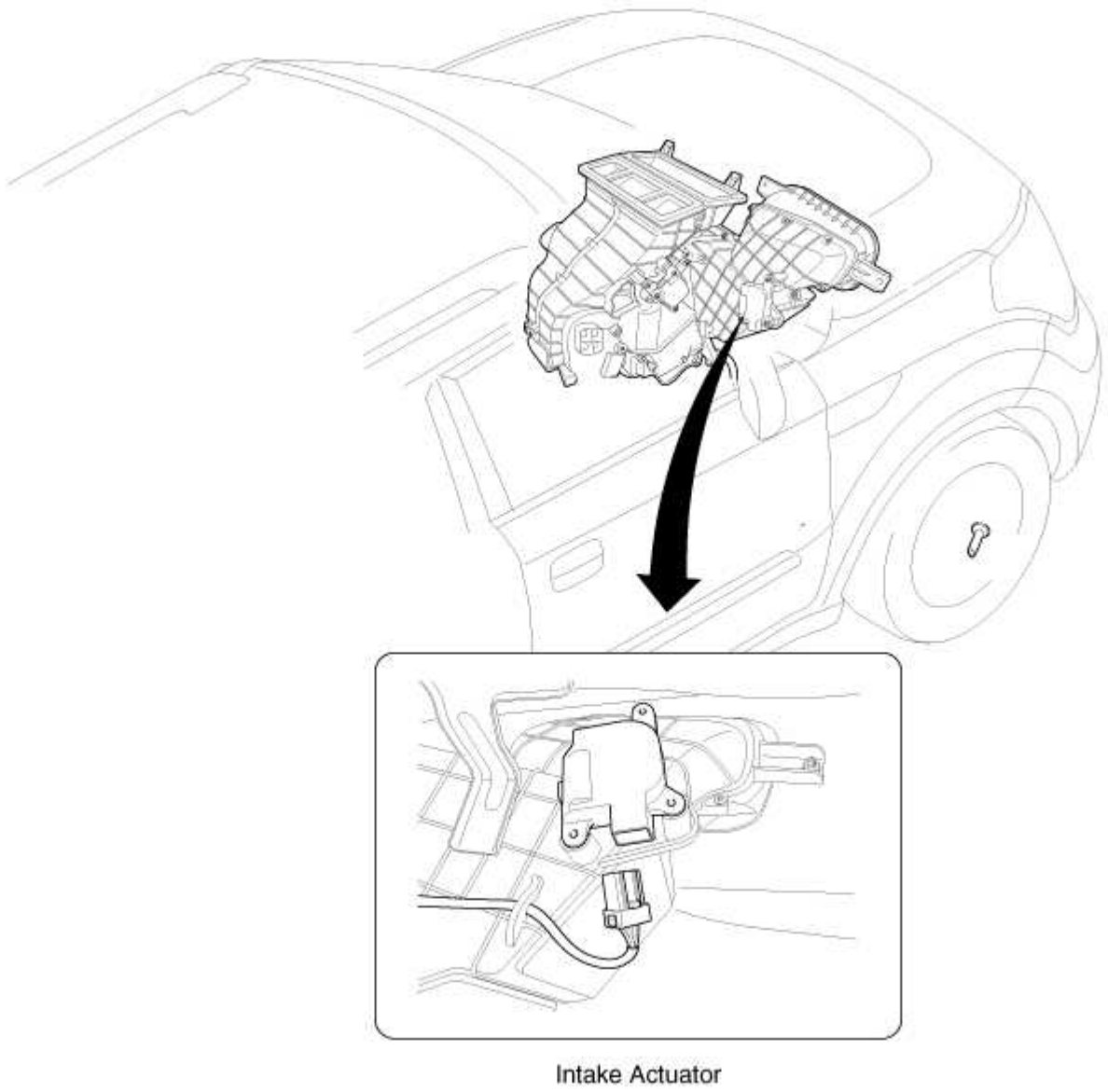
4. Installation is the reverse order of removal.

NOTE

- In case of driving in an air-polluted area or rugged terrain, check and replace the air filter as frequently as possible.

Heating,Ventilation, Air Conditioning > Blower > Intake Actuator > Components and Components Location

Component Location



Intake Actuator

Heating,Ventilation, Air Conditioning > Blower > Intake Actuator > Description and Operation

Description

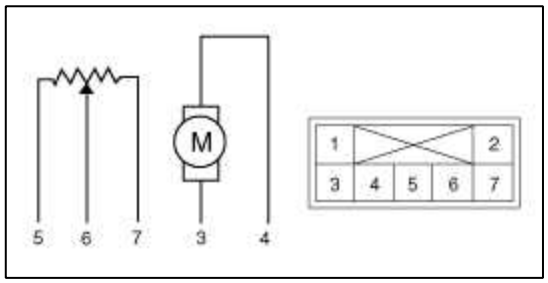
1. The intake actuator is located at the blower unit.
2. It regulates the intake door by signal from control unit.
3. Pressing the intake selection switch will shift between recirculation and fresh air modes.

Heating,Ventilation, Air Conditioning > Blower > Intake Actuator > Repair procedures

Inspection

1. Ignition "OFF”
2. Disconnect the intake actuator connector.

3. Verify that the actuator operates to the fresh position when connecting 12V to the terminal 3 and grounding terminal 4.
4. Verify that the intake actuator operates to the recirculation position when connecting in the reverse.

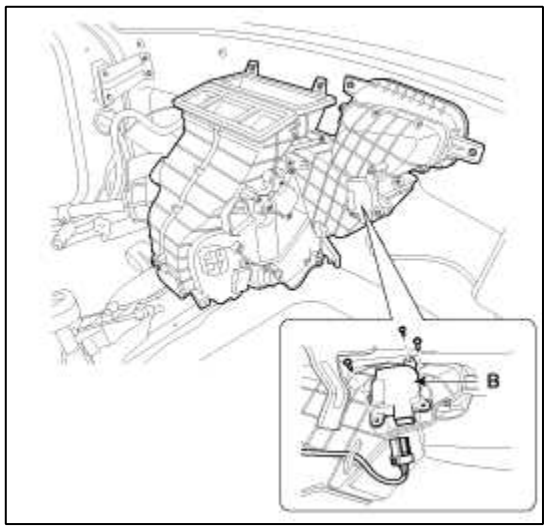


1. - 2. - 3. Fresh 4. Rec	5. 5V (Vcc) 6. Feedback Signal 7. Sensor Ground

5. If the intake actuator is not operated well, substitute with a known-good intake actuator and check for proper operation.
6. If the problem is corrected, replace the intake actuator.

Replacement

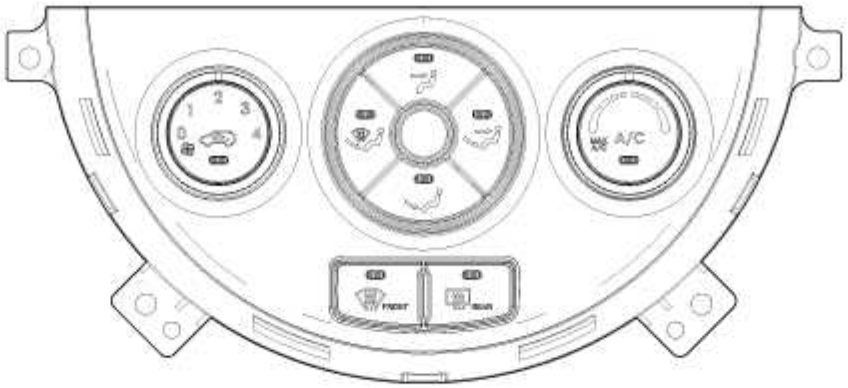
1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad.
   (Refer to BD group - "Crash Pad")
3. Disconnect the intake actuator connector.
4. Loosen the mounting screw and then remove the intake actuator (B) from the blower unit.

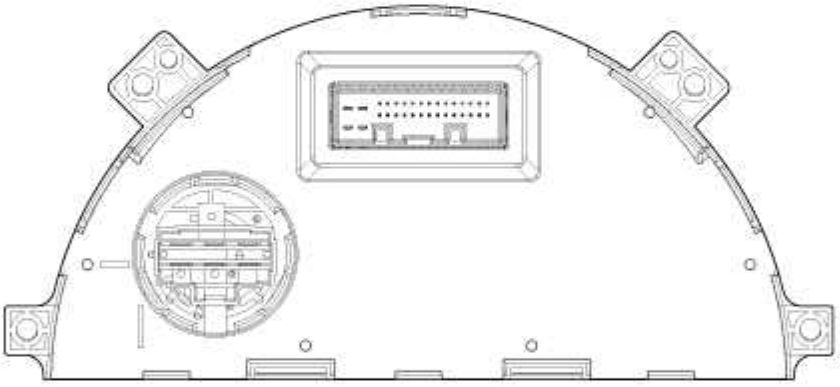


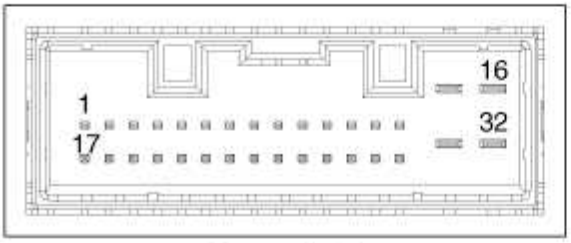
5. Installation is the reverse order of removal.

Heating,Ventilation, Air Conditioning > Controller > Heater & A/C Control Unit(Manual) > Components and Components Location

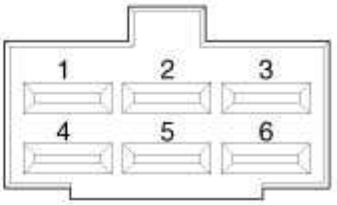
Component







Connector A



Connector B

Connector Pin Function

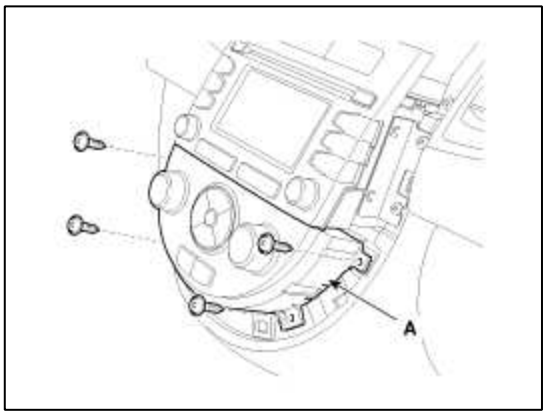
Connector	Pin No	Function	Connector	Pin No	Function
A	1	ILL+ (Tail)	B	1	Ground
	2	Battery		2	Middle High
	3	Mode Actuator (VENT)		3	Middle Low
	4	Mode Actuator (DEF)		4	High
	5	Temp Actuator (COOL)		5	COMMON
	6	Temp Actuator (WARM)		6	Low
	7	Intake Actuator (FRE)			
	8	Intake Actuator (REC)			
	9	-			
	10	DETENT OUT (+)			
	11	Mode Actuator Feedback			
	12	Temp Actuator Feedback			
	13	Intake Actuator Feedback			
	14	Blower COMMON			
	15	MAX Blower ON Signal			
	16	ILL- (Rhestat)			
	17	IGN2			
	18	IGN1			
	19	Sensor Ref (+5V)			
	20	Evaporator Sensor (+)			
	21	Ambient Sensor (+)			
	22	-			
	23	-			
	24	HTD			
	25	Rear Defog Switch			
	26	C-CAN HIGH			
	27	C-CAN LOW			
	28	-			
	29	ECV+			
	30	ECV-			
	31	Sensor Ground			
	32	Ground			

Heating,Ventilation, Air Conditioning > Controller > Heater & A/C Control Unit(Manual) > Repair procedures

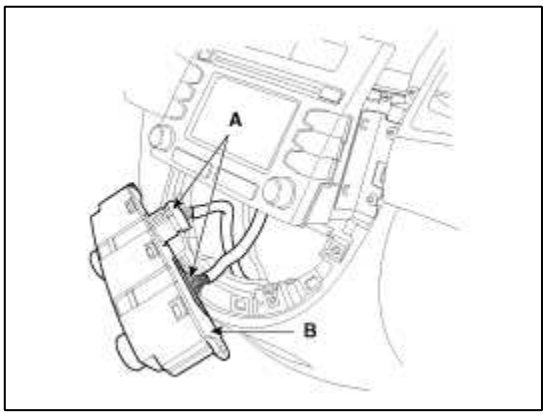
Replacement

1. Disconnect the negative (-) battery terminal.
2. Remove the center speaker. (Refer to BE group)
3. Remove the center facia panel. (Refer to BD group)

4. Remove the heater & A/C controller (A) from center facia panel.



5. Disconnect the connector (A) and then remove the controller (B).

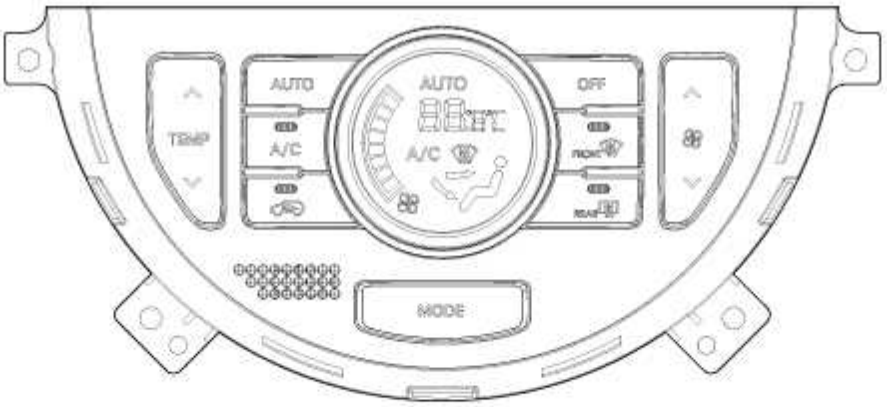


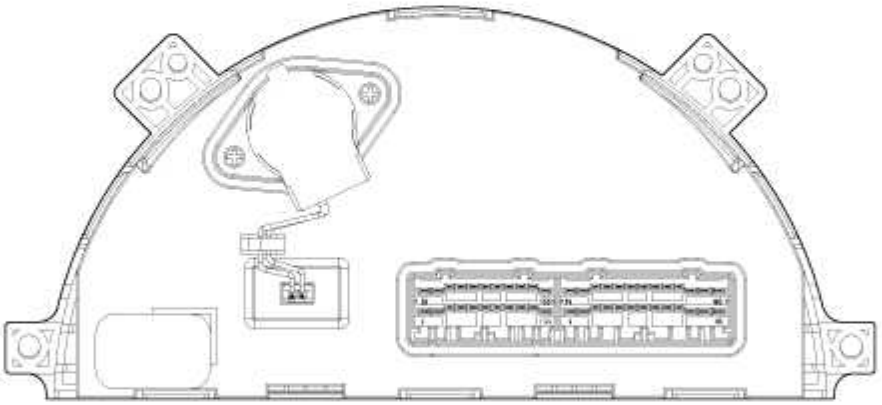
6. Installation is the reverse order of removal.

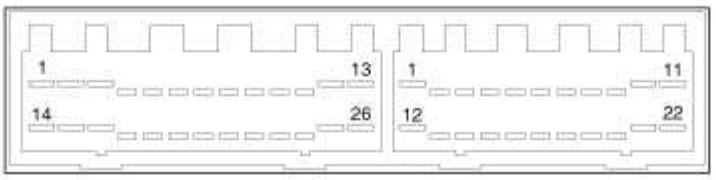
Heating,Ventilation, Air Conditioning > Controller > Heater & A/C Control Unit(Full Automatic) > Components and Components Location

Component

CDP Type





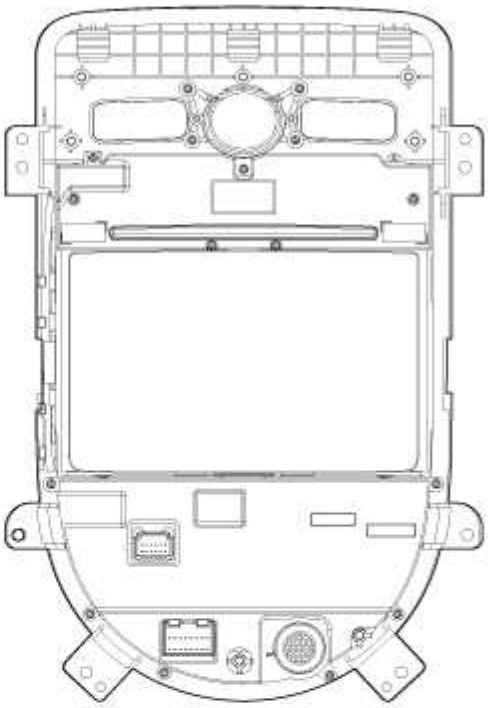


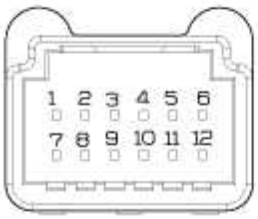
Connector pin function

Connector	Pin No	Function	Connector	Pin No	Function
A	1	ILL+ (Tail)	B	1	Sensor Ref (+5V)
	2	Battery		2	IGN1
	3	-		3	Ambient Sensor (+)
	4	-		4	-
	5	-		5	-
	6	K-LINE		6	Evaporator Sensor (+)
	7	C-CAN HIGH		7	-
	8	C-CAN LOW		8	-
	9	HTD		9	FET (Gate)
	10	Rear Defog Switch		10	FET (Drain Feedback)
	11	-		11	Sensor Ground
	12	DETENT OUT (+)		12	Blower Motor (+)
	13	ILL- (Rhestat)		13	ECV+
	14	IGN2		14	ECV-
	15	IGN1		15	Photo Sensor (-)
	16	Temp Actuator (COOL)		16	-
	17	Temp Actuator (WARM)		17	-
	18	Temp Actuator Feedback		18	-
	19	Mode Actuator (VENT)		19	-
	20	Mode Actuator (DEF)		20	-
	21	Mode Actuator Feedback		21	-
	22	Intake Actuator (FRE)		22	-
	23	Intake Actuator (REC)			
	24	Intake Actuator Feedback			
	25	Ground			
	26	Ground			

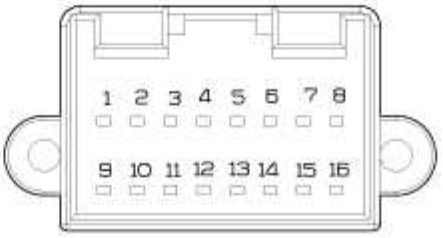
AVN Type







Connector A



Connector B

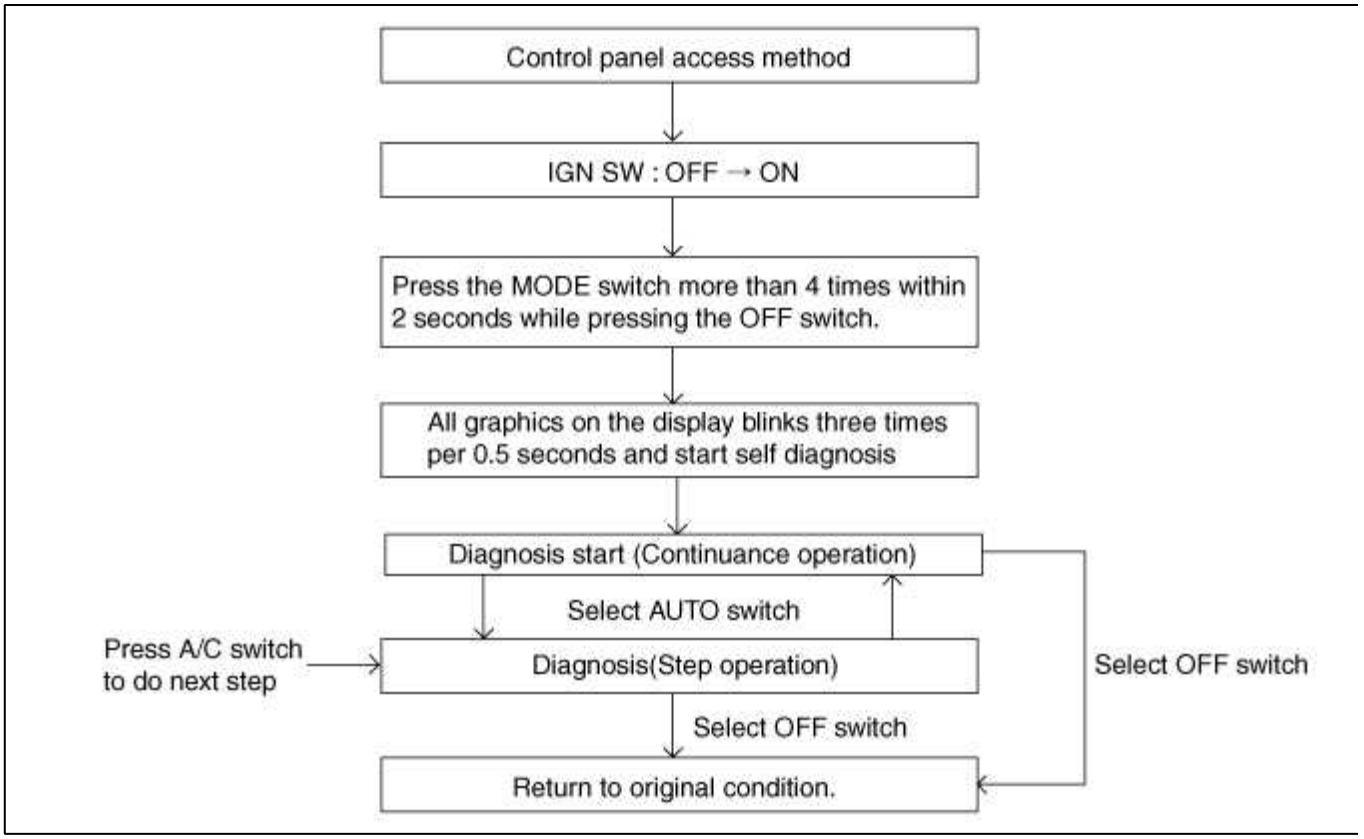
Connector Pin Function

Connector	Pin No	Function	Connector	Pin No	Function
A	1	Ground	B	1	ILL +
	2	Clock		2	-
	3	CD IN LED		3	R-DEF
	4	Eject		4	F-DEF
	5	-		5	F-IND
	6	-		6	CAN-H
	7	Incorder-L_CW		7	ACC
	8	Incorder-L_CCW		8	Battery 12V
	9	Incorder-R_CW		9	ILL -
	10	Incorder-R_CCW		10	-
	11	KEY LEFT		11	R-IND
	12	KEY RIGHT		12	BCM Ground
				13	-
				14	CAN-L
				15	IGN2
				16	Ground

Heating,Ventilation, Air Conditioning > Controller > Heater & A/C Control Unit(Full Automatic) > Repair procedures

Self diagnosis

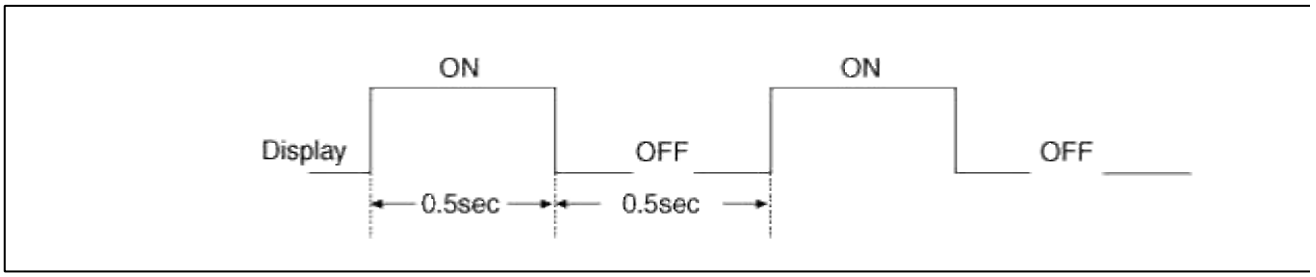
1. Self-diagnosis process.



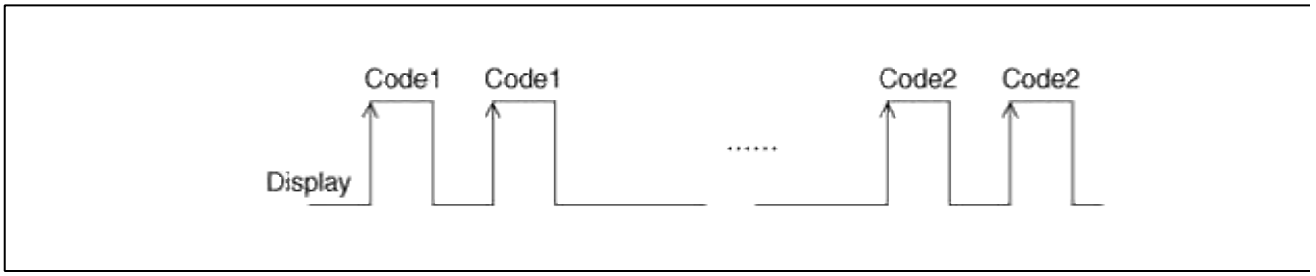
2. How to read self-diagnostic code.
   After the display panel flickers three times every 0.5 second, the corresponding fault code flickers on the setup temperature display panel every 0.5 second and will show two figures. Codes are displayed in numerical format.
   Fault code

Display	Fail description
00	Normal
11	In-car sensor open
12	In-car sensor short
13	Ambient sensor open
14	Ambient sensor short
15	Water temp sensor open
16	Water temp sensor short
17	Evaporator sensor open
18	Evaporator sensor short
19	Temp door potentiometer open/short
20	Temp door potentiometer fault
21	Mode door potentiometer open/short
22	Mode door potentiometer fault
25	Intake door potentiometer open
26	Intake door potentiometer short

3. Fault code display
   (1) Continuance operation : DTC code is one.



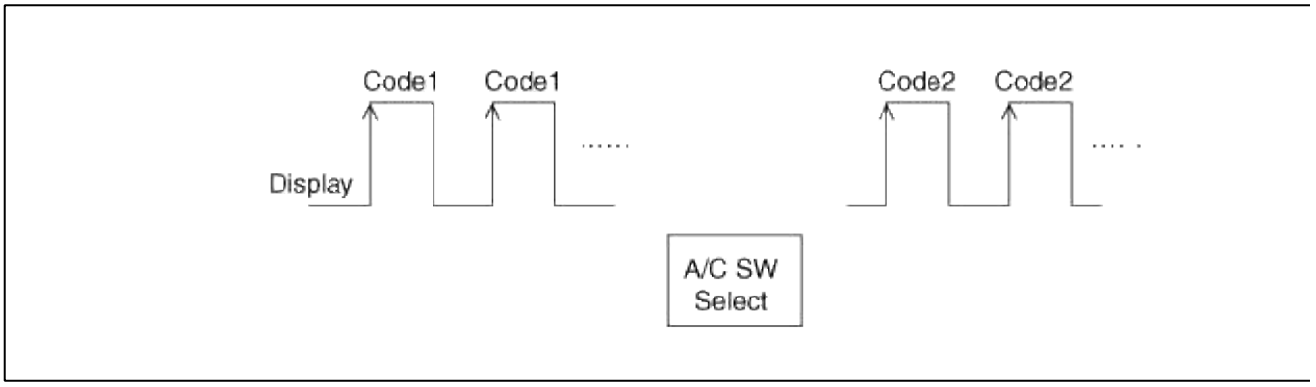
   (2) Continuance operation : DTC code is more two.



(3) STEP operation

A. Normal or one fault code is same as a continuance operation.

B. DTC code as more two.



4. If fault codes are displayed during the check, Inspect malfunction causes by referring to fault codes.

5. Fail safe

(1) In-car temperature sensor: Control with the value of 25°C(77°F)

(2) Ambient temperature sensor: Control with the value of 20°C(67°F)

(3) Evaporator temperature sensor: Control with the value of -2°C(28.4°F)

(4) Water temperature sensor: Control with the value of -2°C(28.4°F)

(5) Temperature control actuator (Air mix potentiometer) :
If temperature setting 17-24.5°C (62.5~76.1°F), fix at maximum cooling position.
If temperature setting 25-32°C (77.0~89.6°F), fix at maximum heating position.

(6) Mode control actuator (Direction potentiometer) :
Fix vent position, while selecting vent mode.
Fix defrost position, while selecting all except vent mode.

(7) Intake control actuator :
Fix fresh position, while selecting fresh mode.
Fix recirculation position, while selecting recirculation mode.

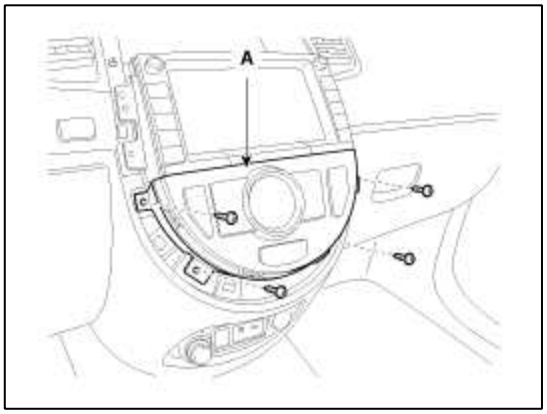
Replacement

1. Disconnect the negative (-) battery terminal.

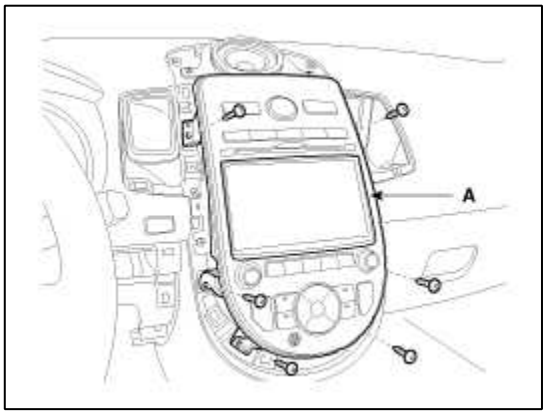
2. Remove the center speaker. (Refer to BE group)

3. Remove the center facia panel. (Refer to BD group)

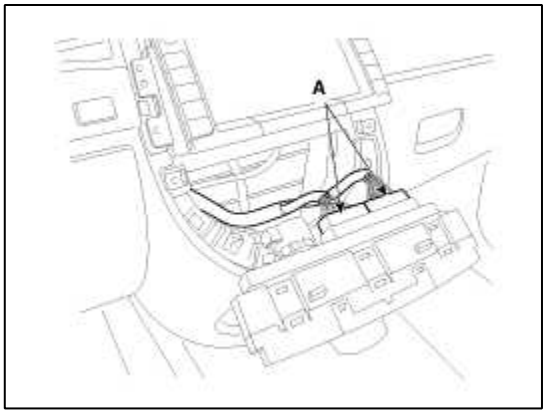
4. Remove the blower and A/C control panel (A), from center fascia.
[CDP]



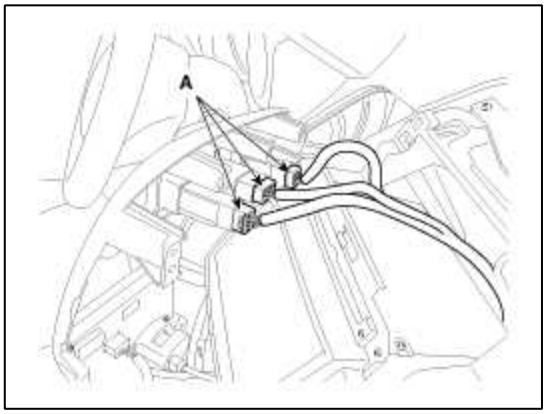
[AVN]

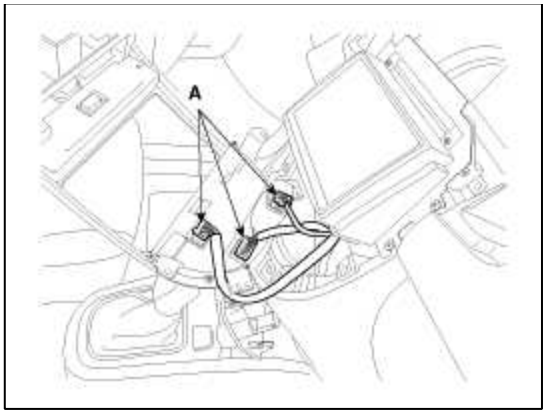


5. Disconnect the connectors (A), then remove the blower and A/C control panel.
[CDP]



[AVN]

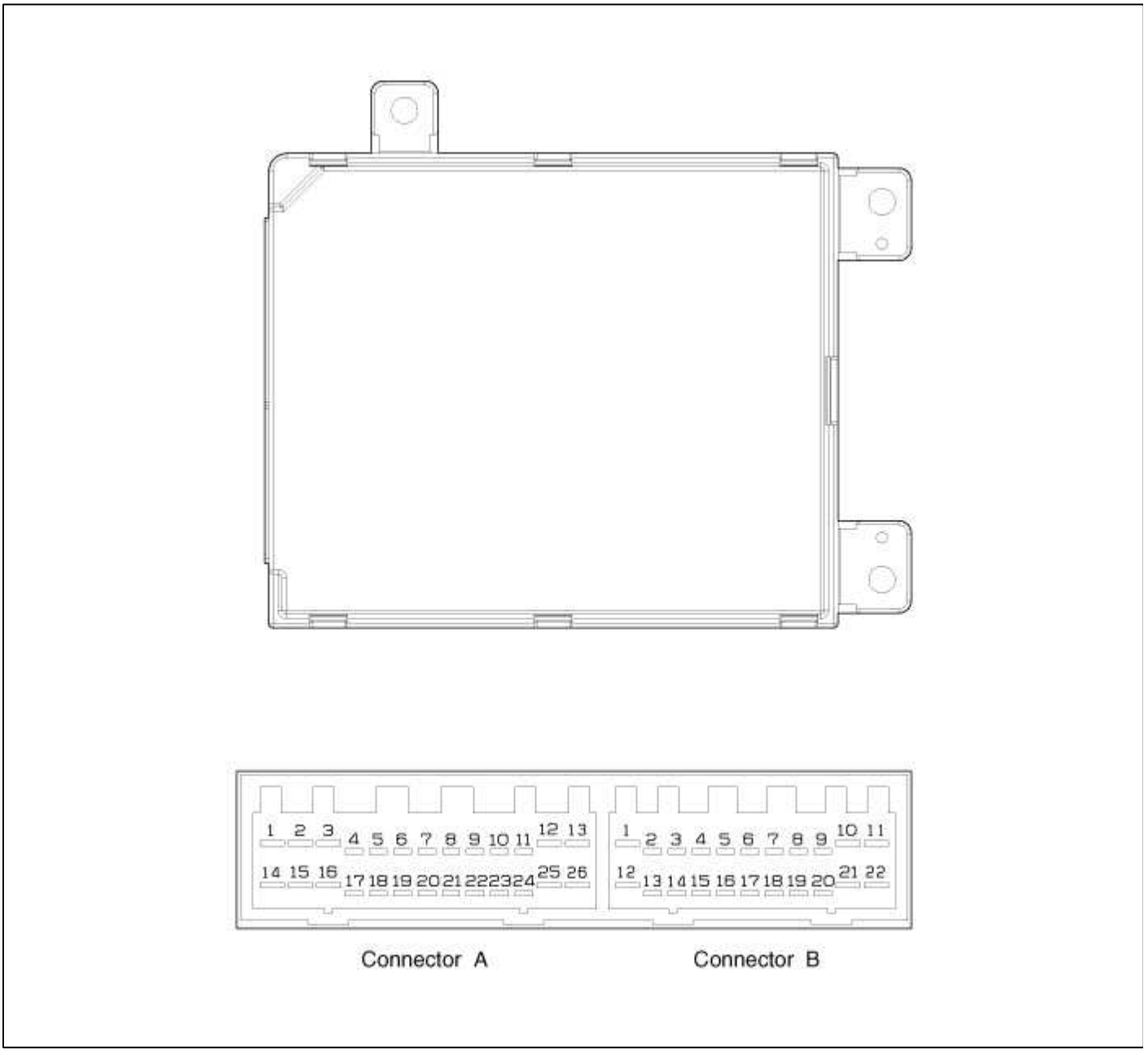




6. Installation is the reverse order of removal.

Heating,Ventilation, Air Conditioning > Controller > Heater Control Unit > Components and Components Location

Components



Connector Pin Function

Connector	Pin No	Function	Connector	Pin No	Function
A	1	-	B	1	Sensor Ref (+5V)
	2	Battery		2	IGN 1
	3	MM-CAN HIGH		3	Ambient Sensor (+)
	4	MM-CAN LOW		4	In-car Sensor (+)
	5	-		5	In-car Motor (-)
	6	K-LINE		6	Evaporator Sensor (+)
	7	C-CAN HIGH		7	DEF Select Signal
	8	C-CAN LOW		8	DEF LED Output
	9	-		9	FET (GATE)
	10	-		10	FET (DRAIN F/B)
	11	-		11	Sensor Ground
	12	-		12	Blower Motor (+)
	13	-		13	ECV +
	14	IGN 2		14	ECV -
	15	IGN 2		15	Photo Sensor (-)
	16	Temp Actuator (COOL)		16	-
	17	Temp Actuator (WARM)		17	-
	18	Temp Actuator Feedback		18	-
	19	Mode Actuator (VENT)		19	-
	20	Mode Actuator (DEF)		20	-
	21	Mode Actuator Feedback		21	-
	22	Intake Actuator (FRE)		22	-
	23	Intake Actuator (REC)			
	24	Intake Actuator Feedback			
	25	Ground			
	26	Ground			

Heating,Ventilation, Air Conditioning > Controller > Heater Control Unit > Repair procedures

Replacement

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad. (Refer to BD group - "Crash Pad")
3. Disconnect the connector.

4. Remove the heater control unit (A).

