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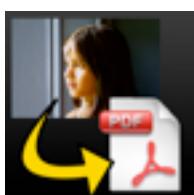


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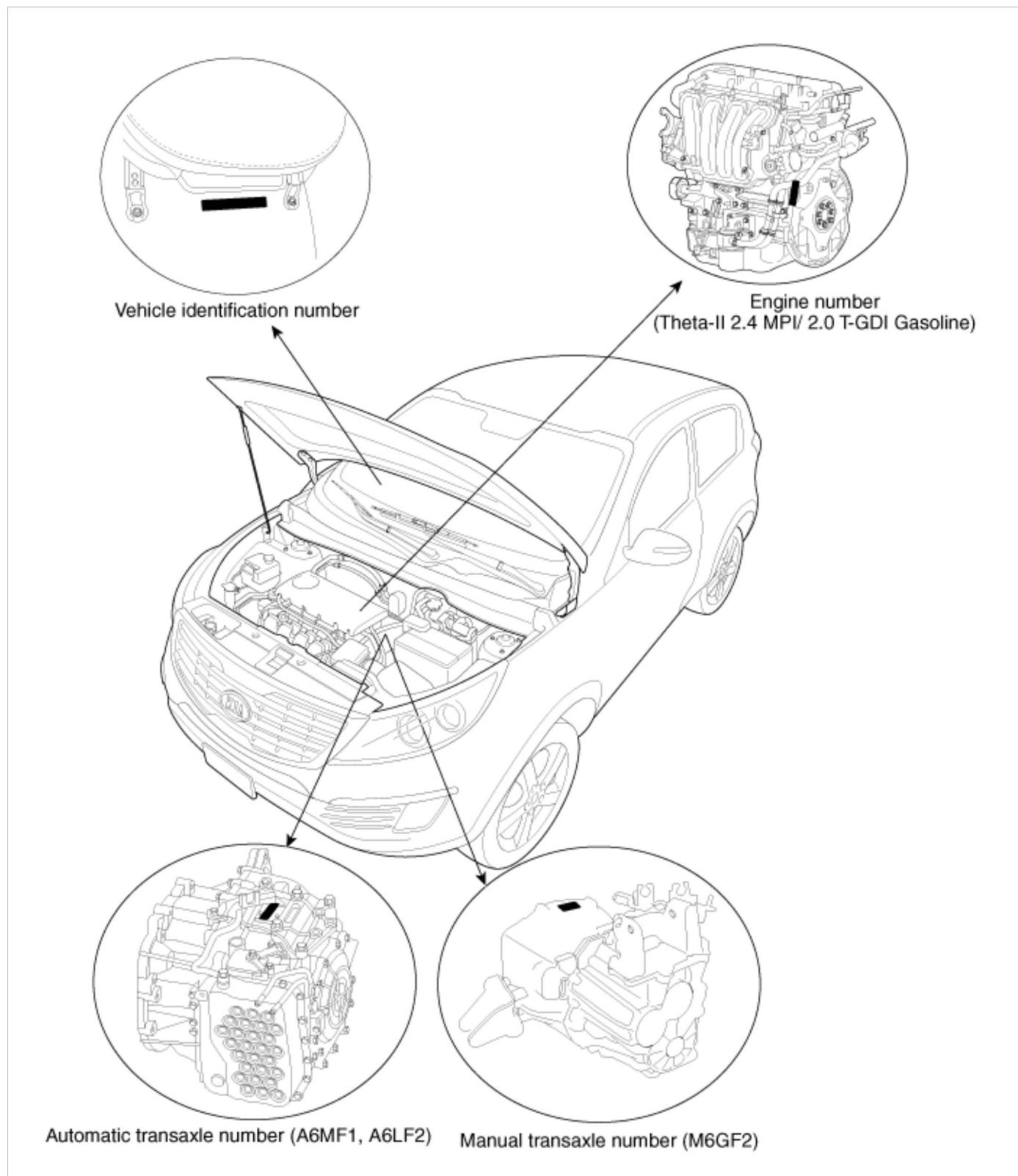
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SPORTAGE(SL) > 2012 > G 2.4 DOHC > General Information

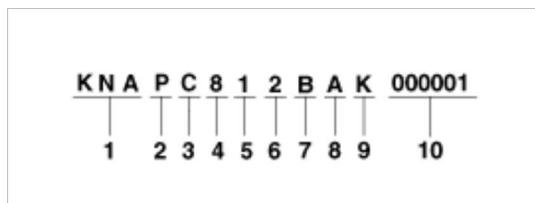
General Information > General Information > General Information

Identification Number Locations



Identification Number Description

Vehicle Identification Number



1. World Manufacturer Identifier (WMI)

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

2. Vehicle line

- P : SPORTAGE

3. Model & Series

- A : Low grade (L)
- B : Middle-Low grade (GL)
- C : Middle grade (GLS, JSL, TAX)
- D : Middle-High grade (HGS)
- E : High grade (TOP)

4. Body/Cabin type, Gross Vehicle Weight Rating

KNA

- 1 : Limousine
- 2 : Sedan - 2 door
- 3 : Sedan - 3 door
- 4 : Sedan - 4 door
- 5 : Sedan - 5 door
- 6 : Coupe
- 7 : Convertible
- 8 : Wagon
- 9 : Commercial Van
- 0 : Pick-Up

KNC (Commercial vehicle / Van)

Except U.S.A, Canada, Mexico, Gulf Cooperation Council, China

- X : Standard Cabin / Semi-Bonnet
- Y : Double Cabin / Bonnet
- Z : Super Cabin / Box

For U.S.A, Canada, Mexico, Gulf Cooperation Council, China

- 2 : Standard Cabin Class-H 4×2
- 3 : Standard Cabin Class-E 4×2 / Semi-Bonnet Class-E 4×2
- 4 : Standard Cabin Class-E 4×4 / Semi-Bonnet Class-E 4×4
- 5 : Standard Cabin Class-F 4×2 / Semi-Bonnet Class-F 4×2
- 6 : Standard Cabin Class-F 4×4 / Semi-Bonnet Class-F 4×4
- 7 : Double Cabin Class-E 4×2 / Bonnet Class-E 4×2
- 8 : Double Cabin Class-E 4×4 / Bonnet Class-E 4×4
- 9 : Double Cabin Class-F 4×2 / Bonnet Class-F 4×2
- 0 : Double Cabin Class-F 4×4 / Bonnet Class-F 4×4
- A : Super Cabin Class-E 4×2 / Box Class-E 4×2
- B : Super Cabin Class-E 4×4 / Box Class-E 4×4
- C : Super Cabin Class-F 4×2 / Box Class-F 4×2
- D : Super Cabin Class-F 4×4 / Box Class-F 4×4

KND

- 1 : Wagon 4×2 Class-A
- 2 : Wagon 4×2 Class-B
- 3 : Wagon 4×2 Class-C

- 4 : Wagon 4x2 Class-D
- 5 : Wagon 4x2 Class-E
- 6 : Wagon 4x2 Class-F
- 7 : Wagon 4x2 Class-G
- A : Wagon 4x4 Class-A
- B : Wagon 4x4 Class-B
- C : Wagon 4x4 Class-C
- D : Wagon 4x4 Class-D
- E : Wagon 4x4 Class-E
- F : Wagon 4x4 Class-F
- G : Wagon 4x4 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	o	o	o	x	x	o	x	x	o	o	x
B	o	o	o	x	x	x	x	x	x	x	x
C	o	o	o	x	x	o	x	x	o	o	o
D	o	o	o	x	x	o	o	x	o	o	x
E	o	o	x	x	x	x	x	x	x	x	x
F	o	o	o	x	x	o	x	x	x	x	x
J	o	o	o	o	x	o	o	x	o	o	x
L	o	o	o	o	x	o	x	x	o	o	x
N	o	x	x	x	x	x	x	x	x	x	x
G	o	o	o	o	x	x	x	x	o	o	x
H	o	o	o	o	x	o	x	x	o	o	o

KNC, KNH

Except U.S.A, Canada, Mexico

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

6. Engine type

- 2 : Gasoline engine 2.4 MPI (Theta-II)
- 6 : Gasoline engine 2.0 T-GDI (Theta-II)

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, x

8. Model year

- A : 2010, B : 2011, C : 2012, D : 2013 ...

9. Plant of production

- 5 : Hwasung (Korea)
- 6 : Sohari (Korea)
- 7 : Kwangju (Korea)
- T : Seosan (Korea)

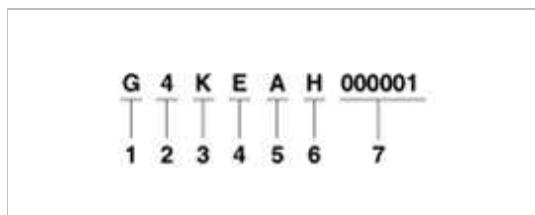
10. Vehicle production sequence number

- 000001 ~ 999999

Paint Code

Code	Color
UD	Clear White
9P	Black Cherry
3D	Bright Silver
E6S	Mineral Silver
D2A	Techno Orange
D5U	Sand Track
BAH	Vintage Blue
BEG	Signal Red
D2B	Electronic Yellow

Engine Number



1. Engine fuel
- G : Gasoline
2. Engine range
- 4 : 4 cycle 4 cylinder
3. Engine development order and capacity
- K : Theta engine (Gasoline)
4. Engine Capacity

- E : 2359cc (Theta-II engine MPI)
- H : 1998cc (Theta-II engine T-GDI)

5. Production year

- A : 2010, B : 2011, C : 2012, D : 2013 ...

6. Plant of production

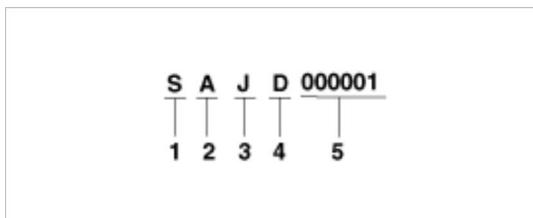
- A : Asan (Korea)
- B : Beijing (China)
- H : Hwasung (Korea)
- K : Montgomery (U.S.A)
- M : Chennai (India)
- P : Poseung (Korea)
- S : Sohari (Korea)
- T : Izmit (Turkey)
- U : Ulsan (Korea)
- W : Shandong (China)
- Z : Zilina (Slovakia)
- 1 : Yancheng (China)

7. Engine production sequence number

- 000001 ~ 999999

Transaxle Number

Manual



1. Model

- S : M6GF2

2. Production year

- A : 2010, B : 2011, C : 2012, D : 2013 ...

3. Plant of production

- J : Hwaseong (Korea)

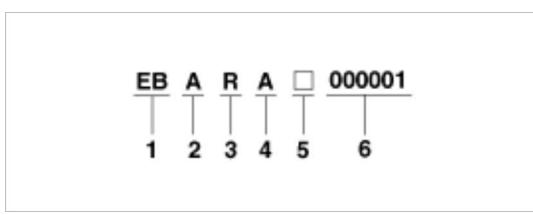
4. Final gear ratio

- D : 5.071 / 3.737

5. Transaxle production sequence number

- 000001 ~ 999999

Automatic



1. Model

- EB : A6MF1 (Theta-II 2.4 MPI 2WD)
- ED : A6MF1 (Theta-II 2.4 MPI 4WD)
- BB : A6LF2 (Theta-II 2.0 T-GDI 2WD)
- BD : A6LF2 (Theta-II 2.0 T-GDI 4WD)

2. Production year

- A : 2010, B : 2011, C : 2012, D : 2013 ...

3. Final gear ratio

- R : 3.195
- F : 3.320

4. Detailed classification

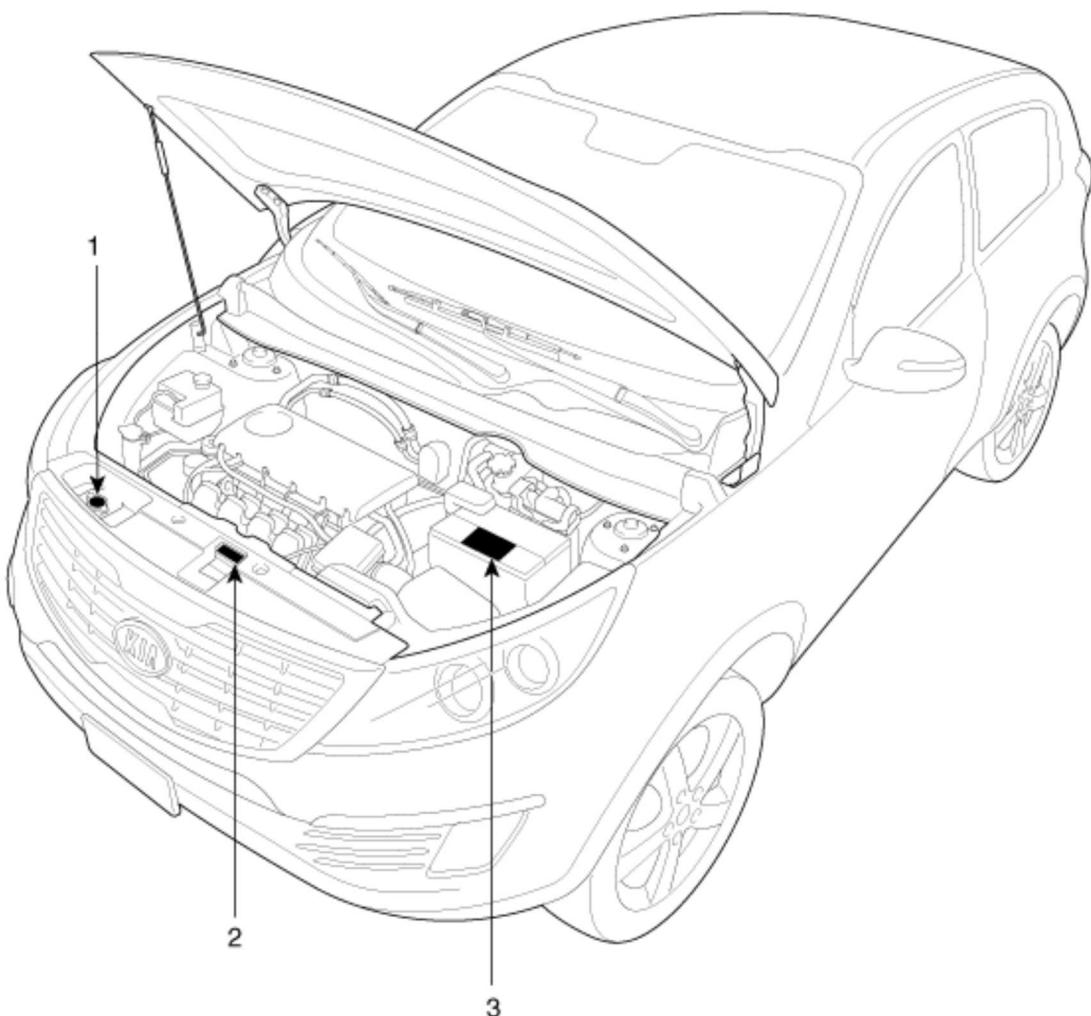
- A : Theta-II 2.4 MPI / 2.0 T-GDI

5. Spare

6. Transaxle production sequence number

- 000001 ~ 999999

Warning / Caution Label Locations



1. Radiator cap caution

2. Fan caution

3. Battery caution

Battery Caution Label Description



[A]



[B]



[C]



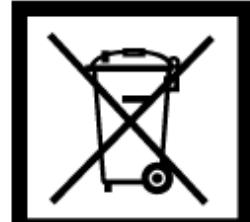
[D]



[E]



[F]



[G]

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, excessive 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, thoroughly 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 handling a battery.

F.

Hydrogen, which is a highly combustible gas, is always present 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 regulations for battery disposal.

Handling And Storage The Battery

Battery Itself	<ul style="list-style-type: none"> Batteries should be stored in cool, dry (27°C / 80.6°F) 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	<ul style="list-style-type: none"> 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 referring to DTC.

Lift And Support Points

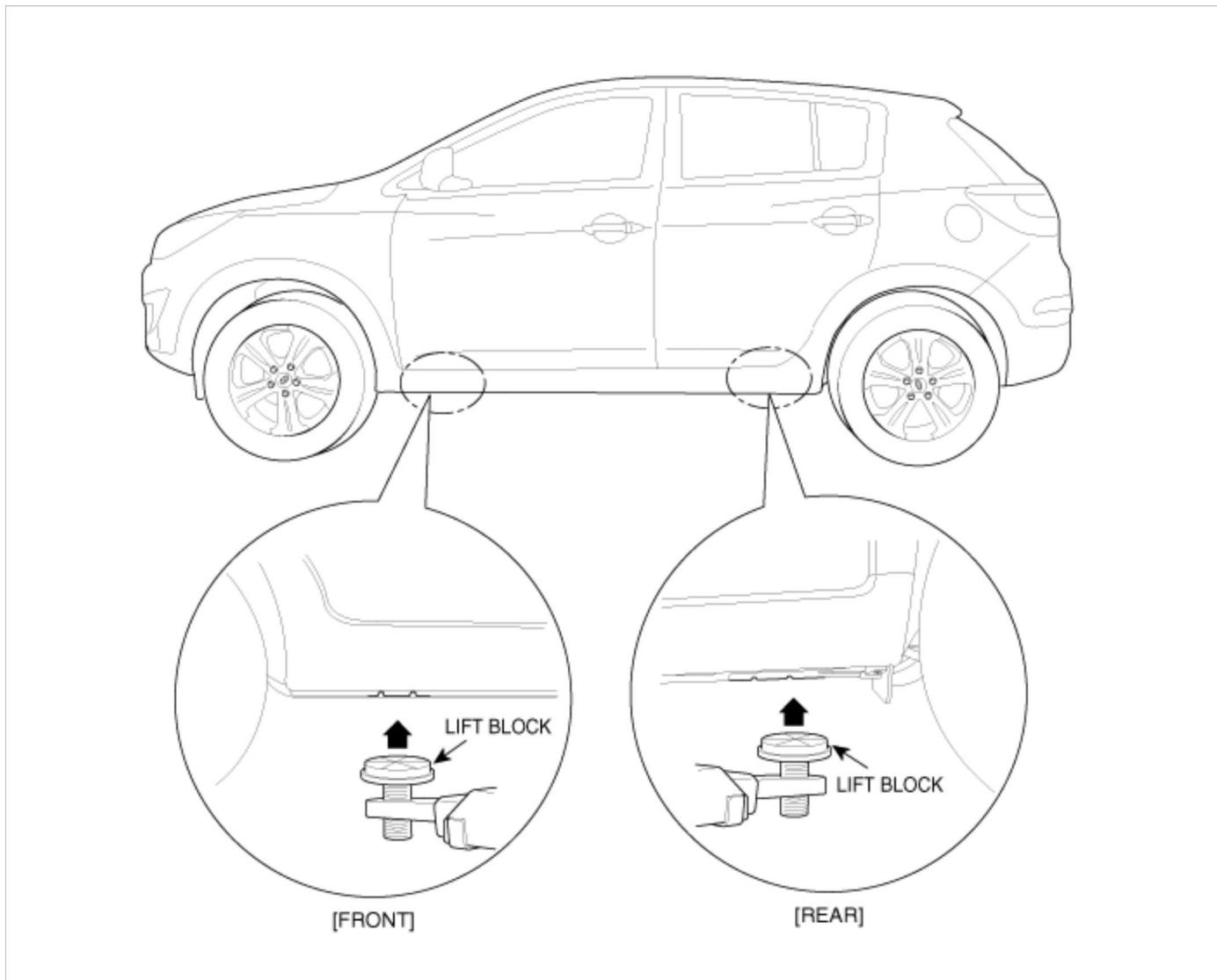
WARNING

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

NOTE

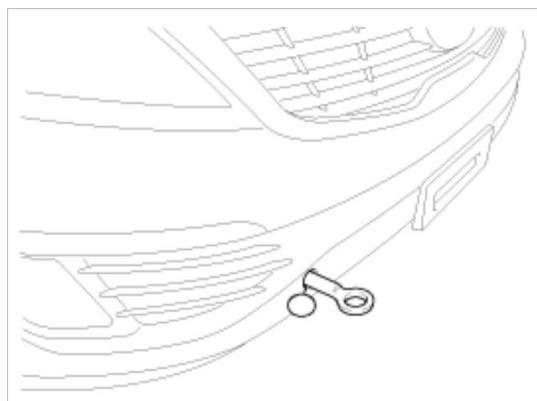
- Since each tire/wheel assembly weights approximately 14kg (30lbs), placing the front wheels in the luggage area can assist with the weight distribution.
- Use the same support points to support the vehicle on safety stands.

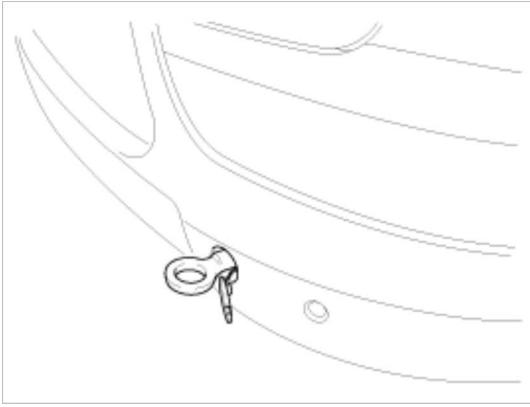
- Place the lift blocks under the support points as shown in the illustration.
- Raise the hoist a few inches (centimeters) and rock the vehicle to be sure it is firmly supported.
- Raise the hoist to full height to inspect the lift points for secure support.



Towing

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





Emergency Towing

There are three popular methods of towing a vehicle :

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

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

Manual Transaxle

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

Automatic Transaxle

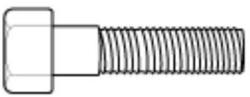
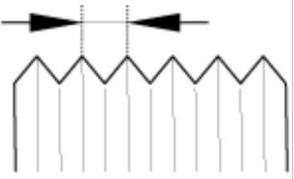
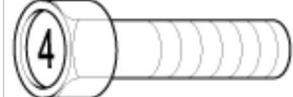
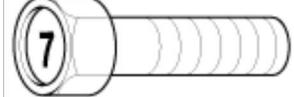
- Release the parking brake.
- Start the engine.
- Shift to [D] position, then [N] position.
- Turn off the engine.

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 flat-bed.
- 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 nominal diameter (mm)	Pitch (mm)	Torque Nm (kg.cm, lb.ft)	
		Head Mark 4	Head Mark 7

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

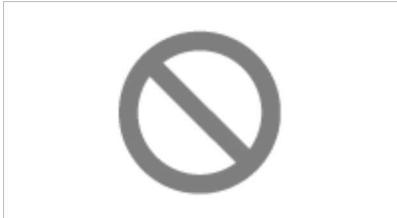
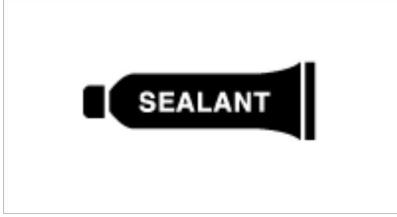
NOTE

- 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.
- 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.
- 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.

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.

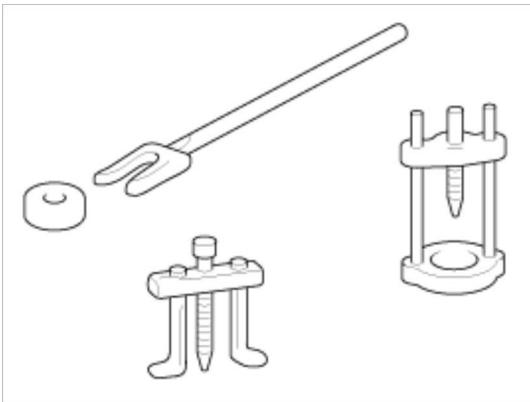
Make sure that the support rod has been released prior to closing the hood. Always check to be sure the hood is firmly latched before driving the vehicle.

Preparation Of Tools And Measuring Equipment

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

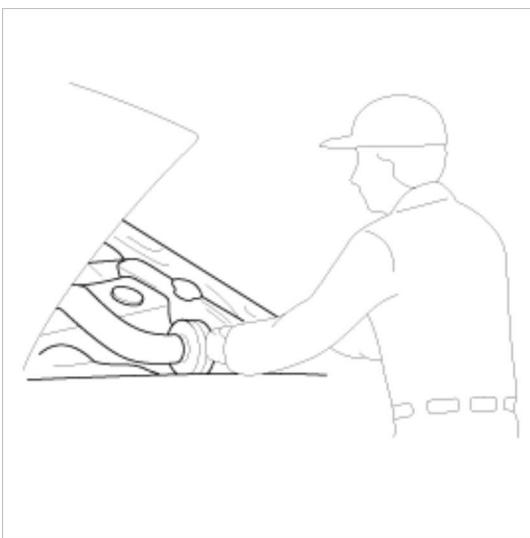
Special Tools

Use special tools when they are required.



Removal Of Parts

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

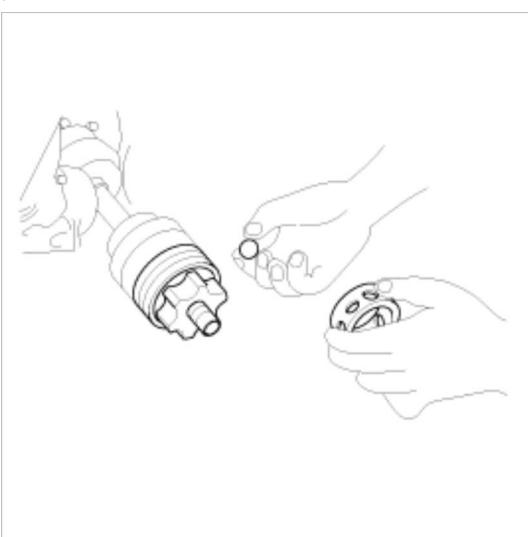


Disassembly

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

1. Inspection of parts

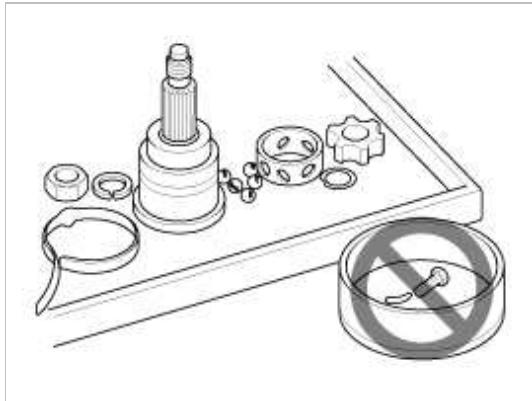
Each part, when removed, should be carefully examined for malfunction, deformation, damage, and other problems.



2. Arrangement of parts

All disassembled parts should be carefully arranged for effective reassembly.

Be sure to separate and correctly identify the parts to be replaced from those that will be used again.



3. Cleaning parts for reuse

All parts to be used again should be carefully and thoroughly cleaned by an appropriate method.



Parts

When replacing parts, use KIA MOTORS genuine parts.

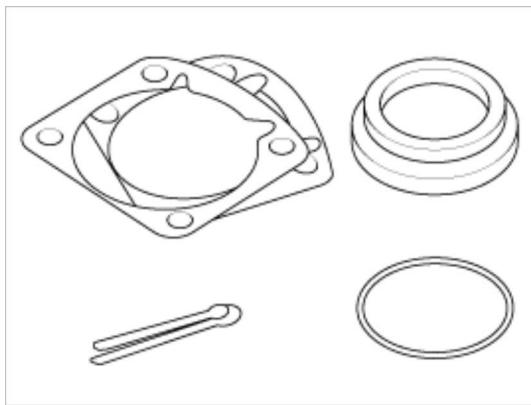


Replacement

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

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

6. Plastic nuts

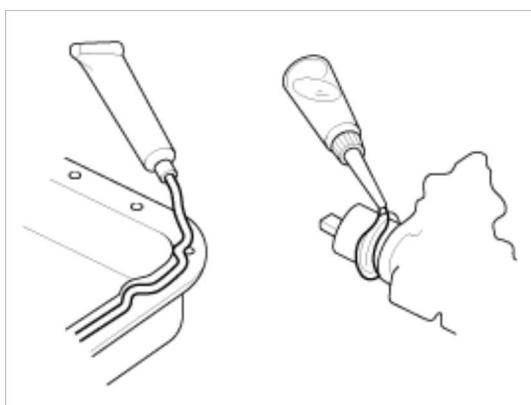


Depending on their location.

7. Sealant should be applied to gaskets.

8. Oil should be applied to the moving components of parts.

9. Specified oil or grease should be applied to the prescribed locations (oil seals, etc) before assembly.

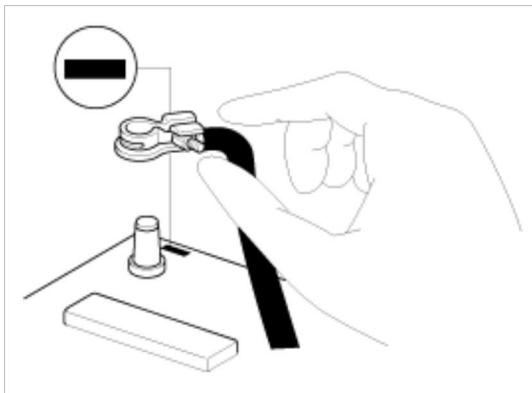


Adjustment

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

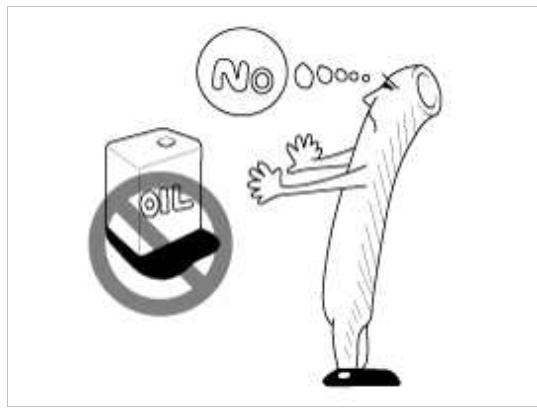
Electrical System

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



Rubber Parts And Tubes

Always prevent gasoline or from touching rubber parts or tubing.

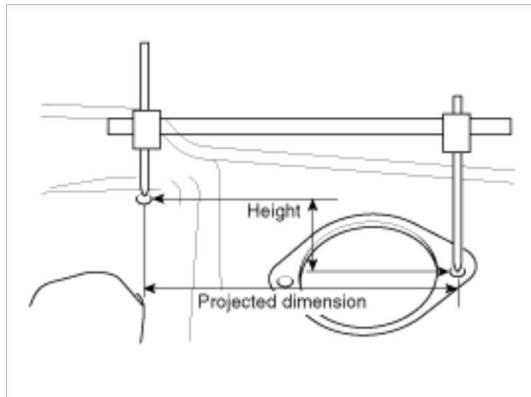


Measuring Body Dimensions

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

Dimensions Projected

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

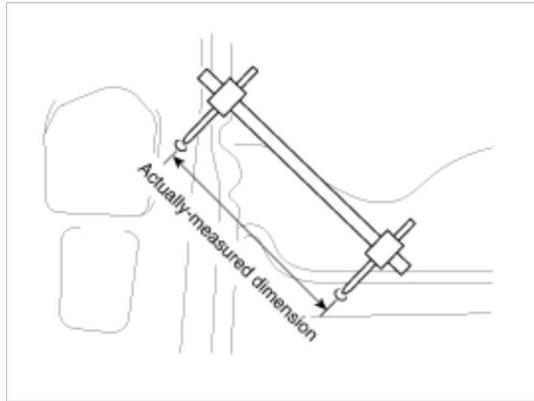


Measuring Actual Dimensions

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

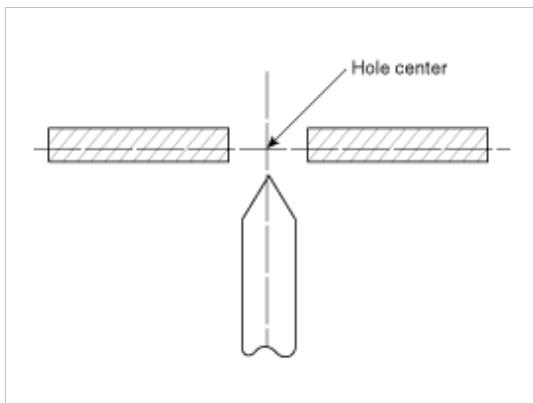
NOTE

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



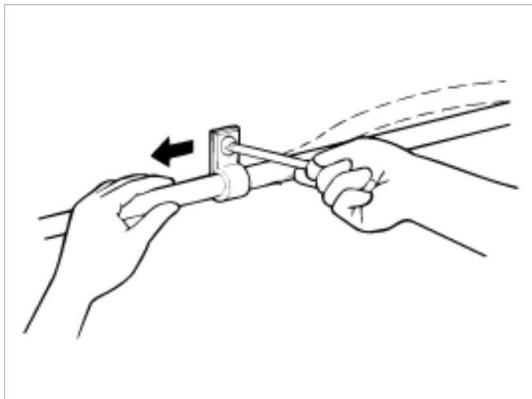
Measurement Point

Measurements should be taken at the center of the hole.



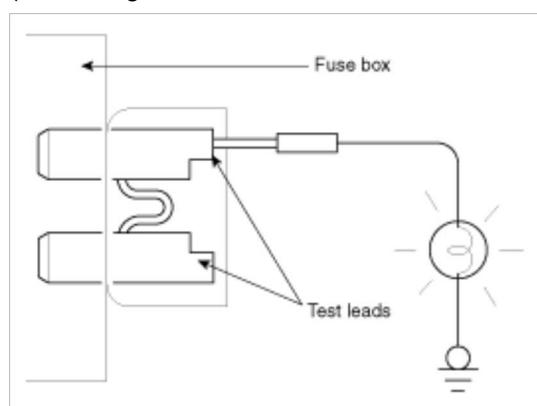
Checking Cables And Wires

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



Check Fuses

A blade type fuse test taps provided to allow checking the fuse itself without removing it 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)

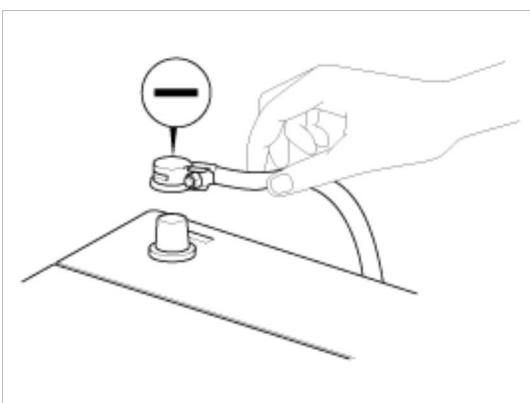


Servicing The Electrical System

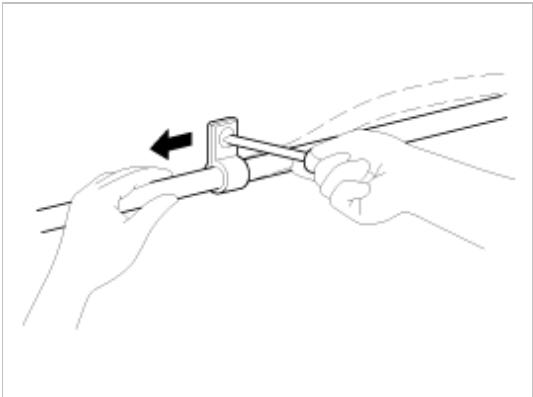
- Prior to servicing the electrical system, be sure to turn off the ignition switch and disconnect the battery ground cable.

NOTE

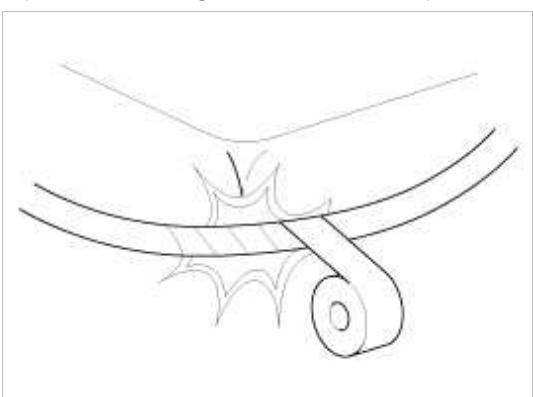
In the course of MFI or ELC system diagnosis, when the battery cable is removed, any diagnostic trouble code retained by the computer will be cleared. Therefore, if necessary, record the diagnostic data before removing the battery cable.



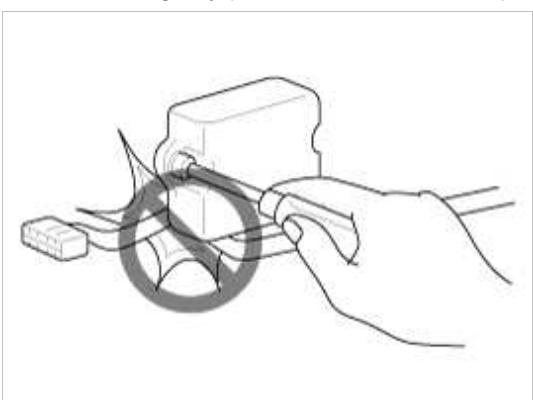
- Attach the wiring harnesses with clamps so that there is no slack. However, for any harness which passes the engine or other vibrating parts of the vehicle, allow some slack within a range that does not allow the engine vibrations to cause the harness to come into contact with any of the surrounding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



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



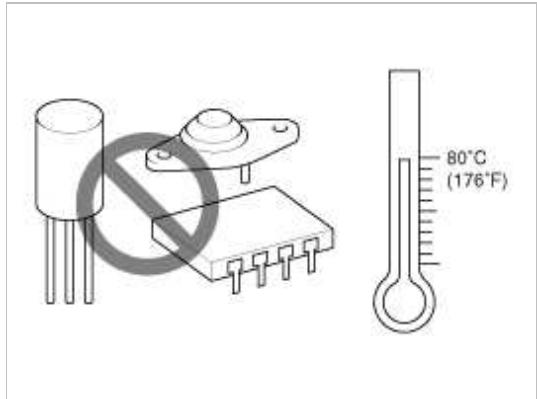
4. When installing any parts, be careful not to pinch or damage any of the wiring harness.



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



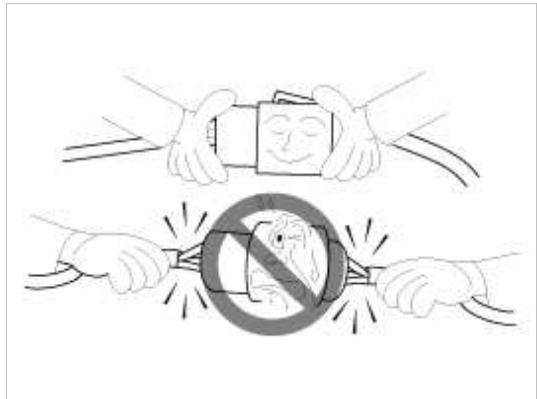
6. The electronic parts used in the computer, relays, etc. are readily damaged by heat. If there is a need for service operations that may cause the temperature to exceed 80°C (176°F), remove the electronic parts before hand.



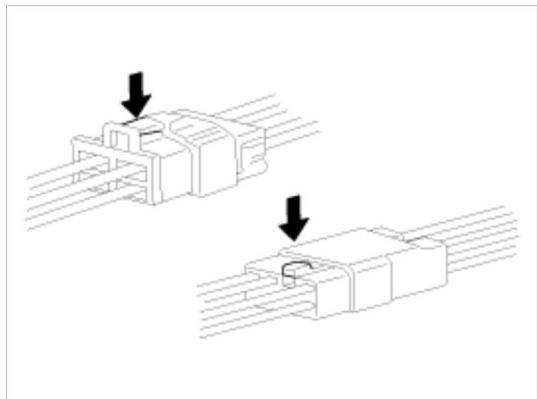
7. Loose connectors cause problems. Make sure that the connectors are always securely fastened.



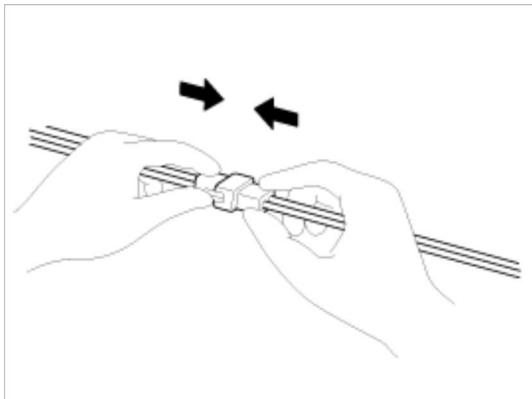
8. When disconnecting a connector, be sure to grip only the connector, not the wires.



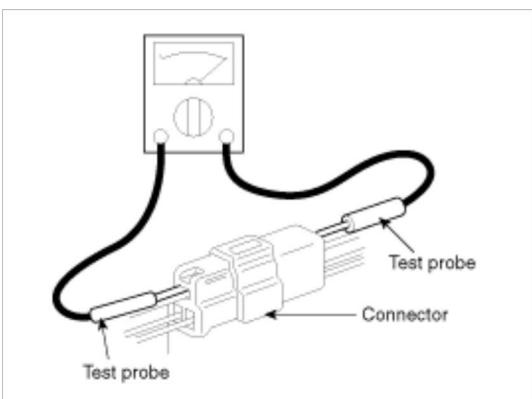
9. Disconnect connector which have catches by pressing in the direction of the arrows shown the illustration.



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



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



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

Nominal size	SAE gauge No.	Permissible current	
		In engine compartment	Other areas
0.3mm ²	AWG 22	-	5A
0.5mm ²	AWG 20	7A	13A
0.85mm ²	AWG 18	9A	17A
1.25mm ²	AWG 16	12A	22A
2.0mm ²	AWG 14	16A	30A
3.0mm ²	AWG 12	21A	40A
5.0mm ²	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 precautions and explain them to your customer.

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



SPORTAGE(SL) > 2012 > G 2.4 DOHC > Body (Interior and Exterior)**Body (Interior and Exterior) > General Information > Specifications****Specifications**

Items		Specification
Hood	Type	Rear hinged, front opening type
Front Door	Construction	Front hinged, full door construction
	Regulator system	Double-arm type
	Locking system	Pin-fork system
Rear Door	Construction	Front hinged, full door construction
	Regulator system	Wire-drum type
	Locking system	Pin-fork system
Tail Gate	Type	Front hinged, gas lifter type
Seat Belts	Front	3 point type with Emergency Locking Retractor (E.L.R)
	Rear	3 point type with Emergency Locking Retractor (E.L.R) 2 point type

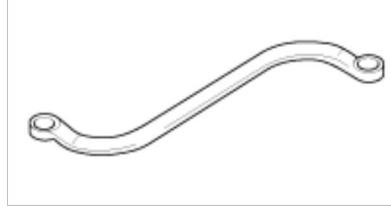
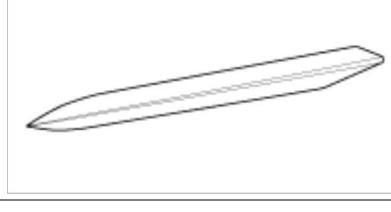
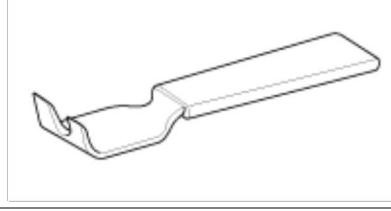
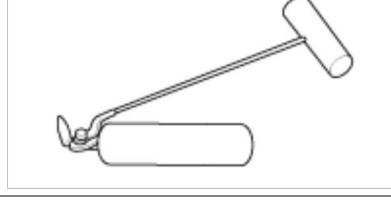
Tightening Torque

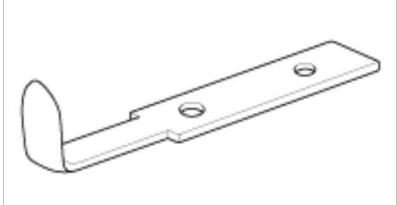
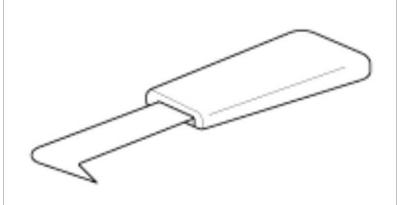
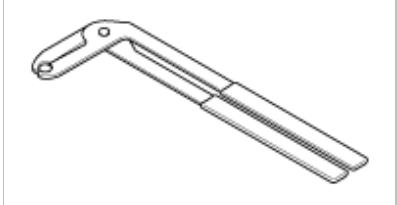
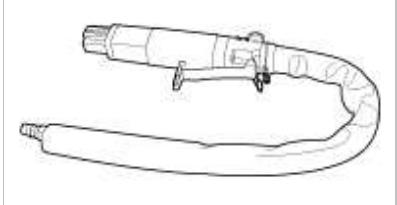
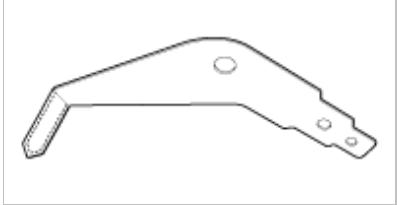
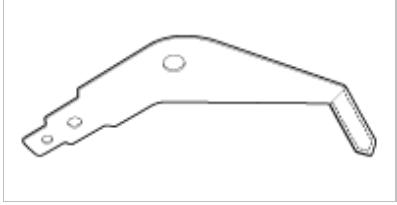
Items		N.m	Kgf.m	lb·ft
Front and rear doors	Door hinge to body	34.3 ~ 41.2	3.5 ~ 4.2	25.3 ~ 30.4
	Door hinge to door	21.6 ~ 26.5	2.2 ~ 2.7	15.9 ~ 19.5
	Door checker to door	6.9 ~ 10.8	0.7 ~ 1.1	5.1 ~ 8.0
	Door checker to body	16.7 ~ 21.6	1.7 ~ 2.2	12.3 ~ 15.9
	Door glass mounting bolt	6.9 ~ 10.8	0.7 ~ 1.1	5.1 ~ 8.0
	Outside handle base mounting bolt	6.9 ~ 10.8	0.7 ~ 1.1	5.1 ~ 8.0
	Door channel mounting nuts	6.9 ~ 10.8	0.7 ~ 1.1	5.1 ~ 8.0
	Latch mounting bolts	6.9 ~ 10.8	0.7 ~ 1.1	5.1 ~ 8.0
	Door module mounting bolts	6.9 ~ 10.8	0.7 ~ 1.1	5.1 ~ 8.0
	Door striker mounting bolts	16.7 ~ 21.6	1.7 ~ 2.2	12.3 ~ 15.9
Tail gate	Tail gate hinge to tail gate	21.6 ~ 26.5	2.2 ~ 2.7	15.9 ~ 19.5
	Tail gate hinge to body	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 mounting bolts	7.8 ~ 11.8	0.8 ~ 1.2	5.8 ~ 8.7
	Hood latch to body mounting nuts	6.9 ~ 10.8	0.7 ~ 1.1	5.1 ~ 8.0
Seat	Front seat mounting bolts	49.0 ~ 63.7	5.0 ~ 6.5	36.2~ 47.0
	Front seat frame mounting bolts	49.0 ~ 63.7	5.0 ~ 6.5	36.2~ 47.0

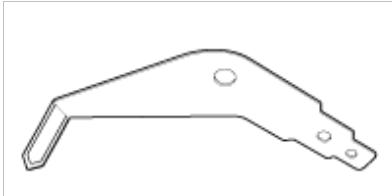
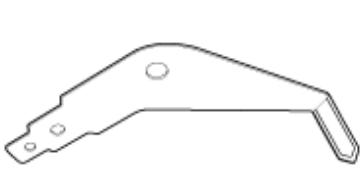
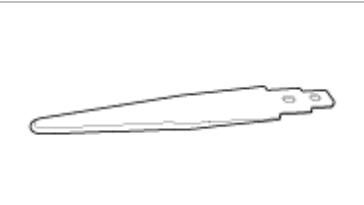
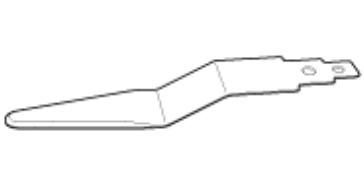
	Rear seat mounting bolts	49.0 ~ 63.7	5.0 ~ 6.5	36.2~ 47.0
Seat belt	Height adjuster mounting bolts	39.2 ~ 53.9	4.0 ~ 5.5	28.9 ~ 39.8
	Front seat belt upper anchor mounting bolt	39.2 ~ 53.9	4.0 ~ 5.5	28.9 ~ 39.8
	Front seat belt lower anchor mounting bolt	39.2 ~ 53.9	4.0 ~ 5.5	28.9 ~ 39.8
	Front seat 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
	Seat belt buckle mounting bolt	39.2 ~ 53.9	4.0 ~ 5.5	28.9 ~ 39.8
Roof rack	Roof rack mounting nuts	3.9 ~ 4.4	0.4 ~ 0.45	2.9 ~ 3.3
Outside rearview mirror	Outside rearview mirror mounting nuts	6.9 ~ 10.8	0.7 ~ 1.1	5.1 ~ 8.0
Wiper arm	Wiper arm mounting nuts	22.6 ~ 26.5	2.3 ~ 2.7	16.6 ~ 19.5
Panoramaroof	Panoramaroof mounting nuts	19.6 ~ 29.4	2.0 ~ 3.0	14.5 ~ 21.7
	Panoramaroof mounting bolts	19.6 ~ 29.4	2.0 ~ 3.0	14.5 ~ 21.7
	Panoramaroof earthing mounting bolt	10.8 ~ 13.7	1.1 ~ 1.4	8.0 ~ 10.1

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

Special Tools

Tool (Number and name)	Illustration	Use
09793-21000 Door hinge adjusting wrench		Adjustment, removal and installation of the door hinge
09800-21000 Ornament remover		Trim removal
09853-31000 Headliner clip remover		Headliner clip removal
09861-31100 Sealant cut-out tool		Cutting windshield sealant (Use with 09861-31200)

09861-31200 Sealant cutting blade		Cutting windshield sealant (Use with 09861-31100)
09861-31000 Windshield molding remover		Windshield molding removal
09880-4F000 Hog ring clip installer		Hog ring clip Installation
09816-2P100 Power silent cutting tool		Tool box for removing panoramaroof
09816-2P110 Air power tool		Air tool for installing blade
09816-2P121 Cutter-1		Blade for removing the front and side area of panoramaroof (This blade has a inclination to progress upward.)
09816-2P122 Cutter-2		Blade for removing the front and side area of panoramaroof (This blade has a inclination to progress upward.)

09816-2P123 Cutter-3		Blade for removing the front and side area of panoramaroof (This blade has a inclination to progress downward.)
09816-2P124 Cutter-4		Blade for removing the front and side area of panoramaroof (This blade has a inclination to progress downward.)
09816-2P127 Cutter-7		Blade for removing the front glass
09816-2P130 Cutter-10		Blade for removing the edge area of panoramaroof

Body (Interior and Exterior) > General Information > Troubleshooting

Troubleshooting

Symptom	Suspect Area	Remedy
Water leaks from panoramaroof	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 panoramaroof	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 resistance or interference of sunroof with drive cables, weatherstrip, etc. due to maladjustment of sunroof	

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

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

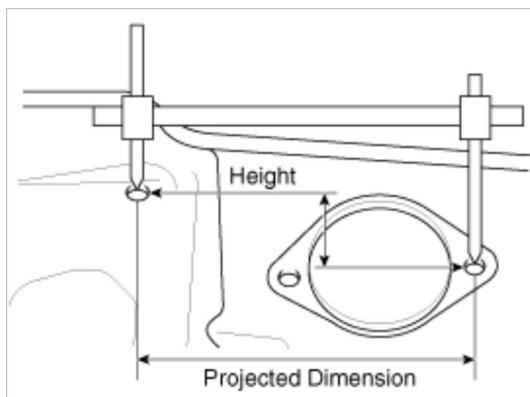
General

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

Measurement Method

Projected Dimensions

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

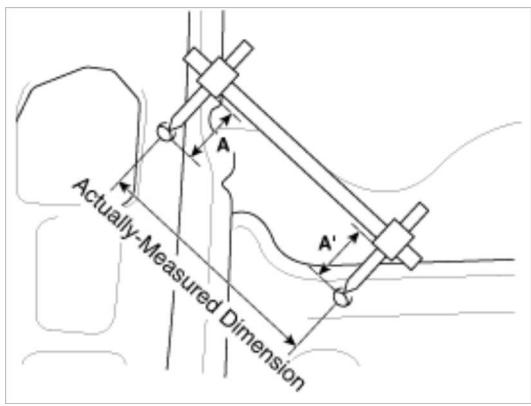


Actual-Measurement Dimensions

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

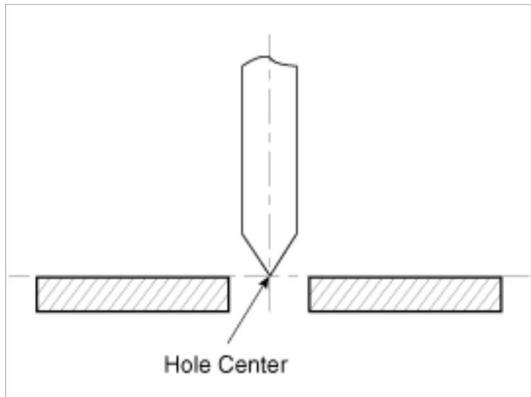
NOTE

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



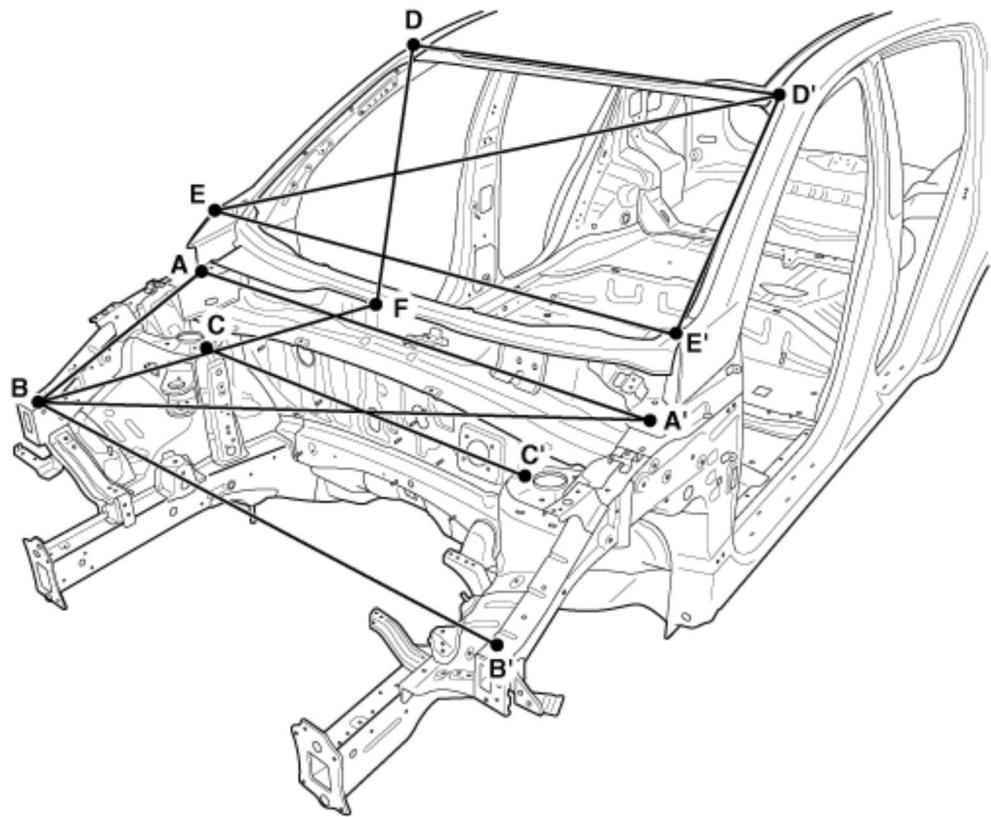
Measurement Point

1. Measurements should be taken at the hole center.



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

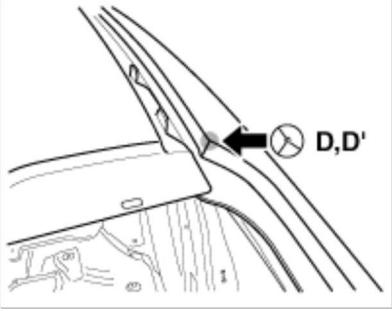
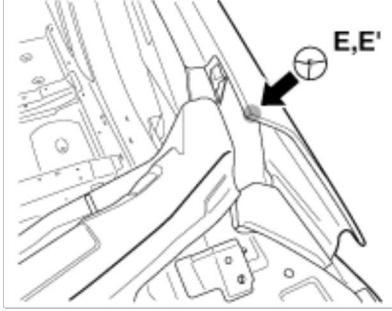
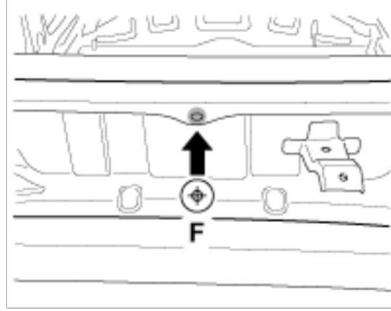
Front Body A



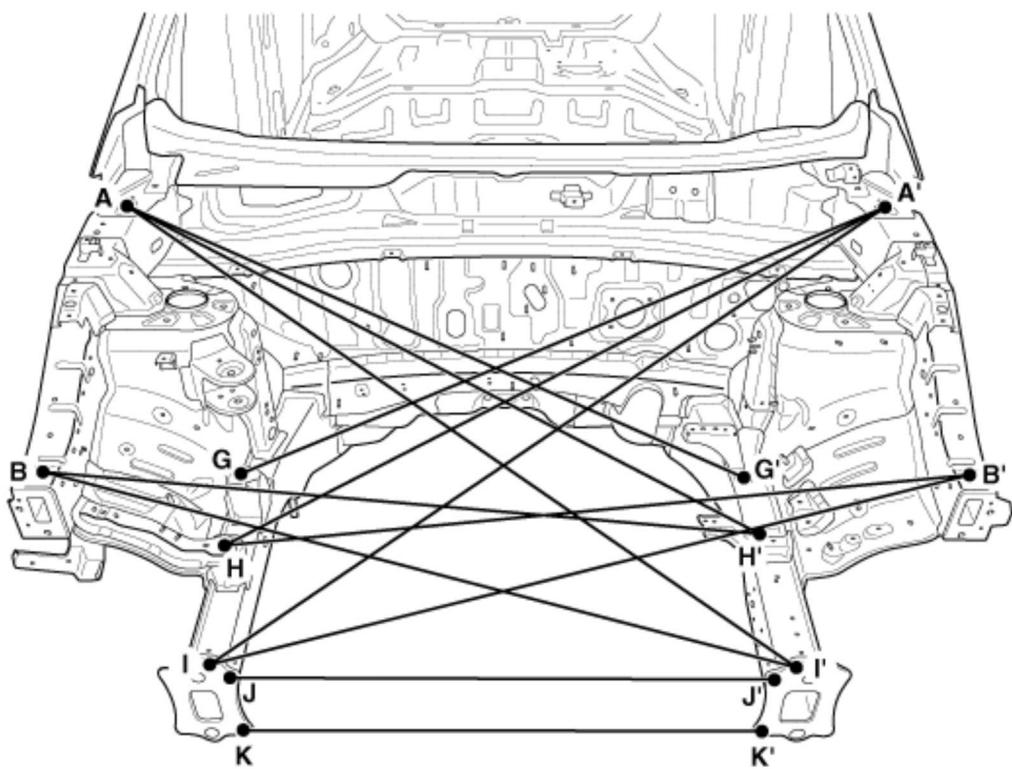
* These dimensions indicated in this figure are actual-measurement dimensions.

Point symbol	A-A'	A-B/A'-B'	A-B'/A'-B	B-B'	C-C'	D-D'	D-E/D'-E'	D-E'/D'-E
Point symbol	E-E'	F-B/F-B'	F-D/F-D'					
Length(mm)	1467	587	1605	1520	1068	1191	795	1538
Length(mm)	1455	962	1126					

Hood hinge mounting hole ($\varnothing 12$)	Fender apron upper panel tooling hole ($\varnothing 8$)	Front suspension mounting hole ($\varnothing 11$)

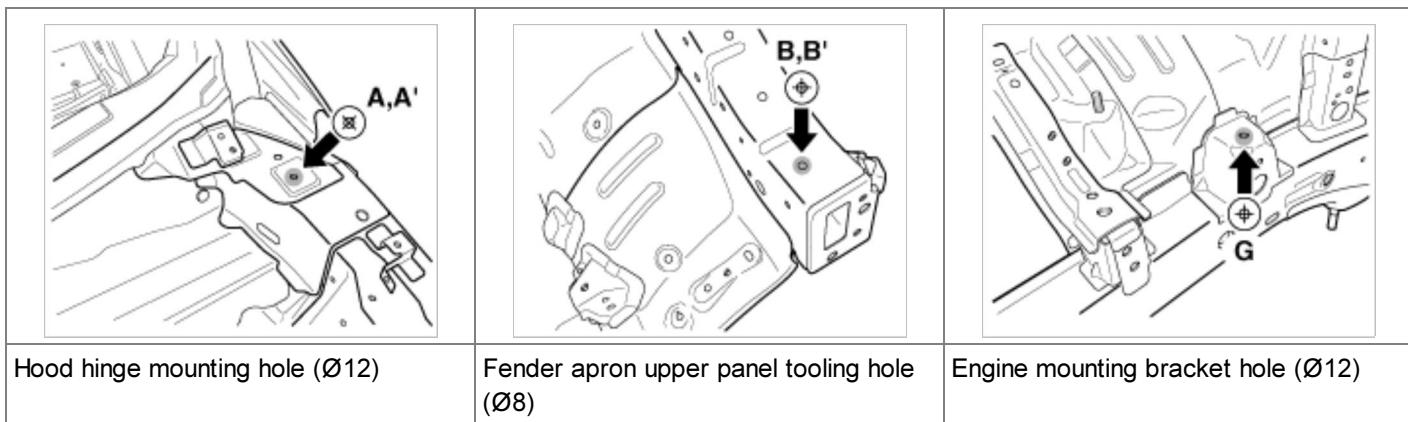
		
Side outer panel corner	Front pillar corner	Cowl panel tooling hole ($\varnothing 10$)

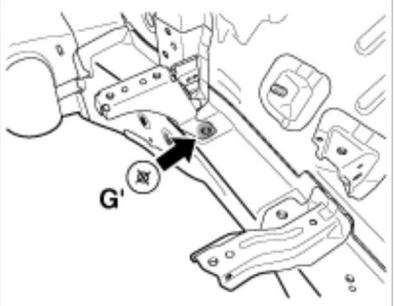
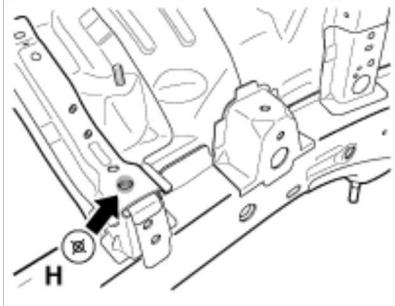
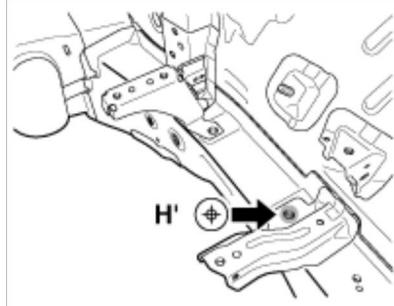
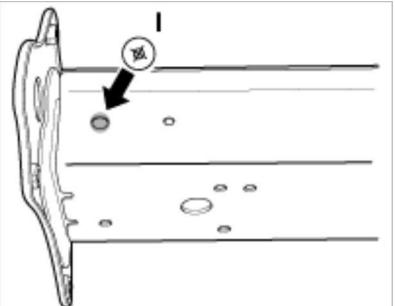
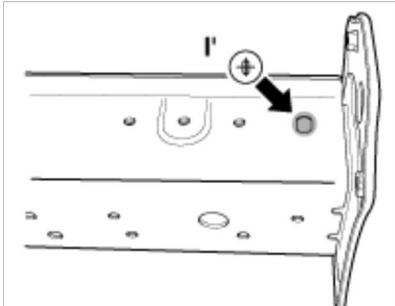
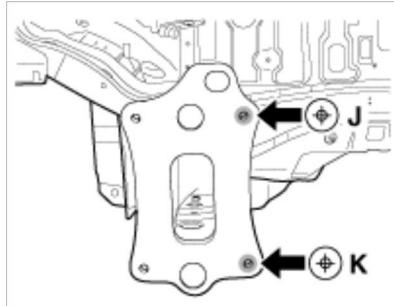
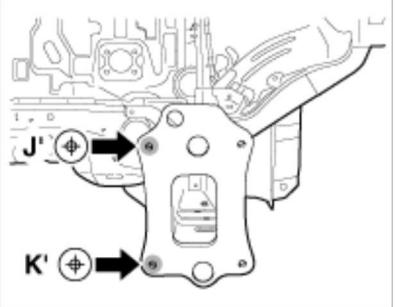
Front Body B



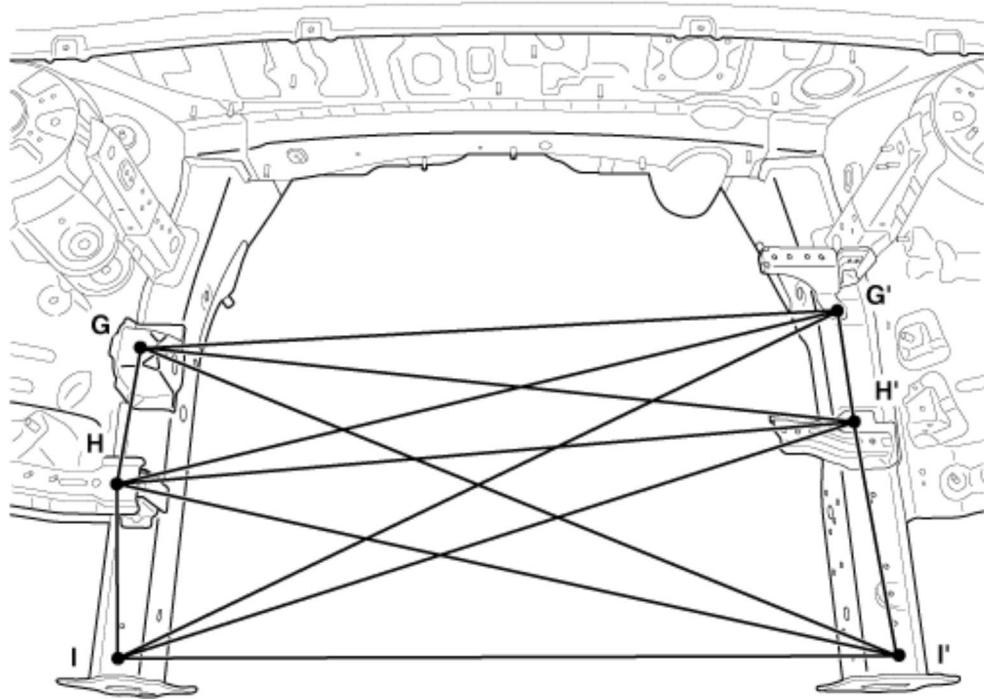
* These dimensions indicated in this figure are actual-measurement dimensions.

Point symbol	A-G'	A'-G	A-H'	A'-H	A-I'	A'-I	B-G'	B'-G
Length(mm)	1329	1333	1369	1401	1514	1514	1307	1287
Point symbol	B-H'	B'-H	B-I'	B'-I	J-J'	K-K'		
Length(mm)	1277	1278	1303	1303	884	884		



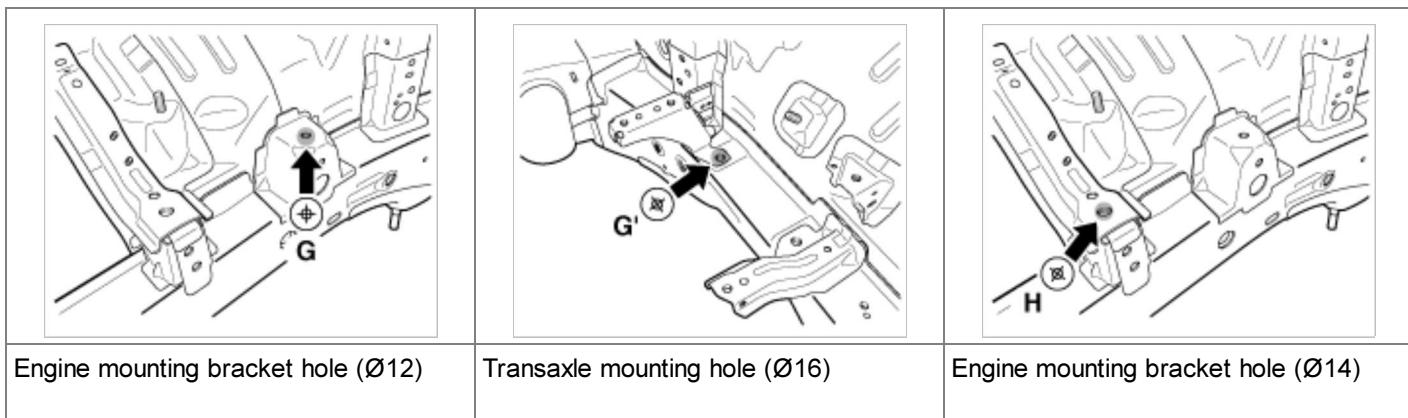
		
Transaxle mounting hole ($\varnothing 16$)	Engine mounting bracket hole ($\varnothing 14$)	Transaxle mounting hole ($\varnothing 16$)
		
Front side member tooling hole ($\varnothing 10$)	Front side member tooling hole (10X14)	Front end module mounting hole ($\varnothing 9$)
		
Front end module mounting hole ($\varnothing 9$)		

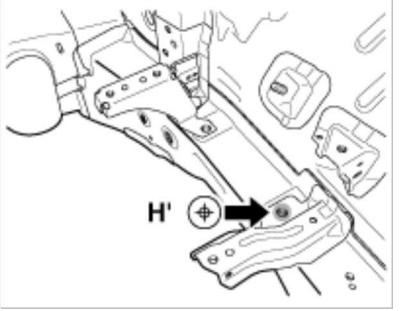
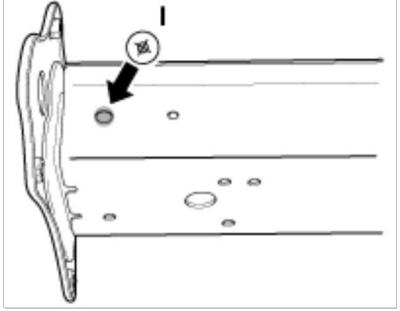
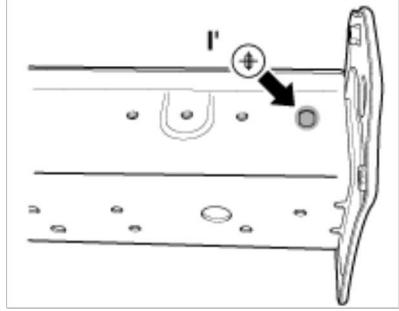
Front Body C



* These dimensions indicated in this figure are actual-measurement dimensions.

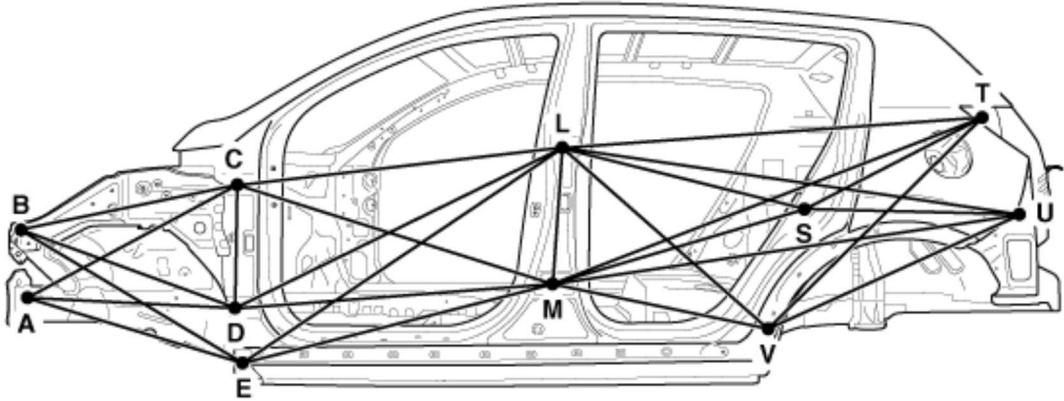
Point symbol	G-G'	G-H	G'-H'	G-H'	G'-H	G-I'	G'-I	H-H'
Length(mm)	985	189	172	984	1027	1075	1097	994
Point symbol	H-I	H'-I'	H-I'	H'-I	H-I'			
Length(mm)	225	315	1028	1032	1000			



		
Transaxle mounting hole ($\varnothing 16$)	Front side member tooling hole ($\varnothing 14$)	Front side member tooling hole (14X10)

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

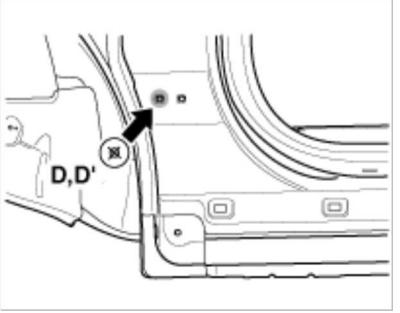
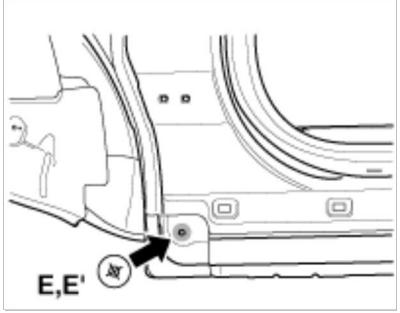
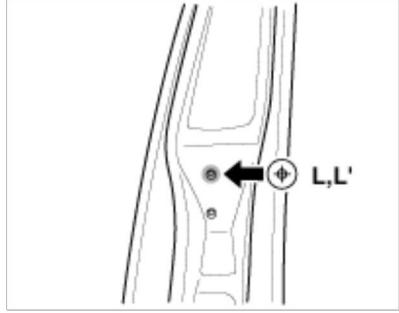
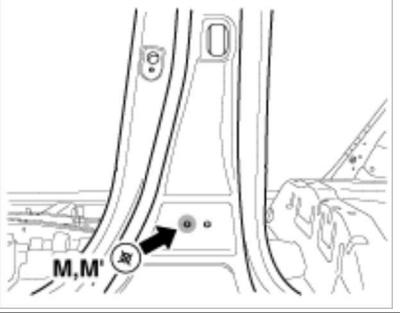
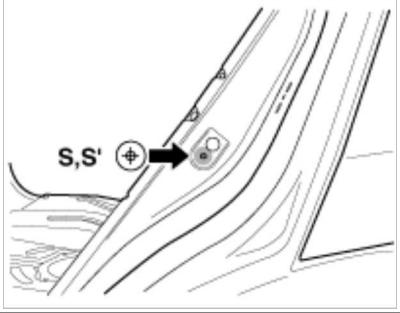
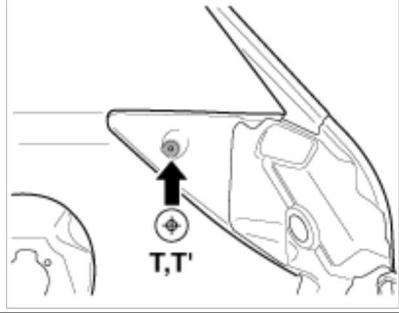
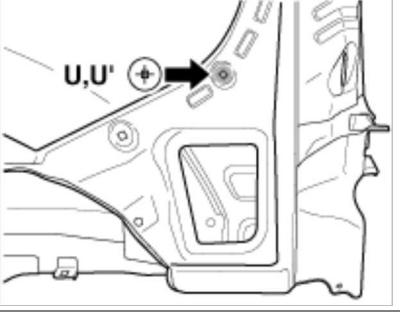
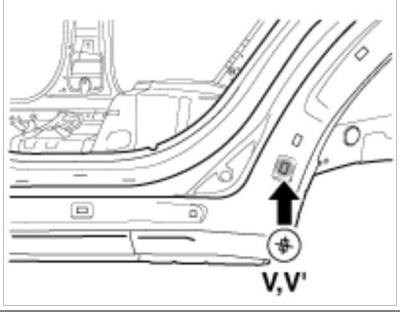
Side Body A



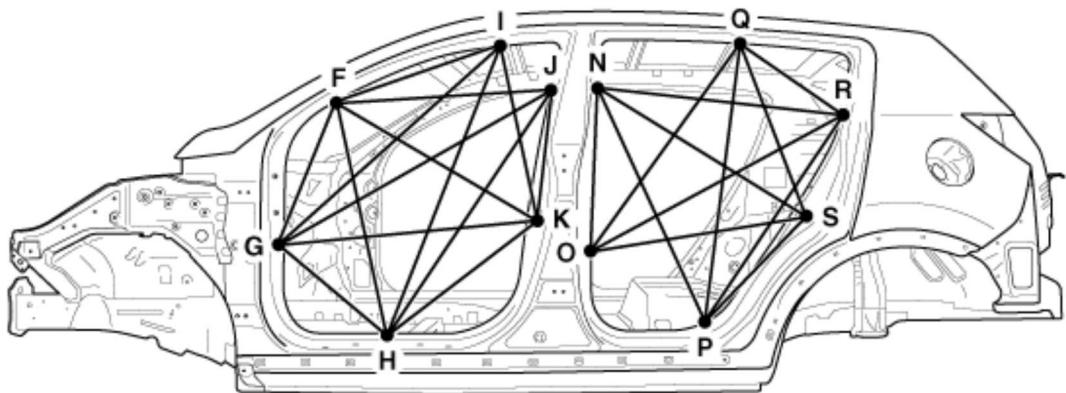
* These dimensions indicated in this figure are actual-measurement dimensions.

Point symbol	A-C	A-D	A-E	B-C	B-D	B-E	C-D	C-L
Length(mm)	1090	1011	1047	820	843	934	415	1105
Point symbol	C-M	D-L	D-M	E-L	E-M	L-M	L-S	L-T
Length(mm)	1133	1220	1066	1293	1075	446	848	1443
Point symbol	L-U	L-V	M-S	M-T	M-U	M-V	S-T	S-U
Length(mm)	1556	878	892	1572	1589	706	690	722
Point symbol	V-T	V-U						
Length(mm)	1047	957						

Front side member tooling hole ($\varnothing 20$)	Fender apron panel tooling hole ($\varnothing 10$)	Front door upper hinge mounting hole ($\varnothing 13$)

		
Front door lower hinge mounting hole (Ø13)	Fender panel mounting hole (Ø6.6)	Rear door upper hinge mounting hole (Ø10)
		
Rear door lower hinge mounting hole (Ø13)	Rear door switch mounting hole (Ø13)	Rear combination lamp mounting hole (Ø10)
		
Rear bumper mounting hole (Ø6)	Side sill moulding mounting hole (8.5X8.5)	

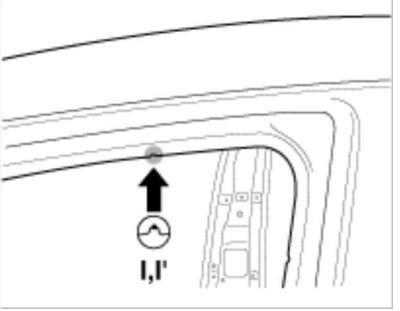
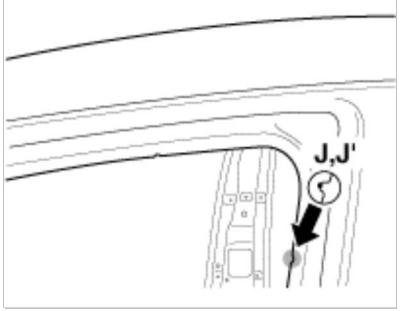
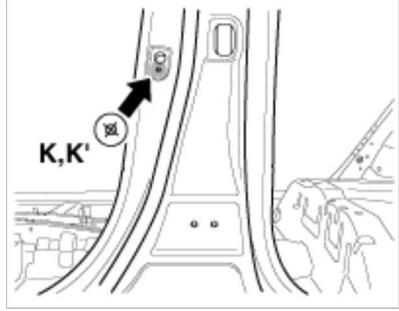
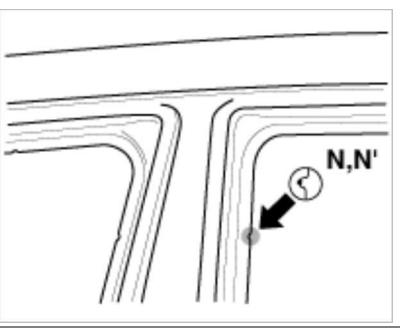
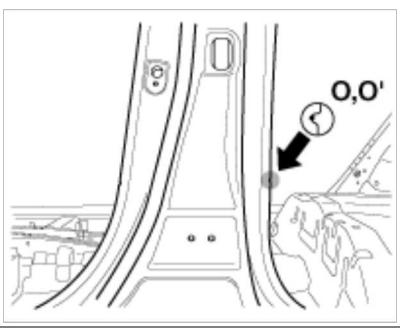
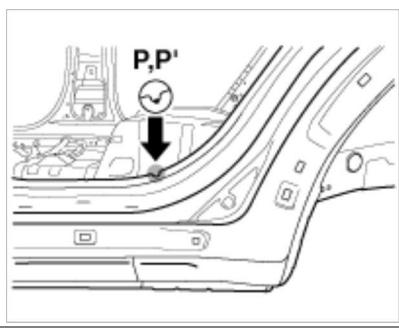
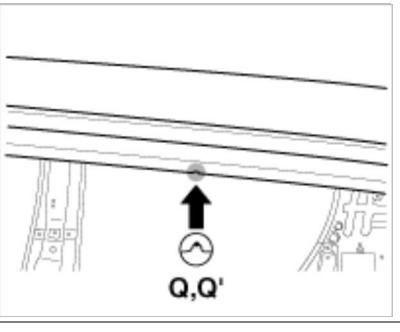
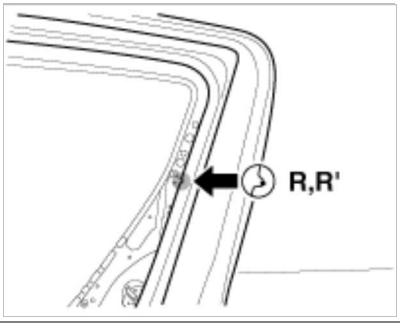
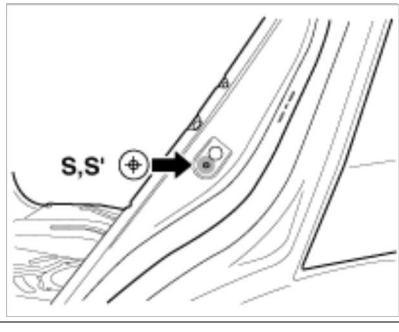
Side Body B



* These dimensions indicated in this figure are actual-measurement dimensions.

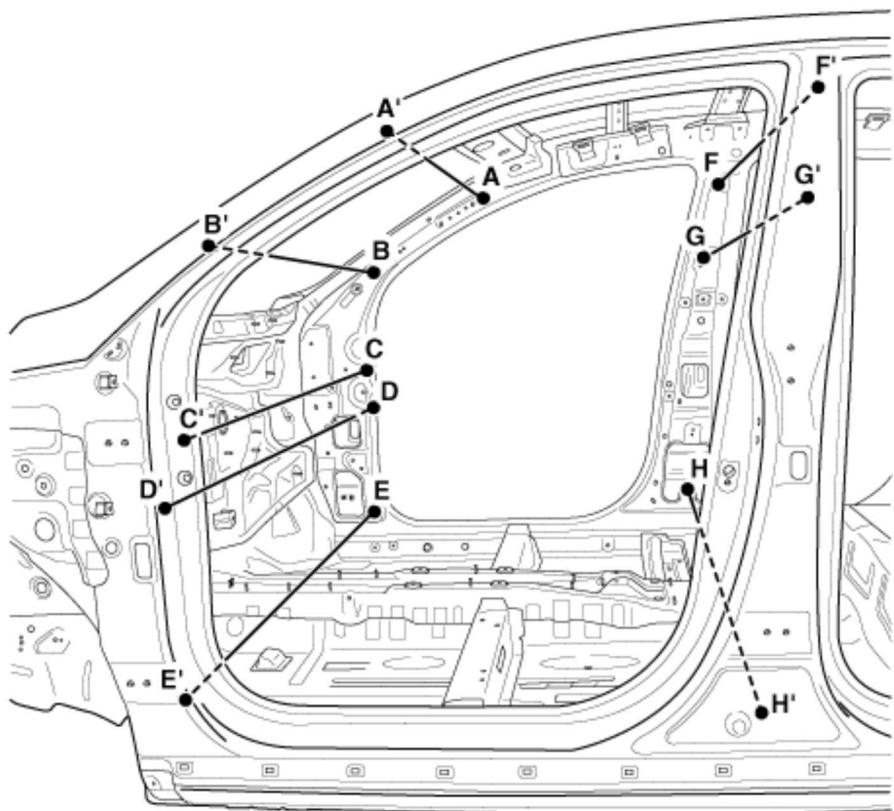
Point symbol	F-G	F-H	F-I	F-J	F-K	G-H	G-I	G-J
Length(mm)	597	854	615	720	789	478	1097	1135
Point symbol	G-K	H-I	H-J	H-K	I-K	J-K	N-O	N-P
Length(mm)	879	1112	1080	628	644	541	685	952
Point symbol	N-R	N-S	O-Q	O-R	O-S	P-Q	P-R	P-S
Length(mm)	872	873	924	1081	753	1010	970	529
Point symbol	Q-R	Q-S						
Length(mm)	478	686						

Side outer panel notch	Side outer panel notch	Side outer panel notch

		
Side outer panel notch	Side outer panel notch	Front door switch mounting hole ($\varnothing 10$)
		
Side outer panel notch	Side outer panel notch	Side outer panel notch
		
Side outer panel notch	Side outer panel notch	Rear door switch mounting hole ($\varnothing 10$)

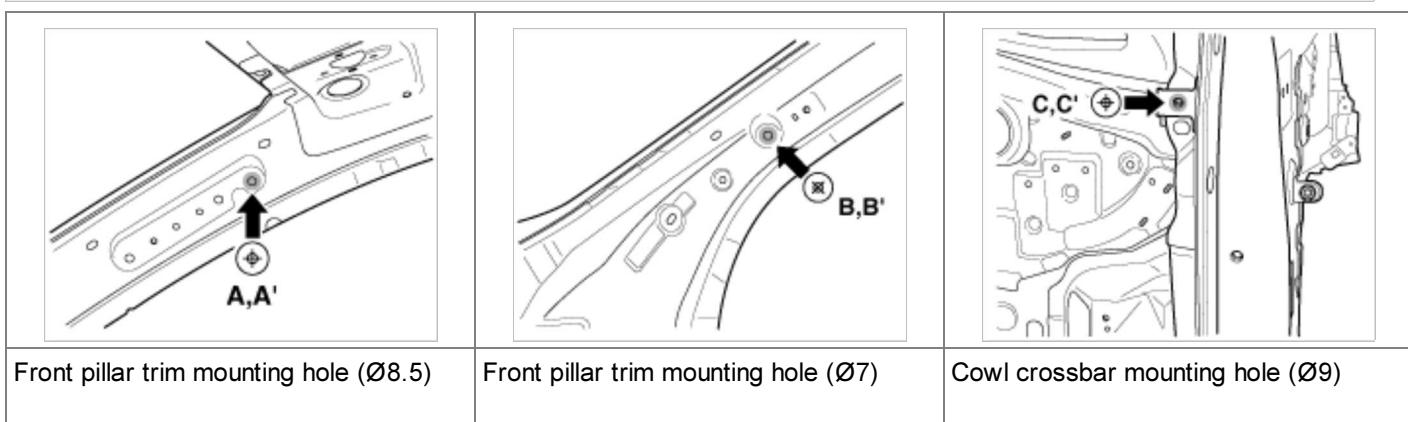
Body (Interior and Exterior) > Body Dimensions > Interior > Body Repair

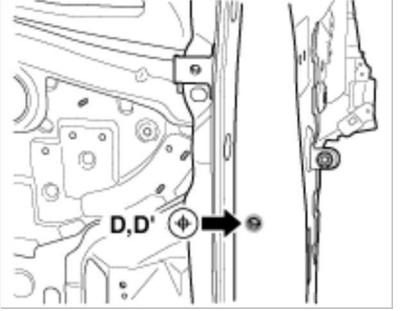
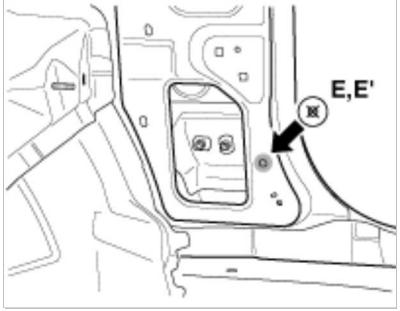
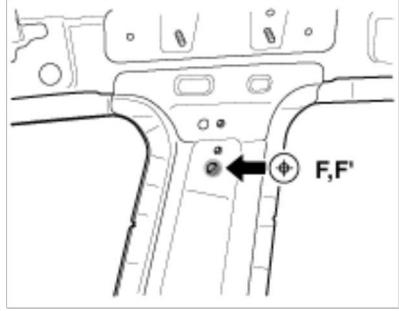
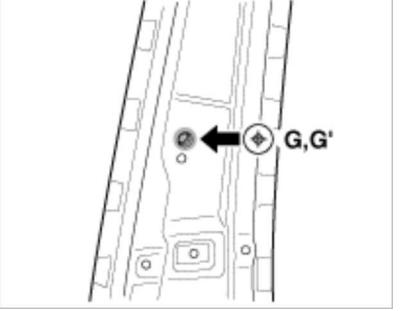
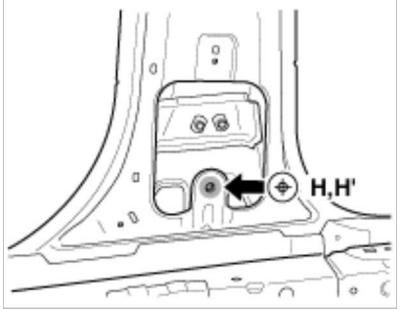
Interior A



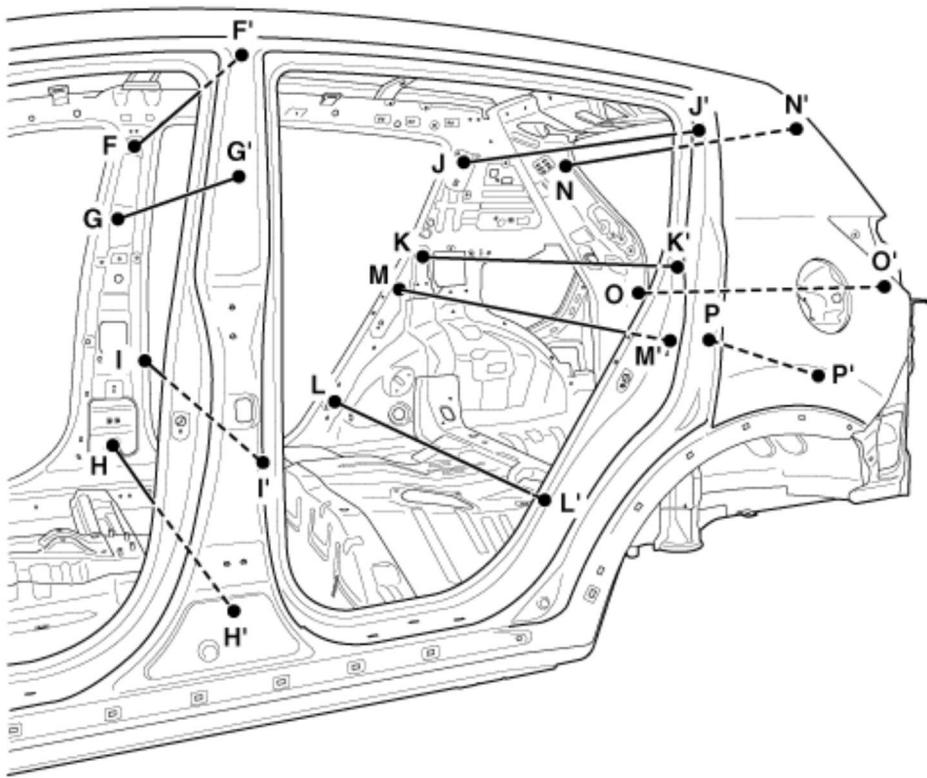
* These dimensions indicated in this figure are actual-measurement dimensions.

Point symbol	A-A'	B-B'	C-C'	D-D'	E-E'	F-F'	G-G'	H-H'
Length(mm)	1255	1380	1436	1532	1437	1250	1391	1412



		
Front door checker mounting hole (Ø13)	Cowl side trim mounting hole (Ø8.5)	Seatbelt height adjust upper mounting hole (Ø14.5)
		
Seatbelt height adjust lower mounting hole (Ø14.5)	Front seatbelt retractor mounting hole (Ø12.2)	

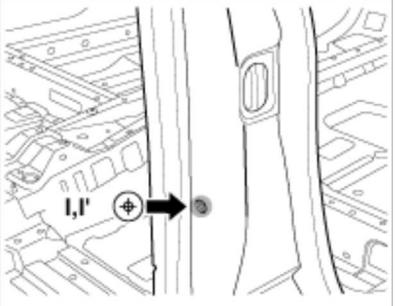
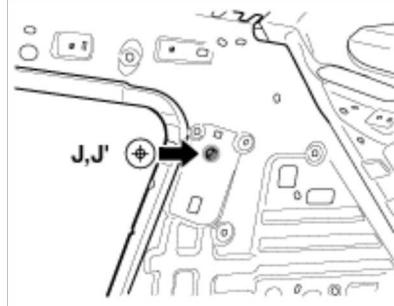
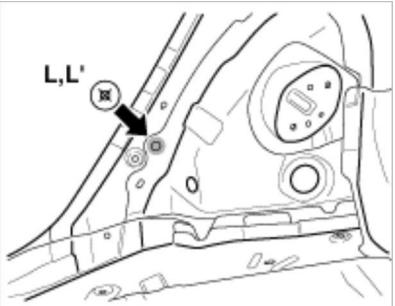
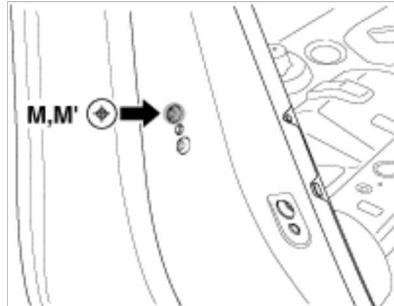
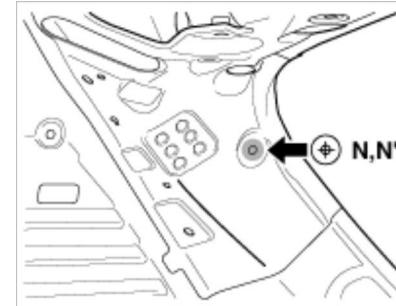
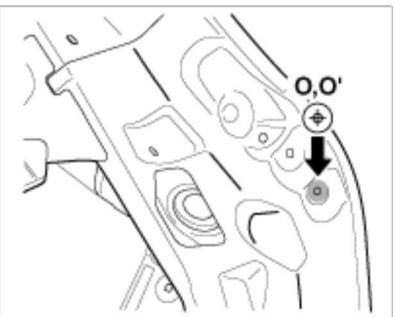
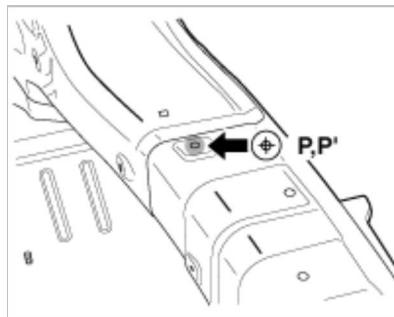
Interior B



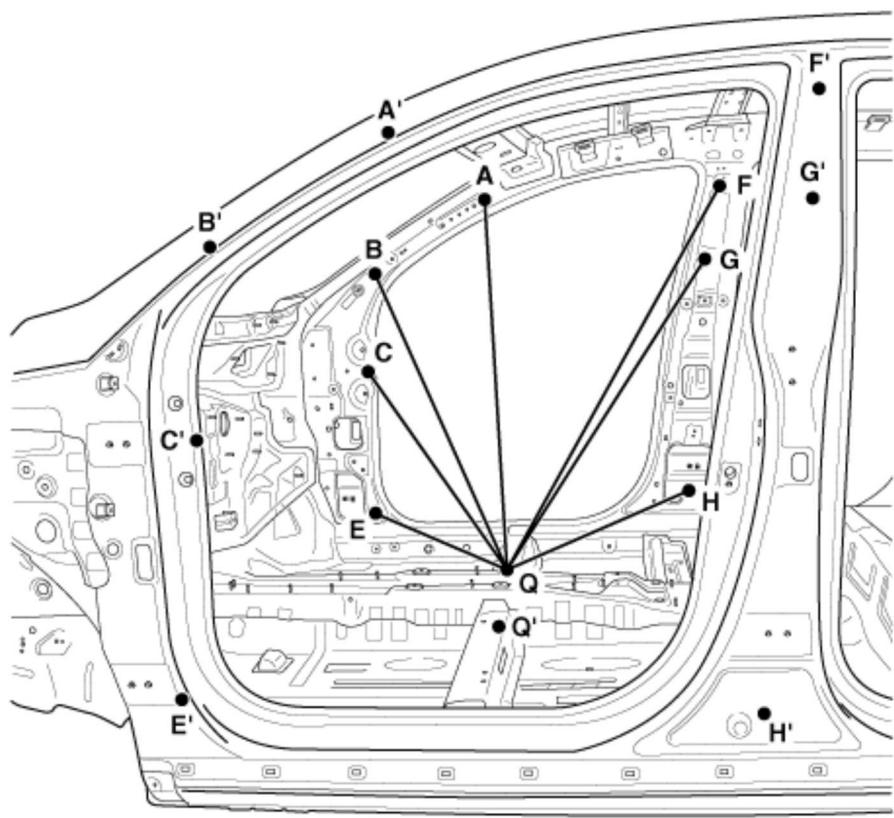
* These dimensions indicated in this figure are actual-measurement dimensions.

Point symbol	F-F'	G-G'	H-H'	I-I'	J-J'	K-K'	L-L'	M-M'
Length(mm)	1250	1391	1412	1540	1224	1376	1437	1525
Point symbol	N-N'	O-O'	P-P'					
Length(mm)	1130	1125	761					

Seatbelt height adjust upper mounting hole ($\varnothing 14.5$)	Seatbelt height adjust lower mounting hole ($\varnothing 14.5$)	Front seatbelt retractor mounting hole ($\varnothing 12.2$)

		
Rear door checker mounting hole (Ø13)	Rear seatbelt anchor mounting hole (Ø19)	Rear seat striker mounting hole (Ø9)
		
Wheel house panel tooling hole (Ø12)	Rear door striker mounting hole (Ø13)	Rear pillar trim mounting hole (Ø8.5)
		
Rear pillar trim mounting hole (Ø8.5)	Transverse rear trim mounting hole (Ø8.5)	

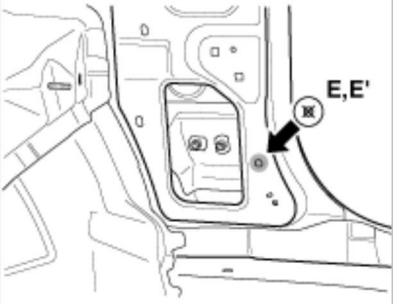
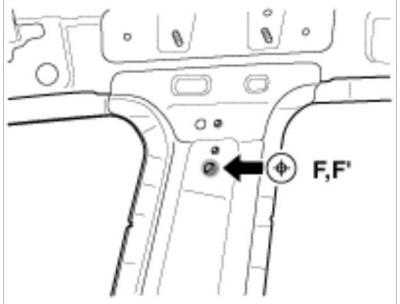
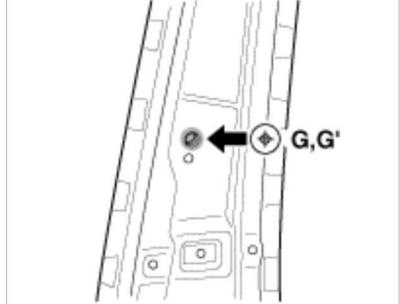
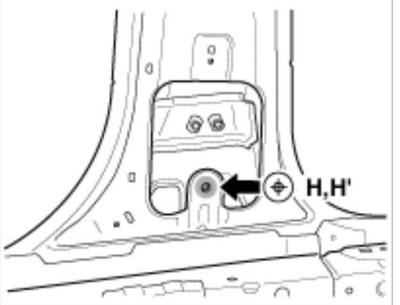
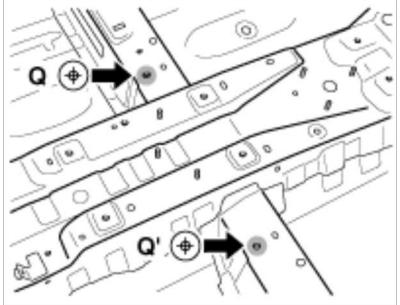
Interior C



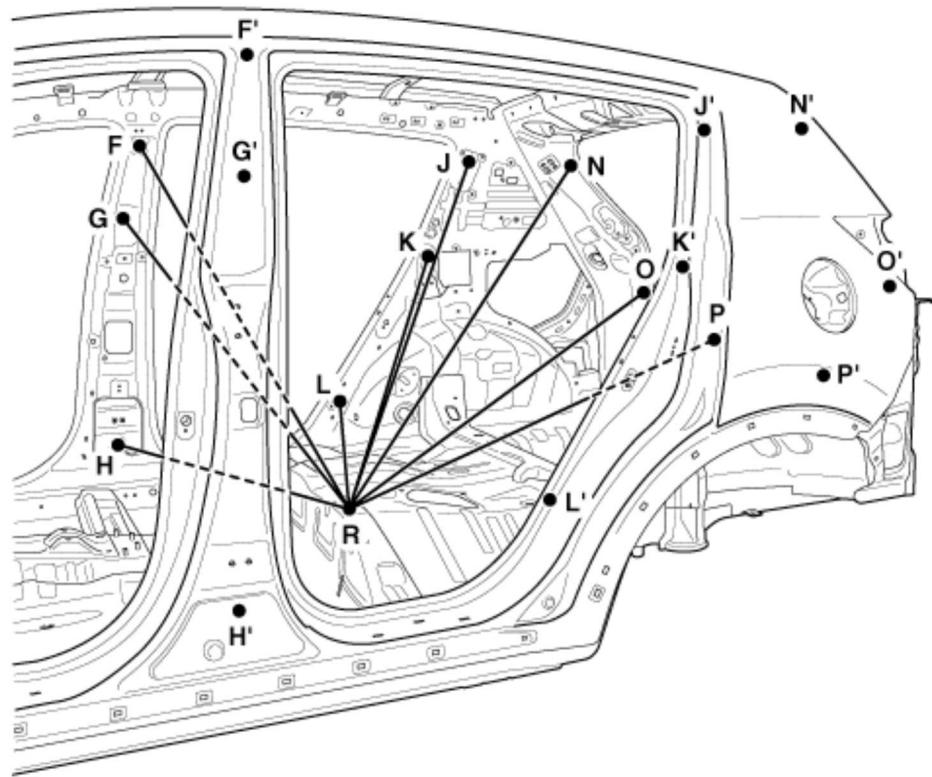
* These dimensions indicated in this figure are actual-measurement dimensions.

Point symbol	Q-A/Q'-A'	Q-B/Q'-B'	Q-C/Q'-C'	Q-E/Q'-E'	Q-F/Q'-F'	Q-G/Q'-G'	Q-H/Q'-H'	
Length(mm)	1089	1018	865	717	1257	1110	765	

Front pillar trim mounting hole ($\varnothing 8.5$)	Front pillar trim mounting hole ($\varnothing 7$)	Cowl crossbar mounting hole ($\varnothing 9$)

		
Cowl side trim mounting hole ($\varnothing 8.5$)	Seatbelt height adjust upper mounting hole ($\varnothing 14.5$)	Seatbelt height adjust lower mounting hole ($\varnothing 14.5$)
		
Front seatbelt retractor mounting hole ($\varnothing 12.2$)	Front seat mounting hole ($\varnothing 11$)	

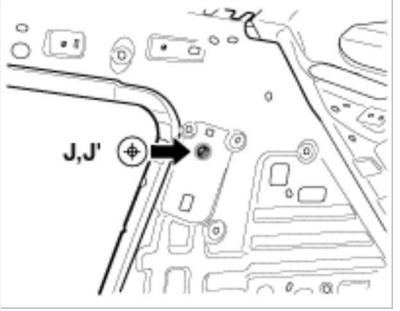
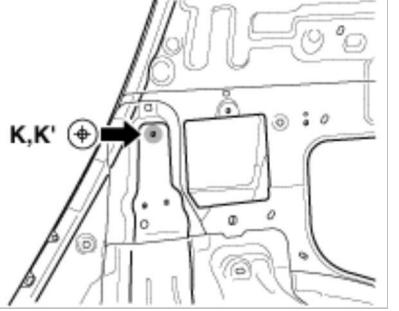
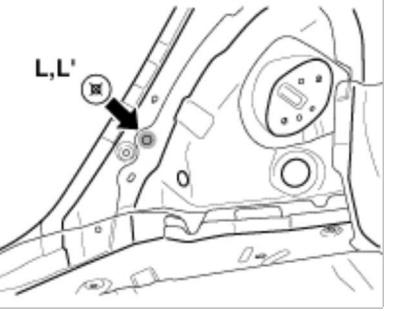
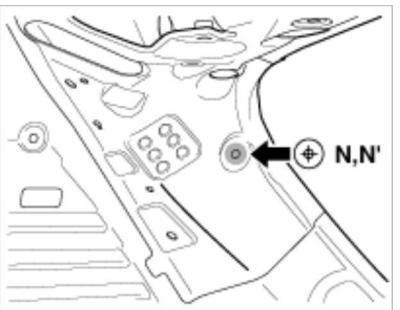
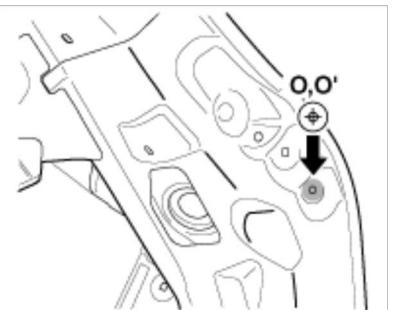
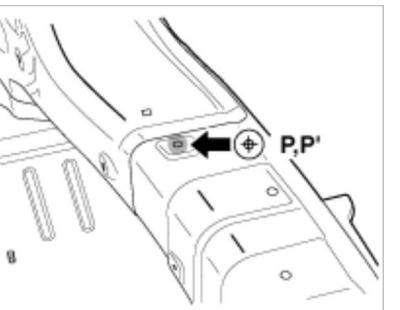
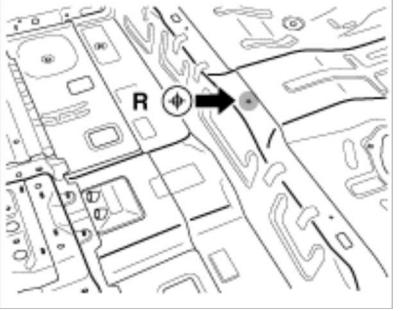
Interior D



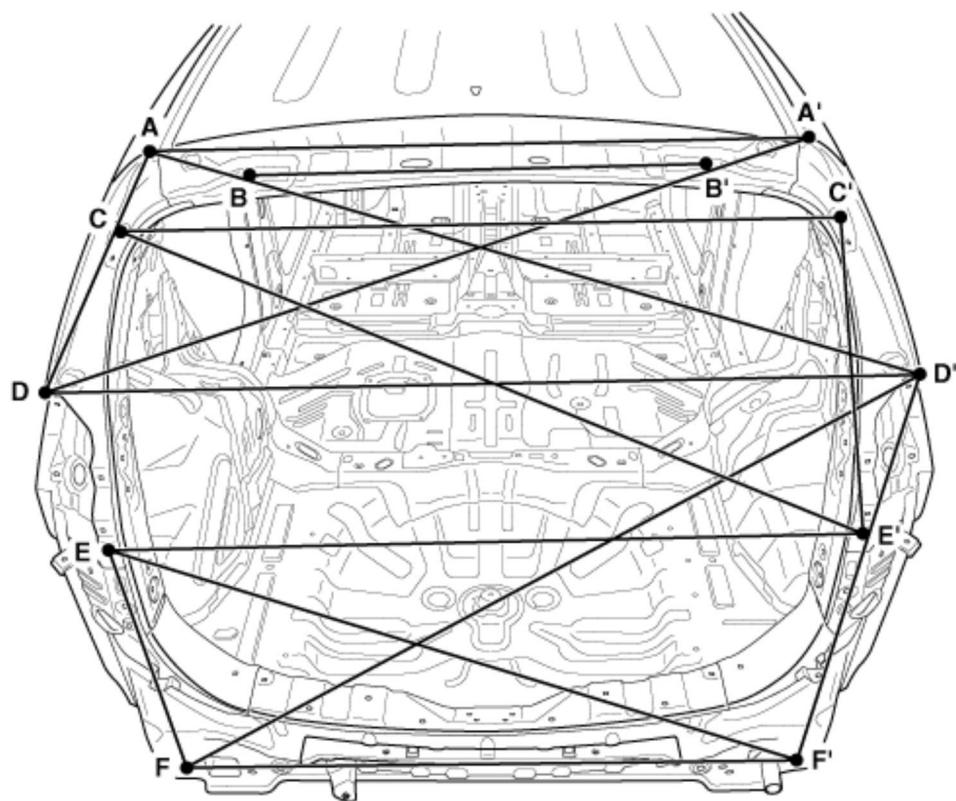
* These dimensions indicated in this figure are actual-measurement dimensions.

Point symbol	R-F/R-F'	R-G/R-G'	R-H/R-H'	R-J/R-J'	R-K/R-K'	R-L/R-L'	R-N/R-N'	R-O/R-O'
Length(mm)	1088	1002	803	1248	1052	792	1451	1535
Point symbol	R-P/R-P'							
Length(mm)	1487							

Seatbelt height adjust upper mounting hole ($\varnothing 14.5$)	Seatbelt height adjust lower mounting hole ($\varnothing 14.5$)	Front seatbelt retractor mounting hole ($\varnothing 12.2$)

		
Rear seatbelt anchor mounting hole ($\varnothing 19$)	Rear seat striker mounting hole ($\varnothing 9$)	Wheel house panel tooling hole ($\varnothing 12$)
		
Rear pillar trim mounting hole ($\varnothing 8.5$)	Rear pillar trim mounting hole ($\varnothing 8.5$)	Transverse rear trim mounting hole ($\varnothing 8.5$)
		
Rear floor panel tooling hole ($\varnothing 6$)		

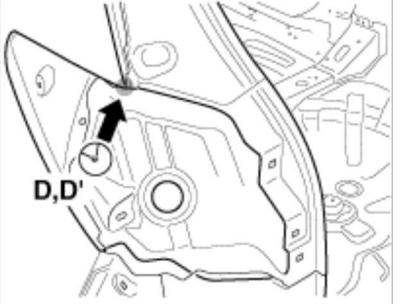
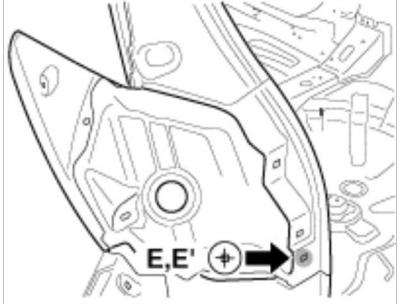
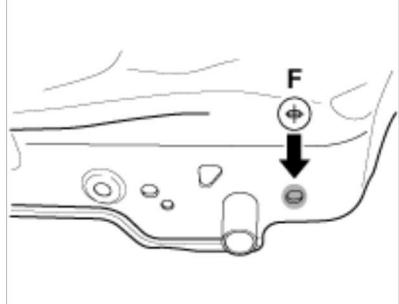
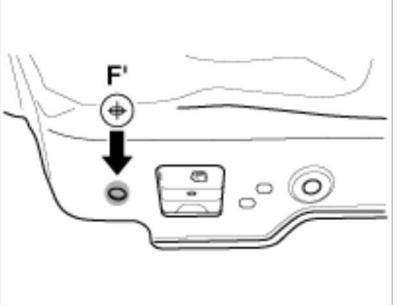
Body (Interior and Exterior) > Body Dimensions > Rear Body > Body Repair



* These dimensions indicated in this figure are actual-measurement dimensions.

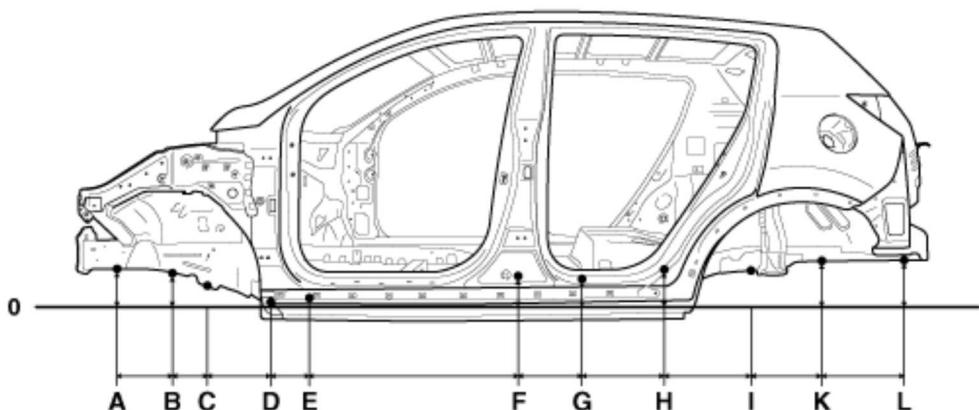
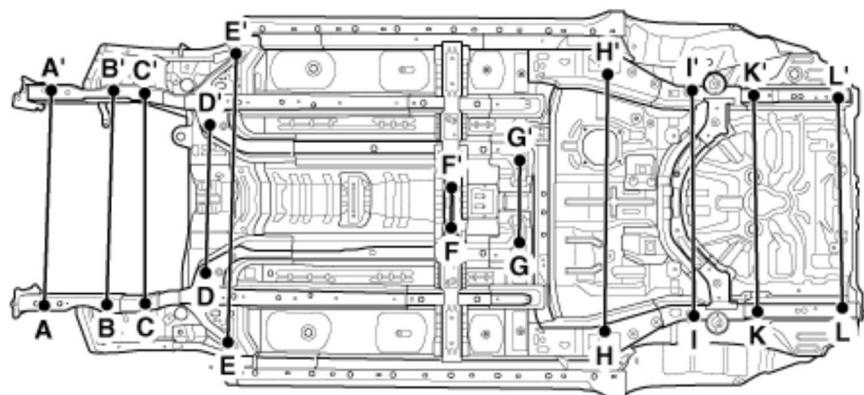
Point symbol	A-A'	A-D/A'-D'	A-D'/A'-D	B-B'	C-C'	C-E/C'-E'	C-E'/C'-E	D-D'
Length(mm)	1074	425	1304	730	1176	516	1290	1416
Point symbol	D-F/D'-F'	D-F'/D'-F	E-E'	E-F/E'-F'	E-F'/E'-F	F-F'		
Length(mm)	745	1472	1188	510	1270	1138		

Side outer panel rear corner	Tail gate hinge mounting hole ($\varnothing 12$)	Tail gate lifter mounting hole ($\varnothing 9$)

		
Side outer panel rear corner	Rear bumper mounting hole (8.5X8.5)	Rear bumper mounting hole (14X16)
		
Rear bumper mounting hole (14X16)		

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

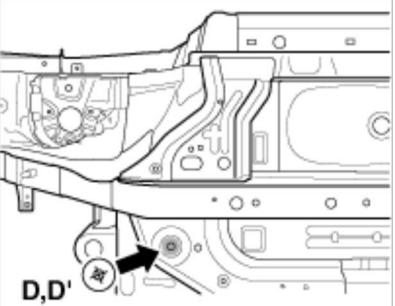
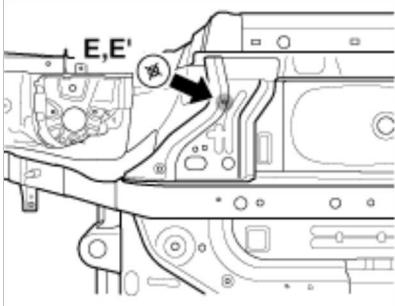
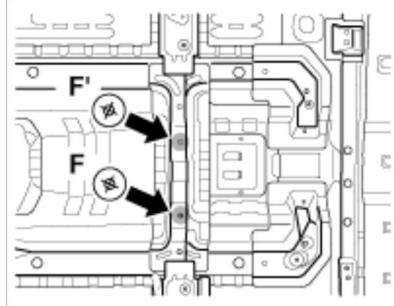
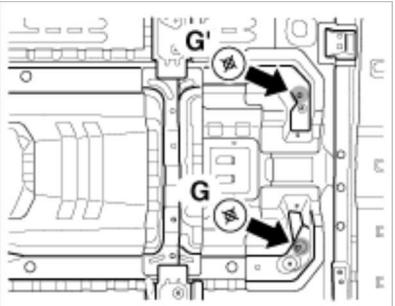
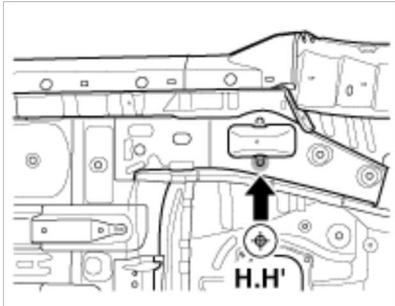
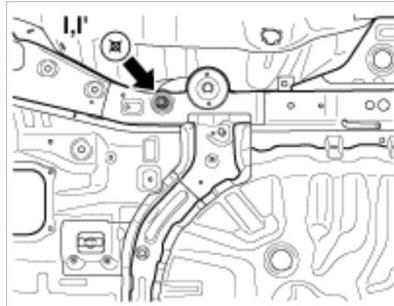
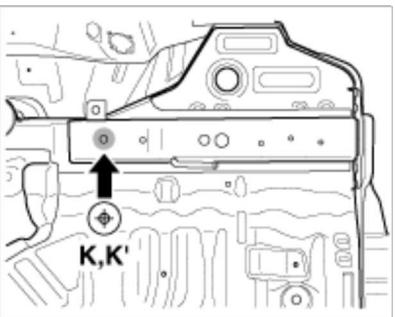
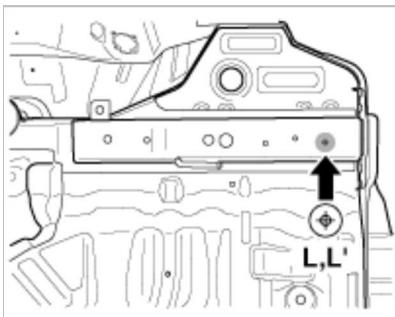
Projected Dimensions



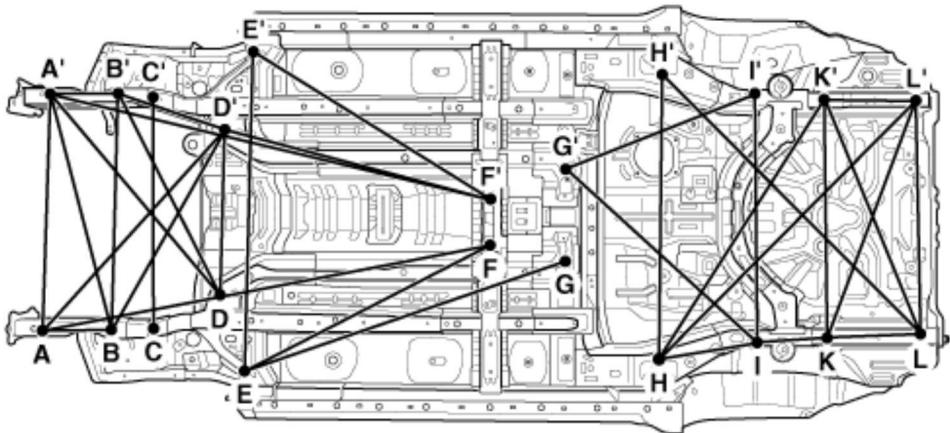
* These dimensions indicated in this figure are actual-measurement dimensions.

Point symbol	A-A'	B-B'	C-C'	D-D'	E-E'	F-F'	G-G'	H-H'
Length(mm)	1002	1002	944	650	1260	180	360	1147
Point symbol	I-I'	K-K'	L-L'	0-A	0-B/0-B'	0-D	0-E	0-F
Length(mm)	1023	1003	1003	163	163/156	-5	8	53
Point symbol	0-G	0-H	0-L	A-B/A'-B'	B-C	C-D	D-E	E-F
Length(mm)	38	91	171	306/307	209	314	102	963
Point symbol	F-G	G-H	H-I	I-L				
Length(mm)	299	387	412	726				

Front side member tooling hole ($\varnothing 6.5$)	Side cover mounting hole ($\varnothing 8$)	Front sub frame mounting hole ($\varnothing 17$)

		
Front sub frame mounting hole ($\varnothing 18$)	Front side member rear extension tooling hole ($\varnothing 8$)	Propeller shaft center bearing bracket hole ($\varnothing 14$)
		
Rear floor front reinforcement tooling hole ($\varnothing 10$)	Rear trailing arm mounting hole ($\varnothing 17$)	Rear suspension mounting hole ($\varnothing 28$)
		
Rear floor side member tooling hole ($\varnothing 14.5$)	Rear floor side member tooling hole ($\varnothing 15$)	

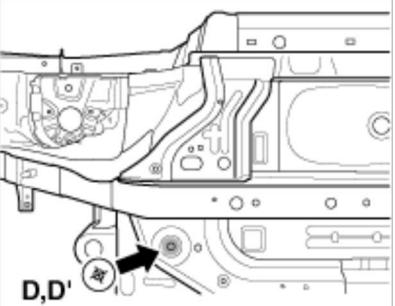
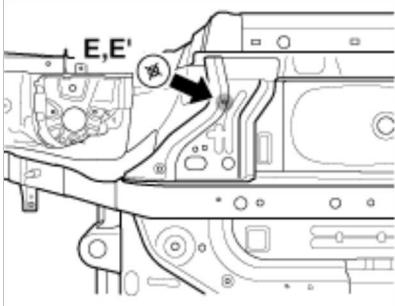
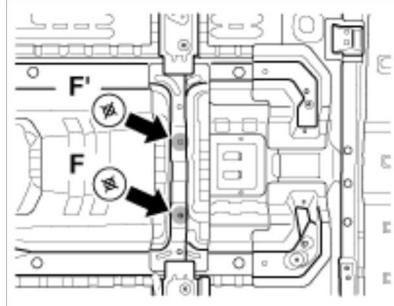
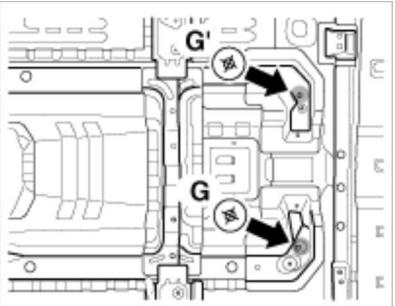
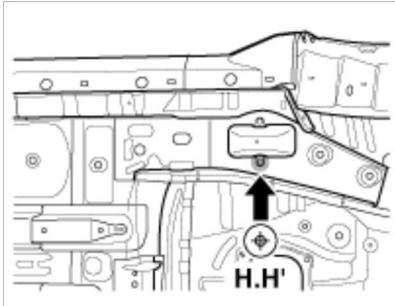
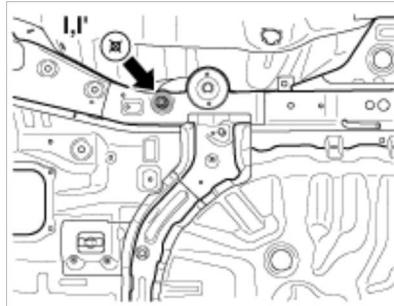
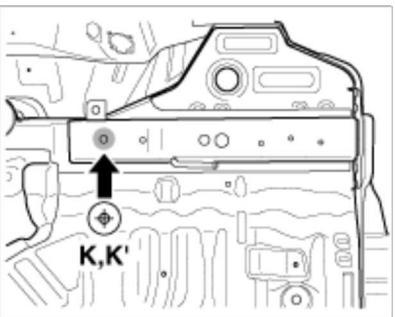
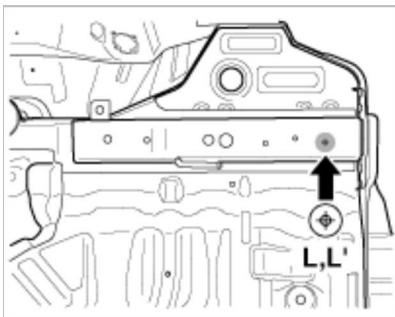
Actual-Measurement Dimensions



* These dimensions indicated in this figure are actual-measurement dimensions.

Point symbol	A-A'	A-B/A'-B'	A-B'/A'-B	A-D/A'-D'	A-D'/A'-D	B-B'	B-D/B'-D'	B-D'/B'-D
Length(mm)	1002	306	1048	863	1180	1002	576	989
Point symbol	C-C'	D-D'	D-F	D'-F'	E-E'	E-F	E'-F'	E-G/E'-G'
Length(mm)	944	650	1086	1098	1260	1091	1119	1339
Point symbol	G-I/G'-I'	G-I'/G'-I	H-H'	H-K/H'-K'	H-K'/H'-K	H-L'	H'-L	I-I'
Length(mm)	868	1059	1147	741	1304	1561	1575	1023
Point symbol	K-K'	K-L	K'-L'	K-L'	K'-L	L-L'		
Length(mm)	1004	406	406	1073	1092	1003		

A,A'	B,B'	C,C'
Front side member tooling hole ($\varnothing 6.5$)	Side cover mounting hole ($\varnothing 8$)	Front sub frame mounting hole ($\varnothing 17$)

		
Front sub frame mounting hole (Ø18)	Front side member rear extension tooling hole (Ø8)	Propeller shaft center bearing bracket hole (Ø14)
		
Rear floor front reinforcement tooling hole (Ø10)	Rear trailing arm mounting hole (Ø17)	Rear suspension mounting hole (Ø28)
		
Rear floor side member tooling hole (Ø14.5)	Rear floor side member tooling hole (Ø15)	

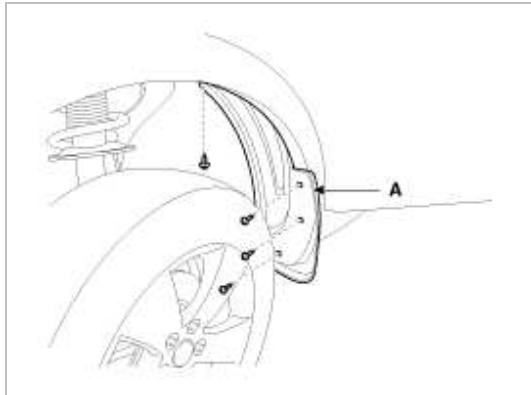
Body (Interior and Exterior) > Exterior > Fender > Repair procedures

Replacement

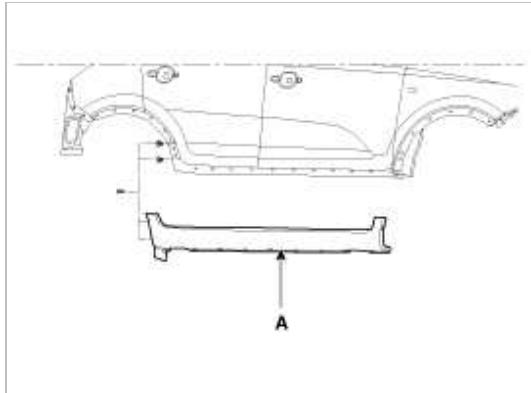
CAUTION

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

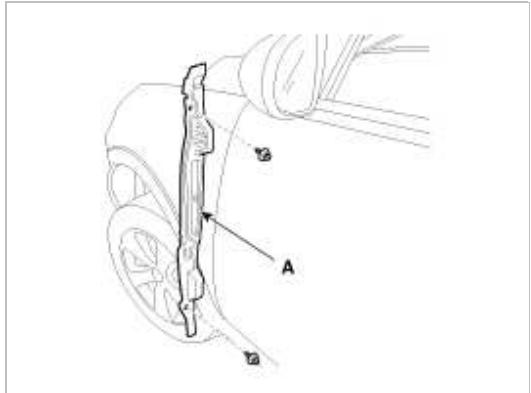
1. Remove the front bumper cover.
(Refer to the BD group – “Front bumper”)
2. Loosen the mud guard (A) mounting screws and clips.



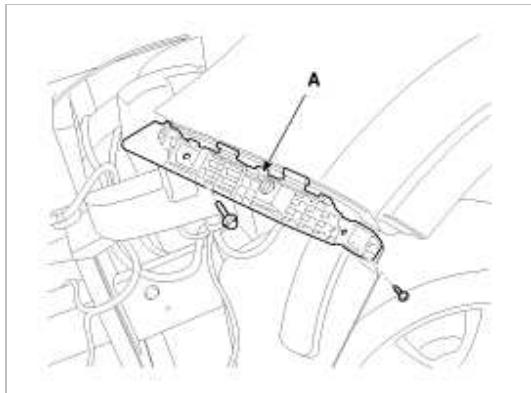
3. After loosening the mounting screws and clips, then remove the side sill molding (A).



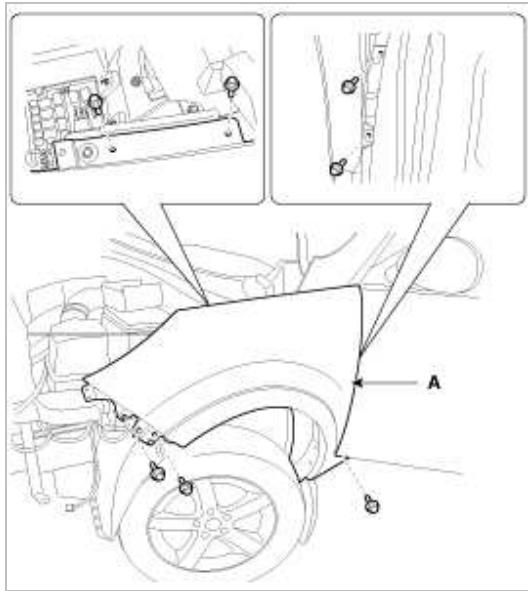
4. Detach the clips and then remove the insulator pad (A).



5. After loosening the mounting screw and bolt, then remove the front bumper side mounting bracket (A).



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



7. Installation is the reverse of removal.

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

Replacement

Hood Assembly Replacement

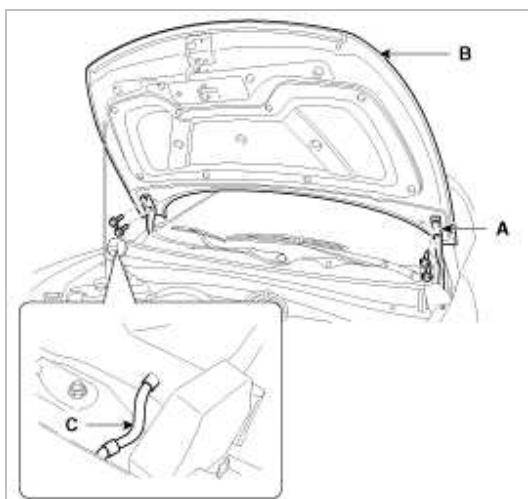
CAUTION

- When removing and installing the hood, an assistant is necessary.
- Take care not to damage the hood and body.

1. After loosening the hood hinge (A) mounting bolts, and then remove the hood (B).
2. Remove the washer nozzle hose (C).

Tightening torque :

21.6 ~ 26.5 N.m (2.2 ~ 2.7 kgf.m, 15.9 ~ 19.5 lb-ft)



3. Installation is the reverse of removal.

NOTE

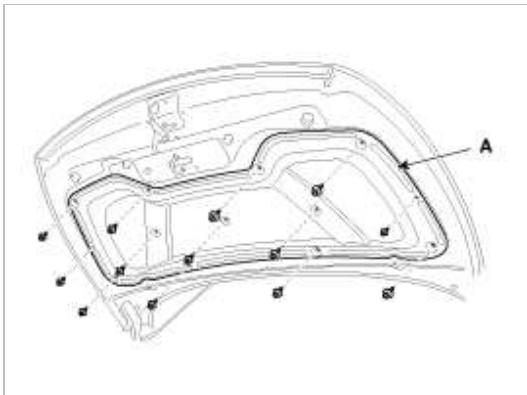
- Make sure the hood opens properly and locks securely.
- Adjust the hood alignment.

Hood Insulator Pad Replacement

1. Using a clip remover detach the clips, and remove the hood insulator pad (A).

CAUTION

- Take care not to scratch the hood panel.



2. Installation is the reverse of removal.

NOTE

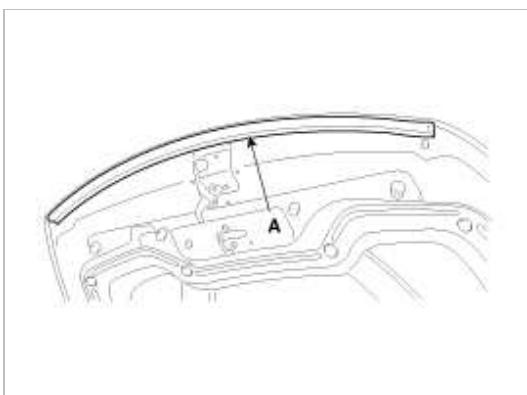
- Replace any damaged clips.

Hood Seal Weatherstrip Replacement

1. Detach the clips, then remove the hood seal weatherstrip (A).

CAUTION

- Be careful not to scratch the hood seal weatherstrip.



2. Installation is the reverse of removal.

NOTE

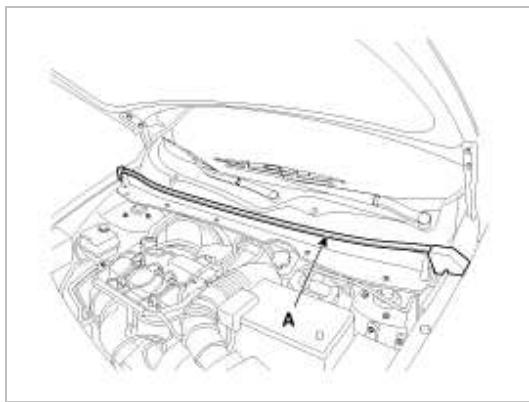
- Replace any damaged clips.

Hood Weatherstrip Replacement

1. Remove the hood weatherstrip (A).

CAUTION

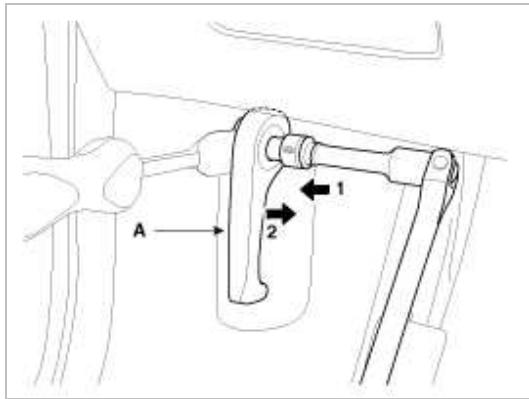
- Take care not to scratch the hood weatherstrip.



2. Installation is the reverse of removal.

Hood Release Handle Replacement

1. Remove the hood release handle (A).



2. Installation is the reverse of removal.

NOTE

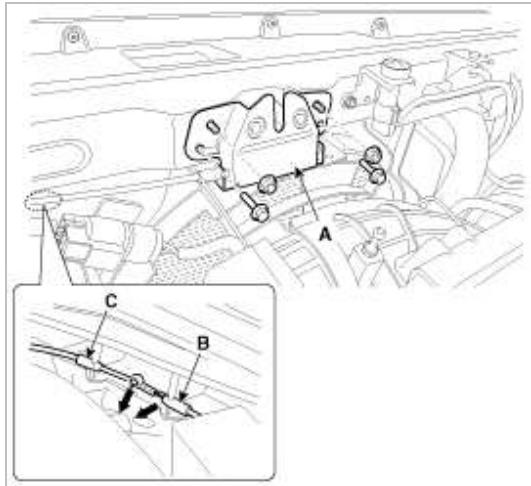
- Make sure the hood latch cable is connected properly.
- Make sure the hood locks securely.

Hood Latch Replacement

1. Remove the hood latch (A) mounting bolts and nuts.
2. Disconnect the hood latch cable (B) and hood release cable (C).

Tightening torque :

Bolts : 7.8 ~ 11.8 N.m (0.8 ~ 1.2 kgf.m, 5.8 ~ 8.7 lb-ft)
nuts : 6.9 ~ 10.8 N.m (0.7 ~ 1.1 kgf.m, 5.1 ~ 8.0 lb-ft)



3. Installation is the reverse of removal.

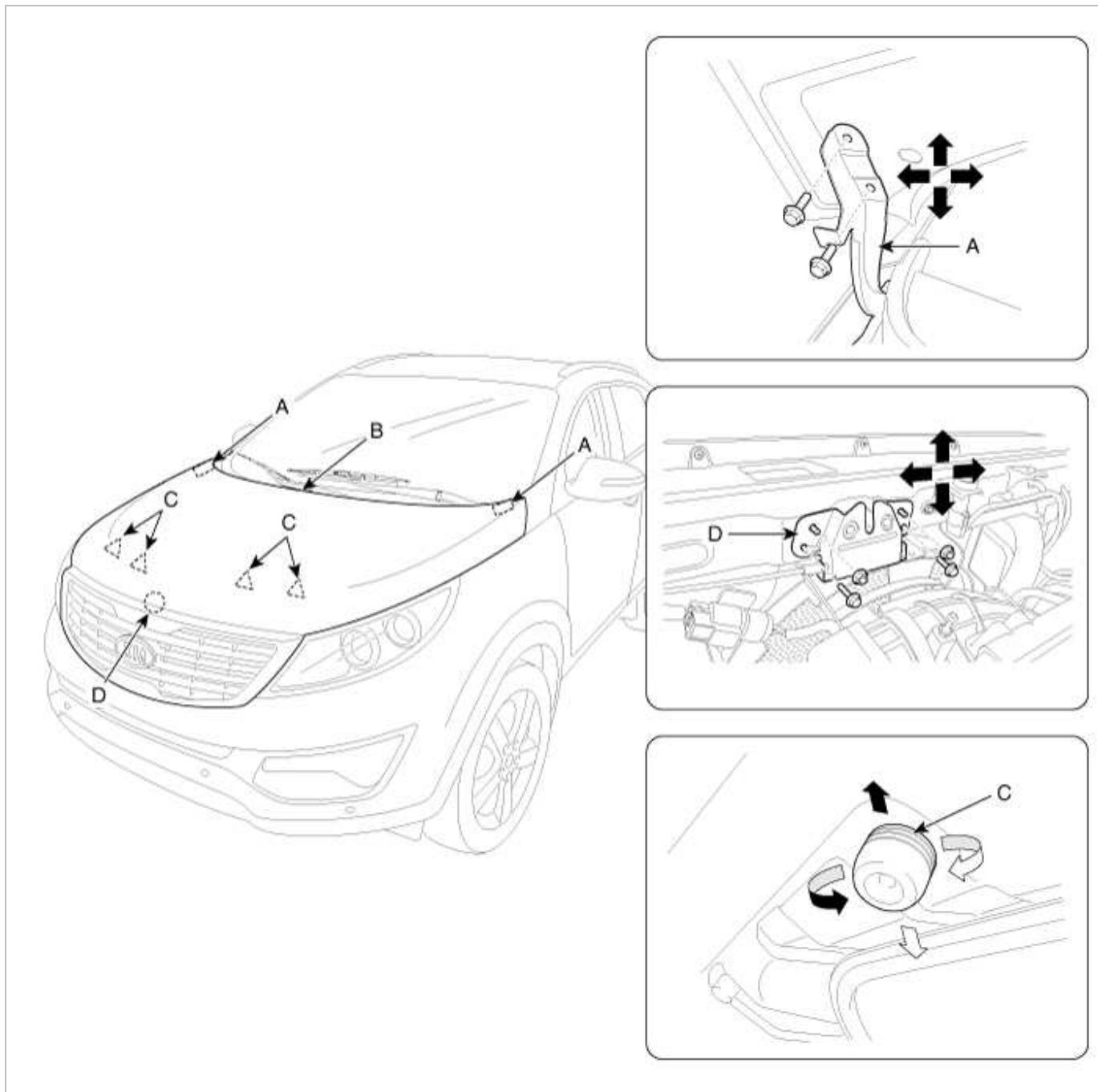
NOTE

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

Adjustment

Hood 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 over slam bumpers (C).
3. After loosening the hood latch (D) mounting bolts and nuts, adjust the latch by moving it up or down, or right or left.



Body (Interior and Exterior) > Exterior > Tail Gate > Repair procedures

Replacement

Tail Gate Trim Replacement

CAUTION

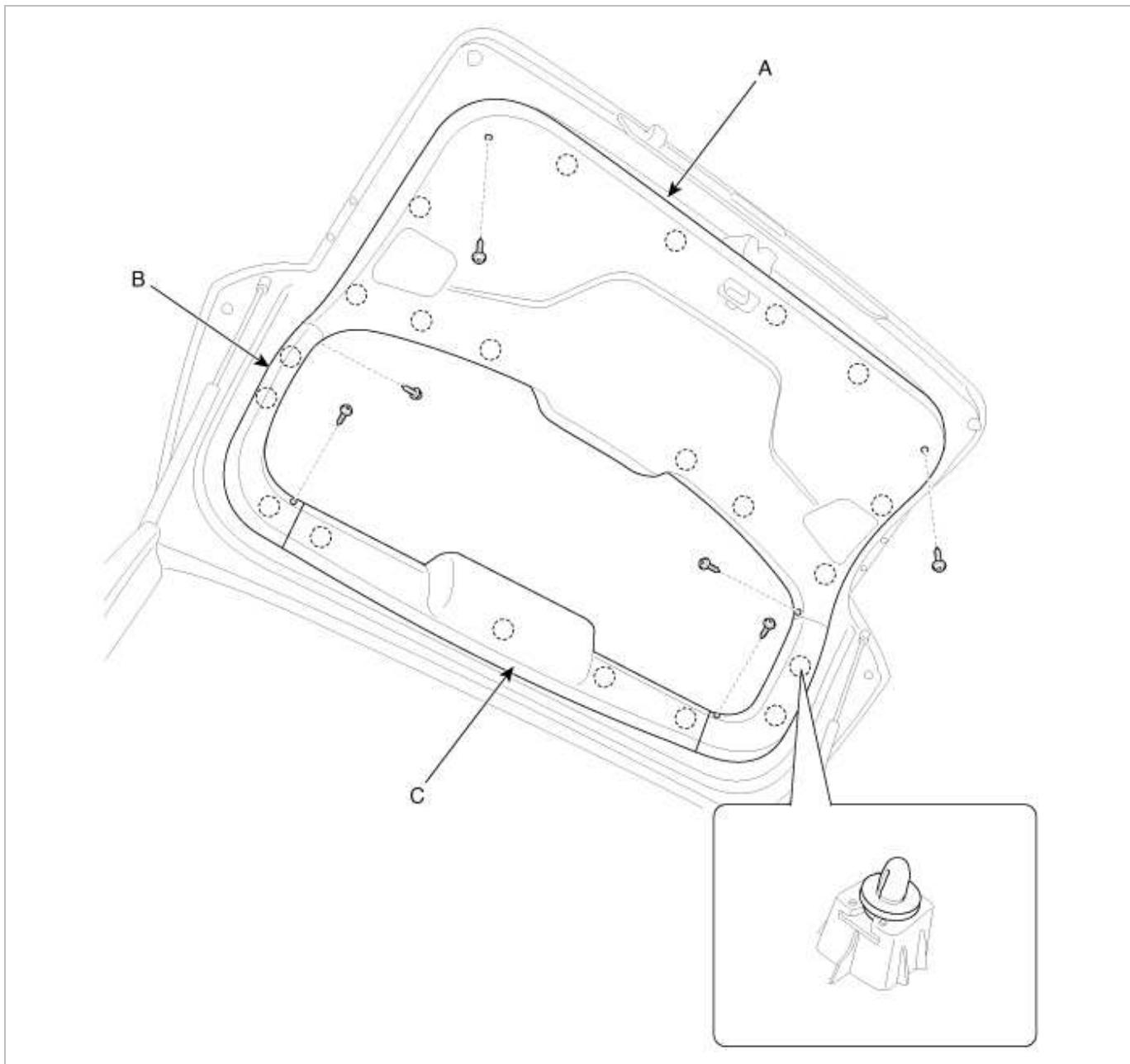
- When prying with a flat-tip screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.

1. Remove the upper trim (C).
2. After loosening the mounting screws, then remove the side trim (B) and tail gate trim (A).

NOTE

- Replace any damaged clips.

3. Installation is the reverse of removal.

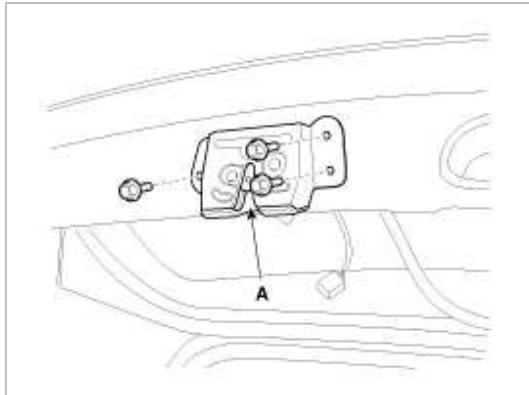


Tail Gate Latch Replacement

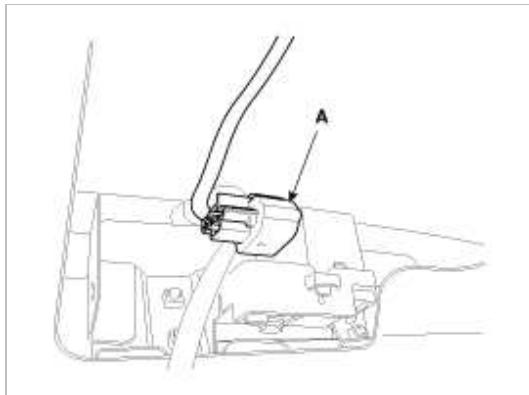
1. Remove the tail gate trim.
2. After loosening the mounting bolts, then remove the latch assembly (A).

Tightening torque :

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



3. Disconnect the tail gate latch connector (A).



4. Installation is the reverse of removal

NOTE

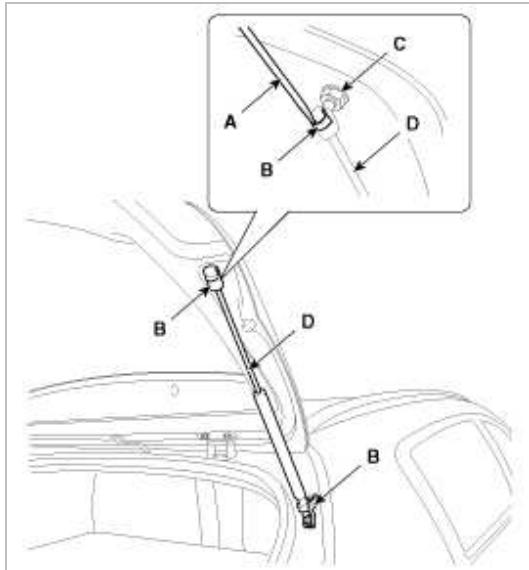
- Make sure the connector is connected properly and the connecting rod is connected properly.
- Make sure the tail gate opens properly and locks securely.

Tail Gate Lift Replacement

NOTE

- Take care not to be closed the tail gate, when removing the lift.

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



- Push the socket of the lifter into the bracket for installation.

NOTE

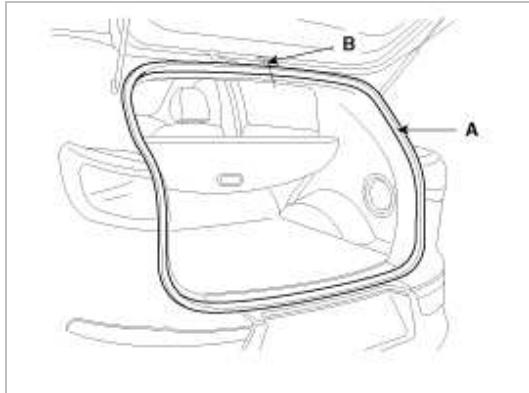
- Make sure the tail gate lock and opens properly and locks securely.

Tail Gate weatherstrip Replacement

CAUTION

- Do not apply sealant to the body.

- Remove the tail gate weatherstrip (A).



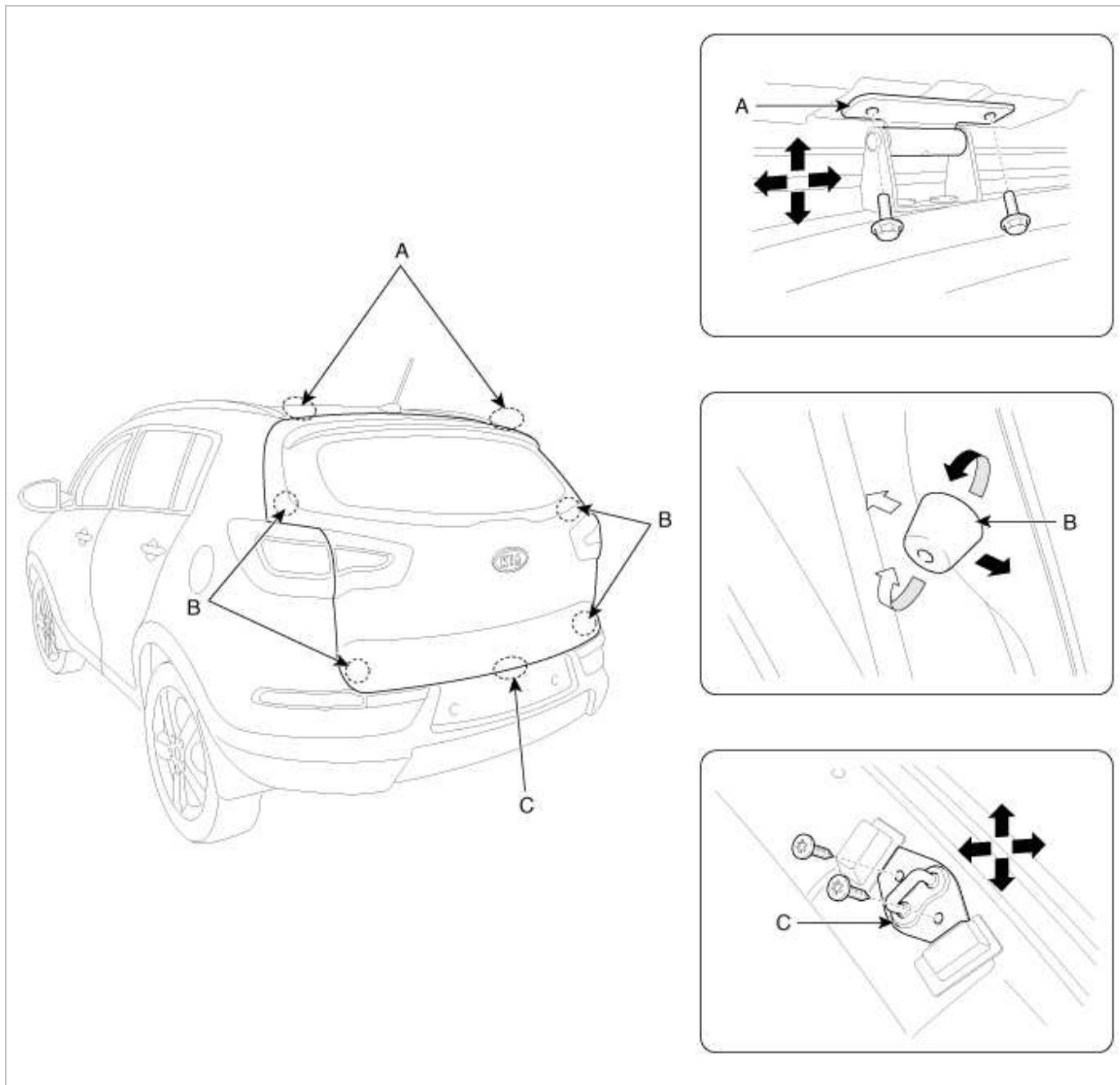
- Installation is the reverse of removal.

NOTE

- Install the weatherstrip aligned with center line (B).

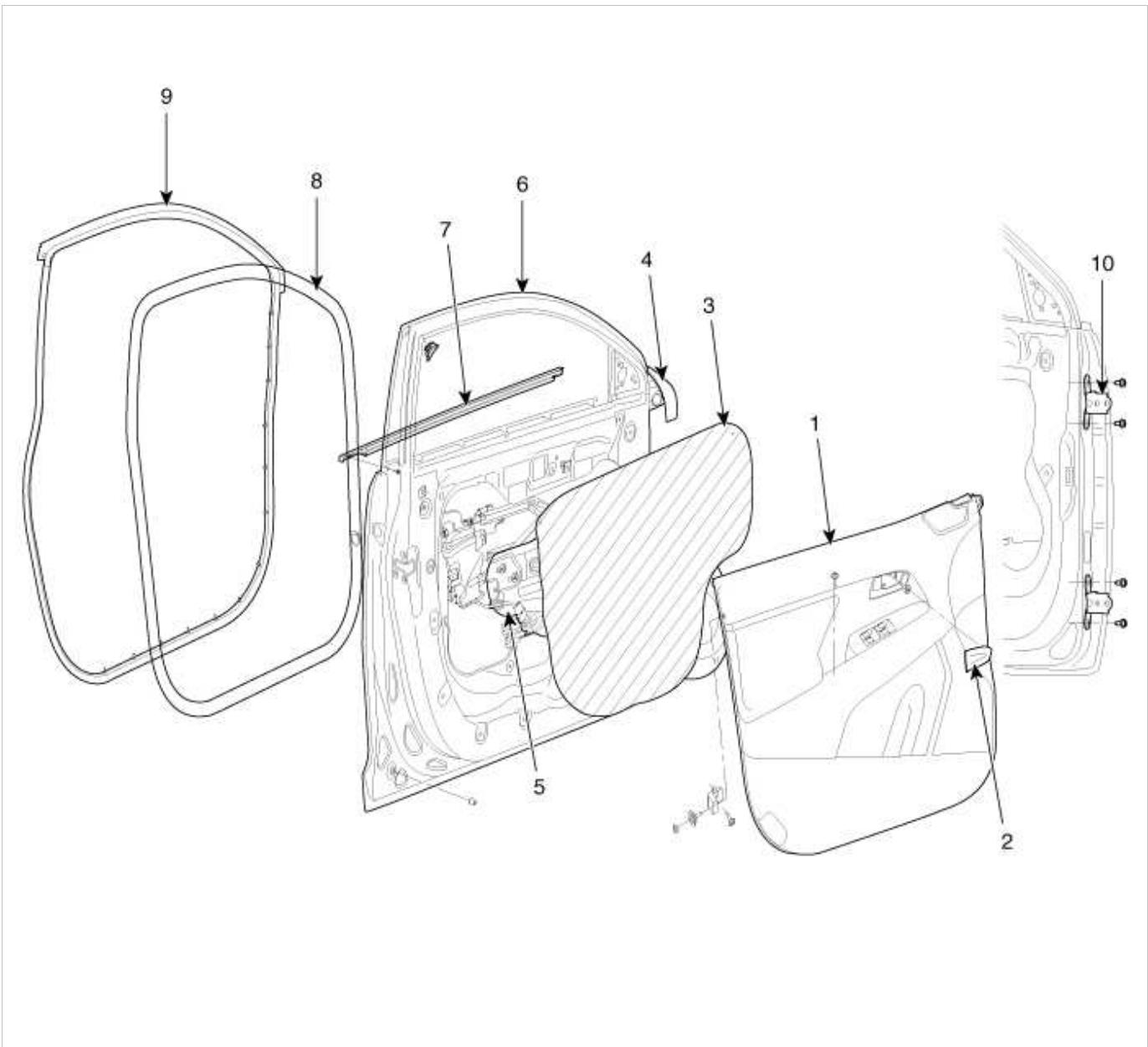
Adjustment

- After loosening the tail gate hinge (A) mounting bolt, adjust the tail gate by moving it up or down, or right or left.
- Adjust the tail gate height by turning the tail gate overslam bumpers (B).
- After loosening the tail gate striker (C) mounting bolts, adjust the tail gate striker by moving it up or down, or right or left.



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

Components



1. Front door trim	6. Front door panel
2. Front door inside handle cap	7. Front door belt outside molding
3. Front door trim seal	8. Front door body side weatherstrip
4. Front door quadrant inner cover	9. Front door side weatherstrip
5. Front door module	10. Front door hinge

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

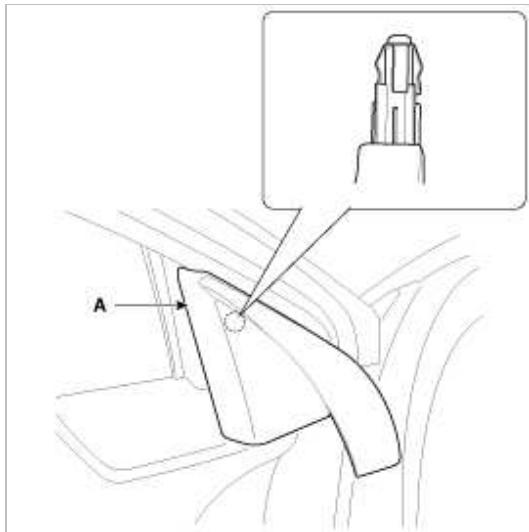
Replacement

Front Door Trim Replacement

CAUTION

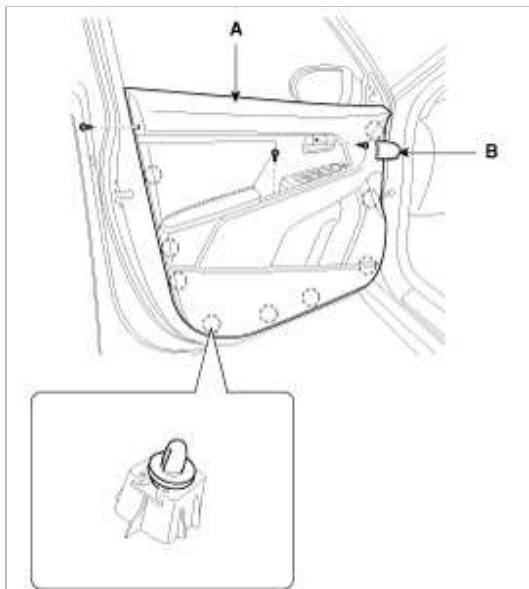
- Take care not to scratch the door trim and other parts.
- Put on gloves to protect your hands.

1. Using a screwdriver or remover, remove the front door quadrant inner cover (A).

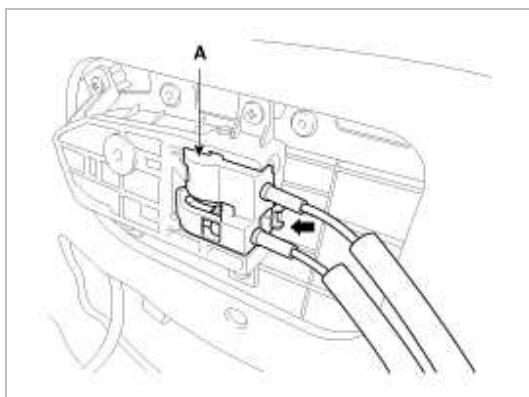


2. Using a screwdriver or remover, remove the front door inside handle cap (B).

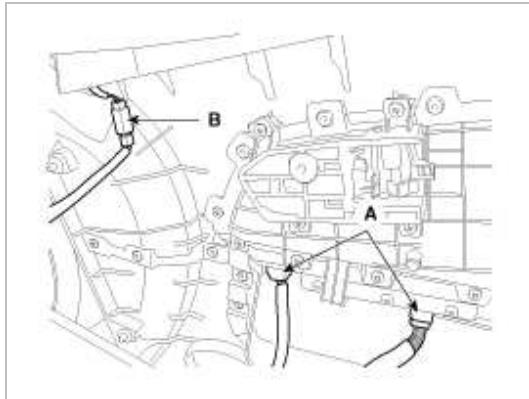
3. After loosening the mounting screws, then remove the front door trim (A).



4. Remove the inside handle cage (A).



5. Disconnect the power window connectors (A) and tweeter speaker connector (B).



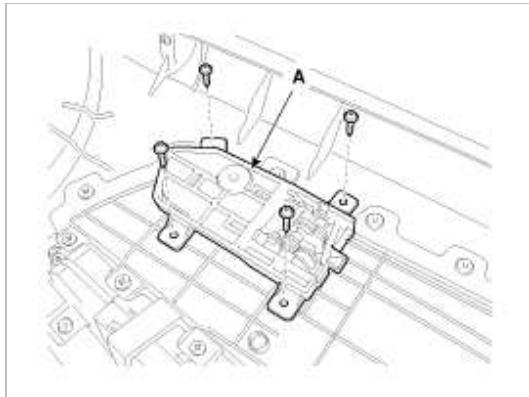
6. Installation is the reverse of removal.

NOTE

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

Inside Handle Replacement

1. Remove the front door trim.
2. After loosening the front door inside handle mounting screws, then remove the front door inside handle (A).



3. Installation is the reverse of removal.

NOTE

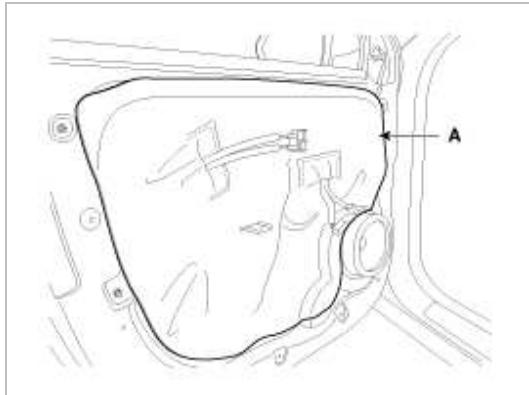
- Replace any damaged clips.
- Make sure the door lock and opens properly.

Glass Replacement

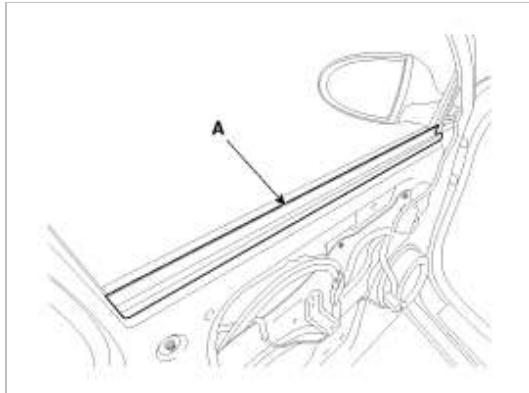
1. Remove the front door trim.
2. Remove the front door trim seal (A).

NOTE

- Replace any damaged door trim seal.



3. Remove the front door belt inner weatherstrip (A).



4. Remove the glass mounting hole plug.

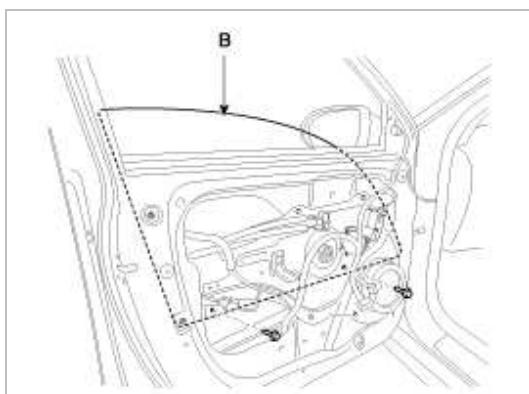
CAUTION

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

5. Carefully move the glass (B) 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 :

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



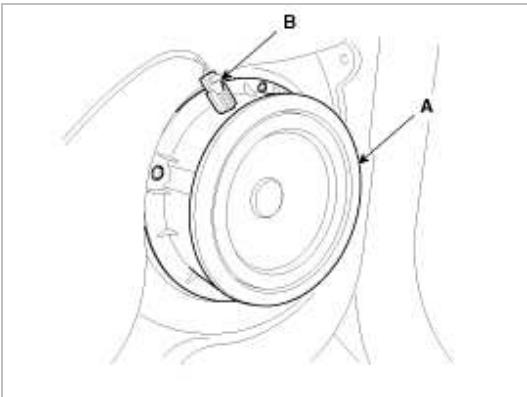
6. Installation is the reverse of removal.

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



4. Installation is the reverse of removal.

NOTE

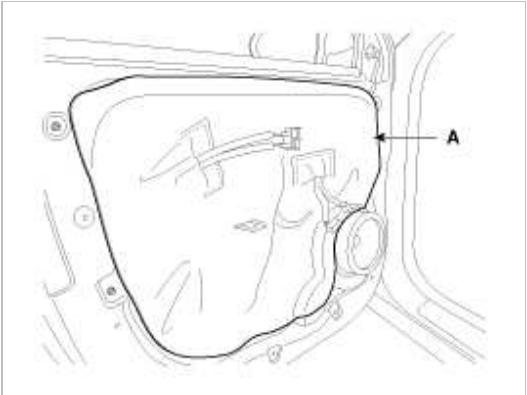
- Use sheet metal screws to secure the speaker.
- Make sure the connector are connected properly and each rod is connected securely.
- Make sure the door lock and opens properly.
- Replace any damaged clips.

Power Window Motor Replacement

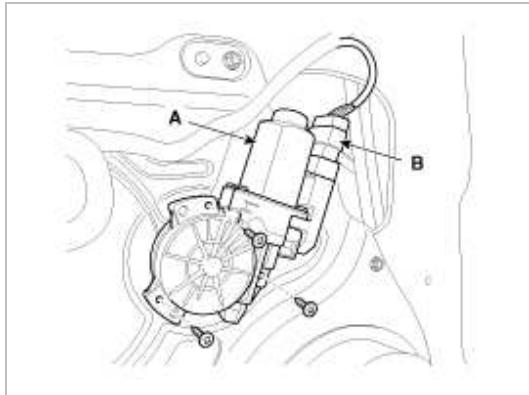
1. Remove the front door trim.
2. Remove the front door trim seal (A).

NOTE

- Replace any damaged door trim seal.



3. Disconnect the connector (B).
4. After loosening the mounting screws, then remove the power window motor (A).



5. 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.
- Replace any damaged clips.
- Make sure the door lock and opens properly.

Door Module Assembly Replacement

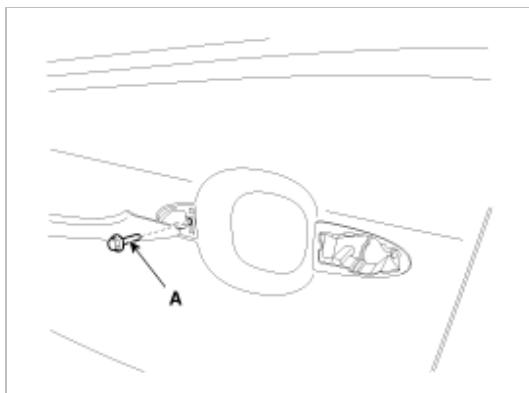
1. Remove the following parts.

- A. Front door trim.
- B. Front door trim seal.
- C. Window glass.
- D. Outside handle.

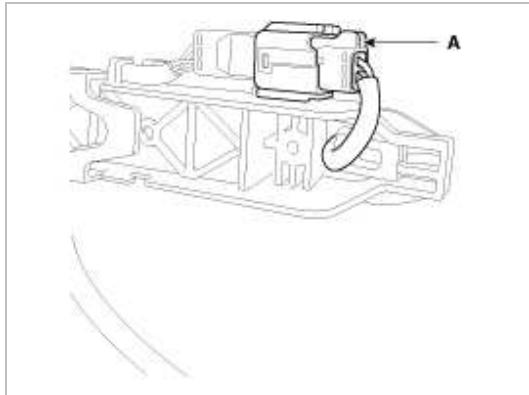
2. Loosen the mounting bolt (A).

Tightening torque :

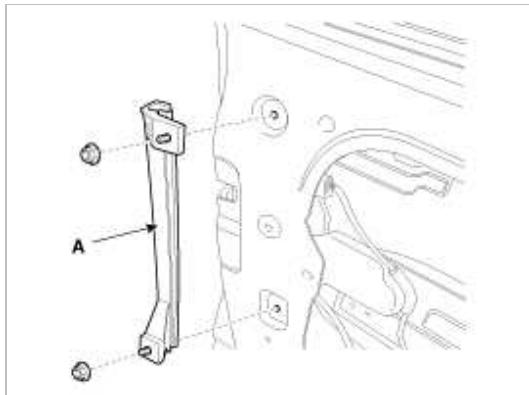
6.9 ~ 10.8 N.m (0.7 ~ 1.1 kgf.m, 5.1 ~ 8.0 lb-ft)



3. Disconnect the outside handle connector (A).



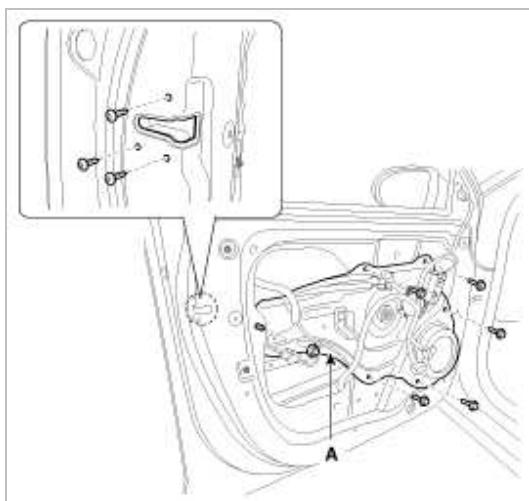
4. After loosening the mounting nuts, then remove the front door channel (A).



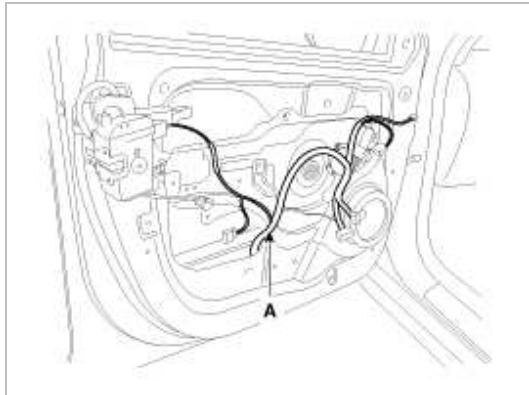
5. After loosening the mounting bolts and nut, then remove the front door module (A).

Tightening torque :

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



6. Disconnect the connectors and front door module wiring harness (A).



7. Installation is the reverse of removal.

NOTE

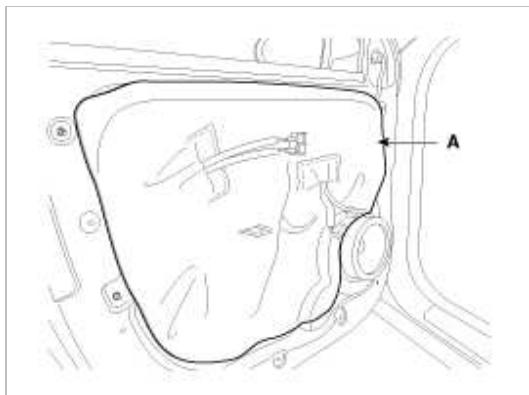
- The area of whole parts should be applied with sufficient grease.
- Make sure the connector is plugged in properly and each rod is connected securely.
- Make sure the door lock and open properly.
- Replace any damaged clips.

Outside Handle Replacement

1. Remove the front door trim.
2. Remove the front door trim seal (A).

NOTE

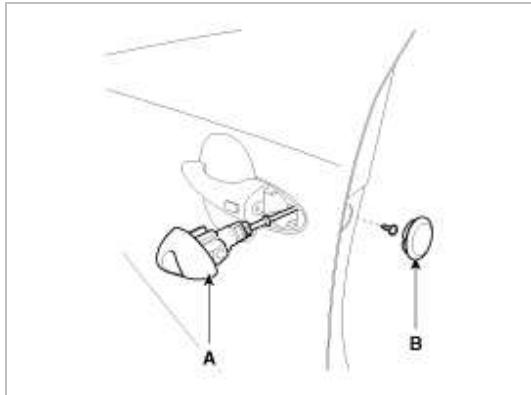
- Replace any damaged door trim seal.



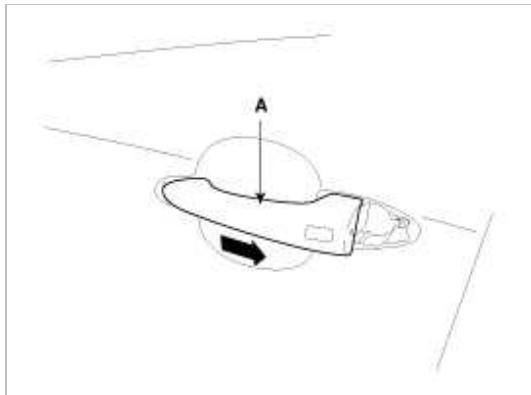
3. Remove the hole plug (B).
4. After loosening the mounting bolt, then remove the outside handle cover (A).

Tightening torque :

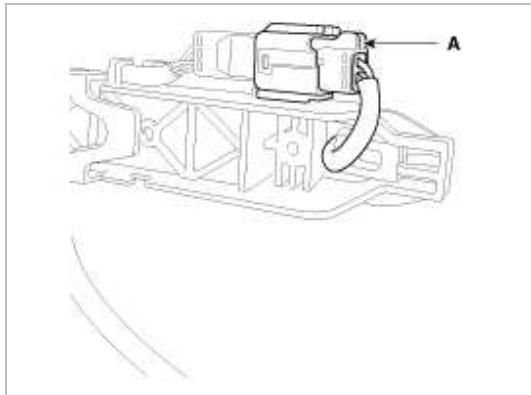
6.9 ~ 10.8 N.m (0.7 ~ 1.1 kgf.m, 5.1 ~ 8.0 lb-ft)



5. Remove the outside handle (A) by sliding it rearward.



6. Disconnect the outside handle connector (A).



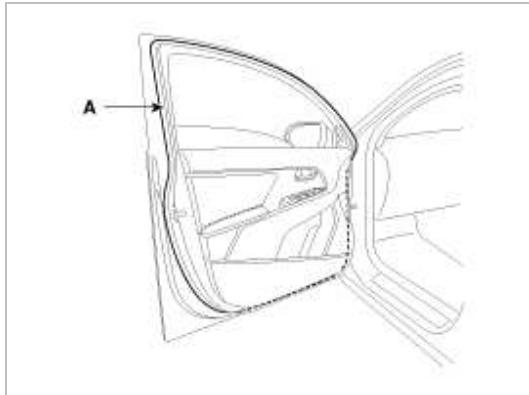
7. Installation is the reverse the removal.

NOTE

- Make sure the door lock and open properly.

Door Weatherstrip Replacement

1. Detach the clips, then remove the front door side weatherstrip(A).



2. Installation is the reverse of removal.

NOTE

- Replace any damaged clips.

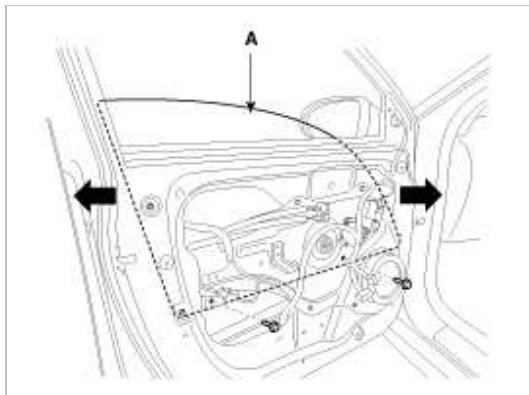
Adjustment

Glass Adjustment

NOTE

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

1. Remove the front door trim.
2. Remove the front door trim seal.
3. Carefully move the glass (A) until you can see the glass mounting bolts, then loosen them.



4. Check that the glass moves smoothly.

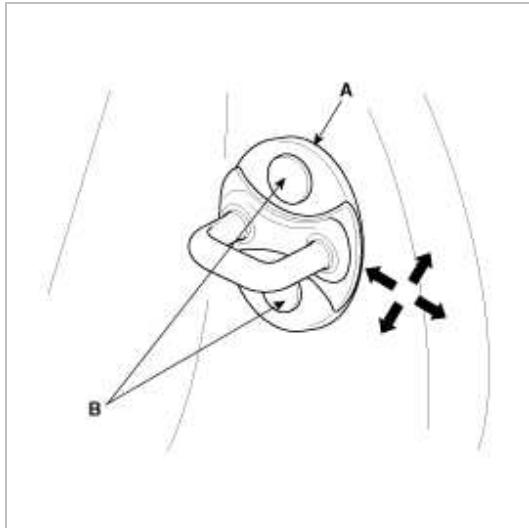
Door Striker Adjustment

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

1. Loosen the screws (B) just enough for the striker to move.

Tightening torque:

(B): 16.7 ~ 21.6 N.m (1.7 ~ 2.2 kgf.m, 12.3 ~ 15.9 lb-ft)



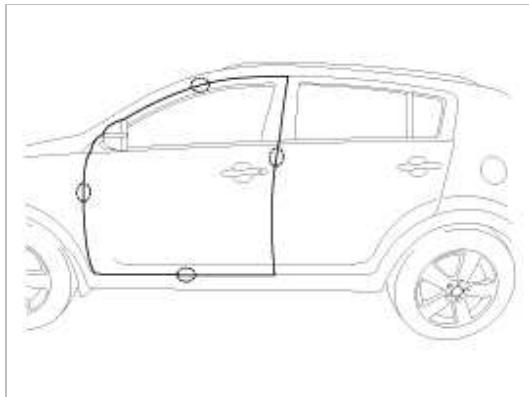
2. Tap on the striker with a plastic hammer to adjust the striker. The striker will not move much, but will give some adjustment.
3. Hold the outer handle out, and push the door against the body to be sure the striker allows a flush fit. If the door latches properly, tighten the screws and recheck.

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.

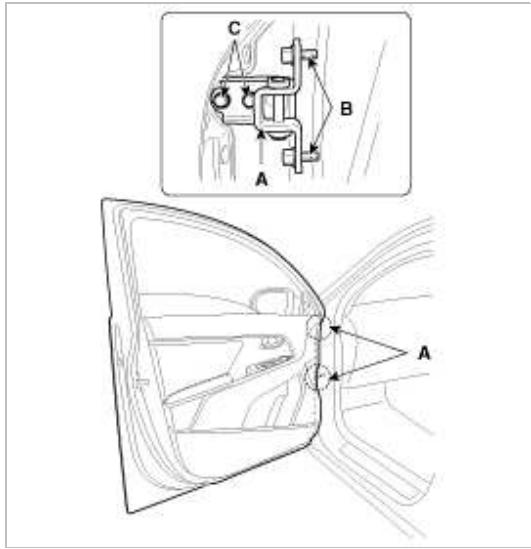
1. Check that the door and body edges are parallel.



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 :

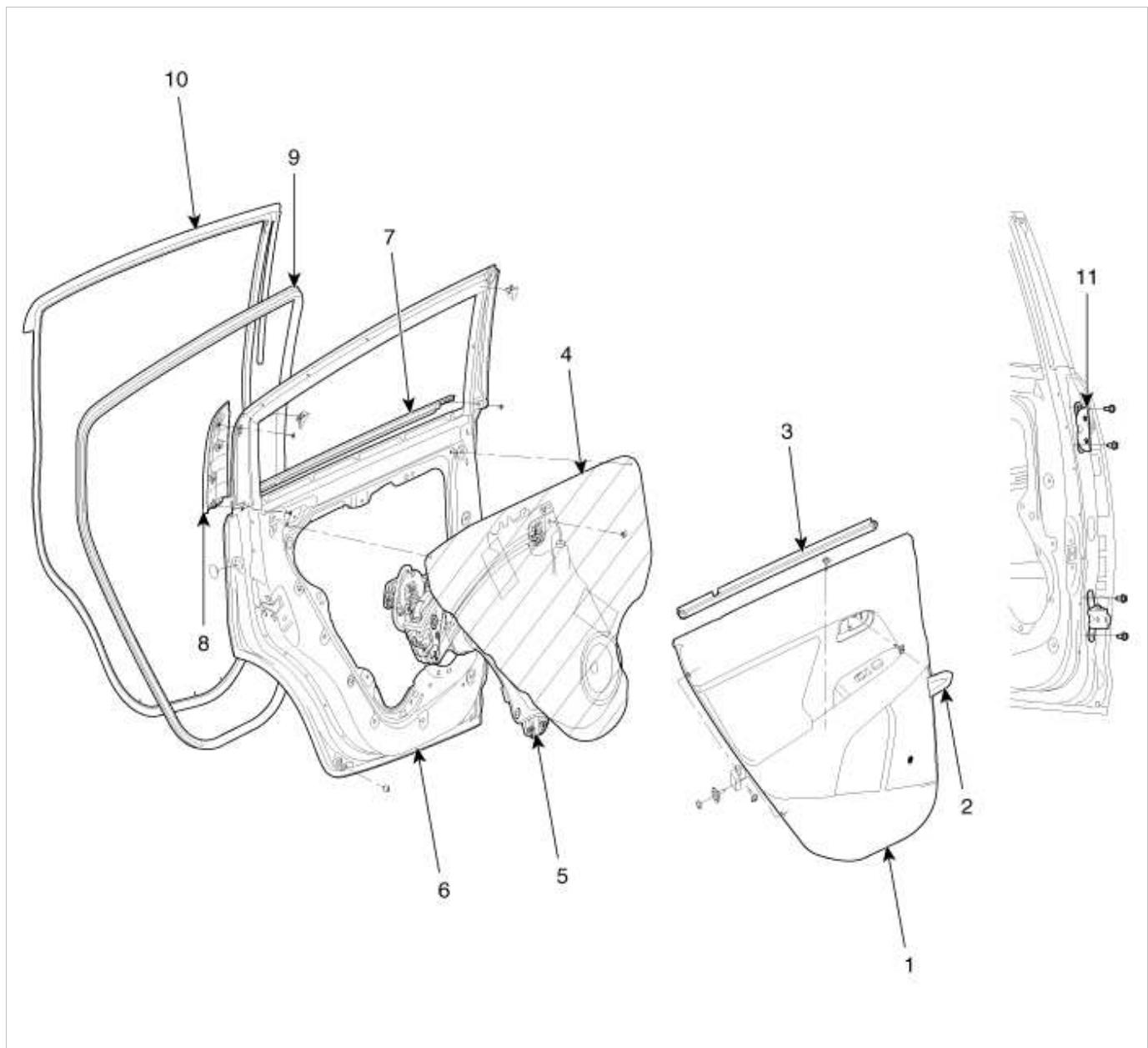
- (B) : 21.6 ~ 26.5 N.m (2.2 ~ 2.7 kgf.m, 15.9 ~ 19.5 lb-ft)
(C) : 34.3 ~ 41.2 N.m (3.5 ~ 4.2 kgf.m, 25.3 ~ 30.4 lb-ft)



4. Grease the pivot portions of the hinges indicated.
5. Check for water leaks.

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

Components



1. Rear door trim 2. Rear door inside handle cap 3. Rear door belt inside weatherstrip 4. Rear door trim seal 5. Rear door module 6. Rear door panel	7. Rear door belt weatherstrip 8. Rear door frame garnish 9. Rear door body side weatherstrip 10. Rear door side weatherstrip 11. Rear door hinge
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Body (Interior and Exterior) > Exterior > Rear Door > Repair procedures

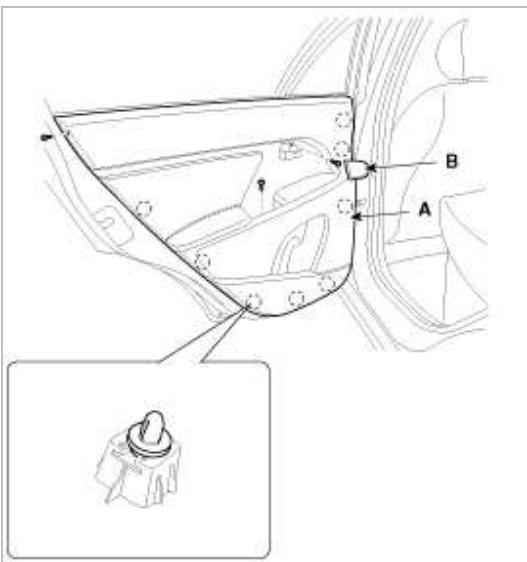
Replacement

Door Trim Replacement

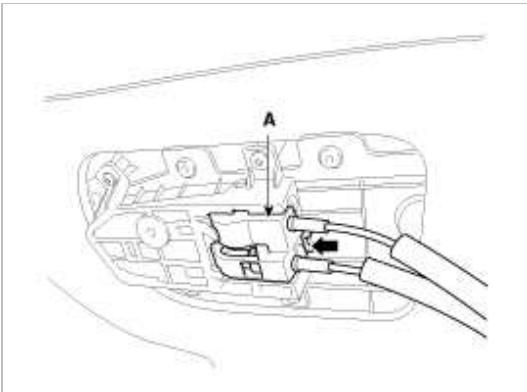
CAUTION

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

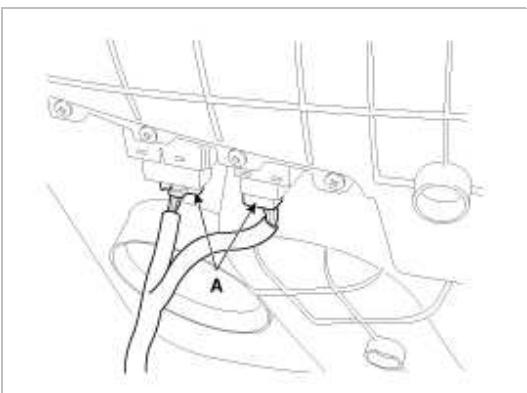
1. Using a screwdriver or remover, remove the rear door inside handle cap (B).
2. After loosening the mounting screws, then remove the rear door trim (A).



3. Remove the inside handle cage (A).



4. Disconnect the power window connectors (A).



5. Installation is the reverse of removal.

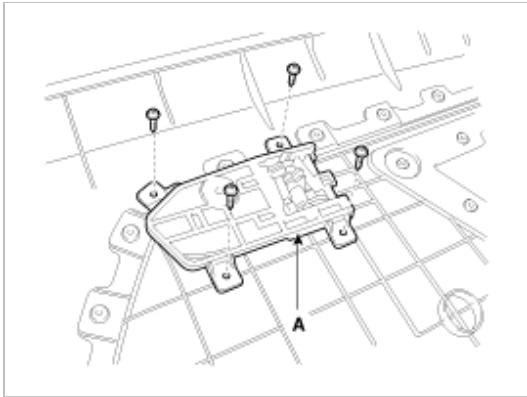
NOTE

- Make sure connectors are connected properly and each rod is connected securely.
- Make sure the door lock and opens properly.
- Replace any damaged clips.

Inside Handle Replacement

1. Remove the rear door trim.

2. After loosening the rear door inside handle mounting screws, then remove the rear door inside handle (A).



3. Installation is the reverse of removal.

NOTE

- Replace any damaged clips.
- Make sure the door lock and opens properly.

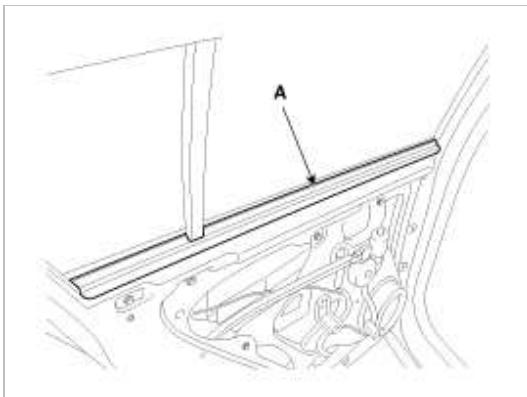
Glass Replacement

CAUTION

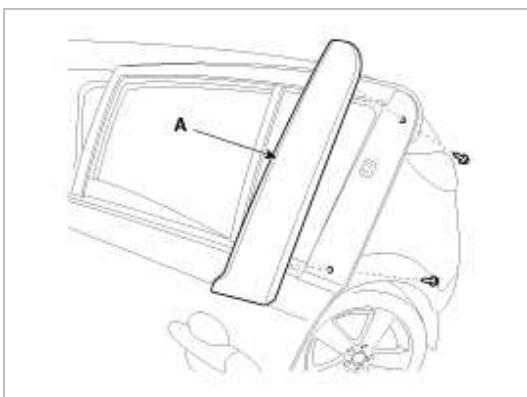
- Put on gloves to protect your hands.

1. Remove the rear door trim.

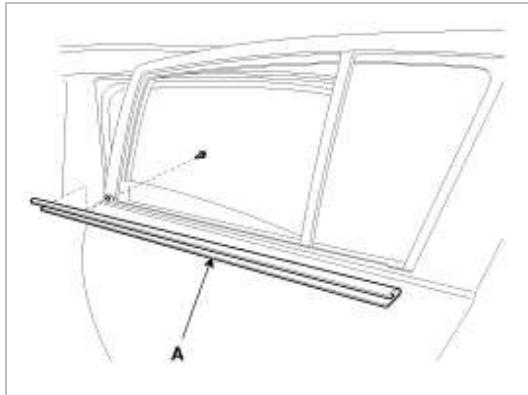
2. Remove the rear door belt inside weatherstrip (A).



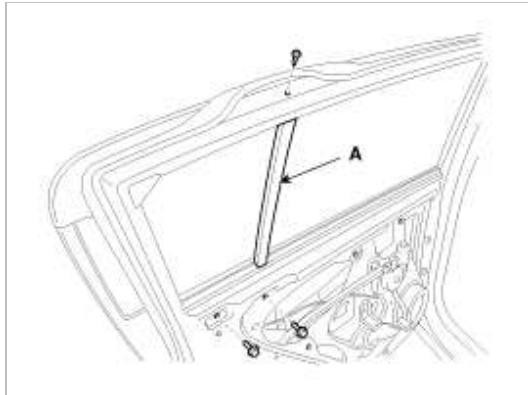
3. After loosening the mounting screws, then remove the rear door frame garnish (A).



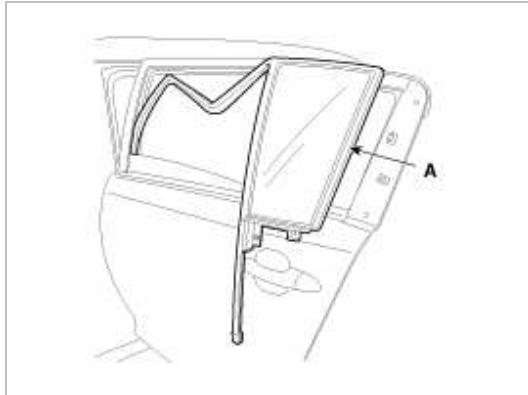
4. After loosening the mounting screws, then remove the rear door belt weatherstrip (A).



5. Loosen the rear channel (A) mounting screw and bolts.



6. Remove the rear door fixed glass (A).



7. Remove the glass mounting hole plug.

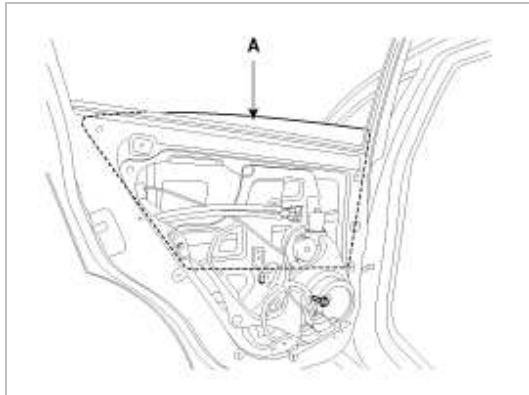
CAUTION

- Use the door switch to align the mounting hole/bolt with the hole in the door.
- If unable to operate the window motor, remove the motor and align the hole by hand.
- Be careful not to drop the glass and/or scratch the glass surface.

8. 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 :

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



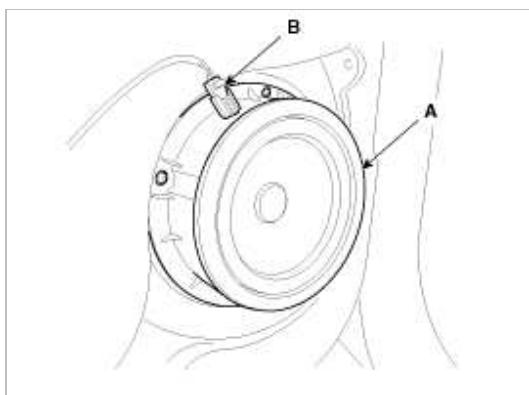
9. Installation is the reverse of removal.

NOTE

- A. Roll the glass up down to see if it moves freely without binding.
- B. Adjust the position of the glass as needed.
- C. Make sure the door lock and opens properly.
- D. Replace any damaged clips

Speaker Replacement

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



4. Installation is the reverse of removal.

NOTE

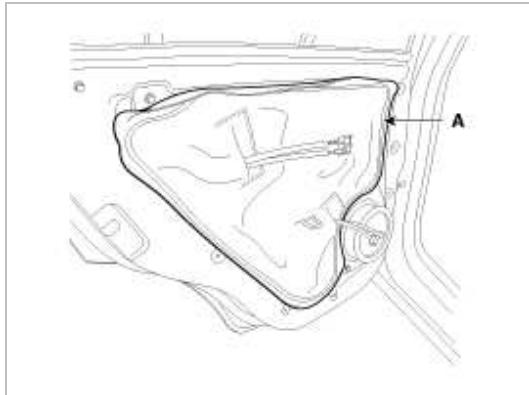
- Use sheet metal screws to secure the speaker.
- Make sure the connector are connected properly and each rod is connected securely.
- Make sure the door lock and opens properly.
- Replace any damaged clips.

Power Window Motor Replacement

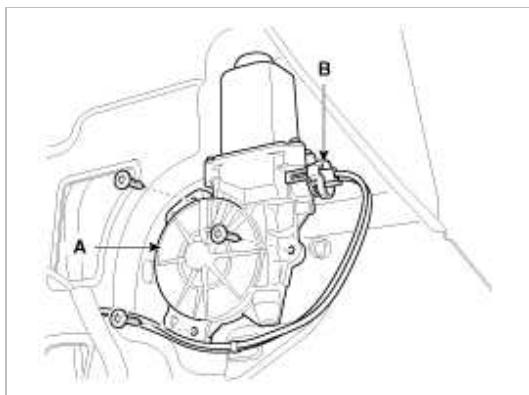
1. Remove the rear door trim.
2. Remove the rear door trim seal (A).

NOTE

- Replace any damaged door trim seal.



3. Disconnect the power window motor connector (B).
4. After loosening the mounting screws, then remove the power window motor (A).



5. Installation is the reverse of removal.

NOTE

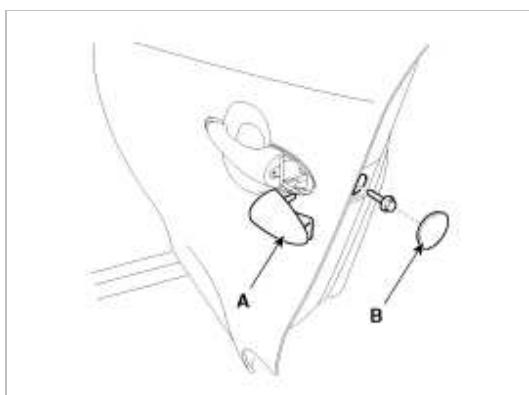
- The area of rotational parts and springs should be applied with sufficient grease.
- Roll the glass up down to see if it move freely without binding.

Outside Handle Replacement

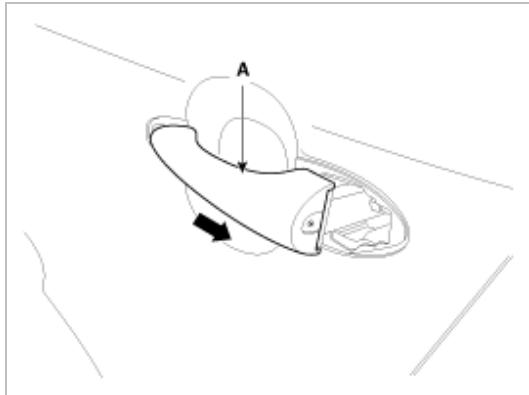
1. Remove the hole plug (B).
2. After loosening the mounting bolt, then remove the outside handle cover (A).

Tightening torque :

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



3. Remove the outside handle (A) by sliding it rearward.



4. Installation is the reverse of removal.

NOTE

- Make sure the door lock and open properly.

Door Module Assembly Replacement

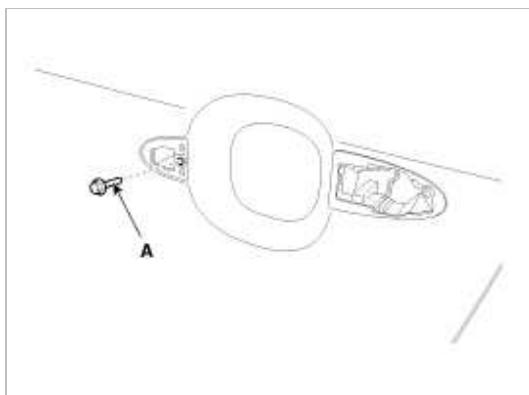
1. Remove the following parts.

- A. Rear door trim
- B. Rear door trim seal
- C. Window glass
- D. Outside handle
- E. Rear channel
- F. Rear door fixed glass

2. Loosen the mounting bolt (A).

Tightening torque :

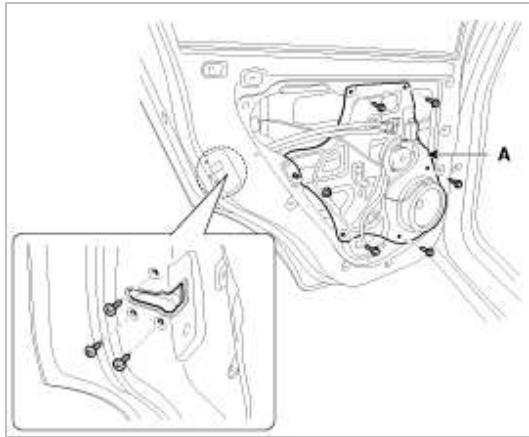
6.9 ~ 10.8 N.m (0.7 ~ 1.1 kgf.m, 5.1 ~ 8.0 lb-ft)



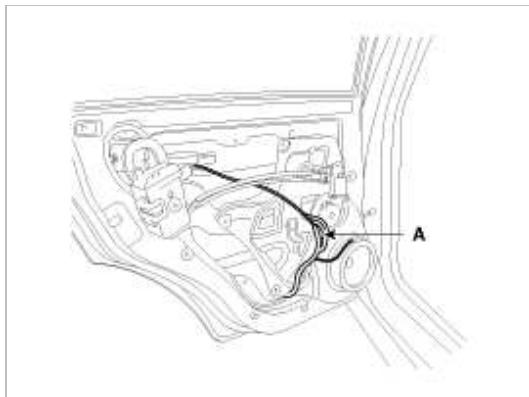
3. After loosening the rear door module mounting bolts and nut, then remove the rear door module (A).

Tightening torque :

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



4. Disconnect the connectors and rear door module wiring harness (A).



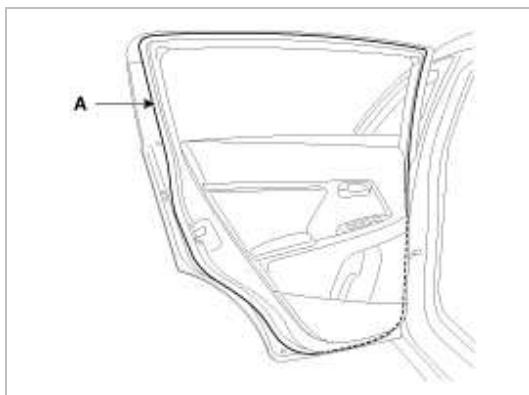
5. Installation is the reverse of removal.

NOTE

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

Door Weatherstrip Replacement

1. Detach the clips, then remove the rear door side weatherstrip (A).



2. Installation is the reverse of the removal.

NOTE

- Replace any damaged clips.

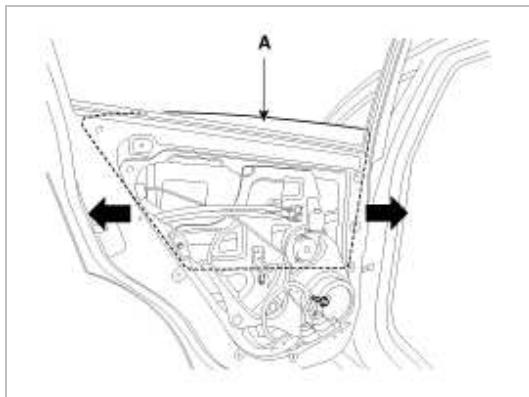
Adjustment

Glass Adjustment

NOTE

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

1. Remove the rear door trim.
2. Remove the rear door trim seal.
3. Carefully move the glass (A) until you can see the glass mounting bolt, then loosen them.



4. Check that the glass moves smoothly.

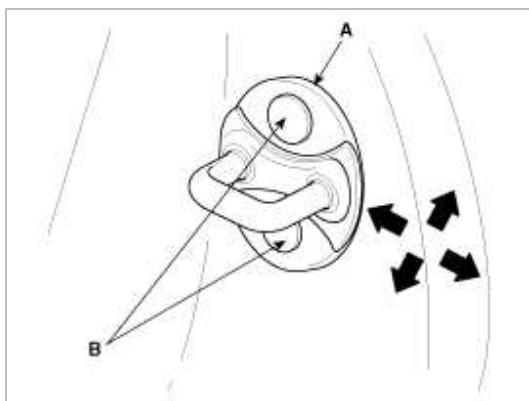
Door Striker Adjustment

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

1. Loosen the screws (B) just enough for the striker to move.

Tightening torque:

(B):16.7 ~ 21.6 N.m (1.7 ~ 2.2 kgf.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.

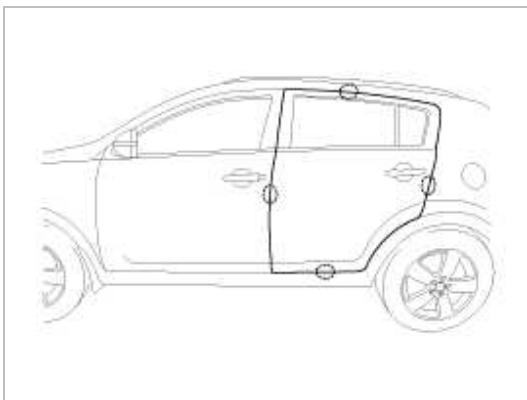
Door Position Adjustment

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.

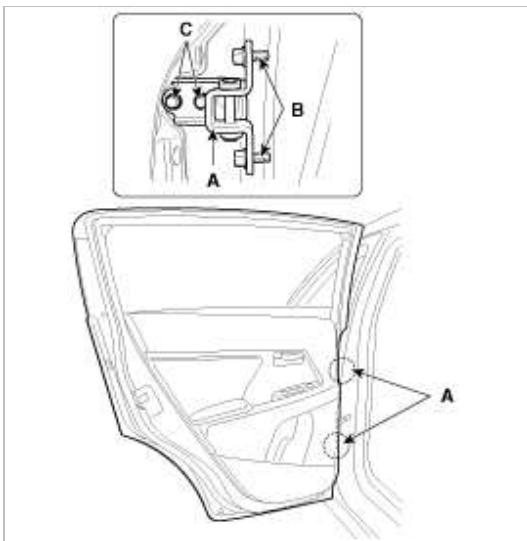
3. Adjust at the hinges (A):

- 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 ~ 26.5 N.m (2.2 ~ 2.7 kgf.m, 15.9 ~ 19.5 lb-ft)

(C) : 34.3 ~ 41.2 N.m (3.5 ~ 4.2 kgf.m, 25.3 ~ 30.4 lb-ft)



4. Grease the pivot portions of the hinges indicated.

5. Check for water leaks.

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

Replacement

Roof Rack Replacement

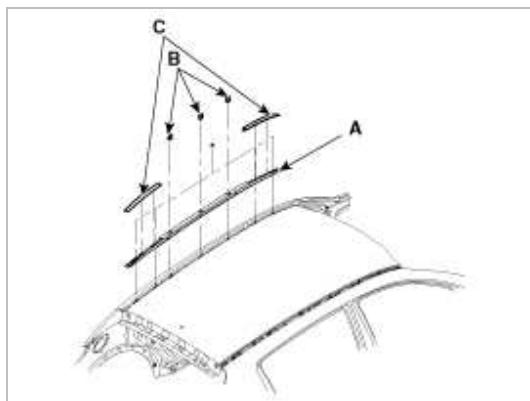
CAUTION

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

1. Using a screwdriver or remover, remove the roof rack cover (C).
2. Using a screwdriver or remover, remove the roof rack side rail cover (B).
3. After loosening the mounting nuts, then remove the roof rack (A).

Tightening torque :

3.9 ~ 4.4 N.m (0.4 ~ 0.45 kgf.m, 2.9 ~ 3.3 lb-ft)



4. Installation is the reverse of removal.

NOTE

- Replace any damage clips.

Roof Rack Replacement [Panoramaroof]

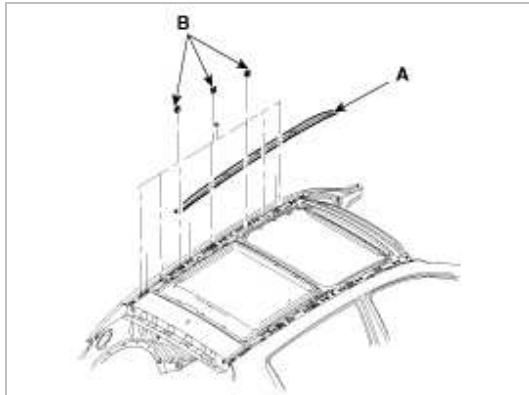
CAUTION

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

1. Using a screwdriver or remover, remove the roof rack side rail cover (B).
2. After loosening the mounting nuts, then remove the roof rack (A).

Tightening torque :

3.9 ~ 4.4 N.m (0.4 ~ 0.45 kgf.m, 2.9 ~ 3.3 lb-ft)



3. Installation is the reverse of removal.

NOTE

- Replace any damage clips.

Roof Molding Replacement

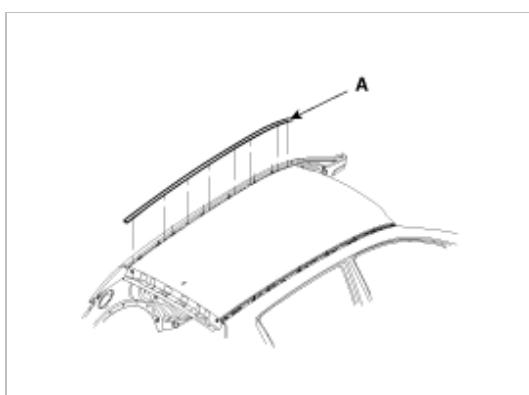
CAUTION

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

1. Remove the roof rack.
2. Using a screwdriver or remover, remove the roof molding (A).

NOTE

- Roof molding is need to changed to new product surely.



3. Installation is the reverse of removal.

NOTE

- Replace any damage clips.

Roof Molding Replacement [Panoramaroof]

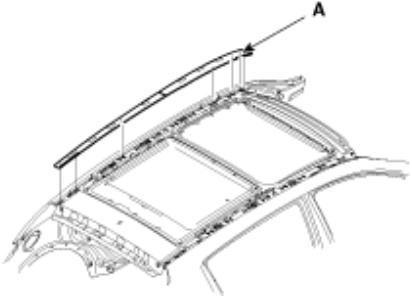
CAUTION

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

1. Remove the roof rack.
2. Using a screwdriver or remover, remove the roof molding (A).

NOTE

- Roof molding is need to changed to new product surely.



3. Installation is the reverse of removal.

NOTE

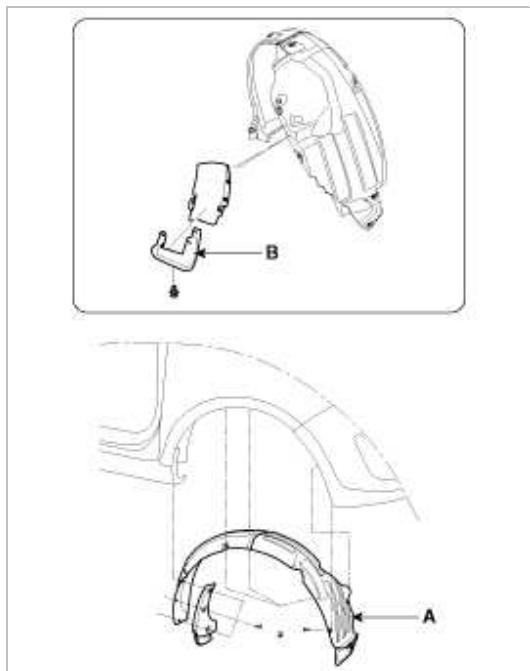
- Replace any damage clips.

Front Wheel Guard And Mud Guard Replacement

CAUTION

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

1. Remove the front tire.
2. After loosening the mounting clips and screws, then remove the front wheel guard (A), mud guard (B).



3. Installation is the reverse of removal.

NOTE

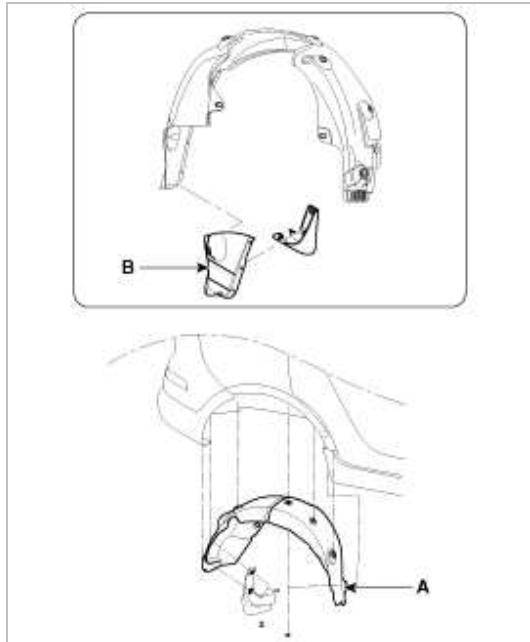
- Replace any damage clips.

Rear Wheel Guard And Mud Guard Replacement

CAUTION

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

1. Remove the rear tire.
2. After loosening the mounting clips and nut, then remove the rear wheel guard (A) and mud guard (B).



3. Installation is the reverse of removal.

NOTE

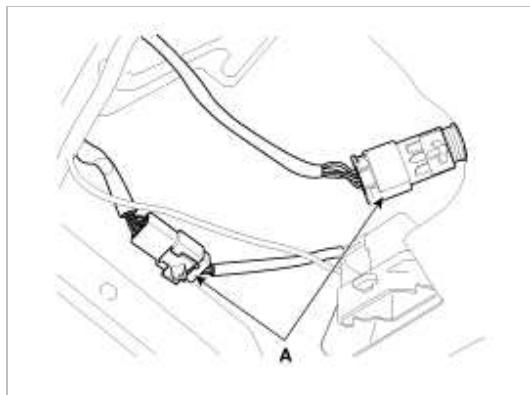
- Replace any damage clips.

Tail Gate Garnish Replacement

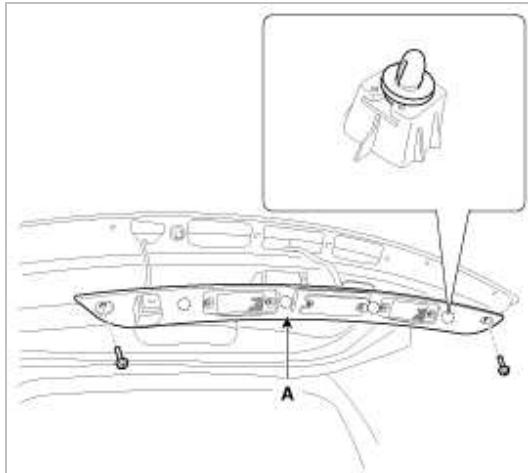
CAUTION

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

1. Remove the tail gate trim.
(Refer to the BD group - "Tail Gate")
2. Disconnect the connectors (A).



3. After loosening the mounting screws, then remove the tail gate garnish (A).



4. Installation is the reverse of removal.

NOTE

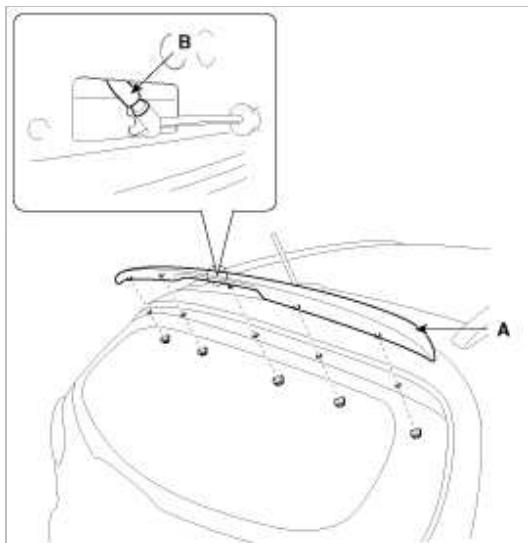
- Replace any damage clips.

Rear Spoiler Replacement

CAUTION

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

1. Remove the tail gate trim.
(Refer to the BD group - "Tail Gate")
2. Disconnect the washer nozzle (B).
3. After loosening the mounting nuts, then remove the rear spoiler (A).



4. Installation is the reverse of removal.

NOTE

- Replace any damage clips.

Fender Garnish Replacement

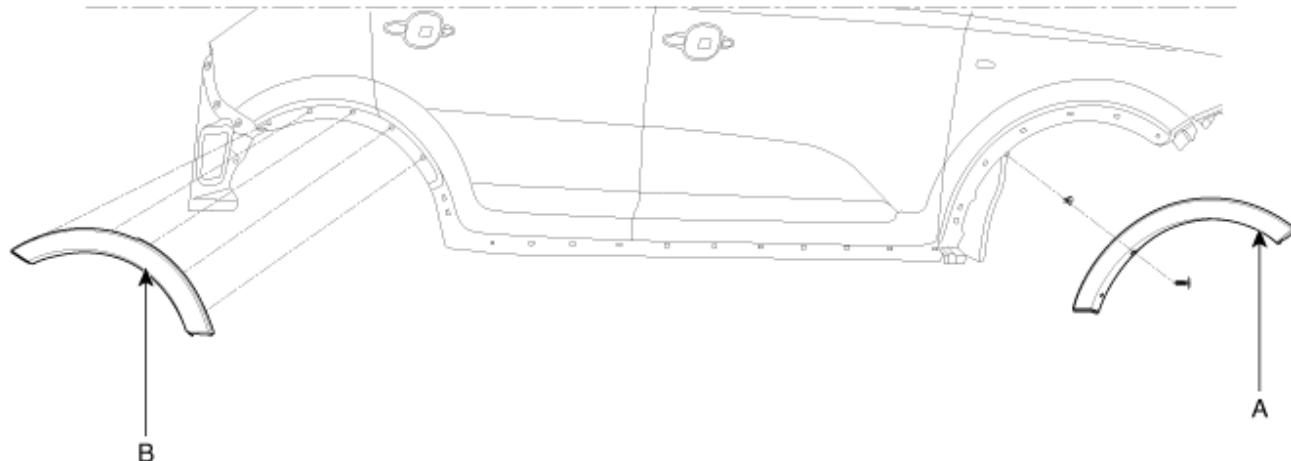
CAUTION

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

1. Loosen the front fender garnish mounting screw.
2. Using a screwdriver or remover, remove the front fender garnish (A).
3. Using a screwdriver or remover, remove the rear fender garnish (B).
4. Installation is the reverse of removal.

NOTE

- Replace any damage clips.



Side Sill Molding Replacement

CAUTION

- When prying with a flat-tip screwdriver, wrap it with protective tape, and apply protective tape around the related

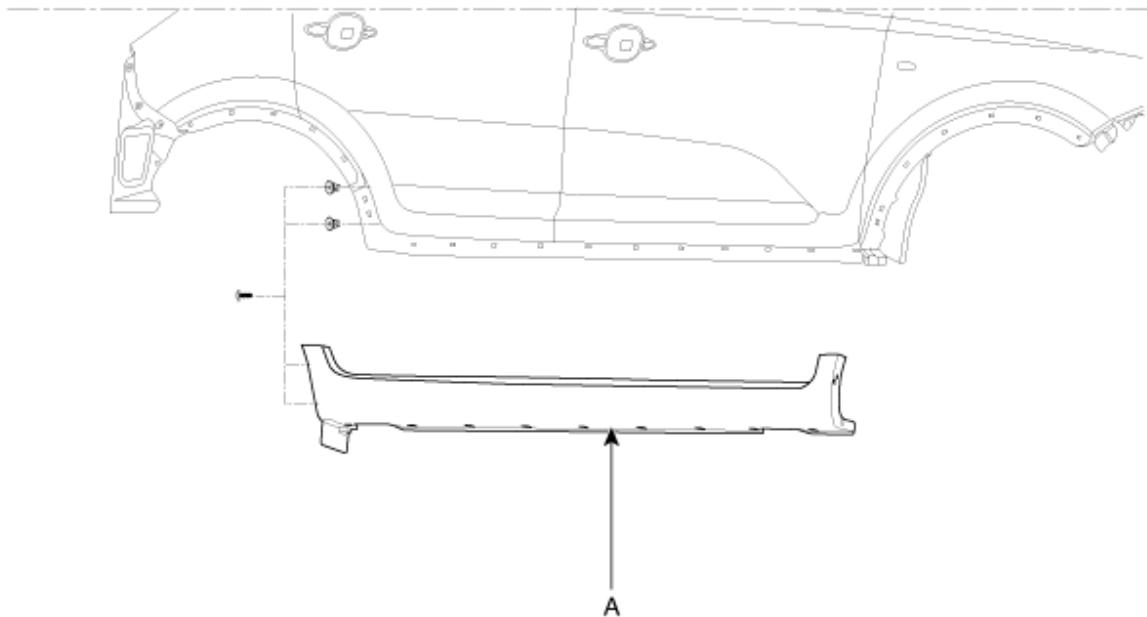
parts, to prevent damaged.

- Put on gloves to protect your hands.
- Take care not to scratch the body surface.

1. Loosen the side sill molding mounting screws.
2. Using a screwdriver or remover, remove the side sill molding (A).
3. Installation is the reverse of removal.

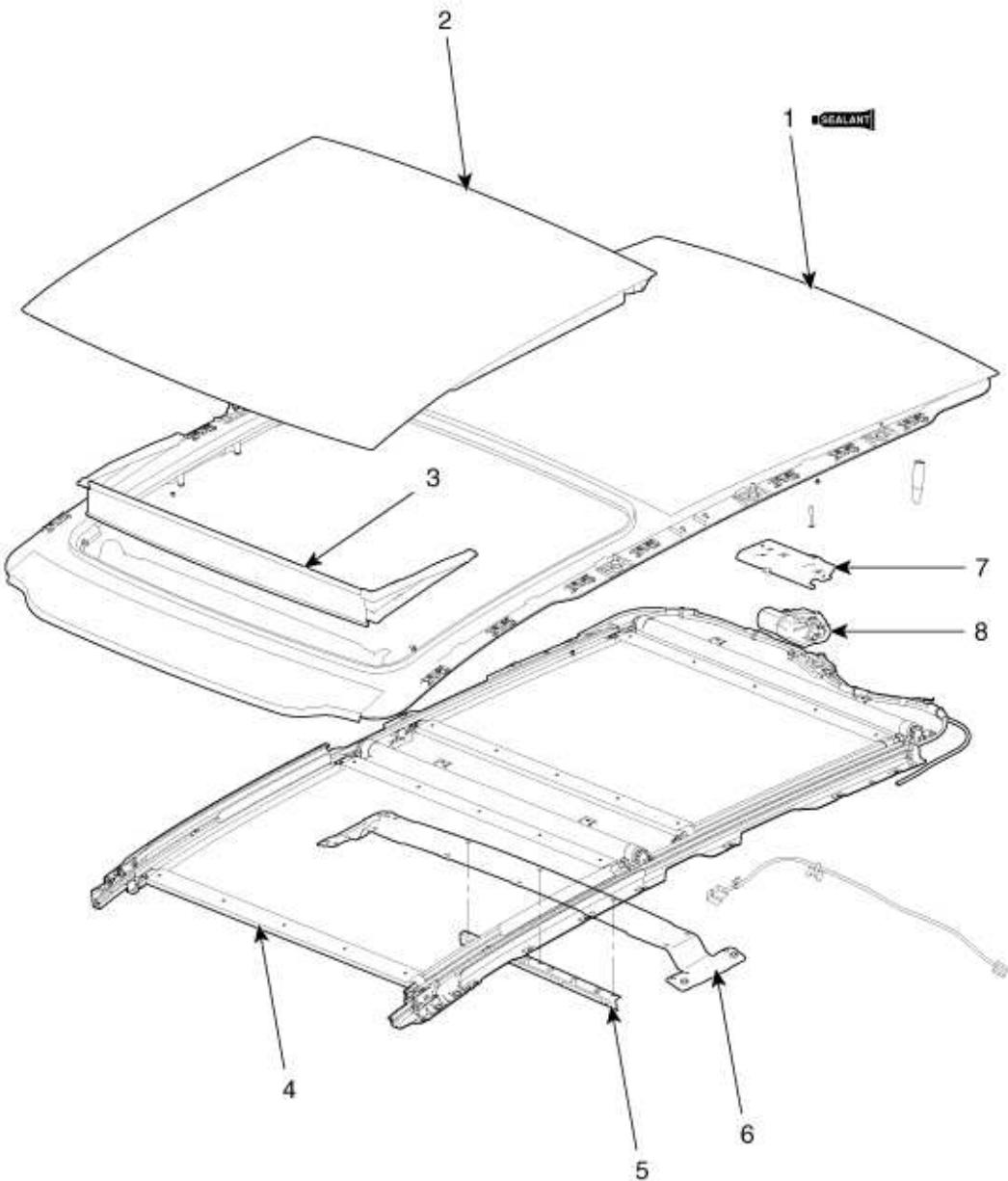
NOTE

- Replace any damage clips.



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

Components



- | | |
|--|---|
| 1. Panoramaroof frame assembly
2. Movable glass assembly
3. Wind deflector assembly
4. Mechanism assembly | 5. Impact bracket
6. Impact cross member assembly
7. EMC metal sheet
8. Motor assembly |
|--|---|

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

Replacement

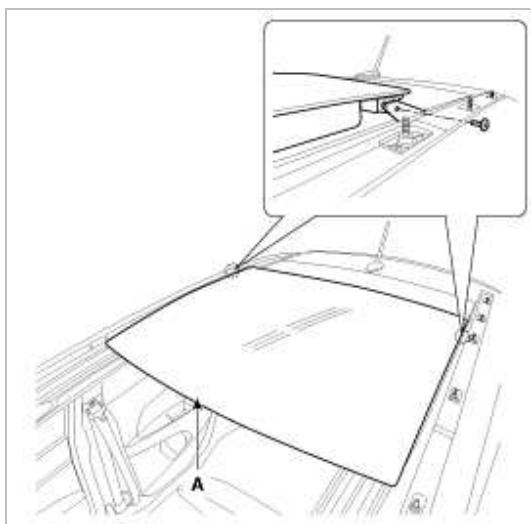
Movable Glass Replacement

1. Remove the roof rack and roof molding.
(Refer to the BD group - "Body Side Moldings")

2. Open the movable glass.
3. Loosen the movable glass (A) mounting screw.

CAUTION

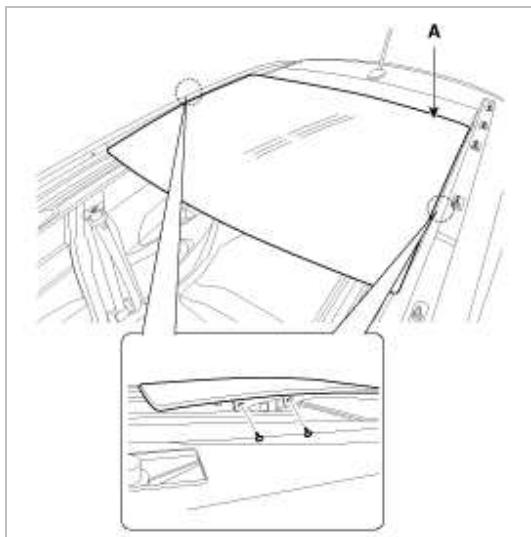
- Do not damage the screw.



4. After loosening the mounting screws, then remove the movable glass (A).

CAUTION

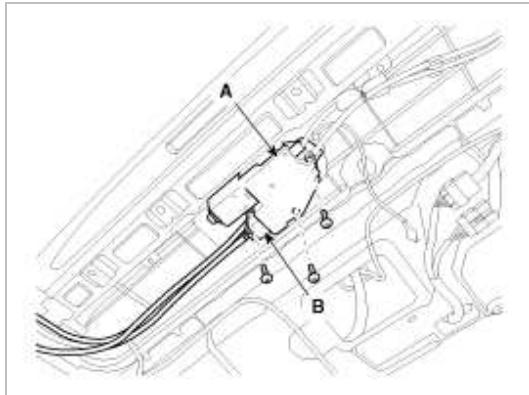
- Do not damage the screw.



5. Installation is the reverse of removal.

Motor Replacement

1. Remove the roof trim.
(Refer to the BD group - "Roof Trim")
2. Disconnect the connector (B).
3. Remove the panoramaroof motor after removing screws from the panoramaroof motor (A).



4. Installation is the reverse of removal.

CAUTION

- Make sure to initialize the motor.

Wind Deflector Replacement

1. Open the movable glass fully.
2. Using a star wrench, the wind deflector loosening the mounting screw.

CAUTION

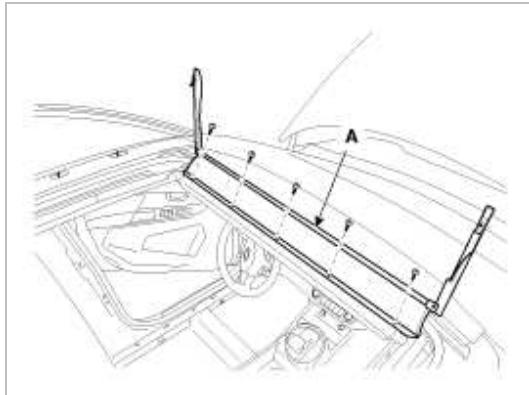
- Do not damage the screw.



3. After loosening the mounting screws, then remove the wind deflector (A).

CAUTION

- Do not damage the screw.

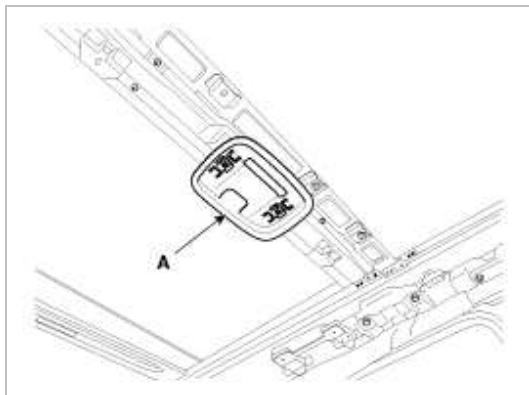


4. Installation is the reverse of removal.

Roll Blind Replacement

Removal

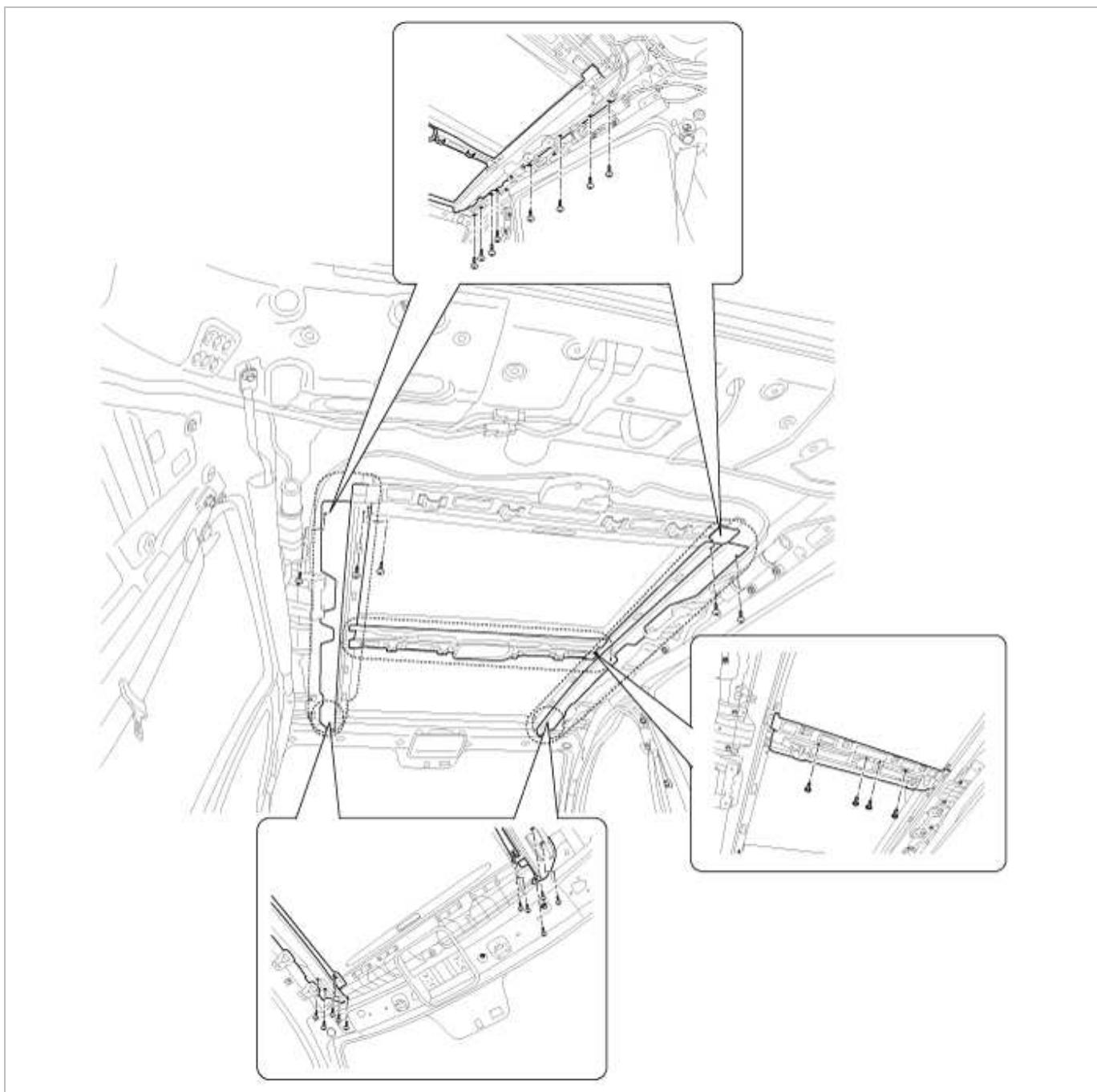
1. Remove the following items.
 - A. Roof trim
(Refer to the BD group - "Roof Trim")
 - B. Movable glass
 - C. Motor
2. Using a screwdriver or remover, remove the room lamp bracket (A).



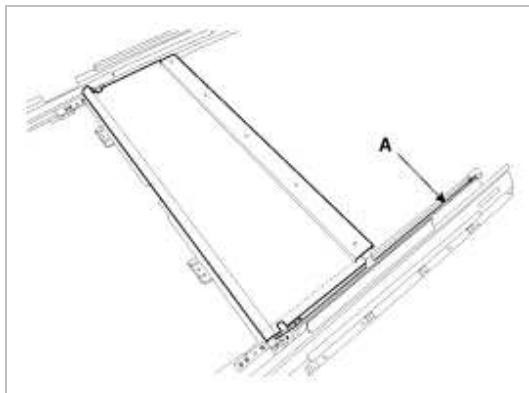
3. Remove the mechanism rail assembly loosening the mounting screw, and then remove the mechanism rail assembly (A).

CAUTION

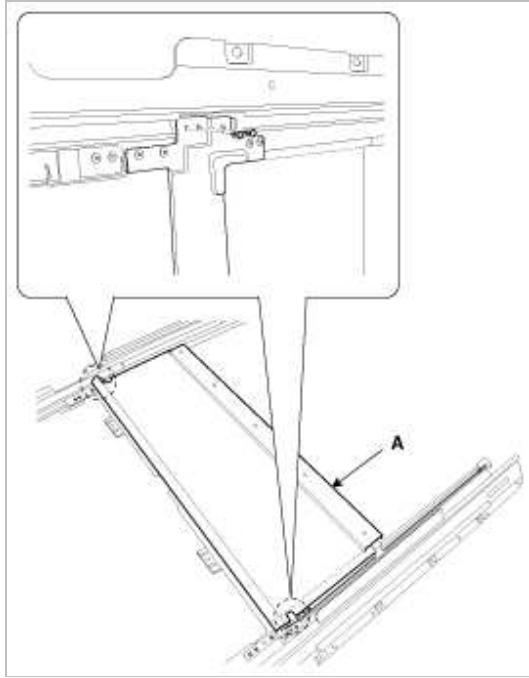
- Do not damage the screws.



4. Cut the tension wire (A) to prevent the injury.



5. After loosening the roll blind mounting screws, and removing the rivet, remove the roll blind (A).

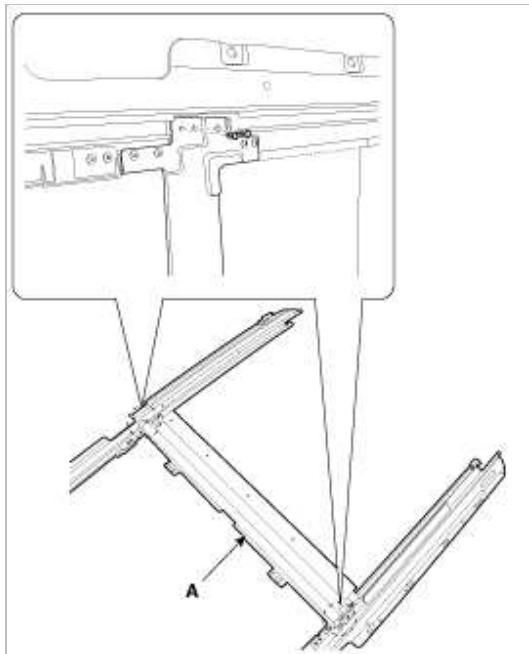


Installation

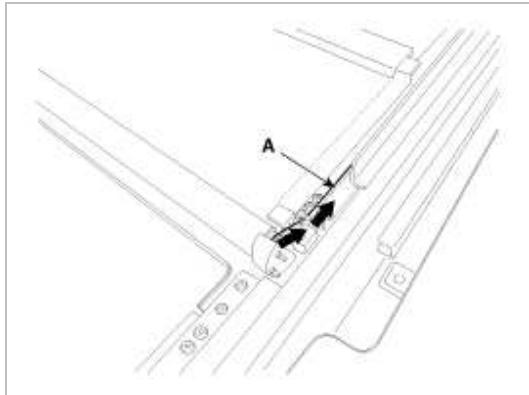
1. Installation the roil blind (A).

NOTE

- Insert the part of fabric both ends to guide.



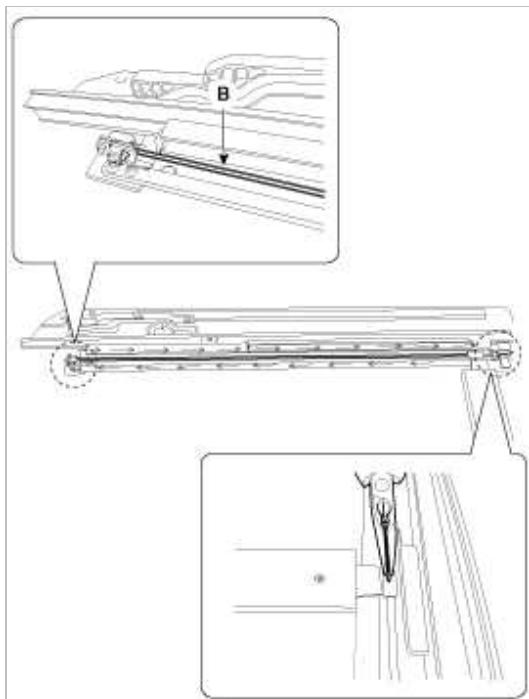
2. Install the wire (A) in arrow direction.



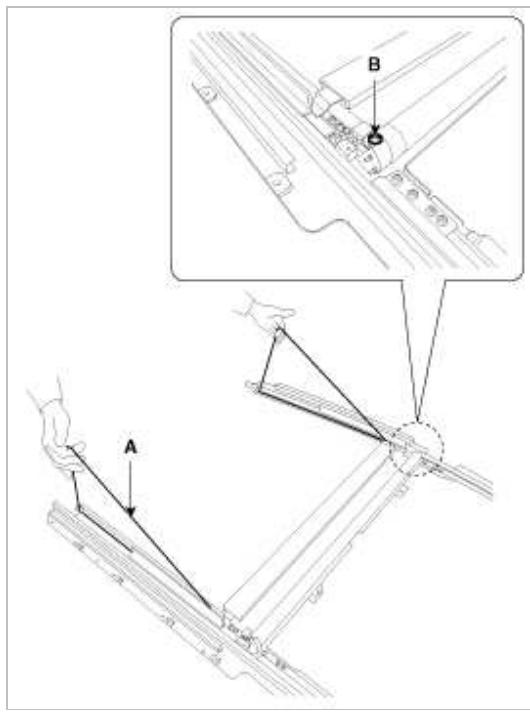
3. Install the wire (B) in arrow direction.

NOTE

- Insert the wire into the cover completely when installing.



4. Pull the wire (A) as below picture.
5. Lay down the wire (A) slowly after removing the clip (B).



NOTE

- Satisfy the coherence condition of roll blind is 6.9 ~ 25.5 N.m (0.7 ~ 2.6 kgf.m, 5.1 ~ 18.8 lb-ft)

6. Installation the following items.

- A. Motor
- B. Movable glass
- C. Roof trim
(Refer to the BD group - "Roof Trim")

Panoramaroof Assembly Replacement

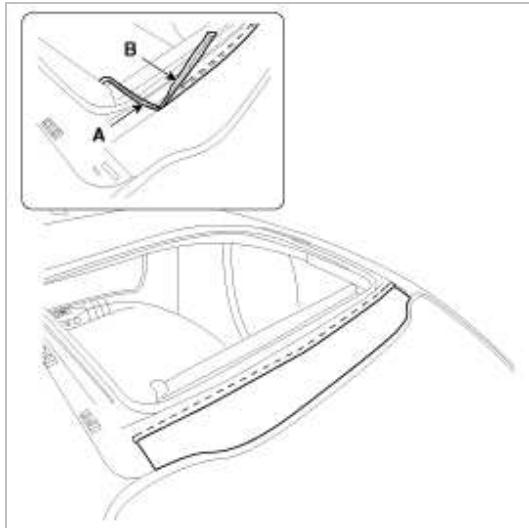
[Removal]

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. Interior trim
(Refer to the BD group - "Interior Trim")
 - D. Roof trim
(Refer to the BD group - "Roof Trim")
 - E. Roof antenna
(Refer to the BE group - "Audio")
 - F. Roof rack & Roof molding
(Refer to the BD group - "Body Side Moldings")
 - G. Wind deflector

NOTE

- To protect the interior, cover the interior before starting removing the panoramaroof.

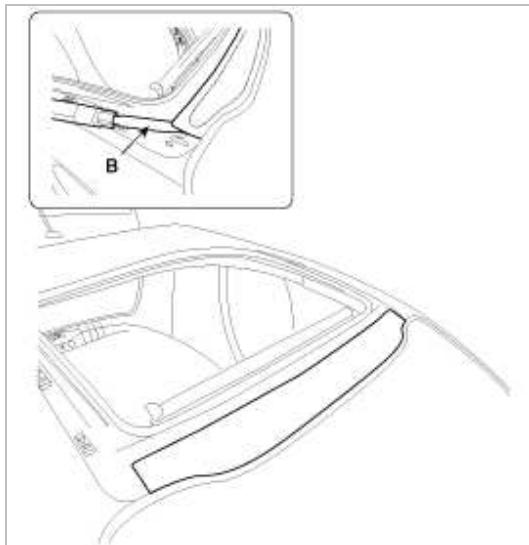
2. Using a cutter knife (B), remove the front glass weatherstrip (A).



3. Open the space between chassis and front glass using flathead screwdriver, and then cut the sealant of rear and side using a tool (09816-2P127) (B).

NOTE

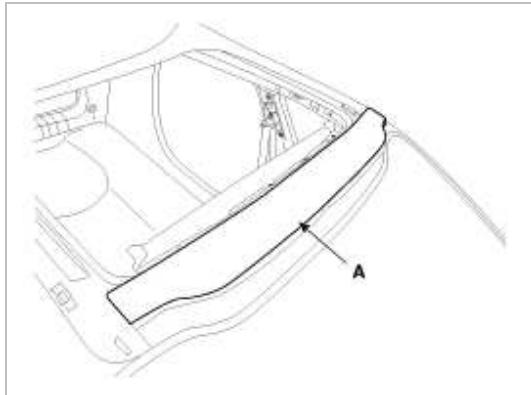
- Be careful not to damage the front glass when open the space between chassis and front glass using flathead screwdriver.



4. Remove the front glass (A).

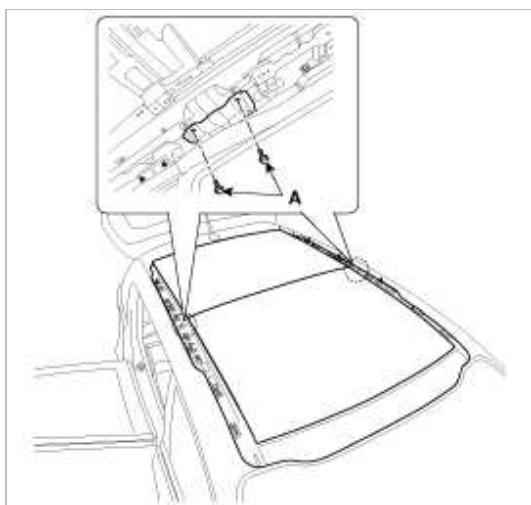
NOTE

- Front glass is need to changed to new product surely.



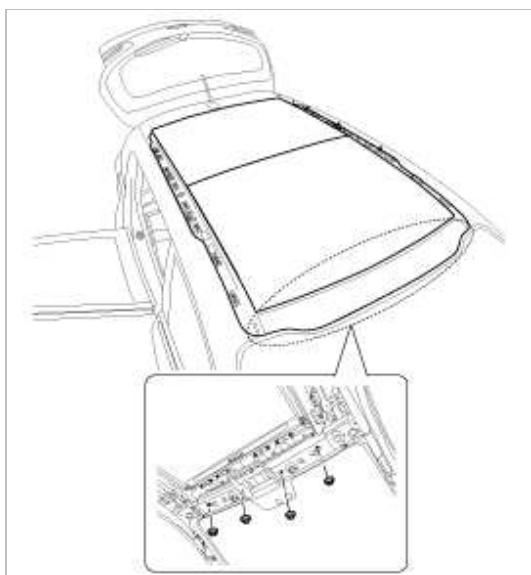
5. Remove the panoramaroof panel mounting bracket loosening the mounting bolts (A).

Tightening torque :
19.6 ~ 29.4 N.m (2.0 ~ 3.0 kgf.m, 14.5 ~ 21.7 lb-ft)



6. Loosen the panoramaroof panel mounting nuts.

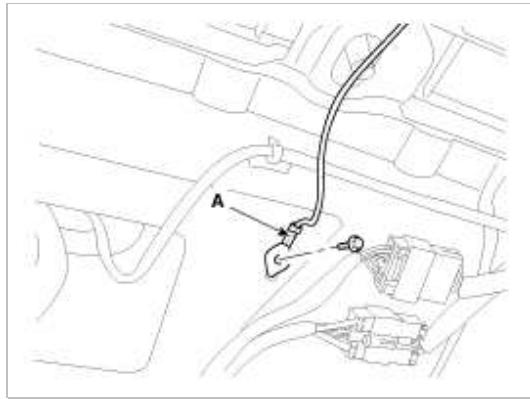
Tightening torque :
19.6 ~ 29.4 N.m (2.0 ~ 3.0 kgf.m, 14.5 ~ 21.7 lb-ft)



7. Disconnect the ground wire (A) by removing the bolt

Tightening torque :

10.8 ~ 13.7 N.m (1.1 ~ 1.4 kgf.m, 8.0 ~ 10.1 lb·ft)



8. Open the space between chassis and panoramaroof using flathead screwdriver, and then cut the sealant of edge using a tool (09816-2P130) (A).

NOTE

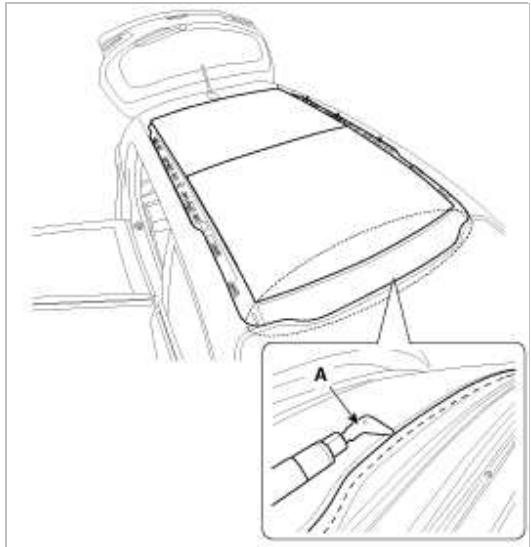
- Be careful not to damage the panoramaroof when inserting tools between the chassis and panoramaroof.



9. Open the space between chassis and panoramaroof using flathead screwdriver, and then cut the sealant of front using a tool (09816-2P121, 09816-2P122) (A).

NOTE

- This blade has a inclination to push upward.
(09816-2P121, 09816-2P122)
- This blade has a inclination to push downward.
(09816-2P123, 09816-2P124)



CAUTION

- Be careful not to damage the panoramaroof when inserting tools between the chassis and panoramaroof.

10. Open the space between chassis and panoramaroof using flathead screwdriver, and then cut the sealant of side using a tool (09816-2P121, 09816-2P122) (A).

NOTE

- This blade has a inclination to push upward.
(09816-2P121, 09816-2P122)
- This blade has a inclination to push downward.
(09816-2P123, 09816-2P124)



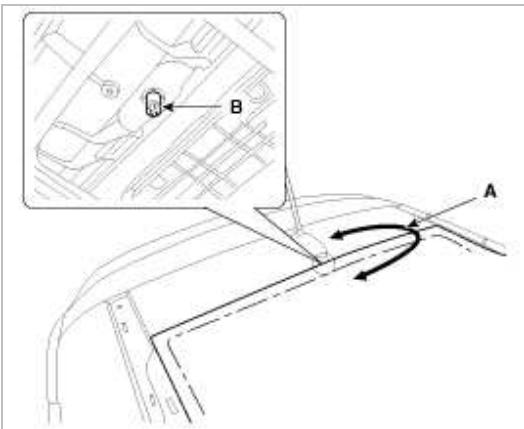
CAUTION

- Be careful not to damage the panoramaroof when inserting tools between the chassis and panoramaroof.

11. Cut off the sealant by pulling the piano wire (A) around the back panoramaroof assembly.

NOTE

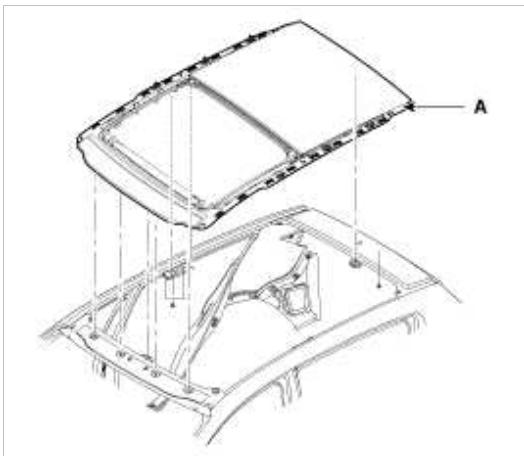
- Be careful of center hole (B) break.



12. Cut the sealant between the panoramaroof and the body, remove the panoramaroof (A).

NOTE

- Work with a minimum of four persons when lifting the panoramaroof on or off the vehicle.

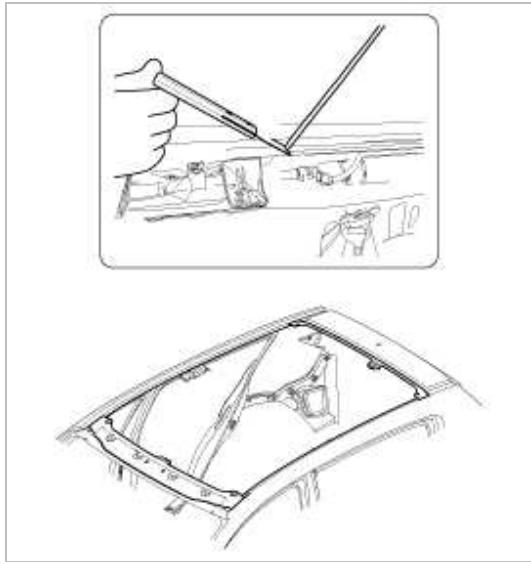


[Installation]

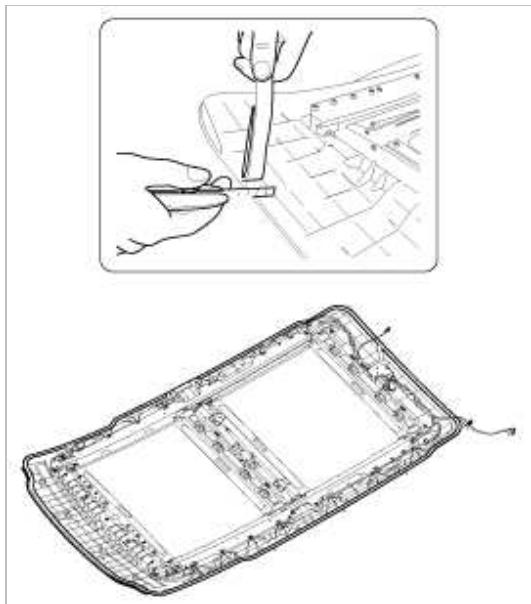
1. With a knife, scrape the old adhesive smooth to a thickness of about 2mm (0.08 in.) on the bonding surface around the entire panoramaroof opening flange

CAUTION

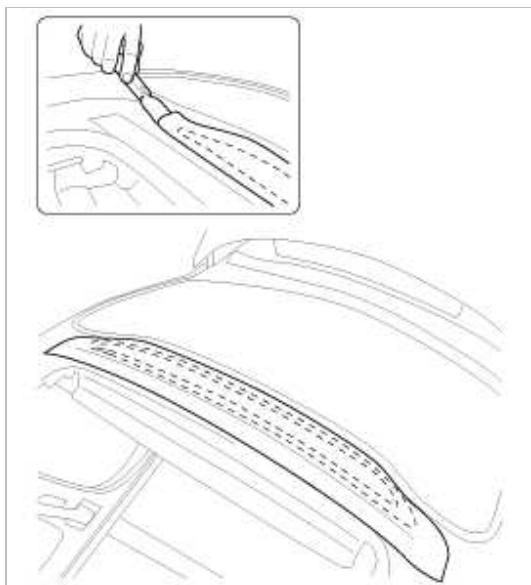
- Do not scrape down to the painted surface of the body; damaged paint will interfere with proper bonding.
- Remove the rubber dam and fasteners from the body.
- Mask off surrounding surfaces before painting.



2. Clean the body bonding surface with a sponge dampened in alcohol. After cleaning, keep oil, grease and water from getting on the clean surface.



3. Remove front glass of the panoramaroof by using a cutter knife.



4. 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 :

CAUTION

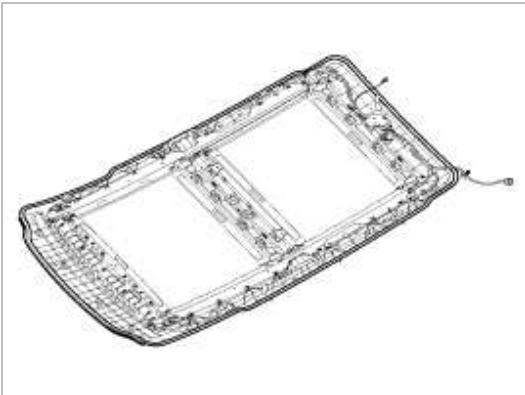
- Do not apply glass primer to the body, and be careful not to mix up glass and body primer sponges.
- Never touch the primed surfaces with your hands.
- Mask off surrounding surfaces before painting.



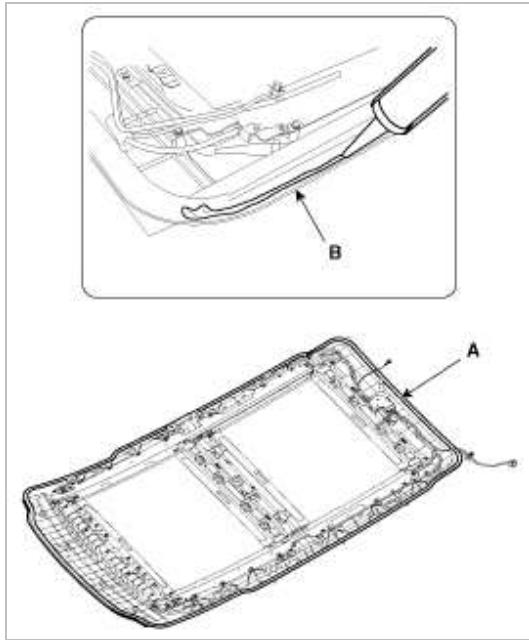
5. Apply a light coat of glass primer to the outside of the fasteners.

CAUTION

- 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.



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



7. Fix the panoramaroof to center hall (A) of body, install carefully the panoramaroof to the body frame.

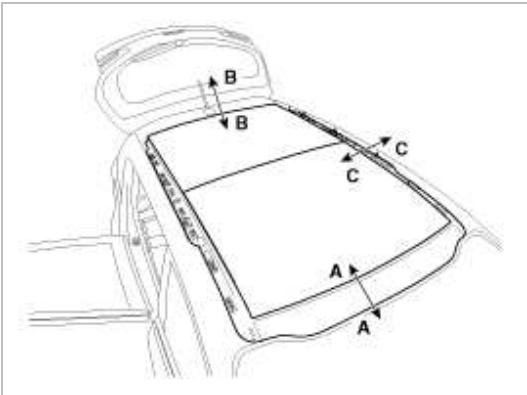
NOTE

- Work with a minimum of four persons when lifting the panoramaroof on or off the vehicle.



8. Check the Clearance and gap for each side after installing the panoramaroof.

	Section	Gap	Clearance
Front edge	A-A	5.7mm (0.2244in)	0.9mm (0.0354in)
Rear edge	B-B	5mm (0.1969in)	2mm (0.0787in)
Side edge	C-C	10mm (0.3937in)	1.2mm (0.0472in)

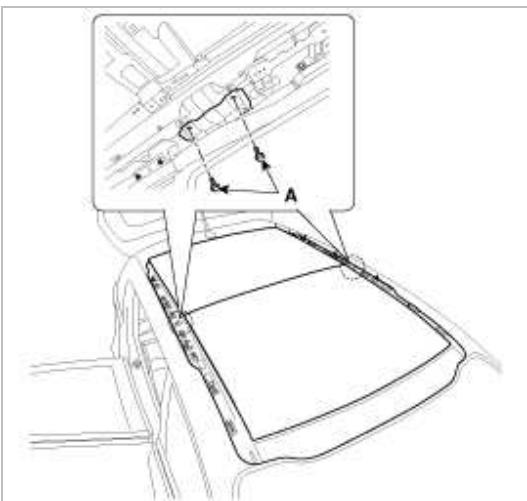


9. Install the bolts (A), to the panoramaroof panel mounting bracket.

Tightening torque :

19.6 ~ 29.4 N.m (2.0 ~ 3.0 kgf.m, 14.5 ~ 21.7lb-ft)

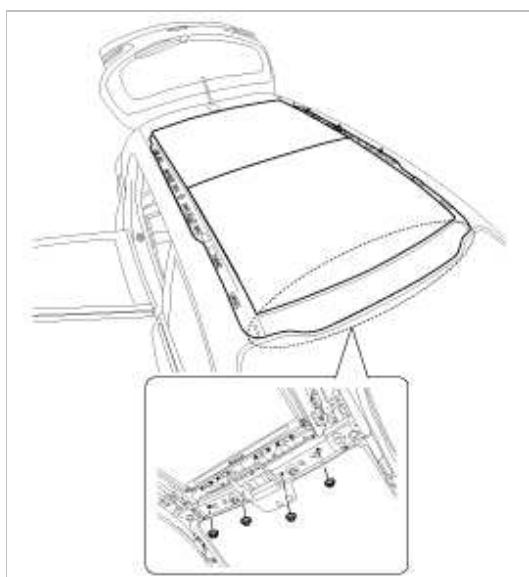
[Front]



10. Install the nuts to the panoramaroof.

Tightening torque :

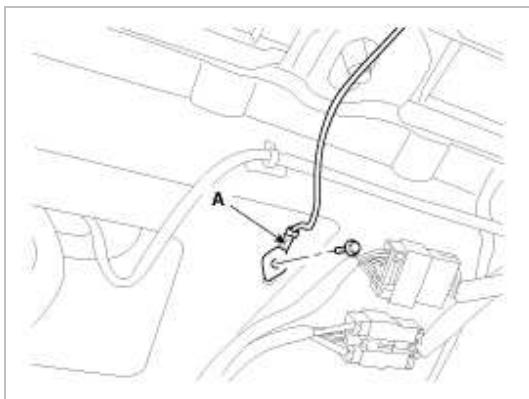
19.6 ~ 29.4 N.m (2.0 ~ 3.0 kgf.m, 14.5 ~ 21.7lb-ft)



11. Install the ground wire (A) mounting bolt.

Tightening torque :

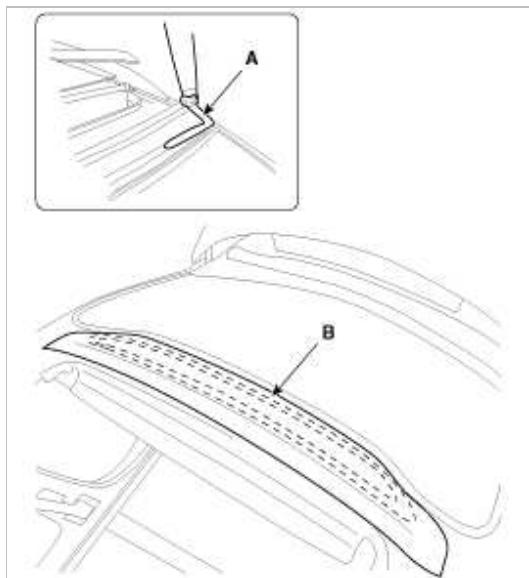
10.8 ~ 13.7 N.m (1.1 ~ 1.4 kgf.m, 8.0 ~ 10.1 lb-ft)



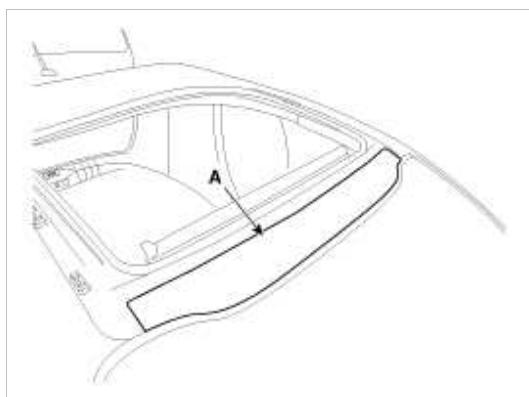
12. Install the roof rack and roof molding.

(Refer to the BD group - "Body Side Moldings")

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



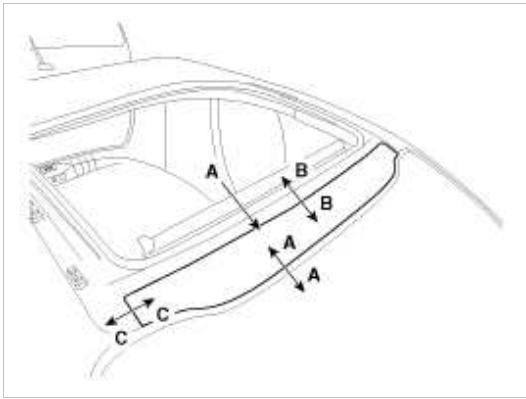
14. Install the front glass (A).



15. Close the movable glass fully.

16. Check the Clearance and gap for each side after installing the front glass (A).

	Section	Gap	Clearance
Front edge	A-A	5.7mm (0.2244 in)	0.9mm (0.0354 in)
Rear edge	B-B	7mm (0.2756 in)	1.2mm (0.0472 in)
Side edge	C-C	0mm	0mm



17. 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.
18. Let the adhesive dry for at least one hour, then spray water over the roof and check for leaks. If a leak occurs, let it dry, then seal with sealant :
 - A. Let the vehicle stand for at least four hours after windshield installation. If the vehicle must be driven within 4 hours, it must be driven slowly.
 - B. Keep the windshield dry for the first hour after installation.
19. 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 to 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).
20. Installation the following items
 - A. Wind deflector
 - B. Roof antenna
(Refer to the BE group - "Audio")
 - C. Roof trim
(Refer to the BD group - "Roof Trim")
 - D. Interior trim
(Refer to the BD group - "Interior Trim")
 - E. Rear seat
(Refer to the BD group - "Rear Seat")
 - F. Front seat
(Refer to the BD group - "Front Seat")

Adjustment

Inspect Glass Alignment

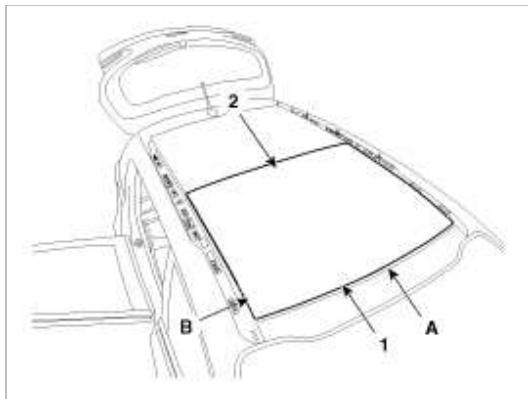
1. Check for abnormal noise or bending during operation.
2. With the sunroof fully closed, check for water leakage.
3. The roof panel (B) should be even with the movable glass (A) weatherstrip, to within the standard value "E" all the way

around. If not, make the following adjustment.

Tightening torque :

Standard value "E" [mm(in.)]

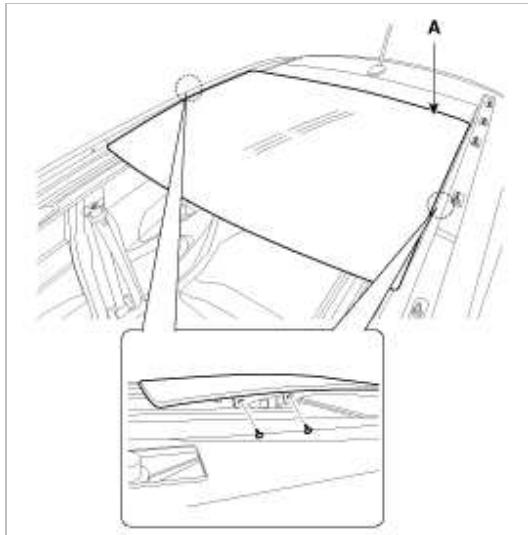
- (1) Front edge : 1.2mm (0.0472 in)
- (2) Rear edge : 1.0mm (0.0394 in)



4. If the position is not as specified, lightly loosen the glass adjusting screws (A) to adjust the glass height and tighten it.

CAUTION

- Do not damage the screws.



How To Initialize Motor

Whenever the battery is disconnected, discharged or the related fuse is replaced or reinstalled, the panoramaroof system must be reset according to the procedure below.

1. Turn the ignition key to the ON position and then close the panoramaroof completely.
2. Release the panoramaroof control levering the switch.
3. Press and hold the CLOSE button for more than 10 seconds until the sunroof has moved slightly.
4. Release the panoramaroof control lever.
5. Press and hold the CLOSE button once again until the sunroof do as follows.
A. Tilt → Slide Open → Slide Close
Then, release the lever.
6. Reset procedure of panorama system is finished.

When To Initialize The Motor

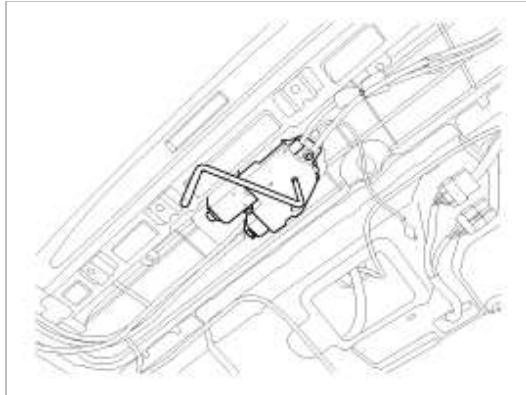
1. At the time of manufacture.
2. If the Initial setting is erased due to loss of power.
3. After using the manual handle.

Operating The Panoramaroof Emergency Handle

1. Use the panoramaroof emergency handle to close and open the panoramaroof manually for the following case only.
 - A. To close the panoramaroof before driving a vehicle in a rainy day or on the highway if the panoramaroof can not be closed due to failure of the panoramaroof motor or controller.
2. Operating method.
 - A. Remove the roof trim
 - B. Push the emergency handle up into the hexagonal drive of the panoramaroof 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 panoramaroof.
 - 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 panoramaroof.
- Damaged to the components may occur.



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

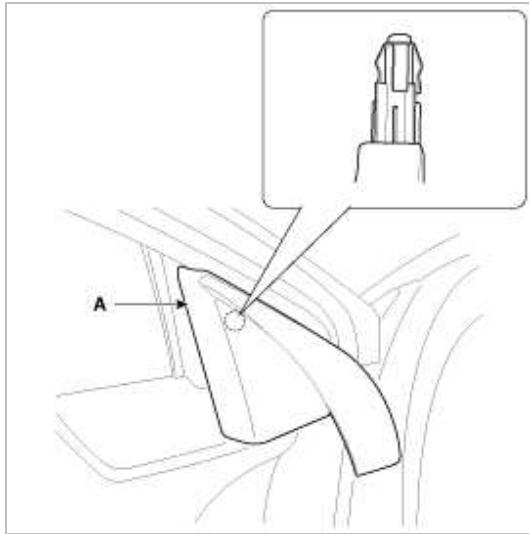
Replacement

Outside Rear View Mirror Assembly Replacement

CAUTION

- 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.

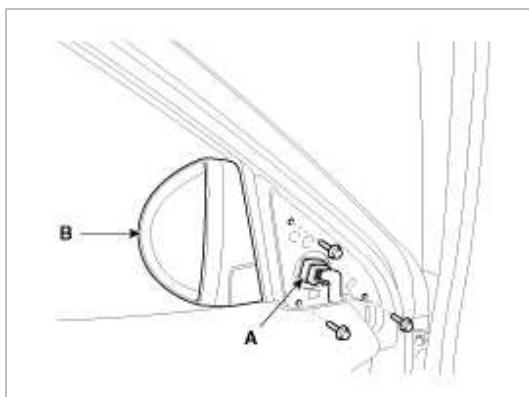
1. Remove the front door quadrant inner cover (A).



2. Disconnect the connector (A).
3. After loosening the mounting bolts, then remove the outside rear view mirror (B).

Tightening torque :

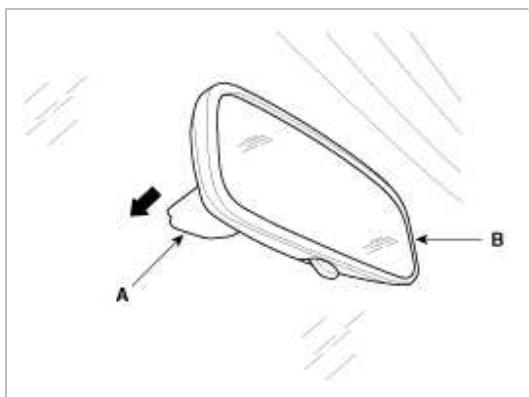
6.9 ~ 10.8 N.m (0.7 ~ 1.1 kgf.m, 5.1 ~ 8.0 lb-ft)



4. 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).



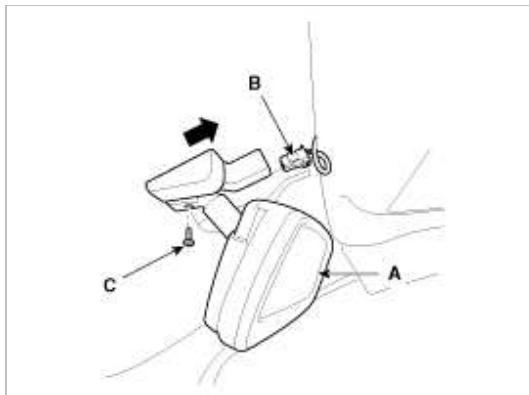
2. Installation is the reverse of removal.

ECM Mirror Replacement

1. Remove the ECM mirror cover (A).



2. Disconnect the ECM mirror connector (B).
3. Loosen the mounting screw (C), push the ECM mirror base up to remove the ECM mirror assembly (A).



4. Installation is the reverse of removal.

NOTE

- Make sure the connector are connected in properly.

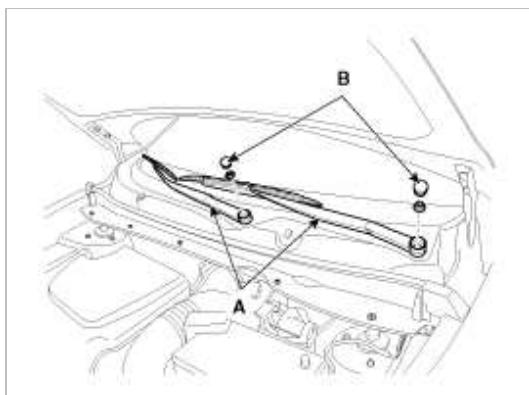
Body (Interior and Exterior) > Exterior > Cowl Top Cover > Repair procedures

Replacement

1. Remove the wiper arm cover (B).
2. After loosening the mounting nuts, then remove the wiper arm (A).

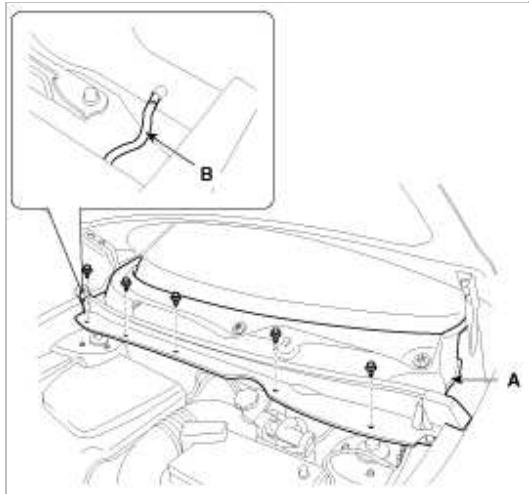
Tightening torque :

22.6 ~ 26.5 N.m (2.3 ~ 2.7 kgf.m, 16.6 ~ 19.5 lb-ft)



3. Remove the washer nozzle hose (B).

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



5. Installation is the reverse of removal.

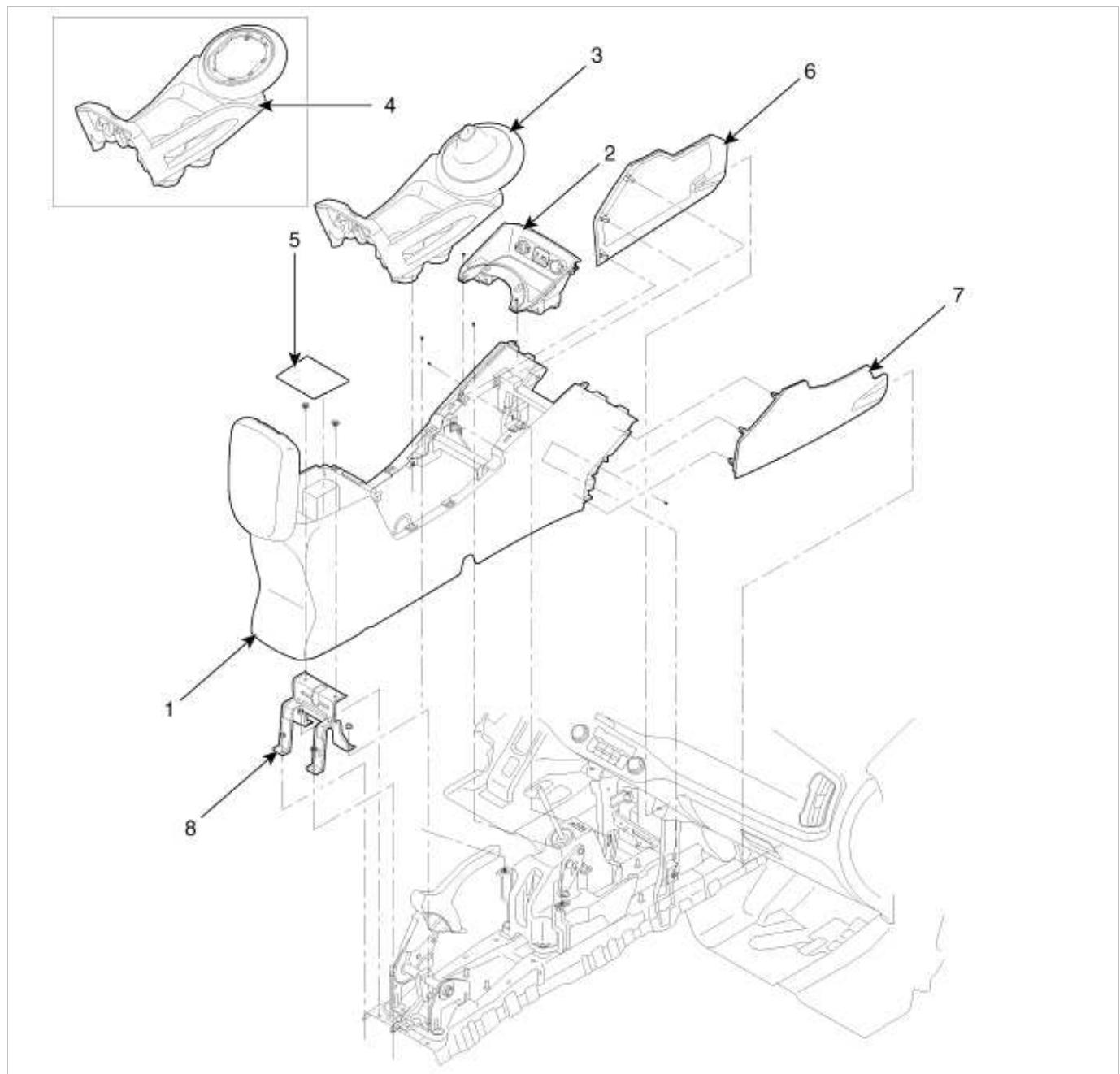
NOTE

- Replace any damage clips.

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

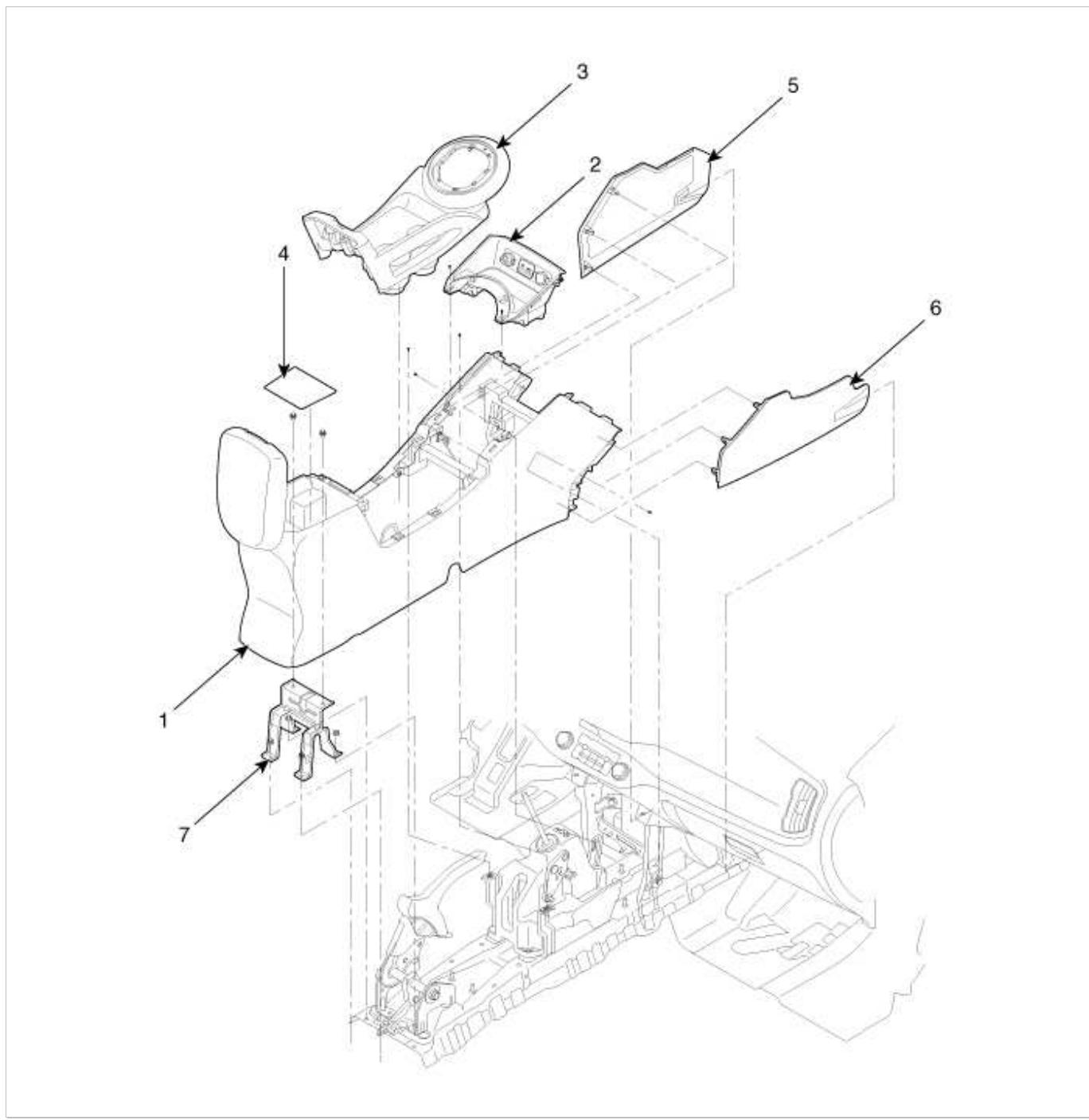
Components

[M/T]



- | | |
|--------------------------------------|----------------------------------|
| 1. Floor console assembly | 5. Console storage box mat |
| 2. Floor console tray | 6. Console side cover [LH] |
| 3. Console upper cover [5 speed M/T] | 7. Console side cover [RH] |
| 4. Console upper cover [6 speed M/T] | 8. Console rear mounting bracket |

[A/T]



- | | |
|--|--|
| 1. Floor console assembly
2. Floor console tray
3. Console upper cover [A/T]
4. Console storage box mat | 5. Console side cover [LH]
6. Console side cover [RH]
7. Console rear mounting bracket |
|--|--|

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

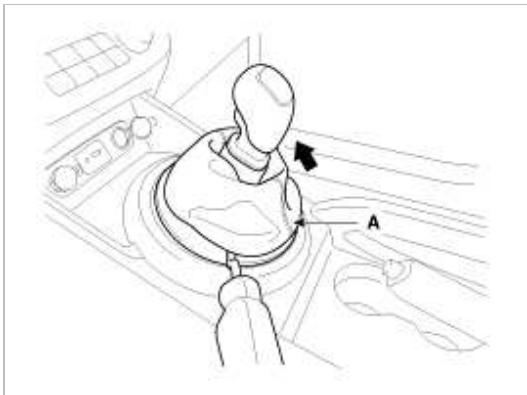
Replacement

Floor Console Replacement [M/T]

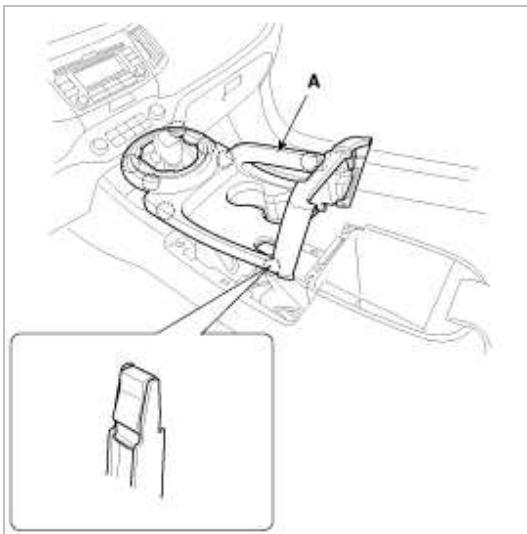
CAUTION

- 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.

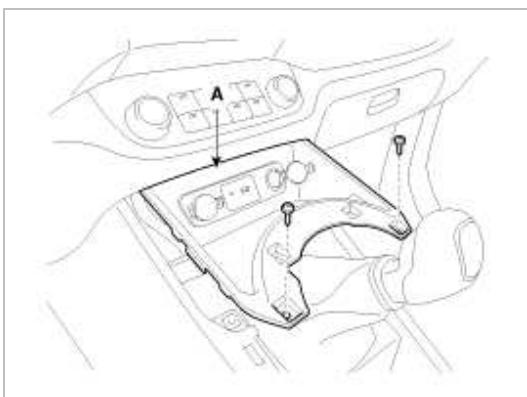
1. Using a screwdriver or remover, remove the gear boots (A).



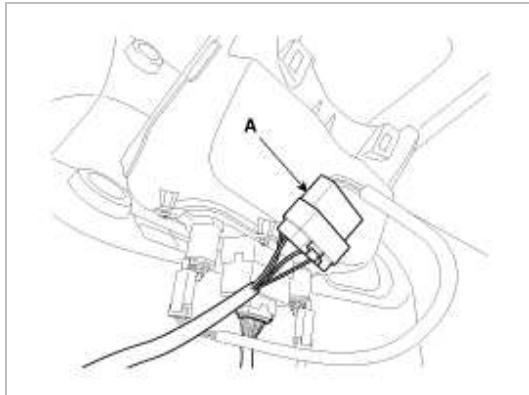
2. Using a screwdriver or remover, remove the console upper cover (A).



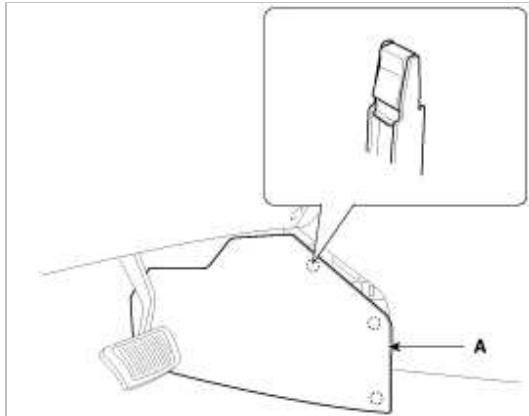
3. After loosening the mounting screws, then remove the floor console tray (A).



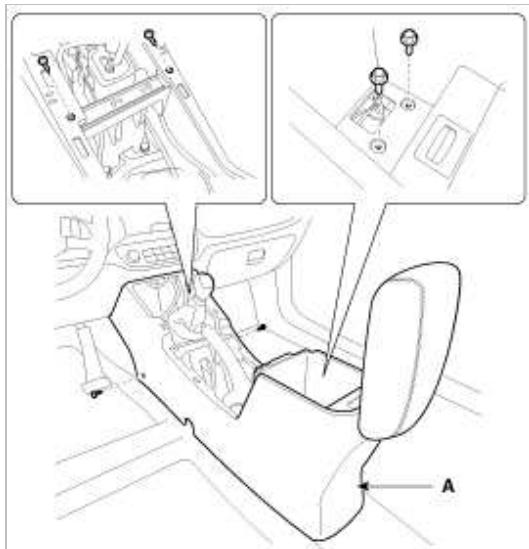
4. Disconnect the connector (A).



5. Remove the console side cover (A).



6. After loosening the mounting screws and bolts, then remove the floor console assembly (A).



7. Installation is the reverse of removal.

NOTE

- Make sure the connector are connected in properly.
- Replace any damage clips.

[A/T]

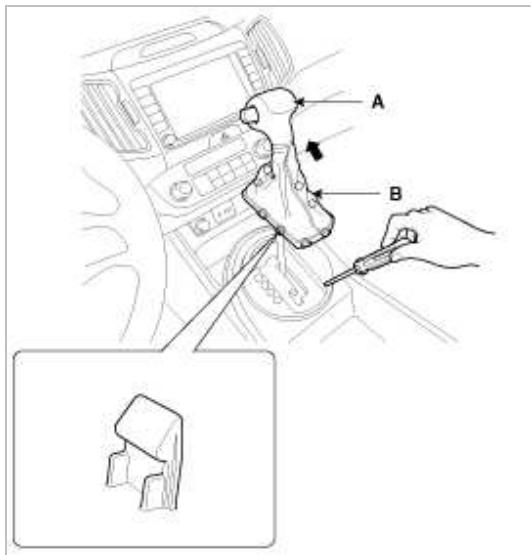
CAUTION

- When prying with a flat-tip screwdriver, wrap it with protective tape, and apply protective tape around the related

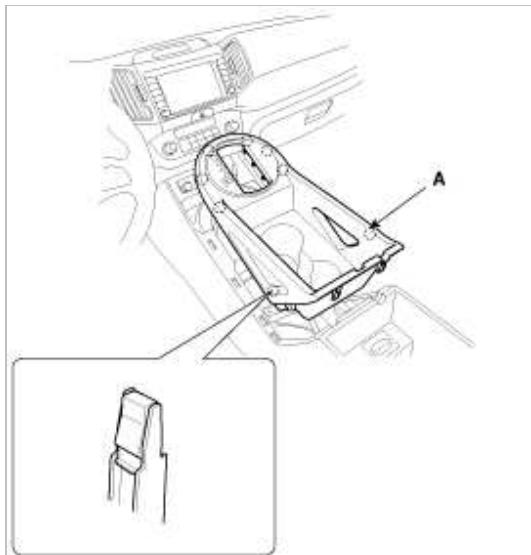
parts, to prevent damage.

- Put on gloves to protect your hands.

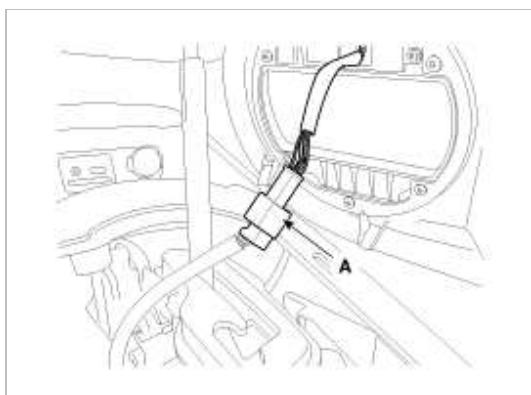
1. Using a screwdriver or remover, remove the gear boots (B) and gear knob (A).



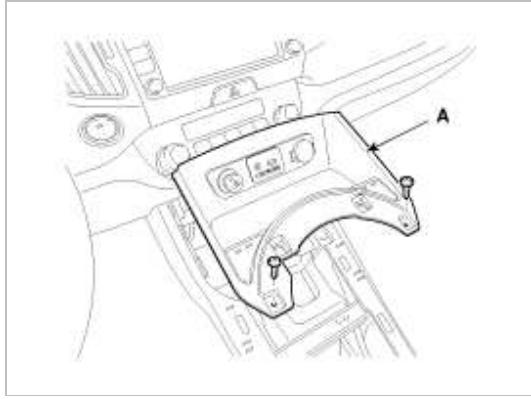
2. Using a screwdriver or remover, remove the console upper cover (A).



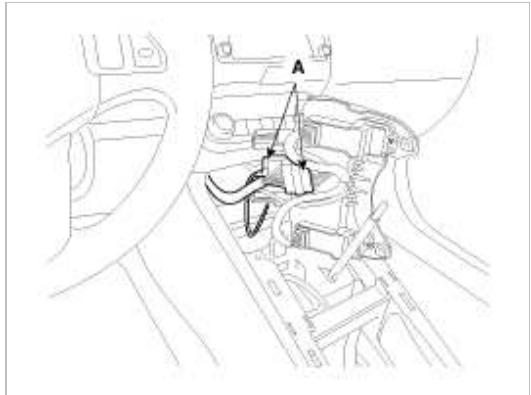
3. Disconnect the connector (A).



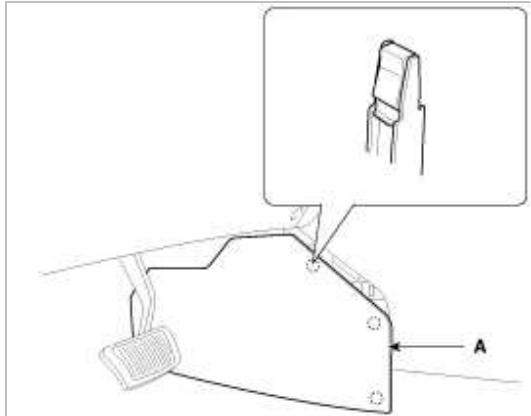
4. After loosening the mounting screws, then remove the floor console tray (A).



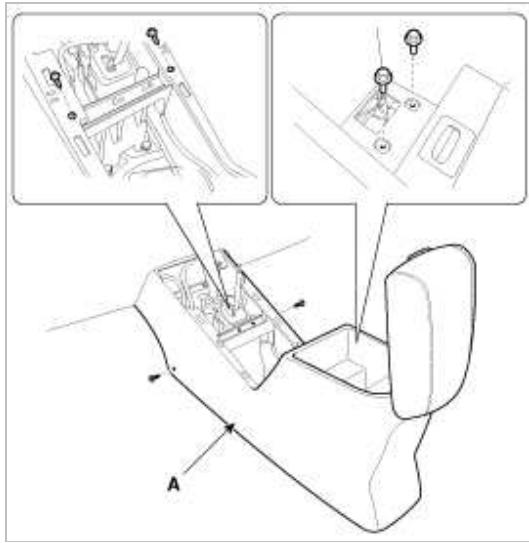
5. Disconnect the connector (A).



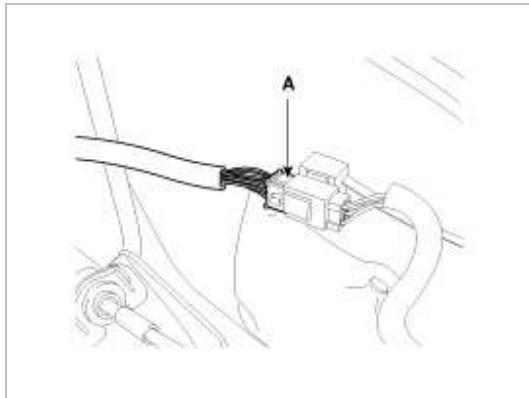
6. Remove the console side cover (A).



7. After loosening the mounting screws and bolts, then remove the floor console assembly (A).



8. Disconnect the floor console main connector (A).



9. Installation is the reverse of removal.

NOTE

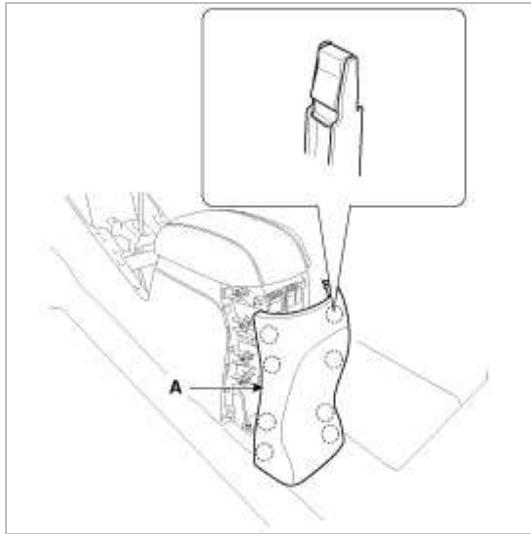
- Make sure the connector are connected in properly.
- Replace any damage clips.

Armrest Replacement

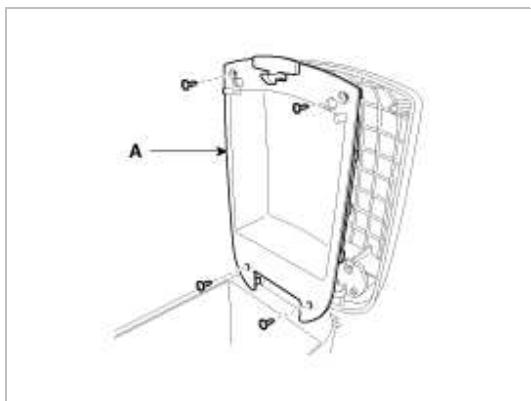
CAUTION

- 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.

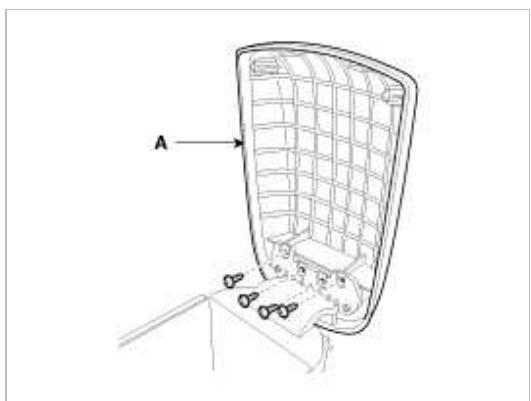
1. Using a screwdriver or remover, remove the rear console cover (A).



2. After loosening the mounting screws, then remove the armrest cover (A).



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



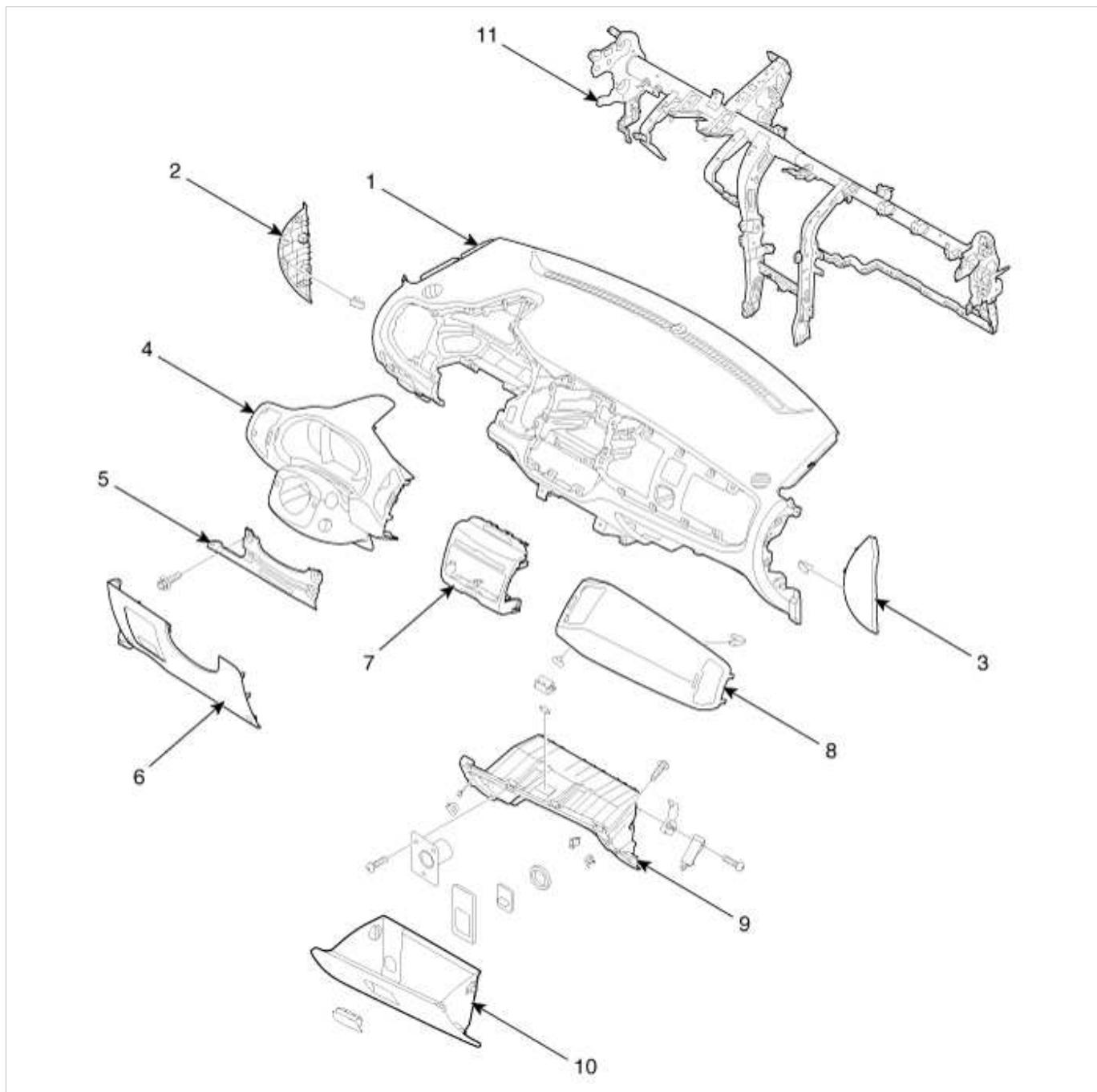
4. Installation is the reverse of removal.

NOTE

- Replace any damage clips.

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

Components



- | | |
|---|---|
| 1. Main crash pad assembly
2. Crash pad side cover [LH]
3. Crash pad side cover [RH]
4. Cluster fascia panel
5. Reinforcing panel
6. Crash pad lower panel | 7. Center facia panel
8. Crash pad garnish
9. Glove box housing
10. Glove box
11. Cowl cross bar assembly |
|---|---|

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

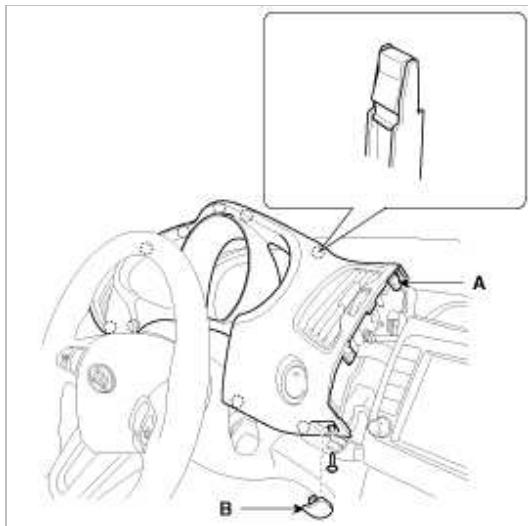
Replacement

Cluster Replacement

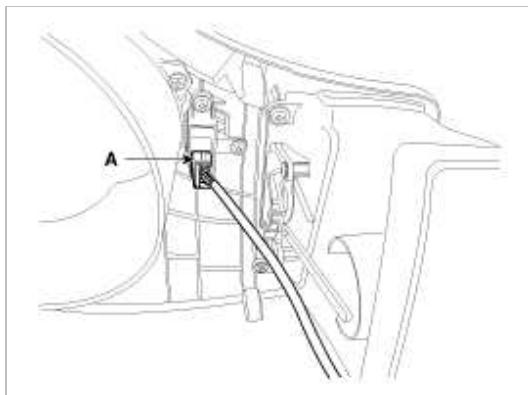
CAUTION

- 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.

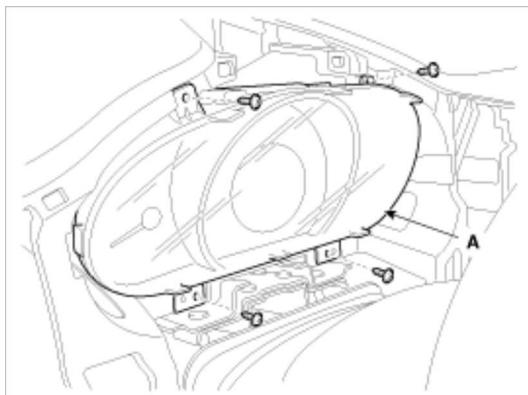
1. Remove the cluster fascia panel cap (B) and then loosening the mounting screw.
2. Using a screwdriver or remover, remove the cluster fascia panel (A).



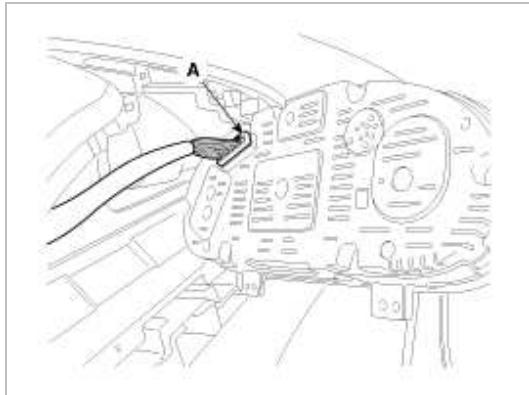
3. Disconnect the connector (A).



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



5. Disconnect the connector (A).



6. Installation is the reverse of removal.

NOTE

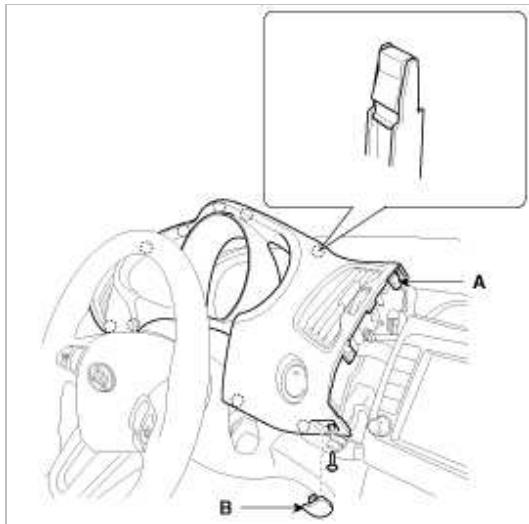
- Make sure the connector is plugged in properly.
- Replace any damage clips.

Center Facia Panel Replacement

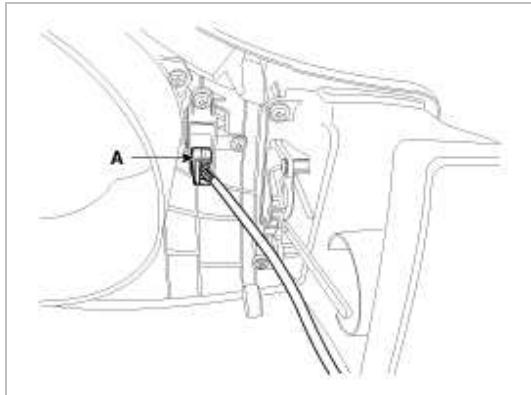
CAUTION

- 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.

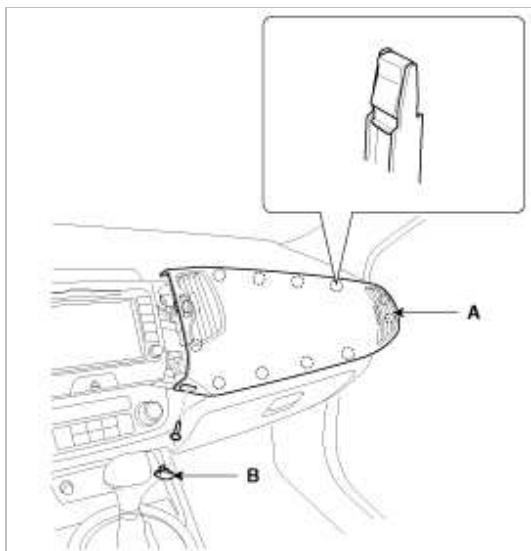
1. Remove the cluster fascia panel cap (B) and then loosening the mounting screw.
2. Using a screwdriver or remover, remove the cluster fascia panel (A).



3. Disconnect the connector (A).



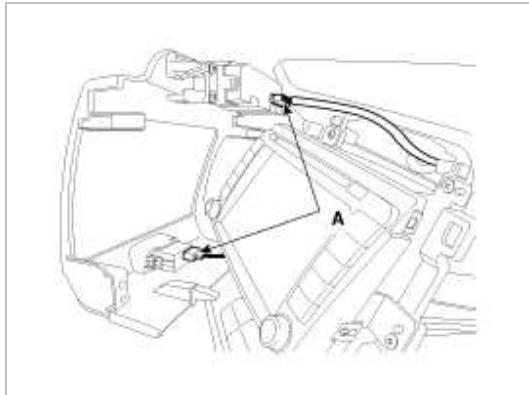
4. Remove the crash pad garnish cap (B) and then loosening the mounting screw.
5. Using a screwdriver or remover, remove the crash pad garnish (A).



6. After loosening the mounting screws, then remove the center facia panel (A).



7. Disconnect the connectors (A).



8. Installation is the reverse of removal.

NOTE

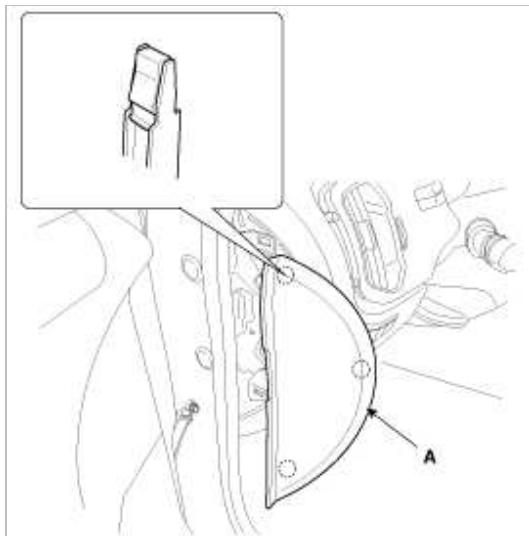
- Make sure the connector are connected in properly.
- Replace any damage clips.

Crash Pad Lower Panel Replacement

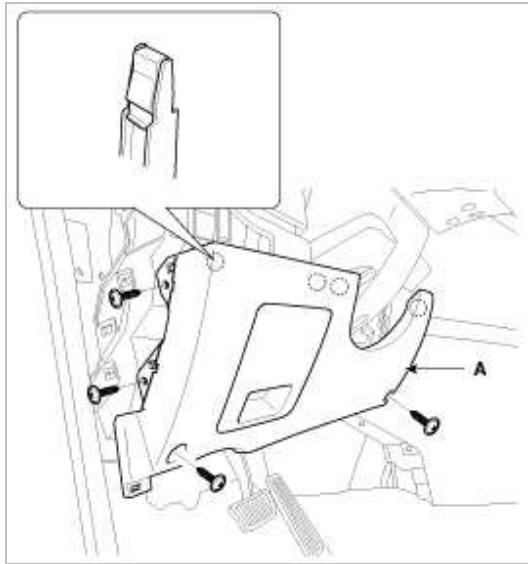
CAUTION

- 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.

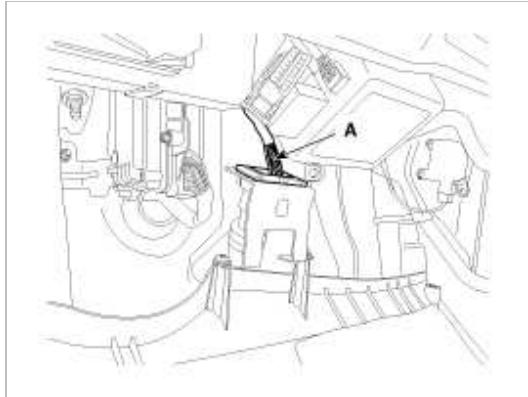
1. Using a screwdriver or remover, remove the crash pad side cover (A).



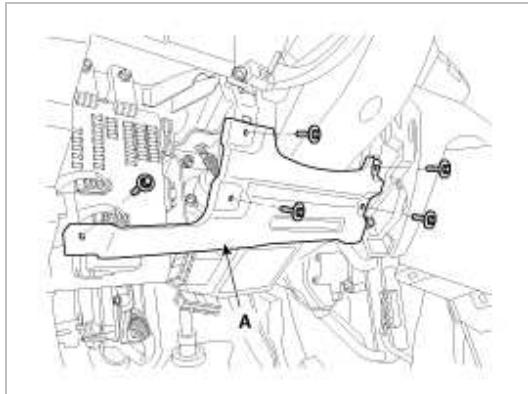
2. After loosening the mounting screws, then remove the crash pad lower panel (A).



3. Disconnect the diagnosis connector (A).



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



5. Installation is the reverse of removal.

NOTE

- Make sure the connector are connected in properly.
- Replace any damage clips.

Audio assembly Replacement

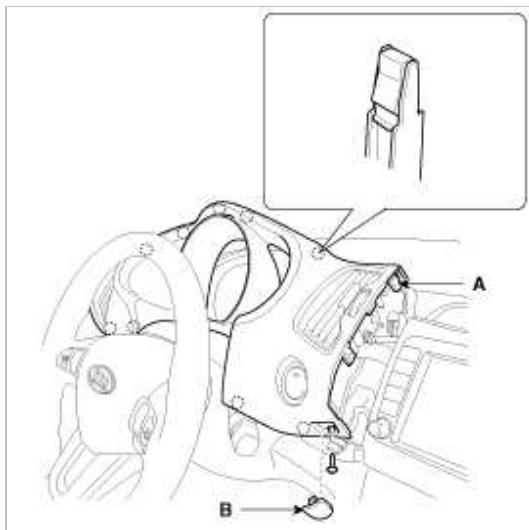
CAUTION

- When prying with a flat-tip screwdriver, wrap it with protective tape, and apply protective tape around the related

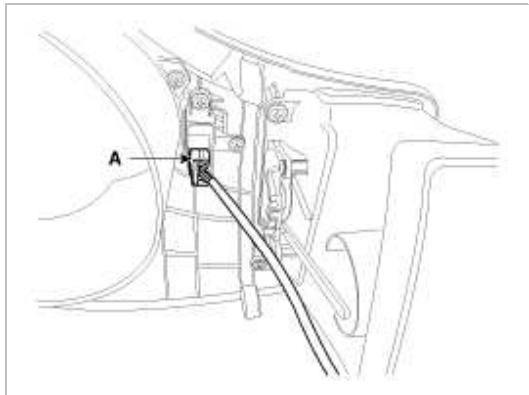
parts, to prevent damage.

- Put on gloves to protect your hands.

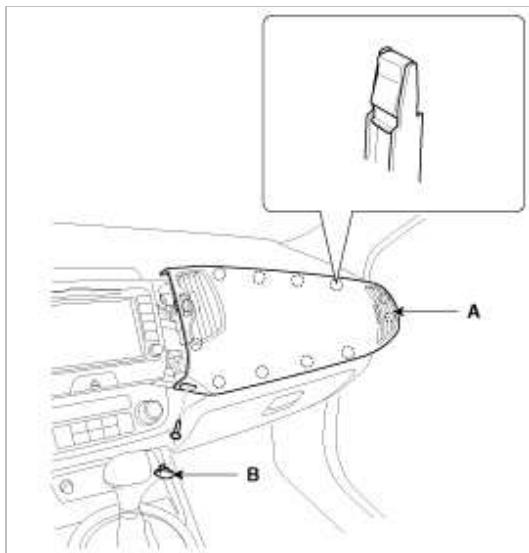
1. Remove the cluster fascia panel cap (B) and then loosening the mounting screw.
2. Using a screwdriver or remover, remove the cluster fascia panel (A).



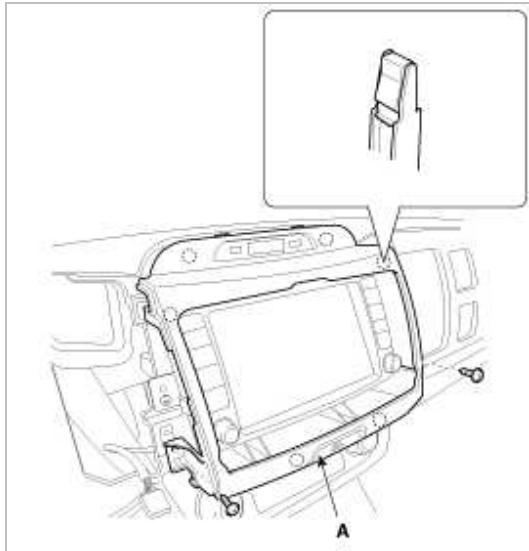
3. Disconnect the connector (A).



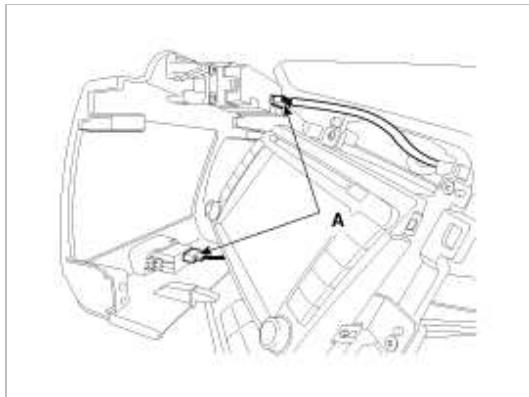
4. Remove the crash pad garnish cap (B) and then loosening the mounting screw.
5. Using a screwdriver or remover, remove the crash pad garnish (A).



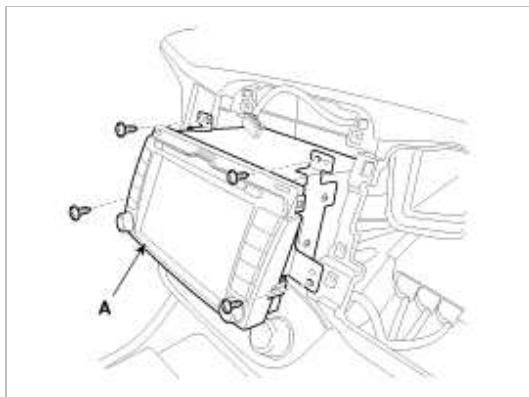
6. After loosening the mounting screws, then remove the center facia panel (A).



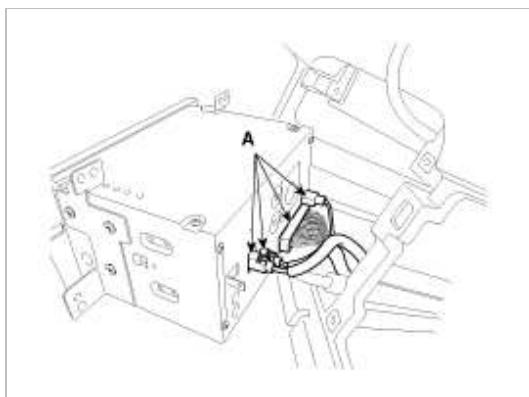
7. Disconnect the connectors (A).



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



9. Disconnect the connectors (A).



10. Installation is the reverse of removal.

NOTE

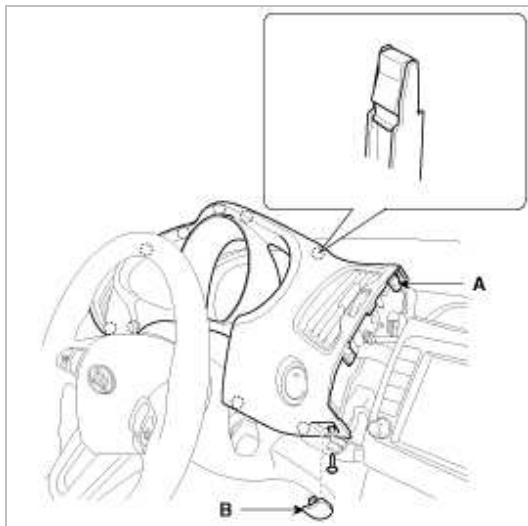
- Make sure the connector are connected in properly.
- Replace any damage clips.

Heater Control Unit Replacement

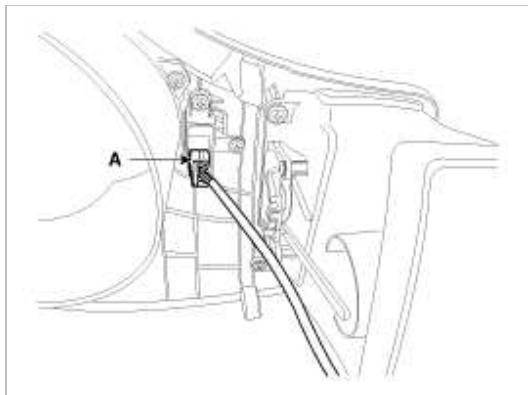
CAUTION

- 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.

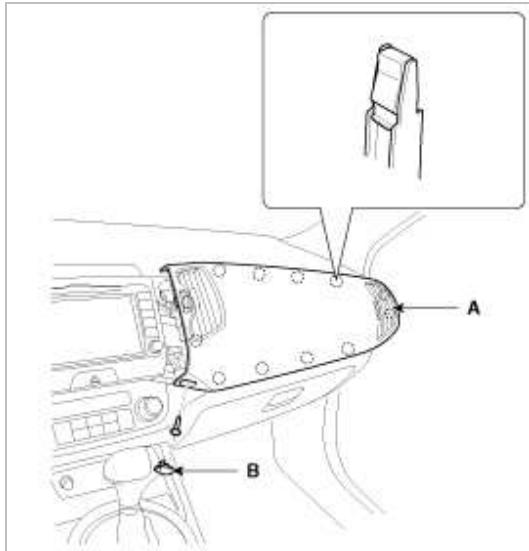
1. Remove the cluster fascia panel cap (B) and then loosening the mounting screw.
2. Using a screwdriver or remover, remove the cluster fascia panel (A).



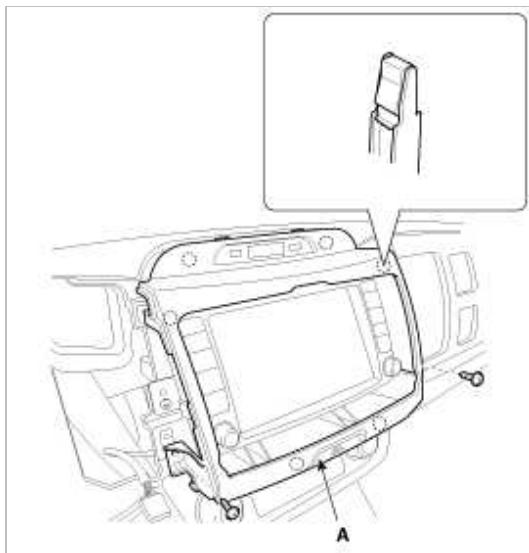
3. Disconnect the connector (A).



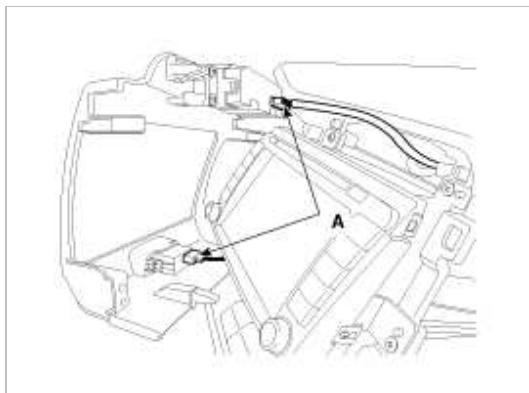
4. Remove the crash pad garnish cap (B) and then loosening the mounting screw.
5. Using a screwdriver or remover, remove the crash pad garnish (A).



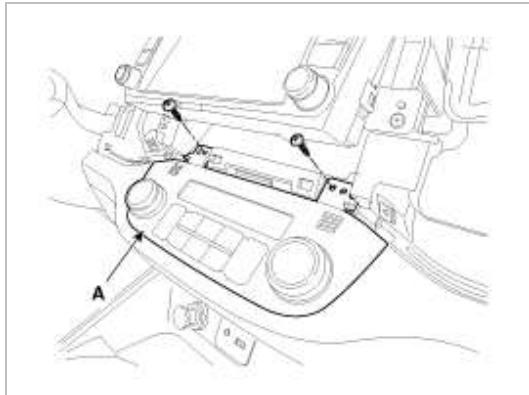
6. After loosening the mounting screws, then remove the center facia panel (A).



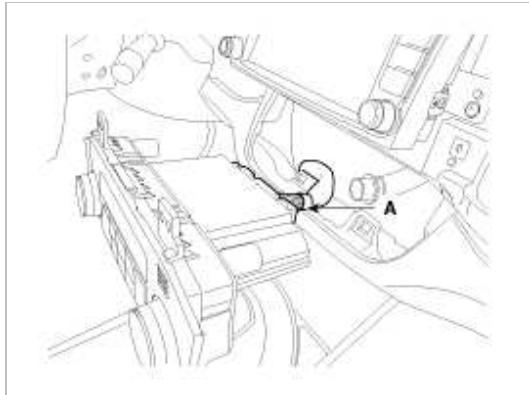
7. Disconnect the connectors (A).



8. After loosening the mounting screws, then remove the heater control unit (A).



9. Disconnect the connector (A).



10. Installation is the reverse of removal.

NOTE

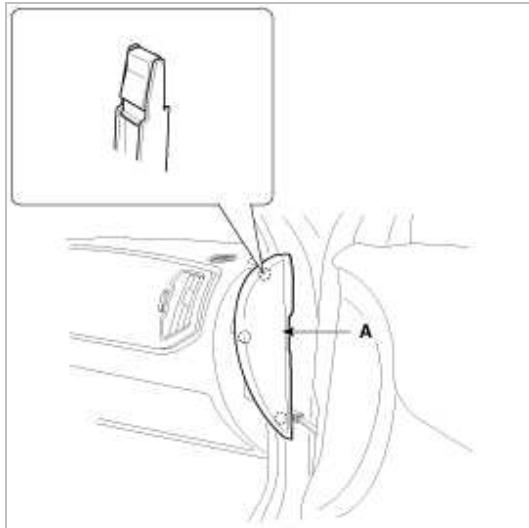
- Make sure the connector are connected in properly.
- Replace any damage clips.

Glove Box Replacement

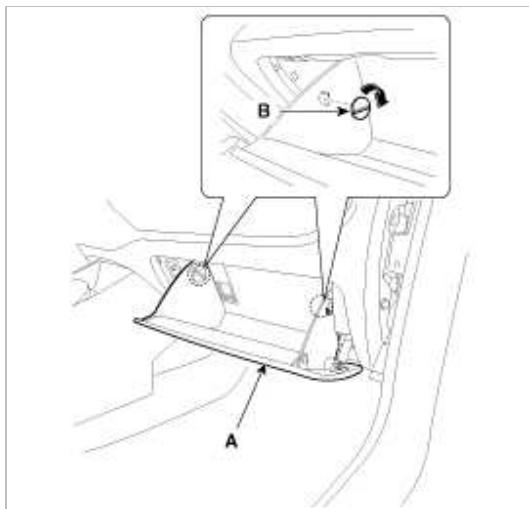
CAUTION

- 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.

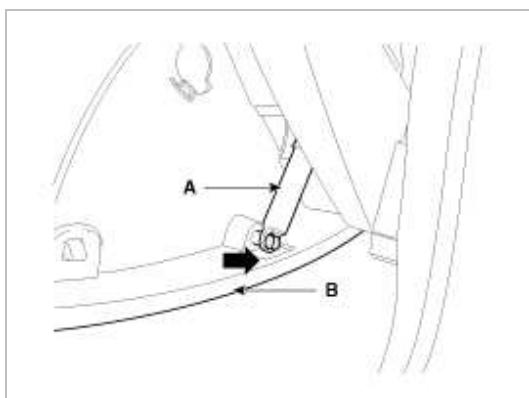
1. Using a screwdriver or remover, remove the crash pad side cover (A).



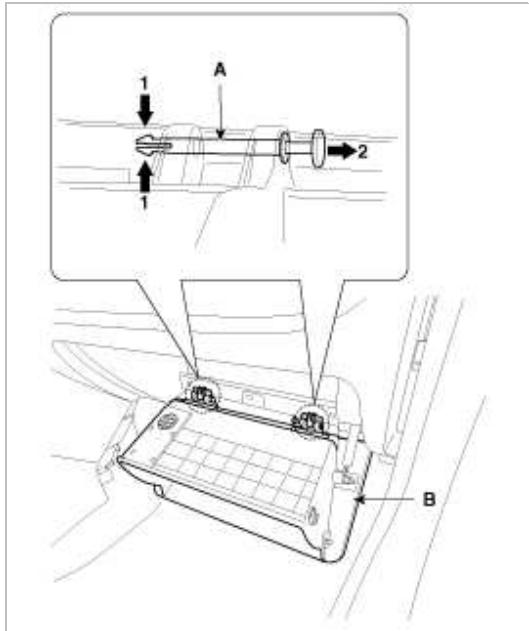
2. Disconnect the guide (B) from the glove box (A).



3. Disconnect the life (A) from the glove box (B).



4. Disconnect the pin (A) and then remove the glove box (B).



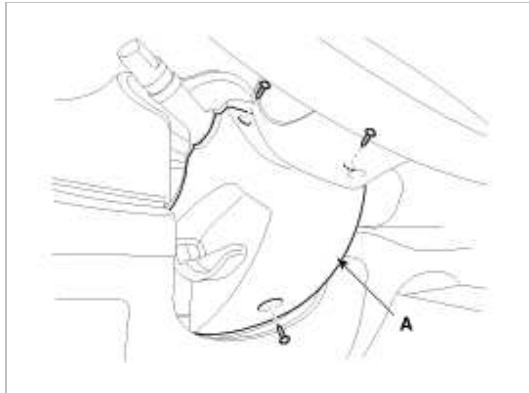
5. Installation is the reverse of removal.

NOTE

- Replace any damage clips.

Shroud Replacement

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



2. Installation is the reverse of removal.

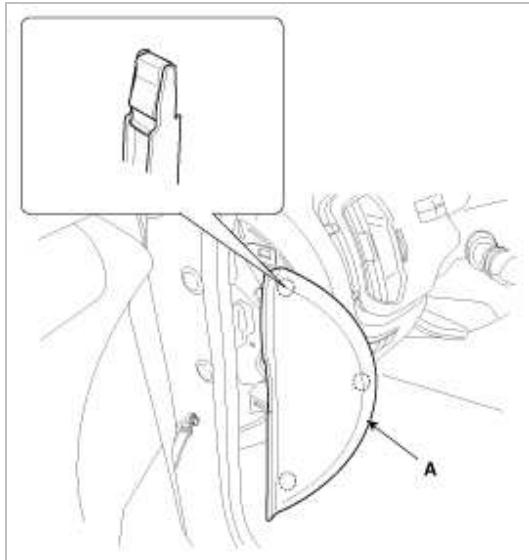
Crash Pad Side Cover Replacement

CAUTION

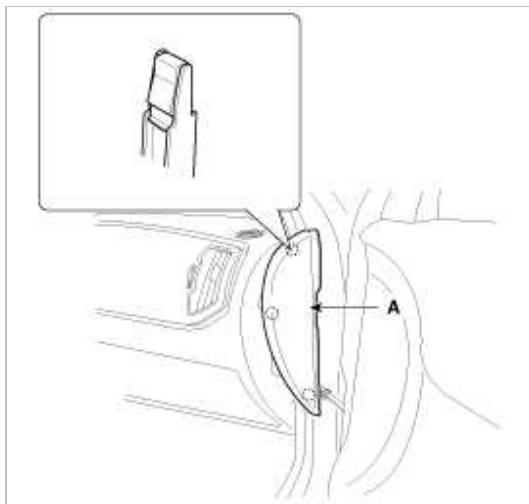
- When prying with a flat-tip screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.

1. Using a screwdriver or remover, remove the crash pad side cover (A).

[Driver's]



[Passenger's]



2. Installation is the reverse the removal.

Main Crash Pad Replacement

CAUTION

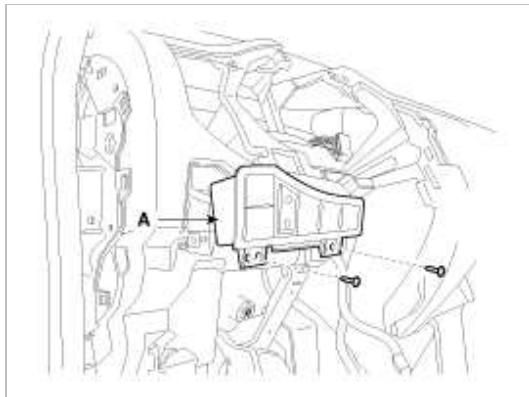
- When prying with a flat-tip screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.

1. Remove the following items.

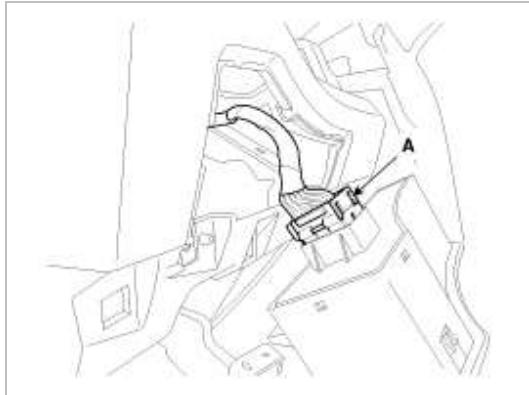
- A. Front seat
(Refer to the BD group – “Front Seat”)
- B. Front pillar trim
(Refer to the BD group – “Interior Trim”)
- C. Floor console assembly
(Refer to the BD group – “Console”)
- D. Cluster fascia panel & Cluster assembly
- E. Crash pad garnish
- F. Glove box
- G. Center fascia panel
- H. Audio assembly
- I. Heater control unit

- J. Crash pad side cover
- K. Cowl side trim
(Refer to the BD group- Interior Trim")
- L. Crash pad lower panel
- M. Steering column
(Refer to the ST group - "Steering Column and Shaft")

2. After loosening the mounting screws, then remove the crash pad switch assembly (A).

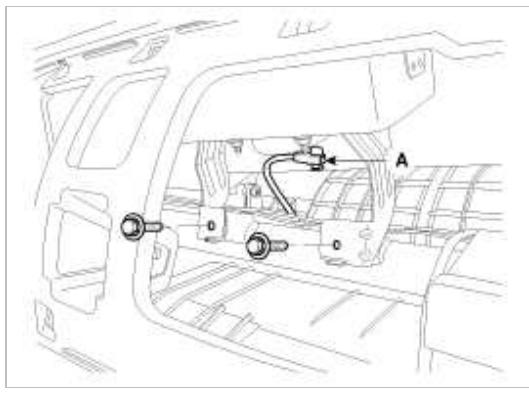


3. Disconnect the connector (A).



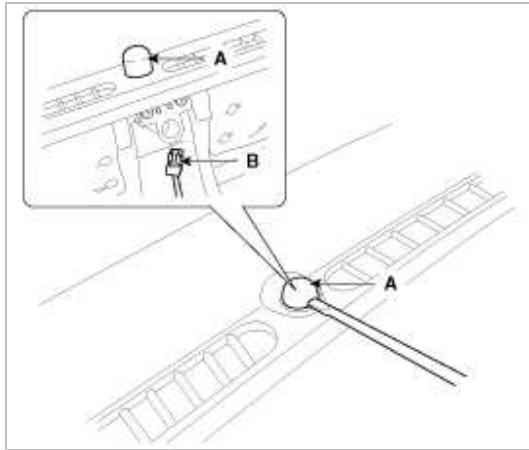
4. Disconnect the passenger's airbag connector (A).

5. Loosen the mounting bolts.

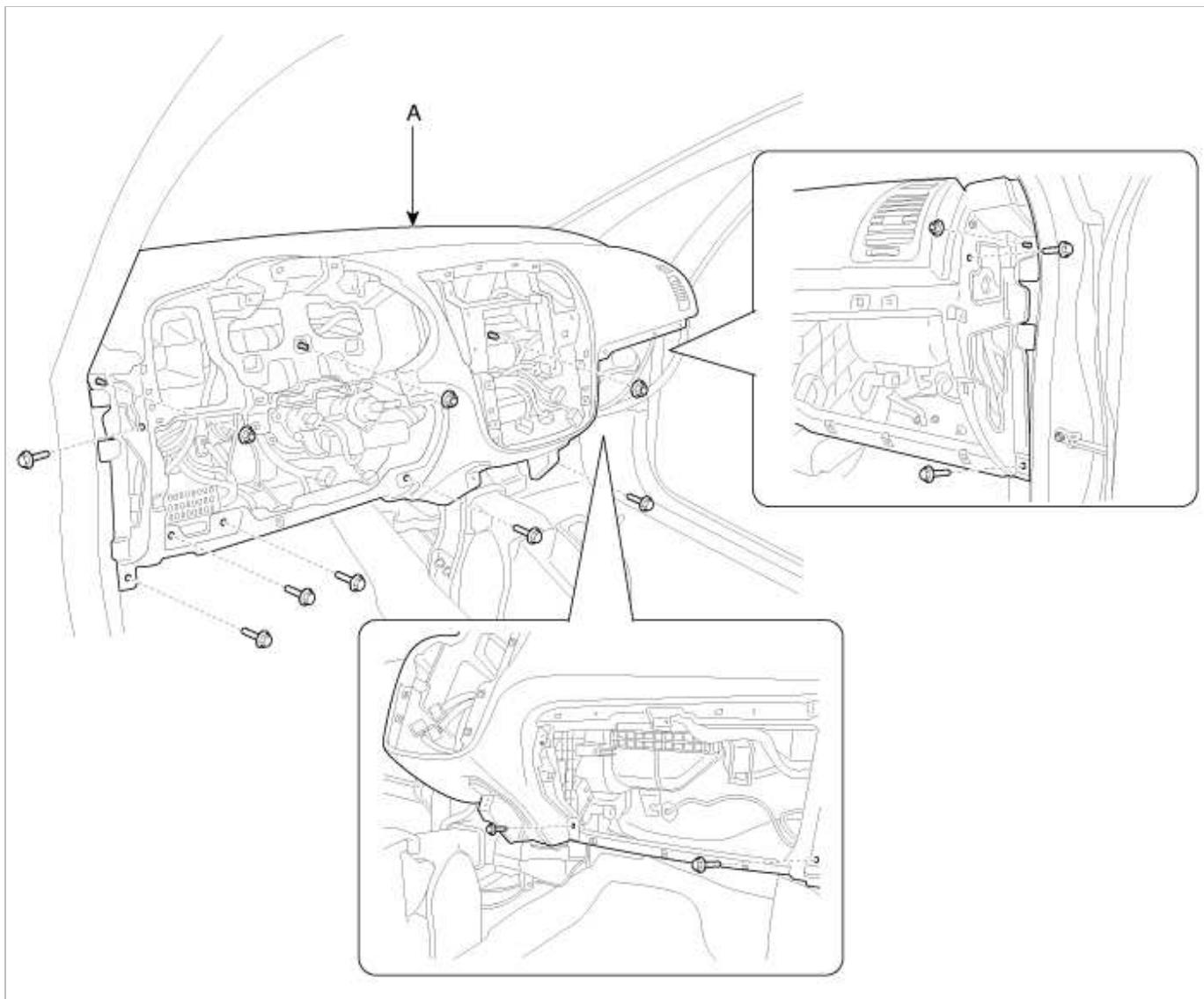


6. Using a screwdriver, remove the photo sensor (A).

7. Disconnect the photo sensor connector (B).



8. After loosening the mounting bolts and nuts, then remove the main crash pad assembly (A).



9. Installation is the reverse of removal.

NOTE

- Make sure the crash pad fits onto the guide pins correctly.
- Before tightening the bolts, make sure the crash pad wire harnesses are not pinched.
- Make sure the connectors are plugged in properly, and the antenna lead is connected properly.

- Enter the anti-theft code for the radio, then enter the customer's radio station presets.

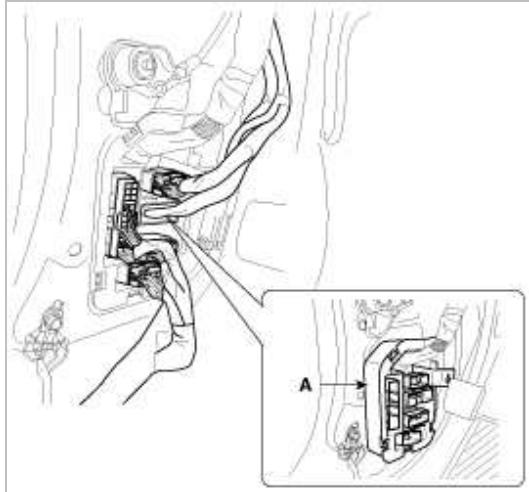
Cowl Cross Bar Replacement

CAUTION

- 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.

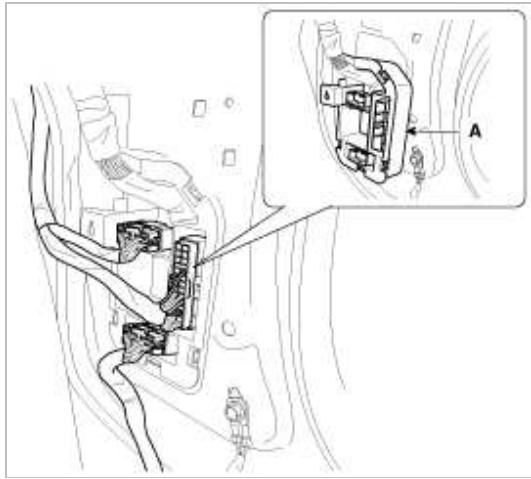
1. Remove the following items.
 - A. Front seat
(Refer to the BD group - "Front Seat")
 - B. Floor Console assembly
(Refer to the BD group - "Console")
 - C. Cowl top cover
(Refer to the BD group - "Cowl Top Cover")
 - D. Cowl side trim
(Refer to the BD group - "Interior Trim")
 - E. Main crash pad
2. Disconnect the blower unit connectors.
(Refer to the HA group - "Air conditioning system, Heater, Blower")
3. Disconnect the wiring connectors.
4. Using a screwdriver or remover, remove the multi box (A).

[Driver's]

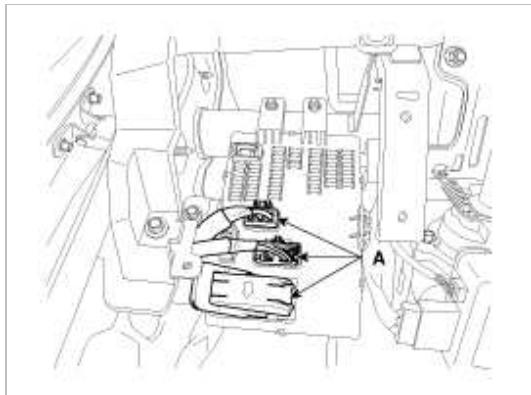


5. Disconnect the wiring connectors.
6. Using a screwdriver or remover, remove the multi box (A).

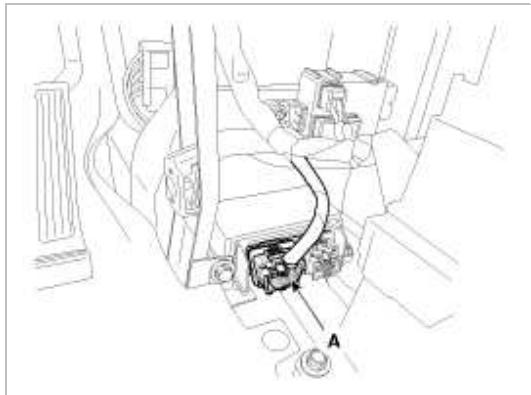
[Passenger's]



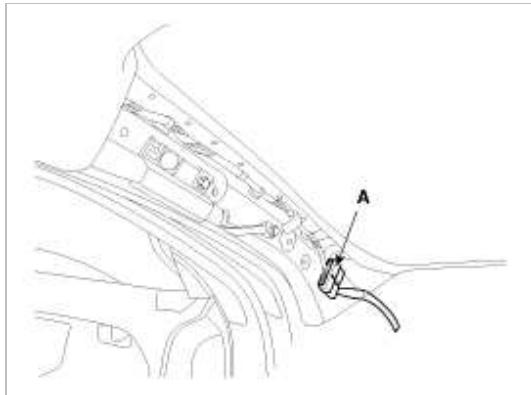
7. Disconnect the connectors (A).



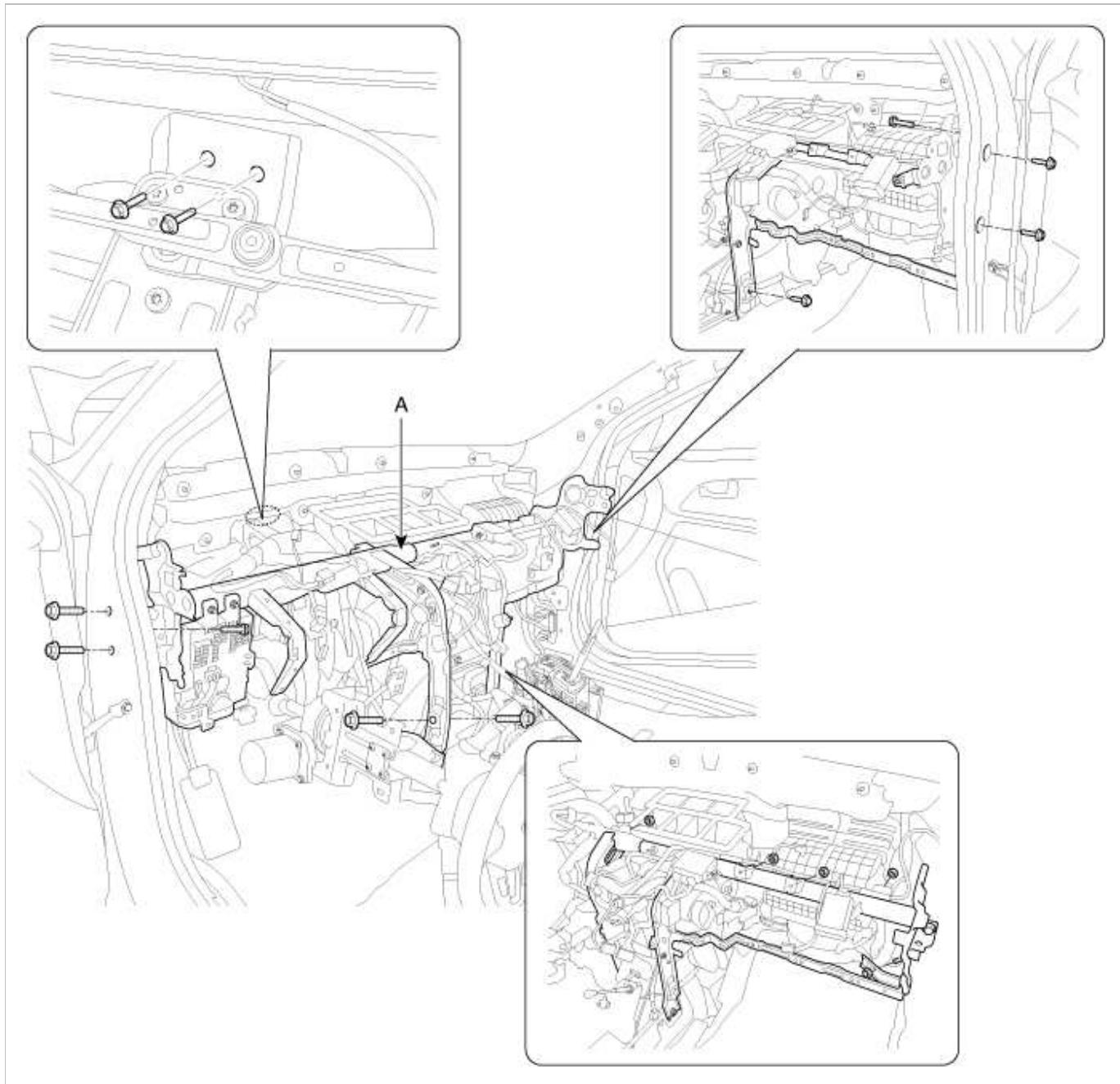
8. Disconnect the airbag control module (SRSCM) connector (A).



9. Disconnect the connector (A) and the mounting clips in the driver's front pillar.



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



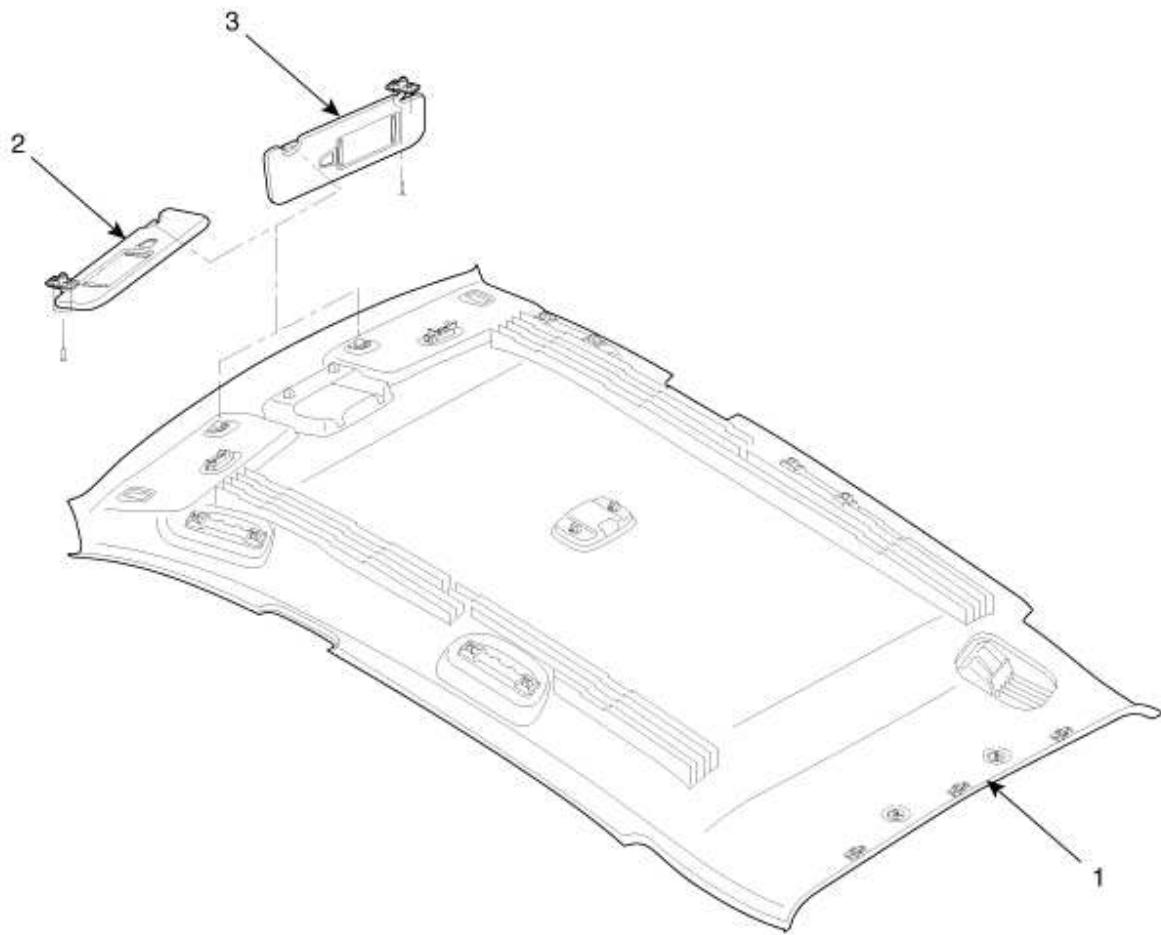
11. Installation is the reverse of removal.

NOTE

- Replace any damage clips.
- Make sure the connectors are plugged in properly.

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

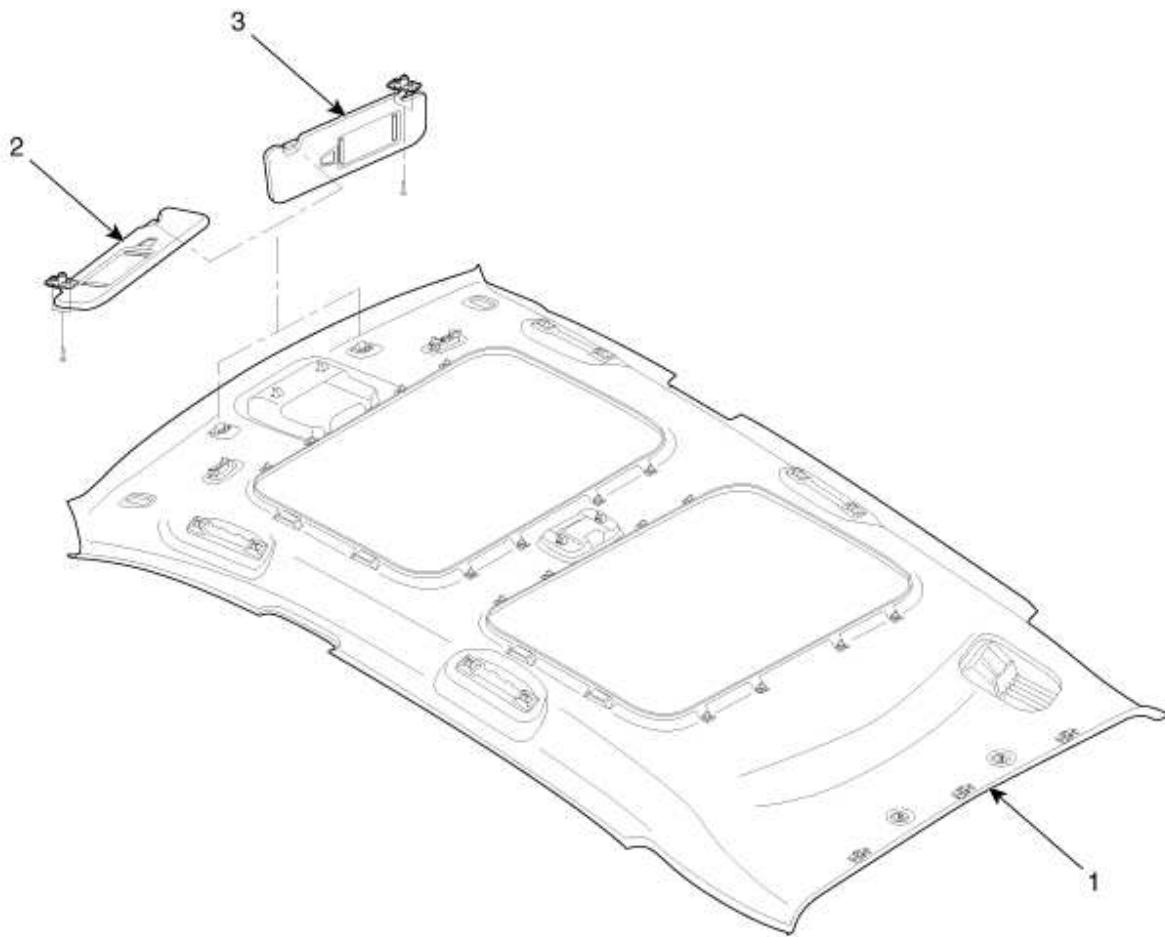
Components



1. Roof trim
2. Sunvisor [Driver's]

3. Sunvisor [Passenger's]

Components [Panoramaroof]



1. Roof trim
2. Sunvisor [Driver's]

3. Sunvisor [Passenger's]

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

Replacement

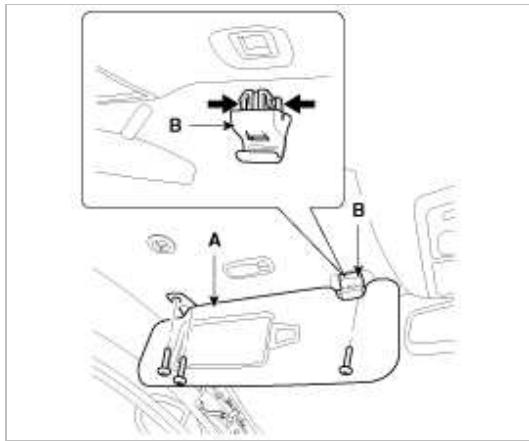
Sunvisor Replacement

CAUTION

- Use a plastic panel removal tool to remove interior trim pieces to without marring the surface.

- Put on gloves to protect your hands.

1. After loosening the mounting screws, then remove the sunvisor (A) and retainer (B).



2. Installation is the reverse of removal.

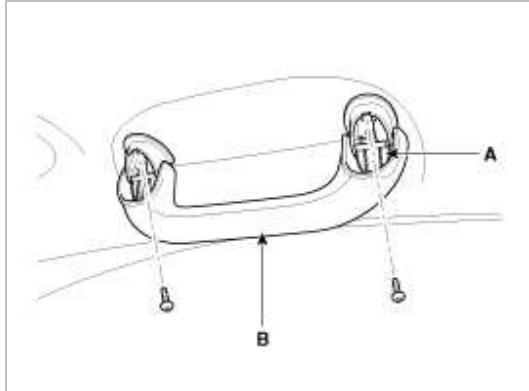
Assist Handle Replacement

CAUTION

- Use a plastic panel removal tool to remove interior trim pieces to without marring the surface.
- Put on gloves to protect your hands.

1. Remove the covers (A).

2. After loosening the mounting screws, then remove the assist handle (B).



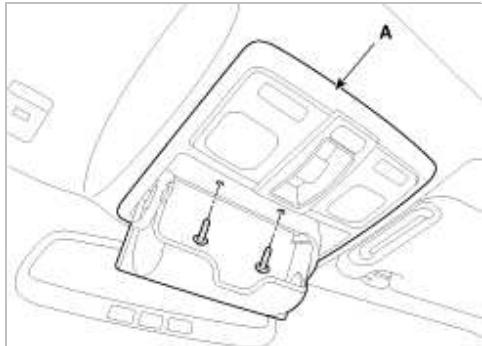
3. Installation is the reverse of removal.

Overhead Console Replacement

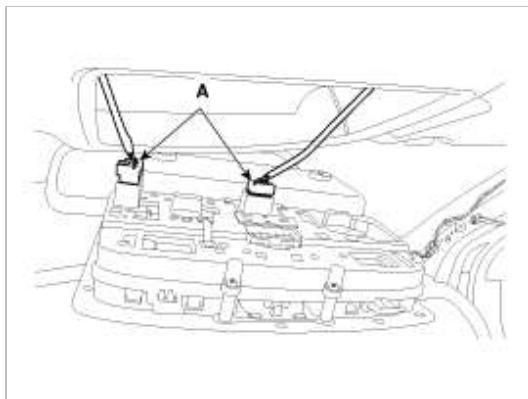
CAUTION

- Use a plastic panel removal tool to remove interior trim pieces to without marring the surface.
- Put on gloves to protect your hands.

1. After loosening the mounting screws, then remove the overhead console assembly (A).



2. Disconnect the connectors (A).



3. Installation is the reverse of removal.

NOTE

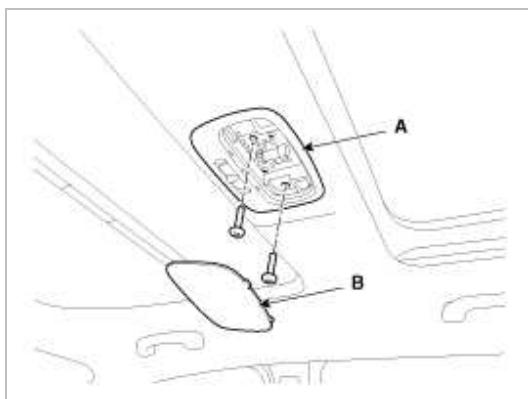
- Make sure the connector is connected properly.

Room Lamp Replacement

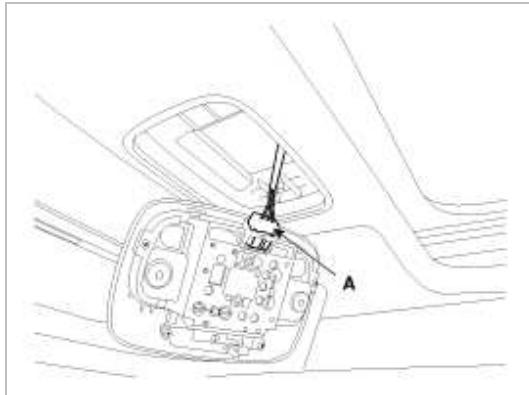
CAUTION

- Use a plastic panel removal tool to remove interior trim pieces to without marring the surface.
- Put on gloves to protect your hands.

1. Using a screwdriver or remover, remove the room lamp cover (B).
2. After loosening the mounting screws, then remove the room lamp (A).



3. Disconnect the connector (A).



4. Installation is the reverse of removal.

NOTE

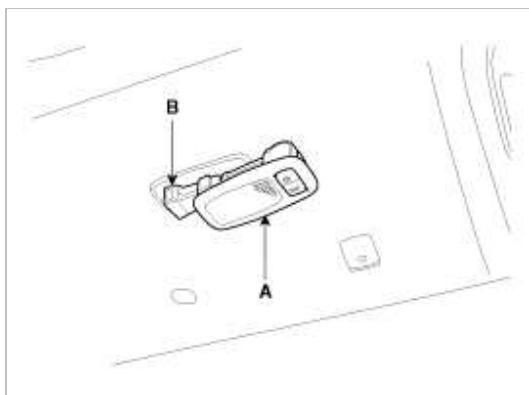
- Make sure the connectors are plugged in properly.

Vanity Lamp Replacement

CAUTION

- Use a plastic panel removal tool to remove interior trim pieces to without marring the surface.
- Put on gloves to protect your hands.

1. Using a screwdriver or remover, remove the vanity lamp (A).
2. Disconnect the connector (B).



3. Installation is the reverse of removal.

NOTE

- Make sure the connector is connected properly.

Roof Trim Replacement

CAUTION

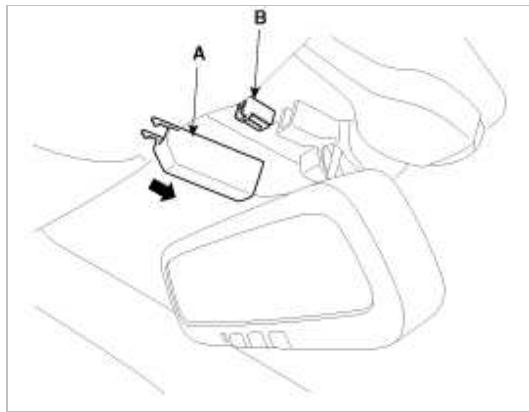
- When prying with a flat-tip screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.

1. Remove the following items.
 - A. Front seat
(Refer to the BD group - "Front Seat")

- B. Rear seat
(Refer to the BD group - "Rear Seat")
- C. Sunvisor
- D. Overhead console
- E. Room lamp
- F. Assist handle
- G. Front pillar trim
(Refer to the BD group - " Interior Trim")
- H. Front door scuff trim & Rear door scuff trim
(Refer to the BD group - " Interior Trim")
- I. Center pillar lower trim & Center pillar upper trim
(Refer to the BD group - " Interior Trim")
- J. Rear pillar trim
(Refer to the BD group - " Interior Trim")

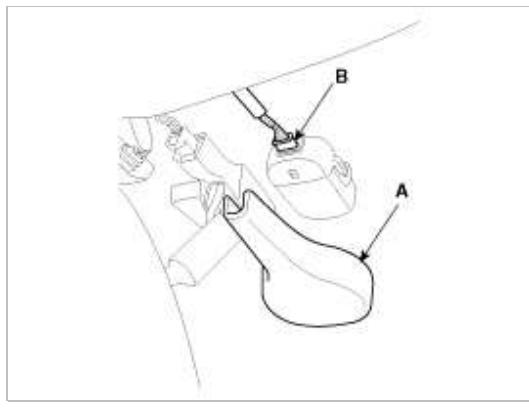
2. Remove the ECM mirror cover (A).

3. Disconnect the ECM mirror connector (B).



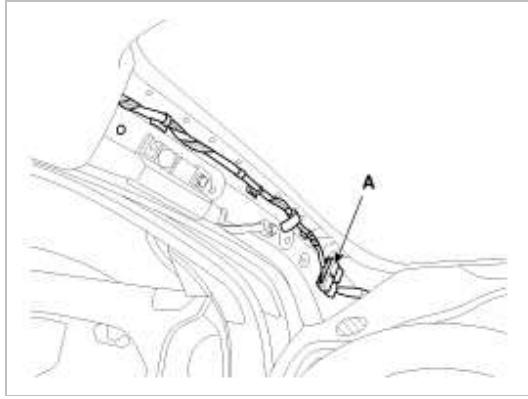
4. Remove the rain sensor cover (A).

5. Disconnect the rain sensor connector (B).

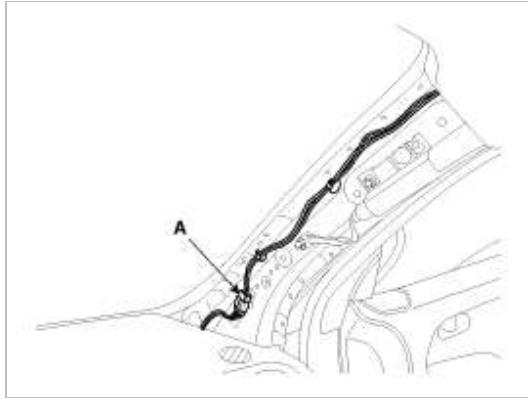


6. Disconnect the roof trim main connector (A).

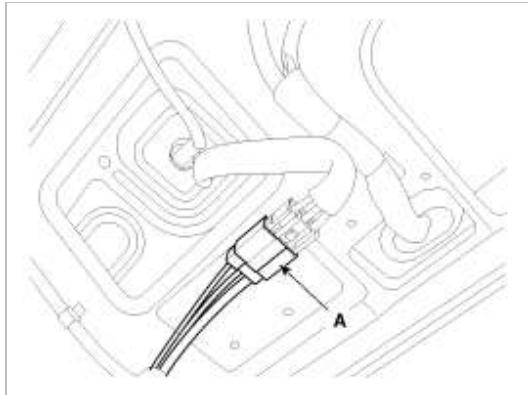
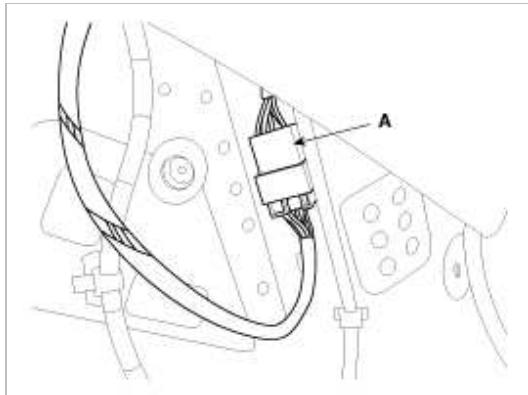
[Driver's]



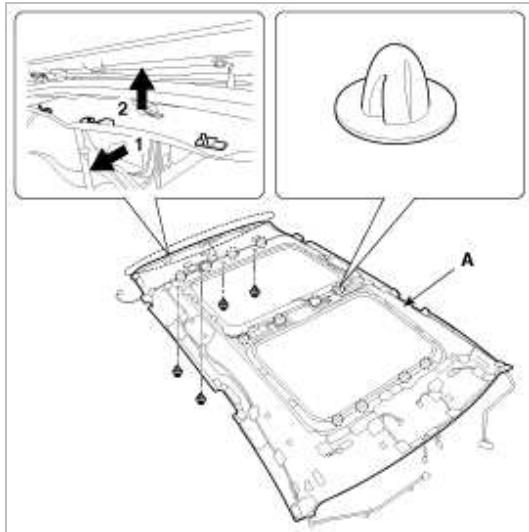
[Passenger's]



7. Disconnect the antenna connector (A).



8. Remove the clips and roof trim (A).



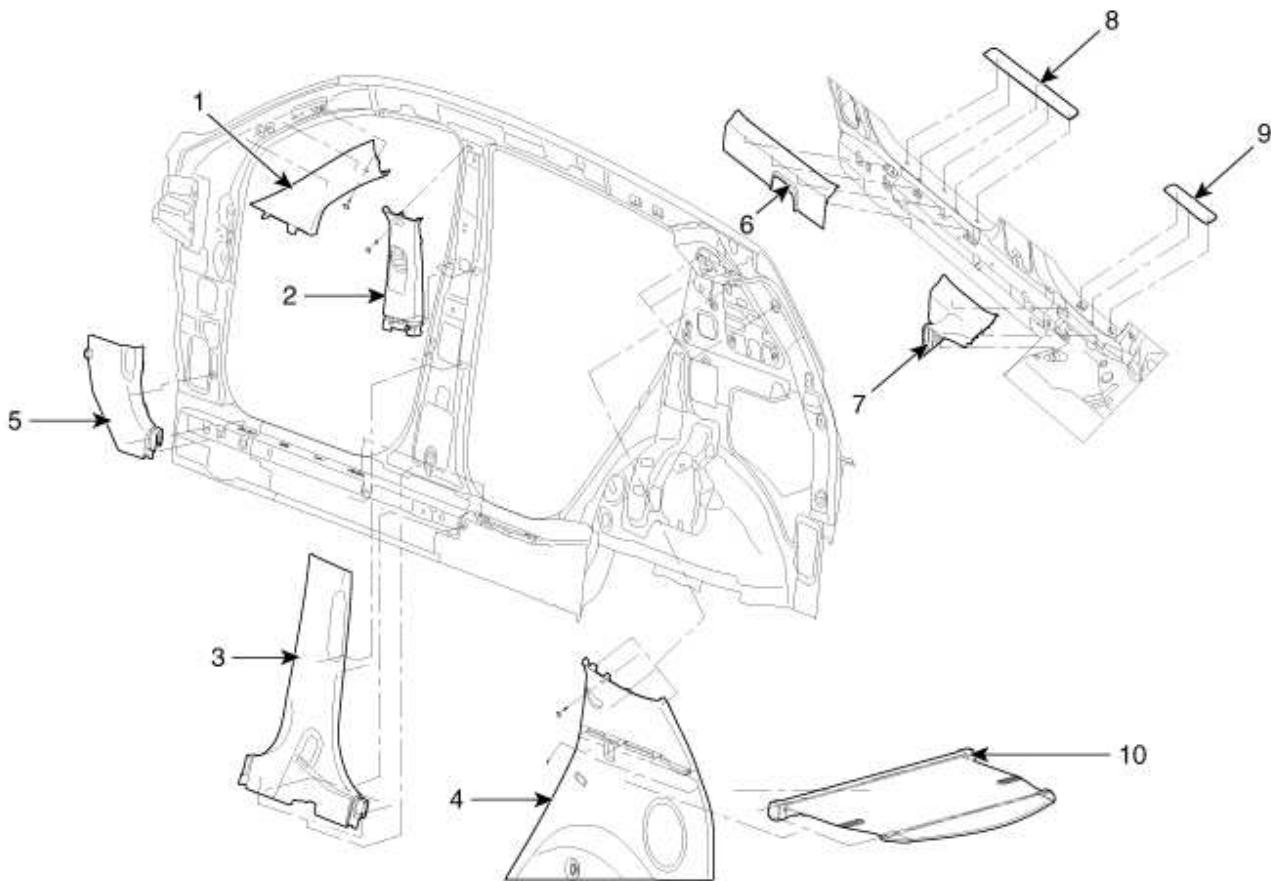
9. Installation is the reverse of removal.

NOTE

- Make sure the connectors are plugged in properly.
- Replace any damage clips.

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

Components



- | | |
|---|--|
| 1. Front pillar trim
2. Center pillar upper trim
3. Center pillar lower trim
4. Luggage side trim
5. Cowl side trim | 6. Front door scuff trim
7. Rear door scuff trim
8. Front step trim
9. Rear step trim
10. Cargo screen |
|---|--|

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

Replacement

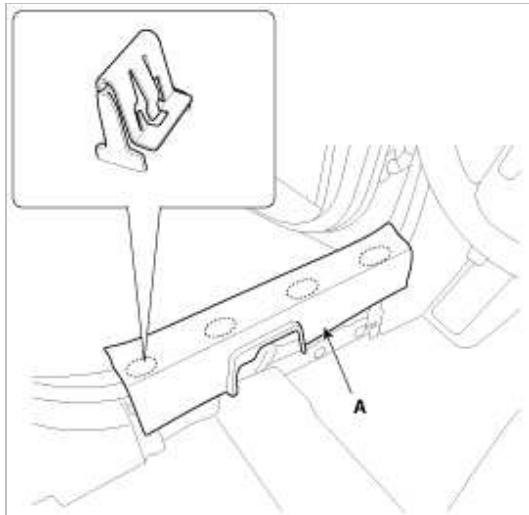
Door Scuff Trim Replacement

CAUTION

- Put on gloves to protect your hands.
- Use a plastic panel removal tool to remove interior trim pieces to without marring the surface.
- Take care not to bend or scratch the trim and panels.

1. Using a screwdriver or remover, remove the front door scuff trim (A).

[Front]

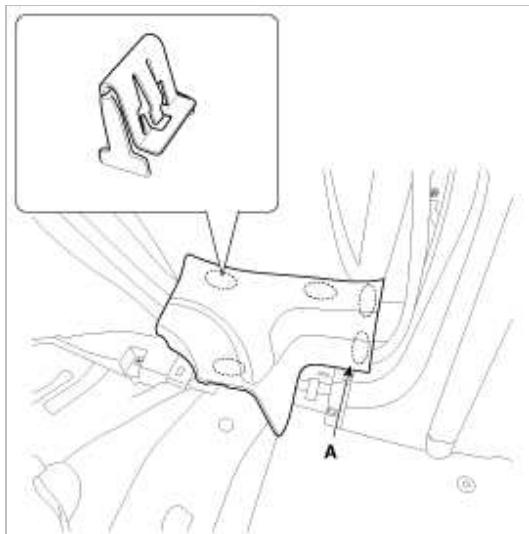


2. Remove the rear seat

(Refer to the BD group - "Rear Seat")

3. Using a screwdriver or remover, remove the rear door scuff trim (A).

[Rear]



4. Installation is the reverse of removal.

NOTE

- Replace any damage clips.

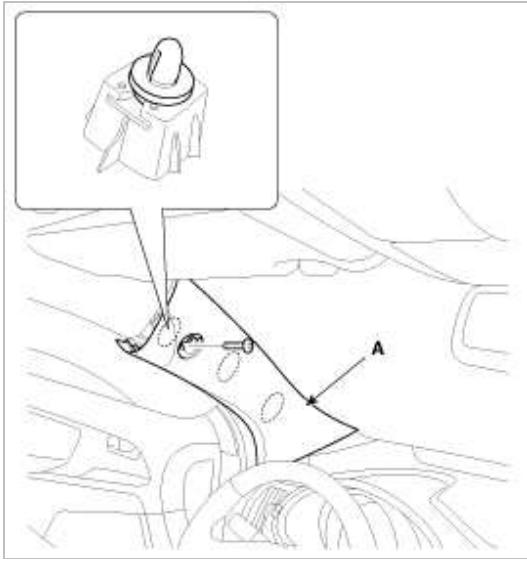
Front Pillar Trim Replacement

CAUTION

- Put on gloves to protect your hands.

- Use a plastic panel removal tool to remove interior trim pieces to without marring the surface.
- Take care not to bend or scratch the trim and panels.

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



2. Installation is the reverse of removal.

NOTE

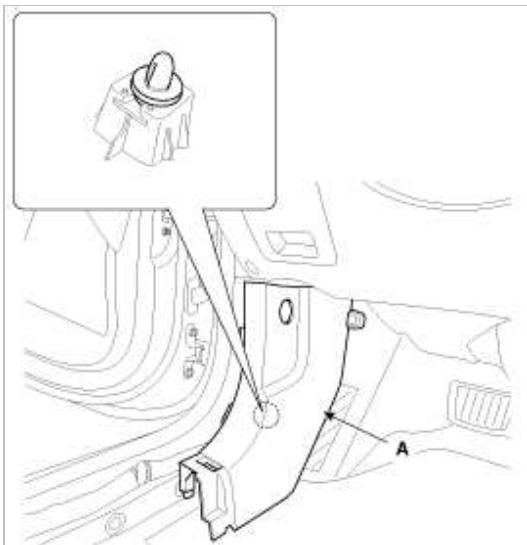
- Replace any damage clips.

Cowl Side Trim Replacement

CAUTION

- Put on gloves to protect your hands.
- Use a plastic panel removal tool to remove interior trim pieces to without marring the surface.
- Take care not to bend or scratch the trim and panels.

1. Remove the front door scuff trim.
2. Remove the hood release handle.
(Refer to the BD group – “Hood”)
3. Using a screwdriver or remover, remove the cowl side trim (A).



4. Installation is the reverse of removal.

NOTE

- Replace any damage clips.

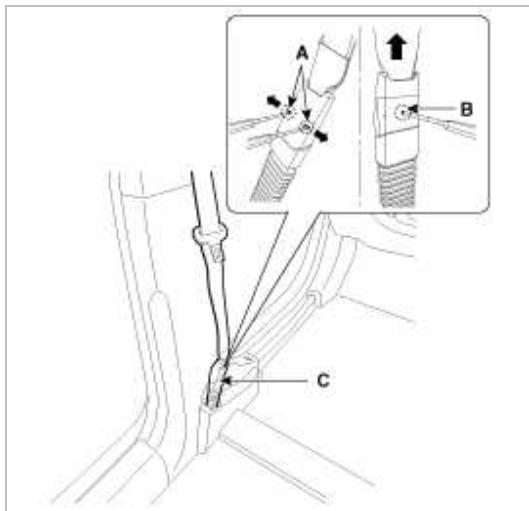
Center Pillar Trim Replacement

CAUTION

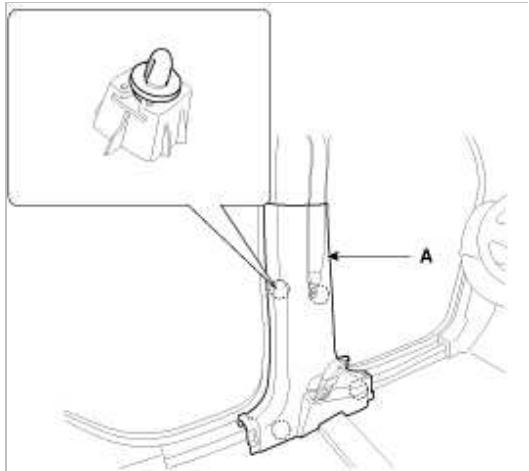
- Put on gloves to protect your hands.
- Use a plastic panel removal tool to remove interior trim pieces to without marring the surface.
- Take care not to bend or scratch the trim and panels.

1. Remove the front door scuff trim and rear door scuff trim.

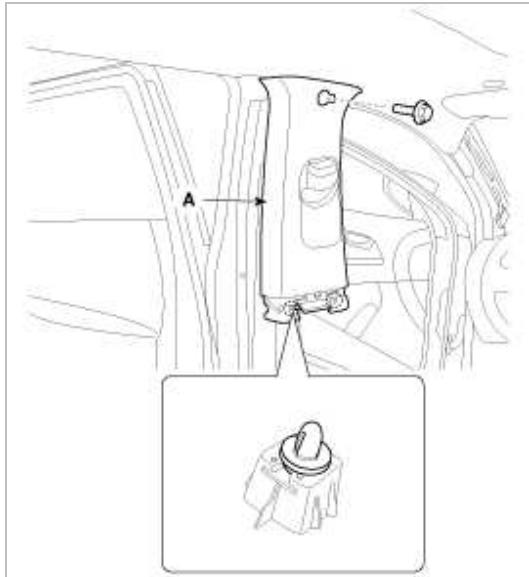
2. To remove the seat belt anchor pretensioner (C), keep on pushing the lock pins (A) as arrow direction. And then remove the seat belt after pushing the lock pin (B).



3. Using a screwdriver or remover, remove the center pillar lower trim (A).



4. After loosening the mounting bolt, then remove the center pillar upper trim (A).



5. Installation is the reverse of removal.

NOTE

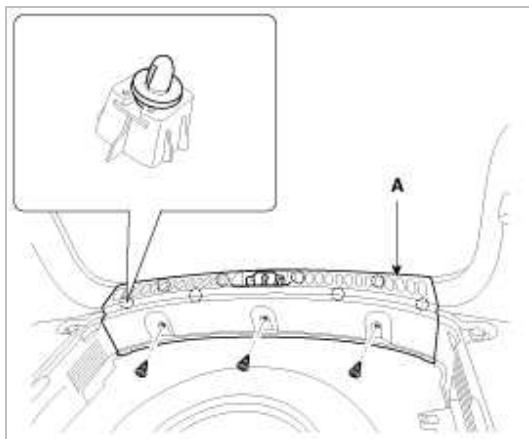
- Replace any damage clips.

Rear Pillar Trim Replacement

CAUTION

- Put on gloves to protect your hands.
- Use a plastic panel removal tool to remove interior trim pieces to without marring the surface.
- Take care not to bend or scratch the trim and panels.

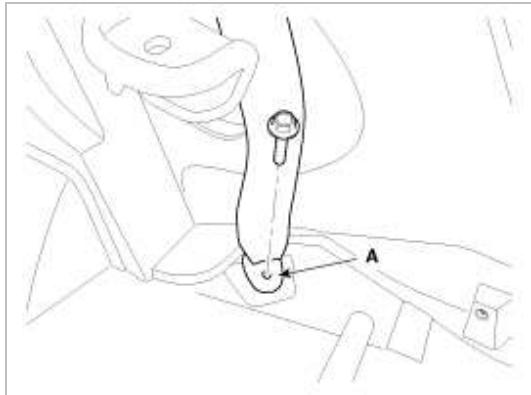
1. Remove the rear seat.
(Refer to the BD group – “Rear Seat”)
2. Remove the rear door scuff trim.
3. Detach the mounting clips, remove the transverse trim (A).



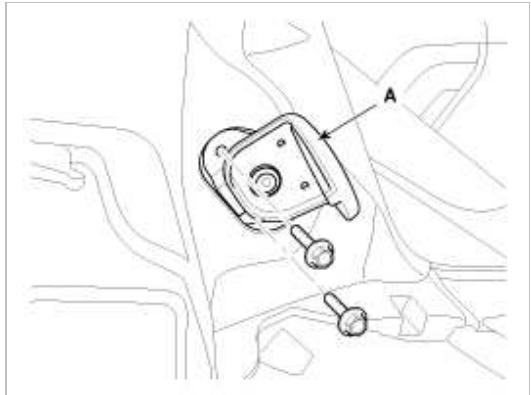
4. After loosening the mounting bolt, then remove the rear seat belt lower anchor (A).

Tightening torque :

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



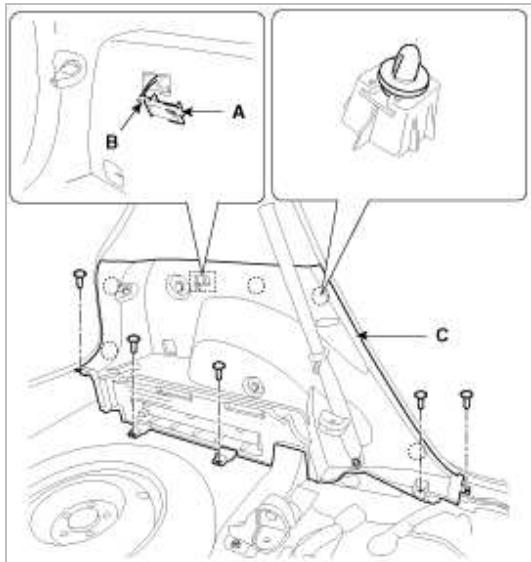
5. After loosening the mounting bolts, then remove the rear seat bracket (A).



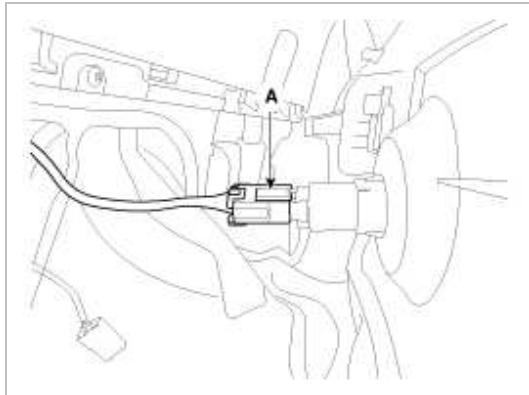
6. Using a screwdriver or remover, remove the lamp (A).

7. Disconnect the connector (B).

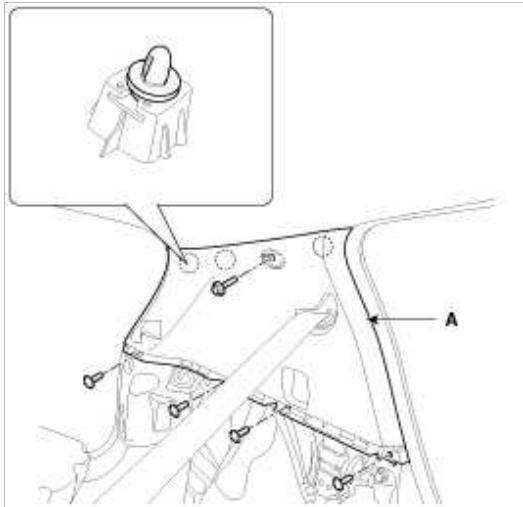
8. After loosening the mounting screws, then remove the luggage side trim (C).



9. Disconnect the connector (A).



10. After loosening the mounting screws and bolt, then remove the rear pillar trim (A).



11. Installation is the reverse of removal.

NOTE

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

Luggage Side Trim Replacement

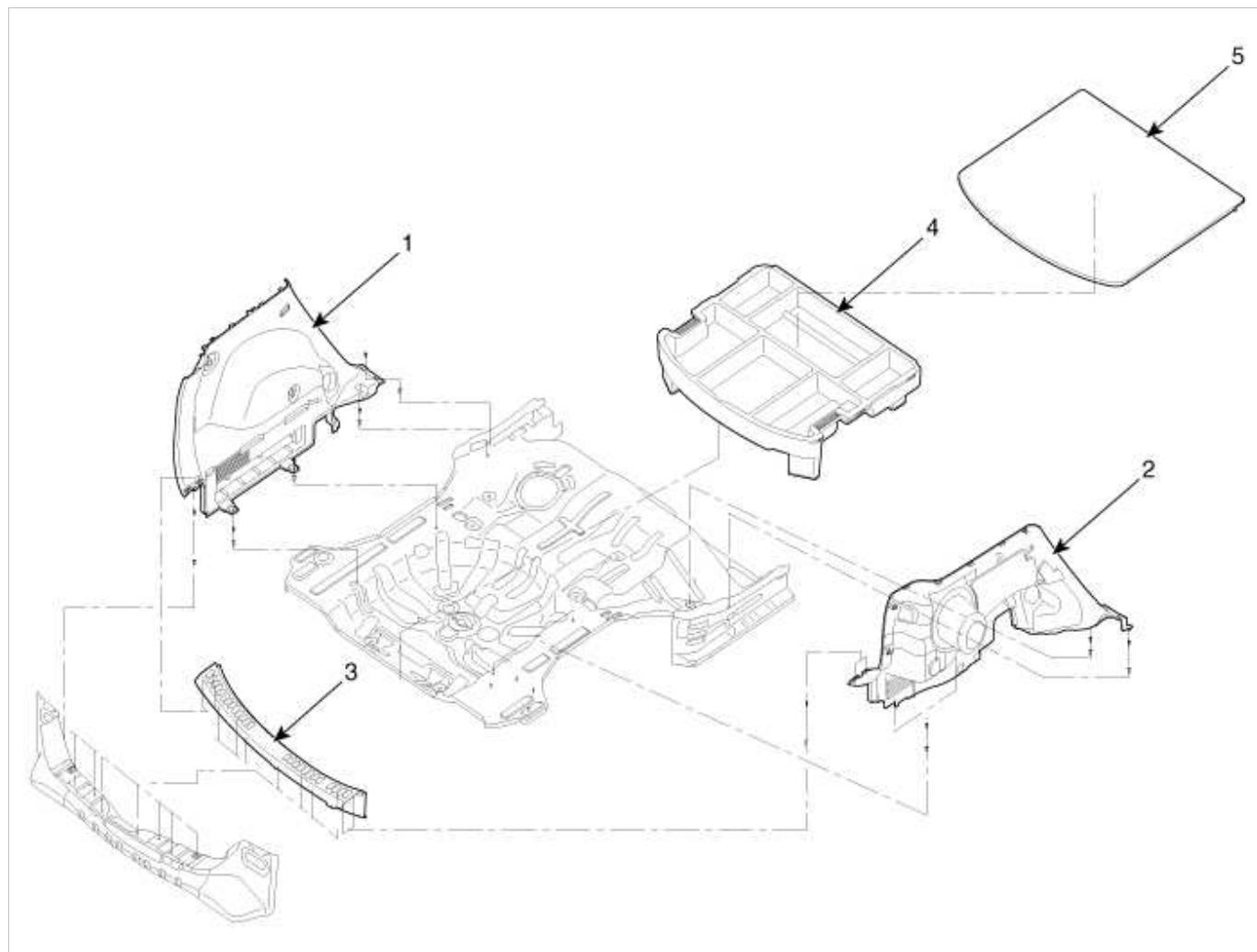
CAUTION

- Put on gloves to protect your hands.
- Use a plastic panel removal tool to remove interior trim pieces to without marring the surface.
- 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 transverse trim.
3. Remove the rear door scuff trim.
4. After loosening the mounting screws, then remove the luggage side trim.
5. Installation is the reverse of removal.

NOTE

- Replace any damage clips.

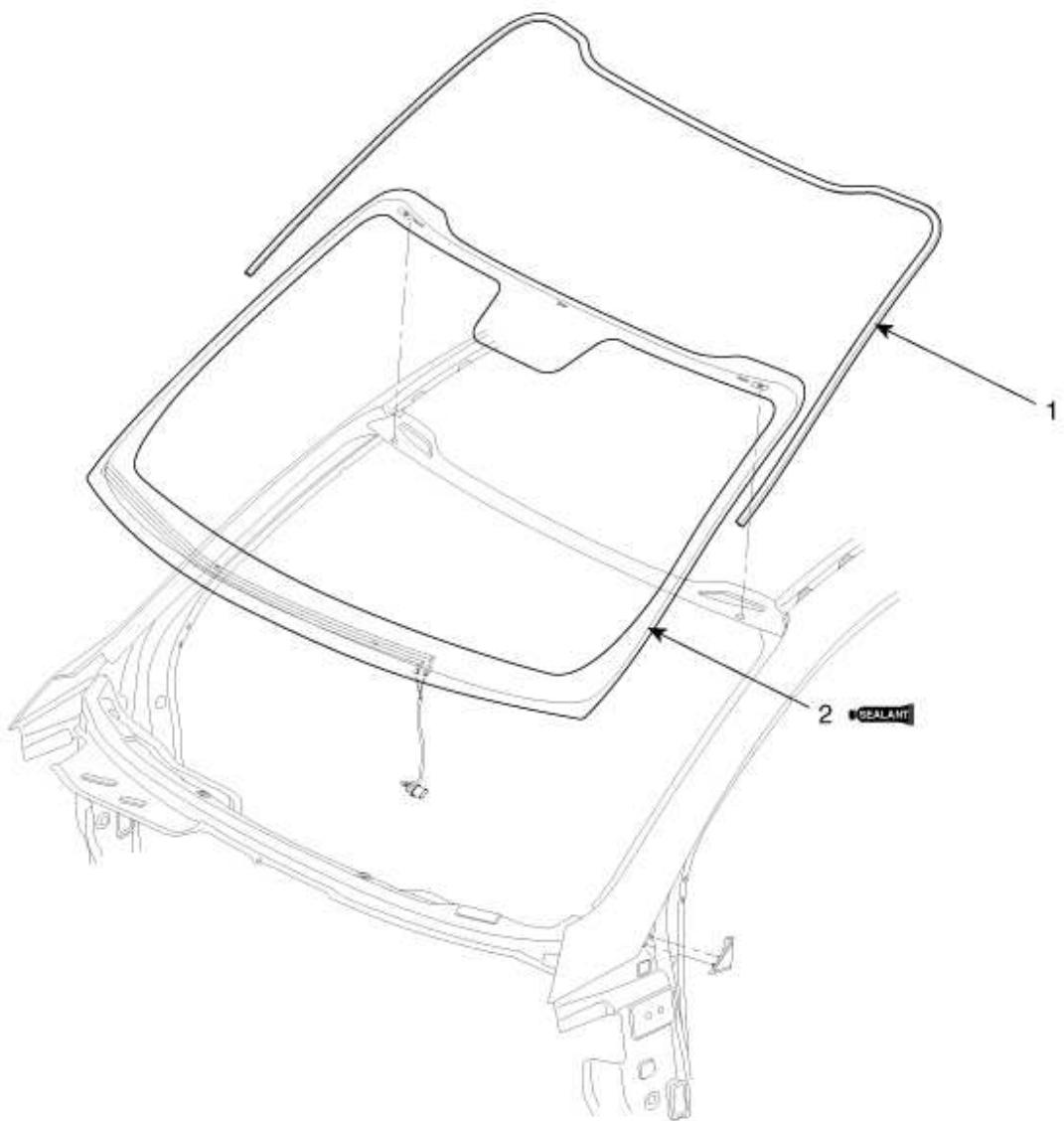


- 1. Luggage side trim [LH]
- 2. Luggage side trim [RH]
- 3. Rear transverse trim

- 4. Luggage center tray
- 5. Luggage covering board

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

Components



1. Windshield side molding

2. Windshield glass

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

Replacement

Removal

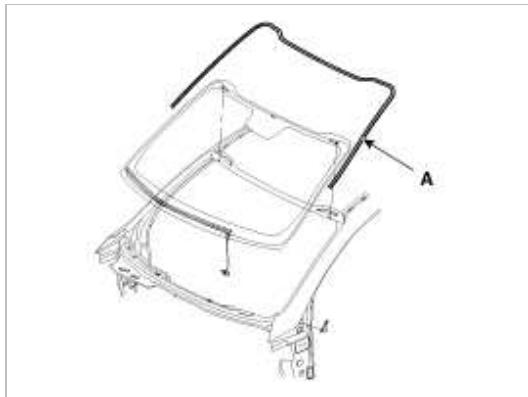
CAUTION

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

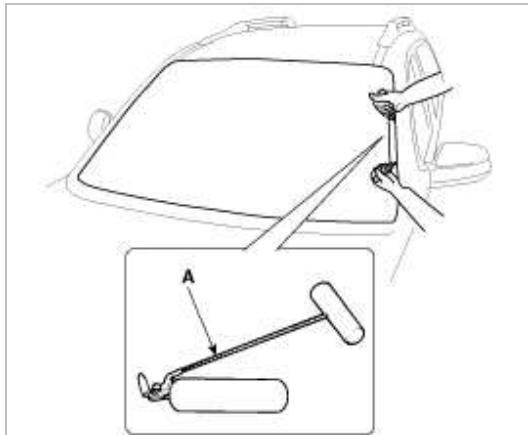
1. Remove the following items.

- A. Front pillar trim
(Refer to the BD group – “Interior Trim”)
- B. Inside rearview mirror
(Refer to the BD group – “Mirror”)
- C. Rain sensor
(Refer to the BE group – “Rain Sensor”)
- D. Wiper arm
(Refer to the BD group – “Cowl Top Cover”)
- E. Cowl top cover
(Refer to the BD group – “Cowl Top Cover”)
- F. Windshield glass deicer connector
(Refer to the BE group – “Windshield Deicer”)

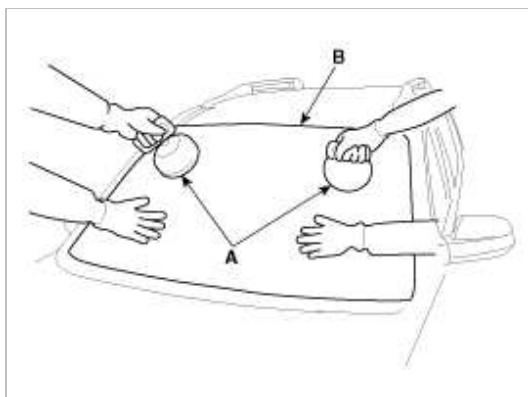
2. Using a screwdriver or remover, remove the windshield side molding (A).



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

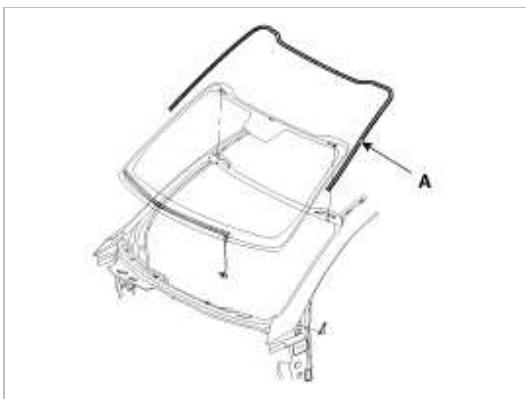


4. Remove the windshield glass (B) carefully using the glass holder (A).

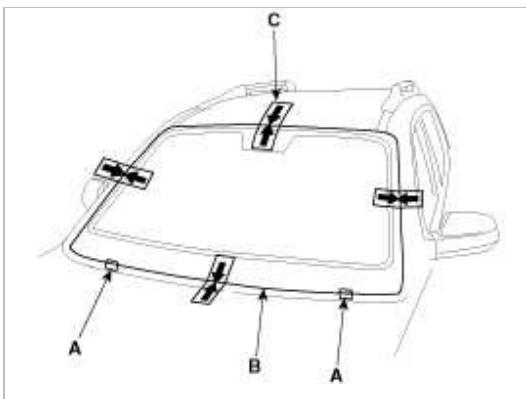


Installation

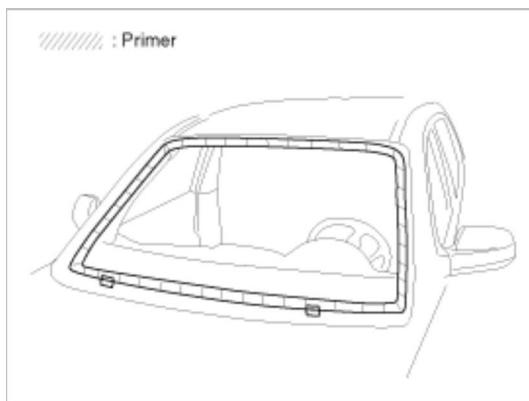
1. With a knife, scrape the old adhesive smooth to a thickness of about 2mm (0.08 in.) on the bonding surface around the entire windshield opening flange:
 - A. Do not scrape down to the painted surface of the body; damaged paint will interfere with proper bonding.
 - B. Remove the rubber dam and fasteners from the body.
 - C. Mask off surrounding surfaces before painting
2. Clean the bonding surface with a sponge dampened in alcohol. After cleaning, keep oil, grease and water from getting on the clean surface.
3. Install the windshield side molding (A) and fasteners. Do not allow any gaps.



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).



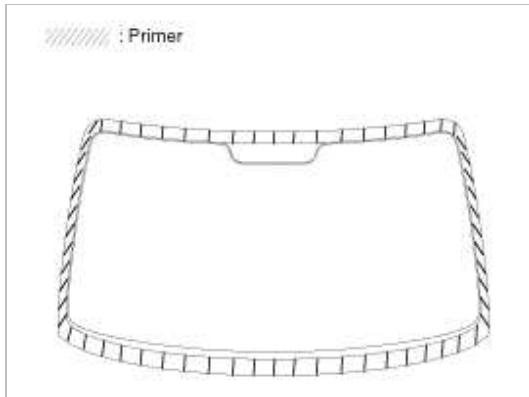
5. With a sponge, apply a light coat of body primer to the original adhesive remaining around the windshield opening flange. Let the body primer dry for at least 10 minutes.
 - A. Do not apply glass primer to the body, and be careful not to mix up glass and body primer sponges.
 - B. Never touch the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



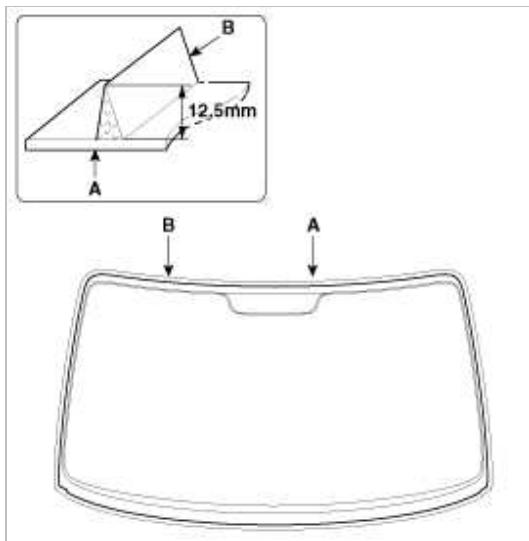
6. Apply a light coat of glass primer to the outside of the fasteners.

NOTE

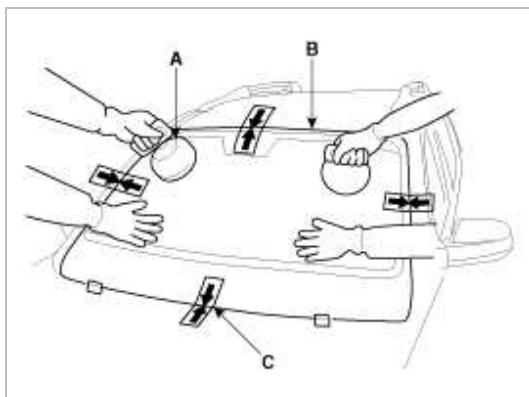
- Never touch the primed surface with your hand If you do, the adhesive may not bond to the glass properly, causing a leak after the windshield glass is installed.
- Do not apply body primer to the glass.
- Keep water, dust, and abrasive materials away from the primer.



7. 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 (B) around the edge of the windshield (A) 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.



8. 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.



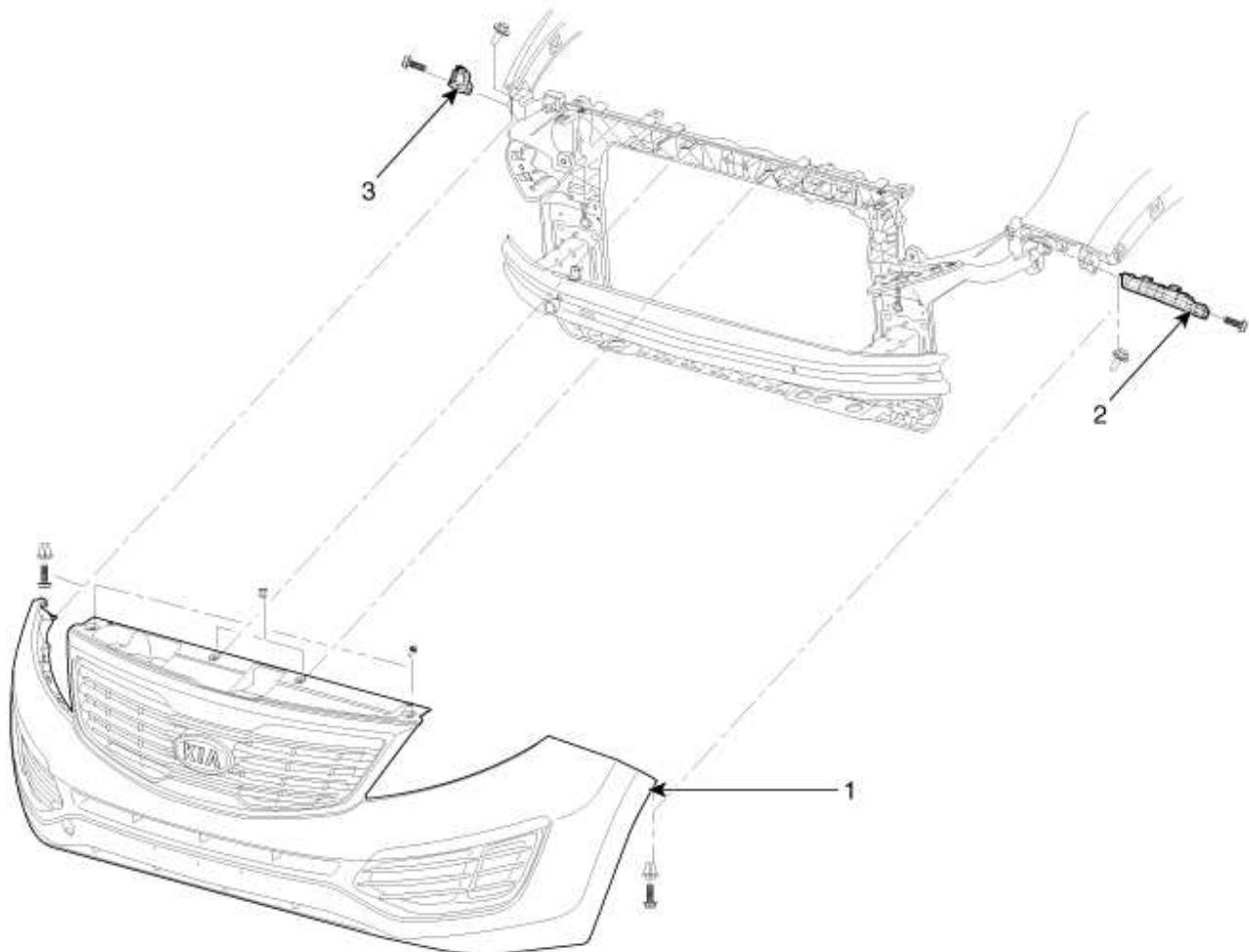
9. Scrape or wipe the excess adhesive off with a putty knife or towel. To remove adhesive from a painted surface or the

windshield, wipe with a soft shop towel dampened with alcohol.

10. 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.
11. 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 to 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)
12. Installation the following items.
 - A. Windshield glass deicer connector
(Refer to the BE group – “Windshield Deicer”)
 - B. Cowl top cover
(Refer to the BD group – “Cowl Top Cover”)
 - C. Wiper arm
(Refer to the BD group – “Cowl Top Cover”)
 - D. Rain sensor
(Refer to the BE group – “Rain Sensor”)
 - E. Inside rearview mirror
(Refer to the BD group – “Mirror”)
 - F. 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

2. Front bumper side bracket [LH]

3. Front bumper side bracket [RH]

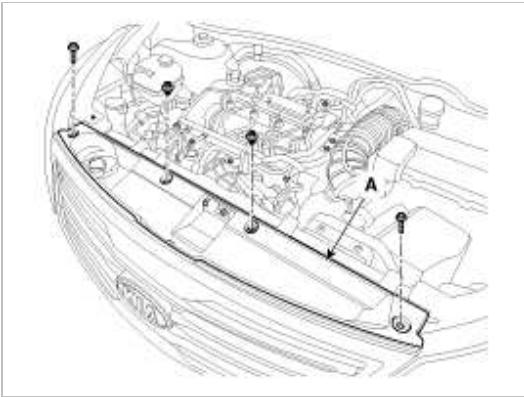
Body (Interior and Exterior) > Bumper > Front Bumper > Repair procedures

Replacement

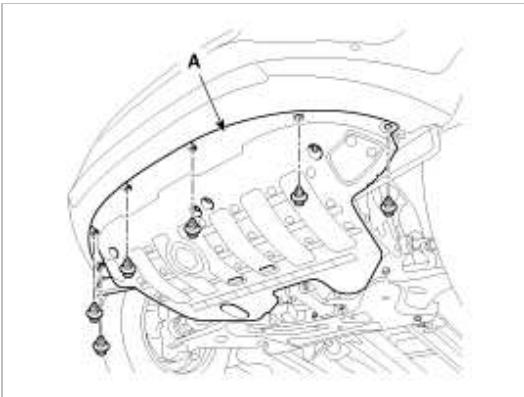
CAUTION

- Put on gloves to protect your hands.
- Use a plastic panel removal tool to remove interior trim pieces to without marring the surface.
- Take care not bend or scratch the cover and other parts.

1. Loosen the radiator upper cover (A) mounting clips and bolts.



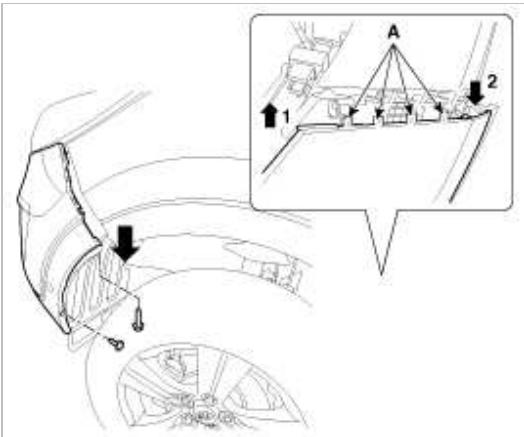
2. Remove the under cover (A) mounting clips.



3. After loosening the front bumper side's mounting screw, then disconnect the side's.

CAUTION

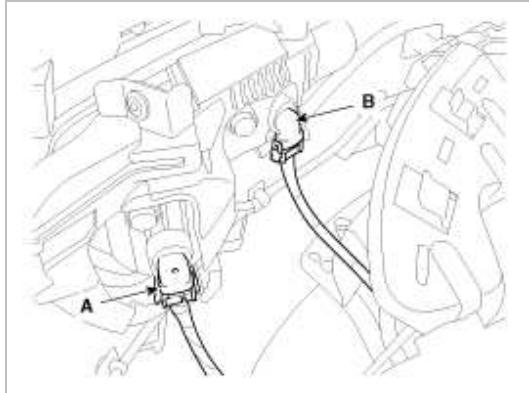
- When you pull out the front bumper, the front bumper could be damaged by the projection (A).



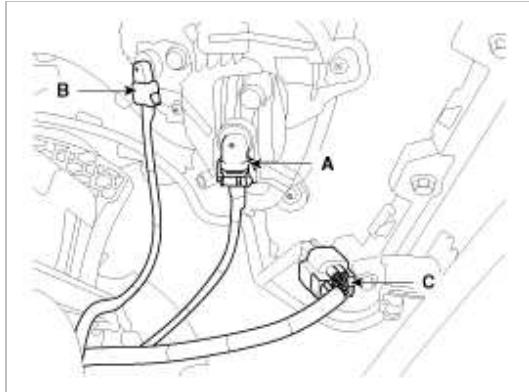
4. Disconnect the fog lamp (A), turn signal lamp (B), front sensor (C).

5. Remove the front bumper.

[LH]



[RH]



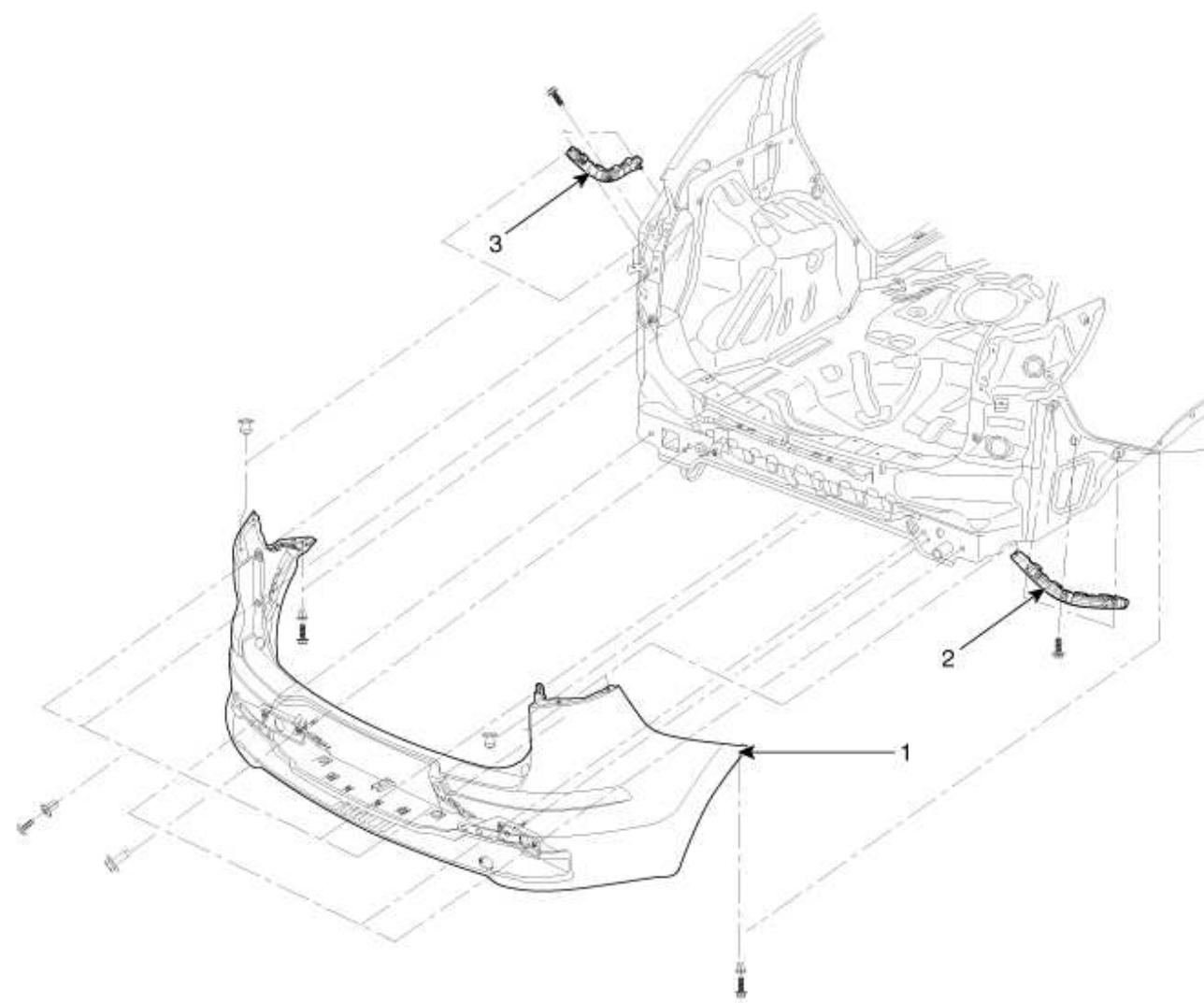
6. Installation is the reverse of removal.

NOTE

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

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

Components



1. Front bumper cover
2. Front bumper side bracket [RH]

3. Front bumper side bracket [LH]

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

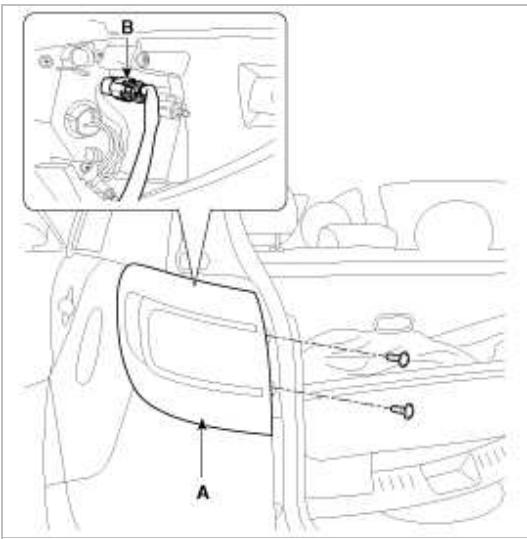
Replacement

CAUTION

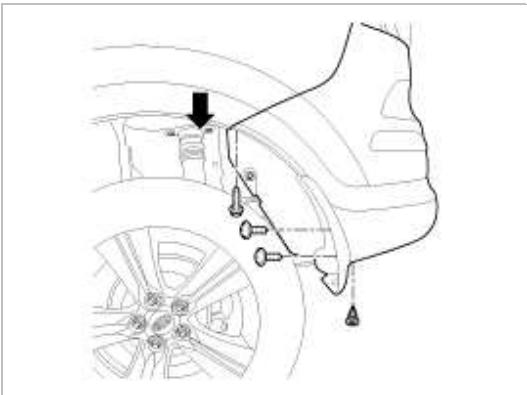
- Put on gloves to protect your hands.
- Use a plastic panel removal tool to remove interior trim pieces to without marring the surface.
- Take care not bend or scratch the cover and other parts.

1. After loosening the mounting screws, then remove the rear combination lamp (A).

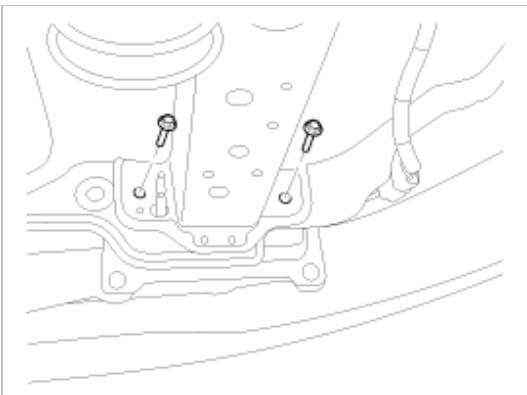
2. Push the lock pin, disconnect the connector (B).



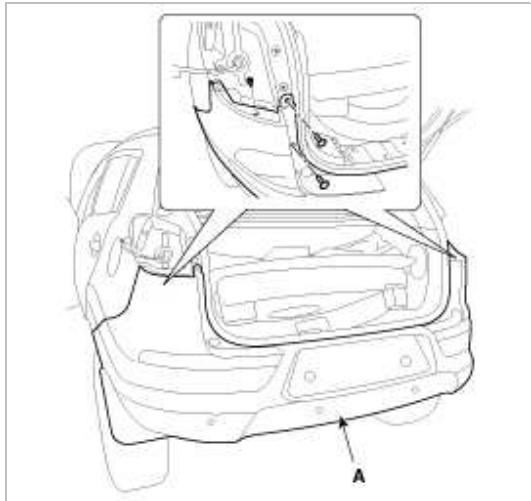
3. After loosening the rear bumper side's mounting screws and clip, then disconnect the side's.



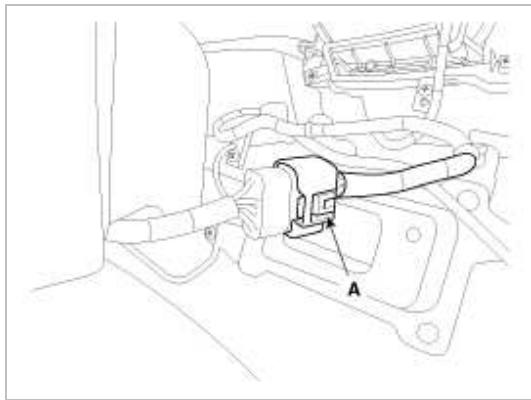
4. Loosen the mounting bolts.



5. After loosening the mounting screws and clip, then remove the rear bumper (A).



6. Push the lock pin, disconnect the rear bumper main connector (A).



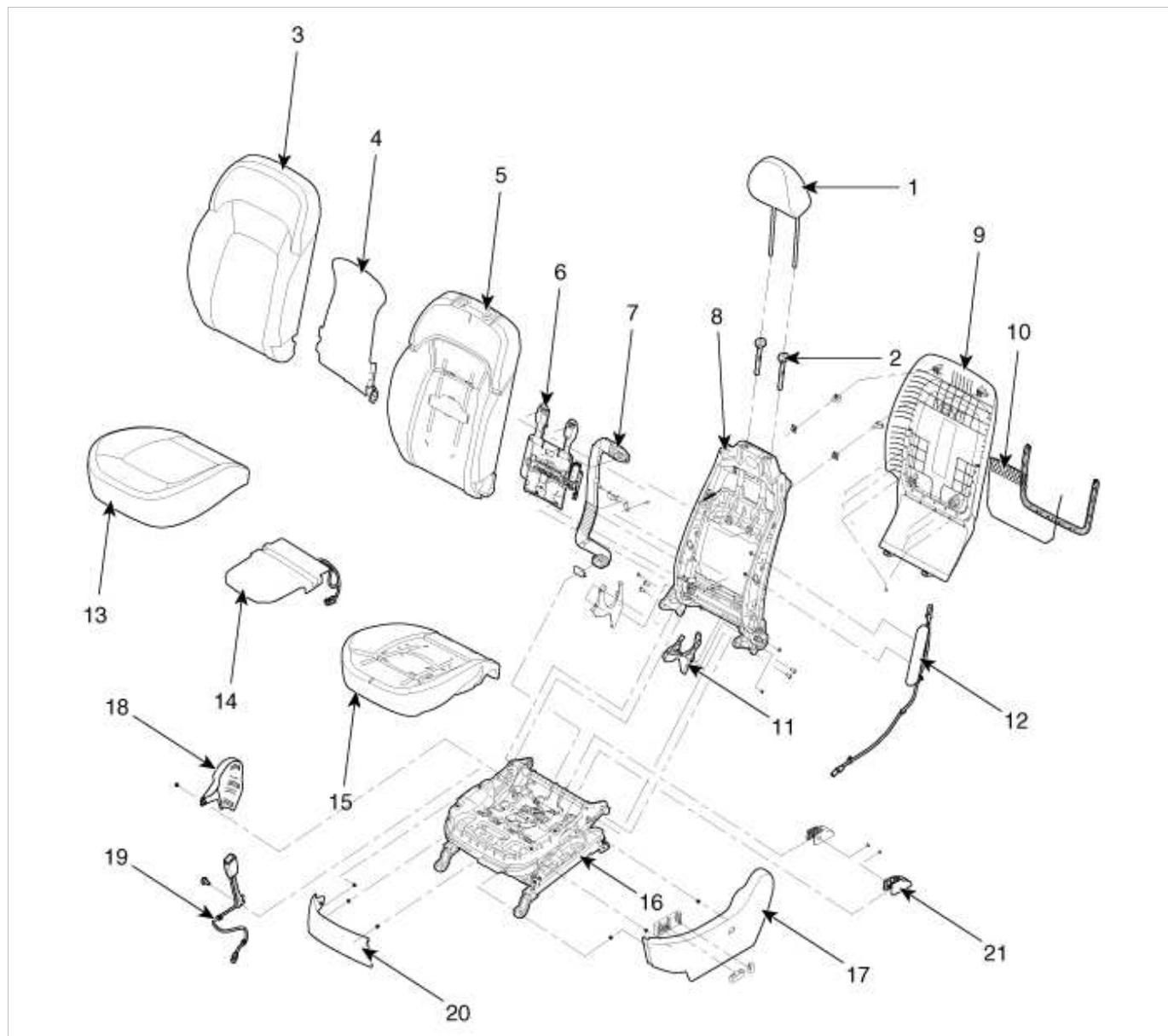
7. Installation is the reverse of removal.

NOTE

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

Body (Interior and Exterior) > Seat & Power Seat > Front Seat > Components and Components Location

Components



1. Headrest	8. Front seat back frame	15. Front seat cushion pad
2. Headrest guide	9. Front seat back cover	16. Front seat cushion frame
3. Front seat back cover	10. Front seat map pocket	17. Front shield outer cover
4. Front seat back heater	11. Front inside cover	18. Front shield inner cover
5. Front seat back pad	12. Front airbag module	19. Front seat buckle
6. Front seat back power lumbar	13. Front seat cushion cover	20. Front shield cover
7. Front seat back duct	14. Front seat cushion heater	21. Front foot cover

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

Replacement

Seat Assembly Replacement

1. Remove the front foot cover.
2. After loosening the front seat assembly mounting bolts, remove the front seat assembly (A).

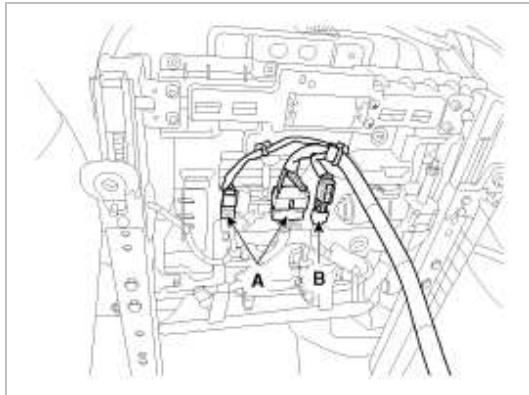
Tightening torque :

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

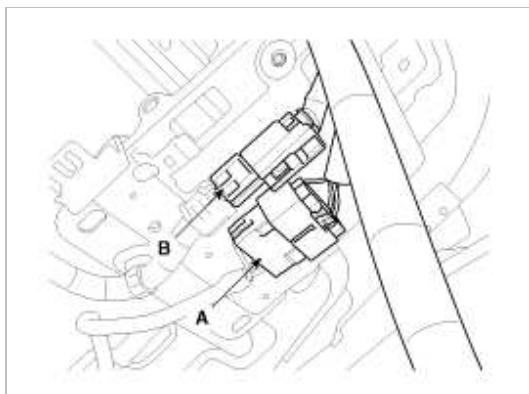


3. Disconnect the power seat connectors (A), airbag connector (B).

[Driver's]



[Passenger's]



4. Installation is the reverse of removal.

NOTE

- Be sure to perform PODS re-zero with the GDS after replacing parts (passenger's)
(Refer to page RT - "Airbag")

CAUTION

Seat Mounting Bolt Installation Procedure

- 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.

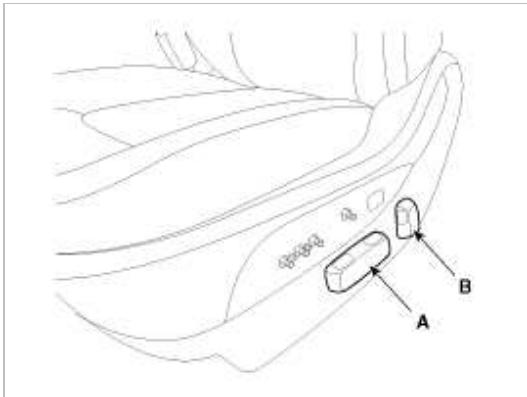
- Set the seat into the most rearward position. Check the front mounting bolt completely.
- Check that the seat operates back and forth smoothly and the locking portion locks properly.

Front Shield Outer 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.

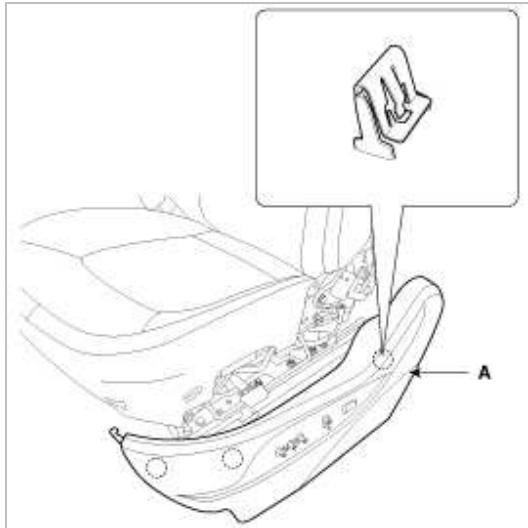
1. Remove the recliner switch (A) and height switch (B).



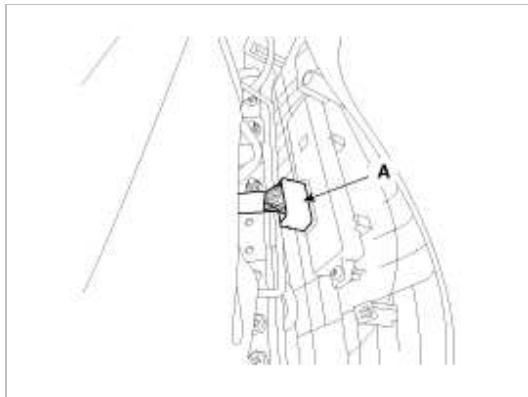
2. Using a screwdriver or remover, remove the front shield cover (A).



3. Using a screwdriver or remover, remove the front shield outer cover (A).



4. Disconnect the connector (A).



5. Installation is the reverse of removal.

NOTE

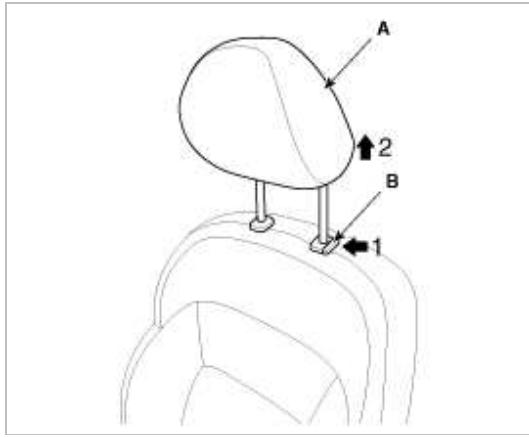
- Make sure the connectors are plugged in properly.
- Replace any damage clips.
- Be sure to perform PODS re-zero with the GDS after replacing parts (passenger's)
(Refer to page RT -"Airbag")

Seat Back Cover Replacement

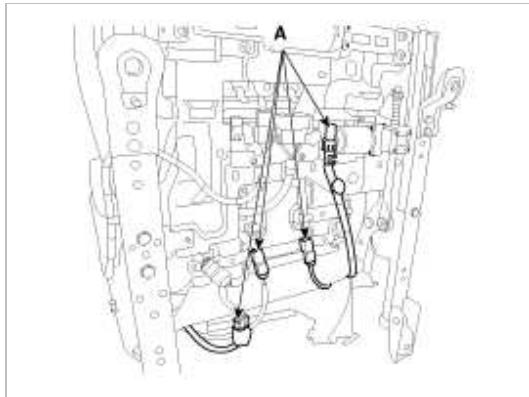
CAUTION

- 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 front seat assembly.
2. Push the lock pin (B), remove the headrest (A).



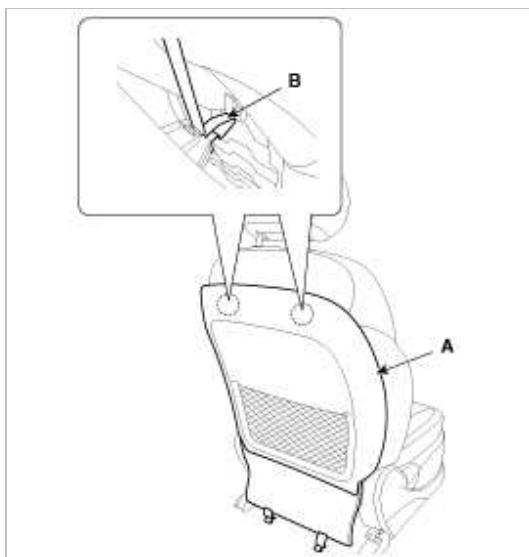
3. Disconnect the connectors (A).



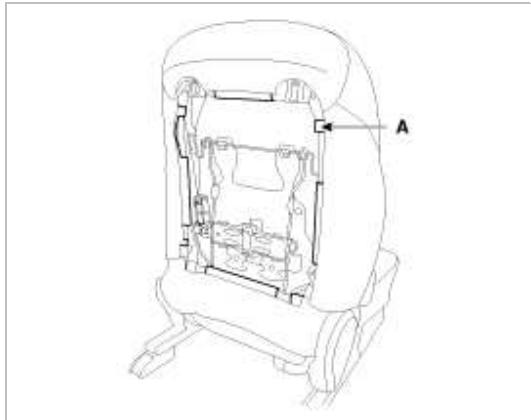
4. Push the clips (B), from the front seat back cover (A).

CAUTION

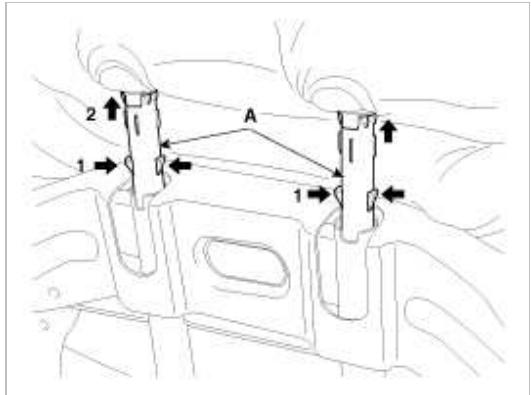
- Push the middle area of clip using the flat head screwdriver.
- Be careful not to damage the clips.



5. Push the porotector (A) by the seat back frame.



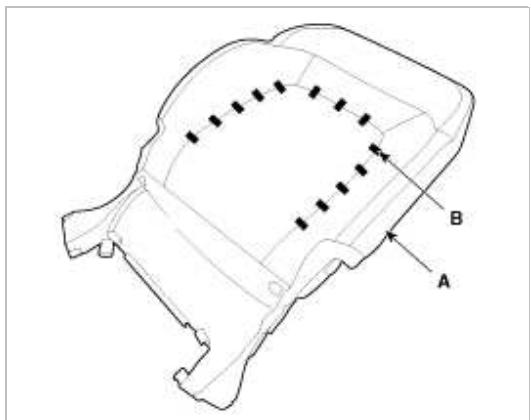
6. Pull out the headrest guides (A) while pinching the end of the guides, and remove them.



7. Remove the seat back cover (A) from the frame.



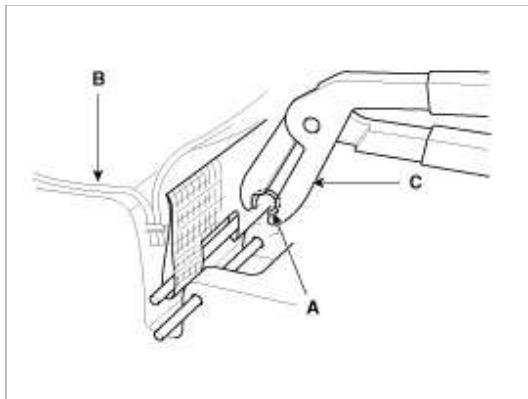
8. After removing the hog ring clips (B) on the front of seat back and remove the seat back cover (A).



9. 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).

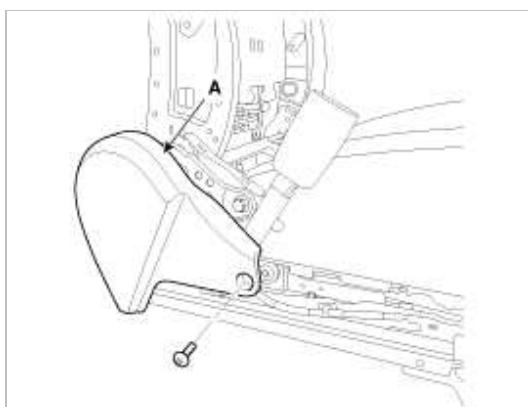


NOTE

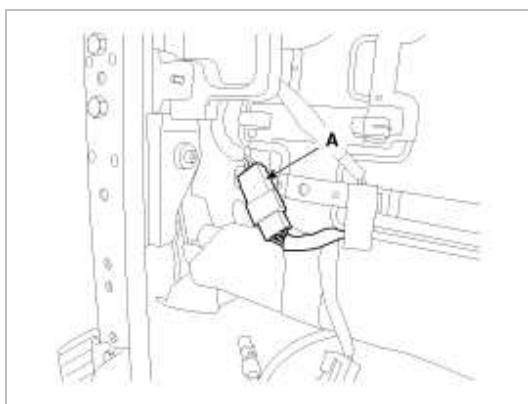
- Be sure to perform PODS re-zero with the GDS after replacing parts (Passenger's)
(Refer to page RT - "Airbag")

Seat Cushion Cover Replacement

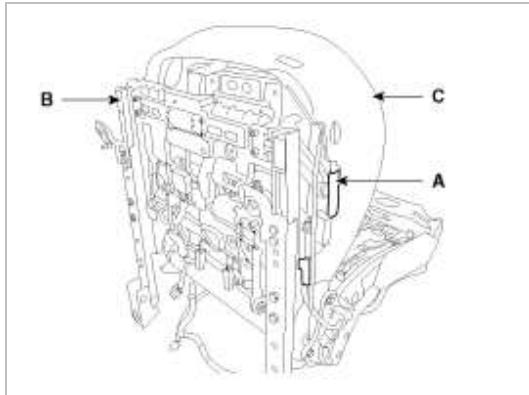
1. Remove front seat assembly.
2. Remove the front shield outer cover.
3. After loosening the mounting screw, then remove the front shield inner cover (A).



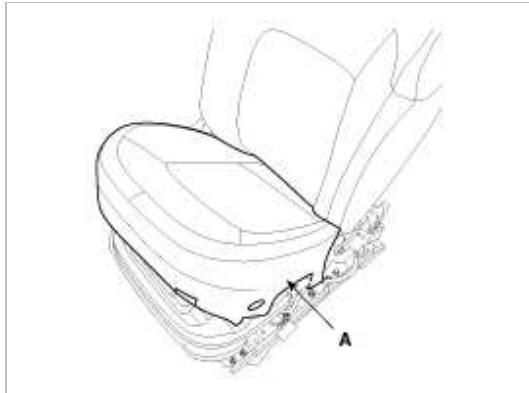
4. Disconnect the connector (A).



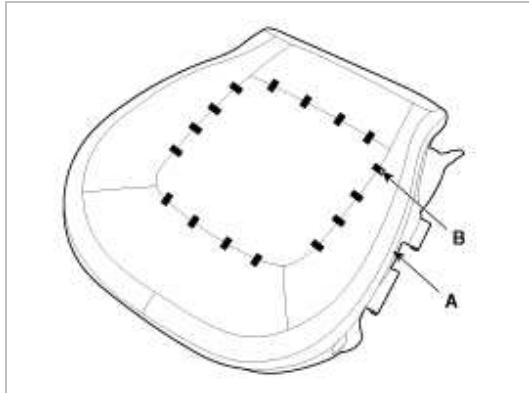
5. Push the protector (A) and then seat cushion cover (C) from the frame (B).



6. Remove the seat cushion cover (A) from the frame.



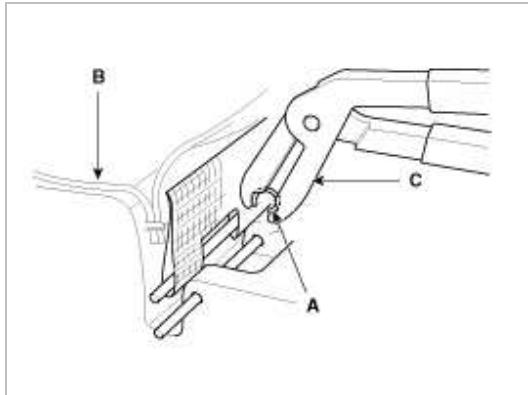
7. After removing the hog ring clips (B) on the front of seat cushion and remove the seat cushion cover (A).



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).



NOTE

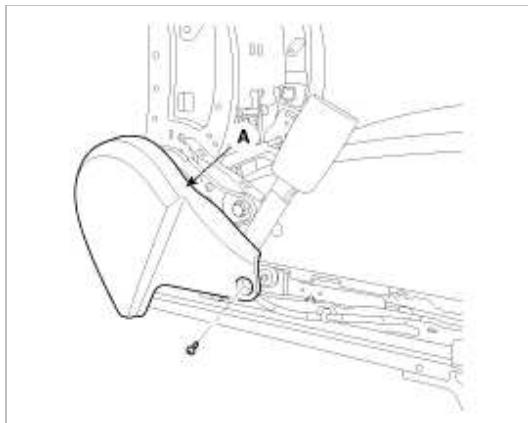
- Be sure to perform PODS re-zero with the GDS after replacing parts (Passenger's)
(Refer to page RT - "Airbag")

Seat Frame Replacement

1. Remove the following items.

- A. Front seat
- B. Seat back cover
- C. Seat cushion cover

2. After loosening the mounting screw, then remove the front shield inner cover (A).



3. Disconnect the connector (C).

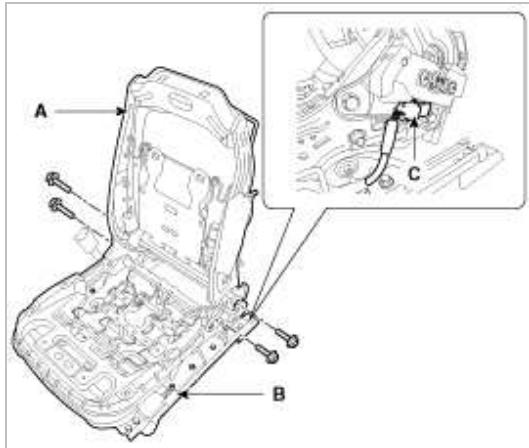
4. After loosening the mounting bolts, then disconnect the seat back frame (A) and seat cushion frame (B).

NOTE

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

Tightening torque :

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



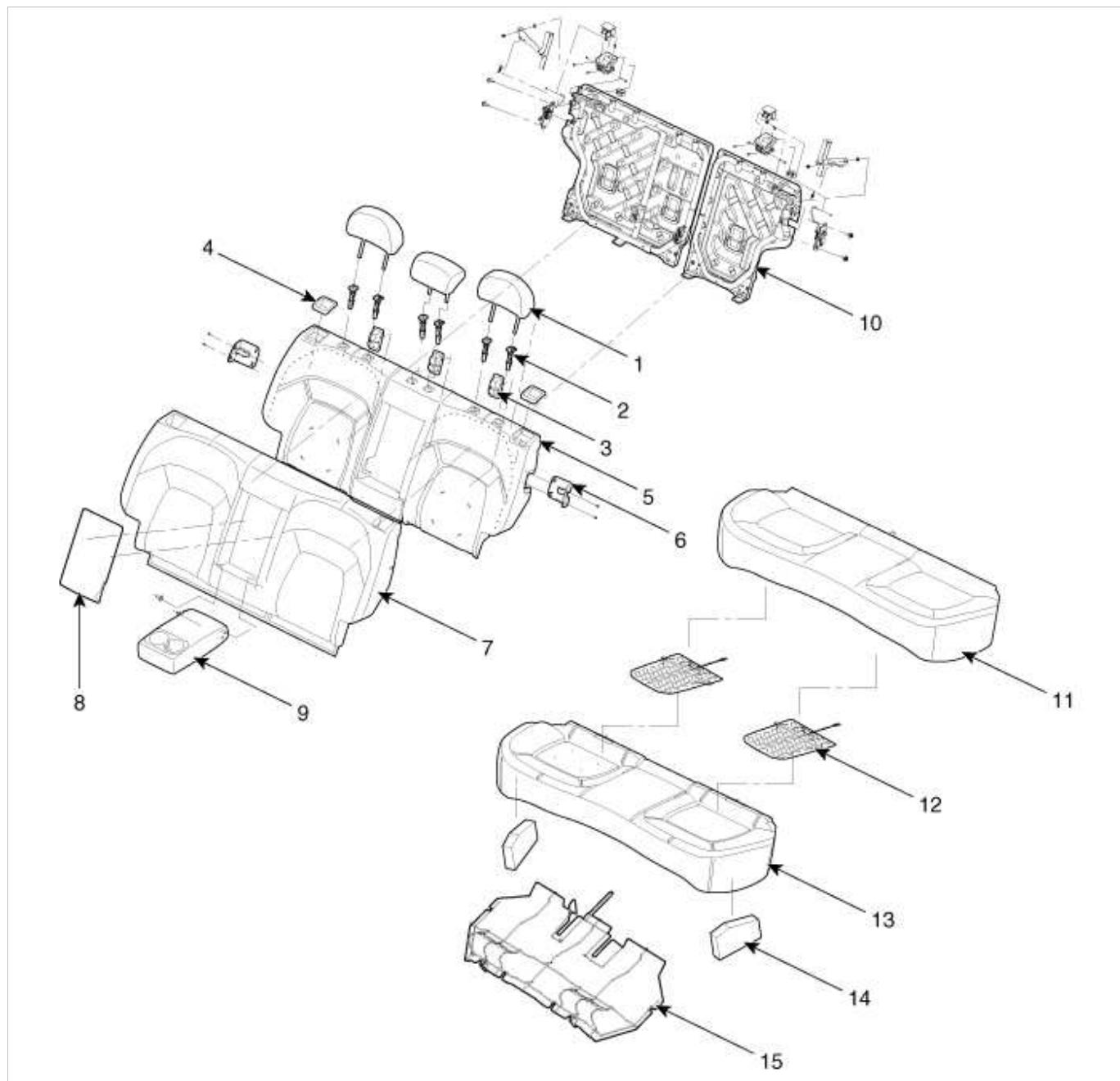
5. Installation is the reverse of removal.

NOTE

- Be sure to perform PODS re-zero with the GDS after replacing parts (Passenger's)
(Refer to page RT - "Airbag")

Body (Interior and Exterior) > Seat & Power Seat > Rear Seat > Components and Components Location

Components



1. Headrest	6. Latch cover	11. Rear seat cushion cover
2. Headrest guide	7. Rear seat back cover	12. Rear seat cushion warmer
3. Tether anchor garnish	8. Armrest board	13. Rear seat cushion pad
4. Upper bezel	9. Rear armrest	14. Insert pad rear cushion
5. Rear seat back pad	10. Rear seat back frame	15. Rear seat cushion frame

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

Replacement

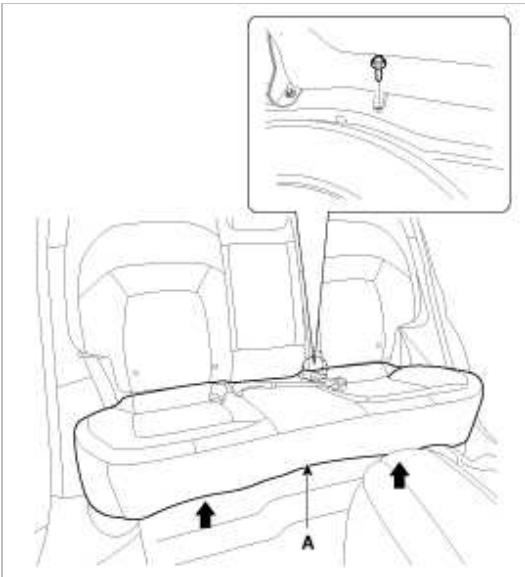
Seat Assembly Replacement

- After loosening the mounting bolt, then remove the rear seat cushion (A).

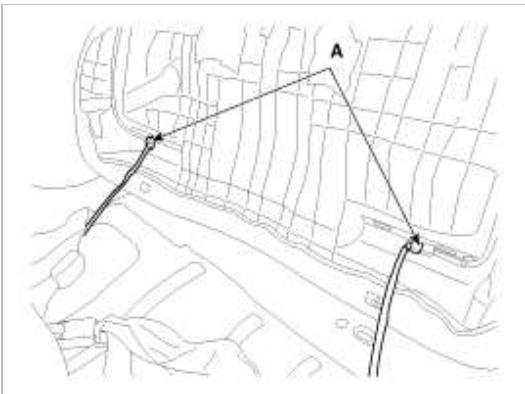
Tip CAUTION que :

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

- Remove the rear cushion to direction of the arrow.



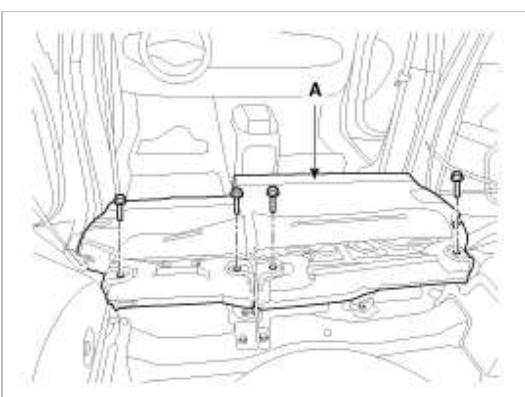
2. Disconnect the rear seat cushion warmer connectors (A).



3. After loosening the mounting bolts, then remove the rear seat back (A).

Tightening torque :

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



4. Installation is the reverse of removal.

NOTE

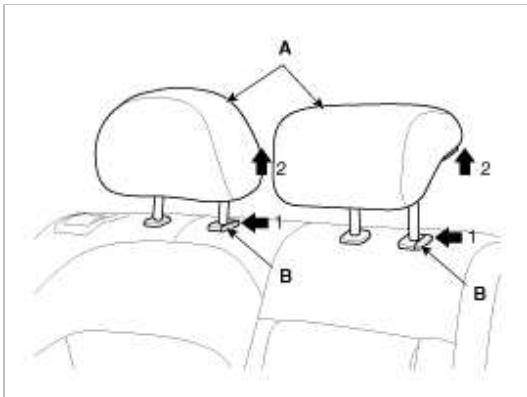
- Make sure the connector is connected properly.

Seat Back Cover Replacement [RH]

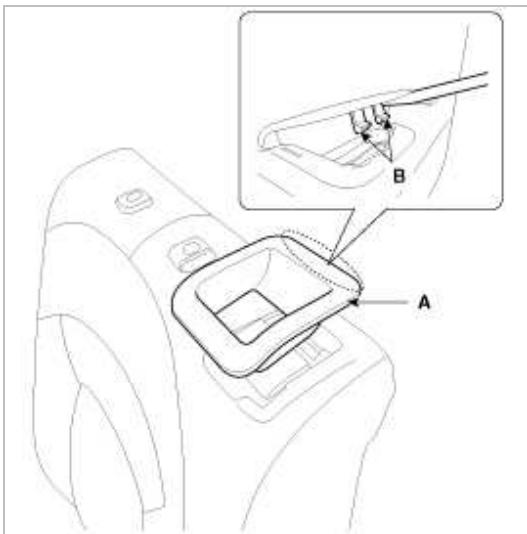
CAUTION

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

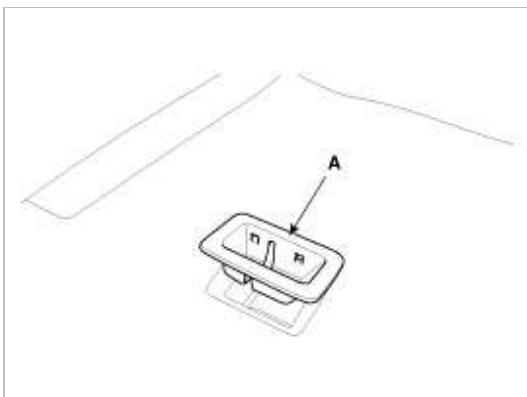
1. Remove the rear seat assembly.
2. Push the lock pin (B) and then remove the headrest (A).



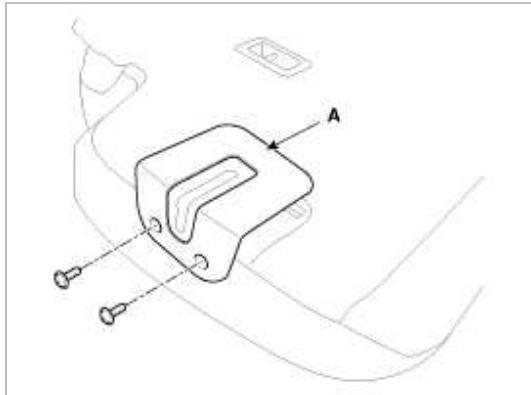
3. Push the hook (B) and then remove the upper bezel (A).



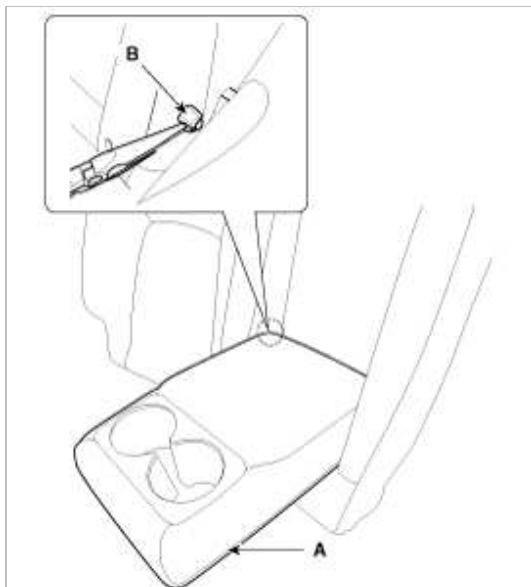
4. Using a screwdriver or remover, remove the tether anchor garnish (A).



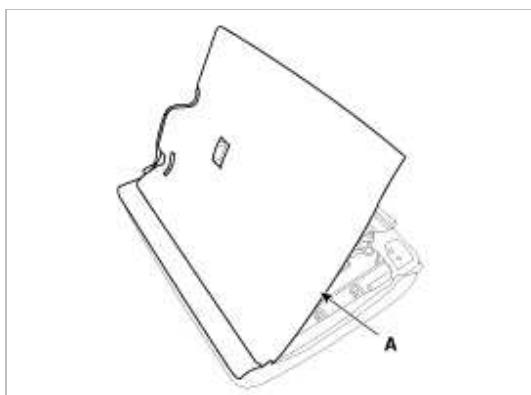
5. After loosening the mounting screws, then remove the latch cover (A).



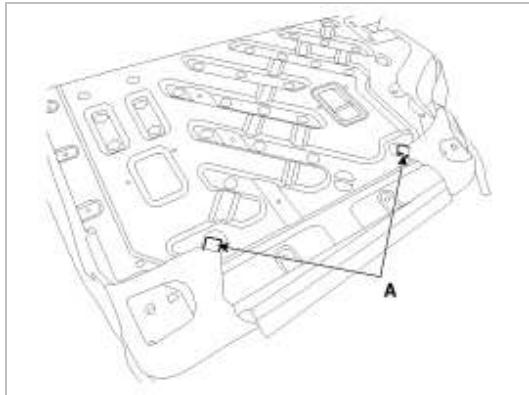
6. Using a long nose, remove the rock pin (B) and armrest (A).



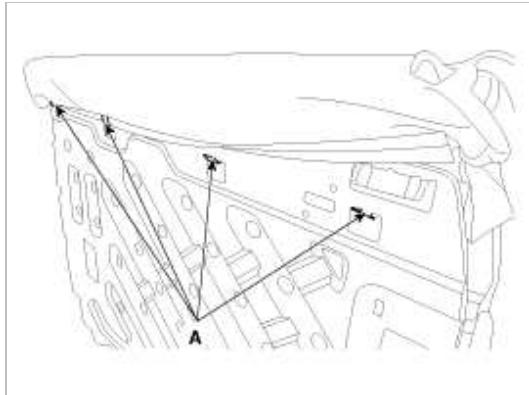
7. Zip off the seat back cover (A), and then full it up.



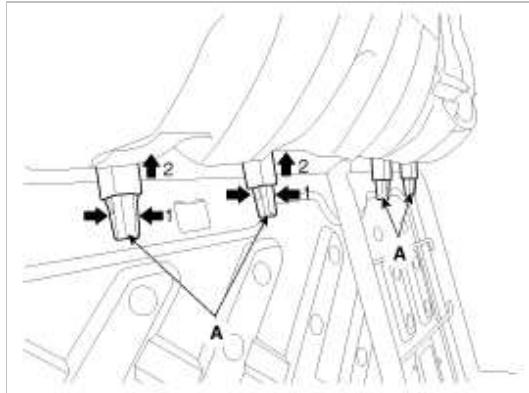
8. Disconnect the protector (A).



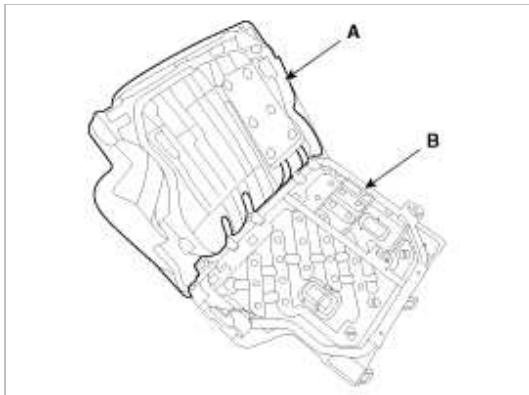
9. Disconnect the hooks (A).



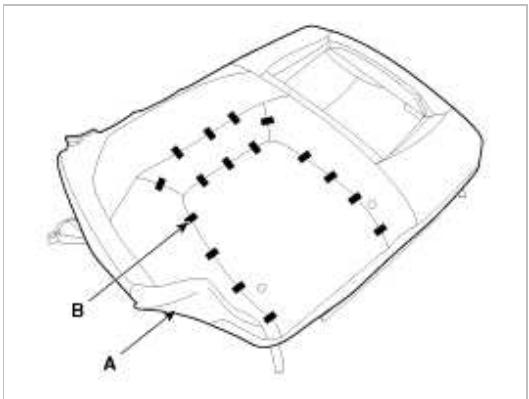
10. Pull out the headrest guides (A) while pinching the end of the guides, and remove them.



11. Remove the seat back cover (A) from the seat back frame (B).



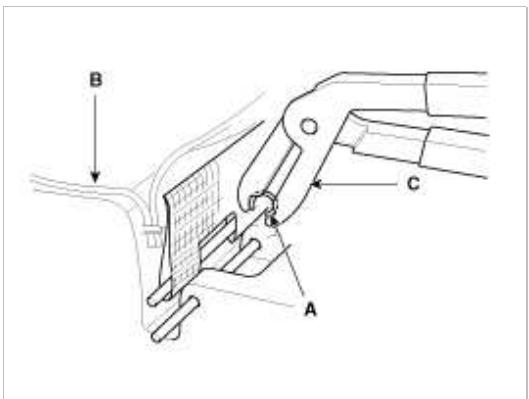
12. After removing the hog ring clips (B) on the rear of seat back, remove the seat back cover (A).



13. Installation is the reverse of removal.

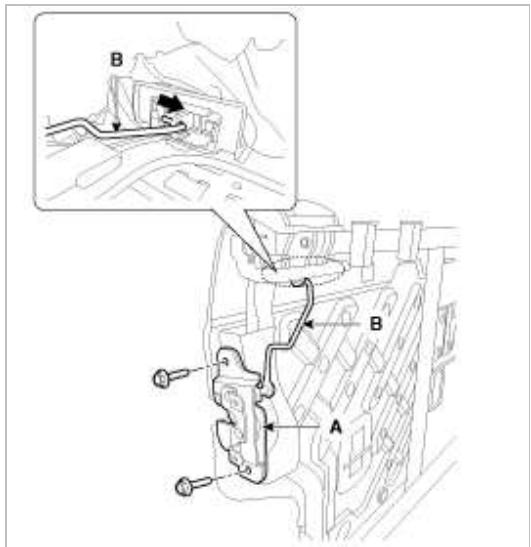
NOTE

- 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

1. Remove the seat back cover.
2. After loosening the mounting bolts and then disconnecting the rod (B).
3. Remove the rear seat latch (A).



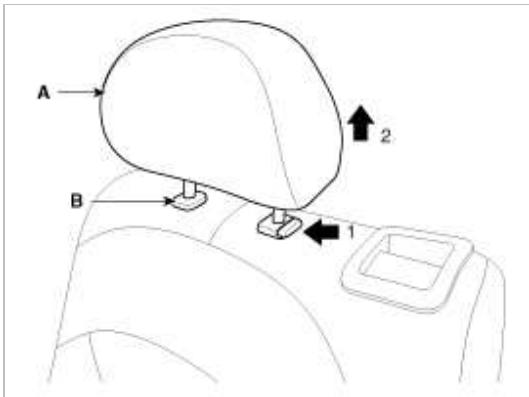
4. Installation is the reverse of removal.

Seat Back Cover Replacement [LH]

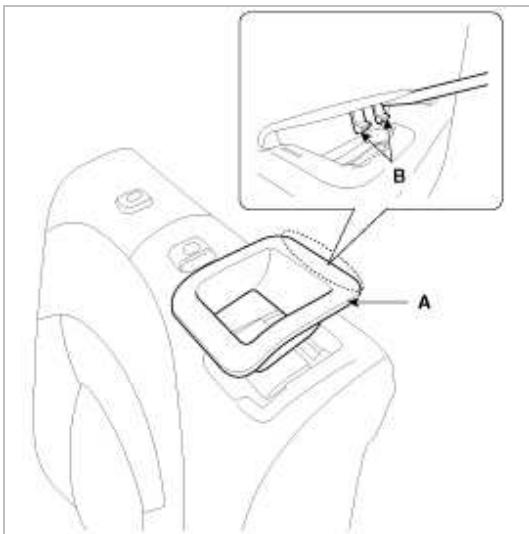
CAUTION

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

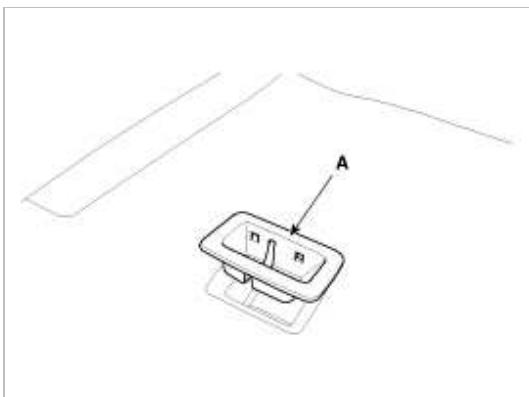
1. Remove the rear seat assembly.
2. Push the lock pin (B) and then remove the headrest (A).



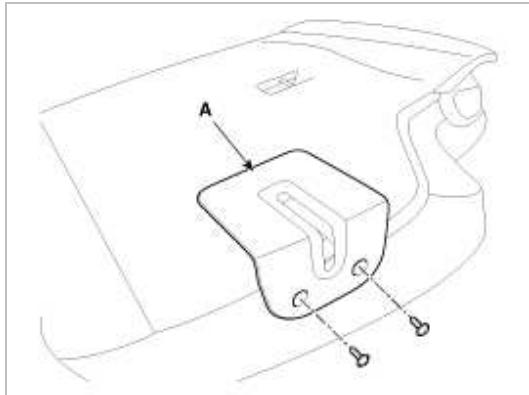
3. Push the hook (B) and then remove the upper bezel (A).



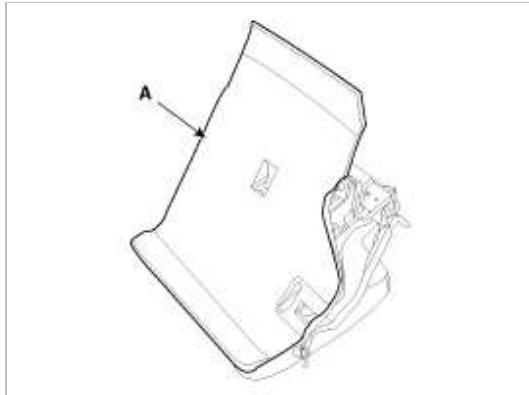
4. Using a screwdriver or remover, remove the tether anchor garnish (A).



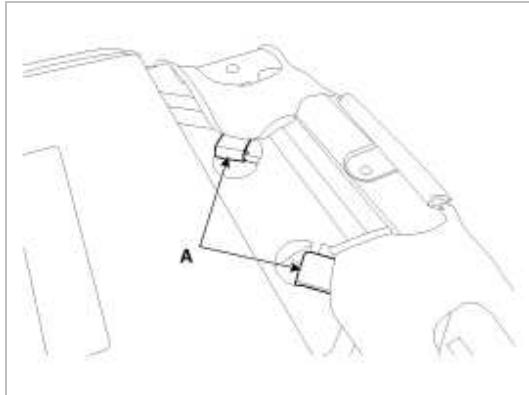
5. After loosening the mounting screws, then remove the latch cover (A).



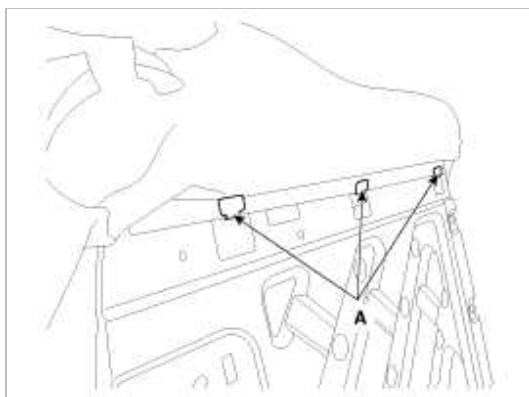
6. Zip off the seat back cover (A), and then pull it up.



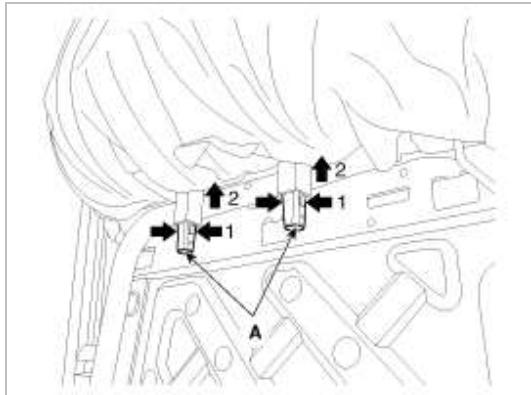
7. Disconnect the protector (A).



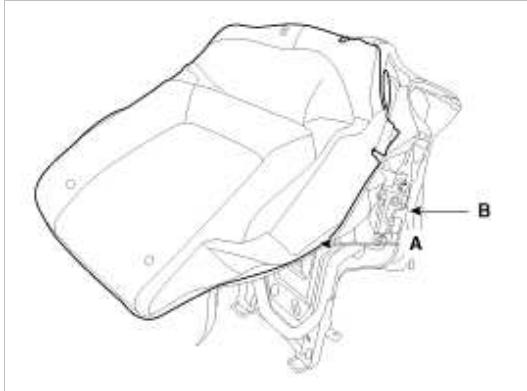
8. Disconnect the hooks (A).



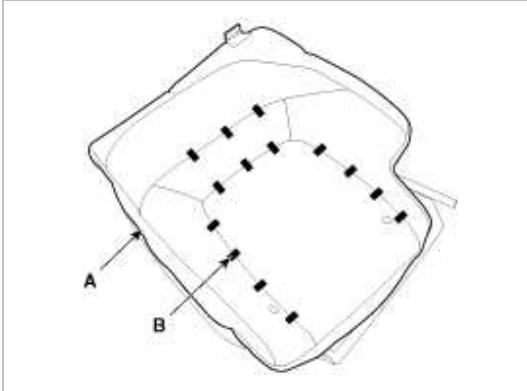
9. Pull out the headrest guides (A) while pinching the end of the guides, and remove them.



10. Remove the seat back cover (A) from the seat back frame (B).



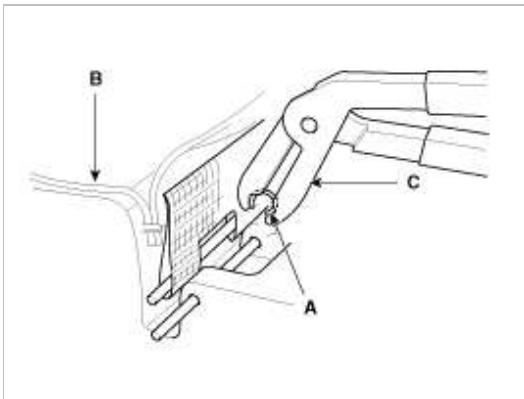
11. After removing the hog ring clips (B) on the rear of seat back, remove the seat back cover (A).



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)].



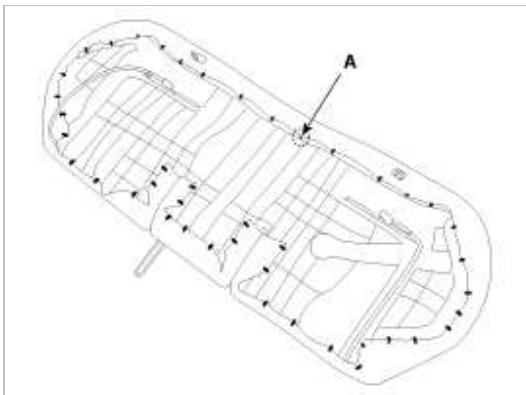
Rear Seat Cushion Cover Replacement

CAUTION

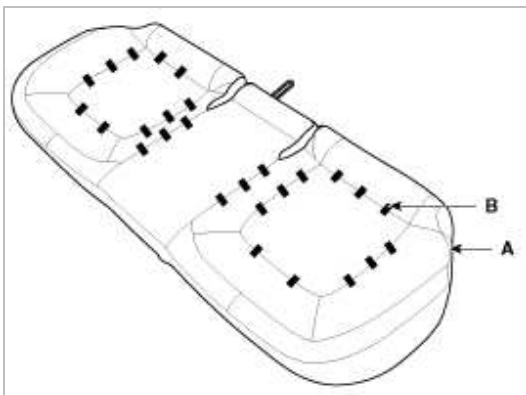
- When prying with a flat-tip screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damaged.
- Put on gloves to protect your hands.

1. Remove the rear seat cushion.

2. Remove the hog ring clips (A).



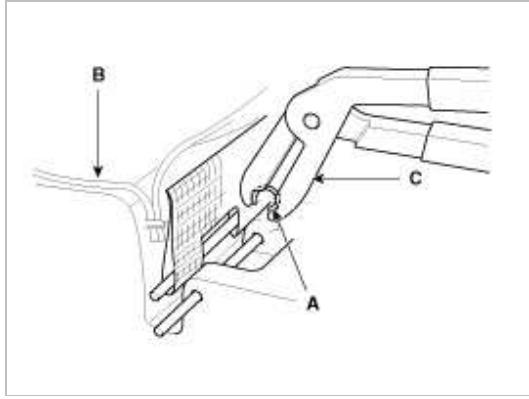
3. After removing the hog ring clips (B) on the rear of seat cushion, remove the seat cushion cover (A).



4. Installation is the reverse of removal.

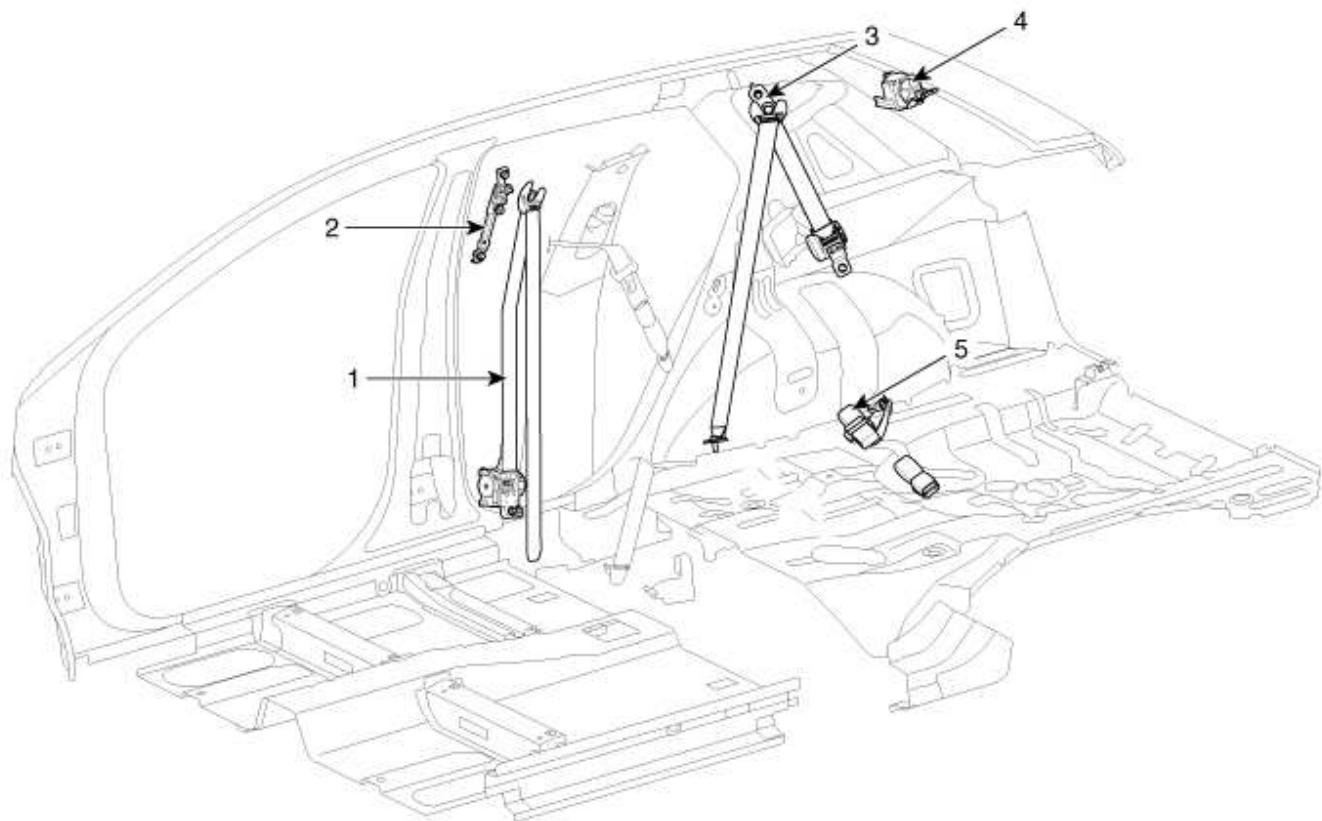
NOTE

- 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 > Components and Components Location

Components



- | | |
|---|--|
| 1. Front seat belt
2. Height adjuster
3. Rear seat belt | 4. Rear seat belt [Center]
5. Rear seat belt buckle |
|---|--|

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

Replacement

Front Seat Belt Replacement

CAUTION

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

1. Remove the following items first :

A. Front seat assembly

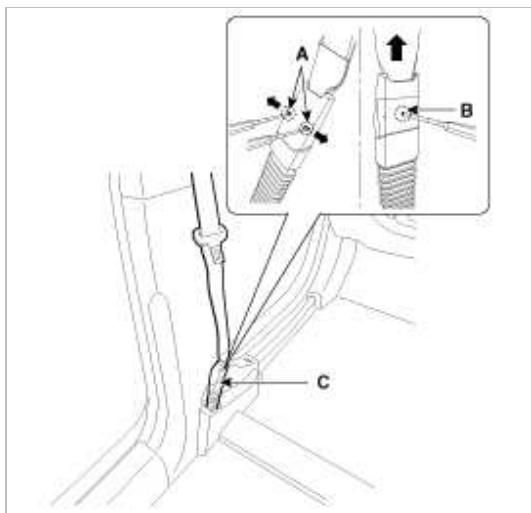
(Refer to the BD group - "Front Seat")

B. Front door scuff trim & Rear door scuff trim

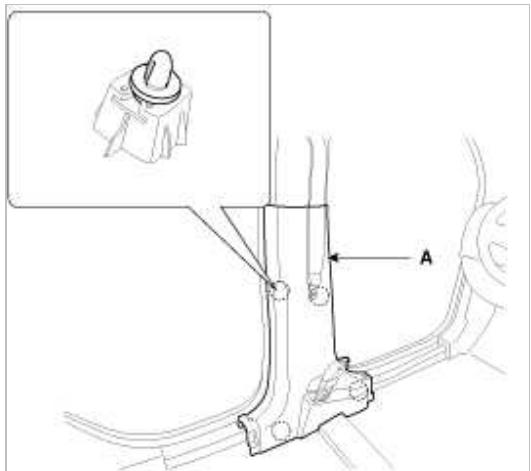
(Refer to the BD group - "Interior Trim")

2. To remove the seat belt anchor pretensioner (C), keep on pushing the lock pins (A) as arrow direction.

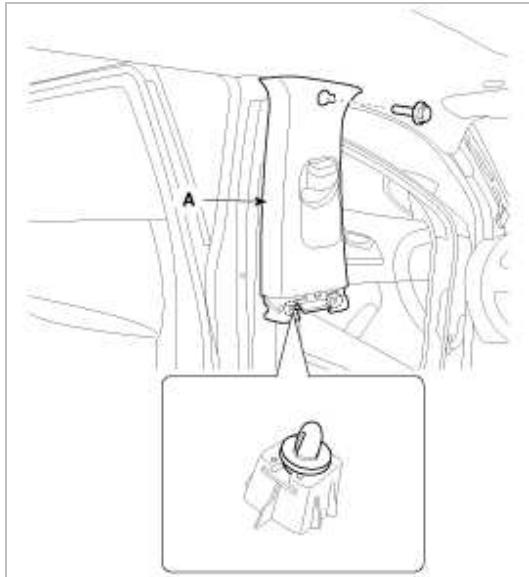
And then remove the seat belt after pushing the lock pin (B).



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



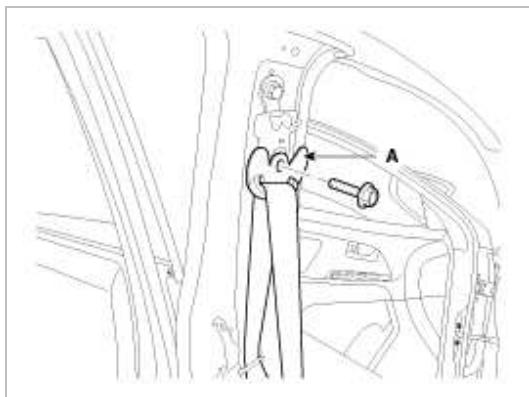
4. After loosening the mounting bolt, then remove the center pillar upper trim (A) .



5. After loosening the mounting bolt, then remove the front seat belt upper anchor (A).

Tightening torque :

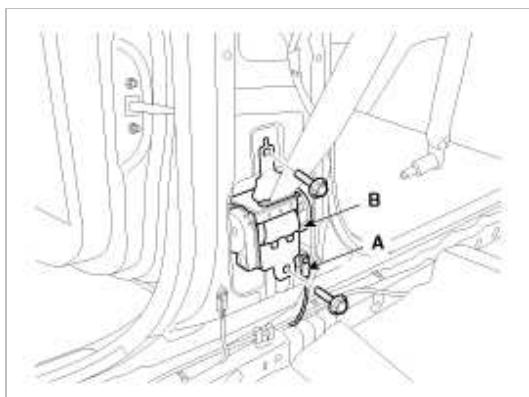
39.2 ~ 53.9 N.m (4.0 ~ 5.5 kgf.m, 28.9 ~ 39.8 lb-ft)



6. After disconnecting the pretensioner connector lock pin, remove the SIS connector (A), loosen the mounting bolt, then remove the pretensioner (B).

Tightening torque :

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



7. Installation is the reverse of removal.

Height Adjust Replacement

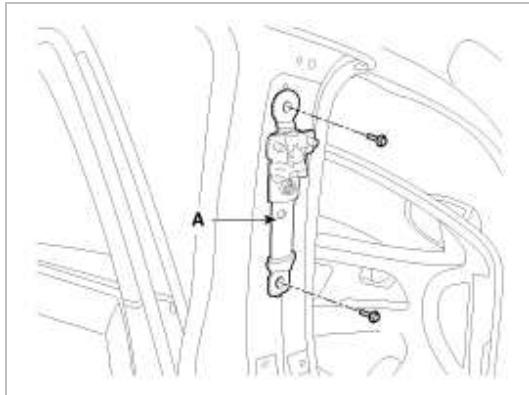
1. Remove the following items first :

- 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")
- F. Front seat belt upper anchor

2. After loosening the bolts, then remove the height adjustor (A).

Tightening torque :

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



3. Installation is the reverse of removal.

NOTE

- Replace any damaged clips.
- Make sure the height adjust properly.

Front Seat Belt Buckle Replacement

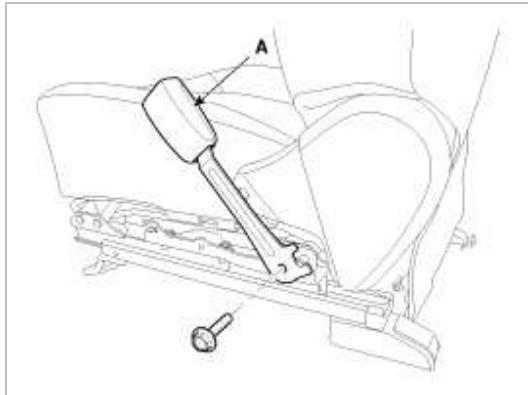
1. Remove the following items first :

- A. Front seat assembly
(Refer to the BD group - "Front Seat")

2. After loosening the mounting bolt, then remove the front seat belt buckle (A).

Tightening torque :

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



3. Installation is the reverse of removal.

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

Replacement

Rear Seat Belt Replacement

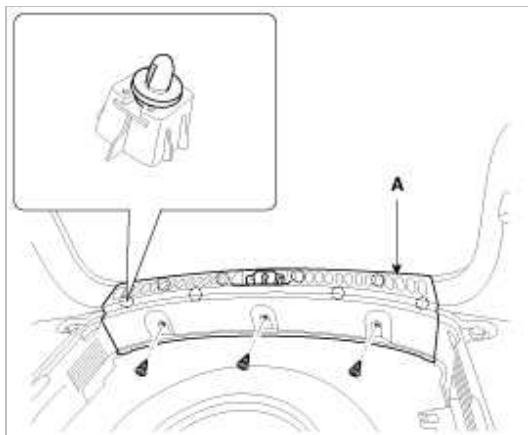
CAUTION

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

1. Remove the following items first.

- A. Rear seat assembly
(Refer to the BD group - "Rear Seat")
- B. Front door scuff trim & Rear door scuff trim
(Refer to the BD group - "Interior Trim")

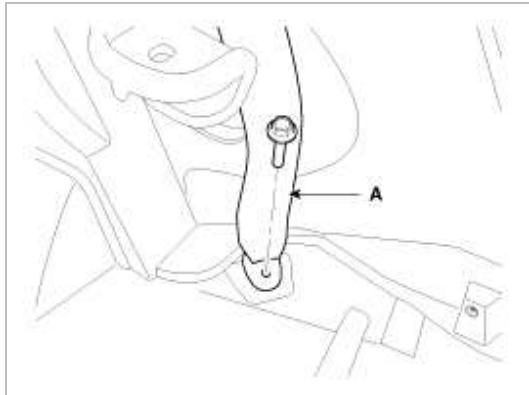
2. Remove the clips and rear transverse trim (A).



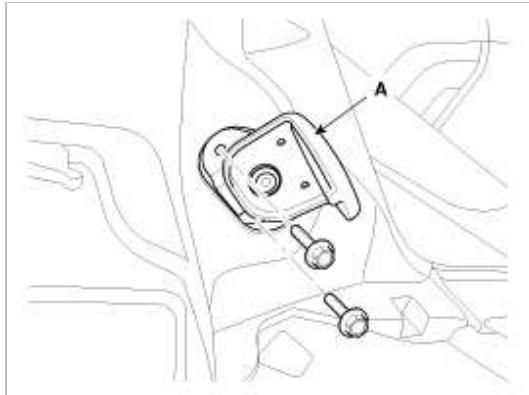
3. After loosening the mounting bolt, then remove the rear seat belt lower anchor (A).

Tightening torque :

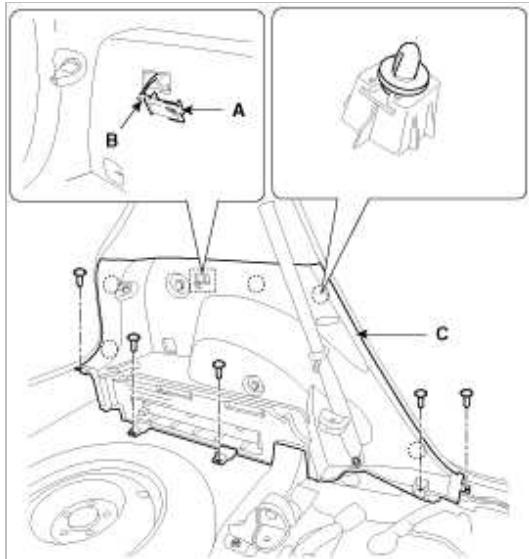
39.2 ~ 53.9 N.m (4.0 ~ 5.5 kgf.m, 28.9 ~ 39.8 lb-ft)



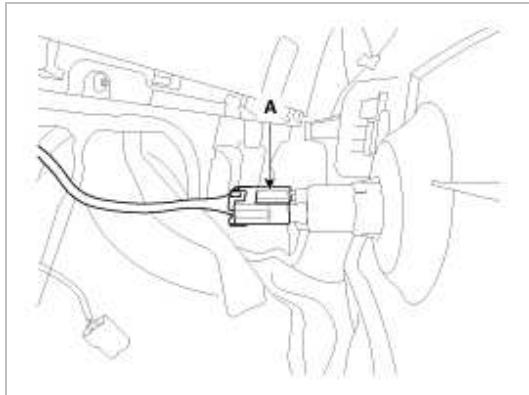
4. After loosening the mounting bolts, then remove the rear seat mounting bracket (A).



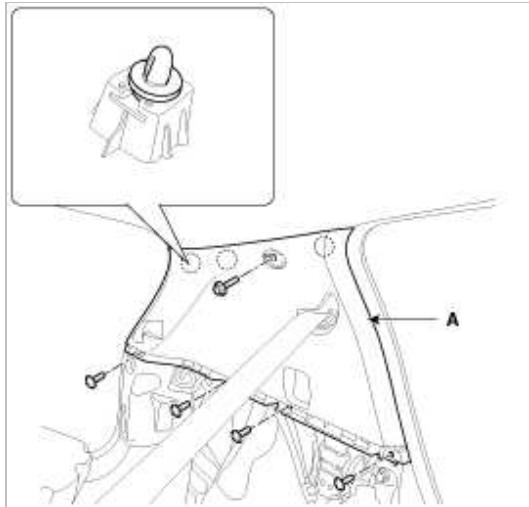
5. Using a screwdriver or remover, remove the lamp (A).
6. Disconnect the connector (B).
7. After loosening the mounting screws, then remove the luggage side trim (C).



8. Disconnect the connector (A).



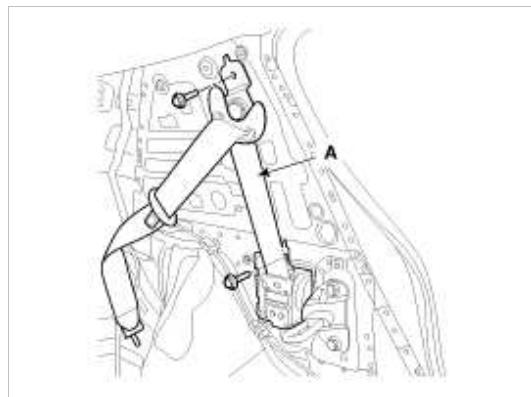
9. After loosening the mounting bolt and screws, then remove the rear pillar trim (A).



10. After loosening the mounting bolts, then remove the rear seat belt (A).

Tightening torque :

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



11. Installation is the reverse of removal.

NOTE

- Replace any damaged clips.
- Make sure the connectors are plugged in properly.

Rear Seat Belt Buckle Replacement

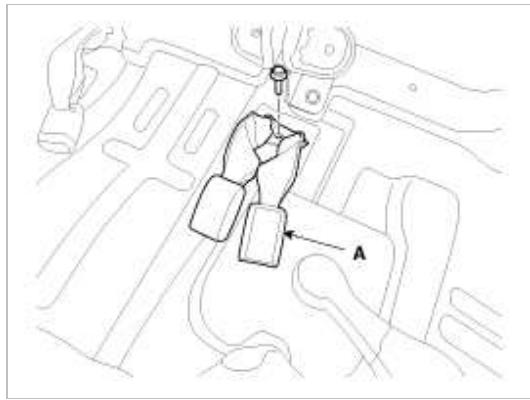
1. Remove the rear seat.
(Refer to the BD group - "Rear Seat")

2. After loosening the mounting bolt, then remove the rear seat belt buckle (A).

Tightening torque :

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

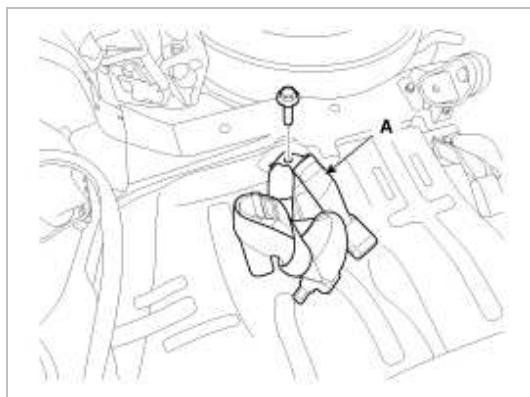
[LH]



[RH]

Tightening torque :

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



3. Installation is the reverse of removal.



SPORTAGE(SL) > 2012 > G 2.4 DOHC > Brake System**Brake System > General Information > Specifications****Specifications**

Item		Specification	
Master cylinder	Type	Tandem	
	Cylinder I.D.	22.22mm	
	Piston stroke	45±1 mm (1.77±0.039 in)	
	Fluid level switch	Provided	
Brake booster	Type	11" Single	
	Boosting ratio	9:1	
Front Disc brake	Type	2WD	4WD
		Ventilated disc	Ventilated disc
	Disc O.D.	Ø 280 mm (11.02 in)	Ø 300 mm (11.81 in)
	Disc thickness	26 mm (1.02 in)	28 mm (1.10 in)
	Caliper piston	Single	Single
	Cylinder I.D.	Ø 57.2mm (2.25 in)	Ø 60.6mm (2.39 in)
Rear brake	Type	2WD	4WD
		Solid disc	Solid disc
	Disc O.D.	262 mm (10.31 in)	Ø 284 mm (11.18 in)
	Disc thickness	10 mm (0.39 in)	10 mm (0.39 in)
	Caliper piston	Single	Single
	Cylinder I.D.	Ø 34 mm(1.34 in)	Ø 34 mm (1.34 in)
Parking brake	Type	2WD	4WD
		DIH (Drum in hat)	DIH (Drum in hat)
	Drum I.D.	Ø 168 mm (6.61 in)	Ø 190 mm (7.48 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 ~ 16 V			
	Operating Temperature	-40 ~ 120 °C (-40 ~ 248°F)			
	Motor power	270 W			
Active Wheel speed sensor	Supply voltage	DC 4.5 ~ 20 V			
	Output current low	5.9 ~ 8.4 mA			
	Output current high	11.8 ~ 16.8 mA			
	Output range	1 ~ 2500 Hz			
	Tone wheel	Front	48 teeth		
		Rear	2WD : 47 teeth, 4WD : 48 teeth		
	Air gap	Front	0.4 ~ 1.5 mm		
		Rear	2WD : 0.4 ~ 1.5mm, 4WD : 0.4 ~ 1.0mm		
Steering Wheel	Operating Voltage	8 ~ 16 V			

Angle Sensor	Current Consumption	Max. 150 mA
	Output measurement range	-780 ~ +779.9 °
	Operating Angular velocity	0 ~ 1016 °/sec
Yaw rate& Lateral & Longitudinal G sensor (CAN TYPE)	Operating Voltage	10 V ~ 16 V
	Current Consumption	Max. 140 mA
	Yaw rate sensor measurement range	-75 ~ +75 °/sec
	Lateral and Longitudinal G sensor measurement range	-14.715 ~ 14.715 m/s ²

Service Standard

Items	Standard vale
Brake pedal height	165 mm (6.50 in)
Brake pedal Full stroke	135 mm (5.31 in)
Stop lamp clearance	1.5 ~ 2.0 mm (0.06 ~ 0.08 in)
Brake pedal free play	3 ~ 8 mm (0.12 ~ 0.31 in)
Front brake disc thickness	2WD : 26 mm (1.02 in), 4WD : 28 mm (1.10 in),
Front brake disc pad thickness	11 mm (0.43 in)
Rear brake disc thickness	10 mm (0.39 in)
Rear brake disc pad thickness	10 mm (0.39 in)

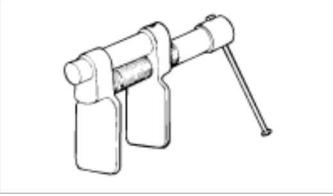
Tightening Torques

Items	N.m	kgf.m	lb-ft
Hub nut	88.3 ~ 107.9	9.0 ~ 11.0	65.1 ~ 79.6
Master cylinder to brake booster	7.9 ~ 11.8	0.8 ~ 1.2	5.8 ~ 8.7
Brake booster mounting nuts	16.7 ~ 25.5	1.7 ~ 2.6	12.3 ~ 18.8
Air bleeding screw	6.9 ~ 12.7	0.7 ~ 1.3	5.1 ~ 9.4
Brake tube flare nuts	12.7 ~ 16.7	1.3 ~ 1.7	9.4 ~ 12.3
Front caliper guide rod bolts	21.6 ~ 31.4	2.2 ~ 3.2	15.9 ~ 23.1
Rear caliper guide rod bolts	21.6 ~ 31.4	2.2 ~ 3.2	15.9 ~ 23.1
Front caliper assembly to knuckle	78.5 ~ 98.1	8.0 ~ 10.0	57.9 ~ 72.3
Rear caliper assembly to knuckle	78.5 ~ 98.1	8.0 ~ 10.0	57.9 ~ 72.3
Brake hose to caliper	24.5 ~ 29.4	2.5 ~ 3.0	18.1 ~ 21.7
Brake pedal member bracket bolts	16.7 ~ 25.5	1.7 ~ 2.6	12.3 ~ 18.8
Brake pedal shaft nut	24.5 ~ 34.3	2.5 ~ 3.5	18.1 ~ 25.3
Stop lamp switch lock nut	11.8 ~ 14.7	1.2 ~ 1.5	8.7 ~ 10.8
Front wheel speed sensor mounting bolt	6.9 ~ 10.8	0.7 ~ 1.1	5.0 ~ 8.0
HECU bracket mounting bolt and nut	12.7 ~ 16.7, 16.7 ~ 22.6	1.3 ~ 1.7, 1.7 ~ 2.3	9.4 ~ 12.3, 12.3 ~ 16.6
Yaw rate&G sensor mounting bolts	7.9 ~ 10.8	0.8 ~ 1.1	5.8 ~ 8.0

Lubricants

Items	Recommended	Quantity
Brake fluid	DOT 3 or DOT 4	As required
Brake pedal bushing and bolt	Chassis grease	As required
Parking brake shoe and backing plate contacting surface	Heat resistance grease	As required
Caliper guide rod and boot	AI-11P	0.8 ~ 2.0g

Brake System > General Information > Special Service Tools**Special Service Tools**

Tool(Number and Name)	Illustration	Use
09581-11000 Piston expander		Spreading the front disc brake piston.

Brake System > General Information > Troubleshooting**Troubleshooting****Problem Symptoms Table**

Use the table below to help you find the cause of the problem. The numbers indicate the priority of the like cause of the problem. Check each part in order.

If necessary, replace these parts.

Symptom	Suspect Area	Reference
Lower pedal or spongy pedal	1. Brake system (Fluid leaks) 2. Brake system (Air in) 3. Piston seals (Worn or damaged) 4. Rear brake shoe clearance(Out of adjustment) 5. Master cylinder (Inoperative)	repair air-bleed replace adjust replace
Brake drag	1. Brake pedal free play (Minimum) 2. Parking brake lever travel (Out of adjustment) 3. Parking brake wire (Sticking) 4. Rear brake shoe clearance(Out of adjustment) 5. Pad or lining (Cracked or distorted) 6. Piston (Stuck) 7. Piston (Frozen) 8. Anchor or Return spring (Inoperative) 9. Booster system (Vacuum leaks) 10. Master cylinder (Inoperative)	adjust adjust repair adjust replace replace replace replace repair replace
Brake pull	1. Piston (Sticking) 2. Pad or lining (Oily) 3. Piston (Frozen) 4. Disc (Scored) 5. Pad or lining (Cracked or distorted)	replace replace replace replace replace
Hard pedal but brake inefficient	1. Brake system (Fluid leaks) 2. Brake system (Air in) 3. Pad or lining (Worn) 4. Pad or lining (Cracked or distorted) 5. Rear brake shoe clearance(Out of adjustment) 6. Pad or lining (Oily) 7. Pad or lining (Glazed) 8. Disc (Scored) 9. Booster system (Vacuum leaks)	repair air-bleed replace replace adjust replace replace replace repair
Noise from brake	1. Pad or lining (Cracked or distorted) 2. Installation bolt (Loosen) 3. Disc (Scored) 4. Sliding pin (Worn) 5. Pad or lining (Dirty) 6. Pad or lining (Glazed) 7. Anchor or Return spring (Faulty) 8. Brake pad shim (Damage) 9. Shoe hold-down spring (Damage)	replace adjust replace replace clean replace replace replace replace
Brake fades	1. Master cylinder (Inoperative)	replace

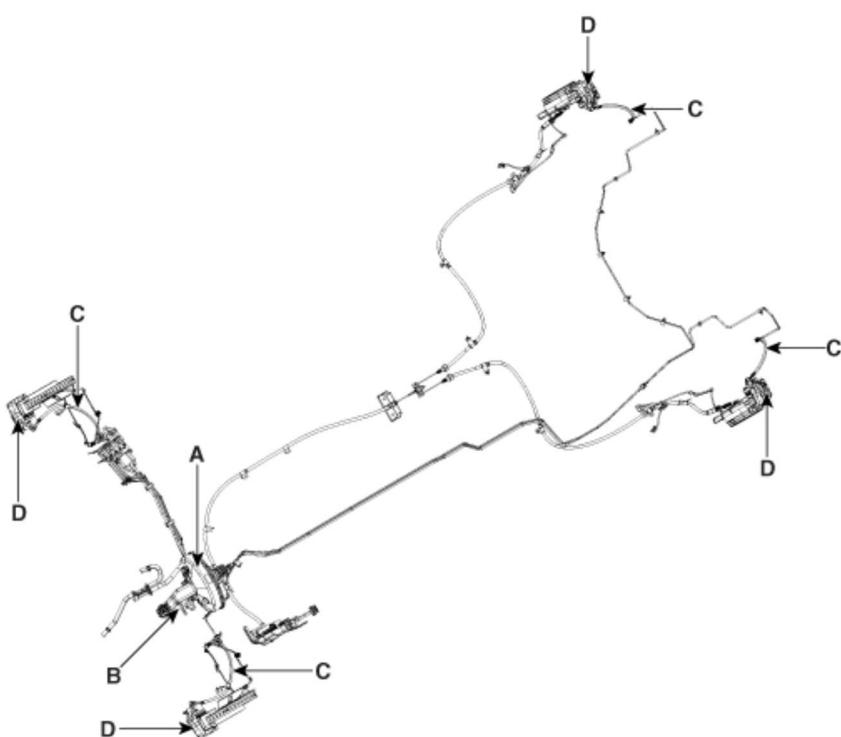
Brake vibration, pulsation	1. Brake booster (Vacuum leaks) 2. Pedal free play 3. Master cylinder (Inoperative) 4. Caliper (Damage) 5. Master cylinder cap seal 6. Damaged brake lines	replace adjust replace replace replace replace
Brake Chatter	Brake chatter is usually caused by loose or worn components, or glazed or burnt linings. Rotors with hard spots can also contribute to brake chatter. Additional causes of chatter are out-of-tolerance rotors, brake lining not securely attached to the shoes, loose wheel bearings and contaminated brake lining.	

Brake System > 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 seem hard to depress, check the brake booster. Replace the brake booster as an assembly if it does not work properly or if there are signs of leakage.
Piston cup and pressure cup inspection (B)	<ul style="list-style-type: none"> 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)	<p>Check brake operation by applying the brakes.</p> <p>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.</p>

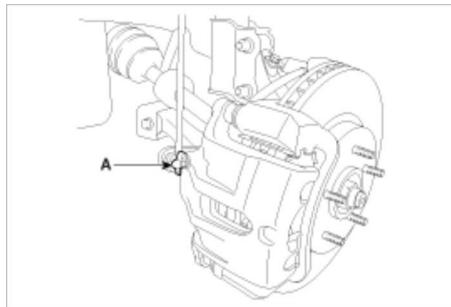
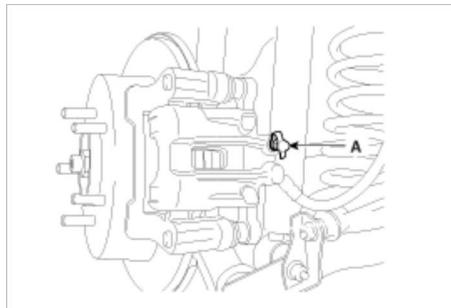


Brake System Bleeding

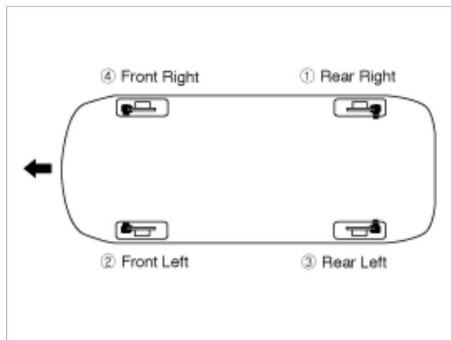
CAUTION

- 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.

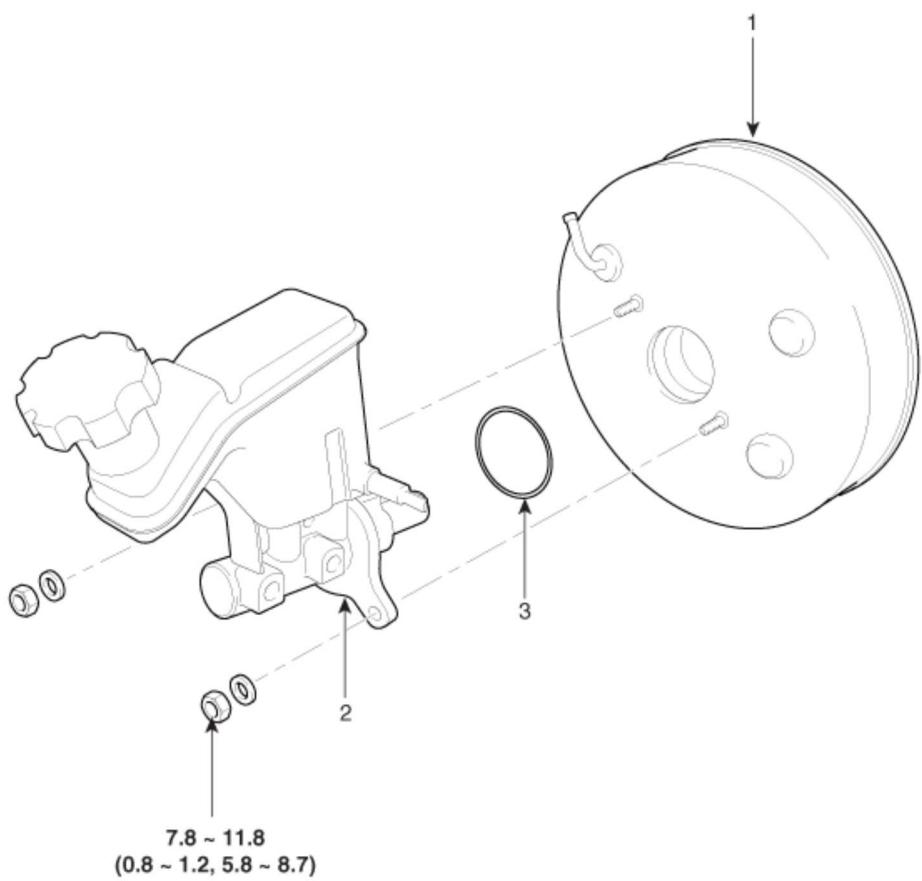
Front**Rear**

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 (1)

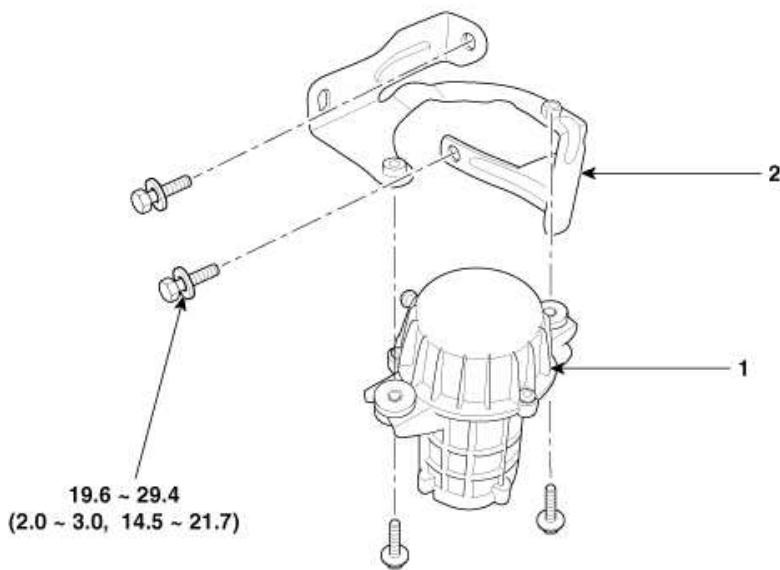


Torque : N.m (kgf.m, lb-ft)

1. Brake booster	3. O-ring
2. Master cylinder assembly	

Components (2)

[2.0 T - GDI ENGINE ONLY]



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

1. Vacuum pump

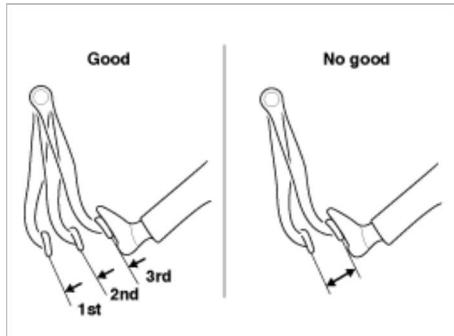
2. Bracket

Brake System > Brake System > Brake Booster > Repair procedures

Brake Booster Operating Test

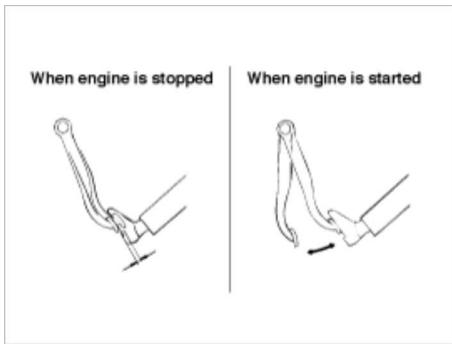
For simple checking of the brake booster operation, carry out the following tests.

- 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.



- With the engine stopped, step on the brake pedal several times.

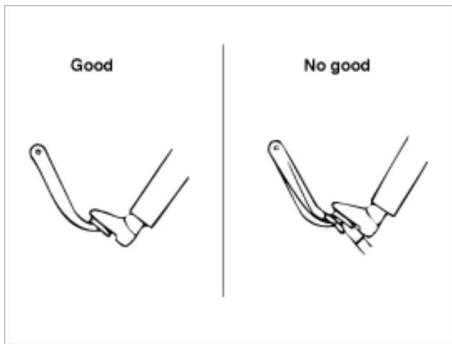
Then step on the brake pedal and start the engine. If the pedal moves downward slightly, the booster is in good condition. If there is no change, the booster is inoperative.



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.

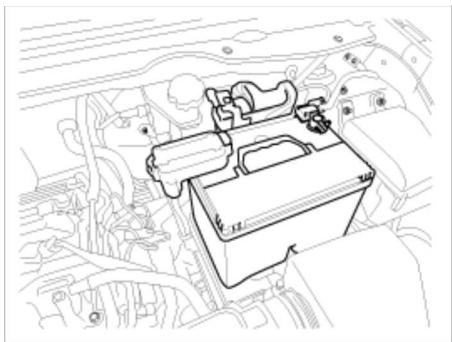
Even if one of the above three tests is not okay, check the check valve, vacuum hose and booster for malfunction.



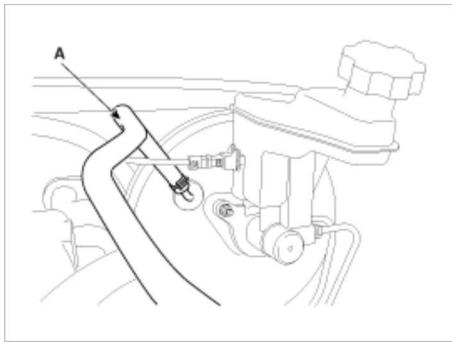
Removal

Brake Booster

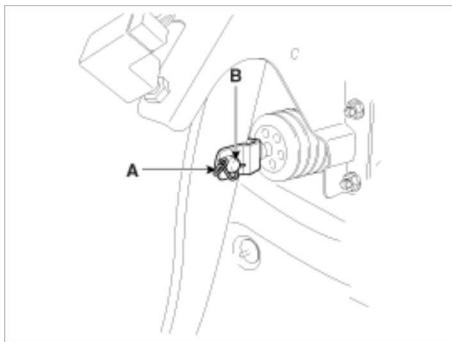
1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Disconnect the battery terminal and then remove the battery.



3. Disconnect the ECM connector and then ECM and battery tray.
4. Disconnect the vacuum hose (A) from the brake booster.



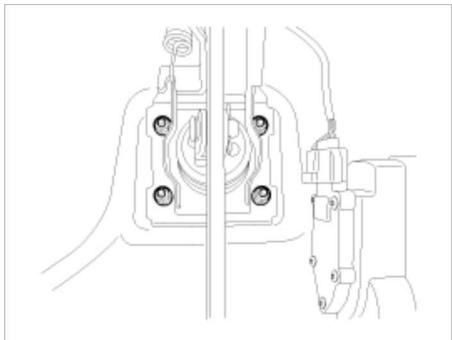
5. Remove the master cylinder. (Refer to Master cylinder)
6. Remove the snap pin (A) and clevis pin (B).



7. Remove the mounting nuts.

Tightening torque:

16.7 ~ 25.5 N.m (1.7 ~ 2.6 kgf.m, 12.3 ~ 18.8 lb-ft)



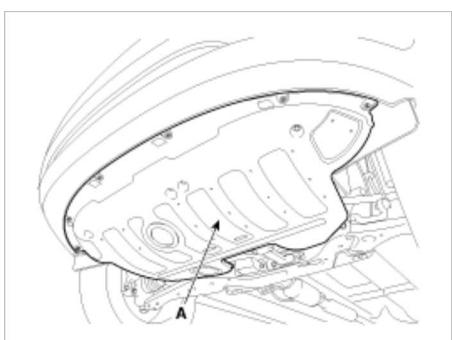
8. Remove the brake booster.

Vacuum Pump

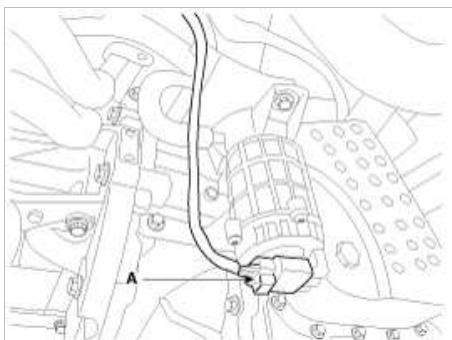
1. Turn ignition switch OFF.
2. Remove the under covers (A).

Tightening torque:

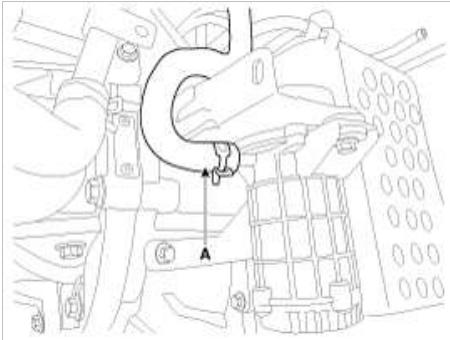
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)



3. Disconnect the vacuum pump connector (A).



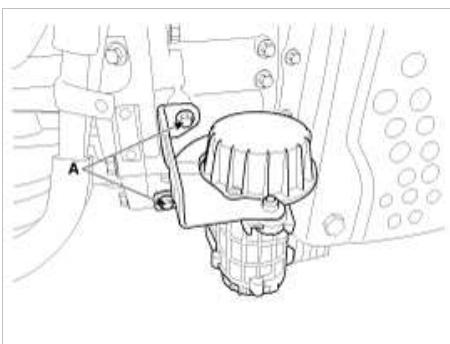
4. Disconnect the vacuum hose (A).



5. Loosen the vacuum pump bracket bolts (A), and then remove vacuum pump and bracket.

Tightening torque:

19.6 ~ 29.4 N.m (2.0 ~ 3.0 kgf.m, 14.5 ~ 21.7 lb-ft)



6. Remove the 2 bolts, and then remove the bracket from vacuum pump.

Inspection

1. Inspect the check valve in the vacuum hose, intensifier and the connecting section.

CAUTION

Do not remove the check valve from the vacuum hose.

2. Check the boot for damage.

Vacuum Pump

1. Check the brake warning lamp in the IGN ON position.

NOTE

Brake warning lamp is ON as below conditions.

1. Parking brake warning
2. Low brake fluid level warning
3. Low brake vacuum pressure warning
 - Vacuum pump is abnormal condition
 - Vacuum pump CAN communication is abnormal condition
 - Vacuum switch is abnormal condition

2. Check that the brake warning lamp is ON after the release the parking brake with a sufficient brake fluid level.

If the brake warning lamp is ON, check the below points.

- (1) Is the brake warning lamp ON within 5 seconds after IGN ON? (CAN Timeout Error)

NOTE

CAN Timeout Error ; The brake warning lamp is ON when the communication fails more than 2 seconds between vacuum pump and cluster.

YES

- Reinstall the vacuum pump connector after removing it. And if the brake warning lamp is ON within 5 seconds after IGN ON, replace the vacuum pump.

NO

► Check the 2).

(2) Is the brake warning lamp ON within 45 ~ 55 seconds?

YES

► Brake vacuum switch is normal condition.

NO

► Check the 3).

(3) Is the brake warning lamp ON within 15 ~ 35 seconds after removing the vacuum hose from the brake booster?

YES

► Replace the vacuum pump.

NO

► Vacuum pump is normal condition.

Installation

Brake Booster

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. Adjust the brake pedal height and free play.

(Refer to Brake pedal height and free play adjustment)

3. After installing, bleed the brake system. (Refer to Brake system bleeding)

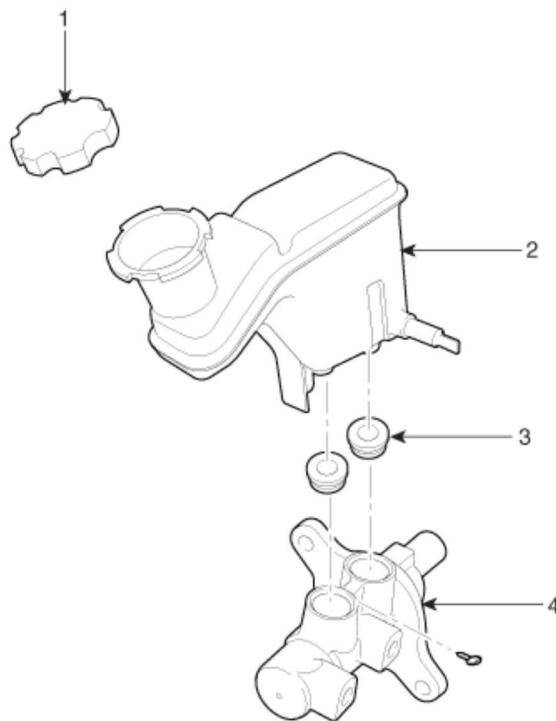
Vacuum Pump

1. Installation is the reverse of removal.

2. Tighten the vacuum pump mounting bolts to the specified torque.

Brake System > Brake System > Master Cylinder > Components and Components Location

Components



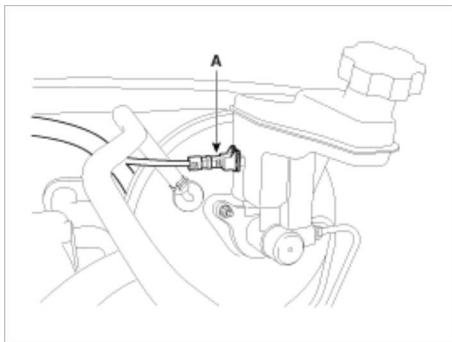
1. Reservoir cap
2. Reservoir

3. Grommet
4. Master cylinder

Brake System > Brake System > Master Cylinder > Repair procedures

Removal

1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
 2. Disconnect the battery terminal and then remove the battery.
-
3. Disconnect the ECM connector and the ECM and battery tray.
 4. Disconnect the brake fluid level switch connector (A), and remove the reservoir cap.



5. 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.

6. Disconnect the brake tube (A) from the master cylinder by loosening the tube flare nut.

Tightening torque:

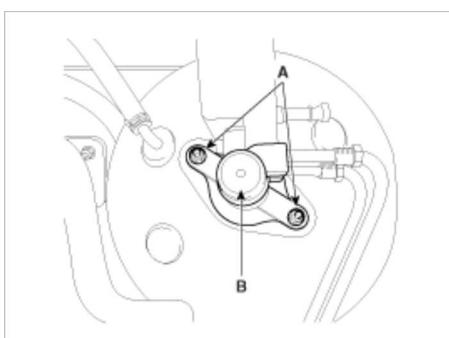
16.7 ~ 22.6N.m (1.7 ~ 2.3kgf.m, 12.3 ~ 16.6lb-ft)



7. Remove the master cylinder (B) from the brake booster after loosening the mounting nuts (A).

Tightening torque:

7.9 ~ 11.8N.m (0.8 ~ 1.2kgf.m, 5.8 ~ 8.7lb-ft)

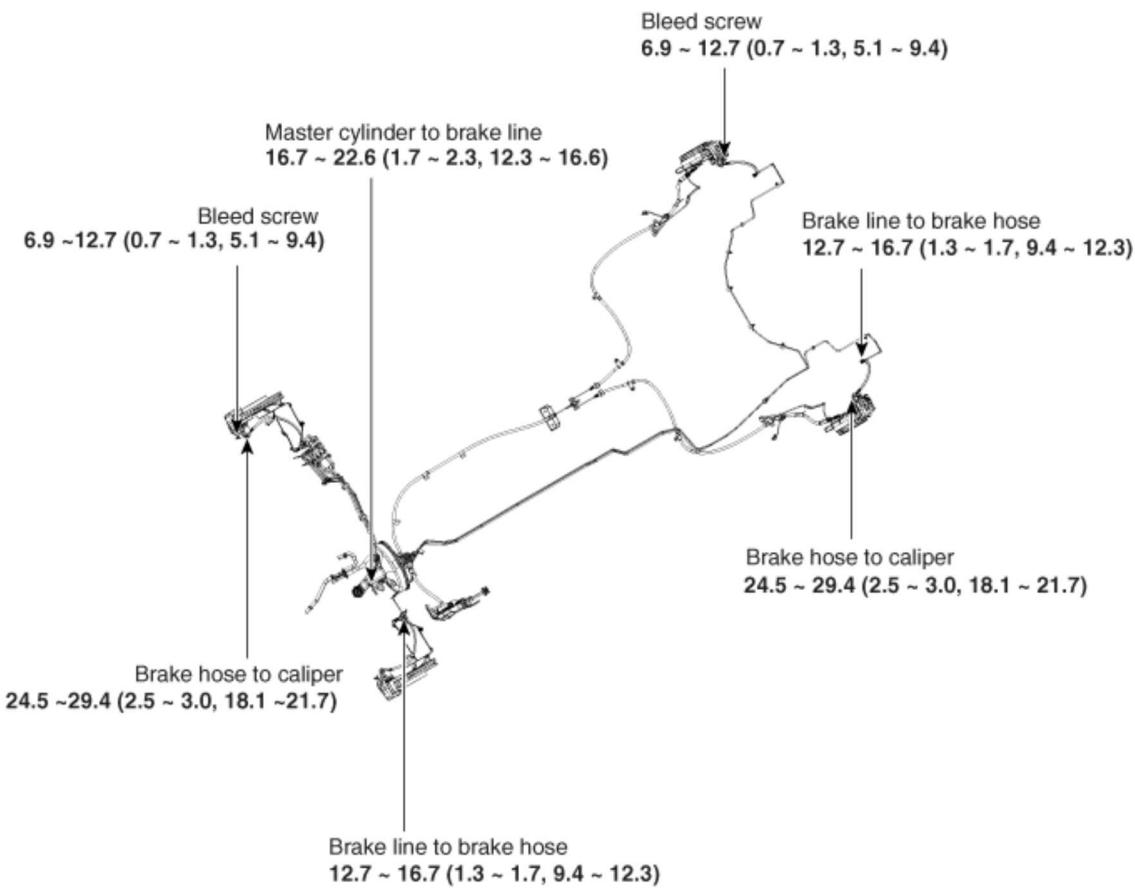


Installation

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)

Brake System > Brake System > Brake Line > Repair procedures

Removal

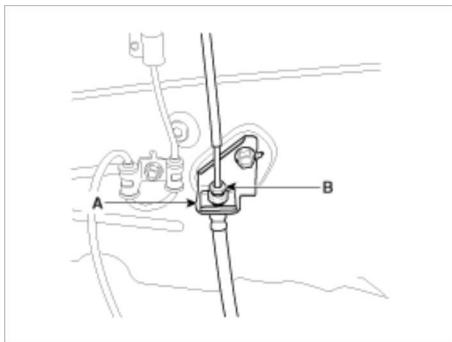
1. Disconnect the brake fluid level switch connector, and remove the reservoir cap.
2. Remove the brake fluid from the master cylinder reservoir with a syringe.

CAUTION

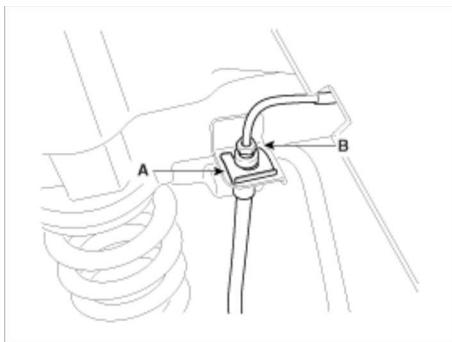
Do not spill brake fluid on the vehicle, it may damage the paint; if brake fluid does contact the paint, wash it off immediately with water.

3. Remove the wheel & tire.
4. Remove the brake hose clip (A).

Front



Rear



5. Disconnect the brake tube by loosening the tube flare nut (B).

Tightening torque:

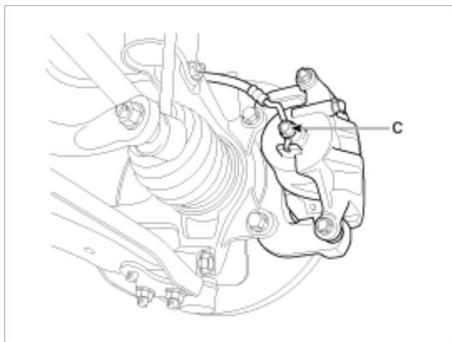
12.7 ~16.7 N.m (1.3 ~1.7 kgf.m, 9.4 ~12.3 lb-ft)

6. Disconnect the brake hose from the brake caliper by loosening the bolt (C).

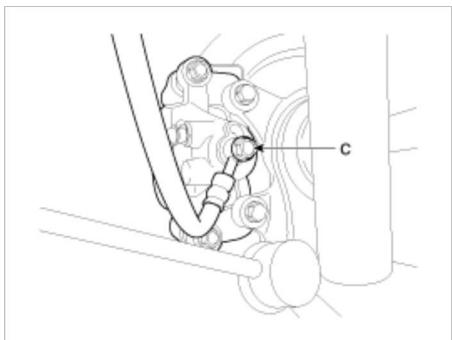
Tightening torque:

24.5 ~29.4 N.m (2.5 ~3.0 kgf.m, 18.1 ~21.7 lb-ft)

Front



Rear



Inspection

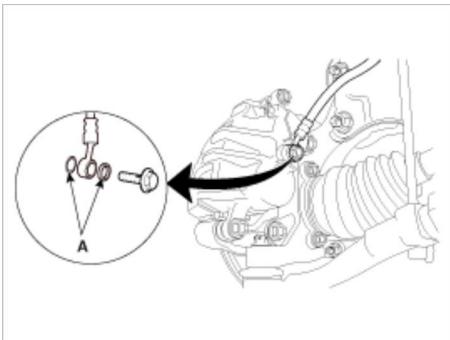
1. Check the brake tubes for cracks, crimps and corrosion.
2. Check the brake hoses for cracks, damage and fluid leakage.
3. Check the brake tube flare nuts for damage and fluid leakage.
4. Check brake hose mounting bracket for crack or deformation.

Installation

1. Installation is the reverse of removal.

CAUTION

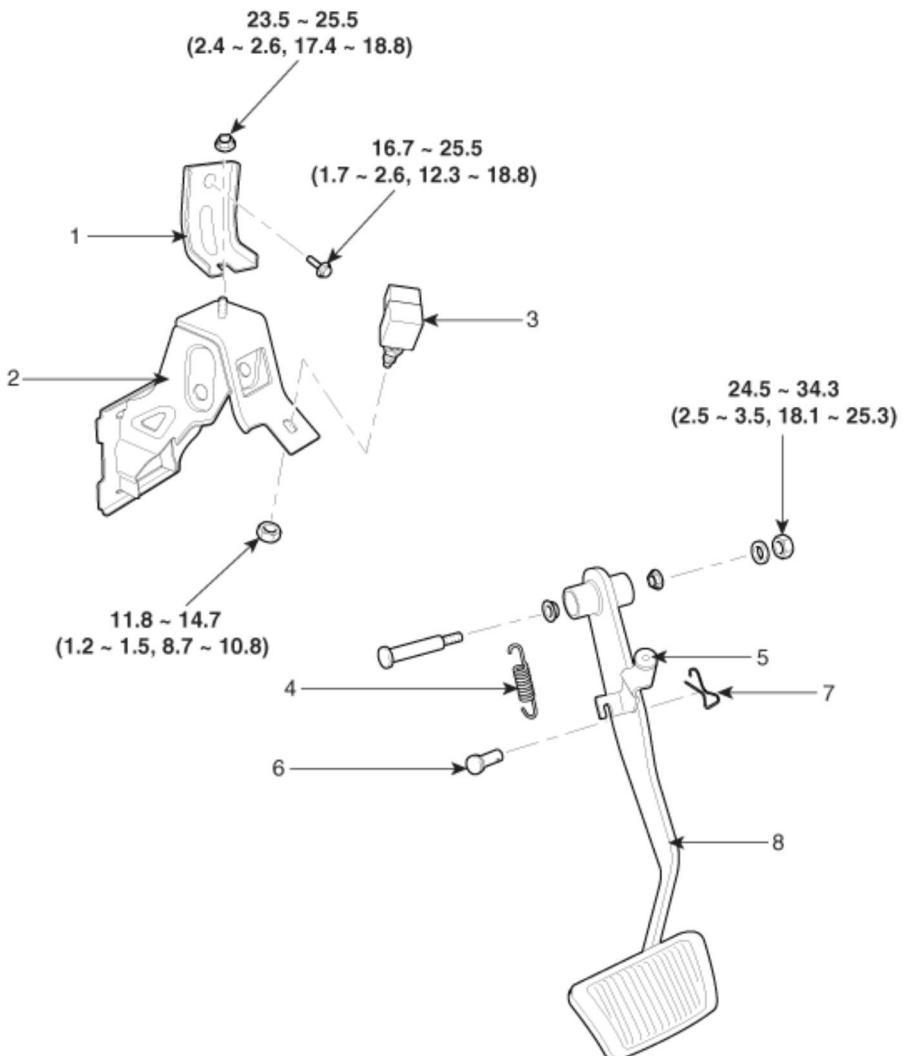
Use a new washer (A) whenever installing.



2. After installation, bleed the brake system. (Refer to Brake system bleeding)
3. Check the spilled brake oil.

Brake System > Brake System > Brake Pedal > Components and Components Location

Components



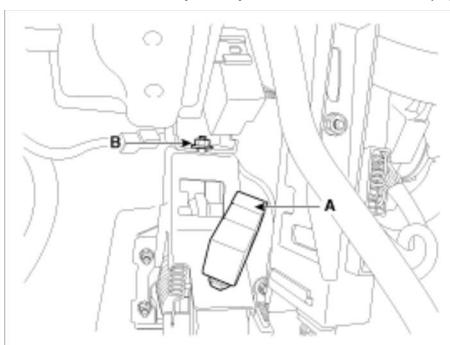
Torque : Nm (kgf.m, lb-ft)

- | | |
|--------------------------------|------------------------|
| 1. Cowl bracket | 5. Brake pedal stopper |
| 2. Brake pedal member assembly | 6. Clevis pin |
| 3. Stop lamp switch | 7. Snap pin |
| 4. Return spring | 8. Brake pedal |

Brake System > Brake System > Brake Pedal > Repair procedures

Removal

1. Remove the crash pad lower panel and reinforcement panel. (Refer to the Body group- crash pad).
2. Pull down steering column shaft after removing bolts and nuts.
3. Disconnect the stop lamp switch connector (A).

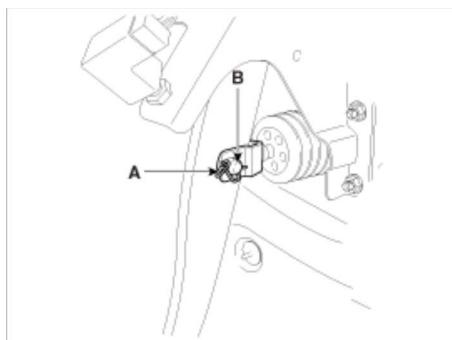


4. Remove the brake pedal member mounting nut (B).

Tightening torque:

16.5 ~ 25.5 N.m (1.7 ~ 2.6 kgf.m, 12.3 ~ 18.8 lb-ft)

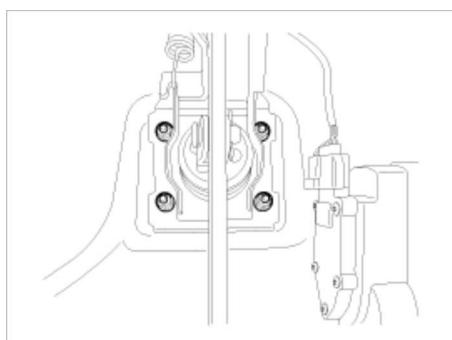
5. Remove the snap pin (A) and clevis pin (B).



6. Remove the brake pedal member assembly mounting nuts and then remove the brake pedal assembly.

Tightening torque:

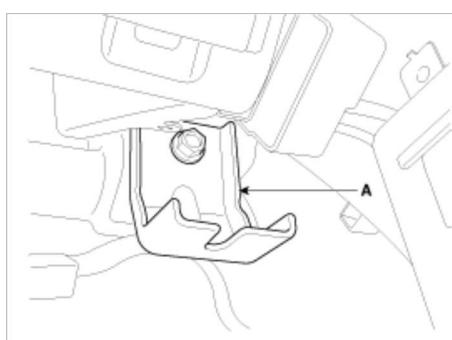
16.7 ~ 25.5 N.m (1.7 ~ 2.6 kgf.m, 12.3 ~ 18.8 lb-ft)



7. Remove the cowl bracket (A).

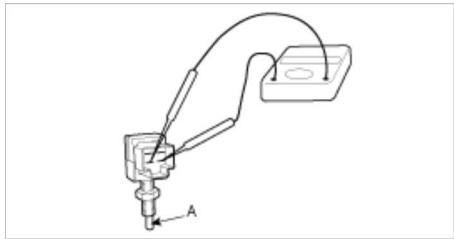
Tightening torque:

23.5 ~ 25.5 N.m (2.4 ~ 2.6 kgf.m, 17.4 ~ 18.8 lb-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.

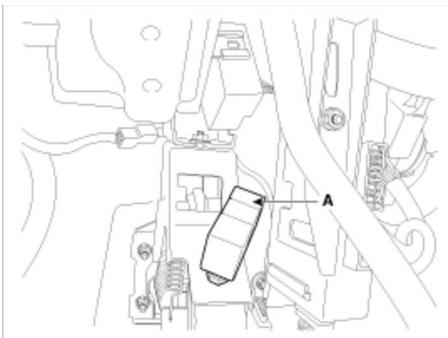
2. Adjust the brake pedal height and free play.

3. Check the brake pedal operation.

Adjustment

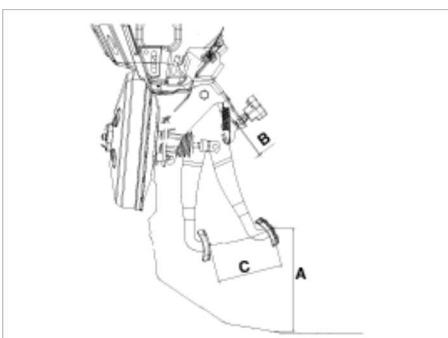
Brake Pedal Height and Free Play

1. Disconnect the stop lamp switch connector (A) and loosen the stop lamp switch lock nut.



2. Adjust the brake pedal height (A) as illustration below.

Pedal height (A) : 165 mm (6.50 in)
Full stroke (C) : 135 mm (5.31 in)



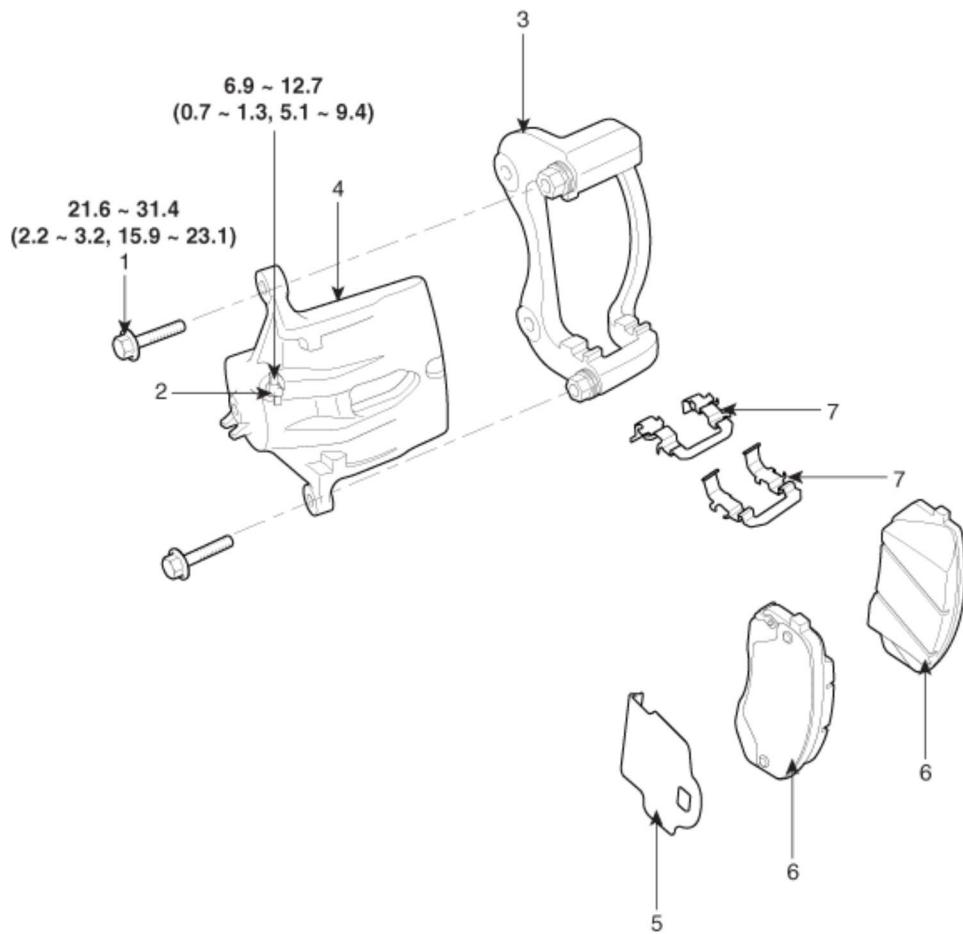
3. Adjust the stop lamp switch clearance (B) and brake pedal free play.

Stop lamp clearance: 1.5 ~ 2.0 mm (0.06 ~ 0.08 in)
Pedal free play: 3.0 ~ 8.0 mm (0.12 ~ 0.31 in)

4. Connect the stop lamp switch connector.

Brake System > Brake System > Front Disc Brake > Components and Components Location

Components



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

- | | |
|--------------------|-------------------|
| 1. Guide rod bolt | 5. Inner pad shim |
| 2. Bleed screw | 6. Brake pad |
| 3. Caliper bracket | 7. Pad retainer |
| 4. Caliper body | |

Brake System > Brake System > Front Disc Brake > Repair procedures

Removal

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. Loosen the hose eyebolt (B) and caliper mounting bolts (C), then remove the front caliper assembly (A).

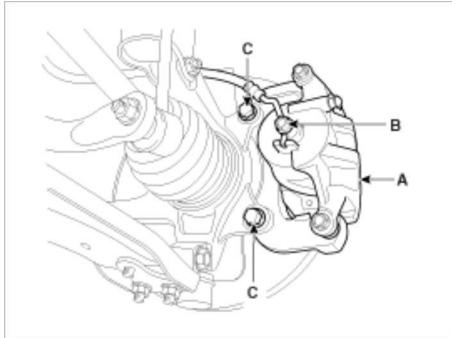
Tightening torque:

Brake hose to caliper(B):

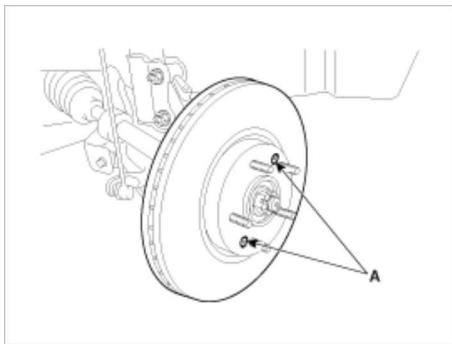
24.5 ~29.4 N.m (2.5 ~3.0 kgf.m, 18.1 ~21.7 lb-ft)

Caliper assembly to knuckle(C):

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



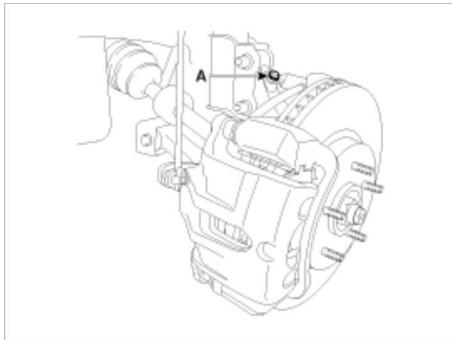
3. Remove the front brake disc by loosening the screws (A).



Replacement

Front brake pads

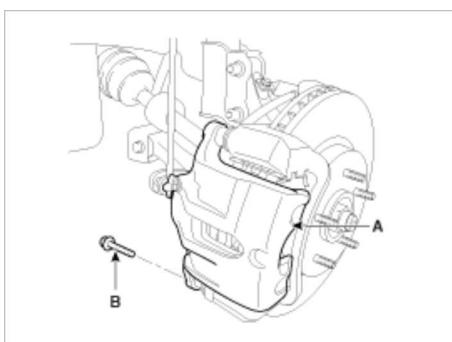
1. Remove the brake hose mounting bracket bolt (A).



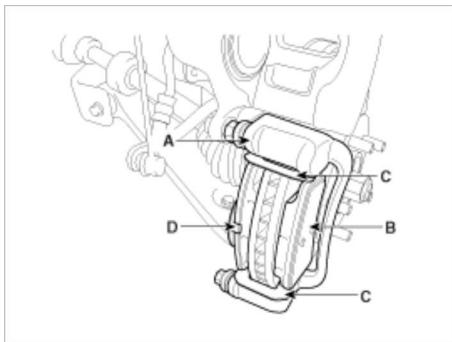
2. Loosen the guide rod bolt (B) and pivot the caliper (A) up out of the way.

Tightening torque:

21.6 ~31.4 N.m (2.2 ~3.2 kgf.m, 15.9 ~23.1 lb-ft)



3. Replace pad shim (D), 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

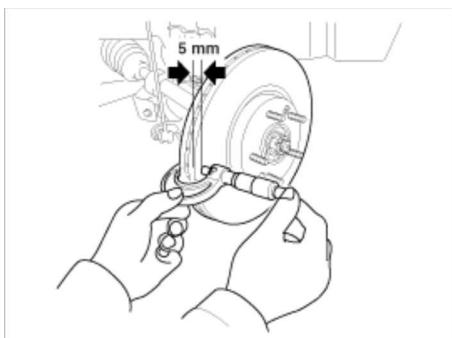
[2WD]

- Standard : 26 mm (1.02 in)
- Service Limit : 24.4 mm (0.96 in)

[4WD]

- Standard : 28 mm (1.10 in)
- Service Limit : 26.4 mm (1.04 in)

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

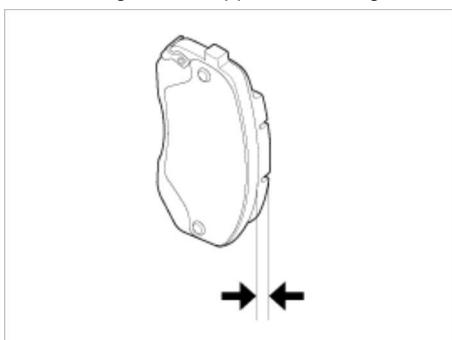
1. Check the pad wear. Measure the pad thickness and replace it, if it is less than the specified value.

Pad thickness

Standard value: 11 mm (0.43 in)

Service limit: 2.0 mm (0.0787 in)

2. Check that grease is applied, to sliding contact points and the pad and backing metal for damage.

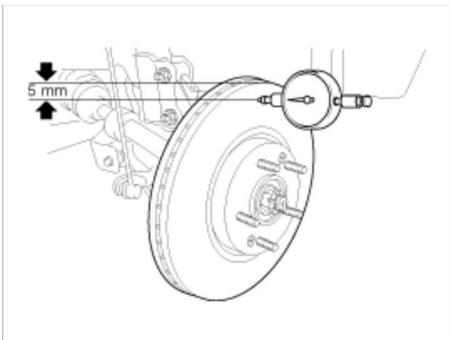


Front brake disc runout check

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

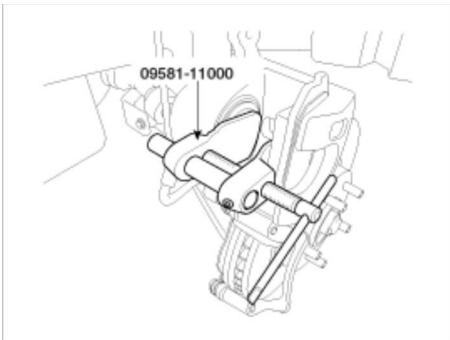
Limit: 0.025 mm (0.00098 in.) or less (new one)



2. If the runout of the brake disc exceeds the limit specification, replace the disc, and then measure the runout again.
3. If the runout does not exceed the limit specification, install the brake disc after turning it 180° and then check the runout of the brake disc again.
4. If the runout cannot be corrected by changing the position of the brake disc, replace the brake disc.

Installation

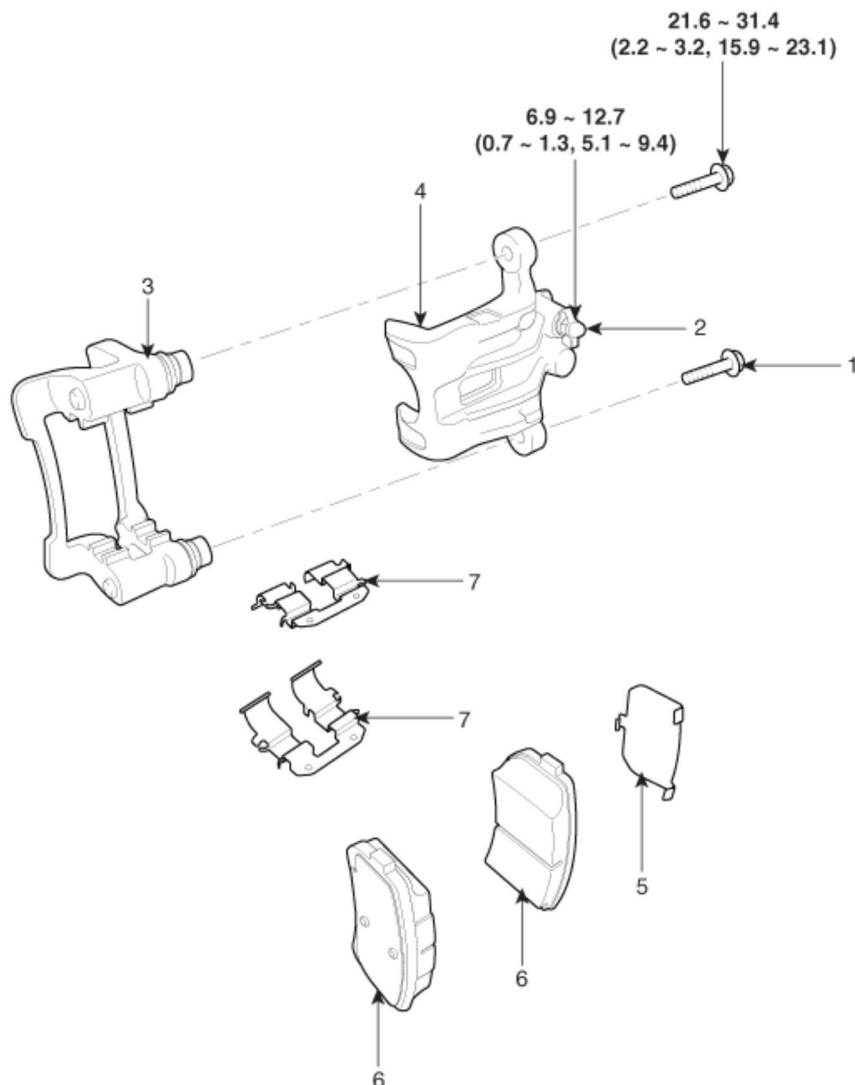
1. Installation is the reverse of removal.
2. Use a SST (09581-11000) when installing the brake caliper assembly.



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	5. Inner pad shim
2. Bleed screw	6. Brake pad
3. Caliper bracket	7. Pad retainer
4. Caliper body	

Brake System > Brake System > Rear Disc Brake > Repair procedures

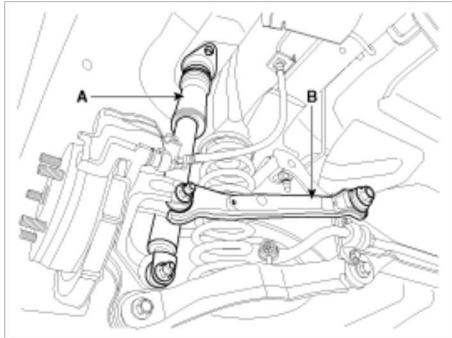
Removal

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 (A). [2WD Only]
(Refer to the Suspension group - rear shock absorber)



3. Remove the rear upper arm (B). [2WD Only]
(Refer to the Suspension group - rear upper arm)
4. Loosen the hose eyebolt (B) and caliper mounting bolts (C), then remove the rear caliper assembly (A).

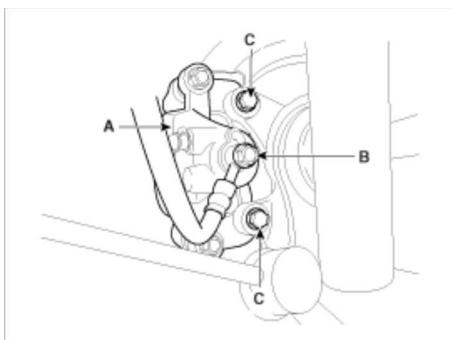
Tightening torque:

Brake hose to caliper(B):

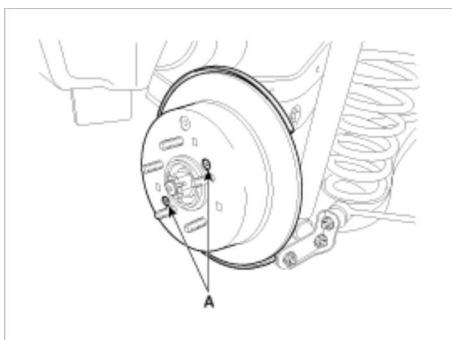
24.5 ~ 29.4 N.m (2.5 ~ 3.0 kgf.m, 18.1 ~ 21.7 lb-ft)

Caliper assembly to carrier(C):

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



5. Remove the rear brake disc by loosening the screws (A).



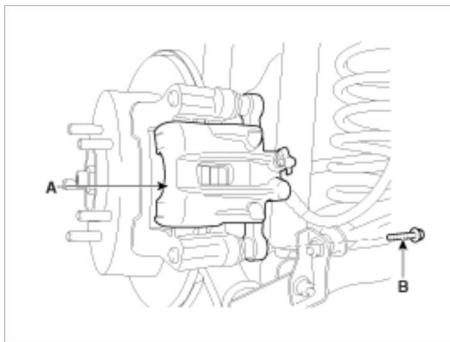
Replacement

Rear brake pads

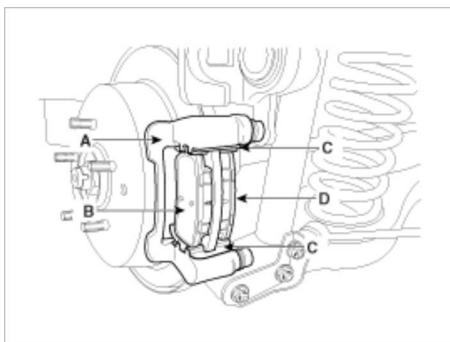
1. Loosen the guide rod bolt (B) and pivot the caliper (A) up out of the way.

Tightening torque:

21.6 ~31.4 N.m (2.2 ~3.2 kgf.m, 15.9 ~23.1 lb-ft)



2. Replace pad shim (D), pad retainers (C) and brake pads (B) in the caliper bracket (A).



Inspection

Rear Brake Disc Thickness Check

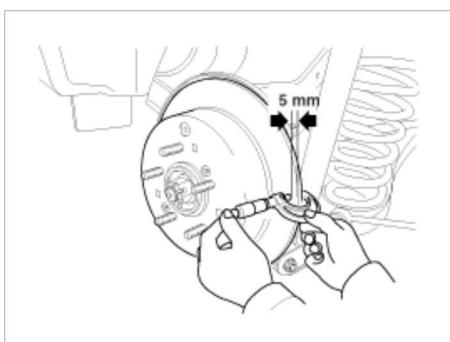
1. Check the brake pads for wear and fade.
2. Check the brake disc for damage and cracks.
3. Remove all rust and contamination from the surface, and measure the disc thickness at 8 points, at least, of same distance (5mm) from the brake disc outer circle.

Brake disc thickness

Standard: 10 mm (0.39 in)

Service limit: 8.4 mm (0.33 in)

Deviation: less than 0.005 mm (0.0002 in)



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: 10 mm (0.393 in)

Service limit: 2.0 mm (0.0787 in)

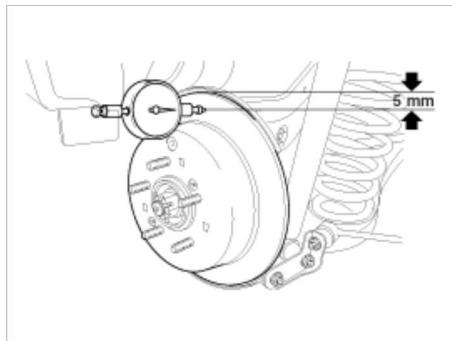
2. Check that grease is applied, to sliding contact points and the pad and backing metal for damage.

Rear Brake Disc 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

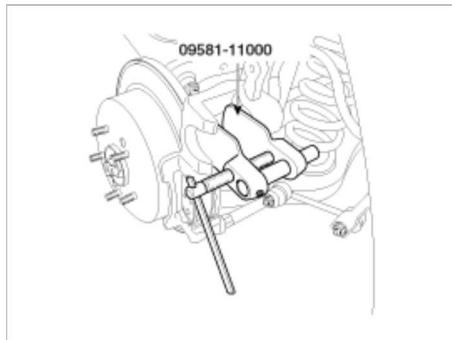
Limit: 0.03 mm (0.00118 in.) or less (new one)



2. If the runout of the brake disc exceeds the limit specification, replace the disc, and then measure the runout again.
3. If the runout exceeds the limit specification, install the brake disc after turning it 180° and then check the runout of the brake disc again.
4. If the runout cannot be corrected by changing the position of the brake disc, replace the brake disc.

Installation

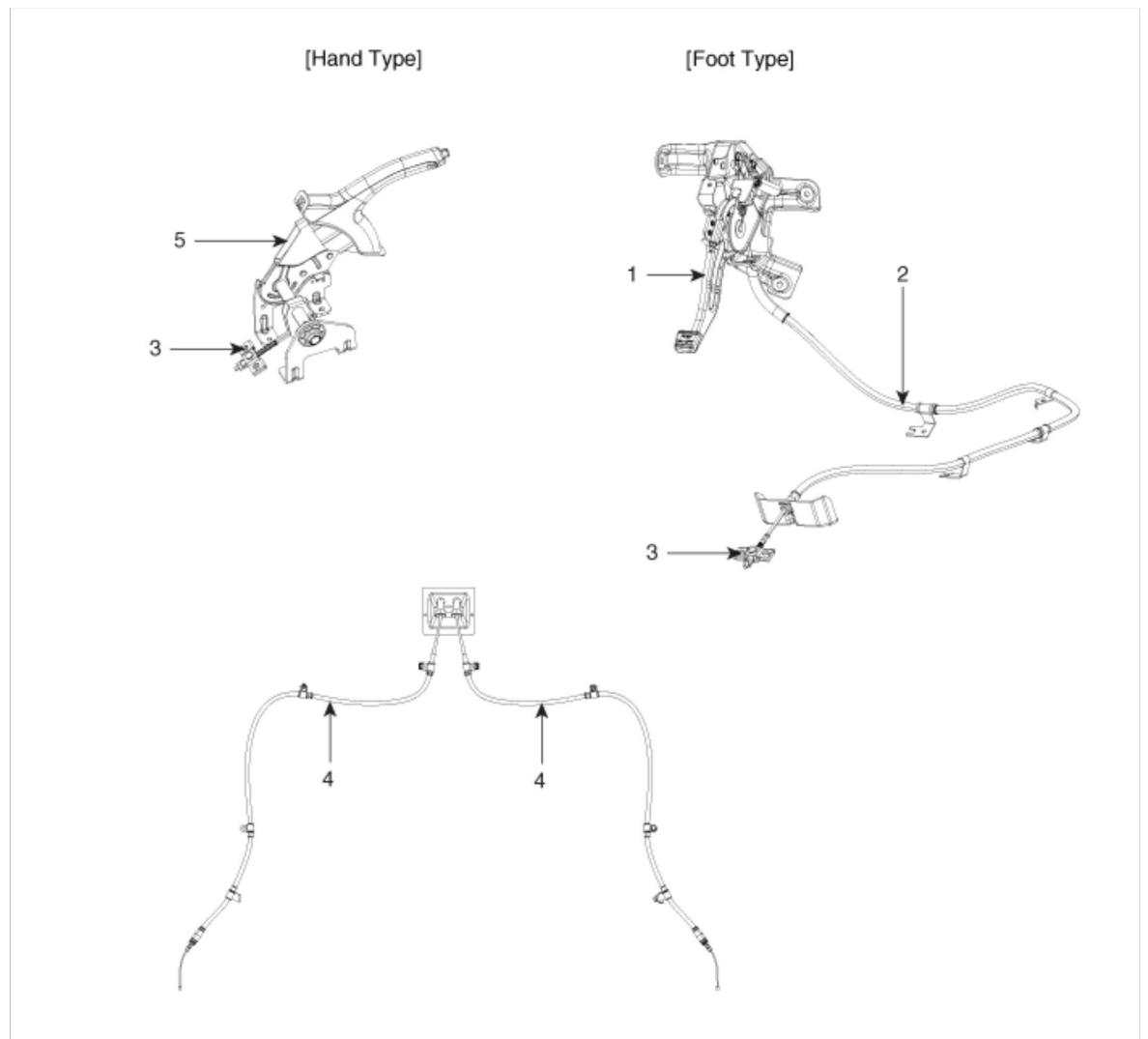
1. Installation is the reverse of removal.
2. Use a SST (09581-11000) when installing the brake caliper assembly.



3. After installation, bleed the brake system. (Refer to Brake system bleeding)

Brake System > Parking Brake System > Parking Brake Assembly > Components and Components Location

Components (1)

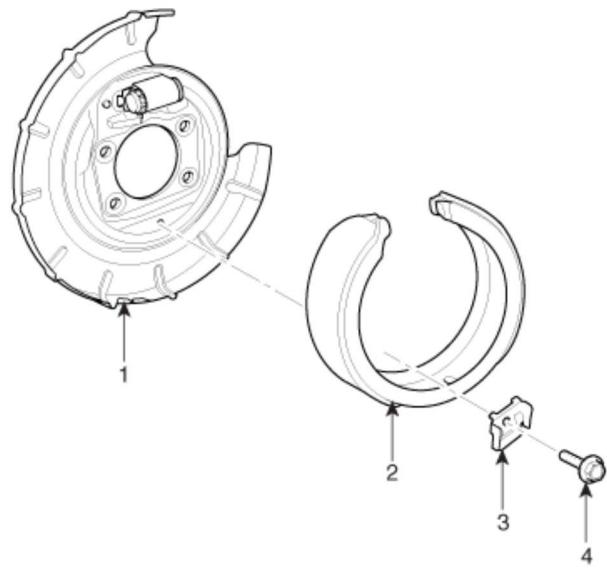


- 1. Parking brake pedal assembly
- 2. Front parking brake cable (Foot type only)
- 3. Equalizer assembly

- 4. Rear parking brake cable
- 5. Parking brake lever assembly

Components (2)

[2WD]

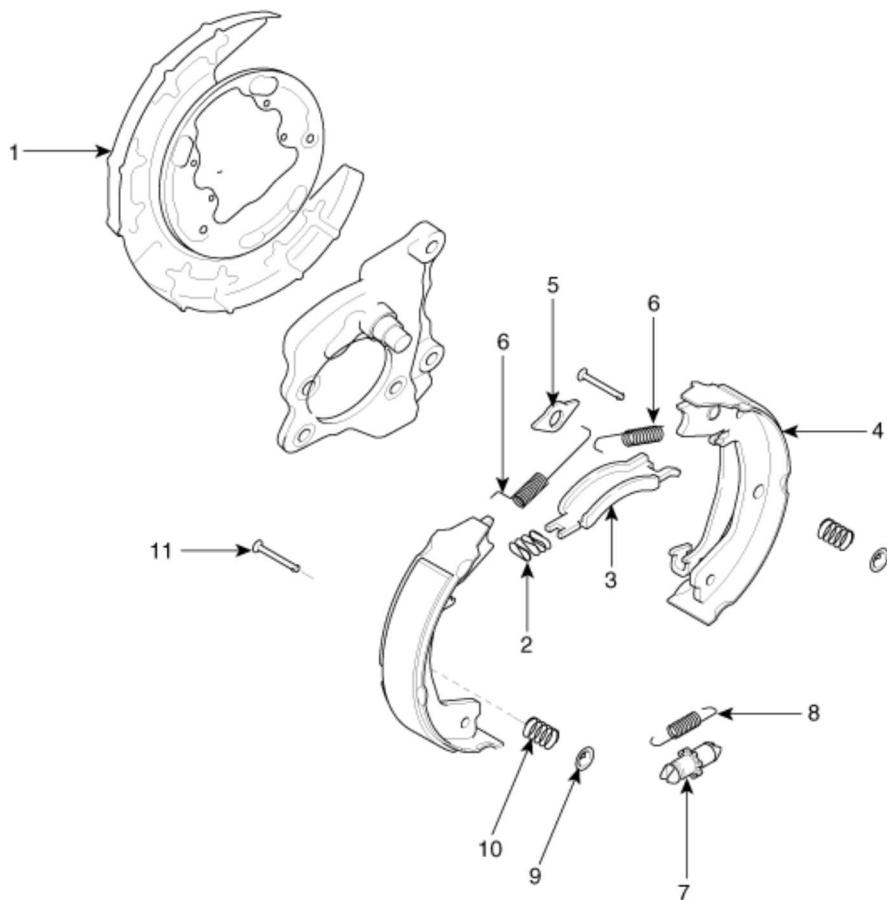


1. Backing plate
2. Brake shoe

3. Shoe hold clip
4. Bolt

Components (3)

[4WD]



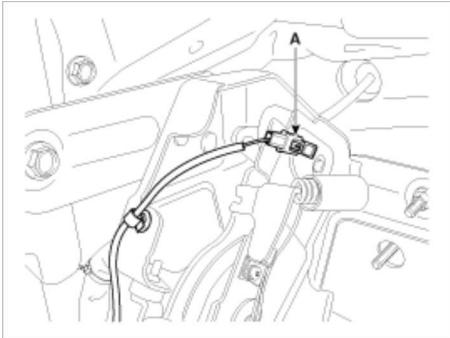
1. Backing plate	7. Adjuster
2. Strut spring	8. Return spring
3. Strut	9. Cup washer
4. Shoe and lining	10. Shoe hold down spring
5. Shoe guide	11. Shoe hold down pin
6. Return spring	

Brake System > Parking Brake System > Parking Brake Assembly > Repair procedures

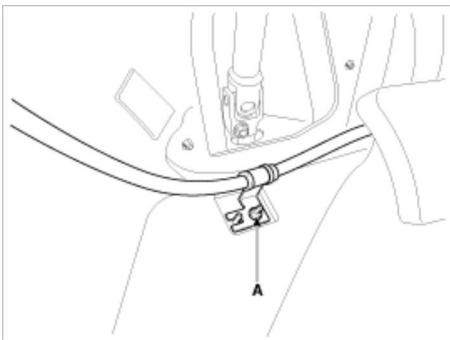
Removal

Parking Brake Pedal [Foot type]

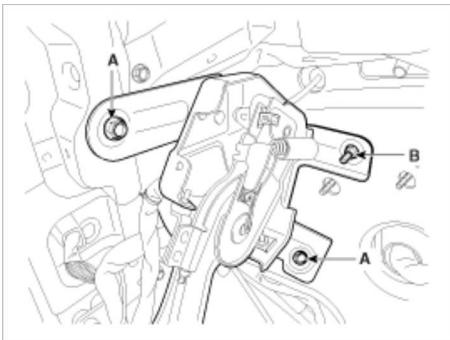
1. Remove the crash pad lower panel and reinforcement panel. (Refer to the Body group-crash pad)
2. Remove the junction box. (Refer to the Body Electrical System group - Fuses and Relays)
3. Disconnect the parking brake switch connector (A).



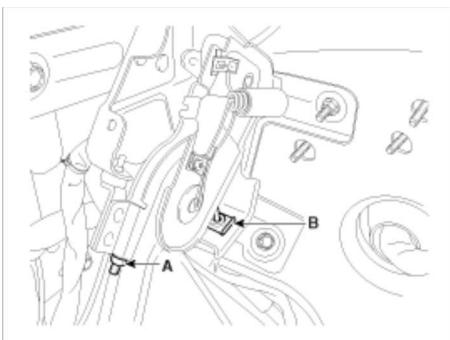
4. Remove the parking brake cable mounting nut (A).



5. Remove the parking brake pedal mounting bolts (A) and nut.(B)

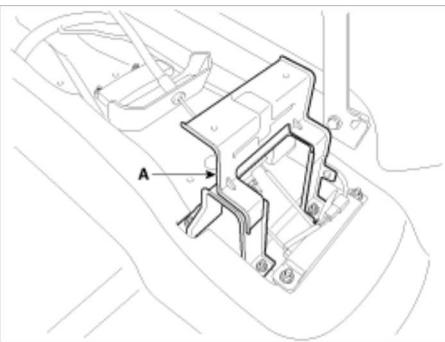


6. Remove the parking brake cable adjusting nut(A) and the fixing clip(B), and then remove the parking brake pedal.

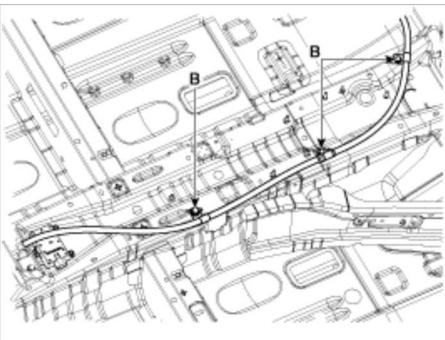
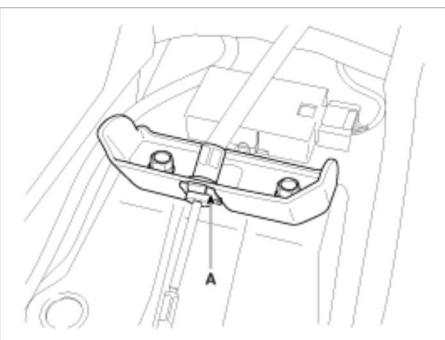


7. Remove the floor console. (Refer to the Body group - Console)

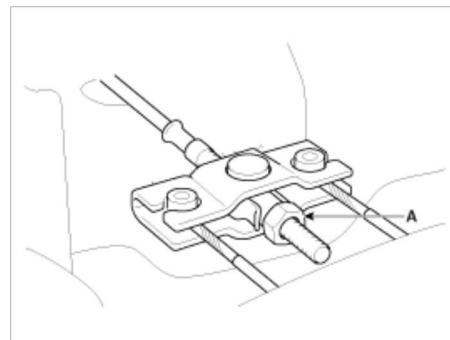
8. Remove the floor console bracket (A).



9. Remove the parking brake cable fixing clip (A) and bolts (B).

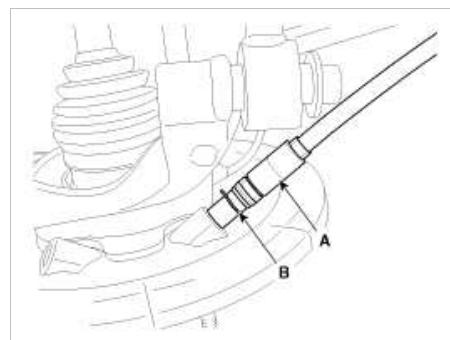


10. Loosen the adjusting nut (A) and then remove the front parking brake cable.



11. Raise the vehicle, and make sure it is securely supported.

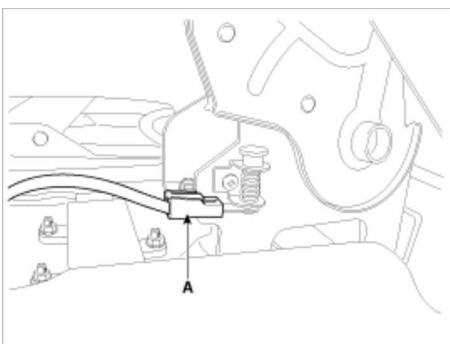
12. Remove the parking brake cable (A) after removing the retaining ring (B).



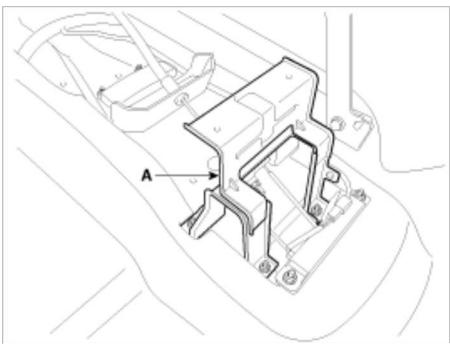
13. Loosen the parking brake cable bracket bolts and remove the rear parking brake cable.

Parking Brake Lever [Hand type]

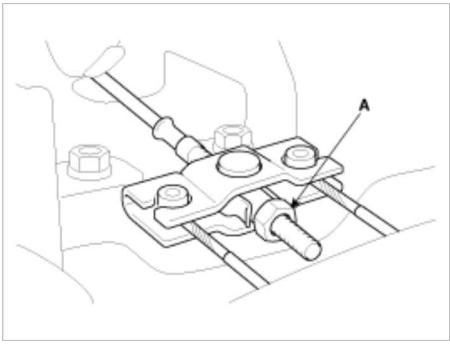
1. Remove the floor console. (Refer to the Body group - Console)
2. Disconnect the connector(A) of parking brake switch.



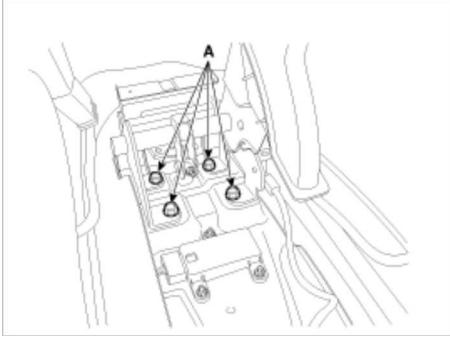
3. Remove the floor console bracket (A).



4. Loosen the adjusting nut(A) and remove the parking brake cables.

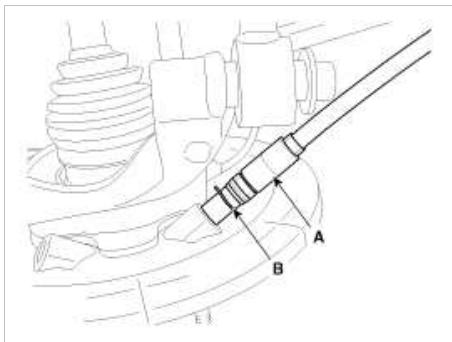


5. Remove the parking brake lever assembly after removing the 4 bolts(A) as shown below.



6. Raise the vehicle and make sure it is securely supported.

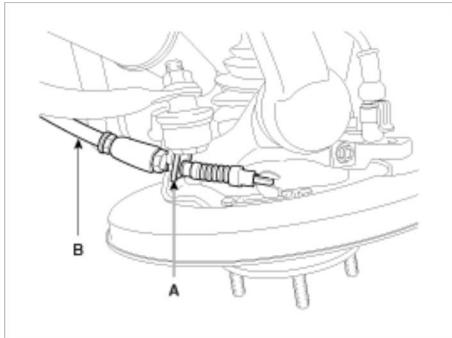
7. Remove the parking brake cable(A) after removing the retaining(B).



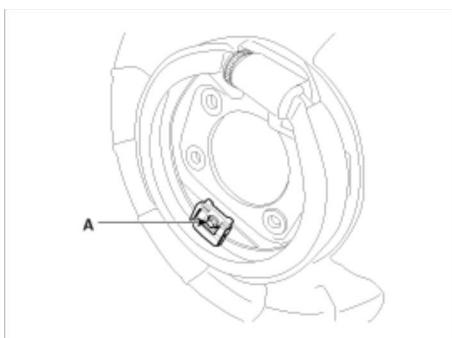
8. Loosen the parking brake cable bracket bolts and remove the parking brake cable.

Parking Brake Shoe [2WD]

1. Raise the vehicle, and make sure it is securely supported.
2. Remove the rear tire and wheel.
3. Remove the rear brake caliper and Rear disc brake.
(Refer to "Rear disc brake removal")
4. Remove the parking brake cable (B), after removing the clip (A).

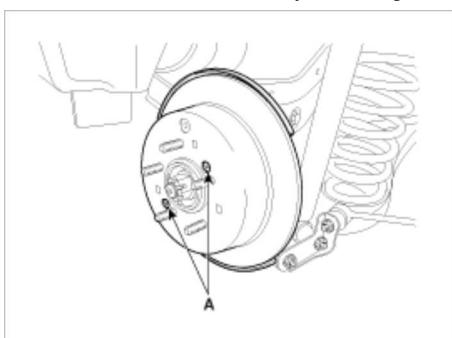


5. Remove the hub assembly and parking brake assembly.
6. Loosen the shoe hold clip mounting bolt (A) and then remove the brake shoe.

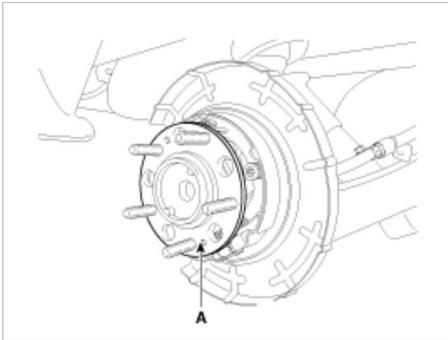


Parking Brake Shoe [4WD]

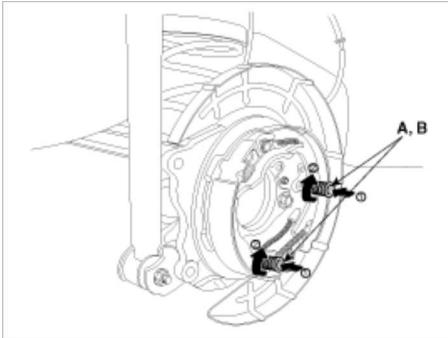
1. Raise the vehicle, and make sure it is securely supported.
2. Remove the rear tire and wheel, then remove the brake caliper. (Refer to "Rear disc brake removal")
3. Remove the rear brake disc by loosening the screws (A).



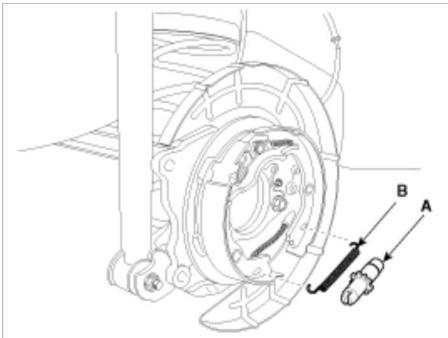
4. Remove the rear hub unit bearing (A).



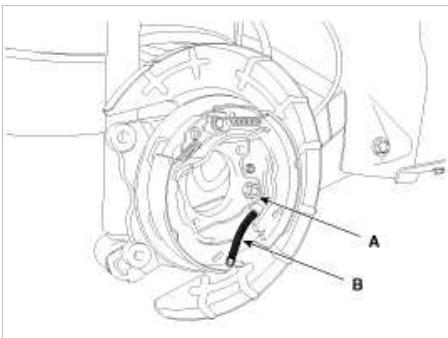
5. Remove the shoe hold down pin (A) and the spring (B) by pushing the retainer spring and turning the pin.



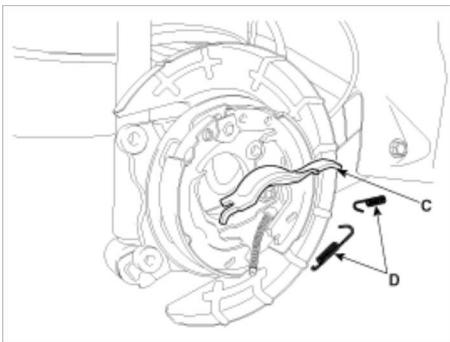
6. Remove the adjuster assembly (A) and the return spring (B).



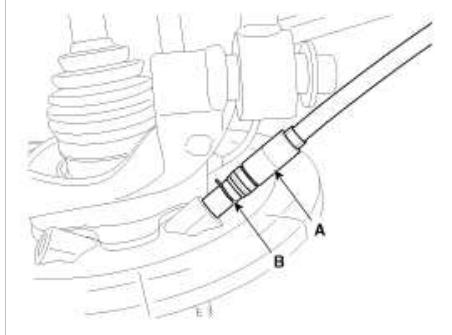
7. Remove the parking brake cable (B) from the brake shoe (A).



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).



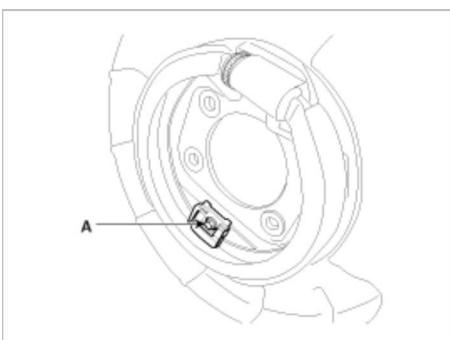
Installation

Parking Brake Shoe [2WD]

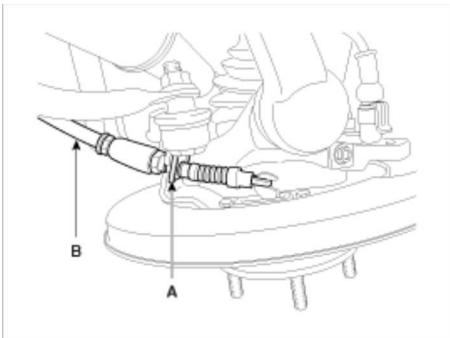
1. Install the brake shoe.
2. Fix the brake shoe with shoe hold clip and then install the bolt (A).

Tightening torque:

2.0 ~ 4.9 N.m (0.2 ~ 0.5 kgf.m, 1.4 ~ 3.6 lb-ft)



3. Install parking brake assembly and hub assembly.
4. Install the parking brake cable (B), then install the clip (A).



5. 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 notches in the opposite direction.
6. Install the brake caliper assembly. (Refer to "Rear brake installation")
7. Install the tire and wheel, after installing the plug on the disc.
8. If the parking brake shoe or the brake disc are replaced a newly one, perform the brake shoe bed-in procedure.
 - (1) Hand type - While operating the parking brake pedal for 68.6N (7kgf, 15.4 lbf) effort, drive the vehicle 500 meters (0.31 miles) at the speed of 30kph (18.6 mph).
 - Foot type - While operating the parking brake lever for 147N (15kgf, 33 lbf) effort, drive the vehicle 500 meters (0.31 miles) at the speed of 30kph (18.6 mph).
- (2) Repeat the above procedure more than three times.
- (3) Must be held on 20% uphill.

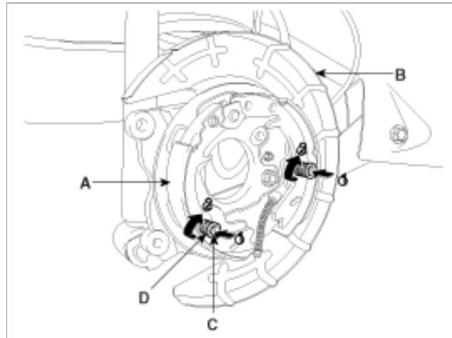
CAUTION

After adjusting parking brake, notice following matter;

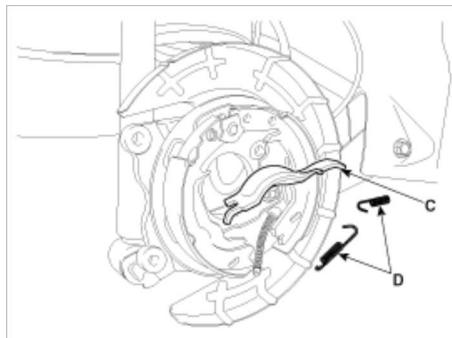
1. Must be free from troubles when the parking pedal is operated at 686.5 N (70 kgf, 154 lbf).
2. Check that all parts move smoothly.
3. The parking brake indicator lamp must be on after the parking pedal is working and must be off after the pedal is released.

Parking Brake Shoe [4WD]

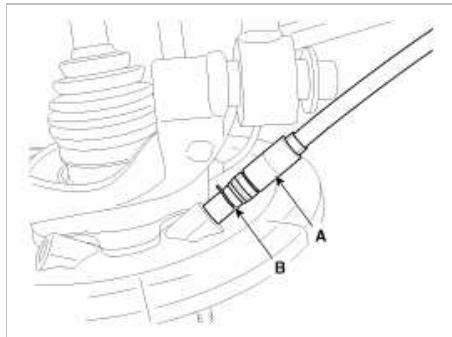
1. Install the brake shoe(A) to the back plate(B).



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 (C) and upper return spring (D), install the adjuster assembly and the lower return spring.



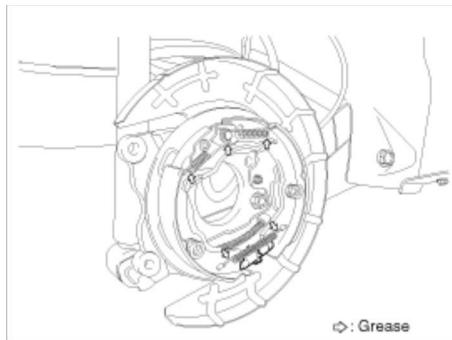
4. Install the parking brake cable (A), then install the retaining (B).



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 notches in the opposite direction.

7. Install the brake caliper. (Refer to "Rear brake installation")

8. Install the tire and wheel.

9. If the parking brake shoe or the brake disc are replaced a newly one, perform the brake shoe bed-in procedure.

(1) Hand type - While operating the parking brake pedal for 68.6N (7kgf, 15.4 lbf) effort, drive the vehicle 500 meters (0.31 miles) at the speed of 30kph (18.6 mph).

Foot type - While operating the parking brake lever for 147N (15kgf, 33 lbf) effort, drive the vehicle 500 meters (0.31 miles) at the speed of 30kph (18.6 mph).

(2) Repeat the above procedure more than three times.

(3) Must be held on at 20% uphill.

CAUTION

After adjusting parking brake, notice following matter;

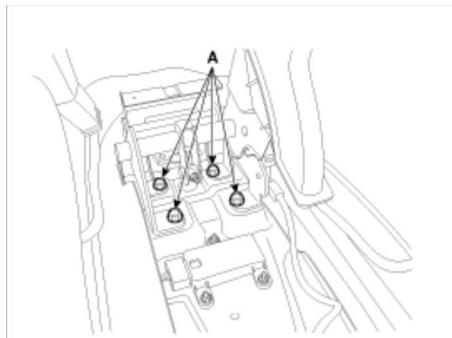
1. Must be free from troubles when the parking pedal is operated at 686.5 N (70 kgf, 154 lbf).

2. Check that all parts move smoothly.

3. The parking brake indicator lamp must be on after the parking pedal is working and must be off after the pedal is released.

Parking Brake Lever [Hand Type]

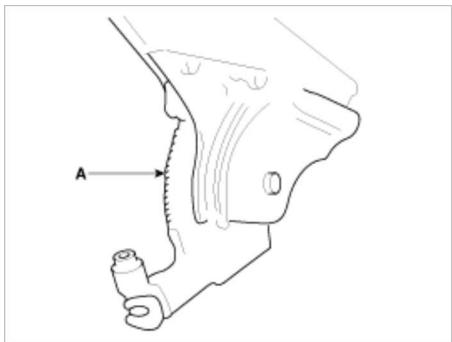
1. Install the parking brake lever assembly, then tighten the mounting bolts(A).



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



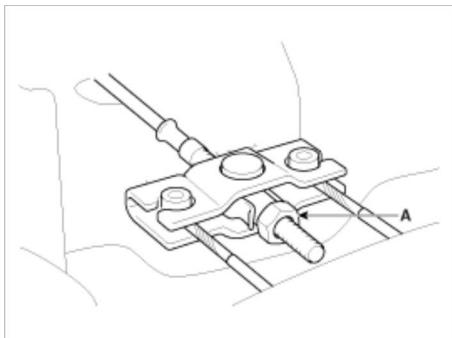
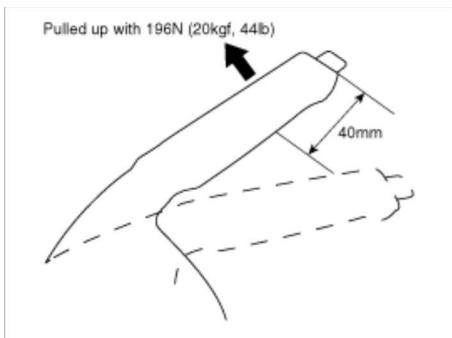
3. Install the parking brake cable adjuster, then adjust the parking brake lever stroke by turning adjusting nut (A).

Parking brake lever stroke :

6 clicks (Pull the lever with 20kgf)

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 of parking brake switch.

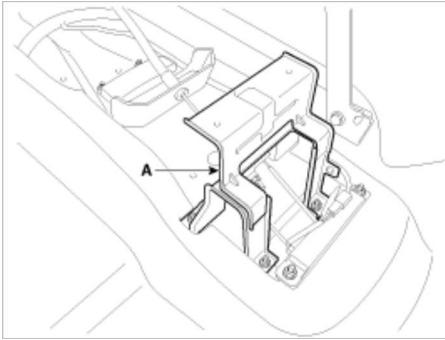
NOTE

Inspect the continuity of parking brake switch.

When the brake lever is pulled : continuity

When the brake lever is released : no continuity

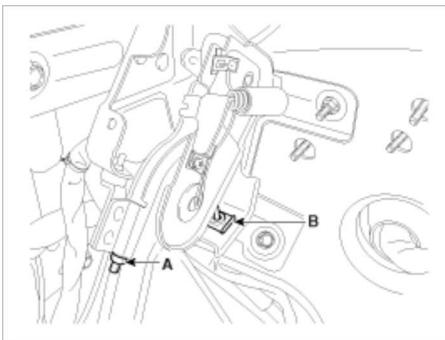
7. Install the floor console bracket (A).



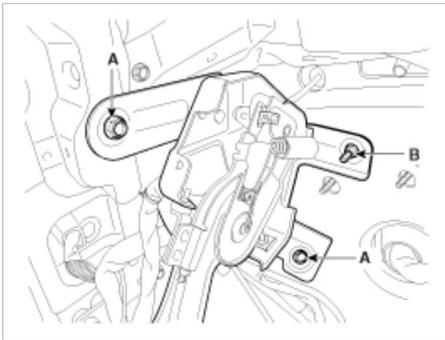
8. Install the floor console. (Refer to Body group - "Floor console")

Parking Brake Pedal [Foot type]

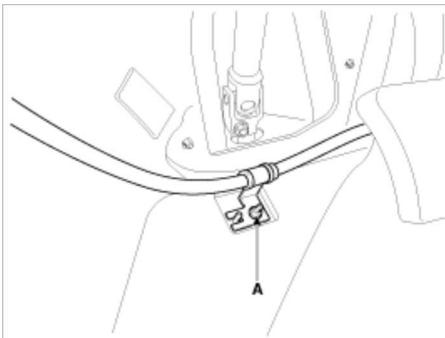
1. Install the parking brake cable.
2. Install the holding clip (B) and the cable adjusting nut(A) after fixing the parking brake cable.



3. Install the parking brake pedal, and then install the parking brake pedal mounting bolts (A) and nut(B).



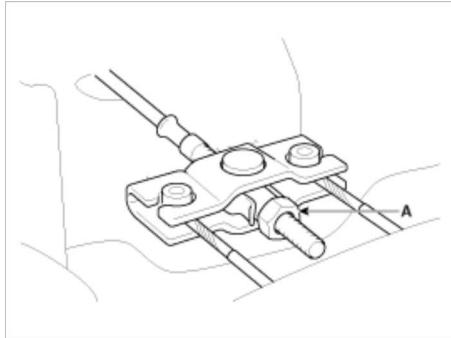
4. Install the parking brake cable mounting nut (A).



5. Adjust the parking brake pedal stroke by turning the adjusting nut (A).

(1) Operate the parking brake pedal through a full stroke over 3 times for setting the parking cables.

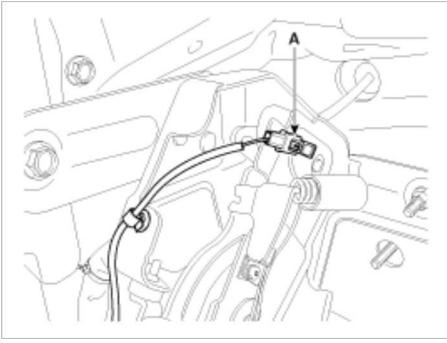
(2) Adjust the adjusting nut (A) for parking brake pedal stroke 4 notches when operating effort is 196N(20kgf.44lb).



CAUTION

1. The parking brake adjustment must be carried out after adjusting the rear shoe.
2. After adjusting parking brake, notice following matter.
 - 1) Must be free from clearance between adjusting nut and pin.
 - 2) Check securely that the brake is not dragging.

6. Reconnect the parking brake switch connector(A).



7. Install the junction box. (Refer to the Body Electrical System group - Fuses and Relays)
8. Install the reinforcement panel and crash pad lower panel. (Refer to Body group - Crash pad)

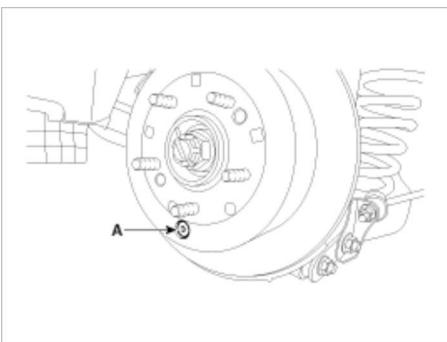
Adjustment

Parking Brake Shoe Clearance Adjustment [2WD]

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 notches in the opposite direction.
No drag force of disc and must be confirmed occurrence of drag froce of disc.
5. Install the rear wheel & tire after installing the plug on the disc.

Parking Brake Shoe Clearance Adjustment [4WD]

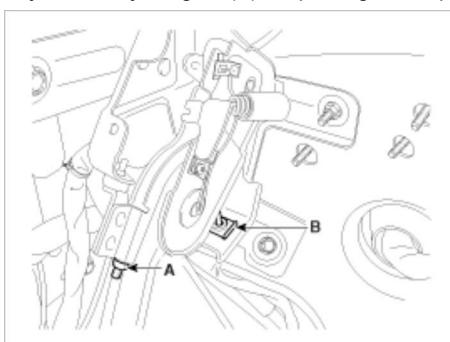
1. Raise the vehicle, and make sure it is securely supported.
2. Remove the rear tire and wheel.
3. Remove the plug (A) from the disc.



4. Rotate the toothed wheel of adjuster by a screw driver until the disc is not moving, and then return it by 3 notches in the opposite direction.
No drag force of disc and must be confirmed occurrence of drag froce of disc.
5. Install the rear wheel & tire after installing the plug on the disc.

Parking Brake Pedal Stroke Adjustment

1. Operate the parking brake pedal through a full stroke over 3 times for setting the parking cables.
2. Adjust the adjusting nut(A) for parking barke pedal stoke 4 notches when operating effort is 196N(20kgf, 44lbf)



CAUTION

1. The parking brake adjustment must be carried out after adjusting the rear shoe.
2. After adjusting parking brake, notice following matter.
 - 1) Must be free from clearance between adjusting nut and pin.
 - 2) Check securely that the brake is not dragging.

Parking Brake Lever Stroke Adjustment

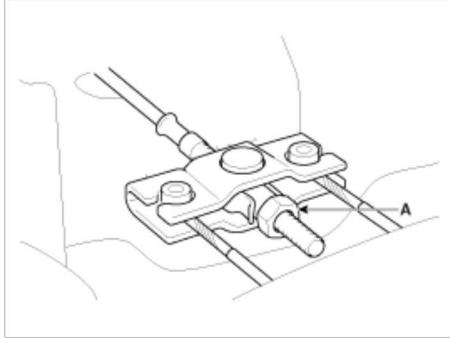
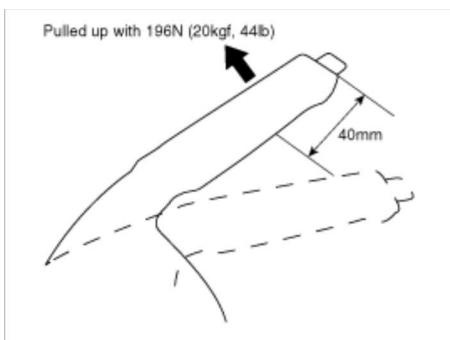
1. Raise the vehicle, and make sure it is securely supported.
2. Remove the floor console rear cover.
3. Adjust the parking brake lever stroke by turning adjusting nut (A).

Parking brake lever stroke :

6 clicks (Pull the lever with 20kgf)

NOTE

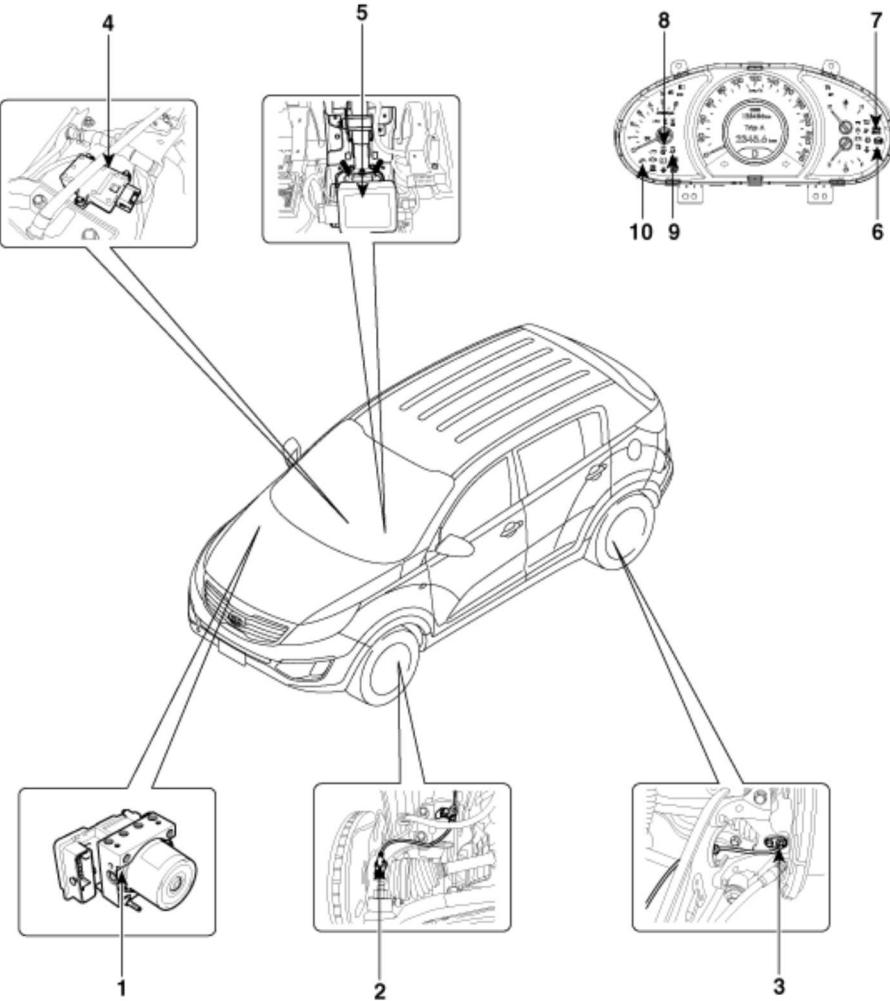
After repairing the parking brake shoe, adjust the brake shoe clearance, and then adjust the parking brake lever stroke. (Refer to "Parking brake shoe installation")



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.

Brake System > ESC(Electronic Stability Control) System > Components and Components Location

Components



1. HECU module 2. Front wheel speed sensor 3. Rear wheel speed sensor 4. Yaw rate & Lateral & Longitudinal G sensor 5. Steering angle sensor	6. ABS Warning lamp 7. Parking brake/EBD warning lamp 8. ESC OFF lamp 9. ESC Function/Warning lamp 10. DBC warning lamp
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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 ESC functions. Whereas the ABS/TCS function controls wheel slip during braking and acceleration and, thus, mainly intervenes in the longitudinal dynamics of the vehicle, active yaw control stabilizes the vehicle about its vertical axis.

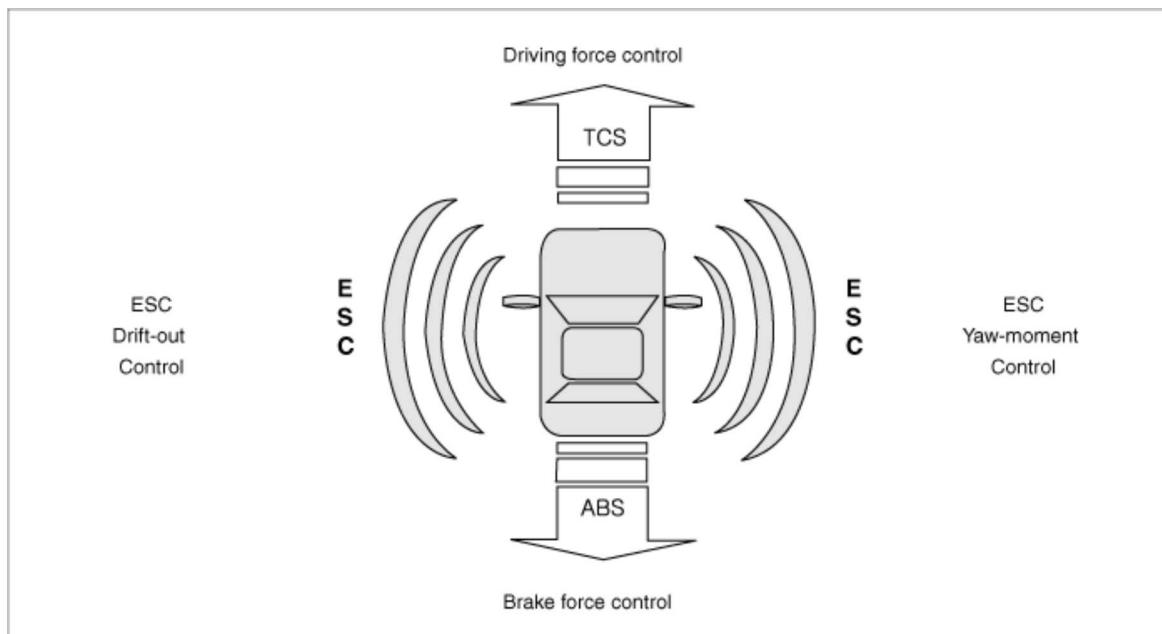
This is achieved by wheel individual brake intervention and adaptation of the momentary engine torque with no need for any action to be taken by

the driver.

ESC essentially consists of three assemblies : the sensors, the electronic control unit and the actuators.

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.

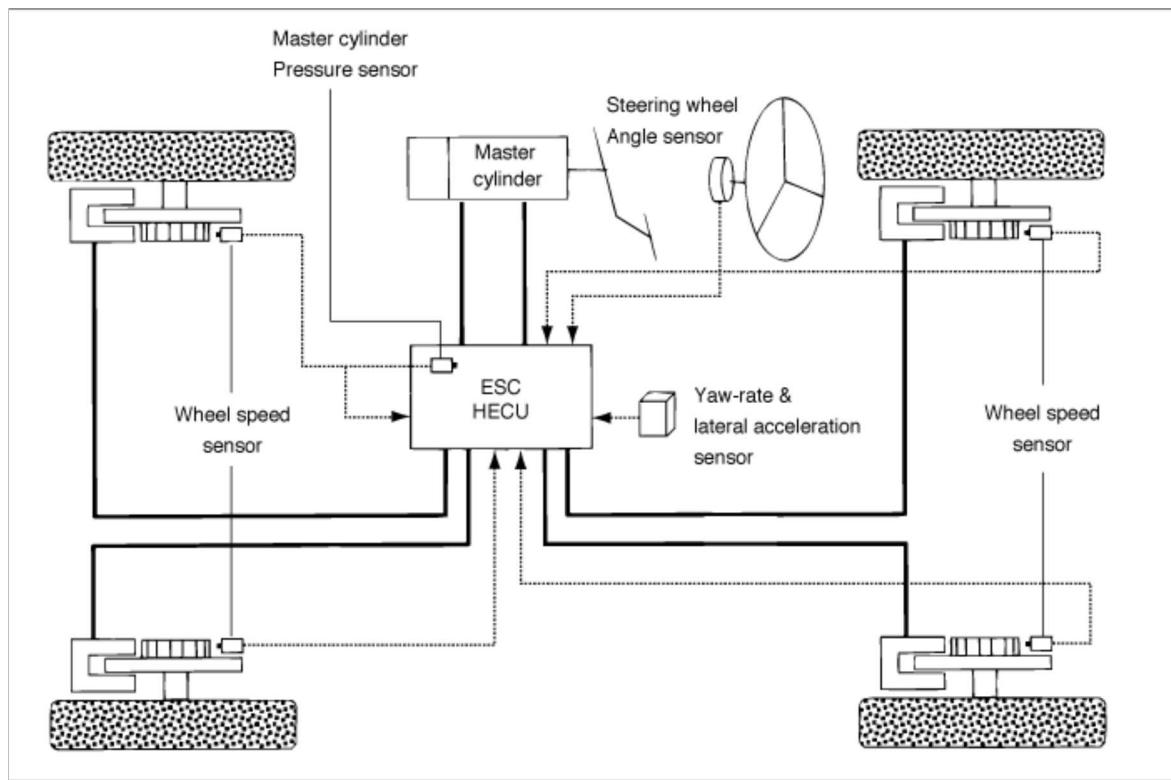
ABS/EBD function : The ECU changes the active sensor signal (current shift) coming from the four wheel sensors to the square wave. By using the input of above signals, the ECU calculates the vehicle speed and the acceleration & deceleration of the four wheels. And, the ECU judges whether the ABS/EBD 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.

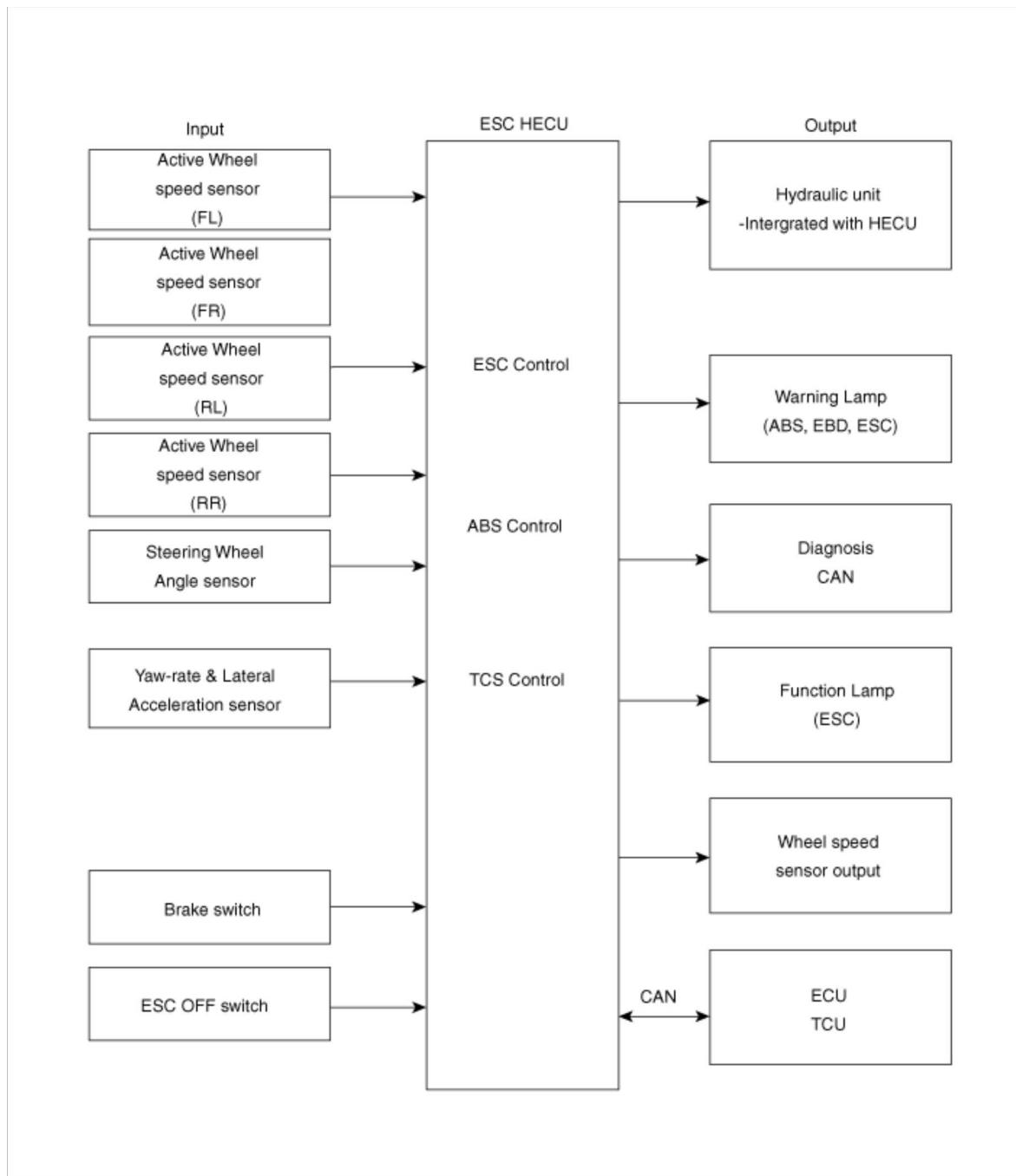
AYC function prevents unstable maneuver of the vehicle. To determine the vehicle maneuver, AYC function uses the maneuver sensor signals(Yaw Rate Sensor, Lateral Acceleration Sensor, Steering Wheel Angle Sensor).

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)

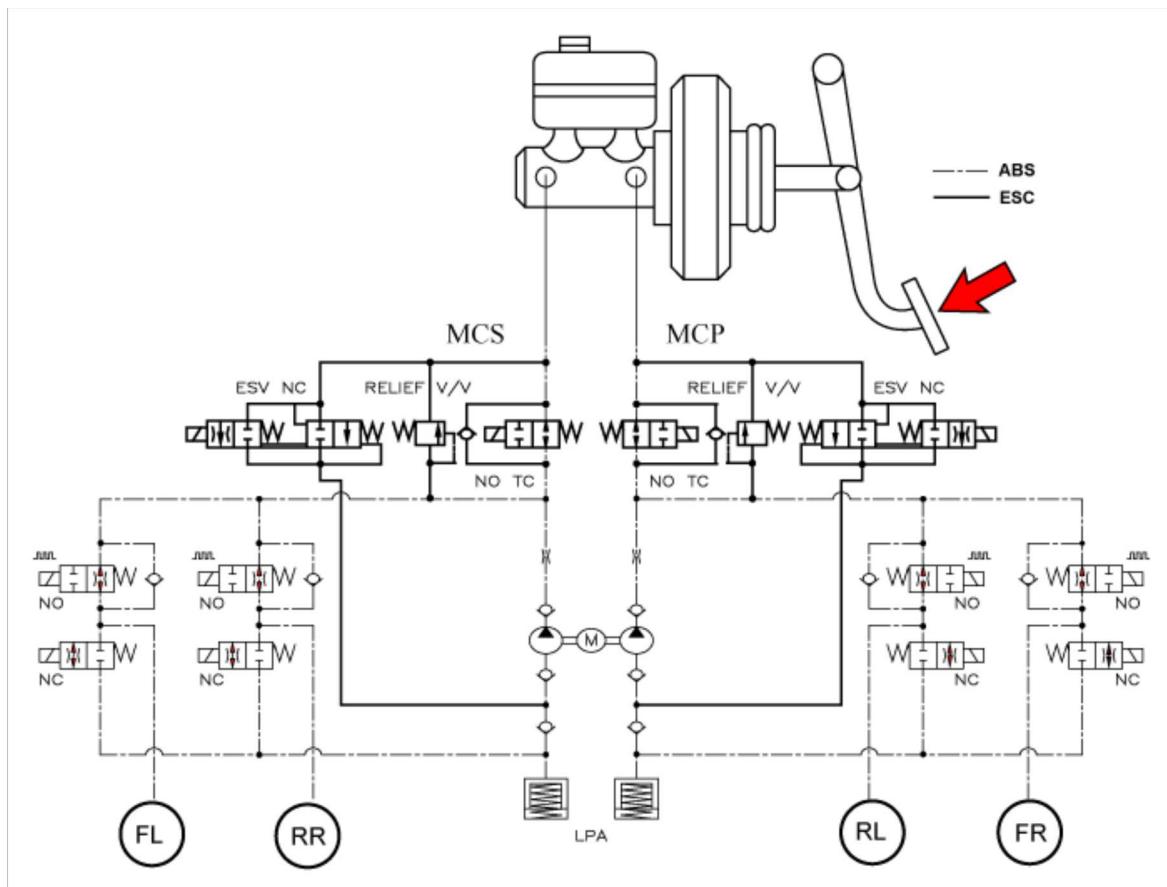


Input and Output Diagram



ESC Operation Mode

ESC Hydraulic System Diagram

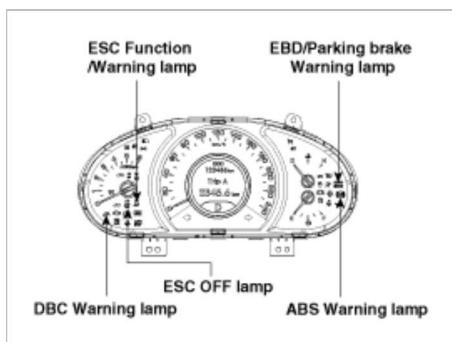


1. ESC Non-operation : Normal braking.

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 module

The active ABS warning lamp module indicates the self-test and failure status of the ABS. The ABS warning lamp shall be on:

- During the initialization phase after IGN ON. (continuously 3 seconds).
- In the event of inhibition of ABS functions by failure.
- During diagnostic mode.

- When the ECU Connector is separated from ECU.
- Cluster lamp is ON when communication is impossible with CAN module.

EBD/Parking Brake Warning Lamp Module

The active EBD warning lamp module indicates the self-test and failure status of the EBD. However, in case the Parking Brake Switch is turned on, the EBD warning lamp is always turned on regardless of EBD functions. The EBD warning lamp shall be on:

- During the initialization phase after IGN ON. (continuously 3 seconds).
- When the Parking Brake Switch is ON or brake fluid level is low.
- When the EBD function is out of order .
- During diagnostic mode.
- When the ECU Connector is separated from ECU.
- Cluster lamp is ON when communication is impossible with CAN module.

ESC function/warming lamp (ESC system)

The ESC function/warming lamp indicates the self-test and failure status of the ESC.

The ESC function/warming lamp is turned on under the following conditions :

- During the initialization phase after IGN ON. (continuously 3 seconds).
- When the ESC function is inhibited by system failure.
- When the ESC control is operating. (Blinking - 2Hz)
- During diagnostic mode.(Except standard mode)
- Cluster lamp is ON when communication is impossible with CAN module.

ESC Off Lamp (ESC system)

The ESC Off lamp indicates the self-test and operating status of the ESC.

The ESC Off lamp operates under the following conditions :

- During the initialization mode after IGN ON. (continuously 3 seconds).
- ESC Off lamp is On when driver input the ESC Off switch.

ESC On/Off Switch (ESC system)

The ESC On/Off Switch shall be used to toggle the ESC function between On/Off states based upon driver input.

The On/Off switch shall be a normally open, momentary contact switch. Closed contacts switch the circuit to ignition.

Initial status of the ESC function is on and switch toggle the state.

DBC Warning Lamp (DBC only)

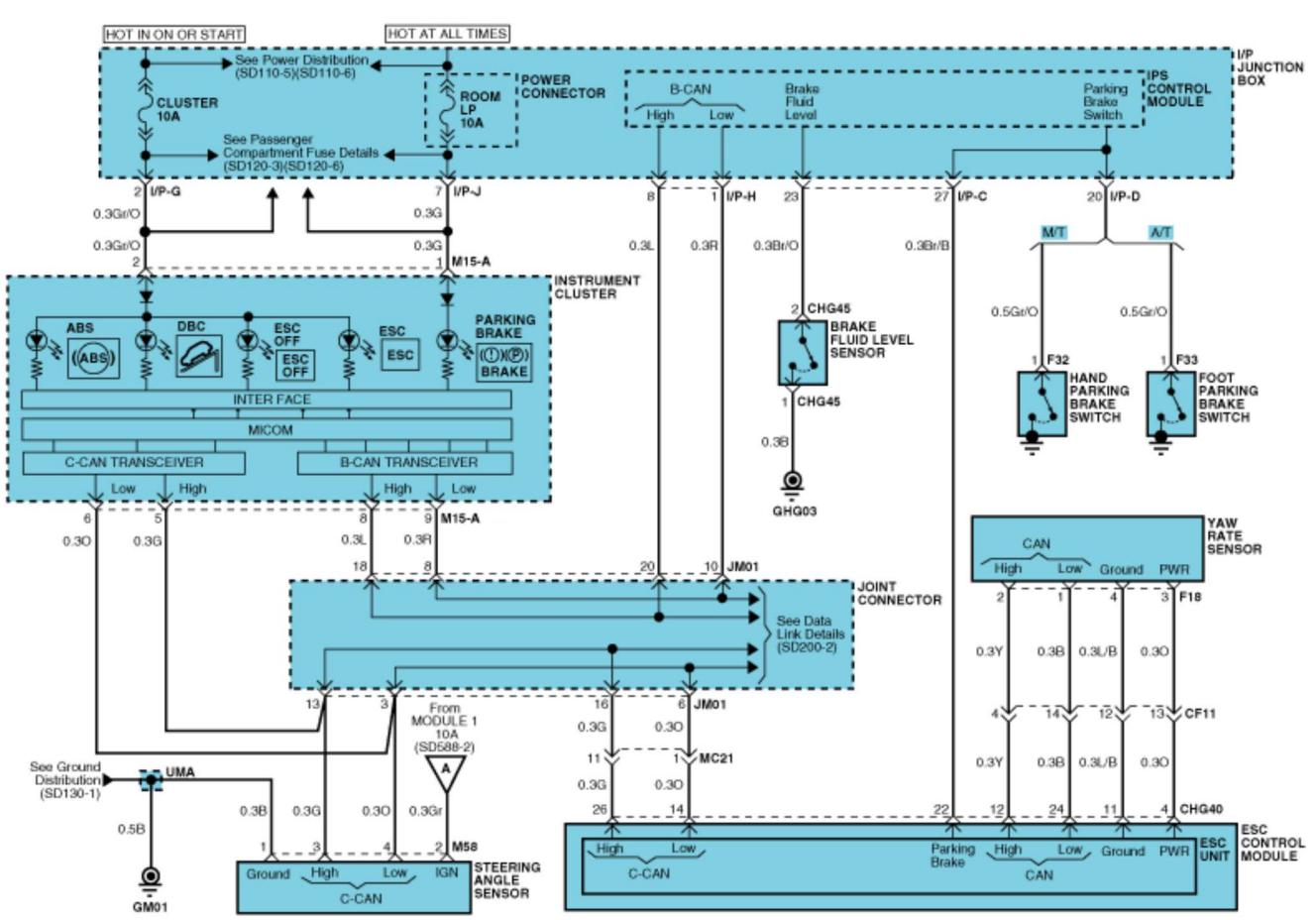
The DBC warning lamp indicates the self-test, failure and operating status of the DBC function.

The DBC lamp operates under the following conditions :

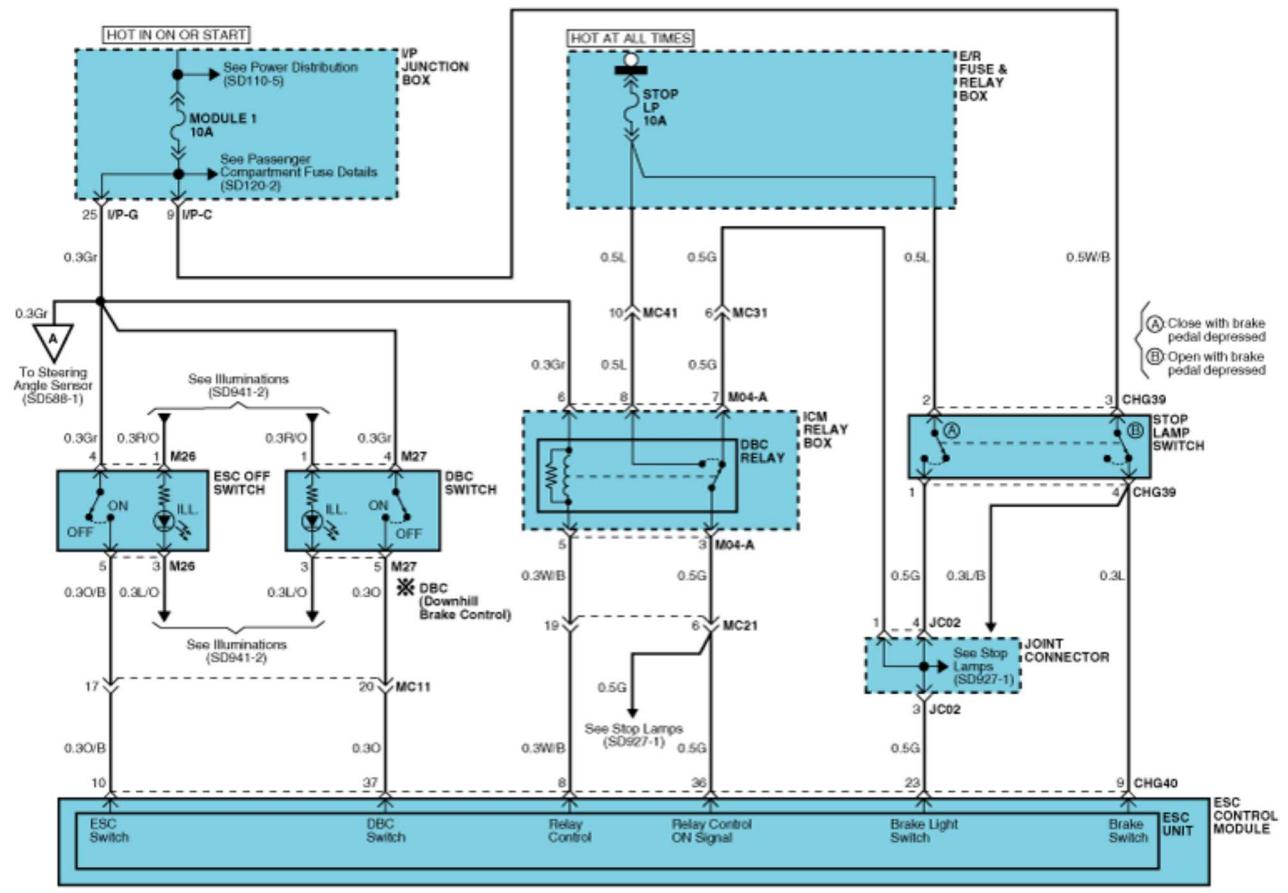
- During the initialization phase after IGN1 ON.
- When driver turn on the DBC function by on/off switch.
- In the event of inhibition of DBC function by failure.
- When the DBC control is operating. (Blinking-2Hz)
- During diagnostic mode. (Except standard mode)
- Cluster lamp is ON when communication is impossible with CAN module.

Brake System > ESC(Electronic Stability Control) System > Schematic Diagrams

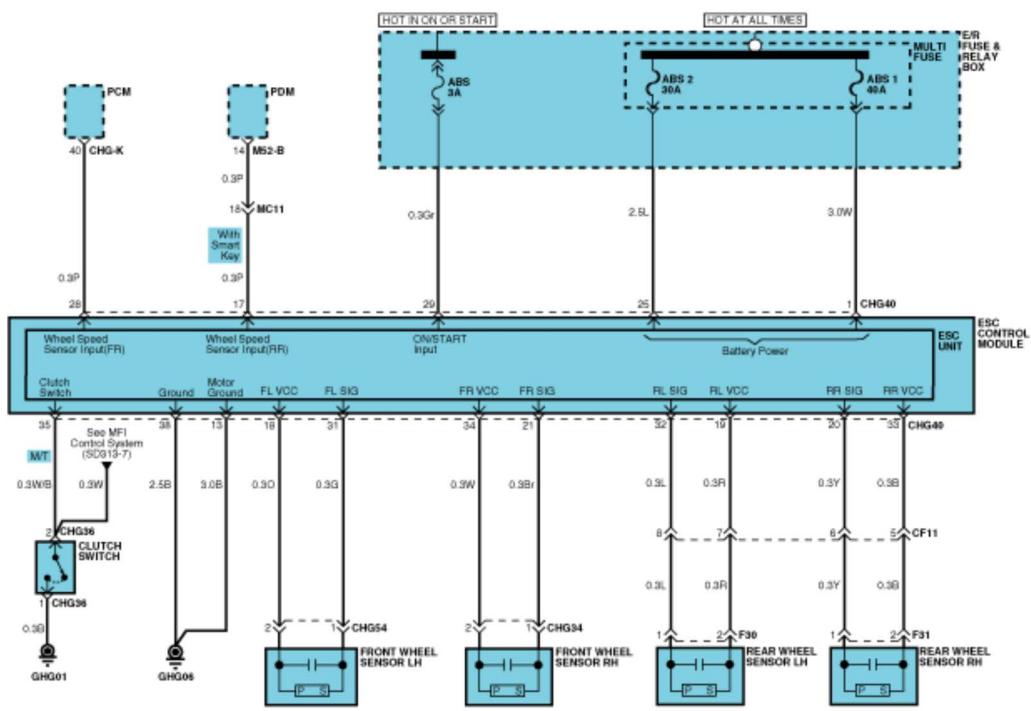
Circuit Diagram - ESC(1)



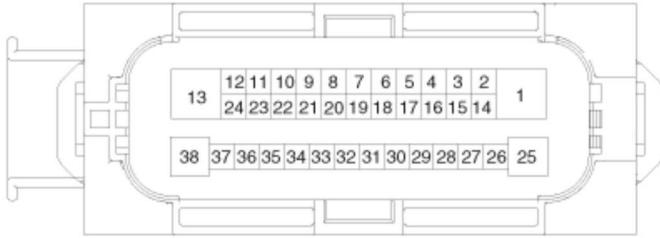
Circuit Diagram - ESC(2)



Circuit Diagram - ESC(3)



ESC connector input/output



Connector Terminal		Specification	Remark
No	Description		
29	IGNITION1(+)	High level of wake up voltage : 4.5V < V < 16.0V Low level of wake up voltage : V < 2.4V Max. 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 Max. 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 Rush current : I < 110A Max current : I < 40A Max leakage current : I < 0.25mA	
38	GROUND	Rated current : I < 550mA Max. current: I < 40A	
13	PUMP MOTOR GROUND	Rush current : I < 110A Max current : I < 40A	
11	SENSOR GROUND	Rated current : I < 250mA	
4	SENSOR POWER	Max current Capability : I < 250mA Max voltage : V_BAT1 -0.8V	
23	BRAKE LIGHT SWITCH	Input voltage (Low) : V < 2V Input voltage (High) : V > 6V	
9	BRAKE SWITCH	Max. Input current : I < 3mA	
22	PARKING BRAKE SWITCH	Input voltage (Low) : V < 2V Input voltage (High) : V > 6V	
35	CLUTCH SWITCH (M/T Only)	Max input current : I < 5mA	
28	SENSOR FRONT RIGHT OUTPUT	External pull up resistance : 1 KΩ < R	
17	SENSOR REAR RIGHT OUTPUT	Output duty : 50 ± 20%	
10	ESC ON/OFF SWITCH	Input voltage (Low) : V < 2V Input voltage (High) : V > 6V	
37	DBC SWITCH	Max input current : I < 3mA	
14	CAN BUS LINE(LOW)	Max. Input current : I < 10mA	
26	CAN BUS LINE(HIGH)		
18	SENSOR FRONT LEFT POWER		
34	SENSOR FRONT RIGHT POWER	Output voltage : V_BAT1 -0.6V ~ V_BAT1 -1.1V	
19	SENSOR REAR LEFT POWER	Output current : Max 30mA	
33	SENSOR REAR RIGHT POWER		
31	SENSOR FRONT LEFT SIGNAL		
21	SENSOR FRONT RIGHT SIGNAL	Input current LOW : 5.9 ~ 8.4mA Input current HIGH : 11.8 ~ 16.8mA	Typ. 7mA
32	SENSOR REAR LEFT SIGNAL	Frequency range : 1 ~ 2500Hz	Typ. 14mA
20	SENSOR REAR RIGHT SIGNAL	Input duty : 50 ± 10%	
12	CAN SENSOR LINE (HIGH)	Max. input current : I < 10mA	
24	CAN SENSOR LINE (LOW)		
8	BRAKE RELAY	Max. current : I < 180mA Max. Output low voltage : V < 1.2V	
36	RELAY STATE MONITORING	Input voltage (Low) : V < 2V Input voltage (High) : V > 6V Max Input current : I < 10mA	

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. 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.
4. Initial checkup is made in the following cases.
 - (1) When the failure is not detected now
 - (2) When ABS and ESC are not in control.
 - (3) Initial checkup is not made after ECU power on.
 - (4) If the vehicle speed is over 5 mph(8 km/h) when the brake lamp switch is off.
 - (5) When the vehicle speed is over 24.8 mph(40 km/h).
5. Though, it keeps on checkup even if the brake lamp switch is on.
6. When performing ABS or ESC control before the initial checkup, stop the initial checkup and wait for the HECU power input again.
7. Judge failure in the following cases.
 - (1) When the power is normal.
 - (2) From the point in which the vehicle speed reaches 4.9 mph(8 km/h) after HECU power on.

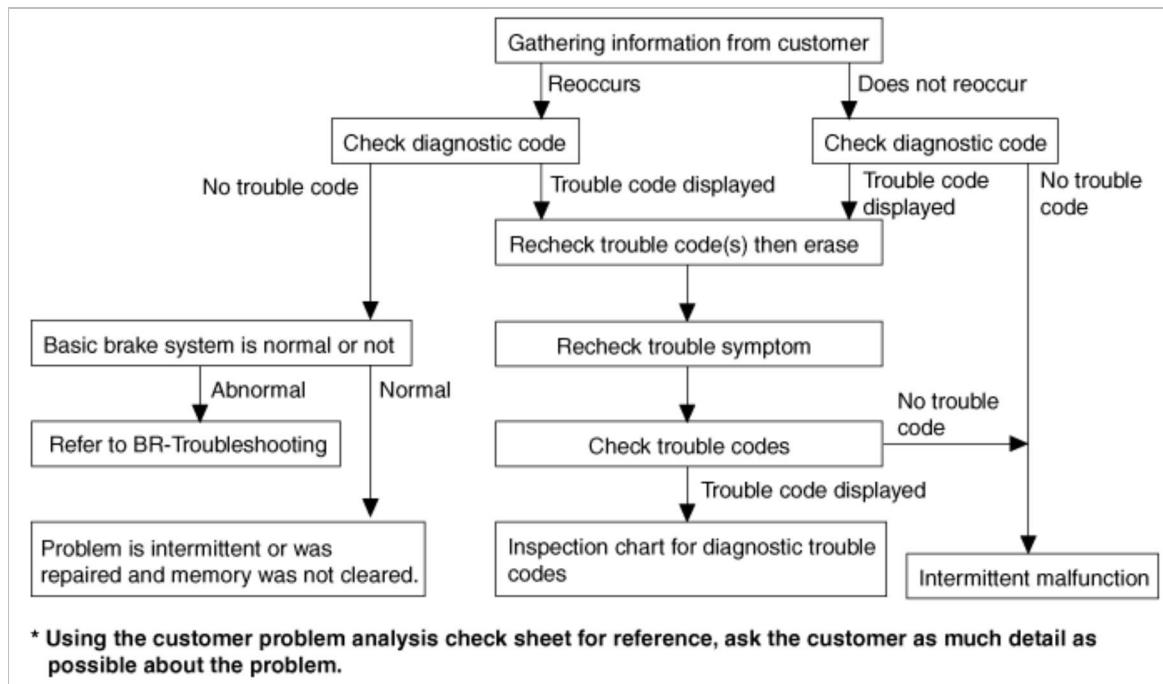
Countermeasures in Fail

1. Turn the system down and perform the following actions and wait for HECU power OFF.
2. Turn the valve relay off.
3. Stop the control during the operation and do not execute any until the normal condition recovers.

Warning Lamp ON

1. ESC warning lamp turn on for 3sec after IGN ON.
2. ESC function lamp blinks when ESC Act.
3. If ESC fail occurred, ESC warning lamp turns ON.
4. 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 phenomena 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	<ol style="list-style-type: none"> 1. Sound of the motor inside the ABS hydraulic unit operation (whine). 2. Sound is generated along with vibration of the brake pedal (scraping). 3. When ABS operates, sound is generated from the vehicle chassis due to repeated brake application and release (Thump : suspension; squeak: tires)
ABS operation (Long braking distance)	For road surfaces such as snow-covered and gravel roads, the braking distance for vehicles with ABS can sometimes be longer than that for other vehicles. Accordingly, advise the customer to drive safely on such roads by lowering the vehicle speed.
Diagnosis detection conditions can vary depending on the diagnosis code. When checking the trouble symptom after the diagnosis code has been erased, ensure that the requirements listed in "Comment" are met.	

ABS Check Sheet

ABS Check Sheet		Inspector's Name _____	
Customer's Name			
	Registration No.		
	Registration Year / /		
Date Vehicle Brought In	/ /	Odometer	Km Miles
Symptoms	<input type="checkbox"/> ABS does not operate.		
	<input type="checkbox"/> ABS does not operate efficiently. <input type="checkbox"/> Intermittent (times a day)		
	ABS Warning Light Abnormal	<input type="checkbox"/> Remains ON	<input type="checkbox"/> Does not light up
Diagnostic Trouble Code Check	1st Time	<input type="checkbox"/> Normal Code	<input type="checkbox"/> Malfunction Code (Code)
	2nd Time	<input type="checkbox"/> Normal Code	<input type="checkbox"/> 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 normal DTC is displayed, check the following probable cause. When the problem is still occurring, inspect 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.

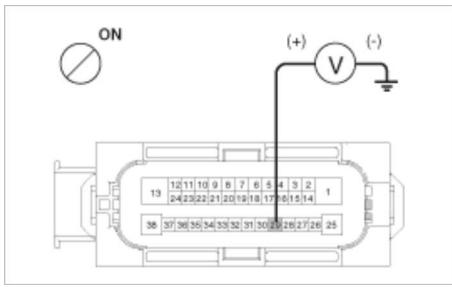
Check the power source circuit

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?

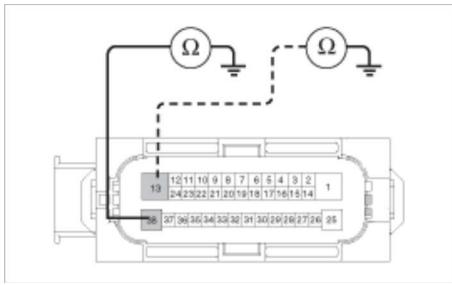
YES	► Check the ground circuit.
NO	► Check the harness or connector between the fuse (3A) in the engine compartment junction block and the ABS control module. Repair if necessary.



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 normal DTC is displayed, check the following probable cause. When the problem is still occurring, inspect the ABS control module.	<ul style="list-style-type: none"> - 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

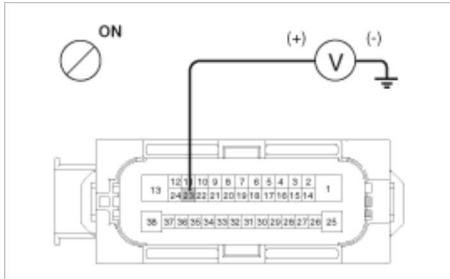
1. Check that stop lamp lights up when brake pedal is depressed and turns off when brake pedal is released.

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.	<ul style="list-style-type: none"> - An open in the wire - Poor ground - Faulty power source circuit

Inspection procedures

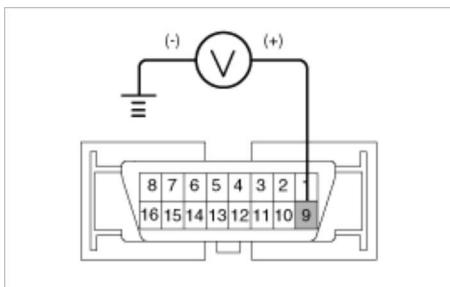
Check The Power Supply Circuit For The Diagnosis

1. Measure the voltage between terminal 9 of the data link connector and body ground.

Specification : approximately B+

2. Is voltage within specification?

YES	► Check the ground circuit for the diagnosis.
NO	► Repair an open in the wire. Check and replace fuse (15A) from the engine compartment junction block.

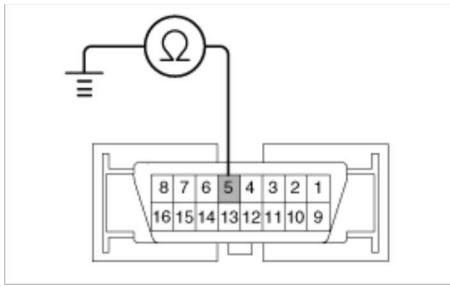


Check the ground circuit for the diagnosis

1. Check for continuity between terminal 5 of the data link connector and body ground.

2. Is there continuity?

NO	► Repair an open in the wire between terminal 5 of the data link connector and ground point.
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**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.	<ul style="list-style-type: none"> - An open in the wire - Faulty HECU - Faulty power source circuit

Inspection procedures

Check for Continuity in the CAN Line

1. Disconnect the connector from the ABS control module.

2. Check for continuity between terminals 26, 14 of the ABS control module connector and 3, 11 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.

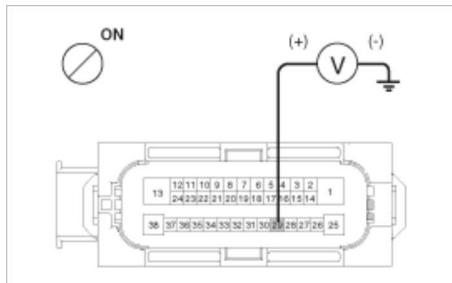
2. Turn the ignition switch ON, measure the voltage between terminal 29 of the ABS control module harness side connector and body ground.

Specification : approximately B+

3. Is voltage within specification?

YES	► Check for poor ground.
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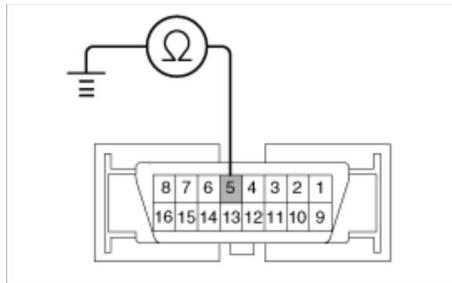
NO	► Check the harness or connector between the fuse (7.5A) in the engine compartment junction block and the ABS control module. Repair if necessary.
-----------	--



Check for poor ground

1. Check for continuity between terminal 5 of the data link connector and ground point.

YES	► Replace the ABS control module and recheck.
NO	► Repair an open in the wire or poor ground



When Ignition Key Is Turned ON (engine OFF), The ABS Warning Lamp Does Not Light Up.

Detecting condition

Trouble Symptoms	Possible Cause
When current flows in the HECU the ABS warning lamp turns from ON to OFF as the initial check. Therefore if the lamp does not light up, the cause may be an open in the lamp power supply circuit, a blown bulb, an open in the both circuits between the ABS warning lamp and the HECU, and the faulty HECU.	<ul style="list-style-type: none"> - 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

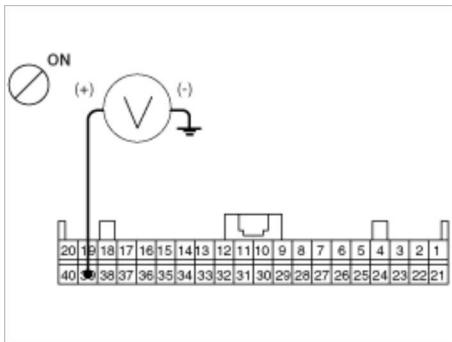
1. Disconnect the connector from the ABS control module and turn the ignition switch ON.
2. Does the ABS warning lamp light up?

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 (M15) and turn the ignition switch ON.
2. Measure the voltage between terminal (M15) 39 of the cluster harness side connector and body ground.

Specification : approximately B+



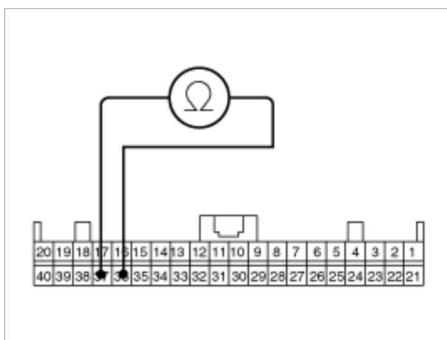
3. Is voltage within specification?

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 (M15).
2. Measure the resistance between terminal (M15) 36 and 37 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 (M15) and ABS HECU connector.
2. Check for continuity between terminal (M15) 36 of the cluster harness side connector and terminal 26 of ABS HECU harness side. Check for continuity between terminal (M15) 37 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	<ul style="list-style-type: none"> - An open in the wire - Faulty instrument cluster assembly - Faulty ABS warning lamp module - Faulty HECU

may be an open or short in the ABS warning lamp circuit.

Inspection procedures

Check DTC Output

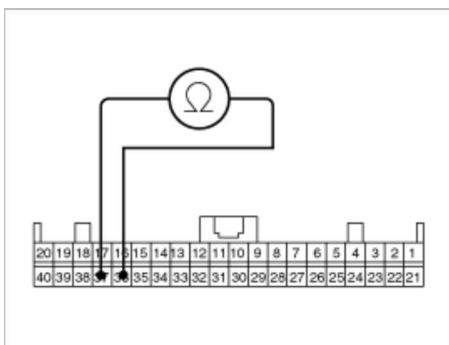
1. Connect the GDS to the 16P data link connector located behind the driver's side kick panel.
2. Check the DTC output using GDS.
3. Is DTC output?

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 (M15).
2. Measure the resistance between terminal (M15) 36 and 37 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 (M15) and ABS HECU connector.
2. Check for continuity between terminal (M15) 36 of the cluster harness side connector and terminal 26 of ABS HECU harness side.
Check for continuity between terminal (M15) 37 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 ESC 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

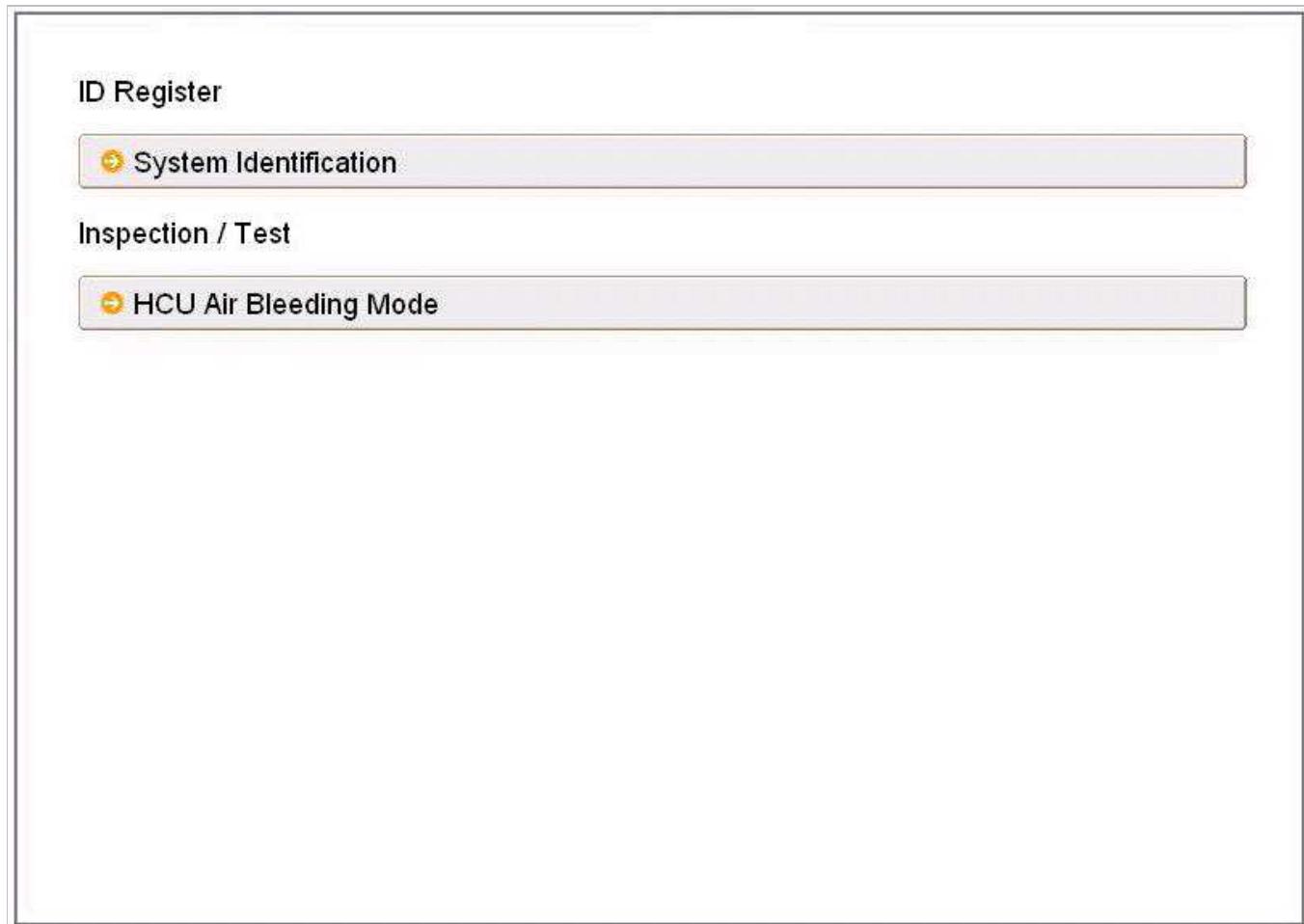
When pressure bleeding, do not depress the brake pedal.
Recommended fluid..... DOT3 or DOT4

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 burning.

- (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.

HCU Air Bleeding Mode



[ABS Air Bleeding Status]

1. Solenoid Valve Status : Close
2. Motor Pump Status : Off

Press [OK] button, if you are ready.

Ok **Cancel**

(5) Wait 60 sec. before operating the air bleeding.
(If not, you may damage the motor.)

HCU Air Bleeding Mode



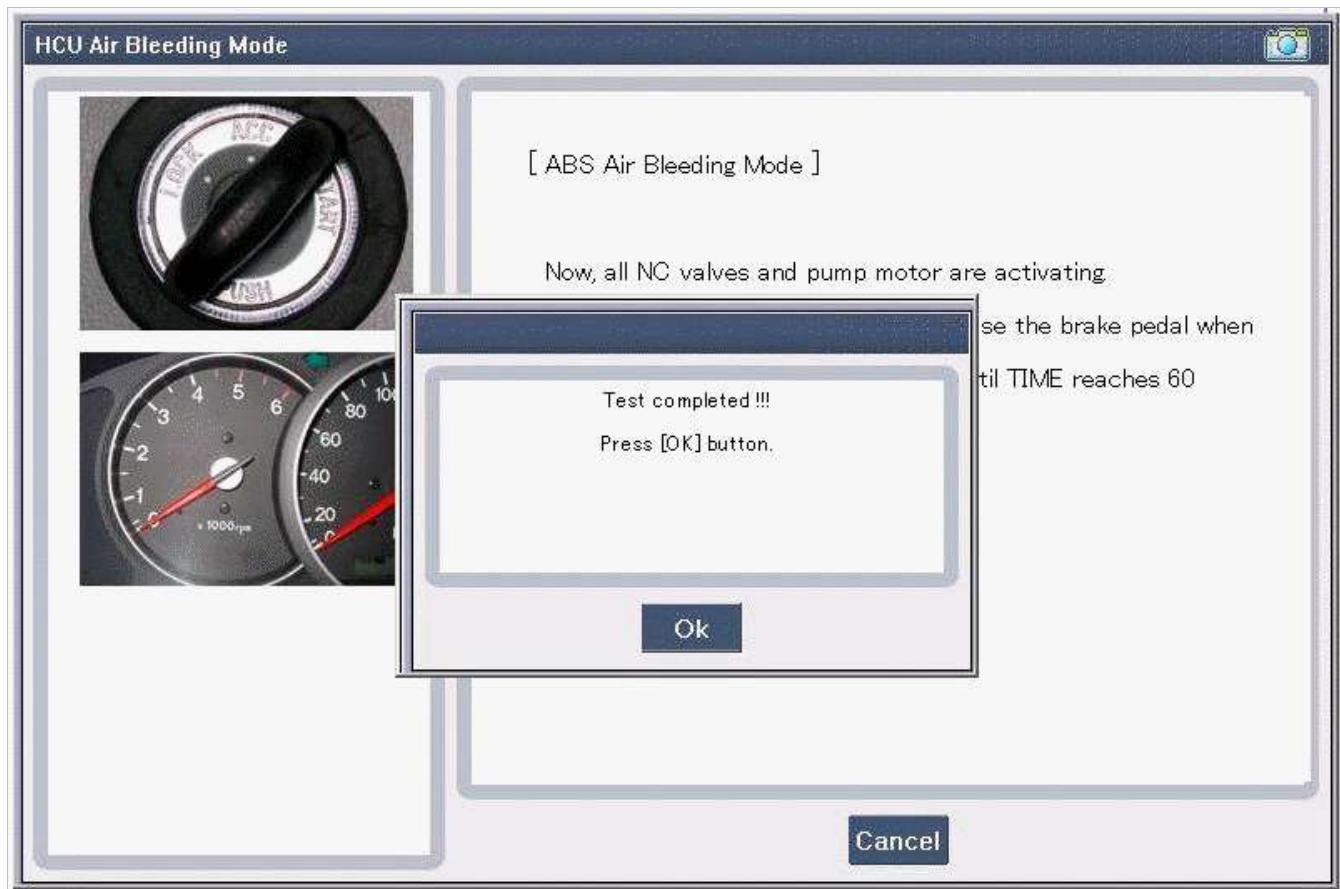
[ABS Air Bleeding Mode]

Now, all NC valves and pump motor are activating
Depress the brake pedal to floor. Release the brake pedal when
pump motor activation stops. Repeat until TIME reaches 60
seconds.

TIME : 05 SEC

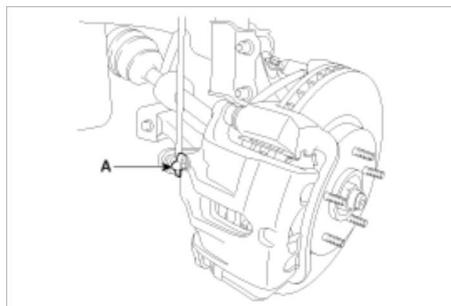
Cancel

(6) Perform the air bleeding.

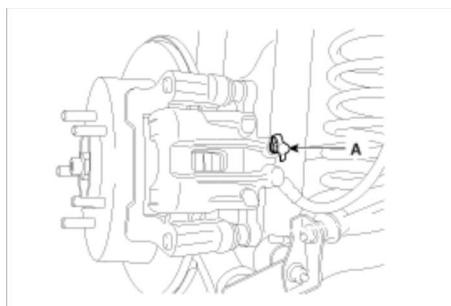


5. Pump the brake pedal several times, and then loosen the bleeder screw until fluid starts to run out without bubbles. Then close the bleeder screw(A).

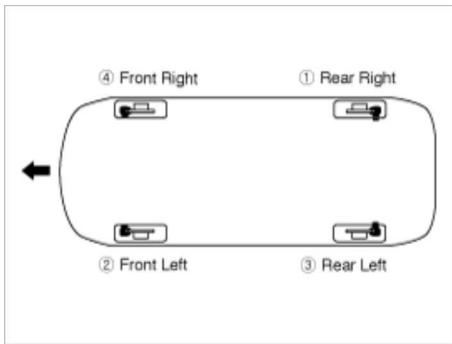
Front



Rear



6. Repeat step 5 until there are no more bubbles in the fluid for each wheel using the chart below for the order of bleeding process.



7. Tighten the bleeder screw.

Bleed screw tightening torque:

7 ~ 13 Nm (0.7 ~ 1.3 kgf.m, 5.4 ~ 9.5 lb-ft)

Brake System > ESC(Electronic Stability Control) System > EBD(Electronic Brake-force Distribution) > Description and Operation

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 to the 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.

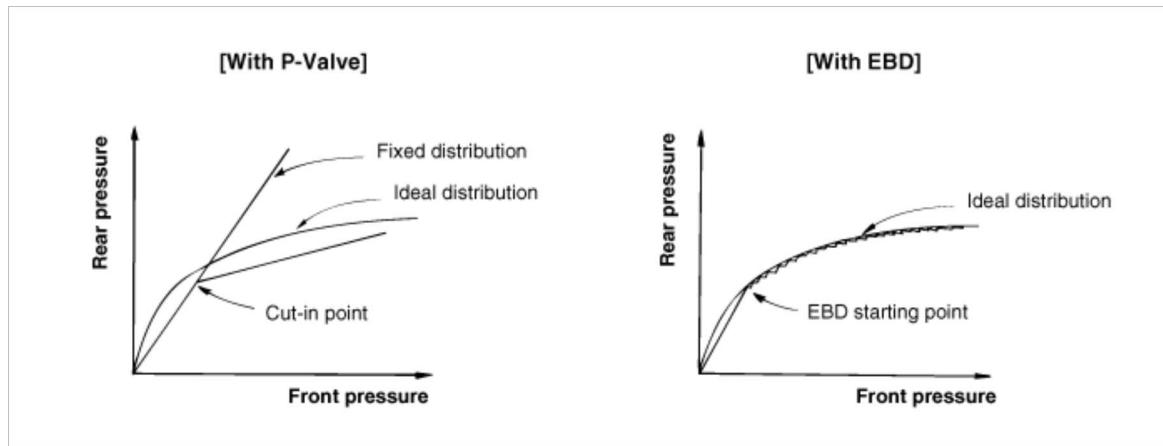
EBD controlled by the ABS Control Module, calculates the slip ratio of each wheel at all times and controls the brake pressure of the rear wheels not to exceed that of the front wheels.

If the EBD fails, the EBD warning lamp (Parking brake lamp) lights up.

Advantages

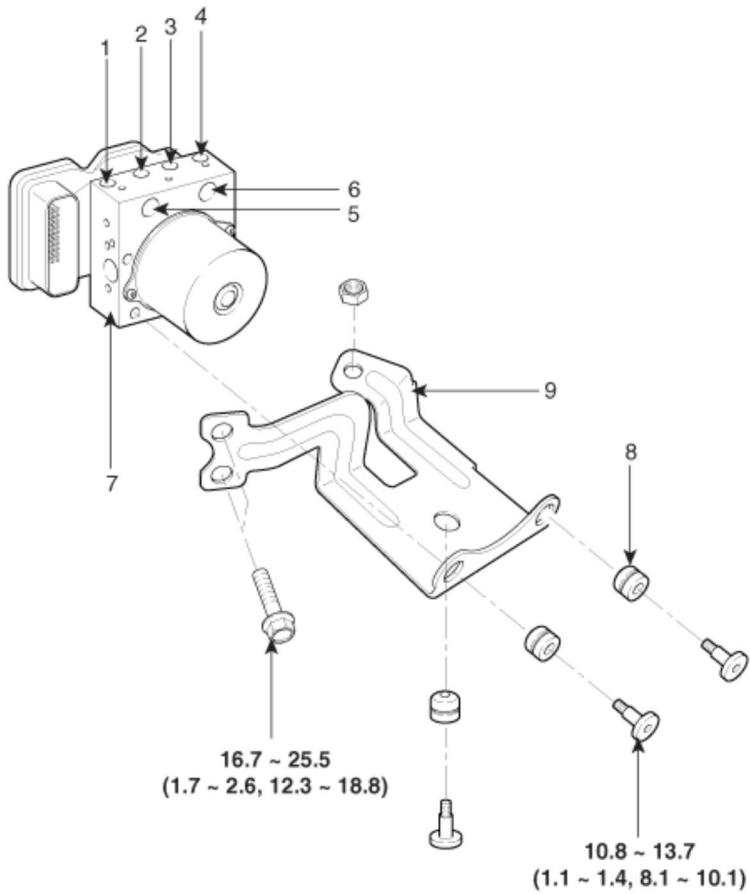
- Function improvement of the base-brake system.
- Compensation for the different friction coefficients.
- Elimination of the proportioning valve.
- Failure recognition by the warning lamp.

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	6. MC1
2. Rear - right tube	7. ESC control module(HECU)
3. Rear - left tube	8. Damper
4. Front - right tube	9. Bracket
5. MC2	

Brake System > ESC(Electronic Stability Control) System > ESC Control Module > Repair procedures

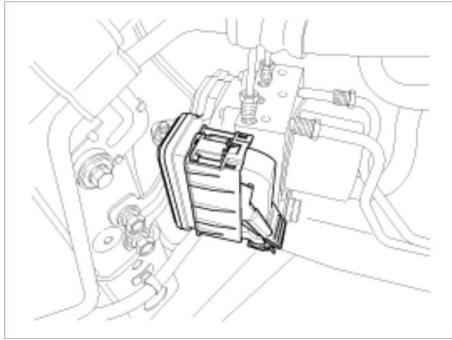
Removal

1. Turn the ignition switch OFF.
2. Disconnect the brake tubes from the HECU by unlocking the nuts counterclockwise with a spanner.

Tightening torque :

12.7 ~ 16.7N.m(1.3 ~ 1.7kgf.m, 9.4 ~ 12.3lb-ft)
16.7 ~ 22.6N.m(1.7 ~ 2.3kgf.m, 12.3 ~ 16.6lb-ft)

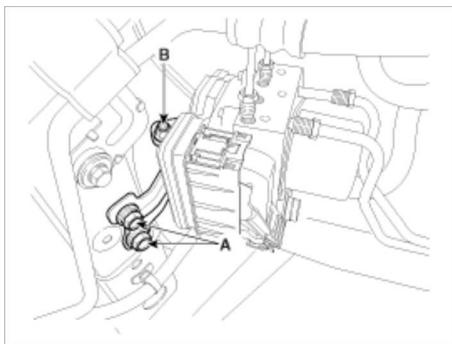
3. Pull up the lock of the ESC control unit connector , then disconnect the connector.



4. Loosen the ESC HECU bracket bolts (A) and nut (B), then remove HECU and bracket.

Tightening torque :

16.7 ~ 25.5N.m(1.7 ~ 2.6kgf.m, 12.3 ~ 18.8lb-ft)



CAUTION

1. Never attempt to disassemble the HECU.
2. The HECU must be transported and stored in.
3. Never shock to the HECU.

5. Remove the 3 bolts, then remove the bracket from HECU.

Tightening torque :

10.8 ~ 13.7N.m(1.1 ~ 1.4kgf.m, 8.0 ~ 10.1lb-ft)

Installation

1. Installation is the reverse of removal.
2. Tighten the HECU mounting bolts and nuts to the specified torque.
3. After installation, bleed the brake system.(Refer to ABS bleeding)

Variant coding

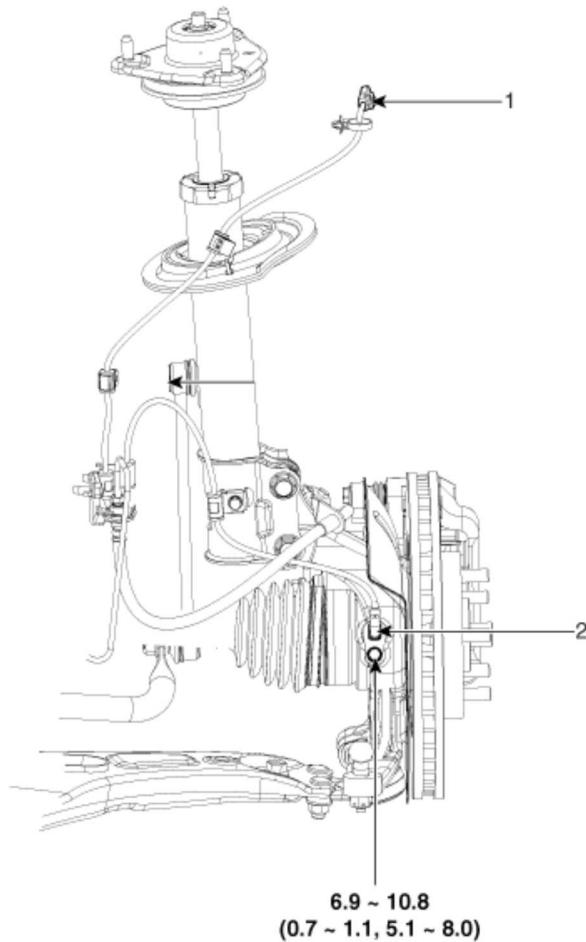
2WD and 4WD vehicle are sharing the HECU each other. To apply appropriate vehicle, HECU needs to variant coding process.

Variant coding process is necessary when :

- HECU is replaced.
- C1702 DTC(variant coding error) code is detected.

Brake System > ESC(Electronic Stability Control) System > Front Wheel Speed Sensor > Components and Components Location

Components



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

- 1. Front wheel speed sensor connector
- 2. Front wheel speed sensor

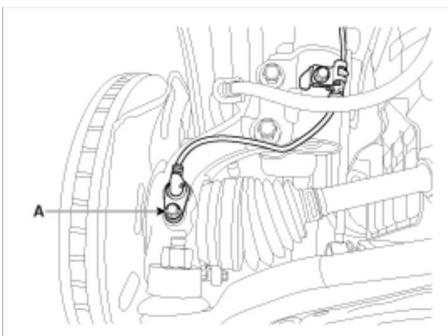
Brake System > ESC(Electronic Stability Control) System > Front Wheel Speed Sensor > Repair procedures

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 .

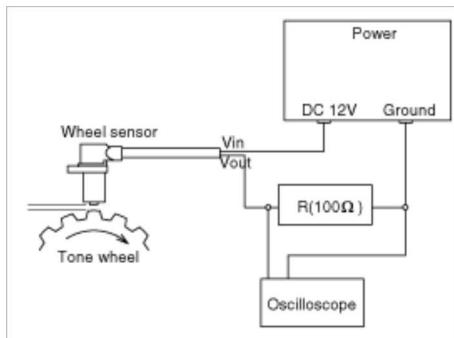
3. Disconnect the front wheel speed sensor connector, then remove the front wheel speed sensor.
4. Installation is the reverse of removal.

Inspection

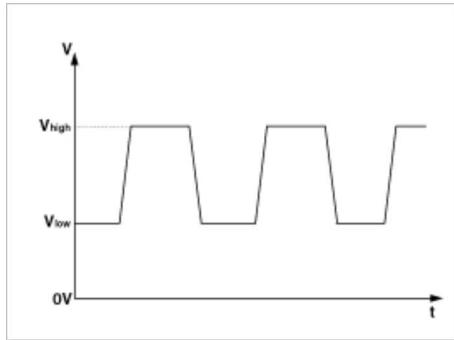
1. Measure the output voltage between the terminal of the wheel speed sensor and the body ground.

CAUTION

In order to protect the wheel speed sensor, when measuring output voltage, a 100 Ω resistor must be used as shown.



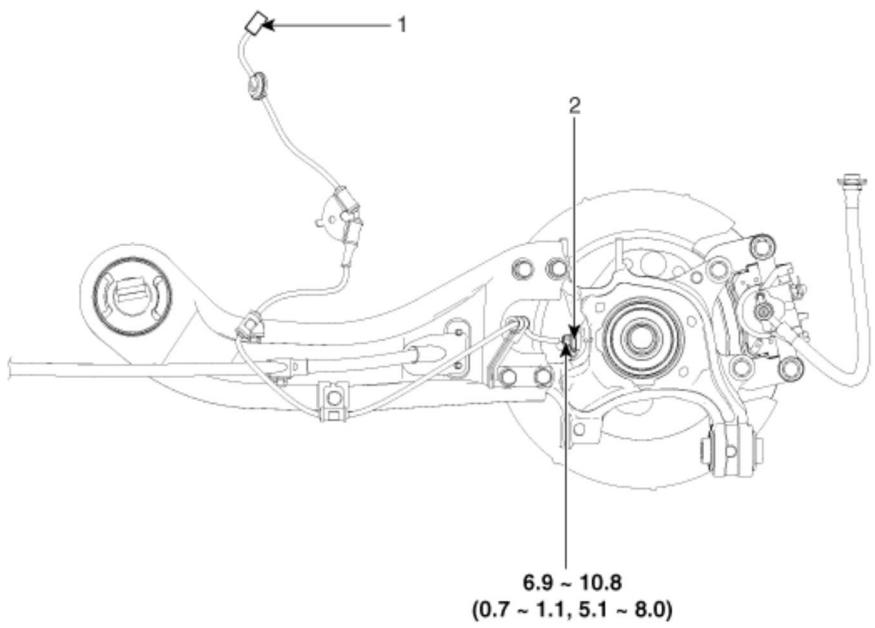
2. Compare the change of the output voltage of the wheel speed sensor to the normal change of the output voltage as shown below.



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



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

1. Rear wheel speed sensor connector
2. Rear wheel speed sensor

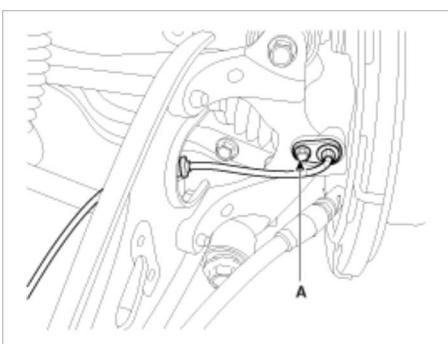
Brake System > ESC(Electronic Stability Control) System > Rear Wheel Speed Sensor > Repair procedures

Removal

1. Remove the rear 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 luggage side trim the disconnect the rear wheel speed sensor connector.

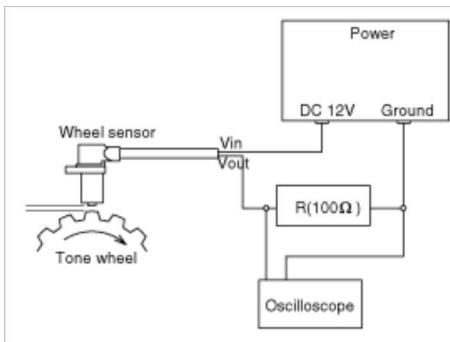
3. Installation is the reverse of removal.

Inspection

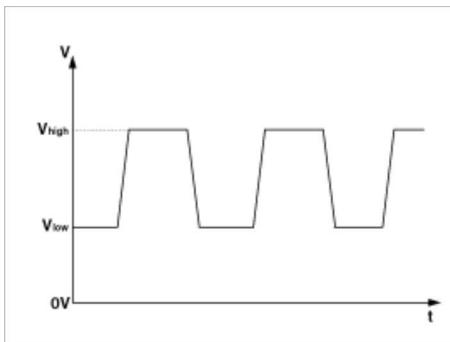
1. Measure the output voltage between the terminal of the wheel speed sensor and the body ground.

CAUTION

In order to protect the wheel speed sensor, when measuring output voltage, a 100 Ω resistor must be used as shown.



2. Compare the change of the output voltage of the wheel speed sensor to the normal change of the output voltage as shown below.



V_low : 0.59V ~ 0.84V

V_high : 1.18V ~ 1.68V

Frequency range : 1 ~ 2,500Hz

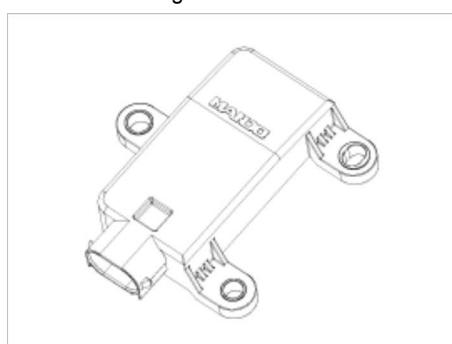
Brake System > ESC(Electronic Stability Control) System > Yaw-rate and Lateral G Sensor > Description and Operation

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's yawing, the ESC control is reactivated.

The lateral G sensor senses vehicle's lateral G. A small element inside the sensor is attached to a deflectable leverarm by later G. Direction and magnitude of lateral G loaded to vehicle can be known with electrostatic capacity changing according to lateral G.

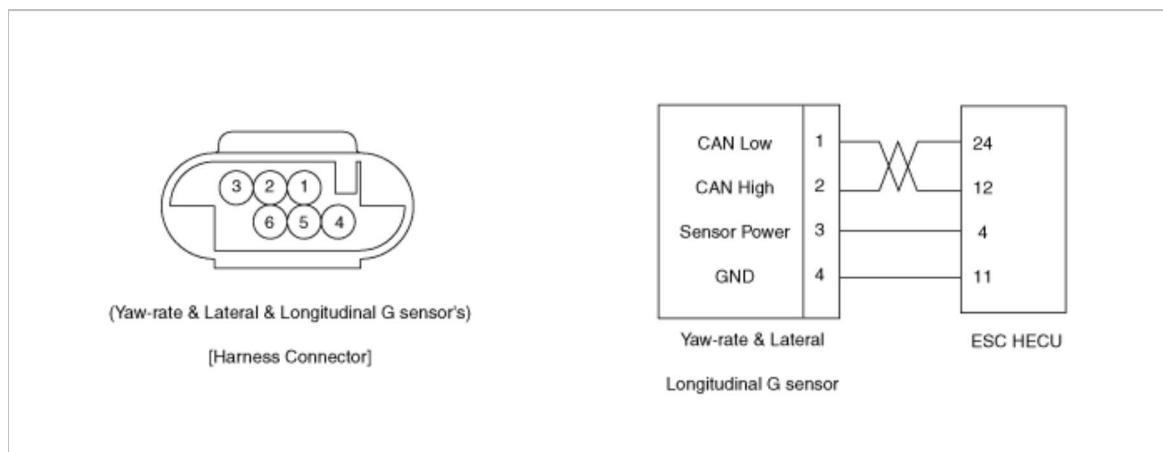


Specifications

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	15 ~ 45Hz	
Lateral G sensor	Measurement range	-14.715 ~ +14.715g	
	Frequency response	50Hz ± 60% (-3dB)	

External Diagram



Brake System > ESC(Electronic Stability Control) System > Yaw-rate and Lateral G Sensor > Repair procedures

Removal

1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Remove the floor console upper cover.
3. Disconnect the yaw rate & lateral & Longitudinal G sensor connector (A).



4. Remove the mounting bolts (B).

Tightening torque:

7.9 ~ 10.8 N.m (0.8 ~ 1.1 kgf.m, 5.8 ~ 8.0 lb-ft)

5. Installation is the reverse of removal.

Brake System > ESC(Electronic Stability Control) System > ESC OFF Switch > Description and Operation

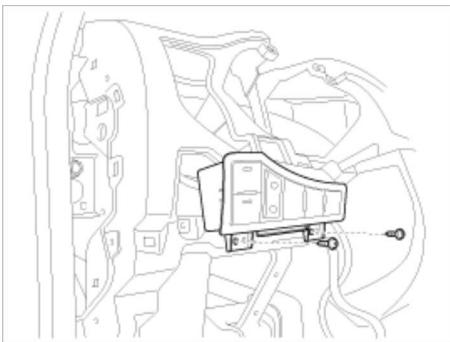
Description

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 crash pad side switch assembly.



3. Check the continuity between the switch terminals as the ESC OFF switch is engaged.

Terminal Position	1	3	7	15
ON	○	○	○	○
OFF			○	○

Brake System > ESC(Electronic Stability Control) System > DBC Switch > Description and Operation

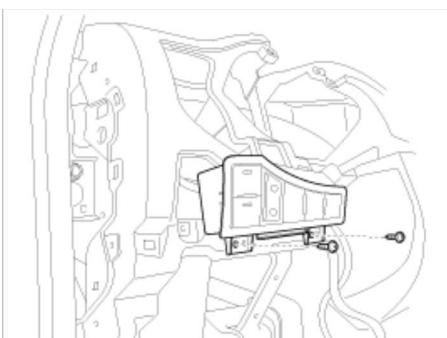
Description

The DBC function is the acronym word of Downhill Brake Control function. When a vehicle goes down the hill, just pushing the DBC switch enables the car to keep its vehicle's speed at a constant value without operating the brake pedal. The DBC function is operated when the vehicle is on the decline and its velocity is under the predetermined speed.

Brake System > ESC(Electronic Stability Control) System > DBC Switch > Repair procedures

Inspection

1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Remove the crash pad side switch assembly.



3. Check the continuity between the switch terminals as the DBC switch is engaged.

Terminal Position	1	6	7	15
ON	○	○	○	○
OFF			○	○

Brake System > ESC(Electronic Stability Control) System > Steering Angle Sensor > Description and Operation

Description

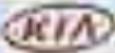
The Steering Angle Sensor (SAS) is installed in MDPS (Motor Driven Power Steering) and it sends messages to HECU through CAN communication line.

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 inspect or replace them. (Refer to "ST (Steering system) Gr.")

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SPORTAGE(SL) > 2012 > G 2.4 DOHC > Clutch System

Clutch System > General Information > Specifications

Specifications

Item		Specification
Clutch operation method		Hydraulic type
Clutch cover assembly	Type	Diaphragm spring strap
Clutch disc	Type	Single dry with diaphragm
	Facing diameter (outside x inside)	Ø239 x Ø170mm (Ø9.4094 x Ø6.6929in.)
Concentric slave cylinder	Facing diameter (inside x outside)	Ø32.2 x Ø44mm (Ø1.2677 x Ø1.7323in.)

Service Standard

Item	Specification
Clutch disc thickness [When free]	8.5 ± 0.3 mm (0.3347 ± 0.012 in.)
Clutch pedal height	167 mm (6.5748 in.)
Clutch pedal free play	6 ~ 13 mm (0.2362 ~ 0.5118 in.)
Clutch pedal stroke	150 ± 3mm (5.9055 ± 0.1181 in.)
Clutch disc rivet depth	1.3 mm (0.0512 in.)
Diaphragm spring end height difference	0.5 mm (0.0197 in.)
Clutch master cylinder clearance to piston	0.15 mm (0.0059 in.)

Tightening Torques

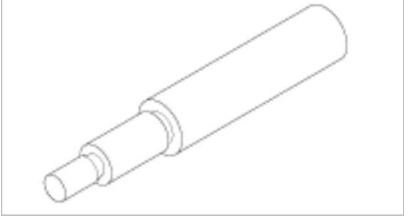
Item	N.m	kgf.m	lb·ft
Clutch cover assembly	24.5~34.3	2.5~3.6	18.1~26.0
Concentric slave cylinder Installation bolt	11.8~14.7	1.2~1.5	8.7~10.8
Ignition lock switch	7.8~9.8	0.8~1.0	5.8~7.2
Clutch pedal mounting nut	16.7~25.5	1.7~2.6	12.3~18.8

Lubricants

Item	Specified lubricants	Quantity
Input spline	CASMOLY L9508	0.2g
Concentric slave cylinder assembly	KLUBER 9R100	As required
Clutch pedal shaft and bushings	Chassis grease SAE J310, NGLI NO.1	

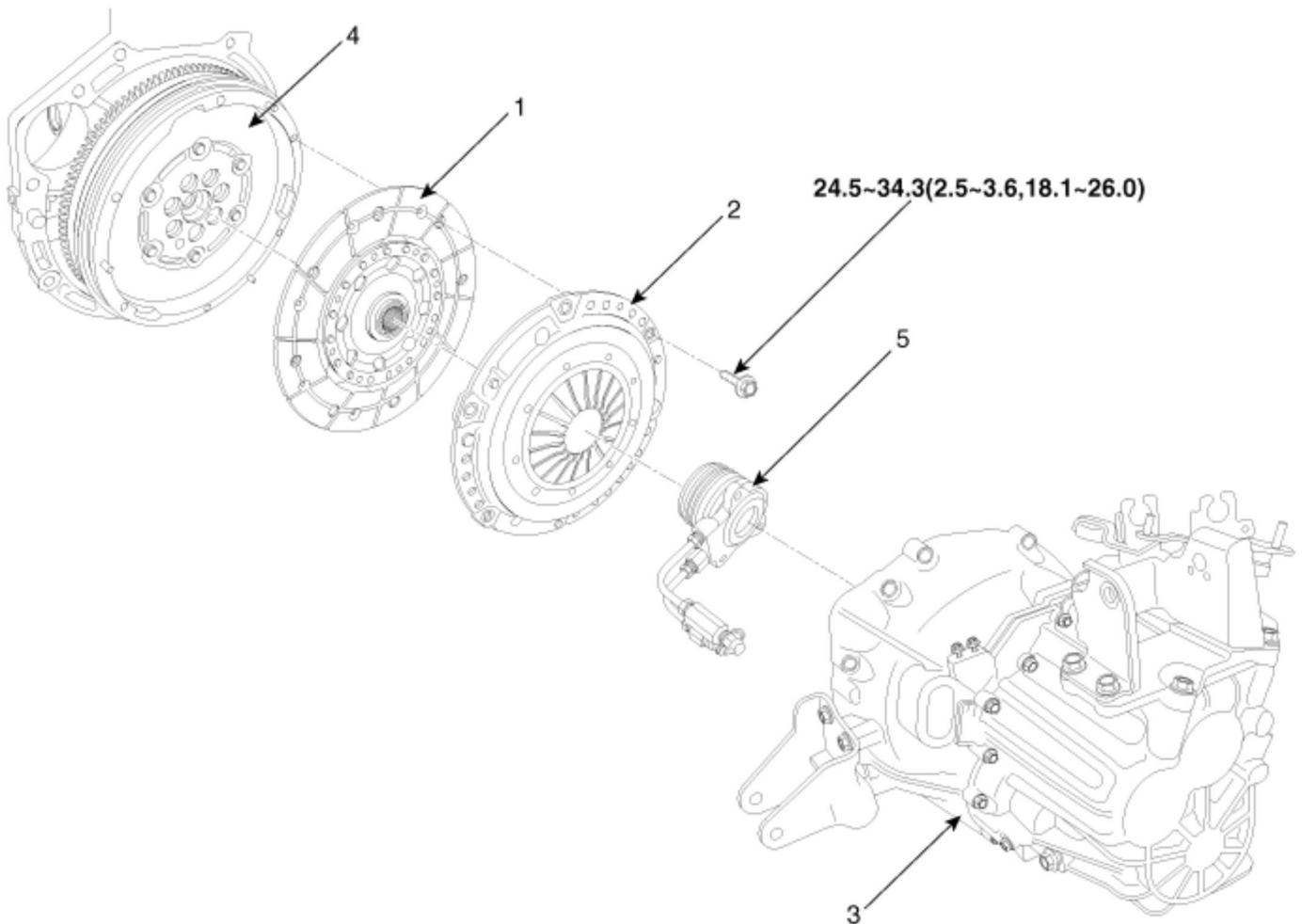
Clutch System > General Information > Special Service Tools

Special Service Tools

Tools (Number and Name)	Illustration	Use
09411-32000 Clutch disc guide		Installation of the clutch disc.

Clutch System > Clutch System > Clutch Cover And Disc > Components and Components Location

Components



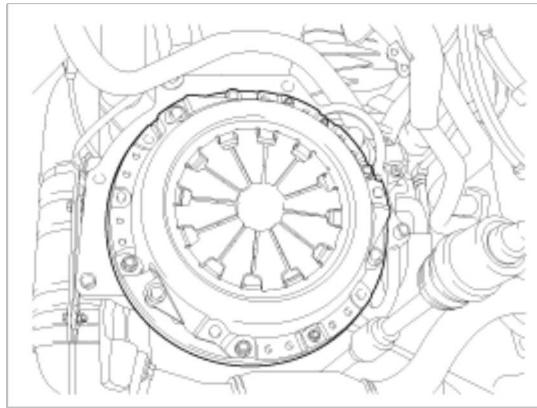
Torque : N.m (kgf.m, lb-ft)

1. Clutch disc	4. Engine flywheel
2. Clutch cover	5. Concentric slave cylinder
3. Manual transaxle	

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 or twist 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] :

8.5 ± 0.3 mm (0.3347 ± 0.012 in.)

Clutch disc rivet depth(B) : 1.3 mm (0.0512 in.)

Installation

NOTE

If reinstalling used cover, the cover should be installed with its clutch disc as a set.

1. Replace a clutch cover and disc as a set.

NOTE

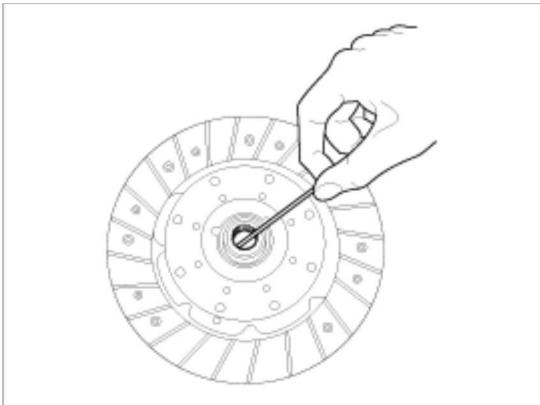
- When replacing only a disc, a slip problem can occur because of the load loss due to uneven surface wear.
- When replacing only a disc, it can be difficult to cut power because the thickness of the disc won't permit it.

2. Apply grease on a disc spline part and transmission input shaft spline part as required.

NOTE

* 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 by centrifugal force which can contaminate the clutch disc. This can cause a loss of friction force causing a slip.



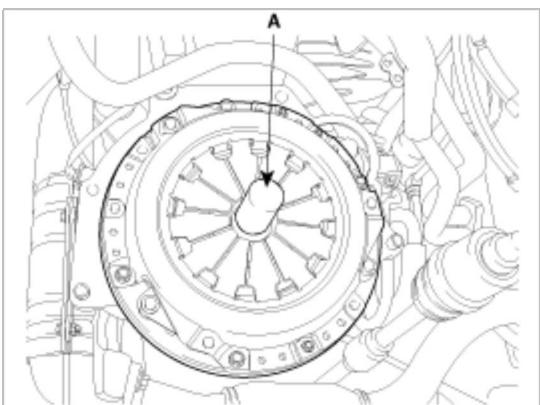
3. The 'T/M SIDE' marked surface should face transmission.

NOTE

- * Possible problems when the disc is installed in the opposite direction.
 - There can be an interference between the concentric slave cylinder on the TM side and a engine flywheel surface.
 - Transaxle shift error or a strange sound can occur due to clutch separation.
 - The concentric slave cylinder can break. If it does, the concentric slave cylinder should be replaced new one.



4. Install the clutch disc and the cover with SST(A : 09411-32000).



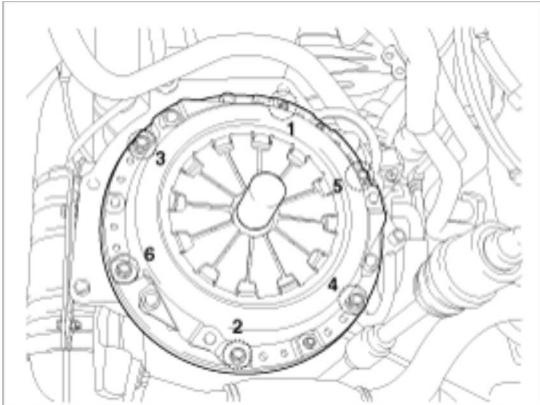
5. Install the clutch cover bolts. Not to be bent or twisted, Tighten them in diagonal directions.

Tightening torque :

24.5~35.3N.m (2.5~3.6kgf.m, 18.1~26.0lb-ft)

CAUTION

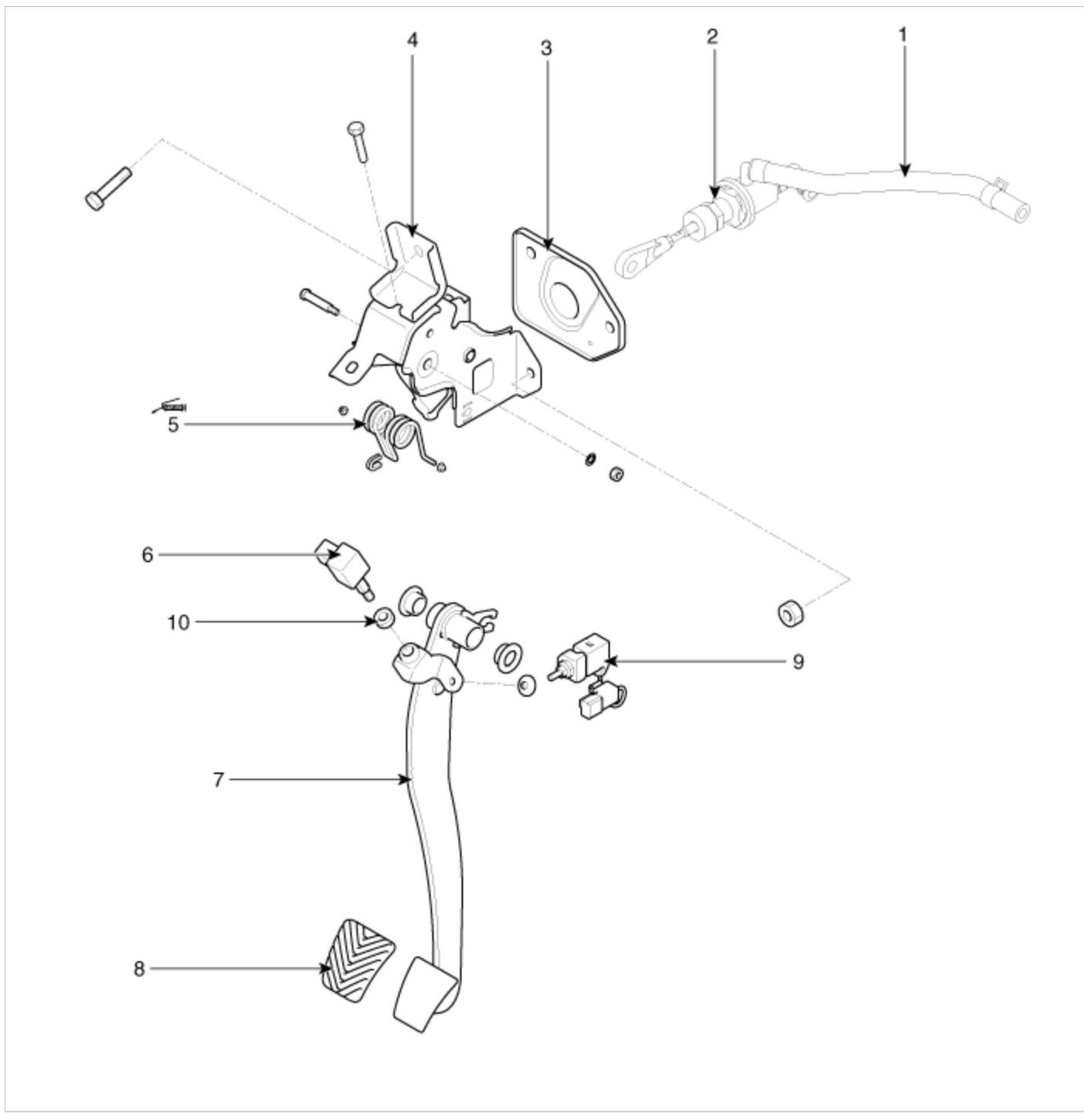
- Loosely tighten every clutch cover bolts, then torque to specifications in a diagonal direction. This can prevent twisting, vibration of the cover, and the lifting of the pressure plate.
- Install the all the components with the specified torques. If not, the clutch torque transmission may have concerns or the mounting bolt can loosen.



6. Install the transaxle assembly.(Refer to "Manual transaxle system" in MT group.)
7. Perform the bleeding air procedure in the concentric slave cylinder. (Refer to Repair procedure in this group.)

Clutch System > Clutch System > Clutch Pedal > Components and Components Location

Components



- | | |
|---------------------|-------------------------|
| 1. Reverse hose | 6. Clutch switch |
| 2. Master cylinder | 7. Clutch arm |
| 3. Siller | 8. Pedal pad |
| 4. Member assembly | 9. Ignition lock switch |
| 5. Turn over spring | 10. Stopper |

Clutch System > Clutch System > Clutch Pedal > Repair procedures

Inspection

Clutch Pedal Inspection

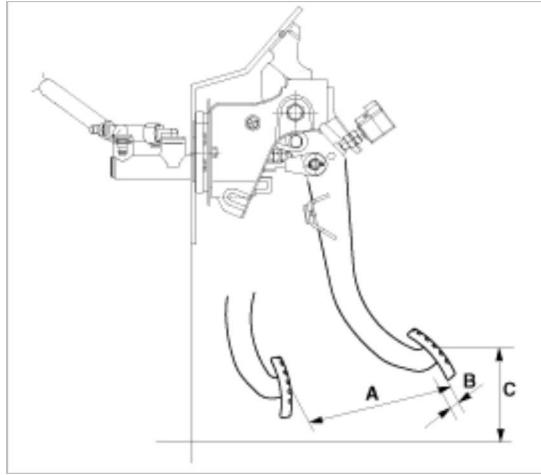
1. Measure the clutch pedal height (from the face of the pedal pad to the floorboard) and the clutch pedal clevis pin play (measured at the face of the pedal pad.)

Standard value

Stroke (A) : $150 \pm 3\text{mm}$ ($5.9055 \pm 0.1181\text{ in.}$)

Free play (B) : $6\sim13\text{ mm}$ ($0.2362\sim0.5118\text{in.}$)

Height (C) : 167mm (6.5748in.)



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 ommissible)
3. Check for continuity between terminals. (refer to the table below)

NOTE

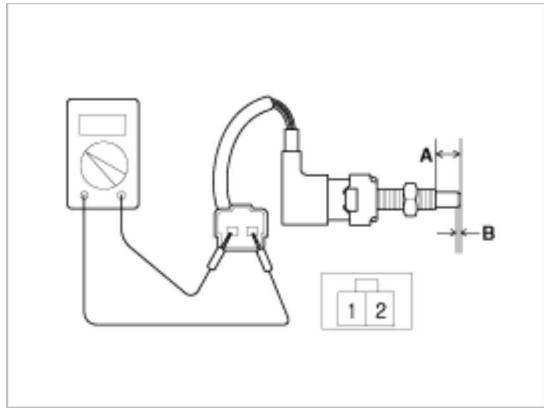
- If there is difference between what tested and the table above, replace the ignition lock switch with a new one.

Pedal position	Clutch switch	Ignition lock switch
Released	Pressed (Continuity)	Released (Open)
Fully pressed	Released (Open)	Pressed (Continuity)

Standard value

Full stroke(A) : $12.0 \pm 0.3\text{mm}$ ($0.4724 \pm 0.0118\text{ in.}$)

ON-OFF point (B) : $2.0 \pm 0.3\text{mm}$ ($0.0787 \pm 0.0118\text{ in.}$)



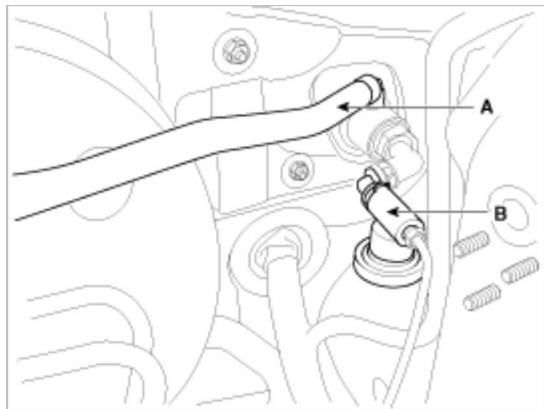
4. If there is difference between what tested and the table above, replace the ignition lock switch with a new one.

Removal

NOTE

Do not spill brake fluid on the vehicle; it may damage the paint if brake fluid does contact the paint, wash it off immediately with water.

1. Remove the brake fluid from the clutch master cylinder reservoir with a syringe.
2. Remove the ECM.(Refer to "Engine Control Module" in FL group).
3. Clamp the clutch master cylinder hose(A). If there is not enough room for clamping, you can also clamp thehose from the brake master cylinder side.
4. Disconnect the clutch master tube line (B) after removing the nut on the clutch master cylinder.

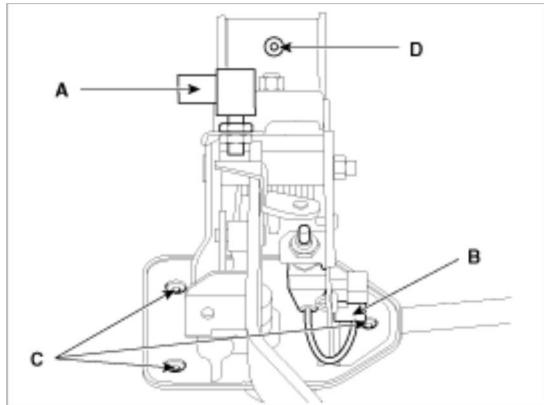


5. Remove the crash pad lower panel. (Refer to "Interior(Crash pad)" in BD group).
6. Disconnect the ignition lock switch connector(B) and clutch switch(A).
7. Remove the clutch pedal assembly mounting nut(C-3ea) and bolts(D-1ea).

Tightening torque :

16.7~25.5 N.m (1.7~2.6 kgf.m, 12.3~18.8 lb-ft)

8. Remove the clutch pedal and the master cylinder assembly together.



Installation

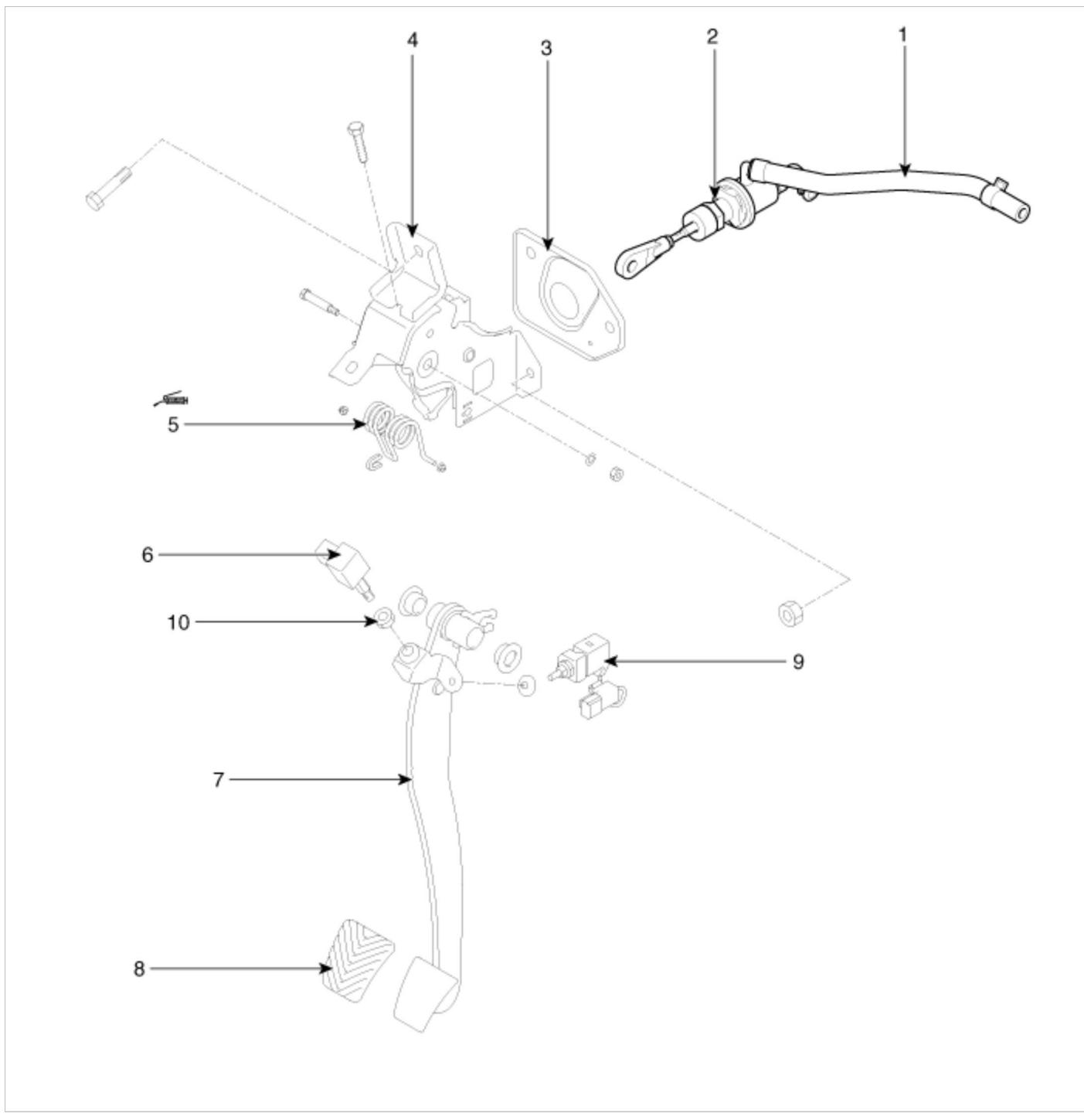
1. Installation is in reverse order of removal.

NOTE

- Inspect the continuity of the ignition lock switch and clutch pedal. (Refer to Repair procedure in this group.)
- Perform the bleeding air procedure in the concentric slave cylinder. (Refer to Repair procedure in this group.)

Clutch System > Clutch System > Clutch Master Cylinder > Components and Components Location

Components



- | | |
|---------------------|-------------------------|
| 1. Reverse hose | 6. Clutch switch |
| 2. Master cylinder | 7. Clutch arm |
| 3. Siller | 8. Pedal pad |
| 4. Member assembly | 9. Ignition lock switch |
| 5. Turn over spring | 10. Stopper |

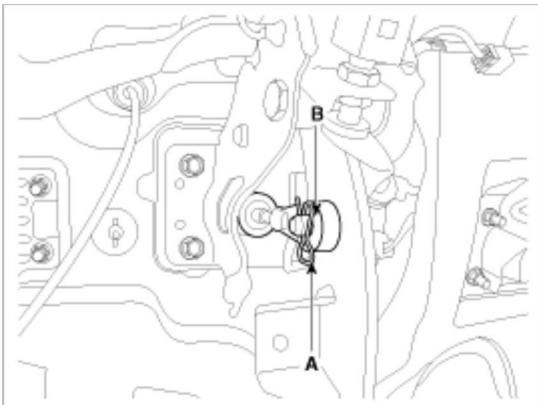
Clutch System > Clutch System > Clutch Master Cylinder > Repair procedures

Removal

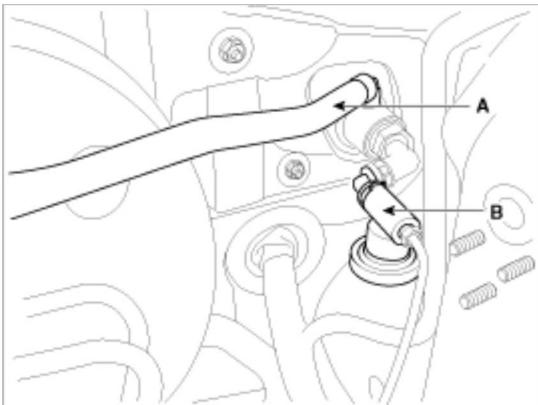
NOTE

Do not spill brake fluid on the vehicle; it may damage the paint if brake fluid does contact the paint, wash it off immediately with water.

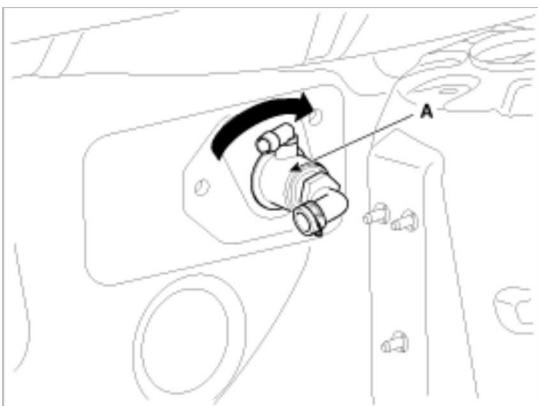
1. Disconnect the push rod from the clutch pedal by removing the snap pin (A) and washer (B).



2. Remove the ECM.(Refer to "Engine Control Module" in FL group).
3. Disconnect the clutch tube (B) and reverse hose(A) from the clutch master cylinder.



4. Remove the clutch master cylinder by turning it clockwise(A).



Installation

1. Installation is in reverse order of removal.

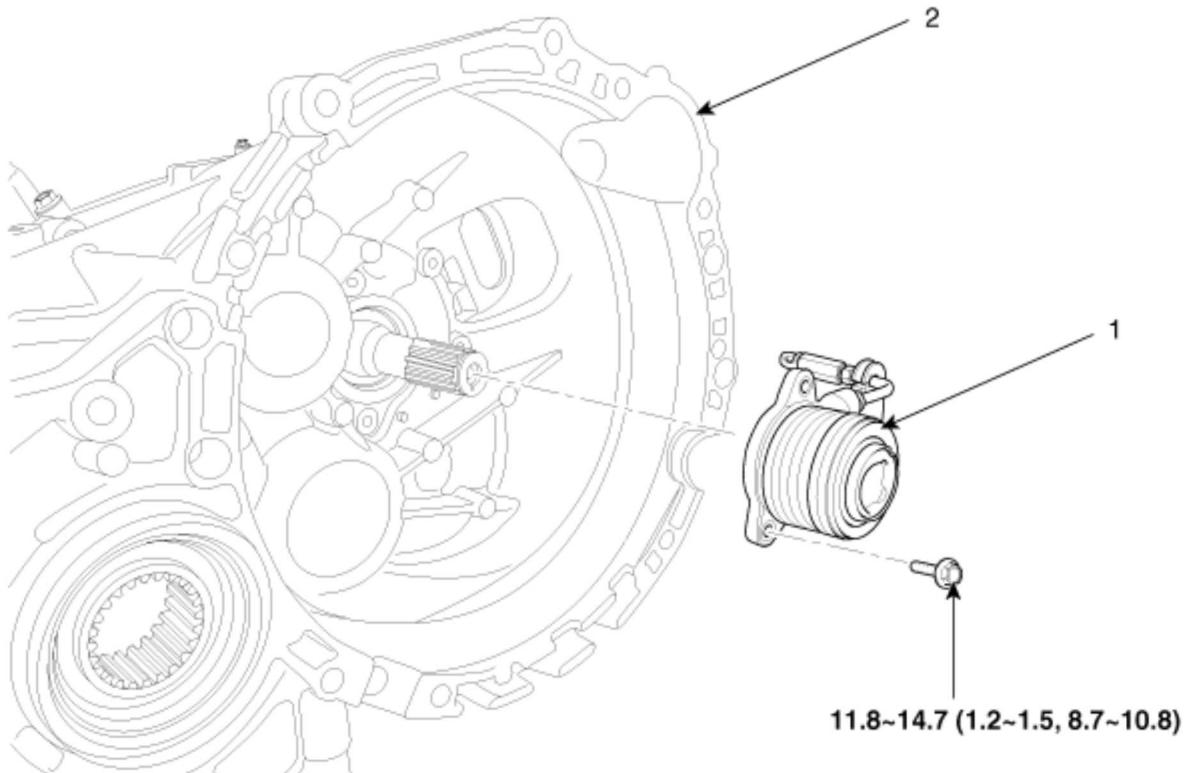
NOTE

- Perform bleeding air procedure in concentric slave cylinder after pouring the brake fluid.(Refer to "Concentric

slave cylinder" in CH group.)

Clutch System > Clutch System > Concentric Slave Cylinder Assembly > Components and Components Location

Components Location



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

1. Concentric Slave Cylinder assembly
2. Manual transaxle case

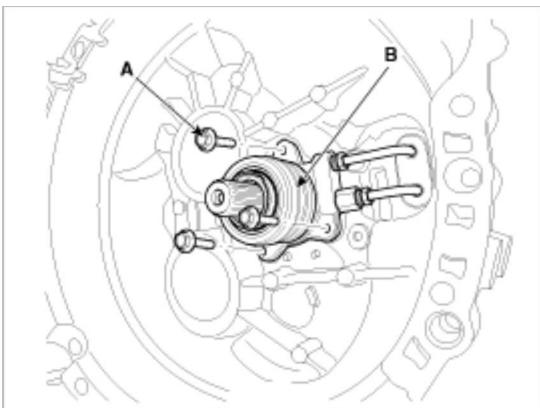
Clutch System > Clutch System > Concentric Slave Cylinder Assembly > Repair procedures

Removal

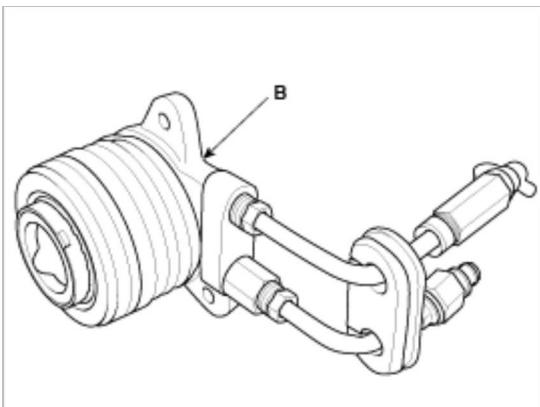
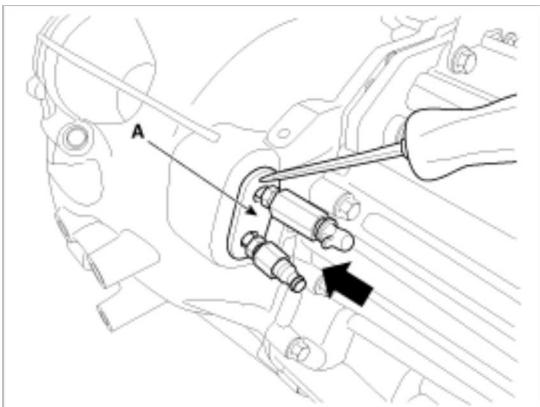
1. Remove the transaxle assembly. (Refer to "Manual transaxle" in MT group)
2. Remove the concentric slave cylinder assembly (B) from the transaxle case by removing bolts (A-3ea).

Tightening torque :

11.8~14.7 N.m (1.2~1.5 kgf.m, 8.7~10.8 lb·ft)



3. Remove the concentric slave cylinder assembly (B) by pushing the rubber (A) to forward.



Installation

1. Installation is in reverse order of removal.

CAUTION

- Install the concentric slave cylinder bolts. Not to be bent or twisted, Tighten them in diagonal directions.
- Cup, Inner surface of body and outer surface of tube guide must be free from flaws.
- When it is assembled, it must be free from invasive foreign matters and oil leakage.

Adjustment

Concentric Slave 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 concentric slave cylinder air bleeder, insert a vinyl hose in the plug.
2. Loosening the plug screw, press and release the clutch pedal about 10 times.

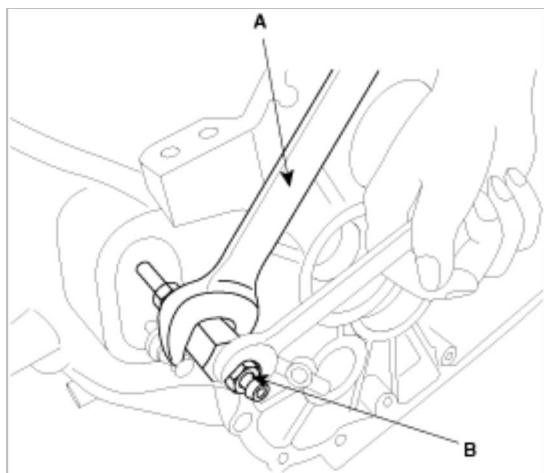
NOTE

Using a flare nut wrench, hold the air bleeder body, being careful not to rotate it (A). Then use a second flare nut wrench on the plug screw to bleed the clutch master cylinder.

3. Tighten the plug(B) during the clutch pedal pressed. Afterwards, raise the pedal with a hand.
4. After pressing the clutch pedal 3 times more, loosen the plug(B) 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, 9.2~13.3 lb-ft)



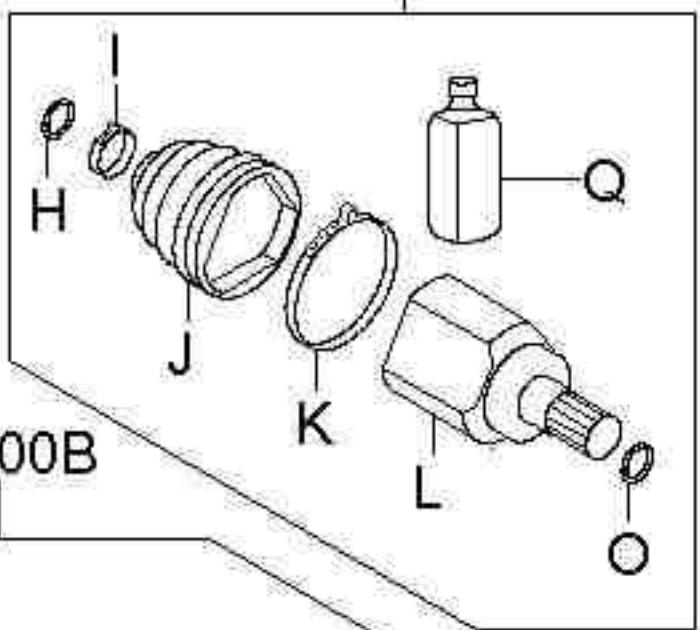
6. Refill the clutch master cylinder with the specified fluid.

CAUTION

1. Do not clamp the pipe of a concentric slave cylinder.
2. Be careful not to damage O-rings.

(RH KIT)

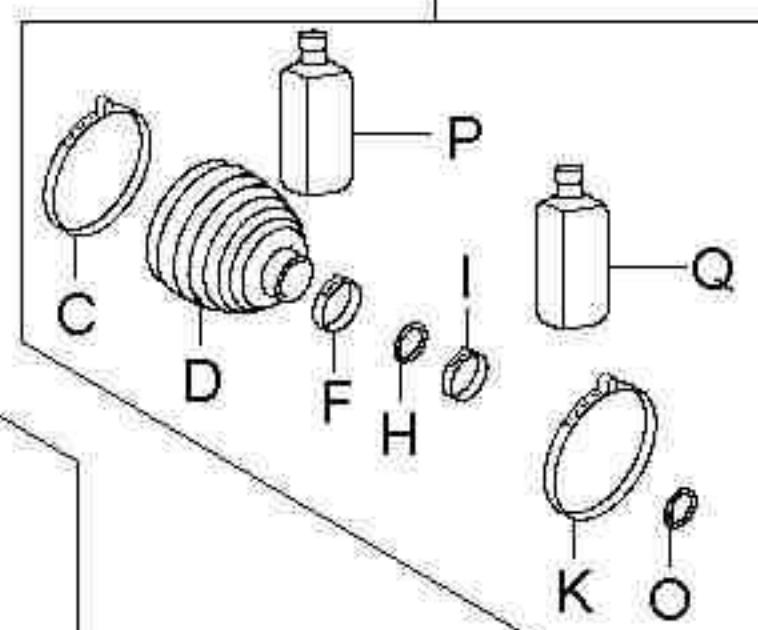
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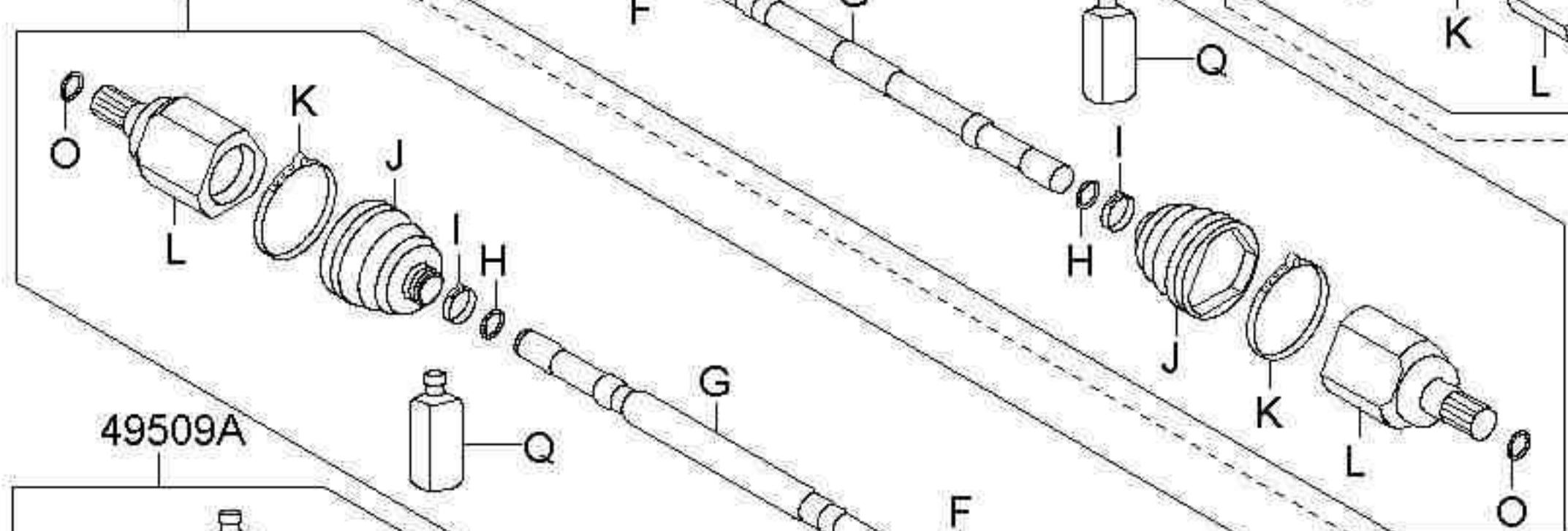
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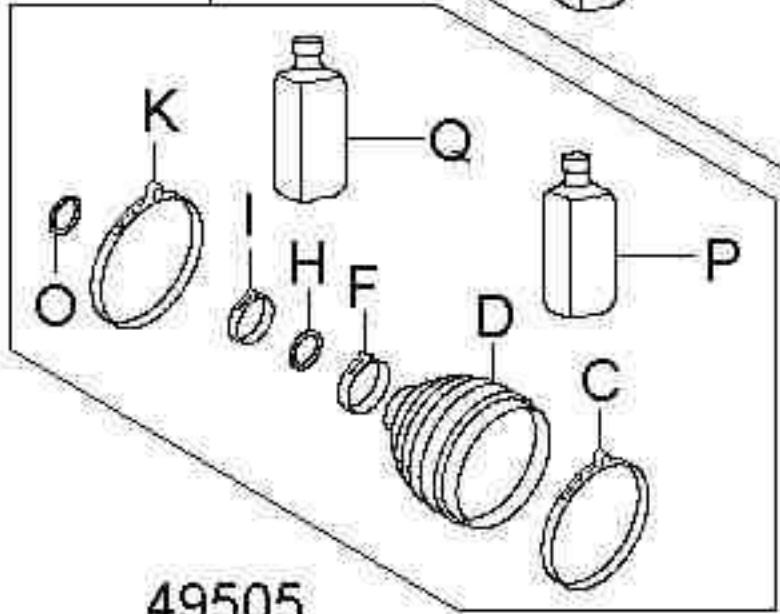


(LH KIT)

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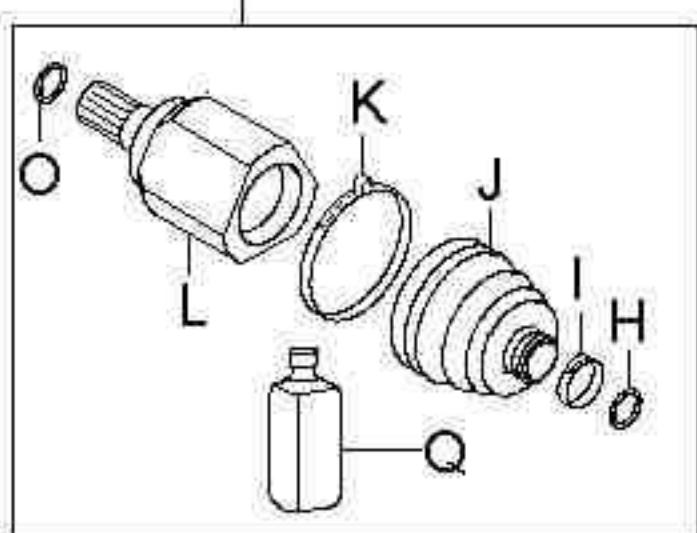
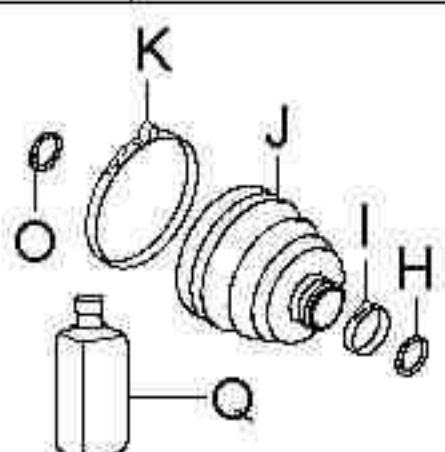


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SPORTAGE(SL) > 2012 > G 2.4 DOHC > Driveshaft and axle**Driveshaft and axle > General Information > Specifications****Specification**

Items		Inner side	Outer side
Front driveshaft	Joint type	VTJ	BJ
	Max. permissible angle	23.5°	46.5°
Rear driveshaft	Joint type	TJ	BJ
	Max. permissible angle	23.5°	46.5°
Rear differential	Oil type	Hypoid gear oil (API GL-5, SAE 75W/90)	
	Oil capacity (L)	About 0.6 ~ 0.7	
	Reduction gear type	Hypoid gear	
	Reduction gear ratio	2.53	
	Final drive gear backlash mm(in.)	0.1 ~ 0.15	
	Differential gear backlash mm(in.)	0 ~ 0.05	

Tightening torque

Items		Nm	kgf.m	lb·ft
Front	Wheel nut	88.3 ~ 107.9	9.0 ~ 11.0	65.1 ~ 79.6
	Driveshaft nut	196.1 ~ 274.5	20.0 ~ 28.0	144.6 ~ 202.5
	Strut assembly lower mounting bolt	137.2 ~ 156.9	14.0 ~ 16.0	101.2 ~ 115.7
	brake caliper mounting bolt	78.4 ~ 98.0	8.0 ~ 10.0	57.8 ~ 72.3
	Wheel speed sensor mounting bolt	6.9 ~ 10.8	0.7 ~ 1.1	5.1 ~ 8.0
	brake disc mounting screw	4.9 ~ 5.9	0.5 ~ 0.6	3.6 ~ 4.3
	Lower arm assembly mounting bolt	137.2 ~ 156.9	14.0 ~ 16.0	101.2 ~ 115.7
	Lower arm ball joint mounting bolt	98.1 ~ 117.7	10.0 ~ 12.0	72.3 ~ 86.8
	Tie rod end ball joint mounting nut	34.3 ~ 44.1	3.5 ~ 4.5	25.3 ~ 32.5
Rear	Wheel nut	88.3 ~ 107.9	9.0 ~ 11.0	65.1 ~ 79.6
	Driveshaft castle nut	196.1 ~ 274.5	20.0 ~ 28.0	144.6 ~ 202.5
	Shock absorber upper mounting nut	137.2 ~ 156.9	14.0 ~ 16.0	101.2 ~ 115.7
	brake caliper mounting bolt	78.4 ~ 98.3	8.0 ~ 10.0	57.8 ~ 72.3
	Wheel speed sensor mounting bolt	6.9 ~ 10.8	0.7 ~ 1.1	5.1 ~ 8.0
	brake disc mounting screw	4.9 ~ 5.9	0.5 ~ 0.6	3.6 ~ 4.3
	Hub assembly mounting bolt	78.5 ~ 88.3	8.0 ~ 9.0	57.9 ~ 65.1
	Upper arm ball joint mounting nut	2WD: 137.2 ~ 156.9 4WD: 98.1 ~ 117.7	2WD: 14.0 ~ 16.0 4WD: 10.0 ~ 12.0	2WD: 101.2 ~ 115.7 4WD: 72.3 ~ 86.8
	Lower arm mounting bolt	137.2 ~ 156.9	14.0 ~ 16.0	101.2 ~ 115.7
	Assist arm ball joint mounting nut	137.2 ~ 156.9	14.0 ~ 16.0	101.2 ~ 115.7
	Trailing arm mounting bolt	34.3 ~ 53.9	3.5 ~ 5.5	25.3 ~ 39.7

Front propellershaft	Front propeller shaft mounting bolt	49.0 ~ 68.6	5.0 ~ 7.0	36.2 ~ 50.6
	Propeller shaft center bearing bracket mounting bolt	49.0 ~ 53.9	5.0 ~ 7.0	36.2 ~ 50.6
Rear Differential	Rear propeller shaft mounting bolt	49.0 ~ 68.6	5.0 ~ 7.0	36.2 ~ 50.6
	Rear differential mounting bolt	68.6 ~ 88.3	7.0 ~ 9.0	50.6 ~ 65.1
	Differential cover mounting bolt	39.2 ~ 49.0	4.0 ~ 5.0	28.9 ~ 36.2
	Rear differential drain plug	49.0 ~ 68.6	5.0 ~ 7.0	36.2 ~ 50.6
	Rear differential filler plug	39.2 ~ 58.8	4.0 ~ 6.0	28.9 ~ 43.3

CAUTION

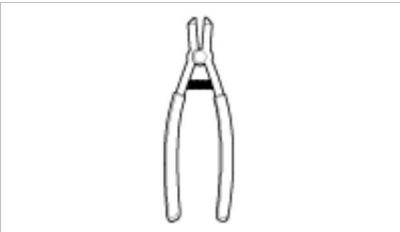
Replace self-locking nuts with new ones after removalbrake.

Lubricants

Items	Lubricants	Quantity
Front driveshaft	BJ	RBA 100g
	VTJ	CW-13TJ 150g
Rear driveshaft	BJ	RBA 60g
	TJ	CW-13TJ 90g

Driveshaft and axle > General Information > Special Service Tools**Special Service Tools**

Tool(Number and Name)	Illustration	Use
09517-43401 Working base		Support for the differential carrier
09517-43500 Adapter		Support for the differential carrier(Use with 09517-43401)

09495-3K000 Band installer		Installation of ear type boot band
09495-39100 Band installer		Installation of hook type boot band

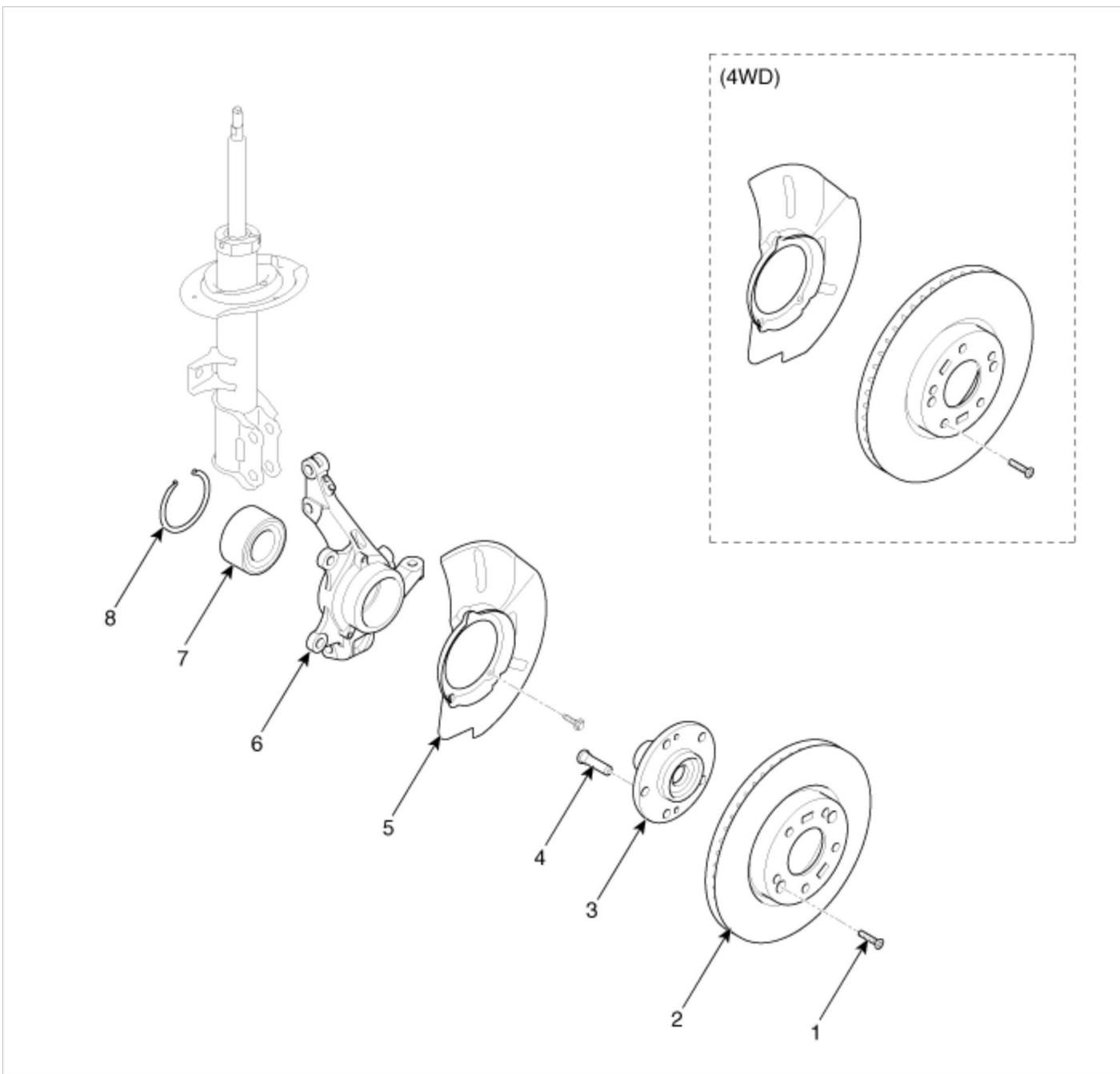
Driveshaft and axle > General Information > Troubleshooting

Troubleshooting

Trouble Symptom	Probable cause	Remedy
Vehicle pulls to one side	Scoring of driveshaft ball joint	Replace
	Wear, rattle or scoring of wheel bearing	Replace
	Defective front suspension and steering	Adjustment or Replace
Vibration	Wear, damage or bending of driveshaft	Replace
	Driveshaft rattle and hub serration	Replace
	Wear, rattle or scratching of wheel bearing	Replace
Shimmy	Defective wheel balance	Adjustment or Replace
	Defective front suspension and steering	Adjustment or Replace
Excessive noise	Wear, damage or bending of driveshaft	Replace
	Rattle of driveshaft and worn hub splines	Replace
	Wear, rattle or scoring of wheel bearing	Replace
	Loose hub nut	Adjustment or Replace
	Defective front suspension and steering	Adjustment or Replace

Driveshaft and axle > Front Axle Assembly > Front Hub / Knuckle / Tone Wheel > Components and Components Location

Components



- | | |
|---------------------|------------------|
| 1. Brake disc screw | 5. Dust cover |
| 2. Brake disc | 6. Knuckle |
| 3. Hub | 7. Wheel bearing |
| 4. Hub bolt | 8. Snap ring |

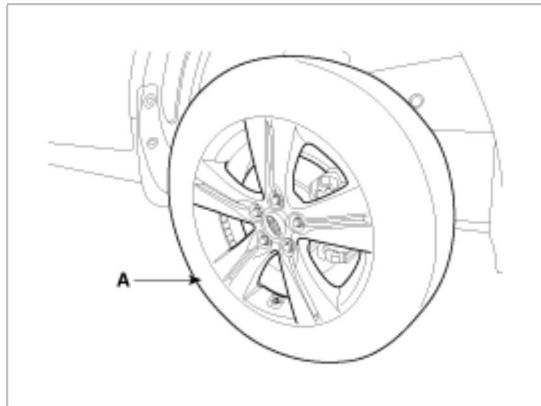
Driveshaft and axle > Front Axle Assembly > Front Hub / Knuckle / Tone Wheel > Repair procedures

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 ~ 107.8N.m (9.0 ~ 11.0kgf.m, 65.0 ~ 79.5lb-ft)



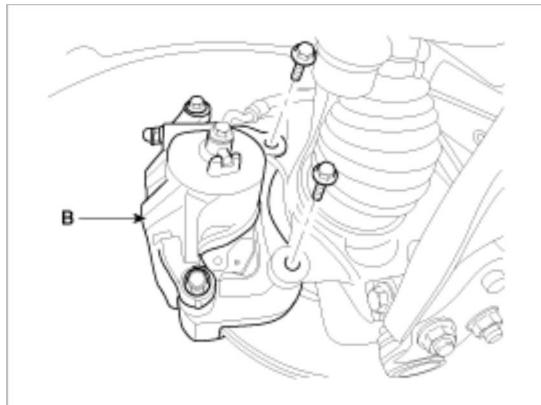
CAUTION

Be careful not to damage to the hub bolts when removing the front wheel and tire (A).

3. Remove the brake caliper mounting bolts, and then hold the brake caliper assembly (B) with wire.

Tightening torque :

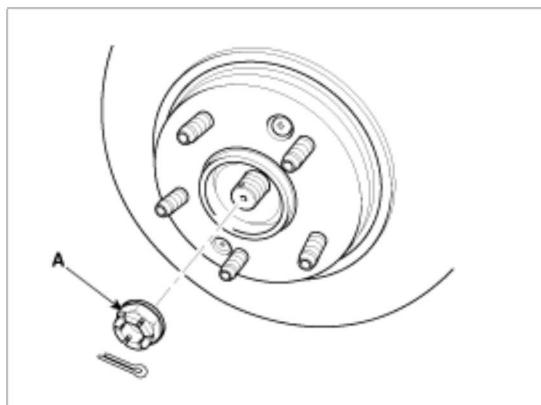
78.4 ~ 98.0N.m (8.0 ~ 10.0kgf.m, 57.8 ~ 72.3lb-ft)



4. Remove castle nut (A) from the front hub.

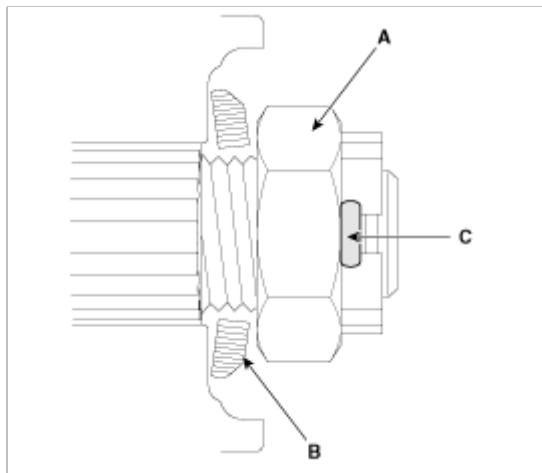
Tightening torque :

196.1 ~ 274.5N.m (20.0 ~ 28.0kgf.m, 144.6 ~ 202.5lb-ft)



CAUTION

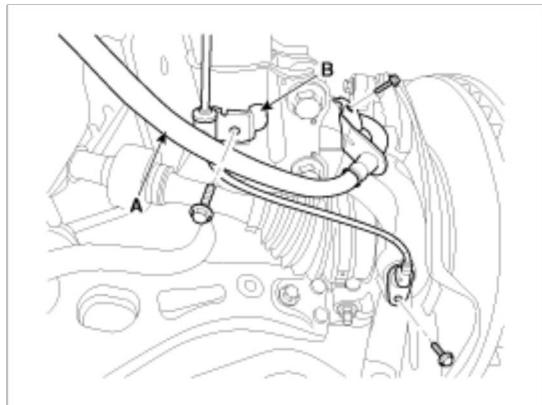
The washer (B) should be assembled with convex surface outward when installing the castle nut (A) and split pin (C). Also, don't reuse split pin (C) when reassembling.



5. Remove the brake hose (A) and wheel speed sensor (B).

Tightening torque :

6.8 ~ 10.8N.m (0.7 ~ 1.1kgf.m, 5.1 ~ 7.9lb-ft)



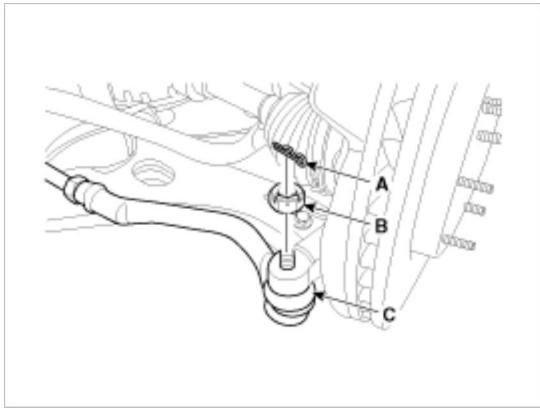
6. Remove the tie rod end ball joint(C) from the knuckle.

(1) Remove the split pin (A).

(2) Remove the castle nut (B).

Tightening torque :

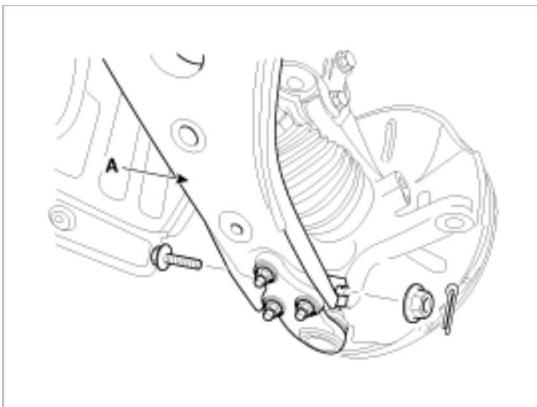
34.3 ~ 44.1N.m (3.5 ~ 4.5kgf.m, 25.3 ~ 32.5lb-ft)



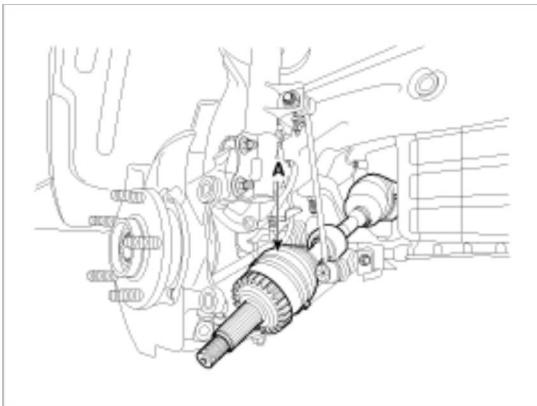
7. Remove the lower arm (A) mounting bolt and nut from the knuckle.

Tightening torque :

98.0 ~ 117.6N.m (10.0 ~ 12.0kgf.m, 72.3 ~ 86.7lb-ft)



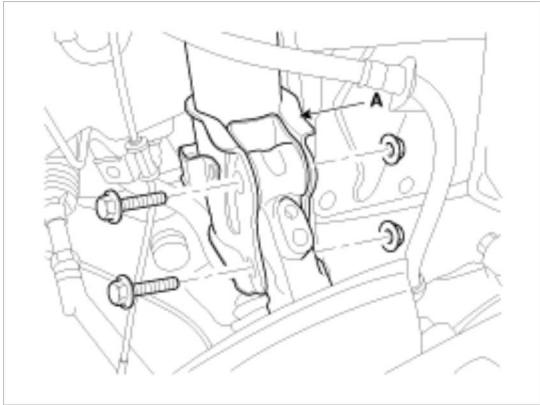
8. Disconnect the drive shaft end (A) from the knuckle.



9. Loosen the strut mounting bolts and then remove the hub and knuckle assembly from the strut assembly (A).

Tightening torque :

137.2 ~ 156.9N.m (14.0 ~ 16.0kgf.m, 101.2 ~ 115.7lb-ft)



CAUTION

Be careful not to damage the boot and rotor teeth.

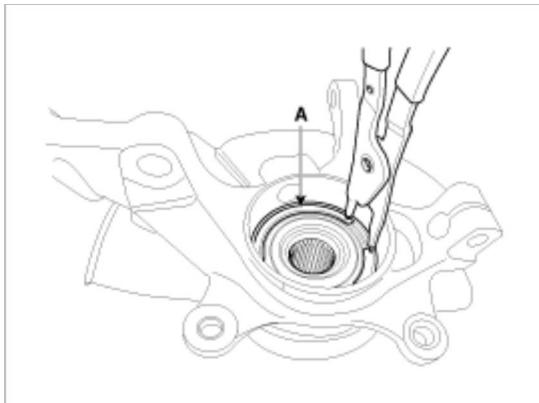
1. Install in the reverse order of removal.

Inspection

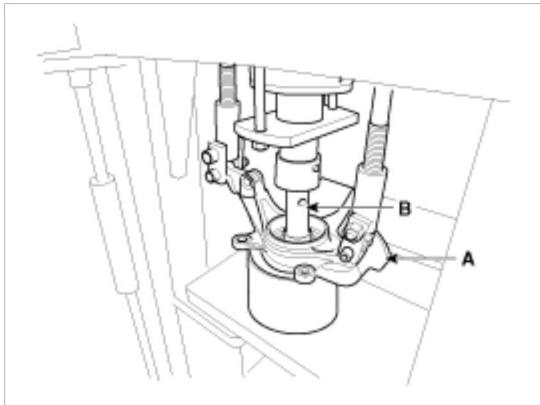
1. Check the hub for cracks and the splines for wear.
2. Check the brake disc for scoring and damage.
3. Check the knuckle for cracks
4. Check the bearing for cracks or damage.

Disassembly

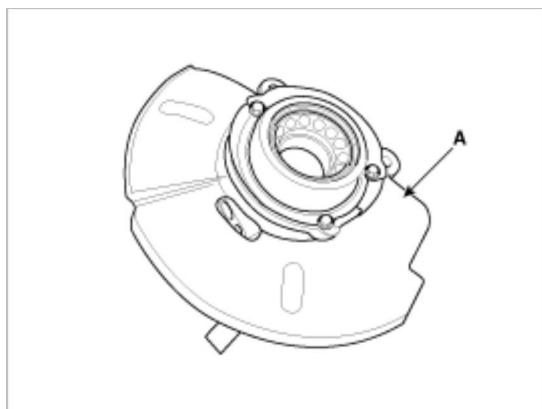
1. Using the snap ring pliers, remove the snap ring (A).



2. Remove the hub assembly from the knuckle assembly.
 - (1) Install the front knuckle assembly (A) on press.
 - (2) Lay a suitable adapter (B) upon the hub assembly shaft.

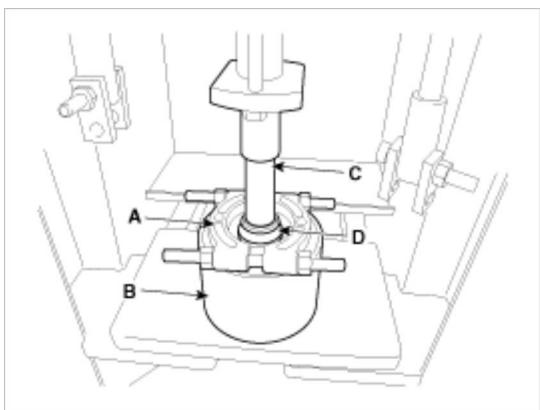


3. Remove the dust cover (A).



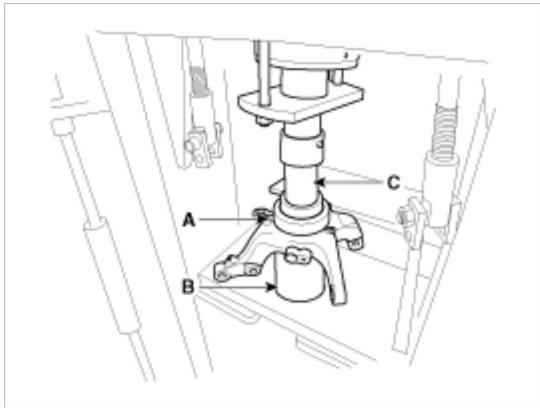
4. Remove the hub bearing inner race from the hub assembly

- (1) Install a suitable tool (A) for removing the hub bearing inner race on the hub assembly.
- (2) Lay the hub assembly and tool (A) upon a suitable adapter (B).
- (3) Lay a suitable adapter (C) upon the hub assembly shaft.
- (4) Remove the hub bearing inner race (D) from the hub assembly by using press.



5. Remove the hub bearing outer race from the knuckle assembly.

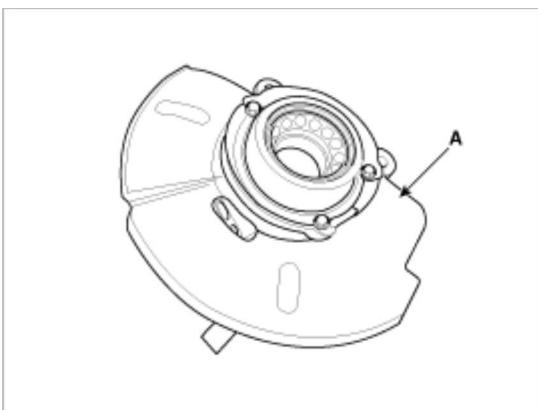
- (1) Lay the hub assembly (A) upon a suitable adapter (B).
- (2) Lay a suitable adapter (C) upon the hub bearing outer race.
- (3) Remove the hub bearing outer race from the knuckle assembly by using press.



6. Replace hub bearing with a new one.

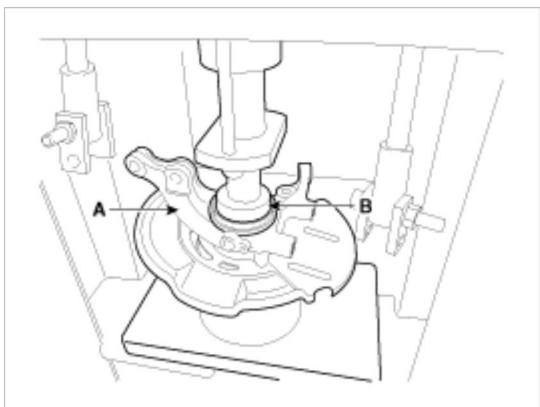
Reassembly

1. Install the dust cover (A).



2. Install the hub bearing to the knuckle assembly.

- (1) Lay the knuckle assembly (A) on press.
- (2) Lay a new hub bearing upon the knuckle assembly (A).
- (3) Lay a suitable adapter (B) upon the hub bearing.
- (4) Install the hub bearing to the knuckle assembly by using press.



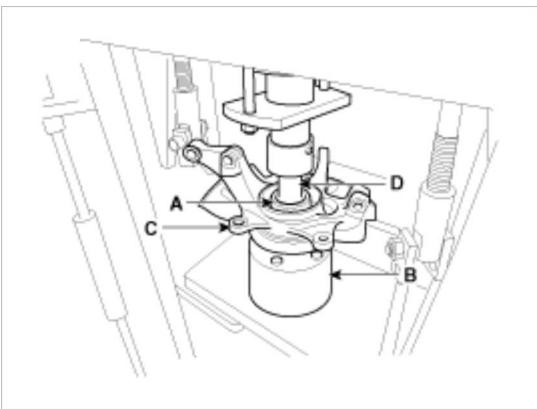
CAUTION

Do not press against the inner race of the hub bearing because that can cause damage to the bearing assembly.

Always use a new wheel bearing assembly.

3. Install the hub assembly to the knuckle assembly.

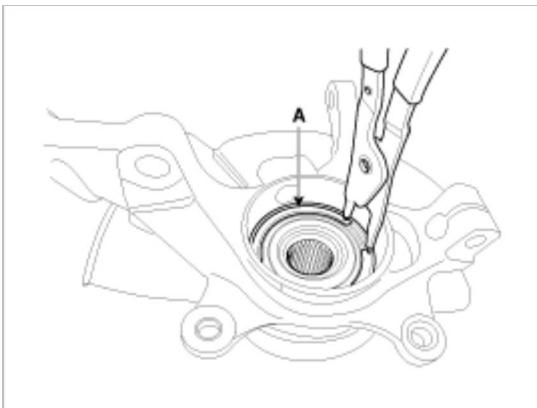
- (1) Lay the hub assembly (A) upon a suitable adapter (B).
- (2) Lay the knuckle assembly (C) upon the hub assembly (A).
- (3) Lay a suitable adapter (D) upon the hub bearing.
- (4) Install the hub assembly (A) to the knuckle assembly (C) by using press.



CAUTION

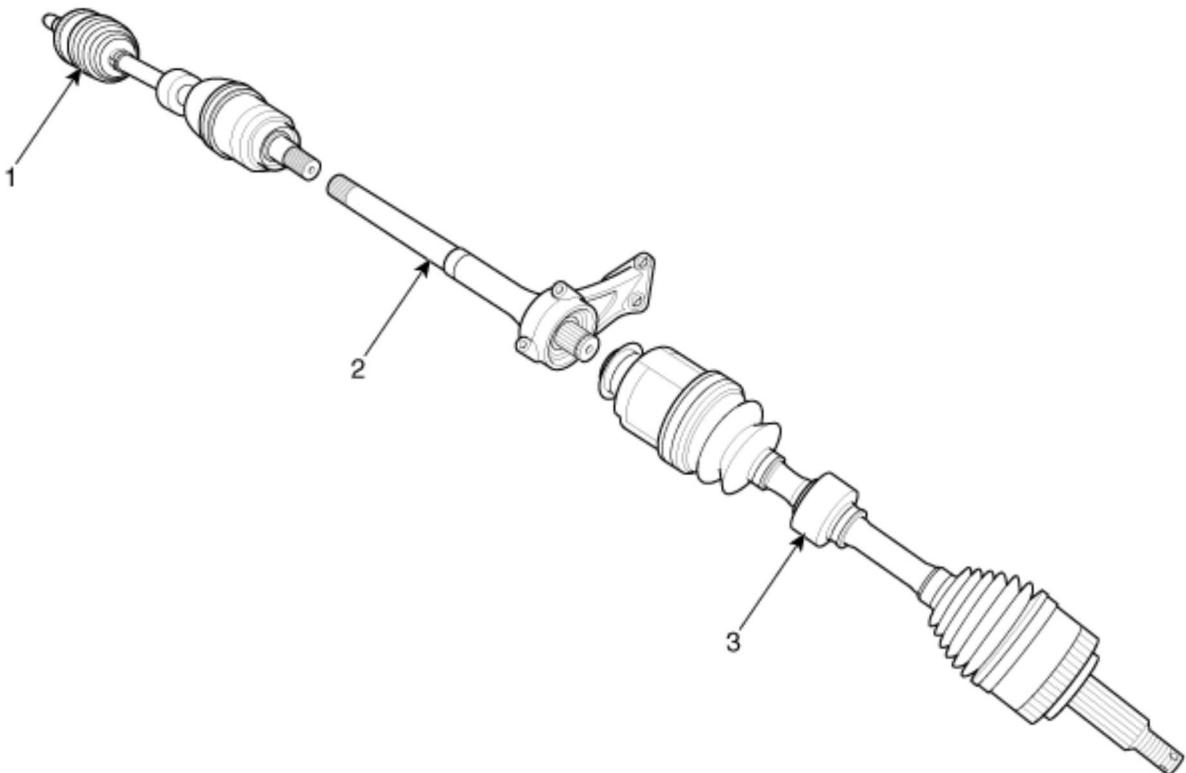
Do not press against the inner race of the hub bearing because that can cause damage to the bearing assembly.

4. Install the snap ring (A).



Driveshaft and axle > Driveshaft Assembly > Front Driveshaft > Components and Components Location

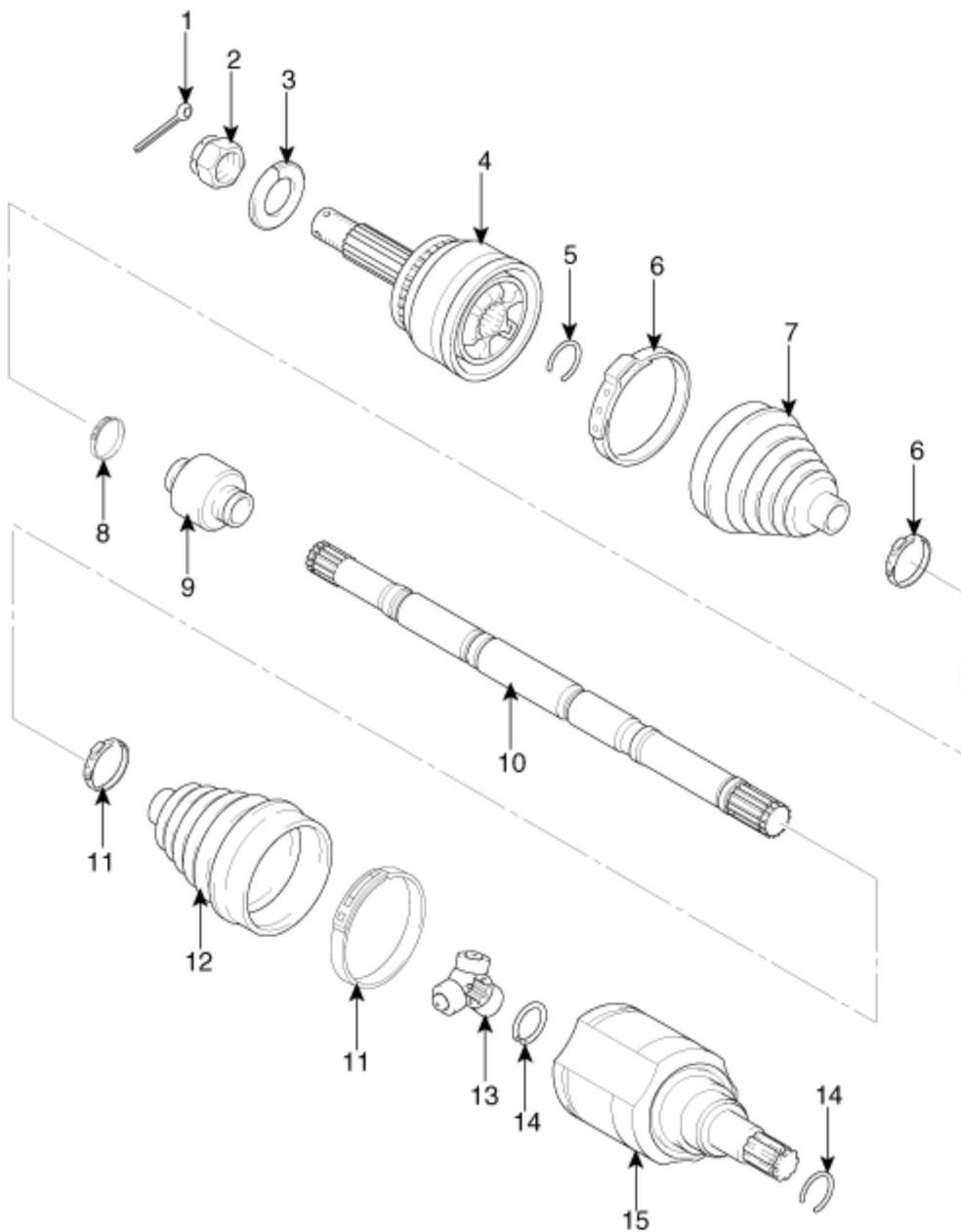
Components



1. Front driveshaft (LH)
2. inner shaft

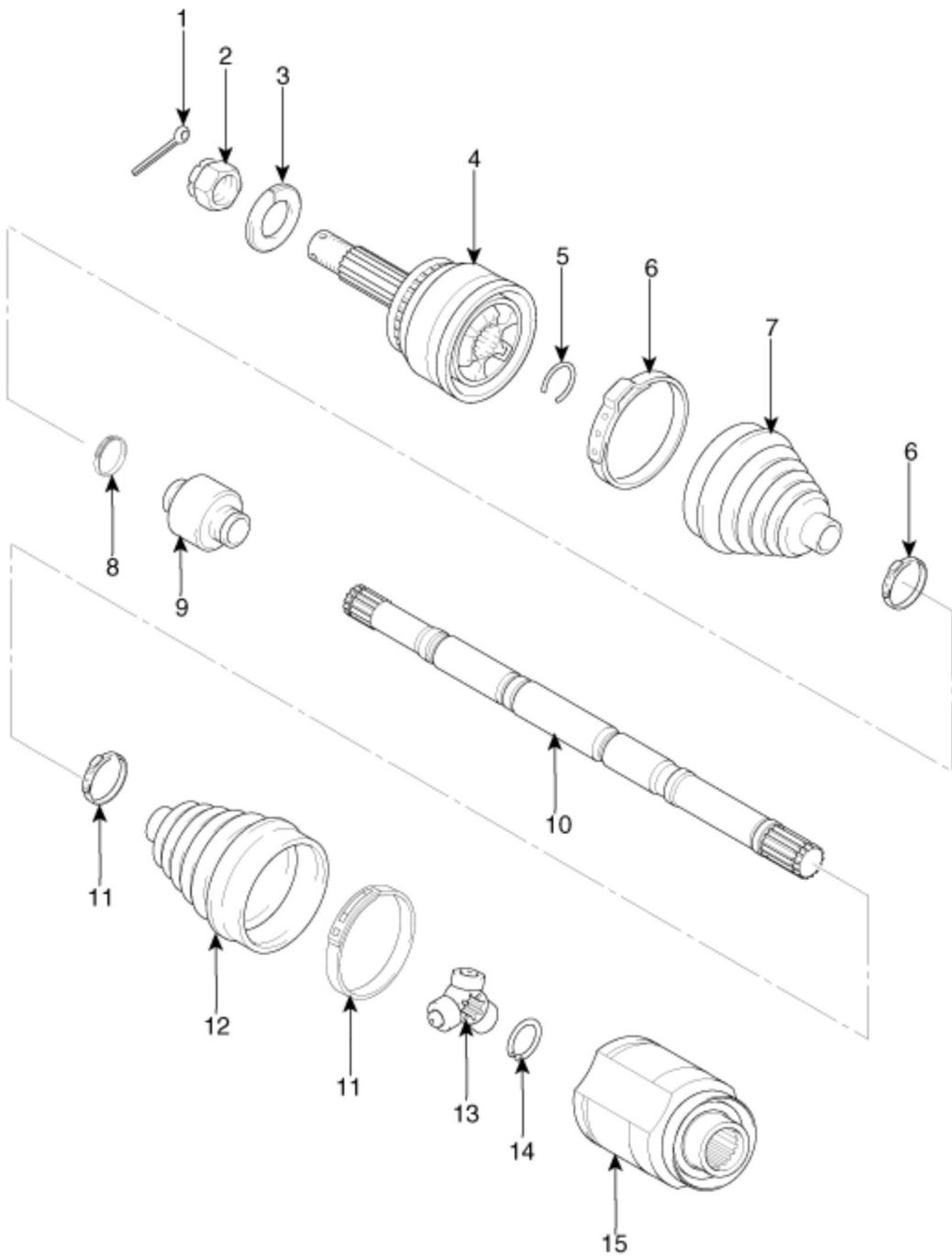
3. Front driveshaft (RH)

[LH]



1. Split pin	6. BJ boot band	11. VTJ boot band
2. Castle nut	7. BJ boot	12. VTJ boot
3. washer	8. Dynamic damper band	13. Spider assembly
4. BJ assembly	9. Dynamic damper	14. Circlip
5. Clip A	10. Shaft	15. VTJ housing

[RH]



1. Split pin	6. BJ boot band	11. VTJ boot band
2. Castle nut	7. BJ boot band	12. VTJ boot
3. Washer	8. Dynamic damper band	13. Spider assembly
4. BJ assembly	9. Dynamic damper	14. Circlip
5. Clip A	10. Shaft	15. VTJ housing

Driveshaft and axle > Driveshaft Assembly > Front Driveshaft > Repair procedures

Replacement

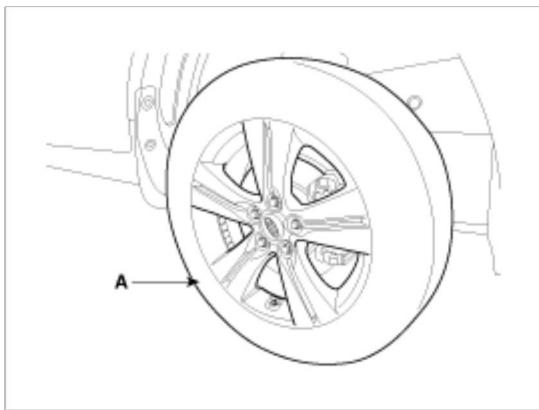
1. Loosen the wheel nuts slightly.

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 ~ 107.8N.m (9.0 ~ 11.0kgf.m, 65.0 ~ 79.5lb-ft)



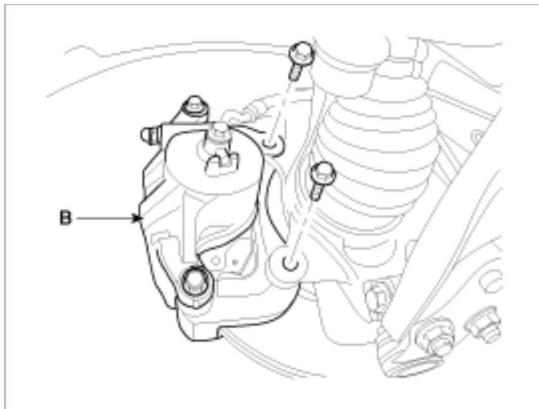
CAUTION

Be careful not to damage to the hub bolts when removing the front wheel and tire (A).

3. Remove the brake caliper mounting bolts, and then hold the brake caliper assembly (B) with wire.

Tightening torque :

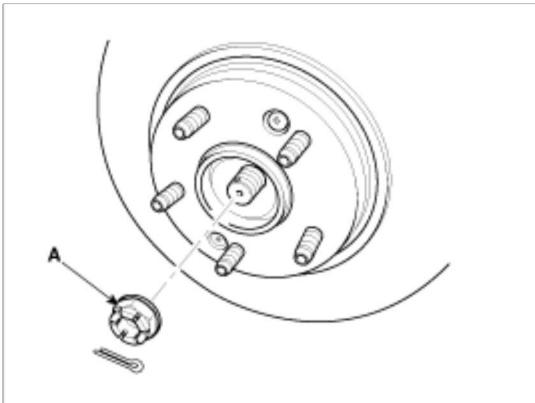
78.4 ~ 98.0N.m (8.0 ~ 10.0kgf.m, 57.8 ~ 72.3lb-ft)



4. Remove castle nut (A) from the front hub.

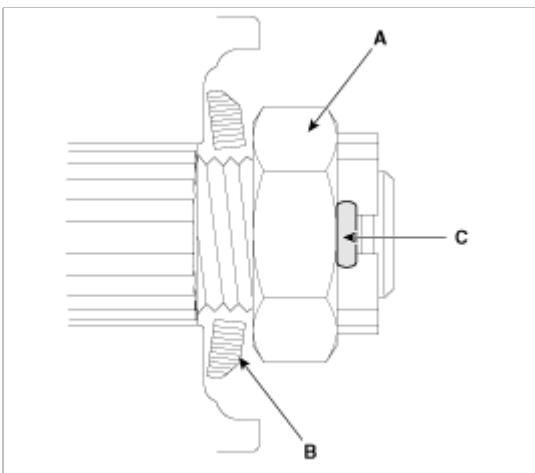
Tightening torque :

196.1 ~ 274.5N.m (20.0 ~ 28.0kgf.m, 144.6 ~ 202.5lb-ft)



CAUTION

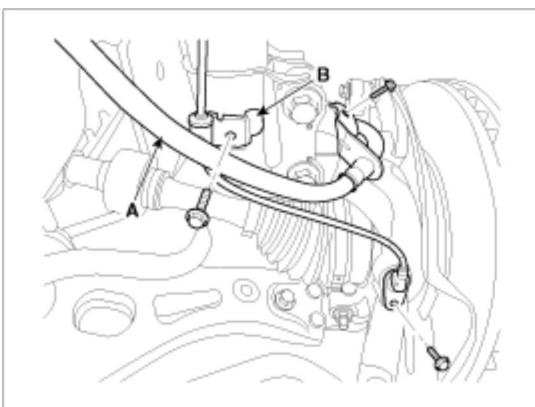
The washer (B) should be assembled with convex surface outward when installing the castle nut (A) and split pin (C). Also, don't reuse split pin (C) when reassembling.



5. Remove the brake hose (A) and wheel speed sensor (B).

Tightening torque :

6.8 ~ 10.8N.m (0.7 ~ 1.1kgf.m, 5.1 ~ 7.9lb-ft)



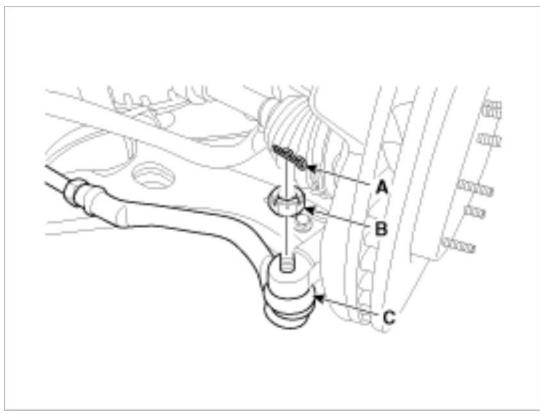
6. Remove the tie rod end ball joint(C) from the knuckle.

(1) Remove the split pin (A).

(2) Remove the castle nut (B).

Tightening torque :

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



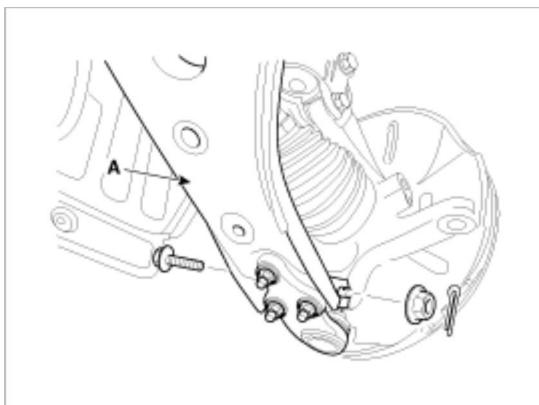
CAUTION

Apply a few drops of oil to the special tool. (Boot contact part)

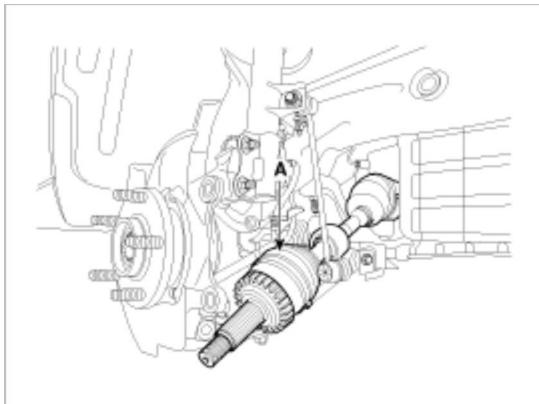
7. Remove the lower arm (A) mounting bolt from the knuckle.

Tightening torque :

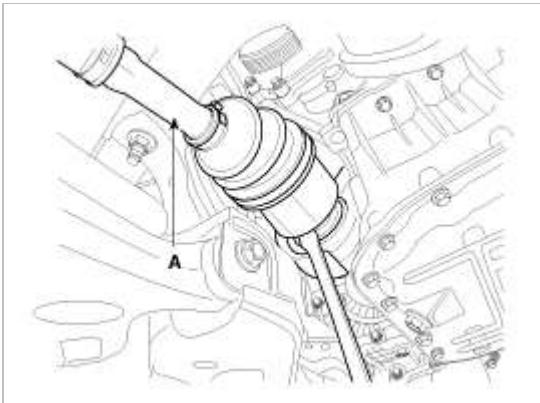
98.0 ~ 117.6N.m (10.0 ~ 12.0kgf.m, 72.3 ~ 86.7lb-ft)



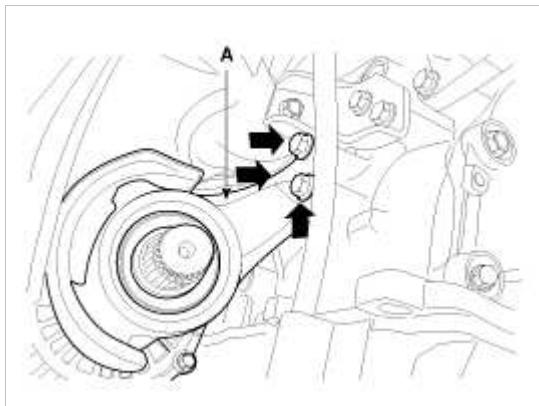
8. Disconnect the drive shaft end (A) from the knuckle.



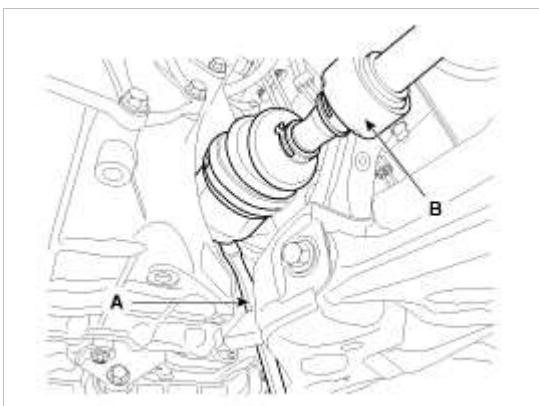
9. Remove the driveshaft assembly (A) from the inner shaft.



10. Remove the inner shaft mounting bolts and then disconnect the inner shaft (A).



11. Insert a pry bar (A) between the transaxle case and joint case , and separate the driveshaft (B) from the transaxle case.



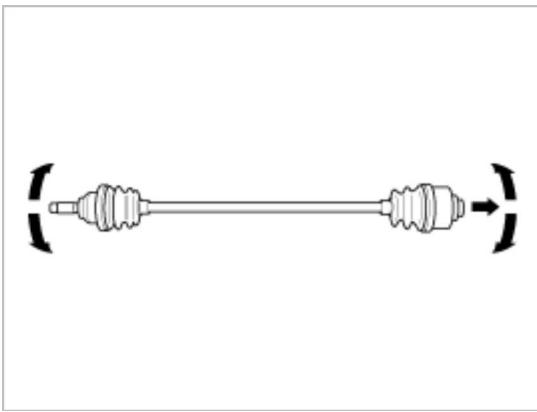
12. Install in the reverse order of removal.

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 ball joint for wear and damage.
3. Check the splines for wear and damage.
4. Check the dynamic damper for cracks, wear and position.



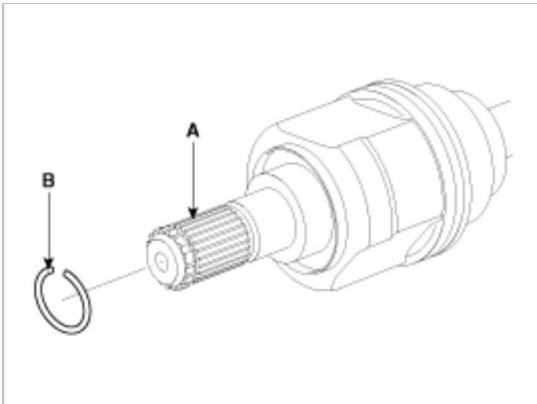
5. Check the driveshaft for cracks and wears.

Disassembly

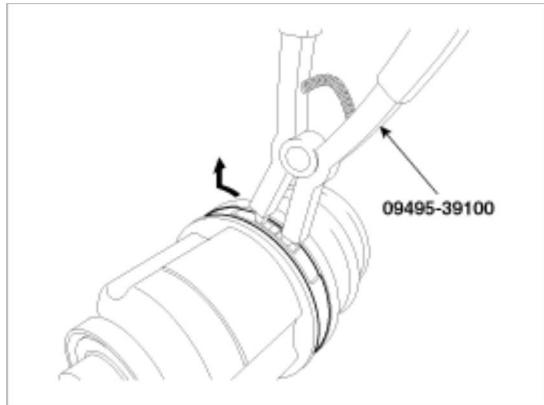
CAUTION

- Do not disassemble the BJ assembly.
- Special grease must be applied to the driveshaft joint. Do not substitute with another type of grease.
- The boot band should be replaced with a new one.

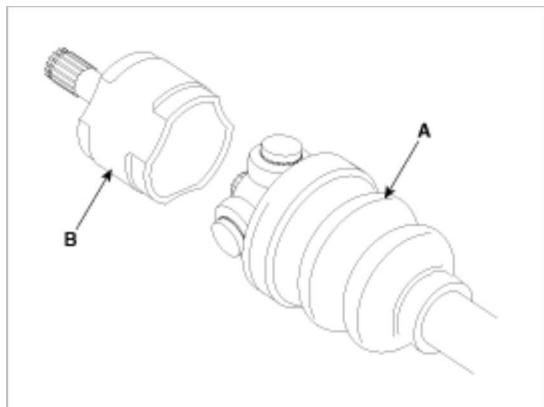
1. Remove the circlip (B) from driveshaft splines (A) of the transaxle side VTJ case.



2. Remove the both boot clamps from the transaxle side VTJ case. Using a flat-tipped (-) screwdriver, remove the both clamps of the transaxle side.

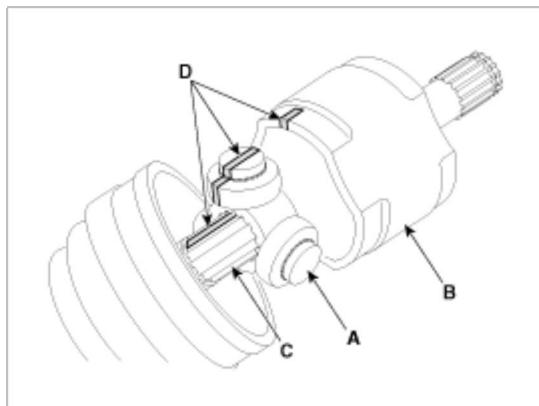


3. Pull out the boot from the transaxle side joint (VTJ).
4. While dividing joint boot (A) of the transaxle side, wipe the grease in VTJ case (B) and collect them respectively.

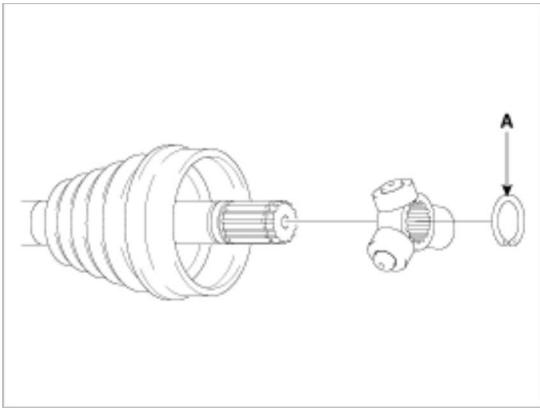


CAUTION

- Be careful not to damage the boot.
- According to below the illustrated, put marks (D) on roller of spider assembly (A), VTJ case (B) and spline part (C), to assist in re-assembly.



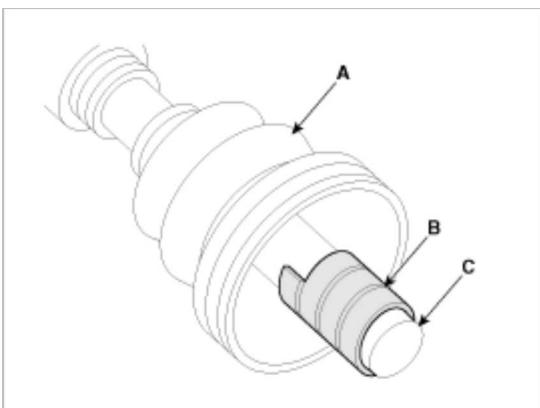
5. Using a snap ring plier or flat-tipped (-) screwdriver, remove the circlip (A).



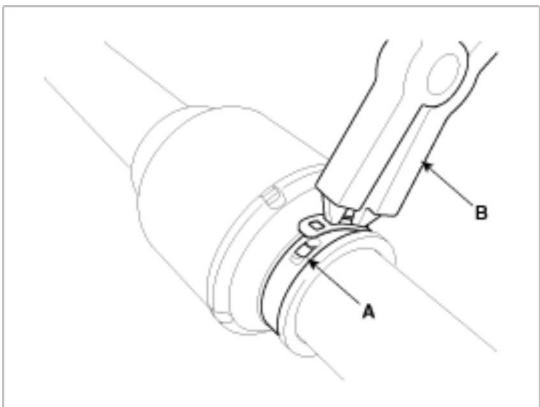
6. Clean the spider assembly.
7. Remove the boot (A) of the transaxle side joint (VTJ).

CAUTION

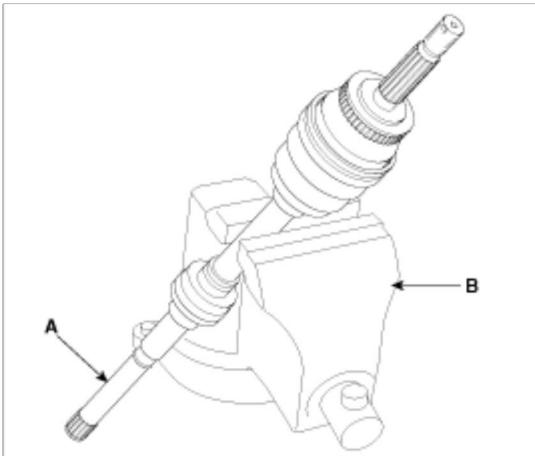
For reusing the boot (A), wrap tape (B) around the driveshaft splines (C) to protect the boot (A).



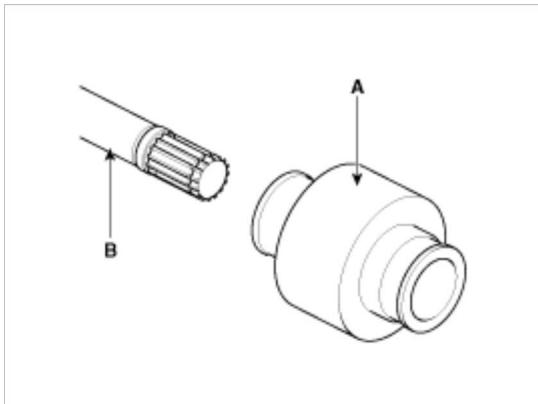
8. Using a plier or flat-tipped (-) screwdriver, remove the clamp (B) of the dynamic damper (A).



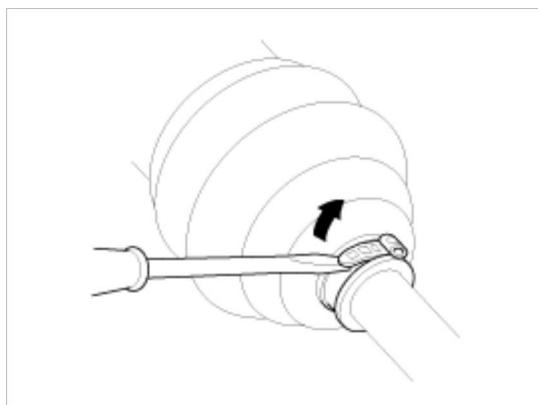
9. Fix the driveshaft (A) with a vice (B) as illustrated.



10. Apply soap powder on the shaft to prevent being damaged between the shaft spline and the dynamic damper when the dynamic damper is removed.
11. Separate the dynamic damper (A) from the shaft (B) carefully.



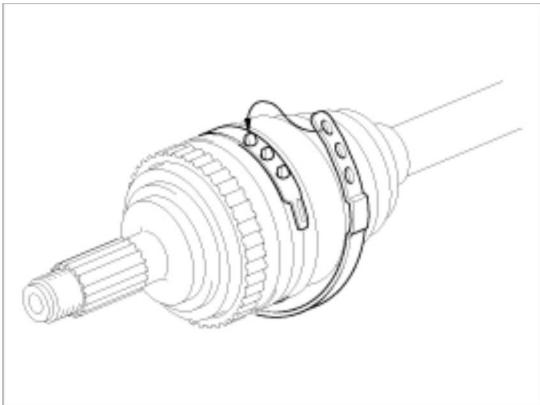
12. Using a plier or flat-tipped (-) screwdriver, remove the clamp on the side of wheel.



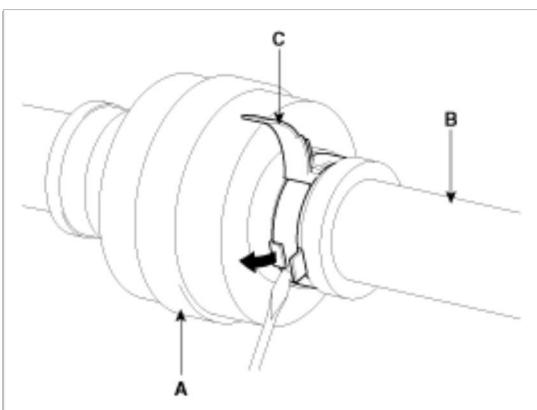
13. Pull out the joint (BJ) on the side of wheel into the transaxle direction. Be careful not to damage the boot.

Reassembly

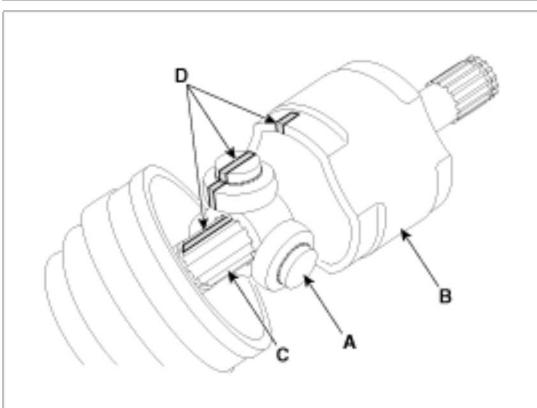
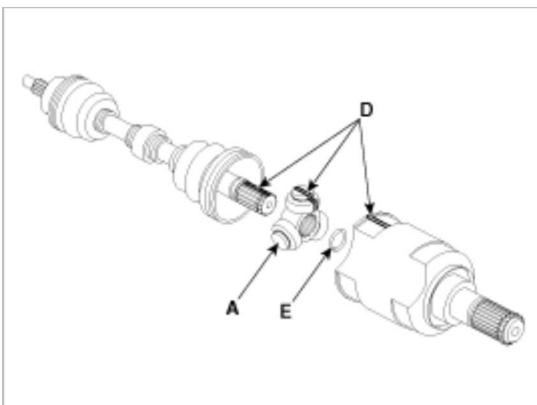
1. Wrap tape around the driveshaft splines (VTJ. side) to prevent damage to the boots.
2. Apply grease to the driveshaft and install the BJ boots.
3. Install the bands to both BJ boots.



4. To reassemble the dynamic damper (A), keeping the shaft (B) in the straight line. Tighten the dynamic damper (A) with dynamic damper band (C), as the illustration.

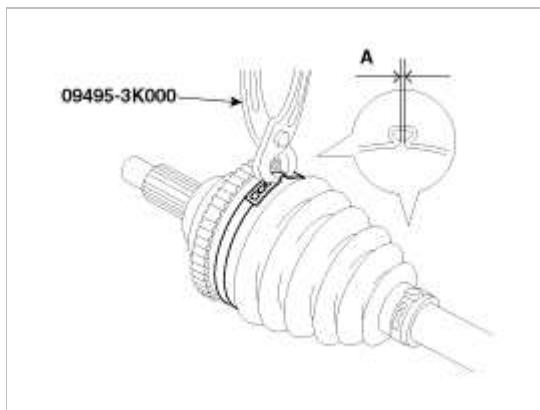


5. Install the VTJ boot bands and VTJ boot.
6. Install the spider assembly (A) and the circlip (E) to the spline (C) on the driveshaft.
At this time align the marks (D) each other.



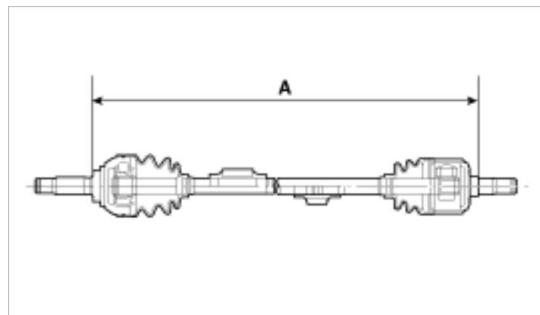
7. Install the clip to the VTJ case (B).
8. Add the specified grease to the VTJ as much as wiped away at inspection.
9. Install the VTJ boots.
10. Install the bands to both VTJ boots.
11. Using the SST(09495-3K000), secure the boot bands.

Clearance (A) : 2.0 mm (0.079 in.) or less



12. To control the air in the VTJ boot, keep the specified distance between the boot bands when they are tightened.

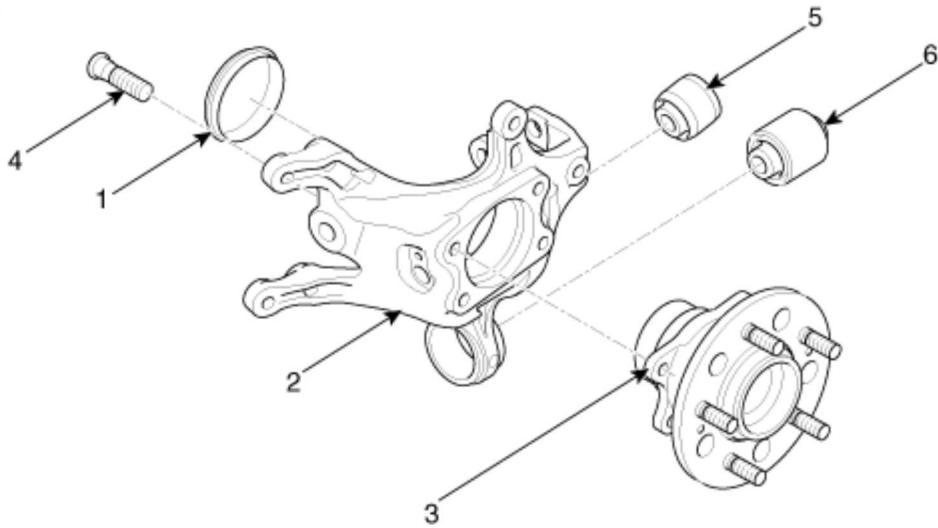
Distance (A)	LH side	RH side
Gasoline 2.0/2.4 AT 2WD(mm)	536.6 +26.8/-20.2	827.5 +26.8/-20.2
Gasoline 2.0/2.4 AT 4WD(mm)	531.6 +26.8/-20.2	511.4 +26.8/-20.2
Gasoline 2.0 MT 2WD(mm)	557.9	835.7 +26.8/-20.2
Gasoline 2.0 MT 4WD(mm)	+26.8/-20.2	511.4 +26.8/-20.2
Gasoline 2.4 MT 2WD(mm)	542.0	855.4 +26.8/-20.2
Gasoline 2.4 MT 4WD(mm)	+26.8/-20.2	511.4 +26.8/-20.2



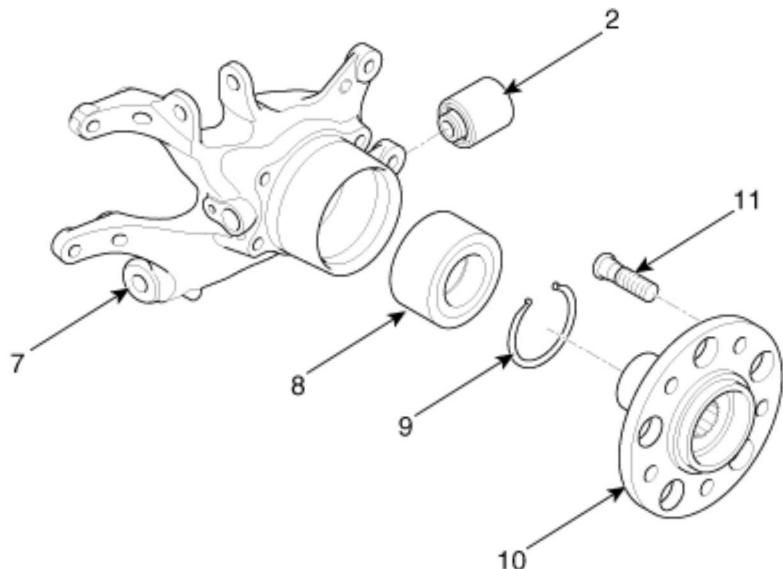
Driveshaft and axle > Rear Axle Assembly > Rear Hub - Carrier > Components and Components Location

Components

(2WD)



(4WD)



- | | |
|---------------------------|---------------------|
| 1. Hub cover | 7. Carrier assembly |
| 2. Carrier assembly | 8. Bearing |
| 3. Hub & bearing assembly | 9. Snap ring |
| 4. Hub mounting bolt | 10. Hub assembly |
| 5. Bushing | 11. Hub bolt |
| 6. Bushing | 12. Bushing |

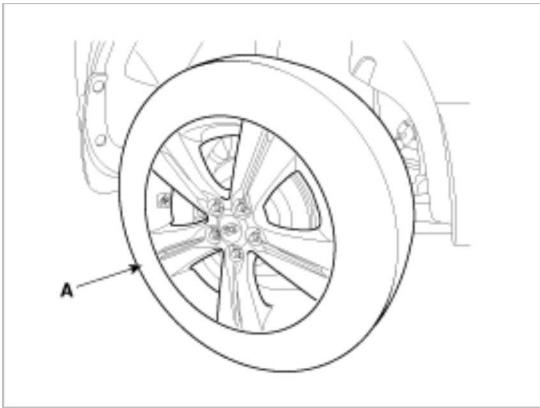
Driveshaft and axle > Rear Axle Assembly > Rear Hub - Carrier > Repair procedures

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 ~ 107.8N.m (9.0 ~ 11.0kgf.m, 65.0 ~ 79.5lb-ft)



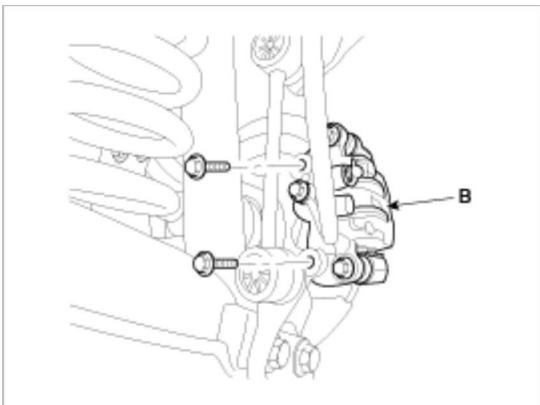
CAUTION

Be careful not to damage to the hub bolts when removing the rear wheel and tire (A).

3. Remove the brake caliper mounting bolts , and then hold the brake caliper assembly (B) with wire.

Tightening torque :

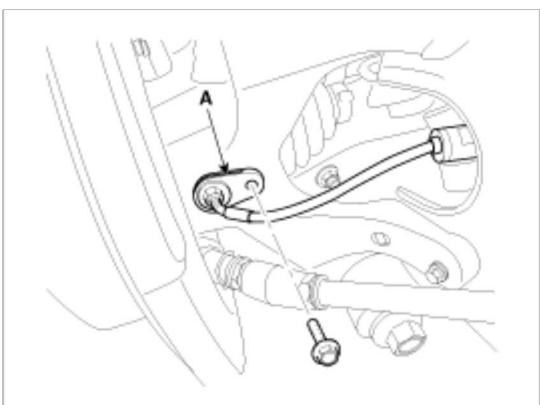
78.4 ~ 98.0N.m (8.0 ~ 10.0kgf.m, 57.8 ~ 72.3lb-ft)



4. Remove the wheel speed sensor (A), from the knuckle.

Tightening torque :

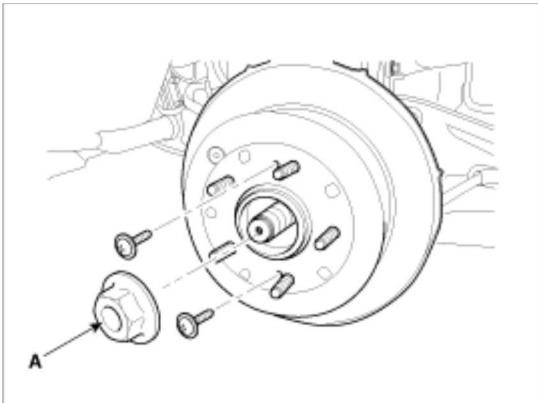
6.8 ~ 10.8N.m (0.7 ~ 1.1kgf.m, 5.1 ~ 7.9lb-ft)



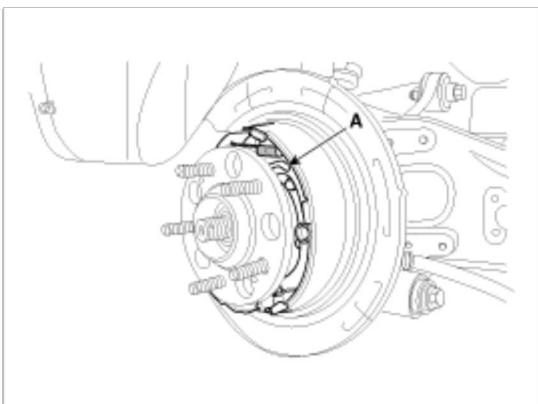
5. Remove castle nut (A) from the rear hub.

Tightening torque :

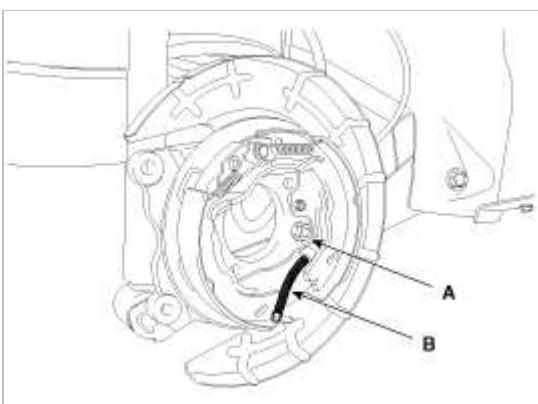
196.1 ~ 274.5N.m (20.0 ~ 28.0kgf.m, 144.6 ~ 202.5lb-ft)



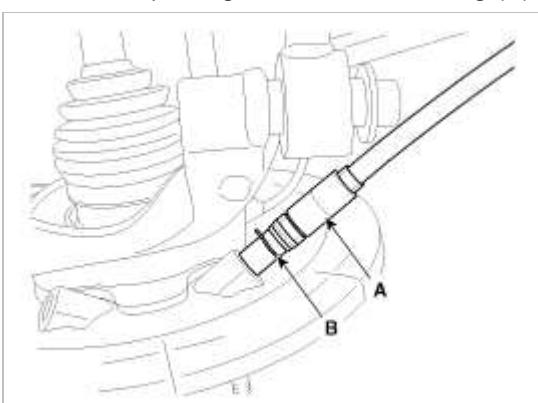
6. Remove the rear brake lining assembly (A). (Refer to BR group - Parking brake system)



7. Remove the parking brake cable (B) from the brake shoe (A).



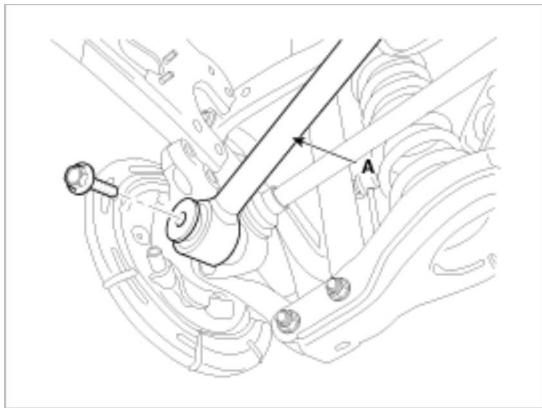
8. Remove the parking brake cable retaining (B), from the parking brake cable (A).



9. Remove the assist arm (A) from the rear axle carrier.

Tightening torque :

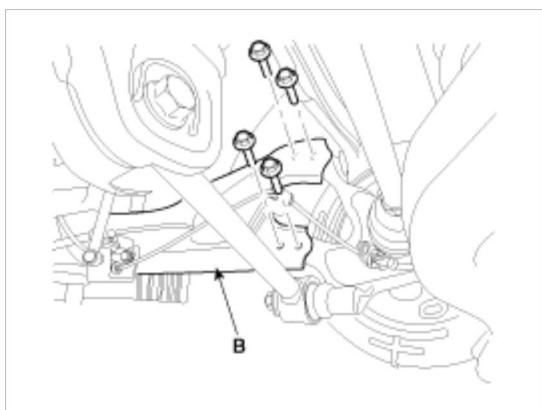
137.2 ~ 156.9N.m (14.0 ~ 16.0kgf.m, 101.2 ~ 115.7lb-ft)



10. Remove the trailing arm (B) from the rear axle carrier.

Tightening torque :

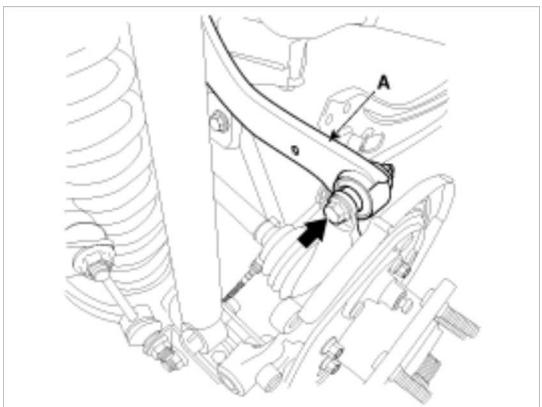
34.3 ~ 53.9N.m (3.5 ~ 5.5kgf.m, 25.3 ~ 39.7lb-ft)



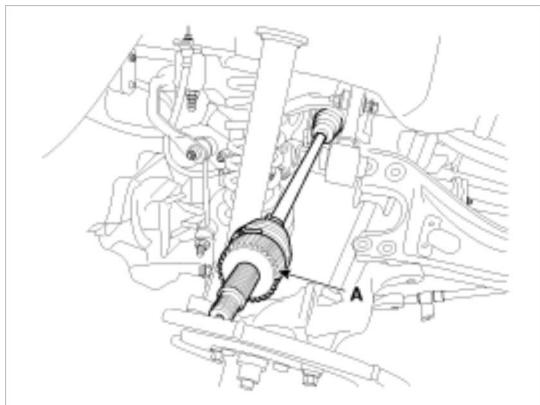
11. Remove the upper arm (A) from the rear axle carrier.

Tightening torque :

98.0 ~ 117.6N.m (10.0 ~ 12.0kgf.m, 72.3 ~ 86.7lb-ft)



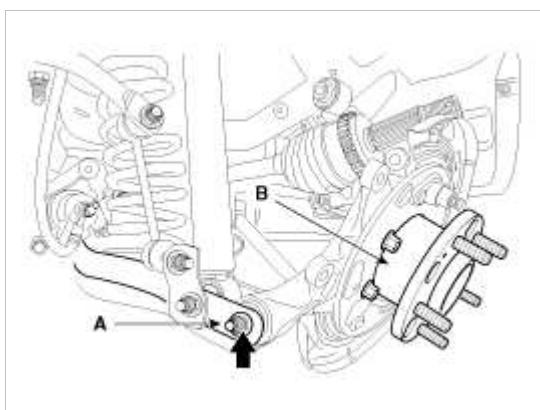
12. Push the rear axle carrier outward and separate the driveshaft (A) from the axle hub .



13. Remove the lower arm (A) from the rear axle carrier(B).

Tightening torque :

137.2 ~ 156.9N.m (14.0 ~ 16.0kgf.m, 101.2 ~ 115.7lb-ft)



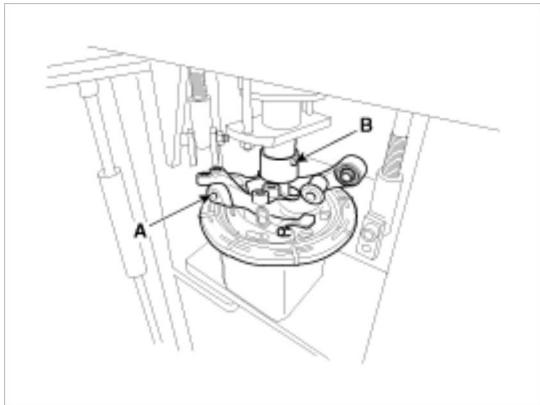
14. Install in the reverse order of removal.

Inspection

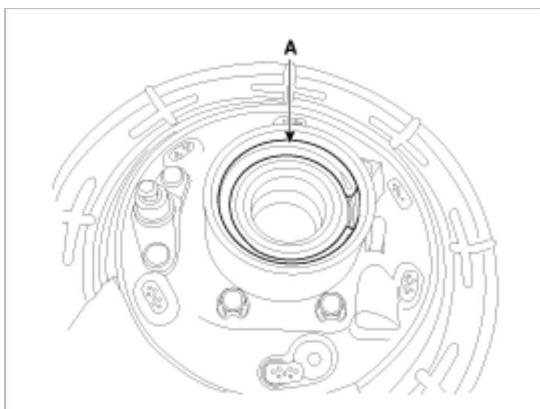
1. Check the hub for cracks and the splines for wear.
2. Check the brake disc for scoring and damage.
3. Check the rear axle carrier for cracks
4. Check the bearing for cracks or damage.

Disassembly

1. Remove the hub assembly form the near knuckle assembly.
 - (1) Install the rear knuckle assembly (A) on press.
 - (2) Lay a suitable adapter (B) upon the hub assembly shaft.

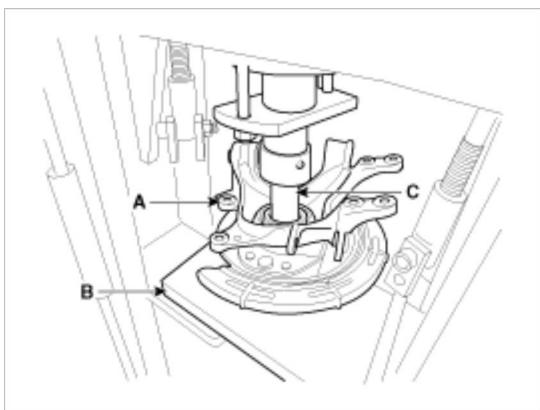


2. Using the snap ring pliers, remove the snap ring (A).



3. Remove the hub bearing outer race from the hub assembly.

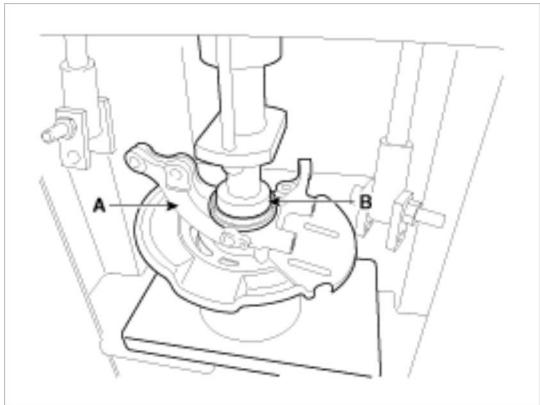
- (1) Lay the knuckle assembly (A) upon a suitable adapter (B).
- (2) Lay a suitable adapter (C) upon the hub bearing outer race.
- (3) Remove the hub bearing outer race from the knuckle assembly by using press.



4. Replace hub bearing with a new one.

Reassembly

1. Install the hub bearing to the knuckle assembly.
 - (1) Lay the knuckle assembly (A) on press.
 - (2) Lay a new hub bearing upon the knuckle assembly (A).
 - (3) Lay a suitable adapter (B) upon the hub bearing.
 - (4) Install the hub bearing to the knuckle assembly by using press.



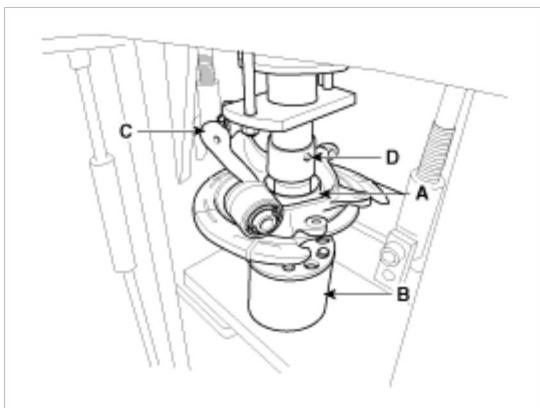
CAUTION

Do not press against the inner race of the hub bearing because that can cause damage to the bearing assembly.

Always use a new wheel bearing assembly.

2. Install the hub assembly to the knuckle assembly.

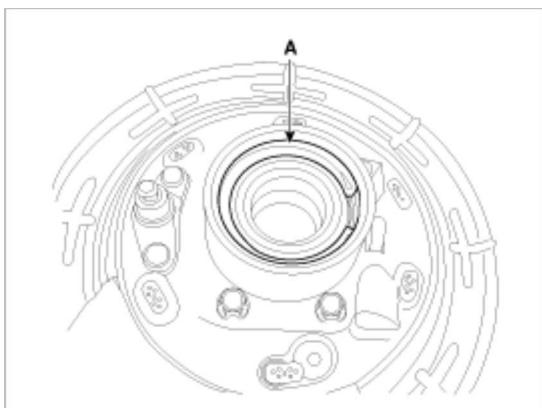
- (1) Lay the hub assembly (A) upon a suitable adapter (B).
- (2) Lay the knuckle assembly (C) upon the hub assembly (A).
- (3) Lay a suitable adapter (D) upon the hub bearing.
- (4) Install the hub assembly (A) to the knuckle assembly (C) by using press.



CAUTION

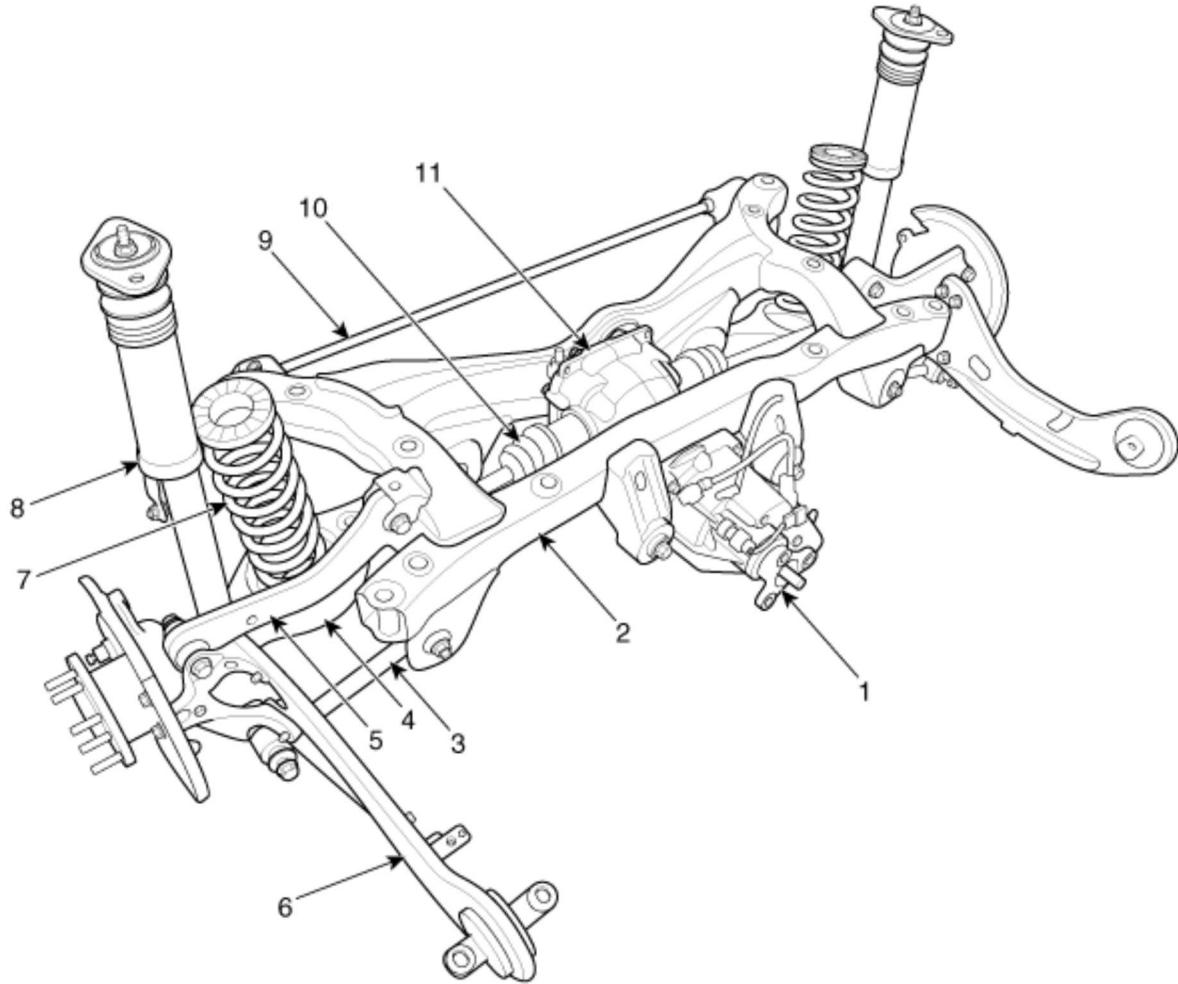
Do not press against the inner race of hub bearing because that can cause damage to the bearing assembly.

3. Install the snap ring (A).



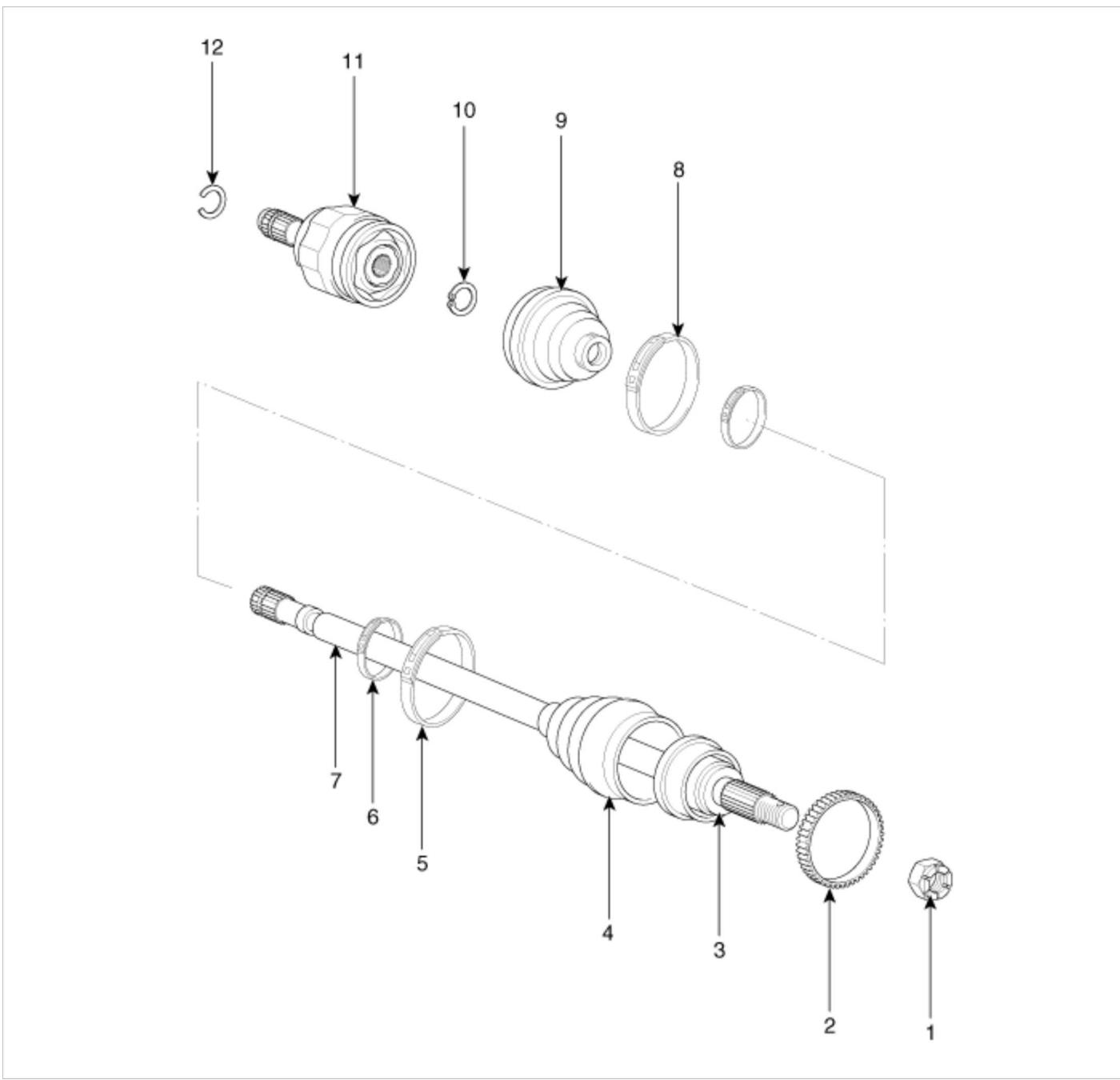
Driveshaft and axle > Rear Driveshaft Assembly > Rear Driveshaft > Components and Components Location

Component location



- | | |
|---------------|-----------------------------------|
| 1. Coupling | 6. Trailing arm |
| 2. Sub frame | 7. Coil spring |
| 3. Assist arm | 8. Shock absorber |
| 4. Lower arm | 9. Stabilizer |
| 5. Upper arm | 10. Drive shaft |
| | 11. Differential carrier assembly |

Components



1. Lock nut	5. BJ boot big part band	9. TJ boot
2. Tone wheel	6. Boot small part band	10. Snap ring
3. BJ assembly	7. Shaft	11. TJ assembly
4. BJ boot	8. TJ boot big part band	12. Circlip

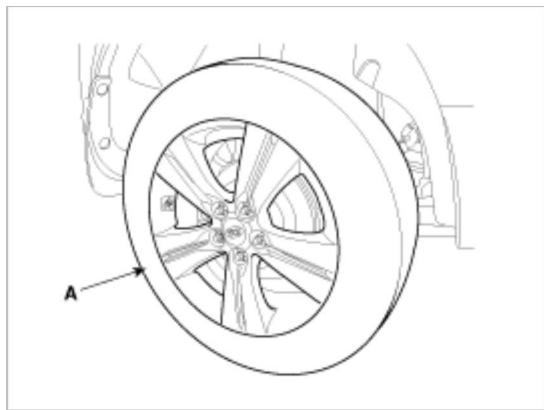
Driveshaft and axle > Rear Driveshaft Assembly > Rear Driveshaft > Repair procedures

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 ~ 107.8N.m (9.0 ~ 11.0kgf.m, 65.0 ~ 79.5lb-ft)



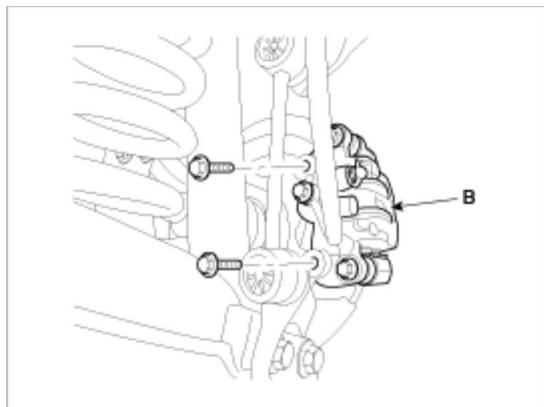
CAUTION

Be careful not to damage to the hub bolts when removing the rear wheel and tire (A).

3. Remove the brake caliper mounting bolts , and then hold the brake caliper assembly (B) with wire.

Tightening torque :

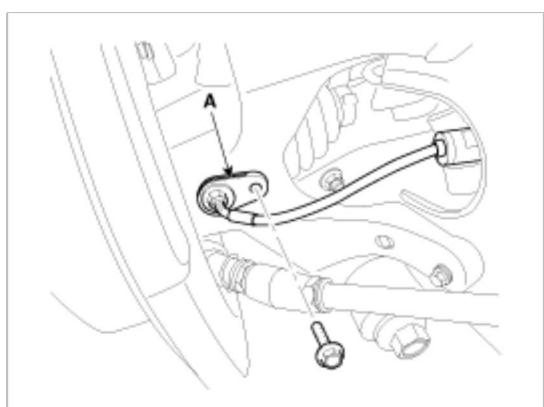
78.4 ~ 98.0N.m (8.0 ~ 10.0kgf.m, 57.8 ~ 72.3lb-ft)



4. Remove the wheel speed sensor (A), from the knuckle.

Tightening torque :

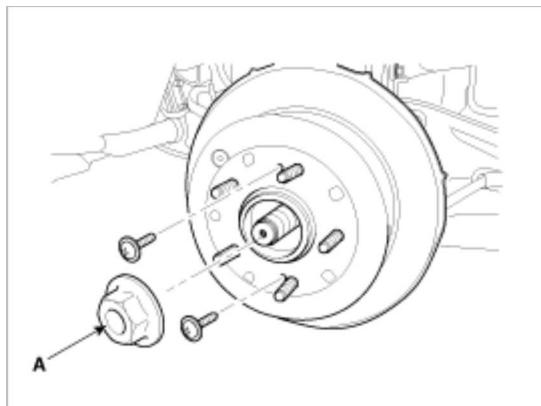
6.8 ~ 10.8N.m (0.7 ~ 1.1kgf.m, 5.1 ~ 7.9lb-ft)



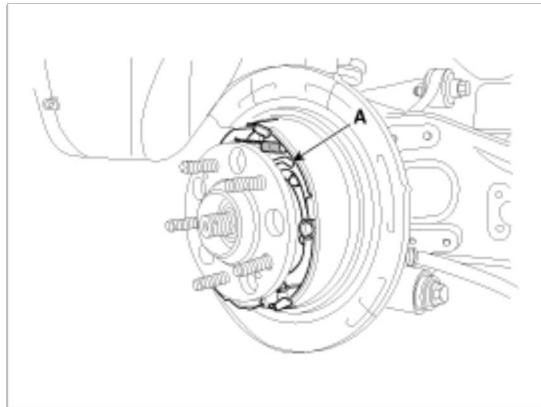
5. Remove castle nut (A) from the rear hub.

Tightening torque :

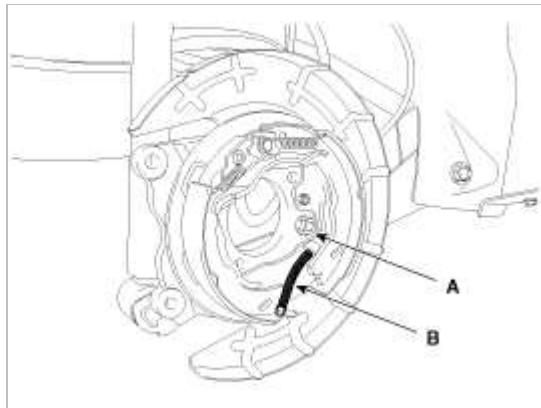
196.1 ~ 274.5N.m (20.0 ~ 28.0kgf.m, 144.6 ~ 202.5lb·ft)



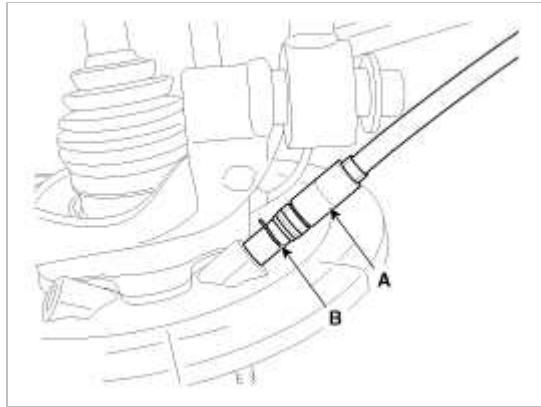
6. Remove the rear brake lining assembly (A). (Refer to BR group - Parking brake system)



7. Remove the parking brake cable (B) from the brake shoe (A).



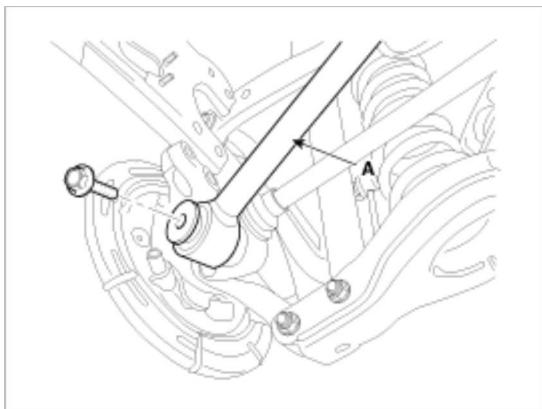
8. Remove the parking brake cable retaining (B), from the parking brake cable (A).



9. Remove the assist arm (A) from the rear axle carrier.

Tightening torque :

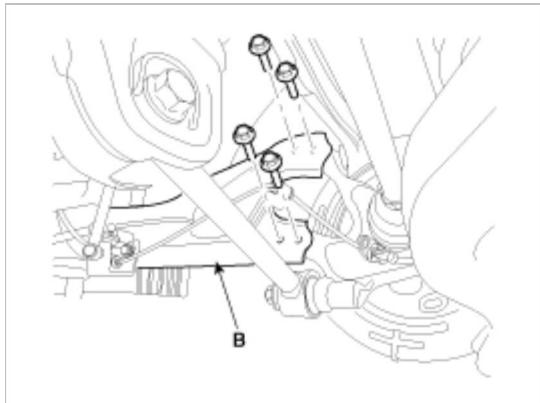
137.2 ~ 156.9N.m (14.0 ~ 16.0kgf.m, 101.2 ~ 115.7lb-ft)



10. Remove the trailing arm (B) from the rear axle carrier.
-

Tightening torque :

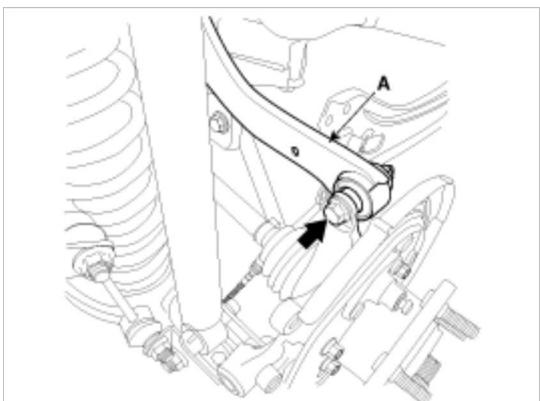
34.3 ~ 53.9N.m (3.5 ~ 5.5kgf.m, 25.3 ~ 39.7lb-ft)



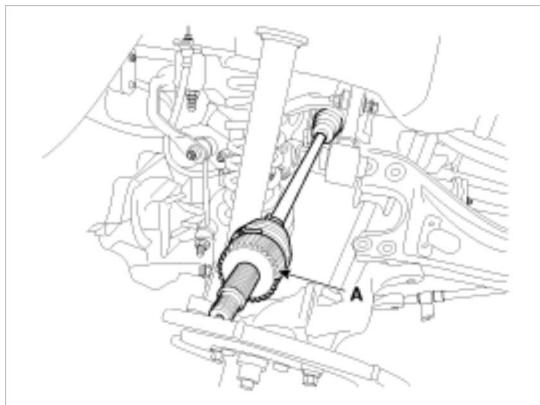
11. Remove the upper arm (A) from the rear axle carrier.
-

Tightening torque :

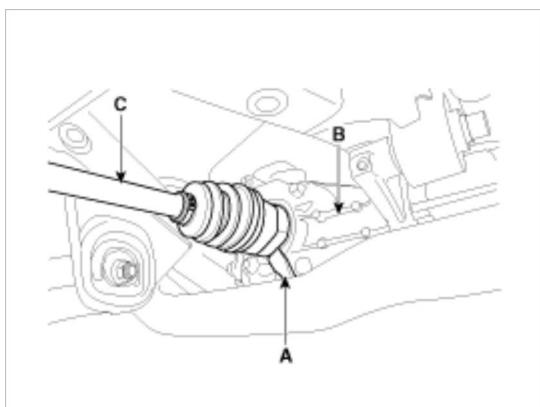
98.0 ~ 117.6N.m (10.0 ~ 12.0kgf.m, 72.3 ~ 86.7lb-ft)



12. Push the rear axle carrier outward and separate the driveshaft (A) from the axle hub.



13. Insert a pry bar (A) between the differential case and joint case, and separate the driveshaft (B) from the differential case.

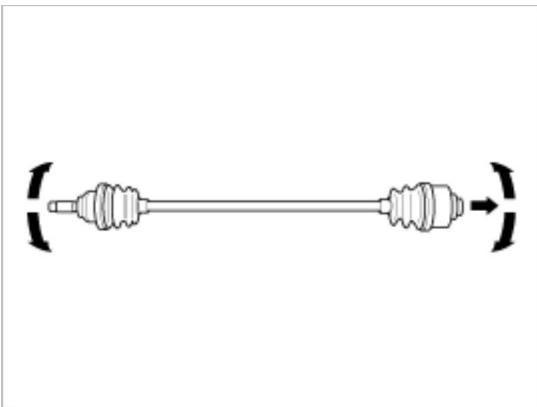


CAUTION

- Use a pry bar (A) being careful not to damage the differential 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 differential case with the oil seal cap to prevent contamination.
- Support the driveshaft properly.
- Replace the retainer ring whenever the driveshaft is removed from the differential case.

Inspection

1. Check the driveshaft boots for damage and deterioration.
2. Check the ball joint for wear and damage.
3. Check the splines for wear and damage.

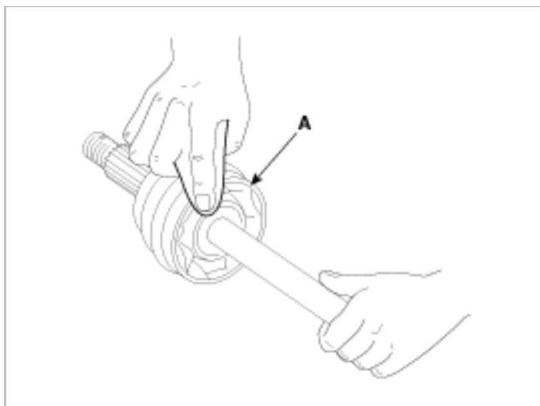


4. Check the driveshaft for cracks and wears.
5. Check the TJ outer race, inner race, cage and balls for rust or damage.
6. Check for water, foreign matter, or rust in the BJ boot.

CAUTION

When the BJ assembly (A) is to be reused, do not wipe away the grease.

Check that there are no foreign substances in the grease. If necessary, clean the BJ assembly (A) and replace grease.



Disassembly

CAUTION

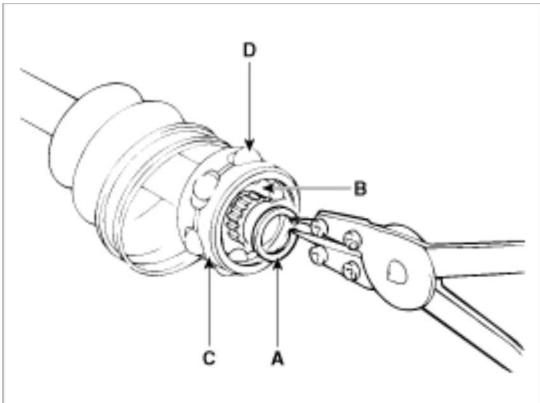
- Do not disassemble the BJ assembly.
- Special grease must be applied to the driveshaft joint. Do not substitute with another type of grease.
- The boot band should be replaced with a new one.

1. Remove the TJ boot bands and pull the TJ boot from the TJ outer race.
 - (1) Using a pliers or flat-tipped (-) screwdriver, remove the LH boot band and LH TJ boot band from the driveshaft.
 - (2) Remove RH boot band and RH TJ boot band in the same way of LH removal procedure.

CAUTION

Be careful not to damage the boot.

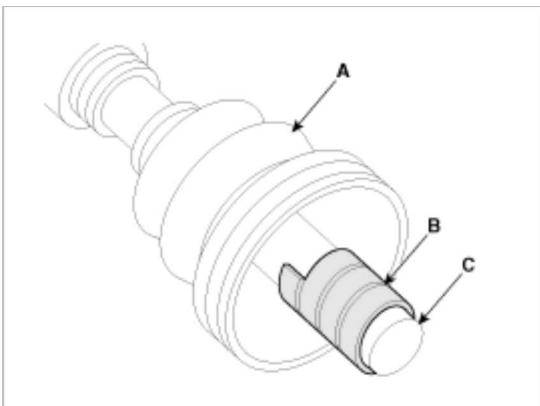
2. Pull out the driveshaft from the TJ outer race.
3. Remove the snap ring (A) and take out the inner race(B), cage(C) and balls(D) as an assembly.



4. Clean the inner race, cage and balls without disassembling.
5. Remove the BJ boot bands and pull out the TJ boot and BJ boot.

CAUTION

If the boot (A) is to be reused, wrap tape(B) around the driveshaft splines(C) to protect the boot (A).

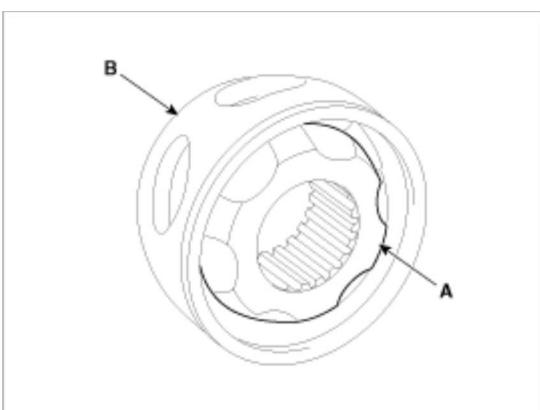


Reassembly

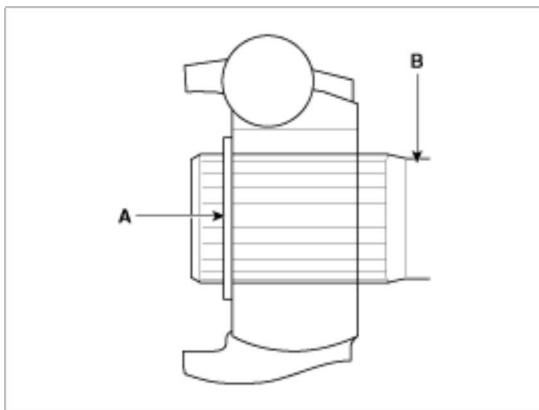
1. Wrap tape around the driveshaft splines (TJ side) to prevent damage to the boots.
2. Apply grease to the driveshaft and install the boots.
3. Apply the specified grease to the inner race (A) and cage (B). Install the cage (B) so that it is offset on the race as shown.

CAUTION

Use the grease included in the repair kit.



4. Apply the specified grease to the cage and fit the balls into the cage.
5. Position the chamfered side (A) as shown in the illustration. Install the inner race on the driveshaft(B), and then the snap ring.

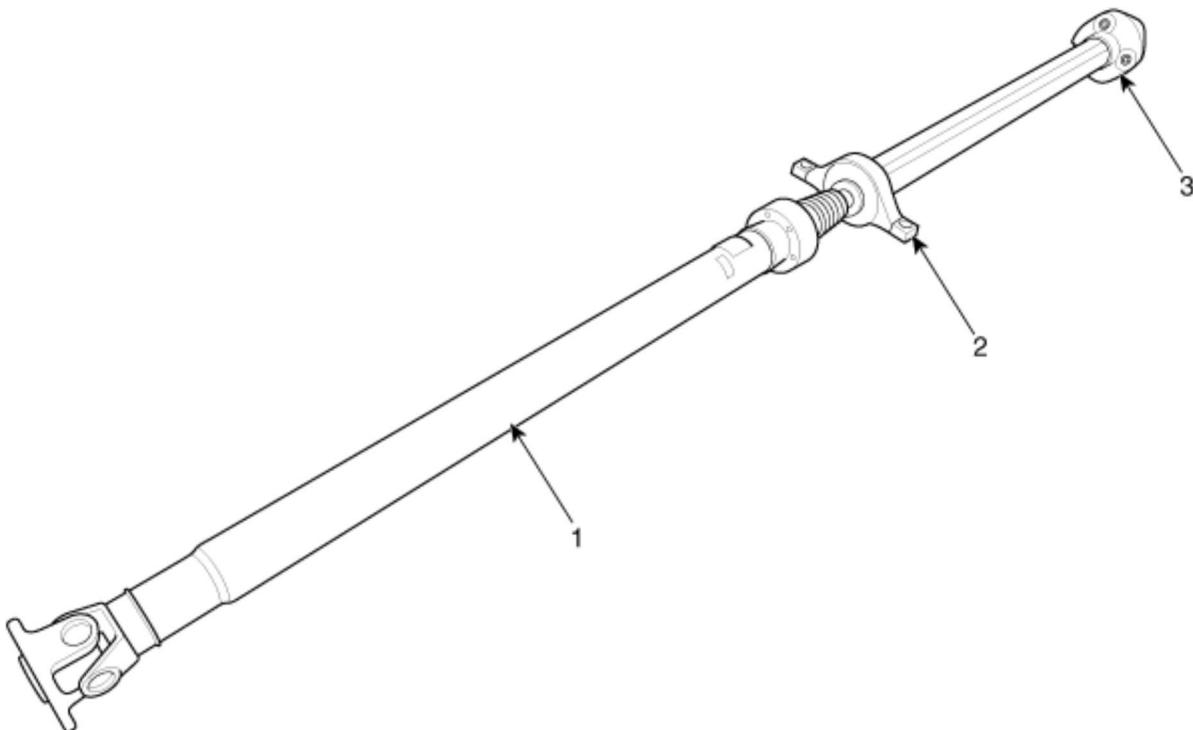


6. Apply the specified grease to the outer race and install the BJ outer race onto the driveshaft.
7. Apply the specified grease into the TJ boot and install the boot with a clip.
8. Tighten the TJ boot bands.
9. Add the specified grease to the BJ as much as wiped away at inspection.
10. Install the boots.
11. Tighten the BJ boot bands.
12. To control the air in the TJ boot, keep the specified distance between the boot bands when they are tightened.

Distance (mm)	LH	RH
ALL	699.5 +22.8/-19.3	680.3 +22.8/-19.3

Driveshaft and axle > Propeller Shaft Assembly > Propeller Shaft > Components and Components Location

Components



1. Front propeller shaft
2. Center bearing bracket

3. Rear propeller shaft

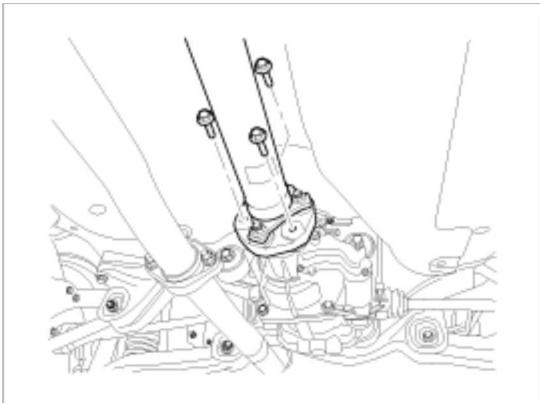
Driveshaft and axle > Propeller Shaft Assembly > Propeller Shaft > Repair procedures

Replacement

1. After making a match mark on the flange yoke and transaxle companion, remove the propeller shaft mounting bolts.

Tightening torque :

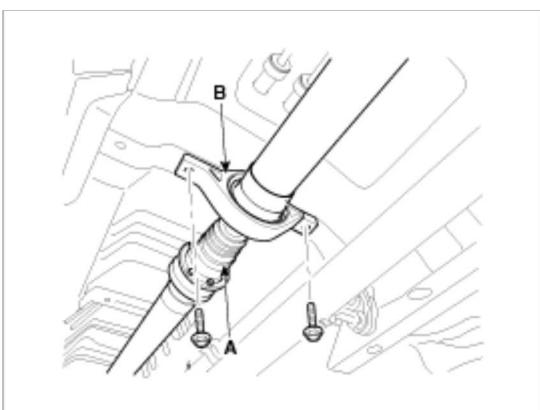
49.0 ~ 68.6N.m (5.0 ~ 7.0kgf.m, 36.1 ~ 50.6lb-ft)



2. Remove the center bearing bracket (A) mounting bolts.

Tightening torque :

49.0 ~ 68.6N.m (5.0 ~ 7.0kgf.m, 36.1 ~ 50.6lb-ft)



3. After making a match mark on the flange yoke and transaxle companion, remove the propeller shaft mounting bolts.

Tightening torque :

49.0 ~ 68.6N.m (5.0 ~ 7.0kgf.m, 36.1 ~ 50.6lb-ft)



CAUTION

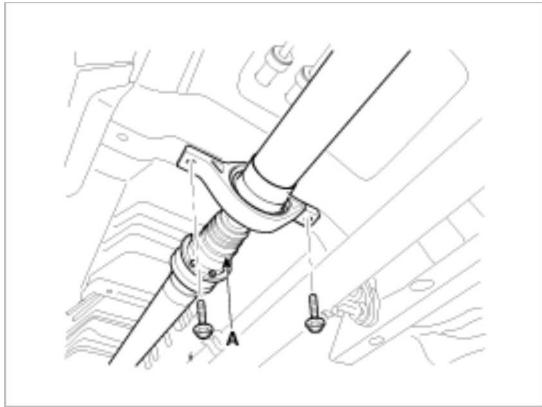
Use the hexagonal wrench to prevent damage of bolt head when removing bolts.

4. Install in the reverse order of removal.

Inspection

CV Joint and boots

1. Shift the transmission lever to Neutral.
2. Raise the vehicle off the ground, and support it with safety stands in the proper locations.
3. Check the center bearing for excessive play or rattle and rubber for rent. If the center bearing has excessive play or rattle and rubber has rent, replace the propeller shaft assembly.

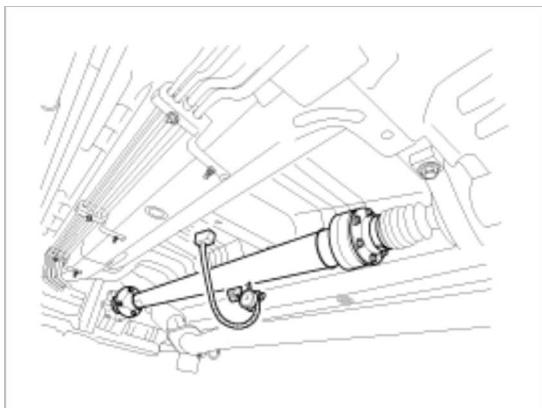


4. Check the CV joint boot for damage and deterioration. If the boot is damaged or deteriorated, replace the propeller shaft assembly.
5. Check the CV joint for excessive play or rattle. If the CV joint has excessive play or rattle, replace the propeller shaft assembly.

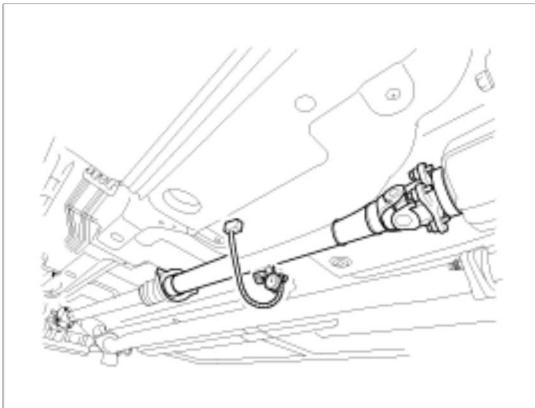
Propeller shaft runout

1. Install a dial indicator with its needle on the center of front propeller shaft or rear propeller shaft.
2. Turn the propeller shaft slowly and check the runout. Repeat this procedure for the other propeller shaft.

Front Propeller Shaft Runout : 0.3mm (0.012in.)



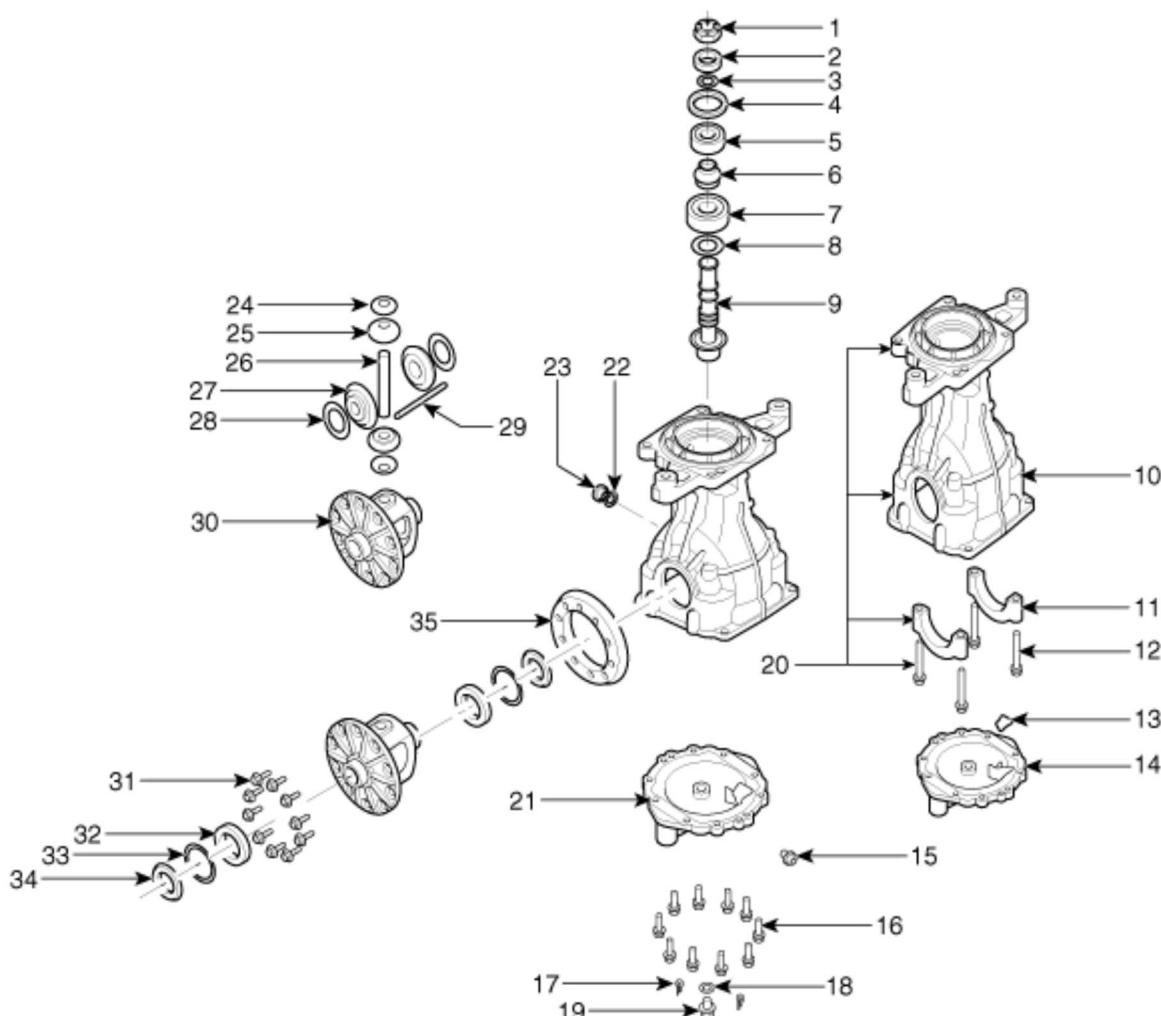
Rear Propeller Shaft Runout : 0.3mm (0.012in.)



3. If the runout on either propeller shaft exceeds the service limit, replace the propeller shaft assembly.

Driveshaft and axle > Differential Carrier Assembly > Rear Differential Carrier > Components and Components Location

Component



1. Drive pinion nut	13. Plate baffle	25. Diff pinion
2. Oil seal	14. Carrier cover	26. Diff shaft
3. O-ring	15. Vent plug	27. Diff gear
4. Oil seal	16. Cover fix bolt	28. Diff gear washer
5. Front bearing	17. Dower pin	29. Lock pin

- | | | |
|--------------------------|--------------------------|--------------------|
| 6. Spacer | 18. Filler gasket | 30. Diff case |
| 7. Rear bearing | 19. Filler plug | 31. Ring gear bolt |
| 8. Inner shim | 20. Carrier sub assembly | 32. Diff bearing |
| 9. Drive pinion gear | 21. Cover sub assembly | 33. Diff shim |
| 10. Differential carrier | 22. Drain plug gasket | 34. Diff oil seal |
| 11. Bearing cap | 23. Drain plug | 35. F/driven gear |
| 12. Bearing cap bolt | 24. Diff pinion washer | |

Driveshaft and axle > Differential Carrier Assembly > Rear Differential Carrier > Repair procedures

Replacement

1. Drain the differential gear oil.

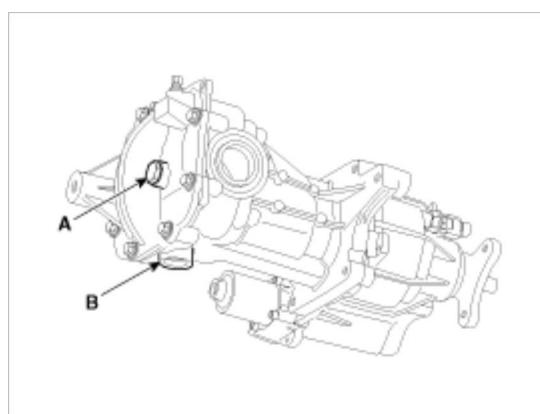
NOTE

Filler plug (A) & Drain plug (B) tightening torque.

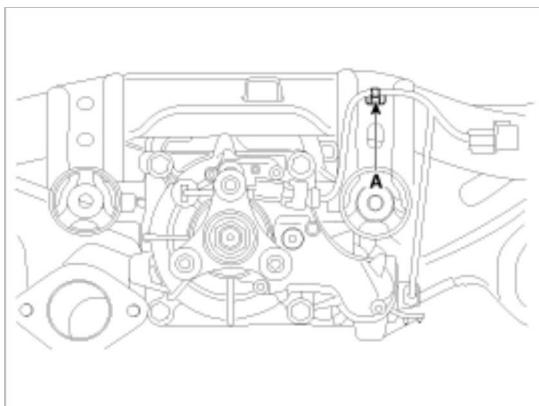
Tightening torque

Filler plug (A): 39.2 ~ 58.8 N.m (4.0 ~ 6.0 kgf.m, 28.9 ~ 43 lb-ft)

Drain plug (B): 49.0 ~ 68.6 N.m (5.0 ~ 7.0 kgf.m, 36.2 ~ 50.6 lb-ft)



2. Remove the rear drive shaft. (Refer to rear drive shaft.)
3. Remove the propeller shaft. (Refer to propeller shaft.)
4. Disconnect the coupling control connector wire clip (A).



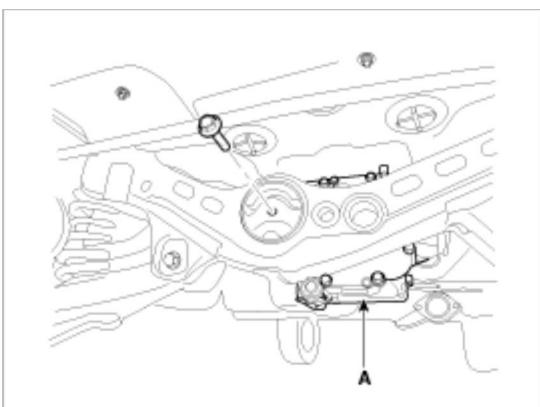
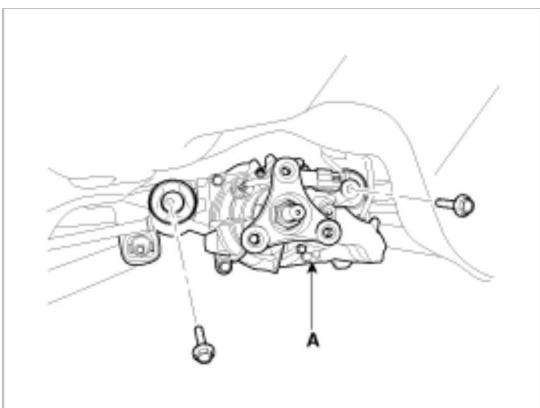
5. Disconnect the coupling control connector (A).



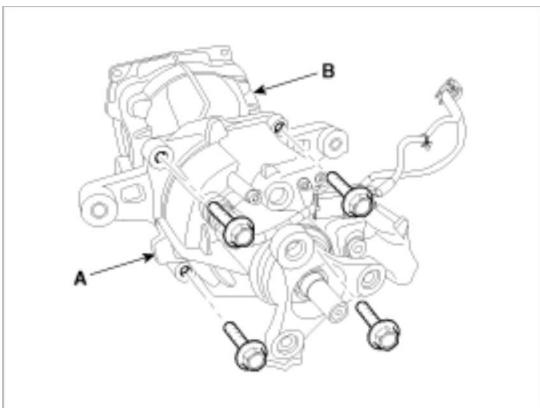
6. Support the differential assembly (A) with the jack.

Tightening torque :

68.6 ~ 88.3N.m (7.0 ~ 9.0kgf.m , 50.6 ~ 65.1lb-ft)



7. After loosen the bolt and then remove the differential carrier (B) from the coupling(A).



8. Install in the reverse order of removal.
9. Add diff gear oil fluid to differential carrier.

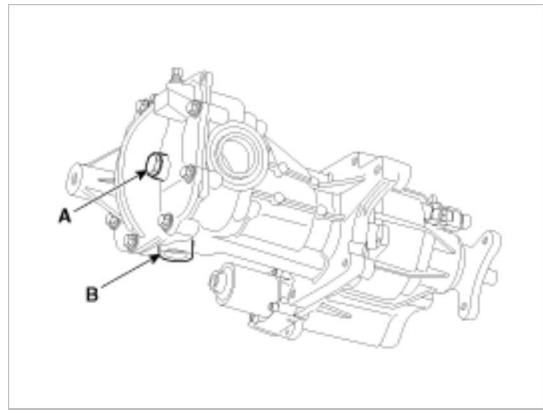
NOTE

Filler plug (A) & Drain plug (B) tightening torque.

Tightening torque

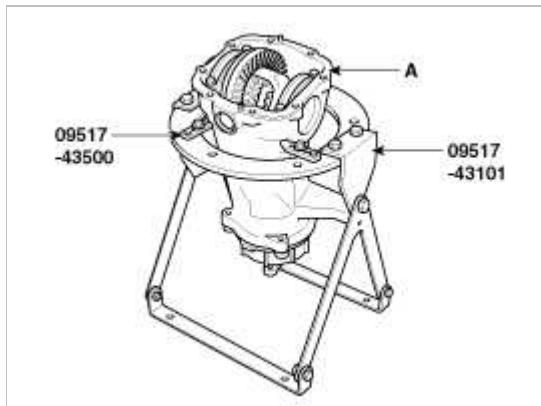
Filler plug (A): 39.2 ~ 58.8 N.m (4.0 ~ 6.0 kgf.m, 28.9 ~ 43 lb-ft)

Drain plug (B): 49.0 ~ 68.6 N.m (5.0 ~ 7.0 kgf.m, 36.2 ~ 50.6 lb-ft)



Inspection

Install the differential carrier assembly(A) with the special tools(09517-43401 & 09517-43500). Then carry out the following inspection.



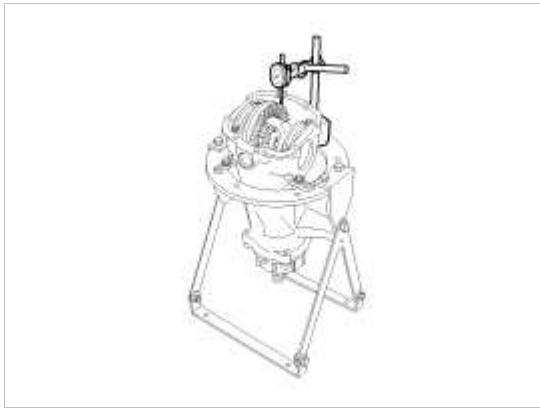
1. Check the final drive gear backlash by the following procedure.
(1) Place the drive pinion and move the drive gear to check backlash is within the standard range.

NOTE

Measure at 4 points on the gear periphery.

Standard value :

0.10 ~ 0.15mm (0.0039 ~ 0.0059in.)



2. Check the drive gear back-face lash by the following procedure.

- (1) Place a dial gauge on the back-face of the drive gear and measure the runout.

Limit : 0.05 mm (0.002 in)



- (2) If the runout is beyond the limit, check that there are no foreign substances between the drive gear and differential case and, that the bolts fixing the drive gear are not loose.

3. Check the differential gear backlash by the following procedure.

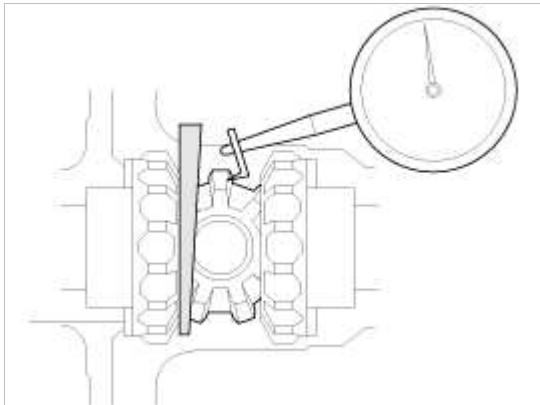
- (1) Fix the side gear with a wedge so it cannot move and measure the differential gear backlash with a dial indicator on the pinion gear.

Standard value :

0 ~ 0.05 mm (0 ~ 0.002 in)

NOTE

Take the measurements at two places on the pinion gear.



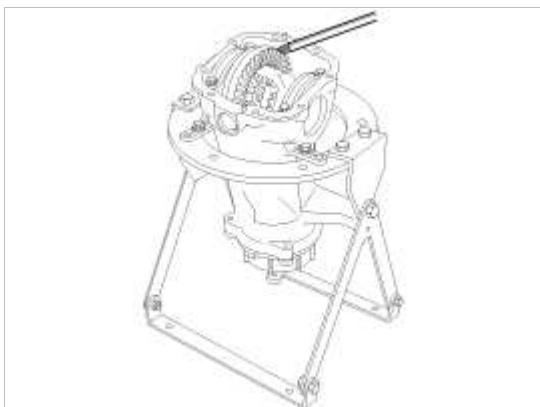
(2) If the backlash exceeds the limit, adjust using side bearing spacers.

NOTE

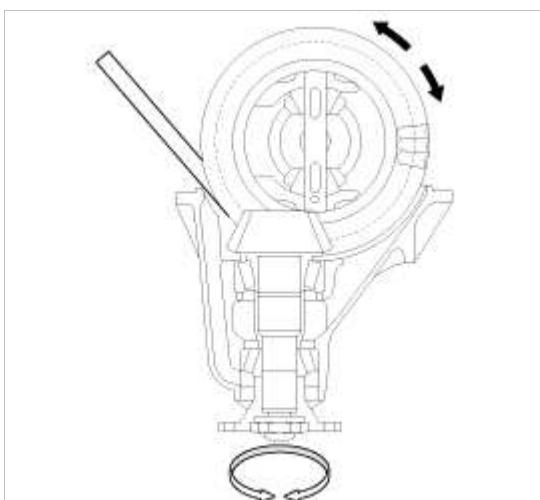
If adjustment is impossible, replace the side gear and pinion gear as a set.

4. Check the tooth contact of the final drive gear by the following procedure.

(1) Apply the same amount of machine blue slightly to both surfaces of the drive gear teeth.



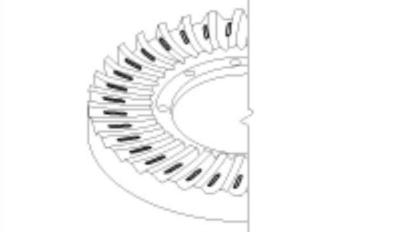
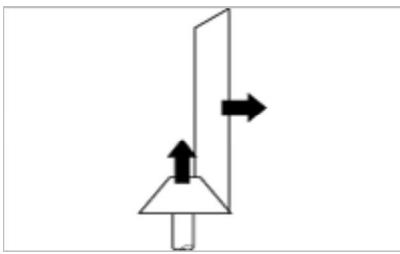
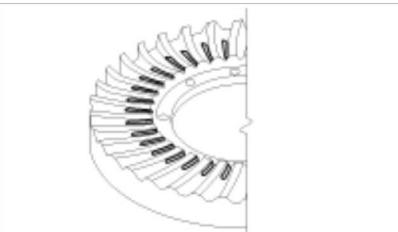
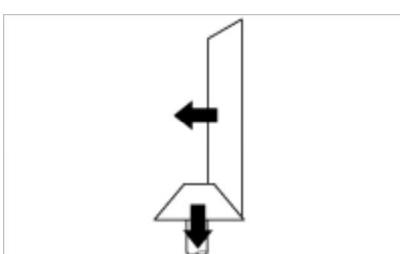
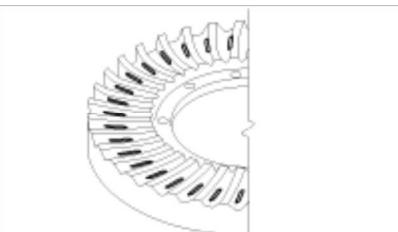
(2) Insert a brass rod between the differential carrier and the differential case, and then rotate the companion flange by hand (once in the normal direction, and then once in the reverse direction) while applying a load to the drive gear so that some torque (approximately 25~30Nm) is applied to the drive pinion.



CAUTION

If the drive gear is rotated too much, the tooth contact pattern will become unclear and difficult to check.

(3) Check the tooth contact pattern.

Tooth contact	Contact state	Solution
Standard contact		
1. Heal contact		<p>Increase the thickness of the pinion height adjusting shim, and position the drive pinion closer to the center of the drive gear.</p> <p>Also, for backlash adjustment, reposition the drive gear further from the drive pinion.</p> 
2. Face contact		
3. Toe contact		<p>Decrease the thickness of the pinion height adjusting shim, and position the drive pinion further from the center of the drive gear.</p> <p>Also, for backlash adjustment, reposition the drive gear closer to the drive pinion.</p> 
4. Flank contact		

NOTE

- Tooth contact pattern is a method for judging the result of the adjustment of drive pinion height and final drive gear backlash. The adjustment of drive pinion height and final drive gear backlash should be repeated until the tooth contact patterns are similar to the standard tooth contact pattern.
- When you cannot obtain a correct pattern, the drive gear and drive pinion have exceeded their limits. Both gears should be replaced as a set.

5. Check the oil leaks and the lip part for chew or wear.
6. Check the bearings for wear or discoloration.
7. Check the gear carrier for cracks.

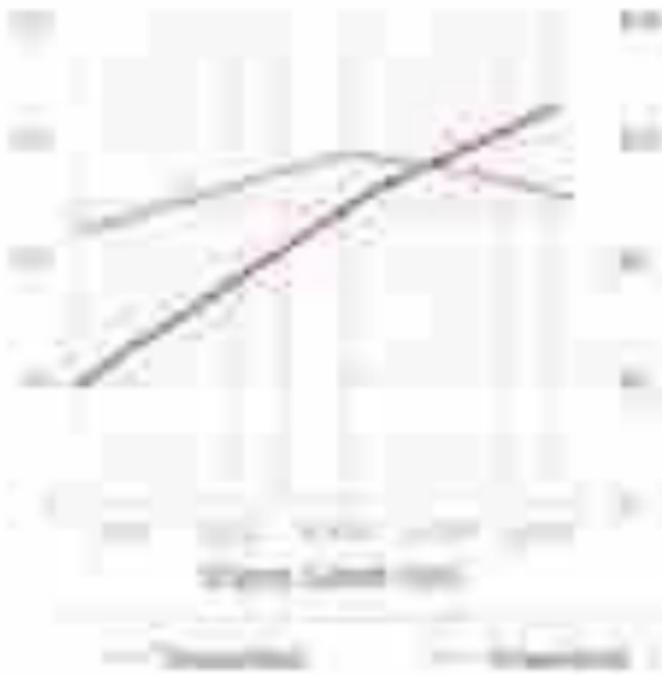
8. Check the drive pinion and drive gear for wear or cracks.
9. Check the side gears, pinion gears and pinion shaft for wear or damage.
10. Check the side gear spline for wear or damage.



Opel 2.4 C-VT petrol engine

Max. Power 180 kW (243 bhp) at 6,000 rpm

Max. Torque 327 Nm (24,000 rpm)



SPORTAGE(SL) > 2012 > G 2.4 DOHC > Emission Control System

Emission Control System > General Information > Description and Operation

Description

Emissions Control System consists of three major systems.

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

Emission Control System > General Information > Specifications

Specifications

Purge Control Solenoid Valve (PCSV)

▷ Specification

Item	Specification
Coil Resistance (Ω)	19.0 ~ 22.0 [20°C(68°F)]

Fuel Tank Pressure Sensor (FTPS)

▷ Type: Piezo-Resistive Pressure Sensor

▷ Specification

Pressure [kPa (kgf/cm ² , in H ₂ O)]	Output Voltage (V)
-6.67 (-0.068, -26.8)	0.5
0	2.5
+6.67 (0.068, 26.8)	4.5

Canister Close Valve (CCV)

▷ Specification

Item	Specification
Coil Resistance (Ω)	19.8 ~ 21.8 [20°C(68°F)]

Tightening Torques

Item	kgf.m	N.m	lb·ft
Positive crankcase ventilation valve installation	0.19 ~ 0.29	1.9 ~ 2.8	1.4 ~ 2.1
Canister installation screw	0.2 ~ 0.3	1.96 ~ 2.94	1.45 ~ 2.17
Auxiliary canister installation bolt	0.4 ~ 0.6	3.9 ~ 5.9	2.9 ~ 4.3
Fuel tank air filter bracket installation nut	0.5 ~ 0.53	4.8 ~ 5.2	3.54 ~ 3.84

Emission Control System > General Information > Troubleshooting

Troubleshooting

Symptom	Suspect area
Engine will not start or struggle to start	Vapor hose damaged or disconnected
Engine struggles to start	Malfunction of the Purge Control Solenoid Valve
Rough idle or engine stalls	Vapor hose damaged or disconnected
	Malfunction of the PCV valve
Rough idle	Malfunction of the Evaporative Emission Control System
Excessive oil consumption	Positive crankcase ventilation line clogged

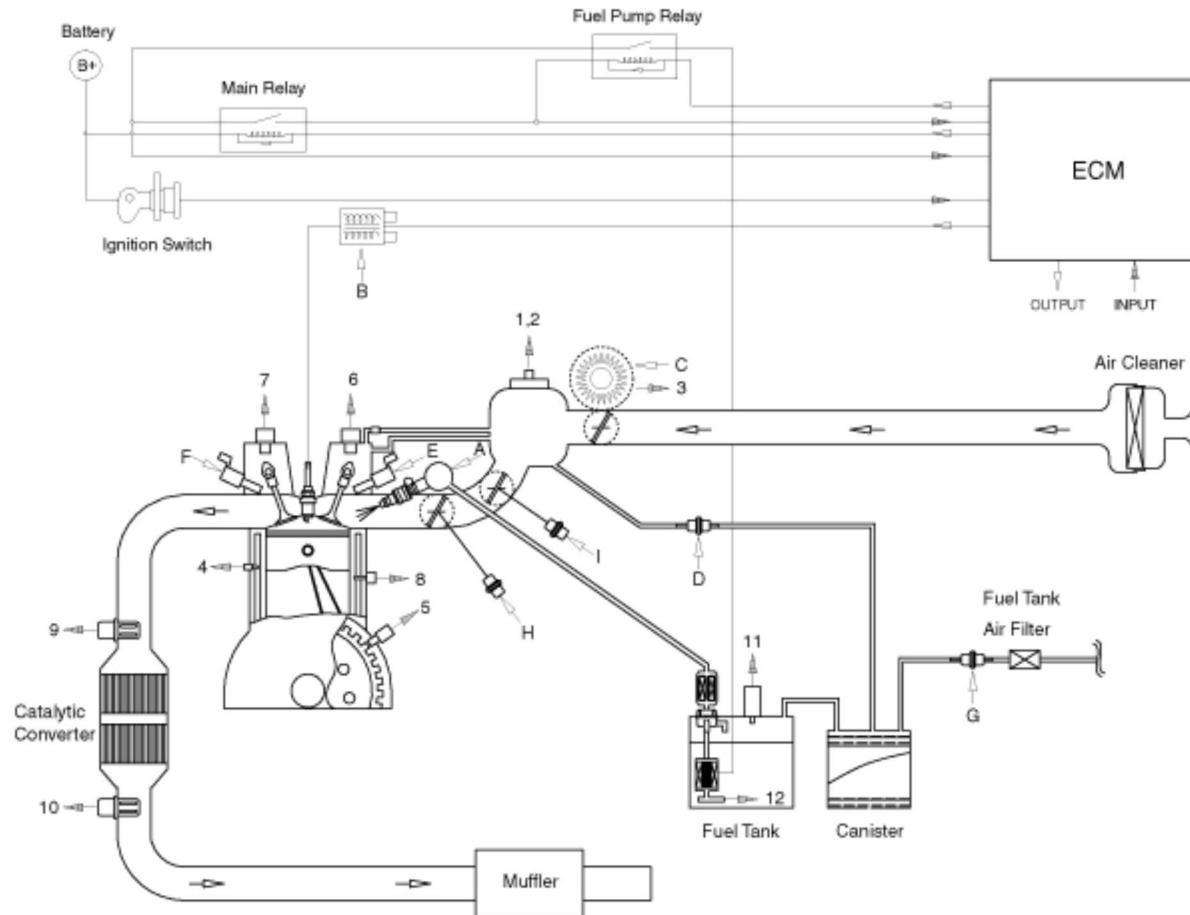
Emission Control System > General Information > Schematic Diagrams

Schematic Diagram

1. Manifold Absolute Pressure Sensor (MAPS)
2. Intake Air Temperature Sensor (IATS)
3. Throttle Position Sensor (TPS) [Integrated into ETC Module]
4. Engine Coolant Temperature Sensor (ECTS)
5. Crankshaft Position Sensor (CKPS)
6. Camshaft Position Sensor (CMPS) [Bank 1 / Intake]
7. Camshaft Position Sensor (CMPS) [Bank 1 / Exhaust]
8. Knock Sensor (KS)
9. Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 1]
10. Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2]
11. Fuel Tank Pressure Sensor (FTPS)
12. Fuel Level Sensor (FLS)
- Accelerator Position Sensor (APS)
- A/C Pressure Transducer (APT)
- Ignition Switch Signal
- Battery Power Signal
- Vehicle Speed Signal
- Inhibitor Switch Signal
- Power Steering Switch Signal
- Brake Switch Signal

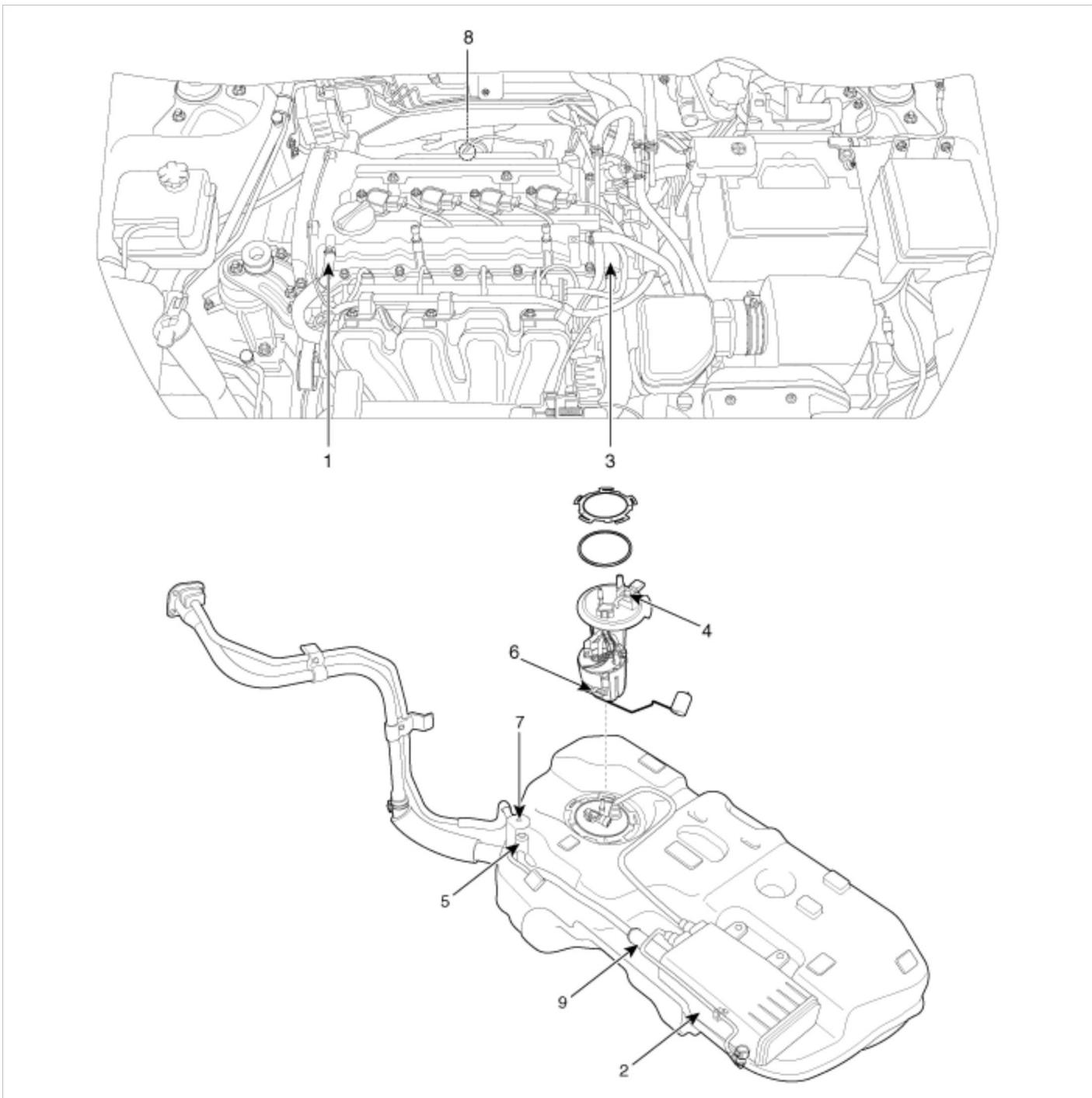


- A. Injector
- B. Ignition Coil
- C. ETC Motor [Integrated into ETC Module]
- D. Purge Control Solenoid Valve (PCSV)
- E. CVVT Oil Control Valve (OCV) [Bank 1 / Intake]
- F. CVVT Oil Control Valve (OCV) [Bank 1 / Exhaust]
- G. Canister Close Valve (CCV)
- H. Variable Intake Motion Actuator (VIMA) Valve
- I. Variable Intake Solenoid (VIS) Valve
- Main Relay
- Fuel Pump Relay
- A/C Control
- Self Diagnosis

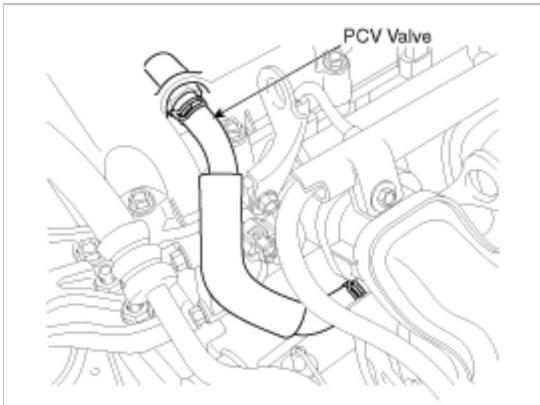


Emission Control System > General Information > Components and Components Location

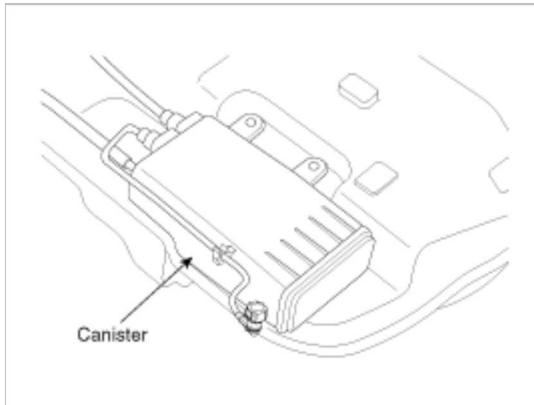
Components Location



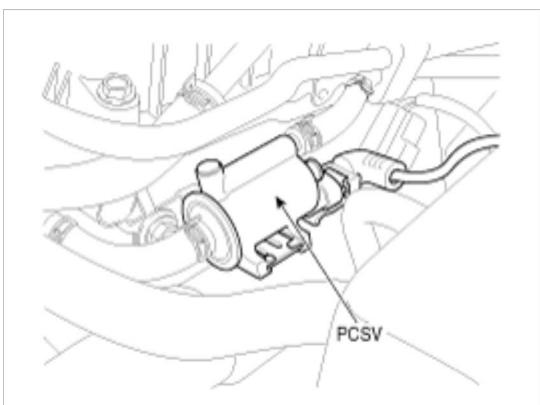
1. PCV Valve	2. Canister
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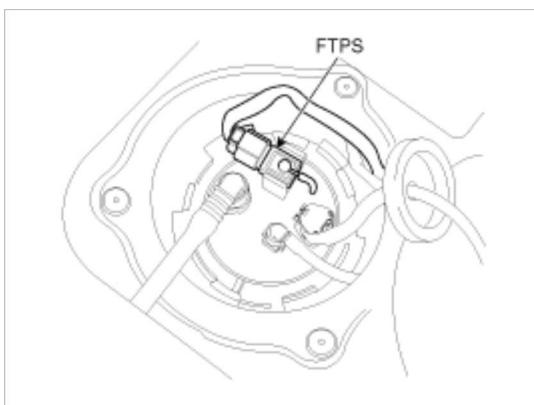
3. Purge Control Solenoid Valve (PCSV)



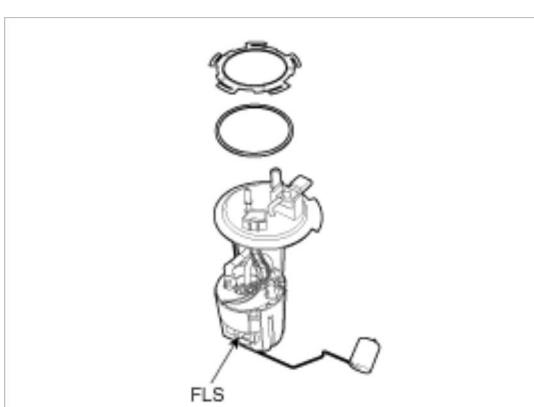
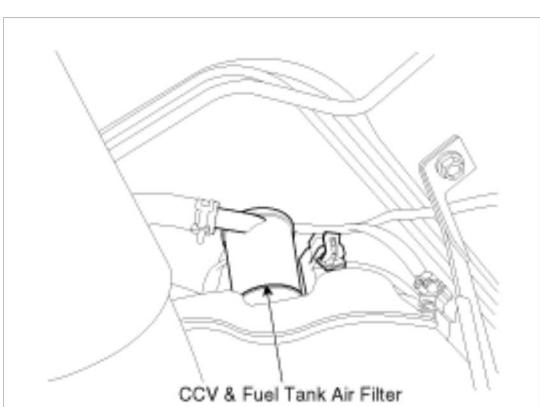
4. Fuel Tank Pressure Sensor (FTPS)



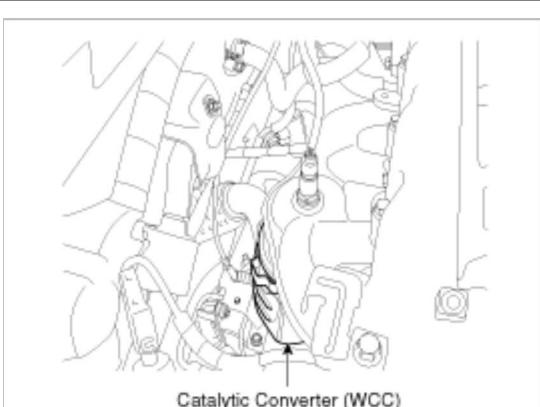
5. Canister Close Valve (CCV)
7. Fuel Tank Air Filter



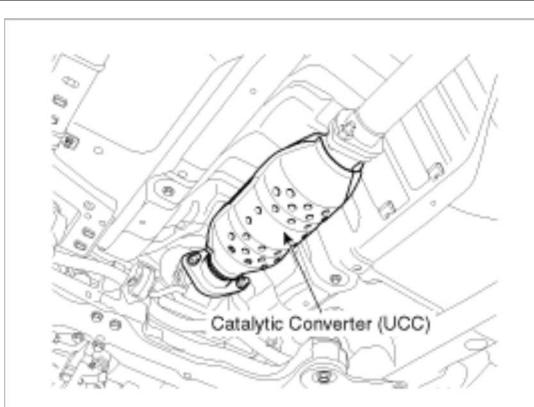
6. Fuel Level Sensor (FLS)



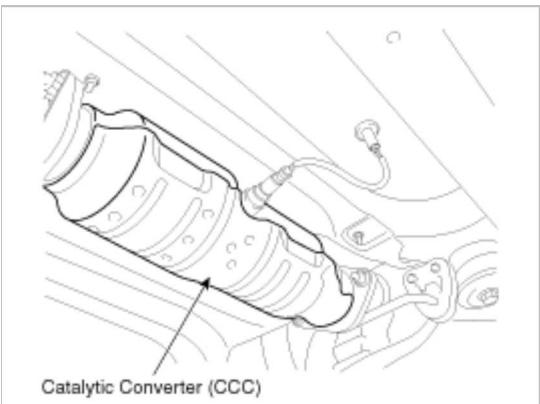
8. Catalytic Converter [SULEV] (WCC)



8. Catalytic Converter [SULEV] (UCC)

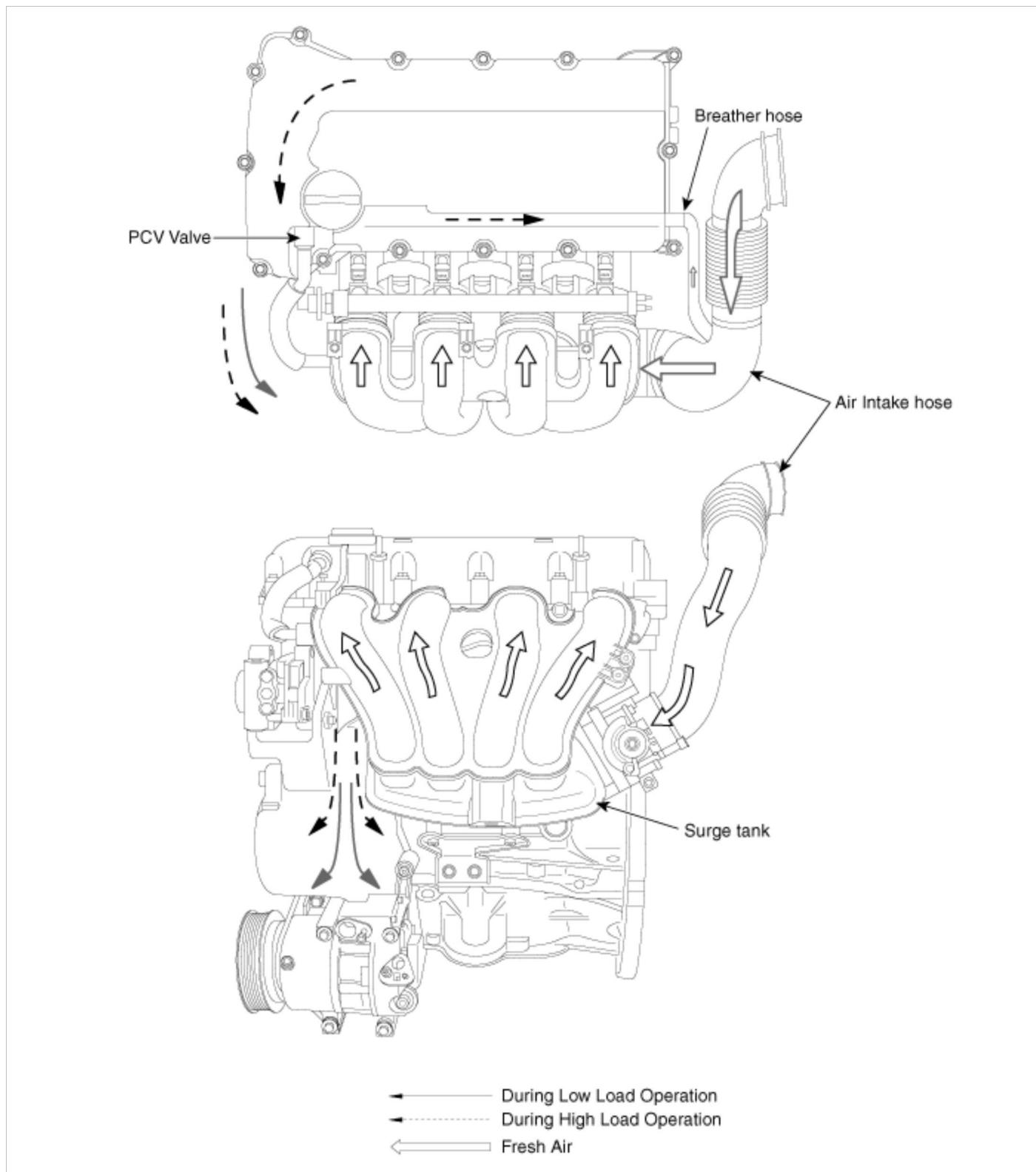


8. Catalytic converter [ULEV] (CCC)



Emission Control System > Crankcase Emission Control System > Schematic Diagrams

Schematic Diagram



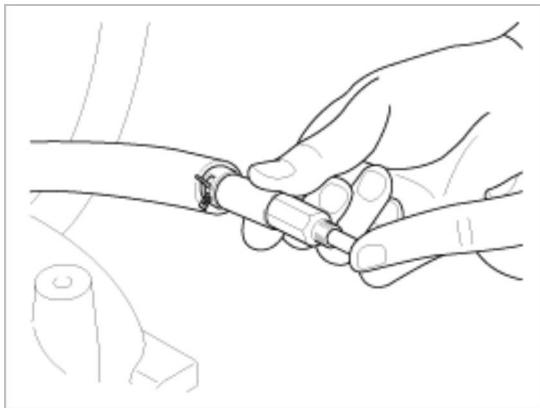
Emission Control System > Crankcase Emission Control System > Repair procedures

Inspection

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

NOTE

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



4. If the vacuum is not felt inspect PCV operation, if operating correctly clean or replace the vapor hose.

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

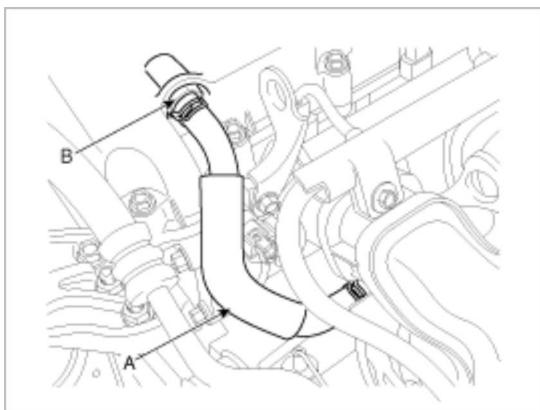
Operation Principle

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

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

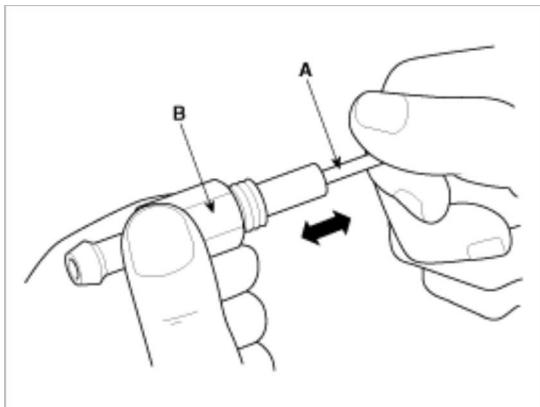
Removal

1. Disconnect the vapor hose (A).
2. Remove the PCV valve (B).



Inspection

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



NOTE

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

Installation

1. Installation is reverse of removal.

PCV Valve installation:

1.9 ~ 2.8 N.m (0.19 ~ 0.29 kgf.m, 1.4 ~ 2.1 lb-ft)

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

Description

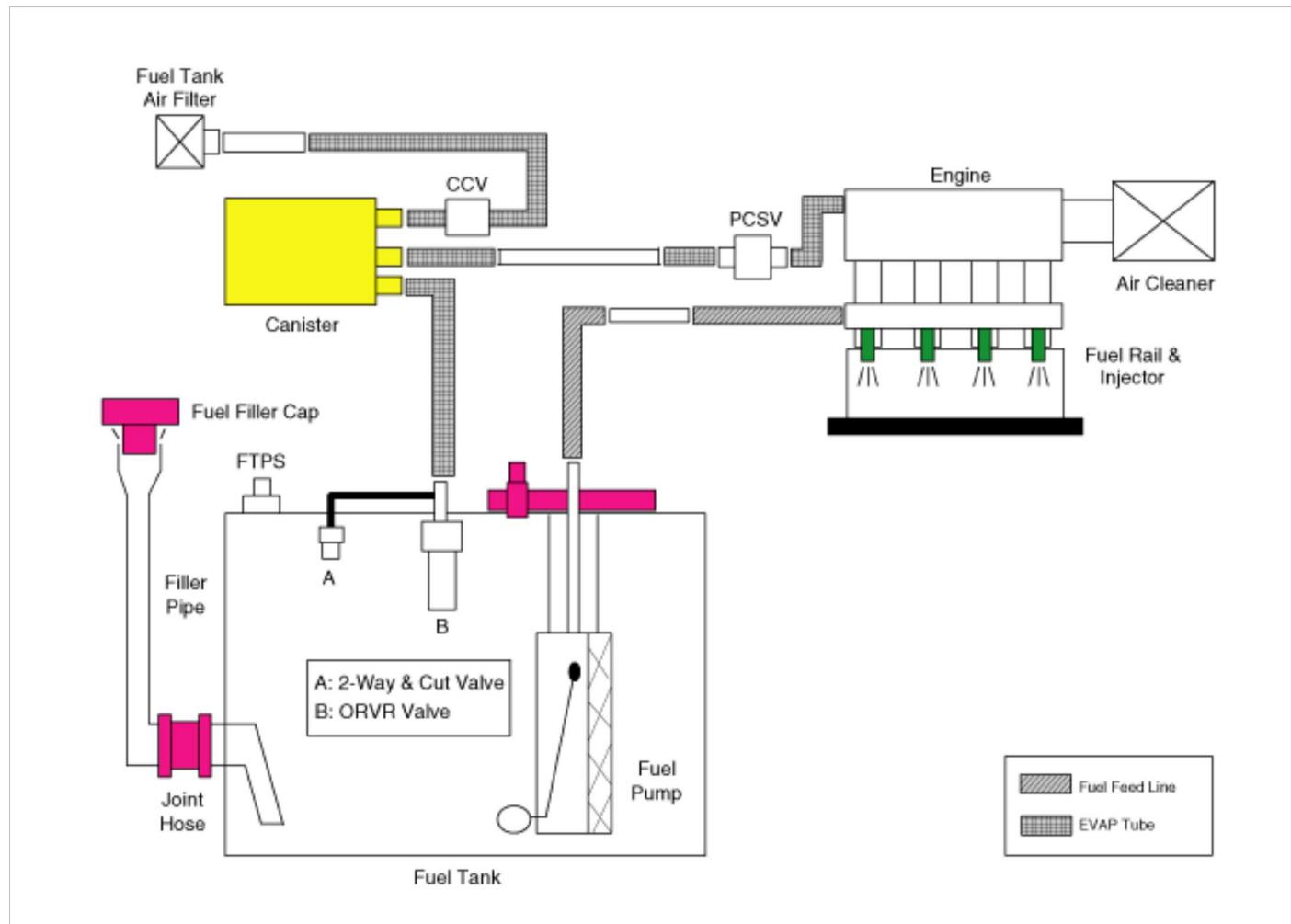
The Evaporative Emission Control System prevents fuel vapor stored in fuel tank from vaporizing into the atmosphere. When the fuel evaporates in the fuel tank, the vapor passes through vent hoses or tubes to a canister filled with charcoal.

The canister temporarily holds the vapor in the charcoal. The ECM will control the system in order to draw the gathered

vapor into the combustion chambers during certain operating conditions. Engine manifold vacuum is used to draw the vapor into intake manifold.

Emission Control System > Evaporative Emission Control System > Schematic Diagrams

Schematic Diagram



Canister

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

Purge Control Solenoid Valve (PCSV)

The Purge Control Solenoid Valve (PCSV) is installed in the passage connecting the canister to the intake manifold. It is a duty type solenoid valve and is operated by ECM/PCM signal.

To draw the absorbed vapor into the intake manifold, the ECM/PCM will open the PCSV, otherwise the passage remains closed.

Fuel Filler Cap

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

Fuel Tank Pressure Sensor (FTPS)

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

Canister Close Valve (CCV)

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

Evaporative System Monitoring

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

Vapor Generation Checking

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

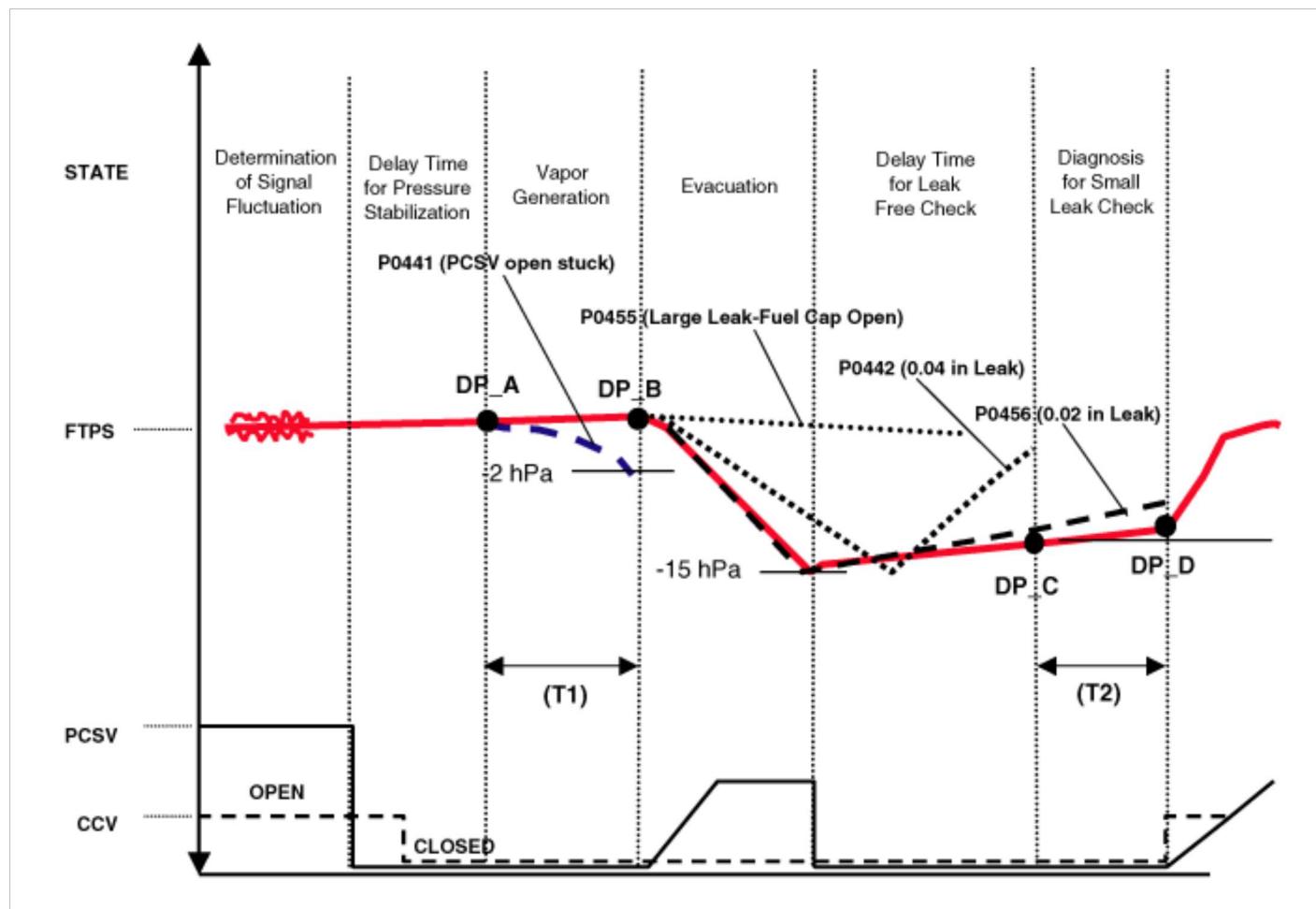
Evacuation

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

Leaking Checking

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

Evaporative System Monitoring

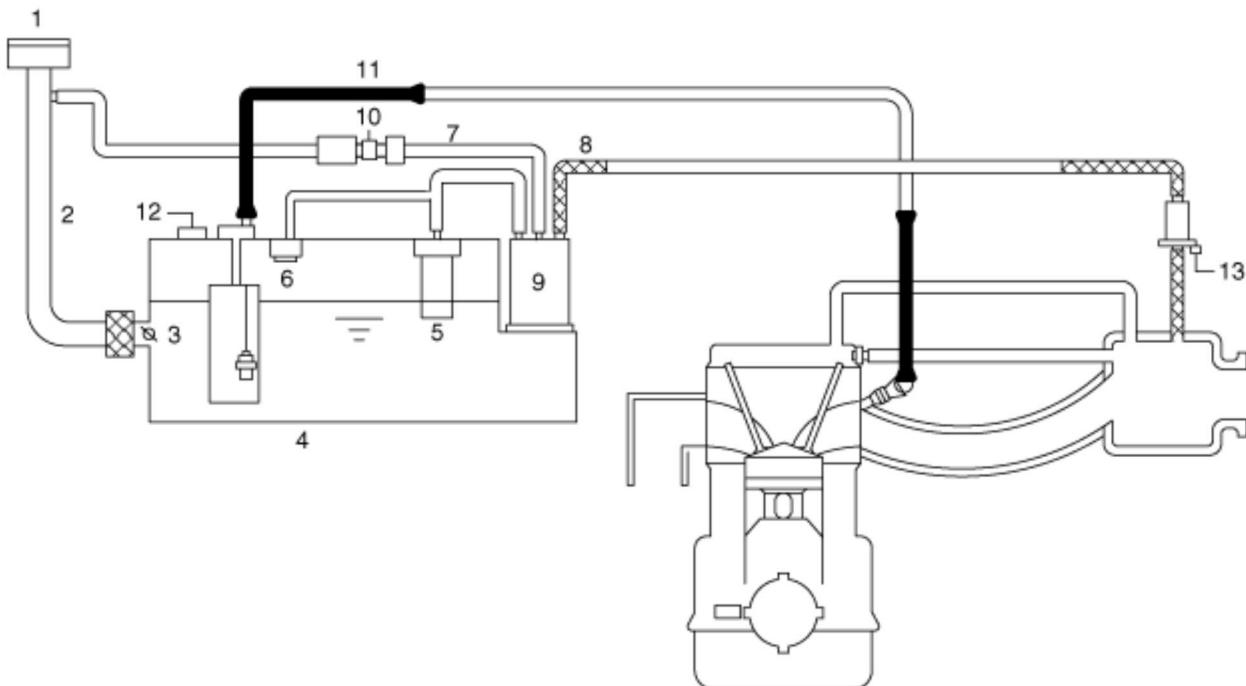


Evaporative And ORVR Emission Control System

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

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

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



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

Emission Control System > Evaporative Emission Control System > Repair procedures

Inspection

[System Inspection]

1. Disconnect the vapor hose from the intake manifold and connect a vacuum pump to the nipple on the intake manifold.
· At Cold Engine [Engine Coolant Temperature < 60°C(140°F)]

Engine Operating Condition	Applied Vacuum	Result
Idle	Min. 20 inHg (Min. 0.7 kgf/cm ² , Min. 67.7 kPa)	
3,000rpm		Vacuum is held

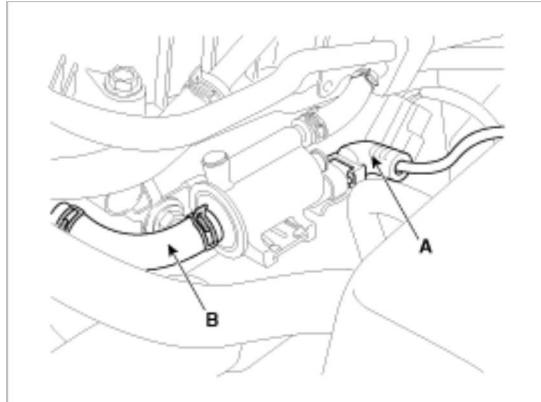
2. Check the following points with applied vacuum at the purge control solenoid valve (PCSV).

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

Engine Operating Condition	Applied Vacuum	Result
Idle	Min. 20 inHg (Min. 0.7 kgf/cm ² , Min. 67.7 kPa)	Vacuum is held
Within 3 minutes after engine start at 3,000 rpm	Try to apply vacuum	Vacuum is released
In 3 minutes after engine start at 3,000 rpm	Min. 20 inHg (Min. 0.7 kgf/cm ² , Min. 67.7 kPa)	Vacuum will be held momentarily, after which, it will be released

[PCSV Inspection]

1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Disconnect the PCSV connector (A).
3. Disconnect the vapor hose (B) which is connected to the intake manifold from the PCSV.



4. After connecting a vacuum pump to the nipple, apply vacuum.
5. With the PCSV control line grounded, check the valve operation with battery voltage applied to the PCSV(Open) and removed(Closed).

Battery Voltage	Valve	Vacuum
Connected	Open	Released
Disconnected	Close	Maintained

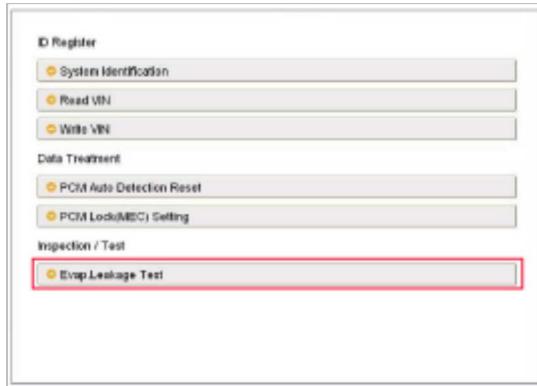
6. Measure the coil resistance of the PCSV.

Specifications:

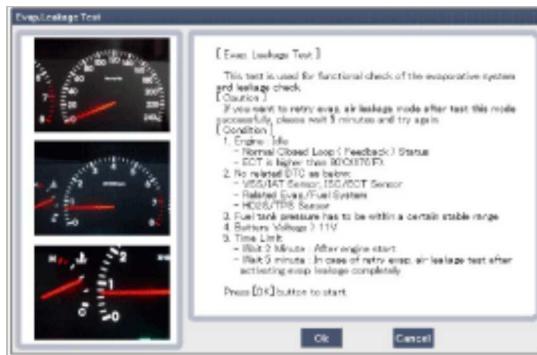
19.0 ~ 22.0Ω [20°C(68°F)]

[EVAP. Leakage Test]

1. Select "Evap. Leakage Test".



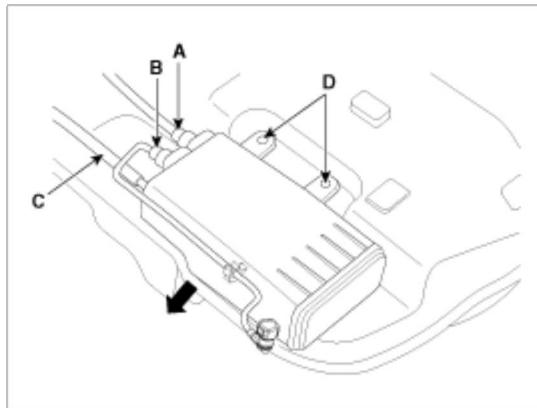
2. Proceed with the test according to the screen introductions.



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

Removal

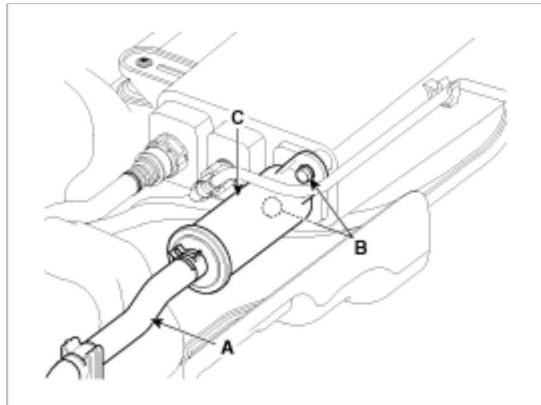
1. Remove the fuel tank. (Refer to "Fuel tank" in FL group.)
2. Disconnect the vapor tube quick-connector (A,B) and the ventilation hose (C).
3. Remove the canister in the direction of an arrow after removing the installation screws (D).



[SULEV Only]

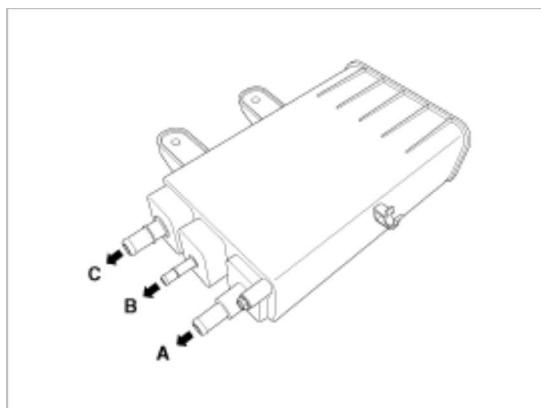
Auxiliary Canister

1. Disconnect the ventilation hose (A) and then remove the bolts (B).
2. Remove the auxiliary canister (C).



Inspection

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



A: Canister ↔ Atmosphere

B: Canister ↔ Intake Manifold

C: Canister ↔ Fuel Tank

Installation

Installation is the reverse of removal.

Canister installation screw:

1.96 ~ 2.94 N.m (0.2 ~ 0.3 kgf.m, 1.45 ~ 2.17 lb-ft)

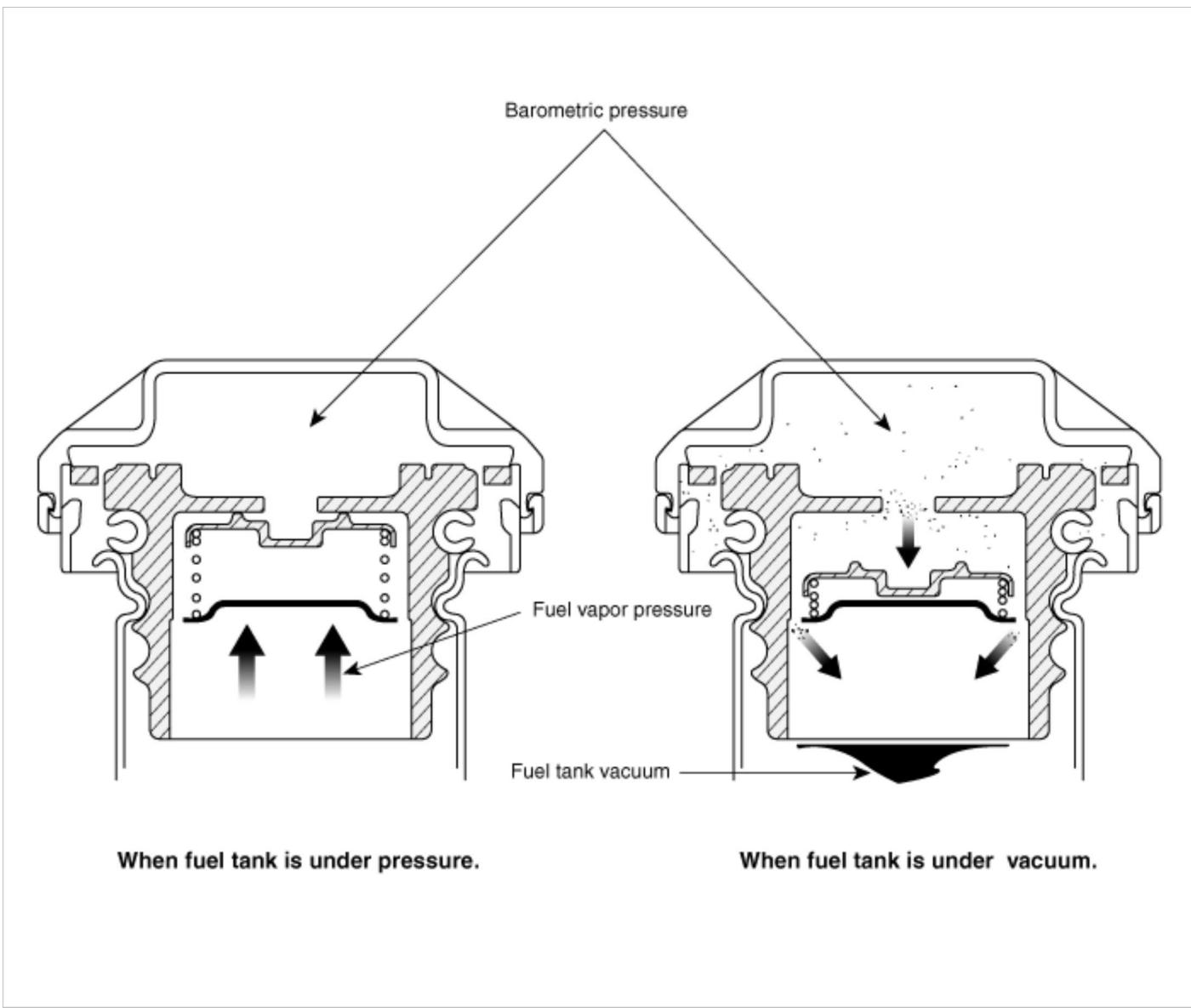
Auxiliary canister installation bolt:

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

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

Description

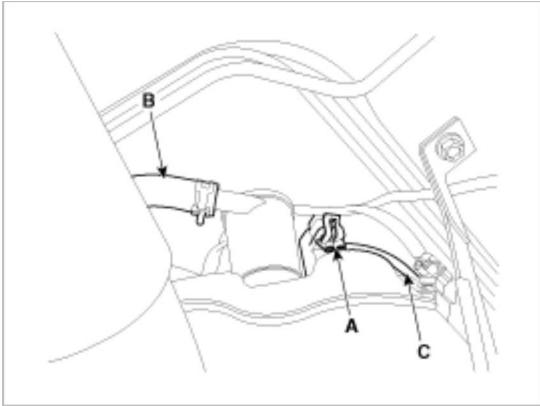
A ratchet tightening device on the threaded fuel filler cap reduces the chances of incorrect installation, which seals the fuel filler. After the gasket on the fuel filler cap and the filler neck flange contact each other, the ratchet produces a loud clicking noise indicating the seal has been set.



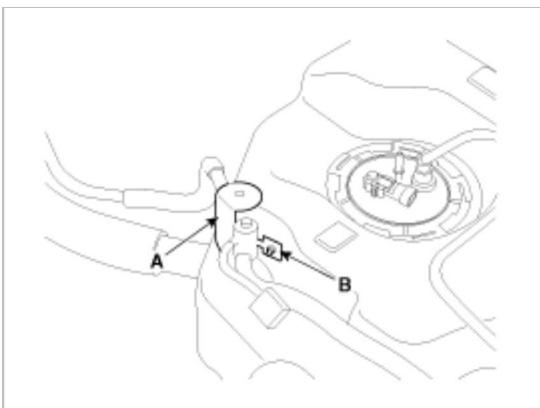
Emission Control System > Evaporative Emission Control System > Fuel Tank Air Filter > Repair procedures

Removal

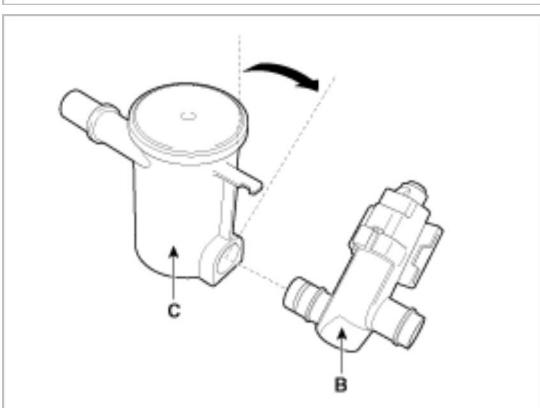
1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Lift the vehicle with a jack.
3. Disconnect the canister close valve connector (A).
4. Disconnect the ventilation hose (B) and vapor hose (C).



5. Remove the fuel tank air filter and canister close valve assembly (A) after removing the installation nut (B).



6. Release the lever (A), and then separate the canister close valve (B) from the fuel tank air filter (C) after rotating it in the direction of the arrow in the figure.



7. Install a new fuel tank air filter in accordance with the reverse order.

Installation

Installation is the reverse of removal.

Fuel tank air filter bracket installation nut: 4.8 ~ 5.2 N.m (0.5 ~ 0.53 kgf.m, 3.54 ~ 3.84 lb-ft)

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

Description

Exhaust emissions (CO, HC, NOx) are controlled by a combination of engine modifications and the addition of special control components.

Modifications to the combustion chamber, intake manifold, camshaft and ignition system form the basic control system. These items have been integrated into a highly effective system which controls exhaust emissions while maintaining good drivability and fuel economy.

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

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

This in turn allows the engine to produce exhaust gas of the proper composition to permit the use of a three way catalyst. The three way catalyst is designed to convert the three pollutants [hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx)] into harmless substances. There are two operating modes in the MFI system.

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

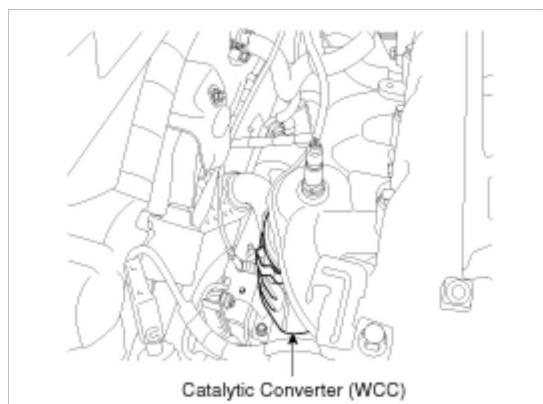
Emission Control System > Exhaust Emission Control System > Catalytic Converter > Description and Operation

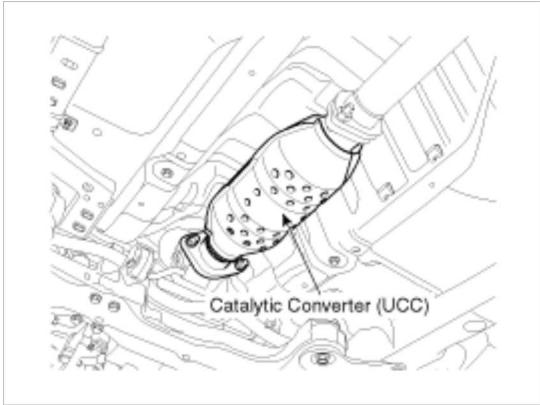
Description

The catalytic converter of the gasoline engine is a three way catalyst. It oxidizes carbon monoxide and hydrocarbons (HC), and separates oxygen from the oxides of nitrogen (NOx).

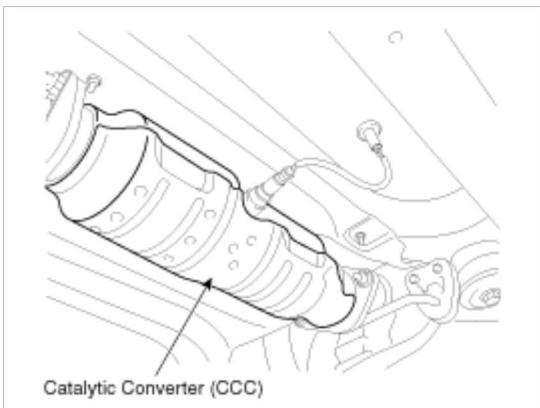
There are two types of three-way catalyst; Palette type and Monolith type.

[SULEV]





[ULEV]



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

Description

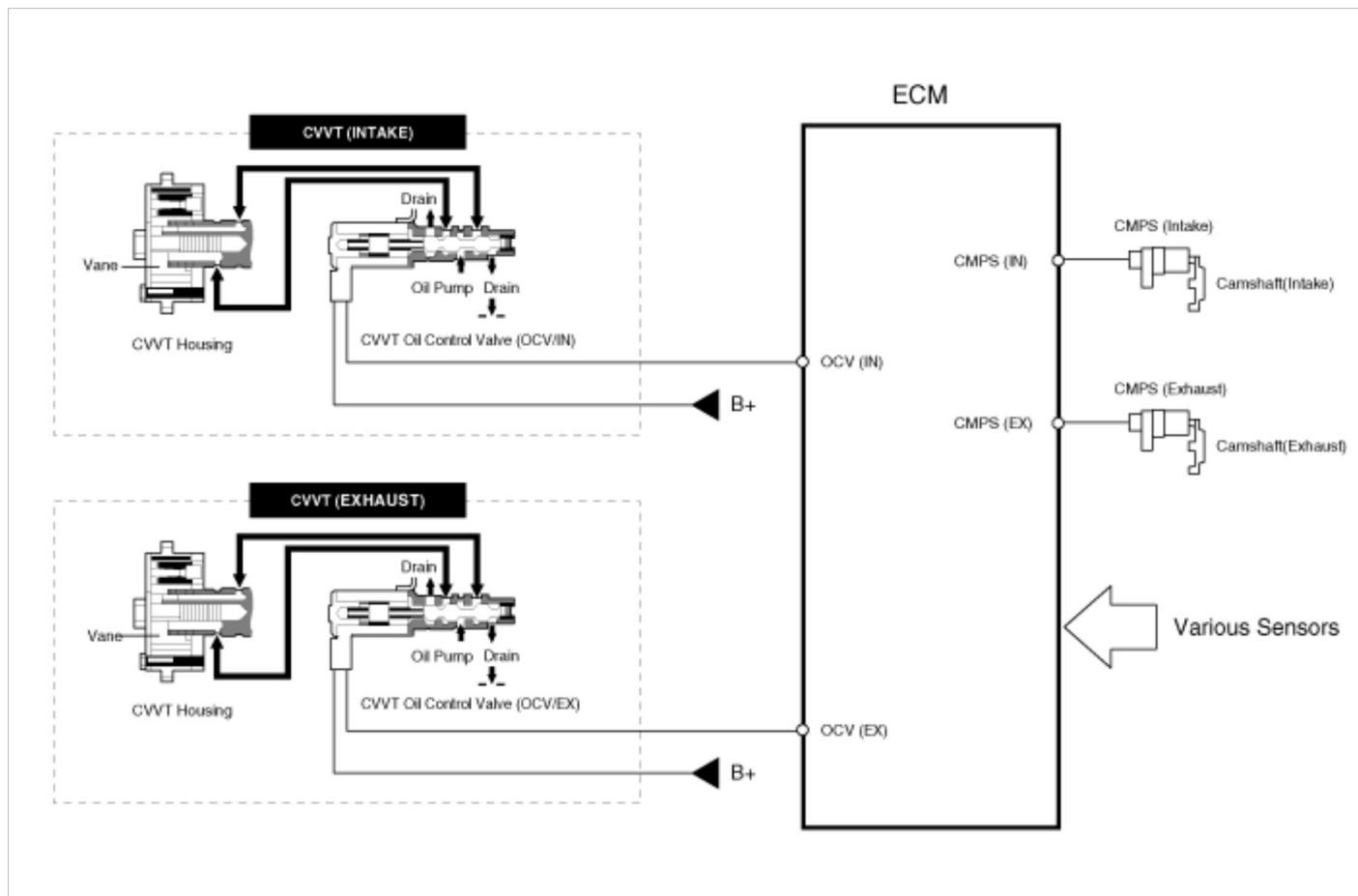
Continuous Variable Valve Timing (CVVT) system advances or retards the valve timing of the intake and exhaust valve in accordance with the ECM control signal which is calculated by the engine speed and load.

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

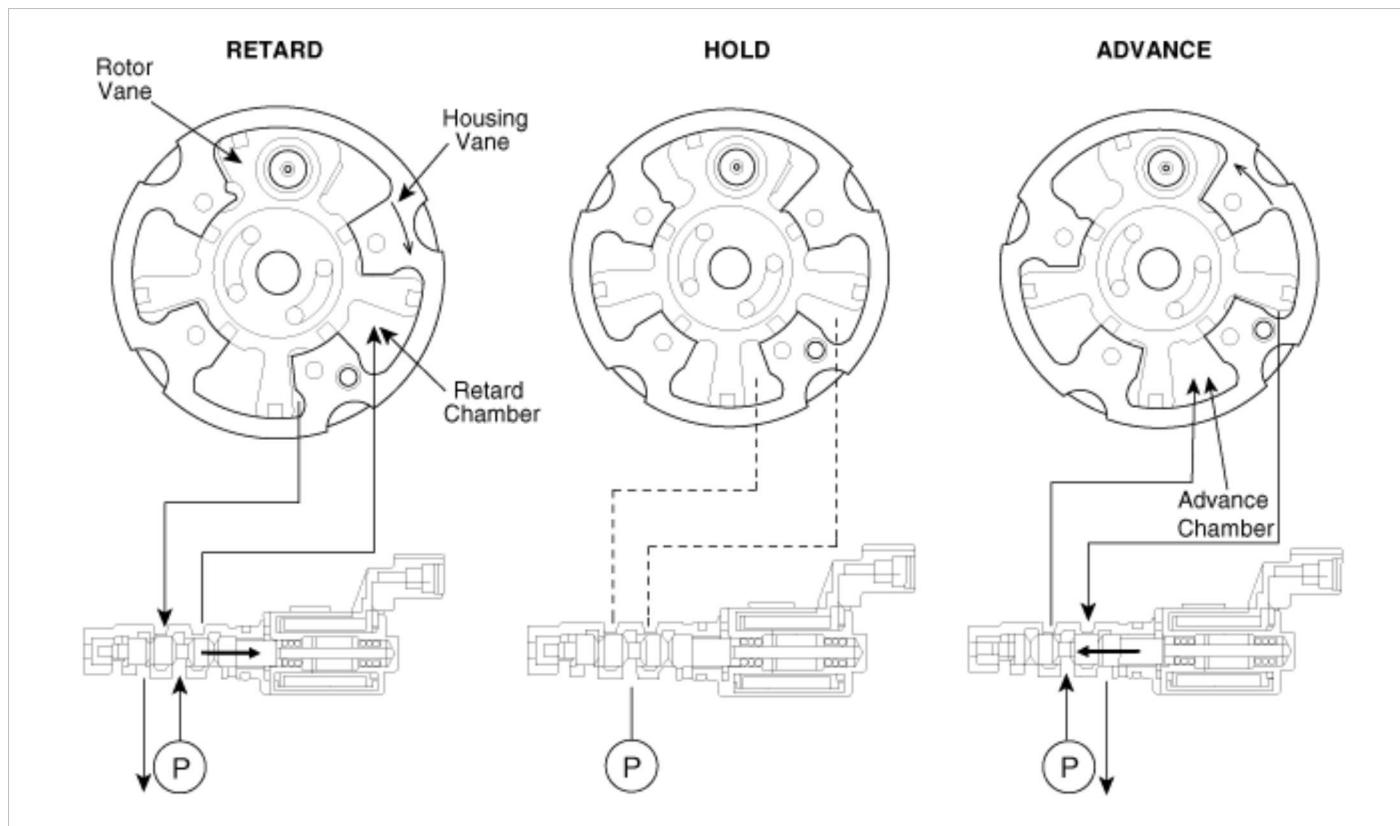
- the CVVT Oil Control Valve (OCV) which supplies the engine oil to the cam phaser or runs out the engine oil from the cam phaser in accordance with the ECM PWM (Pulse With Modulation) control signal,
- and the Cam Phaser which varies the cam phase by using the hydraulic force of the engine oil.

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.

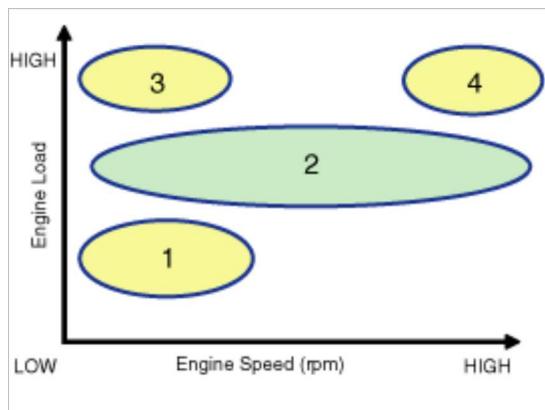


Operation Principle

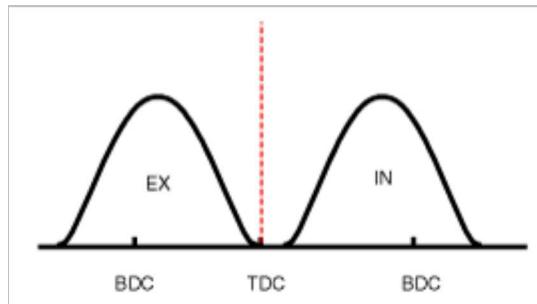
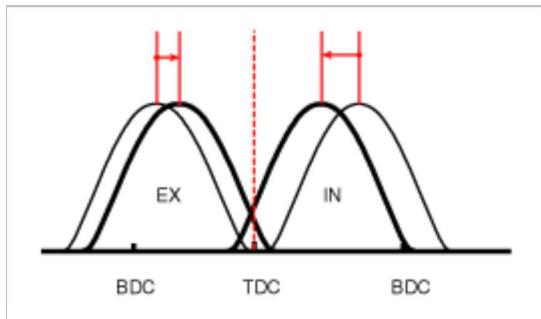
The CVVT has the mechanism rotating the rotor vane with hydraulic force generated by the engine oil supplied to the advance or retard chamber in accordance with the CVVT oil control valve control.



[CVVT System Mode]



(1) Low Speed / Low Load	(2) Part Load
(3) Low Speed / High Load	(4) High Speed / High Load



Driving Condition	Exhaust Valve		Intake Valve	
	Valve Timing	Effect	Valve Timing	Effect
(1) Low Speed /Low Load	Completely Advance	* Valve Under-lap * Improvement of combustion stability	Completely Retard	* Valve Under-lap * Improvement of combustion stability
(2) Part Load	Retard	* Increase of expansion work * Reduction of pumping loss * Reduction of HC	Retard	* Reduction of pumping loss
(3) Low Speed /High Load	Retard	* Increase of expansion work	Advance	* Prevention of intake back flow (Improvement of volumetric efficiency)
(4) High Speed /High Load	Advance	* Reduction of pumping loss	Retard	* Improvement of volumetric efficiency



SPORTAGE(SL) > 2012 > G 2.4 DOHC > Engine Electrical System

Engine Electrical System > General Information > Specifications

Specifications

Ignition System

Items		Specification
Ignition coil	Primary resistance	0.62 ± 10 %
	Secondary resistance	7.0kΩ ± 15 %
Spark plugs	Type	FK16HQR11
	Gap	1.0 ~ 1.1mm (0.0394 ~ 0.0433in.)

Starting System

Items		Specification
Starter	Rated voltage	12 V, 1.2 kW
	No. of pinion teeth	11
	No-load characteristics	Voltage
		11.5 V
		Ampere
		90A, MAX
	Speed	2,600 rpm, MIN

Charging System

Items		Specification	
		NON-AMS	AMS
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	-
		Internal mode	14.55 ± 0.2V
	Temperature compensation	External mode	-
		Internal mode	-3.5 ± 1mV/°C
Battery	Type	56 - 26 FL	
	Cold cranking amperage [at -18°C (-0.4°F)]	600 A	
	Reserve capacity	113 min	
	Specific gravity [at 25°C (77°F)]	1.280 ± 0.01	

CAUTION

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

NOTE

- Battery type notation : MF **4|8**-**2|3****G****L**
 ① ② ③ ④ ⑤

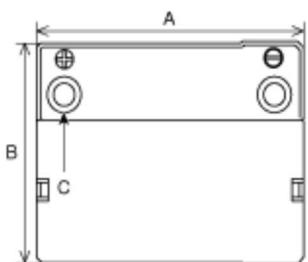
① : Battery type
 - MF : Maintenance Free

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 (Crank 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	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

Reference Service Tools

Tool (Number and name)	Illustration	Use
Alternator pulley remover wrench (09373-27000)		Removal and installation of alternator pulley
Micro-570 Battery checker		- Check the battery condition - Check the charging and starting system

Engine Electrical System > General Information > General Information

The Micro 570 Analyzer

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

CAUTION

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

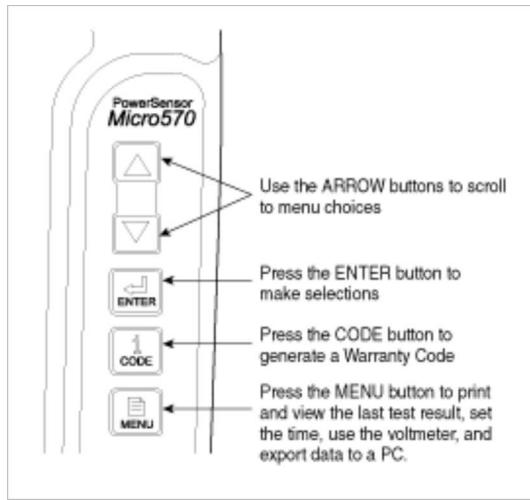
※ When charging battery by test result, Battery must be fully charged.

To get accurate test result, battery surface voltage must have subsided ahead before test when you test battery after charged. (See following Battery Test Results)



Keypad

The Micro 570 button on the key pad provide the following functions :



Battery Test Procedure

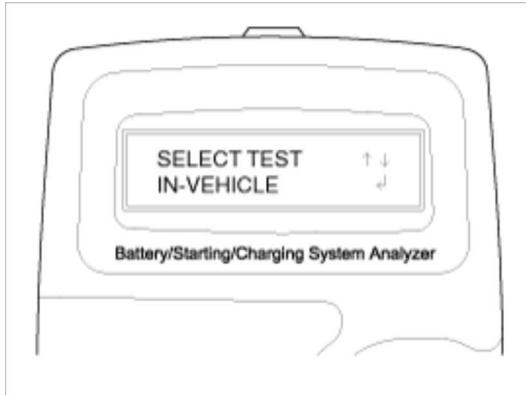
1. Connect the tester to the battery.
 - A. Red clamp to battery positive (+) terminal.
 - B. Black clamp to battery negative (-) terminal.



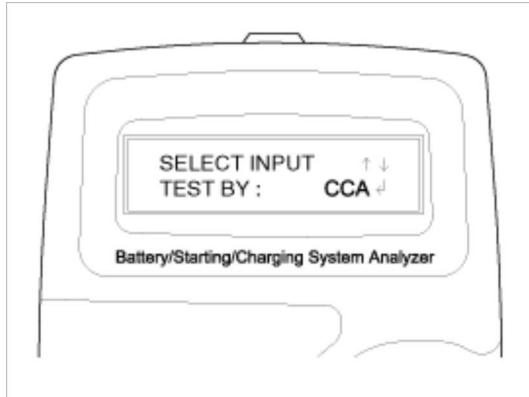
CAUTION

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

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



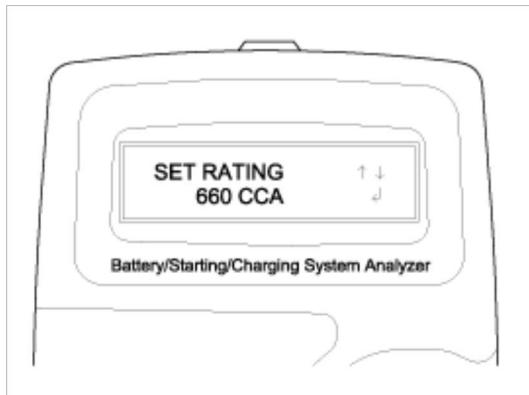
3. Select CCA and press the ENTER button.



NOTE

CCA : Cold cranking amps, is an SAE specification for cranking battered at -0.4°F (-18°C).

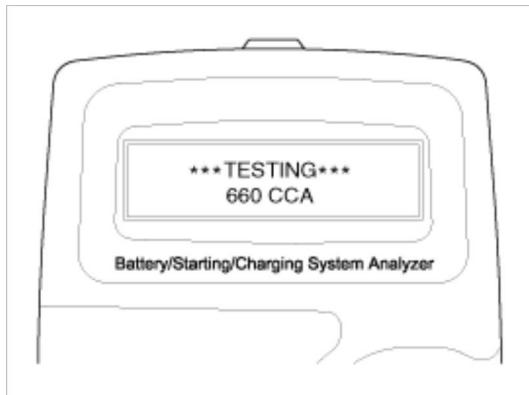
- Set the CCA value displayed on the screen to the CCA value marked on the battery label by pressing up and down buttons and press ENTER.



NOTE

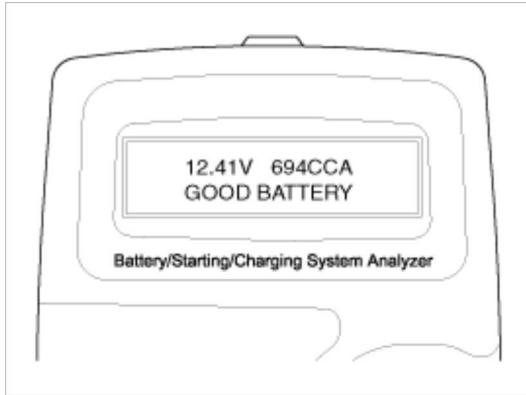
The battery ratings(CCA) displayed on the tester must be identical to the ratings marked on battery label.

- The tester will conduct battery test.



- The tester displays battery test results including voltage and battery ratings.

Refer to the following table and take the appropriate action as recommended by the Micro 570.



Battery Test Results

Result On Printer	Remedy
GOOD BATTERY	No action is required.
GOOD RECHARGE	<p>Battery is in a good state. Recharge the battery and use.</p> <p>※ You have to follow instruction below when you charge battery and retest, otherwise test result can be inaccurate. (See 'Charge and Retest method after battery charge' below.)</p>
CHARGE & RETEST	<p>Battery is not charged properly.</p> <ul style="list-style-type: none"> - Charge and test the battery again. <p>※ You have to follow instruction below when you charge battery and retest, otherwise test result can be inaccurate. (See 'Charge and Retest method after battery charge' below.)</p>
REPLACE BATTERY	<p>Replace battery and recheck the charging system.</p> <ul style="list-style-type: none"> - Improper connection between battery and vehicle cables may cause "REPLACE BATTERY". Retest the battery after removing cables and connecting the tester to the battery terminal directly prior to replacing the battery.
BAD CELL-REPLACE	<p>Charge and retest the battery.</p> <ul style="list-style-type: none"> - If the Micro 570 recommends "REPLACE BATTERY", replace the battery and recheck the charging system.

[Charge and Retest method after battery charge]

Battery charge

Set battery charger to 'Auto Mode' (The Mode that charging current drops as the battery charges.) and charge battery until charging current down close to zero or the charger alerts you with an alarm when charge is complete.

(Minimum charging time recommended: More than 3 hours with Auto Mode that explained above)

A. If battery is not fully charged, battery surface voltage will be high while the amount of current charged (CCA) in battery is low. If you measure the battery under this condition, tester may misjudge that battery sulfation occurred because the amount of current in battery is too low in comparison with battery voltage.

* Surface voltage: When battery is charged electrolyte temperature increases and chemical reaction become active resulting in an excessive increase of battery voltage.

It is known that it takes approximate one day to subside this increased surface voltage completely.

Battery Test after charge

Do not test battery right after the charge. Test battery after battery surface voltage has subsided as instructed in the following procedure.

- (1) When battery charge is complete, install the battery in the vehicle.
- (2) Put IG key to ON position and turn on head lamp with low beam, and wait 5 minutes. (Discharge for 5 minutes)
- (3) Turn off the head lamp and IG key, and wait 5 minutes. (Waiting for 5 minutes)
- (4) Remove +, - cable from the battery and test battery.

WARNING

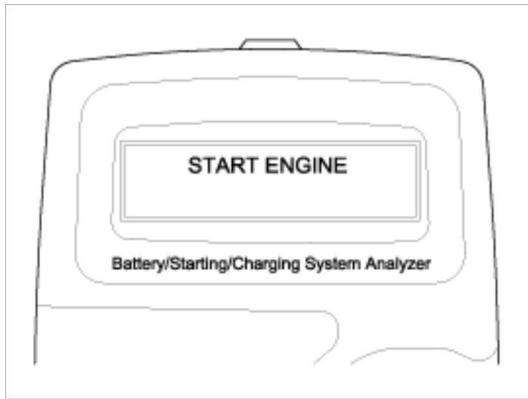
Whenever filing a claim for battery, the print out of the battery test results must be attached.

Starter Test Procedure

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

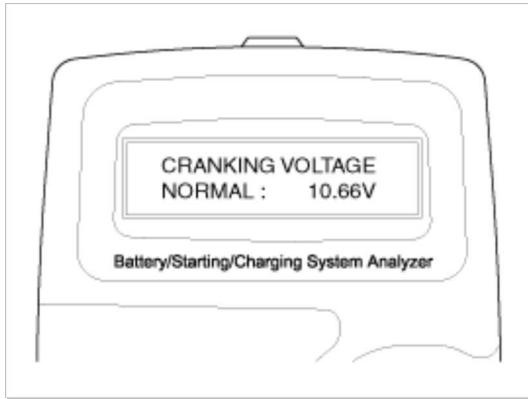


8. Start the engine.



9. Cranking voltage and starter test results will be displayed on the screen.

Refer to the following table and take the appropriate action as recommended by the Micro 570.

**Starter Test Results**

Result On Printer	Remedy
CRANKING VOLTAGE NORMAL	System shows a normal starter draw.
CRANKING VOLTAGE LOW	Cranking voltage is lower than normal level. - Check starter.
CHARGE BATTERY	The state of battery charge is too low to test. - Charge the battery and retest.

REPLACE BATTERY

Replace battery.

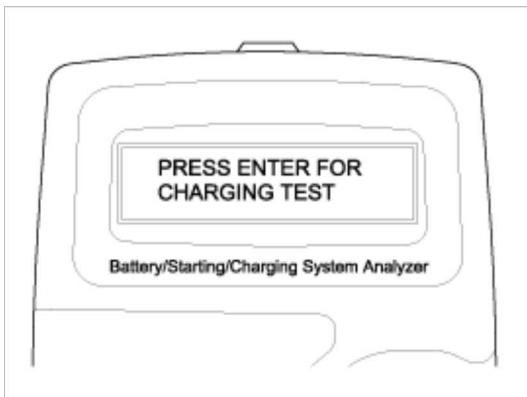
- If the vehicle is not started though the battery condition of "GOOD BATTERY" is displayed, check wiring for open circuit, battery cable connection, starter and repair or replace as necessary.
- If the engine does crank, check fuel system.

NOTE

When testing the vehicle with old diesel engines, the test result will not be favorable if the glow plug is not heated. Conduct the test after warming up the engine for 5 minutes.

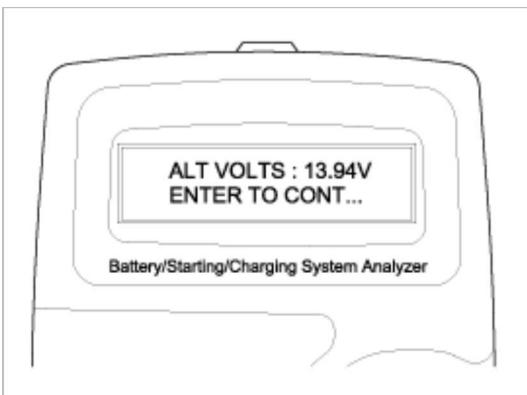
Charging System Test Procedure

10. Press ENTER to begin charging system test.

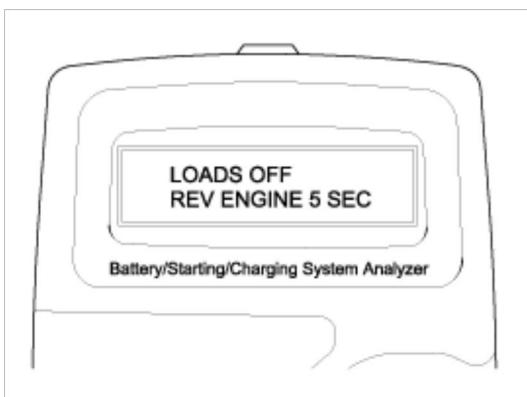


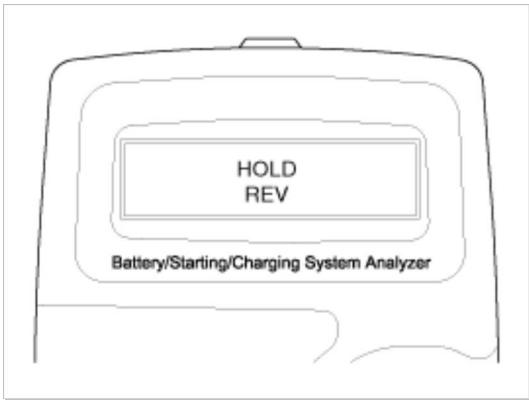
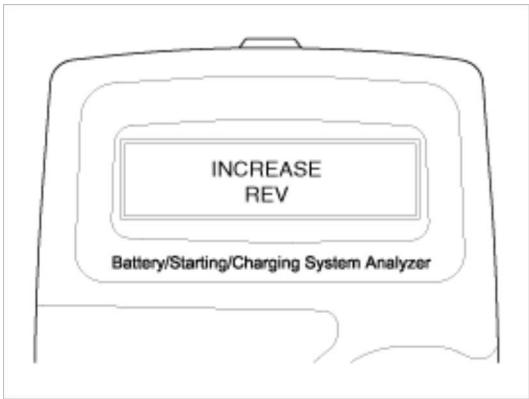
11. The tester displays the actual voltage of alternator.

Press ENTER to continue.

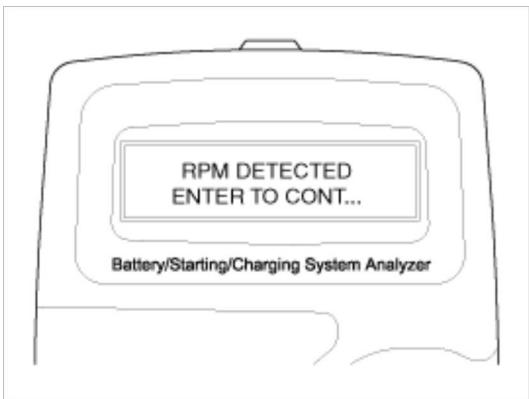


12. Turn off all electrical load and rev engine for 5 seconds with pressing the accelerator pedal. (Follow the instructions on the screen)

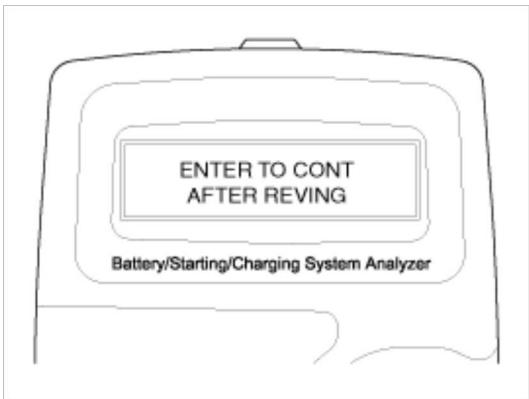




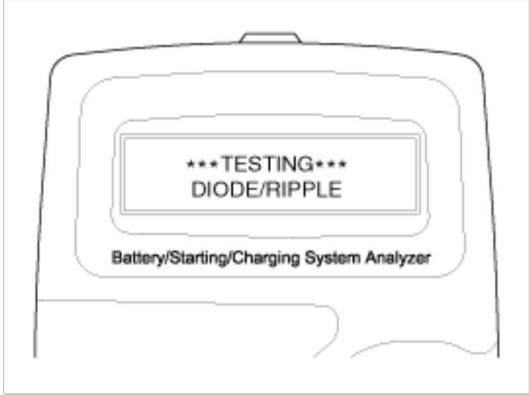
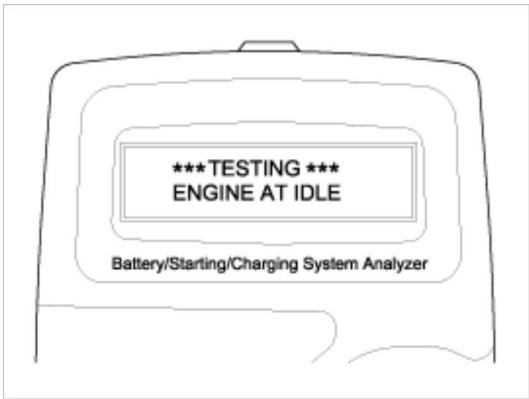
13. The message that engine RPM is detected will be displayed on the screen. Press ENTER to continue.



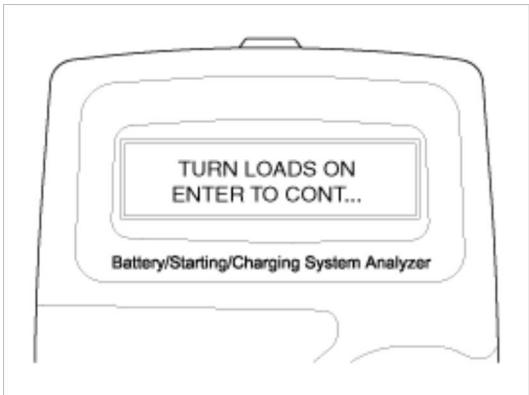
14. If the engine RPM is not detected, press ENTER after revving engine.



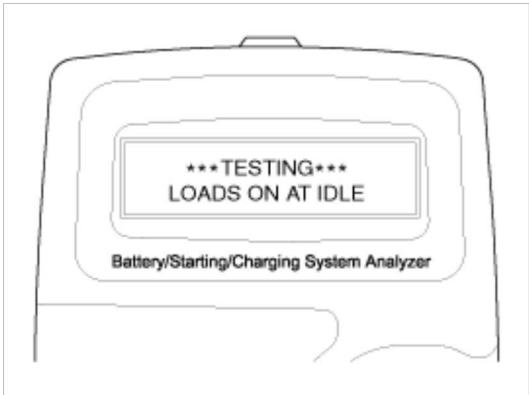
15. The tester will conduct charging system test during loads off.



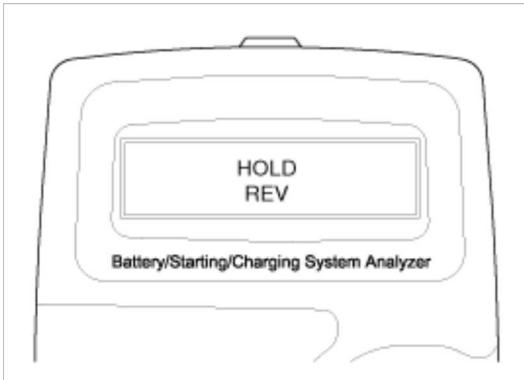
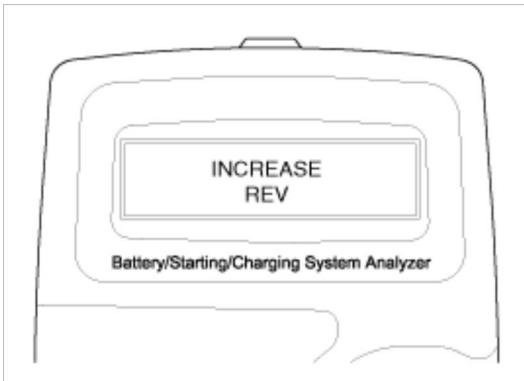
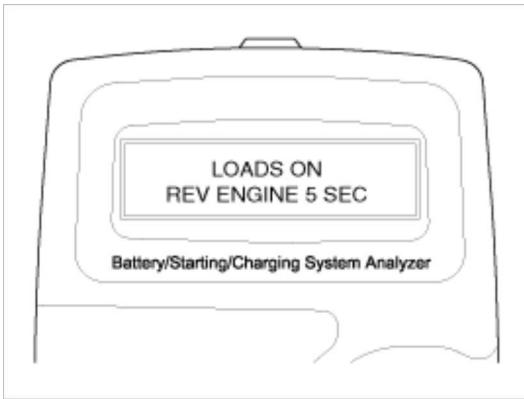
16. Turn on electrical loads (air conditioner, lamps, audio and etc). Press ENTER to continue.



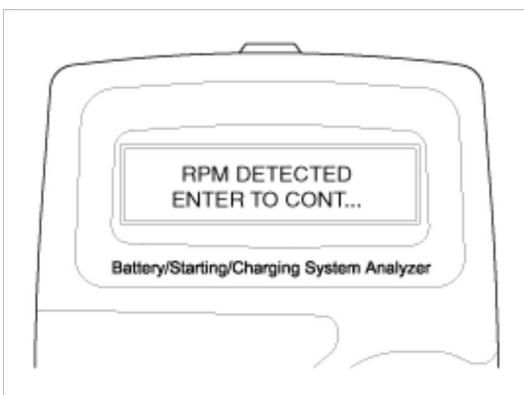
17. The tester will conduct charging system test during loads on.



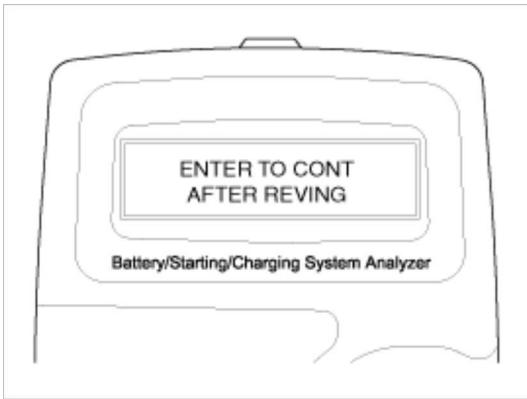
18. Rev engine for 5 seconds with pressing the accelerator pedal. (Follow the instructions on the screen)



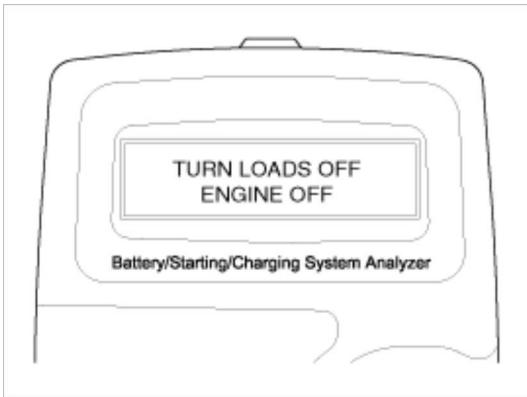
19. The message that engine RPM is detected will be displayed on the screen. Press ENTER to continue.



20. If the engine RPM is not detected, press ENTER after revving engine.

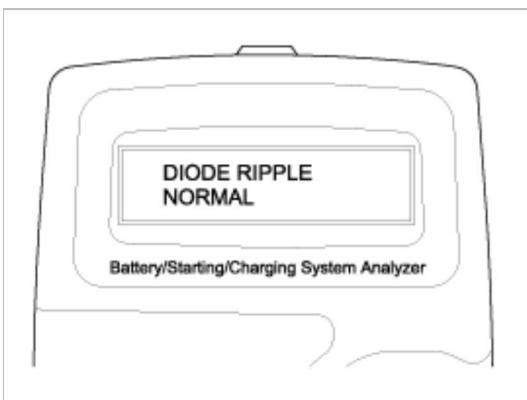
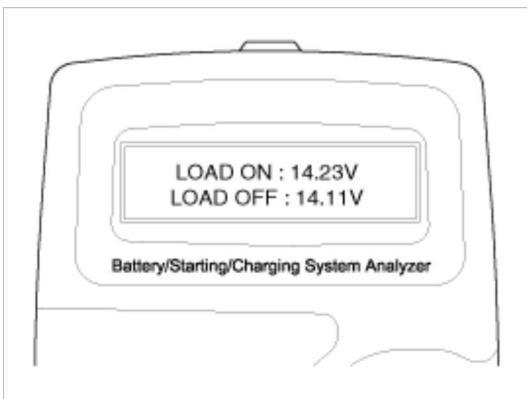


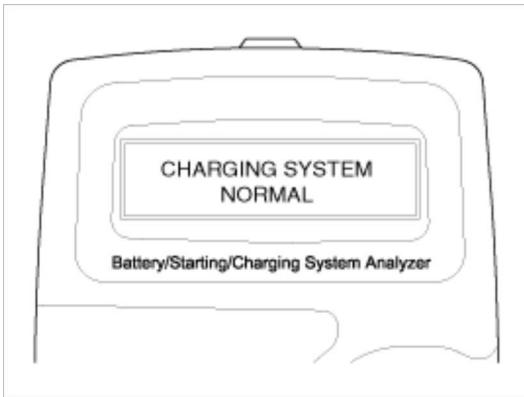
21. Turn off electrical loads (air conditioner, lamps, audio and etc). Turn the engine off.



22. Charging voltage and charging system test results will be displayed on the screen.

Shut off engine and disconnect the tester clamps from the battery. Refer to the following table and take the appropriate action as recommended by the Micro 570.





Charging System Test Results

Result On Printer	Remedy
CHARGING SYSTEM NORMAL / DIODE RIPPLE NORMAL	Charging system is normal.
NO CHARGING VOLTAGE	Alternator does not supply charging current to battery. - Check belts, connection between alternator and battery and replace belts or cable or alternator as necessary.
LOW CHARGING VOLTAGE	Alternator does not supply charging current to battery and electrical load to system fully. - Check belts and alternator and replace as necessary.
HIGH CHARGING VOLTAGE	The voltage from alternator to battery is higher than normal limit during voltage regulating. - Check connection and ground and replace regulator as necessary. - Check electrolyte level in the battery.
EXCESS RIPPLE DETECTED	One or more diodes in the alternator is not functioning properly. - Check alternator mounting and belts and replace as necessary.

Engine Electrical System > Ignition System > Description and Operation

Description

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

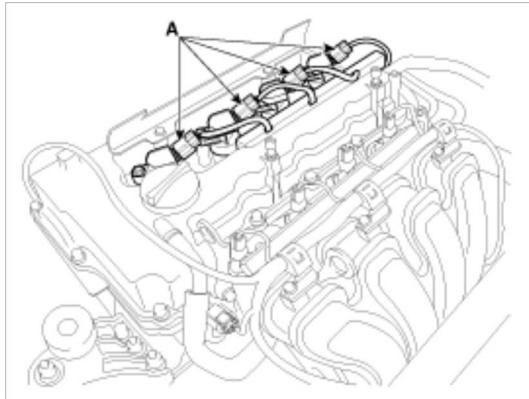
The engine operating conditions (speed, load, warm-up condition, etc.) are detected by the various sensors. Based on these sensor signals and the ignition timing data, signals to interrupt the primary current are sent to the ECM. The ignition coil is activated, and timing is controlled.

Engine Electrical System > Ignition System > Repair procedures

On-vehicle Inspection

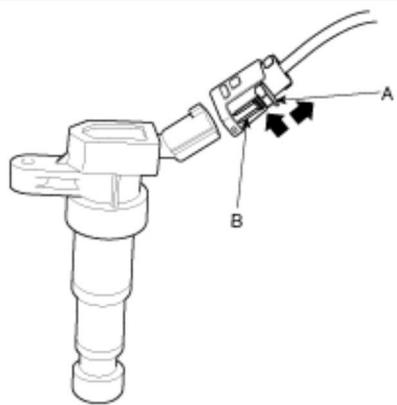
Spark Test

1. Remove the ignition coil connectors (A).

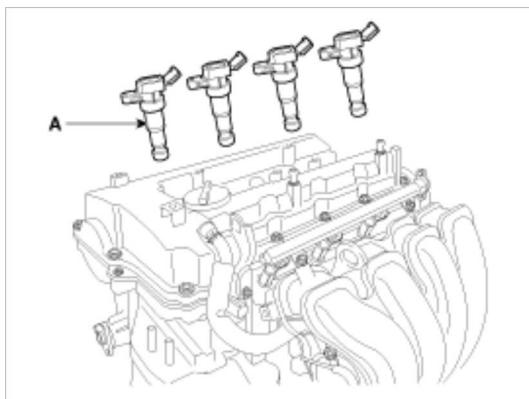


NOTE

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



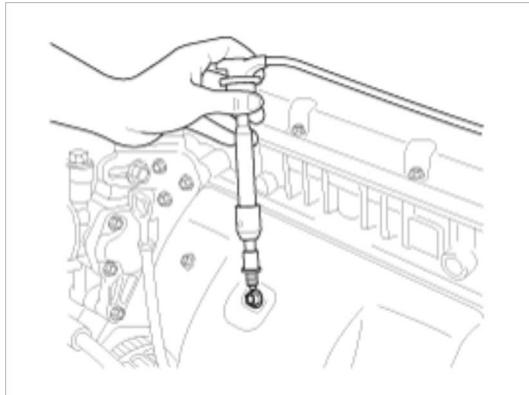
2. Remove the ignition coils (A).



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

4. Install the spark plug to the ignition coil.

5. Ground the spark plug to the engine.



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

NOTE

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.

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

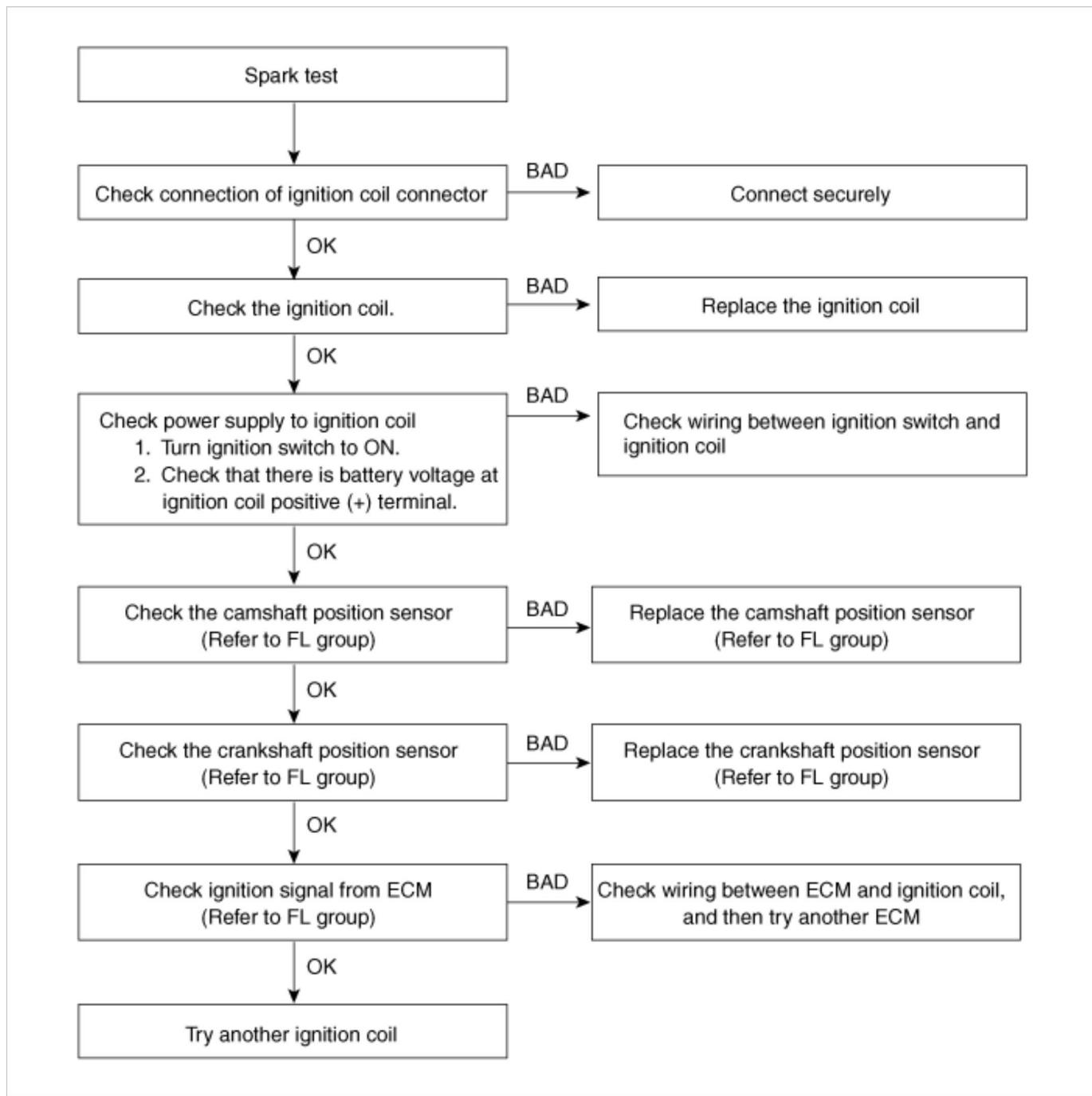
Tightening torque :

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

NOTE

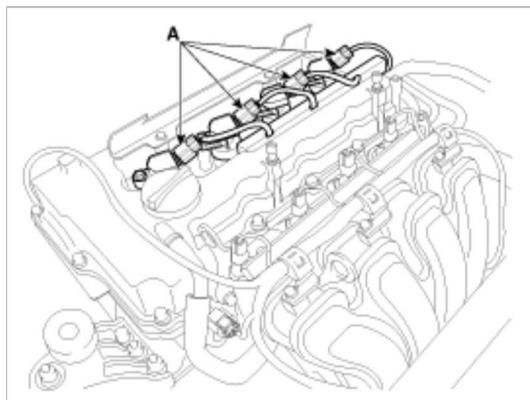
When inserting ignition coil into the cylinder head cover for spark plug to be inserting ignition coil, the sealing cap of ignition coil must be mated totally with inner side of cylinder head.

10. Reconnect the ignition coil connectors.



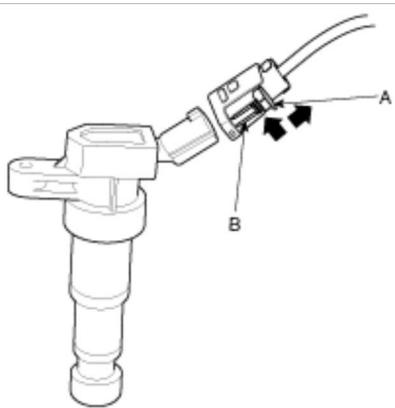
Inspect Spark Plug

1. Remove the ignition coil connectors (A).



NOTE

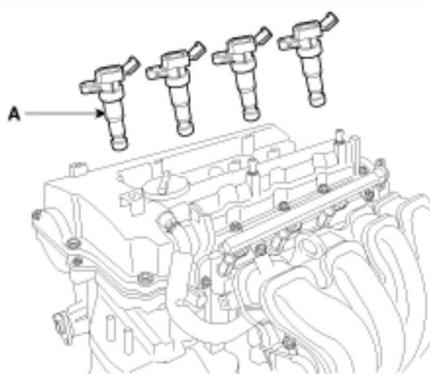
When removing the ignition coil connector, pull the lock pin (A) and push the clip (B).



2. Remove the ignition coils (A).

Tightening torque :

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

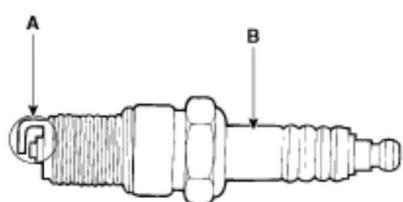


3. Using a spark plug socket, remove the spark plug.

CAUTION

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

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

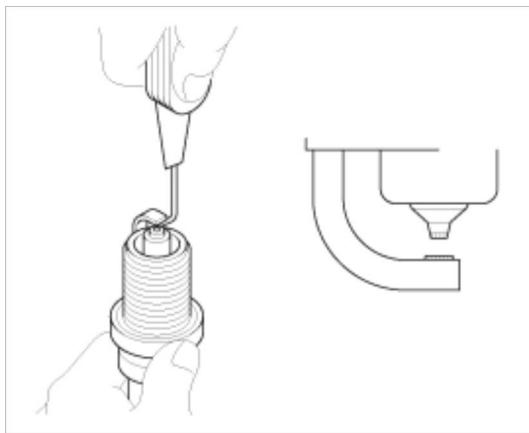
**Inspection Of Electrodes**

Condition	Dark deposits	White deposits
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Description	- Fuel mixture too rich - Low air intake	- Fuel mixture too lean - Advanced ignition timing - Insufficient plug tightening torque
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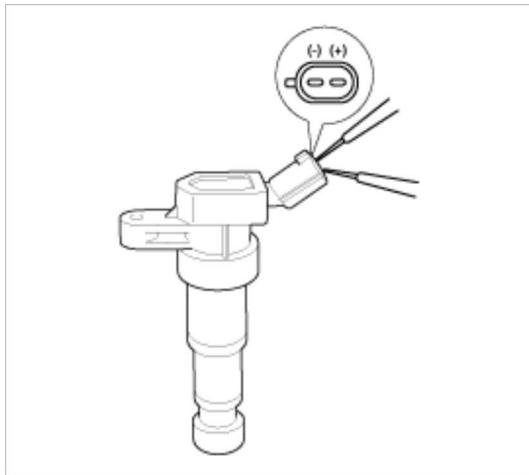
5. Check the electrode gap (A).

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



Inspect Ignition Coil

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



Standard value: $0.62\Omega \pm 10\%$

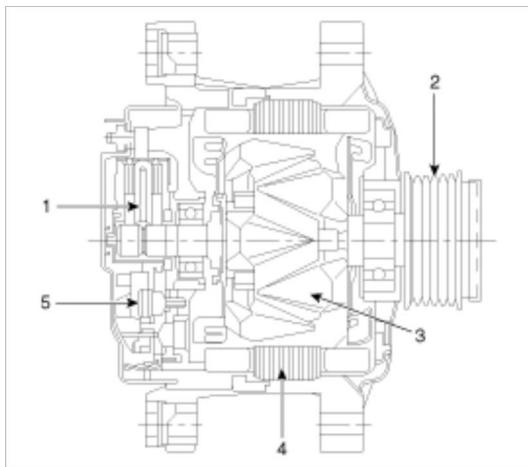
Engine Electrical System > Charging System > Description and Operation

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. The brush holder contains a built-in electronic voltage regulator.



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.

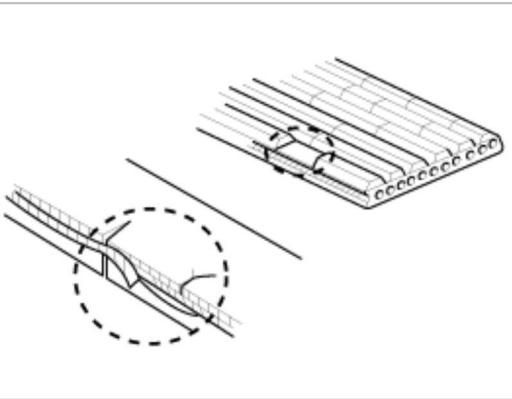
Inspect Drive Belt

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.



Visually Check Alternator Wiring And Listen For Abnormal Noises

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

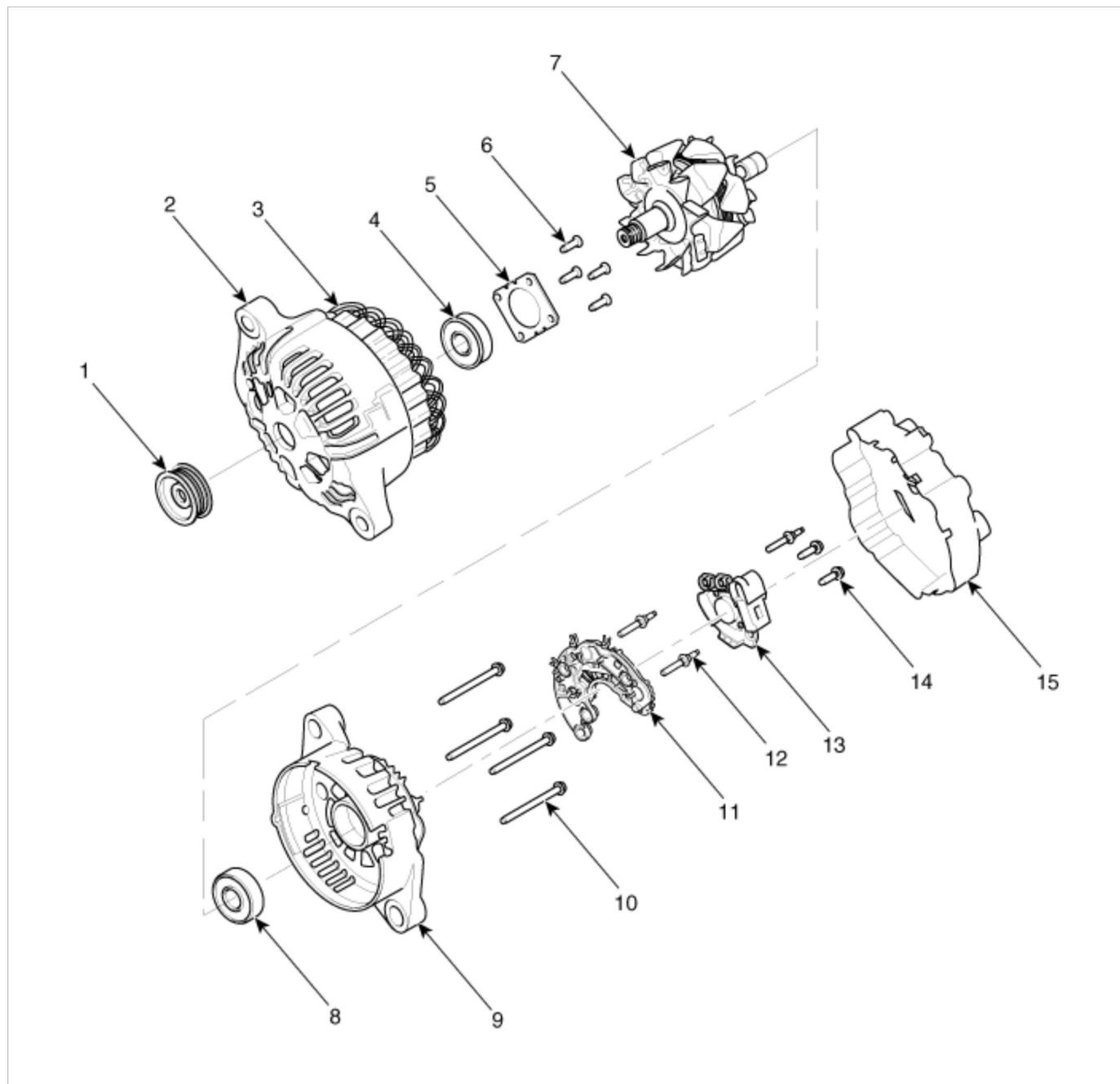
Check Discharge Warning Light Circuit

1. Warm up the engine and then turn it off.
2. Turn off all accessories.
3. Turn the ignition switch "ON". Check that the discharge warning light is lit.
4. Start the engine. Check that the light is lit.

If the light does not go off as specified, troubleshoot the discharge light circuit.

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

Components



1. Pulley	6. Bearing retainer bolt	11. Rectifier
2. Front housing	7. Rotor	12. Rectifier bolt
3. Stator	8. Rear bearing	13. Regulator assembly
4. Front bearing	9. Rear housing	14. Regulator bolt
5. Bearing retainer	10. Through bolt	15. 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)

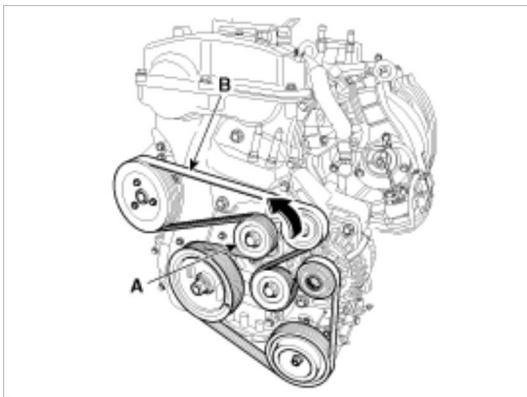
(-) terminal (without battery sensor):

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)

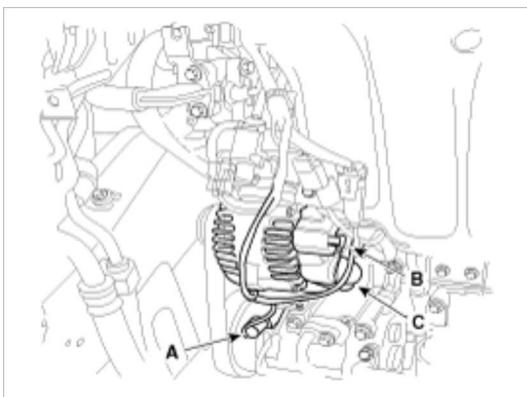
-
2. Remove the drive belt (B) after turning the drive belt tensioner (A) counterclockwise.



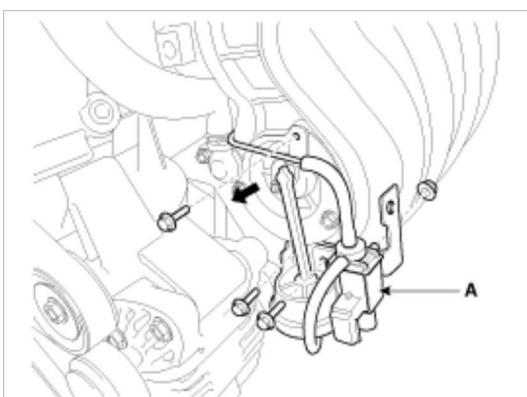
3. Disconnect the A/C compressor switch connector (A), the alternator connector (B), and the cable (C) from alternator "B" terminal.

Tightening torque :

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



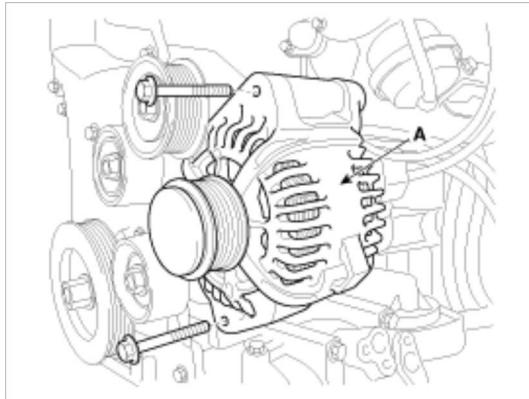
4. Remove the VIS(Variable intake system) actuator/valve (A) from the intake manifold.



5. Pull out the through bolt and then remove the alternator (A).

Tightening torque :

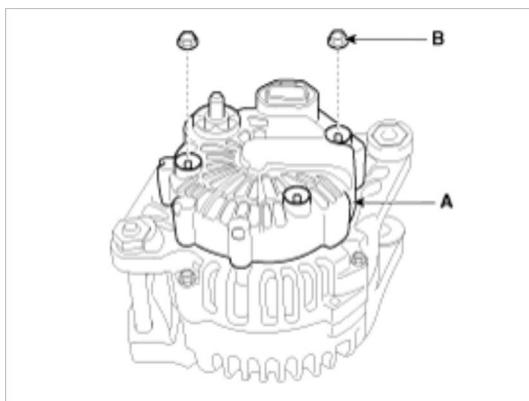
49.0 ~ 63.7N.m (5.0 ~ 6.5kgf.m, 36.2 ~ 47.0lb-ft)



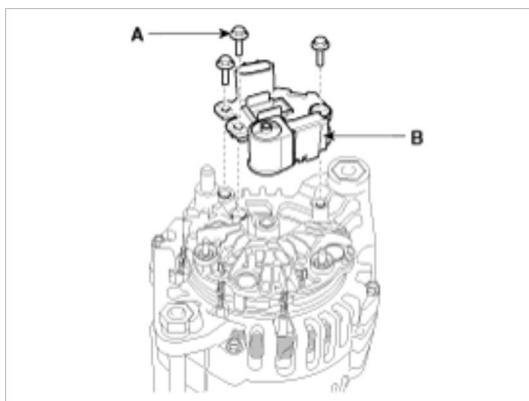
6. Installation is the reverse order of removal.

Disassembly

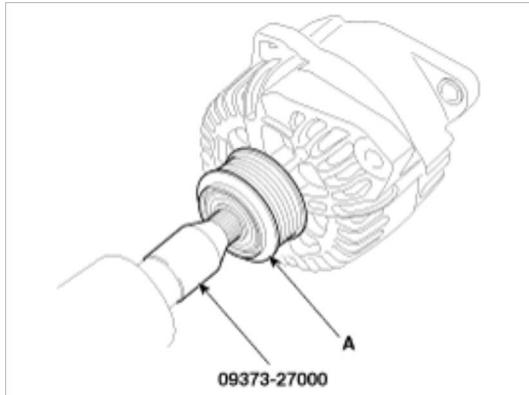
1. Loosen the nuts (B) and then remove the cover (A).



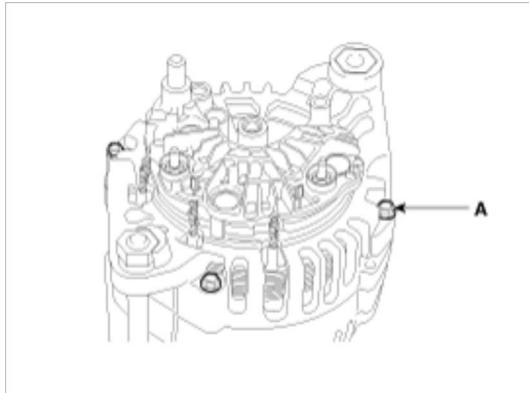
2. Loosen the mounting bolts (A) and remove the regulator assembly (B).



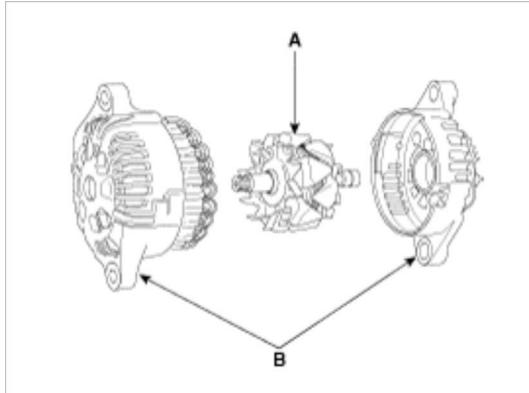
3. Using the SST (09373-27000), remove the pulley (A).



4. Loosen the 4 through bolts (A) and then remove the rear housing with the rectifier by loosen the clamping wires.



5. Disconnect the rotor (A) and the housing (B).

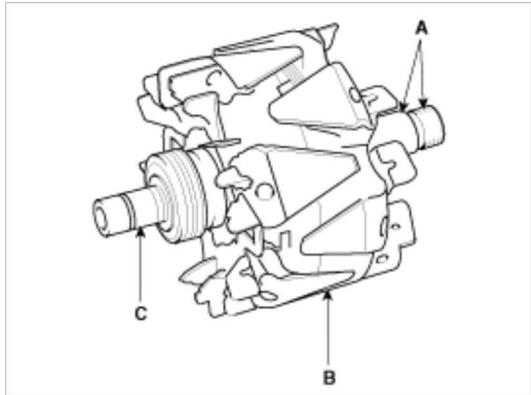


6. Reassembly is the reverse order of disassembly.

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).



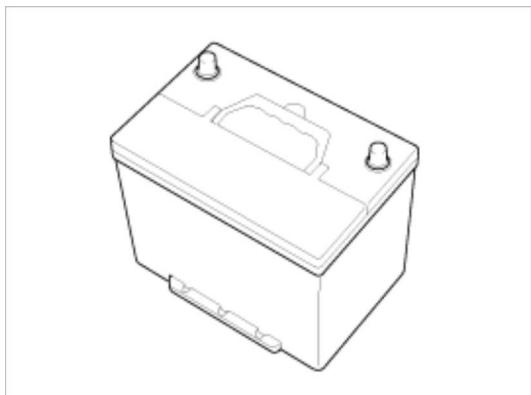
2. Check that there is no continuity between each lead and the coil core.

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

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

Description

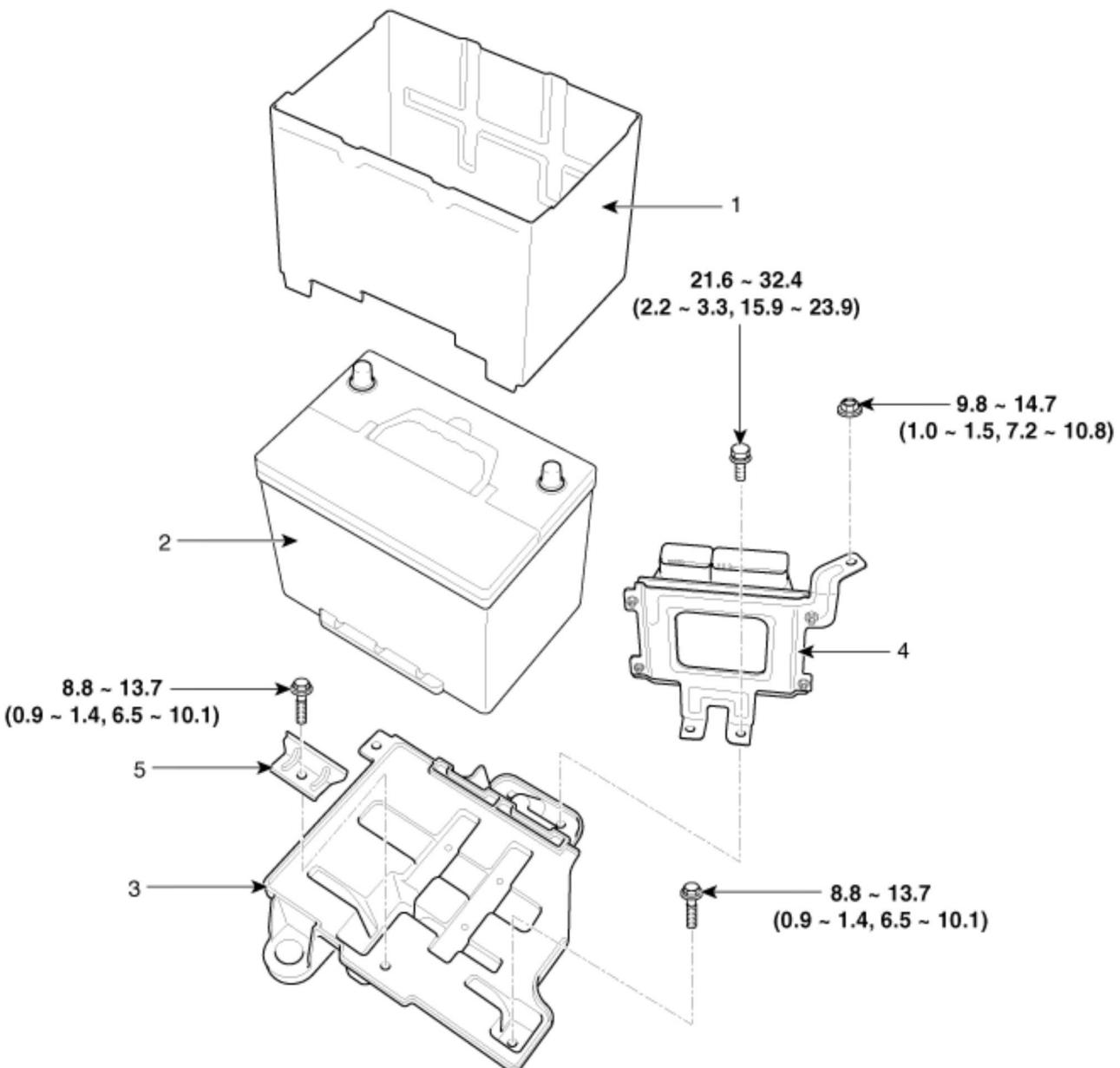
1. The maintenance-free battery is, as the name implies, totally maintenance free and has no removable battery cell caps.
2. Water never needs to be added to the maintenance-free battery.
3. The battery is completely sealed, except for small vent holes in the cover.



NOTE

After disconnecting then reconnecting the battery negative cable, reset some parts that require the reset procedures.

(Refer to BE group . GeneralInformation)

Engine Electrical System > Charging System > Battery > Components and Components Location
Components
**Torque : N.m (kgf.m, lb-ft)**

- | | |
|---------------------------|-----------------------------|
| 1. Battery insulation pad | 4. ECM & bracket assembly |
| 2. Battery | 5. Battery mounting bracket |
| 3. Battery tray | |

Engine Electrical System > Charging System > Battery > Repair procedures

Removal and Installation

1. Remove the battery.

- (1) Disconnect 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)

- (2) Disconnect the battery positive terminal (B).

Tightening torque :

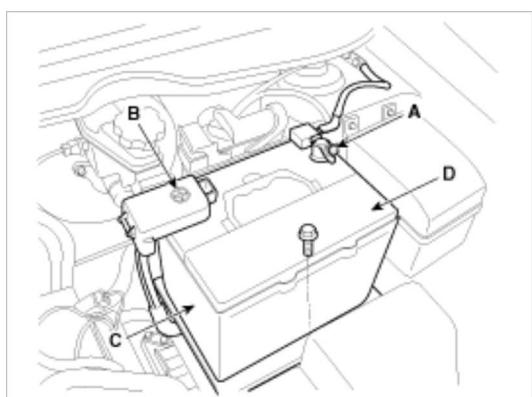
7.8 ~ 9.8 N.m (0.8 ~ 1.0 kgf.m, 5.8 ~ 7.2 lb-ft)

- (3) Remove the battery insulation pad (C).

- (4) Remove the battery mounting bracket, and the battery (D).

Tightening torque :

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



2. Remove the air duct and air cleaner assembly. (Refer to EM group).

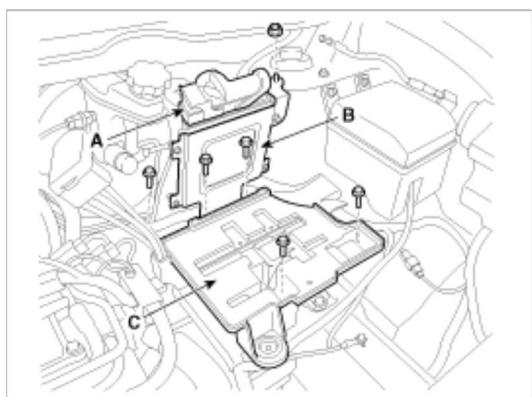
3. Remove the ECM (B) and the battery tray (C) after disconnecting the ECM connector (A).

Tightening torque

ECM bracket nut : 9.8 ~ 14.7N.m (1.0 ~ 1.5kgf.m, 7.2 ~ 10.8lb-ft)

ECM bracket bolts : 21.6 ~ 32.4N.m (2.2 ~ 3.3kgf.m, 15.9 ~ 23.9lb-ft)

Battery tray bolts : 8.8 ~ 13.7N.m (0.9 ~ 1.4kgf.m, 6.5 ~ 10.1lb-ft)



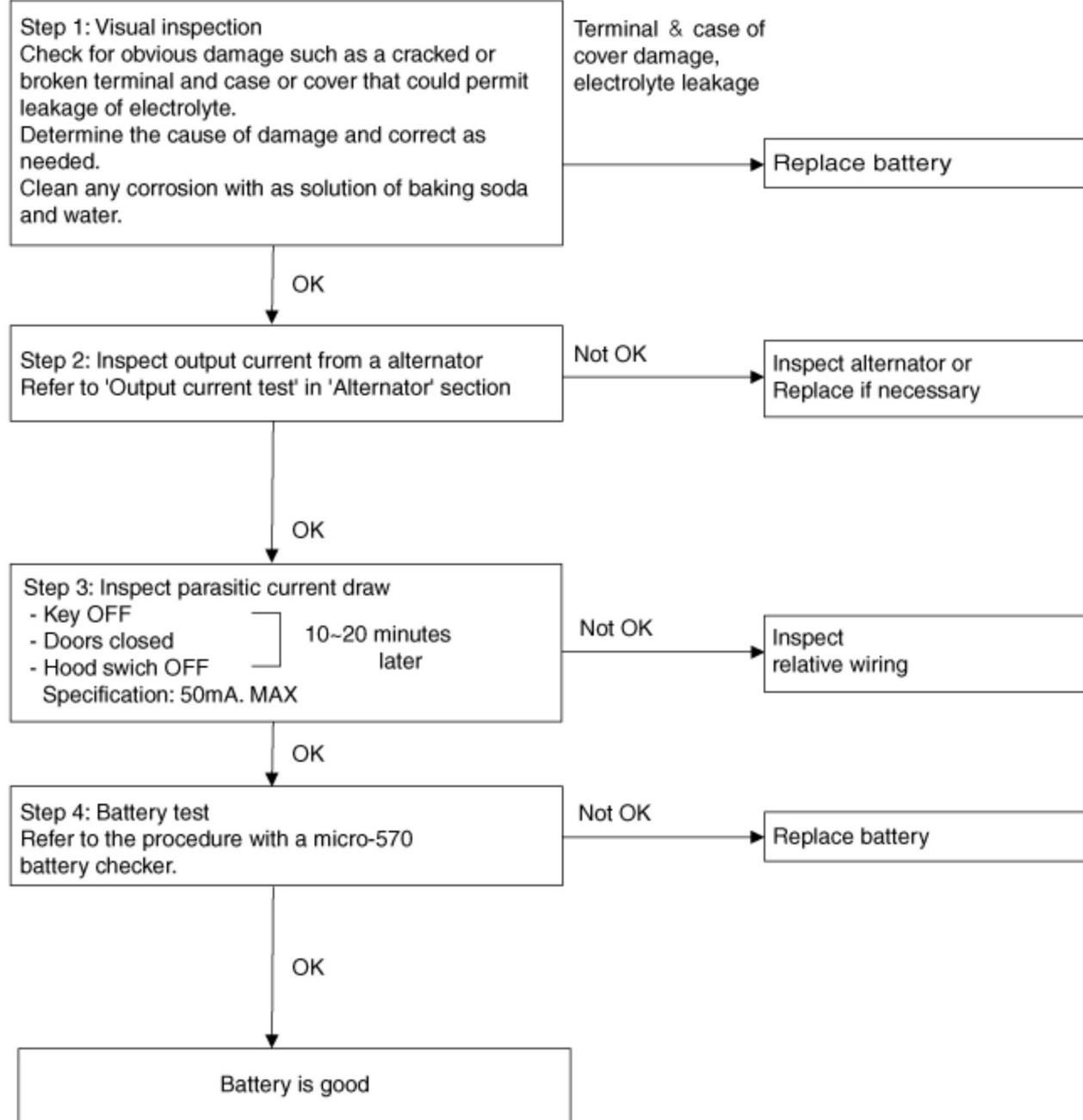
4. Installation is the reverse order of removal.

CAUTION

When installing the battery, fix the mounting bracket on the tray correctly.

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.

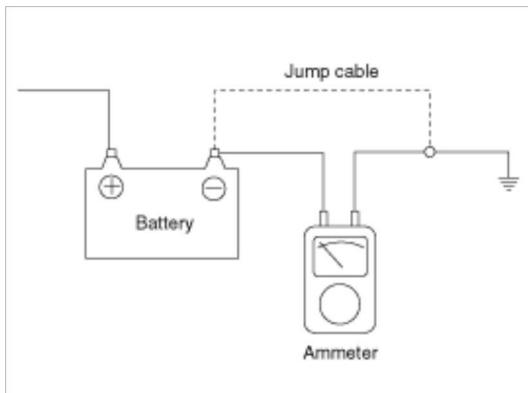
4. Connect an ammeter in series between the battery (-) terminal and the ground cable, and then disconnect the clamp from the battery (-) terminal slowly.

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

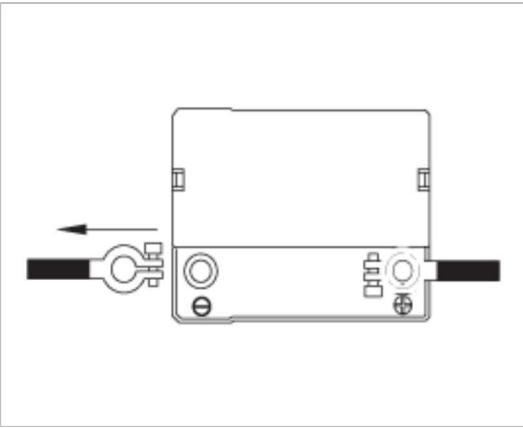
1. Make sure the ignition switch and all accessories are in the OFF position.

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 worn 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

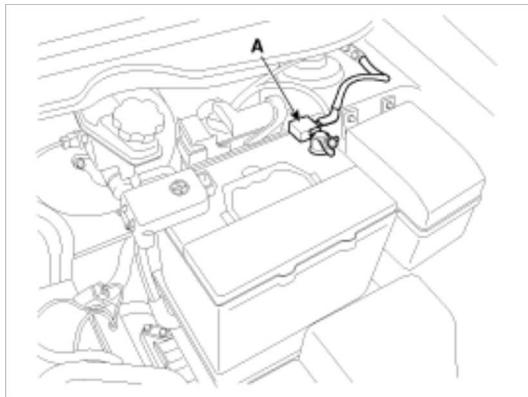
When batteries are being charged, an explosive gas forms beneath the cover of each cell. Do not smoke near batteries being charged or which have recently been charged. Do not break live circuit at the terminals of batteries being charged.

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 are 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.

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

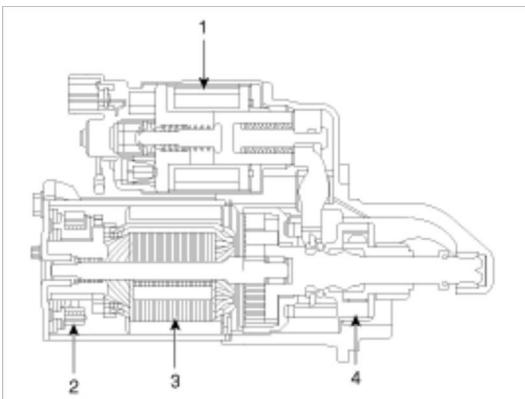
Description

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.



1. Solenoid
2. Brush
3. Armature
4. Overrun clutch

Engine Electrical System > Starting System > Repair procedures

Troubleshooting Starter Circuit

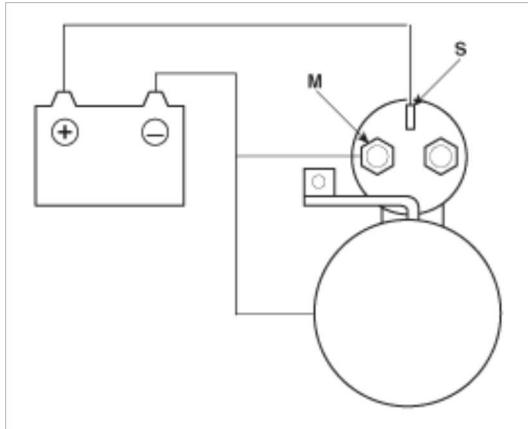
NOTE

The battery must be in good condition and fully charged.

1. Disconnect the injector connectors.
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.

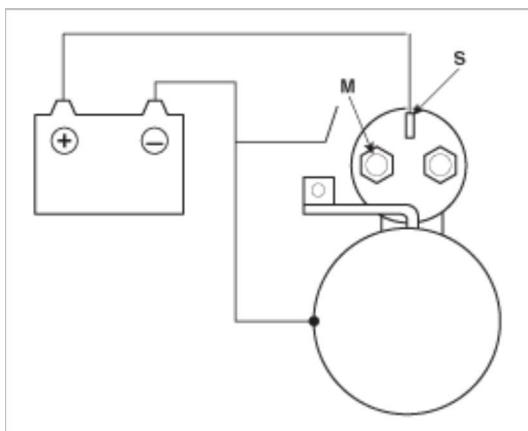
Starter Solenoid Test

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.

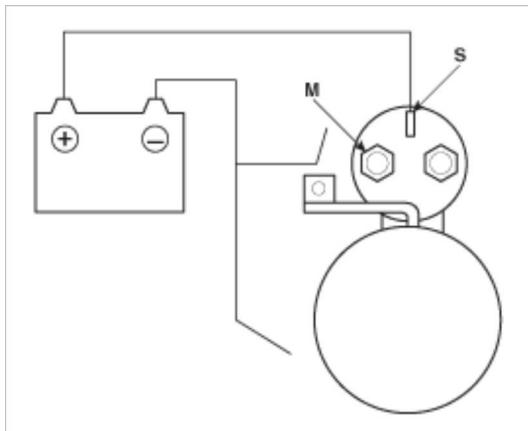


3. Disconnect the battery from the M terminal.

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.

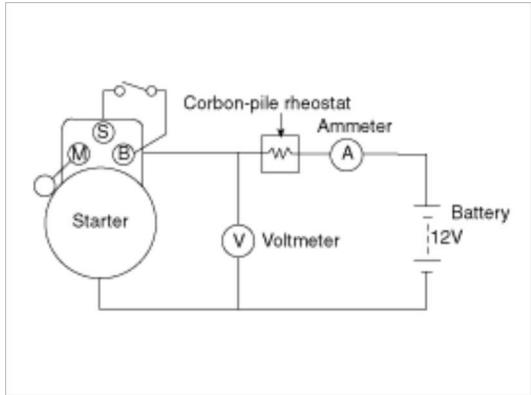


4. Disconnect the battery also from the body. If the pinion retracts immediately, it is working properly. To avoid damaging the starter, do not leave the battery connected for more than 10 seconds.



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.



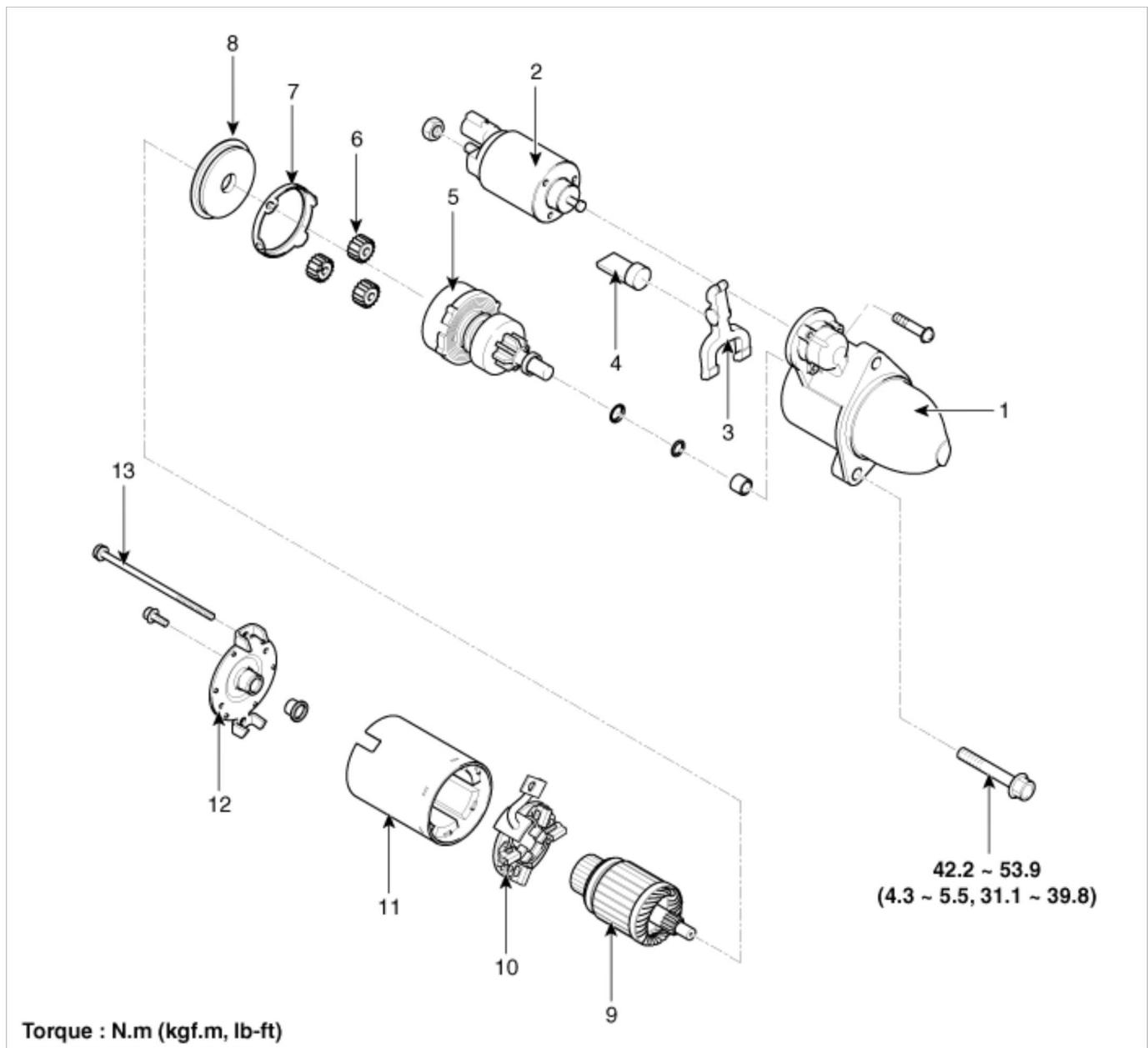
4. Rotate carbon pile to the off position.
5. Connect the battery cable from battery's negative post to the starter motor body.
6. Adjust until battery voltage shown on the voltmeter reads 11.5volts.
7. Confirm that the maximum amperage is within the specifications and that the starter motor turns smoothly and freely.

Max. Current : 90A

Min. Speed : 2,600 rpm

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

Components



- | | |
|------------------------------|---------------------------|
| 1. Front housing | 8. Shield |
| 2. Starter solenoid assembly | 9. Armature assembly |
| 3. Lever | 10. Brush holder assembly |
| 4. Lever packing | 11. Yoke assembly |
| 5. Planet shaft assembly | 12. Rear housing |
| 6. Planetary gear assembly | 13. Through bolt |
| 7. Packing | |

Engine Electrical System > Starting System > Starter > Repair procedures

Removal and Installation

1. Disconnect the battery negative cable.

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)

2. Disconnect the starter cable (A) from the B terminal on the solenoid, then disconnect the connector (B) from the S terminal.

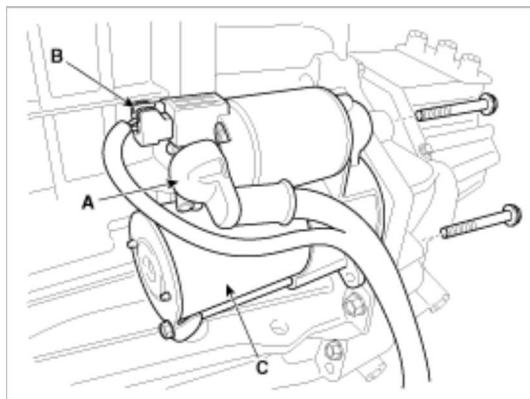
Tightening torque :

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

3. Remove the 2 bolts holding the starter, then remove the starter (C).

Tightening torque :

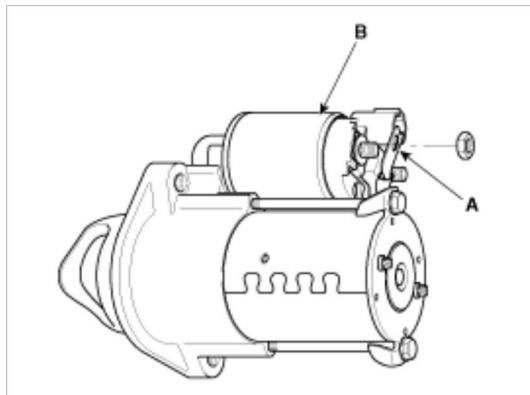
42.2 ~ 53.9N.m (4.3 ~ 5.5kgf.m, 31.1 ~ 39.8lb-ft)



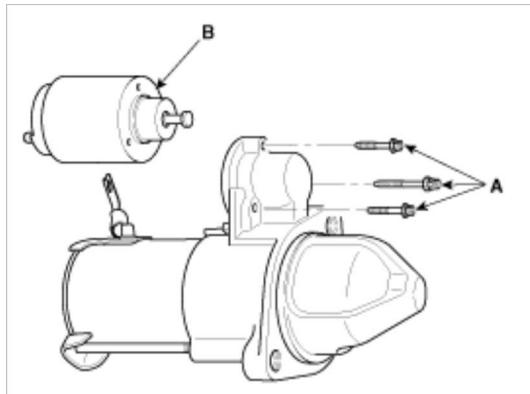
4. Installation is the reverse of removal.

Disassembly

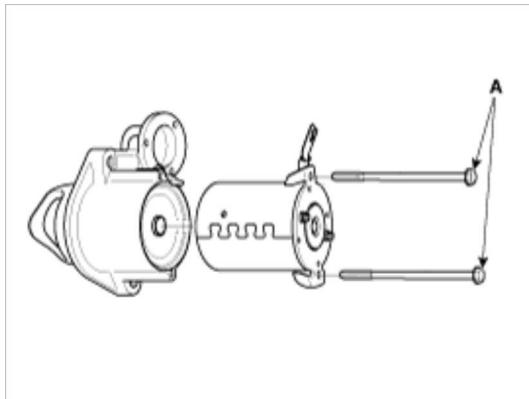
1. Disconnect the M-terminal (B) on the starter solenoid assembly (A).



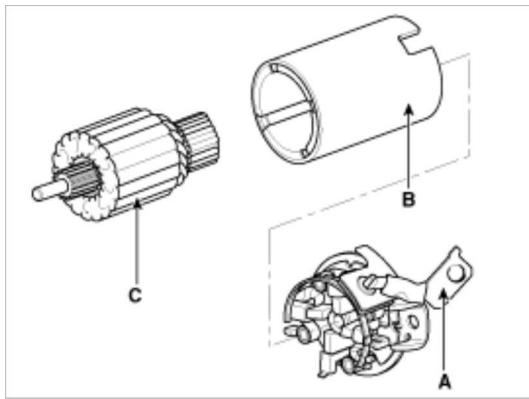
2. After loosening the screws (A), detach the starter solenoid assembly (B).



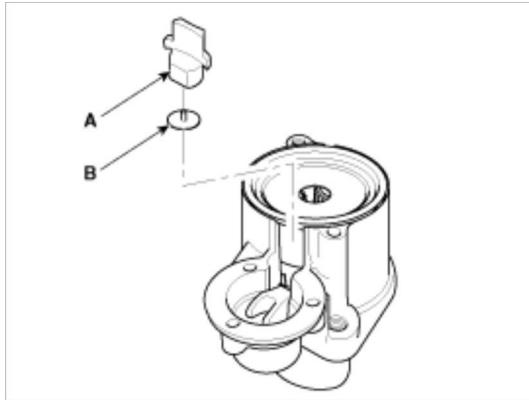
3. Loosen the through bolts (A).



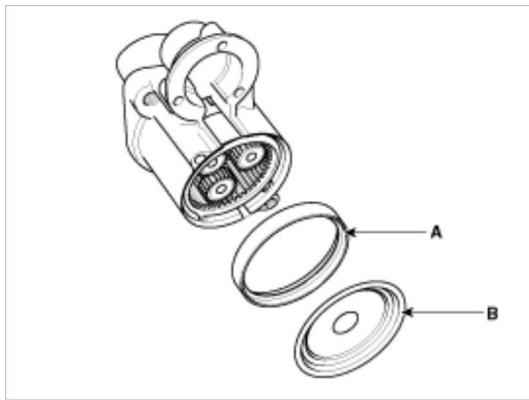
4. Remove the brush holder assembly (A), yoke (b) and armature (C).



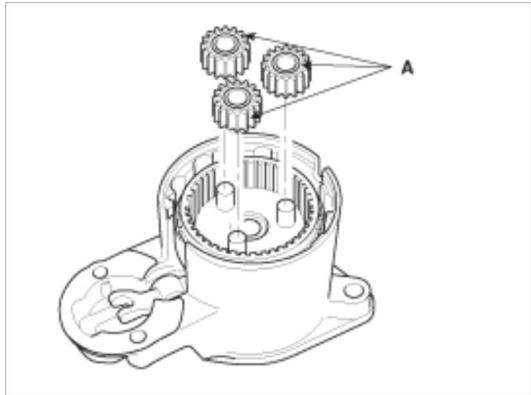
5. Remove the lever plate (B) and lever packing (A).



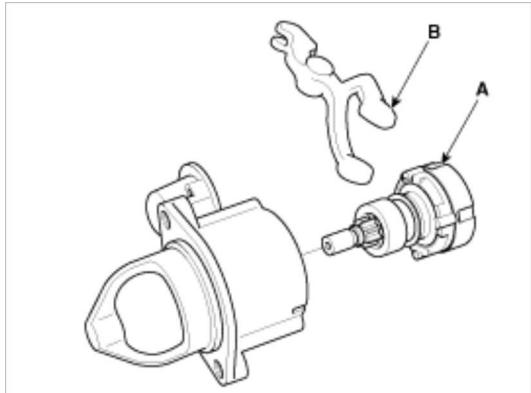
6. Remove the packing (A) and shield (B).



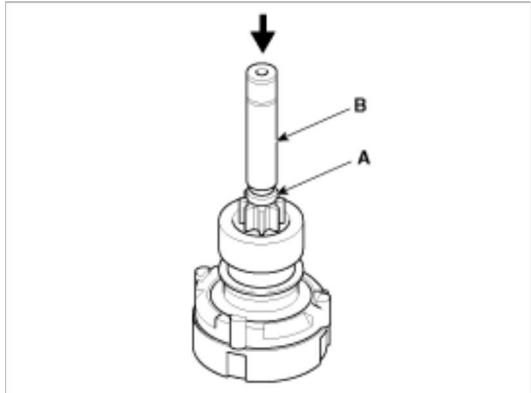
7. Disconnect the planet gear (A).



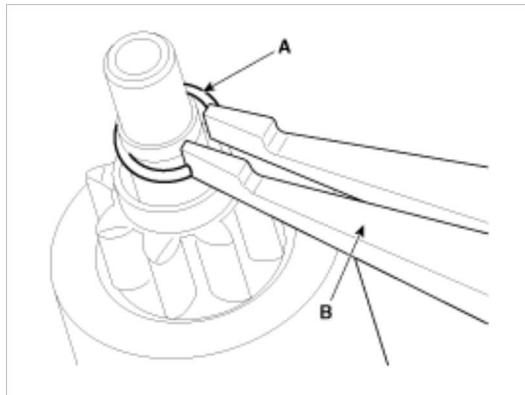
8. Disconnect the planet shaft assembly (A) and lever (B).



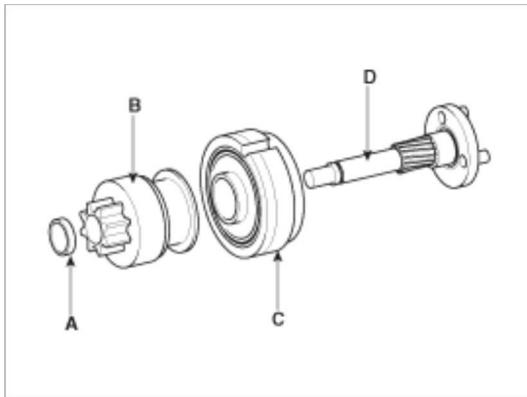
9. Press the stopper (A) using a socket (B).



10. After removing the stop ring (A) using stop ring pliers (B).

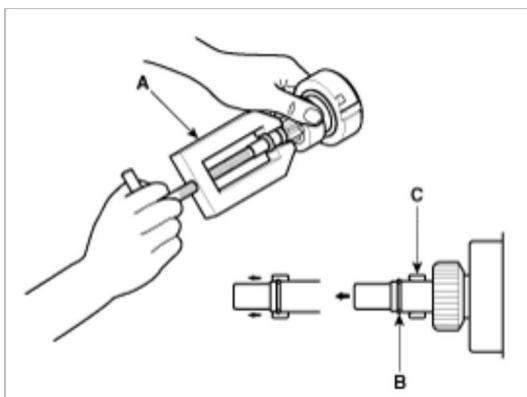


11. Disconnect the stopper (A), overrunning clutch (B), internal gear (C) and planet shaft (D).



NOTE

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

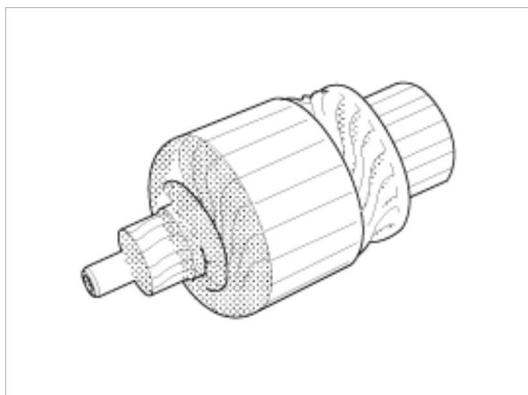


12. Reassembly is the reverse of disassembly.

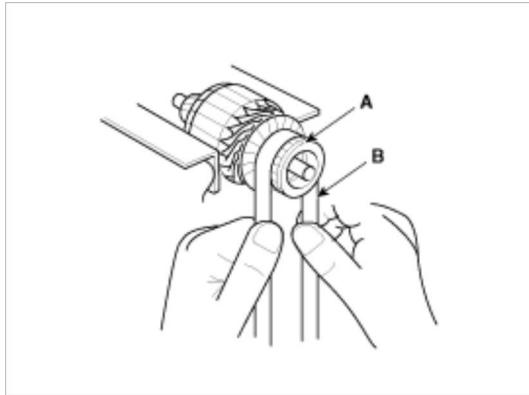
Inspection

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) : 27.0 mm (1.06 in.)

Service limit : 26.0 mm (1.02 in.)



6. Measure the commutator (A) runout.

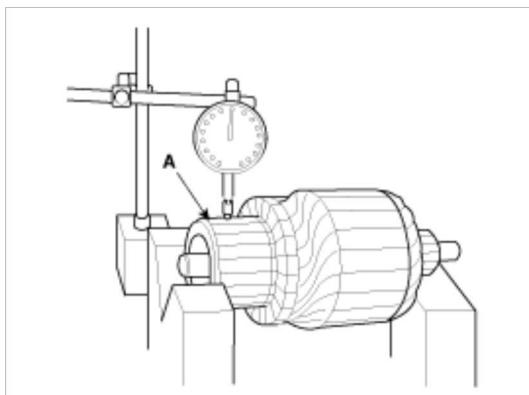
A. If the commutator runout is within the service limit, check the commutator for carbon dust or brass chips between the segments.

B. If the commutator run out is not within the service limit, replace the armature.

Commutator runout

Standard (New): 0.05mm (0.0019in.) max

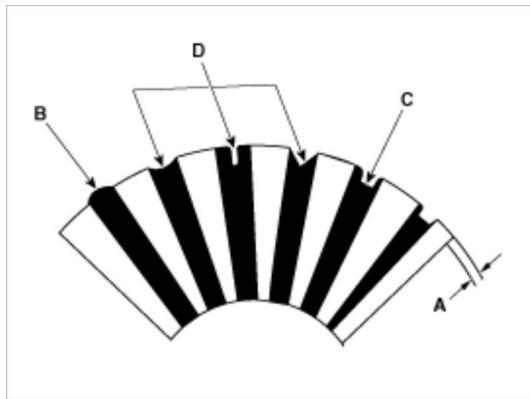
Service limit: 0.08mm (0.0031in.)



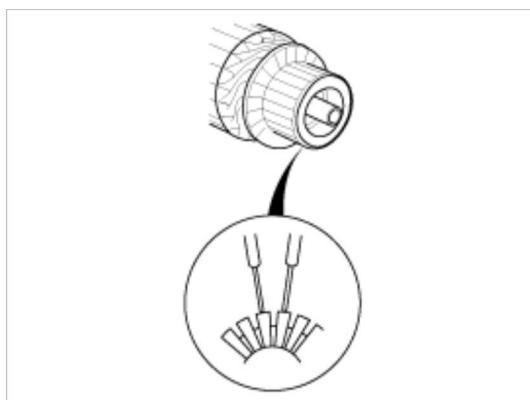
7. Check the mica depth (A). If the mica is too high (B), undercut the mica with a hacksaw blade to the proper depth. Cut away all the mica (C) between the commutator segments. The undercut should not be too shallow, too narrow, or v-shaped (D).

Commutator mica depth

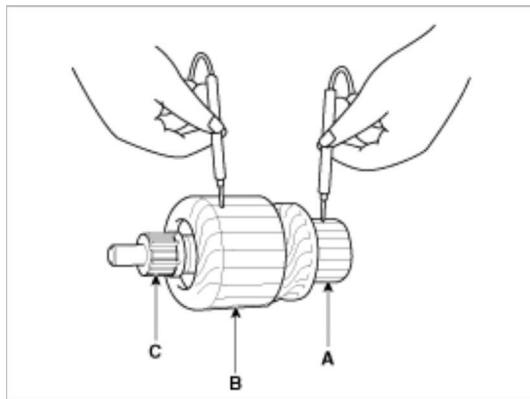
Standard (New) : 0.8 mm (0.0314in.)
Limit : 0.2mm (0.0079 in.)



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

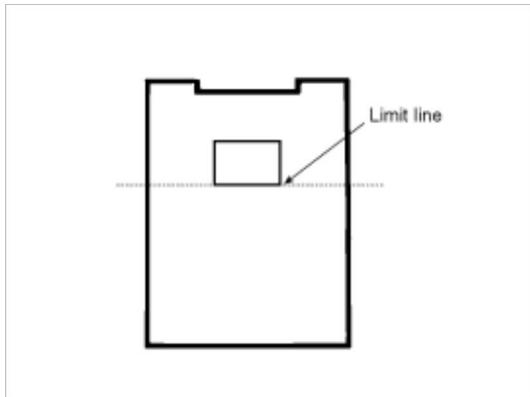


9. Check with an ohmmeter that no continuity exists between the commutator (A) and armature coil core (B), and between the commutator and armature shaft (C). If continuity exists, replace the armature.



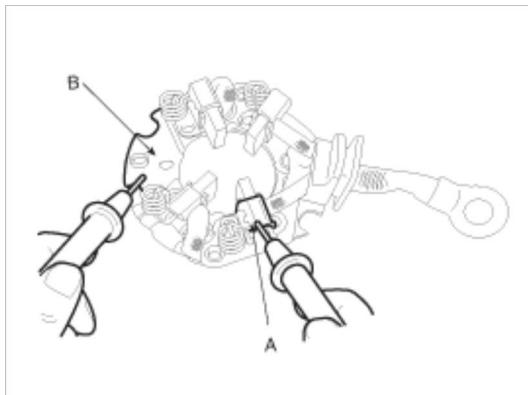
Inspect Starter Brush

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

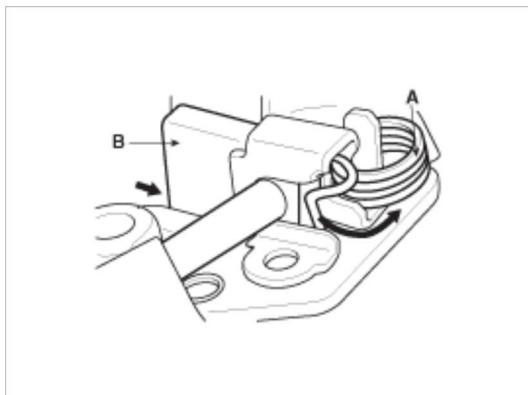


Starter Brush Holder Test

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



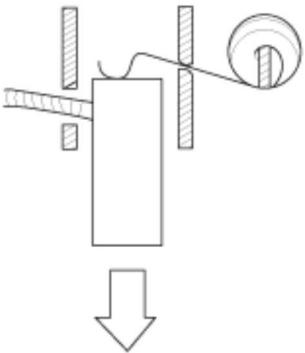
2. Pry back each brush spring (A) with a screwdriver, then position the brush (B) about halfway out of its holder, and release the spring to hold it there.



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.

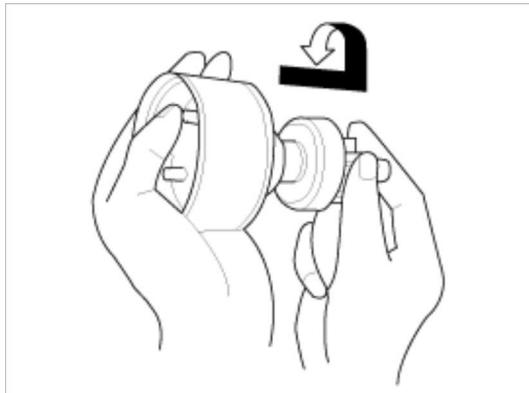
NOTE

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.

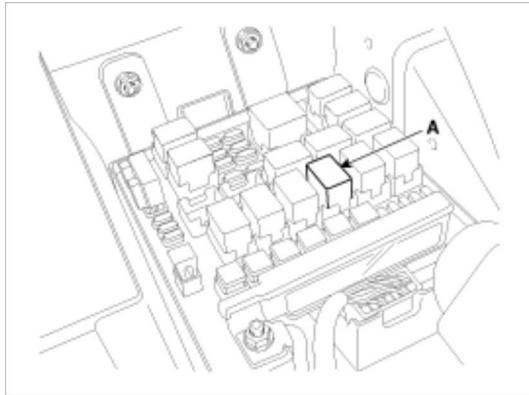
Cleaning

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).

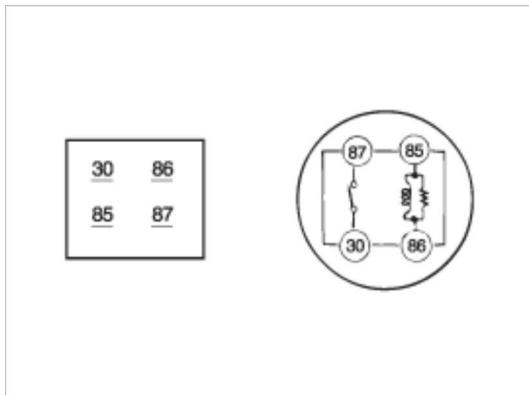


3. Using an ohmmeter, check that there is continuity between each terminal.

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.



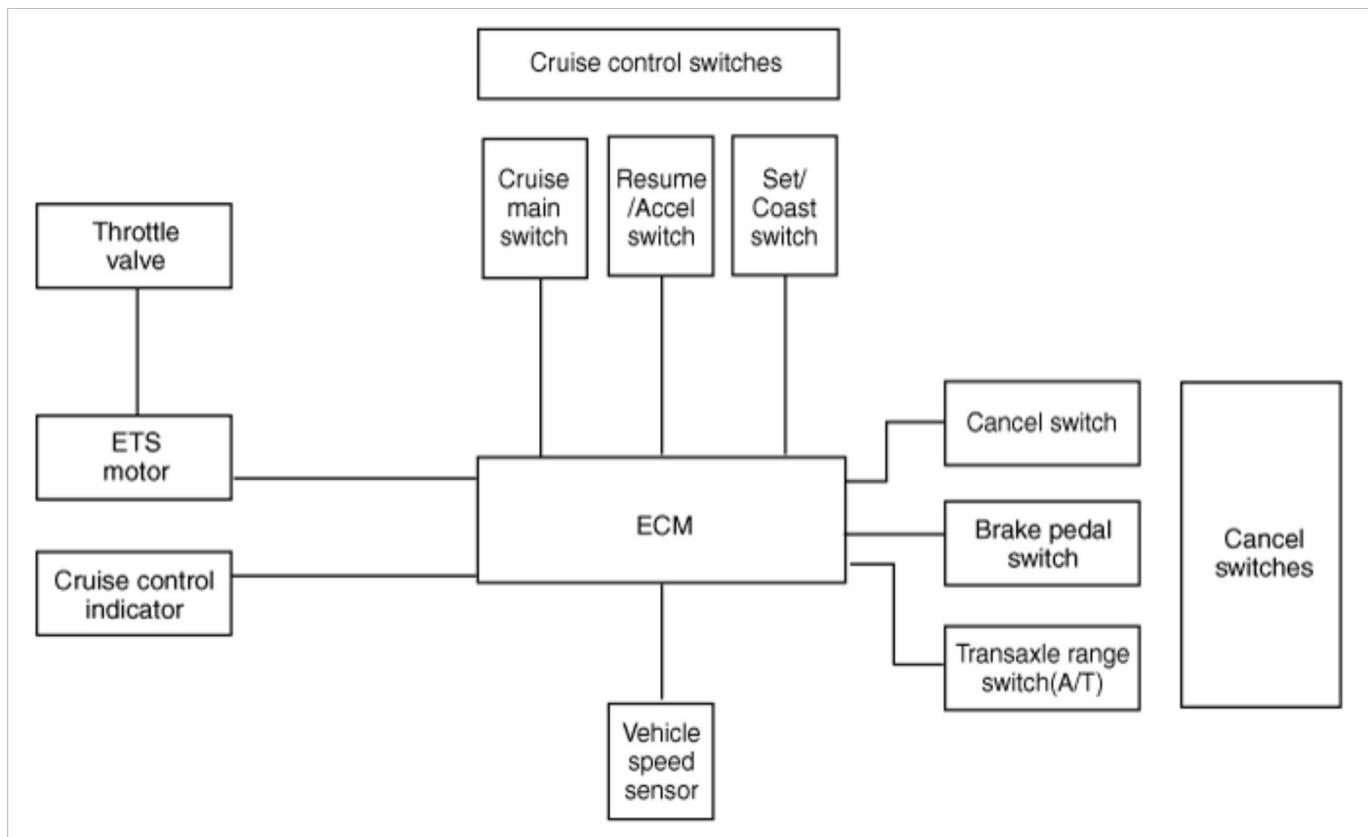
5. If there is no continuity, replace the starter relay.

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 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 1.6km/h (1.0mph).

Cancel switch (CANCEL)

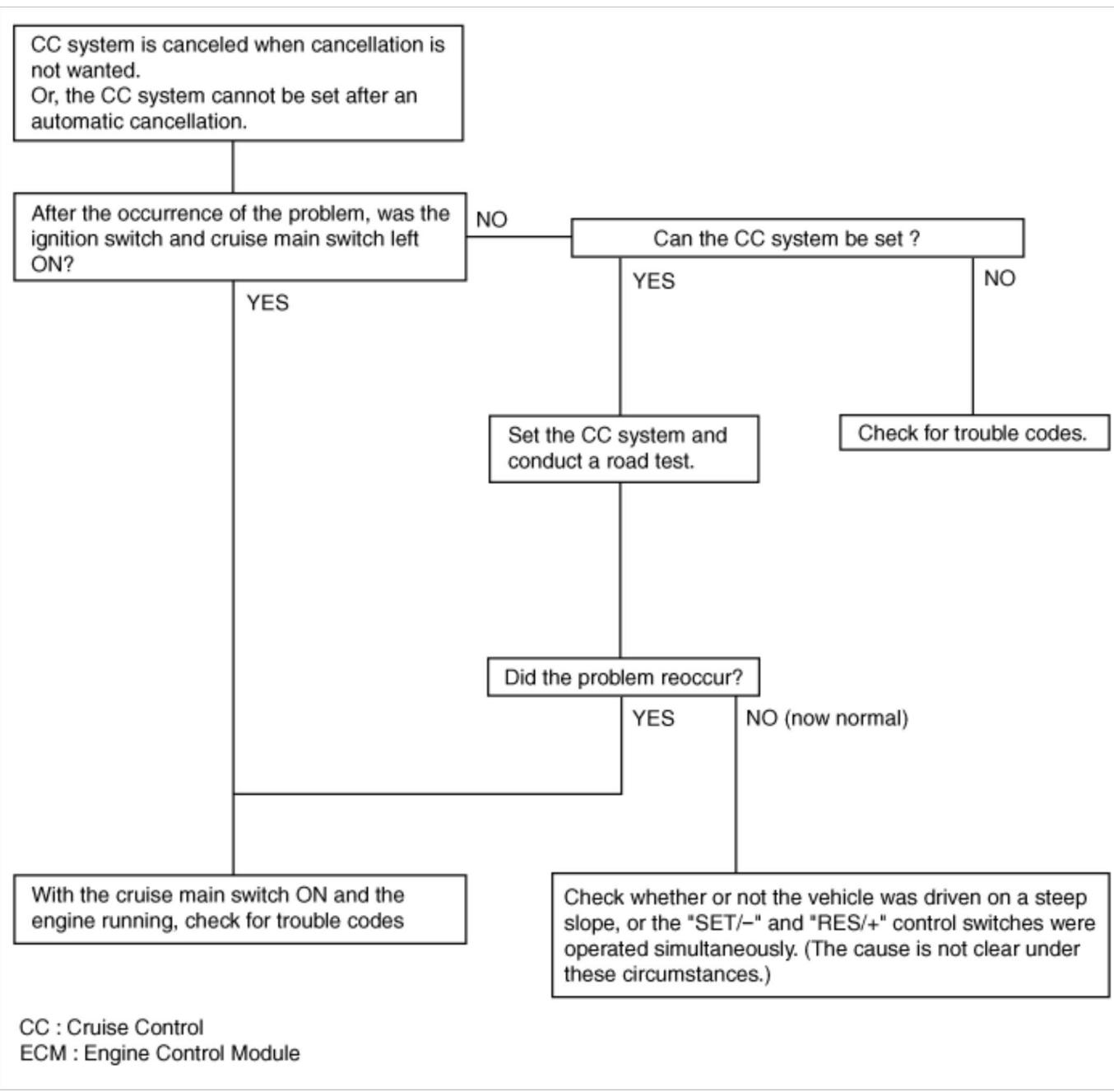
The cruise control system is temporarily disengaged by pushing the "CANCEL" switch.

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 "Surging" (repeated alternating acceleration and deceleration) occurs after setting	Malfunction of the vehicle speed sensor circuit	Repair the vehicle speed sensor system, or replace the part
	Malfunction of 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

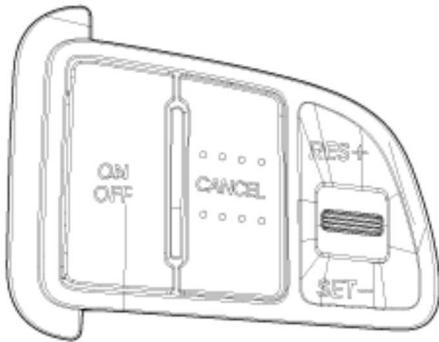
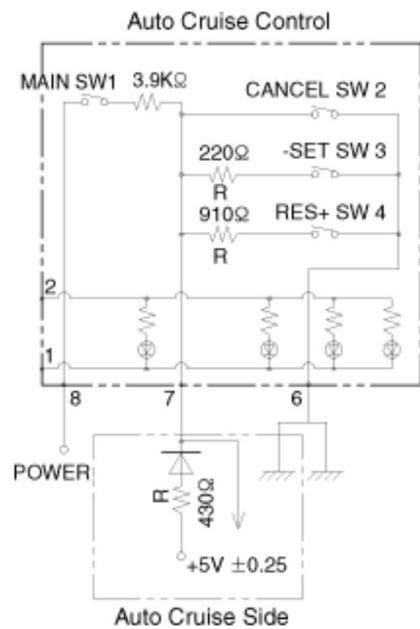
Trouble Symptom 8

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

[Auto Cruise Control]



[RH]

Connector RH	
No	Connector
1	ILL (-)
2	ILL (+)
3	-
4	-
5	-
6	ACC GND
7	ACC signal
8	ACC power

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

Removal and Installation

1. Disconnect the battery (-) terminal.

Tightening torque:

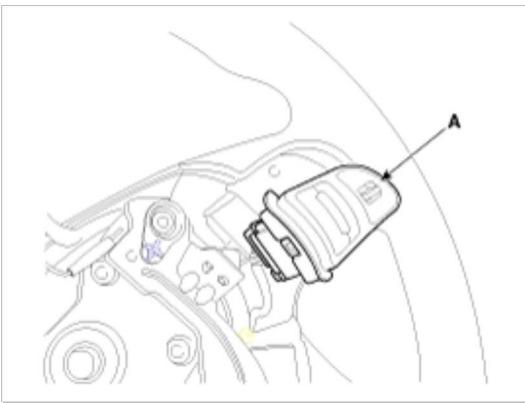
Without battery sensor :

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)

2. Remove the air-bag module from the steering wheel. (Refer to RT group)
3. Remove the steering wheel. (Refer to ST group)
4. Remove the cruise control switch (A) after unfastening the 2 screws and disconnecting the switch connector.

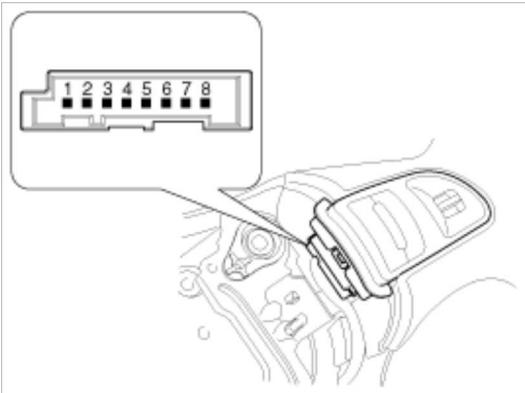


5. Installation is reverse order of removal.

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	$0\Omega \pm 5\%$
SET/-	6 - 7	$220\Omega \pm 5\%$
RES/+	6 - 7	$910\Omega \pm 5\%$
ON/OFF	7 - 8	$3900\Omega \pm 5\%$

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).

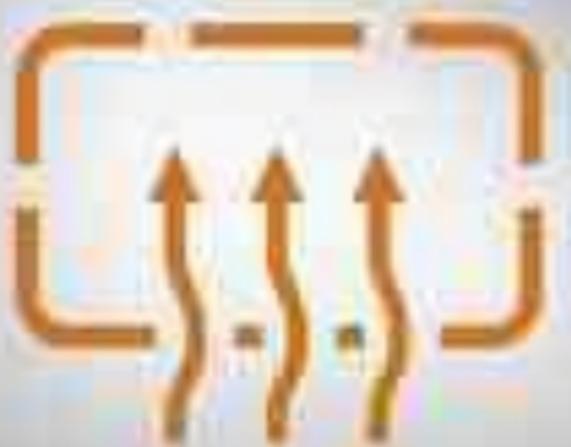
Function switch	Terminal	Voltage
CANCEL	6 - 7	$0.0 \pm 0.22V$

SET/-	6 - 7	1.5 ± 0.22V
RES/+	6 - 7	3.0 ± 0.22V
ON/OFF	7 - 8	-

3. If not within specification, inspect the control switch resistance.

The measuring resistance value is not within specification, replace the switch and measure the voltage again.

4. If resistance is OK but, measuring voltage is not within specification, inspect the wiring harness and connectors between the switch and the ECM.



SPORTAGE(SL) > 2012 > G 2.4 DOHC > Heating, Ventilation, Air Conditioning**Heating, Ventilation, Air Conditioning > General Information > Specifications****Specification****Air Conditioner**

Item		Specification
Compressor	Type	DVE16
	Oil type & Capacity	PAG OIL 120±10
	Pulley type	6PK-TYPE
	Displacement	160cc/rev
Condenser	Heat rejection	14,000 ±5% kcal/hr
A/C Pressure transducer	The method to measure the pressure	Voltage= 0.00878835 * Pressure (psig) + 0.5
Expansion valve	Type	Block type
Refrigerant	Type	R-134a
	Capacity [oz.(g)]	17.9 ± 0.88 (510 ± 25)

Blower Unit

Item		Specification
Blower	Operating method	Actuator
	Type	Sirocco
	Speed step	Auto + 8 speed (Automatic), 1~4speed (Manual)
	Speed control	Power mosfet (Auto), Resistor(manual)
Air filter	Type	Particle filter

Heater And Evaporator Unit

Item		Specification
Heater	Type	Pin & Tube type
	Heating capacity	4,600 - 5% kcal/hr
	Mode operating method	Actuator
	Temperature operating method	Actuator
Evaporator	Temperature control type	Evaporator temperature sensor
	A/C ON/OFF [°C(°F)]	ON : 1.5 ± 0.5 (34.7 ± 32.9) OFF: -0.5 ± 0.5 (32.9 ± 32.9)

Heating, Ventilation, Air Conditioning > General Information > Troubleshooting**Troubleshooting****Problem Symptoms Table**

Before replacing or repairing air conditioning components, first determine if the malfunction is due to the refrigerant charge, air flow or compressor.

Use the table below to help you find the cause of the problem. The numbers indicate the priority of the likely cause of the problem. Check each part in order. If necessary, replace these parts.

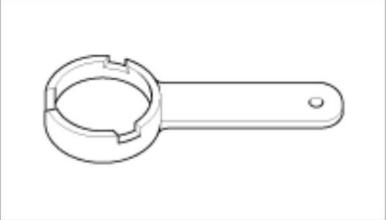
After correcting the malfunction, check the complete system to ensure that performance is satisfactory.

Symptom	Suspect Area
No blower operation	1. Blower fuse 2. Blower motor 3. Power mosfet, Blower resistor 4. Blower speed control switch 5. 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 comes out	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 assembly 10. Wire 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, Mode actuator
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
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Heating, Ventilation, Air Conditioning > General Information > Special Service Tools

Special Service Tools

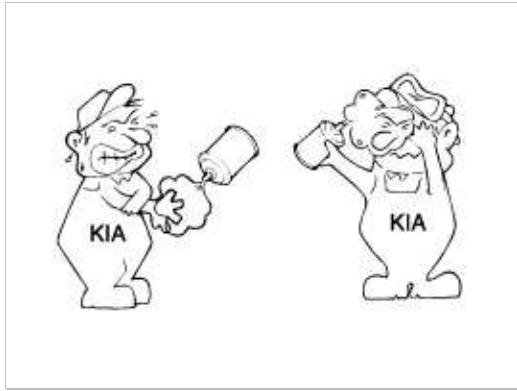
Tool (Number and name)	Illustration	Use
09977-29000 Disc & hub assembly bolt remover		Removal and installation of disc & hub assembly.

Heating, Ventilation, Air Conditioning > Air Conditioning System > General Safety Information and Caution

Instructions

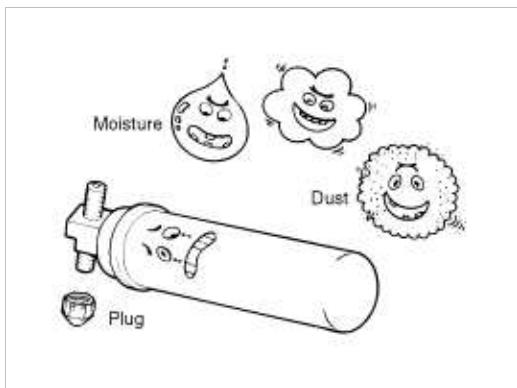
When Handling Refrigerant

- 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.
- 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.
- The R-134a container is highly pressurized. Never leave it in a hot place, and check storage temperature is below 52°C (126°F).
- 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.
- Use only recommended lubricant for R-134a systems. If lubricants other than the recommended one used, system failure may occur.
- PAG lubricant absorbs moisture from the atmosphere at a rapid rate, therefore the following precautions must be observed:
 - When removing refrigerant components from a vehicle, cap the components immediately to prevent entry of moisture.
 - When installing refrigerant components to a vehicle, do not remove the cap until just before connecting the components.
 - Complete the connection of all refrigerant tubes and hoses without delay to prevent the A/C system from taking on moisture.
 - Use the recommended lubricant from a sealed container only.
- If an accidental discharge in the system occurs, ventilate the work area before resuming of service.



When replacing parts ON A/C system

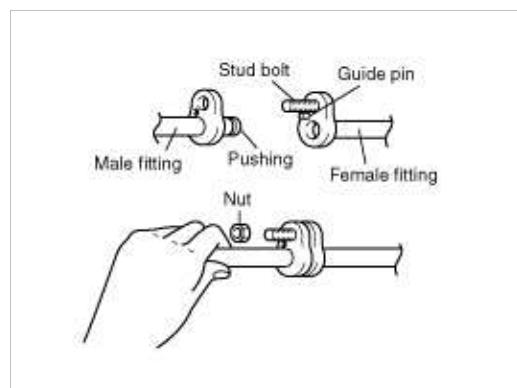
1. Never open or loosen a connection before discharging the system.
2. Seal the open fittings of components with a cap or plug immediately to prevent intrusion of moisture or dust.
3. Do not remove the sealing caps from a Replacement component until it is ready to be installed.
4. Before connecting an 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 lubricant) and lubricate by using compressor oil. Tighten the nut to specified torque.



Size	Tightening torque [N.m (kgf.m, lb.ft)]	
	General bolt, nut	
	Bolt(4T), Nut(4T)	Bolt(8T), Nut(6T)
M6	4 - 6 (0.4 - 0.6, 2.9 - 4.3)	8 - 12 (0.8 - 1.2, 5.7 - 8.6)

M8	9 - 14 (0.9 - 1.4, 6.5 - 10)	20 - 30 (2.0 - 3.0, 14 - 21.6)
M10	19 - 28 (1.9 - 2.8, 13.7 - 20)	45 - 60 (4.5 - 6.0, 32 - 43.3)
Size	Flange bolt, nut	
	Bolt(4T), Nut(4T)	Bolt(8T), Nut(6T)
M6	4 - 6 (0.4 - 0.6, 2.9 - 4.3)	9 - 14 (0.9 - 1.4, 6.5 - 10.1)
M8	10 - 15 (1.0 - 1.5, 7 - 10)	22 - 33 (2.2 - 3.3, 15.9 - 23.8)
M10	21 - 31 (2.1 - 3.1, 15 - 22)	50 - 65 (5.0 - 6.5, 36.1 - 7.0)

NOTE

- T means tensile intensity, which is stamped on the head of bolt only numeral.

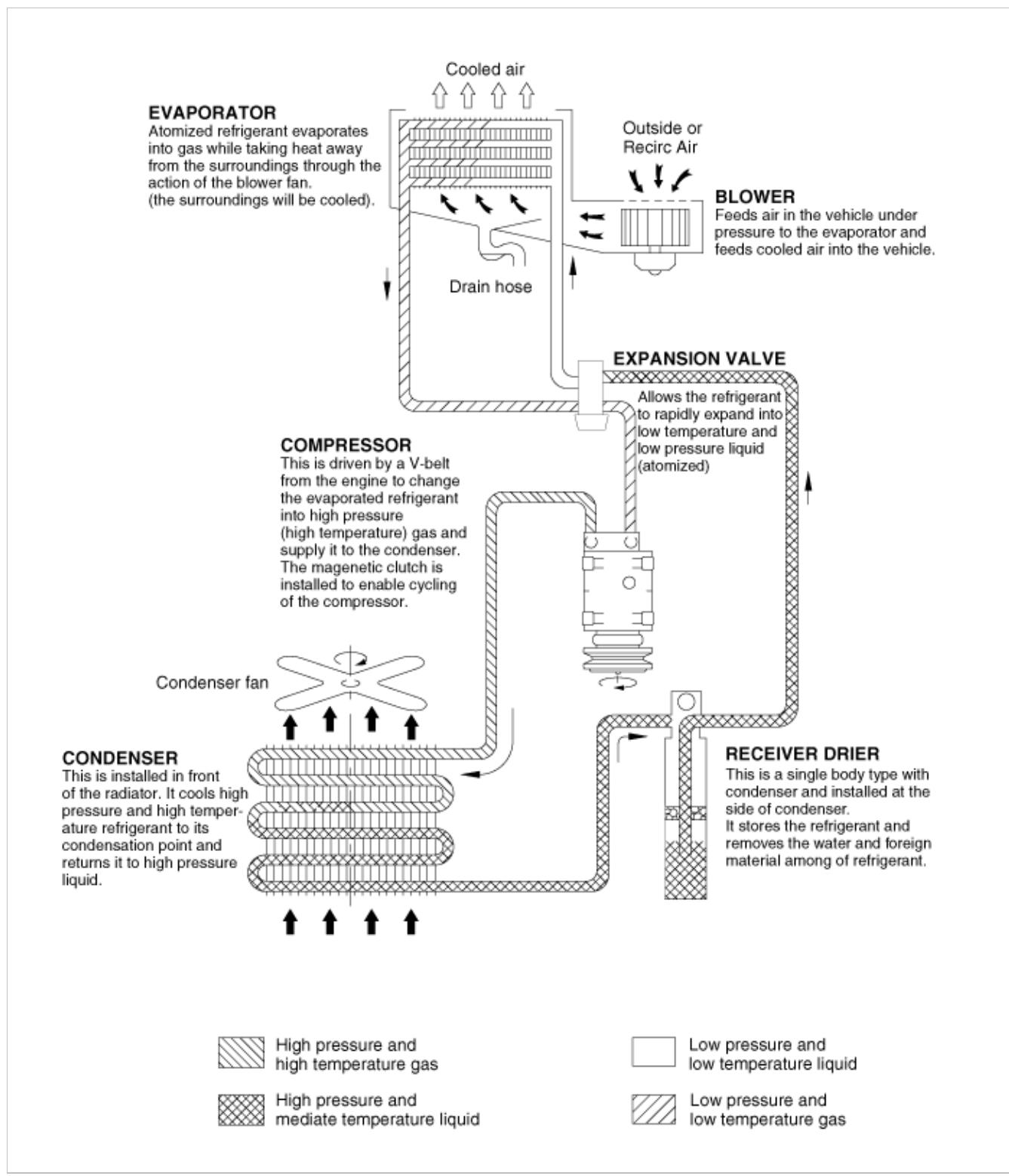
Handling tubing and fittings

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

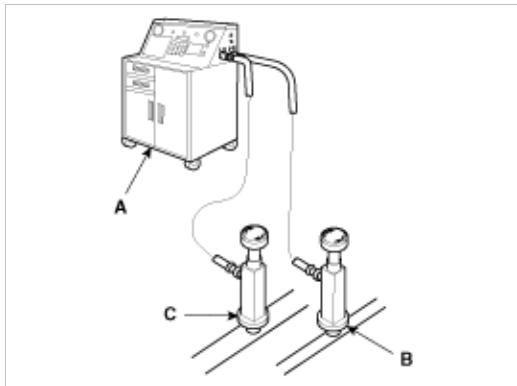
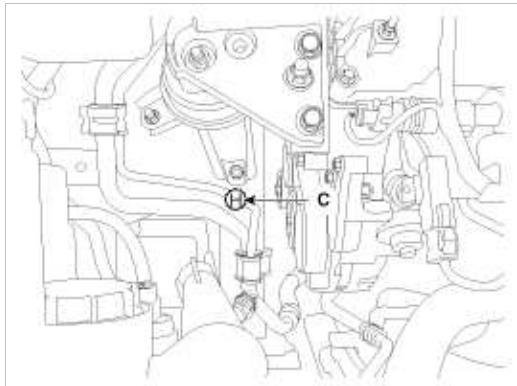
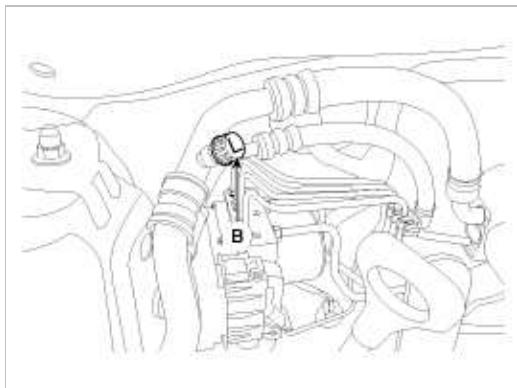
- Air conditioning refrigerant or lubricant vapor can irritate your eyes, nose, or throat.
- Be careful when connecting service equipment.
- Do not breathe refrigerant or vapor.

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

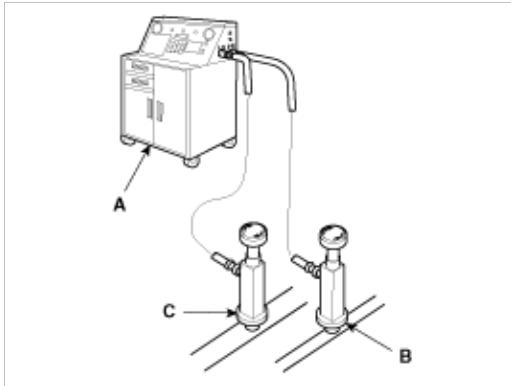
- Air conditioning refrigerant or lubricant vapor can irritate your eyes, nose, or throat.

- 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.

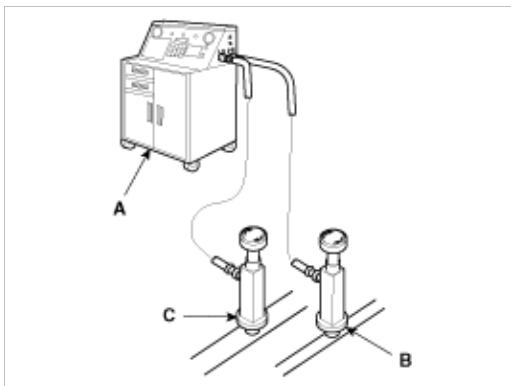
CAUTION

- 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 18.0 ± 0.88 oz. (510 ± 25 g) of R-134a refrigerant. Do not overcharge the system the compressor will be damaged.

Refrigerant Leak Test

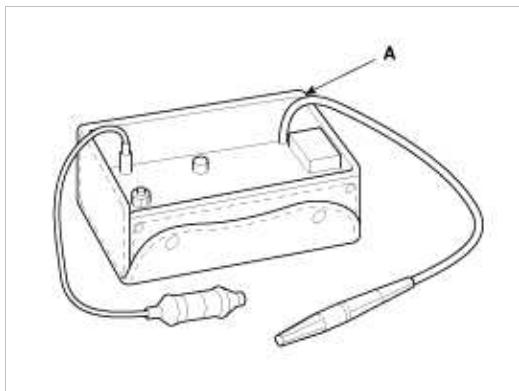
Always conduct a leak test with an electronic leak detector whenever leakage or refrigerant is suspected and when conducting service operations which are accompanied by disassembly or loosening or connection fittings.

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:

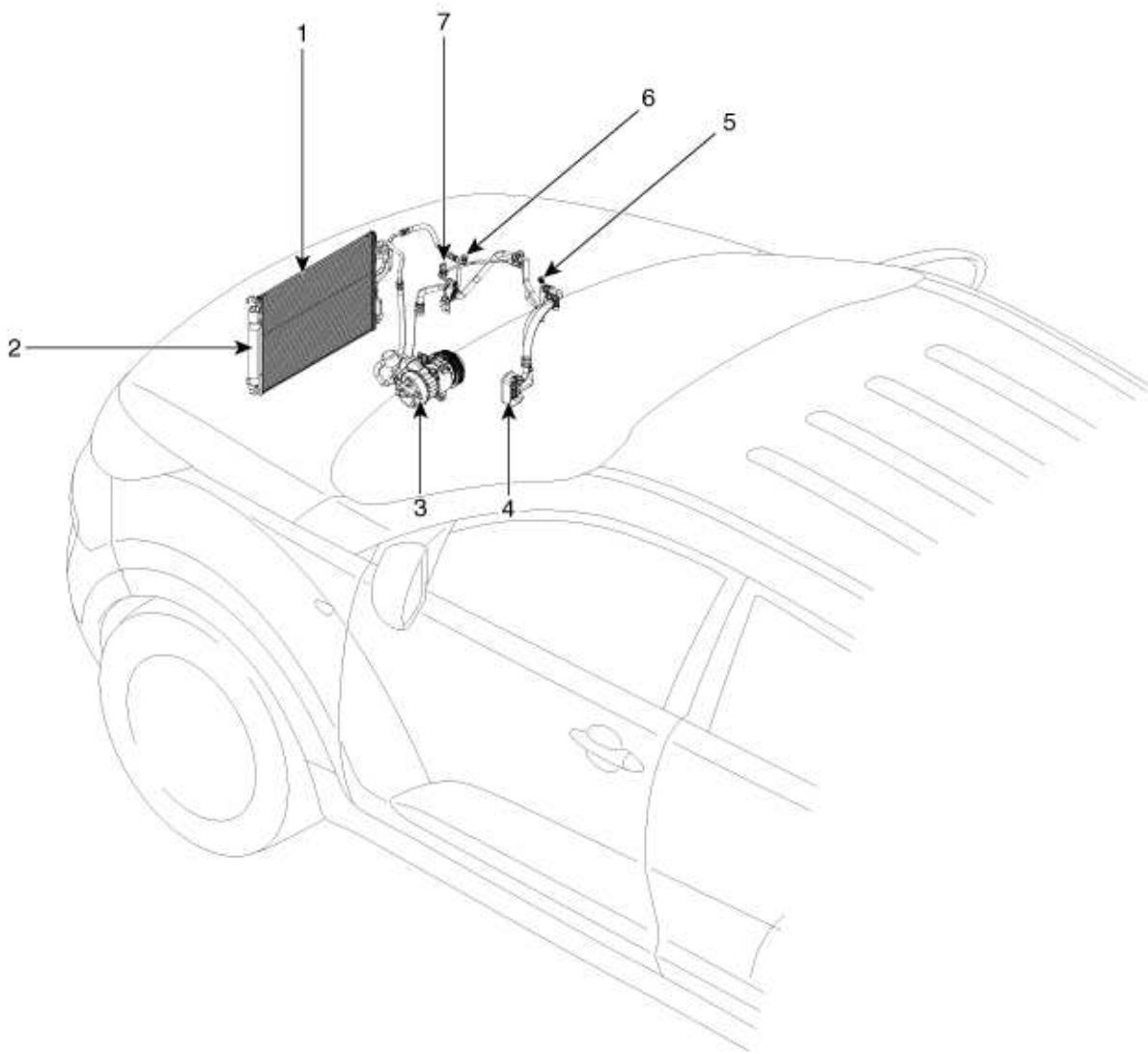
1. Check the torque on the connection fittings and, if too loose, tighten to the proper torque. Check for gas leakage with a leak detector (A).
2. If leakage continues even after the fitting has been tightened, discharge the refrigerant from the system, disconnect the fittings, and check their seating 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

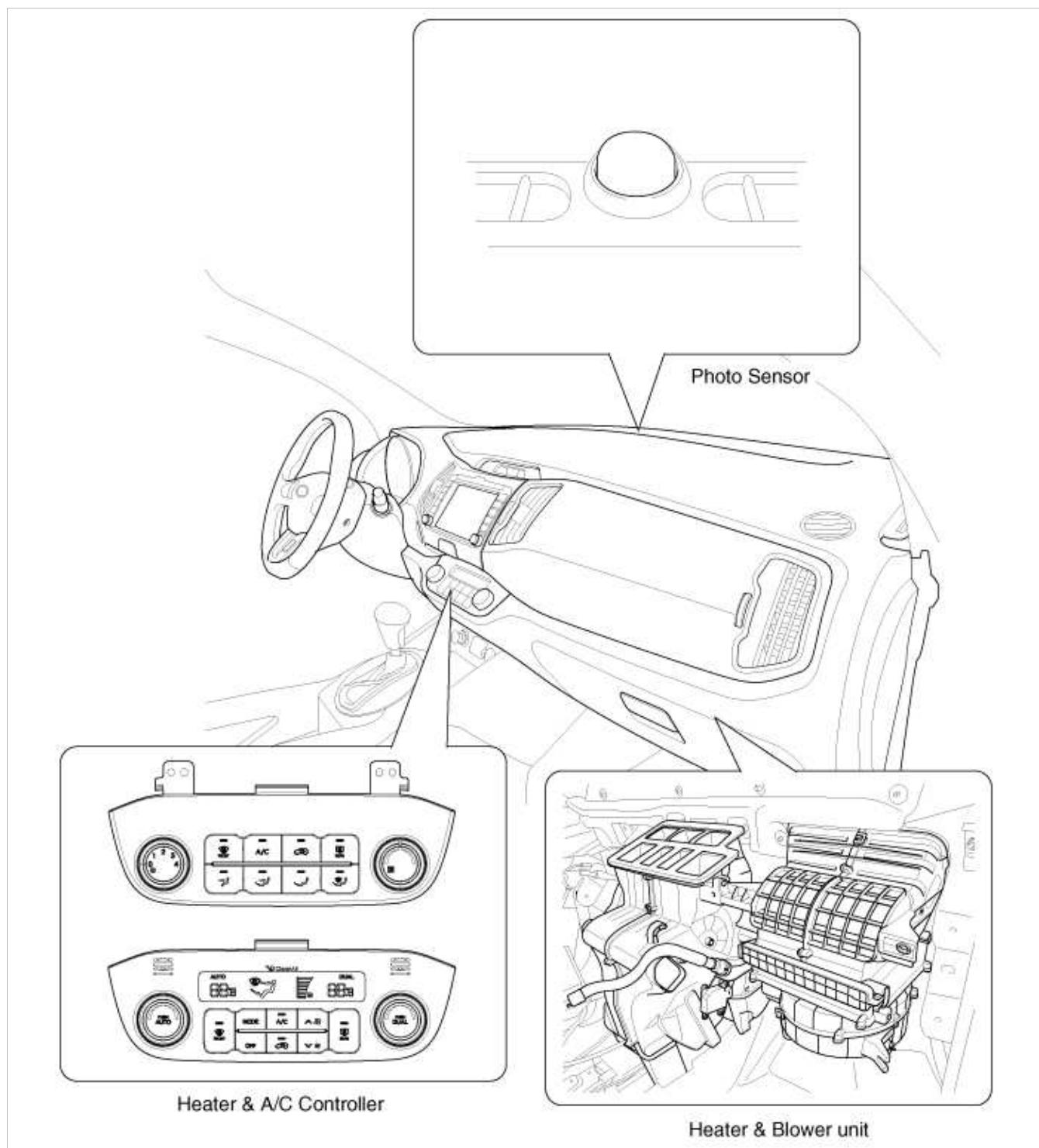
Component Location Index

Engine Room



- | | |
|---|---|
| <ul style="list-style-type: none">1. Condenser2. Receiver-drier3. Compressor4. Expansion Valve | <ul style="list-style-type: none">5. Service port (High)6. Service port (Low)7. A/C Pressure Transducer |
|---|---|

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

PAG OIL : 120 ± 10 cc

Oil Return Operation

There is close affinity between the oil and the refrigerant.

During normal operation, part of the oil recirculation 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:

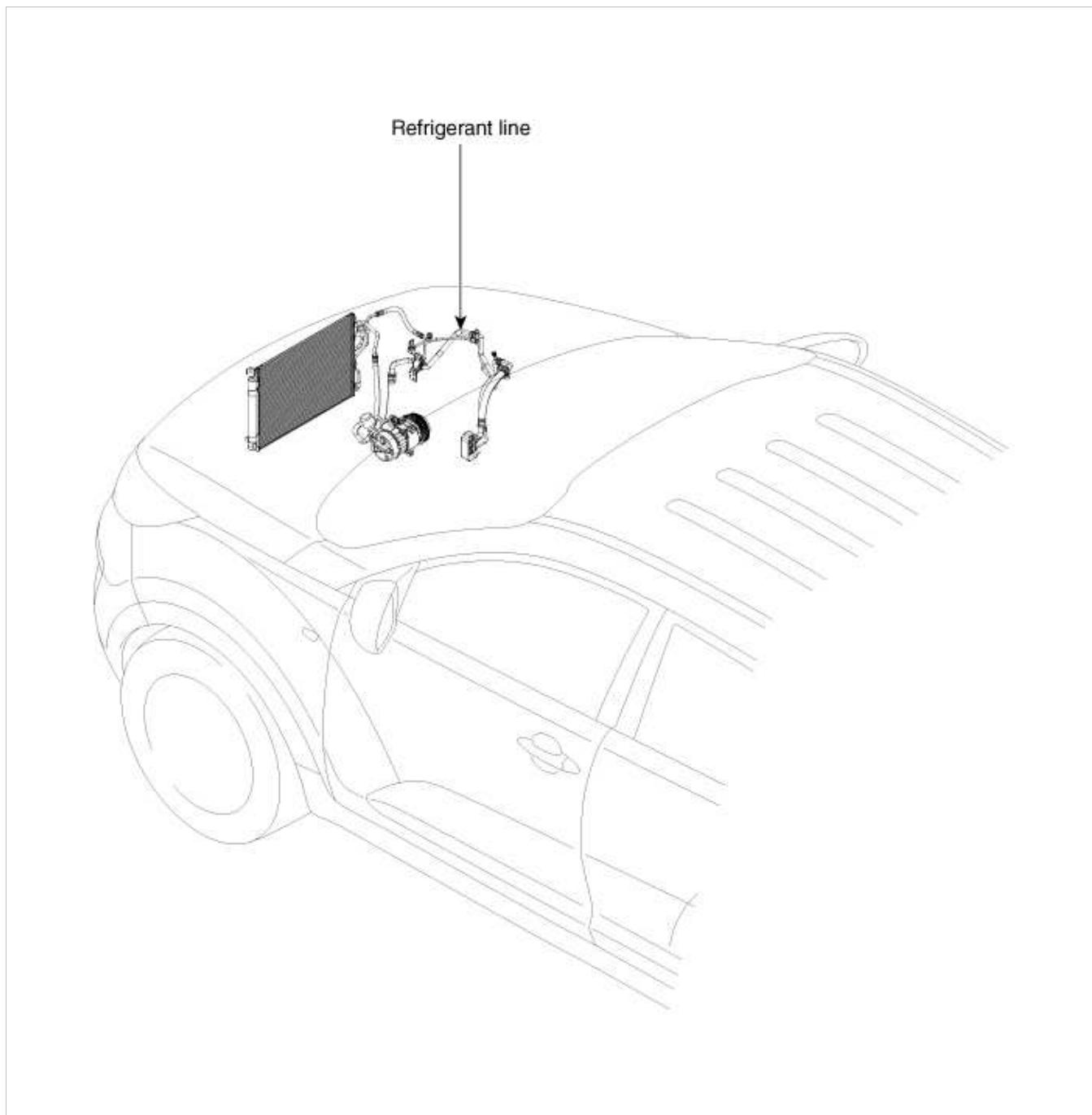
The specified volume - volume of removed compressor = volume to drain from the new compressor.

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 > 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	lb·ft
Condenser - Discharge hose	3.9~9.8	0.6~1.0	4.3~7.2
Condenser - Liquid tube			
Compressor - Discharge hose	19.6~24.5	2.0~2.5	14.4~18.0
Compressor - Suction hose			
Expansion valve - Evaporator	11.8~14.7	1.2~1.5	8.7~10.9

4. Evacuate air in refrigeration system and charge system with refrigerant.

Specified amount : $510 \pm 25\text{g}$ ($17.9 \pm 0.88\text{oz}$)

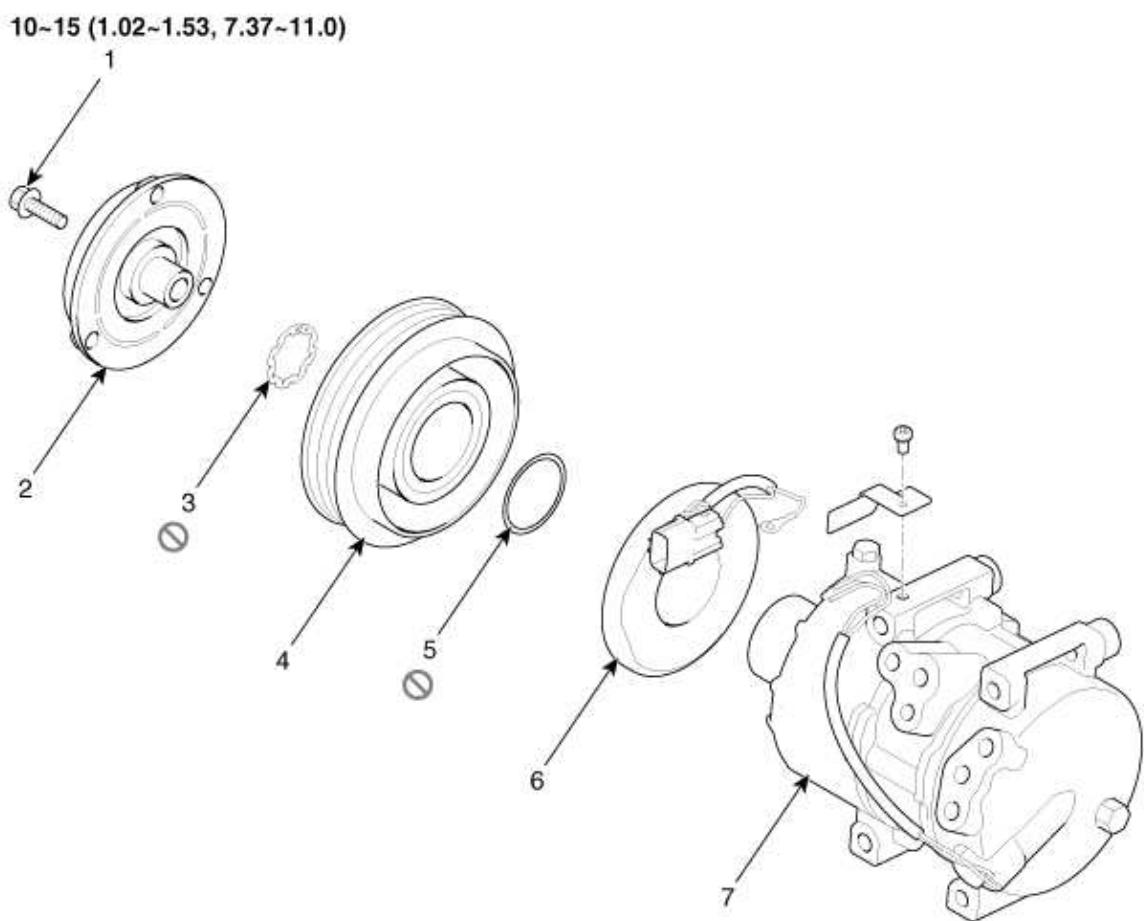
5. Inspect for leakage of refrigerant.

Using a gas leak detector, check for leakage of refrigerant.

6. Inspect A/C operation.

Heating, Ventilation, Air Conditioning > Air Conditioning System > Compressor > Components and Components Location

Components



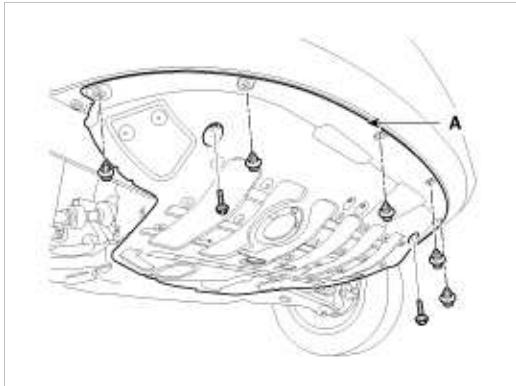
Torque : N.m (kgf.m, lb-ft)

1. Bolt	5. Retainer Ring (Field coil)
2. Disc & Hub Assembly	6. Field Coil
3. Retainer Ring (Pulley)	7. Compressor Assembly
4. Pulley	

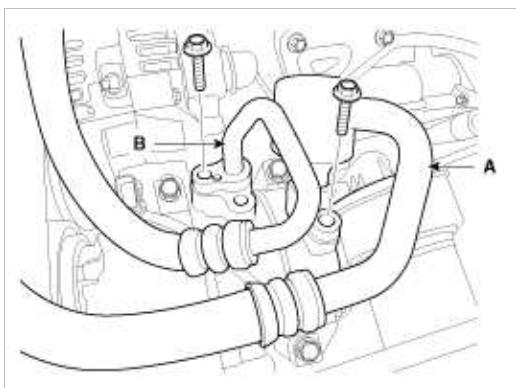
Heating, Ventilation, Air Conditioning > Air Conditioning System > Compressor > Repair procedures

Removal

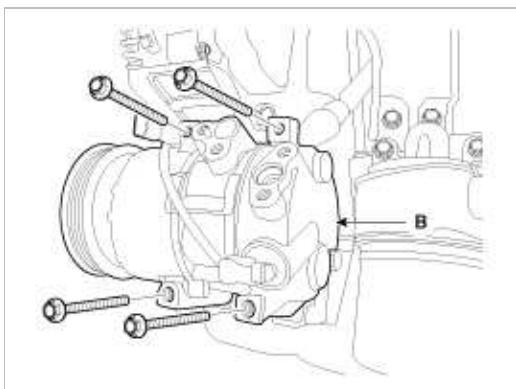
1. If the compressor is marginally operable, run the engine at idle speed, and let the air conditioning work for a few minutes, then shut the engine off.
2. Disconnect the negative cable from the battery.
3. Recover the refrigerant with a recovery/charging station.
4. Loosen the drive belt.
(Refer to EM group - "Drive belt")
5. Loosen the mount bolts and then remove the under cover (A).



6. 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.



7. Disconnect the compressor clutch connector, and then remove mounting bolts and the compressor(B).

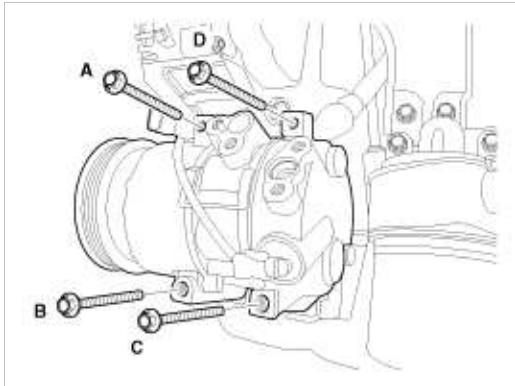


Installation

1. Make sure of the length of compressor mounting bolts, and then tighten it A→B→C→D order.

Tightening torque :

20.0~32.9N.m (2.04~3.36kgf.m, 14.7~24.3lbf.ft)

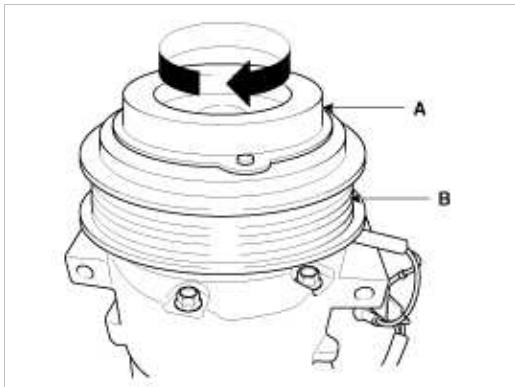


2. Install in the reverse order of removal, and note these items.

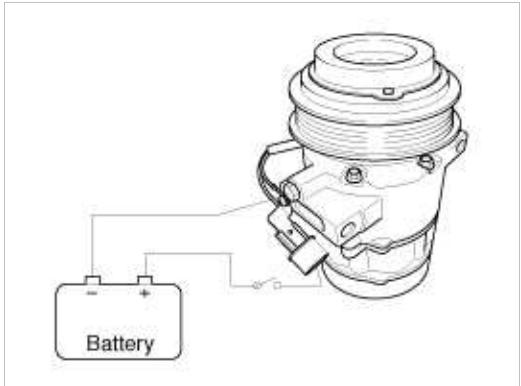
- A. If you're installing a new compressor, drain all the refrigerant oil from the removed compressor, and measure its volume. Subtract the volume of drained oil from 120cc(4.20 oz.) the result is the amount of oil you should drain from the new compressor (through the suction fitting).
- B. Replace the O-rings with new ones at each fitting, and apply a thin coat of refrigerant oil before installing them. Be sure to use the right O-rings for R-134a to avoid leakage.
- C. To avoid contamination, do not return the oil to the container once dispensed, and never mix it with other refrigerant oils.
- D. Immediately after using the oil, replace the cap on the container and seal it to avoid moisture absorption.
- E. Do not spill the refrigerant oil on the vehicle; it may damage the paint; if the refrigerant oil contacts the paint, wash it off immediately.
- F. Adjust the drive belt (Refer to HA-14)
- 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.

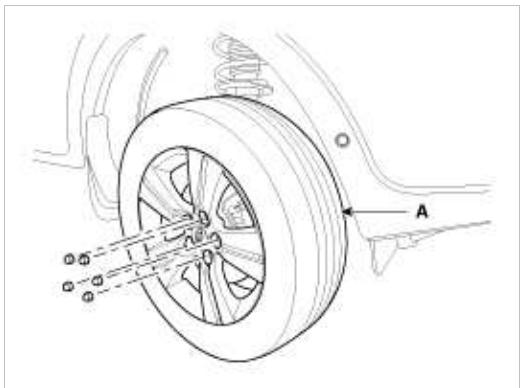


3. Check operation of the magnetic clutch. Connect the compressor side terminals to the battery (+) terminal and the ground battery (-) terminal to the compressor body. Check the magnetic clutch operating noise to determine the condition.

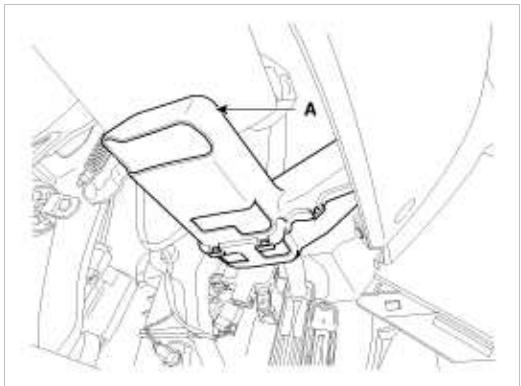


Disassembly

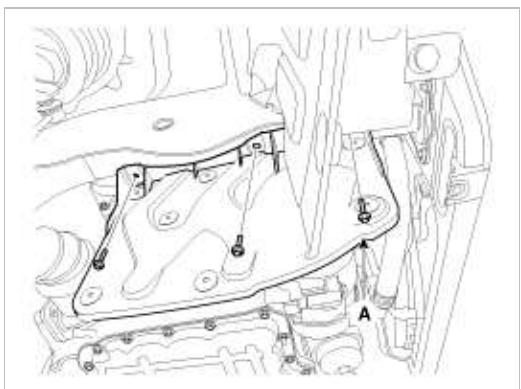
1. Remove the front left tire (A).



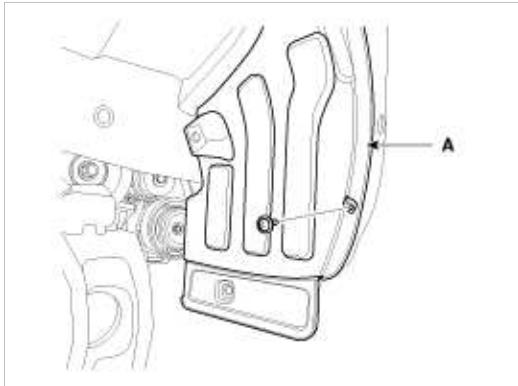
2. Loosen the mount bolts and then remove the under cover (A).



3. Remove the engine side cover (A).



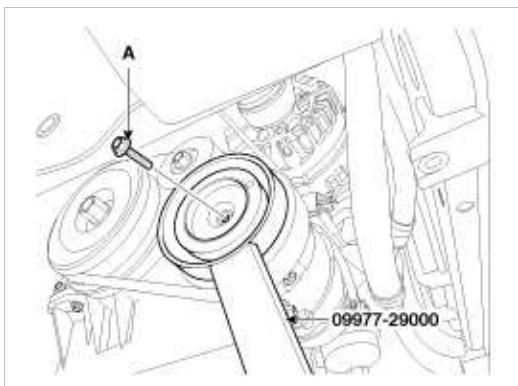
4. Remove the wheel house (A).



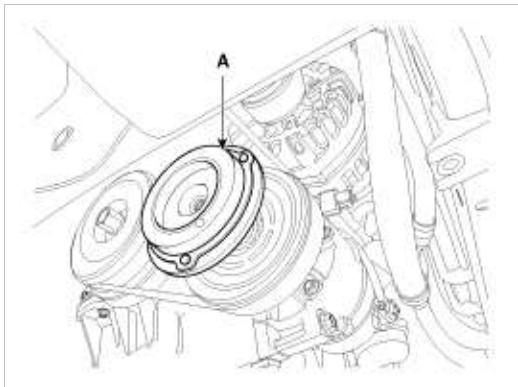
5. Remove the center bolt (A) while holding the disc & hub assembly with SST(09977-29000).

Tightening torque :

10~15N.m (1.02~1.53kgf.m, 7.37~11lbf.ft)



6. Remove the disc & hub assembly (A).



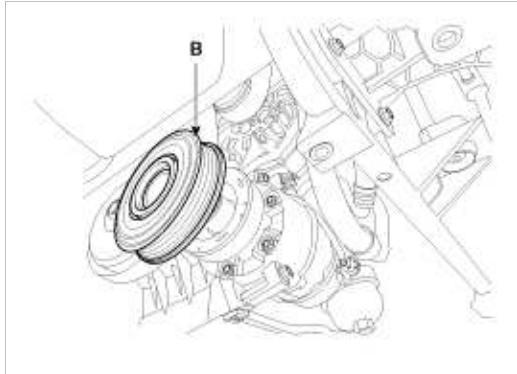
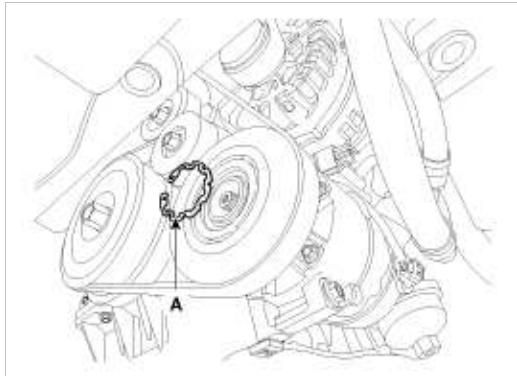
7. Loosen the drive belt.

(Refer to EM group - "Drive belt")

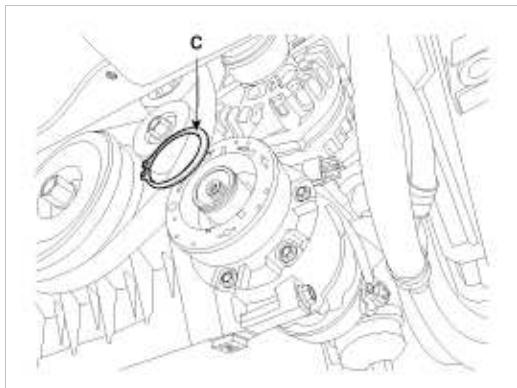
8. Disconnect the retainer ring (A) and then remove the pulley (B).

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.

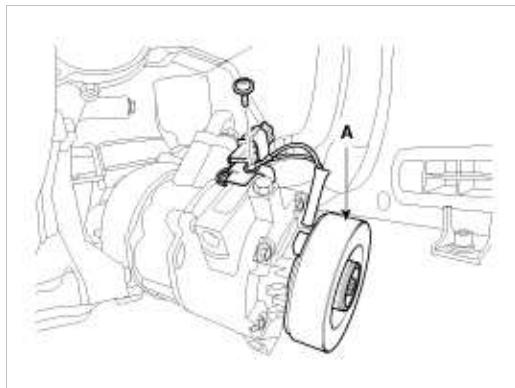


9. Remove the retainer ring (B) and then remove the field coil (C) . Be careful not to damage the coil and compressor.



10. To prepare work space, loosen the compressor mounting bolts.

11. Disconnect the connector and ground screw and than remove the field coil (A).

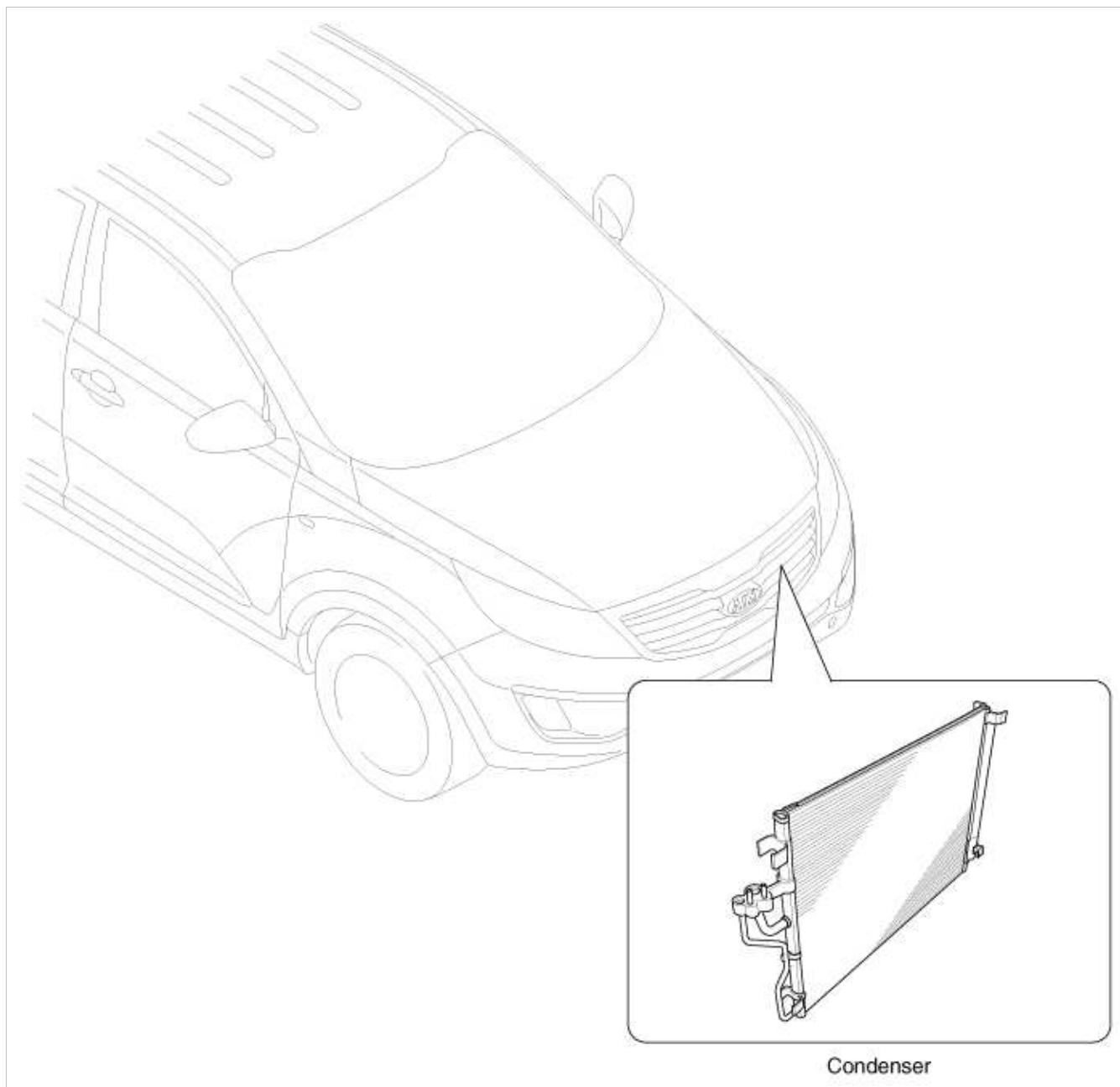


12. Reassemble the compressor clutch in the reverse order of disassembly, and note these items :

- 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

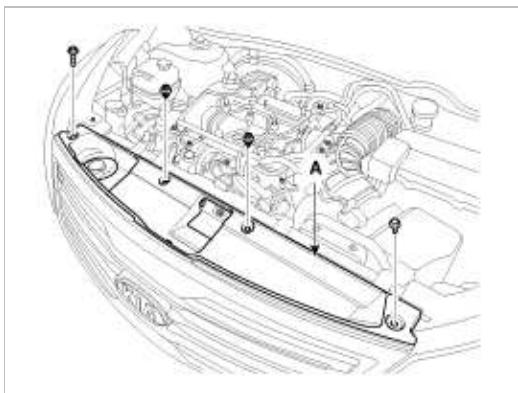
Inspection

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.

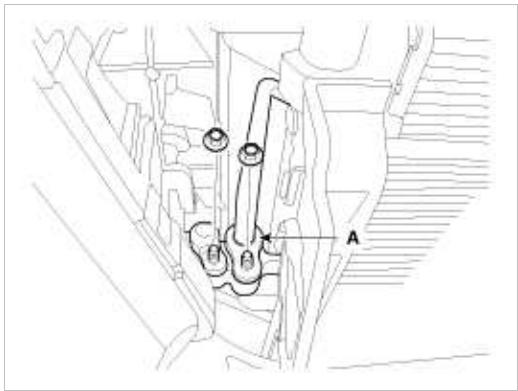
Replacement

1. Recover the refrigerant with a recovery/ recycling/ charging station.

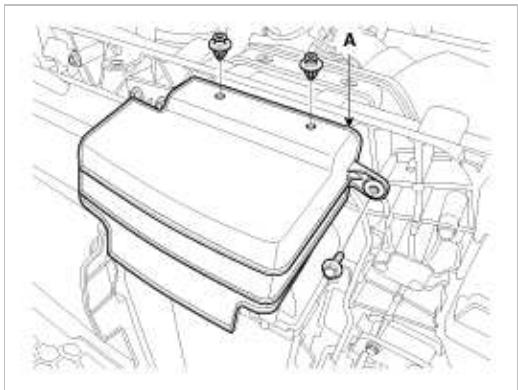
2. Disconnect the negative (-) battery terminal.
3. Remove the front bumper upper cover (A).



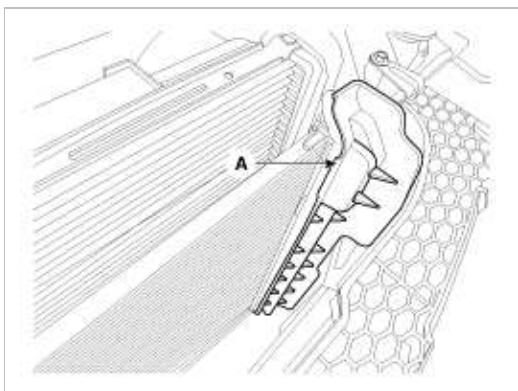
4. Remove the discharge line and liquid line (A) from the condenser.



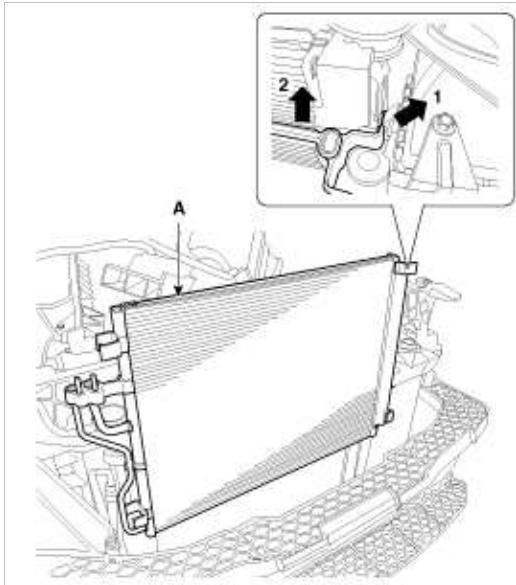
5. Remove the intercooler cover (A).



6. Remove the condenser side cover (A).



7. Remove the condenser (A) from radiator.



8. Install in the reverse order of removal, and note these items :

- If you're installing a new condenser, add refrigerant oil ND-OIL8.
- Replace the O-rings with new ones at each fitting, and apply a thin coat of refrigerant oil before installing them. Be sure to use the right O-rings for R-134a to avoid leakage.
- Be careful not to damage the radiator and condenser fins when installing the condenser.
- Be sure to install the lower mount cushions of condenser securely into the holes.
- Charge the system, and test its performance.

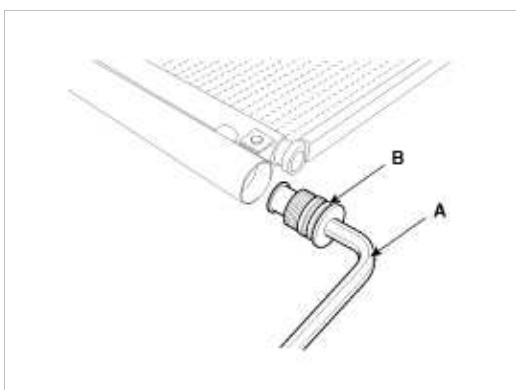
Heating, Ventilation, Air Conditioning > Air Conditioning System > Receiver-Drier > Repair procedures

Replacement

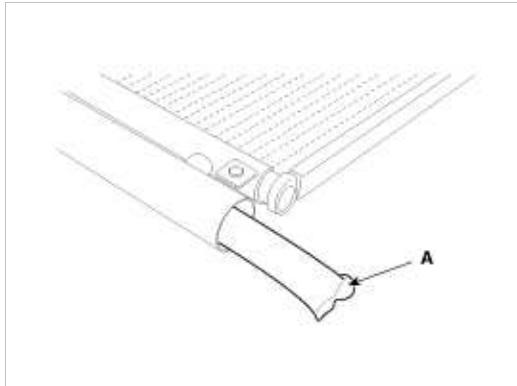
- Remove the condenser, and then remove the bottom cap (B) with L wrench (A) from the condenser.

Tightening torque :

20~25N.m (2.0~2.5kgf.m, 14.5~18.2lb-ft)



- Remove the desiccant (A) from condenser using a long nose plier. Check for crumbled desiccant and clogged bottom cap filter.



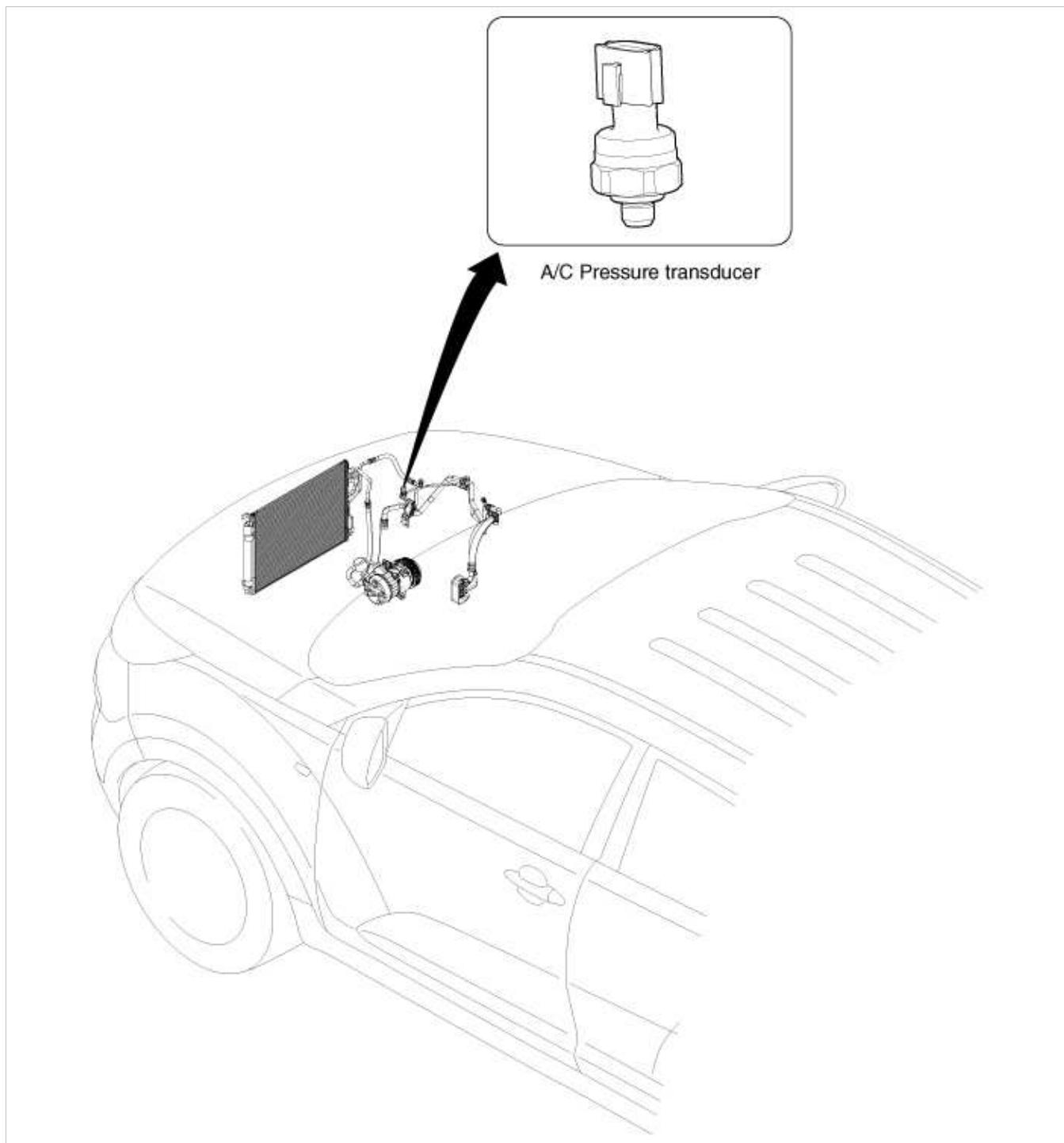
3. Apply air conditioning compressor oil along the O-rings and threads of the new bottom cap.
4. Insert the new desiccant into the receiver drier tank. The desiccant must be sealed in vacuum before it is exposed to air for use.
5. Install the new bottom cap to the condenser.

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

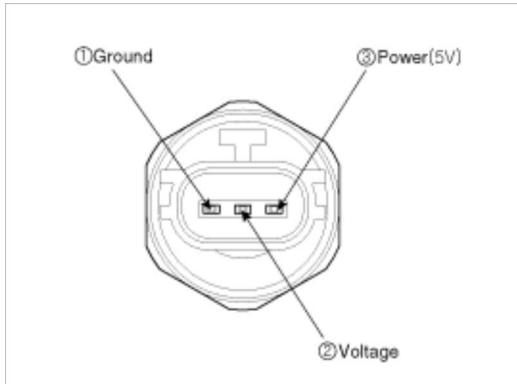
Description

A/C pressure transducer convert the pressure value of high pressure line into voltage value after it is measured. By voltage value, the engine ECU controls cooling fan by operating it high speed or low speed. Engine ECU stops the operation of compressor when the temperature of refrigerant line is too high or too low 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 measuring voltage output between NO.1 and NO.2 terminals.



2. Inspect the voltage value whether it is sufficient to be regular value or not.

$$\text{Voltage} = 0.00878835 * \text{Pressure} + 0.37081095 \text{ [PSIA]}$$

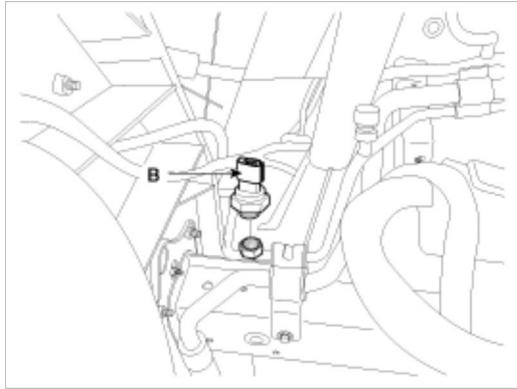
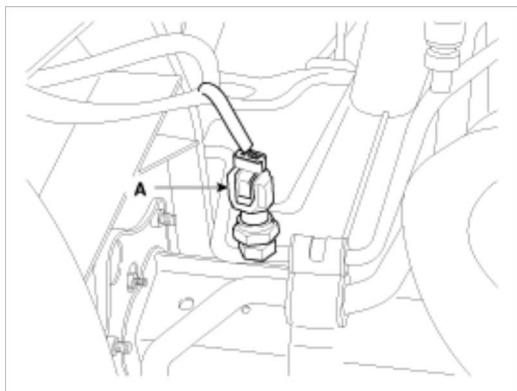
3. If the measured voltage value is not specification, replace the A/C pressure transducer.

Replacement

1. Disconnect the negative (-) battery terminal.
2. Recover the refrigerant with a recovery/charging station.
3. Disconnect the A/C pressure transducer connector (3P) (A).

Tightening torque:

10~12 N.m (1.0~1.2 kgf.m, 7.4~8.8 lb-ft)



CAUTION

Take care that liquid & suction pipe are not bent.

4. Installation is the reverse order of removal.

Heating, Ventilation, Air Conditioning > Air Conditioning System > Evaporator Temperature Sensor > Description and Operation

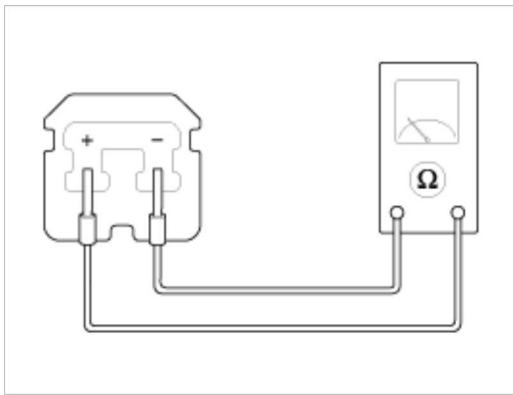
Description

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 "1" and "2" of evaporator temperature sensor.

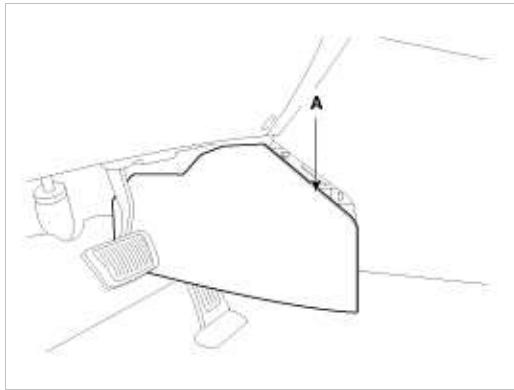


Specification

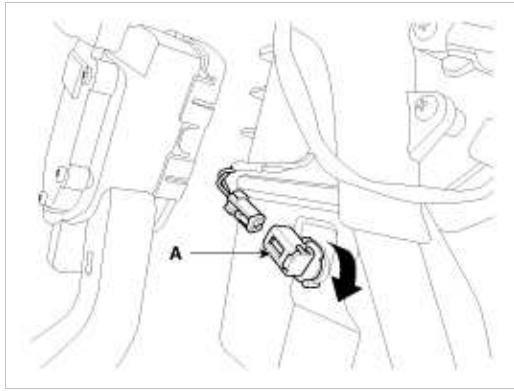
Evaporator core temperature [°C(°F)]	Resistance[KΩ]	Voltage[V]
-10(14)	17.93	3.22 ± 0.5
-5(23)	14.22	2.94 ± 0.5
0(32)	11.36	2.67 ± 0.5
5(41)	9.14	2.39 ± 0.5
10(50)	7.40	2.13 ± 0.5
15(59)	6.02	1.88 ± 0.5
20(68)	4.94	1.66 ± 0.5
25(77)	4.066	1.45 ± 0.5
30(86)	3.369	1.26 ± 0.5
35(95)	2.85	1.1 ± 0.5
40(104)	2.348	0.95 ± 0.5
45(113)	1.975	0.83 ± 0.5
50(122)	1.668	0.72 ± 0.5

Replacement

1. Remove the console extension cover (A).



2. Remove the evaporator temperature sensor (A), by pulling it after rotating 90° in a clockwise direction.



3. Installation is the reverse order of removal.

Heating, Ventilation, Air Conditioning > Air Conditioning System > Photo Sensor > Description and Operation

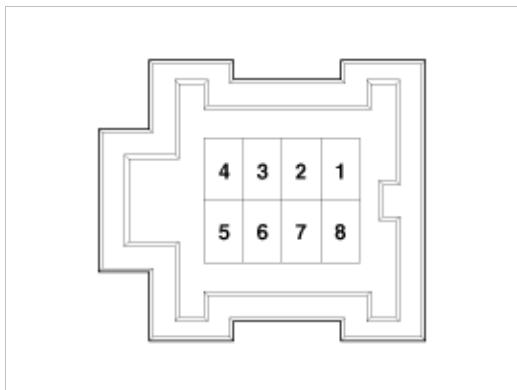
Description

1. The photo sensor is located at the right 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

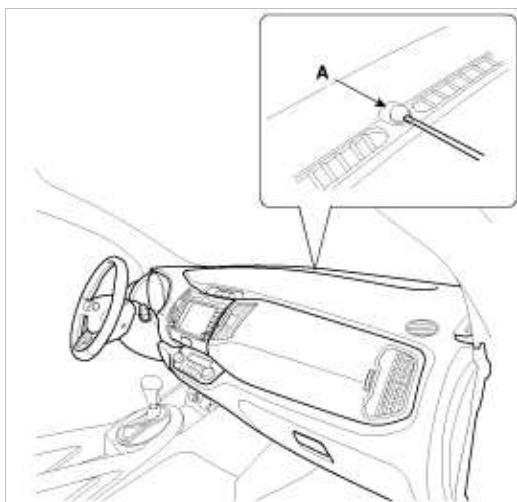
1. Ignition "ON"
2. Using the scan tool.
3. Emit intensive light toward photo sensor using a lamp, and check the output voltage change.
4. The voltage will rise with higher intensive light and reduce with lower intensive light.



1. Sensor Ground	5. -
2. Photo Sensor Signal	6. DR Photo Sensor (-)
3. -	7. PA Photo Sensor (-)
4. -	8. 5V (Vcc)

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.

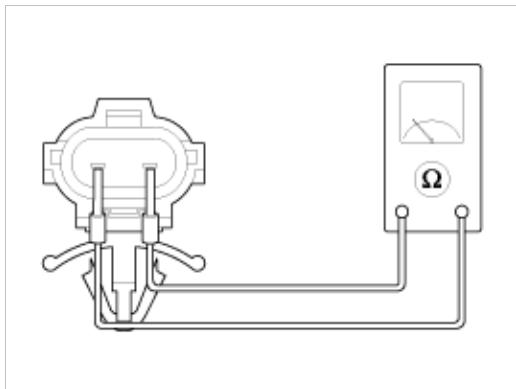
NOTE

If the ambient temperature is below 1.0°C (33.8°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

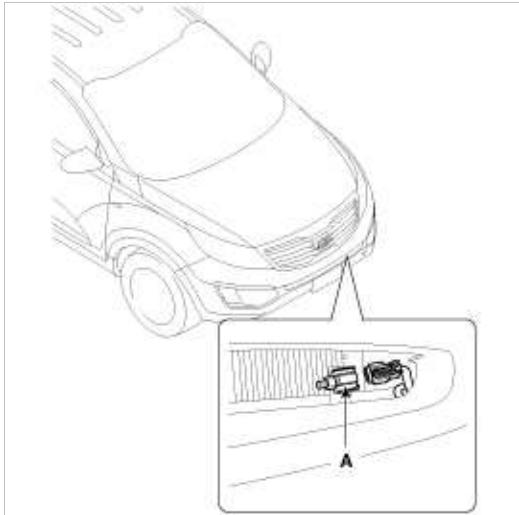
Specification

Ambient temperature [°C(°F)]	Resistance between terminals 1and 2 (kΩ)
-30(-22)	507
-20(-4)	284.5
-10(14)	164.2
0 (32)	97.5
10 (50)	59.6
20 (68)	37.46
30(86)	24.18
40(104)	16
50(122)	10.83

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

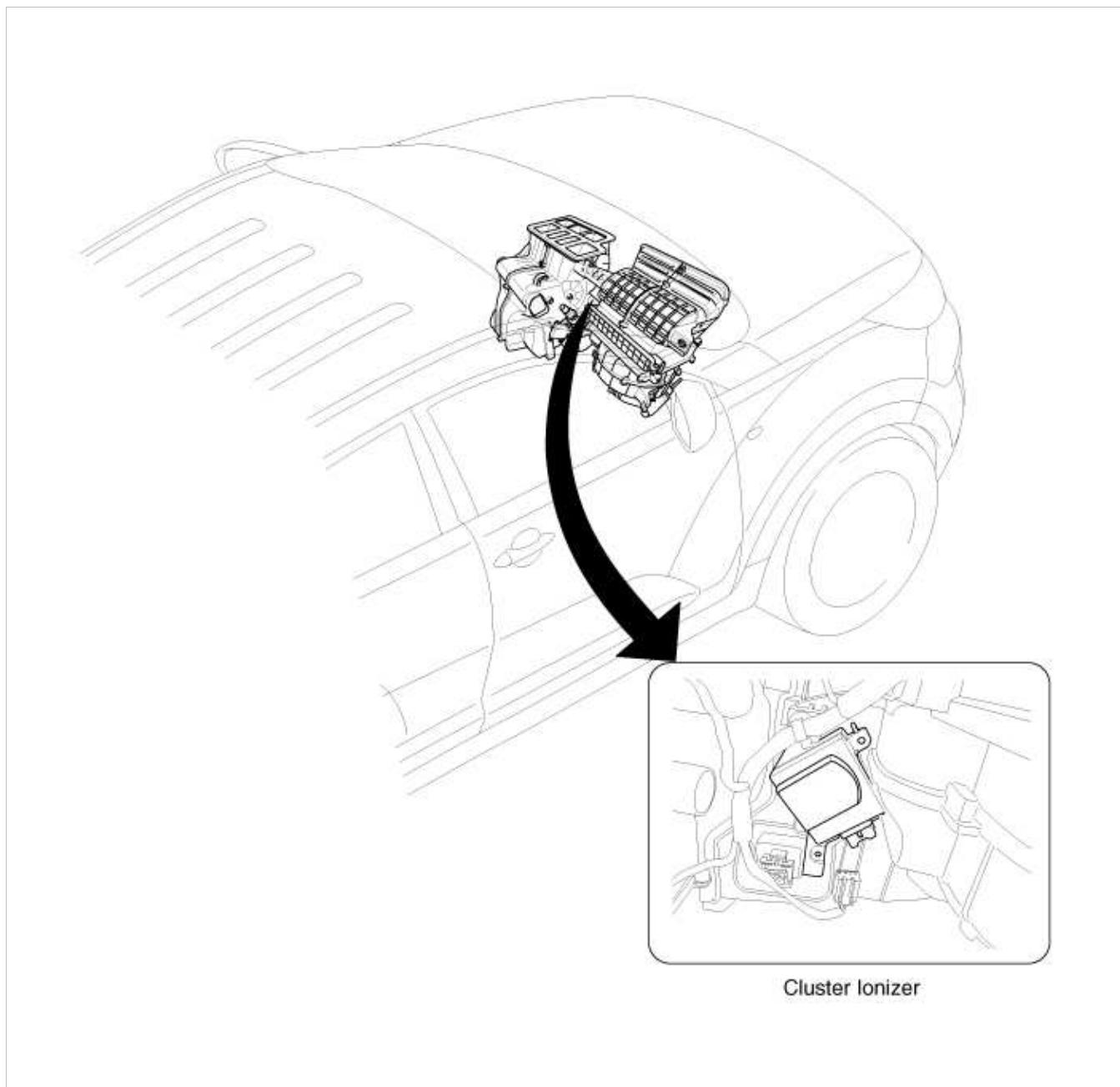
1. Disconnect the negative (-) battery terminal.
2. Disconnect the connector and then remove the ambient temperature sensor (A).



3. Installation is the reverse order of removal.

Heating, Ventilation, Air Conditioning > Air Conditioning System > Cluster ionizer > Components and Components Location

Component Location



Heating, Ventilation, Air Conditioning > Air Conditioning System > Cluster ionizer > Description and Operation

Description

1. The function of cluster ionizer is cleaning air by sterilizing and dissolving of air conditioner.
2. The function of cluster ionizer is controlling mold caused by stench of air conditioner and external inflow of air.

Heating, Ventilation, Air Conditioning > Air Conditioning System > Cluster ionizer > Repair procedures

Inspection

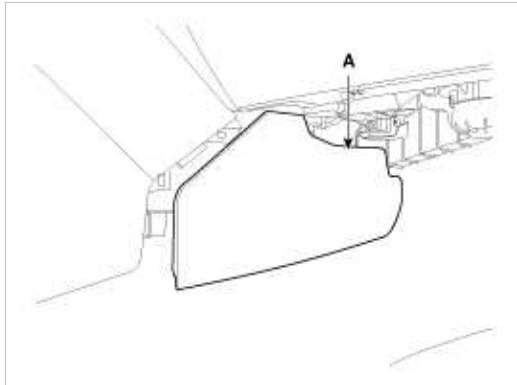
1. Press the OFF switch more than 4 times within 2 seconds while pressing the MODE switch.

Display	Fail description
00	Normal

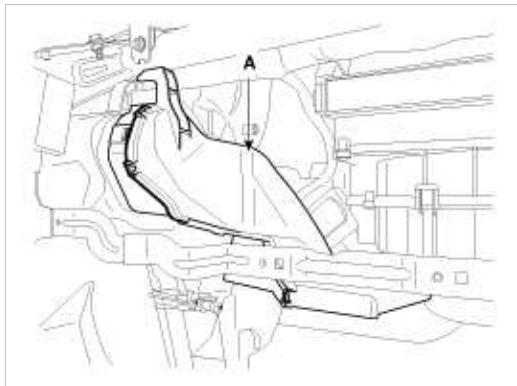
* Diagnostic procedure refer to DTC code.

Replacement

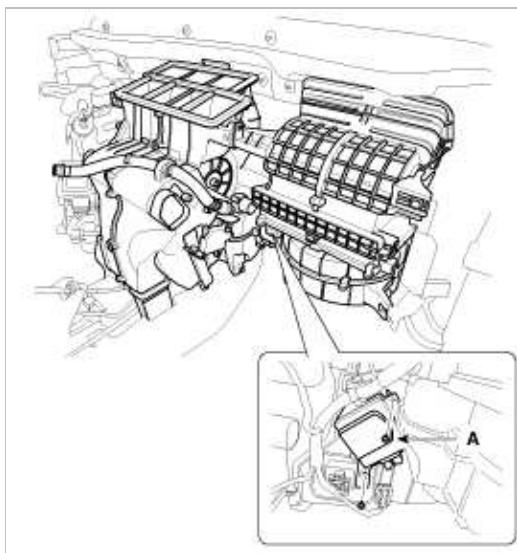
1. Disconnect the negative (-) battery terminal.
2. Remove the extension cover (A).



3. Remove the shower duct (A).



4. Loosen the screws and then remove the cluster ionizer (A).

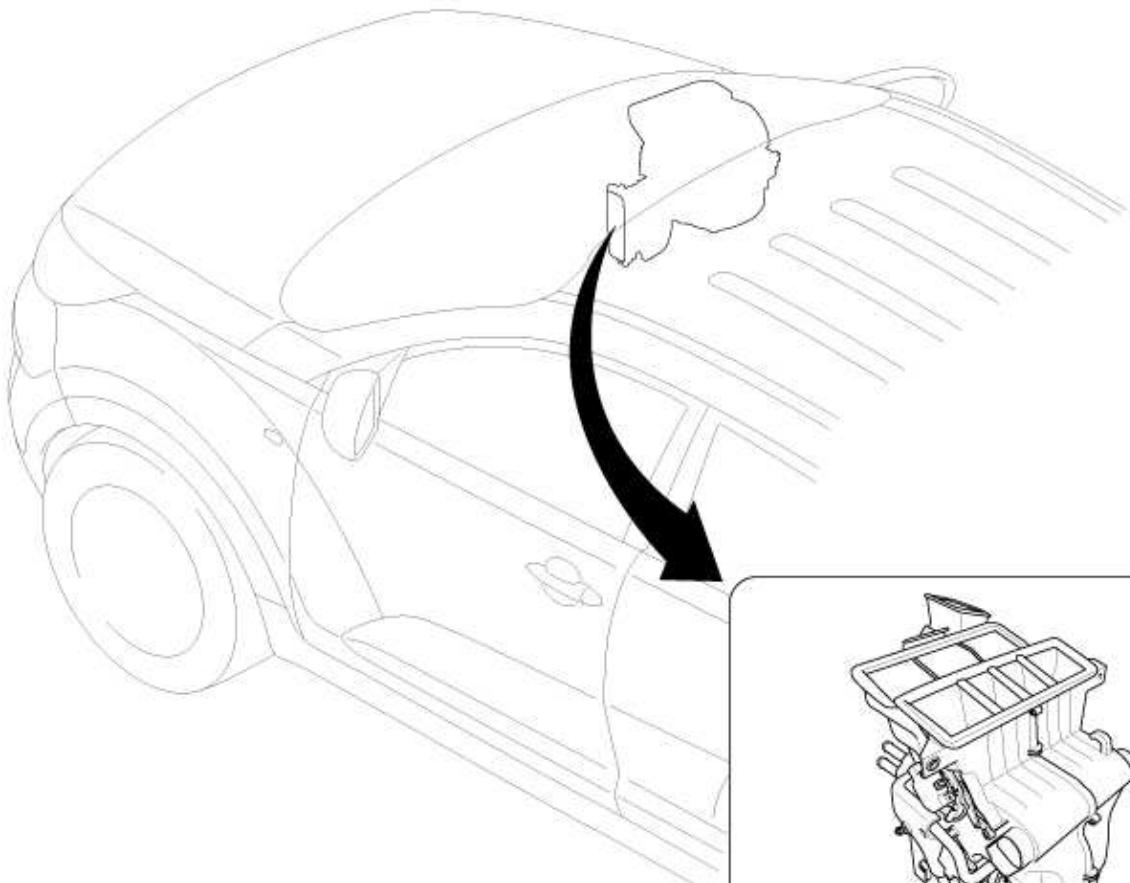


5. Installation is the reverse order of removal.

Heating, Ventilation, Air Conditioning > Heater > Heater Unit > Components and Components

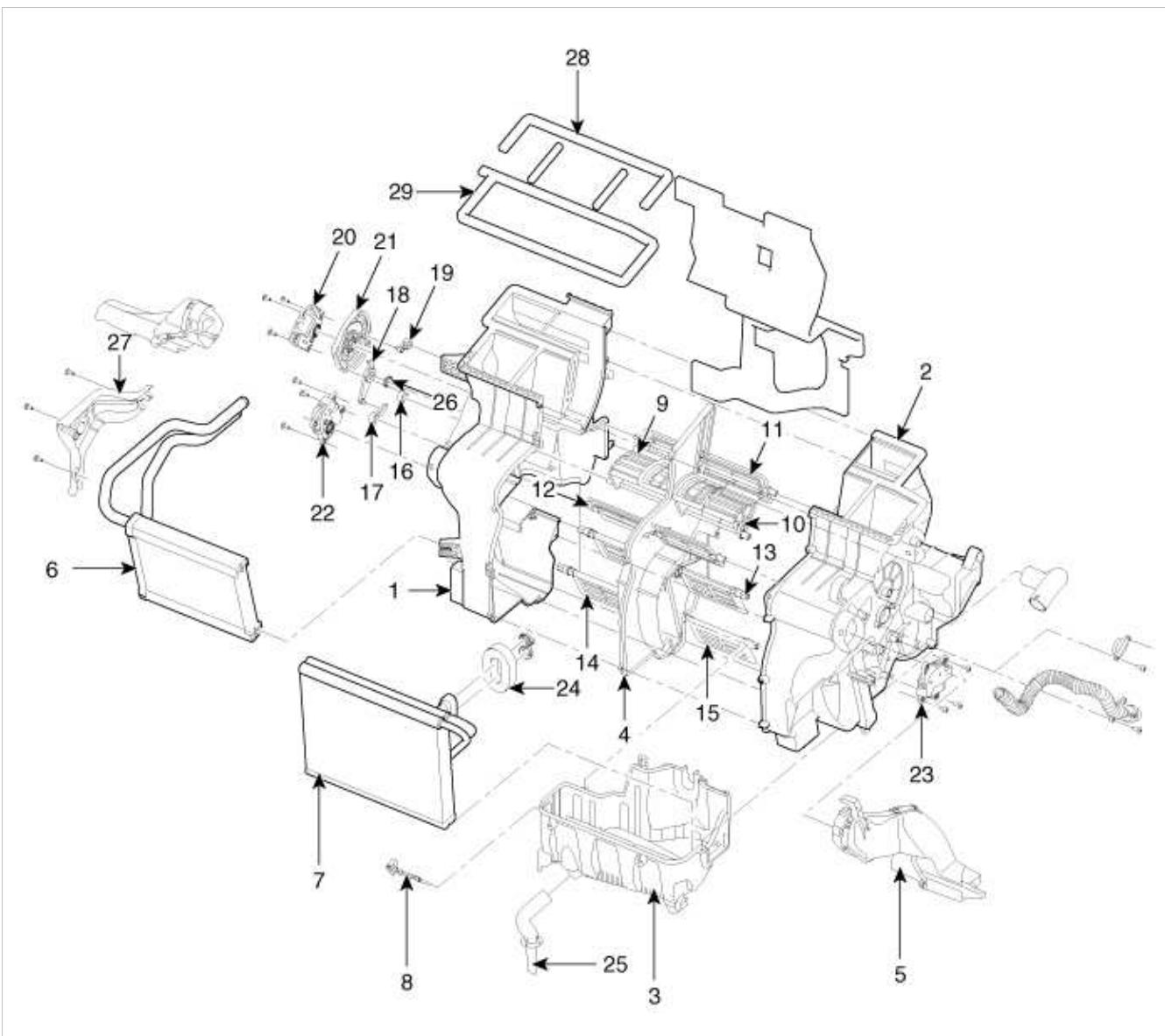
Location

Component Location



Heater unit

Components

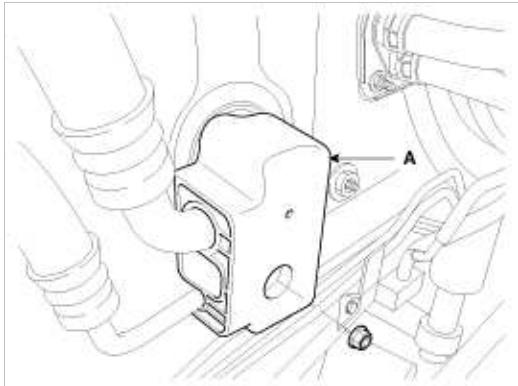


1. Heater Case (LH)	11. Def Door	21. Mode Cam
2. Heater Case (RH)	12. Foot Door	22. Temp Control Actuator
3. Heater Lower Case	13. Temp Control Door	23. Temp Control Actuator
4. Separator	14. Temp Control Door	24. Flange Seal
5. Shower Duct	15. Temp Control. Door	25. Drain Hose
6. Heater Core	16. Vent Door Arm	26. Washer Spring
7. Evaporator Core	17. Foot Lever	27. Heater Core Cover
8. Evaporator Sensor	18. Foot Door Arm	28. Flange Seal
9. Vent Door	19. Def Lever	29. Flange Seal
10. Vent Door	20. Mode Control Actuator	

Heating, Ventilation, Air Conditioning > Heater > Heater Unit > Repair procedures

Replacement

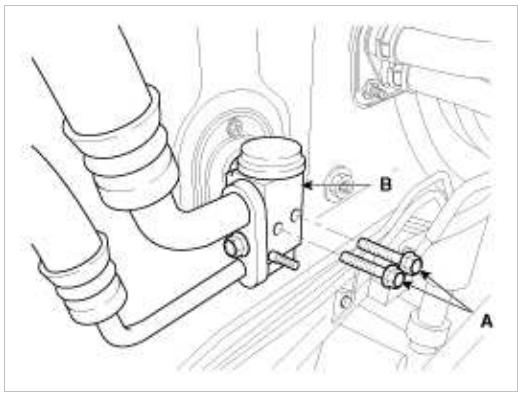
1. Disconnect the negative (-) battery terminal.
2. Recover the refrigerant with a recovery/ recycling/ charging station.
3. When the engine is cool, drain the engine coolant from the radiator.
4. Remove the expansion valve cover (A).



5. Remove the bolts (A) and the expansion valve (B) from the evaporator core.

Tightening torque :

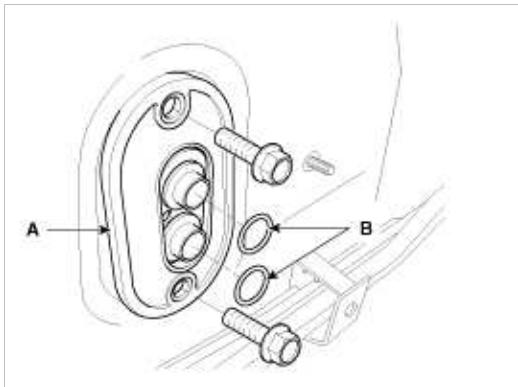
7.8 ~ 11.7 N.m (0.8 ~ 1.2 kgf.m, 5.7 ~ 8.6 lb-ft)



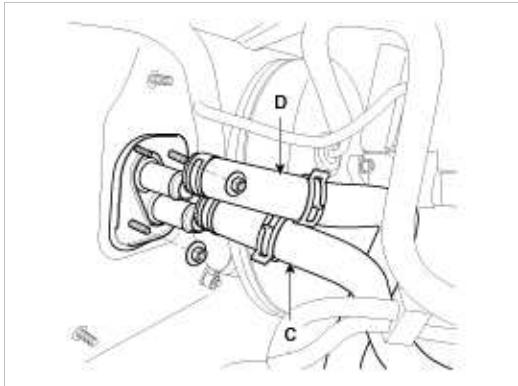
CAUTION

Plug or cap the lines immediately after disconnecting them to avoid moisture and dust contamination.

6. Remove the expansion valve flange (A).



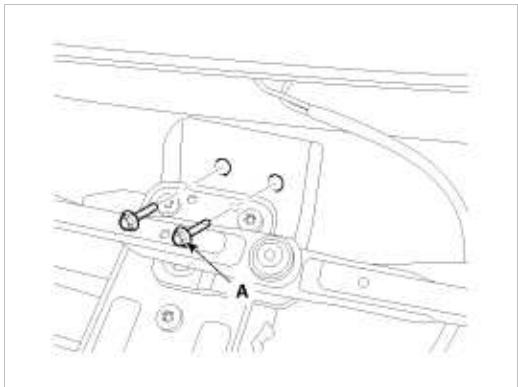
7. Disconnect the inlet (C) and outlet (D) heater hoses from the heater unit.



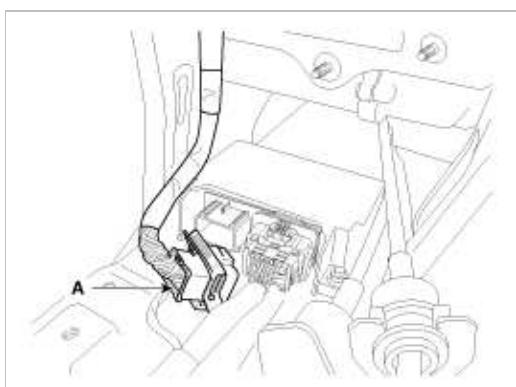
CAUTION

Engine coolant will run out when the hoses are disconnected; drain it into a clean drip pan. Be sure not to let coolant spill on electrical parts or painted surfaces. If any coolant spills, rinse it off immediately.

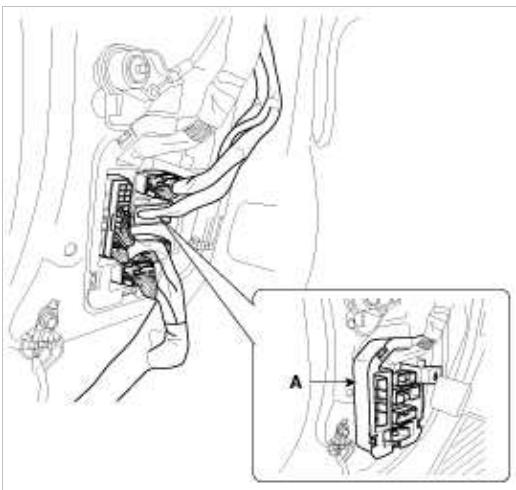
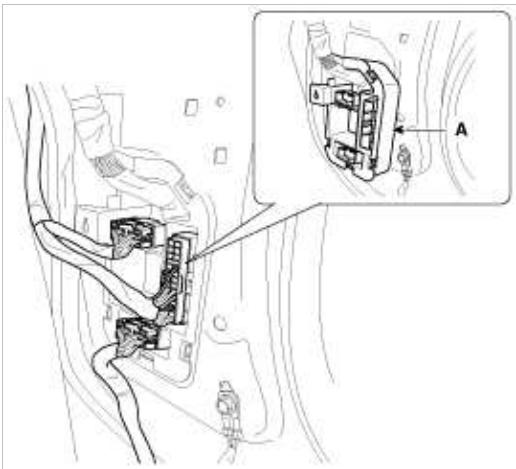
8. Remove the cowl top cover.
(Refer to BD group - "Cowl Top Cover").
9. Loosen the cowl cross member mounting bolts (A).



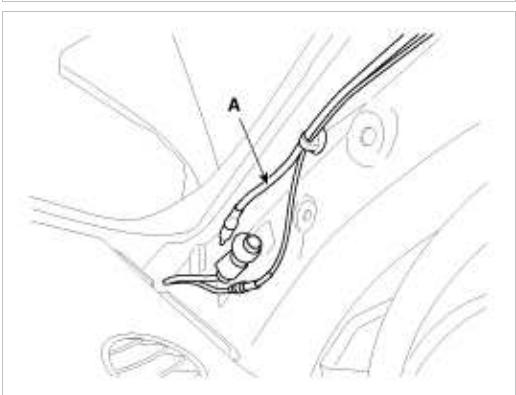
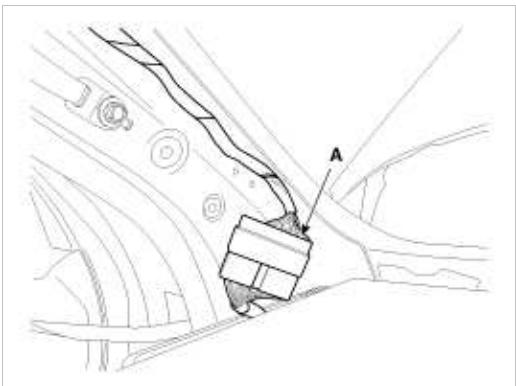
10. Remove the steering handle and column.
(Refer to ST group - "Steering Column")
11. Remove the center console.
(Refer to BD group - "Center Console")
12. Disconnect the airbag connector (A).



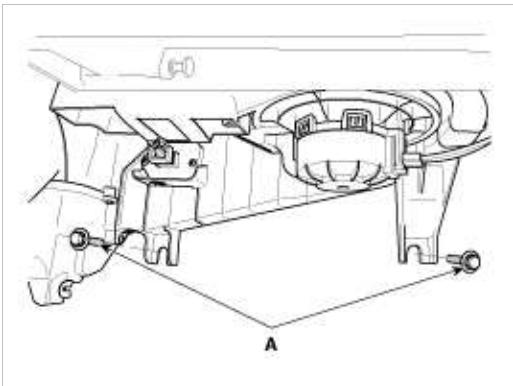
13. Disconnect the connectors and then remove the left & right multi box (A).



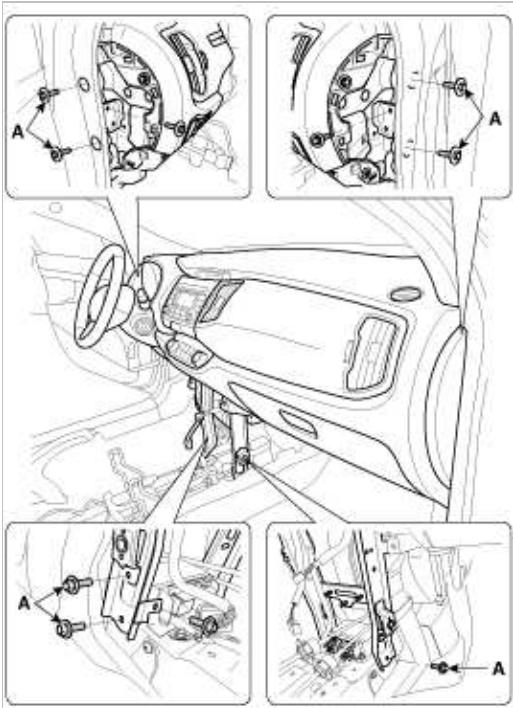
14. Remove the left & right filler trim and than disconnect the connector (A).



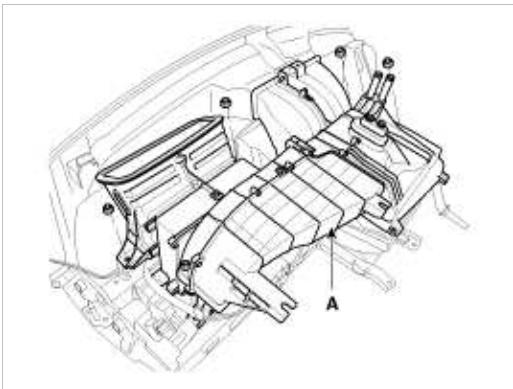
15. Remove the heater & blower unit after loosening mounting bolts (A).



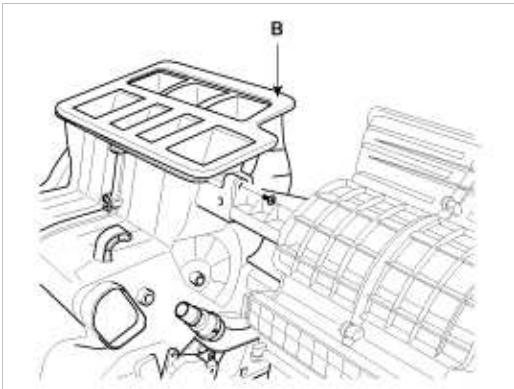
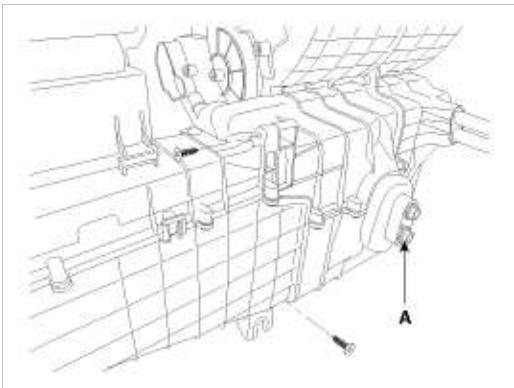
16. Loosen the cowl cross member mounting bolts (A) and then remove the crash pad and heater blower unit.



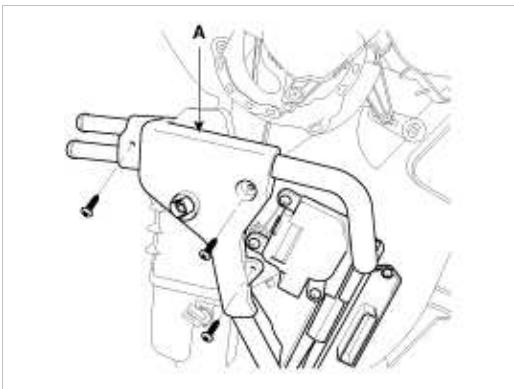
17. Disconnect the connectors and then remove the heater blower unit (A) from crash pad.



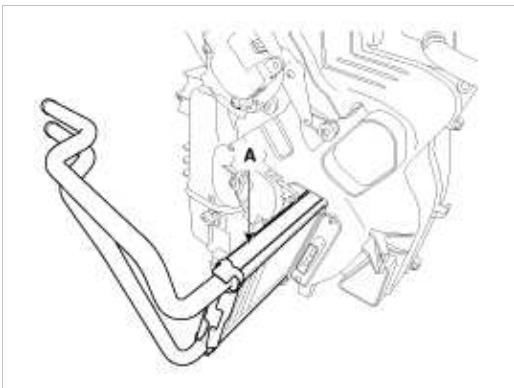
18. Remove the blower unit (A) from heater unit (B) after loosening screws.



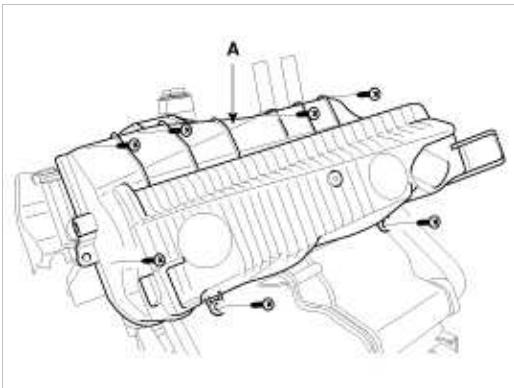
19. Loosen the mounting screw and then remove the heater core cover (A).



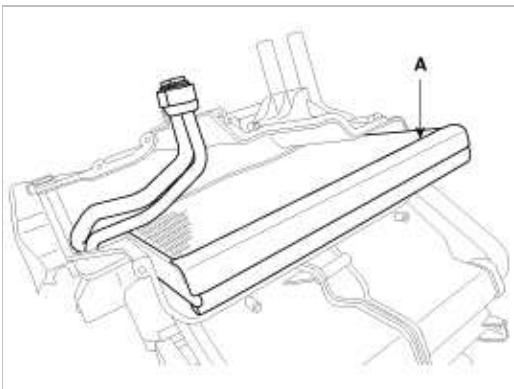
20. Disconnect the heater core (A) from heater unit.



21. Loosen the heater unit lower case mount screw and then remove the heater unit lower case (A).



22. Remove the evaporator core (A).



23. Be careful that the inlet and outlet pipe are not bent during heater core removal, and pull out the heater core.

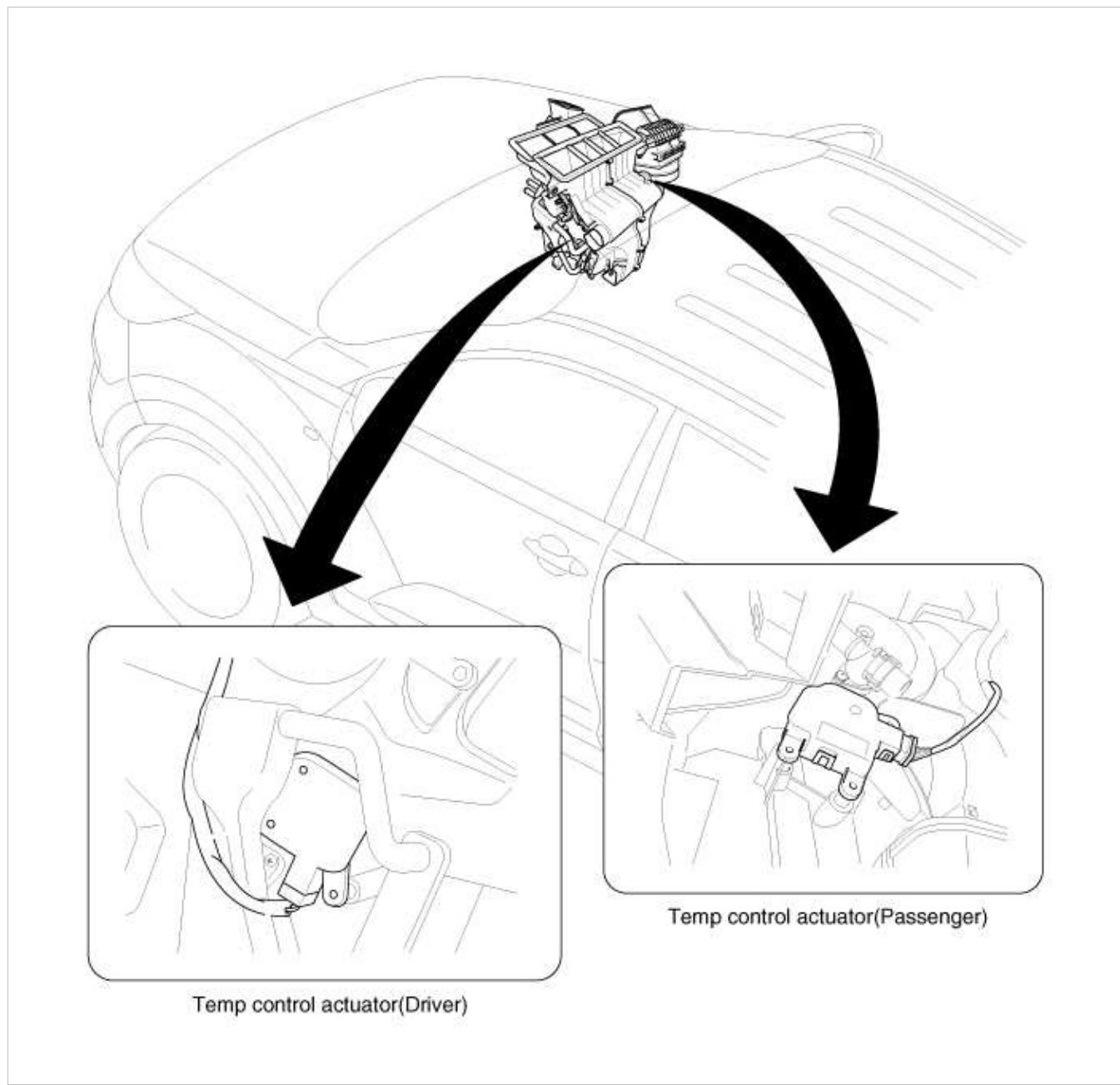
24. Installation is the reverse order of removal.

25. Installation is the reverse order of removal, and note these items :

- A. If you're installing a new evaporator, add refrigerant oil (ND-OIL8).
- B. Replace the O-rings with new ones at each fitting, and apply a thin coat of refrigerant oil before installing them. Be sure to use the right O-rings for R-134a to avoid leakage.
- C. Immediately after using the oil, replace the cap on the container, and seal it to avoid moisture absorption.
- D. Do not spill the refrigerant oil on the vehicle ; it may damage the paint ; if the refrigerant oil contacts the paint, wash it off immediately
- E. Apply sealant to the grommets.
- F. Make sure that there is no air leakage.
- G. Charge the system and test its performance.
- H. Do not interchange the inlet and outlet heater hoses and install the hose clamps securely.
- I. Refill the cooling system with engine coolant

Heating, Ventilation, Air Conditioning > Heater > Temperature Control Actuator > Components and Components Location

Component Location



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

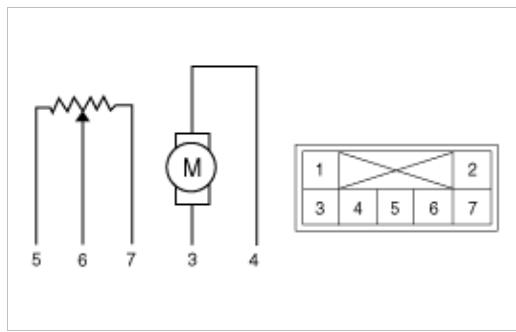
Inspection

1. Ignition "OFF"
2. Disconnect the connector of temperature control actuator.

3. Verify that the temperature control actuator operates to the hot position when connecting 12V to the terminal 3 and grounding terminal 4.

Verify that the temperature control actuator operates to the cool position when connecting in the reverse.

[Drive]



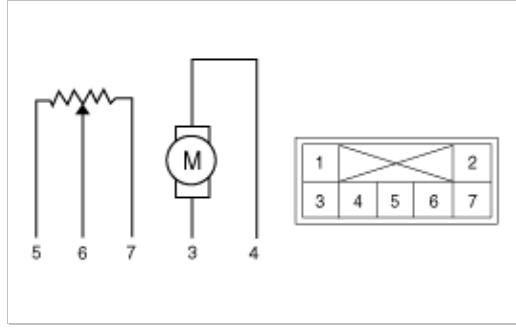
1. -	5. Sensor ground
2. -	6. Feedback signal
3. Hot position	7. 5V (Vcc)
4. Cool position	

4. Check the voltage between terminals 5 and 6(Drive).

Specification

Door position	Voltage(5-6)	Error detecting
Max. cooling	$0.4 \pm 0.15V$	Low voltage : 0.1V or less
Max. heating	$4.6 \pm 0.15V$	High voltage : 4.9V or more

[Passenger]



1. -	5. 5V (Vcc)
2. -	6. Feedback signal
3. Cool position	7. Sensor ground
4. Hot position	

5. Check the voltage between terminals 6 and 7(Passenger).

Specification

Door position	Voltage(6-7)	Error detecting
Max. cooling	$0.4 \pm 0.15V$	Low voltage : 0.1V or less
Max. heating	$4.6 \pm 0.15V$	High voltage : 4.9V or more

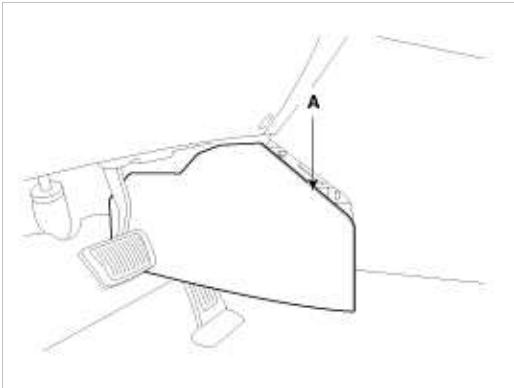
It will feedback current position of actuator to controls.

6. If the measured voltage is not specification, substitute with a known-good temperature control actuator and check for proper operation.

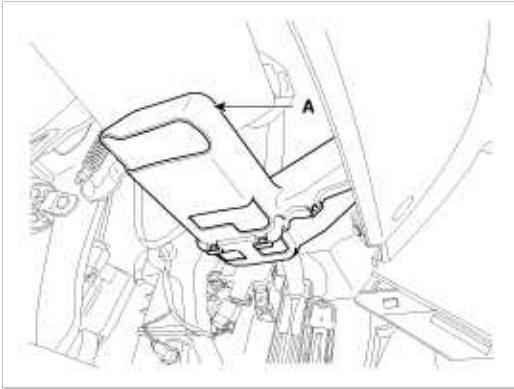
7. If the problem is corrected, replace the temperature control actuator.

Replacement

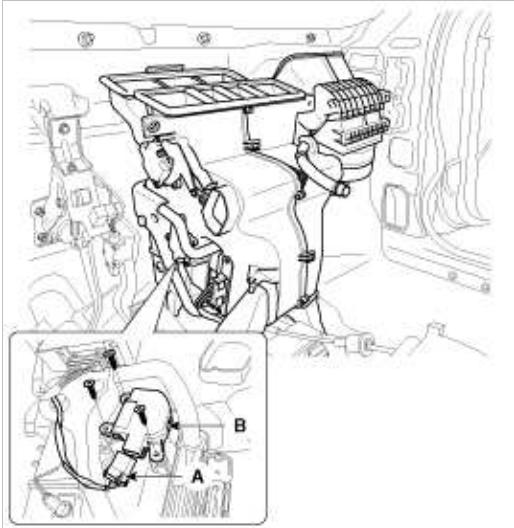
1. Disconnect the negative (-) battery terminal.
2. Remove the left extension cover (A).



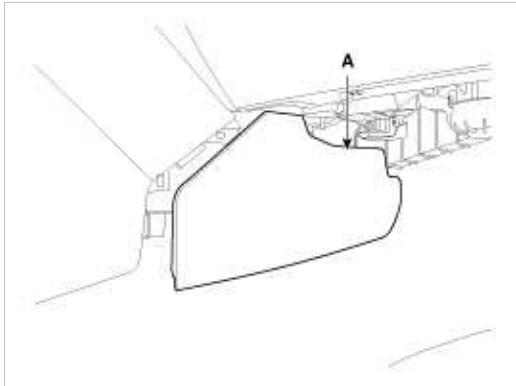
3. Remove the left shower duct (A).



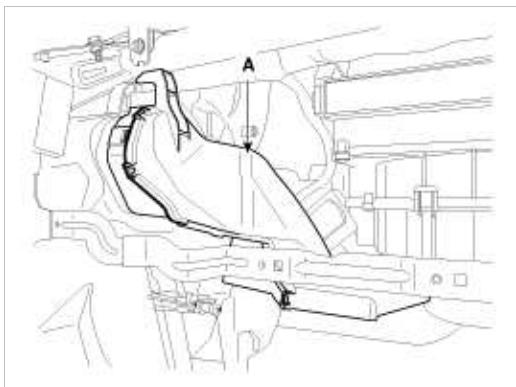
4. Disconnect the temperature control actuator connector (A).
5. Loosen the mounting screw and then remove the temperature control actuator (B).



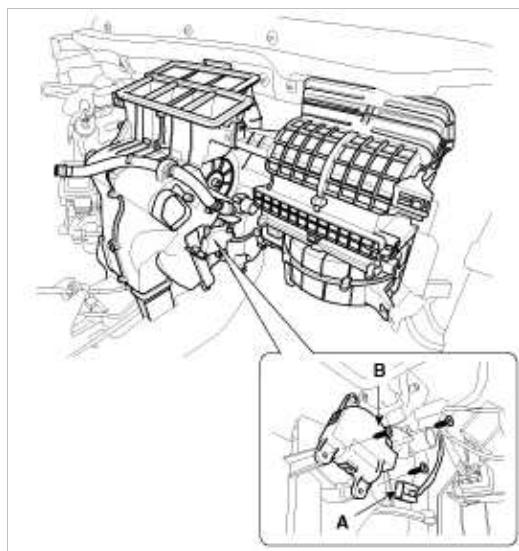
6. Remove the right extension cover (A).



7. Remove the main crash pad.
(Refer to BD group - "Crash Pad")
8. Remove the right shower duct (A).



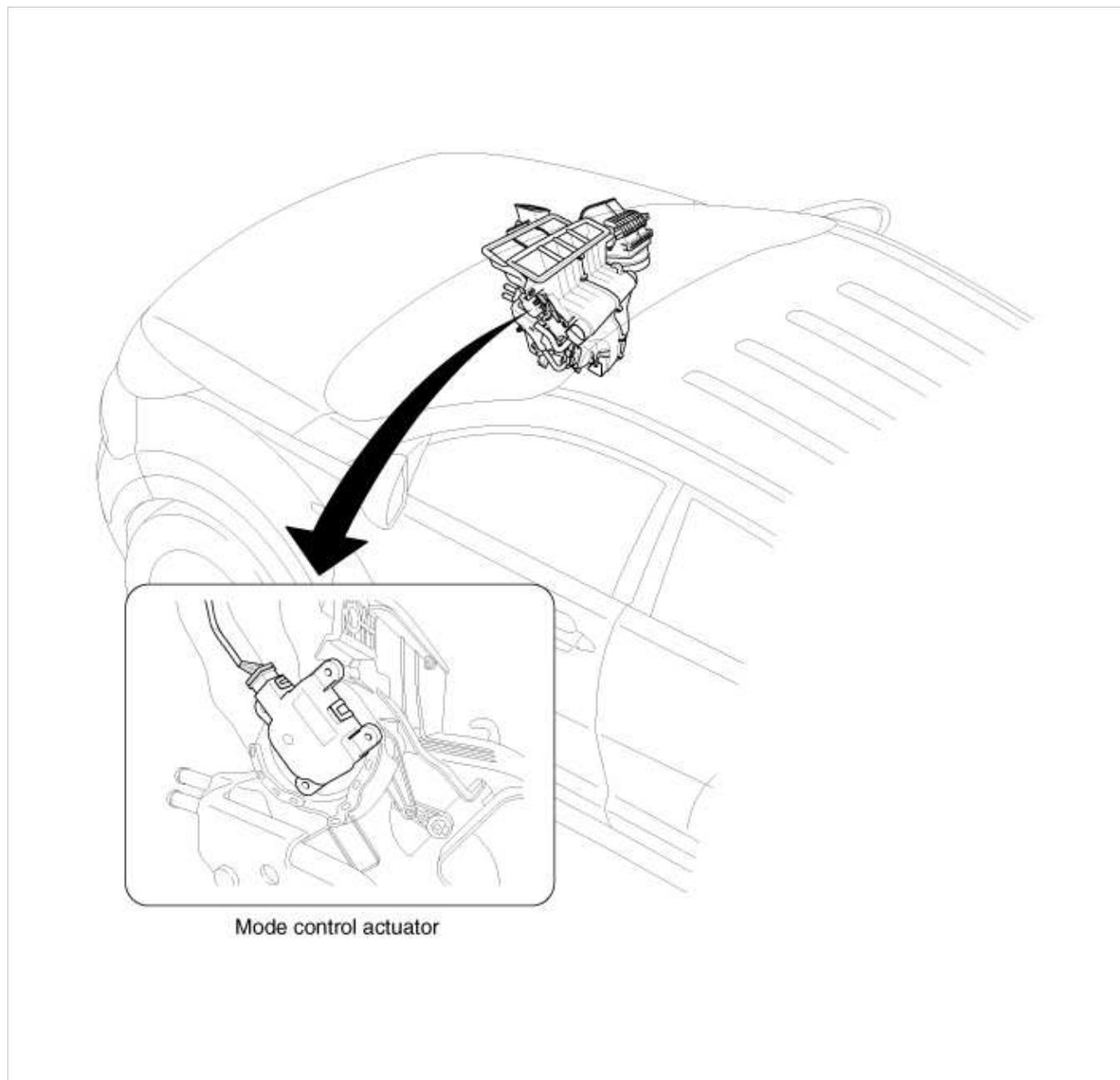
9. Disconnect the temperature control actuator connector (A).
10. Loosen the mounting screw and then remove the temperature control actuator (B).



11. Installation is the reverse order of removal.

Heating, Ventilation, Air Conditioning > Heater > Mode Control Actuator > Components and Components Location

Component Location



Heating, Ventilation, Air Conditioning > Heater > Mode Control Actuator > Description and Operation

Description

The mode control actuator is located at the heater unit.

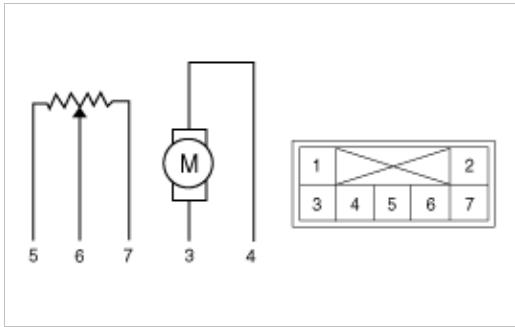
It adjusts position of mode door by operating mode control actuator based on signal of A/C control unit. Pressing mode select switch makes the mode control actuator shift in order of vent → B/L → floor → mix.

Heating, Ventilation, Air Conditioning > Heater > Mode Control Actuator > Repair procedures

Inspection

1. Ignition "OFF"
2. Disconnect the connector of mode control actuator.
3. Verify that the mode control actuator operates to the defrost mode when connecting 12V to the terminal 3 and grounding terminal 4.

4. Verify that the mode control actuator operates to the vent mode when connecting in the reverse.



1. -	5. Sensor ground
2. -	6. Feedback signal
3. Defrost mode	7. 5V(Vcc)
4. Vent mode	

5. Check the voltage between terminals 5 and 6.

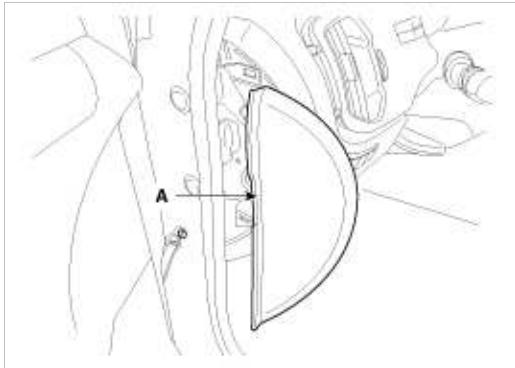
Door position	Voltage (5-6)	Error detecting
Vent	$0.4 \pm 0.15V$	Low voltage : 0.1V or less
Defrost	$4.6 \pm 0.15V$	High voltage : 4.9V or more

It will feedback current position of actuator to controls.

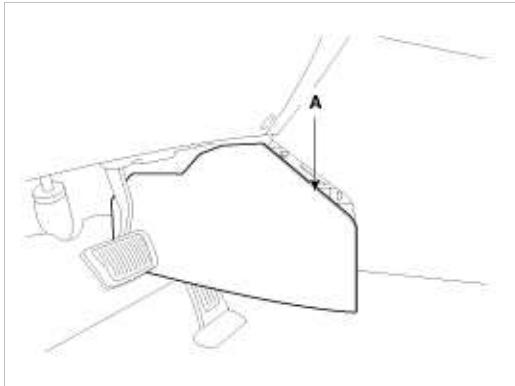
6. If the measured voltage is not specification, substitute with a known-good mode control actuator and check for proper operation.
 7. If the problem is corrected, replace the mode control actuator.

Replacement

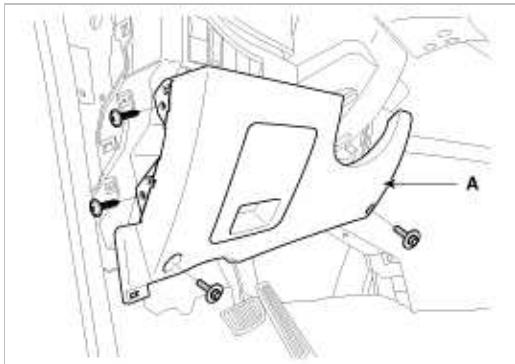
1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad left side cover (A).



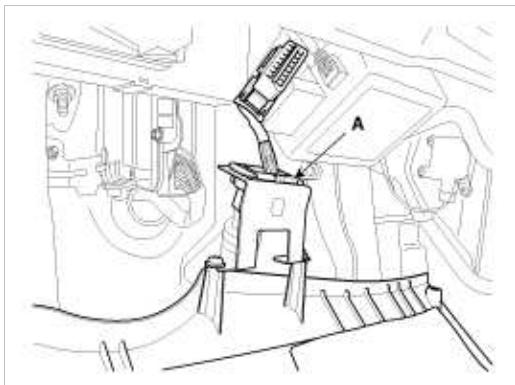
3. Remove the left extension cover(A).



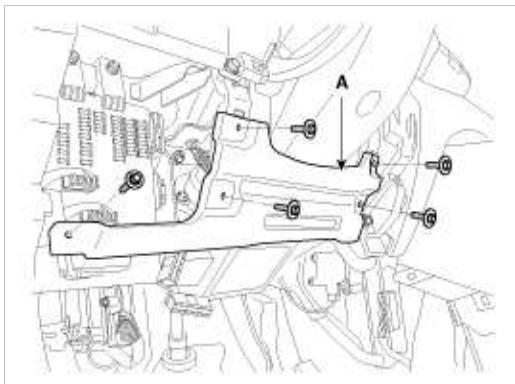
4. Remove the crash pad lower cover (A).



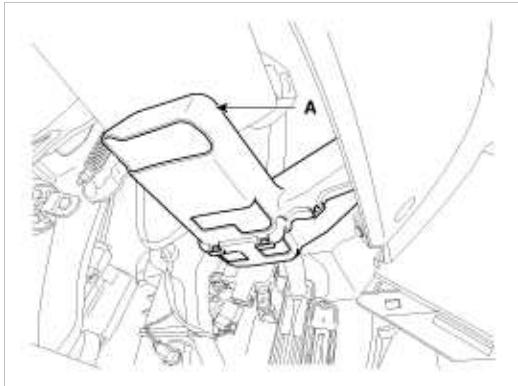
5. Disconnect the diagnosis connector (A).



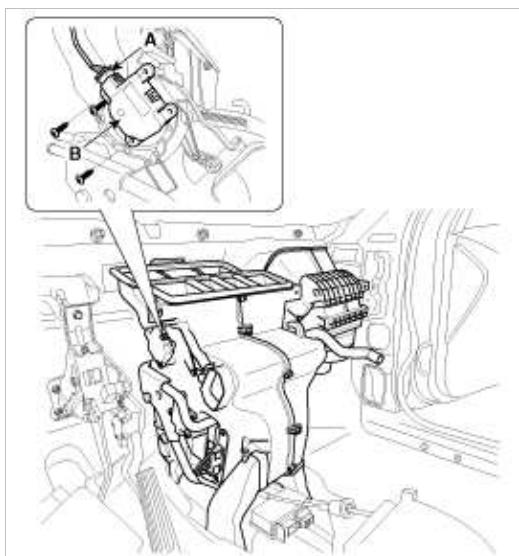
6. Remove the reinforcing panel (A).



7. Remove the left shower duct (A).



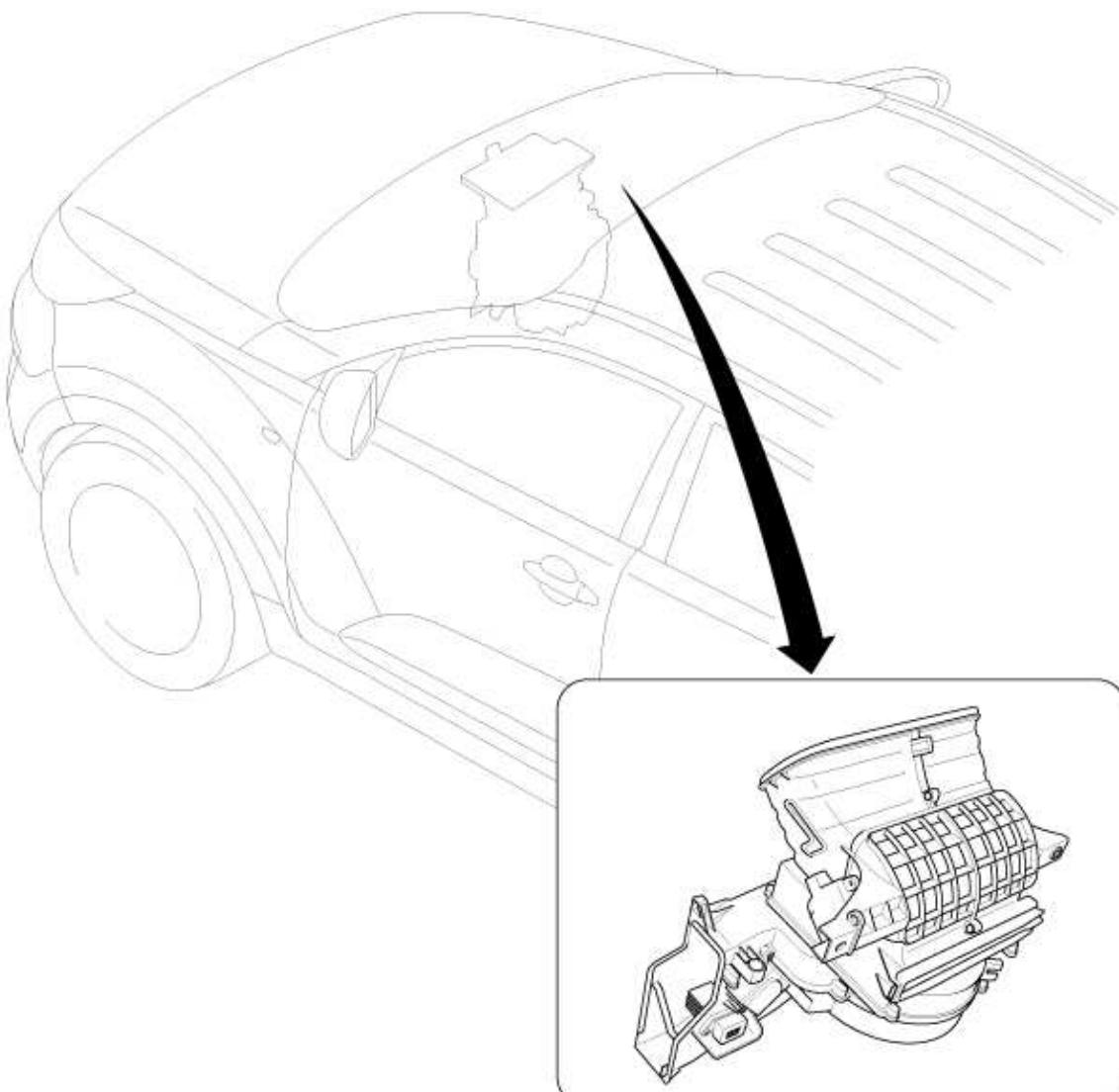
8. Remove the BCM.
(Refer to BE group - "BCM")
9. Disconnect the mode control actuator connector (A).
10. Loosen the mounting screw and then remove the mode control actuator (B).



11. Installation is the reverse order of removal.

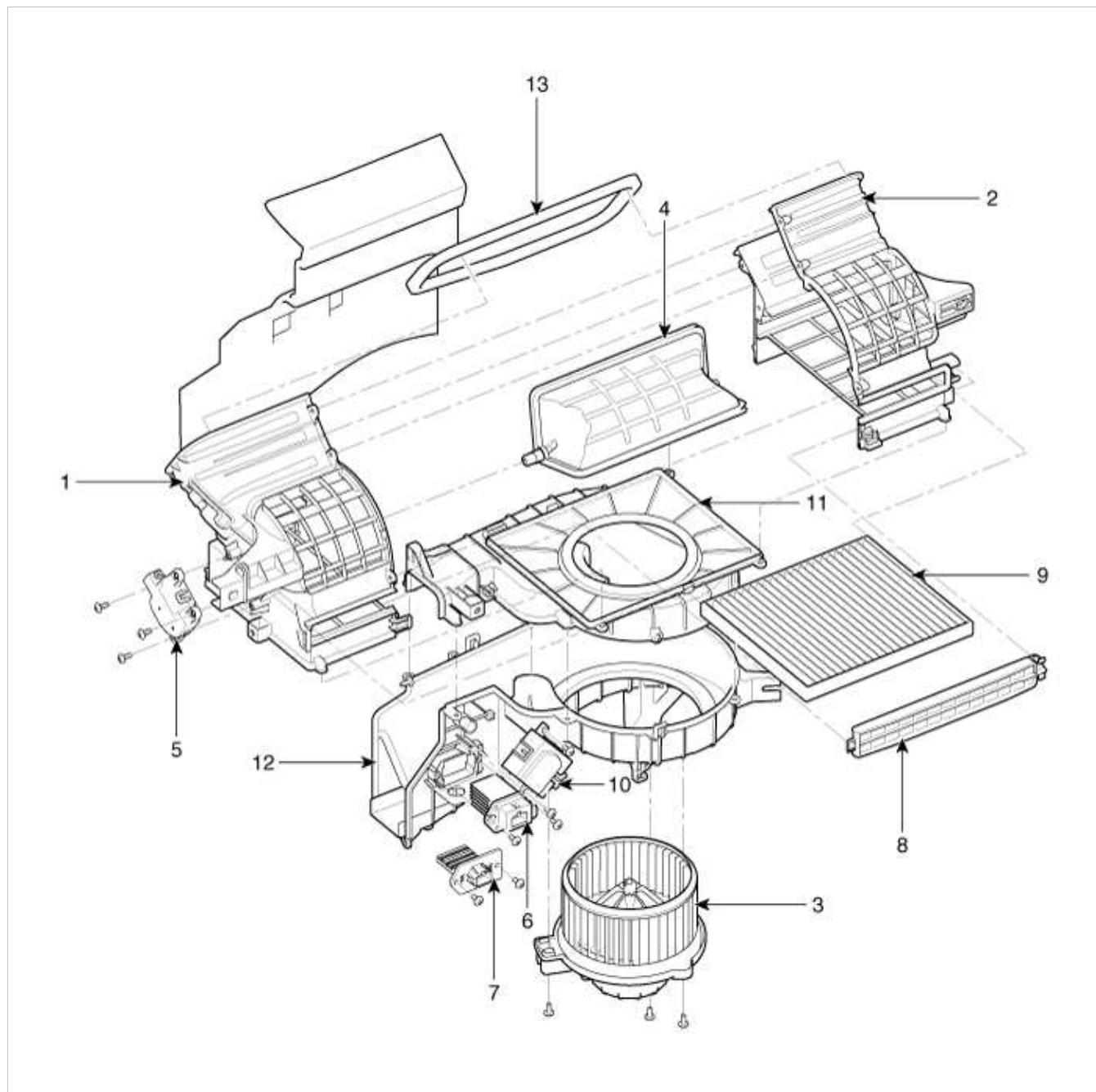
Heating, Ventilation, Air Conditioning > Blower > Blower Unit > Components and Components Location

Component Location



Blower unit

Components

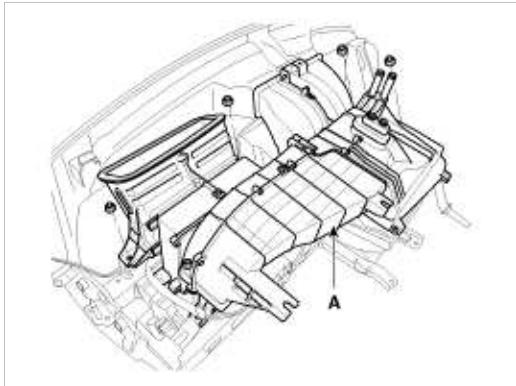


1. Intake case (LH)	6. Mofet [Auto type]	11. Blower case (Upper)
2. Intake case (RH)	7. Resistor [Manual type]	12. Blower case (Lower)
3. Blower motor	8. Climate control air filter cover	13. Intake seal
4. Intake door	9. Climate control air filter	
5. Intake actuator	10. Ionizer	

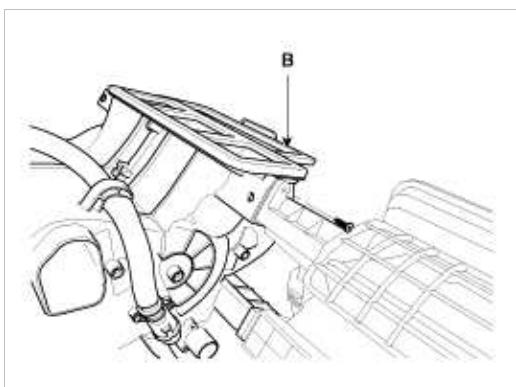
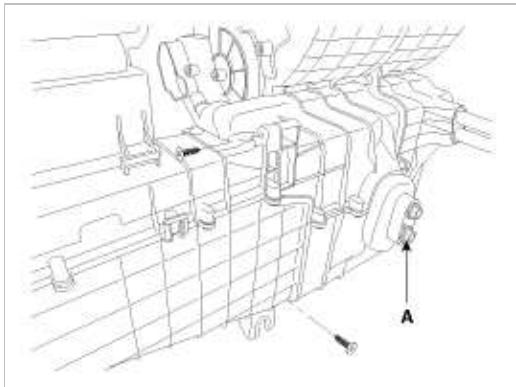
Heating, Ventilation, Air Conditioning > Blower > Blower Unit > Repair procedures

Replacement

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad and heater blower unit.
(Refer to HA group - "Heater Unit")
3. Remove the heater blower unit (A) from crash pad.



4. Remove the blower unit (A) from the heater unit (B) after loosening a mounting bolt and screws.



NOTE

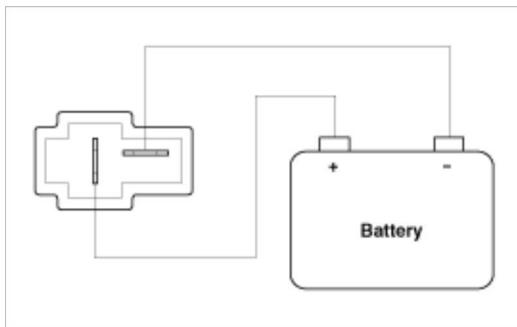
Make sure that there is no air leaking out of the blower and duct joints.

5. Installation is the reverse order of removal.

Heating, Ventilation, Air Conditioning > Blower > Blower Motor > Repair procedures

Inspection

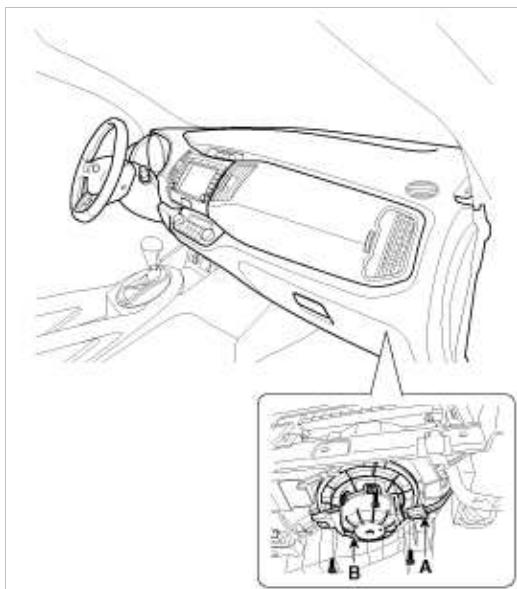
1. Connect the battery voltage and check the blower motor rotation.



2. If the blower motor is not operating when voltage is applied, substitute with a known-good blower motor and check for proper operation.
3. If the problem is corrected, replace the blower motor.

Replacement

1. Disconnect the negative (-) battery terminal.
2. Disconnect the connector (A) of the blower motor.
3. Remove the blower motor (B) after loosening the mounting screws.

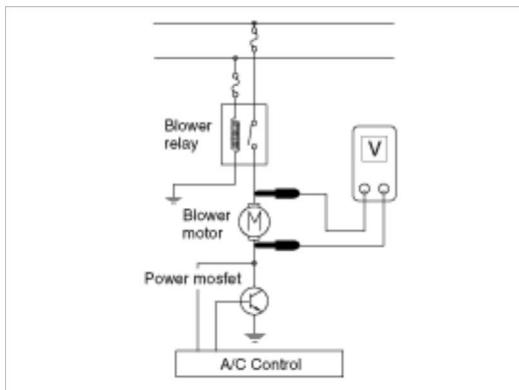


4. Installation is the reverse order of removal.

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	4.0 ±0.5V	
Second speed	5.1 ±0.5V	
Third speed	6.2 ±0.5V	
Fourth speed	7.4 ±0.5V	
Fifth speed	8.6 ±0.5V	
Sixth speed	9.7 ±0.5V	
Seventh speed	10.8 ±0.5V	
eighth speed	Battery	

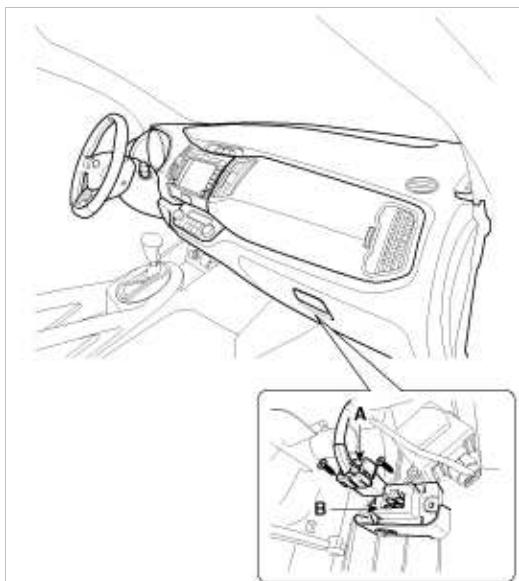
*AUTO COOLING : Auto speed (4.5V~B+)

*AUTO HEATING : Auto speed (4.5V~11.0V)

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. Disconnect the power mosfet connector (A) and then remove the power mosfet (B) after loosening the mounting screws.

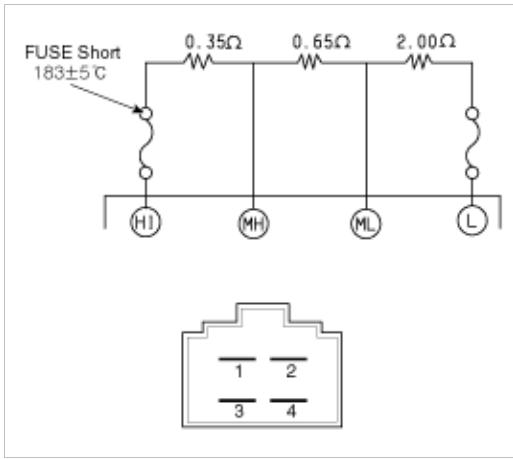


3. Installation is the reverse order of removal.

Heating, Ventilation, Air Conditioning > Blower > Blower Resistor > Repair procedures

Inspection

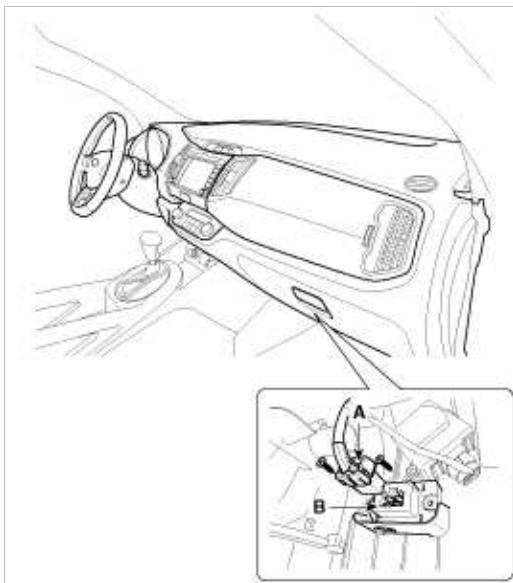
1. Measure terminal-to-terminal resistance of the blower resistor.
2. measured resistance is not within specification, the blower resistor must be replaced. (After removing the resistor)



- | | |
|-------|-------|
| 1. ML | 3. LO |
| 2. MH | 4. HI |

Replacement

1. Disconnect the negative (-) battery terminal.
2. Disconnect the blower resistor connector (A) and then remove the blower resistor (B) after loosening the mounting screws.



3. Installation is the reverse order of removal.

Heating, Ventilation, Air Conditioning > Blower > Climate Control Air Filter > Description and Operation

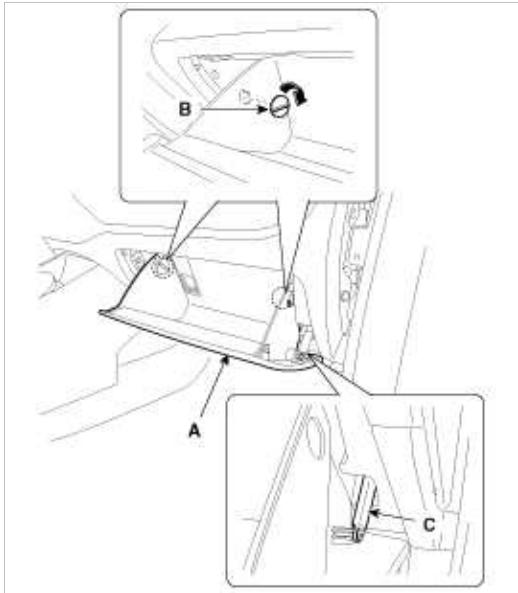
Description

This has particle filter which eliminates foreign materials and odor. The particle filter includes odor filter as well as conventional dust filter to ensure comfortable interior environment.

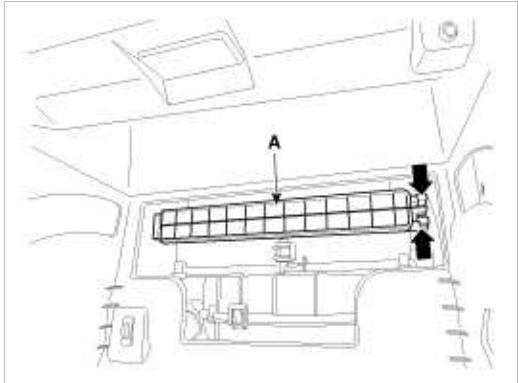
Heating, Ventilation, Air Conditioning > Blower > Climate Control Air Filter > Repair procedures

Replacement

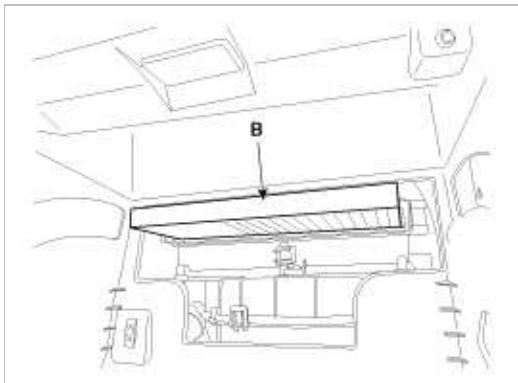
1. Disconnect the damper (B) and glove box lift (C) from the glove box (A).



2. Remove the filter cover with pushing the knob.



3. Replace the air filter (B), install it after making sure of the direction of air filter.



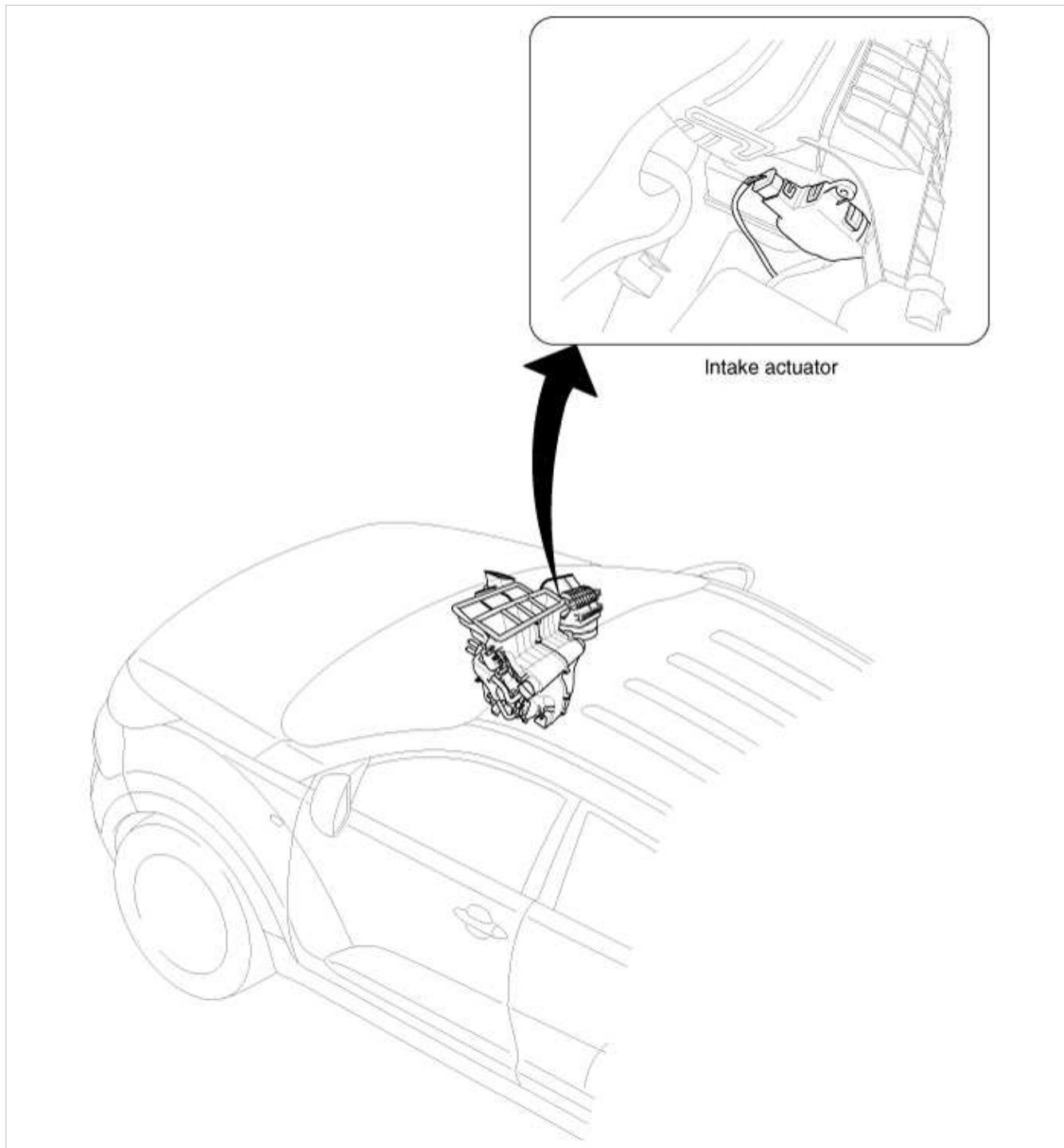
NOTE

In case of driving in an air-polluted area or rugged terrain, check and replace the air filter as frequently as possible.

4. Installation is the reverse order of removal.

Heating, Ventilation, Air Conditioning > Blower > Intake Actuator > Components and Components Location

Component Location



Heating, Ventilation, Air Conditioning > Blower > Intake Actuator > Description and Operation

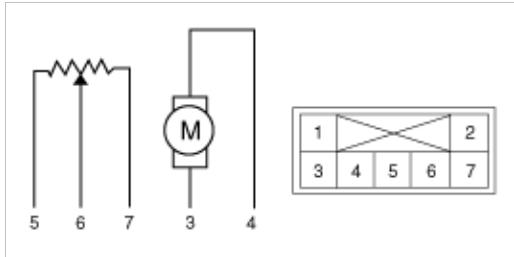
Description

1. The intake actuator is located at the blower unit.
2. It regulates the intake door by signal from control unit.
3. Pressing the intake selection switch will shift between recirculation and fresh air modes.

Heating, Ventilation, Air Conditioning > Blower > Intake Actuator > Repair procedures

Inspection

1. Ignition "OFF"
2. Disconnect the intake actuator connector.
3. Verify that the actuator operates to the recirculation position when connecting 12V to the terminal 3 and grounding terminal 4.
4. Verify that the intake actuator operates to the fresh position when connecting in the reverse.



1. -	5. 5V (Vcc)
2. -	6. Feedback Signal
3. Fresh	7. Sensor Ground
4. Recirculation	

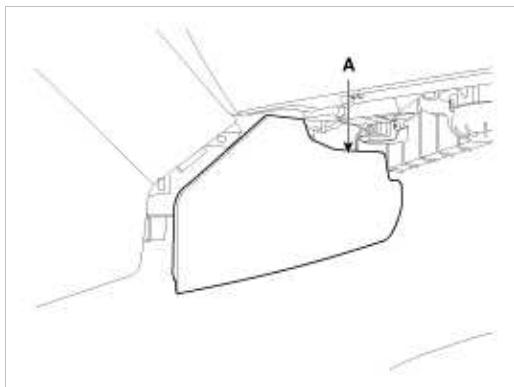
5. Check the voltage between terminals 6 and 7.

Door position	Voltage(6-7)	Error detecting
Fresh	$0.4 \pm 0.15V$	Low voltage : 0.1V or less
Recirculation	$4.6 \pm 0.15V$	High voltage : 4.9V or more

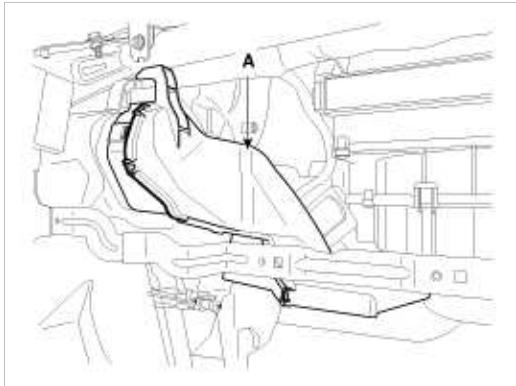
6. If the intake actuator is not operated well, substitute with a known-good intake actuator and check for proper operation.
7. If the problem is corrected, replace the intake actuator.

Replacement

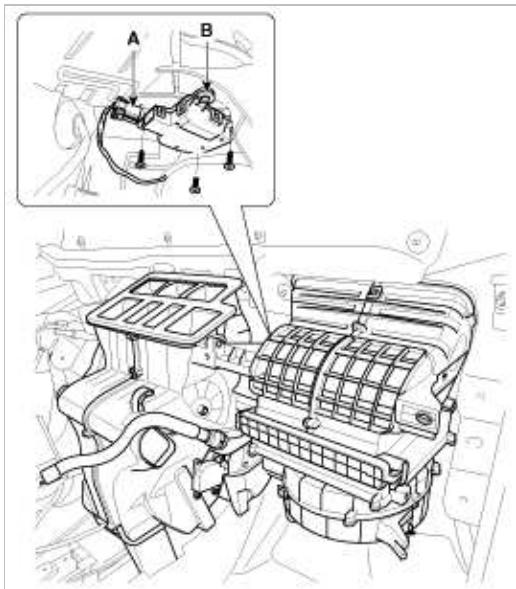
1. Disconnect the negative (-) battery terminal.
2. Remove the right extension cover (A).



3. Remove the crash pad.
(Refer to BD group - "Crash Pad")
4. Remove the right shower duct (A).



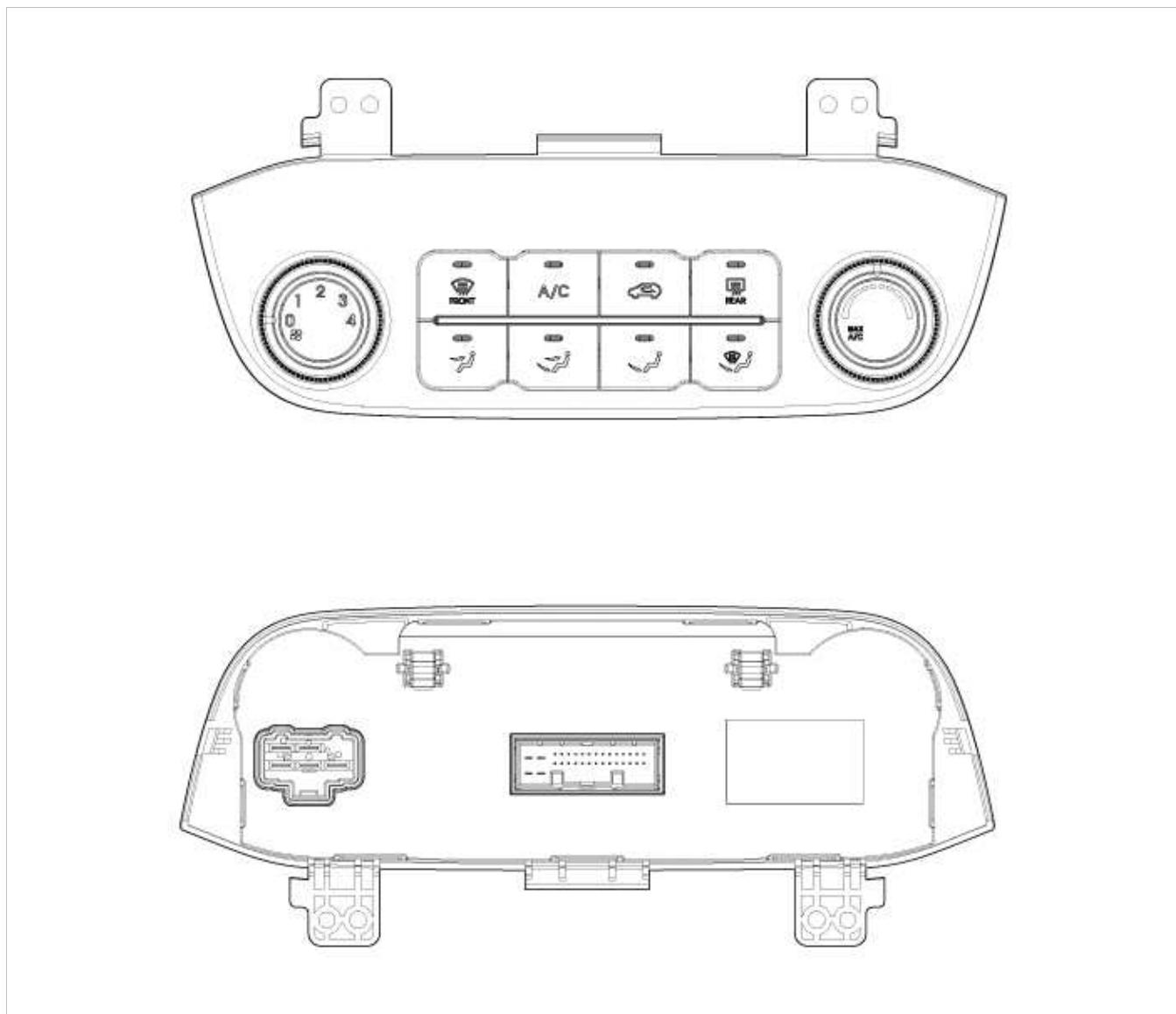
5. Disconnect the Intake actuator connector (A).
6. Loosen the mounting screw and then remove the intake actuator (B).



7. Installation is the reverse order of removal.

Heating, Ventilation, Air Conditioning > Controller > Heater & A/C Control Unit(Manual) > Components and Components Location

Components



Connector Pin Function

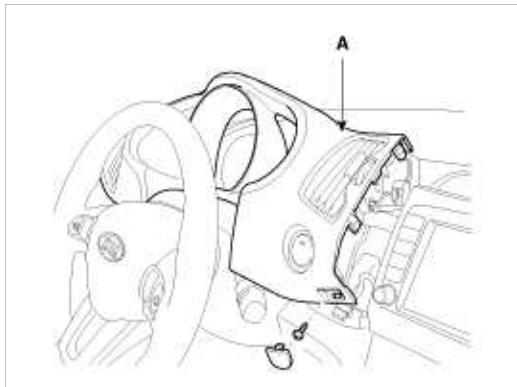
Connector	Pin No	Function	Connector	Pin NO	Function
Connector(A)	1	High	Connector(B)	1	Tail Lamp (ILL+)
	2	Middle High		2	Battery
	3	Middle Low		3	Mode Actuator (VENT)
	4	-		4	Mode Actuator (DEF)
	5	GND		5	Temp Actuator (COOL)
	6	Low		6	Temp Actuator (WARM)
				7	Intake Actuator (FRE)
				8	Intake Actuator (REC)
				9	-
				10	Detent
				11	Mode Actuator (F/B)
				12	Temp Actuator (F/B)
				13	Intake Actuator (F/B)
				14	Blower Motor Common (-)

15	Blower F/B
16	Rheostat (ILL-)
17	IG2
18	IG1
19	Can (HIGH)
20	Can (LOW)
21	HTD(Rear DEF IND.)
22	ECV IN
23	ECV OUT
24	-
25	Vref (+5V)
26	Evaporator Sensor
27	Ambient Sensor
28	-
29	-
30	-
31	Sensor GND
32	GND

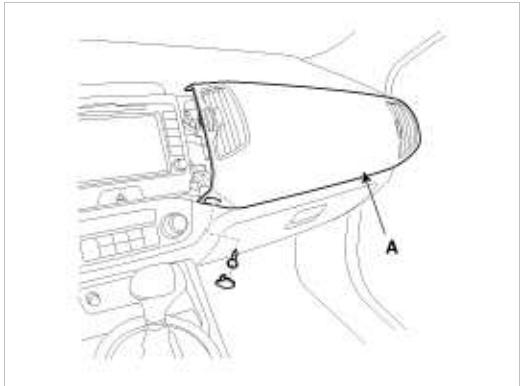
Heating, Ventilation, Air Conditioning > Controller > Heater & A/C Control Unit(Manual) > Repair procedures

Replacement

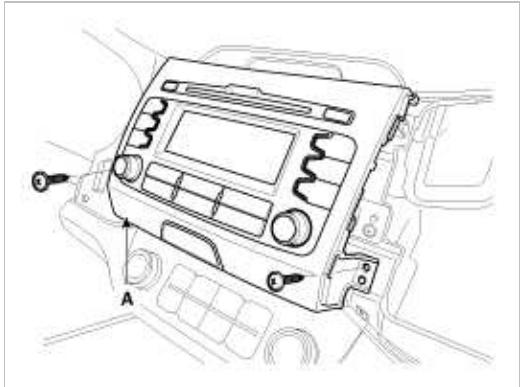
1. Disconnect the negative (-) battery terminal.
2. Using the screwdriver, remove the cluster facia panel (A).



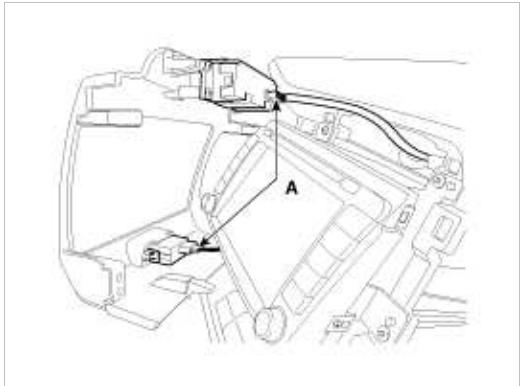
3. Using the screwdriver, remove the crash pad garnish (A).



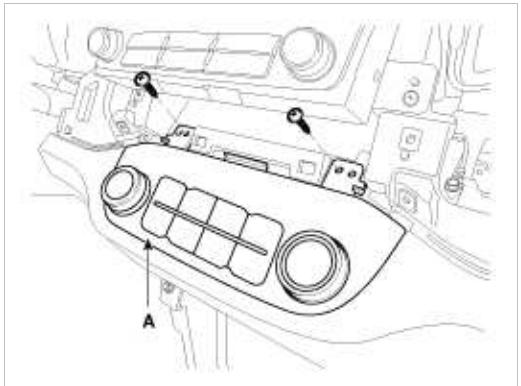
4. Using the screwdriver, remove the screws and center facia panel (A).



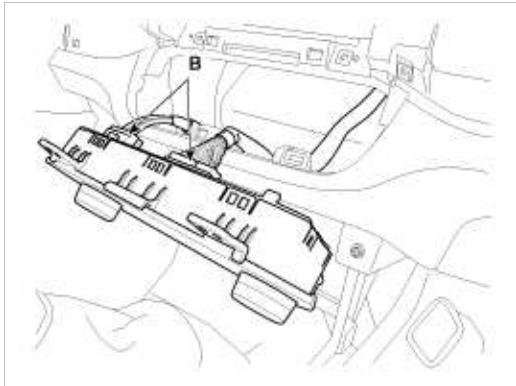
5. Disconnect the center facia connectors (A).



6. Loosen the control panel mounting screws and then remove the control panel (A).



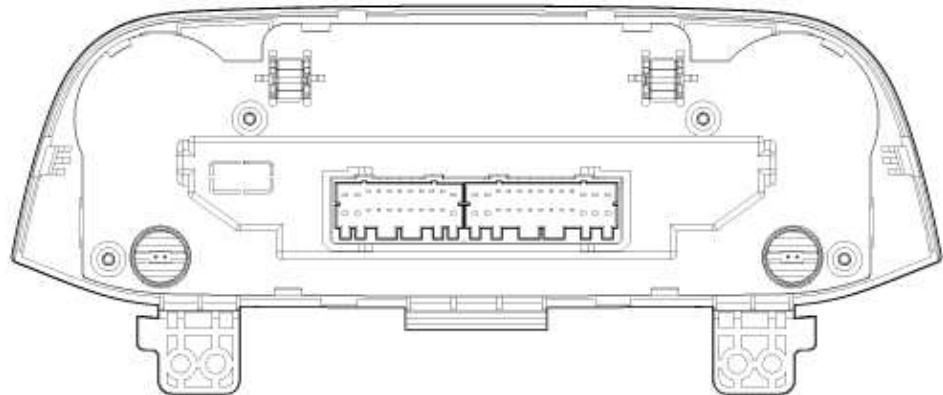
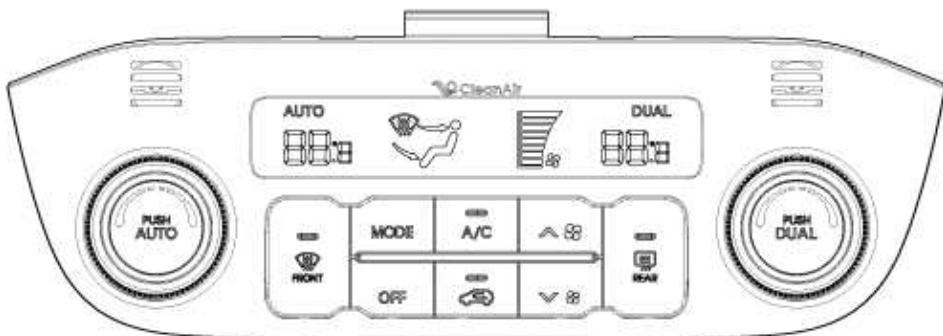
7. Disconnect the connectors and then remove the control panel(B).



8. Installation is the reverse order of removal.

Heating, Ventilation, Air Conditioning > Controller > Heater & A/C Control Unit(Full Automatic) > Components and Components Location

Component



Connector Pin Function

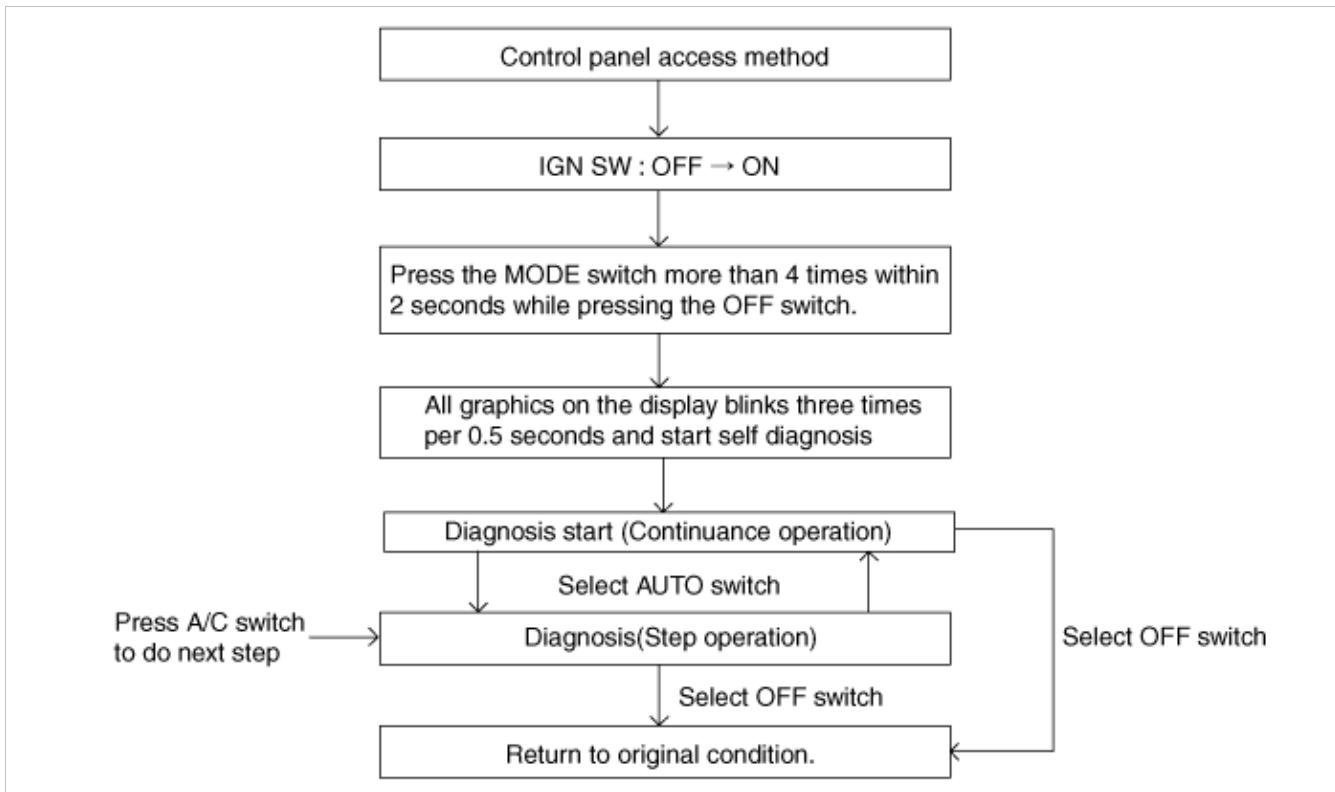
Connector	Pin NO	Function	Connector	Pin NO	Function
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Connector(A)	1	Battery	Connector(B)	1	CAN (LOW)
	2	Tail Lamp (ILL+)		2	CAN (HIGH)
	3	IG2		3	Intake Actuator (F/B)
	4	DR Temp Actuator (COOL)		4	Mode Actuator (F/B)
	5	DR Temp Actuator (WARM)		5	PS Temp Actuator (F/B)
	6	Detent		6	DR Temp Actuator (F/B)
	7	Mode Actuator (VENT)		7	Diagnosis (Cluster Ion)
	8	Mode Actuator (DEF)		8	V Ref (+5V)
	9	-		9	-
	10	-		10	-
	11	-		11	ECV IN
	12	Rheostat (ILL-)		12	GND
	13	GND		13	HI- Scan(L-line)
	14	IG1		14	Evaporator Sensor
	15	Ion Signal		15	Ambient Sensor
	16	Intake Actuator (FRE)		16	-
	17	Intake Actuator (REC)		17	LH Photo (-)
	18	Clean Signal		18	RH Photo (-)
	19	Blower Motor (+)		19	-
	20	PS Temp Actuator (COOL)		20	-
	21	PS Temp Actuator (WARM)		21	-
	22	Power Mosfet (GATE)		22	ECV Out
	23	Power Mosfet (DRAIN)			
	24	HTD(Rear Def Ind.)			
	25	Rear Def S/W (Low)			
	26	Sensor GND			

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
17	Evaporator sensor open
18	Evaporator sensor short
19	Temp door potentiometer open/short- Drive
20	Temp door potentiometer fault- Drive
21	Mode door potentiometer open/short
22	Mode door potentiometer fault
25	Intake door potentiometer open
26	Intake door potentiometer short
32	Temp door potentiometer open/short - Passenger
33	Temp door potentiometer fault - Passenger
45	APT CAN signal fault
46	-
47	RPM CAN signal fault
48	Vehicle speed CAN signal fault

49	Engine coolant temp CAN signal fault
50	Cluster ion generator fault

3. Fault code display

(1) Continuance operation : DTC code is one.



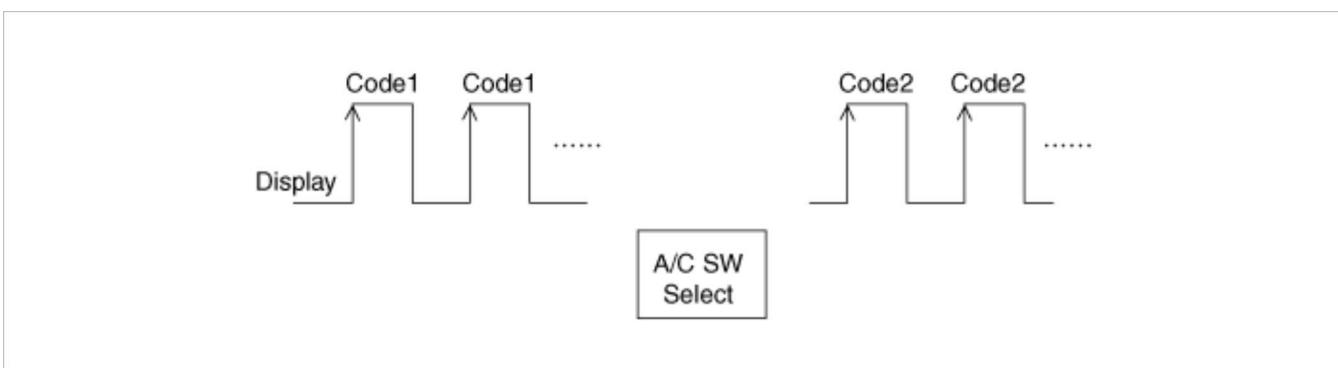
(2) Continuance operation : DTC code of two or more.



(3) STEP operation

A. Nomal or one fault code is same as a continuance operation.

B. DTC code os more two.



4. If fault codes are displayed during the check, Inspect specific malfunctions causes by fault codes.

5. Fail safe

(1) In-car temperature sensor: Control with the value of 23°C(73.4°F)

(2) Ambient temperature sensor: Control with the value of 20°C(67°F)

(3) Evaporator temperature sensor: Control with the value of -2°C(28.4°F)

(4) Water temperature sensor: Control with the value of 85°C(185°F)

(5) Temperature control actuator (Air mix potentiometer) :

If temperature setting 17°C-24.5°C, fix at maximum cooling position.

If temperature setting 25°C-32°C, fix at maximum heating position.

(6) Mode control actuator (Direction potentiometer) :

Fix vent position, while selecting vent mode.

Fix defrost position, while selecting all except vent mode.

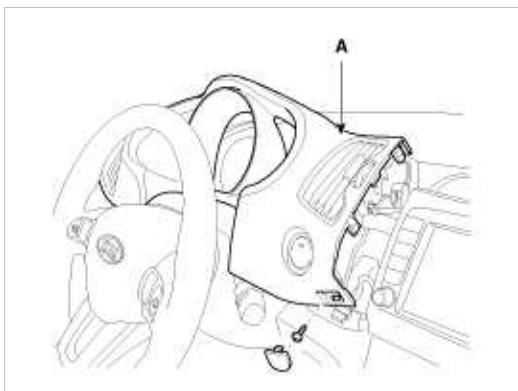
(7) Intake control actuator :

Fix fresh position, while selecting fresh mode.

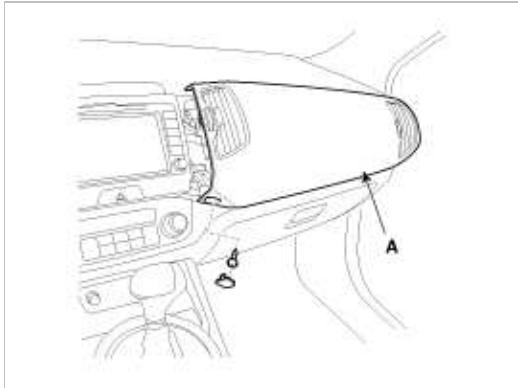
Fix recirculation position, while selecting recirculation mode.

Replacement

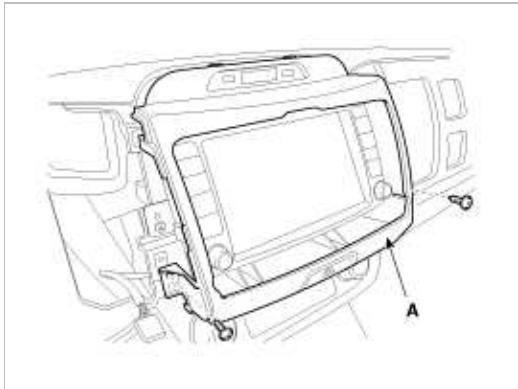
1. Disconnect the negative (-) battery terminal.
2. Using the screwdriver, remove the cluster facia panel (A).



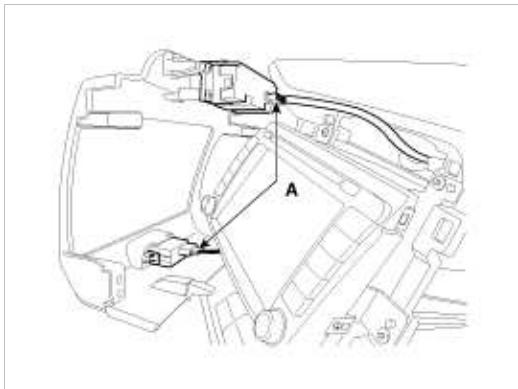
3. Using the screwdriver, remove the crash pad garnish (A).



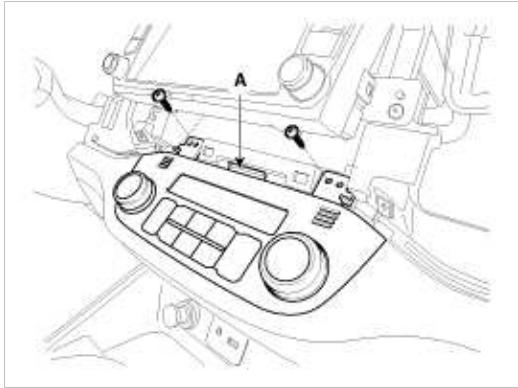
4. Using the screwdriver, remove the center facia panel (A).



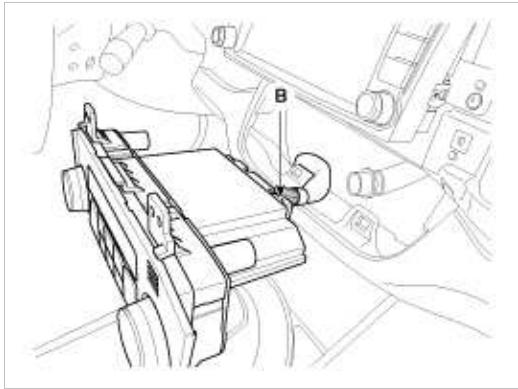
5. Disconnect the center facia connectors (A).



6. Loosen the control panel mounting screws and then remove the control panel (A).



7. Disconnect the connectors and then remove the control panel (B).



8. Installation is the reverse order of removal.

SPORTAGE(SL) > 2012 > G 2.4 DOHC > Manual Transaxle System**Manual Transaxle System > General Information > Specifications****Specifications**

Manual transaxle type		M6GF2	
Engine type		Gasoline 2.4	
		2WD	4WD
Gear ratio	1st	3.267	
	2nd	1.794	
	3rd	1.542	
	4th	1.176	
	5th	0.974	
	6th	0.829	
	Reverse	3.416	
Final gear ratio		5.071(1,2,R)	
		3.737(3,4,5,6)	

Tightening Torques

Item	N.m	kgf.m	lb·ft
Oil drain plug bolt	58.9~78.5	6.0~8.0	43.4~57.9
Oil filler plug bolt	29.4~34.3	3.0~3.5	21.7~25.3
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 mounting bracket bolt	88.3~107.9	9.0~11.0	65.1~79.6
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

Item	Specified lubricants	Quantity
Manual transaxle oil	SAE 75W/85, API GL-4	1.8L(0.48 U.S. gal., 1.90 U.S. qt., 1.58Imp. qt.)
Manual transaxle input spline	CASMOLY L9508	0.2 gr.
Concentric slave cylinder assembly	KLUBER 9R100	As required

Manual Transaxle System > General Information > Special Service Tools

Special Service Tools

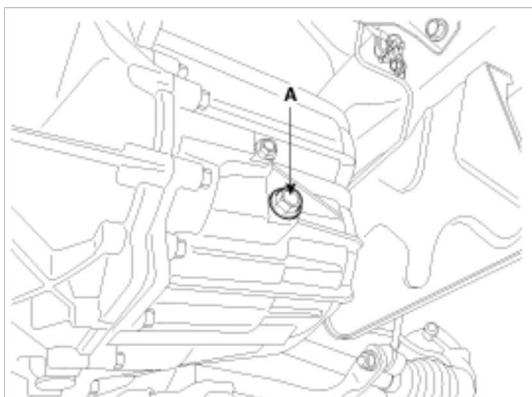
Tool (Number and name)	Illustration	Use
09200-38001 Engine support fixture (Beam)		Removal and installation of the transaxle. Except lower supporter, use beam only with new engine support fixture supporter(SST No.:09200-2S000)
09200 - 2S000 Engine support fixture (Supporter)		Removal and installation of the transaxle. Use this supporter with the upper beam of the engine support fixture(SST No.:09200-38001)

Manual Transaxle System > Manual Transaxle System > Repair procedures

Inspection

Manual transaxle oil Inspection

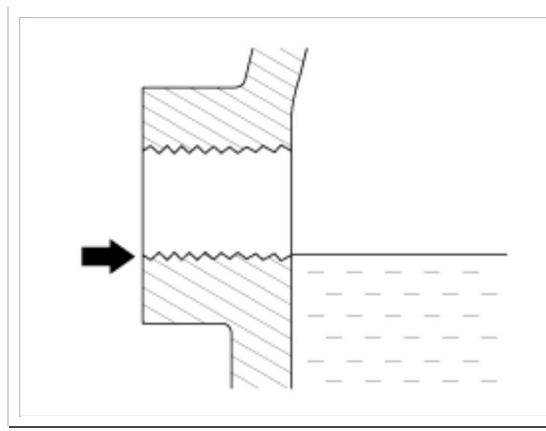
1. Park the vehicle on a level ground and stop the engine.
2. Retighten the oil filler plug(A) with a new washer.



3. Check level with finger.

NOTE

Oil level must be up to fill the hole, if not, add oil until it runs over.



4. Retighten the oil filler plug(A) with a new washer.

Tightening torque :

29.4~34.3N.m (3.0~3.5kgf.m, 21.7~25.3lb-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 new gasket.

Tightening torque :

58.9~78.5N.m (6.0~8.0kgf.m, 43.4~57.9lb-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

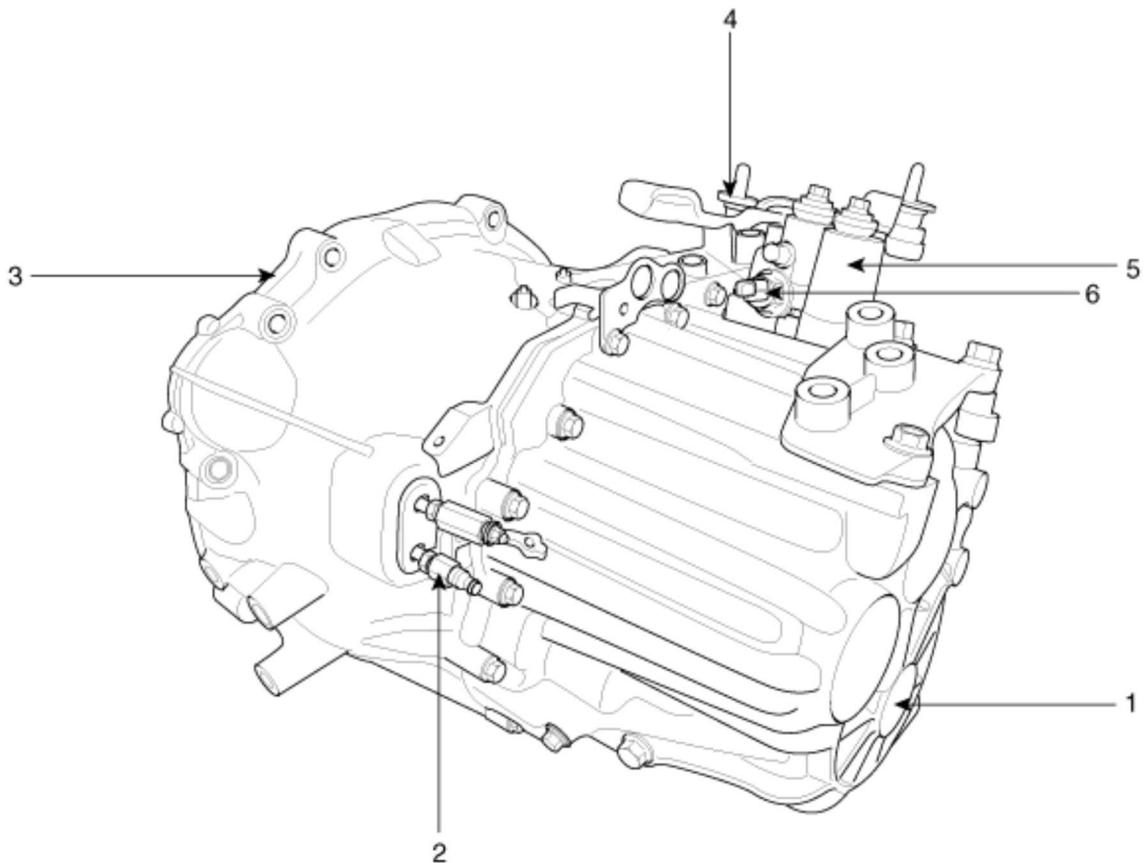
Oil capacity : 1.8L(0.48 U.S. gal., 1.90 U.S. qt., 1.58Imp. qt.)

Manual Transaxle System > Manual Transaxle System > Manual Transaxle > Components and Components Location

Components



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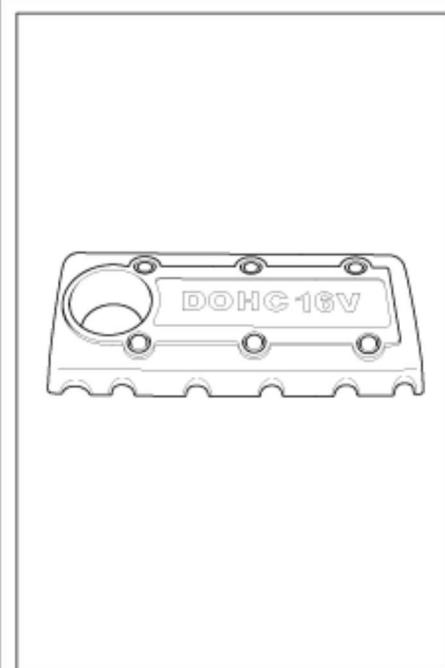
- 1. Manual transaxle case
- 2. Concentric slave cylinder
- 3. Clutch housing

- 4. Shift cable bracket assembly
- 5. Control complete shaft
- 6. Back-up lamp switch

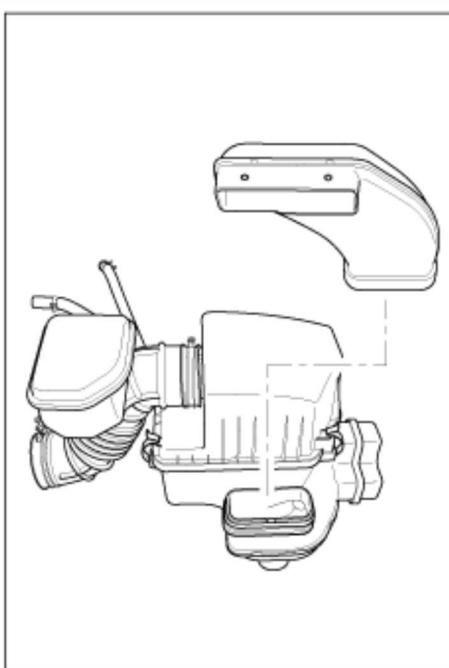
Manual Transaxle System > Manual Transaxle System > Manual Transaxle > Repair procedures

Removal

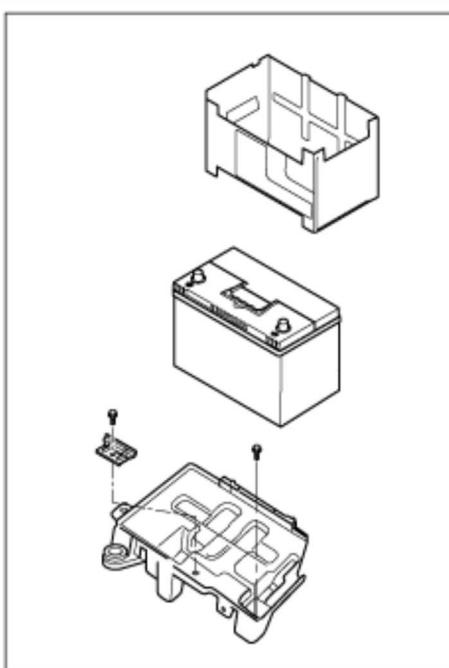
1. Remove the following items;
 - A. Engine cover (A). (Refer to "Intake and Exhaust system" in EM group.)
 - B. Air cleaner assembly and air duct(B) . (Refer to "Intake and Exhaust system" in EM group.)
 - C. Battery and battery tray (C). (Refer to "Charging system" in EE group.)



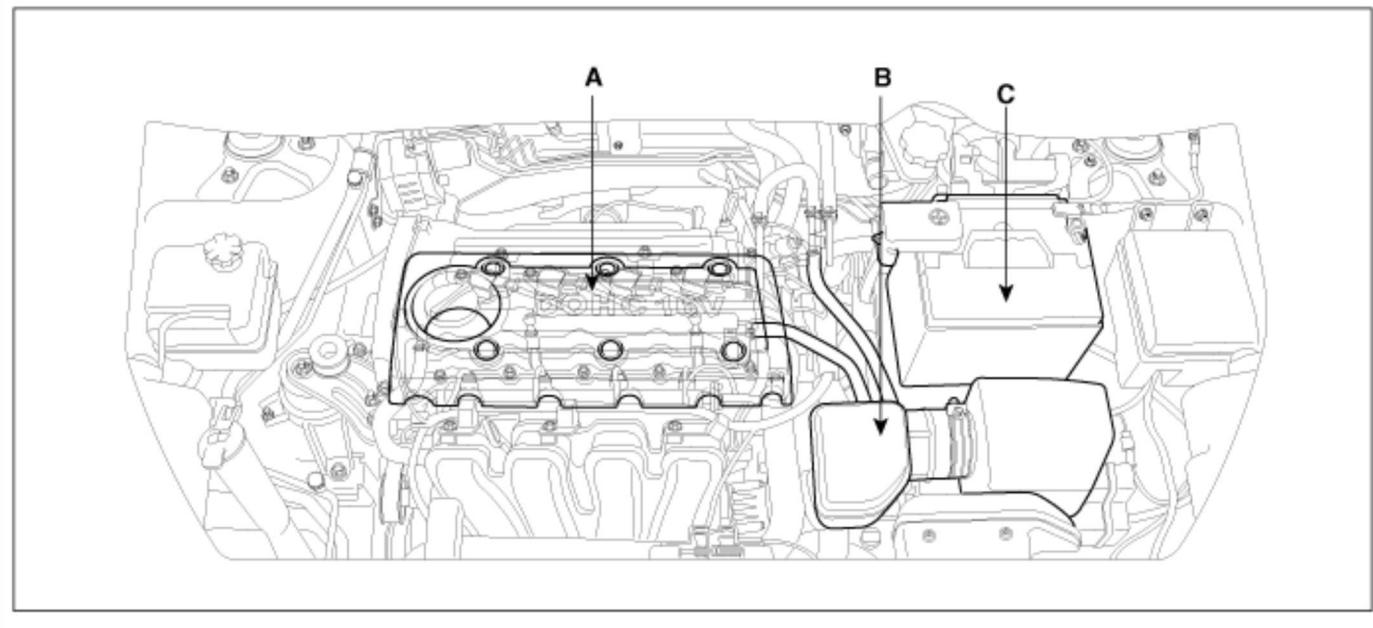
[A]



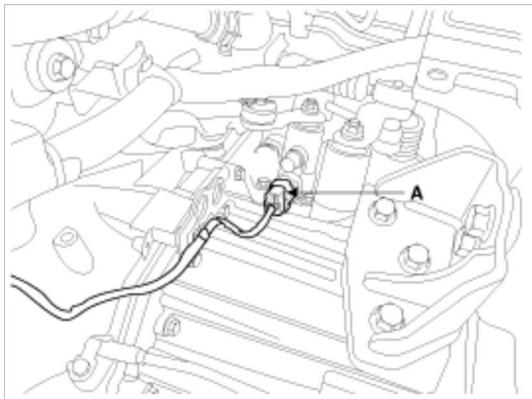
[B]



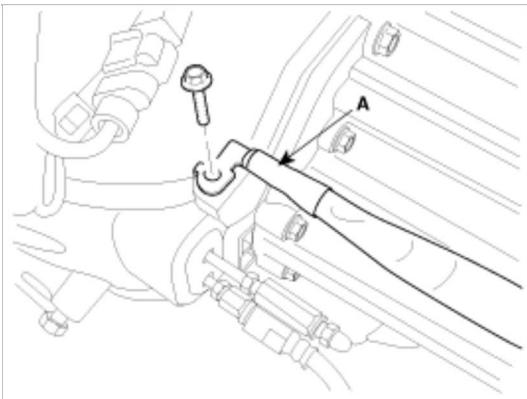
[C]



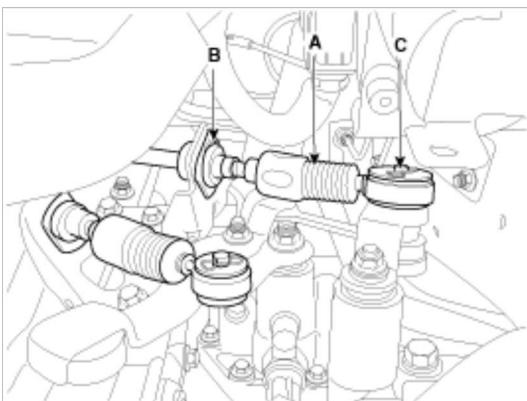
2. Disconnect the back up lamp switch connector (A).



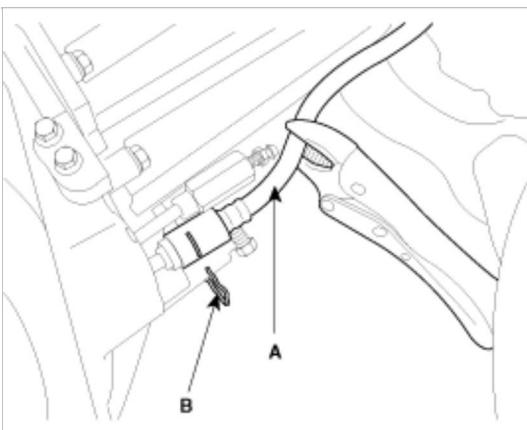
3. Remove the ground (A).



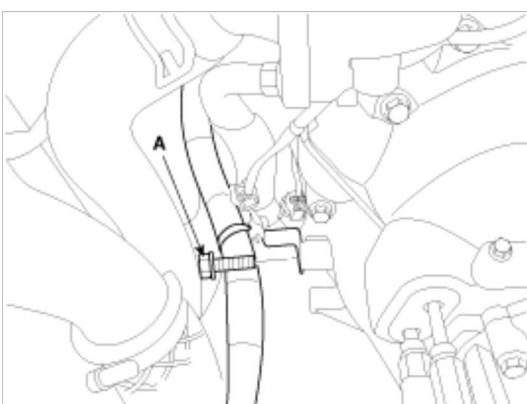
4. Disconnect the cable assembly (A) after removing the clips (B) and pins (C).



5. Disconnect the concentric slave cylinder tube(A) after removing the pins(B).

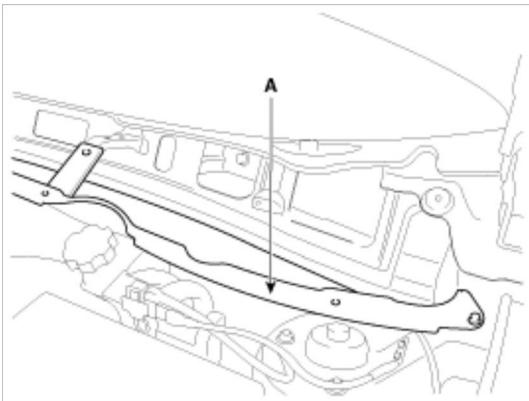


6. Remove the wiring bracket bolt (A).

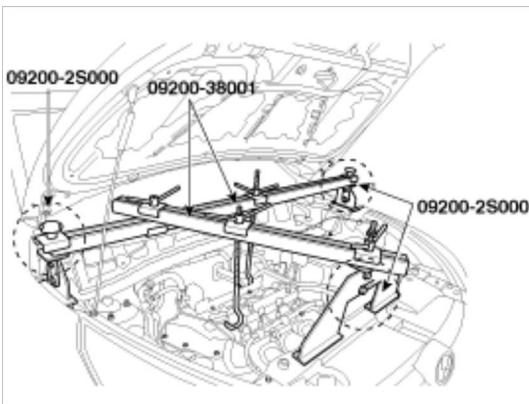


7. Remove the cowl top cover or wiper motor. (Refer to "Windshield Wiper/Washer" in BE group.)

8. Remove the cowl complete assembly panel(A).



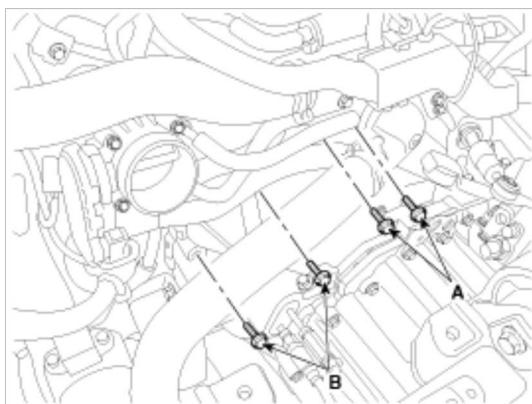
9. Using the engine support fixture (Support SST No.: 09200-2S000, Beam SST No.: 09200-38001), hold the engine and transaxle assembly safely.



10. Remove the transaxle upper mounting bolt (A-2ea) and the start motor mounting bolt (B-2ea).

Tightening torque :

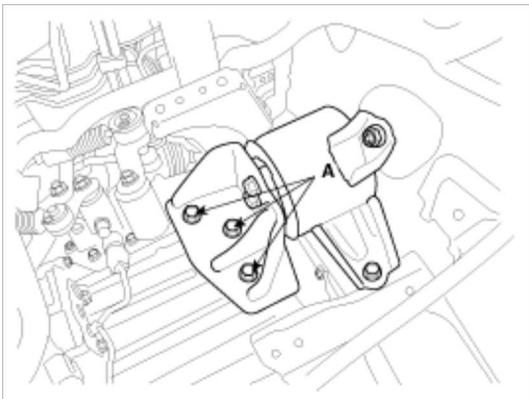
42.2~53.9N.m (4.3~5.5kgf.m, 31.1~39.8lb-ft)



11. Supporting the transaxle with a jack, remove the mounting bolts(A).

Tightening torque :

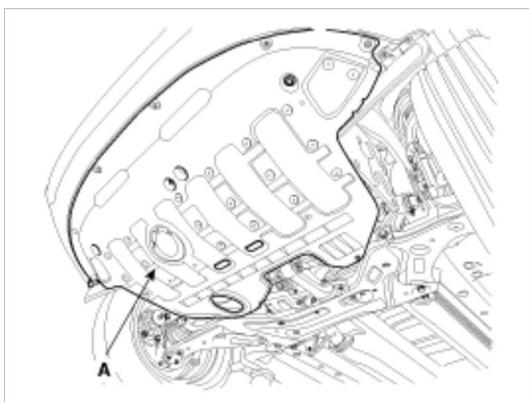
88.3~107.9N.m (9.0~11.0kgf.m, 65.1~79.6lb-ft)



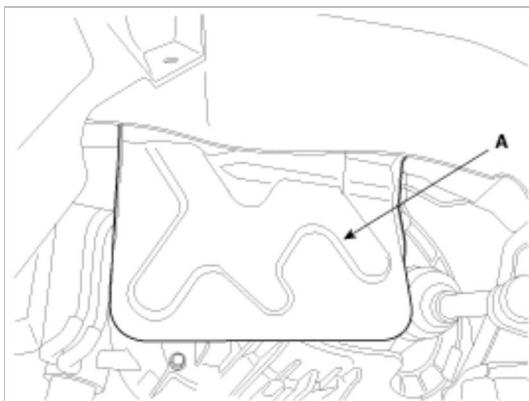
12. Remove the under cover (A).

Tightening torque :

19.6~21.6N.m (2.0~2.2kgf.m, 14.5~15.9lb-ft)



13. Remove the side cover(A).

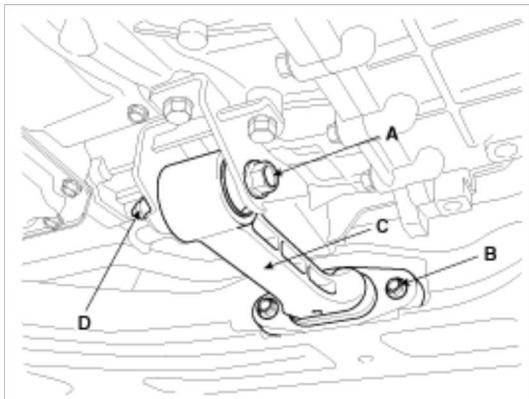


14. Remove the roll rod bracket(C) after removing bolt(A,B).

Tightening torque :

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

(D) 107.9~127.5N.m (11~13kgf.m, 79.6~94.1lb-ft)



15. Remove the following items;

- A. Drive shaft assembly. (Refer to "Drive shaft assembly" in DS group.)
- B. Sub frame assembly. (Refer to "Front suspension system" in SS group)
- C. In the case of 4WD vehicle, remove the transfer assembly. (Refer to "Transfer assembly" in WD group)

NOTE

In the case of 2WD vehicle, not remove the transfer assembly.

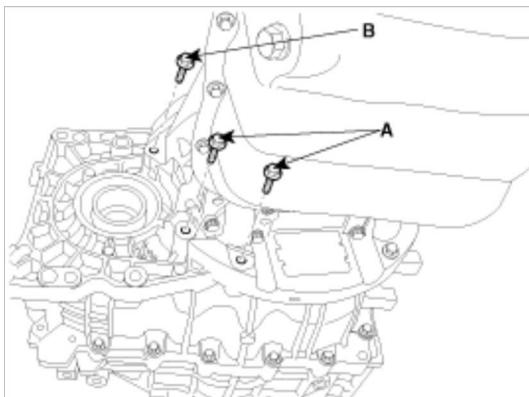
16. Remove the mounting bolts(A-4ea, B-2ea) of lower part of the transaxle, and the left side cover and remove the transaxle assembly by supporting it with a jack.

CAUTION

Be careful not to damage other system or parts near by when removing the engine and transaxle assembly.

Tightening torque :

- (A) 42.2~48.1 N.m (4.3~4.9kgf.m, 31.1~35.4lb-ft)
- (B) 42.2~53.9 N.m (4.3~5.5kgf.m, 31.1~39.8lb-ft)



Installation

1. Installation is the reverse of removal.

CAUTION

- Adding Manual transaxle fluid. (Refer to "Manual transaxle system" in this group.)
- Perform bleeding air procedure in concentric slave cylinder after pouring the brake fluid.(Refer to "Concentric slave cylinder" in CH group.)

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

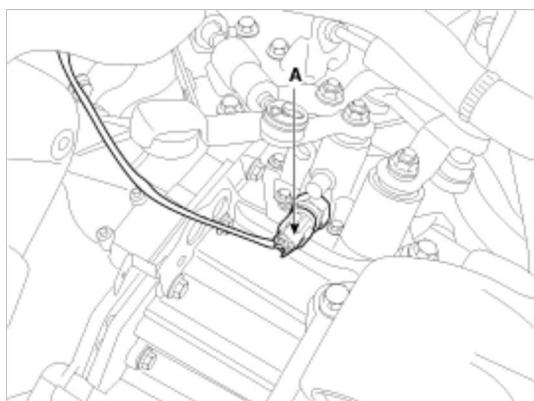
Specifications

1. Working voltage : DC 10~15V
2. Operating force : 3.0kg Max.
3. Voltage drop : - 0.4V
4. Working temperature : -30°C ~ 100°C [-30°F ~ 212°F]

Manual Transaxle System > Manual Transaxle Control System > Back-up Lamp Switch > Repair procedures

Inspection

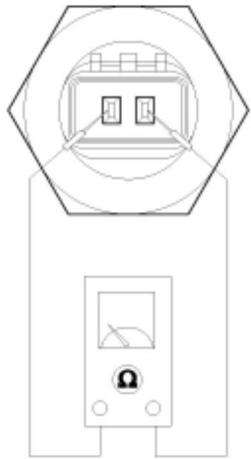
1. Disconnect the back up lamp switch connector(A).



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.

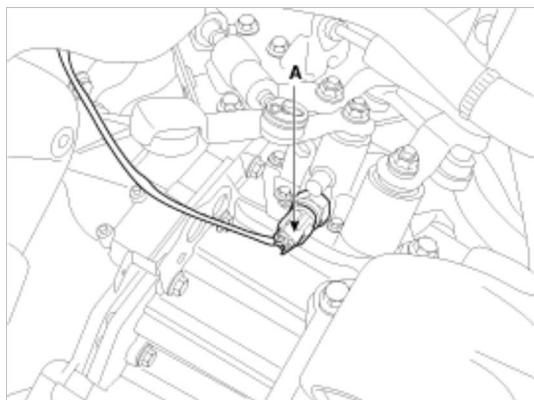
Condition	1	2
Reverse Range	●	
Other Range		●

*The back up Lamp "ON" shall keep over 0.5mm(0.02in) From ON-OFF point.

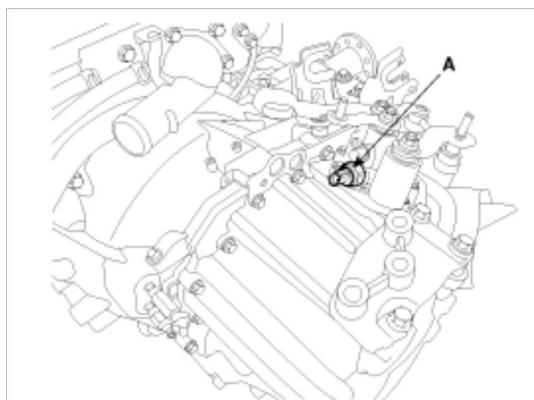


Replacement

1. Disconnect the back up lamp switch connector(A).



2. Remove the back up lamp switch (A).



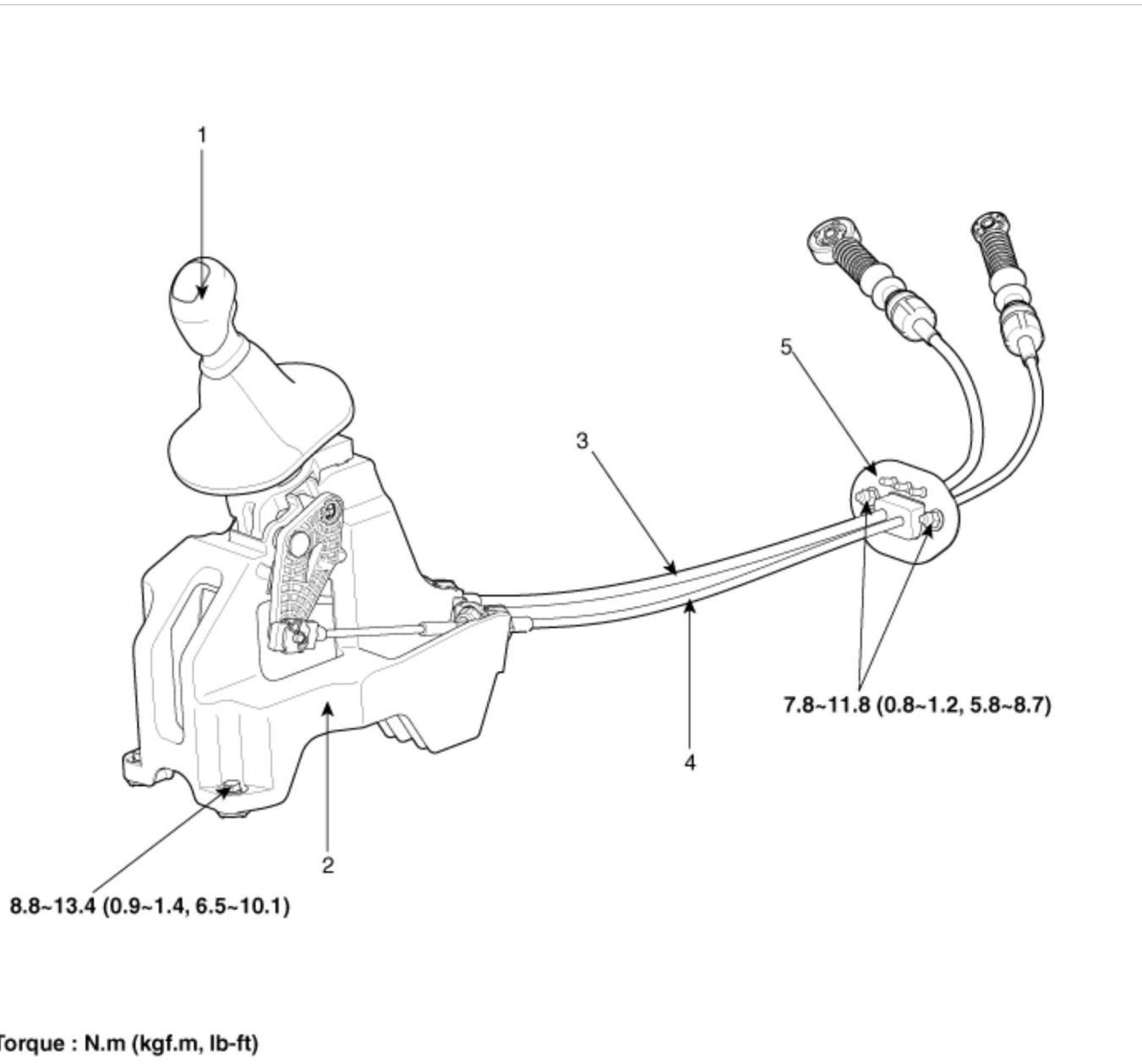
3. Replace a new one and install the back up lamp switch.

Tightening torque :

29.4~34.3N.m (3.0~3.5kgf.m, 21.7~25.3lb·ft)

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

Components

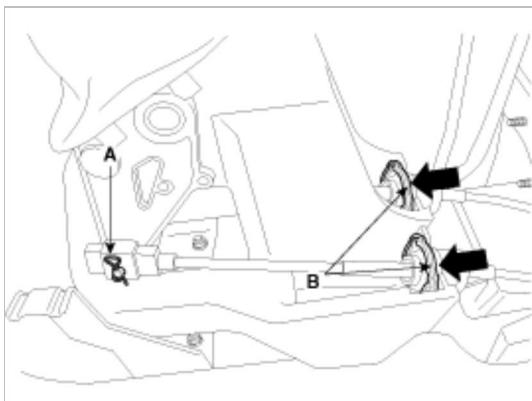


Manual Transaxle System > Manual Transaxle Control System > Shift Lever > Repair procedures

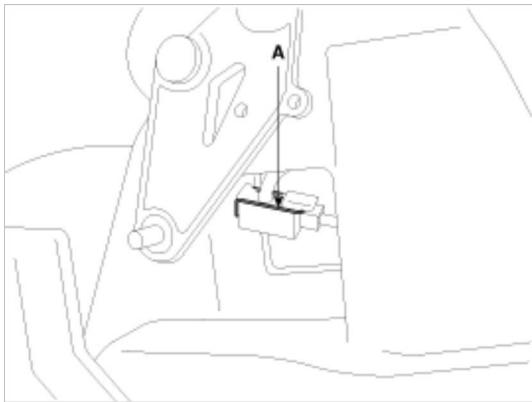
Removal

Shift Lever Assembly Replacement

1. Remove the floor Interior console assembly. (Refer to "Interior(Console)" in BD group)
2. Remove the select cable snap pin (A) and the clip (B) from the select cable assembly.



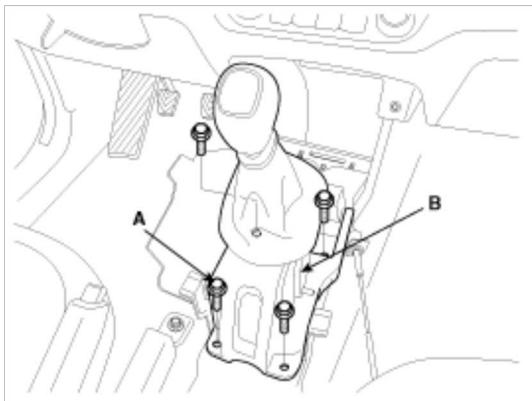
3. Remove the clip (A) from the shift cable assembly.



4. Remove the shift lever assembly(B) after removing shift lever assembly installation bolt(A).

Tightening torque :

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



5. Installation is the reverse of removal.

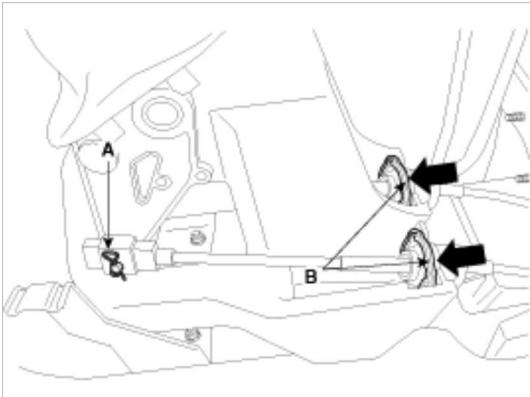
NOTE

- Make sure vehicle does not roll before setting room side shift lever and T/M side manual control lever to "N" position.

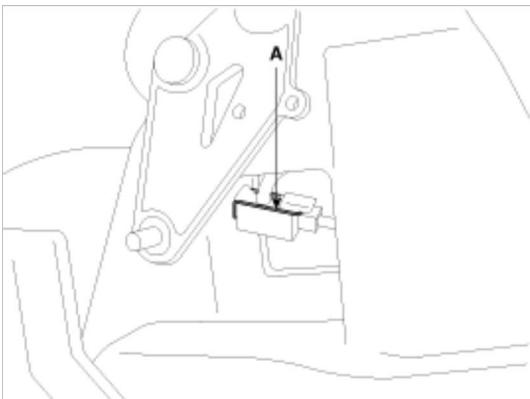
Shift Cable Replacement

1. Remove the floor Interior console assembly. (Refer to "Interior(Console)" in BD group)

2. Remove the select cable snap pin (A) and the clip (B) from the select cable assembly.



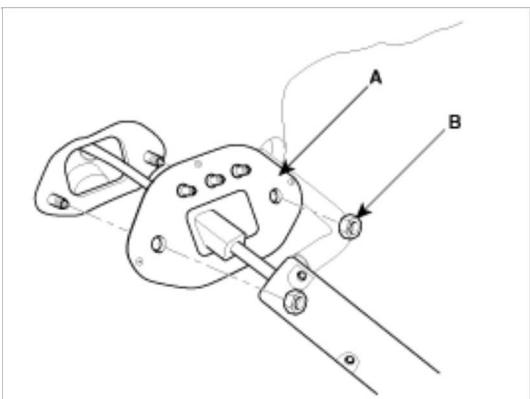
3. Remove the clip (A) from the shift cable assembly.



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

Tightening torque :

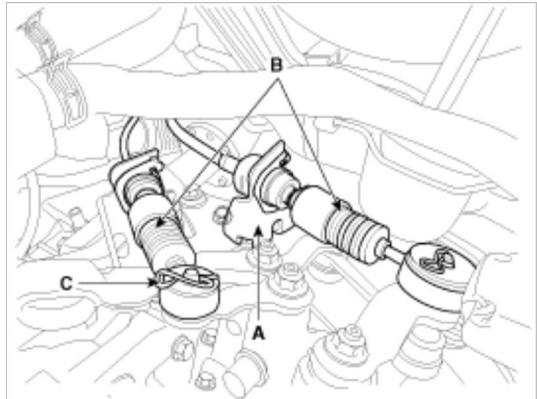
7.8~11.8N.m (0.8~1.2kgf.m, 5.8~8.7lb-ft)



5. Remove the cable(B) from the cable bracket(A) at manual transaxle assembly side.

6. Remove the pins(C).

7. Remove the shift cable and select cable at cabin room.



8. Installation is the reverse of removal.

NOTE

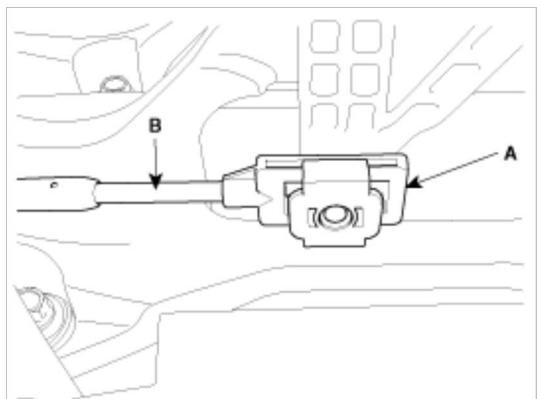
- Make sure vehicle does not roll before setting room side shift lever and T/M side manual control lever to "N" position.

Inspection

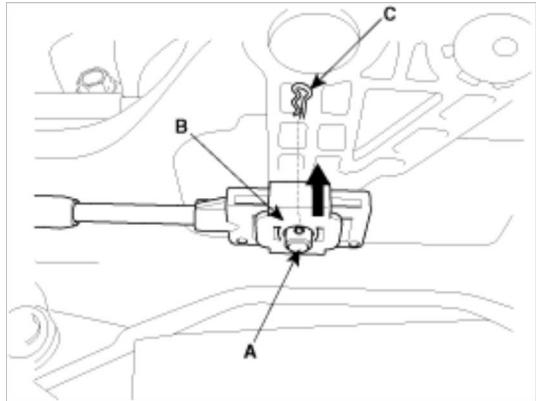
1. Check the select cable for proper operation and for damage.
2. Check the shift cable for proper operation and for damage.
3. Check the boots for damage.
4. Check the boots for wear abrasion sticking, restricted movement or damage.
5. Check for the weak or damaged spring.

Adjustment

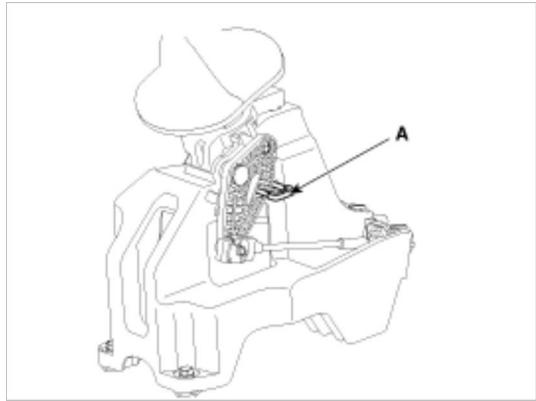
1. Install the guide member (A) of the select cable (B).



2. Adjust the slide clip (B) to fit it into the select lever pin (A) and install the snap pin (C).



3. Remove neutral position pin (A) after shift lever assembly.





SPORTAGE(SL) > 2012 > G 2.4 DOHC > Restraint**Restraint > General Information > General Information****General Information**

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 a reset.
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 GDS.
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 GDS. 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 GDS 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.
8. SRSCM will determine whether passenger put on seat belt by the signal from built-in switch in seat belt buckle, and deploy front seat airbag at each set crash speed.
9. Side airbag deployment will be determined by SRSCM that will detect satellite sensor impact signal upon side crash, irrespective to seat belt condition.
10. Vehicle on an even surface not to be damaged the rollover sensor.
Ignition switched off during the SRSCM repair procedure.
11. Check for the normal operation of SRSCM after repair procedure.

Restraint > General Information > Specifications**Specification**

Item	Resistance (Ω)
Driver Airbag (DAB)	1.5 ~ 6.0
Passenger Airbag (PAB)	1.5 ~ 6.0
Side Airbag (SAB)	1.5 ~ 6.0
Curtain Airbag (CAB)	1.5 ~ 6.0
Seat Belt Pretensioner (BPT)	1.5 ~ 6.0

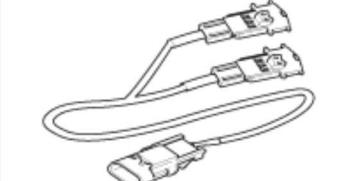
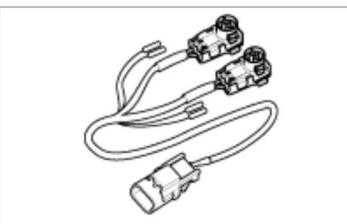
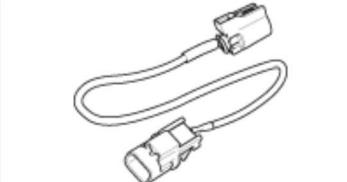
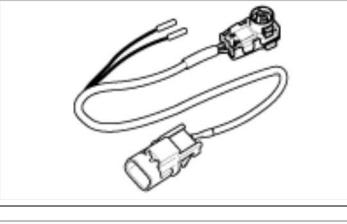
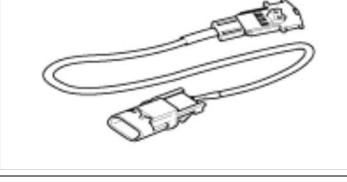
Tightening Torques

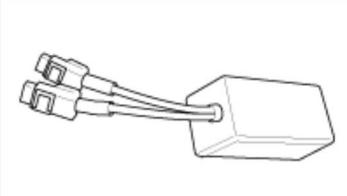
Item	N.m	kgf.m	lb-ft
Driver Airbag (DAB)	7.8 ~ 10.8	0.8 ~ 1.1	5.8 ~ 8.0
Passenger Airbag (PAB)	7.8 ~ 11.8	0.8 ~ 1.2	5.8 ~ 8.7

Curtain Airbag (CAB)	7.0 ~ 9.0	0.7 ~ 0.9	5.1 ~ 6.6
Seat Belt Anchor Bolt	39.2 ~ 53.9	4.0 ~ 5.5	28.9 ~ 39.8
SRSCM	6.8 ~ 9.2	0.7 ~ 0.9	5.0 ~ 6.8
Front Impact Sensor (FIS) Mounting Bolt	7.0 ~ 9.0	0.7 ~ 0.9	5.1 ~ 6.6
Pressure Side Impact Sensor (PSIS) Mounting Screw	1.1 ~ 1.3	0.11 ~ 1.3	0.7 ~ 1.0
Side Impact Sensor (SIS) Mounting Bolt	7.0 ~ 9.0	0.7 ~ 0.9	5.1 ~ 6.6

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-38510		Use with deployment tool. (DAB)
Deployment adapter 0957A-3Q100		Use with deployment tool. (PAB)
Deployment adapter 0957A-3F100		Use with deployment tool. (SAB)
Deployment adapter 0957A-3S100		Use with deployment tool. (CAB)
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 SRSCM parts (including the disconnection of the connectors), always disconnect the SRSCM 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.

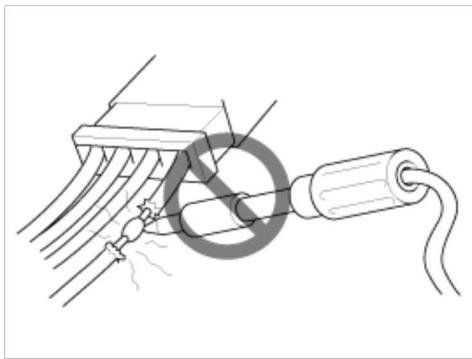


- Store the removed airbag on secure, flat surface away from any high heat source (exceeding 85 C/185 F).
- Never perform electrical inspections to the airbags, such as measuring resistance.
- Do not position yourself in front of the airbag assembly during removal, inspection, or replacement.
- Refer 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.

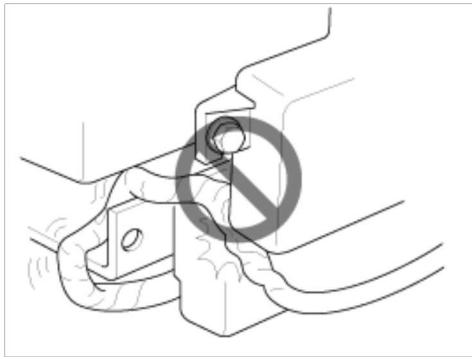
Wiring Precautions

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.



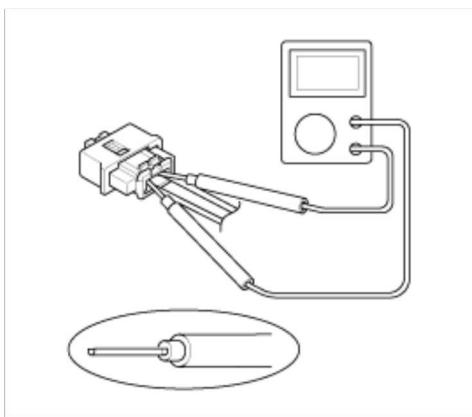
- Be sure to install the harness wires so that they are not pinched, or interfere with other parts.



- 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.

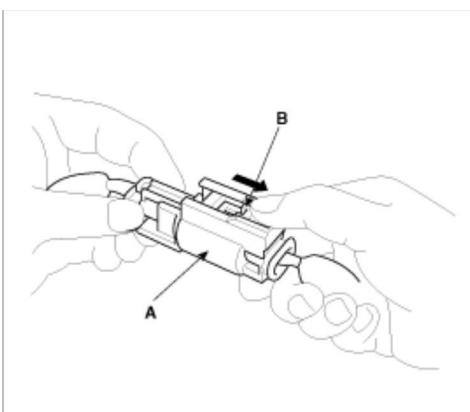
Spring-laded Lock Connector

Some SRS system connectors have a spring-loaded lock.

Airbag Connector

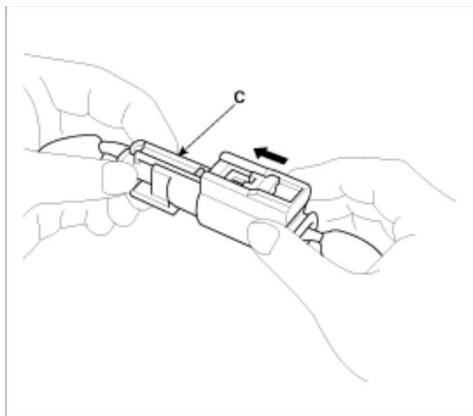
Disconnecting

To release the lock, pull the spring-loaded sleeve (A) and the slider (B), while holding the opposite half of the connector.
Pull the connector halves apart. Be sure to pull on the sleeve and not on the connector half.



Connecting

Hold both connector halves and press firmly until the projection(C) of the sleeve-side connector clicks to lock.



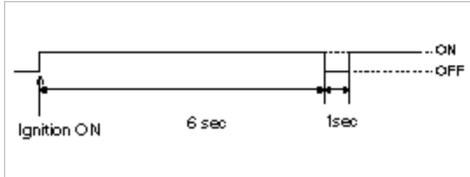
Restraint > General Information > Description and Operation

Warning Lamp Activation

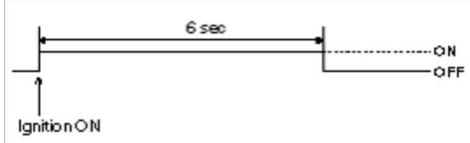
Warning Lamp Behavior after Ignition On

As soon as the operating voltage is applied to the SRSCM ignition input, the SRSCM activates the warning lamp for a LED lamp check. The lamp shall turn on for 6 seconds during the initialization phase and be turned off afterward. However, in order to indicate the driver, the warning lamp shall turn on for 6 seconds and off for one second then on continuously after the operating voltage is applied if any active fault exists.

1. Active fault.



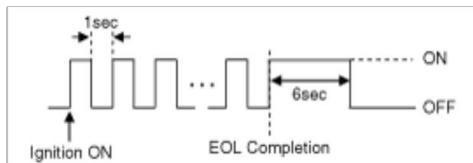
2. Normal or historical fault exist.



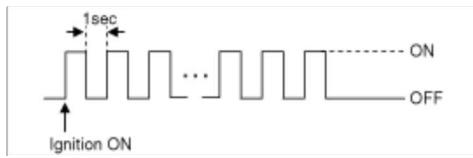
3. When turning the ignition switch ON during variant coding (EOL) mode, the airbag warning lamp is turned on and blinks at intervals of 1 second till the coding is completed.

In case the variant coding is normally completed, the airbag warning lamp is turned on for 6 seconds, and then turned off. Otherwise the airbag warning lamp continuously blinks at intervals of 1 second.

- (1) In case the variant coding is normally completed



- (2) In case the variant coding is not completed



When there is active fault in airbag system or SRSCM internal fault, the variant coding (EOL) can't be completed. In this case, do the variant coding (EOL) procedure again after troubleshooting with the GDS.

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:

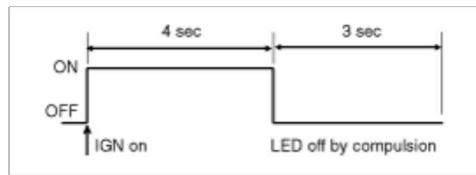
1. Loss of battery supply to the SRSCM : warning lamp turned on continuously.

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.

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 child (or child seat), the Passenger Airbag is disabled and the Telltale Lamp is turned ON to inform the driver that the PAB is disabled. As soon as operating voltage is applied to the SRSCM ignition input, the SRSCM activates telltale lamp prove out. PODS will send an indeterminate status to the SRSCM as a default setting for passenger airbag deployment during the prove out period.

After ignition on, telltale lamp will turn on for 4 seconds and turn off for 3 seconds during the initialization phase and be turned NO afterward until receipt of valid enabled message from PODS system.



Restraint > General Information > Repair procedures

Component Replacement After Deployment

NOTE

Before doing any SRS repairs, use the GDS Pro to check for DTCs. Refer to the Diagnostic Trouble Code list for repairing of the related DTCs.

When the front airbag(s) deployed after a collision, replace the following items.

- SRSCM
- Deployed airbag(s)
- Seat belt pretensioner(s)
- Front impact sensors
- SRS wiring harnesses
- Inspect the clock spring for heat damage.
If any damage found, replace the clock spring.

When the side/curtain airbag(s) deployed after a collision, replace the following items.

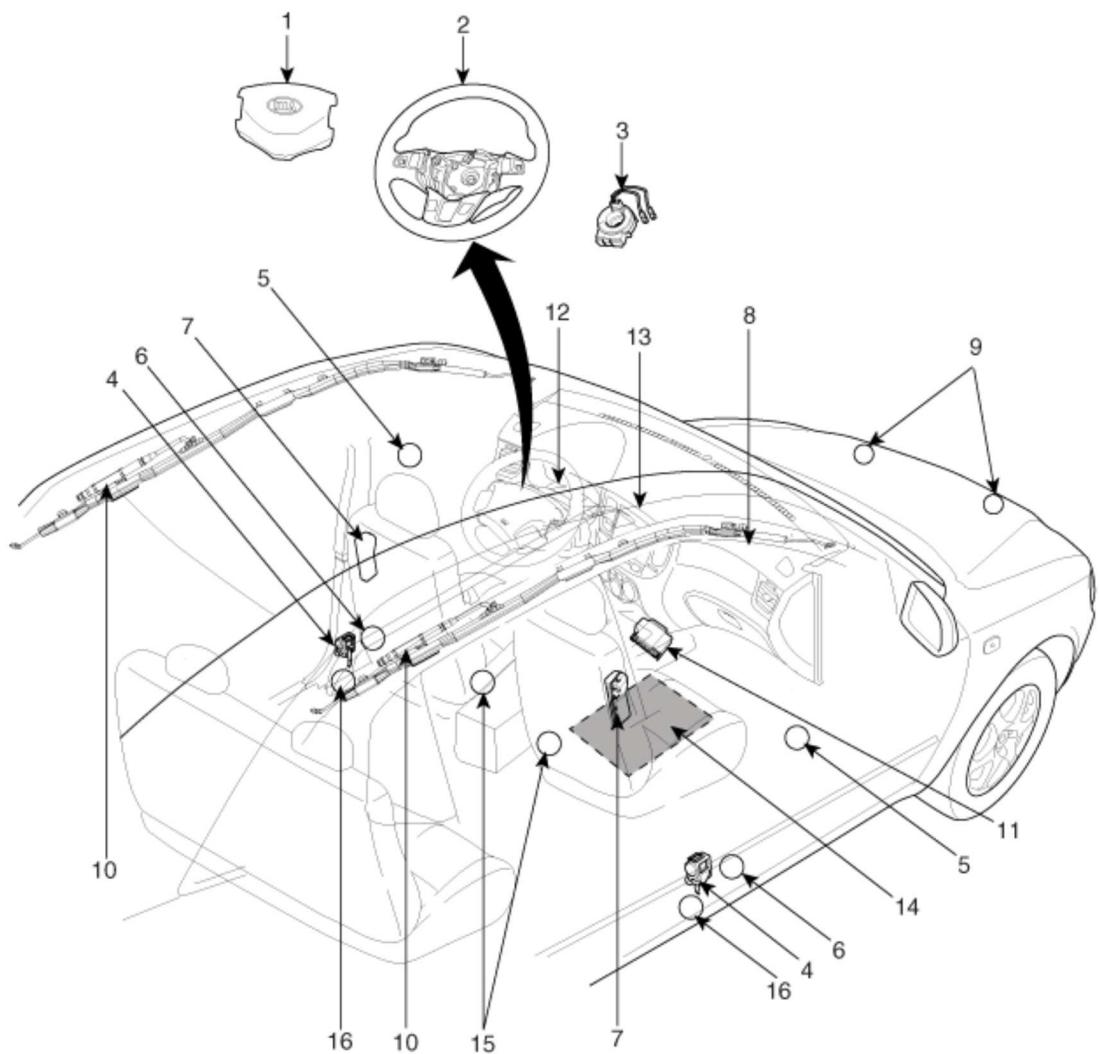
- SRSCM
- Deployed airbag(s)
- Side impact sensor(s) for the deployed side(s)
- SRS wiring harnesses

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 six seconds and then go off.

Restraint > General Information > Components and Components Location

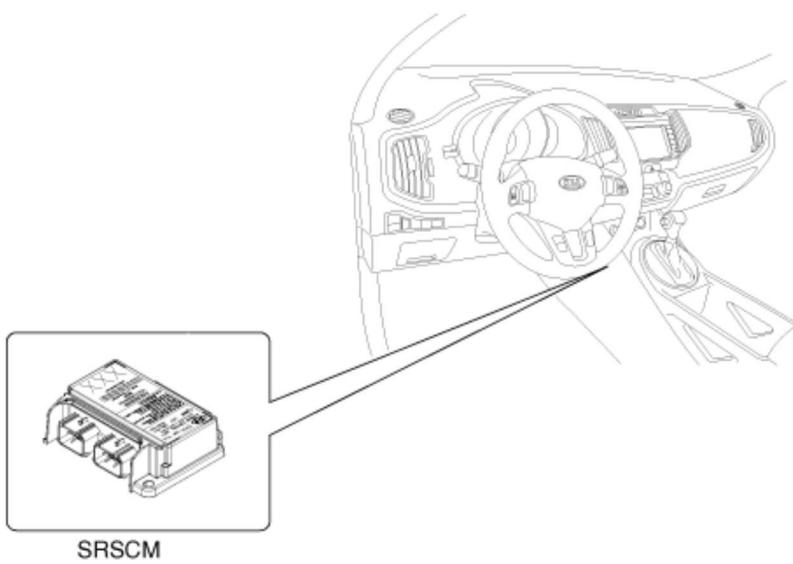
Components



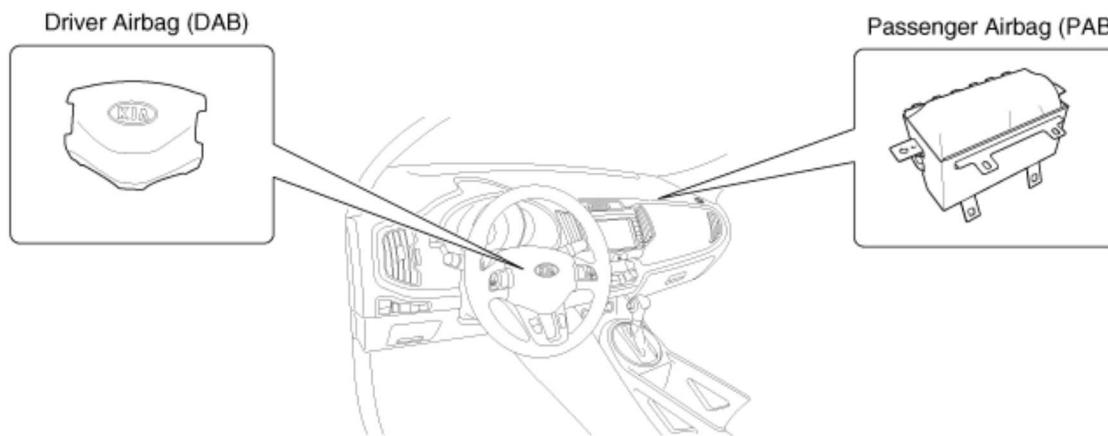
1. Driver Airbag (DAB) 2. Steering Wheel 3. Clock Spring 4. Seat Belt Pretensioner (BPT) 5. Pressure Side Impact Sensor (P-SIS) 6. Side Impact Sensor (SIS) 7. Side Airbag (SAB) 8. Passenger Airbag (PAB)	9. Front Impact Sensor (FIS) 10. Curtain Airbag (CAB) 11. Supplemental Restraint System Control Module(SRSCM) 12. Airbag Warning Lamp 13. Telltale Lamp 14. Passenger Occupant Detecting System (PODS) 15. Belt Tension Sensor 16. Anchor Pretensioner (APT)
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Components Location

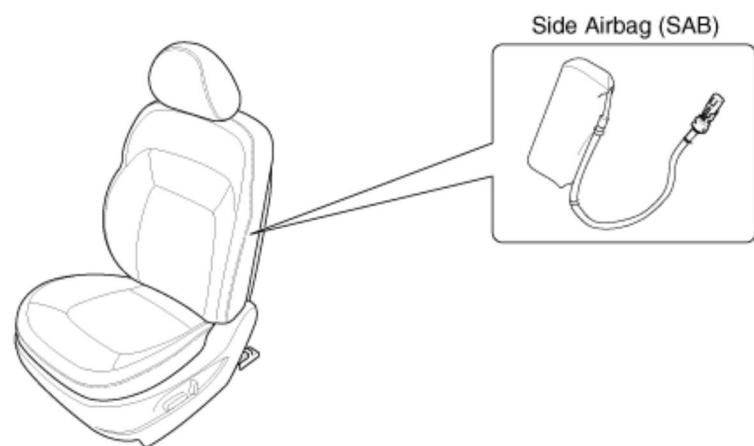
Supplemental Restraint System Control Module (SRSCM)



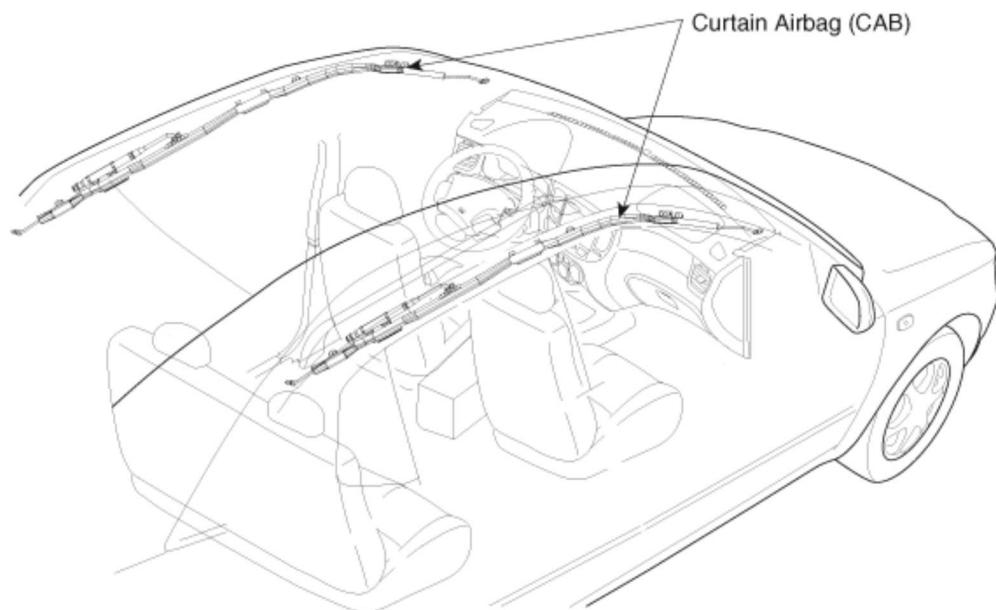
Driver Airbag (DAB) / Passenger Airbag (PAB)



Side Airbag (SAB)

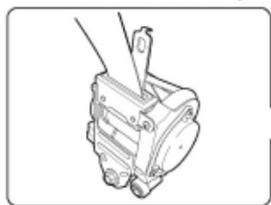


Curtain Airbag (CAB)

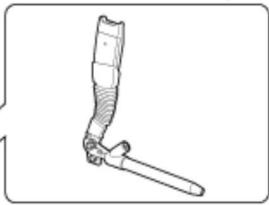


Seat Belt Pretensioner (BPT)/ Anchor Pretensioner (APT)

Seat Belt Pretensioner (BPT)



Anchor Pretensioner (APT)

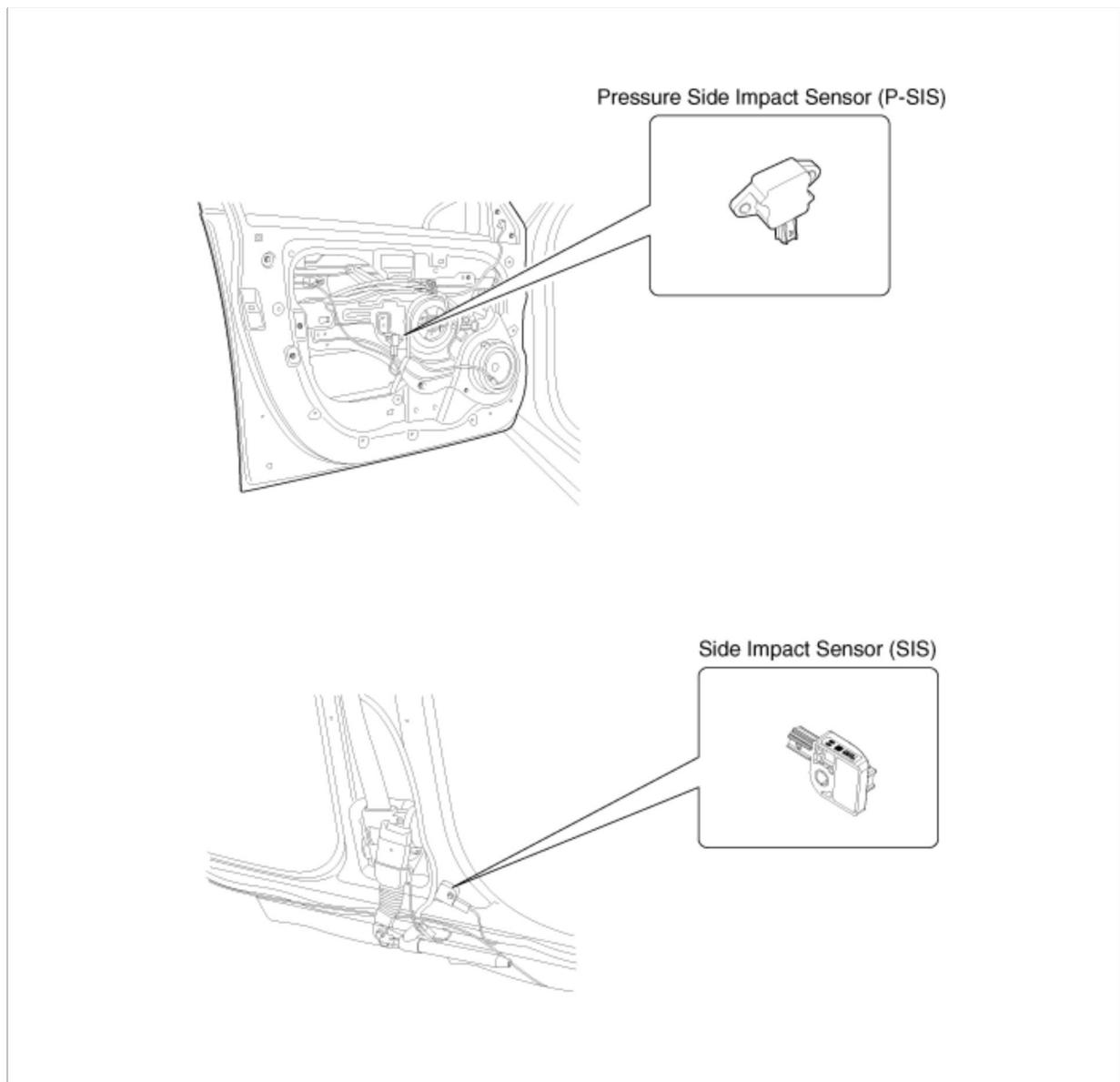


Front Impact Sensor (FIS)

Front Impact Sensor (FIS)



Side Impact Sensor (SIS)



Restraint > SRSCM > SRS Control Module (SRSCM) > Description and Operation

Description

The primary purpose of the SRSCM (Supplemental Restraints System Control Module) is to discriminate between an event that warrants restraint system deployment and an event that does not. The SRSCM must decide whether to deploy the restraint system or not. After determining that pretensioners and/or airbag deployment is required, the SRSCM must supply sufficient power to the pretensioners and airbag igniters to initiate deployment.

The SRSCM determines that an impact may require deployment of the pretensioners and airbags from data obtained from impact sensors and other components in conjunction with a safing function.

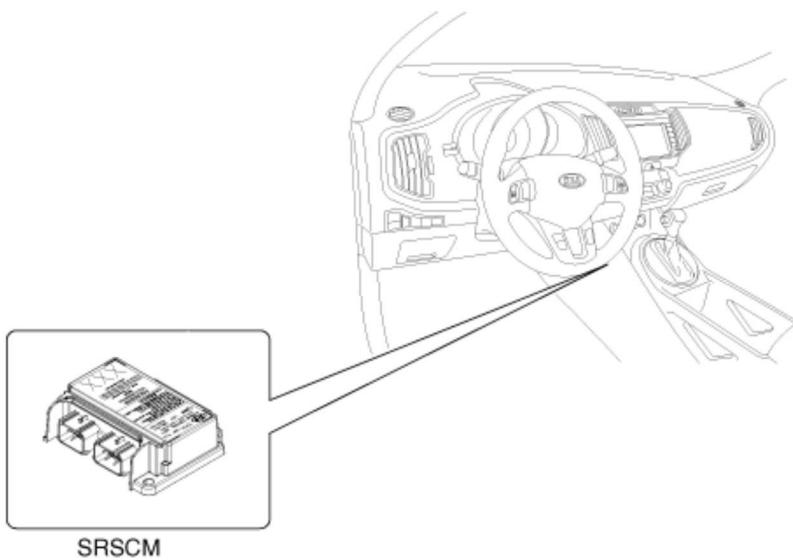
The SRSCM will not be ready to detect a crash or to activate the restraint system devices until the signals in the SRSCM circuitry stabilize.

It is possible that the SRSCM could activate the safety restraint devices in approximately 2 seconds but is guaranteed to fully function after prove-out is completed.

The SRSCM must perform a diagnostic routine and light a system readiness indicator at key-on. The system must perform a continuous diagnostic routine and provide fault annunciation through a warning lamp indicator in the event of fault detection. A serial diagnostic communication interface will be used to facilitate servicing of the restraint control system.

Restraint > SRSCM > SRS Control Module (SRSCM) > Components and Components Location

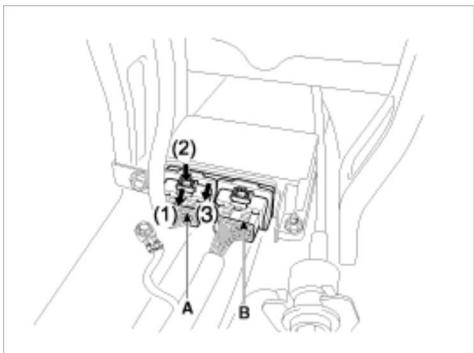
Components



Restraint > SRSCM > SRS Control Module (SRSCM) > Repair procedures

Removal

1. Remove 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 upper cover. (Refer to the Body group - console)
5. Remove the shift lever assembly. (Refer to the transaxle system group - shift lever)
6. Pull the lock (1) forward and then pull the lever (3) after pressing the lever lock (2).
Disconnect the airbag system control module connector. (A and B)



7. Remove the SRSCM mounting nuts(3EA) from the SRSCM, then remove the SRSCM.

CAUTION

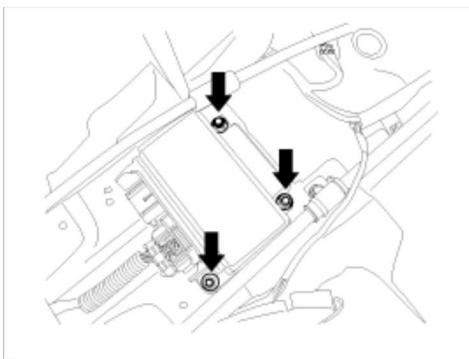
You must remove or install SRSCM at the ignition switch OFF because SRSCM has overturn sensing function. SAB, CAB, BPT may be deployed if you shake SRSCM at the direction of up and down or right and left at the ignition switch ON.

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 nuts.

Tightening torque :

6.8 ~ 9.2 N.m (0.7 ~ 0.9 kgf.m, 5.0 ~ 6.8 lb·ft)



NOTE

Use new mounting bolts when replacing the SRSCM after a collision.

4. Connect the SRSCM harness connector.
5. Install the shift lever assembly. (Refer to the transaxle system group - shift lever)
6. Install the floor console upper cover. (Refer to the Body group - console)
7. Connect the DAB, PAB, SAB, CAB and BPT connectors.
8. Reconnect the battery negative cable.
9. 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.

CAUTION

SRSCM can sense a vehicle rollover. SAB, CAB, BPT can deploy if mechanic moves the SRSCM on vehicle during IGN ON state. For this reason, be sure to turn the IGN OFF and then remove the SRSCM from vehicle.

Variant coding

After replacing the SRSCM with a new one, the "Variant Coding" procedure must be preformed.

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), DTC B1102 will be displayed. In this case, charge the battery before anything else, and then perform the variant coding procedure.
DTC B1762 (ACU Coding Error) and B1102 (Battery Voltage Low) may be displayed simultaneously.

Variant coding Procedure

■ On-Line type on GDS

1. Ignition "OFF", connect GDS.
 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

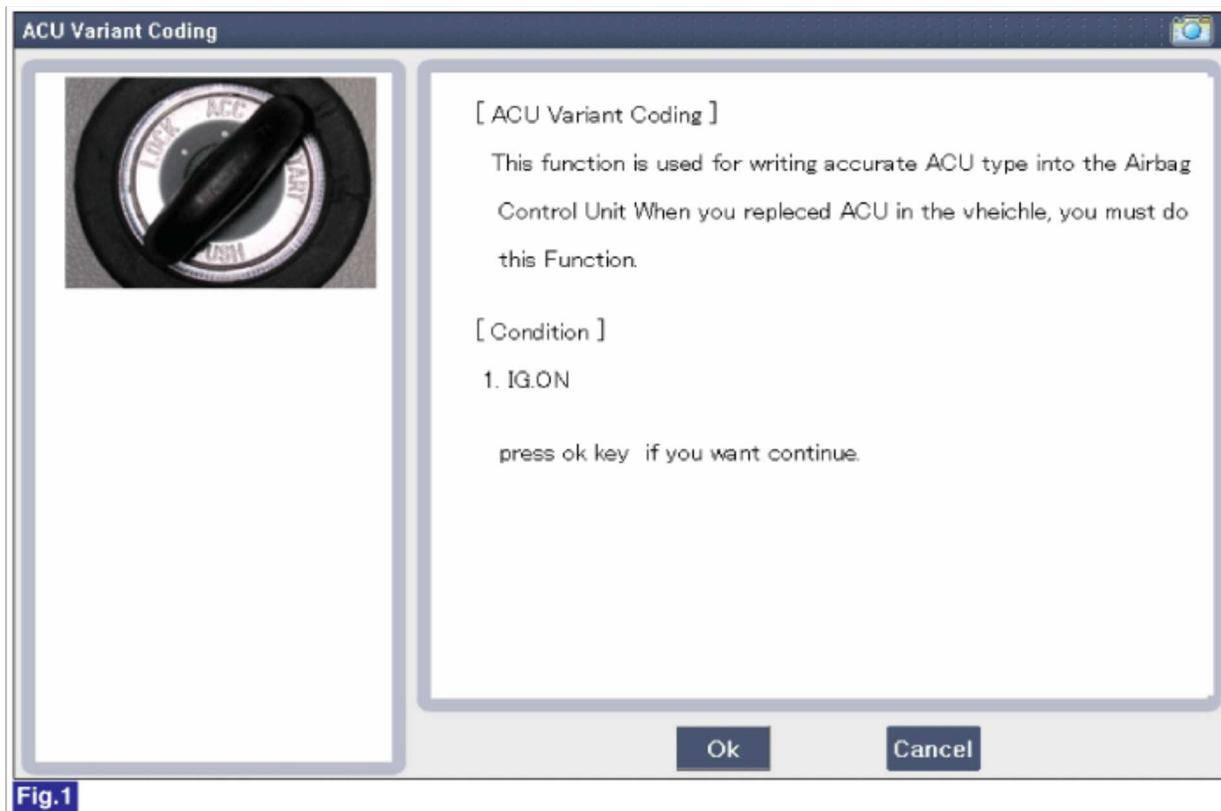


Fig.1

2) VIN Code entering screen

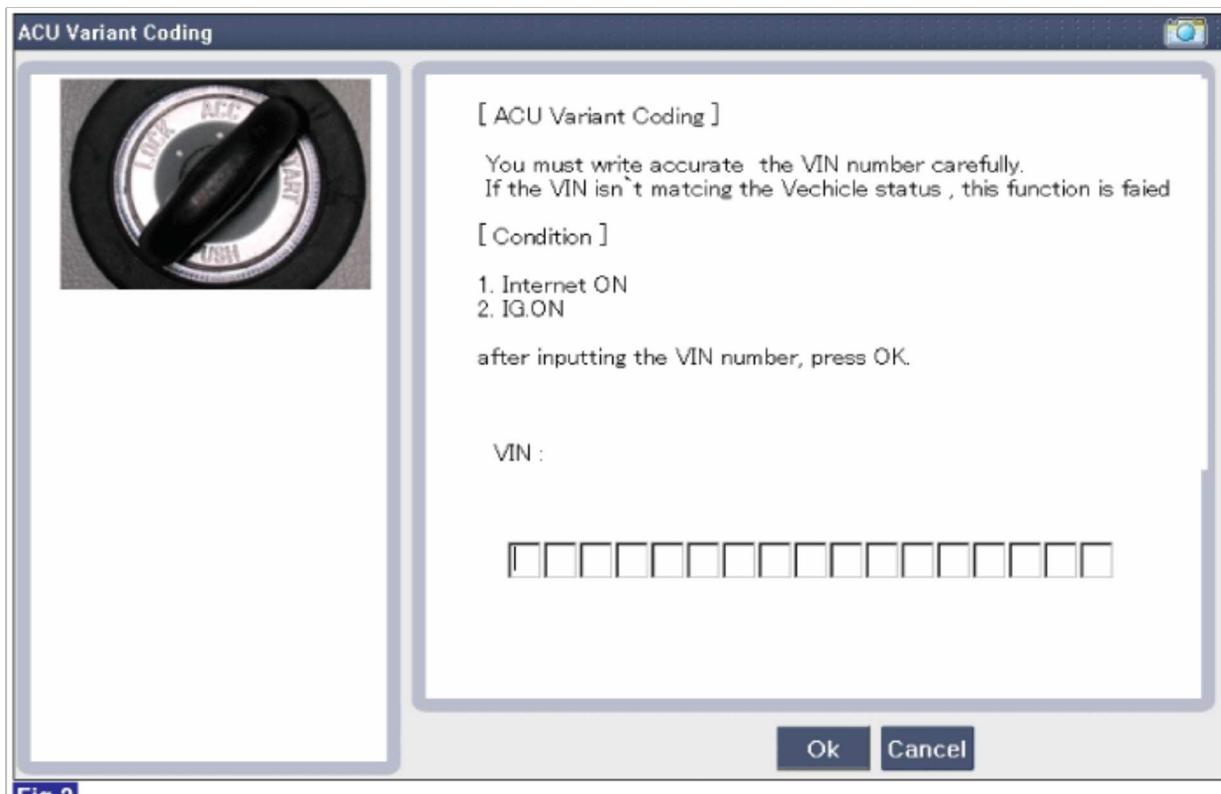


Fig.2

3) Variant coding's proceeding screen-1

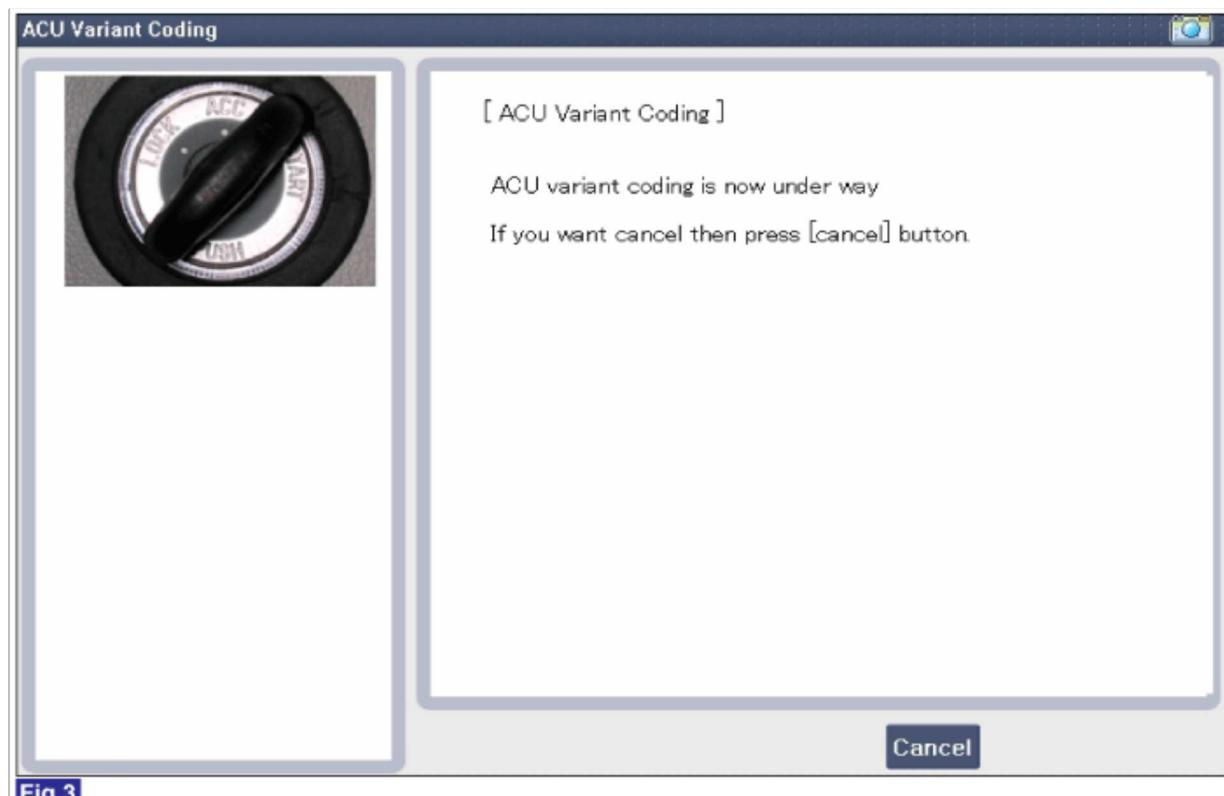


Fig.3

4) Variant coding's proceeding screen-2

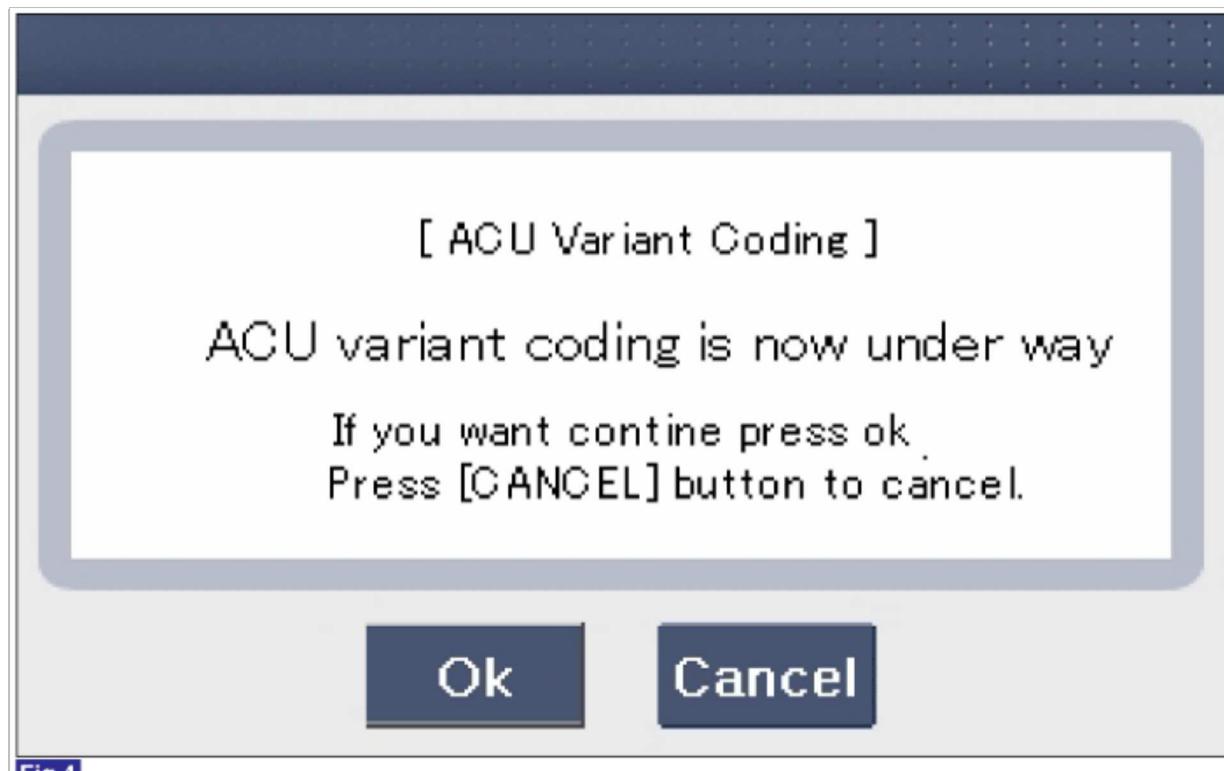


Fig.4

5) Variant coding is completed

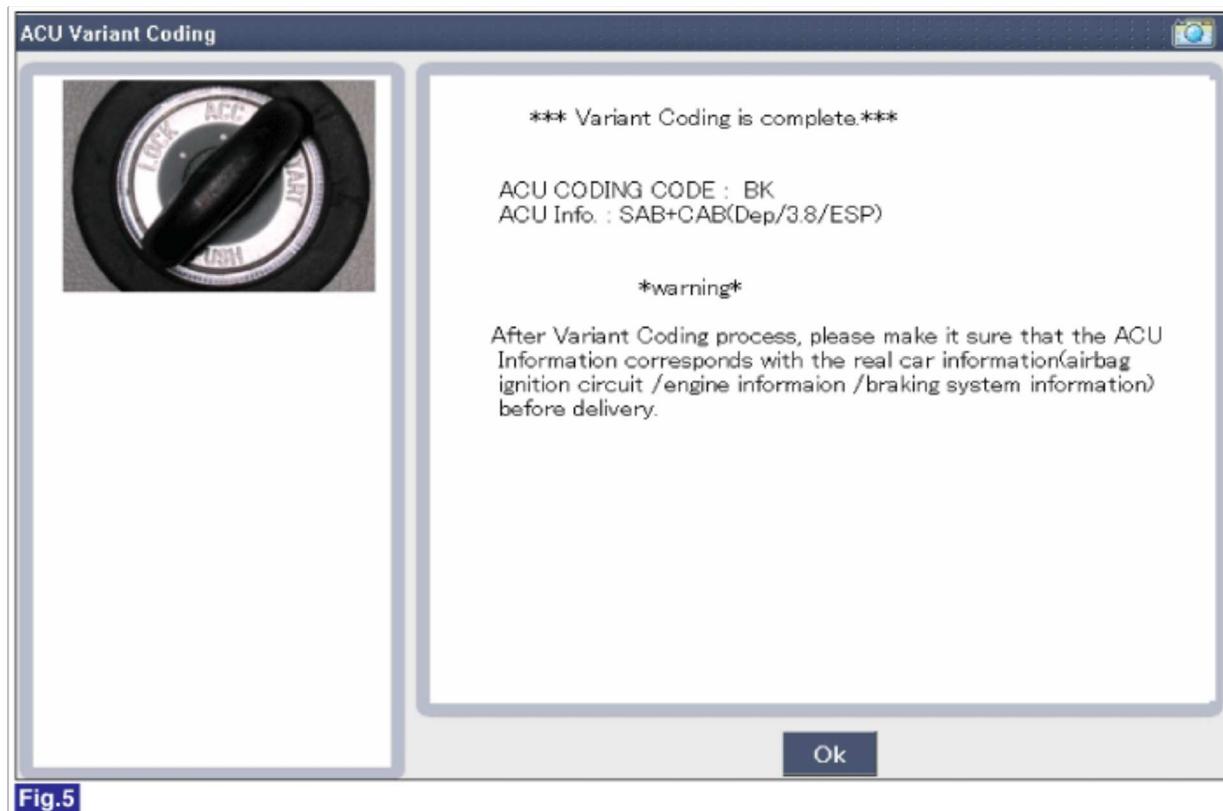


Fig.5

NOTE

- 1) This screen is opened when you try the variant coding again on the SRSCM which has bee performed variant coding.



Fig.6

- 2) Screen of communication failure

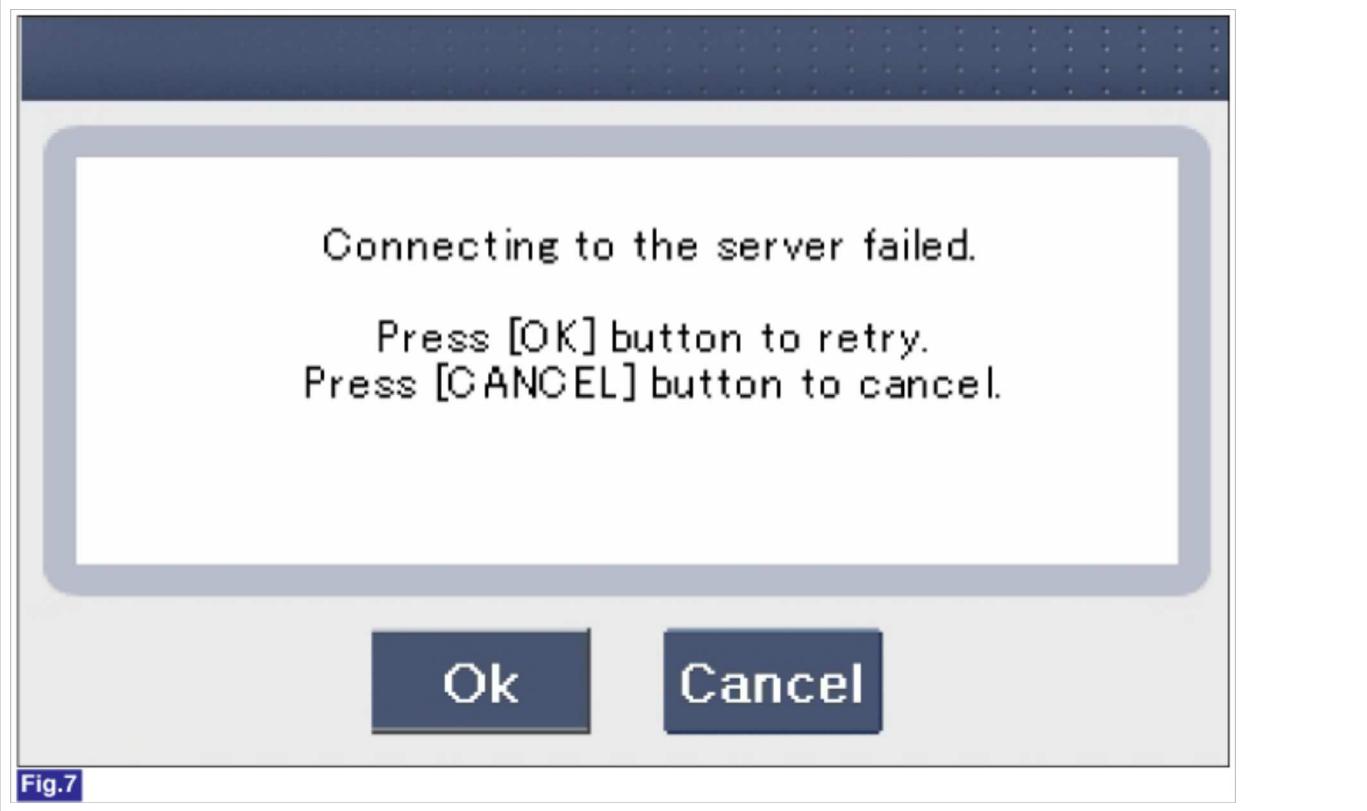


Fig.7

■ Off-line type on GDS (This can be used when not connecting to internet)

1) Initial ACU Variant Coding screen

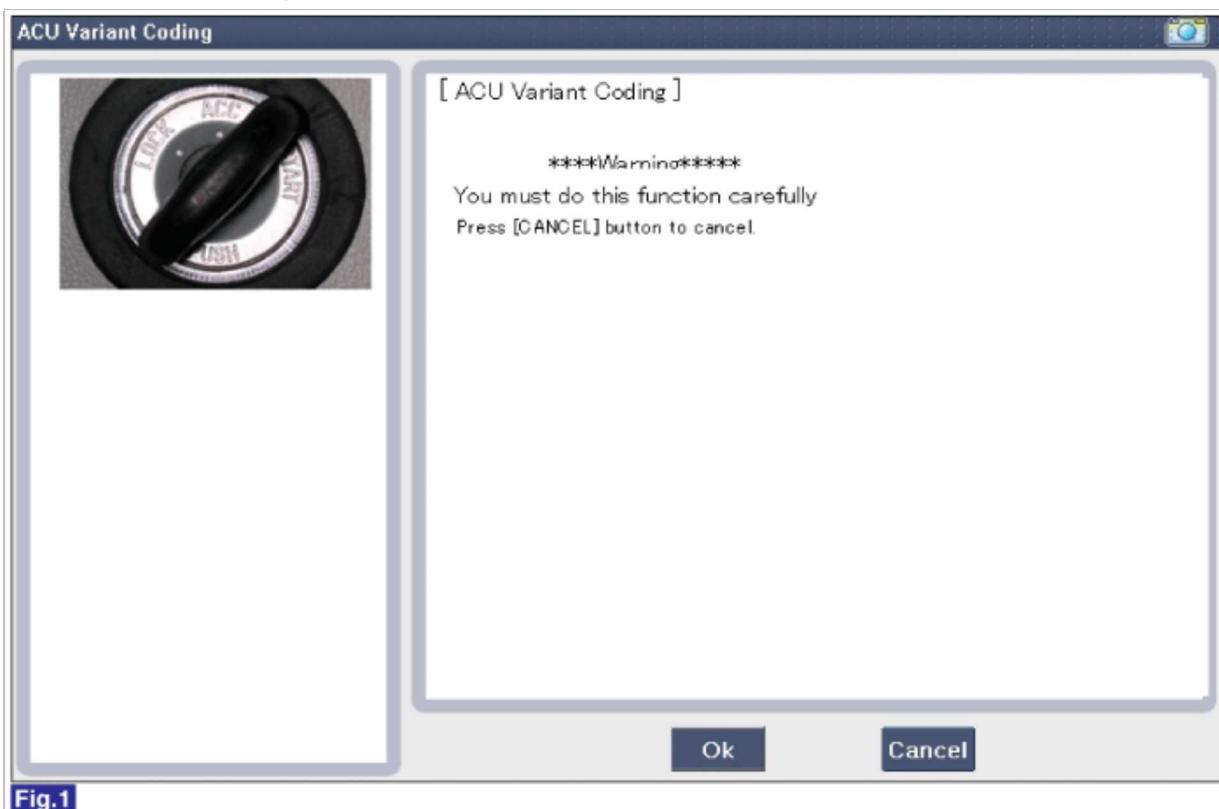


Fig.1

2) ACU Coding Code entering screen

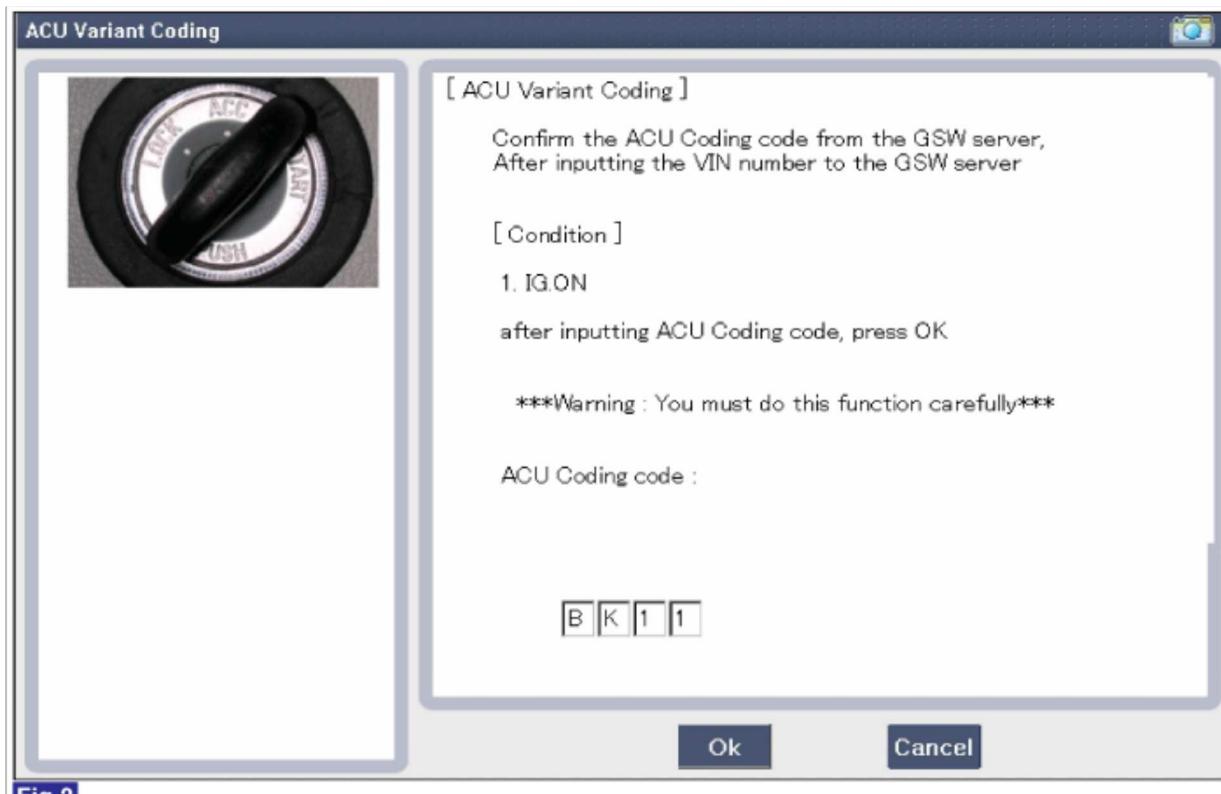


Fig.2

3) Screen of rechecking ACU Coding code's entering

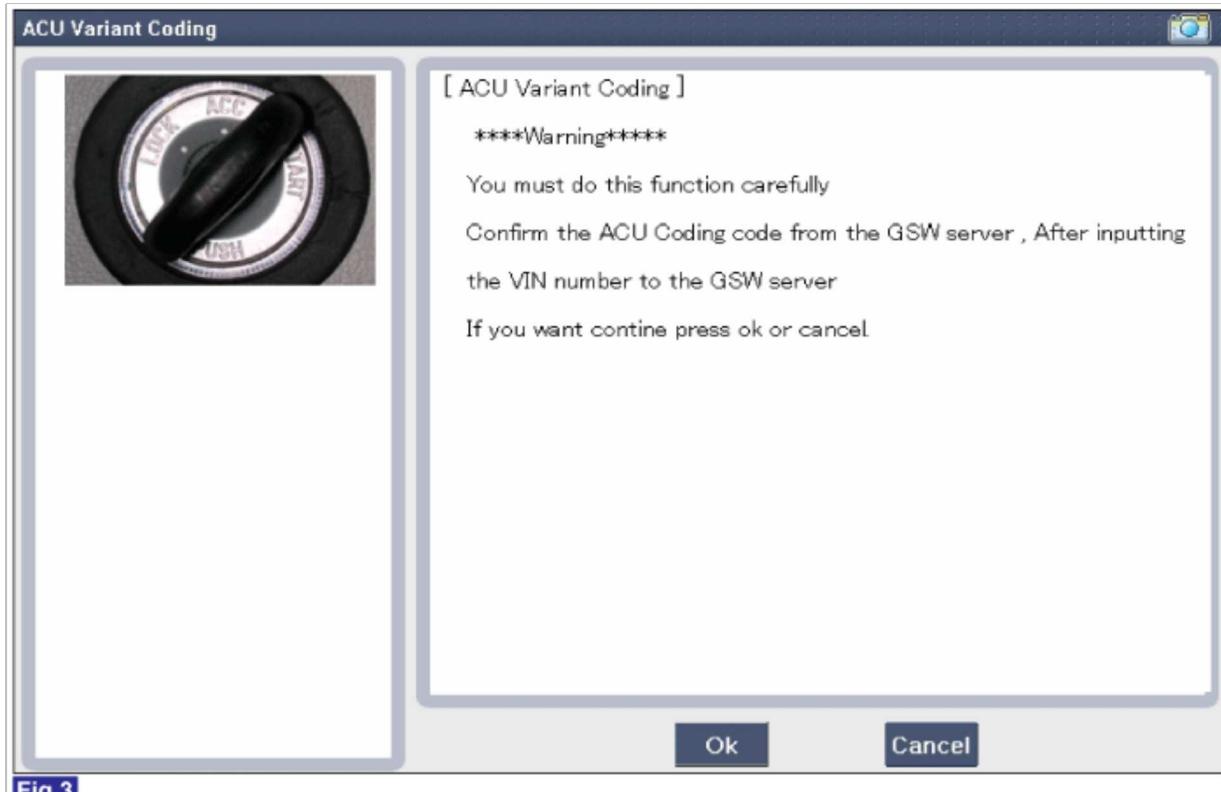


Fig.3

4) Variant coding's proceeding screen-1

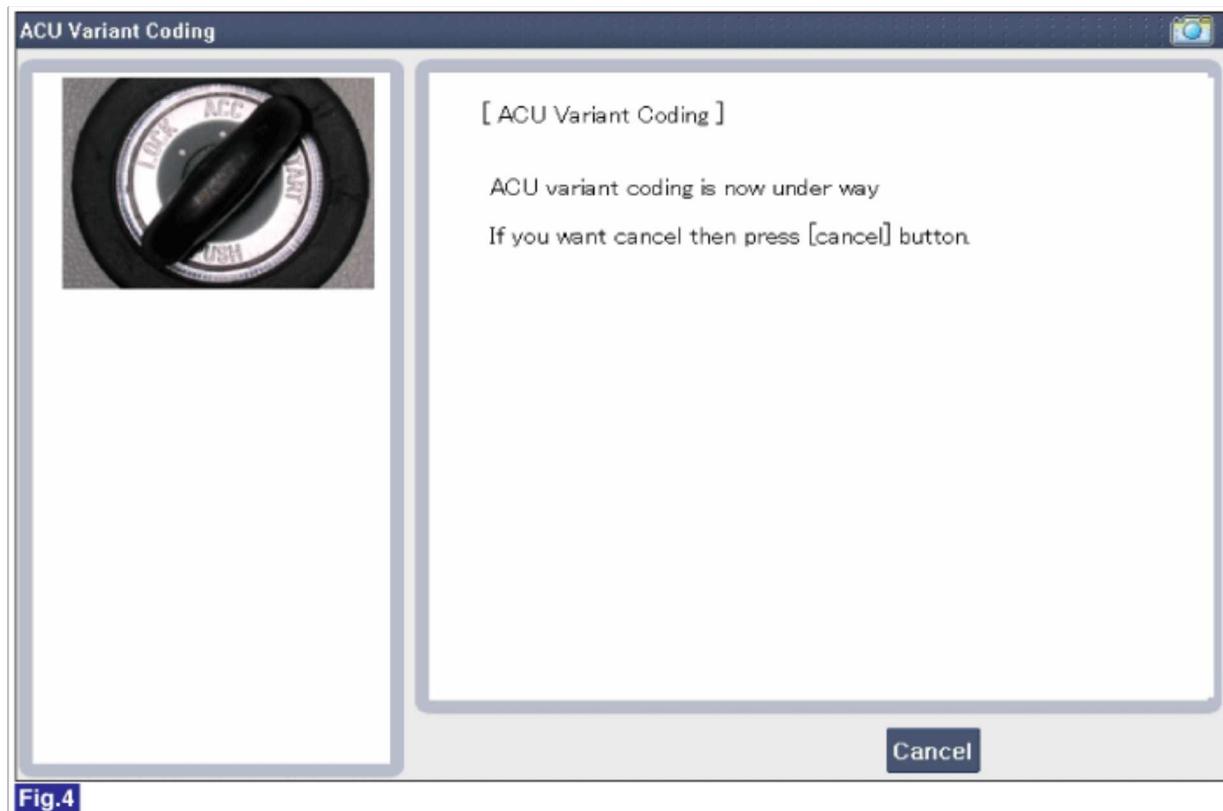


Fig.4

5) Variant coding's proceeding screen-2

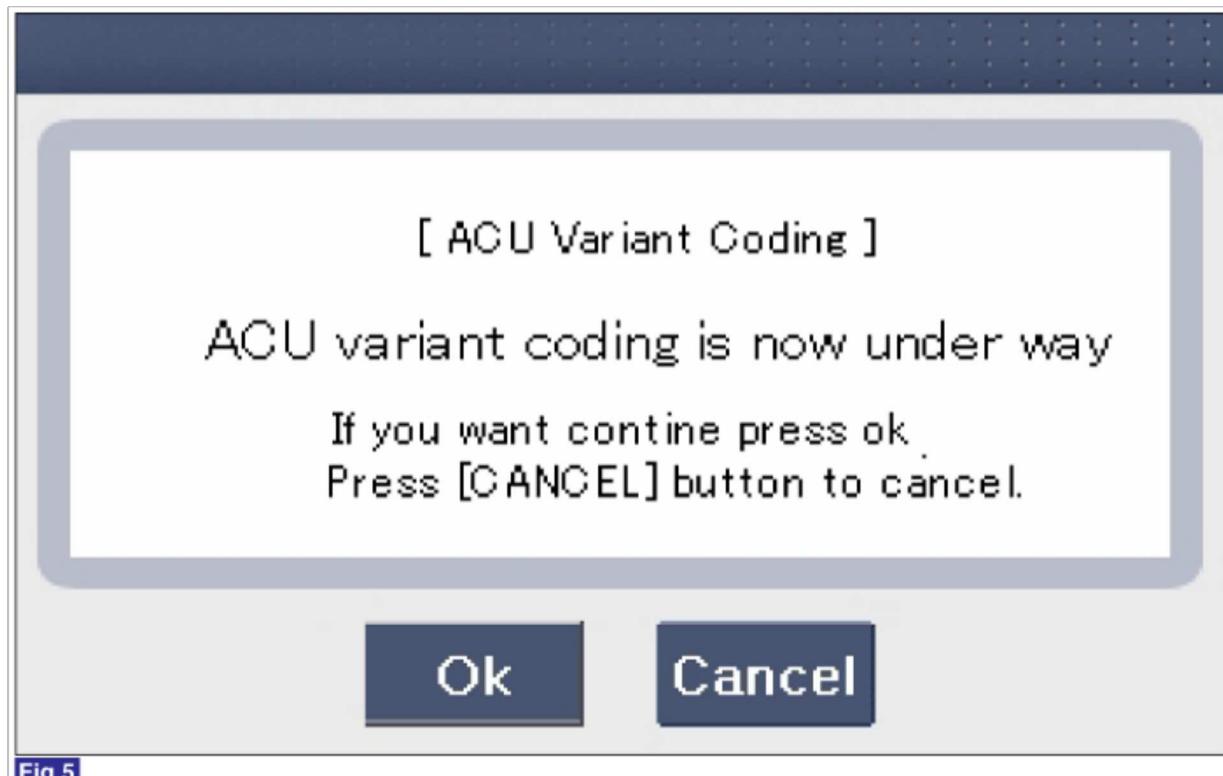


Fig.5

6) Variant coding is completed

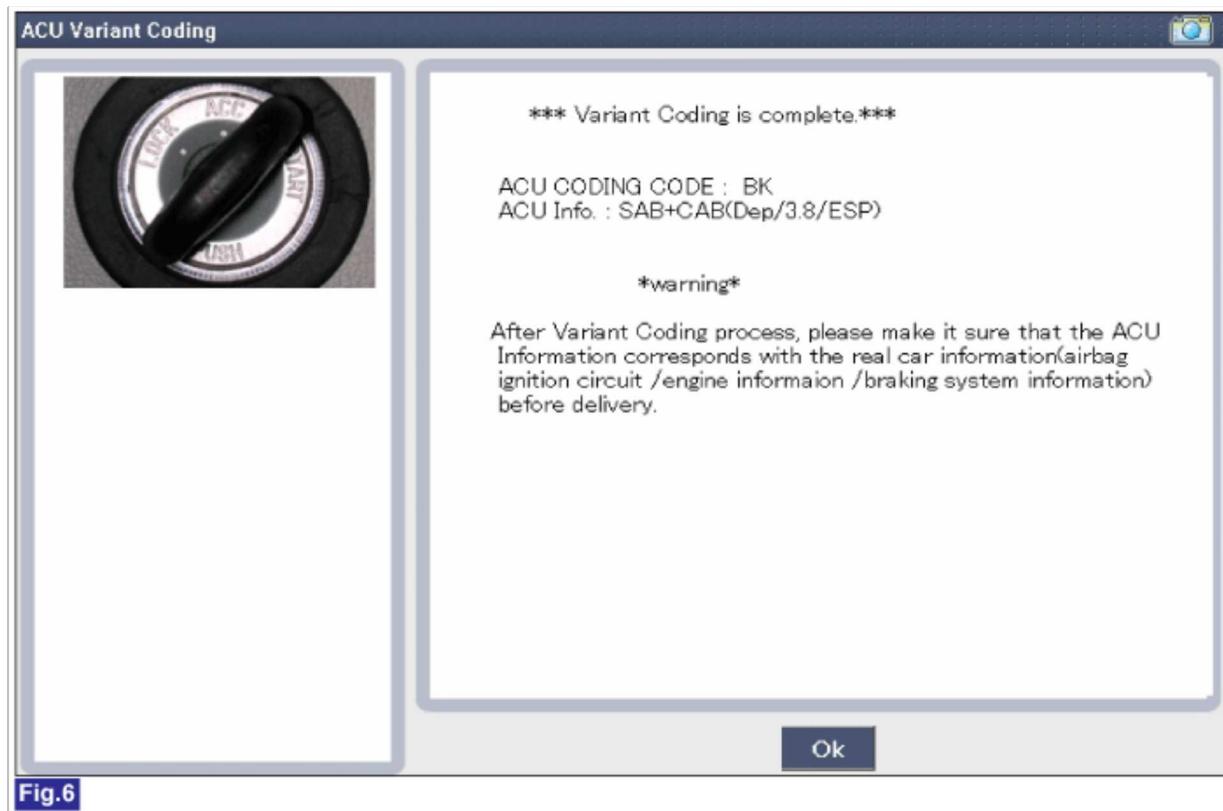


Fig.6

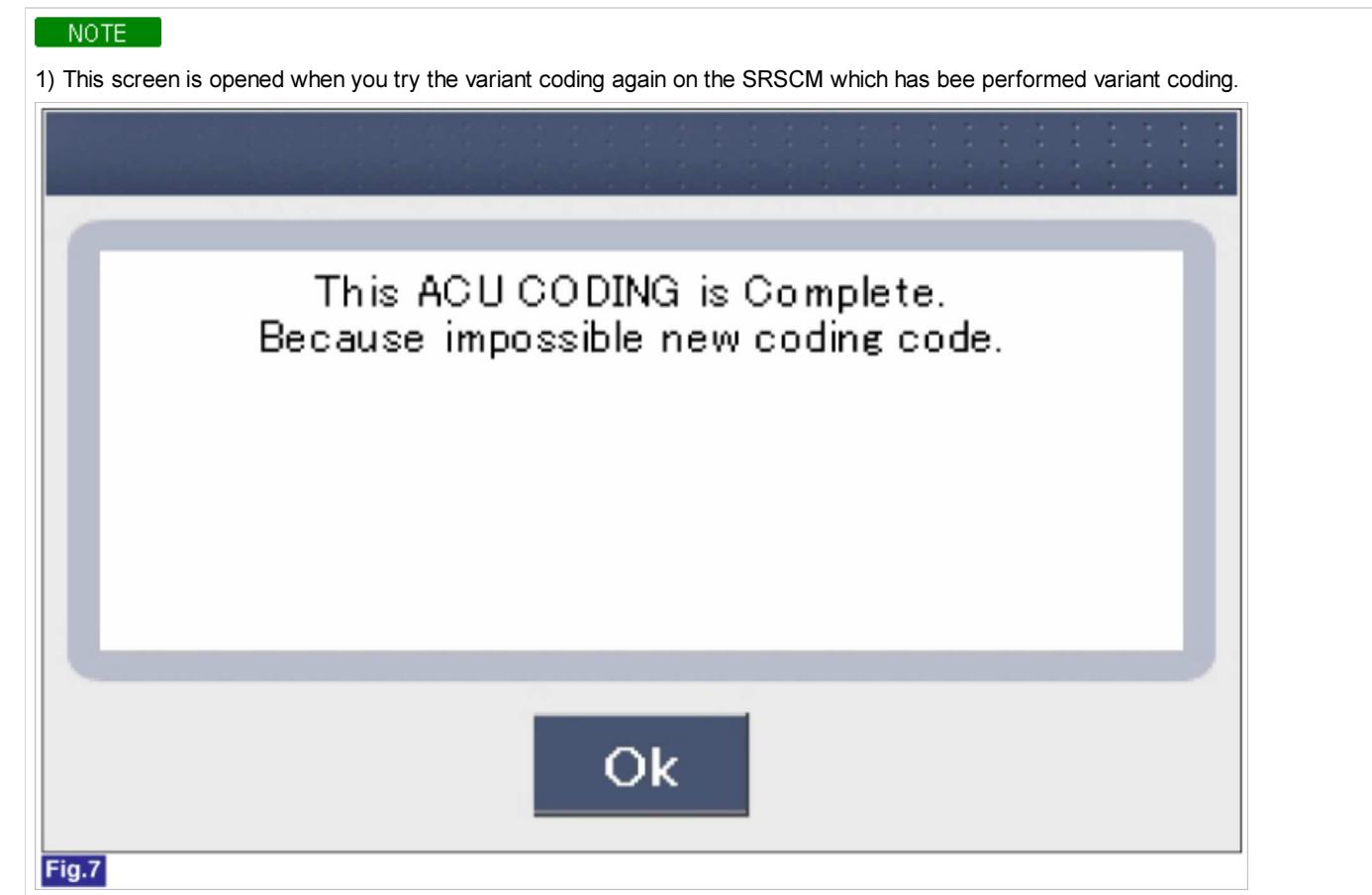


Fig.7

Restraint > SRSCM > Front Impact Sensor (FIS) > Description and Operation

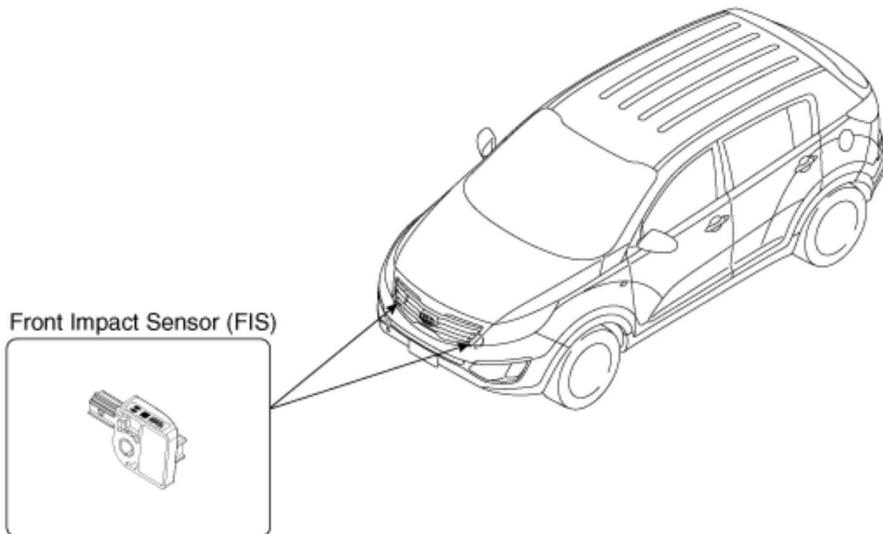
Description

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



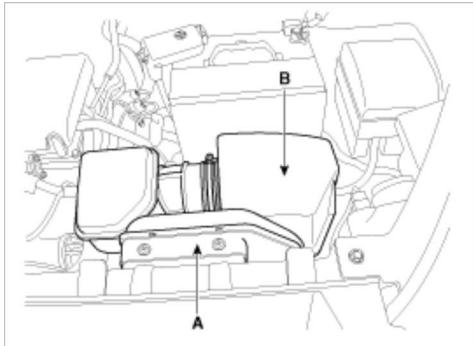
Restraint > SRSCM > Front Impact Sensor (FIS) > Repair procedures

Removal

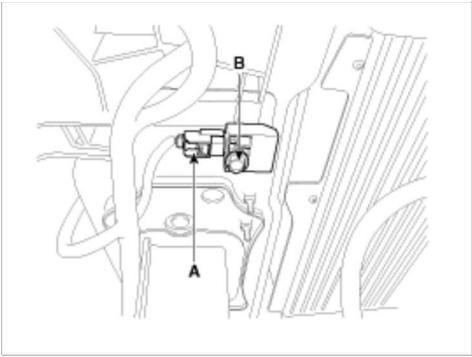
CAUTION

- 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. Remove the air duct (A) and air cleaner assembly (B). (Driver front impact sensor only)



3. Disconnect the front impact sensor connector (A).



4. Remove the front impact sensor mounting bolt (B).
5. 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 :

7.0 ~ 9.0 Nm (0.7 ~ 0.9 kgf.m, 5.1 ~ 6.6 lb.ft)

3. Connect the front impact sensor connector.
4. Install the air duct and air cleaner assembly. (Driver front impact sensor only)
5. Reconnect the battery negative cable.
6. 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).

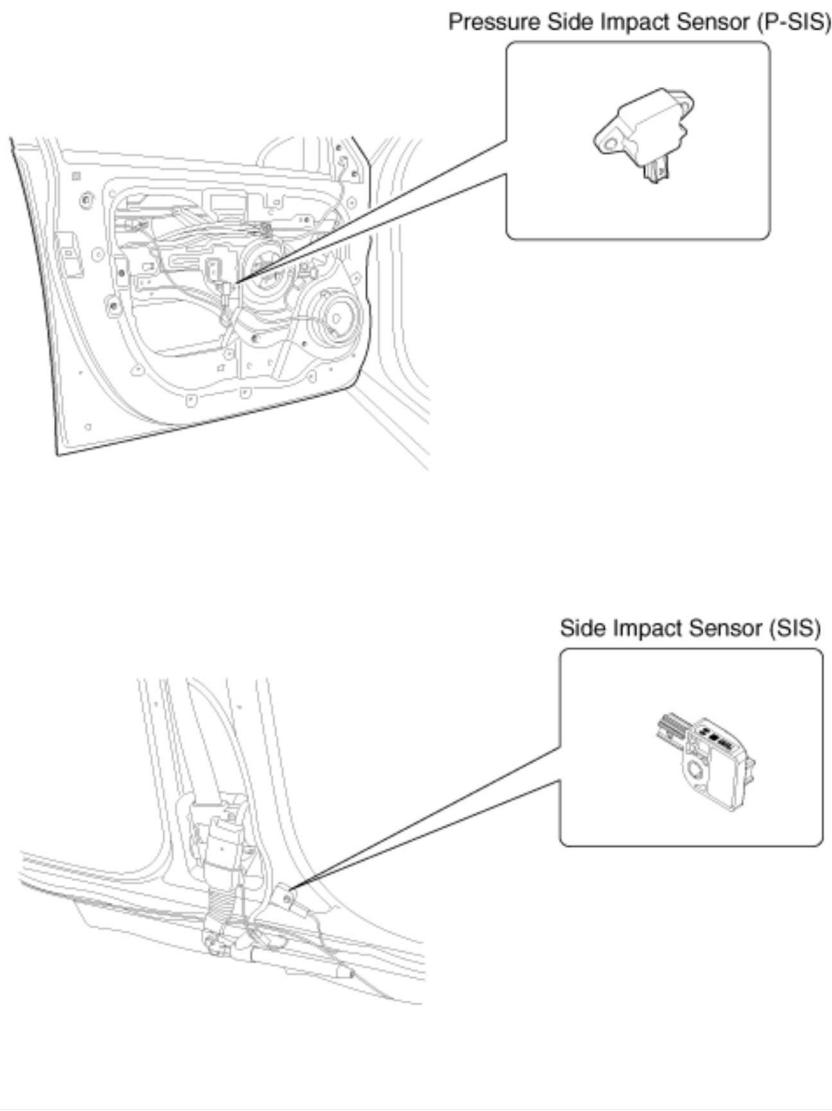
Side Pressure Sensor is also called P-SIS because that detects pressure due to collision at its mounting location.

Side Impact Sensor is also called A-SIS because that detects acceleration.

SRSCM decides deployment or not of the airbag and the time of deployment through the collision signal of SIS when the collision occurred.

Restraint > SRSCM > Side Impact Sensor (SIS) > Components and Components Location

Components



Restraint > SRSCM > Side Impact Sensor (SIS) > Repair procedures

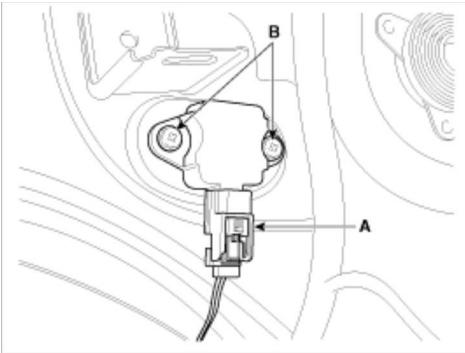
Removal

Pressure Side Impact Sensor

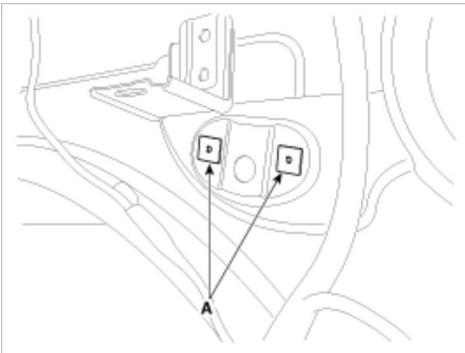
CAUTION

- 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 front side impact sensor connector (A) and remove the front side impact sensor mounting screws (B).

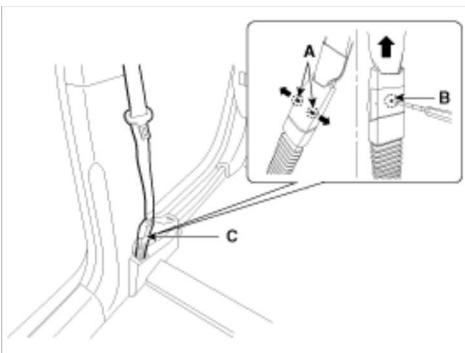


4. Remove the screw grommets (A).

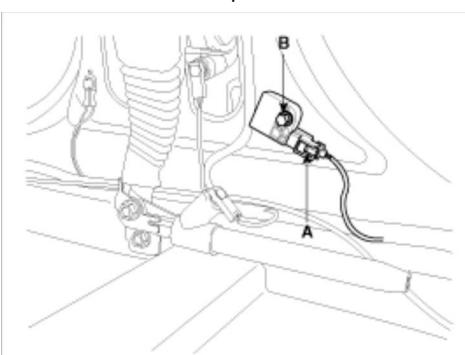


Side Impact Sensor

1. Disconnect the battery negative cable and wait for at least three minutes before beginning work.
2. To remove the seat belt anchor pretensioner (C), keep on pushing the lock pins (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 (A).



6. Loosen the side impact sensor mounting bolt (B) and remove the side impact sensor.

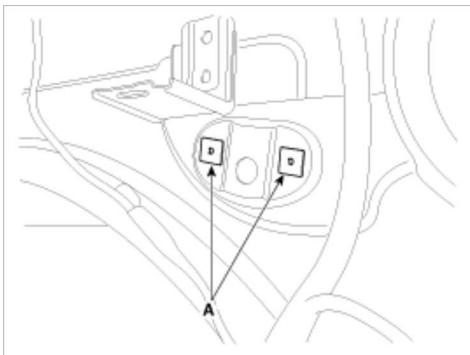
Installation

Pressure 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 screw grommets (A).



CAUTION

- Do not reuse the screw grommets (A), whenever installing.

2. Install the new front 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, 0.7 ~ 1.0 lb-ft)

3. Install the front door trim. (Refer to the Body group- Front door)

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 front 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 torque because the Pressure – Side Impact Sensors (P-SIS) may be broken or the screw grommet may be rotated.
- Problems may occur in the durability of P-SIS or impact sensing performance may be depreciated if screw grommet is rotated.
- The door module must not be deformed because SRSCM judges a 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 :

7.0 ~ 9.0 N.m (0.7 ~ 0.9 kgf.m, 5.1 ~ 6.6 lb-ft)

2. Install the center pillar trim (Refer to the Body group - Interior trim)

3. Install the door scuff trim. (Refer to the Body group - Interior trim)

4. Insert the seat belt to the anchor pretensioner.

5. Reconnect the battery negative cable.

6. After installing the Side Impact Sensor, confirm proper system operation:

- Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

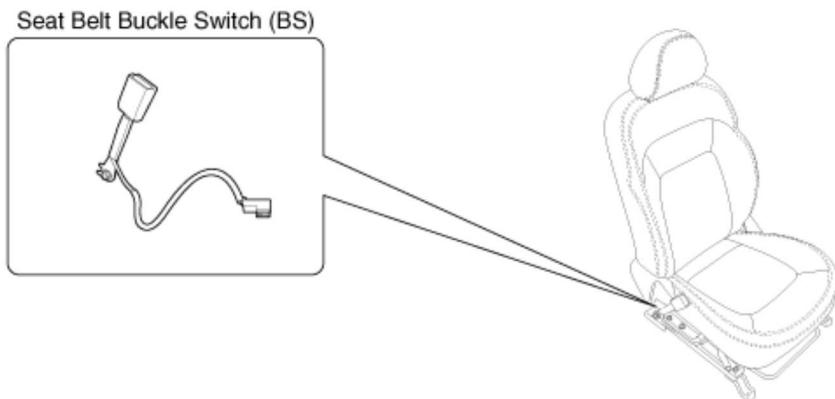
Restraint > SRSCM > Seat Belt Buckle Switch (BS) > Description and Operation

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 not be deactivated.

Restraint > SRSCM > Seat Belt Buckle Switch (BS) > Components and Components Location

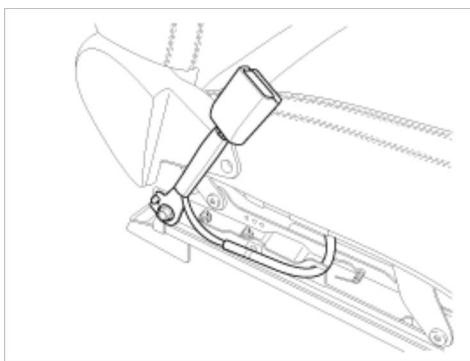
Components



Restraint > SRSCM > Seat Belt Buckle Switch (BS) > Repair procedures

Removal

- Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
- Remove the front seat assembly. (Refer to the Body group- Front seat)
- 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. 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 seat belt buckle switch.

Tightening Torque :

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

4. Install the front seat assembly. . (Refer to the Body group- Front 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 > Passive Occupant Detection System (PODS) > Description and Operation**Description**

The system is intended to classify the occupancy status of the front passenger seat in a motor vehicle based upon the measured force on the bottom seat cushion.

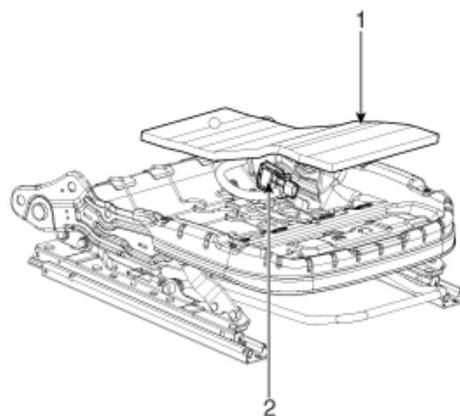
The system also communicates to the SRSCM whether to allow or inhibit the deployment of the passenger airbags and/or pretensioner based upon this status.

The System also measured dynamic responses of the occupant. This information is used to identify when a child seat is cinched down tightly with the seat belt, and to also determine if the seat is unoccupied.

However, the dynamic measurements are not intended, nor capable of monitoring the seating position of the occupant, nor can they determine the proximity of the occupant to the inflator modules.

The system should not be confused with an occupant position recognition system, or any other occupant proximity sensor.

The Passive Occupant Detection System (PODS) utilizes bladder placed between the passenger seat cushion and suspension to measure the occupant's loading force on the passenger seat. The sensor mat is connected to smart digital pressure sensor which is mounted under the seat pan. The quantitative force determined by the system is compared to a given threshold for determination of passenger airbag suppression.

Restraint > SRSCM > Passive Occupant Detection System (PODS) > Components and Components Location**Components**

1. Sensor mat
2. PODS Unit

Restraint > SRSCM > Passive Occupant Detection System (PODS) > Repair procedures

Removal

1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
2. Remove the front passenger seat assembly. (Refer to the Body group- Seat)
3. Remove the seat cushion as an assembly. (Refer to the Body group- Seat)

Installation

1. Install the PODS equipped seat cushion 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 the PODS, 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. 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 PODS does not require suppression and the passenger airbag is enabled.

NOTE

Be sure to perform PODS reset with scantool after replacing PODS equipped seat cushion.

PODS Re-zero procedure

You should perform PODS Re-zero procedure after service or replacement about all part of the passenger seat.

1. Ignition "OFF", connect GDS.
2. Ignition "ON" & Engine "OFF", select Airbag system and "PODS Reset" mode.



3. The GDS will show the two PODS RESET function steps.
 - (1) Erase PODS diagnostic codes.
 - (2) PODS initialization.



CAUTION

This step must be done PODS re-zero, when the front passenger seat is empty.

4. Press the OK button to erase the PODS related diagnostic codes.



5. Press OK button to initialize the PODS.



CAUTION

This step must be done PODS re-zero, when the front passenger seat is empty.

6. The PODS initialization procedure will be performed.



7. Check PODS situation with selecting " Pass. Airbag Realtime Info" after performing PODS Reset procedure.



8. Perform inspection with pressing OK button.

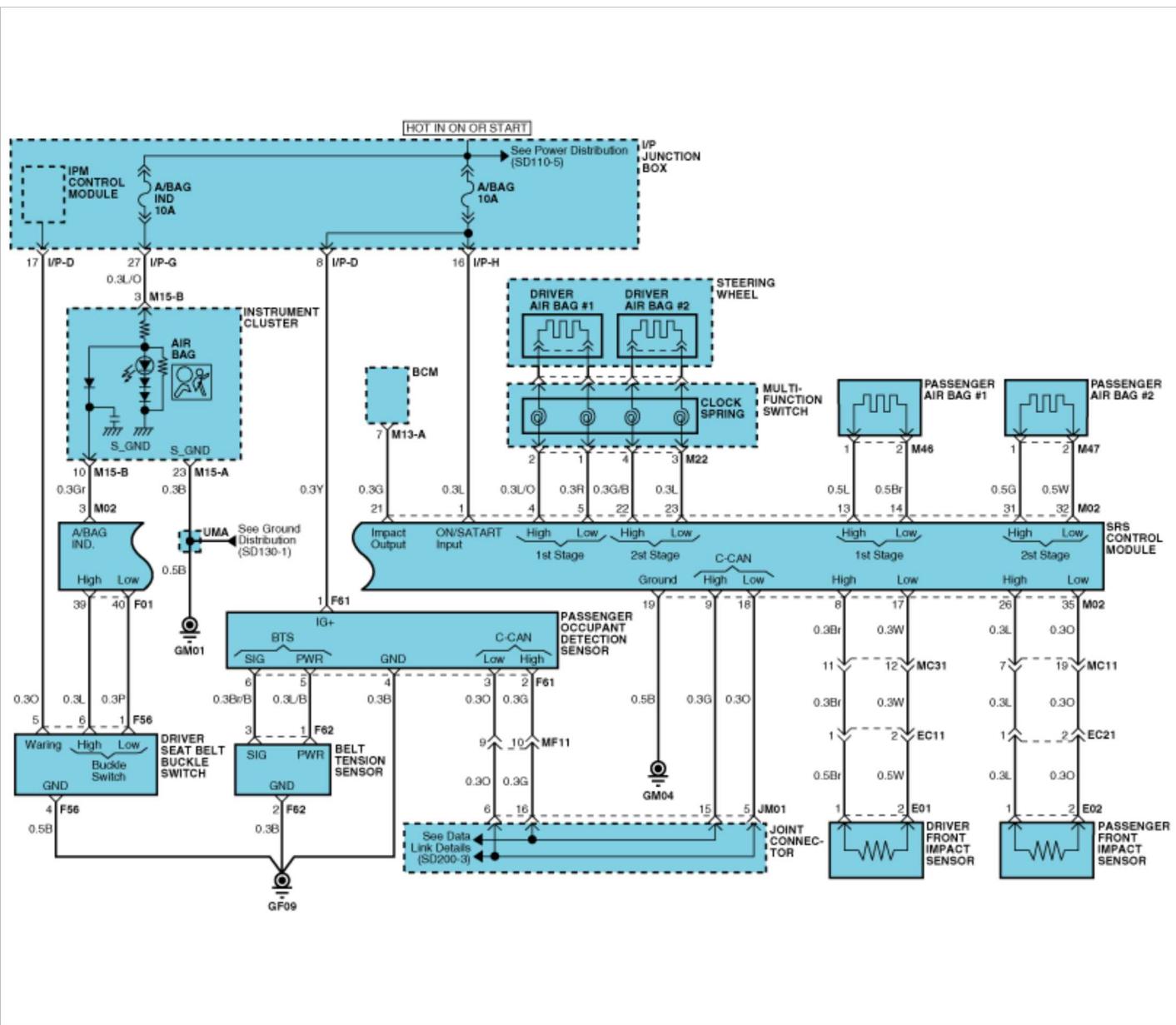


9. Finish the procedure with pressing cancel button if there is no problem after inspecting each status as below.

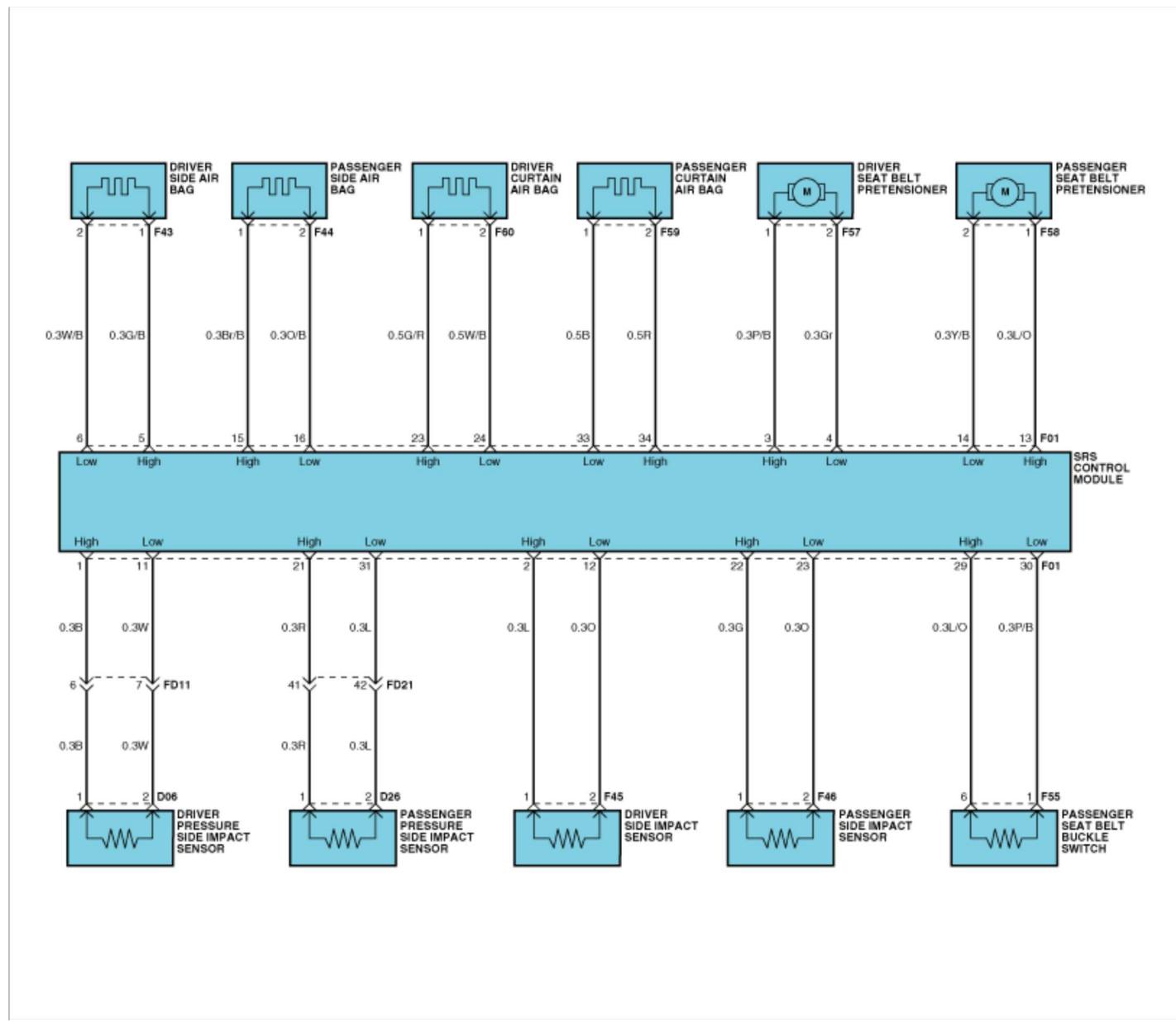


Restraint > SRSCM > Schematic Diagrams

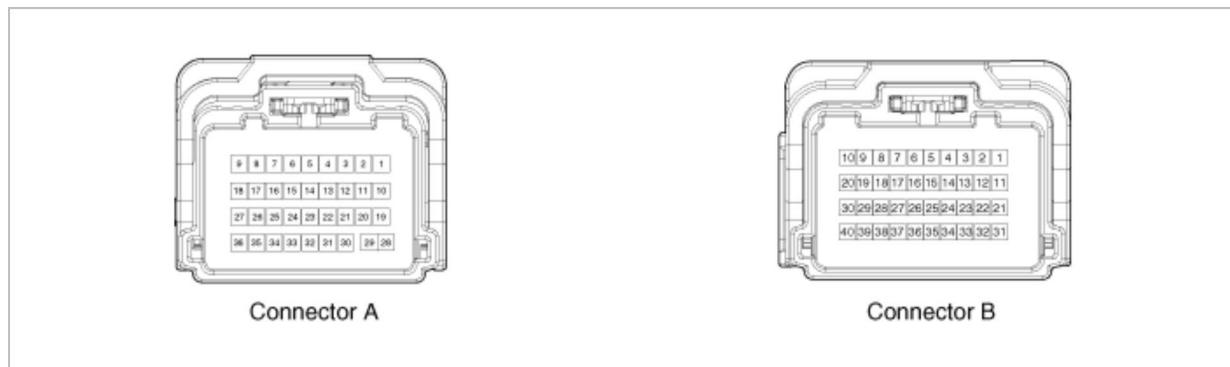
Circuit Diagram (1)



Circuit Diagram (2)



Harness Connector



Pin	Function (Connector A)	Pin	Function (Connector A)
1	Ignition	1	Pressure side impact sensor [Driver] High
2	-	2	Side impact sensor [Driver] High
3	Airbag warning lamp	3	Seat belt pretensioner [Driver] High
4	(1st stage) Driver airbag High	4	Seat belt pretensioner [Driver] Low

5	(1st stage) Driver airbag Low	5	Side airbag [Driver] High
6	-	6	Side airbag [Driver] Low
7	-	7	-
8	Front impact sensor [Driver] High	8	-
9	CAN_High	9	-
10	-	10	-
11	-	11	Pressure side impact sensor [Driver] Low
12	Telltale warning lamp	12	Side impact sensor [Driver] Low
13	(1st stage) Passenger airbag High	13	Seat belt pretensioner [Passenger] High
14	(1st stage) Passenger airbag Low	14	Seat belt pretensioner [Passenger] Low
15	-	15	Side airbag [Passenger] High
16	-	16	Side airbag [Passenger] Low
17	Front impact sensor [Driver] Low	17	-
18	CAN_Low	18	-
19	Ground	19	-
20	-	20	-
21	Crash Output	21	Pressure side impact sensor [Passenger] High
22	(2nd stage) Driver airbag High	22	Side impact sensor [Passenger] High
23	(2nd stage) Driver airbag Low	23	Curtain airbag [Driver] High
24	-	24	Curtain airbag [Driver] Low
25	-	25	Anchor pretensioner [Driver] High
26	Front impact sensor [Passenger] High	26	Anchor pretensioner [Driver] Low
27	-	27	-
28	-	28	-
29	-	29	Seat buckle switch [Passenger] High
30	Seat belt reminder interface [Passenger]	30	Seat buckle switch [Passenger] Low
31	(2nd stage) Passenger airbag High	31	Pressure side impact sensor [Passenger] Low
32	(2nd stage) Passenger airbag Low	32	Side impact sensor [Passenger] Low
33	-	33	Curtain airbag [Passenger] High
34	-	34	Curtain airbag [Passenger] Low
35	Front impact sensor [Passenger] Low	35	Anchor pretensioner [Passenger] High
36	-	36	Anchor pretensioner [Passenger] Low
		37	-
		38	-
		39	Seat buckle switch [Driver] High
		40	Seat buckle switch [Driver] Low

Restraint > Airbag Module > Driver Airbag (DAB) Module and Clock Spring > Description and Operation

Description

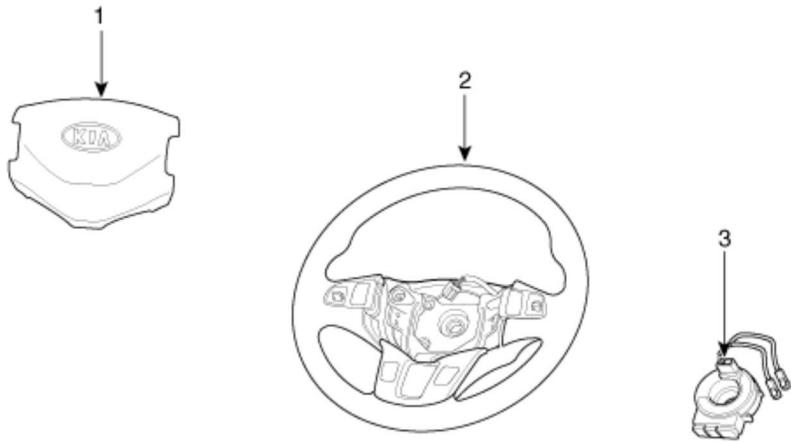
Driver Airbag (DAB) is installed in the steering wheel and electrically connected to SRSCM via the clock spring. It protects the driver by deploying the airbag when frontal crash occurs. The SRSCM determines deployment of the Driver Airbag (DAB).

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

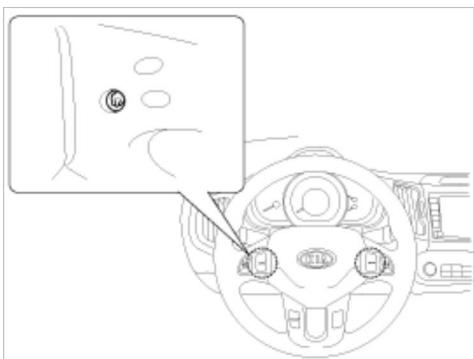


1. Driver Airbag (DAB)
2. Steering Wheel
3. Clock Spring

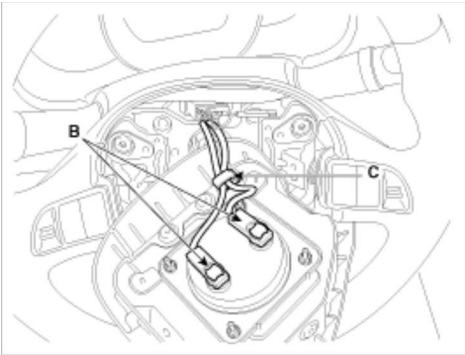
Restraint > Airbag Module > Driver Airbag (DAB) Module and Clock Spring > Repair procedures

Removal

1. Disconnect the battery negative cable and wait for at least three minutes before beginning work.
2. Remove the airbag module mounting bolts (2EA).



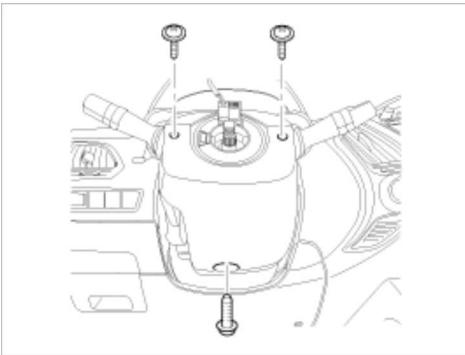
3. Remove the wiring fixing clip (C), and then release the connector locking pin to disconnect the driver airbag module connector (B).



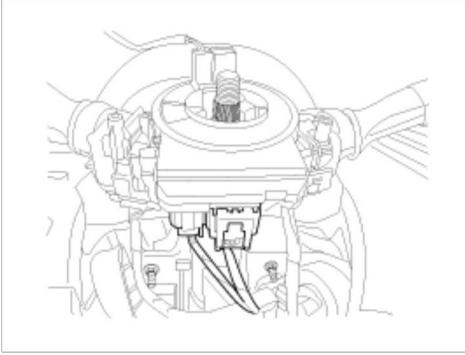
CAUTION

The removed airbag module should be stored in a clean, dry place with the pad cover facing up.

4. Remove the steering wheel and steering wheel column cover. (Refer to the Steering System group- Steering Column and Shaft)



5. Disconnect the clock spring and horn connector, then remove the clock spring.



Inspection

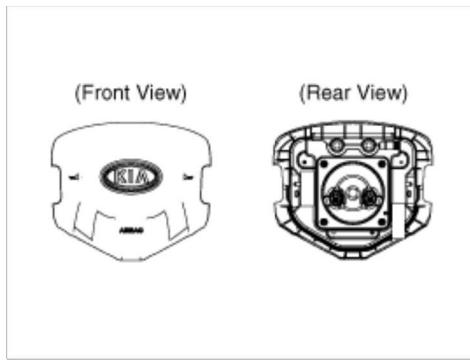
Driver Airbag (DAB)

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.

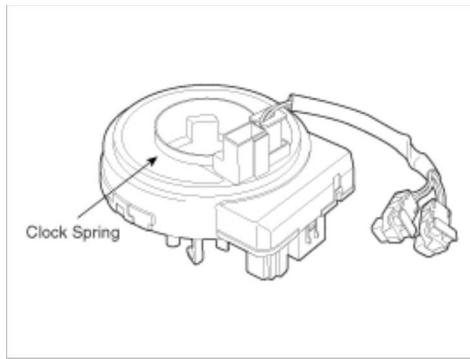
1. Check pad cover for dents, cracks or deformities.
2. Check the airbag module for denting, cracking or deformation.
3. Check hooks and connectors for damage, terminals for deformities, and harness for binds.
4. Check airbag inflator case for dents, cracks or deformities.



5. Install the airbag module to the steering wheel to check for fit or alignment with the wheel.

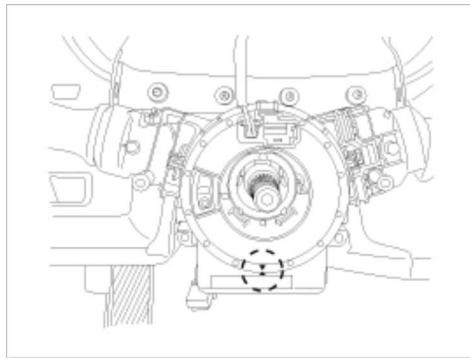
Clock Spring

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

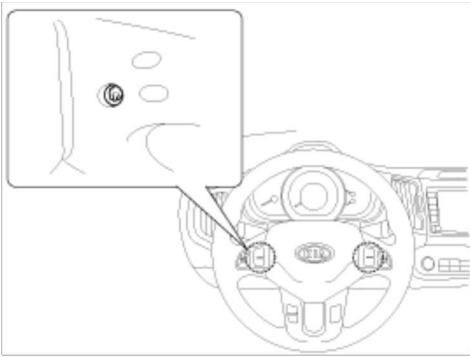
1. Remove the ignition key from the vehicle.
2. Disconnect the battery negative cable from battery and wait for at least three minutes before beginning work.
3. Connect the clock spring harness connector and horn harness connector to the clock spring.
4. Set the center position by setting the marks between the clock spring and the cover into line. Make an array the mark (►) by turning the clock spring clockwise to the stop and then 2.0 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 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 N.m (0.8 ~ 1.1 kgf.m, 5.1 ~ 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

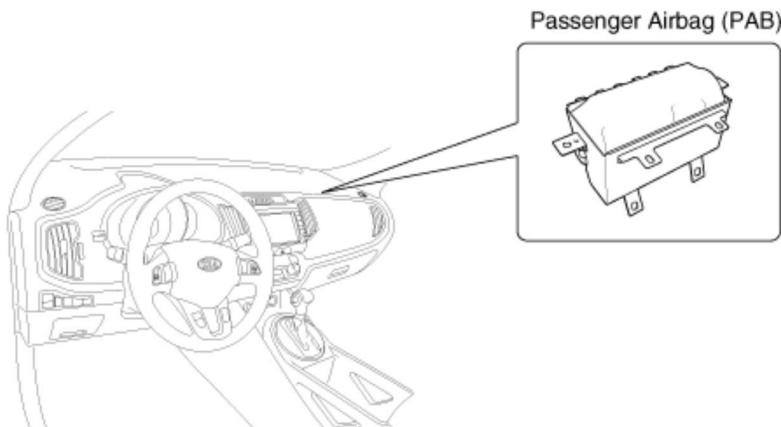
The passenger airbag (PAB) is installed inside the crash pad and protects the front passenger in the event of a frontal crash. The SRSCM determines if and when to deploy the PAB.

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

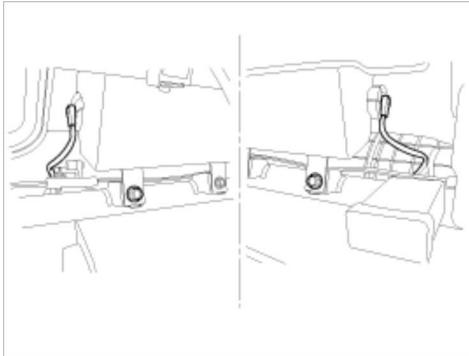


Restraint > Airbag Module > Passenger Airbag (PAB) Module > Repair procedures

Removal

1. Disconnect the battery negative cable and wait for at least three minutes before beginning work.
2. Remove the crash pad garnish. (Refer to the Body group- crash pad).

3. Disconnect the passenger airbag connector and remove the PAB 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 nuts(4EA) from the crash pad. Then remove the passenger airbag.

CAUTION

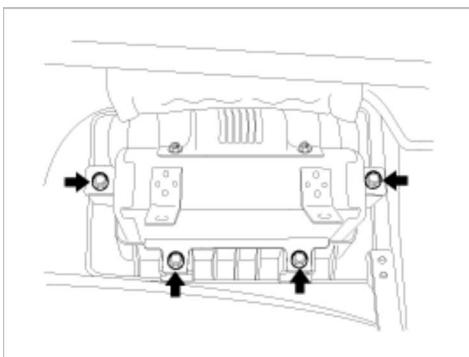
The removed airbag module should be stored in a clean, dry place with the airbag cushion up.

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 bolts.

Tightening torque :

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



4. Install the heater duct to the crash pad.
5. Install the crash pad. (Refer to the Body group- crash pad)
6. Tighten the passenger airbag mounting bolt.

Tightening torque :

18.6 ~ 26.5 N.m (1.9 ~ 2.7 kgf.m, 13.7 ~ 19.2 lb-ft)

7. Connect the passenger airbag harness connector to the SRS main harness connector.
8. Reinstall the crash pad garnish. (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

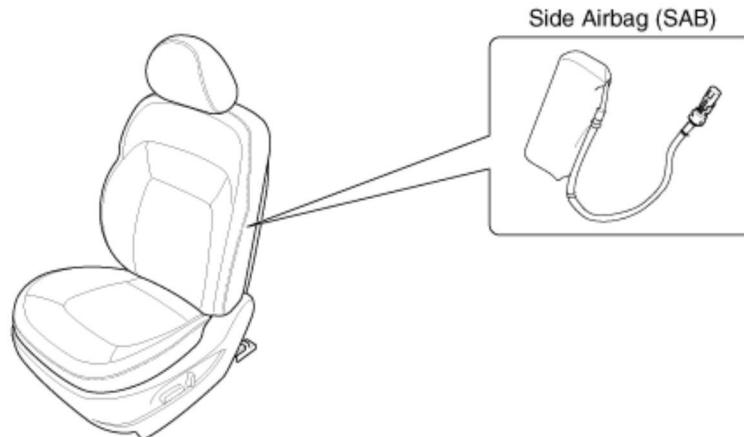
The Side Airbags (SAB) are installed inside the front seat and protects the driver and passenger from danger when side crash occurs. The SRSCM determines deployment of side airbag by using Side Impact Sensor (SIS) signal.

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

NOTE

The side airbag cannot be disassembled from the seat back assembly, so replace assembly when replacing the side airbag.

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 assembly. (Refer to the Body group- Seat)

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.
- 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. Install the new seat back assembly.
(Refer to the Body group - Seat)
4. Install the front seat assembly.
(Refer to the Body group - Seat)
5. Recline and slide the front seat forward fully, make sure the harness wires are not pinched or interfering with other parts.
6. Reconnect the battery negative cable.
7. After installing the side airbag (SAB), confirm proper system operation:
 - A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

Restraint > Airbag Module > Curtain Airbag (CAB) Module > Description and Operation

Description

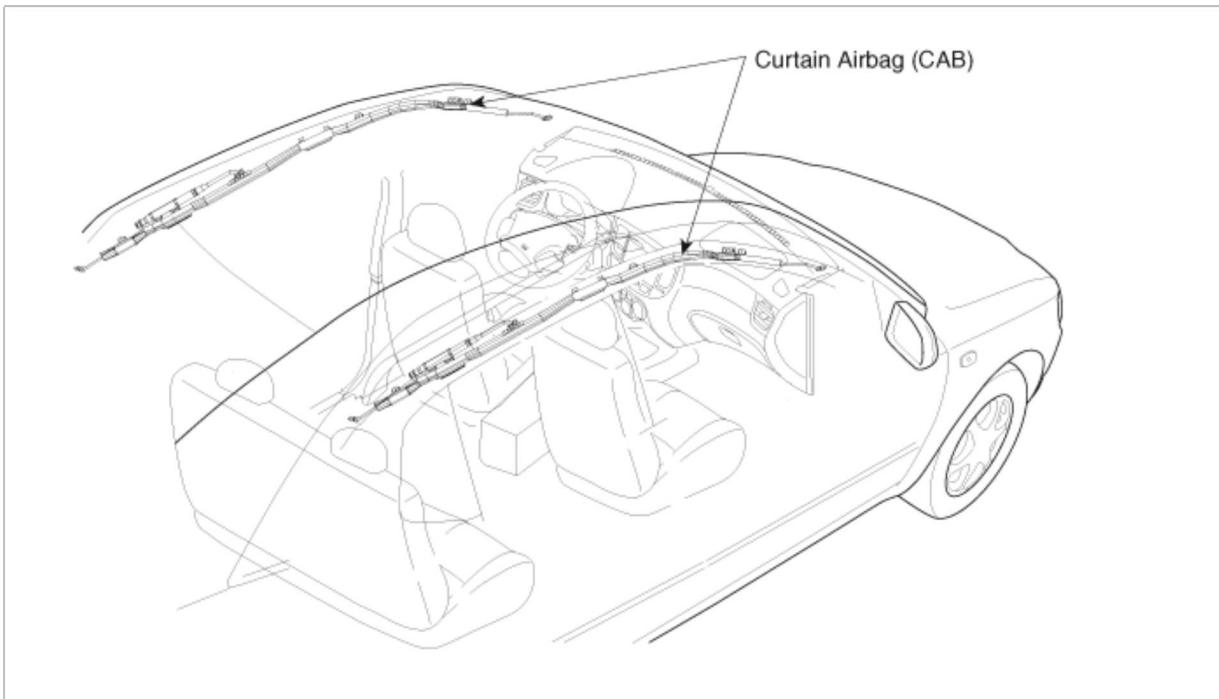
Curtain airbags are installed inside the headliner (LH and RH) and protect the driver and passenger from danger when side crash occurs. The SRSCM determines deployment of curtain airbag by using side impact sensor (SIS) signal.

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

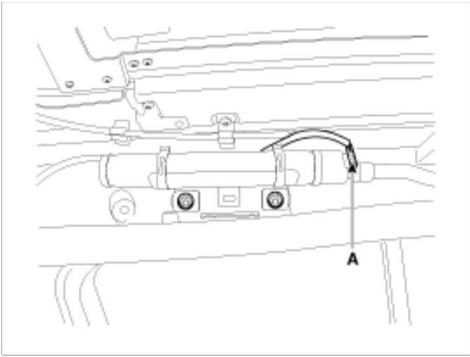
Components



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 roof trim. (Refer to the Body group- Interior)
3. Disconnect the curtain airbag harness connector (A).



- After loosening the mounting bolts and nuts remove the curtain airbag.

Installation

- Remove the ignition key from the vehicle.
- Disconnect the battery negative cable and wait for at least three minutes.
- Tighten the curtain airbag mounting bolts.

Tightening torque :

7.0 ~ 9.0 N.m (0.7 ~ 0.9 kgf.m, 5.1 ~ 6.6 lb-ft)

CAUTION

- Never twist the airbag module when installing it. If the module is twisted, airbag module may operate abnormally.

- Connect the curtain airbag connector.
- Install the roof trim. (Refer to the Body group- Interior)
- Reconnect the battery negative cable.
- After installing the curtain airbag (CAB), confirm proper system operation:
 - Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

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.

- Turn the ignition switch OFF, and disconnect the battery negative cable and wait at least three minutes.
- Confirm that each airbag or side airbag is securely mounted.
- Confirm that the special tool is functioning properly by following the check procedure.
 - Driver's Airbag :
 - Remove the driver's airbag and install the SST (0957A-38510).
 - Install the driver's airbag on the steering wheel.
 - Front Passenger's Airbag :
 - Remove the glove box housing, and then disconnect the connector between the front passenger's airbag and SRS main harness.
 - Install the SST(0957A-3Q100).

(3) Side Airbag :

- A. Disconnect the 2P connector between the side airbag and 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-3S100).

(5) Seat Belt Pretensioner :

- A. Disconnect the 2P connector from the seat belt pretensioner.
- B. Install the SST (0957A-38500).

(6) Anchor Pretensioner :

- A. Disconnect the 2P connector from the anchor 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 deflation)

7. Dispose of the complete airbag. No parts 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.

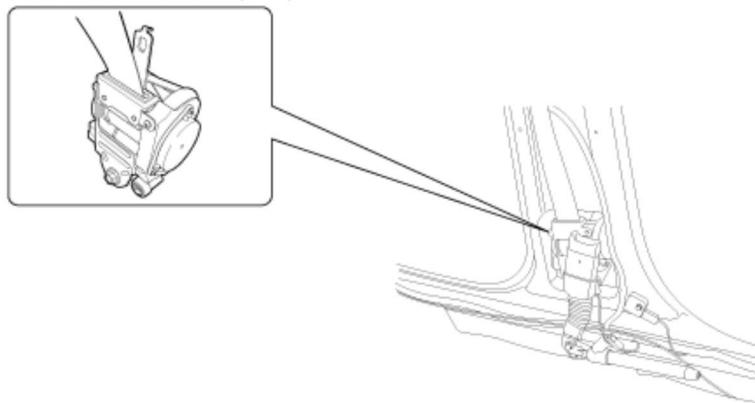
CAUTION

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

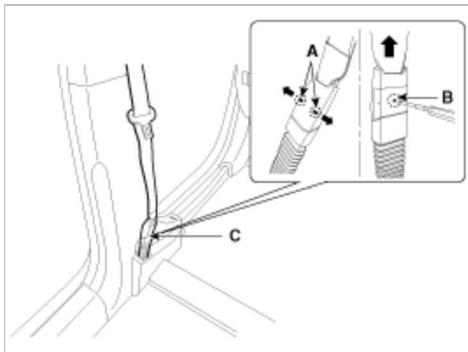
Seat Belt Pretensioner (BPT)



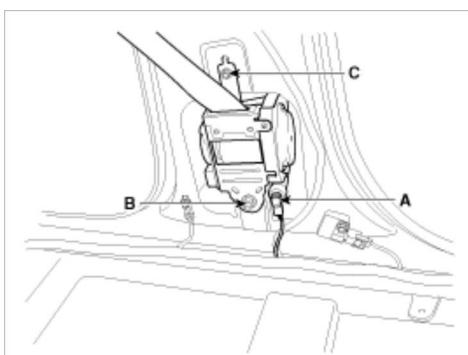
Restraint > Seat Belt Pretensioner > Seat Belt Pretensioner (BPT) > Repair procedures

Removal

1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
2. 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).



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 (A).



6. Loosen the seat belt pretensioner mounting bolt (B,C) 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.

Tightening torque :

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

4. Connect the seat belt pretensioner (BPT) connector.
5. Install the upper anchor bolts.

Tightening torque :

39.2 ~ 53.9 N.m (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. Insert the seat belt to the anchor pretensioner.
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 > Description and Operation

Description

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. Anchor pretensioner is supported by two cables and it is an auxiliary equipment to prevent a driver 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 > Components and Components Location

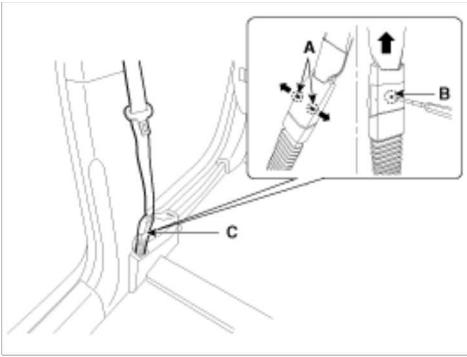
Components



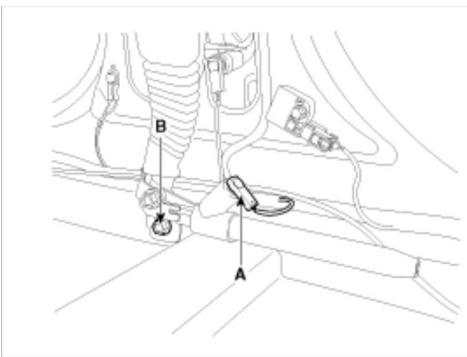
Restraint > Seat Belt Pretensioner > Anchor Pretensioner > Repair procedures

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 pins (A) as arrow direction. And then remove the seat belt after pushing the lock pin (B).



3. Remove the following parts. (Refer to the Body group-Interior trim)
 - A. Door scuff trim
 - B. Center pillar trim
4. Disconnect the anchor pretensioner connector (A).



5. 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 following parts. (Refer to the body group - Interior trim)
 - A. Center pillar trim
 - B. Door scuff trim
6. Insert the seat belt to the anchor pretensioner.

NOTE

Make sure the lock pin is connected in properly.

7. Reconnect the battery negative cable.
8. 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.



SPORTAGE(SL) > 2012 > G 2.4 DOHC > Steering System

Steering System > General Information > Specifications

Specifications

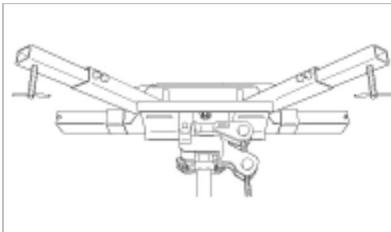
Item		Specification
Type		Motor Driven Power Steering
Steering gear	Type	Rack & Pinion
	Rack stroke	153mm
Steering angle(Max.)	Inner	39.5°±1.30°
	Outer	31.9°

Tightening Torques

Item	Tightening torque (kgf.m)		
	Nm	kgf.m	lb-ft
Hub nuts	88.3 ~ 107.9	9.0 ~ 11.0	65.1 ~ 79.6
Steering wheel lock nut	39.2 ~ 49.0	4.0 ~ 5.0	28.9 ~ 36.2
Steering column mounting bolts and nuts	12.7 ~ 17.7	1.3 ~ 1.8	9.4 ~ 13.0
Universal joint to pinion of steering gear	32.4 ~ 37.3	3.3 ~ 3.8	23.9 ~ 27.5
Tie rod end castle nut	23.5 ~ 33.3	2.4 ~ 3.4	17.4 ~ 24.6
Lower arm ball joint bolt and nut	98.1 ~ 117.7	10.0 ~ 12.0	72.3 ~ 86.8
Steering gear box mounting bolts	58.8 ~ 78.5	6.0 ~ 8.0	43.4 ~ 57.9
Stabilizer link nut	98.1 ~ 117.7	10.0 ~ 12.0	72.3 ~ 86.8
Sub frame mounting bolts & nuts	176.5~ 196.1	18.0 ~ 20.0	130.2 ~ 144.7
Roll rod mounting bolt & nut	107.9 ~ 127.5	11.0 ~13.0	79.6 ~ 94.0

Steering System > General Information > Special Service Tools

Special Service Tools

Tool (Number and Name)	Illustration	Use
09624-38000 Crossmember supporter		Supporting of the crossmember.

Steering System > Electric Power Steering > Description and Operation

Description

EPS (Electric power steering, Column assist type) system uses an electric motor to assist the steering force and it is an engine operation independent steering system.

EPS control module controls the motor operation according to information received from each sensor and CAN (Controller Area Network),

resulting in a more precise and timely control of steering assist than conventional engine-driven hydraulic systems.

Components (Steering Angle Sensor, Torque Sensor, Fail-safe relay, etc.) of the EPS system are located inside the steering column & EPS unit assembly.

The steering column & EPS unit assembly must not be disassembled to inspect.

The replace them.

Note With Regard to diagnosis

Trouble factor	Check item	Trouble symptom	Explanation	Note
Drop, impact, and overload	Motor	Abnormal noise	- Visible or invisible damage can occur. The steering wheel could pull to one side by using the dropped parts.- Precise parts of motor/ECU are sensitive to vibration and impact.- Overload can cause unexpected damage	- Do not use the impacted EPS.- Do not overload each parts.
	ECU	Circuit damage- Wrong welding point- Broken PCB- Damaged precise parts		
	Torque sensor	Insufficient steering effort	Overload to INPUT shaft can cause malfunction of the torque sensor	- Do not impact the connecting parts (When inserting and torquing)- Use the specified tool to remove the steering wheel. (Do not hammer on it)- Do not use the impacted EPS
	Shaft	Insufficient steering effort (Uneven between LH and RH)		Do not use the impacted EPS
Pull/Dent	Harness	- Malfunction- impossible power operation- Malfunction of EPS	Disconnection between harness connecting portion and harness	Do not overload the harness
Abnormal storage temperature	Motor/ECU	Abnormal steering effort by improper operation of the motor/ECU	- Waterproof at the normal condition- Even a little moisture can cause malfunction of the precise parts of the motor/ECU	- Keep the normal temperature and proper moisture, while storing- Avoid drowning

1. Do not impact the electronic parts, if they are dropped or impacted, replace them with new ones.
2. Avoid heat and moisture to the electronic parts.
3. Do not contact the connect terminal to avoid deformation and static electricity.
4. Do not impact the motor and torque sensor parts, if they are dropped or impacted, replace them with new ones.
5. The connector should be disconnected or connected with IG OFF.

Steering System > Electric Power Steering > Repair procedures

General Inspection

After or before servicing the EPS system, perform the troubleshooting and test procedure as follows. Compare the system condition with normal condition in the table below and if abnormal symptom is detected, perform necessary remedy and inspection.

Test condition	Normal condition: Motor must not supply steering assist.		
	Symptom	Possible cause	Remedy
IG Off	Motor supplies steering assist.	ASP is not calibrated.	Perform the ASP calibration using a scan tool.
		IG power supplies	Inspect the IG power supply line.

Test condition	Normal condition: Motor must not supply steering assist, Warning lamp is illuminated.		
	Symptom	Possible cause	Remedy
IG On/Engine Off	Motor supplies steering assist.	ASP is not calibrated.	Perform the ASP calibration using a scan tool.
		EMS CAN signal is not received.	Inspect the CAN line.
	Warning lamp is not illuminated.	Cluster fault	Inspect the cluster and cluster harness

Test condition	Normal condition: Motor supplies steering assist, Warning lamp is not illuminated.		
	Symptom	Possible cause	Remedy
IG On/Engine On	Warning lamp is illuminated and Motor dose not supply steering assist.	EPS (Hot at all times) and IG power supply fault	Inspect the connector and harness for EPS (Hot at all times) and IG power supply line.
		DTC is detected by system.	Perform the self test using a scan tool and repair or replace.
	Warning lamp is illuminated and Motor supplies steering assist.	ASP is not calibrated.	Perform the ASP calibration using a scan tool.
		CAN communication between EPS and cluster is fault.	Inspect the CAN line.

ASP: Absolute Steering Position

CAN: Controller Area Network

EMS: Engine Management System

CAUTION

If there is no EPS warning light illumination, then there is not malfunction of EPS system.

The following symptoms may occur during normal vehicle operation.

- After turning the ignition switch on, the steering wheel becomes stiffer while it performs EPS system diagnostics for about 2 seconds, then it becomes normal steering condition.
- After turning the ignition switch on or off, EPS relay noise may occur but it is normal.
- While steered, when the vehicle is stopped or in low driving speed, motor noise may occur but it is normal operation.

Caution when ASP (Absolute Steering Position) calibration or EPS type recognition

- Check if the battery is fully charged before ASP calibration or EPS type recognition.
- Be careful not to disconnect any cables connected to the vehicle or scan tool during ASP calibration or EPS type

recognition.

- When the ASP calibration or EPS type recognition is completed, turn the ignition switch off and wait for several seconds, then start the engine to confirm normal operation of the vehicle.

Scan tool (Hi-Scan Pro) installation

1. Attach the CAN interface module to the Hi-Scan Pro main body and securely tighten the two bolts.
2. Install the CAN interface module to the Data Link Cable and securely tighten the two bolts.

ASP Calibration Using GDS

1. Select "Steering Angle Sensor".
2. Proceed with the test according to the screen introductions.



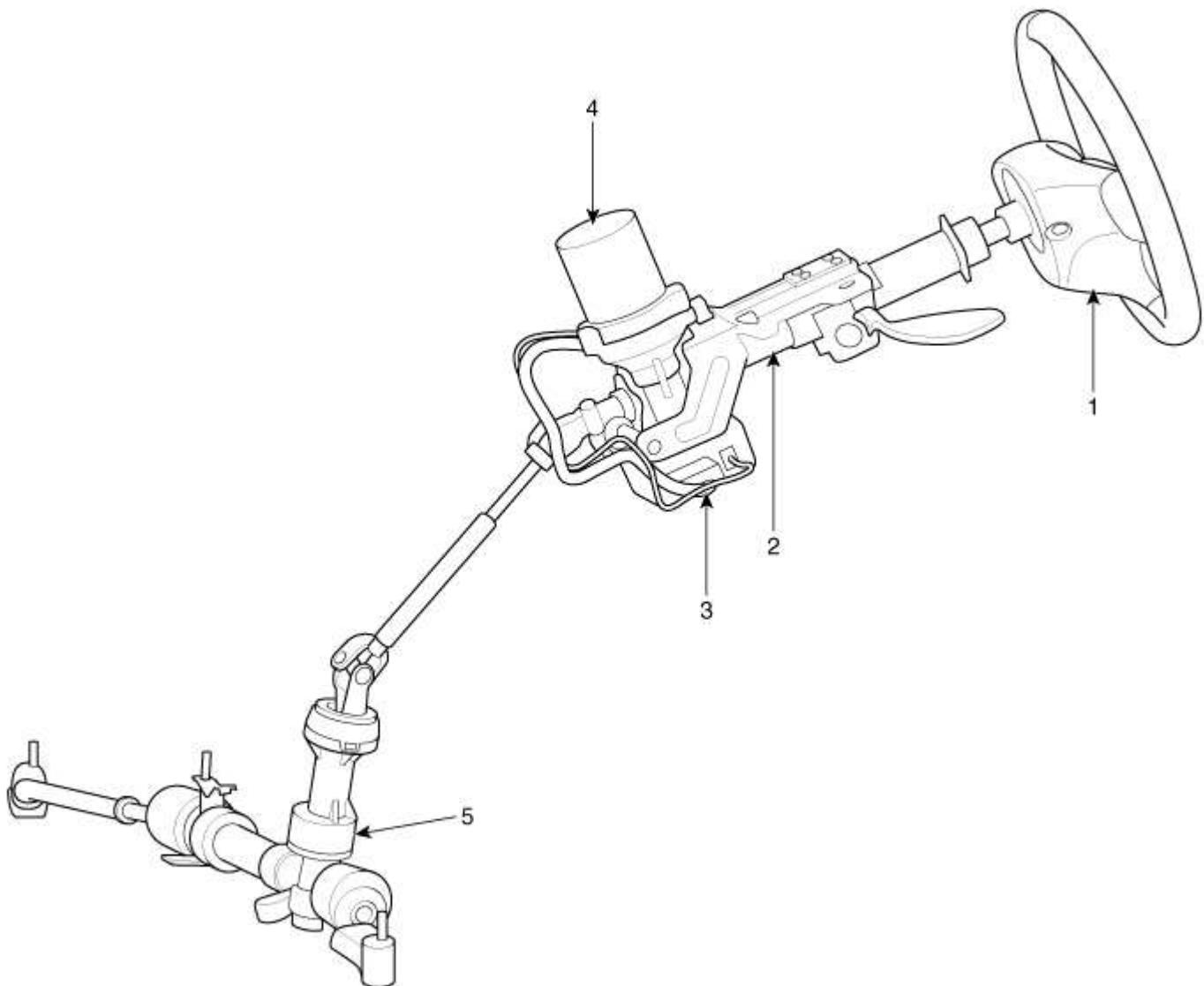
EPS Type Recognition Procedure

1. Select "EPS Variant Coding".
2. Proceed with the test according to the screen introductions.



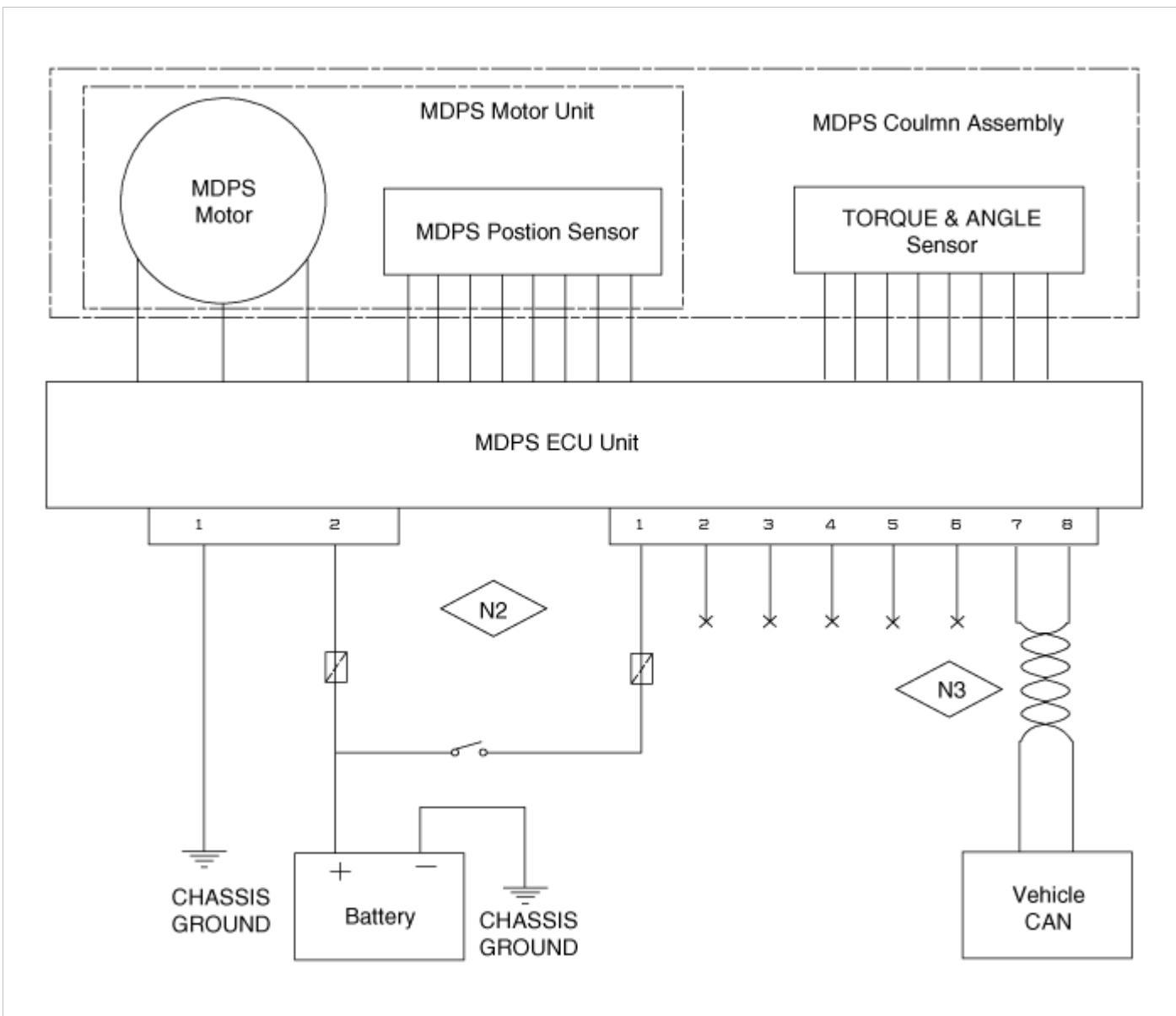
Steering System > Electric Power Steering > Components and Components Location

Components

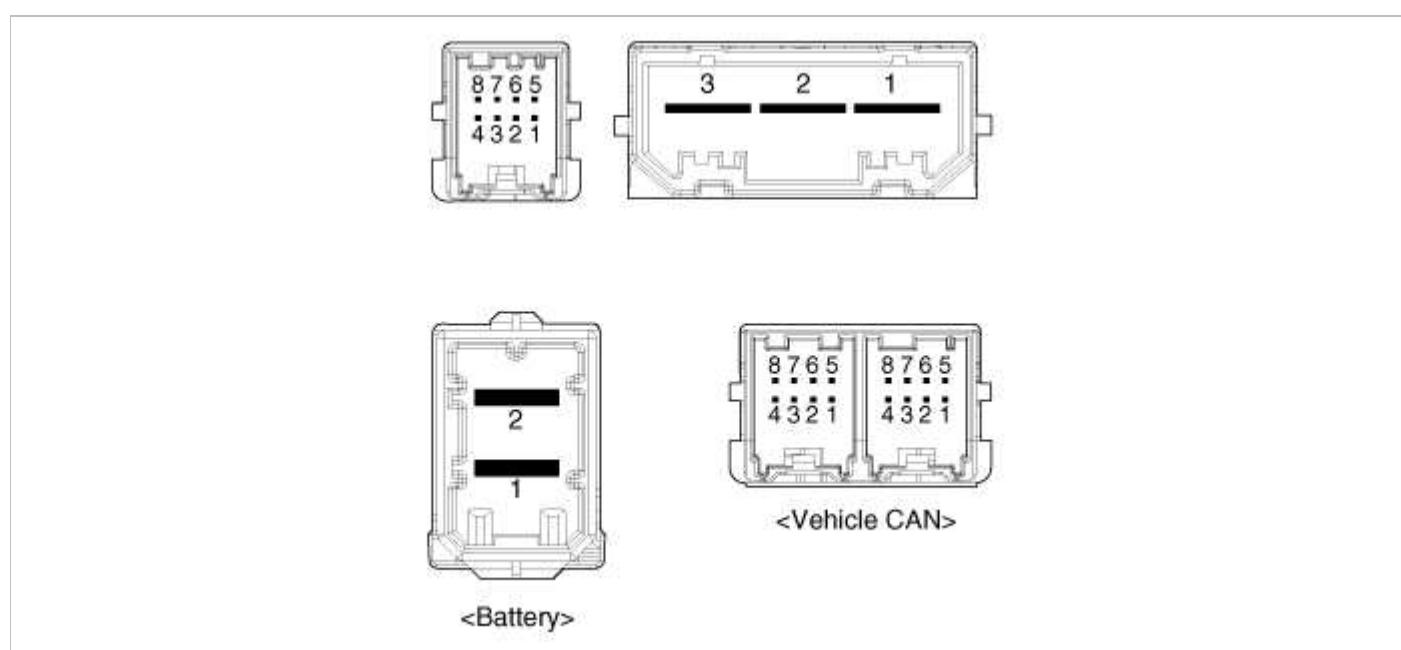


- | | |
|---|----------------------------------|
| 1. Steering wheel
2. Steering column
3. ECU | 4. Motor
5. Steering gear box |
|---|----------------------------------|

MDPS Circuit Diagram



Harness Connector



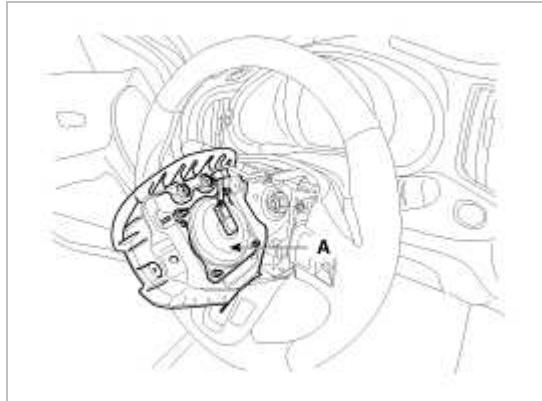
Type	Pin No	Description
Battery	1	Battery -
	2	Battery +
Vehicle	1	IGN
	2	-
	3	-
	4	-
	5	-
	6	-
	7	High_CAN
	8	Low_CAN

Steering System > Electric Power Steering > Steering Column and Shaft > Repair procedures

Replacement

1. Disconnect the battery negative cable from the battery and then wait for at least 30 seconds.
2. Turn the steering wheel so that the front wheels can face straight ahead.
3. Remove the airbag module (A).

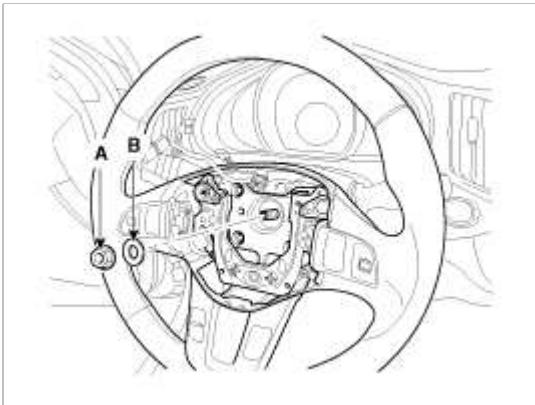
(Refer to "Airbag Module" in RT group)



4. Disconnect the locknut (A) & washer (B) and then remove the steering wheel from the steering column shaft.

Tightening torque :

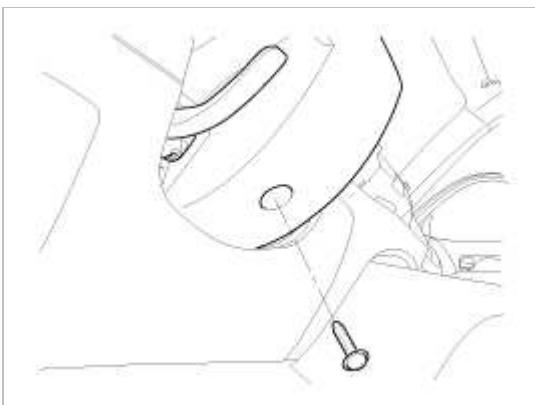
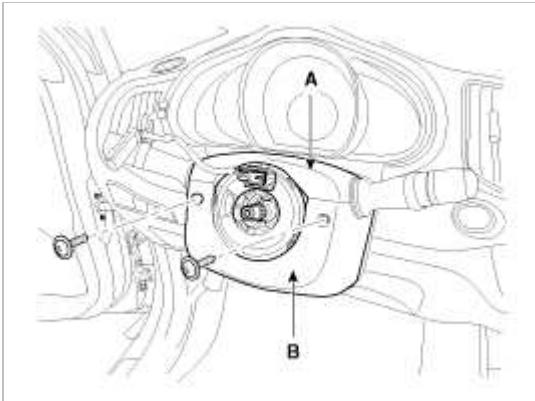
39.2 ~ 49.0N.m (4.0 ~ 5.0kgf.m, 28.9 ~ 36.2lb-ft)



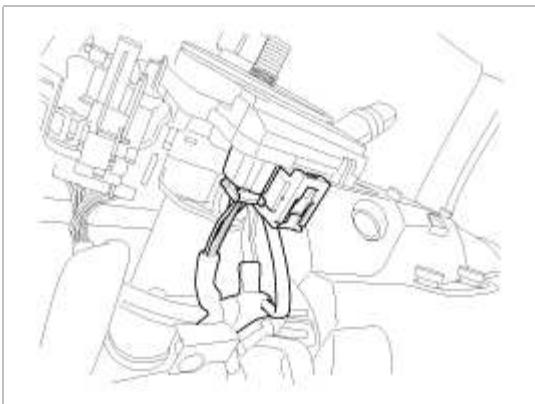
CAUTION

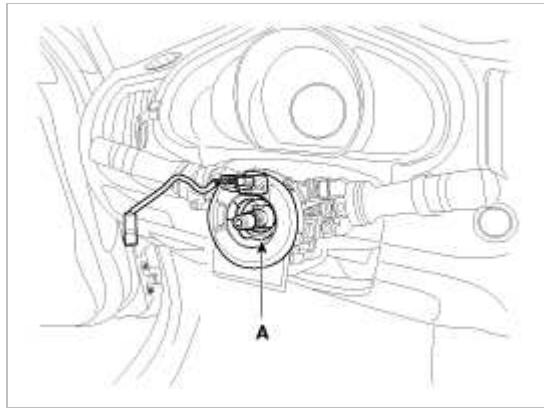
Do not hammer on the steering wheel to remove it may damage the steering column.

5. Remove the steering column upper (A) and lower (B) shroud.

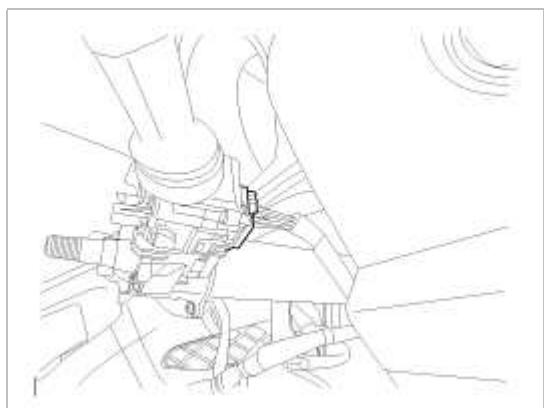
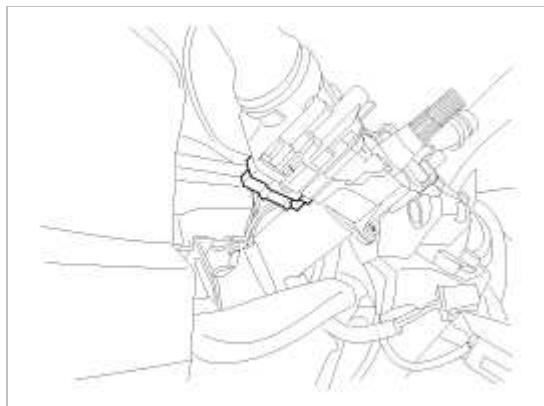
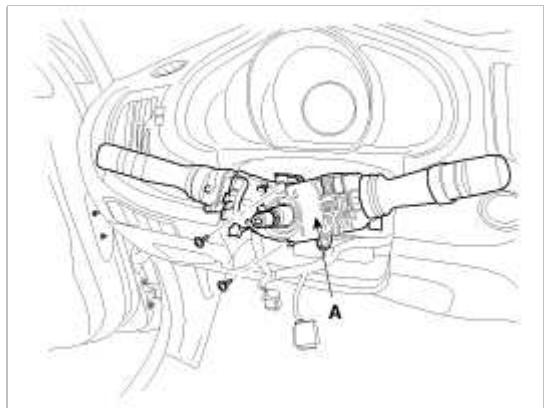


6. Remove the clock spring (A).

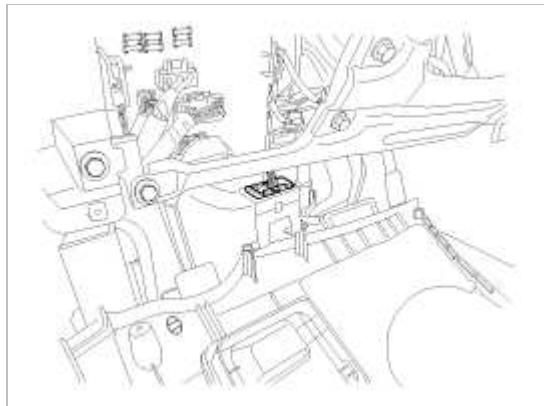
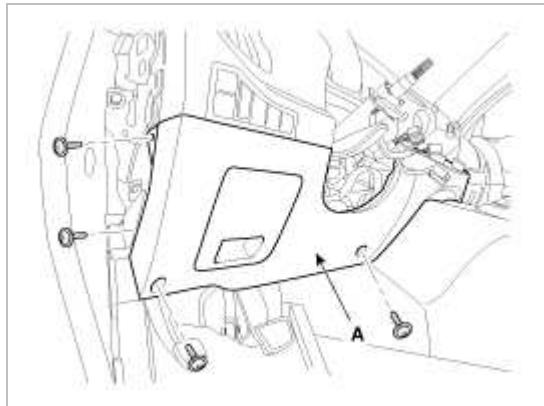
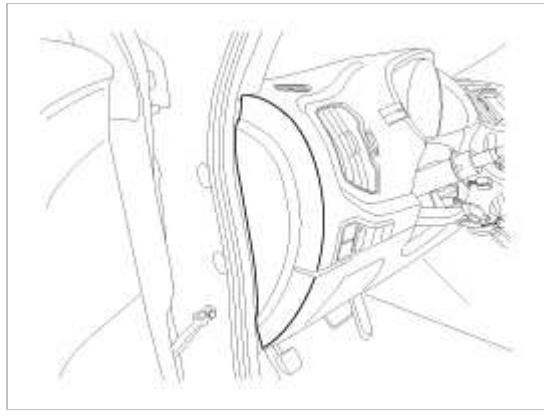




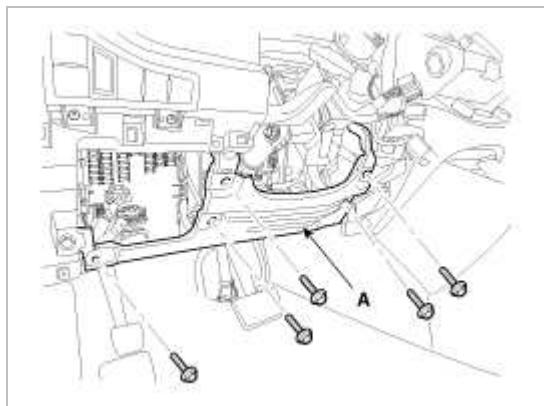
7. Remove the multifunction switches (A).



8. Remove the crash lower panel (A).



9. Loosen the bolt & nut and then remove the panel (A).

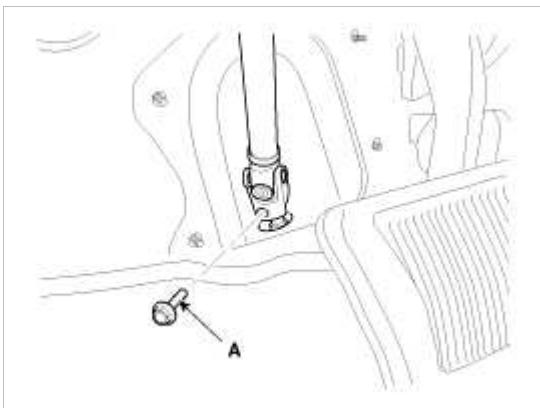


10. Remove the dust cover.

11. Loosen the bolt (A) and then disconnect the universal joint assembly from the pinion of the steering gear box.

Tightening torque :

32.4 ~ 37.3N.m (3.3 ~ 3.8kgf.m, 23.9 ~ 27.5lb-ft)



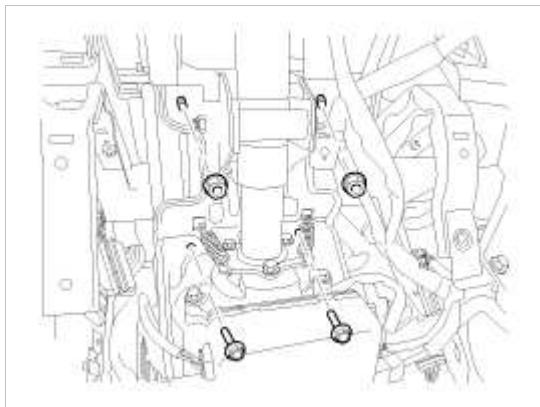
CAUTION

- Do not use the bolt again.

12. Disconnect all connectors connected the steering column.
13. Remove the steering column by loosening the mounting bolts and nuts..

Tightening torque :

12.7 ~ 17.7N.m (1.3 ~ 1.8kgf.m, 9.4 ~ 13.0lb-ft)

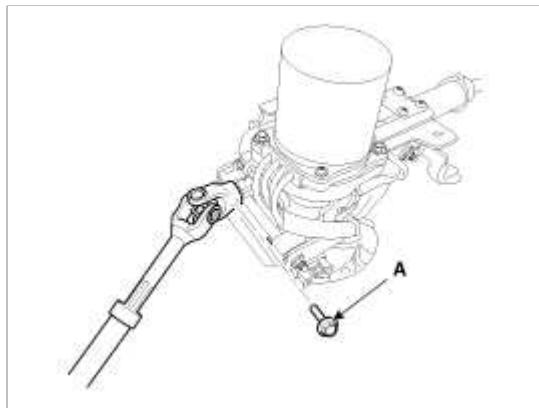


14. Installation is the reverse of the removal.

Disassembly

Universal joint assembly

1. Loosen the bolt (A) and then disconnect the universal joint assembly from the steering column assembly.



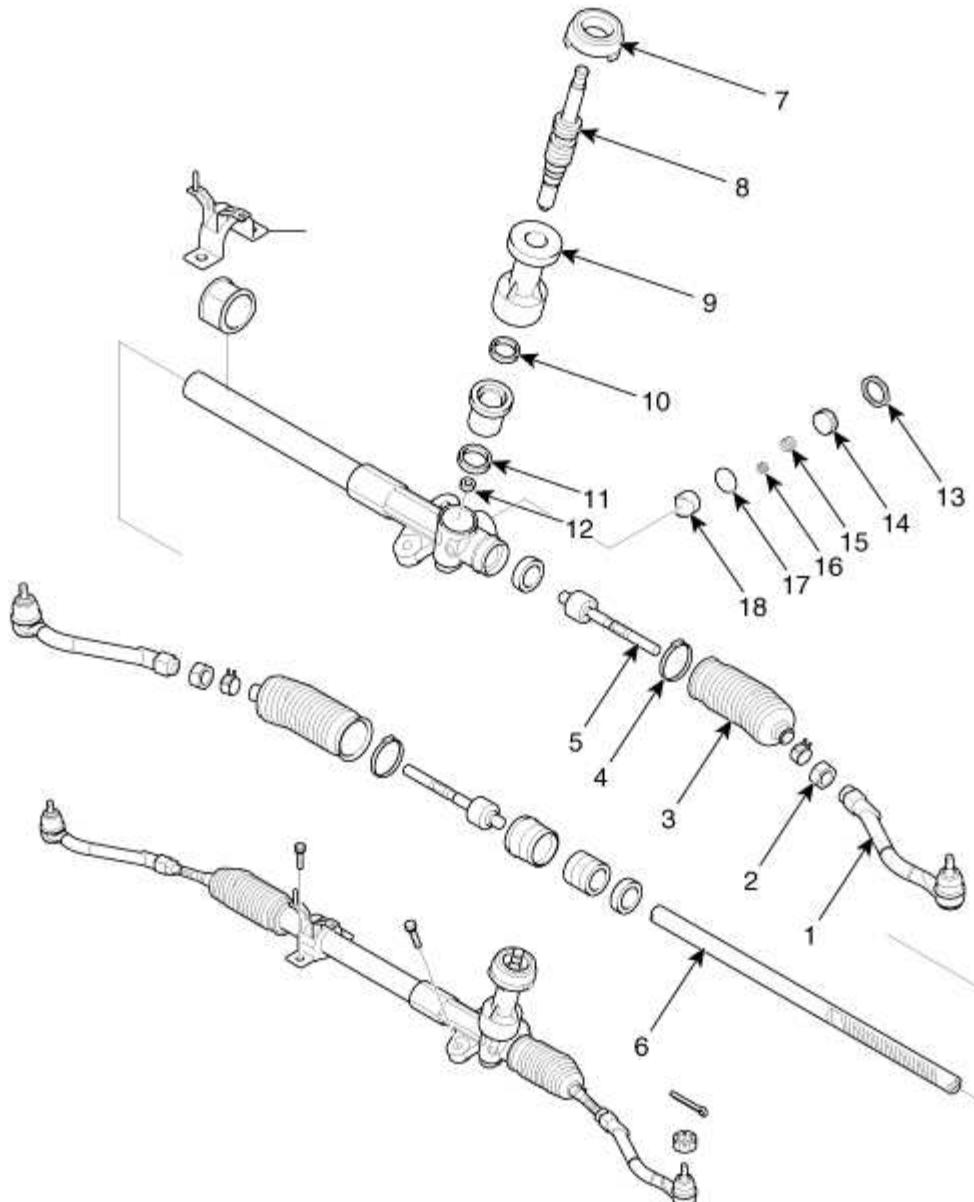
2. Reassembly is the reverse of the disassembly.

Inspection

1. Check the steering column for damage and deformation.
2. Check the join bearing for damage and wear.
3. Check the tilt bracket for damage and cracks.
4. 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
2. Lock nut
3. Bellows

7. Dust packing
8. Pinion assembly
9. Dust cap

13. Lock nut
14. Yoke plug
15. Yoke spring

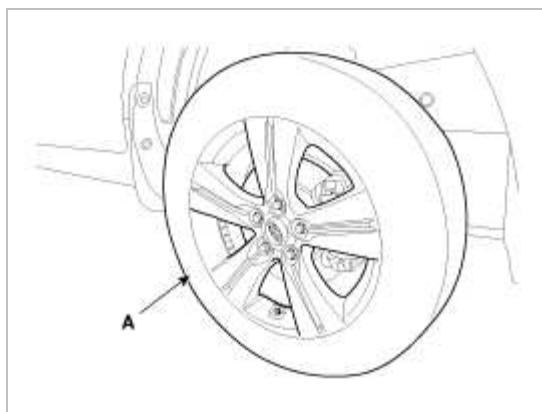
- | | | |
|-----------------|--------------------|---------------------------|
| 4. Bellows band | 10. Oil seal | 16. O-ring |
| 5. Tie rod | 11. Ball bearing | 17. Spring |
| 6. Rack bar | 12. Needle bearing | 18. Support yoke assembly |

Steering System > Electric Power Steering > Steering Gear box > Repair procedures

Replacement

1. Remove the front wheel & tire.

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

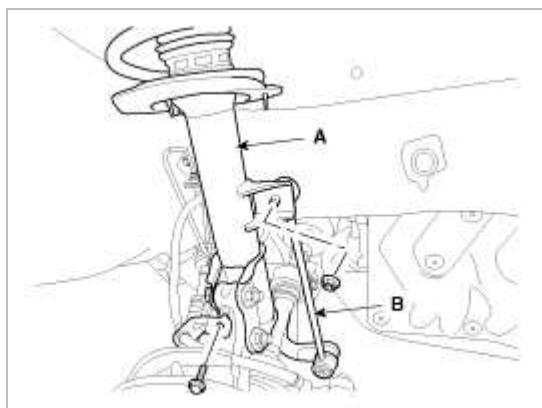


CAUTION

Be careful not to damage to the hub bolts when removing the front wheel & tire (A).

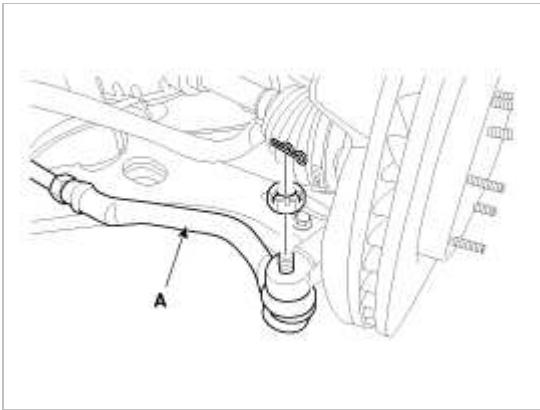
2. Disconnect the stabilizer link (B) with the front strut assembly (A) after loosening the nut.

Tightening torque :
98.1 ~ 117.7N.m (10.0 ~ 12.0kgf.m, 72.3 ~ 86.8lb-ft)



3. Remove the split pin and castle nut and then disconnect the tie-rod end (A) from the front knuckle.

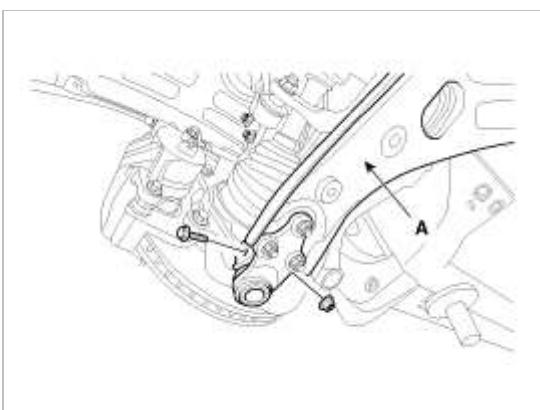
Tightening torque :
23.5 ~ 33.3N.m(2.4 ~ 3.4kgf.m, 17.4 ~ 24.6lb-ft)



4. Loosen the bolt & nut and then remove the lower arm (A).

Tightening torque :

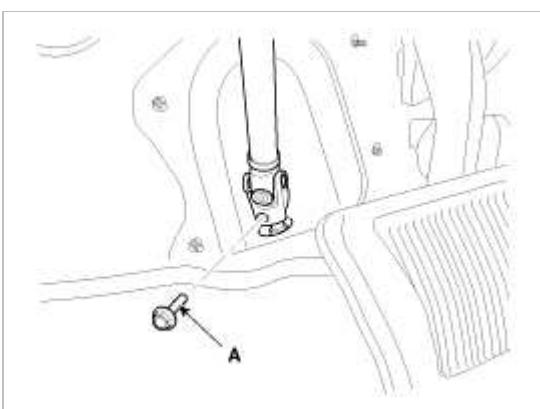
98.1 ~ 117.7N.m (10.0 ~ 12.0kgf.m, 72.3 ~ 86.8lb-ft)



5. Remove the dust cover.
6. Loosen the bolt (A) and then disconnect the universal joint assembly from the pinion of the steering gear box.

Tightening torque :

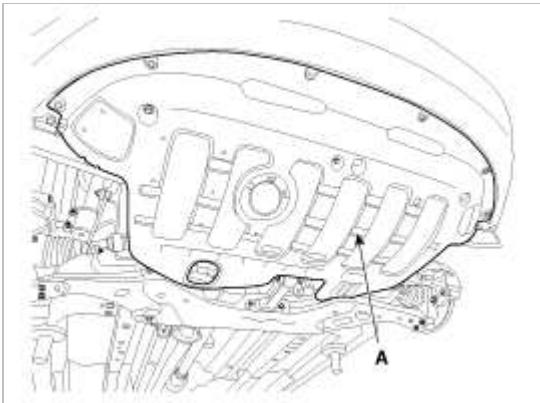
32.4 ~ 37.3N.m (3.3 ~ 3.8kgf.m, 23.9 ~ 27.5lb-ft)



CAUTION

- Keep the neutral-range to prevent the damage of the clock spring inner cable when you handle the steering wheel.
- Do not use the bolt again.

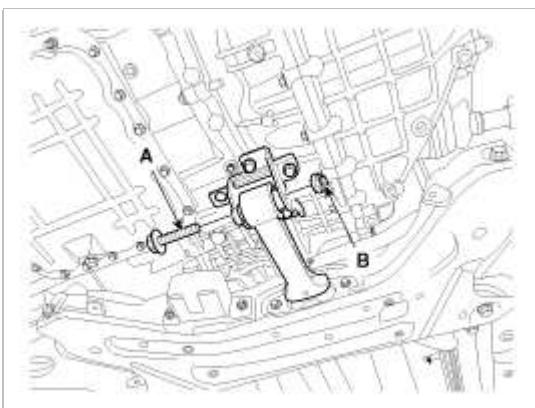
7. Remove the under cover (A).



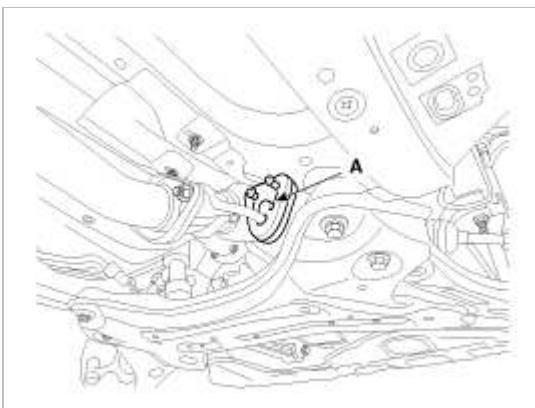
8. Loosen the bolt (A) & nut (B) and then remove the roll rod stopper.

Tightening torque :

107.9 ~ 127.5N.m (11.0 ~ 13.0kgf.m, 79.6 ~ 94.0lb-ft)



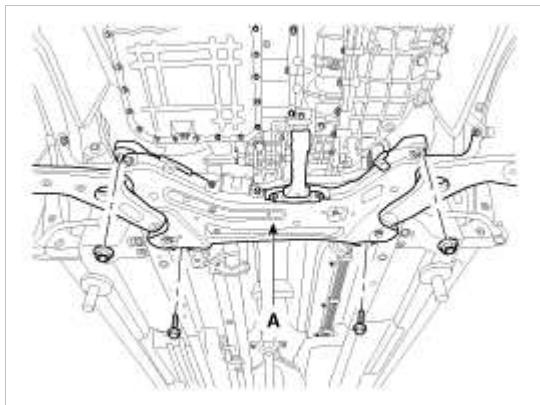
9. Disconnect the muffler rubber hanger (A).



10. Loosen the bolts & nuts and then remove the sub frame.

Tightening torque :

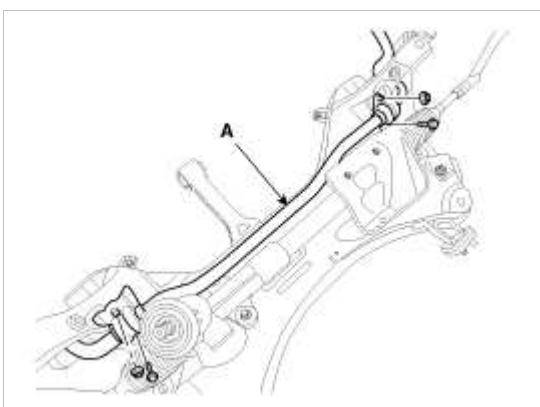
176.5 ~ 196.1N.m (18.0 ~ 20.0kgf.m, 130.2 ~ 144.7lb-ft)



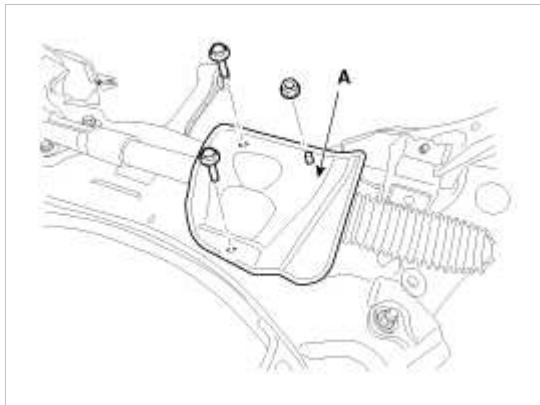
11. Loosen the bolt and then remove the stabilizer (A).

Tightening torque :

44.1 ~ 53.9N.m (4.5 ~ 5.5kgf.m, 32.5 ~ 39.8lb-ft)



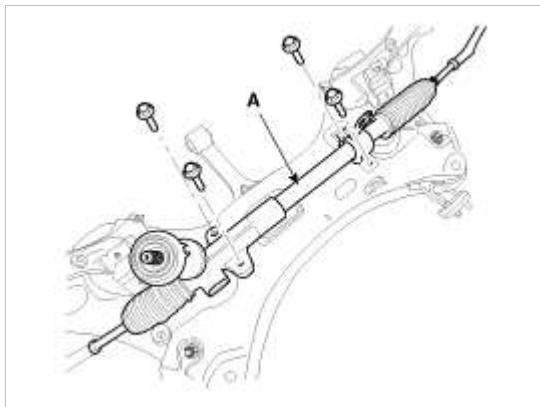
12. Loosen the bolt & nut and then remove the protector (A).



13. Loosen the bolt and then remove the steering gear box (A).

Tightening torque :

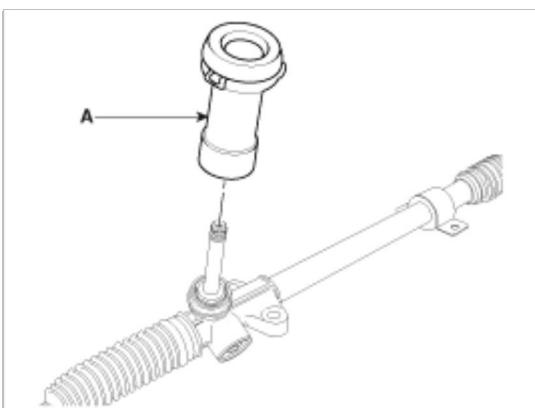
58.8 ~ 78.5N.m (6.0 ~ 8.0kgf.m, 43.4 ~ 57.9lb-ft)



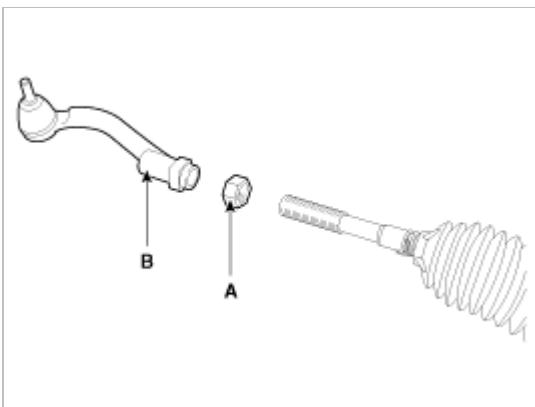
14. Installation is the reverse of the removal.

Disassembly

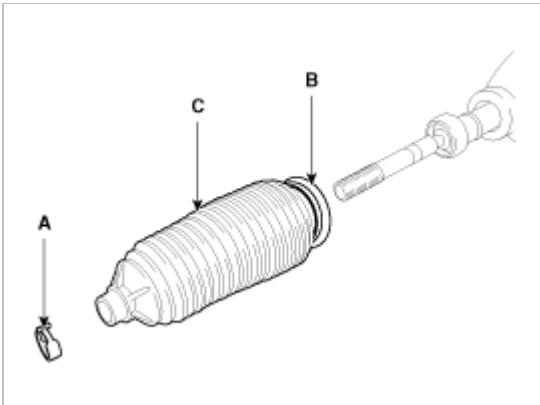
1. Remove the dust packing & cap (A) from the pinion housing.



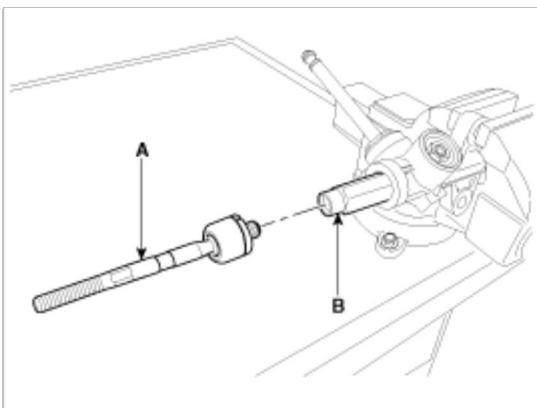
2. Loosen the lock nut and then remove the tie rod end (B) and lock nut (A) from the tie rod.



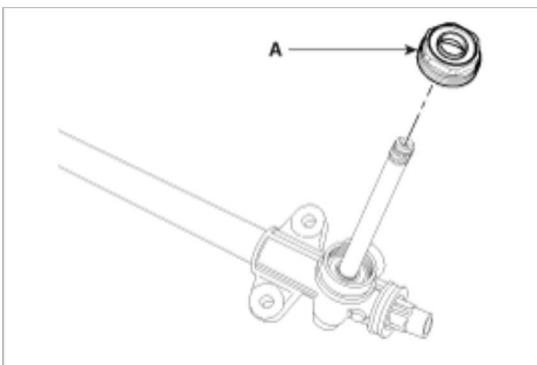
3. Remove the bellows clip (A) and band (B) and then pull the bellows (C) away from the end of the tie rod.



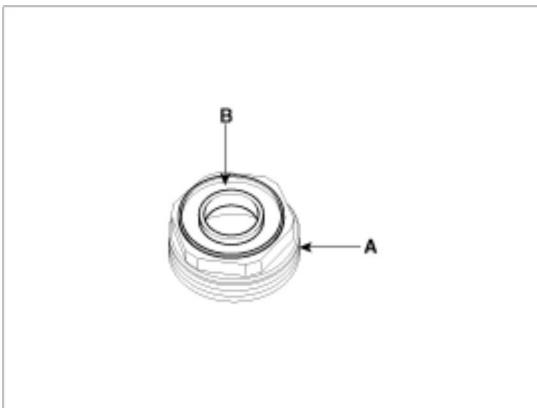
4. Remove the tie rod (B) from the rack bar (A) by unscrewing the tie rod inner ball joint.



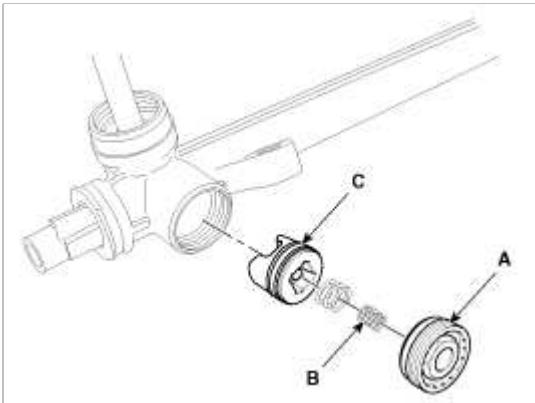
5. Remove the plug (A) from the pinion housing.



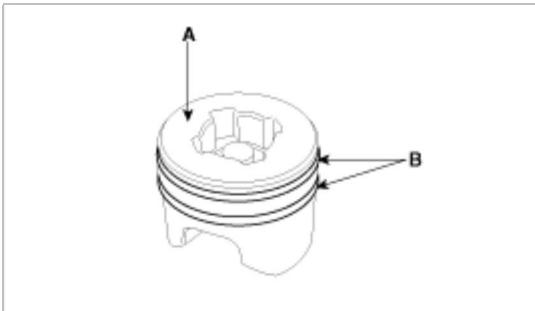
6. Remove the oil seal (B) from the plug (A).



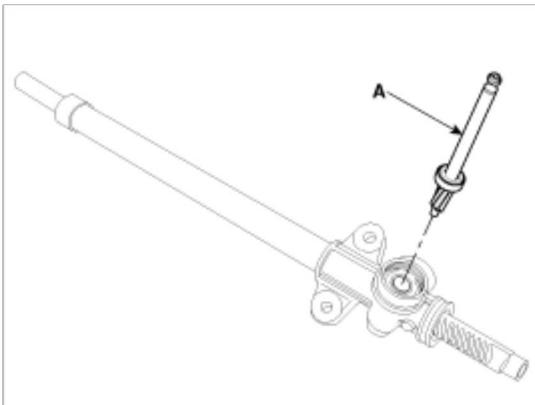
7. Remove the yoke plug (A) and spring (B) and then pull out the support yoke (C).



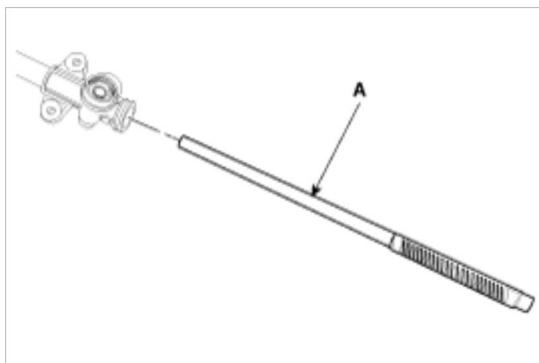
8. Remove the O-ring (B) from the support yoke assembly (A).



9. Pull the pinion assembly (A) out of the pinion housing.



10. Pull the rack bar (A) out of the rack housing.



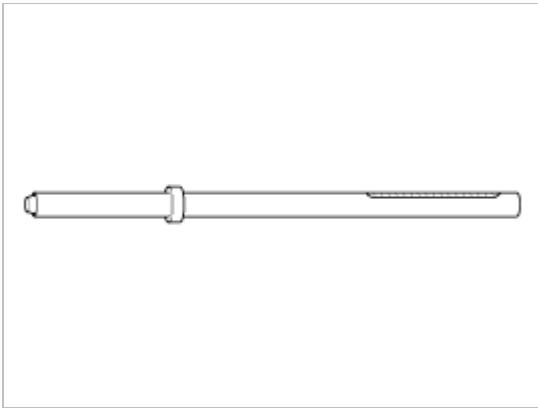
11. Reassembly is the reverse of the disassembly.

Inspection

1. Rack bar

A. Check the rack gear for damage.

B. Check the rack bar for bend and deformation.



2. Pinion assembly

- A. Check the pinion gear for damage
- B. Check the oil seal for damage.



3. Check the inside of rack housing for damage.

4. Check the bellows for being torn.



SPORTAGE(SL) > 2012 > G 2.4 DOHC > Suspension System**Suspension System > General Information > Specifications****Specifications****Front Suspension**

Item		Specification
Suspension type		Macpherson Strut
Shock absorber	Type	Gas
		H.P.D (High Performance Damper)
Coil spring	Free Height [I.D. color]	318.1 mm (Green - Green)
		312.8 mm (Yellow - Yellow)

Rear Suspension

Item		Specification
Suspension type		Multi link
Shock absorber	Type	Gas
		H.P.D (High Performance Damper)
Coil spring	Free Height [I.D. color]	330.1 mm (Pink - Yellow)
		317.4 mm (Pink - Orange)

Wheel & Tire

Item		Specification
Wheel	Aluminum	6.5J * 16
		6.5J * 17
		7.0J * 18
Tire		215/70 R16
		225/60 R17
		235/55 R18
Tire pressure	215/70 R16	2.3+0.07kg/cm ² (33+1.0psi)
	225/60 R17	
	235/55 R18	
	T155/90 D16	4.2+0.07kg/cm ² (60+1.0psi)

Wheel Alignment

Item		Specification	
		Front	Rear
Toe-in	Individual	0°±0.1°	0.1°±0.1°
	Total	0°±0.2°	0.2°±0.2°
Camber angle		-0.5°±0.5°	-1.0°±0.5°
Caster angle		4.02°±0.5°	-

King-pin angle	12.91°±0.5°	-
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Tightening torque

Front Suspension

Item	Tightening torque (kgf.m)		
	Nm	kgf.m	lb·ft
Wheel nut	88.3 ~ 107.9	9.0 ~ 11.0	65.1 ~ 79.6
Strut assembly to knuckle	137.3 ~ 156.9	14.0 ~ 16.0	101.3 ~ 115.7
Strut assembly lock nut	44.1 ~ 58.8	4.5 ~ 6.0	32.5 ~ 43.4
Stabilizer link to strut assembly	98.1 ~ 117.7	10.0 ~ 12.0	72.3 ~ 86.8
Lower arm to sub frame (Front)	117.7 ~ 137.3	12.0 ~ 14.0	86.8 ~ 101.3
Lower arm to sub frame (Rear)	137.3 ~ 156.9	14.0 ~ 16.0	101.3 ~ 115.7
Lower arm to knuckle	98.1 ~ 117.7	10.0 ~ 12.0	72.3 ~ 86.8
Stabilizer bar to stabilizer link	98.1 ~ 117.7	10.0 ~ 12.0	72.3 ~ 86.8
Stabilizer bracket mounting bolts	44.1 ~ 53.9	4.5 ~ 5.5	32.5 ~ 39.8
Sub frame mounting bolts	176.5 ~ 196.1	18.0 ~ 20.0	130.2 ~ 144.7
Sub frame bracket mounting bolts	44.1 ~ 58.8	4.5 ~ 6.0	32.5 ~ 43.4
Tie rod end castle nut	34.3 ~ 44.1	3.5 ~ 4.5	25.3 ~ 32.5
Universal joint to pinion of steering gear	29.4 ~ 34.3	3.0 ~ 3.5	21.7 ~ 25.3
Roll rod mounting bolt & nut	107.9 ~ 127.5	11.0 ~ 13.0	79.6 ~ 94.0

Rear Suspension

Item	Tightening torque (kgf.m)		
	Nm	kgf.m	lb·ft
Hub nuts	88.3 ~ 107.9	9.0 ~ 11.0	65.1 ~ 79.6
Trailing arm to body	98.1 ~ 117.7	10.0 ~ 12.0	72.3 ~ 86.8
Trailing arm to knuckle	34.3 ~ 53.9	3.5 ~ 5.5	25.3 ~ 39.8
Assist arm to sub frame	107.9 ~ 117.7	11.0 ~ 12.0	79.6 ~ 86.8
Assist arm to knuckle	2WD	44.1 ~ 53.9	4.5 ~ 5.5
	4WD	137.3 ~ 156.9	14.0 ~ 16.0
Lower arm to sub frame	337.3 ~ 156.9	14.0 ~ 16.0	101.3 ~ 115.7
Lower arm to knuckle	137.3 ~ 156.9	14.0 ~ 16.0	101.3 ~ 115.7
Upper arm to sub frame	2WD	137.3 ~ 156.9	14.0 ~ 16.0
	4WD	98.1 ~ 117.7	10.0 ~ 12.0
Upper arm to knuckle	2WD	137.3 ~ 156.9	14.0 ~ 16.0
	4WD	98.1 ~ 117.7	10.0 ~ 12.0
Shock absorber to frame	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0
Shock absorber to knuckle	137.3 ~ 156.9	14.0 ~ 16.0	101.3 ~ 115.7
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

Sub frame mounting bolt & nut	156.9 ~ 176.5	16.0 ~ 18.0	115.7 ~ 130.2
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Suspension System > General Information > Special Service Tools

Special Service Tools

Tool (Number and Name)	Illustration	Use
09546-26000 Strut spring compressor		Compression of coil spring
09624-38000 Crossmember supporter		Supporting of the crossmember

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	Correct Replace Replace

	Bent lower arm	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

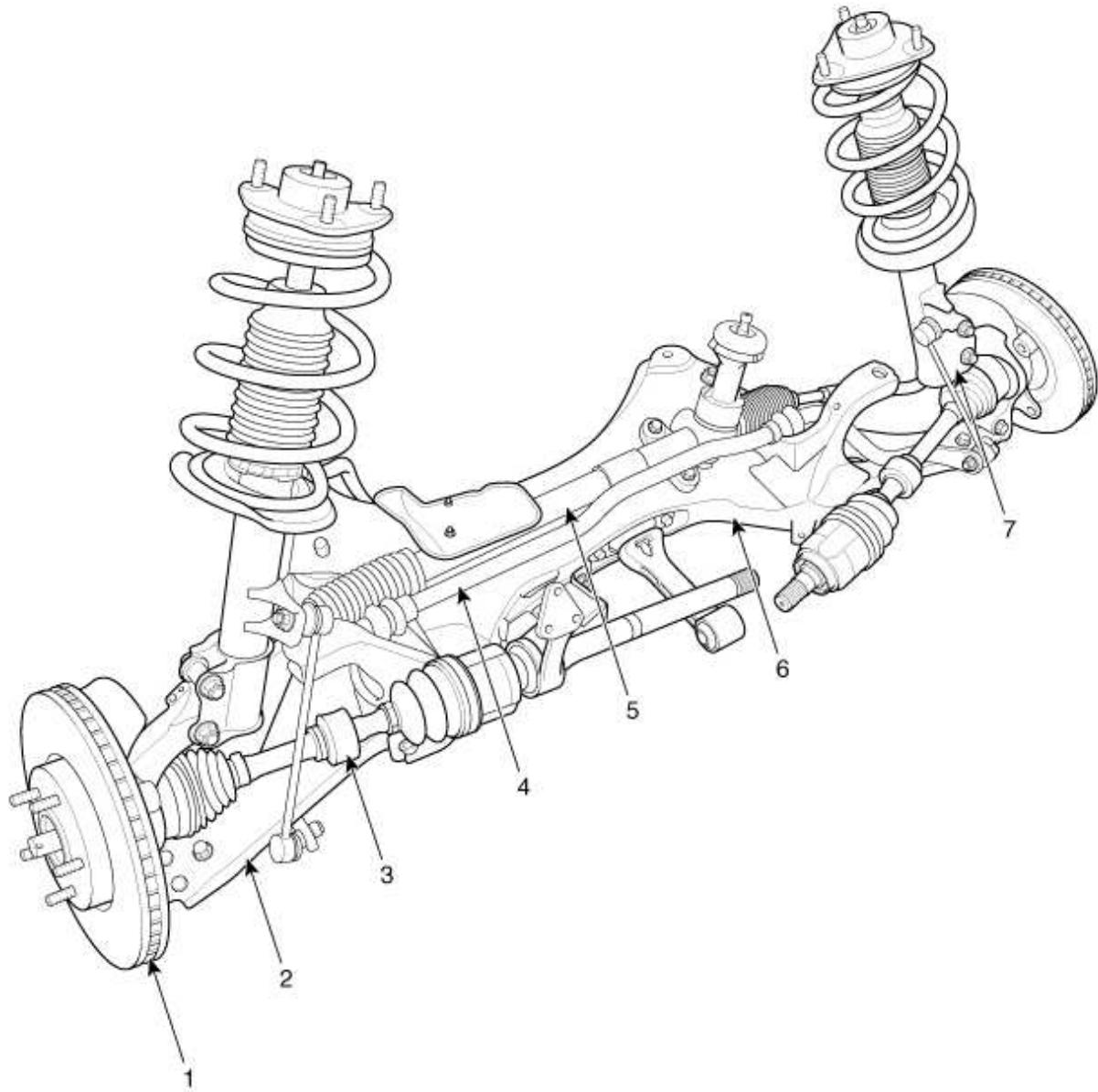
Wheel /tire noise, vibration and harshness concerns are directly related to vehicle speed and are not generally affected by acceleration, coasting or decelerating. Also, out-of-balance wheel and tires can vibrate at more than one speed. A vibration that is affected by the engine rpm, or is eliminated 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
<ul style="list-style-type: none"> Center-tread down to fabric due to excessive over inflated tires Lack of rotation Excessive toe on drive wheels Heavy acceleration on drive 	<ul style="list-style-type: none"> Under-inflated tires Worn suspension components Excessive cornering speeds Lack of rotation 	<ul style="list-style-type: none"> Toe adjustment out of specification Camber out of specification Damaged strut Damaged lower arm
Partial wear	Feathered edge	Wear pattern
<ul style="list-style-type: none"> Caused by irregular burrs on brake drums 	<ul style="list-style-type: none"> Toe adjustment out of specification Damaged or worn tie rods Damaged knuckle 	<ul style="list-style-type: none"> Excessive toe on non-drive wheels Lack of rotation

Suspension System > Front Suspension System > Components and Components Location

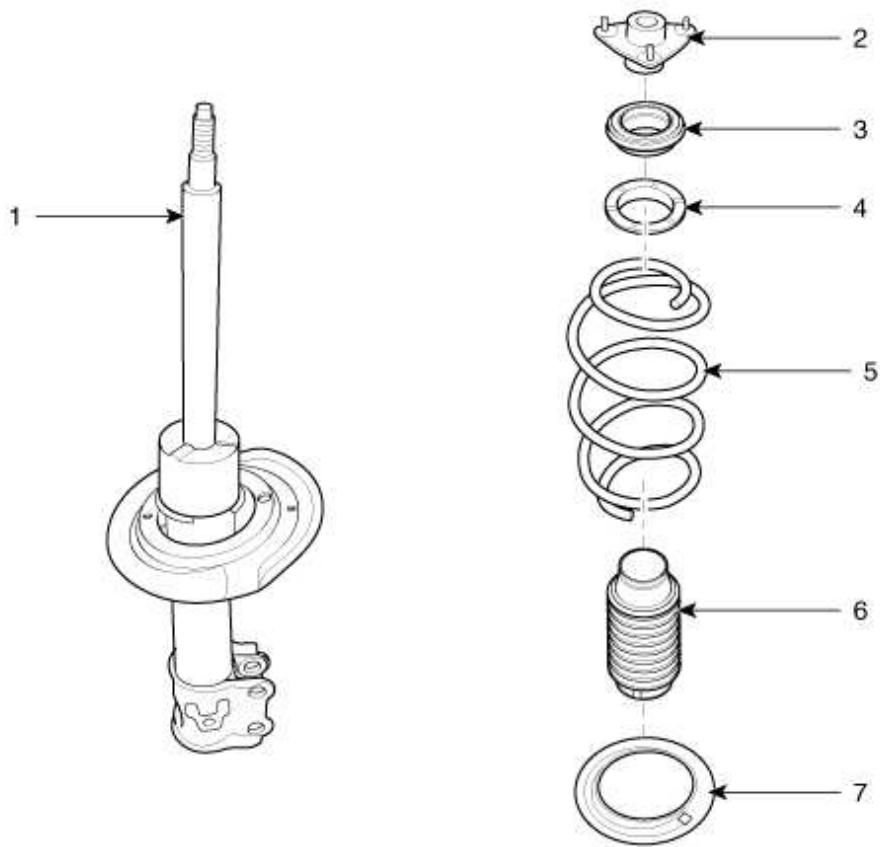
Components Location



- | | |
|--|--|
| 1. Front axle
2. Front lower arm
3. Drive shaft
4. Stabilizer bar | 5. Steering gearbox
6. Sub frame
7. Front strut assembly |
|--|--|

Suspension System > Front Suspension System > Front Strut Assembly > Components and Components Location

Components



- 1. Strut assembly
- 2. Insulator
- 3. Bearing
- 4. Spring upper pad

- 5. Spring
- 6. Dust cover
- 7. Spring lower pad

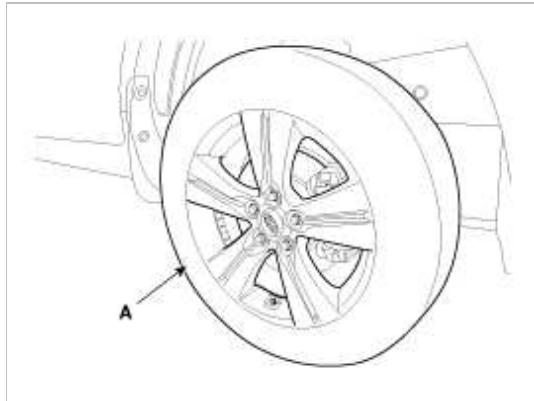
Suspension System > Front Suspension System > Front Strut Assembly > Repair procedures

Replacement

1. Remove the front wheel & tire.

Tightening torque :

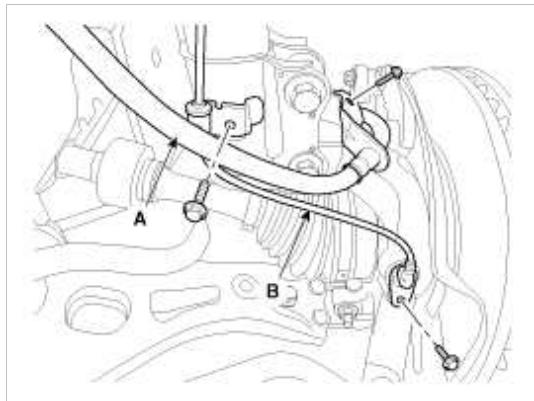
88.3 ~ 107.9N.m (9.0 ~ 11.0kgf.m, 65.1 ~ 79.6lb-ft)



CAUTION

Be careful not to damage to the hub bolts when removing the front wheel & tire (A).

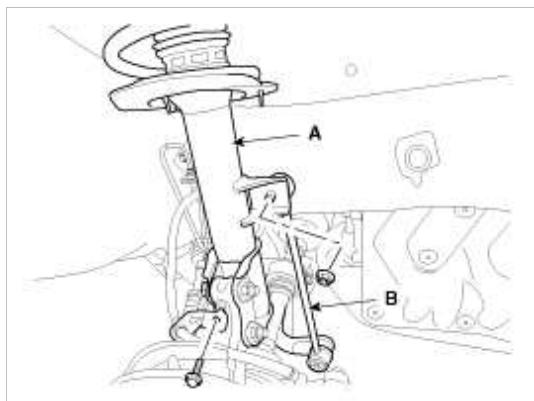
2. Remove the brake hose (A) & wheel speed sensor bracket (B) from the front strut assembly by loosening mounting bolts.



3. Disconnect the stabilizer link (B) from the front strut assembly (A) after loosening the nut.

Tightening torque :

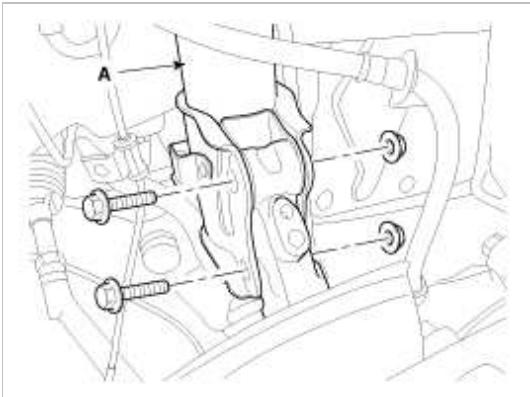
98.1 ~ 117.7N.m (10.0 ~ 12.0kgf.m, 72.3 ~ 86.8lb-ft)



4. Disconnect the front strut assembly (A) with the knuckle by loosening the bolt & nut.

Tightening torque :

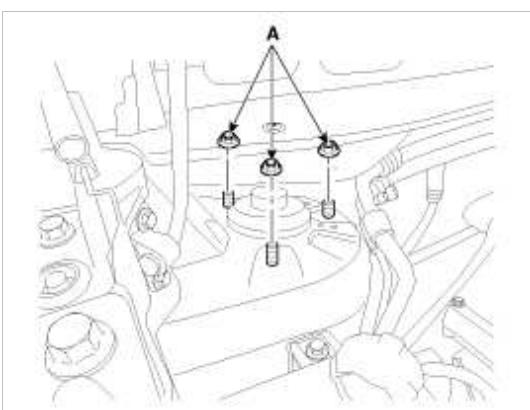
137.3 ~ 156.9N.m (14.0 ~ 16.0kgf.m, 101.3 ~ 115.7lb-ft)



5. Remove the front strut assembly and then loosen the strut mounting nuts (A).

Tightening torque :

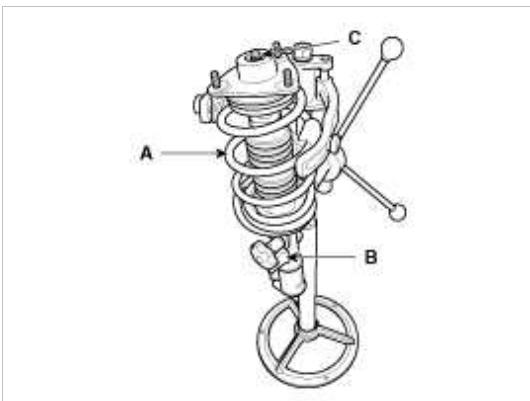
44.1 ~ 58.8N.m (4.5 ~ 6.0kgf.m, 32.5 ~ 43.4lb·ft)



6. Installation is the reverse of removal.

Disassembly

1. Using the special tool (09546-26000), compress the coil spring (A).

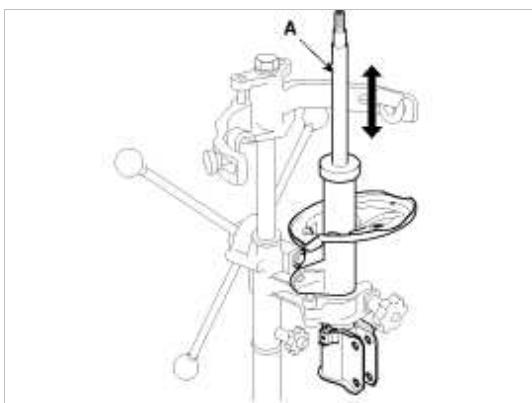


2. Remove the self-locking nut (C) from the strut assembly (B).
3. Remove the insulator, spring seat, coil spring and dust cover from the strut assembly.
4. Reassembly is the reverse of the disassembly.

Inspection

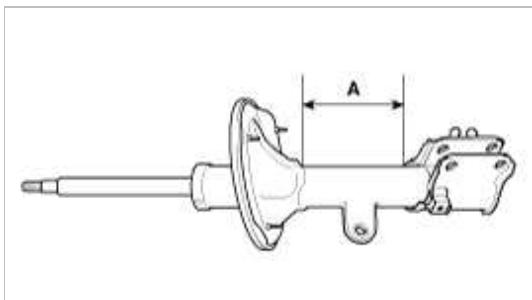
1. Check the strut bearing for wear and damage.

2. Check the spring upper and lower seat for damage and deterioration.
3. Compress and extend the piston rod (A) and check that there is no abnormal resistance or unusual sound during operation.



Disposal

1. Fully extend the piston rod.
2. Drill a hole on the A section to remove gas from the cylinder.



CAUTION

The gas coming out is harmless, but be careful of chips that may fly when drilling.
Be sure to wear safety goggles or eye protection when performing this task.

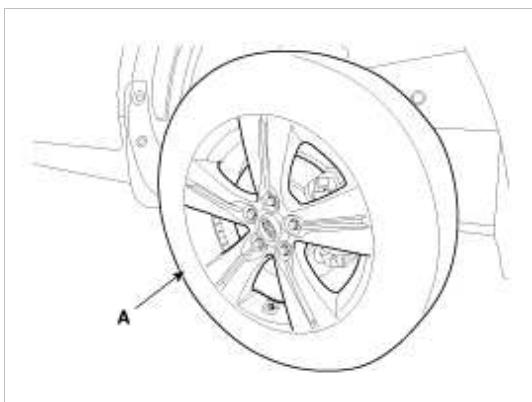
Suspension System > Front Suspension System > Front Lower Arm > Repair procedures

Replacement

1. Remove the front wheel & tire.

Tightening torque :

88.3 ~ 07.9N.m (9.0 ~ 11.0kgf.m, 65.1 ~ 79.6lb-ft)



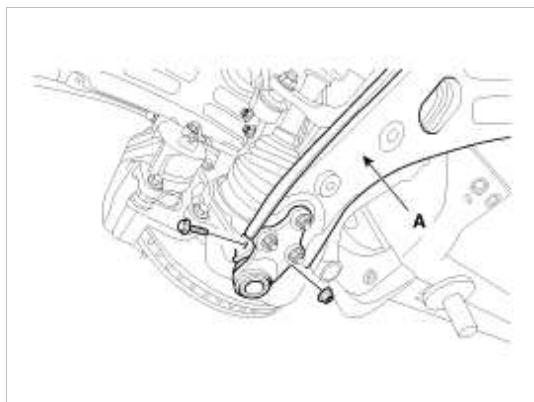
CAUTION

Be careful not to damage to the hub bolts when removing the front wheel & tire (A).

2. Loosen the bolt & nut and then remove the lower arm (A).

Tightening torque :

98.1 ~ 117.7N.m (10.0 ~ 12.0kgf.m, 72.3 ~ 86.8lb-ft)



3. Remove the front lower arm (A) and then loosen the bolts & nuts.

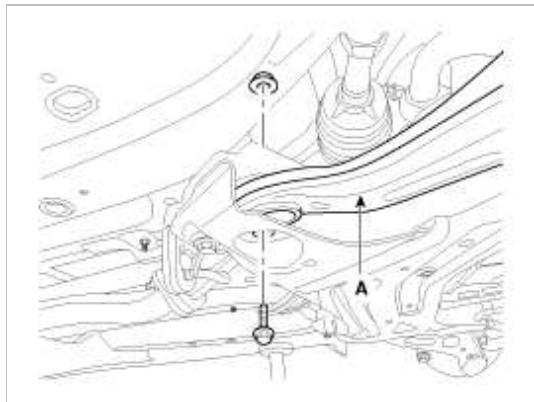
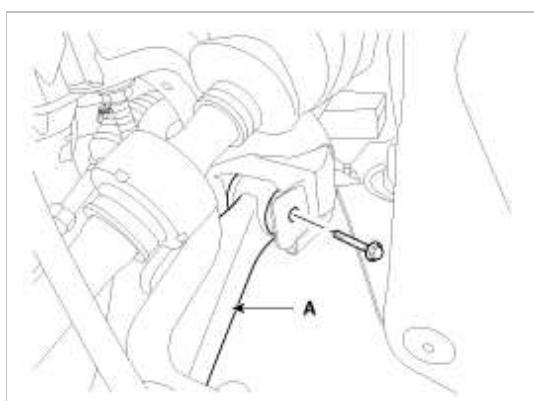
Tightening torque :

Front

117.7 ~ 137.3N.m (12.0 ~ 14.0kgf.m, 86.8 ~ 101.3lb-ft)

Rear

137.3 ~ 156.9N.m (14.0 ~ 16.0kgf.m, 101.3 ~ 115.7lb-ft)



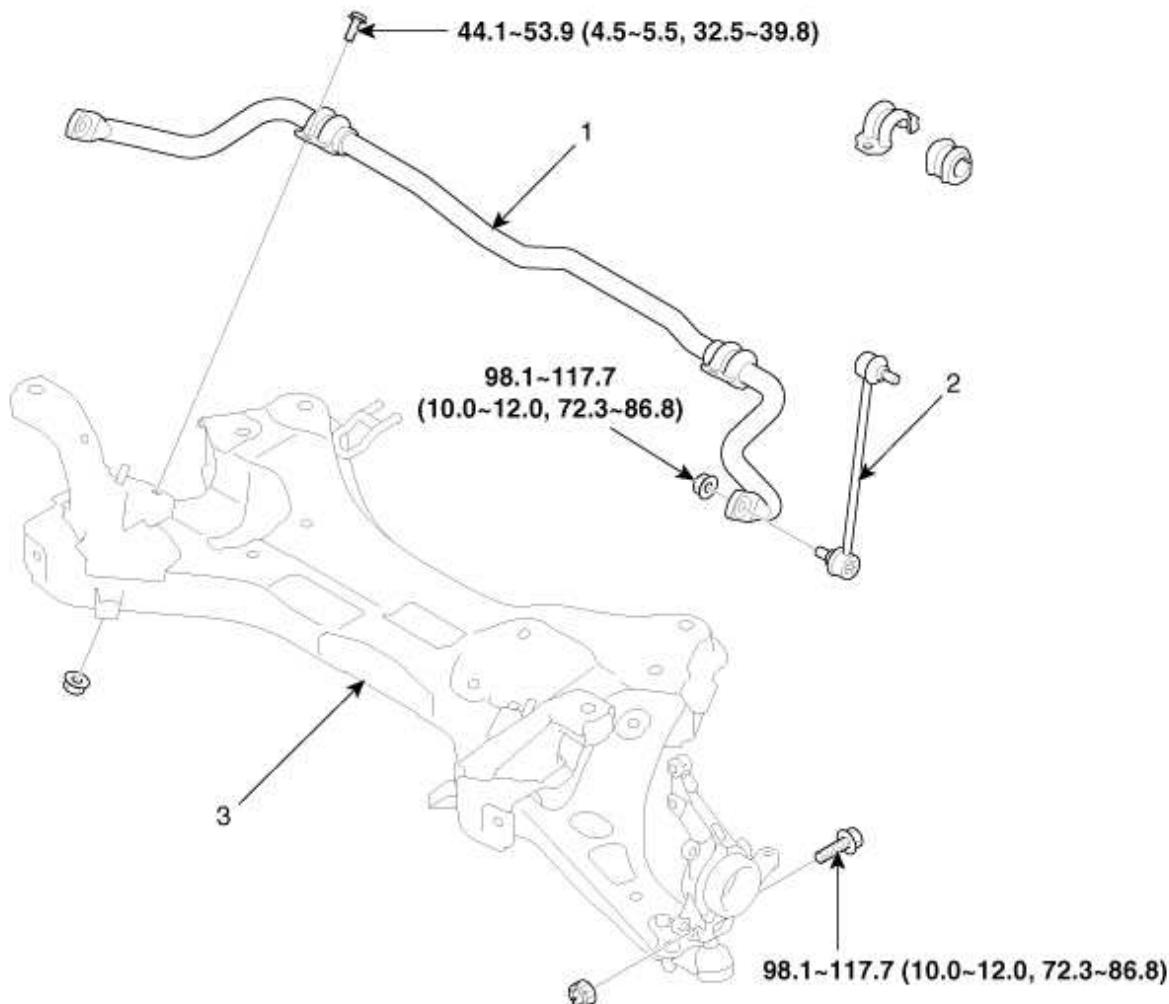
4. Installation is the reverse of removal.

Inspection

1. Check the bushing for wear and deterioration.
2. Check the lower arm for bending or breakage.
3. Check the lower arm for deformation.
4. Check the all bolts and nuts.

Suspension System > Front Suspension System > Front Stabilizer Bar > Components and Components Location

Components



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

- | | |
|--------------------|--------------|
| 1. Stabilizer bar | 3. Sub frame |
| 2. Stabilizer link | |

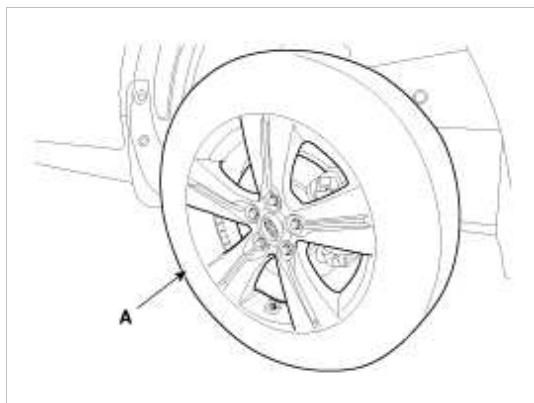
Suspension System > Front Suspension System > Front Stabilizer Bar > Repair procedures

Replacement

1. Remove the front wheel & tire.

Tightening torque :

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



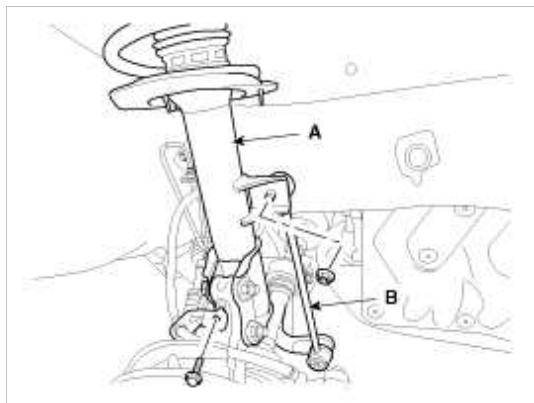
CAUTION

Be careful not to damage to the hub bolts when removing the front wheel & tire (A).

2. Disconnect the stabilizer link (B) from the front strut assembly (A) after loosening the nut.

Tightening torque :

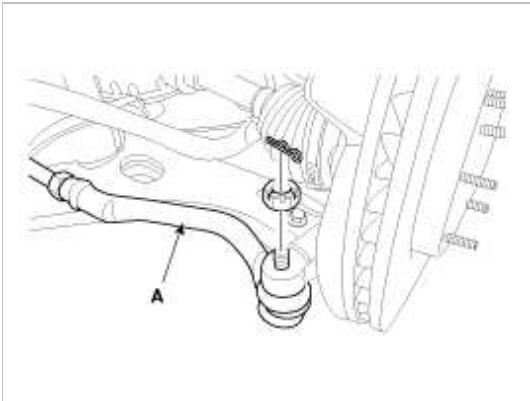
98.1 ~ 117.7N.m (10.0 ~ 12.0kgf.m, 72.3 ~ 86.8lb-ft)



3. Remove the split pin and castle nut and then disconnect the tie-rod end (A) from the front knuckle.

Tightening torque :

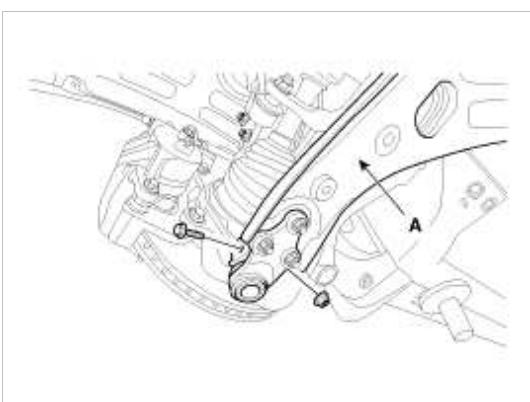
34.3 ~ 44.1N.m (3.5 ~ 4.5kgf.m, 25.3 ~ 32.5lb-ft)



4. Loosen the bolt & nut and then remove the lower arm (A).

Tightening torque :

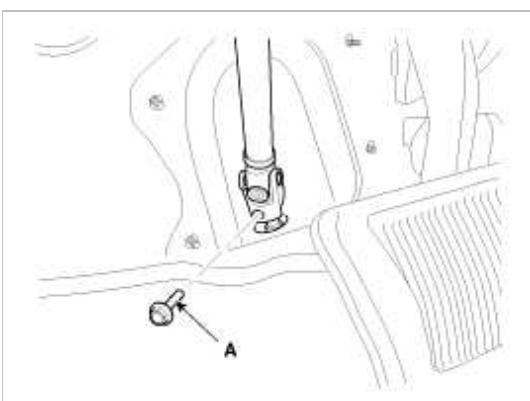
98.1 ~ 117.7N.m (10.0 ~ 12.0kgf.m, 72.3 ~ 86.8lb-ft)



5. Remove the dust cover.
6. Loosen the bolt (A) and then disconnect the universal joint assembly from the pinion of the steering gear box.

Tightening torque :

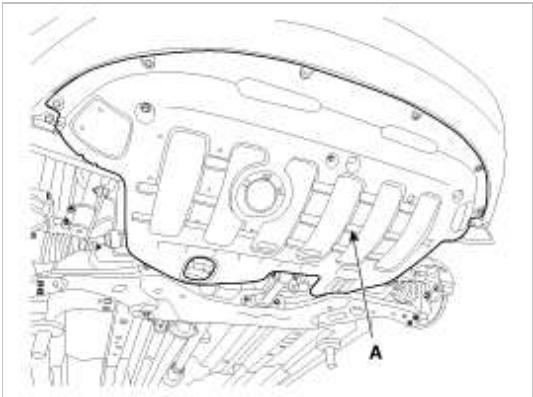
29.4 ~ 34.3N.m (3.0 ~ 3.5kgf.m, 21.7 ~ 25.3lb-ft)



CAUTION

- Keep the neutral-range to prevent the damage of the clock spring inner cable when you handle the steering wheel.
- Do not use the bolt again.

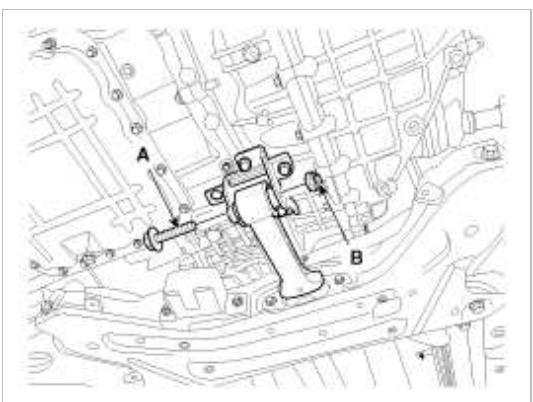
7. Remove the under cover (A).



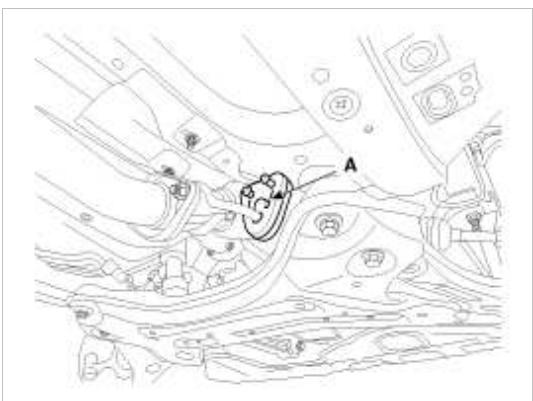
8. Loosen the bolt (A) & nut (B) and then remove the roll rod stopper.

Tightening torque :

107.9 ~ 127.5N.m (11.0 ~ 13.0kgf.m, 79.6 ~ 94.0lb-ft)



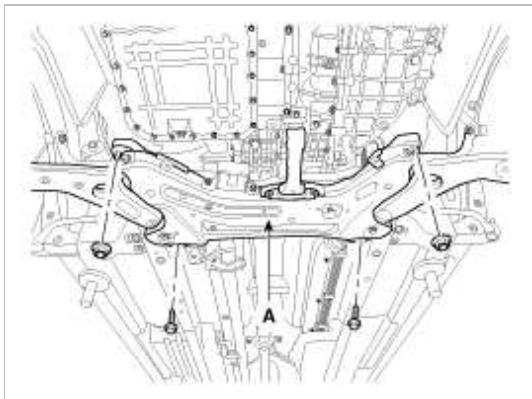
9. Disconnect the muffler rubber hanger (A).



10. Loosen the bolts & nuts and then remove the sub frame.

Tightening torque :

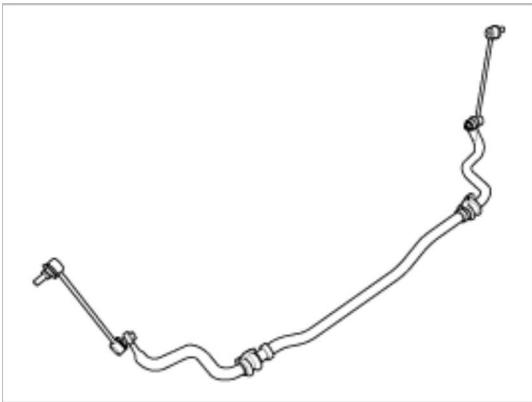
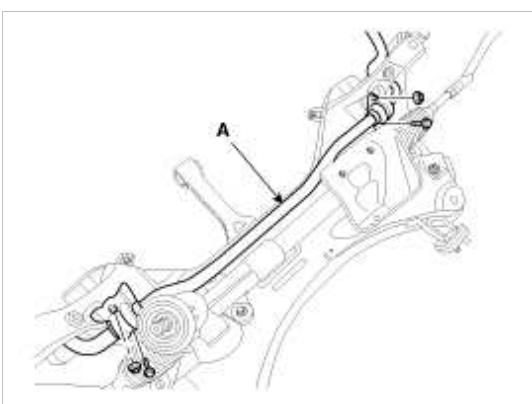
176.5 ~ 196.1N.m (18.0 ~ 20.0kgf.m, 130.2 ~ 144.7lb-ft)



11. Loosen the bolt and then remove the stabilizer (A) from the sub frame.

Tightening torque :

44.1 ~ 53.9N.m (4.5 ~ 5.5kgf.m, 32.5 ~ 39.8lb-ft)



12. 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.

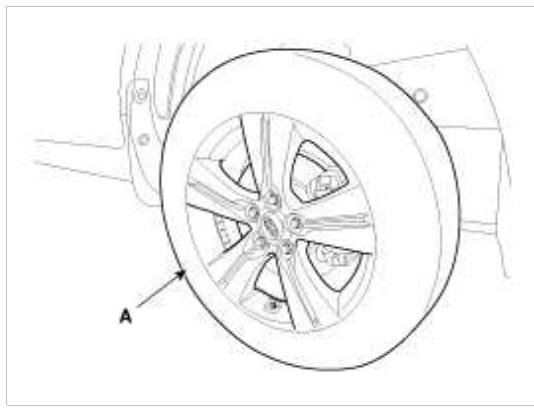
Suspension System > Front Suspension System > Front Cross Member > Repair procedures

Replacement

1. Remove the front wheel & tire.

Tightening torque :

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



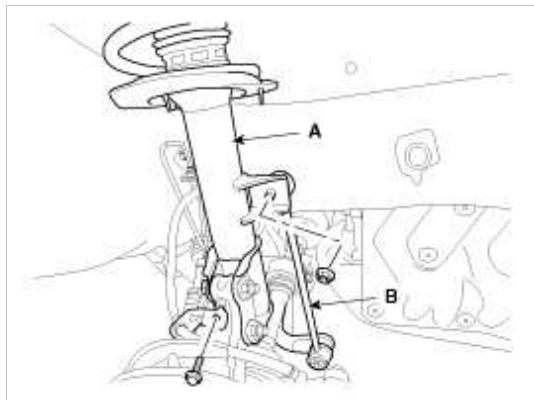
CAUTION

Be careful not to damage to the hub bolts when removing the front wheel & tire (A).

2. Disconnect the stabilizer link (B) from the front strut assembly (A) after loosening the nut.

Tightening torque :

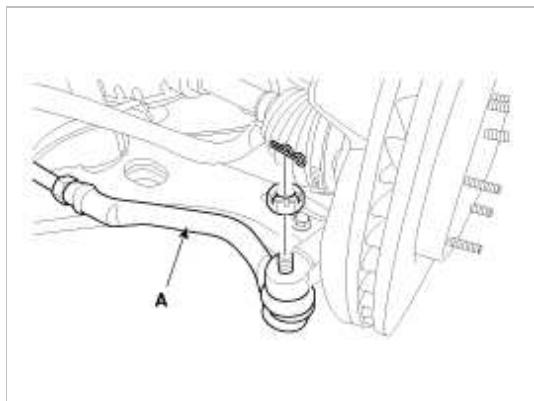
98.1 ~ 117.7N.m (10.0 ~ 12.0kgf.m, 72.3 ~ 86.8lb-ft)



3. Remove the split pin and castle nut and then disconnect the tie-rod end (A) from the front knuckle.

Tightening torque :

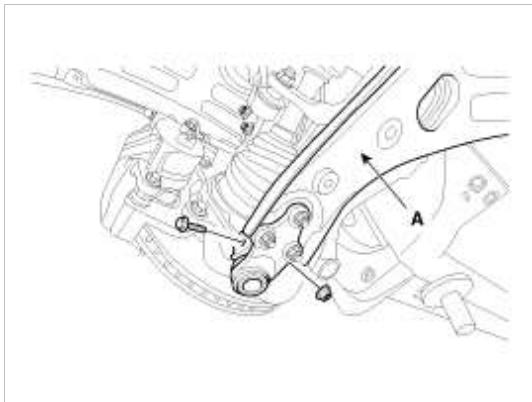
34.3 ~ 44.1N.m (3.5 ~ 4.5kgf.m, 25.3 ~ 32.5lb-ft)



4. Loosen the bolt & nut and then remove the lower arm (A).

Tightening torque :

98.1 ~ 117.7N.m (10.0 ~ 12.0kgf.m, 72.3 ~ 86.8lb-ft)

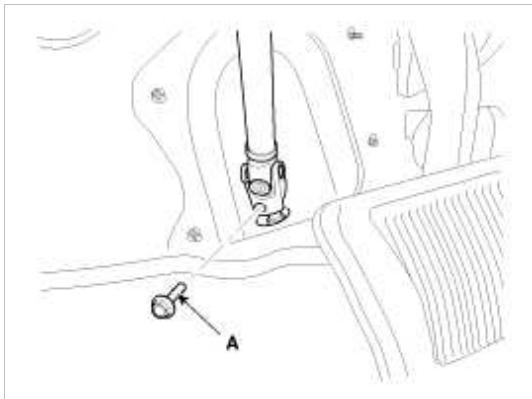


5. Remove the dust cover.

6. Loosen the bolt (A) and then disconnect the universal joint assembly from the pinion of the steering gear box.

Tightening torque :

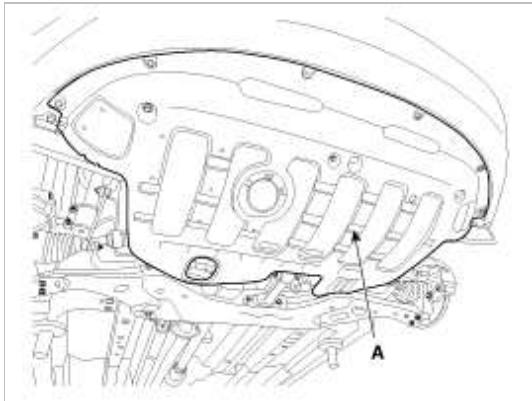
29.4 ~ 34.3N.m (3.0 ~ 3.5kgf.m, 21.7 ~ 25.3lb-ft)



CAUTION

- Keep the neutral-range to prevent the damage of the clock spring inner cable when you handle the steering wheel.
- Do not use the bolt again.

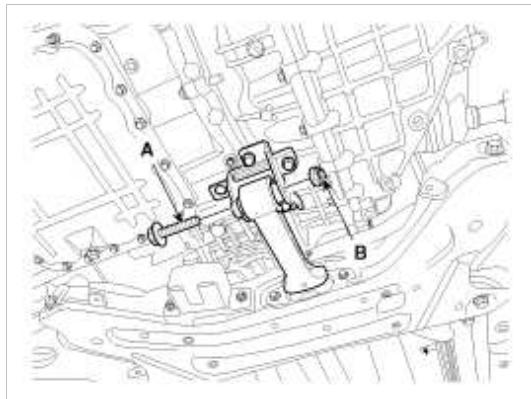
7. Remove the under cover (A).



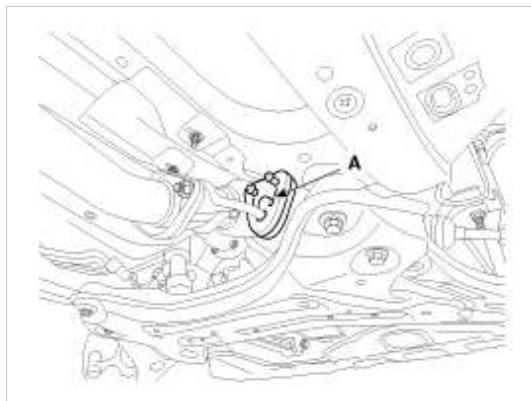
8. Loosen the bolt (A) & nut (B) and then remove the roll rod stopper.

Tightening torque :

107.9 ~ 127.5N.m (11.0 ~ 13.0kgf.m, 79.6 ~ 94.0lb-ft)



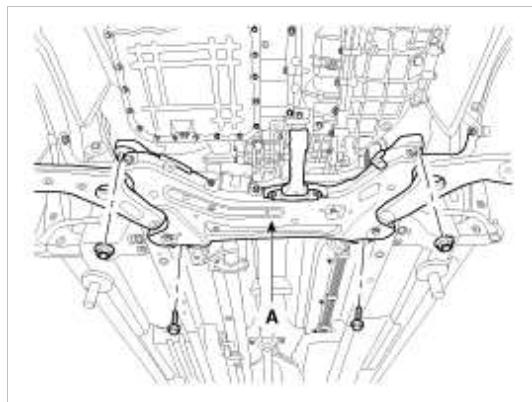
9. Disconnect the muffler rubber hanger (A).



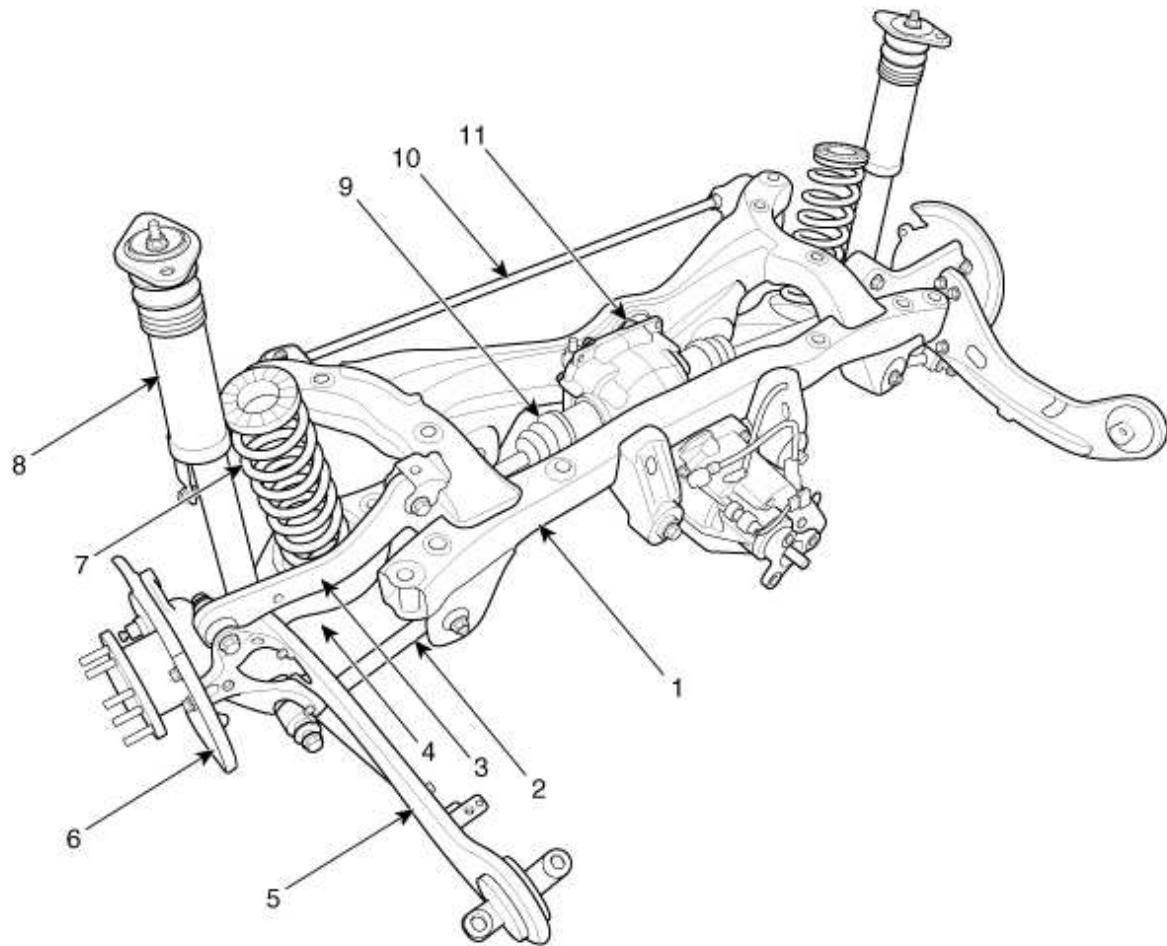
10. Loosen the bolts & nuts and then remove the sub frame.
-

Tightening torque :

176.5 ~ 196.1N.m (18.0 ~ 20.0kgf.m, 130.2 ~ 144.7lb-ft)



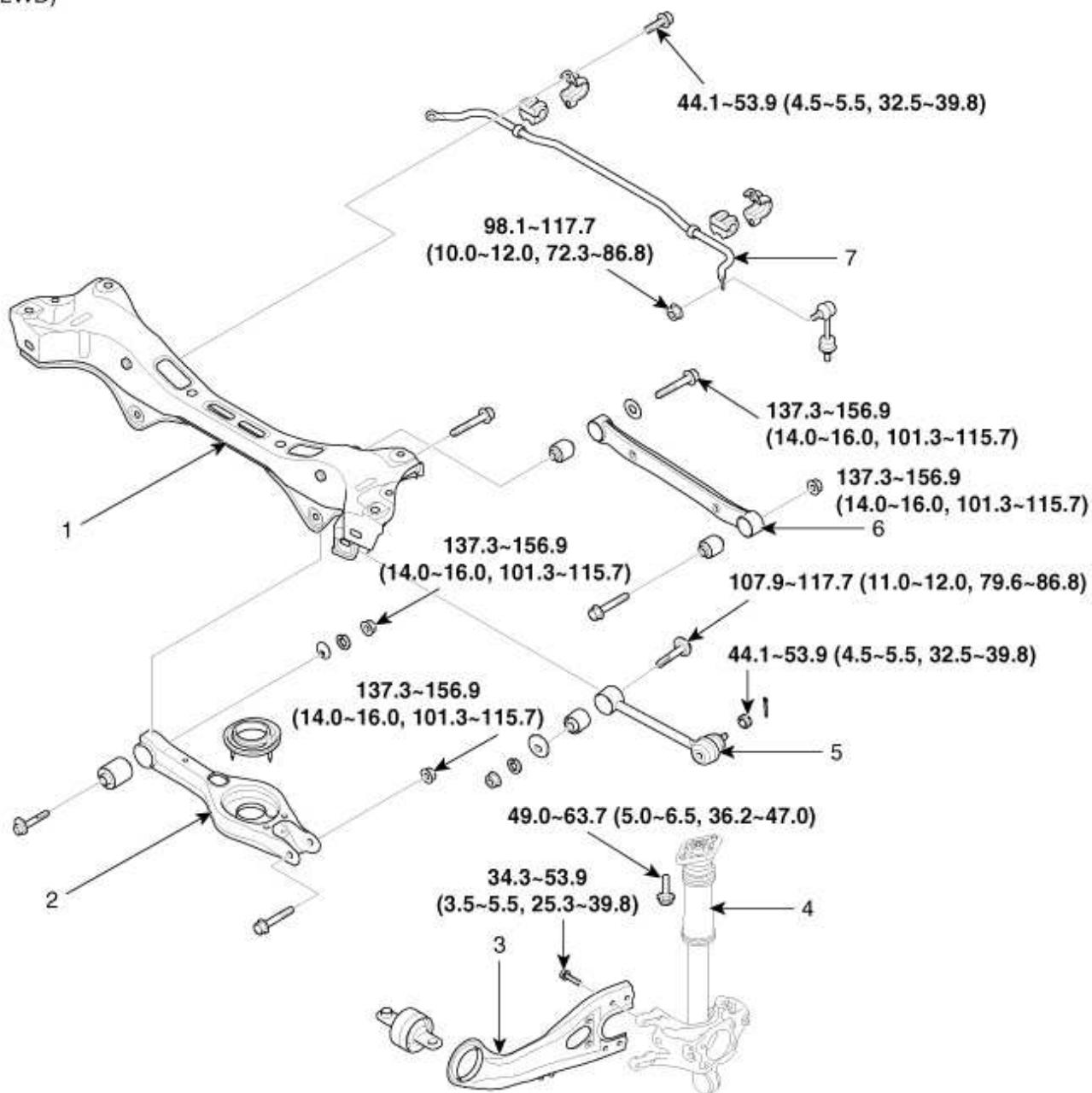
11. Remove the front lower arm.
(Refer to Front lower arm)
12. Remove the front stabilizer.
(Refer to Front stabilizer)
13. Remove the steering gearbox.
(Refer to "Steering Gearbox" in ST group)
14. Installation is the reverse of removal.

Suspension System > Rear Suspension System > Components and Components Location**Components Location**

1. Sub frame	7. Coil spring
2. Assist arm	8. Shock absorber
3. Upper arm	9. Drive shaft
4. Lower arm	10. Stabilizer
5. Trailing arm	11. Differential carrier
6. Rear axle	

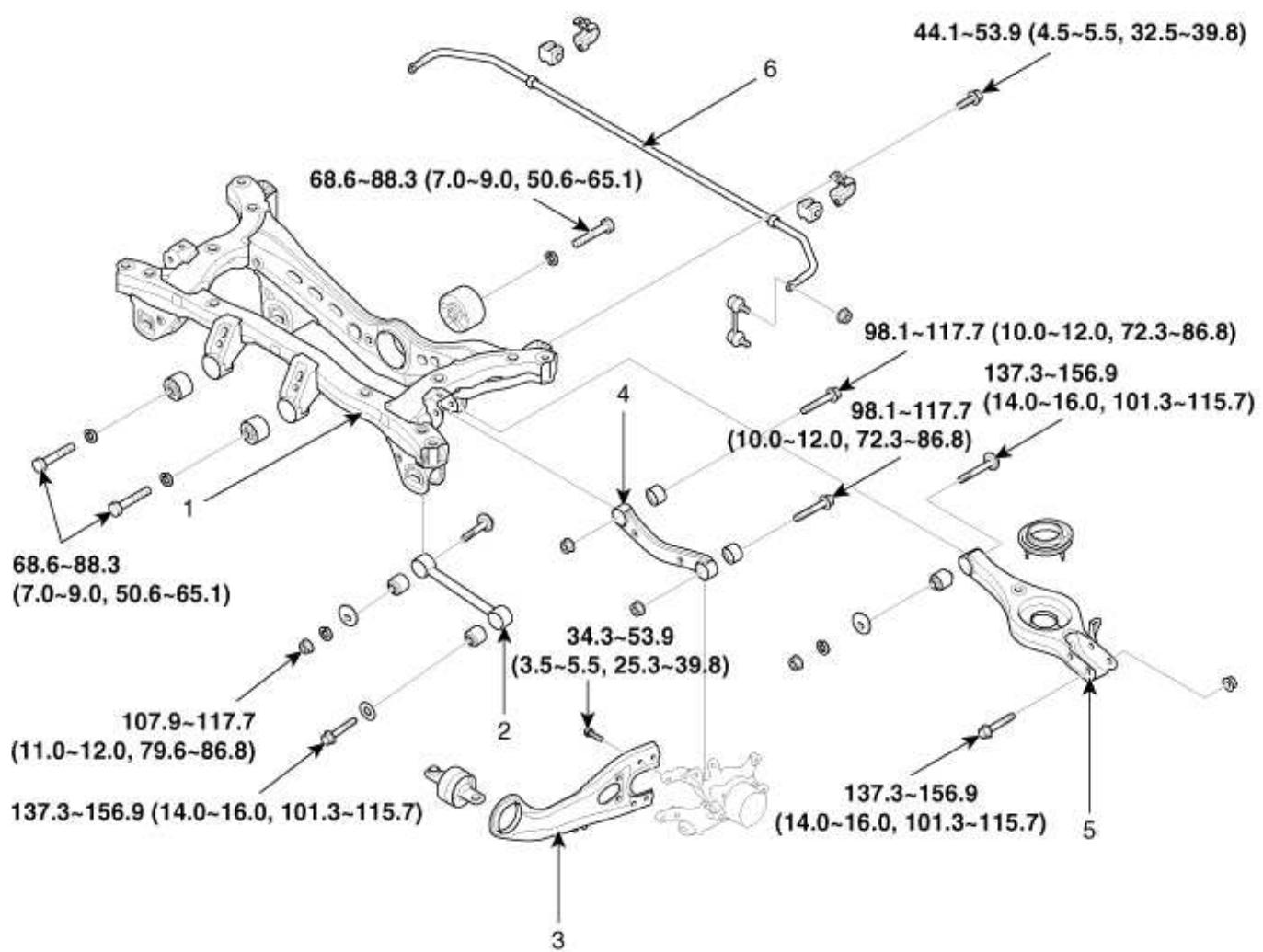
Components

(2WD)

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

- | | |
|-------------------|-------------------|
| 1. Sub frame | 5. Assist arm |
| 2. Lower arm | 6. Upper arm |
| 3. Trailing arm | 7. Stabilizer bar |
| 4. Shock absorber | |

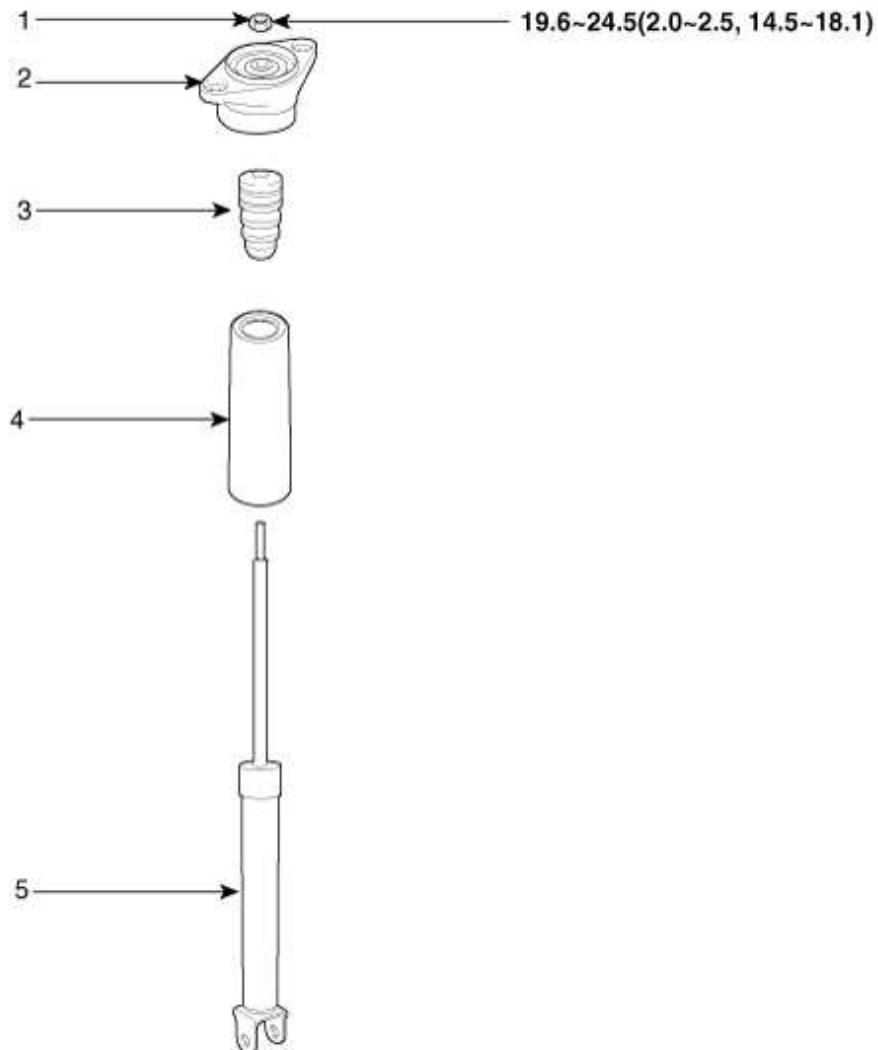
(4WD)

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

1. Sub frame	4. Upper arm
2. Assist arm	5. Lower arm
3. Trailing arm	6. Stabilizer bar

Suspension System > Rear Suspension System > Rear Shock Absorber > Components and Components Location

Components



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

1. Self locking nut 2. Bracket assembly 3. Bumper rubber	4. Dust cover 5. Shock absorber
--	------------------------------------

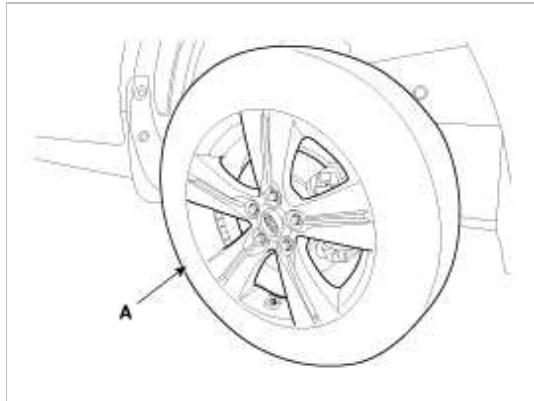
Suspension System > Rear Suspension System > Rear Shock Absorber > Repair procedures

Replacement

1. Remove the rear wheel & tire.

Tightening torque :

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



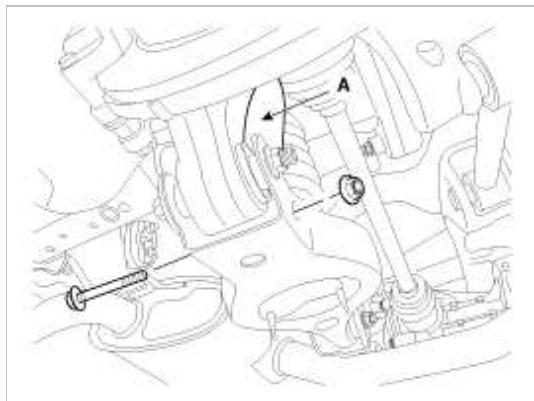
CAUTION

Be careful not to damage to the hub bolts when removing the front wheel & tire (A).

2. Loosen the bolt & nut and then disconnect the shock absorber (A) with the rear axle.

Tightening torque :

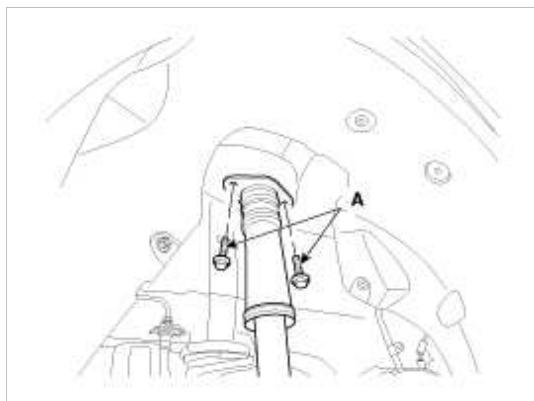
137.3 ~ 156.9N.m (14.0 ~ 16.0kgf.m, 101.3 ~ 115.7lb-ft)



3. Loosen the shock absorber mounting bolts (A).

Tightening torque :

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

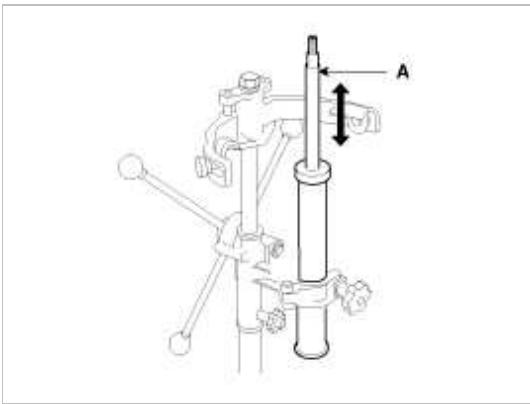


4. Installation is the reverse of removal.

Inspection

1. Check the rubber parts for wear and deterioration.

2. Compress and extend the piston rod (A) and check that there is no abnormal resistance or unusual sound during operation.



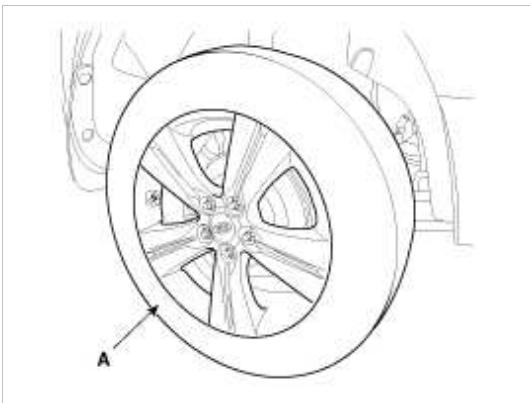
Suspension System > Rear Suspension System > Rear Upper Arm > Repair procedures

Replacement

1. Remove the rear wheel & tire.

Tightening torque :

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



CAUTION

Be careful not to damage to the hub bolts when removing the front wheel & tire (A).

2. Loosen the bolt & nut and then remove the rear upper arm (A) with the rear axle.

Tightening torque :

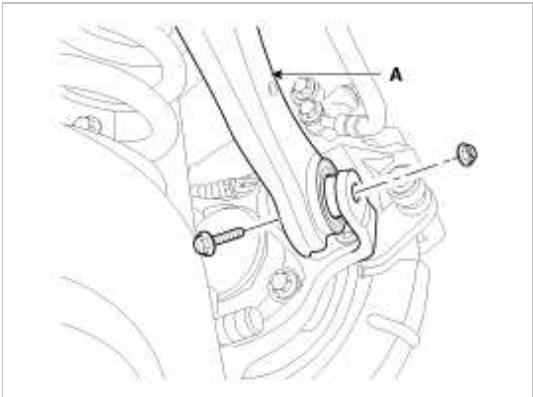
2WD

137.3 ~ 156.9N.m (14.0 ~ 16.0kgf.m, 101.3 ~ 115.7lb-ft)

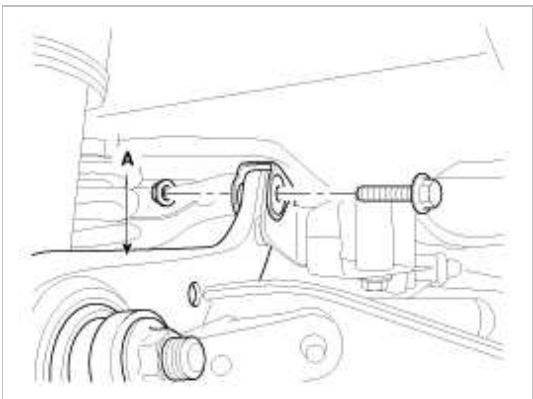
4WD

98.1 ~ 117.7N.m (10.0 ~ 12.0kgf.m, 72.3 ~ 86.8lb-ft)

[2WD]



[4WD]



3. Loosen the bolt & nut and then remove the rear upper arm (A) with the sub frame.

Tightening torque :

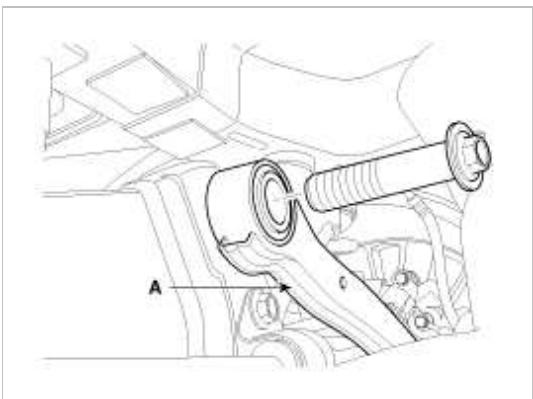
2WD

137.3 ~ 156.9N.m (14.0 ~ 16.0kgf.m, 101.3 ~ 115.7lb-ft)

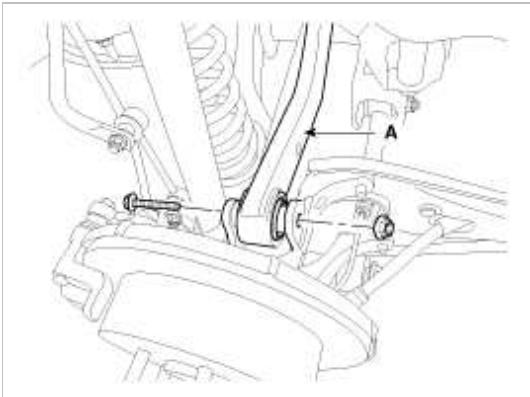
4WD

98.1 ~ 117.7N.m (10.0 ~ 12.0kgf.m, 72.3 ~ 86.8lb-ft)

[2WD]



[4WD]



4. Installation is the reverse of removal.

CAUTION

Install the rear upper arm so that the letter 'R' can face the rear of vehicle.

Inspection

1. Check the bushing for wear and deterioration.
2. Check the rear upper arm or damage and deformation.
3. Check for all bolts and nut.

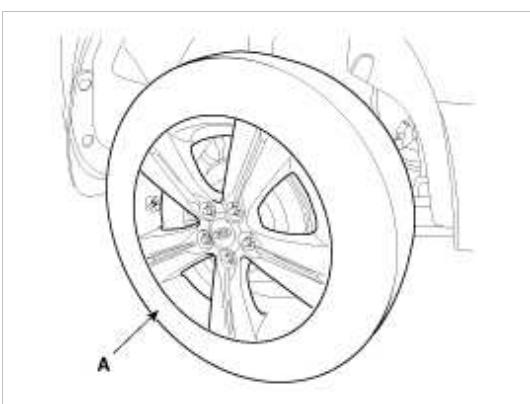
Suspension System > Rear Suspension System > Rear Lower Arm > Repair procedures

Replacement

1. Remove the rear wheel & tire.

Tightening torque :

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



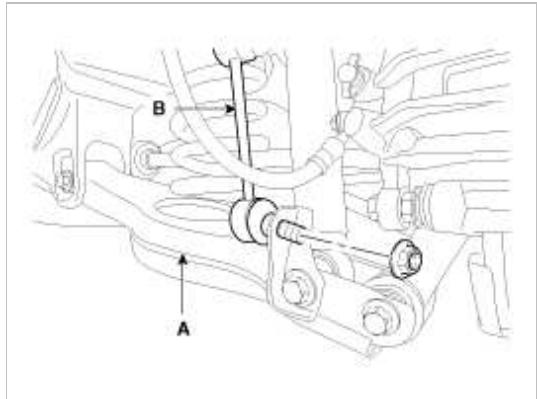
CAUTION

Be careful not to damage to the hub bolts when removing the front wheel & tire (A).

2. Loosen the nut and then remove the rear stabilizer link (B) with the rear lower arm (A).

Tightening torque :

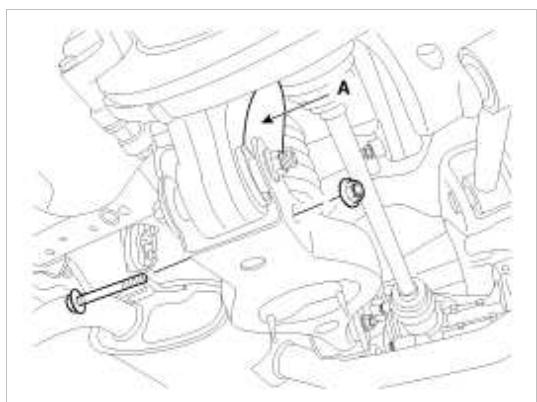
98.1 ~ 117.7N.m (10.0 ~ 12.0kgf.m, 72.3 ~ 86.8lb-ft)



3. Loosen the bolt & nut and then remove the rear shock absorber (A) with the lower arm.

Tightening torque :

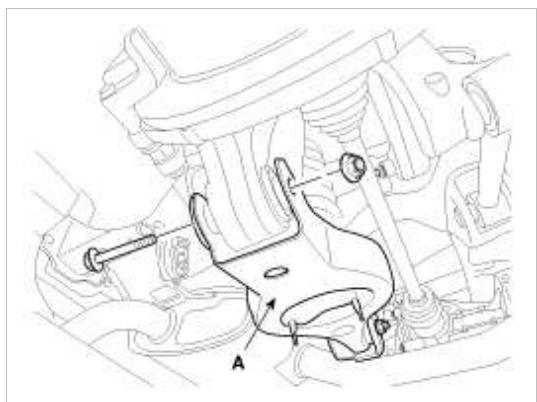
137.3 ~ 156.9N.m (14.0 ~ 16.0kgf.m, 101.3 ~ 115.7lb-ft)



4. Loosen the bolt & nut and then remove the rear lower arm (A) with the rear axle.

Tightening torque :

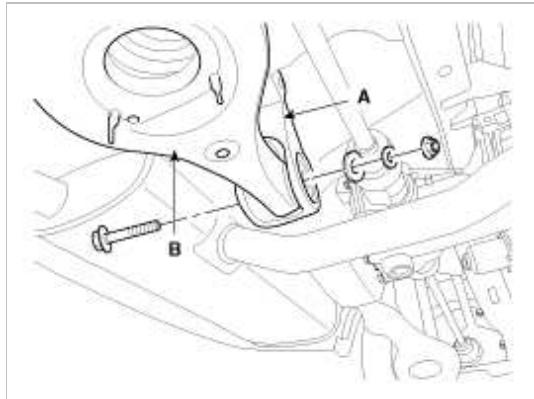
137.3 ~ 156.9N.m (14.0 ~ 16.0kgf.m, 101.3 ~ 115.7lb-ft)



5. Loosen the bolt & nut and then remove the rear lower arm (B) with the sub frame (A).

Tightening torque :

137.3 ~ 156.9N.m (14.0 ~ 16.0kgf.m, 101.3 ~ 115.7lb-ft)



6. Installation is the reverse of removal.

Inspection

1. Check the bushing for wear and deterioration.
2. Check the rear lower arm for deformation.
3. Check the coil spring and spring pad for deterioration and deformation.
4. Check for all bolts and nut.

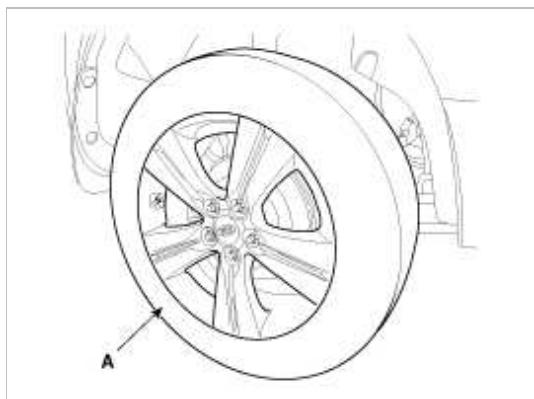
Suspension System > Rear Suspension System > Rear Stabilizer Bar > Repair procedures

Replacement

1. Remove the rear wheel & tire.

Tightening torque :

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



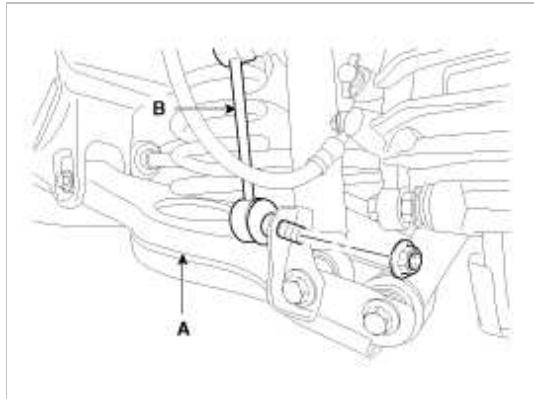
CAUTION

Be careful not to damage to the hub bolts when removing the front wheel & tire (A).

2. Loosen the nut and then remove the rear stabilizer link (B) with the rear lower arm (A).

Tightening torque :

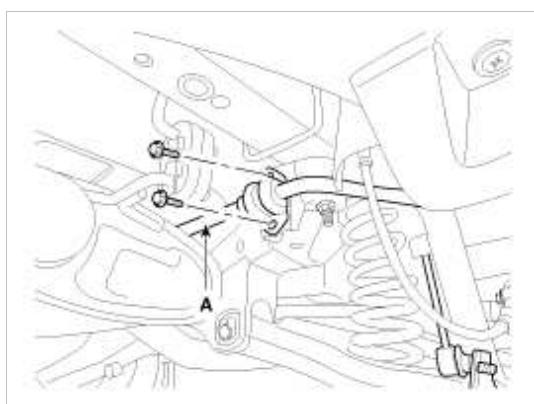
98.1 ~ 117.7N.m (10.0 ~ 12.0kgf.m, 72.3 ~ 86.8lb-ft)



3. Loosen the mounting bolt and then remove the stabilizer bar (A) with the sub frame.

Tightening torque :

44.1 ~ 53.9N.m (4.5 ~ 5.5kgf.m, 32.5 ~ 39.8lb-ft)



4. Installation is the reverse of removal.

Inspection

1. Check the rear stabilizer bar for deformation.
2. Check the rear stabilizer link ball joint for damage.

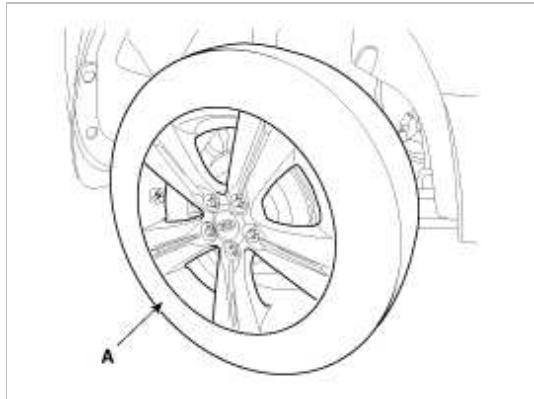
Suspension System > Rear Suspension System > Rear Assist Arm > Repair procedures

Replacement

1. Remove the rear wheel & tire.

Tightening torque :

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



CAUTION

Be careful not to damage to the hub bolts when removing the front wheel & tire (A).

2. Remove the sprit pin and castle nut or bolt and then disconnect the rear assist arm (A) from the rear axle.

Tightening torque :

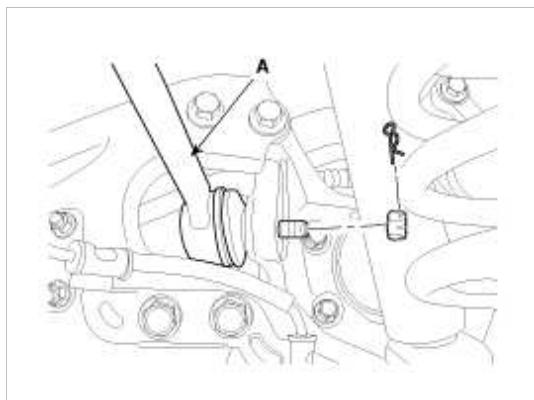
2WD

44.1 ~ 53.9N.m (4.5 ~ 5.5kgf.m, 32.5 ~ 39.8lb-ft)

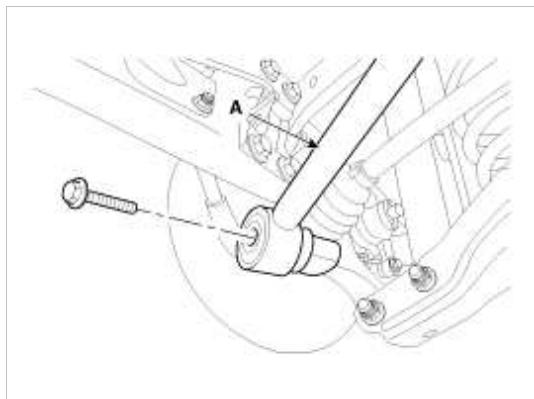
4WD

137.3 ~ 156.9N.m (14.0 ~ 16.0kgf.m, 101.3 ~ 115.7lb-ft)

[2WD]



[4WD]

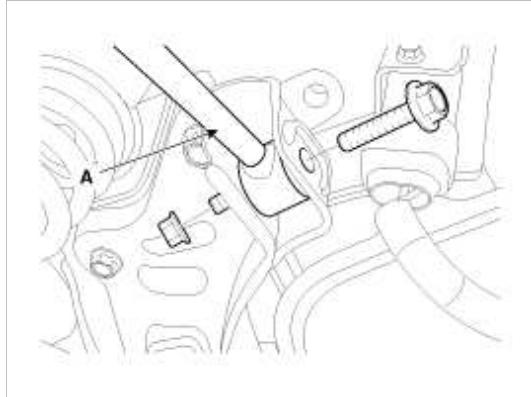


3. Loosen the bolt & nut and then remove the rear assist arm (A) from the sub frame.

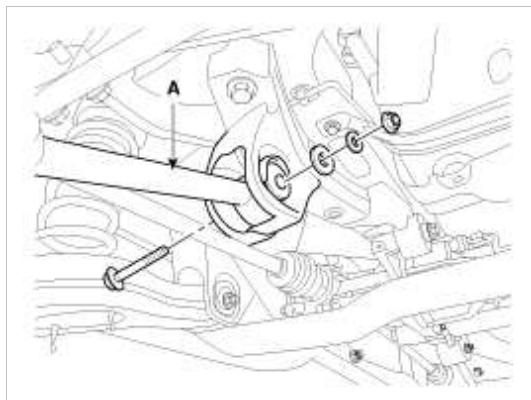
Tightening torque :

107.9 ~ 117.7N.m (11.0 ~ 12.0kgf.m, 79.6 ~ 86.8lb-ft)

[2WD]



[4WD]



4. Installation is the reverse of removal.

Inspection

1. Check the bushing for wear and deterioration.
2. Check the rear assist arm for deformation.
3. Check ball joint for damage.
4. Check for the all bolts and nuts.

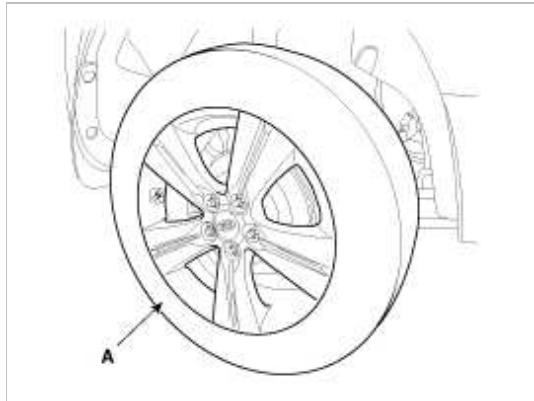
Suspension System > Rear Suspension System > Trailing Arm > Repair procedures

Replacement

1. Remove the rear wheel & tire.

Tightening torque :

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



CAUTION

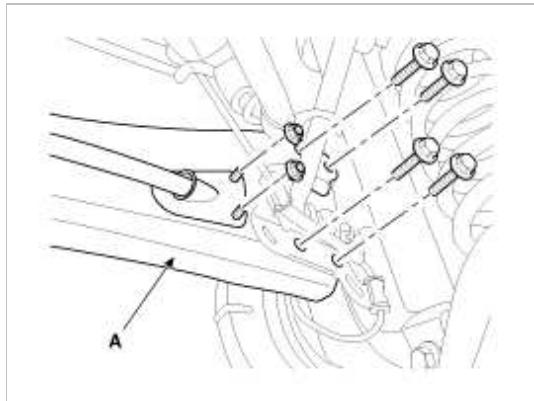
Be careful not to damage to the hub bolts when removing the front wheel & tire (A).

2. Loosen the nuts & bolts and then remove the trailing arm (A) from the rear axle.

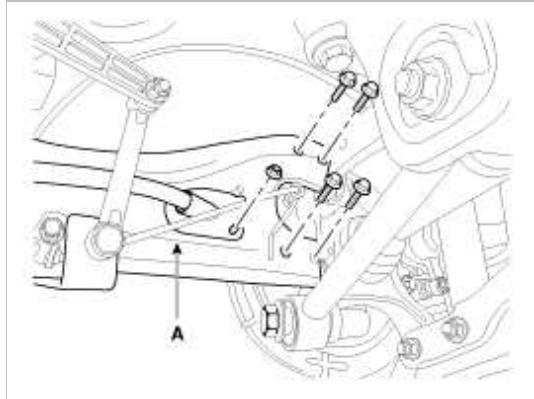
Tightening torque

34.3 ~ 53.9N.m (3.5 ~ 5.5kgf.m, 25.3 ~ 39.8lb-ft)

[2WD]

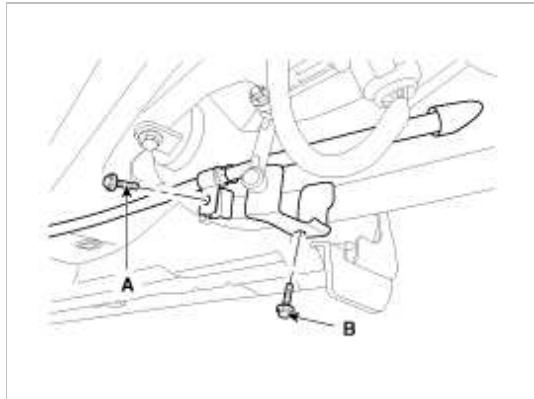


[4WD]

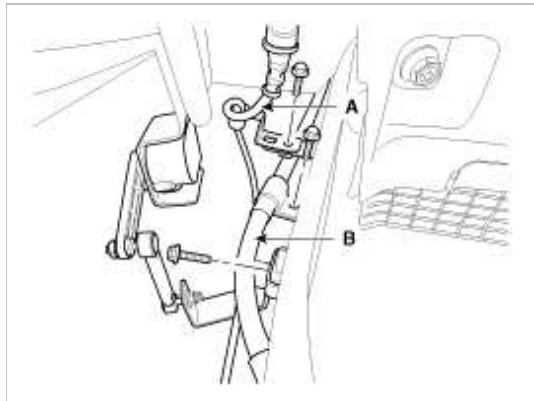


3. Loosen the parking brake cable bracket bolt (A) & height sensor bracket bolt (B).

[2WD]



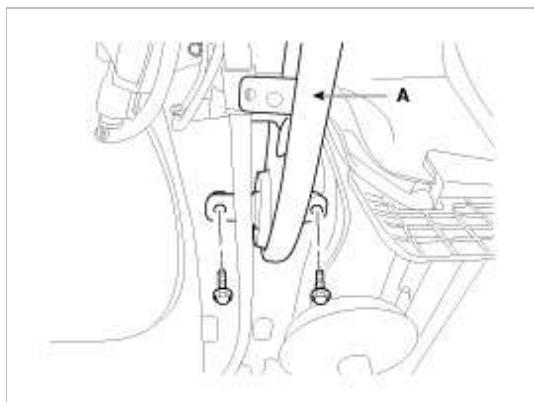
[4WD]



4. Loosen the mounting bolt and then remove the trailing arm (A) with the frame.

Tightening torque :

98.1 ~ 117.7N.m (10.0 ~ 12.0kgf.m, 72.3 ~ 86.8lb-ft)



5. Installation is the reverse of removal.

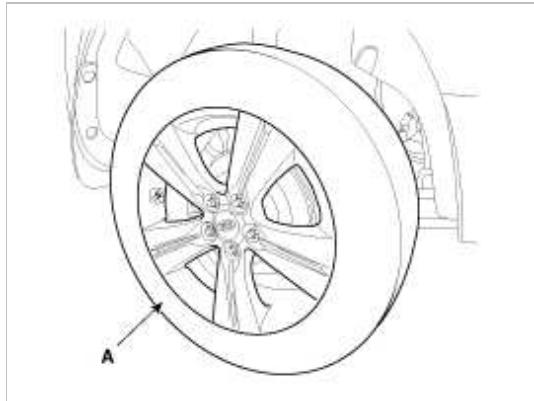
Suspension System > Rear Suspension System > Rear Cross Member > Repair procedures

Replacement

1. Remove the rear wheel & tire.

Tightening torque :

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



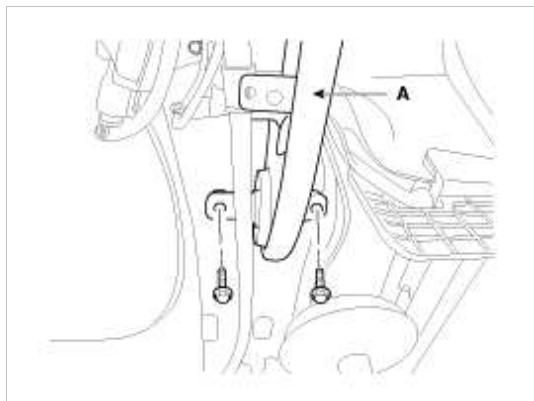
CAUTION

Be careful not to damage to the hub bolts when removing the front wheel & tire (A).

2. Remove the parking brake cable.
(Refer to "Parking Brake System" in BR group)
3. Loosen the bolt and then remove the trailing arm (A).

Tightening torque :

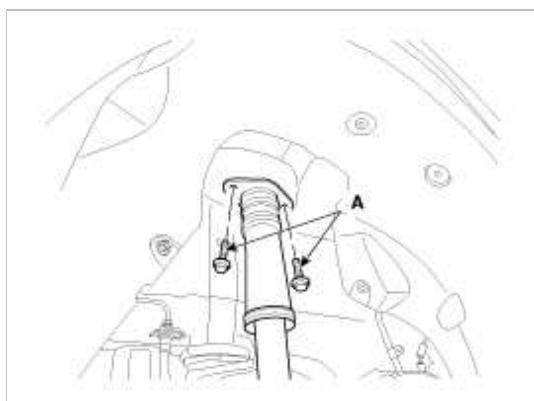
98.1 ~ 117.7N.m (10.0 ~ 12.0kgf.m, 72.3 ~ 86.8lb-ft)



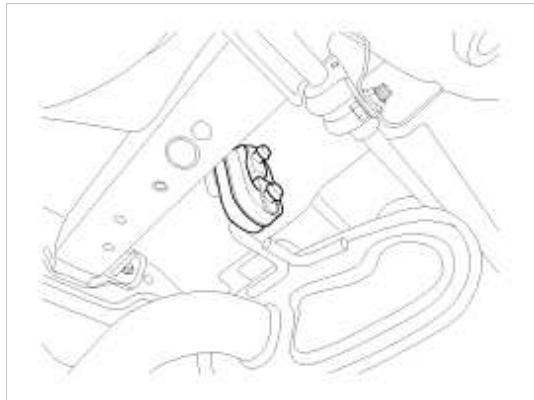
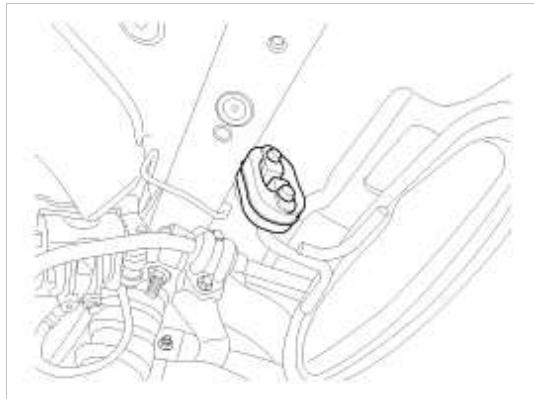
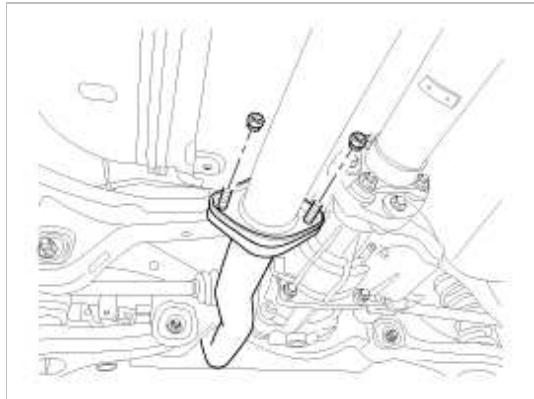
4. Loosen the shock absorber mounting bolts (A).

Tightening torque :

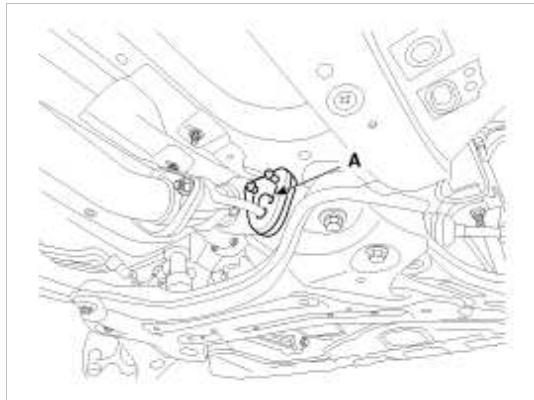
49.0 ~ 63.7N.m (5.0 ~ 6.5kgf.m, 36.2 ~ 47.0lb-ft)



5. Remove the rear muffler.



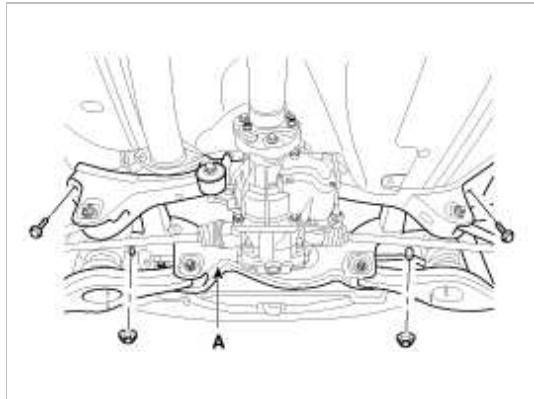
6. Loosen the bolt and then remove the propellar shaft (A).



7. Loosen the mounting bolts and then remove the rear cross member (A) with the frame.

Tightening torque :

156.9 ~ 176.5N.m (16.0 ~ 18.0kgf.m, 115.7 ~ 130.2lb-ft)



8. Remove the rear lower arm.
(Refer to lower arm)
9. Remove the rear shock absorber.
(Refer to rear shock absorber)
10. Remove the rear upper arm.
(Refer to rear upper arm)
11. Remove the trailing arm.
(Refer to trailing arm)
12. Remove the rear assist arm.
(Refer to rear assist arm)
13. Remove the drive shaft.
(Refer to "Rear Drive Shaft" in DS group)
14. Remove the differential carrier.
(Refer to "Differential Carrier" in DS group)
15. Installation is the reverse of removal.

Suspension System > Tires/Wheels > Tire > Repair procedures

Tire wear

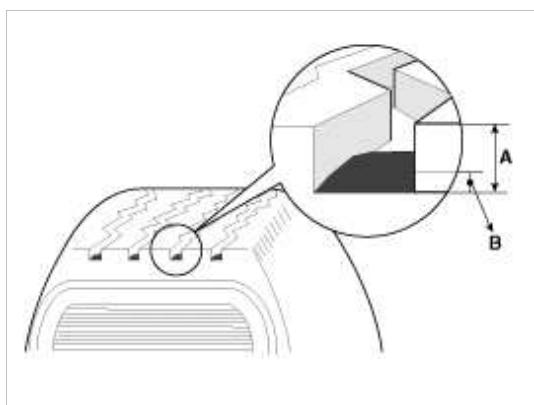
1. Measure the tread depth of the tires.

Tread depth [limit] : 1.6 mm (0.063 in.)

2. If the remaining tread (A) depth is less than the limit, replace the tire.

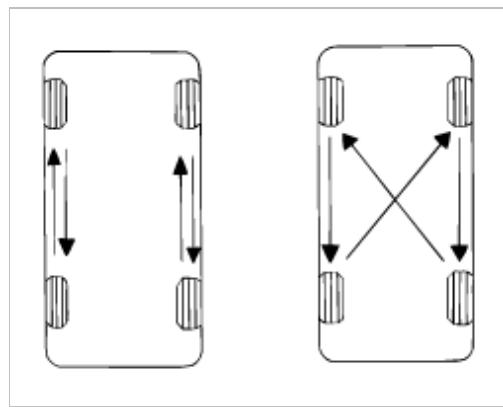
NOTE

When the tread depth of the tires is less than 1.6 mm(0.063 in.), the wear indicators (B) will appear.



Tire Rotation

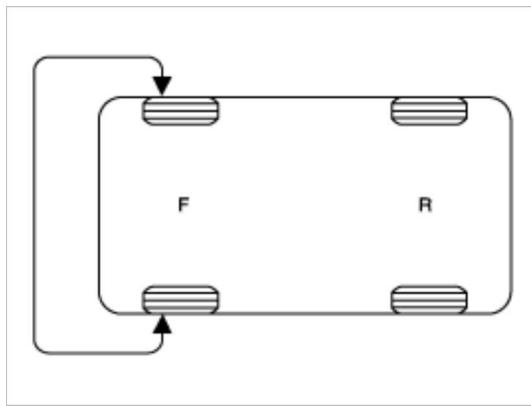
Rotate the tires in the pattern illustrated.



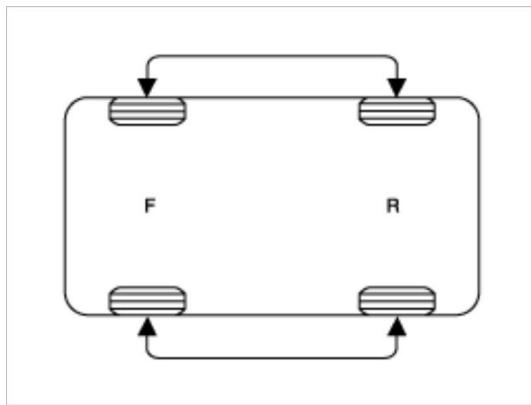
Checking For Pull and Wander

If the steering pulls to one side, rotate the tires according to the following wheel rotation procedure.

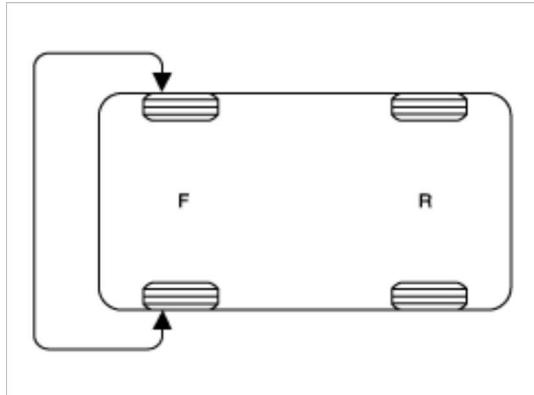
1. Rotate the front right and front left tires, and perform a road test in order to confirm vehicle stability.



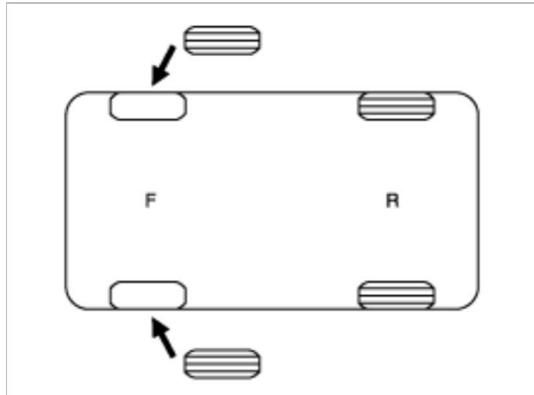
2. If the steering pulls to the opposite side, check vehicle's wheel alignment specification first before rotating the tires according to the following wheel rotation procedure.



3. If the steering continues to pull to one side, rotate the front right and left tires again, and perform a road test.



4. If the steering continues to pull to the opposite side, replace the front wheels with new ones.



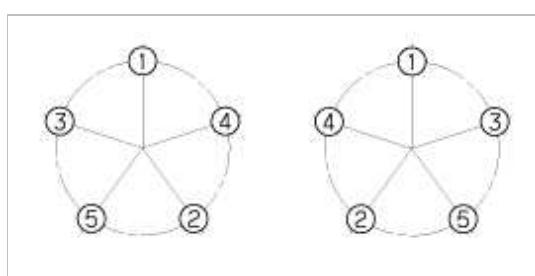
Suspension System > Tires/Wheels > Wheel > Repair procedures

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

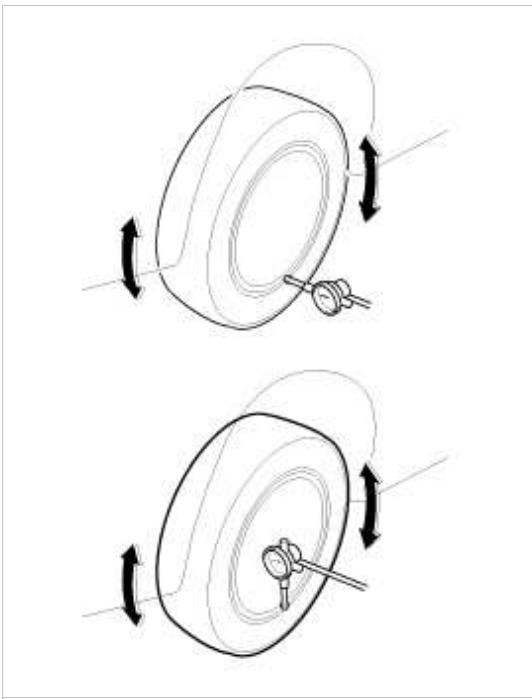
When using an impact gun, final tightening torque should be checked using a torque wrench.

Run out inspection

1. Jack up the vehicle.
2. Measure the wheel Run-out by using a dial indicator as illustration below.

Run-out	Aluminum	Steel
Radial mm(in.)	Below 0.3(0.012)	Below 1.0(0.039)
Axial mm(in.)	Below 0.3(0.012)	Below 0.6(0.024)

3. If measured value exceeds the standard value, replace the wheel.



Suspension System > Tires/Wheels > Alignment > Repair procedures

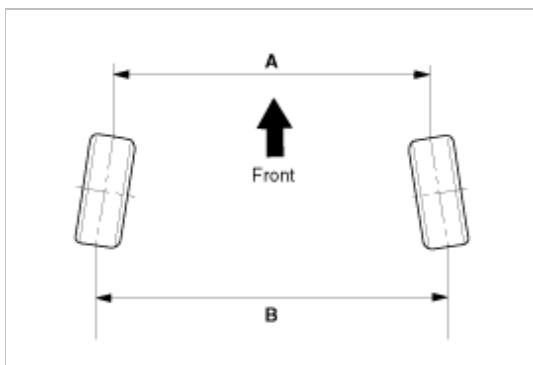
Front Wheel Alignment

CAUTION

When using a commercially available computerized wheel alignment equipment to inspect the front wheel alignment, always position the vehicle on a level surface with the front wheels facing straight ahead.

Prior to inspection, make sure that the front suspension and steering system are in normal operating condition and that the tires are inflated to the specified pressure.

Toe



B - A > 0: Toe in (+)

B - A < 0: Toe out (-)

Toe adjustment

1. Loosen the tie rod end lock nut.
2. Remove the bellows clip to prevent the bellows from being twisted.

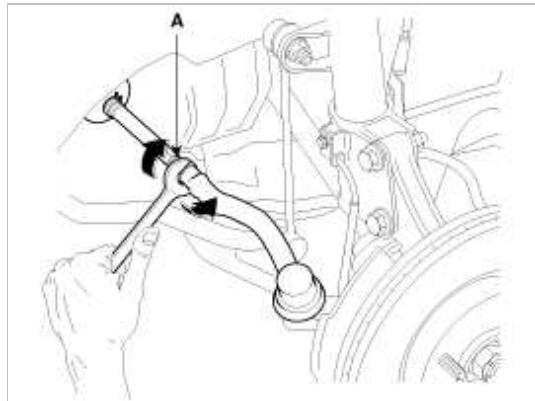
3. Adjust the toe by screwing or unscrewing the tie rod. Toe adjustment should be made by turning the right and left tie rods by the same amount.

Toe

Total : $0^\circ \pm 0.2^\circ$

Individual : $0^\circ \pm 0.1^\circ$

Tie rod	Turning direction	Toe
LH (Driver's side)	Backward	Decrease (Toe in)
	Forward	Increase (Toe out)
RH	Backward	Increase (Toe out)
	Forward	Decrease (Toe in)



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 : $-0.5^\circ \pm 0.5^\circ$

Caster angle : $4.02^\circ \pm 0.5^\circ$

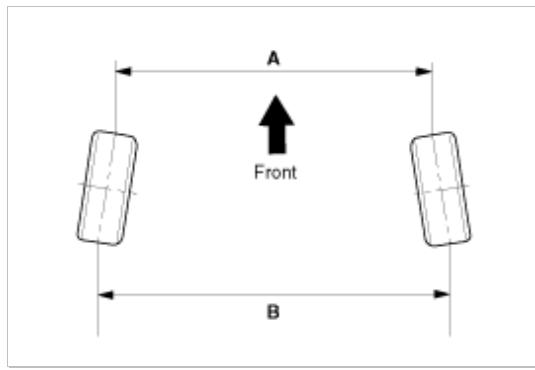
Rear Wheel Alignment

CAUTION

When using a commercially available computerized wheel alignment equipment to inspect the rear wheel alignment, always position the vehicle on a level surface.

Prior to inspection, make sure that the rear suspension system is in normal operating condition and that the tires are inflated to the specified pressure.

Toe



B - A > 0: Toe in (+)
 B - A < 0: Toe out (-)

Toe adjustment

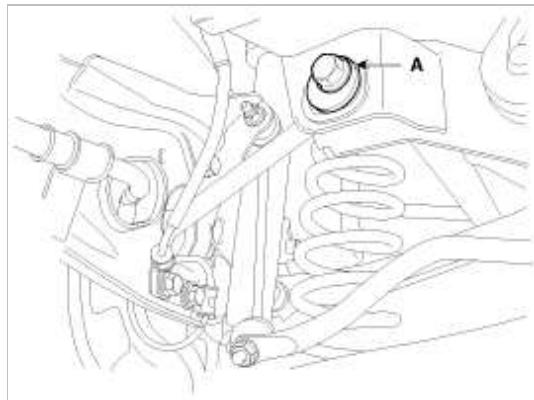
1. Loosen the nut holding the assist arm cam bolt (A).
2. Adjust rear toe by turning the rear assist arm cam bolt (A) clockwise or counter clockwise. Toe adjustment should be made by turning the right and left cam bolt by the same amount.

Toe

Total : $0.2^\circ \pm 0.2^\circ$

Individual : $0.1^\circ \pm 0.1^\circ$

Cam bolt	Turning direction	Toe
LH (Driver's side)	Clockwise	Decrease (Toe out)
	Counter clockwise	Increase (Toe in)
RH	Clockwise	Increase (Toe in)
	Counter clockwise	Decrease (Toe out)



3. When completing the toe adjustment, tighten the nut to specified torque.

Tightening torque :

107.9 ~ 117.7N.m (11.0 ~ 12.0kgf.m, 79.6 ~ 86.8lb-ft)

Camber

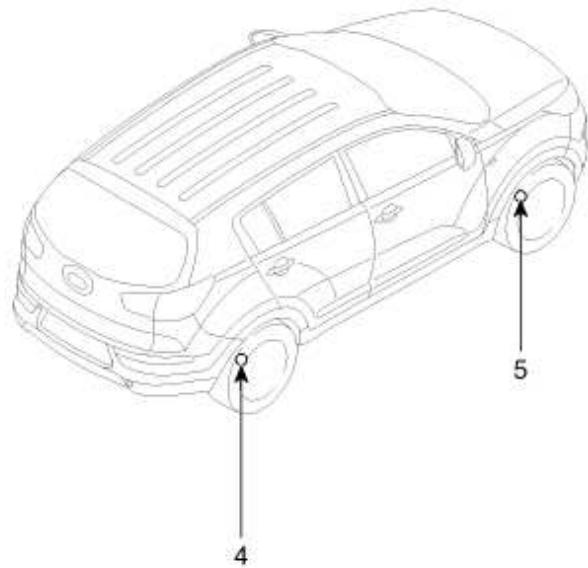
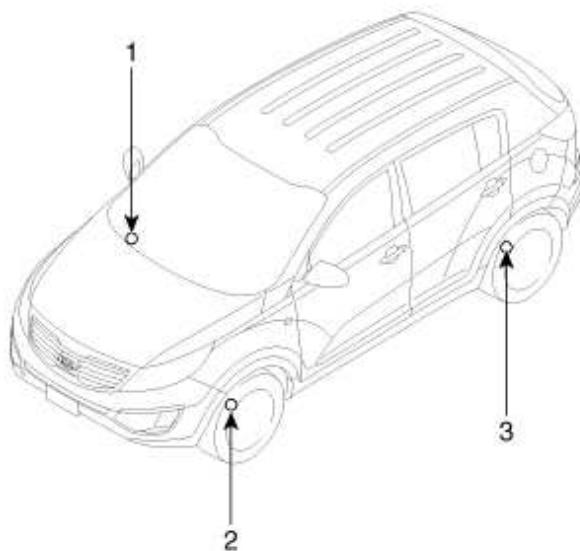
Adjust the camber by turning the cambolt of the rear lower arm.

Camber: $-1.0^\circ \pm 0.5^\circ$

Cam bolt	Turning direction	Toe
LH (Driver's side)	Clockwise	Camber -
	Counter clockwise	Camber +
RH	Clockwise	Camber +
	Counter clockwise	Camber -

Suspension System > Tire Pressure Monitoring System > Components and Components Location

Components Location



1. Receiver	4. TPMS Sensor
2. TPMS Sensor	5. TPMS Sensor
3. TPMS Sensor	

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

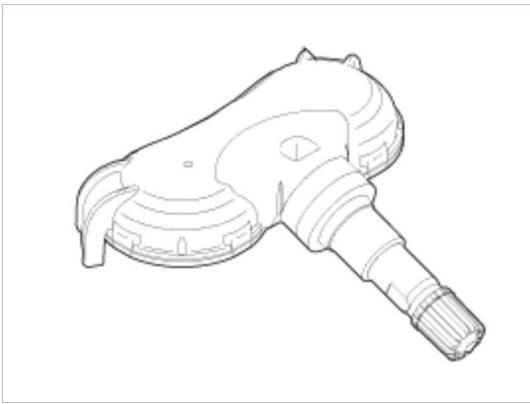
1. Turn on condition
 - A. When the system detects a fault that is external to the receiver/ sensor.
 - B. When the system detects a receiver fault.
 - C. When the system detects a sensor fault.
2. Turn off condition
 - A. If the fault is considered as 'critical', then the lamp is held on throughout the current Ignition cycle (even if the DTC has been de-activated). This is because it is important to bring the problem to the drivers attention. On the following Ignition cycle, the de-activated conditions will be re-checked. If the de-activate 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 stored 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 also 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. TPM sensor for SL should be set to low line.

Suspension System > Tire Pressure Monitoring System > TPMS Sensor > Repair procedures

Removal

Tire Removal

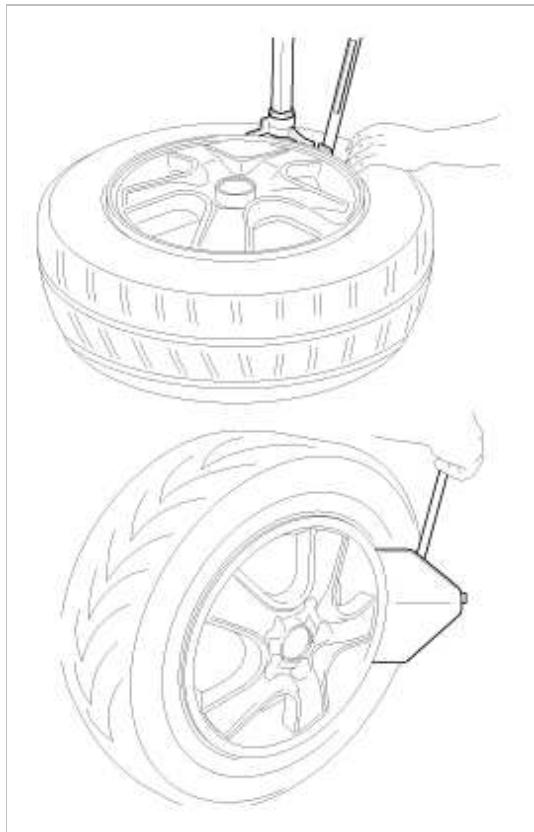
1. Deflate tire & remove balance weights.

NOTE

Sensor can be unscrewed before unseating the tire bead.

CAUTION

- The tire bead should be broken approx. 90° from the valve side of the wheel. The bead breaker should not be set too deep.
- Avoid tire/tool contact with the valve on dismount.
- Dismount should end near the valve.

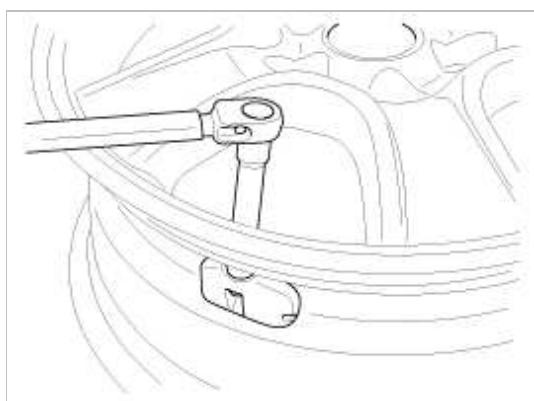


Sensor Removal

CAUTION

Handle the sensor with care.

1. Remove the valve nut.



CAUTION

The valve nut should not be re-used.

2. Discard the valve assembly.

Installation

Sensor Fit

CAUTION

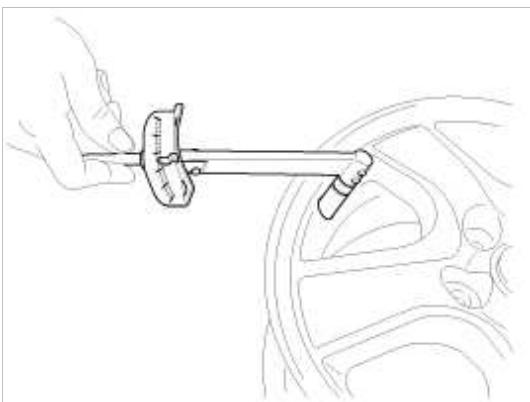
- Handle the sensor with care.
- Avoid lubricant contact.
- Ensure that the wheel to be fitted is designed for sensor mount. There should normally be a mark to indicate this.
- Ensure that the valve hole and mating face of the wheel are clean.

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).

Set Sensor Status

Set Sensor Status



ITEM	VALUE	UNIT
ID:	8D19D18F	
Pressure:	47.7	psi
Temperature:	55	'F
Battery Level:	OK	
Sensor Option:	HIGH	
Transmission:	LF INITIATE TM	
Tire Type:	65 psi	
Sensor State:	Normal Fixed	

No. 1

No. 2

ITEM	VALUE	UNIT
ID:	8CE49E5D	
Pressure:	47.9	psi
Temperature:	55	'F
Battery Level:	OK	
Sensor Option:	HIGH	
Transmission:	LF INITIATE TM	
Tire Type:	65 psi	
Sensor State:	Normal Fixed	

No. 3

No. 4

ITEM	VALUE	UNIT
ID:	8D146A9A	
Pressure:	47.7	psi
Temperature:	53	'F
Battery Level:	OK	
Sensor Option:	HIGH	
Transmission:	LF INITIATE TM	
Tire Type:	65 psi	
Sensor State:	Normal Fixed	

High	Low	Retry
------	-----	-------

High	Low	Retry
------	-----	-------

High	Low	Retry
------	-----	-------

High	Low	Retry
------	-----	-------

Cancel

Set Sensor Status



ITEM	VALUE	UNIT
ID :	8D19D18F	
Pressure :	47.7	psi
Temperature :	55	'F
Battery Level :	OK	
Sensor Option :	LOW	
Transmission :	LF INITIATE TM	
Tire Type :	65 psi	
Sensor State :	Normal Fixed	

No. 1

No. 2

ITEM	VALUE	UNIT
ID :	8CE49E5D	
Pressure :	48.5	psi
Temperature :	59	'F
Battery Level :	OK	
Sensor Option :	LOW	
Transmission :	LF INITIATE TM	
Tire Type :	65 psi	
Sensor State :	Normal Fixed	

No. 3

No. 4

ITEM	VALUE	UNIT
ID :	8D146A9A	
Pressure :	47.9	psi
Temperature :	53	'F
Battery Level :	OK	
Sensor Option :	LOW	
Transmission :	LF INITIATE TM	
Tire Type :	65 psi	
Sensor State :	Normal Fixed	

ITEM	VALUE	UNIT
ID :	8D17A5A9	
Pressure :	47.7	psi
Temperature :	55	'F
Battery Level :	OK	
Sensor Option :	LOW	
Transmission :	LF INITIATE TM	
Tire Type :	65 psi	
Sensor State :	Normal Fixed	

High Low Retry

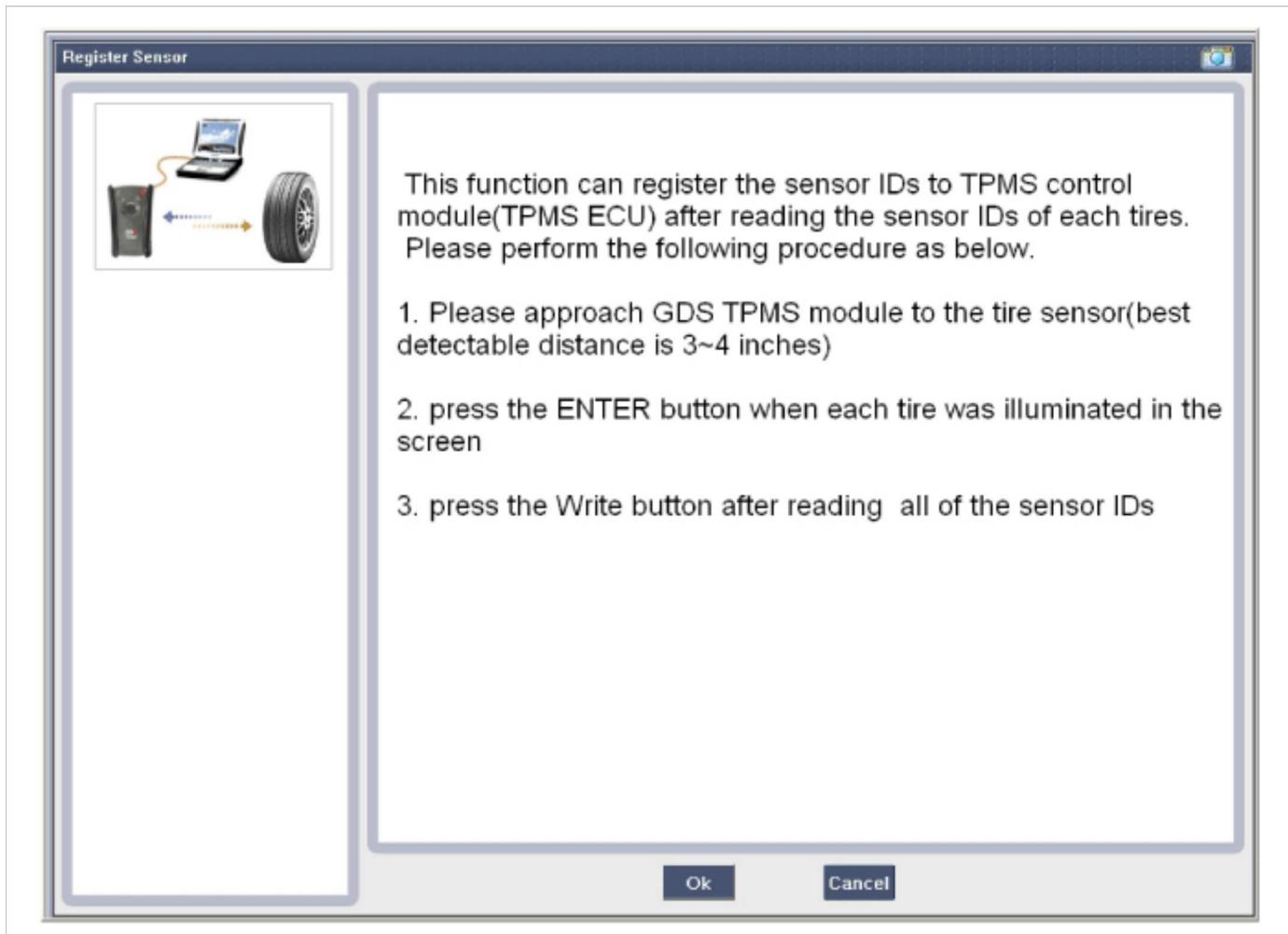
High Low Retry

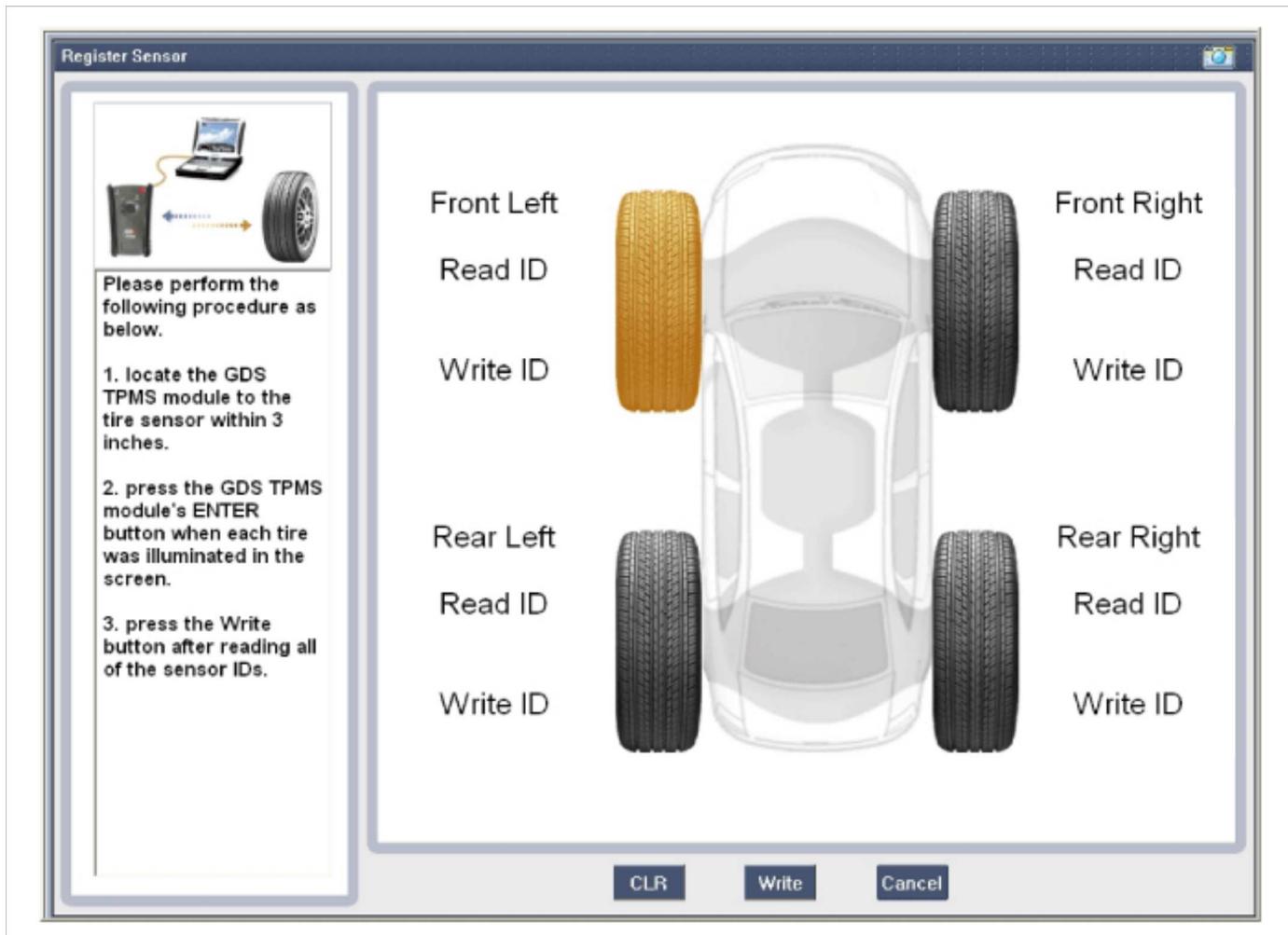
High Low Retry

High Low Retry

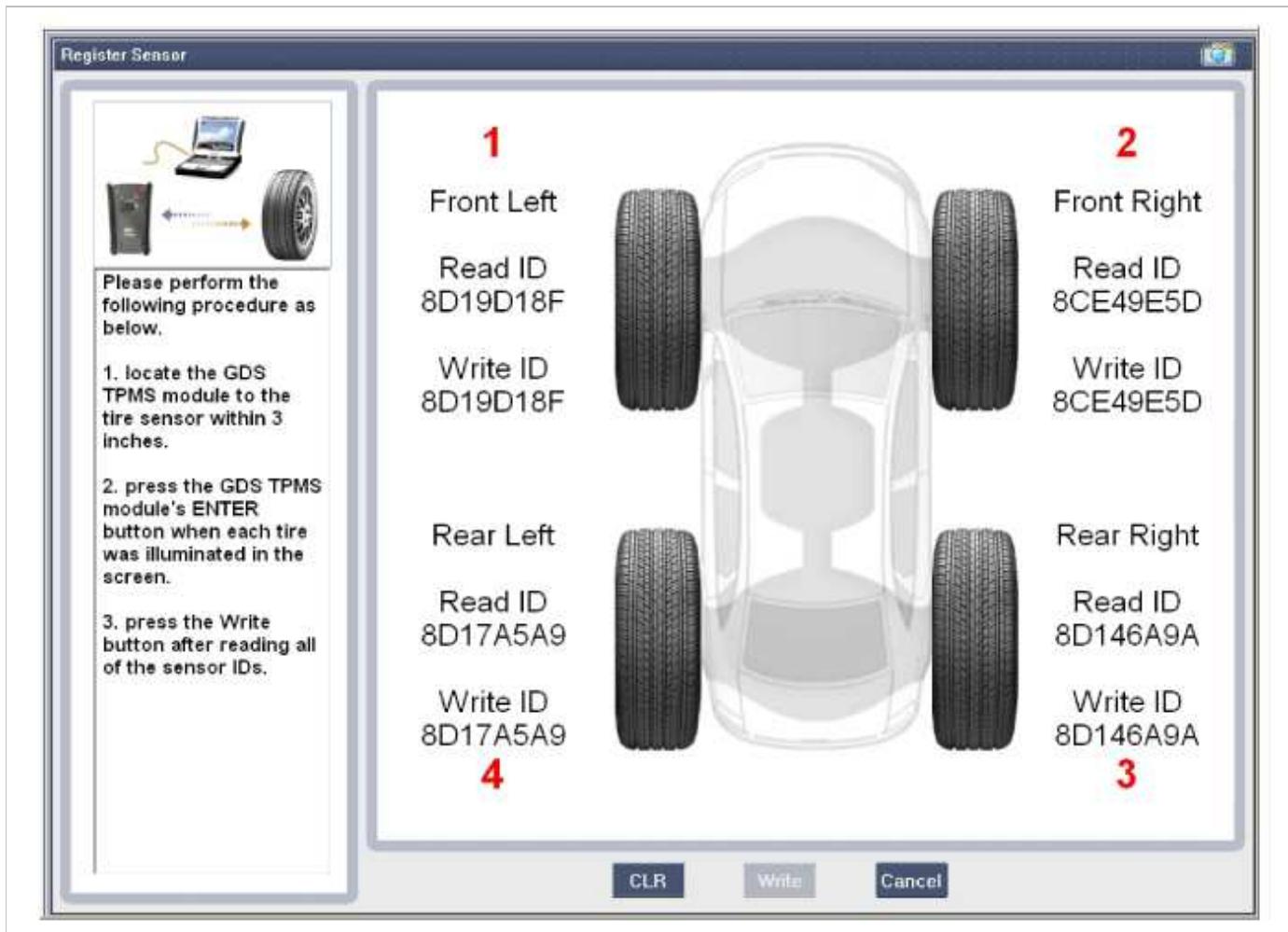
Cancel

Sensor ID Writing (Wireless)

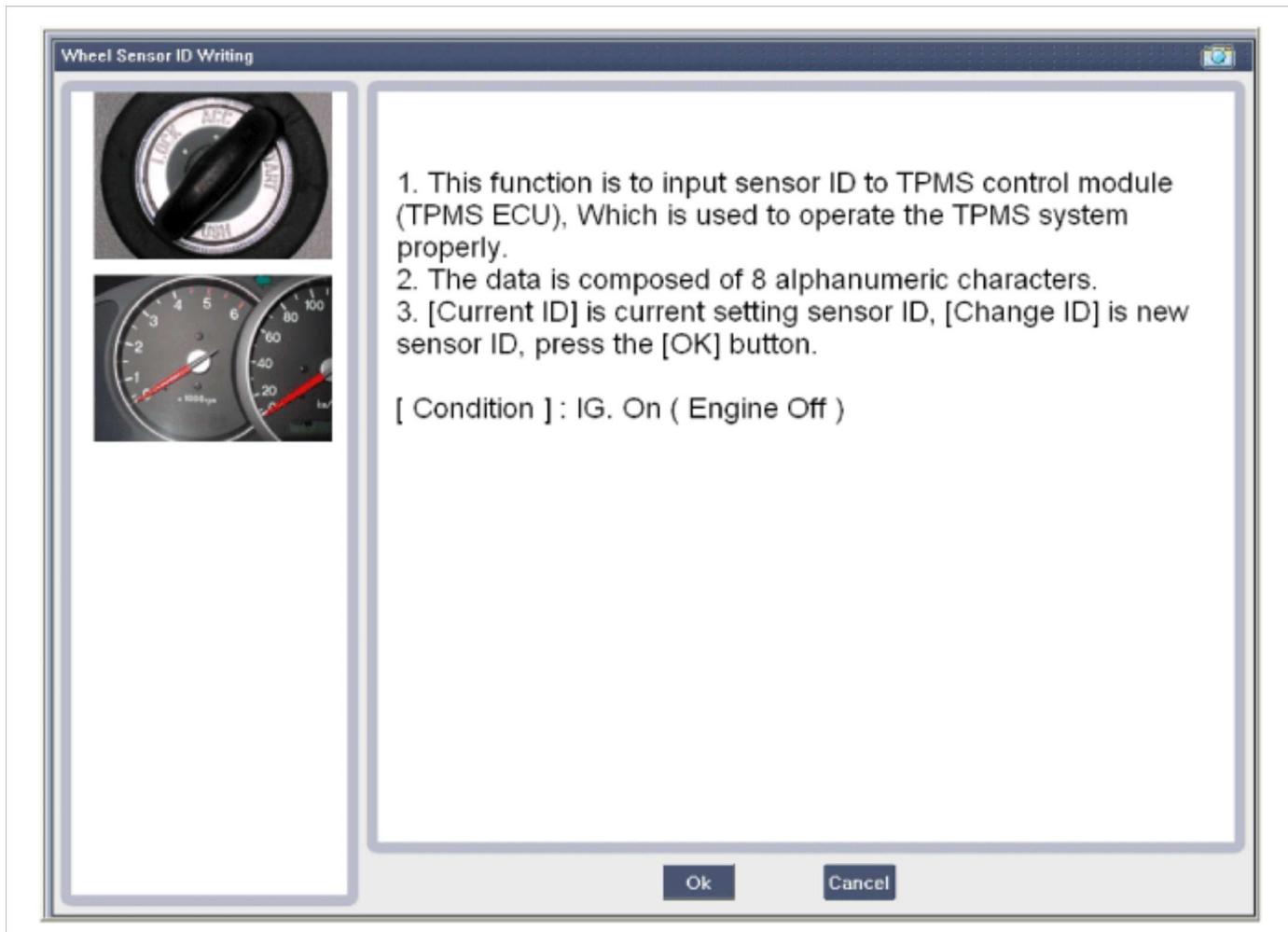


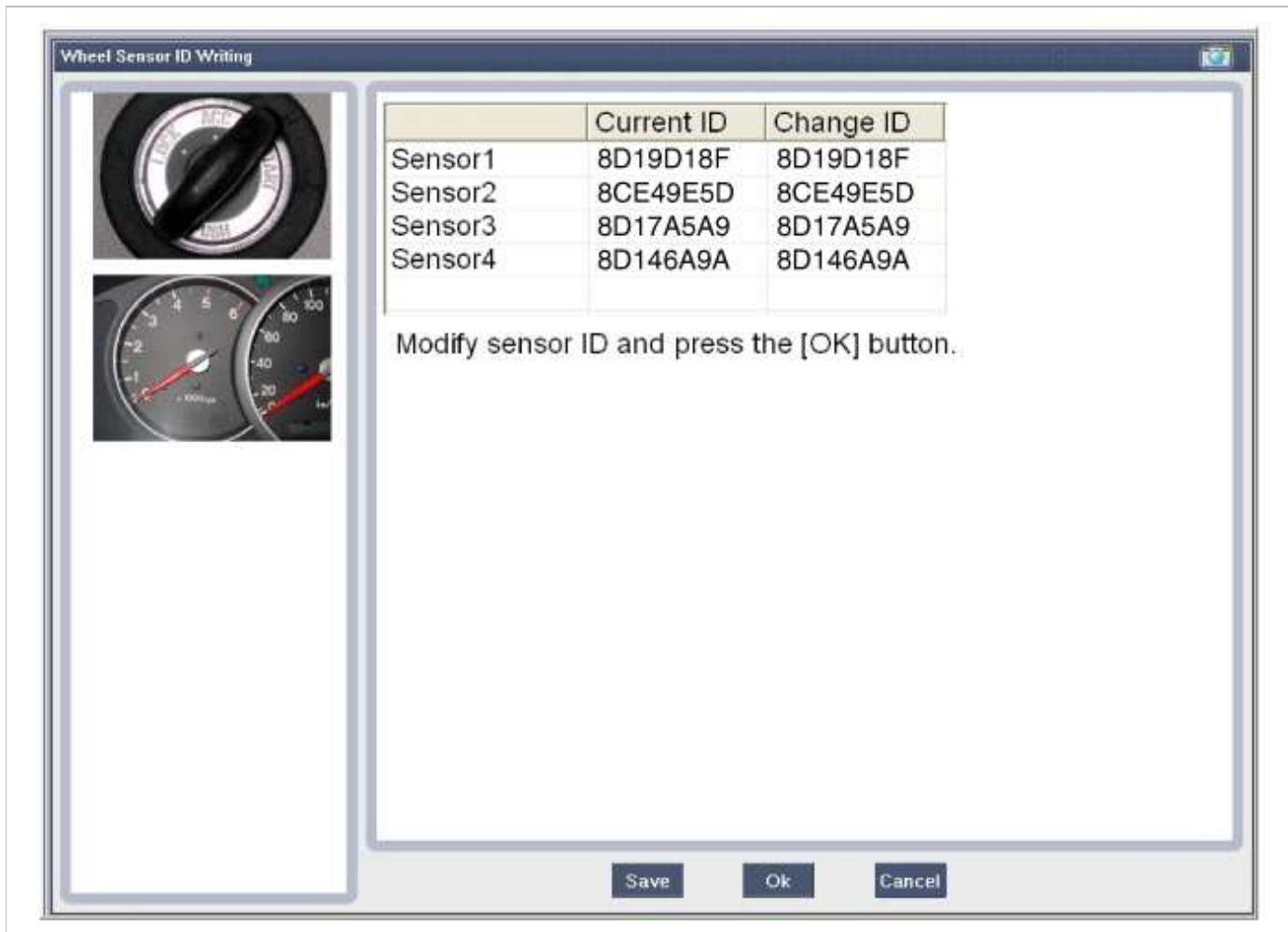


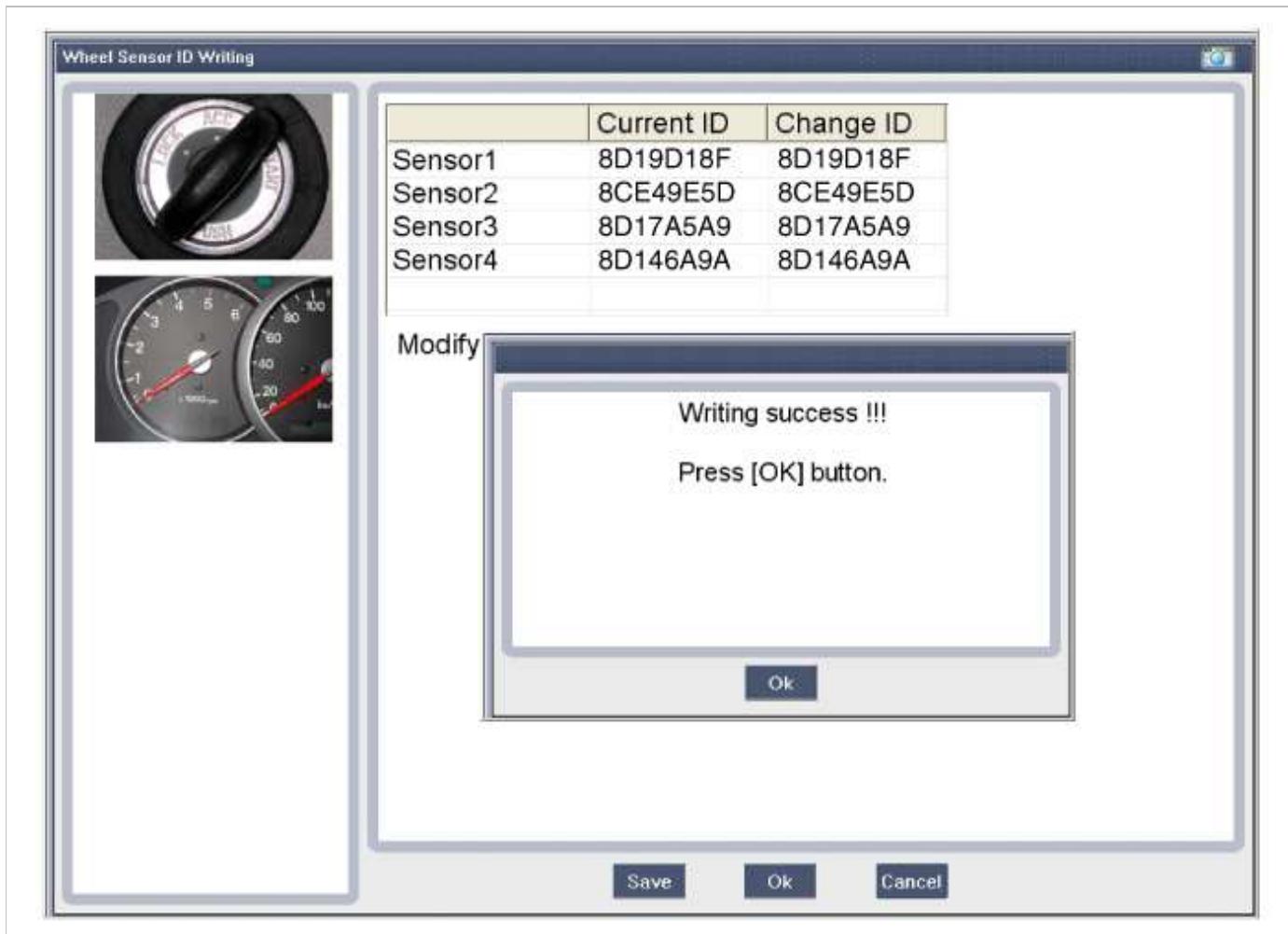




Sensor ID Writing



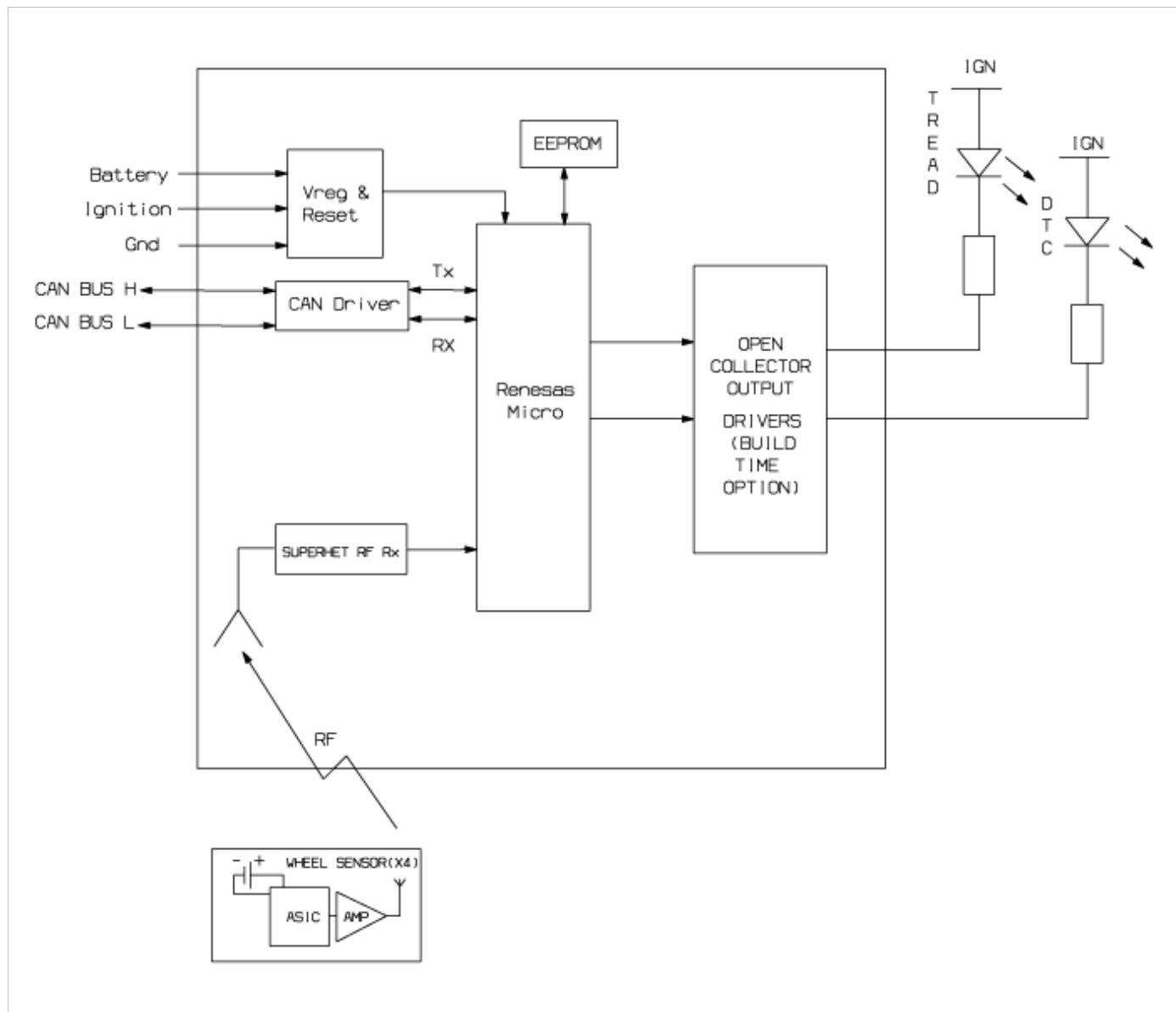
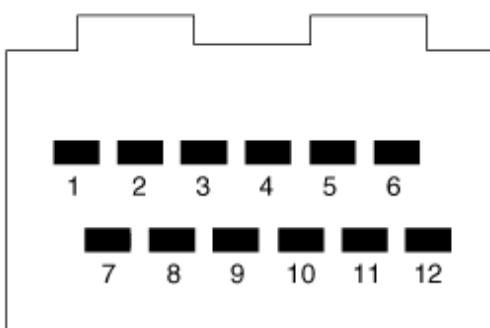




Suspension System > Tire Pressure Monitoring System > TPMS Receiver > Components and Components Location

Components

TPMS Receiver Circuit Diagram

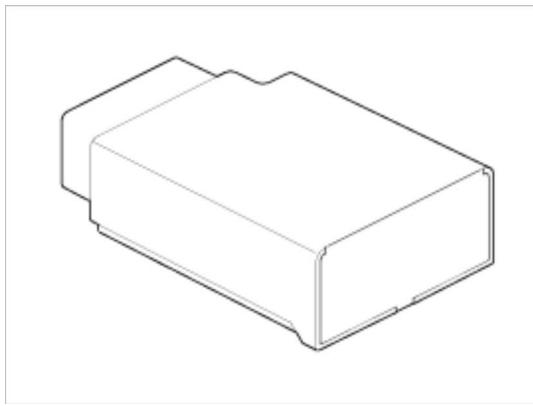
**Harness Connector**

Pin	Description
1	Battery
2	CAN_High
3	GND
4	-
5	-

6	-
7	IGN
8	CAN_Low
9	-
10	-
11	-
12	-

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

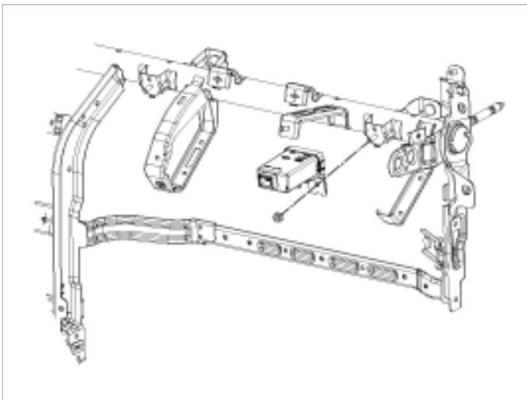
Replacement

NOTE

When the receiver first arrives for replacement :

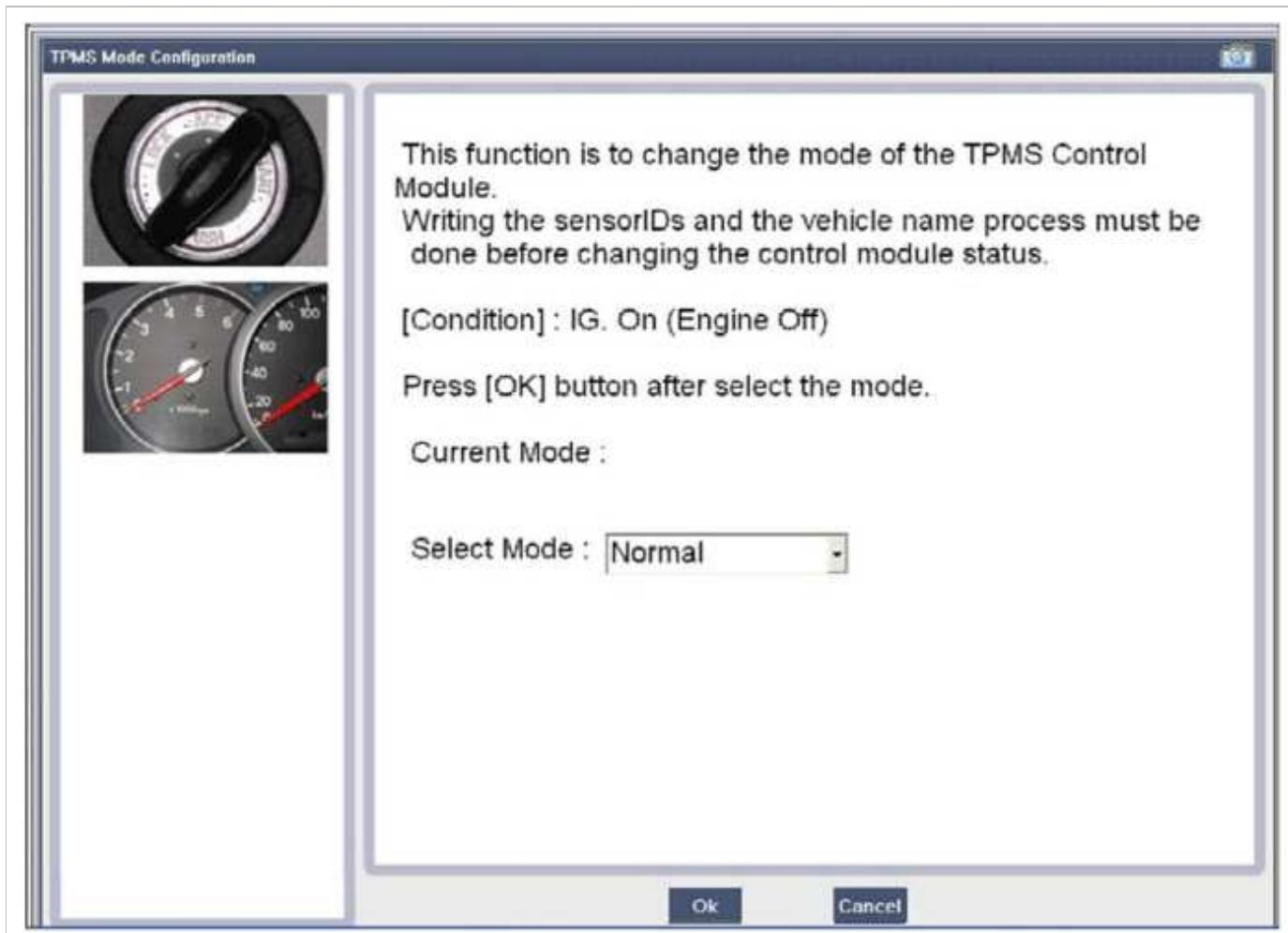
- 1) It will be in Virgin State.
- 2) It will not be configured for any specific platform.
- 3) It will not have any sensor ID's memorized.

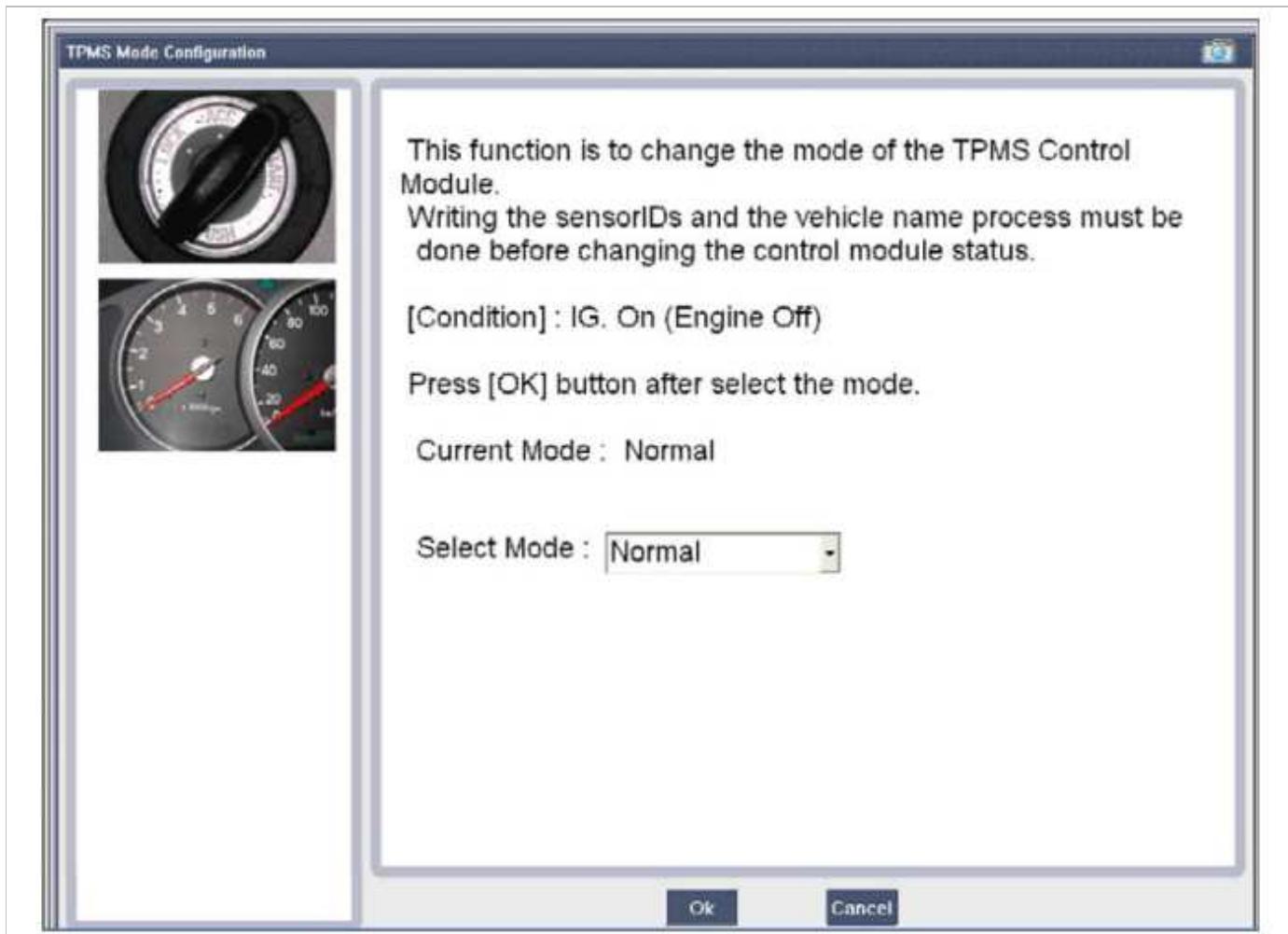
1. Disconnect vehicle battery.
2. Remove the crash pad garnish.
(Refer to "Crash Pad" in BD group)
3. Remove faulty part and fit bracket assembly to new part.



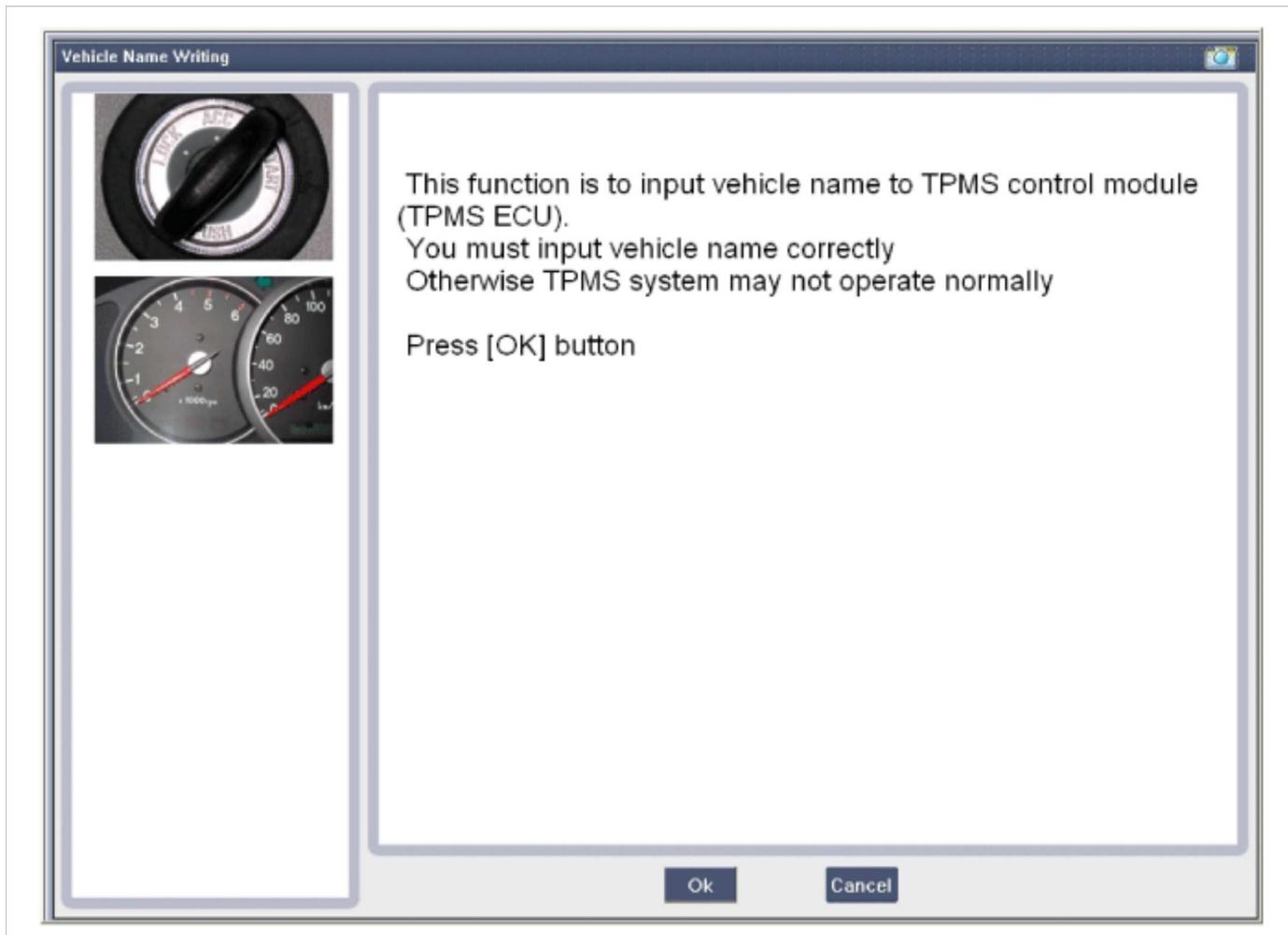
4. Secure new part to vehicle and fit connector.
5. Re-connect battery and turn Ignition on.
6. Check that TREAD Lamp flash rate matches Virgin State indication.

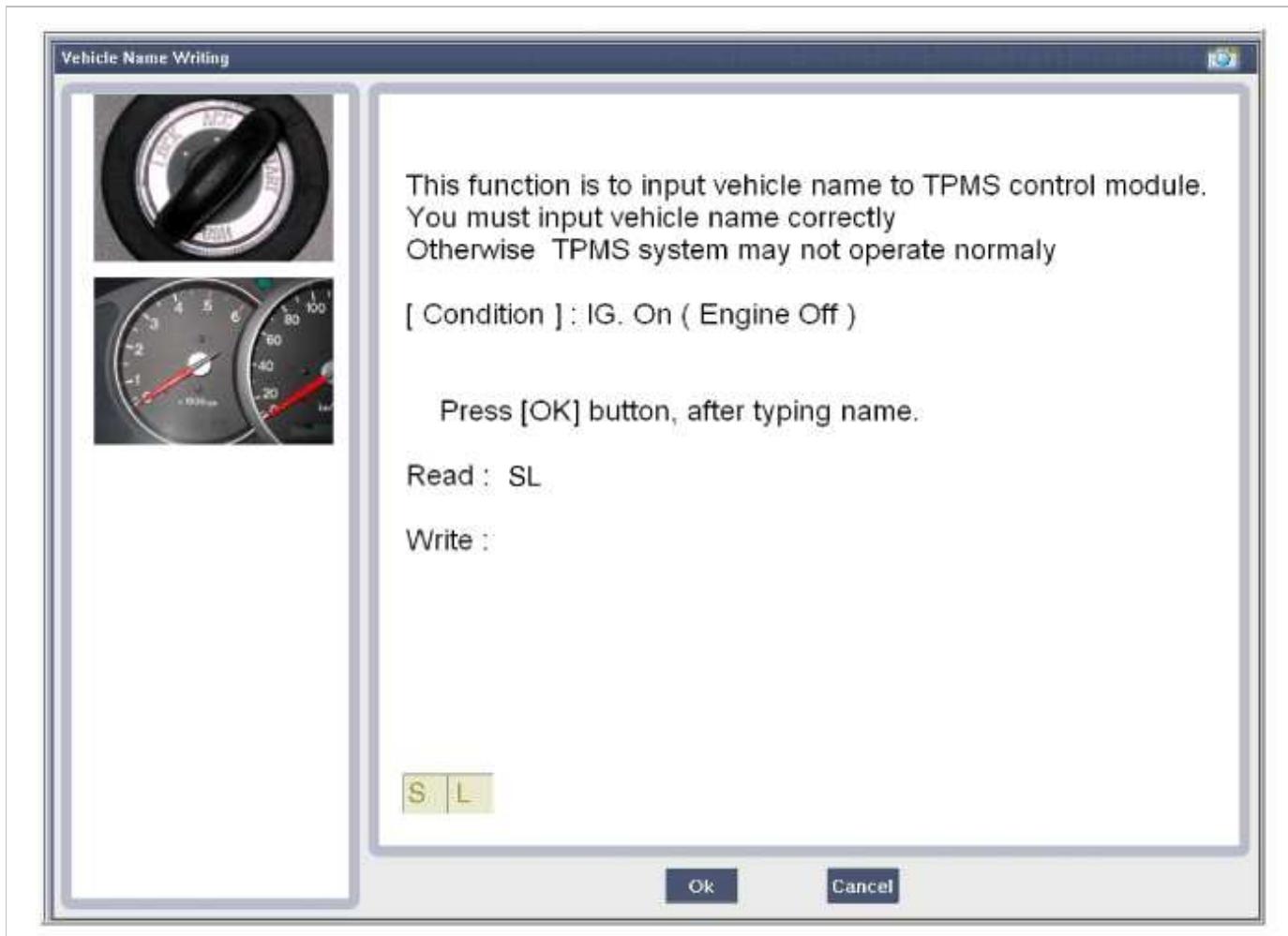
TPMS Mode Configuration

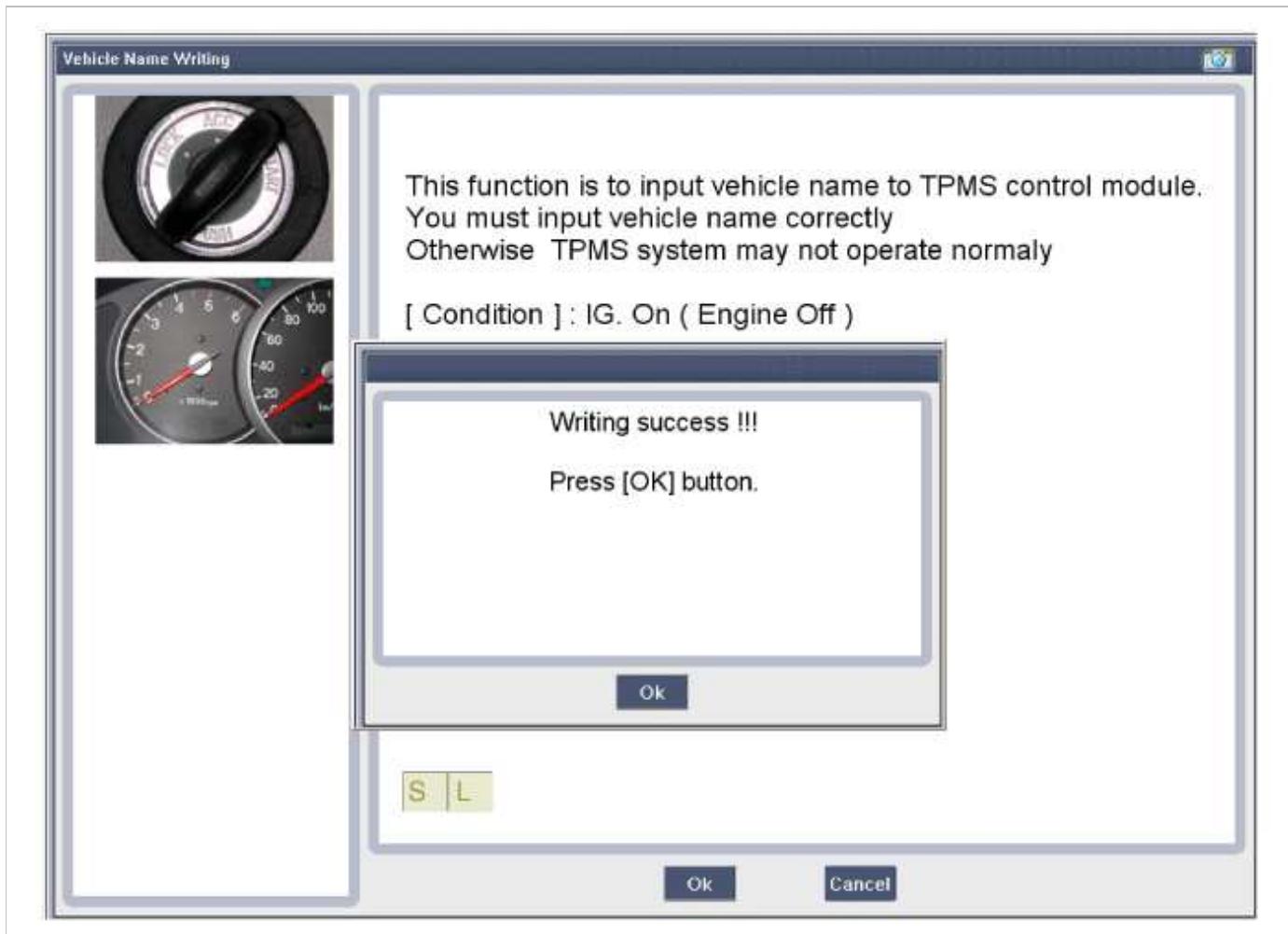


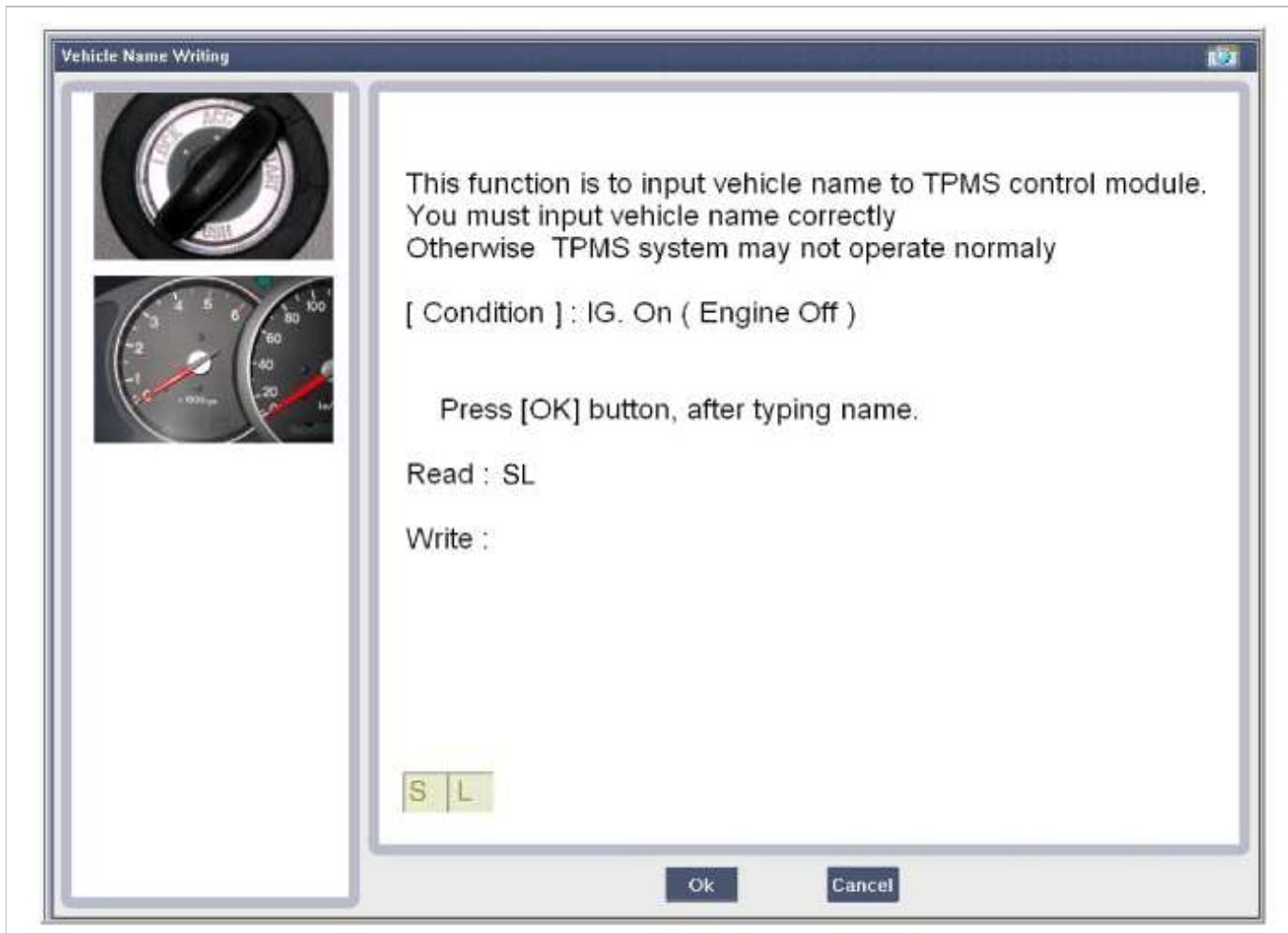


Vechicle Name Writing

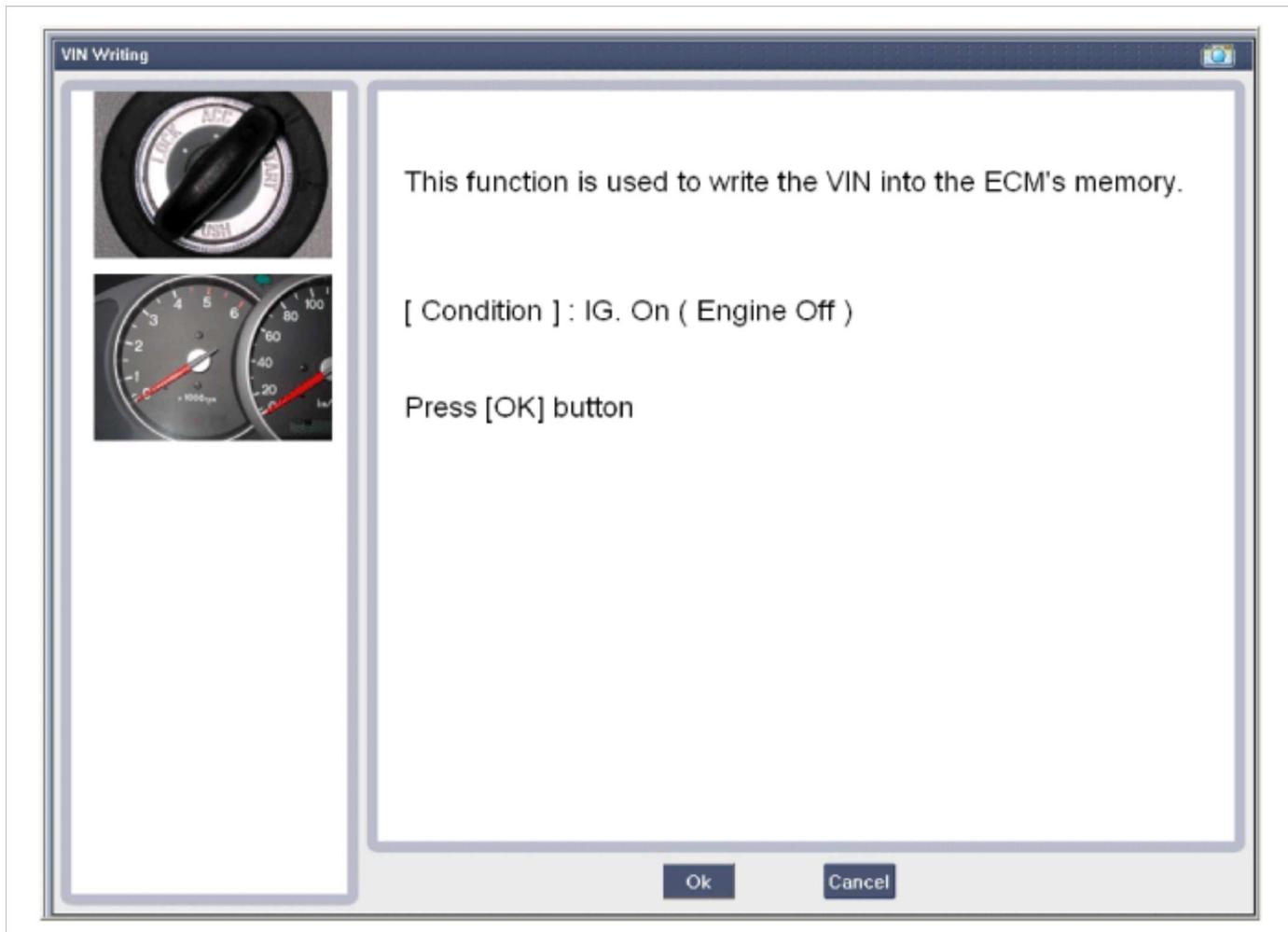


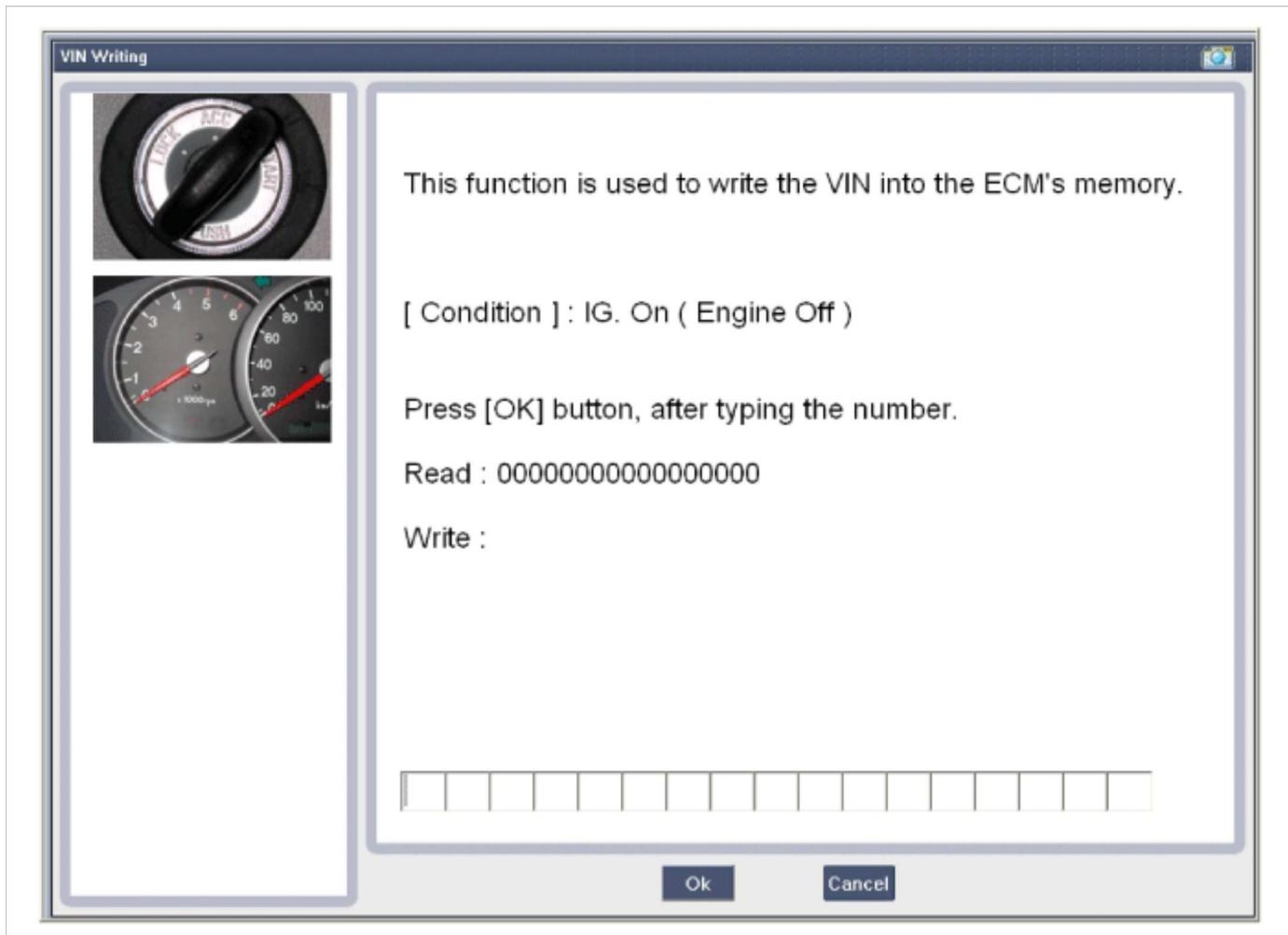


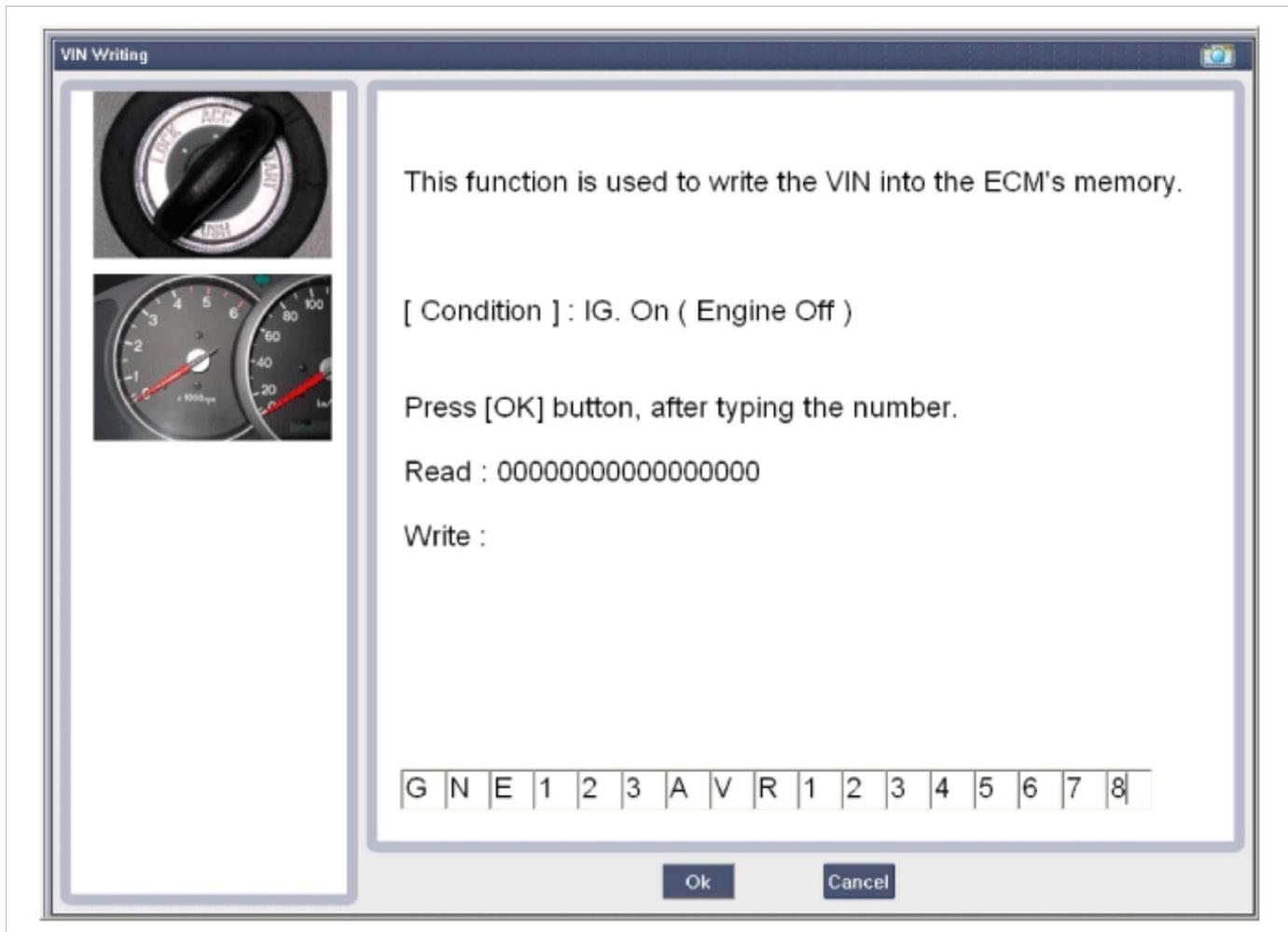


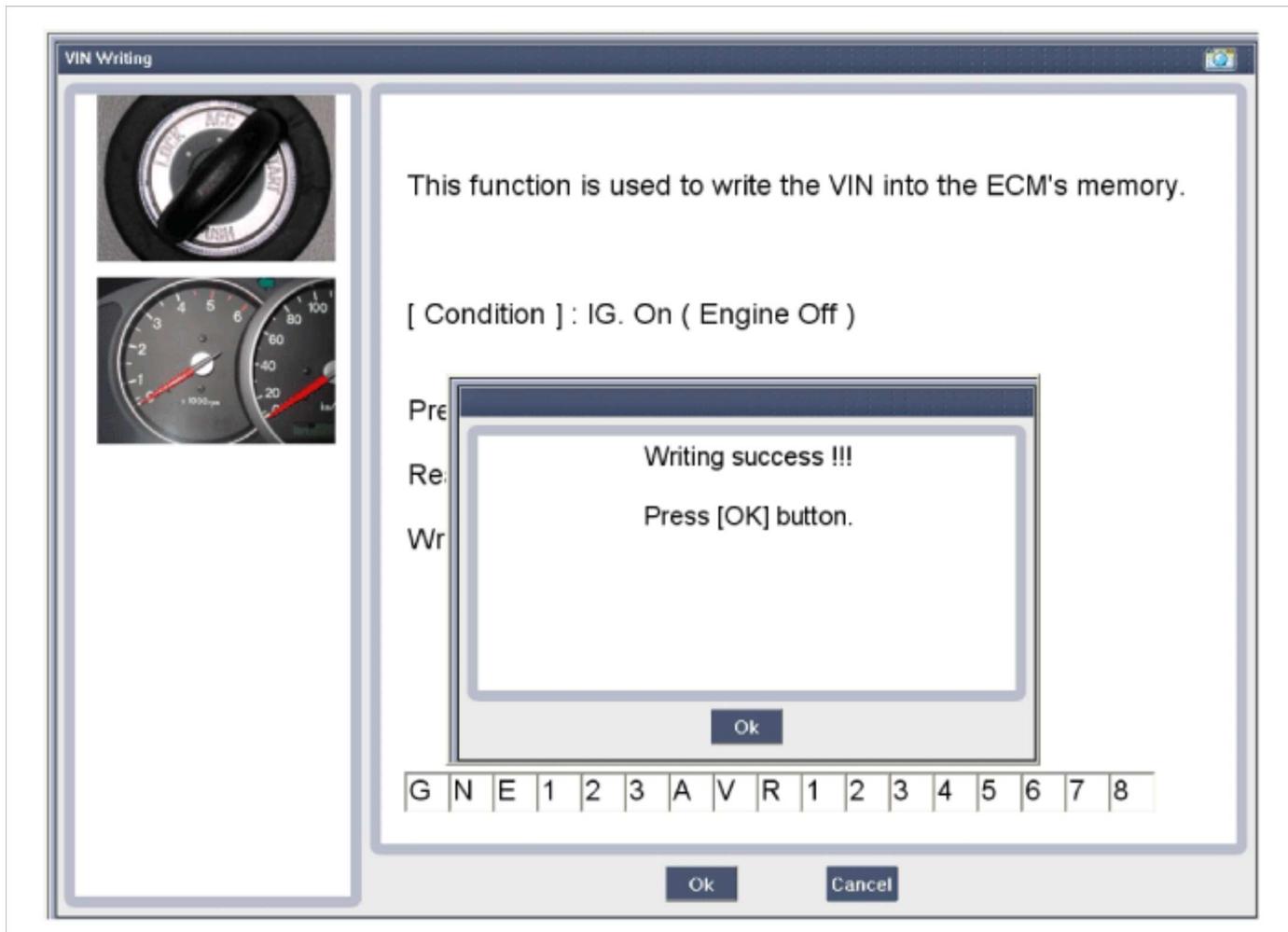


VIN Writing









VIN Writing



This function is used to write the VIN into the ECM's memory.

[Condition] : IG. On (Engine Off)

Press [OK] button, after typing the number.

Read : GNE123AVR12345678

Write :

--	--	--	--	--	--	--	--	--	--	--	--

Ok Cancel



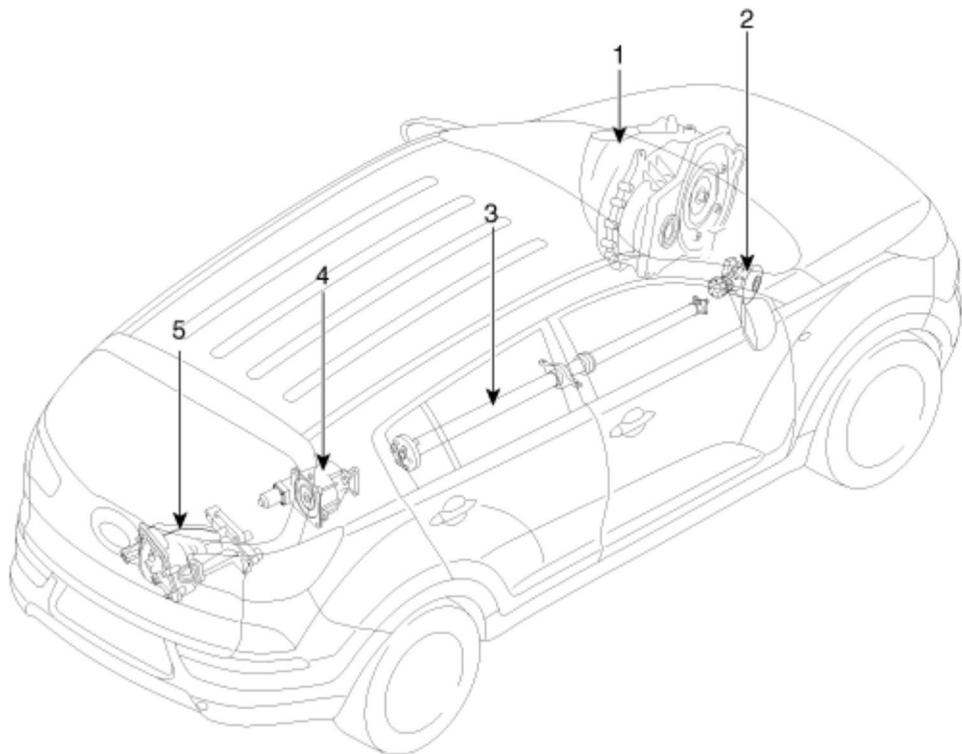
SPORTAGE(SL) > 2012 > G 2.4 DOHC > 4 Wheel Drive (4WD) System**4 Wheel Drive (4WD) System > General Information > Specifications****Specifications****Tightening Torques**

Items	N.m	Kgf.m	lb·ft
Transfer assembly mounting bolts	60.8~65.7	6.2~6.7	44.8~48.5
4WD ECM mounting nuts	9.8~11.8	1.0~1.2	7.2~8.7
Coupling assembly mounting bolts	56.9~64.7	5.8~6.6	42.0~47.7
Propeller shaft mounting bolts	49.0~68.6	5.0~7.0	36.2~50.6
Transfer oil drain plug	39.2~58.8	4.0~6.0	28.9~43.4
Transfer oil filler plug	39.2~58.8	4.0~6.0	28.9~43.4

Lubricants

Items	Specification	Capacity
Transfer oil	HYPOID GEAR OIL API GL-5, SAE 75W/90 (SHELL SPIRAX X or equivalent)	0.6L (0.16 U.S.gal., 0.63 U.S.qt, 0.53 Imp.qt.)
Coupling oil	SHELL TF0870	0.485L(0.13 U.S.gal.,0.51U.S.qt,0.43Imp.qt.)

4 Wheel Drive (4WD) System > Transfer Assembly > Front Wheel Transfer Assembly > Components and Components Location**Components Location**



1. Automatic transaxle
 2. Transfer assembly
 3. Propeller shaft

4. Coupling assembly
 5. Differential assembly

4 Wheel Drive (4WD) System > Transfer Assembly > Front Wheel Transfer Assembly > Repair procedures

Inspection

Transfer Oil Inspection

Transfer oil should be inspected and refilled every 30 months or 37,500 miles.

Transfer Oil Replacement

1. Transfer oil is not replaced in normal condition. But it should be replaced every 75,000 miles in severe driving conditions.

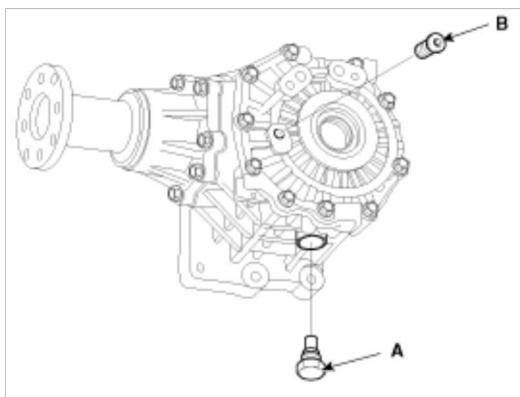
NOTE

Severe driving conditions

1. Driving in dusty, rough roads
2. Driving in mountain areas
3. Driving for patrol car, taxi, commercial car or vehicle towing
4. Driving over 170Km/h

CAUTION

Transfer oil should be replaced if the transfer assembly is fall into the water.



Tightening torque

Oil drain plug(A) :

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

Filler plug(B) :

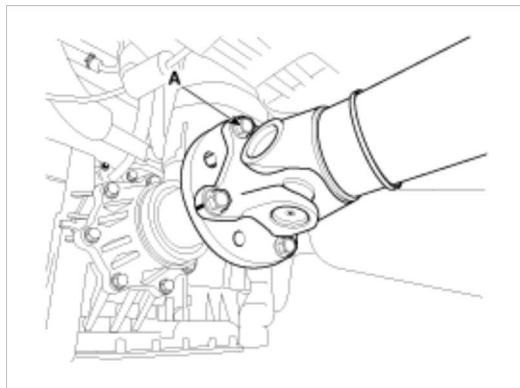
39.2~58.8N.m (4.0~6.0kgf.m, 28.9~43.4lb-ft)

Removal

1. Lift up the vehicle.
2. Remove the propeller shaft bolts.(A-4ea)

Tightening torque :

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

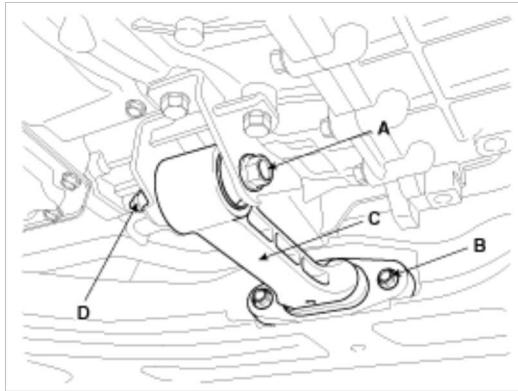


3. Remove the right driveshaft (passenger side) from the transfer case. (Refer to "Drive shaft" in DS group)
4. Remove the roll rod bracket(C) after removing bolt(A,B).

Tightening torque :

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

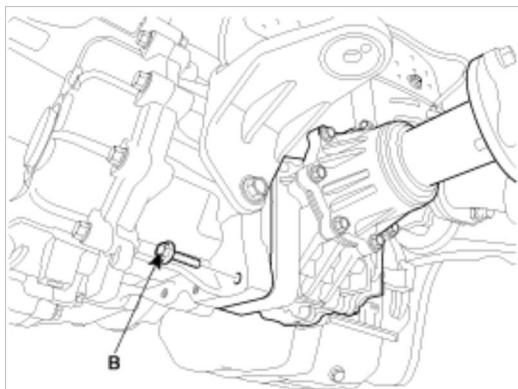
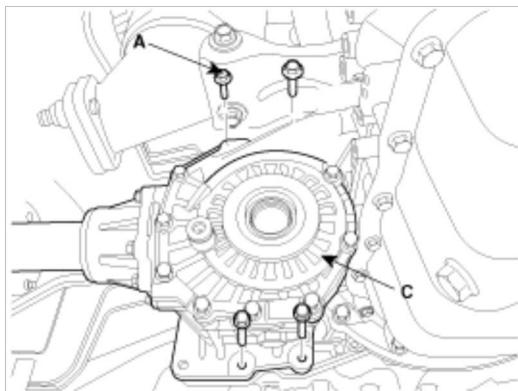
(D) 107.9~127.5N.m (11~13kgf.m, 79.6~94.1lb-ft)



5. Remove the sub frame. ("Front suspension system" in SS group)
6. Remove the transfer case up and down mounting bolt (A-4ea, B-1ea).

Tightening torque :

(A, B) 60.8~65.7N.m (6.2~6.7kgf.m, 44.8~48.5lb-ft)



7. Remove the transfer case (C) with the lever after supporting the transfer case with a jack.

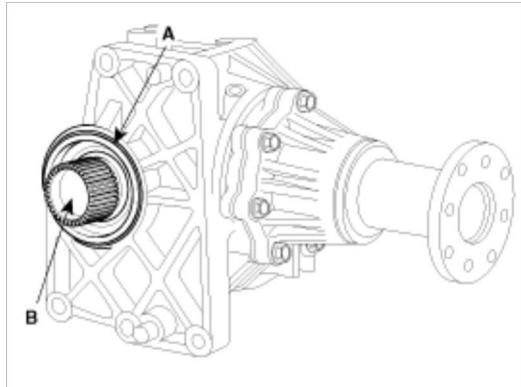
Installation

1. Installation is the reverse of removal.

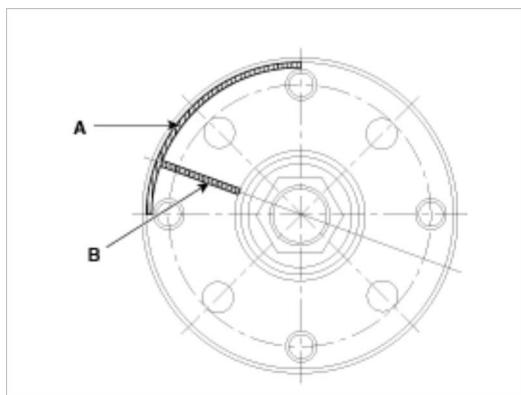
NOTE

1. Be careful not to damage the O-ring (A). If the O-ring is damaged, replace with a new one.
2. Smear and cover splines (B) with molybdenum type high pressure grease.

TECHLUBE MEGAMAX - ALPHA OR EQUIVALENT



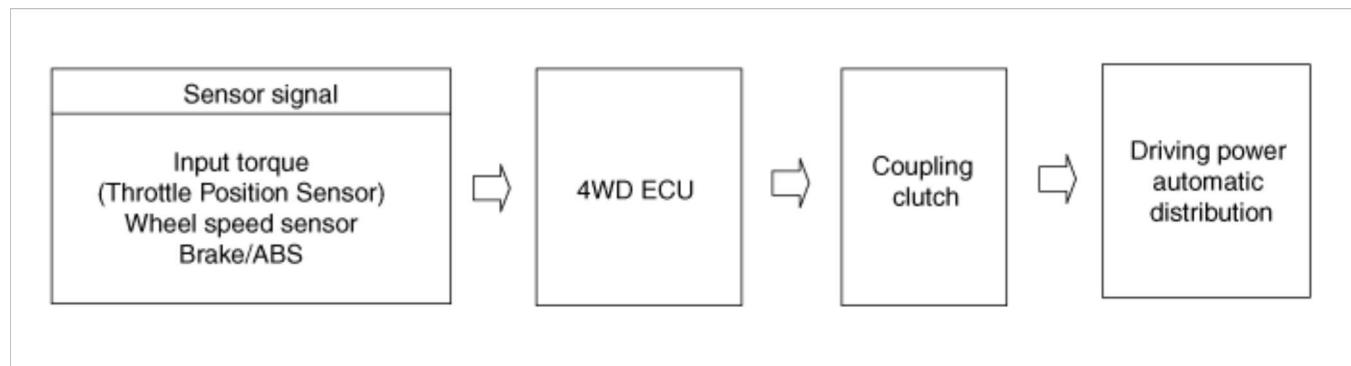
3. Install the propeller shaft near runout marking (Transfer assembly 1ea(A), propeller shaft 1ea(B)).



4 Wheel Drive (4WD) System > 4WD Control System > 4WD ECU > Description and Operation

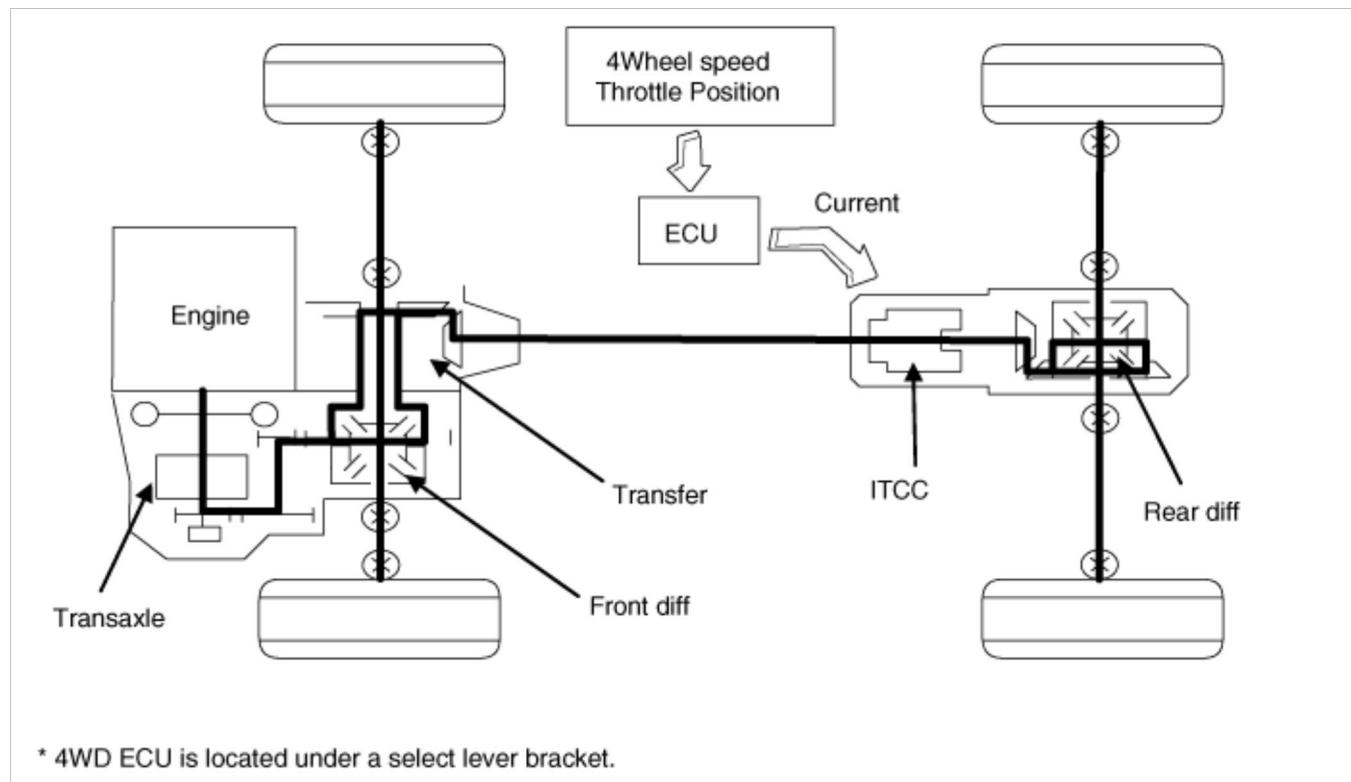
Description

4WD ECU processes signals from various sensors and determines the current road and driving conditions. The ECU then utilizes this information to implement precision control over the 4WD coupling's multi-plate clutch and variably adjust the amount of torque delivered to the rear wheels.

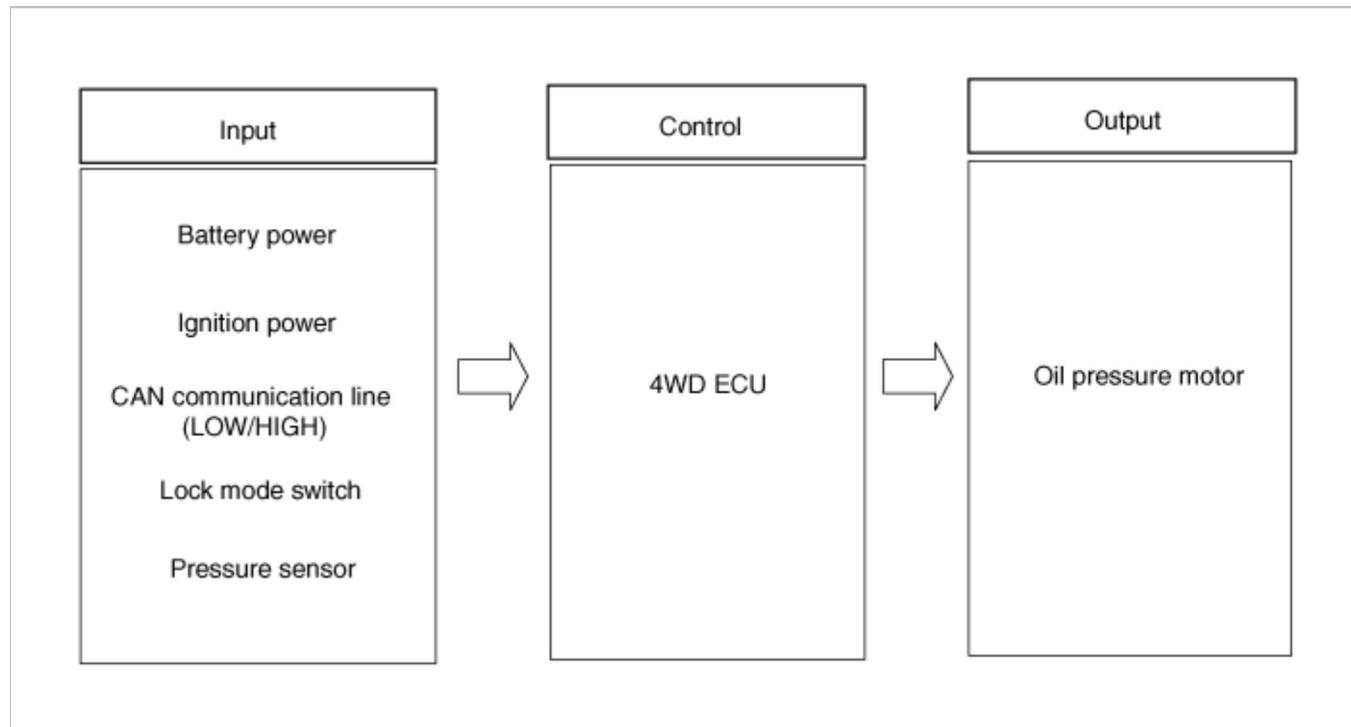


4 Wheel Drive (4WD) System > 4WD Control System > 4WD ECU > Flow Diagram

Power Flow Diagram



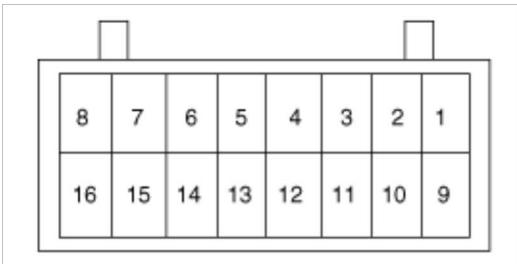
4WD ECU Input&Output Diagram



4 Wheel Drive (4WD) System > 4WD Control System > 4WD ECU > Schematic Diagrams

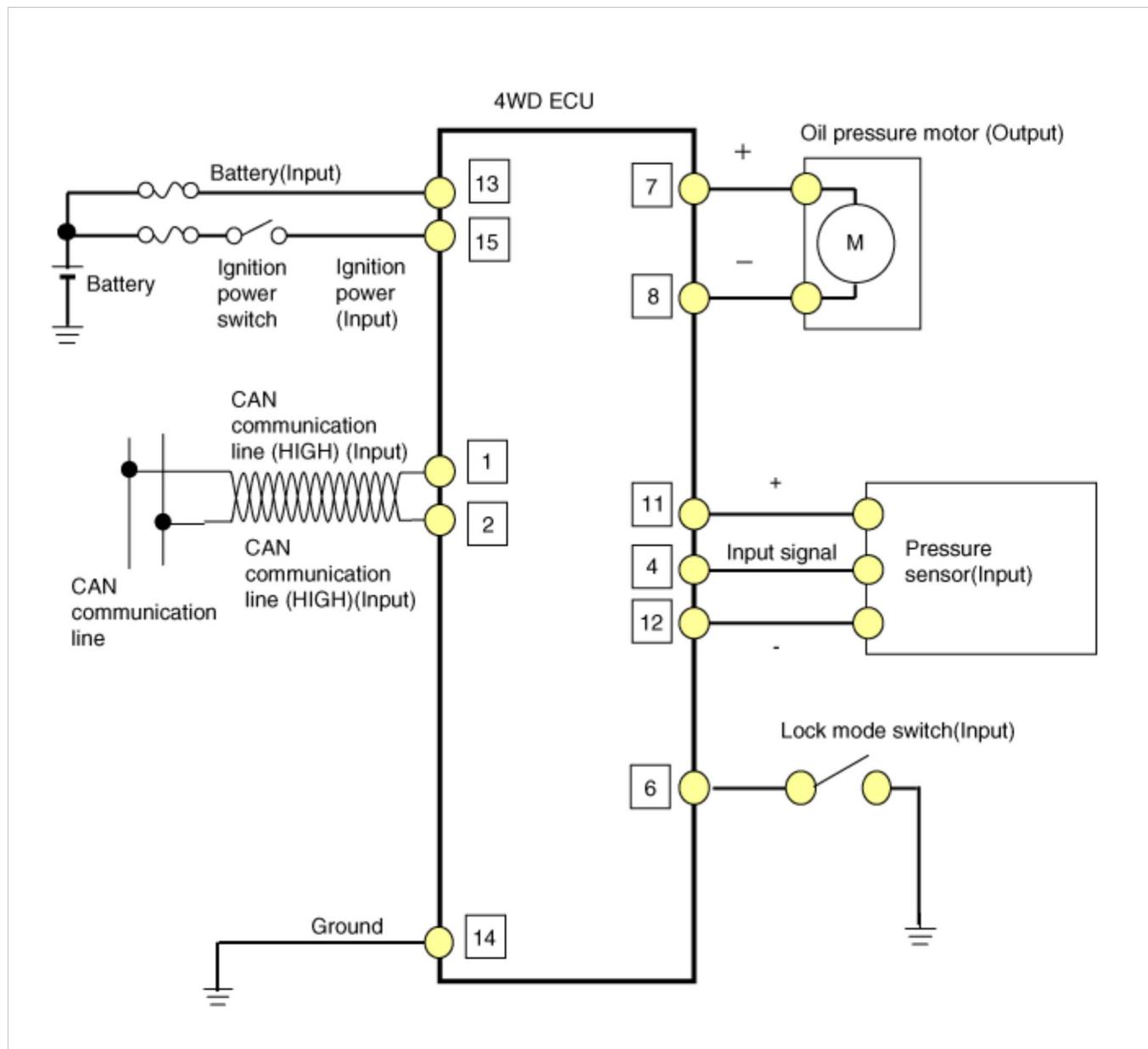
Circuit Diagram

4WD ECU Connector



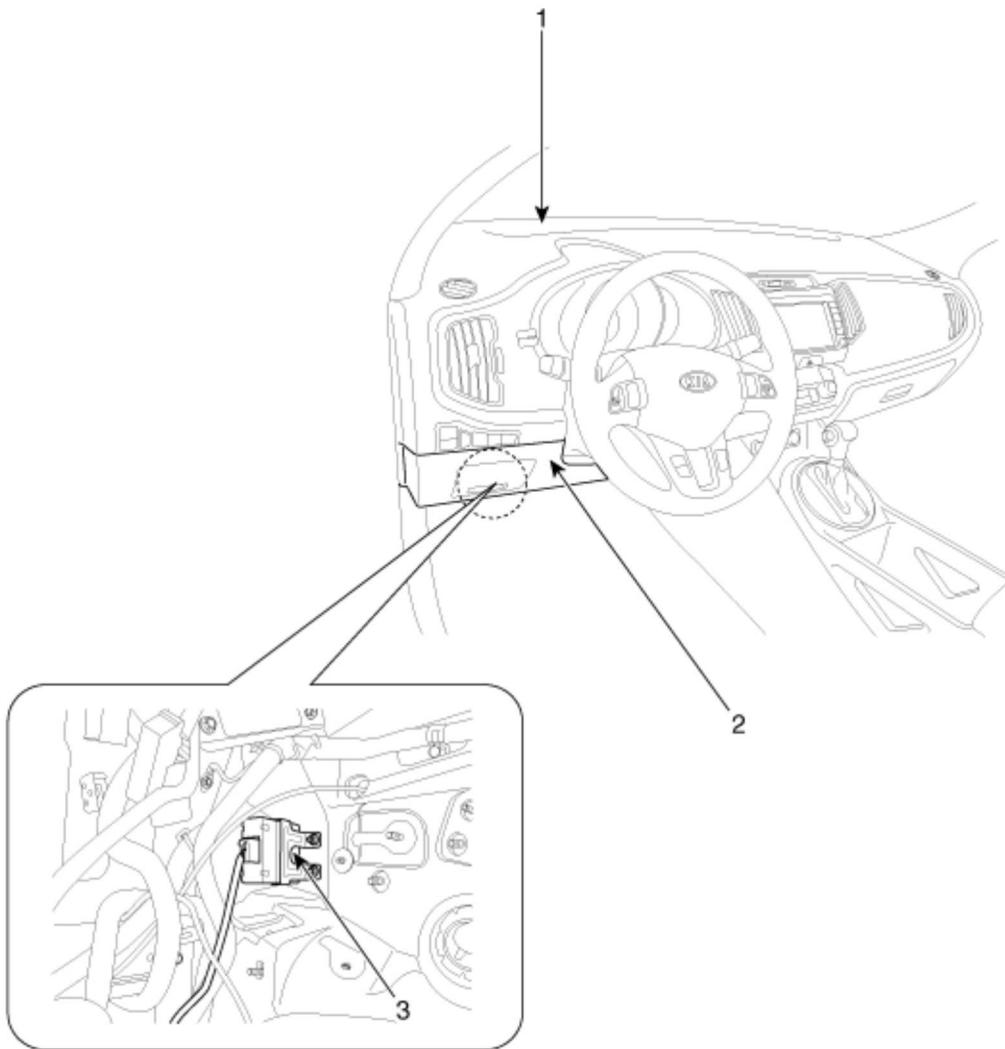
Pin	Function
1	Oil pressure motor A
2	Oil pressure motor B
3	Lock mode switch
4	-
5	Input sensor signal(+)
6	-
7	CAN communication line (High)
8	CAN communication line (Low)
9	-
10	-
11	-
12	IG power
13	Ground
14	Battery power
15	Input sensor signal(-)
16	Pressure sensor(Input)
17	-
18	-

4WD ECU Circuit Diagram



4 Wheel Drive (4WD) System > 4WD Control System > 4WD ECU > Components and Components Location

Component Location



1. Crash pad
2. Crash lower panel
3. 4WD ECU

4 Wheel Drive (4WD) System > 4WD Control System > 4WD ECU > Repair procedures

Replacement

CAUTION

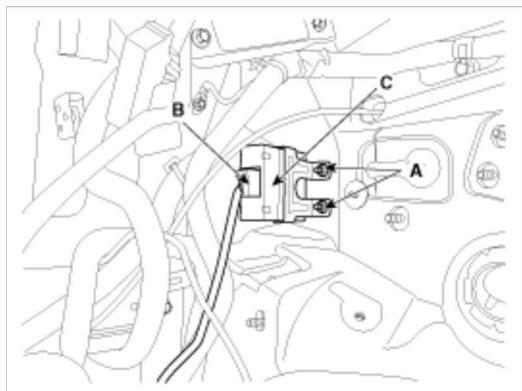
Prior to replacing the 4WD ECU, check the 4WD ECU's clutchlearing with the GDS tool. (Refer to " Coupling assembly " in 4WD group)

1. Remove the lower panel. (Refer to "Crash Pad" in BD group)
2. Remove the IPM.(Refer to "Fuses and Relays" in BE group)

3. Remove the parking brake pedal.(Refer to "Parking Brake System" in BR group)
4. Remove the 4WD ECU(C) after removing the nut (A-2ea) and the connector (B).

Tightening torque:

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



5. Installation is the reverse of removal.

CAUTION

Prior to installing a new ECU, upload the original ECU's clutch learning to the replacement ECU using the GDS tool.
(Refer to "Coupling assembly" in 4WD group)

4 Wheel Drive (4WD) System > Coupling Assembly > Direct Electro Hydraulic Actuator Coupling > Description and Operation

Description

4WD ECU processes signals from various sensors and determines the current road and driving conditions. The ECU then utilizes this information to implement precision control over the 4WD coupling's multi-plate clutch and variably adjust the amount of torque delivered to the rear wheels.

Four Wheel Drive (4WD) transfer mode selection

1. AUTO MODE:

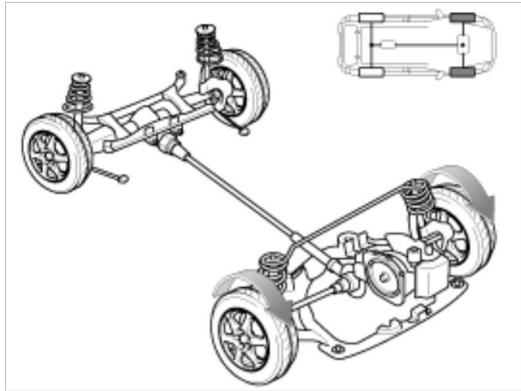
- A. When driving in 4WD AUTO mode, the vehicle operates similar to conventional 2WD vehicles under normal operating conditions. However, if the system determines that there is a need for the 4WD mode, the engine's driving power is distributed to all four wheels automatically without driver intervention.
- B. When driving on normal roads and pavement, the vehicle moves similar to conventional 2WD vehicles.

2. LOCK MODE:

- A. This mode is used for climbing or descending sharp grades, off-road driving, driving on sandy and muddy roads, etc., to maximize traction.
- B. This mode automatically begins to deactivate at speeds above 30 km/h (19 mph) and is shifted to 4WD AUTO mode at speed above 40 km/h (25 mph). If the vehicle speed decelerates to below 30 km/h (19 mph), however, the transfer mode is shifted into 4WD LOCK mode again.

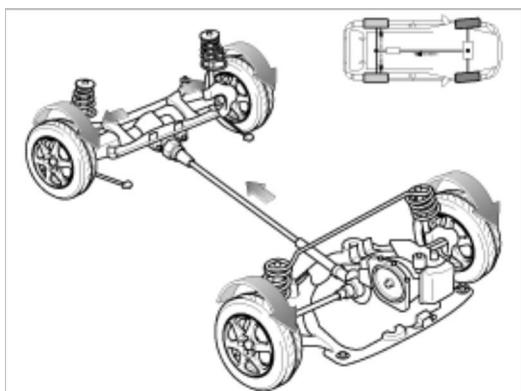
Electronic Coupling - 4WD Control (By Driving Condition)

1. Cruising (Auto Mode)
 - Power is delivered mostly to the front wheels.



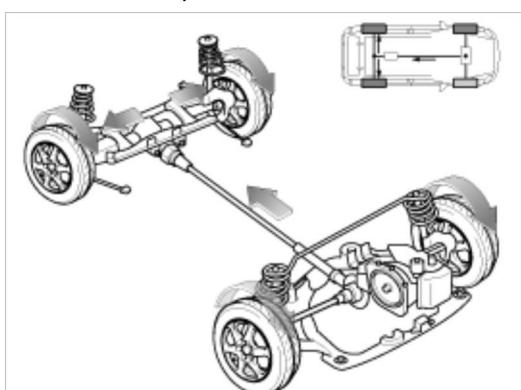
2. Cornering (Auto Mode)

- Adjusts the amount of power to the rear wheels based on the turning radius and cornering speed.



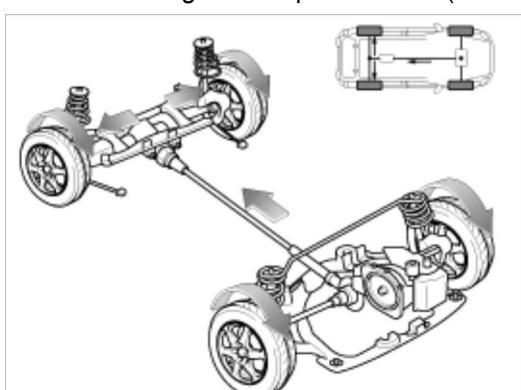
3. Wheel Slip (Auto Mode)

- If one or both of the front wheels lose traction, the system transfers an appropriate amount of power to the rear wheels based on the slip amount at the front wheels.



4. Lock Mode

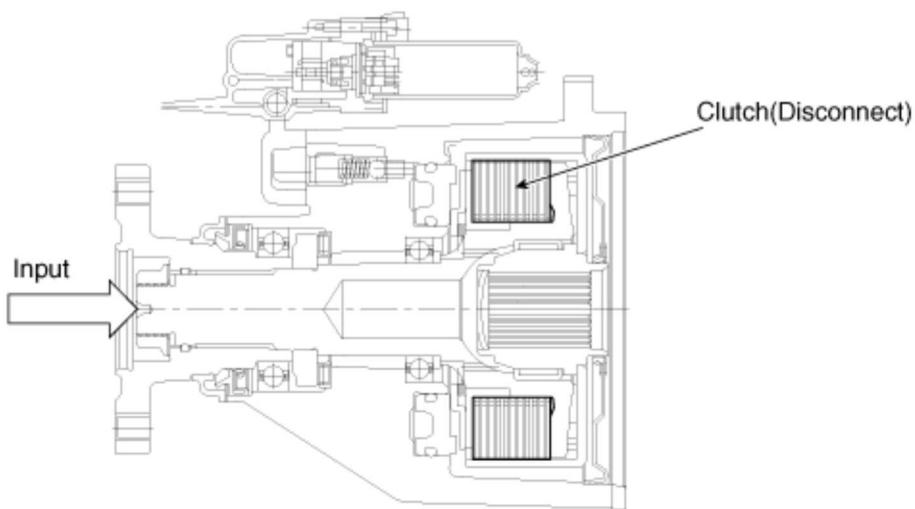
- Maximizes rough terrain performance (active only at speeds below 40 km/h).



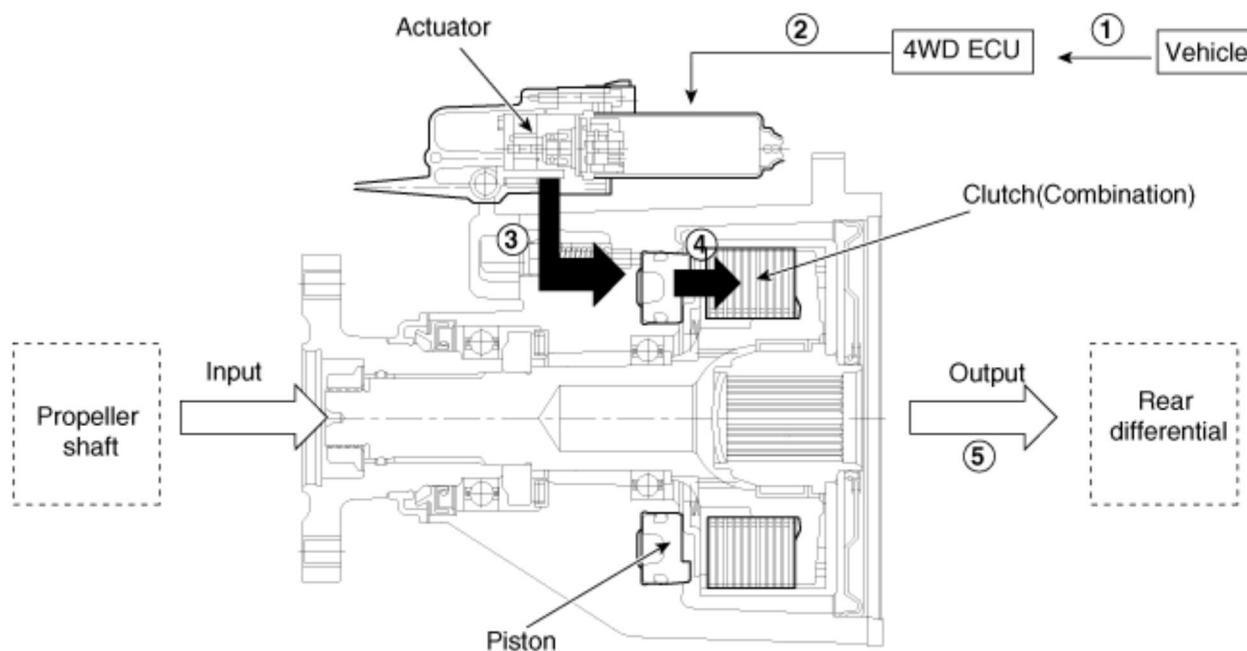
Operation

Electronic Coupling

[Inactive]



[Active]

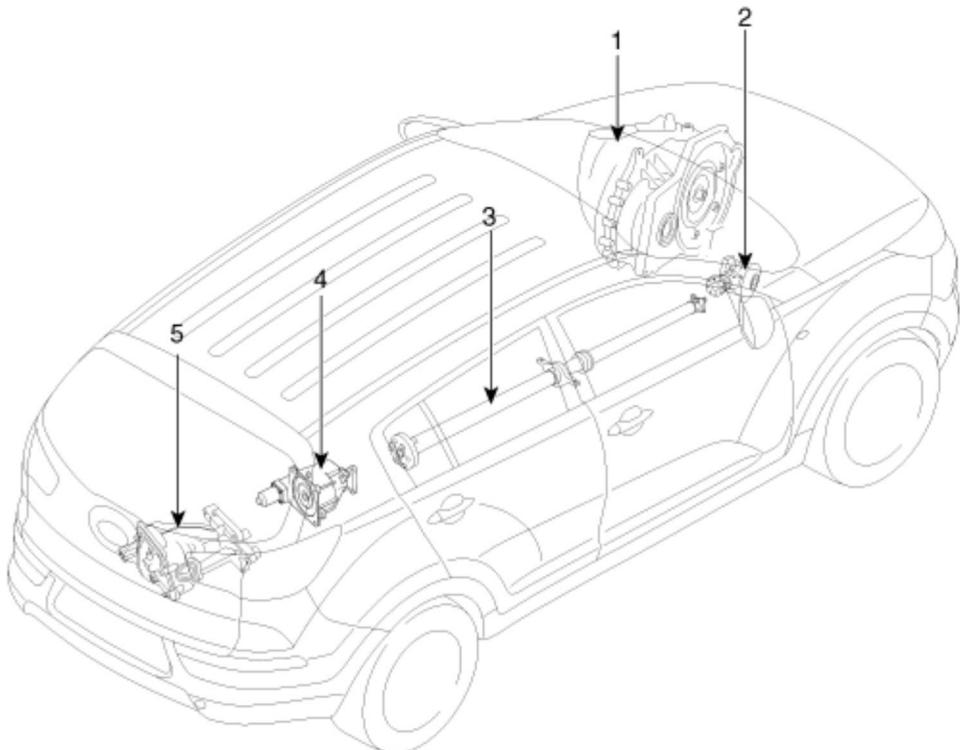


Operation Order

1. 4WD ECU receives CAN signals from the vehicle's sensors.
2. 4WD ECU calculates the necessary amount of rear-wheel torque and sends the corresponding driving current to the actuator (electronic motor and hydraulic pump).
3. Hydraulic pressure generated by the actuator moves the piston.
4. Friction from the piston's movement engages the clutch.
5. Power is delivered to the rear wheels.

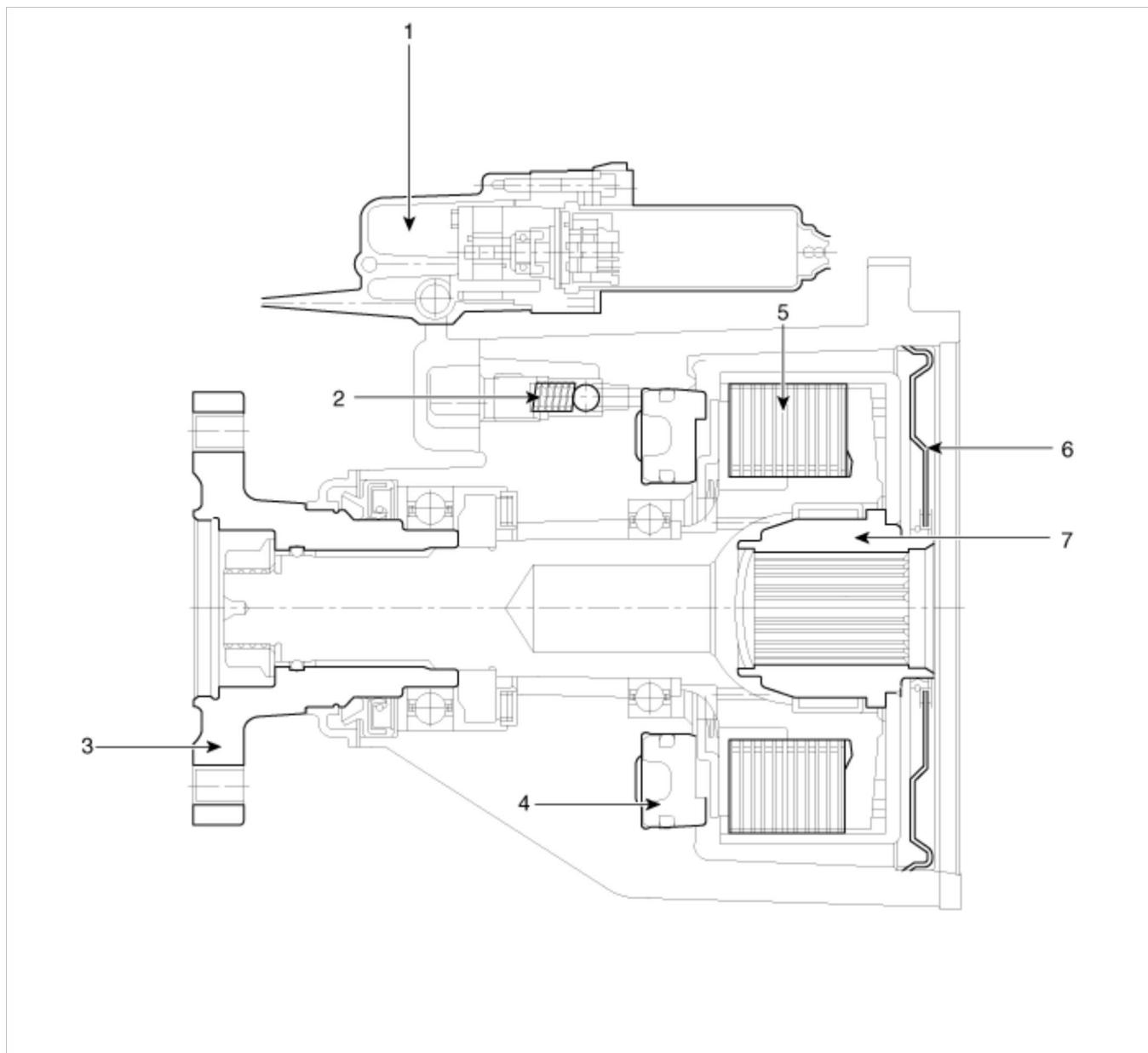
**4 Wheel Drive (4WD) System > Coupling Assembly > Direct Electro Hydraulic Actuator
Coupling > Components and Components Location**

Component Location



- | | |
|---|--|
| <p>1. Automatic transaxle
2. Transfer assembly
3. Propeller shaft</p> | <p>4. Coupling assembly
5. Differential assembly</p> |
|---|--|

Components



- 1. Actuator
- 2. Bleed valve
- 3. Flange & Input shaft
- 4. Piston

- 5. Clutch pack
- 6. Oil seal cover
- 7. Hub

4 Wheel Drive (4WD) System > Coupling Assembly > Direct Electro Hydraulic Actuator Coupling > Repair procedures

Inspection

NOTE

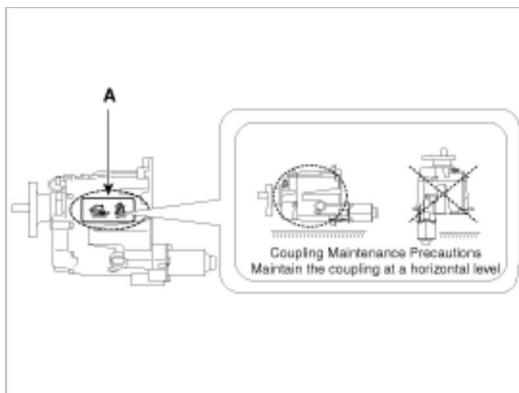
All units are filled up with coupling fluid (ultra-low viscosity ATF) prior to shipping. Inspection, fill-up, and replacement of coupling fluid is therefore not necessary (zero maintenance, lifetime fluid).

Removal

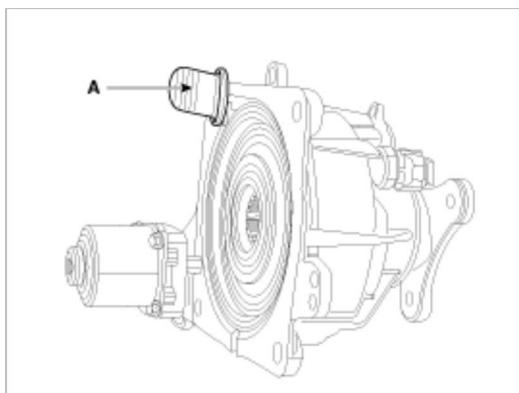
CAUTION**Coupling Maintenance Precautions**

Maintain the coupling at a horizontal level.

- Refer to the handling caution level (A) when servicing the coupling (removal, installation, replacement, etc.).



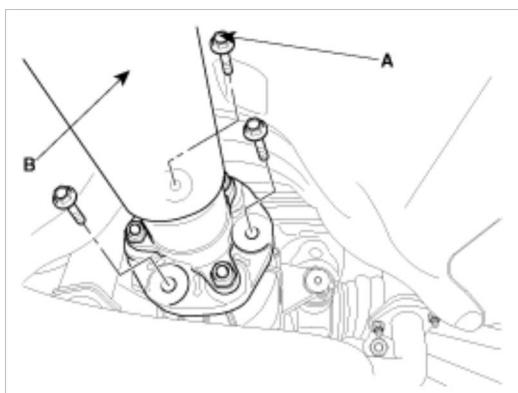
- Remove the dipstick and then mount the coupling assembly to the rear differential assembly.
- Maintain the coupling at a horizontal level after removing the dipstick to prevent the fluid from spilling out.



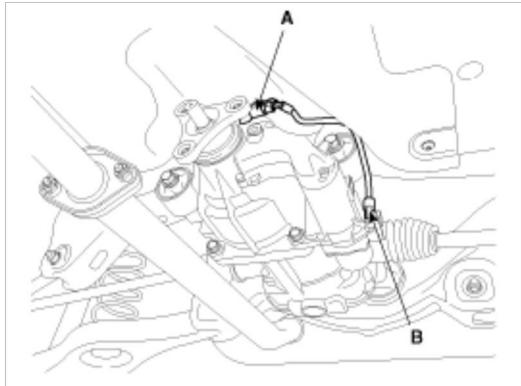
1. Remove the 4WD coupling assembly bolts (A-3ea) mounted to the rear propeller shaft (B).

Tightening torque :

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



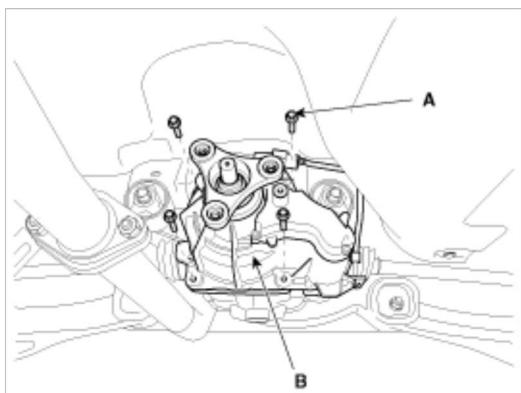
2. Using a flat tool, separate the propeller shaft from 4WD coupling assembly.
3. Remove the electric magnetic clutch connector(A).



4. Remove the 4WD coupling assembly mounting bolts (A-4ea).

Tightening torque :

58.8~63.7N.m (6.0~6.5kgf.m, 43.4~47.0lb-ft)



5. Using a flat tool, separate the 4WD coupling assembly from the rear differential carrier assembly.

Installation

1. Installation is the reverse of removal.

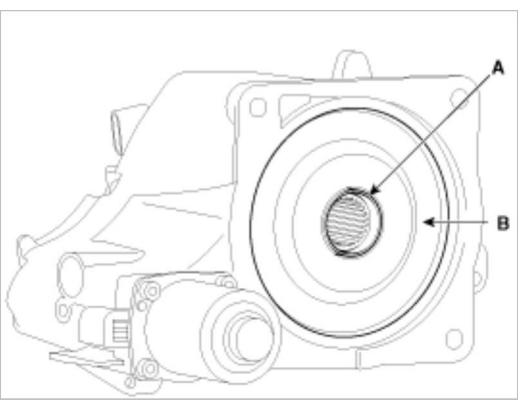
NOTE

- Grease the spline hole (A) of the coupling assembly.

Grease

Extreme Pressure(EP) grease containing molybdenum disulfide(MoS₂)

- When installation the coupling, be careful not to damage the oil seal (B).



CAUTION

After replacing the coupling, reset the 4WD ECU's clutch learning using the GDS tool. (Refer to " Coupling assembly " in 4WD group)

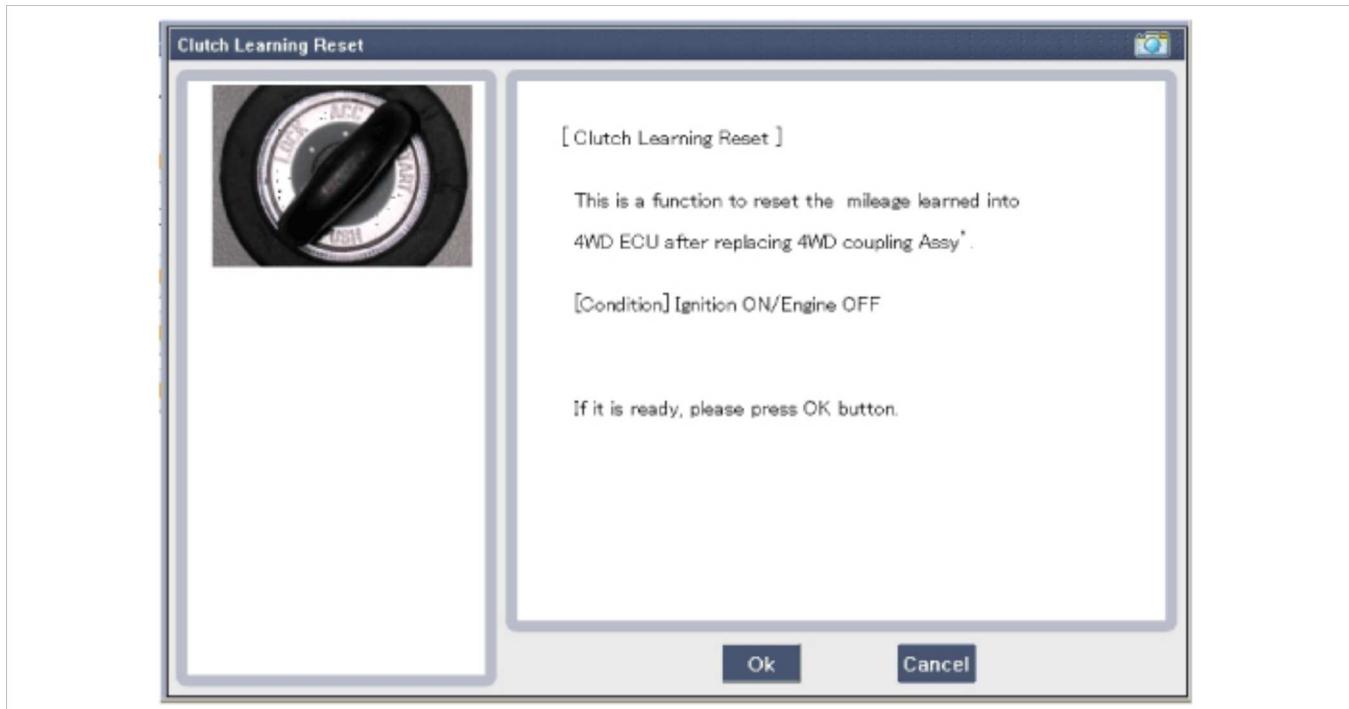
Adjustment

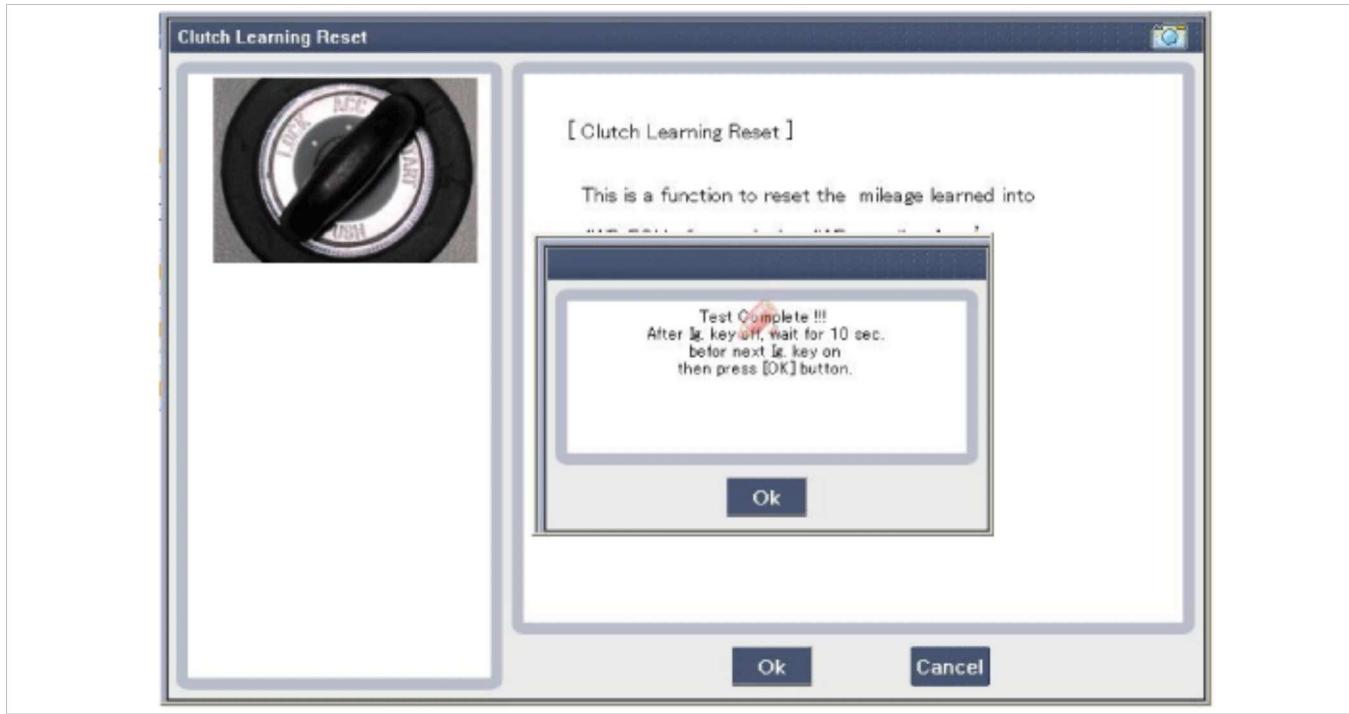
Description

The friction material inside the coupling will degrade over time. Therefore, corresponding compensation values must be referenced and entered after replacing the controller or the coupling.

Compensation Requirement and Procedure

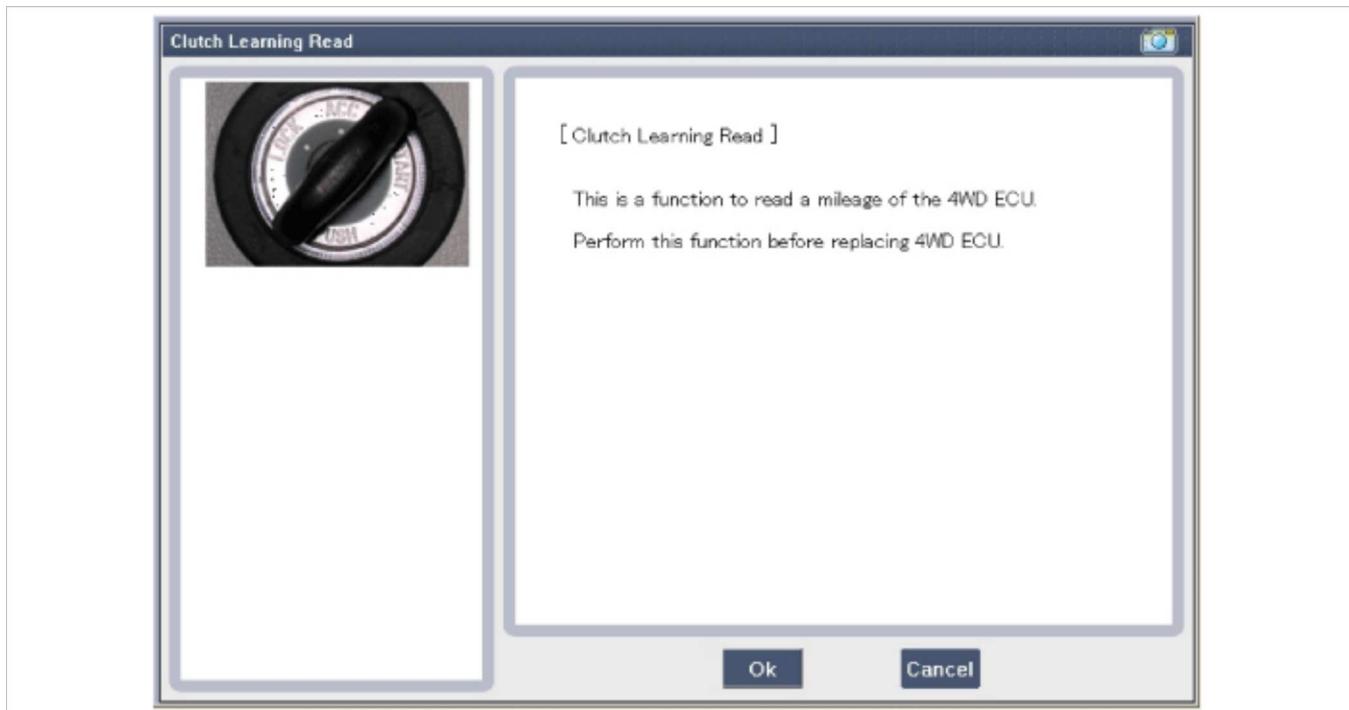
1. Simultaneous replacement of 4WD ECU (Controller) and coupling
 - A. Does not require compensation.
2. Replacement of coupling only
 - A. Reset the 4WD ECU's (Controller) clutch learning.

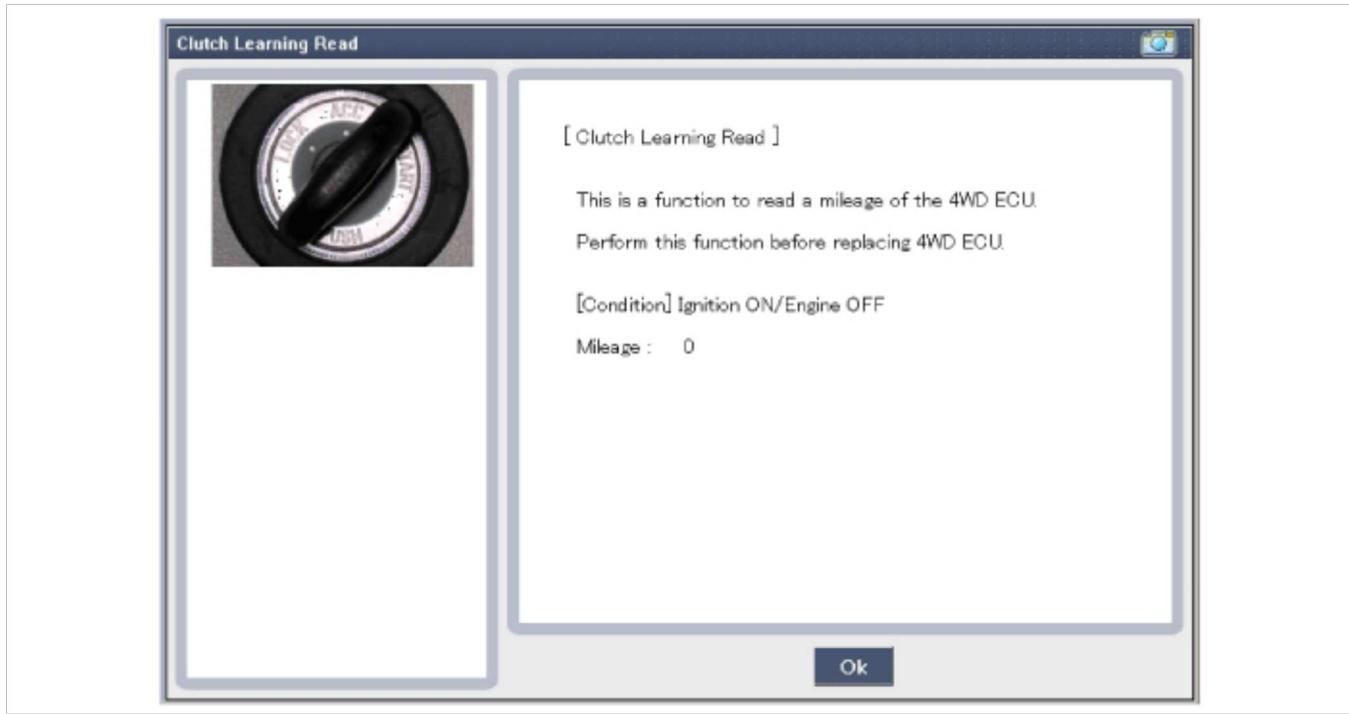




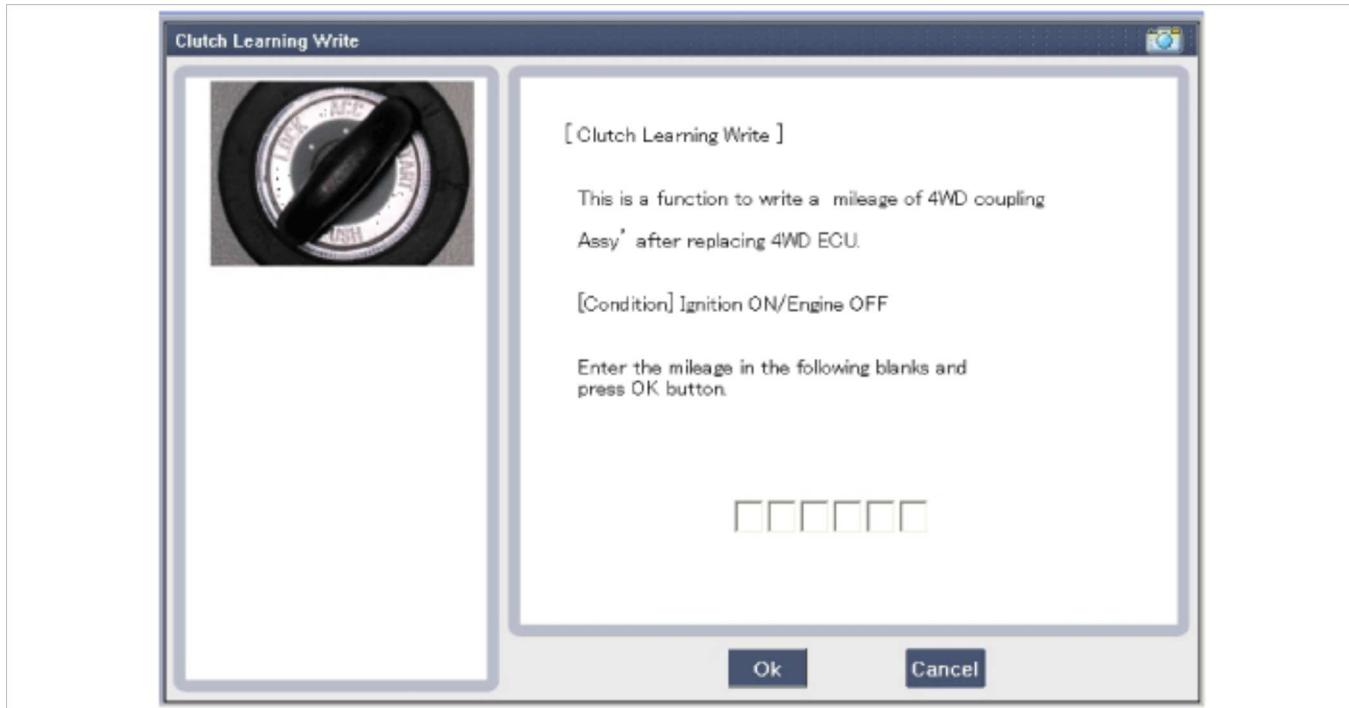
3. Replacement of 4WD ECU (Controller) only

- A. Before replacement: Check the ECU's clutch learning.





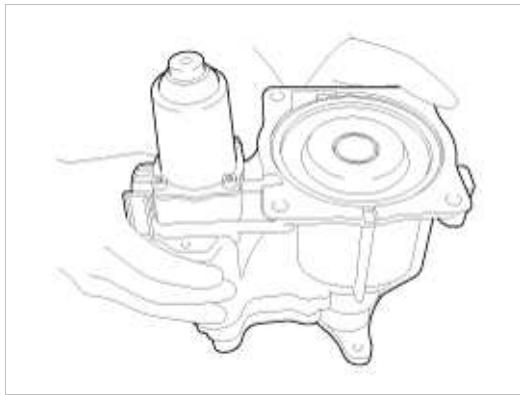
B. After replacement: Enter the original ECU's clutch learning into the replacement ECU.



4 Wheel Drive (4WD) System > Coupling Assembly > Oil hydraulic Motor(Actuator) > Description and Operation

Description

The 4WD ECM controls the Pump Motor Pump (Actuator) to generating an oil pressure. The pressure engages a multiple disk clutch to transfer torque to the rear wheels. The torque to the rear wheels varies according to the pressure on the clutch.

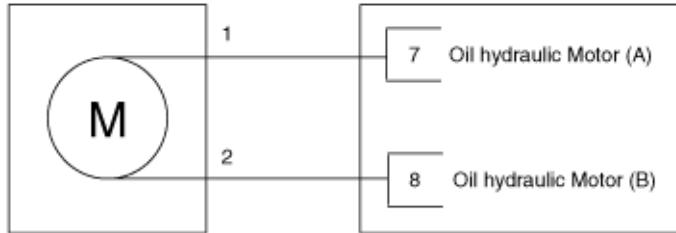


4 Wheel Drive (4WD) System > Coupling Assembly > Oil hydraulic Motor(Actuator) > Schematic Diagrams

Circuit Diagram

[Circuit Diagram]

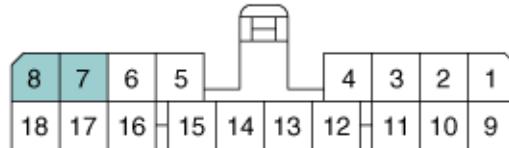
[Oil hydraulic Motor]



[Connection Information]

Terminal	Connected to	Function
1	4WD ECU(7)	Oil hydraulic Motor (A) output
2	4WD ECU(8)	Oil hydraulic Motor (B) output

[Harness Connector]



[Oil hydraulic Motor]

[4WD ECU]

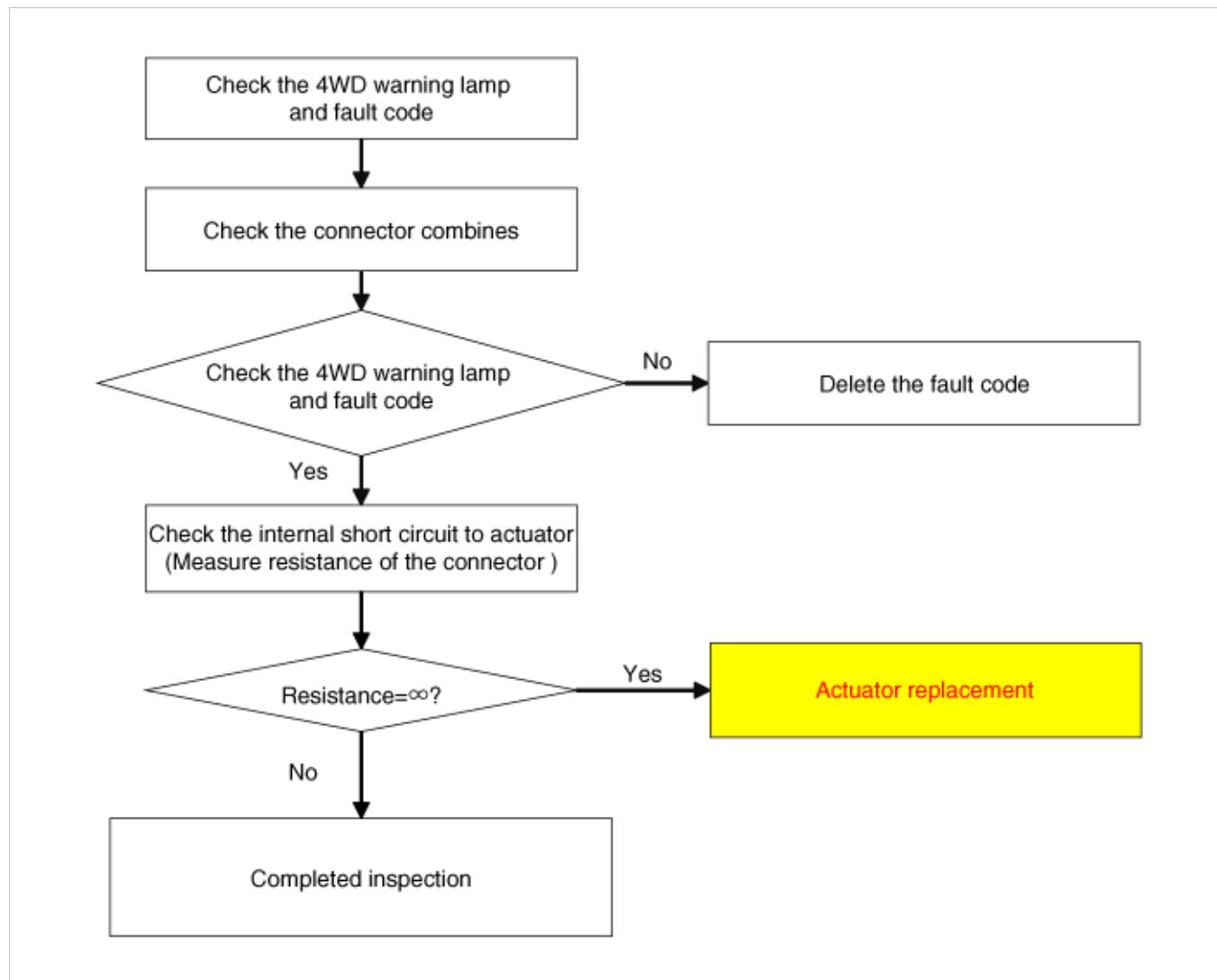
4 Wheel Drive (4WD) System > Coupling Assembly > Oil hydraulic Motor(Actuator) > Repair procedures

Inspection

NOTE

If you have trouble code related to the oil hydraulic motor(actuator) (P1825, P1826, P1827, P1828), check oil hydraulic motor (actuator) according to the inspection process.

Oil Hydraulic Motor (Actuator) Inspection Procedure

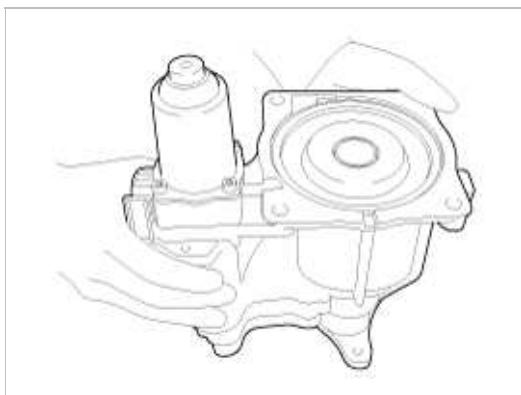


Removal

1. Remove the coupling assembly.
(Refer to "coupling assembly" in 4WD group)
2. Keep going perpendicular state after remove the coupling assembly.

NOTE

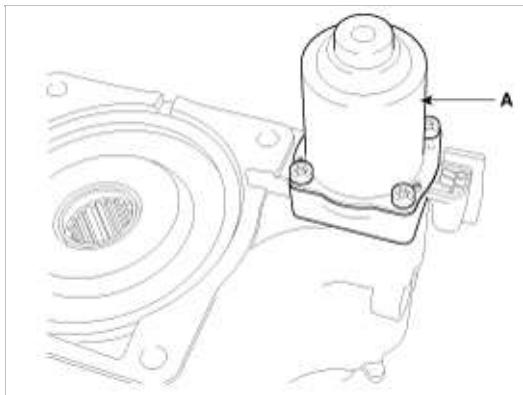
- Keep going perpendicular state during remove(install) the hydraulic motor (actuators).



3. Remove the hydraulic motor (actuators) after loosening bolts with hex wrench.

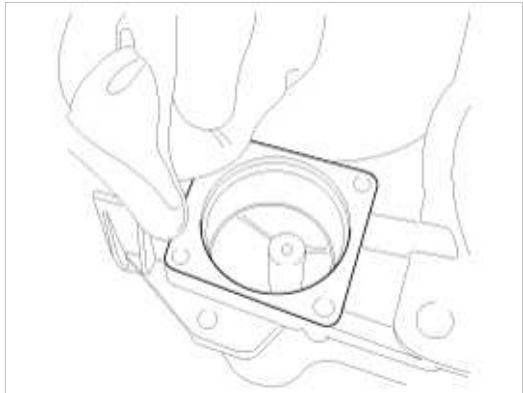
CAUTION

- Remove the hydraulic motor (actuators) after dropping residual oil as much as possible inside the coupling. (about 5~10 sec)

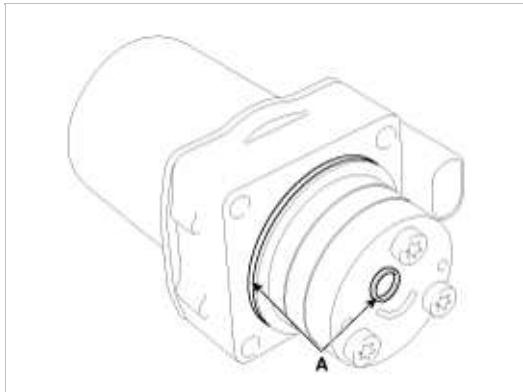


Installation

1. Before installation, wipe the surface with a clean cloth.



2. Check the O-rings of the new hydraulic motor (actuators).



CAUTION

- You have to prevent any dust from entering inside hydraulic motors (actuators) and housing.

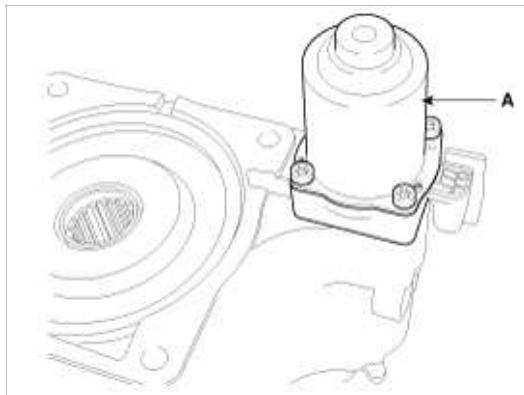
3. Tighten the bolts after install the hydraulic motor (actuators).

CAUTION

- When installing, motor connector has to toward in the direction of outside of the Coupling.

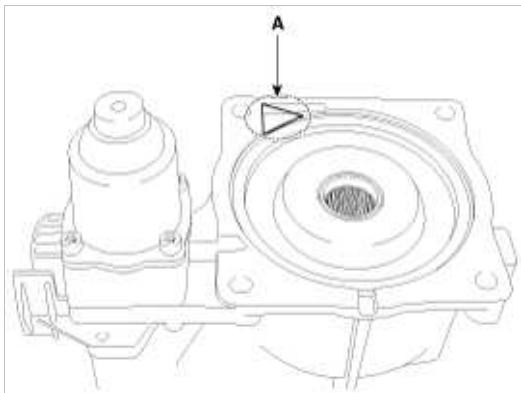
Tightening torque:

8.8 ~ 10.8 N.m (0.9 ~ 1.1 kgf.m, 6.5 ~ 8.0 lb-ft)

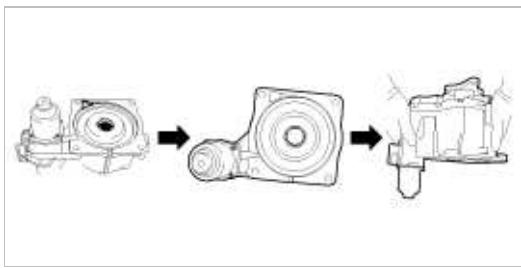


NOTE

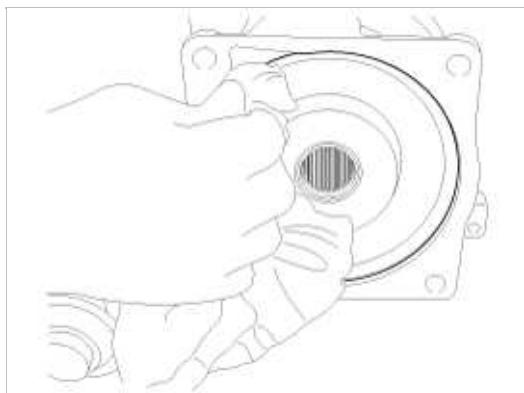
- When installing, oil can be reflux by the pressure in air breather hole.(Oil reflux weight: about 5 ~ 10ml)



- Change direction in the direction of the arrow and lay on the floor as shown in the illustration.
※ The reflux oil will flow to the bottom.
- You have to prevent additional backflow in according to order as shown in the illustration.



4. Wipe the flowed oil to around the surface with a clean cloth.



5. Measure the weight of the coupling.

Coupling assembly weight:

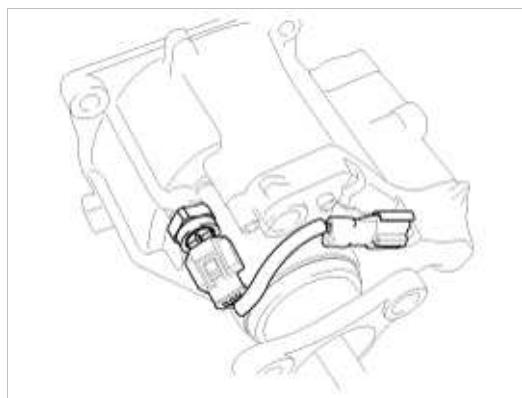
8.18 ~ 8.23kg (Current oil capacity 490ml)

CAUTION

- If the weight of the coupling assembly is less than 8.18kg, must be replace the coupling assembly because of suspect excessive reflux.

4 Wheel Drive (4WD) System > Coupling Assembly > Pressure Sensor > Description and Operation**Description**

The 4WD ECU makes a Motor Pump(Actuator) turn round for generating an oil pressure. And then it presses a multiple disk clutch and transfers the generated torque into rear wheels. Its torque value varies according to a pressure status.

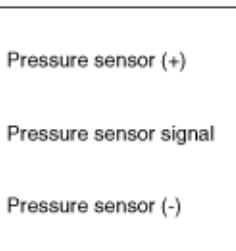
**4 Wheel Drive (4WD) System > Coupling Assembly > Pressure Sensor > Schematic Diagrams****Circuit Diagram**

[Circuit Diagram]

[Pressure sensor]



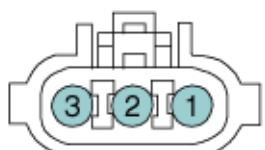
[4WD ECU]



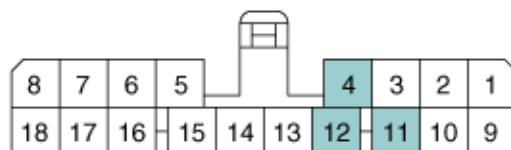
[Connection Information]

Terminal	Connected to	Function
1	4WD ECU(11)	Pressure sensor (+) Input
2	4WD ECU(4)	Pressure sensor signal Input
3	4WD ECU(12)	Pressure sensor (-) Input

[Harness Connector]



[Pressure sensor]



[4WD ECU]

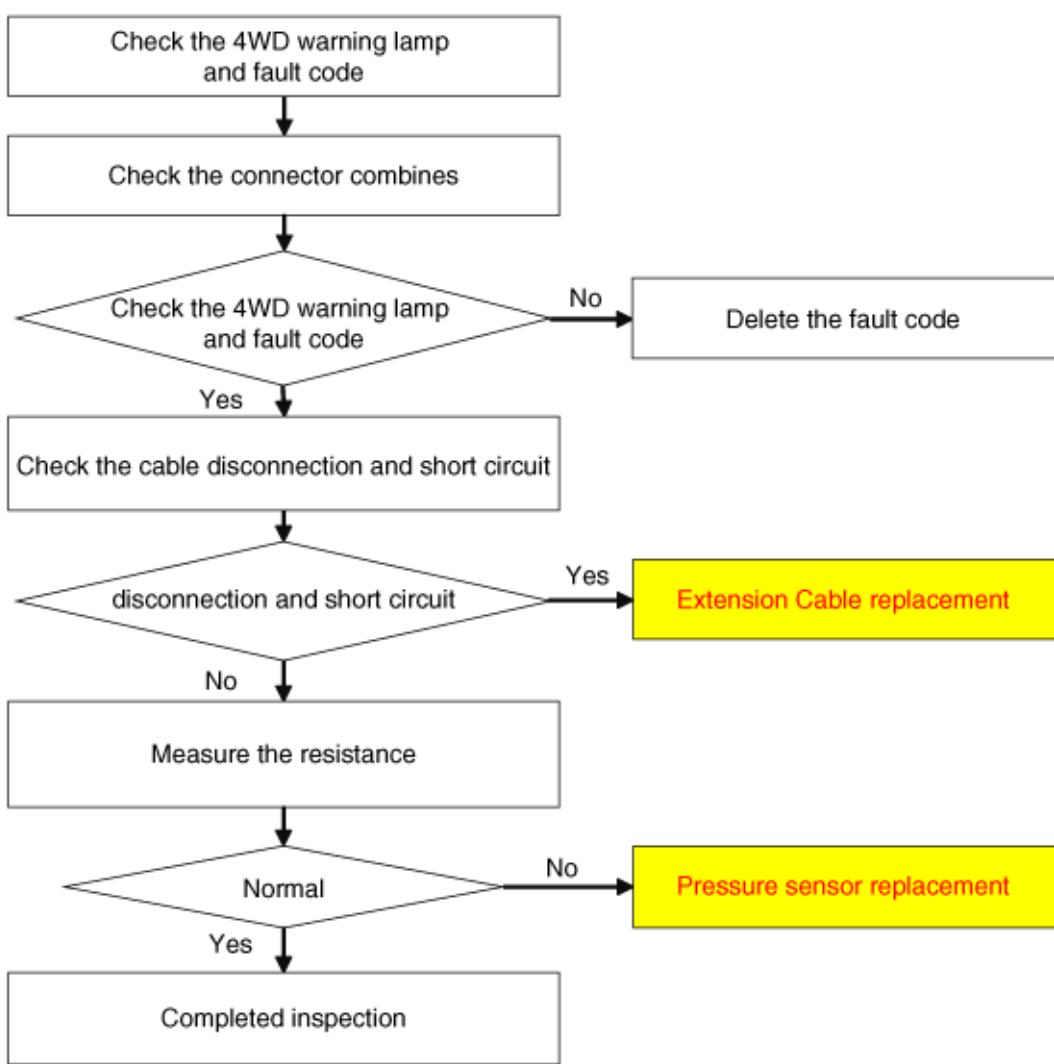
4 Wheel Drive (4WD) System > Coupling Assembly > Pressure Sensor > Repair procedures

Inspection

NOTE

If you have trouble code related to the pressure sensor (P1825, P1826, P1827, P1828), check pressure sensor according to the inspection process.

Pressure Sensor Inspection Procedure



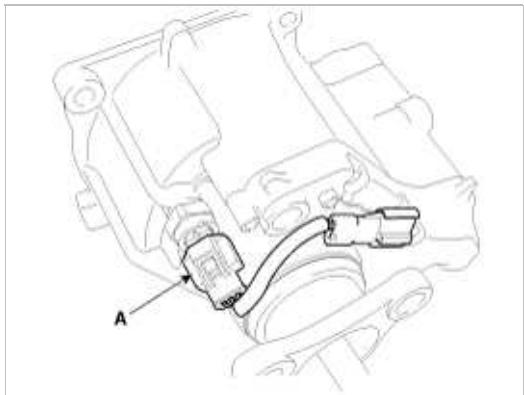
Measure the resistance of pressure sensor

1. Turn ignition switch OFF.
2. Disconnect the pressure sensor connector.
3. Measure resistance between sensor terminal and terminal.
4. Check the measured resistance. (Refer to table)

Terminal	Resistance
PIN 2 – PIN 3	2.755 ~ 4.133 kΩ
PIN 1 – PIN 3	1.892 ~ 2.838 kΩ
PIN 1 – PIN 2	1.714 ~ 2.838 kΩ

Removal

1. Remove the coupling assembly.
(Refer to "coupling assembly" in 4WD group)
2. Remove the extension Cable (A).



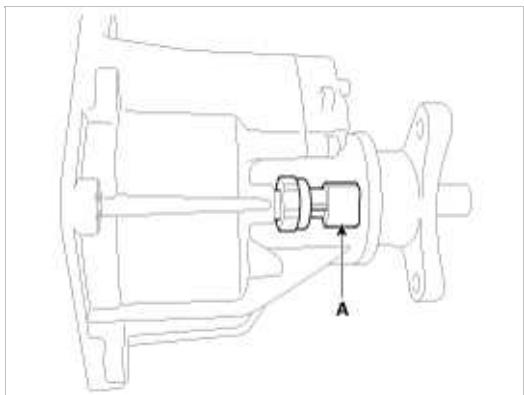
3. Remove the pressure sensor (A) with 24mm socket.

CAUTION

- Keep going horizontal state to prevent leaks during remove the pressure sensor.

Tightening torque:

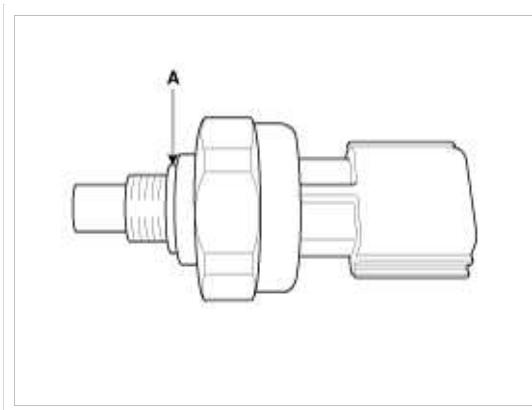
7.8 ~ 9.8 N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2 lb-ft)



Installation

CAUTION

- Check the cleanliness of the pressure sensor before installation.
- Check the pressure sensor O-ring (A).



1. Installation is the reverse of removal.

SPORTAGE(SL) > 2012 > G 2.4 DOHC > Automatic Transaxle System

Automatic Transaxle System > General Information > Specifications

Specifications

Item	Specifications	
Transmission type	A6MF1	
Engine model	Gasoline 2.4	
Torque converter type	3-element, 1-stage, 2-phase type	
Torque converter size	Ø236 mm (9.2913 in.)	
Oil pump system	Parachoid	
Friction elements	Clutch: 2EA	
	Brake: 3EA	
	OWC : 1EA	
Planetary gear	3EA	
Gear ration	1st	4.212
	2nd	2.637
	3rd	1.800
	4th	1.386
	5th	1.000
	6th	0.772
	Reverse	3.385
Final gear ratio	3.195	
Fluid pressure balance piston	2EA	
Accumulator	4EA	
Solenoid valve	8EA (VFS:6EA, ON/OFF:2EA)	
Shift lever position	4 Range (P,R,N,D)	
Oil filter	1EA	

VFS: Variable Force Solenoid

Sensors

Input Speed Sensor

- ▷ Type: Hall effect sensor
- ▷ Specifications

Operation condition (°C)°F	((-40~150)) -40~302	
Air gap(mm)in.	(0.95~1.65)0.037~0.065	
Output voltage(V)	High	1.18~1.68
	Low	0.59~0.84

Output Speed Sensor

- ▷ Type: Hall effect sensor
- ▷ Specifications

Operation condition (°C)°F		((-)40~150)) -40~302
Air gap(mm)in.		(0.25~0.7)0.01~0.027
Output voltage	High	1.18~1.68
	Low	0.59~0.84

Oil Temperature Sensor

- ▷ Type: Negative thermal coefficient type
- ▷ Specifications

Temp.[(°C)°F]	Resistance (kΩ)
(-40)-40	48.1
(-20)-4.0	15.6
(0)32.0	5.88
(20)68.0	2.51
(40)104.0	1.11
(60)140.0	0.61
(80)176.0	0.32
(100)212.0	0.18
(120)248.0	0.10
(140)284.0	0.06
(150)302	0.05

Inhibitor Switch

- ▷ Type: Combination of output signals from 4 terminals
- ▷ Specifications

Power supply (V)	12
Output type	Pin to Pin

Solenoid Valves

Direct control VFS[26/B, T/CON]

- ▷ Control type : Normal low type

Control Pressure kpa(kgf/cm ² , psi)	9.81~500.14(0.1~5.1,1.42~72.54)
Current value(mA)	50~850
Internal resistance(Ω)	5.1

Direct control VFS[UD/B, OD/C, 35R/C]

- ▷ Control Type : Normal high type

Control Pressure kpa(kgf/cm ² , psi)	500.14~9.81(5.1~0.1,72.54~1.42)
Current value(mA)	50~850
Internal resistance(Ω)	5.1

Line Pressure Control VFS

- ▷ Control type : Normal high type

Control Pressure kpa(kgf/cm ² , psi)	500.14~9.81(5.1~0.1, 72.54~1.42)
Current value(mA)	50~850
Internal resistance(Ω)	5.1

ON/OFF Solenoid Valve(SS-A, SS-B)

▷ Control type : Normal low type

Control pressure kpa(kgf/cm ² , psi)	490.33(5.0, 71.12)
Internal resistance(Ω)	10~11

Solenoid Valve Operation Table

	SS-A	SS-B	UD/B-VFS	OD/C-VFS	35R/C-VFS	26/B-VFS
			N/H	N/H	N/H	N/L
N, P	•		•		•	
1	Δ			Δ	•	
2				•	•	•
3		•		•		
4					•	
5		•	•			
6			•		•	•
L	•				•	
R	•	•	•			

• : Connected status

Δ : Connected at vehicle speed above 8km/h

Tightening Torques

Item	N.m	Kgf.m	lb·ft
TCM installation mounting bolt	9.8~11.8	1.0~1.2	7.2~8.7
Shift cable bracket mounting bolt	14.7~21.6	1.5~2.2	10.8~15.9
Input shaft speed sensor mounting bolt	9.8~11.8	1.0~1.2	7.2~8.7
Output shaft speed sensor mounting bolt	9.8~11.8	1.0~1.2	7.2~8.7
Shift lever assembly bolt	8.8~13.7	0.9~1.4	9.4~10.8
Inhibitor switch mounting bolt	9.8~11.8	1.0~1.2	7.2~8.7
Valve body cover mounting bolt	13.8~14.7	1.3~1.5	9.4~10.8
Eyebolt	34.3~44.1	3.5~4.5	25.3~32.6
Oil drain plug	34.3~44.1	3.5~4.5	25.3~32.6
Oil level plug	34.3~44.1	3.5~4.5	25.3~32.6
Torque converter mounting bolt	45.1~52.0	4.6~5.3	33.3~38.3
Starter motor mounting bolts	42.2~53.9	4.3~5.5	31.1~39.8
Automatic transaxle upper mounting bolt (TM=>Eng)	42.2~53.9	4.3~5.5	31.1~39.8
Automatic 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

Automatic transaxle support bracket bolt	88.3~107.9	9.0~11.0	65.1~79.6
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Lubricants

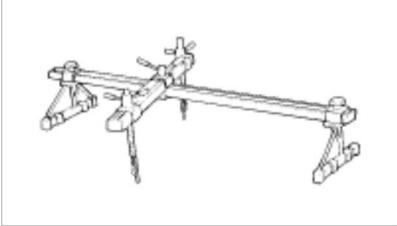
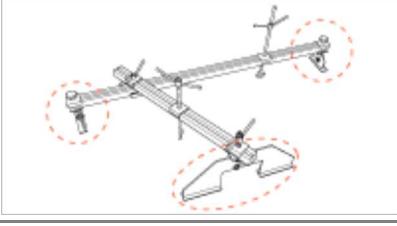
Item	Specified lubricant	Quantity
Transaxle fluid	SK ATF SP-IV, MICHANG ATF SP-IV, NOCA ATF SP-IV, Kia Genuine ATF SP-IV or other brands meeting the above specification approved by Kia Motors Corp.	7.1L (1.88 U.S gal., 7.50 U.S.qt., 6.24 Imp.qt.)

Sealant

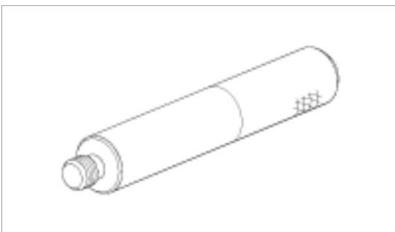
Item	Specified sealant
Rear cover	LOCTITE FMD-546 or THREE-BOND TB1281B
Torque converter housing	
Valve body cover	

Automatic Transaxle System > General Information > Special Service Tools

Special Service Tools

Tools (Number and name)	Illustration	Use
09200-38001 Engine support fixture (Beam)		Removal and installation of the transaxle. Except lower supporter, use beam only with new engine support fixture supporter(SST No.:09200-2S000)
09200-2S000 Engine support fixture (Supporter)		Removal and installation of the transaxle. Use this supporter with the upper beam of the engine support fixture(SST No.:09200-38001)
09453-3L241 Oil seal installer		Installation of transaxle case oil seal. [Using with handle (SST No.:09231-H1100)]

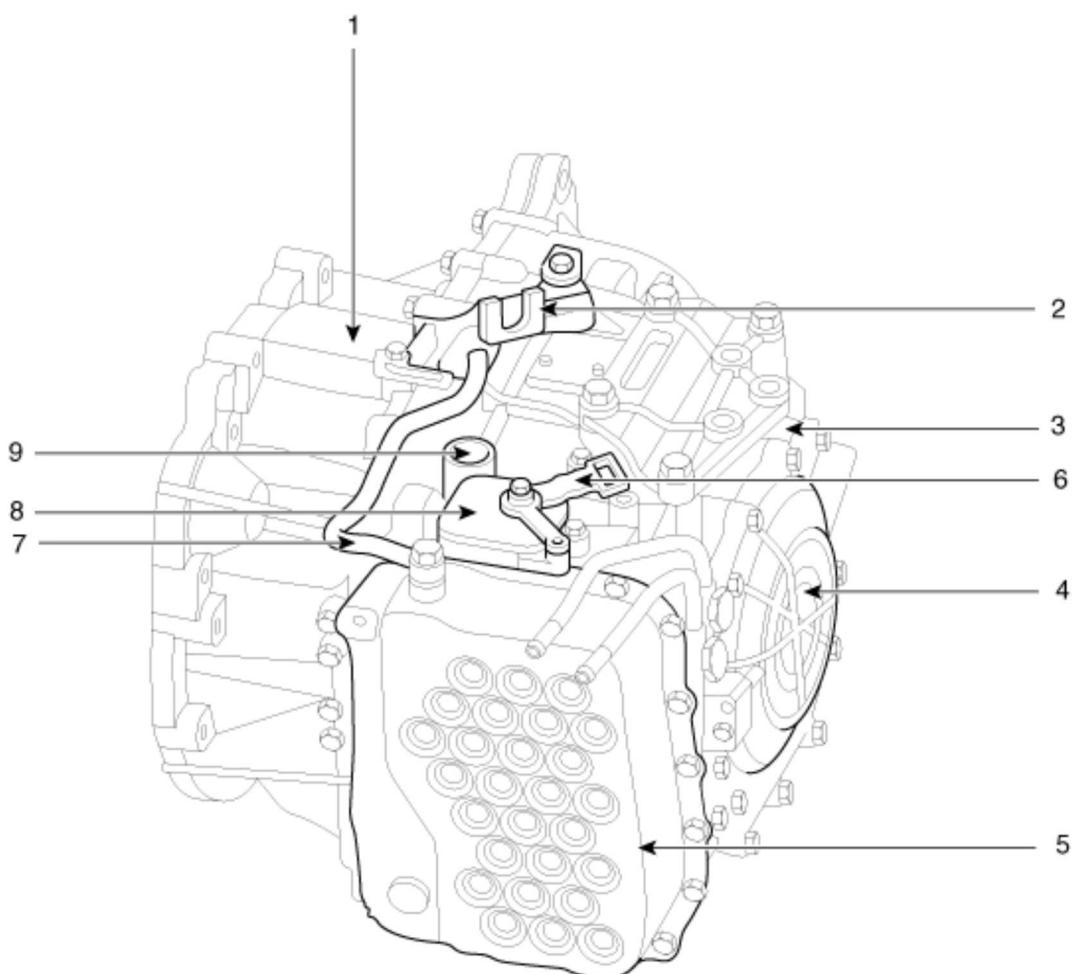
09231-H1100
Bar



Installation of transaxle case oil seal.
[Using with oil seal installer (SST
No.: 09453-3L241)]

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

Components Location

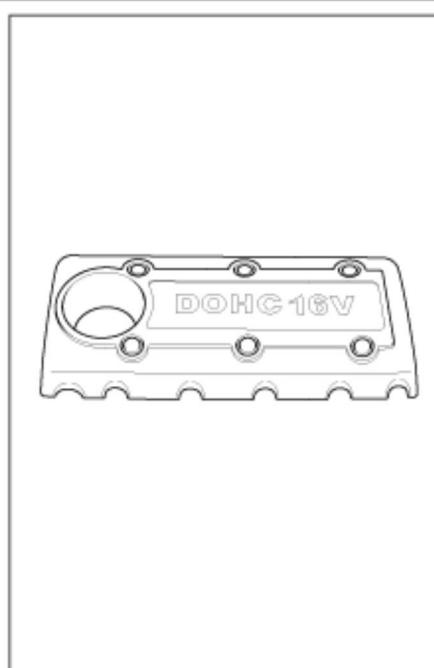


- | | |
|-----------------------------|-----------------------------|
| 1. Converter housing | 6. Manual control lever |
| 2. Shift cable bracket | 7. Air breather hose |
| 3. Automatic transaxle case | 8. Inhibitor switch |
| 4. Rear cover | 9. Solenoid valve connector |
| 5. Valve body cover | |

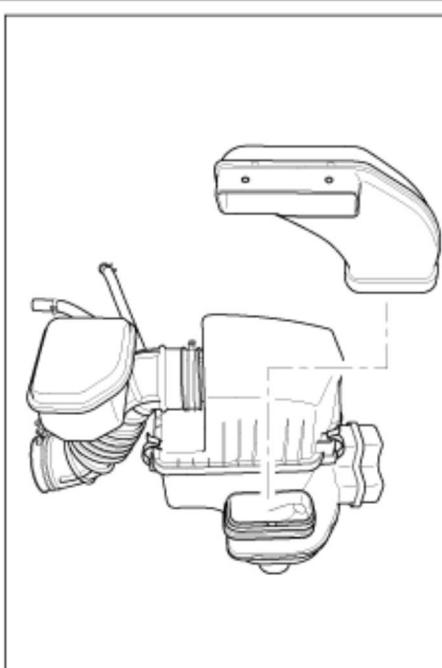
Automatic Transaxle System > Automatic Transaxle System > Automatic Transaxle > Repair procedures

Removal

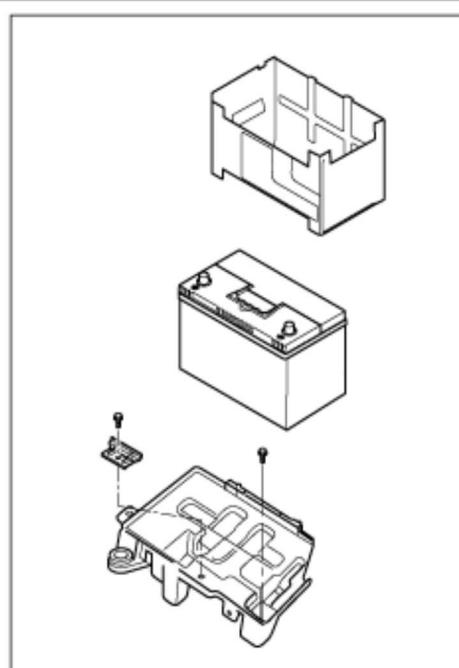
1. Remove the following items;
 - A. Engine cover (A).
 - B. Air cleaner assembly and air duct (B). (Refer to "Intake and Exhaust system" in EM group.)
 - C. Battery and battery tray (C). (Refer to "Charging system" in EE group.)



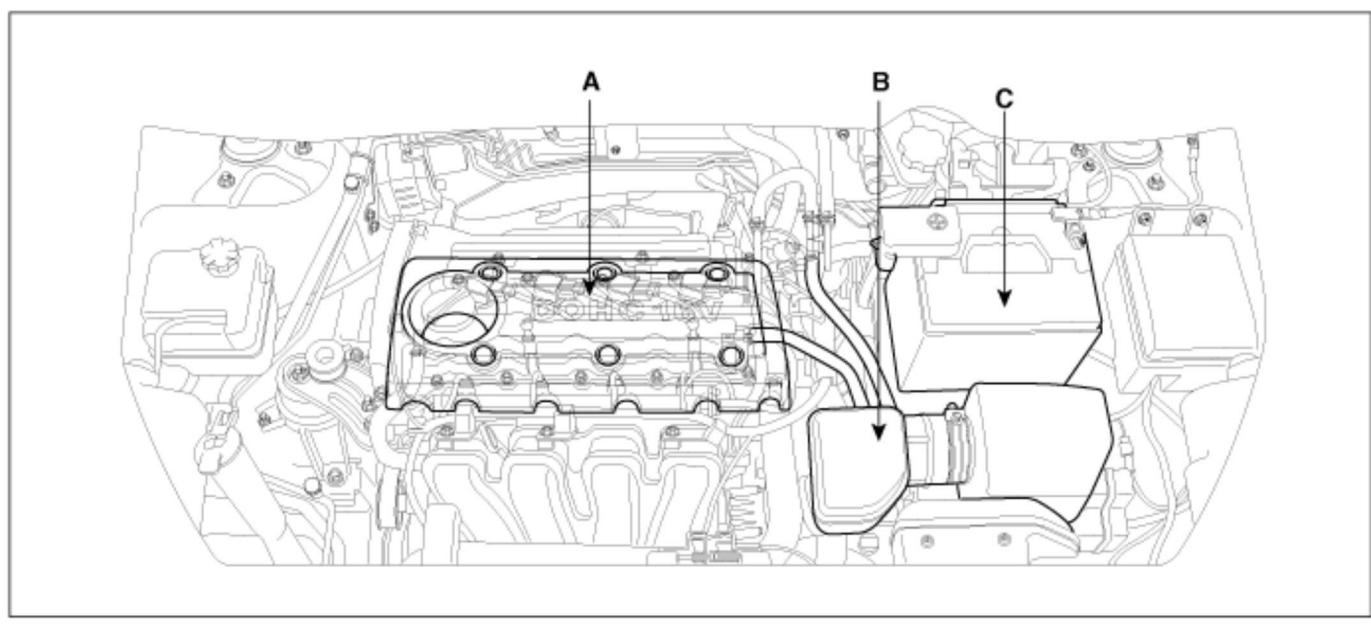
[A]



[B]



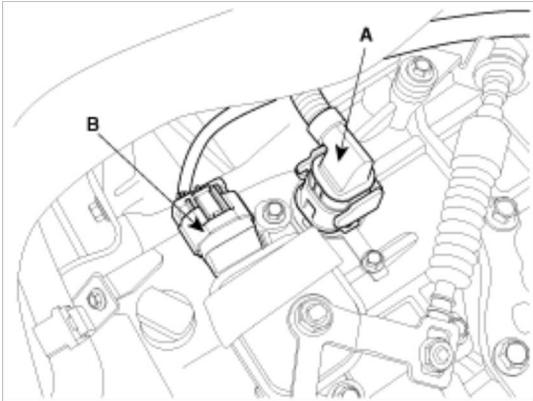
[C]



2. Remove the ground line after removing the bolt (A).



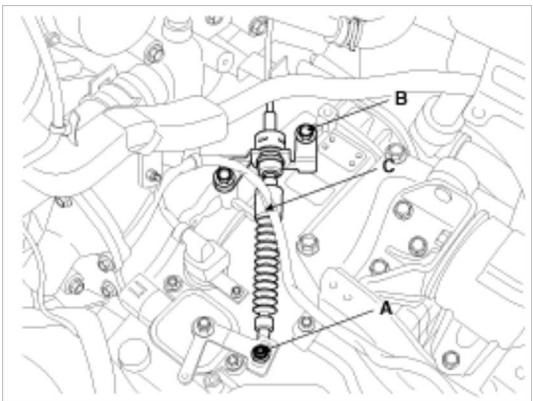
3. Disconnect the solenoid valve connector (A) and inhibitor switch connector (B).



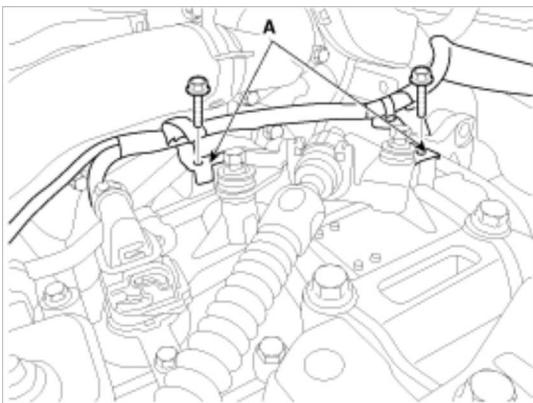
4. Remove the control cable (C) after removing the nut (A) and the bolt (B).

Tightening torque:

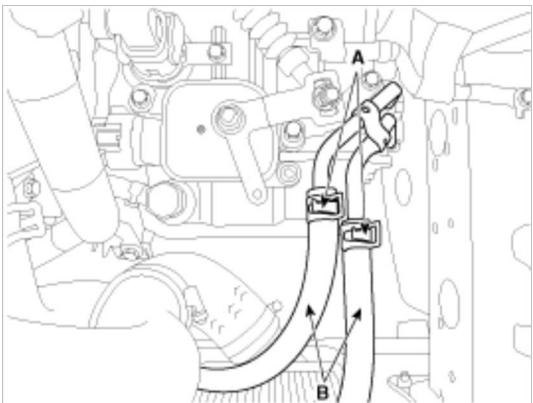
- (A) 7.8 ~ 11.8 N.m (0.8 ~ 1.2 kgf.m, 5.8 ~ 8.7 lb-ft)
(B) 14.7 ~ 21.6 N.m(1.5 ~2.2 kgf.m, 10.9 ~15.9 lb-ft)
-



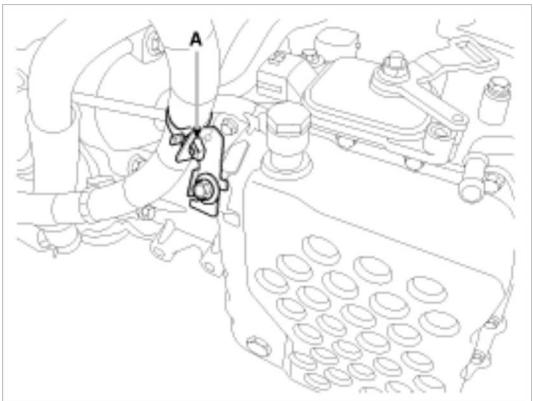
5. Remove the solenoid valve connector and inhibitor switch connector wiring mounting bracket (A).



6. Disconnect the hose (B) after removing the automatic transaxle fluid cooler hose clamp (A).



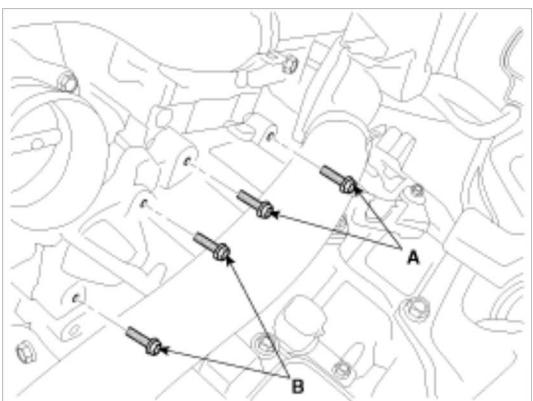
7. Remove the wiring bracket installation bolt (A).



8. Remove the automatic transaxle upper mounting bolt (A-2ea) and the starter motor mounting bolt (B-2ea).

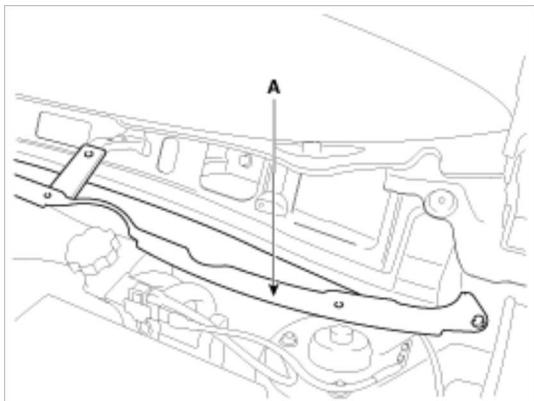
Tightening torque:

(A),(B) : 42.2 ~ 54.0 N.m (4.3 ~5.5 kgf.m, 31.1 ~ 39.8 lb-ft)

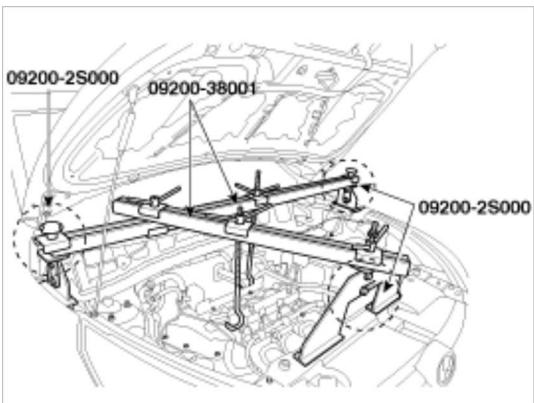


9. Remove the cowl top cover or wiper motor. (Refer to "Windshield Wiper/Washer" in BE group.)

10. Remove the cowl complete assembly panel (A).



11. Using the engine support fixture (Support SST No.: 09200-2S000, Beam SST No.: 09200-38001), hold the engine and transaxle assembly safely.



12. Remove the automatic transaxle mounting support bracket bolt (A).

Tightening torque:

88.3 ~ 107.9 N.m (9.0 ~ 11.0 kgf.m, 65.1 ~ 79.8 lb-ft)

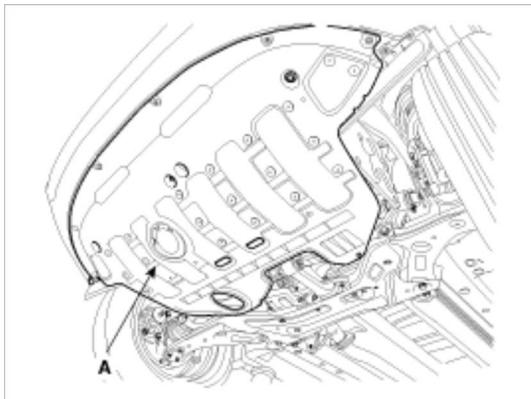


13. Lift the vehicle with a jack.

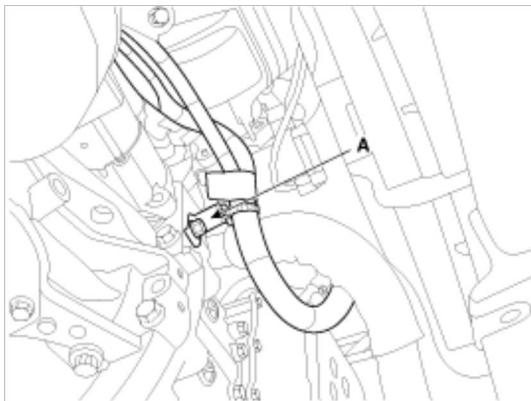
14. Remove the under cover (A).

Tightening torque:

19.6 ~ 24.5 N.m (2.0 ~ 2.5 kgf.m, 14.5 ~ 18.1 lb-ft)



15. Remove the wiring bracket installation bolt (A).



16. Remove the following items;

2WD

A. Remove the drive shaft assembly. (Refer to "Drive shaft assembly" in DS group.)

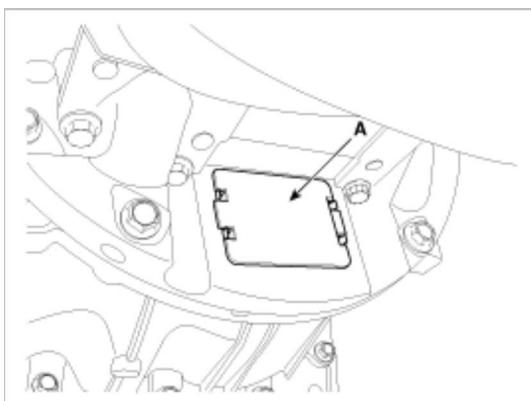
4WD

A. Sub frame assembly. (Refer to "Front suspension system" in SS group.)

B. Drive shaft assembly. (Refer to "Drive shaft assembly" in DS group.)

C. Transfer assembly. (Refer to "Transfer assembly" in WD group)

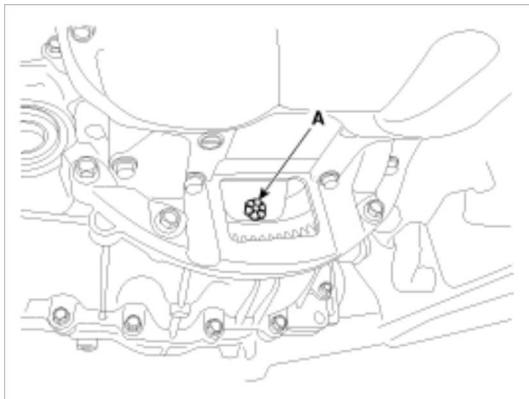
17. Remove the dust cover(A).



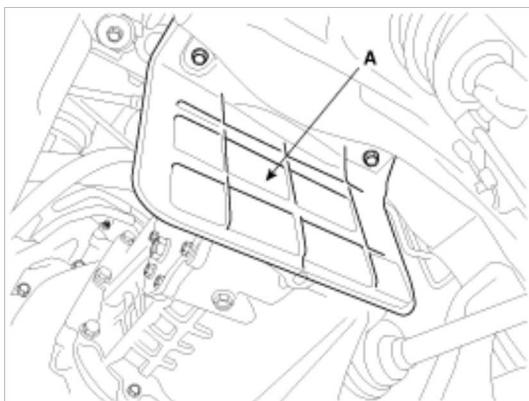
18. Remove the torque converter mounting bolt (A-4ea) with rotating the crankshaft.

Tightening torque:

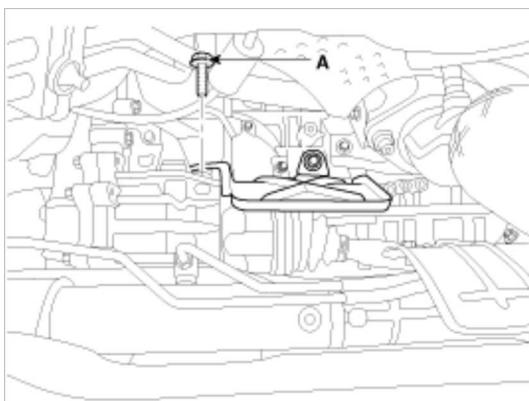
45.1 ~ 52.0 N.m (4.6 ~ 5.3 kgf.m, 33.3 ~ 38.3 lb-ft)



19. Remove the side cover (A).



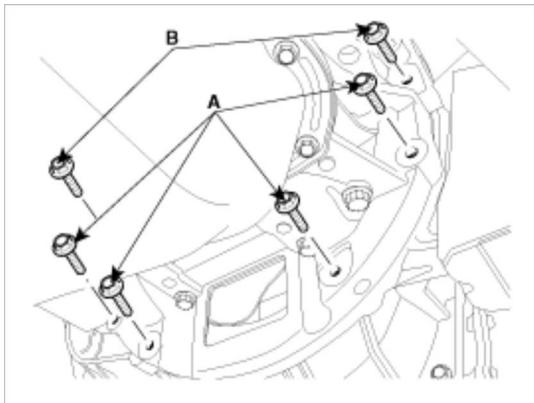
20. Remove the drive shaft cover mounting bolt (A).



21. Remove the automatic transaxle with a jack after removing the mounting bolt (A-4ea, B-2ea).

Tightening torque:

- (A) 42.2 ~ 48.1 N.m (4.3 ~ 4.9 kgf.m, 31.1 ~ 35.4 lb-ft)
(B) 42.2 ~ 54.0 N.m (4.3 ~ 5.5 kgf.m, 31.1 ~ 39.8 lb-ft)
-



Installation

1. Installation is the reverse of removal.

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, 09453-3L240).

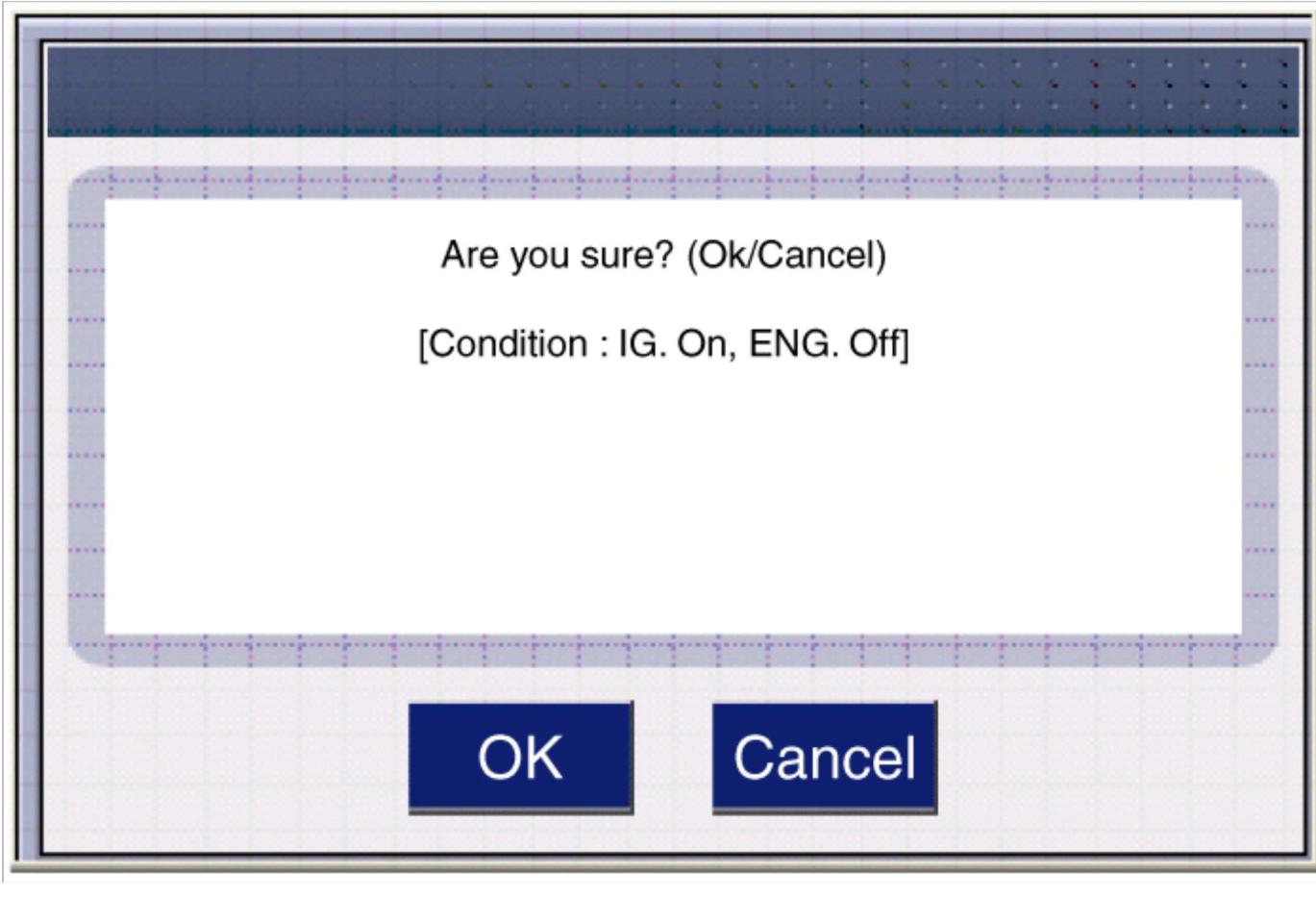
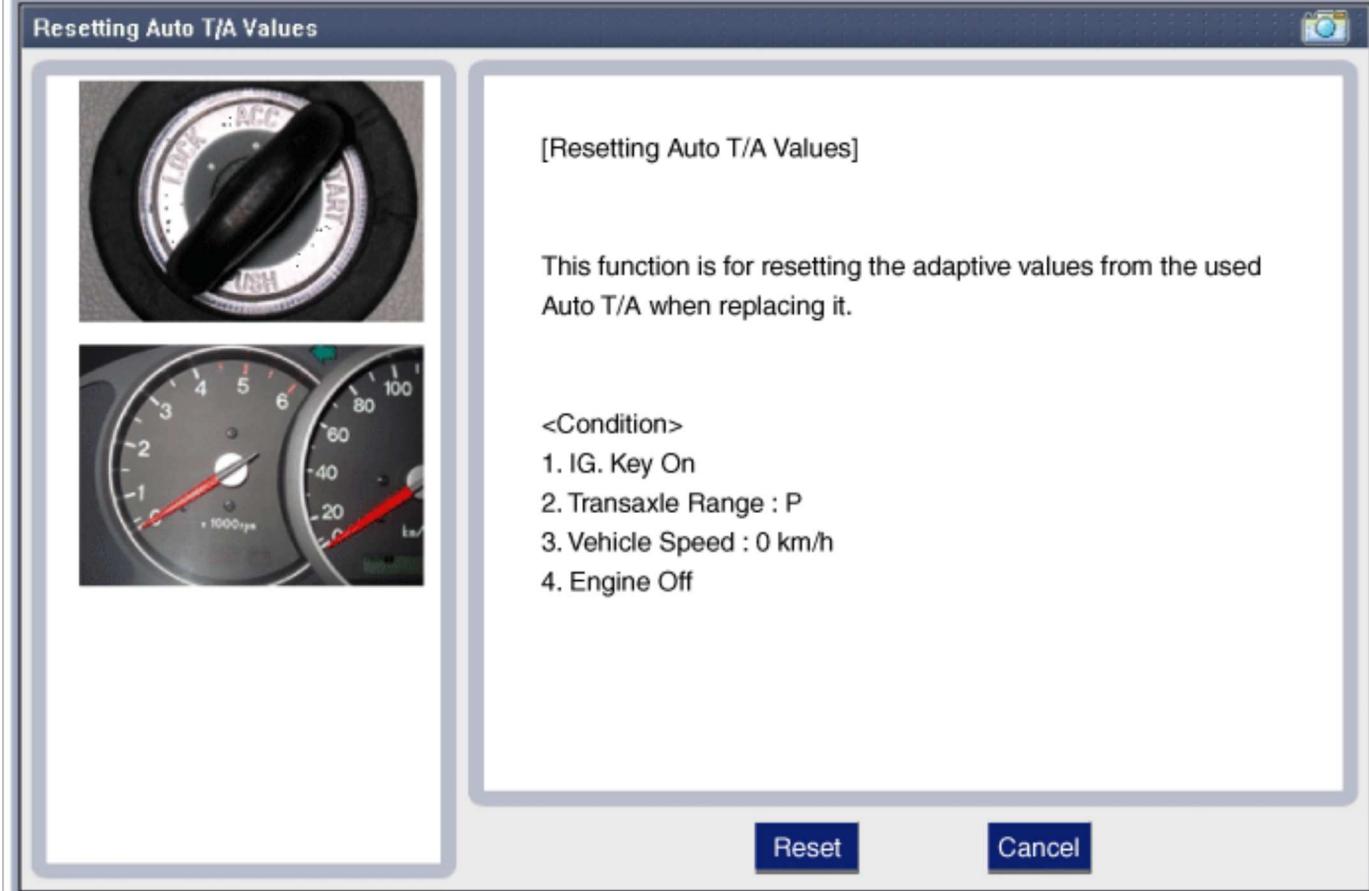
NOTE

After replacement or reinstallation procedure of the automatic transaxle assembly, must perform procedures below.

- Adding automatic transaxle fluid. (Refer to "Hydraulic system (Fluid)" in this group)
- After servicing the automatic transaxle or TCM, clear the diagnostic trouble codes (DTC) using the GDS tool. Diagnostic trouble codes (DTC) cannot be cleared by disconnecting the battery.
- When deleting diagnostic trouble code, use the GDS as possible.
- When replacing the automatic transaxle, reset the automatic transaxle's values by using the GDS.
- Perform TCM learning after replacing the transaxle to prevent slow transaxle response, jerky acceleration and jerky startup. (Refer to "Automatic transaxle control system (Repair procedures)" in this group)

NOTE

- When replacing the automatic transaxle, reset the automatic transaxle's values by using the GDS.
[Condition]
 - IG Key On
 - Transaxle Range:P
 - Vehicle Speed :0 km/h
 - Engine Off





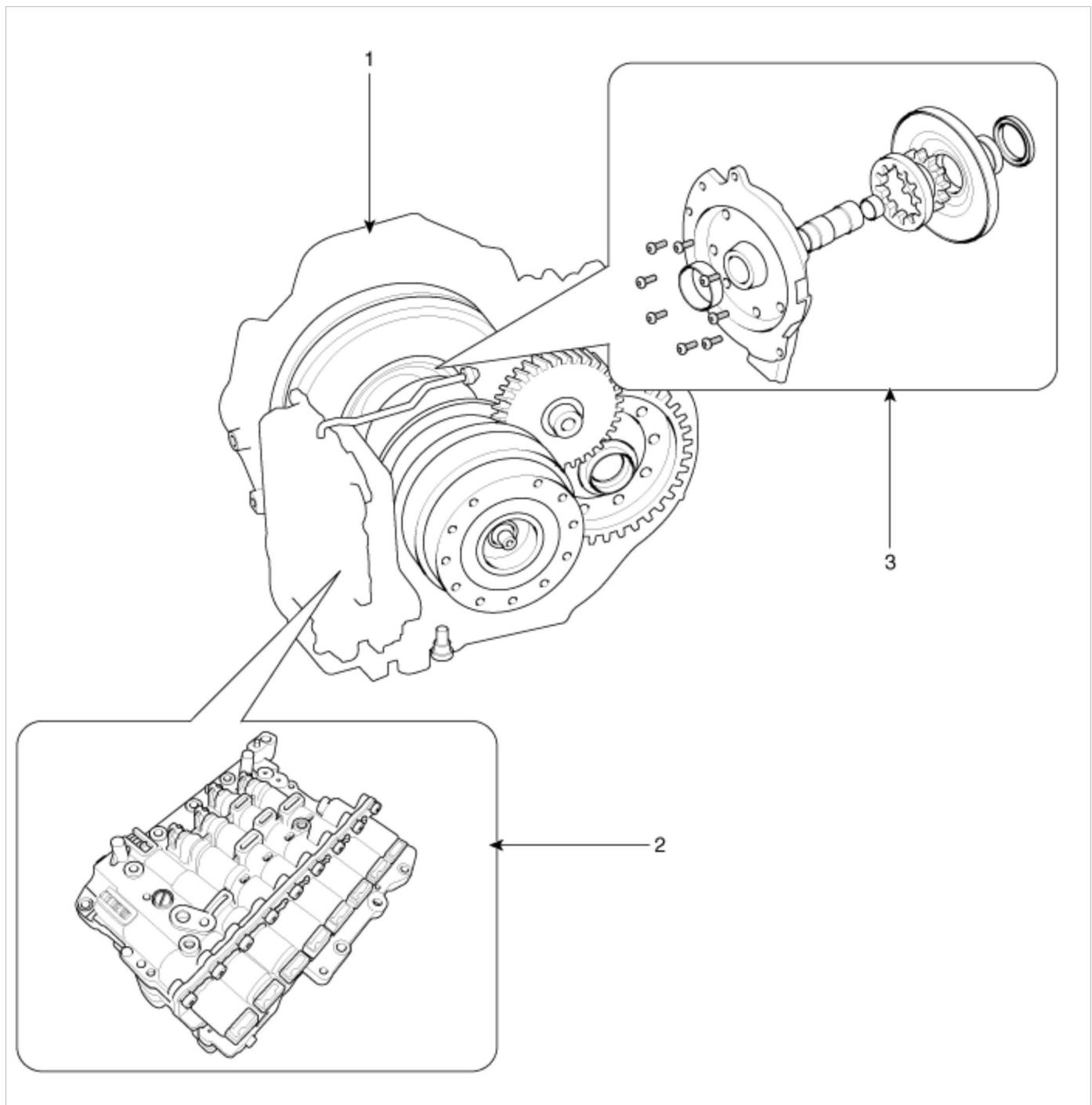
Automatic Transaxle System > Hydraulic System > Description and Operation

Description

The hydraulic system consists of oil, an oil filter, an oil pump, and a valve body (valves and solenoid valves). The oil pump is powered by the engine. ATF passes through the oil filter and gets distributed along the oil channels. The oil becomes highly pressurized as it exits the oil pump and passes through the line pressure valve before being fed to the clutch & brake control valve, clutch, and brakes. TCM controls the hydraulic pressure using solenoid valves and controls clutch and brake operations.

Automatic Transaxle System > Hydraulic System > Components and Components Location

Components Location

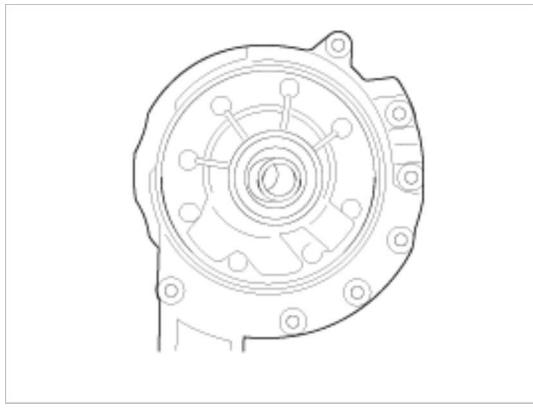


1. Automatic transaxle
2. Valve body assembly
3. Oil pump assembly

Automatic Transaxle System > Hydraulic System > Oil Pump > Description and Operation

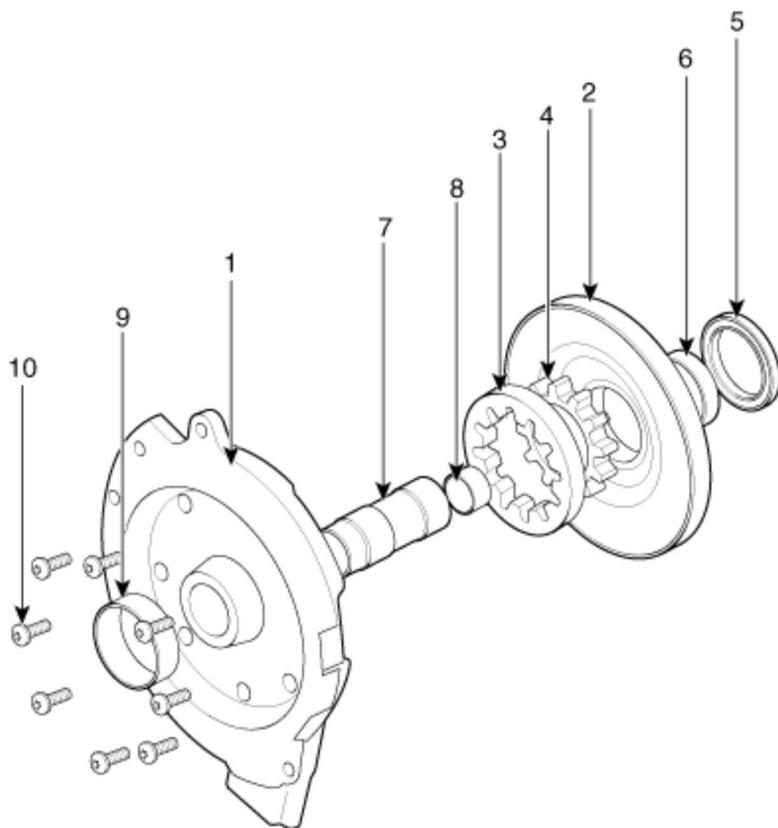
Description

The oil pump is built-in as a single unit with the 26 brake chamber. Rotation of the pump builds the hydraulic pressure needed for the lubrication of the various parts of the transaxle and operation of the clutch and brakes. The oil also circulates through the torque converter and the cooler.



Automatic Transaxle System > Hydraulic System > Oil Pump > Components and Components Location

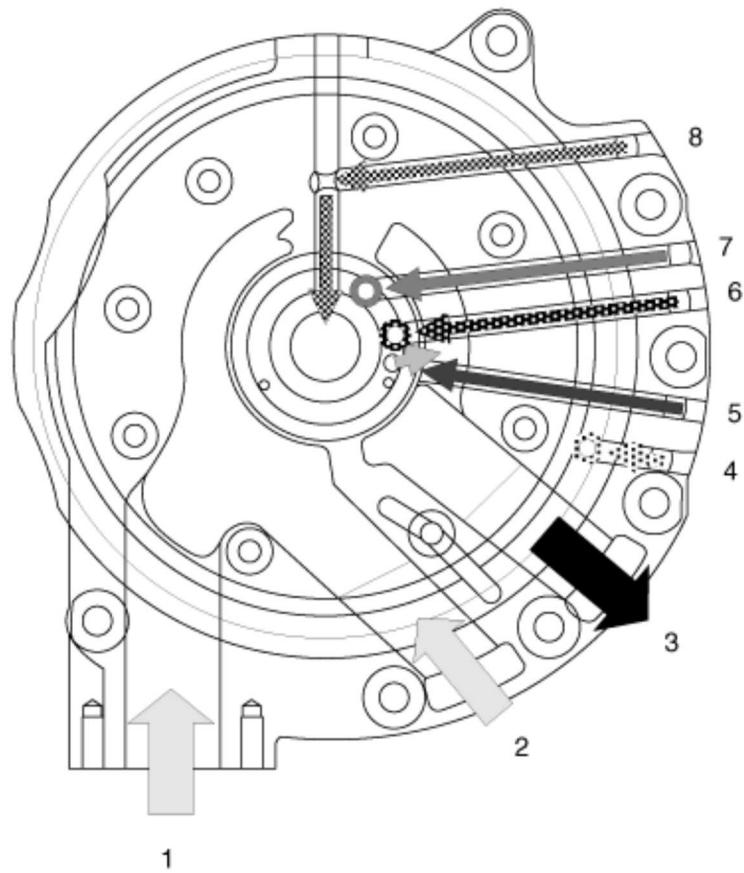
Components



- 1. Reaction shaft support assembly
- 2. Oil pump housing
- 3. Driven gear
- 4. Drive gear
- 5. Oil seal

- 6. Bush-Housing
- 7. Reaction shaft
- 8. Bush- Reaction shaft
- 9. Sleeve
- 10. Bolt

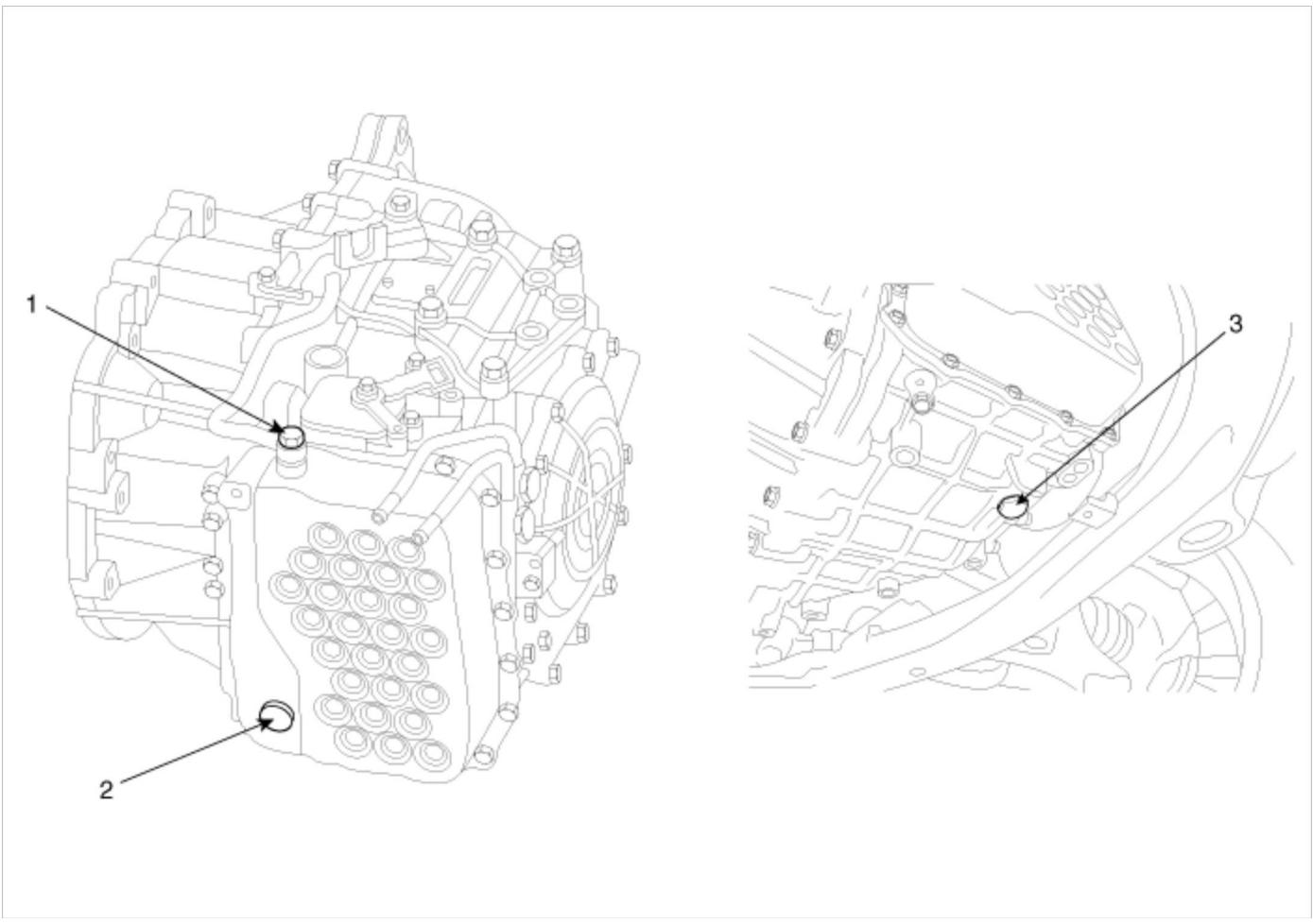
Oil Pump Operation Flow



- | | |
|----------------------------|--------------------------------------|
| 1. Inhale(Oil filter) | 5. 35R/C operation pressure |
| 2. Inhale(Valve body) | 6. Lubrication |
| 3. Outlet | 7. Line up clutch operation pressure |
| 4. 26/B operation pressure | 8. Line up clutch cancellation |

Automatic Transaxle System > Hydraulic System > Fluid > Components and Components Location

Components Location



1. Injection hole(eyebolt)
2. Oil level plug
3. Oil drain plug

Automatic Transaxle System > Hydraulic System > Fluid > Repair procedures

Service Adjustment Procedure

Oil level Check

NOTE

A check of ATF level is not normally required during scheduled services. If an oil leak is found, perform the oil level check procedure after repairs are completed.

CAUTION

When checking the oil level, be careful not to enter dust, foreign matters, etc. from fill hole.

1. Remove the eyebolt (A).

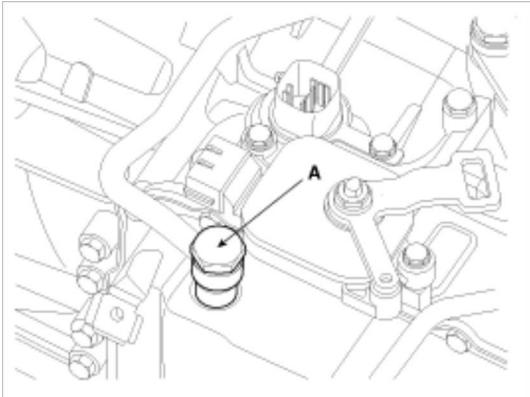
Eyebolt tightening torque:

34.3 ~ 44.1 N.m (3.5 ~ 4.5 kgf.m, 25.3 ~ 32.6 lb-ft)

CAUTION

Always replace the gasket of the eyebolt use new one whenever loosening eyebolt.

2. Add ATF SP-IV 700cc to the ATF injection hole.

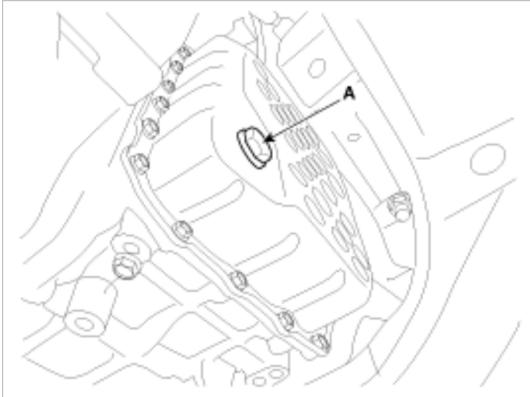


3. Start the engine. (Don't step on brake and accelerator simultaneously.)
4. Confirm that the temperature of the A/T oil temperature sensor is 50~60°C(122~140°F) with the GDS.
5. Shift the select lever slowly from "P" to "D", then "D" to "P" and repeat one more at idle.

CAUTION

Keep on each speed position more than 2 sec.

6. Lift the vehicle, then remove the oil level plug (A) from the valve body cover.



CAUTION

At this time, the vehicle must be at a level state.

7. If the oil flows out of the overflow plug in thin steady stream, the oil level is correct.
Then finish the procedure and tighten the oil plug.

NOTE

Oil level check (excess or shortage) method

- Excess: Oil flows out in thick stream.
- Shortage: No oil flows out of the overflow plug.

CAUTION

If there is no damage at the automatic transaxle and the oil cooler, the oil cooler hose, transaxle case, valve body

tightening state are normal, ATF must drip out after performing above 1 to 7 procedures. After performing above 1 to 7 procedures, if the oil doesn't drip out, inspect the automatic transaxle assembly.

CAUTION

Replace the gasket of the oil level plug and use new one whenever loosening the oil level plug.

Oil level plug tightening torque:

34.3 ~ 44.1 N.m (3.5 ~ 4.5 kgf.m, 25.3 ~32.6 lb-ft)

- Put down the vehicle with the lift and then tighten the eyebolt.

Replacement

NOTE

ATF of 6 speed automatic transaxle doesn't need to be replaced. If the vehicle is used severely in business or personal use, replace ATF every 60,000 miles.

Severe usage is defined as

- Driving in rough road (Bumpy, Gravel, Snowy, Unpaved road, etc)
- Driving in mountain road, ascent/descent
- Repetition of short distance driving
- More than 50% operation in heavy city traffic during hot weather above 32°C(89.6°F) .
- Police, Taxi, Commercial type operation or trailer towing, etc

- Remove the drain plug (A) and reinstall the drain plug after draining ATF totally.



Drain plug tightening torque:

34.3 ~ 44.1 N.m (3.5 ~ 4.5 kgf.m, 25.3 ~32.6 lb-ft)

CAUTION

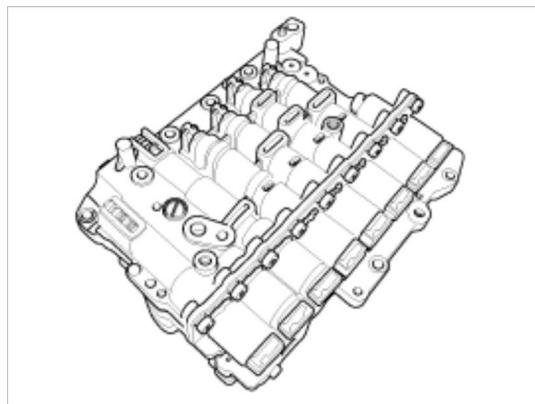
The gasket of the drain plug use new one.

- Fill the oil about 5 liters through eyebolt.
- Check the oil level. (Refer to "Hydraulic system (Fluid)" in this group)

Automatic Transaxle System > Hydraulic System > Valve Body > Description and Operation

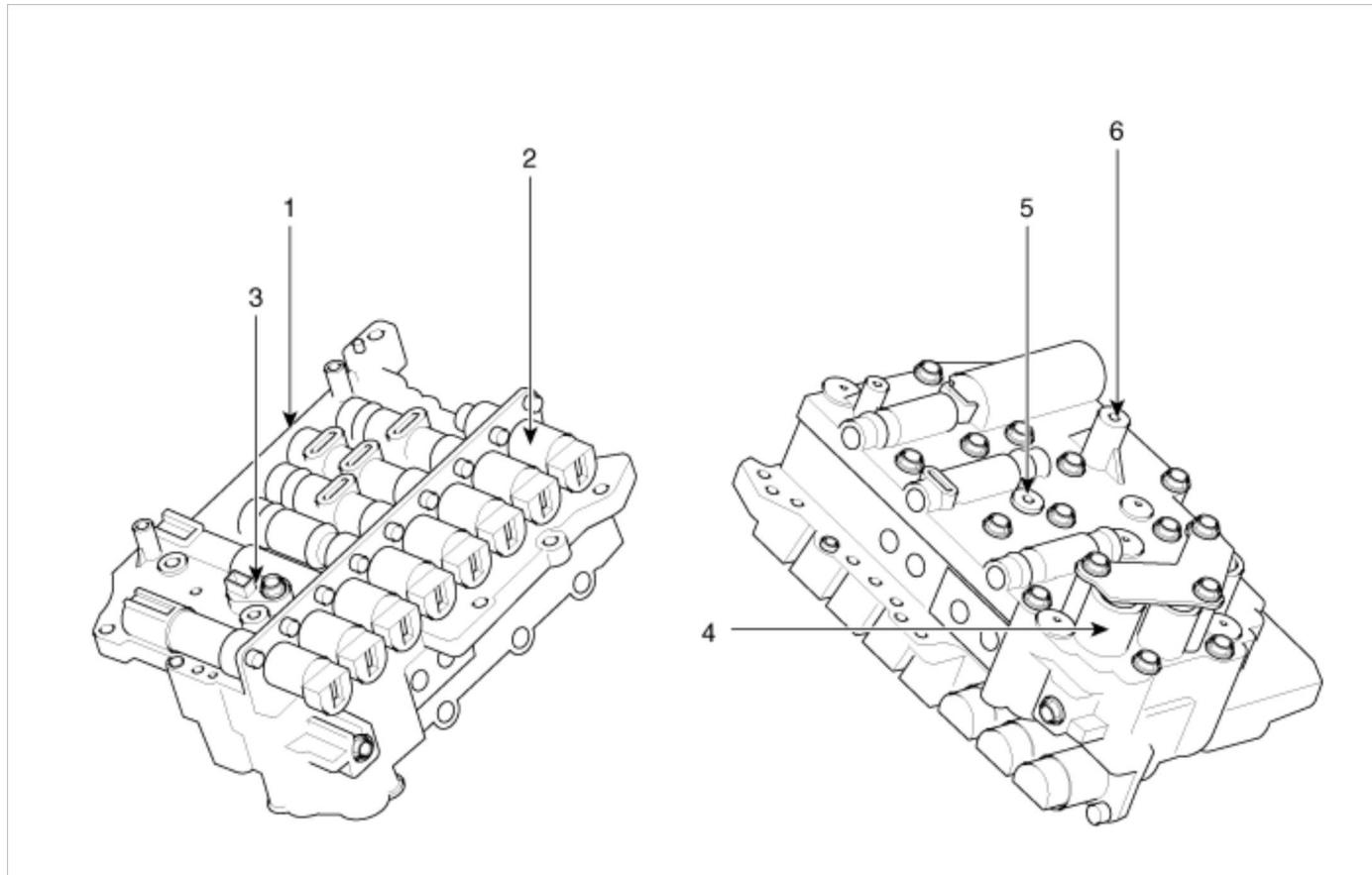
Description

The valve body is essential to automatic transaxle control and consists of various valves used to control the oil feed from the oil pump. Specifically, these valves consist of pressure regulator valves, oil redirection valves, shift valves, and manual valves. The body also features electronic solenoid valves that ensure smooth gear changes.



Automatic Transaxle System > Hydraulic System > Valve Body > Components and Components Location

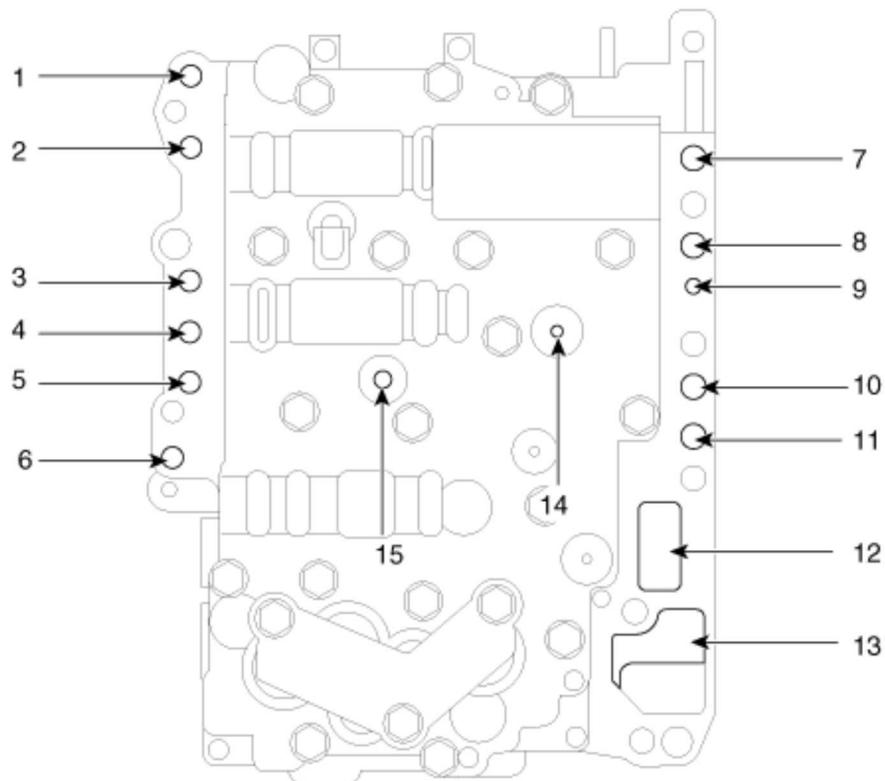
Components Location



- 1. PCV adjust screw
- 2. Solenoid valve
- 3. Oil temperature sensor

- 4. Accumulator
- 5. Low & reverse brake(LR/B) pressure flow hole
- 6. Under drive brake (UD/B) pressure flow hole

Valve Body Flow



- | | |
|-----------------------------|----------------------------|
| 1. To cooler | 9. Lubrication(front) |
| 2. From cooler | 10. 35R clutch pressure |
| 3. Lubrication(rear) | 11. 26 brake pressure |
| 4. Overdrive pressure | 12. From oil pump |
| 5. Reducing pressure (red2) | 13. To oil pump |
| 6. Reducing pressure (red1) | 14. Underdrive pressure |
| 7. From damper pressure | 15. Low & reverse pressure |
| 8. To damper pressure | |

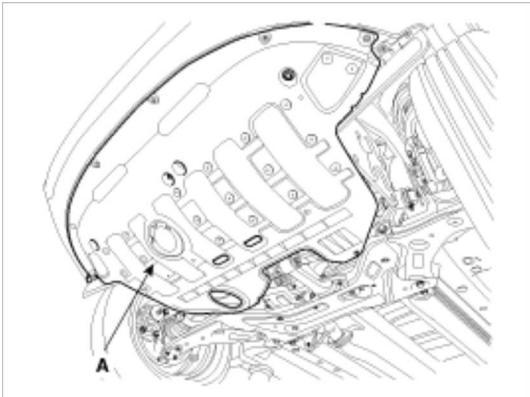
Automatic Transaxle System > Hydraulic System > Valve Body > Repair procedures

Removal

1. Remove the battery and the battery tray. (Refer to "Charging system" in EE group.)
2. Remove the under cover (A).

Tightening torque:

19.6 ~ 24.5 N.m (2.0 ~ 2.5 kgf.m, 14.5 ~ 18.1 lb-ft)



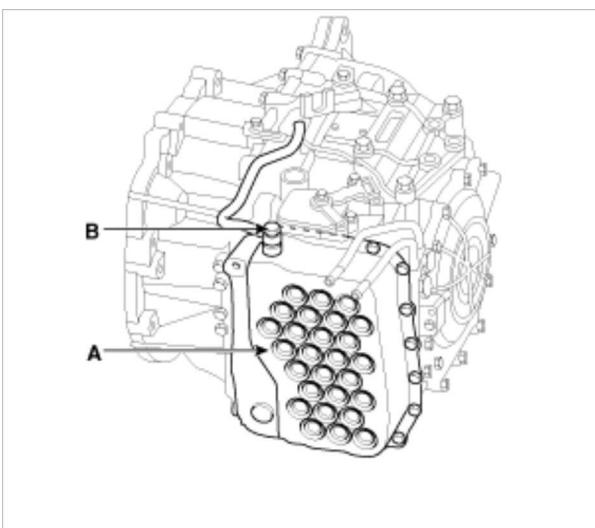
3. Replace new gasket and the plug after draining the automatic transaxle fluid by removing the drain plug. (Refer to "Hydraulic system (Fluid)" in this group)
4. Remove the valve body cover (A) and eyebolt (B).

Tightening torque:

(A) 13.8~14.7N.m (1.3~1.5kgf.m, 9.4~10.8lb-ft)
(B) 34.3~44.1N.m (3.5~4.5kgf.m, 25.3~32.6lb-ft)

CAUTION

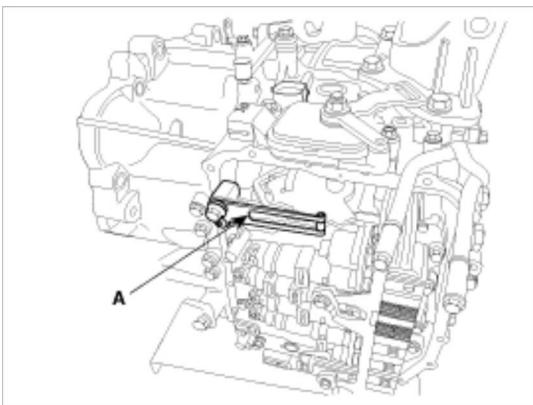
Always replace the gasket of the eyebolt use new one whenever loosening eyebolt.



5. Remove the plate and the detent spring (A) after removing the bolt.

Tightening torque:

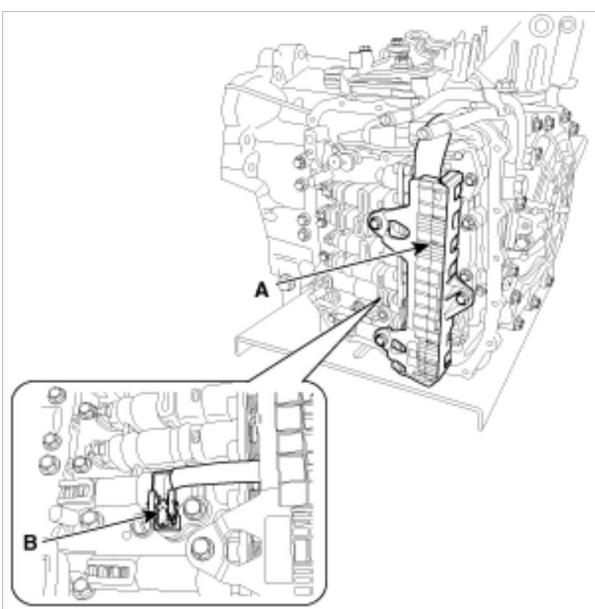
24.5 ~ 35.3 N.m (2.5 ~ 3.6 kgf.m, 18.1 ~ 26.0 lb-ft)



6. Remove the bolt (3ea) after disconnecting the solenoid valve (A) connector and the oil temperature sensor connector (B).

Tightening torque:

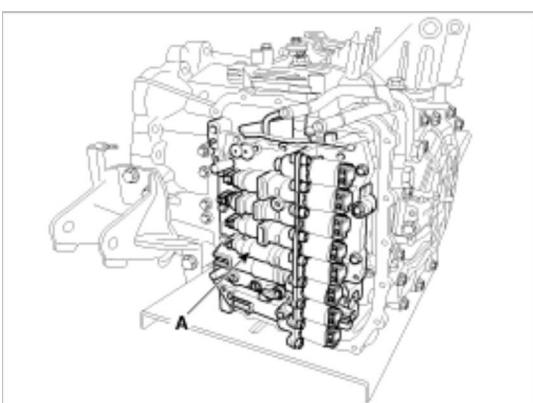
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)



7. Remove the valve body assembly (A).

Tightening torque:

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



Installation

1. Installation is the reverse of removal.

CAUTION

After replacement or reinstallation procedure of the valve body assembly, must perform procedures below.

NOTE

- Continue to apply liquid gasket at application points at the valve body cover with Ø2.5mm (0.0984in.) thickness.

Liquid gasket Part name :

Threebond 1281B or LOCTITE FMD-546

- Adding automatic transaxle fluid. (Refer to "Hydraulic system (Fluid)" in this group)
- Perform TCM learning after replacing the valve body to prevent slow transaxle response, jerky acceleration and jerky startup. (Refer to "Automatic transaxle control system (Repair procedures)" in this group)

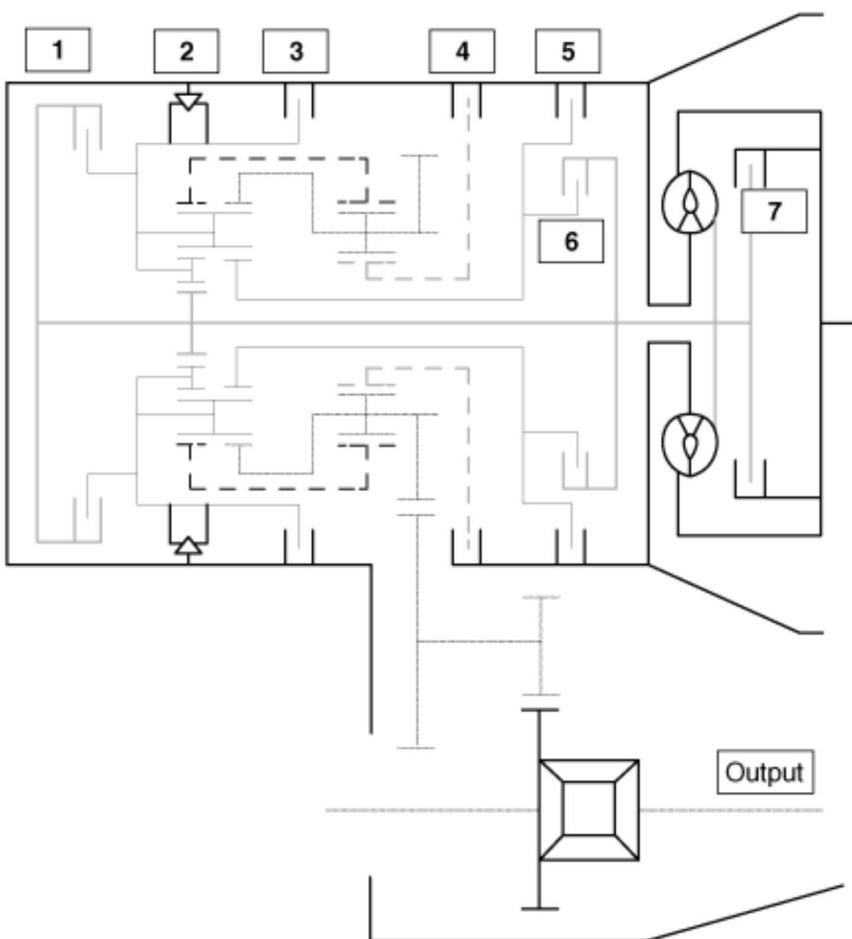
Automatic Transaxle System > Clutch & Brake > Description and Operation

Description

The 6-spd automatic transaxle consists of an overdrive clutch (OD/C), a one-way clutch (OWC), a lower and reverse brake (LR/B), an underdrive brake (UD/B), a 26 brake (26/B), and a 35R clutch (35R/C). These clutches and brakes are operated by controlling the hydraulic pressure.

Automatic Transaxle System > Clutch & Brake > Components and Components Location

Components Location

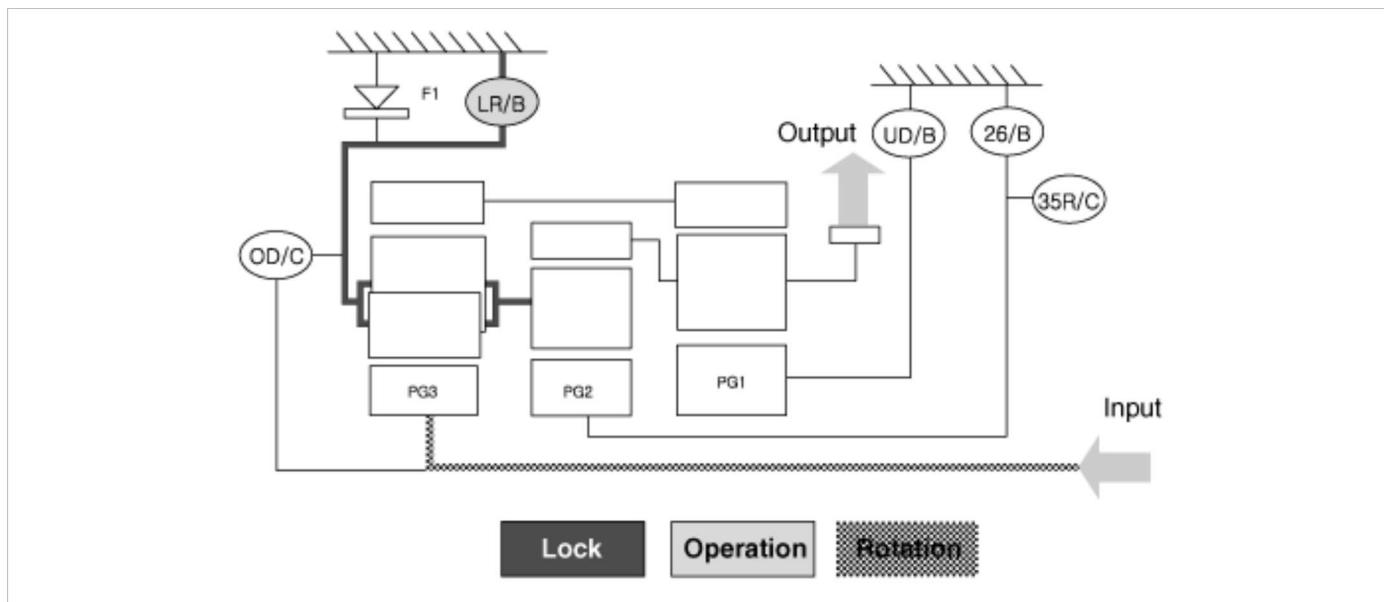


- | | |
|-------------------------------|------------------------|
| 1. Overdrive clutch (OD/C) | 5. 26 brake(26/B) |
| 2. One way clutch (OWC) | 6. 35R clutch (35R/C) |
| 3. Low & Reverse brake (LR/B) | 7. Damper clutch (D/C) |
| 4. Underdrive brake (UD/B) | |

Automatic Transaxle System > Clutch & Brake > Flow Diagram

Power Flow Chart

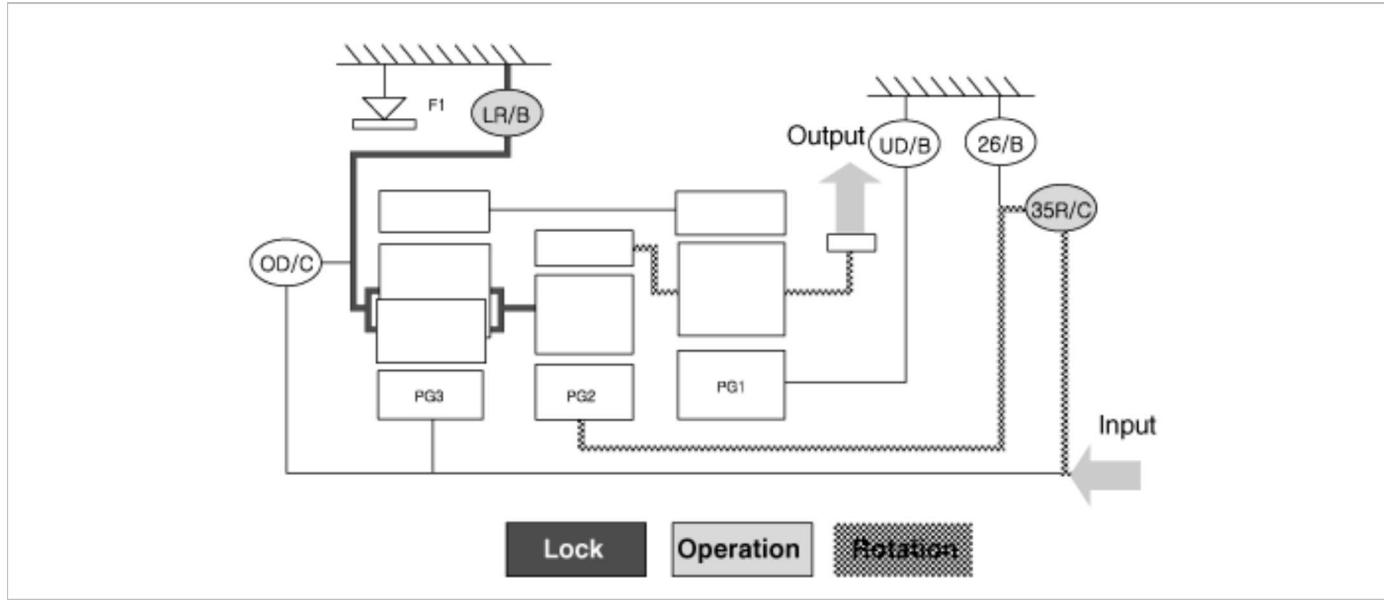
P,N	UD/B	LR/B	26/B	35R/C	OD/C	OWC
		•				



■ Direction of Rotation

- ▶ Lower & Reverse Brake (LR/B) Activation → Overdrive (O/D) Hub Lock → Mid & Rear P/C Lock
- ▶ Input Shaft Rotation → Rear Sun Gear Rotation → Rear Inner Pinion Rotation (Reverse) → Rear Outer Pinion Rotation → Rear Annulus Gear Rotation → Front Annulus Gear Rotation → Front Pinion Rotation → Front Sun Gear Rotation (Reverse) → Underdrive (U/D) Hub Rotation (Reverse)
- ▶ Input shaft rotation → Overdrive Clutch (OD/C) Retainer Rotation
- ▶ Input shaft rotation → 35R Clutch Rotation

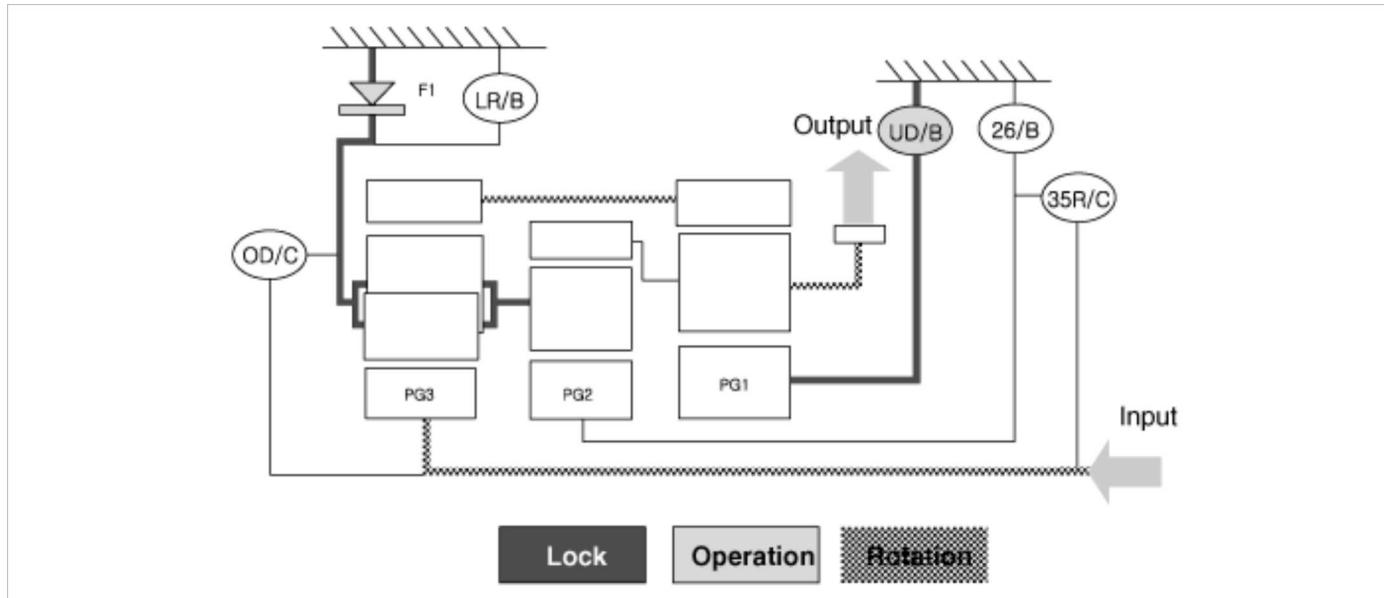
R	UD/B	LR/B	26/B	35R/C	OD/C	OWC
•		•		•		



■ Power Delivery Route

- ▶ Middle carrier locked and middle sun gear in rotation
- ▶ Rotating the middle planetary gear's sun gear while its carrier is locked in place slows down and reverse rotates the annulus gear (front carrier), resulting in power transfer to the front carrier.
- ▶ The rear planetary gear's rear and front annulus gears rotate at a reduced rate, resulting in reverse, zero load rotation of the front planetary gear's front sun gear.

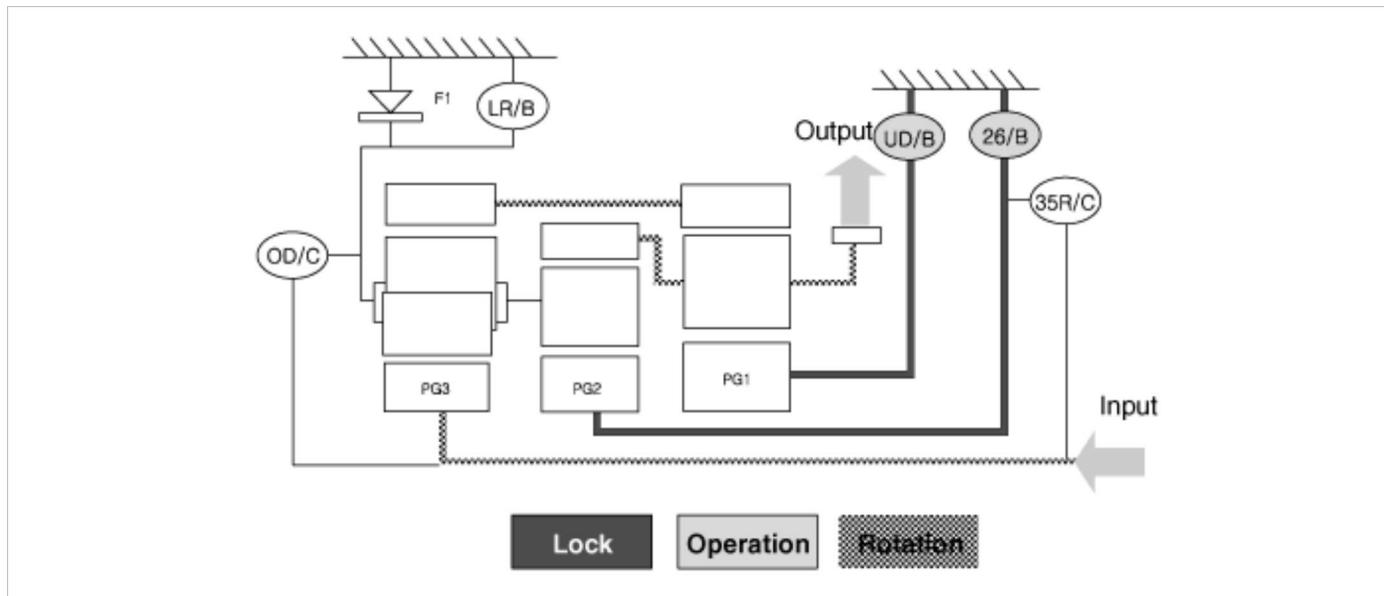
D1	UD/B	LR/B	26/B	35R/C	OD/C	OWC
•		(○)				•



■ Power Delivery Route

- Front sun gear and middle & rear carrier locked and rear sun gear in constant rotation
- When the rear sun gear is rotated, power is reduced at the rear planetary gear and then delivered to the rear and front annulus gears. The power is then reduced again at the front planetary gear, whose sun gear is locked in place, and then delivered to the front carrier.
- Here, the middle annulus gear, which comprises of a single unit with the front carrier, rotates and results in reverse, zero load rotation of the middle sun gear.

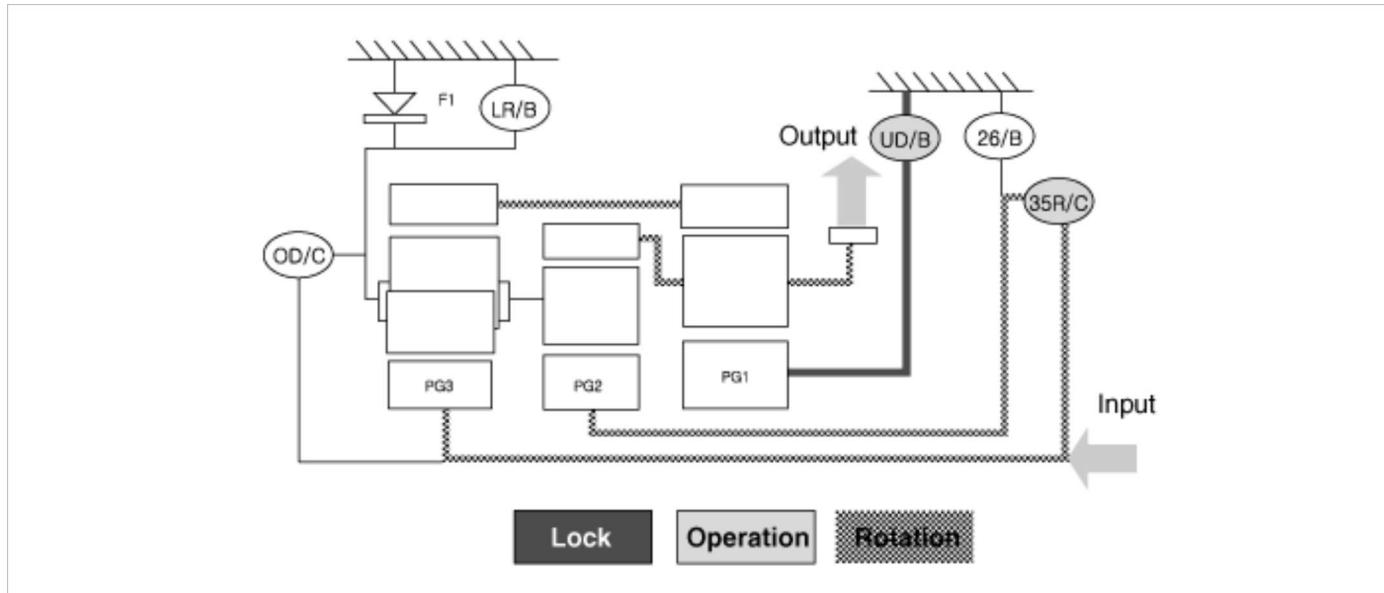
D2	UD/B	LR/B	26/B	35R/C	OD/C	OWC
	•		•			



■ Power Delivery Route

- Front sun gear and middle sun gear locked and rear sun gear in constant rotation
- Rotating the rear sun gear delivers power to the rear & front annulus gears, and reaction from the front carrier and the middle annulus gear, to which the sun gear is attached, transfers to the middle and rear carriers, resulting in power equilibrium and power transfer to the front carrier.

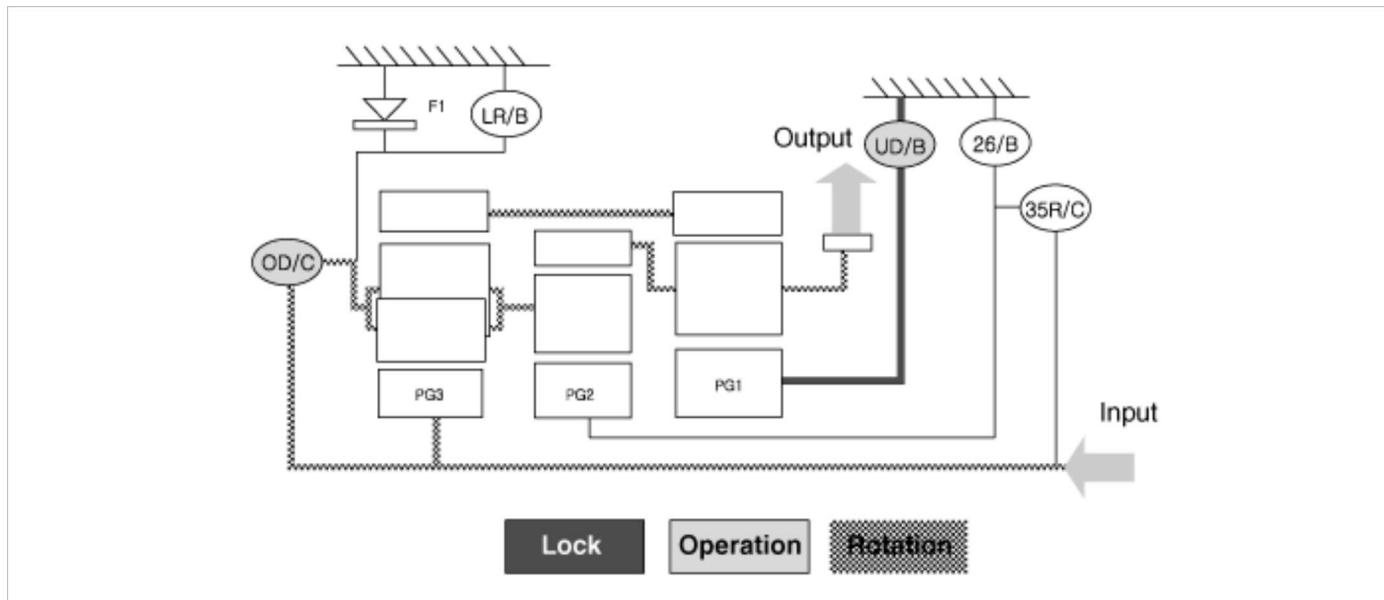
D3	UD/B	LR/B	26/B	35R/C	OD/C	OWC
	•			•		



■ Power Delivery Route

- ▶ Front sun gear locked and middle and rear sun gears in rotation
- ▶ Rotating the middle sun gear and the rear sun gear transfers power to the rear and front annulus gears, and reaction from the front carrier and the middle annulus gear, to which the sun gear is attached, transfers to the middle and rear carriers, resulting in power equilibrium and power transfer to the front carrier.

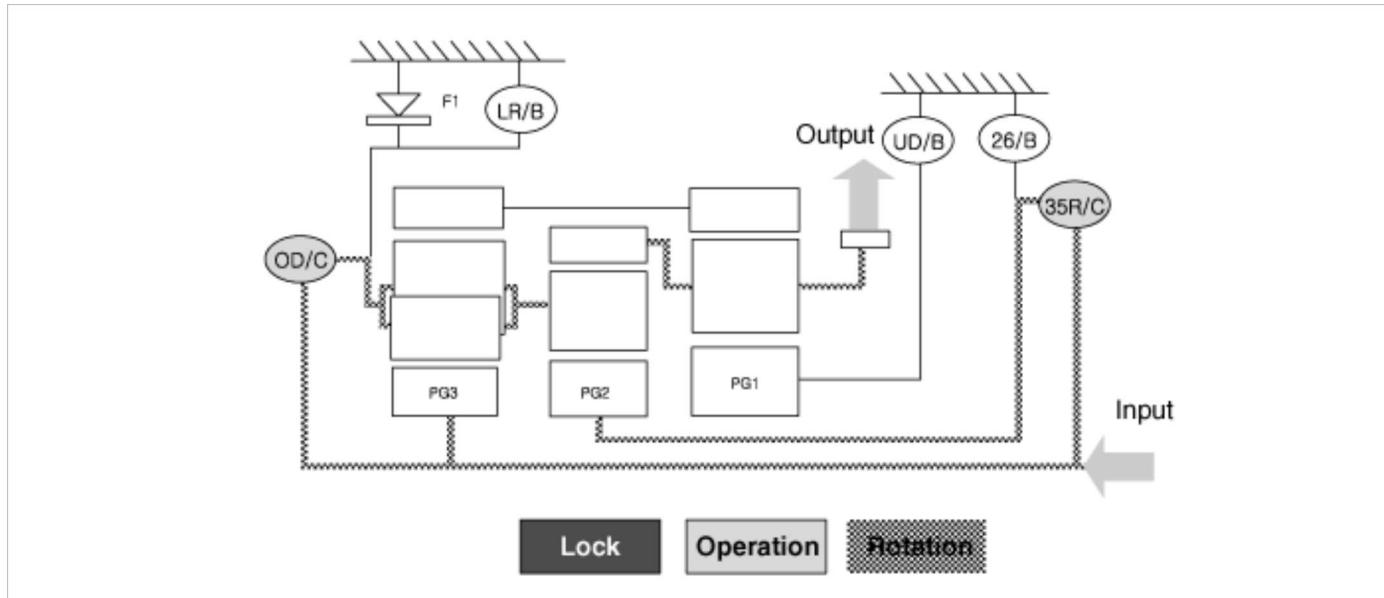
D4	UD/B	LR/B	26/B	35R/C	OD/C	OWC
	•					•



■ Power Delivery Route

- ▶ Front sun gear locked and rear carrier and rear sun gears in rotation
- ▶ Activation of the overdrive clutch (OD/C) synchronizes the rear planetary gear's carrier and sun gears. The 1:1 rotation ratio passes through the rear and front annulus gears and reaches the front planetary gear's front carrier, to which the sun gear is attached.
- ▶ Here, the middle planetary gear's middle sun gear rotates at a faster rate in the normal direction and at zero load due to the actions of the reduced annulus gear and the carrier having a 1:1 rotation ratio.

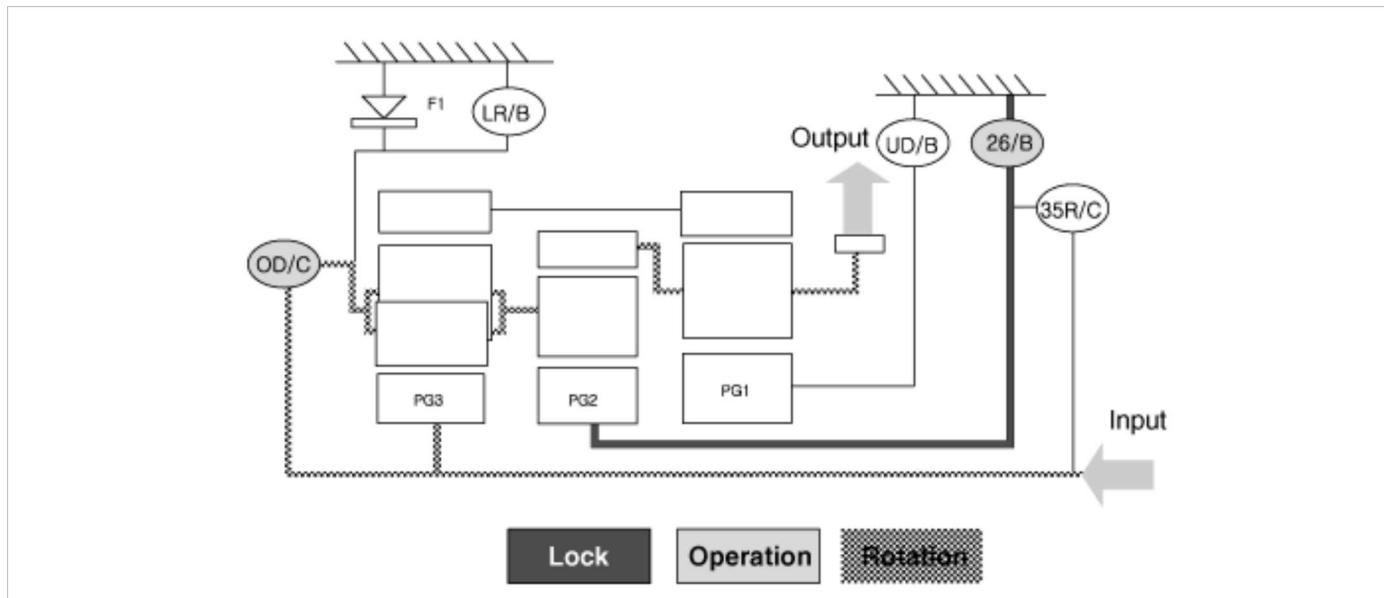
D5	UD/B	LR/B	26/B	35R/C	OD/C	OWC
				•	•	



□ Power Delivery Route

- ▶ Middle and rear carriers, middle sun gear, and rear sun gear in rotation
- ▶ The middle planetary gear's middle carrier and sun gear rotate simultaneously, resulting in the 1:1 rotation ratio being transferred to the middle annulus gear (front carrier).
- ▶ Here, the rear planetary gear rotates in a 1:1 rotation ratio, as it would when the 4th gear is engaged; however, the front planetary gear remains unrestrained and the front sun gear rotates in the normal direction, at a zero load, and at a rotation ratio of 1:1.

D6	UD/B	LR/B	26/B	35R/C	OD/C	OWC
			•		•	



□ Power Delivery Route

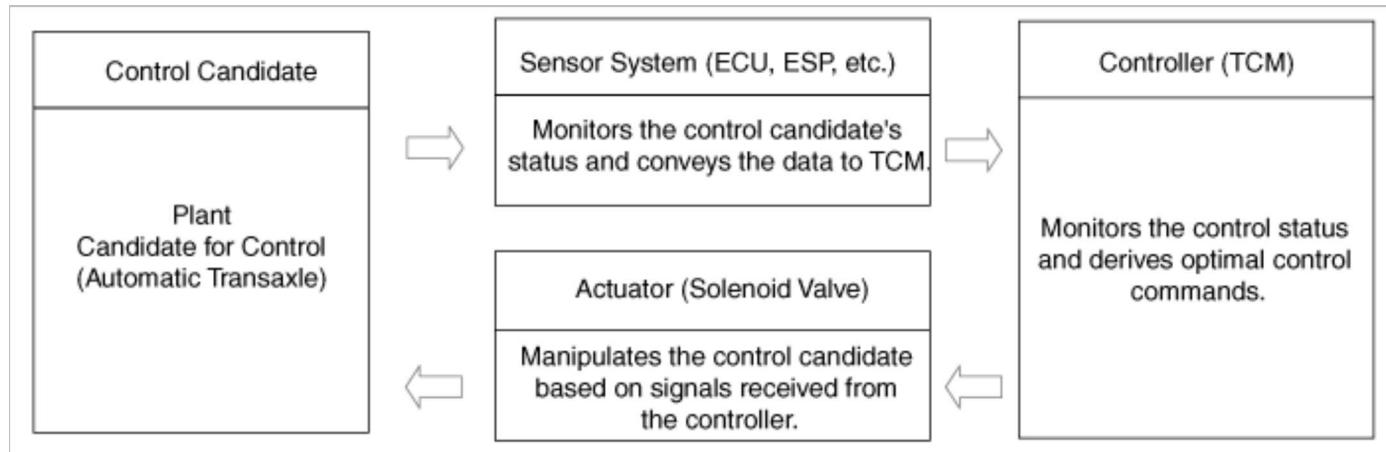
- ▶ Middle carrier in rotation and middle sun gear locked
- ▶ When the middle planetary gear's sun gear is locked in place and the train's carrier's allowed to rotate, the middle annulus gear increases its rate of rotation and transfers power to the front carrier.
- ▶ Here, the rear planetary gear maintains a 1:1 rotation ratio as it would when 4th or 5th gear is engaged; however, the front planetary gear remains unrestrained and the front sun gear rotates at a faster rate in the normal direction and at zero load.

Automatic Transaxle System > Automatic Transaxle Control System > Description and Operation

Description

Automatic transaxle system relies on various measurement data to determine the current control status and extrapolate the necessary compensation values. These values are used to control the actuators and achieve the desired control output. If a problem with the drivetrain, including the transaxle, has been identified, perform self-diagnosis and basic transaxle inspection (oil and fluid inspection) and then check the control system's components using the diagnosis tool.

Control System Composition



Fault Diagnosis

Features a fail-safe mechanism that prevents dangerous situations from developing in the event of a transaxle failure. The limp home mode engages if the transaxle malfunctions. In this mode, the transaxle operates at a minimal functionality level, making it possible for the vehicle to reach a service center.

Fail-Safe: Prevents dangerous situations from developing in the event of a malfunction.

Limp Home: Maintains minimal functionality (*) in the event of a malfunction, making it possible for the vehicle to reach a service center.

(*) Minimal Functionality: Drive (fixed gear setting), Reverse, and Neutral

Self-diagnosis

TCM is in constant communication with the control system's components (sensors and solenoids). If an abnormal signal is received for longer than the predefined duration, TCM recognizes a fault, stores the fault code in memory, and then sends out a fault signal through the self-diagnosis terminal. Such fault codes are independently backed up and will not be cleared even if the ignition switch is turned off, the battery is disconnected, or the TCM connector is disconnected.

CAUTION

Disconnecting a sensor or an actuator connector while the ignition switch is in the "On" position generates a diagnostic trouble code (DTC) and commits the code to memory. In such event, disconnecting the battery will not clear the fault diagnosis memory. The diagnosis tool must be used to clear the fault diagnosis memory.

CAUTION

- Before removing or installing any part, read the diagnostic trouble codes and then disconnect the battery negative (-) terminal.
- Before disconnecting the cable from battery terminal, turn the ignition switch to OFF. Removal or connection of the battery cable during engine operation or while the ignition switch is ON could cause damage to the TCM.
- When checking the generator for the charging state, do not disconnect the battery '+' terminal to prevent the ECM from damage due to the voltage.
- When charging the battery with the external charger, disconnect the vehicle side battery terminals to prevent damage to the TCM.

Checking Procedure (Self-diagnosis)

CAUTION

- When battery voltage is excessively low, diagnostic trouble codes can not be read. Be sure to check the battery for voltage and the charging system before starting the test
- Diagnosis memory is erased if the battery or the TCM connector is disconnected. Do not disconnect the battery before the diagnostic trouble codes (DTC) are completely read and recorded.

Inspection Procedure (Using the GDS)

1. Turn OFF the ignition switch.
2. Connect the GDS to the data link connector on the lower crash pad.
3. Turn ON the ignition switch.
4. Use the GDS to check the diagnostic trouble code.
5. Repair the faulty part from the diagnosis chart.
6. Erase the diagnostic trouble code.
7. Disconnect the GDS.

CAUTION

- Perform TCM learning after replacing the automatic transaxle to prevent slow automatic transaxle response, jerky acceleration and jerky startup. (Refer to "Automatic transaxle control system (Repair procedures)" in this group)
- Adding automatic transaxle fluid. (Refer to "Hydraulic system (Fluid)" in this group)
- After servicing the automatic transaxle or TCM, clear the diagnostic trouble code (DTC) using the GDS tool. Diagnostic trouble codes (DTC) cannot be cleared by disconnecting the battery.

Automatic Transaxle System > Automatic Transaxle Control System > Repair procedures

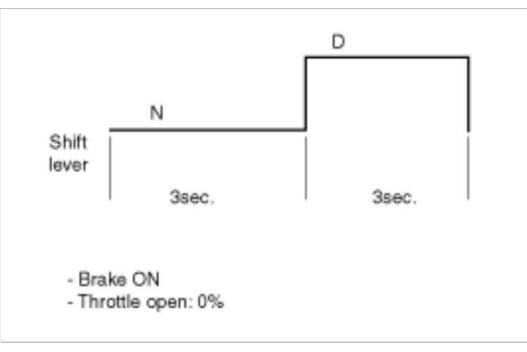
Adjustment

TCM Learning

When shift shock is occurred or parts related with the transaxle are replaced, TCM learning should be performed. In the following case, TCM learning is required.

- Transaxle assembly replacement
 - TCM replacement
 - TCM upgrading
1. TCM learning condition
 - A. ATF temperature: 60~115°C (140~239°F)
 2. TCM learning procedure
 - A. Stop learning

Repeat the below shift pattern four times or more with stepping on the brake.

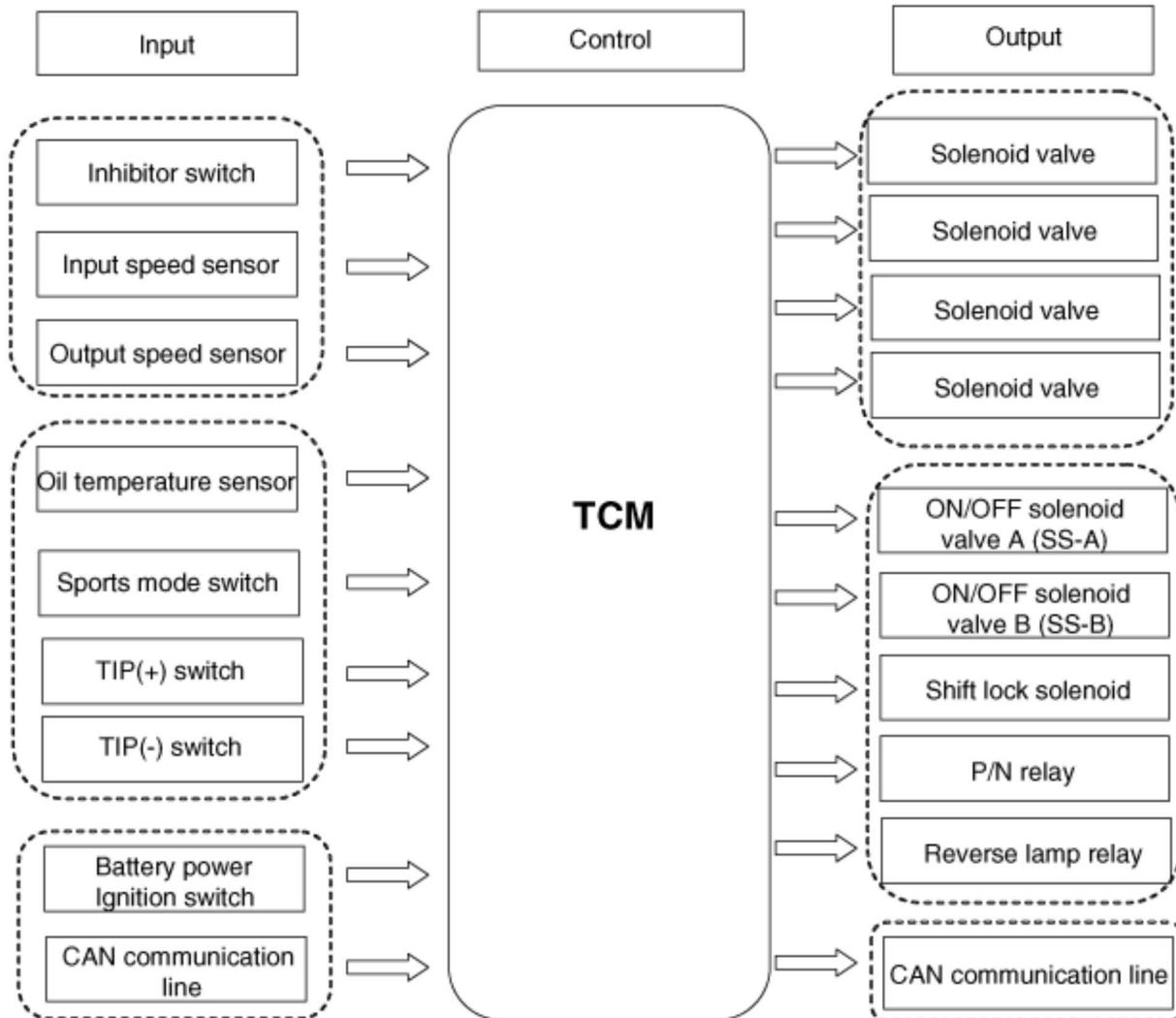


- B. Driving learning

1. Drive the vehicle through all gears at D range. Drive from stop to 1st to 2nd to 3rd to 4th to 5th to 6th with keeping fixed throttle open.
2. Down shift from 6th to 5th, 5th to 4th, 4th to 3rd, 3rd to 2nd, 2nd to 1st.
3. Repeat the above driving pattern four times or more.
Up-shift throttle open : 15~30%

Automatic Transaxle System > Automatic Transaxle Control System > Schematic Diagrams

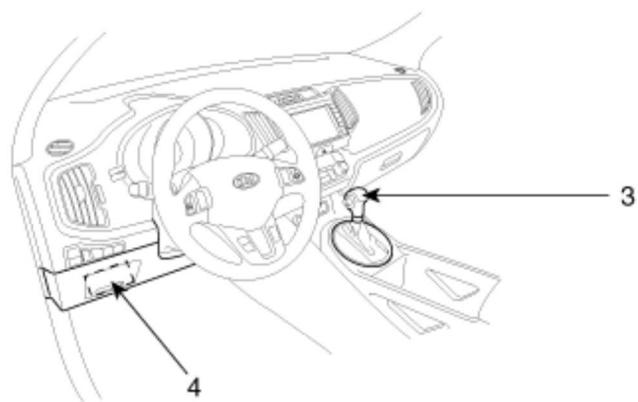
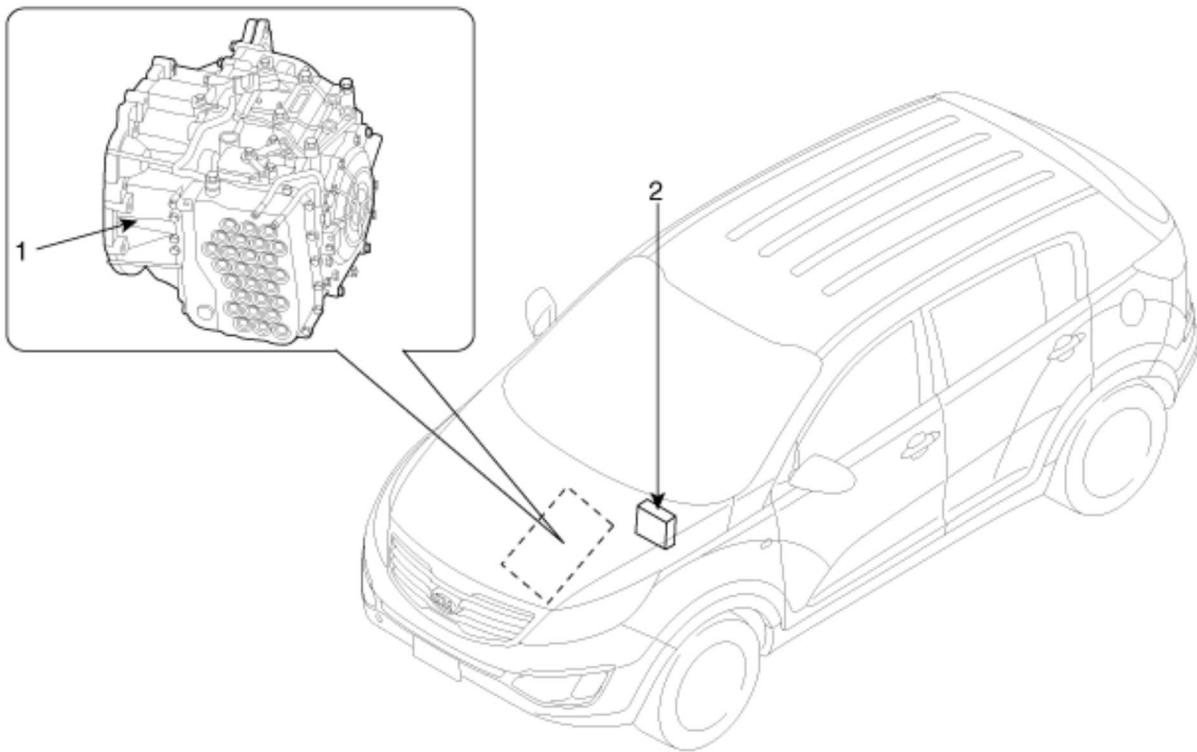
Circuit Diagram



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

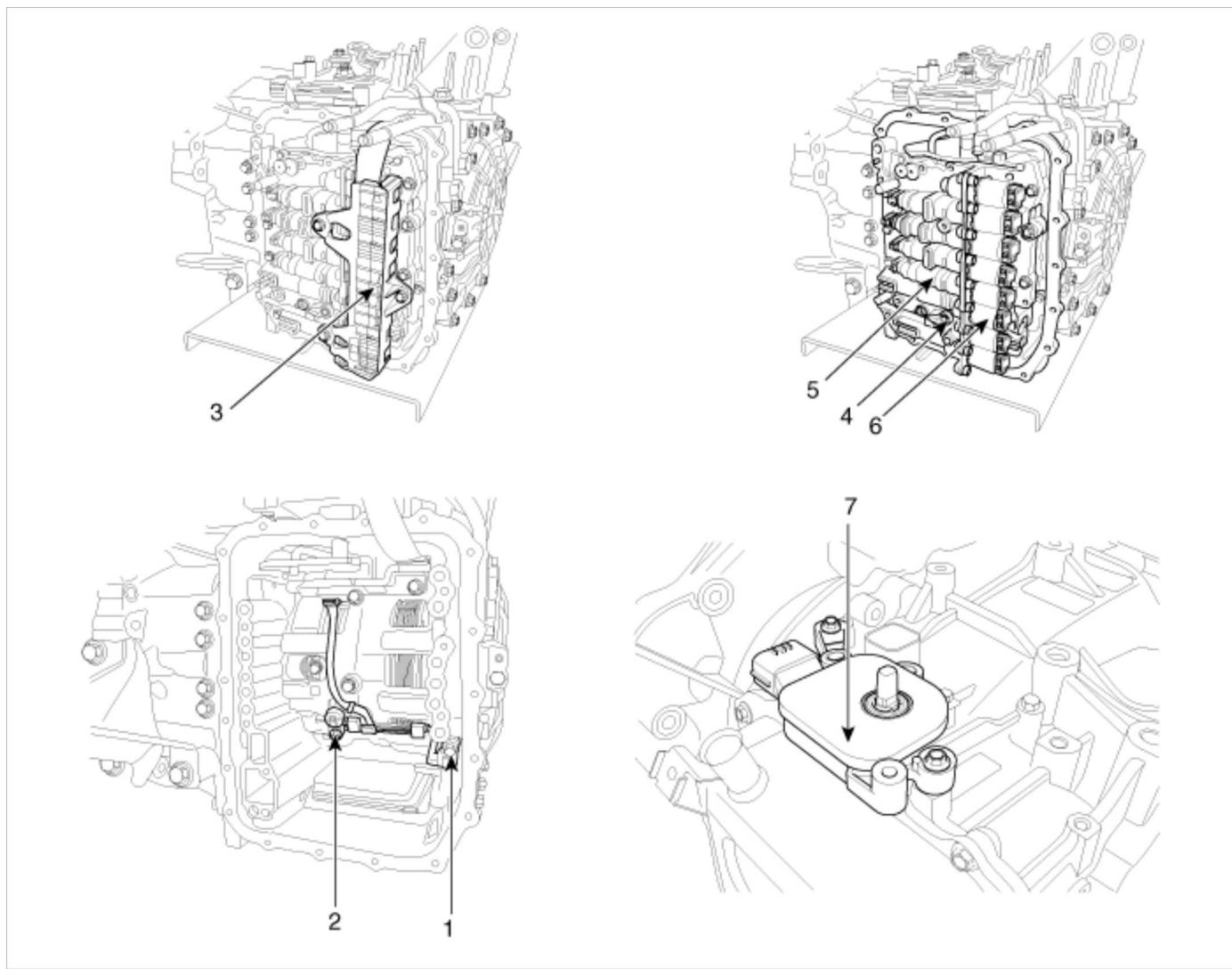
Components Location

[Vehicle Components]



- | | |
|-----------------------------------|----------------|
| 1. Automatic transaxle | 3. Shift lever |
| 2. Transaxle control module (TCM) | 4. DLC |

[Transaxle Components]



- | | |
|---|--|
| 1. Input speed sensor
2. Output speed sensor
3. Solenoid valve connect
4. Oil temperature sensor | 5. Valve body assembly
6. Solenoid valve
7. Inhibitor switch |
|---|--|

Automatic Transaxle System > Automatic Transaxle Control System > Transaxle Control Module (TCM) > Description and Operation

Description

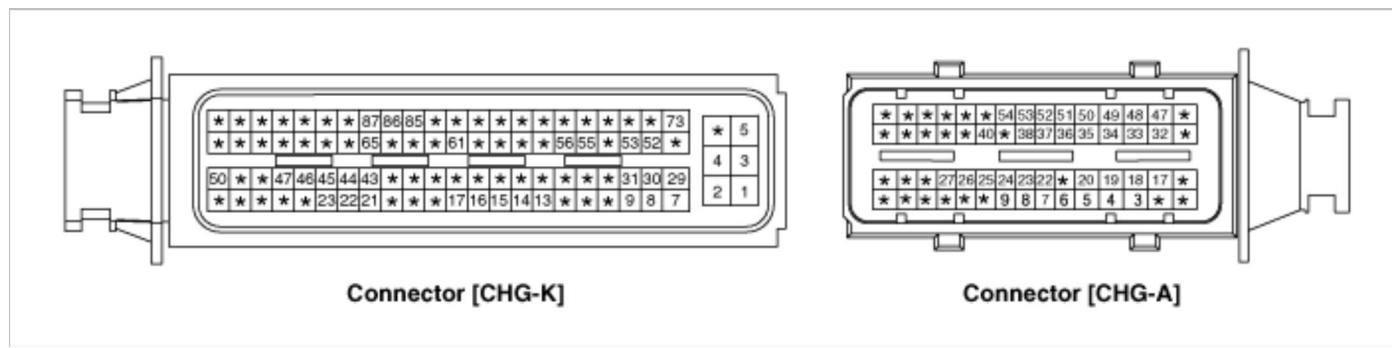
Transaxle Control Module (TCM) is the automatic transaxle's brain. The module receives and processes signals from various sensors and implements a wide range of transaxle controls to ensure optimal driving conditions for the driver. TCM is programmed for optimal response to any on-road situation. In the event of a transaxle failure or malfunction, TCM stores the fault information in memory so that the technician may reference the code and quickly repair the transaxle.

Functions

- Monitors the vehicle's operating conditions to determine the optimal gear setting.
- Performs a gear change if the current gear setting differs from the identified optimal gear setting.
- Determines the need for damper clutch (D/C) activation and engages the clutch accordingly.
- Calculates the optimal line pressure level by constantly monitoring the torque level and adjusts the pressure accordingly.
- Diagnoses the automatic transaxle for faults and failures.

Automatic Transaxle System > Automatic Transaxle Control System > Transaxle Control Module (TCM) > Schematic Diagrams

TCM connector and terminal function



TCM Terminal Function

Connector [CHG-A]

Pin	Description	Pin	Description
1	-	31	-
2	-	32	ON/OFF solenoid valve B(SS-B)
3	Line pressure control solenoid valve (LINE_VFS)	33	ON/OFF solenoid valve A (SS-A)
4	Torque converter control solenoid valve (T/CON_VFS)	34	Ground (Power 1)
5	35R clutch control solenoid valve (35R/C_VFS)	35	Ground (Power 2)
6	Input speed sensor power	36	Sports mode down switch
7	Output speed sensor power	37	Sports mode up switch
8	Input speed sensor signal	38	Sports mode Select switch
9	Output speed sensor signal	39	-
10	-	40	Inhibitor switch signal "S1"
11	-	41	-
12	-	42	-
13	-	43	-
14	-	44	-
15	-	45	-
16	-	46	-
17	Underdrive brake control solenoid valve (UD/B_VFS)	47	Solenoid supply power 1
18	26 brake control solenoid valve (26/B_VFS)	48	Solenoid supply power 2
19	Shift lock solenoid	49	TCM Input power 1 (For solenoid)
20	Overdrive clutch control solenoid valve (OD/C_VFS)	50	TCM Input power 2 (For solenoid)
21	-	51	Reserved
22	Rear lamp relay	52	Reserved
23	-	53	Oil temperature sensor (-)
24	Start relay	54	Oil temperature sensor (+)

25	Inhibitor switch signal "S2"	55	-
26	Inhibitor switch signal "S3"	56	-
27	Inhibitor switch signal "S4"	57	-
28	-	58	-
29	-	59	-
30	-	60	-

Connector [CHG-K]

Pin	Description	Pin	Description
1	Power ground	31	Power ground
2	Battery power (B+)	32	Battery power (B+)
3	Power ground	33	CAN communication line (HIGH)
4	Battery power (B+)	34	CAN communication line (Low)

TCM Terminal input/ output signal**Connector [CHG-A]**

Pin	Description	Condition	Input/output value	
			Type	Level
1	-			
2	-			
3	Line pressure control solenoid valve (LINE_VFS)		Output	0V/Battery voltage level
				9V < Battery voltage level < 16V
4	Torque converter control solenoid valve (T/CON_VFS)		Output	0V/Battery voltage level
				9V < Battery voltage level < 16V
5	35R clutch control solenoid valve (35R/C_VFS)		Output	0V/Battery voltage level
				9V < Battery voltage level < 16V
6	Input speed sensor power	ON	Power	0V/7.5V
		OFF		
7	Output speed sensor power	ON	Power	0V/7.5V
		OFF		
8	Input speed sensor signal	High	Input	0.7V/1.4V
		Low		
9	Output speed sensor signal	High	Input	0.7V/1.4V
		Low		
10	-			
11	-			
12	-			
13	-			
14	-			
15	-			

16	-			
17	Underdrive brake control solenoid valve (UD/B_VFS)		Output	0V/Battery voltage level
				9V < Battery voltage level < 16V
				Power supply : V_SOL2
18	26 brake control solenoid valve (26/B_VFS)		Output	0V/Battery voltage level
				9V < Battery voltage level < 16V
				Power supply : V_SOL2
19	Shift lock solenoid	High	Output	0V/Battery voltage level
		Low		9V < Battery voltage level < 16V
20	Overdrive clutch control solenoid valve (OD/C_VFS)		Output	0V/Battery voltage level
				9V < Battery voltage level < 16V
				Power supply : V_SOL1
21	-			
22	Rear lamp relay	R ON	Output	0V/Battery voltage level
		Other		9V < Battery voltage level < 16V
23	-			
24	Start relay	High	Output	0V/Battery voltage level
		Low		9V < Battery voltage level < 16V
25	Inhibitor switch signal "S2"	High	Input	0V/Battery voltage level
		Low		9V < Battery voltage level < 16V
26	Inhibitor switch signal "S3"	High	Input	0V/Battery voltage level
		Low		9V < Battery voltage level < 16V
27	Inhibitor switch signal "S4"	High	Input	0V/Battery voltage level
		Low		9V < Battery voltage level < 16V
28	-			
29	-			
30	-			
31	-			
32	ON/OFF solenoid valve B(SS-B)	High	Output	0V/Battery voltage level
		Low		9V < Battery voltage level < 16V
33	ON/OFF solenoid valve A (SS-A)	High	Output	0V/Battery voltage level
		Low		9V < Battery voltage level < 16V
34	Ground (Power 1)		Ground	0V
35	Ground (Power 2)		Ground	0V
36	Sports mode down switch	Down ON	Input	0V/Battery voltage level
		Other		9V < Battery voltage level < 16V
37	Sports mode up switch	Up ON	Input	0V/Battery voltage level
		Other		9V < Battery voltage level < 16V
38	Sports mode select switch	Sport mode	Input	0V/Battery voltage level

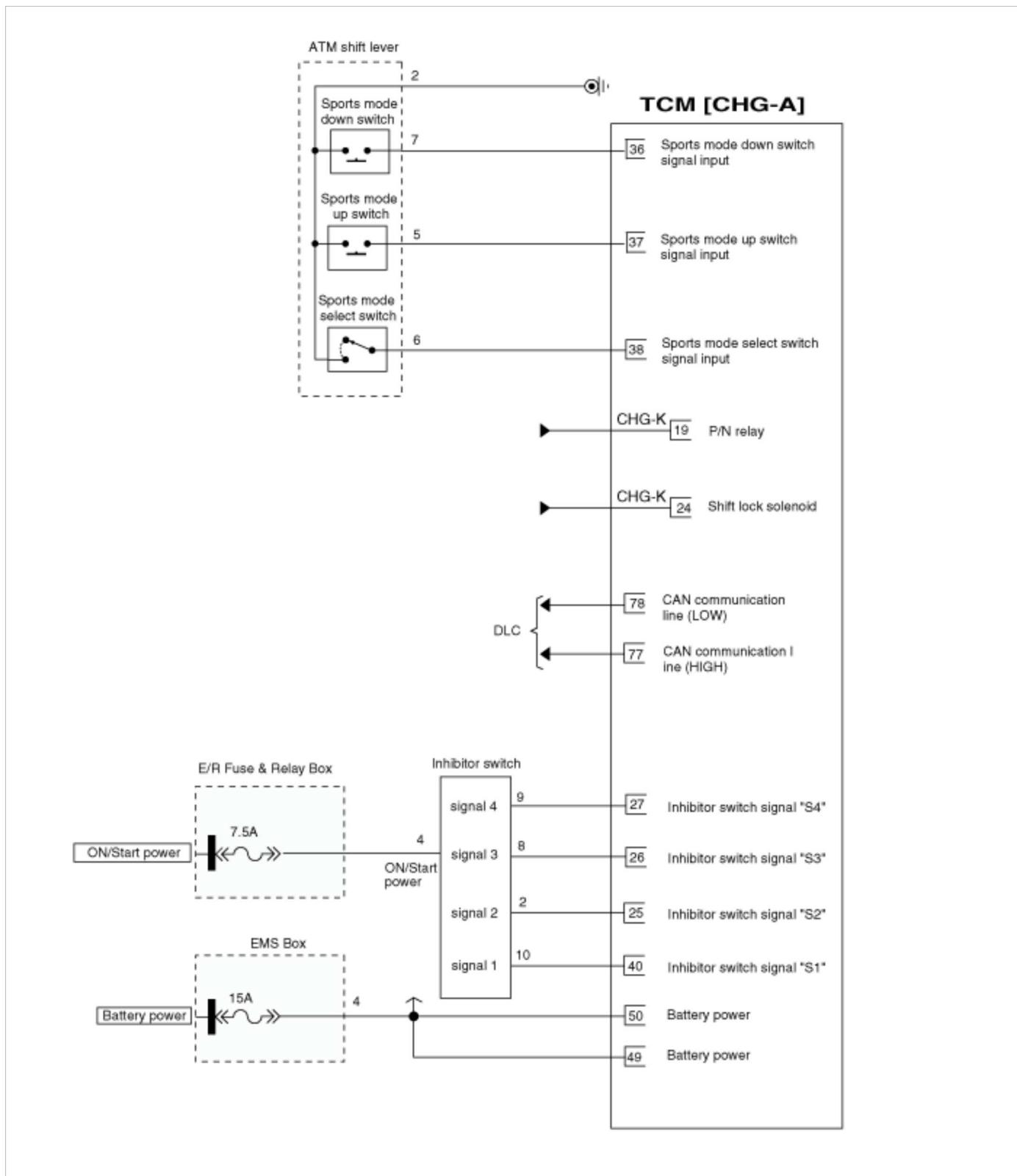
		Other		9V < Battery voltage level < 16V
39	-			
40	Inhibitor switch signal "S1"	High	Input	0V/Battery voltage level
		Low		9V < Battery voltage level < 16V
41	-			
42	-			
43	-			
44	-			
45	-			
46	-			
47	Solenoid supply power 1	ON	Power	0V/Battery voltage level
		OFF		9V < Battery voltage level < 16V
48	Solenoid supply power 2	ON	Power	0V/Battery voltage level
		OFF		9V < Battery voltage level < 16V
49	TCM Input power 1 (For solenoid)		Power	Battery voltage level
				9V < Battery voltage level < 16V
50	TCM Input power 2 (For solenoid)		Power	Battery voltage level
				9V < Battery voltage level < 16V
51	-			
52	-			
53	Oil temperature sensor (-)		Ground	0V
54	Oil temperature sensor (+)	ON	Input	0V/3.3V
		OFF		
55	-			
56	-			
57	-			
58	-			
59	-			
60	-			

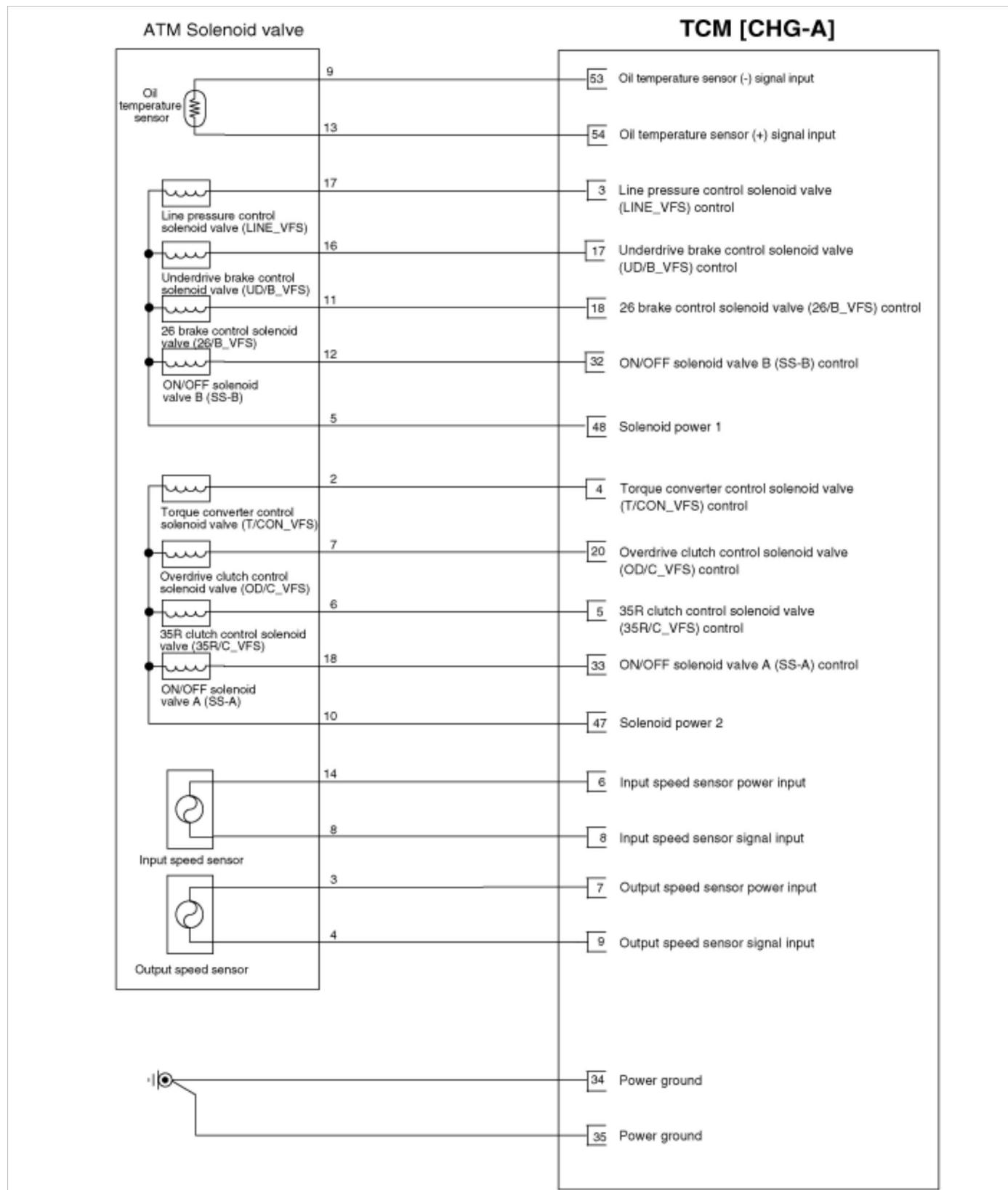
Connector [CHG-K]

Pin	Description	Condition	Type	Level
1	Power ground		Ground	0V
2	Battery power (B+)	ON	Power	0V/Battery voltage level
		OFF		9V < Battery voltage level < 16V
3	Power ground		Ground	0V
4	Battery power (B+)	ON	Power	0V/Battery voltage level
		OFF		9V < Battery voltage level < 16V
5	Power ground		Ground	0V
6	Battery power (B+)		Power	Battery voltage level

9V < Battery voltage level < 16V

Circuit Diagram





Automatic Transaxle System > Automatic Transaxle Control System > Transaxle Control Module (TCM) > Repair procedures

Inspection

TCM Problem Inspection Procedure

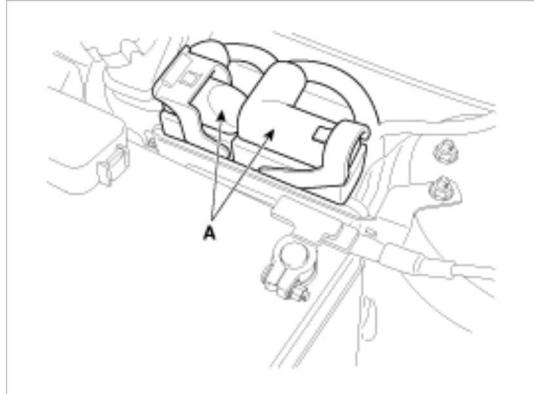
1. TEST TCM GROUND CIRCUIT: Measure resistance between TCM and chassis ground using the backside of TCM harness connector as TCM side check point. If the problem is found, repair it.

Specification: Below 1Ω

2. TEST TCM CONNECTOR: Disconnect the TCM connector and visually check the ground terminals on TCM 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 TCM could be faulty. If so, make sure there were no DTC's before swapping the TCM with a new one, and then check the vehicle again. If DTC's were found, examine this first before swapping TCM.
4. RE-TEST THE ORIGINAL TCM: Install the original TCM (may be broken) into a known-good vehicle and check the vehicle. If the problem occurs again, replace the original TCM with a new one. If problem does not occur, this is intermittent problem (Refer to "Intermittent Problem Inspection Procedure" in Basic Inspection Procedure).

Replacement

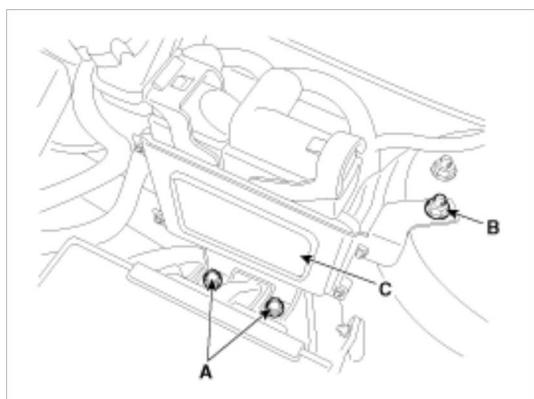
1. Turn ignition switch OFF.
2. Disconnect the negative (-) battery cable.
3. Disconnect the TCM connector (A).



4. Remove the TCM (C) after removing the mounting bolts (A) and nut (B).

TCM installation bolt/nut :

- (A) 21.6~32.4 N.m (2.2 ~ 2.3 kgf.m, 15.9~23.9 lb-ft)
(B) 9.8~14.7 N.m (1.0 ~ 2.5 kgf.m, 7.2~10.8 lb-ft)
-



Installation

1. Installation is reverse of removal.

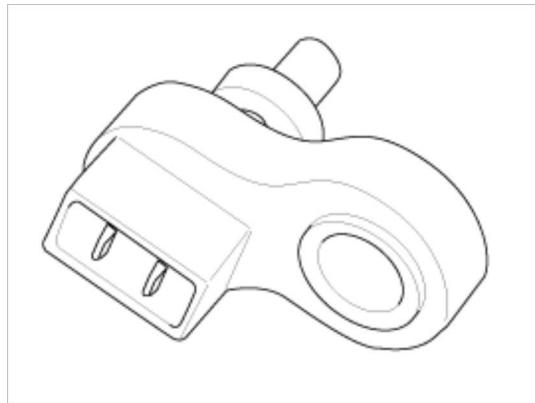
NOTE

In the case of the vehicle equipped with immobilizer or button engine start system, perform "Key Teaching" procedure together (Refer to "Immobilizer" or "Button Engine Start System in BE group).

Automatic Transaxle System > Automatic Transaxle Control System > Transaxle Oil Temperature Sensor > Description and Operation

Description

Transaxle oil temperature sensor monitors the automatic transaxle fluid's temperature and conveys the readings to TCM. It is an NTC (Negative Thermal Coefficient) sensor whose resistance has an inversely proportional relationship with the temperature level. Data produced by this sensor is used to identify damper clutch activation and deactivation zones within the low temperature and high temperature range and to compensate hydraulic pressure levels during gear changes.

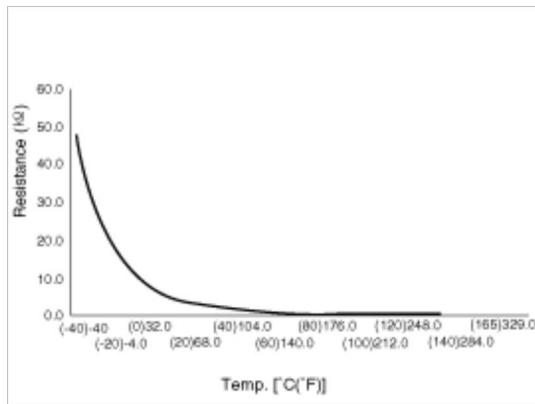


Automatic Transaxle System > Automatic Transaxle Control System > Transaxle Oil Temperature Sensor > Specifications

Specifications

▷ Type: Negative Thermal Coefficient Type

Temp. [({°C}){°F}]	Resistance (kΩ)
(-40)-40	48.1
(-20)-4.0	15.6
(0)32.0	5.88
(20)68.0	2.51
(40)104.0	1.11
(60)140.0	0.61
(80)176.0	0.32
(100)212.0	0.18
(120)248.0	0.10
(140)284.0	0.06
(150)302	0.05



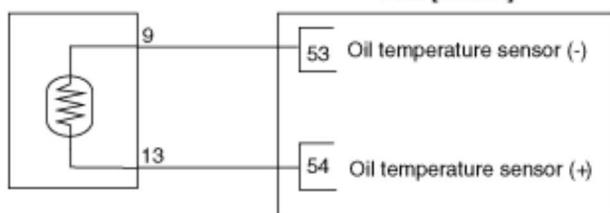
Automatic Transaxle System > Automatic Transaxle Control System > Transaxle Oil Temperature Sensor > Schematic Diagrams

Circuit Diagram

[Circuit Diagram]

[Connection Information]

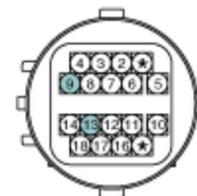
Oil Temperature Sensor [CRD04]



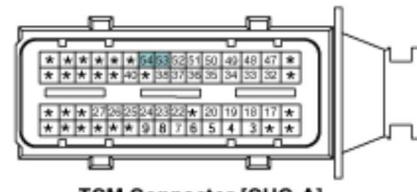
TCM [CHG-A]

Terminal	Connected to	Function
9	TCM CHG-A (53)	Oil temperature sensor (-)
13	TCM CHG-A (54)	Oil temperature sensor (+)

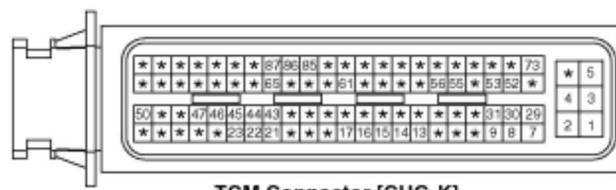
[Harness Connector]



Solenoid Valve Connector [CRD04]



TCM Connector [CHG-A]



TCM Connector [CHG-K]

Automatic Transaxle System > Automatic Transaxle Control System > Transaxle Oil Temperature Sensor > Repair procedures

Inspection

1. Turn ignition switch OFF.
2. Disconnect the oil temperature sensor connector.
3. Measure resistance between sensor signal terminal and sensor ground terminal.

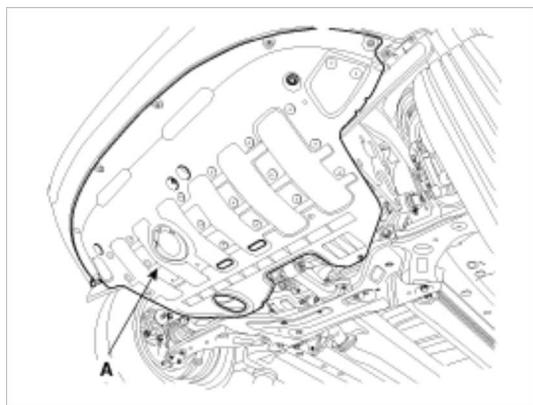
4. Check that the resistance is within the specification.

Removal

1. Remove the battery and the battery tray. (Refer to "Charging system" in EE group.)
2. Remove the under cover (A).

Tightening torque:

19.6 ~ 24.5 N.m (2.0 ~ 2.5 kgf.m, 14.5 ~ 18.1 lb-ft)



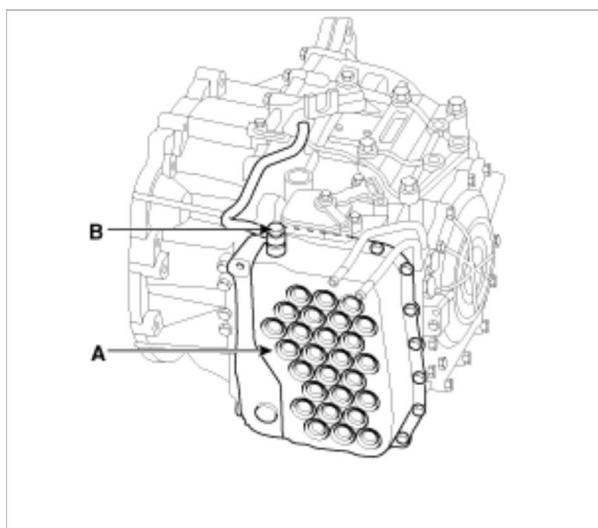
3. Replace new gasket and the plug after draining the automatic transaxle fluid by removing the drain plug. (Refer to "Hydraulic system (Fluid)" in this group)
4. Remove the valve body cover (A) and eyebolt (B).

Tightening torque:

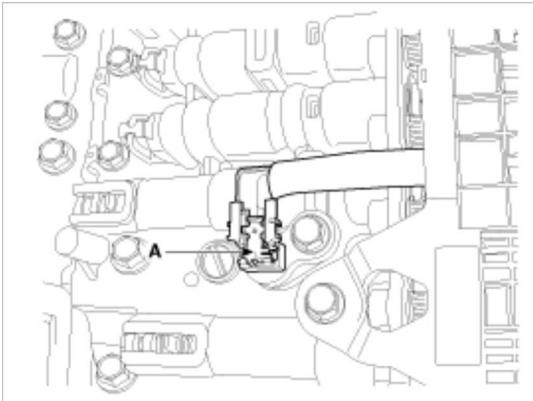
(A) 13.8~14.7N.m(1.3~1.5kgf.m, 9.4~10.8lb-ft)
(B) 34.3~44.1N.m(3.5~4.5kgf.m, 25.3~32.6lb-ft)

CAUTION

Always replace the gasket of the eyebolt use new one whenever loosening eyebolt.



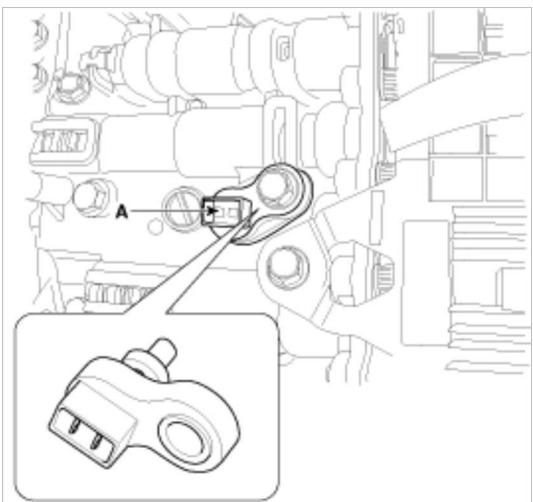
5. Disconnect the oil temperature sensor connector (A).



6. Remove the oil temperature sensor (A) after removing a bolt.

Tightening torque:

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



Installation

1. Installation is the reverse of removal.

NOTE

After replacement or reinstallation procedure of the valve body assembly, must perform procedures below.

- Continue to apply liquid gasket at application points at the valve body cover with Ø2.5mm (0.0984in.) thickness.

Liquid gasket Part name :

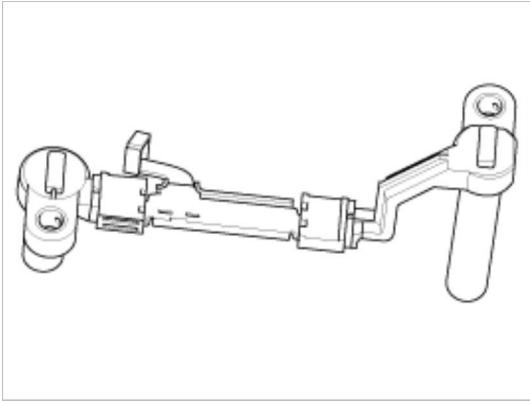
Threebond 1281B or LOCTITE FMD-546

- Adding automatic transaxle fluid. (Refer to "Hydraulic system (Fluid)" in this group)

Automatic Transaxle System > Automatic Transaxle Control System > Input Speed Sensor > Description and Operation

Description

Input speed sensor is a vital unit that measures the rate of rotation of the input shaft inside the transaxle and delivers the readings to the TCM. The sensor provides critical input data that's used in feedback control, damper clutch control, gear setting control, line pressure control, clutch activation pressure control, and sensor fault analysis.



Automatic Transaxle System > Automatic Transaxle Control System > Input Speed Sensor > Specifications

Specifications

▷ Type: Hall effect sensor

Operation condition [°C(°F)]		((-40~150)) -40~302
Air gap(mm)in.		(0.95~1.65)0.037~0.065
Output voltage(V)	High	1.18~1.68
	Low	0.59~0.84

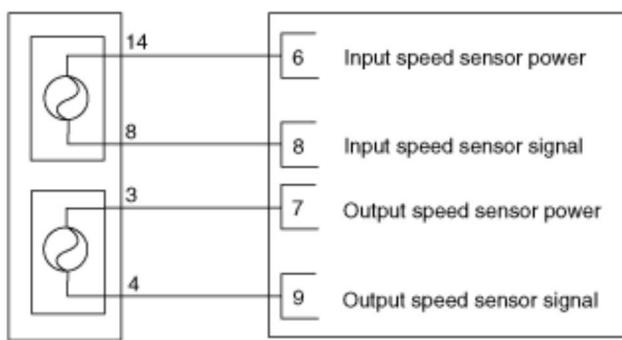
Automatic Transaxle System > Automatic Transaxle Control System > Input Speed Sensor > Schematic Diagrams

Circuit Diagram

[Circuit Diagram]

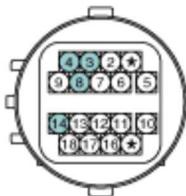
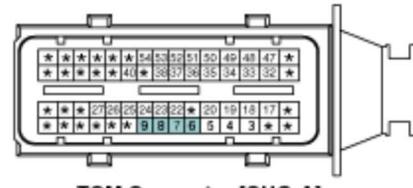
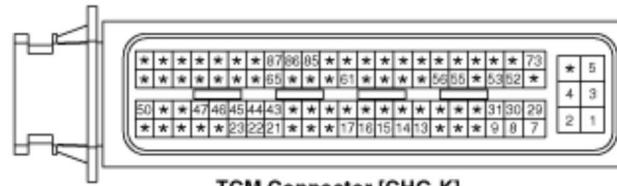
[Connection Information]

**Input & Output
Speed Sensor
[CRD04]**

TCM[CHG-A]

Terminal	Connected to	Function
14	TCM CHG-A (6)	Input speed sensor power
8	TCM CHG-A (8)	Input speed sensor signal
3	TCM CHG-A (7)	Output speed sensor power
4	TCM CHG-A (9)	Output speed sensor signal

[Harness Connector]

**Solenoid Valve Connector[CRD04]****TCM Connector [CHG-A]****TCM Connector [CHG-K]**
Automatic Transaxle System > Automatic Transaxle Control System > Input Speed Sensor > Troubleshooting
Signal Waveform

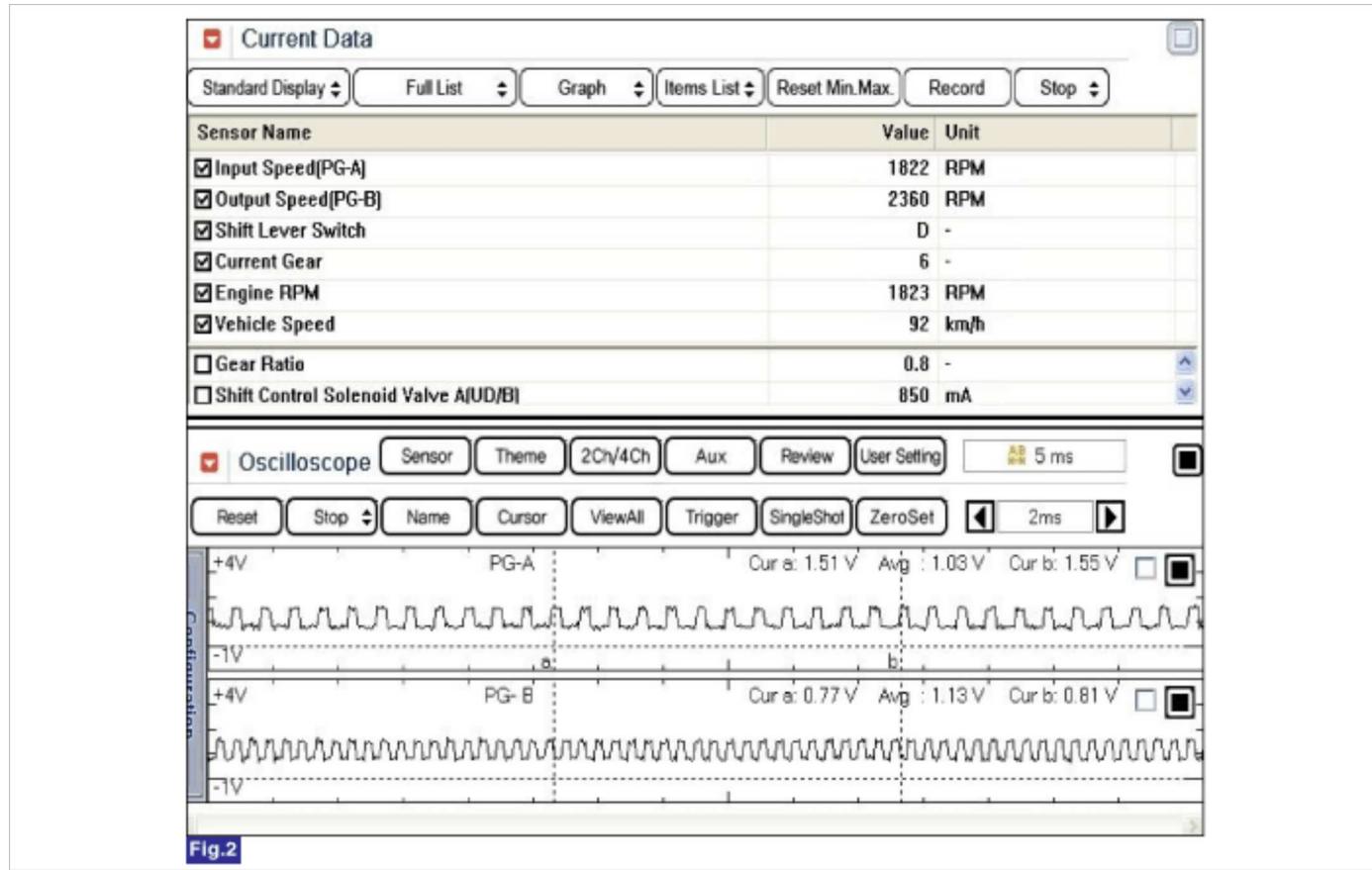
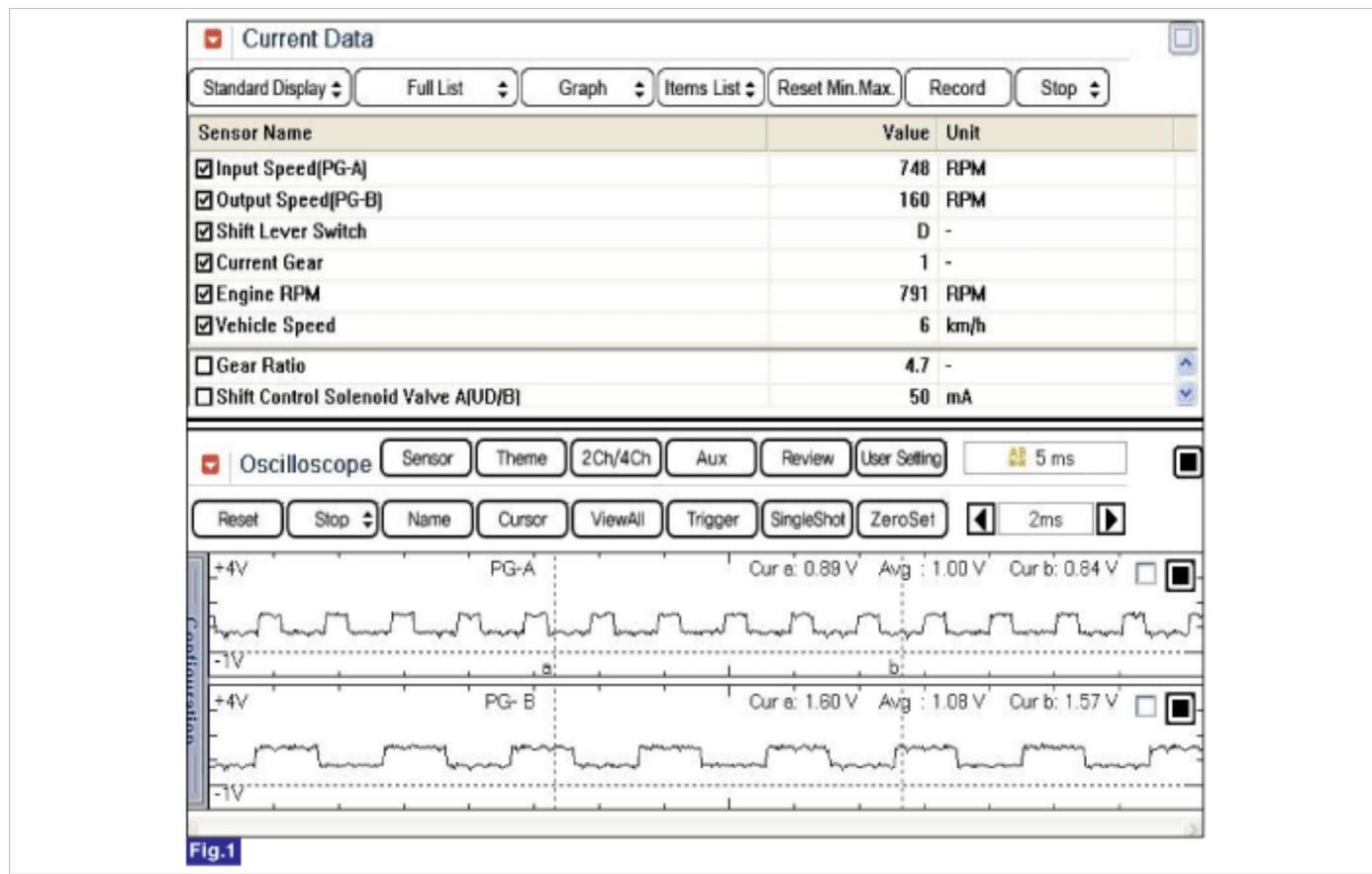


Fig 1) Input/Output speed sensor at low speed
 Fig 2) Input/Output speed sensor at high speed

Automatic Transaxle System > Automatic Transaxle Control System > Input Speed Sensor > Repair procedures

Inspection

1. Check signal waveform of Input & output speed sensor using the GDS.

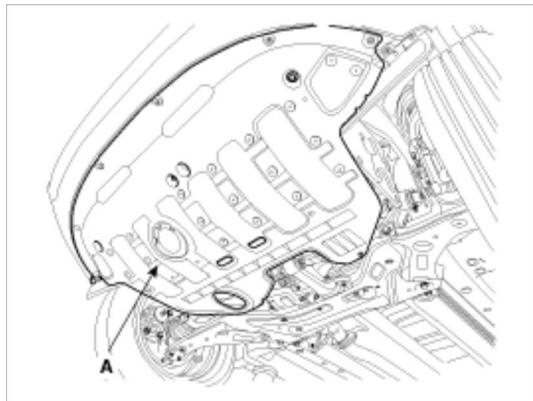
Specification: Refer to "Signal Wave Form" section.

Removal

1. Remove the battery and the battery tray. (Refer to "Charging system" in EE group.)
2. Remove the under cover (A).

Tightening torque:

19.6 ~ 24.5 N.m (2.0 ~ 2.5 kgf.m, 14.5 ~ 18.1 lb-ft)



3. Replace new gasket and the plug after draining the automatic transaxle fluid by removing the drain plug. (Refer to "Hydraulic system (Fluid)" in this group)
4. Remove the valve body cover (A) and eyebolt (B).

Tightening torque:

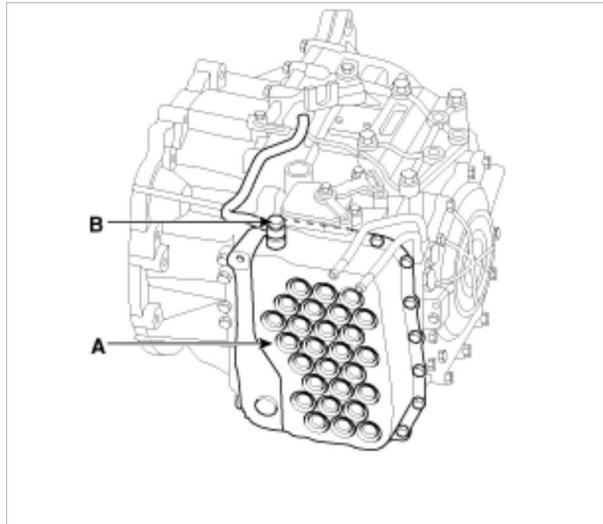
(A) 13.8~14.7N.m (1.3~1.5kgf.m, 9.4~10.8lb-ft)
(B) 34.3~44.1N.m (3.5~4.5kgf.m, 25.3~32.6lb-ft)

CAUTION

Always replace the gasket of the eyebolt use new one whenever loosening eyebolt.

NOTE

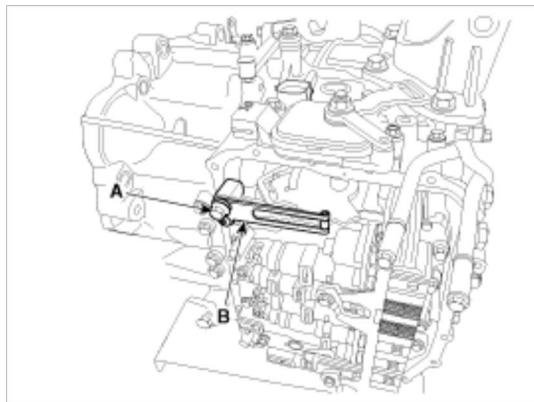
Remove installation bolts in the engine compartment first andthen remove others under the vehicle.



5. Remove the plate and the detent spring (A) after removing the bolt.

Tightening torque:

24.5 ~ 35.3 N.m (2.5 ~ 3.6 kgf.m, 18.1 ~ 26.0 lb-ft)



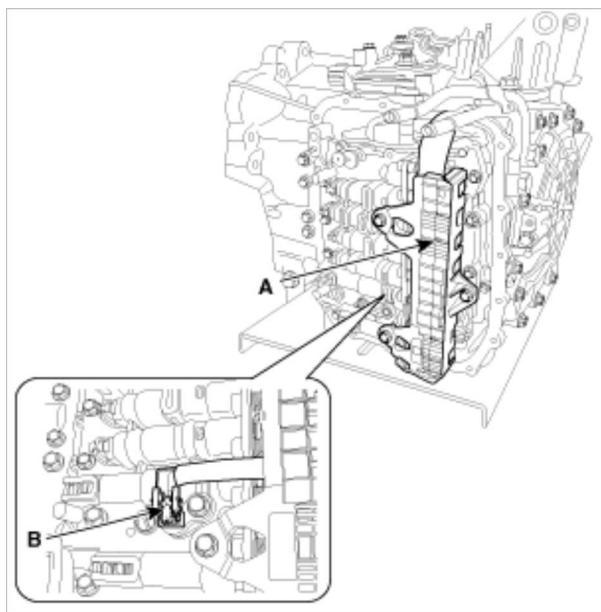
6. Remove the bolt (3ea) after disconnecting the solenoid valve connector (A) and the oil temperature sensor connector (B).

Tightening torque:

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

CAUTION

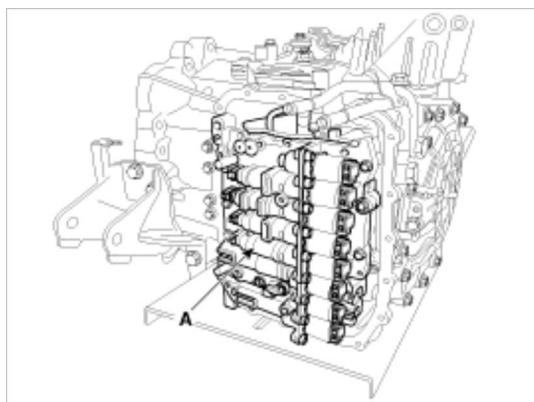
Be careful not to damage the harness lock connector.



7. Remove the valve body assembly (A).

Tightening torque:

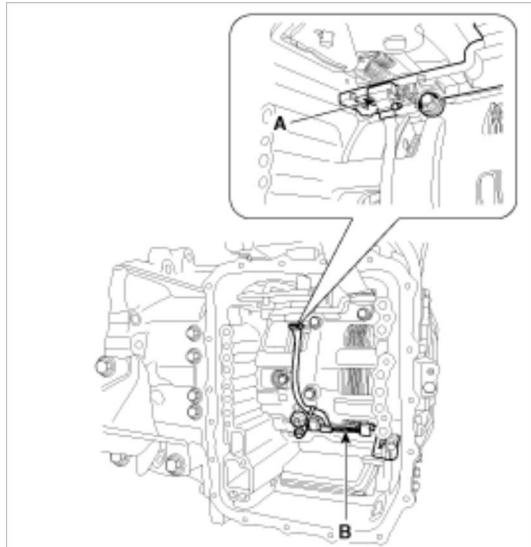
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)



8. Disconnect the input & output speed sensor connector(A).
9. Remove the input & output speed sensor (B) after removing the bolts(2ea).

Tightening torque:

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



Installation

1. Installation is the reverse of removal.

NOTE

After replacement or reinstallation procedure of the valve body assembly, must perform procedures below.

- Continue to apply liquid gasket at application points at the valve body cover with Ø2.5mm (0.0984in.) thickness.

Liquid gasket Part name :

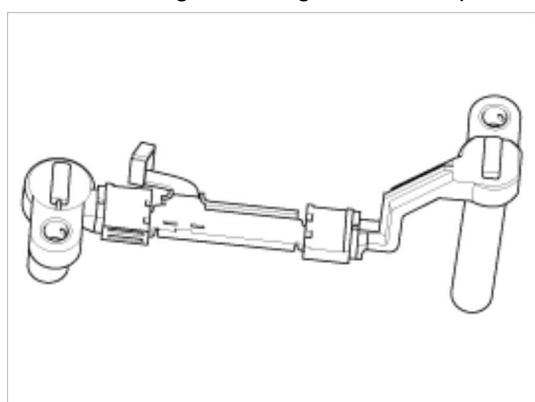
Threebond 1281B or LOCTITE FMD-546

- Adding automatic transaxle fluid. (Refer to "Hydraulic system (Fluid)" in this group)

Automatic Transaxle System > Automatic Transaxle Control System > Output Speed Sensor > Description and Operation

Description

The output speed sensor is a vital unit that measures the rate of rotation of the transaxle's turbine shaft and output shaft, and delivers the readings to the TCM. The sensor provides critical input data that's used in feedback control, damper clutch control, gear setting control, line pressure control, clutch activation pressure control, and sensor fault analysis.



Automatic Transaxle System > Automatic Transaxle Control System > Output Speed Sensor > Specifications

Specifications

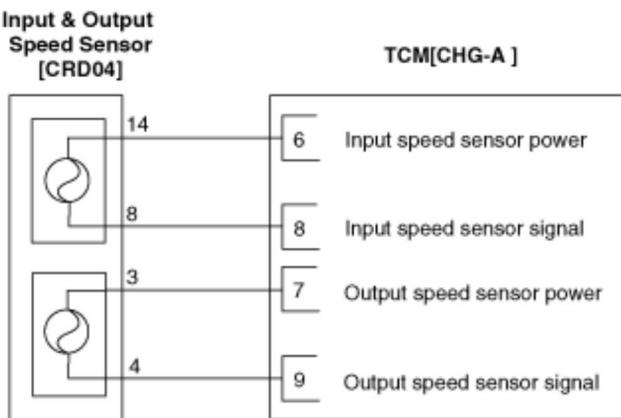
▷ Type: Hall effect sensor

Operation condition [°C(°F)]		((-40~150)) -40~302
Air gap(mm)in.		(0.25~0.7)0.01~0.027
Output voltage	High	1.18~1.68
	Low	0.59~0.84

Automatic Transaxle System > Automatic Transaxle Control System > Output Speed Sensor > Schematic Diagrams

Circuit Diagram

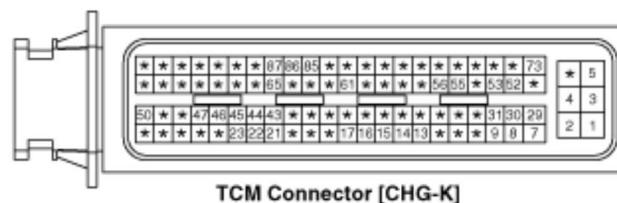
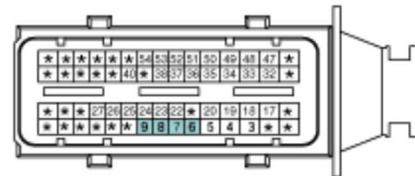
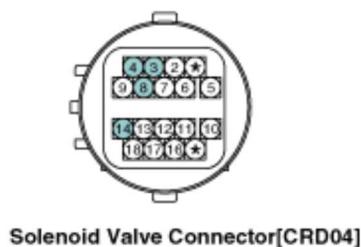
[Circuit Diagram]



[Connection Information]

Terminal	Connected to	Function
14	TCM CHG-A (6)	Input speed sensor power
8	TCM CHG-A (8)	Input speed sensor signal
3	TCM CHG-A (7)	Output speed sensor power
4	TCM CHG-A (9)	Output speed sensor signal

[Harness Connector]



Automatic Transaxle System > Automatic Transaxle Control System > Output Speed Sensor > Troubleshooting

Signal Waveform

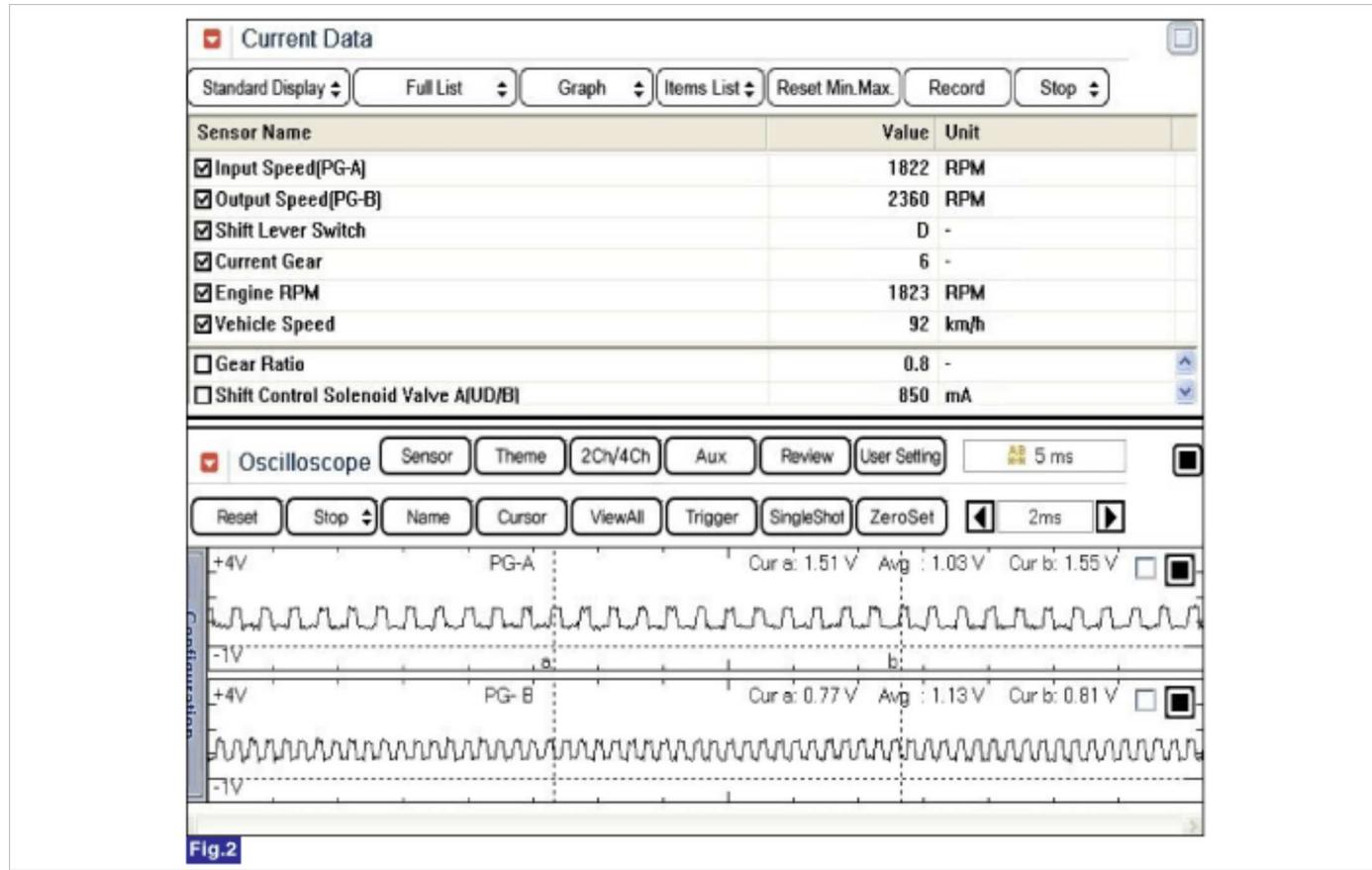
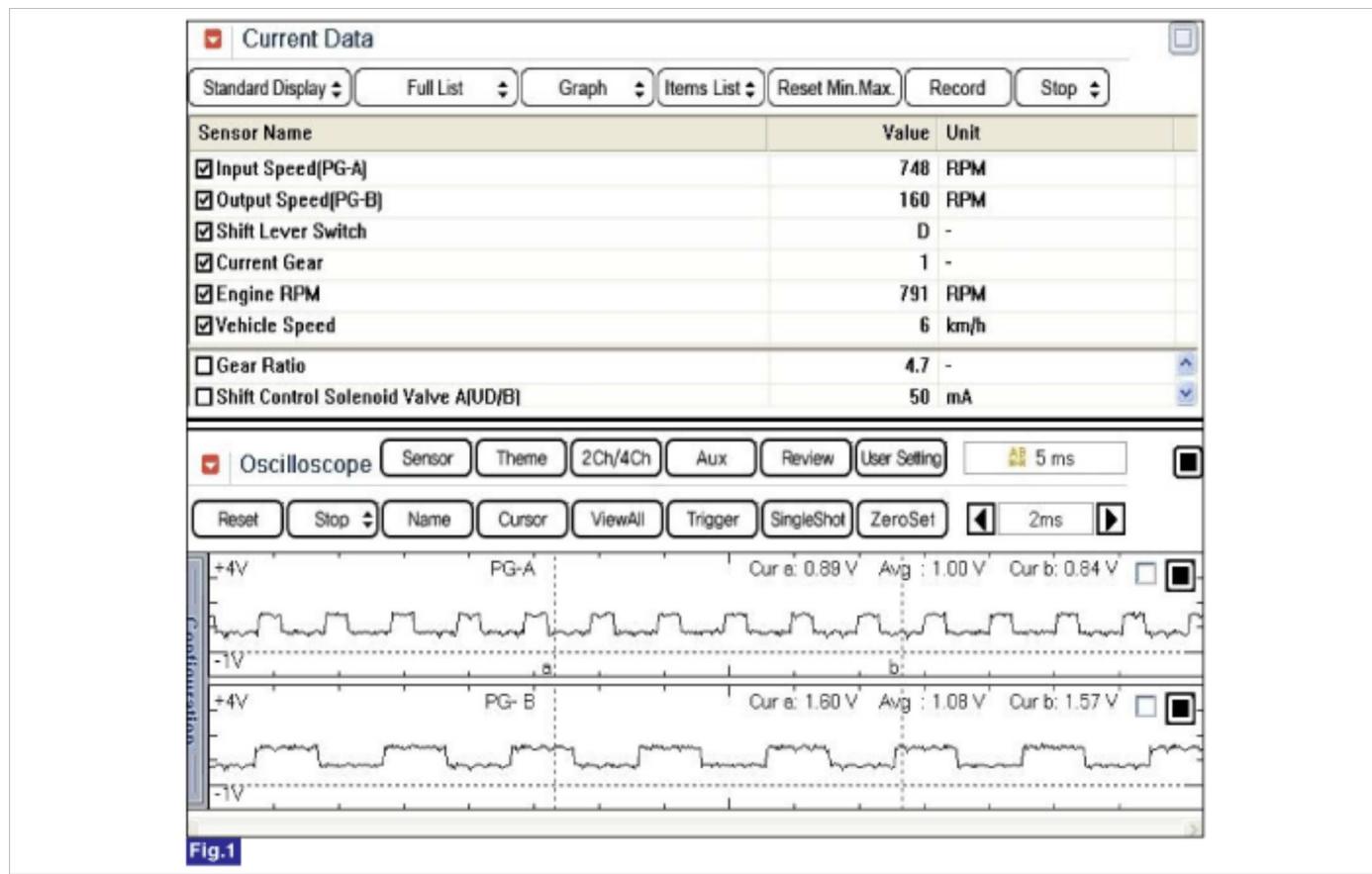


Fig 1) Input/Output speed sensor at low speed
 Fig 2) Input/Output speed sensor at high speed

Automatic Transaxle System > Automatic Transaxle Control System > Output Speed Sensor > Repair procedures

Inspection

1. Check signal waveform of Input & output speed sensor using the GDS.

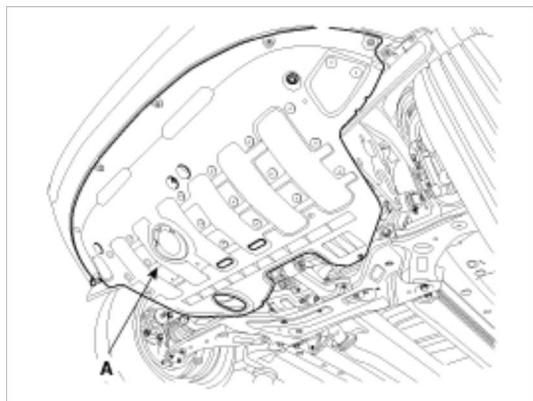
Specification: Refer to "Signal Wave Form" section.

Removal

1. Remove the battery and the battery tray. (Refer to "Charging system" in EE group.)
2. Remove the under cover (A).

Tightening torque:

19.6 ~ 24.5 N.m (2.0 ~ 2.5 kgf.m, 14.5 ~ 18.1 lb-ft)



3. Replace new gasket and the plug after draining the automatic transaxle fluid by removing the drain plug. (Refer to "Hydraulic system (Fluid)" in this group)
4. Remove the valve body cover (A) and eyebolt (B).

Tightening torque:

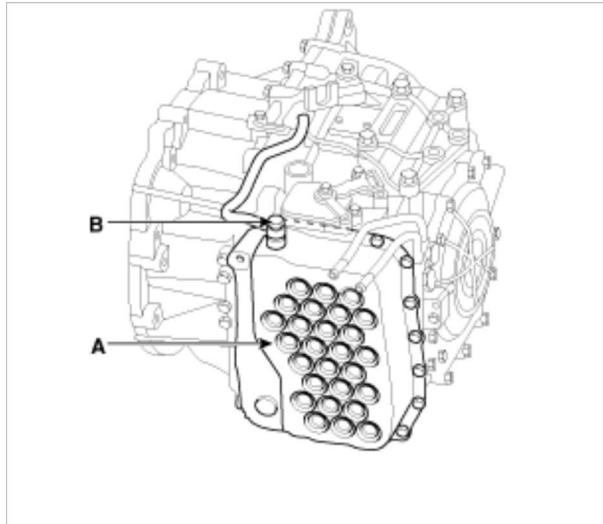
(A) 13.8~14.7N.m (1.3~1.5kgf.m, 9.4~10.8lb-ft)
(B) 34.3~44.1N.m (3.5~4.5kgf.m, 25.3~32.6lb-ft)

CAUTION

Always replace the gasket of the eyebolt use new one whenever loosening eyebolt.

NOTE

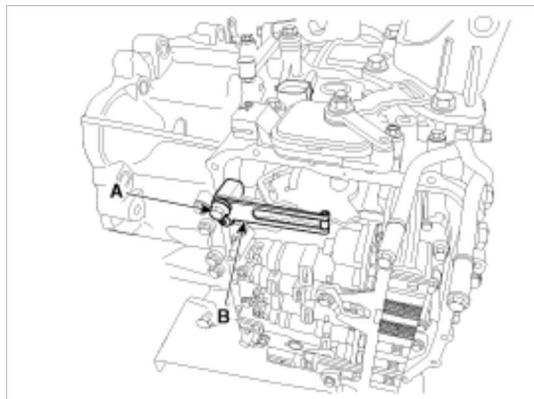
Remove installation bolts in the engine compartment first and .



5. Remove the plate and the detent spring (A) after removing the bolt.

Tightening torque:

24.5 ~ 35.3 N.m (2.5 ~ 3.6 kgf.m, 18.1 ~ 26.0 lb-ft)



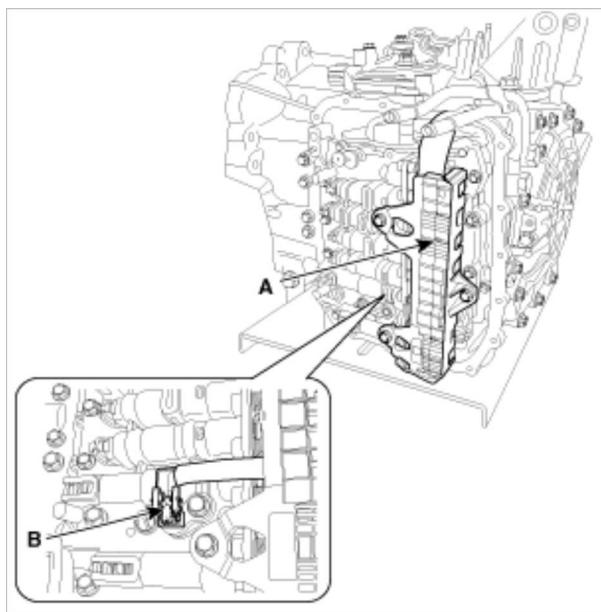
6. Remove the bolt (3ea) after disconnecting the solenoid valve connector (A) and the oil temperature sensor connector (B).

Tightening torque:

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

CAUTION

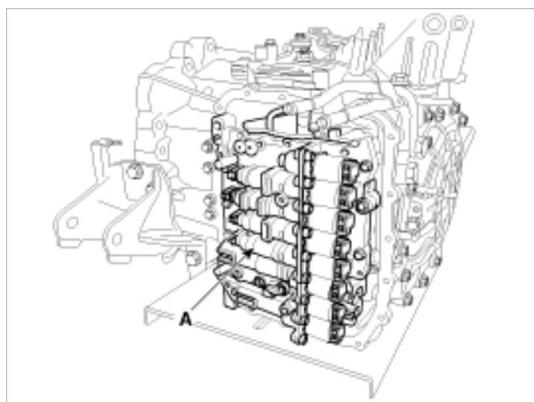
Be careful not to damage the harness lock connector.



7. Remove the valve body assembly (A).

Tightening torque:

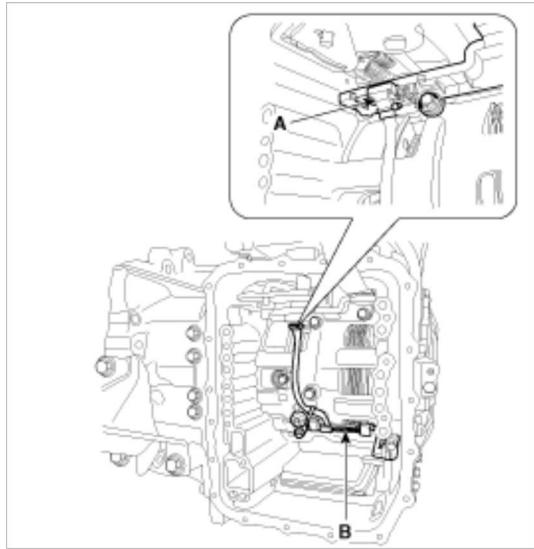
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)



8. Disconnect the input & output speed sensor connector(A).
9. Remove the input & output speed sensor (B) after removing the bolts(2ea).

Tightening torque:

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



Installation

1. Installation is the reverse of removal.

NOTE

After replacement or reinstallation procedure of the valve body assembly, must perform procedures below.

- Continue to apply liquid gasket at application points at the valve body cover with Ø2.5mm (0.0984in.) thickness.

Liquid gasket Part name :

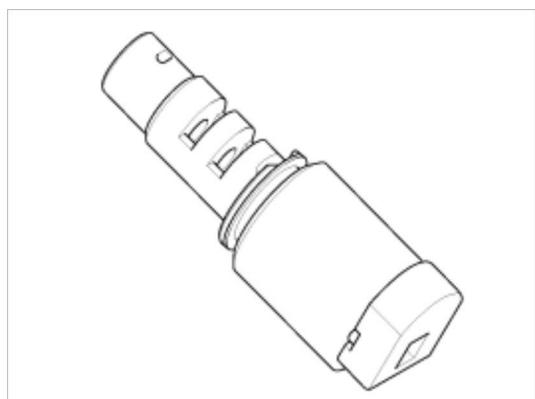
Threebond 1281B or LOCTITE FMD-546

- Adding automatic transaxle fluid. (Refer to "Hydraulic system (Fluid)" in this group)

Automatic Transaxle System > Automatic Transaxle Control System > Torque Converter Control Solenoid Valve (T/CON_VFS) > Description and Operation

Description

Torque converter control solenoid valve (T/CON_VFS) is attached to the valve body. This variable force solenoid valve directly controls the hydraulic pressure inside the torque converter.



Automatic Transaxle System > Automatic Transaxle Control System > Torque Converter Control Solenoid Valve (T/CON_VFS) > Specifications

Specifications

Direct control VFS[T/CON]

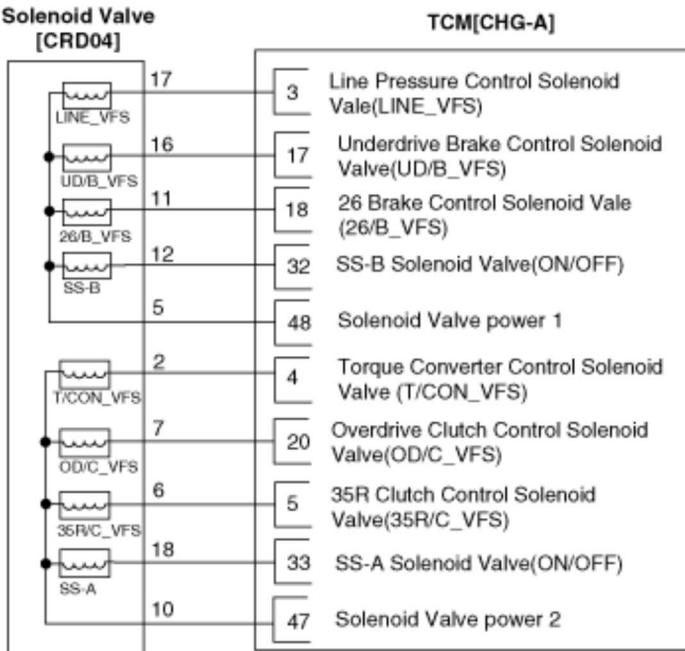
▷ Control type : Normal low type

Control Pressure kpa(kgf/cm ² , psi)	9.81~500.14(0.1~5.1, 1.42~72.54)
Current value(mA)	50~850
Internal resistance(Ω)	5.1

Automatic Transaxle System > Automatic Transaxle Control System > Torque Converter Control Solenoid Valve (T/CON_VFS) > Schematic Diagrams

Circuit Diagram

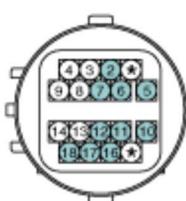
[Circuit Diagram]



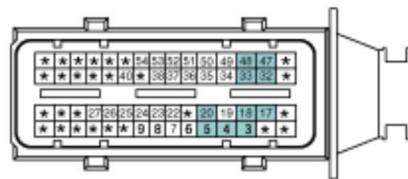
[Connection Information]

Terminal	Connected to	Function
17	TCM CHG-A (3)	Line Pressure Control Solenoid Vale (LINE_VFS)
16	TCM CHG-A (17)	Underdrive Brake Control Solenoid Valve(UD/B_VFS)
11	TCM CHG-A (18)	26 Brake Control Solenoid Vale(26/B_VFS)
12	TCM CHG-A (32)	SS-B Solenoid Valve(ON/OFF)
5	TCM CHG-A (48)	Solenoid Valve power 1
2	TCM CHG-A (4)	Torque Converter Control Solenoid Valve(T/CON_VFS)
7	TCM CHG-A (20)	Overdrive Clutch Control Solenoid Valve(OD/C_VFS)
6	TCM CHG-A (5)	35R Clutch Control Solenoid Valve(35R/C_VFS)
18	TCM CHG-A (33)	SS-A Solenoid Valve(ON/OFF)
10	TCM CHG-A (47)	Solenoid Valve power 2

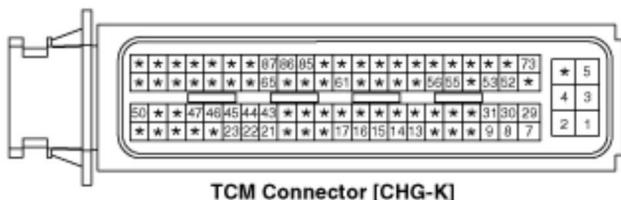
[Harness Connector]



Solenoid Valve Connector [CRD04]



TCM Connector [CHG-A]



TCM Connector [CHG-K]

Automatic Transaxle System > Automatic Transaxle Control System > Torque Converter Control Solenoid Valve (T/CON_VFS) > Repair procedures

Inspection

1. Turn ignition switch OFF.
2. Disconnect the oil temperature sensor connector.
3. Measure resistance between sensor signal terminal and sensor ground terminal.
4. Check that the resistance is within the specification.

Removal

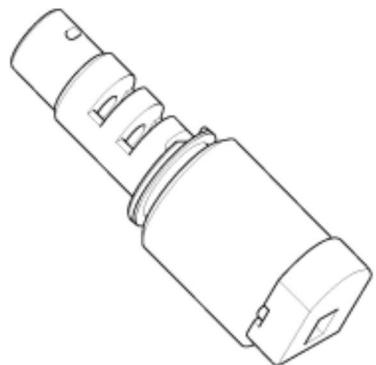
NOTE

Replacing an on/off solenoid valve (SS-A, SS-B) does not require additional hydraulic pressure adjustment; however, the hydraulic pressure will need to be adjusted after replacing the VFS solenoid valve. If replacing the VFS solenoid valve; also replace the valve body assembly. (Refer to "Valve Body" in this group)

Automatic Transaxle System > Automatic Transaxle Control System > 26 Brake Control Solenoid Valve(26/B_VFS) > Description and Operation

Description

26 brake control solenoid valve(26/B_VFS) is attached to the valve body. This variable force solenoid valve directly controls the hydraulic pressure inside the 26 brake.



Automatic Transaxle System > Automatic Transaxle Control System > 26 Brake Control Solenoid Valve(26/B_VFS) > Specifications

Specifications

Direct control VFS[26/B]

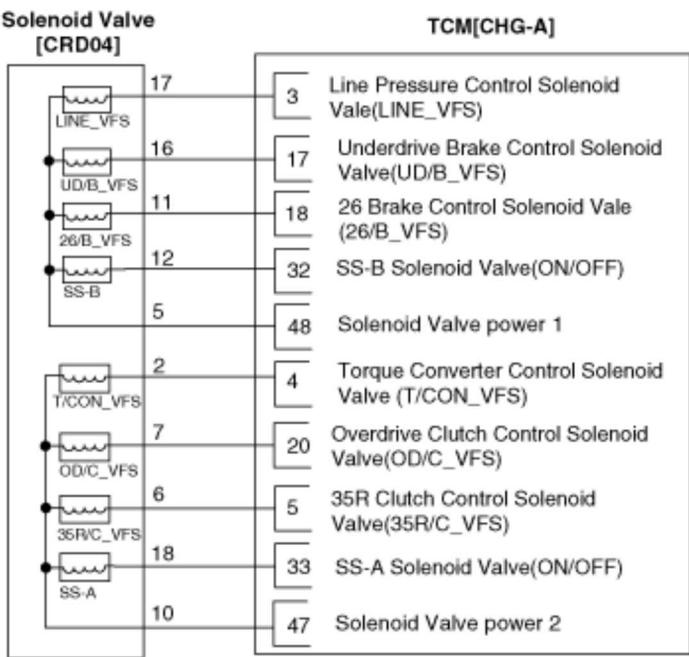
▷ Control type : Normal low type

Control Pressure kpa(kgf/cm ² , psi)	9.81~500.14(0.1~5.1, 1.42~72.54)
Current value(mA)	50~850
Internal resistance(Ω)	5.1

Automatic Transaxle System > Automatic Transaxle Control System > 26 Brake Control Solenoid Valve(26/B_VFS) > Schematic Diagrams

Circuit Diagram

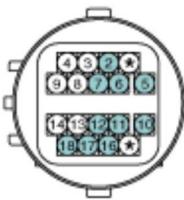
[Circuit Diagram]



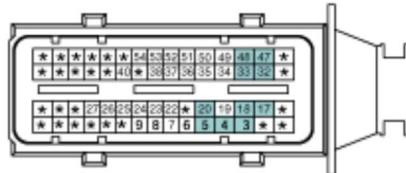
[Connection Information]

Terminal	Connected to	Function
17	TCM CHG-A (3)	Line Pressure Control Solenoid Vale (LINE_VFS)
16	TCM CHG-A (17)	Underdrive Brake Control Solenoid Valve(UD/B_VFS)
11	TCM CHG-A (18)	26 Brake Control Solenoid Vale(26/B_VFS)
12	TCM CHG-A (32)	SS-B Solenoid Valve(ON/OFF)
5	TCM CHG-A (48)	Solenoid Valve power 1
2	TCM CHG-A (4)	Torque Converter Control Solenoid Valve(T/CON_VFS)
7	TCM CHG-A (20)	Overdrive Clutch Control Solenoid Valve(OD/C_VFS)
6	TCM CHG-A (5)	35R Clutch Control Solenoid Valve(35R/C_VFS)
18	TCM CHG-A (33)	SS-A Solenoid Valve(ON/OFF)
10	TCM CHG-A (47)	Solenoid Valve power 2

[Harness Connector]



Solenoid Valve Connector [CRD04]



TCM Connector [CHG-A]



TCM Connector [CHG-K]

Automatic Transaxle System > Automatic Transaxle Control System > 26 Brake Control Solenoid Valve(26/B_VFS) > Repair procedures

Inspection

1. Turn ignition switch OFF.
2. Disconnect the oil temperature sensor connector.
3. Measure resistance between sensor signal terminal and sensor ground terminal.
4. Check that the resistance is within the specification.

Removal

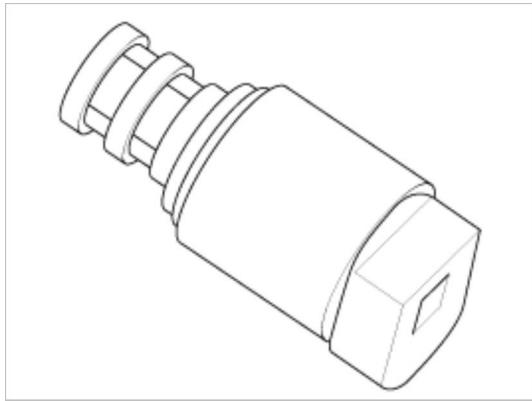
NOTE

Replacing an on/off solenoid valve (SS-A, SS-B) does not require additional hydraulic pressure adjustment; however, the hydraulic pressure will need to be adjusted after replacing the VFS solenoid valve. If replacing the VFS solenoid valve; also replace the valve body assembly. (Refer to "Valve Body" in this group)

Automatic Transaxle System > Automatic Transaxle Control System > Line Pressure Control Solenoid Vale > Description and Operation

Description

Line pressure control solenoid valve is attached to the valve body. This variable force solenoid valve directly controls the hydraulic pressure inside the line pressure.



Automatic Transaxle System > Automatic Transaxle Control System > Line Pressure Control Solenoid Vale > Specifications

Specifications

Direct control VFS[LINE Pressure]

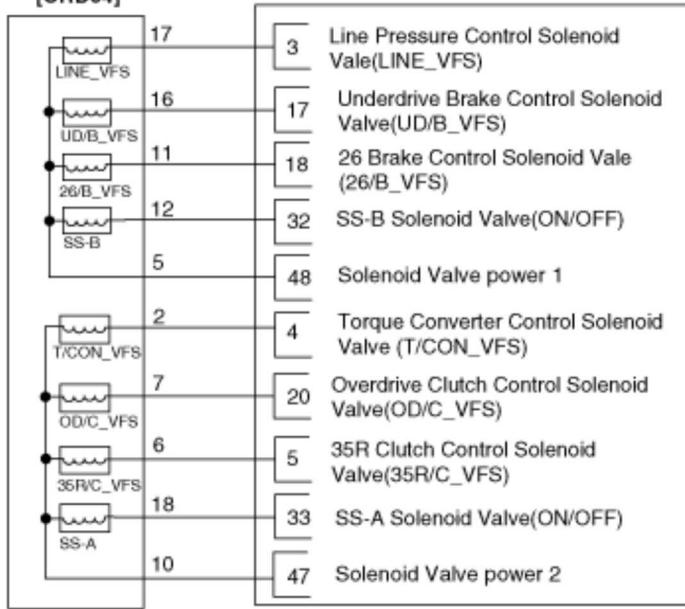
▷ Control type : Normal low type

Control Pressure kpa(kgf/cm ² , psi)	500.14~9.81(5.1~0.1,72.54~1.42)
Current value(mA)	50~850
Internal resistance(Ω)	5.1

Automatic Transaxle System > Automatic Transaxle Control System > Line Pressure Control Solenoid Vale > Schematic Diagrams

Circuit Diagram

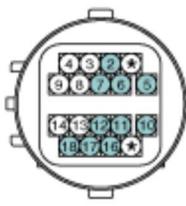
[Circuit Diagram]

Solenoid Valve
[CRD04]

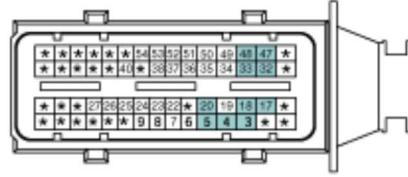
[Connection Information]

Terminal	Connected to	Function
17	TCM CHG-A (3)	Line Pressure Control Solenoid Vale (LINE_VFS)
16	TCM CHG-A (17)	Underdrive Brake Control Solenoid Valve(UD/B_VFS)
11	TCM CHG-A (18)	26 Brake Control Solenoid Vale (26/B_VFS)
12	TCM CHG-A (32)	SS-B Solenoid Valve(ON/OFF)
5	TCM CHG-A (48)	Solenoid Valve power 1
2	TCM CHG-A (4)	Torque Converter Control Solenoid Valve(T/CON_VFS)
7	TCM CHG-A (20)	Overdrive Clutch Control Solenoid Valve(OD/C_VFS)
6	TCM CHG-A (5)	35R Clutch Control Solenoid Valve(35R/C_VFS)
18	TCM CHG-A (33)	SS-A Solenoid Valve(ON/OFF)
10	TCM CHG-A (47)	Solenoid Valve power 2

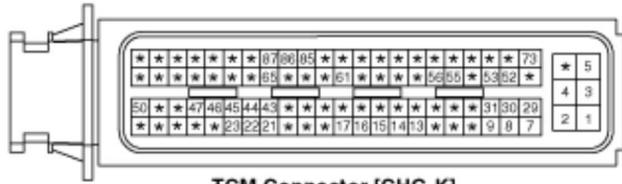
[Harness Connector]



Solenoid Valve Connector [CRD04]



TCM Connector [CHG-A]



TCM Connector [CHG-K]

Automatic Transaxle System > Automatic Transaxle Control System > Line Pressure Control Solenoid Vale > Repair procedures
Inspection

1. Turn ignition switch OFF.
2. Disconnect the oil temperature sensor connector.
3. Measure resistance between sensor signal terminal and sensor ground terminal.
4. Check that the resistance is within the specification.

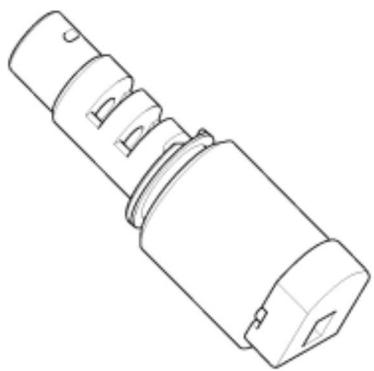
Removal

NOTE

Replacing an on/off solenoid valve (SS-A, SS-B) does not require additional hydraulic pressure adjustment; however, the hydraulic pressure will need to be adjusted after replacing the VFS solenoid valve. If replacing the VFS solenoid valve; also replace the valve body assembly. (Refer to "Valve Body" in this group)

Automatic Transaxle System > Automatic Transaxle Control System > 35R Clutch Control Solenoid Valve(35R/C_VFS) > Description and Operation
Description

35R clutch control solenoid valve(35R/C_VFS) is attached to the valve body. This variable force solenoid valve directly controls the hydraulic pressure inside the 35R clutch.


Automatic Transaxle System > Automatic Transaxle Control System > 35R Clutch Control Solenoid Valve(35R/C_VFS) > Specifications
Specifications

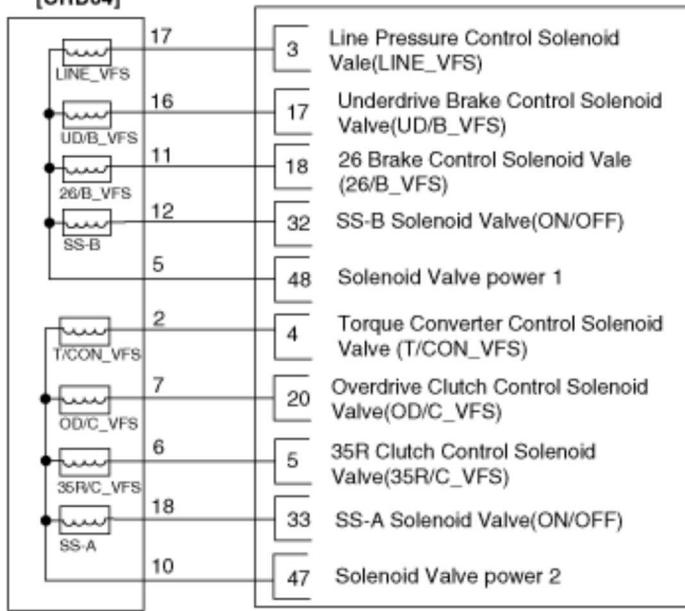
Direct control VFS[35R/C]

▷ Control type : Normal low type

Control Pressure kpa(kgf/cm ² , psi)	500.14~9.81(5.1~0.1,72.54~1.42)
Current value(mA)	50~850
Internal resistance(Ω)	5.1

Automatic Transaxle System > Automatic Transaxle Control System > 35R Clutch Control Solenoid Valve(35R/C_VFS) > Schematic Diagrams
Circuit Diagram

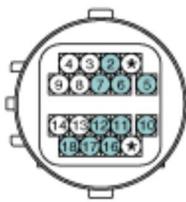
[Circuit Diagram]

Solenoid Valve
[CRD04]

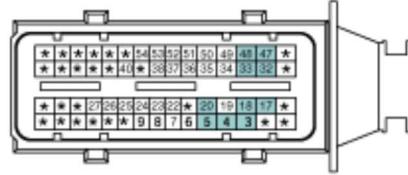
[Connection Information]

Terminal	Connected to	Function
17	TCM CHG-A (3)	Line Pressure Control Solenoid Vale (LINE_VFS)
16	TCM CHG-A (17)	Underdrive Brake Control Solenoid Valve(UD/B_VFS)
11	TCM CHG-A (18)	26 Brake Control Solenoid Vale (26/B_VFS)
12	TCM CHG-A (32)	SS-B Solenoid Valve(ON/OFF)
5	TCM CHG-A (48)	Solenoid Valve power 1
2	TCM CHG-A (4)	Torque Converter Control Solenoid Valve(T/CON_VFS)
7	TCM CHG-A (20)	Overdrive Clutch Control Solenoid Valve(OD/C_VFS)
6	TCM CHG-A (5)	35R Clutch Control Solenoid Valve(35R/C_VFS)
18	TCM CHG-A (33)	SS-A Solenoid Valve(ON/OFF)
10	TCM CHG-A (47)	Solenoid Valve power 2

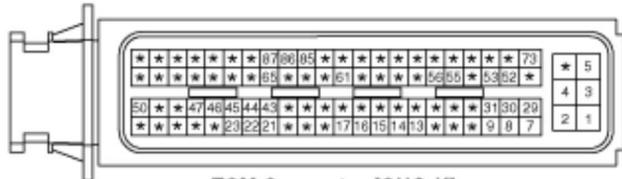
[Harness Connector]



Solenoid Valve Connector [CRD04]



TCM Connector [CHG-A]



TCM Connector [CHG-K]

Automatic Transaxle System > Automatic Transaxle Control System > 35R Clutch Control Solenoid Valve(35R/C_VFS) > Repair procedures
Inspection

1. Turn ignition switch OFF.
2. Disconnect the oil temperature sensor connector.
3. Measure resistance between sensor signal terminal and sensor ground terminal.
4. Check that the resistance is within the specification.

Removal

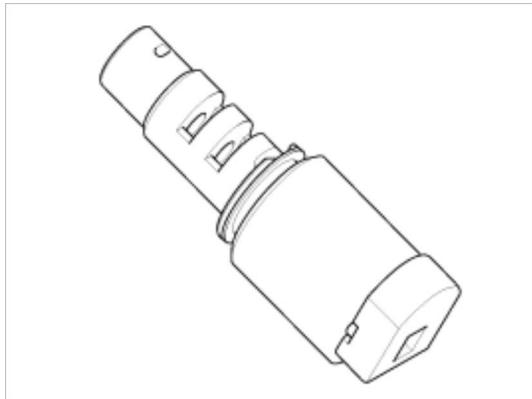
NOTE

Replacing an on/off solenoid valve (SS-A, SS-B) does not require additional hydraulic pressure adjustment; however, the hydraulic pressure will need to be adjusted after replacing the VFS solenoid valve. If replacing the VFS solenoid valve; also replace the valve body assembly. (Refer to "Valve Body" in this group)

Automatic Transaxle System > Automatic Transaxle Control System > Underdrive Brake Control Solenoid Valve(UD/B_VFS) > Description and Operation

Description

Underdrive brake control solenoid valve(UD/B_VFS) is attached to the valve body. This variable force solenoid valve directly controls the hydraulic pressure inside the underdrive brake.



Automatic Transaxle System > Automatic Transaxle Control System > Underdrive Brake Control Solenoid Valve(UD/B_VFS) > Specifications

Specifications

Direct control VFS[35R/C]

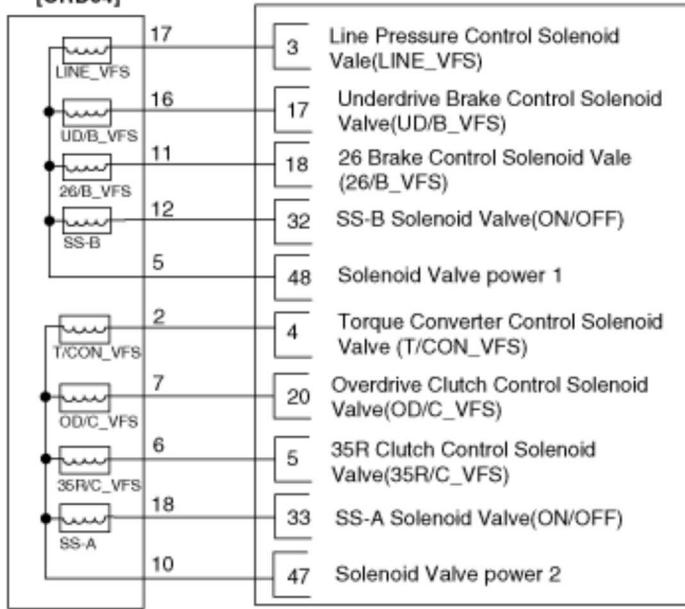
▷ Control type : Normal low type

Control Pressure kpa(kgf/cm ² , psi)	500.14~9.81(5.1~0.1,72.54~1.42)
Current value(mA)	50~850
Internal resistance(Ω)	5.1

Automatic Transaxle System > Automatic Transaxle Control System > Underdrive Brake Control Solenoid Valve(UD/B_VFS) > Schematic Diagrams

Circuit Diagram

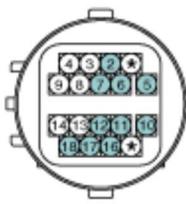
[Circuit Diagram]

Solenoid Valve
[CRD04]

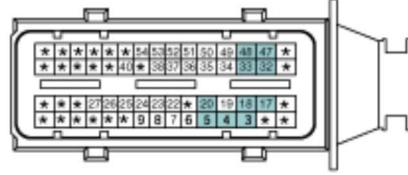
[Connection Information]

Terminal	Connected to	Function
17	TCM CHG-A (3)	Line Pressure Control Solenoid Vale (LINE_VFS)
16	TCM CHG-A (17)	Underdrive Brake Control Solenoid Valve(UD/B_VFS)
11	TCM CHG-A (18)	26 Brake Control Solenoid Vale (26/B_VFS)
12	TCM CHG-A (32)	SS-B Solenoid Valve(ON/OFF)
5	TCM CHG-A (48)	Solenoid Valve power 1
2	TCM CHG-A (4)	Torque Converter Control Solenoid Valve(T/CON_VFS)
7	TCM CHG-A (20)	Overdrive Clutch Control Solenoid Valve(OD/C_VFS)
6	TCM CHG-A (5)	35R Clutch Control Solenoid Valve(35R/C_VFS)
18	TCM CHG-A (33)	SS-A Solenoid Valve(ON/OFF)
10	TCM CHG-A (47)	Solenoid Valve power 2

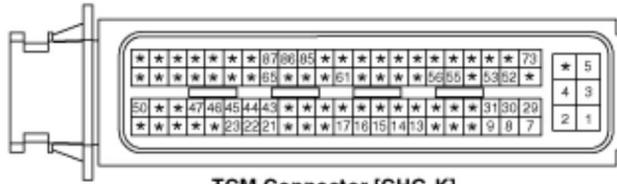
[Harness Connector]



Solenoid Valve Connector [CRD04]



TCM Connector [CHG-A]



TCM Connector [CHG-K]

Automatic Transaxle System > Automatic Transaxle Control System > Underdrive Brake Control Solenoid Valve(UD/B_VFS) > Repair procedures
Inspection

1. Turn ignition switch OFF.
2. Disconnect the oil temperature sensor connector.
3. Measure resistance between sensor signal terminal and sensor ground terminal.
4. Check that the resistance is within the specification.

Removal

NOTE

Replacing an on/off solenoid valve (SS-A, SS-B) does not require additional hydraulic pressure adjustment; however, the hydraulic pressure will need to be adjusted after replacing the VFS solenoid valve. If replacing the VFS solenoid valve; also replace the valve body assembly. (Refer to "Valve Body" in this group)

Automatic Transaxle System > Automatic Transaxle Control System > Overdrive Clutch Control Solenoid Valve(OD/C_VFS) > Description and Operation

Description

Overdrive clutch control solenoid valve(OD/C_VFS) is attached to the valve body. This variable force solenoid valve directly controls the hydraulic pressure inside the overdrive clutch.



Automatic Transaxle System > Automatic Transaxle Control System > Overdrive Clutch Control Solenoid Valve(OD/C_VFS) > Specifications

Specifications

Direct control VFS[35R/C]

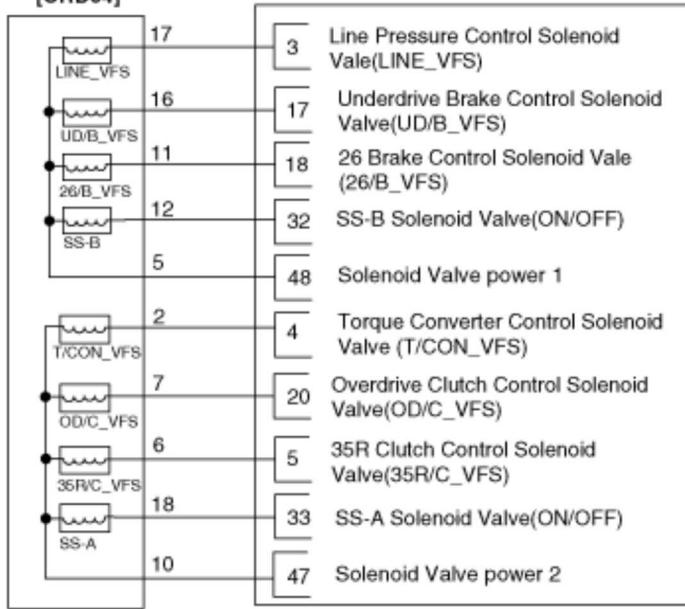
▷ Control type : Normal low type

Control Pressure kpa(kgf/cm ² , psi)	500.14~9.81(5.1~0.1,72.54~1.42)
Current value(mA)	50~850
Internal resistance(Ω)	5.1

Automatic Transaxle System > Automatic Transaxle Control System > Overdrive Clutch Control Solenoid Valve(OD/C_VFS) > Schematic Diagrams

Circuit Diagram

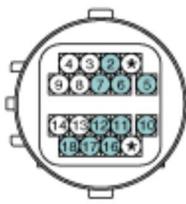
[Circuit Diagram]

Solenoid Valve
[CRD04]

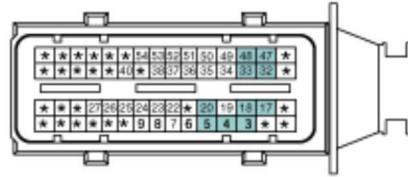
[Connection Information]

Terminal	Connected to	Function
17	TCM CHG-A (3)	Line Pressure Control Solenoid Vale (LINE_VFS)
16	TCM CHG-A (17)	Underdrive Brake Control Solenoid Valve(UD/B_VFS)
11	TCM CHG-A (18)	26 Brake Control Solenoid Vale (26/B_VFS)
12	TCM CHG-A (32)	SS-B Solenoid Valve(ON/OFF)
5	TCM CHG-A (48)	Solenoid Valve power 1
2	TCM CHG-A (4)	Torque Converter Control Solenoid Valve(T/CON_VFS)
7	TCM CHG-A (20)	Overdrive Clutch Control Solenoid Valve(OD/C_VFS)
6	TCM CHG-A (5)	35R Clutch Control Solenoid Valve(35R/C_VFS)
18	TCM CHG-A (33)	SS-A Solenoid Valve(ON/OFF)
10	TCM CHG-A (47)	Solenoid Valve power 2

[Harness Connector]



Solenoid Valve Connector [CRD04]



TCM Connector [CHG-A]



TCM Connector [CHG-K]

Automatic Transaxle System > Automatic Transaxle Control System > Overdrive Clutch Control Solenoid Valve(OD/C_VFS) > Repair procedures
Inspection

1. Turn ignition switch OFF.
2. Disconnect the oil temperature sensor connector.
3. Measure resistance between sensor signal terminal and sensor ground terminal.
4. Check that the resistance is within the specification.

Removal

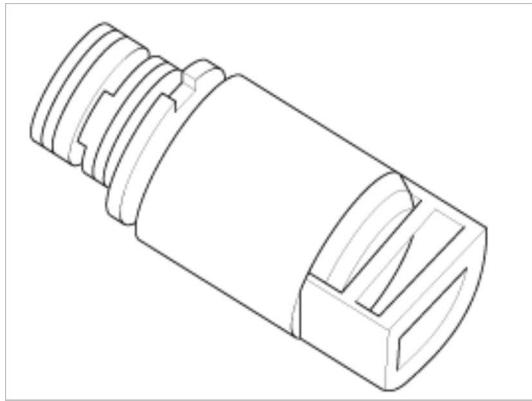
NOTE

Replacing an on/off solenoid valve (SS-A, SS-B) does not require additional hydraulic pressure adjustment; however, the hydraulic pressure will need to be adjusted after replacing the VFS solenoid valve. If replacing the VFS solenoid valve; also replace the valve body assembly. (Refer to "Valve Body" in this group)

Automatic Transaxle System > Automatic Transaxle Control System > SS-A Solenoid Valve(ON/OFF) > Description and Operation

Description

SS-A solenoid valve is attached to the valve body and is an on/off solenoid valve that is used to change gears. SS-A Solenoid valve(ON/OFF) is installed at valve body.



Automatic Transaxle System > Automatic Transaxle Control System > SS-A Solenoid Valve(ON/OFF) > Specifications

Specifications

ON/OFF Solenoid Valve(SS-A, SS-B)

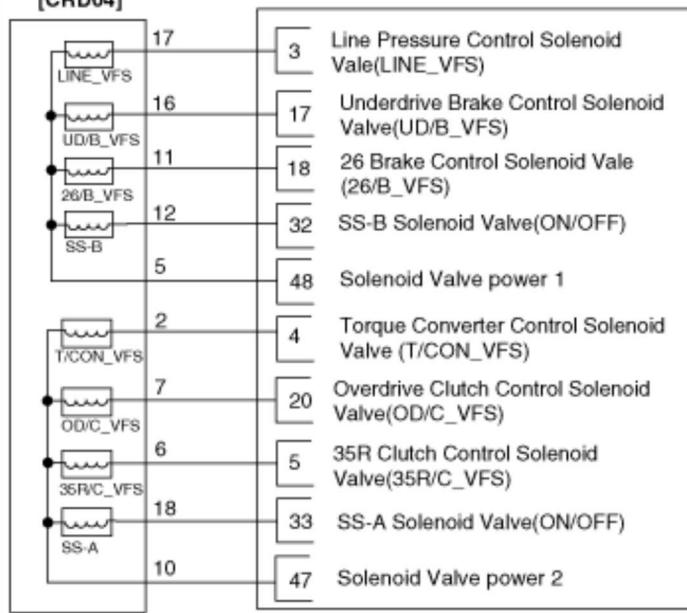
▷ Control type : Normal low type

Control pressure kpa(kgf/cm ² , psi)	490.33(5.0, 71.12)
Internal resistance(Ω)	10~11

Automatic Transaxle System > Automatic Transaxle Control System > SS-A Solenoid Valve(ON/OFF) > Schematic Diagrams

Circuit Diagram

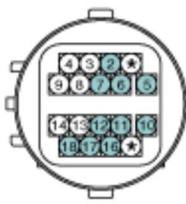
[Circuit Diagram]

Solenoid Valve
[CRD04]

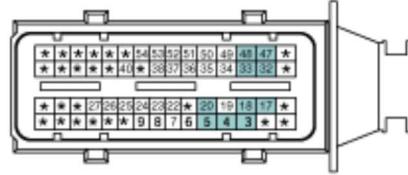
[Connection Information]

Terminal	Connected to	Function
17	TCM CHG-A (3)	Line Pressure Control Solenoid Vale (LINE_VFS)
16	TCM CHG-A (17)	Underdrive Brake Control Solenoid Valve(UD/B_VFS)
11	TCM CHG-A (18)	26 Brake Control Solenoid Vale (26/B_VFS)
12	TCM CHG-A (32)	SS-B Solenoid Valve(ON/OFF)
5	TCM CHG-A (48)	Solenoid Valve power 1
2	TCM CHG-A (4)	Torque Converter Control Solenoid Valve(T/CON_VFS)
7	TCM CHG-A (20)	Overdrive Clutch Control Solenoid Valve(OD/C_VFS)
6	TCM CHG-A (5)	35R Clutch Control Solenoid Valve(35R/C_VFS)
18	TCM CHG-A (33)	SS-A Solenoid Valve(ON/OFF)
10	TCM CHG-A (47)	Solenoid Valve power 2

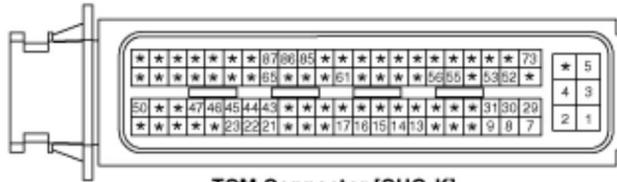
[Harness Connector]



Solenoid Valve Connector [CRD04]



TCM Connector [CHG-A]



TCM Connector [CHG-K]

Automatic Transaxle System > Automatic Transaxle Control System > SS-A Solenoid Valve(ON/OFF) > Repair procedures
Inspection

1. Turn ignition switch OFF.
2. Disconnect the oil temperature sensor connector.
3. Measure resistance between sensor signal terminal and sensor ground terminal.
4. Check that the resistance is within the specification.

Removal

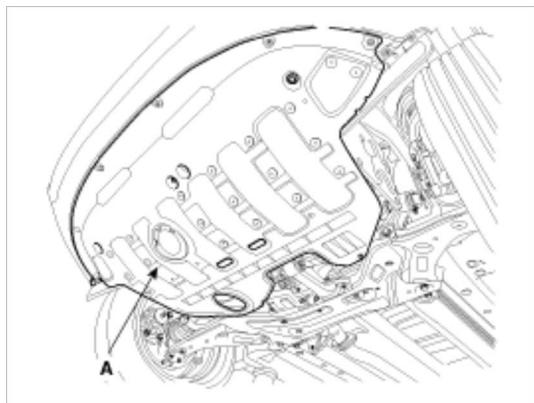
NOTE

Replacing an on/off solenoid valve (SS-A, SS-B) does not require additional hydraulic pressure adjustment; however, the hydraulic pressure will need to be adjusted after replacing the VFS solenoid valve. If replacing the VFS solenoid valve; also replace the valve body assembly. (Refer to "Valve Body" in this group)

1. Remove the battery and the battery tray. (Refer to "Charging system" in EE group.)
2. Remove the under cover (A).

Tightening torque:

19.6 ~ 24.5 N.m (2.0 ~ 2.5 kgf.m, 14.5 ~ 18.1 lb-ft)



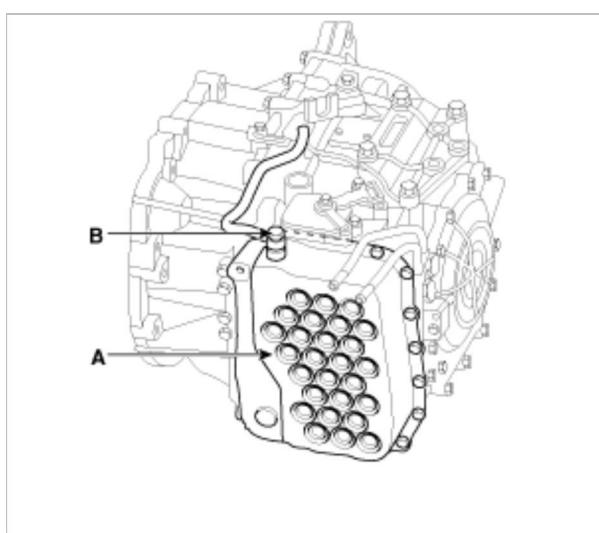
3. Replace new gasket and the plug after draining the automatic transaxle fluid by removing the drain plug. (Refer to "Hydraulic system (Fluid)" in this group)
4. Remove the valve body cover (A) and eyebolt (B).

Tightening torque:

(A) 13.8~14.7N.m (1.3~1.5kgf.m, 9.4~10.8lb-ft)
 (B) 34.3~44.1N.m (3.5~4.5kgf.m, 25.3~32.6lb-ft)

CAUTION

Always replace the gasket of the eyebolt use new one whenever loosening eyebolt.

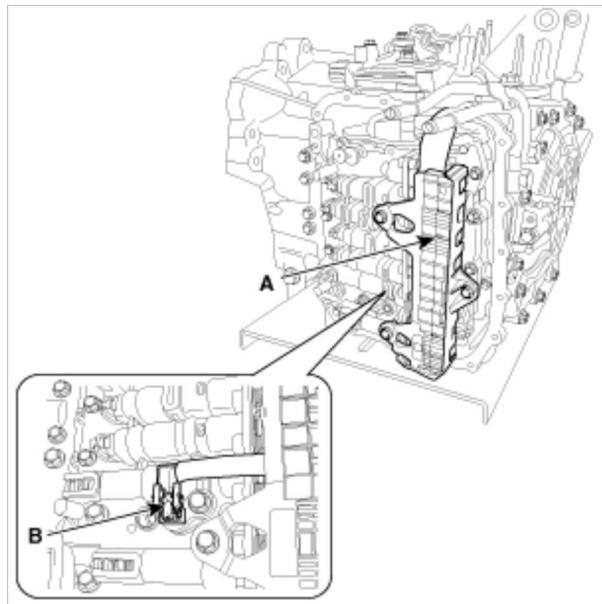
**NOTE**

Remove installation bolts in the engine compartment first and

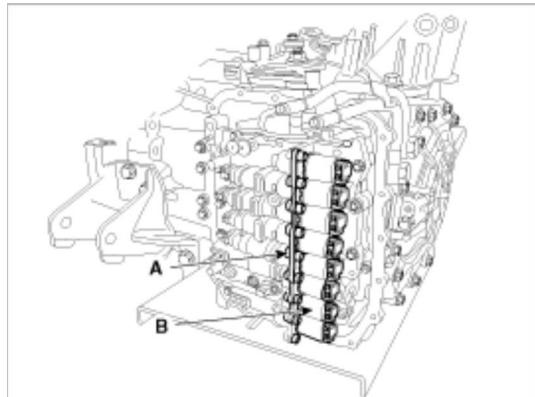
5. Remove the bolt (3ea) after disconnecting the solenoid valve connector (A) and the oil temperature sensor connector (B).

Tightening torque:

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



6. Remove the solenoid valve (B) after removing the solenoid support (A).

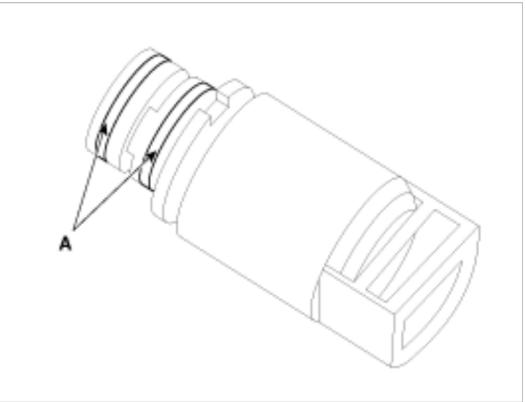


Installation

1. Installation is the reverse of removal.

NOTE

- When installing, apply the ATF oil or white vaseline to the O-ring (A) not to be damaged.



- Continue to apply liquid gasket at application points at the valve body cover with Ø2.5mm (0.0984in.) thickness.

Liquid gasket Part name :

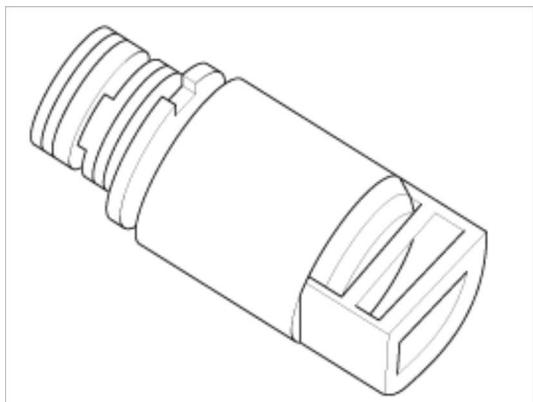
Threebond 1281B or LOCTITE FMD-546

- Adding automatic transaxle fluid. (Refer to "automatic transaxle system" in this group.)

Automatic Transaxle System > Automatic Transaxle Control System > SS-B Solenoid Valve(ON/OFF) > Description and Operation

Description

SS-B solenoid valve is attached to the valve body and is an on/off solenoid valve that is used to change gears. SS-B Solenoid valve(ON/OFF) is installed at valve body.



Automatic Transaxle System > Automatic Transaxle Control System > SS-B Solenoid Valve(ON/OFF) > Specifications

Specifications

ON/OFF Solenoid Valve(SS-A, SS-B)

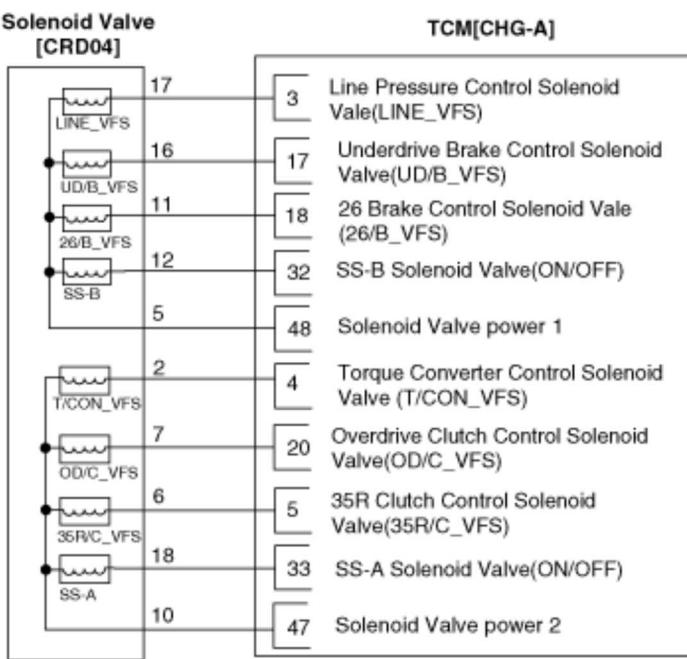
▷ Control type : Normal low type

Control pressure kpa(kgf/cm ² , psi)	490.33(5.0, 71.12)
Internal resistance(Ω)	10~11

Automatic Transaxle System > Automatic Transaxle Control System > SS-B Solenoid Valve(ON/OFF) > Schematic Diagrams

Circuit Diagram

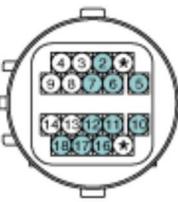
[Circuit Diagram]



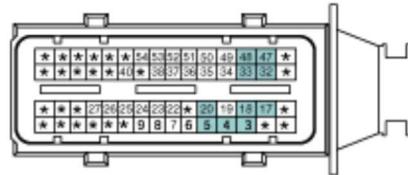
[Connection Information]

Terminal	Connected to	Function
17	TCM CHG-A (3)	Line Pressure Control Solenoid Vale (LINE_VFS)
16	TCM CHG-A (17)	Underdrive Brake Control Solenoid Valve(UD/B_VFS)
11	TCM CHG-A (18)	26 Brake Control Solenoid Vale(26/B_VFS)
12	TCM CHG-A (32)	SS-B Solenoid Valve(ON/OFF)
5	TCM CHG-A (48)	Solenoid Valve power 1
2	TCM CHG-A (4)	Torque Converter Control Solenoid Valve(T/CON_VFS)
7	TCM CHG-A (20)	Overdrive Clutch Control Solenoid Valve(OD/C_VFS)
6	TCM CHG-A (5)	35R Clutch Control Solenoid Valve(35R/C_VFS)
18	TCM CHG-A (33)	SS-A Solenoid Valve(ON/OFF)
10	TCM CHG-A (47)	Solenoid Valve power 2

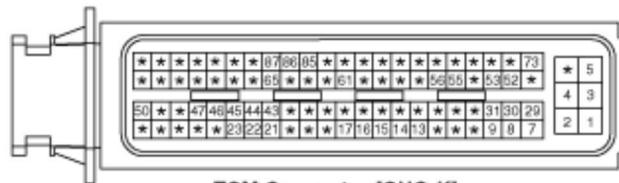
[Harness Connector]



Solenoid Valve Connector [CRD04]



TCM Connector [CHG-A]



TCM Connector [CHG-K]

Automatic Transaxle System > Automatic Transaxle Control System > SS-B Solenoid Valve(ON/OFF) > Repair procedures

Inspection

1. Turn ignition switch OFF.
2. Disconnect the oil temperature sensor connector.
3. Measure resistance between sensor signal terminal and sensor ground terminal.
4. Check that the resistance is within the specification.

Removal

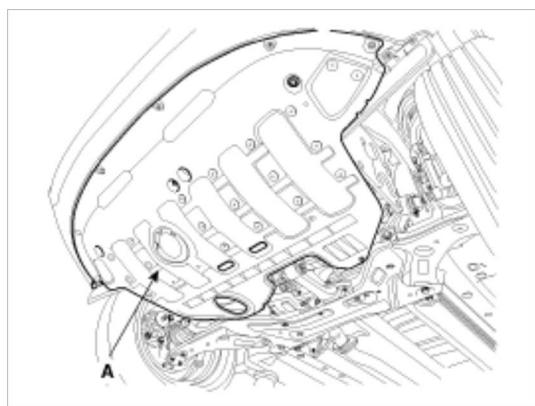
NOTE

Replacing an on/off solenoid valve (SS-A, SS-B) does not require additional hydraulic pressure adjustment; however, the hydraulic pressure will need to be adjusted after replacing the VFS solenoid valve. If replacing the VFS solenoid valve; also replace the valve body assembly. (Refer to "Valve Body" in this group)

1. Remove the battery and the battery tray. (Refer to "Charging system" in EE group.)
2. Remove the under cover (A).

Tightening torque:

19.6 ~ 24.5 N.m (2.0 ~ 2.5 kgf.m, 14.5 ~ 18.1 lb-ft)



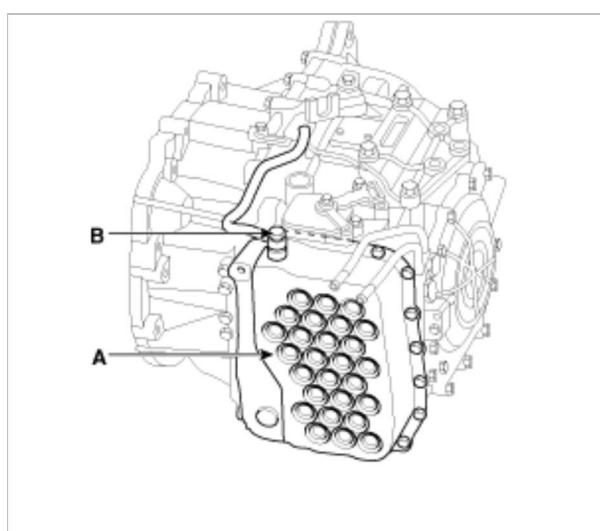
3. Replace new gasket and the plug after draining the automatic transaxle fluid by removing the drain plug. (Refer to "Hydraulic system (Fluid)" in this group)
4. Remove the valve body cover (A) and eyebolt (B).

Tightening torque:

(A) 13.8~14.7N.m (1.3~1.5kgf.m, 9.4~10.8lb-ft)
 (B) 34.3~44.1N.m (3.5~4.5kgf.m, 25.3~32.6lb-ft)

CAUTION

Always replace the gasket of the eyebolt use new one whenever loosening eyebolt.

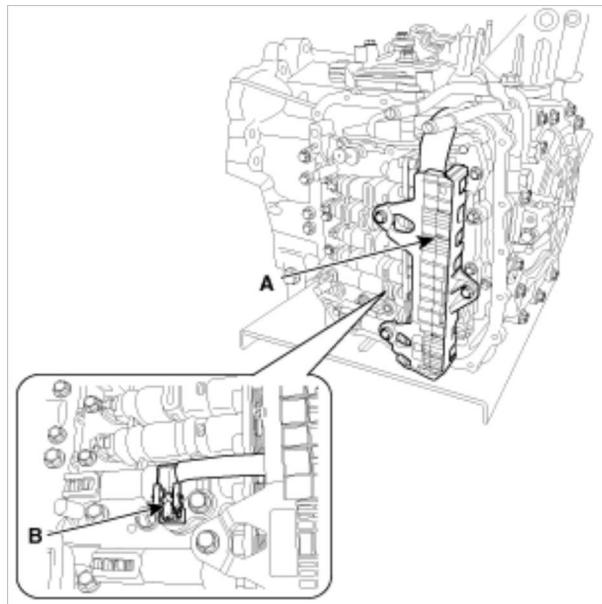
**NOTE**

Remove installation bolts in the engine compartment first and

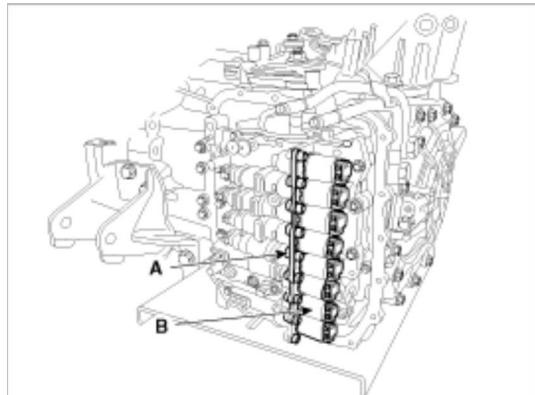
5. Remove the bolt (3ea) after disconnecting the solenoid valve connector (A) and the oil temperature sensor connector (B).

Tightening torque:

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



6. Remove the solenoid valve (B) after removing the solenoid support (A).

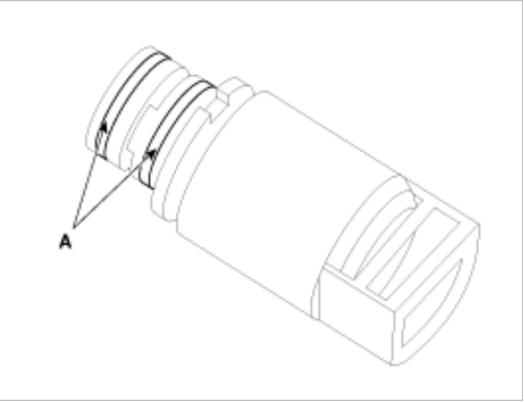


Installation

1. Installation is the reverse of removal.

NOTE

- When installing, apply the ATF oil or white vaseline to the O-ring (A) not to be damaged.



- Continue to apply liquid gasket at application points at the valve body cover with Ø2.5mm (0.0984in.) thickness.

Liquid gasket Part name :

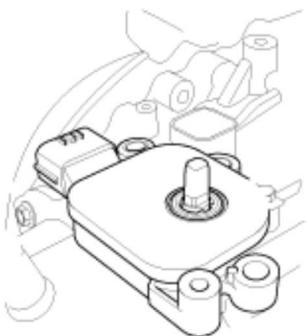
Threebond 1281B or LOCTITE FMD-546

- Adding automatic transaxle fluid. (Refer to "Hydraulic system (Fluid)" in this group)

Automatic Transaxle System > Automatic Transaxle Control System > Inhibitor Switch > Description and Operation

Description

Inhibitor Switch monitors the lever's position(PRND) and is used to control gear setting signals.



Automatic Transaxle System > Automatic Transaxle Control System > Inhibitor Switch > Specifications

Specifications

- ▷ Type: Combination of output signals from 4 terminals

Power supply (V)	12
Output type	Pin to Pin

Signal Code Table

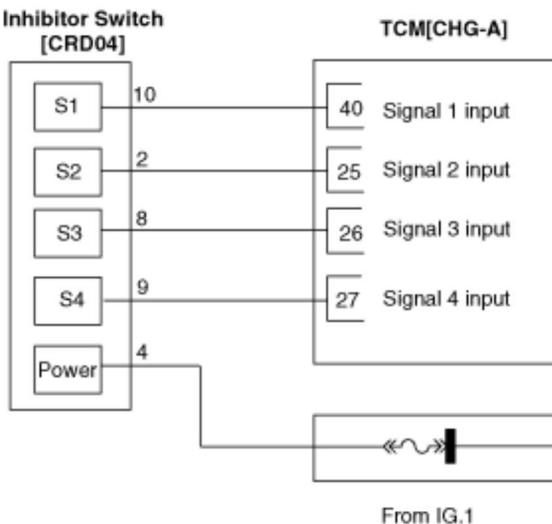
	P	P-R	R	R-N	N	N-D	D
S1	1	0	0	0	1	1	1
S2	0	0	0	1	1	0	0

S3	1	1	0	0	0	0	0
S4	1	1	1	1	1	1	0

Automatic Transaxle System > Automatic Transaxle Control System > Inhibitor Switch > Schematic Diagrams

Circuit Diagram

[Circuit Diagram]



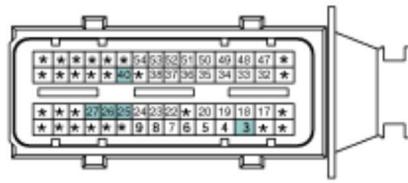
[Connection Information]

Terminal	Connected to	Function
10	TCM CHG-A (40)	Signal 1 input
2	TCM CHG-A (25)	Signal 2 input
8	TCM CHG-A (26)	Signal 3 input
9	TCM CHG-A (27)	Signal 4 input
4	From IG.1	Power (12V)

[Harness Connector]



Solenoid Valve Connector [CRD04]



TCM Connector [CHG-A]



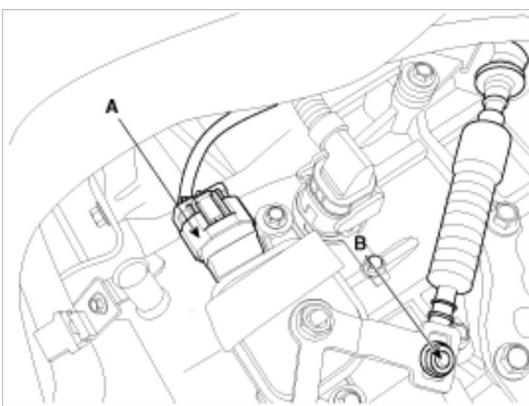
TCM Connector [CHG-K]

Automatic Transaxle System > Automatic Transaxle Control System > Inhibitor Switch > Repair procedures

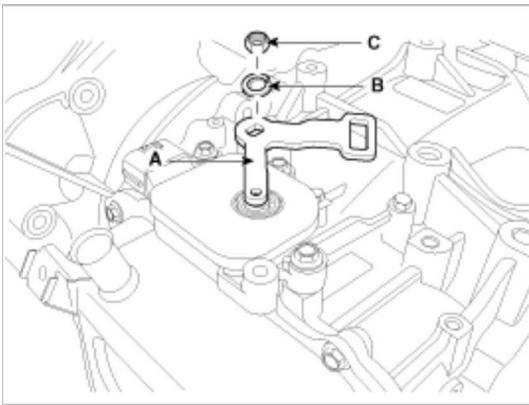
Removal

1. Make sure vehicle does not roll before setting room side shift lever and T/M side manual control lever to "N" position.
2. Remove the battery and the battery tray. (Refer to "Charging system" in EE group.)

3. Remove the air cleaner assembly. (Refer to "Intake manifold" in EM group.)
4. Remove the shift cable mounting nut (B).
5. Disconnect the inhibitor switch connector (A).



6. Remove the manual control lever (A) and the washer (B) after removing a nut (C).



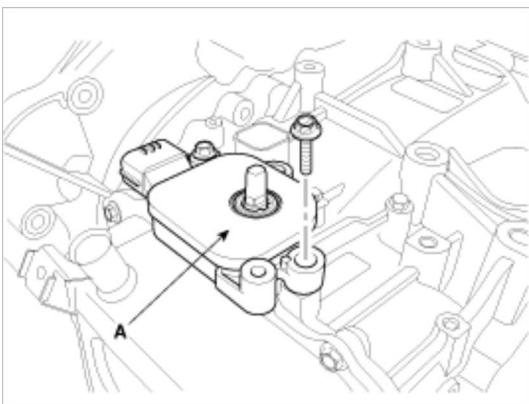
CAUTION

When installing, affix the manual control lever and the inhibitor switch with Ø5mm (0.1969in.). Then tighten the inhibitor assembly mounting bolts.

7. Remove the inhibitor assembly (A) after removing the bolts (2ea).

Tightening torque:

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



CAUTION

When installing, tighten the inhibitor assembly mounting bolt lightly, so that necessary adjustments can be made.

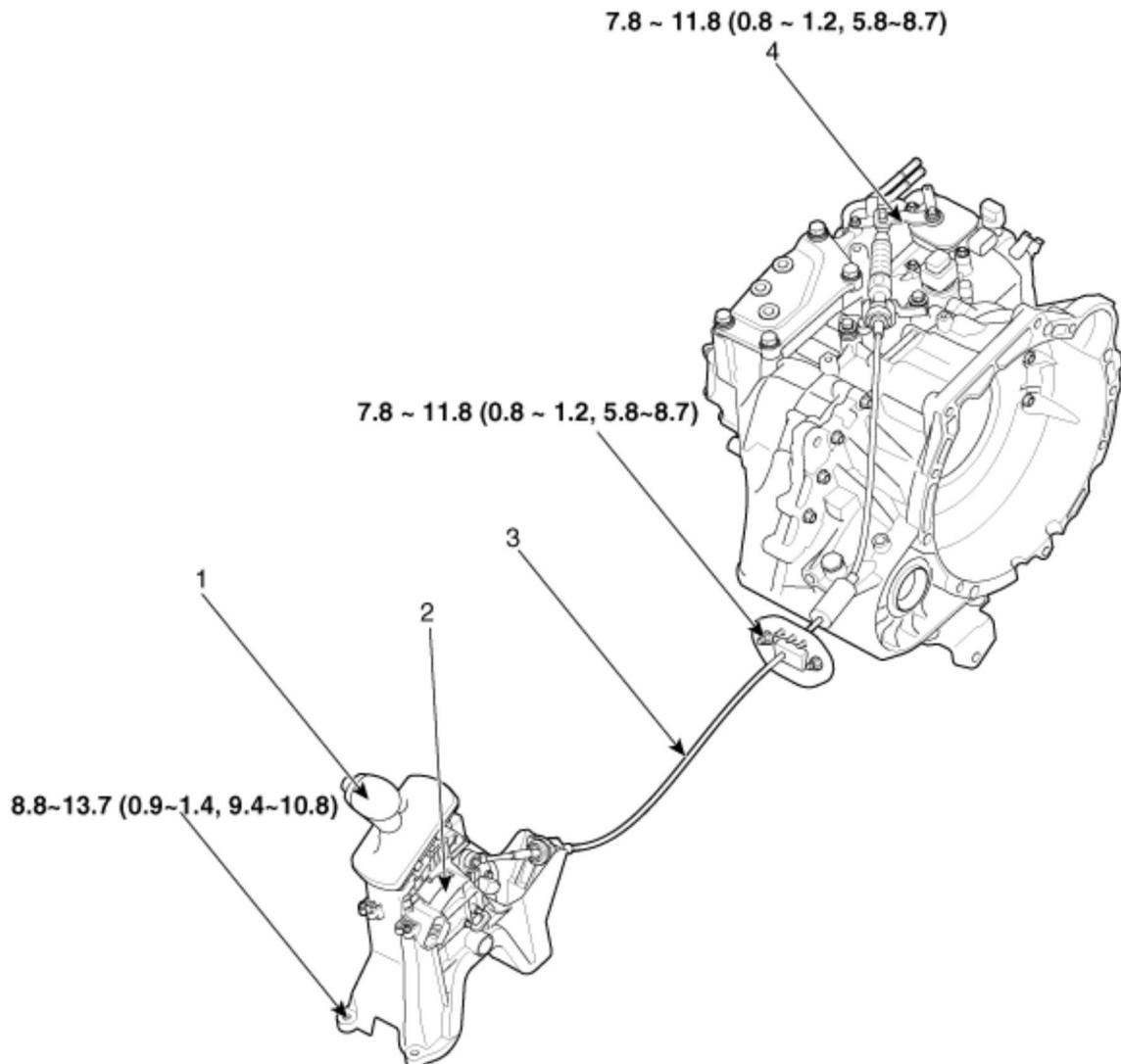
Tighten to specifications.

Installation

1. Installation is the reverse of removal.

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

Components



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

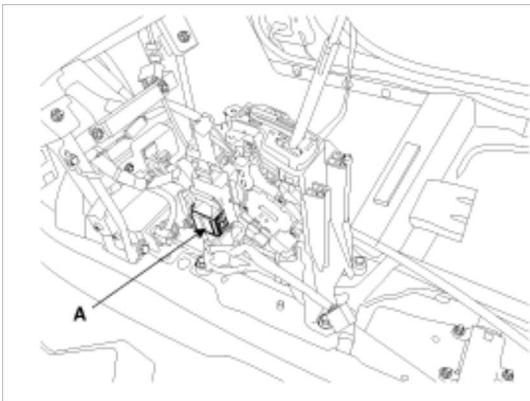
- | | |
|--------------------------------------|------------------------------------|
| 1. Shift lever knob & boots assembly | 3. Control cable assembly |
| 2. Shift lever assembly | 4. Manual control lever (T/M side) |

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

Removal

Shift Lever Assembly Replacement

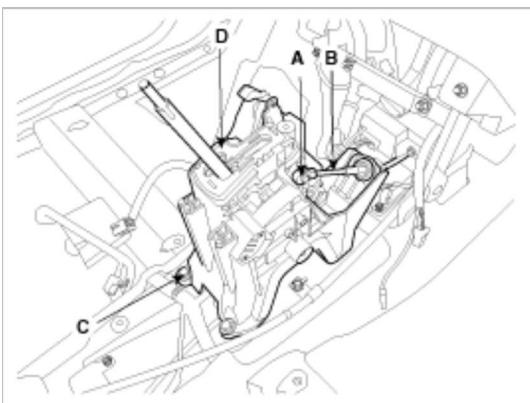
1. Remove the center console assembly. (Refer to "Interior(console)" in BD group.)
2. Disconnect sports mode connector (A).



3. Take off the clip (A) and then remove the shift cable (B).
4. Remove the shift lever assembly (D) by removing the bolts (C-4ea).

Tightening torque:

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



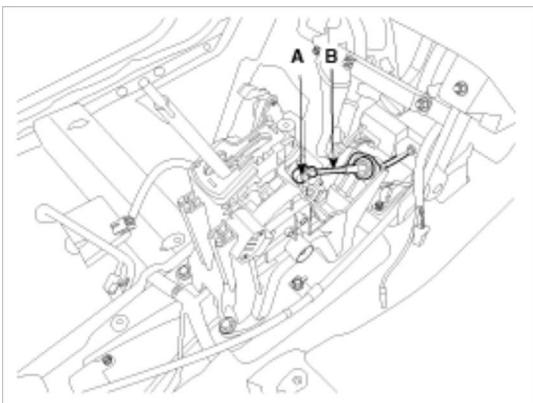
5. Installation is the reverse of removal.

NOTE

Make sure vehicle does not roll before setting room side shift lever and T/M side manual control lever to "N" position.

Control Cable Replacement

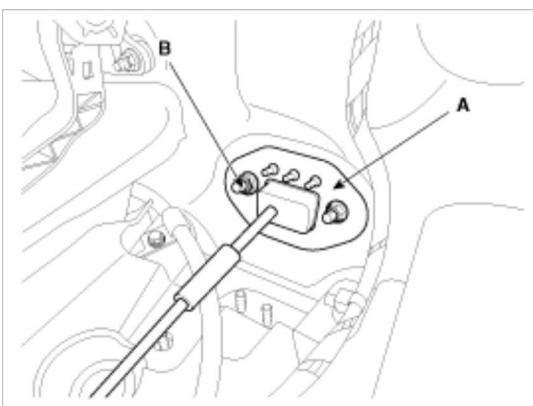
1. Remove the center console assembly. (Refer to "Interior(console)" in BD group.)
2. Take off the clip (A) and then remove the control cable (B).



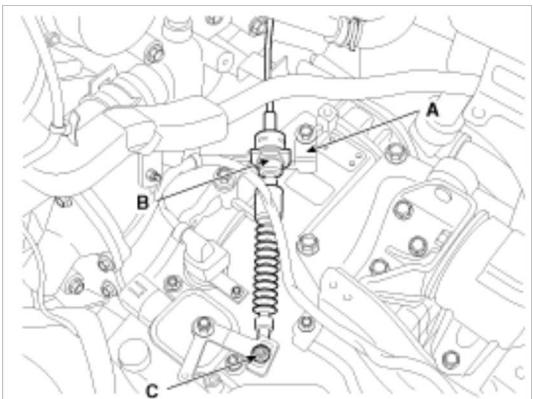
3. Remove the control cable assembly in the vehicle after removing the nuts (B) and the retainer (A).

Tightening torque:

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



4. Remove the nut (C).
5. Remove the cable (B) from the bracket (A) at transaxle assembly side (Refer to "Automatic Transaxle" in this group).



6. Remove the control cable inside of cab.

Inspection

1. Check the damage and operation of the control cable.
2. Check the damage of the boot.
3. Check the damage and corrosion of the bushing.
4. Check the damage or weakening of the spring.

Installation

1. Installation is the reverse of removal.

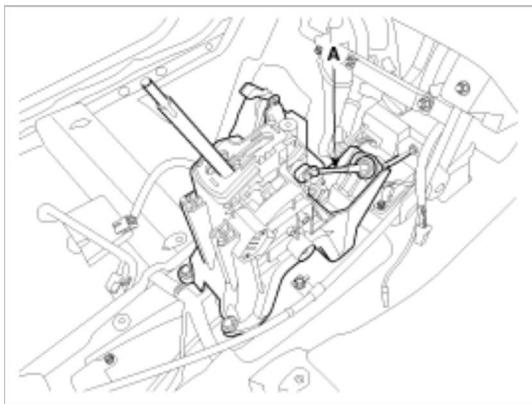
NOTE

Make sure vehicle does not roll before setting room side shift lever and T/M side manual control lever to "N" position.

Adjustment

Adjusting method for T/M control cable

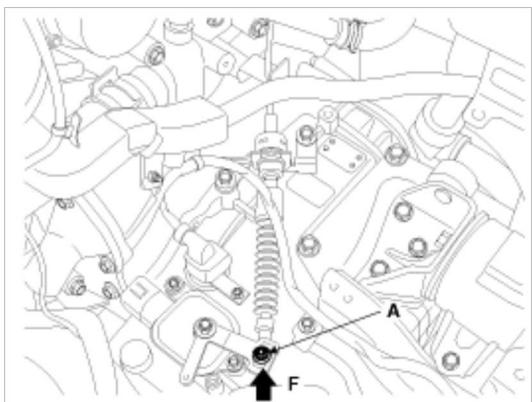
1. Make sure vehicle does not roll before setting room side shift lever and T/M side manual control lever to "N" position.
2. Connect room side shift lever and control cable (A).



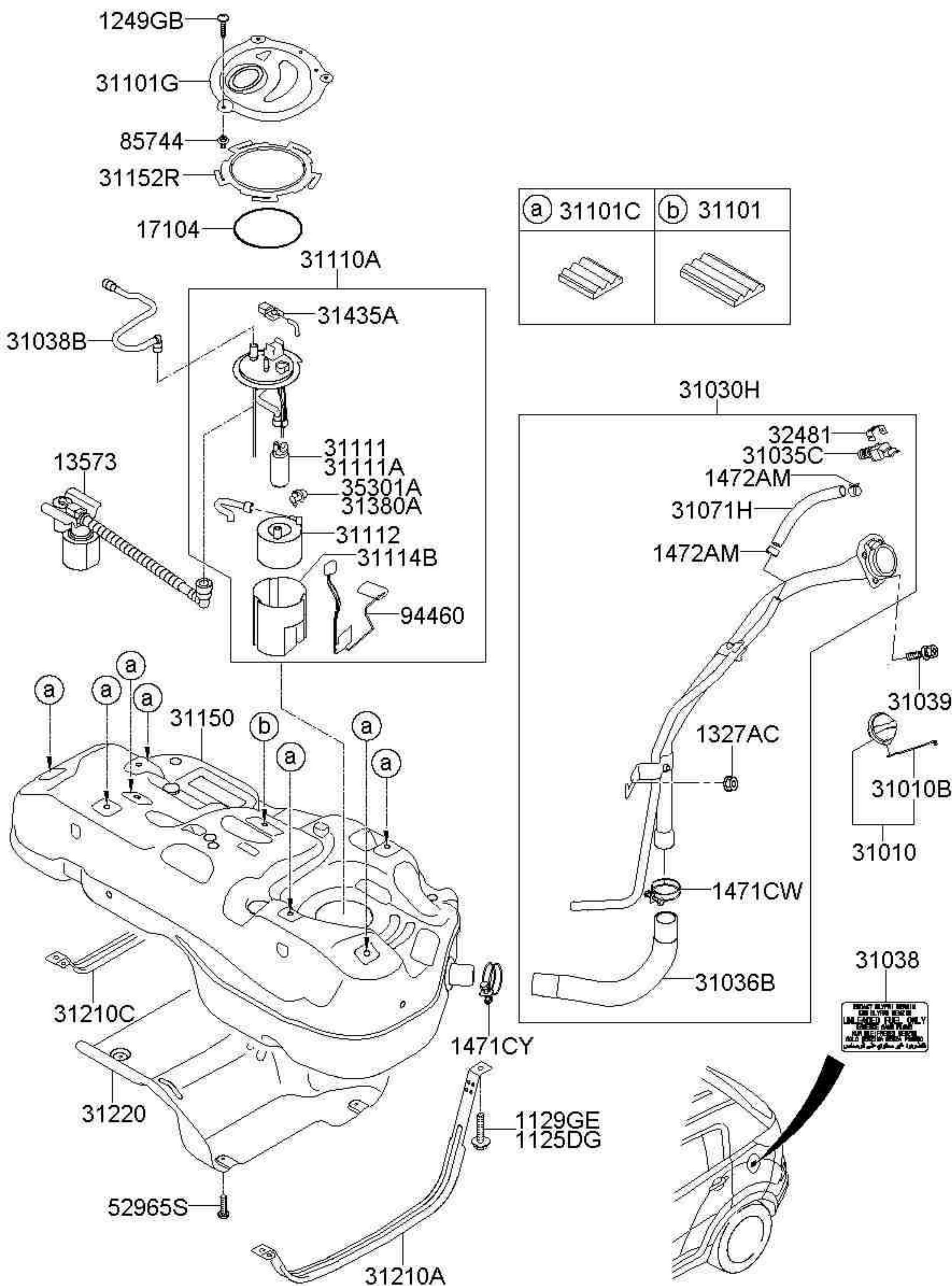
3. Push cable to "F" direction shown to eliminate FREE PLAY.
4. Tighten adjusting nut (A).

Tightening torque:

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



5. After adjusting, check to be sure that this part operates as designed at each range of T/M side corresponding to each position of room lever.



SPORTAGE(SL) > 2012 > G 2.4 DOHC > Fuel System

Fuel System > General Information > Specifications

Specifications

Fuel Delivery System

Items	Specification	
Fuel Tank	Capacity	55 lit. (14.5 U.S.gal., 58.1 U.S.qt., 48.3 Imp.qt.)
Fuel Filter	Type	Paper type
Fuel Pressure Regulator	Regulated Fuel Pressure	324 ~ 363 kPa (3.3 ~ 3.7 kgf/cm ² , 46.9 ~ 52.6 psi)
Fuel Pump	Type	Electrical, in-tank type
	Driven by	Electric motor

Sensors

Manifold Absolute Pressure Sensor (MAPS)

- ▷ Type: Piezo-resistive pressure sensor type
- ▷ Specification

Pressure [kPa (kgf/cm ² , 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 [°C(°F)]	Resistance (kΩ)
-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)	0.76 ~ 0.85
60(140)	0.54 ~ 0.62
80(176)	0.29 ~ 0.34

Engine Coolant Temperature Sensor (ECTS)

- ▷ Type: Thermistor type
- ▷ Specification

Temperature [°C(°F)]	Resistance (kΩ)
-40(-40)	48.14
-20(-4)	14.13 ~ 16.83

0(32)	5.79
20(68)	2.31 ~ 2.59
40(104)	1.15
60(140)	0.59
80(176)	0.32

Throttle Position Sensor (TPS) [integrated into ETC Module]

▷ Type: Variable resistor type

▷ Specification

Throttle Angle(°)	Output Voltage (V)	
	TPS1	TPS2
0	0	5.0
10	0.48	4.52
20	0.95	4.05
30	1.43	3.57
40	1.90	3.10
50	2.38	2.62
60	2.86	2.14
70	3.33	1.67
80	3.81	1.19
90	4.29	0.71
100	4.76	0.24
105	5.0	0
C.T (6~15°)	0.29 ~ 0.71	4.29 ~ 4.71
W.O.T (93~102°)	4.43 ~ 4.86	0.14 ~ 0.57

Item	Resistance (kΩ)
TPS1	0.875 ~ 1.625 [20°C(68°F)]
TPS2	0.875 ~ 1.625 [20°C(68°F)]

Crankshaft Position Sensor (CKPS)

▷ Type: Hall effect type

Camshaft Position Sensor (CMPS)

▷ Type: Hall effect type

Knock Sensor (KS)

▷ Type: Piezo-electricity type

▷ Specification

Item	Specification
Capacitance (pF)	850 ~ 1,150

Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 1]

▷ Type: Zirconia (ZrO₂) [Linear] type

▷ Specification

Item	Specification
Heater Resistance (Ω)	2.5 ~ 4.0 [20°C(69.8°F)]

Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2]

- ▷ Type: Zirconia (ZrO_2) [Binary] type
- ▷ Specification

A/F Ratio (λ)	Output Voltage(V)
RICH	Approx. 0.92
LEAN	Approx. 0.04

Item	Specification
Heater Resistance (Ω)	3.3 ~ 4.1 [21°C(69.8°F)]

Accelerator Position Sensor (APS)

- ▷ Type: Variable resistor type
- ▷ Specification

Accelerator Position	Output Voltage (V)	
	APS1	APS2
C.T	0.7 ~ 0.8	0.29 ~ 0.46
W.O.T	3.85 ~ 4.35	1.93 ~ 2.18

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)	13.8 ~ 15.2 [20°C(68°F)]

ETC Motor [integrated into ETC Module]

- ▷ Specification

Item	Specification
Coil Resistance (Ω)	1.2 ~ 1.8 [20°C(68°F)]

Purge Control Solenoid Valve (PCSV)

- ▷ Specification

Item	Specification

Coil Resistance (Ω)	19.0 ~ 22.0 [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)]

Variable Charge Motion Actuator (VCMA)

▷ Specification

[Motor]

Item	Specification	
Coil Resistance	Normal	1 ~ 999 Ω
	Short Circuit	Below 1 Ω
	Open Circuit	Over 1 k Ω

[Position Sensor]

Item	Specification
Coil Resistance (k Ω)	3.44 ~ 5.16 [20°C(68°F)]

Ignition Coil

▷ Type: Stick type

▷ Specification

Item	Specification
Primary Coil Resistance (Ω)	0.62 ± 10% [20°C(68°F)]
Secondary Coil Resistance (k Ω)	7.0 ± 15% [20°C(68°F)]

Canister Close Valve (CCV)

▷ Specification

Item	Specification
Coil Resistance (Ω)	19.8 ~ 21.8 [20°C(68°F)]

Service Standard

Item	Specification	
Ignition Timing (°)	BTDC 8 ± 10	
Idle Speed (rpm)	A/C OFF	Neutral, N, P-range
		D-range

	A/C ON	Neutral, N, P-range	620 ± 100
		D-range	620 ± 100

Tightening Torques

Engine Control System

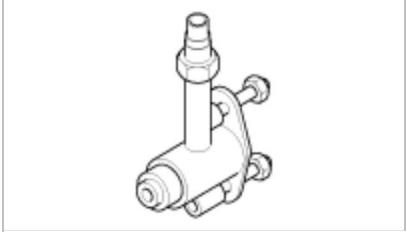
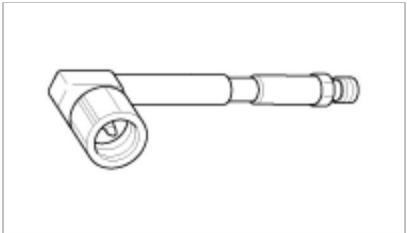
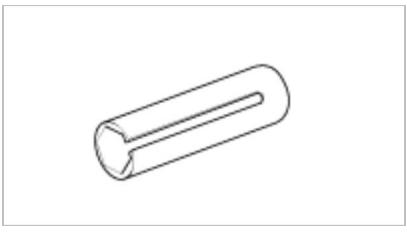
Item	kgf.m	N.m	lb·ft
ECM installation bolt	0.8 ~ 1.2	7.8 ~ 11.8	5.8 ~ 8.7
Manifold absolute pressure sensor installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
Crankshaft position sensor installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
Crankshaft position sensor cover installation bolt (M8)	1.9 ~ 2.4	18.6 ~ 23.5	13.7 ~ 17.4
Crankshaft position sensor cover installation bolt (M6)	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
Camshaft position sensor (Bank 1 / Intake) installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
Camshaft position sensor (Bank 1 / Exhaust) installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
Knock sensor installation bolt	1.9 ~ 2.4	18.6 ~ 23.5	13.7 ~ 17.4
Heated oxygen sensor (Bank 1 / sensor 1) installation [SULEV]	4.0 ~ 5.0	39.2 ~ 49.1	28.9 ~ 36.2
Heated oxygen sensor (Bank 1 / sensor 2) installation [SULEV]	4.0 ~ 5.0	39.2 ~ 49.1	28.9 ~ 36.2
Heated oxygen sensor (Bank 1 / sensor 1) installation [ULEV]	4.5 ~ 5.0	44.1 ~ 49.1	32.6 ~ 36.2
Heated oxygen sensor (Bank 1 / sensor 2) installation [ULEV]	4.5 ~ 5.0	44.1 ~ 49.1	32.6 ~ 36.2
Electronic throttle body installation bolt	0.8 ~ 1.2	7.8 ~ 11.8	5.8 ~ 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
Ignition coil installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
Canister close valve & fuel tank air filter bracket installation nut	0.8 ~ 1.2	7.8 ~ 11.8	5.8 ~ 8.7
Variable charge motion actuator installation bolt	0.8 ~ 1.2	7.8 ~ 11.8	5.8 ~ 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
Filler-neck assembly bracket installation nut	0.4 ~ 0.6	3.9 ~ 5.9	2.9 ~ 4.3
Accelerator pedal module installation nut	1.7 ~ 2.6	16.7 ~ 25.5	12.3 ~ 18.8
Accelerator pedal module installation bolt	0.8 ~ 1.2	7.8 ~ 11.8	5.8 ~ 8.7
Delivery pipe installation bolt	1.9 ~ 2.4	18.6 ~ 23.5	13.7 ~ 17.4
Delivery pipe installation nut (↔ Fuel feed tube)	0.8 ~ 1.0	7.8 ~ 9.8	5.8 ~ 7.2
Fuel pump locking ring (Loosening torque)	Min. 7	Min. 68.65	Min. 50.6

Fuel System > General Information > Special Service Tools

Special Service Tools

Tool (Number and Name)	Illustration	Application
Fuel Pressure Gauge (09353-24100)	 A fuel pressure gauge connected by a flexible hose to a fitting.	Measuring the fuel line pressure
Fuel Pressure Gauge Adapter (09353-38000)	 An adapter with two ports, one for the delivery pipe and one for the fuel feed line.	Connection between the delivery pipe and the fuel feed line
Fuel Pressure Gauge Connector (09353-24000)	 A connector fitting used to connect the Fuel Pressure Gauge (09353-24100) and the Fuel Pressure Gauge Adapter (09353-38000).	Connection between the Fuel Pressure Gauge (09353-24100) and the Fuel Pressure Gauge Adapter (09353-38000)
Heated Oxygen Sensor Socket Wrench (09392-2H100)	 A specialized wrench with a unique profile designed for removing and installing heated oxygen sensors.	Removal and installation of the heated oxygen sensor
Fuel Pump Locking Ring Remover (09310-2S200)	 A crescent-shaped tool used for removing and installing the locking ring on a fuel pump or sub-fuel sender.	Removal and installation of the fuel pump (or sub fuel sender) locking ring

Fuel System > General Information > Troubleshooting

Basic Troubleshooting

Basic Troubleshooting Guide

1	Bring Vehicle to Workshop
2	Analyze Customer's Problem
	<ul style="list-style-type: none"> 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
	<ul style="list-style-type: none"> Connect the GDS to Diagnostic Link Connector (DLC). Record the DTC and Freeze Frame Data.
	 NOTE <i>To erase DTC and Freeze Frame Data, refer to Step 5.</i>
4	Confirm the Inspection Procedure for the System or Part
	<ul style="list-style-type: none"> 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
	<ul style="list-style-type: none"> Go to Step 11, if you recognize the problem.
7	Recreate (Simulate) Symptoms of the DTC
	<ul style="list-style-type: none"> 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
	<ul style="list-style-type: none"> 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
	<ul style="list-style-type: none"> Try to recreate or simulate the condition of the malfunction as described by the customer.
10	Check the DTC
	<ul style="list-style-type: none"> If DTC(s) does/do not occur, refer to INTERMITTENT PROBLEM PROCEDURE in BASIC INSPECTION PROCEDURE. If DTC(s) occur(s), go to Step 11.
11	Perform Troubleshooting Procedure for DTC
12	Adjust or repair the vehicle
13	Confirmation test
14	END

Customer Problem Analysis Sheet

1. VEHICLE INFORMATION

VIN No.		Transmission	<input type="checkbox"/> M/T <input type="checkbox"/> A/T <input type="checkbox"/> CVT <input type="checkbox"/> etc.
Production date		Driving type	<input type="checkbox"/> 2WD (FF) <input type="checkbox"/> 2WD (FR) <input type="checkbox"/> 4WD
Odometer Reading	km/mile	DPF (Diesel Engine)	<input type="checkbox"/> With DPF <input type="checkbox"/> Without DPF

2. SYMPTOMS

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

3. ENVIRONMENT

Problem frequency	<input type="checkbox"/> Constant <input type="checkbox"/> Sometimes (_____) <input type="checkbox"/> Once only <input type="checkbox"/> Other _____
Weather	<input type="checkbox"/> Fine <input type="checkbox"/> Cloudy <input type="checkbox"/> Rainy <input type="checkbox"/> Snowy <input type="checkbox"/> Other _____
Outdoor temperature	Approx. _____ °C/°F
Place	<input type="checkbox"/> Highway <input type="checkbox"/> Suburbs <input type="checkbox"/> Inner City <input type="checkbox"/> Uphill <input type="checkbox"/> Downhill <input type="checkbox"/> Rough road <input type="checkbox"/> Other _____
Engine temperature	<input type="checkbox"/> Cold <input type="checkbox"/> Warming up <input type="checkbox"/> After warming up <input type="checkbox"/> Any temperature
Engine operation	<input type="checkbox"/> Starting <input type="checkbox"/> Just after starting (_____ min) <input type="checkbox"/> Idling <input type="checkbox"/> Racing <input type="checkbox"/> Driving <input type="checkbox"/> Constant speed <input type="checkbox"/> Acceleration <input type="checkbox"/> Deceleration <input type="checkbox"/> A/C switch ON/OFF <input type="checkbox"/> Other _____

4. MIL/DTC

MIL (Malfunction Indicator Lamp)	<input type="checkbox"/> Remains ON <input type="checkbox"/> Sometimes lights up <input type="checkbox"/> Does not light
DTC	<input type="checkbox"/> Normal <input type="checkbox"/> DTC (_____) <input type="checkbox"/> Freeze Frame Data
	<input type="checkbox"/> Normal <input type="checkbox"/> DTC (_____) <input type="checkbox"/> 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.

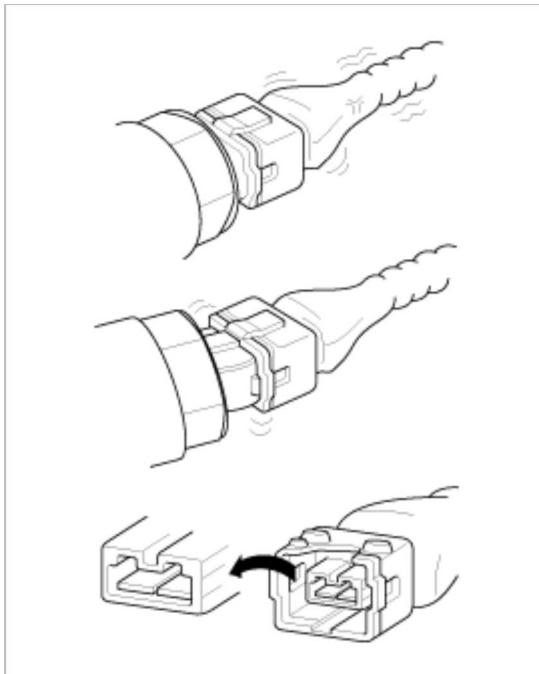
NOTE

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.

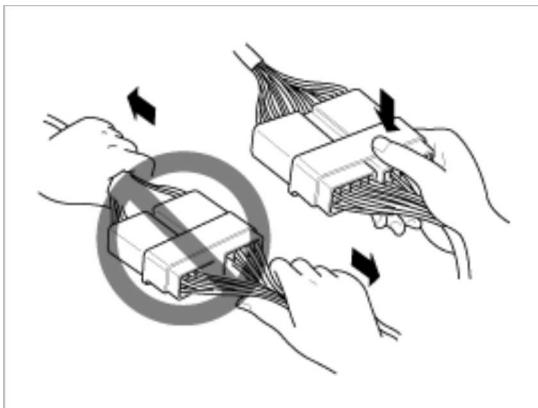
• Simulating Electrical Load

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

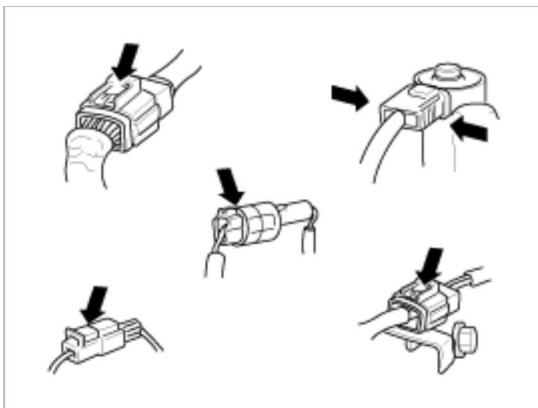
Connector Inspection Procedure

1. Handling of Connector

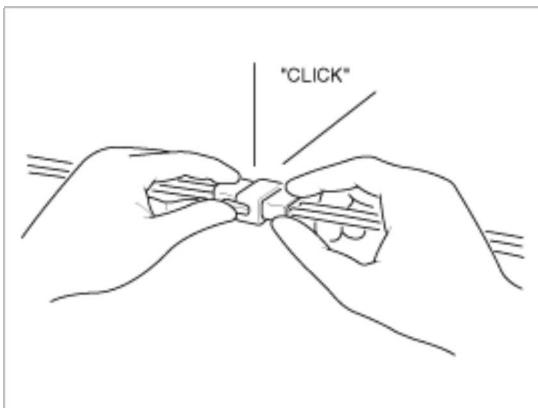
- A. Never pull on the wiring harness when disconnecting connectors.



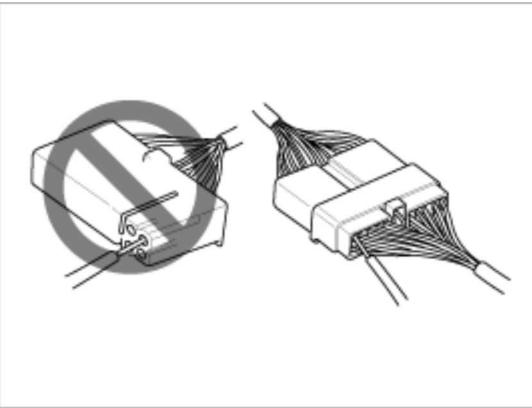
- B. When removing the connector with a lock, press or pull locking lever.



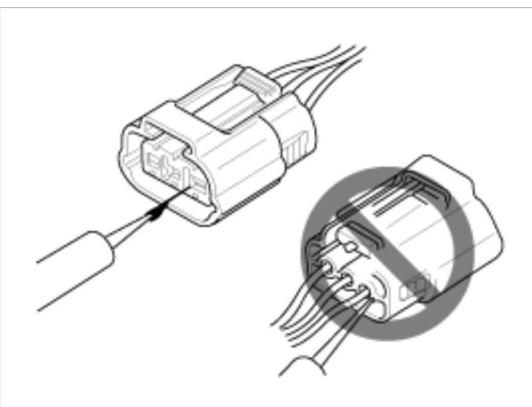
- C. Listen for a click when locking connectors. This sound indicates that they are securely locked.



- 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:

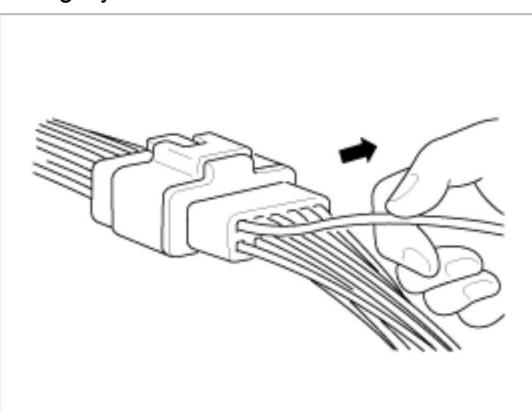
Check missed terminal, crimped terminal or broken core wire by slightly pulling the wire harness.

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

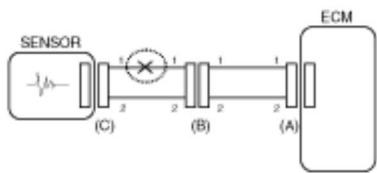
- Check Open Circuit

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

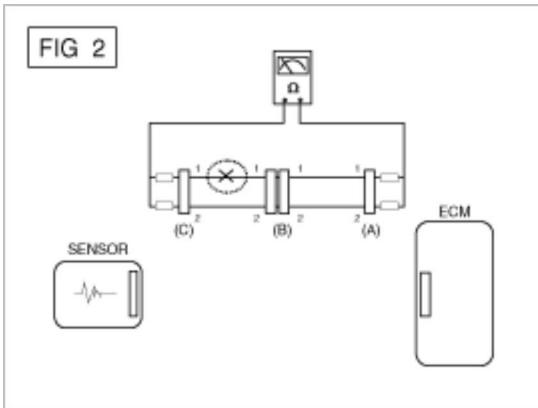
When measuring for resistance, lightly shake the wire harness above and below or from side to side.

Specification (Resistance)

1Ω or less → Normal Circuit

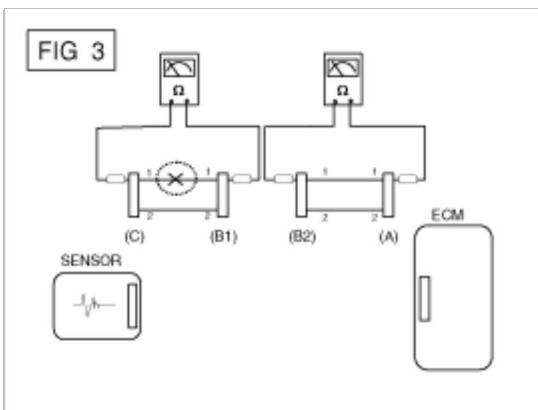
1MΩ or Higher → Open Circuit

- 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].

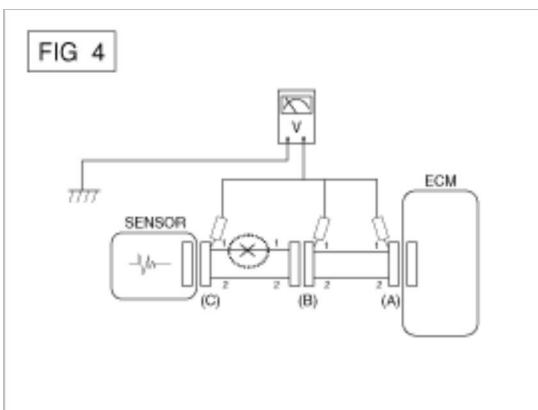
In this case the measured resistance between connector (C) and (B1) is higher than $1M\Omega$ and the open circuit is between terminal 1 of connector (C) and terminal 1 of connector (B1).



3. Voltage Check Method

- A. With each connector still connected, measure the voltage between the chassis ground and terminal 1 of each connectors (A), (B) and (C) as shown in [FIG. 4].

The measured voltage of each connector is 5V, 5V and 0V respectively. So the open circuit is between connector (C) and (B).



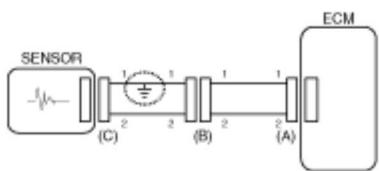
• Check Short Circuit

1. Test Method for Short to Ground Circuit

A. Continuity Check with Chassis Ground

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

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

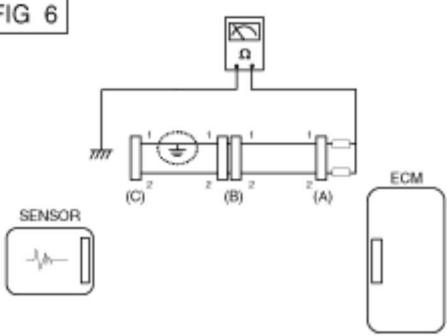
$1M\Omega$ or Higher → Normal Circuit

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 1Ω and higher than $1M\Omega$ respectively.

Specifically the short to ground circuit is line 1 (Line 2 is normal). To find exact broken point, check the sub line of line 1 as described in the following step.

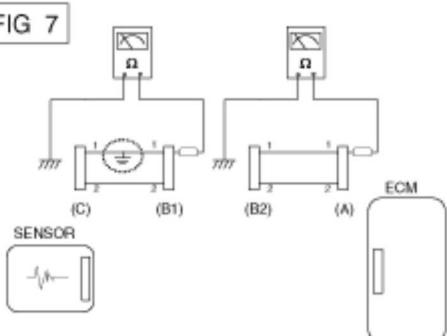
FIG 6



B. Disconnect connector (B), and measure the resistance between connector (A) and chassis ground, and between (B1) and chassis ground as shown in [FIG. 7].

The measured resistance between connector (B1) and chassis ground is 1Ω or less. The short to ground circuit is between terminal 1 of connector (C) and terminal 1 of connector (B1).

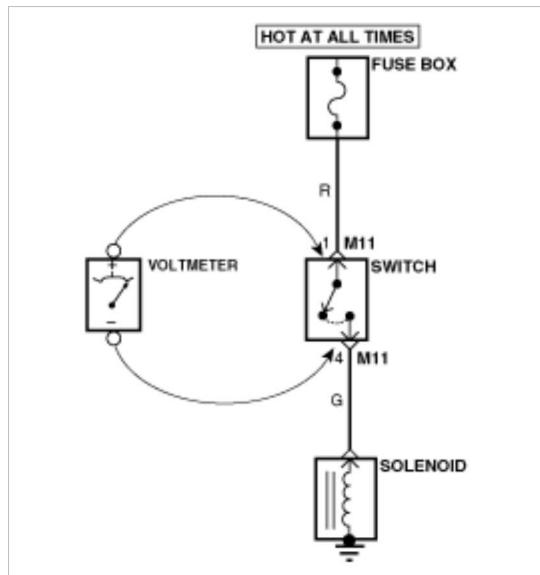
FIG 7



• Testing For Voltage Drop

This test checks for voltage drop along a wire, or through a connection or switch.

- 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)	<ul style="list-style-type: none"> • DTC • Low compression • Intake air leaks • Slipped or broken timing belt • Contaminated fuel
Difficult to start	1. Test the battery 2. Check the fuel pressure 3. Check the ECT sensor and circuit (Check DTC) 4. Check the ignition circuit	<ul style="list-style-type: none"> • DTC • Low compression • Intake air leaks • Contaminated fuel • Weak ignition spark
Poor idling (Rough, unstable or incorrect Idle)	1. Check the fuel pressure 2. Check the Injector 3. Check the long term fuel trim and short term fuel trim (Refer to CUSTOMER DATASTREAM) 4. Check the idle speed control circuit (Check DTC) 5. Inspect and test the Throttle Body 6. Check the ECT sensor and circuit (Check DTC)	<ul style="list-style-type: none"> • DTC • Low compression • Intake air leaks • Contaminated fuel • Weak ignition spark

Engine stall	1. Test the Battery 2. Check the fuel pressure 3. Check the idle speed control circuit (Check DTC) 4. Check the ignition circuit 5. Check the CKPS Circuit (Check DTC)	• DTC • Intake air leaks • Contaminated fuel • Weak ignition spark
Poor driving (Surge)	1. Check the fuel pressure 2. Inspect and test Throttle Body 3. Check the ignition circuit 4. Check the ECT Sensor and Circuit (Check DTC) 5. Test the exhaust system for a possible restriction 6. Check the long term fuel trim and short term fuel trim (Refer to CUSTOMER DATASTREAM)	• DTC • Low compression • Intake air leaks • Contaminated fuel • Weak ignition spark
Knocking	1. Check the fuel pressure 2. Inspect the engine coolant 3. Inspect the radiator and the electric cooling fan 4. Check the spark plugs	• DTC • Contaminated fuel
Poor fuel economy	1. Check customer's driving habitsls · A/C on full time or the defroster mode on? · Are tires at correct pressure? · Is excessively heavy load being carried? · Is acceleration too much, too often? 2. Check the fuel pressure 3. Check the injector 4. Test the exhaust system for a possible restriction 5. Check the ECT sensor and circuit	• DTC • Low compression • Intake air leaks • Contaminated fuel • Weak ignition spark
Hard to refuel (Overflow during refueling)	1. Test the canister close valve 2. Inspect the fuel filler hose/pipe · Pinched, kinked or blocked? · Filler hose is torn 3. Inspect the fuel tank vapor vent hose between the EVAP. canister and air filter 4. Check the EVAP. canister	• Malfunctioning gas station filling nozzle (If this problem occurs at a specific gas station during refueling)

Fuel System > Engine Control System > Description and Operation

OBD-II review

1. Overview

The California Air Resources Board (CARB) began regulation of On Board Diagnostics (OBD) for vehicles sold in California beginning with the 1988 model year. The first phase, OBD-I, required monitoring of the fuel metering system, 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) identifying the specific area of the fault. The OBD system was proposed by CARB to improve air quality by identifying vehicle exceeding emission standards. Passage of the Federal Clean Air Act Amendments in 1990 has also prompted the Environmental Protection Agency (EPA) to develop On Board Diagnostic requirements. CARB OBD-II regulations were followed until 1999 when the federal regulations were used.

The OBD-II system meets government regulations by monitoring the emission control system. When a system or component exceeds emission threshold or a component operates outside tolerance, a DTC will be stored and the MIL

illuminated.

The diagnostic executive is a computer program in the Engine Control Module (ECM) or PowertrainControl Module (PCM) that coordinates the OBD-II self-monitoring system. This program controls all the monitors and interactions, DTC and MIL operation, freeze frame data and scan tool interface.

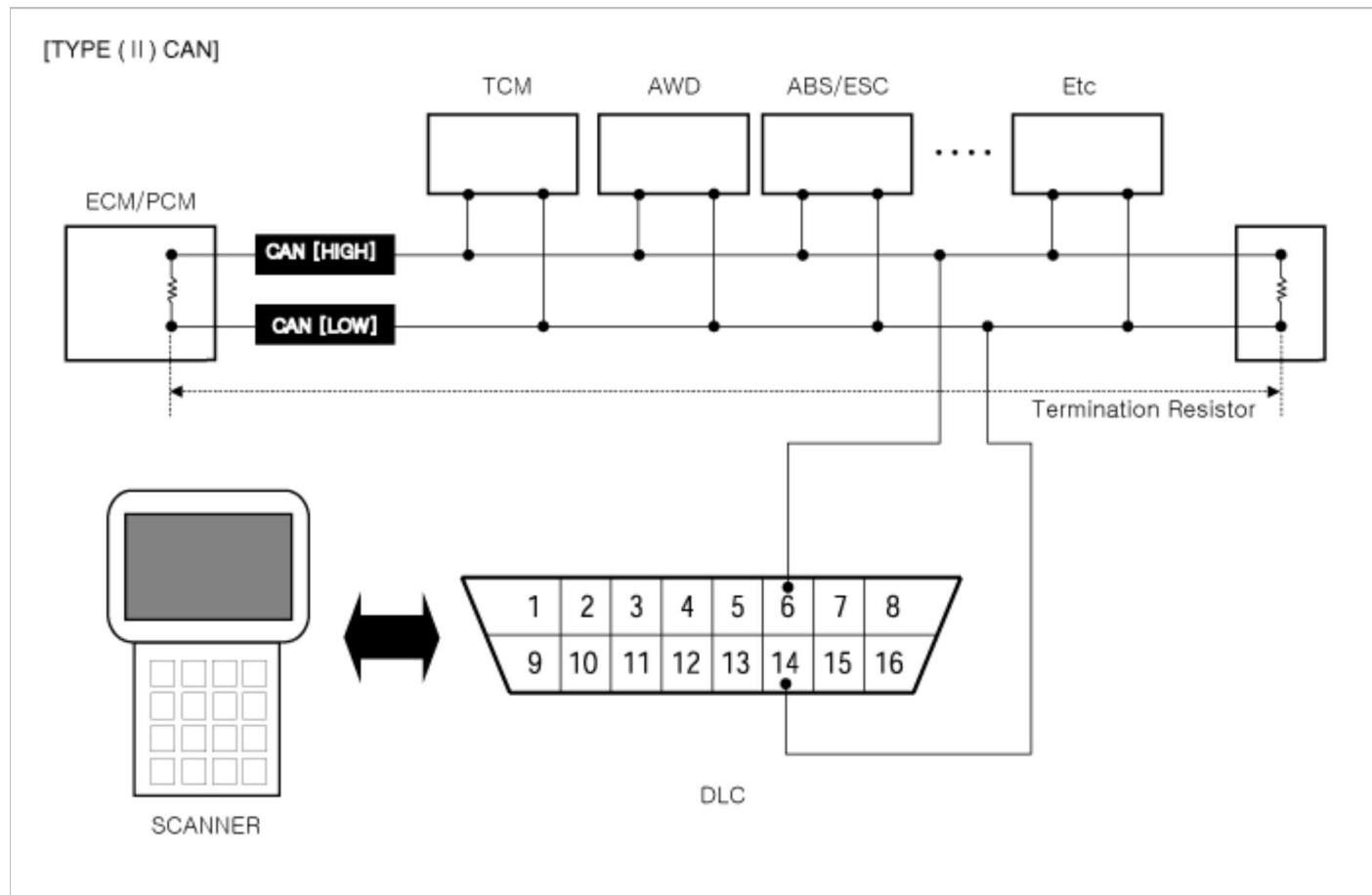
Freeze frame data describes stored engine conditions, such as state of the engine, state of fuel control, spark, RPM, load and warm status at the point the first fault is detected. Previously stored conditions will be replaced only if a fuel or misfire fault is detected. This data is accessible with the scan tool to assist in repairing the vehicle.

The center of the OBD-II system is a microprocessor called the Engine Control Module (ECM) or Powertrain Control Module(PCM).

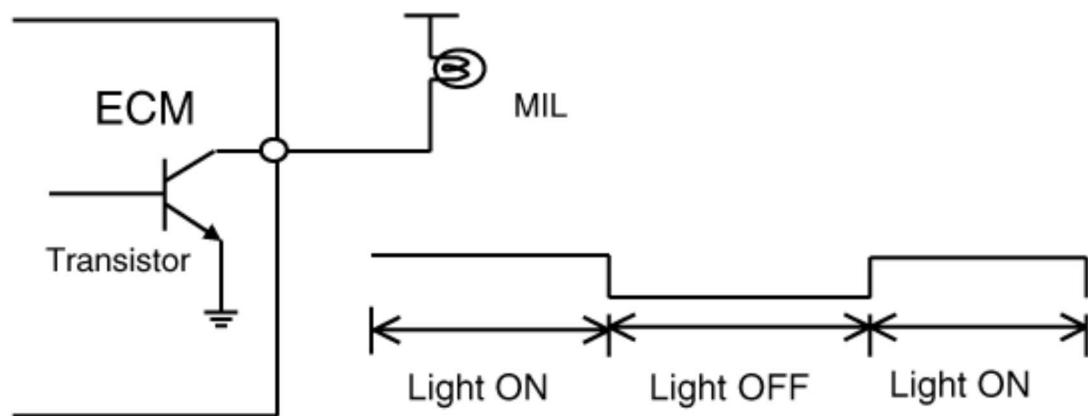
The ECM or PCM receives input from sensors and other electronic components (switches, relays, and others) based on information received and programmed into its memory (keep alive random access memory, and others), the ECM or PCM generates output signals to control various relays, solenoids and actuators.

2. Configuration of hardware and related terms

1) GST (Generic scan tool)



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



The Malfunction Indicator Lamp (MIL) is connected between ECM or PCM-terminal Malfunction Indicator Lamp and battery supply (open collector amplifier).

In most cars, the MIL will be installed in the instrument panel. The lamp amplifier can not be damaged by a short circuit. Lamps with a power dissipation much greater than total dissipation of the MIL and lamp in the tester may cause a fault indication.

- ▷ At ignition ON and engine revolution (RPM)< MIN. RPM, the MIL is switched ON for an optical check by the driver.
- 3) MIL illumination

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

4) MIL elimination

- Misfire and Fuel System Malfunctions:

For misfire or fuel system malfunctions, the MIL may be eliminated if the same fault does not reoccur during monitoring in three subsequent sequential driving cycles in which conditions are similar to those under which the malfunction was first detected.

- All Other Malfunctions:

For all other faults, the MIL may be extinguished after three subsequent sequential driving cycles during which the monitoring system responsible for illuminating the MIL functions without detecting the malfunction and if no other malfunction has been identified that would independently illuminate the MIL according to the requirements outlined above.

5) Erasing a fault code

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

6) Communication Line (CAN)

- Bus Topology : Line (bus) structure
- Wiring : Twisted pair wire
- Off Board DLC Cable Length : Max. 5m
- Data Transfer Rate
- Diagnostic : 500 kbps
- Service Mode (Upgrade, Writing VIN) : 500 or 1Mbps

7) Driving cycle

A driving cycle consists of engine start up, and engine shut off.

8) Warm-up cycle

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

9) Trip cycle

A trip means vehicle operation (following an engine-off period) of duration and driving mode such that all components and

systems are monitored at least once by the diagnostic system except catalyst efficiency or evaporative system monitoring when a steady-speed check is used, subject to the limitation that the manufacturer-defined trip monitoring conditions shall all be encountered at least once during the first engine start portion of the applicable FTP cycle.

10) DTC format

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

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

The following is a list showing what numbers are assigned to each system.

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

The last two numbers of the DTC indicates the component or section of the system where the fault is located.

11) Freeze frame data

When a freeze frame event is triggered by an emission related DTC, the ECM or PCM stores various vehicle information as it existed the moment the fault occurred. 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 occurrence is stored in the freeze frame memory, it will remain there even when the fault occurs 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

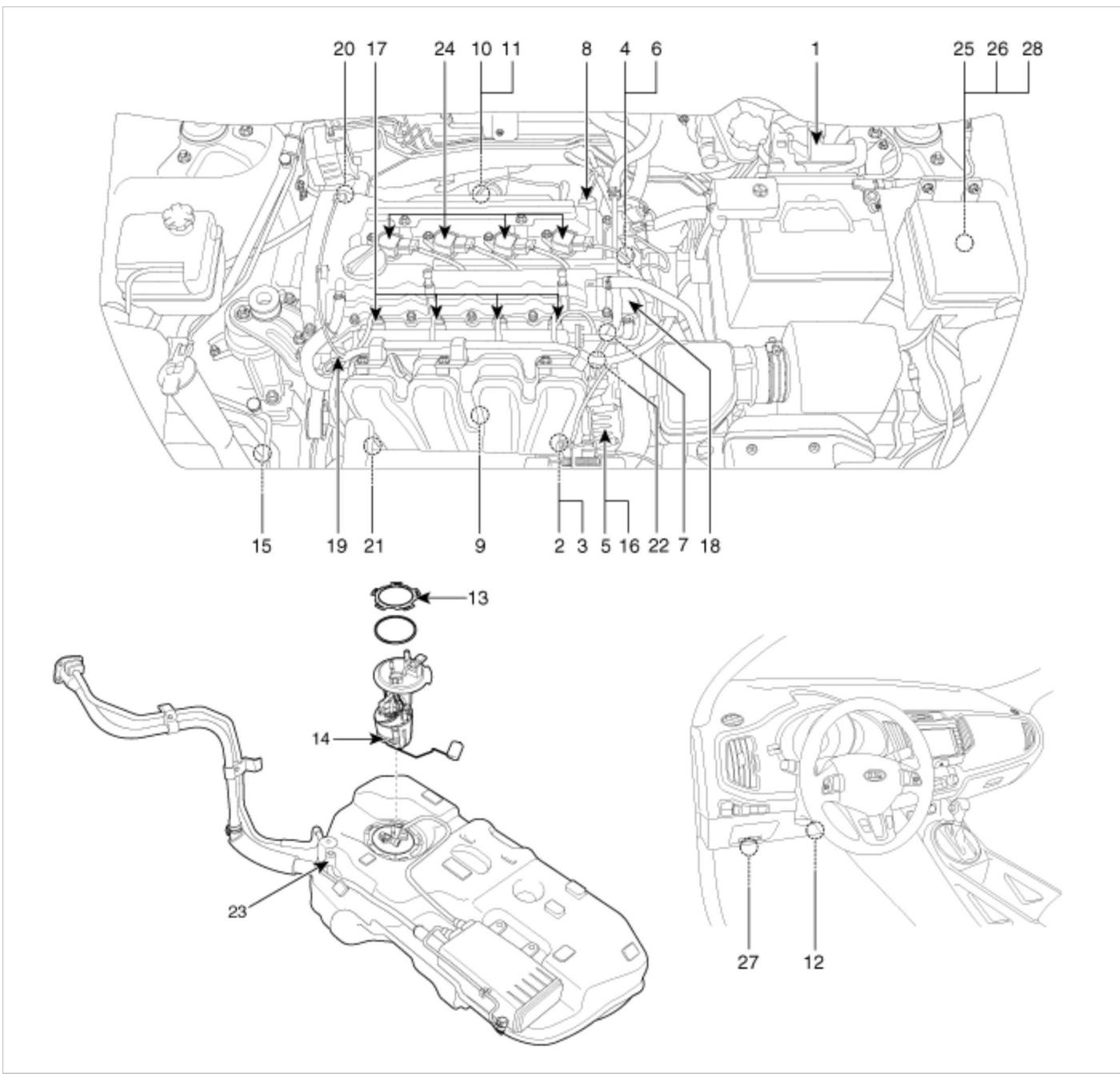
The A/C system monitoring is a self-test strategy within the ECM or PCM that monitors malfunction of all A/C system components at A/C ON.

8) Comprehensive components monitoring

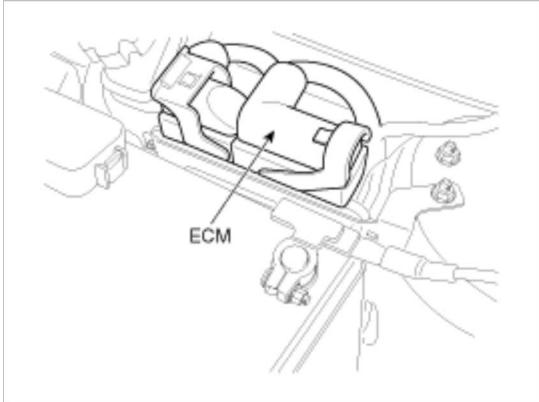
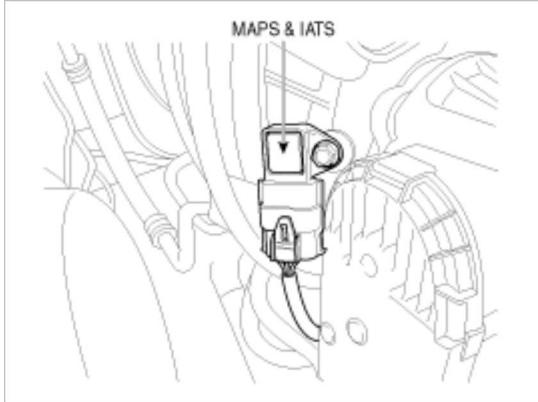
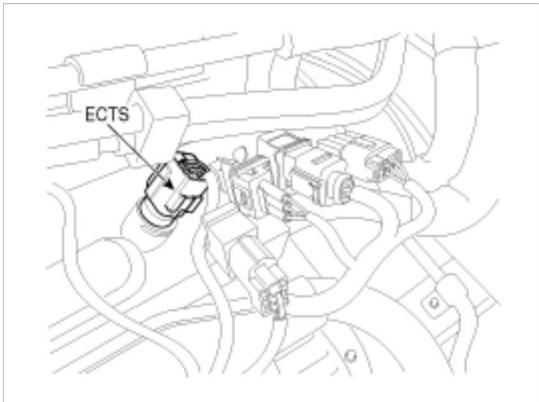
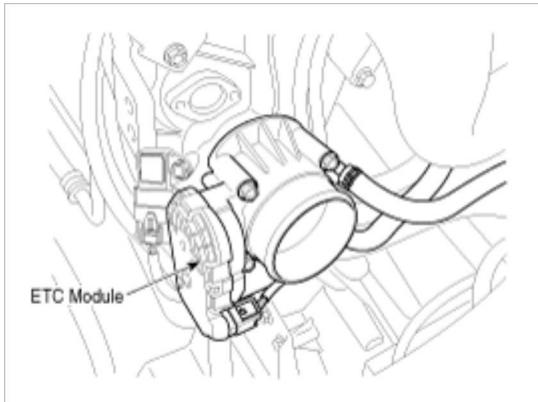
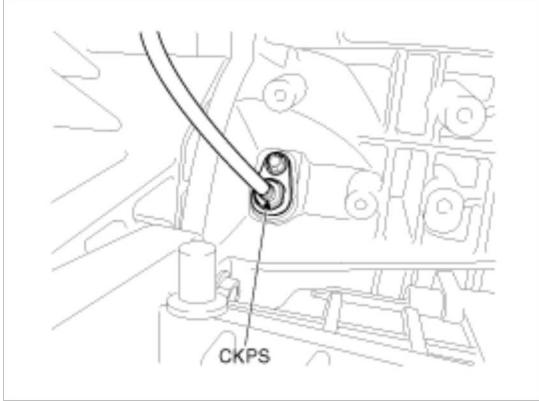
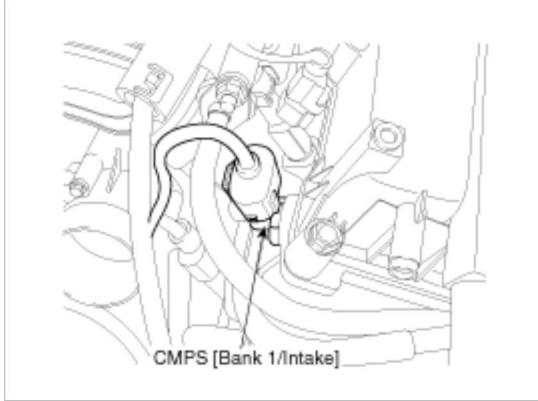
The comprehensive components monitoring is a self-test strategy within the ECM or PCM that detects fault of any electronic powertrain components or system that provides input to the ECM or PCM and is not exclusively an input to any other OBD-II monitor.

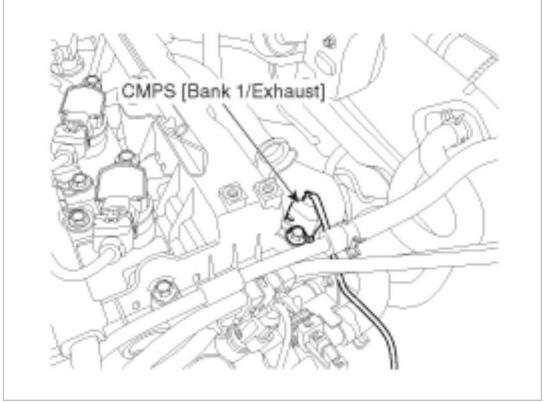
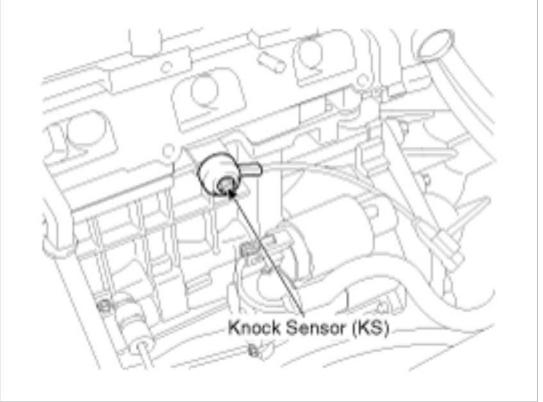
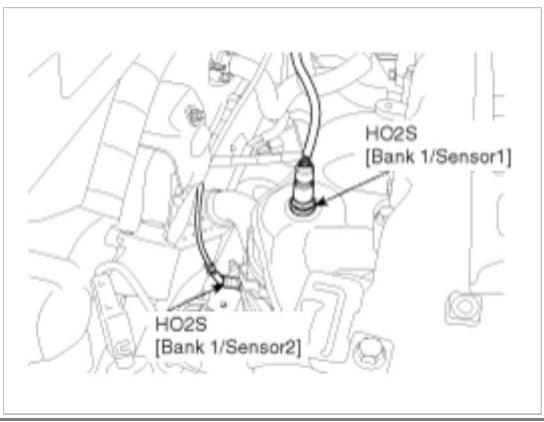
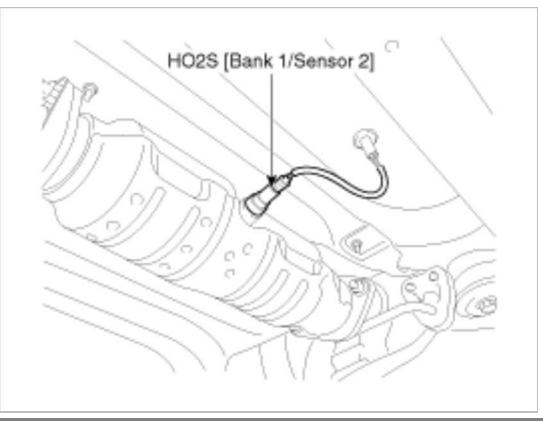
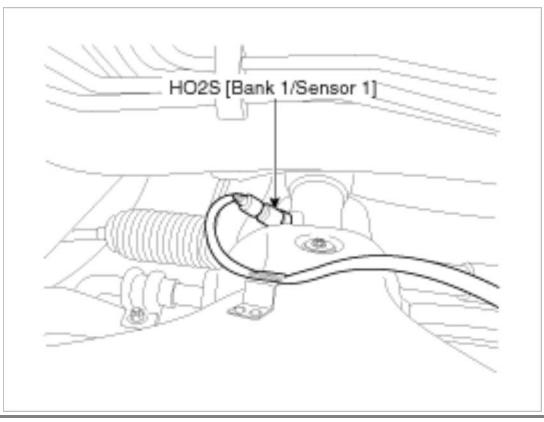
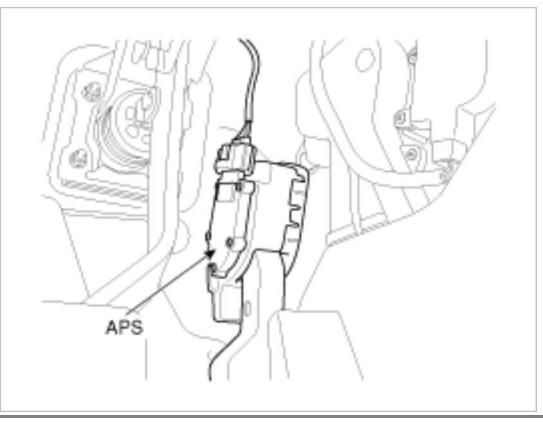
Fuel System > Engine Control System > Components and Components Location

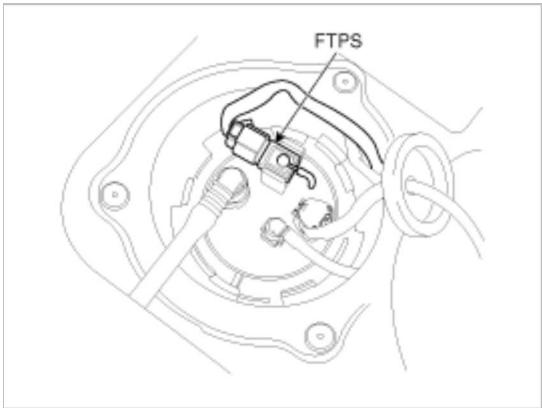
Components Location



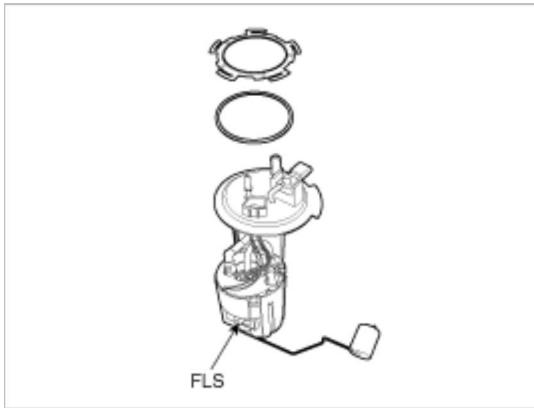
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|--|---|
| 1. Engine Control Module (ECM) | 15. A/C Pressure Transducer (APT) |
| 2. Manifold Absolute Pressure Sensor (MAPS) | 16. ETC Motor [integrated into ETC Module] |
| 3. Intake Air Temperature Sensor (IATS) | 17. Injector |
| 4. Engine Coolant Temperature Sensor (ECTS) | 18. Purge Control Solenoid Valve (PCSV) |
| 5. Throttle Position Sensor (TPS) [integrated into ETC Module] | 19. CVVT Oil Control Valve (OCV) [Bank 1 / Intake] |
| 6. Crankshaft Position Sensor (CKPS) | 20. CVVT Oil Control Valve (OCV) [Bank 1 / Exhaust] |
| 7. Camshaft Position Sensor (CMPS) [Bank 1 / Intake] | 21. Variable Intake Solenoid (VIS) Valve |
| 8. Camshaft Position Sensor (CMPS) [Bank 1 / Exhaust] | 22. Variable Charge Motion Actuator (VCMA) |
| 9. Knock Sensor (KS) | 23. Canister Close Valve (CCV) |
| 10. Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 1] | 24. Ignition Coil |
| 11. Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2] | 25. Main Relay |
| 12. Accelerator Position Sensor (APS) | 26. Fuel Pump Relay |
| 13. Fuel Tank Pressure Sensor (FTPS) | 27. Data Link Connector (DLC) [16-Pin] |
| 14. Fuel Level Sensor (FLS) | 28. 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) 16. 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)

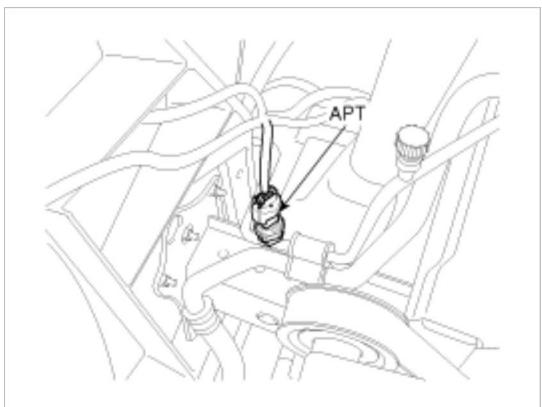
	
10. Heated Oxygen Sensor (HO2S) [SULEV] 11. Heated Oxygen Sensor (HO2S) [SULEV]	10. Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 1] [ULEV]
	
11. Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2] [ULEV]	12. Accelerator Position Sensor (APS)
	
13. Fuel Tank Pressure Sensor (FTPS)	14. Fuel Level Sensor (FLS)



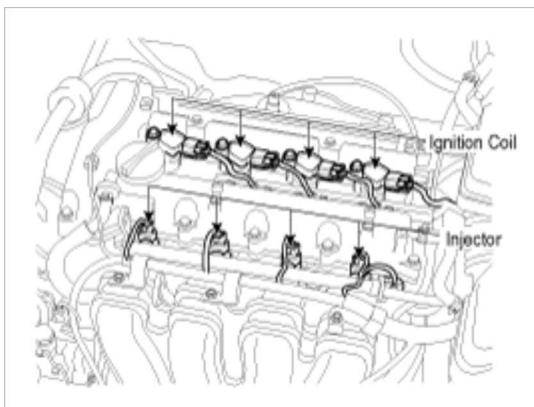
15. A/C Pressure Transducer (APT)



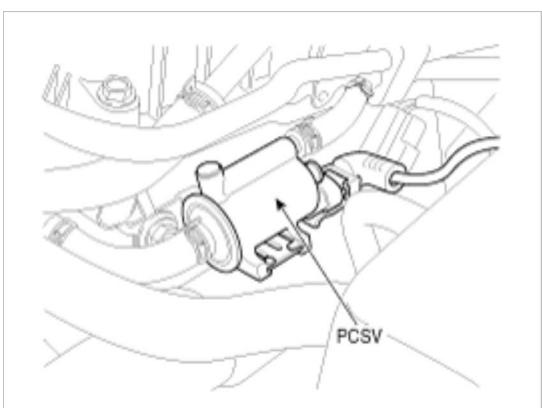
17. Injector
24. Ignition Coil



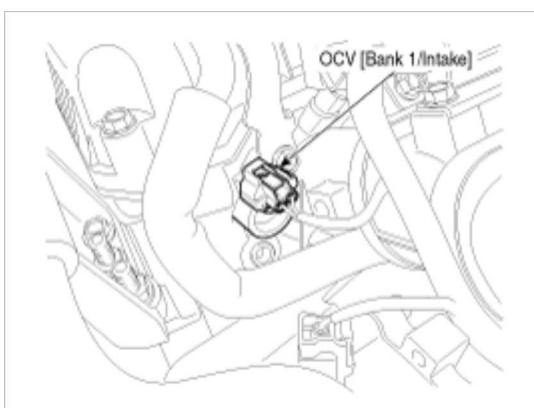
18. Purge Control Solenoid Valve (PCSV)



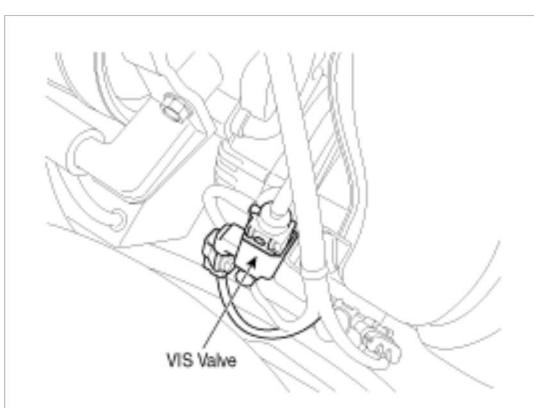
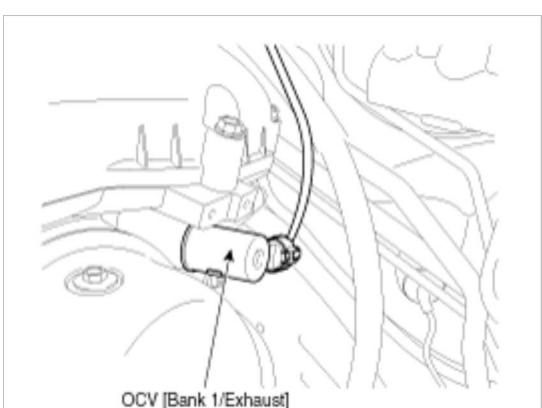
19. CVVT Oil Control Valve (OCV) [Bank 1 / Intake]



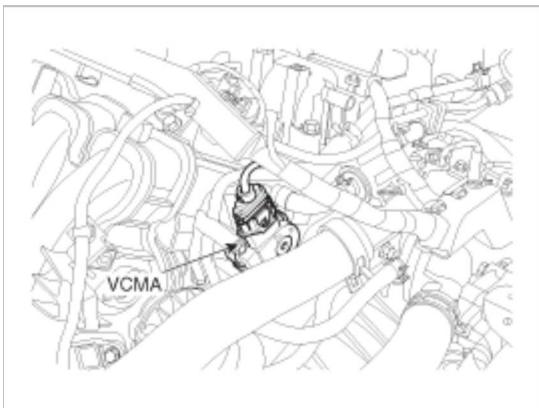
20. CVVT Oil Control Valve (OCV) [Bank 1 / Exhaust]



21. Variable Intake Solenoid (VIS) Valve



22. Variable Charge Motion Actuator (VCMA)

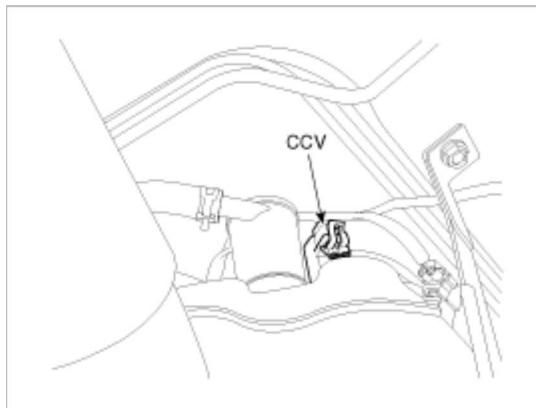


25. Main Relay

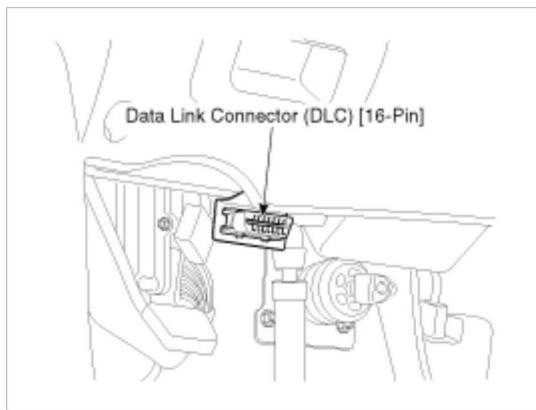
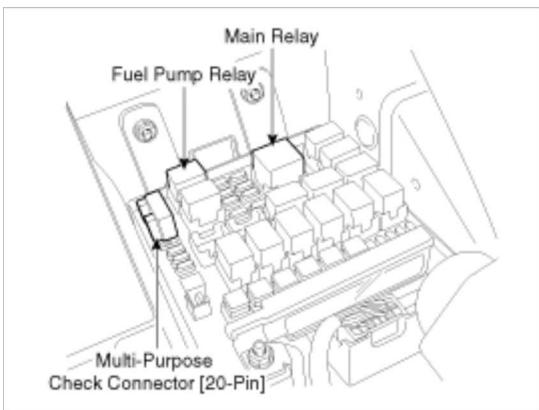
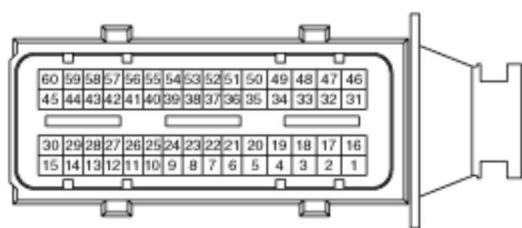
26. Fuel Pump Relay

28. Multi-Purpose Check Connector [20-Pin]

23. Canister Close Valve (CCV)



27. Data Link Connector (DLC) [16-Pin]


Fuel System > Engine Control System > Engine Control Module (ECM) > Schematic Diagrams
ECM Terminal And Input/Output signal


Connector [CHG-A]



Connector [CHG-K]

ECM Terminal Function
Connector [CHG-A]

Pin No.	Description	Connected to
1	Ignition Coil (Cylinder #4) control output	Ignition Coil (Cylinder #4) [With Immobilizer]
	Ignition Coil (Cylinder #1) control output	Ignition Coil (Cylinder #1) [Without Immobilizer]
2	Shield ground	Ignition Coil (Cylinder #1,2,3,4)

3	-	
4	-	
5	-	
6	-	
7	-	
8	-	
9	-	
10	-	
11	-	
12	-	
13	Electrical load [Wiper] signal input	Wiper [Low] Relay
14	Electrical load signal input	Alternator
15	Ground	Cruise Control Switch
16	Ignition Coil (Cylinder #2) control output	Ignition Coil (Cylinder #2) [With Immobilizer]
	Ignition Coil (Cylinder #3) control output	Ignition Coil (Cylinder #3) [Without Immobilizer]
17	-	
18	-	
19	-	
20	-	
21	-	
22	-	
23	-	
24	-	
25	-	
26	-	
27	-	
28	-	
29	Brake Switch 1 signal input	Brake Switch
30	Cruise Control Switch signal input	Cruise Control Switch
31	Ignition Coil (Cylinder #1) control output	Ignition Coil (Cylinder #1) [With Immobilizer]
	Ignition Coil (Cylinder #4) control output	Ignition Coil (Cylinder #4) [Without Immobilizer]
32	-	
33	-	
34	-	
35	-	
36	-	
37	-	
38	-	
39	-	

40	-	
41	-	
42	-	
43	Clutch Switch signal input	Clutch Switch
44	Brake Switch 2 signal input	Brake Switch
45	Motor [+] control output	Variable Charge Motion Actuator (VCMA)
46	Ignition Coil (Cylinder #3) control output	Ignition Coil (Cylinder #3) [With Immobilizer]
	Ignition Coil (Cylinder #2) control output	Ignition Coil (Cylinder #2) [Without Immobilizer]
47	-	
48	-	
49	-	
50	-	
51	-	
52	-	
53	-	
54	-	
55	-	
56	-	
57	-	
58	-	
59	-	
60	Motor [-] control output	Variable Charge Motion Actuator (VCMA)

Connector [CHG-K]

Pin No.	Description	Connected to
1	Power ground	Chassis Ground
2	Battery power (B+)	Ignition Switch
3	Power ground	Chassis Ground
4	Battery power (B+)	Main Relay
5	Power ground	Chassis Ground
6	Battery power (B+)	Battery
7	-	
8	-	
9	Fuel Level Sensor (FLS) signal input	Fuel Level Sensor (FLS)
10	-	
11	-	
12	Knock Sensor (KS) signal input	Knock Sensor (KS)
13	Sensor ground	Accelerator Position Sensor (APS) 2
14	Sensor ground	Engine Coolant Temperature Sensor (ECTS)

15	Camshaft Position Sensor (CMPS) [Bank 1/Exhaust] signal input	Camshaft Position Sensor (CMPS) [Bank 1/Exhaust]
16	-	
17	Crankshaft Position Sensor (CKPS) signal input	Crankshaft Position Sensor (CKPS)
18	Rc/Rp (Pump Cell Voltage)	Heated Oxygen Sensor [Bank 1/Sensor 1]
19	VS+ (NERNST Cell Voltage)	Heated Oxygen Sensor [Bank 1/Sensor 1]
20	VS-/IP- (Common Ground for VS, IP)	Heated Oxygen Sensor [Bank 1/Sensor 1]
21	-	
22	Sensor feedback signal input	Variable Charge Motion Actuator (VCMA)
23	Fuel consumption signal output	Trip Computer
24	-	
25	Injector (Cylinder #1) control output	Injector (Cylinder #1)
26	Injector (Cylinder #3) control output	Injector (Cylinder #3)
27	Injector (Cylinder #4) control output	Injector (Cylinder #4)
28	Injector (Cylinder #2) control output	Injector (Cylinder #2)
29	-	
30	Sensor power (+5V)	Manifold Absolute Pressure Sensor (MAPS)
31	Manifold Absolute Pressure Sensor (MAPS) signal input	Manifold Absolute Pressure Sensor (MAPS)
32	Throttle Position Sensor (TPS) 2 signal input	Throttle Position Sensor (TPS) 2
33	Engine Coolant Temperature Sensor (ECTS) signal input	Engine Coolant Temperature Sensor (ECTS)
34	Sensor ground	Knock Sensor (KS)
35	Accelerator Position Sensor (APS) 2 signal input	Accelerator Position Sensor (APS) 2
36	Sensor power (+5V)	Accelerator Position Sensor (APS) 2
37	Sensor ground	Camshaft Position Sensor (CMPS) [Bank 1/Exhaust]
38	-	
39	Sensor ground	Crankshaft Position Sensor (CKPS)
40	Vehicle speed signal input	ABS/ESP Control Unit
41	-	
42	Rc (Compensative Resistance)	Heated Oxygen Sensor [Bank 1/Sensor 1]
43	Sensor power (+5V)	A/C Pressure Transducer (APT), Fuel Tank Pressure Sensor (FTPS), Variable Charge Motion Actuator (VCMA)
44	Sensor ground	Variable Charge Motion Actuator (VCMA)
45	-	
46	Alternator (COM)	Alternator
47	-	
48	-	
49	-	
50	Variable Intake Solenoid (VIS) Valve control output	Variable Intake Solenoid (VIS) Valve

51	Battery power (B+)	Main Relay
52	Fuel Tank Pressure Sensor (FTPS) signal input	Fuel Tank Pressure Sensor (FTPS)
53	Intake Air Temperature Sensor (IATS) signal input	Intake Air Temperature Sensor (IATS)
54	A/C Pressure Transducer (APT) signal input	A/C Pressure Transducer (APT)
55	-	
56	-	
57	Sensor ground	A/C Pressure Transducer (APT)
58	-	
59	Sensor ground	Throttle Position Sensor (TPS) 1,2
60	Sensor power (+5V)	Accelerator Position Sensor (APS) 1
61	Sensor ground	Accelerator Position Sensor (APS) 1
62	Camshaft Position Sensor (CMPS) [Bank 1/Intake] signal input	Camshaft Position Sensor (CMPS) [Bank 1/Intake]
63	Sensor power (+5V)	Throttle Position Sensor (TPS) 1,2
64	Main Relay control output	Main Relay
65	Cooling Fan Relay [Low] control output	Cooling Fan Relay [Low]
66	CVVT Oil Control (OCV) Valve [Bank 1/Intake] control output	CVVT Oil Control Valve (OCV) [Bank 1/Intake]
67	Purge Control Solenoid Valve (PCSV) control output	Purge Control Solenoid Valve (PCSV)
68	CVVT Oil Control (OCV) Valve [Bank 1/Exhaust] control output	CVVT Oil Control Valve (OCV) [Bank 1/Exhaust]
69	Immobilizer Lamp control output	Immobilizer Lamp [Without Button Engine Start System]
70	Fuel Pump Relay control output	Fuel Pump Relay
71	ETC Motor [+] control output	ETC Motor
72	ETC Motor [-] control output	ETC Motor
73	Sensor ground	Fuel Tank Pressure Sensor (FTPS)
74	Sensor ground	Manifold Absolute Pressure Sensor (MAPS)
75	Immobilizer communication line	Smart key control module [With Button Engine Start System] Immobilizer Control [Without Button Engine Start System]
76	LIN communication signal input	Battery Sensor
77	CAN [High]	Other control module, Data Link Connector (DLC),
78	CAN [Low]	Other control module, Data Link Connector (DLC),
79	-	
80	Throttle Position Sensor (TPS) 1 signal input	Throttle Position Sensor (TPS) 1
81	-	
82	Accelerator Position Sensor (APS) 1 signal input	Accelerator Position Sensor (APS) 1
83	Sensor ground	Camshaft Position Sensor (CMPS) [Bank 1/Intake]

84	Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2] signal input	Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2]
85	Sensor ground	Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2]
86	Engine speed signal output	Power Distribution Module (PDM)
87	A/C Compressor Relay control output	A/C Compressor Relay
88	Cooling Fan Relay [High] control output	Cooling Fan Relay [High]
89	-	
90	-	
91	Canister Close Valve (CCV) control output	Canister Close Valve (CCV)
92	Malfunction Indicator Lamp (MIL) control output	Malfunction Indicator Lamp (MIL)
93	Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 1] Heater control output	Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 1]
94	Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2] Heater control output	Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2]

ECM Terminal Input/ Output signal**Connector [CHG-A]**

Pin No.	Description	Condition	Type	Level	Test Result
1	Ignition Coil (Cylinder #4) control output [With Immobilizer]	Idle	Pulse	1st Voltage: 300~400V	416V
	Ignition Coil (Cylinder #1) control output [Without Immobilizer]			ON Voltage: Max. 2.0V	1.4V
2	Shield	Idle	DC	Frequency	5.2Hz
3	-	Dwell Time	2.78ms		
4	-				
5	-				
6	-				
7	-				
8	-				
9	-				
10	-				
11	-				
12	-				
13	Electrical load [Wiper] signal input				
14	Alternator (FR)	Idle	Pulse	HI: Battery Voltage	13.4V
				LO: Max 1.5V	40 mV
15	Ground	Idle	DC	Max. 50 mV	
16	Ignition Coil (Cylinder #2) control output [With Immobilizer]	Idle	Pulse	1st Voltage: 300~400V	416V
				ON Voltage: Max. 2.0V	1.3V
	Ignition Coil (Cylinder #3) control			Frequency	5.2Hz

	output [Without Immobilizer]			Dwell Time	2.73ms
17	-				
18	-				
19	-				
20	-				
21	-				
22	-				
23	-				
24	-				
25	-				
26	-				
27	-				
28	-				
29	Brake Switch 1 signal input	Brake ON	DC	Battery Voltage	
		Brake OFF		Max. 0.5 V	
30	Cruise control Switch signal input	Cruise ON	DC	Battery Voltage	
		Cruise OFF		4.3 ~ 4.7V	
31	Ignition Coil (Cylinder #1) control output [With Immobilizer]	Idle	Pulse	1st Voltage: 300~400V	408V
	ON Voltage: Max. 2.0V			1.6V	
	Frequency			5.2Hz	
	Ignition Coil (Cylinder #4) control output [Without Immobilizer]			Dwell Time	2.74ms
32	-				
33	-				
34	-				
35	-				
36	-				
37	-				
38	-				
39	-				
40	-				
41	-				
42	-				
43	Clutch Switch signal input	Release	DC	Max. 0.5V	
		Push		Battery Voltage	
44	Brake Switch 2 signal input	Push	DC	Max. 0.5V	
		Normal		Battery Voltage	
45	Motor [+] control output	Engine Run	PWM	High: Battery Voltage	
				Low: Max. 0.5V	
				Duty: 50%	

46	Ignition Coil (Cylinder #3) control output [With Immobilizer]	Idle	Pulse	1st Voltage: 300~400V	410V		
				ON Voltage: Max. 2.0V	1.5V		
	Ignition Coil (Cylinder #2) control output [Without Immobilizer]			Frequency	5.2Hz		
				Dwell Time	2.78ms		
47	-						
48	-						
49	-						
50	-						
51	-						
52	-						
53	-						
54	-						
55	-						
56	-						
57	-						
58	Power Steering Pressure Switch signal input	S/W ON	DC	Max. 0.5V			
		S/W OFF		Battery Voltage			
59	-						
60	Motor [-] control output	Engine Run	PWM	High: Battery Voltage			
				Low: Max. 0.5V			
				Duty: 50%			

Connector [CHG-K]

Pin No.	Description	Condition	Type	Level	Test Result
1	Power ground	Idle	DC	Max. 50mV	
2	Battery power (B+)	IG OFF	DC	Max. 0.5V	10.2mV
		IG ON		Battery Voltage	12.02V
3	Power ground	Idle	DC	Max. 50mV	2.8mV
4	Battery power (B+)	IG OFF	DC	Max. 1.0V	3.1mV
		IG ON		Battery Voltage	12.1V
5	Power ground	Idle	DC	Max. 50mV	1.8mV
6	Battery power (B+)	Always (Without Ignition key)	Current	Below 2.0 mA	0.4 mA
			DC	Battery Voltage	12.88V
7	-				
8	Fuel Level Sensor (FLS) [MIDDLE] signal input	IG ON	Analog	0.88 ~ 8.45V	
9	Fuel Level Sensor (FLS) [TOTAL] signal input	IG ON	Analog	0.88 ~ 8.45V	
10	-				

11	-				
12	Knock Sensor (KS) signal input	Knocking	Variable Frequency	-0.3 ~ 0.3V	
		Normal		0 V	
13	Sensor ground	Idle	DC	Max. 50mV	30mV
14	Sensor ground	Idle	DC	Max. 50mV	12.4mV
15	Camshaft Position Sensor (CMPS) [Bank 1/Exhaust] signal input	Idle	Pulse	HI: Vcc or Battery Voltage	5.0V
				LO: Max. 0.5V	0.2V
				FREQ: 5.36Hz	
16	Sensor ground	Idle	DC	Max. 50mV	29.0mV
17	Crankshaft Position Sensor (CKPS) signal input	Idle	Pulse	HI: Vcc or Battery Voltage	5.00V
				LO: Max. 0.5V	40mV
				FREQ: 600Hz	
18	Rc/Rp (Pump Cell Voltage)	Idle	Analog	Normal: 450±50 mV Rich: Max. Normal+150 mV Lean: Min. Normal-150 mV	
19	VS+ (NERNST Cell Voltage)	Idle	Analog	Normal: 450±50 mV Rich: Max. Normal+150 mV Lean: Min. Normal-150 mV	
20	VS-/IP- (Common Ground for VS, IP)	Idle	Analog	Reference for V_IP, V_N	
21	Sensor feedback signal input	Idle	DC	0.5 ~ 4.5V	
22	-				
23	Fuel consumption signal output	Idle	Pulse	HI: Battery Voltage	13.7V
				LO: Max. 0.5V	0V
				Frequency	3.33Hz
				Pulse Width	500µs
24	-				
25	Injector (Cylinder #1) control output	Idle	Pulse	HI: Battery Voltage	13.8V
				LO: Max. 1.0V	200mV
				Vpeak: Max. 80V	54.1V
				Frequency	5.21Hz
				Dwell Time	2.74ms
26	Injector (Cylinder #3) control output	Idle	Pulse	HI: Battery Voltage	13.9V
				LO: Max. 1.0V	170mV
				Vpeak: Max. 80V	53.9V
				Frequency	5.18Hz
				Dwell Time	2.73ms
27	Injector (Cylinder #4) control output	Idle	Pulse	HI: Battery Voltage	14V
				LO: Max. 1.0V	160mV
				Vpeak: Max. 80V	54.3V
				Frequency	5.24Hz

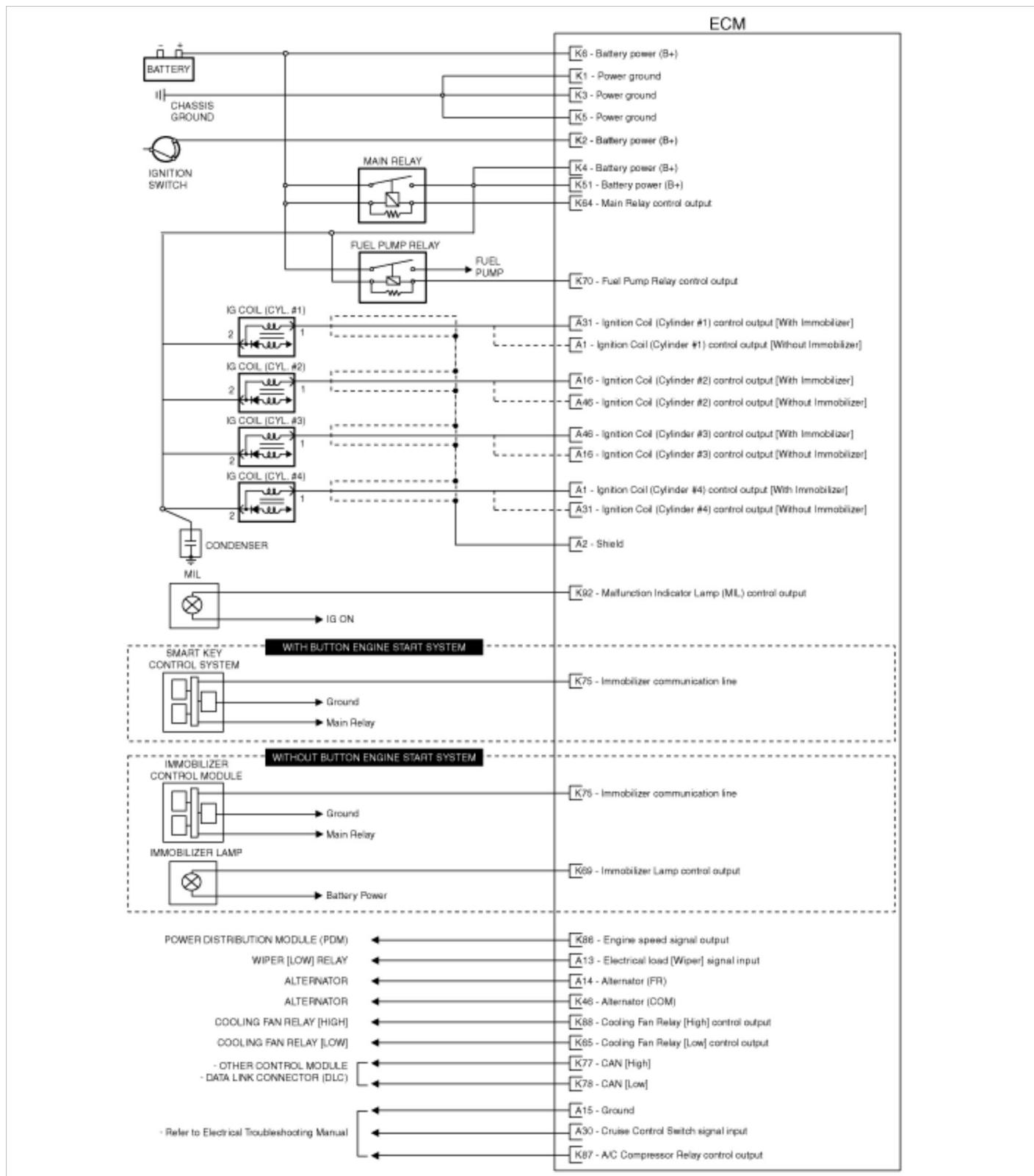
				Dwell Time	2.70ms
28	Injector (Cylinder #2) control output	Idle	Pulse	HI: Battery Voltage	14.1V
				LO: Max. 1.0V	160mV
				Vpeak: Max. 80V	53.9V
				Frequency: 5.21Hz	5.21Hz
				Dwell Time: 2.73ms	2.74ms
29	-				
30	Sensor power (+5V)	IG OFF	DC	Max. 0.5V	0mV
		IG ON		4.9 ~ 5.1V	4.98V
31	Manifold Absolute Pressure Sensor (MAPS) signal input	Idle	Analog	0.8 ~ 1.6V	1.37V
32	Throttle Position Sensor (TPS) 2 signal input	C.T	Analog	4.2 ~ 5.0V	4.52V
		W.O.T		3.3 ~ 3.8V	3.68V
33	Engine Coolant Temperature Sensor (ECTS) signal input	Idle	Analog	0.5 ~ 4.5V	1.02V
34	Sensor ground	Idle	DC	Max. 50mV	8mV
35	Accelerator Position Sensor (APS) 2 signal input	C.T	Analog	Max. 1.0V	0.4V
		W.O.T		1.5 ~ 3.0V	1.9V
36	Sensor power (+5V)	IG OFF	DC	Max. 0.5V	5mV
		IG ON		4.9 ~ 5.1V	5.02V
37	Sensor ground	Idle	DC	Max. 50mV	11mV
38	-				
39	Sensor ground	Idle	DC	Max. 50mV	11mV
40	Vehicle speed signal input	Vehicle Run	Pulse	HI: Min. 4.5V	5.0V
				LO: Max. 0.5V	0V
				Frequency	46.9Hz at Idle
				Duty(-)	50.4% at Idle
41	-				
42	Rc (Compensative Resistance)	Idle	Analog	$ Rc-Rc/Rp < \pm 0.1V$	
43	Sensor power (+5V)	IG OFF	DC	Max. 0.5V	
		IG ON		4.9 ~ 5.1V	
44	Sensor ground	Always	DC	0 ~ 0.5V	5mV
45	-				
46	Alternator (COM)				
47	-				
48	-				
49	-				
50	Variable Intake Solenoid (VIS) Valve control output	Active	DC	Max. 1.0V	316mV
		Inactive		Battery Voltage	14.0V
51	Battery power (B+)	IG OFF	DC	Max. 1.0V	3.1mV

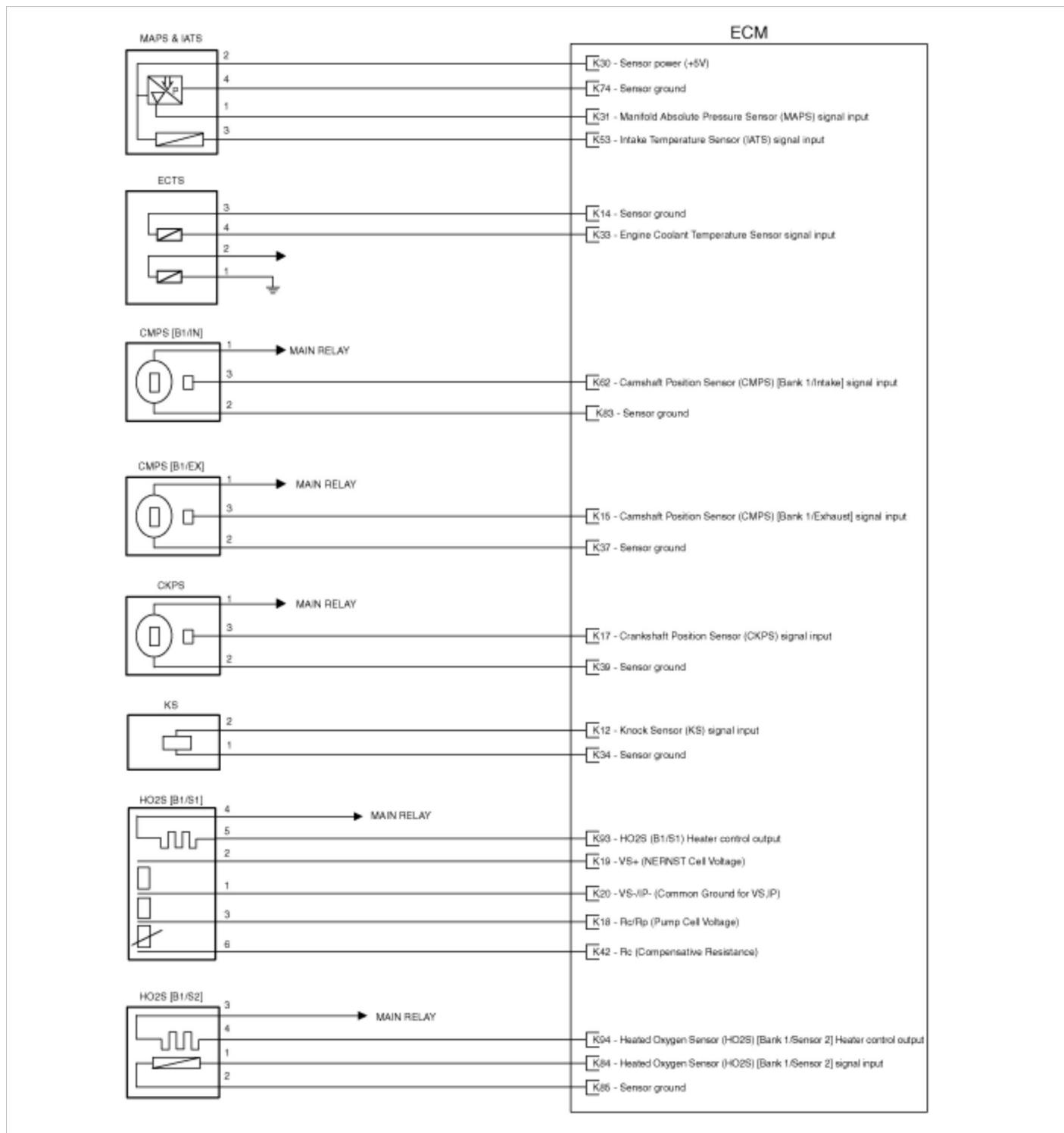
		IG ON		Battery Voltage	12.3V
52	Fuel Tank Pressure Sensor (FTPS) signal input	Idle	Analog	0.4 ~ 4.6V	
53	Intake Air Temperature Sensor (IATS) signal input	Idle	Analog	0 ~ 5.0V	2.55V
54	A/C Pressure Transducer (APT) signal input	Idle	DC	0.4 ~ 4.6V	A/C OFF: 1.29V A/C ON: 2.01V
55	-				
56	-				
57	Sensor ground	Idle	DC	Max. 50mV	11mV
58	-				
59	Sensor ground	Idle	DC	Max. 50mV	6mV
60	Sensor power (+5V)	IG OFF	DC	Max. 0.5V	10mV
		IG ON		4.9 ~ 5.1V	5.02V
61	Sensor ground	Idle	DC	Max. 50mV	30mV
62	Camshaft Position Sensor (CMPS) [Bank 1/Intake] signal input	Idle	Pulse	Hi: Vcc or Battery Voltage	5.0V
				LO: Max. 0.5V	0.2V
				Frequency	5.2Hz
63	Sensor power (+5V)	IG OFF	DC	Max. 0.5V	0V
		IG ON		4.9 ~ 5.1V	5.03V
64	Main Relay control output	Relay OFF	DC	Battery Voltage	12.3V
		Relay ON		Max. 1.0V	730mV
65	Cooling Fan Relay [Low] control output	A/C ON	Pulse	Hi: Battery Voltage	10.4V
				LO: 0 ~ 0.5V	60mV
66	CVVT Oil control (OCV) Valve [Bank 1/Intake] control output	Idle	Pulse	Hi: Battery Voltage	15.0V
				LO: Max. 1.0V	120mV
				Frequency	300Hz
				Duty(+)	84.70%
67	Purge control Solenoid Valve (PCSV) control output	Inactive Active	Pulse	Hi: Battery Voltage	14.3V
				LO: Max. 1.0V	80mV
				Vpeak: Max. 70V	57.0V
				Frequency	16Hz
68	CVVT Oil control (OCV) Valve [Bank 1/Exhaust] control output	Idle	Pulse	Hi: Battery Voltage	13.5V
				LO: Max. 1.0V	100mV
				Vpeak: Max. 70V	13.5V
				Frequency	300Hz
69	Immobilizer Lamp control output	Lamp OFF	DC	Hi: Battery Voltage	13.2V
		Lamp ON		LO: Max. 2.0V	40mV
70	Fuel Pump Relay control output	Relay OFF	DC	Battery Voltage	12.8V

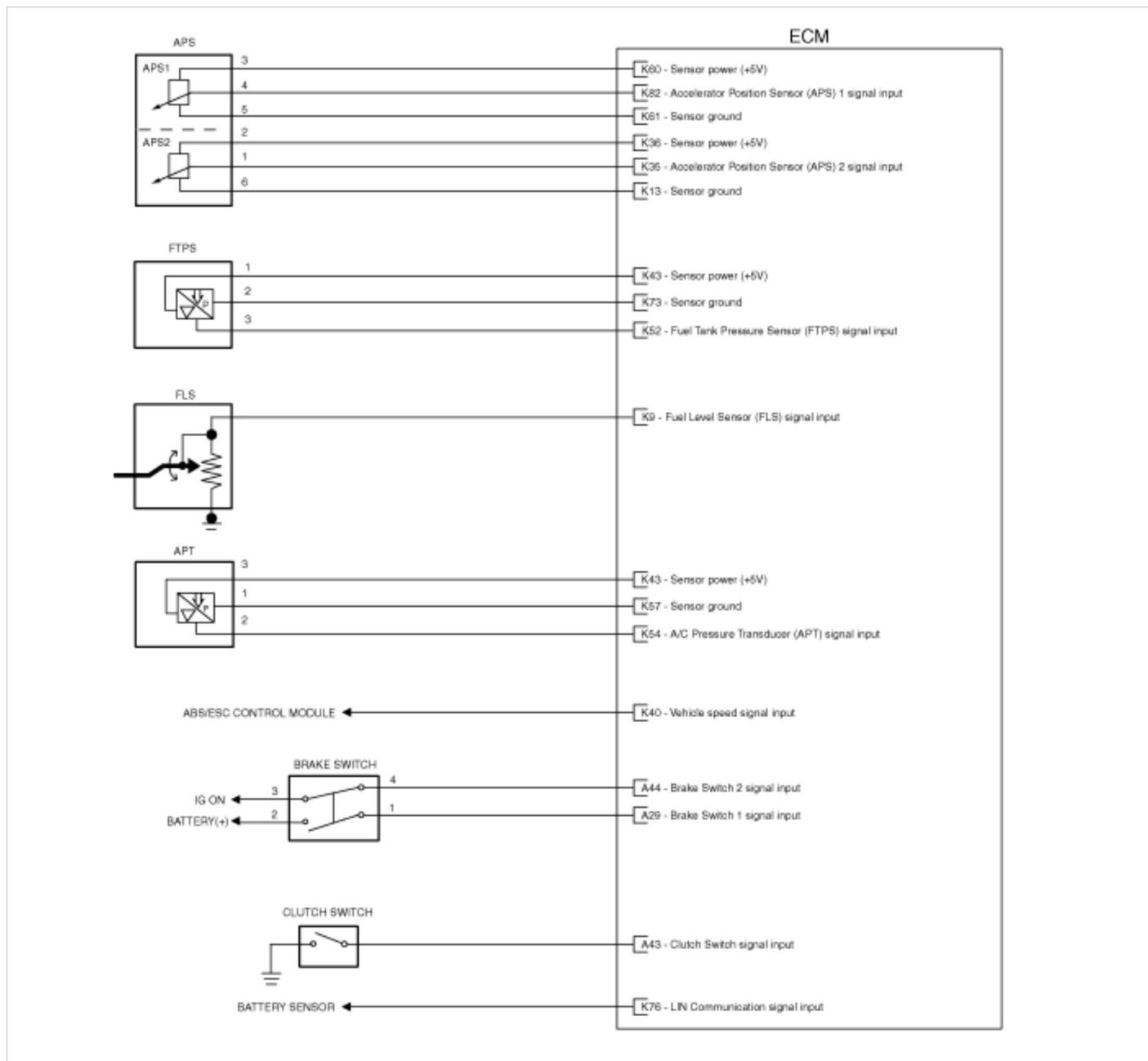
		Relay ON		Max. 1.0V	40mV
71	ETC Motor [+] control output	Idle	Pulse	Hi: Battery Voltage	13.4V
				LO: Max . 1.0V	0V
72	ETC Motor [-] control output	Idle	Pulse	Hi: Battery Voltage	13.3V
				LO: Max . 1.0V	0V
73	Sensor ground	Idle	DC	Max. 50mV	
74	Sensor ground	Idle	DC	Max. 50mV	7mV
75	Immobilizer communication line	During communicating	Pulse	Hi: Min. 8.5V	11.8V
				LO: Max. 3.5V	1.0V
76	LIN communication signal input				
77	CAN [High]	Recessive	Pulse	2.0 ~ 3.0V	2.58V
		Dominant		2.75~4.5V	3.54V
78	CAN [Low]	Recessive	Pulse	2.0 ~ 3.0V	2.64V
		Dominant		0.5~2.25V	1.52V
79	-				
80	Throttle Position Sensor (TPS) 1 signal input	C.T	Analog	0.3 ~ 0.9 V	0.65V
		W.O.T		1.5 ~ 3.0 V	1.63V
81	-				
82	Accelerator Position Sensor (APS) 1 signal input	C.T	Analog	Max. 1.0V	0.8V
		W.O.T		Min. 4.0V	4.0V
83	Sensor ground	Idle	DC	Max. 50 mV	12mV
84	Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2] signal input	Idle	DC	Rich: 0.6 ~ 1.0V	74 mV
				Lean: Max. 0.4V	70mV
85	Sensor ground	Idle	DC	Max. 50 mV	10 mV
86	Engine speed signal output	Idle	Pulse	Hi: Battery Voltage	14.0V
				LO: Max. 0.5V	60mV
				Frequency: 20~26Hz	21Hz
				Duty(+)	50%
87	A/C Compressor Relay control output	A/C OFF	DC	Battery Voltage	14.3 V
		A/C ON		Max. 1.0V	102mV
88	Cooling Fan Relay [High] control output	Relay OFF	DC	Battery Voltage	
		Relay ON		Max. 1.0V	
89	-				
90	-				
91	Canister Close Valve (CCV) control output	Active Inactive	Pulse	High: Battery Voltage	13.0V
				Low: Max. 1.0V	20mV
				V peak: Max. 70V	57.7V
92	Malfunction Indicator Lamp (MIL) control output	Lamp OFF	DC	Battery Voltage	13.8V
		Lamp ON		Max. 1.0V	54mV

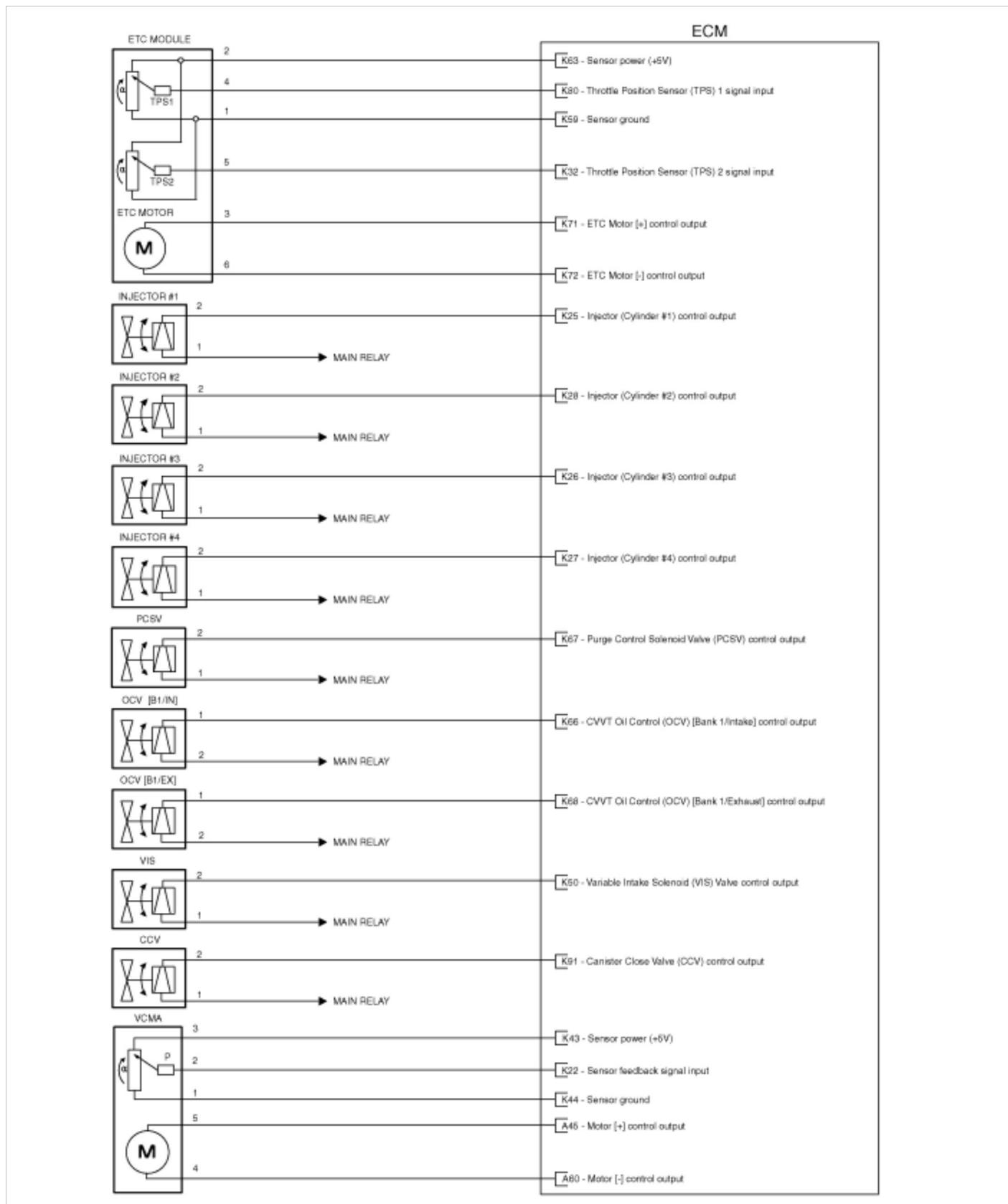
				Hi: Battery Voltage	14.4V
93	Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 1] Heater control output	Engine Run	Pulse	LO: Max. 1.0V	0.36V
				Frequency	10.0Hz
				Duty(+)	58.30%
94	Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2] Heater control output	Engine Run	Pulse	Hi: Battery Voltage	14.0V
				LO: Max. 1.0V	0.31V
				Frequency	7.68Hz
				Duty(+)	53.9%

Circuit Diagram









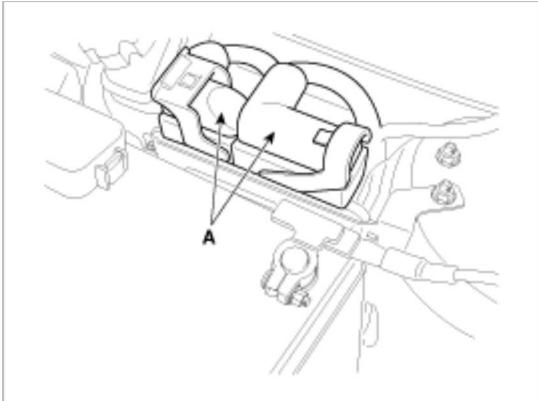
Fuel System > Engine Control System > Engine Control Module (ECM) > Repair procedures

Removal

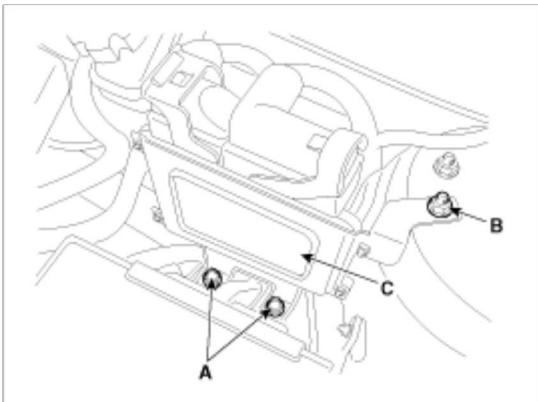
NOTE

In the case of the vehicle equipped with immobilizer or button engine start system, perform "Key Teaching" procedure together (Refer to "Immobilizer" or "Button Engine Start System in BE group").

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 EE group).
4. Remove the mounting bolts (A) and a nut (B), and then remove the ECM (C).



Installation

NOTE

In the case of the vehicle equipped with immobilizer or button engine start system, perform "Key Teaching" procedure together (Refer to "Immobilizer" or "Button Engine Start System in BE group").

1. Installation is reverse of removal.

ECM installation bolt:

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

ECM Problem Inspection Procedure

- 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.
- 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 specification below.

swapping the ECM with a new one, and then check the vehicle again. If DTC's were found, examine this first before swapping ECM.

- 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).

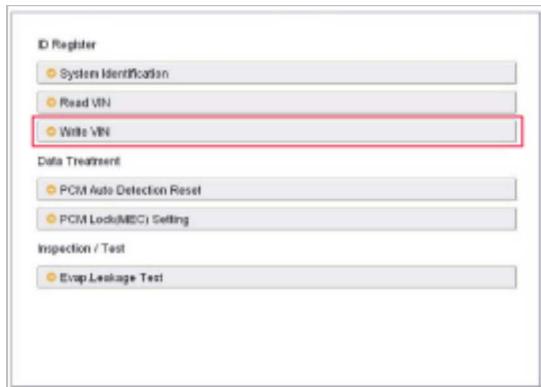
VIN Programming Procedure

VIN (Vehicle Identification Number) is a number that has the vehicle's information (Maker, Vehicle Type, Vehicle Line/Series, Body Type, Engine Type, Transmission Type, Model Year, Plant Location and so forth. For more information, please refer to the group "GI" in this SERVICE MANUAL). When replacing an ECM, the VIN must be programmed in the ECM. If there is no VIN in ECM memory, the fault code (DTC P0630) is set.

CAUTION

The programmed VIN cannot be changed. When writing the VIN, confirm the VIN carefully

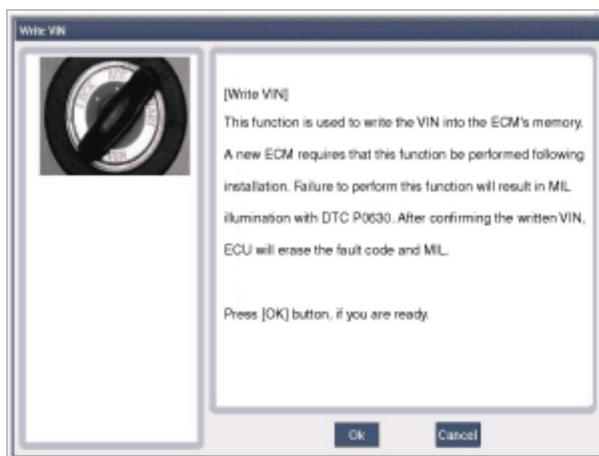
- Select "VIN Writing" function in "Vehicle S/W Management".
- Select "Write VIN" in "ID Register".



- Input the VIN.

WARNING

Before inputting the VIN, confirm the VIN again because the programmed VIN cannot be changed.

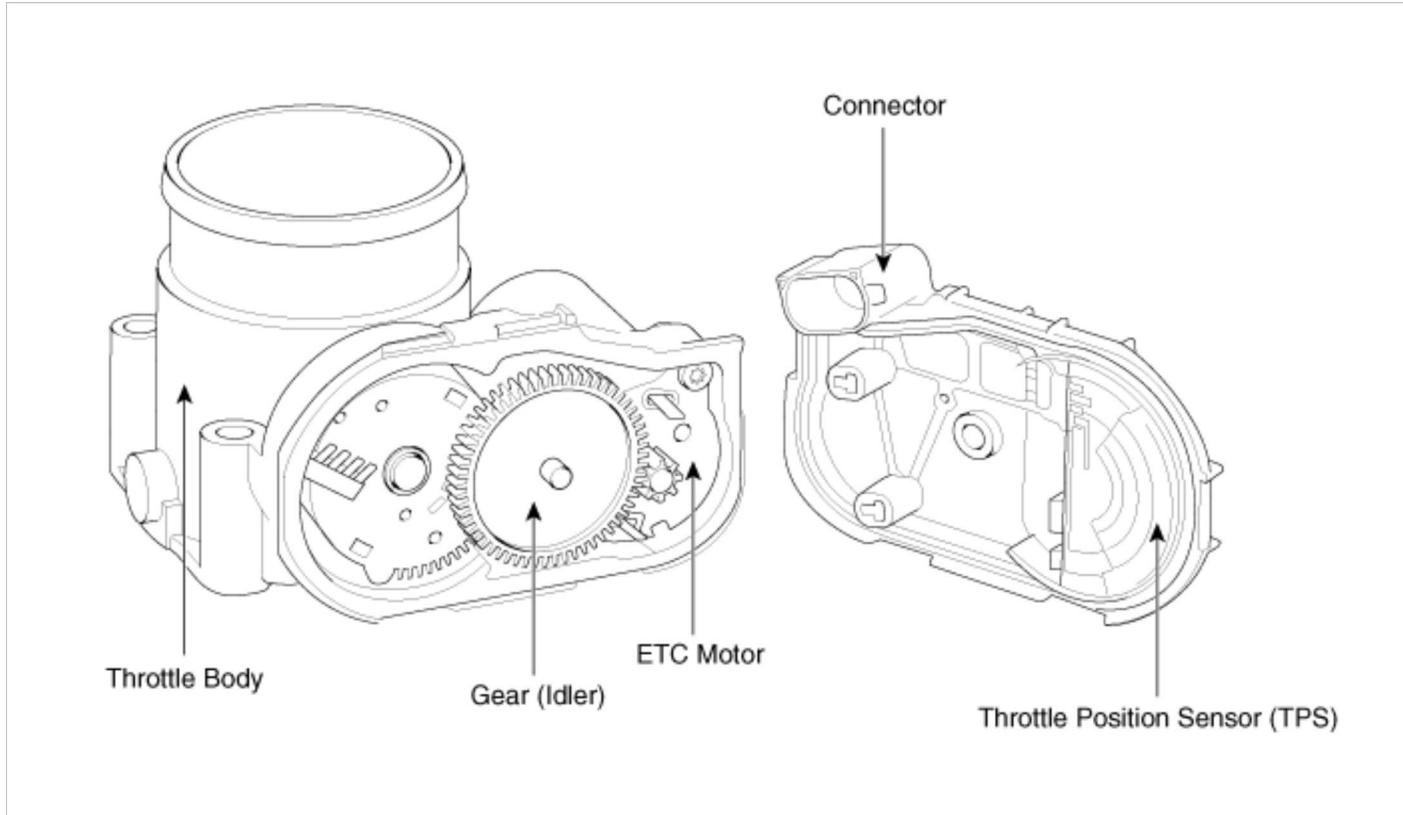
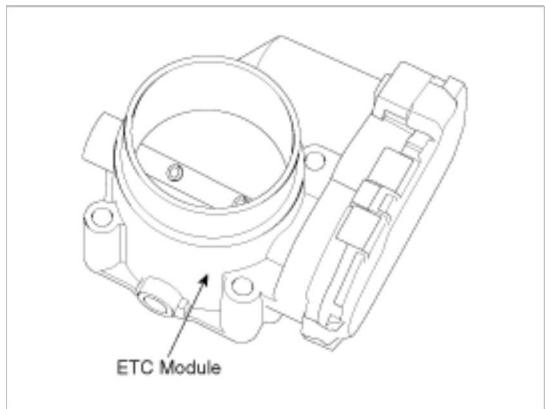


- Turn the ignition switch OFF, then back ON.

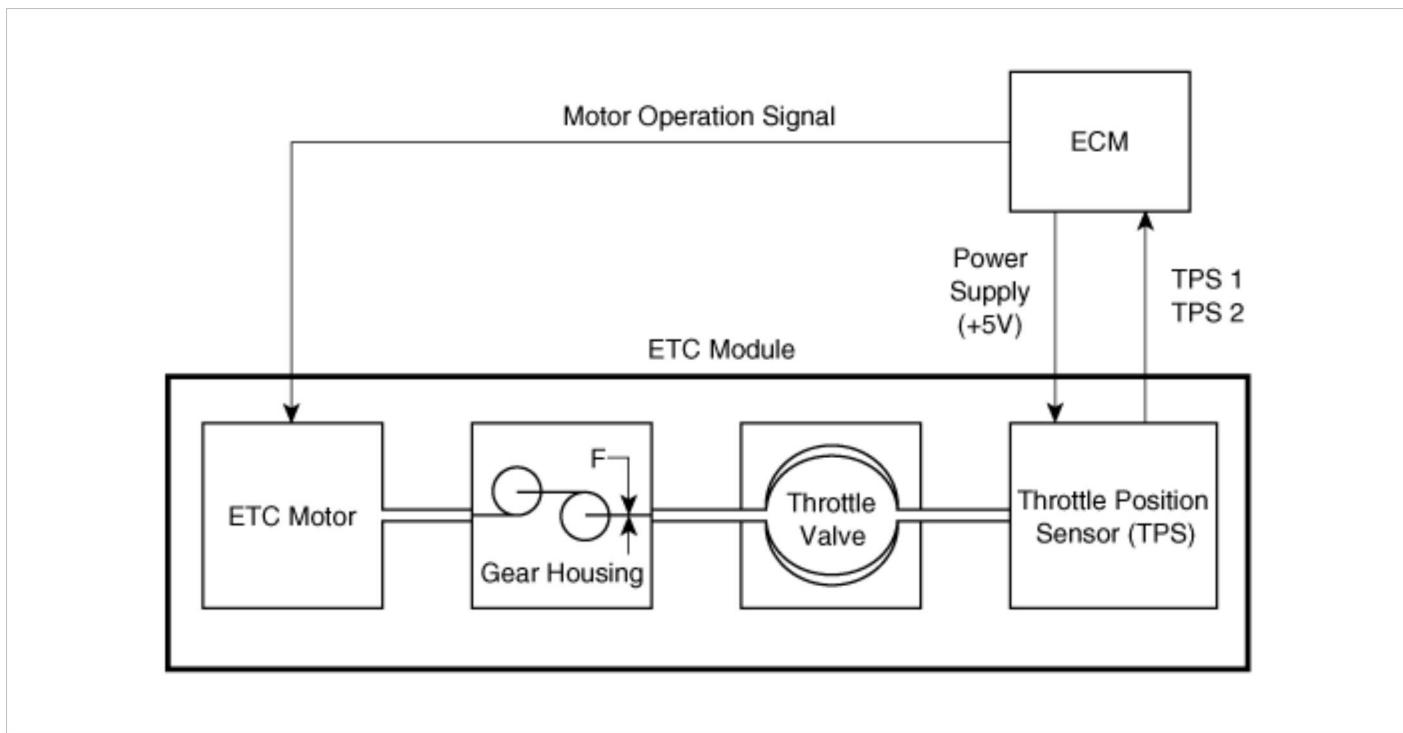
Fuel System > Engine Control System > ETC (Electronic Throttle Control) System > Description and Operation

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.



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 5°	
TPS	TPS 1 fault	Replace it with TPS 2
	TPS 2 fault	Replace it with TPS 1
	TPS 1,2 fault	Throttle valve stuck at 5°
APS	APS 1 fault	Replace it with APS 2
	APS 2 fault	Replace it with APS 1
	APS 1,2 fault	Throttle valve stuck at 5°

NOTE

When throttle value is stuck at 5°, engine speed is limited at below 1,500rpm and vehicle speed at maximum 40 ~ 50 km/h (25 ~ 31 mph)

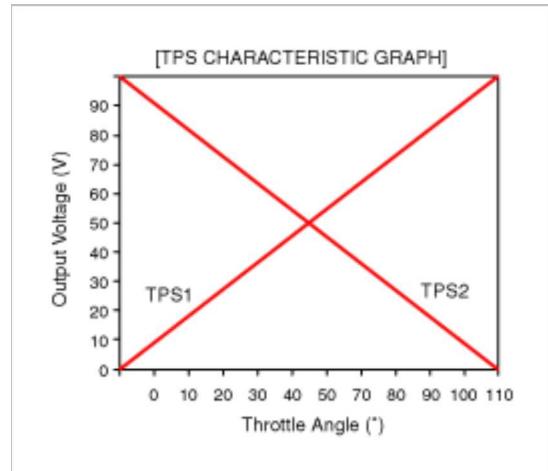
Fuel System > Engine Control System > ETC (Electronic Throttle Control) System > Specifications

Specification

[Throttle Position Sensor (TPS)]

Throttle Angle(°)	Output Voltage(V)	
	TPS1	TPS2

0	0.0	5.0
10	0.48	4.52
20	0.95	4.05
30	1.43	3.57
40	1.90	3.10
50	2.38	2.62
60	2.86	2.14
70	3.33	1.67
80	3.81	1.19
90	4.29	0.71
100	4.76	0.24
105	5.0	0
C.T (6 ~ 15°)	0.29 ~ 0.71	4.29 ~ 4.71
W.O.T (93 ~ 102°)	4.43 ~ 4.86	0.14 ~ 0.57



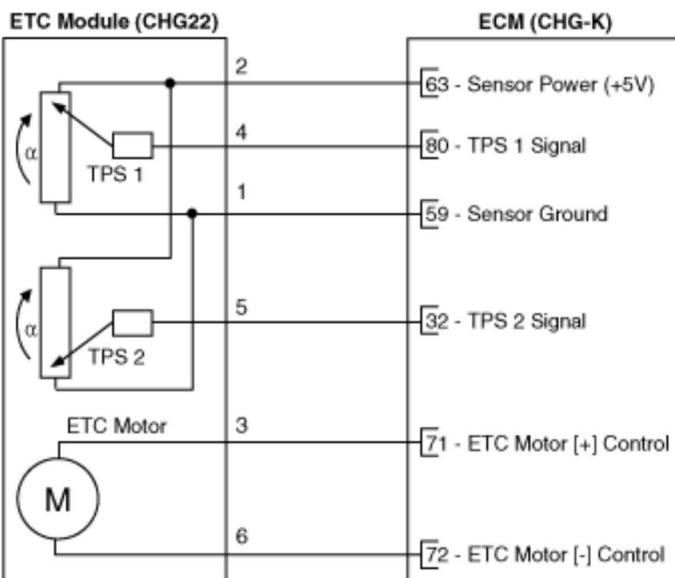
Item	Sensor Resistance(kΩ)
TPS1	0.875 ~ 1.625 [20°C(68°F)]
TPS2	0.875 ~ 1.625 [20°C(68°F)]

[ETC Motor]

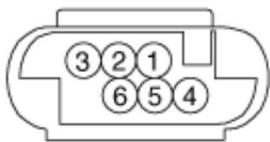
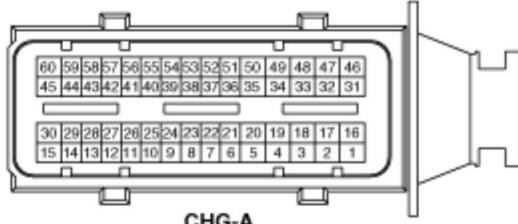
Item	Specification
Coil Resistance (Ω)	1.2 ~ 1.8 [20°C(68°F)]

Fuel System > Engine Control System > ETC (Electronic Throttle Control) System > Schematic Diagrams

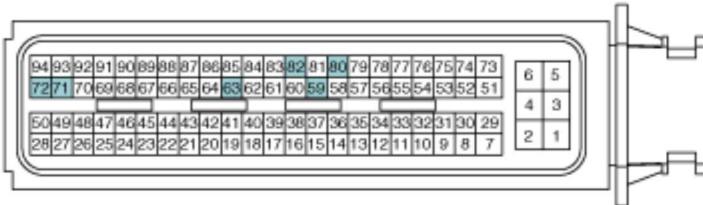
Circuit Diagram

[Circuit Diagram]**[Connection Information]**

Terminal	Connected to	Function
1	ECM CHG-K (59)	Sensor Ground
2	ECM CHG-K (63)	Sensor Power (+5V)
3	ECM CHG-K (71)	ETC Motor [+]-Control
4	ECM CHG-K (80)	TPS 1 Signal
5	ECM CHG-K (32)	TPS 2 Signal
6	ECM CHG-K (72)	ETC Motor [-]-Control

[Harness Connector]CHG22
ETC Module

CHG-A

CHG-K
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.

Throttle Angle	Output Voltage (V)	
	TPS 1	TPS 2
C.T	0.3 ~ 0.9	4.2 ~ 5.0
W.O.T	1.5 ~ 3.0	3.3 ~ 3.8

3. Turn the ignition switch OFF and disconnect the scantool from the DLC.
4. Disconnect the ETC module connector and measure the resistance between the ETC module terminals 1 and 2.

Specification: Refer to "Specification"

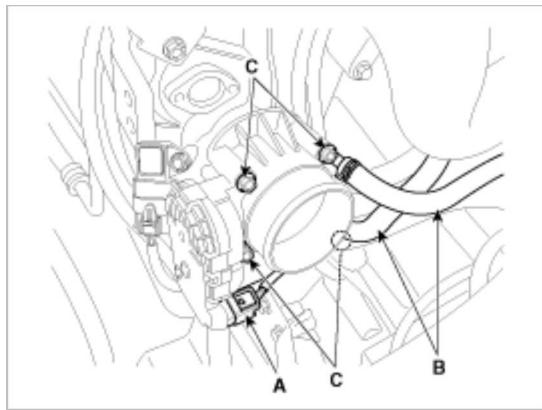
ETC Motor

1. Turn the ignition switch OFF.
2. Disconnect the ETC module connector.
3. Measure resistance between the ETC module terminals 3 and 6.
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 (B).
5. Remove the installation bolts (C), and then remove the ETC module from the engine.



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.

Electronic throttle body Installation bolt:

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

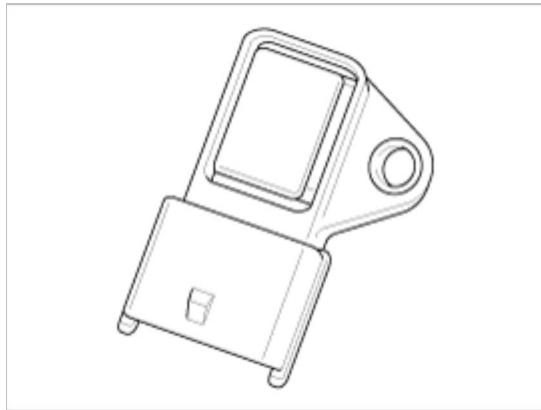
Fuel System > Engine Control System > Manifold Absolute Pressure Sensor (MAPS) > Description and Operation

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.

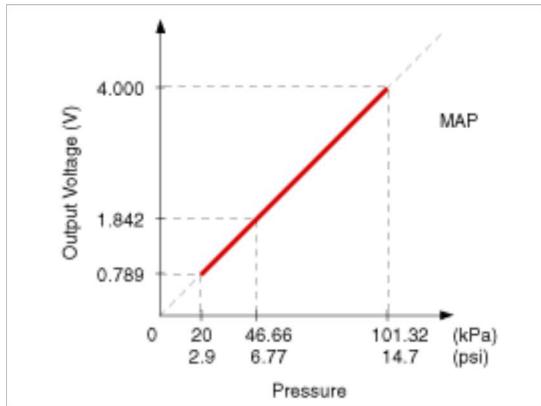
The MAPS consists of a piezo-electric element and a hybrid IC amplifying the element output signal. The element is silicon diaphragm type and adapts pressure sensitive variable resistor effect of semi-conductor. Because 100% vacuum and the manifold pressure apply to both sides of the sensor respectively, 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

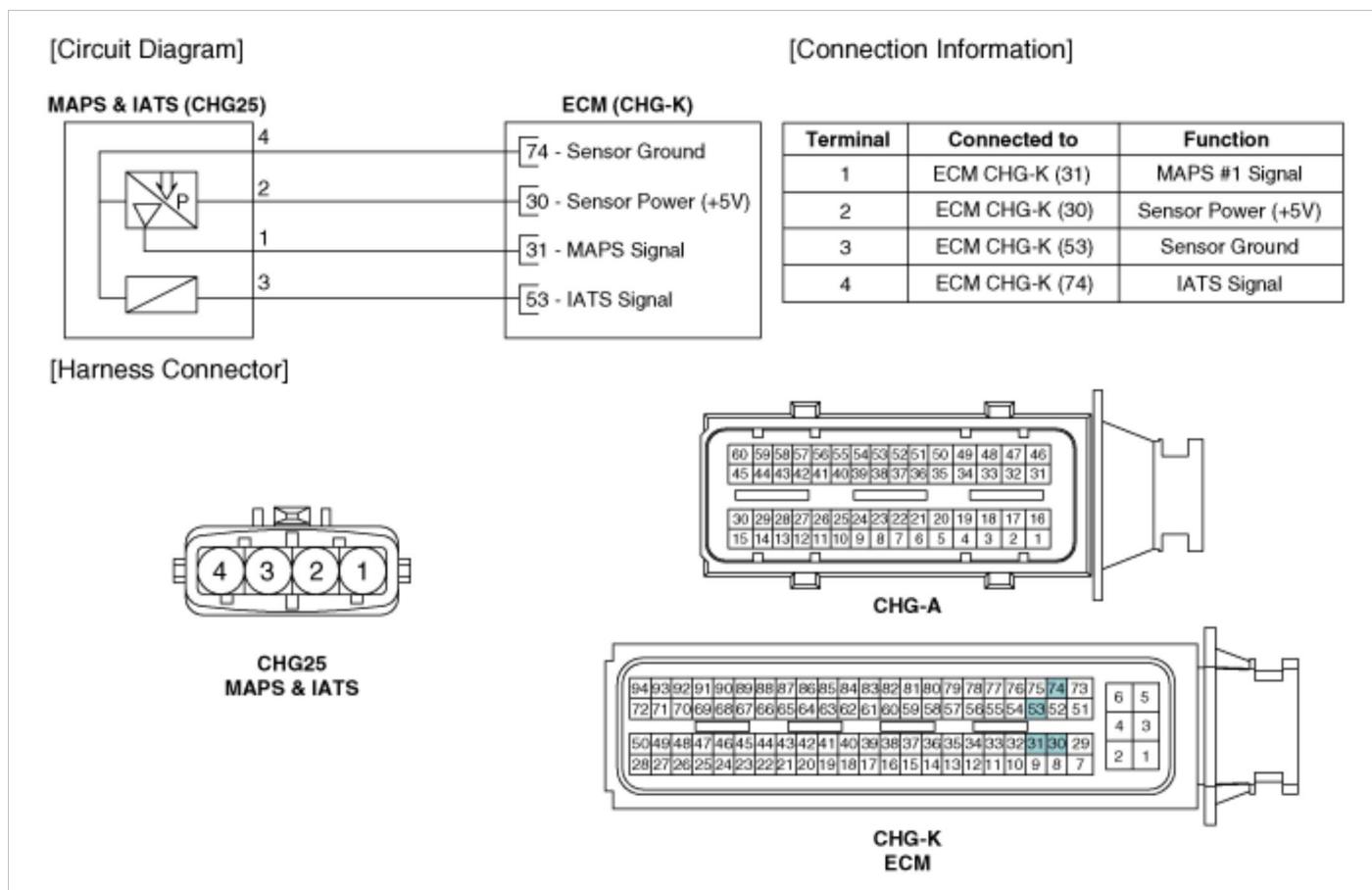
Specification

Pressure [kPa (kgf/cm ² , 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) > Schematic Diagrams

Circuit Diagram



Fuel System > Engine Control System > Manifold Absolute Pressure Sensor (MAPS) > Repair procedures

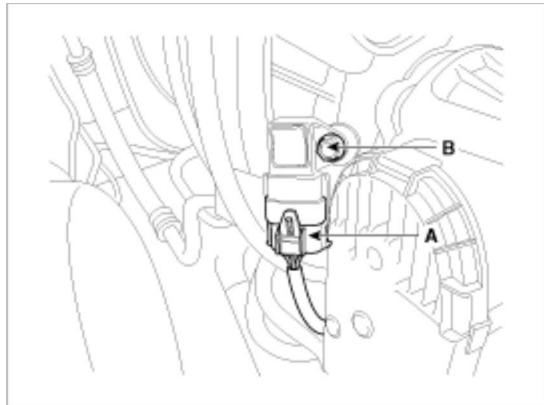
Inspection

1. Connect the GDS on the Data Link Connector (DLC).
2. Measure the output voltage of the MAPS at idle and IG ON.

Condition	Output Voltage (V)
IG ON	3.9 ~ 4.1
Idle	0.8 ~ 1.6

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. 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.

Manifold absolute pressure sensor installation bolt:

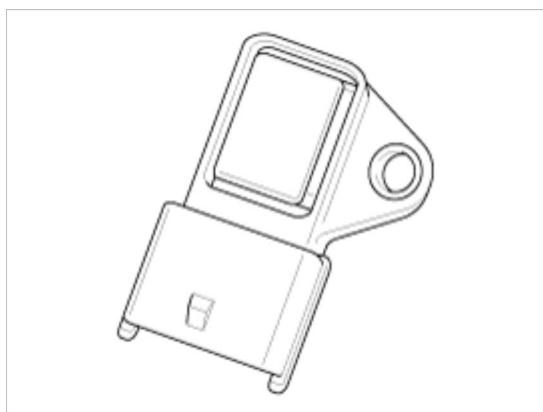
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)

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 its resistance changes in reverse proportion to the temperature.



Fuel System > Engine Control System > Intake Air Temperature Sensor (IATS) >

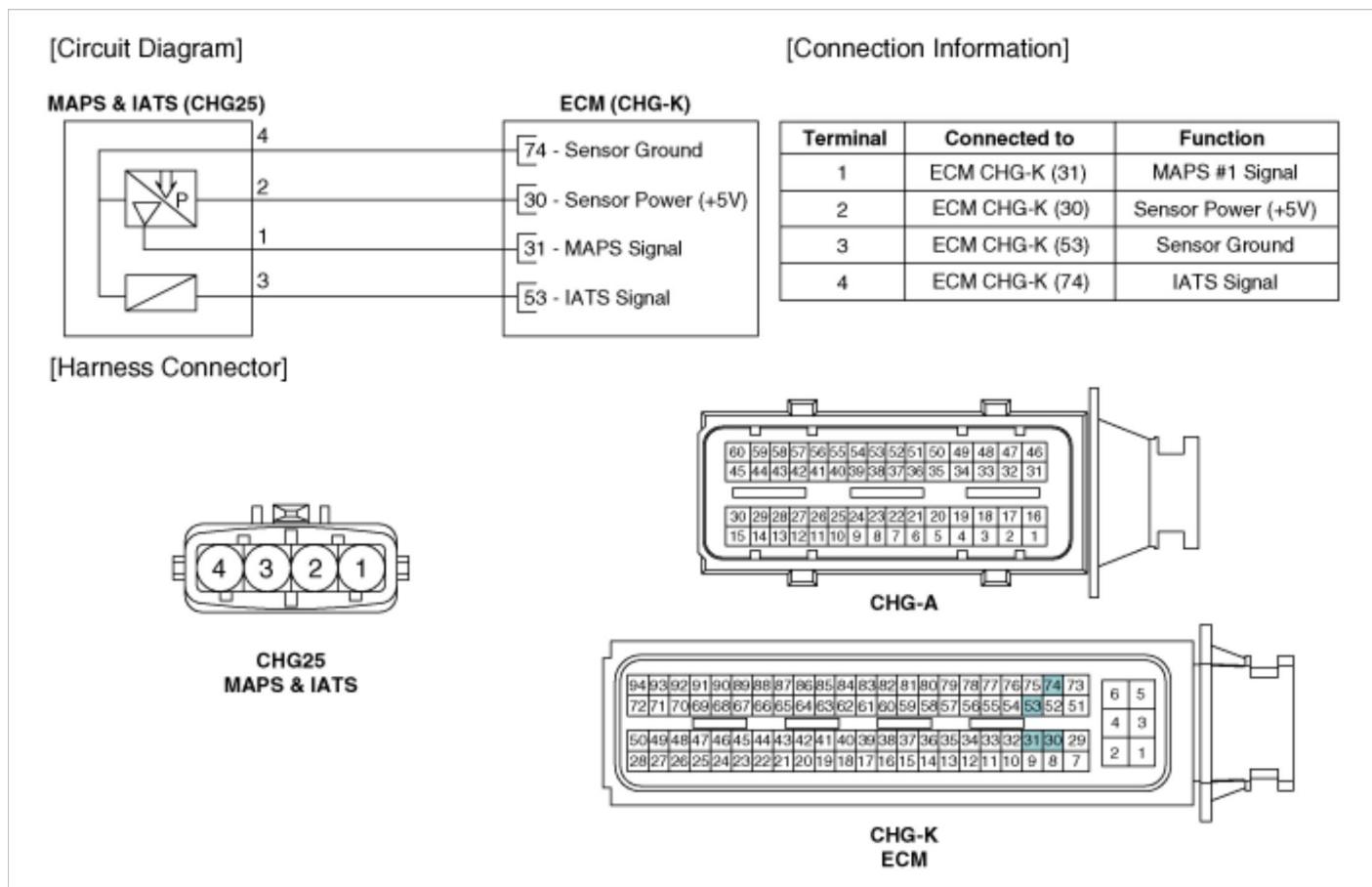
Specifications

Specification

Temperature [°C(°F)]	Resistance (kΩ)
-40(-40)	40.93 ~ 48.35
-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)	0.76 ~ 0.85
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



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"

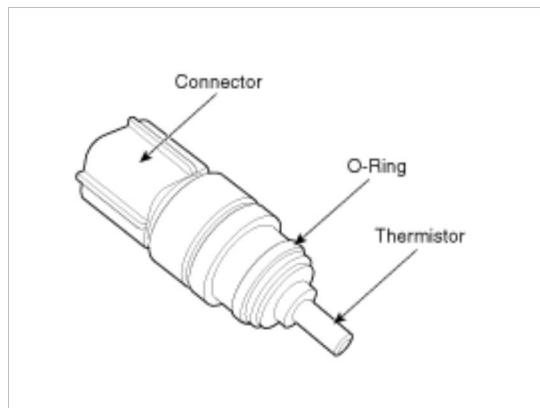
Fuel System > Engine Control System > Engine Coolant Temperature Sensor (ECTS) > Description and Operation

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 whose resistance changes with the temperature.

The electrical resistance of the ECTS decreases as the temperature increases, and increases as the temperature decreases. The reference +5V is supplied to the ECTS via a resistor in the ECM. That is, the resistor in the ECM and the thermistor in the ECTS are connected in series. When the resistance value of the thermistor in the ECTS changes according to the engine coolant temperature, the output voltage also changes.

During cold engine operation, the ECM increases the fuel injection duration and controls the ignition timing using the information of engine coolant temperature to avoid engine stalling and improve drivability.



Fuel System > Engine Control System > Engine Coolant Temperature Sensor (ECTS) > Specifications

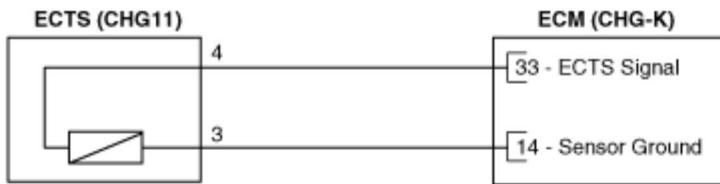
Specification

Temperature		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

[Circuit Diagram]



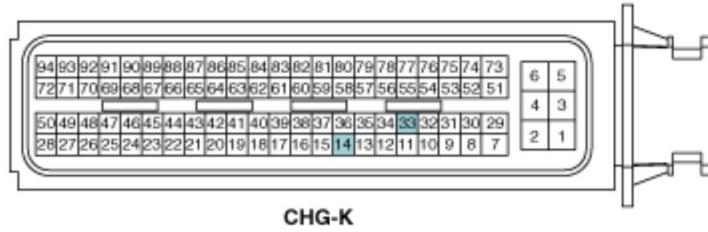
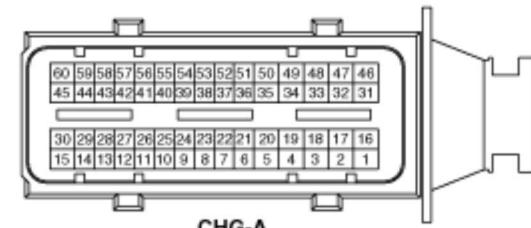
[Connection Information]

Terminal	Connected to	Function
1	-	-
2	-	-
3	ECM CHG-K (14)	Sensor Ground
4	ECM CHG-K (33)	ECTS Signal

[Harness Connector]



CHG11
ECTS



Fuel System > Engine Control System > Engine Coolant Temperature Sensor (ECTS) > Repair procedures

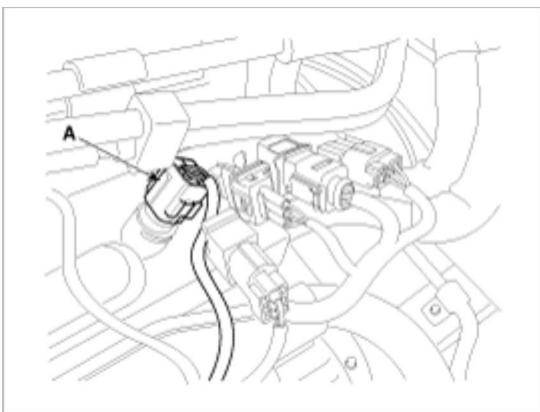
Inspection

1. Turn the ignition switch OFF.
2. Disconnect the ECTS connector.
3. Remove the ECTS.
4. After immersing the thermistor of the sensor into engine coolant, measure resistance between the ECTS terminals 3 and 4.
5. Check that the resistance is within the specification.

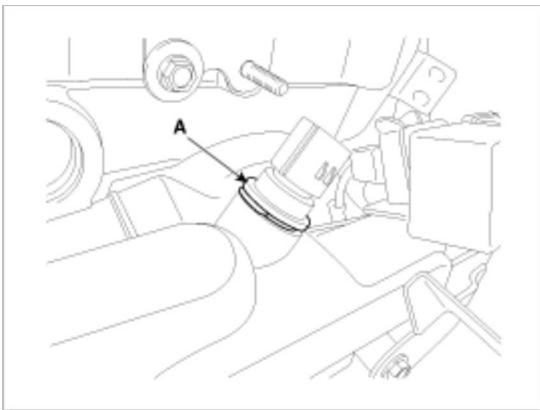
Specification: Refer to "Specification"

Removal

1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Disconnect the engine coolant temperature sensor connector (A).



3. Remove the fixing clip (A), and then pull the sensor from the water temperature control assembly.



CAUTION

Note that engine coolant may be flowed out from the water temperature control assembly when removing the sensor.

4. 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.

CAUTION

- Apply the engine coolant to the O-ring.

CAUTION

- Insert the sensor in the installation hole and be careful not to damage.

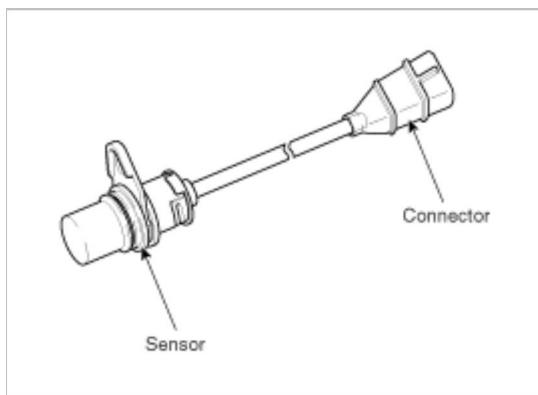
1. Installation is reverse of removal.

Fuel System > Engine Control System > Crankshaft Position Sensor (CKPS) > Description and Operation

Description

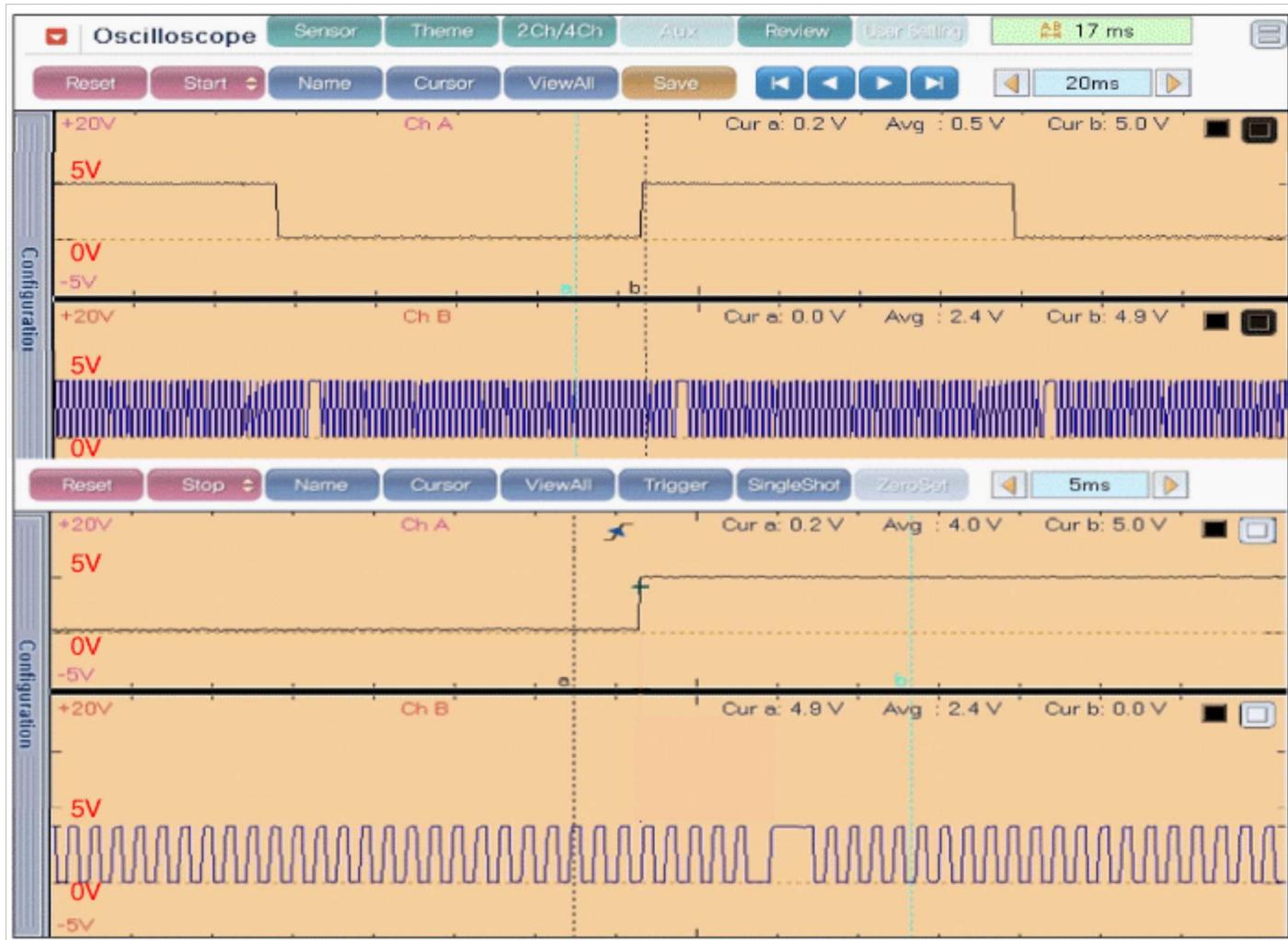
Crankshaft Position Sensor (CKPS) detects the crankshaft position and is one of the most important sensors of the engine control system. If there is no CKPS signal input, fuel is not supplied. That is, vehicle can't run without CKPS signal. This sensor is installed on the cylinder block or the transaxle housing and generates alternating current by magnetic flux field which is made by the sensor and the target wheel when engine runs.

The target wheel consists of 58 slots and 2 missing slots on 360 degrees CA (Crank Angle).



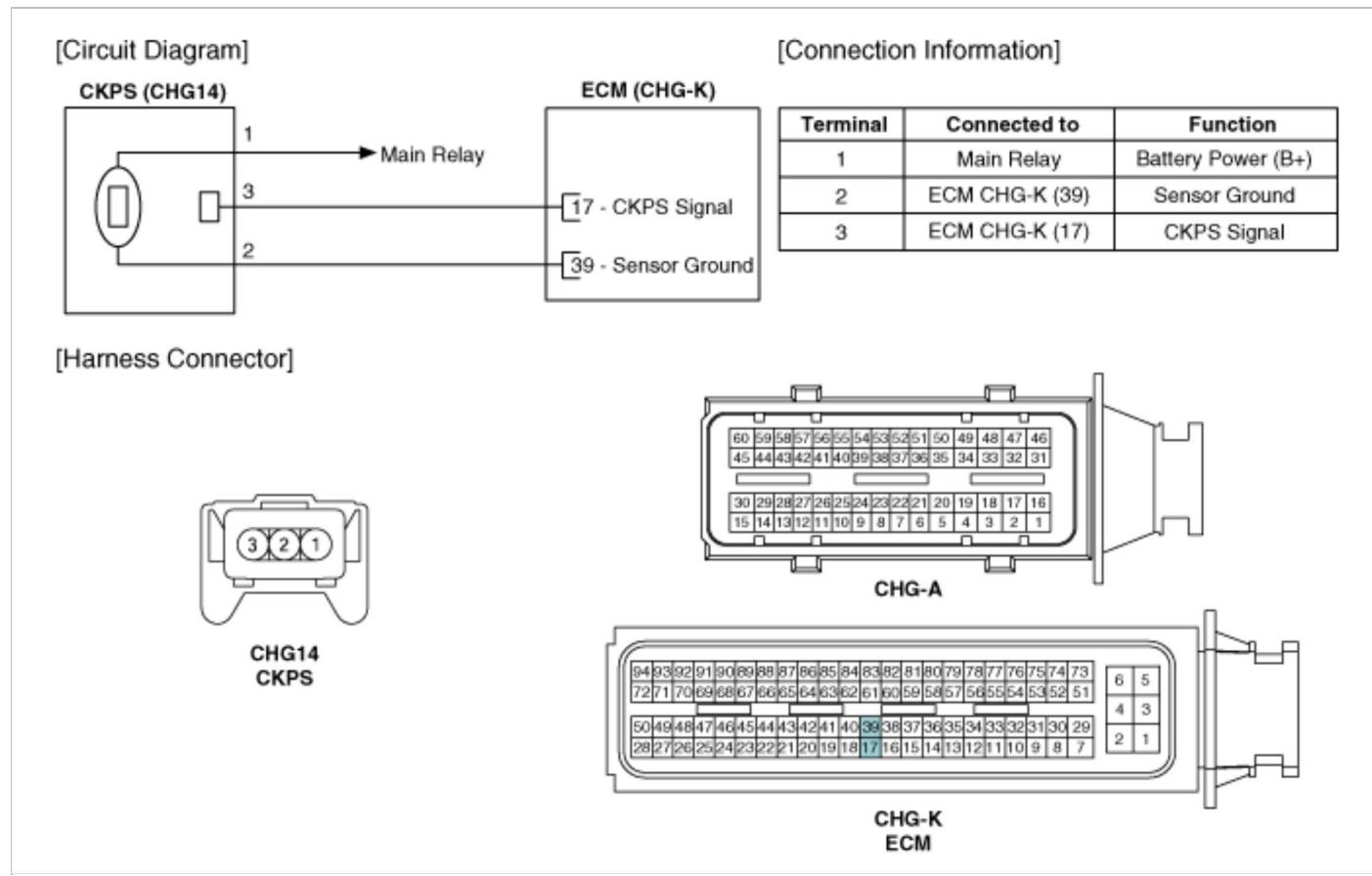
Fuel System > Engine Control System > Crankshaft Position Sensor (CKPS) > Troubleshooting

Wave Form



Fuel System > Engine Control System > Crankshaft Position Sensor (CKPS) > Schematic Diagrams

Circuit Diagram



Fuel System > Engine Control System > Crankshaft Position Sensor (CKPS) > Repair procedures

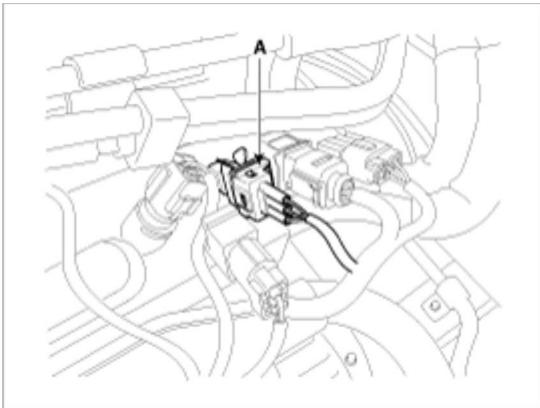
Inspection

1. Check the signal waveform of the CMPS and CKPS using the GDS.

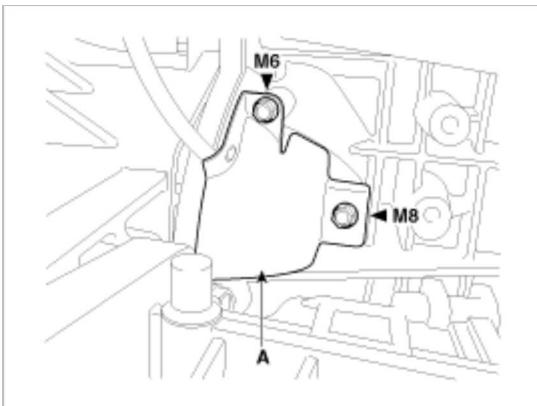
Specification: Refer to "Wave Form"

Removal

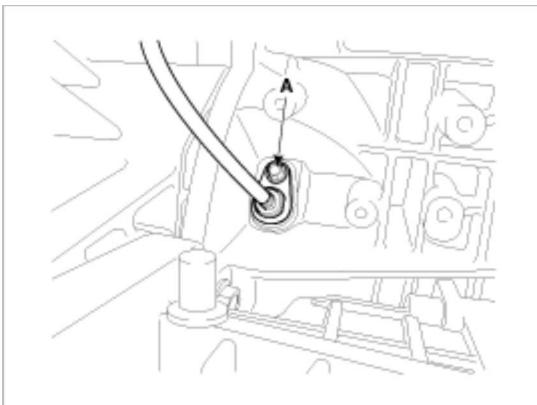
1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Disconnect the crankshaft position sensor connector (A).



3. Remove the protector (A).



4. Remove the installation bolt (A), and then remove the crankshaft position sensor.



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

- Apply the engine oil to the O-ring.

CAUTION

- Insert the sensor in the installation hole and be careful not to damage when installation.

1. Installation is reverse of removal.

Crankshaft position sensor installation bolt: 9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)

Crankshaft position sensor protector installation bolt (M8): 18.6 ~ 23.5 N.m (1.9 ~ 2.4 kgf.m,

13.7 ~ 17.4 lb-ft)

Crankshaft position sensor protector installation bolt (M6): 9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)

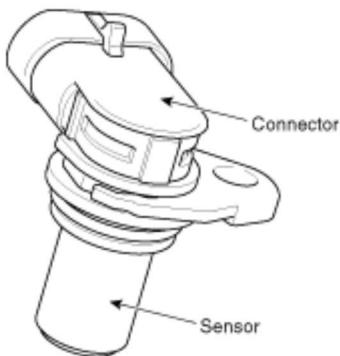
Fuel System > Engine Control System > Camshaft Position Sensor (CMPS) > Description and Operation

Description

Camshaft Position Sensor (CMPS) is a hall sensor and detects the camshaft position by using a hall element.

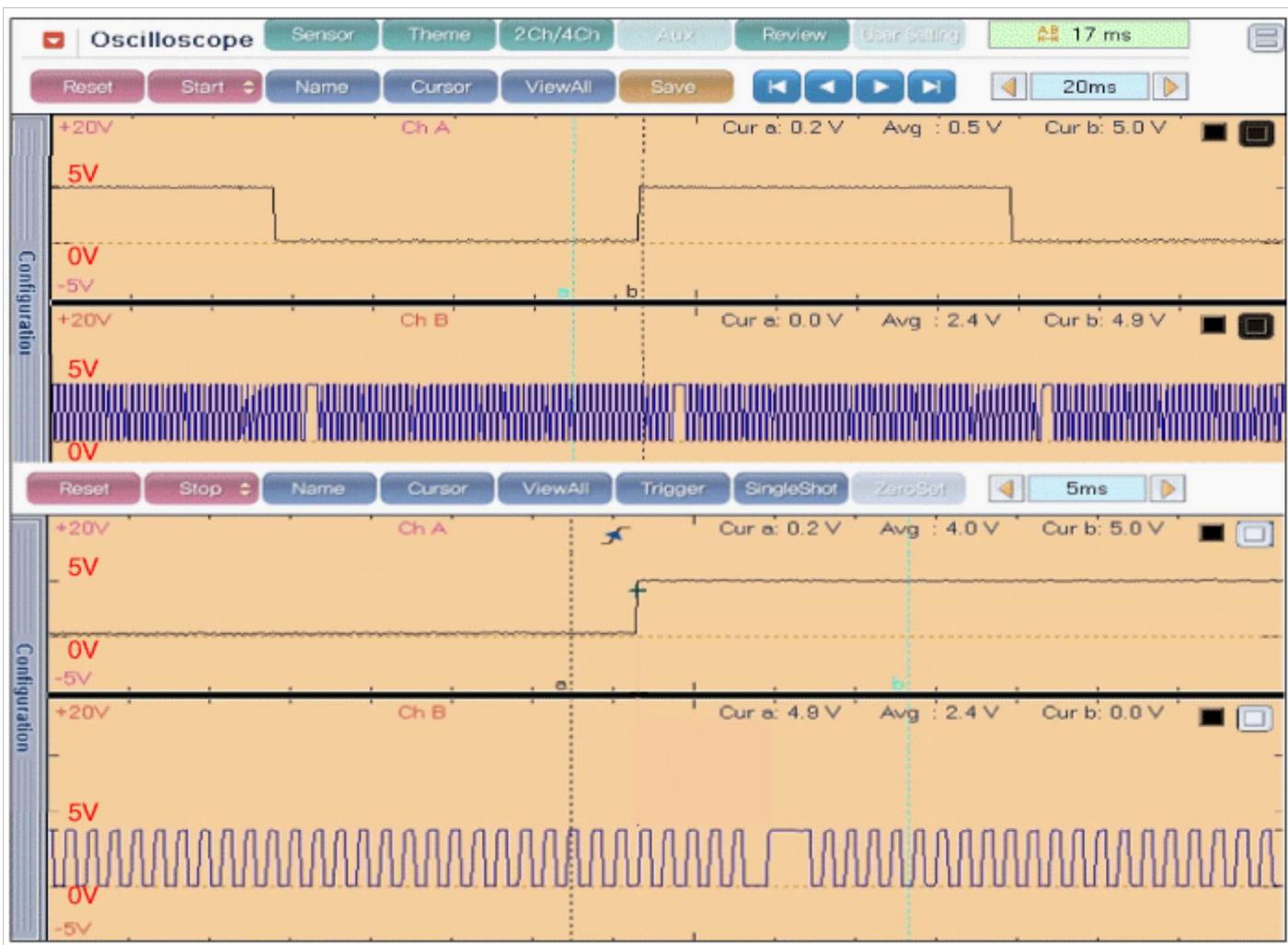
It is related with Crankshaft Position Sensor (CKPS) and detects the piston position of each cylinder which the CKPS can't detect.

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.



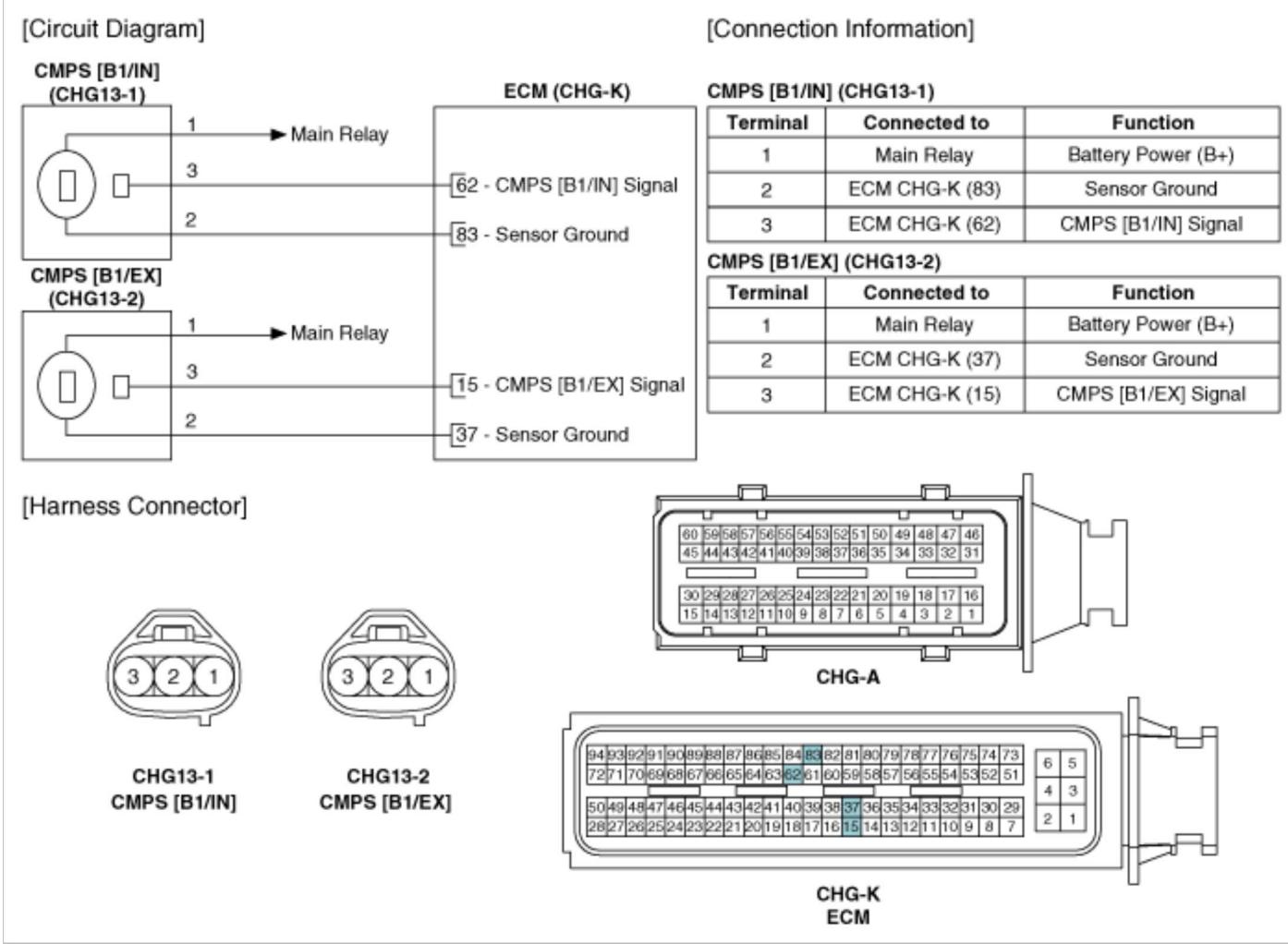
Fuel System > Engine Control System > Camshaft Position Sensor (CMPS) > Troubleshooting

Wave Form



Fuel System > Engine Control System > Camshaft Position Sensor (CMPS) > Schematic Diagrams

Circuit Diagram



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"

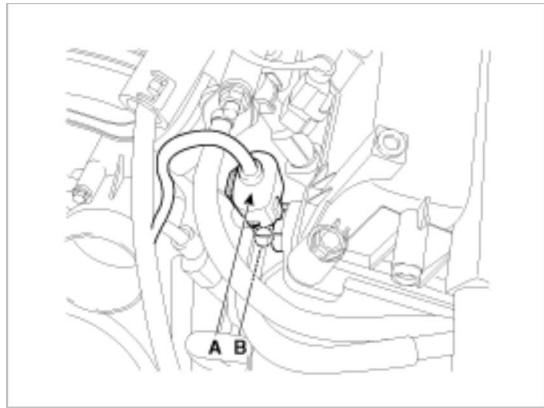
Removal

WARNING

- DON'T remove the camshaft position sensor during engine running or right after engine stops, or a scald by the flowed out engine oil may occur.

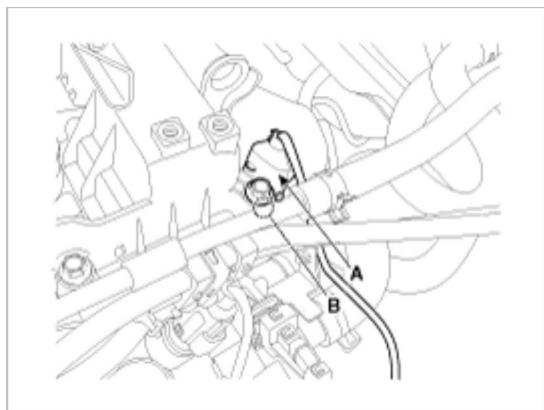
[Bank 1 / Intake]

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. In this case, use it after inspecting.

CAUTION

- Apply the engine oil to the O-ring.

CAUTION

- Insert the sensor in the installation hole and be careful not to damage when installation.

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.

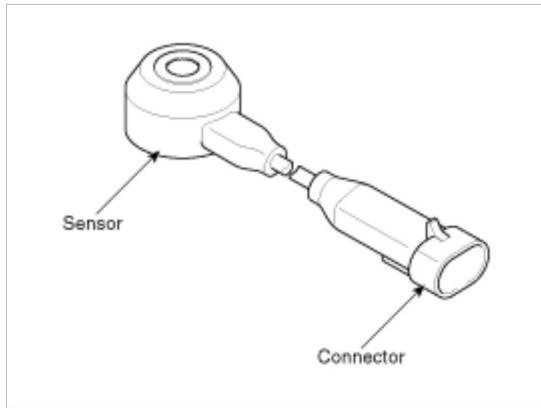
Camshaft position sensor installation bolt:
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)

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.



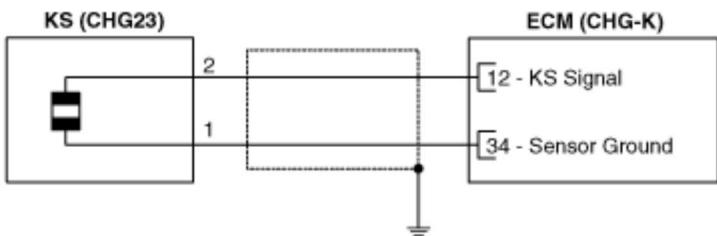
Fuel System > Engine Control System > Knock Sensor (KS) > Specifications

Specification

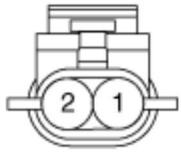
Item	Specification
Capacitance (pF)	850 ~ 1,150

Fuel System > Engine Control System > Knock Sensor (KS) > Schematic Diagrams

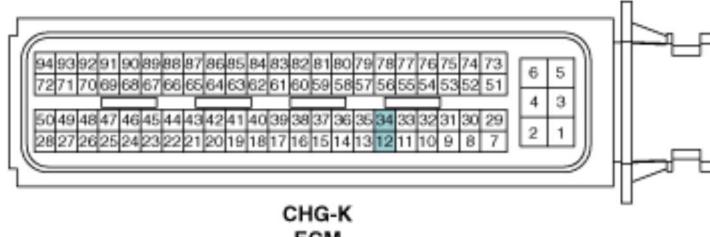
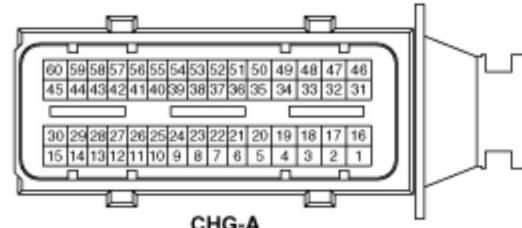
Circuit Diagram

[Circuit Diagram]**[Connection Information]**

Terminal	Connected to	Function
1	ECM CHG-K (34)	KS Signal
2	ECM CHG-K (12)	Sensor Ground

[Harness Connector]

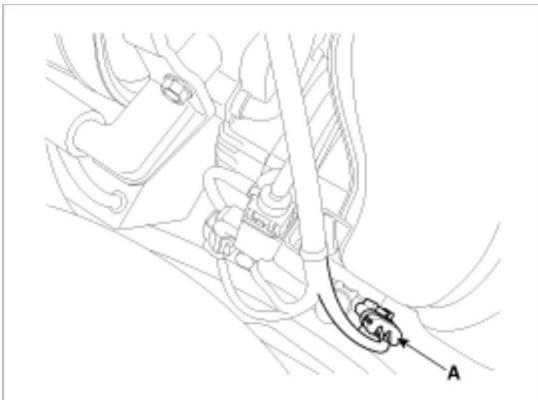
**CHG23
KNOCK SENSOR**



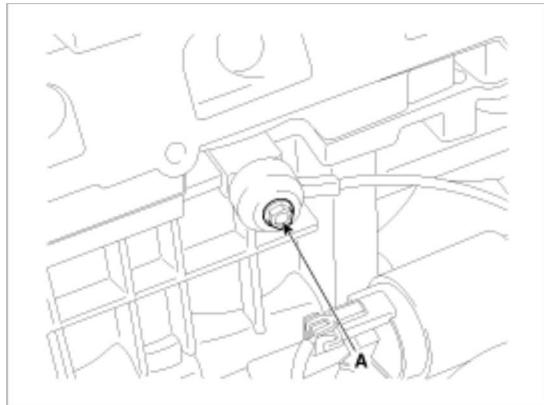
Fuel System > Engine Control System > Knock Sensor (KS) > Repair procedures

Removal

1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Drain the engine coolant (Refer to "Cooling System" in EM group).
3. Remove the radiator upper hose (Refer to "Cooling System" in EM group).
4. Disconnect the knock sensor connector (A).



5. Remove the intake manifold (Refer to "Intake And Exhaust System" in EM group).
6. Remove the installation bolt (A), 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. In this case, use it after inspecting.

1. Installation is reverse of removal.

Knock sensor installation bolt:

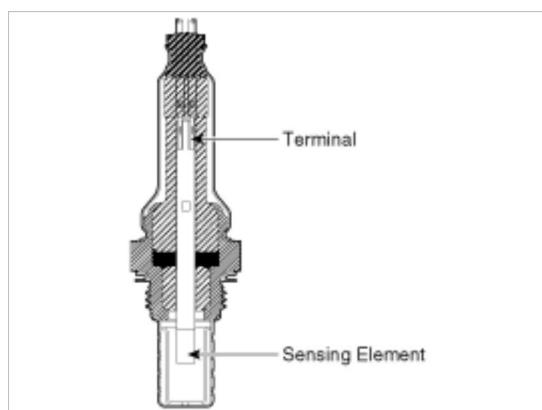
18.6 ~ 23.5 N.m (1.9 ~ 2.4 kgf.m, 13.7 ~ 17.4 lb-ft)

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 Catalytic Converter. It 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] (Linear type)

Item	Specification
Heater Resistance (Ω)	2.5 ~ 4.0 [20°C(68°F)]

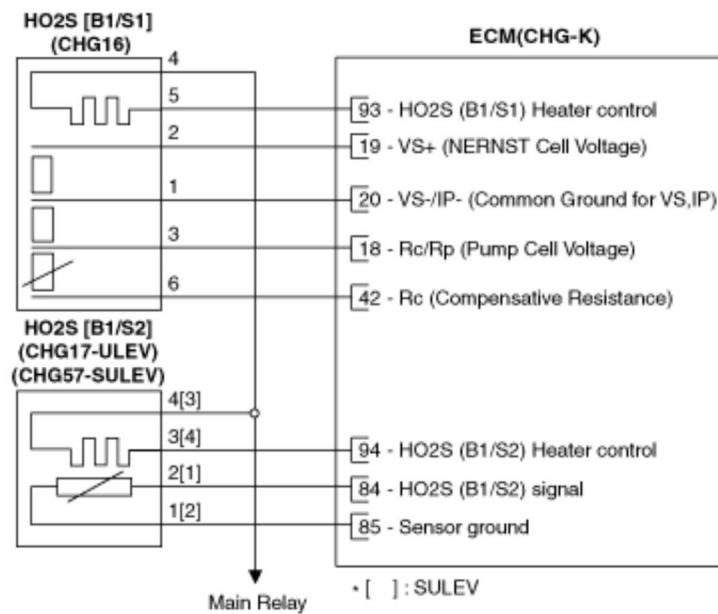
HO2S [Bank 1/Sensor 2] (Binary type)

A/F Ratio (λ)	Output Voltage(V)
RICH	Approx. 0.92
LEAN	Approx. 0.04

Item	Specification
Heater Resistance (Ω)	3.3 ~ 4.1 Ω [21°C(69.8°F)]

Fuel System > Engine Control System > Heated Oxygen Sensor (HO2S) > Schematic Diagrams**Circuit Diagram**

[Circuit Diagram]



[Connection Information]

HO2S [B1/S1] (CHG16)

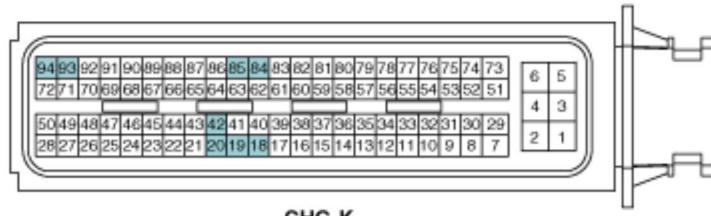
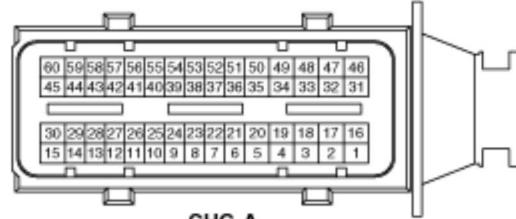
Terminal	Connected to	Function
1	ECM CHG-K (20)	VS-/IP- (Common Ground for VS,IP)
2	ECM CHG-K (19)	VS+ (NERNST Cell Voltage)
3	ECM CHG-K (18)	Rc/Rp (Pump Cell Voltage)
4	Main Relay	Power Supply (B+)
5	ECM CHG-K (93)	Heater control
6	ECM CHG-K (42)	Rc (Compensative Resistance)

HO2S [B1/S2] (CHG17-ULEV) HO2S [B1/S2] (CHG57-SULEV)

Terminal	Connected to	Function
1[2]	ECM CHG-K (85)	Sensor Ground
2[1]	ECM CHG-K (84)	HO2S (B1/S2) Signal
3[4]	ECM CHG-K (94)	Heater control
4[3]	Main Relay	Power Supply (B+)

* [] : SULEV

[Harness Connector]



CHG-K
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].
Measure resistance between the HO2S terminals 3 and 4 [B1/S2].
4. Check that the resistance is within the specification.

Specification: Refer to "Specification"

Removal

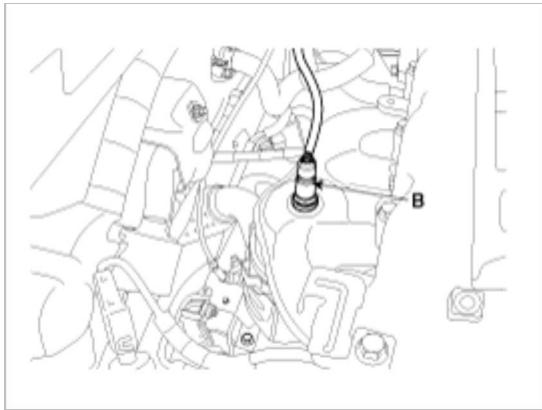
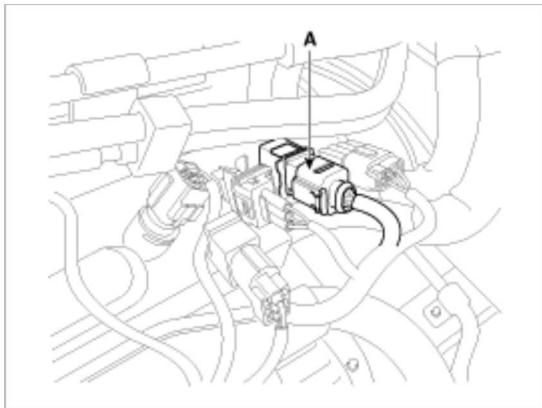
[SULEV]

1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Disconnect the connector (A), and then remove the sensor (B).

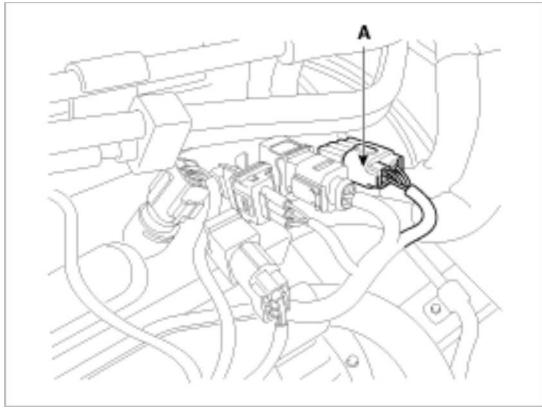
NOTE

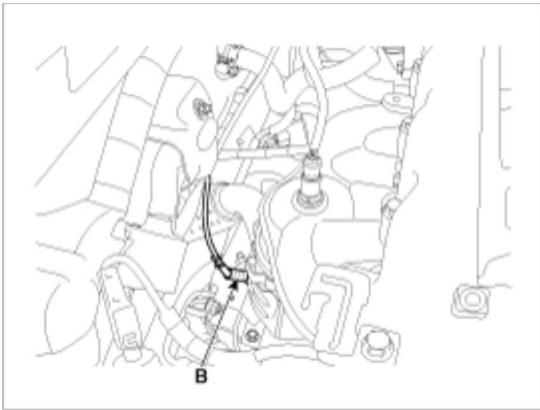
Note that the SST (Part No.: 09392-2H100) is useful when removing the heated oxygen sensor.

[Bank 1 / Sensor 1]



[Bank 1 / Sensor 2]





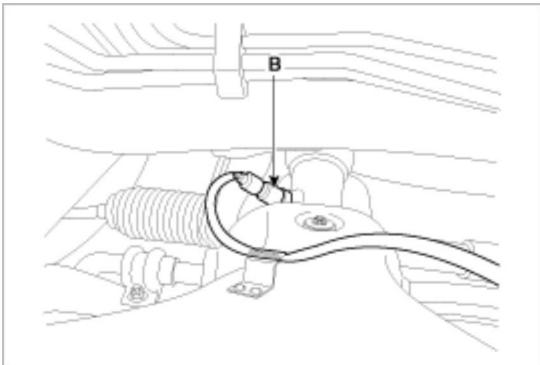
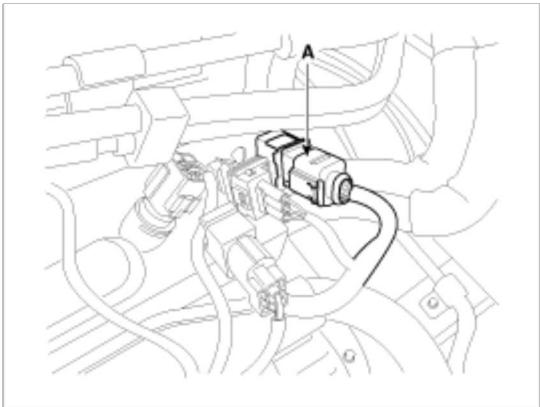
[ULEV]

[Bank 1 / Sensor 1]

1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Disconnect the connector (A), and then remove the sensor (B).

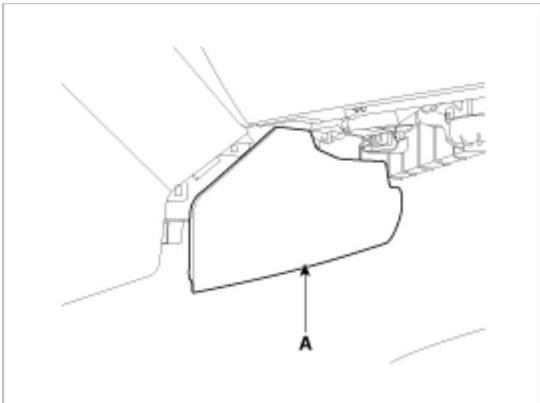
NOTE

Note that the SST (Part No.: 09392-2H100) is useful when removing the heated oxygen sensor.



[Bank 1 / Sensor 2]

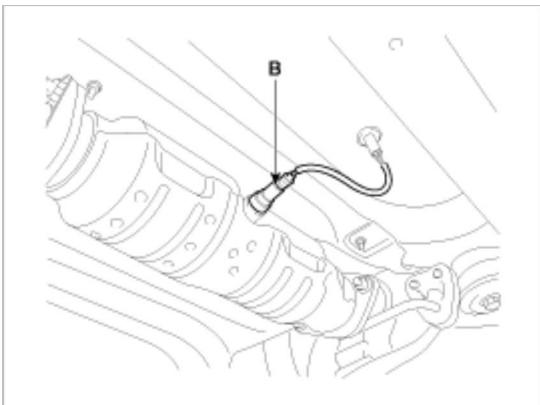
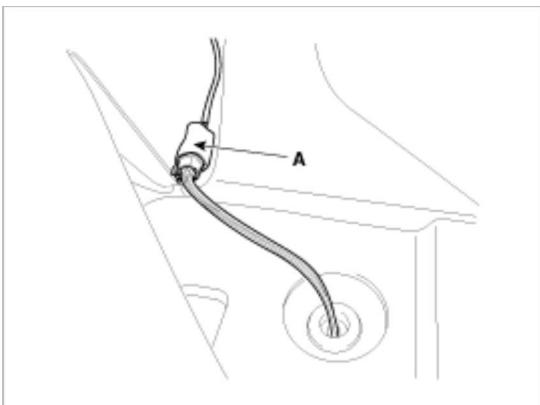
1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Remove the console side cover (A).



3. 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.



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

- 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 [SULEV]:

39.2 ~ 49.1 N.m (4.0 ~ 5.0 kgf.m, 28.9 ~ 36.2 lb-ft)

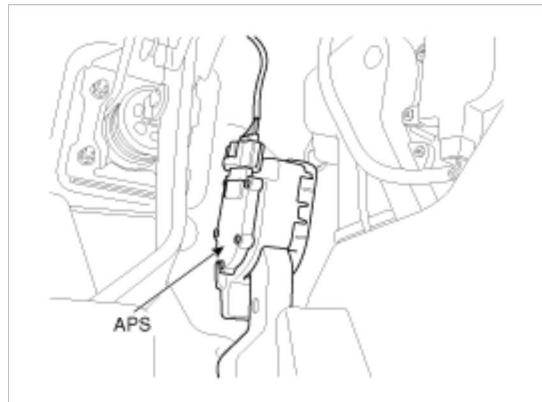
Heated oxygen sensor installation [ULEV]:

44.1 ~ 49.1 N.m (4.5 ~ 5.0 kgf.m, 32.6 ~ 36.2 lb-ft)

Fuel System > Engine Control System > Accelerator Position Sensor (APS) > Description and Operation

Description

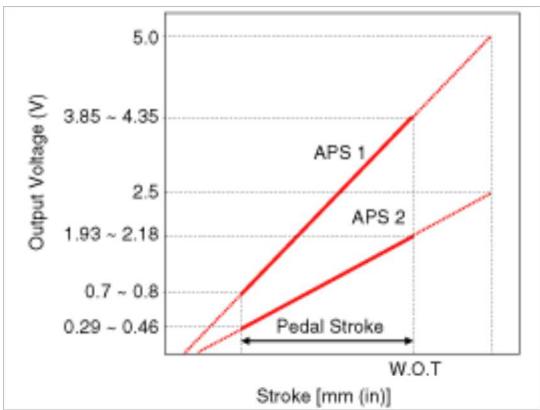
Accelerator Position Sensor (APS) is installed on the accelerator pedal module and detects the rotation angle of the accelerator pedal. The APS is one of the most important sensors in engine control system, so it consists of the two sensors which adapt individual sensor power and ground line. The second 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

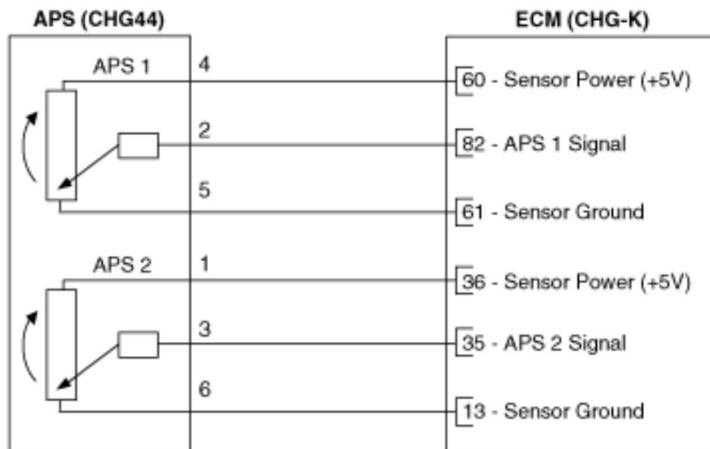
Accelerator Position	Output Voltage (V)	
	APS1	APS2
C.T	0.7 ~ 0.8	0.29 ~ 0.46
W.O.T	3.85 ~ 4.35	1.93 ~ 2.18



Fuel System > Engine Control System > Accelerator Position Sensor (APS) > Schematic Diagrams

Circuit Diagram

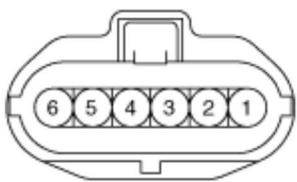
[Circuit Diagram]



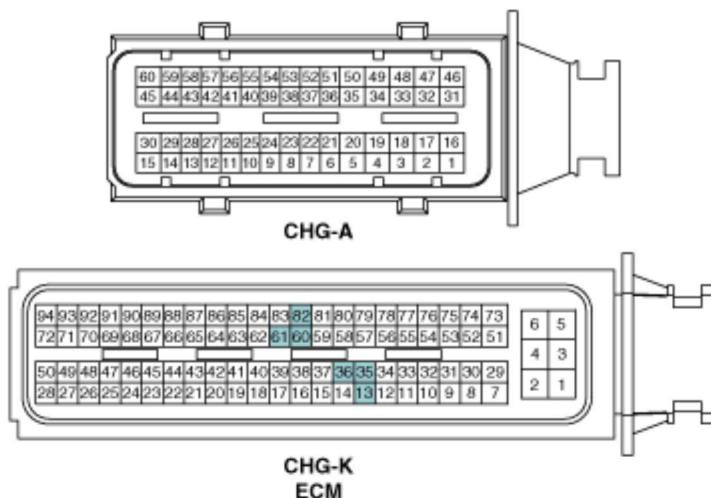
[Connection Information]

Terminal	Connected to	Function
1	ECM CHG-K (36)	APS 2 Sensor Power (+5V)
2	ECM CHG-K (82)	APS 1 Signal
3	ECM CHG-K (35)	APS 2 Signal
4	ECM CHG-K (60)	APS 1 Sensor Power (+5V)
5	ECM CHG-K (61)	APS 1 Sensor Ground
6	ECM CHG-K (13)	APS 2 Sensor Ground

[Harness Connector]



CHG44
APS



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

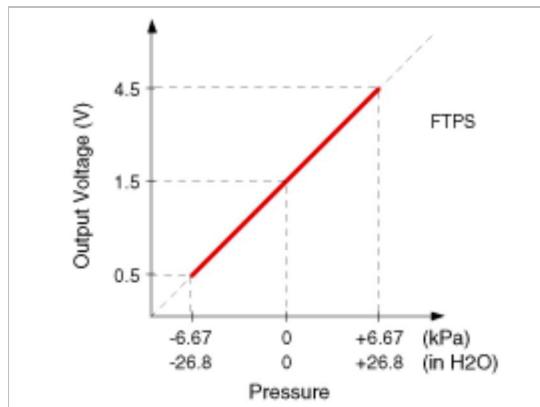
Fuel Tank Pressure Sensor (FTPS) is a component of the evaporative emission control system and is installed on the fuel tank, the fuel pump, or the canister. It checks the purge control solenoid valve operation and detects a leakage of the system.



Fuel System > Engine Control System > Fuel Tank Pressure Sensor (FTPS) > Specifications

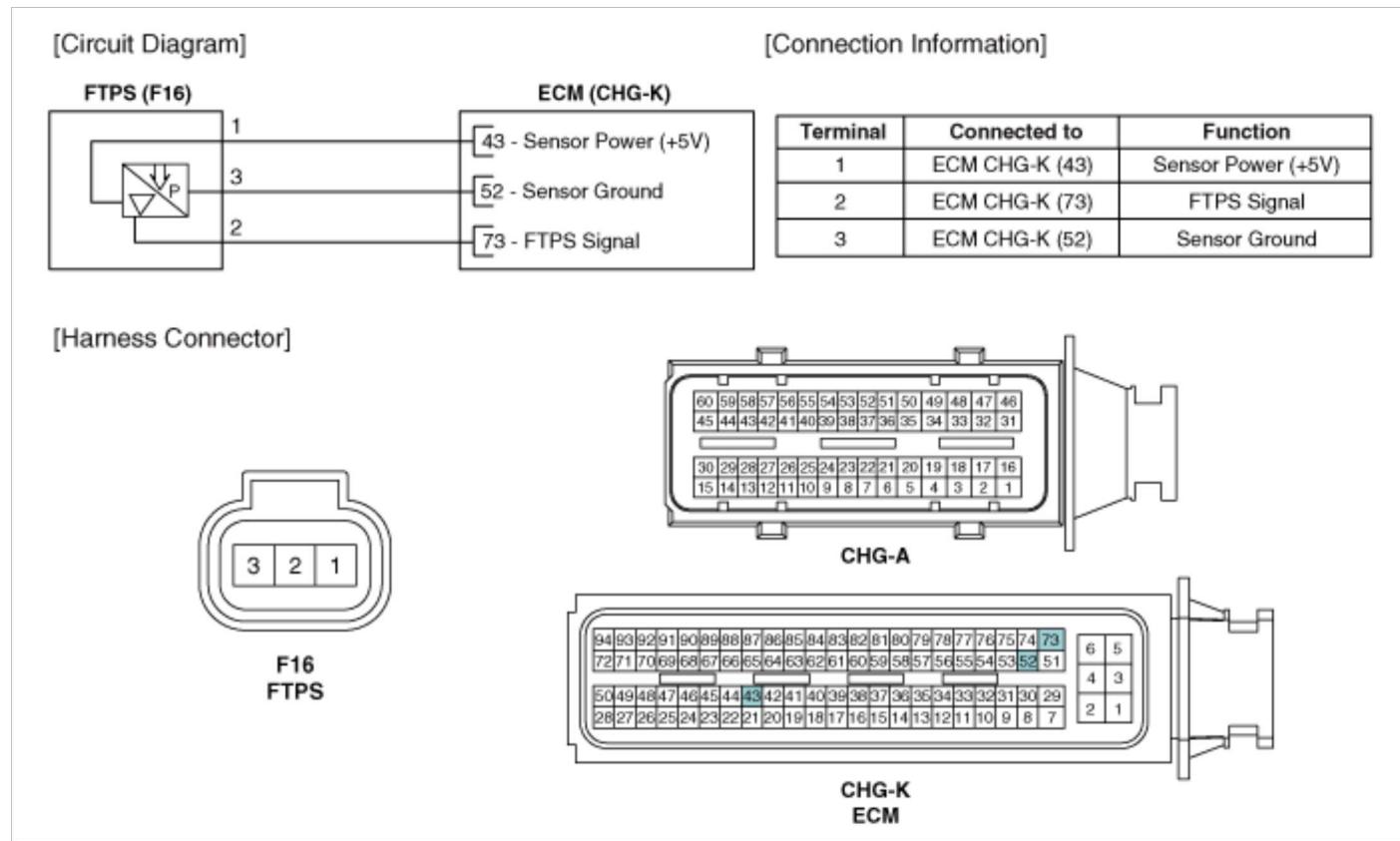
Specification

Pressure [kPa (kgf/cm ² , in H ₂ O)]	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



Fuel System > Engine Control System > Fuel Tank Pressure Sensor (FTPS) > Repair procedures

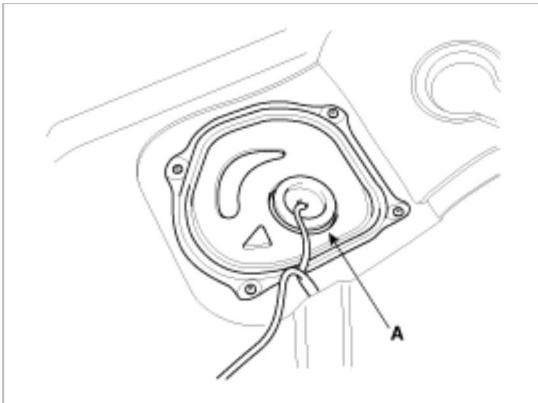
Inspection

1. Connect the GDS on the Data Link Connector (DLC).
2. Measure the output voltage of the FTPS.

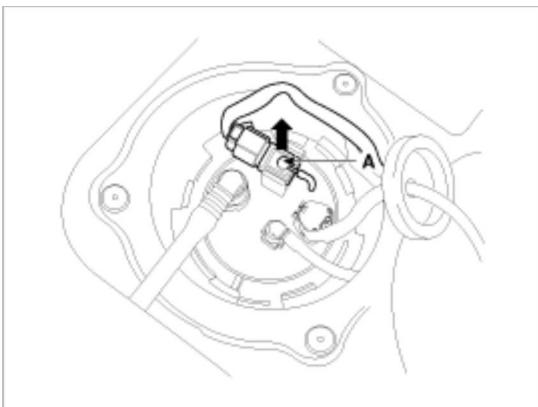
Specification: Refer to "Specification"

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 (A).
5. Remove the fuel tank pressure sensor 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

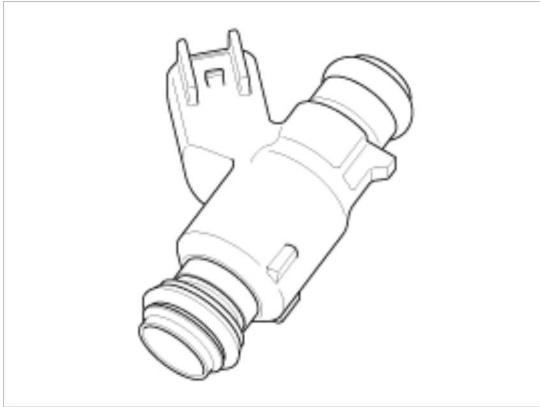
- Insert the sensor in the installation hole and be careful not to damage when installation.

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.



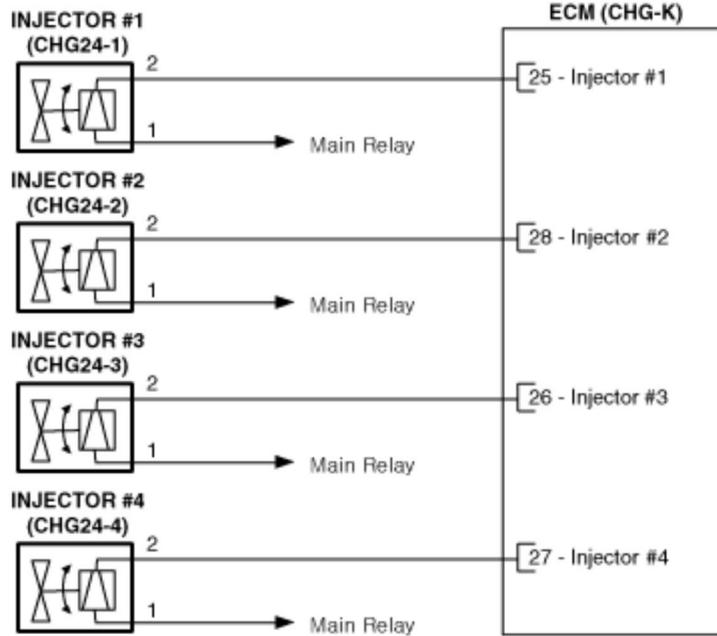
Fuel System > Engine Control System > Injector > Specifications

Specification

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

Fuel System > Engine Control System > Injector > Schematic Diagrams

Circuit Diagram

[Circuit Diagram]**[Connection Information]****INJECTOR #1 (CHG24-1)**

Terminal	Connected to	Function
1	Main Relay	Battery Power (B+)
2	ECM CHG-K (25)	Injector #1 Control

INJECTOR #2 (CHG24-2)

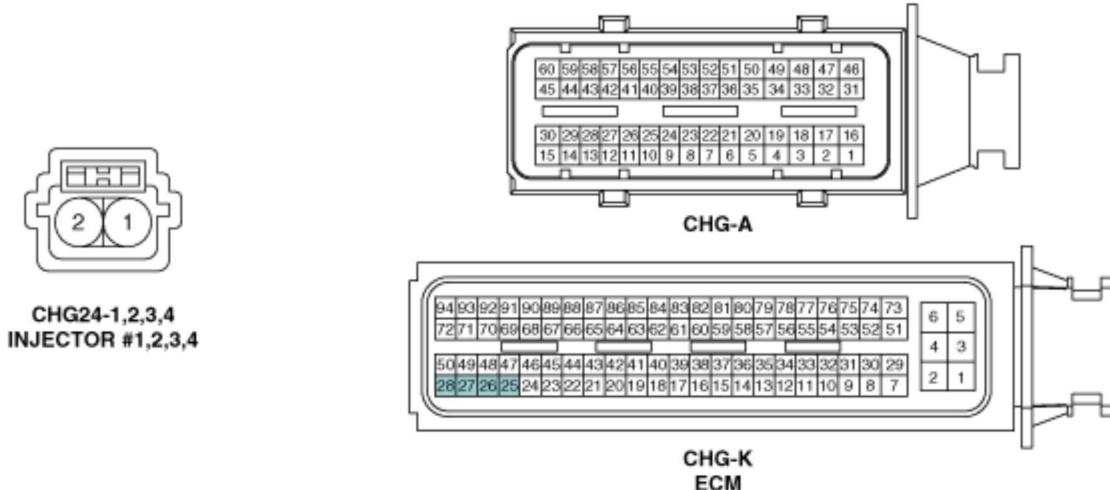
Terminal	Connected to	Function
1	Main Relay	Battery Power (B+)
2	ECM CHG-K (28)	Injector #2 Control

INJECTOR #3 (CHG24-3)

Terminal	Connected to	Function
1	Main Relay	Battery Power (B+)
2	ECM CHG-K (26)	Injector #3 Control

INJECTOR #4 (CHG24-4)

Terminal	Connected to	Function
1	Main Relay	Battery Power (B+)
2	ECM CHG-K (27)	Injector #4 Control

[Harness Connector]**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

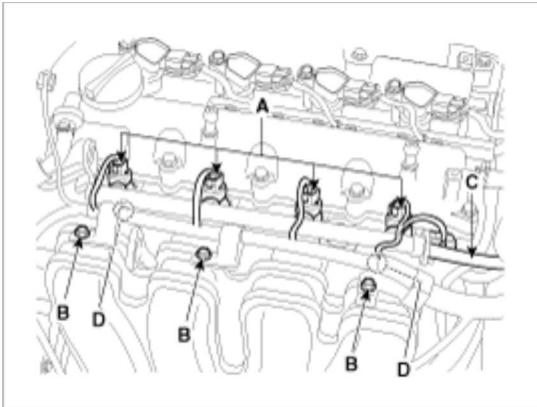
1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.

2. Release the residual pressure in fuel line (Refer to “Release Residual Pressure in Fuel Line” in this group).

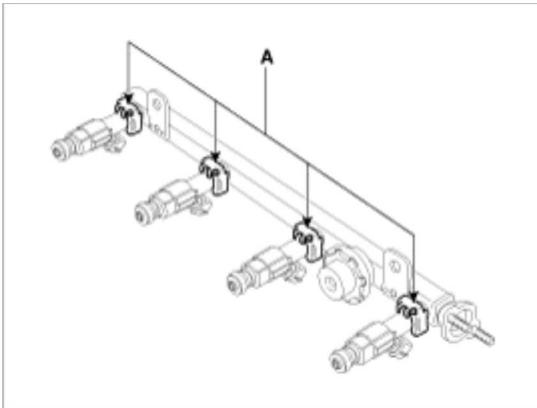
CAUTION

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. Disconnect the injector connector (A).
4. Remove the wiring harness bracket installation bolt (B).
5. Remove the installation nut, and then disconnect the fuel feed tube (C).
6. Remove the installation bolt (D), and then remove the delivery pipe & injector assembly from the engine.



7. Remove the fixing clip (A), and then separate the injector from the delivery pipe.



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

- Apply the engine oil to the injector O-ring.

CAUTION

- Inspect the injector O-ring when installing.

1. Installation is reverse of removal.

Delivery pipe installation bolt:

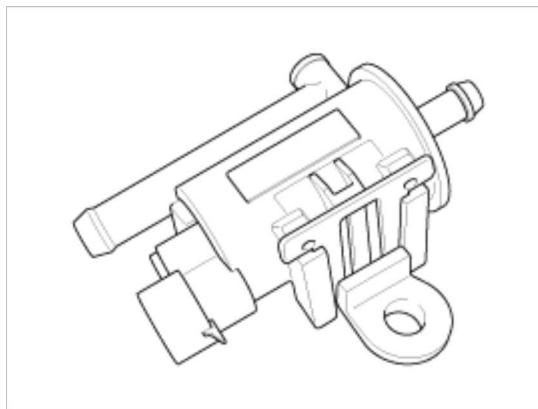
18.6 ~ 23.5 N.m (1.9 ~ 2.4 kgf.m, 13.7 ~ 17.4 lb-ft)

Delivery pipe installation nut (↔ Fuel feed tube):

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

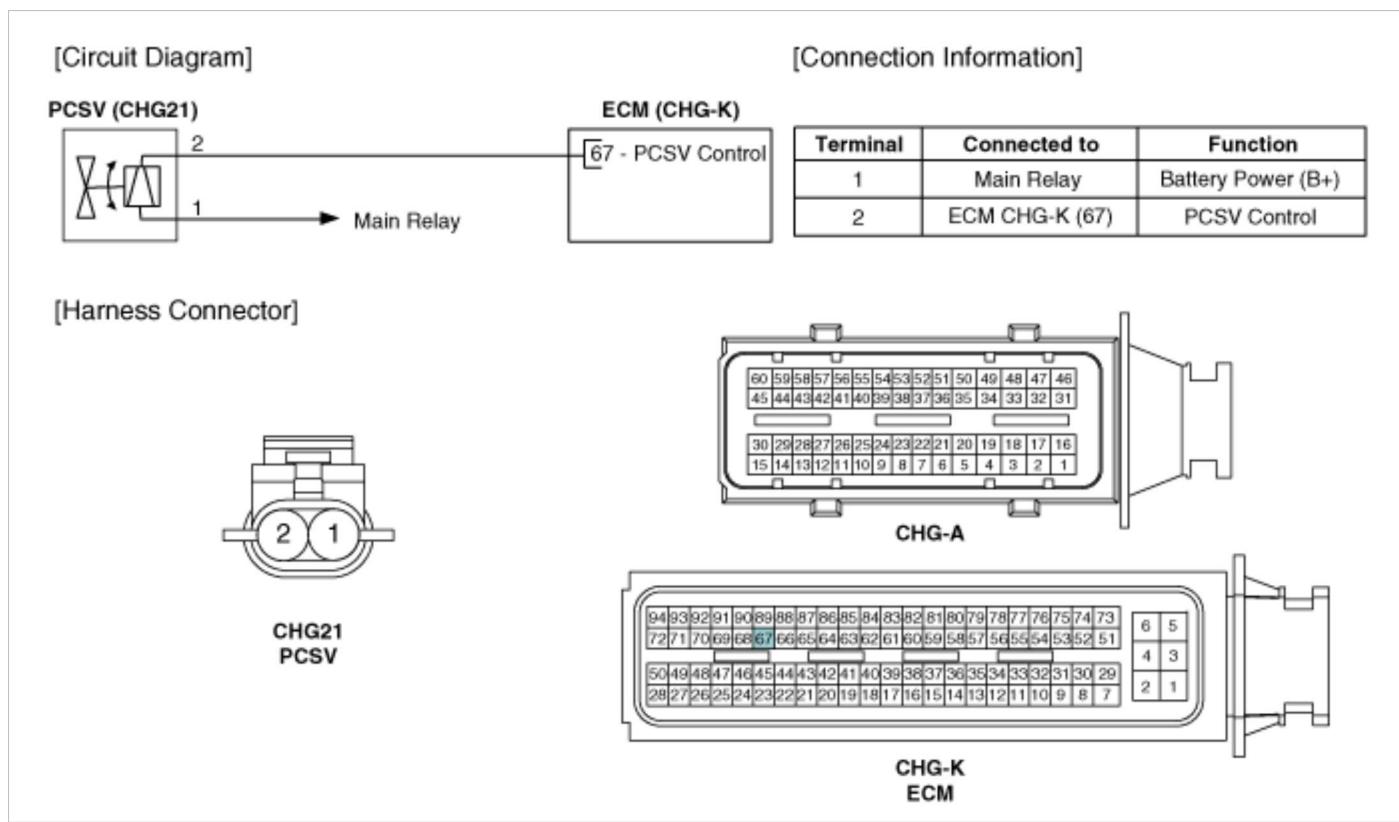
Fuel System > Engine Control System > Purge Control Solenoid Valve (PCSV) > Description and Operation
Description

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)	19.0 ~ 22.0 [20°C(68°F)]

Fuel System > Engine Control System > Purge Control Solenoid Valve (PCSV) > Schematic Diagrams
Circuit Diagram



Fuel System > Engine Control System > Purge Control Solenoid Valve (PCSV) > Repair procedures

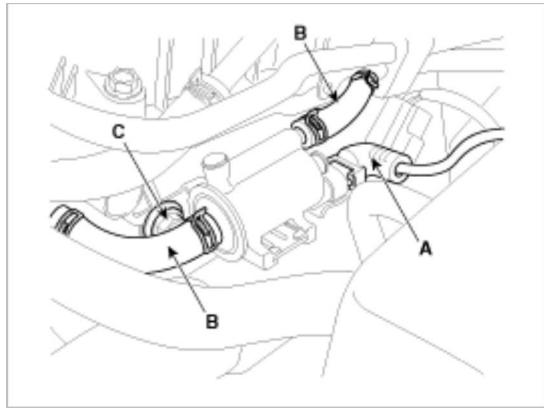
Inspection

1. Turn 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 bracket installation bolt (C), and then remove the valve from the surge tank.



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

- 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.

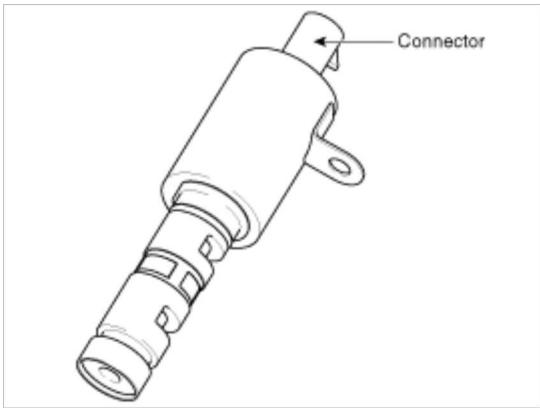
By controlling CVVT, the valve over-lap or under-lap occurs, which makes better fuel economy and reduces exhaust gases (NOx, HC) and improves engine performance through reduction of pumping loss, internal EGR effect, improvement of combustion stability, improvement of volumetric efficiency, and increase of expansion work.

This system consist of

-the CVVT Oil Control Valve (OCV) which supplies the engine oil to the cam phaser or runs out the engine oil from the cam phaser in accordance with the ECM PWM (Pulse With Modulation) control signal,

-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.



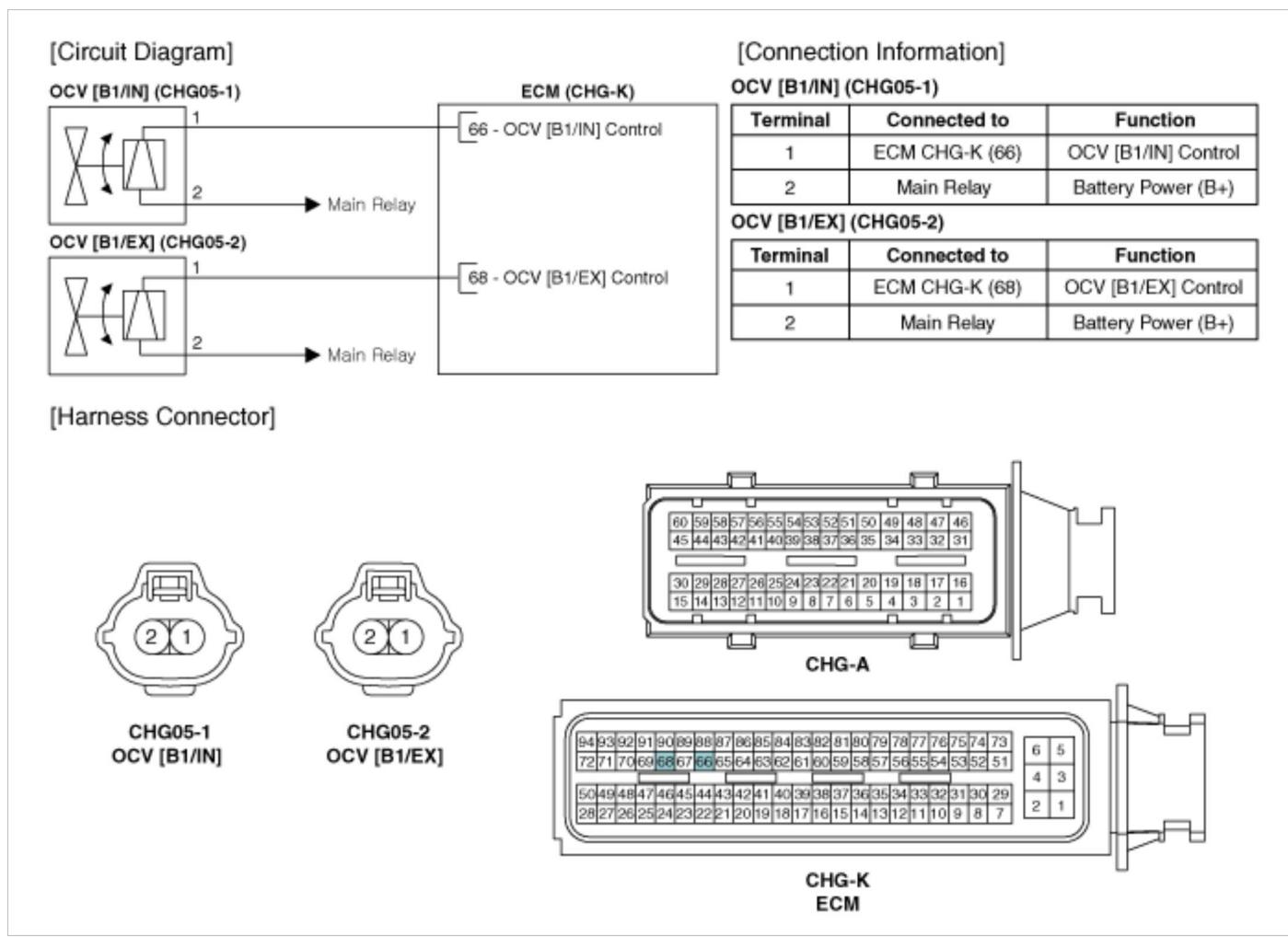
Fuel System > Engine Control System > CVVT Oil Control Valve (OCV) > Specifications

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



Fuel System > Engine Control System > CVVT Oil Control Valve (OCV) > Repair procedures

Inspection

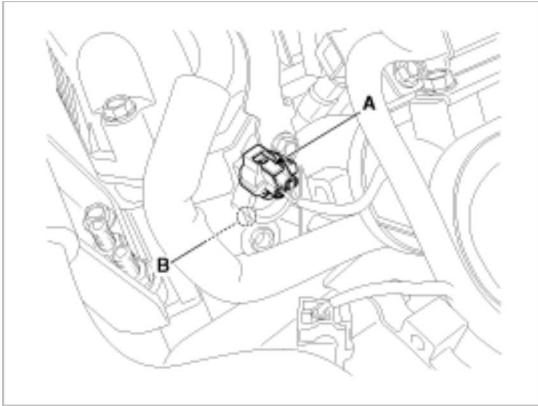
1. Turn the ignition switch OFF.
2. Disconnect the OCV connector.
3. Measure resistance between the OCV terminals 1 and 2.
4. Check that the resistance is within the specification.

Specification: Refer to "Specification"

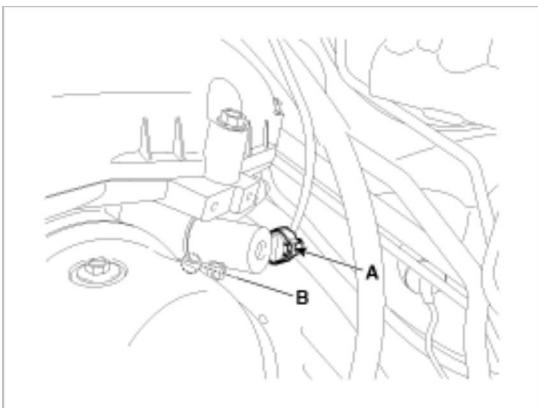
Removal

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. In this case, use it after inspecting.

CAUTION

- Apply engine oil to the valve O-ring.

1. Installation is reverse of removal.

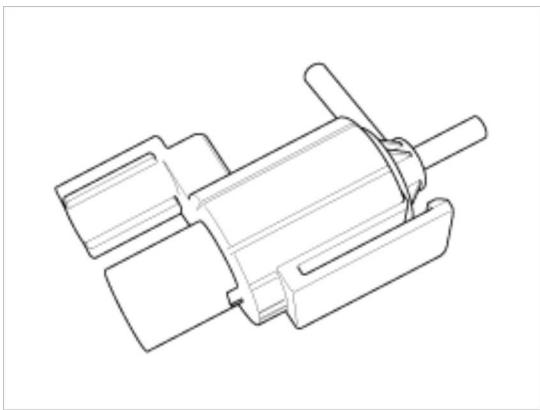
CVVT oil control valve installation bolt:

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

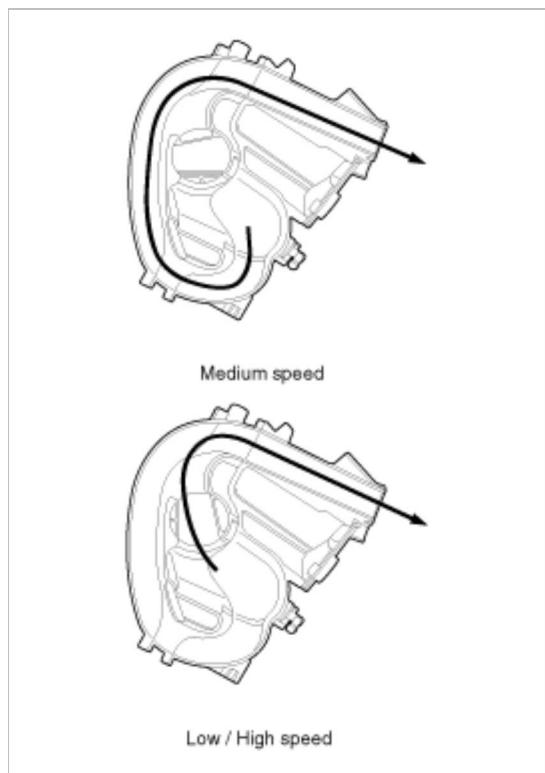
Fuel System > Engine Control System > Variable Intake Solenoid (VIS) Valve > Description and Operation

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

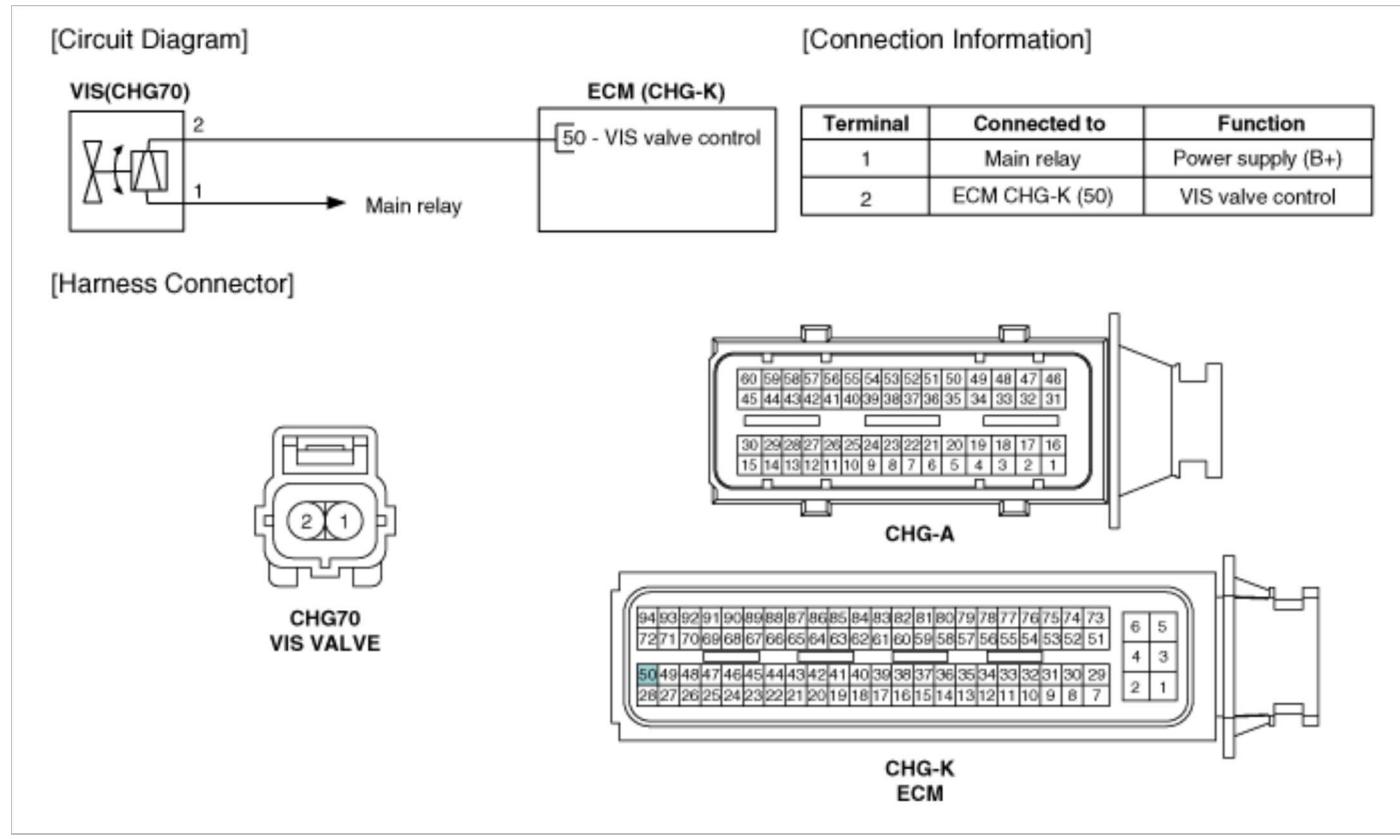
Specification

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



Fuel System > Engine Control System > Variable Intake Solenoid (VIS) Valve > Repair procedures

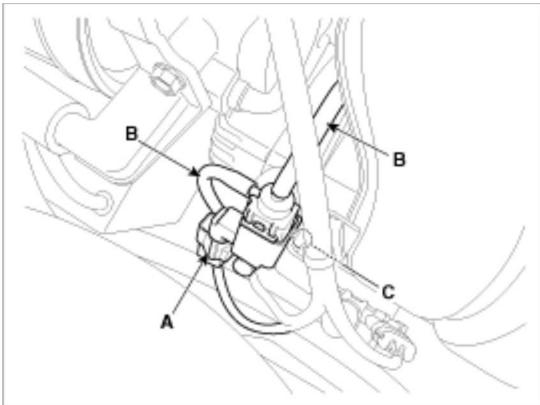
Inspection

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 nut (C), and then remove the valve from the surge tank.



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

- Be careful of foreign material not to flow into the valve.

1. Installation is reverse of removal.

Fuel System > Engine Control System > Canister Close Valve (CCV) > Description and Operation

Description

Canister Close Valve (CCV) is installed on the canister ventilation line. It seals evaporative emission control system by shutting the canister from the atmosphere when leakage detecting system operates.



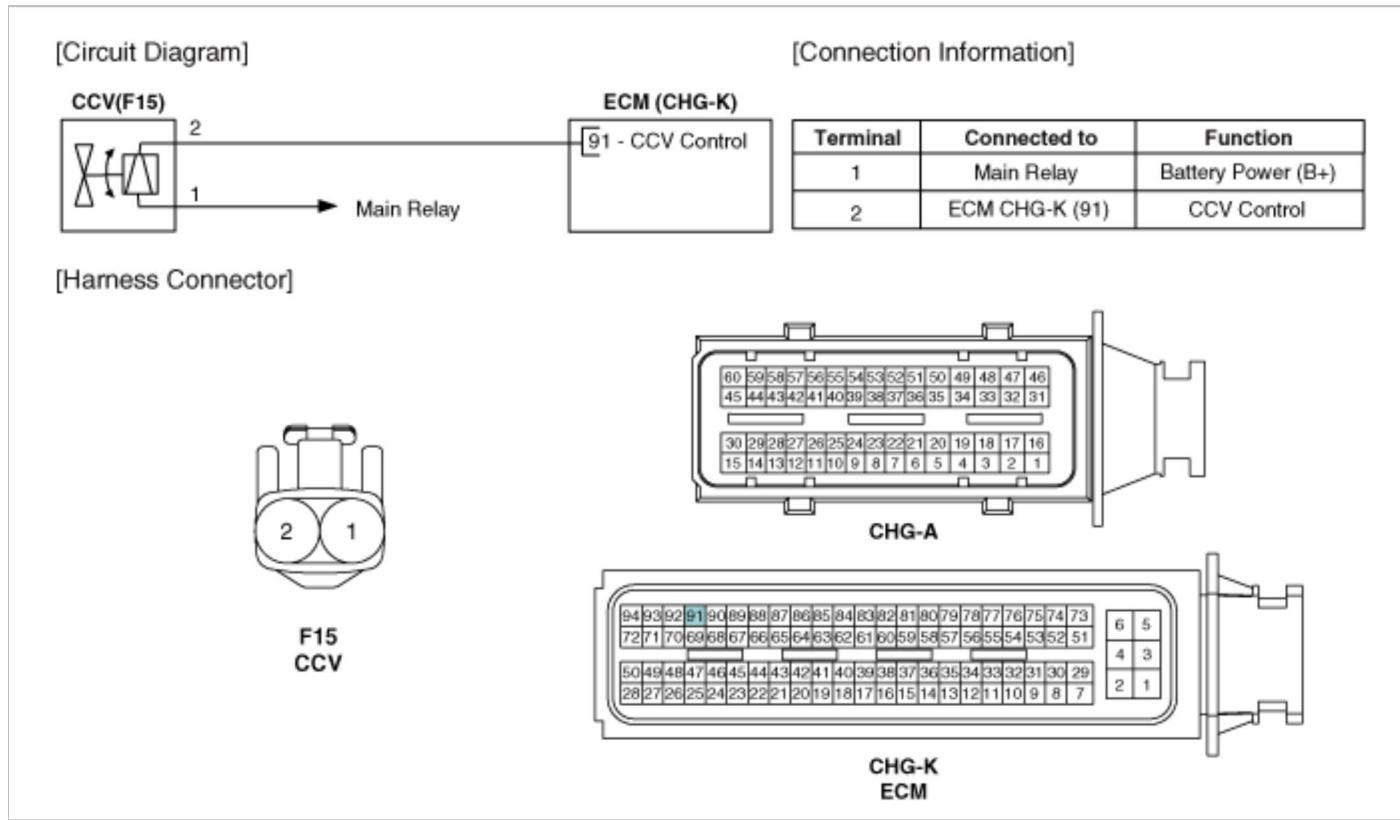
Fuel System > Engine Control System > Canister Close Valve (CCV) > Specifications

Specification

Item	Specification
Coil Resistance (Ω)	19.8 ~ 21.8 [20°C(68°F)]

Fuel System > Engine Control System > Canister Close Valve (CCV) > Schematic Diagrams

Circuit Diagram



Fuel System > Engine Control System > Canister Close Valve (CCV) > Repair procedures

Inspection

1. Turn the ignition switch OFF.
2. Disconnect the CCV connector.
3. Measure resistance between the CCV terminal 1 and 2.
4. Check that the resistance is within the specification.

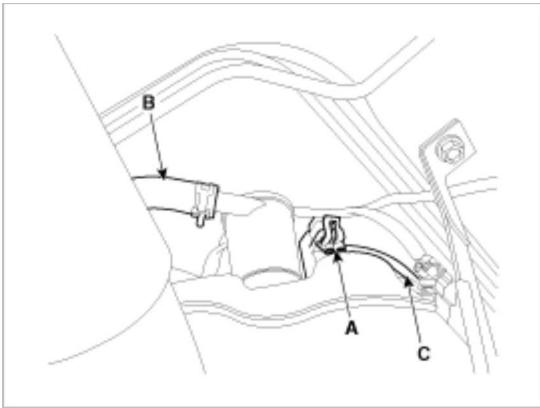
Specification: Refer to "Specification"

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.

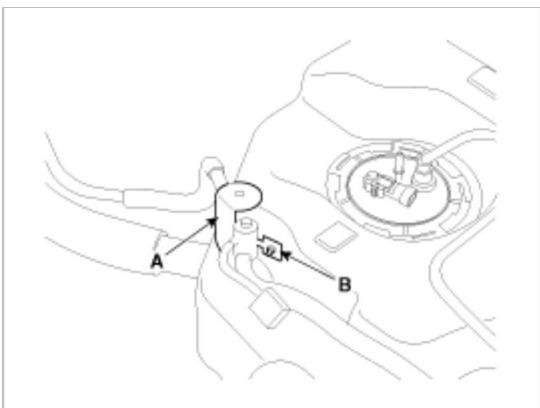
Specification: Vacuum maintained

Removal

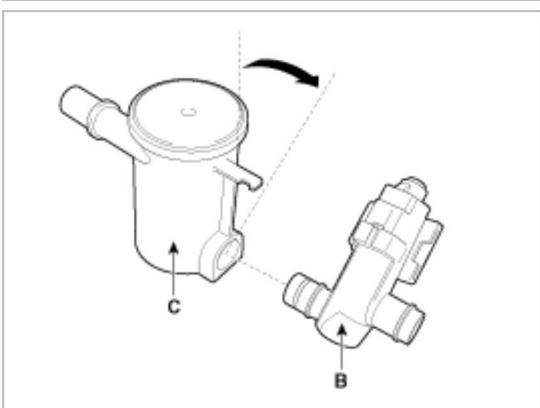
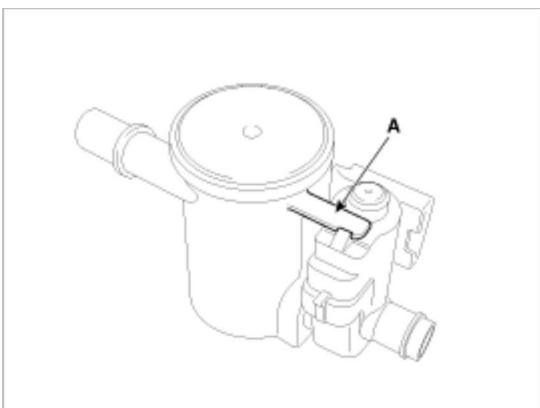
1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Lift the vehicle.
3. Disconnect the canister close valve connector (A).
4. Disconnect the ventilation hose (B,C) from the fuel tank air filter and canister close valve.



5. Remove the fuel tank air filter and canister close valve assembly (A) after removing the mounting nut (B).



6. Release the lever (A), and then separate the canister close valve (B) from the fuel tank air filter (C) after rotating it in the direction of the arrow in the figure.



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 & fuel tank air filter bracket installation nut:

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

Fuel System > Engine Control System > Variable Charge Motion Actuator (VCMA) > Description and Operation

Description

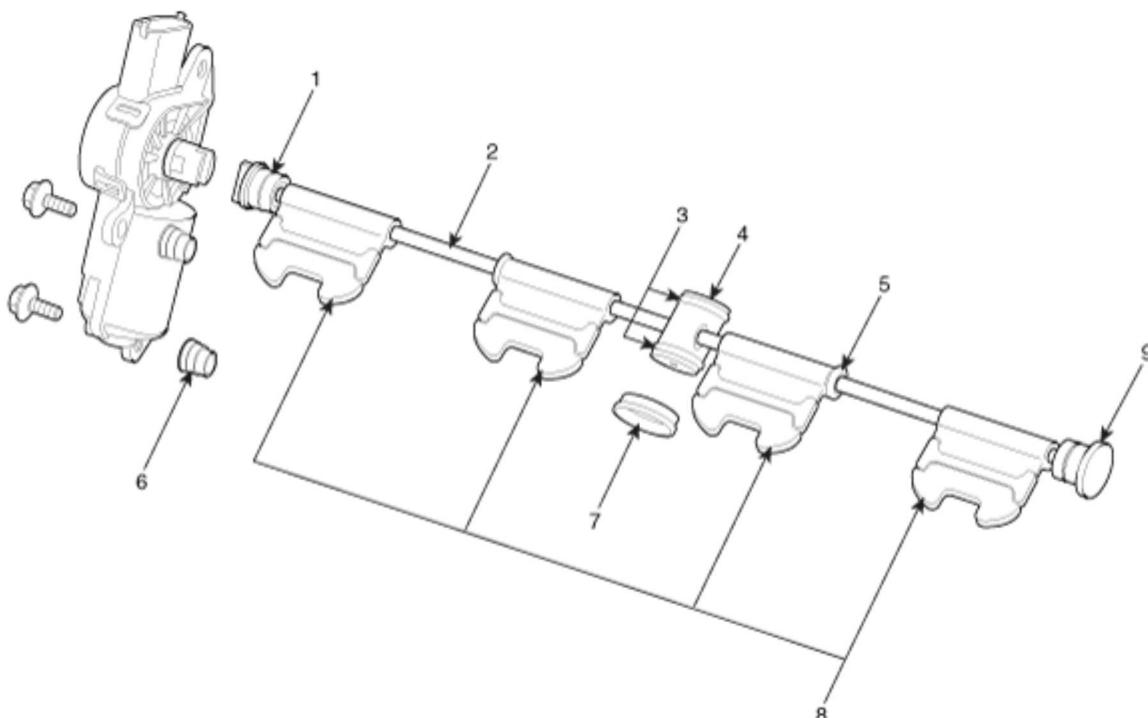
The Variable Charge Motion Actuator (VCMA) is installed on the inlet of the intake manifold.

It consists of a DC motor which actuates the VCM valve and a position sensor which detects the position of the VCM valve.

The VCM system tumbles air flow entering into combustion chamber of each cylinder by closing the VCM valve in the cold start conditions.

This tumble effect reduces emission gas by increasing air/ fuel mixture.

Fuel System > Engine Control System > Variable Charge Motion Actuator (VCMA) > Components and Components Location

Components

1. Coupling
2. Shaft

6. Insert nut
7. Stabilizer Cover

- 3. Stabilizer O-ring
- 8. Valve
- 4. Stabilizer
- 9. Hole cover
- 5. O-ring

Fuel System > Engine Control System > Variable Charge Motion Actuator (VCMA) > Specifications

Specification

Motor

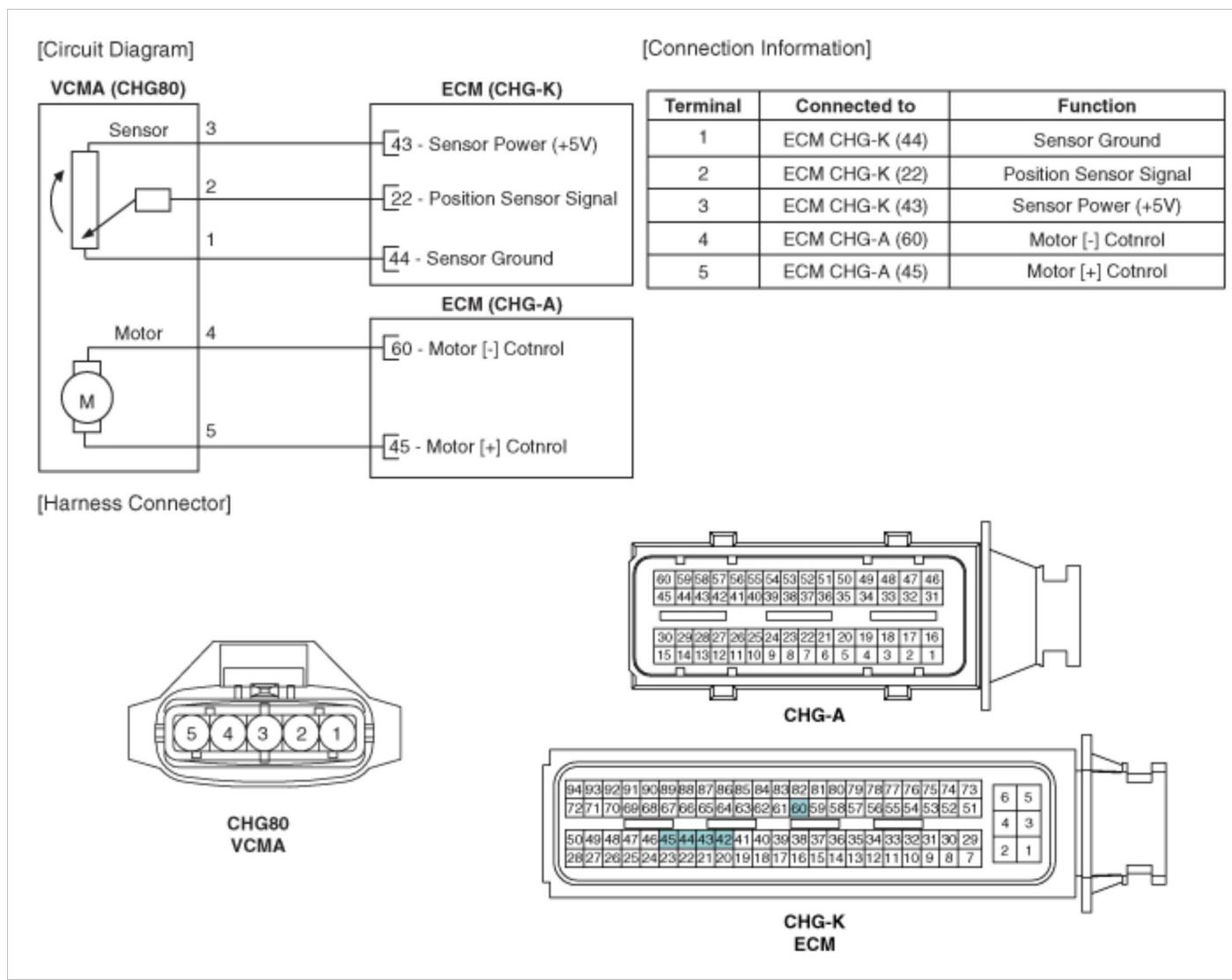
Item	Specification	
Coil Resistance	Normal	1 ~ 999 Ω
	Short Circuit	Below 1 Ω
	Open Circuit	Over 1 kΩ

Position sensor

Item	Specification
Coil Resistance (kΩ)	3.44 ~ 5.16 [20°C(68°F)]

Fuel System > Engine Control System > Variable Charge Motion Actuator (VCMA) > Schematic Diagrams

Circuit diagram



Fuel System > Engine Control System > Variable Charge Motion Actuator (VCMA) > Repair procedures

Inspection

1. Turn ignition switch OFF.
2. Disconnect the VCMA connector.
3. Check that the VCMA is not stuck by foreign material.
4. Measure resistance between motor (+) and (-) control terminals of the motor.
5. Check that the resistance is within the specification.

Specification:

[Normal] 1 ~ 999 Ω

[Short circuit] Below 1 Ω

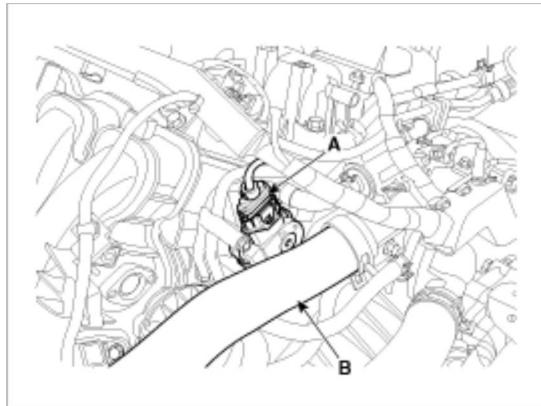
[Open circuit] Over 1 kΩ

6. Measure resistance between voltage supply terminal and ground terminal of the position sensor.
7. Check that the resistance is within the specification.

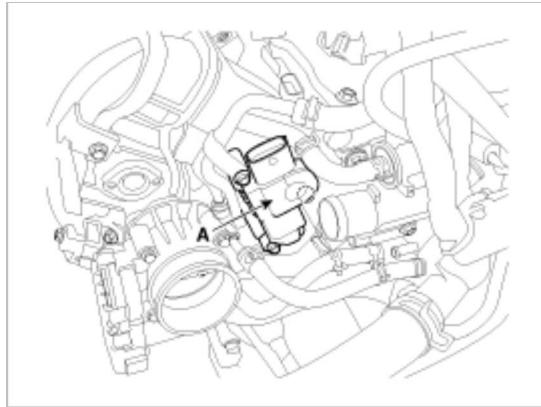
Specification: 3.44 ~ 5.16 [20°C(68°F)]

Removal

1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Disconnect the VCMA connector (A).
3. Disconnect the engine coolant hose (B).



4. Remove the VCMA (A) after removing 3 installation 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.

CAUTION

The VCM actuator has to be installed at the fully closing positon of the VCM valve.
If it doesn't, the VCM coupling of the VCM shaft can't be put in the the VCM actuator.

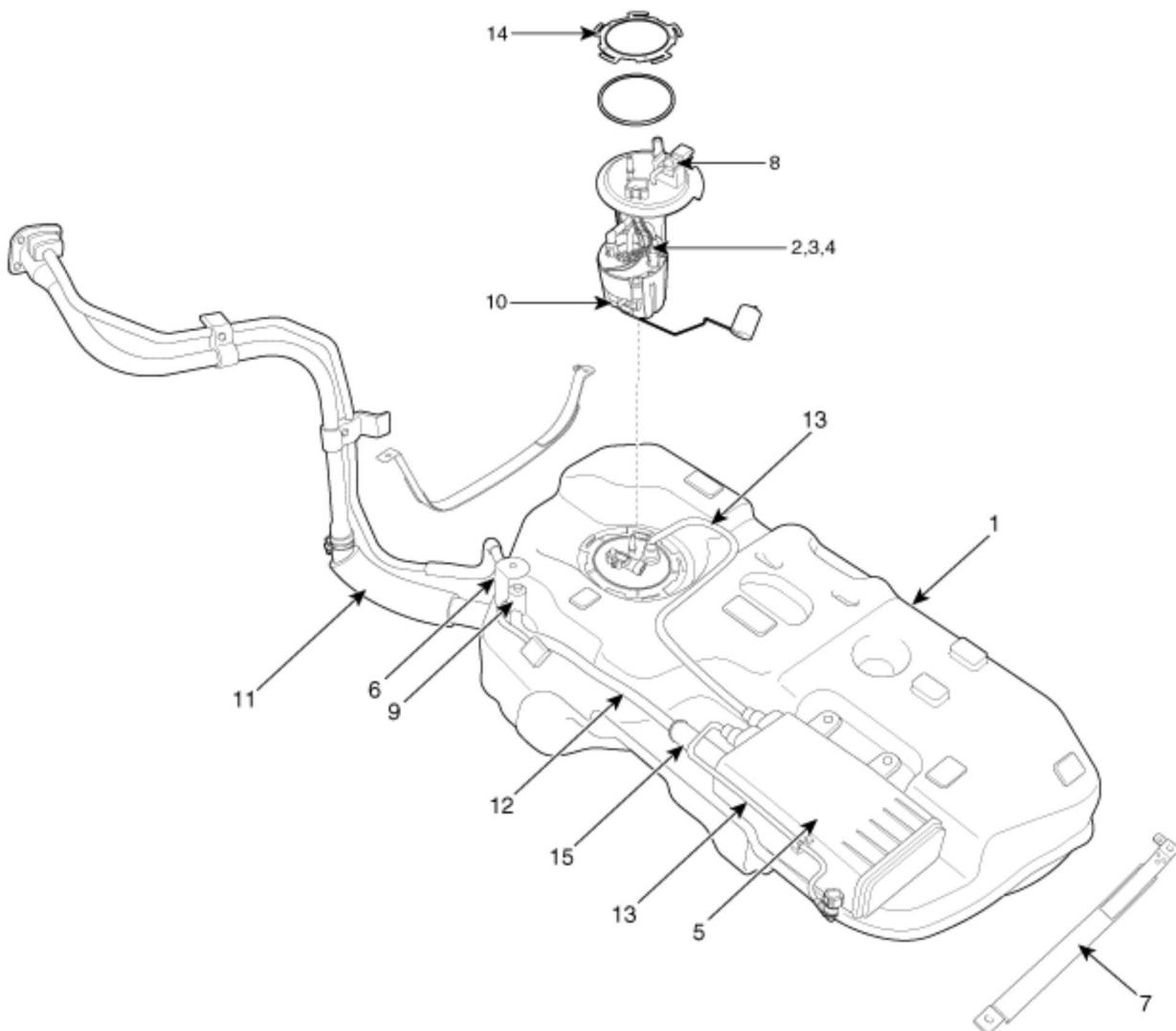
1. Installation is reverse of removal.

Variable charge motion actuator 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 > Components and Components Location

Components Location



1. Fuel tank	8. Fuel tank pressure sensor (FTPS)
2. Fuel pump	9. Canister close valve (CCV)
3. Fuel filter	10. Fuel level sensor (FLS)
4. Fuel pressure regulator	11. Fuel filler hose
5. Canister	12. Ventilation hose
6. Fuel tank air filter	13. Vapor tube
7. Fuel tank band	14. Fuel pump locking ring
	15. Auxiliary canister (SULEV only)

Fuel System > Fuel Delivery System > Repair procedures

Fuel Pressure Test

- 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.

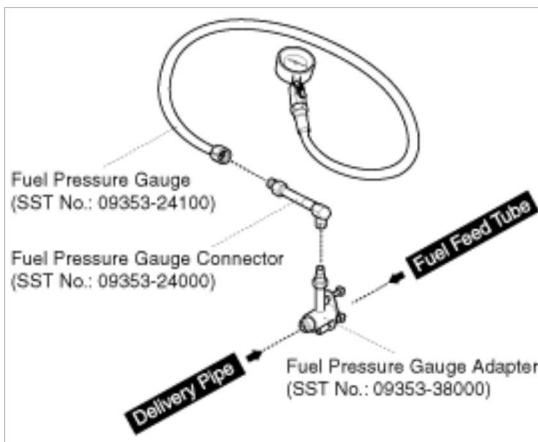
2. Install the Special Service Tool (SST).

- (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: 324 ~ 363 kPa (3.3 ~ 3.7 kgf/cm², 46.9 ~ 52.6 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").

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.

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.

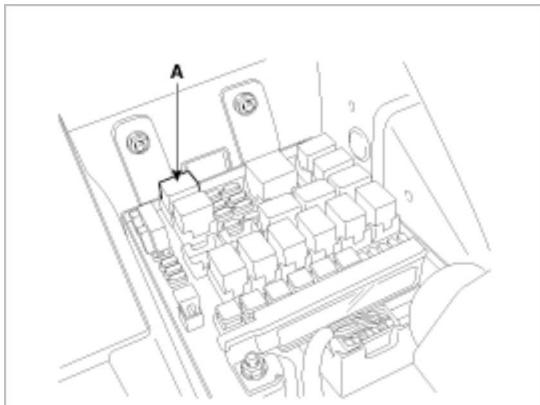
Release Residual Pressure in Fuel Line

CAUTION

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.

1. Turn the ignition switch OFF and disconnect the battery (-) cable.

2. Remove the fuel pump relay (A).



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. Connect the battery (-) cable.

4. Start the engine and let idle, and then turn the ignition switch OFF after the engine has stopped on its own.

5. Disconnect the battery (-) cable, and then install the fuel pump relay (A).

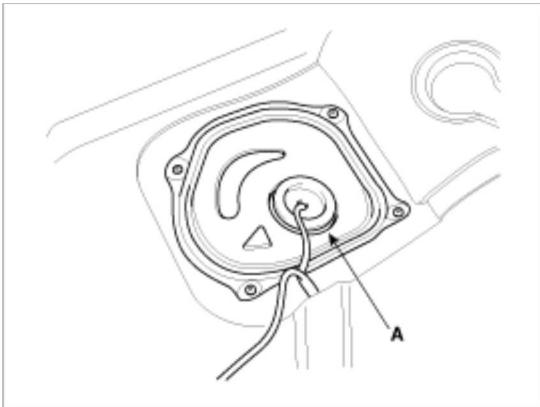
6. Connect the battery (-) cable.

- Delete the Diagnostic Trouble Code (DTC) related the fuel pump relay with the GDS.

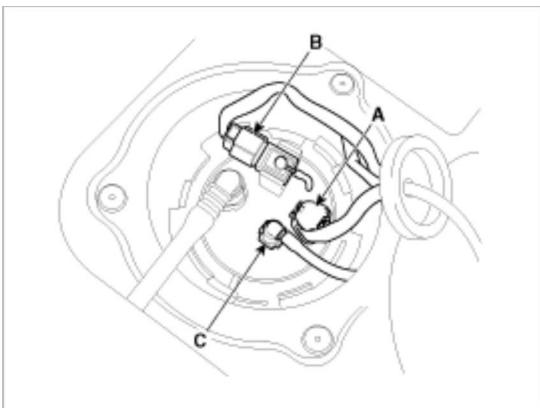
Fuel System > Fuel Delivery System > Fuel Tank > Repair procedures

Removal

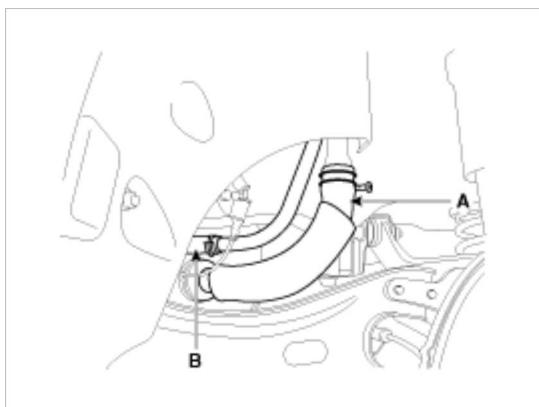
- Release the residual pressure in fuel line (Refer to "Release Residual Pressure in Fuel Line" in this group).
- Remove the rear seat cushion (Refer to "Seat" in BD group).
- Remove the fuel pump service cover (A).



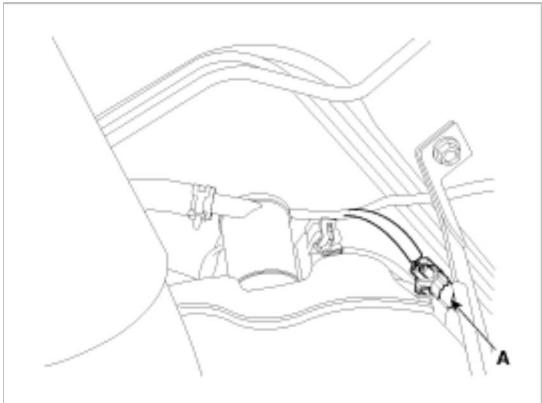
- Disconnect the fuel pump connector (A) and the fuel tank pressure sensor connector (B).
- Disconnect the fuel feed tube quick connector (C).



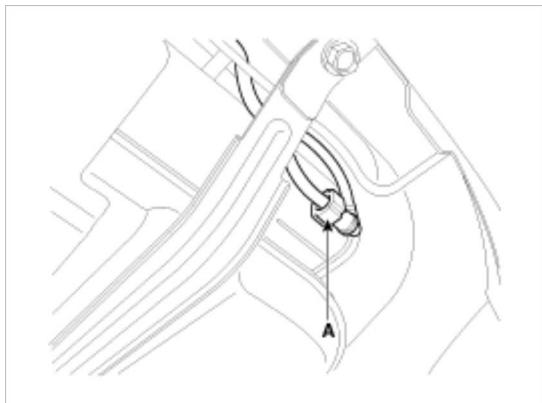
- Remove the rear - LH wheel & tire.
- Lift the vehicle and support the fuel tank with a jack.
- Remove the center muffler assembly (Refer to "Intake And Exhaust System" in EM group).
- Remove the propeller shaft (Refer to "Propeller Shaft Assembly" in DS group) [4WD].
- Disconnect the fuel filler hose (A) and the ventilation hose (B).



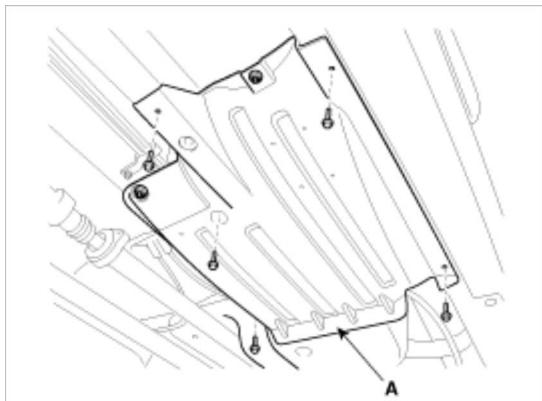
11. Disconnect the canister close valve connector (A).



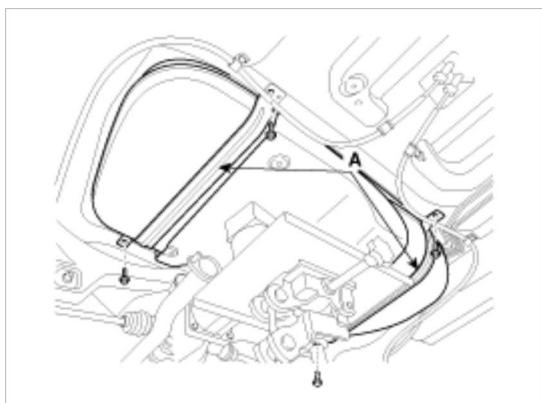
12. Disconnect the vapor tube quick-connector (A).



13. Remove the under cover (A).



14. Remove the fuel tank from the vehicle after removing the fuel tank band (A).



NOTE

When removing the fuel tank, the fuel tank must be tilted because of interfering with coupling.

Installation

1. Installation is reverse of removal.

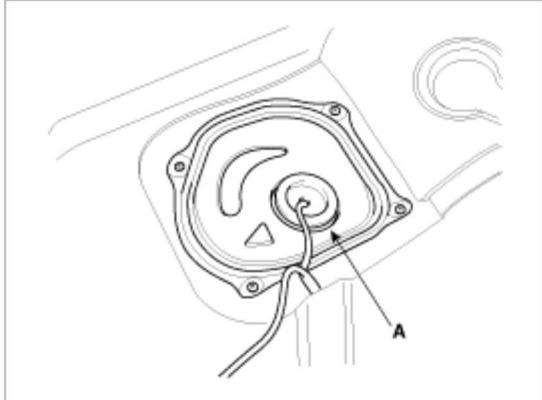
Fuel tank band installation nut:

39.2 ~ 54.0 N.m (4.0 ~ 5.5 kgf.m, 28.9 ~ 39.8 lb-ft)

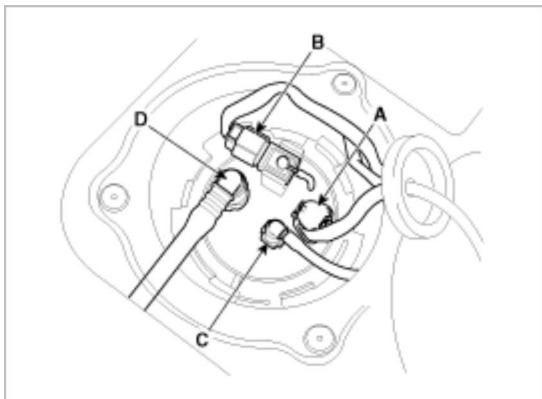
Fuel System > Fuel Delivery System > Fuel Pump > Repair procedures

Removal

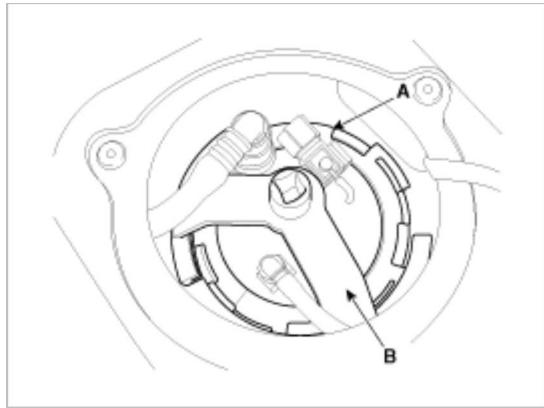
1. Release the residual pressure in fuel line (Refer to “Release Residual Pressure in Fuel Line” in this group).
2. Remove the rear seat (Refer to “Seat” in BD group).
3. Remove the fuel pump service cover (A).



4. Disconnect the fuel pump connector (A) and the fuel tank pressure sensor connector (B).
5. Disconnect the fuel feed tube quick connector (C) and the vapor tube quick-connector (D).

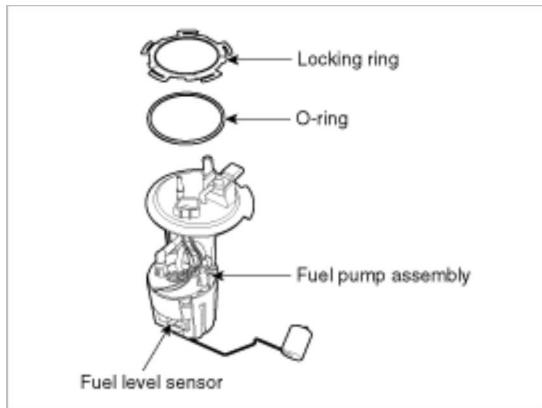


6. Remove locking ring (A) by using the special service tool (B) [No.:09310-2S200].



Fuel pump locking ring loosening torque: Min. 68.65 M.m (Min. 7 kgf.m, Min. 50.6 lb-ft)

7. Remove the fuel pump from the fuel tank.



Installation

1. Installation is reverse of removal.

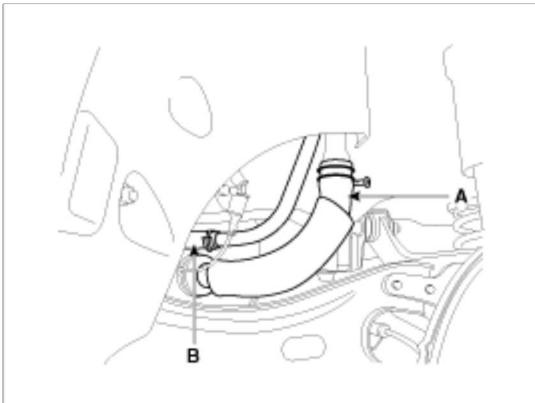
CAUTION

Be careful of fuel pump direction when installing (Refer to the groove in the fuel tank).

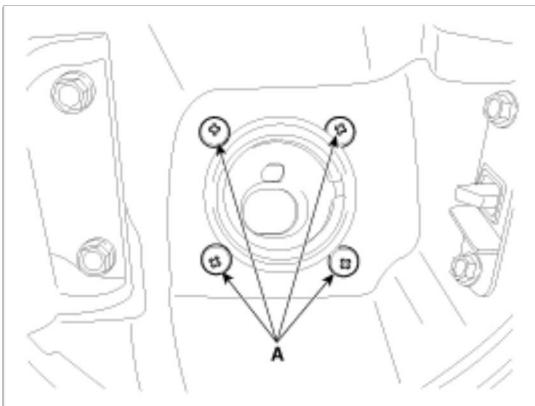
Fuel System > Fuel Delivery System > Filler-Neck Assembly > Repair procedures

Removal

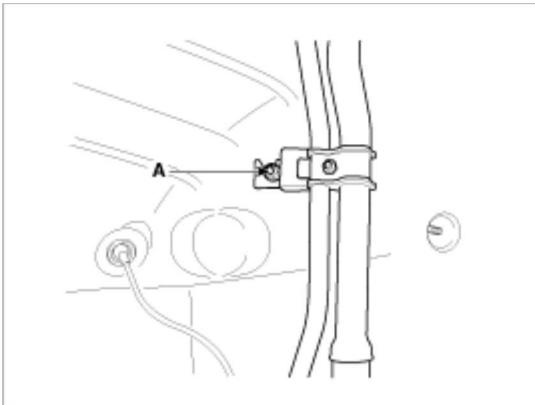
1. Remove the rear-LH wheel, tire, and the inner wheel house.
2. Disconnect the fuel filler hose (A) and the ventilation hose (B).



3. Open the fuel filler door and unfasten the filler-neck assembly mounting screw (A).



4. Remove the filler-neck assembly from the vehicle after removing the bracket mounting nut (A).



Installation

1. Installation is reverse of removal.

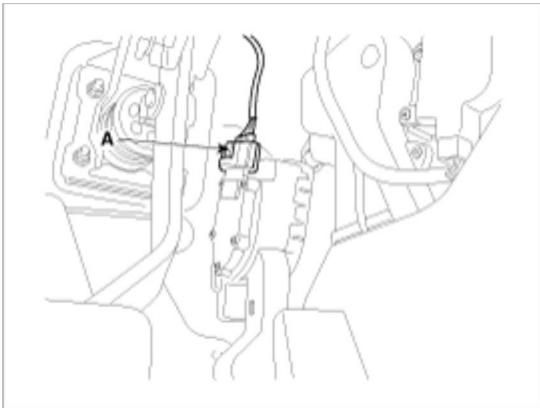
Filler-neck assembly bracket installation nut :

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

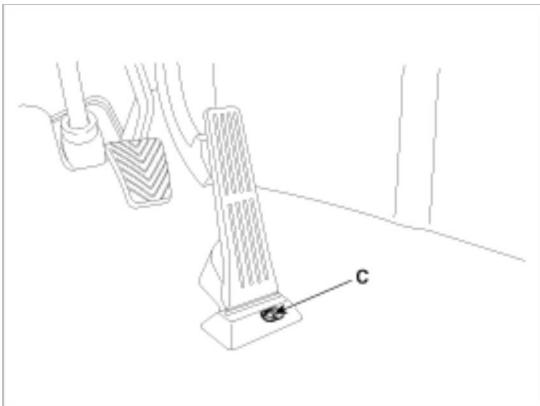
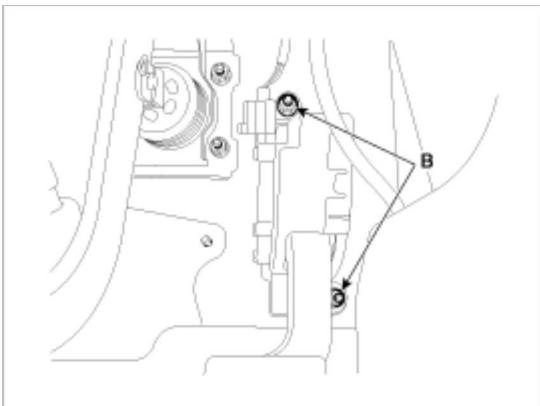
Fuel System > Fuel Delivery System > Accelerator Pedal > Repair procedures

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), the bolt (C) 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)

Accelerator pedal module installation bolt:

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

Fuel System > Fuel Delivery System > Delivery Pipe > Repair procedures

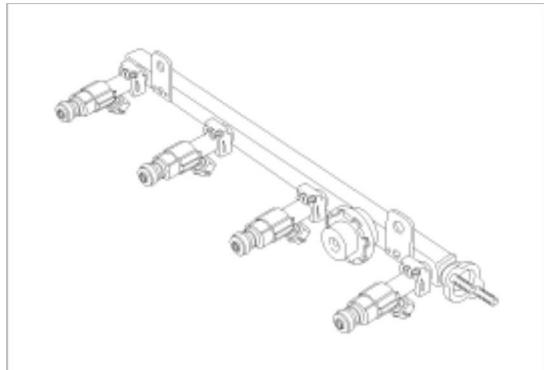
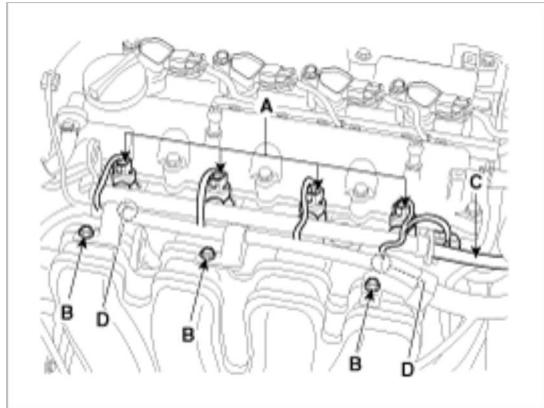
Removal

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. Disconnect the injector connector (A).
4. Remove the wiring harness bracket installation bolt (B).
5. Remove the installation nut, and then disconnect the fuel feed tube (C).
6. Remove the installation bolt (D), and then remove the delivery pipe & injector assembly from the engine.



Installation

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)

Delivery pipe installation nut (↔ Fuel feed tube):

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