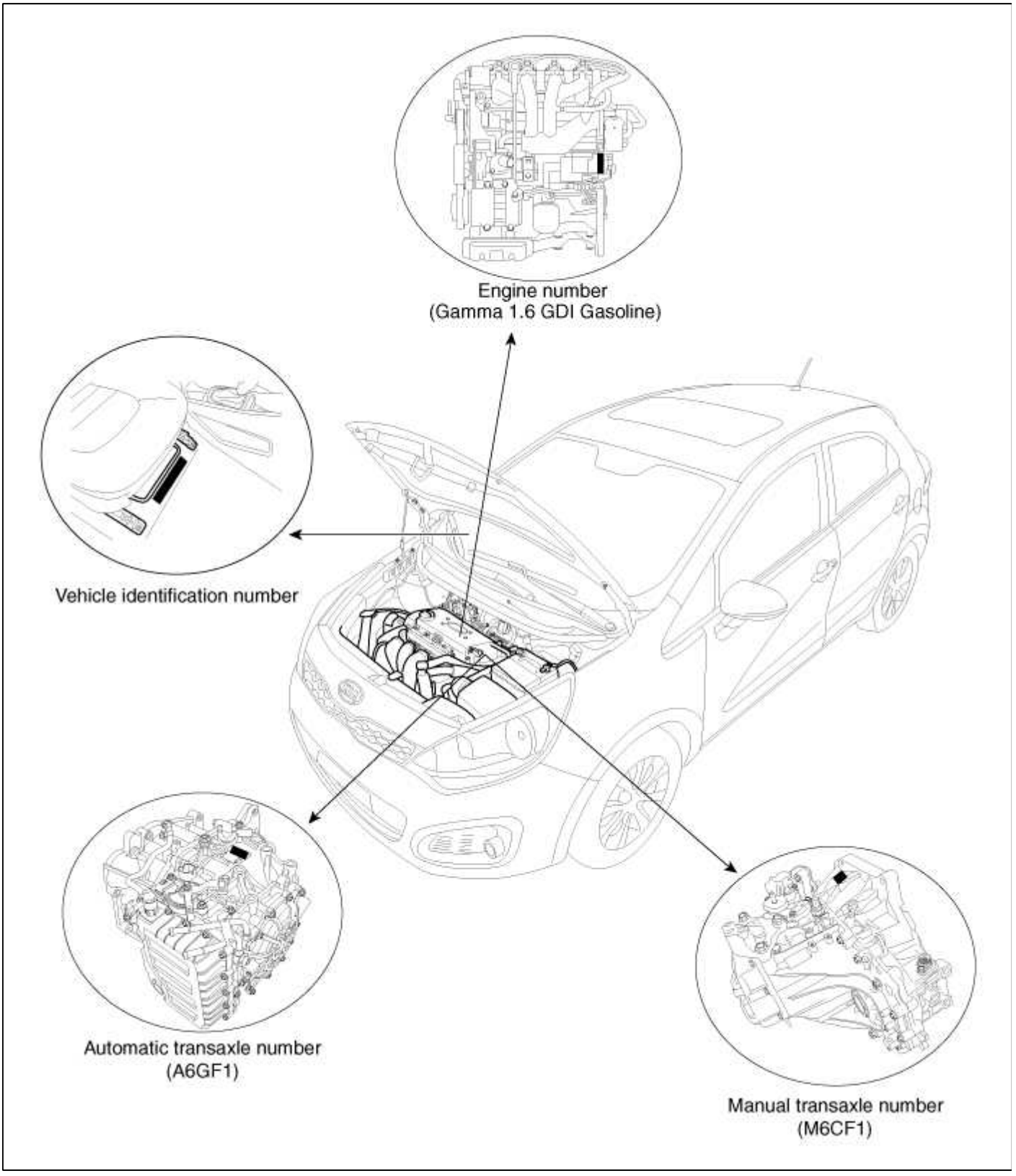
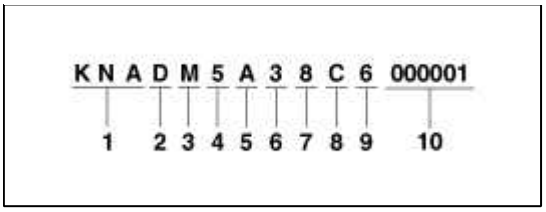
RIO(UB) > 2012 > G 1.6 GDI > General Information

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
   - D : RIO
3. Model & Series
   - L : Low grade (L)
   - M : Middle-Low grade (GL)
   - N : Middle grade (GLS, JSL, TAX)
   - P : Middle-High grade (HGS)
   - R : 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 4×2 Class-D
- 5 : Wagon 4×2 Class-E
- 6 : Wagon 4×2 Class-F
- 7 : Wagon 4×2 Class-G
- A : Wagon 4×4 Class-A
- B : Wagon 4×4 Class-B
- C : Wagon 4×4 Class-C
- D : Wagon 4×4 Class-D
- E : Wagon 4×4 Class-E
- F : Wagon 4×4 Class-F
- G : Wagon 4×4 Class-G

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

5. Restraint system, Brake system

KNA, KND

Except U.S.A, Canada, Mexico
- 0 : Both side - None
- 1 : Both side - Active belt
- 2 : Both side - Passive belt

For U.S.A, Canada, Mexico

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

KNC, KNH

Except U.S.A, Canada, Mexico
- 7 : Hydraulic brake system
- 8 : Pneumatic brake system
- 9 : Mixed brake system

For U.S.A, Canada, Mexico

- X : Hydraulic brake system
- Y : Pneumatic brake system
- Z : Mixed brake system

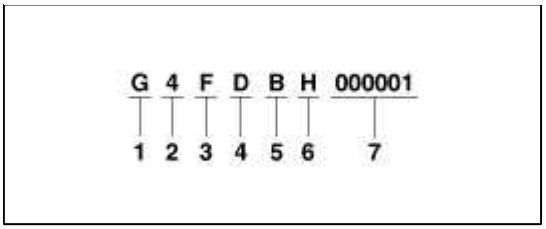
6. Engine type
   - 3 : Gasoline engine 1.6 (Gamma)
7. Check digit or Driver's side & Transmission
   Except U.S.A, Canada, Mexico, Gulf Cooperation Council, China, Yemen
   - A : LHD & MT
   - B : LHD & AT
   - C : LHD & MT+Transfer
   - D : LHD & AT+Transfer
   - E : LHD & CVT
   - L : RHD & MT
   - M : RHD & AT
   - N : RHD & MT+Transfer
   - S : RHD & AT+Transfer
   - T : RHD & CVT

   For U.S.A, Canada, Mexico, Gulf Cooperation Council, China, Yemen
   - Check digit : 0 ~ 9, ×
8. Model year
   - A : 2010, B : 2011, C : 2012, D : 2013, E : 2014 …
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	Clean White
3D	Bright Silver
ABT	Graphite
9B	Black
BEG	Signal Red
BLA	Formal Deep Blue
FDP	Fresh Beige
DBS	Wendy Brown
F2G	Caramel Yellow
FBD	Electric Blue

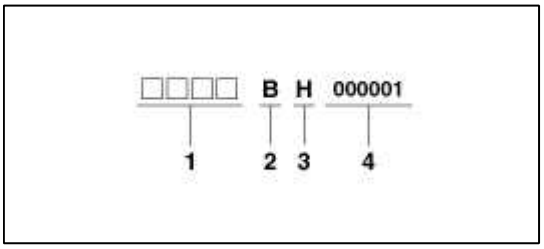
Engine Number



1. Engine fuel
   - G : Gasoline
2. Engine range
   - 4 : 4 cycle 4 cylinder
3. Engine development order and capacity
   - F : Gamma engine (Gasoline)
4. Engine Capacity
   - D : 1,591cc (Gamma GDI)
5. Production year
   - A : 2010, B : 2011, C : 2012, D : 2013, E : 2014 …
6. Plant of production
   - A : Asan (Korea)
   - B : Beijing (China)
   - H : Hwasung (Korea)
   - K : Montgomery (U.S.A)
   - M : Chennai (India)
   - P : Poseung (Korea)
   - S : Sohari (Korea)
   - T : Izmit (Turkey)
   - U : Ulsan (Korea)
   - W : Shandong (China)
   - Z : Zilina (Slovakia)
   - 1 : Yancheng (China)
7. Engine production sequence number
   - 000001 ~ 999999

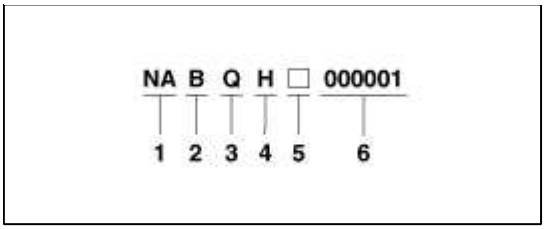
Transaxle Number

Manual



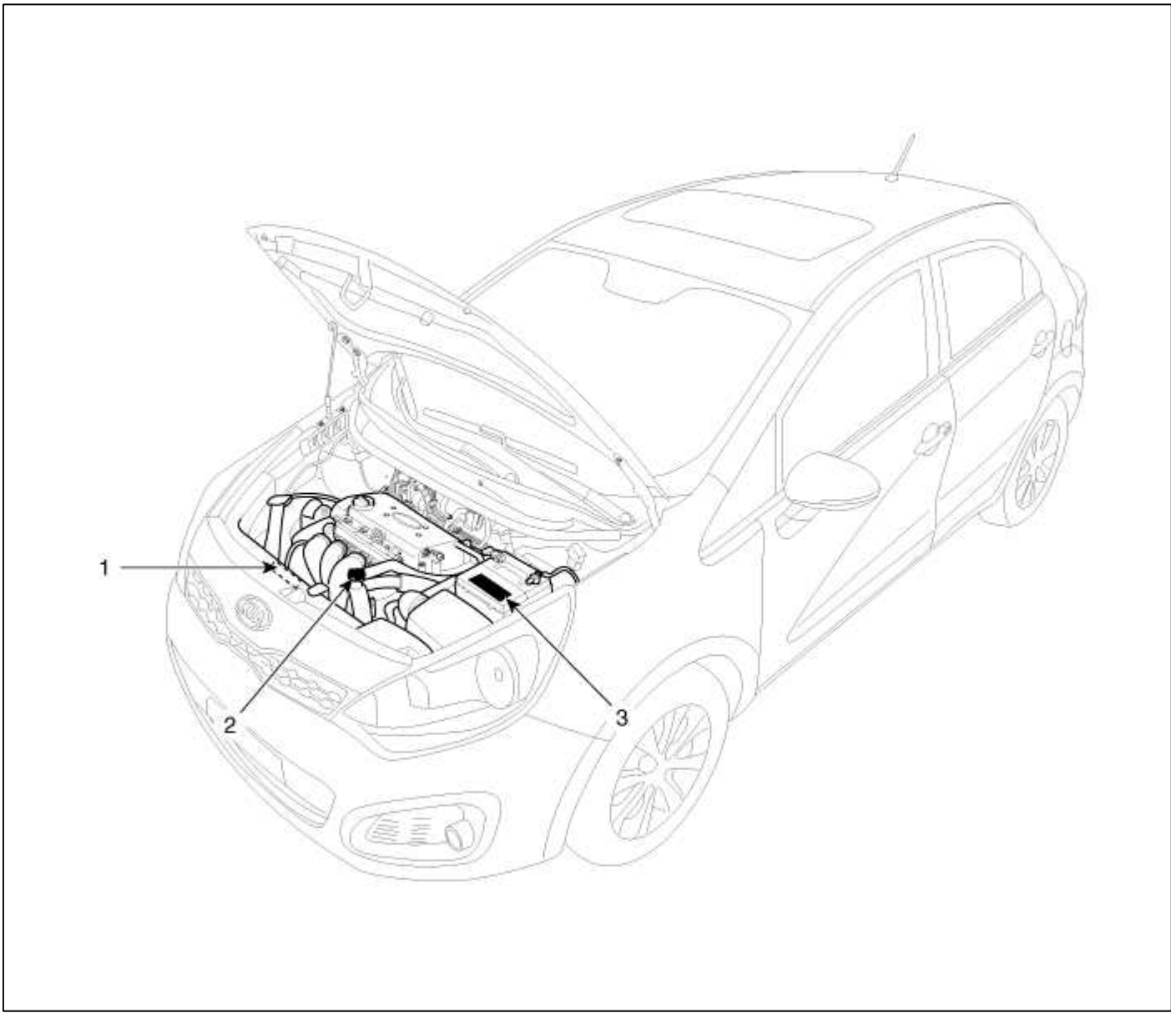
1. Assembly code of plant
2. Production year
   - A : 2010, B : 2011, C : 2012, D : 2013, E : 2014 …
3. Plant of production
   - H : Hwasung (Korea)
4. Transaxle production sequence number
   - 000001~999999

Automatic



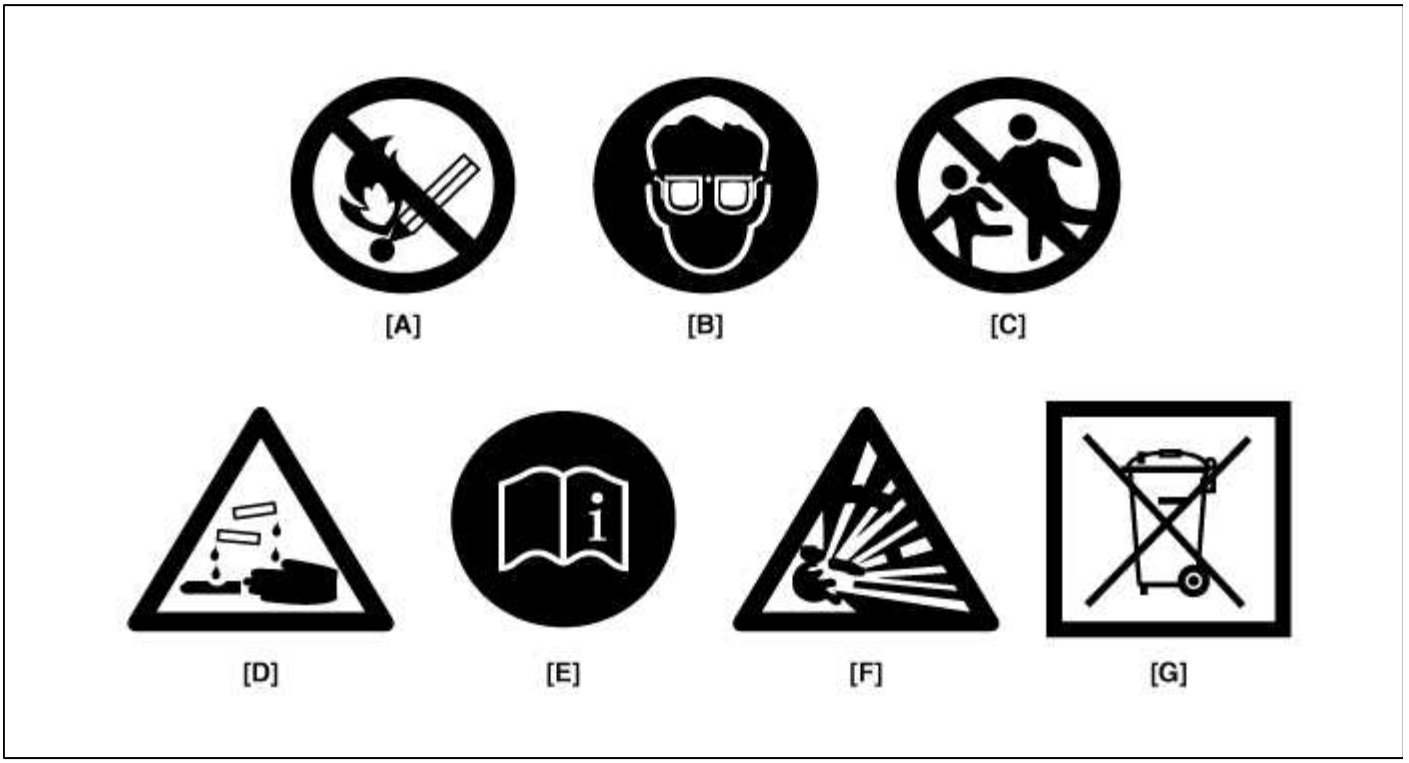
1. Model
   - NA : A6GF1
2. Production year
   - A : 2010, B : 2011, C : 2012, D : 2013, E : 2014 …
3. Gear ratio
   - Q : 3.270
4. Detailed classification
   - H : Gamma 1.6 GDI engine (Non-ISG)
   - I : Gamma 1.6 GDI engine (ISG)
5. Spare
6. Transaxle production sequence number
   - 000001 ~ 999999

Warning / Caution Label Locations



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

Battery Caution Label Description



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, throughly wash the contacted area. If you feel a pain or a burning sensation, get medical attention immediately.

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

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

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	• 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	• When storing the vehicle for long periods of time, make sure to remove the memory fuse at junction box to prevent natural discharging. • Also, run the engine for battery charging within 1 month if the memory fuse wasn't removed from the start of vehicle storing. If the memory fuse was removed, run the engine for battery charging within 3 months from the start of vehicle storing.

NOTE

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

Lift And Support Points

WARNING

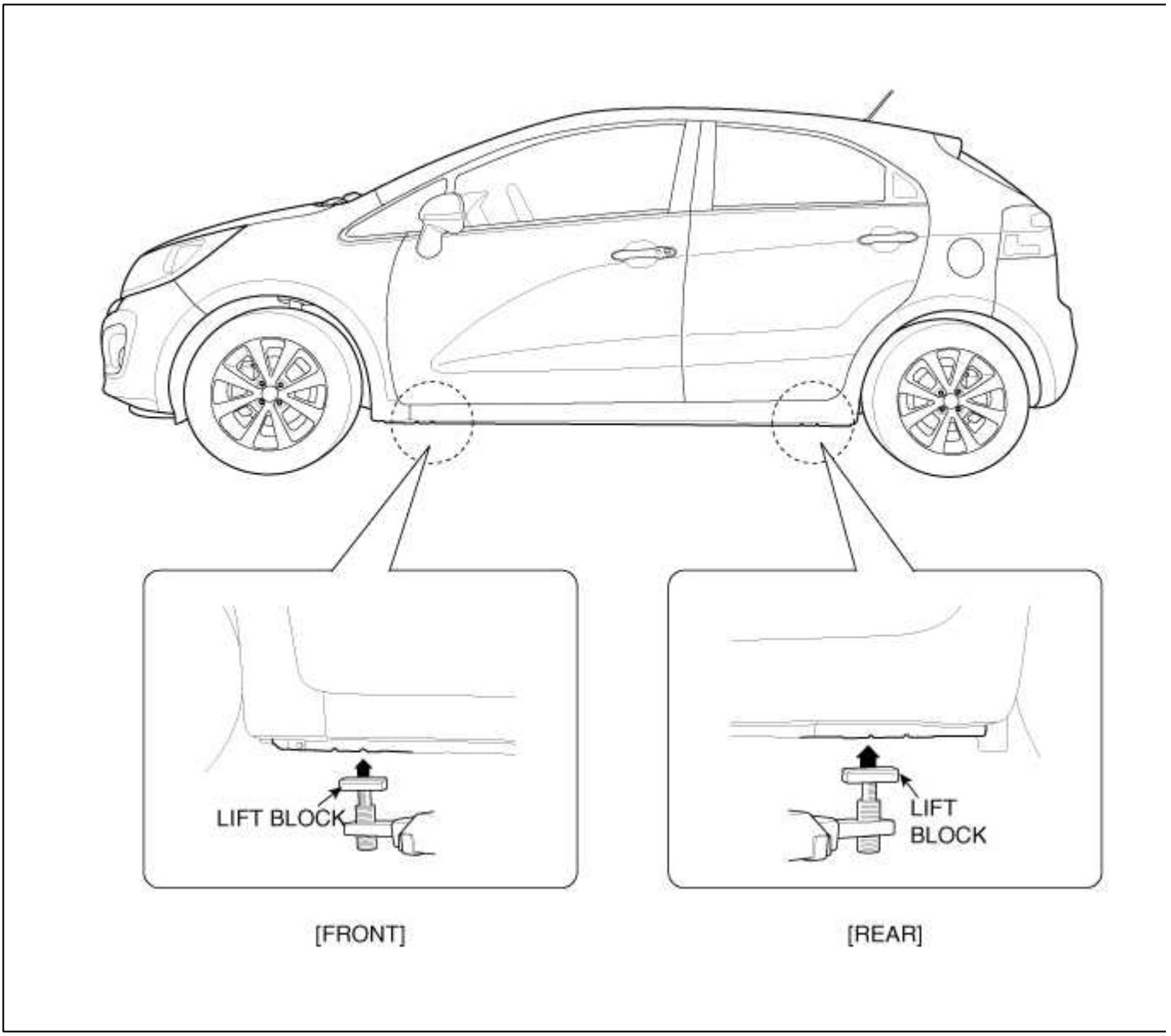
When heavy rear components such as suspension, fuel tank, spare tire, tailgate and trunk lid are to be removed, place additional weight in the luggage area before hoisting. When substantial weight is removed from the rear of the vehicle, the center of gravity may change and can cause the vehicle to tip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

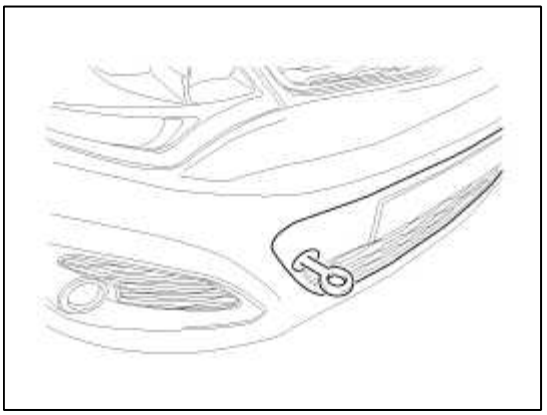
1. Place the lift blocks under the support points as shown in the illustration.
2. Raise the hoist a few inches (centimeters) and rock the vehicle to be sure it is firmly supported.

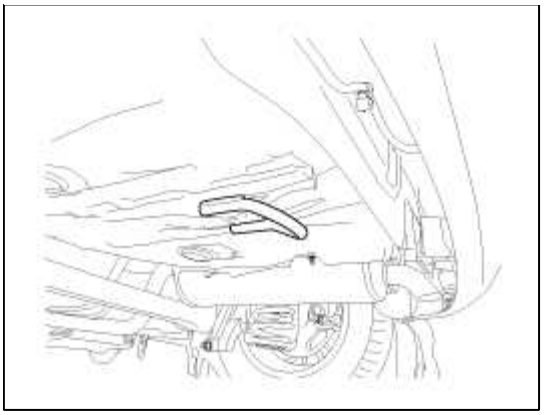
3. Raise the hoist to full height to inspect the lift points for secure support.



Towing

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





Emergency Towing

There are three popular methods of towing a vehicle :

- The operator loads the vehicle on the back of truck. This is best way of transporting the vehicle.
- The tow truck uses two pivoting arms that go under the tires 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

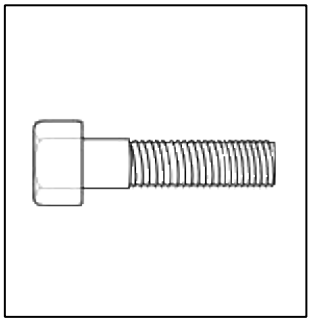
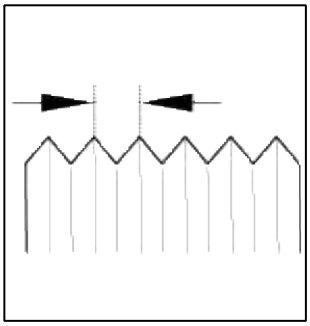
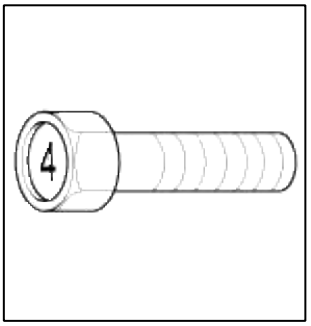
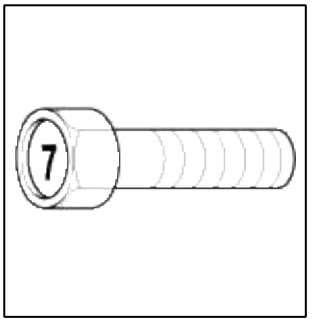
Automatic Transaxle

- 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

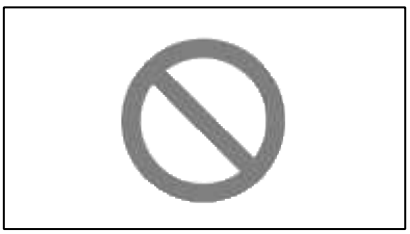
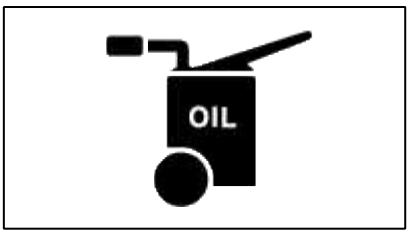
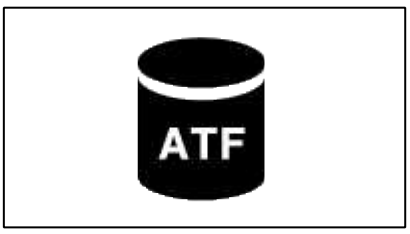
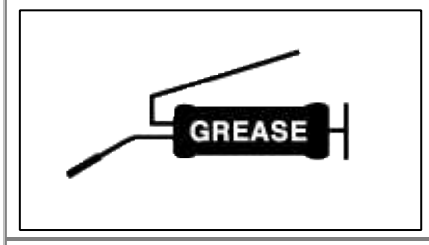
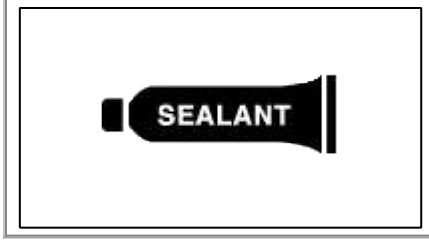
Bolt nominal diameter (mm)	Pitch (mm)	Torque Nm (kg.cm, lb.ft)	
		Head Mark 4	Head Mark 7
			
M5	0.8	3 ~ 4 (30 ~ 40, 2.2 ~ 2.9)	5 ~ 6 (50 ~ 60, 3.6 ~ 4.3)
M6	1.0	5 ~ 6 (50 ~ 50, 3.6 ~ 4.3)	9 ~ 11 (90 ~ 110, 6.5 ~ 8.0)
M8	1.25	12 ~ 15 (120 ~ 150, 9 ~ 11)	20 ~ 25 (200 ~ 250, 14.5 ~ 18.0)
M10	1.25	25 ~ 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

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

Meaning Of Symbols

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

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

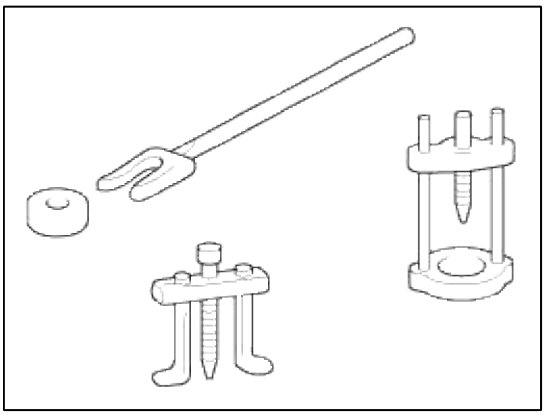
The support rod must be inserted into the hole near the edge of the hood whenever you inspect the engine compartment to prevent the hood from falling and causing possible injury.
Make sure that the support rod has been released prior to closing the hood. Always check to be sure the hood is firmly latched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

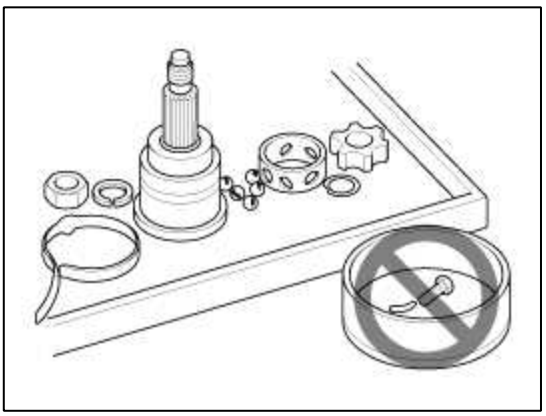
First find the cause of the problem and then determine whether removal or disassembly before starting the job.

Disassembly

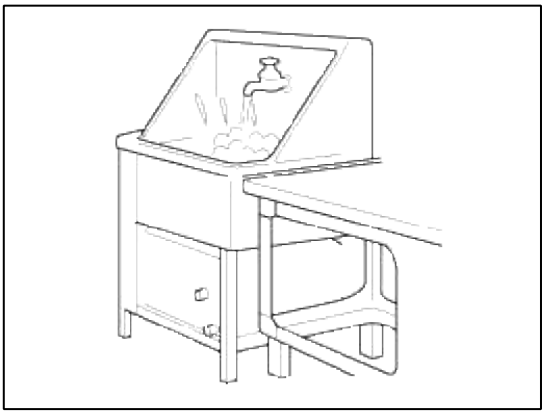
If the disassembly procedure is complex, requiring many parts to be disassembled, all parts should be disassembled in a way that will not affect their performance or external appearance.

1. **Inspection of parts**
   Each part, when removed, should be carefully on suspected 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.



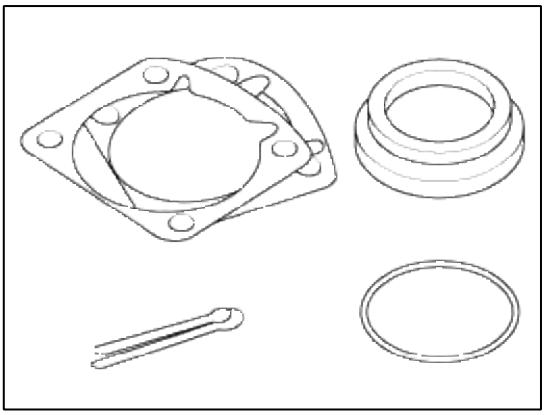
Parts
When replacing parts, use KIA MOTORS genuine parts.

Replacement

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

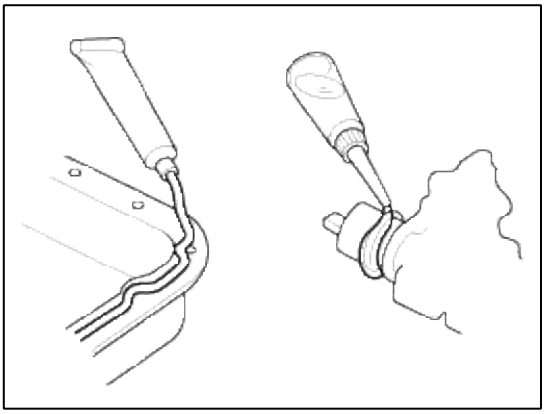
If removed, the following parts should always be replaced with new ones.

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.

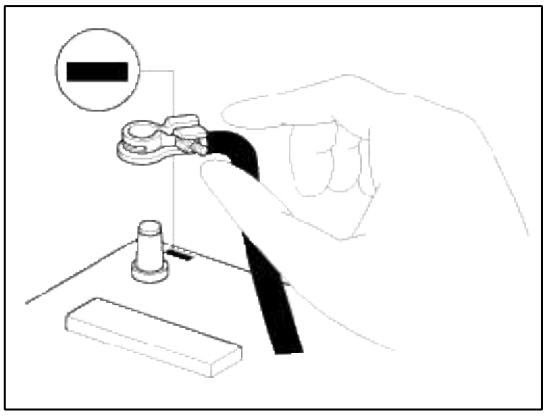


Adjustment

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

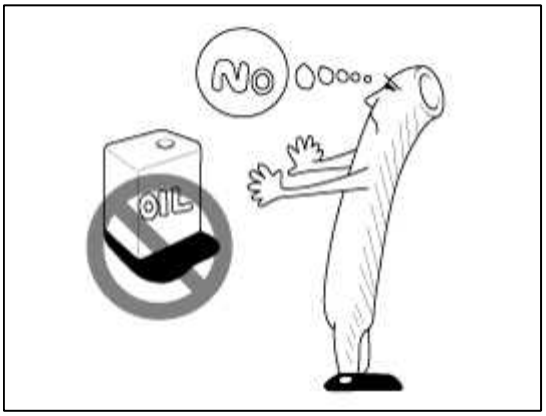
Electrical System

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.



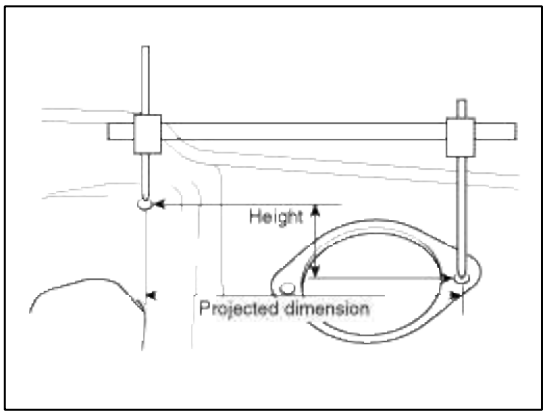
Measuring Body Dimensions

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 used for body alterations.

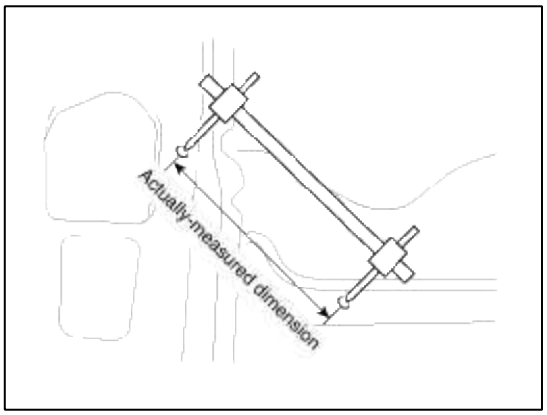
2. If the length of the tracking gauge probes is adjustable, measure it by lengthening one of two probes as long as the different value in height of the two surface.



Measuring Actual Dimensions

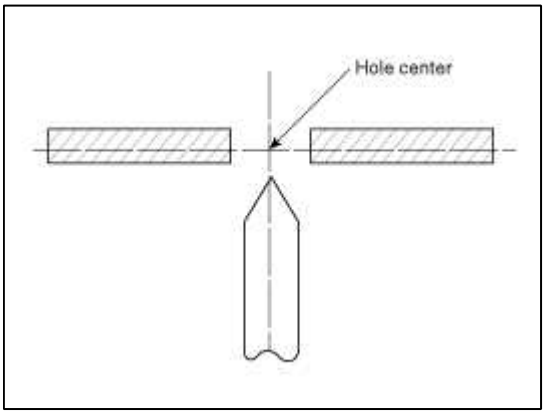
1. These dimensions indicate the actual linear distance between measurement points, and are used as the reference dimensions when a tracking gauge is used for measurement.
2. First adjust both probes to the same length (A=A') before measurement.

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



Measurement Point

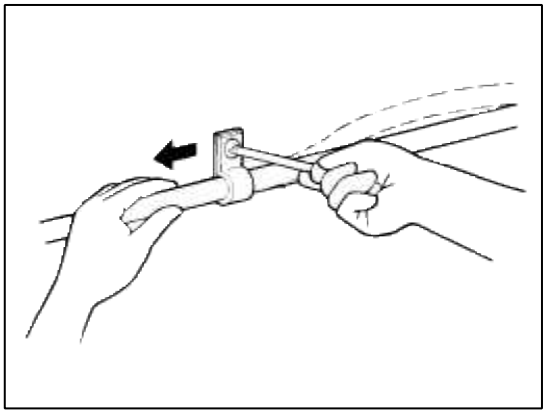
Measurements should be taken at the center of the hole.



Checking Cables And Wires

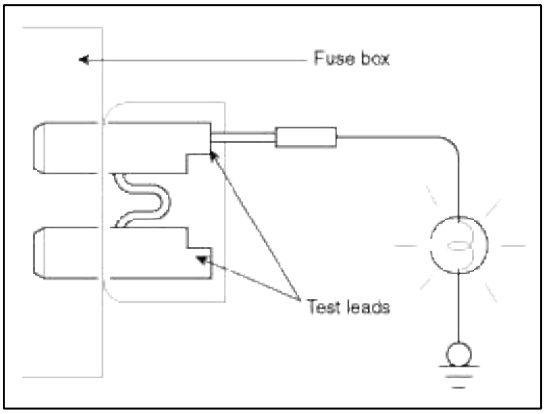
1. Check the terminal for tightness.
2. Check terminals and wires for corrosion from battery electrolyte, etc.
3. Check terminals and wires for open circuits.
4. Check wire insulation and coating for damage, cracks and degrading.
5. Check the conductive parts of terminals for contact with other metallic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

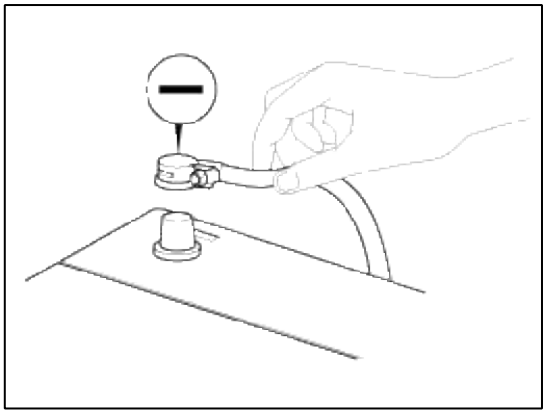
A blade type fuse test taps provided to allow checking the fuse itself without removing if from the fuse box. The fuse is good if the test lamp lights up when one lead is connected to the test taps (one at a time) and the other lead is grounded. (Turn the ignition switch so that the fuse circuit becomes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



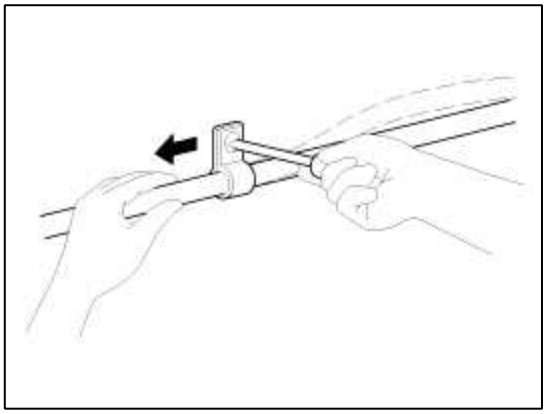
Servicing The Electrical System

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

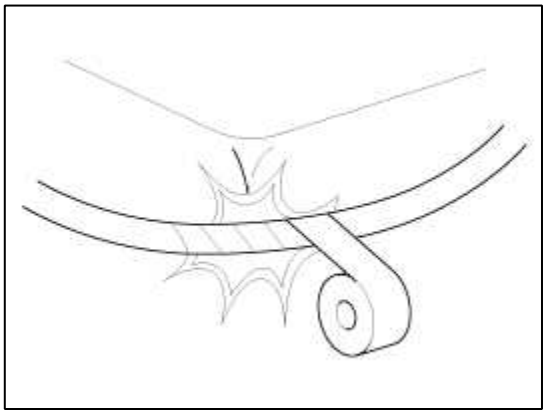
> NOTE
>
> In the course of MFI or ELC system diagnosis, when the battery cable is removed, any diagnostic trouble code retained by the computer will be cleared. There fore, if necessary, record the diagnostic data before removing the battery cable.



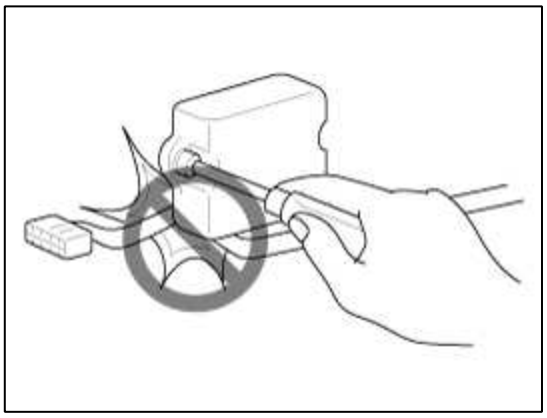
2. Attach the wiring harnesses with clamps so that there is no slack. However, for any harness which passes the engine or other vibrating parts of the vehicle, allow some slack within a range that does not allow the engine vibrations to cause the harness to come into contact with any of the surrounding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



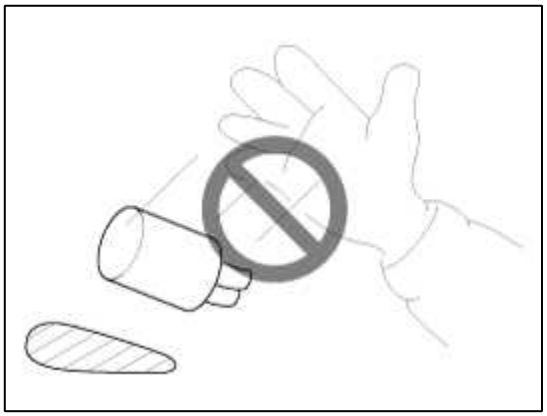
3. If any section of a wiring harness interferes with the edge of a parts, or a corner, wrap the section of the harness with tape or something similar in order to protect if from damage.



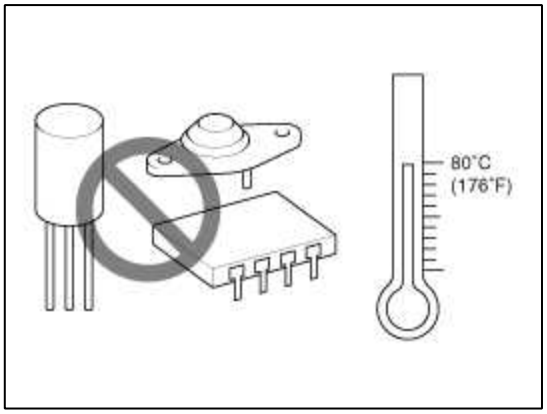
4. When installing any parts, be careful not to pinch or damage any of the wiring harness.



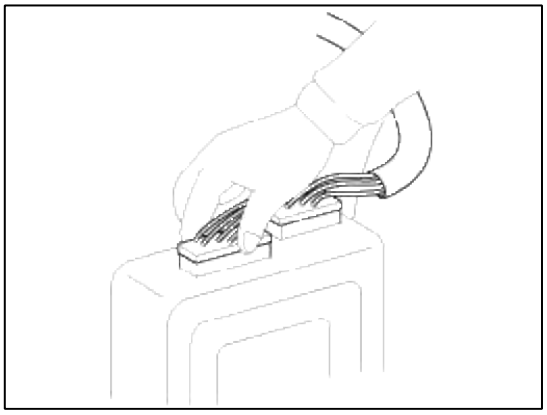
5. Never throw relays, sensors or electrical parts, or expose them to strong shock.



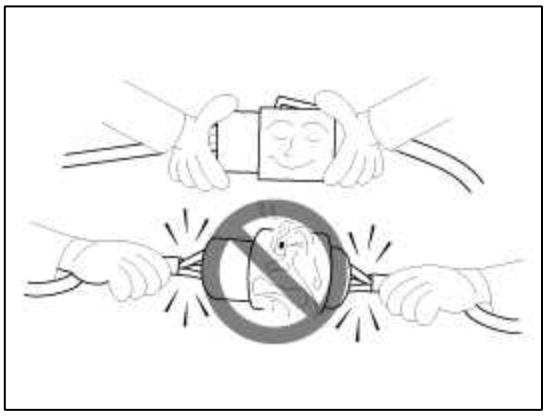
6. The electronic parts used in the computer, relays, etc. are readily damaged by heat. If there is a need for service operations that may cause the temperature to exceed 80°C (176°F), remove the electronic parts before hand.



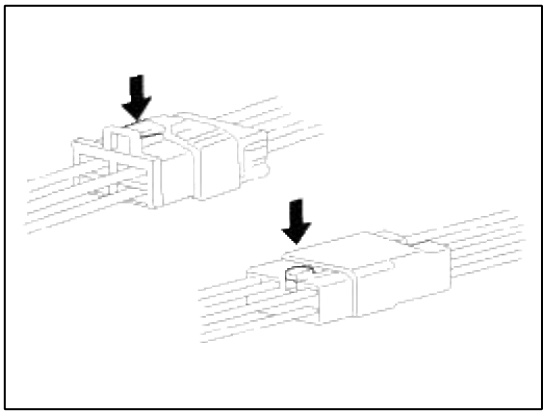
7. Loose connectors cause problems. Make sure that the connectors are always securely fastened.



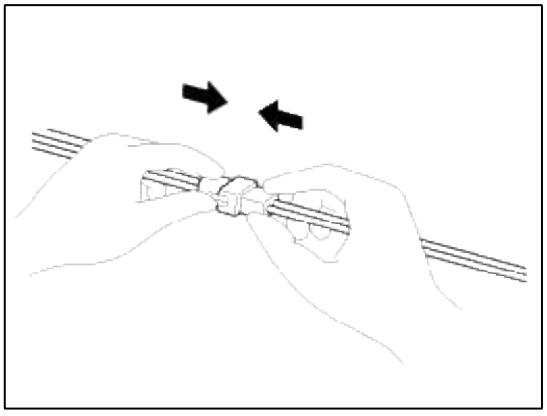
8. When disconnecting a connector, be sure to grip only the connector, not the wires.



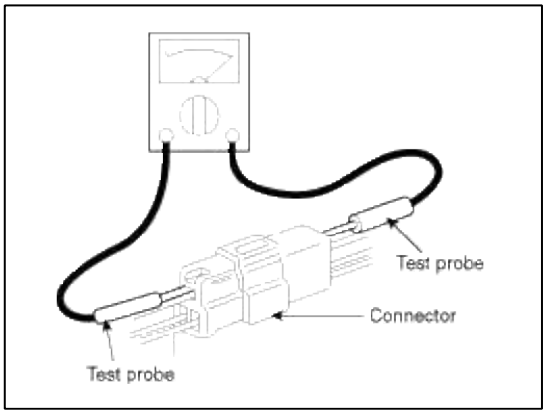
9. Disconnect connector which have catches by pressing in the direction of the arrows shown the illustration.



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
0.3mm²	AWG 22	-	5A
0.5mm²	AWG 20	7A	13A
0.85mm²	AWG 18	9A	17A
1.25mm²	AWG 16	12A	22A
2.0mm²	AWG 14	16A	30A
3.0mm²	AWG 12	21A	40A
5.0mm²	AWG 10	31A	54A

Precautions For Catalytic Converter

CAUTION

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

RIO(UB) > 2012 > G 1.6 GDI > Automatic Transaxle System

Automatic Transaxle System > General Information > Specifications

Specifications

Item		Specifications
Transmission type		A6GF1
Engine model		Gasoline 1.6 GDI
Torque converter type		3-element, 1-stage, 2-phase type
Torque converter size		Ø225 mm (8.8583 in.)
Oil pump system		Parachoid
Friction elements		Clutch: 2EA
		Brake: 3EA
		OWC: 1EA
Planetary gear		3EA
Gear ratio	1st	4.400
	2nd	2.726
	3rd	1.834
	4th	1.392
	5th	1.000
	6th	0.774
	Reverse	3.440
Final gear ratio		3.270
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.		(1.2 ~ 1.8) 0.0472 ~ 0.0709
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.		(0.85 ~ 1.3) 0.0335 ~ 0.0512
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	0.05

Inhibitor Switch

Type: Combination of output signals from 4 terminals

Specifications

Power supply (V)	12
Output type	Combination of output signals

Solenoid Valves

Direct control VFS[26/B, T/CON]

Control type : Normal low type

Control Pressure kpa (kgf/cm², 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/cm², 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/cm², 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/cm², 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	13.7 ~ 15.7	1.4 ~ 1.6	10.8 ~ 11.6
Eyebolt	2.9 ~ 4.9	0.3 ~ 0.5	2.2 ~ 3.6
Oil drain 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 bolt	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

Lubricants

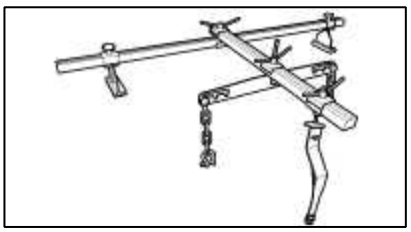
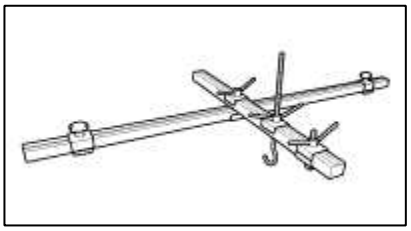
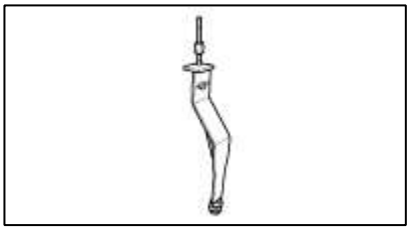
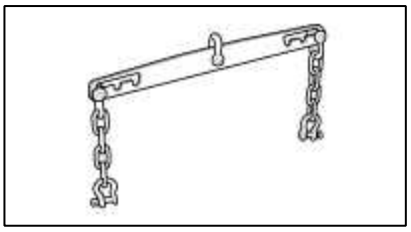
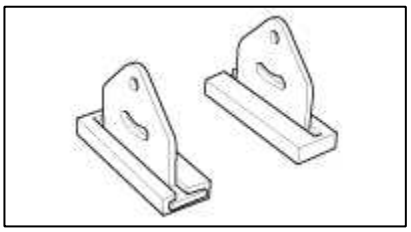
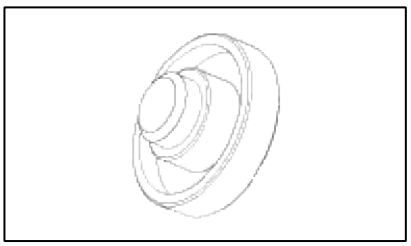
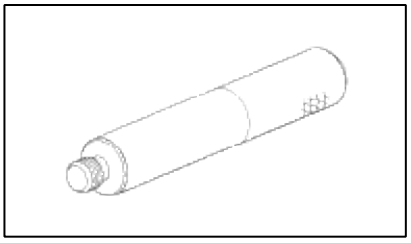
Item	Specified lubricant	Quantity
Transaxle fluid	SK ATF SP- , MICHANG ATF SP- , NOCA ATF SP- , Kia Genuine ATF SP- or other brands meeting the above specification approved by Kia Motors Corp.	7.3L (1.93 U.S gal., 7.71 U.S.qt., 6.42 Imp.qt.)

Sealant

Item	Specified sealant
Rear cover	LOCTITE FMD-546
Torque converter housing	
Valve body cover	

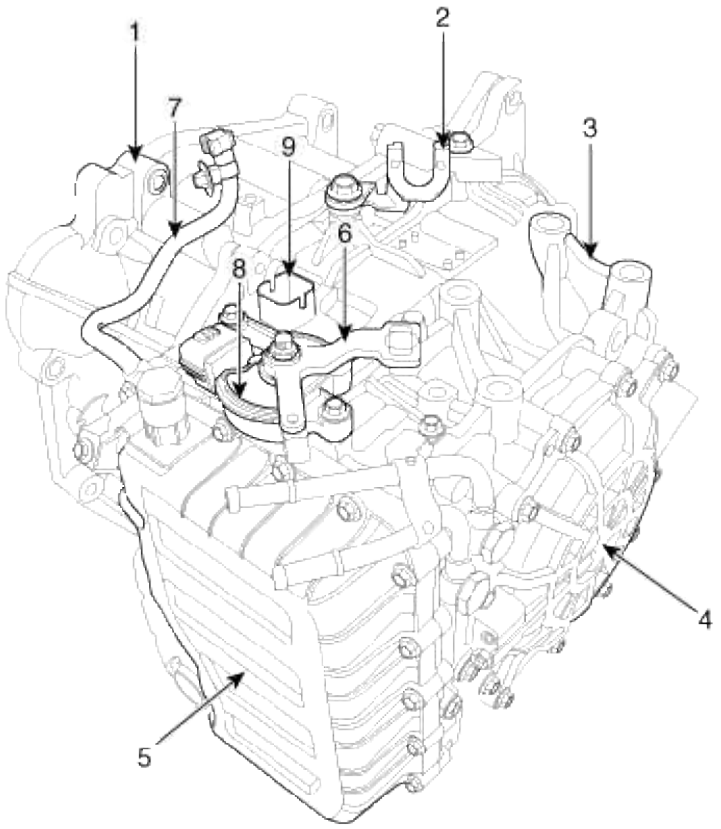
Automatic Transaxle System > General Information > Special Service Tools

Special Service Tools

Tool (Number and Name)	Illustration	Use
09200-38001,3N000 (Beam) 09200-1P100, 4X000 (Adapter) 09200-2S200 (Supporter) Engine support assembly		Removal and installation of the transaxle. Use assembling 09200-1P100, 4X000 (Adapter) and 09200-2S200 (Supporter) on 09200-38001, 3N000(Beam).
09200-3N000 Engine support fixture (Beam)		Removal and installation of the transaxle. Use this adapter (SST No. : 09200-1P100, 4X000) with the supporter (SST No. : 09200-2S200). Permit operating with 09200-38001.
09200-1P100 Engine support fixture (Adapter)		Removal and installation of the transaxle. Use this beam (SST No. : 09200-38001/09200-3N000) with the supporter (SST No. : 09200-2S200) and adapter (SST No. : 09200-4X000)
09200-4X000 Engine support fixture (Adapter)		Removal and installation of the transaxle. Use this beam (SST No. : 09200-38001/3N000) with the supporter (SST No. : 09200-2S200) and adapter (SST No. : 09200-1P100)
09200-2S200 Engine support fixture (Supporter)		Removal and installation of the transaxle. Use this beam (SST No. : 09200-38001/09200-3N000) with the adapter (SST No. : 09200-1P100, 4X000)
09452-26100 Oil seal installer		Installation of transaxle case oil seal. [Using with handle (SST No.:09231-H1100)]
09231-H1100 Bar		Installation of transaxle case oil seal. [Using with oil seal installer (SST No.:09452-26100)]

Automatic Transaxle System > Automatic Transaxle System > Automatic Transaxle > Components and Components Location

Components Location

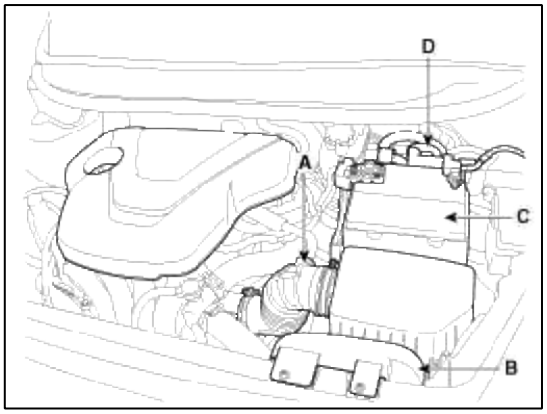


1. Converter housing	6. Manual control lever
2. Shift cable bracket	7. Air breather hose
3. Automatic transaxle case	8. Inhibitor switch
4. Rear cover	9. Solenoid valve
5. Valve body cover	connector

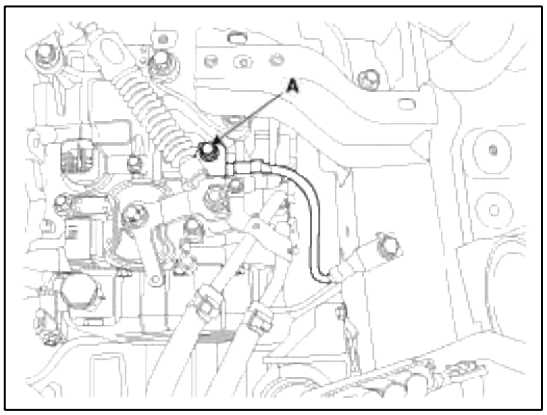
Automatic Transaxle System > Automatic Transaxle System > Automatic Transaxle > Repair procedures

Removal

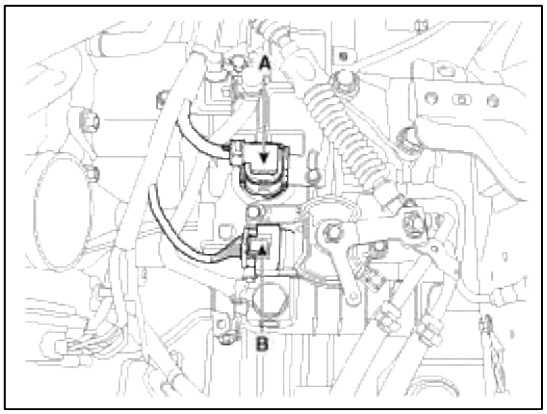
1. Remove the following items;
   A. Air cleaner assembly (A) and air duct (B).
      (Refer to "Intake and Exhaust system" in EM group.)
   B. Battery and battery tray (C).
      (Refer to "Charging system" in EE group.)
   C. ECM (D).
      (Refer to "Engine Control System" in FL group.)



2. Remove the ground line after removing the bolt (A).

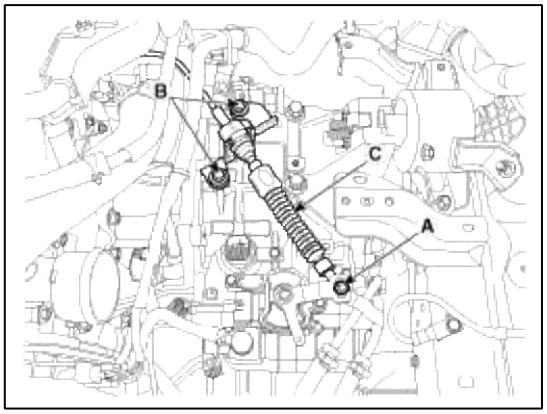


3. Dissconnect the solenoid valve connector (A) and inhibitor switch connector (B).

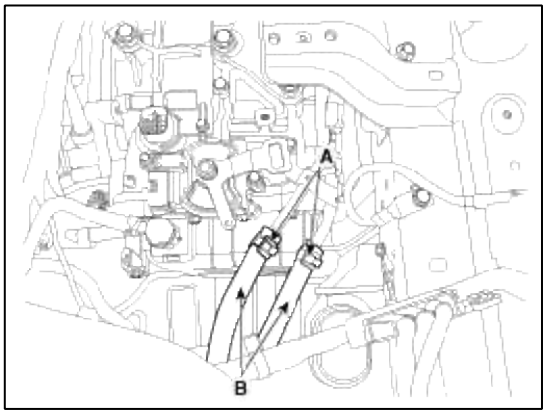


4. Remove the control cable (C) after removing the nut (A) and the bolt (B).

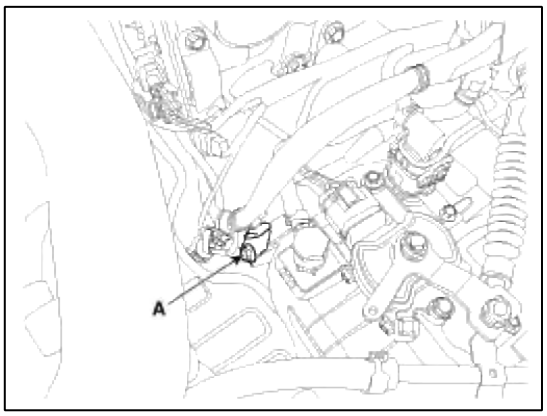
Tightening torque:
(A) 9.8 ~ 13.7 N.m (1.0 ~ 1.4 kgf.m, 7.2 ~ 10.1 lb-ft)
(B) 14.7 ~ 21.6 N.m(1.5 ~ 2.2 kgf.m, 10.9 ~ 15.9 lb-ft)



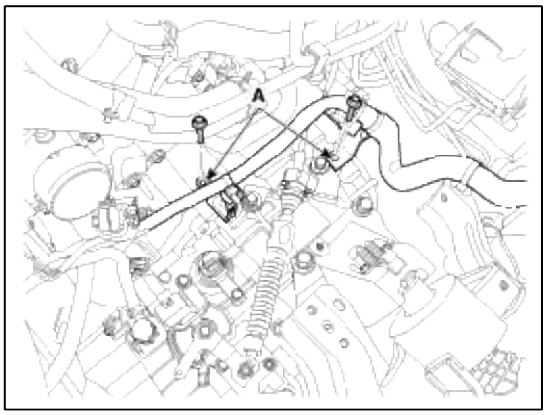
5. Disconnect the hose (B) after removing the automatic transaxle fluid cooler hose clamp (A).



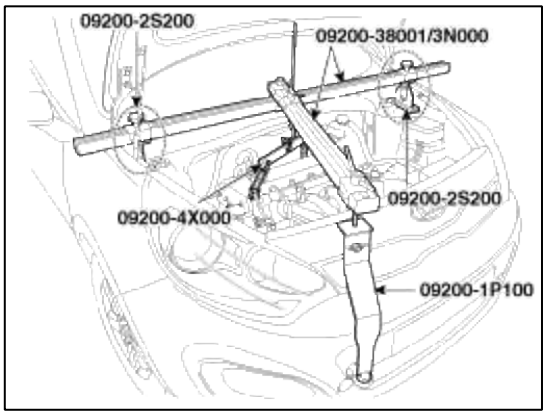
6. Remove the wiring mounting bolt (A).



7. Remove the solenoid valve connector and inhibitor switch connector wiring mounting bracket (A).

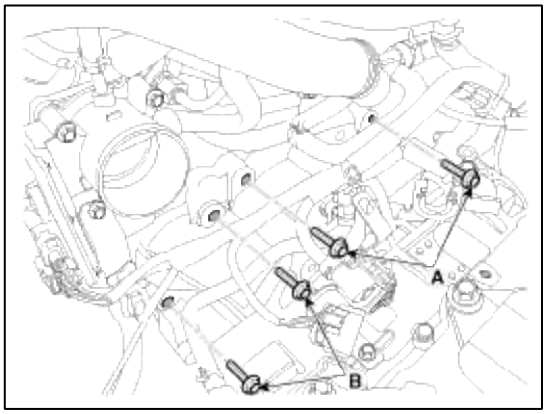


8. Using the engine support fixture (Support SST No.: 09200-2S200, Adapter SST No.: 09200-1P000, 4X000, Beam SST No.: 09200-38001/3N000), hold the engine and transaxle assembly safely.

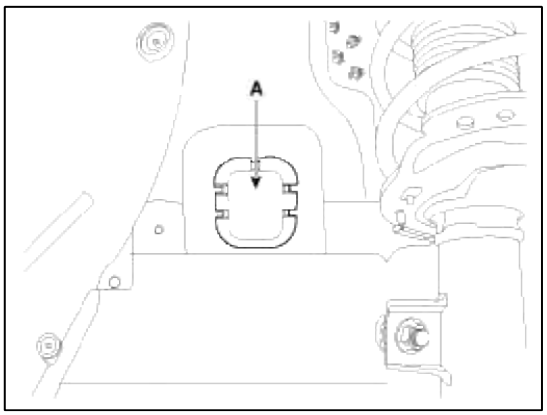


9. Remove the automatic transaxle upper mounting bolt (A-2ea) and the starter motor mounting bolt (B-2ea).

Tightening torque:
(A,B) 42.2 ~ 54.0 N.m (4.3 ~ 5.5 kgf.m, 31.1 ~ 39.8 lb-ft)

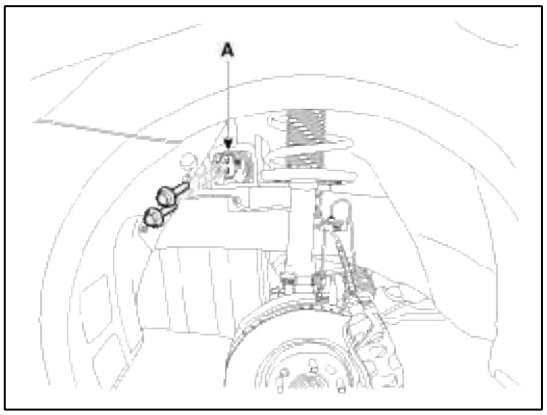


10. Remove the mounting cover (A).



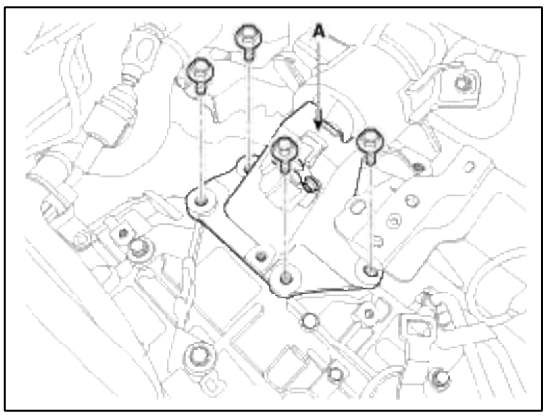
11. Remove the support bracket mounting bolts (A).

Tightening torque:
88.3 ~ 107.9 N.m (9.0 ~ 11.0 kgf.m, 65.1 ~ 79.8 lb-ft)

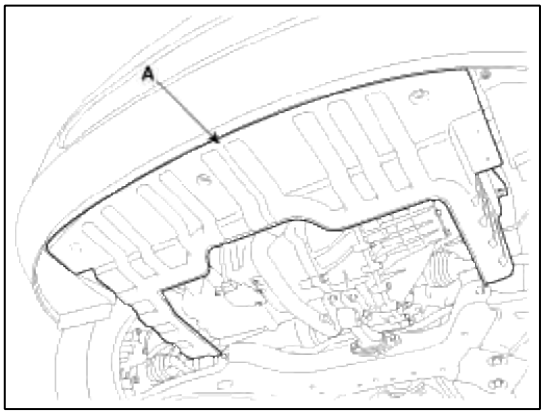


12. Remove the automatic transaxle support bracket (A).

Tightening torque:
58.8 ~ 78.5 N.m (6.0 ~ 8.0 kgf.m, 43.4 ~ 57.9 lb-ft)

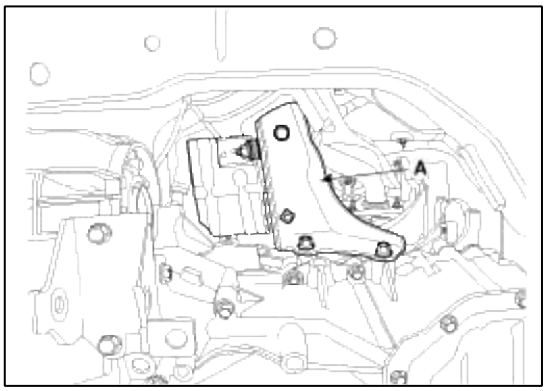


13. Lift the vehicle with a jack.
14. Remove the under cover (A).

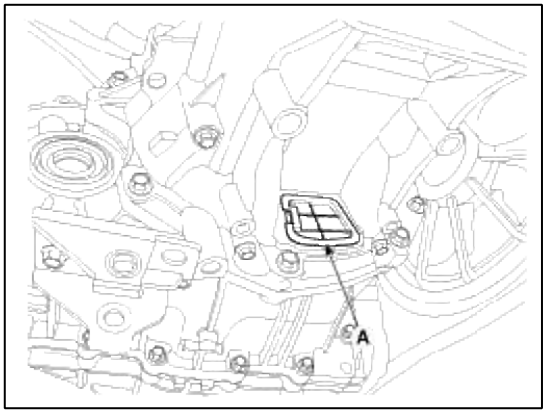


15. Remove the drive shaft assembly.
(Refer to "Drive shaft assembly" in DS group.)

16. Remove the drive shaft cover (A).

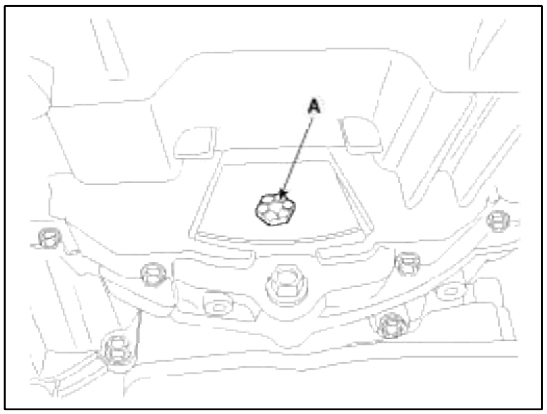


17. Remove the dust cover (A).



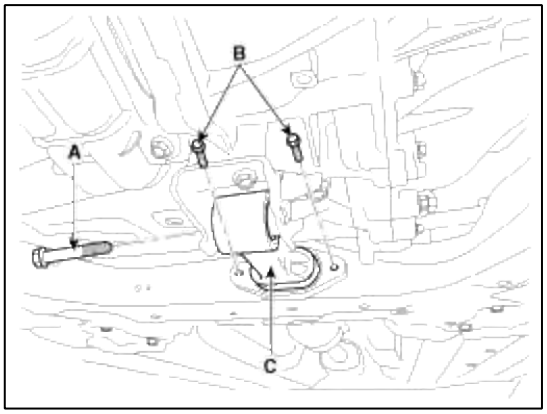
18. Remove the torque converter mounting bolt (A-4ea) with rotating the crankshaft.

Tightening torque:
45.1 ~ 52.0 N.m (4.6 ~ 5.3 kgf.m, 33.3 ~ 38.3 lb-ft)



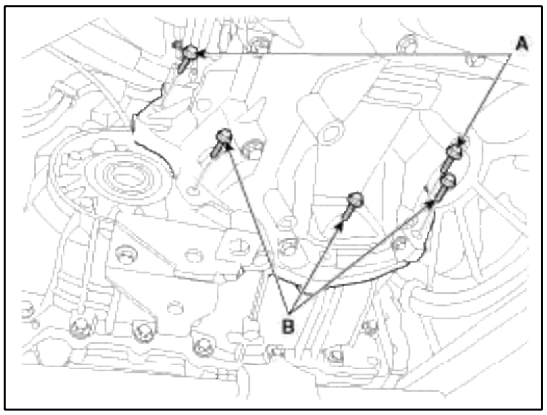
19. Remove the roll rod bracket (C) after removing bolt (A,B).

Tightening torque:
(A) 49.0 ~ 63.7 N.m (5.0 ~ 6.5 kgf.m, 36.2 ~ 47.0 lb-ft)
(B) 107.9 ~ 127.5 N.m (11.0 ~ 13.0 kgf.m, 79.6 ~ 94.1 lb-ft)



20. Remove the automatic transaxle with a jack after removing the mounting bolt (A-2ea, B-3ea).

Tightening torque:
(A) 42.2 ~ 53.9 N.m (4.3 ~ 5.5 kgf.m, 31.1 ~ 39.8 lb-ft)
(B) 39.2 ~ 46.1 N.m (4.0 ~ 4.7 kgf.m, 28.9 ~ 34.0 lb-ft)



Installation

1. Installation is the reverse of removal.

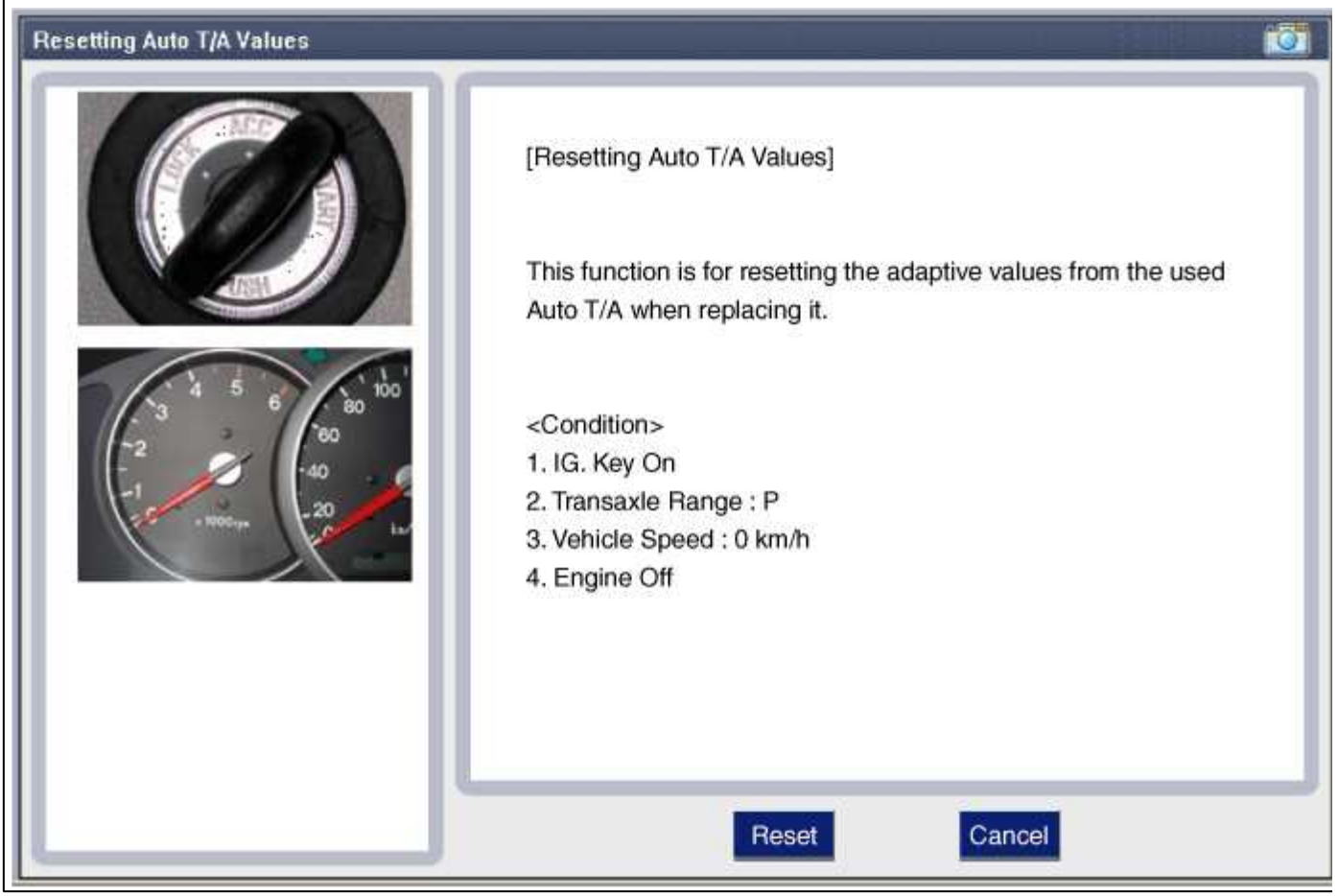
CAUTION

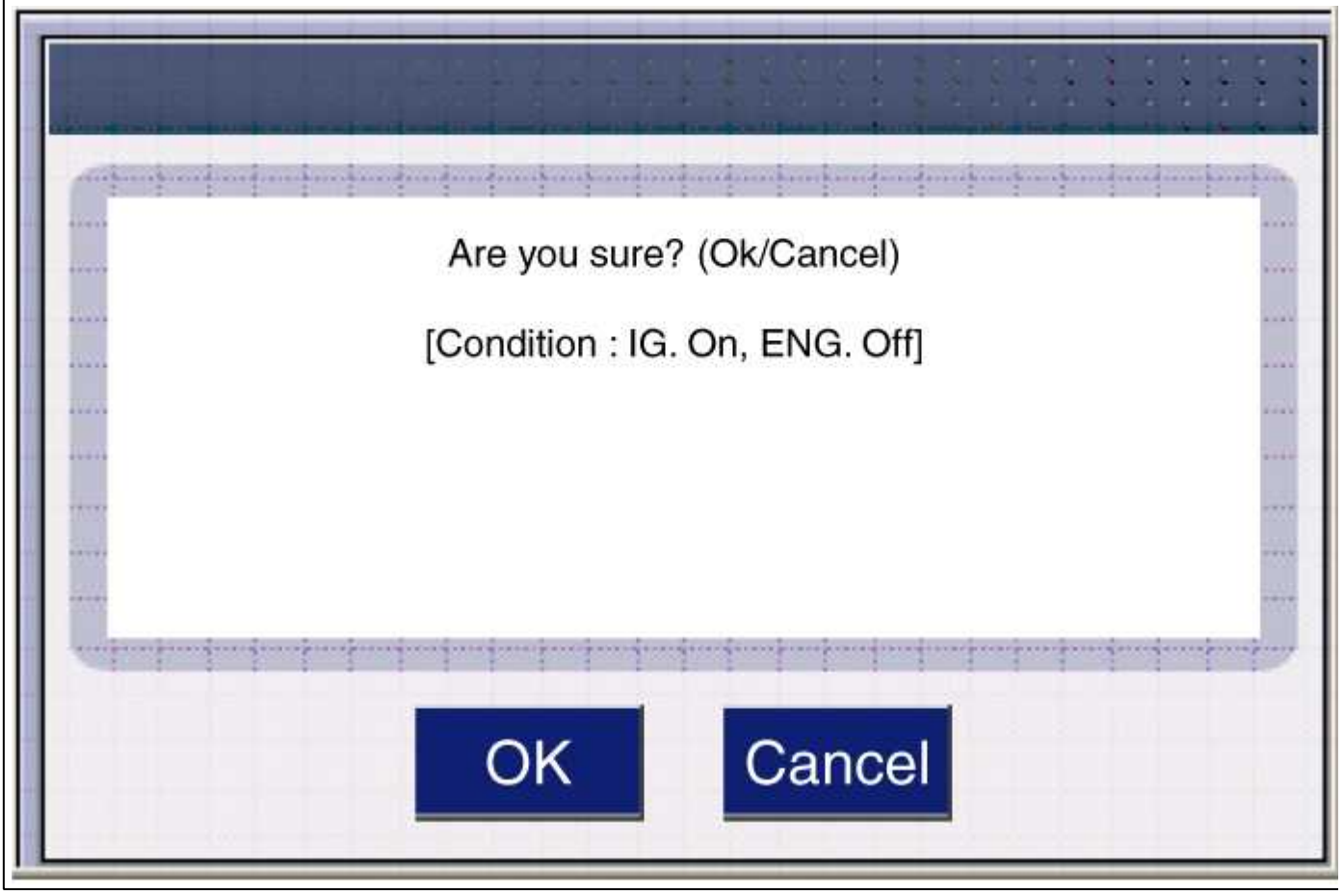
If the oil seal on the transaxle case side is damaged and fluid is leaking, replace the oil seal with a new unit. When installing the new oil seal, use the specialized tool (oil seal installer, 09452-26100).

NOTE

After replacement or reinstallation procedure of the automatic transaxle assembly, must perform procedures below.

- Power steering fluid replacement and air bleeding. (Refer to "General information" in ST group)
- 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.


Resetting Auto T/A Values
[Resetting Auto T/A Values]
This function is for resetting the adaptive values from the used Auto T/A when replacing it.
<Condition>
1. IG. Key On
2. Transaxle Range : P
3. Vehicle Speed : 0 km/h
4. Engine Off
Reset
Cancel


Are you sure? (Ok/Cancel)
[Condition : IG. On, ENG. Off]
OK
Cancel

- 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)

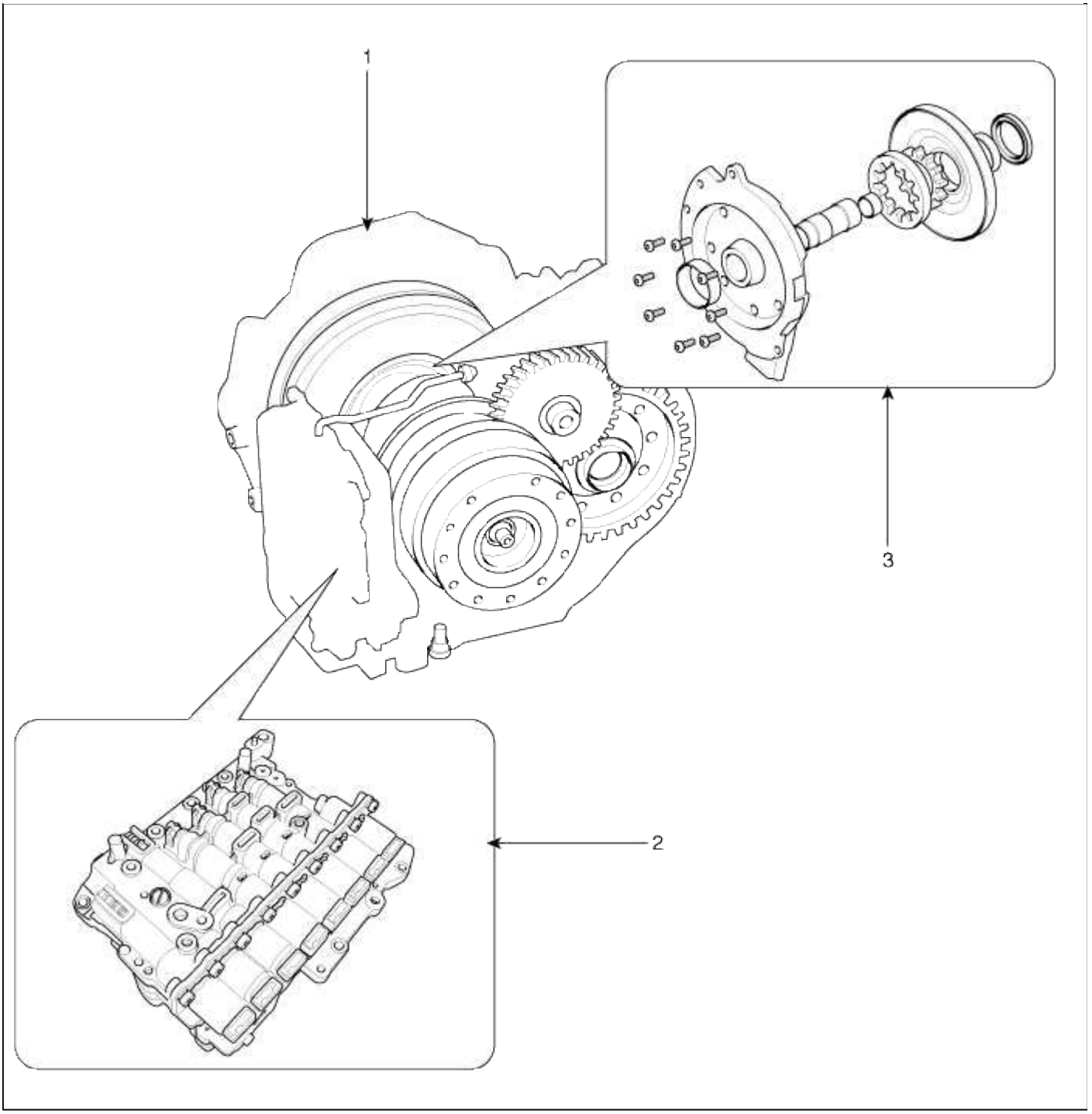
Automatic Transaxle System > Hydraulic System > Description and Operation

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

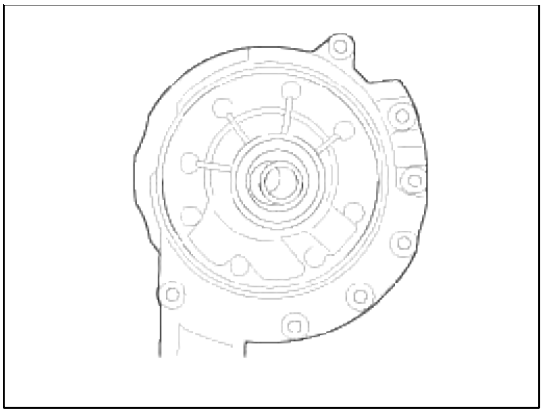


1. Automatic transaxle
2. Valve body assembly
3. Oil pump assembly

Automatic Transaxle System > Hydraulic System > Oil Pump > Description and Operation

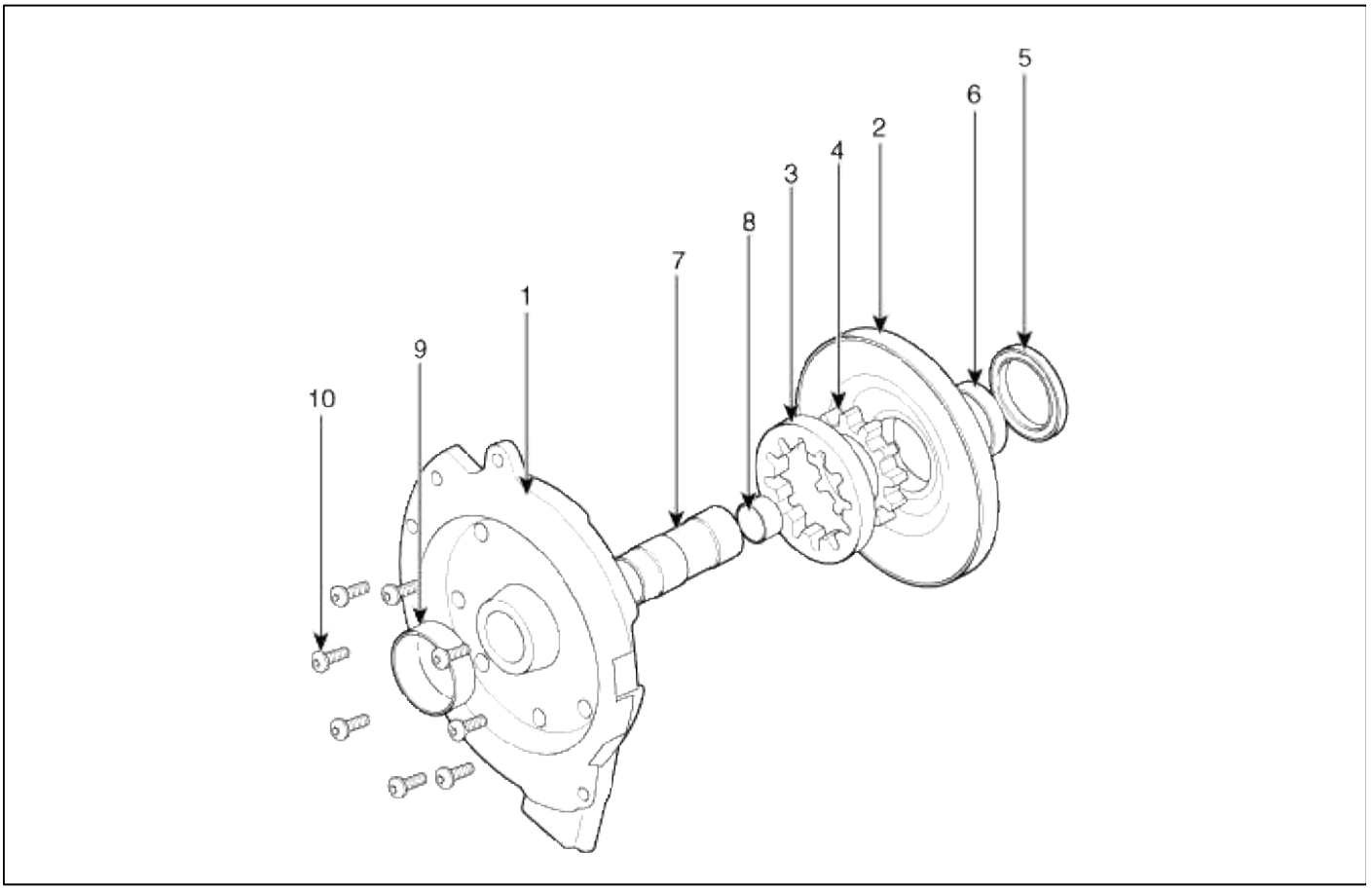
Description

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.



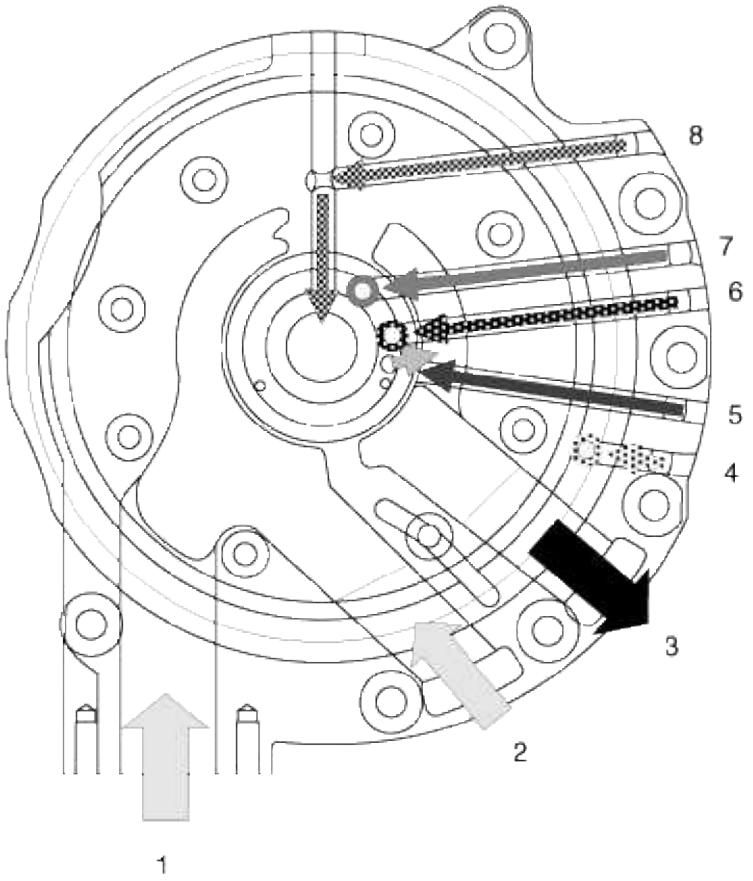
Automatic Transaxle System > Hydraulic System > Oil Pump > Components and Components Location

Components



1. Oil pump cover 2. Oil pump housing 3. Driven gear 4. Drive gear 5. Oil seal	6. Bushing-housing 7. Reaction shaft 8. Bushing-reaction shaft 9. Sleeve 10. Bolt

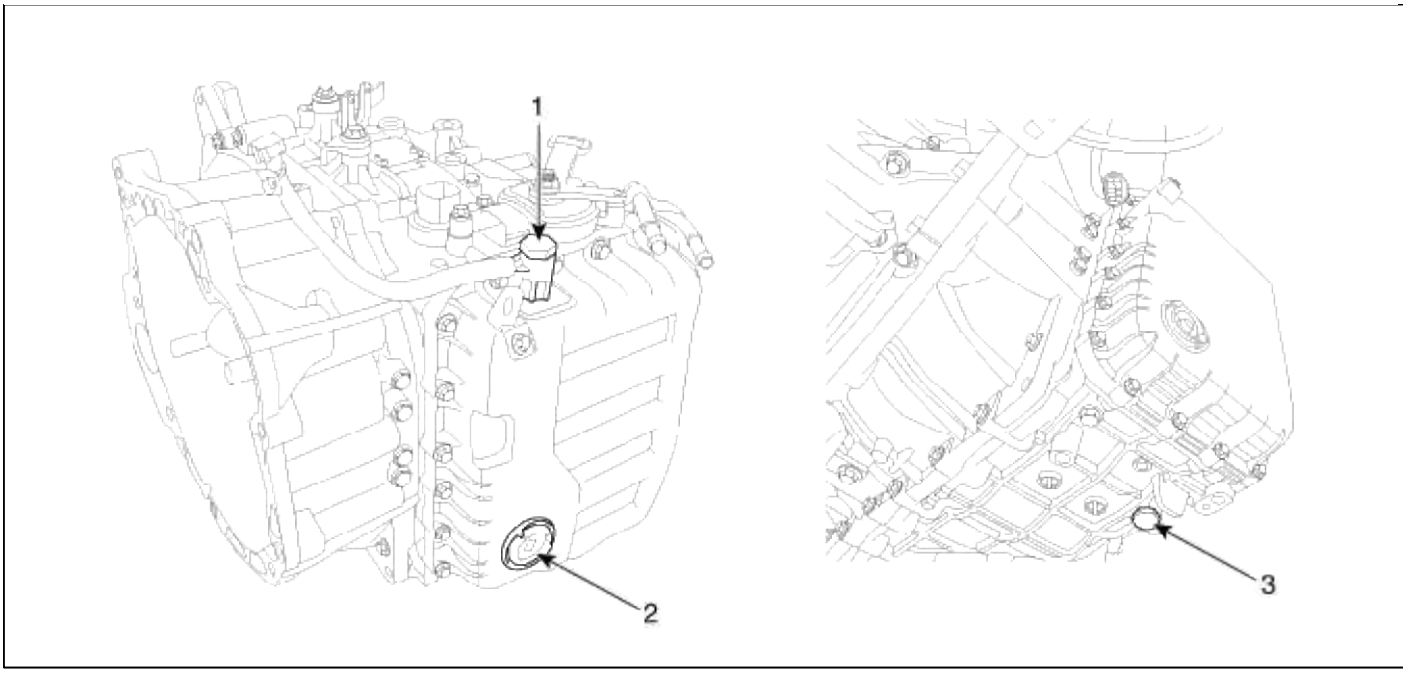
Oil Pump Operation Flow



1. Inhale(Oil filter) 2. Inhale(Valve body) 3. Outlet 4. 26/B operation pressure	5. 35R/C operation pressure 6. Lubrication 7. Lock up clutch apply pressure 8. Lock up clutch release pressure

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.

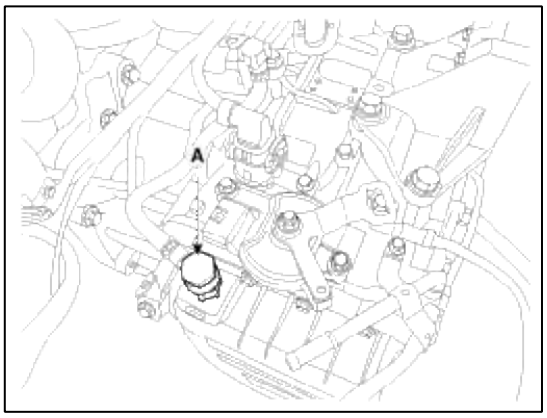
1. Remove the eyebolt (A).

Eyebolt tightening torque:
4.9 ~ 5.9 N.m (0.5 ~ 0.6 kgf.m, 3.6 ~ 4.3 lb-ft)

CAUTION

Always replace the gasket of the eyebolt use new one whenever loosening eyebolt.

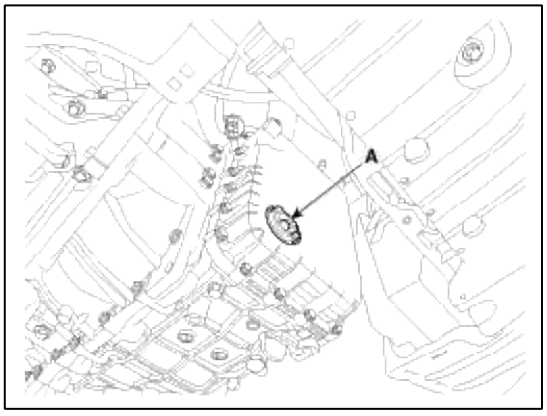
2. Add ATF SP-IV 700cc to the ATF injection hole.



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:
Tightening up stopper

8. Put down the vehicle with the lift and then tighten the eyebolt.

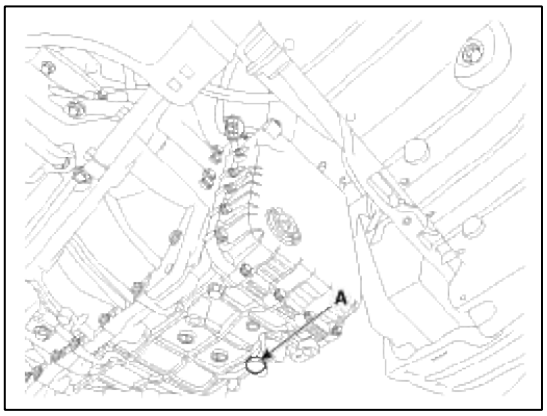
Replacement

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

1. 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

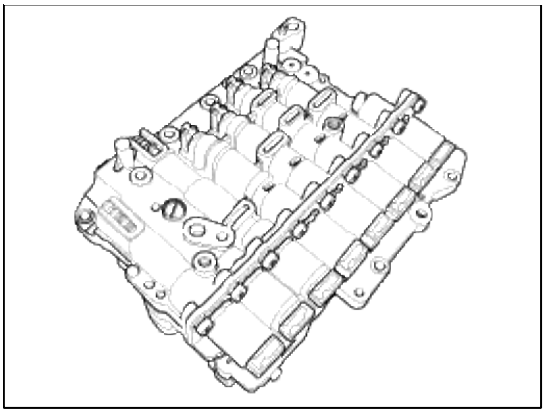
The gasket of the drain plug use new one.

2. Fill the oil about 5 liters through eyebolt.
3. Check the oil level.
(Refer to "Hydraulic system (Fluid)" in this group)

Automatic Transaxle System > Hydraulic System > Valve Body > Description and Operation

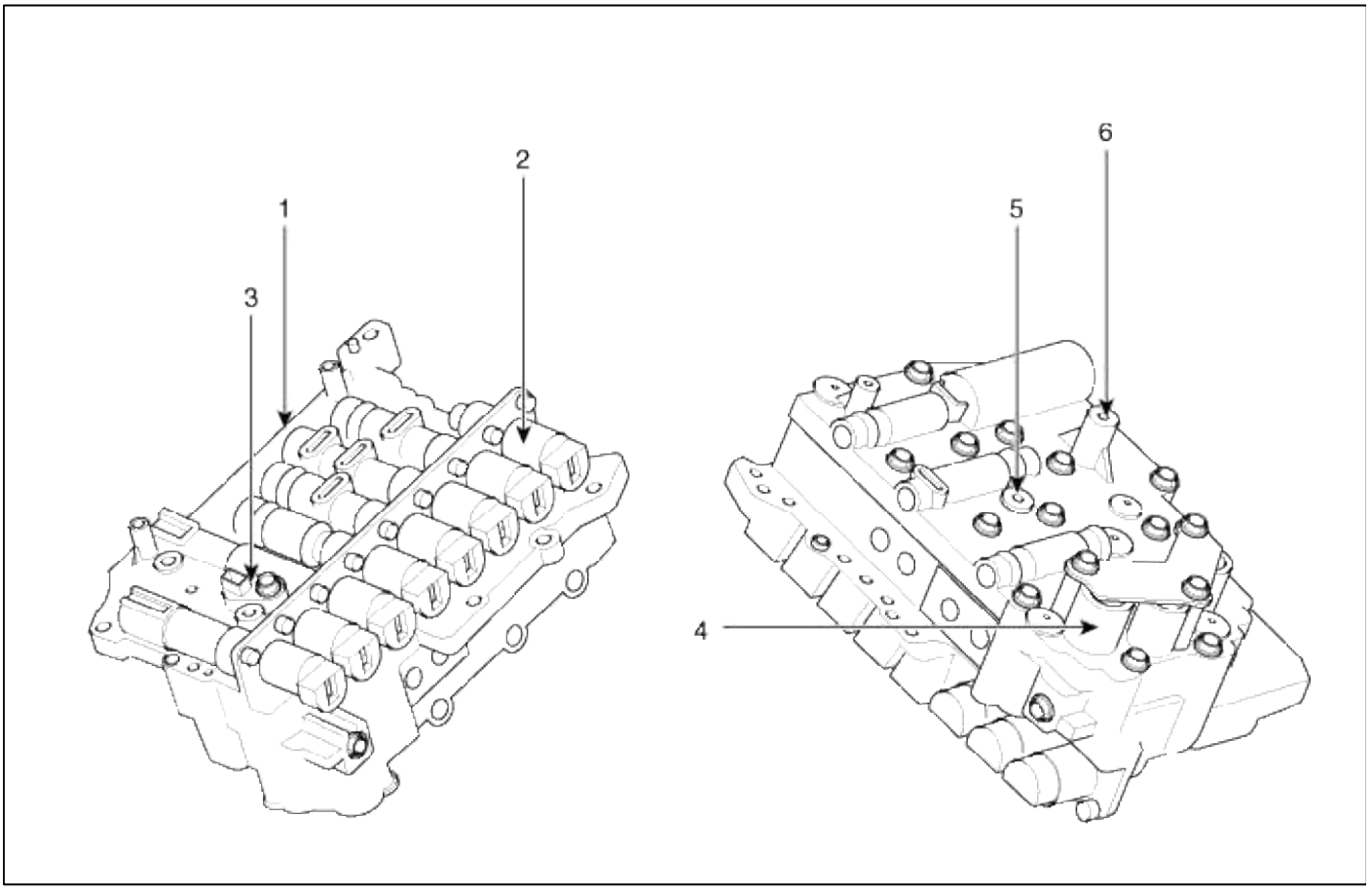
Description

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.



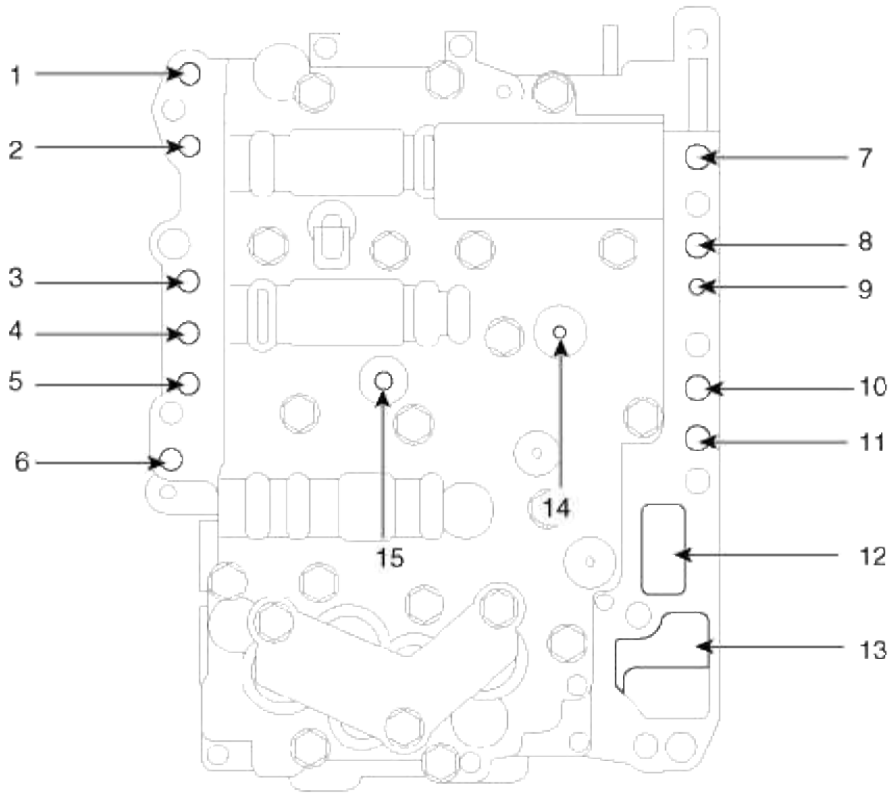
Automatic Transaxle System > Hydraulic System > Valve Body > Components and Components Location

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. OD Clutch pressure	12. From oil pump
5. Reducing pressure (red2)	13. To oil pump
6. Reducing pressure (red1)	14. UD Brake pressure
7. From damper pressure	15. Low & reverse
8. To damper pressure	pressure

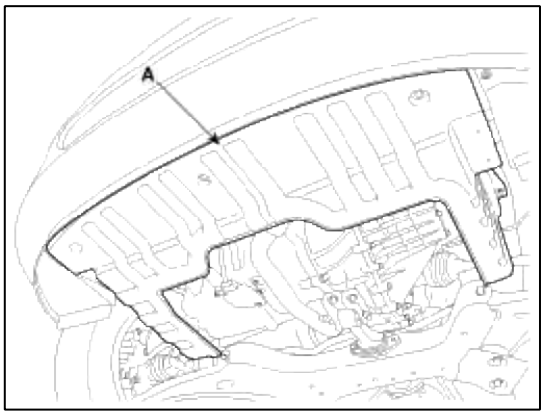
Automatic Transaxle System > Hydraulic System > Valve Body > Repair procedures

Removal

1. Remove the battery and the battery tray.
   (Refer to "Charging system" in EE group.)

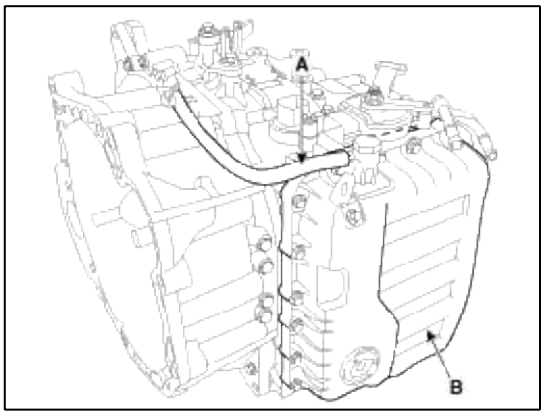
2. Remove the under cover (A).

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



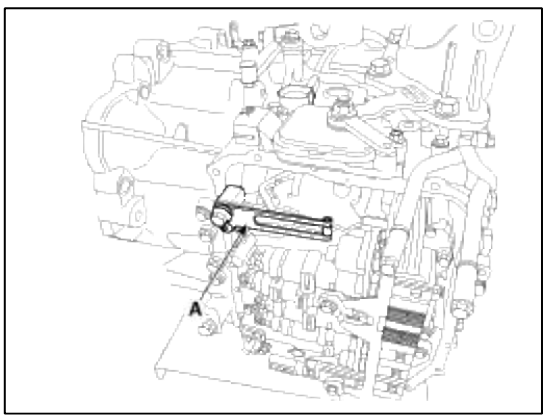
3. Replace new gasket and the plug after draining the automatic transaxle fluid by removing the drain plug. (Refer to "Hydraulic system (Fluid)" in this group)
4. Remove the valve body cover (B).

Tightening torque:
13.7 ~ 15.7 N.m (1.4 ~ 1.6 kgf.m, 10.1 ~ 11.6 lb-ft)



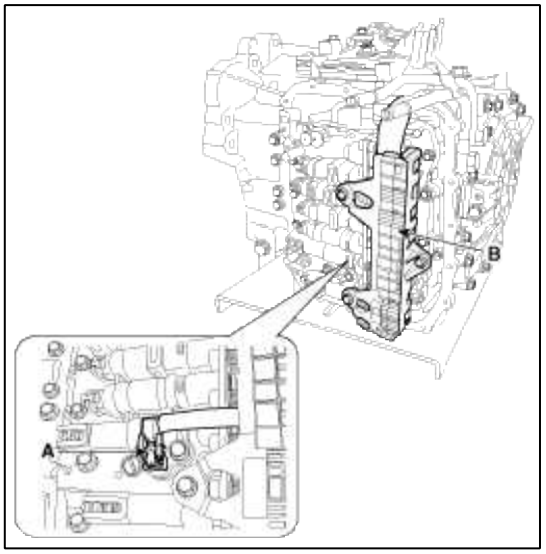
5. Remove thd air breather hose (A).
6. Remove the plate and the detent spring (A) after removing the bolt.

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



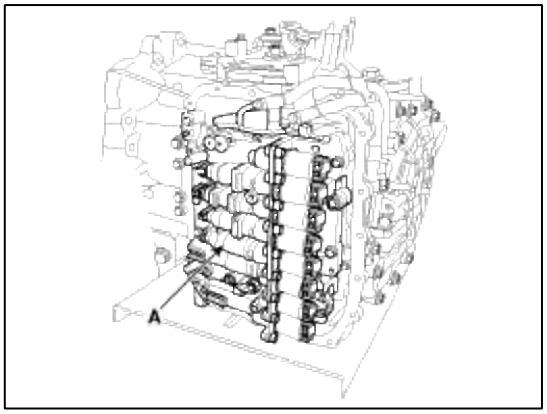
7. Remove the bolt (3ea) after disconnecting the solenoid valve (B) connector and the oil temperature sensor connector (A).

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



8. 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

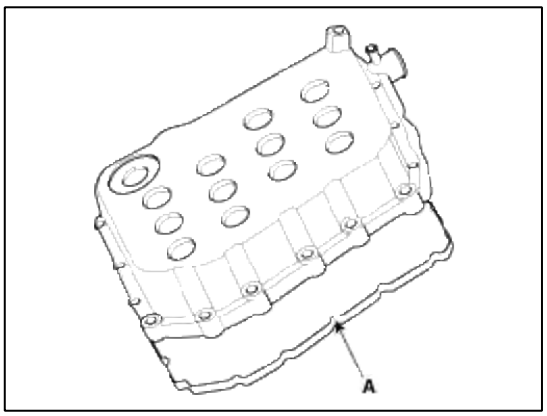
1. Installation is the reverse of removal.

CAUTION

After replacement or reinstallation procedure of the valve body assembly, must perform procedures below.

NOTE

- The gasket of the valve body gasket (A) use new one.



- 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)

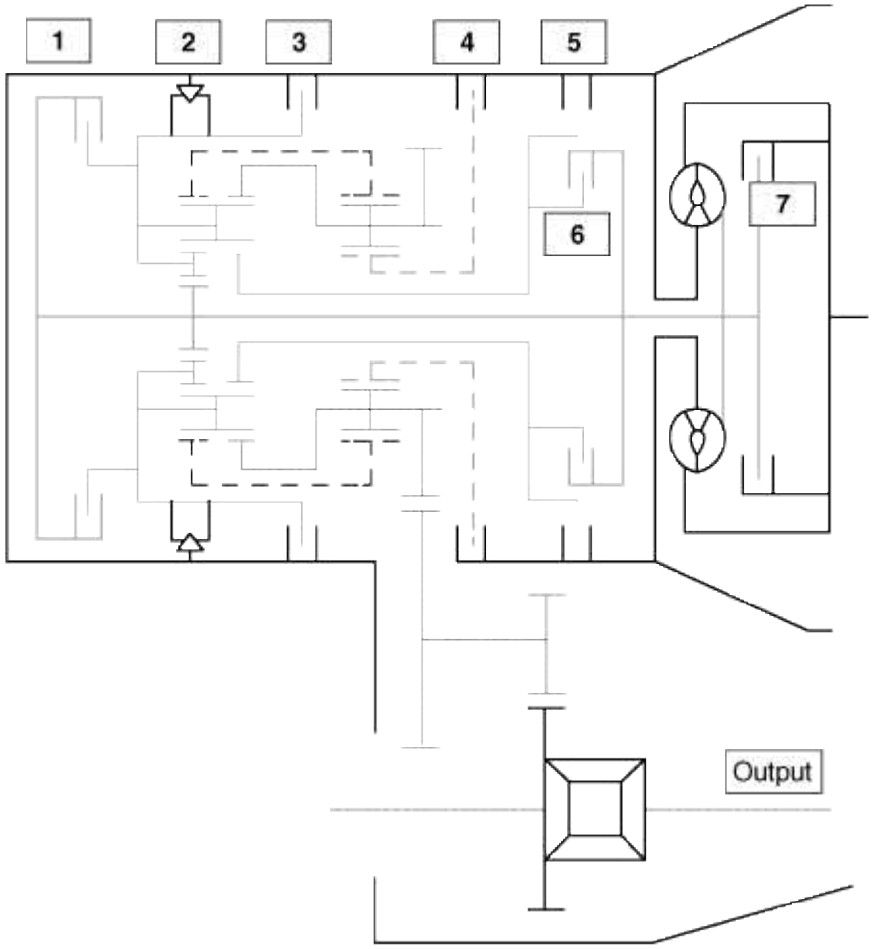
Automatic Transaxle System > Clutch & Brake > Description and Operation

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

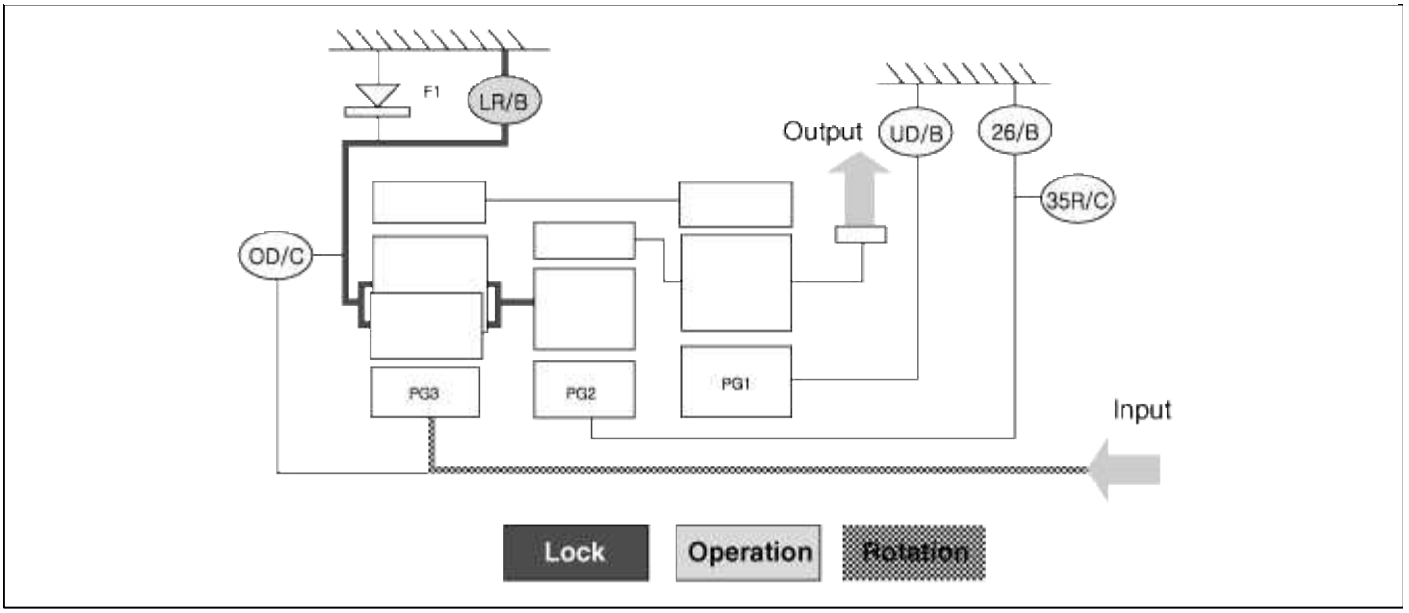


1. Overdrive clutch (OD/C) 2. One way clutch (OWC) 3. Low & Reverse brake (LR/B) 4. Underdrive brake (UD/B)	5. 26 brake(26/B) 6. 35R clutch (35R/C) 7. Damper clutch (D/C)

Automatic Transaxle System > Clutch & Brake > Flow Diagram

Power Flow Chart

	UD/B	LR/B	26/B	35R/C	OD/C	OWC
P,N		•				



Direction of Rotation

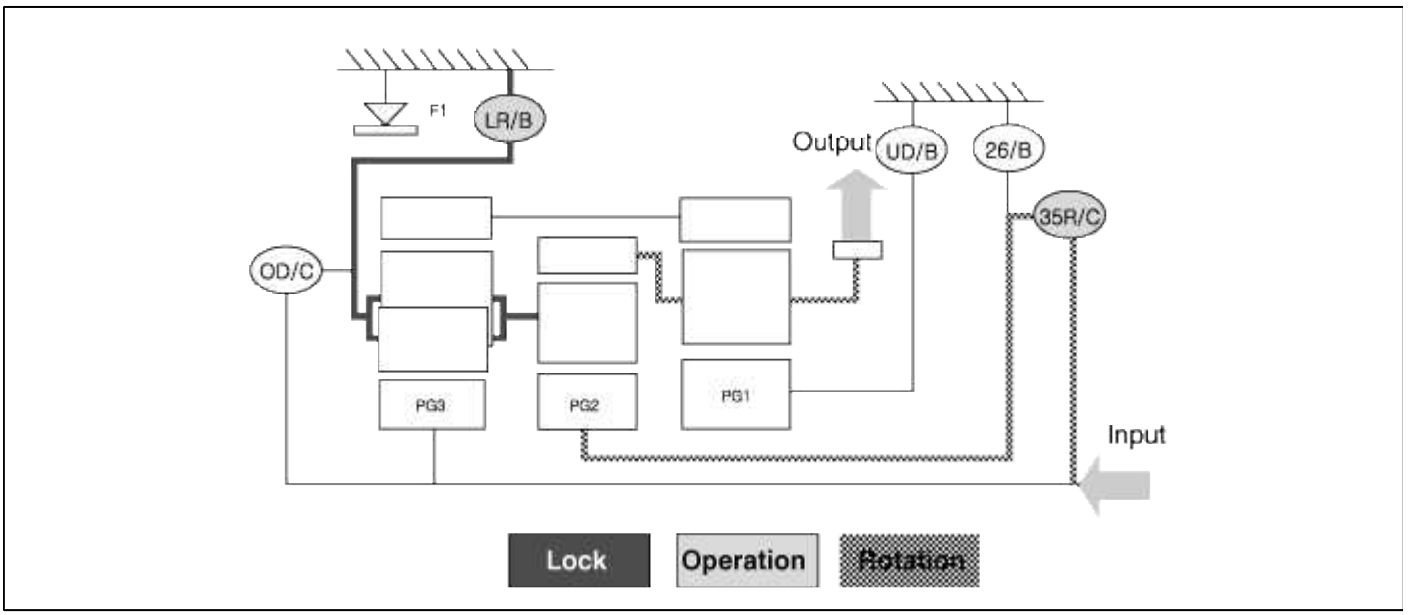
Lower & Reverse Brake (LR/B) Activation → Overdrive (O/D) Hub Lock → Mid & Rear P/C Lock

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

	UD/B	LR/B	26/B	35R/C	OD/C	OWC
R		●		●		



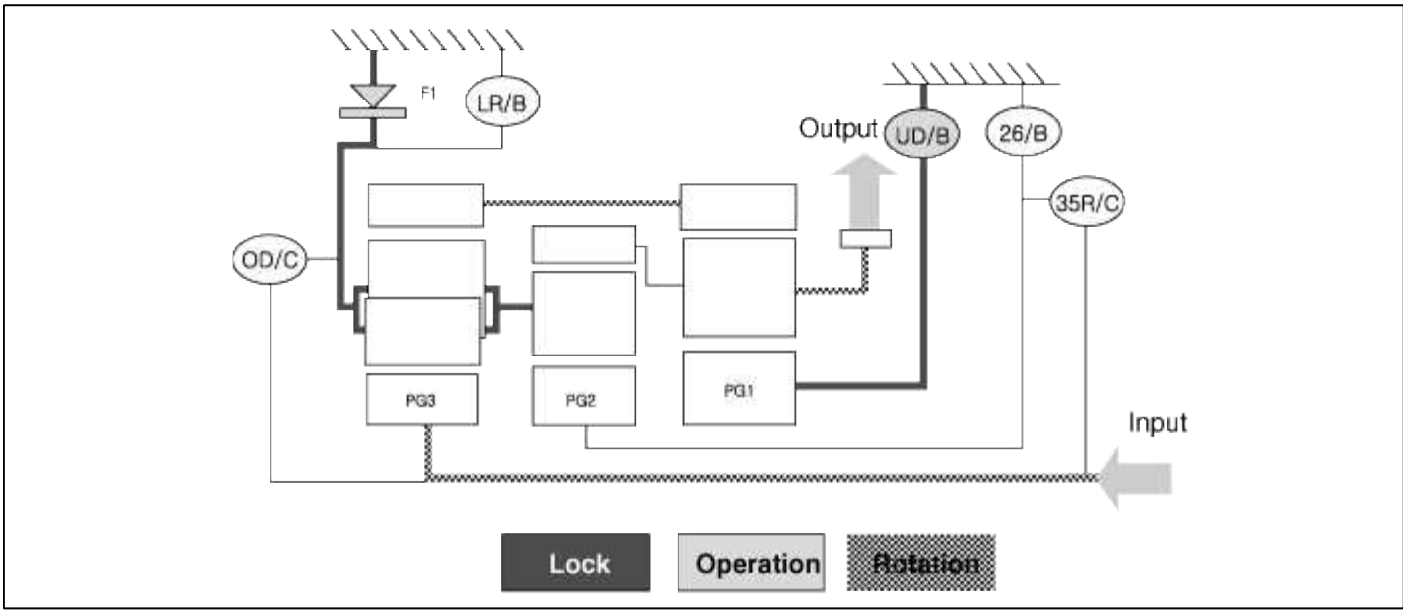
Power Delivery Route

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
	●	(○)				●



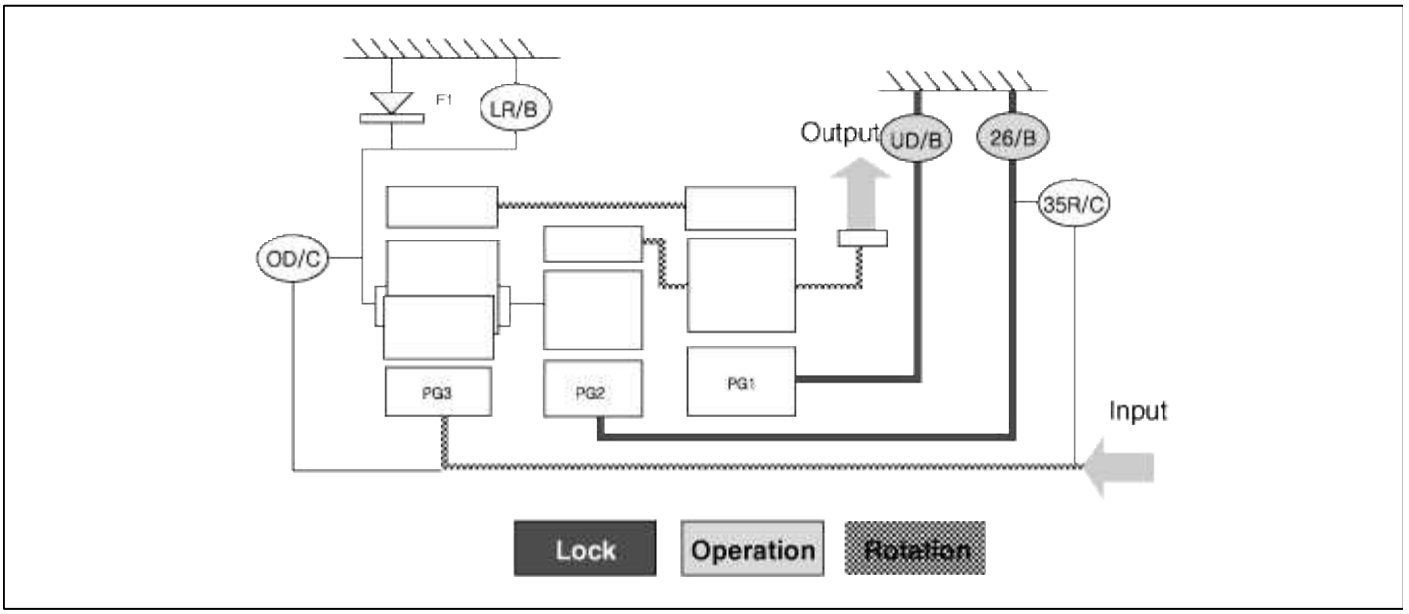
Power Delivery Route

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
	●		●			



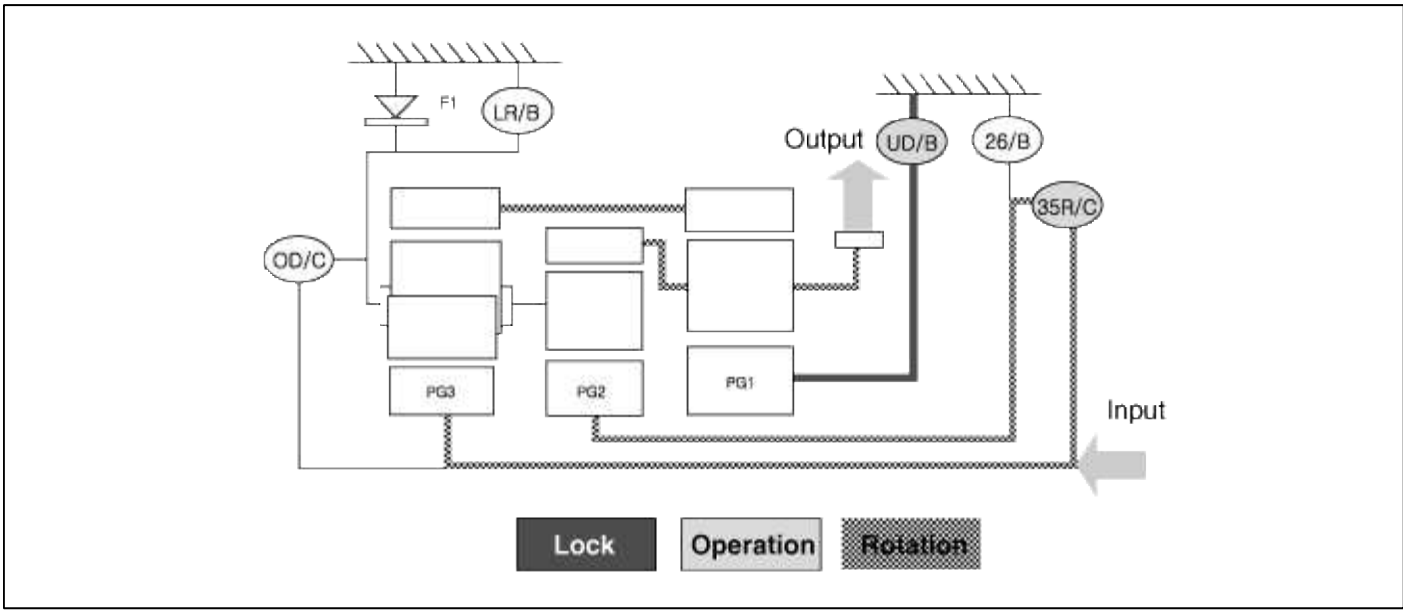
Power Delivery Route

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.

	UD/B	LR/B	26/B	35R/C	OD/C	OWC
D3	●			●		

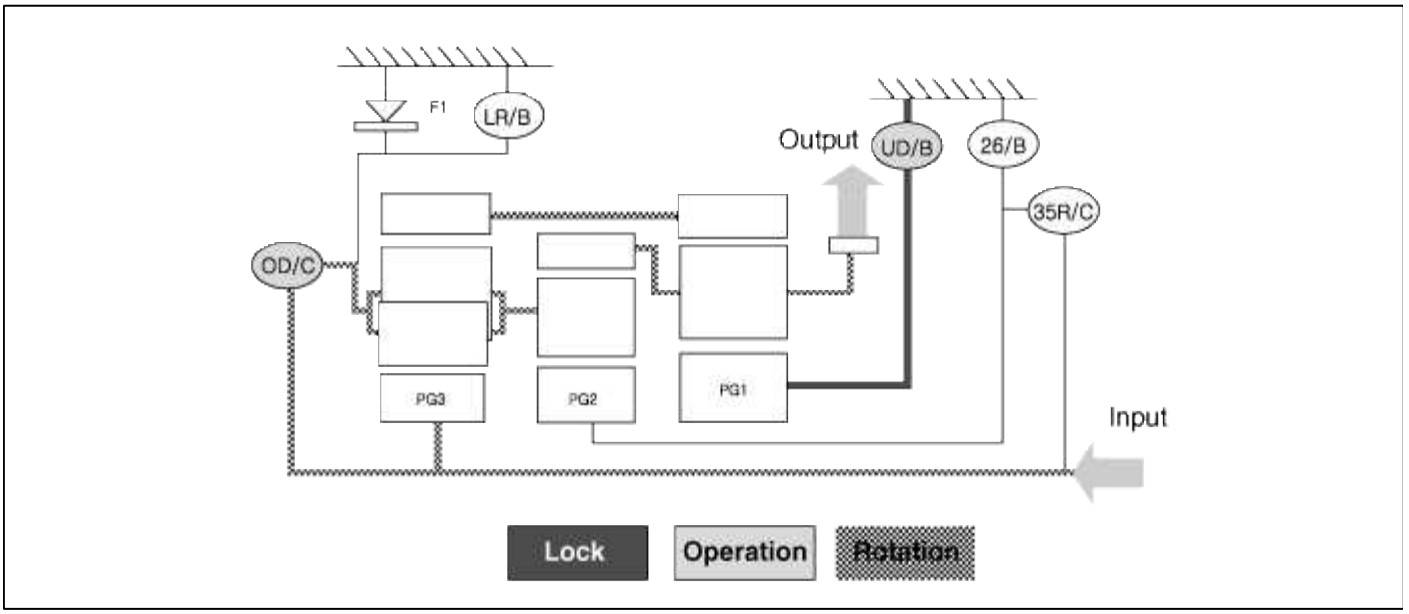


Power Delivery Route

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.

	UD/B	LR/B	26/B	35R/C	OD/C	OWC
D4	●				●	



Power Delivery Route

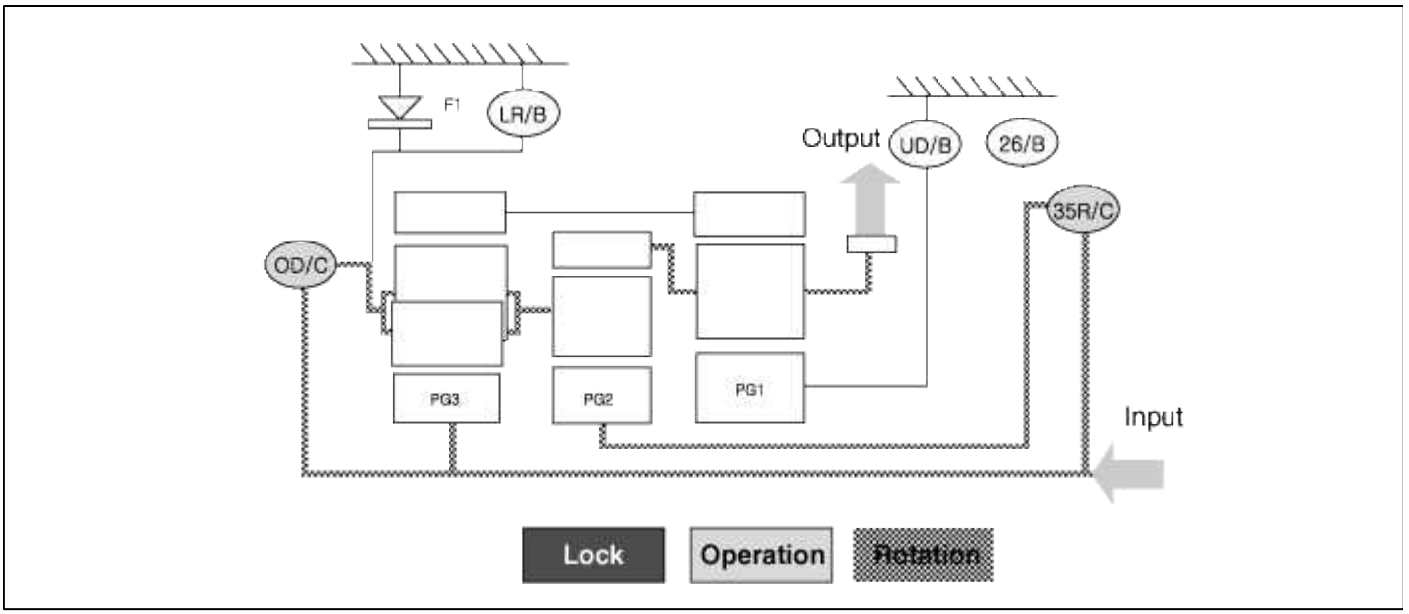
Front sun gear locked and rear carrier and rear sun gears in rotation

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.

	UD/B	LR/B	26/B	35R/C	OD/C	OWC
D5				●	●	



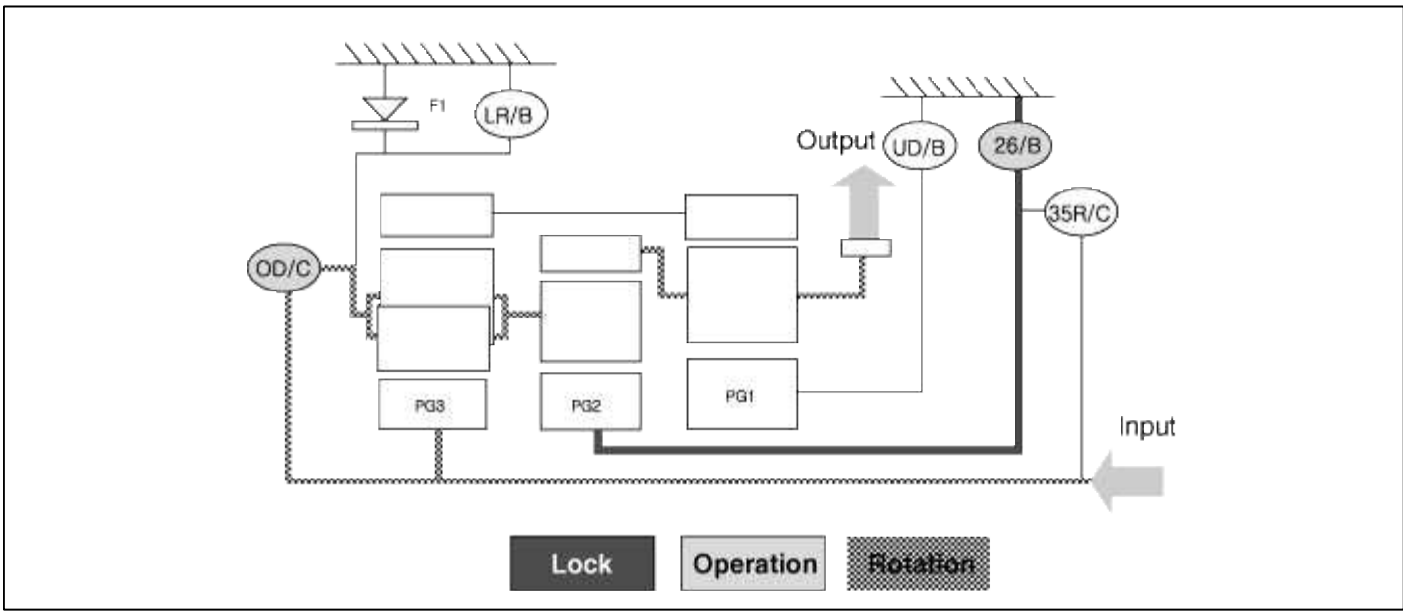
Power Delivery Route

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.

	UD/B	LR/B	26/B	35R/C	OD/C	OWC
D6			●		●	



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.

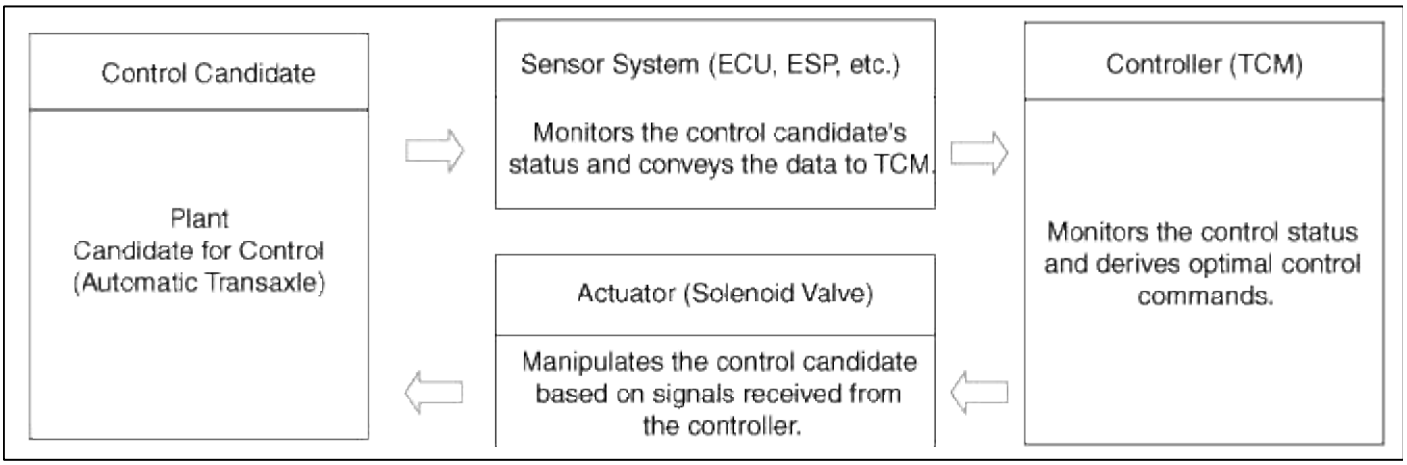
Here, the rear planetary gear maintains a 1:1 rotation ratio as it would when 4th or 5th gear is engaged; however, the front planetary gear remains unrestrained and the front sun gear rotates at a faster rate in the normal direction and at zero load.

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.
- 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.

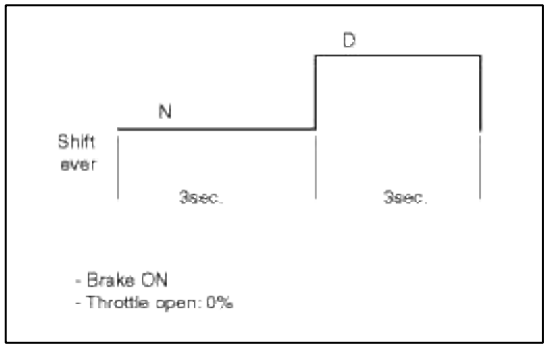
- Transaxle assembly replacement
- TCM replacement
- TCM upgrading

1. TCM learning condition
   A. ATF temperature: 40 ~ 100°C (104 ~ 212°F)

2. TCM learning procedure

A. Stop learning

Repeat the below shift pattern four times or more with stepping on the brake.

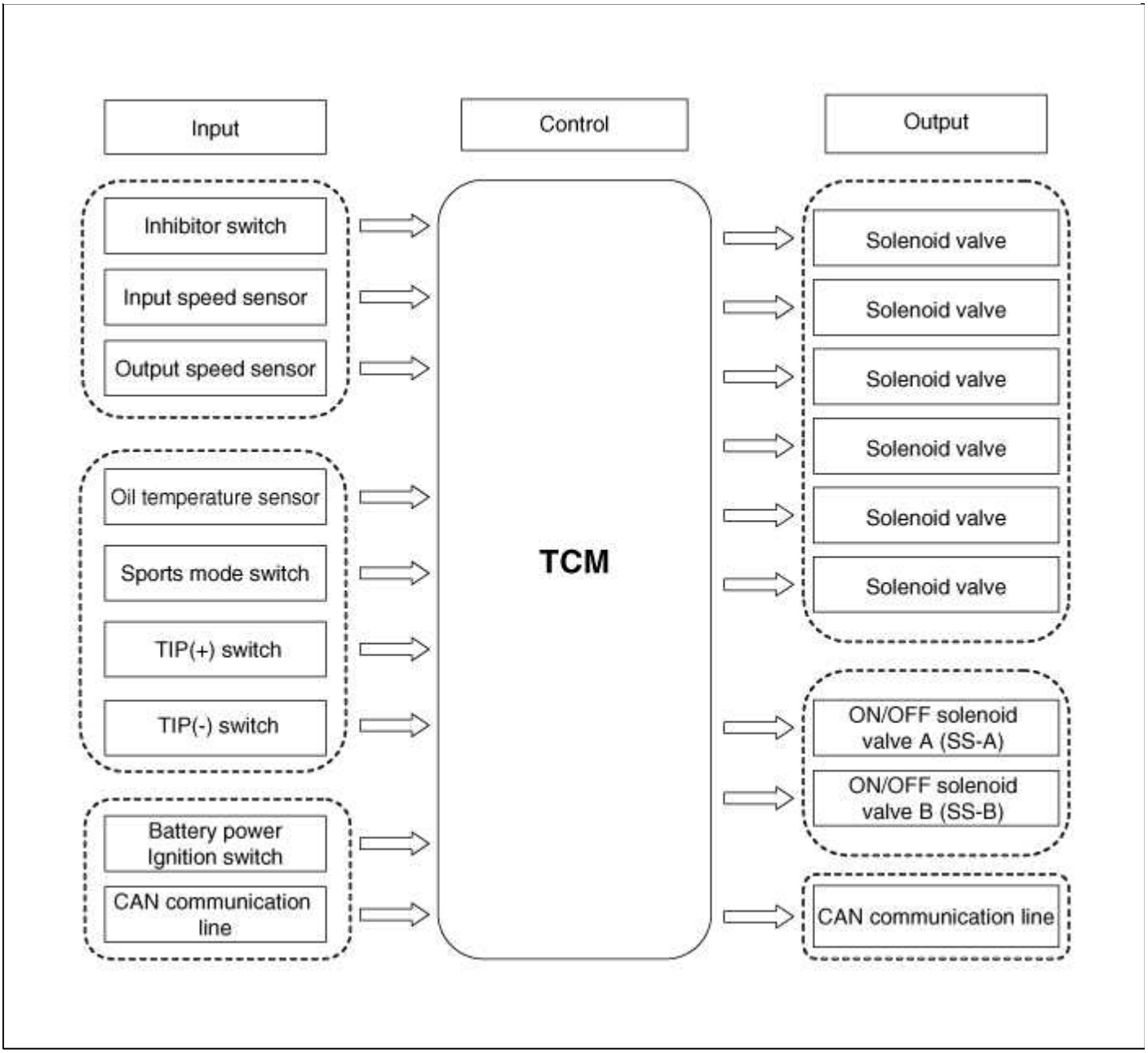


B. Driving learning

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 ~ 25%

Automatic Transaxle System > Automatic Transaxle Control System > Schematic Diagrams

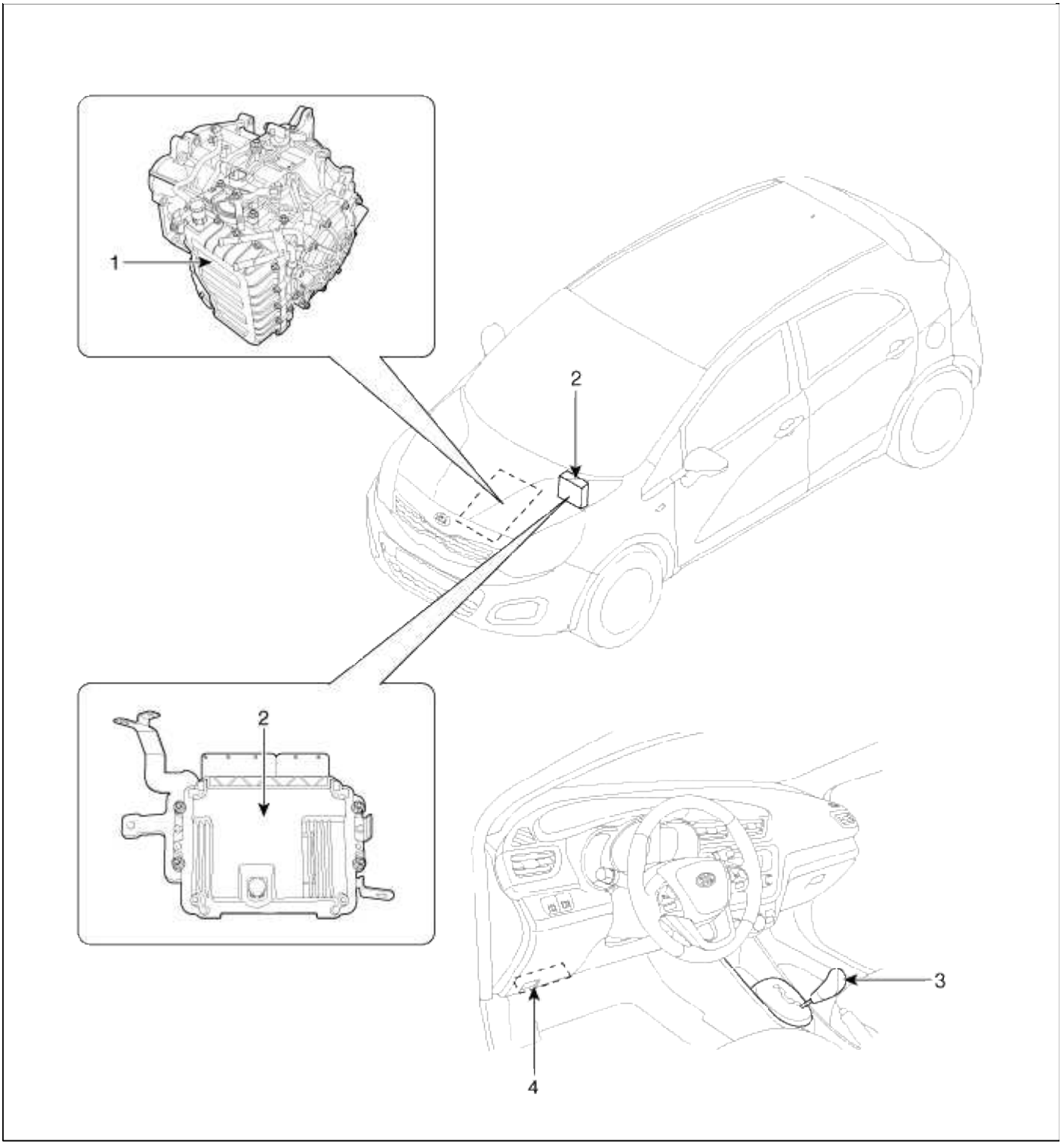
Circuit Diagram



Automatic Transaxle System > Automatic Transaxle Control System > Components and Components Location

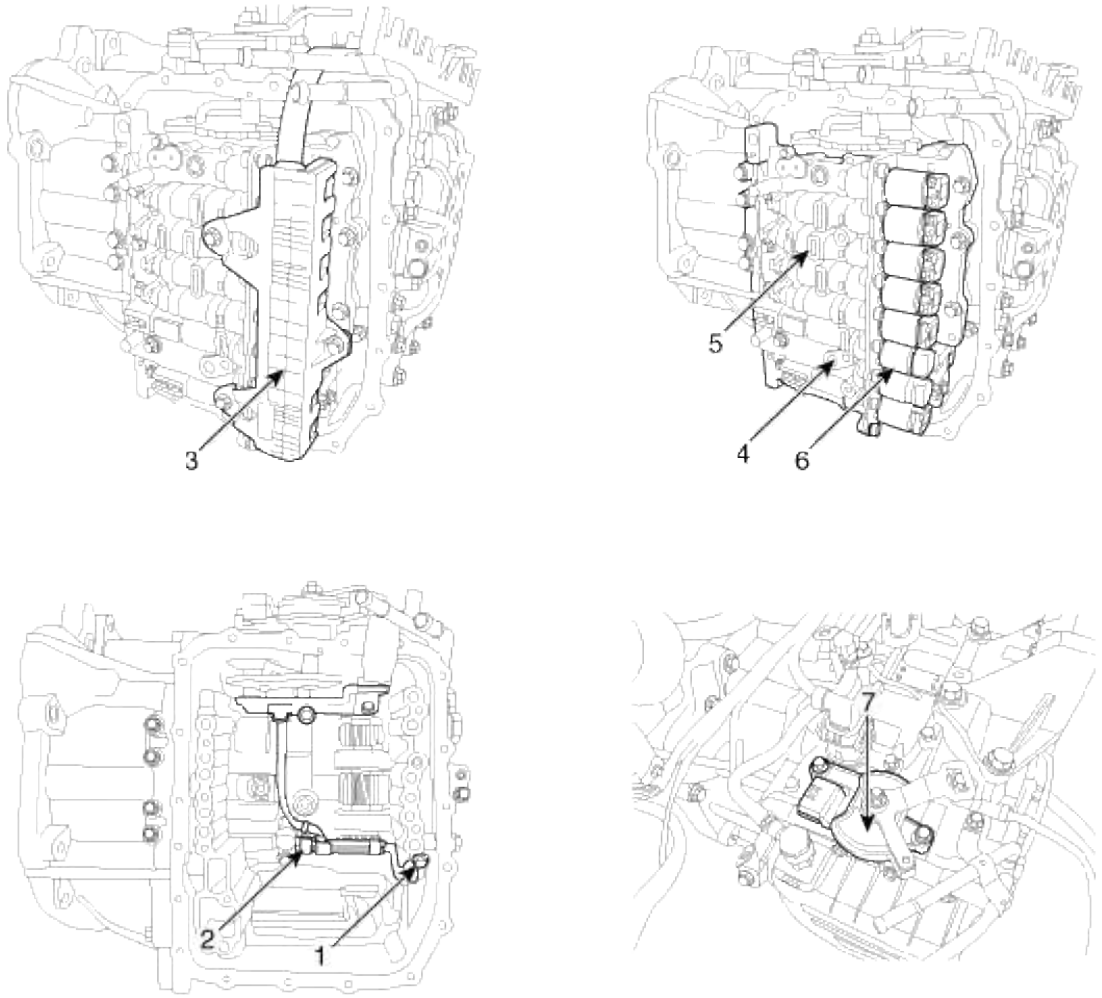
Components Location

[Vehicle Components]



1. Automatic transaxle 2. Transaxle control module (TCM)	3. Shift lever 4. Data Link Connector (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

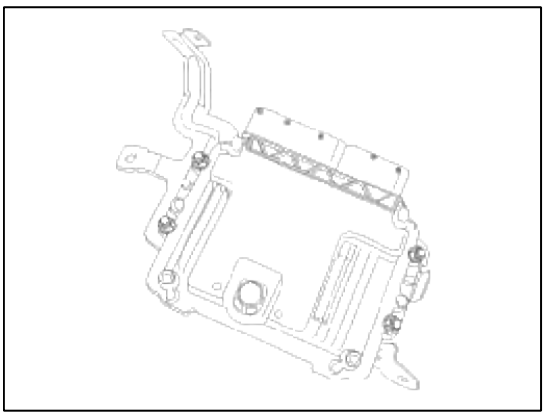
Description

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

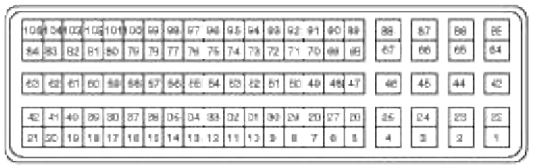
- Monitors the vehicle's operating conditions to determine the optimal gear setting.
- Performs a gear change if the current gear setting differs from the identified optimal gear setting.
- Determines the need for damper clutch (D/C) activation and engages the clutch accordingly.

- 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.

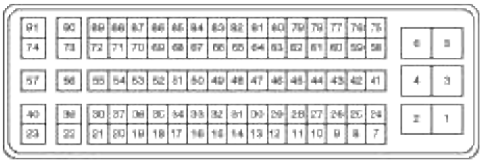


Automatic Transaxle System > Automatic Transaxle Control System > Transaxle Control Module (TCM) > Schematic Diagrams

TCM connector and terminal function



TCM Connector [EGGG-AA]



TCM Connector [EGGG-AK]

TCM Terminal Function

Connector [EGGG-AA]

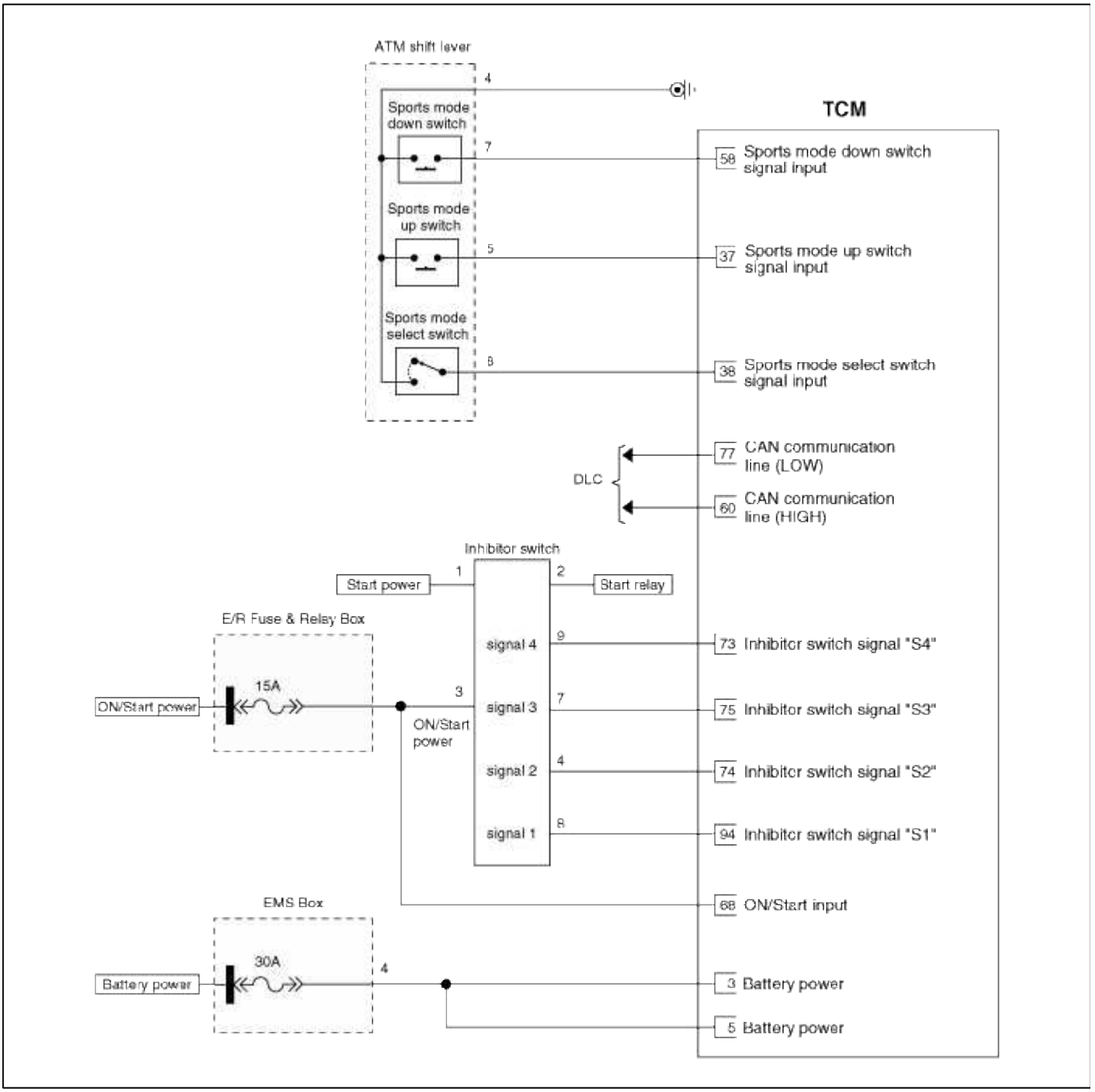
Pin	Description	Pin	Description
22	Shift solenoid D (VFS-OD)	73	Inhibitor switch signal "S4"
23	Pressure cont solenoid (VFS-LINE)	74	Inhibitor switch signal "S2"
26	Shift solenoid F (SS-B)	75	Inhibitor switch signal "S3"
37	Sports mode up switch	87	Solenoid power 1
38	Sports mode select switch	88	Solenoid power 2
39	Oil temperature sensor (+)	89	Shift solenoid E (SS-A)
43	Shift solenoid A (VFS-UD)	94	Inhibitor switch signal "S1"
44	Shift solenoid C (VFS-35R)	95	Output speed sensor power
45	Torque converter control solenoid (T/CON_VFS)	96	Input speed sensor power
46	Shift solenoid B (VFS-26B)	99	Input speed sensor signal
58	Sports mode down switch	100	Output speed sensor signal
59	Oil temperature sensor (-)		

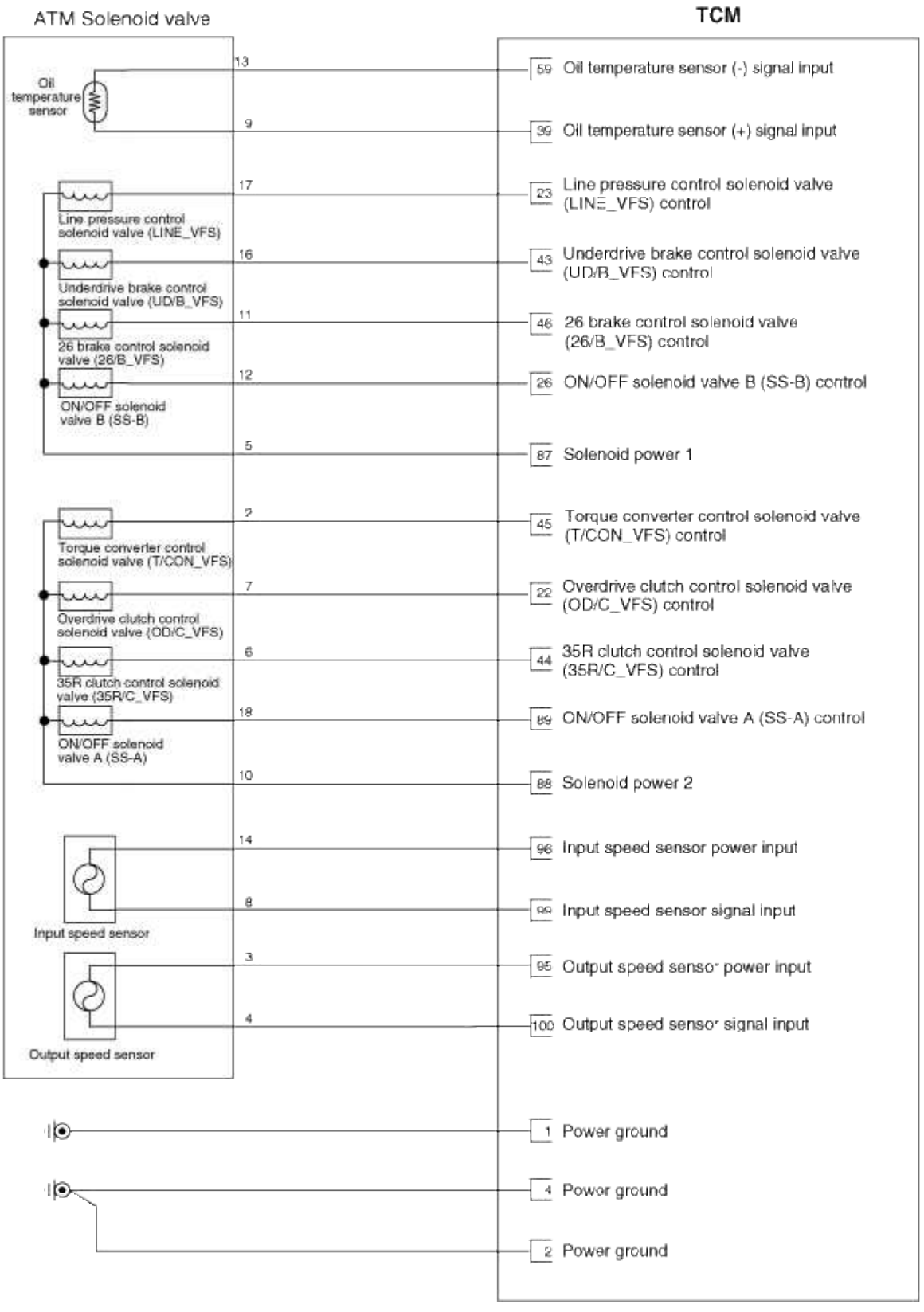
Connector [EGGG-AK]

Pin	Description	Pin	Description
1	GND (Power)	5	VB
2	GND (Power)	60	CAN High
3	VB (Battery voltage)	68	IG.1 (Ignition key)
4	Ground (Power)	77	CAN Low

TCM Terminal input/ output signal

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).

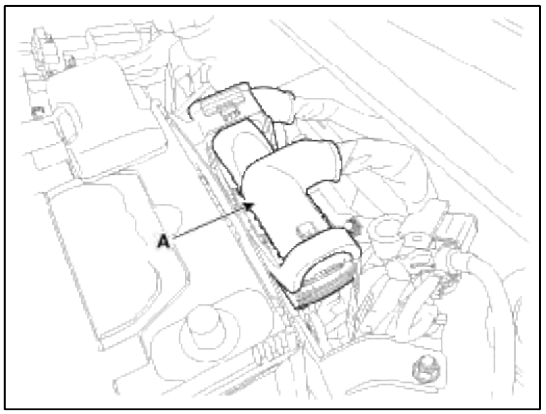
Replacement

NOTE

When replacing the TCM, the vehicle equipped with immobilizer must be performed the procedure as below.
[In the case of installing used TCM]
1. Perform "TCM neutralization mode" procedure with GDS. (Refer to "Immobilizer" in BE group)
2. Insert the key and turn it to the IGN ON and OFF position.

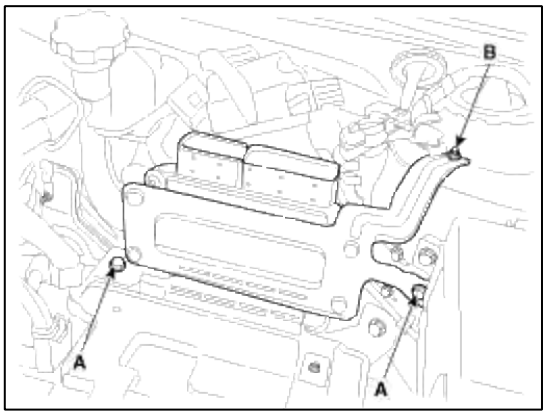
Then the TCM key register process is completed automatically.
[In the case of installing new TCM]– Insert the key and turn it to the IGN ON and OFF position.
Then the TCM key register process is completed automatically.

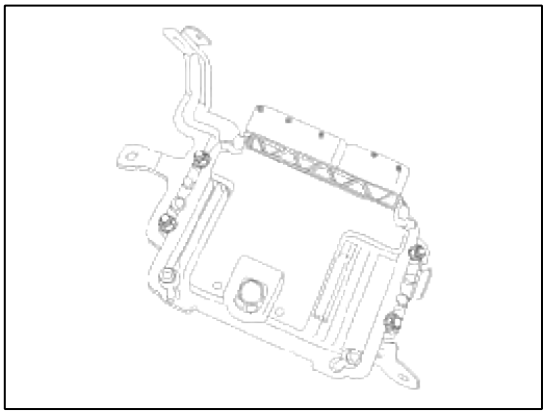
1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Disconnect the TCM connector (A).



3. Remove the bracket installation bolts (A) and the nut (B).

TCM installation bolt/nut :
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)





Installation

1. Installation is reverse of removal.

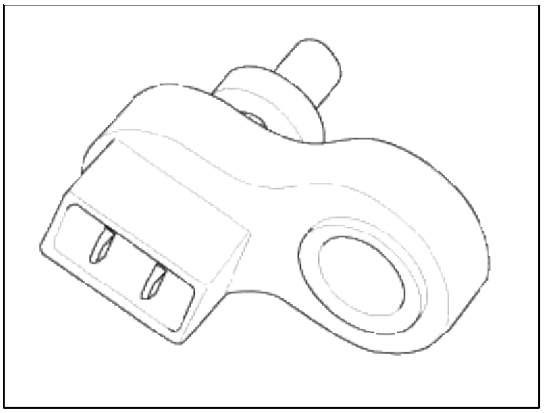
NOTE

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.

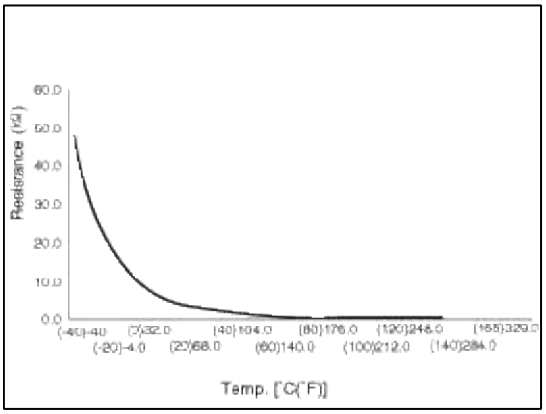


Automatic Transaxle System > Automatic Transaxle Control System > Transaxle Oil Temperature Sensor > Specifications

Specifications

Type: Negative Thermal Coefficient Type

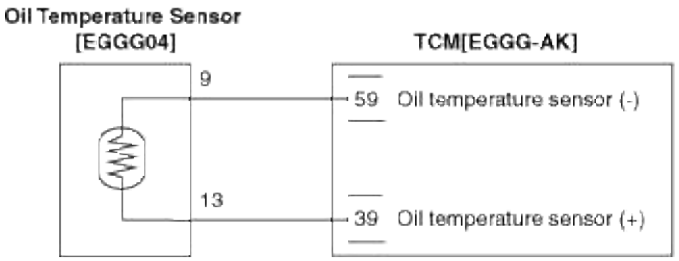
Temp.[(°C)°F]	Resistance (kΩ)
(-40)-40	48.1
(-20)-4.0	15.6
(0)32.0	5.88
(20)68.0	2.51
(40)104.0	1.11
(60)140.0	0.61
(80)176.0	0.32
(100)212.0	0.18
(120)248.0	0.10
(140)284.0	0.06
(150)302.0	0.05



Automatic Transaxle System > Automatic Transaxle Control System > Transaxle Oil Temperature Sensor > Schematic Diagrams

Circuit Diagram

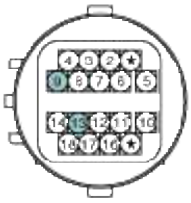
[Circuit Diagram]



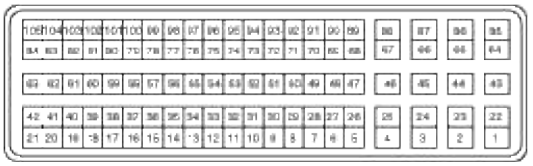
[Connection Information]

Terminal	Connected to	Function
9	TCM(59)	Oil temperature sensor (-)
13	TCM(39)	Oil temperature sensor (+)

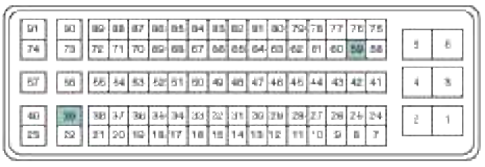
[Harness Connector]



Solenoid Valve Connector [EGGG04]



TCM Connector [EGGG-AA]



TCM Connector [EGGG-AK]

Automatic Transaxle System > Automatic Transaxle Control System > Transaxle Oil Temperature Sensor > Repair procedures

Inspection

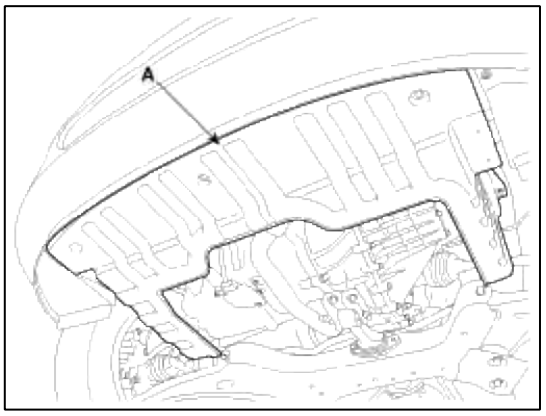
1. Turn ignition switch OFF.
2. Disconnect the solenoid valve connector.
3. Measure resistance between sensor signal terminal and sensor ground terminal.
4. Check that the resistance is within the specification.

Removal

1. Remove the battery and the battery tray.
   (Refer to "Charging system" in EE group.)

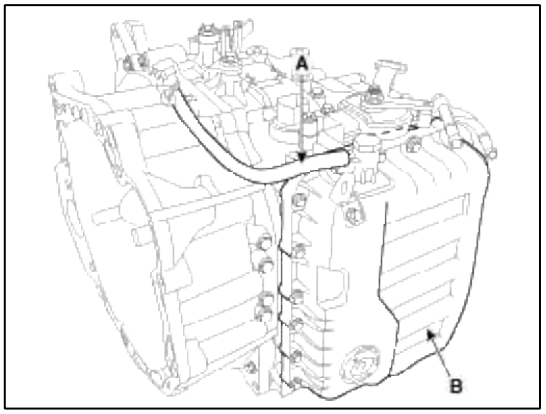
2. Remove the under cover (A).

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

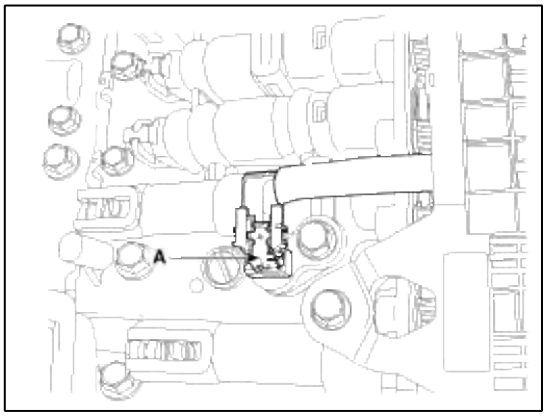


3. Replace new gasket and the plug after draining the automatic transaxle fluid by removing the drain plug. (Refer to "Hydraulic system (Fluid)" in this group)
4. Remove the air breather hose (A).
5. Remove the valve body cover (B).

Tightening torque:
13.7 ~ 15.7 N.m (1.4 ~ 1.6 kgf.m, 10.8 ~ 11.6 lb-ft)

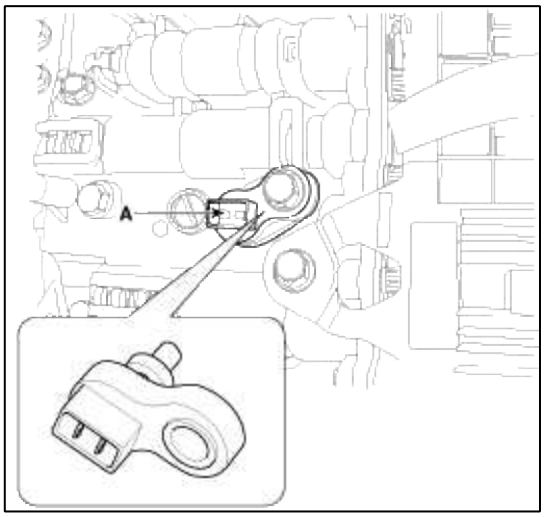


6. Disconnect the oil temperature sensor connector (A).



7. 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)



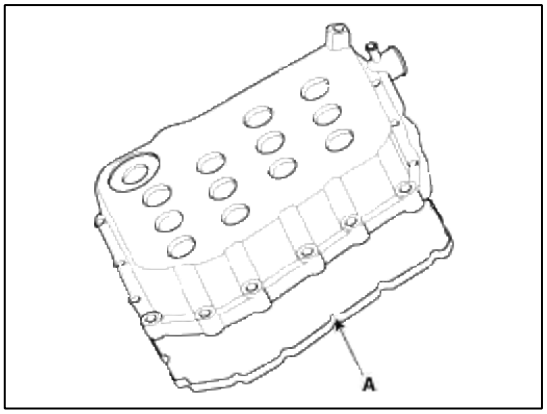
Installation

1. Installation is the reverse of removal.

NOTE

After replacement or reinstallation procedure of the valve body assembly, must perform procedures below.

- The gasket of the valve body gasket (A) use new one.

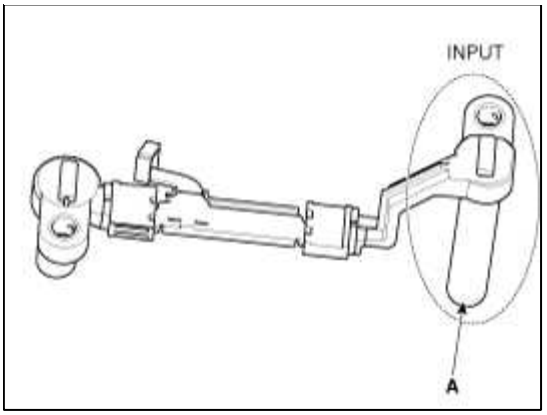


- Adding automatic transaxle fluid.
  (Refer to "Hydraulic system (Fluid)" in this group)

Automatic Transaxle System > Automatic Transaxle Control System > Input Speed Sensor > Description and Operation

Description

Input speed sensor (A) 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

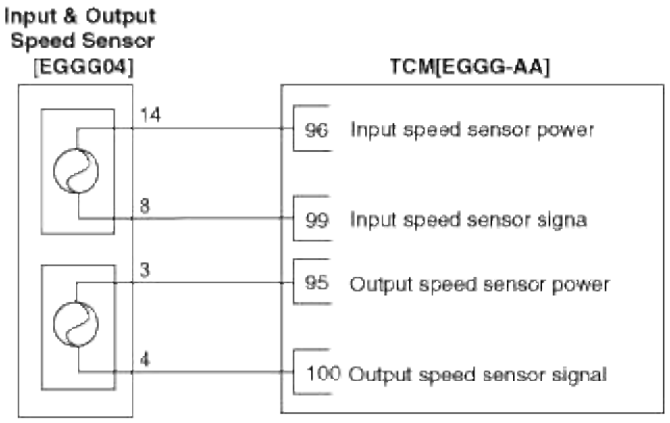
Type: Hall effect sensor

Operation condition [°C(°F)]		((-)40 ~ 150)) -40 ~ 302
Air gap(mm)in.		(1.2 ~ 1.8) 0.0472 ~ 0.0709
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

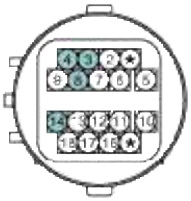
[Circuit Diagram]



[Connection Information]

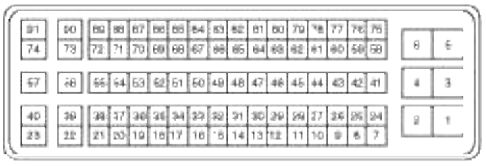
Terminal	Connected to	Function
14	TCM(96)	Output speed sensor signal
8	TCM(99)	Input speed sensor power
3	TCM(95)	nput speed sensor signal
4	TCM(100)	Output speed sensor power

[Harness Connector]



Solenoid Valve Connector [EGGG04]

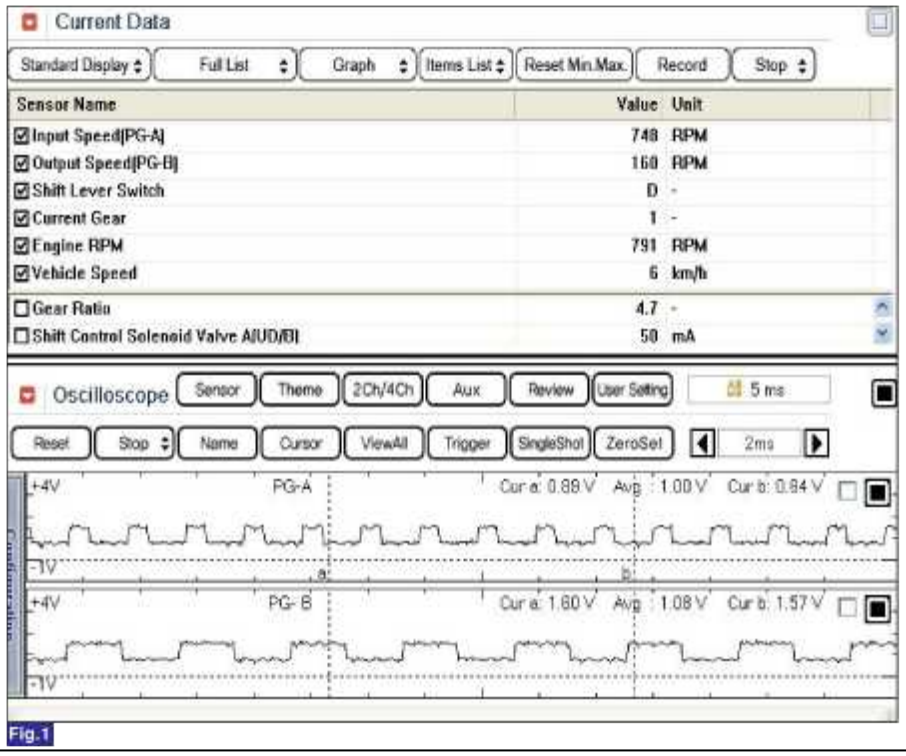
TCM Connector [EGGG-AA]



TCM Connector [EGGG-AK]

Automatic Transaxle System > Automatic Transaxle Control System > Input Speed Sensor > Troubleshooting

Signal Waveform



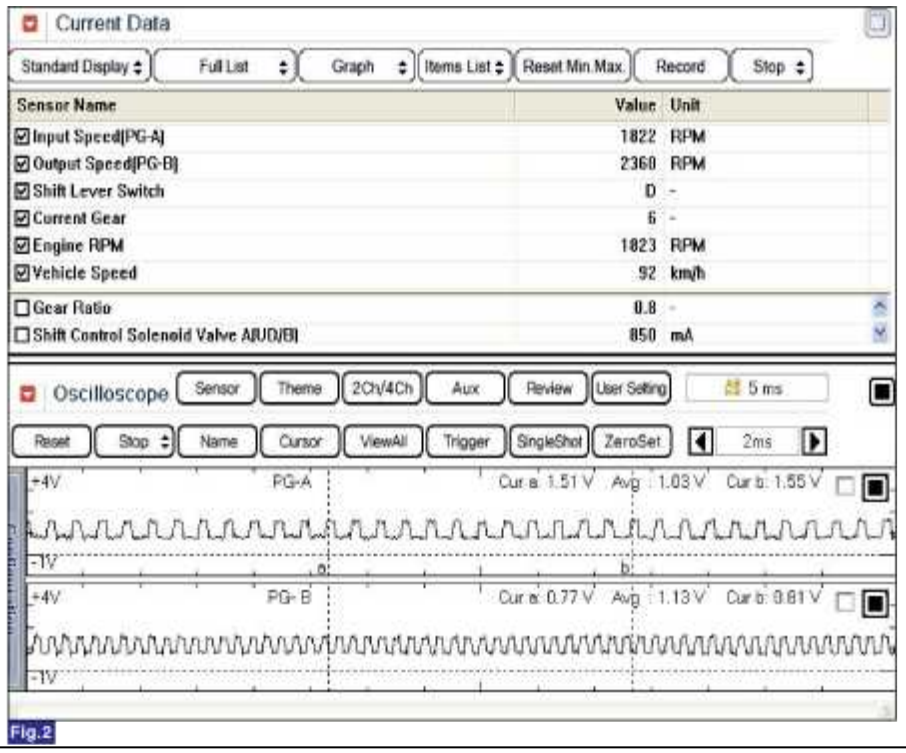


Fig 1) Input/Output speed sensor at low speed
Fig 2) Input/Output speed sensor at high speed

Automatic Transaxle System > Automatic Transaxle Control System > Input Speed Sensor > Repair procedures

Inspection

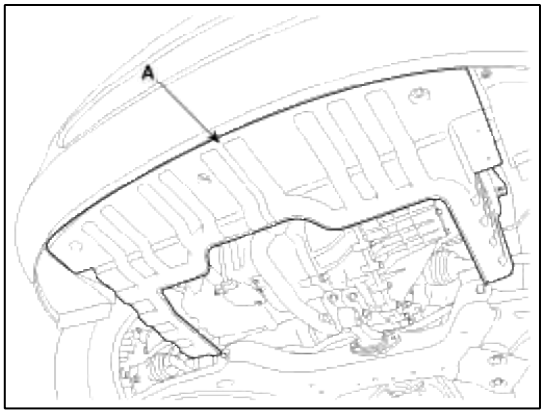
1. Check signal waveform of Input & output speed sensor using the GDS.

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

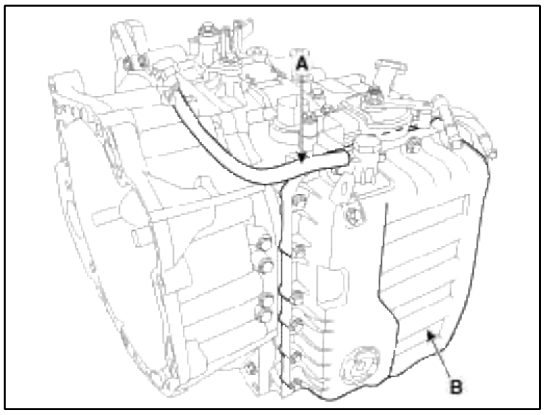


3. Replace new gasket and the plug after draining the automatic transaxle fluid by removing the drain plug. (Refer to "Hydraulic system (Fluid)" in this group)
4. Remove the air breather hose (A).
5. Remove the valve body cover (B).

Tightening torque:
13.7 ~ 15.7 N.m (1.4 ~ 1.6 kgf.m, 10.8 ~ 11.6 lb-ft)

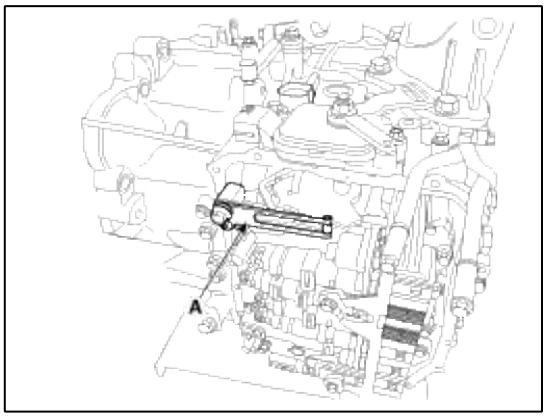
NOTE

Remove installation bolts in the engine compartment first and then remove others under the vehicle.



6. Remove the plate and the detent spring (A) after removing the bolt.

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

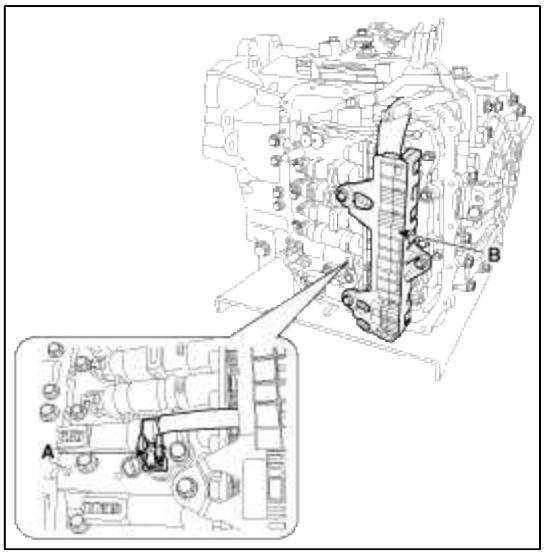


7. Remove the bolt (3ea) after disconnecting the solenoid valve connector (B) and the oil temperature sensor connector (A).

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

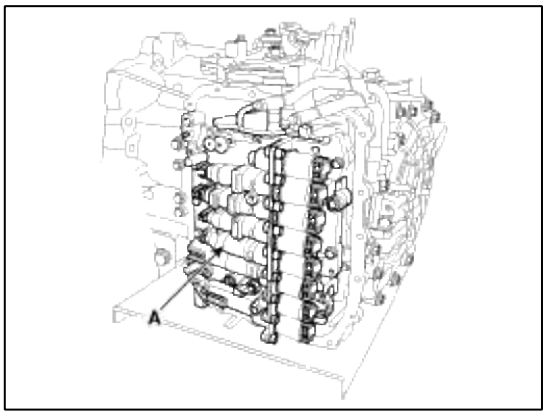
CAUTION

Be careful not to damage the harness lock connector.



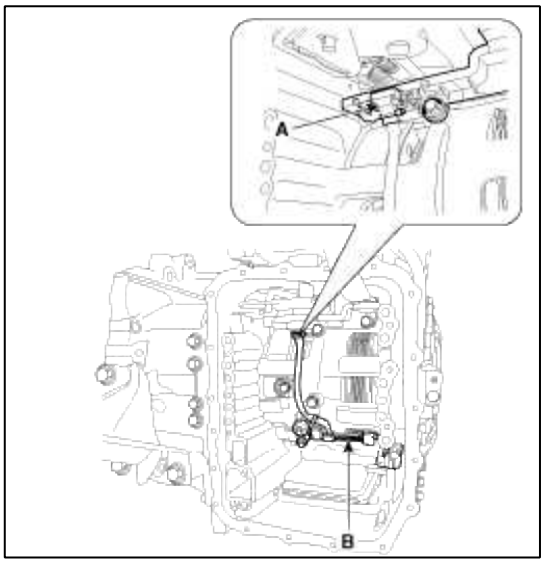
8. Remove the valve body assembly (A).

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



9. Disconnect the input & output speed sensor connector (A).
10. 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)



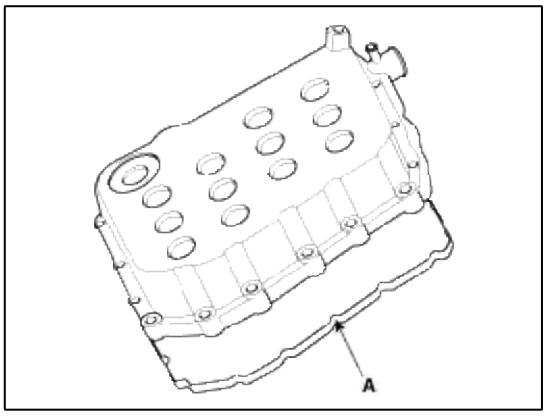
Installation

1. Installation is the reverse of removal.

NOTE

After replacement or reinstallation procedure of the valve body assembly, must perform procedures below.

- The gasket of the valve body gasket (A) use new one.

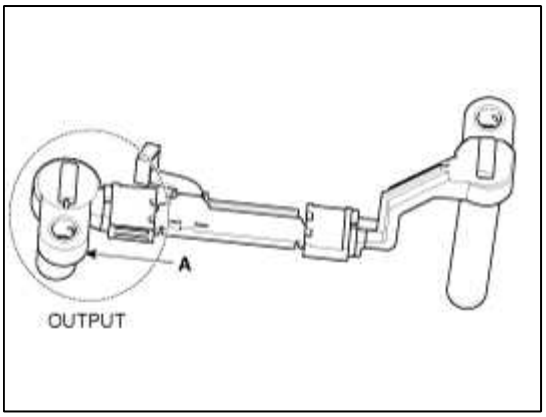


- Adding automatic transaxle fluid.
  (Refer to "Hydraulic system (Fluid)" in this group)

Automatic Transaxle System > Automatic Transaxle Control System > Output Speed Sensor > Description and Operation

Description

The output speed sensor (A) 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

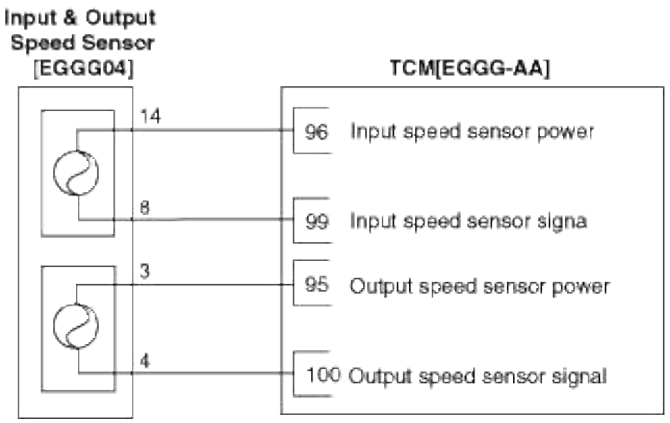
Type: Hall effect sensor

Operation condition [°C(°F)]		((-)40 ~ 150)) -40 ~ 302
Air gap(mm)in.		(0.85 ~ 1.3) 0.0335 ~ 0.0512
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

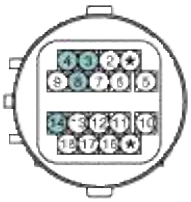
[Circuit Diagram]



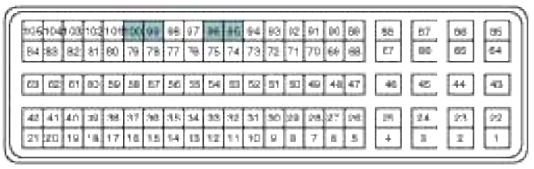
[Connection Information]

Terminal	Connected to	Function
14	TCM(96)	Output speed sensor signal
8	TCM(99)	Input speed sensor power
3	TCM(95)	nput speed sensor signal
4	TCM(100)	Output speed sensor power

[Harness Connector]



Solenoid Valve Connector [EGGG04]

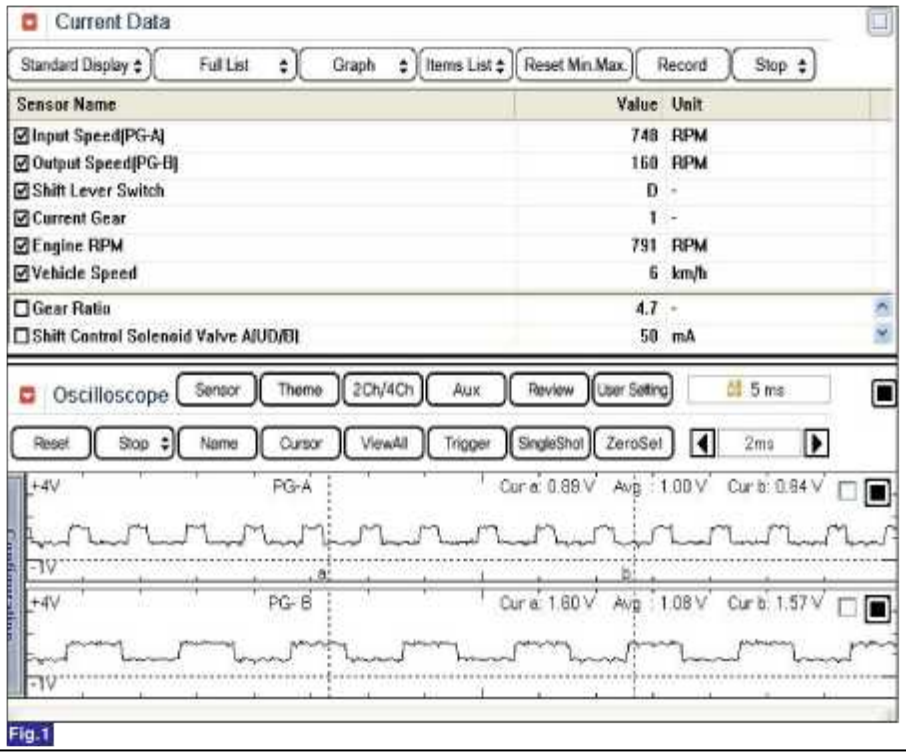


TCM Connector [EGGG-AA]

TCM Connector [EGGG-AK]

Automatic Transaxle System > Automatic Transaxle Control System > Output Speed Sensor > Troubleshooting

Signal Waveform



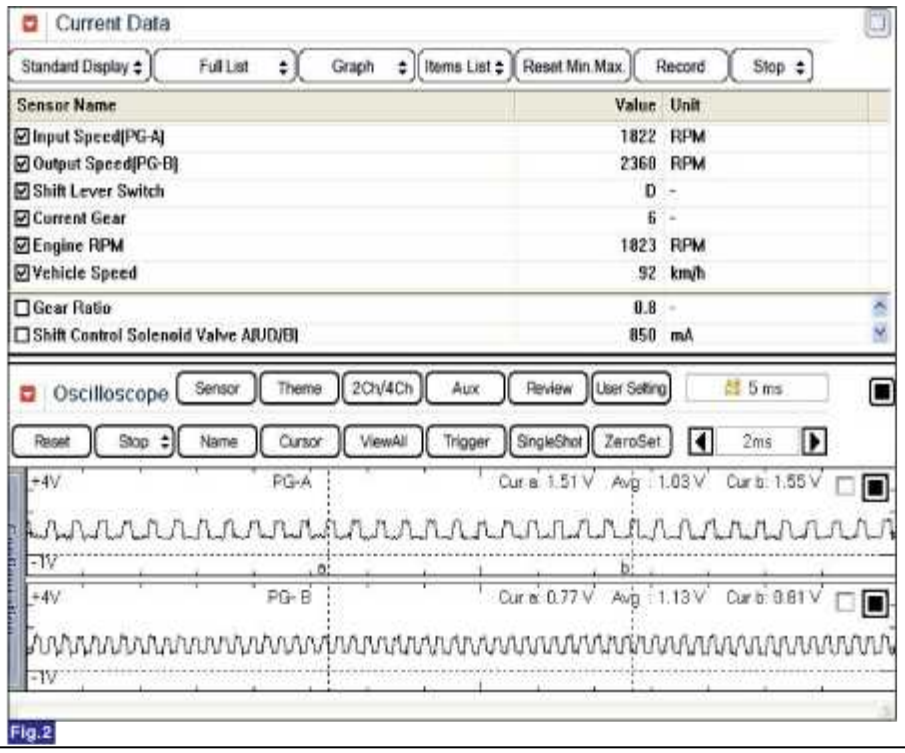


Fig 1) Input/Output speed sensor at low speed
Fig 2) Input/Output speed sensor at high speed

Automatic Transaxle System > Automatic Transaxle Control System > Output Speed Sensor > Repair procedures

Inspection

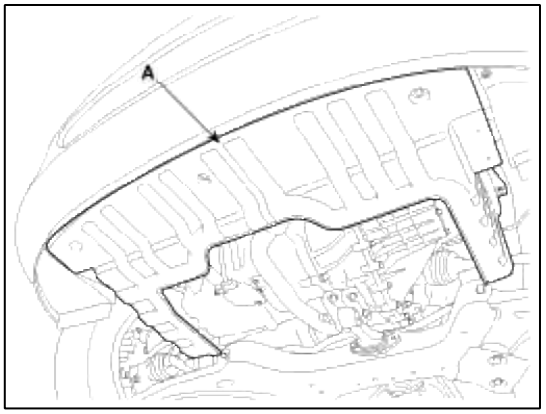
1. Check signal waveform of Input & output speed sensor using the GDS.

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:
6.9 ~ 10.8 N.m (0.7 ~ 1.1 kgf.m, 5.1 ~ 8.0 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 air breather hose (A).
5. Remove the valve body cover (B).

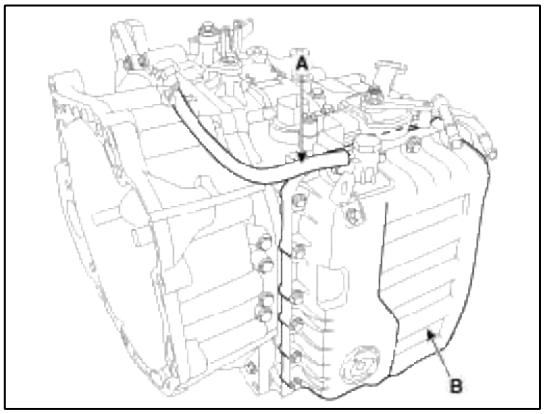
Tightening torque:
13.7 ~ 15.7 N.m (1.4 ~ 1.6 kgf.m, 10.8 ~ 11.6 lb-ft)

CAUTION

Always replace the gasket of the eyebolt use new one whenever loosening eyebolt.

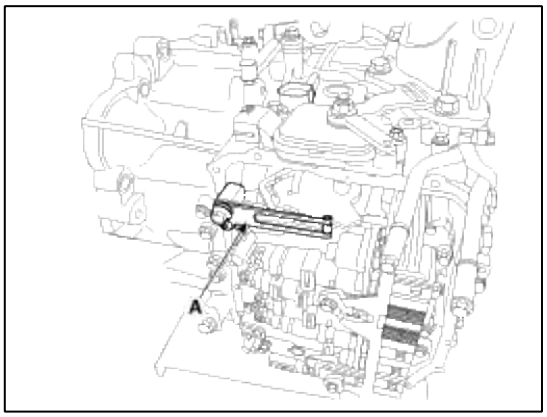
NOTE

Remove installation bolts in the engine compartment first and then remove others under the vehicle.



6. Remove the plate and the detent spring (A) after removing the bolt.

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

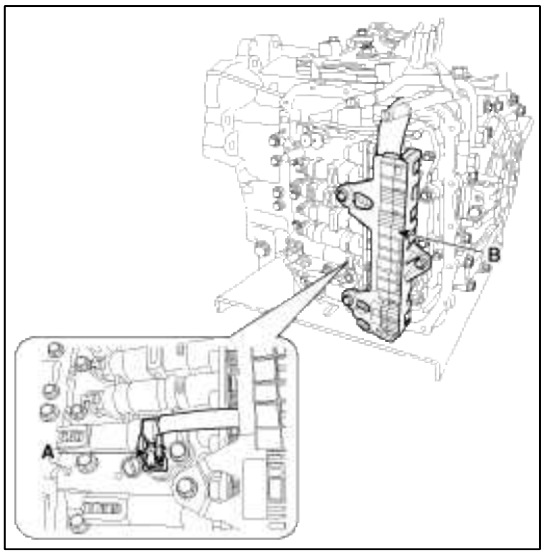


7. Remove the bolt (3ea) after disconnecting the solenoid valve connector (B) and the oil temperature sensor connector (A).

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

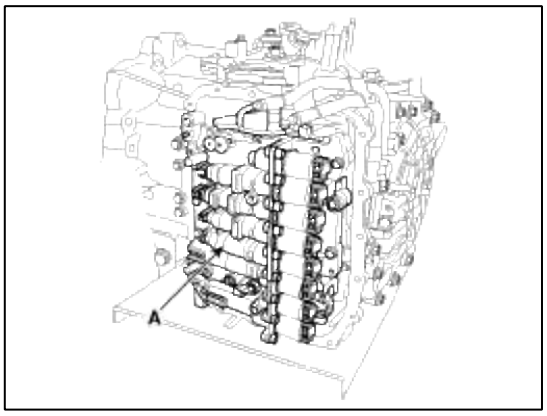
CAUTION

Be careful not to damage the harness lock connector.



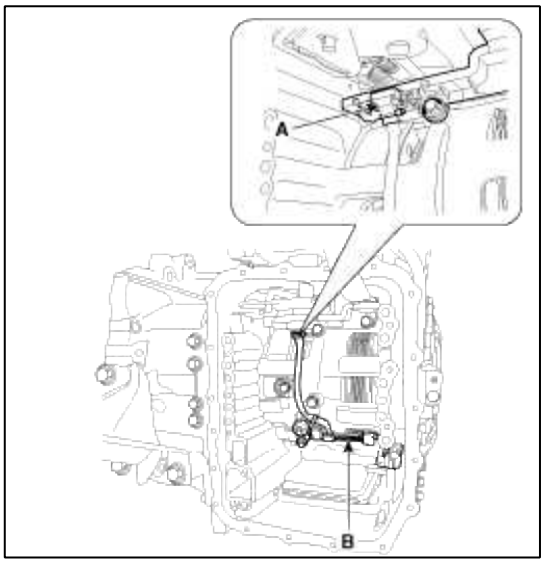
8. Remove the valve body assembly (A).

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



9. Disconnect the input & output speed sensor connector (A).
10. 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)



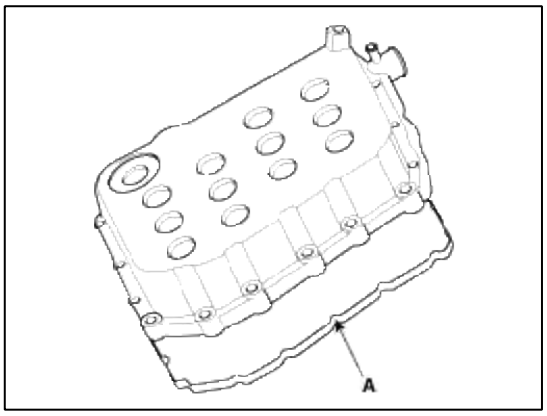
Installation

1. Installation is the reverse of removal.

NOTE

After replacement or reinstallation procedure of the valve body assembly, must perform procedures below.

- The gasket of the valve body gasket (A) use new one.

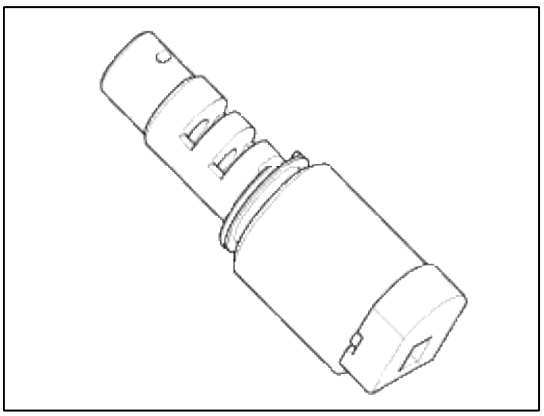


- Adding automatic transaxle fluid.
  (Refer to "Hydraulic system (Fluid)" in this group)

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]

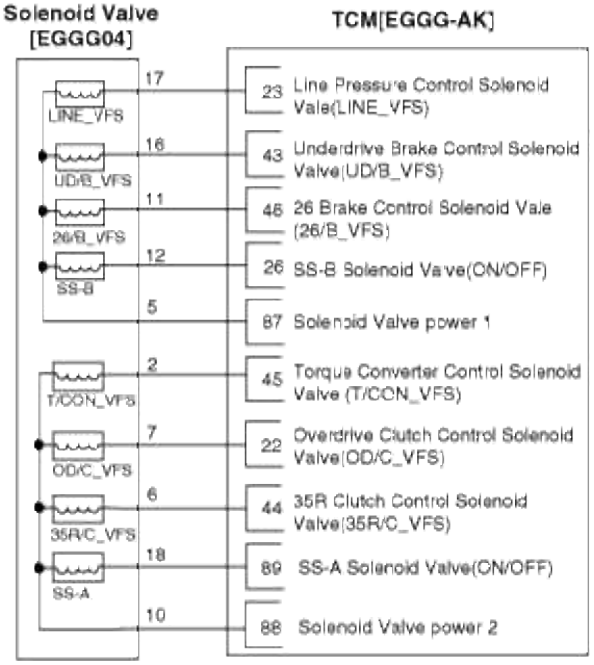
Control type : Normal low type

Control Pressure kpa (kgf/cm², 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

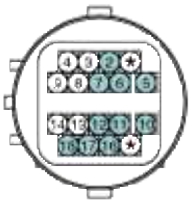
[Circuit Diagram]



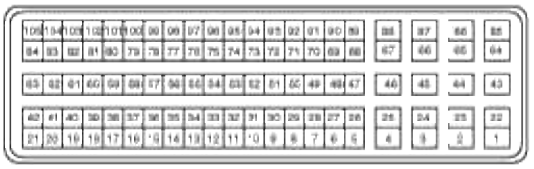
[Connection Information]

Terminal	Connected to	Function
17	TCM(23)	Line Pressure Control Solenoid Vale (LINE_VFS)
16	TCM(43)	Underdrive Brake Control Solenoid Valve (UD/B_VFS)
11	TCM(46)	26 Brake Control Solenoid Vale (26/B_VFS)
12	TCM(26)	SS-B Solenoid Valve (ON/OFF)
5	TCM(87)	Solenoid Valve power 1
2	TCM(45)	Torque Converter Control Solenoid Valve (T/CON_VFS)
7	TCM(22)	Overdrive Clutch Control Solenoid Valve (OD/C_VFS)
6	TCM(44)	35R Clutch Control Solenoid Valve (35R/C_VFS)
18	TCM(89)	SS-A Solenoid Valve (ON/OFF)
10	TCM(88)	Solenoid Valve power 2

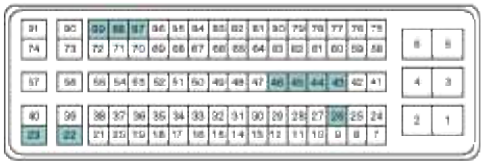
[Harness Connector]



Solenoid Valve Connector [EGGG04]



TCM Connector [EGGG-AA]



TCM Connector [EGGG-AK]

Automatic Transaxle System > Automatic Transaxle Control System > Torque Converter Control Solenoid Valve (T/CON_VFS) > Repair procedures

Inspection

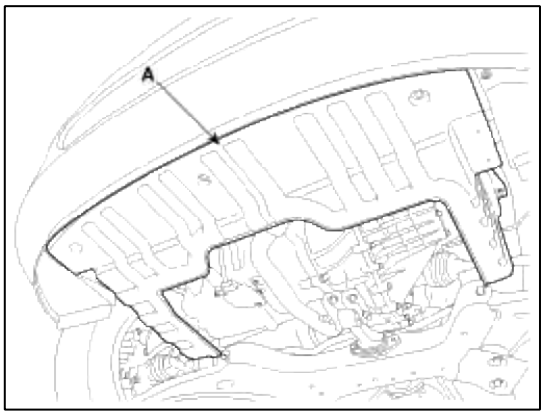
1. Turn ignition switch OFF.
2. Disconnect the solenoid valve connector.
3. Measure resistance between sensor signal terminal and sensor ground terminal.
4. Check that the resistance is within the specification.

Removal

1. Remove the battery and the battery tray.
   (Refer to "Charging system" in EE group.)

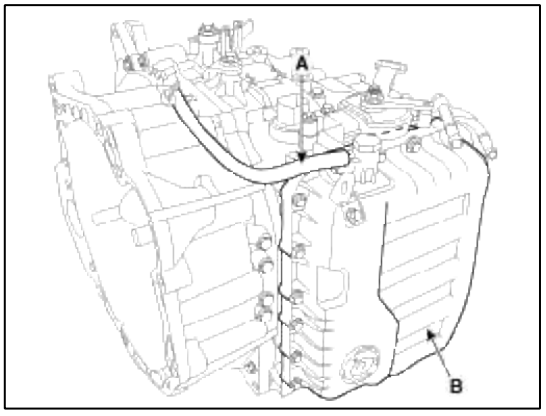
2. Remove the under cover (A).

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



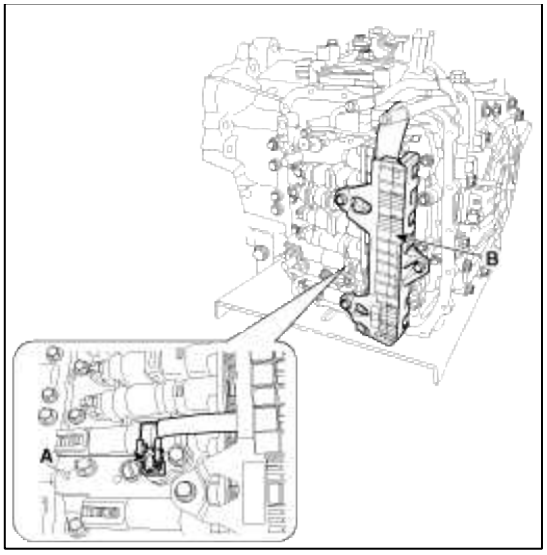
3. Replace new gasket and the plug after draining the automatic transaxle fluid by removing the drain plug. (Refer to "Hydraulic system (Fluid)" in this group)
4. Remove the air breeder hose (A).
5. Remove the valve body cover (B).

Tightening torque :
13.7 ~ 15.7 N.m (1.4 ~ 1.6 kgf.m, 10.1 ~ 11.6 lb-ft)



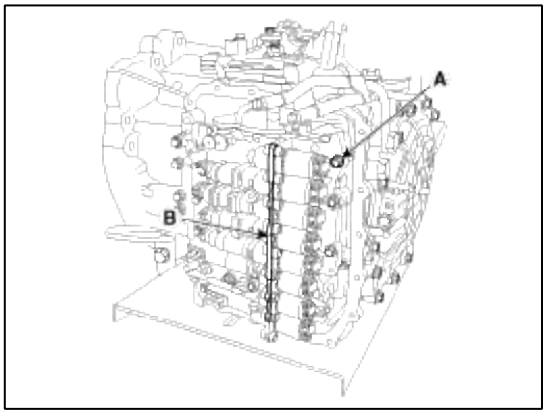
6. Remove the bolt (3ea) after disconnecting the solenoid valve connector (B) and the oil temperature sensor connector (A).

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

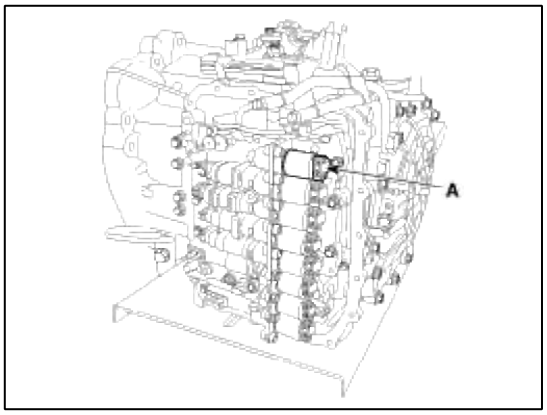


7. Remove the solenoid valve support bracket (B) and the valve body mounting bolt (A-1ea).

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



8. Remove the torque converter control solenoid valve (A).

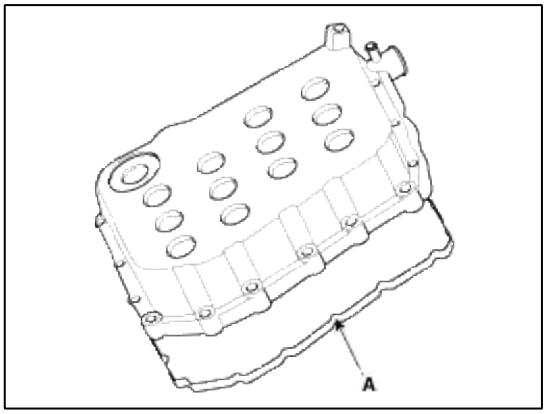


Installation

1. Installation is the reverse of removal.

NOTE

- The gasket of the valve body gasket (A) use new one.
- Adding automatic transaxle fluid.
  (Refer to "Hydraulic system (Fluid)" in this group)

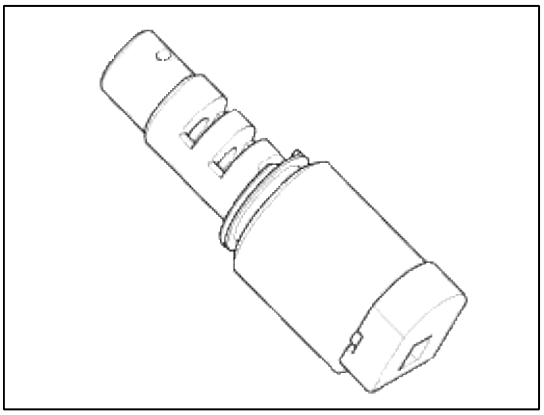


- Perform TCM learning after replacing the automatic transaxle to prevent slow automatic transaxle response, jerky acceleration and jerky startup.
  (Refer to "Automatic transaxle control system (Repair procedures)" in this group)

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]

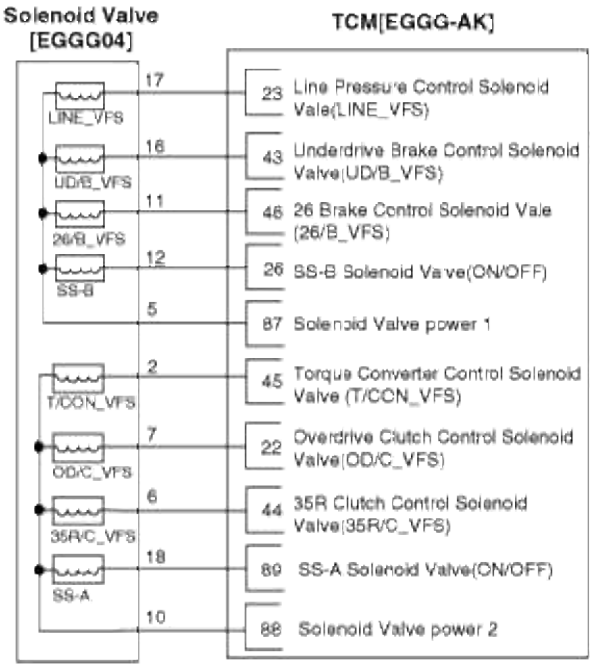
Control type : Normal low type

Control Pressure kpa (kgf/cm², 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

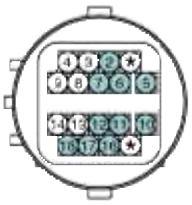
[Circuit Diagram]



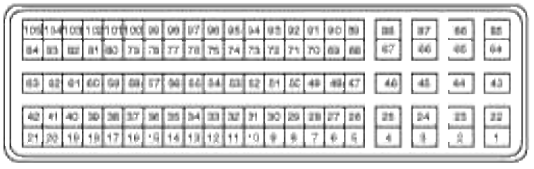
[Connection Information]

Terminal	Connected to	Function
17	TCM(23)	Line Pressure Control Solenoid Vale (LINE_VFS)
16	TCM(43)	Underdrive Brake Control Solenoid Valve (UD/B_VFS)
11	TCM(46)	26 Brake Control Solenoid Vale (26/B_VFS)
12	TCM(26)	SS-B Solenoid Valve (ON/OFF)
5	TCM(87)	Solenoid Valve power 1
2	TCM(45)	Torque Converter Control Solenoid Valve (T/CON_VFS)
7	TCM(22)	Overdrive Clutch Control Solenoid Valve (OD/C_VFS)
6	TCM(44)	35R Clutch Control Solenoid Valve (35R/C_VFS)
18	TCM(89)	SS-A Solenoid Valve (ON/OFF)
10	TCM(88)	Solenoid Valve power 2

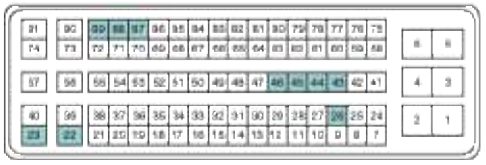
[Harness Connector]



Solenoid Valve Connector [EGGG04]



TCM Connector [EGGG-AA]



TCM Connector [EGGG-AK]

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 solenoid valve connector.
3. Measure resistance between sensor signal terminal and sensor ground terminal.
4. Check that the resistance is within the specification.

Removal

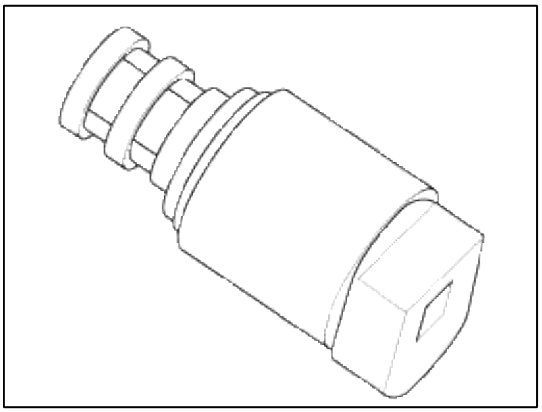
NOTE

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 Valve > 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 Valve > Specifications

Specifications

Direct control VFS[LINE Pressure]

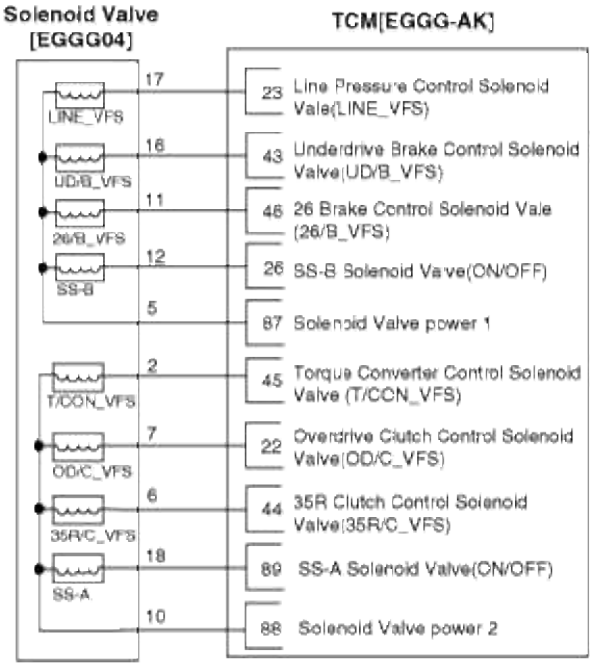
Control type : Normal low type

Control Pressure kpa (kgf/cm², 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 Valve > Schematic Diagrams

Circuit Diagram

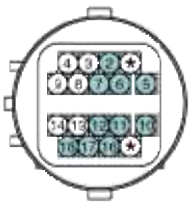
[Circuit Diagram]



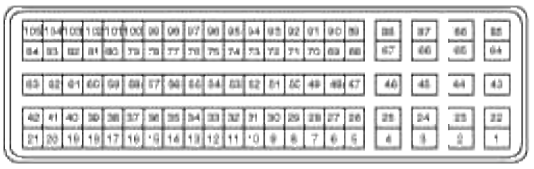
[Connection Information]

Terminal	Connected to	Function
17	TCM(23)	Line Pressure Control Solenoid Vale (LINE_VFS)
16	TCM(43)	Underdrive Brake Control Solenoid Valve (UD/B_VFS)
11	TCM(46)	26 Brake Control Solenoid Vale (26/B_VFS)
12	TCM(26)	SS-B Solenoid Valve (ON/OFF)
5	TCM(87)	Solenoid Valve power 1
2	TCM(45)	Torque Converter Control Solenoid Valve (T/CON_VFS)
7	TCM(22)	Overdrive Clutch Control Solenoid Valve (OD/C_VFS)
6	TCM(44)	35R Clutch Control Solenoid Valve (35R/C_VFS)
18	TCM(89)	SS-A Solenoid Valve (ON/OFF)
10	TCM(88)	Solenoid Valve power 2

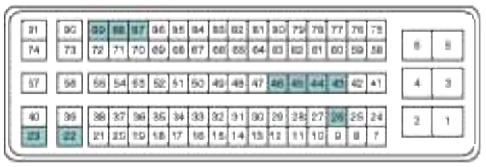
[Harness Connector]



Solenoid Valve Connector [EGGG04]



TCM Connector [EGGG-AA]



TCM Connector [EGGG-AK]

Automatic Transaxle System > Automatic Transaxle Control System > Line Pressure Control Solenoid Valve > Repair procedures

Inspection

1. Turn ignition switch OFF.
2. Disconnect the solenoid valve connector.
3. Measure resistance between sensor signal terminal and sensor ground terminal.
4. Check that the resistance is within the specification.

Removal

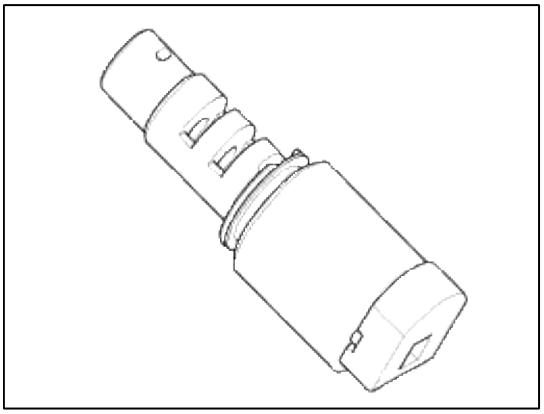
NOTE

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]

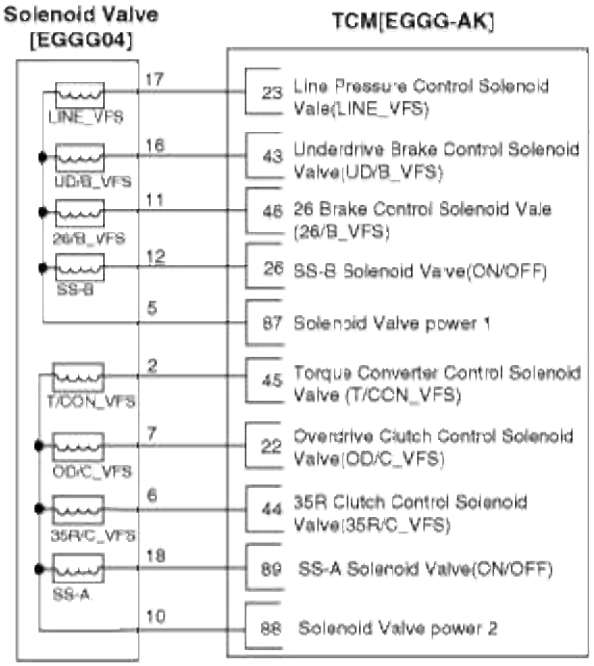
Control type : Normal low type

Control Pressure kpa (kgf/cm², 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

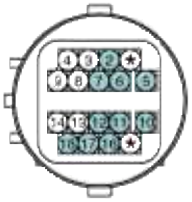
[Circuit Diagram]



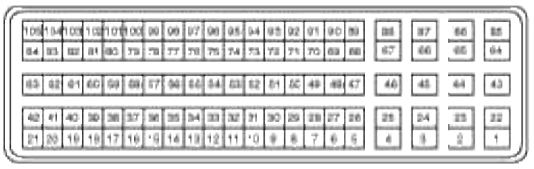
[Connection Information]

Terminal	Connected to	Function
17	TCM(23)	Line Pressure Control Solenoid Vale (LINE_VFS)
16	TCM(43)	Underdrive Brake Control Solenoid Valve (UD/B_VFS)
11	TCM(46)	26 Brake Control Solenoid Vale (26/B_VFS)
12	TCM(26)	SS-B Solenoid Valve (ON/OFF)
5	TCM(87)	Solenoid Valve power 1
2	TCM(45)	Torque Converter Control Solenoid Valve (T/CON_VFS)
7	TCM(22)	Overdrive Clutch Control Solenoid Valve (OD/C_VFS)
6	TCM(44)	35R Clutch Control Solenoid Valve (35R/C_VFS)
18	TCM(89)	SS-A Solenoid Valve (ON/OFF)
10	TCM(88)	Solenoid Valve power 2

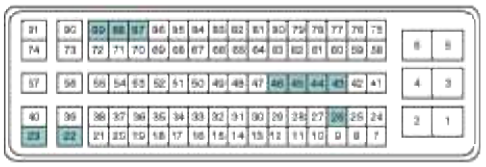
[Harness Connector]



Solenoid Valve Connector [EGGG04]



TCM Connector [EGGG-AA]



TCM Connector [EGGG-AK]

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 solenoid valve connector.
3. Measure resistance between sensor signal terminal and sensor ground terminal.
4. Check that the resistance is within the specification.

Removal

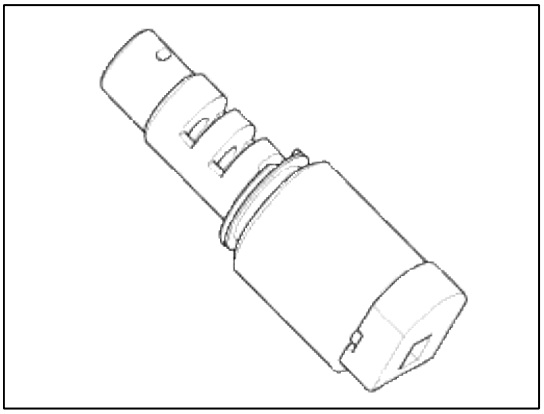
NOTE

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]

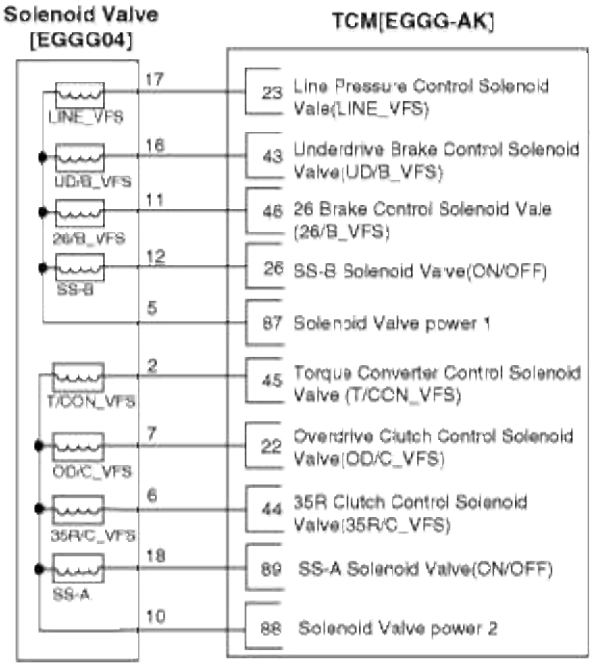
Control type : Normal low type

Control Pressure kpa (kgf/cm², 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

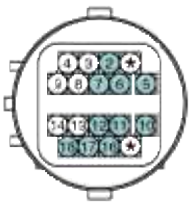
[Circuit Diagram]



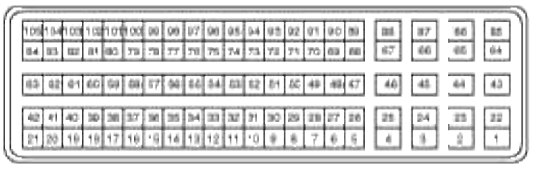
[Connection Information]

Terminal	Connected to	Function
17	TCM(23)	Line Pressure Control Solenoid Vale (LINE_VFS)
16	TCM(43)	Underdrive Brake Control Solenoid Valve (UD/B_VFS)
11	TCM(46)	26 Brake Control Solenoid Vale (26/B_VFS)
12	TCM(26)	SS-B Solenoid Valve (ON/OFF)
5	TCM(87)	Solenoid Valve power 1
2	TCM(45)	Torque Converter Control Solenoid Valve (T/CON_VFS)
7	TCM(22)	Overdrive Clutch Control Solenoid Valve (OD/C_VFS)
6	TCM(44)	35R Clutch Control Solenoid Valve (35R/C_VFS)
18	TCM(89)	SS-A Solenoid Valve (ON/OFF)
10	TCM(88)	Solenoid Valve power 2

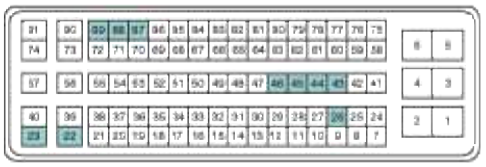
[Harness Connector]



Solenoid Valve Connector [EGGG04]



TCM Connector [EGGG-AA]



TCM Connector [EGGG-AK]

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 solenoid valve connector.
3. Measure resistance between sensor signal terminal and sensor ground terminal.
4. Check that the resistance is within the specification.

Removal

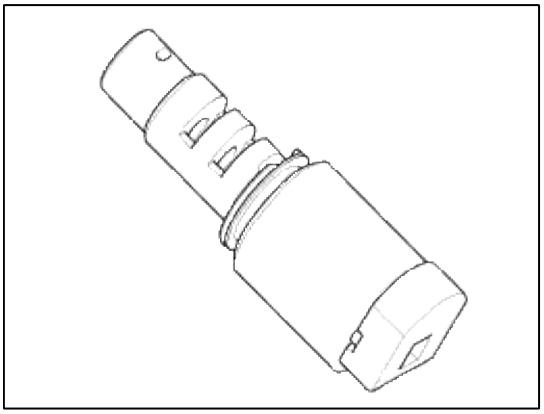
NOTE

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]

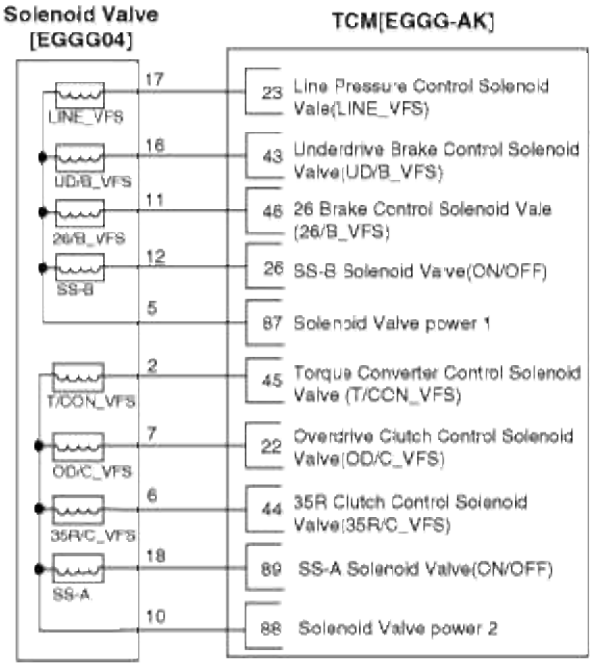
Control type : Normal low type

Control Pressure kpa (kgf/cm², 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

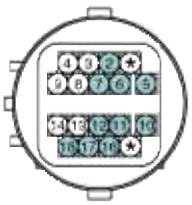
[Circuit Diagram]



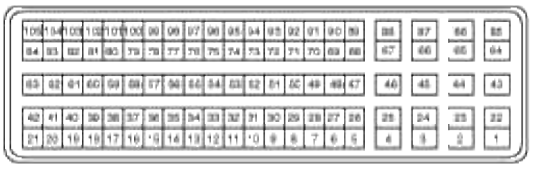
[Connection Information]

Terminal	Connected to	Function
17	TCM(23)	Line Pressure Control Solenoid Vale (LINE_VFS)
16	TCM(43)	Underdrive Brake Control Solenoid Valve (UD/B_VFS)
11	TCM(46)	26 Brake Control Solenoid Vale (26/B_VFS)
12	TCM(26)	SS-B Solenoid Valve (ON/OFF)
5	TCM(87)	Solenoid Valve power 1
2	TCM(45)	Torque Converter Control Solenoid Valve (T/CON_VFS)
7	TCM(22)	Overdrive Clutch Control Solenoid Valve (OD/C_VFS)
6	TCM(44)	35R Clutch Control Solenoid Valve (35R/C_VFS)
18	TCM(89)	SS-A Solenoid Valve (ON/OFF)
10	TCM(88)	Solenoid Valve power 2

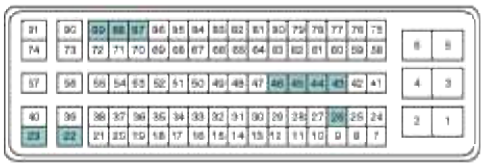
[Harness Connector]



Solenoid Valve Connector [EGGG04]



TCM Connector [EGGG-AA]



TCM Connector [EGGG-AK]

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 solenoid valve connector.
3. Measure resistance between sensor signal terminal and sensor ground terminal.
4. Check that the resistance is within the specification.

Removal

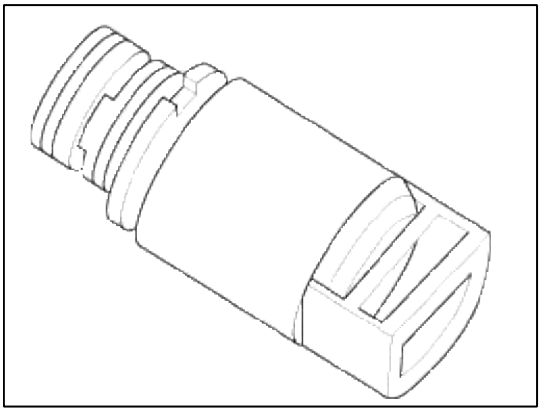
NOTE

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)

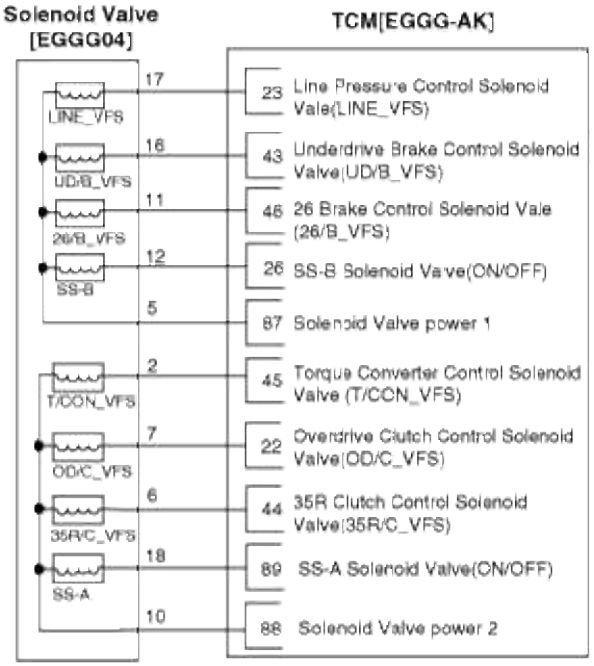
Control type : Normal low type

Control pressure kpa (kgf/cm², 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

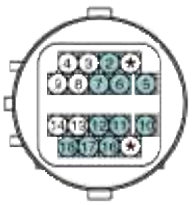
[Circuit Diagram]



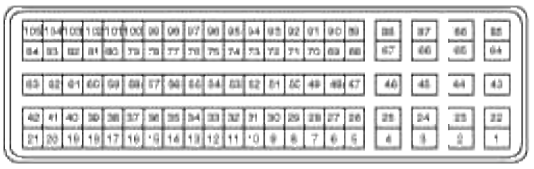
[Connection Information]

Terminal	Connected to	Function
17	TCM(23)	Line Pressure Control Solenoid Vale (LINE_VFS)
16	TCM(43)	Underdrive Brake Control Solenoid Valve (UD/B_VFS)
11	TCM(46)	26 Brake Control Solenoid Vale (26/B_VFS)
12	TCM(26)	SS-B Solenoid Valve (ON/OFF)
5	TCM(87)	Solenoid Valve power 1
2	TCM(45)	Torque Converter Control Solenoid Valve (T/CON_VFS)
7	TCM(22)	Overdrive Clutch Control Solenoid Valve (OD/C_VFS)
6	TCM(44)	35R Clutch Control Solenoid Valve (35R/C_VFS)
18	TCM(89)	SS-A Solenoid Valve (ON/OFF)
10	TCM(88)	Solenoid Valve power 2

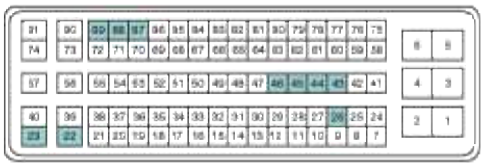
[Harness Connector]



Solenoid Valve Connector [EGGG04]



TCM Connector [EGGG-AA]



TCM Connector [EGGG-AK]

Automatic Transaxle System > Automatic Transaxle Control System > SS-A Solenoid Valve(ON/OFF) > Repair procedures

Inspection

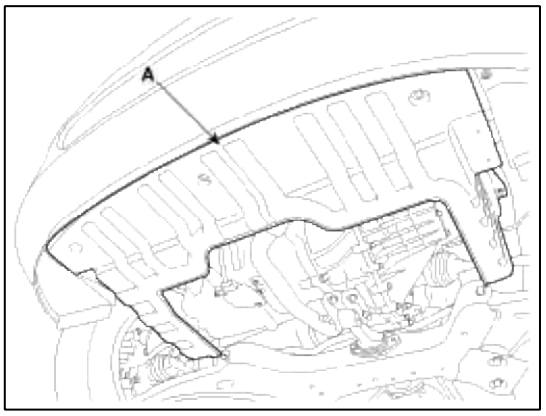
1. Turn ignition switch OFF.
2. Disconnect the solenoid valve connector.
3. Measure resistance between sensor signal terminal and sensor ground terminal.
4. Check that the resistance is within the specification.

Removal

1. Remove the battery and the battery tray.
   (Refer to "Charging system" in EE group.)

2. Remove the under cover (A).

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

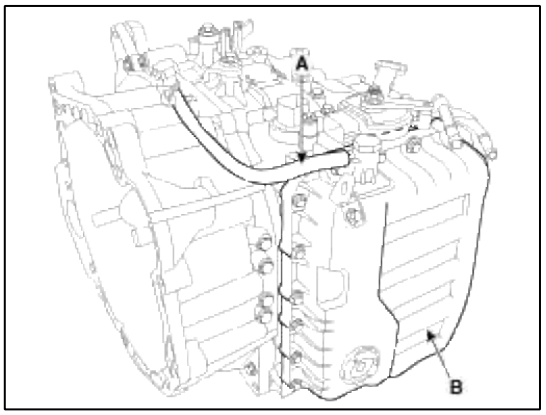


3. Replace new gasket and the plug after draining the automatic transaxle fluid by removing the drain plug. (Refer to "Hydraulic system (Fluid)" in this group)
4. Remove the air breather hose (A).
5. Remove the valve body cover (B).

Tightening torque:
13.7 ~ 15.7 N.m (1.4 ~ 1.6 kgf.m, 10.1 ~ 11.6 lb-ft)

CAUTION

Always replace the gasket of the eyebolt use new one whenever loosening eyebolt.

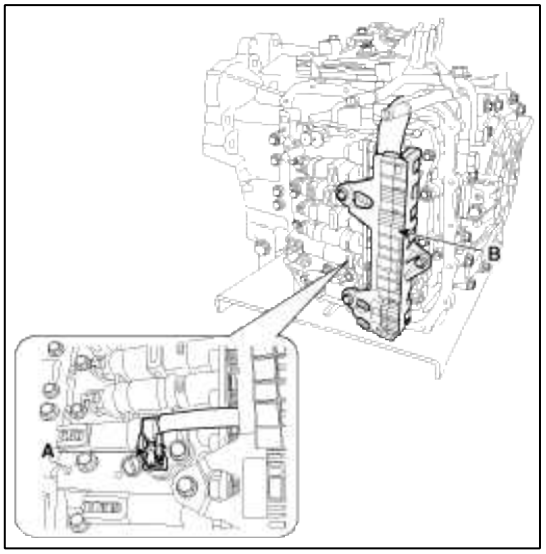


NOTE

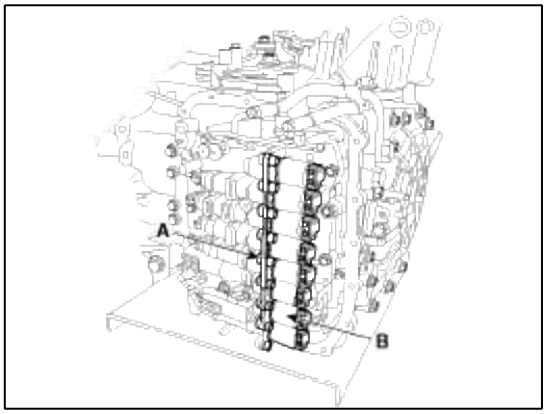
Remove installation bolts in the engin room first and then remove others under the vehicle.

6. Remove the bolt (3ea) after disconnecting the solenoid valve connector (B) and the oil temperature sensor connector (A).

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



7. Remove the solenoid valve (B) after removing the solenoid support (A).

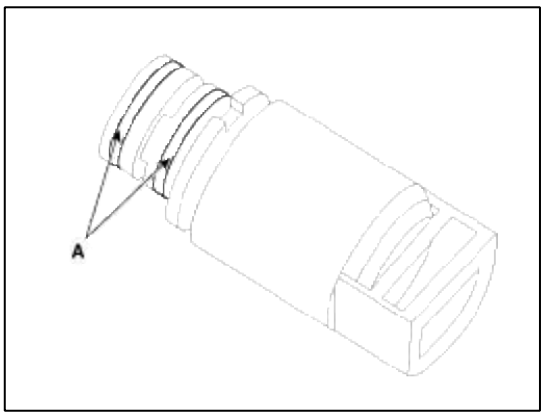


Installation

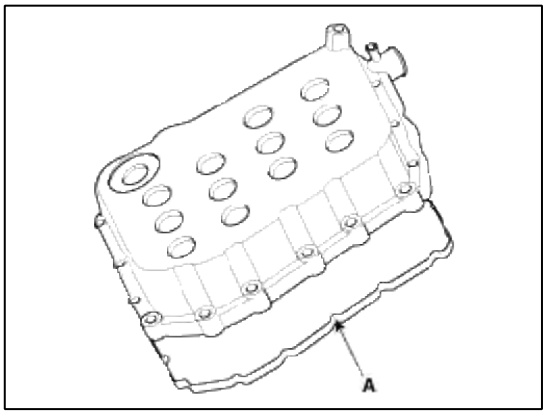
1. Installation is the reverse of removal.

NOTE

- When installing, apply the ATF oil or white vaseline to the O-ring (A) not to be damaged.



- The gasket of the valve body gasket (A) use new one.

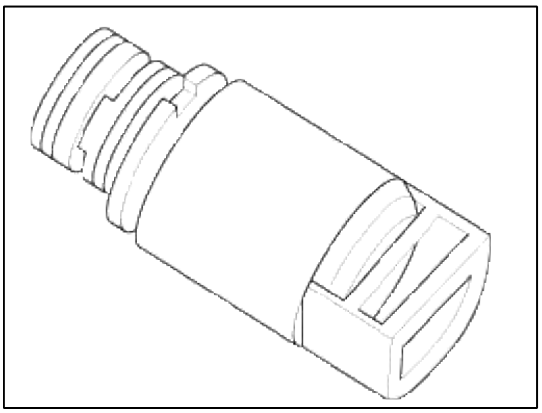


- Adding automatic transaxle fluid.
  (Refer to "automatic transaxle system" in this group.)

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)

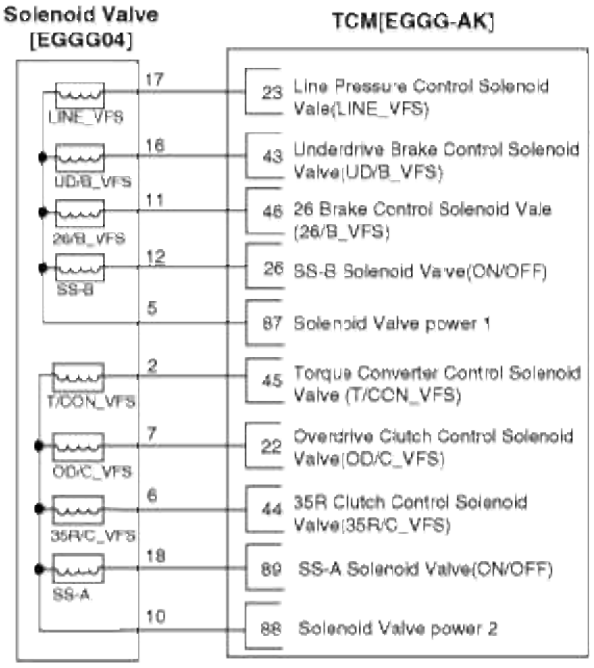
Control type : Normal low type

Control pressure kpa (kgf/cm², 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

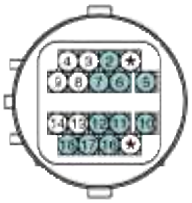
[Circuit Diagram]



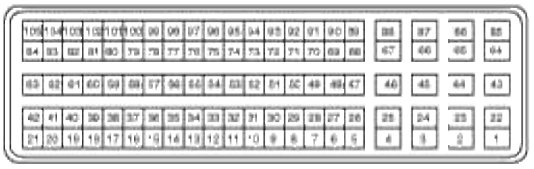
[Connection Information]

Terminal	Connected to	Function
17	TCM(23)	Line Pressure Control Solenoid Vale (LINE_VFS)
16	TCM(43)	Underdrive Brake Control Solenoid Valve (UD/E_VFS)
11	TCM(46)	26 Brake Control Solenoid Vale (26/B_VFS)
12	TCM(26)	SS-B Solenoid Valve (ON/OFF)
5	TCM(87)	Solenoid Valve power 1
2	TCM(45)	Torque Converter Control Solenoid Valve (T/CON_VFS)
7	TCM(22)	Overdrive Clutch Control Solenoid Valve (OD/C_VFS)
6	TCM(44)	35R Clutch Control Solenoid Valve (35R/C_VFS)
18	TCM(89)	SS-A Solenoid Valve (ON/OFF)
10	TCM(88)	Solenoid Valve power 2

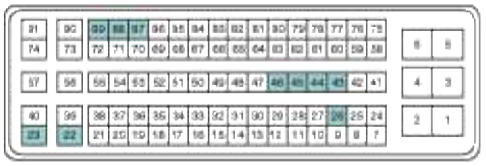
[Harness Connector]



Solenoid Valve Connector [EGGG04]



TCM Connector [EGGG-AA]



TCM Connector [EGGG-AK]

Automatic Transaxle System > Automatic Transaxle Control System > SS-B Solenoid Valve(ON/OFF) > Repair procedures

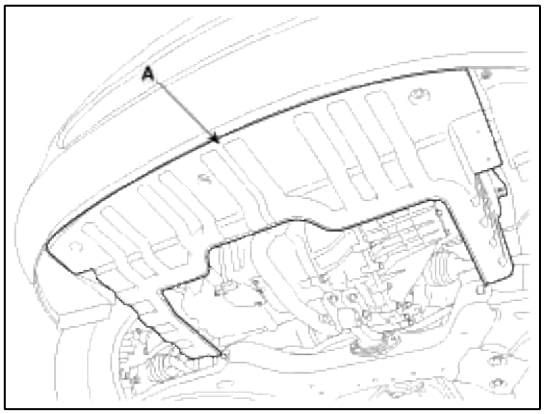
Inspection

1. Turn ignition switch OFF.
2. Disconnect the solenoid valve 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:
6.9 ~ 10.8 N.m (0.7 ~ 1.1 kgf.m, 5.1 ~ 8.0 lb-ft)

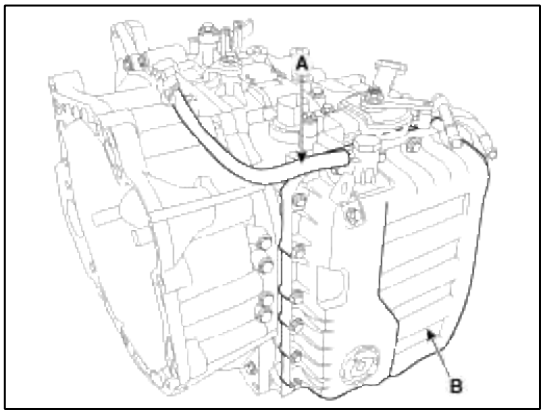


3. Replace new gasket and the plug after draining the automatic transaxle fluid by removing the drain plug. (Refer to "Hydraulic system (Fluid)" in this group)
4. Remove the valve body cover (A) and eyebolt (B).

Tightening torque:
13.7 ~ 15.7 N.m (1.4 ~ 1.6 kgf.m, 10.1 ~ 11.6 lb-ft)

CAUTION

Always replace the gasket of the eyebolt use new one whenever loosening eyebolt.

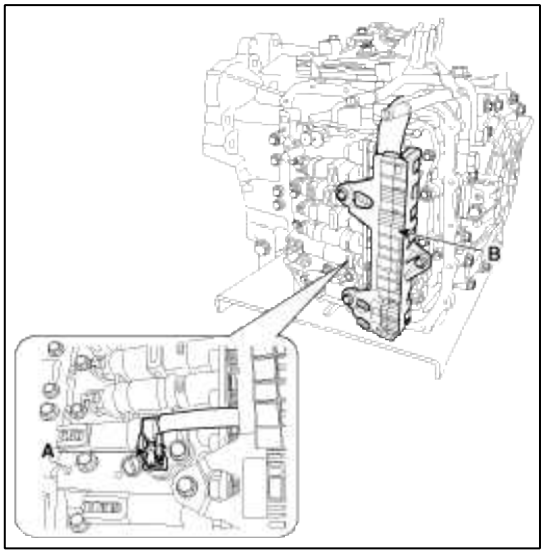


NOTE

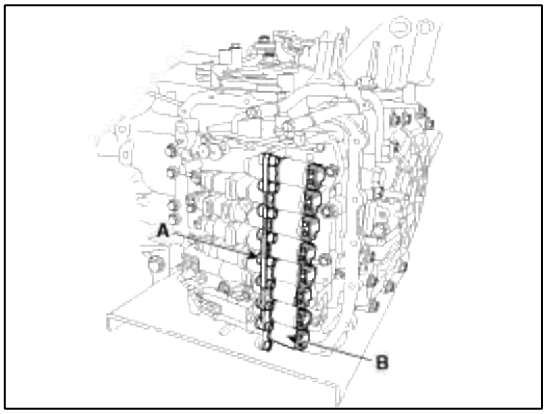
Remove installation bolts in the engin room first and then remove others under the vehicle.

5. Remove the bolt (3ea) after disconnecting the solenoid valve connector (B) and the oil temperature sensor connector (A).

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).

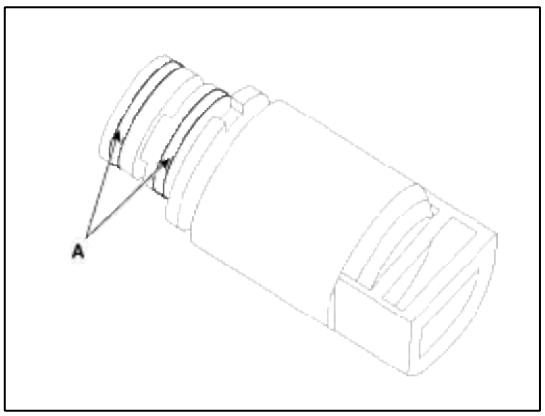


Installation

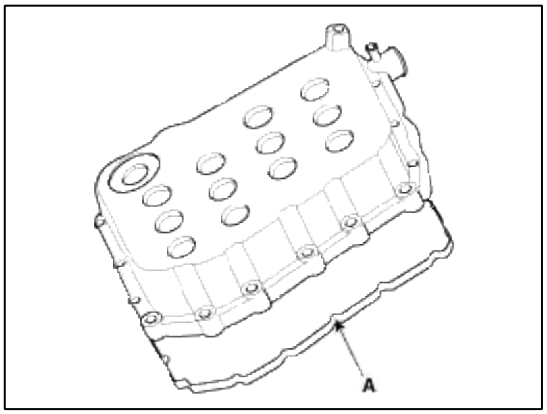
1. Installation is the reverse of removal.

NOTE

- When installing, apply the ATF oil or white vaseline to the O-ring (A) not to be damaged.



- The gasket of the valve body gasket (A) use new one.

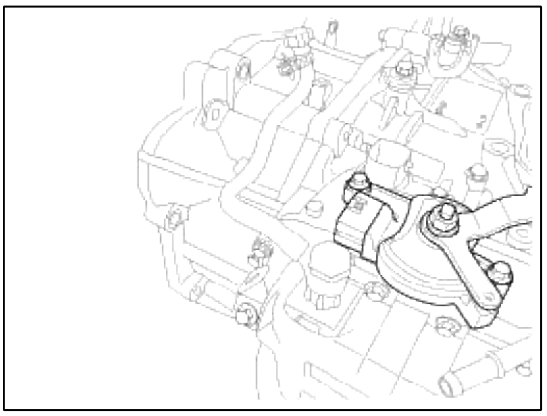


- Adding automatic transaxle fluid.
  (Refer to "Hydraulic system (Fluid)" in this group)

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	Combination of output signals

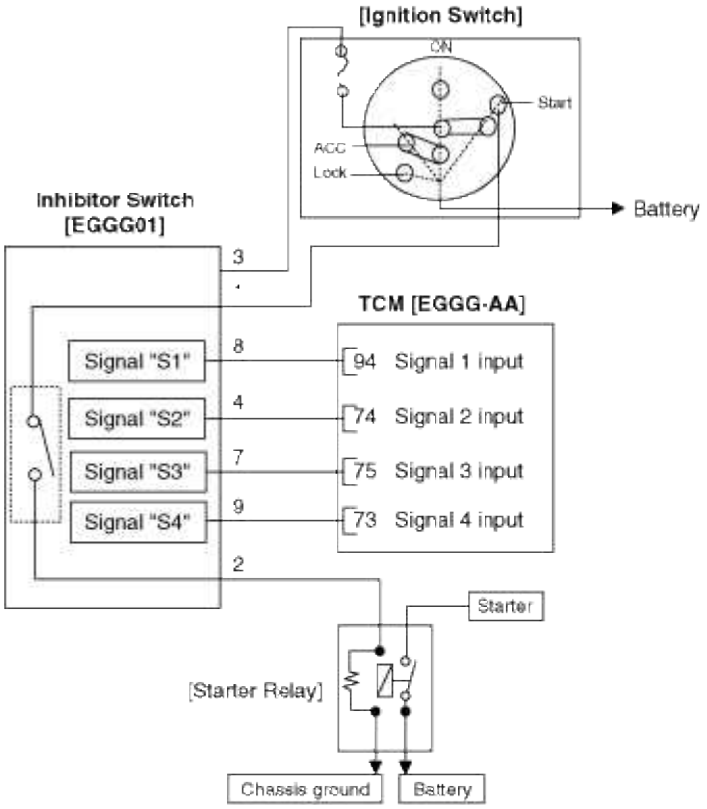
Signal Code Table

	P	P-R	R	R-N	N	N-D	D
S1	12V	12V	0	0	0	0	0
S2	0	12V	12V	12V	0	12V	0
S3	0	0	0	12V	12V	0	0
S4	0	0	0	0	0	12V	12V

Automatic Transaxle System > Automatic Transaxle Control System > Inhibitor Switch > Schematic Diagrams

Circuit Diagram

[Circuit Diagram]

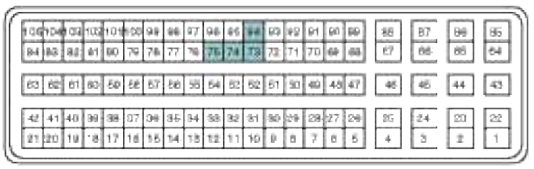


[Connection Information]

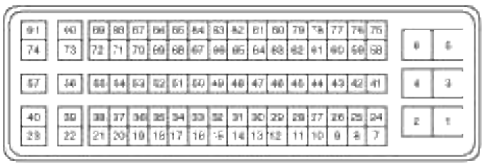
Terminal	Connected to	Function
4	TCM (74)	Signal 2 input
8	TCM (94)	Signal 1 input
7	TCM (75)	Signal 3 input
9	TCM (73)	Signal 4 input
3	Ignition switch	Ignition ON
1	Ignition switch	Starter power(ON)
2	Starter relay	Starter relay

[Harness Connector]

Inhibitor Switch Connector [EGGG01]



TCM Connector [EGGG-AA]



TCM Connector [EGGG-AK]

Automatic Transaxle System > Automatic Transaxle Control System > Inhibitor Switch > Repair procedures

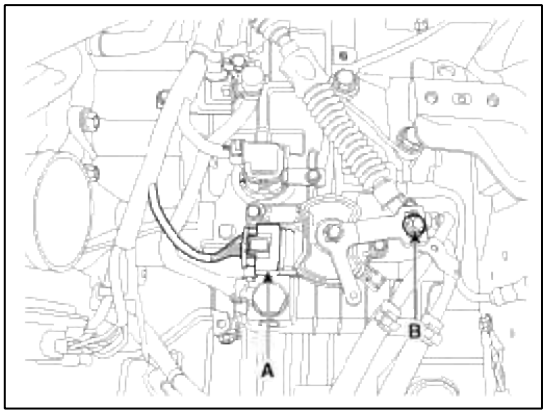
Removal

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.)

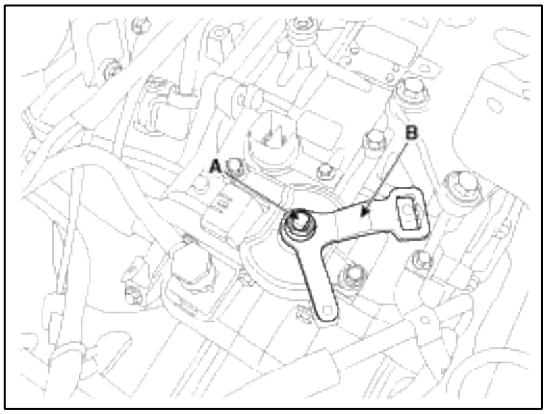
4. Remove the shift cable mounting nut (B).

Tightening torque:
7.8 ~ 11.8 N.m (0.8 ~ 1.2 Kgf.m, 5.7 ~ 8.6 lb-ft)

5. Disconnect the inhibitor switch connector (A).



6. Remove the manual control lever (B) and the washer after removing a nut (A).

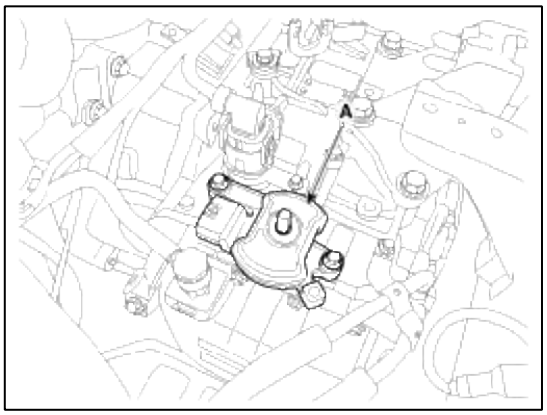


CAUTION

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

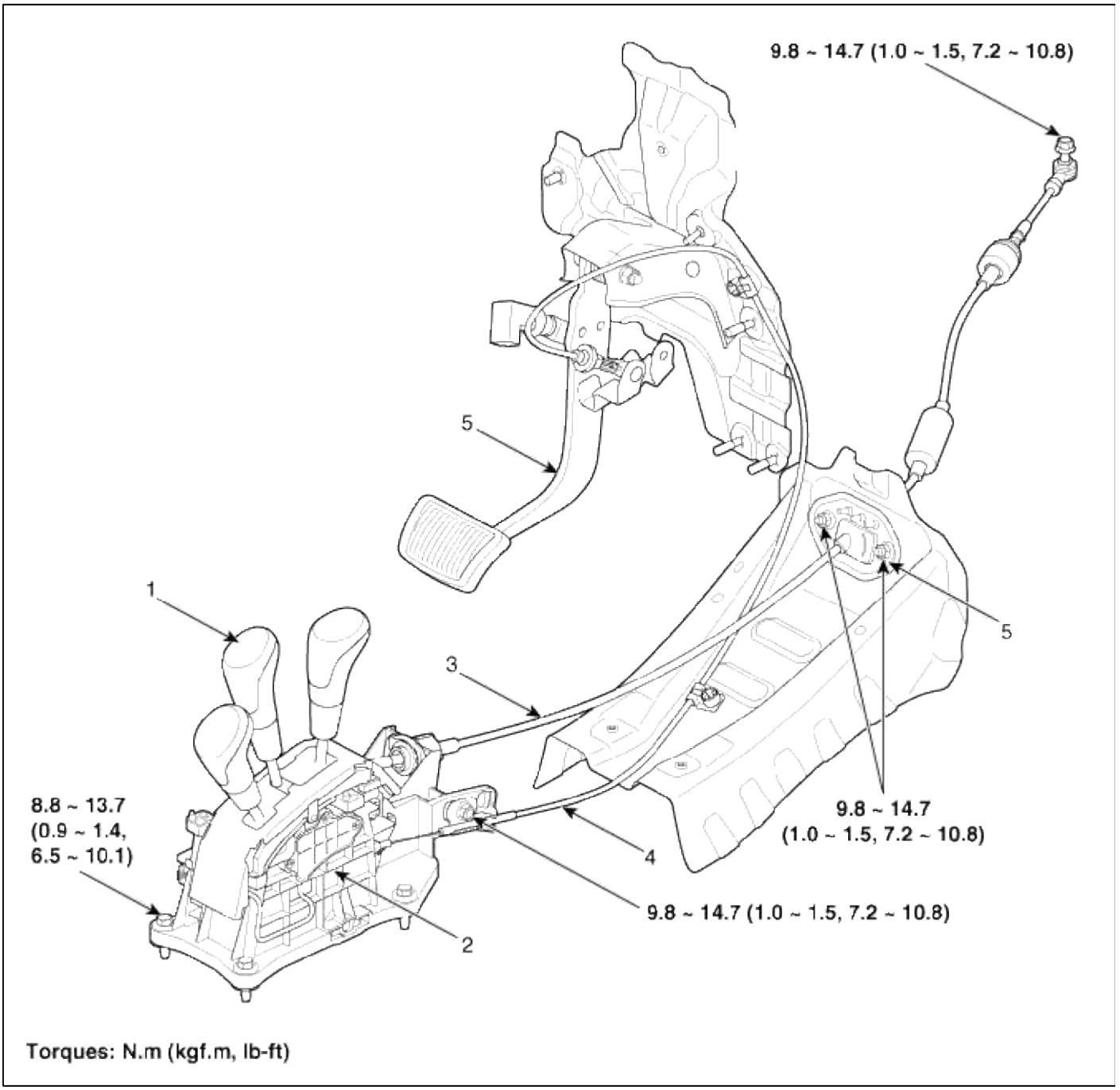
When installing, tighten the inhibitor assembly mounting bolt lightly, so that necessary adjustments can be made. Tighten to specifications.

Installation

1. Installation is the reverse of removal.

Automatic Transaxle System > Automatic Transaxle Control System > Shift Lever > Components and Components Location

Components



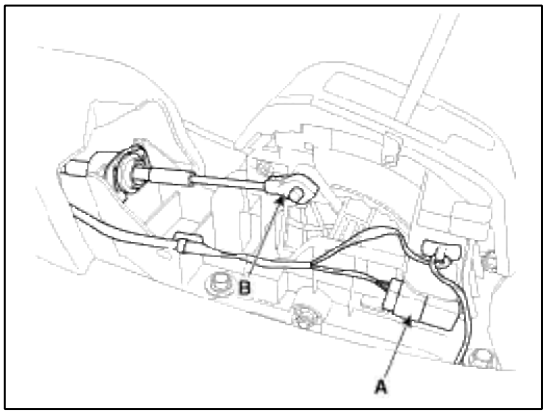
1. Shift lever knob 2. Shift lever assembly 3. Control cable	4. Shift lock cable assembly 5. Retainer 6. Brake pedal assembly

Automatic Transaxle System > Automatic Transaxle Control System > Shift Lever > Repair procedures

Removal

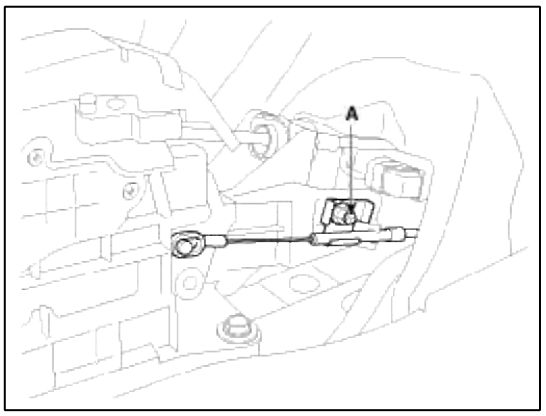
Shift Lever Assembly Replacement

1. Remove the center console.
   (Refer to "interior (console)" in BD group)
2. Disconnect the connector (A)
3. Remove the control cable (B).



4. Remove the shift lock cable (A).

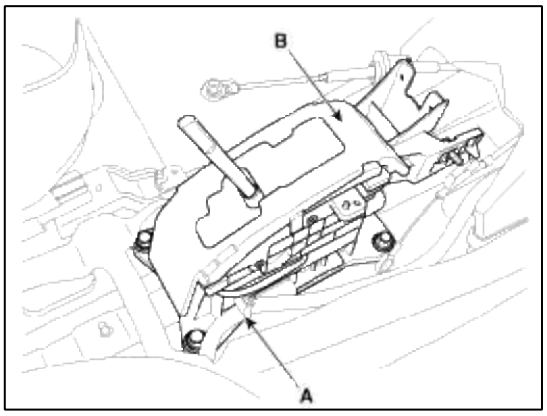
Tightening torque:
9.8 ~ 14.7 N.m (1.0 ~ 1.5 kgf.m, 7.2 ~ 10.8 lb-ft)



5. Remove the wiring clip (A).

6. Remove the AT lever(shift lever) assembly (B) by removing the bolts (4ea).

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



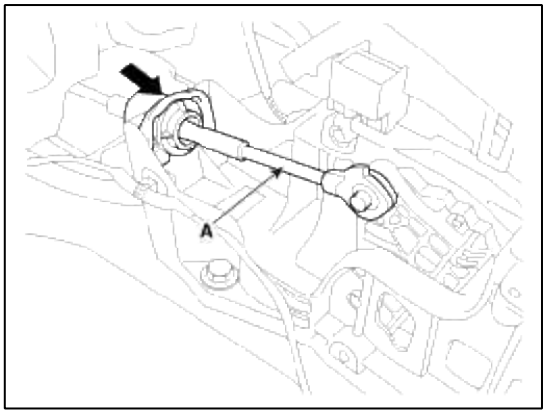
7. Installation is the reverse of removal.

NOTE

Adjust the shift lock cable.
(Refer to "adjustment shift lock cable" in this group)

Control Cable Assembly Replacement

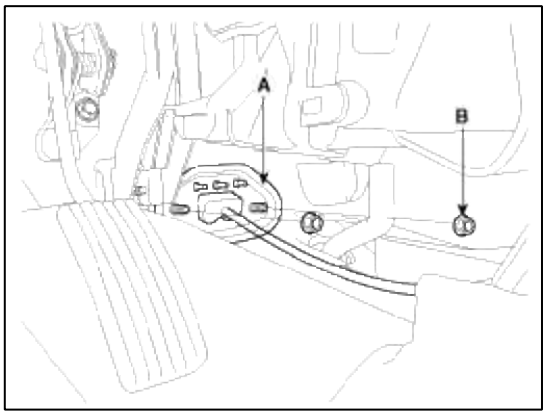
1. Remove the center console.
(Refer to "interior (console)" in BD group)
2. Remove the control cable (A).



3. Remove the crash pad.
(Refer to "Interior(Crash pad)" in BD group.)
4. Remove the heater unit.
(Refer to "Heater(Heater unit)" in HA group.)

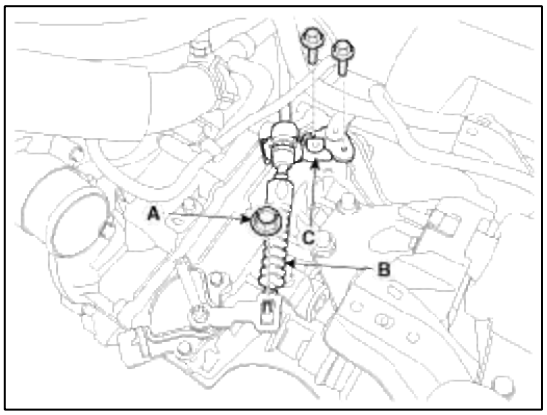
5. Remove the retainer (A) and nuts (B).

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



6. Remove the nut (A) from the manual control lever.
7. Remove the control cable (B) from the bracket (C) at transaxle assembly side.
(Refer to "Automatic Transaxle" in this group)

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



8. Remove the control cable at cabin room.
9. Installation is the reverse of removal.

NOTE

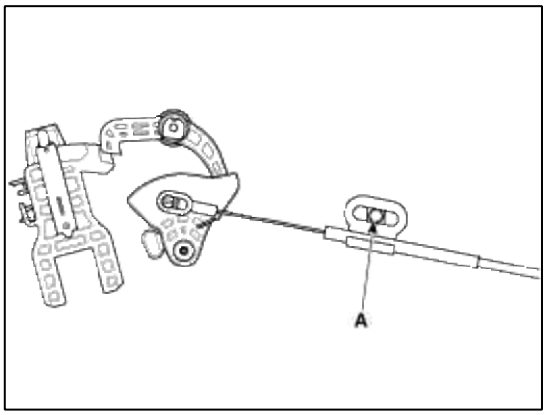
- Set room side AT lever(shift lever) and automatic transaxle side manual control lever to "N" position.
- Control cable must be free unreasonable bending.

Shift Lock Cable Replacement

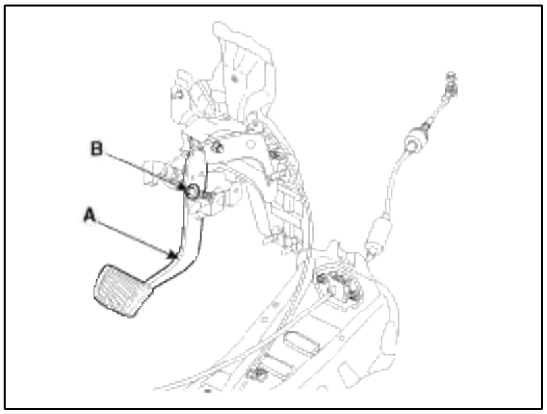
1. Remove the center console.
(Refer to "interior(console)"in BD group.

2. Remove the shift lock cable (A).

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



3. Remove the shift lock cable (B) from the brake pedal (A).



4. Installation is the reverse of removal.

NOTE

Shift lock cable must be free unreasonable bending.

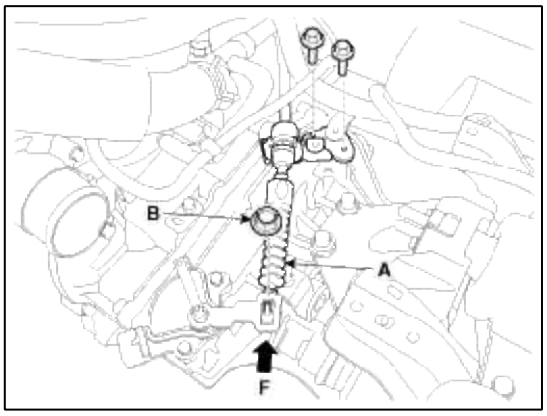
Adjustment

Adjusting the control cable

1. Set room side AT lever(shift lever) and automatic transaxle side manual control lever to "N" position.
2. Connect control cable to room side AT lever(shift lever).
3. Fix temporary control cable (A) in automatic transaxle side manual control lever.
4. Push the control cable (A) lightly to "F" direction shown to eliminate the free play.

5. Tighten the adjusting nut (B).

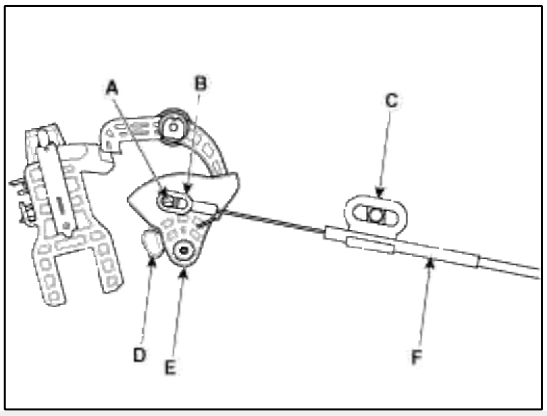
Tightening torque:
9.8 ~ 14.7 N.m (1.0 ~ 1.5 kgf.m, 7.2 ~ 10.8 lb-ft)



6. After adjusting, check that this part operates at each range of the manual control lever corresponding to each position of the AT lever(shift lever).

Adjusting Procedure For Lock Cam And Shift Lock Cable

1. Shift lock cable must be fixed to brake pedal(brake pedal must not be pressed down), and at lever(shift lever) must be "N" position
2. Shift lock cable must be assembled to at lever(shift lever) assembly as shown in fig. 1. cable end must be inserted into fixing pin (A) of lock cam securely.
3. Maintain close adhesion lock cam (E) and lock cam stopper (D) slightly pull outer casing of shift lock cable (E) in direction "E" to remove slack of shift lock cable (E).
4. After checking that cable end is touched to cable fixing pin of lock cam, fix adjust plate.
5. Check that cable end (B) is touched to cable fixing pin of lock cam (A).



Checking List Of Shift Lock

1. Brake pedal being not depressed.
   AT lever (shift lever) must not be shifted from "P" position to "R" posion.
2. Brake pedal being not depressed.
   AT lever (shift lever) must not be shifted from "N" position to "R" posion.
3. Brake pedal being deprseeed by stroke 15-26mm in "P" position.
   Push button can be operated and AT lever (shift lever) can be shifted smoothly from each position to other positions.
4. Brake pedal must be operated smoothly without interruption at all positions.

RIO(UB) > 2012 > G 1.6 GDI > 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	Wire-drum 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

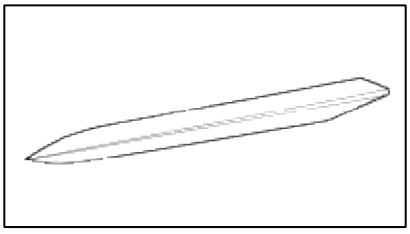
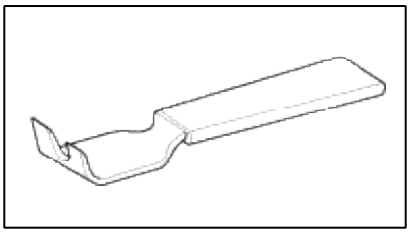
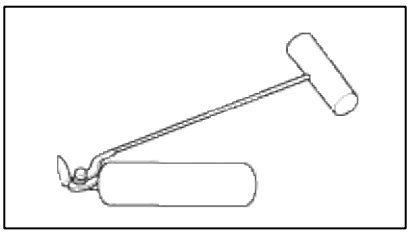
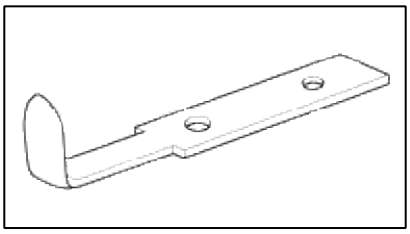
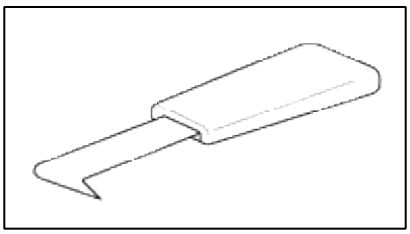
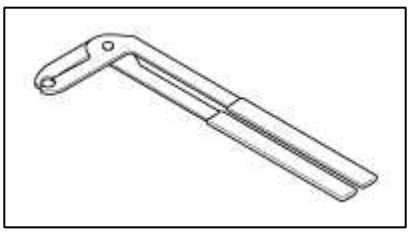
Tightening Torque

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	21.6 ~ 32.3	2.2 ~ 3.3	15.9 ~ 23.9
	Door glass mounting bolt	7.8 ~ 11.8	0.8 ~ 1.2	5.8 ~ 8.7
	Door outside handle cover mounting bolts	7.8 ~ 10.8	0.8 ~ 1.1	5.8 ~ 8.0
	Door channel mounting nuts	3.9 ~ 5.9	0.4 ~ 0.6	2.9 ~ 4.3
	Latch mounting bolts	7.8 ~ 10.8	0.8 ~ 1.1	5.8 ~ 8.0
	Door power window regulator mounting nuts	3.9 ~ 5.9	0.4 ~ 0.6	2.9 ~ 4.3
	Door striker mounting bolts	8.8 ~ 13.7	0.9 ~ 1.4	6.5 ~ 10.1
Tail gate	Tail gate hinge to tail gate	6.9 ~ 10.8	0.7 ~ 1.1	5.1 ~ 8.0
	Tail gate hinge to body	6.9 ~ 10.8	0.7 ~ 1.1	5.1 ~ 8.0
	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
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 cushion mounting bolts	19.6 ~ 29.4	2.0 ~ 3.0	14.5 ~ 21.7
	Rear seat back hinge mounting bolts	19.6 ~ 29.4	2.0 ~ 3.0	14.5 ~ 21.7
	Rear seat latch mounting bolts	19.6 ~ 29.4	2.0 ~ 3.0	14.5 ~ 21.7
Seat belt	Height adjuster mounting bolts	39.2 ~ 53.9	4.0 ~ 5.5	28.9 ~ 39.8
	Front seat belt upper anchor mounting bolt	39.2 ~ 53.9	4.0 ~ 5.5	28.9 ~ 39.8
	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
	Center rear seat belt retractor mounting nut	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
Outside rearview mirror	Outside rearview mirror mounting bolts	6.9 ~ 10.8	0.7 ~ 1.1	5.1 ~ 8.0
Quarter fixed glass & molding	Quarter fixed glass & molding mounting nuts	3.9 ~ 4.4	0.4 ~ 0.45	2.9 ~ 3.3
Delta glass	Delta glass mounting nuts	3.9 ~ 4.4	0.4 ~ 0.45	2.9 ~ 3.3
Wiper arm	Wiper arm mounting nuts	22.6 ~ 26.5	2.3 ~ 2.7	16.6 ~ 19.5
Sunroof	Sunroof mounting nuts	3.9 ~ 5.9	0.4 ~ 0.6	2.9 ~ 4.3
	Sunroof mounting bolts	6.9 ~ 10.8	0.7 ~ 1.1	5.1 ~ 8.0

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

Special Tools

Tool (Number and name)	Illustration	Use
09800-21000 Ornament remover		Trim removal
09853-31000 Headliner clip remover		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

Body (Interior and Exterior) > General Information > Troubleshooting

Troubleshooting

Symptom	Suspect Area	Remedy (Refer to page)
Water leaks from sunroof	Dirt accumulated in drain tube	Clear dirt inside of drain
	Clogged drain tube	Blow air into drain to remove dirt

	Broken or dislocated drain tube, defective or cracked clip	Check tube installation and flange contact
	Deteriorated roof lid weatherstrip	Replace
	Excessive roof lid-to-body clearance and improperly fitted weatherstrip	Adjust
Wind noise around sunroof	Loosen or deformed deflector, gaps in body work	Retighten adjust or replace
Sunroof lid makes a noise when move	Foreign particles lodged in guide rail	Check drive cable and guide rails for foreign particles
	Loosen 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 tomal adjustment 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 Re-tighten motor
	Worn out or damaged motor pinion bearing	Replace motor assembly
	Worn out or deformed drive cable	Replace
Door glass fails to operate up and down	Incorrect window glass installation	Adjust position
	Damaged or faulty regulator arm or regulator	Correct or replace
Door does not open or close completely	Incorrect door installation	Adjust position
	Defective door check assembly	Correct or replace
	Door hinge requires grease	Apply grease
Hood does not open or close completely	Striker and latch not properly aligned	Adjust
	Incorrectly installed hood	Adjust
	Incorrect hood bumper height	Adjust
Water leak through windshield end rear window	Defective seal	Fill with sealant
	Defective flange	Correct

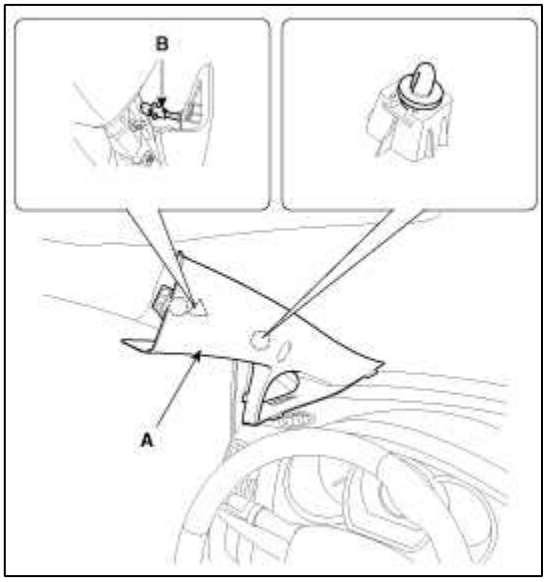
Body (Interior and Exterior) > Exterior > Fender > Repair procedures

Replacement

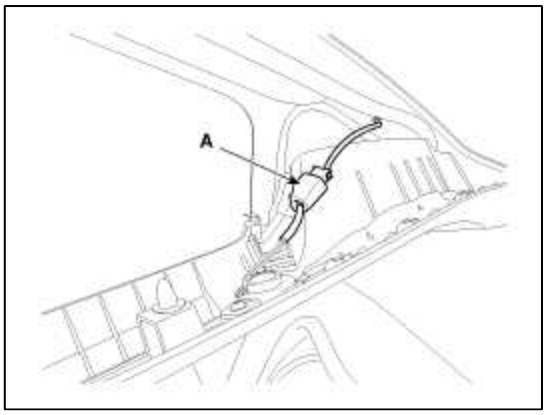
CAUTION

- 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. Remove the head lamps.
   (Refer to the BE group – "Head Lamps")
3. Using a screwdriver or remover, remove the front pillar trim (A).

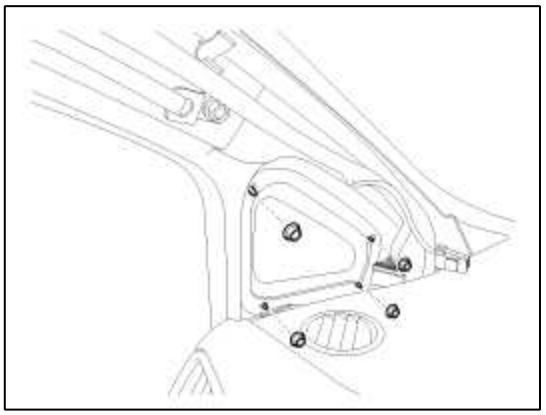


4. Disconnect the tweeter speaker connector (A).

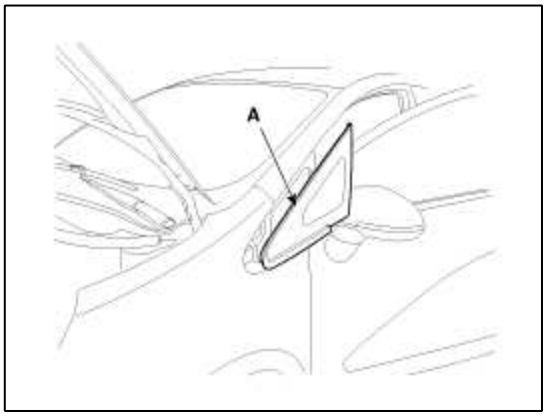


5. Loosen the delta glass mounting nuts.

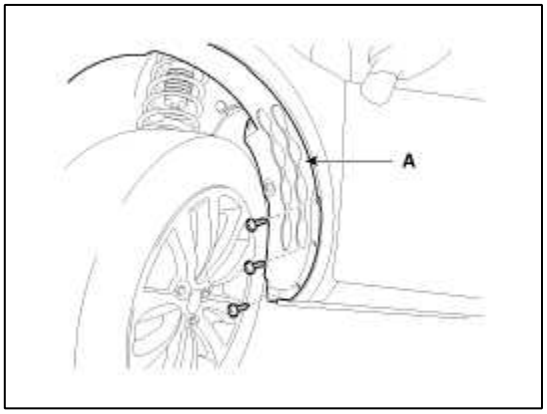
Tightening torque :
3.9 ~ 4.4 N.m (0.4 ~ 0.45 kgf.m, 2.9 ~ 3.3 lb-ft)



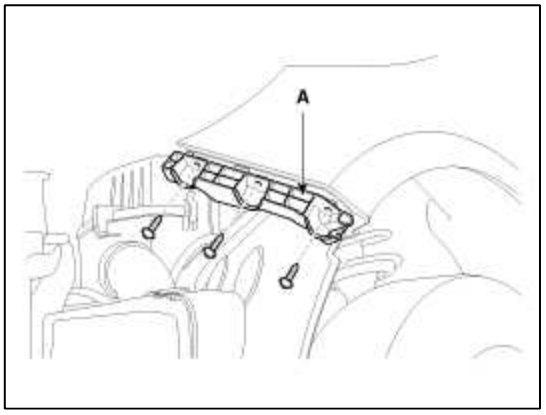
6. Remove the delta glass (A).



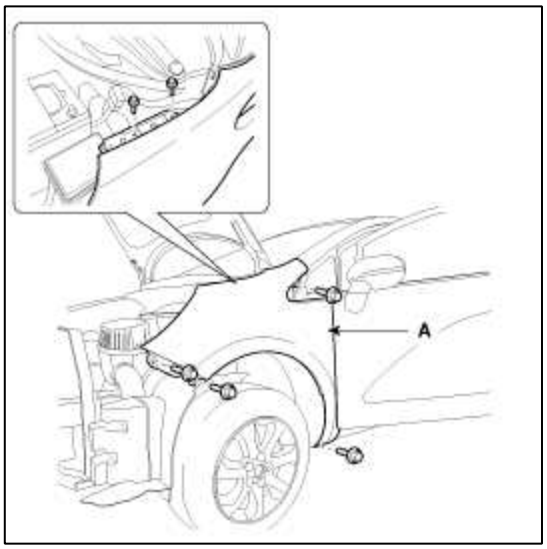
7. Loosen the wheel guard (A) mounting screws.



8. After loosening the mounting screws, then remove the front bumper side mounting bracket (A).



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



10. Installation is the reverse of removal.

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

Replacement

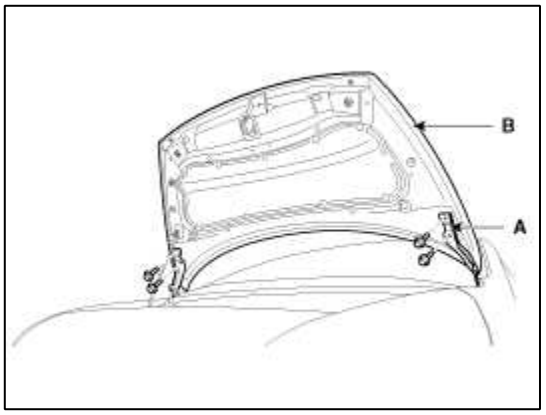
Hood Assembly Replacement

CAUTION

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

1. After loosening the hood hinge (A) mounting bolts, and then remove the hood (B).

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



2. Installation is the reverse of removal.

NOTE

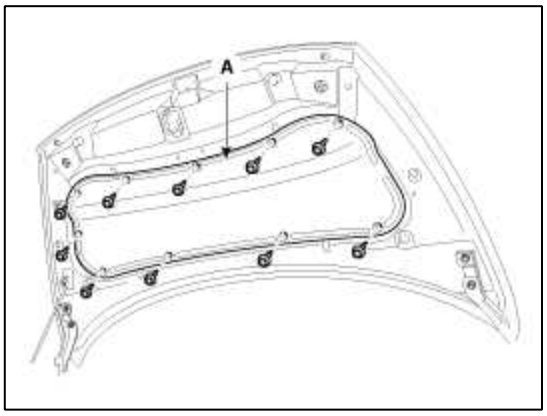
- Make sure the hood opens properly and locks securely.
- Adjust the hood alignment.

Hood Insulator Pad Replacement

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

CAUTION

- Be careful not to scratch the hood panel.



2. Installation is the reverse of removal.

NOTE

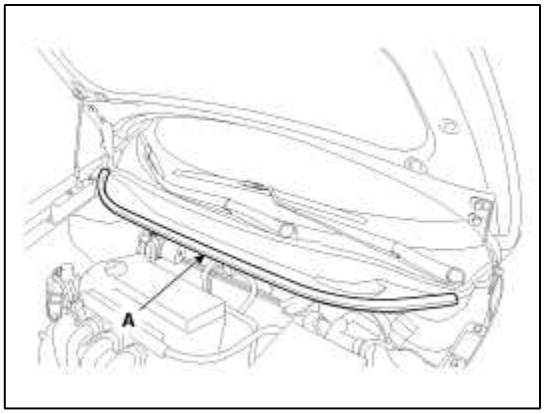
- Replace any damaged clips.

Hood Weatherstrip Replacement

1. Remove the hood weatherstrip (A).

CAUTION

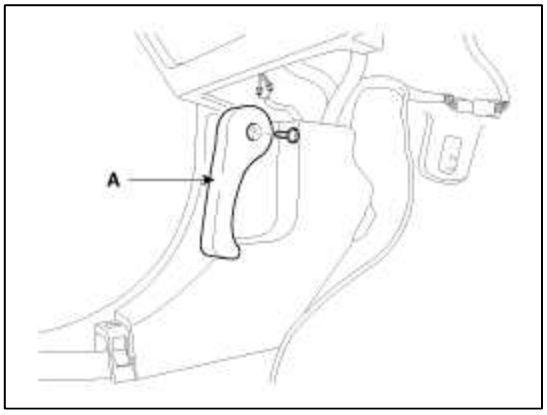
- Take care not to scratch the hood weatherstrip.



2. Installation is the reverse of removal.

Hood Release Handle Replacement

1. After loosening the mounting screw, then remove the hood release handle (A).



2. Installation is the reverse of removal.

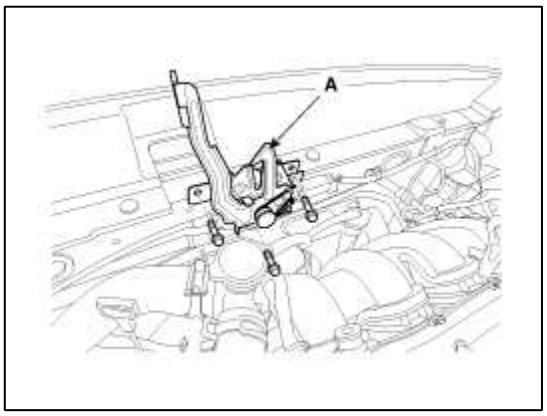
NOTE

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

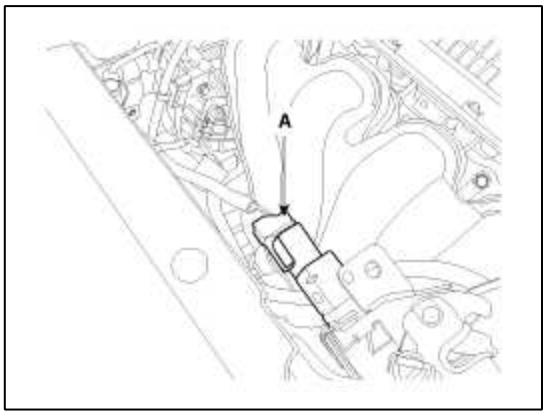
Hood Latch Replacement

1. Remove the hood latch (A) mounting bolts.

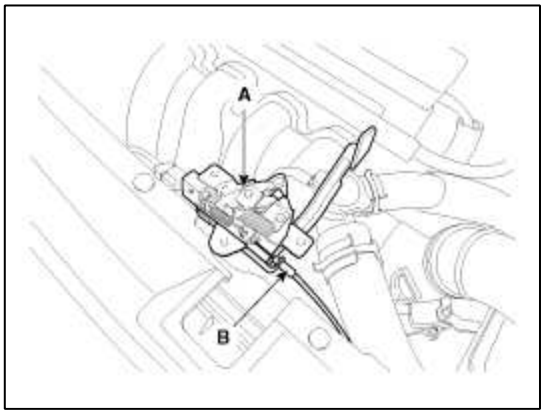
Tighening torque :
7.8 ~ 11.8 N.m (0.8 ~ 1.2 kgf.m, 5.8 ~ 8.7 lb-ft)



2. Disconnect the hood latch connector (A).



3. Disconnect the hood latch cable (B) and remove the hood latch (A).



4. Installation is the reverse of removal.

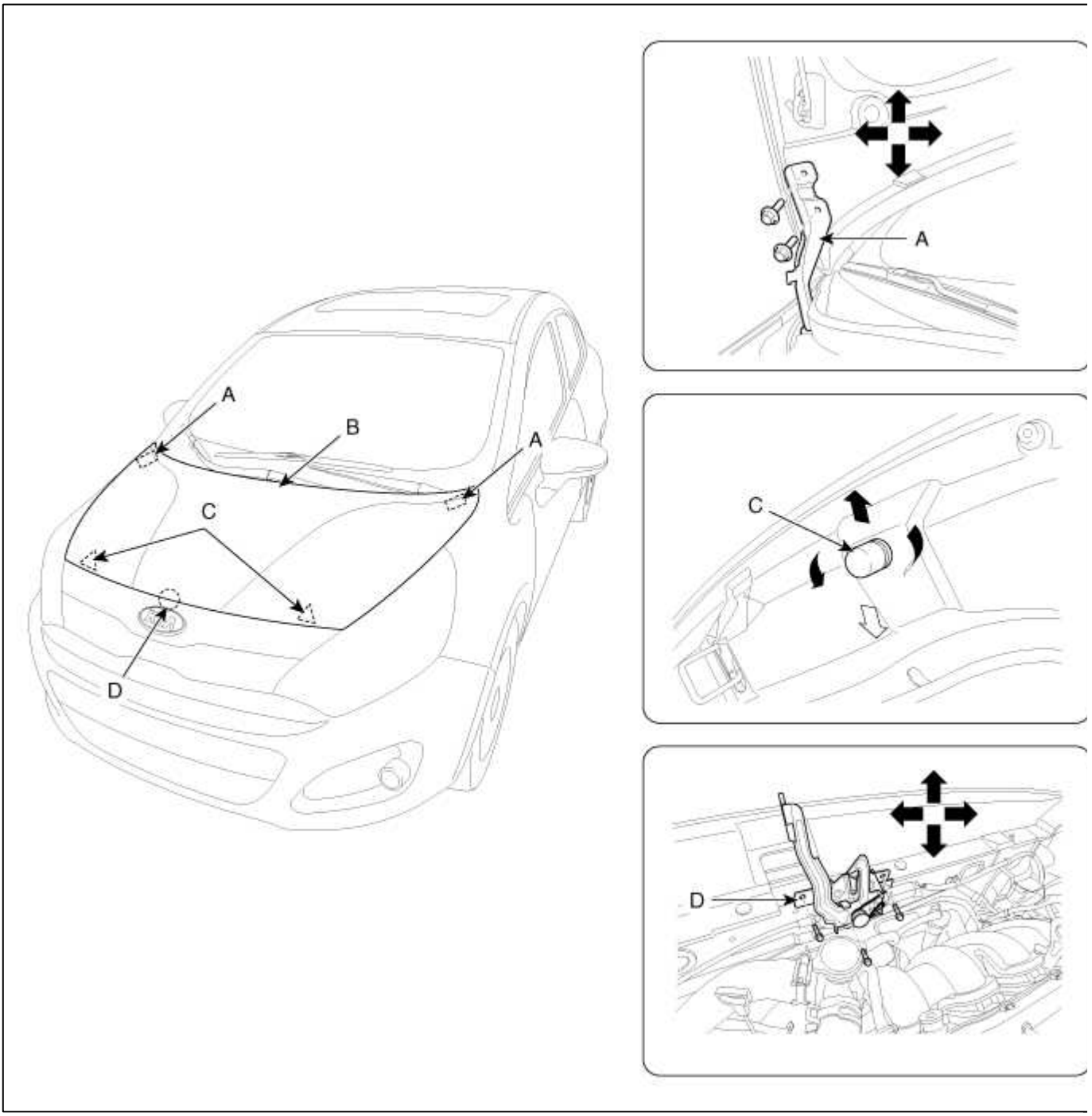
NOTE

- Make sure the hood latch release cable is connected properly.
- Make sure the hood locks/unlocks and opens/closes properly.
- Adjust the latch alignment.

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 le



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

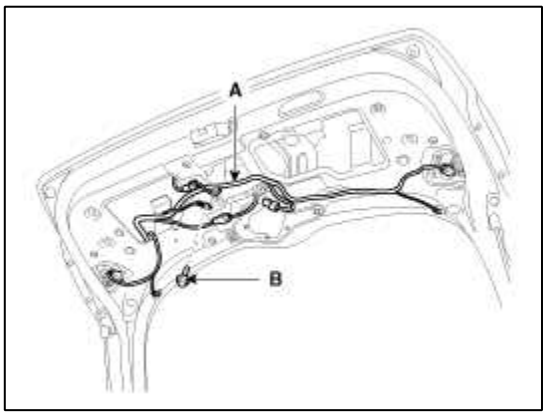
Replacement

Tail Gate Assembly Replacement

CAUTION

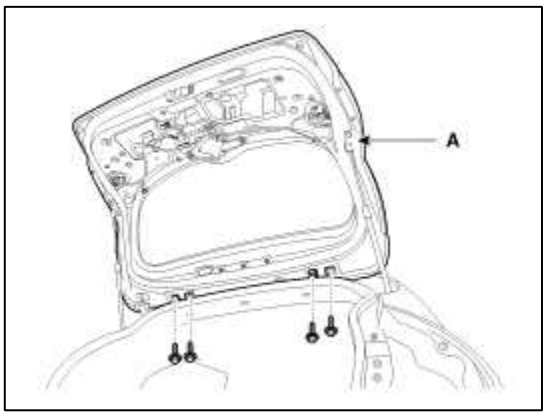
- When removing and installing the tail gate, an assistant is necessary.
- Take care not to damaged the tail gate and body.

1. Remove the following items :
   A. Tail gate trim
2. Loosen the mounting ground bolt (B).
3. Disconnect the connectors and tail gate wiring harness (A).

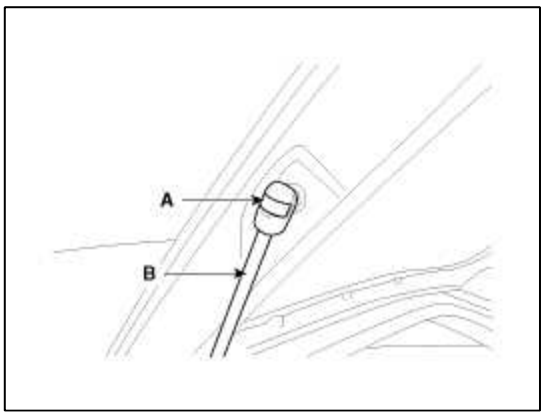


4. After loosening the mounting bolts, then remove the tail gate assembly (A).

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



5. Using a screwdriver, lift the socket clips (A) up slightly on both ends of the tail gate lifter (B).



6. Installation is the reverse of removal.

NOTE

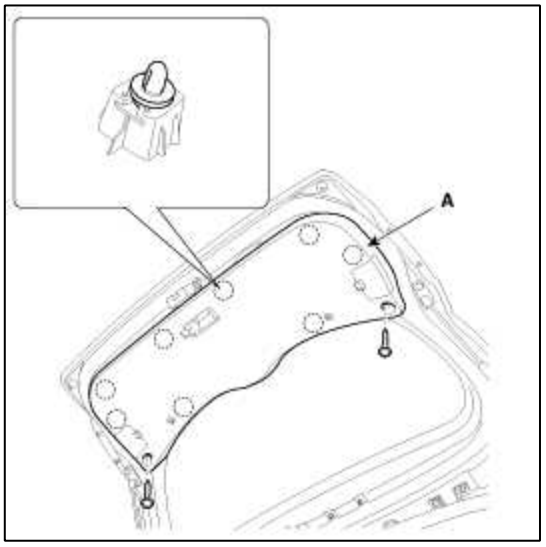
- Make sure the tail gate opens properly and locks securely.
- Adjust the tail gate alignment.
- Make sure the connectors are connected in properly.
- Replace any damage clips.

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.
- Take care not to scratch the body surface.

1. After loosening the mounting screws, then remove the tail gate trim (A).



2. Installation is the reverse of removal.

NOTE

- Replace any damage clips.

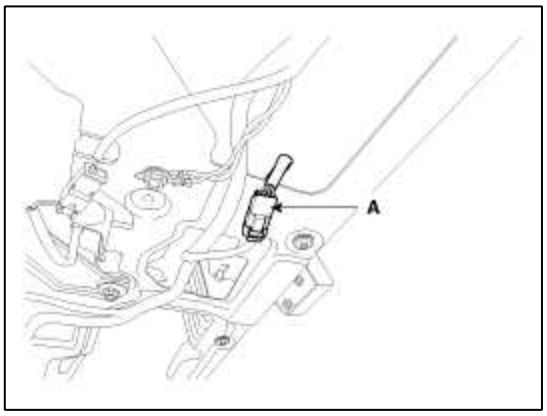
Tail Gate Latch Replacement

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.
- Take care not to scratch the body surface.

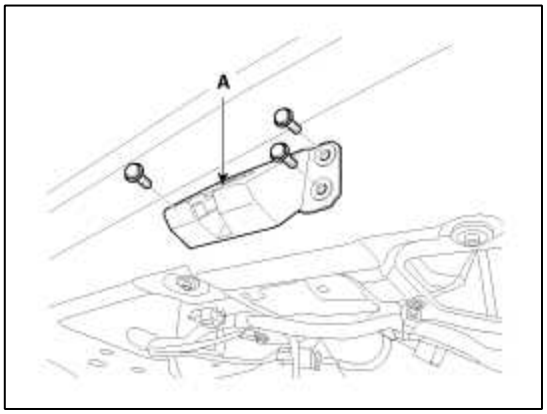
1. Remove the following items :
   A. Tail gate trim

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



3. After loosening the mounting bolts, then remove the tail gate latch assembly (A).

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.

NOTE

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

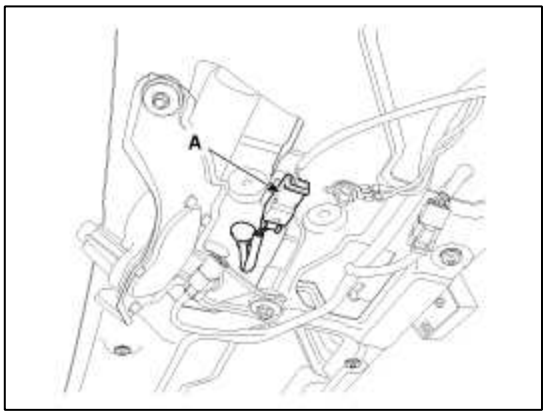
Tail Gate Outside Handle Replacement

CAUTION

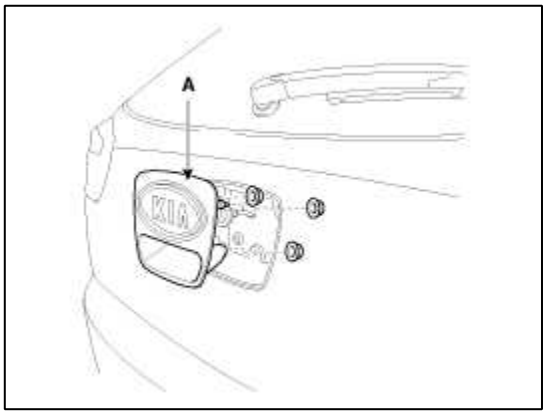
- When prying with a flat-tip screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.
- Take care not to scratch the body surface.

1. Remove the following items :
   A. Tail gate trim

2. Disconnect the tail gate outside handle connector (A).



3. After loosening the mounting nuts, then remove the tail gate outside handle (A).



4. Installation is the reverse of removal

NOTE

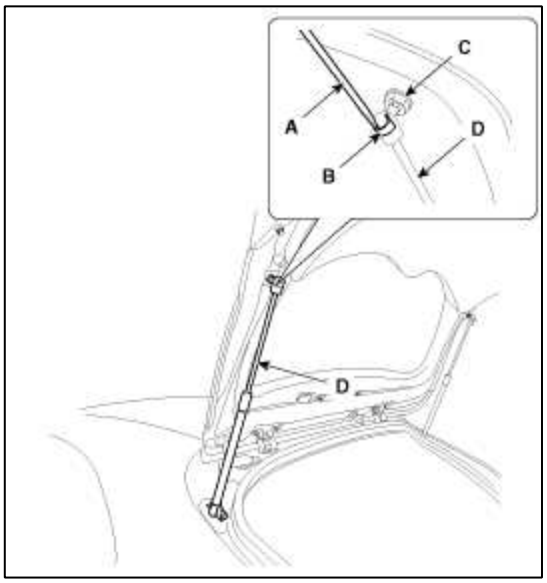
- Make sure the tail gate opens properly and locks securely.
- Make sure the connector is connected properly and the connecting rod is connected properly.
- Replace any damaged clips.

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 lifer (D), and then remove the lifter from the bracket (C).



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

NOTE

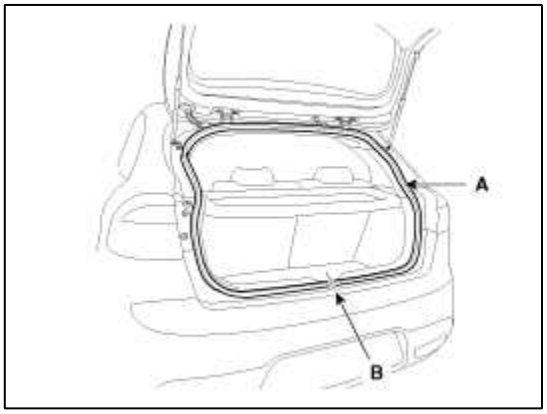
- Make sure the tail gate lock and opens properly and locks securely.

Tail Gate weatherstrip Replacement

CAUTION

- Do not apply sealant to the body.

1. Remove the tail gate weatherstrip (A).



2. Installation is the reverse of removal.

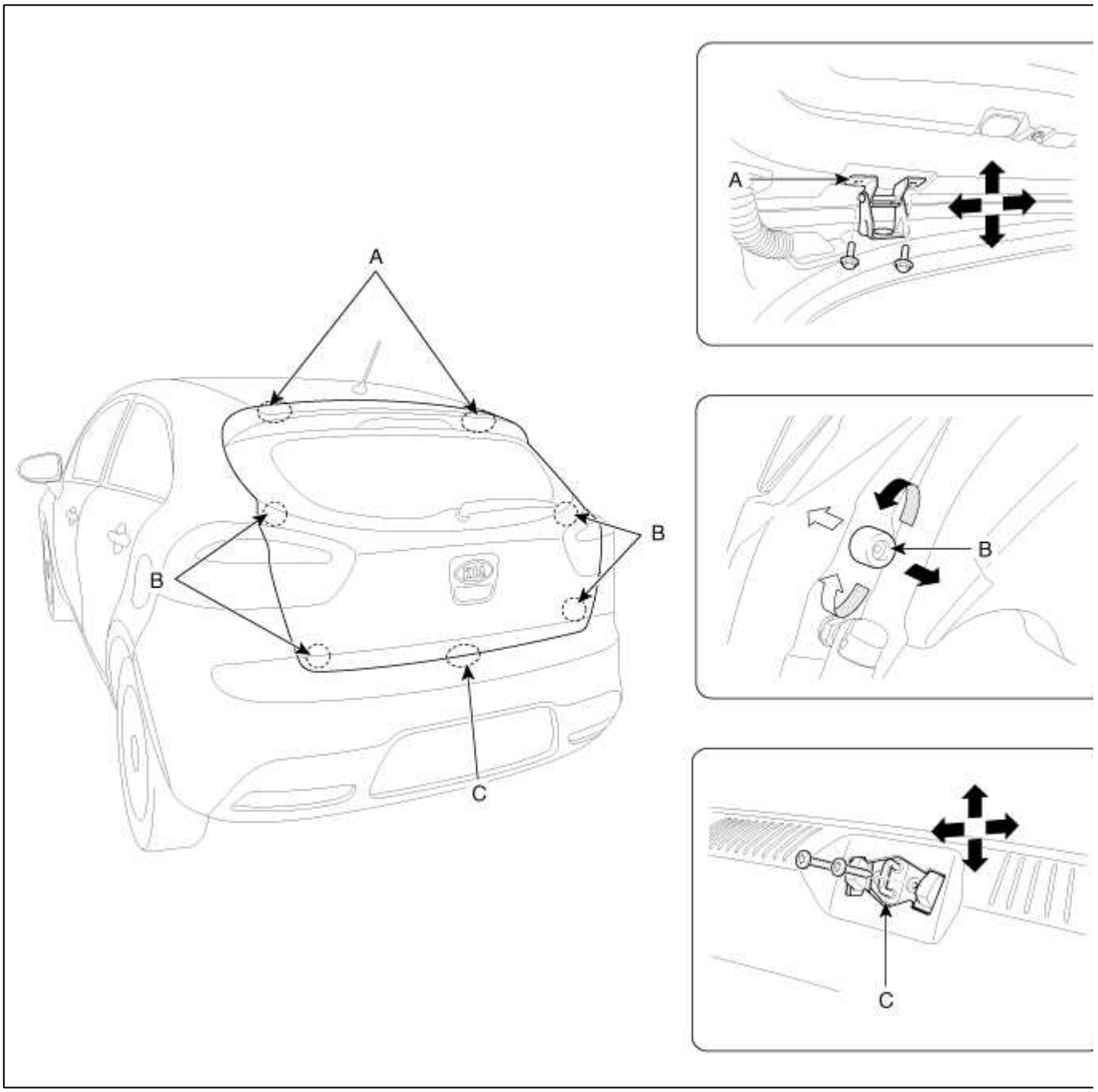
NOTE

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

Adjustment

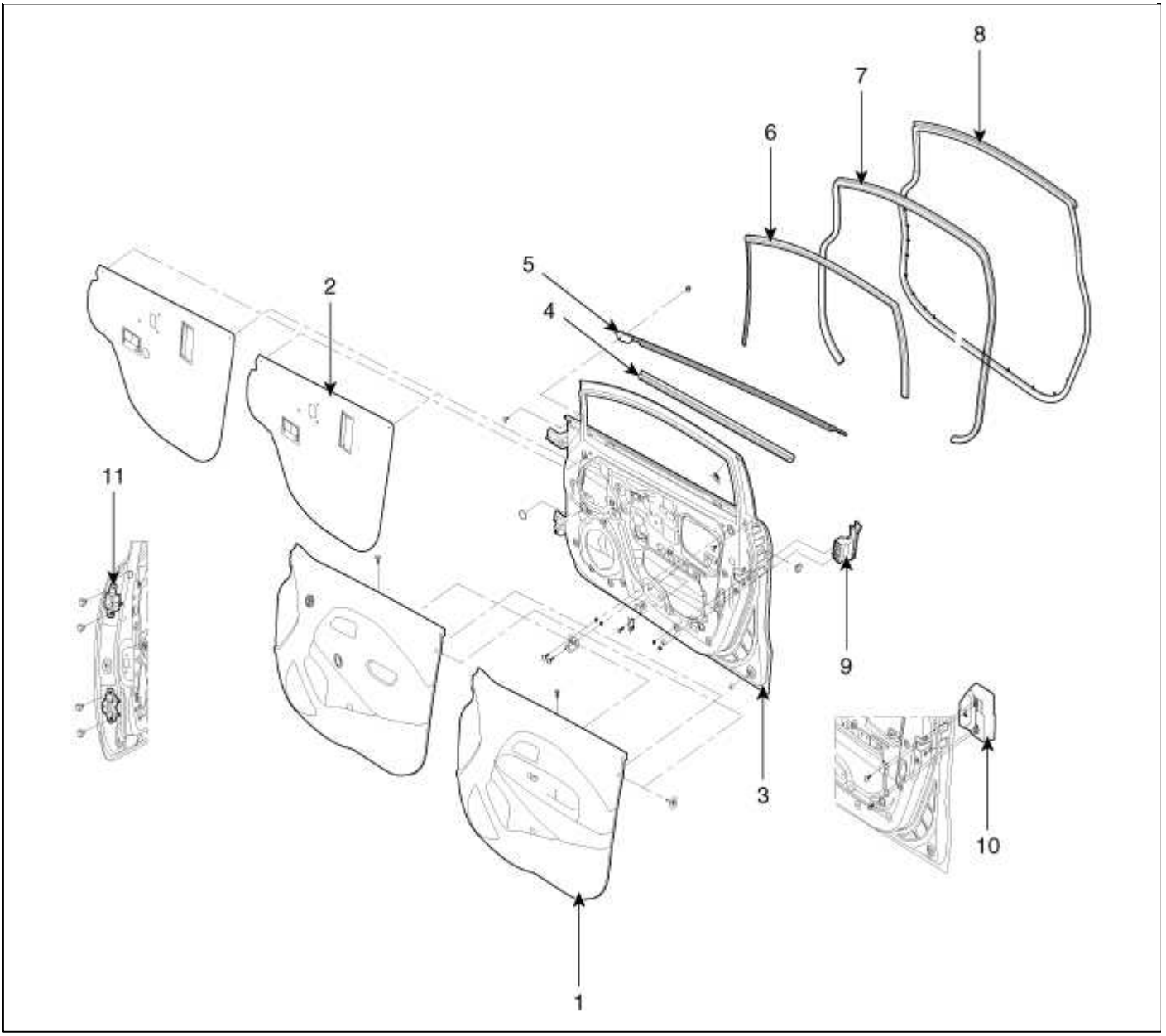
1. After loosening the tail gate hinge (A) mounting bolt, adjust the tail gate by moving it up or down, or right or left.
2. Adjust the tail gate height by turning the tail gate overslam bumpers (B).

3. After loosening the tail gate striker (C) mounting bolts, adjust the tail gate striker by moving it up or down, or right left.



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

Components



1 . Front door trim	7. Front door body side weatherstrip
2 . Front door trim seal	8 . Front door side weatherstrip
3 . Front door panel	9 . Front door rear channel & run assembly
4. Front door belt inside weatherstrip	10 . Front door side impact pad
5 . Front door belt outside weatherstrip	11. Front door hinge
6. Front door window glass run assembly	

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

Replacement

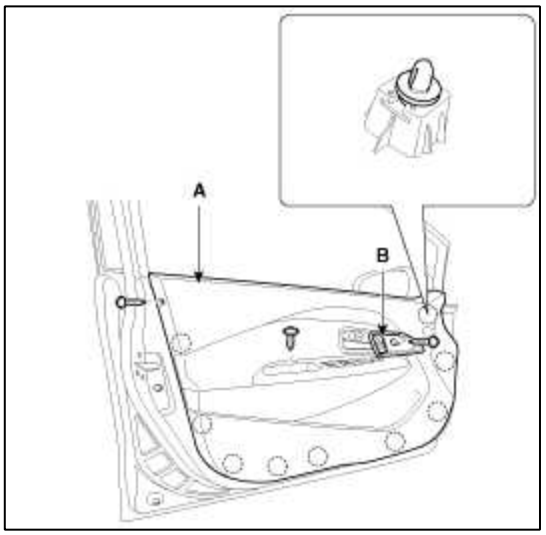
Front Door Trim Replacement

CAUTION

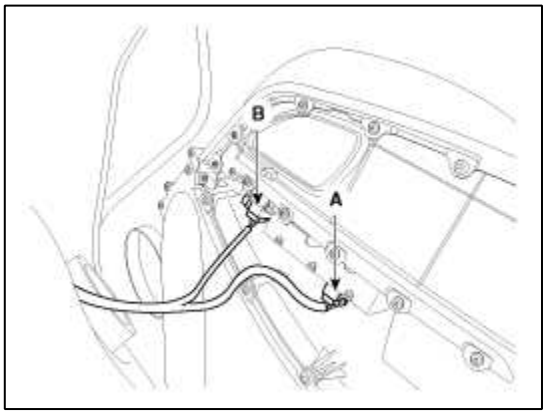
- Take care not to scratch the door trim and other parts.
- Put on gloves to protect your hands.

1. After loosening the mounting screw, then remove the front door inside handle housing (B).

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



3. Disconnect the power window connector (A) and outside mirror folding switch connector (B).



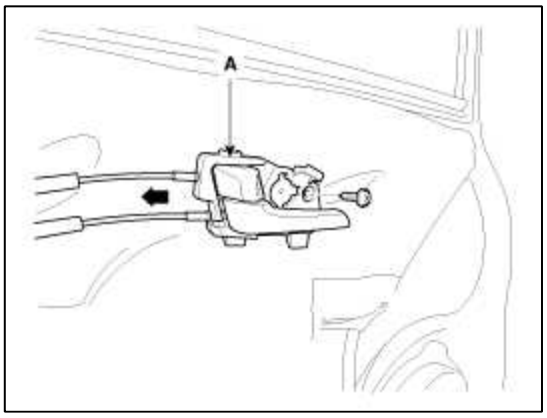
4. Installation is the reverse of removal.

NOTE

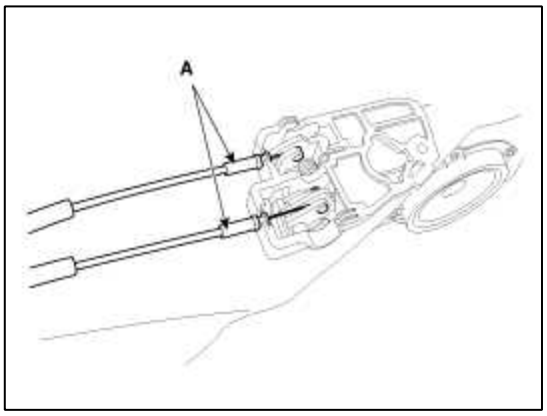
- Make sure of connectors is plugged in properly and each rod is connected securely.
- Make sure the door lock and opens properly.
- Replace any damaged clips.

Inside Handle Replacement

1. Remove the following items :
   A. Front door trim
2. After loosening the mounting screw, then remove the front door inside handle (A).



3. Disconnect the front door inside handle cable (A).



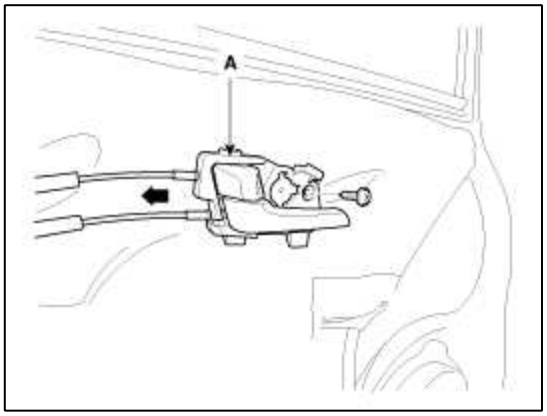
4. Installation is the reverse of removal.

NOTE

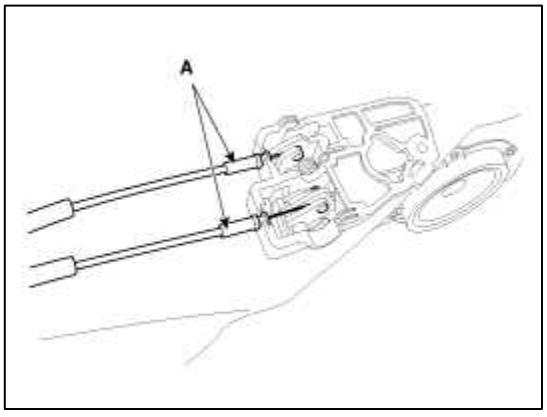
- Replace any damaged clips.
- Make sure the door lock and opens properly.

Glass Replacement

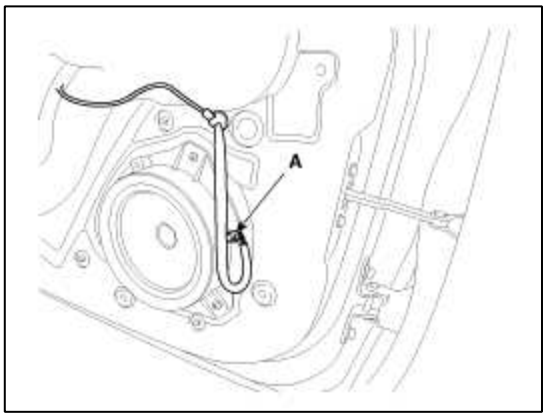
1. Remove the following items :
   A. Front door trim
2. After loosening the mounting screw, then remove the front door inside handle (A).



3. Disconnect the front door inside handle cable (A).



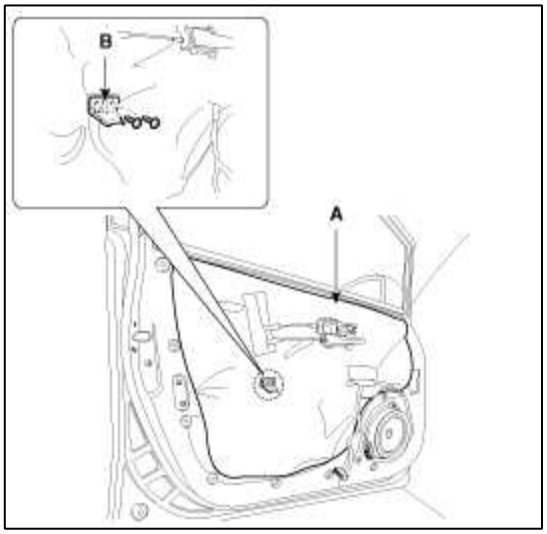
4. Disconnect the front door speaker connector (A).



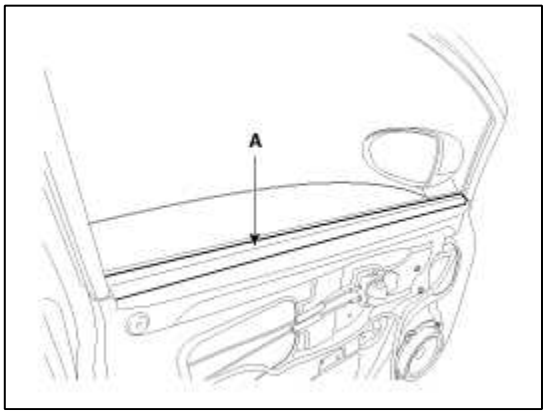
5. After loosening the mounting screws, then remove the front door trim seal mounting bracket (B).
6. Remove the front door trim seal (A).

NOTE

- Replace any damaged door trim seal.



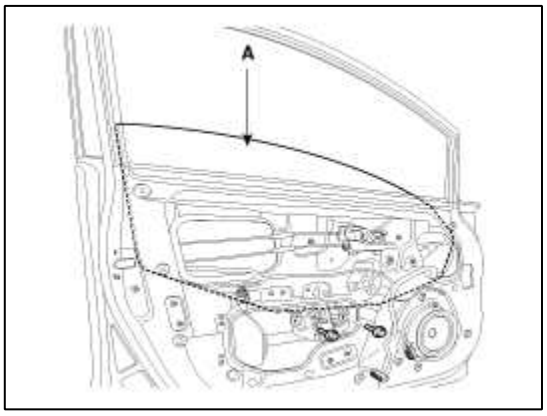
7. Remove the front door belt inside weatherstrip (A).



8. Carefully move the glass (A) until you can see the bolts, then loosen them. Separate the glass from the glass run and carefully pull the glass out through the window slot.

> CAUTION
>
> • Take care not to drop to glass and scratch the glass surface.

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

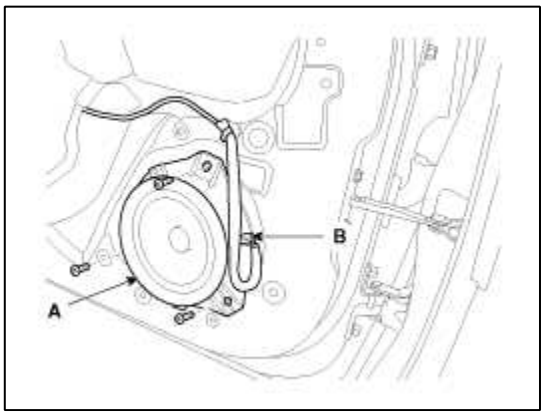


9. Installation is the reverse of removal.

> 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 following items :
   A. Front door trim
2. Disconnect the speaker connector (B).
3. After loosening the mounting screws, then remove the front door speaker (A).



4. Installation is the reverse of removal.

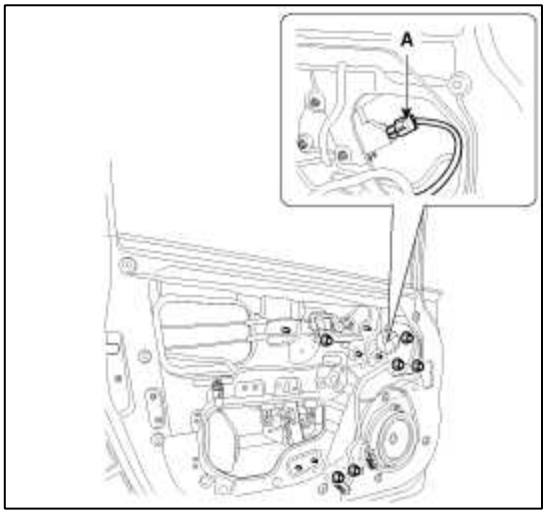
NOTE

- Use sheet metal screws to secure the speaker.
- Make sure connectors are connected properly and each rod is connected securely.
- Make sure the door locks/unlocks and opens/closes properly.
- Replace any damaged clips.

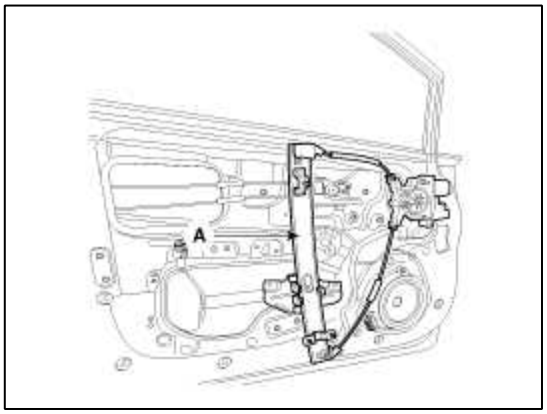
Door Power Window Regulator Assembly Replacement

1. Remove the following items :
   A. Front door trim
   B. Front door trim seal
   C. Front door glass
2. Loosen the front door power window regulator mounting nuts.
3. Disconnect the front door power window motor connector (A).

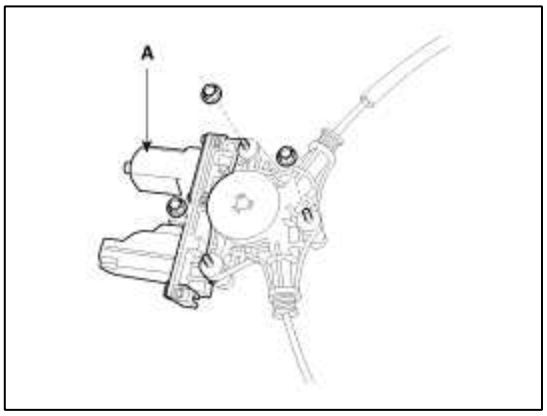
Tightening torque :
3.9 ~ 5.9N.m (0.4 ~ 0.6kgf.m, 2.9 ~ 4.3 lb-ft)



4. Remove the front door power window regulator assembly (A).



5. After loosening the mounting nuts, then remove the front door power window motor (A).



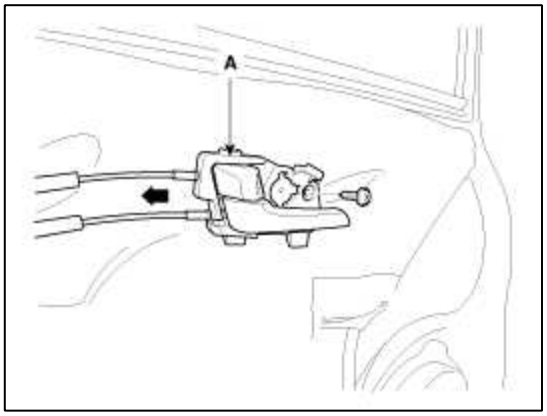
6. Installation is the reverse of removal.

NOTE

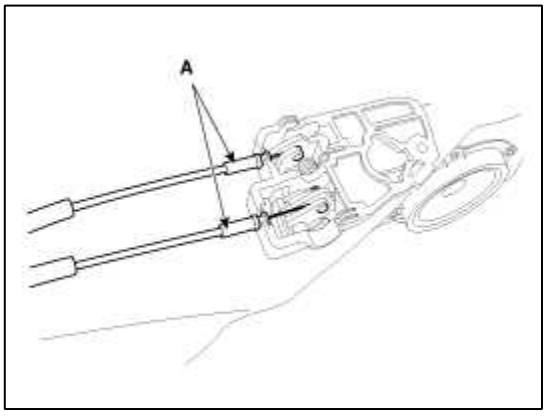
- Grease should be applied to areas where there is rotational parts and springs.
- Roll the glass up and down to see if it move freely without binding.

Outside Handle Replacement

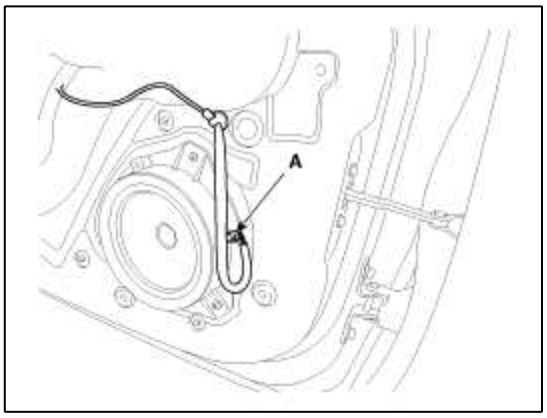
1. Remove the following items :
   A. Front door trim
2. After loosening the mounting screw, then remove the front door inside handle (A).



3. Disconnect the front door inside handle cable (A).



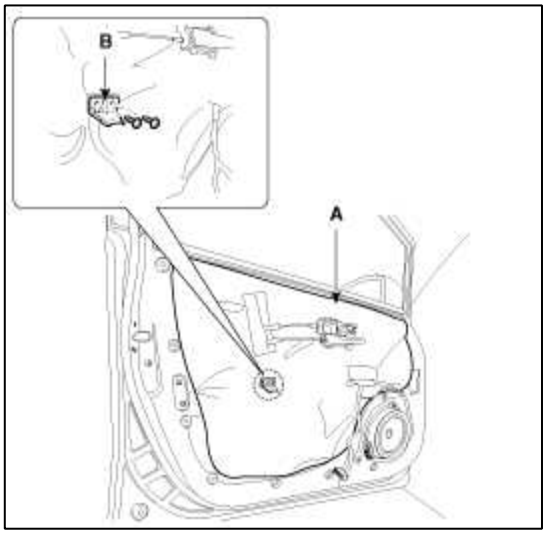
4. Disconnect the front door speaker connector (A).



5. After loosening the mounting screws, then remove the front door trim seal mounting bracket (B).
6. Remove the front door trim seal (A).

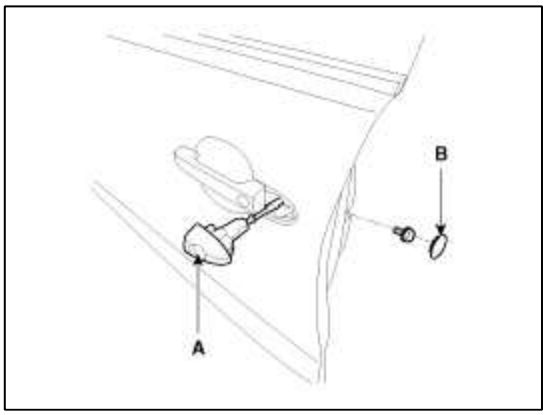
NOTE

- Replace any damaged door trim seal.

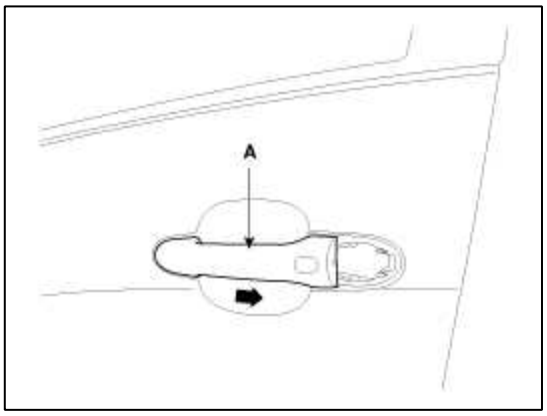


7. Remove the hole plug (B).
8. After loosening the mounting bolt, then remove the outside handle cover (A).

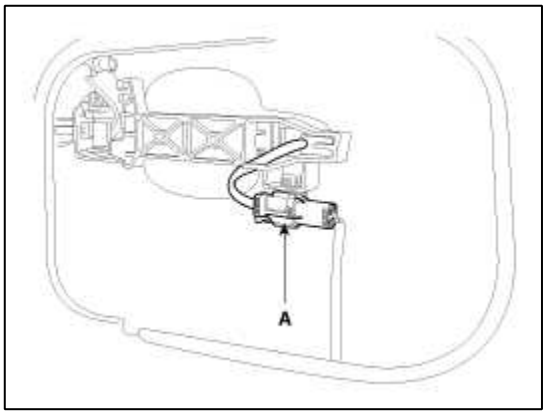
Tightening torque :
7.8 ~ 10.8 N.m (0.8 ~ 1.1 kgf.m, 5.8 ~ 8.0 lb-ft)



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



10. Disconnect the outside handle connector (A).



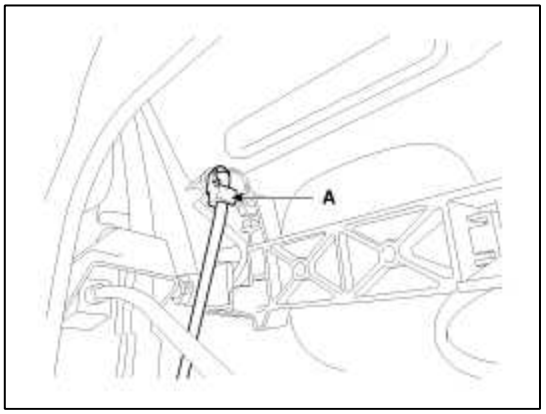
11. Installation is the reverse of removal.

NOTE

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

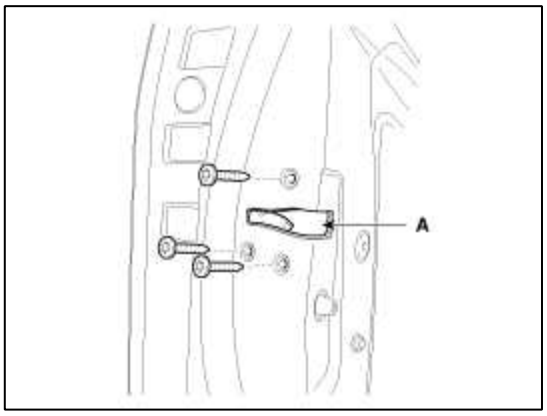
Door Latch Replacement

1. Remove the following items :
   A. Front door trim
   B. Front door trim seal
2. Disconnect the outside handle rod (A).

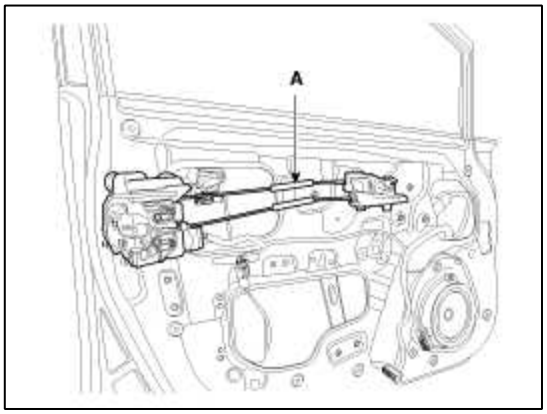


3. Loosen the front door latch (A) mounting screws.

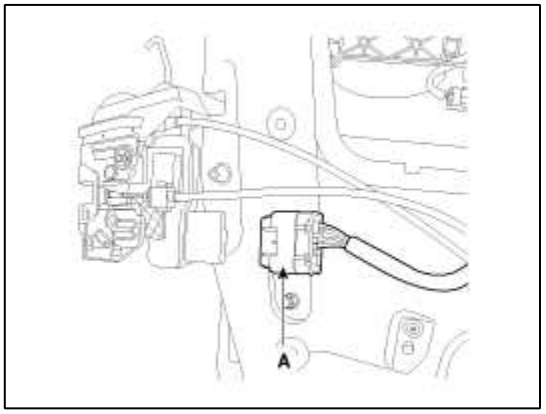
Tightening torque :
7.8 ~ 10.8 N.m (0.8 ~ 1.1 kgf.m, 5.8 ~ 8.0 lb-ft)



4. Remove the front door latch assembly (A).



5. Disconnect the front door latch connector (A).



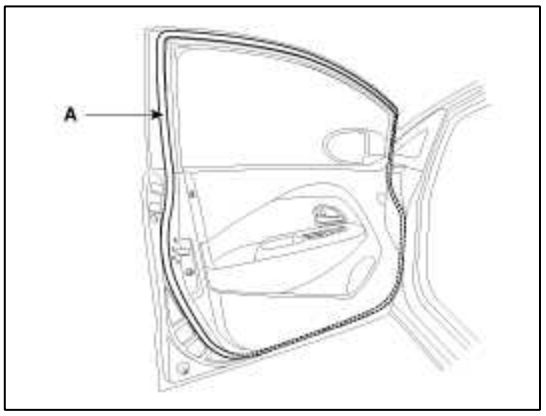
6. Installation is the reverse of removal.

NOTE

- Make sure the connector is connected properly.
- Make sure the door locks/unlocks and opens/closes properly.
- Replace any damaged clips.

Door Side 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.

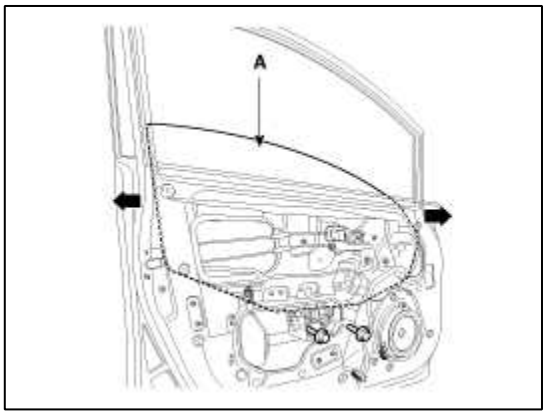
Adjustment

Glass Adjustment

NOTE

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

1. Remove the following items :
   A. Front door trim
   B. Front door trim seal
2. Carefully move the glass (A) until you can see the glass mounting bolts, then loosen them.



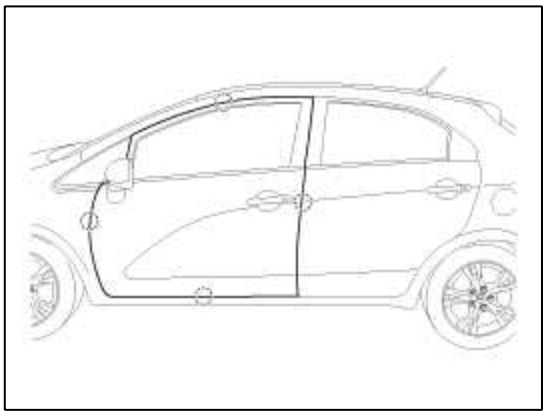
3. Check that the glass moves smoothly.

Door Position Adjustment

NOTE

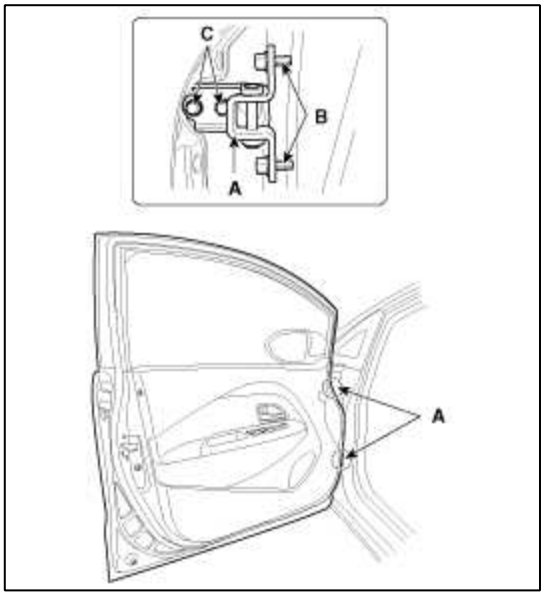
- After installing the door, check for a flush fit with the Body, then check for equal gaps between the front, rear, and bottom, door edges and the body. Check that the door and body edges are parallel. Before adjusting, replace the mounting bolts.

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)



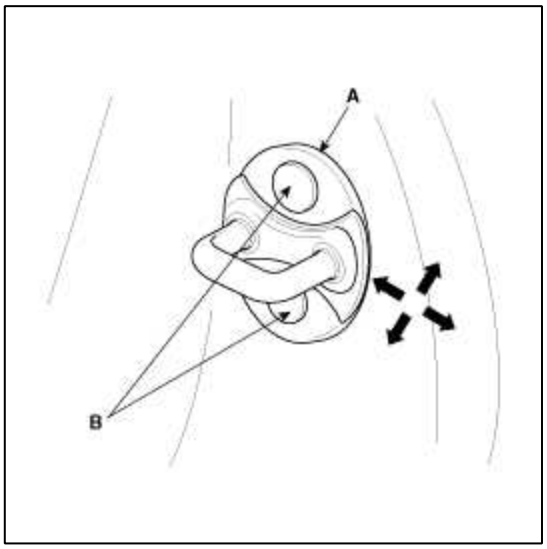
4. Grease the pivot portions of the hinges indicated.
5. Check for water leaks.

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.

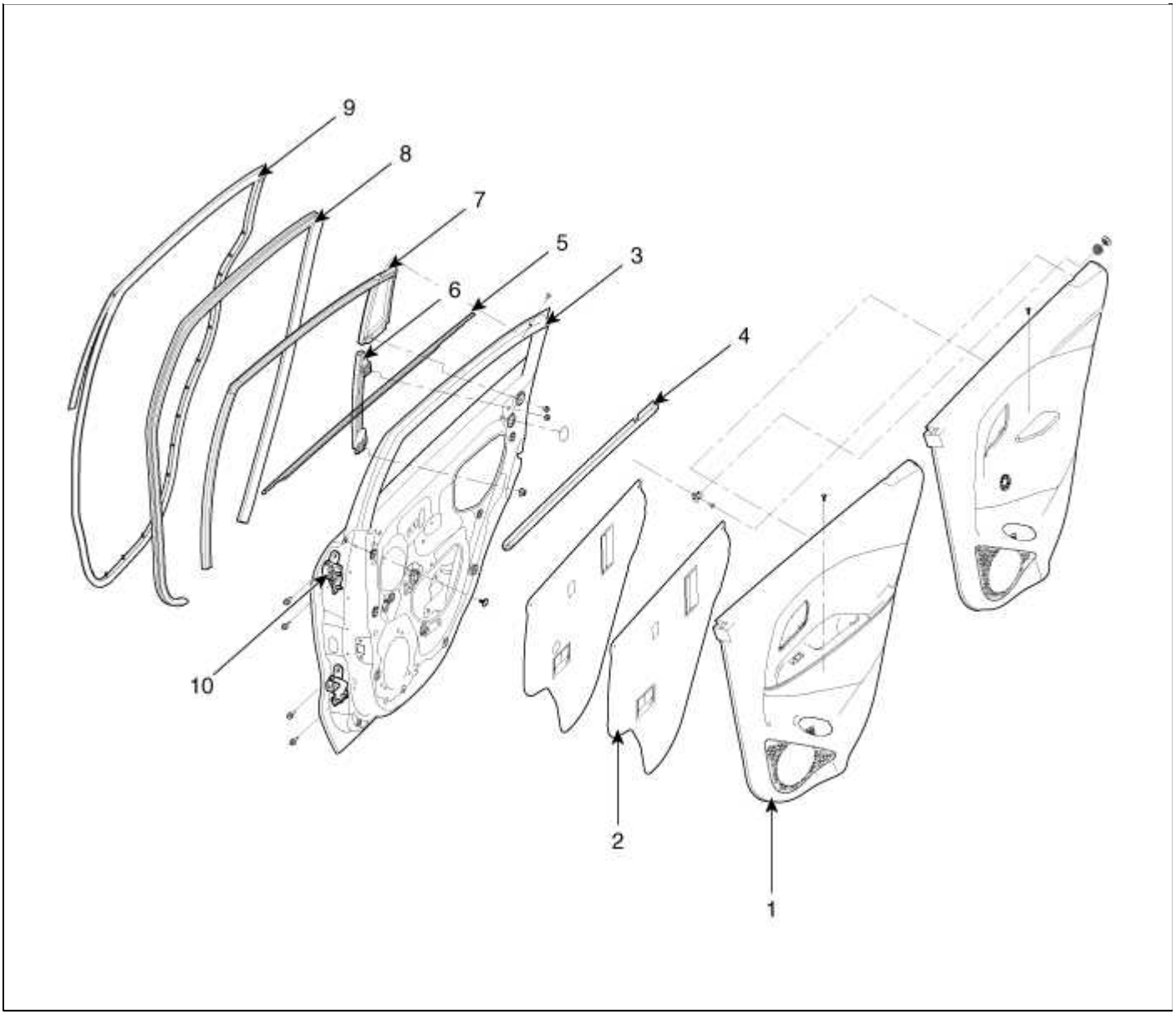
Tightening torque:
(B) : 8.8 ~ 13.7 N.m (0.9 ~ 1.4 kgf.m, 6.5 ~ 10.1 lb-ft)



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

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

Components



1 . Rear door trim 2 . Rear door trim seal 3 . Rear door panel 4 . Rear door belt inside weatherstrip 5 . Rear door belt outside weatherstrip	6 . Rear door delta lower run & channel assembly 7 . Rear door window run & fixed glass 8. Rear door body side weatherstrip 9 . Rear door side weatherstrip 10 . Rear door hinge

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

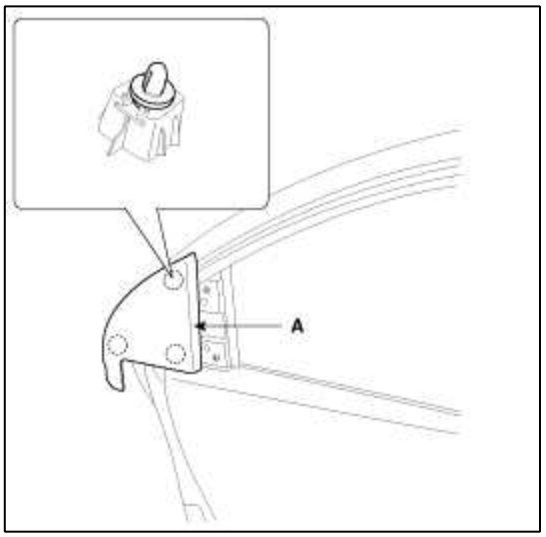
Replacement

Door Trim Replacement

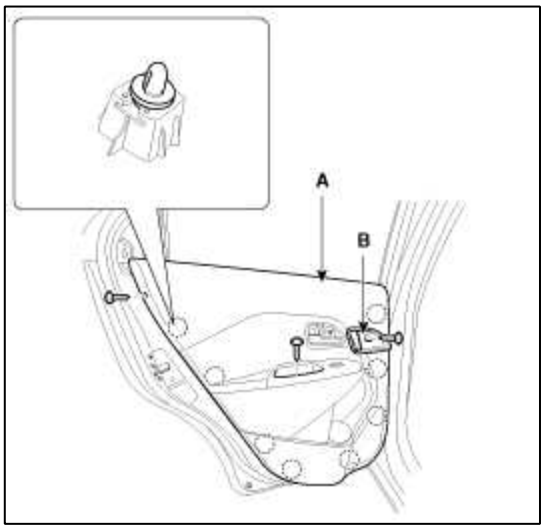
CAUTION

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

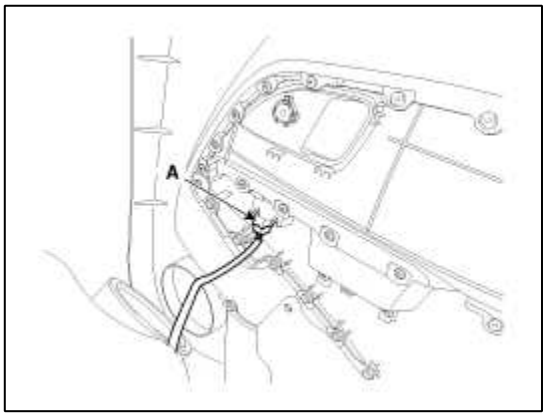
1. Using a screwdriver or remover, remove the rear door delta inner cover (A).



2. After loosening the mounting screw, then remove the rear door inside handle housing (B).
3. After loosening the mounting screws, then remove the rear door trim (A).



4. Disconnect the power window connector (A).



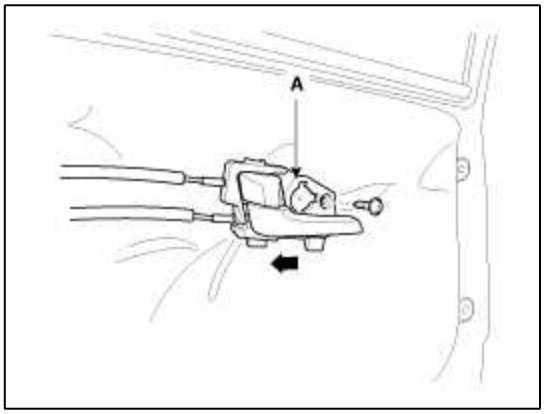
5. Installation is the reverse of removal.

NOTE

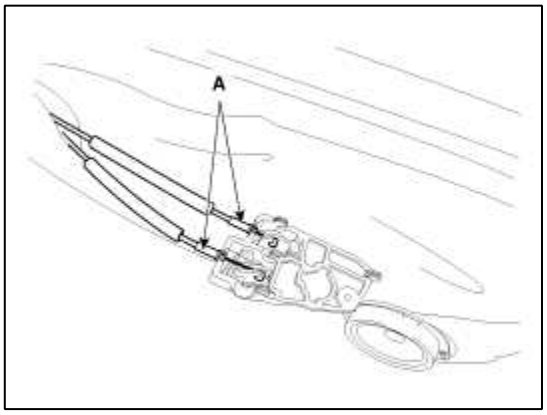
- Make sure connectors are connected properly and each rod is connected securely.
- Make sure the door lock and opens properly.
- Replace any damaged clips.

Inside Handle Replacement

1. Remove the following items :
   A. Rear door trim.
2. After loosening the mounting screw, then remove the rear door inside handle (A).



3. Disconnect the rear door inside handle cable (A).



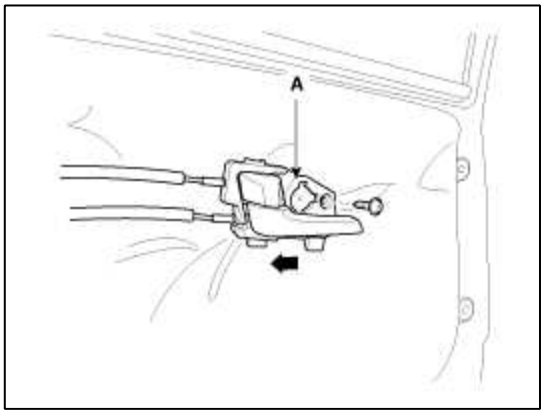
4. Installation is the reverse of removal.

NOTE

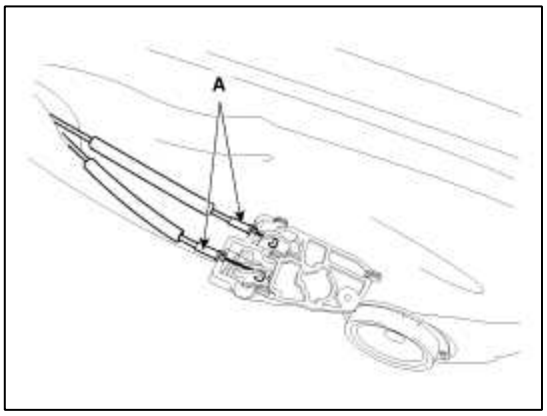
- Replace any damaged clips.
- Make sure the door lock and opens properly.

Glass Replacement

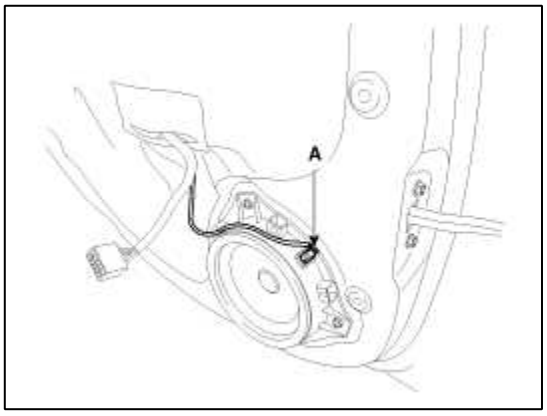
1. Remove the following items :
   A. Rear door trim.
2. After loosening the mounting screw, then remove the rear door inside handle (A).



3. Disconnect the rear door inside handle cable (A).



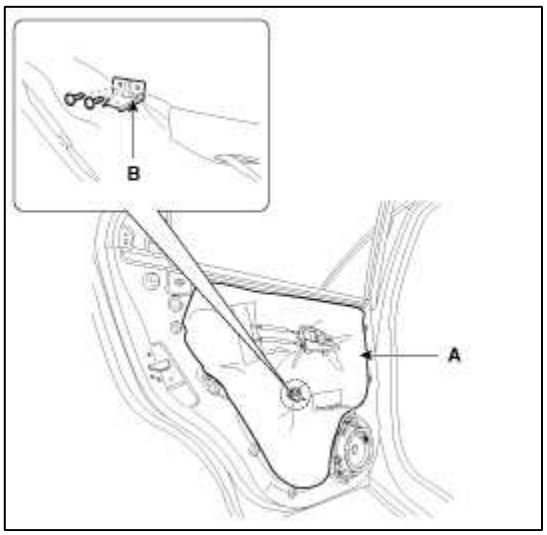
4. Disconnect the rear door speaker connector (A).



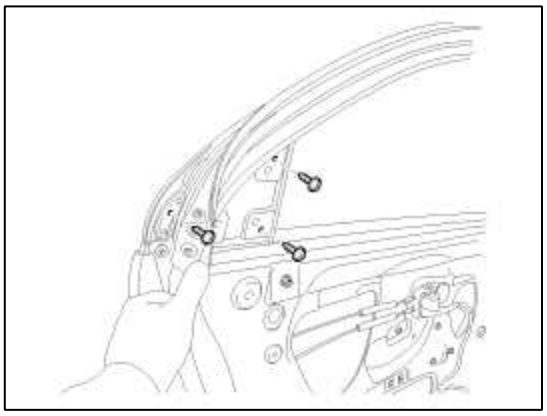
5. After loosening the mounting screws, then remove the rear door trim seal mounting bracket (B).
6. Remove the rear door trim seal (A).

NOTE

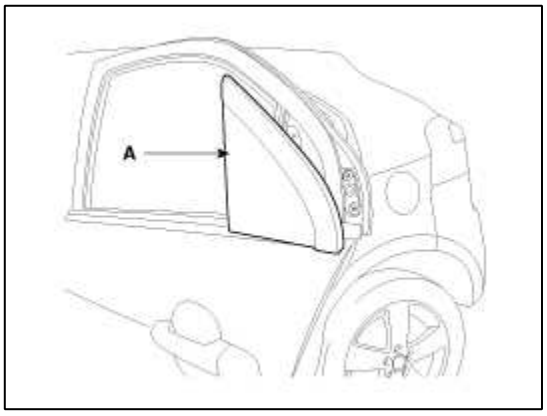
- Replace any damaged door trim seal.



7. Loosen the rear door delta molding mounting screws.

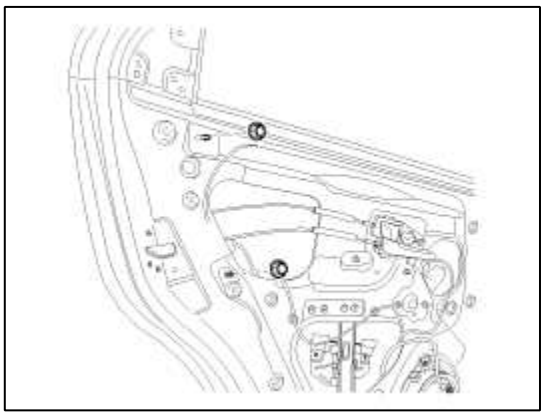


8. Remove the rear door delta molding (A).

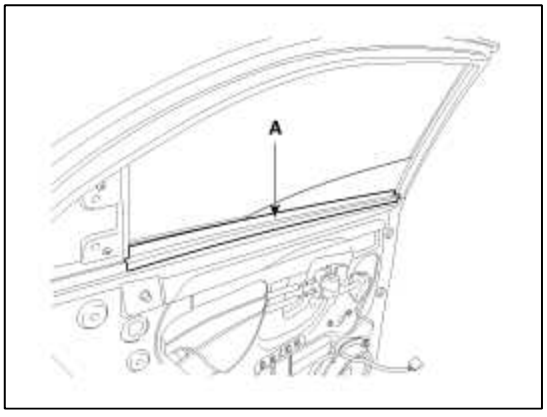


9. Loosen the rear door channel mounting nuts.

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



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

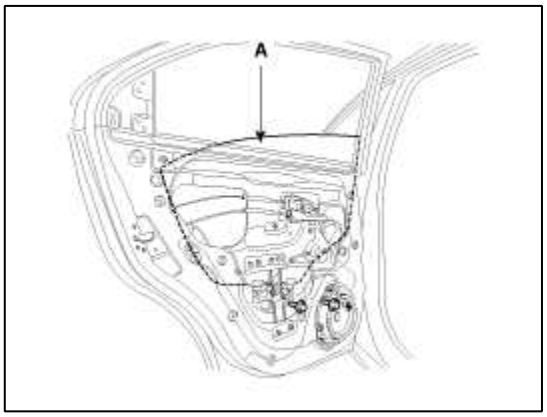


11. Carefully move the glass (A) until you can see the bolts, then loosen them. Separate the glass from the glass run and carefully pull the glass out through the window slot.

CAUTION

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

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



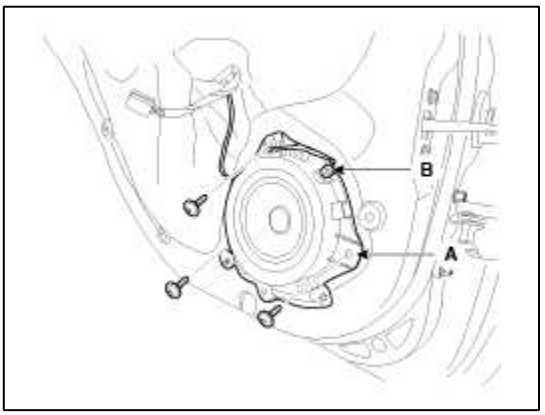
12. Installation is the reverse of removal.

NOTE

A. Roll the glass up down to see if it move freely without binding.
B. Adjust the position of the glass as necessary.

Speaker Replacement

1. Remove the following items :
   A. Rear door trim.
2. Disconnect the speaker connector (B).
3. After loosening the mounting screws, then remove the rear door speaker (A).



4. Installation is the reverse of removal.

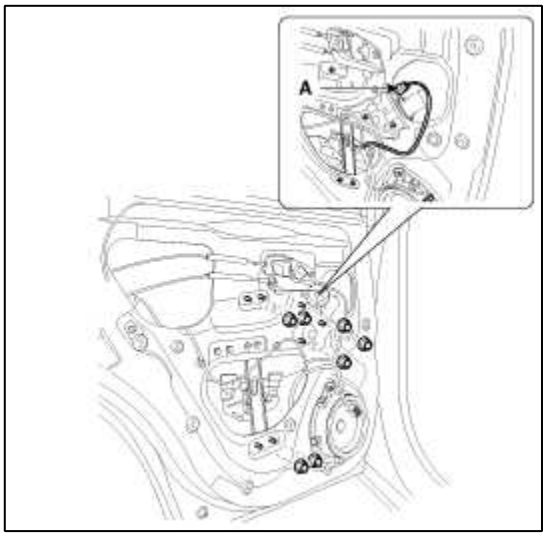
NOTE

- Use sheet metal screws to secure the speaker.
- Make sure connectors are connected properly and each rod is connected securely.
- Make sure the door locks/unlocks and opens/closes properly.
- Replace any damaged clips.

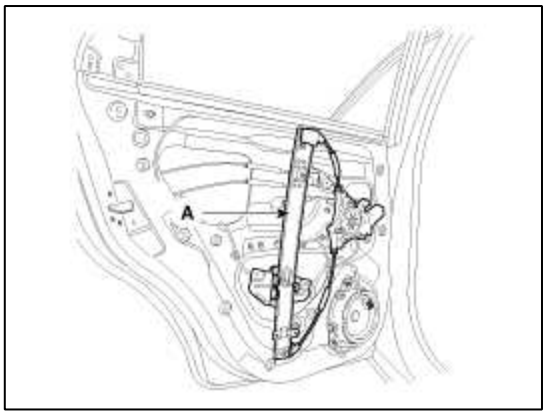
Door Power Window Regulator Assembly Replacement

1. Remove the following items :
   A. Rear door trim
   B. Rear door trim seal
   C. Rear door glass
2. Loosen the rear door power window regulator mounting nuts.
3. Disconnect the rear door power window motor connector (A).

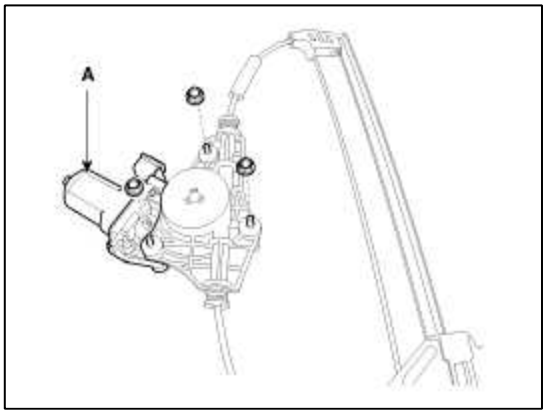
Tightening torque :
3.9 ~ 5.9 N.m (0.4 ~ 0.6 kgf.m, 2.9 ~ 4.3 lb-ft)



4. Remove the rear door power window regulator assembly (A).



5. After loosening the mounting nuts, then remove the rear door power window motor (A).



6. Installation is the reverse of removal.

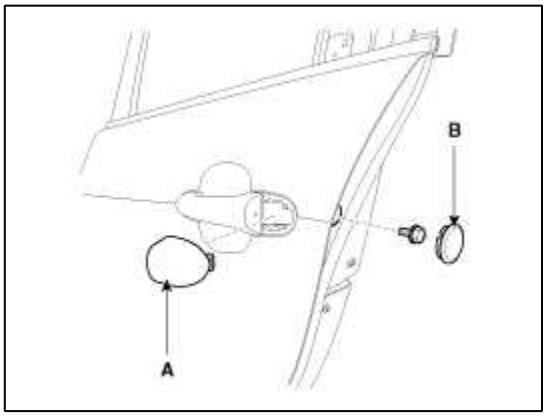
NOTE

- Grease should be applied to areas where there is rotational parts and springs.
- Roll the glass up and down to see if it move freely without binding.

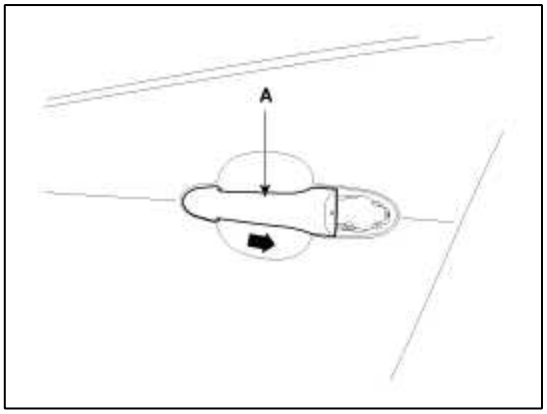
Outside Handle Replacement

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

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



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



4. Installation is the reverse of removal.

NOTE

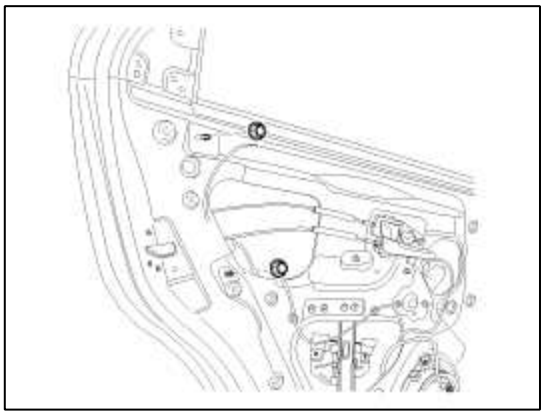
- Make sure the door locks/unlocks and opens/closes properly.
- Make sure the door locks and opens properly.

Door Latch Replacement

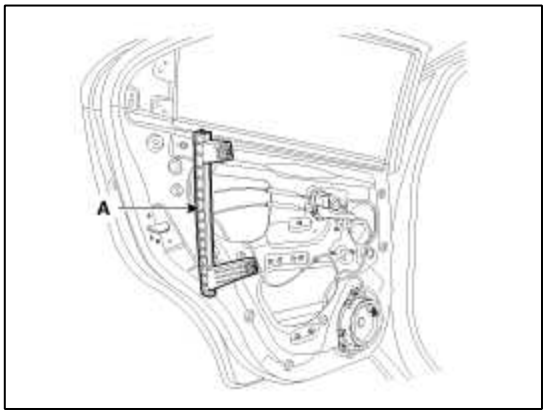
1. Remove the following items :
   A. Rear door trim
   B. Rear door trim seal

2. Loosen the rear door channel mounting nuts.

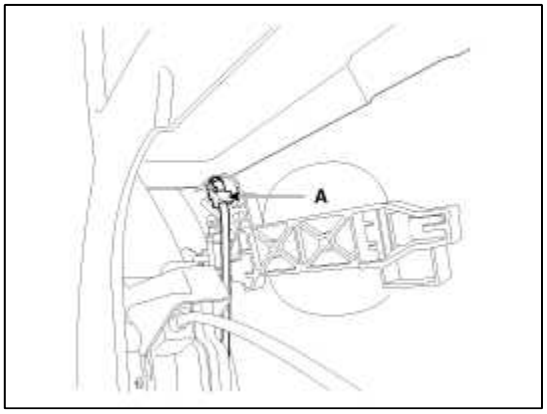
Tightening torque :
3.9 ~ 5.9 N.m (0.4 ~ 0.6 kgf.m, 2.9 ~ 4.3 lb-ft)



3. Remove the rear door channel (A).

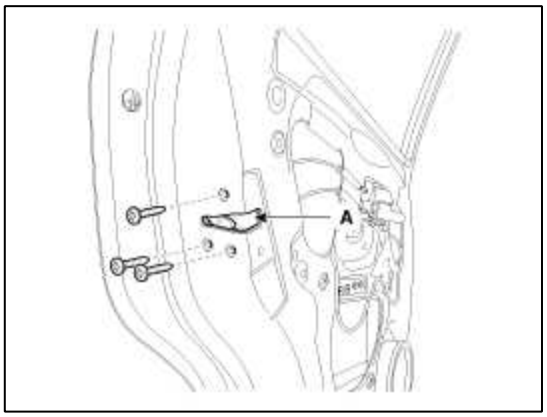


4. Disconnect the outside handle rod (A).

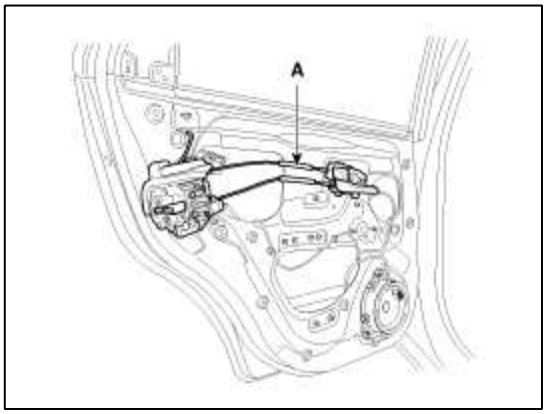


5. Loosen the rear door latch (A) mounting screws.

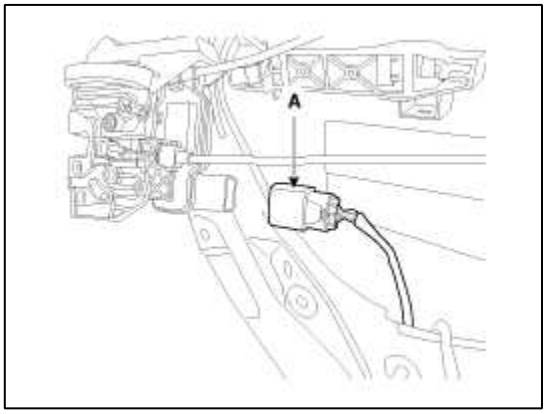
Tightening torque :
7.8 ~ 10.8 N.m (0.8 ~ 1.1kgf.m, 5.8 ~ 8.0 lb-ft)



6. Remove the rear door latch assembly (A).



7. Disconnect the rear door latch connector (A).



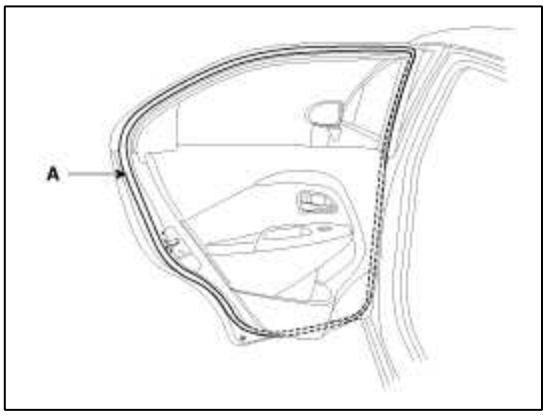
8. Installation is the reverse of removal.

NOTE

- Make sure the connector is connected properly.
- Make sure the door locks/unlocks and opens/closes properly.
- Replace any damaged clips.

Door Side Weaterstrip Replacement

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



2. Installation is the reverse the removal.

NOTE

- Replace any damaged clips.

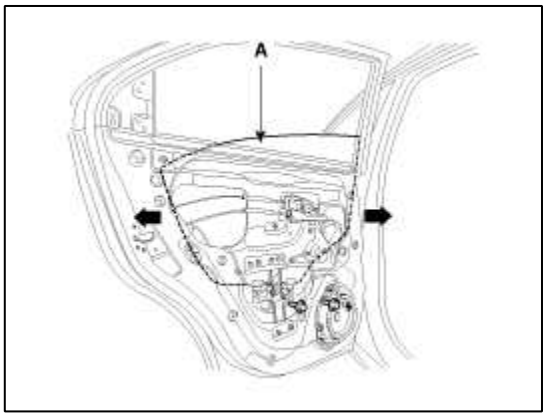
Adjustment

Glass Adjustment

NOTE

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

1. Remove the following items :
   A. Rear door trim
   B. Rear door trim seal
2. Carefully move the glass (A) until the glass mounting bolts are visible, then loosen them.



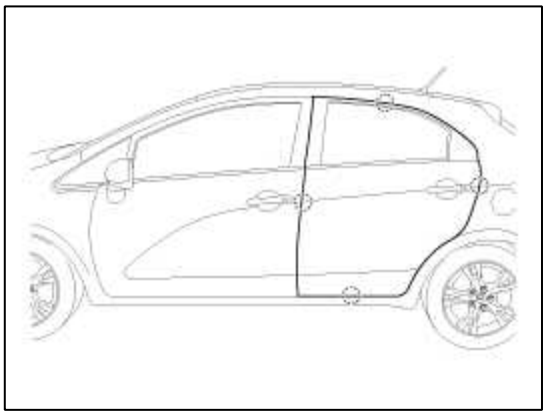
3. Check that the glass moves smoothly.

Door Position Adjustment

NOTE

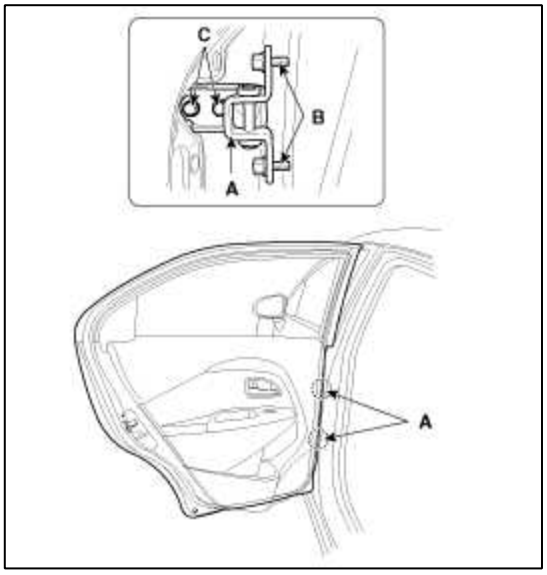
- After installing the door, check for a flush fit with the Body, then check for equal gaps between the front, rear, and bottom, door edges and the body. Check that the door and body edges are parallel. before adjusting, replace the mounting bolts.

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)



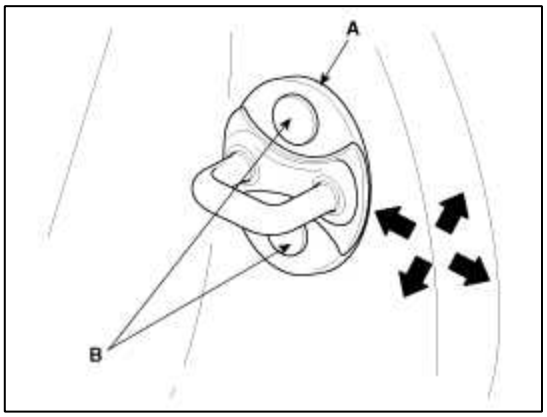
4. Grease the pivot portions of the hinges indicated.
5. Check for water leaks.

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



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

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

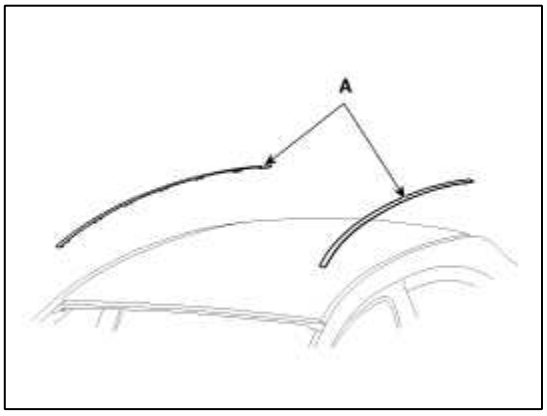
Replacement

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

1. Using a screwdriver or remover, remove the roof garnish (A).



2. Installation is the reverse of removal.

NOTE

- Replace any damaged clips.

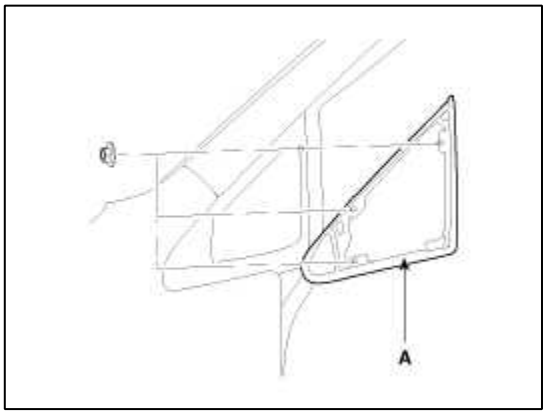
Delta Glass Replacement

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.
- Take care not to scratch the body surface.

1. Remove the following items :
   A. Front pillar trim
      (Refer to the BD group - "Interior Trim")
2. After loosening the mounting nuts, then remove the delta glass (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 damaged clips.

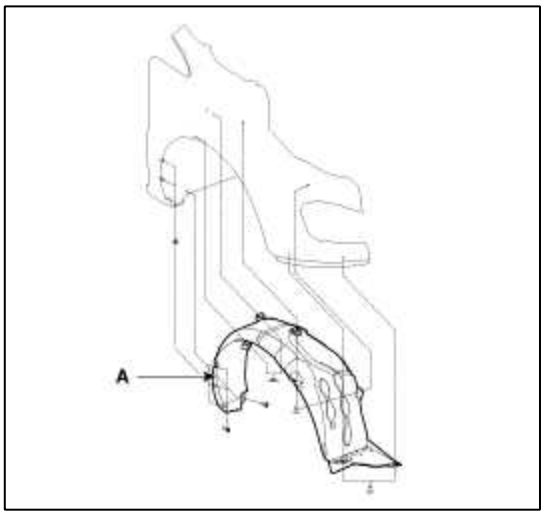
Front Wheel Guard Replacement

CAUTION

- When prying with a flat-tip screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- 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 screws and clips, then remove the front wheel guard (A).



3. Installation is the reverse of removal.

NOTE

- Replace any damaged clips.

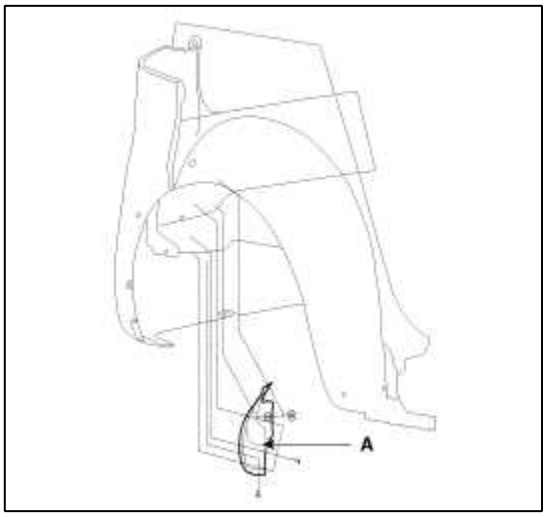
Rear Wheel Guard Replacement

CAUTION

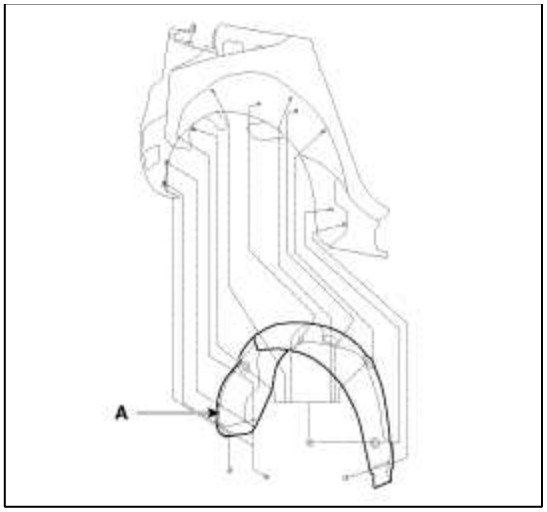
- When prying with a flat-tip screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.
- Take care not to scratch the body surface.

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

[A Type]



[B Type]



3. Installation is the reverse of removal.

NOTE

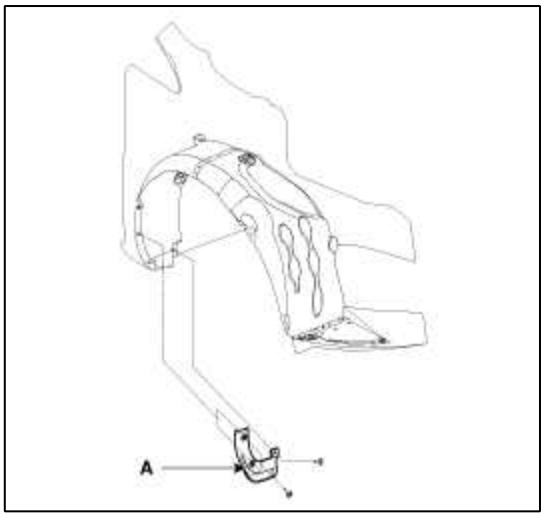
- Replace any damaged clips.

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

1. After loosening the mounting clip and screws, then remove the front mud guard (A).



2. Installation is the reverse of removal.

NOTE

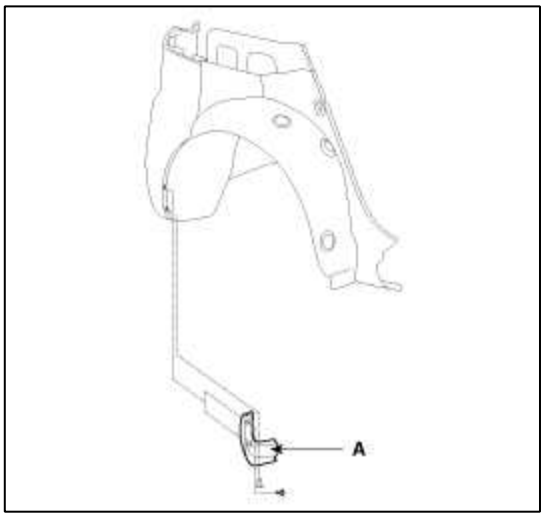
- Replace any damaged clips.

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

1. After loosening the mounting clip and screws, then remove the rear mud guard (A).



2. Installation is the reverse of removal.

NOTE

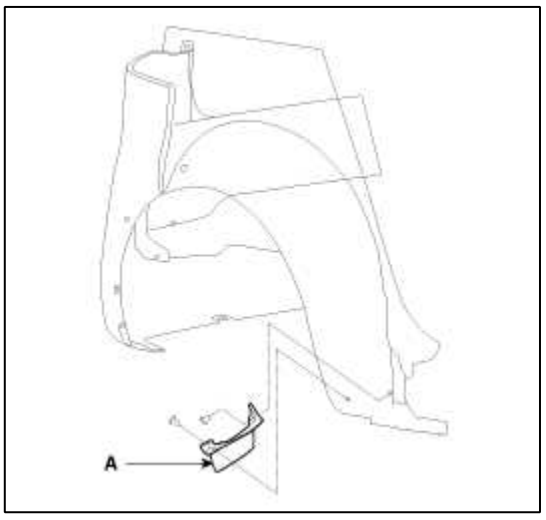
- Replace any damaged clips.

Rear Wheel Deflector 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.
- Take care not to scratch the body surface.

1. After loosening the mounting clips, then remove the rear wheel deflector (A).



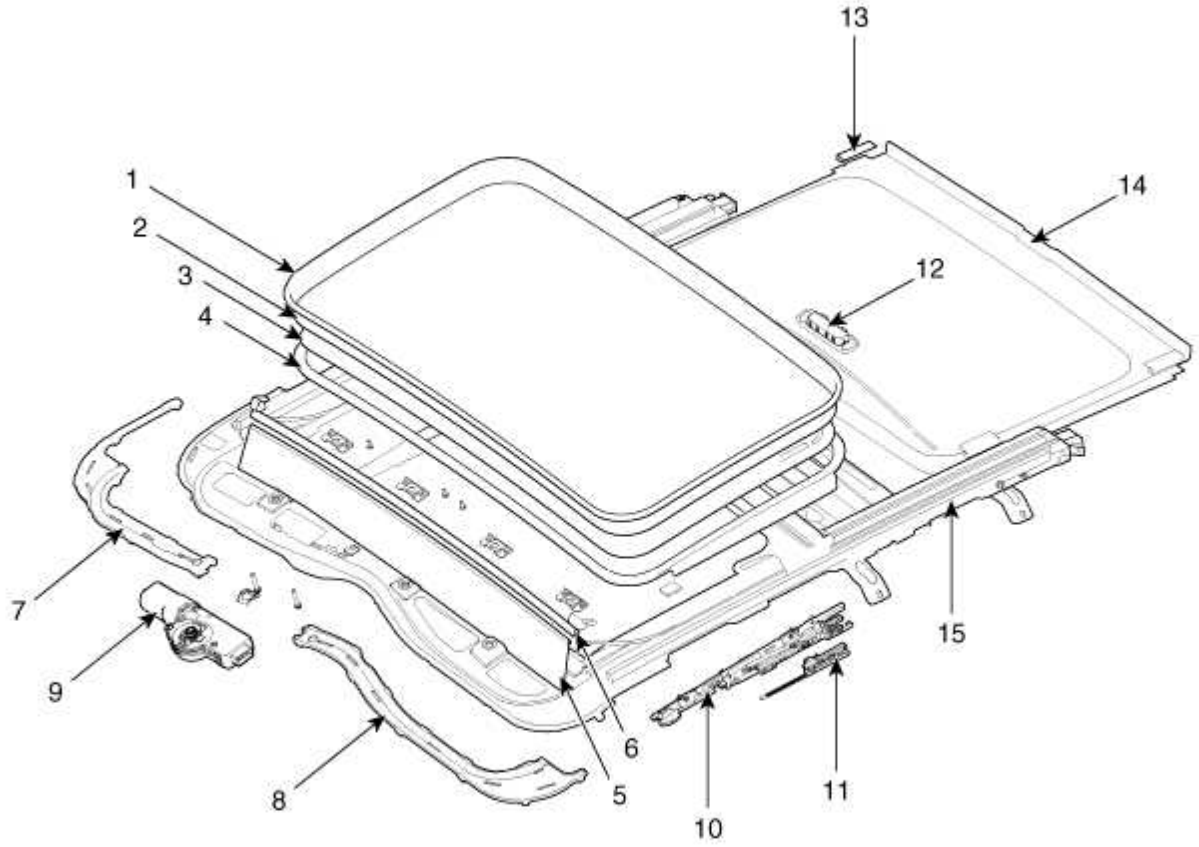
2. Installation is the reverse of removal.

NOTE

- Replace any damaged clips.

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

Components



1 . Glass panel assembly 2 . Glass panel 3 . Reinforcement glass 4 . Encapsulated glass panel 5 . Wind deflector net assembly 6 . Wind deflector beam 7 . Plate cover [RH] 8 . Plate cover [LH]	9 . Motor assembly 10 . Mechanism assembly 11 . Drive cable assembly 12 . Handle sunshade bracket 13 . Sunshade slide pad 14 . Sunshade assembly 15. Sunroof frame assembly

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

Replacement

Glass Replacement

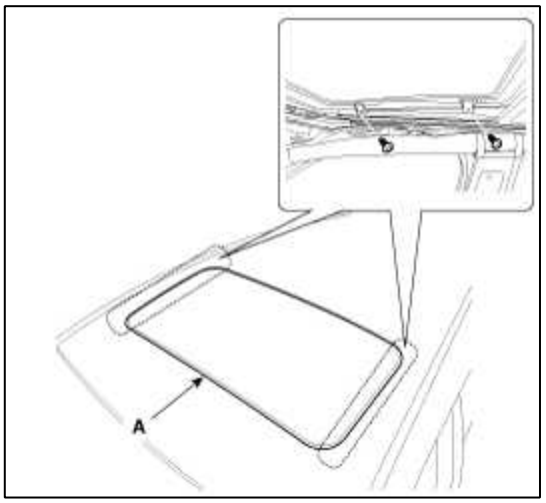
NOTE

- Put on glove to protect your hands.

1. Remove the glass (A) by lifting it up.

CAUTION

- Do not damage the roof panel.



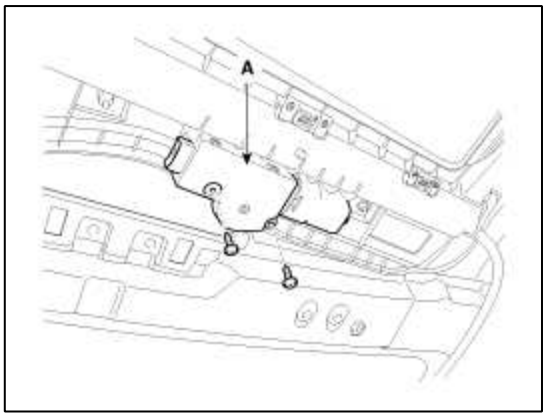
2. Installation is the reverse of removal.

Motor Replacement

CAUTION

- Confirm the position of guide whether it is closed or not when you remove the motor.

1. Remove the roof trim.
   (Refer to the BD group - "Roof Trim")
2. After loosening the mounting screws, then remove the motor assembly (A).



3. Installation is the reverse of removal.

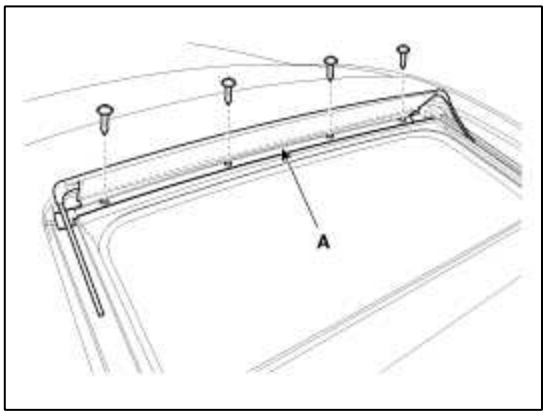
CAUTION

- Make sure to initialize the motor.

Deflector Replacement

1. Open the glass fully.

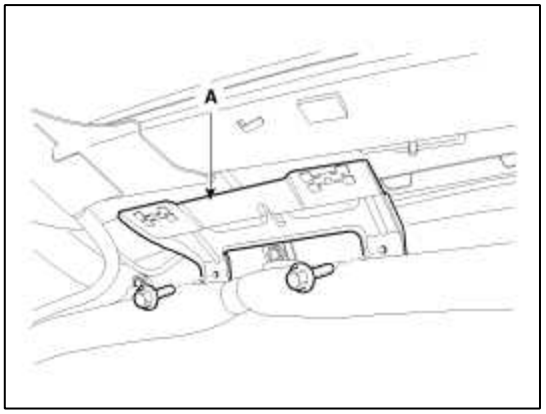
2. After loosening the mounting screws, then remove the deflector (A).



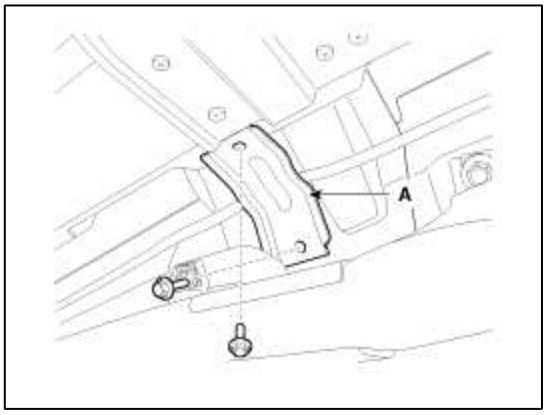
3. Installation is the reverse of removal.

Sunroof Assembly Replacement

1. Remove the follows parts :
   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. Sunroof glass.
2. After loosening the mounting bolts, then remove the assist handle bracket (A).



3. After loosening the mounting bolts, then remove the sunroof center bracket (A).



4. Disconnect the drain tubes (B).

5. After loosening the mounding bolts and nuts, remove the sunroof assembly (A).

Tightening torque:
(C) : 6.9 ~ 10.8 N.m (0.7 ~ 1.1 kgf.m, 5.1 ~ 8.0 lb-ft)
(D) : 3.9 ~ 5.9 N.m (0.4 ~ 0.6 kgf.m, 2.9 ~ 4.3 lb-ft)

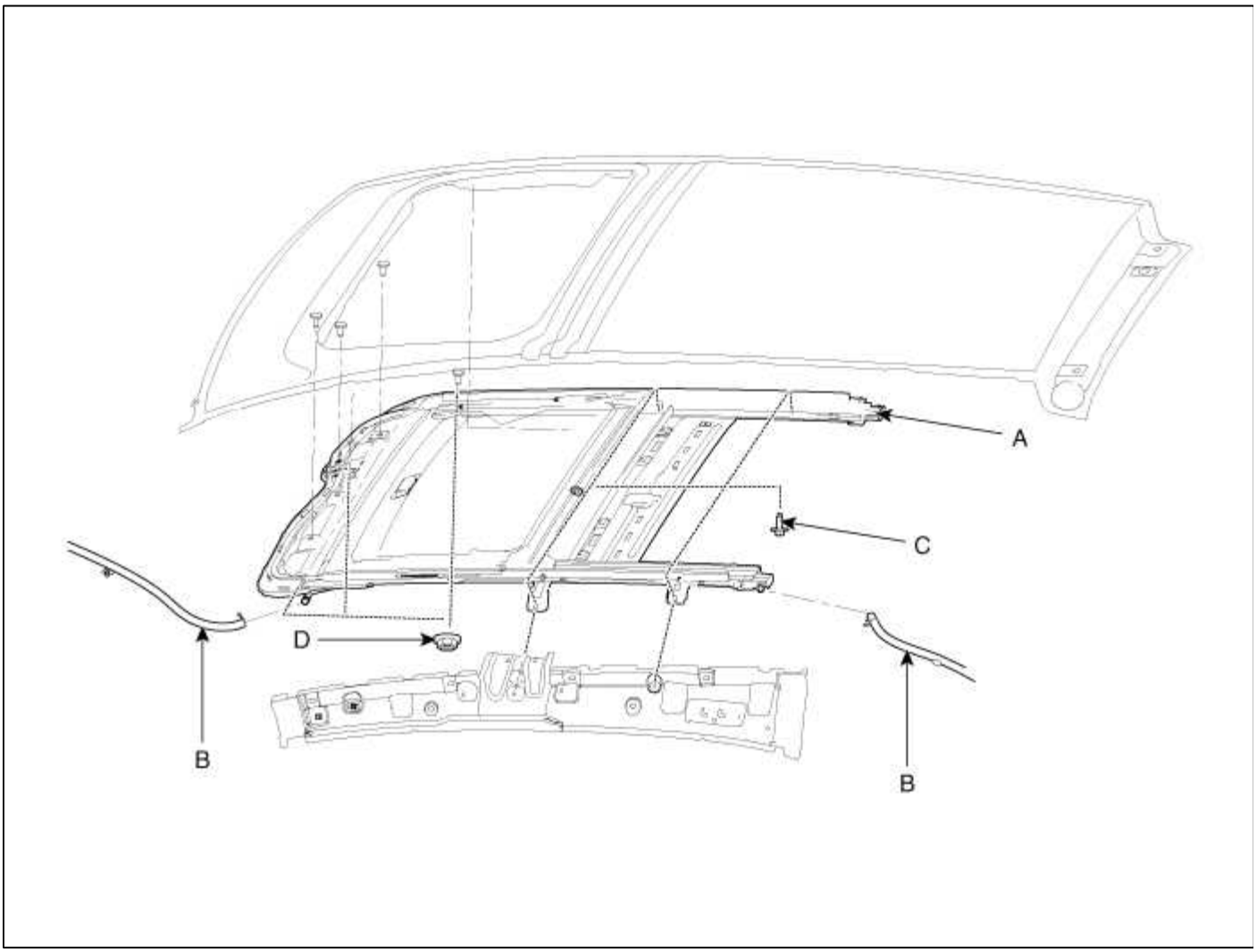
CAUTION

- Take care not to scratch the interior trims and other parts.

6. Installation is the reverse of removal.

CAUTION

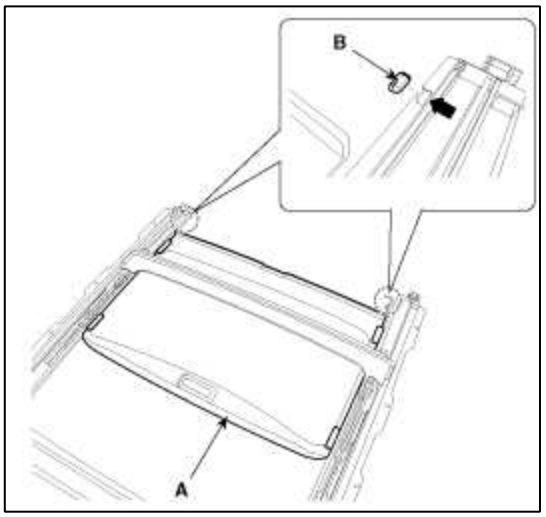
- Make sure to initialize the motor.



Sunshade Replacement

1. Remove the sunroof assembly.
2. Remove the sunshade stopper (B).

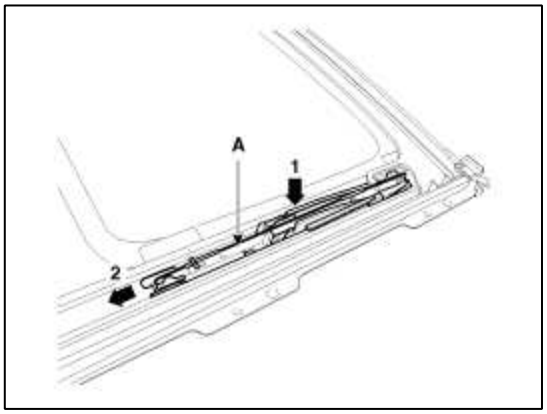
3. Remove the sunshade assembly (A).



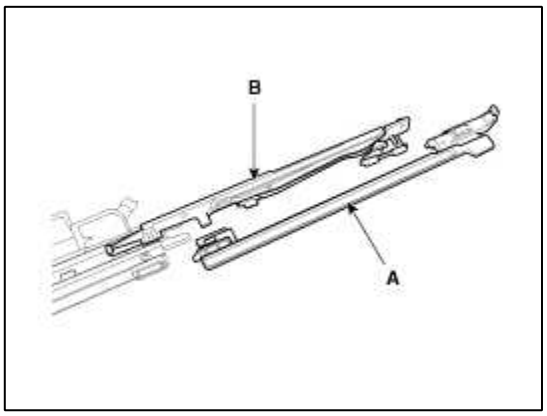
4. Installation is the reverse of removal.

Guide Assembly Replacement

1. Remove the sunroof assembly.
2. Remove a drip link assembly (A) after lowering a guide thoroughly by pushing a slide to rear.

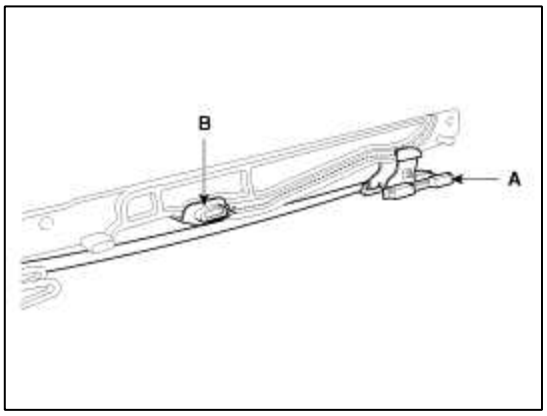


3. Remove the guide (A) and drip link (B).



4. Remove the drip link stopper (B).

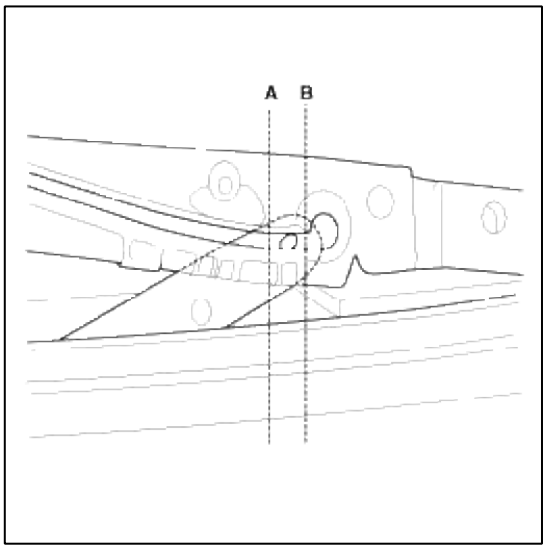
5. Remove the drip link assembly (A).



6. Installation is the reverse of removal.

CAUTION

- Make sure to align the slide with the center of "(A)" and "(B)"
- Make sure to initialize the motor.

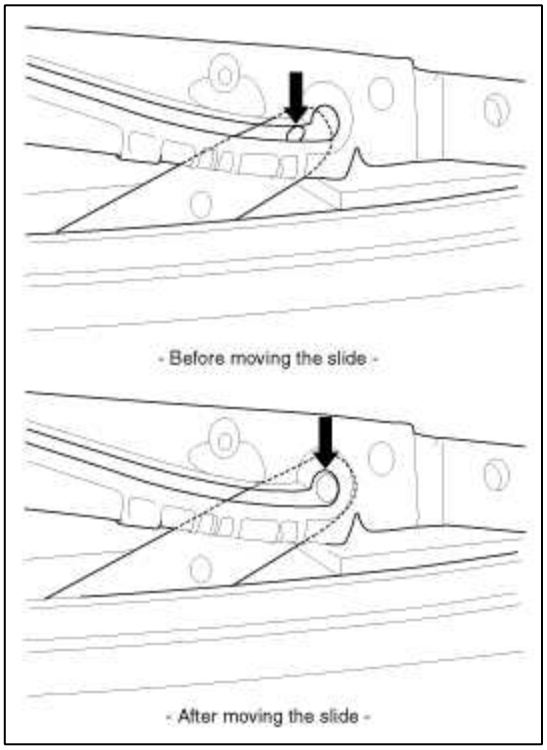


Adjustment

How To Initialize

1. Check that the glass has been installed.
   A. Finished height adjustment.

2. Push the close switch. (Keep on pushing the switch)
   A. Press and hold the CLOSE button for more than 10 seconds until the sunroof moves up to the tilt position.



3. Release the sunroof CLOSE button with in 3 seconds. And then press and hold the CLOSE button once again within 3 seconds until the sunroof do as follows;
   A. Tilt up → Slide Open → Slide Close
4. Then release the lever.
5. When the sunroof is closed completely, turn OFF the UP switch initialize the motor completely.

When To Initialize The Motor

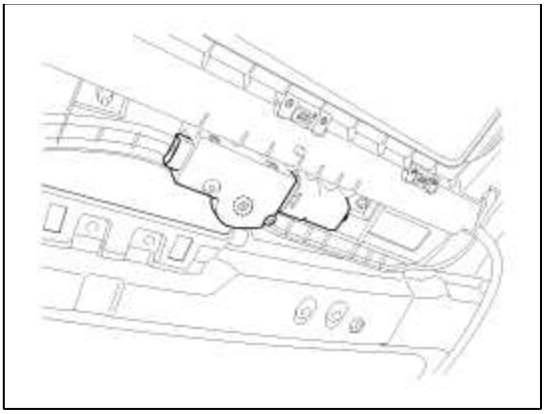
1. After initial vehicle assembly.
2. If the initial value is erased or damaged because of short power electric discharge during operation.
3. After using the manual handle.

Operating The Sunroof Emergency Handle

1. Use the sunroof emergency handle to close or open the sunroof manually if the sunroof cannot be closed electronically due to motor or controller electrical malfunction.
2. Operating method.
   A. Remove the roof trim.
   B. Push the emergency handle up into the hexagonal drive (A) of the sunroof motor. You must push hard enough to disengage the motor clutch; otherwise the emergency handle will slip due to incomplete fit in the motor.
   C. Carefully turn the emergency handle clockwise to close the sunroof.
   D. After closing the sunroof, wiggle the handle back and forth as you remove the tool from the motor, to ensure the motor clutch reengages.
   E. A 5mm hex socket may be used in place of the emergency handle, with a" Speeder" type handle.

CAUTION

- Do not use power tools to operate the sunroof.
- Damage to the components may occur.



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

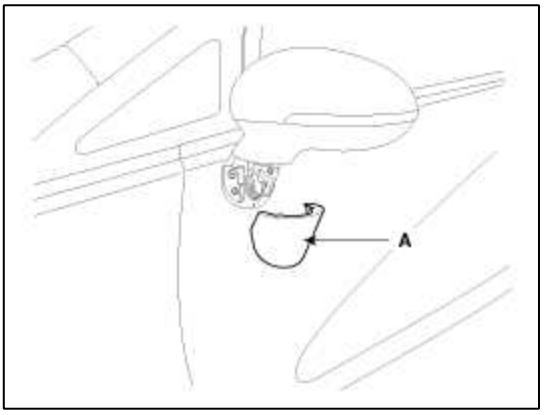
Replacement

Outside Rear View Mirror Replacement

CAUTION

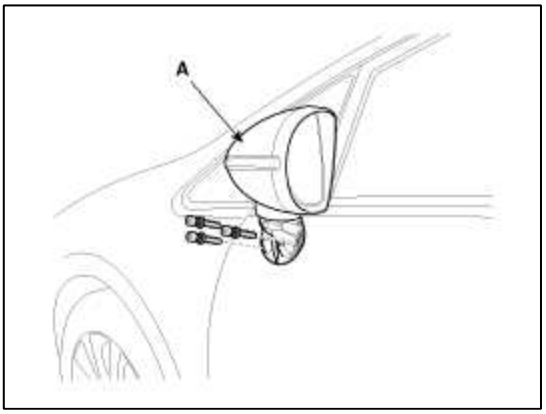
- When prying with a flat-tip screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.

1. Using a screwdriver or remover, remove the outside rear view mirror cover (A).

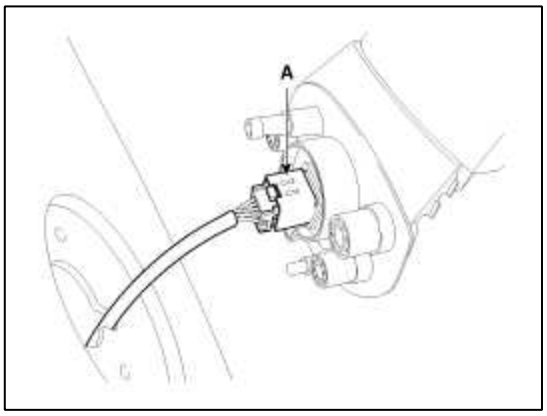


2. After loosening the mounting bolts, then remove the outside rear view mirror (A).

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



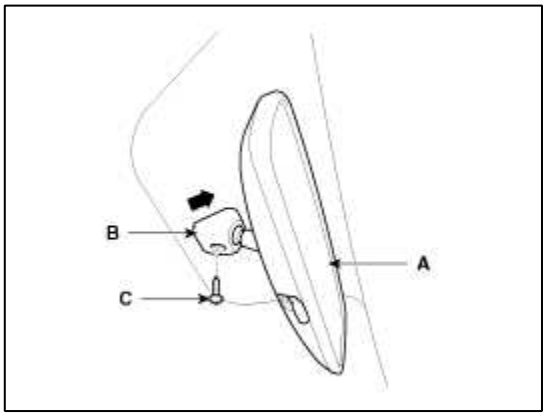
3. Disconnect the outside rear view mirror connector (A).



4. Installation is the reverse of removal.

Inside Rear view Mirror Replacement

1. Loosen the mounting screw (C).
2. Push the inside rear view mirror base (B) up to remove to inside rear view mirror assembly (A).



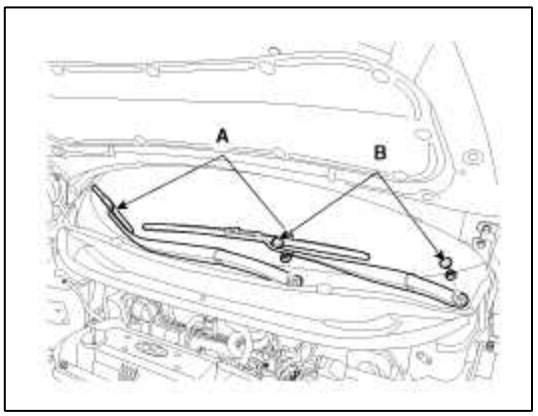
3. Installation is the reverse of removal.

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

Replacement

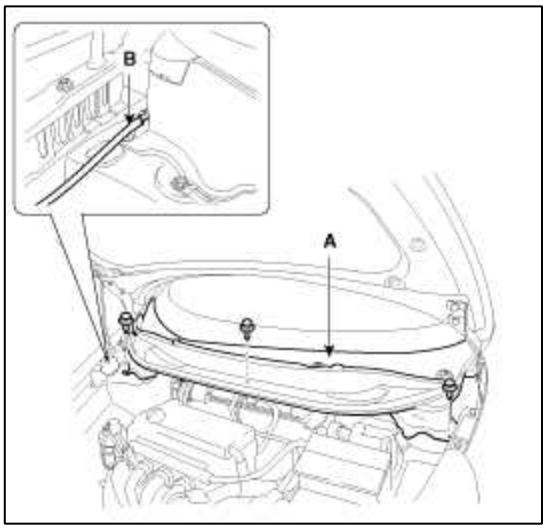
1. Remove the wiper arm cover (B).
2. After loosening the mounting nuts, then remove the wiper arm (A).

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).



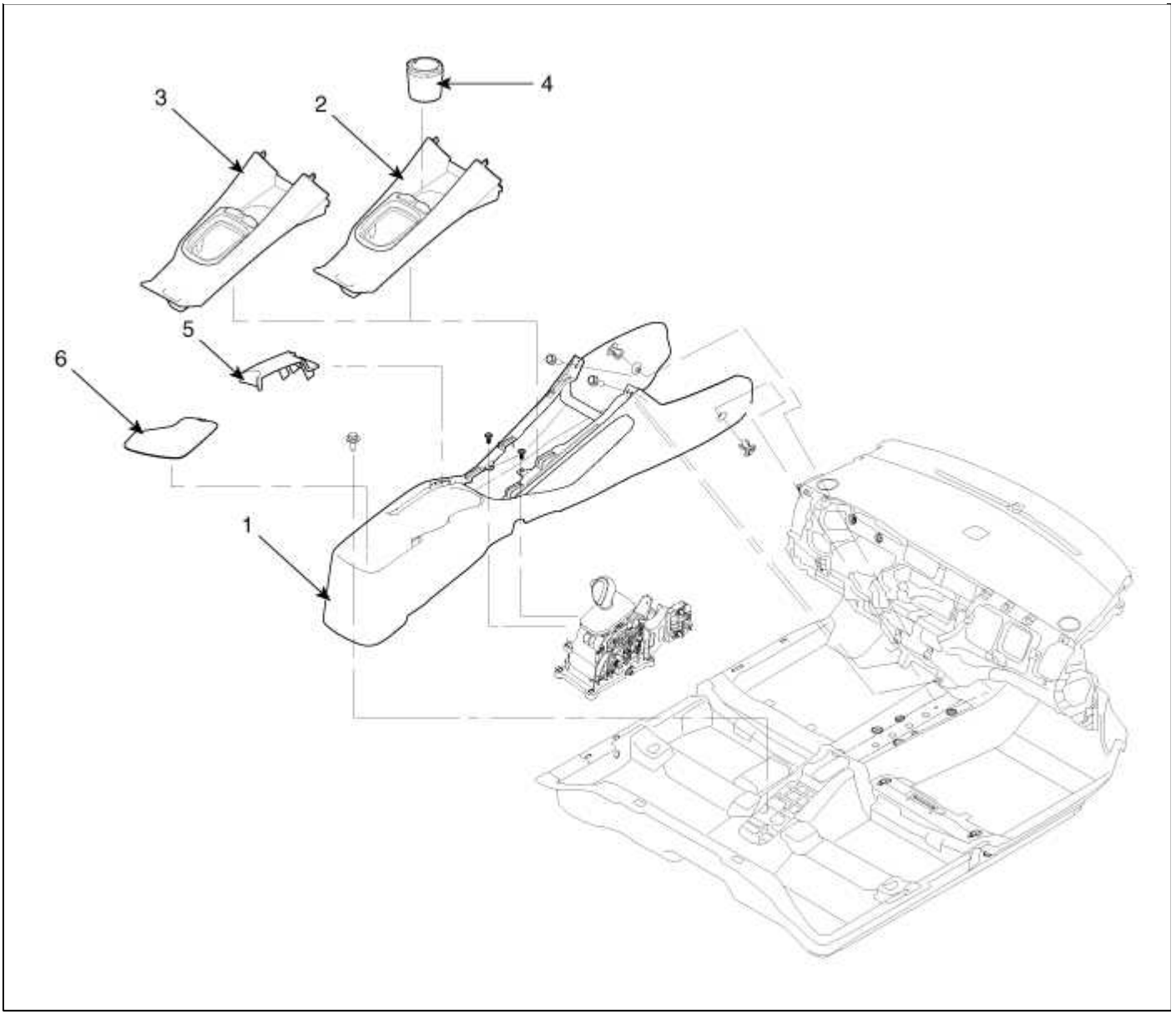
5. Installation is the reverse of removal.

NOTE

- Replace any damage clips.

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

Components



1 . Floor console assembly 2 . Console upper cover [M/T] 3 . Console upper cover [A/T]	4. Potable ash tray 5 . Parking brake cover 6 . Floor console pad

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

Replacement

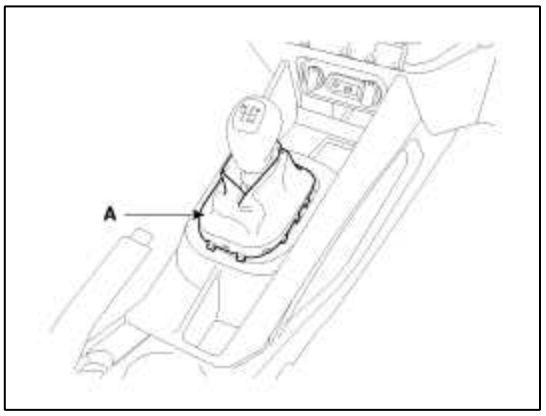
Floor Console Replacement

[M/T]

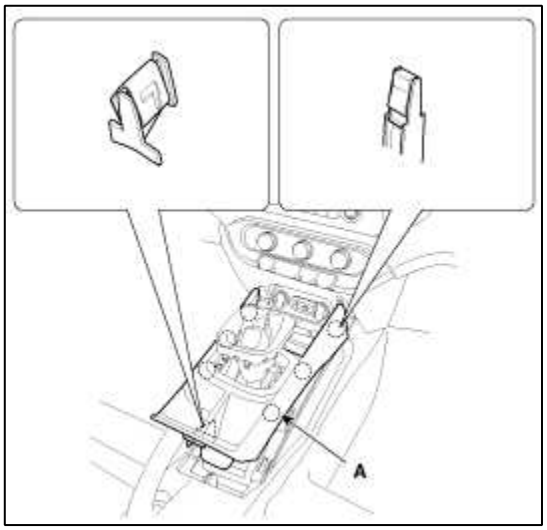
CAUTION

- A plastic trim tool is recommended, but if prying with a screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.

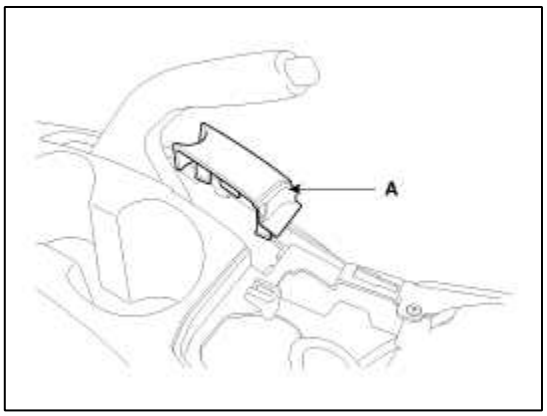
1. Using a screwdriver or remover, remove the gear boots (A).



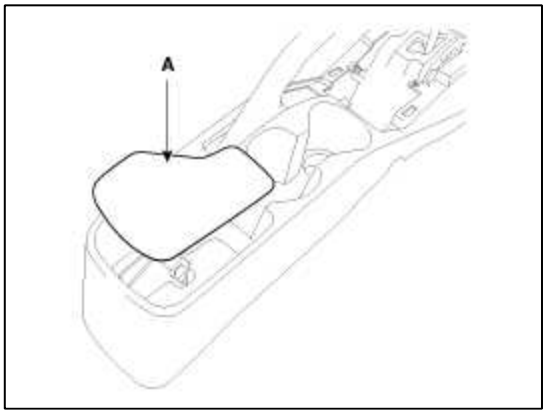
2. Using a screwdriver or remover, remove the console upper cover (A).



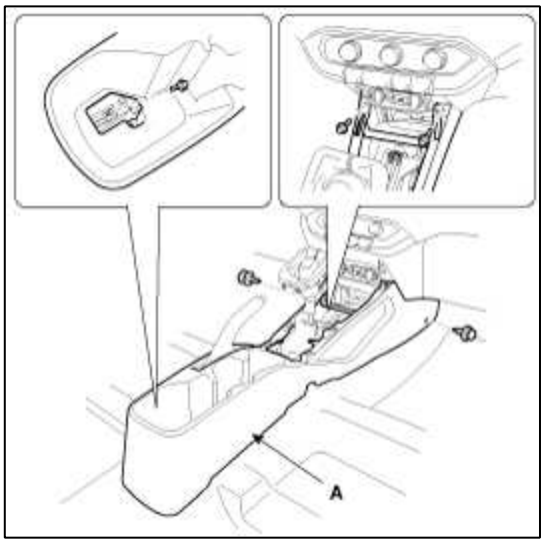
3. Using a screwdriver or remover, remove the parking brake cover (A).



4. Remove the floor console pad (A).



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



6. Installation is the reverse of removal.

NOTE

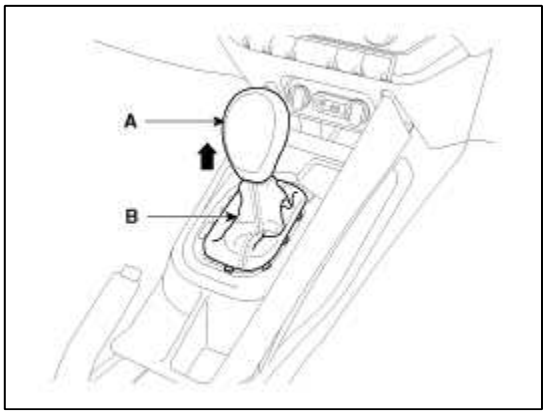
- Make sure the connector are connected in properly.
- Replace any damage clips.

[A/T]

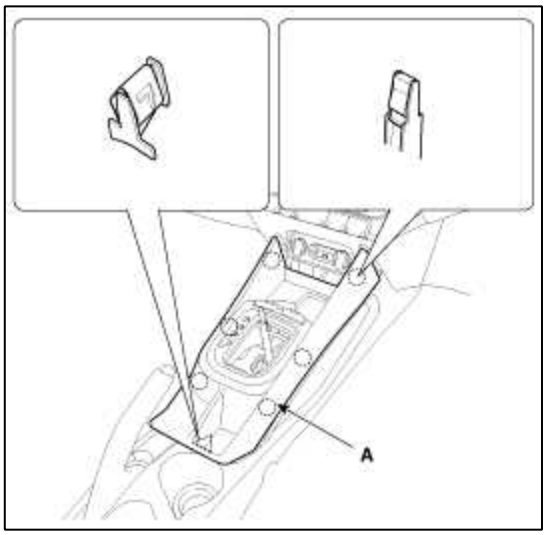
CAUTION

- A plastic trim tool is recommended, but if prying with a screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.

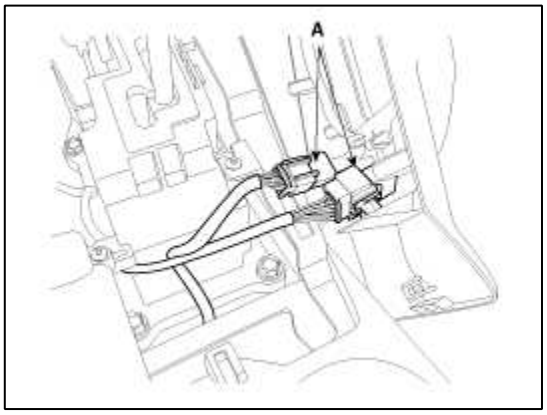
1. Using a screwdirver or remover, remove the gear boots (B) and gear knob (A).



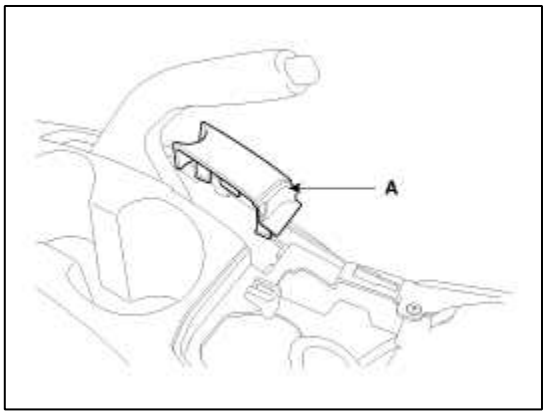
2. Using a screwdriver or remover, remove the console upper cover (A).



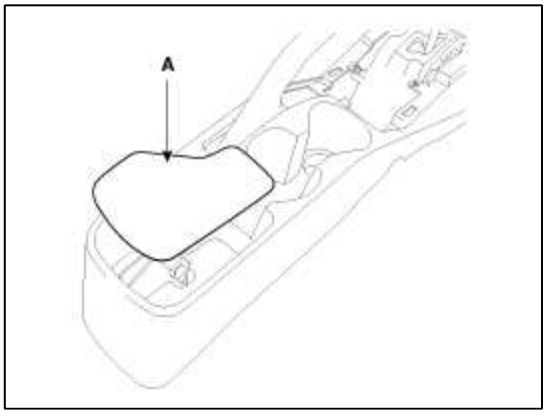
3. Disconnect the connectors (A).



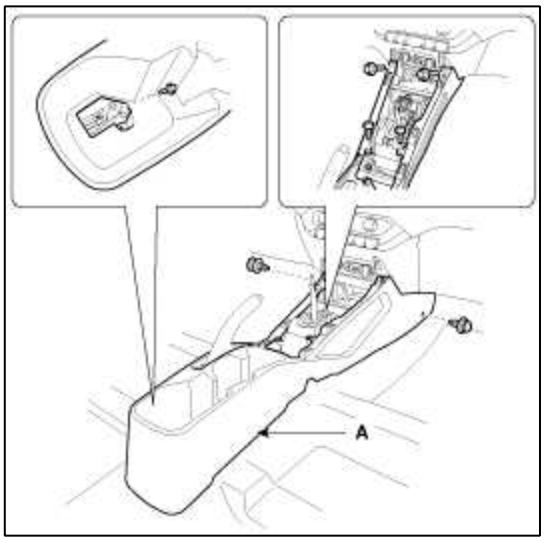
4. Using a screwdriver or remover, remove the parking brake cover (A).



5. Remove the floor console pad (A).



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



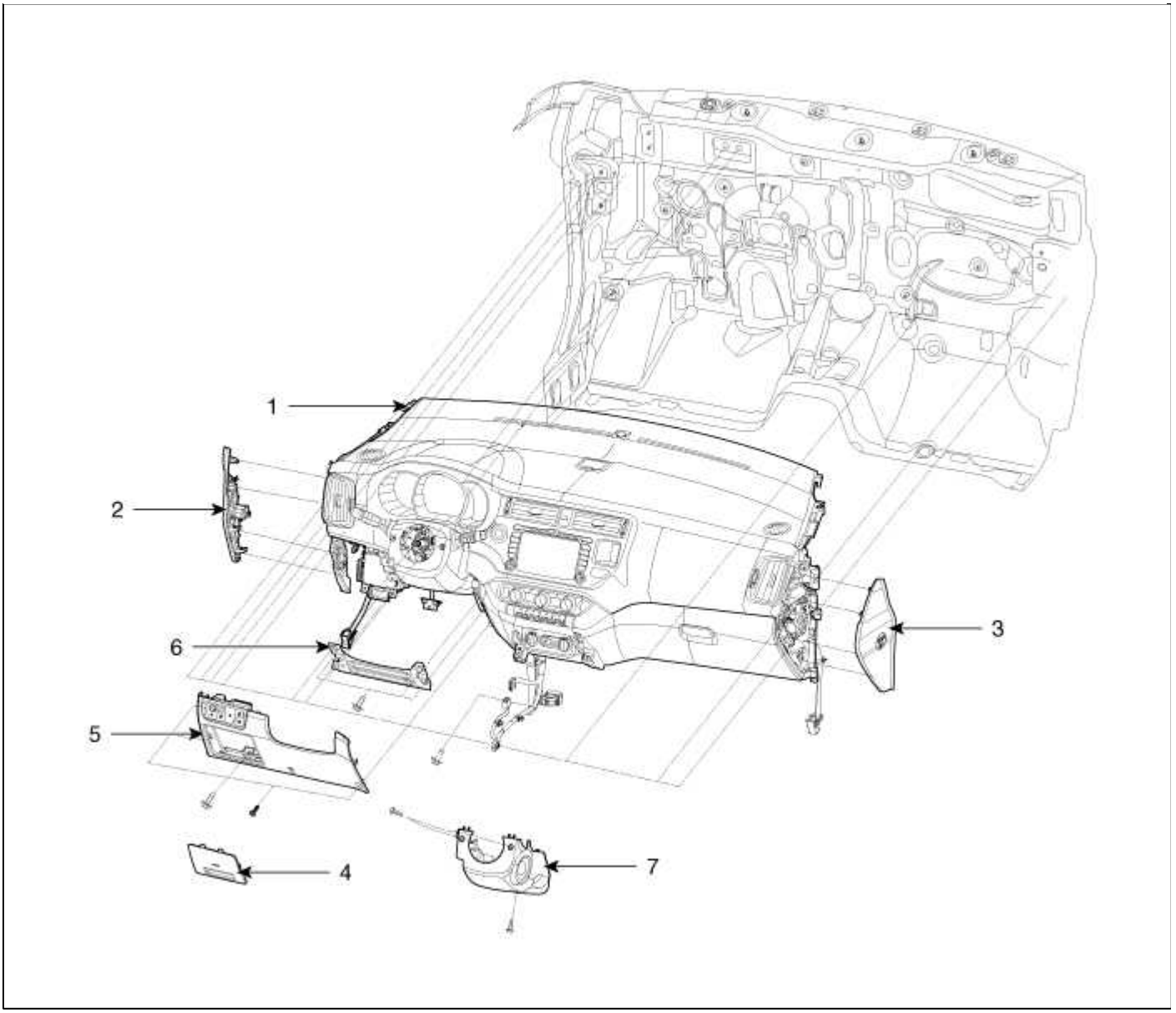
7. Installation is the reverse of removal.

NOTE

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

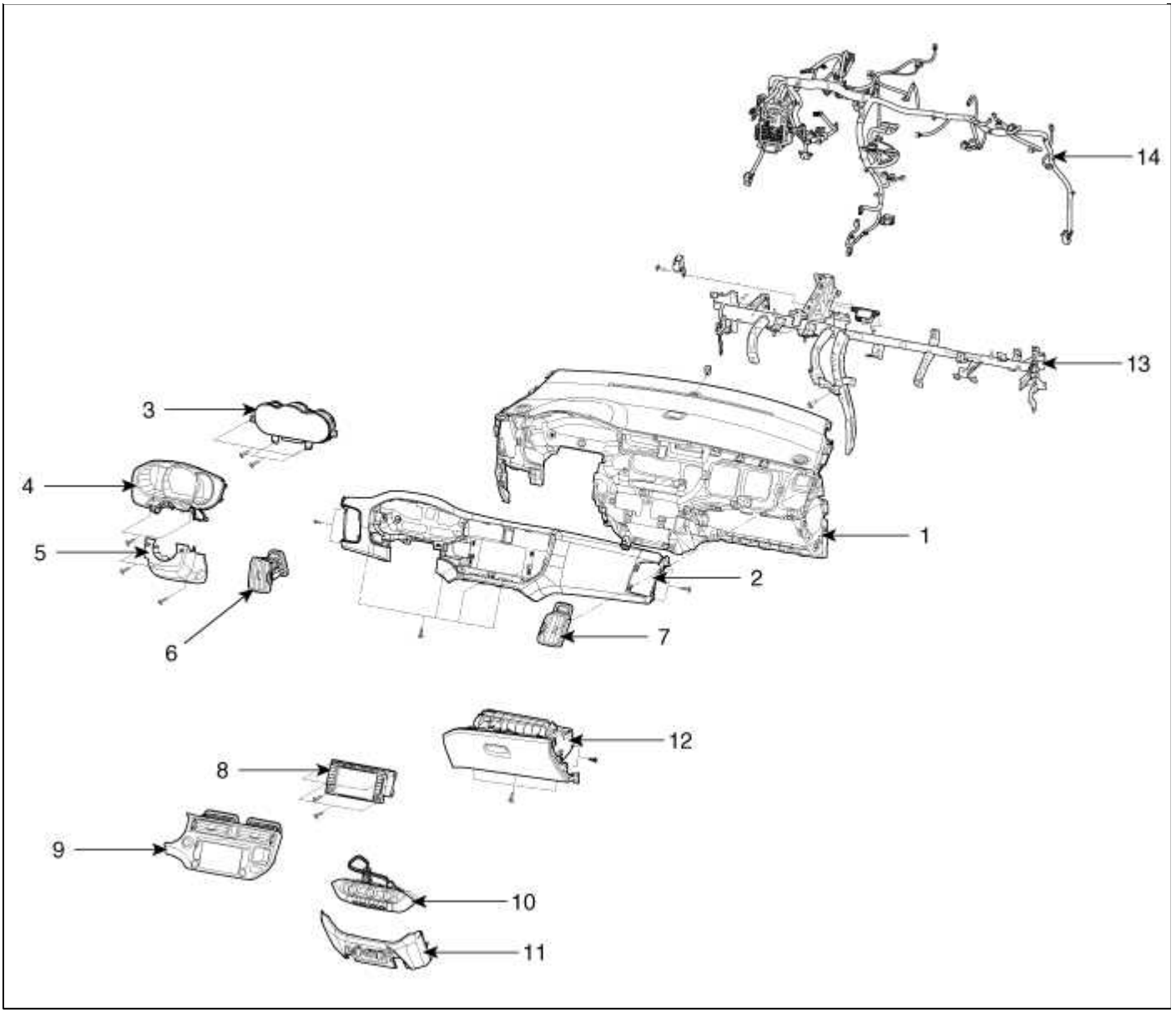
Body (Interior and Exterior) > Interior > Crash Pad > Components and Components Location

Components (1)



1 . Main crash pad assembly	5 . Crash pad lower panel
2 . Crash pad side cover [LH]	6 . Knee bolster panel
3 . Crash pad side cover [RH]	7 . Steering column lower shroud
4 . Fuse box cover	

Components (2)



1 . Main crash pad cover	8 . Audio assembly
2 . Crash pad upper panel	9 . Center fascia panel
3 . Cluster assembly	10 . Heater control unit
4 . Cluster fascia panel	11 . Crash pad center panel
5 . Steering column lower Shroud	12 . Glove box
	13 . Cowl cross bar assembly
6 . Side air vent duct [LH]	14 . Main wiring harness
7 . Side air vent duct [RH]	

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

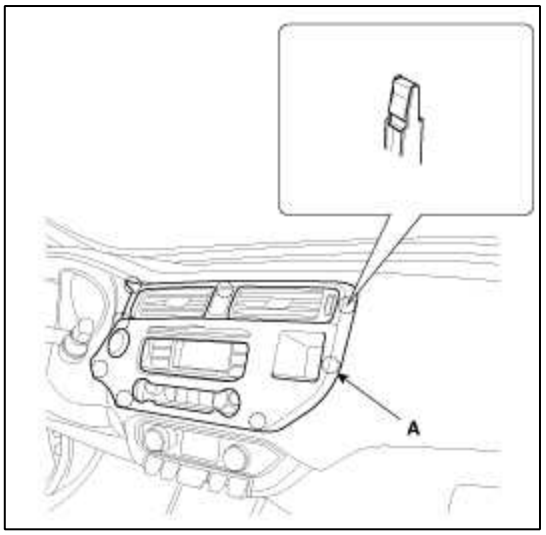
Replacement

Cluster Replacement

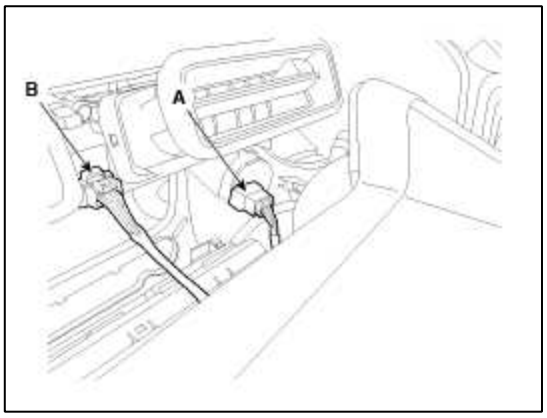
CAUTION

- A plastic trim tool is recommended, but if prying with a screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Take care not to bend or scratch the trim and panels.
- Put on gloves to protect your hands.

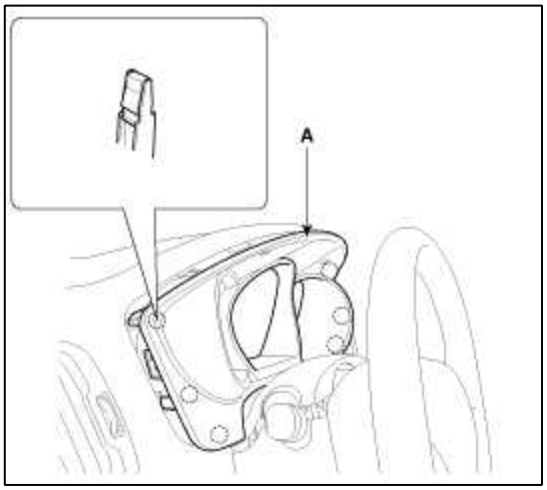
1. Using a screwdriver or remover, remove the center fascia panel (A).



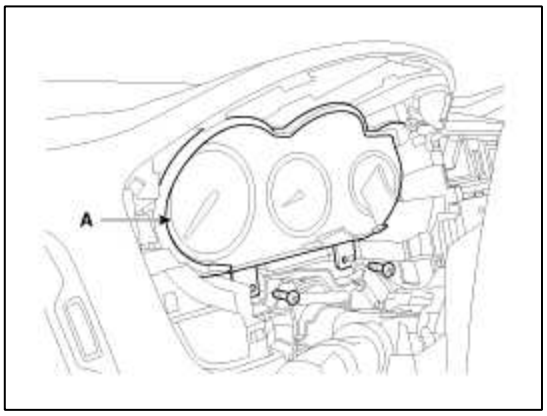
2. Disconnect the start/stop button connector (A) and hazard switch connector (B).



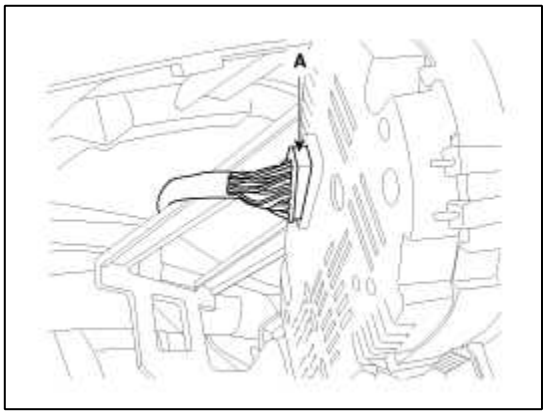
3. Using a screwdriver or remover, remove the cluster fascia panel (A).



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



5. Disconnect the cluster connector (A).



6. Installation is the reverse of removal.

NOTE

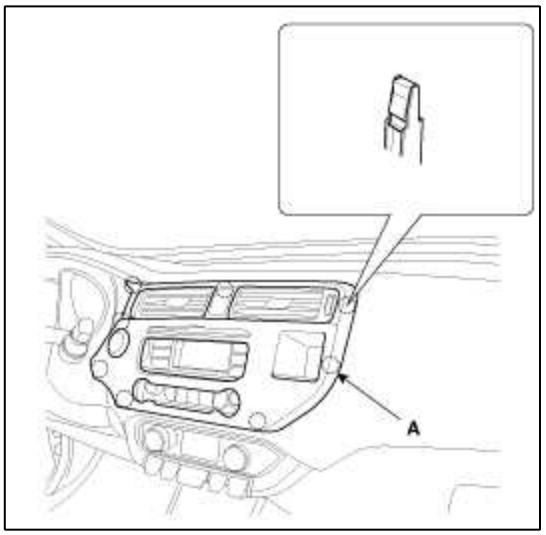
- Make sure the connectors are connected in properly.
- Replace any damage clips.

Center Fascia Panel Replacement

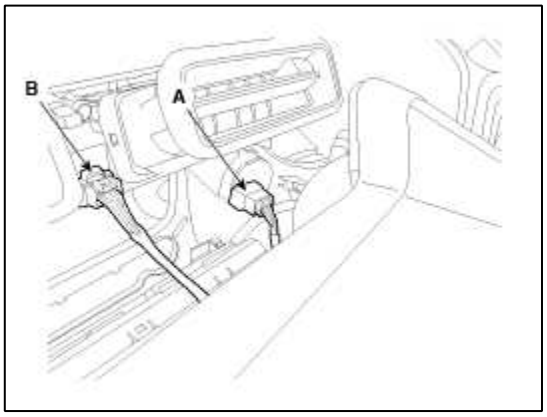
CAUTION

- A plastic trim tool is recommended, but if prying with a screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Take care not to bend or scratch the trim and panels.
- Put on gloves to protect your hands.

1. Using a screwdriver or remover, remove the center fascia panel (A).



2. Disconnect the start/stop button connector (A) and hazard switch connector (B).



3. Installation is the reverse of removal.

NOTE

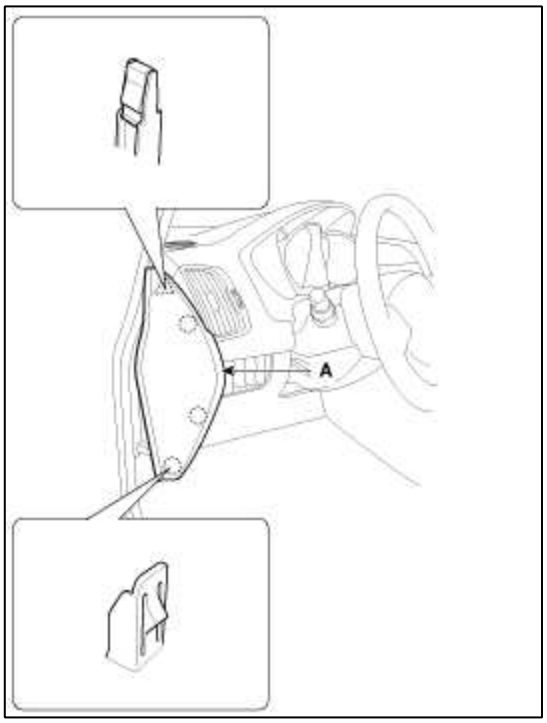
- Make sure the connector are connected in properly.
- Replace any damage clips.

Crash Pad Lower Panel Replacement

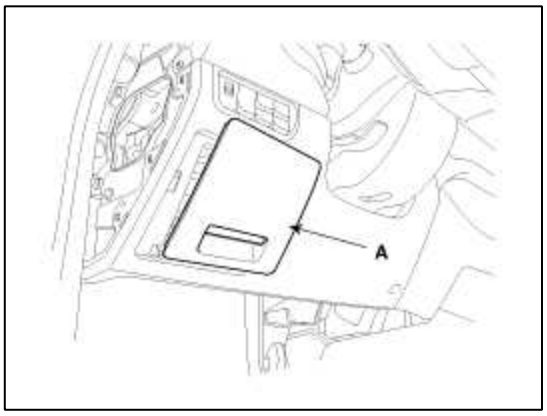
CAUTION

- A plastic trim tool is recommended, but if prying with a screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Take care not to bend or scratch the trim and panels.
- Put on gloves to protect your hands.

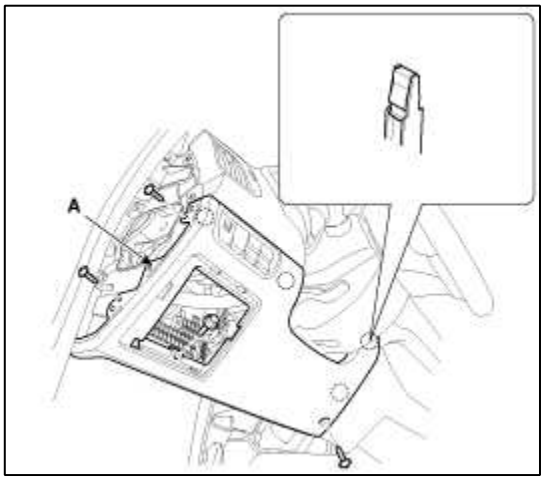
1. Using a screwdriver or remover, remove the crash pad side cover (A).



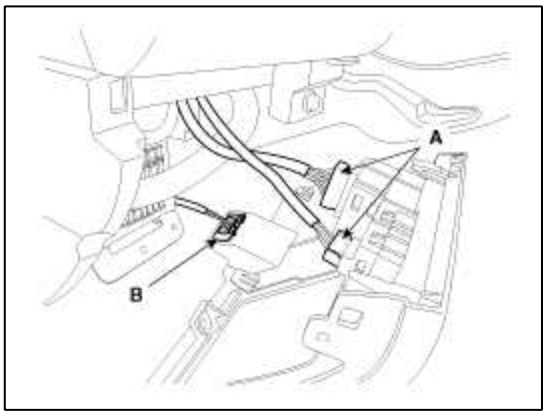
2. Using a screwdriver or remover, remove the fuse box cover (A).



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



4. Disconnect the connectors (A) and diagnosis connector (B).



5. Installation is the reverse of removal.

NOTE

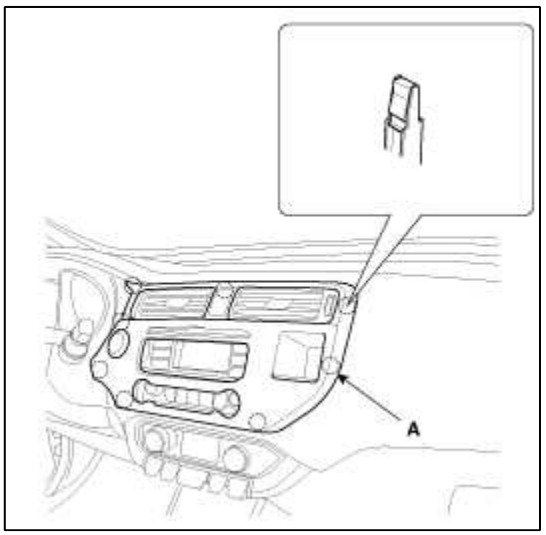
- Make sure the connectors are connected in properly.
- Replace any damage clips.

Audio assembly Replacement

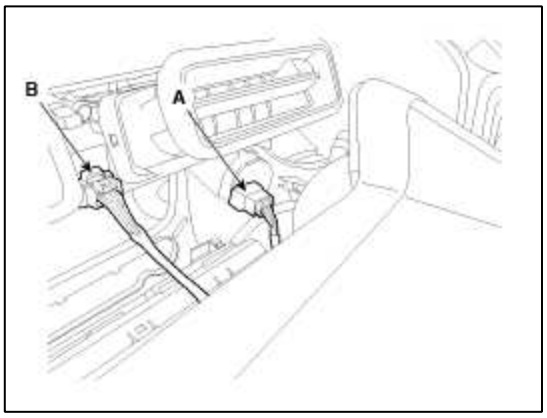
CAUTION

- A plastic trim tool is recommended, but if prying with a screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Take care not to bend or scratch the trim and panels.
- Put on gloves to protect your hands.

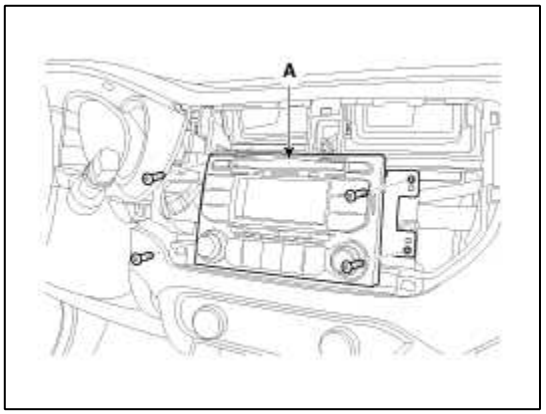
1. Using a screwdriver or remover, remove the center fascia panel (A).



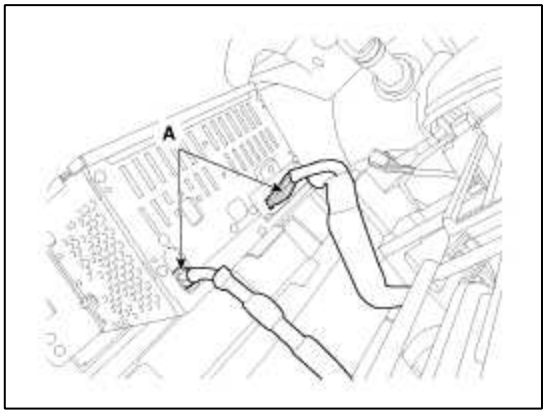
2. Disconnect the start/stop button connector (A) and hazard switch connector (B).



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



4. Disconnect the connectors (A).



5. Installation is the reverse of removal.

NOTE

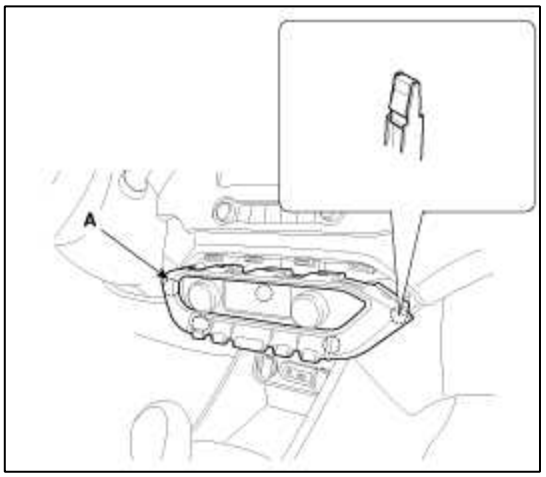
- Make sure the connectors are connected in properly.
- Replace any damaged clips.

Heater Control Unit Replacement

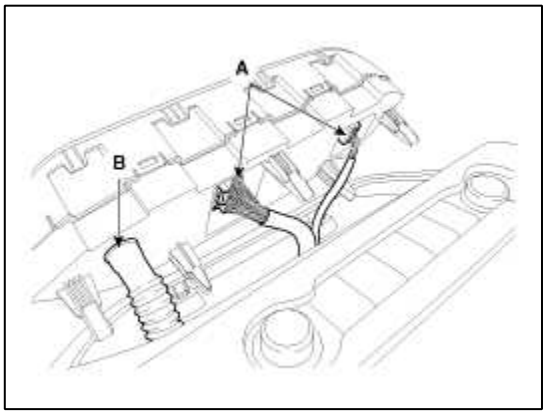
CAUTION

- A plastic trim tool is recommended, but if prying with a screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Take care not to bend or scratch the trim and panels.
- Put on gloves to protect your hands.

1. Using a screwdriver or remover, remove the heater control unit (A).



2. Disconnect the connectors (A) and hose (B).



3. Installation is the reverse of removal.

NOTE

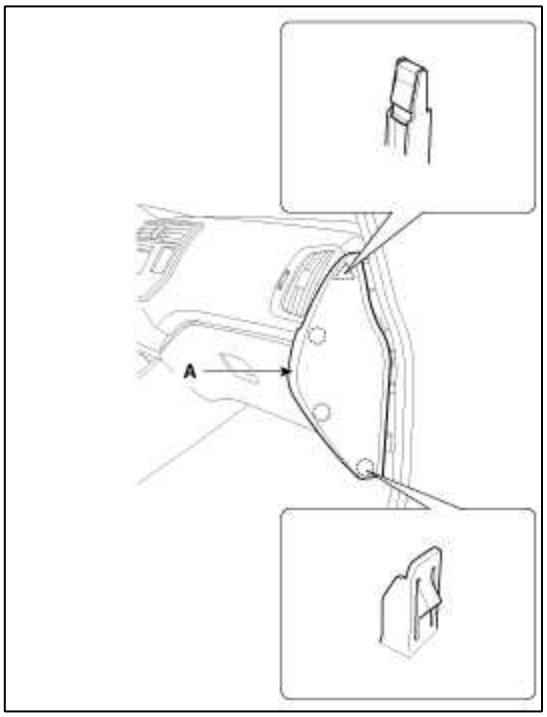
- Make sure the connectors are connected in properly.
- Replace any damaged clips.

Glove Box Replacement

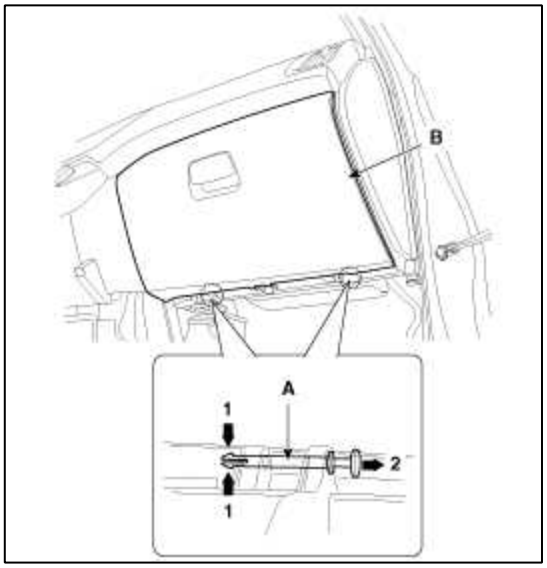
CAUTION

- A plastic trim tool is recommended, but if prying with a screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Take care not to bend or scratch the trim and panels.
- Put on gloves to protect your hands.

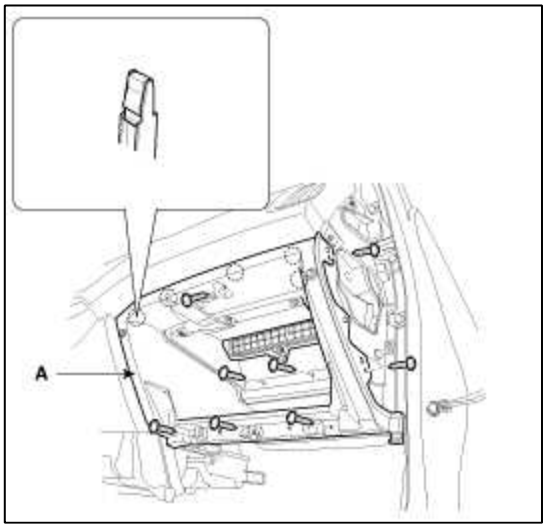
1. Using a screwdriver or remover, remove the crash pad side cover (A).



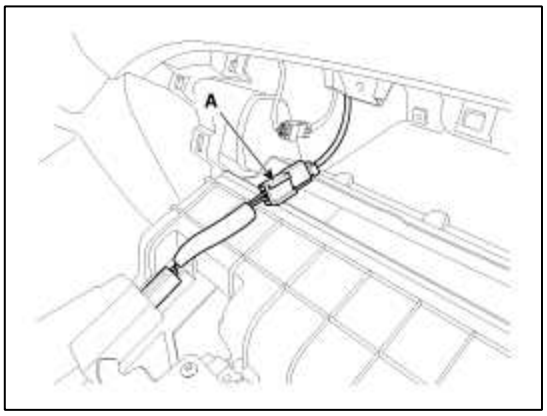
2. Disconnect the pins (A) and then remove the glove box (B).



3. After loosening the mounting screws, then remove the glove box housing (A).



4. Disconnect the glove box lamp connector (A).



5. Installation is the reverse of removal.

NOTE

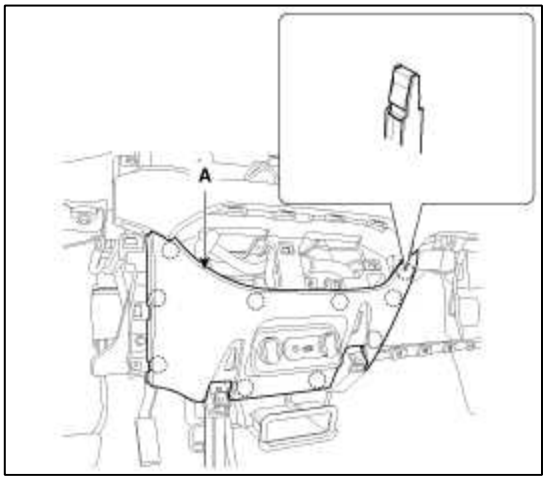
- Make sure the connectors are connected in properly.
- Replace any damage clips.

Crash Pad Center Panel Replacement

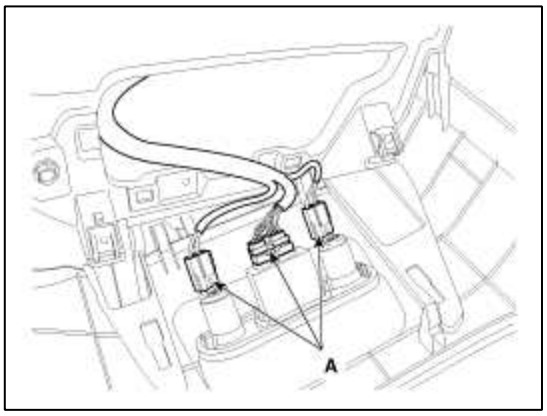
CAUTION

- A plastic trim tool is recommended, but if prying with a screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Take care not to bend or scratch the trim and panels.
- Put on gloves to protect your hands.

1. Remove the following items :
   A. Floor console assembly
      (Refer to the BD group – “Console”)
   B. Crash pad side cover [LH, RH]
   C. Crash pad lower panel
   D. Glove box & Glove box housing
   E. Heater control unit
2. Using a screwdriver or remover, remove the crash pad center panel (A).



3. Disconnect the connectors (A).



4. Installation is the reverse of removal.

NOTE

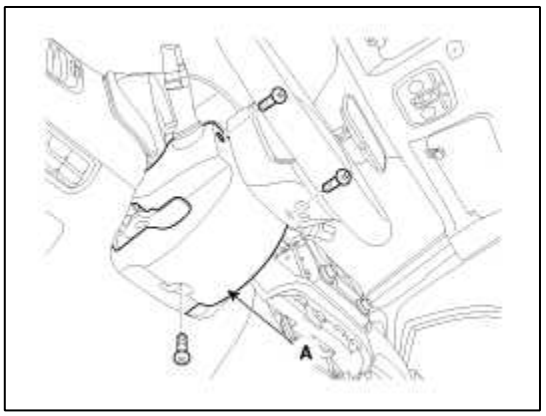
- Make sure the connectors are connected in properly.
- Replace any damage clips.

Steering Column Lower Shroud Assembly Replacement

CAUTION

- A plastic trim tool is recommended, but if prying with a screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Take care not to bend or scratch the trim and panels.
- Put on gloves to protect your hands.

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



2. Installation is the reverse of removal.

NOTE

- Replace any damage clips.

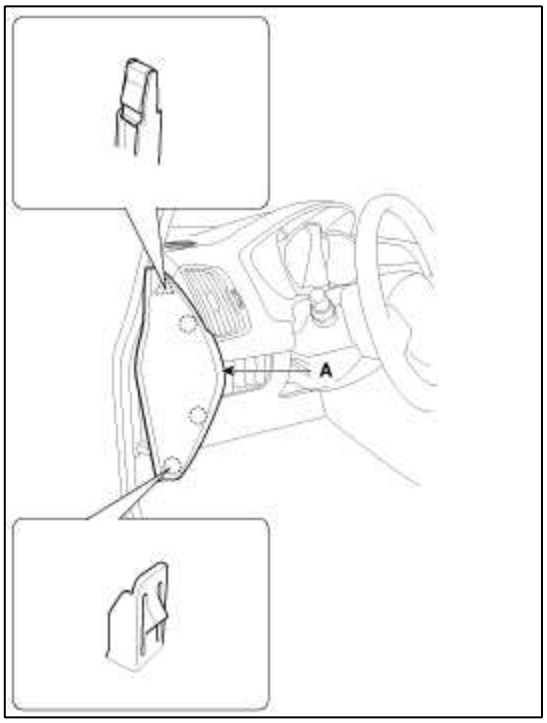
Crash Pad Side Cover Replacement

CAUTION

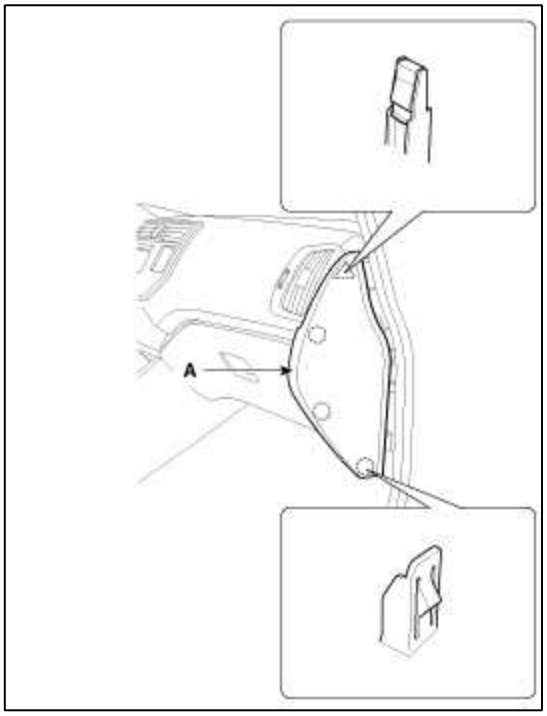
- A plastic trim tool is recommended, but if prying with a screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Take care not to bend or scratch the trim and panels.
- Put on gloves to protect your hands.

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

[Driver's]



[Passenger's]



2. Installation is the reverse of removal.

NOTE

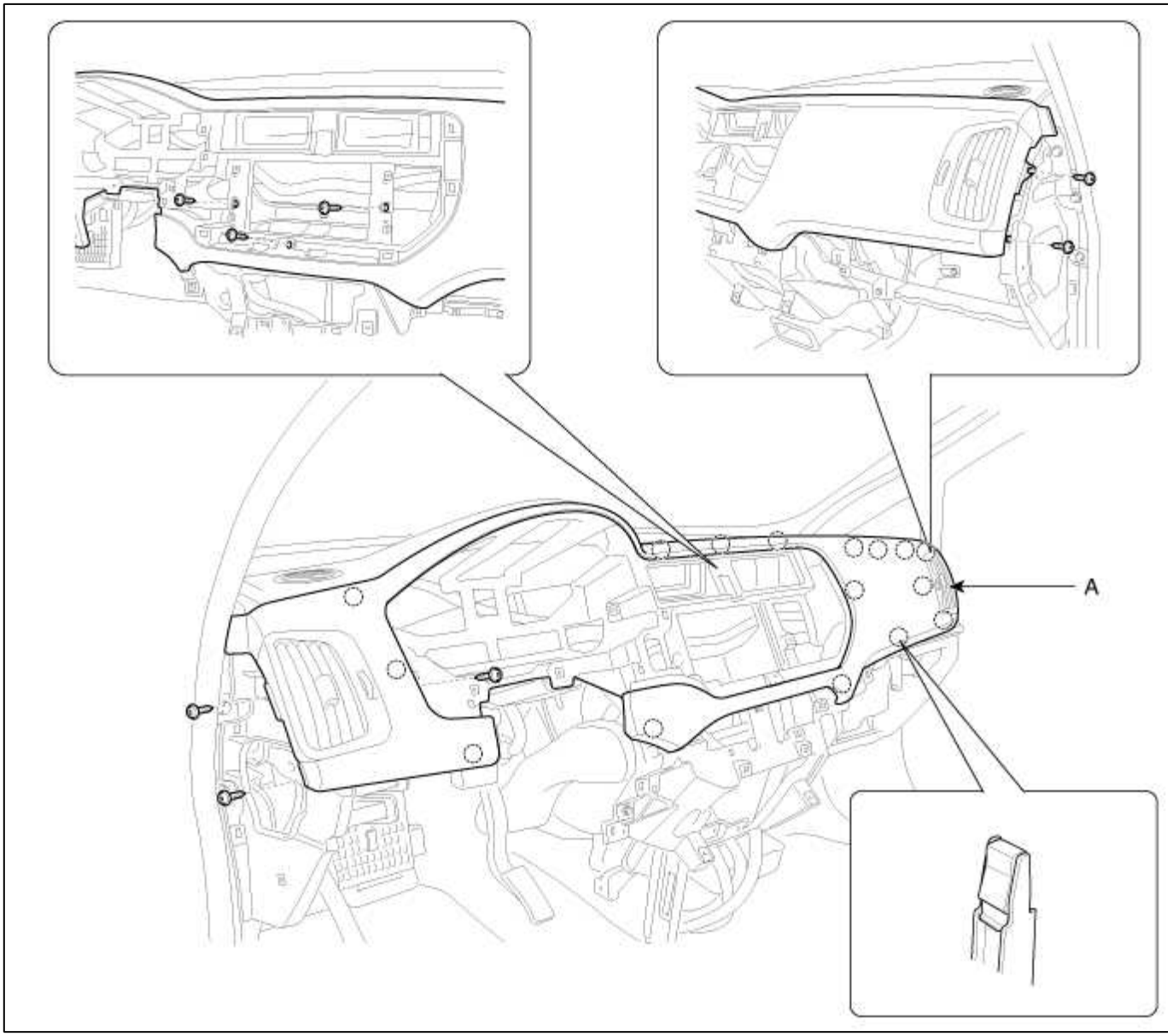
- Replace any damaged clips.

Crash Pad Upper Panel Replacement

CAUTION

- A plastic trim tool is recommended, but if prying with a screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Take care not to bend or scratch the trim and panels.
- Put on gloves to protect your hands.

1. Remove the following items :
   A. Center fascia panel
   B. Audio assembly
   C. Cluster fascia panel
   D. Cluster assembly
   E. Crash pad side cover [LH, RH]
   F. Crash pad lower panel
   G. Glove box & Glove box housing
   H. Heater control unit
2. After loosening the mounting screws, then remove the crash pad upper panel (A).



3. Installation is the reverse of removal.

NOTE

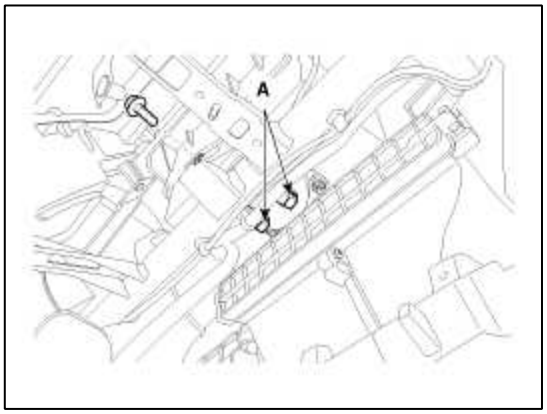
- Make sure the connectors are connected in properly.
- Replace any damage clips.

Main Crash Pad Replacement

CAUTION

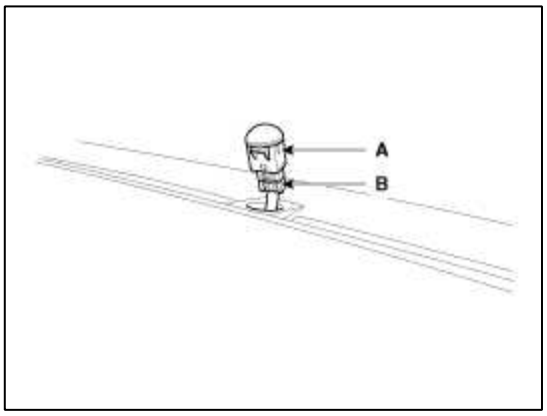
- A plastic trim tool is recommended, but if prying with a screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Take care not to bend or scratch the trim and panels.
- Put on gloves to protect your hands.

1. Remove the following items :
   A. Front seat
      (Refer to the BD group - "Front Seat")
   B. Front pillar trim
      (Refer to the BD group – “Interior Trim”)
   C. Floor console assembly
      (Refer to the BD group - "Console")
   D. Front door scuff trim
      (Refer to the BD group – “Interior Trim”)
   E. Cowl side trim
      (Refer to the BD group – “Interior Trim”)
   F. Center fascia panel
   G. Audio assembly
   H. Cluster fascia panel
   I. Cluster assembly
   J. Crash pad side cover [LH, RH]
   K. Crash pad lower panel
   L. Glove box & Glove box housing
   M. Heater control unit
   N. Steering column lower shroud & Steering column upper shroud
   O. Crash pad center panel
   P. Crash pad upper panel
2. Disconnect the steering column connectors.
   (Refer to the ST group - "Steering Column and Shaft")
3. Down the steering column after loosening the mounting bolts.
   (Refer to the ST group - "Steering Column and Shaft")
4. Disconnect the passenger`s airbag connectors (A).
5. Loosen the mounting bolt.

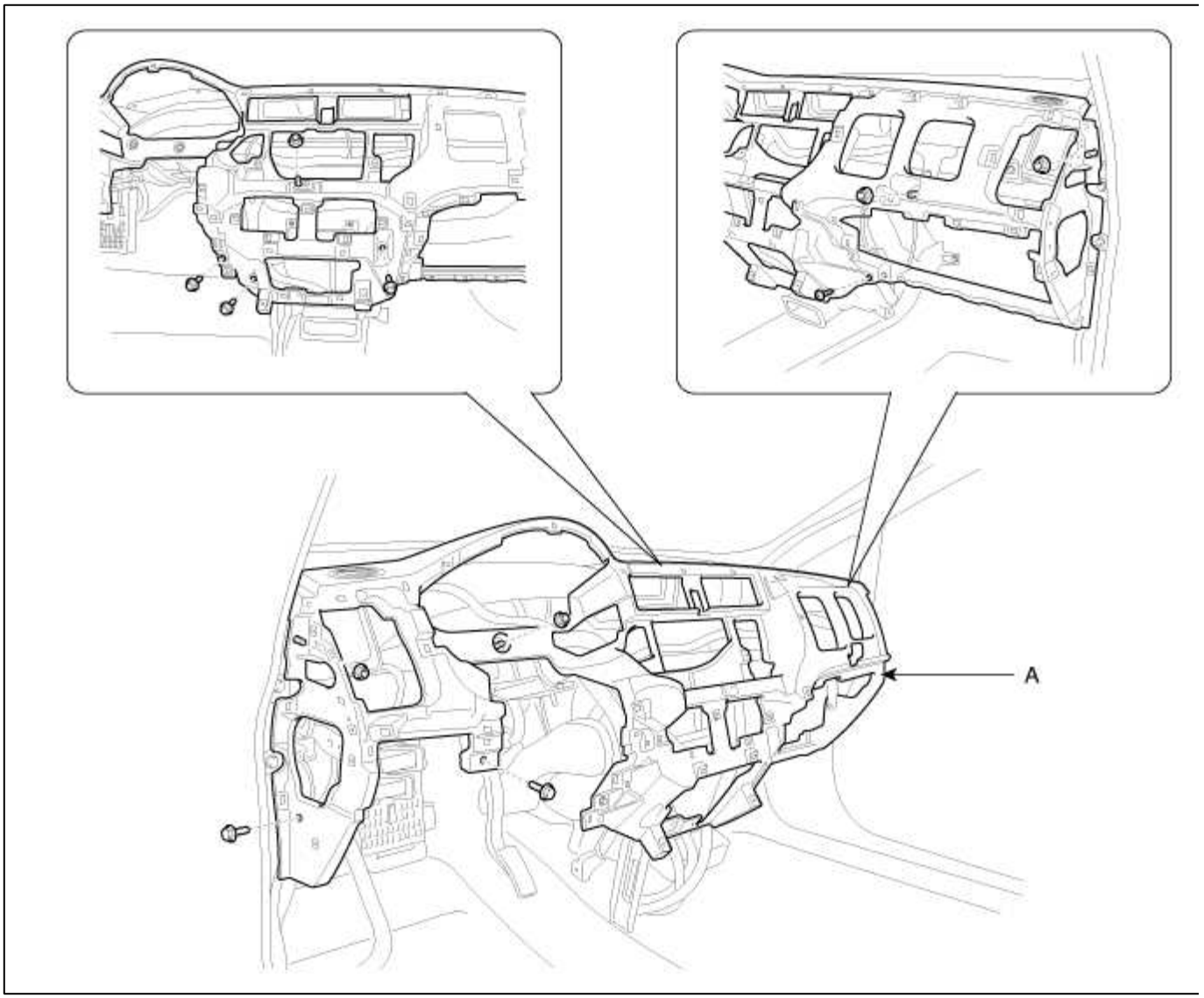


6. Using a screwdriver or remover, remove the photo sensor (A).

7. Disconnect the photo sensor connector (B).



8. After loosening the mounting bolts, nuts, screw, 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.

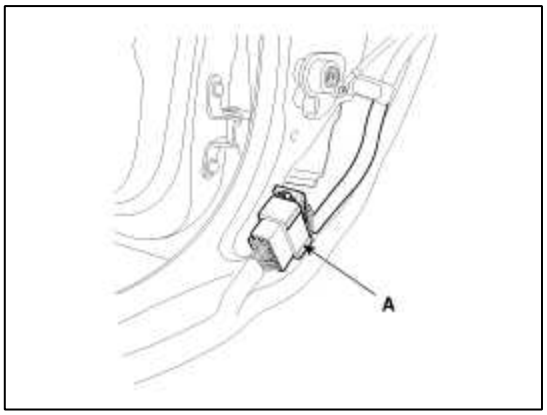
Cowl Cross Bar Replacement

CAUTION

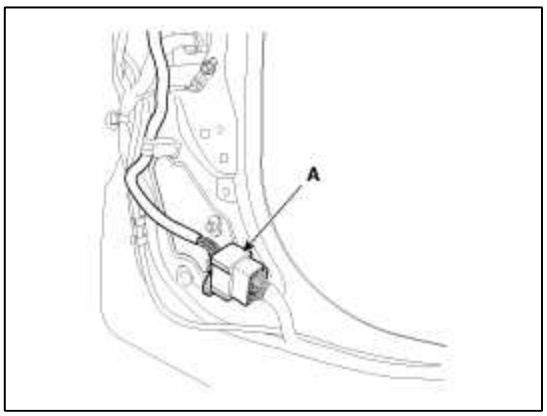
- A plastic trim tool is recommended, but if prying with a screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Take care not to bend or scratch the trim and panels.
- Put on gloves to protect your hands.

1. Remove the following items :
   A. Front seat
      (Refer to the BD group – “Front Seat”)
   B. Front pillar trim
      (Refer to the BD group – “Interior Trim”)
   C. Floor console assembly
      (Refer to the BD group – “Console”)
   D. Front door scuff trim
      (Refer to the BD group – “Interior Trim”)
   E. Cowl side trim
      (Refer to the BD group – “Interior Trim”)
   F. Cowl top cover
      (Refer to the BD group - "Cowl Top Cover")
   G. Main crash pad assembly
2. Disconnect the blower unit connectors.
   (Refer to the HA group - "Air conditioning system, Heater, Blower")
3. Disconnect the multi box connectors (A).

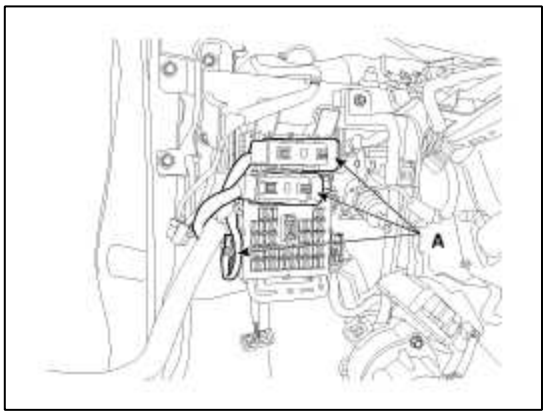
[Driver's]



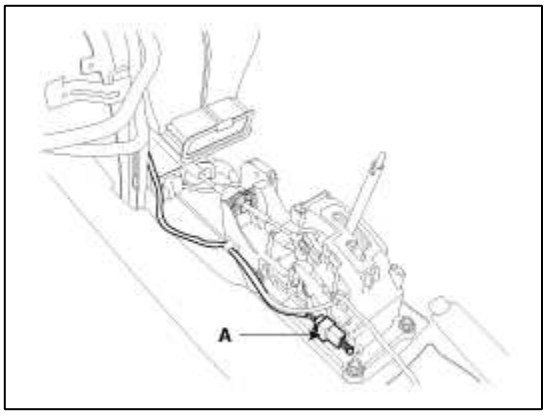
[Passenger's]



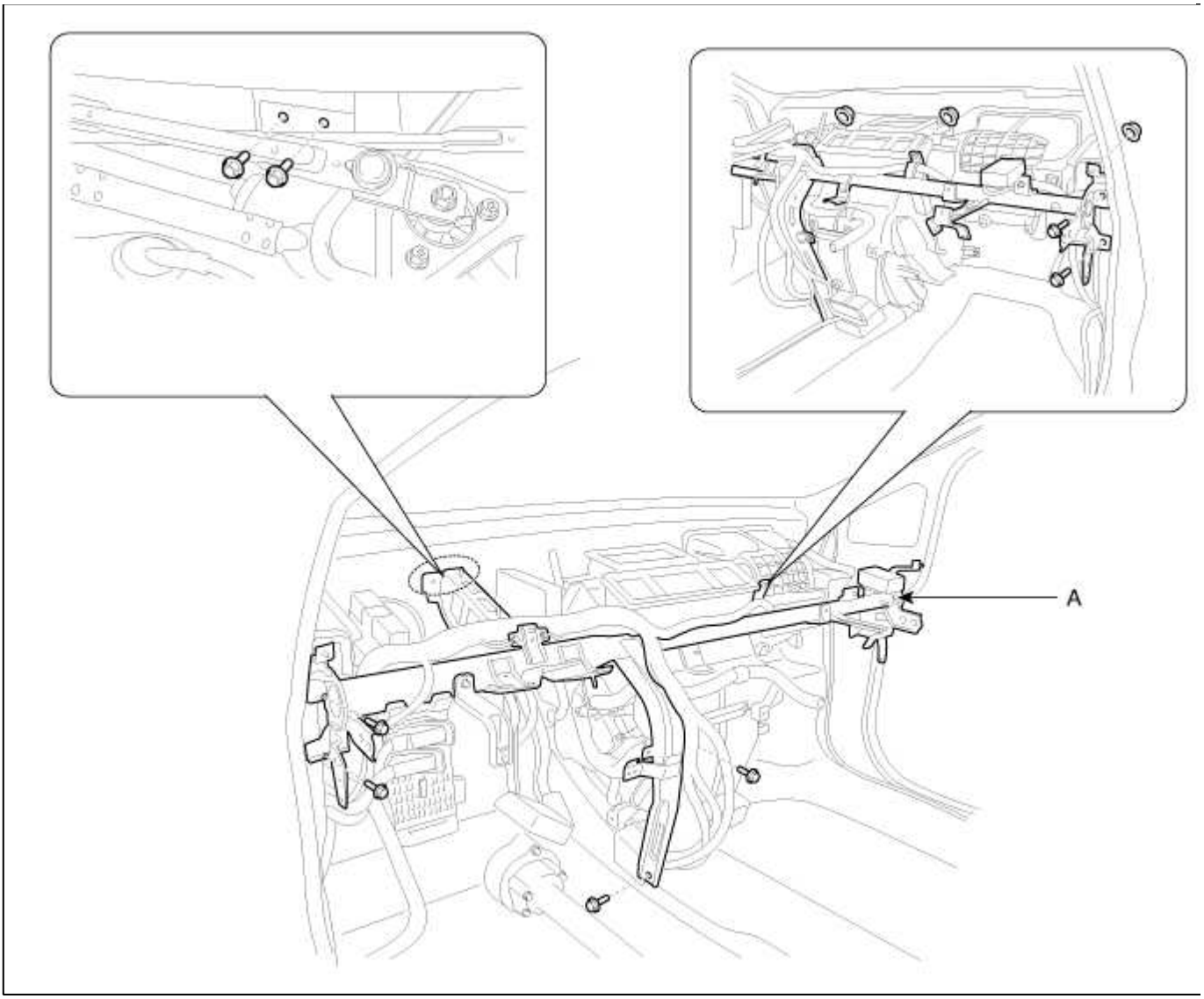
4. Disconnect the passenger compartment junction box connectors (A).



5. Disconnect the airbag control module (SRSCM) connectors (A).



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



7. Installation is the reverse of removal.

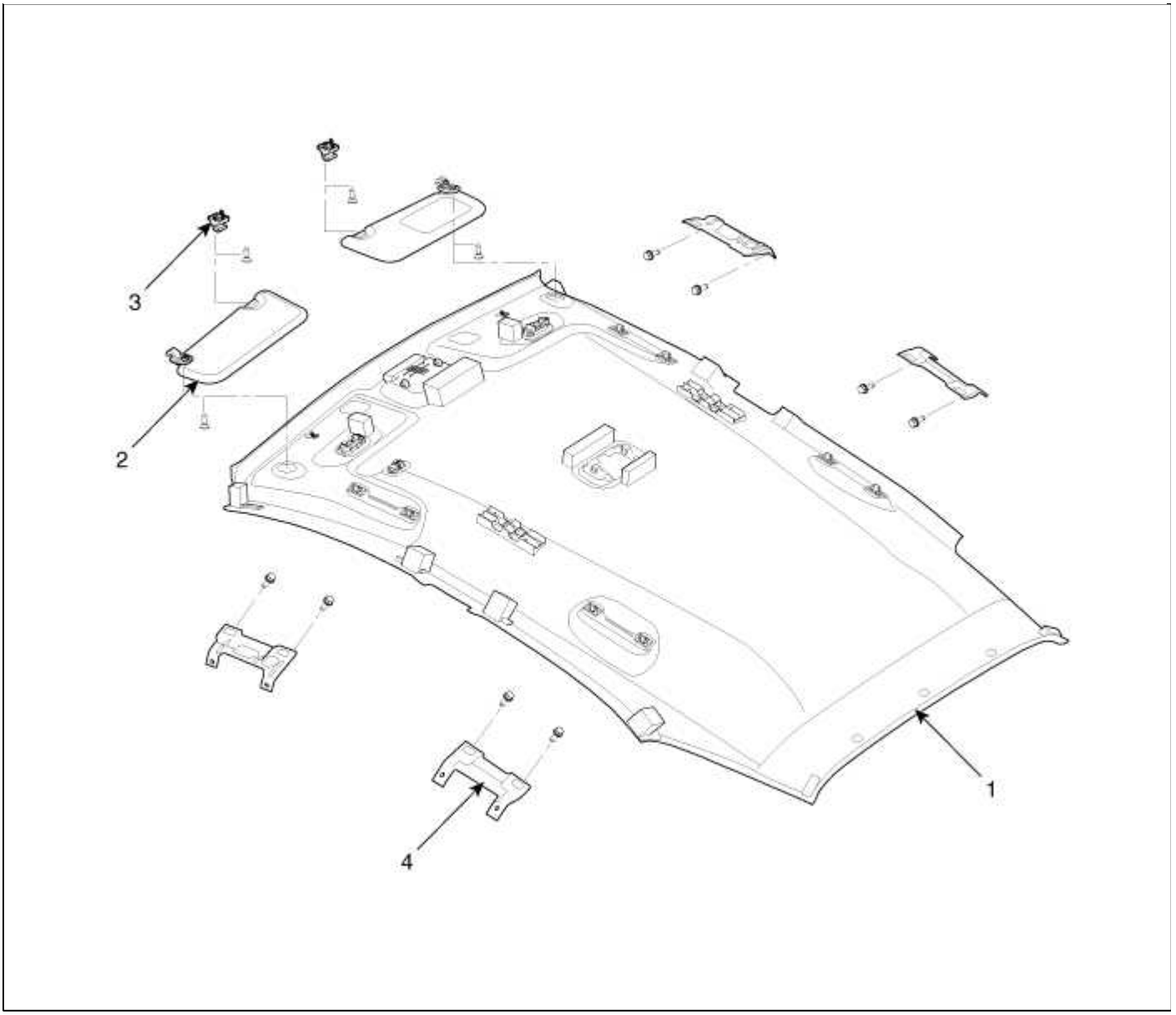
NOTE

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

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

Components

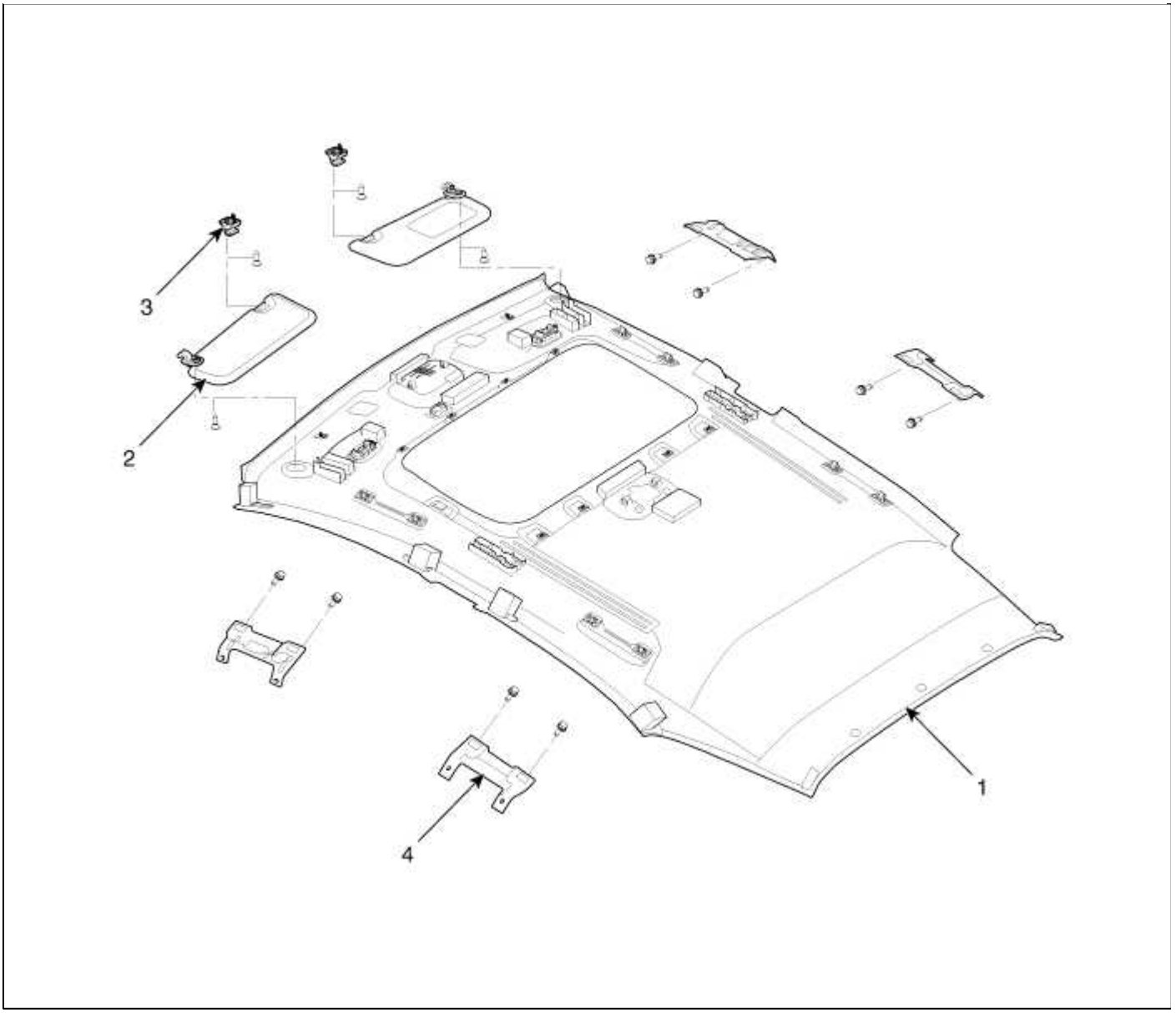
[General Type]



1 . Roof trim 2 . Sunvisor	3 . Retainer 4 . Assist handle bracket assembly

Components

[Sunroof Type]



1 . Roof trim 2 . Sunvisor	3 . Retainer 4. Assist handle bracket assembly

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

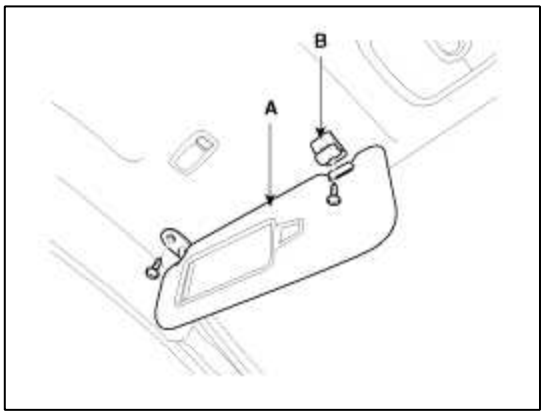
Replacement

Sunvisor Replacement

CAUTION

- Use a plastic panel removal tool to remove interior trip 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).



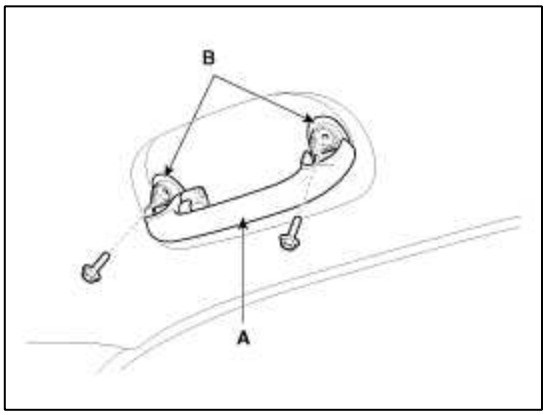
2. Installation is the reverse of removal.

Assist Handle Replacement

CAUTION

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

1. Remove the covers (B).
2. After loosening the mounting bolts, then remove the assist handle (A).



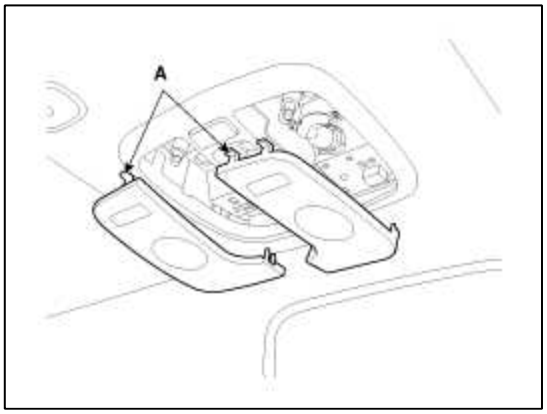
3. Installation is the reverse of removal.

Overhead Console Replacement

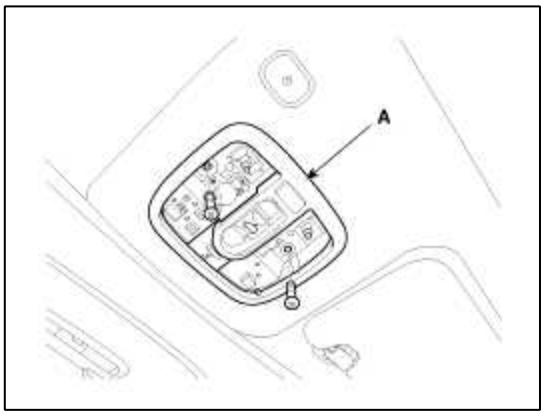
CAUTION

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

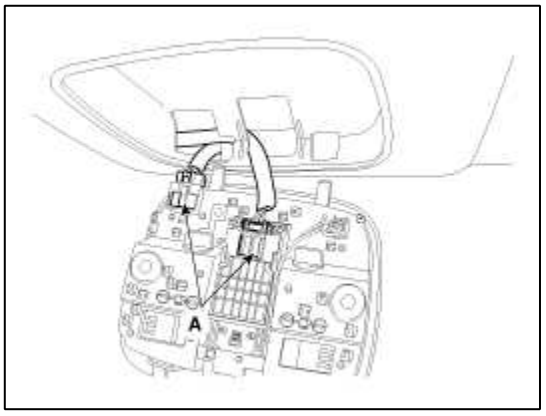
1. Using a screwdriver or remover, remove the overhead console cover (A).



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



3. Disconnect the connectors (A).



4. Installation is the reverse of removal.

NOTE

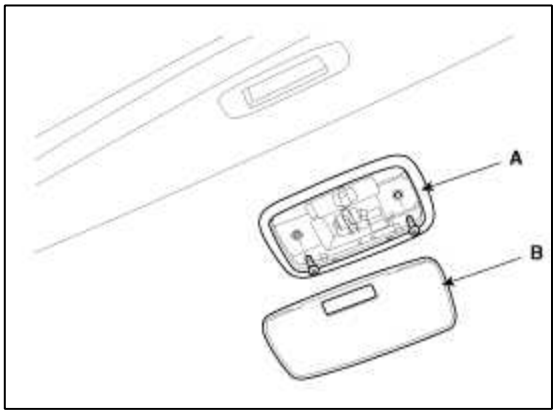
- Make sure the connector is connected properly.

Room Lamp Replacement

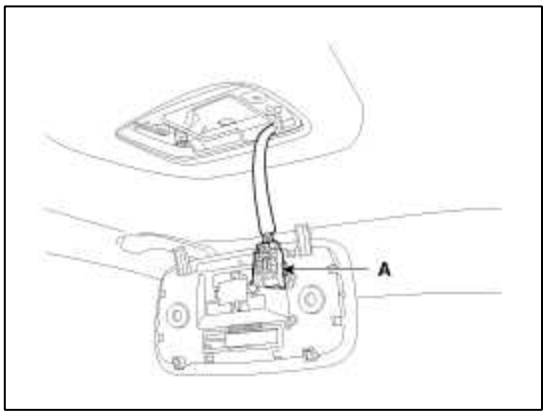
CAUTION

- Use a plastic panel removal tool to remove interior trip 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

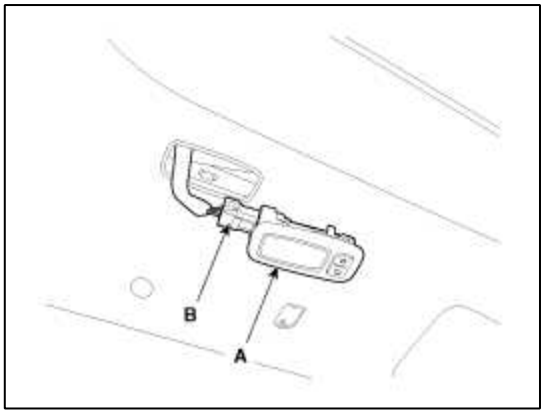
- Make sure the connectors are connected in properly.
- Replace any damage clips.

Vanity Lamp Replacement

CAUTION

- Use a plastic panel removal tool to remove interior trip 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

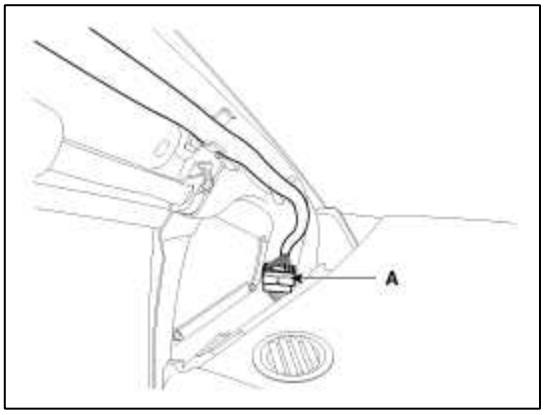
- Make sure the connectors are connected in properly.
- Replace any damage clips.

Roof Trim Replacement

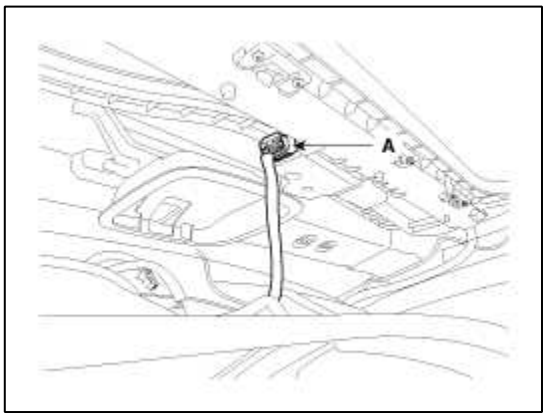
CAUTION

- 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.

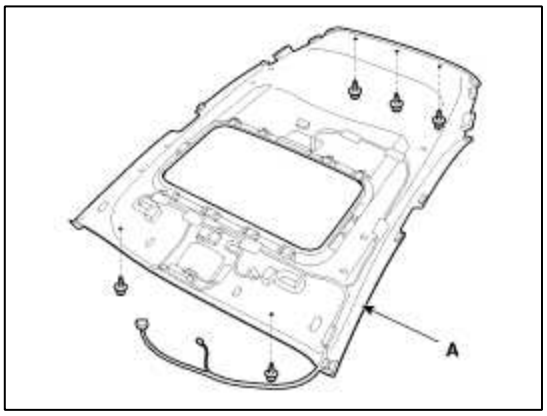
1. Remove the following items :
   A. Front seat
      (Refer to the BD group - "Front Seat")
   B. Rear seat
      (Refer to the BD group - "Rear Seat")
   C. Sunvisor
   D. Overhead console
   E. Room lamp
   F. Sunglass case
   G. Assist handle
   H. Front pillar trim
      (Refer to the BD group - " Interior Trim")
   I. Front door scuff trim & Rear door scuff trim
      (Refer to the BD group - " Interior Trim")
   J. Center pillar lower trim & Center pillar upper trim
      (Refer to the BD group - " Interior Trim")
   K. Luggage side trim
      (Refer to the BD group - " Interior Trim")
   L. Rear pillar trim
      (Refer to the BD group - " Interior Trim")
2. Disconnect the roof trim main connector (A).



3. Disconnect the sunroof motor connector (A).



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



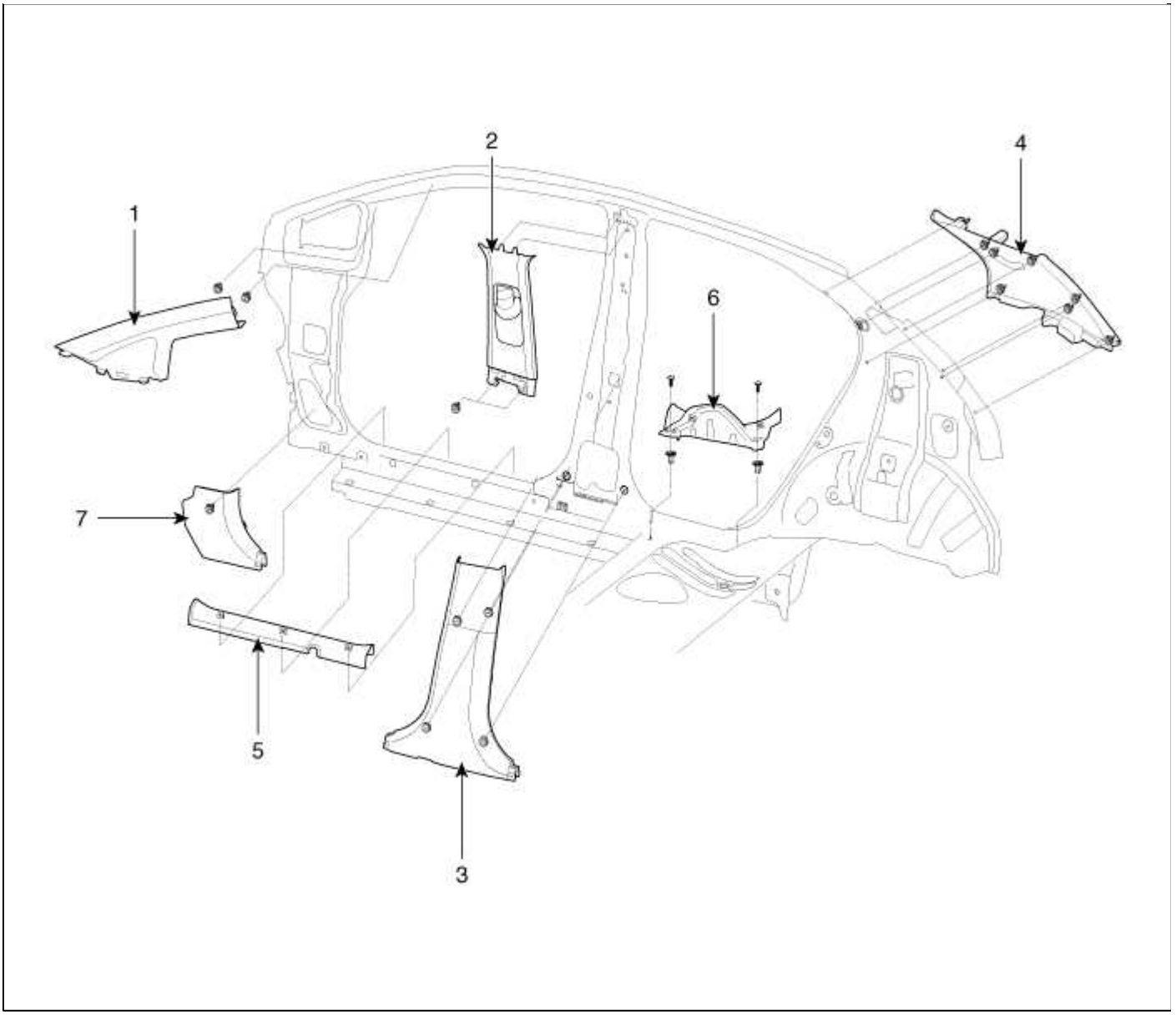
5. Installation is the reverse of removal.

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 . Rear pillar trim	5 . Front door scuff trim 6 . Rear door scuff trim 7 . Cowl side trim

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

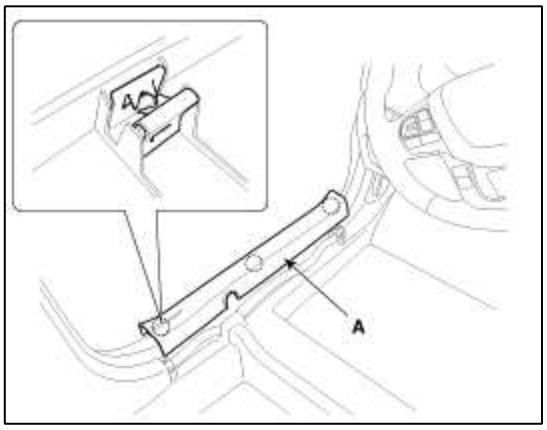
Replacement

Door Scuff Trim Replacement

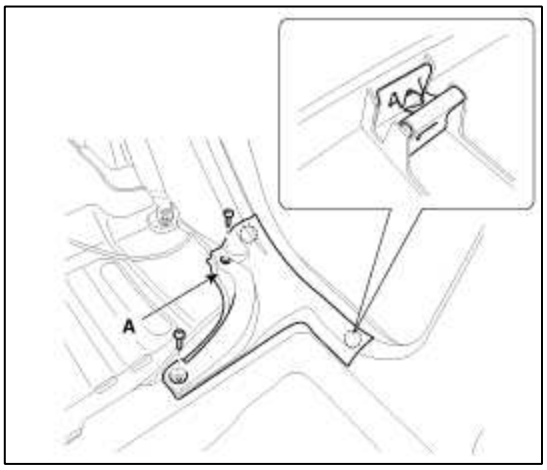
CAUTION

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

1. Using a screwdrier or remover, remove the front door scuff trim (A).
   [Front]



2. Remove the rear seat cushion.
   (Refer to the BD group - "Rear Seat")
3. After loosening the mounting screws, then remove the rear door scuff trim (A).
   [Rear]



4. Installation is the reverse of removal.

NOTE

- Replace any damage clips.

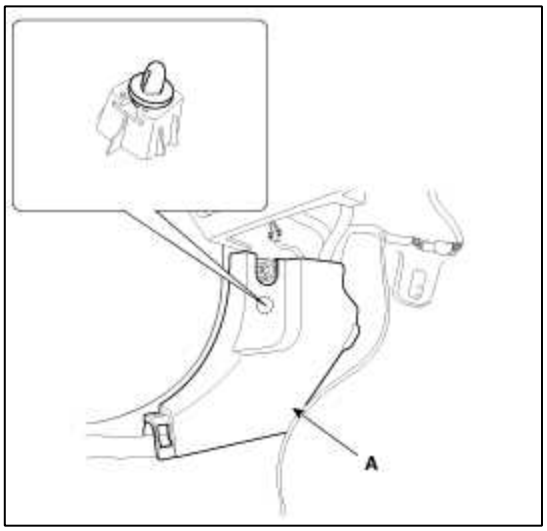
Cowl Side Trim Replacement

CAUTION

- Put on gloves to protect your hands.
- Use a plastic panel removal tool to remove interior trip 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.

Front Pillar Trim Replacement

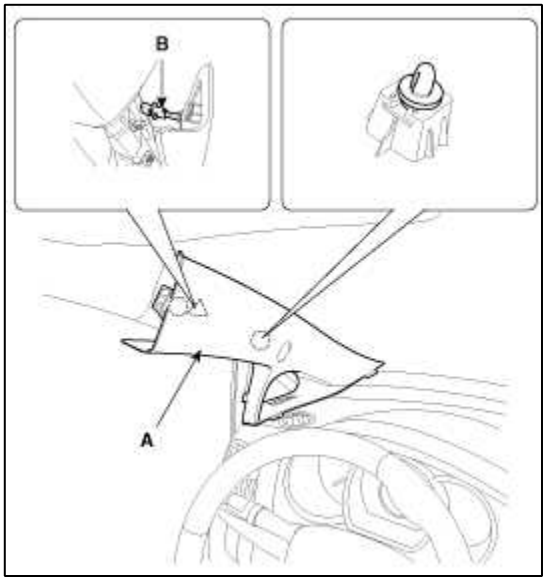
CAUTION

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

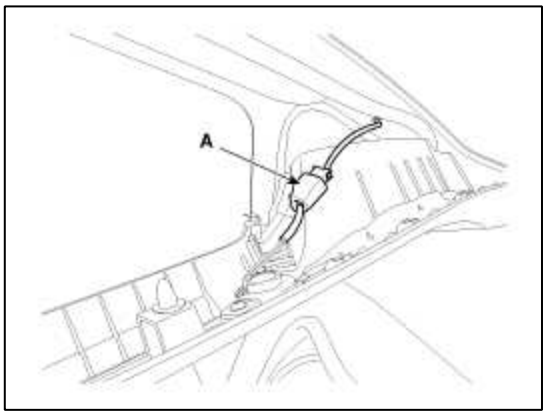
1. Using a screwdriver or remover, remove the front pillar trim (A).

CAUTION

- Lock pin (B) is need to changed to new product surely.



2. Disconnect the tweeter speaker connector (A).



3. Installation is the reverse of removal.

NOTE

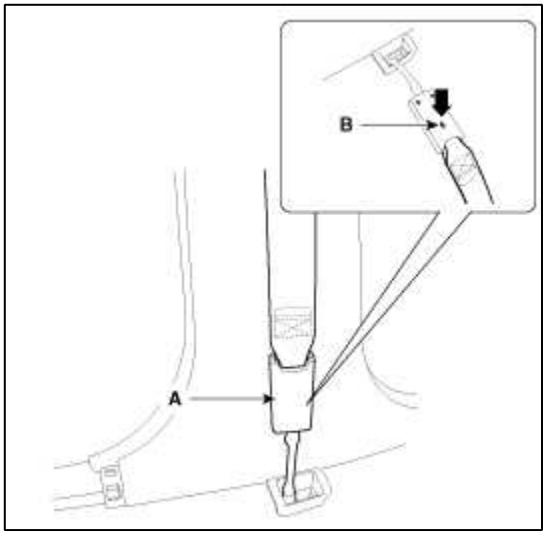
- Replace any damage clips.
- Make sure the connector is connected properly.

Center Pillar Trim Replacement

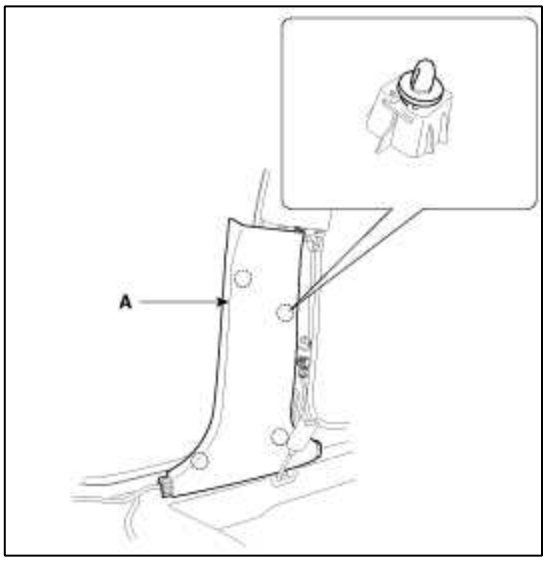
CAUTION

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

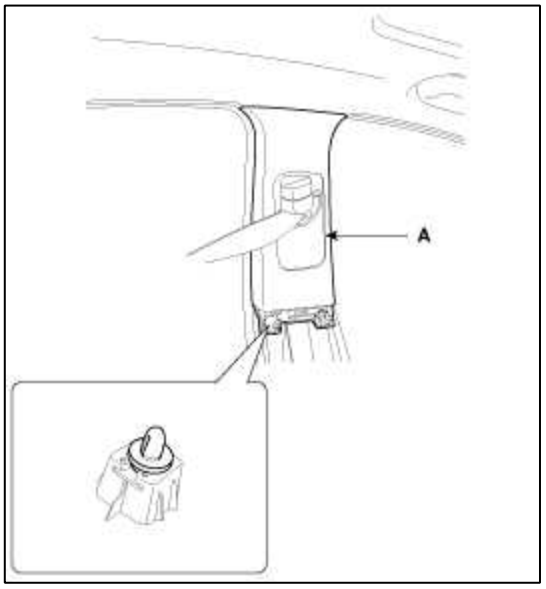
1. Remove the following items :
   A. Front door scuff trim
   B. Rear door scuff trim
2. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
3. The seat belt anchor pretensioner (A) can be removed after pushing the lock pin (B) as arrow direction.



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



5. Using a screwdriver or remover, remove the center pillar upper trim (A).



6. Installation is the reverse of removal.

NOTE

- Replace any damage clips.

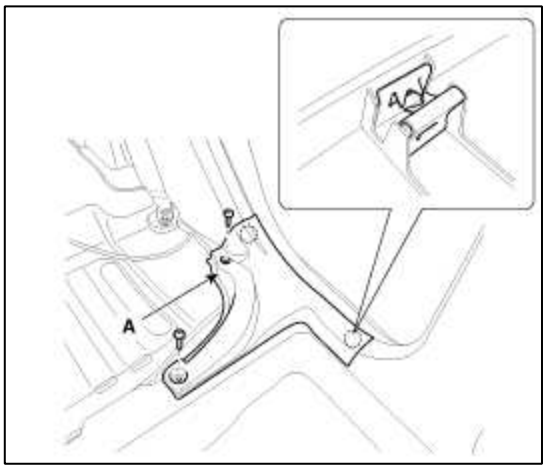
Rear Pillar Trim Replacement

CAUTION

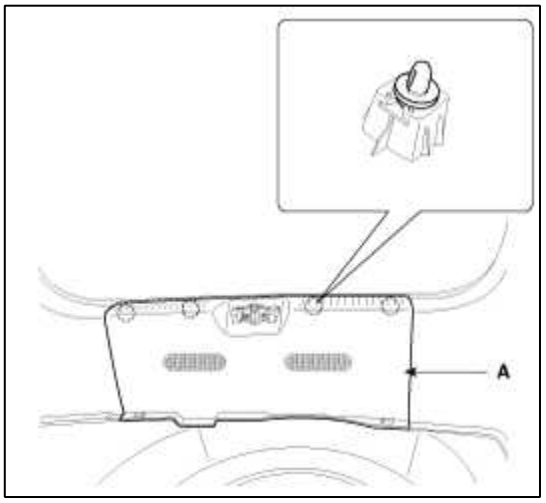
- Put on gloves to protect your hands.
- Use a plastic panel removal tool to remove interior trip pieces to without marring the surface.
- Take care not to bend or scratch the trim and panels.

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

2. After loosening the mounting screws, then remove the rear door scuff trim (A).

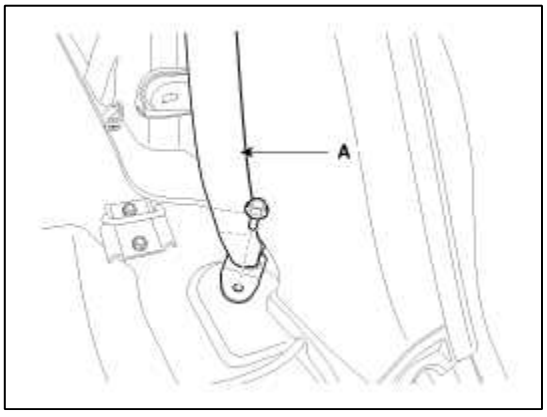


3. Using a screwdriver or remover, remove the rear transverse trim (A).

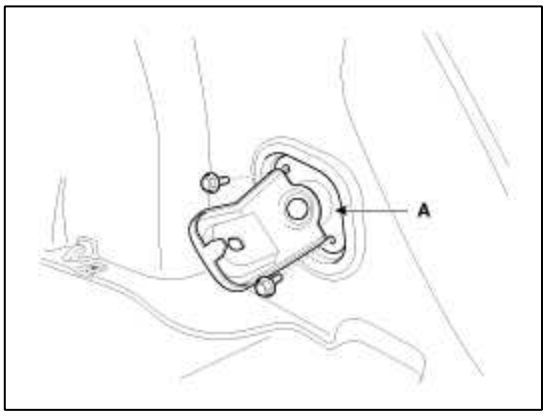


4. After loosening the mounting bolt, then remove the rear seat belt lower anchor (A).

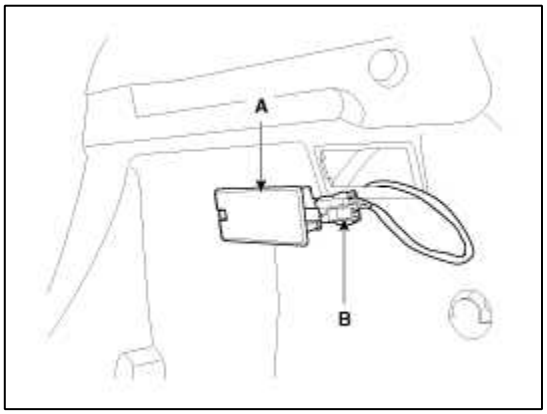
Tightening torque :
39.2 ~ 53.9 N.m (4.0 ~ 5.5 kgf.m, 28.8 ~ 39.8 lb-ft)



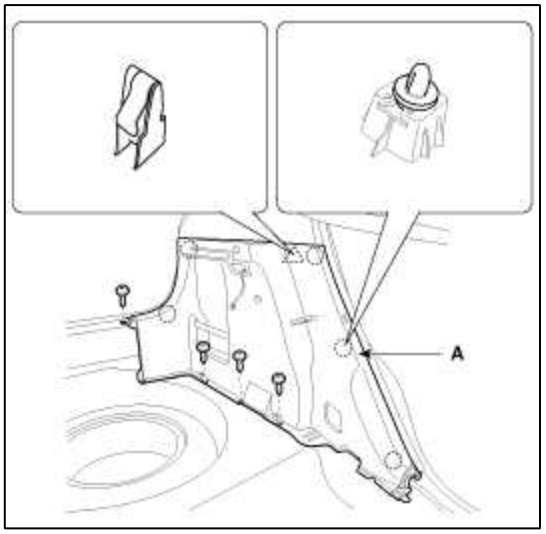
5. After loosening the mounting blots, then remove the rear seat bracket (A).



6. Using a screwdriver or remover, remove the lamp (A).
7. Disconnect the lamp connector (B).

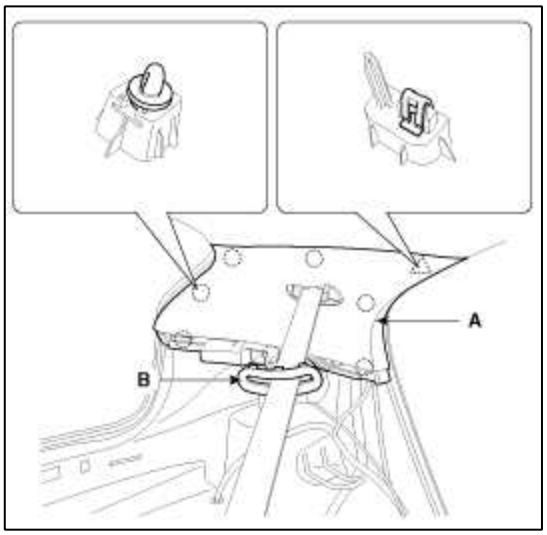


8. After loosening the mounting screws, then remove the luggage side trim (A).



9. Remove the rear seat belt upper anchor cover (B).

10. Using a screwdriver or remover, remove the rear pillar trim (A).



11. Installation is the reverse of removal.

NOTE

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

Luggage Side Trim Replacement

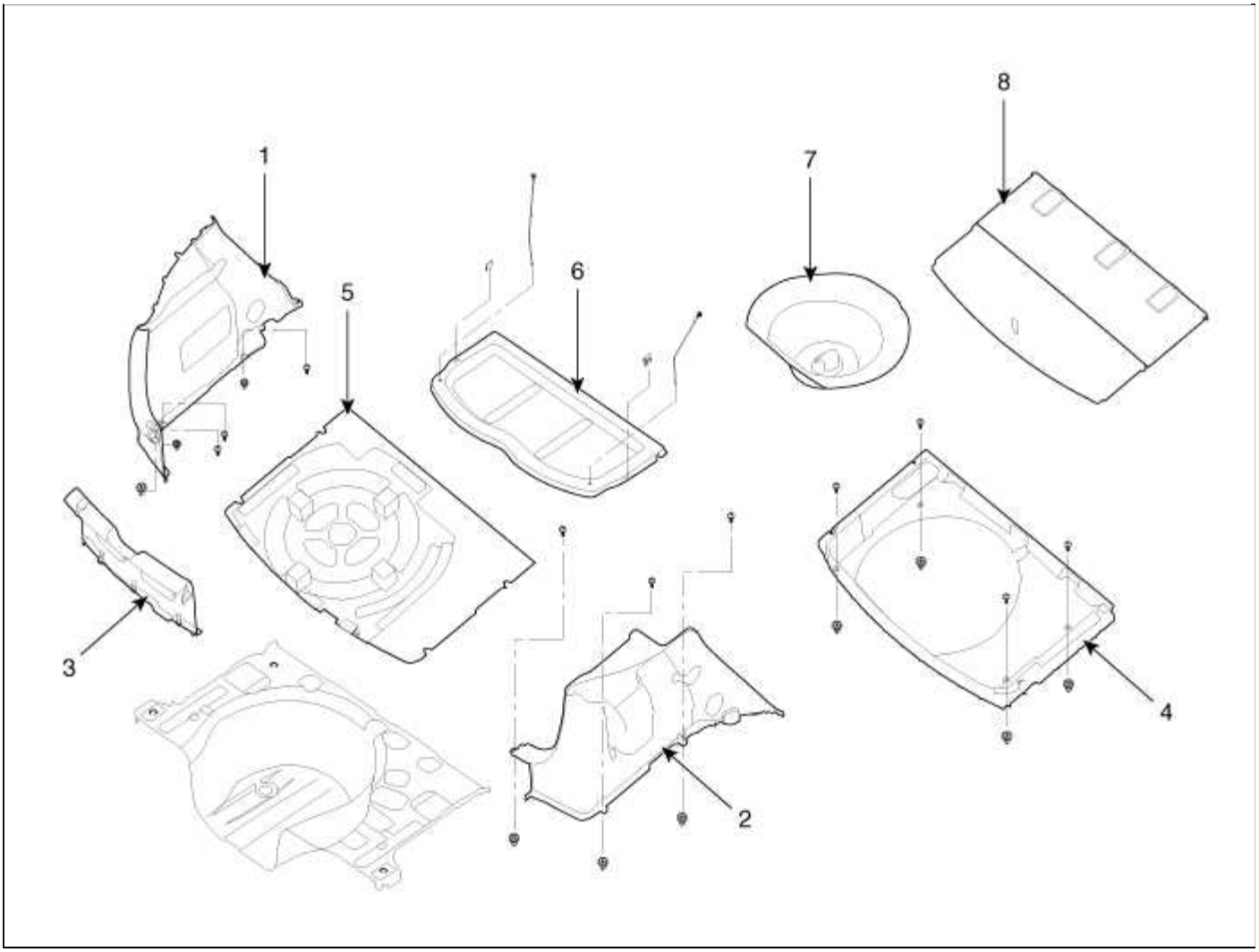
CAUTION

- Put on gloves to protect your hands.
- Use a plastic panel removal tool to remove interior trip 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. Remove the rear transverse trim.
4. After loosening the mounting screws, then remove the luggage side trim.
5. Installation is the reverse of removal.

NOTE

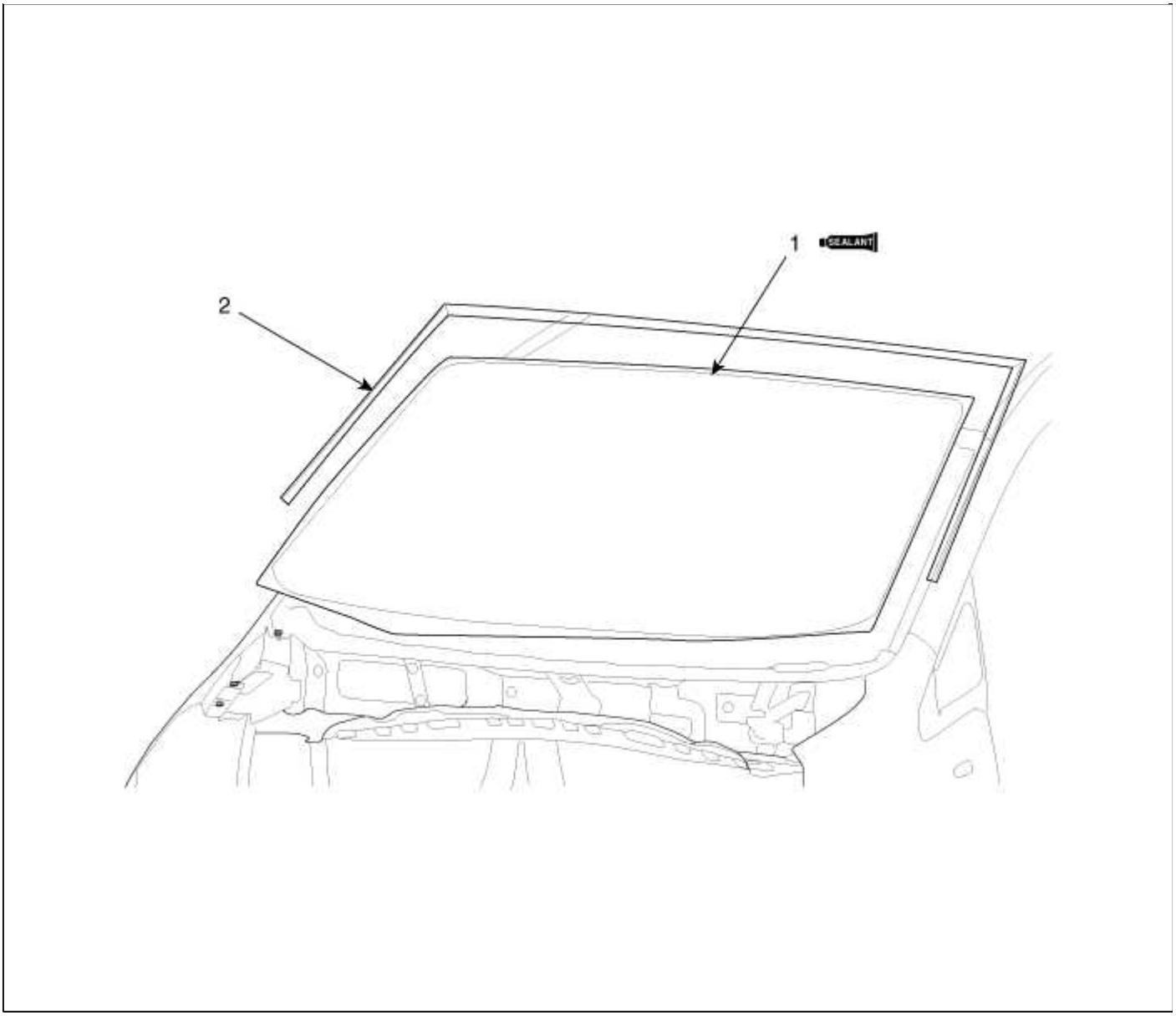
- Replace any damage clips.



1 . Luggage side trim [LH] 2 . Luggage side trim [RH] 3 . Rear transverse trim 4 . Luggage floor box trim	5 . Luggage covering complete assembly (1) 6 . Covering shelf side damper 7 . Luggage tray 8 . Luggage covering complete assembly (2)

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

Components



1. Windshield glass	2. Windshield glass molding

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

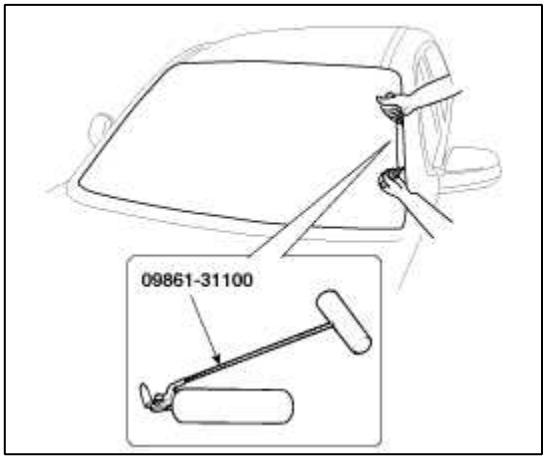
Replacement

Removal

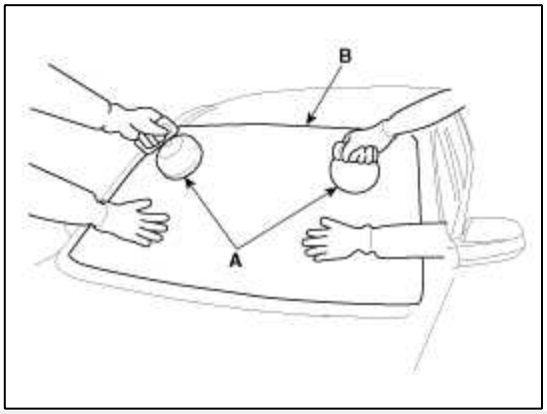
CAUTION

- 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. Wiper arm
      (Refer to the BD group – "Cowl Top Cover")
   D. Cowl top cover
      (Refer to the BD group – "Cowl Top Cover")
2. Cut out the sealant using the sealant cutting tool(A)(09861-31100).



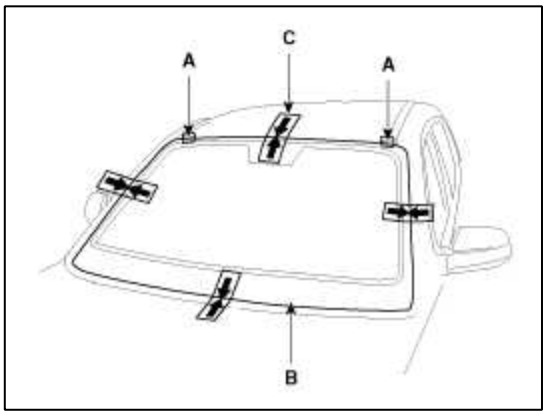
3. Remove the windshield glass (B) carefully using the glass holder (A).



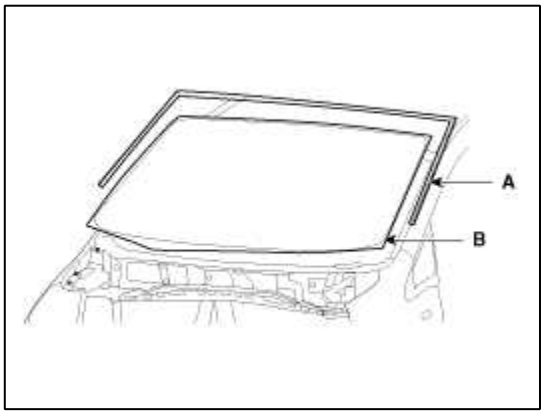
Installation

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 fastereners from the body.
   C. Mask off surrounding surfaces before painting
2. Clean the bonding surface with a sponge dampened in alcohol. After cleaning, keep oil, grease and water from getting on the clean surface.

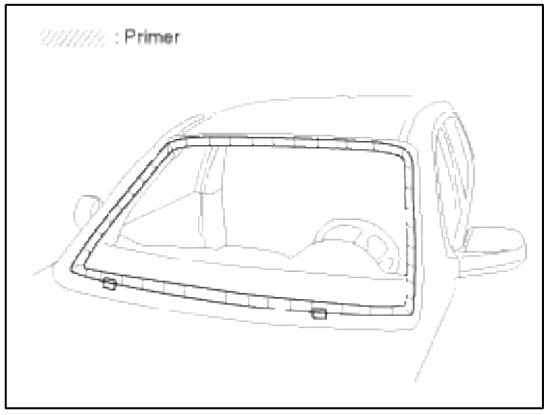
3. Install the spacer (A) install the windshield glass (B) temporarily with marking sure to position them on the center, and then place the alignment mark (C).



4. Install windshield side molding (A) on the windshield glass (B).



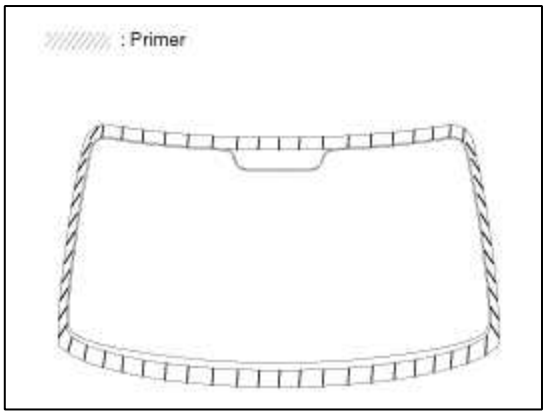
5. With a sponge, apply a light coat of body primer to the original adhesive remaining around the windshield opening flange. Let the body primer dry for at least 10 minutes.
   A. Do not apply glass primer to the body, and be careful not to mix up glass and body primer sponges.
   B. Never touch the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



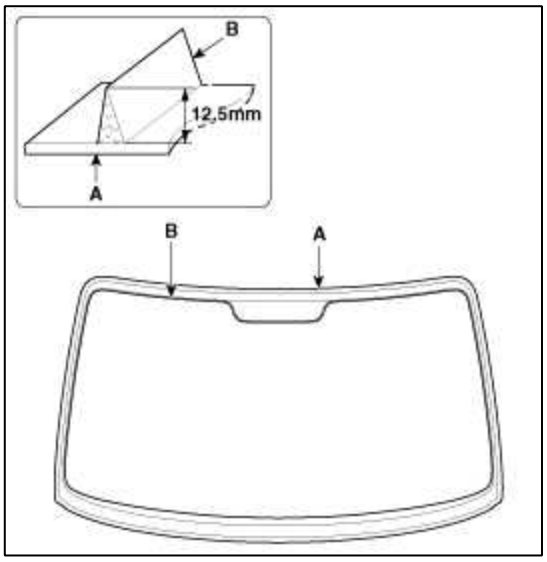
6. Apply a light coat of glass primer to the outside of the fasteners.

NOTE

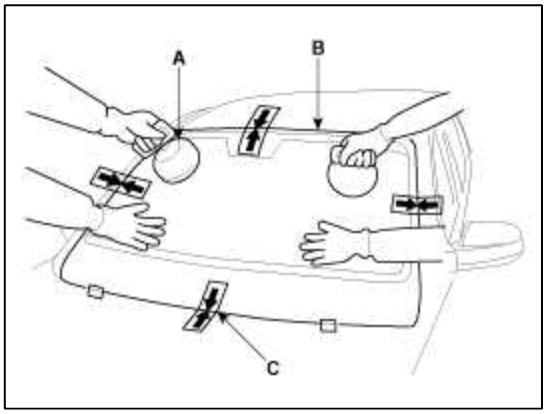
- Never touch the primed surface with your hand If you do, the adhesive may not bond to the glass properly, causing a leak after the windshield glass is installed.
- Do not apply body primer to the glass.
- Keep water, dust, and abrasive materials away from the primer.



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 glass (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.



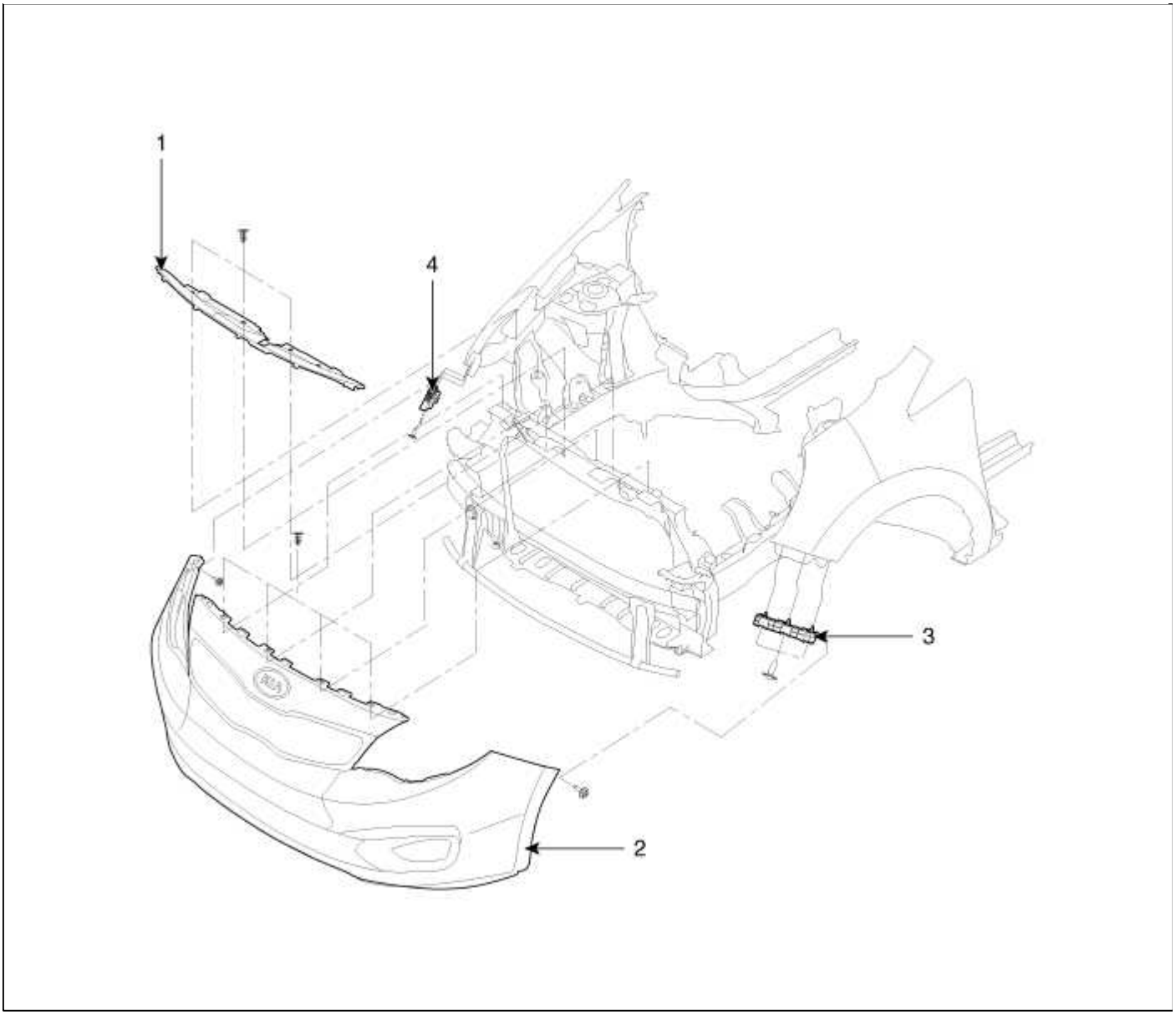
8. Use suction cups (A) to hold the windshield glass (B) over the opening, align it with the alignment marks (C) made in step 15, and set it down on the adhesive. Lightly push on the windshield until its edges are fully seated on the adhesive all the way around. Do not open or close the doors until the 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 the three days:
    A. Slam the door with all the windows rolled up.
    B. Twist the body excessively (such as when going in and out of driveways at an angle or driving over rough, uneven roads)
12. Installation the following items :
    A. Cowl top cover
       (Refer to the BD group – "Cowl Top Cover")
    B. Wiper arm
       (Refer to the BD group – "Cowl Top Cover")
    C. Inside rearview mirror
       (Refer to the BD group – "Mirror")
    D. Front pillar trim
       (Refer to the BD group – "Interior Trim")

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

Components



1 . Radiator grille upper cover 2 . Front bumper cover	3 . Front bumper side bracket [LH] 4 . Front bumper side bracket [RH]

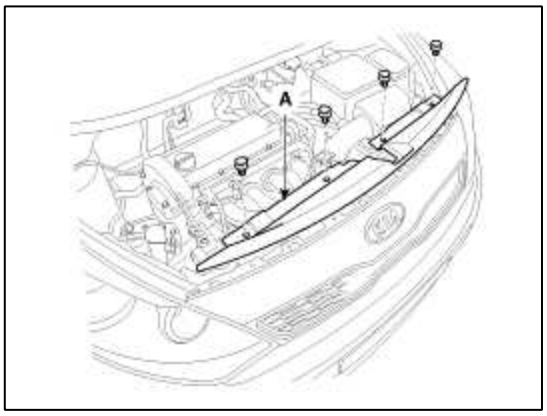
Body (Interior and Exterior) > Bumper > Front Bumper > Repair procedures

Replacement

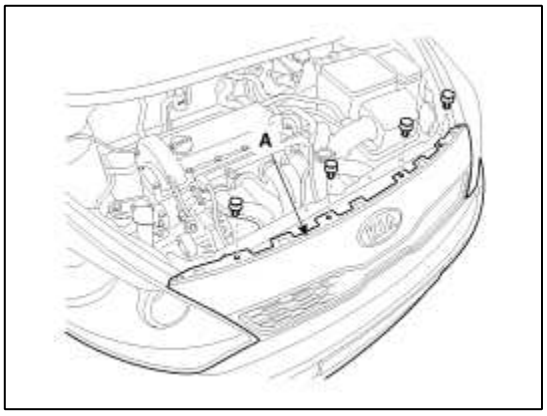
CAUTION

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

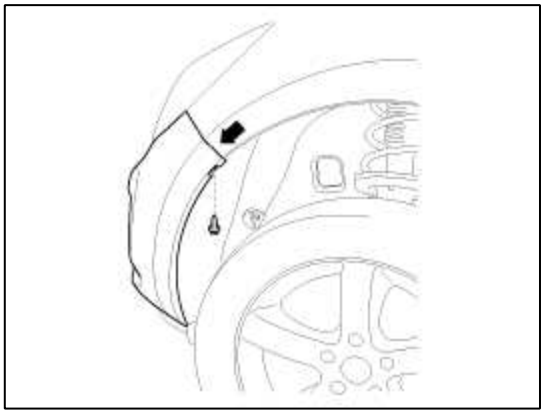
1. After loosening the mounting clips, then remove the radiator grille upper cover (A).



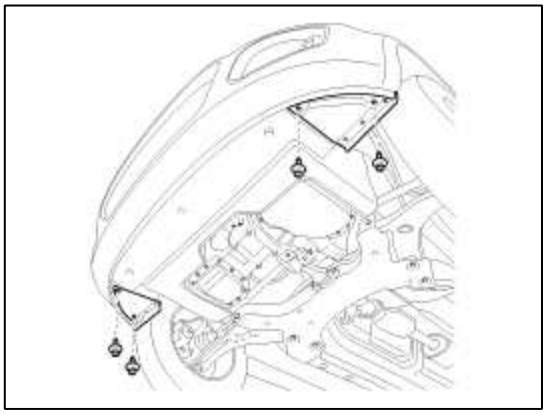
2. Loosen the front bumper upper (A) mounting clips.



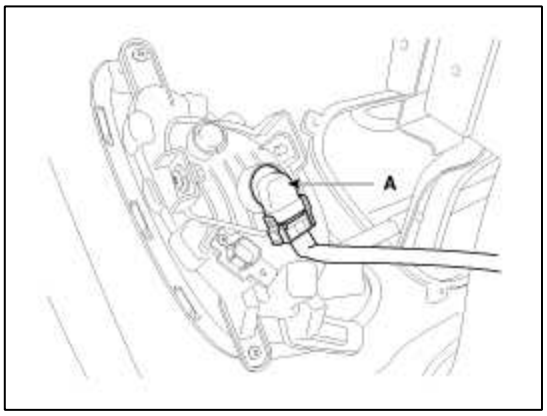
3. After loosening the front bumper side's mounting screw, then disconnect the side's.



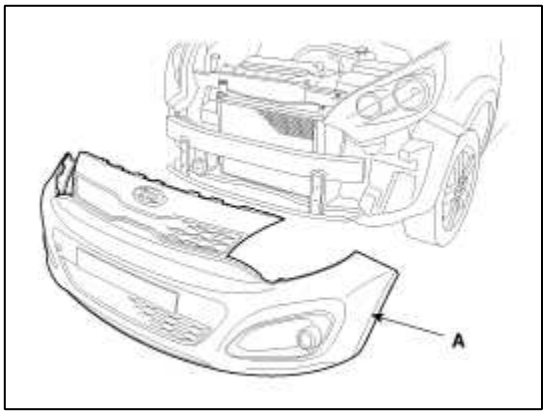
4. Remove the front bumper lower mounting clips.



5. Disconnect the fog lamp connector (A).



6. Remove the front bumper cover (A).



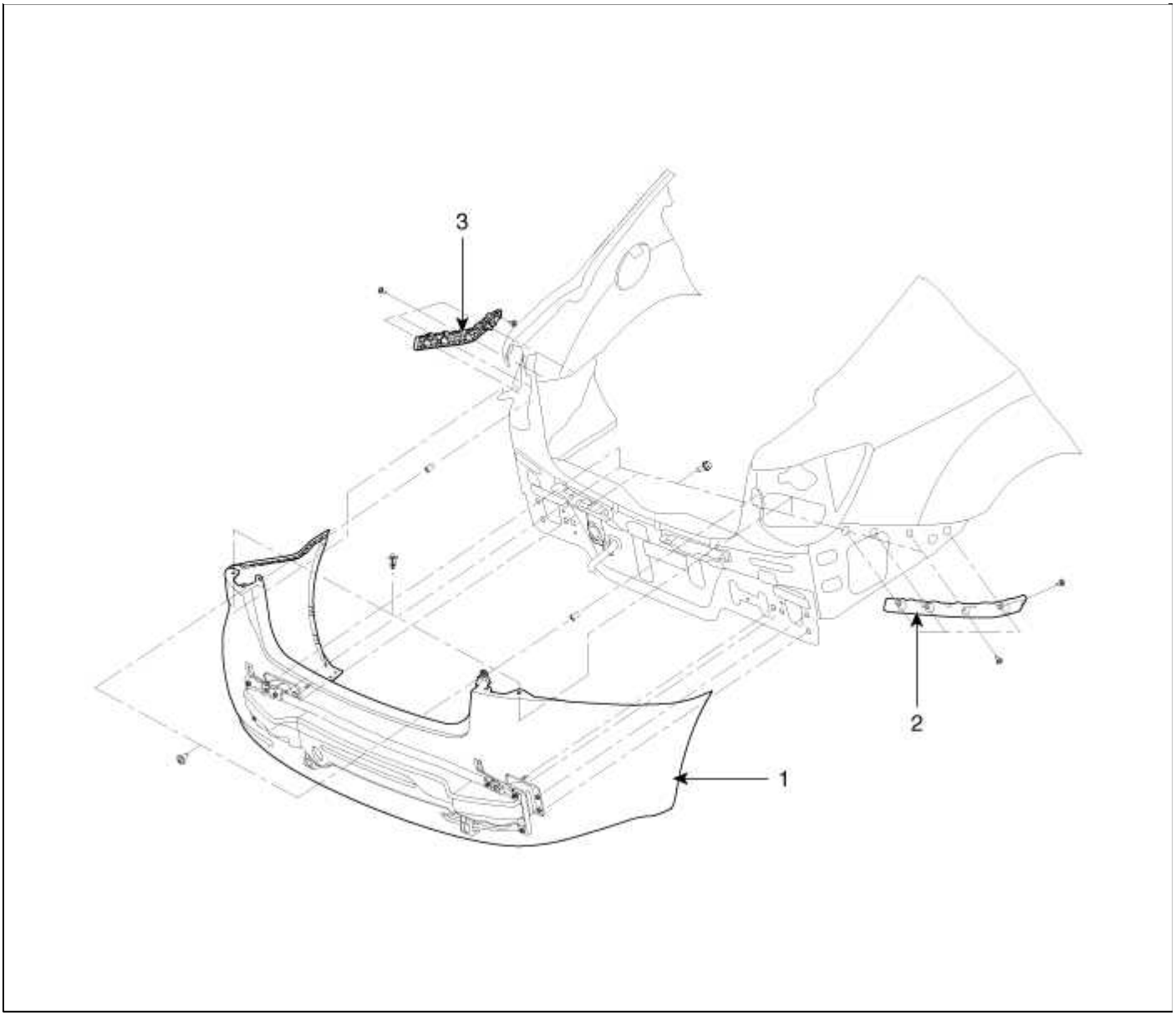
7. Installation is the reverse of removal.

NOTE

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

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

Components



1. Rear bumper cover 2. Rear bumper side bracket [RH]	3. Rear bumper side bracket [LH]

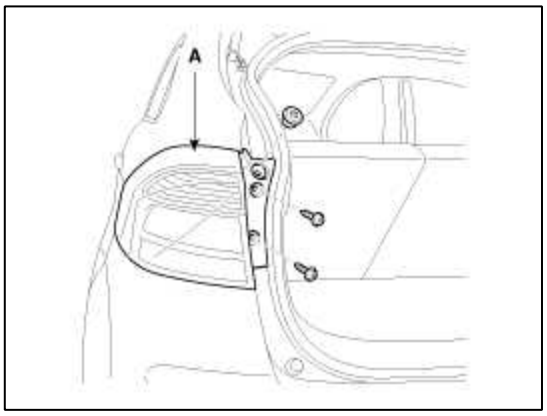
Body (Interior and Exterior) > Bumper > Rear Bumper > Repair procedures

Replacement

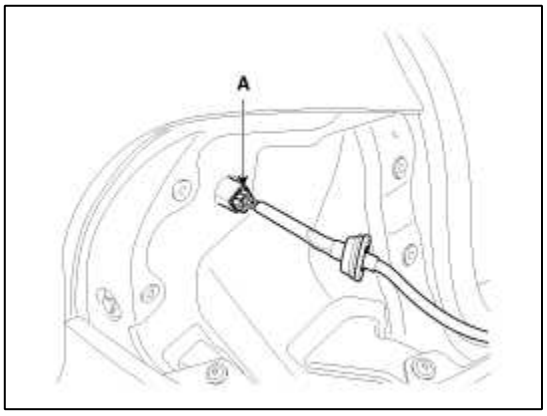
CAUTION

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

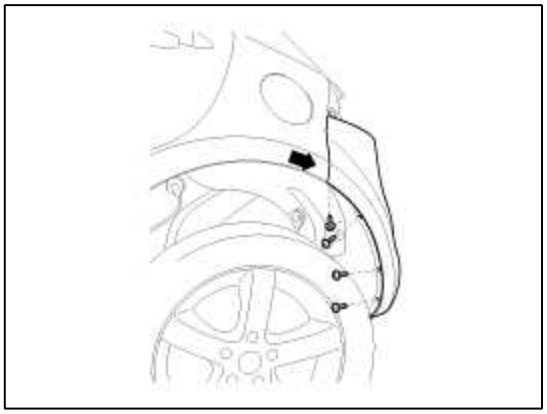
1. After loosening the mounting screws, then remove the rear combination lamp (A).



2. Disconnect the rear combination lamp connector (A).



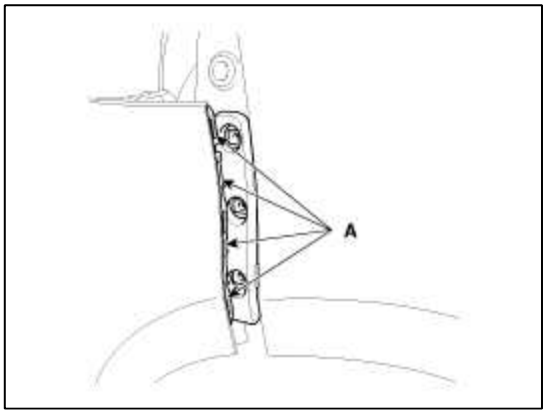
3. After loosening the rear bumper side's mounting screws, then disconnect the side's.



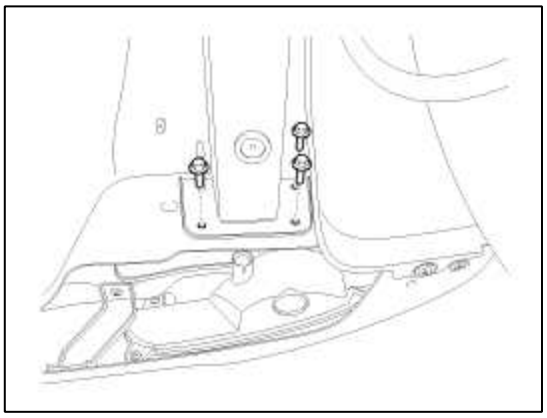
4. Remove the rear bumper after pull out the rear bumper.

CAUTION

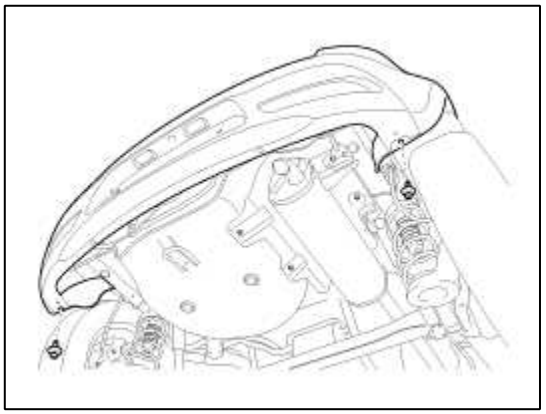
- When you pull out the rear bumper, the rear bumper could be damaged by the projection (A).



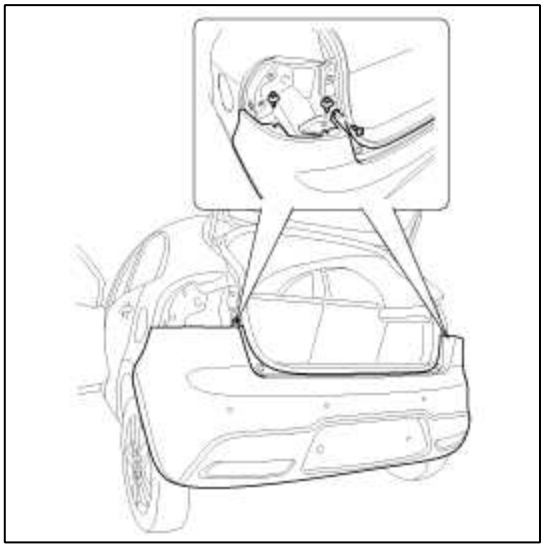
5. Loosen the rear bumper lower mounting bolts.



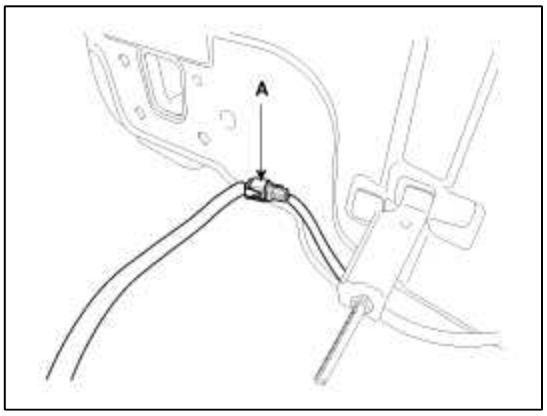
6. Loosen the rear bumper lower mounting clips.



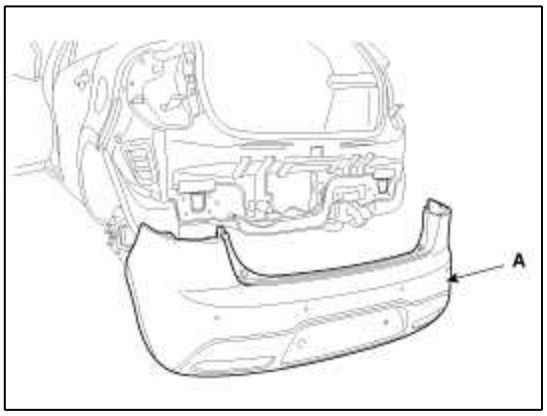
7. Loosen the rear bumper side mounting screw and clips.



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



9. Remove the rear bumper cover (A).



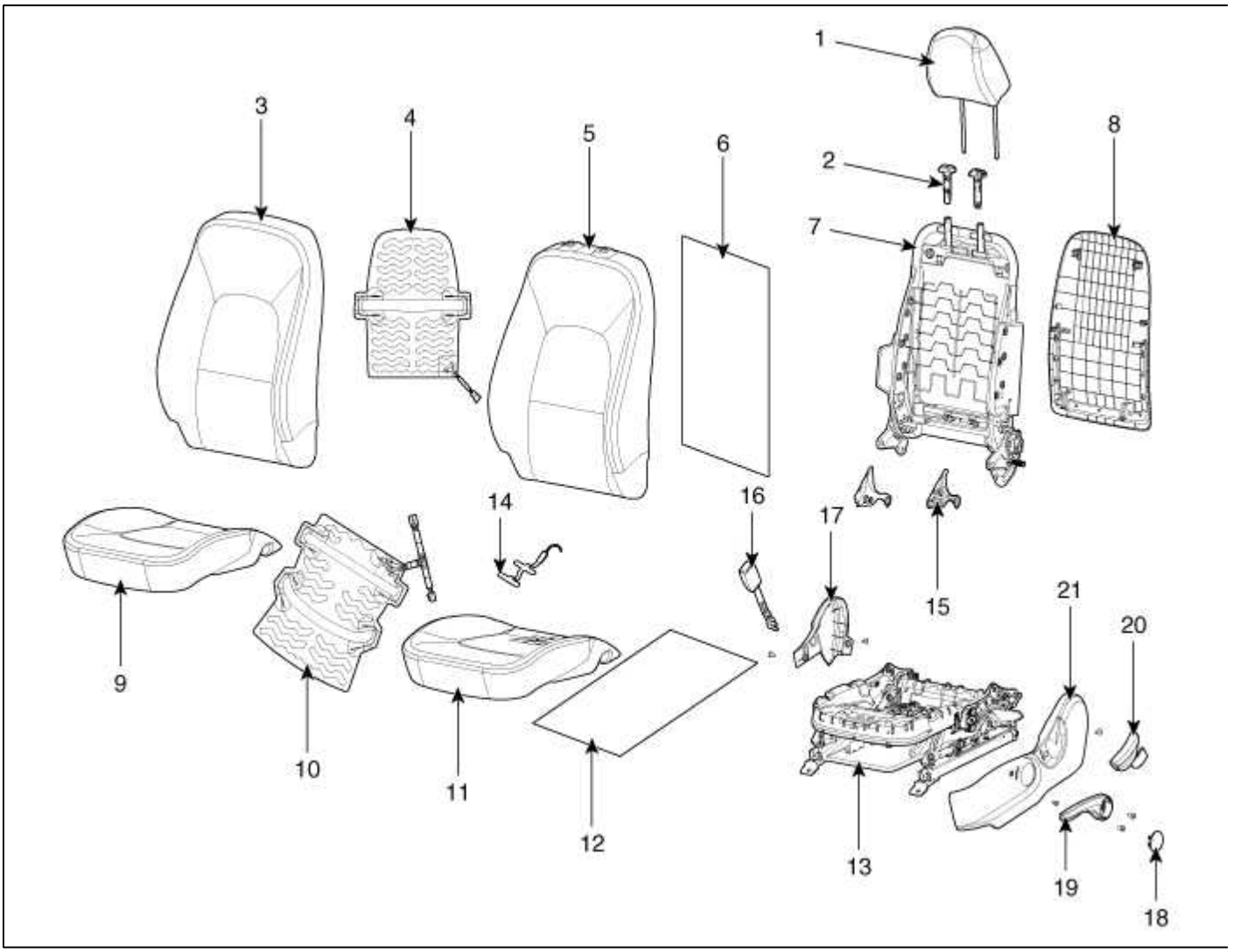
10. Installation is the reverse of removal.

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	12 . Front seat cushion silener cloth
2 . Headrest guide	13 . Front seat cushion frame assembly
3 . Front seat back cover	14 . SBR mat
4 . Front seat back warmer	15 . Front recliner cover
5 . Front seat back pad	16 . Front seat belt buckle
6 . Front seat back silener cloth	17 . Shield inner cover
7 . Front seat back frame assembly	18 . Pumping lever cap
8 . Front seat back board	19 . Pumping lever
9 . Front seat cushion cover	20 . Recliner knob
10 . Front seat cushion warmer	21 . Shield outer cover
11 . Front seat cushion pad	

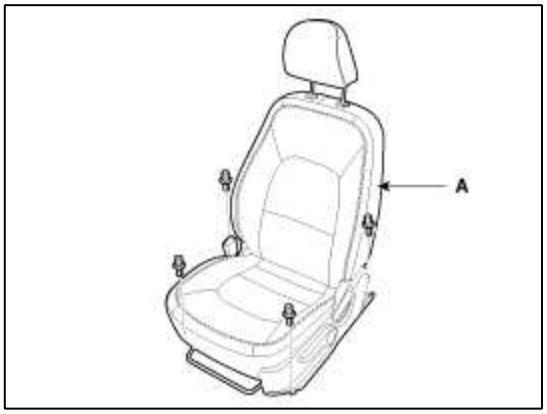
Body (Interior and Exterior) > Seat & Power Seat > Front Seat > Repair procedures

Replacement

Front Seat Assembly Replacement

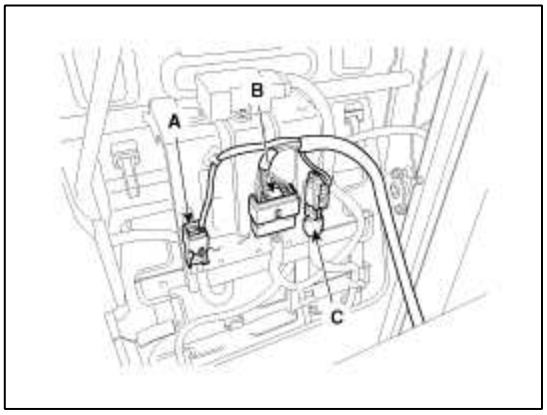
1. After loosening the front seat assembly mounting bolts, remove the front seat assembly (A).

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

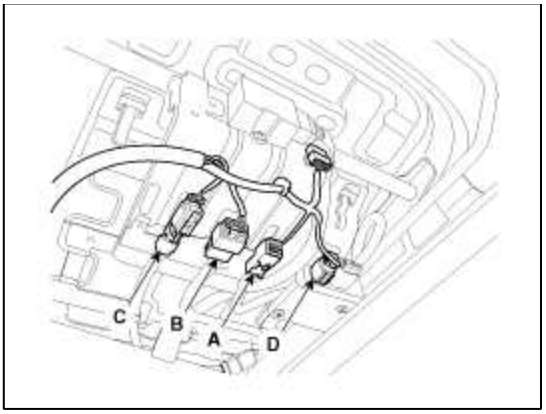


2. Disconnect the seat buckle connector (A), seat warmer connector (B), SAB connector(C), WCS connector (D).

[Driver's]



[Passenger's]



3. Installation is the reverse of removal.

CAUTION

Seat Mounting Bolt Installation Procedure

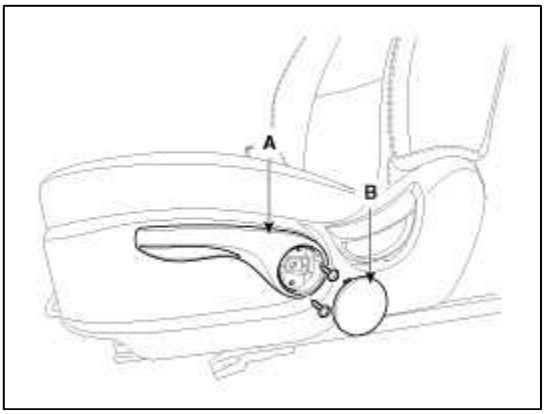
- Set the into the most rearward position. Check then each slide is locked, and then Tighten the front mounting bolt temporarily.
- Set the seat into most forward position. Check that each slide is locked, and then Tighten the rear mounting bolt completely.
- Set the seat into the most rearward position. Check the front mounting bolt completely.
- Check that the seat operates back and forth smoothy and the locking portion locks properly.

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.

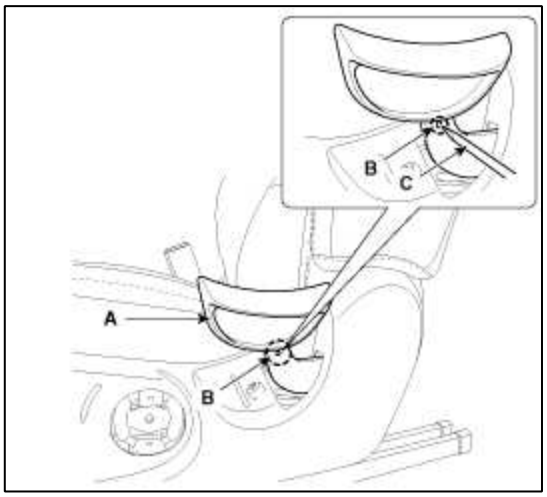
1. Remove the height knob cap (B).
2. After loosening the mounting screws, then remove the pumping lever (A).



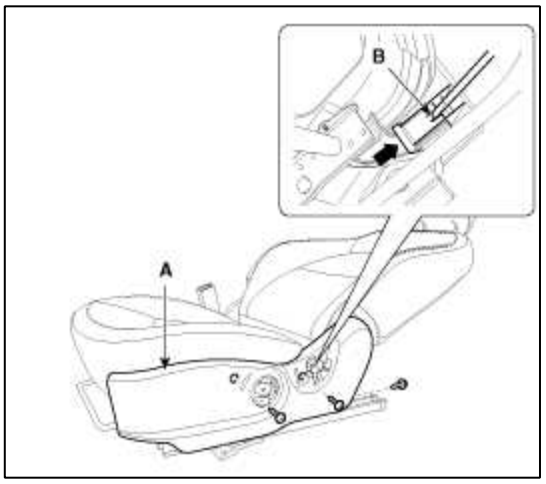
3. To, disengage the lock pin, pull the recliner lever (A) after pushing lock pin hole (B) with the pointed instrument (C).

NOTE

- Be careful not to damage the lock pin.



4. Loosen the shield outer cover mounting screws.
5. To remove the shield outer cover (A), disengage the lock pin (B) and remove the shield outer cover (A).



6. Installation is the reverse of removal.

NOTE

- Replace any damaged clips.

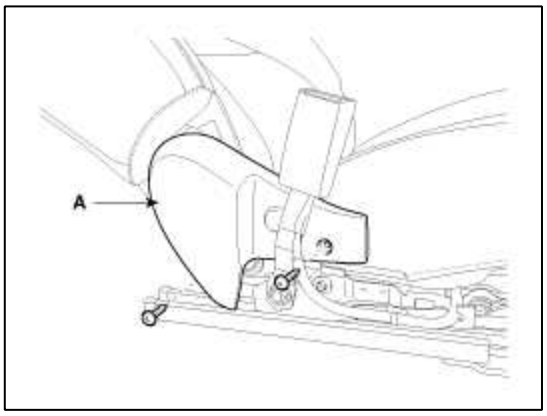
Shield Inner Cover Replacement

CAUTION

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

1. Remove the following items first.:
   A. Front seat assembly

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



3. Installation is the reverse of removal.

NOTE

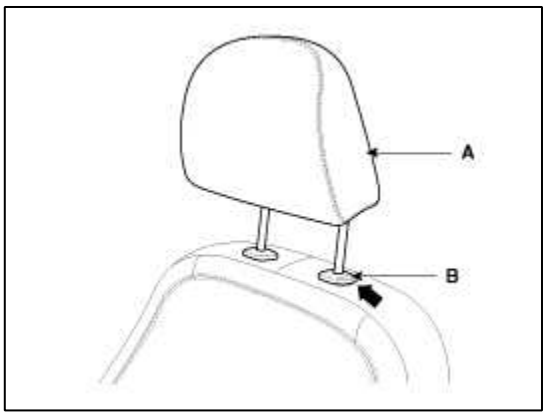
- Replace any damaged clips.

Front Seat Back Cover Replacement

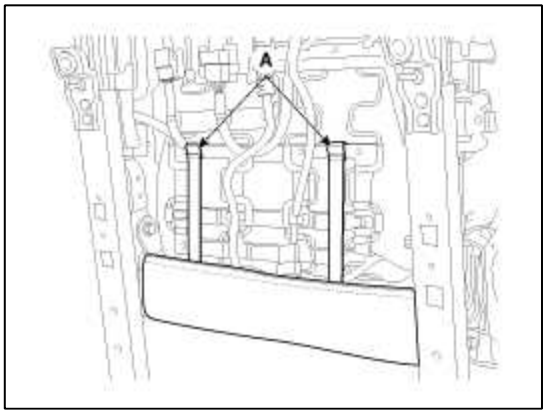
CAUTION

- 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.

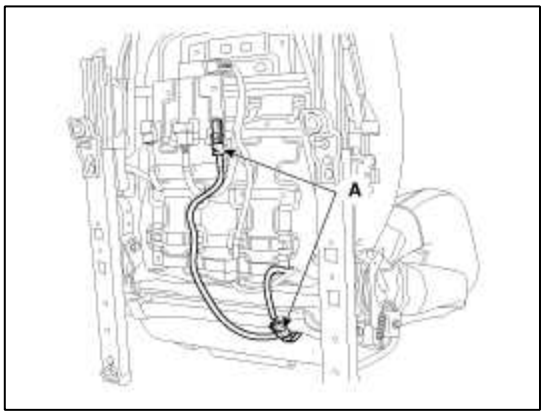
1. Remove the following items first :
   A. Front seat assembly
   B. Shield outer cover
2. Push the lock pin (B), remove the headrest (A).



3. Remove the protector (A).



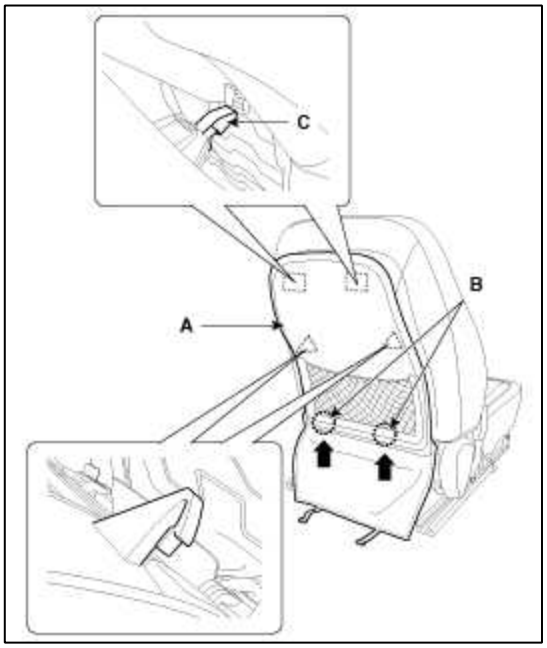
4. Disconnect the connectors (A).



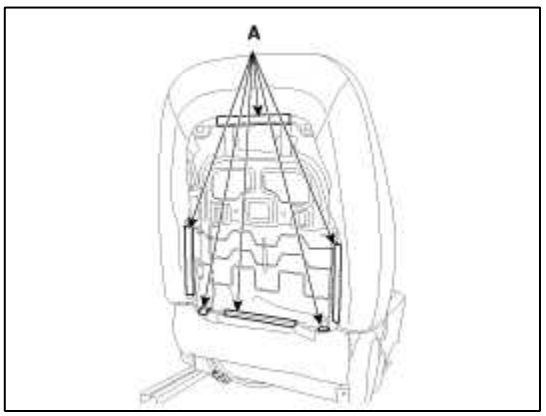
5. To disengage the lock pin (C), lift up the front seat back board (A) to the arrow direction with holding the bottom place (B).

CAUTION

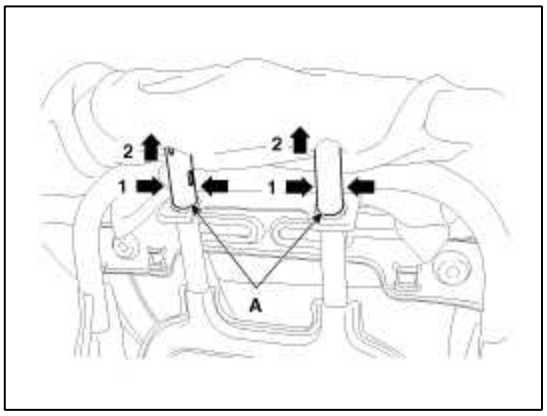
- Be careful not to damage the lock pin.



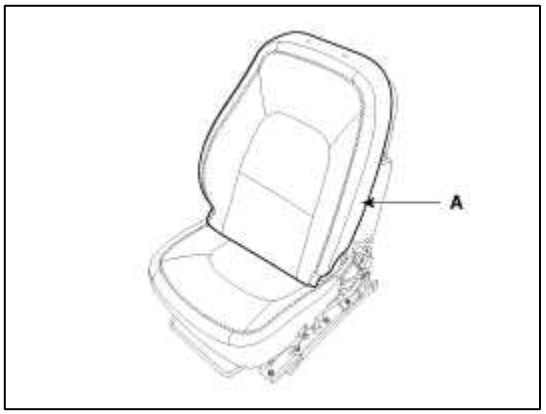
6. Push the protecter (A) by the seat back frame.



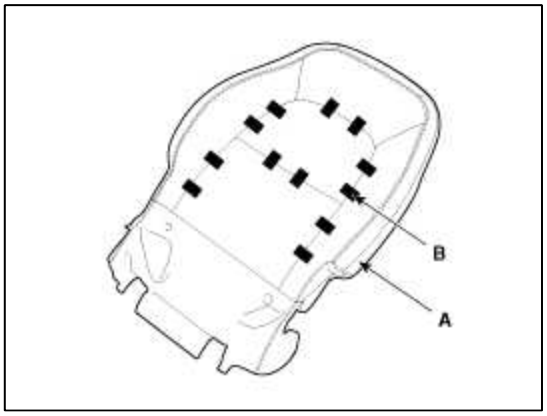
7. Pull out the headrest guides (A) while pinching the end of the guides, and remove them.



8. Remove the front seat back cover (A) from the frame.



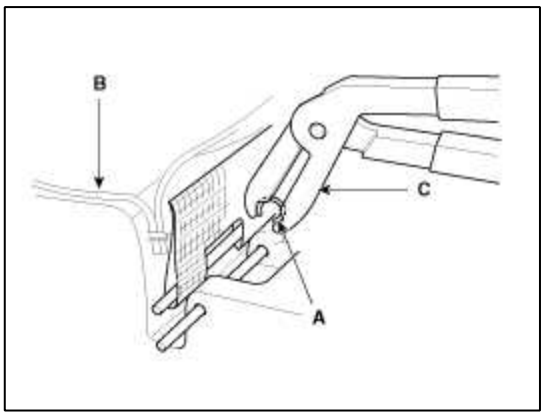
9. After removing the hog-ring clips (B) on the front of seat back and remove the front seat back cover (A).



10. 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)].

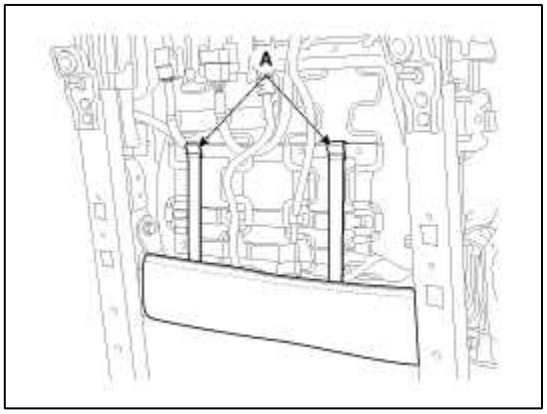


Front Seat Cushion Cover Replacement

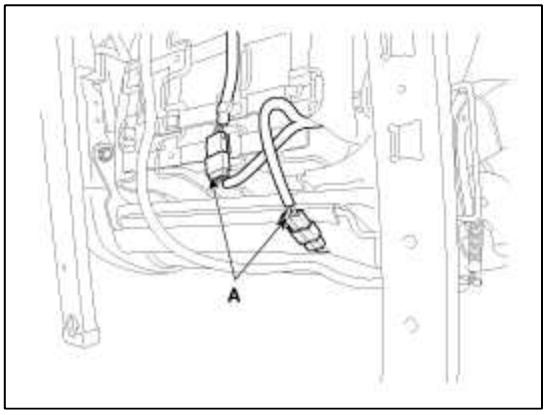
CAUTION

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

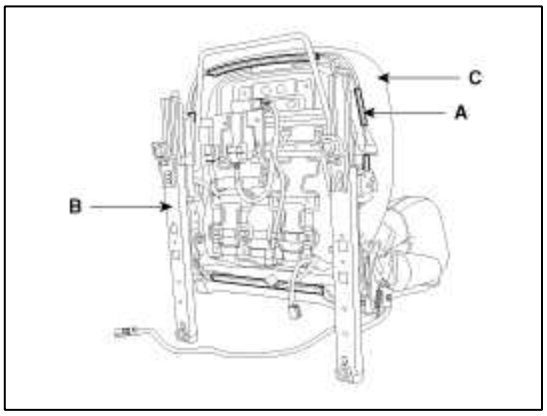
1. Remove the following items first :
   A. Front seat assembly
   B. Shield outer cover
2. Remove the protector (A).



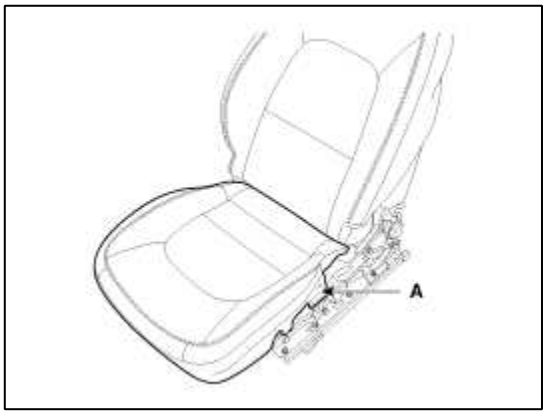
3. Disconnect the connectors (A).



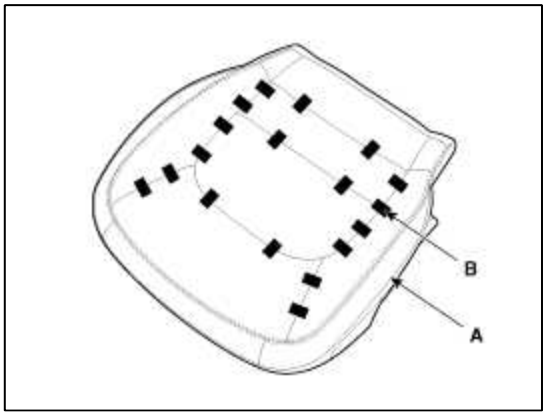
4. Push the protecter(A), and then front seat cushion cover (C) from the frame(B).



5. Remove the front seat cushion cover (A) from the frame.



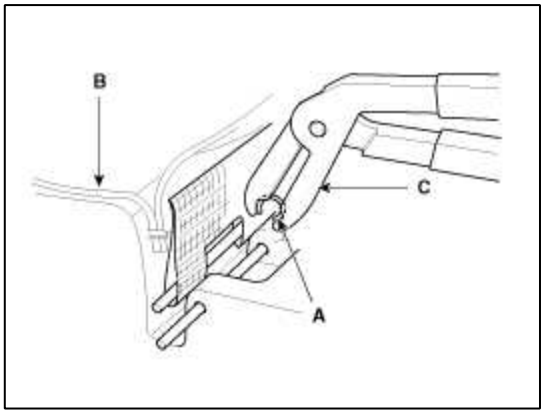
6. After removing the hog-ring clips (B) on the front of seat cushion and remove the front seat cushion cover (A).



7. 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)].

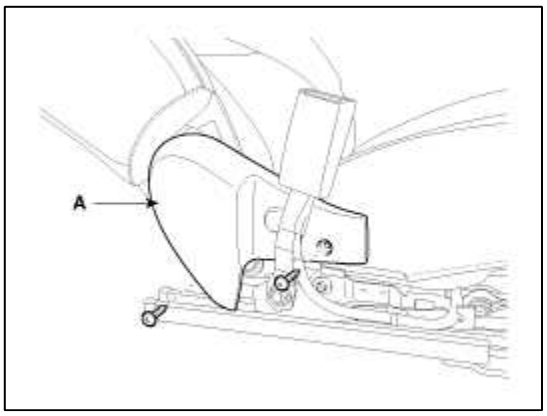


Front Seat Frame Replacement

CAUTION

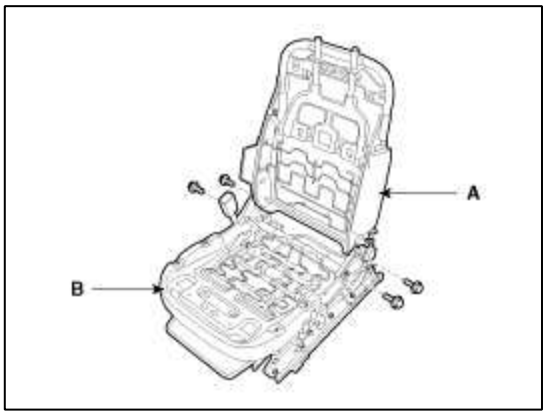
- When prying with a flat-tip screwdriver, wrap it with protective tape, and apply protective tape around the related parts your hands.
- Put on gloves to protect your hands.

1. Remove the following items first :
   A. Front seat assembly
   B. Shield outer cover
   C. Front seat back cover
   D. Front seat cushion cover
2. After loosening the mounting screws, then remove the shield inner cover (A).



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

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



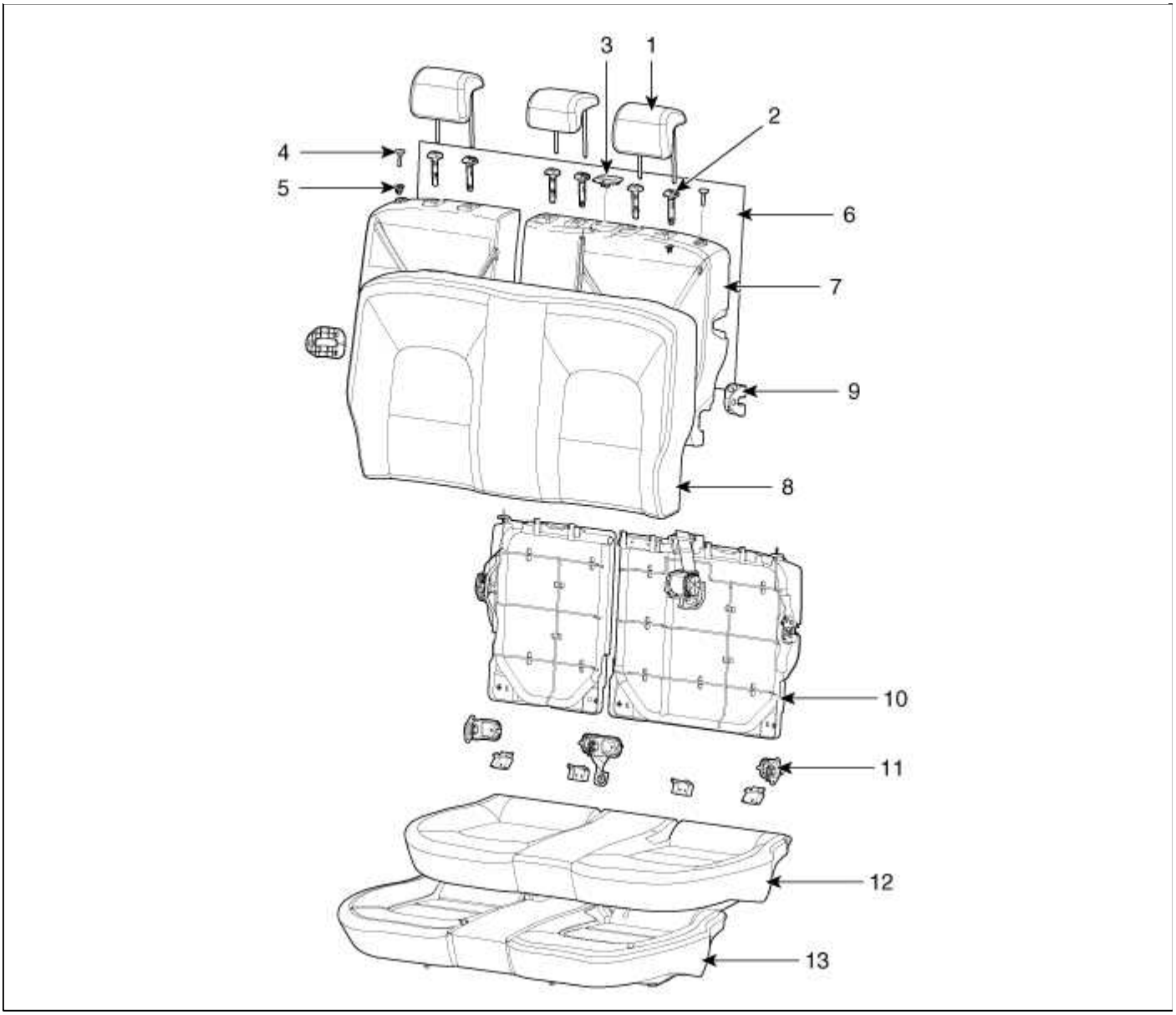
4. Installation is the reverse of removal.

NOTE

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

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

Components



1. Headrest 2 . Headrest guide 3 . Webbing guide 4 . Rear latch knob 5 . Rear back knob bush 6 . Rear seat back silencer cloth 7 . Rear seat back pad	8 . Rear seat back cover 9 . Rear seat back latch cover 10 . Rear seat back frame assembly 11 . Rear seat back hinge assembly 12 . Rear seat cushion cover 13 . Rear seat cushion pad

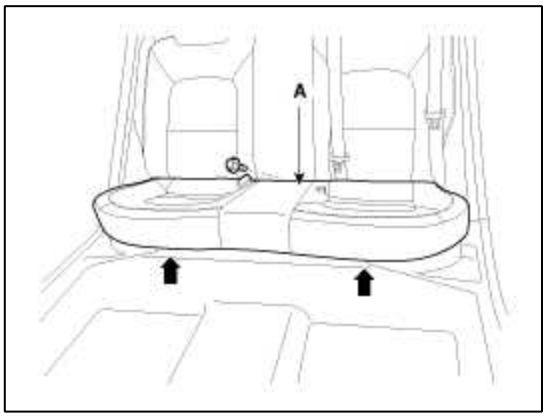
Body (Interior and Exterior) > Seat & Power Seat > Rear Seat > Repair procedures

Replacement

Rear Seat Assembly Replacement

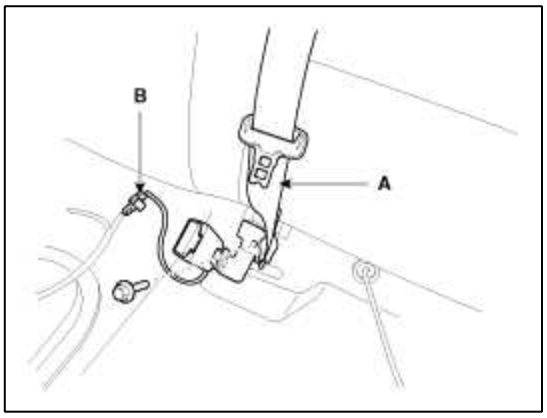
1. After loosening the mounting bolt, then remove the rear seat cushion (A).

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



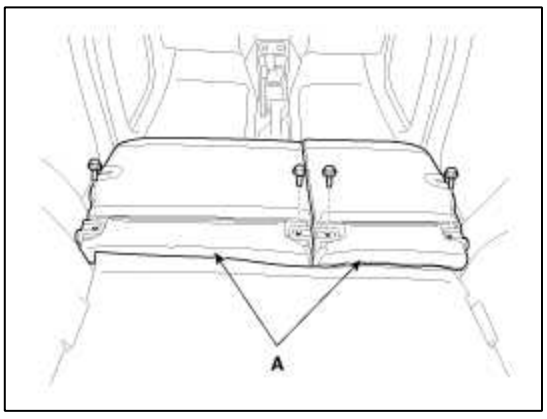
2. Disconnect the rear seat buckle connector (B).
3. After loosening the mounting bolt, then remove the center rear seat belt lower anchor (A).

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



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

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



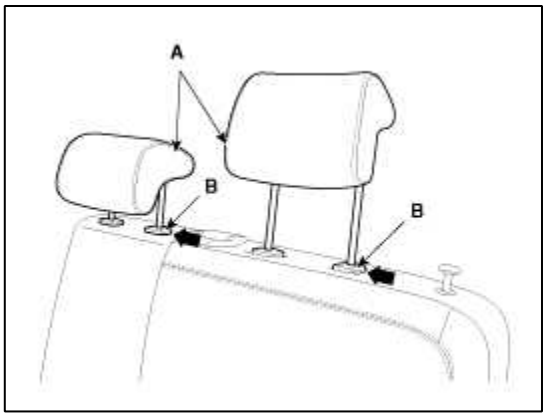
5. Installation is the reverse of removal.

Rear Seat Back Cover Replacement [LH]

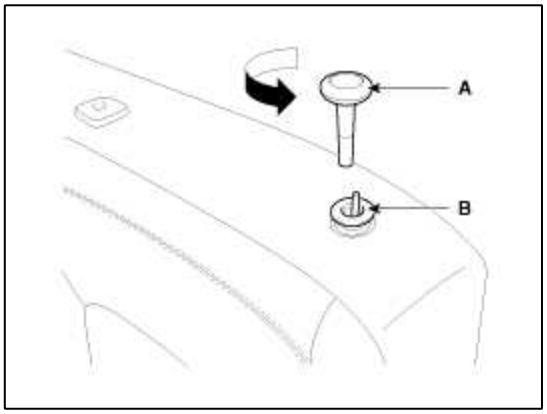
CAUTION

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

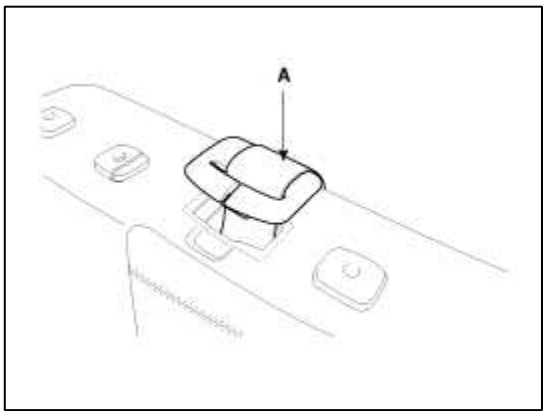
1. Remove the following items first :
   A. Rear seat back assembly [LH]
2. Push the lock pin (B), remove the headrest (A).



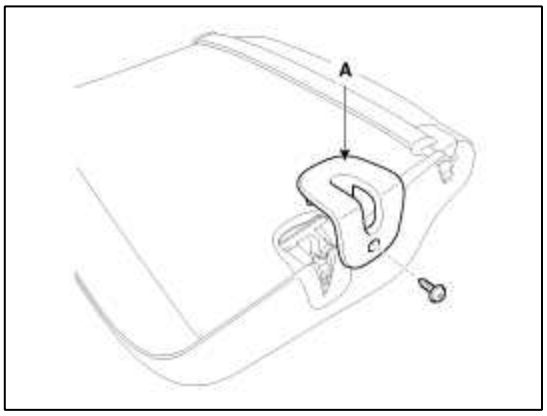
3. Remove the rear latch knob (A) after turning in the counter clock-wise direction.
4. Remove the rear back knob bush (B).



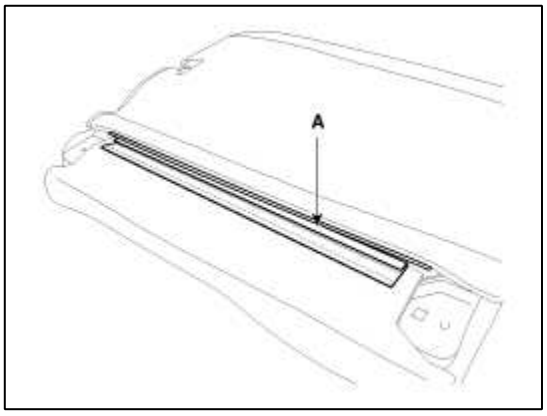
5. Using a screwdriver or remover, remove the webbing guide (A).



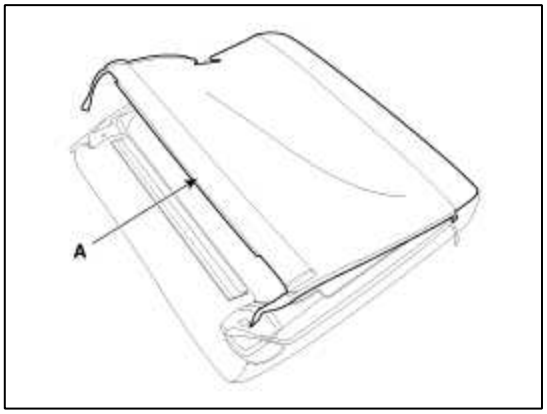
6. After loosening the mounting screw, then remove the rear seat back latch cover (A).



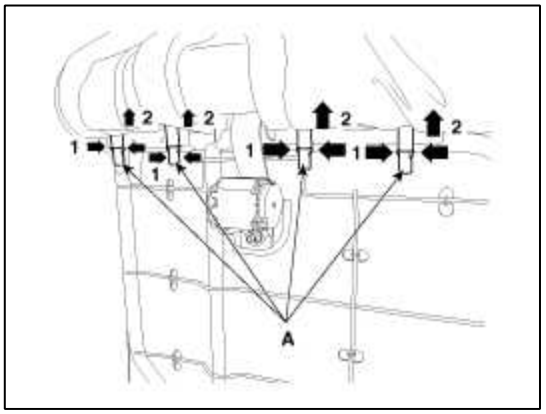
7. Remove the rear seat back lower mounting protector (A).



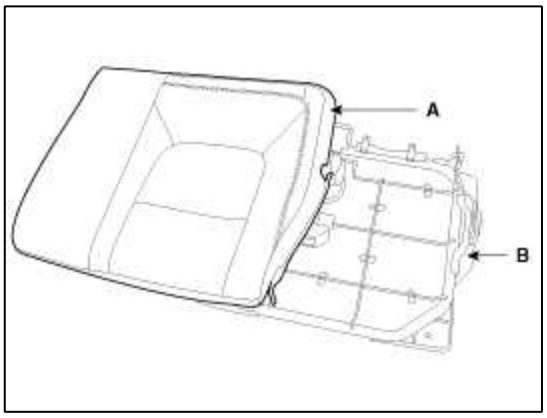
8. Zip off the rear seat back cover (A), and then full it up.



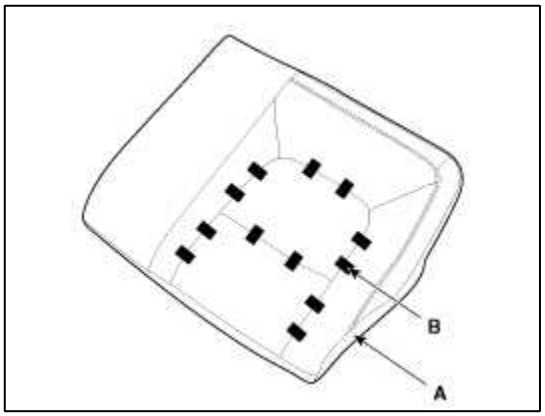
9. Pull out the headrest guides (A) while pinching the end of the guides, and remove them.



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



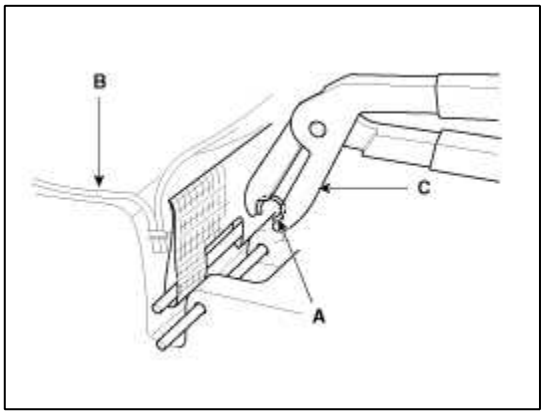
11. After removing the hog-ring clips (B) on the rear of seat back and remove the rear seat back cover (A).



12. Installation is the reverse of removal.

NOTE

- To prevent wrinkles, make sure the material is stretched evenly over the cover (B) before securing the hog-ring clips (A).
- Replace the hog ring clips with new ones using special tool [C (09880-4F000)].



Rear Seat Latch Replacement [LH]

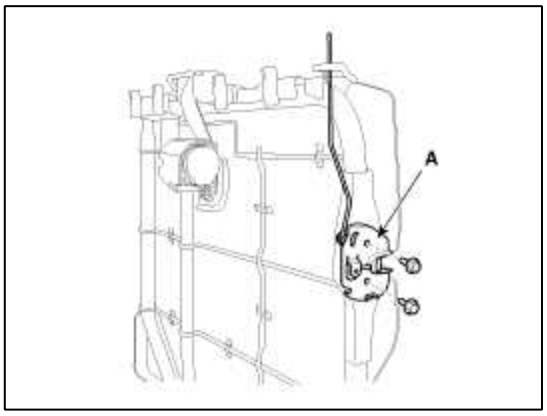
CAUTION

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

1. Remove the following items first :
   A. Rear seat back assembly [LH]
   B. Rear seat back cover [LH]

2. After loosening the mounting bolts, then remove the rear seat latch assembly (A).

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



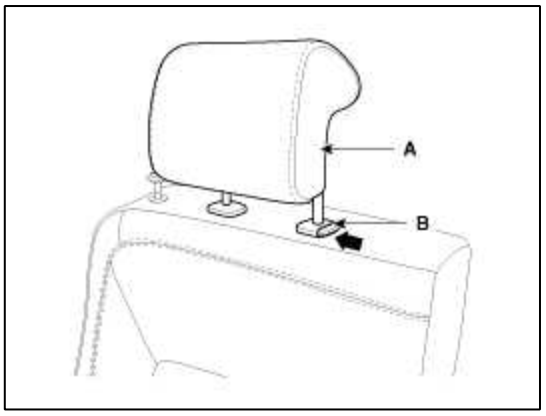
3. Installation is the reverse of removal.

Rear Seat Back Cover Replacement [RH]

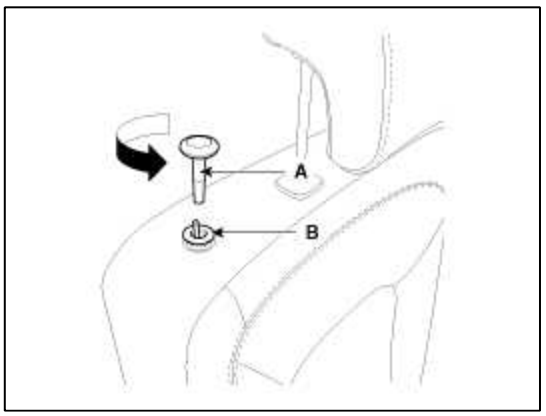
CAUTION

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

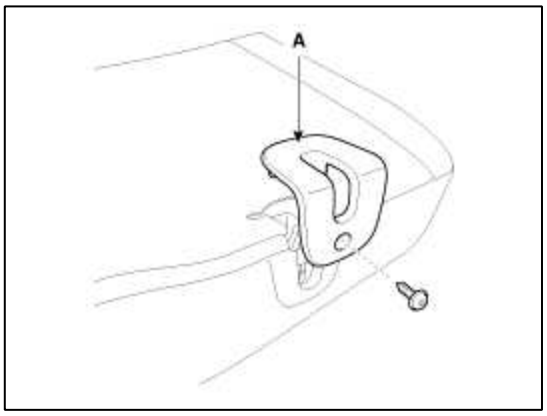
1. Remove the following items first :
   A. Rear seat back assembly [RH]
2. Push the lock pin (B), remove the headrest (A).



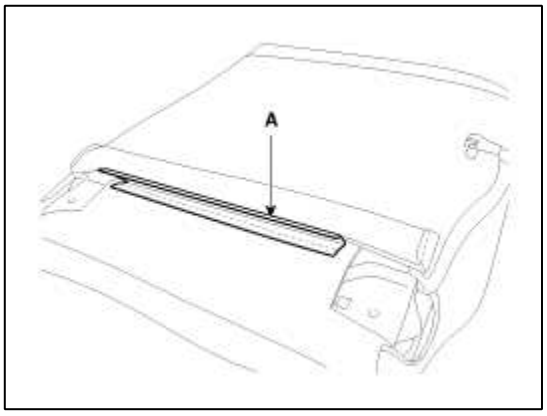
3. Remove the rear latch knob (A) after turning in the counter clock-wise direction.
4. Remove the rear back knob bush (B).



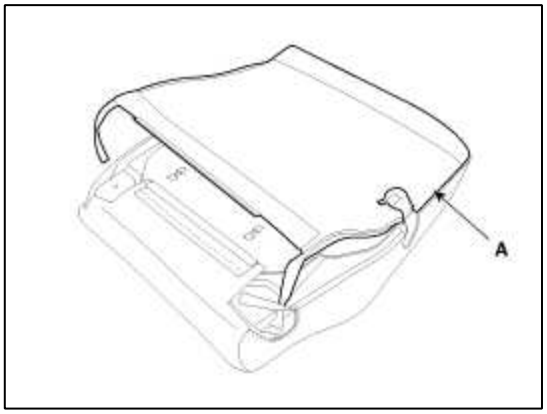
5. After loosening the mounting screw, then remove the rear seat back latch cover (A).



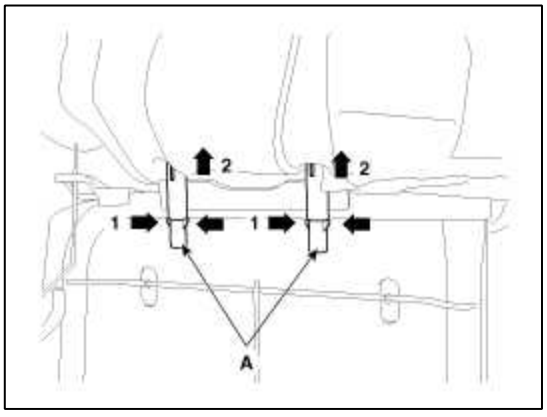
6. Remove the rear seat back lower mounting protector (A).



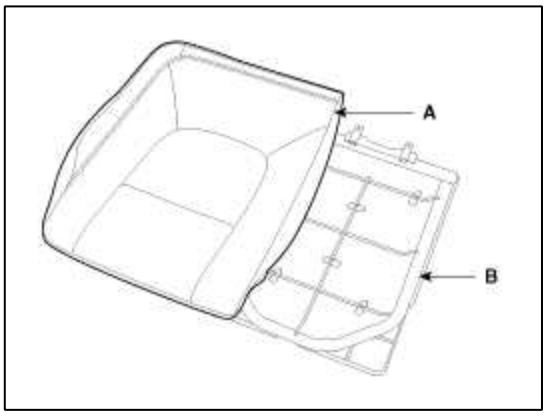
7. Zip off the rear seat back cover (A), and then full it up.



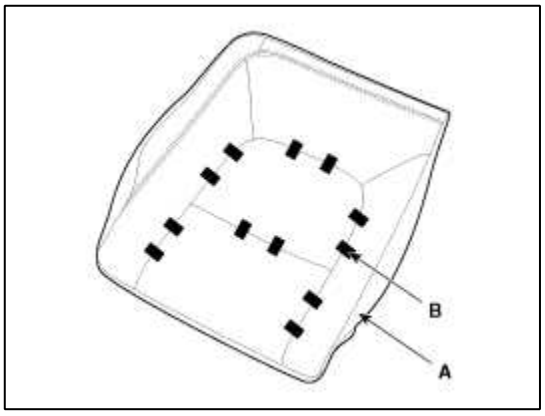
8. Pull out the headrest guides (A) while pinching the end of the guides, and remove them.



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



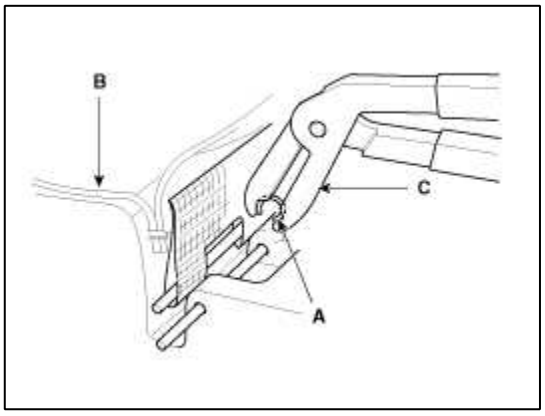
10. After removing the hog-ring clips (B) on the rear of seat back and remove the rear seat back cover (A).



11. Installation is the reverse of removal.

NOTE

- To prevent wrinkles, make sure the material is stretched evenly over the cover (B) before securing the hog-ring clips (A).
- Replace the hog ring clips with new ones using special tool [C (09880-4F000)].



Rear Seat Latch Replacement [RH]

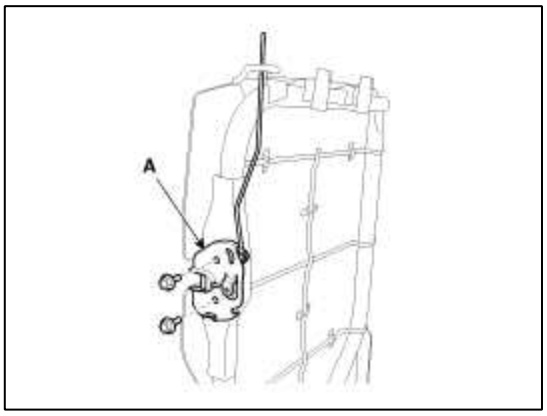
CAUTION

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

1. Remove the following items first :
   A. Rear seat back assembly [RH]
   B. Rear seat back cover [RH]

2. After loosening the mounting bolts, then remove the rear seat latch assembly (A).

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



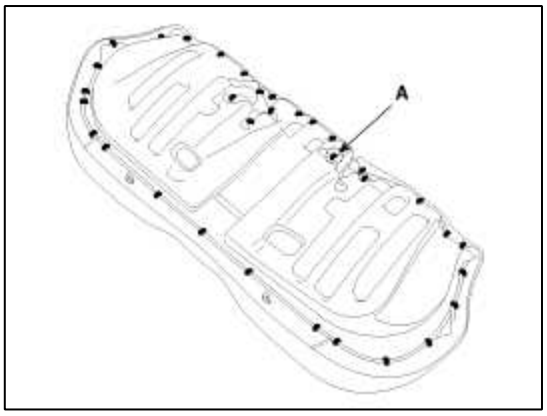
3. Installation is the reverse of removal.

Rear Seat Cushion Cover Replacement

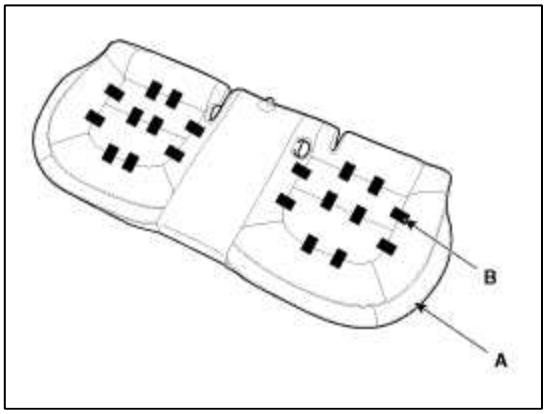
CAUTION

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

1. Remove the following items first :
   A. Rear seat cushion cover assembly
2. Remove the hog-ring clips (A).



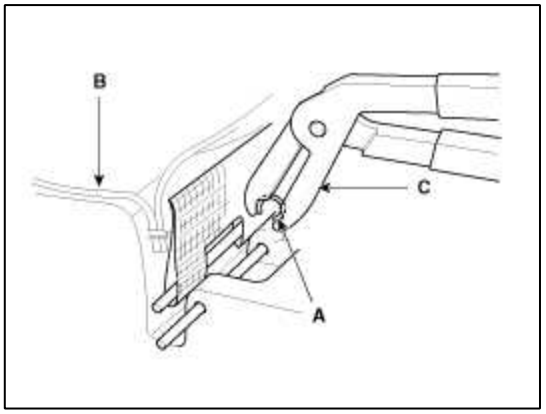
3. After removing the hog-ring clips (B) on the rear of seat cushion and remove the rear seat cushion cover (A).



4. Installation is the reverse of removal.

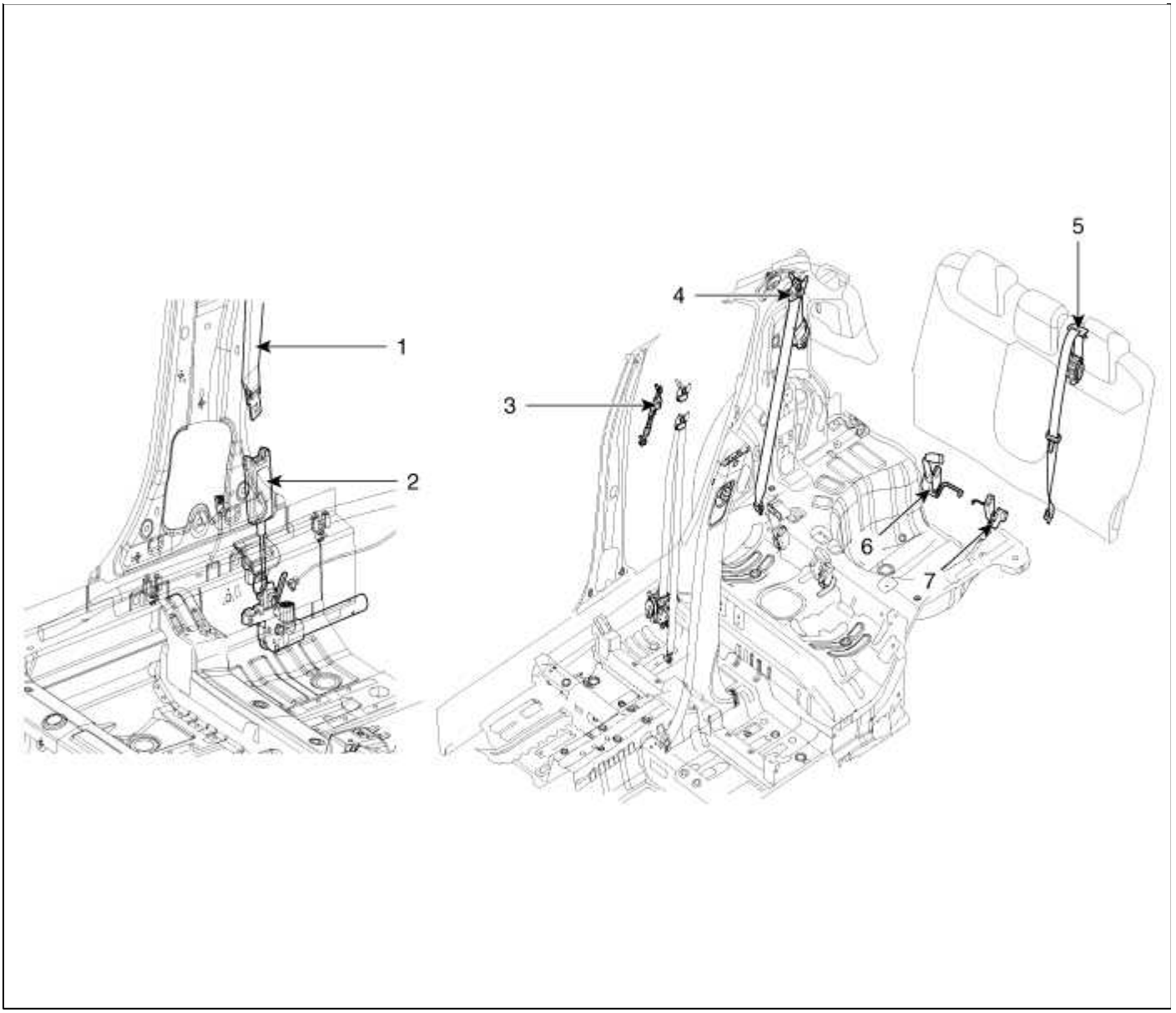
NOTE

- To prevent wrinkles, make sure the material is stretched evenly over the cover (B) before securing the hog-ring clips (A).
- Replace the hog ring clips with new ones using special tool [C (09880-4F000)].



Body (Interior and Exterior) > Seat Belt > Components and Components Location

Components



1 . Front seat belt 2. Anchor pretensioner 3 . Height adjuster 4. Rear seat belt	5. Rear center seat belt 6. Rear seat belt buckle [RH] 7. Rear seat belt buckle [LH]

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

Replacement

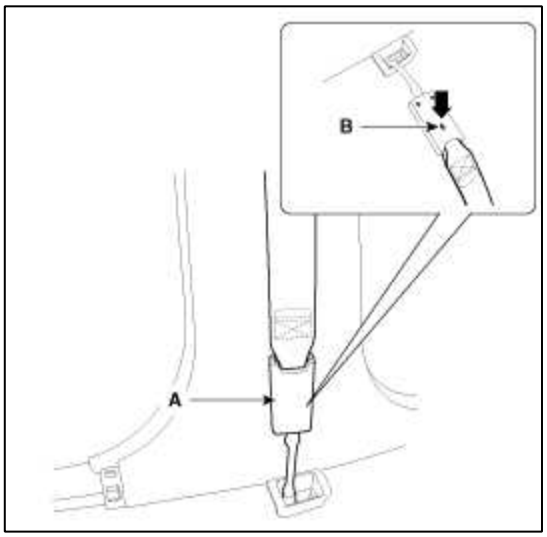
Front Seat Belt Replacement

CAUTION

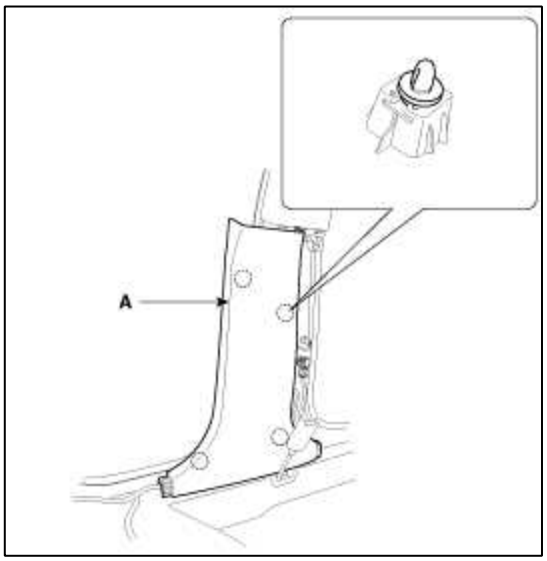
- When installing the belt, make sure not to damaged the pretensioner.

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")

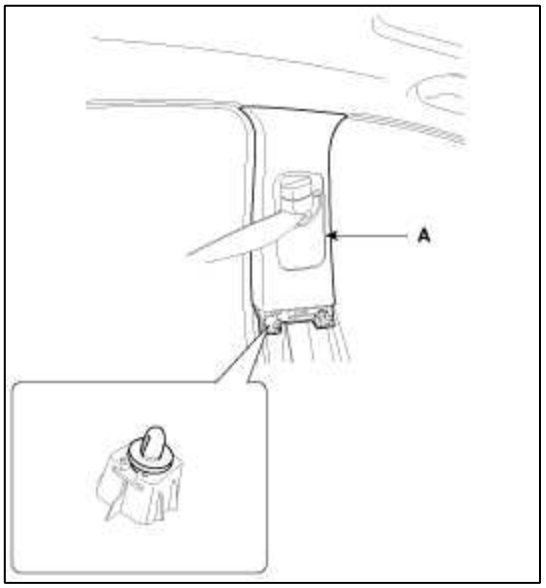
2. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
3. The seat belt anchor pretensioner (A) can be removed after pushing the lock pin (B) as arrow direction.



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

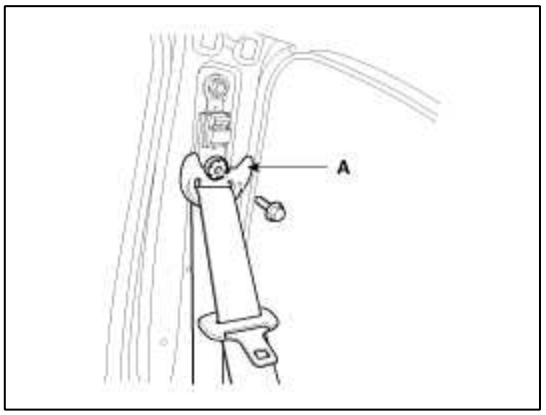


5. Using a screwdriver or remover, remove the center pillar upper trim (A).



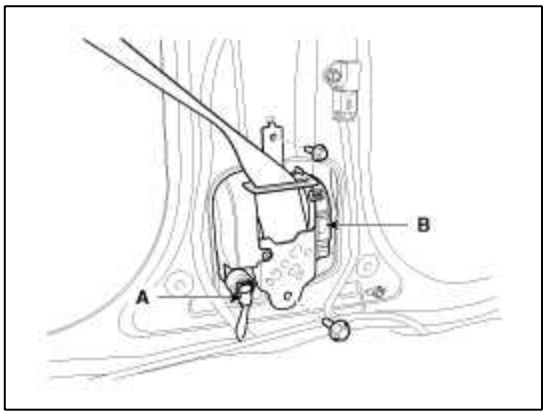
6. After loosening the mounting bolt, then remove the front seat belt upper anchor (A).

Tightening torque :
39.2 ~ 53.9 N.m (4.0 ~ 5.5 kgf.m, 28.8 ~ 39.8 lb-ft)



7. After disconnecting the pretensioner connector lock pin, remove the seat belt pretensioner 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, 28.8 ~ 39.8 lb-ft)



8. Installation is the reverse of removal.

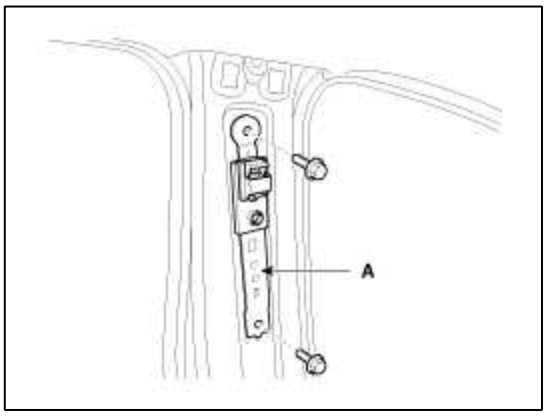
CAUTION

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

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, 28.8 ~ 39.8 lb-ft)



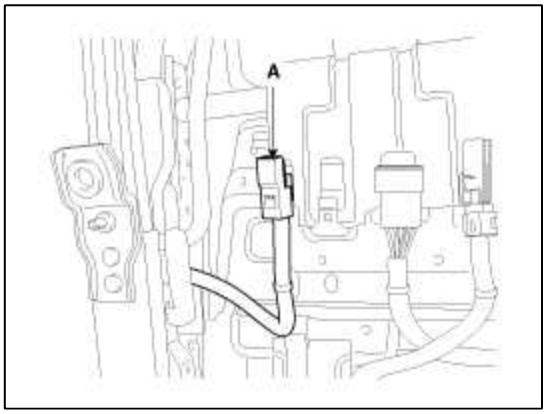
3. Installation is the reverse of removal.

NOTE

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

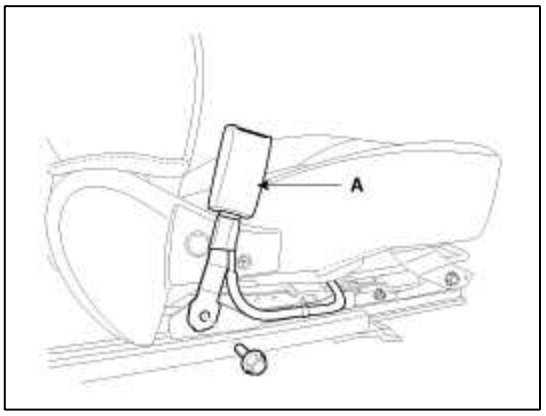
Front Seat Belt Buckle Replacement

1. Remove the following items first :
   A. Front seat assembly
      (Refer to the BD group - "Front Seat")
2. Remove the front seat belt buckle connector mounting clip (A).



3. 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, 28.8 ~ 39.8 lb-ft)



4. Installation is the reverse of removal.

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

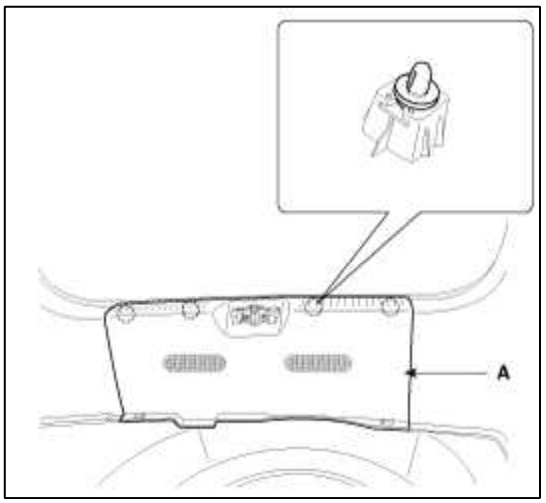
Replacement

Rear Seat Belt Replacement

CAUTION

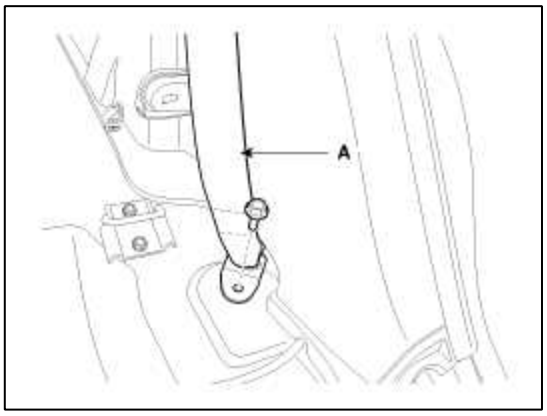
- When installing the belt, make sure not to damaged the retractor.

1. Remove the following items first :
   A. Rear seat assembly
      (Refer to the BD group - "Rear Seat")
   B. Rear door scuff trim
      (Refer to the BD group - "Interior Trim")
2. Using a screwdriver or remover, remove the rear transverse trim (A).

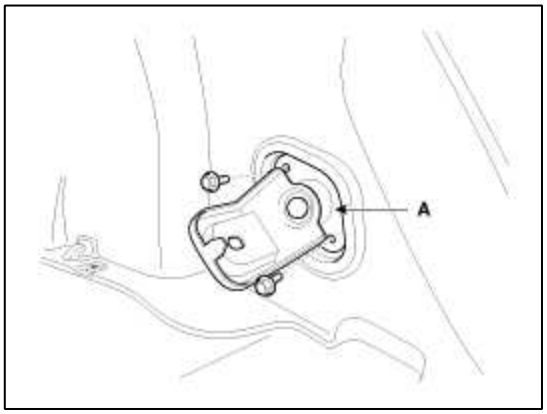


3. After loosening the mounting bolt, then remove the rear seat belt lower anchor (A).

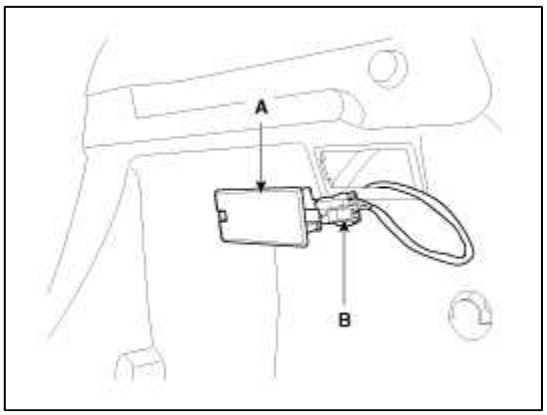
Tightening torque :
39.2 ~ 53.9 N.m (4.0 ~ 5.5 kgf.m, 28.8 ~ 39.8 lb-ft)



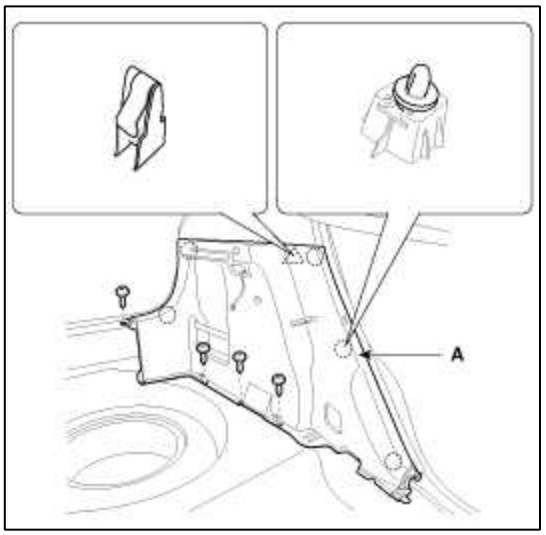
4. After loosening the mounting blots, then remove the rear seat bracket (A).



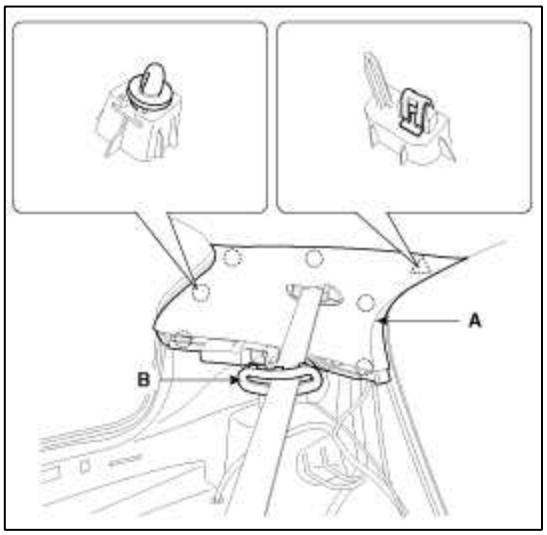
5. Using a screwdriver or remover, remove the lamp (A).
6. Disconnect the lamp connector (B).



7. After loosening the mounting screws, then remove the luggage side trim (A).

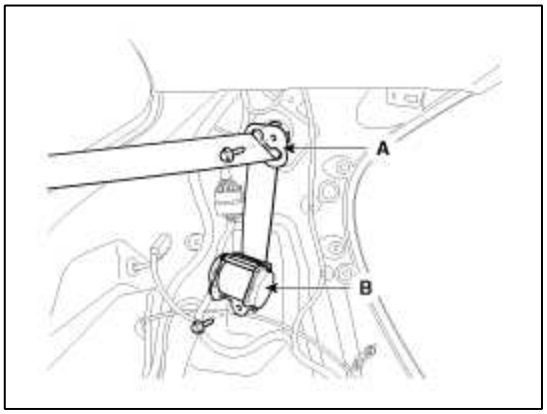


8. Remove the rear seat belt upper anchor cover (B).
9. Using a screwdriver or remover, remove the rear pillar trim (A).



10. After loosening the mounting bolt, then remove the rear seat belt (A) and rear seat belt retractor (B).

Tightening torque :
39.2 ~ 53.9 N.m (4.0 ~ 5.5 kgf.m, 28.8 ~ 39.8 lb-ft)



11. Installation is the reverse of removal.

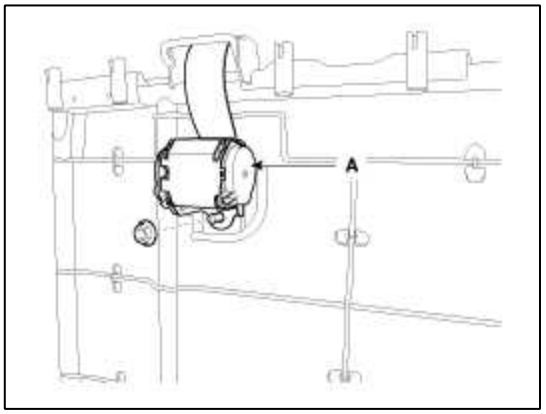
NOTE

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

Center Rear Seat Belt

1. Remove the following items first :
   A. Rear seat back assembly [LH]
      (Refer to the BD group - "Rear Seat")
   B. Rear seat back cover [LH]
      (Refer to the BD group - "Interior Trim")
2. After loosening the mounting nut, then remove the center rear seat belt retractor (A).

Tightening torque :
39.2 ~ 53.9 N.m (4.0 ~ 5.5 kgf.m, 28.8 ~ 39.8 lb-ft)



3. Installation is the reverse of removal.

NOTE

- Replace any damaged clips.

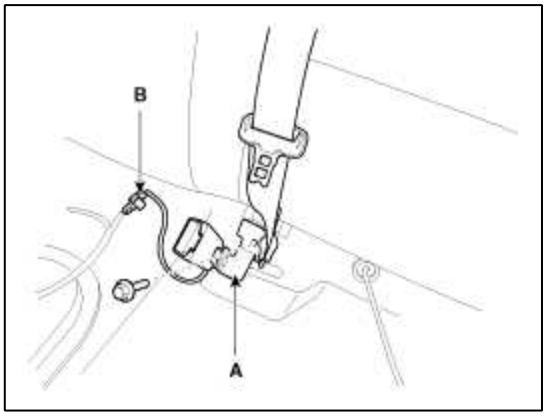
Rear Seat Belt Buckle Replacement

1. Remove the following items first :
   A. Rear seat cushion assembly
      (Refer to the BD group - "Rear Seat")
2. Disconnect the rear seat buckle connector (B).

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

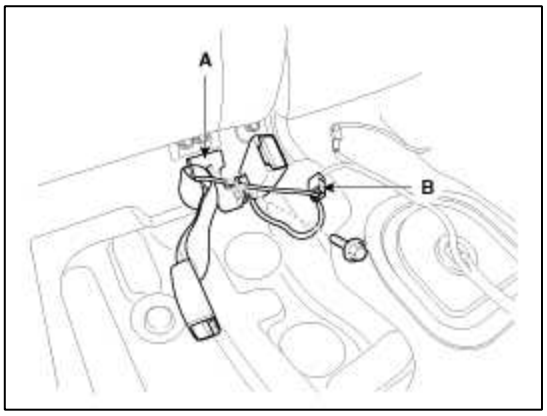
Tightening torque :
39.2 ~ 53.9 N.m (4.0 ~ 5.5 kgf.m, 28.8 ~ 39.8 lb-ft)

[LH]



[RH]

Tightening torque :
39.2 ~ 53.9 N.m (4.0 ~ 5.5 kgf.m, 28.8 ~ 39.8 lb-ft)



4. Installation is the reverse of removal.

RIO(UB) > 2012 > G 1.6 GDI > Body Electrical System

Body Electrical System > General Information > General Information

General Troubleshooting Information

Before Troubleshooting

1. Check applicable fuses in the appropriate fuse/relay box.
2. Check the battery for damage, state of charge, and clean and tight connections.
   (Refer to the EE group - "Battery")

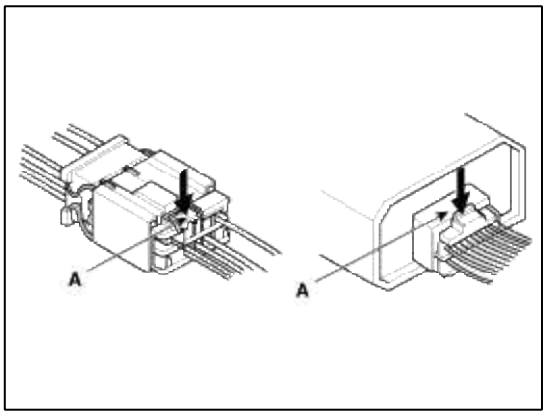
NOTE

- Do not quick-charge a battery unless the battery ground cable has been disconnected, otherwise you will damage the alternator diodes.
- Do not attempt to crank the engine with the battery ground cable loosely connected or you will severely damage the wiring.

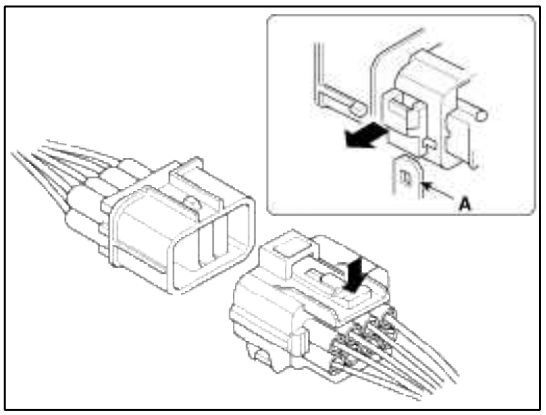
3. Check the alternator belt tension.

Handling Connectors

1. Make sure the connectors are clean and have no loose wire terminals.
2. Make sure multiple cavity connectors are packed with grease (except watertight connectors).
3. All connectors have push-down release type locks (A).

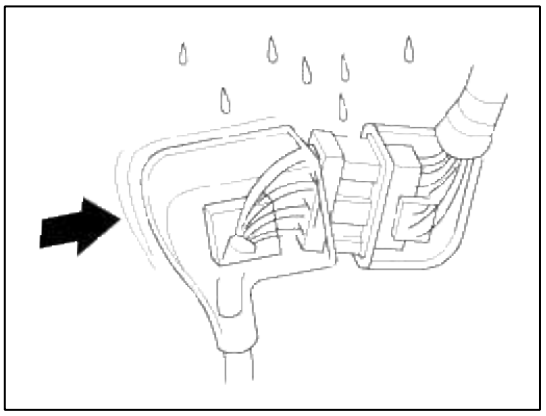


4. Some connectors have a clip on their side used to attach them to a mount bracket on the body or on another component. This clip has a pull type lock.
5. Some mounted connectors cannot be disconnected unless you first release the lock and remove the connector from its mount bracket (A).

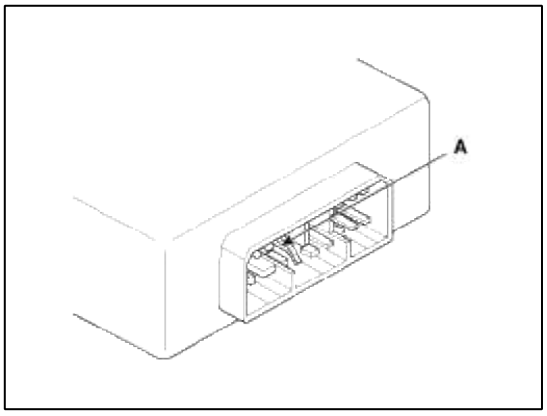


6. Never try to disconnect connectors by pulling on their wires; pull on the connector halves instead.

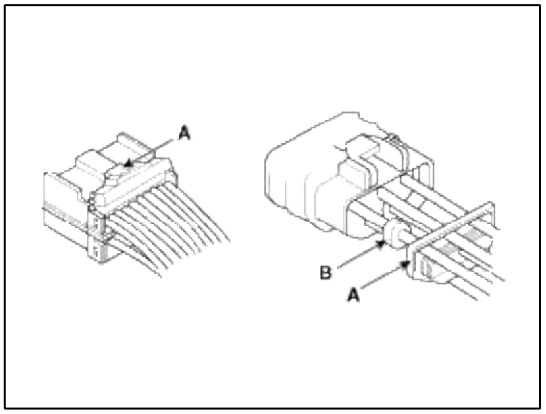
7. Always reinstall plastic covers.



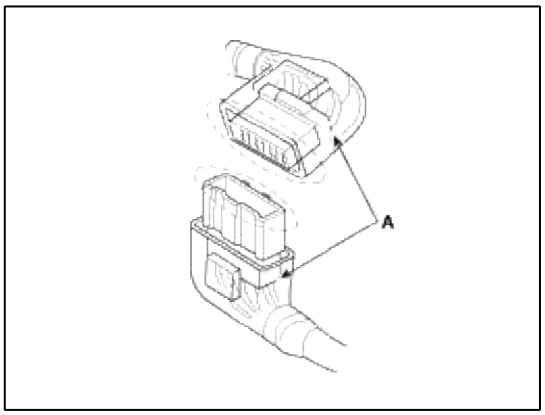
8. Before connecting connectors, make sure the terminals (A) are in place and not bent.



9. Check for loose retainer (A) and rubber seals (B).

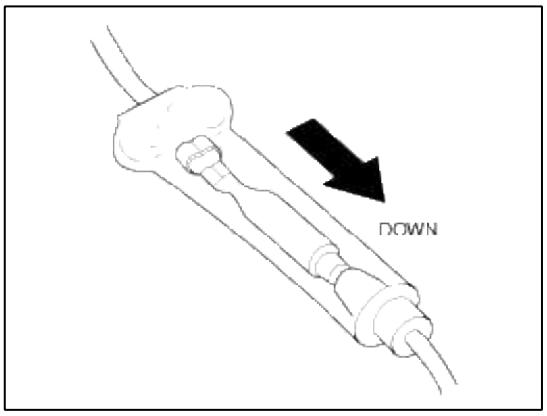


10. The backs of some connectors are packed with grease. Add grease if necessary. If the grease (A) is contaminated, replace it.



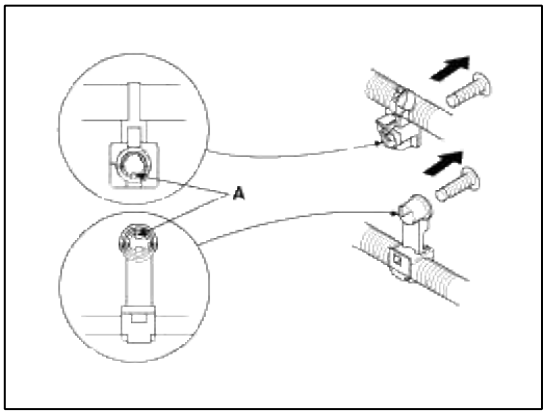
11. Insert the connector all the way and make sure it is securely locked.

12. Position wires so that the open end of the cover faces down.

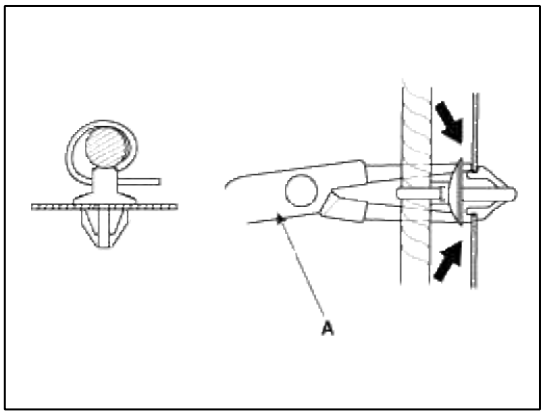


Handling Wires And Harnesses

1. Secure wires and wire harnesses to the frame with their respective wire ties at the designated locations.
2. Remove clips carefully; don't damage their locks (A).

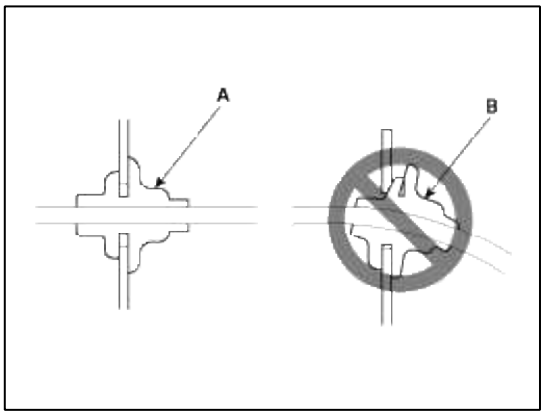


3. Slip pliers (A) under the clip base and through the hole at an angle, and then squeeze the expansion tabs to release the clip.



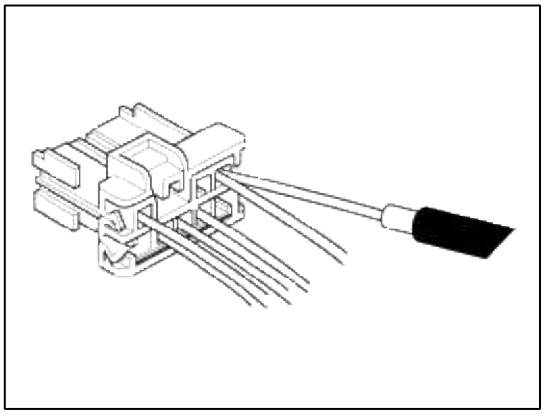
4. After installing harness clips, make sure the harness doesn't interfere with any moving parts.
5. Keep wire harnesses away from exhaust pipes and other hot parts, from sharp edges of brackets and holes, and from exposed screws and bolts.

6. Seat grommets in their grooves properly (A). Do not leave grommets distorted (B).

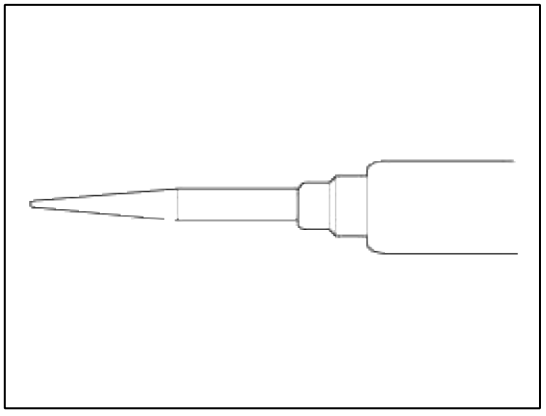


Testing And Repairs

1. Do not use wires or harnesses with broken insulation.
   Replace them or repair them by wrapping the break with electrical tape.
2. After installing parts, make sure that no wires are pinched under them.
3. When using electrical test equipment, follow the manufacturer's instructions and those described in this manual.
4. If possible, insert the remover tool from the wire side (except waterproof connector).



5. Use a remover tool with a tapered tip.



   Refer to the user's guide in the wiring repair kit II (Pub. No. : 0K000 003 A05)

Five-step Troubleshooting

1. Verify the complaint
   Turn on all the components in the problem circuit to verify the customer complaint. Note the symptoms. Do not begin disassembly or testing until you have narrowed down the problem area.
2. Analyze the schematic
   Look up the schematic for the problem circuit.
   Determine how the circuit is supposed to work by tracing the current paths from the power feed through the circuit components to ground. If several circuits fail at the same time, the fuse or ground is a likely cause.
   Based on the symptoms and your understanding of the circuit operation, identify one or more possible causes of the problem.

3. Isolate the problem by testing the circuit.
   Make circuit tests to check the diagnosis you made in step 2. Keep in mind that a logical, simple procedure is the key to efficient troubleshooting.
   Test for the most likely cause of failure first. Try to make tests at points that are easily accessible.
4. Fix the problem
   Once the specific problem is identified, make the repair. Be sure to use proper tools and safe procedures.
5. Make sure the circuit works
   Turn on all components in the repaired circuit in all modes to make sure you've fixed the entire problem. If the problem was a blown fuse, be sure to test all of the circuits on the fuse. Make sure no new problems turn up and the original problem does not recur.

Battery Reset

Description

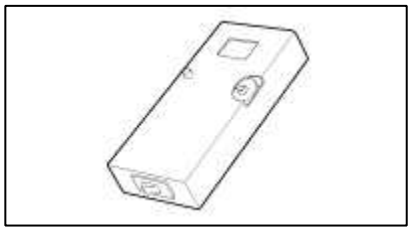
When reconnecting the battery cable after disconnecting, recharging battery after discharged or installing the memory fuse located on the driver's side panel after removing, be sure to reset systems mentioned in the below table.
In addition, when replacing or reinstalling their fuses after removing, they should be reset according to the below table. Please refer to the below table when servicing.

System	Resetting
Auto up/down window	Whenever the battery is disconnected, discharged or the related fuse is replaced or reinstalled, reset the Auto up/down window system according to the procedure below. 1) Turn the ignition switch to the ON position. 2) Pull up the power window switch in order that the window can close completely, and then keep pulling up the power switch for about 1 second.
Sunroof	Whenever the battery is disconnected, discharged or the related fuse is replaced or reinstalled, the sunroof system must be reset according to the procedure below. 1) Turn the ignition switch to the ON position. 2) According to the position of the sunroof, do the following. - In case the sunroof is closed completely or tilted: Push the sunroof control lever upward until the sunroof tilts completely upward. - In case the sunroof is open: Push the sunroof control lever forward until the sunroof closes completely. Push the sunroof control lever upward until the sunroof tilts completely upward. 3) Release the sunroof control lever. 4) Push the sunroof control lever upward until the sunroof has returned to the original tilt position after it is raised a little higher than the maximum tilt position. Then, release the lever. 5) Push the sunroof control lever upward until the sunroof operates as follows; TILT DOWN → SLIDE OPEN → SLIDE CLOSE Then, release the lever.
Trip computer	When the battery is disconnected and reconnected, the set functions of the trip computer become initialized. So, you need to explain this information to the customer.
Clock	Whenever the battery terminals or related fuses are disconnected, you must reset the time. When the ignition switch is in the ACC or ON position, the clock buttons operate as follows: 1. Press the SETUP button for more than 1 second. If the audio is turned on, push the SETUP button and select the clock mode turning the TUNE knob. 2. Adjust the hour and press the ENTER button to set. 3. Use the same method to adjust the minute and press the ENTER button to complete.

Audio	When the battery is disconnected and reconnected, the customer's radio stations become initialized. So, you need to record the customer's radio stations prior to service, and after service, set the customer's radio stations into the audio.

Body Electrical System > General Information > Special Service Tools

Special Service Tools

Tool (Number and Name)	Illustration	Application
RKE Battery Checker (09954-2P100)		Measuring the RKE battery voltage

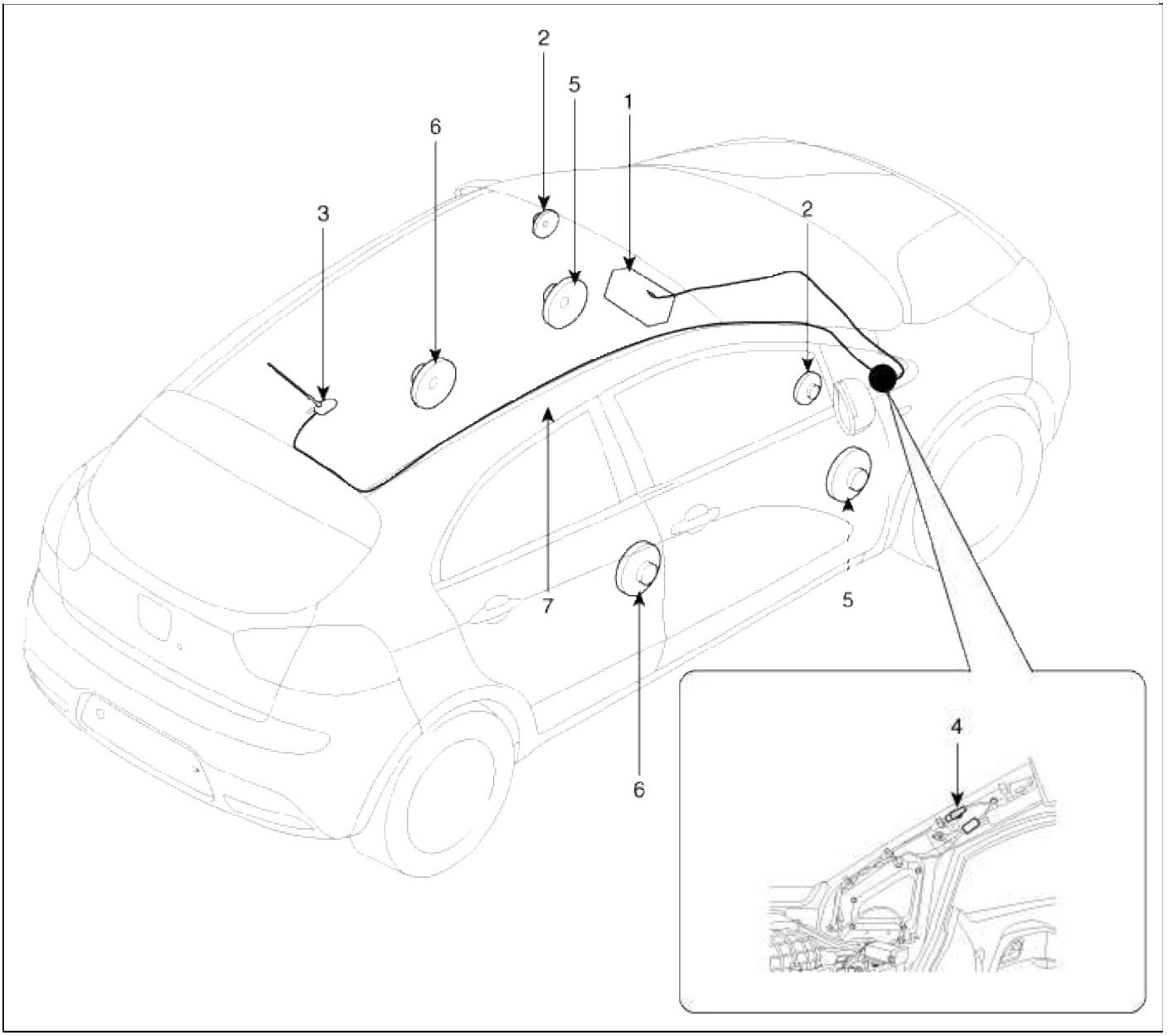
Body Electrical System > Audio > Specifications

Specification

Item	Specification	
Model	Radio / VCD / MP3 (BA900)	Radio / CD / MP3 (PA30A)
Power supply	DC 14.4V	
Load Impedance	4Ω X 4	
Tuning type	PLL synthesized type	
Antenna	80PF 75Ω	
Dark current	Max. 3.0 mA (Head unit only)	Max. 1.0 mA (Head unit only)

Body Electrical System > Audio > Components and Components Location

Component Location

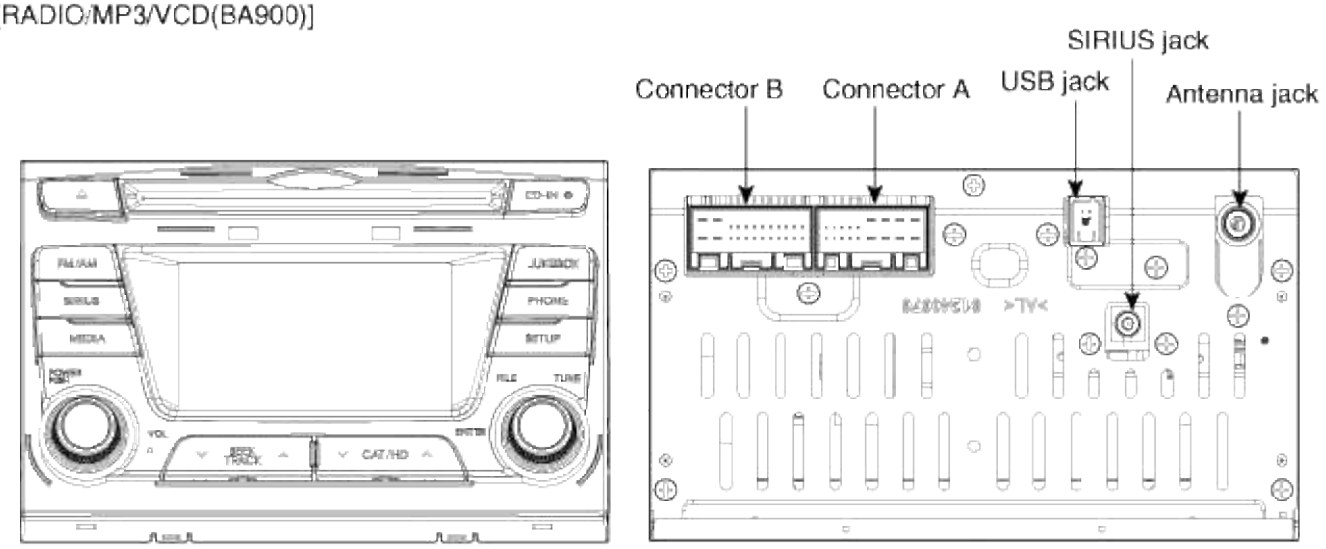


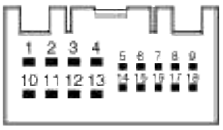
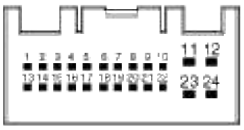
1. Audio unit 2. Tweeter speaker 3. Roof antenna (Radio) 4. Antenna cable connector	5. Front door speaker 6. Rear door speaker 7. Antenna feeder cable

Body Electrical System > Audio > Audio Unit > Components and Components Location

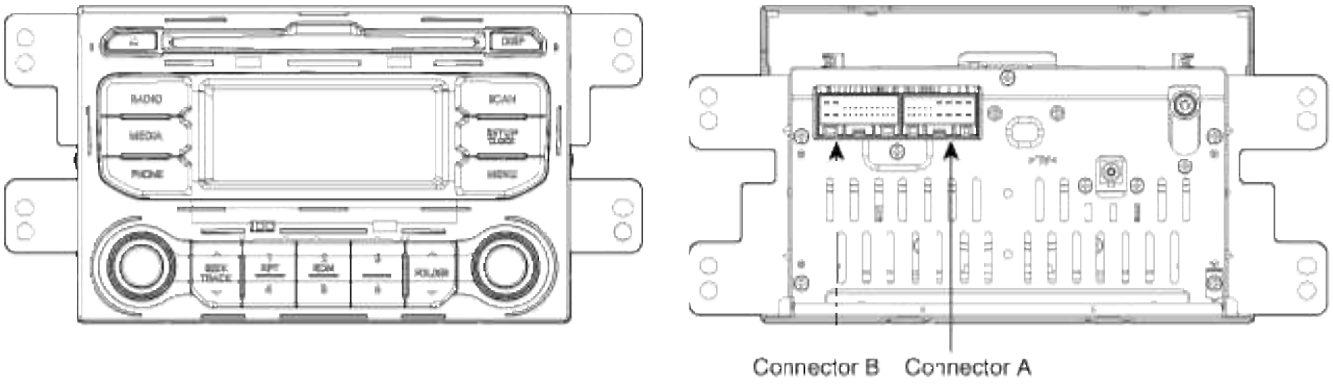
Components (BA900)

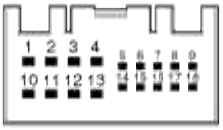
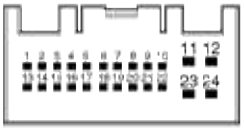
[RADIO/MP3/VCD(BA900)]



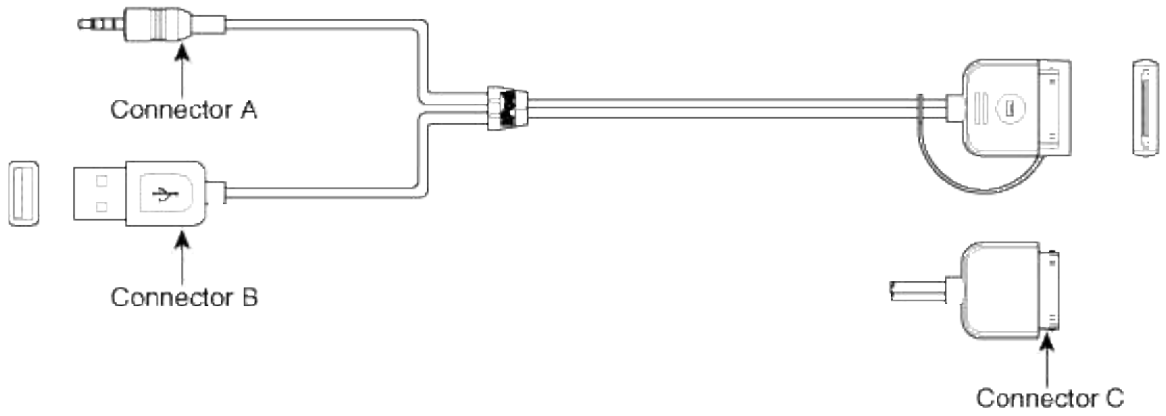
		
Pin No	Connector A	Connector B
1	Rear left speaker (+)	-
2	Front left speaker (+)	-
3	Front right speaker (+)	-
4	Rear right speaker (+)	Steering wheel remote
5	-	-
6	-	Camera VIN
7	IGN	Camera B+
8	Illumination (+)	AUX R IN
9	-	AUX GND
10	Rear left speaker (-)	Mic(+) (Blue tooth)
11	Front left speaker (-)	ACC
12	Front right speaker (-)	B+
13	Rear right speaker (-)	-
14	-	-
15	-	Auto light
16	Door unlock	Speed
17	Illumination (-)	Remote GND
18	Remote anntena	Camera VGND
19		Camera REQ
20		AUX DETECT
21		AUX L IN
22		Mic(-) (Blue tooth)
23		Camera PGND
24		Power GND

Components (PA30A)



		
Pin No	Connector A	Connector B
1	Rear left speaker (+)	-
2	Front left speaker (+)	-
3	Front right speaker (+)	-
4	Rear right speaker (+)	Steering wheel remote
5	-	-
6	-	USB D+
7	IGN	USB / IPOD VDD
8	Illumination (+)	AUX R IN
9	Detent	AUX GND
10	Rear left speaker (-)	Mic(+) (Blue tooth)
11	Front left speaker (-)	ACC
12	Front right speaker (-)	B+
13	Rear right speaker (-)	-
14	-	-
15	-	-
16	-	Speed
17	Illumination (-)	Remote GND
18	Remote anntena	USB D-
19		USB / IPOD GND
20		AUX DETECT
21		AUX L IN
22		Mic(-) (Blue tooth)
23		-
24		Power GND

Components(iPod cable assembly)



Connector A(4 pins)	
Pin	Description
AUX 1	Audio L
AUX 2	Audio R
AUX 3	Video
AUX 4	Audio ground

Connector B(4 pins)	
Pin	Description
USB 1	USB/iPod 5V
USB 2	USB D+ / iPod Tx
USB 3	USB D- / iPod Rx
USB 4	USB/iPod ground

Connector C(30 pins)			
1		16	Ground
2		17	
3		18	Rx
4	D+	19	Tx
5		20	Accessory detect
6	D-	21	
7		22	
8	USB Power	23	Video
9		24	
10	Accessory identify	25	
11		26	
12		27	Aux - L
13		28	Aux - R
14		29	Ground
15	Ground	30	Ground

Body Electrical System > Audio > Audio Unit > Repair procedures

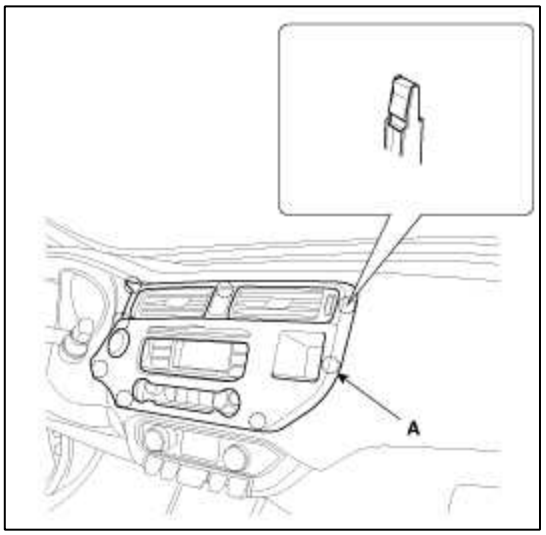
Removal

NOTE

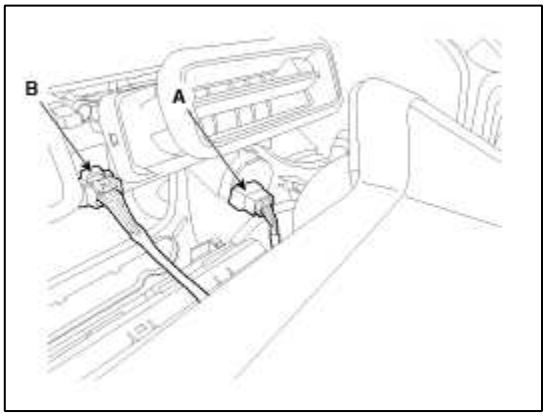
- Take care not to scratch the center fascia panel and related parts.
- Eject all the disc before removing the audio unit to prevent damaging the CD player's load mechanism.

1. Disconnect the negative (-) battery terminal.

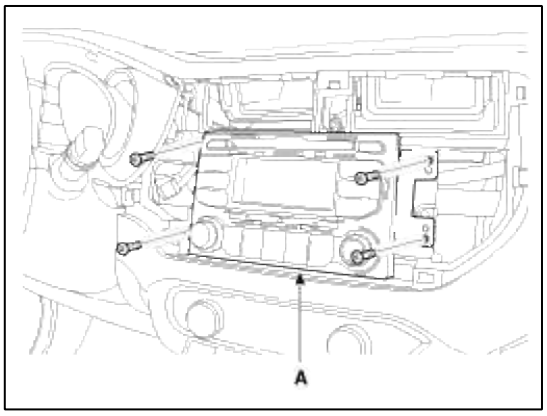
2. Using a screwdriver or trim remover, remove the center fascia panel (A).



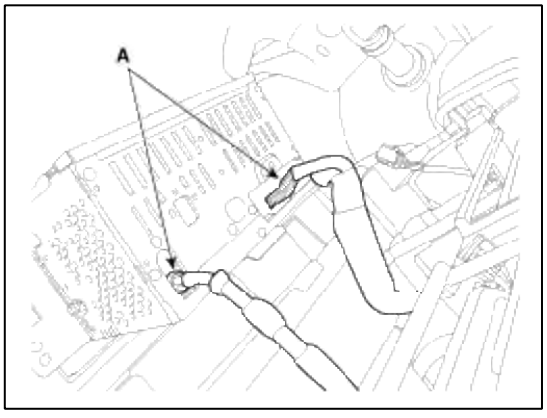
3. Disconnect the start/stop button connector (A) and hazard switch connector (B).



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



5. Disconnect the audio connector and cable (A).



Installation

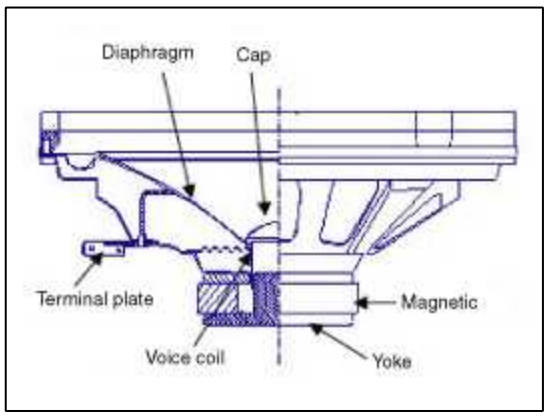
1. Connect the audio unit connectors and cable.
2. Install the audio unit.
3. Install the crash pad center fascia garnish.
4. Check the audio system.

> NOTE
>
> Make sure the audio head unit connectors are plugged in properly, and the antenna cable is connected properly.

Body Electrical System > Audio > Speakers > Repair procedures

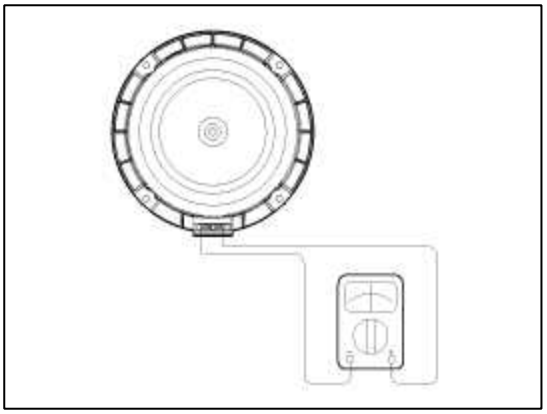
Inspection

1. Troubleshooting for Speaker
   (1) Basic inspection of speaker
   Inspect the sound from speaker after verifying that the speaker mounting screws is removed and the wiring connector is connected precisely to remove vibration transmitted from body trims and surrounding parts.



   (2) Case Troubleshooting

No.	Case	Inspection/Remedy
1	Trembling sound	1. Before replacing the speaker, inspect that the mounting screw is installed normally. 2. After re-installing the speaker, verify that no trembling sound is heard. 3. When hearing a trembling sound again, replace the speaker with new one.
2	Noise	1. Check if the wiring connector is connected normally. If not, reconnect the wiring connector. 2. In case of radio static, check if there is a noise from CD. 3. If a noise is heard with the radio and CD on, replace the speaker with new one. NOTE In case there is only radio static, this causes from poor radio reception. Thus the speaker needs no repair and replacement.
		Inspection of the wiring connection between the battery and the speaker 1. Before replacing the speaker, inspect the wiring connection between the battery and the speaker is normal.

3	Speaker in operative	2. Check the supplying power to the speaker and the resistance, then inspect the sound quality. ■ Specified impedance : 4 ± 0.6Ω  3. If the speaker works poorly, replace it with new one.

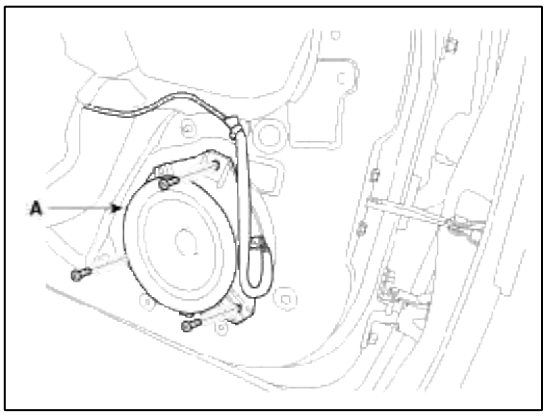
CAUTION

- When handling the speakers, do not damage the speaker with impact, Like drop or throw.
- Be careful not to cover water and oil over the speaker.
- Caution during handling of speaker because the material of diaphragm is paper which is easy to be torn by impact and external force.
- Modifying the audio system may cause damage the speakers.
- If this is the case, The speakers are not covered by the manufacturer's warranty.

Removal

Front Speaker

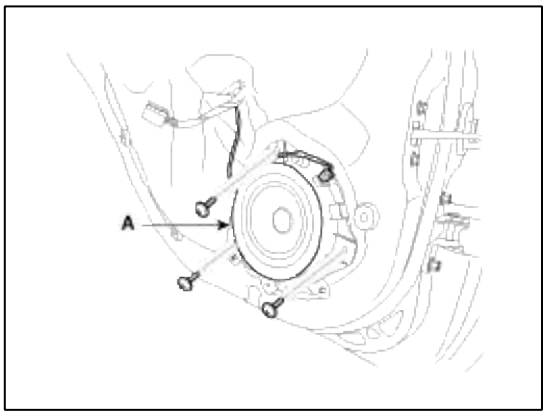
1. Remove the front door trim panel.
   (Refer to the BD group - "Front door")
2. Remove the front speaker (A) after loosening 3 screws.



Rear Speaker

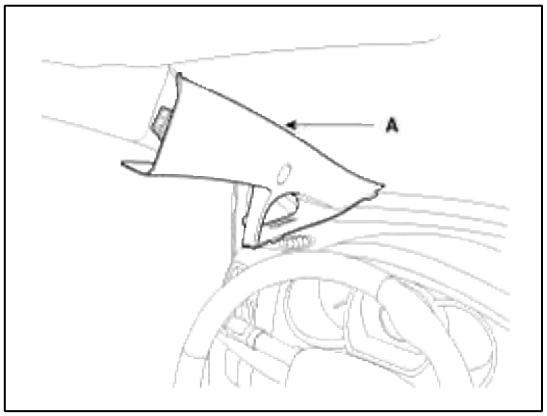
1. Remove the rear door trim panel.
   (Refer to the BD group - "Rear door")

2. Remove the rear speaker (A) after removing 3 screws.

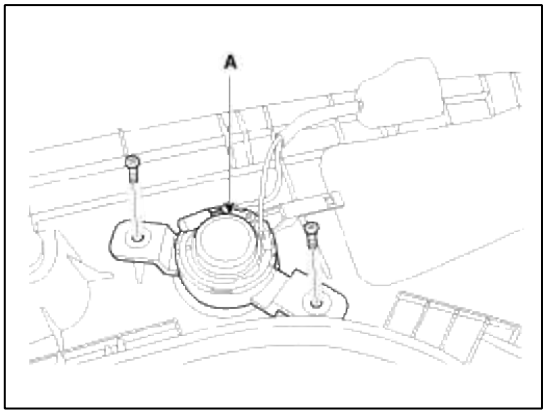


Tweeter Speaker

1. Remove the front pillar trim (A).



2. Remove the tweeter speaker (A) after disconnecting the connector and loosening 2 screws.



Installation

Front Speaker

1. Install the front speaker.
2. Install the front door trim.

Rear Speaker

1. Install the rear speaker.
2. Install the rear door trim.

Tweeter Speaker

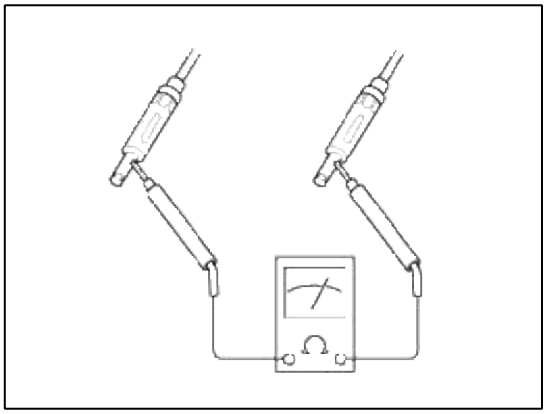
1. Install the tweeter speaker after connecting the tweeter speaker connector.
2. Install the front pillar trim.

Body Electrical System > Audio > Antenna > Repair procedures

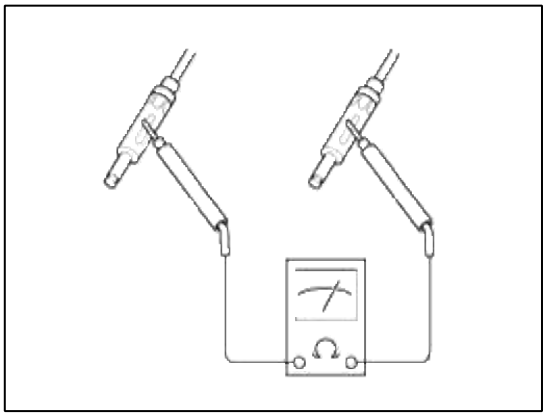
Inspection

Antenna Cable

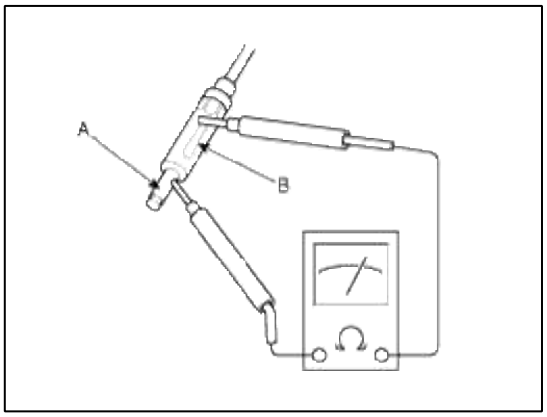
1. Remove the antenna jack from the audio unit and antenna.
2. Check for continuity between the center poles of antenna cable.



3. Check for continuity between the outer poles of antenna cable. There should be continuity.



4. If there is no continuity, replace the antenna cable.
5. Check for continuity between the center pole (A) and outer pole (B) of antenna cable. There should be no continuity.

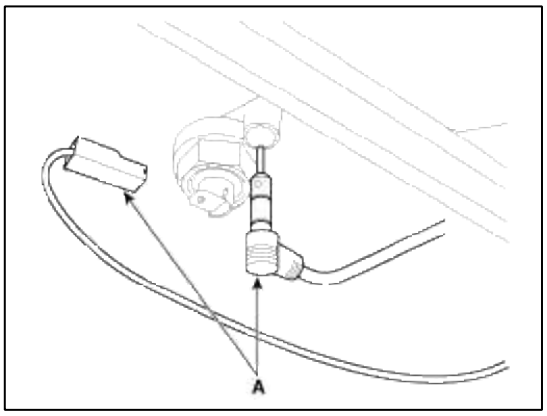


6. If there is continuity, replace the antenna cable.

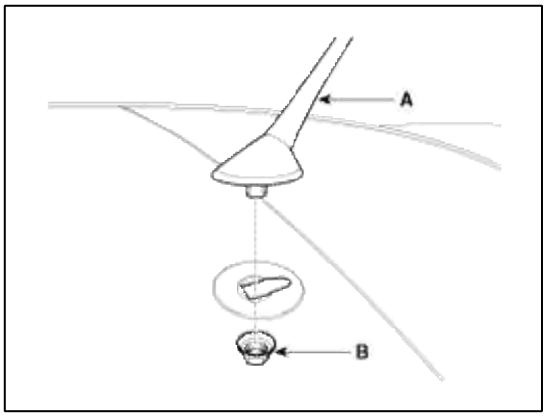
Removal

1. Remove the rear roof trim.
   (Refer to the Body group - Roof trim).

2. Disconnect the antenna cable and the connector (A).



3. Remove the roof antenna(A) after removing a nut(B).



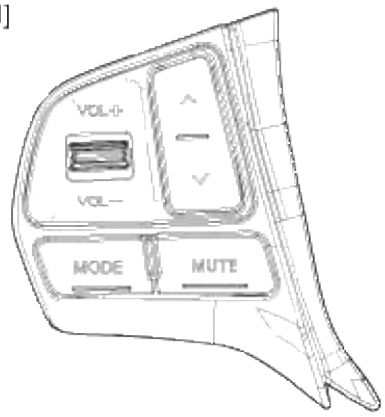
Installation

1. Install the roof antenna, then connect the cable and the connector.
2. Install the rear roof trim.

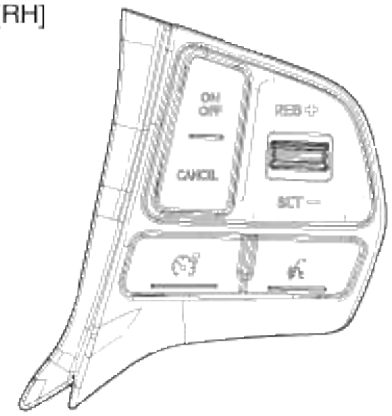
Body Electrical System > Audio > Audio Remote Control > Schematic Diagrams

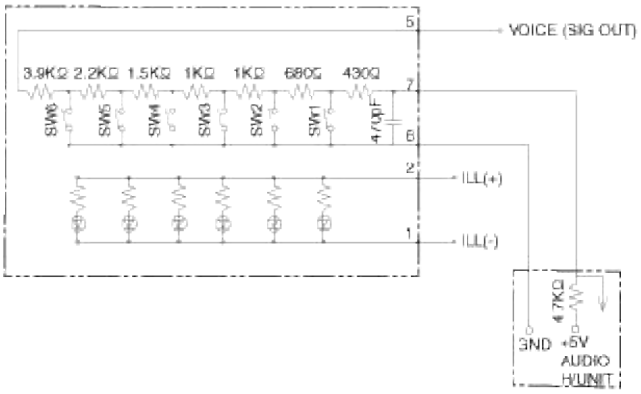
Circuit Diagram (1)

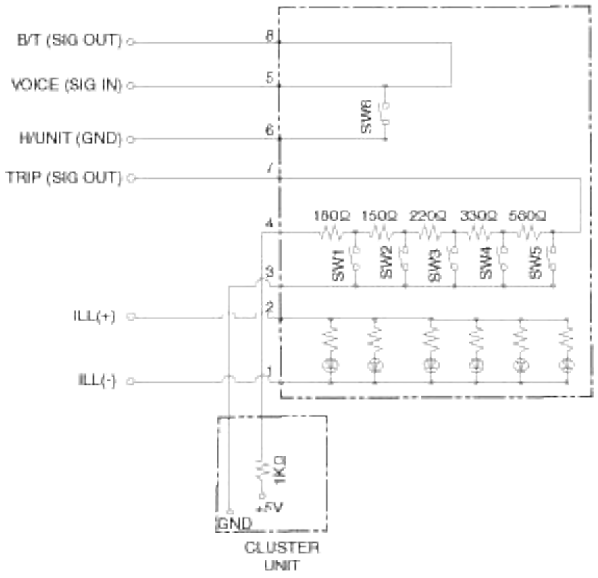
Audio [LH]

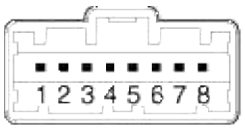
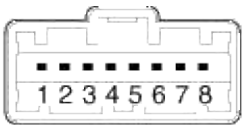


Cruise [RH]

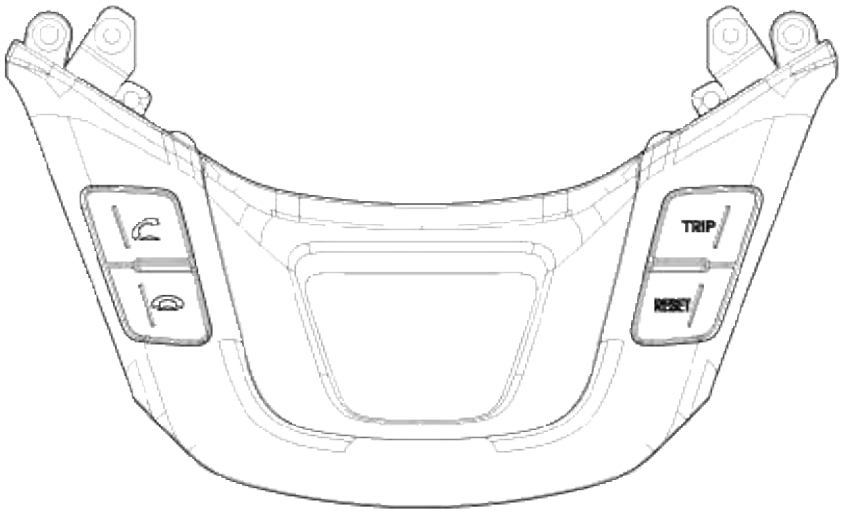


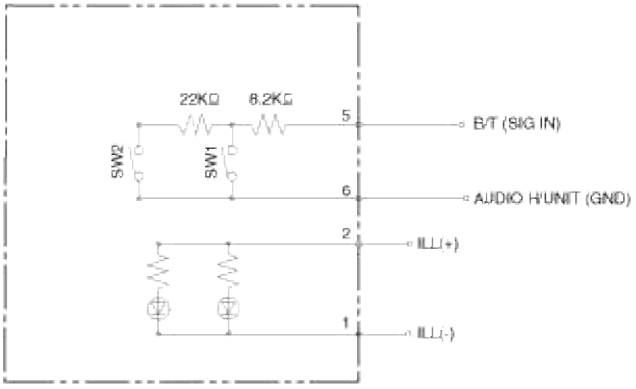


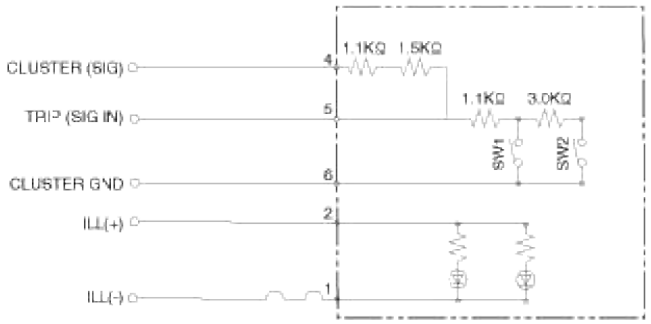


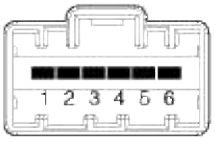
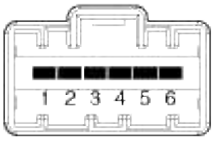
Audio connector (LH)		Cruise connector (RH)	
			
Pin No.	Description	Pin No.	Description
1	Illumination (-)	1	Illumination (-)
2	Illumination (+)	2	Illumination (+)
3	-	3	Cluster ground
4	-	4	Cluster signal
5	Voice (Signal OUT)	5	Voice (Signal IN)
6	Audio head unit (Ground)	6	Audio head unit (Ground)
7	Audio head unit (Signal OUT)	7	Trip (Signal OUT)
8	-	8	Bluetooth (Signal OUT)

Circuit Diagram (2)





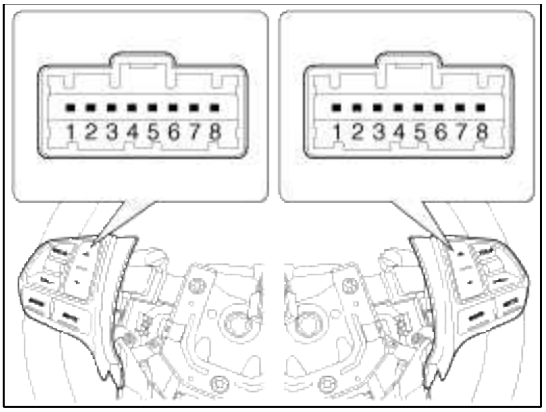


Audio connector (LH)		Cruise connector (RH)	
			
Pin No.	Description	Pin No.	Description
1	Illumination (-)	1	Illumination (-)
2	Illumination (+)	2	Illumination (+)
3	-	3	-
4	-	4	Cluster signal
5	Bluetooth (Signal IN)	5	Trip (Signal IN)
6	Audio head unit (Ground)	6	Cluster ground

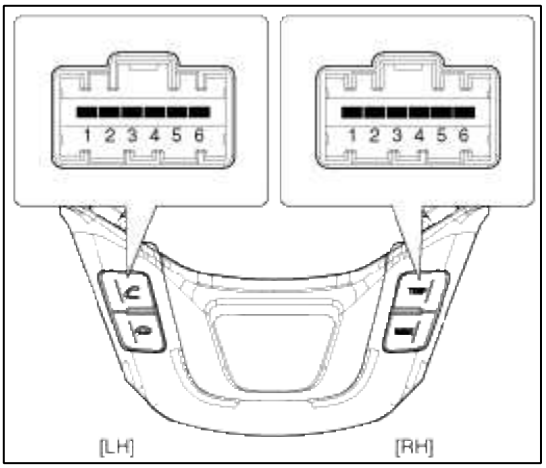
Body Electrical System > Audio > Audio Remote Control > Repair procedures

Inspection

1. Check the audio remote control switch (A) for resistance between No.5 and No.7 terminals in each switch position.



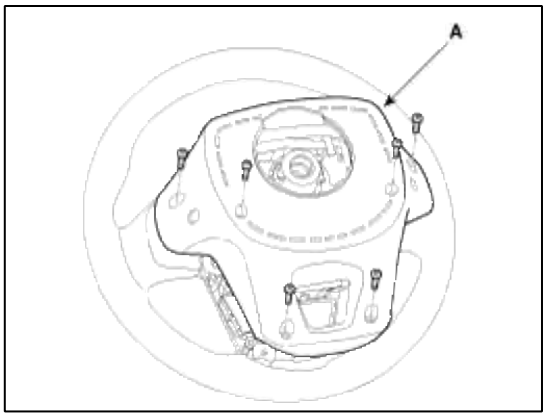
Switch	Connector terminal	Resistance (± 5%)
SEEK UP	6-7 (LH)	430 Ω
SEEK DOWN	6-7 (LH)	1.11 kΩ
MODE	6-7 (LH)	2.11 kΩ
MUTE	6-7 (LH)	3.11 kΩ
VOLUME UP	6-7 (LH)	4.61 kΩ
VOLUME DOWN	6-7 (LH)	6.81 kΩ
CANCEL	3-4 (RH)	180 Ω
SET -	3-4 (RH)	330 Ω
RES +	3-4 (RH)	550 Ω
ON/ OFF	3-4 (RH)	880 Ω
SLD	3-4 (RH)	1.44 kΩ
VOICE	3-4 (RH)	10.71 kΩ



Switch	Connector terminal	Resistance (± 5%)
END	5-6 (Lower LH)	18.91 kΩ
SEND	5-6 (Lower LH)	40.91 kΩ
TRIP	5-6 (Lower RH)	2.54 kΩ
RESET	5-6 (Lower RH)	5.54 kΩ

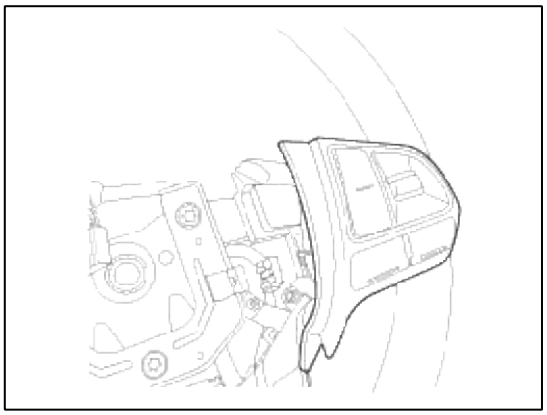
Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the driver airbag module.
   (Refer to the RT group - "DAB and Clock spring")
3. Remove the steering wheel.
   (Refer to the ST group - "Steering column & shaft")
4. Remove the steering wheel cover (A) after loosening 6 screws.

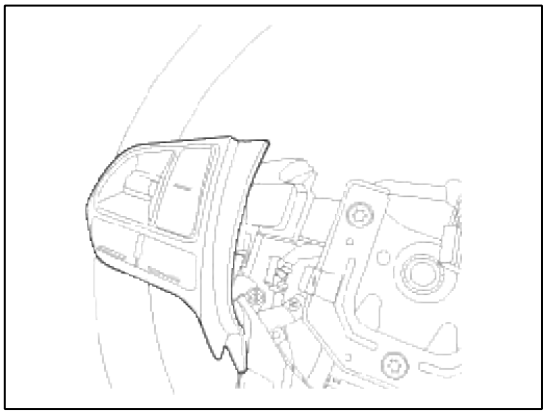


5. Remove the remote control switch (B) after loosening 2 screws and disconnecting the connector (A).

[RH]



[LH]



Installation

1. Reassemble the steering wheel remote control switch after connecting the connector.
2. Reassemble the steering wheel.

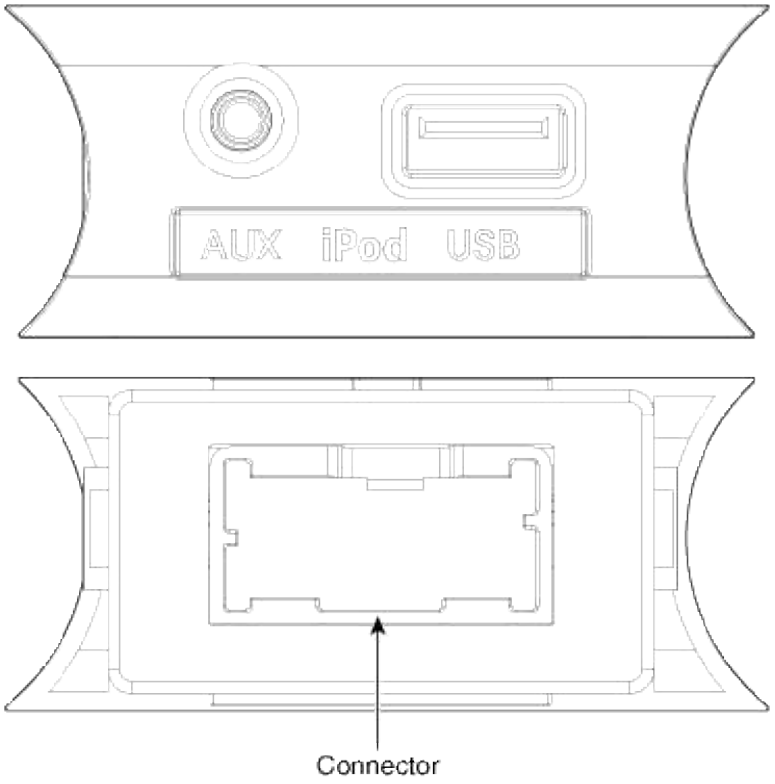
3. Reassemble the driver airbag module.

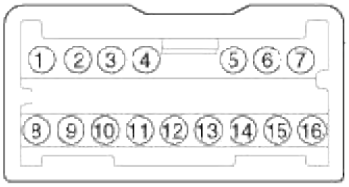
NOTE

Make sure the audio remote control switch and the airbag module connectors are plugged in properly.

Body Electrical System > Audio > Multimedia Jack > Schematic Diagrams

Circuit Diagram



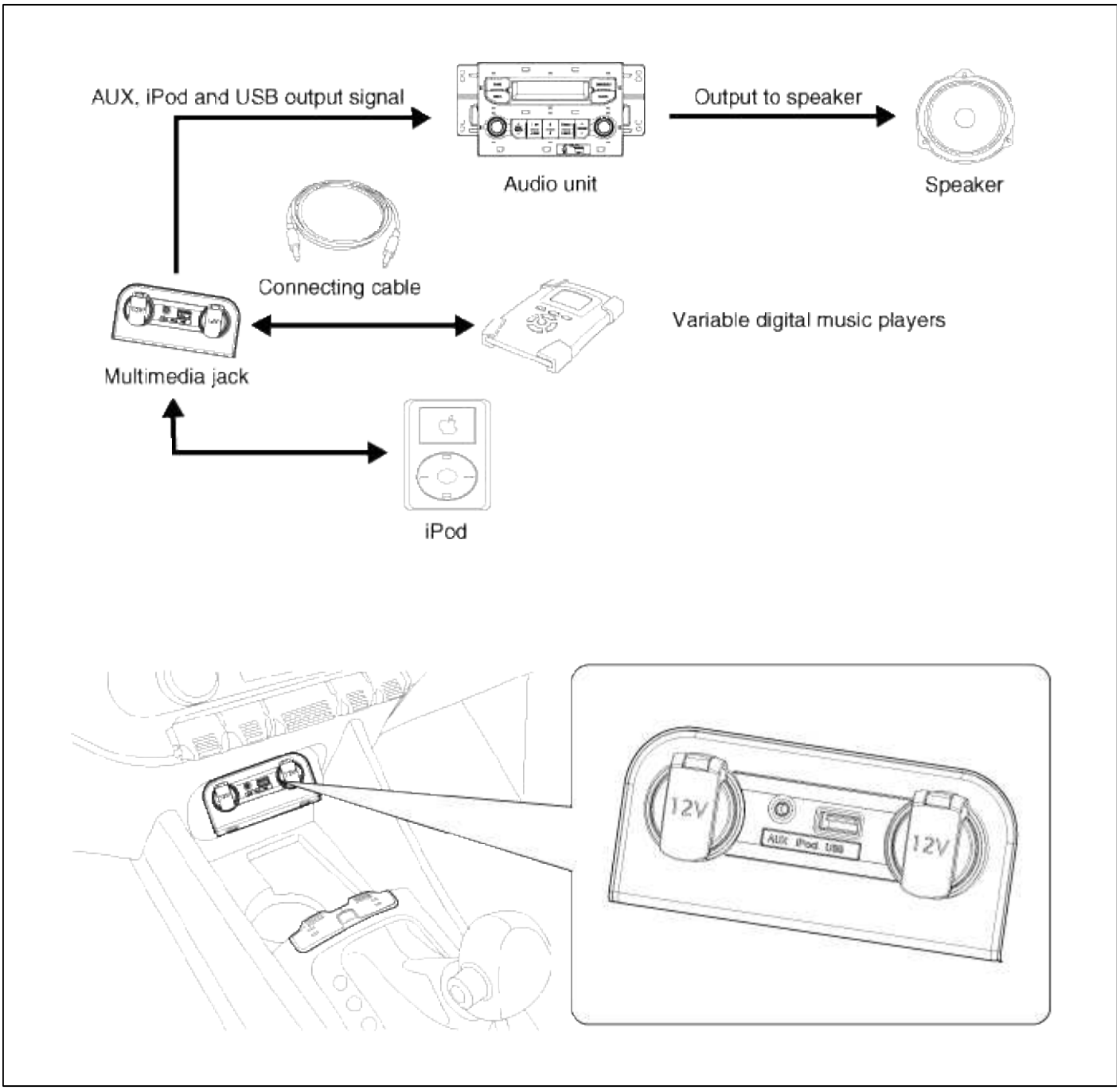
Output Connector	Pin No.	Description
	1	USB/iPod 5V
	2	USB D-/iPod TX
	3	USB D+/iPod RX
	4	USB/iPod Ground
	5	-
	6	AUX Reference
	7	AUX Input (LH)
	8	Illumination (+)
	9	Illumination (-)
	10	-
	11	Multimedia jack Ground
	12	-
	13	-
	14	AUX Detent
	15	-
	16	AUX Input (RH)

Body Electrical System > Audio > Multimedia Jack > Description and Operation

Description

The multimedia jack on the console upper cover is for customers who like to listen to external portable music players like the MP3, iPod and etc., through the vehicle's sound system when it is linked to this jack. The customer has this added option.

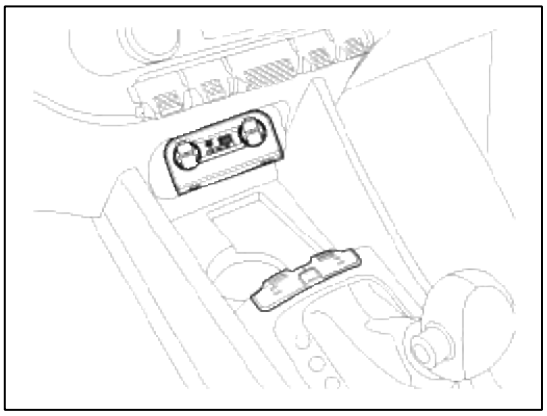
In case of distortions from media connected to the AUX source, the audio unit may not be defective but the output level of the used media does not match the specification of the AUX input.



Body Electrical System > Audio > Multimedia Jack > Repair procedures

Removal

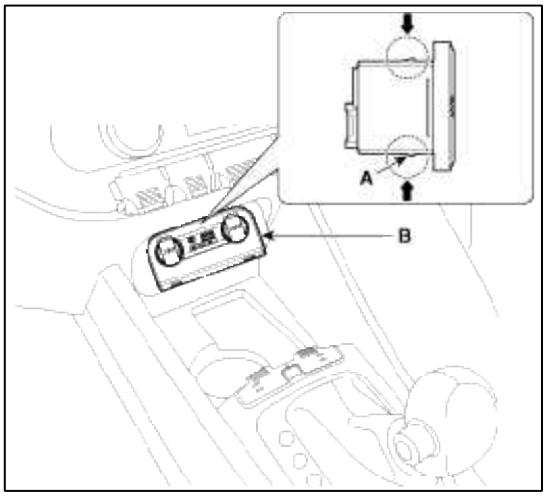
1. Using a screwdriver or remover, remove the multimidia jack assembly.



NOTE

Take care not to scratch the center fascia tray and related parts.

2. Remove the multimedia jack (B) from the console under cover after releasing the fixed hooks (A).



3. Disconnect the multimedia jack connector.

Installation

1. Install the multimedia jack.
2. Connect the multimedia jack connector.

NOTE

Make sure the multimedia connector and the console upper cover connectors are plugged in properly.

Body Electrical System > Audio > Troubleshooting

Troubleshooting

Customer Complaint Analysis Check Sheet

TROUBLE IN	☐ ALL ☐ AM ☐ FM ☐ CD ☐ MP3 ☐ CD changer ☐ AMP ☐ Others
TROUBLE OCCURS	☐ Always ☐ Engine start ☐ Engine Running ☐ Cold ☐ Warm ☐ Sometimes ☐ Most of the time ☐ Engine off
TYPE OF TROUBLE	☐ Will not play ☐ Weak ☐ Squealing noise ☐ Display/illumination poor ☐ CD skips & jumps ☐ CD will not eject or insert ☐ Others (Describe) :
OTHERS	▶ Customer complaint contents : ▶ Have you checked customer's defects :
★ Using the customer complaint analysis check sheet for reference, ask the customer for as much detail as possible about the problem.	

There are six areas where a problem can occur: wiring harness, the radio, the CD player, speaker, antenna, etc. Troubleshooting enables you to confine the problem to a particular area.

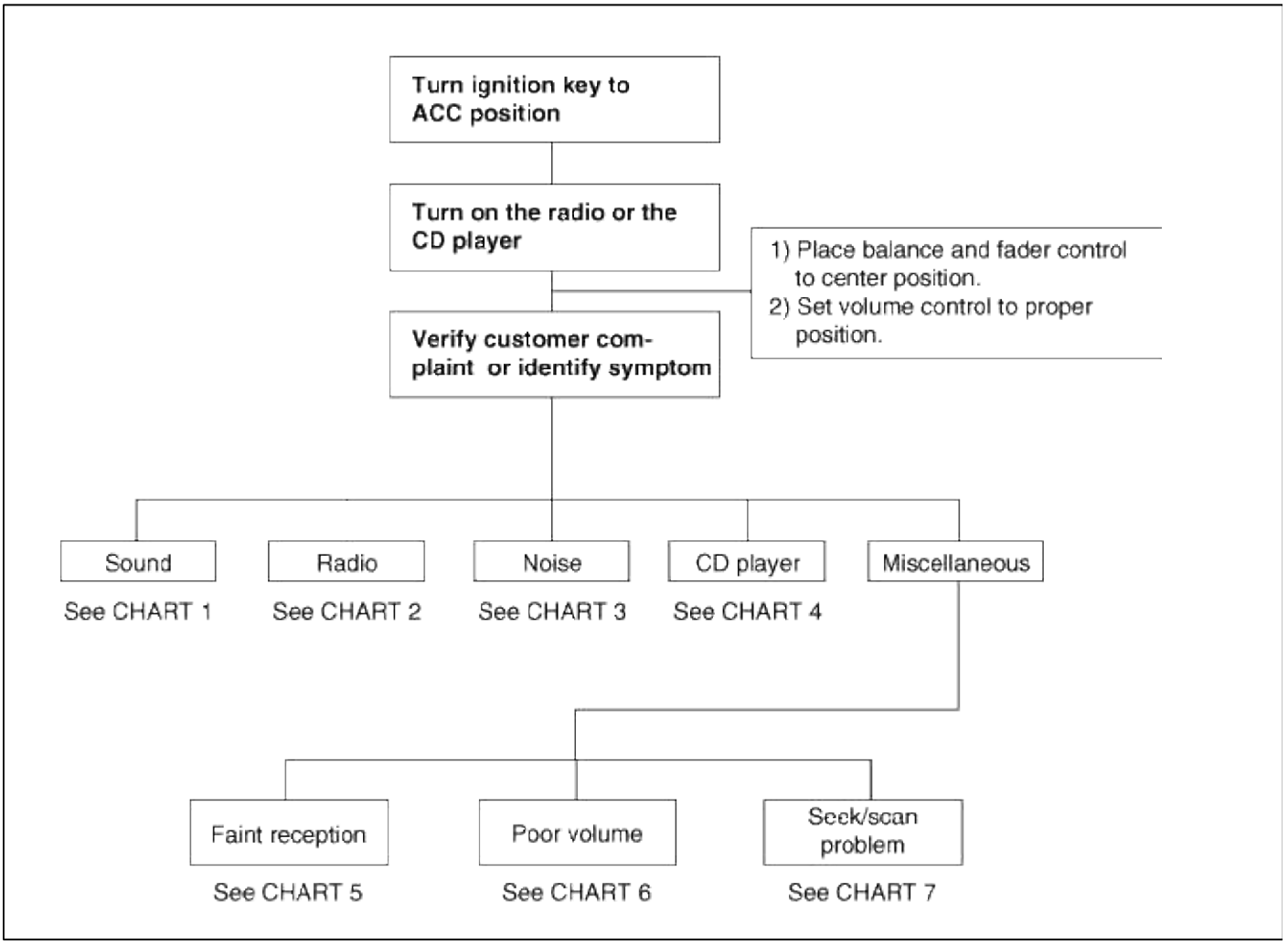
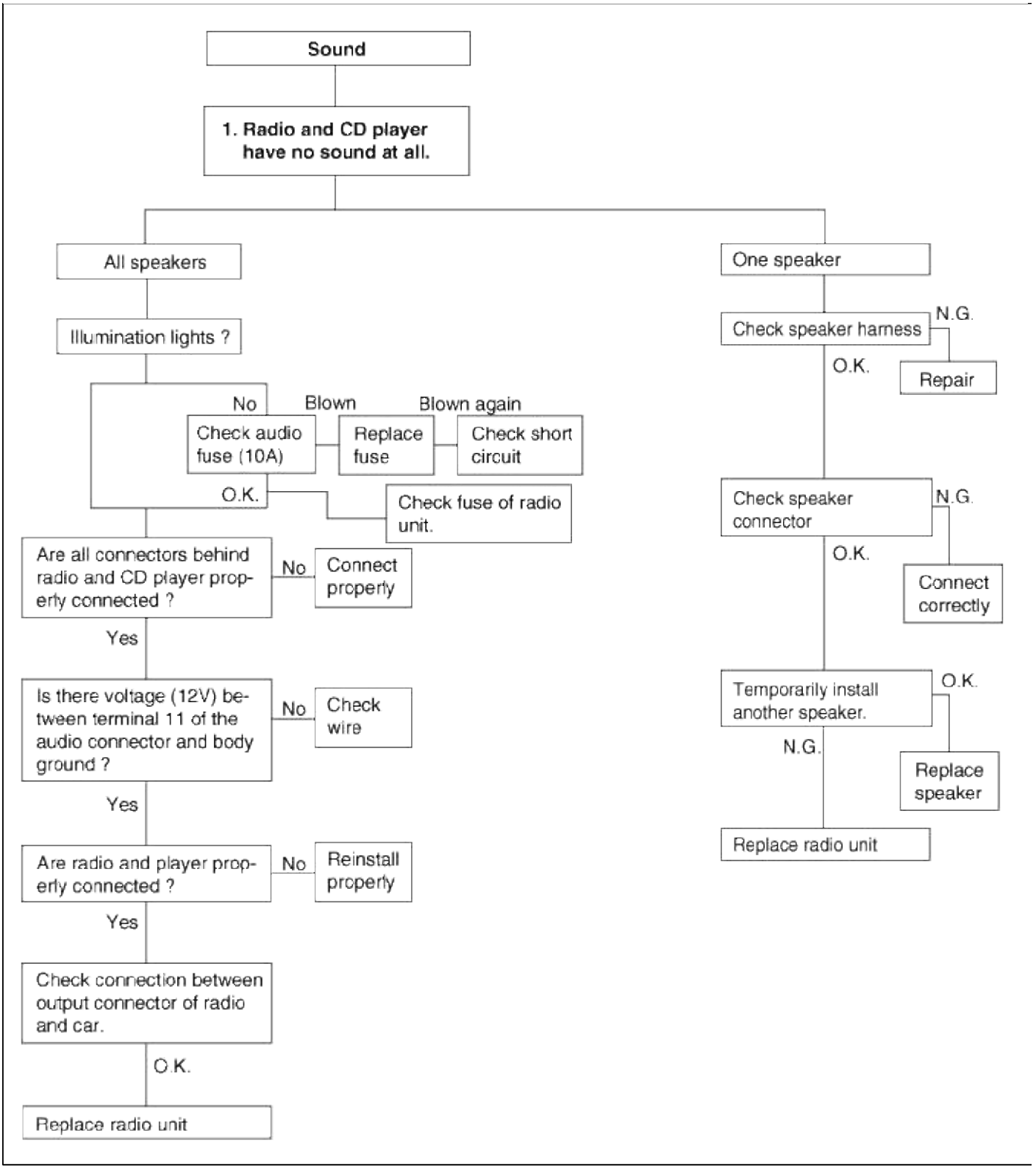


Chart 1


Sound
1. Radio and CD player have no sound at all.
All speakers
Illumination lights ?
No
Blown
Blown again
Check audio fuse (10A)
Replace fuse
Check short circuit
O.K.
Check fuse of radio unit.
Are all connectors behind radio and CD player properly connected ?
No
Connect properly
Yes
Is there voltage (12V) between terminal 11 of the audio connector and body ground ?
No
Check wire
Yes
Are radio and player properly connected ?
No
Reinstall properly
Yes
Check connection between output connector of radio and car.
O.K.
Replace radio unit
One speaker
Check speaker harness
N.G.
O.K.
Repair
Check speaker connector
N.G.
O.K.
Connect correctly
Temporarily install another speaker.
O.K.
N.G.
Replace speaker
Replace radio unit

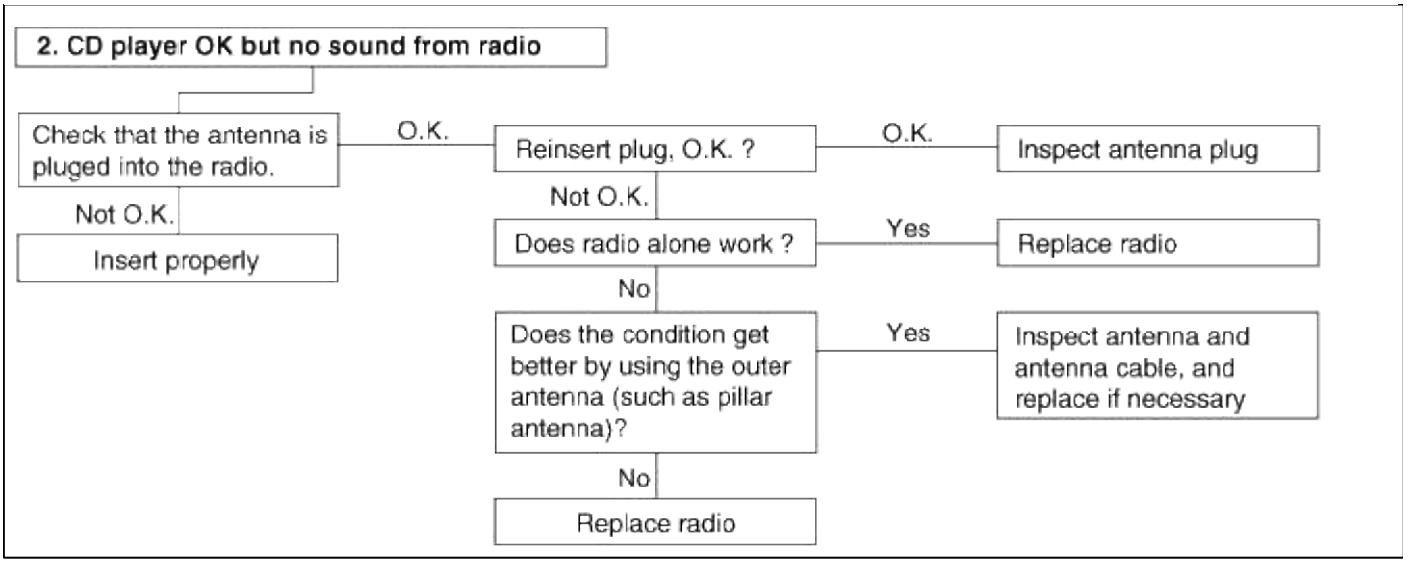


Chart 2

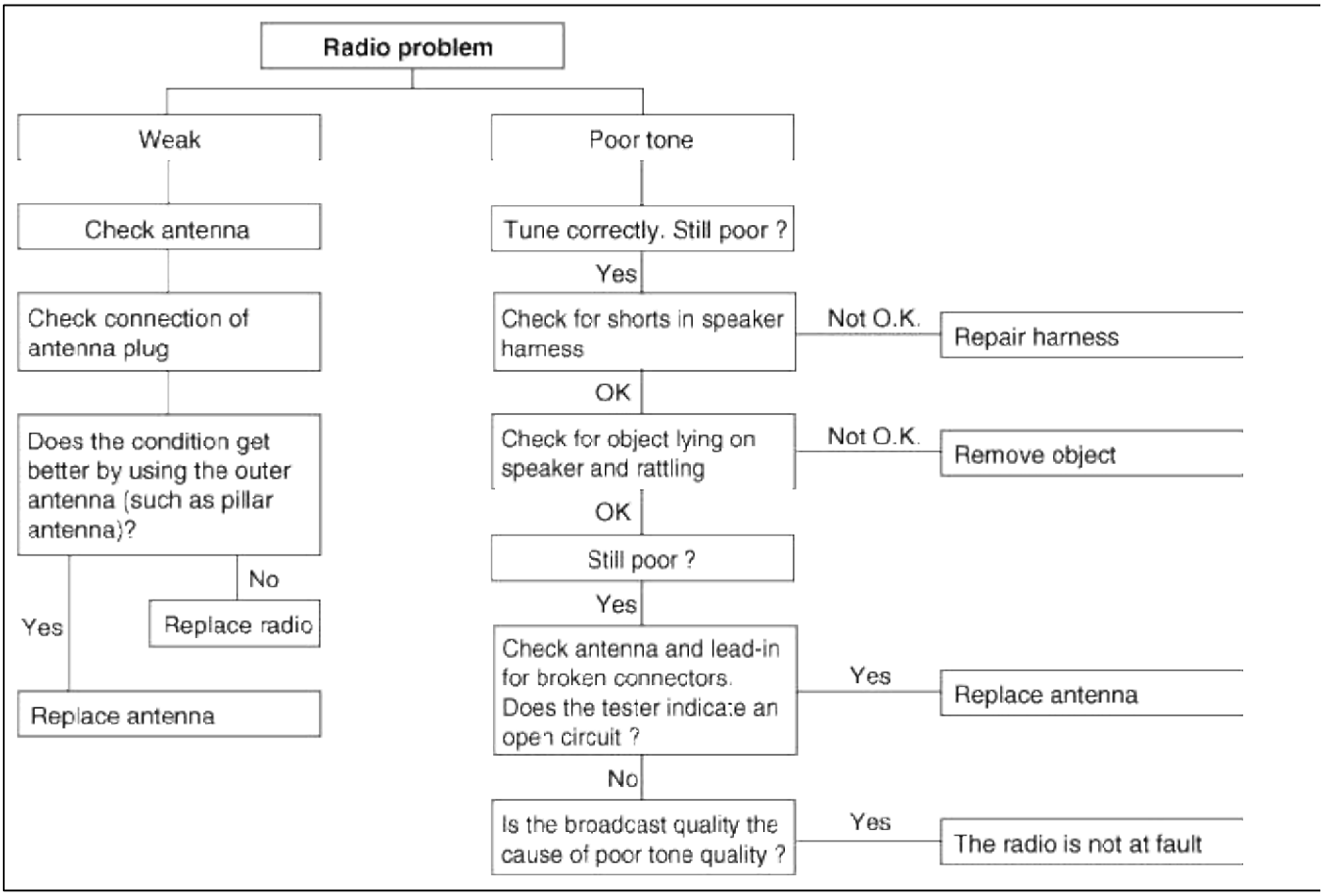


Chart 3

1. RADIO

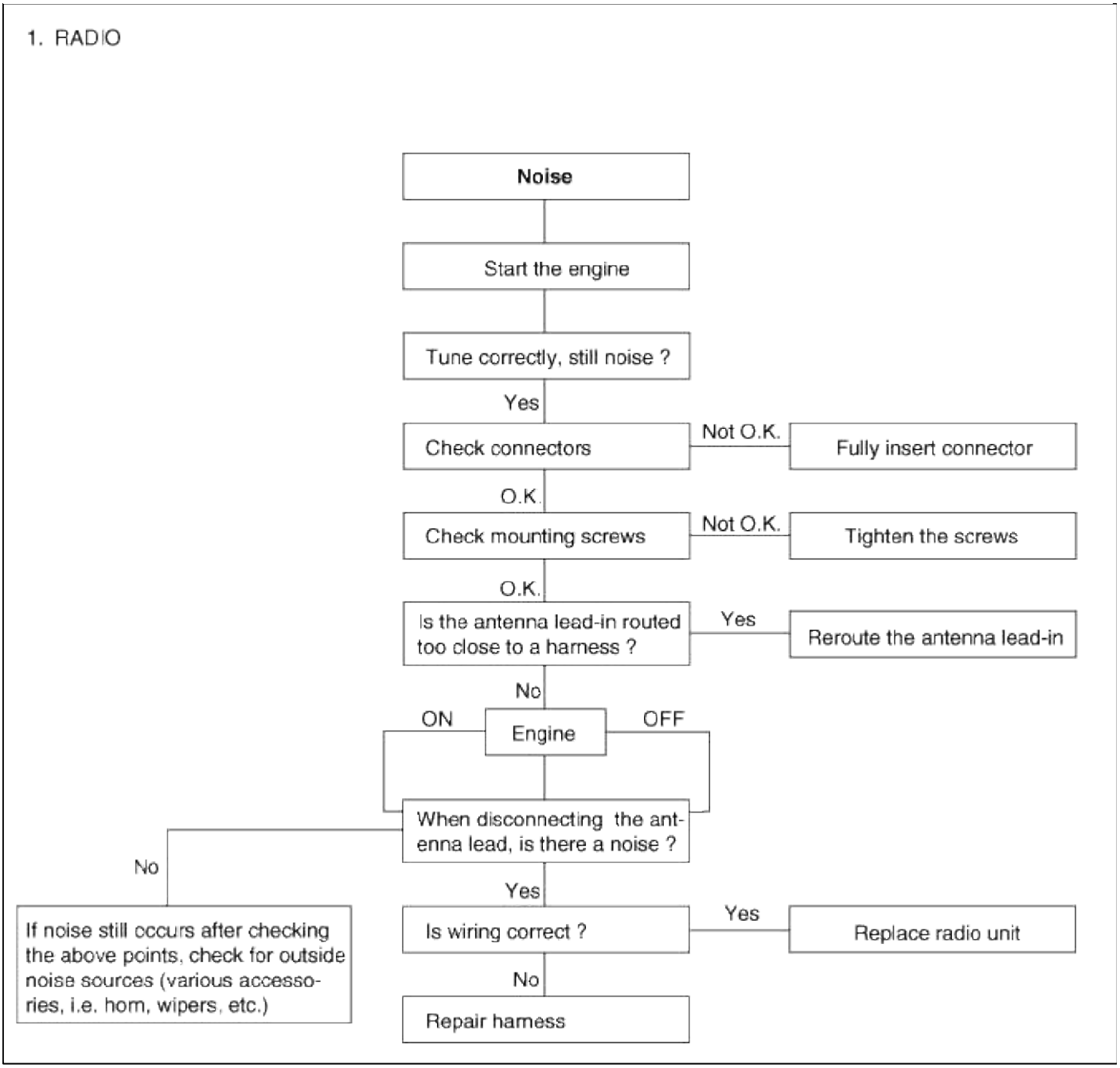
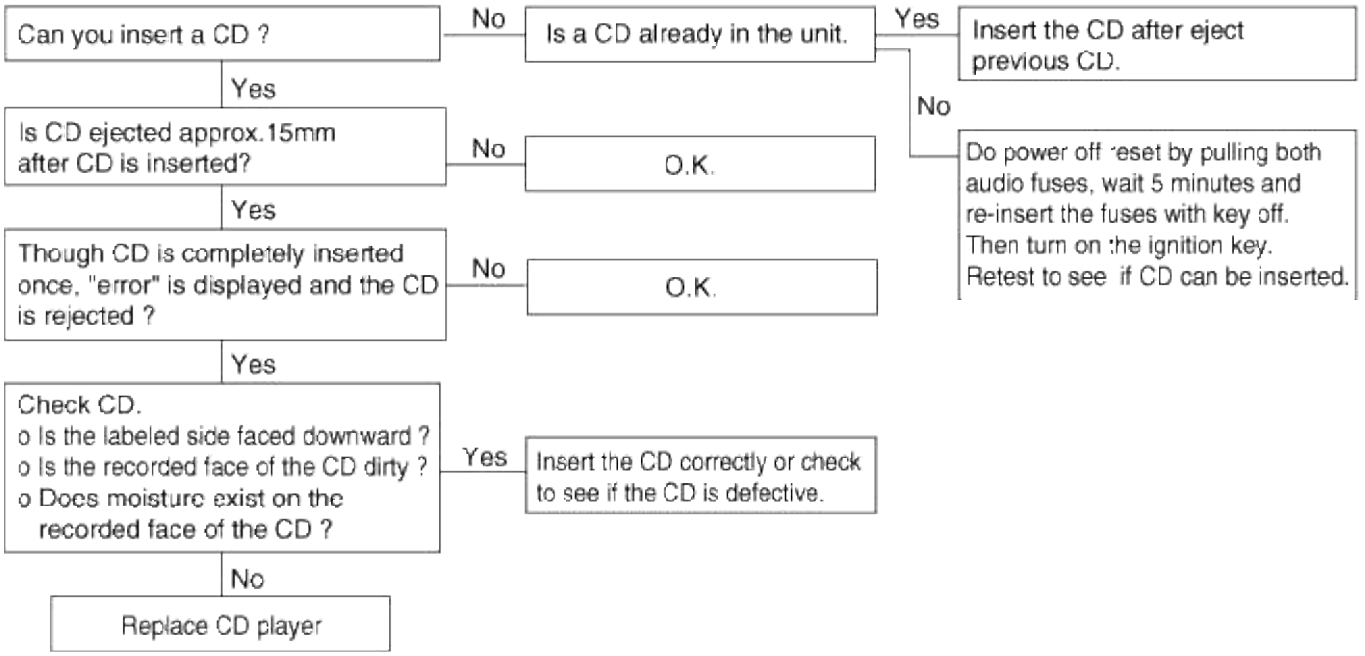
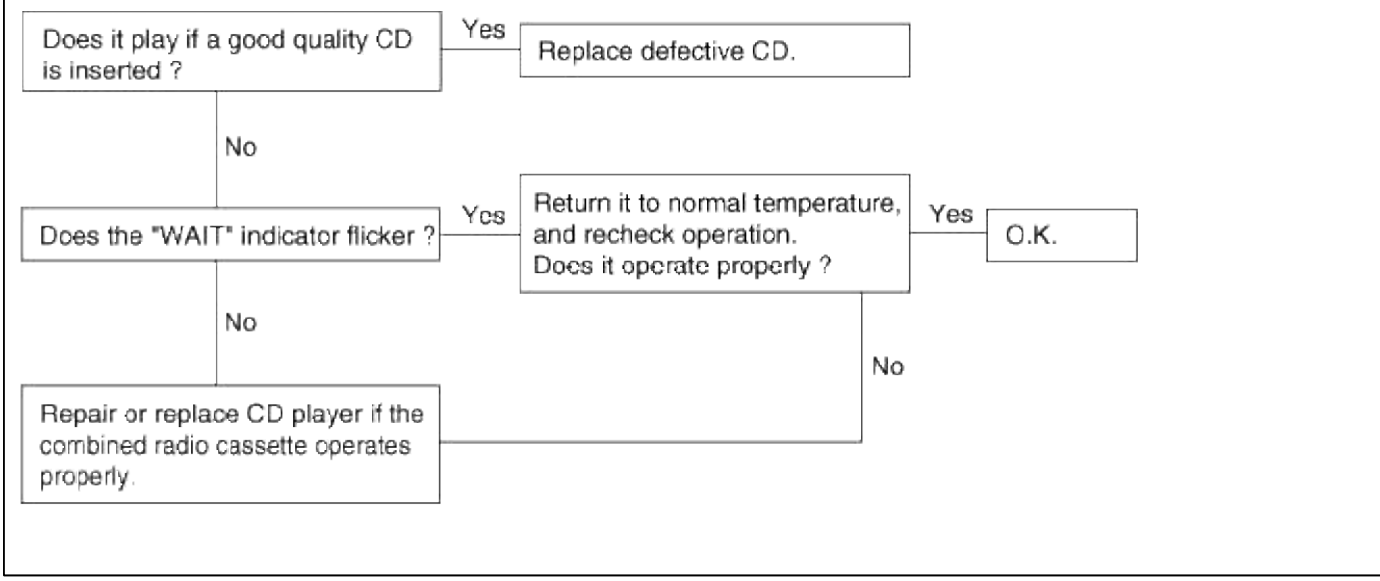


Chart 4

1. CD WILL NOT BE ACCEPTED

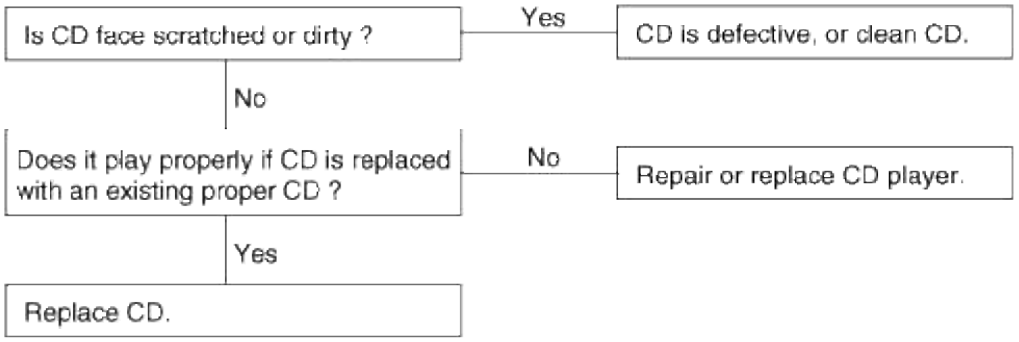


2. NO SOUND

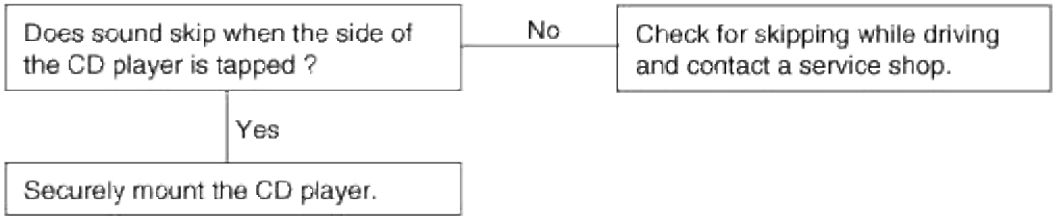


3. CD SOUND SKIPS

1) Sound sometimes skips when parking.



2) Sound sometimes skips when driving.
(Stop vehicle, and check it.)
(Check by using a CD which is free of scratches, dirt or other damage.)



4. SOUND QUALITY IS POOR

Does it play properly if another good-quality CD is loaded ?
- Yes → Replace CD
- No → Repair or replace CD player.

5. CD WILL NOT EJECT

Is the ignition key at ACC or ON ?
- No → Turn the key to ON.
- No → If CD does not eject, don't try removing it. The player may be damaged. Therefore, contact a service shop for repairs.

6. NO SOUND FROM ONE SPEAKER

Check with radio OK?
- No → Jump to Chart 1.
- Yes → Does it play properly if another CD is played ?
  - Yes → Replace CD.
  - No → Repair or replace the radio.

Chart 5

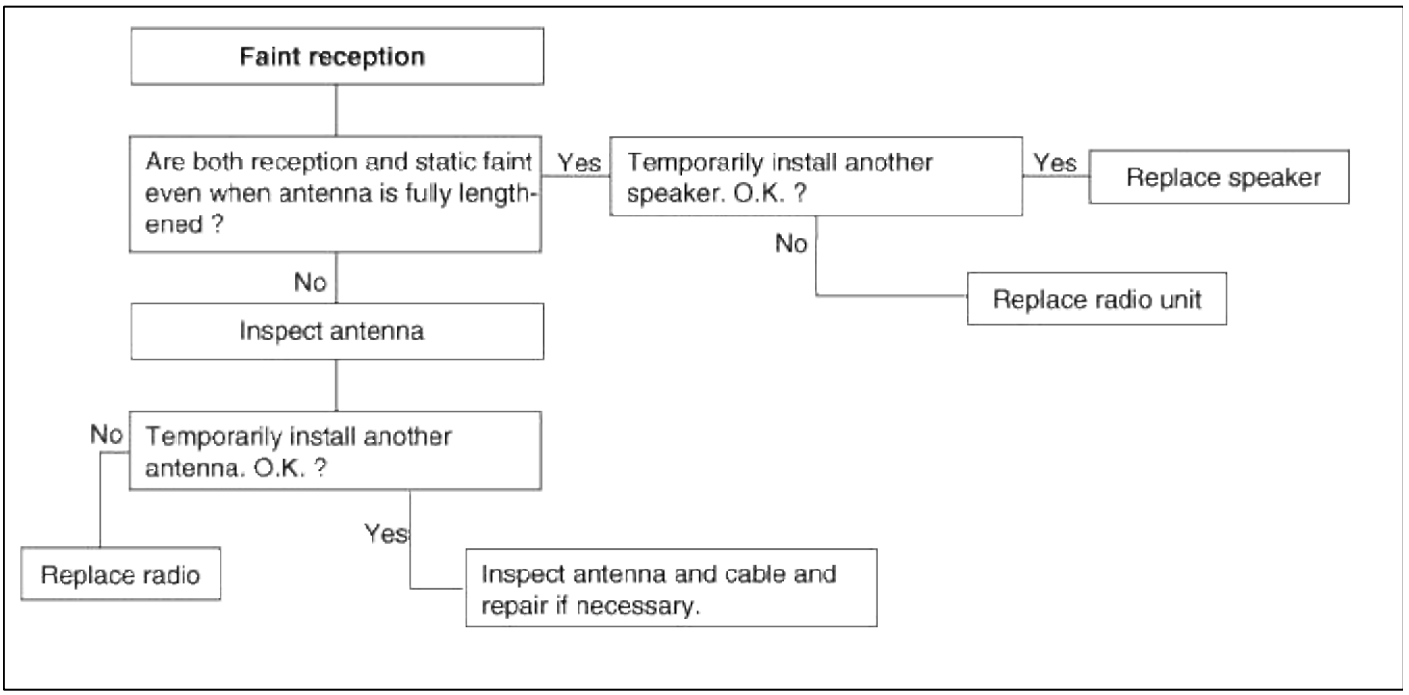


Chart 6

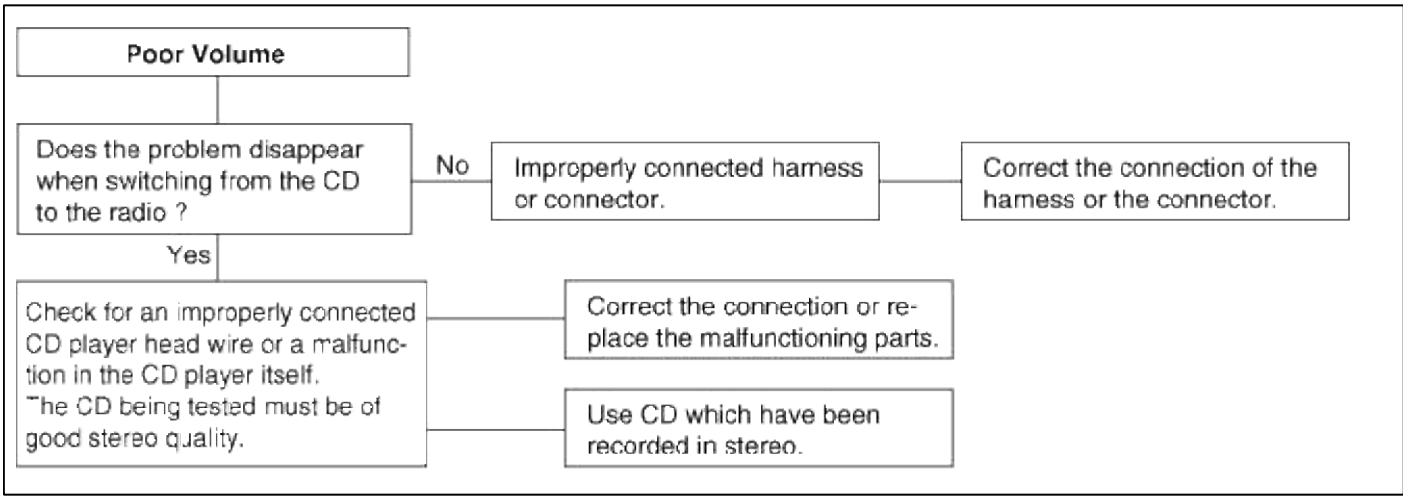
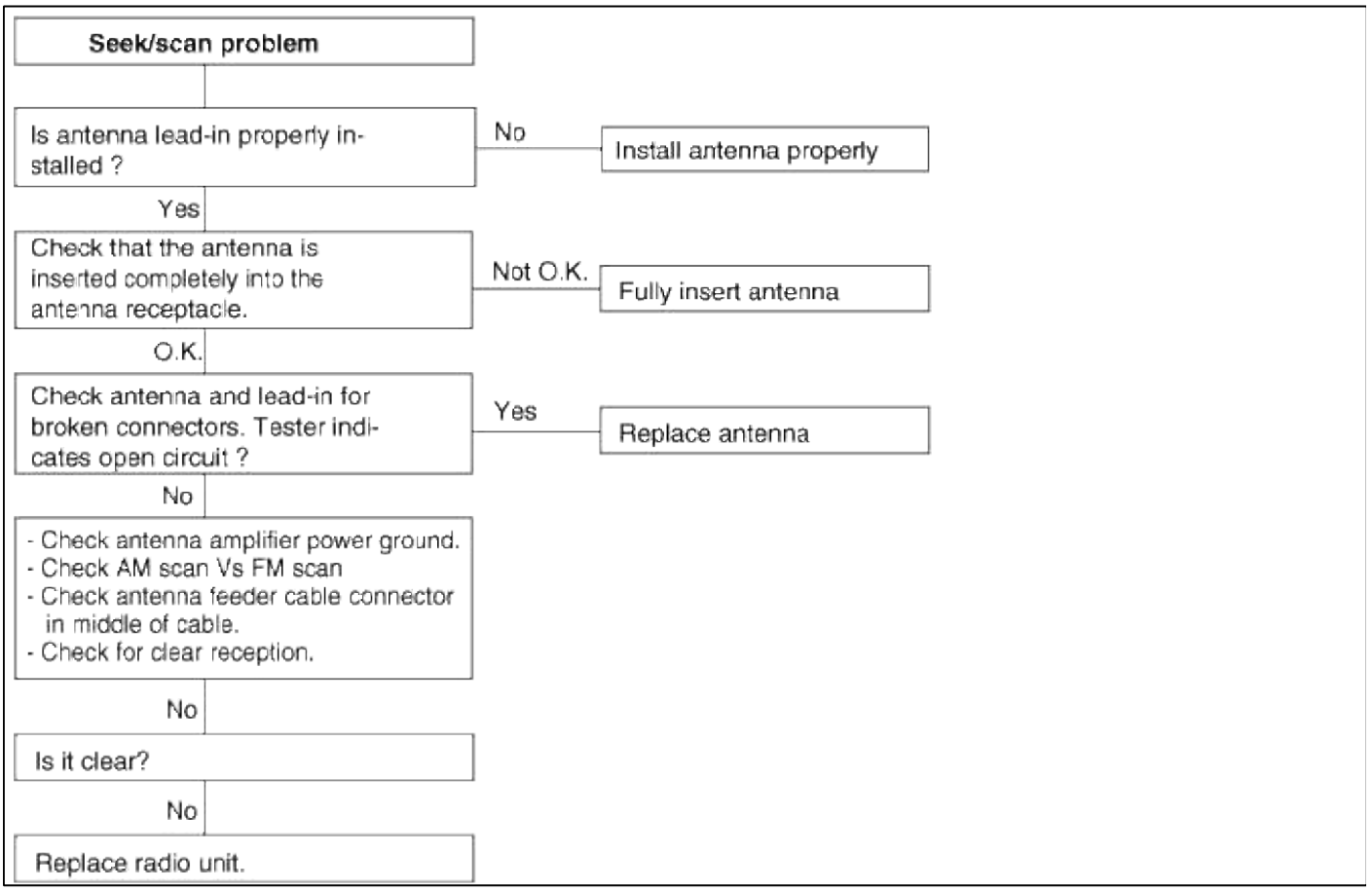


Chart 7



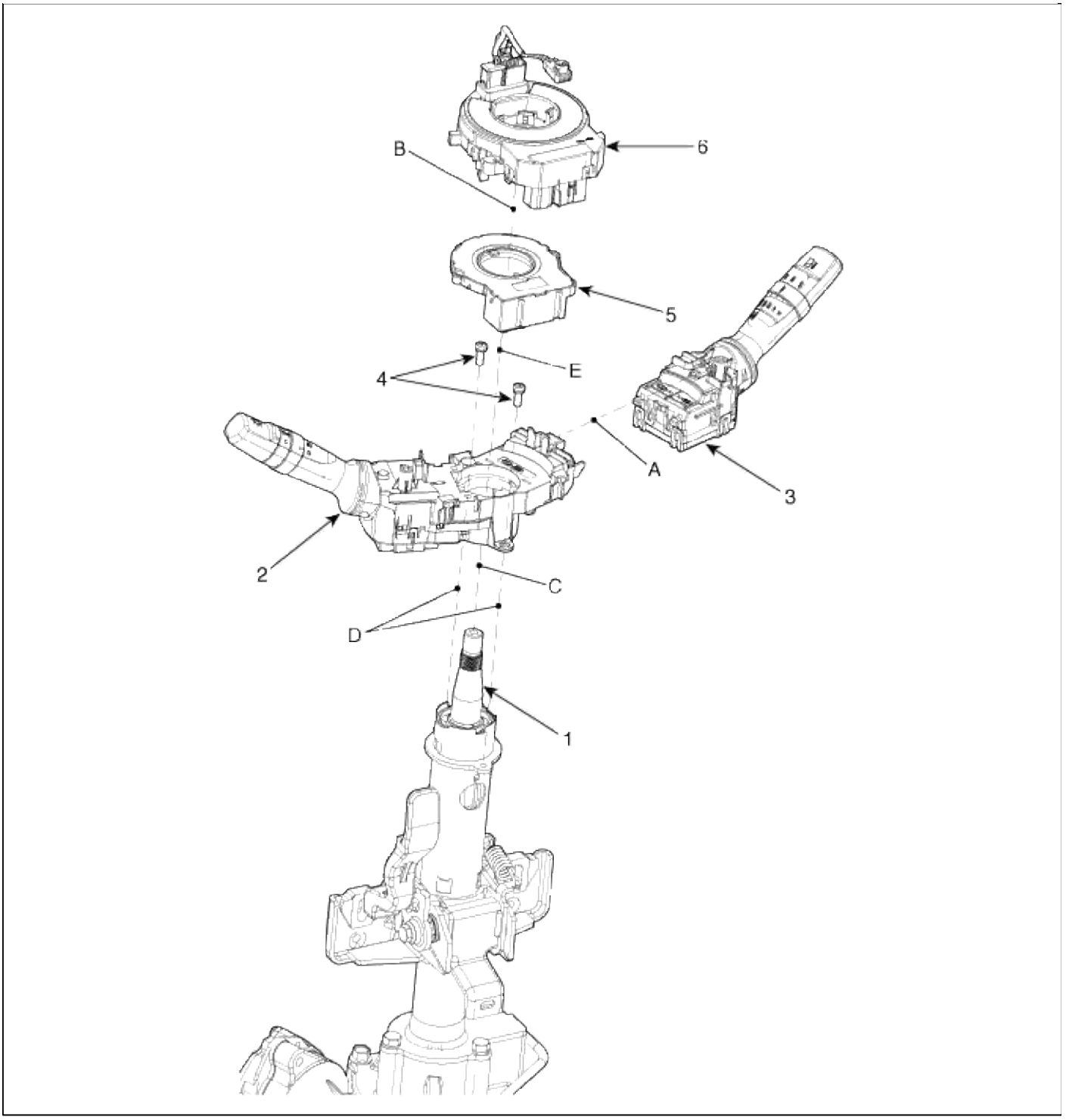
Body Electrical System > Multifunction switch > Specifications

Specifications

Items		Specifications
Rated voltage		DC 12V
Operating temperature range		-30°C ~ +80°C (-22 ~ +176°F)
Rated load	Dimmer and passing switch	High : 1A (Lamp load) Low : 1A (Lamp load) Passing : 1A (Lamp load)
	Lighting switch	1A (Lamp load)
	Turn signal & lane change switch	6.6 ± 0.5A (Lamp load)
	Front & rear fog lamp switch	1A (Relay load)
	Wiper & mist switch	Mist, Low, High : 4A (Motor load) Intermittent : 0.22 ± 0.05 A (Relay load) Lock : 28 A (Motor load)
	Front & Rear washer switch	5 A (Motor load)
	Variable intermittent volume switch (Rain Sensor)	Max. 25 mA
	Rear wiper switch	0.2A (Relay load)

Body Electrical System > Multifunction switch > Components and Components Location

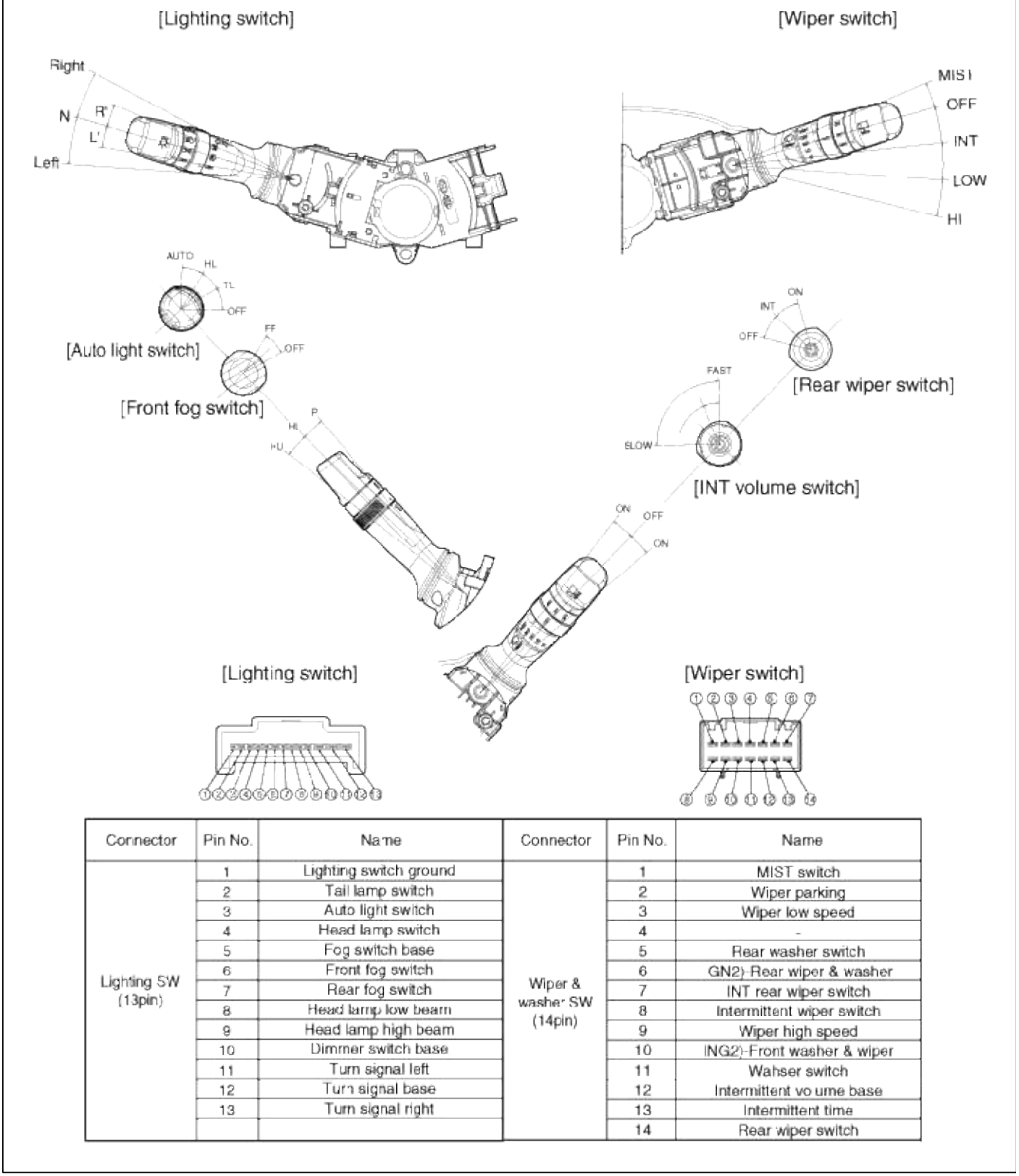
Component(1)



Installation order : A → B → C → D → E

1. Steering column shaft 2. Lighting switch 3. Wiper and washer switch	4. Screw 5. Steering angle sensor 6. Clock spring

Component(2)



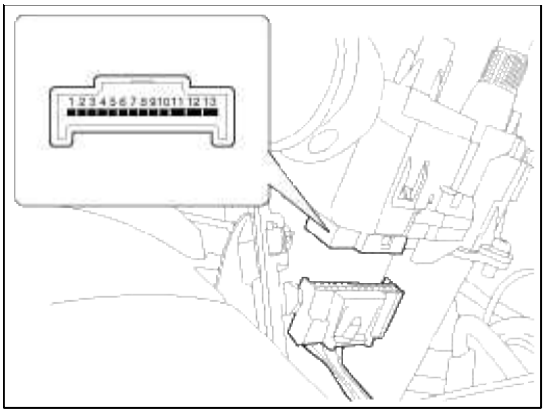
Connector	Pin No.	Name	Connector	Pin No.	Name
Lighting SW (13pin)	1	Lighting switch ground	Wiper & washer SW (14pin)	1	MIST switch
	2	Tail lamp switch		2	Wiper parking
	3	Auto light switch		3	Wiper low speed
	4	Head lamp switch		4	-
	5	Fog switch base		5	Rear washer switch
	6	Front fog switch		6	GN2)-Rear wiper & washer
	7	Rear fog switch		7	INT rear wiper switch
	8	Head lamp low beam		8	Intermittent wiper switch
	9	Head lamp high beam		9	Wiper high speed
	10	Dimmer switch base		10	ING2)-Front washer & wiper
	11	Turn signal left		11	Wahser switch
	12	Turn signal base		12	Intermittent vo ume base
	13	Turn signal right		13	Intermittent time
				14	Rear wiper switch

Body Electrical System > Multifunction switch > Repair procedures

Inspection

Lighting Switch Inspection

With the multifunction switch in each position, make sure that continuity exists between the terminals below. If continuity is not as specified, replace the multifunction switch.



Lighting switch (Auto Light)

Terminal / Position	1	2	4	3
OFF				
Tail	○	○		
H / Lamp	○	○	○	
AUTO	○			○

Lighting switch

Terminal / Position	1	2	4
OFF			
Tail	○	○	
H / Lamp	○	○	○

HS : Head lamp switch(Short inside)
Dimmer And Passing Switch

Terminal / Position	10	8	9	1
High	○		○	
Low	○	○		
Passing	○		○	○

Turn Signal Switch

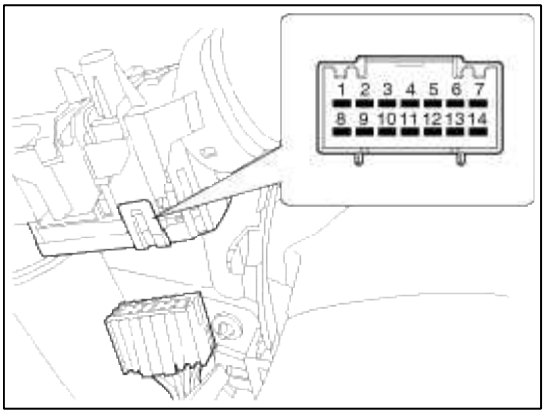
Terminal / Turn signal switch		12	11	13
Turn	L	○	○	
	N			
	R		○	○

Front Fog Lamp Switch

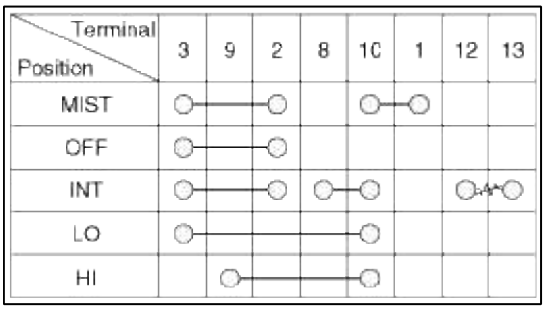
Terminal / Position	5	6
OFF		
Front	○	○

Wiper And Washer Switch Inspection

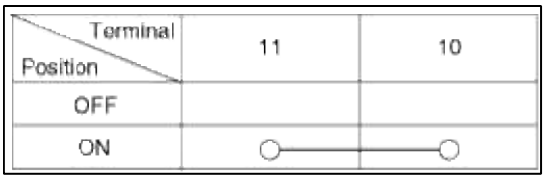
With the multifunction switch in each position, make sure that continuity exists between the terminals below. If continuity is not as specified, replace the multi-function switch.



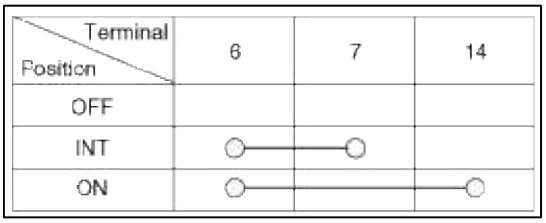
Wiper Switch (Intermittent)



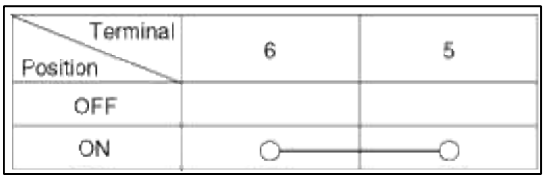
Washer Switch



Rear wiper switch



Rear washer switch

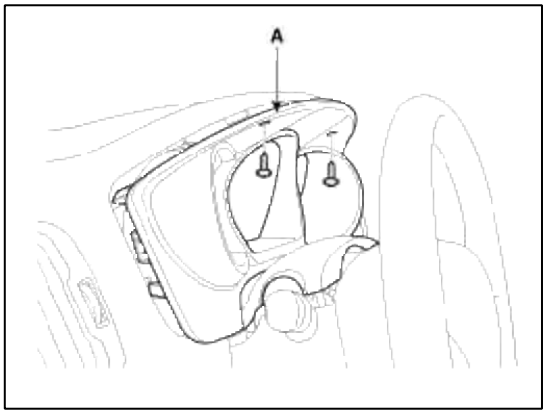


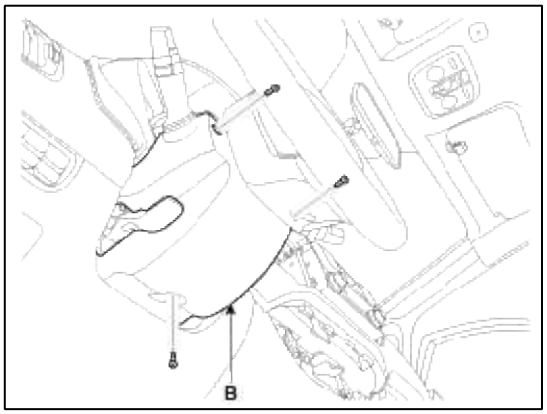
Removal

Wiper and Washer Switch

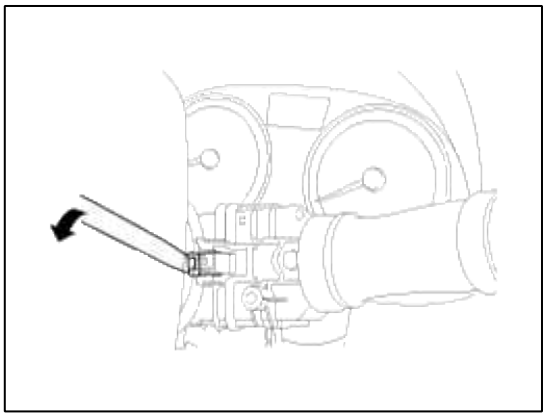
1. Disconnect the negative (-) battery terminal.

2. Remove the steering wheel.
   (Refer to the ST group - "Steering column & shaft")
3. Remove the steering column upper (A) and lower (B) shrouds after removing the screw.





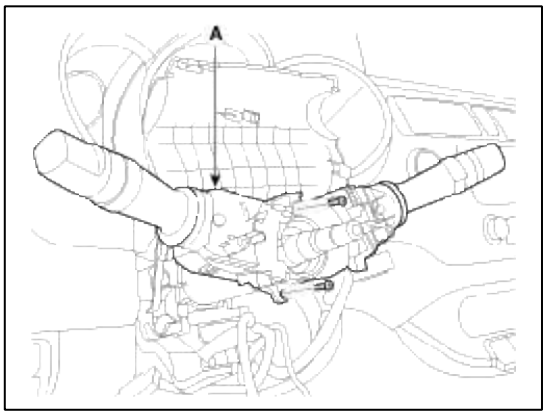
4. Disconnect the connector(A). Release the lock of wiper switch using tool without removing the steering wheel and the clock spring.
   Remove the wiper and washer switch.



Multifunction Switch Assembly

1. Disconnect the negative (-) battery terminal.
2. Remove the steering wheel.
   (Refer to the ST group - "Steering column & shaft")
3. Remove the steering column upper and lower shrouds after removing 3 screws.
4. Remove the clock spring.
   (Refer to the RT group - "Airbag module")

5. Disconnect the lighting switch connector and wiper & washer switch connector.
   Remove the multifunction switch assembly (A) after loosening 2 mounting screws.



Installation

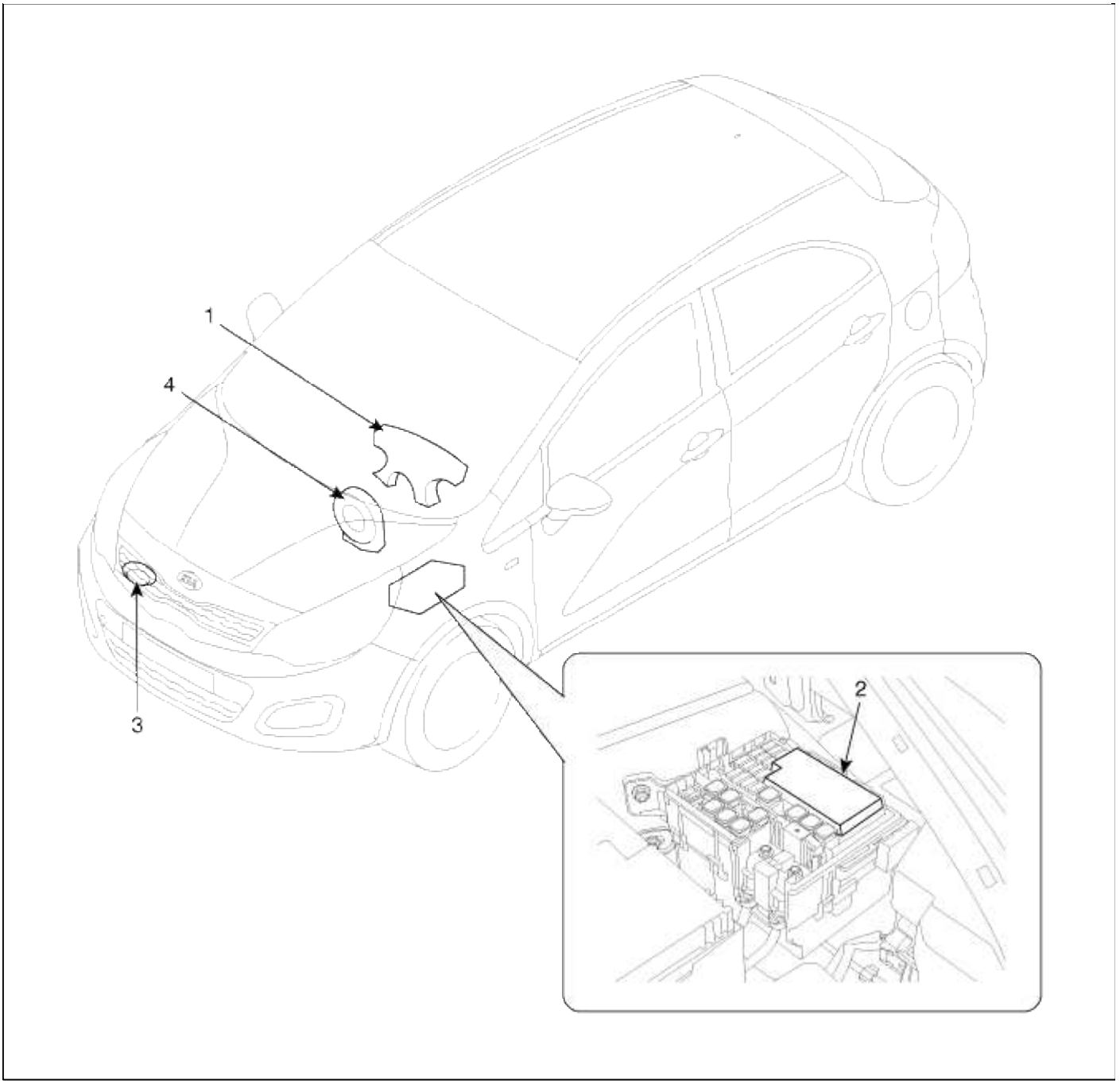
Multifunction Switch

1. Install the multifunction switch.
2. Install the clock spring.
3. Install the steering column upper and lower shrouds.
4. Install the steering wheel.

> NOTE
>
> Make sure the multifunction switch connectors are plugged in properly.

Body Electrical System > Horn > Components and Components Location

Component Location



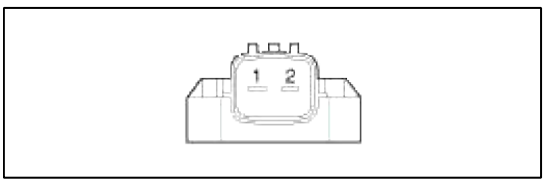
1. Horn switch 2. Horn relay (Egine Room Relay)	3. Horn 4. Clock spring

Body Electrical System > Horn > Repair procedures

Inspection

Horn Inspection

Test the horn by connecting battery voltage to the 2 terminal and ground the 1 terminal.



1 : 12V Ground(-)
2 : 12V (+)

NOTE

Take care not to damage the horn when connecting the battery voltage to the correct terminal.

The horn should make a sound. If the horn fails to make a sound, replace it.

Removal

1. Remove the under cover.
2. Remove the mounting nut and disconnect the horn connector, then remove the horn (A).

Installation

1. Connect the horn connector, then reassemble the horn.

Body Electrical System > AVN System > Specifications

Specifications

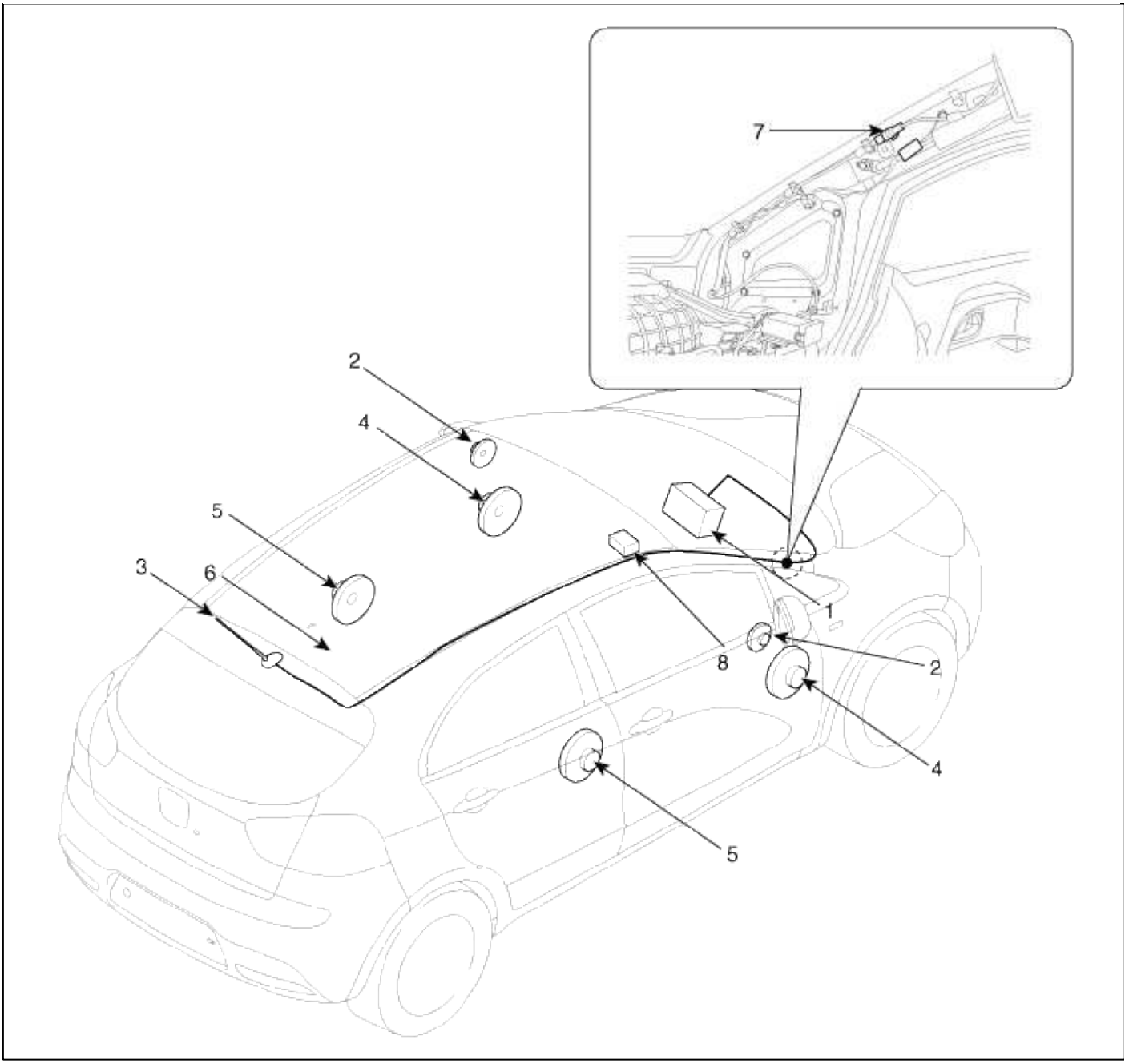
Item	Specification
Power source	DC 14.4V (-) ground
Frequency range / Channel space	FM : 87.5 ~ 107.9 MHz / 200 K AM : 530 ~ 1710 KHz / 10 K
Tuning type	PLL SYNTHESIZED TUNING
Impedance	2Ω X 4
Antenna	80 PF 75Ω
Dark current	MAX 3mA (Head unit only)
S/N	FM : MIN 50 dB AM : MIN 40 dB
Temperature range	Operating : -20 °C~ +65 °C (-4 °F~ +149 °)F Storage : -30 °C~ +80 °C (-22 °F~ +316 °F)

GPS

Item	Specification
Frequency	1.57542 GHz
Channel	12CH

Body Electrical System > AVN System > Components and Components Location

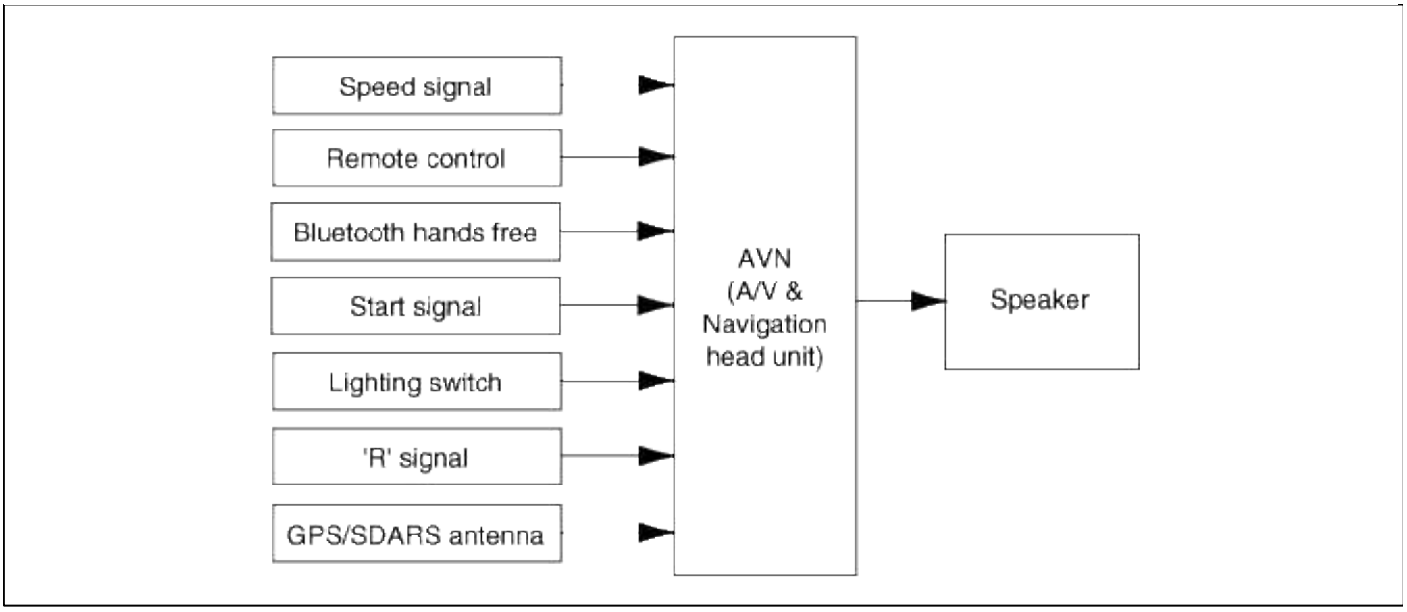
Components Location



1. AVN (A/V & Navigation head unit) 2. Midrange speaker 3. Roof antenna (GPS Radio) 4. Front door speaker	5. Rear door speaker 6. Antenna feeder cable 7. Feeder cable joint connector 8. Multimedia jack

Body Electrical System > AVN System > Schematic Diagrams

System Block Diagram



Body Electrical System > AVN System > Description and Operation

Description

Limitations Of The Navigation system

GPS Signal Reception State

As the GPS satellite frequency is received/transmitted in straight lines, reception may not work if something is placed on or near the GPS antenna or when traveling through the following locations.

- Tunnels
- Basement parking structures
- Underneath an overpass
- Roads within forested areas
- Areas near high rise buildings
- Roads within canyons

Vehicle Position Display

1. If multipass errors occur due to reflections from buildings or related causes, the current position mark on the navigation may differ from the actual position of the vehicle.
2. The position of the vehicle on the navigation may be different from the actual position if the vehicle is under any of the following conditions. Driving for a short period of time should correct the problem.
   A. When driving on a Y-shaped road with a narrow angle, the current position may be displayed in the opposite direction.
   B. If the vehicle is loaded onto a car transport vehicle, the current position mark may be stalled on the last position prior to loading.
   C. When driving on a spiral-shaped road.
   D. When driving in mountain regions with sharp turns or sudden brakes.
   E. When entering a road after having been in an underground parking structure, building parking structure, or turnable with many rotations.
   F. When the tires have recently been replaced (Especially upon use of spare or studless tires)
   G. If the battery terminal is removed.
   H. When driving in city streets, the current position may be displayed on the opposite side or on an off-road position.
   I. When changing the zoom level from the maximum zoom in level to a different zoom level, the current position mark may be displayed on a different road.
   J. When driving in heavy traffic with frequent go · stops in traffic or intersections.

K. When driving under slippery conditions, such as heavy sand, snow, etc.
L. When driving with the tire chain in place.
M. When using a tire with an incorrect size specification.
N. When the tire pressure for the 4 tires are different.
O. When the replacement tire is a worn or used tire (Especially studless tires having passed a 2nd seasons, etc.)
P. When driving near high-rise buildings
Q. If a roof carrier has been installed
R. When driving under high speeds or having calculated a long-distance route.

Route Guidance

Suitable route guidance may not occur caused by search conditions or the driving position.

- Guidance to go straight may be given while driving on a straight road.
- Guidance may not be given even when having turned at an intersection.
- There are certain intersections in which guidance may not occur.
- A route guidance signaling entrance into a no enter zone may occur (No enter zone, road under construction, etc.)
- Guidance may be given to a position removed from the actual destination if roads to reach the actual destination do not exist or are too narrow.
- Faulty voice guidance may be given if the vehicle breaks from the designated route (ex : if a turn is made at an intersection while the navigation provided guidance to go straight).
- Map Data may be missing or incorrect causing route guidance to not be given.

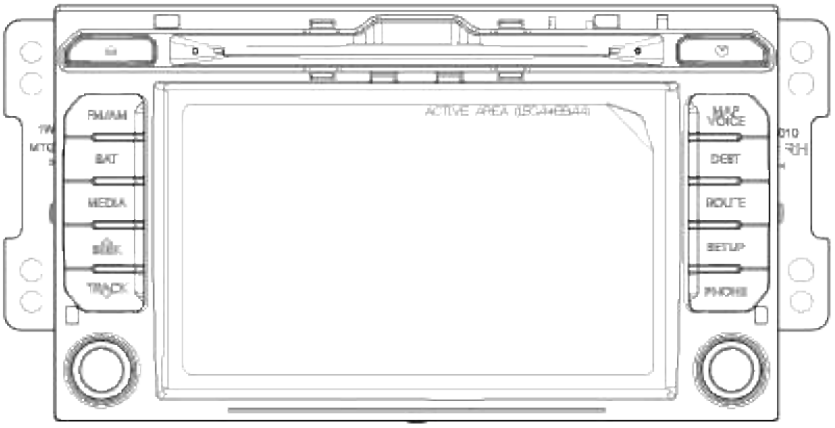
Route Re-calculation

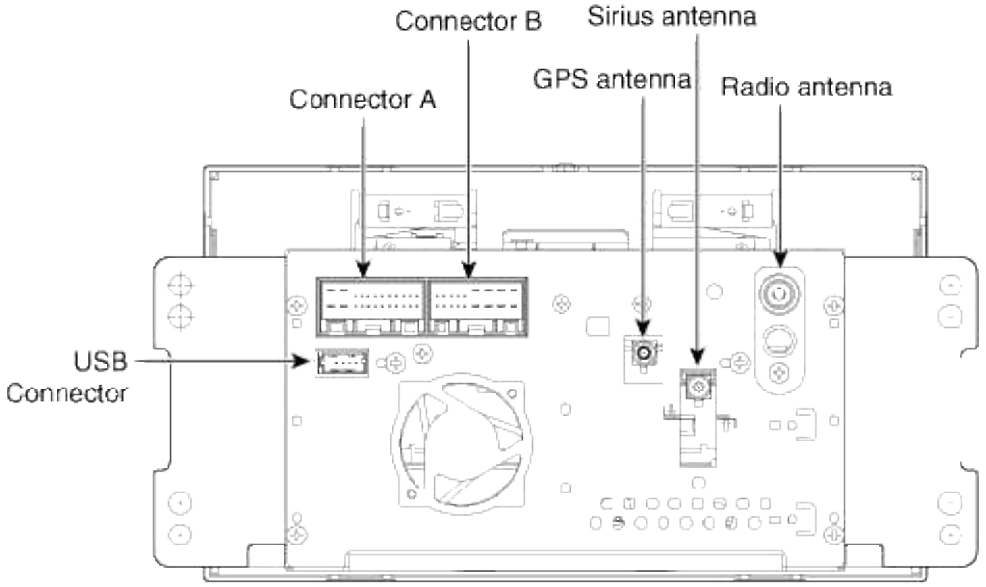
The following phenomena may occur after conducting route recalculation.

- Guidance may be given to a position differing from the current position when turning at an intersection.
- Route recalculation may take a longer period of time when driving under high speeds.
- A route guidance signaling for a U-Turn in a No U-Turn location may occur.
- A route guidance signaling entrance into a no enter zone may occur (No enter zone, road under construction, etc).
- Guidance may be given to a position removed from the actual destination do not exist or are too narrow.
- Faulty voice guidance may be given if the vehicle breaks from the designated route (ex : if a turn is made at an intersection while the navigation provided guidance to go straight)

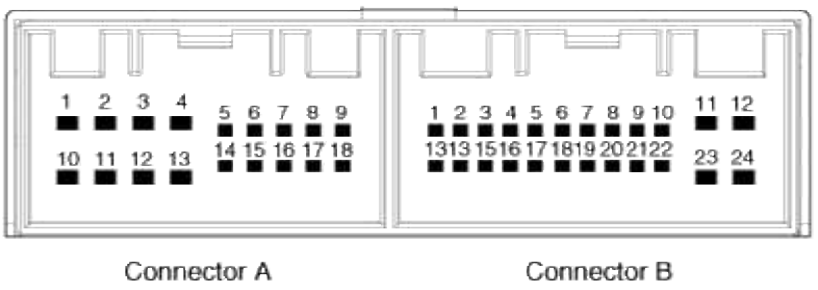
Body Electrical System > AVN System > AVN Head Unit > Components and Components Location

Components

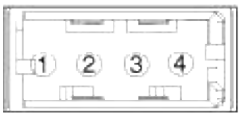


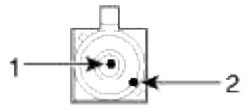


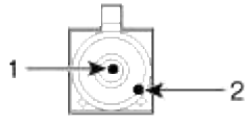
AVN (A/V & Navigation) Head Unit Connector

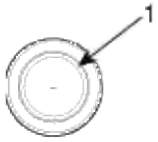


NO	Connector A	Connector B
1	Rear left spearker +	-
2	Front left speaker +	-
3	Front right speaker +	-
4	Rear right speaker +	-
5	Back view camera ground	Remote switch
6	Back view camera power	-
7	ALT_L	-
8	Illumination +	AUX video
9	R position	AUX audio_R
10	Rear left spearker -	AUX audio ground
11	Front left speaker -	MIC +
12	Front right speaker -	ACC
13	Rear right speaker -	Battery +
14	Back view camera video ground	-
15	Back view camera video power	A/V tail
16	Door unlock	P position
17	Illumination -	Speed
18	Antenna power	Remote ground
19		AUX video ground
20		AUX detect
21		AUX audio_L
22		MIC -
23		Ground
24		Ground

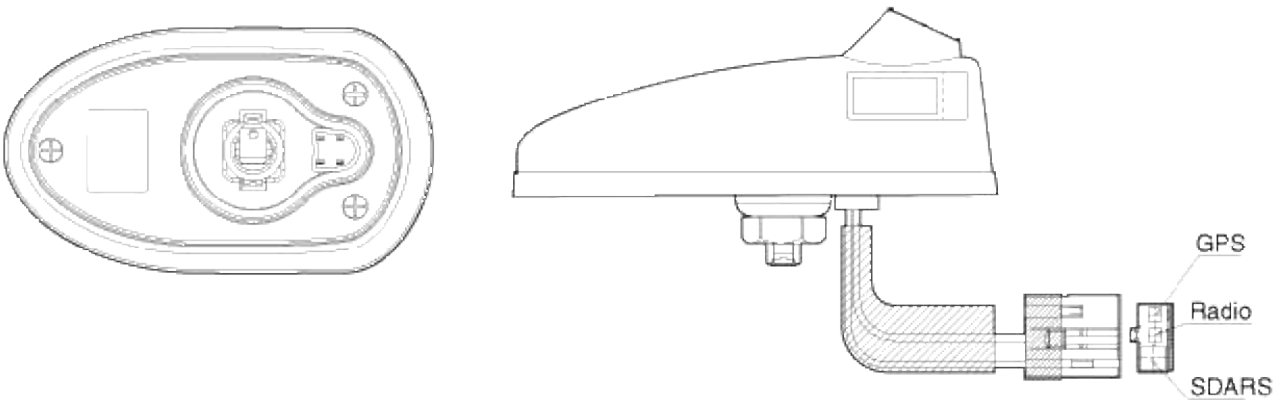
USB connector	Pin No.	Description	Pin No.	Description
	1	USB VCC	3	USB D (-)
	2	USB D (+)	4	USB ground

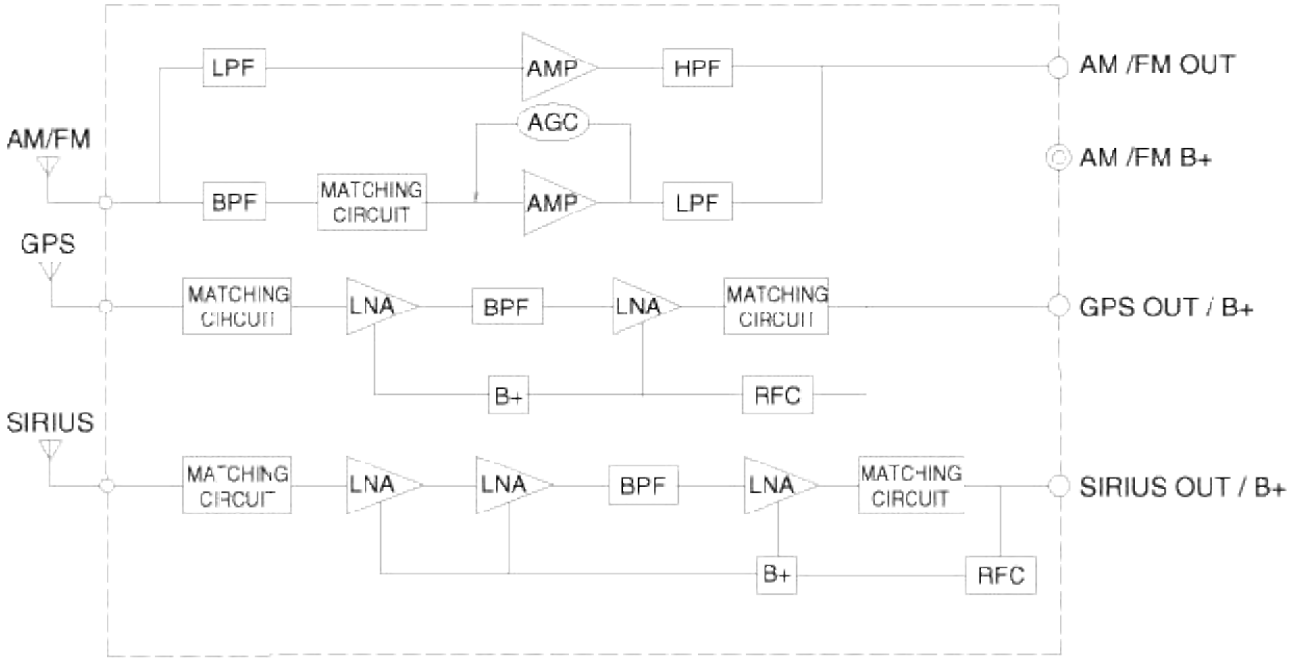
GPS antenna	Pin No.	Description	Pin No.	Description
	1	GPS Signal	2	Ground

Sirus antenna	Pin No.	Description	Pin No.	Description
	1	Sirius signal	2	Ground

Radio antenna	Pin No.	Description	Pin No.	Description
	1	FM / AM	2	Ground

[Roof Antenna (Radio + GPS + SDARS)]





※ LNA : Low Noise Amplifier
BPF : Band Pass Filter
RFC : Radio Frequency Choke

Body Electrical System > AVN System > AVN Head Unit > Repair procedures

Removal

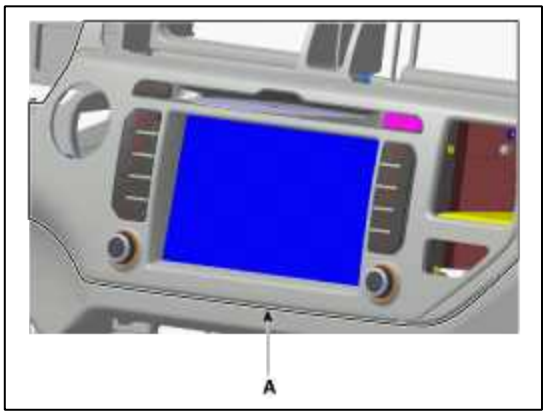
AVN Head Unit

NOTE

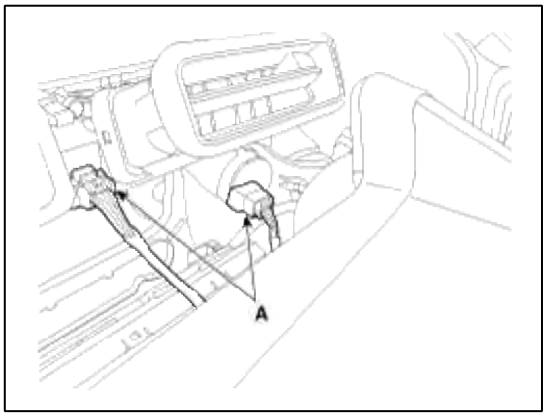
- Take care not to scratch the center fascia panel and related parts.
- Eject all the disc before removing the AVN head unit to prevent damaging the CD player's load mechanism.

1. Disconnect the negative (-) battery terminal.

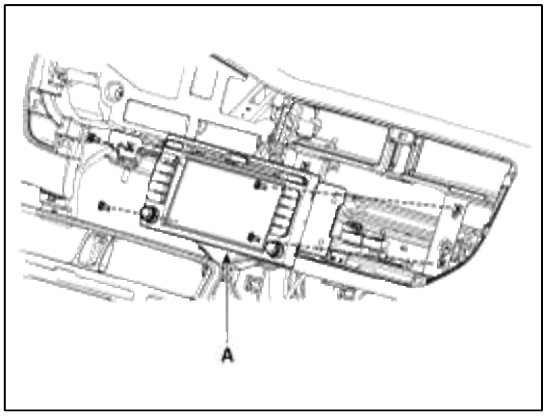
2. Remove the crash pad center fascia panel (A).
   (Refer to the BD group - "Crash pad")



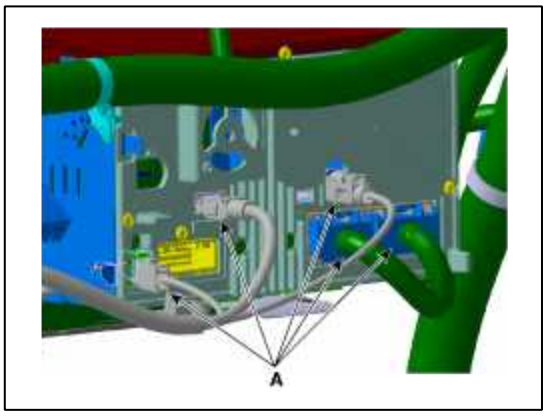
3. Disconnect the center fascia panel connectors (A).



4. Remove the AVN head unit (A) after loosening the mounting screws.



5. Remove the AVN head unit connectors and cables.

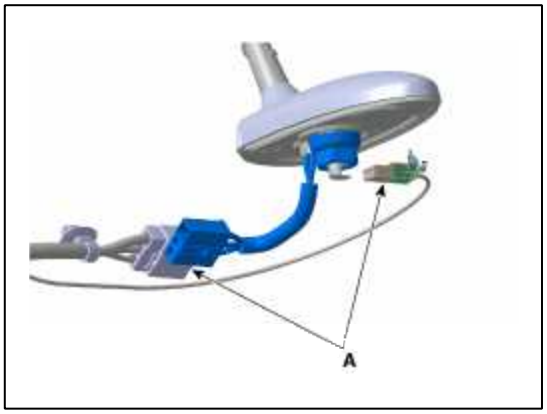


NOTE

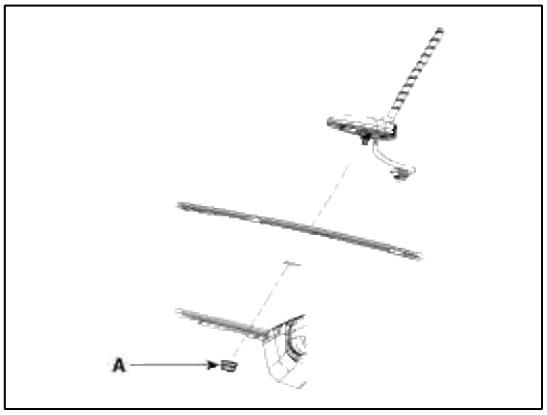
- If CD does not eject, don't try to remove it.
- The player may be damaged.
- Therefore, contact a service shop for repairs.

Roof Antenna (Radio + GPS)

1. Remove the rear roof trim.
   (Refer to the BD group - "Roof trim")
2. Disconnect the antenna cable and the connector (A).



3. Remove the roof antenna after removing a nut (A).



Installation

AVN Head Unit

1. Connect the AVN head unit connectors and cable.
2. Install the AVN head unit.
3. Install the center fascia panel.

4. Connet the battery (-) terminal.

> NOTE
>
> Make sure the AVN Head unit connectors are plugged in properly and the antenna cable is connected properly.

Roof Antenna

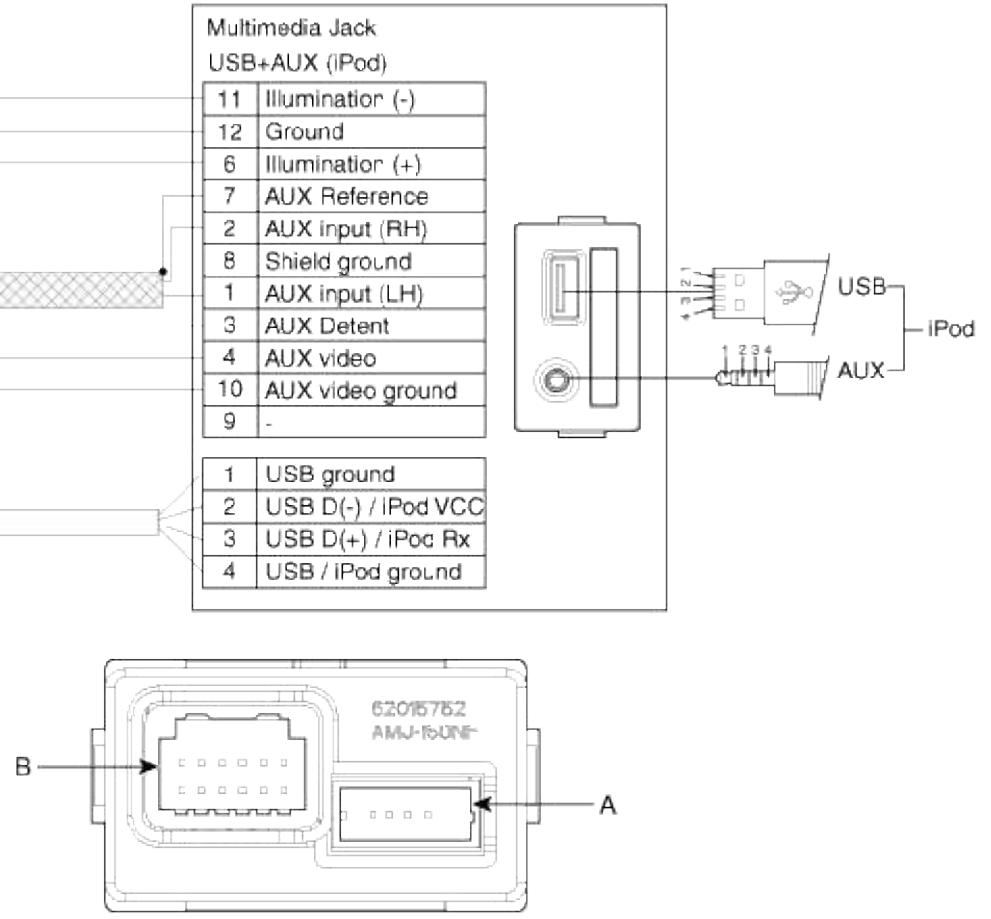
1. Installation the roof antenna.
2. Connect the cable and the connector.
3. Install the rear roof trim.

> NOTE
>
> - Make sure that the cables and connectors are plugged in properly.
> - Check the AVN system.

Body Electrical System > AVN System > Multimedia Jack > Schematic Diagrams

Circuit Diagram

[AUX, USB Jack (AVN)]



Connector A	Pin No.	USB connector
①②③④	1	USB / iPod VCC
	2	USB D (-) / iPod Tx
	3	USB D (+) / iPod Rx
	4	USB / iPod ground

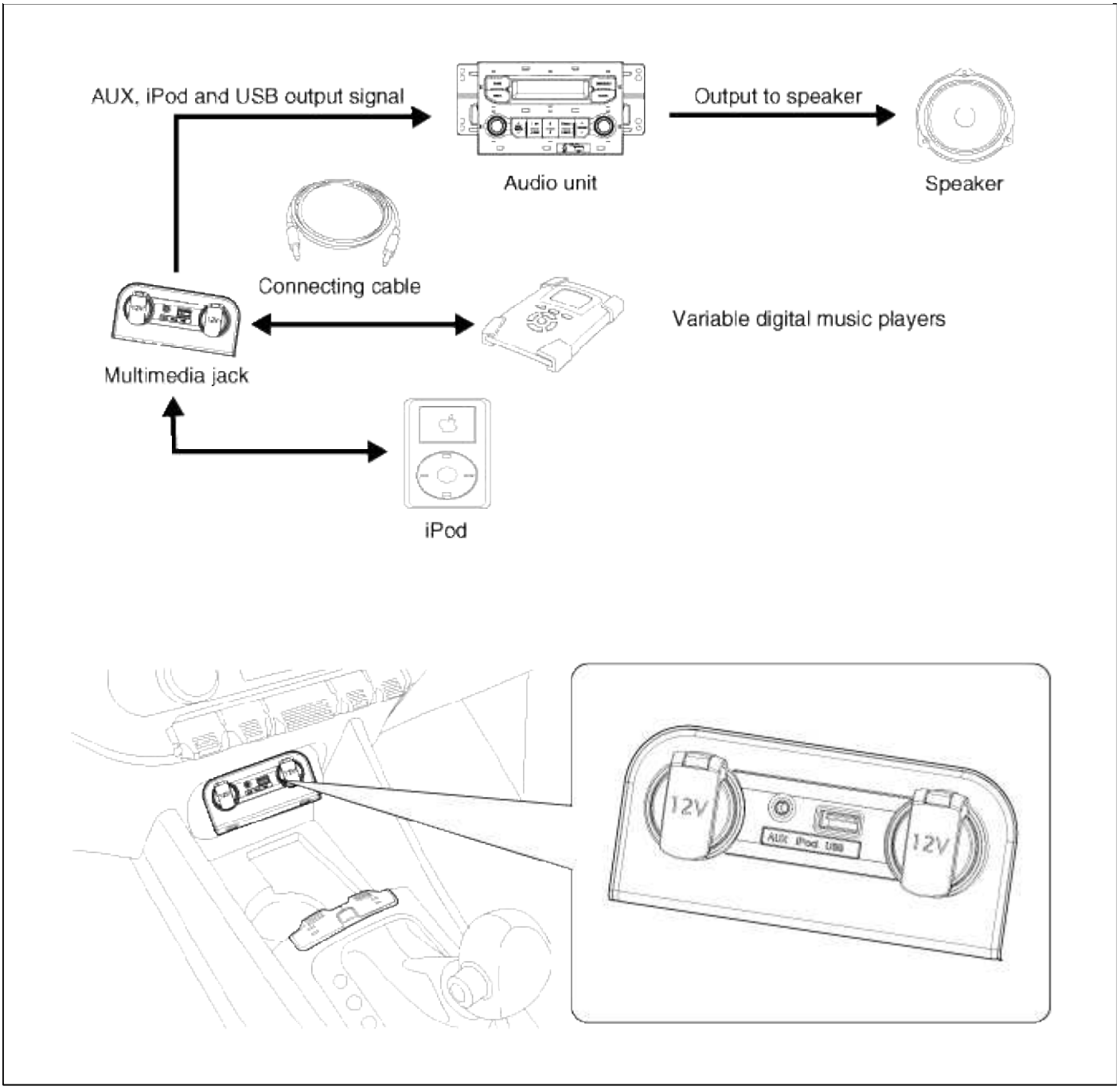
Connector B	Pin No.	AUX connector
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫	1	AUX input (LH)
	2	AUX input (RH)
	3	AUX Detent
	4	AUX Video
	5	-
	6	Illumination (+)
	7	AUX Reference
	8	Shield Ground
	9	-
	10	AUX Video ground
	11	Illumination (-)
	12	Ground

Body Electrical System > AVN System > Multimedia Jack > Description and Operation

Description

The multimedia jack on the console upper cover is for customers who like to listen to external portable music players like the MP3, iPod and etc., through the vehicle's sound system when it is linked to this jack. The customer has this added option.

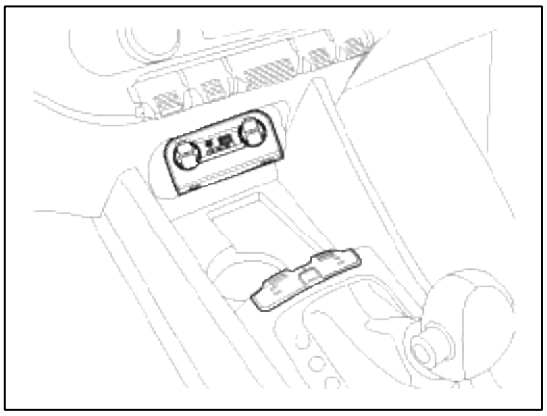
In case of distortions from media connected to the AUX source, the audio unit may not be defective but the output level of the used media does not match the specification of the AUX input.



Body Electrical System > AVN System > Multimedia Jack > Repair procedures

Removal

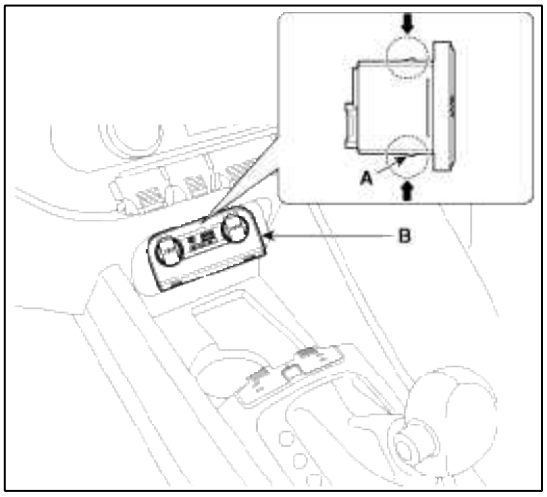
1. Using a screwdriver or remover, remove the multimidia jack assembly.



NOTE

Take care not to scratch the center fascia tray and related parts.

2. Remove the multimedia jack (B) from the console under cover after releasing the fixed hooks (A).



3. Disconnect the multimedia jack connector.

Installation

1. Install the multimedia jack.
2. Connect the multimedia jack connector.

NOTE

Make sure the multimedia connector and the console upper cover connectors are plugged in properly.

Body Electrical System > AVN System > Troubleshooting

Troubleshooting Guide

Before Thinking The Product Has Malfunctioned

1. Errors which occur during the operation or installation of the device may be mistaken as a malfunction of the actual device.
2. If you are having problems with the divice, try the suggestions listed below.
3. If the problems persist, contact your point of purchase or the nearest service center.

Problem	Function
There are small red, blue, or green dots on the screen	Because the LCD is manufactured with technology requiring high point density, a pixel deficiency or lighting may occur within 0.01% of total pixels.
The sound or image is not working	• Has the switch for the vehicle been turned to [ACC] or [ON]? • Has the SYSTEM been turned OFF?
The video is being displayed but sound is not working	• Has the volume been set to a low level? • Has the volume been set on mute?
When the power is turned on, the corners of the screen are dark	• The display looking somewhat darker after prolonged periods of use is a normal phenomenon with LCD panels. It is not a malfunction. • If the screen is very dark, contact your point of purchase or the nearest service center.
Sound is working from only one speaker	• Is the position of FAL/BAL sound controls or volume adjusted to only one side?
Sound and video does not work in AUX mode	Is the audio and video connector jacks fully inserted into the AUX terminal?
The external device is not working	Is the external device connected with a standard connector cable?
The road is missing	Some map data may be missing or incorrect.
The road name is spoken incorrectly	The TTS(Text To Speech) engine speaks the street name based off of the phonetic spelling. This will continuously be update with the map datebase.

Troubleshooting

Problem	Possible Cause	Solution
The power does not turn on.	The fuse is disconnected.	Replace with a suitable fuse. If the fuse is disconnected again, please contact your point of purchase or service center.
	Device is not properly connected.	Check to see that the device has been properly connected.
XM only goes through one category	The XM mode is in category.	Press the mode button to change to channel mode.
The CD does not play.	The DISC has not been inserted or has been inserted upside down.	Insert the disc properly so that the sides are facing the correct direction.
	The DISC has been contaminated.	Wipe dirt dirt and other foreign substances from the DISC.
	The vehicle battery is low.	Charge the battery. If the problem persists, please contact your point of purchase or service center.
	A disc which is not supported by the device has been inserted.	Insert a disc which is supported for play by the device.
The sound does not	• The volume level is set the	• Adjust the volume level.

work.	lowest level. • The connector is not properly connected. • The device is currently fast-forwarding, rewinding, scanning, or playing in slow mode.	• Check the connection state. • The sound will not work when the device is fast-forwarding, rewinding, scanning, or playing in slow mode.
The sound or video quality is low.	• The DISC is dirty or scrached. • Vibration is occuring from the position in which the conversion switch has been installed. • The color and tone quality of the image is low.	• Wipe off water or dirt from the DISC. Do not use a disc which has been scrached. • The sound may be short-circuited and the image distorted if the device begins to vibrate. The device will return to normal operation once the vibration has stopped. • Aging of the video display and deterioration in performance may cause certain quality degradations.
The USB does not work.	• USB memory is damaged. • USB memory has been contaminated. • A separately purchased USB HUB is being used. • A USB extension cable is being used. • A USB which is not a Metal Cover Type USB Memory is being used. • A HDD type, CF, SD Memory is being used. • There are no music files which can be played.	• Please use after formatting the USB into FAT 12/16/32 format. • Remove any foreign substances on the contact surface of the USB memory and multimedia terminal. • Directly connect the USB memory with the multimedia terminal on the vehicle. • Directly connect the USB memory with the multimedia terminal on the vehicle. • Use a standard USB memory. • Use a standard USB memory. • Only MP3, WMA file formats are supported. Please use only the supported music file formats.
The iPod is not recognized even though it has been connected.	• There are no titles which can be played. • The iPod firmware version has not been properly updated. • The iPod device does not recognize downloads.	• Use iTunes to download and save MP3 files into the iPod. • Use iTunes to update the firmware version and reconnect the iPod with the device. • Reset the iPod and reconnect with the device.

Body Electrical System > Smart key System > Specifications

Specification

Smart Key Unit

Items	Specification
Rated voltage	DC 12V
Operating voltage	DC 9 ~ 16V
Operating temperature	-30°C ~ 75°C (-22°F ~ 167°F)
Dark current	Max. 5mA

Smart Key fob

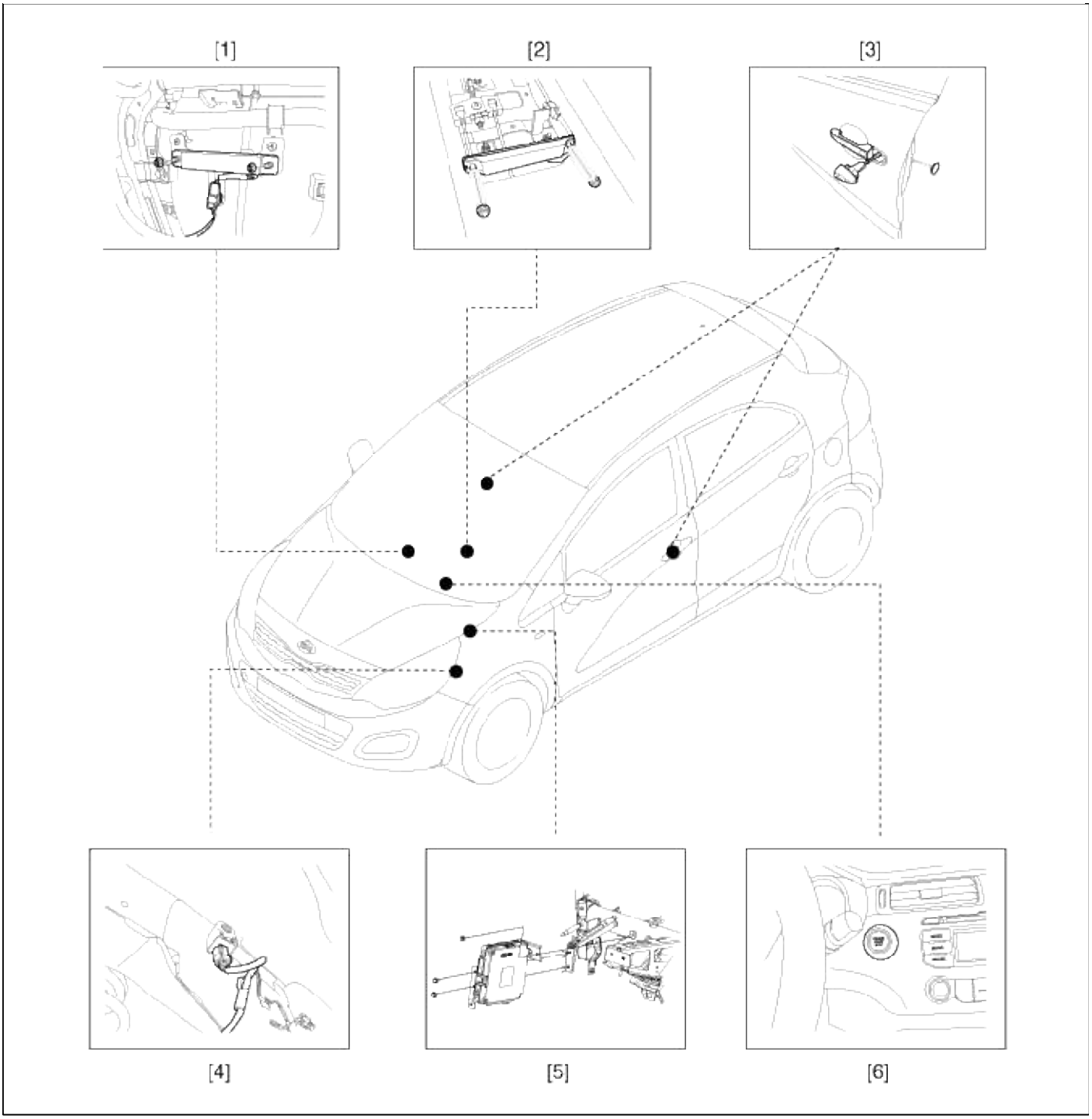
Items	Specification
Battery	Lithium battery 3V 1EA
Distance	30m from vehicle, RF : 30m, Passive(LF) : 0.7m
Battery life	More than 2years (10 times / a day) WARNING An inappropriately disposed battery can be harmful to the environment and human health. Dispose the battery according to your local law(s) or requlation.
Push buttons	4 (Lock, Unlock, Trunk/Tailgate, Panic)
Frequency(Rx)	125 kHz
Frequency(Tx)	315 MHz
Numbers	2EA

Antenna

Items	Specification
Rated voltage	DC 12V
Operating voltage	DC 9 ~ 16V
Operating temperature	-30°C ~ 75°C (-22°F ~ 167°F)
Frequency	125kHz
Numbers	Interior(3EA), Door(2EA), Bumper(1EA)

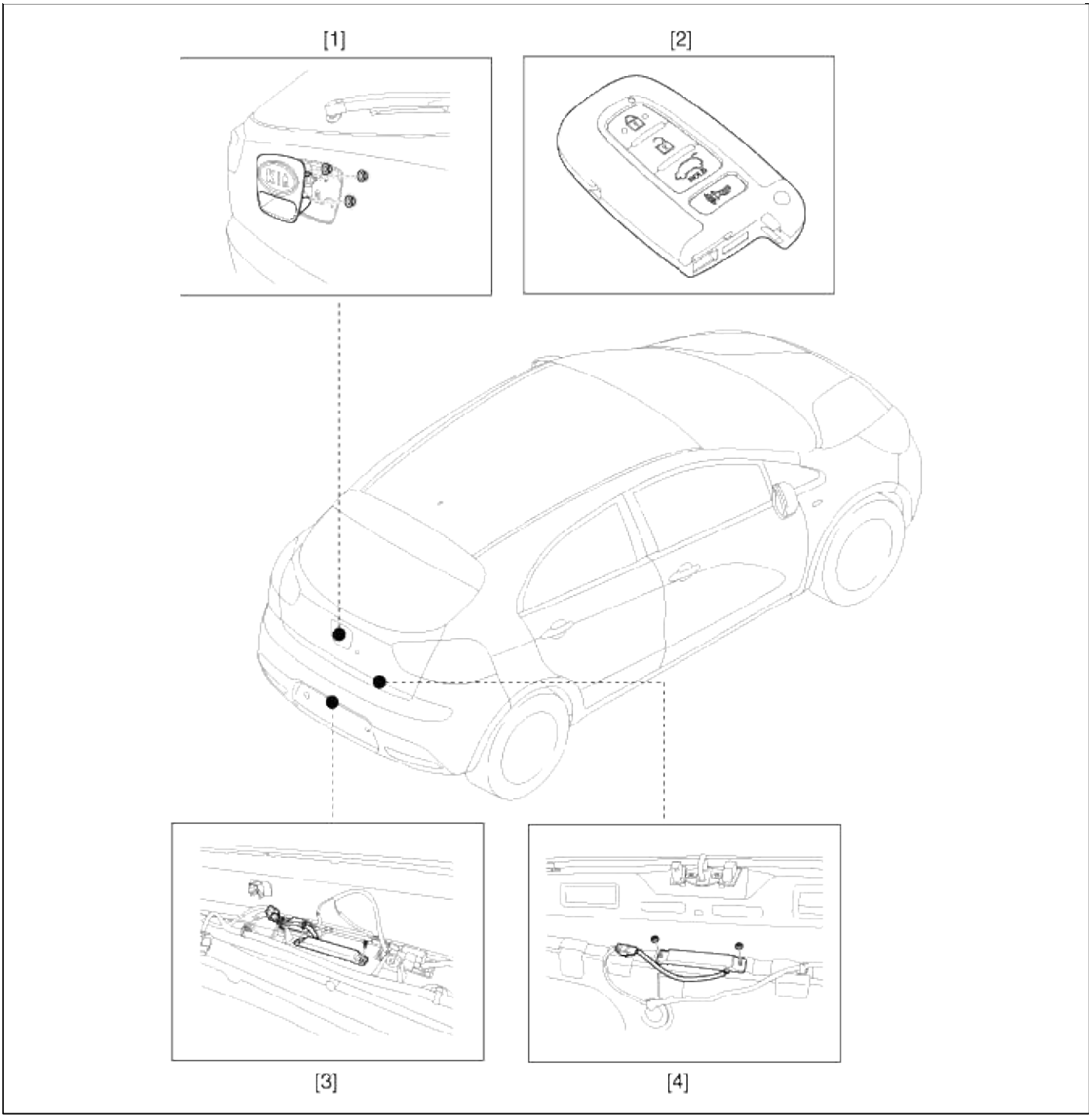
Body Electrical System > Smart key System > Components and Components Location

Component Location (1)



1. Interior antenna 1 2. Interior antenna 2 3. Door outside handle	4. Buzzer 5. Smart key unit 6. SSB (Start Stop Button)

Component Location (2)



1. Tailgate open switch 2. Fob key	3. Bumper antenna 4. Trunk antenna

Body Electrical System > Smart key System > Description and Operation

Description

The SMART KEY system is a system that allows the user to access and operate a vehicle in a very convenient way. To access the vehicle, no traditional key or remote control unit is needed.

The user carries a SMART KEY fob which does not require any conscious actions by the user (e.g. operate a RKE button). The SMART KEY system is triggered by pressing a push button in the door handle.

After being triggered the vehicle sends out a request in a limited range. If the SMART KEY fob receives this request, it automatically sends a response to the vehicle. Then the system decides whether to perform a particular

action (unlocking, locking…) or remain inactive.
Again, a communication between the vehicle and the SMART KEY fob is needed before any actions will be performed.
The System offers the following features :

- Passive unlock via door driver side and passenger side
- Passive locking via door driver side and passenger side
- Passive start
- Passive access trunk via the trunk lid switch at the trunk
- Passive locking via tailgate
- Max. 2 fobs can be handled by the system
- Immobilizer backup antenna driver integrated into SSB for TP authentication (i.e. limp home mode)
- Communication with engine management system
- Communication with SRX
- LF-RF communication

1. Passive unlock
   The system allows the user to access (unlock) the vehicle without performing any actions with the SMART KEY fob. This feature could be different depending on platform as follows:
   A. Pressing Push button in door handle
2. Passive locking
   The system allows the user to lock the vehicle by pushing a button on door handle with the SMART KEY fob.
3. Button start
   The system allows to switch the power modes (Off, Accessory, Ignition), as well as to start and stop the vehicle's engine without performing any actions with the SMART KEY fob. See Button Engine Start system specification.
4. LIMP HOME Mode
   Additionally, the system offers so called "limp home mode", which is the user can operate all vehicle functions by pushing the key into the SSB.

Smart Key ECU (SMK ECU)
The SMK ECU manages all functions related to "Passive Unlock", "Passive Lock" and "Passive Authorization for Engine Start Operation".
It reads the inputs (Push button in door handle, Start Stop Button (SSB), PARK position Switch), controls the outputs (e.g. exterior and interior antennas), and communicates via the CAN/LIN (depends on the vehicle) as well as a single line interface to further devices of the car.
It reads the inputs (Push button in door handle, Start Stop Button (SSB), PARK position Switch), controls the outputs (e.g. exterior and interior antennas), and communicates via the CAN as well as a single line interface to further devices of the car.
For communication with the SMART KEY fob, SMK ECU generates a request (challenge) as an encoded and modulated 125 kHz signal at the inductive antenna outputs and receives the SMART KEY fob's response via the external RF receiver.
The main functional blocks of the SMK ECU are:

- Power supply
- Microcontroller with FLASH Memory
- Single Line Interface to SRX
- Single Line Interface to EMS
- Input stage
- LF antenna amplifier/driver
- CAN communication with BCM
- LIN communication with other unit (depending on platform)

The LF antenna amplifier/driver generates a 125 kHz sinusoidal carrier signal which is distributed to the different

antennas.

Smart Key fob

The system supports up to 3 SMART KEY fobs.

The main functions of the SMART KEY fob are:

- Passive functionality: receives LF-challenge and sends automatically RF response.
- Classic RKE function by action up to 6 push buttons.
- Transponder-functionality in case of a flat battery or a disturbed communication.
- LED for operation feedback and battery monitoring.

NOTE

The fob's LED indicator may continue to light even with a low transmitter battery.
If the performance or range of the fob is less than expected, check the transmitter battery.

Antennas

1. Emitting LF Antennas:
   Inductive antennas in and at the vehicle are used to transform the current, driven by the SMK ECU antenna driver, into a 125 kHz magnetic field, which is the carrier for the SMART KEY challenge.
   Three antennas cover the vehicle's exterior: two antennas in the Door Handles (DS and PS) cover the area around the doors; one antenna in the rear bumper covers the area around the trunk.
   Two antennas cover the vehicle's exterior: two antennas in the Door Handles (DS and PS) cover the area around the doors.
   Up to three antennas cover the vehicle's interior and the trunk interior: two in the passenger compartment and one in the trunk.
2. Bidirectional Immobilizer Antenna (for Limp Home):
   The Immobilizer Backup Antenna is used for sending and receiving data: it emits a magnetic field (125 - 135 kHz challenge) and receives changes in the field strength (response of Transponder).

Door Handle

The front door handles of the two doors (driver door / passenger door) are equipped with emitting LF-antennas to emit the 125 kHz signals. The front door handles are also equipped with a push button.

Push Button

The push button in door handle serves as a trigger to indicate the user's intent to unlock or lock the vehicle.

The push buttons are installed at front doors, integrated into the door handles.

Another button is installed at the trunk lid.

Operation

Passive Functions

The system allows the user to access the vehicle without having to perform any actions (e.g. RKE button pressing) with the SMART KEY fob. It is sufficient that a valid SMART KEY fob is located within a defined and limited range with respect to the vehicle. So the system is capable of detecting and authenticating a SMART KEY fob in the ranges as specified below.

Operating Range

The SMART KEY fob receives and interprets a challenge sent from the vehicle via the exterior antennas in a free space range of min. 0.7m measured around the exterior antennas which are integrated in the door handles; refer to the below given picture. The trunk access range is also min. 0.7m measured from the antenna position.

The SMART KEY fob receives and interprets a challenge sent from the vehicle via the exterior antennas in a free space range of min. 0.7m measured around the exterior antennas which are integrated in the door handles; refer to the below given picture

Passive Access (Passive Entry)

Pressing one of the push buttons in the door handles when all doors locked indicates the operator's intent to access the vehicle and thus triggers the system for unlock

Passive Locking (Exit)

Pressing one of the push buttons in the door handles when one of the following condition is fulfilled:

- At least one door is unlocked and two_steps timer is not running or
- Two_steps timer is running and one of the push button except Front Left side is triggered

indicates the operator's intent to lock the vehicle and thus triggers the system for a lock.

Passive Open Tailgate

Pressing the Trunk Lid Switch when trunk is closed indicates the operator's intent to open the trunk and thus triggers the system. Subsequently, the SMK ECU sends a LF-challenge to the SMART KEY fob via the exterior bumper antenna. The SMART KEY fob answers with a RF-response. If the received response matches the expected answer, SMK ECU sends a "trunk open" message via the CAN network.

Passive Trunk Warning

Whenever the trunk is closed, SMK ECU uses a suitable search strategy to avoid trunk buzzer warning by a fob outside the vehicle. Then SMK searches for a SMART KEY fob in the interior of the trunk. If a valid SMART KEY fob is found in the trunk, the SMK ECU activates SMK external buzzer (TBD) to inform the user that the trunk has been closed with a fob inside the trunk.

SMK will send the trunk open command to BCM for trunk reopening if Trunk reopening bit is set(BK)For this functionality, a "valid" SMART KEY fob means any SMART KEY fob that belongs to the vehicle, even if it's DEACTIVATED.

NOTE

- A blind spot in the trunk similar to any RF disturbance may lead to no trunk warning. Due to the penetration of the bumper antenna into the trunk area the lid may open without an Identification Device outside.
- A blind spot in the trunk similar to any RF disturbance may lead to no trunk warning

Smart Key Reminder 1

1. Preconditions:
   All terminals OFF & at least one door open & locking status is not locked checked by SMK periodically every 100ms, as long as CAN/LIN active.
2. Event:
   At least 1 door knob status changed from unlock to lock.
3. SMK actions:
   A. IF NO fob-IN ACTIVE
      SMK performs a search for the fobs in the interior of the vehicle. The same LF-strategy has to be used as it is defined for the ID out warning (registering only, no authentication)
   B. IF fob-IN ACTIVE
      SMK searches valid TP
   If no fob or no TP has been found, no action is required.
   If any valid fob or valid TP has been found, SMK unlocks the vehicle by sending a CAN Key Reminder unlock message with the fob number.
   If any valid fob has been found, SMK unlocks the vehicle by sending a CAN/LIN Key Reminder unlock message with the fob number.

Smart Key Reminder 2

1. Preconditions:
   All terminals OFF & any door (including trunk) open & no fob-IN & no locking status (checked by SMK periodically every 100ms, as long as CAN/LIN active)
2. Vehicle action:
   Closing last door or trunk with knobs locked state, or with a locking in progress

3. SMK actions:
   Before elapsing 500ms after the closing if all doors are locked then:
   A. IF NO fob-IN ACTIVE
      SMK performs a search for the fobs in the interior of the vehicle.
      The same LF-strategy has to be used as it is defined for the ID out warning (registering only, no authentication)
   B. IF fob-IN ACTIVE
      SMK searches valid TP
   If no fob has been found, no action is required.
   If any valid fob or valid TP has been found, SMK sends unlock command via CAN and activates ext. buzzer warning.
   If any valid fob has been found, SMK sends unlock command via CAN/LIN and activates ext. buzzer warning.

Smart Key Door Lock Warning

Door Lock Warning 1

1. Preconditions:
   While (at least one door knob is unlocked) & (ACC ON or IGN ON) & (No fob-IN) :
   A. (All doors are closed) & (trunk closed)
2. Event:
   A. User presses the push button in door handle or trunk
3. SMK actions:
   SMK performs a search for the fobs outside of the vehicle; the same LF-strategy has to be used as it is defined for "Scenario Access with I/O Distinction".

Door Lock Warning 2

1. Preconditions:
   Same as passive locking precondition but with at least one door open.
2. Event:
   User presses the door handle Push button .
3. SMK actions:
   SMK performs a search for the fobs outside of the vehicle; the same LF-strategy has to be used as it is defined for "Scenario Access with I/O Distinction".
   If no fob has been found, no action is required.
   If the preconditions are no longer valid during buzzer active time (3 seconds), the SMK ECU stops the buzzer immediately.

Door Lock Warning 3

1. Preconditions:
   Same as passive locking precondition
2. User action:
   A. User presses the door handle Push button
3. SMK ECU actions:
   A. If ATWS(Anti Theft Warning System) is in DISARM status, SMK ECU performs a search for the fob inside of the vehicle (use "Door Lock Warning 3" scenario)

If no fob has been found, the passive locking is performed.
If any valid fob has been found, SMK ECU activates the external buzzer.
If the activity timer elapsed or ACC ON or IGN1 ON or NOT All door closed or fob-IN, the SMK ECU stops the buzzer immediately.
After searching of inside fob, SMK ECU also performs a search for fobs outside of the vehicle.

Smart Key Lamp Warning

1. SMK actions:
   As long as the preconditions are valid, the SMK ECU performs a periodical search for the fobs in the interior of the vehicle; the same LF-strategy has to be used as it is defined for the ID out warning (registering only, no authentication); periodical means, the search is done every 3 seconds.
   If no fob has been found, the SMK ECU starts Key out indicator lamp activation as all preconditions are valid and will perform another search 3 seconds later.

If any valid fob has been found, the SMK ECU stops the Key out indicator lamp and will (if one door is open) perform another search 3 seconds later; if no door is open then it's only at the next When the preconditions are still valid, the search resumes by opening of one door.

Failsafe Functions (Backup For Limp Home)

In case of a discharged battery of the SMART KEY fob or disturbed transmission, the following functions are available:

- Unlocking / locking of doors or trunk (or tailgate depending of the vehicle configuration): use of mechanical key

User Information Functions

ID OUT Warning

1. Preconditions:
   A. (ACC or IGN1) & (any door open or trunk open)
2. Event:
   The last opened door is closed
3. SMK action:
   SMK searches for a SMART KEY fob in the interior.
   A. If no valid SMART KEY fob is found, the SMK activates external buzzer and also sends ID OUT warning via CAN (exterior buzzer warning and internal buzzer warning).
   B. If a door is opened and closed again during terminals on and inside valid fob, SMK re-enables the authentication and stops the warning. If the terminal is in ACC, SMK shall turn on immobilizer lamp.

NOTE

If there is a LF error (LF overheating or LF antenna failure), the system will have the same behavior as it is with no fob found.

Immobilizer Lamp

Removing the PIF from the MSL and reinserting the PIF and pushing the MSL Knob will switch the lamp on again.

Fob Battery Low Voltage Detection

To detect fob low battery condition, certain battery voltage measurement and low voltage detection strategy are implemented into fob. The measurement of the battery voltage will be done if fob button is pressed or if a LF measurement command is received.

If the fob has detected a low battery voltage, the LED will not be switched on at button press.

Learning Description

In this chapter, the learning procedure for SMK, fobs is described.

For the learning of the SMK, fobs, it's necessary to have a connection to the diagnostic tool.

Learning MODE

Whatever the mode, the learning procedures are managed by the SMK.

Prior to start learning service, Fob-In signal must be active and the vehicle secret code (called as PIN code) should be known.

Teaching MODE

This mode is used by the dealers in order to replace SMK and/or the set of keys, or to register additional keys for an existing system. That means the system already has been learnt with certain PIN Code. The PIN Code is fixed for the life time of the vehicle, therefore the same PIN Code must be used in this mode. Otherwise learning will be failed

Teaching MODE Procedure Description (Step By Step)

Objective: Key teaching procedure at service station

Initial state:

- SMK replacement: SMK is not learnt, SMART fob are already learnt with same PIN code
- Additional or new keys teaching: SMK is already learnt with same PIN code

Body Electrical System > Smart key System > Repair procedures

Inspection

Self Diagnosis With GDS

Smart key system defects can be quickly diagnosed with the GDS. GDS operates actuator quickly to monitor, input/output value and self diagnosis.

The following three features will be major problem in SMART KEY system.

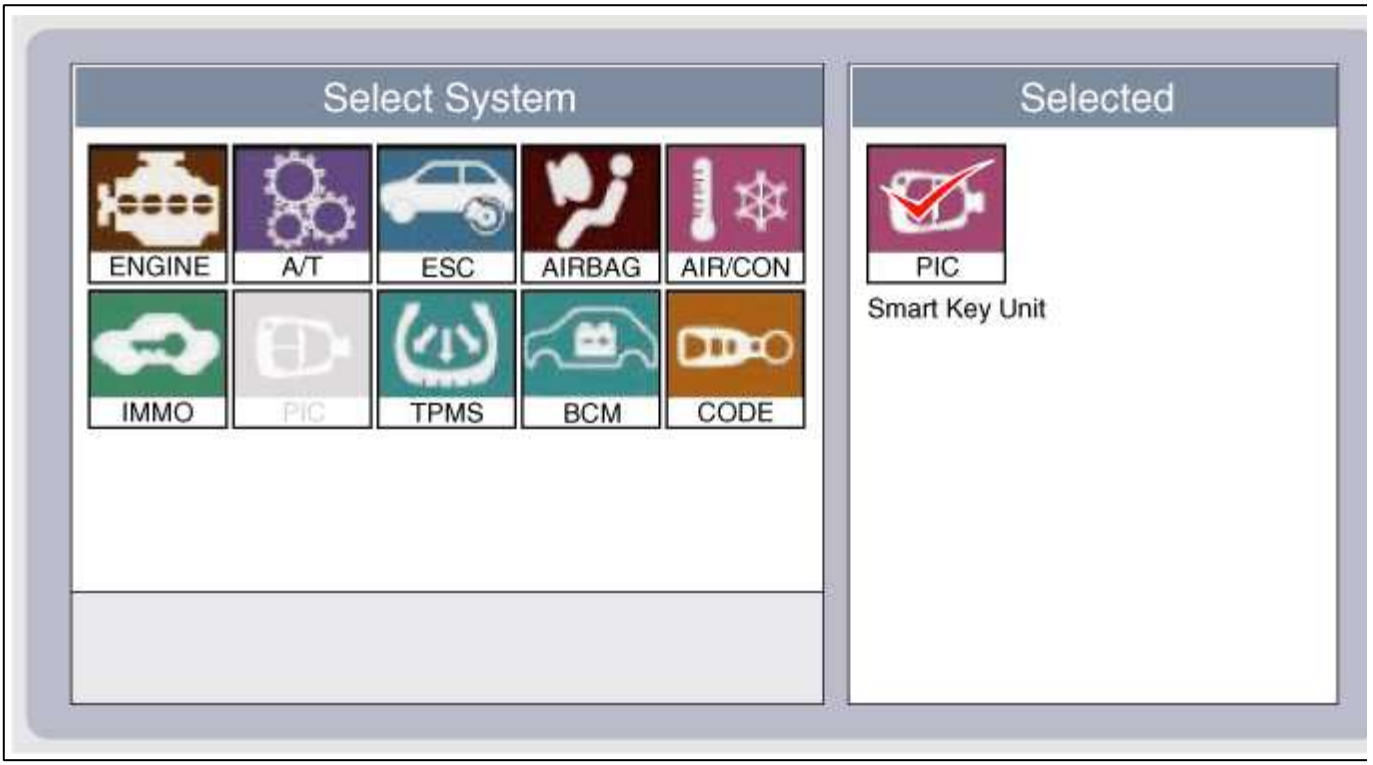
1. Problem in SMART KEY unit input.
2. Problem in SMART KEY unit.
3. Problem in SMART KEY unit output.

The following three diagnostic solutions will be the main solution process to a majority of concerns.

1. SMART KEY unit Input problem : switch diagnosis
2. SMART KEY unit problem : communication diagnosis
3. SMART KEY unit Output problem : antenna and switch output diagnosis

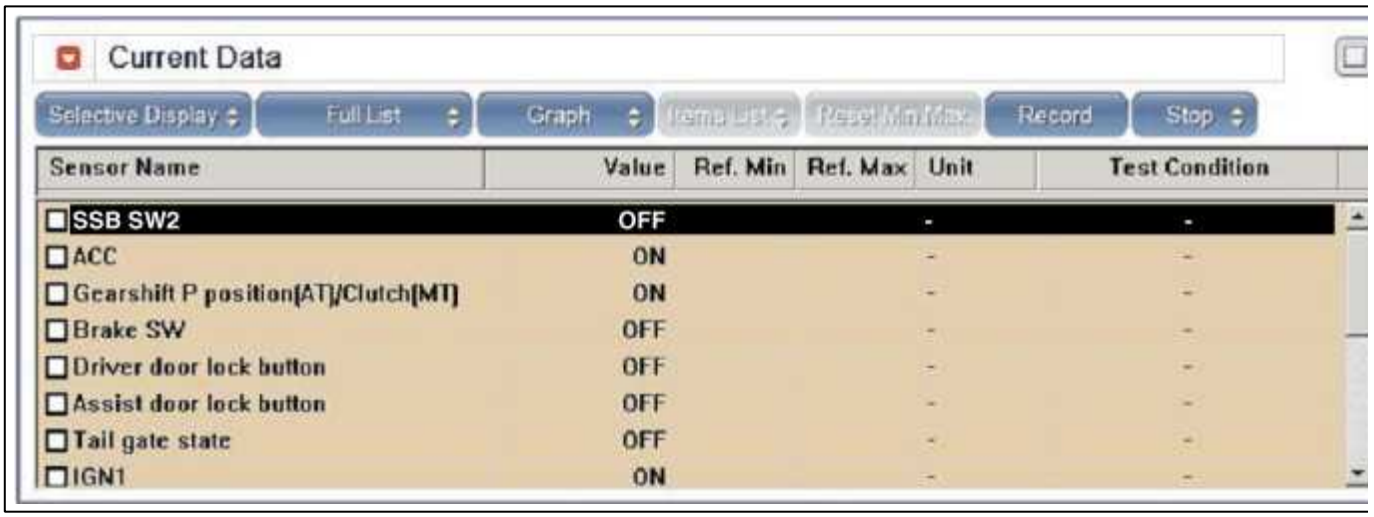
Switch Diagnosis

1. Connect the cable of GDS to the data link connector in driver side crash pad lower panel, turn the power on GDS.
2. Select the vehicle model and then SMART KEY system.



3. Select the "SMART KEY unit".

4. After IG ON, select the "Current data".



5. You can see the situation of each switch on scanner after connecting the "current data" process.

Display	Description
FL Toggle switch	ON : Push button is ON in the driver door handle.
FR Toggle switch	ON : Push button is ON in the assist door handle.
Trunk switch	ON : Trunk button is ON.
Gear P Position	ON : Shift lever is P position.
IGN 1	ON : IGN switch is IG position.
ACC	ON : IGN switch is ACC position.
Push Knob switch	ON : Push knob switch is ON.
External Buzzer	ON : Buzzer is ON.

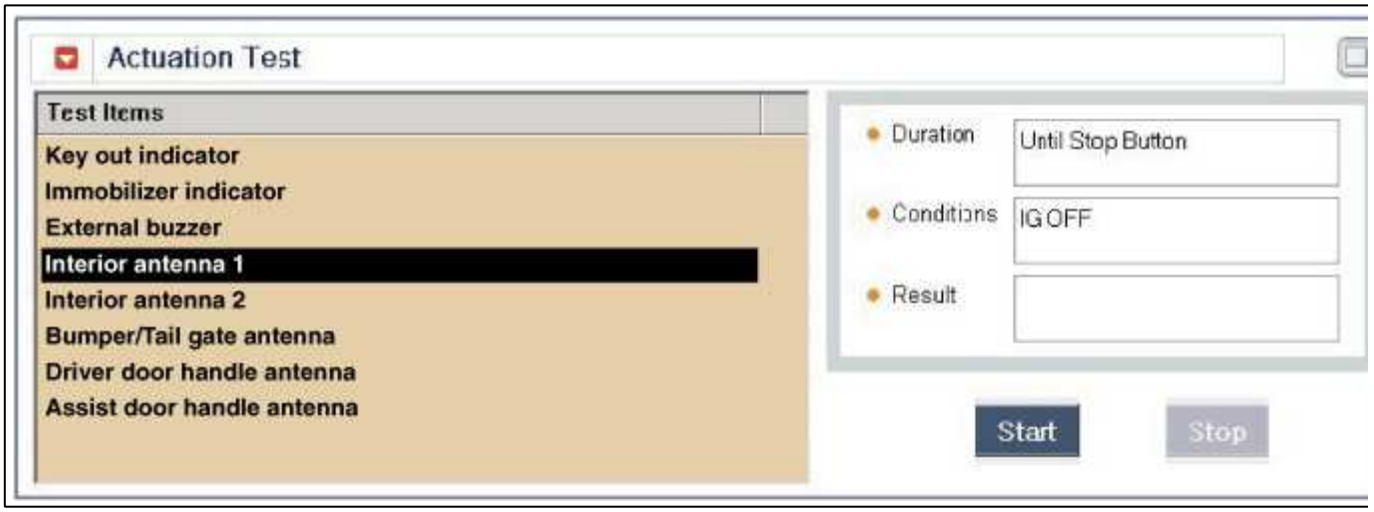
Communication Diagnosis With GDS (Self Diagnosis)

1. Communication diagnosis checks that the each linked components operates normal.
2. Connect the cable of GDS to the data link connector in driver side crash pad lower panel.
3. After IG ON, select the "DTC".

Antenna Actuation Diagnosis

1. Connect the cable of GDS to the data link connector in driver side crash pad lower panel.

2. After IG ON, select the "ACTUATION TEST".



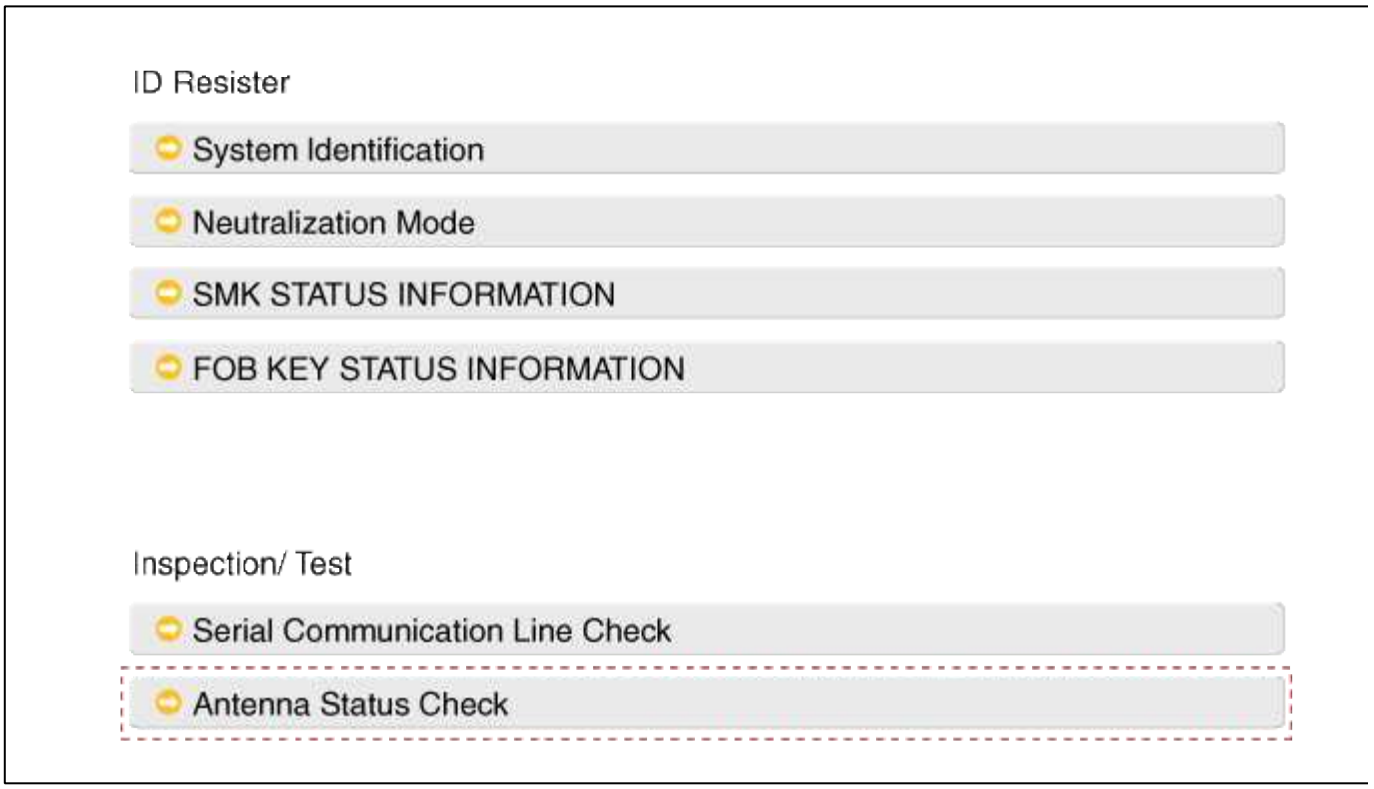
3. Set the smart key near the related antenna and operate it with a GDS.

4. If the LED of smart key is blinking, the smart key is normal.
5. If the LED of smart key is not blinking, check the voltage of smart key battery.
6. Antenna actuation
   A. INTERIOR Antenna 1
   B. INTERIOR Antenna 2
   C. Trunk antenna
   D. BUMPER/Antenna
   E. DRV_DR Antenna
   F. AST_DR Antenna

Antenna Status Check

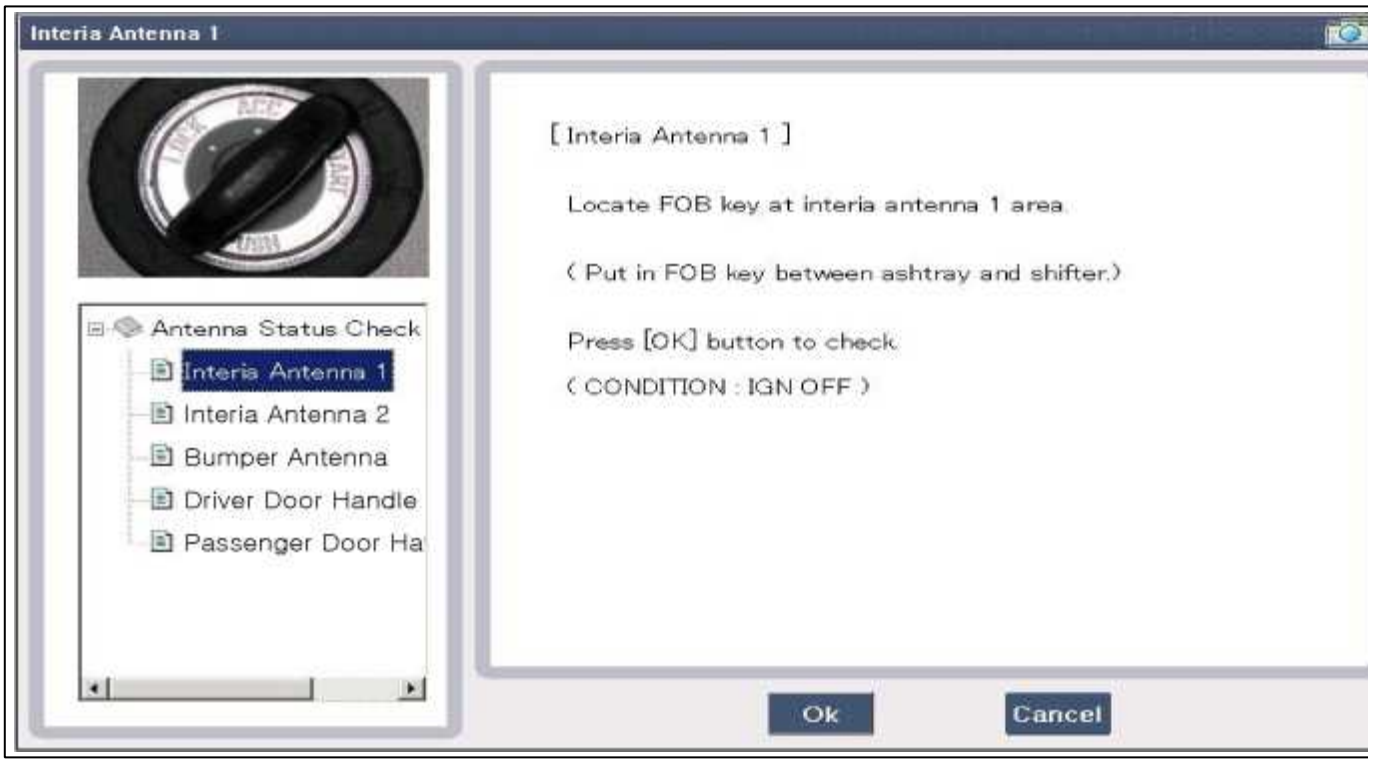
1. Connect the cable of GDS to the data link connector in driver side crash pad lower panel.

2. Select the "Antenna Status Check".



3. After IG ON, select the "Antenna Status Check".

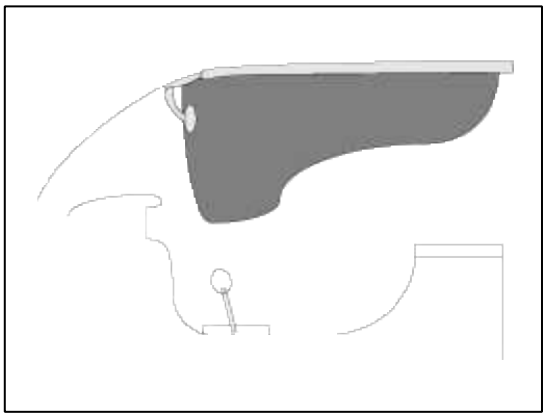
4. Set the smart key near the related antenna and operate it with a GDS.



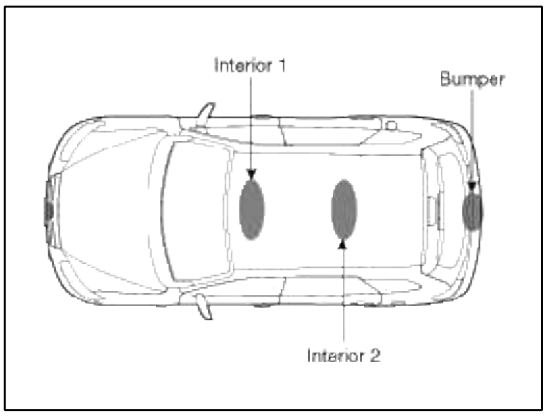
5. If the smart key runs normal , the related antenna, smart key(transmission, reception) and exterior receiver are normal.
6. Antenna status
   A. INTERIOR Antenna 1
   B. INTERIOR Antenna 2
   C. Trunk antenna
   D. BUMPER/Antenna
   E. DRV_DR Antenna
   F. AST_DR Antenna

Interior Antenna Actuation Check

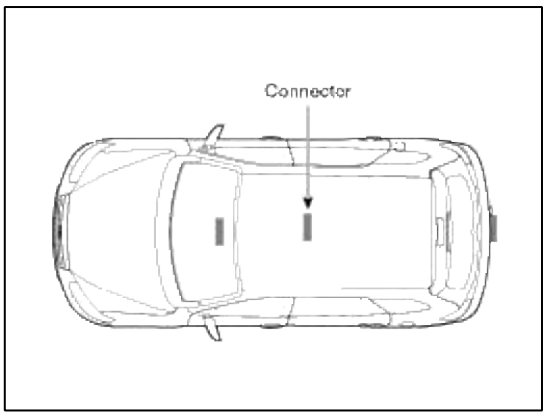
1. Set the smart key in the following shade area and check the IG ON.



2. If the ignition is ON, the antenna runs normal.
3. Check the interior antenna ignition mode.
4. Set the smart key in the following shade area and actuate the antenna. Check the LED of smart key is blinking.



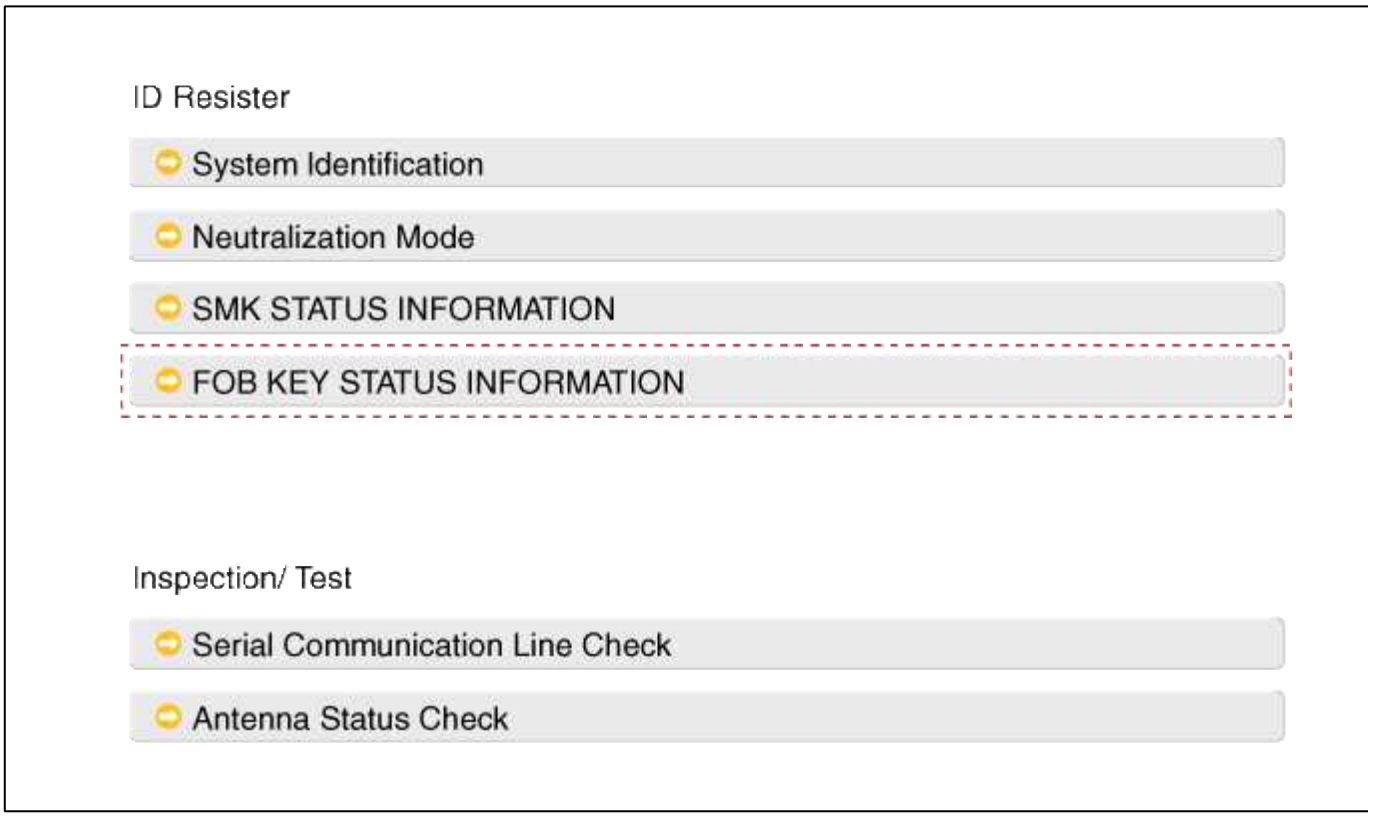
5. If the LED of smart key is not blinking, check the antenna in shade area.

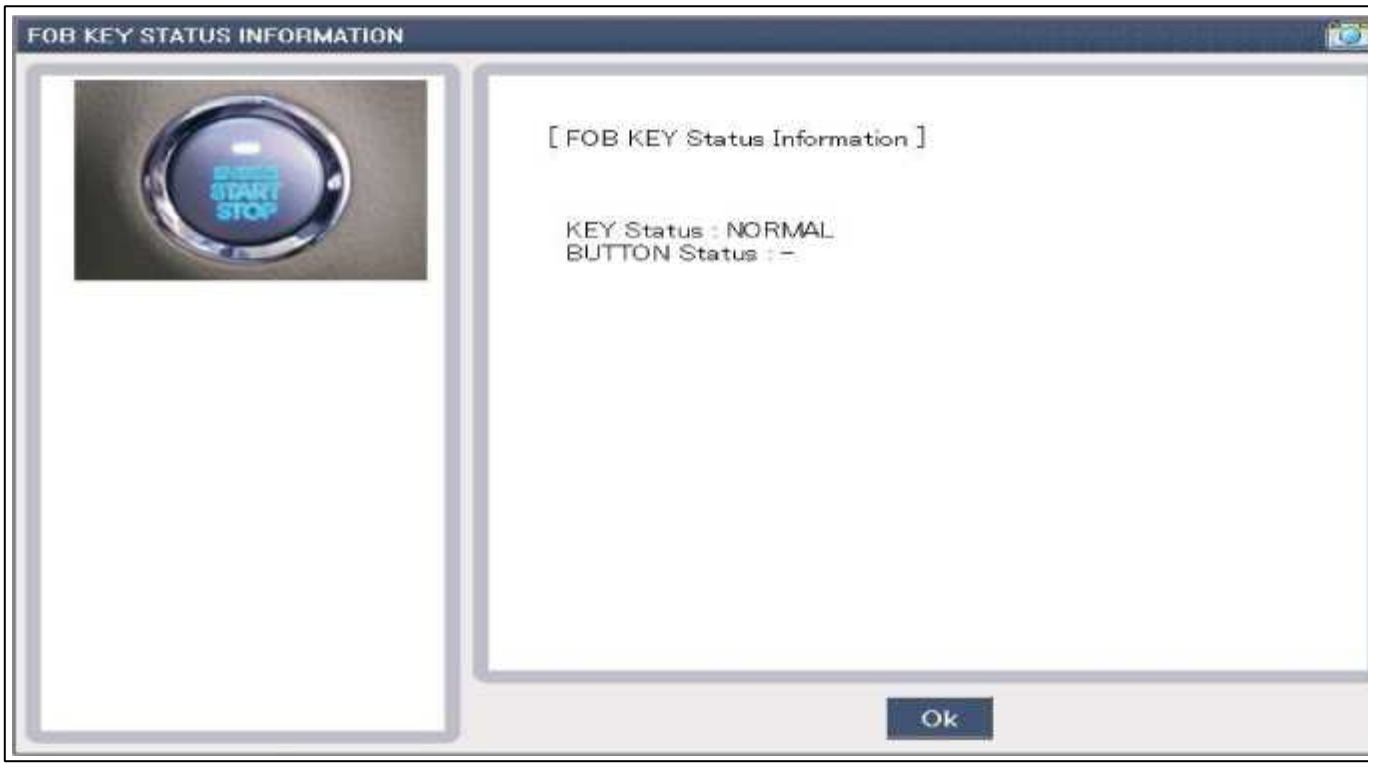


FOB Status Check

1. Connect the cable of GDS to the data link connector in driver side crash pad lower panel.

2. After IG ON, select the "FOB KEY STATUS INFO".

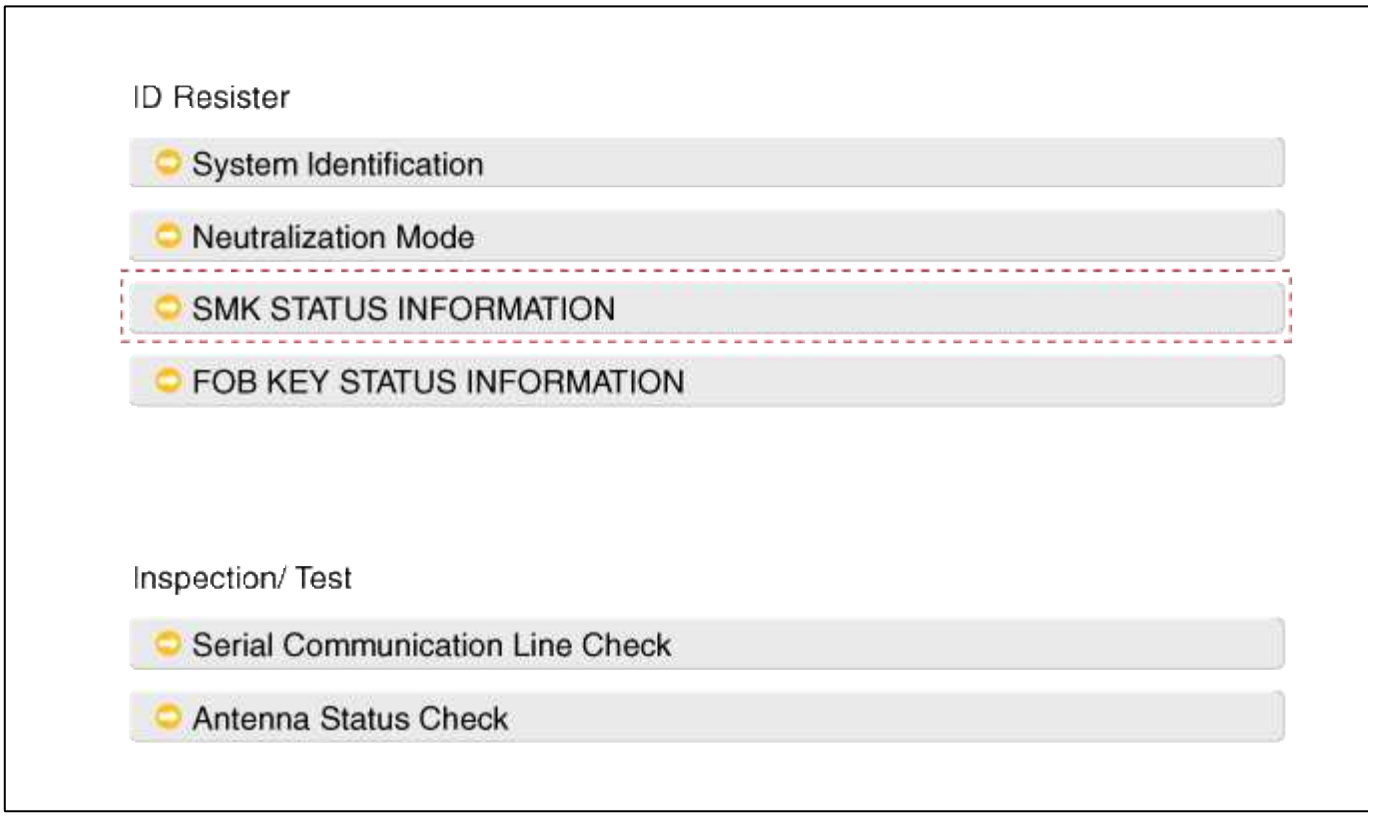


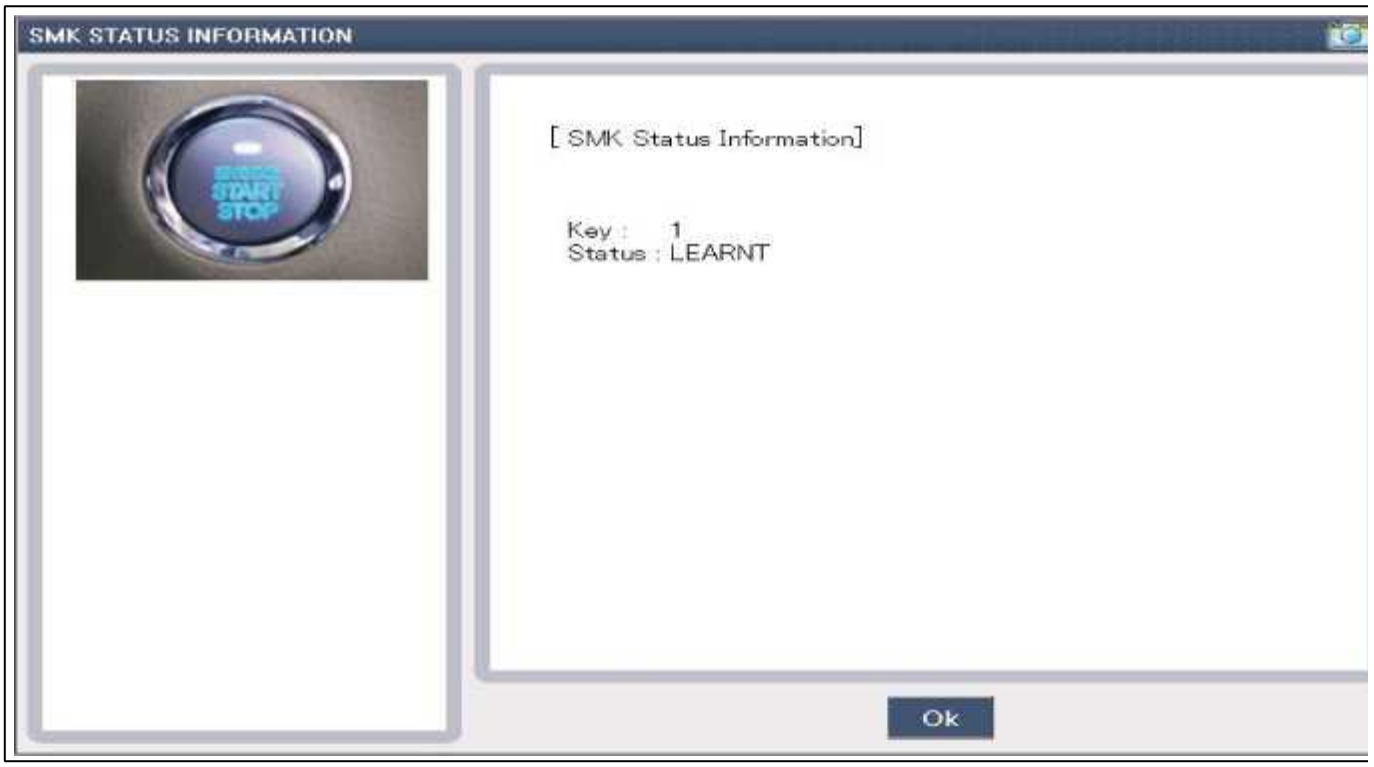


Smart Key Status Check

1. Connect the cable of GDS to the data link connector in driver side crash pad lower panel.

2. After IG ON, select the "SMK STATUS INFO".





Neutralization Status Check

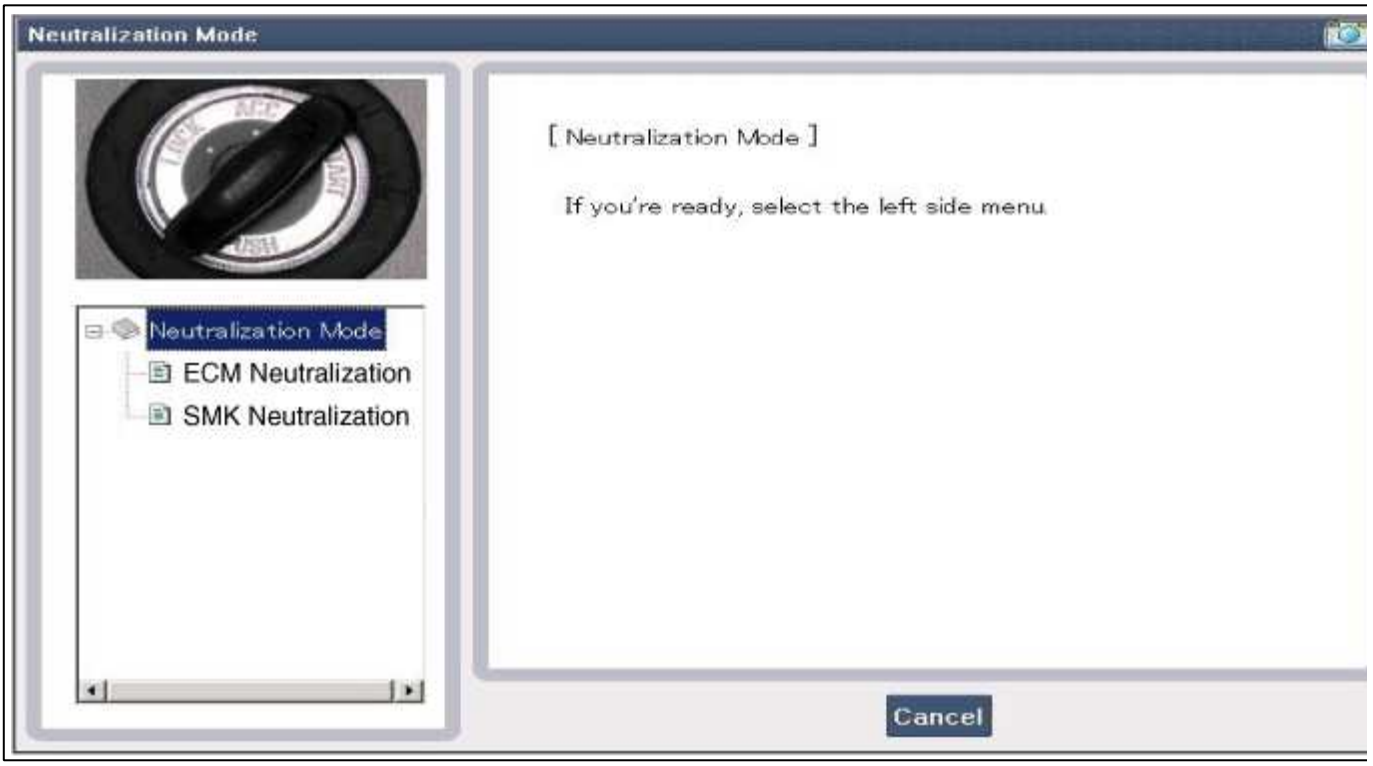
1. Connect the cable of GDS to the data link connector in driver side crash pad lower panel.
2. After IG ON, select the "Neutralization mode".

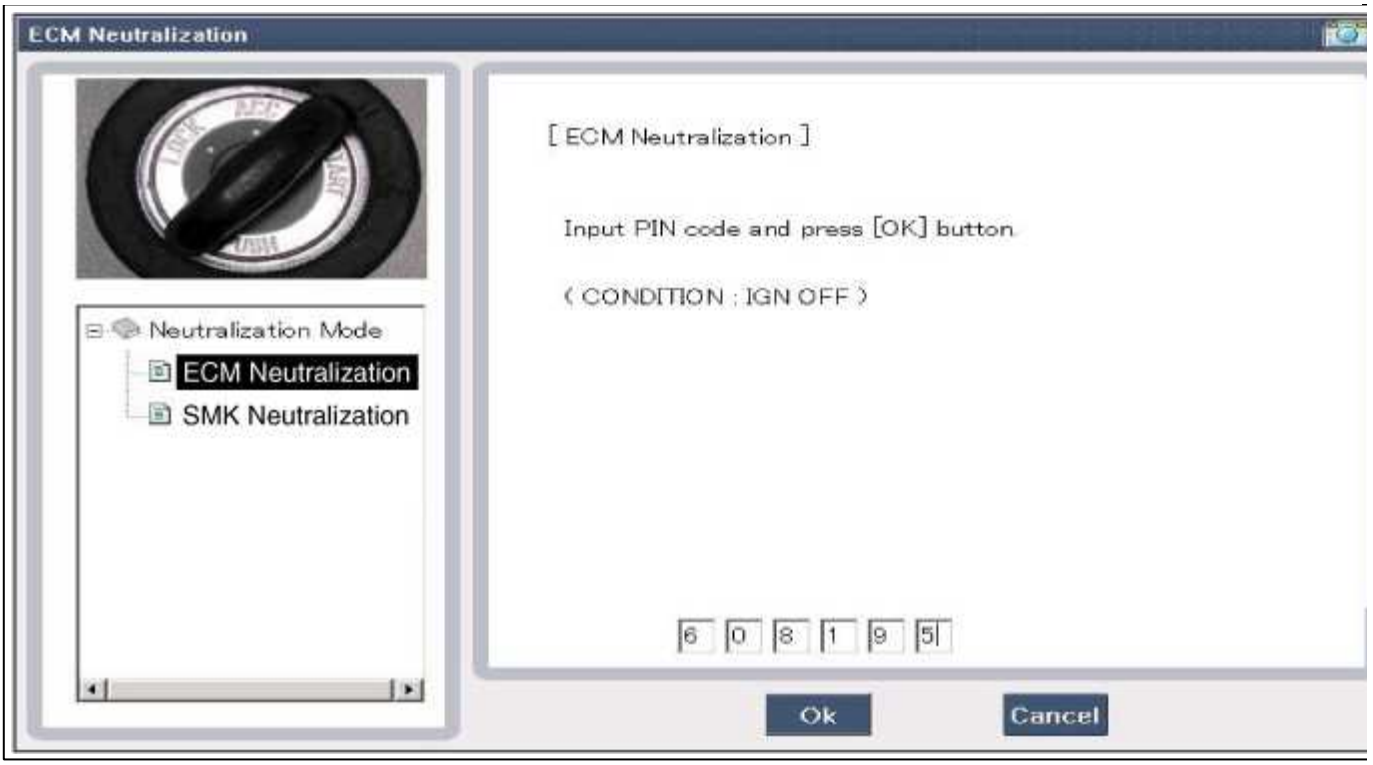
ID Resister

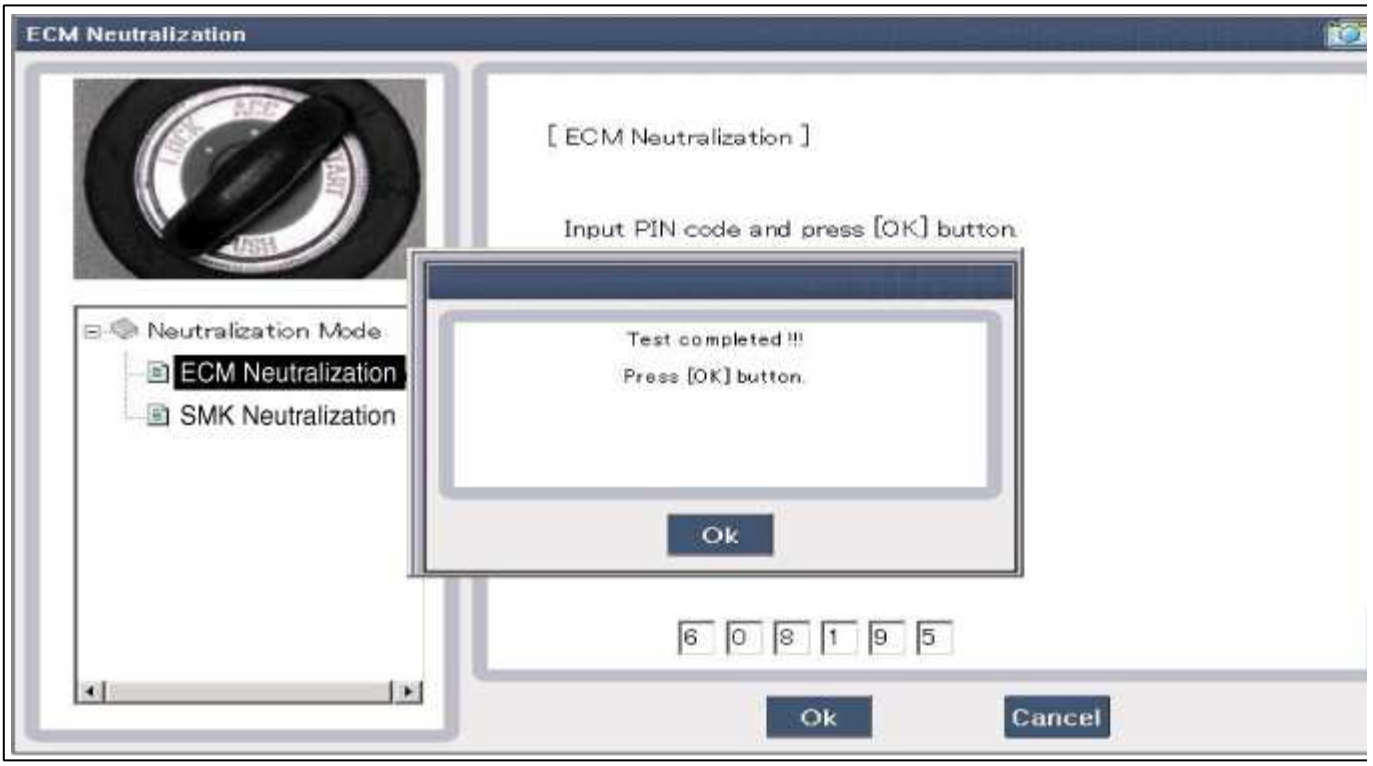
- System Identification
- Neutralization Mode
- SMK STATUS INFORMATION
- FOB KEY STATUS INFORMATION

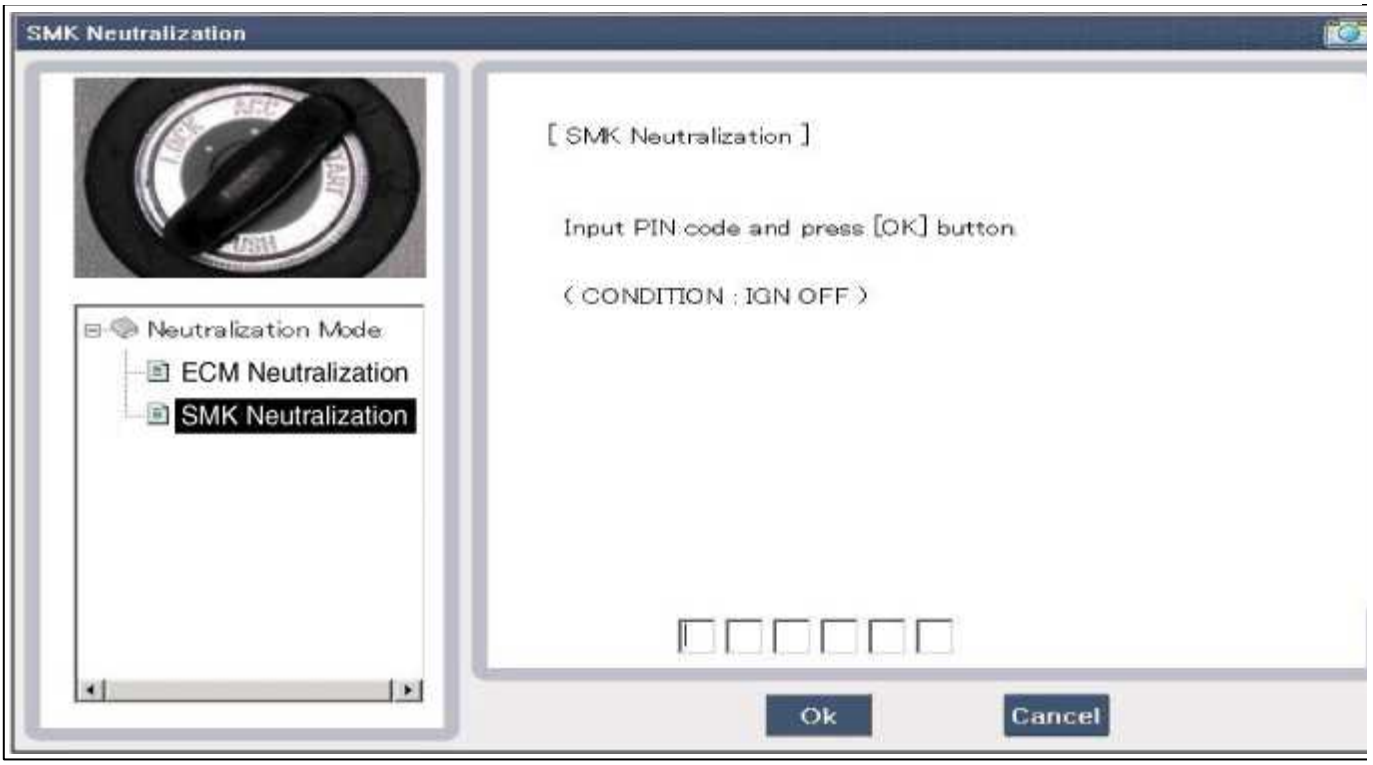
Inspection/ Test

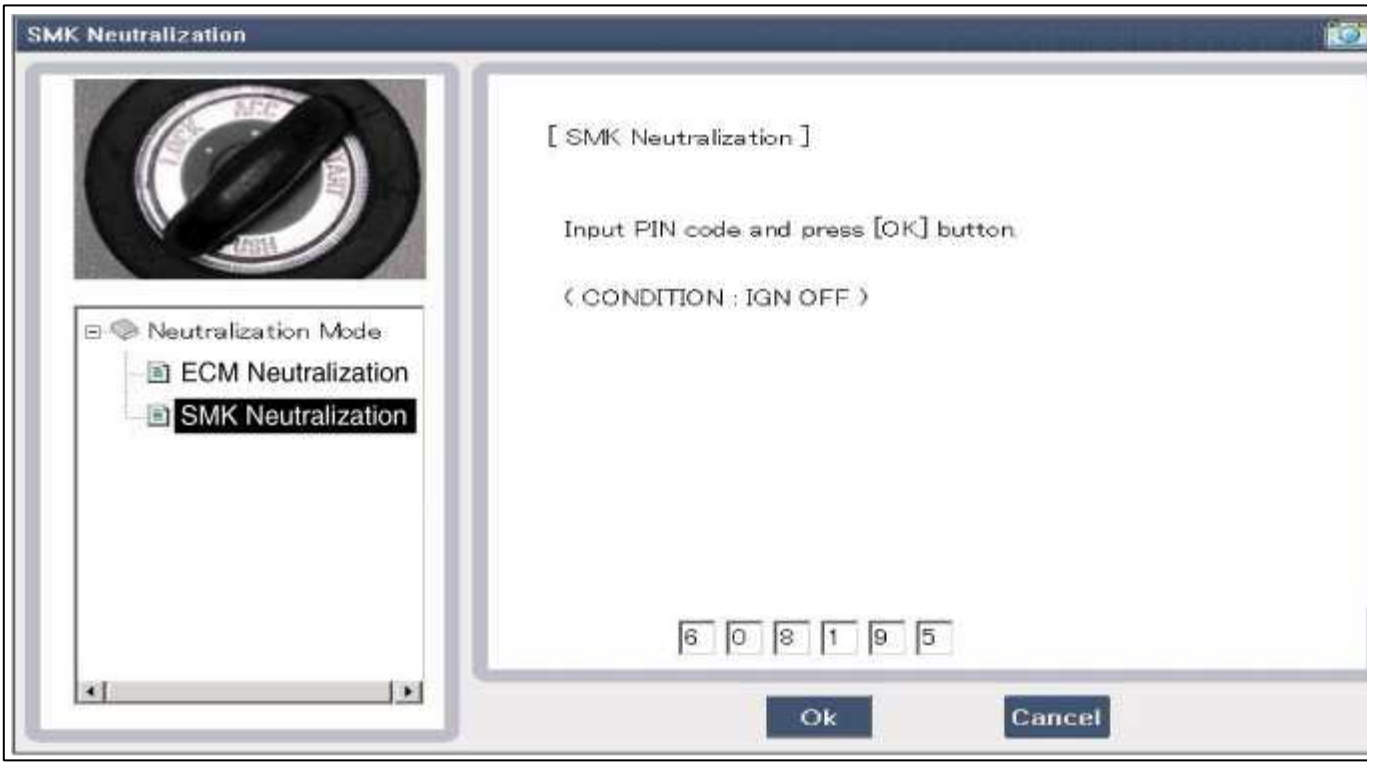
- Serial Communication Line Check
- Antenna Status Check

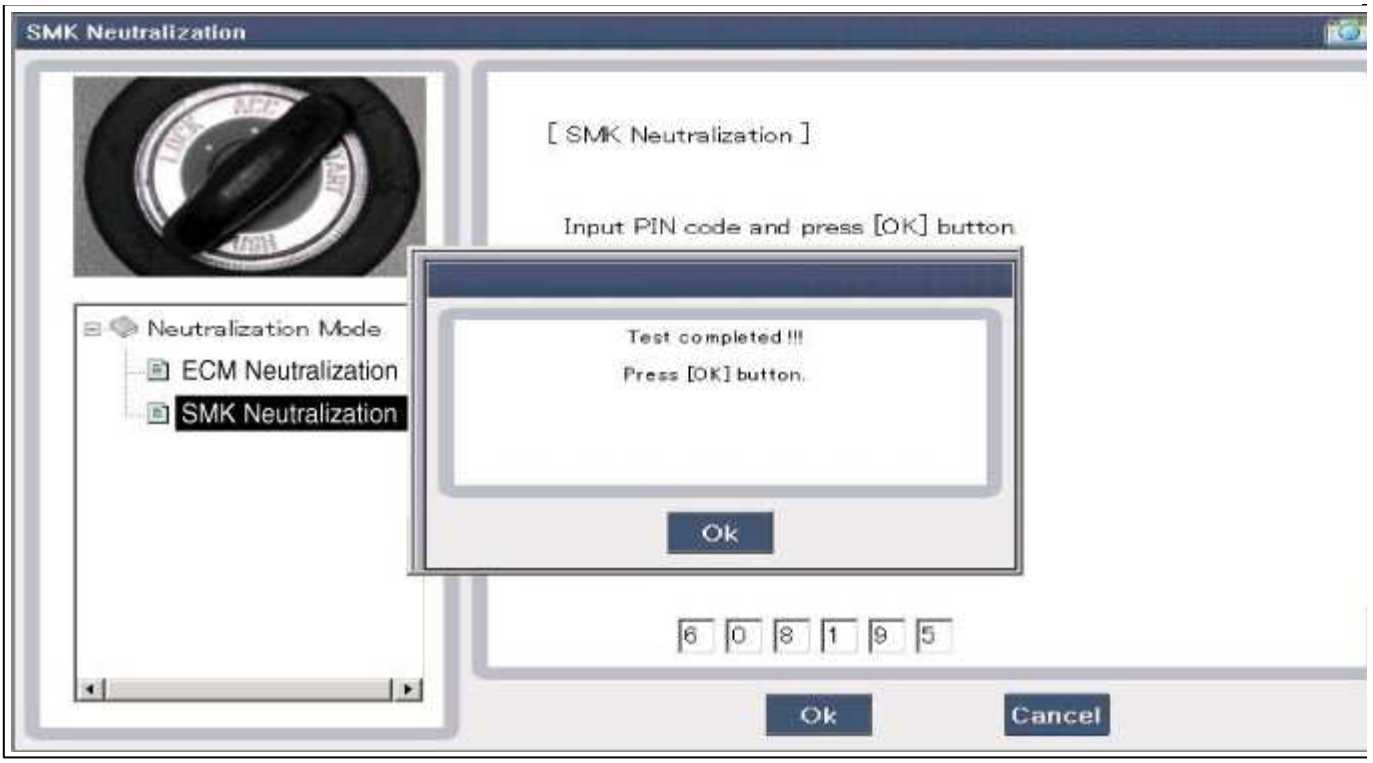



ECM Neutralization
Neutralization Mode
ECM Neutralization
SMK Neutralization
[ECM Neutralization]
Input PIN code and press [OK] button.
(CONDITION : IGN OFF)
6 0 8 1 9 5
Ok
Cancel


ECM Neutralization
Neutralization Mode
ECM Neutralization
SMK Neutralization
[ECM Neutralization]
Input PIN code and press [OK] button.
Test completed !!!
Press [OK] button.
Ok
6 0 8 1 9 5
Ok
Cancel


SMK Neutralization
Neutralization Mode
ECM Neutralization
SMK Neutralization
[SMK Neutralization]
Input PIN code and press [OK] button
(CONDITION : IGN OFF)
Ok
Cancel


SMK Neutralization
Neutralization Mode
ECM Neutralization
SMK Neutralization
[SMK Neutralization]
Input PIN code and press [OK] button
(CONDITION : IGN OFF)
6 0 8 1 9 5
Ok
Cancel



Input Switch List

No	Item name	Unit
1	SSB switch2	-
2	ACC	-
3	IGN1	-
4	Gear 'P' Position	-
5	Brake switch	-
6	FL Door Lock Button	-
7	FR Door Lock Button	-
8	Trunk Lid switch	-
9	Battery Voltage	-
10	Alternator Voltage	-
11	KEY out Indicator Lamp	-
12	Immobilizer Lamp	-
13	External Buzzer	-

Actuator List

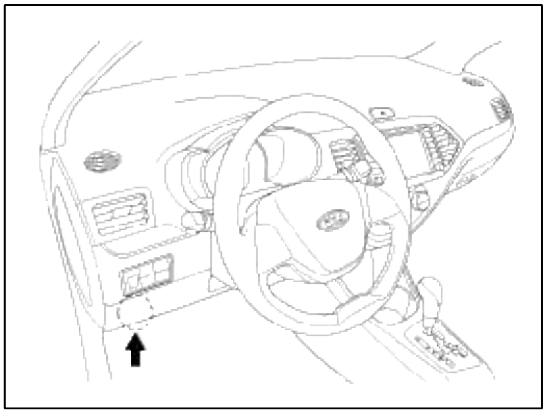
No.	Item name	Condition
1	Immo.indicator Lamp	Ignition switch ON Engine off
2	External Buzzer	Ignition switch ON Engine off
3	Interior Antenna 1 Active	Ignition switch ON Engine off
4	Interior Antenna 2 Active	Ignition switch ON Engine off
5	Bumper Antenna Active	Ignition switch ON Engine off
6	DRV DR Antenna Active	Ignition switch ON Engine off
7	AST DR Antenna Active	Ignition switch ON Engine off

Body Electrical System > Smart key System > Smart key > Repair procedures

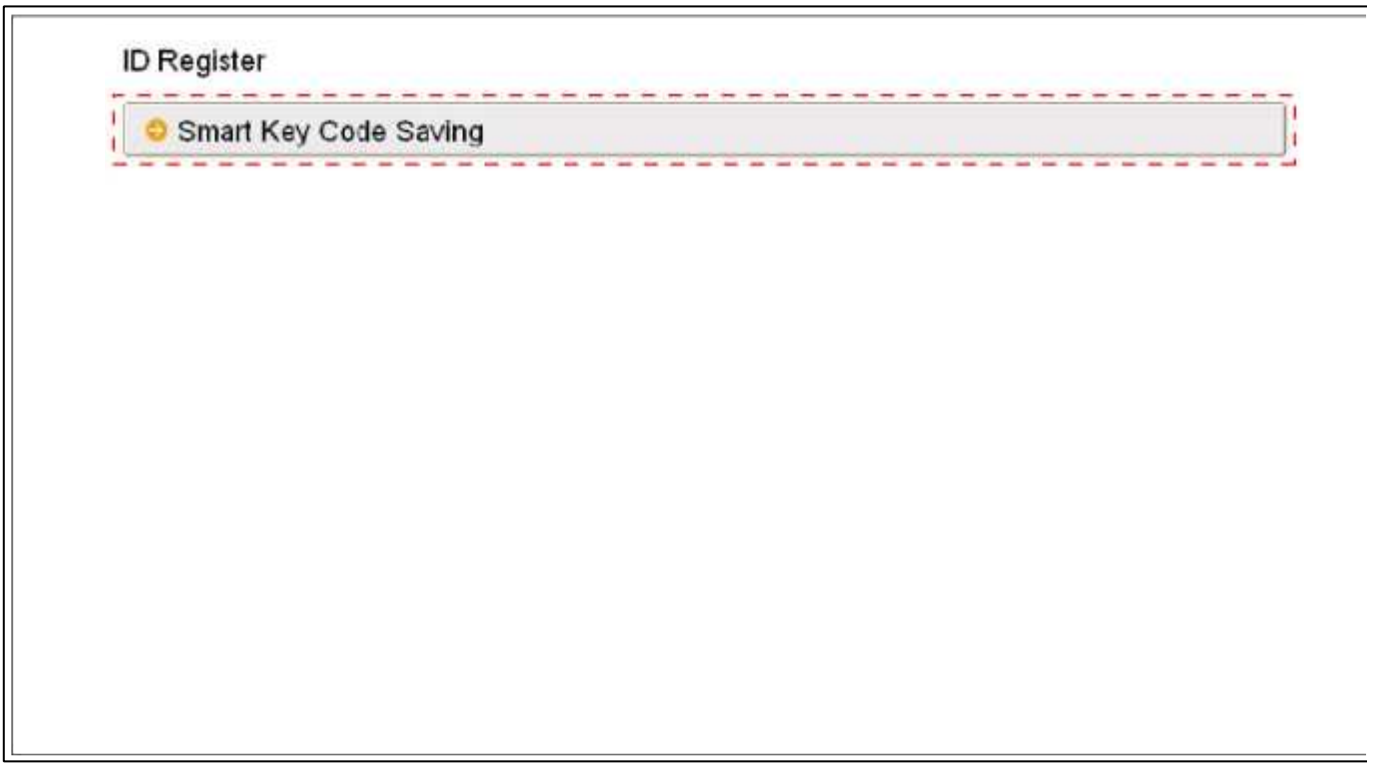
Smart Key

Smart Key Code Saving

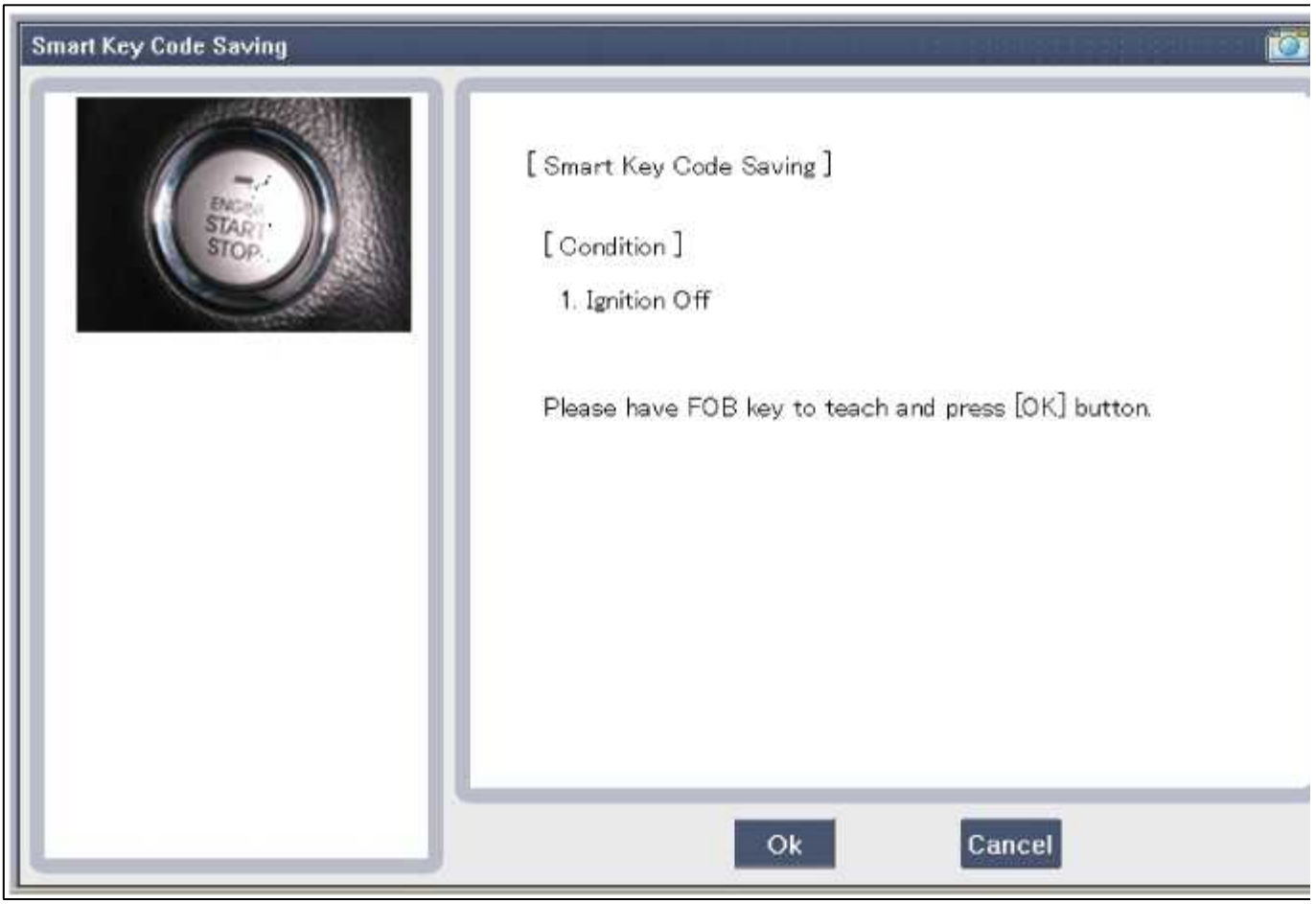
1. Connect the DLC cable of GDS to the data link connector in driver side crash pad lower panel, turn the power on GDS.



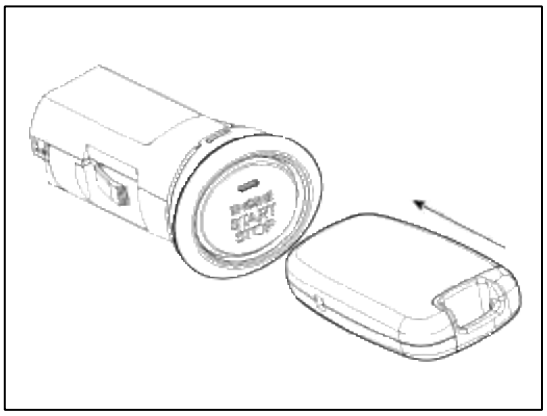
2. Select the vehicle model and then do "Smart key code saving".



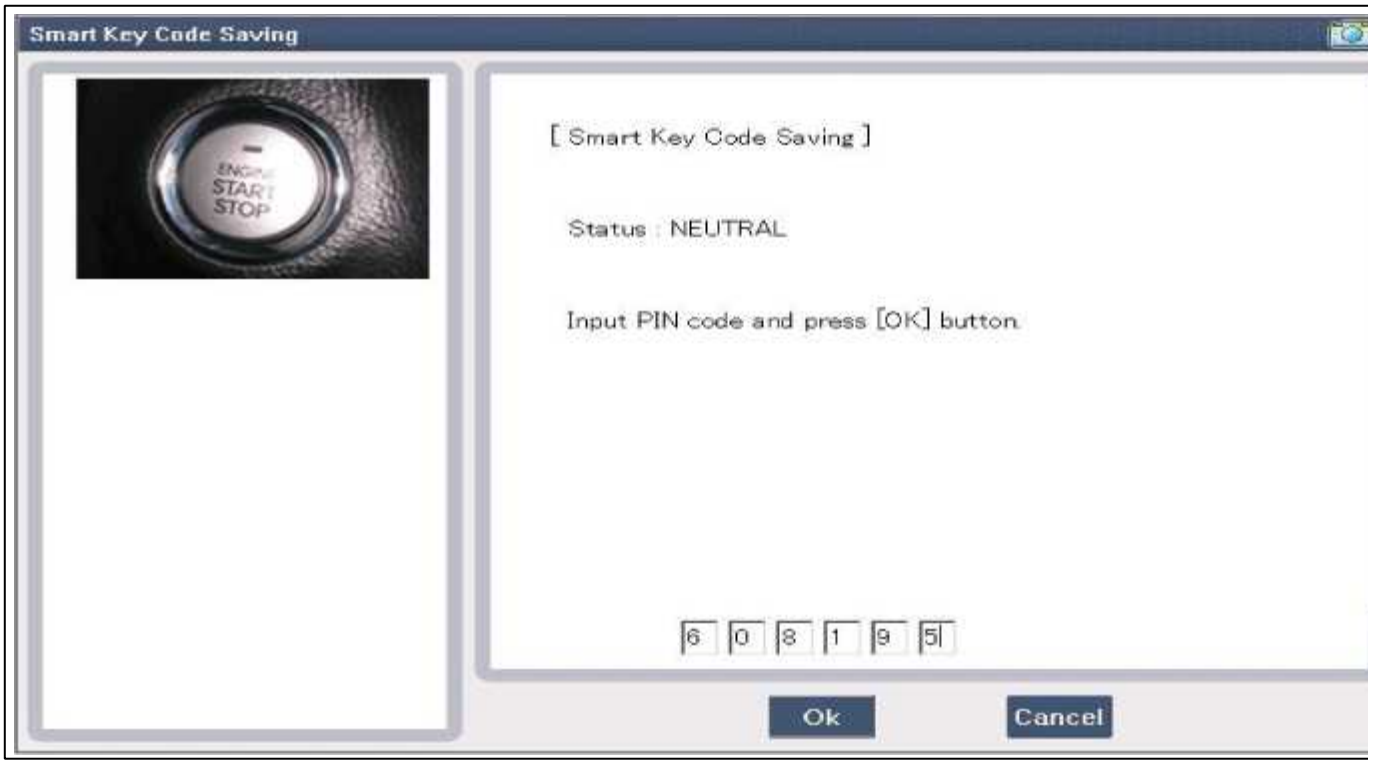
3. After selecting "Smart key code saving" menu, push "Enter" key, then the screen will be shown as below.

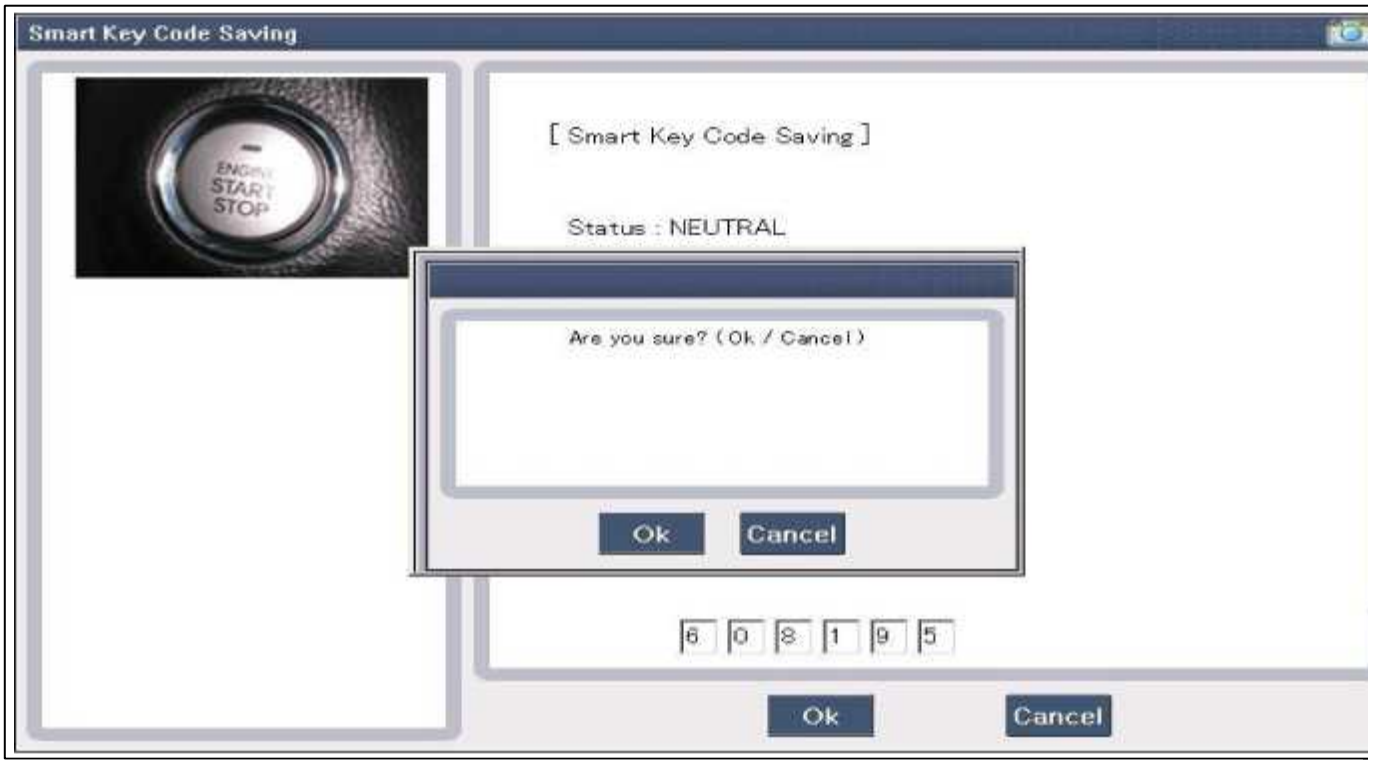


4. After pushing the SSB with the teaching key, press "OK" button.

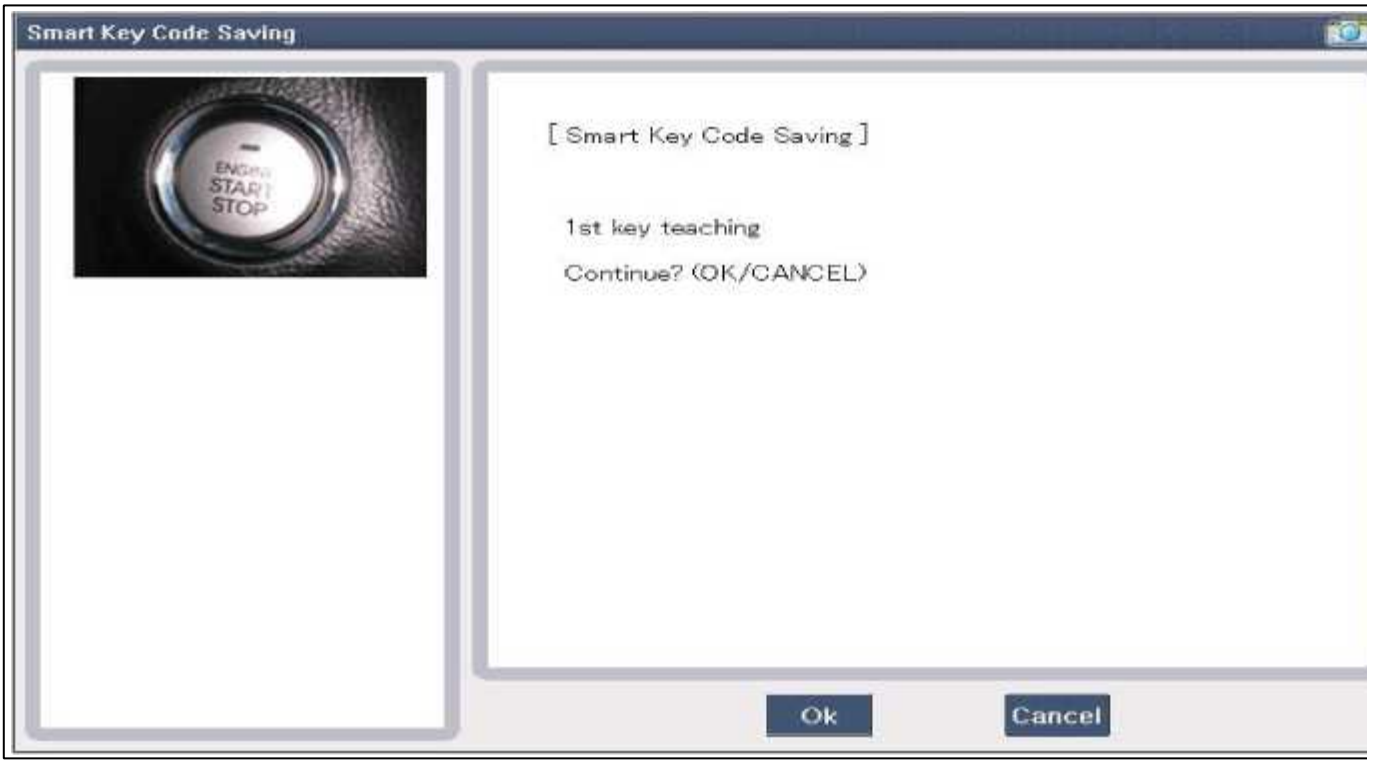


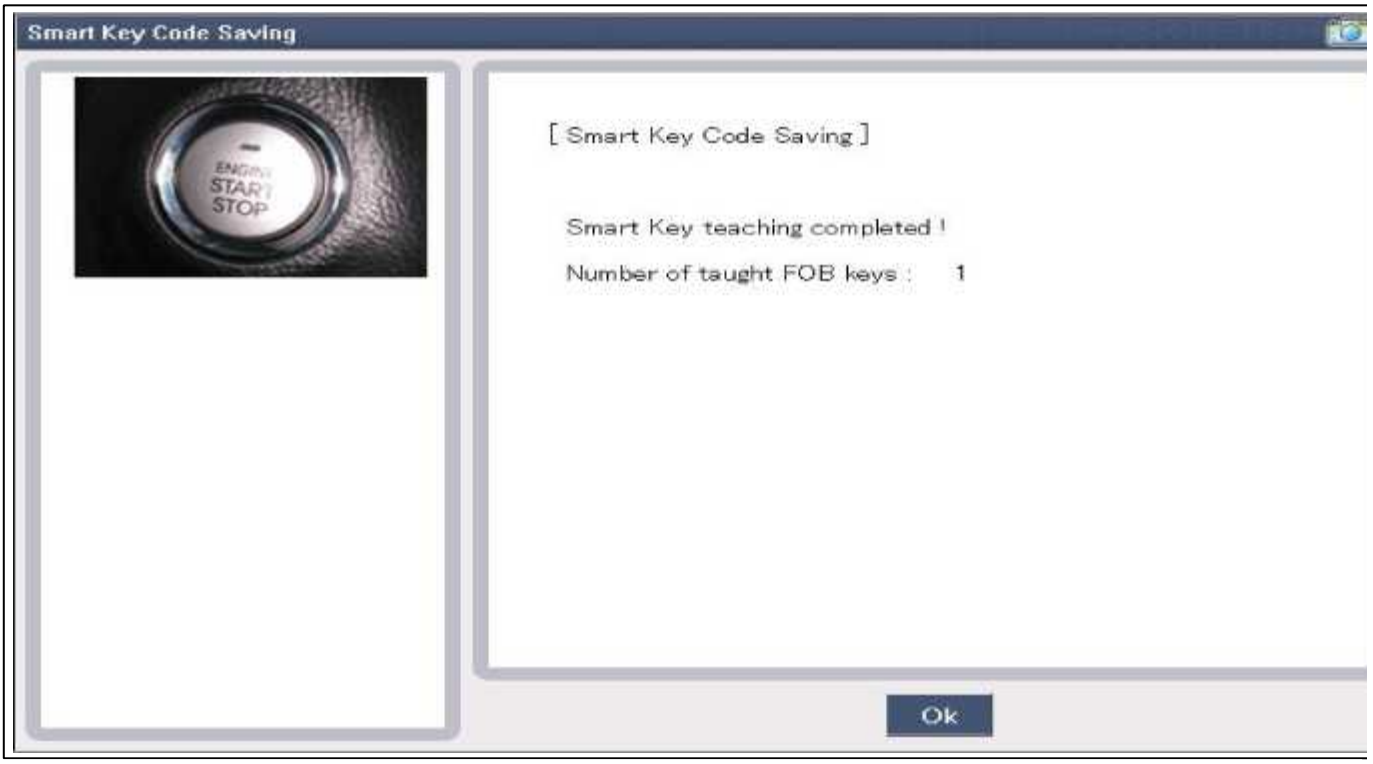
5. Input the "Pin code" for first key teaching.



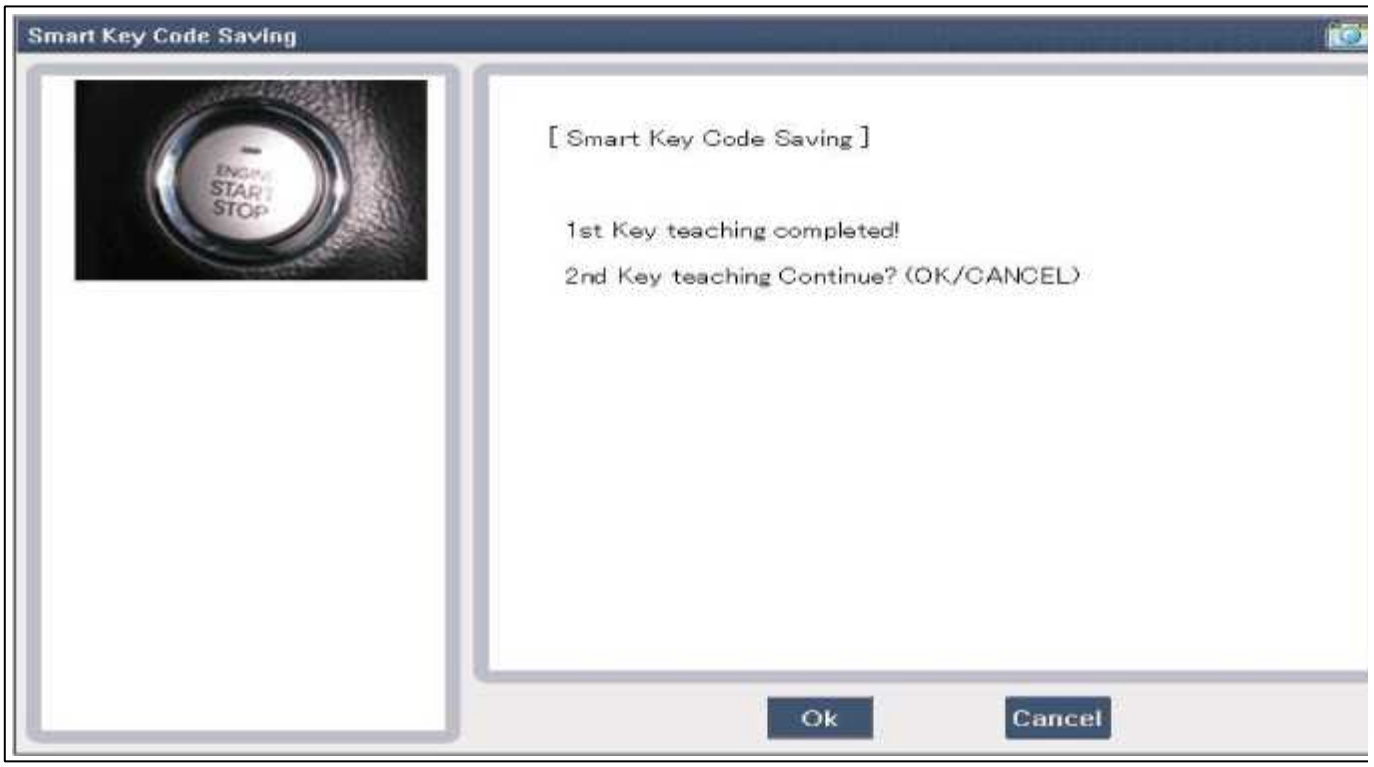


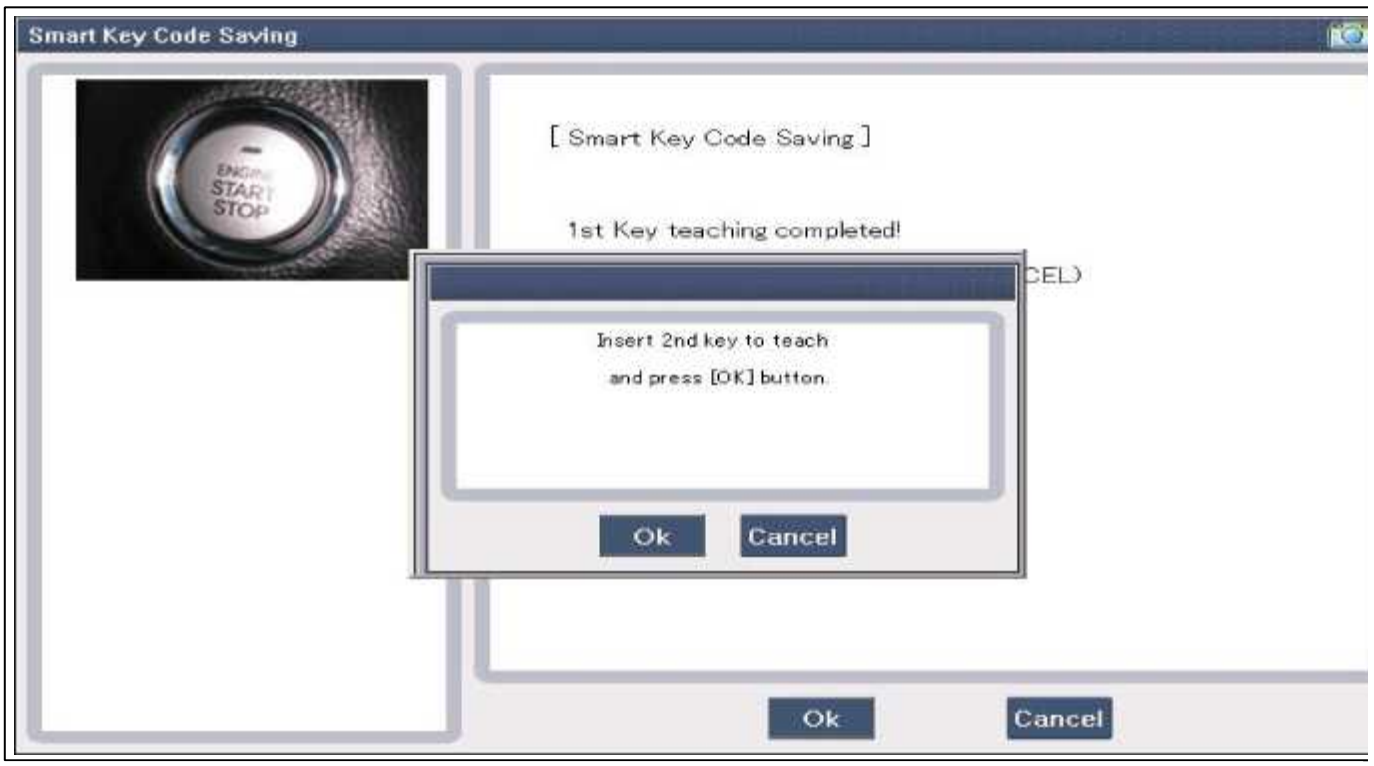
6. Confirm the message "First key teaching completed".



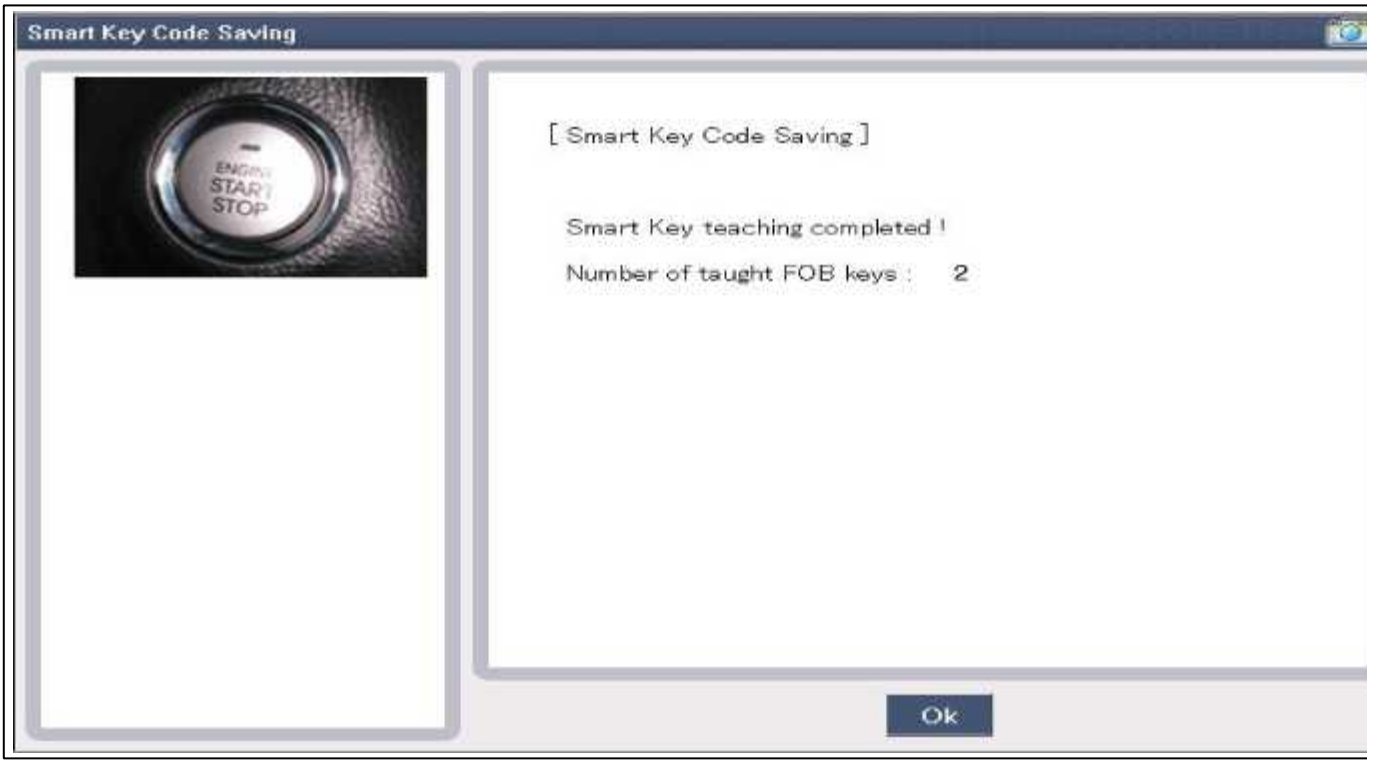


7. Input the "Pin code" for second key teaching.





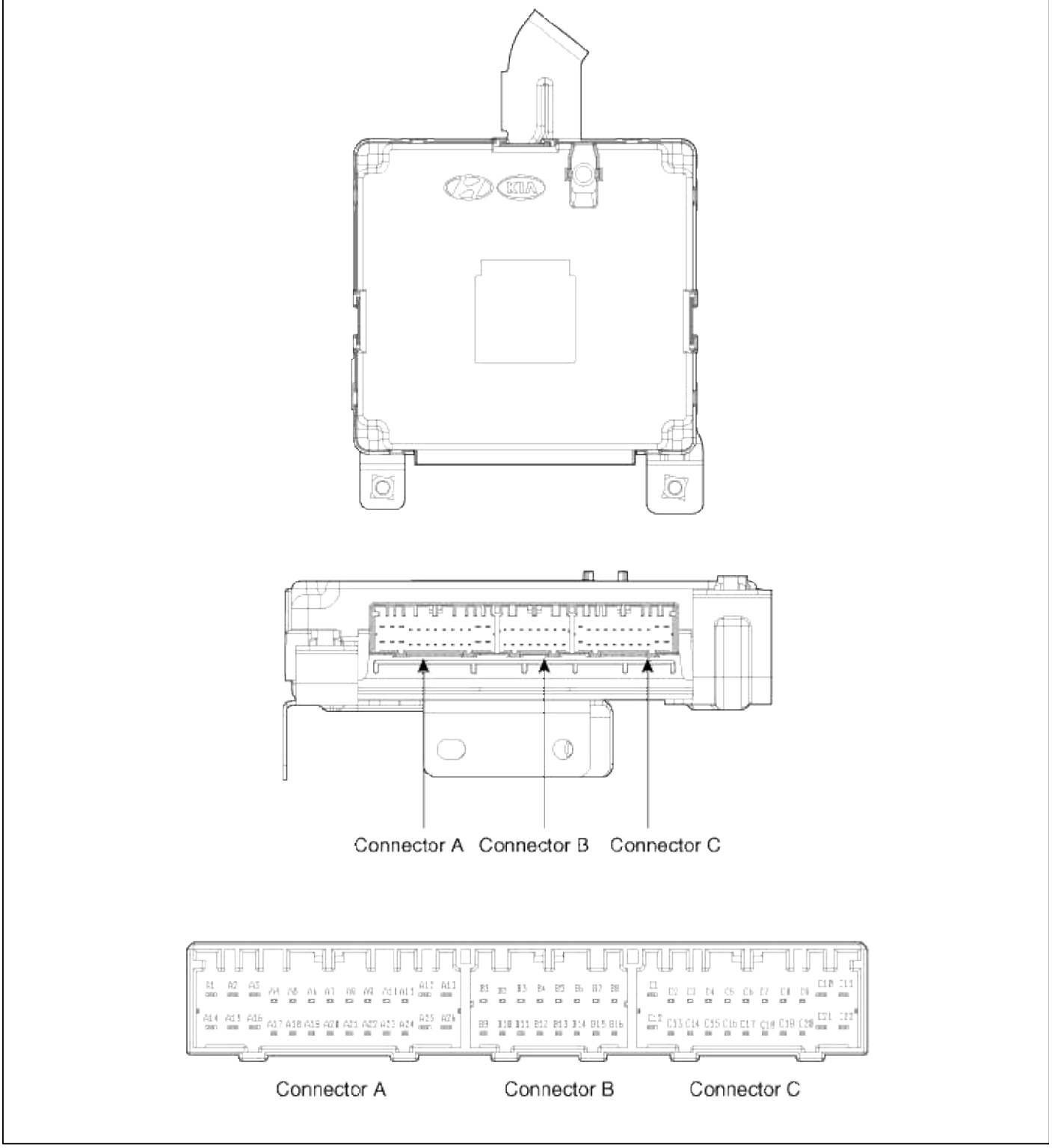
8. Confirm the message "Second key teaching completed".



9. Then the screen will be shown as below when key teaching process is completed.

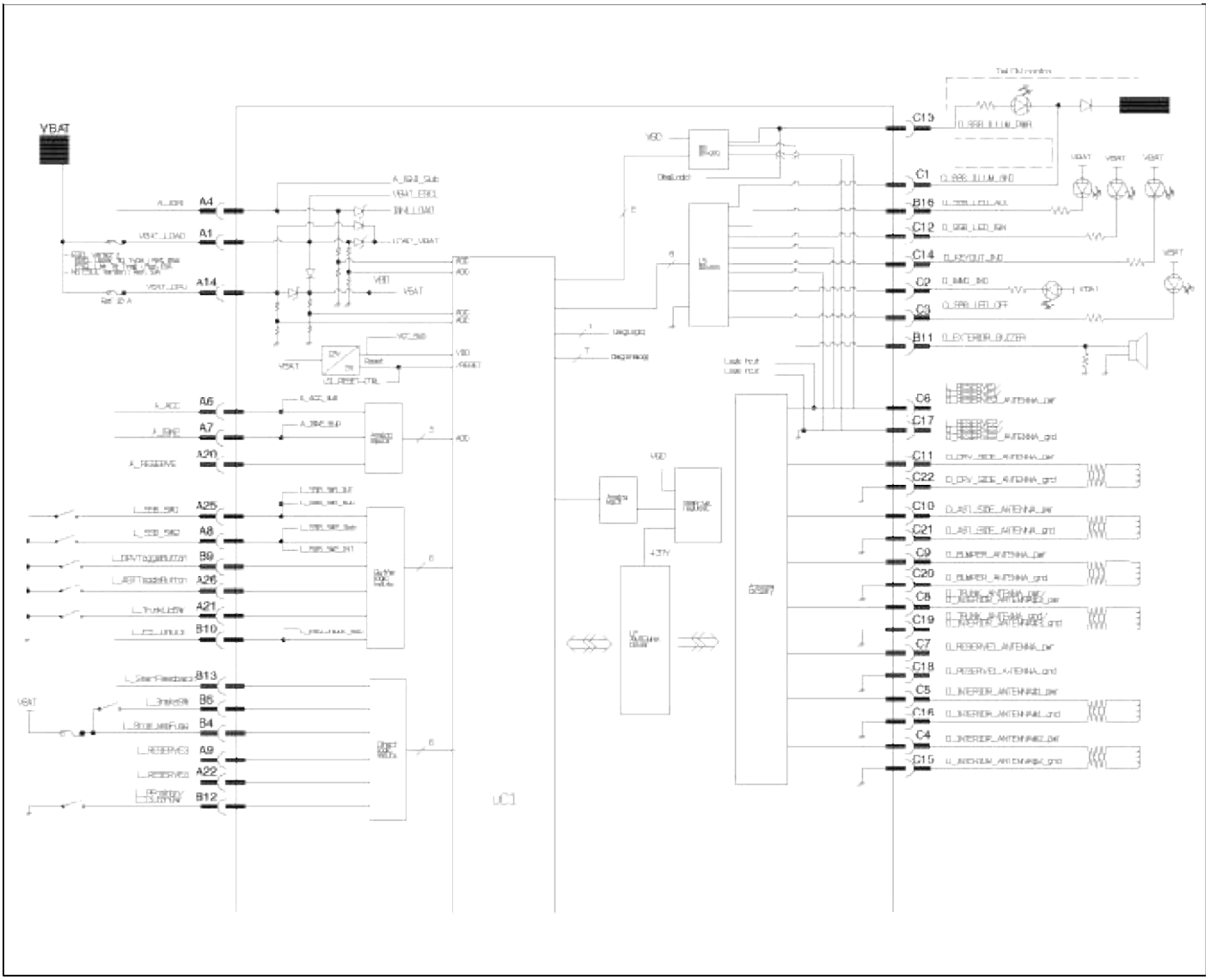
Body Electrical System > Smart key System > Smart key unit > Components and Components Location

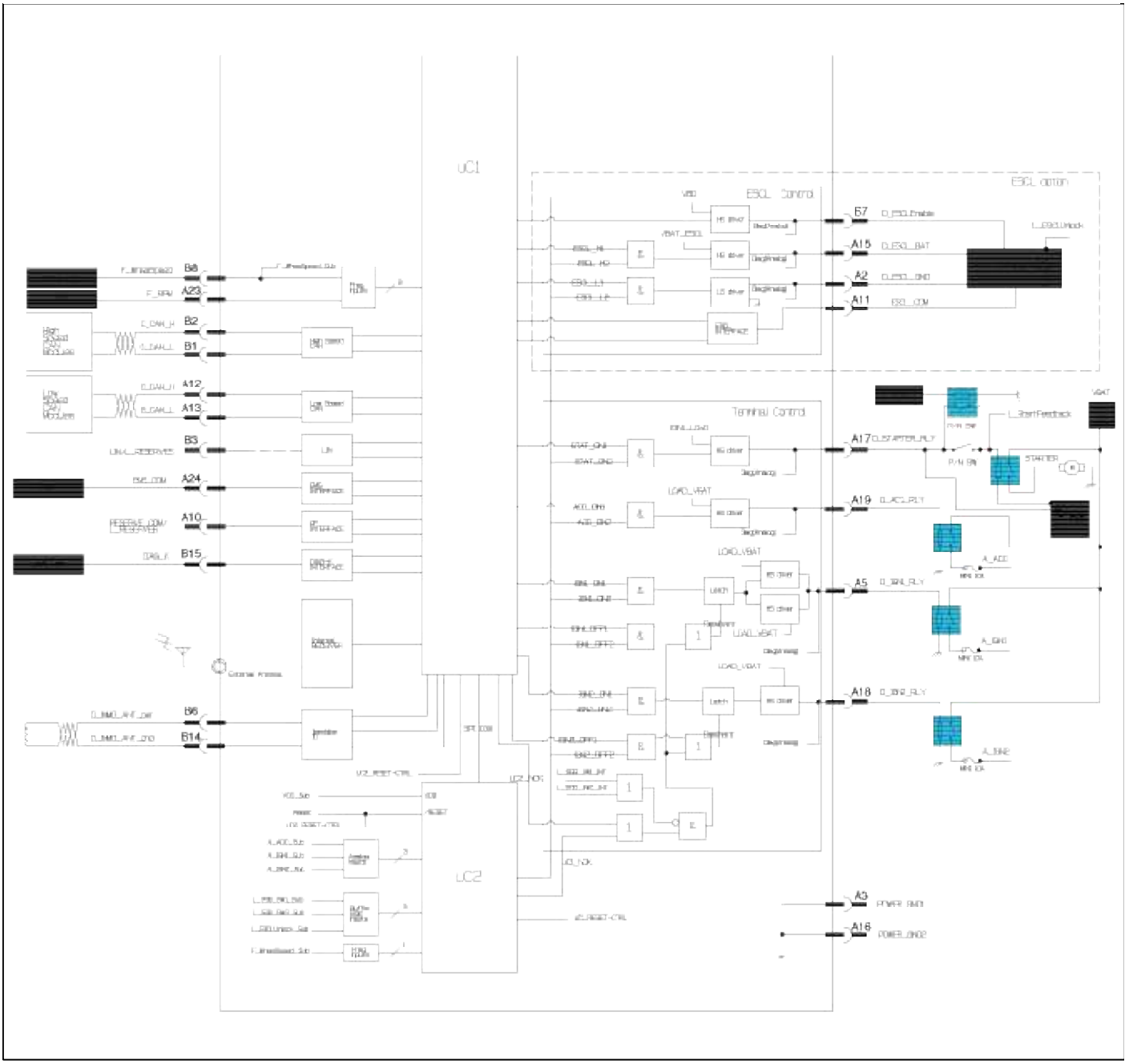
Component



Body Electrical System > Smart key System > Smart key unit > Schematic Diagrams

Circuit diagram


VBAT
A4
A1
A14
A5
A7
A20
A25
A8
B9
A26
A21
B10
B13
B5
B4
A9
A22
B12
C13
C1
B16
C12
C14
C2
C3
B11
C6
C17
C11
C22
C10
C21
C9
C20
C8
C19
C7
C18
C5
C16
C4
C15
UC1



No.	Connector A(26 pins)	No.	Connector B(16 pins)	No.	Connector C(22 pins)
1	VBAT_LOAD	1	C_CAN_L	1	O_SSB_illumination_GND
2	O_ESCL_GND	2	C_CAN_H	2	O_IMMO_IND
3	Power_GND 1	3	-	3	O_SSB_LED_OFF
4	A_IGN1	4	L_Stop Lamp Fuse	4	O_Interior_antenna #2_Power
5	O_IGN1_Relay	5	L_Brake switch	5	O_Interior_antenna #1_Power
6	A_ACC	6	O_IMMO_antenna_power	6	-
7	A_IGN 2	7	O_ESCL_enable	7	-
8	L_SSB switch 2	8	F_Wheel speed	8	O_Trunk_antenna_power/ O_Interior_antenna #3_Power
9	-	9	L_DRV toggle button	9	O_Bumper_antenna_power/ O_Interior_antenna_Power
10	-	10	L_ESCL_unlock	10	O_RH_side_antenna_power

11	ESCL_COM	11	O_exterior buzzer	11	O_LH_side_antenna_power
12	B_CAN_H	12	L_P position/L_Clutch switch	12	O_SSB_LED_BLUE/ O_SSB_LED_IGN
13	B_CAN_L	13	L_start feedback	13	O_SSB_illumination_power
14	VBAT_CPU	14	O_IMMO_antenna_GND	14	O_KEYOUT_IND
15	O_ESCL_BAT	15	DIAG-K	15	O_interior_antenna#2_GND
16	POWER_GND 2	16	O_SSB_LED_AMBER/ O_SSB_LED_ACC	16	O_interior_antenna#1_GND
17	O_Starter_Relay			17	O_RESERVE2_antenna_GND O_RESERVE2/ L_RESERVE2
18	O_IGN2_Relay			18	O_RESERVE1_antenna_GND
19	O_ACC_Relay			19	O_Trunk_antenna_GND/ O_Interior_antenna #3_GND
20	-			20	O_Bumper_antenna_GND/ O_Interior_antenna #3_GND
21	L_Trunklid_Switch			21	O_RH_side_antenna_GND
22	-			22	O_LH_side_antenna_GND
23	F_RPM				
24	EMS_COM				
25	L_SSB_Switch 1				
26	L_ASTtoggle button				

Body Electrical System > Smart key System > Smart key unit > Repair procedures

Inspection

Smart Key Unit

- Refer to the BE group - inspection / self diagnosis with GDS.

Smart Key Switch

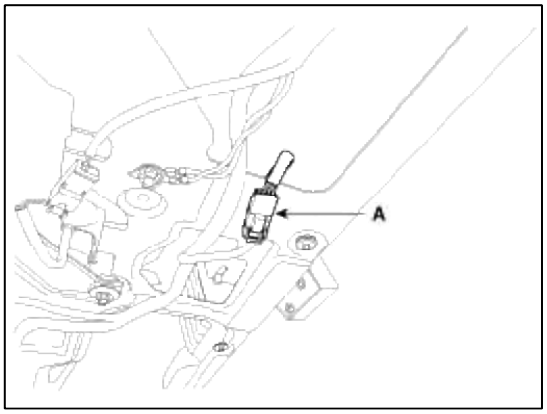
- Refer to the BE group - inspection / self diagnosis with GDS.

Antenna

- Refer to the BE group - inspection / self diagnosis with GDS.

Trunk Lid Open Switch

1. Check for continuity between the Trunk lid open switch terminals.



2. If continuity is not specified, inspect the switch

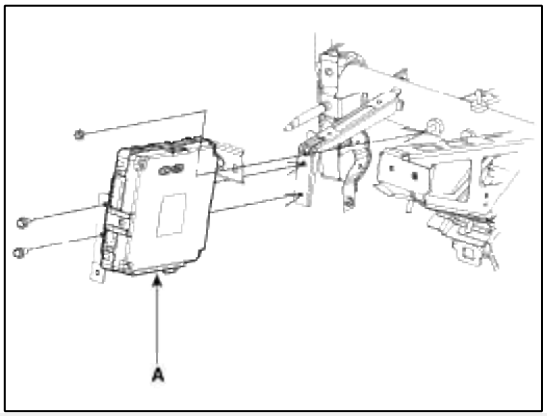
Terminal / Position	1	2
OFF		
ON	○	○

Removal

Smart key unit

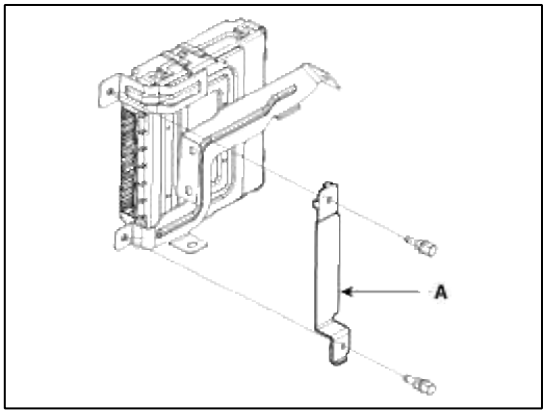
[USA]

1. Disconnect the negative(-) battery terminal.
2. Remove the smart key unit (A) after disconnecting the connector and loosening the mounting nut (1EA) and bolts (2EA).

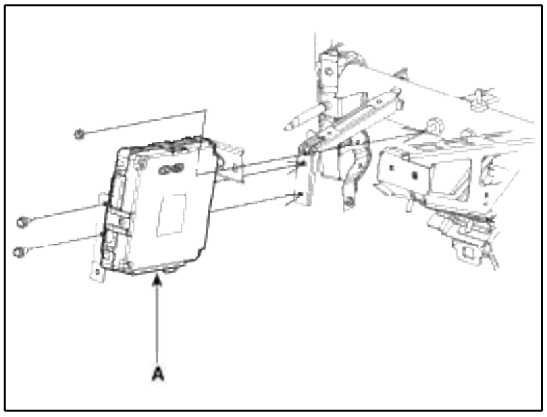


[CANADA]

1. Disconnect the negative(-) battery terminal.
2. Remove the bracket (A) after loosening the bolts (2EA).



3. Remove the smart key unit (A) after disconnecting the connector and loosening the mounting nut (1EA) and bolts (2EA).

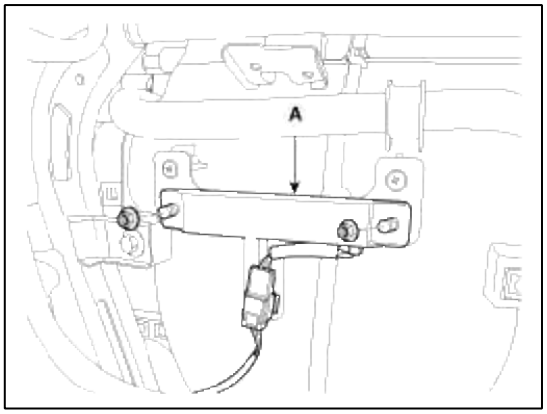


Interior 1 Antenna

NOTE

- Take care not to scratch the crash pad and related parts

1. Disconnect the negative(-) battery terminal.
2. Remove the heater & A/C controller..
   (Refer to the HA group - "Controller")
3. Remove the interior 1 antenna (A) after disconnecting the connector and loosening the nuts (2EA).



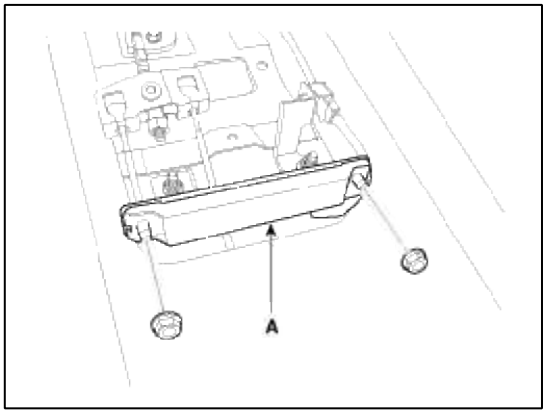
Interior 2 Antenna

1. Disconnect the negative(-) battery terminal.
2. Remove the console.
   (Refer to the BD group - "Console")

NOTE

Take care not to damage and scratch the console and its related parts.
Apply the protective tapes to the console and its related parts.

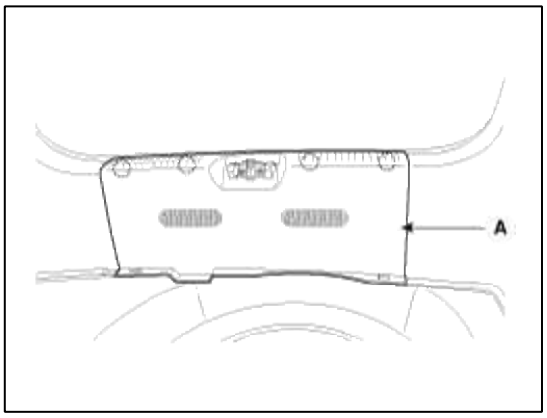
3. Disconnect the interior 2 antenna connector, then remove the interior 2 antenna (A) after loosening nuts (2EA).



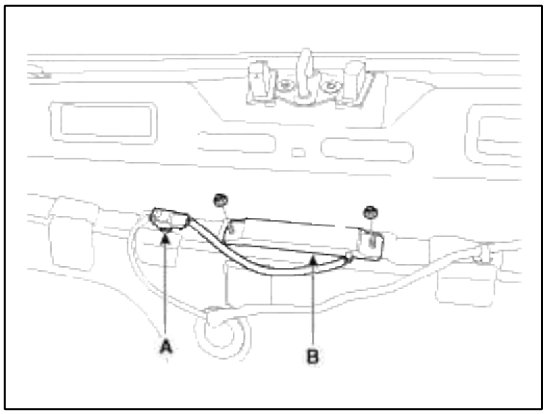
Trunk Antenna

1. Disconnect the negative(-) battery terminal.

2. Remove the trunk transverse trim (A).

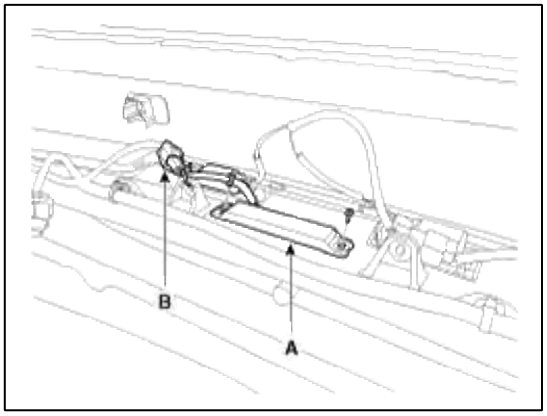


3. Disconnect the trunk antenna connector (A) and remove the trunk antenna (B) after loosening nuts (2EA).



Exterior Bumper Antenna

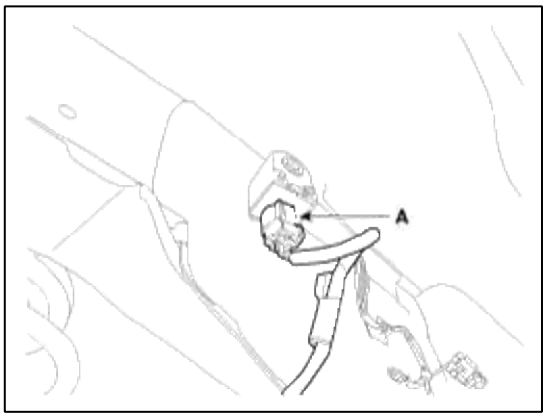
1. Disconnect the negative(-) battery terminal.
2. Remove the rear bumper.
   (Refer to the BD group - "Rear bumper")
3. Disconnect the antenna connector (B) and remove the exterior bumper antenna (A) after loosening the screws (2EA).



Buzzer

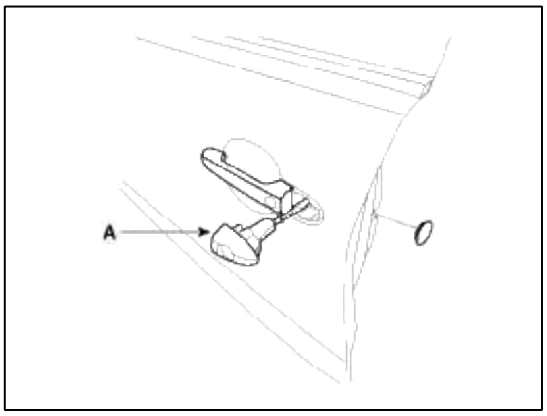
1. Disconnect the negative(-) battery terminal.
2. Remove the left side wheel guard.

3. Remove the external buzzer (A) after disconnecting the connector.

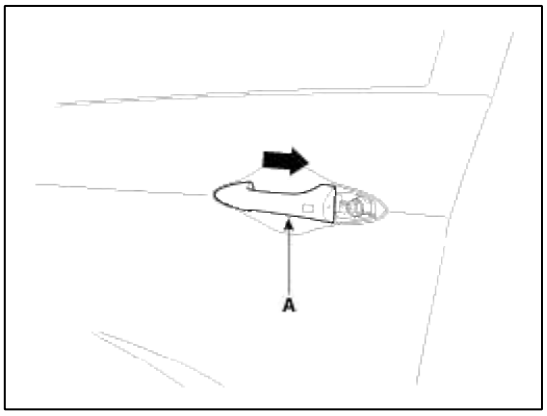


Door Outside Handle

1. Disconnect the negative (-) battery terminal.
2. Remove the front door module.
   (Refer to the BD group - "Front door")
3. After loosening the mounting bolt, then remove the outside handle cover (A).



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

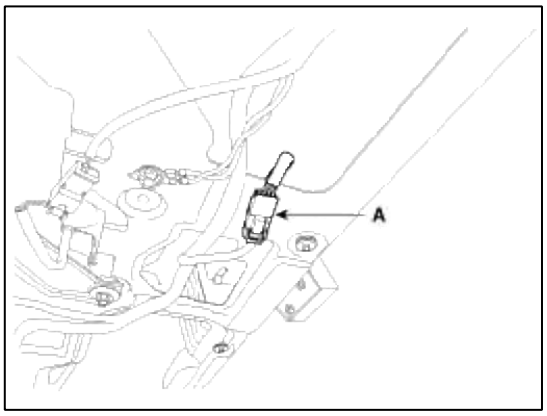


5. Disconnect the outside handle connector.

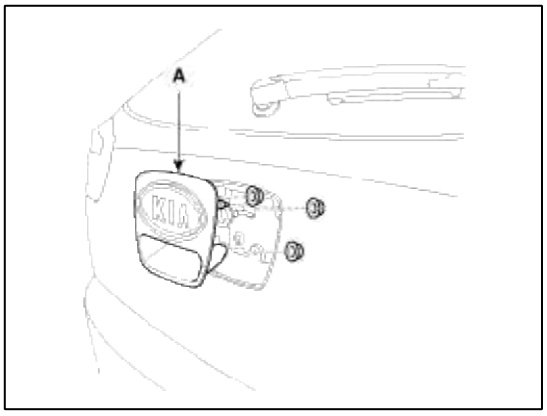
Trunk lid open switch

1. Disconnect the negative(-) battery terminal.
2. Remove the trunk door trim.
   (Refer to the BD group - "Trunk")

3. Disconnect the trunk lid open switch connector (A).



4. Remove the trunk open switch (A) from the trunk garnish.



Installation

Smart Key Unit

1. Install the smart key unit.
2. Install the smart key unit mounting nuts and connector.
3. Install the negative (-) battery terminal and check the smart key system.

Interior 1 Antenna

1. Install the interior 1 antenna.
2. Install the heater & A/C controller.
3. Install the negative (-) battery terminal and check the smart key system.

Interior 2 Antenna

1. Install the interior 2 antenna.
2. Install the console.
3. Install the negative (-) battery terminal and check the smart key system.

Trunk Antenna

1. Install the trunk antenna.
2. Install the trunk transverse trim.
3. Install the negative (-) battery terminal and check the smart key system.

Exterior Bumper Antenna

1. Install the exterior bumper antenna.
2. Install the rear bumper.
3. Install the negative (-) battery terminal and check the smart key system.

Buzzer

1. Install the buzzer.
2. Install the left side wheel guard.
3. Install the negative (-) battery terminal and check the smart key system.

Trunk Lid Open Switch

1. Install the trunk lid open switch.

2. Install the trunk trim.
3. Install the negative (-) battery terminal and check the smart key system.

Door Outside Handle

1. Install the outside handle.
2. Install the door trim.
3. Install the negative (-) battery terminal and check the smart key system.

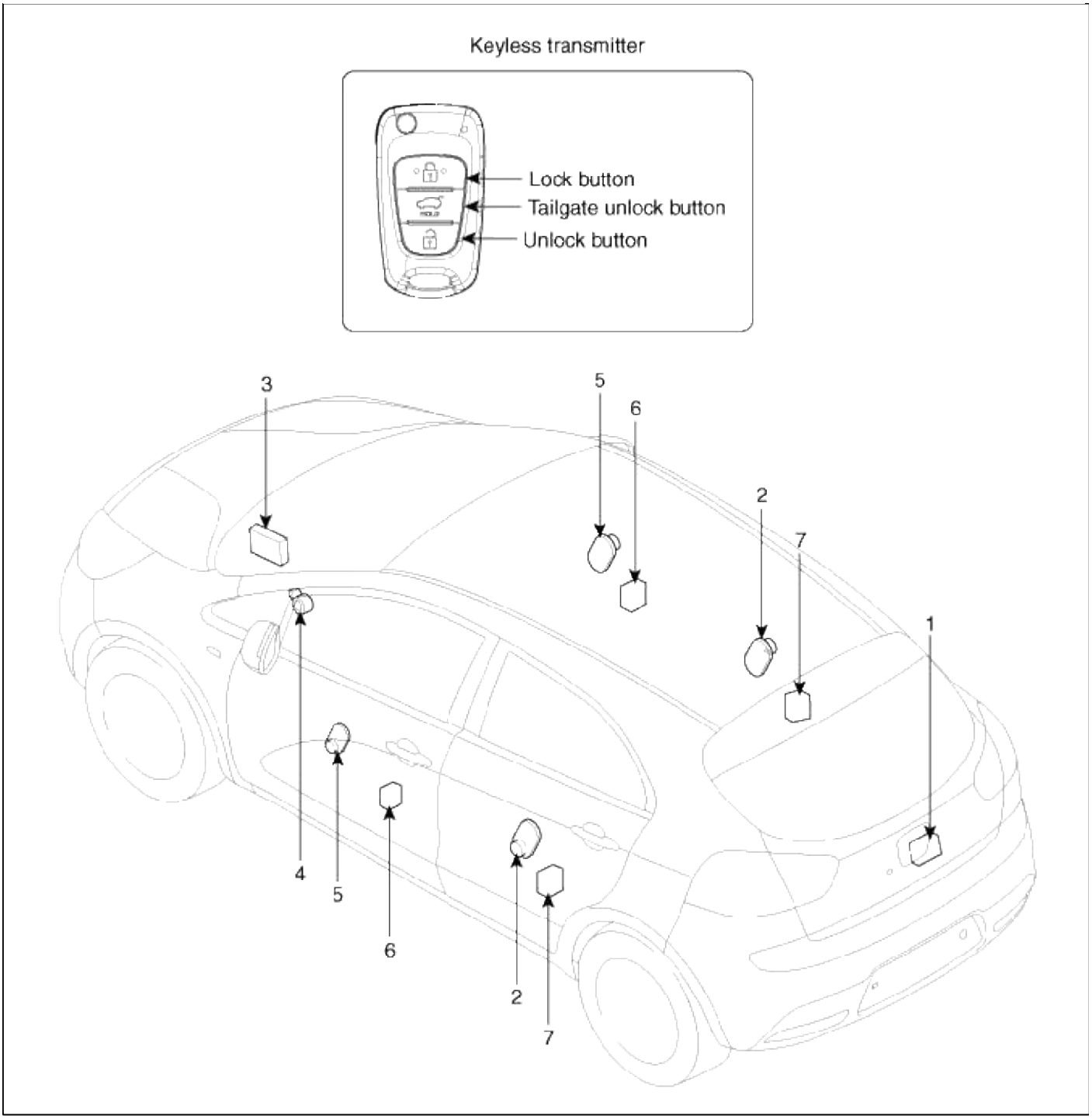
Body Electrical System > Keyless Entry And Burglar Alarm > Specifications

Specifications

Item	Specification
Rated voltage	DC 3V
Service voltage range	DC 2.7V ~ 3.5V
Temperature range	-4°F ~ 140°F (-20°C ~ +60°C)
Storage temperature range	-40°F ~ 185°F (-40°C ~ +85°C) (Without battery)
Modulation method	FSK
Keyless entry transmitter Power source	Lithium 3V battery (1EA)
Transmissible distance	10m or more
Life of battery	2 years or more (at 20 times per day)
Button	3 (Door lock, Door unlock, Tailgate unlock)
Transmission frequency	315 MHz

Body Electrical System > Keyless Entry And Burglar Alarm > Components and Components Location

Component Location



1. Tailgate actuator & switch 2. Rear door switch 3. Body control module 4. Key warning switch	5. Front door switch 6. Front door lock actuator & switch 7. Rear door lock actuator & switch

Body Electrical System > Keyless Entry And Burglar Alarm > Description and Operation

Description

Keyless Entry System

The keyless entry system allows you to lock and unlock the vehicle with the remote transmitter. When you push the LOCK button, all doors lock. When you push the UNLOCK button again, all doors unlock.

The room lamp, if its switch is in the center position, will come on when you press the UNLOCK button. If you do

not open a door, the light will go off in about 30 seconds, the doors will automatically relock. If you relock the doors with the remote transmitter within 30 seconds, the light will go off immediately.
You cannot lock or unlock the doors with the remote transmitter if the key is in the ignition switch.
The system will signal you when the doors lock and unlock by flashing the hazard lamp once when they lock and closed, and twice when they unlock.

Function

Keyless Entry Function
DOOR LOCK / UNLOCK are performed with remote controller.
1. Keyless entry function is performed in a state that key in switch is eliminated from key cylinder
2. LOCK / UNLOCK signals are received from the transmitter and DOOR LOCK / UNLOCK signals are output.

Transmitter(TX) Spec
1. Transmission Distance : 10m or more from outside of the car
2. Registration procedure of the transmitter
   (1) In registration mode, it shall be possible to register up to Max 4EA.
   (2) At re-registration, data are registered newly after deleting the previous TX DATA

No.	Saved CODE	CODE to change	Changed CODE
1	None	A	A
2	A	B	B(A is deleted)
3	B	C,D	C,D(B is deleted)
4	C,D	E,F,G	E,F,G(C,D is deleted)
5	E,F,G	H,I,J,K	H,I,J,K(E,F,G is deleted)
6	A,B	C,D,E,F,G	C,D,E,F
7	A,B	C,C,D,E,F	C,D,E
8	A,B,C,D	A	A
9	A,B,C,D	E	E

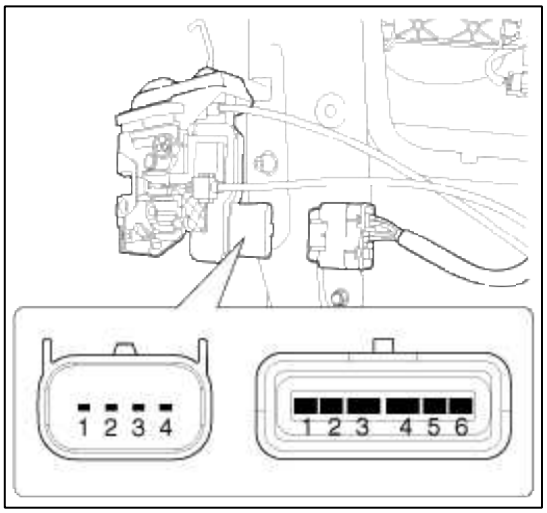
   (3) For the registration procedures by using Diagnostic tester, refer to "TRANSMITTER CODE REGISTRATION".
3. Transmitter signal & Receiver specification
   (1) Transmission signal
      A. Transmit relevant transmission DATA (Transmission frame) twice by pushing TX SW.
      B. Only LOCK signal is output when pushing TX LOCK switch and UNLOCK switch at the same time.

Body Electrical System > Keyless Entry And Burglar Alarm > Repair procedures

Inspection

Front Door Lock Actuator and Switch
1. Remove the front door trim.
   (Refer to the Body group - Front door)
2. Remove the front door latch.
   (Refer to the Body group - Front door).

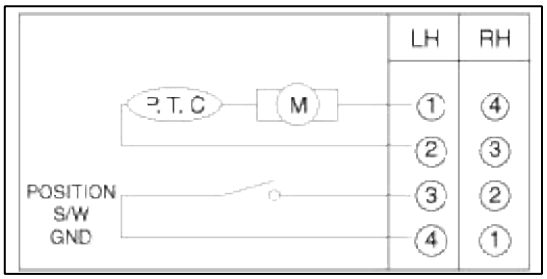
3. Disconnect the connectors from the actuator.



4. Check actuator operation by connecting power and ground according to the table.
   Check for continuity between the terminals in each switch position when inserting the key into the door according to the table

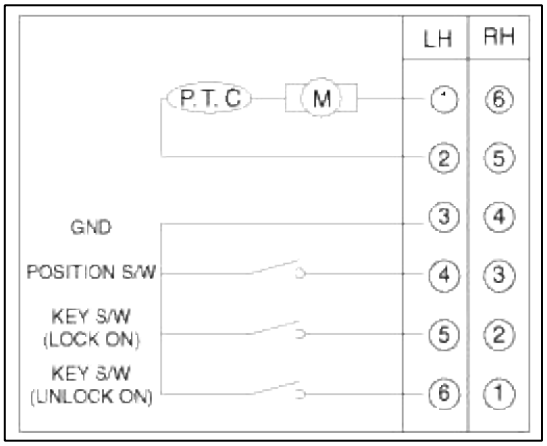
> NOTE
>
> To prevent damage to the actuator, apply battery voltage only momentarily.

[without key (4Pin)]



OPERATION / TERMINAL	C/LOCK		C/UNLOCK	
	LH	RH	LH	RH
①	-	GND	+	GND
②	+	OFF	-	ON
③	OFF	-	ON	+
④	GND	+	GND	-

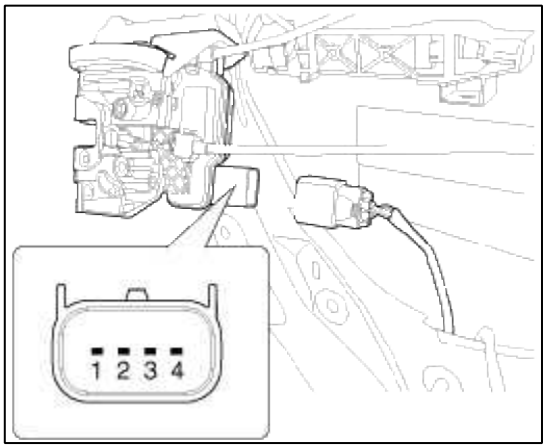
[with key (6Pin)]]



Operation / Terminal	C/LOCK		C/UNLOCK		Key LOCK		Key UNLOCK	
	LH	RH	LH	RH	LH	RH	LH	RH
①	-		+					ON
②	+		-			ON		
③	GND	OFF	GND	ON	GND		GND	
④	OFF	GND	ON	GND		GND		GND
⑤		-		+	ON			
⑥		+		-			ON	

Rear Door Lock Actuator and Switch

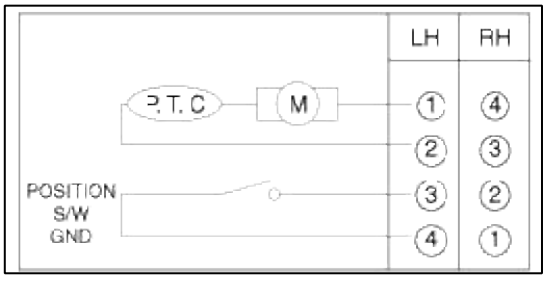
1. Remove the rear door trim.
   (Refer to the Body group - Rear door)
2. Remove the rear door latch.
   (Refer to the Body group - Rear door)
3. Disconnect the connectors from the actuator.



4. Check actuator operation by connecting power and ground according to the table.
   Check for continuity between the terminals in each switch position when inserting the key into the door according to the table

NOTE

To prevent damage to the actuator, apply battery voltage only momentarily.



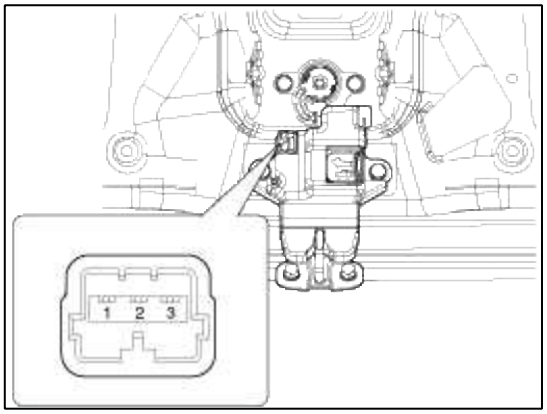
OPERATION / TERMINAL	C/LOCK		C/UNLOCK	
	LH	RH	LH	RH
①		GND	+	GND
②	+	OFF	-	ON
③	OFF	-	ON	+
④	GND	+	GND	-

Trunk lid/ Tailgate release actuator

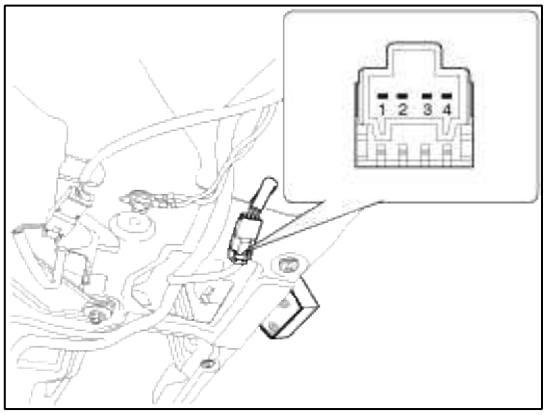
1. Disconnect the negative battery terminal.

2. Remove the rear trunk lid trim (the tailgate trim) and then remove the trunk lid switch (the tailgate switch) fromm the actuator.

[Trunk lid latch]



[Tailgate latch]

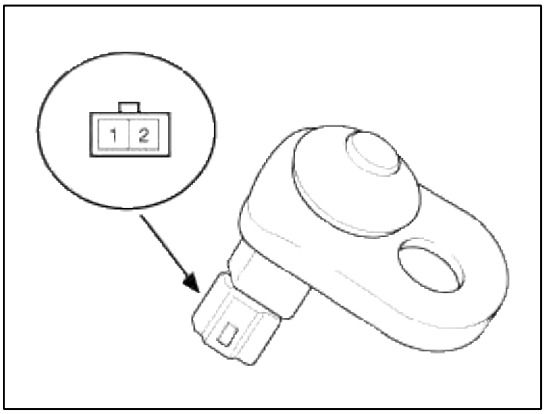


3. Check for continuity between the terminals in each switch position according to the table.

Terminal / Position	2	3
Lock		
Unlock	○	○

Door switch

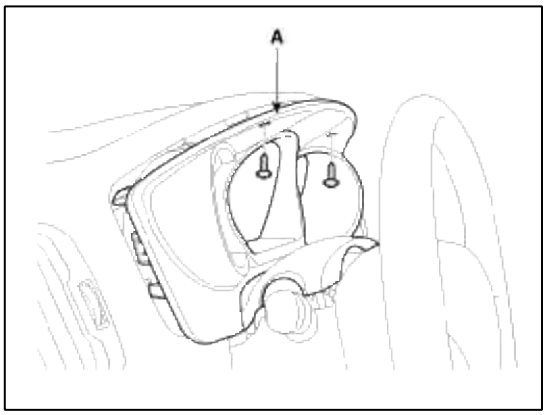
Remove the door switch and check for continuity between the terminals.

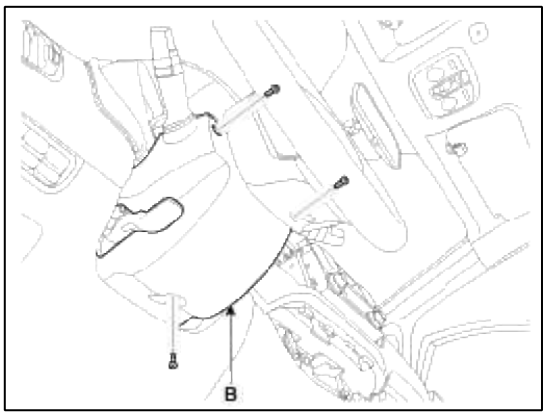


Terminal / Position	1	2	Body (Ground)
Free(Door open)	○	○	○
Push(Door close)			

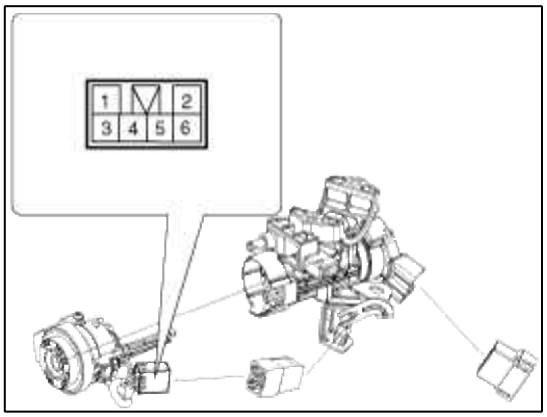
Door warning switch

1. Remove the steering column upper (A) and lower (B) shrouds after removing the screws.





2. Disconnect the 6P connector from the door warning switch.



3. Check for continuity between the terminals in each position according to the table.

Terminal / Key position	5	6
Insert	○	○
Removal		

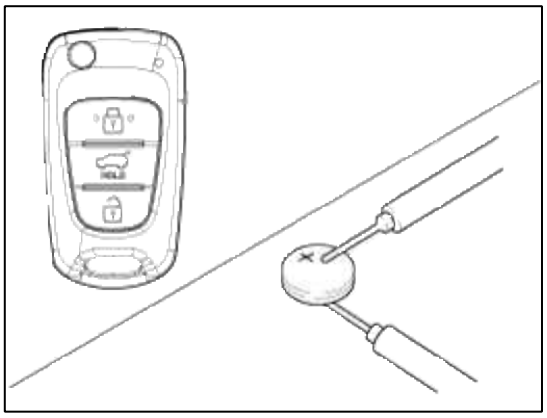
Body Electrical System > Keyless Entry And Burglar Alarm > Transmitter > Repair procedures

Inspection

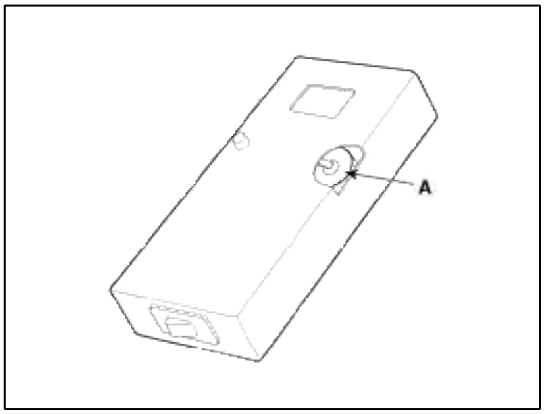
1. Check that the red light flickers when the door lock or unlock button is pressed on the transmitter.

2. Remove the battery and check voltage if the red light doesn't flicker.

Standard voltage : 3V



3. Insert the battery (A) into the tester (09954-2p100).



4. Push the test button and If "0.00" is displayed on screen, it means that the battery voltage is 2V or less.
5. If "L" is displayed on screen, it means that the battery is low power and it needs to replace.
6. To prevent the discharge of electricity, turn the tester power off.
7. Replace the transmitter battery with a new one, if voltage is low power then try to lock and unlock the doors with the transmitter by pressing the lock or unlock button five or six times.
8. If the doors lock and unlock, the transmitter is O.K, but if the doors don't lock and unlock, register the transmitter code, then try to lock and unlock the doors.
9. If the doors lock and unlock, the transmitter is O.K, but if the doors don't lock and unlock, replace the transmitter.

WARNING

An inappropriately disposed battery can be harmful to the environment and human health.
Dispose the battery according to your local law(s) or regulation.

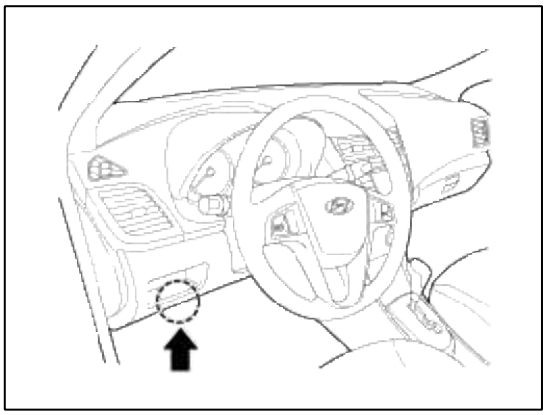
Transmitter Code Registration (Using Code Saver)

1. Open Door.
2. Connect POWER (B+) and GND, signal line of Code Saver.
3. If connection is normal, signal line is activated and RED LED turns ON.
4. If switch of Code Saver turns ON, data via signal line will be transmitted.
5. BCM enters into Code Save mode when it receives data from Code Saver and send Code Save Start signal via signal line.
6. Code Saver turns Green LED ON when it receives Code Save Start signal.
7. When you press Lock or Unlock button of transmitter, BCM will save Codes.
8. If there are 2 transmitters for Code Saving, register by performing item 7).

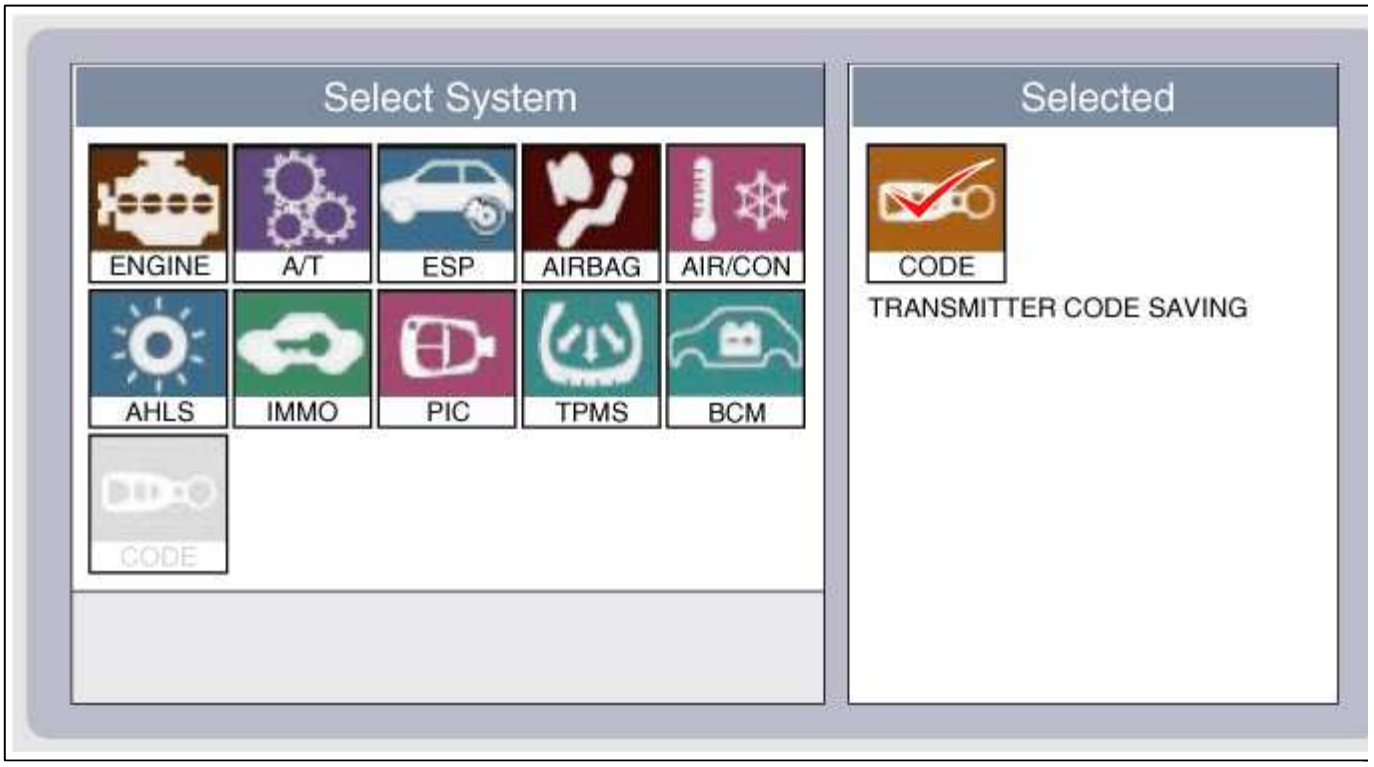
9. If switch of Code Saver turns OFF or is disconnected, Code Saving mode will be finished.

Transmitter Code Registration (Using GDS)

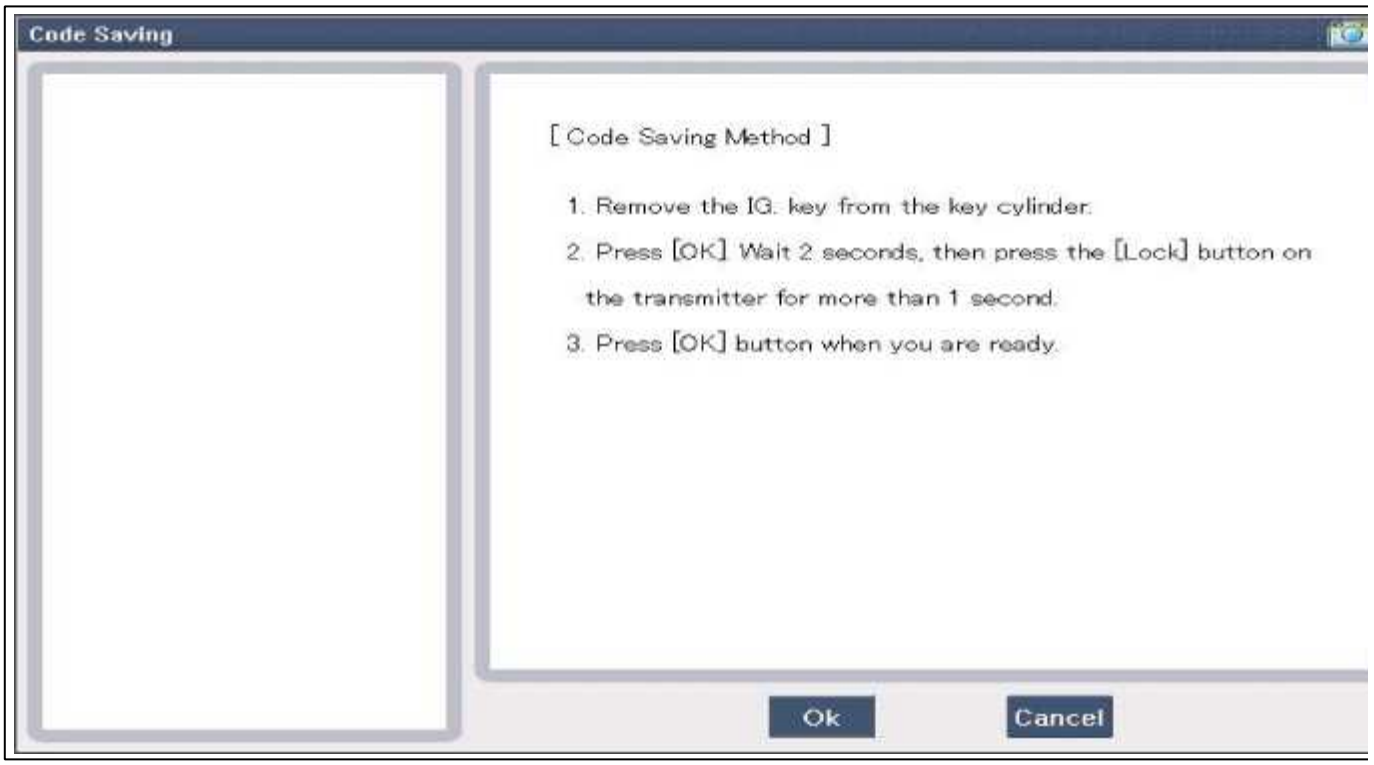
1. Connect the DLC cable of GDS to the data link connector (16 pins) in driver side crash pad lower panel, turn the power on GDS.



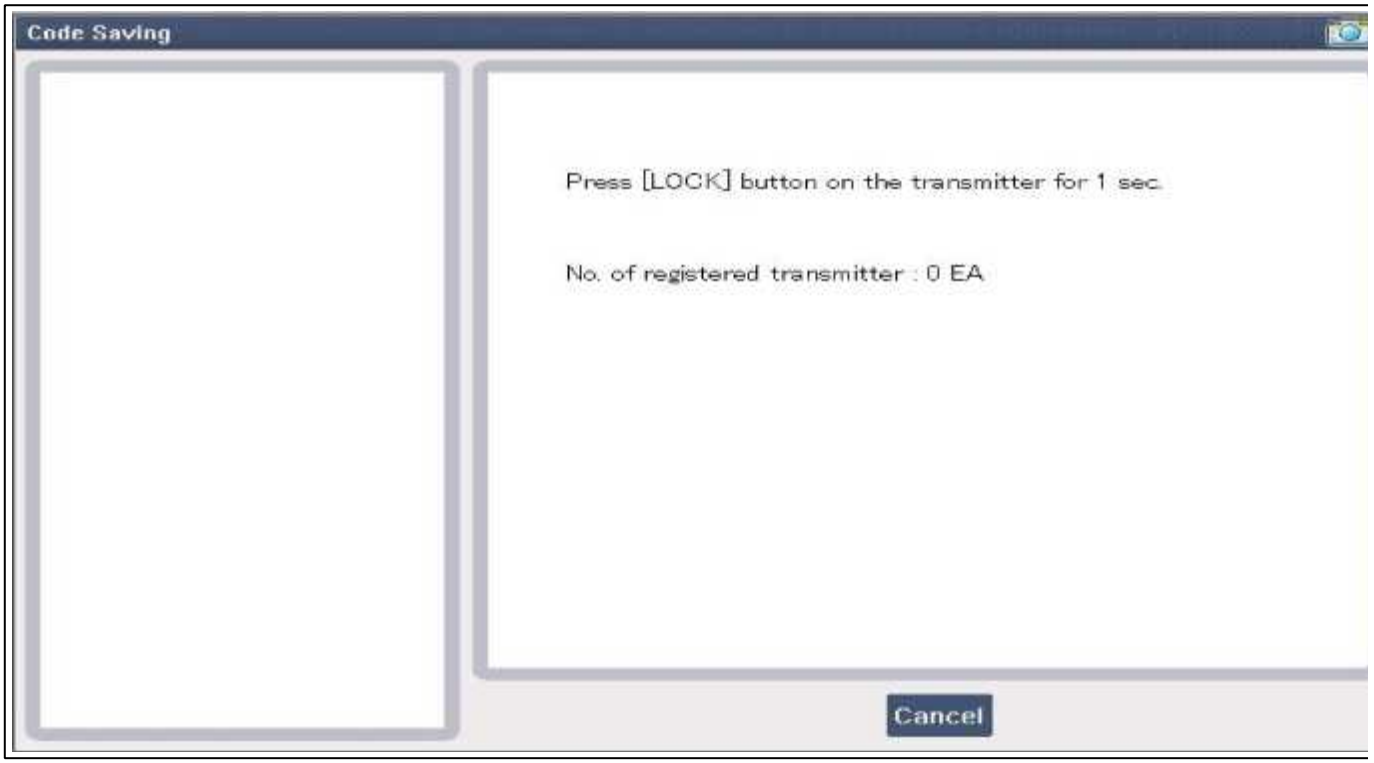
2. Select the vehicle model and then do "CODE SAVING"

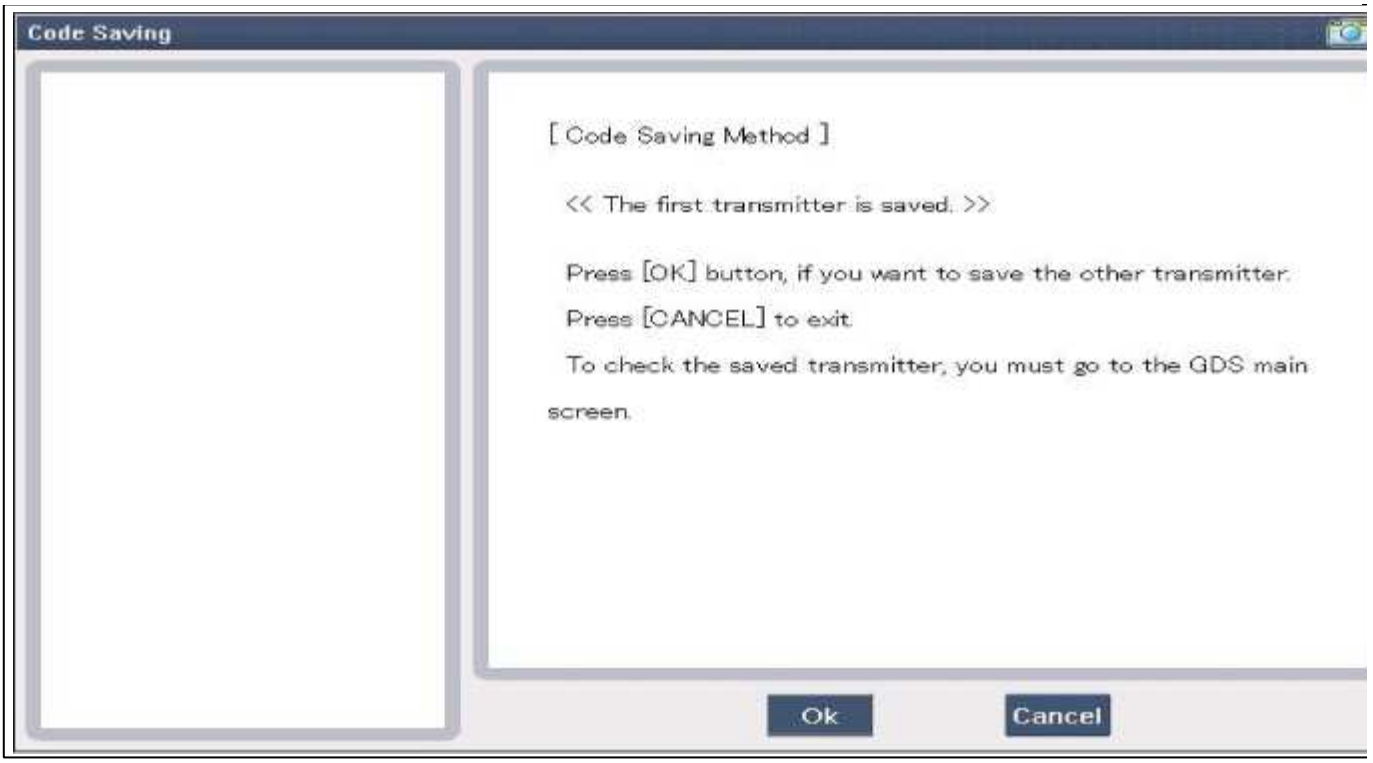


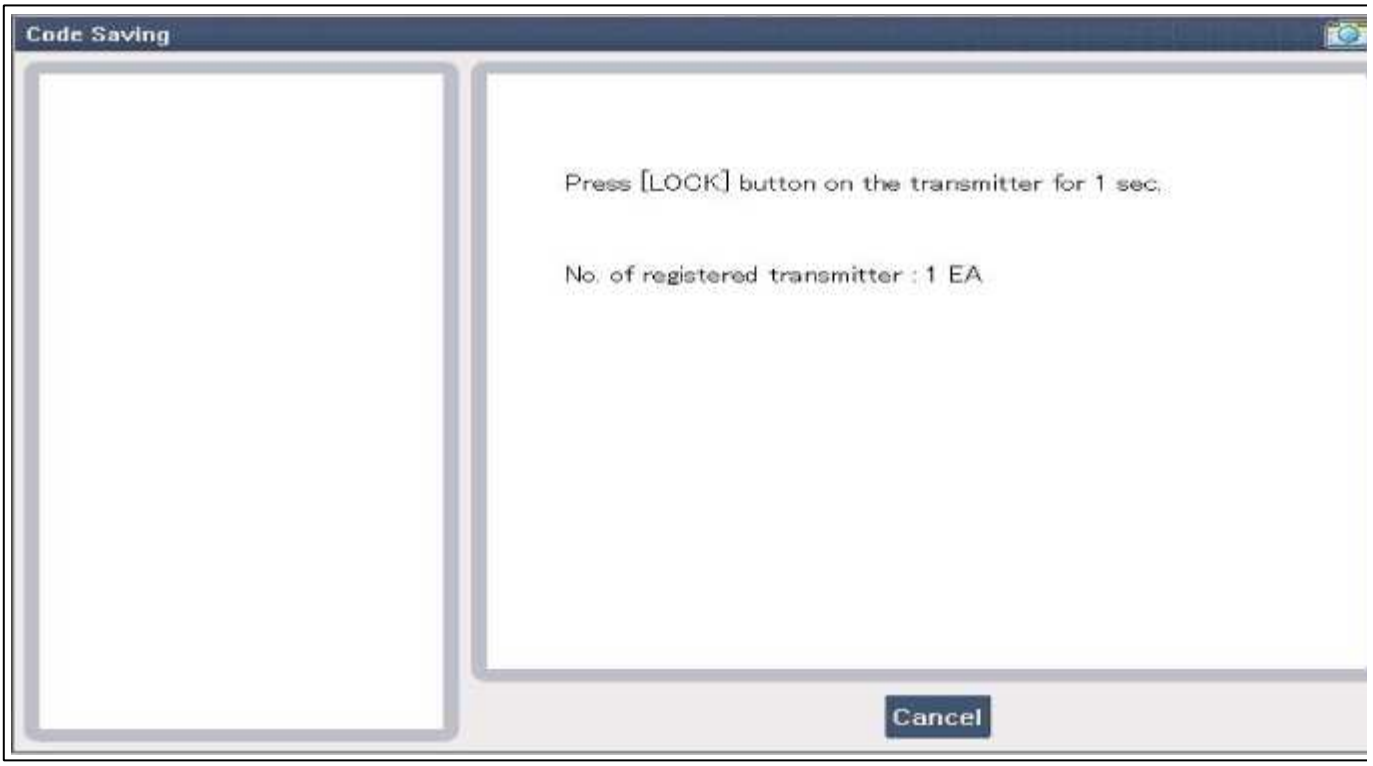
3. After selecting "CODE SAVING" menu, button "ENTER" key, then the screen will be shown as below.

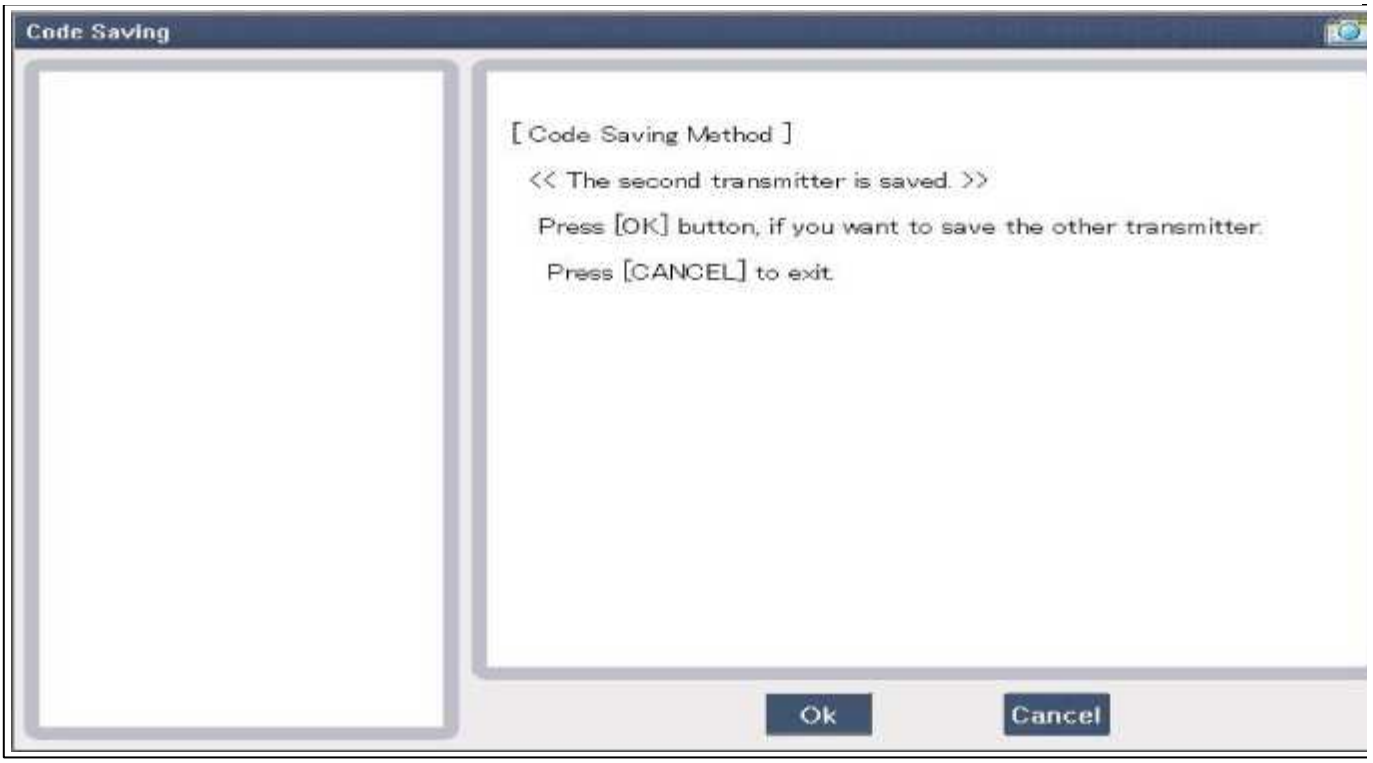


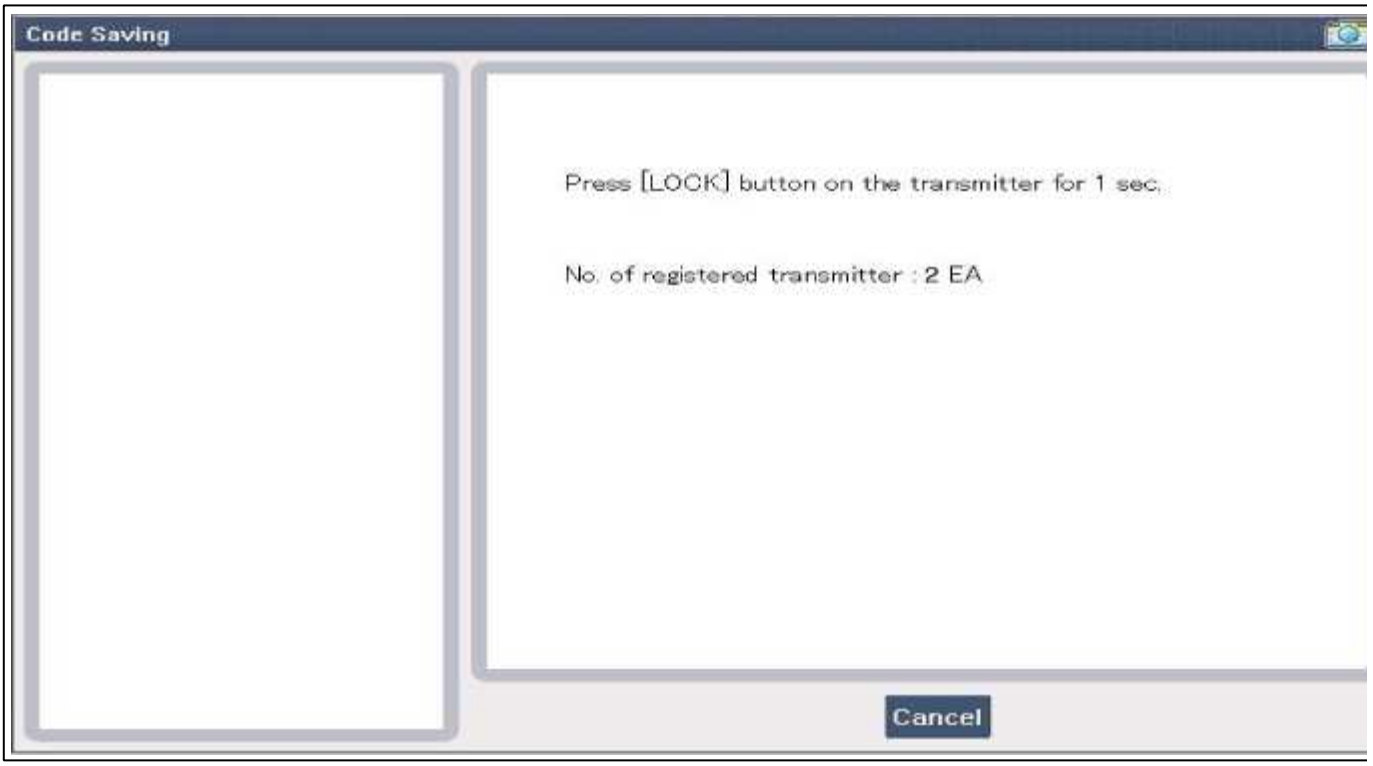
4. After removing the ignition key from key cylinder, push "ENTER" key to proceed to the next mode for code savin Follow steps 1 to 4 and then code saving is completed.

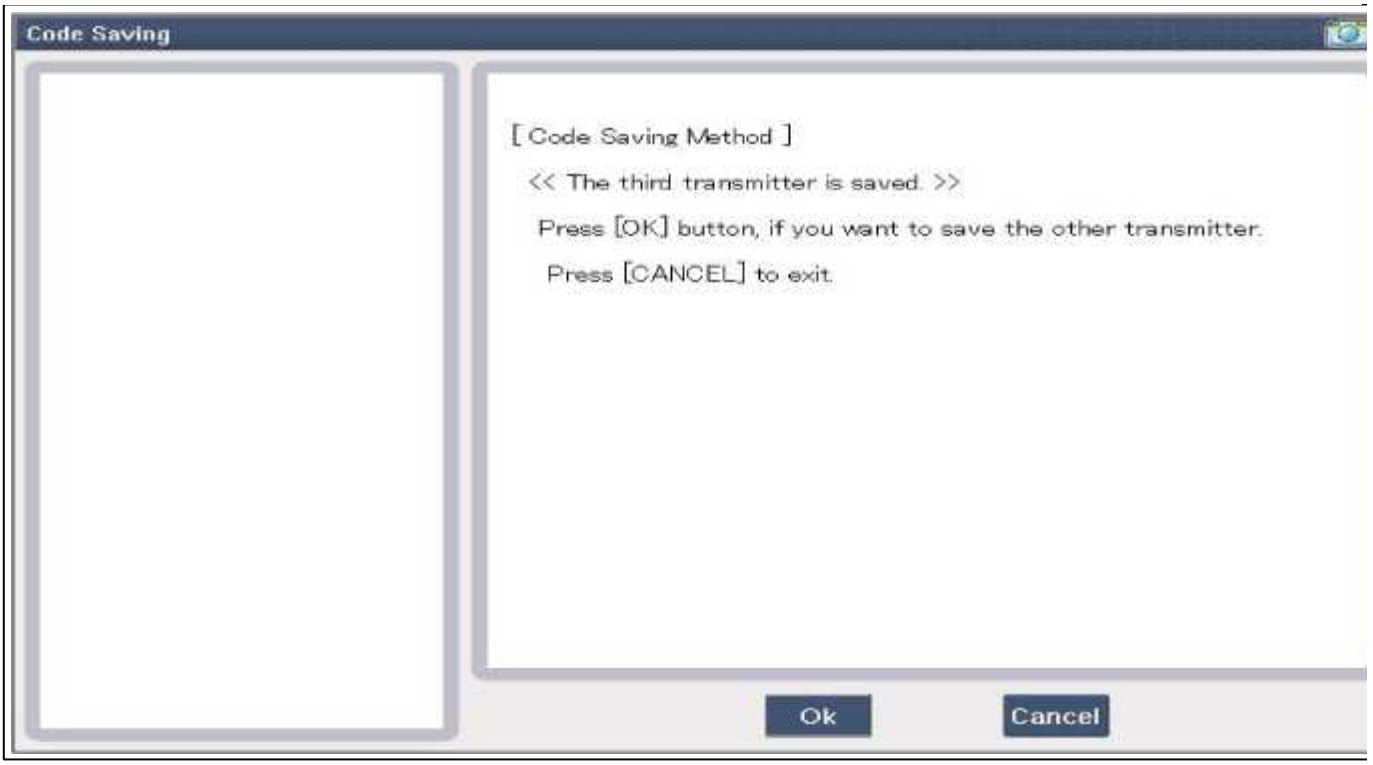


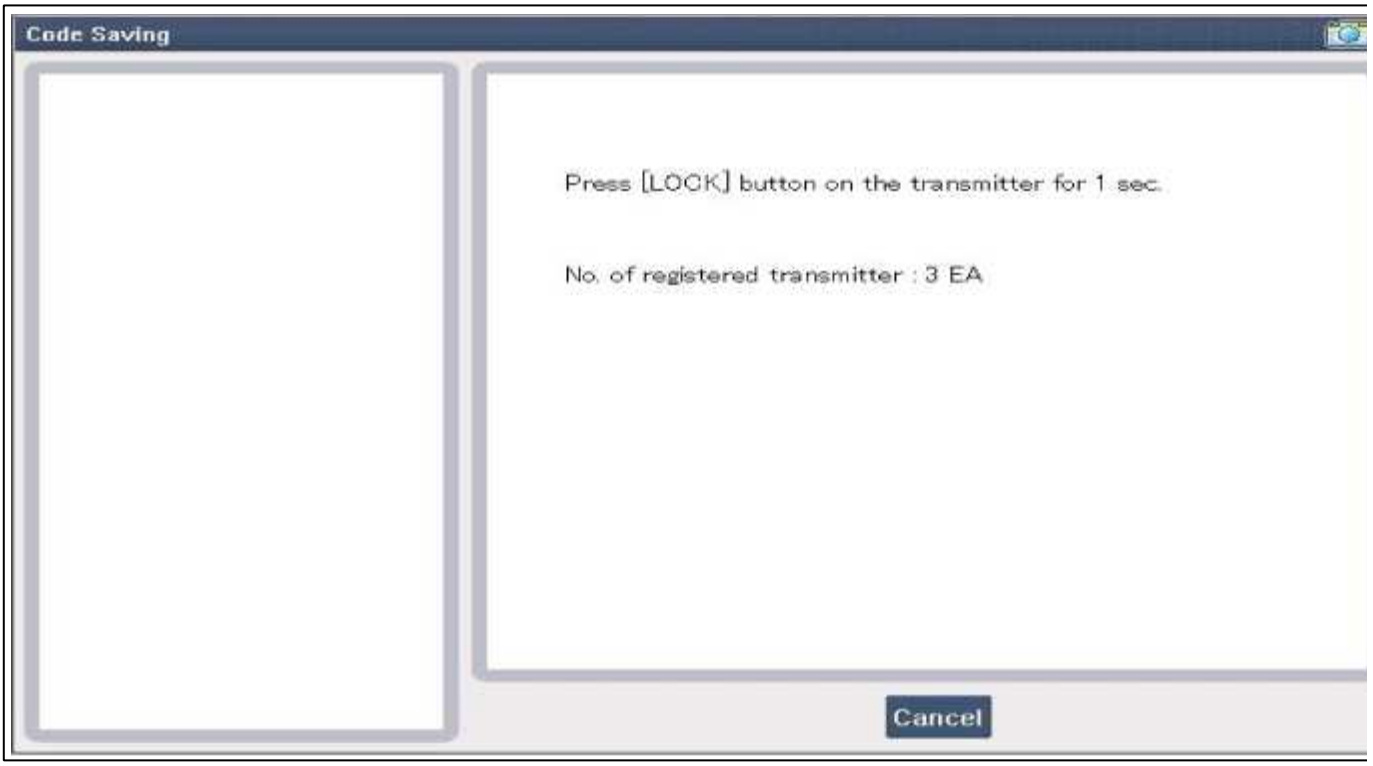

Code Saving
[Code Saving Method]
<< The first transmitter is saved. >>
Press [OK] button, if you want to save the other transmitter.
Press [CANCEL] to exit.
To check the saved transmitter, you must go to the GDS main screen.
Ok
Cancel

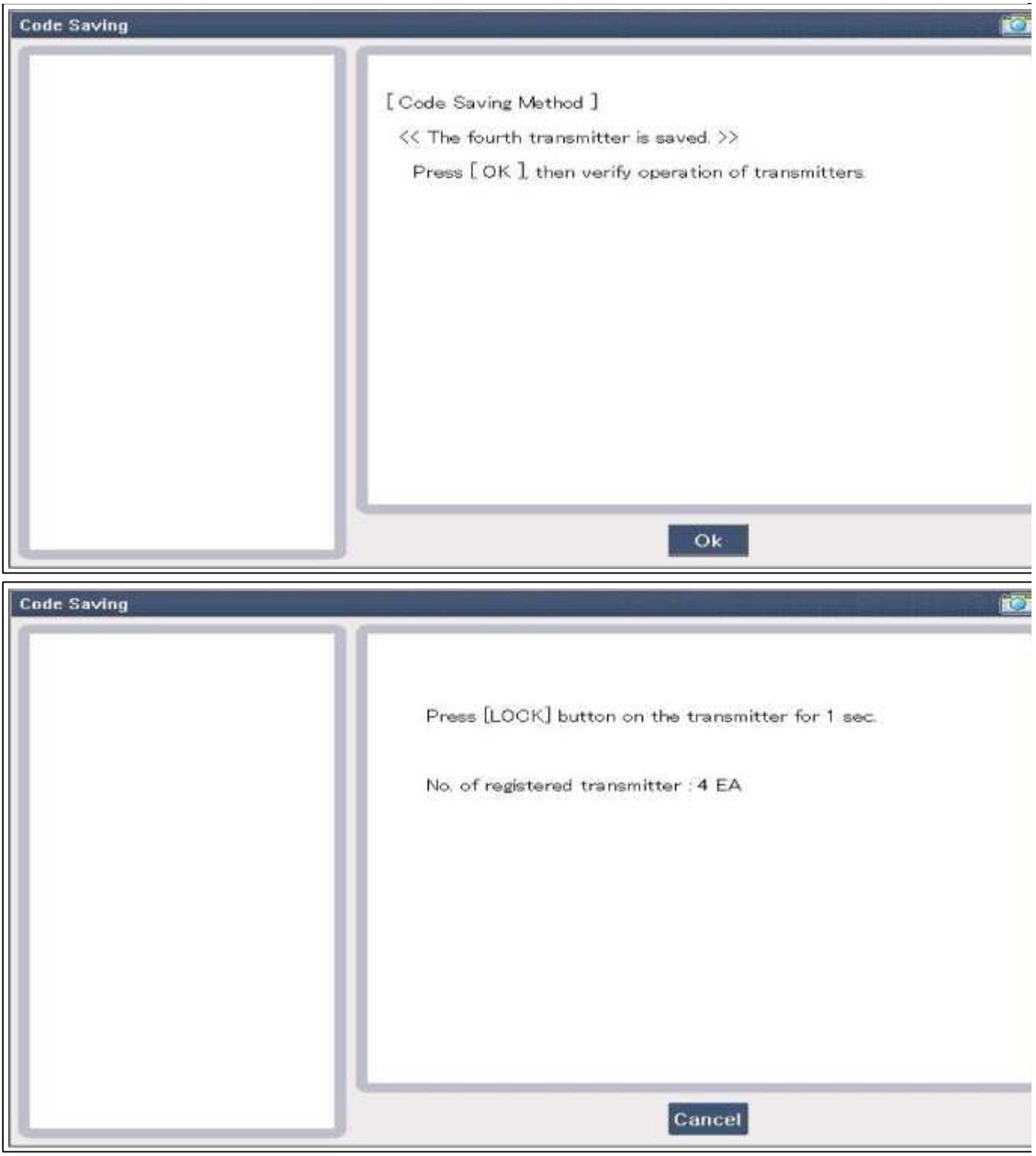

Code Saving
Press [LOCK] button on the transmitter for 1 sec.
No. of registered transmitter : 1 EA
Cancel


Code Saving
[Code Saving Method]
<< The second transmitter is saved. >>
Press [OK] button, if you want to save the other transmitter.
Press [CANCEL] to exit.
Ok
Cancel


Code Saving
Press [LOCK] button on the transmitter for 1 sec.
No. of registered transmitter : 2 EA
Cancel


Code Saving
[Code Saving Method]
<< The third transmitter is saved. >>
Press [OK] button, if you want to save the other transmitter.
Press [CANCEL] to exit.
Ok
Cancel


Code Saving
Press [LOCK] button on the transmitter for 1 sec.
No. of registered transmitter : 3 EA
Cancel



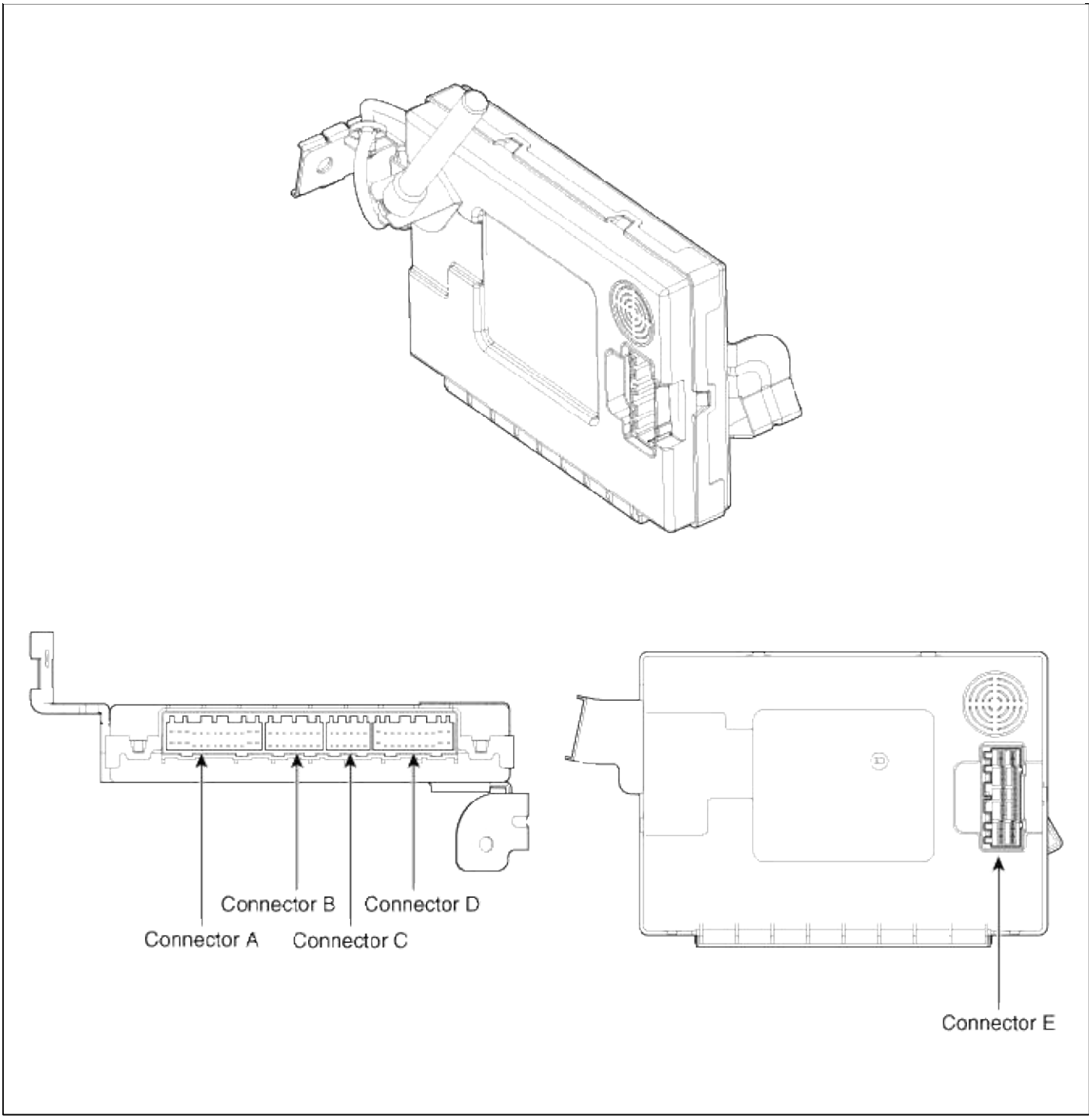
Body Electrical System > BCM (Body Control Module) > Body Control Module (BCM) > Specifications

Specifications

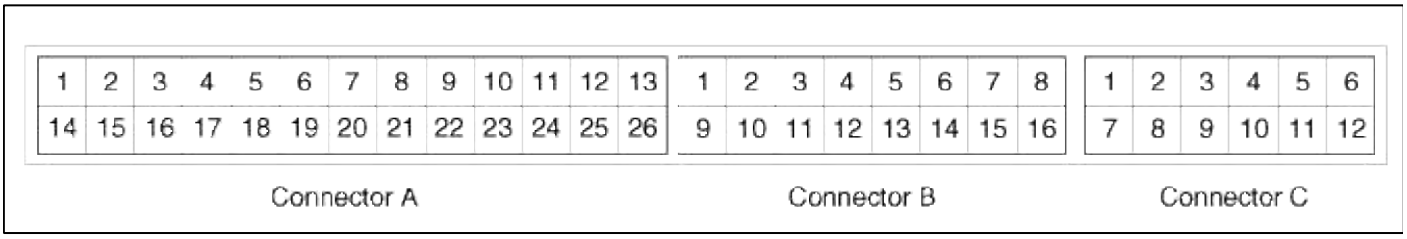
Item		Requirement	Remark
Rated voltage		DC 12V	Shall activate normally in these range.
Operating voltage range		DC 9 ~ 16V	
Operating temperature range		-30°C ~ +75°C (-22°F ~ +167°F)	
Storage temperature range		-40°C ~ +85°C (-40°F ~ +185°F)	
Dark Current	Keyless (with security indicator)	5.5	Measure when the state, all output loads are OFF and there are no Input SW(including TX operation) changes, continues 2sec.
	SMK (with security indicator)	4.5	
	Non keyless	3.0	

Body Electrical System > BCM (Body Control Module) > Body Control Module (BCM) > Components and Components Location

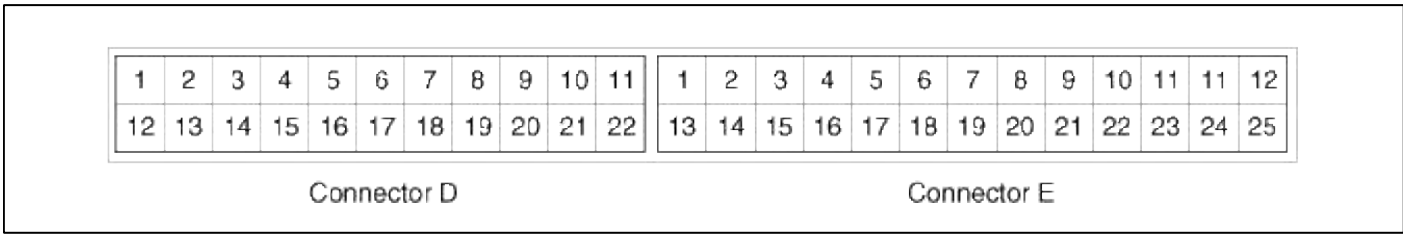
Components



BCM connectors



Pin No.	Connector A	Connector B	Connector C
1	Battery (+)	K_LINE	Turn signal switch (RH)
2	Ignition 2	Central door lock/ unlock switch	Turn signal switch (LH)
3	Ignition 1	RPAS OFF switch	Parking brake switch
4	Tailgate handle switch	Hazard switch	Auto light switch
5	Driver door key unlock switch	Power window unlock switch	-
6	Driver door key lock switch	Power window lock switch	Ground 3
7	Tail lamp switch	Wiper intermittent volume	CAN_H
8	Seat belt switch	LIN	CAN_L
9	Assist seat belt switch	Head lamp low switch	Auto light power
10	Front fog lamp switch	Door enable	Auto right signal
11	Rear fog lamp switch	Crash input	Burglar horn relay
12	Head lamp high switch	Defogger switch	Burglar alram relay
13	Ground 1	Wahser switch	
14	Rear left door switch	Wiper mist switch	
15	Rear left door unlock switch	Wiper intermittent switch	
16	Inhibit "R"	Rear washer switch	
17	Key IN switch		
18	ACC		
19	Hood switch		
20	Driver door unlock switch		
21	Assist door unlock switch		
22	Rear right door unlock switch		
23	Driver door switch		
24	Assist door switch		
25	Rear right door switch		
26	Tailgate switch		



Pin No.	Connector D	Connector E
1	Power window relay	Static bend power
2	Assist seat belt indicator	Static bend (RH)
3	Room lamp	Turn power
4	Rear wiper relay	Rear right turn signal
5	Tail lamp relay	Rear left turn signal
6	Head lamp relay	Front right turn signal
7	Head lamp high relay	Front left turn signal
8	Front fog lamp relay	Rear left seat belt switch
9	Rear fog lamp relay	Center seat belt switch
10	Rear deicer relay	Rear right seat belt switch
11	-	Assist door key unlock switch
12	AV tail	Interior lamp power
13	Navigation wake up	Interior lamp output
14	Wiper relay	Static bend (LH)
15	Hazard indicator	Break switch
16	RPAS OFF indicator	Central door lock indicator
17	Ground 2	Rear wiper switch
18	Door lock relay	Rear wiper INT switch
19	Door unlock relay	Head lamp low control
20	Dead lock relay	AT solenoid
21	Tailgate unlock relay	Side air bag option
22	Key hole illumination	Rear right seat belt indicator
23		Center seat belt indicator
24		Rear left seat belt indicator
25		Dedicated DRL outupt
26		Dedicated DRL power

Input/ Output Description

Function	I/O	Connector No	Description	Active	Remark
Power	B+	A1	Supply power to BCM	Power	
	POWER_GND	A13	Ground	GND	
	SIGNAL_GND	D17	Ground	GND	
	POWER	C9	Auto light sensor power	Power	

	AutoLight_GND	C6	Auto light sensor ground	GND	
Analog Input	A_IGN1	A3	Ignition1 voltage signal input	AD	
	A_IGN2	A2	Ignition2 voltage signal input	AD	
	A_ACC	A18	Accessory voltage signal input	AD	
	A_FrontIntVolume	B7	Wiper intermittent volume input	AD	
	A_AutoLightSig	C10	Auto light sensor signal input	AD	SENSOR
Logic Input	L_InhibitR	A16	Inhibit R signal input	High	
	L_WasherSW	B13	Front Washer switch signal input	High	
	L_WiperMistSW	B14	Mist switch signal input	High	
	L_WiperIntmtSW	B15	Front Intermittent switch signal input	High	
	L_RearWasherSW	B16	Rear Washer switch signal input	High	5DR/3DR
	L_RearWiperINTSW	E18	Rear Wiper Intermittent switch signal input	High	5DR/3DR
	L_RearWiperSW	E17	Rear Wiper On switch signal input	High	5DR/3DR
	L_KeyInSW	A17	Key In switch signal input	High	
	L_BreakSW	E15	Break switch signal input	High	
	L_TailLampSW	A7	Tail switch signal input	Low	
	L_RPASOffSW	B3	PAS Off switch signal input	Low	
	L_DrlEnable	B10	Europe DRL Option signal input	Low	
	L_TailGateHandleSW	A4	Tail Gate Handle signal input	Low	5DR/3DR
	L_DRVDoorKeyUnlockSW	A5	Drive Door Key Unlock signal input	Low	
	L_DRVDoorKeyLockSW	A6	Drive Door Key Lock signal input	Low	
	L_CTRDRLockUnlockSW	B2	Central Door Lock/Unlock switch signal input	Low	
	L_SeatBeltSW	A8	Drive Seat Belt signal input	Low	
	L_AutoLightSW	C4	Auto Light switch signal input	Low	
	L_HeadLampLowSW	B9	Head Lamp switch signal input	Low	
	L_HeadLampHISW	A12	Head Lamp Hi switch signal input	Low	
	L_FrontFogSW	A10	Front Fog switch signal input	Low	

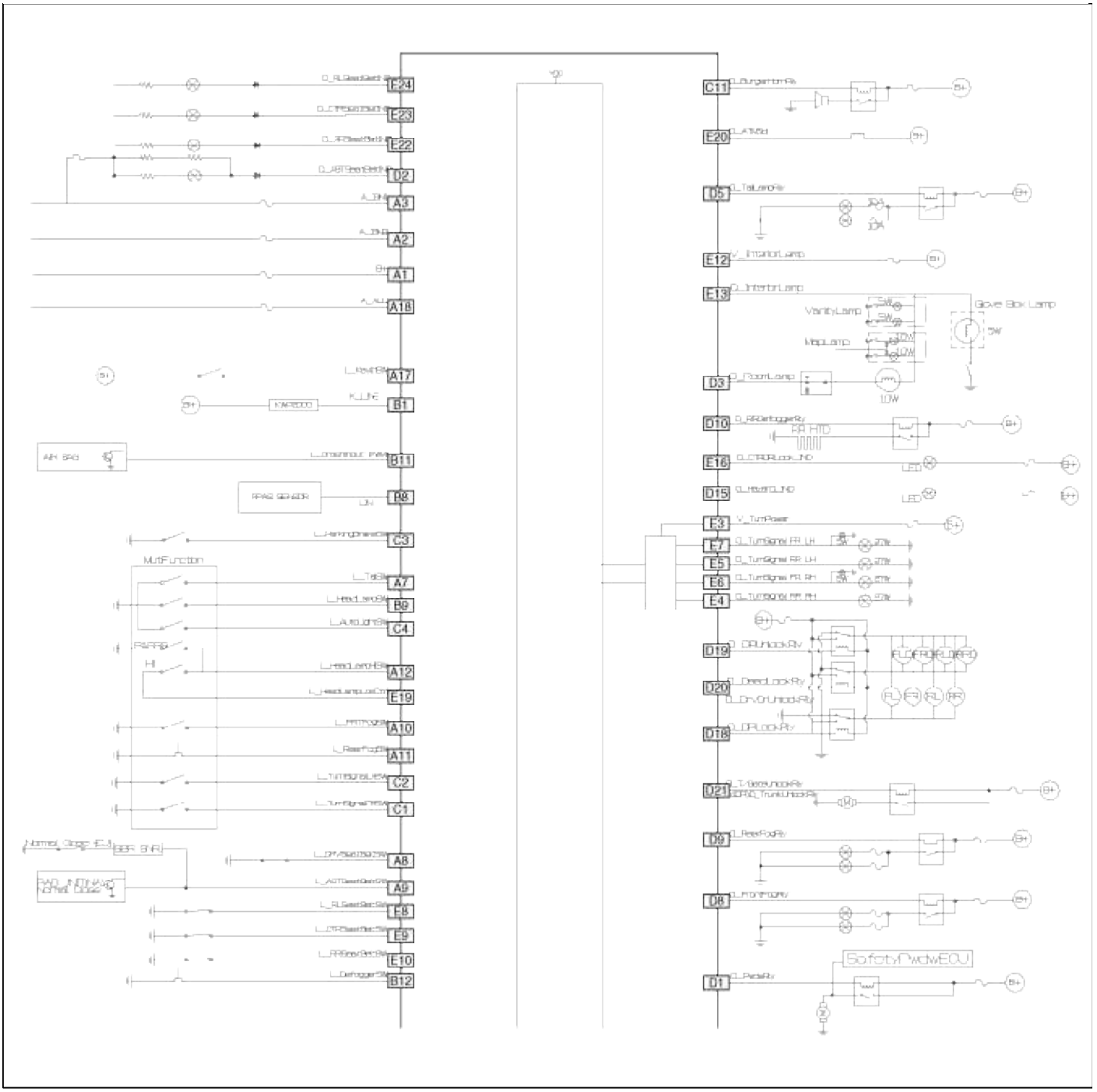
L_RearFogSW	A11	Rear Fog switch signal input	Low	
L_DefoggerSW	B12	Rear Defogger switch signal input	Low	
L_AstSeatBeltSW	A9	Assist Seat Belt SW signal input	Low	
L_RLDoorSW	A14	Rear Left Door switch signal input	Low	
L_SideAirBagOpt	E21	Side Airbag Option signal input	Low	
L_RLDoorUnlockSW	A15	Rear Left Door switch unlock signal input	Low	
L_HoodSW	A19	Hood switch signal input	Low	
L_ParkingBreakSW	C3	Break input signal	Low	
L_DRVDoorUnlockSW	A20	Drive Door unlock signal input	Low	
L_ASTDoorUnlockSW	A21	Assist Door unlock signal input	Low	
L_RRDoorUnlockSW	A22	Rear Right Door unlock signal inpur	Low	
L_DRVDoorSW	A23	Driver Door switch signal input	Low	
L_ASTDoorSW	A24	Assist Door switch signal input	Low	
L_RRDoorSW	A25	Rear Right Door switch signal input	Low	
L_TailGateSW	A26	Tail Gate lock/unlock state signal input	Low	5DR/3DR
L_TrunkSW				4DR
L_HazardSW	B4	Hazard switch signal input	Low	
L_PwdwUnlockSW	B5	Power window unlock signal input	Low	
L_PwdwLockSW	B6	Power window lock signal input	Low	
L_TurnSigRHSW	C1	Turn signal right input	Low	
L_TurnSigLHSW	C2	Turn signal left input	Low	
L_RLSeatBeltSW	E8	Rear seat belt left switch signal input	Low	
L_CTRSeatBeltSW	E9	Rear seat belt center switch signal input	Low	
L_RRSeatBeltSW	E10	Rear seat belt right switch signal input	Low	

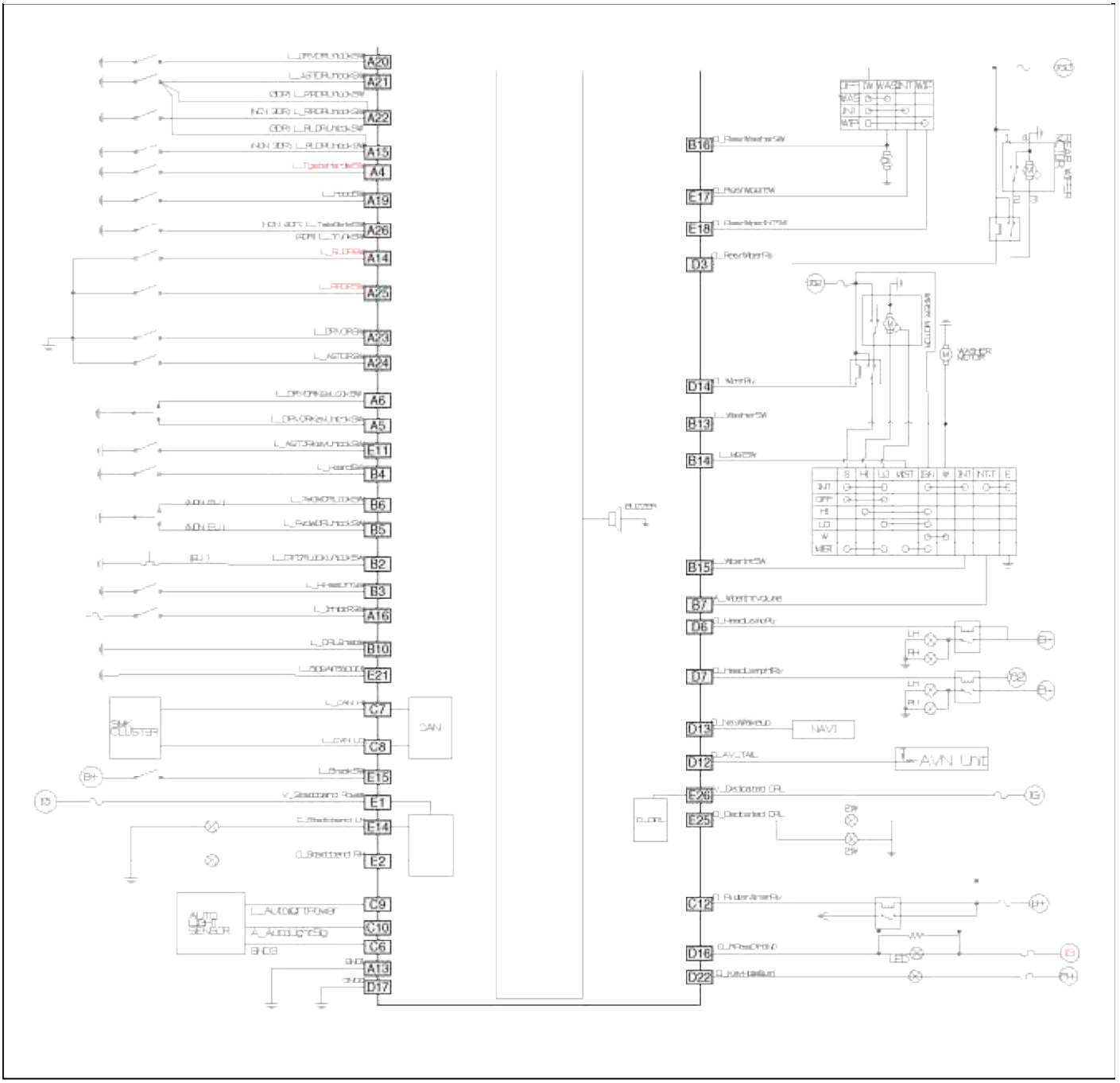
	L_ASTDoorKeyUnlockSW	E11	Assist door key unlock switch signal input	Low	
PWM Input	P_CrashInput	B11	Crash Input signal	PWM	AIR BAG
Communication	K_Line	B1	Diagnostic Communication line K for Tester	Data	
	LIN	B8	LIN network communication line	Data	RPAS
	CAN_H	C7	Can network communication line (high)	Data	
	CAN_L	C8	Can network communication line (low)	Data	
Output	O_BuglarHornRly	C11	Buglar alarm Relay output	Low	
	O_KeyHoleILL	D22	Key Hole Illumination output	Low	
	O_WiperRly	D14	Front Wiper Relay output	Low	
	O_RRWiperRly	D4	Rear Wiper Relay output	Low	
	O_HeadLampLowCtrl	E19	Head Lamp Low signal	Low	
	O_BurglaarAlarmRly	C12	Start Inhibit Relay output	Low	
	O_RearFogRly	D9	Rear Fog Relay output	Low	
	O_TailLampRLY	D5	Tail Lamp Rela output	Low	
	O_HeadLampRLY	D6	Head Lamp low Relay output	Low	
	O_FRTFogRLY	D8	Front fog Lamp Relay output	Low	
	O_RRDeicerRLY	D10	Rear Deicer Relay output	Low	
	O_NaviWakeup	D13	Navi wakeup signal output	Low	
	O_Hazard_IND	D15	Hazard indicator signal output	Low	
	O_DRLockRLY	D18	Door Lock signal output	Low	
	O_DRUnlockRLY	D19	Door Unlock signal output	Low	
	O_DeadLockRLY	D20	Dead Lock signal output	Low	
	O_CTRDRLockIND	E16	Central Door Lock indicator output	Low	
	O_TailGateUnlockRLY	D21	Tail Gate Unlock signal output	Low	5DR/3DR
	O_TrunkUnlockRly				4DR
	O_AstSeatBeltIND	D2	Assist Seat Belt Indicator output	Low	
	O_RLSeatBeltIND	E24	Rear Left Seat Belt Indicator output	Low	
	O_CTRSeatBeltIND	E23	Center Seat Belt Indicator output	Low	
	O_RRSeatBeltIND	E22	Rear Right Seat Belt Indicator output	Low	

	O_AVTail	D12	AV Tail output	Low	AV Module
	O_ATMSol	E20	ATM Solenoid output	Low	
	O_HeadLampHiRLY	D7	Head Lamp high Relay output	Low	
	O_TurnSigRRRH	E4	Turn signal rear right signal output	High	
	O_RpadOffIND	D16	RPAS off Indicator output	High	
	O_TurnSigRRLH	E5	Turn signal rear left signal output	High	
	O_TurnSigFRRH	E6	Turn signal front right signal output	High	
	O_TurnSigFRLH	E7	Turn signal front left signal output	High	
	O_InteriorLamp	E13	Interior Lamp autocut signal output	High	
	O_StaticBend_LH	E14	Static Bending left signal output	High	
	O_HeadLampHigh_LH(4DR)				
	O_StaticBend_RH	E2	Static bending right signal output	High	
	O_HeadLampHigh_RH(4DR)				
	O_RoomLamp	D3	Room Lamp output	PWM	Low Side
	O_Dedicated_DRL	E25	Dedicated DRL signal output	High	
Power	V_TurnPower	E3	Turn signal IPS power		
	V_StaticBend	E1	Static bending IPS power		
	V_HeadLampHigh(4DR)				
	V_InteriorLamp	E12	Interior Lamp autocut IPS power		
	V_Dedicated_DRL	E26	Dedicated DRL IPS power		

Body Electrical System > BCM (Body Control Module) > Body Control Module (BCM) > Schematic Diagrams

Circuit Diagram


E24
E23
E22
D2
A3
A2
A1
A18
A17
B1
B11
B8
C3
A7
B9
C4
A12
E19
A10
A11
C2
C1
A8
A9
E8
E9
E10
B12
MultiFunction
C11
E20
D5
E12
E13
VanityLamp
MapLamp
Glove Box Lamp
D3
D10
E16
D15
E3
E7
E5
E6
E4
D19
D20
D18
D21
D9
D8
D1

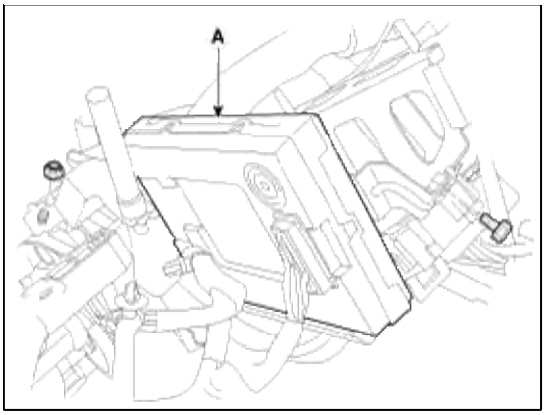


Body Electrical System > BCM (Body Control Module) > Body Control Module (BCM) > Description and Operation

BCM Overview

The Body Control Module (A) supplies vehicle occupants with visual and audible information and controls various vehicle functions.

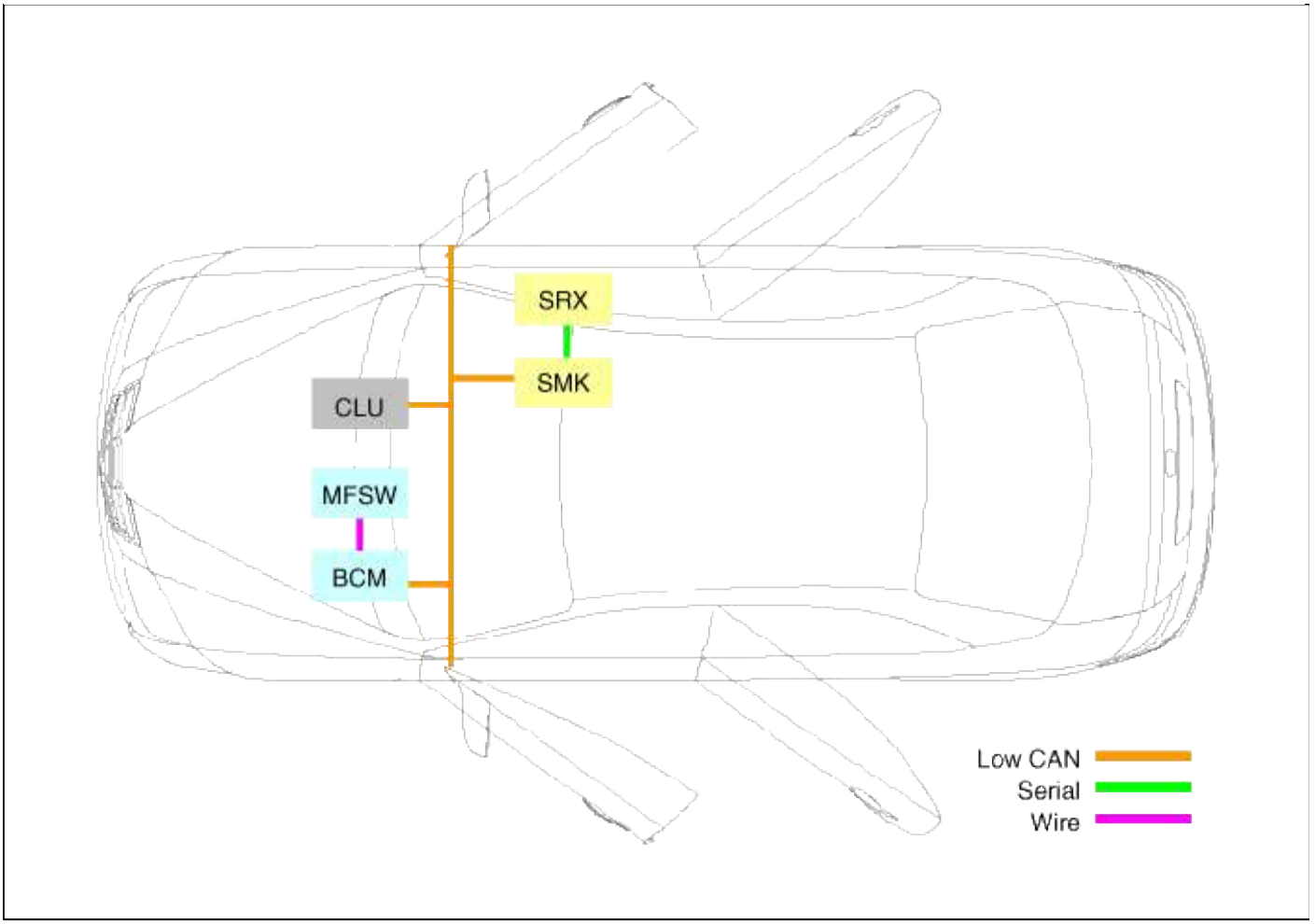
To provide and receive information, the module is interfaced to the vehicle's CAN bus communications network.



The BCM provides the following features :

- Door lock control
- Burglar alarm control
- Decayed room lamp control
- Tailgate open control
- Warning(Buzzer and indicator) control
- Wiper control (Front/ Rear)
- Lamp control (Tail, Head Lamp, Fog lamp, Room lamp, Rear Fog lamp, DRL, SBL Etc.)
- Defroster cotrol
- Burglar Alarm Horn control
- Panic control
- MTS control
- RPAS control

Communication Network



Function

1. Door lock control
   A. Central Door Lock/Unlock Switch Control Function
   B. Centrol Door Lock/Unlock Mechanical Key(Door Key) Control Function
   C. Doors Lock/Unlock by RKE
   D. Doors Lock/Unlock by SMK
   E. Doors Relock by ATWS Function
   F. Doors Lock/Unlock by Auto Door
   G. Doors Unlock by Crash
   H. Doors Unlock by Key Reminder
   I. Dead lock/unlock Function
   J. RKE Door Lock/Unlocking Function
   K. Burglar Alarm Relock Door Lock Control Function
   L. SMK Door Lock/Unlocking Function
   M. Central Door Lock/Unlock Button Control Function
   N. Crash Unlock Control Function
   O. Door Lock by Shift-Lever
   P. Door Lock by Vehicle Speed
   Q. Door Unlock by Shift-Lever
   R. Door Unlock by Key Off
   S. Key Reminder Unlock Function
   T. Dead Lock/Unlock Function

U. Central Unlocking by EC Unlock Control Function
V. Priority of Door Lock System
2. Burglar alarm control
A. Tailgate Type Burglar Alarm Control Function
B. Lock Confirmation Function
C. Chirp Sound Control Function
D. Horn Answer Back Control Function
3. Tailgate open control
A. Tailgate Release Control Function
B. Tailgate Status Indicator Function
4. Warning control
A. SMKWarning Function
B. SBW - SBSW Function
C. SBR - NADRV Function
D. SBR - NAAST Function
E. SBR - EC DRV Function
F. SBR - EC AST Function
G. SBR - Rear Function
H. Driver Seatbelt Indicator Output Control Function
I. Driver Seatbelt Indicator Output Control Function
J. Assistant Seatbelt Indicator Output Control Function
K. Rear Seatbelt Indicator Output Control Function
L. Key Reminder Warning(Key Operated Warning) Function
M. Parking Brake Warning Function
N. Internal Buzzer Output Control Function
O. Chirp Sound Option Control Function
P. External Buzzer Output Control Function
Q. Alarm Horn Control Function
R. RPAS Off Mode Indicator Control Function
S. RPAS Initialization Function
T. RPAS Warning Sound Control Function
5. Wiper control
A. Front Wiper Mist Control Function
B. Front Wiper Intermittent Control Function
C. Front Wiper Washer Control Function
D. Front Wiper Washer Control Function
E. Rear Wiper On Switch Control
F. Rear Washer Wiper Control
G. Rear Wiper Intermittent Control

6. Lamp control
   A. Tail Lamp by Switch Control Function
   B. Tail Lamp by Auto Light Control Function
   C. Tail Lamp by Escort Control Function
   D. Tail Lamp by Welcome Control Function
   E. Tail Lamp Autocut Control Function
   F. Output control of Tail Lamp
   G. Head Lamp Low by Switch Control Function
   H. Head Lamp Low by Escort Control Function
   I. Head Lamp Low by Welcome Control Function
   J. Head Lamp Low by Auto Light Control Function
   K. Head Lamp High by Switch Control Function
   L. Head Lamp High and Low by Passing Switch Control Function
   M. Output control of Head Lamp Low
   N. Output control of Head Lamp High
   O. Output control of Head Lamp High Indicator
   P. EC DRL Lamp Function
   Q. Tail Lamp Control by Auto light Mode Control Function
   R. Head Lamp Low Control by Auto light Mode Control Function
   S. Front Fog Lamp by Switch Control Function
   T. Rear Fog Lamp by Switch Control Function
   U. Room Lamp On / Off / Decaying Control Function
   V. Static Bending lamp Control Function
7. Timer control
   A. Rear Defogger Control Function
   B. Power Window Main Timer Control Function
8. Panic control
   A. Panic Alarm Control Function

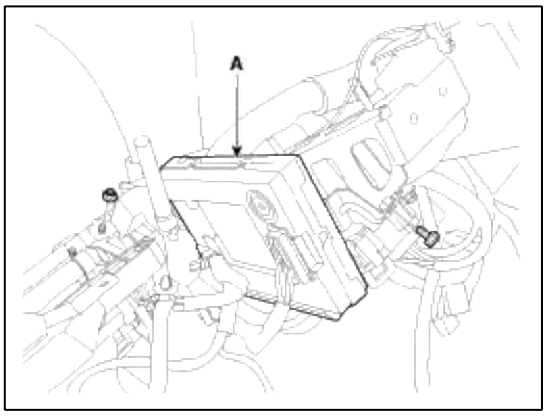
Body Electrical System > BCM (Body Control Module) > Body Control Module (BCM) > Repair procedures

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad lower panel.
   (Refer to the BD group - "Crash pad")

> NOTE
>
> Take care not to scratch the crash pad and related parts.

3. Disconnect the connectors and remove the BCM (A) after loosening the nut and the bolt.

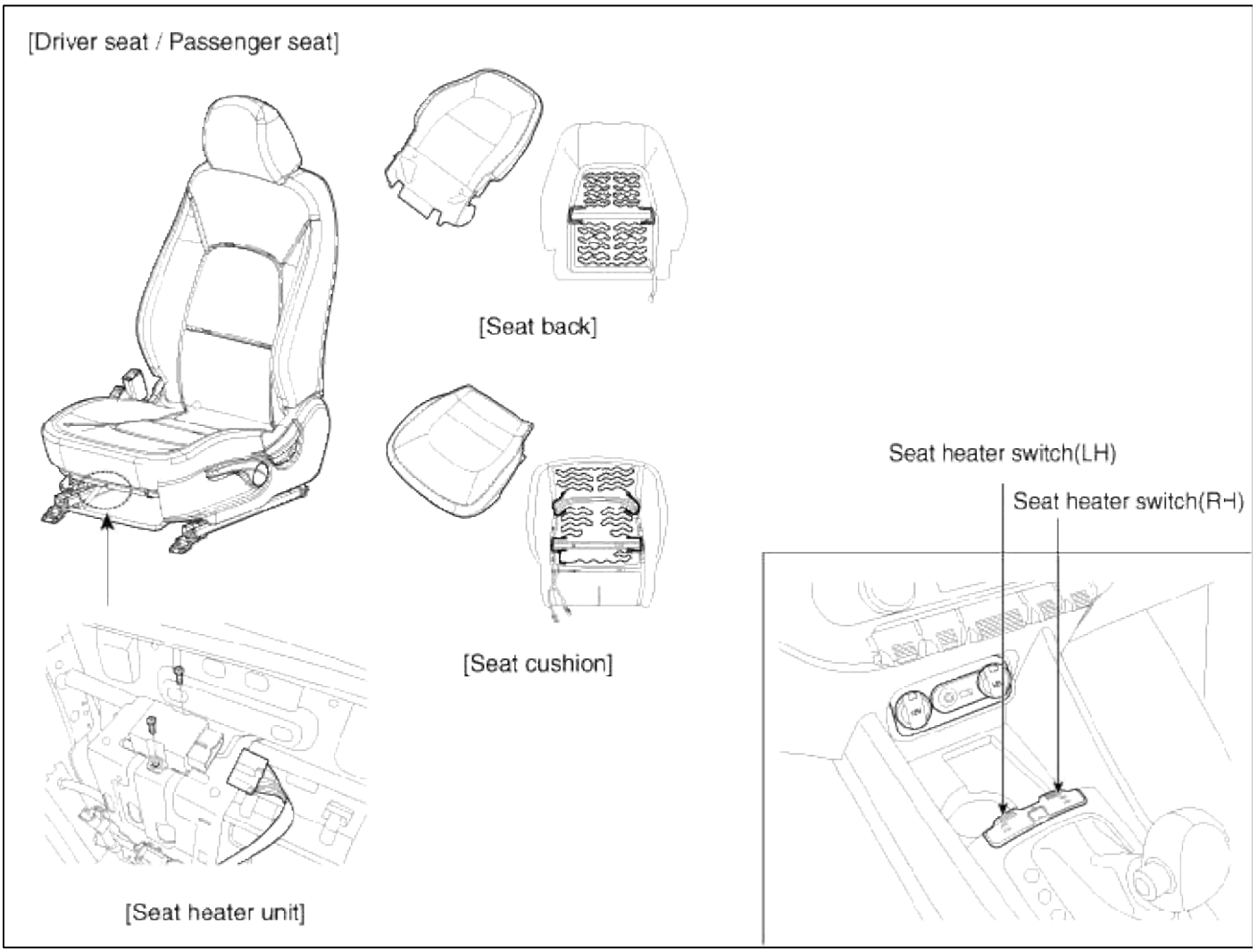


Installation

1. Install the BCM.
2. Install the crash pad lower panel.

Body Electrical System > Seat Electrical > Seat Heater > Components and Components Location

Components



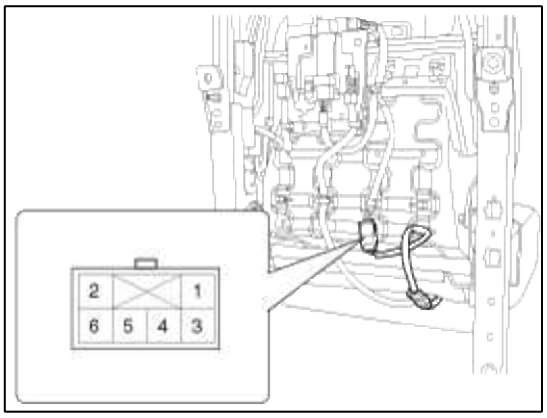
Body Electrical System > Seat Electrical > Seat Heater > Repair procedures

Inspection

Driver seat and Passenger seat

1. Check for continuity and measure the resistance between terminals.

[Cushion]



Pin No.	Description	Pin No.	Description
1	Heater(-)	4	NTC -
2	Heater(+)	5	NTC +

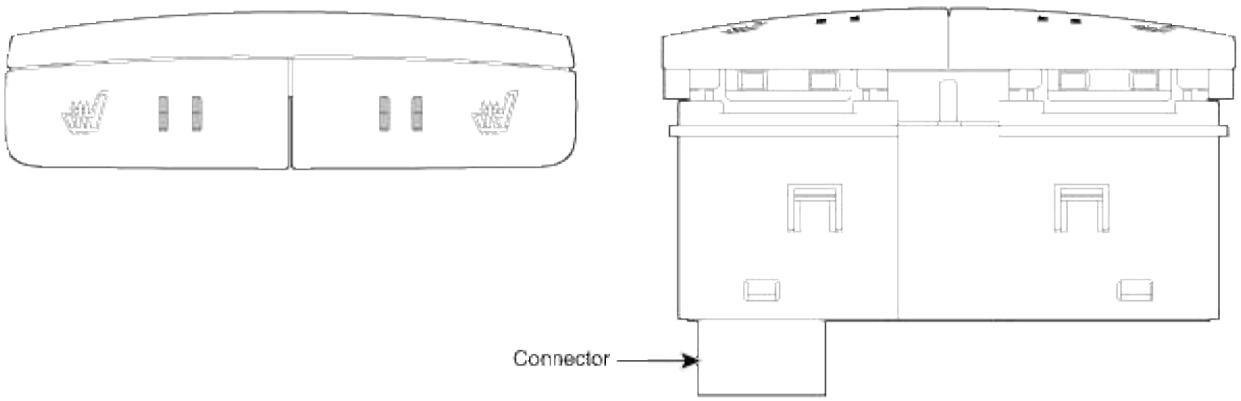
Average Max. temperature
- Cushion : HIGH : 42 ± 2°C / LOW : 39 ± 2°C
- Back : HIGH : 52 ± 2°C / LOW : 46 ± 2°C

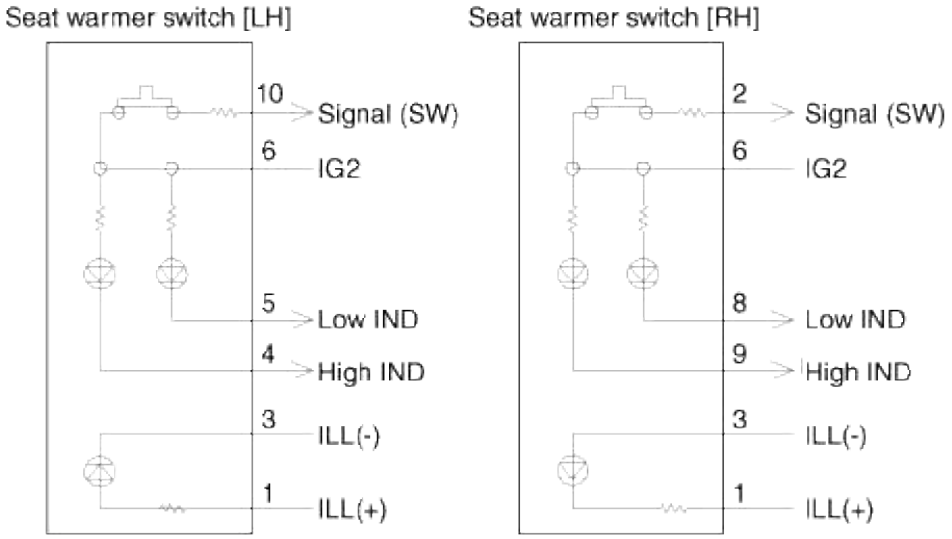
2. Operate the seat heater after connecting the connector, and then check the thermostat by measuring the temperature of seat surface.

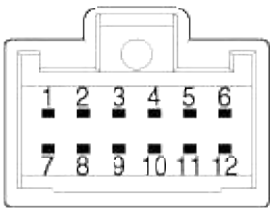
Standard value (Fabric / Leather)
- Cushion : 1.18Ω ± 10%
- Back : 1.13Ω ± 10%
- Set : 2.31Ω ± 10%

Body Electrical System > Seat Electrical > Seat Heater Switch > Schematic Diagrams

Schematic Diagram







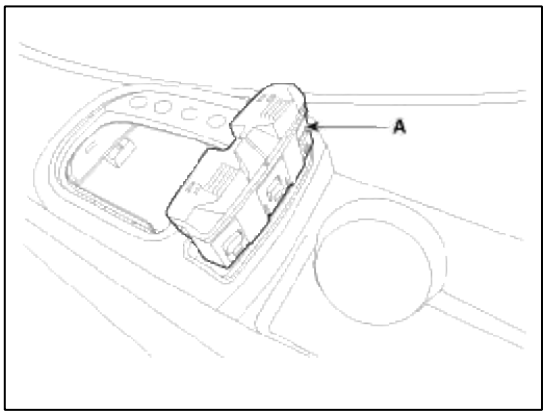
Connector A		Connector B	
No.	Description	No.	Description
1	Illumination (-)	7	-
2	Seat warmer switch (RH)	8	Seat warmer low indicator (RH)
3	Illumination (+)	9	Seat warmer high indicator (RH)
4	Seat warmer low indicator (LH)	10	Seat warmer switch (RH)
5	Seat warmer high indicator (LH)	11	-
6	Ignition 2	12	-

Body Electrical System > Seat Electrical > Seat Heater Switch > Repair procedures

Removal

1. Disconnect the battery (-) terminal.
2. Remove the console assembly.
   (Refer to the BD group - "Console")

3. Remove the seat heater switch (A) and disconnect the connector.



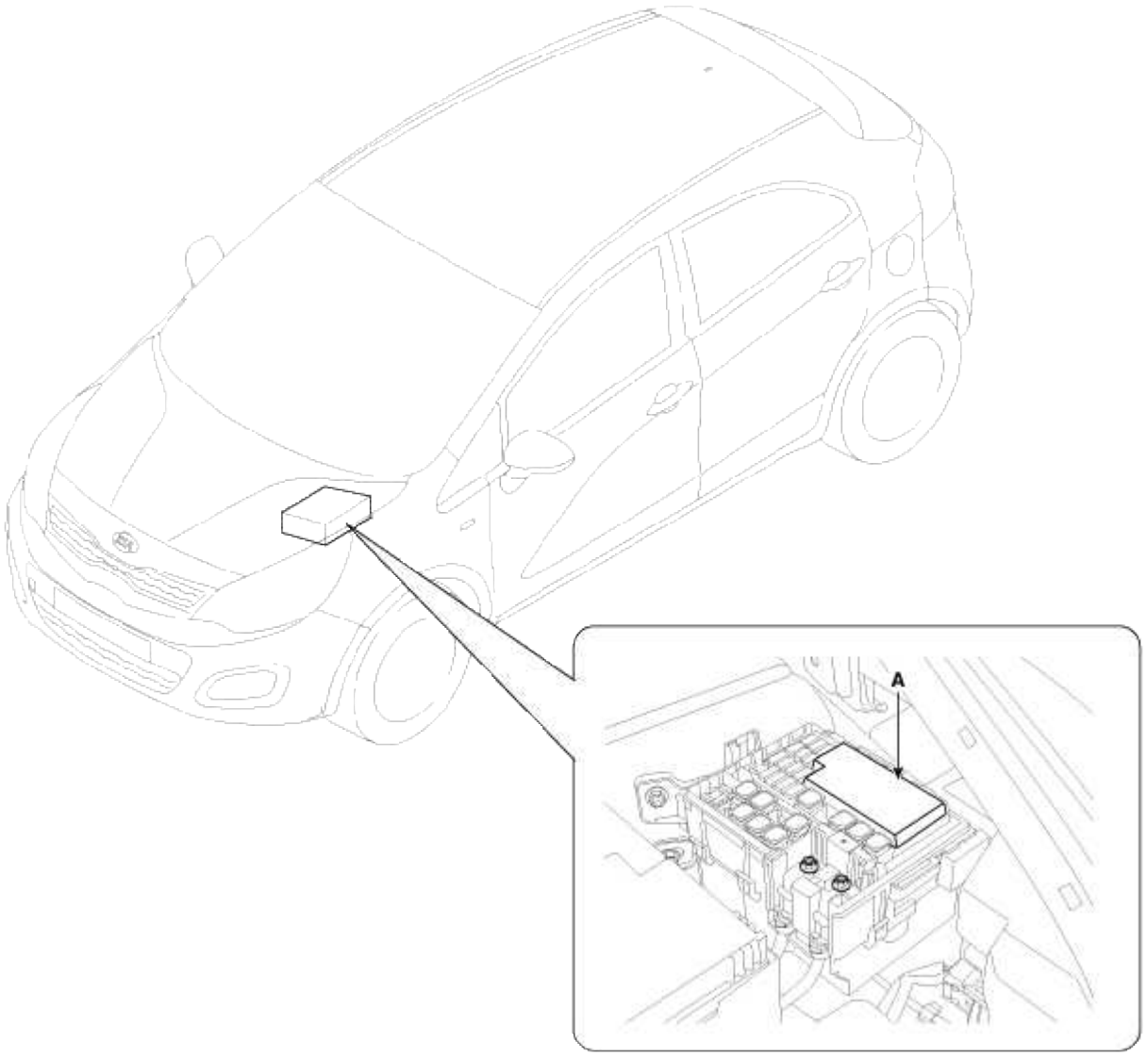
Installation

1. Install the seat heater switch.
2. Install the console assembly.
3. Connect the battery (-) terminal.

Body Electrical System > Fuses And Relays > Components and Components Location

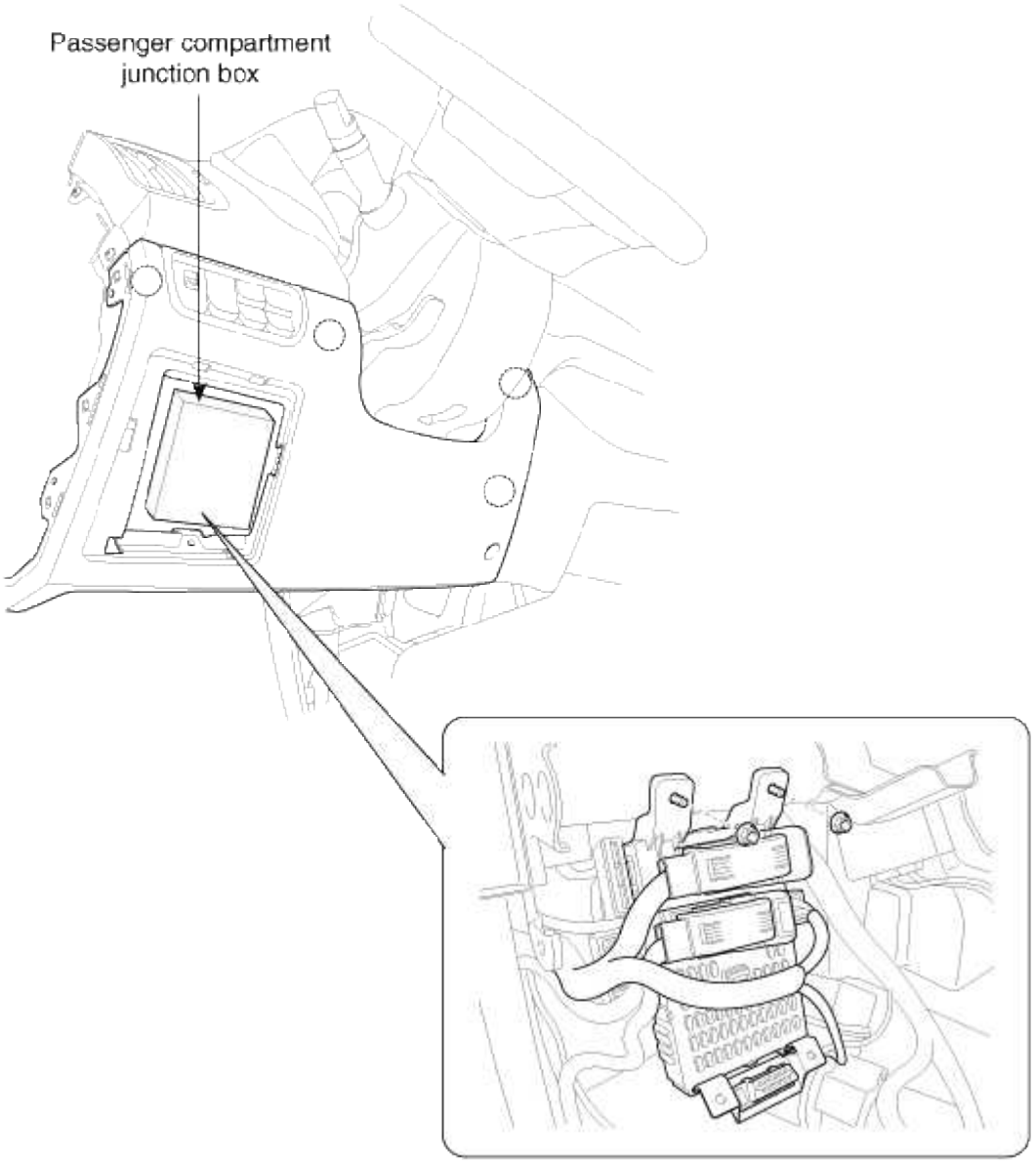
Component Location

[Engine Room Relay Box]



1. PCB fuse & relay box (Head lamp low/ hi, Fuel pump #1, HAC, Engine control, Front wiper, Rain sensor, Blower, Cooling fan low/ hi, Horn, Buglar alarm horn, Start relay)

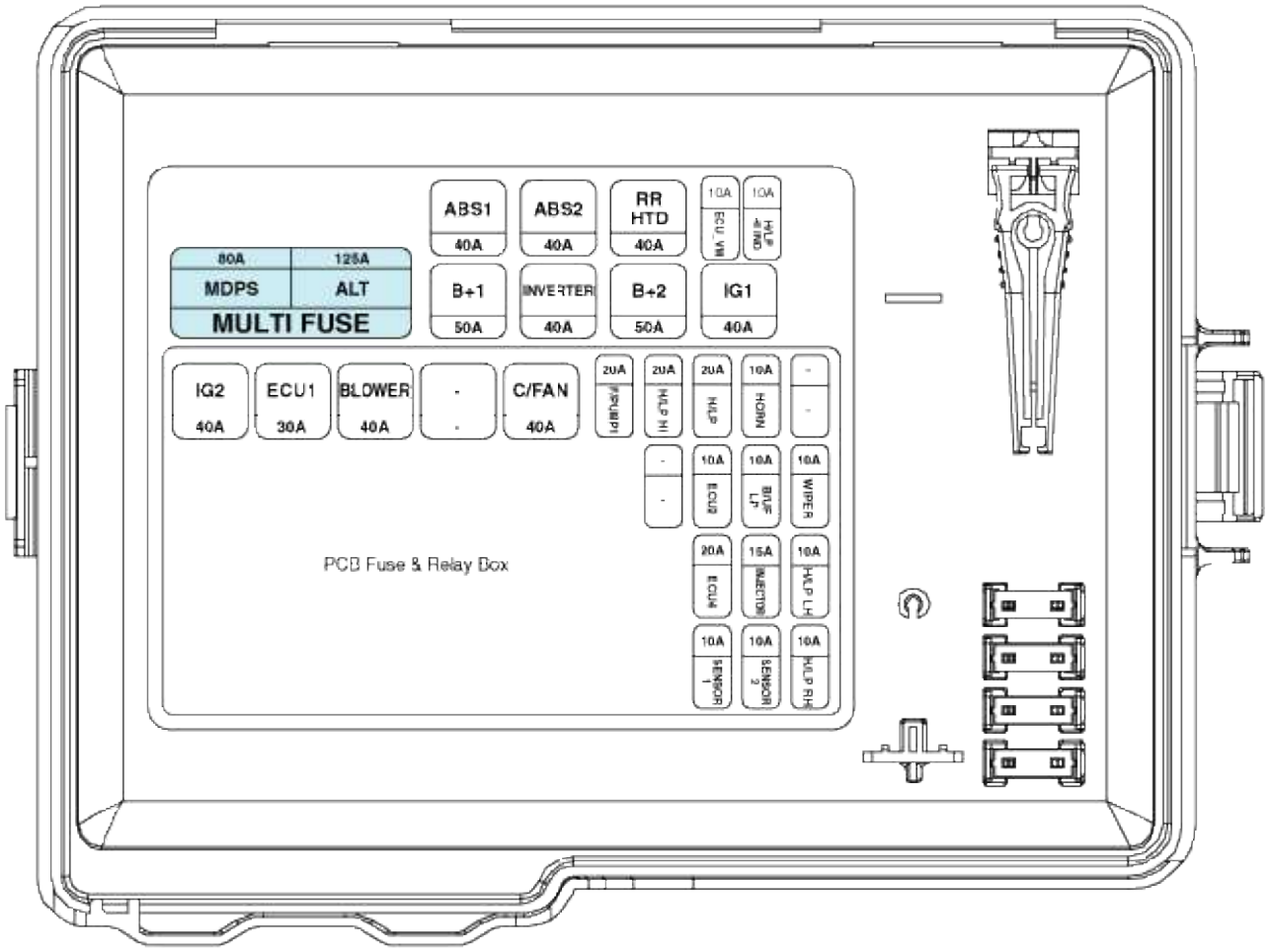
[Interior Junction Box]



Body Electrical System > Fuses And Relays > Relay Box (Engine Compartment) > Components and Components Location

Components

E/R JUNCTION BOX



※ USE THE DESIGNATED FUSE & RELAY ONLY

Circuit

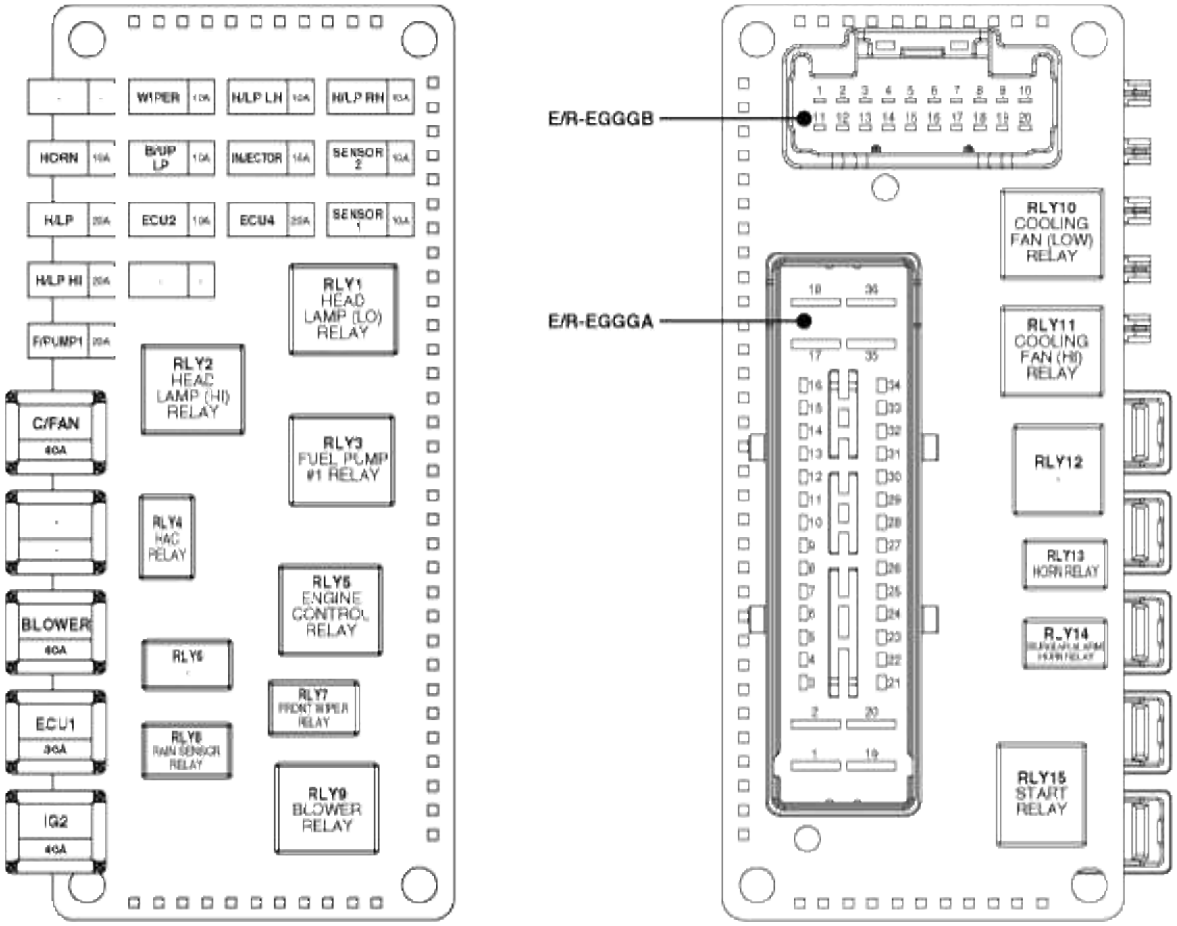
Fuse Name		(A)	Circuit Protected
MULTI FUSE	MDPS	80A	EPS Control Mocule
	ALT	125A	Alternator
FUSE	B+1	50A	I/P Junction Box (Power Connector Fuse : ROOM LP 10A / AUDIO 20A, Fuse : FOG LP FRT 15A / MODULE 1 10A / STOP LP 15A, Tail Lamp Relay)
	INVERTER	40A	Inverter
	B+2	50A	I/P Junction Box (Fuse : HAZARD 15A / PDM 1 25A / PDM 2 10A / SUNROOF 15A / DR LOCK 20A / SAFETY POWER WINDOW 25A / S/HEATER 2 15A, FOLD'G MIRR 10A / Power Window Relay)
	IG1	40A	With Smart Key - PDM Relay Box (ESCL (ACC) Relay, ESCL (IG1) Relay) W/O Smart Key - Ignition Switch
	ABS1	40A	ESC Module, Multipurpose Check Connector
	ABS2	40A	ESC Module
	RR HTD	40A	I/P Junction Box (Rear Defogger Relay)
	ECU_VM	10A	PCM
	H/LP HI IND	10A	Instrument Cluster

※ USE THE DESIGNATED FUSE & RELAY ONLY

PCB FUSE & RELAY BOX

< FRONT >

< REAR >



NO.	RELAY NAME	TYPE
1	HEAD LAMP (LO) RELAY	PCB MICRO
2	HEAD LAMP (HI) RELAY	PCB MICRO
3	FUEL PUMP #1 RELAY	PCB MICRO
4	HAC RELAY	PCB MINI
5	ENGINE CONTROL RELAY	PCB MICRO
6	-	-
7	FRONT WIPER RELAY	PCB MINI
8	RAIN SENSOR RELAY	PCB MINI
9	BLOWER RELAY	PCB MICRO
10	COOLING FAN (LOW) RELAY	PCB MICRO
11	COOLING FAN (HI) RELAY	PCB MICRO
12	-	-
13	HORN RELAY	PCB MINI
14	BUGLAR ALARM HORN RELAY	PCB MINI
15	START RELAY	PCB MICRO

※ USE THE DESIGNATED FUSE & RELAY ONLY

PCB FUSE & RELAY BOX

Circuit

Fuse Name	(A)	Circuit Protected
IG2	40A	PCB Fuse & Relay Box (Start Relay), W/O Smart Key - Ignition Switch, With Smart Key - PDM Relay Box (ESCL (IG2) Relay)
ECU1	30A	PCB Fuse & Relay Box (Engine Control Relay, ECU2 10A)
BLOWER	40A	PCB Fuse & Relay Box (Blower Relay)
-	-	-
C/FAN	40A	PCB Fuse & Relay Box (Cooling Fan (Low) Relay, Cooling Fan (Hi) Relay)
F/PUMP1	20A	PCB Fuse & Relay Box (Fuel Pump #1 Relay)
H/LP HI	20A	PCB Fuse & Relay Box (Head Lamp (HI) Relay)
H/LP	20A	PCB Fuse & Relay Box (Head Lamp (LO) Relay)
HORN	10A	PCB Fuse & Relay Box (Horn Relay, Burglar Alarm Horn Relay)
-	-	-
-	-	-
ECU2	10A	M/T - ECM, A/T - E/R Junction Box (ECU_VM 10A)
B/UP LP	10A	A/T - PCM, Transaxle Range Switch
WIPER	10A	ECM/PCM, Rain Sensor
ECU4	20A	ECM/PCM
INJECTOR	15A	ECM/PCM, PCB Fuse & Relay Box (Fuel Pump #1 Relay)
H/LP LH	10A	Head Lamp LH
SENSOR1	10A	Purge Control Solenoid Valve, Variable Intake Solenoid Valve, Canister Close Valve, PCB Fuse & Relay Box (Cooling Fan (Low) Relay, Cooling Fan (Hi) Relay)
SENSOR2	10A	Oil Control Valve #1/#2, Oxygen Sensor (Up/Down)
H/LP RH	10A	Head Lamp RH

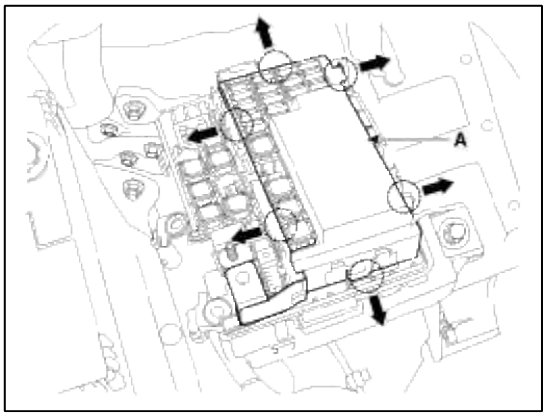
※ USE THE DESIGNATED FUSE & RELAY ONLY

Body Electrical System > Fuses And Relays > Relay Box (Engine Compartment) > Repair procedures

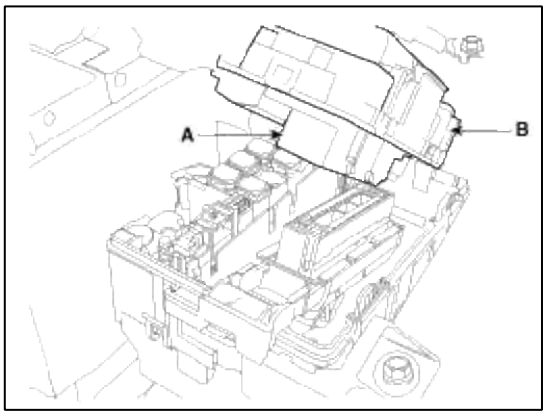
Inspection

Replacement of EMS box

1. Disconnect the negative (-) battery terminal.
2. Push hooks in the engine room relay box out to the arrow direction and put up the EMS box assembly (A).



3. Disconnect the connector (A) and remove the EMS box assembly (B).

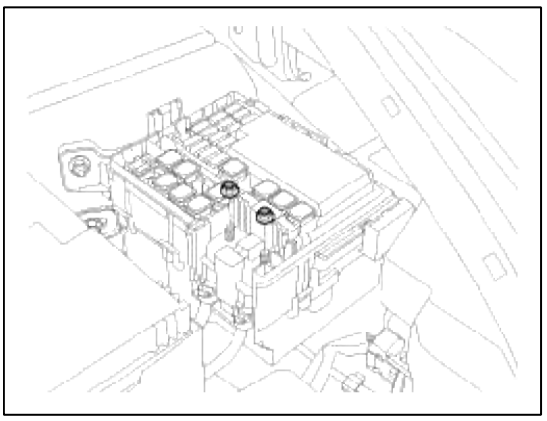


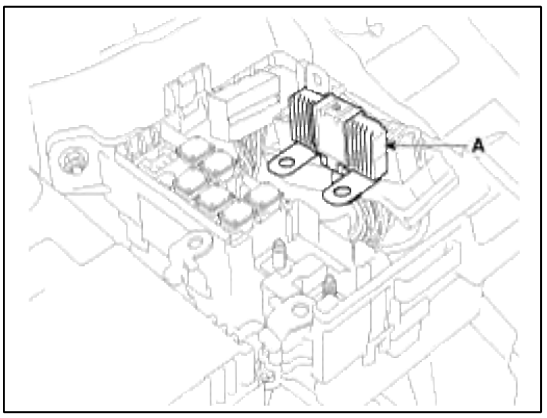
Fuse Inspection

1. Be sure there is no play in the fuse holders, and that the fuses are held securely.
2. Are the fuse capacities for each circuit correct?
3. Are there any blown fuses?
   If a fuse is to be replaced, be sure to use a new fuse of the same capacity. Always determine why the fuse blew first and completely eliminate the problem before installing a new fuse.

Multi Fuse

Multi Fuse is for optimizing the engine room package.





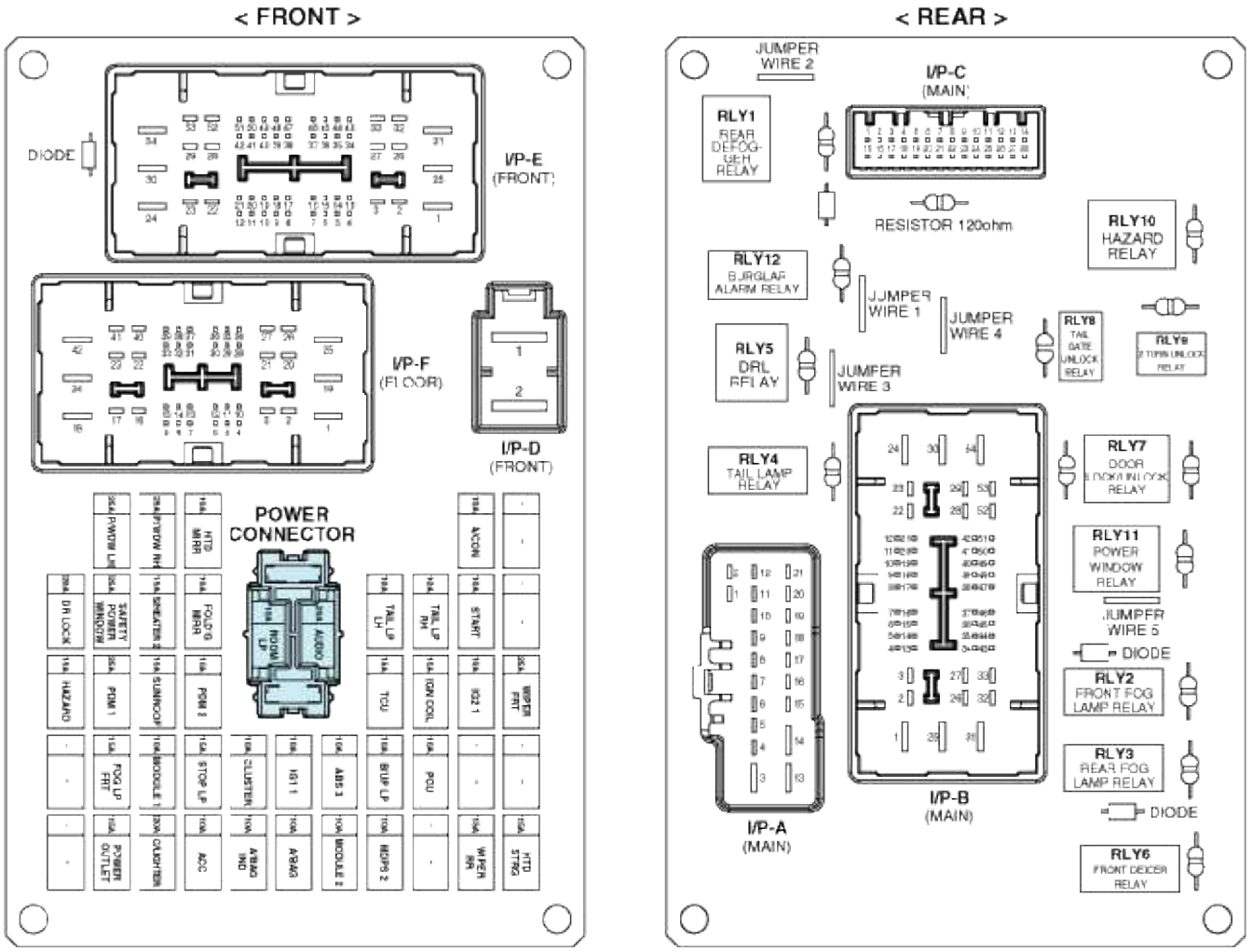
NOTE

- Multi fuse (A) is needed to replace entirely when there is damage to only one fuse.
- When replace the multi fuse, refer to the "Engine compartment - component location" diagram exactly.
- Use the multi fuse capacities for each circuit correctly.

Body Electrical System > Fuses And Relays > Relay Box (Passenger Compartment) > Components and Components Location

Components

I/P JUNCTION BOX



NO.	NAME	TYPE
1	REAR DEFOGGER RELAY	PCB MINI
2	FRONT FOG LAMP RELAY	PCB MICRO
3	REAR FOG LAMP RELAY	PCB MICRO
4	TAIL LAMP RELAY	PCB MICRO
5	DRL RELAY	-
6	FRONT DEICER RELAY	-
7	DOOR LOCK/ UNLOCK RELAY	TWIN PCB MICRO
8	TAILGATE UNLOCK RELAY	PCB MICRO
9	2 TURN UNLOCK RELAY	PCB MICRO
10	HAZARD RELAY	-
11	POWER WINDOW RELAY	PCB MINI
12	BURGLAR ALARM RELAY	PCB MICRO

※ USE THE DESIGNATED FUSE & RELAY ONLY

I/P JUNCTION BOX

Fuse Name	(A)	Circuit Protected
-	-	-
POWER OUTLET	15A	Power Outlet
CIGLIGHTER	20A	Cigarette Lighter
ACC	10A	Front Map Lamp, Power Outside Mirror Switch, BCM, Low DC-DC Convertor, Smart Key Control Module, Audio, A/V & Navigation Head Unit, Digital Clock
A/BAG IND	10A	Instrument Cluster
A/BAG	10A	SBR PAB Indicator, SRS Control Module Passenger Weight Classification Sensor
MODULE 2	10A	BCM
MDPS 2	10A	EPS Control Module
-	-	-
WIPER RR	15A	Multifunction Switch, Rear Wiper Relay, Rear Wiper Motor
HTD STRG	15A	Steering Wheel Heater
FOG LP RR	10A	-
FOG LP FRT	15A	Front Fog Lamp Relay
MODULE 1	10A	ATM Shift Lever Switch, Door Warning Switch
STOP LP	15A	Data Link Connector, Smart Key Control Module, Stop Lamp Switch Stop Lamp Relay, PCB Fuse & Relay Box (HAC Relay)
CLUSTER	10A	Audio, BCM, ATM Shift Lever ILL., Crash Pad Switch Instrument Cluster, Tire Pressure Monitoring Module
IG1 1	10A	Multipurpose Check Connector, Driver CCS Seat Warmer Module Passenger Seat Warmer Module With ISG : Crash Pad Switch Low DC-DC Convertor
ABS 3	10A	Crash Pad Switch, ESC Module PCB Fuse & Relay Box (HAC Relay)
BACK LP	10A	Back-Up Lamp Switch
PCU	10A	Vehicle Speed Sensor, Stop Lamp Switch, Inverter A/C Control Module
-	-	-
-	-	-
HAZARD	15A	Hazard Switch, BCM
PDM 1	25A	Smart Key Control Module
SUNROOF	15A	Sunroof Motor

Fuse Name	(A)	Circuit Protected
PDM 2	10A	Immobilizer Module, Start/Stop Button Switch, Smart Key Control Module
TCU	15A	Smart Key Control Module, Immobilizer Module, ECM/PCM, Transaxle Range Switch
IGN COIL	15A	Ignition Coil #1/#2/#3/#4, Condenser
IG2 1	10A	BCM, Smart Key Control Module, Driver CCS Seat Warmer Module Cluster Ionizer, Rain Sensor, A/C Control Module, Sunroof Motor PCB Fuse & Relay Box (Blower Relay, Head Lamp (HI) Relay, Fuel Pump #1 Relay)
WIPER FRT	25A	Multifunction Switch, Front Wiper Motor PCB Fuse & Relay Box (Rain Sensor Relay, Front Wiper Relay)
DOOR LOCK	20A	Door Lock/Unlock Relay, Tail Gate Unlock Relay, Two Turn Unlock Relay
SAFETY POWER WINDOW	25A	Driver Safety Power Window Module
S/HEATER 2	15A	Seat Warmer Switch, Driver CCS Seat Warmer Module, Passenger Seat Warmer Module
FOLD'G MIRR	10A	Power Outside Mirror Switch
ROOM LP	10A	BCM, Door Warning Switch, Tire Pressure Monitoring Module Instrument Cluster, Digital Clock, A/C Control Module Luggage Lamp
AUDIO	20A	With ISG : Low DC-DC Convertor W/O ISG : Audio, A/V & Navigation Head Unit
TAIL LH	10A	Head Lamp LH, License Lamp Rear Combination Lamp (IN/OUT) LH
TAIL RH	10A	Head Lamp RH, License Lamp, ILL. (+), Rear Combination Lamp (IN/OUT) RH
START	10A	With Burglar Alarm : Burglar Alarm Relay W/O Burglar Alarm : Transaxle Range Switch (A/T), Smart Key Control Module (M/T), Ignition Lock Switch (M/T), ECM (M/T), PCB Fuse & Relay Box (Start Relay) (M/T)
-	-	-
P/WDW LH	25A	Power Window Main Switch, Rear Power Window Switch LH Driver Safety Power Window Module
P/WDW RH	25A	Power Window Main Switch, Rear Power Window Switch RH Passenger Power Window Switch
HTD MIRR	10A	ECM/PCM, A/C Control Module Driver/Passenger Power Outside Mirror
A/CON	10A	A/C Control Module
BLOWER	10A	-

: POWER CONNECTOR

※ USE THE DESIGNATED FUSE & RELAY ONLY

Body Electrical System > Fuses And Relays > Relay Box (Passenger Compartment) > Repair procedures

Fuse Inspection

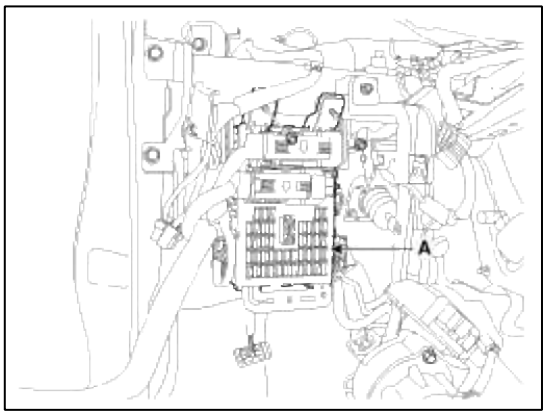
1. Be sure there is no play in the fuse holders, and that the fuses are held securely.
2. Are the fuse capacities for each circuit correct?
3. Are there any blown fuses?
   If a fuse is to be replaced, be sure to use a new fuse of the same capacity. Always determine why the fuse blew first and completely eliminate the problem before installing a new fuse.

Removal

Passenger Compartment Junction Box

1. Disconnect the negative(-) battery terminal.
2. Remove the crash pad lower panel.
   (Refer to the BD group - "Crash pad")
3. Disconnect the connectors from the fuse side of the interior junction box.

4. Remove the interior junction box(A) after loosening the mounting nuts (2EA).



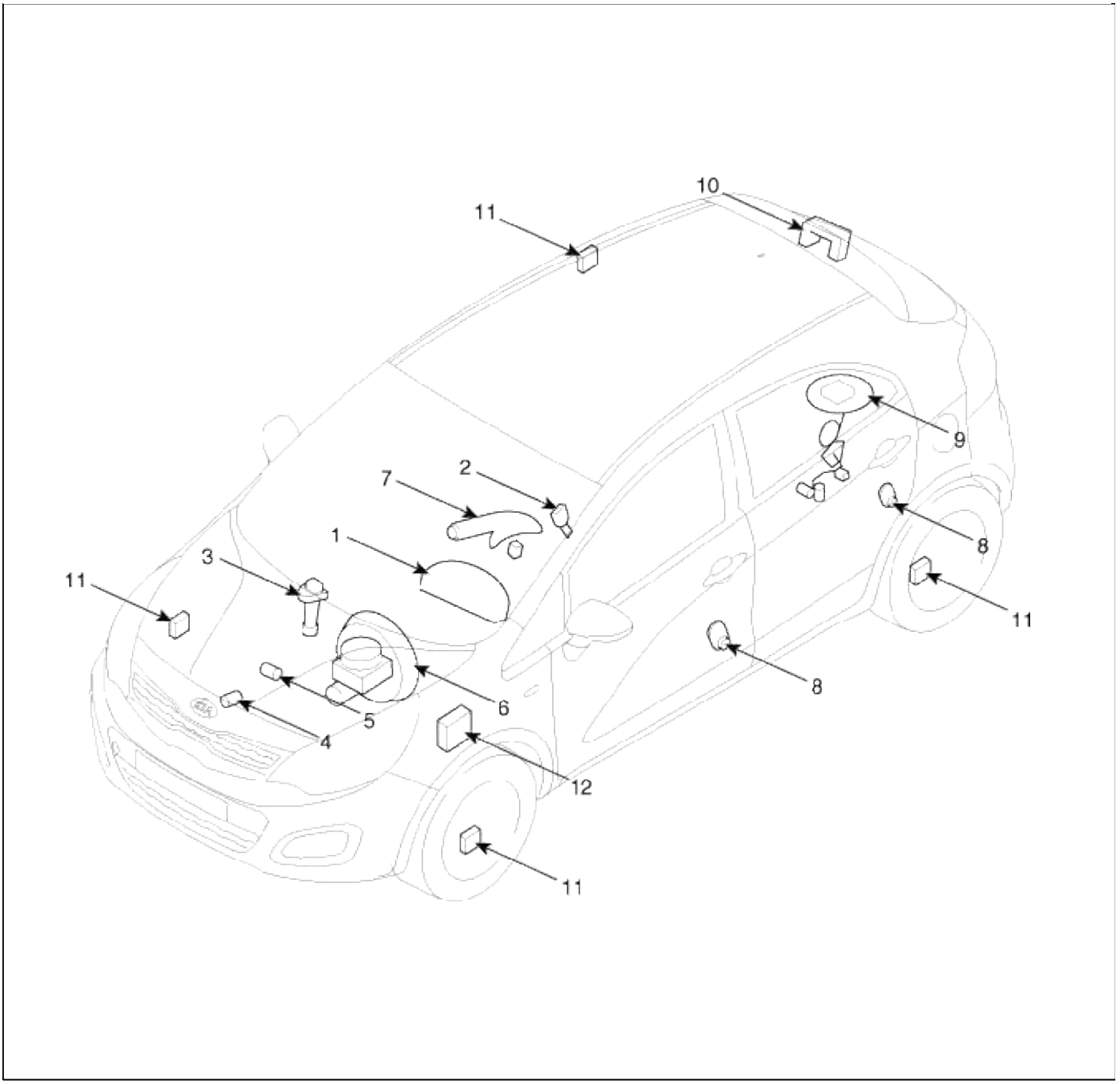
5. Disconnect the connectors from the back side of the smart junction box.

Installation

1. Install the interior junction box.
2. Install the crash pad lower panel.
3. Check that all system operates normally.

Body Electrical System > Indicators And Gauges > Components and Components Location

Component Location



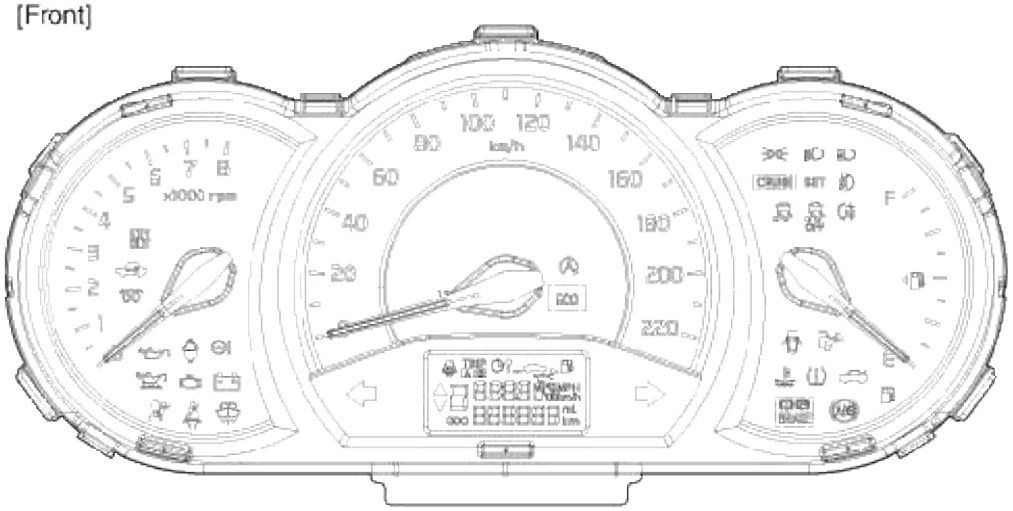
1. Instrument cluster assembly 2. Seat belt switch 3. Vehicle speed sensor 4. Engine coolant temperature sender 5. Oil pressure switch 6. Brake fluid level warning switch	7. Parking brake switch 8. Door switch 9. Fuel gauge sender 10. Tailgate open switch 11. Wheel speed sensor 12. ABS ECU

Body Electrical System > Indicators And Gauges > Instrument Cluster > Components and Components Location

Components

[Standard]

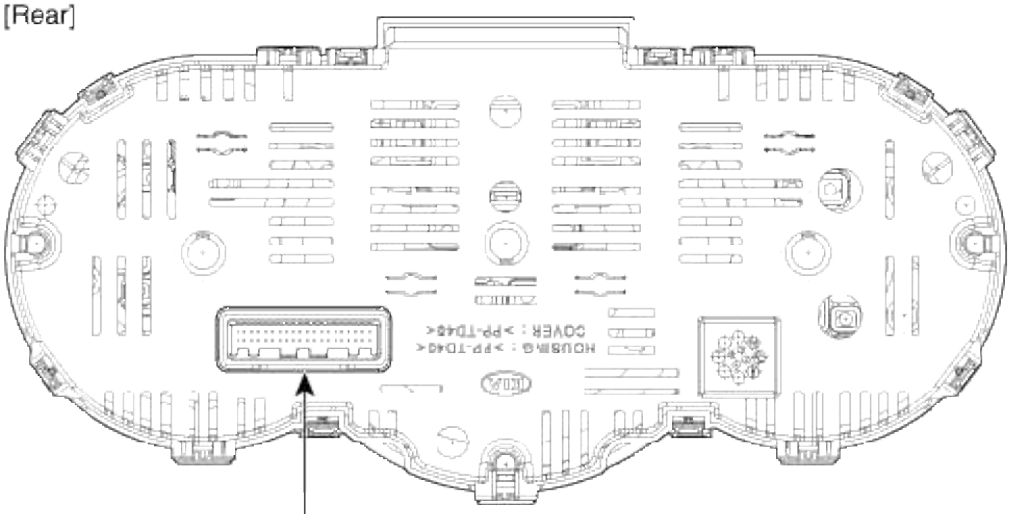
[Front]

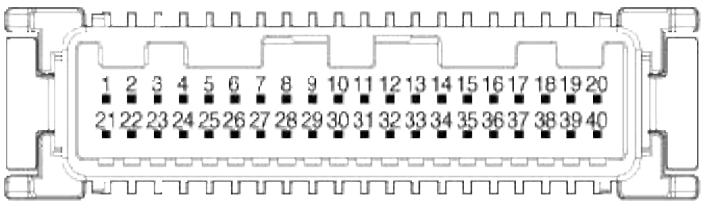


[USA]

[CANADA]

[Rear]

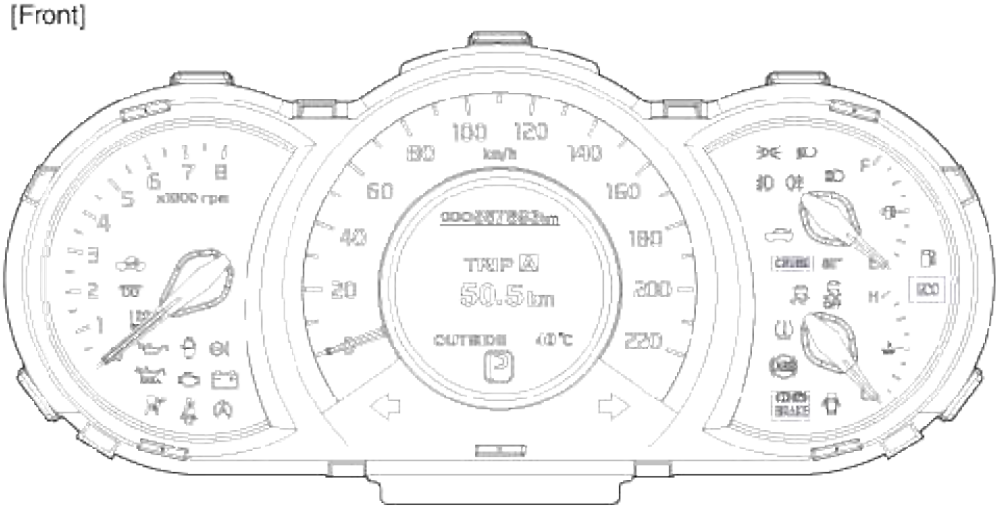




Pin No.	Description	Pin No.	Description
1	Cluster ground	21	S ground
2	P ground	22	Fuel (-)
3	Rheostat output	23	-
4	Rheostat detent output	24	DC-DC (ISG)
5	ALT L output	25	Battery (+)
6	High beam (+)	26	Ignition 1
7	4P output	27	Speed
8	AT P output	28	-
9	AT N output	29	C_CAN_HIGH
10	AT D output	30	C_CAN_LOW
11	Fuel input	31	B_CAN_LOW
12	-	32	B_CAN_HIGH
13	Parking brake	33	Rheostat up
14	Airbag supply	34	Rheostat down
15	Check engine	35	Cluster signal
16	Water seperator	36	Active ECO
17	-	37	-
18	Immobilizer	38	Oil pressure
19	Key out	39	Battery charge
20	Wahser low	40	Illumination (+)

[Supervision]

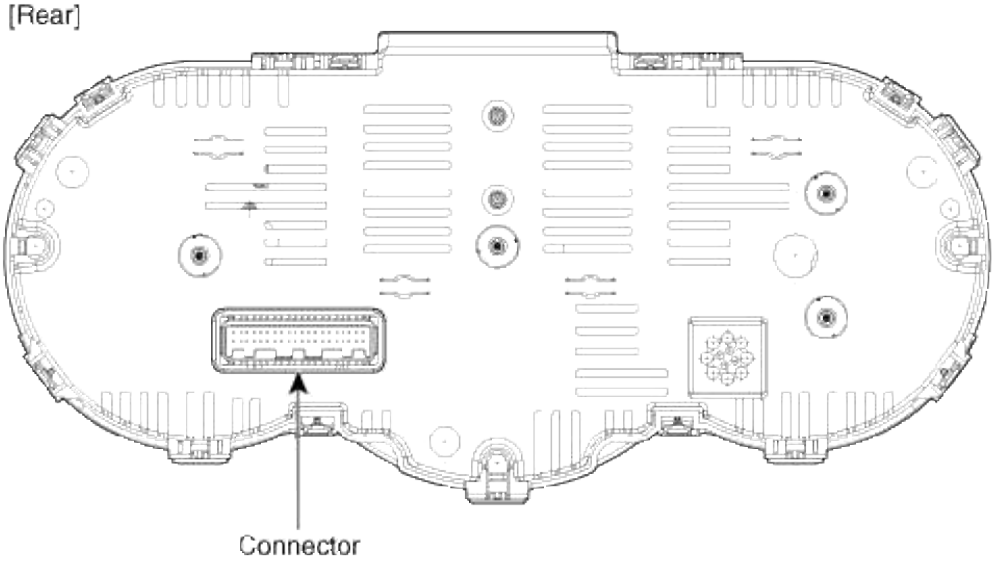
[Front]

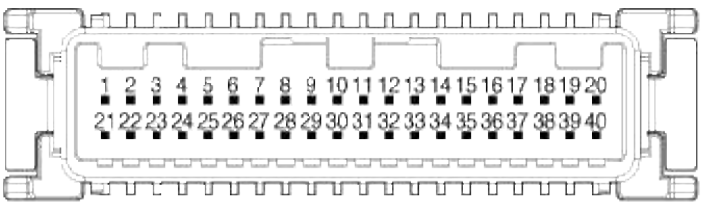


[USA]

[CANADA]

[Rear]



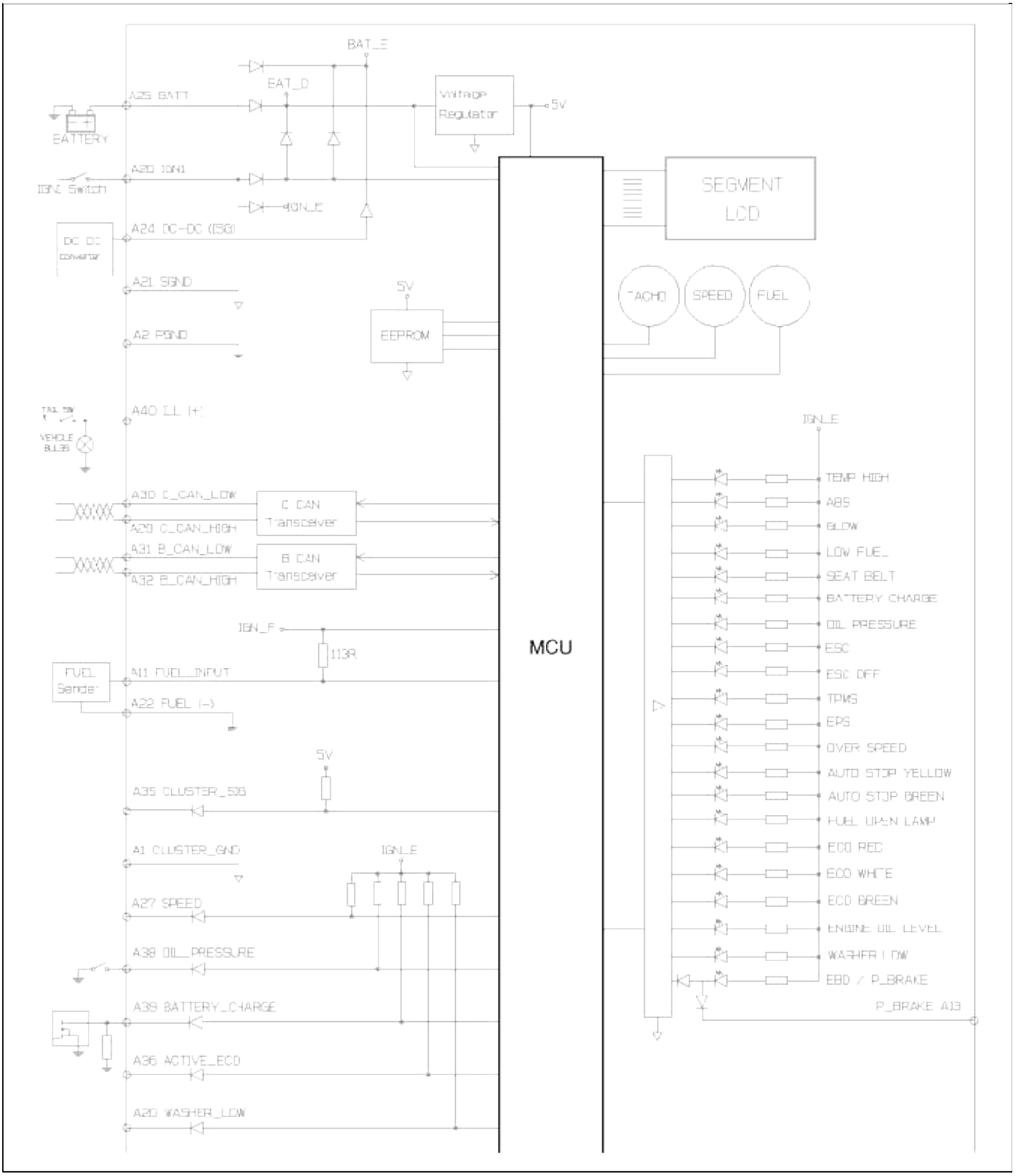


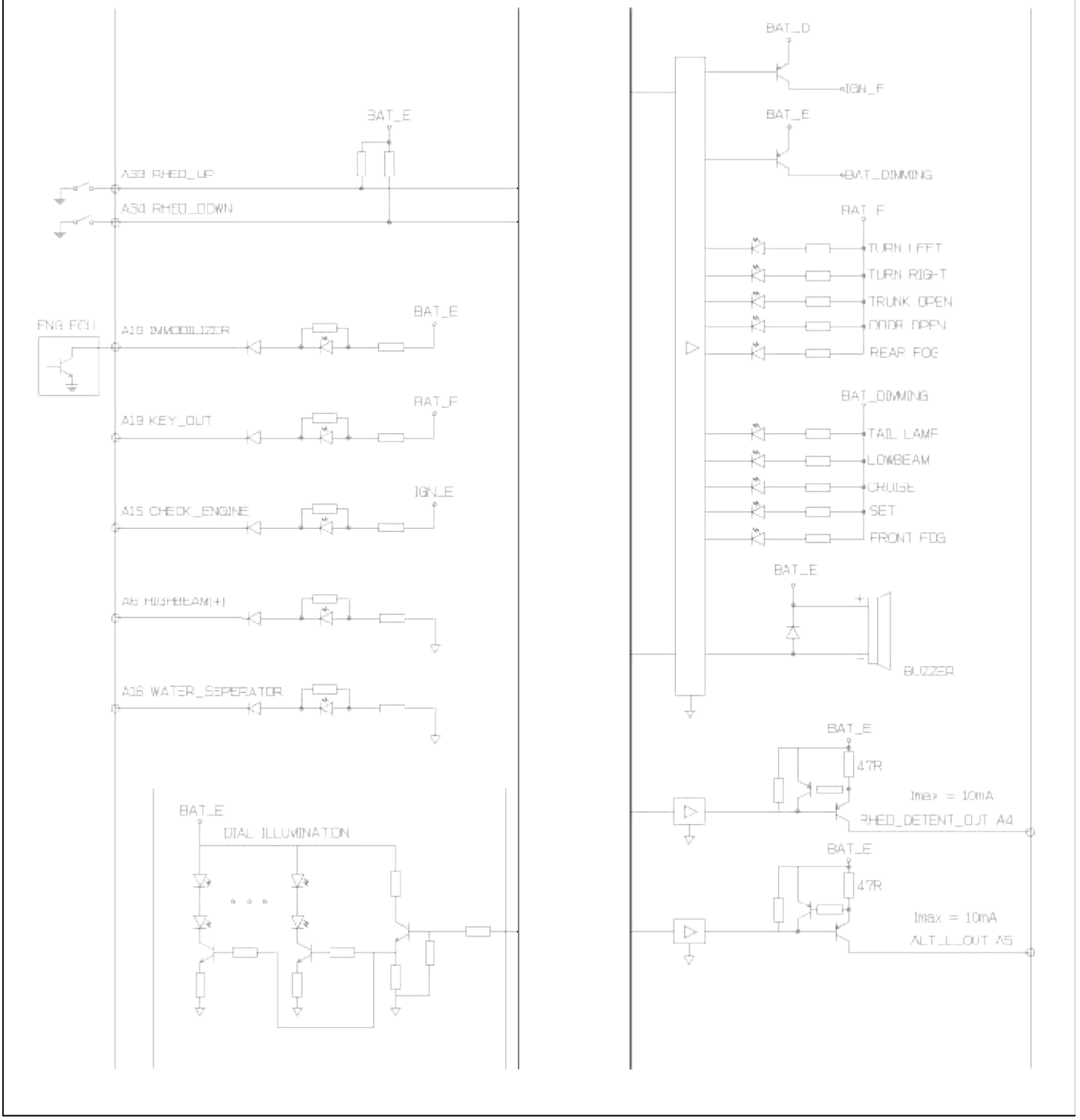
Pin No.	Description	Pin No.	Description
1	Cluster ground	21	S ground
2	P ground	22	Fuel (-)
3	Rheostat output	23	-
4	Rheostat detent output	24	DC-DC (ISG)
5	ALT L output	25	Battery (+)
6	High beam (+)	26	Ignition 1
7	4P output	27	Speed
8	AT P output	28	-
9	AT N output	29	C_CAN_HIGH
10	AT D output	30	C_CAN_LOW
11	Fuel input	31	B_CAN_LOW
12	-	32	B_CAN_HIGH
13	Parking brake	33	Rheostat up
14	Airbag supply	34	Rheostat down
15	Check engine	35	Cluster signal
16	Water seperator	36	Active ECO
17	-	37	-
18	Immobilizer	38	Oil pressure
19	-	39	Battery charge
20	Wahser low	40	Illumination (+)

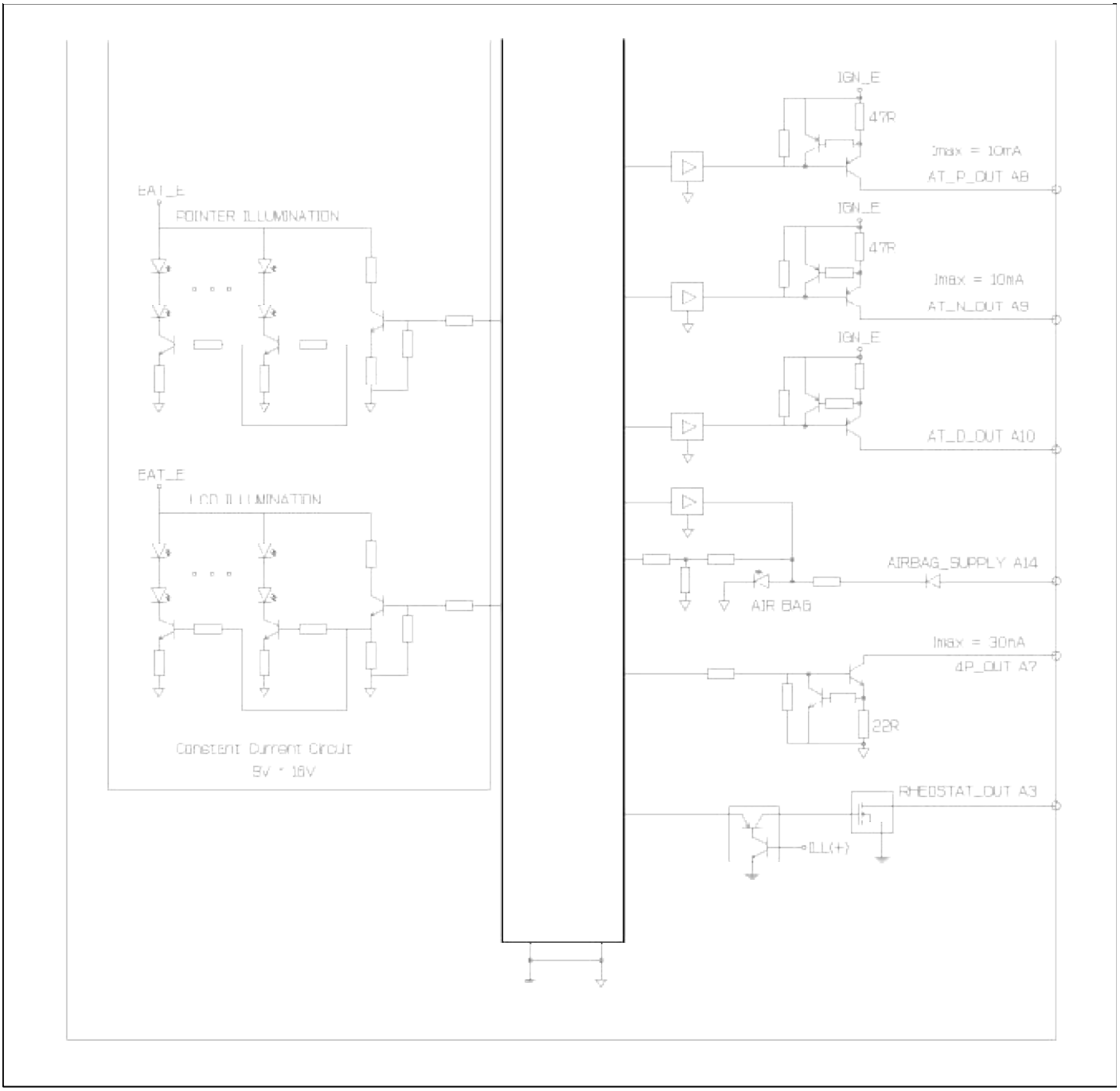
Body Electrical System > Indicators And Gauges > Instrument Cluster > Schematic Diagrams

Circuit Diagram

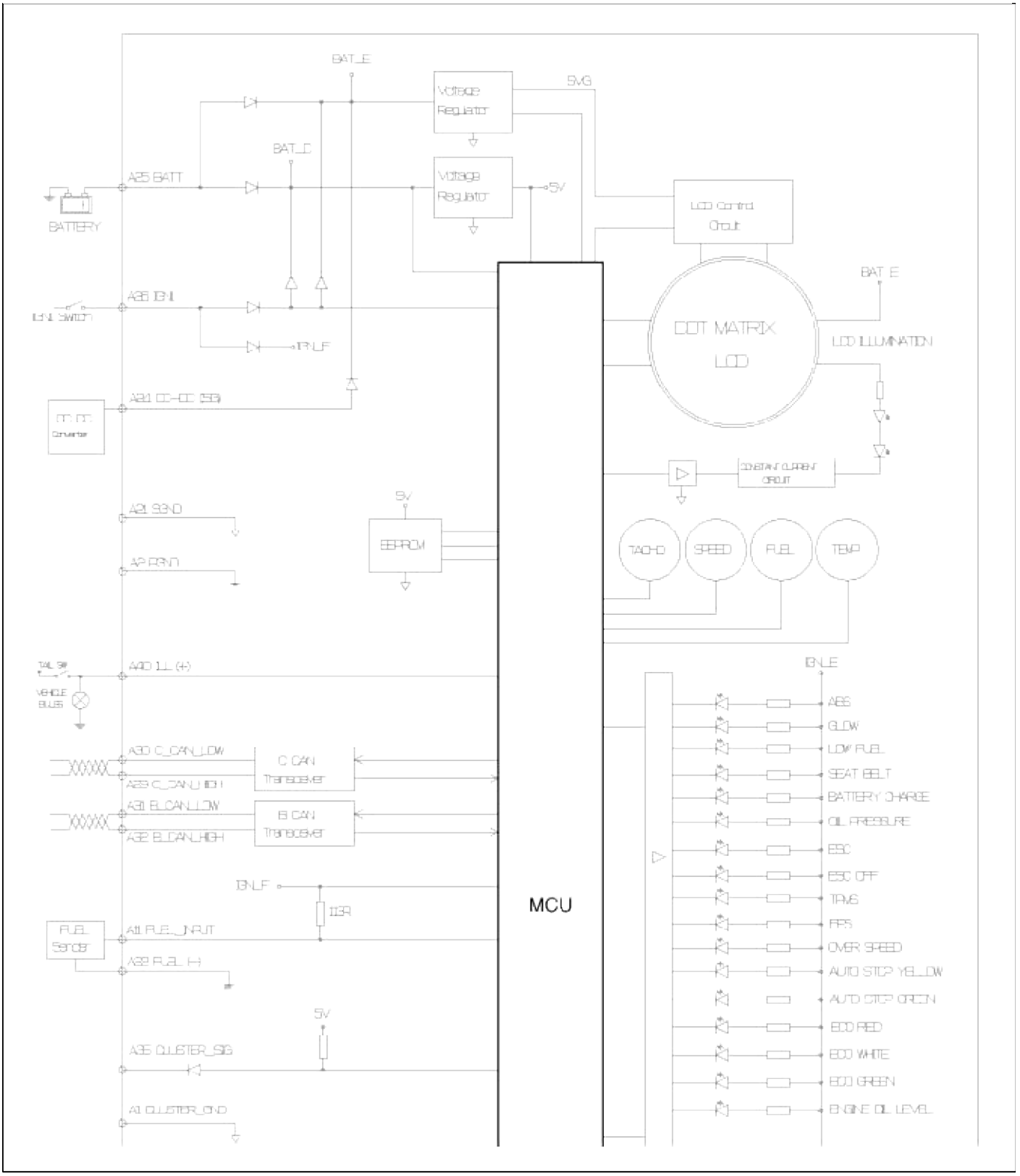
[Standard]

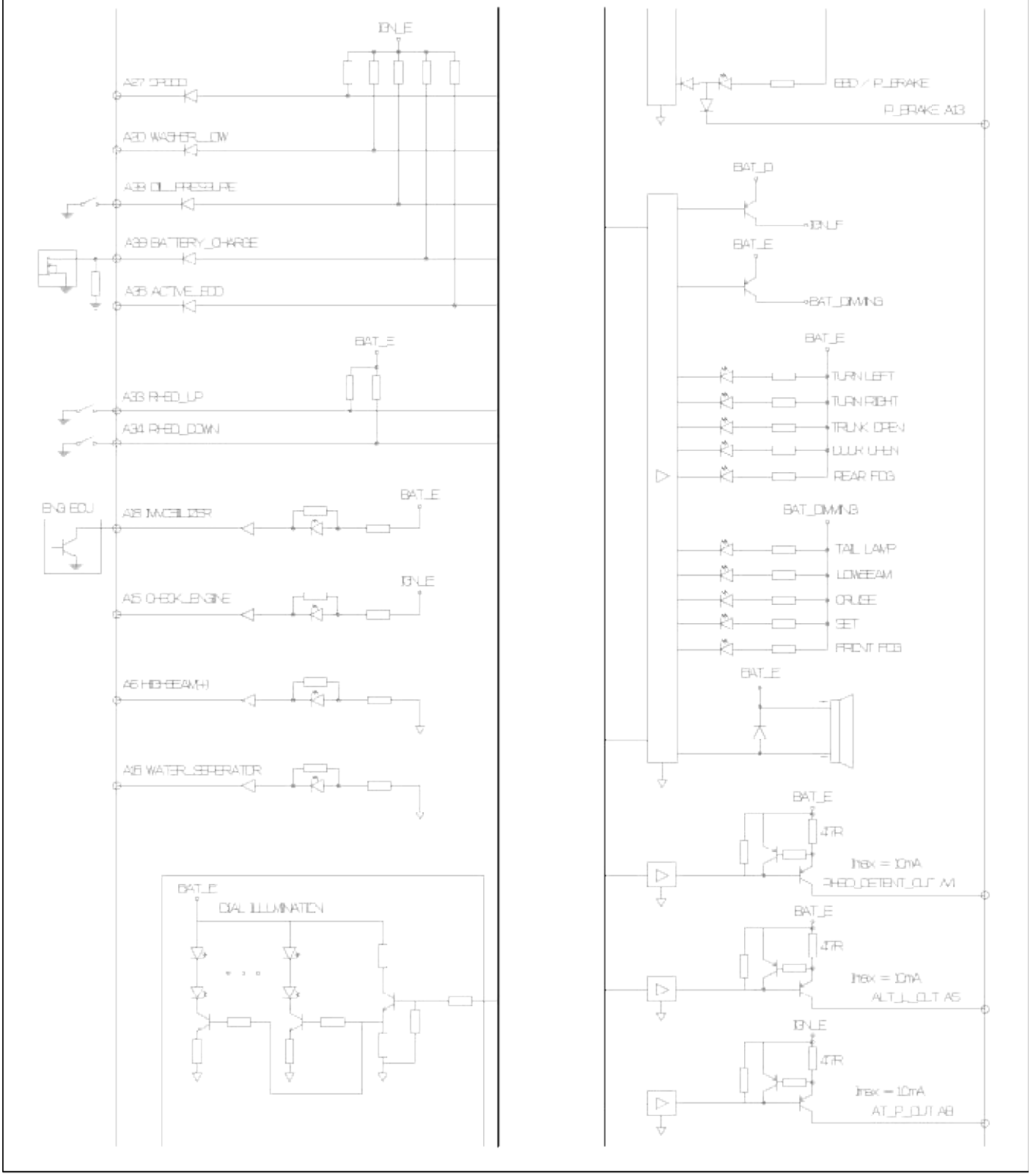

BAT_E
BAT_D
A25 BATT
BATTERY
Voltage Regulator
5V
A20 IGN1
IGN1 Switch
IGN_E
SEGMENT LCD
DC DC converter
A24 DC-DC (ISG)
TACHO
SPEED
FUEL
A21 SGND
5V
EEPROM
A2 PGND
A40 ILL (+)
IGN_E
TEMP HIGH
ABS
BLOW
LOW FUE_
SEAT BELT
BATTERY CHARGE
OIL PRESSURE
ESC
ESC OFF
TPMS
EPS
OVER SPEED
AUTO STOP YELLOW
AUTO STOP BREEN
FUEL OPEN LAMP
ECO RED
ECO WHITE
ECO BREEN
ENGINE OIL LEVEL
WASHER LOW
EBD / P_BRAKE
P_BRAKE A13
A30 C_CAN_LOW
A29 C_CAN_HIGH
C CAN Transceiver
A31 B_CAN_LOW
A32 B_CAN_HIGH
B CAN Transceiver
MCU
IGN_F
113R
FUEL Sender
A11 FUEL_INPUT
A22 FUEL (-)
5V
A35 CLUSTER_5V
A1 CLUSTER_GND
IGN_E
A27 SPEED
A38 OIL_PRESSURE
A39 BATTERY_CHARGE
A36 ACTIVE_ECO
A20 WASHER_LOW

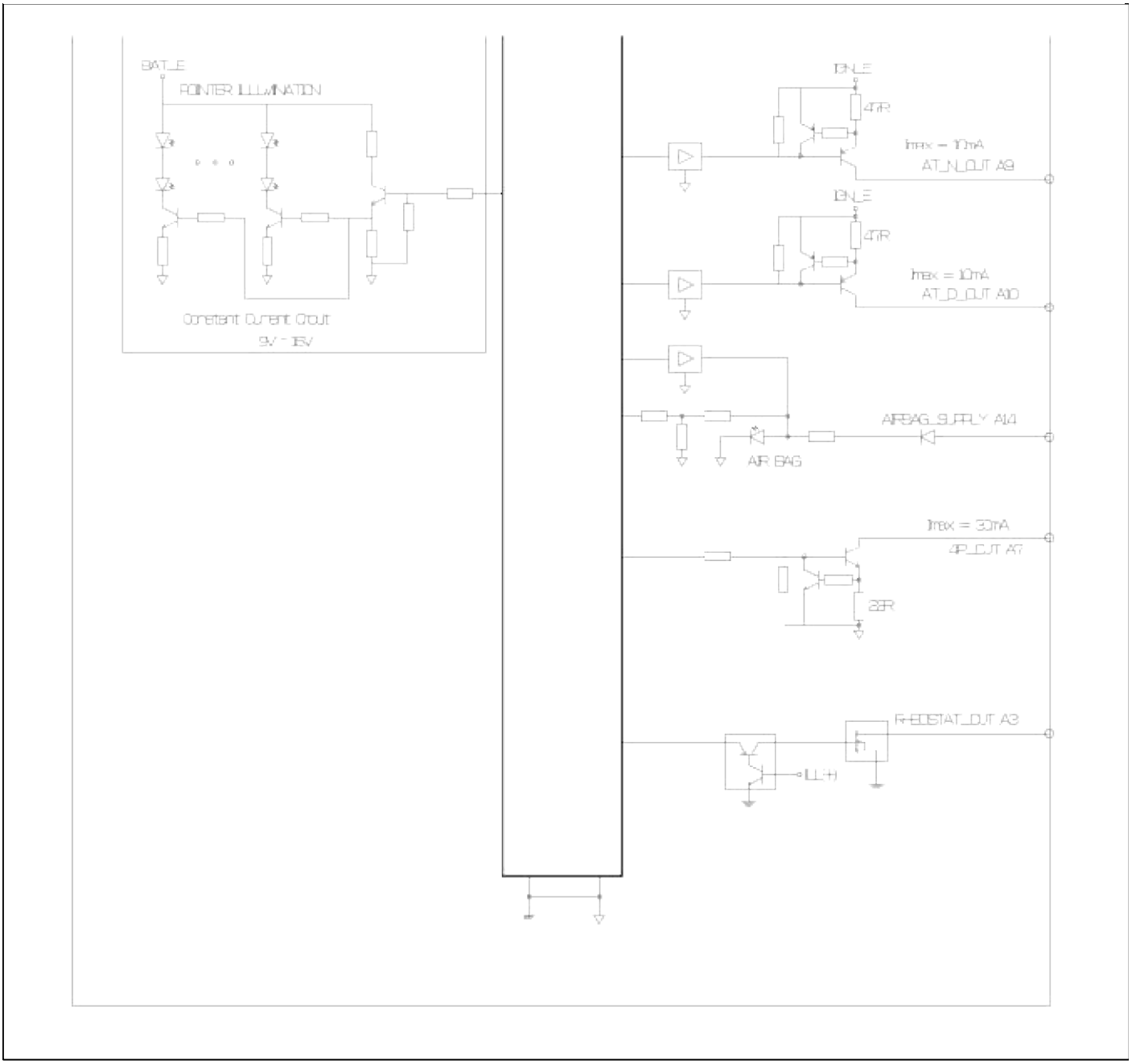

BAT_E
A33 RHEO_UP
A31 RHEO_DOWN
ENG ECU
BAT_E
A18 IMMOBILIZER
BAT_F
A19 KEY_OUT
IGN_E
A15 CHECK_ENGINE
A6 HIGHBEAM(+)
A16 WATER_SEPERATOR
BAT_E
DIAL ILLUMINATON
BAT_D
IGN_F
BAT_E
BAT_DIMMING
BAT_F
TURN LEFT
TURN RIGHT
TRUNK OPEN
DOOR OPEN
REAR FOG
BAT_DIMMING
TAIL LAMP
LOWBEAM
CRUISE
SET
FRONT FOG
BAT_E
BUZZER
BAT_E
47R
Imax = 10mA
RHEO_DETENT_OUT A4
BAT_E
47R
Imax = 10mA
ALT_L_OUT A5



[Supervision]


BAT_E
Voltage Regulator
5VG
BAT_C
A25 BATT
Voltage Regulator
5V
BATTERY
LCD Control Circuit
A26 IGN
IGN SWITCH
IGNLF
DOT MATRIX LCD
BAT_E
LCD ILLUMINATION
A24 DC-DC (5V)
DC-DC Converter
CONSTANT CURRENT CIRCUIT
5V
A21 SGND
EEPROM
A22 PGND
TACHO
SPEED
FUEL
TEMP
TAIL SW
A40 ILL (+)
VEHICLE BUS
IGNLF
ABS
GLOW
LOW FUEL
SEAT BELT
BATTERY CHARGE
OIL PRESSURE
ESC
ESC OFF
TANS
FPS
OVER SPEED
AUTO STOP YELLOW
AUTO STOP GREEN
EGO RED
EGO WHITE
EGO GREEN
ENGINE OIL LEVEL
A30 C_CAN_LOW
C CAN Transceiver
A29 C_CAN_HIGH
A31 EL_CAN_LOW
B CAN Transceiver
A32 EL_CAN_HIGH
MCU
IGNLF
133R
FUEL Sender
A11 FUEL_INPUT
A32 FUEL_H
5V
A35 CLUSTER_SIG
A1 CLUSTER_GND


IGN_E
A27 SPEED
A30 WASHER_LOW
A33 OIL_PRESSURE
A34 BATTERY_CHARGE
A35 ACTIVE_ECO
BAT_E
A33 RHEO_UP
A34 RHEO_DOWN
ENG ECU
A51 IMMOBILIZER
BAT_E
IGN_E
A5 CHECK_ENGINE
A5 HIGHBEAM(H)
A5 WATER_SEPERATOR
BAT_E
DIAL ILLUMINATION
ECO / P_BRAKE
P_BRAKE A13
BAT_D
IGN_F
BAT_E
BAT_DIMMING
BAT_E
TURN LEFT
TURN RIGHT
TRUNK OPEN
DOOR OPEN
REAR FOG
BAT_DIMMING
TAIL LAMP
LOWBEAM
CRUISE
SET
FRONT FOG
BAT_E
BAT_E
47R
Imax = 10mA
RHEO_DETENT_OUT A1
BAT_E
47R
Imax = 10mA
ALT_L_OUT A5
IGN_E
47R
Imax = 10mA
AT_P_OUT A8



Body Electrical System > Indicators And Gauges > Instrument Cluster > Repair procedures

Inspection

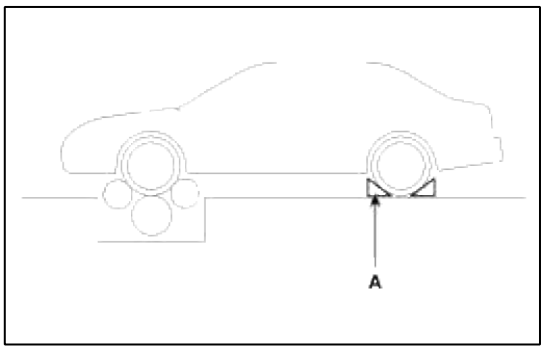
Speedometer

1. Adjust the pressure of the tires to the specified level.
2. Drive the vehicle onto a speedometer tester. Use wheel chocks (A) as appropriate.

3. Check if the speedometer indicator range is within the standard values.

> CAUTION
>
> Do not operate the clutch suddenly or increase/ decrease speed rapidly while testing.

> NOTE
>
> Tire wear and tire over or under inflation will increase the indication error.



[km/h]

Velocity (km/h)	20	40	60	80	100	120
Tolerance (km/h)	+2.5 +4.5	+2.0 +4.4	+2.3 +4.9	+2.8 +5.8	+3.5 +8.5	+4.7 +7.7
Velocity (km/h)	140	160	180	200	220	-
Tolerance (km/h)	+5.9 +8.9	+7.0 +10.0	+8.0 +11.0	+9.0 +12.0	+10.0 +13.0	-

[MPH]

Velocity (mph)	20	40	60	80	100	120	140
Tolerance (mph)	+2.2 +3.6	+2.3 +4.3	+2.6 +5.0	+3.8 +6.6	+4.0 +7.0	+5.0 +8.2	+8.0 +9.4

Tachometer

1. Connect the GDS to the diagnostic link connector or install a tachometer.

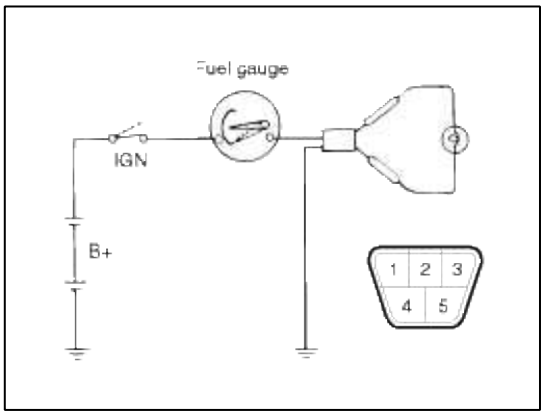
2. With the engine started, compare the readings of the tester with that of the tachometer. Replace the tachometer if the tolerance is exceeded.

> **CAUTION**
>
> 1. Reversing the connections of the tachometer will damage the transistor and diodes inside.
> 2. When removing or installing the tachometer, be careful not to drop it or subject it to severe shock.

Revolution (rpm)	1,000	2,000	3,000	4,000	Remark
Tolerance (rpm)	±100	±125	±150	±170	Gasoline
Revolution (rpm)	5,000	6,000	7,000	8,000	Remark
Tolerance (rpm)	±200	±240	±260	±260	Gasoline

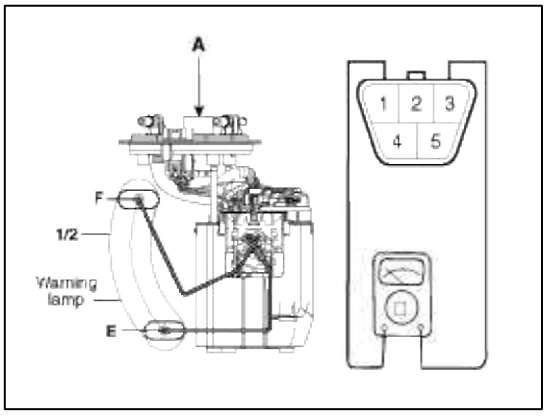
Fuel Gauge

1. Disconnect the fuel sender connector from the fuel sender.
2. Connect a 3.4 watt, 12V test bulb to terminals 1 and 3 on the wire harness side connector.
3. Turn the ignition switch to the ON, and then check that the bulb lights up and the fuel gauge needle moves to full.



Main Fuel Gauge Sender

1. Using an ohmmeter, measure the resistance between terminals 1 and 3 of sender connector (A) at each float level.



2. Also check that the resistance changes smoothly when the float is moved from "E" to "F".

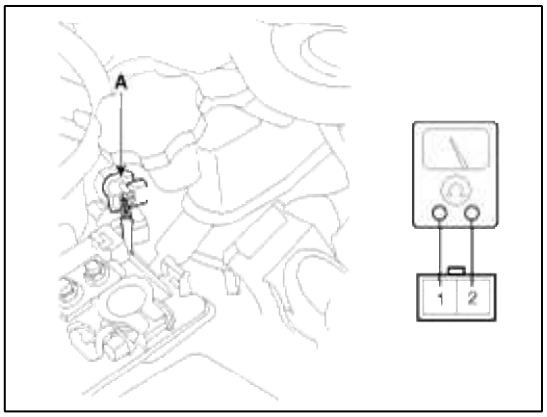
Position	Liter (ℓ)	gal.	Resistance (±2Ω)
Sender (E)	2.8	0.74	200
Warning lamp ON	5.8	1.53	170
1/2	22.3	5.89	66
Sender (F)	41.8	11.04	8

3. If the height resistance is unsatisfied, replace the fuel sender as an assembly.

> CAUTION
>
> After completing this test, wipe the sender dry and reinstall it in the fuel tank.

Brake Fluid Level Warning Switch

1. Remove the connector (A) from the switch located at the brake fluid reservoir.
2. Verify that continuity exists between switch terminals 1 and 2 while pressing the switch (float) down with a rod.



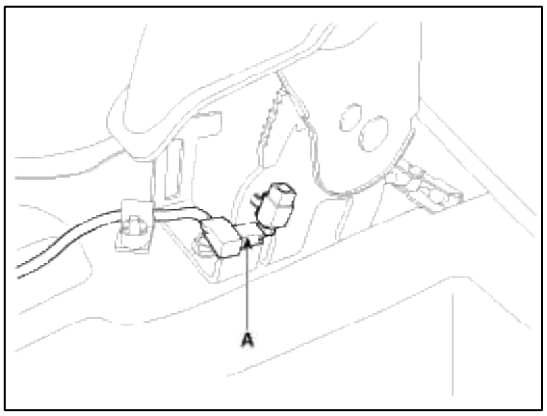
Brake Fluid Level Warning Lamp

1. Ignition "ON"
2. Release the parking brake.
3. Remove the connector from the brake fluid level warning switch.
4. Ground the connector at the harness side.
5. Verify that the warning lamp lights.

Parking Brake Switch

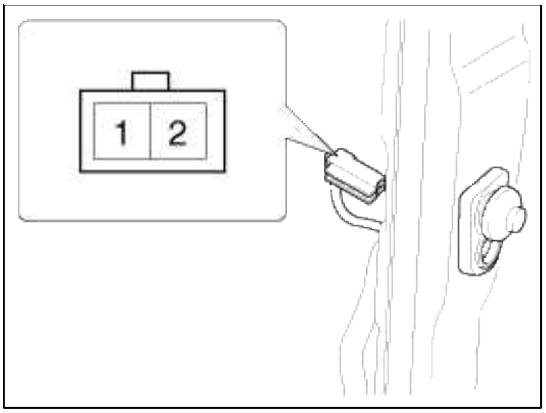
The parking brake switch (A) is a pulling type. It is located under the parking brake lever. To adjust, move the switch mount up and down with the parking brake lever released all the way.

1. Check that there is continuity between the terminal and switch body with the switch ON (Lever is pulled).
2. Check that there is no continuity between the terminal and switch body with the switch OFF (Lever is released). If continuity is not as specified, replace the switch or inspect its ground connection.



Door Switch

Remove the door switch and check for continuity between the terminals.

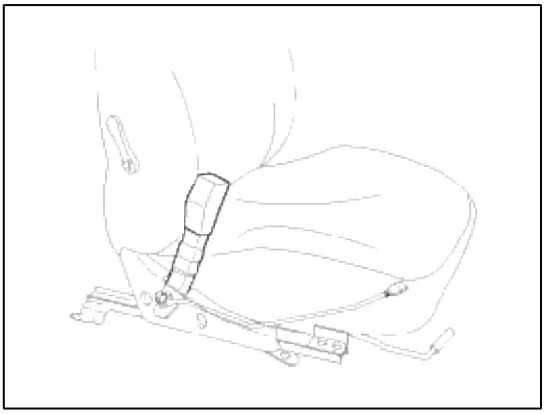


Terminal / Position	1	2	Body (Ground)
Free(Door open)	○	○	○
Push(Door close)			

Seat Belt Switch

1. Remove the connector from the switch.
2. Check for continuity between terminals.

Seat belt condition	Continuity
Fastened	Non-conductive (∞Ω)
Not fastened	Conductive (Ω)



Seat Belt Warning Lamp

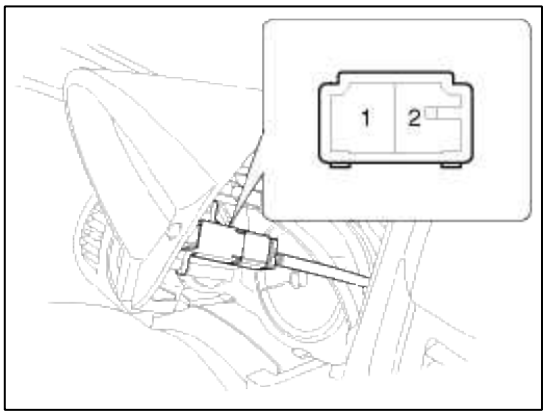
With the ignition switch turned ON, verify that the lamp glows.

Seat belt condition	Warning lamp
Fastened	OFF
Not fastened	ON

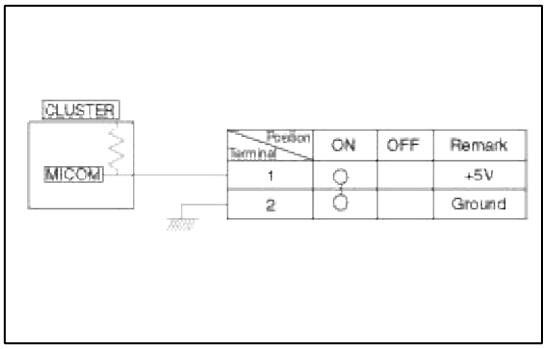
Trip Switch

1. Disconnect the negative (-) battery terminal.

2. Remove the trip switch (A) from the cluster fascia panel.



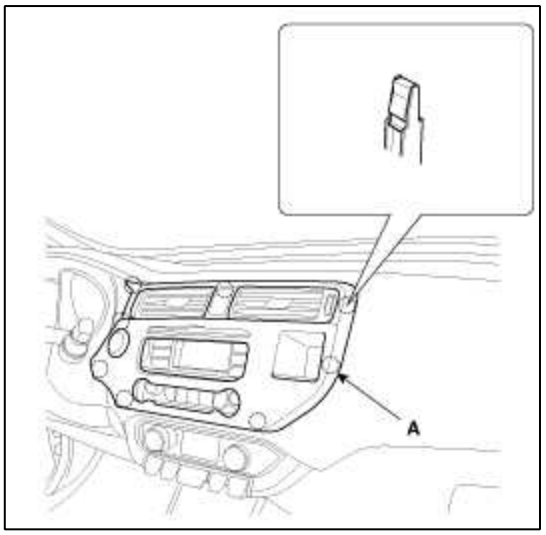
3. Check for continuity between the terminals in each switch position according to the table.



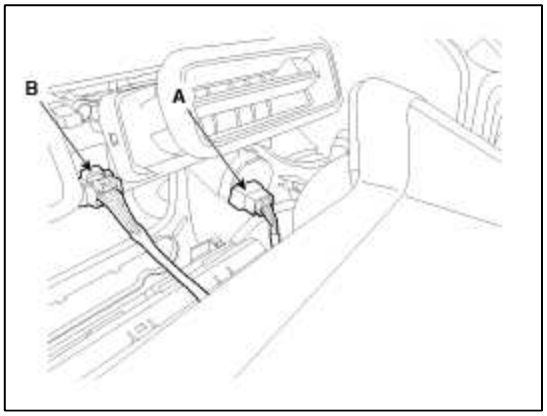
Position / Terminal	ON	OFF	Remark
1	○		+5V
2	○		Ground

Removal

1. Disconnect the negative (-) battery terminal.
2. Using a screwdriver or romover, remove the cluster fascia panel (A).

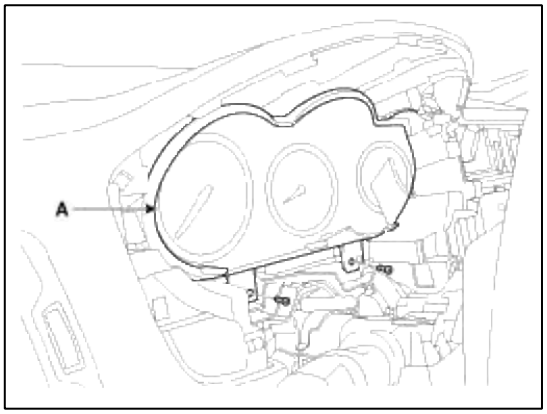


3. Disconnect the start/stop button connector (A) and hazard switch connector (B).

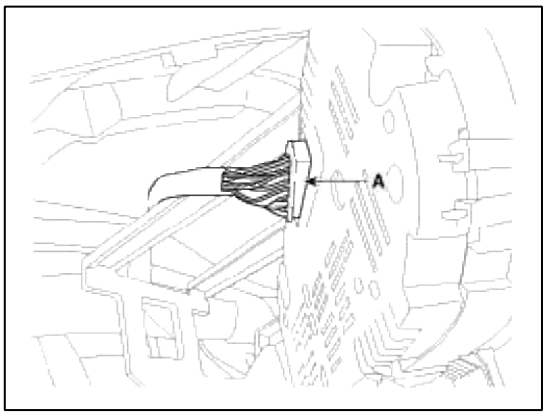


4. Using a screwdriver or remover, remove the cluster fascia panel (A).

5. Remove the cluster fascia (A) from the crash pad after removing 2 screws.



6. Disconnect the cluster fascia connecters (A) and then remove the cluster.



Installation

1. Connect the cluster connector.
2. Install the cluster assembly.
3. Install the center fascia panel.

Body Electrical System > Indicators And Gauges > Troubleshooting

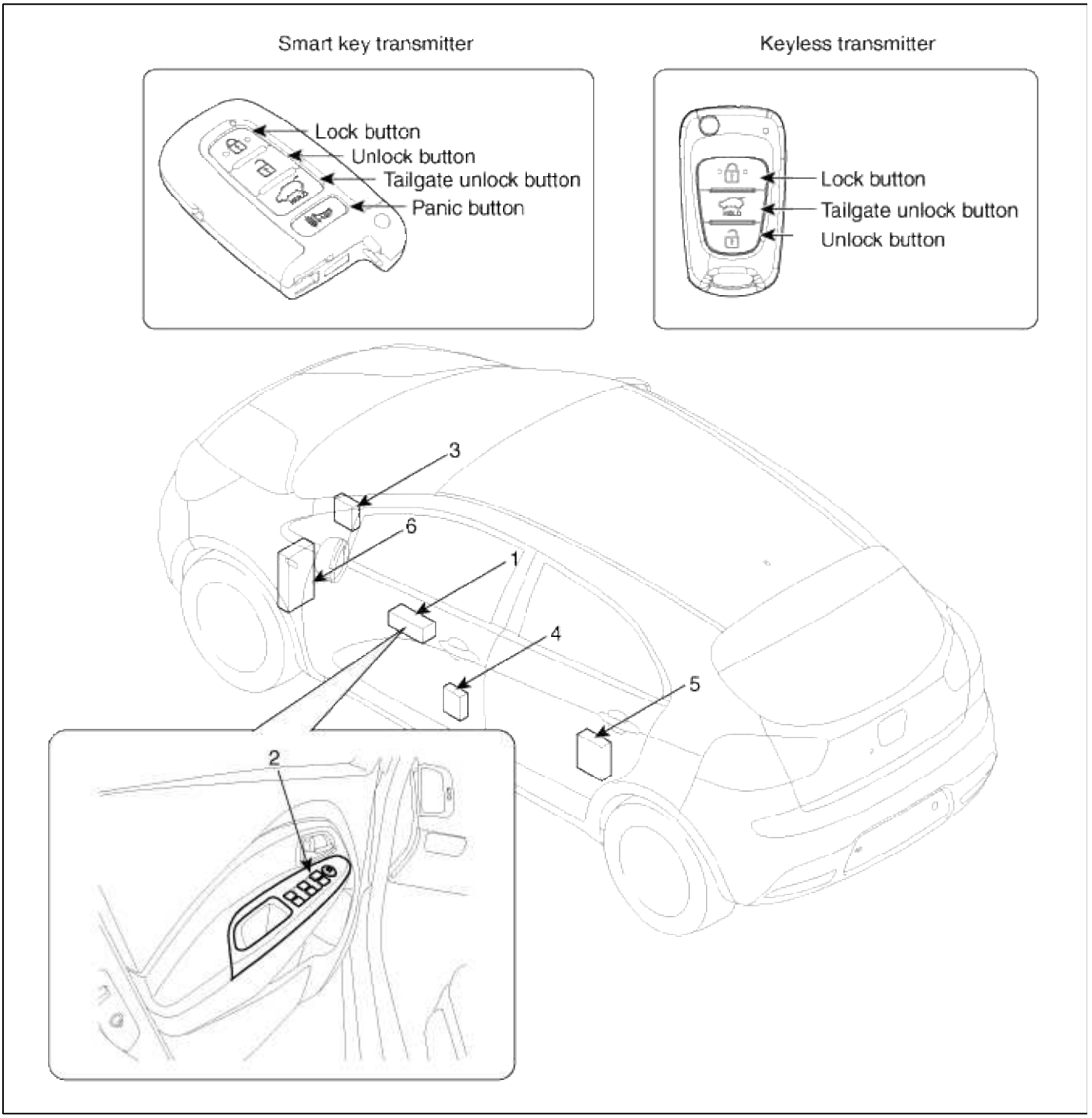
Troubleshooting

Symptom	Possible cause	Remedy
Speedometer does not operate	Cluster fuse (10A) is blown	Check for short and replace fuse
	Speedometer faulty	Check speedometer
	Vehicle speed sensor faulty	Check vehicle speed sensor
	Wiring or ground faulty	Repair if necessary
Tachometer does not operate	Cluster fuse (10A) is blown	Check for short and replace fuse
	Tachometer faulty	Check tachometer
	Wiring or ground faulty	Repair if necessary
Fuel gauge does not operate	Cluster fuse (10A) is blown	Check for short and replace fuse

	Fuel gauge faulty	Check gauge
	Fuel sender faulty	Check fuel sender
	Wiring or ground faulty	Repair if necessary
Low fuel warning lamp does not light up	Cluster fuse (10A) is blown	Check for short and replace fuse
	LED burned out	Replace cluster
	Fuel sender faulty	Check fuel sender
	Wiring or ground faulty	Repair if necessary
Water temperature gauge does not operate	Cluster fuse (10A) is blown	Check for short and replace fuse
	Water temperature gauge faulty	Check gauge
	Water temperature sender faulty	Check sender
Oil pressure warning lamp does not light up	Cluster fuse (10A) is blown	Check for short and replace fuse
	Bulb burned out	Replace bulb
	Oil pressure switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Parking brake warning lamp does not light up	Cluster fuse (10A) is blown	Check for short and replace fuse
	LED burned out	Replace cluster
	Brake fluid level warning switch faulty	Check switch
	Parking brake switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Open door warning lamp and trunk lid warning lamp do not light up	Room lamp fuse (10A) is blown	Check for short and replace fuse
	LED burned out	Replace cluster
	Door switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Seat belt warning lamp does not light up	Cluster fuse (10A) is blown	Check for short and replace fuse
	LED burned out	Replace cluster
	Seat belt switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary

Body Electrical System > Power Door Locks > Components and Components Location

Component Location



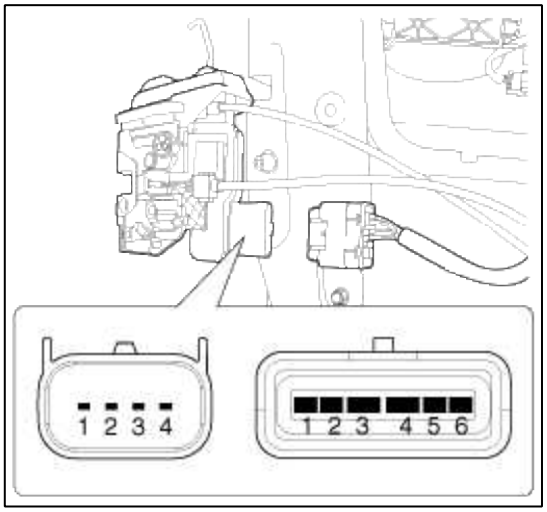
1. Driver power window switch 2. Door lock switch 3. BCM (Body Control Module)	4. Front door lock actuator 5. Rear door lock actuator 6. Internal junction box

Body Electrical System > Power Door Locks > Power Door Lock Actuators > Repair procedures

Inspection

Front Door Lock Actuator and Switch

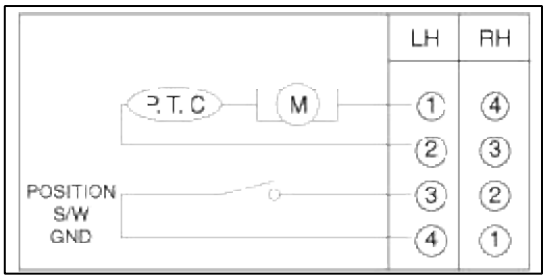
1. Remove the front door trim.
   (Refer to the Body group - Front door)
2. Remove the front door latch.
   (Refer to the Body group - Front door).
3. Disconnect the connectors from the actuator.



4. Check actuator operation by connecting power and ground according to the table.
   Check for continuity between the terminals in each switch position when inserting the key into the door according to the table

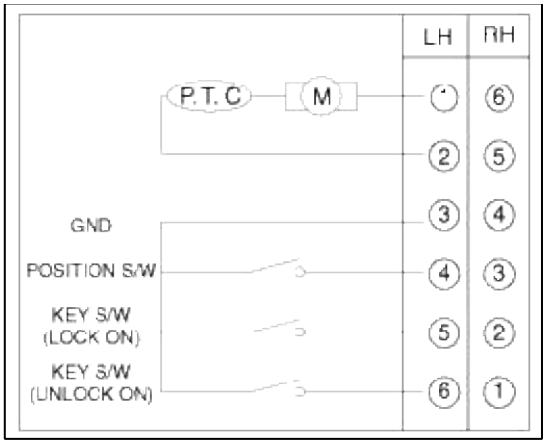
> **NOTE**
>
> To prevent damage to the actuator, apply battery voltage only momentarily.

[Without key (4Pin)]



OPERATION / TERMINAL	C/LOCK		C/UNLOCK	
	LH	RH	LH	RH
①	-	GND	+	GND
②	+	OFF	-	ON
③	OFF	-	ON	+
④	GND	+	GND	-

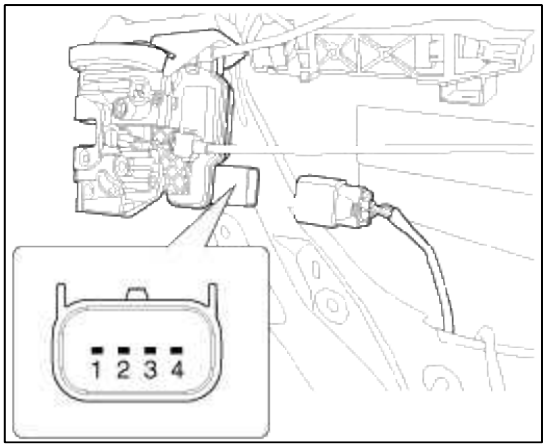
[With key (6Pin)]



Operation / Terminal	C/LOCK		C/UNLOCK		Key LOCK		Key UNLOCK	
	LH	RH	LH	RH	LH	RH	LH	RH
①	-		+					ON
②	+		-			ON		
③	GND	OFF	GND	ON	GND		GND	
④	OFF	GND	ON	GND		GND		GND
⑤		-		+	ON			
⑥		+		-			ON	

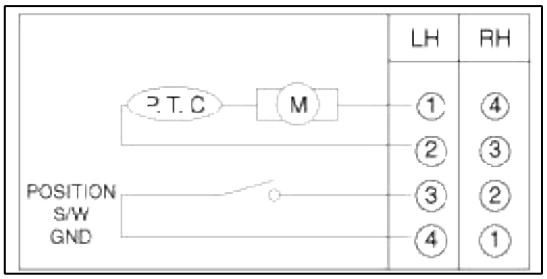
Rear Door Lock Actuator and Switch

1. Remove the rear door trim.
   (Refer to the Body group - Rear door)
2. Remove the rear door latch.
   (Refer to the Body group - Rear door)
3. Disconnect the connectors from the actuator.



4. Check actuator operation by connecting power and ground according to the table.
   Check for continuity between the terminals in each switch position when inserting the key into the door according to the table

> **NOTE**
>
> To prevent damage to the actuator, apply battery voltage only momentarily.



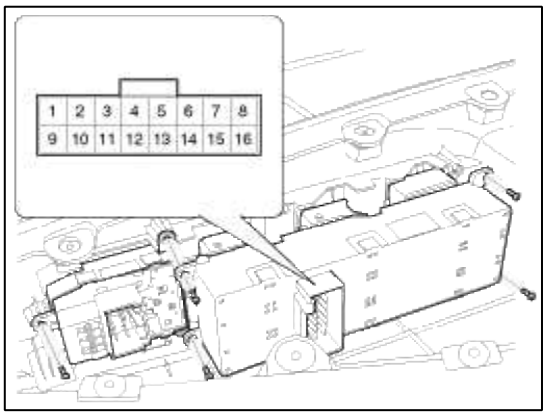
OPERATION / TERMINAL	C/LOCK		C/UNLOCK	
	LH	RH	LH	RH
①	-	GND	+	GND
②	+	OFF	-	ON
③	OFF	-	ON	+
④	GND	+	GND	-

Body Electrical System > Power Door Locks > Power Door Lock Switch > Repair procedures

Inspection

Driver Door Lock Switch Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim panel.
   (Refer to the BD group - "Front door")
3. Disconnect the connector from the power window switch module.



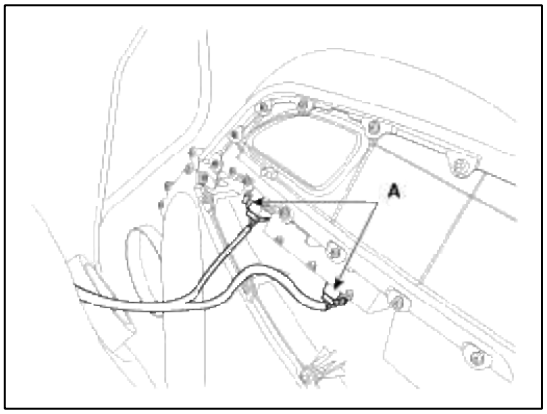
4. Check for continuity between the terminals in each switch position according to the table.

erminal / Position	1	2	15
Lock	○		○
Unlock		○	○

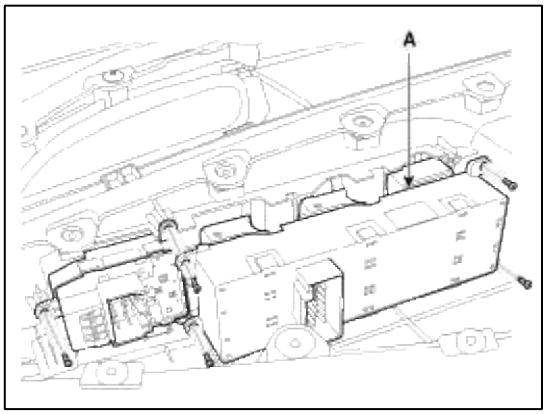
Removal

1. Disconnect the negative(-) battery terminal.

2. Remove the front door trim panel.
   (Refer to the BD group - "Front door")
3. Disconnect the power window switch module connector (A) from the wiring harness.



4. Remove the power window switch module (A) from the door trim after loosening the mounting screws (5EA).



NOTE

- Be careful not to damage door trim panel and door module mounting hooks.

Installation

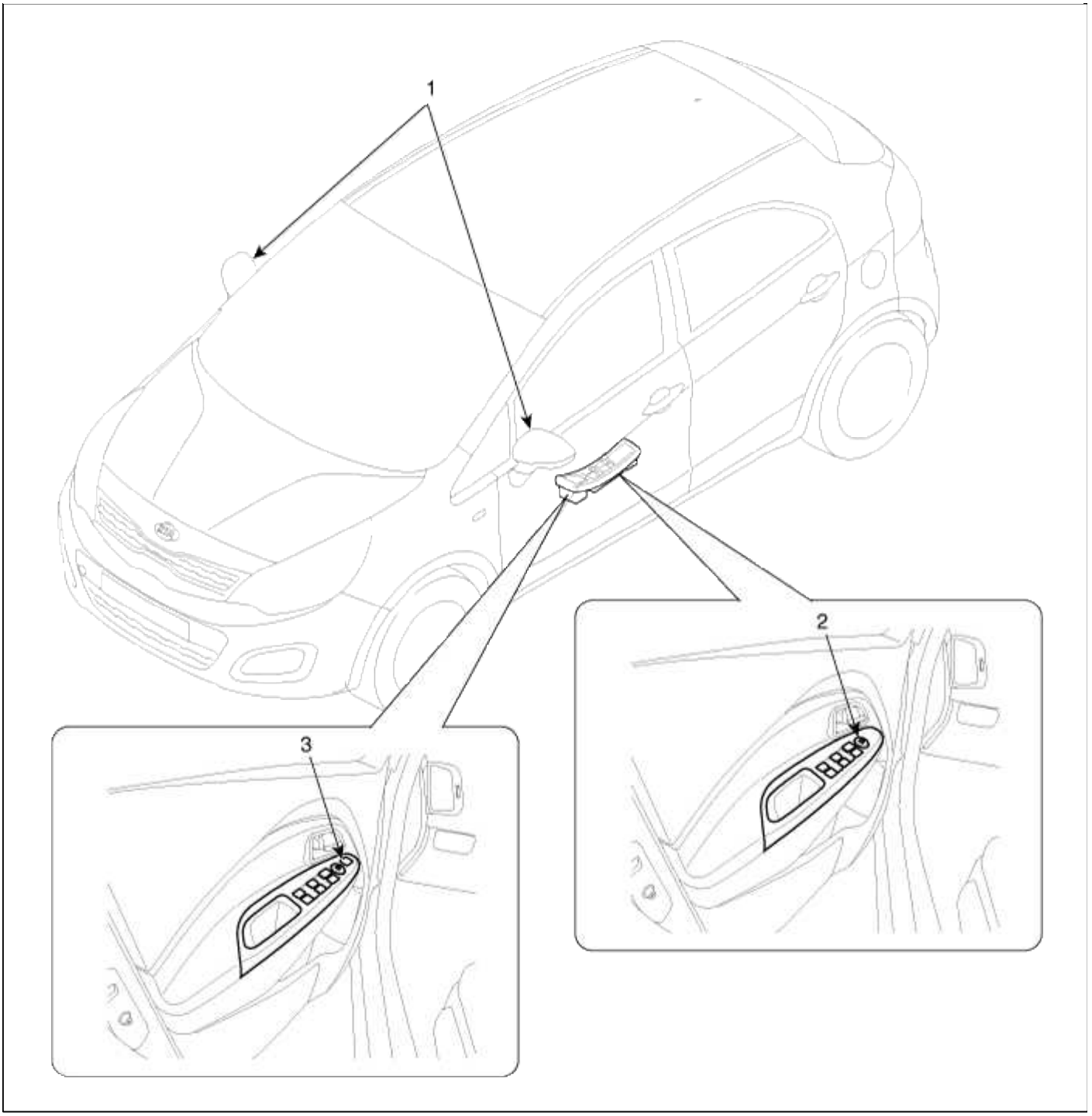
1. Install the power window switch module.
2. Install the door trim panel after reconnecting the relevant connectors

NOTE

- Make sure that the power window switch module connectors are plugged properly.
- Check that the power window switch and door lock switch operate normally.

Body Electrical System > Power Door Mirrors > Components and Components Location

Component Location

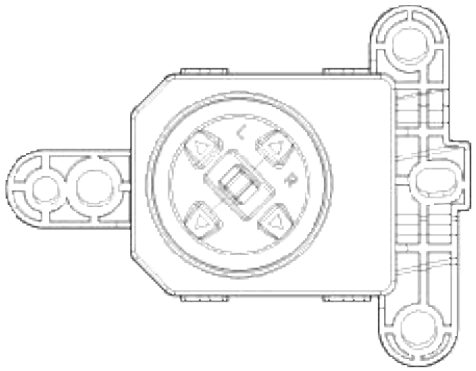


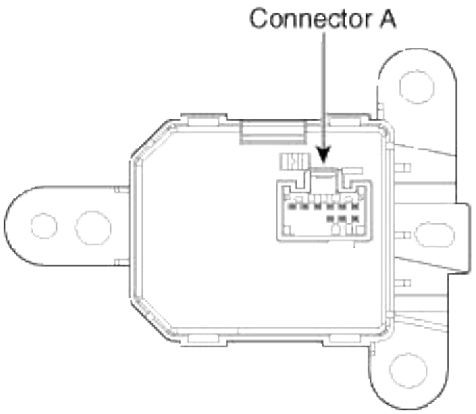
1. Power door mirror 2. Power door mirror switch	3. Folding mirror switch

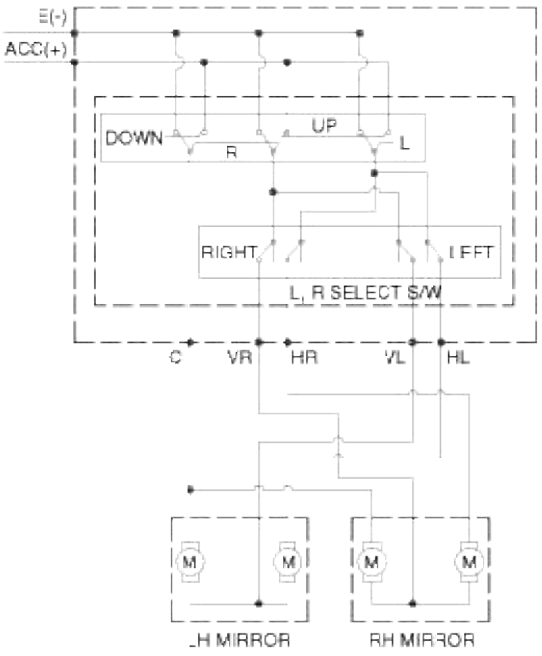
Body Electrical System > Power Door Mirrors > Power Out Side Mirror Switch > Components and Components Location

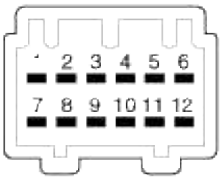
Component

[Standard]



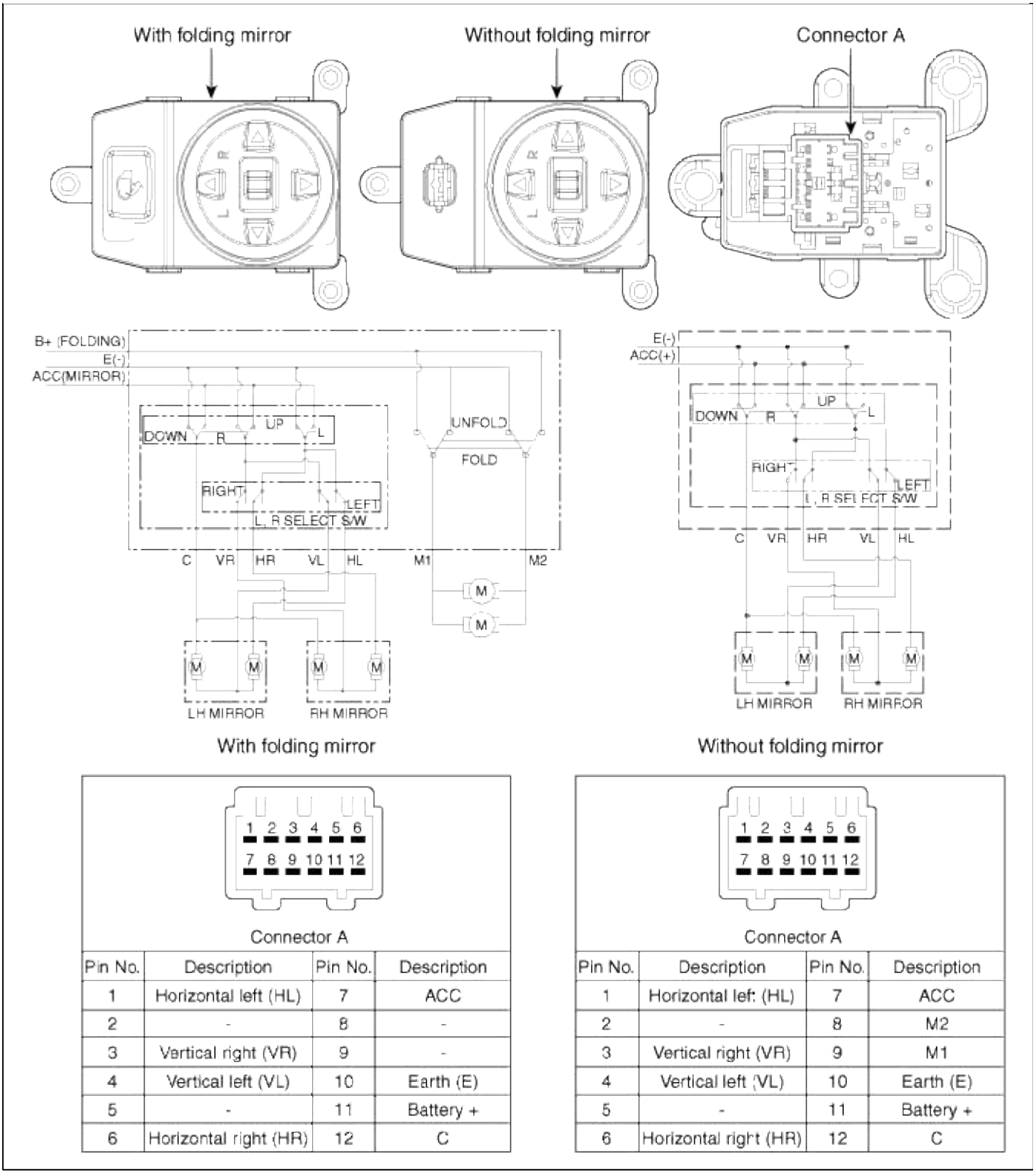






Connector A

Pin No.	LHD	RHD
1	Earth	ACC
2	-	Vertical left (VL)
3	-	Horizontal left (HL)
4	Horizontal left (HL)	-
5	Vertical left (VL)	-
6	ACC	Earth
7	-	C
8	-	Veritcal right (VR)
9	-	Horizontal right (HR)
10	Horizontal right (HR)	-
11	Veritcal right (VR)	-
12	C	-



Connector A

Pin No.	Description	Pin No.	Description
1	Horizontal left (HL)	7	ACC
2	-	8	-
3	Vertical right (VR)	9	-
4	Vertical left (VL)	10	Earth (E)
5	-	11	Battery +
6	Horizontal right (HR)	12	C

Connector A

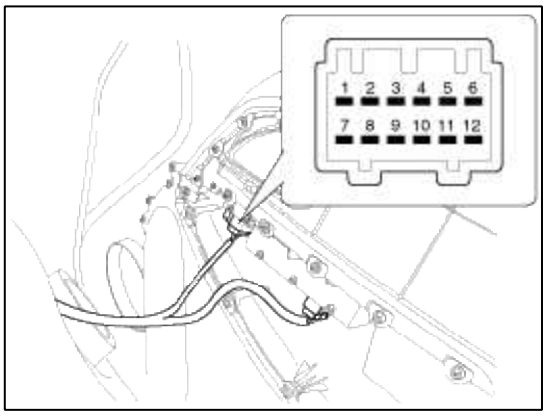
Pin No.	Description	Pin No.	Description
1	Horizontal lef: (HL)	7	ACC
2	-	8	M2
3	Vertical right (VR)	9	M1
4	Vertical left (VL)	10	Earth (E)
5	-	11	Battery +
6	Horizontal right (HR)	12	C

Body Electrical System > Power Door Mirrors > Power Out Side Mirror Switch > Repair procedures

Inspection

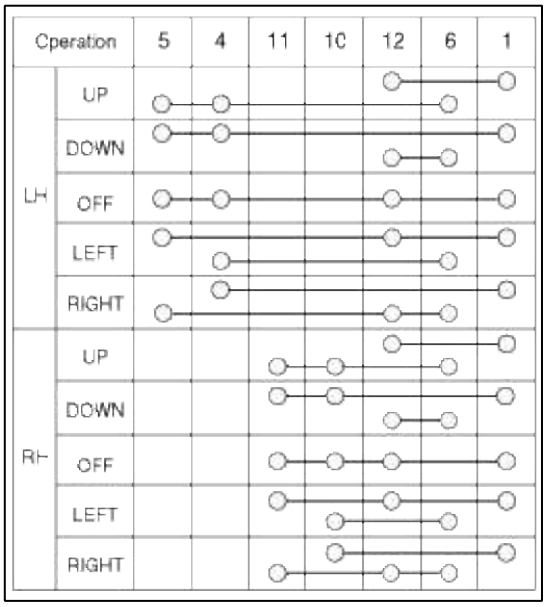
1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim panel.
   (Refer to the BD group - "Front door")

3. Disconnect the connector from the power window switch module.

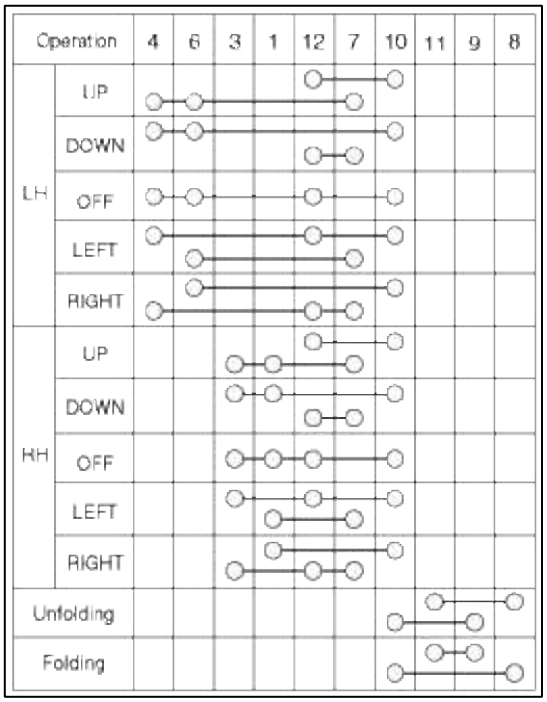


4. Check for continuity between the terminals in each switch position according to the table.

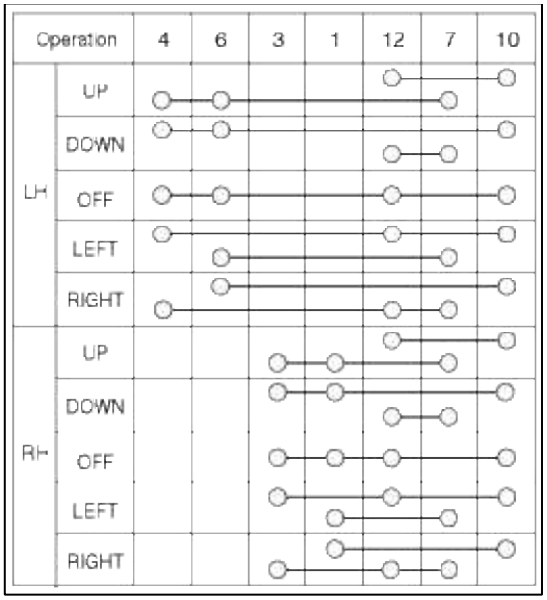
[Standard]



[Power Mirror Switch - With Folding Mirror]



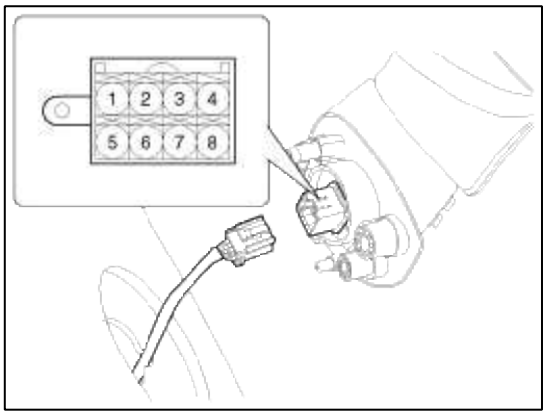
[Power Mirror Switch - Without Folding Mirror]



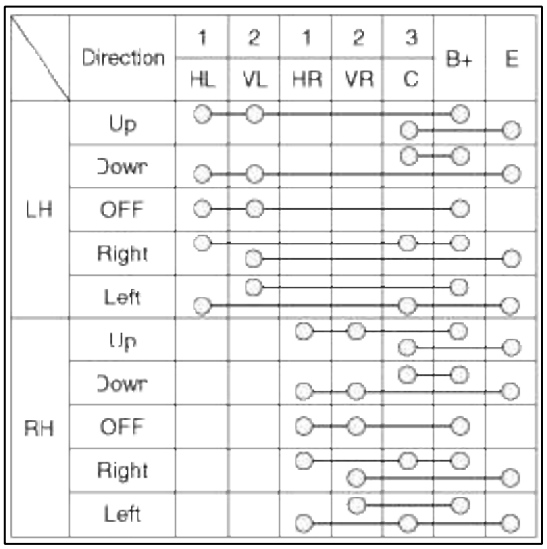
Body Electrical System > Power Door Mirrors > Power Door Mirror Actuator > Repair procedures

Inspection

1. Remove the front door quadrant delta cover.
   (Refer to the BD group - "Front door")
2. Disconnect the power door mirror connector from the harness.



3. Apply battery voltage to each terminal as shown in the table and verify that the mirror operates properly.



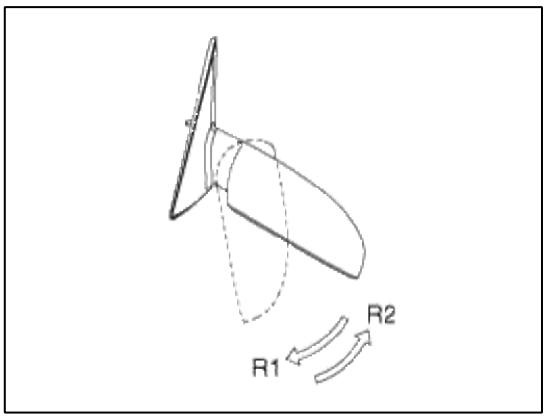
Side Repeater Lamp

Terminal / Position	6	7
Lamp	B	E

Mirror Heater

Terminal / Position	8	7
Heater	B	E

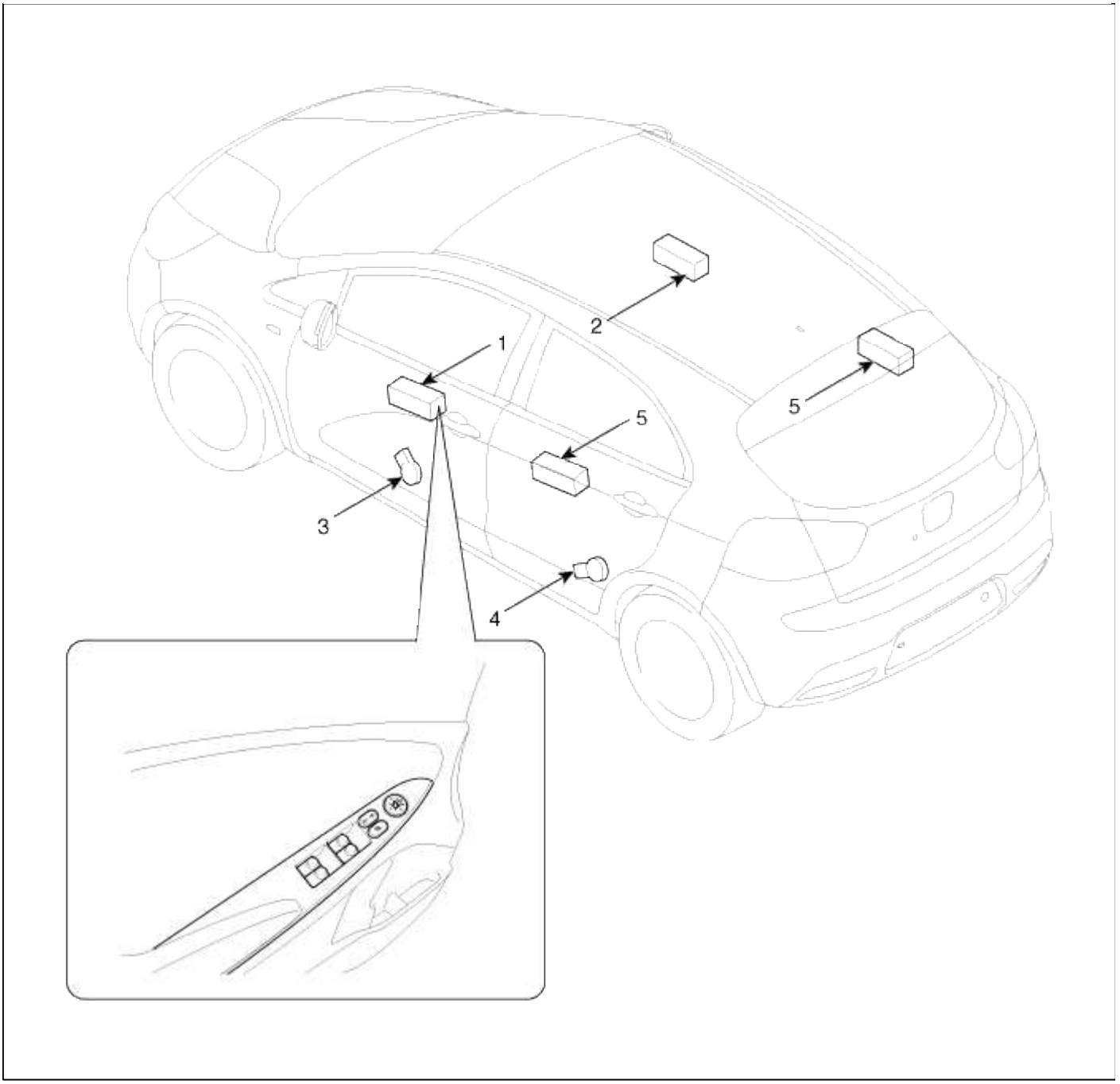
With Folding Mirror



Terminal / Direction	B+	E	4	5
Folding R1	○	○	○	○
Folding R2	○	○	○	○

Body Electrical System > Power Windows > Components and Components Location

Component Location



1. Driver power window main switch 2. Passenger power window switch 3. Front window motor	4. Rear window motor 5. Rear window switch

Body Electrical System > Power Windows > Description and Operation

Operation

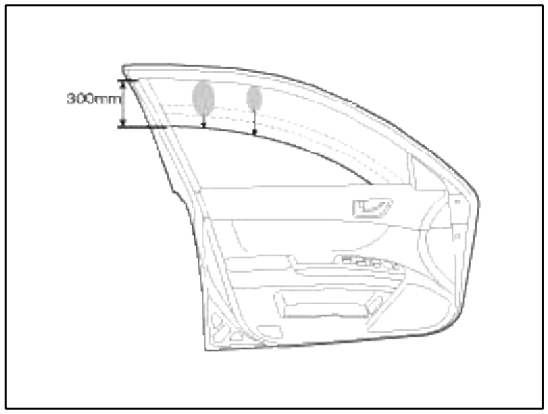
Function Of Safety Power Window

When all door (Front, Rear) power window auto-up switch is operated, safety function is activated.

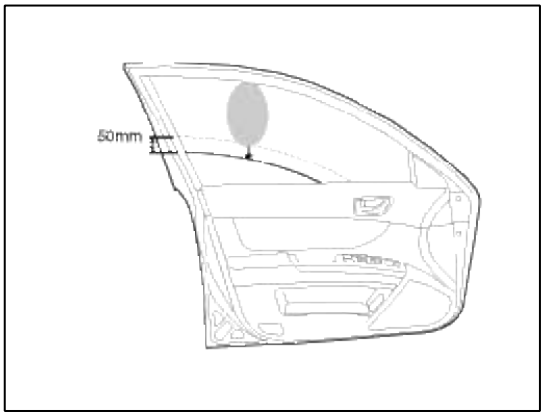
1. Safety function condition

When detect the force of 100N during the window rising, window is reversed.

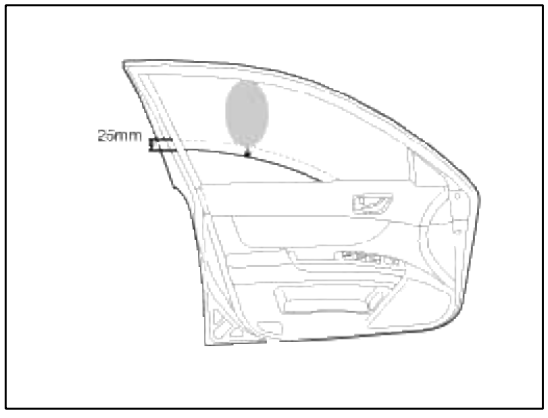
2. Length of window reversing (except holding the auto-up switch)
   A. When detect the jamming during the 4mm ~ 250mm from top of the door.
      → Window is reversed until 300mm from top of the door.



   B. When detect the jamming over the 250mm from top of the door.
      → Window is reversed until 50mm from jamming position.
      → Window is reversed 50mm or bottom position in case of 50mm reversing distance.



   C. When detect the jamming over 300mm from top of the door.
      → Window stops at reverse point.
3. Length of window reversing (holding the auto-up switch)
   A. When detect the jamming during holding the auto-up switch.
      → Window is reversed until 25mm from jamming position.
   B. Auto-up function is not available during the 5 seconds from above condition.
      → When holding the auto-up switch, window is operated as a manual-up function. (Safety function is not activated.)
   C. When detect the jamming during holding the auto-up switch again.
      → Window is reversed until 25mm from jamming position.
   D. When holding the auto-up switch after 5 seconds from above condition.
      → Window is reverse until 25mm from jamming position.



4. Safety function is not available area
   Safety function is not available during the 4mm from top of the door.

Normalization (Teaching)

After power on reset or error detection, the motor has to be nomalized at the fully closed position.

How to be nomalized:

- Move the window upwards into the fully closed position. As the window reaches the fully closed position, hold the power window switch in auto for T≥2 seconds.
  If the block is reconized, the system state turns to normalized.

Recall And Storing The Normalization (teaching) Information

ECU records the normalization information into the specified location in Flash ROM. (as long as Flash ROM page is valid)

- Stroing conditions : Entering to sleep mode after valid switch input. Entering to low voltage(7.5V) after valid switch input.
- Recall conditions : Engine=ON or Power ON reset

Denormalization (Memory reset)

Under conditions below, ECU turns to denormalized status. After demormalization, auto up and safety function shall not be operated. In order to make these function active again, ECU should go through the mormalization process.

- Denormalization conditions :

1. Continuous 15 times reverses
2. Power off during motor operation
3. Driver side door opened and window glass is at the bottom (hard stop position) with IGN on, IGN off → within 2 sec, IGN on → Press Manual Down switch 3 times within 5 sec → De-normalization

Door and Glass status	IGN status	Input time	IGN status	Switch input status			Switch input times	Normalization status
				Re-input time	IGN status	Switch input		
Driver side door opened, Window glass is bottom with IGN on (Hard stop)	IGN Off	T≤2 sec	IGN On	T≤5 sec	IGN On	Press and release Manual down switch	3 times	De-normalization

Window Position Control

To detect the window position and direction of motor rotation, hall sensors are employed. ECU recognizes the fully closed position of the window and sets this relative window position value as "0". When the window goes downwards, based on the information from the hall sensor, the relative position value increments. On the contrary, when the window goes upwards, it decrements.

Thermal Protection

Thermal protection by software module is implemented to prevent from destruction of motor during overload condition. Motor temperature is estimated by integrating squared motor current as an estimate for heating power integral. When estimated motor temperature exceeds EEPROM programmable upper limit, motor is deactivated for fixed delay time (default value = 30 sec.)

Thermal shutdown during a window operation will not interrupt the operation due to safety reasons.

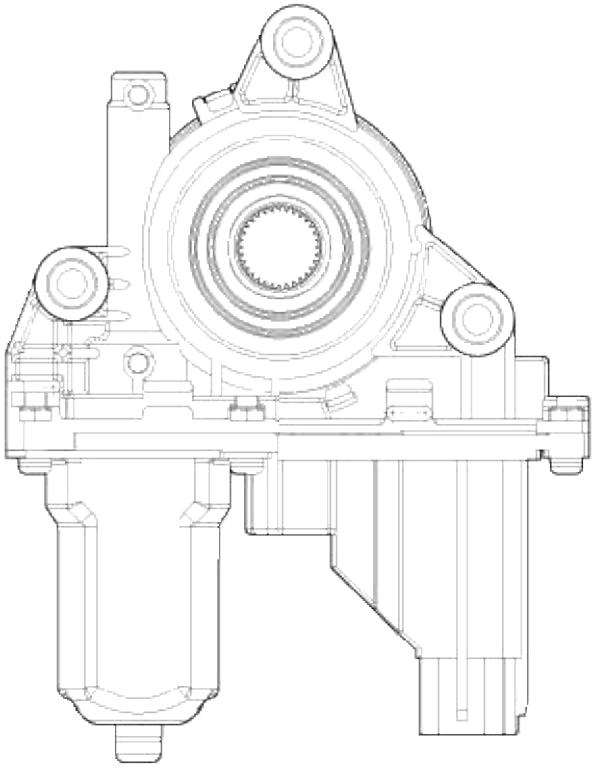
Operation Time Limiter

Maximal operation time of power window motor is limited to 15 sec (EEPROM programmable).

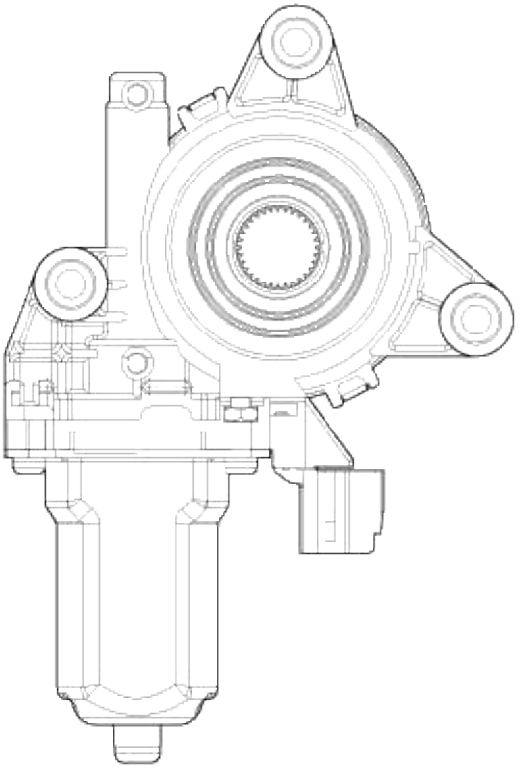
Body Electrical System > Power Windows > Power Window Motor > Schematic Diagrams

Circuit Diagram

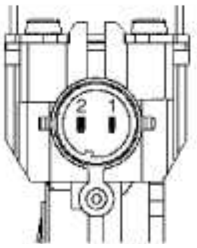
[Safety power window]



[General]



Pin No.	Description	Pin No.	Description
1	Battery +	4	Up
2	Ignition 2	5	Down
3	Auto	6	Ground



Pin No.	Description
1	⊕
2	⊖

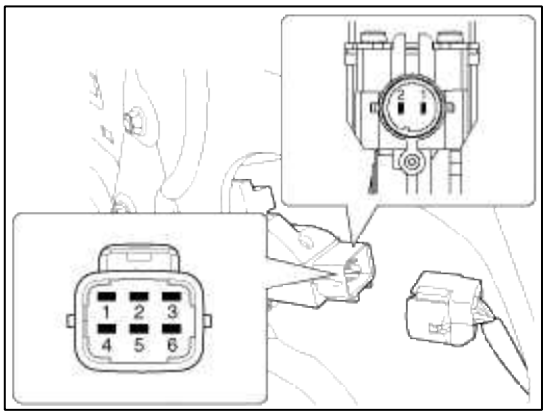
Body Electrical System > Power Windows > Power Window Motor > Repair procedures

Inspection

Front Power Window Motor Inspection

1. Remove the front door trim panel.
   (Refer to the BD group - "Front door")

2. Disconnect the connector from the motor.



3. Connect the motor terminals No.1 and No.2 directly to battery voltage (12V) and connect the motor terminals No.6 directly to battery (-). And then check that the motor operates smoothly. If the operation is abnormal, replace the motor.

[Safety Power Window]

Position \ Terminal	1	2	3	4	5	6
UP	⊕	⊕		⊖		⊖
DOWN	⊕	⊕			⊖	⊖

4. Connect the motor terminals directly to battery voltage (12V) and check that the motor operates smoothly. Next, reverse the polarity and check that the motor operates smoothly in the reverse direction. If the operation is abnormal, replace the motor.

[General]

Position \ Terminal			1	2
LH	UP	Clockwise	⊖	⊕
	DOWN	Counter-clockwise	⊕	⊖
RH	DOWN	Clockwise	⊕	⊖
	UP	Counter-clockwise	⊖	⊕

Rear Power Window Motor Inspection

1. Remove the rear door trim panel.
   (Refer to the BD group - "Rear door")
2. Disconnect the 2P connector from the motor.

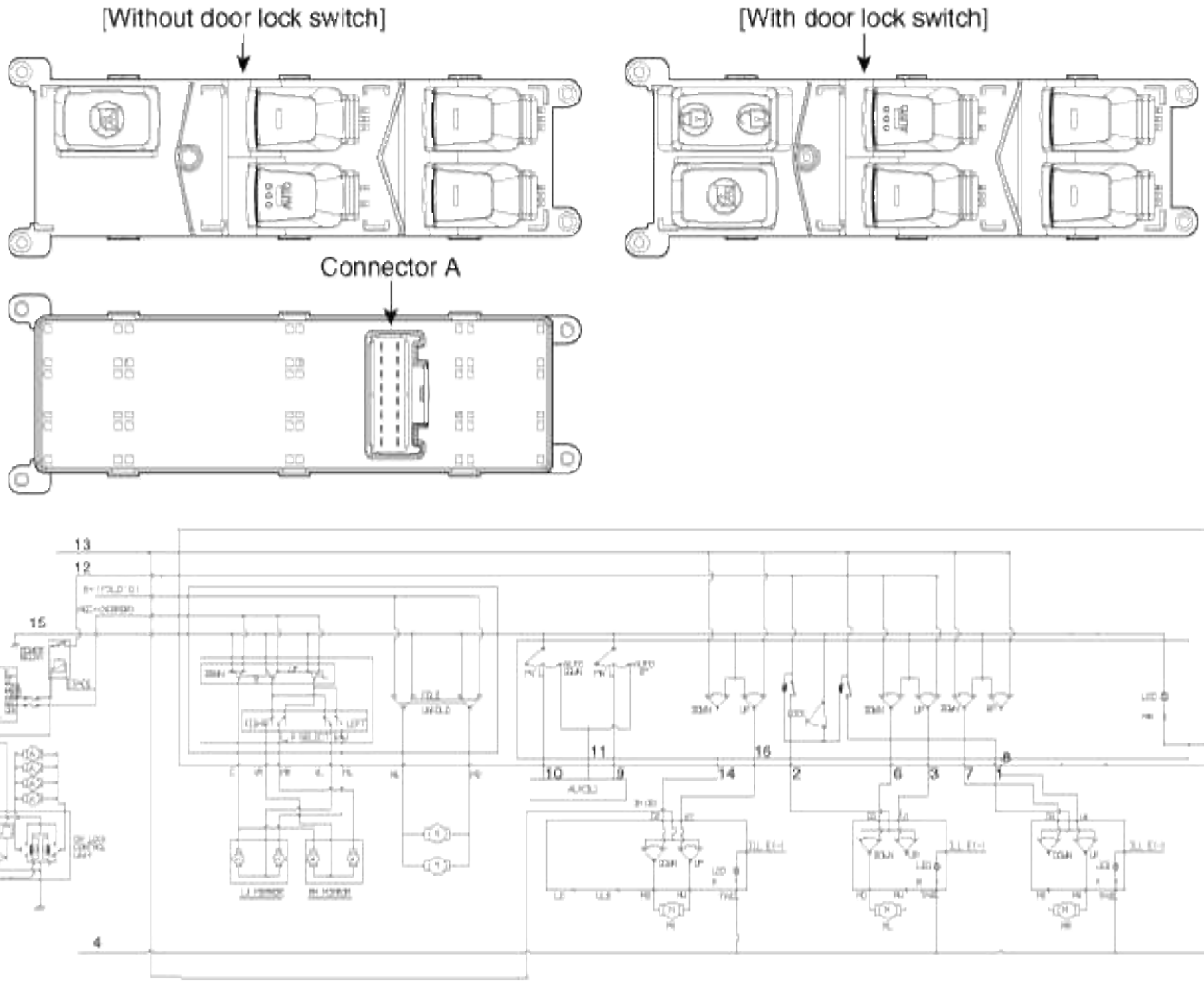
3. Connect the motor terminals directly to battery voltage (12V) and check that the motor operates smoothly. Next, reverse the polarity and check that the motor operates smoothly in the reverse direction. If the operation is abnormal, replace the motor.

Position \ Terminal			1	2
LH	DOWN	Clockwise	⊕	⊖
	UP	Counter-clockwise	⊖	⊕
RH	UP	Clockwise	⊖	⊕
	DOWN	Counter-clockwise	⊕	⊖

Body Electrical System > Power Windows > Power Window Switch > Schematic Diagrams

Circuit Diagram

Driver Power Window Switch



Connector A	

Pin No.	Description	Pin No.	Description
1	S (L)	9	Front left up
2	S (R)	10	Front left down
3	Rear left down	11	Auto
4	Tail	12	Batter (+) (LH)
5	-	13	Batter (+) (RH)
6	Rear left up	14	Front right down
7	Rear right down	15	Ground
8	Rear right up	16	Front right up

Passenger Power Window Switch

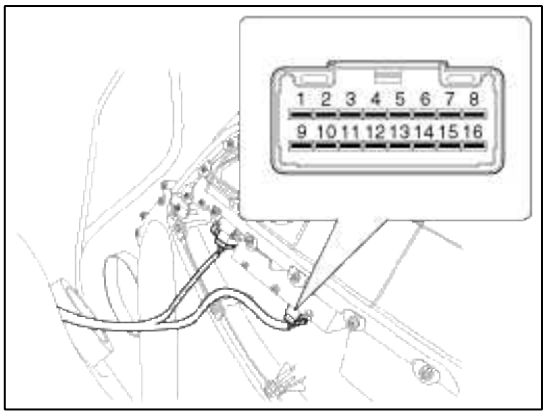
Rear Power Window Switch

Body Electrical System > Power Windows > Power Window Switch > Repair procedures

Inspection

Power Window Main Switch Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim panel.
   (Refer to the BD group - "Front door")
3. Disconnect the connector from the switch.



4. Check for continuity between the terminals in each switch position according to the table. If the continuity condition is not normal, replace the switch.

Terminal / Position	3	2	8
Lock	○	—	○
Unlock		○	○

Terminal / Position	Front left				Front right			
	15	9	10	11	13	16	14	15
Up	○	○			○	○	○	
Auto up	○	○		○				
OFF						○	○	○
Down	○		○		○		○	○
Auto down	○		○					

Terminal / Position	Rear left				Rear right			
	12	6	3	15	13	8	7	15
Up	○	○	○	○	○	○	○	
Auto up								
OFF		○	○	○		○	○	○
Down	○	○		○	○		○	○

Passenger Power Window Switch Inspection

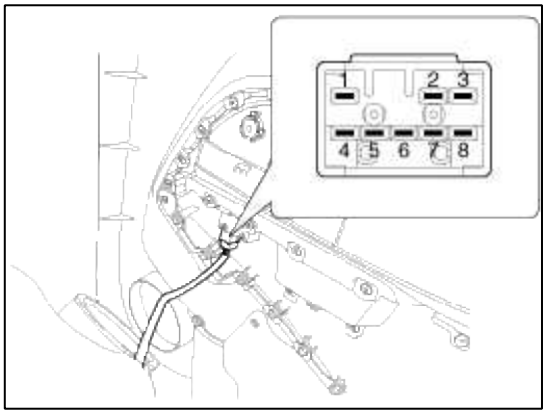
1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim panel.
   (Refer to the BD group - "Front door")
3. Disconnect the connector from the switch.

4. Check for continuity between the terminals in each switch position according to the table. If the continuity condition is not normal, replace the switch.

Rear Power Window Switch Inspection

1. Disconnect the negative (-) battery terminal.

2. Remove the rear door trim panel.
   (Refer to the BD group - "Rear door")
3. Disconnect the 8P connector from the switch.

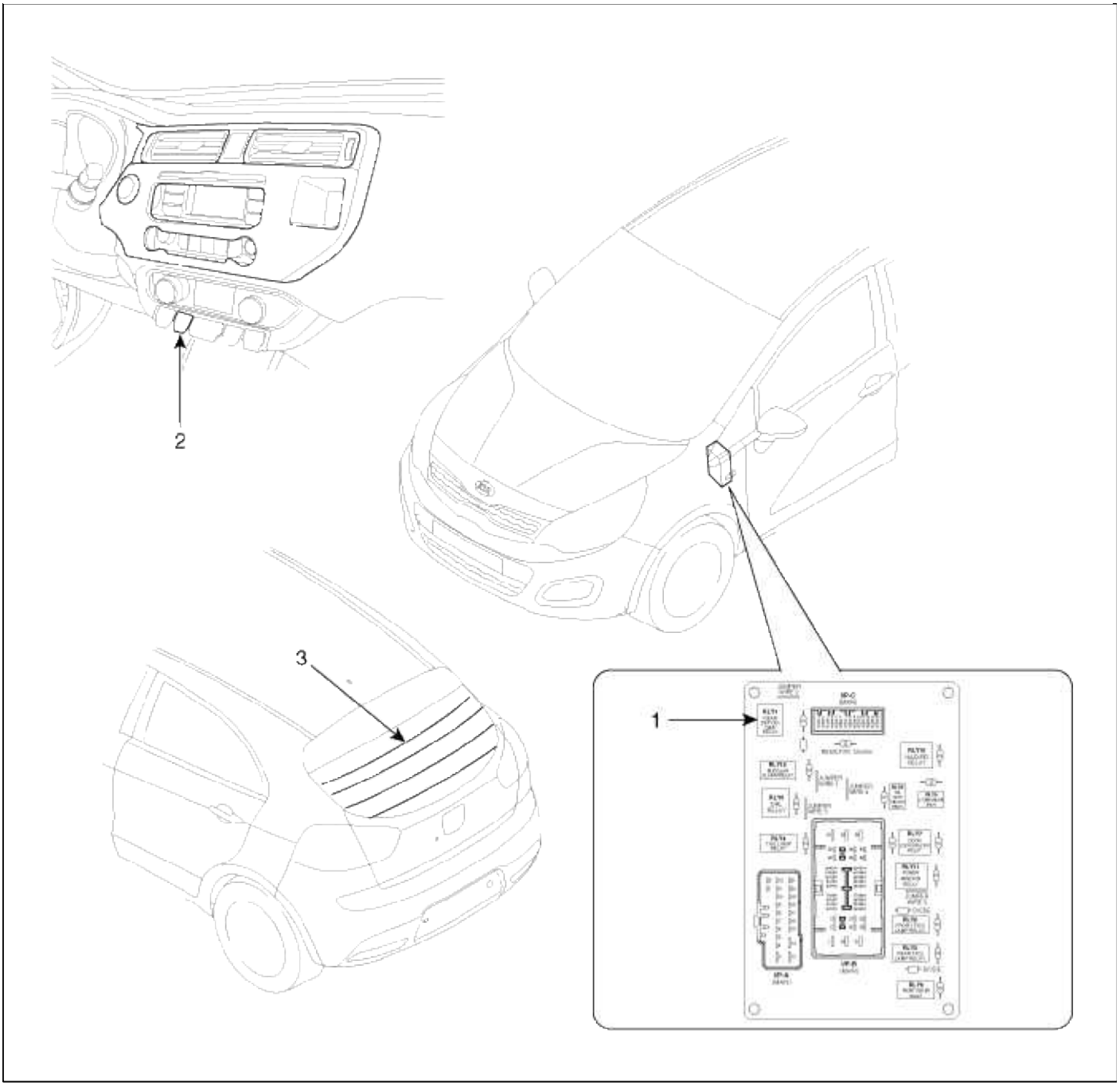


4. Check for continuity between the terminals in each switch position according to the table. If the continuity condition is not normal, replace the switch.

Terminal / Position	6	4	8	3	1
UP	○		○	○	○
OFF		○	○	○	○
DOWN	○	○		○	○

Body Electrical System > Rear Glass Defogger > Components and Components Location

Component Location



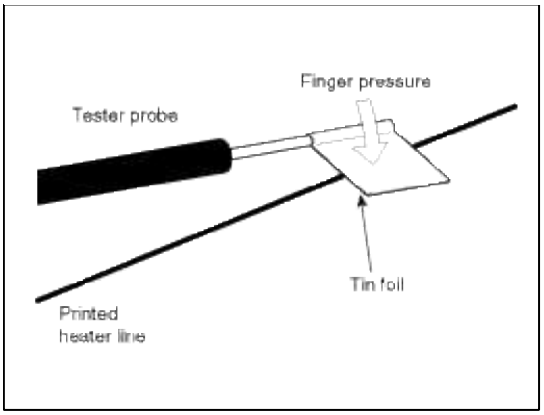
1. Rear glass defogger relay (Interior junction box) 2. Rear glass defogger switch	3. Rear glass defogger

Body Electrical System > Rear Glass Defogger > Rear Glass Defogger Printed Heater > Repair procedures

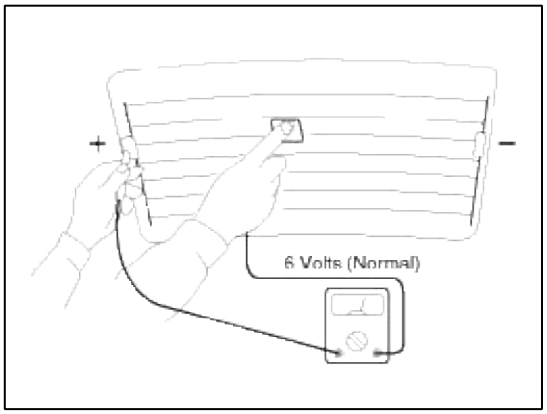
Inspection

CAUTION

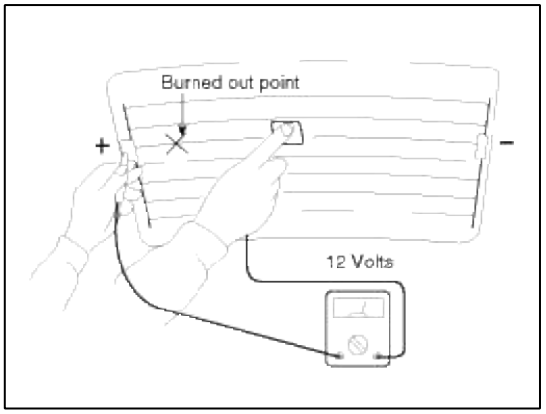
Wrap tin foil around the end of the voltmeter test lead to prevent damaging the heater line. Apply finger pressure on the tin foil, moving the tin foil along the grid line to check for open circuits.



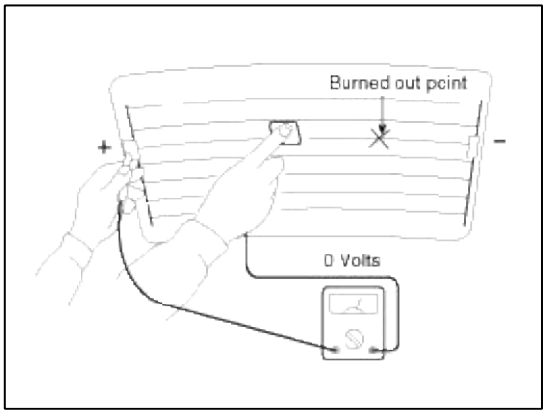
1. Turn on the defogger switch and use a voltmeter to measure the voltage of each heater line at the glass center point. If a voltage of approximately 6V is indicated by the voltmeter, the heater line of the rear window is considered satisfactory.



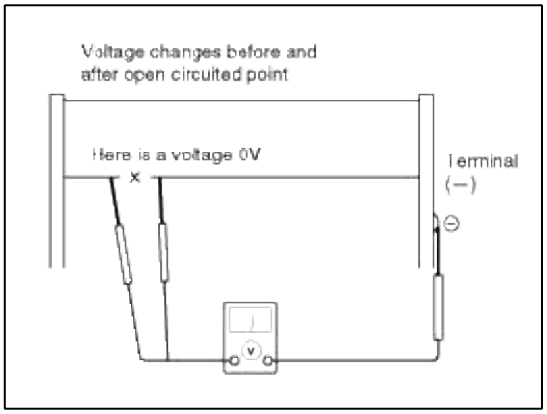
2. If a heater line is burned out between the center point and (+) terminal, the voltmeter will indicate 12V.



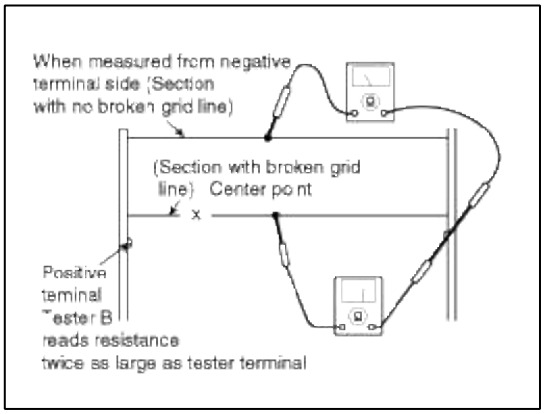
3. If a heater line is burned out between the center point and (-) terminal, the voltmeter will indicate 0V.



4. To check for open circuits, slowly move the test lead in the direction that the open circuit seems to exist. Try to find a point where a voltage is generated or changes to 0V. The point where the voltage has changed is the open-circuit point.



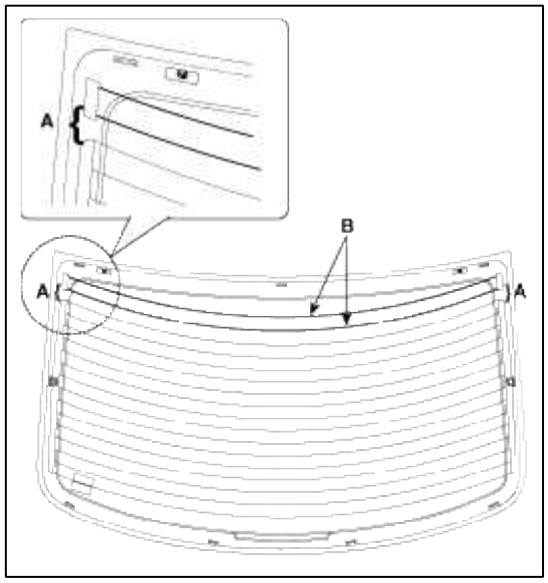
5. Use an ohmmeter to measure the resistance of each heater line between a terminal and the center of a grid line, and between the same terminal and the center of one adjacent heater line. The section with a broken heater line will have a resistance twice as that in other sections. In the affected section, move the test lead to a position where the resistance sharply changes.



Repair Of Broken Heater Line

CAUTION

The two upper lines(B) of the rear window heater do not function, but are decorative patterns. If you connect this part(A), other electric systems or vehicle are damaged because of electronic load. You never connect this part(A).

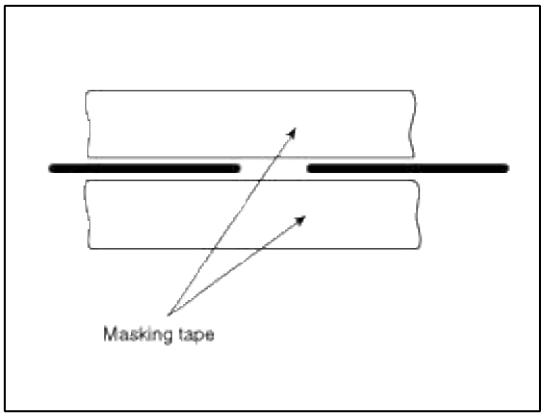


Prepare the following items:

1. Conductive paint.
2. Paint thinner.

3. Masking tape.
4. Silicone remover.
5. Using a thin brush:
   Wipe the glass adjacent to the broken heater line, clean with silicone remover and attach the masking tape as shown. Shake the conductive paint container well, and apply three coats with a brush at intervals of about 15 minutes apart. Remove the tape and allow sufficient time for drying before applying power. For a better finish, scrape away excess deposits with a knife after the paint has completely dried. (Allow 24 hours).

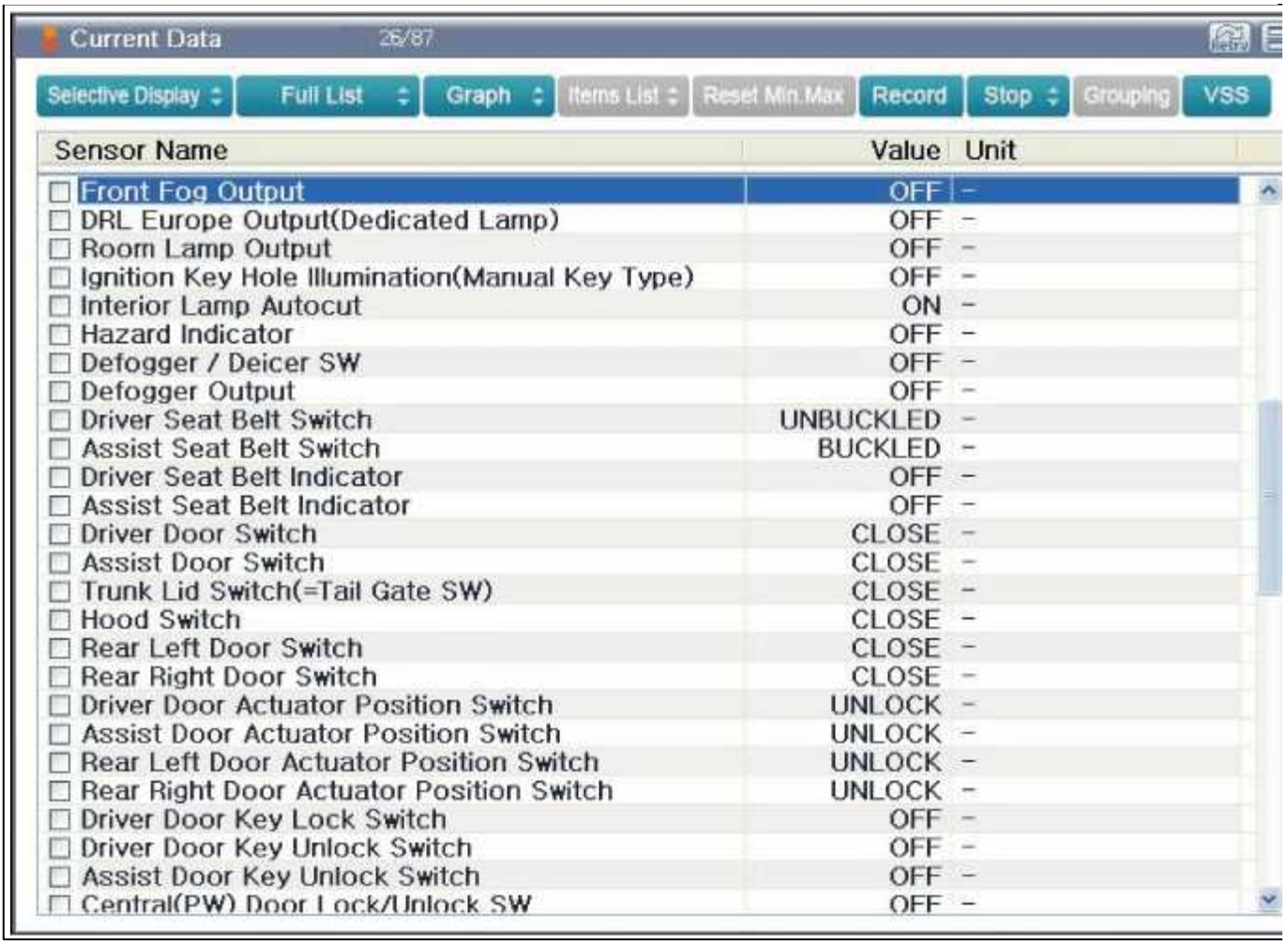
> CAUTION
>
> After repairing the heater line, clean a glass with a soft towel or clean the grid line with a small amount of wet towel.



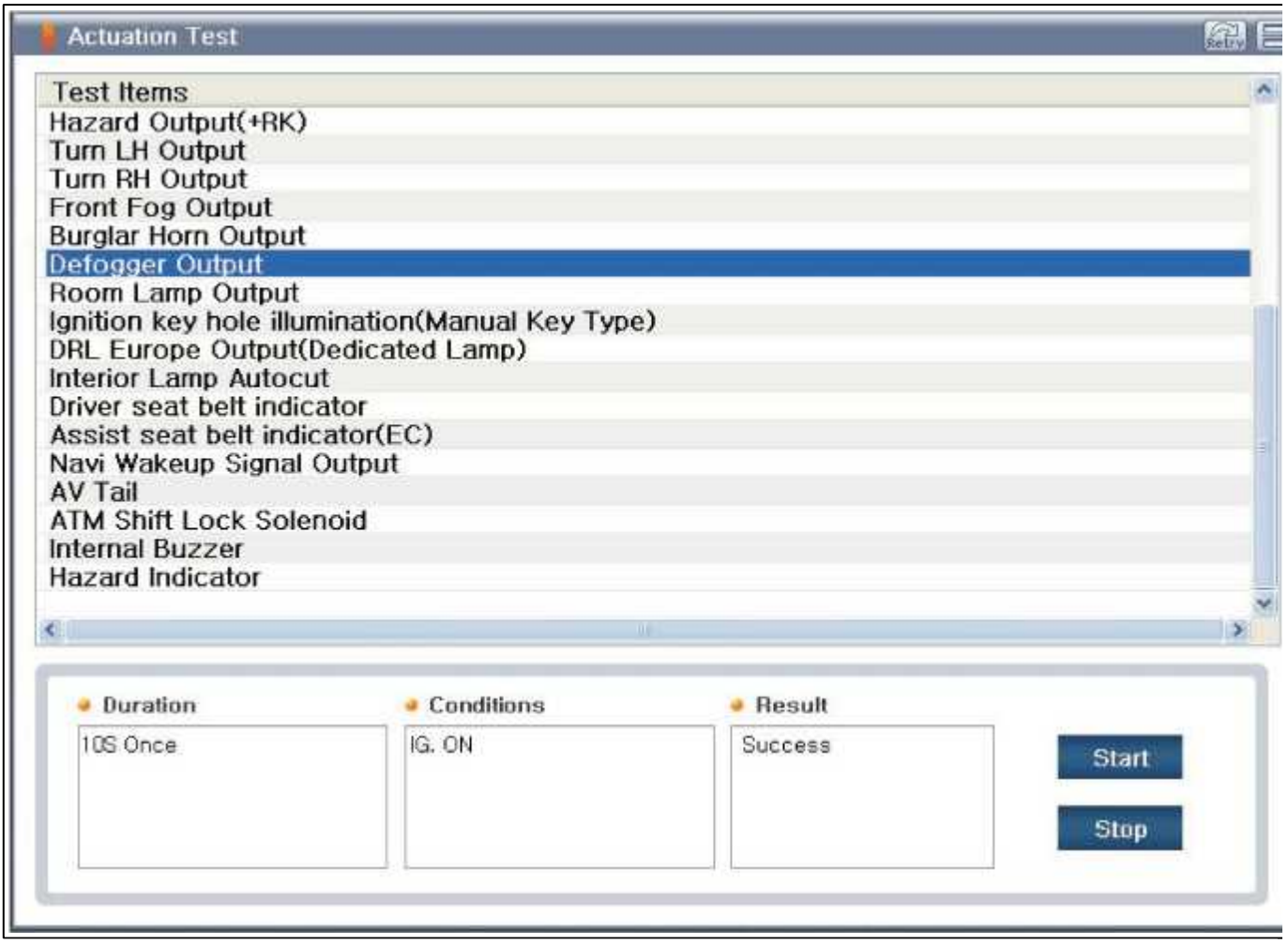
Body Electrical System > Rear Glass Defogger > Rear Glass Defogger Switch > Repair procedures

Inspection

1. It will be able to diagnose defects of rear glass defogger with GDS quickly. GDS can operates actuator forcefully, input/output value monitoring and self diagnosis.
2. Select "Current data", if you will check current data of rear glass defogger system. It provides input/output status o rear glass defogger.

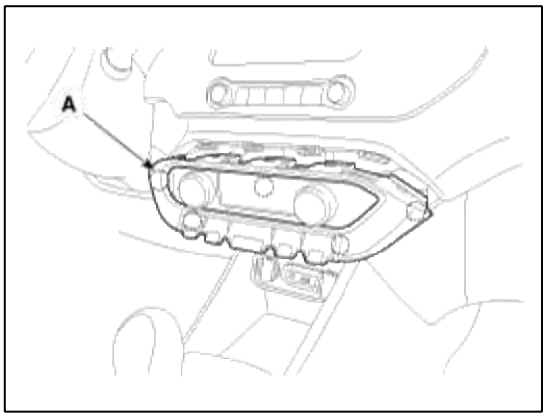


3. If you will check the rear glass defogger operation forcefully, select "Actuation test".

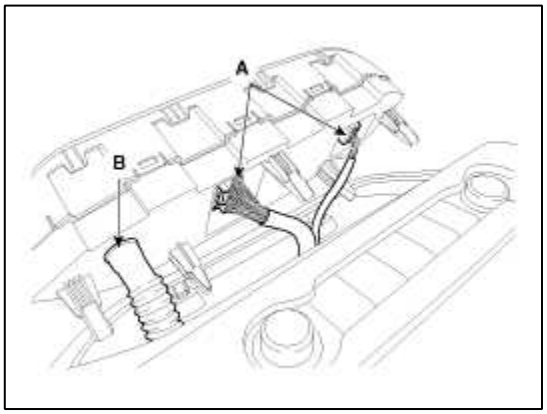


Removal

1. Disconnect the negative (-) battery terminal.
2. Using a csrewdriver or remover, remove the heater cotrol unit (A).



3. Disconnect the connectors (A) and hose (B).

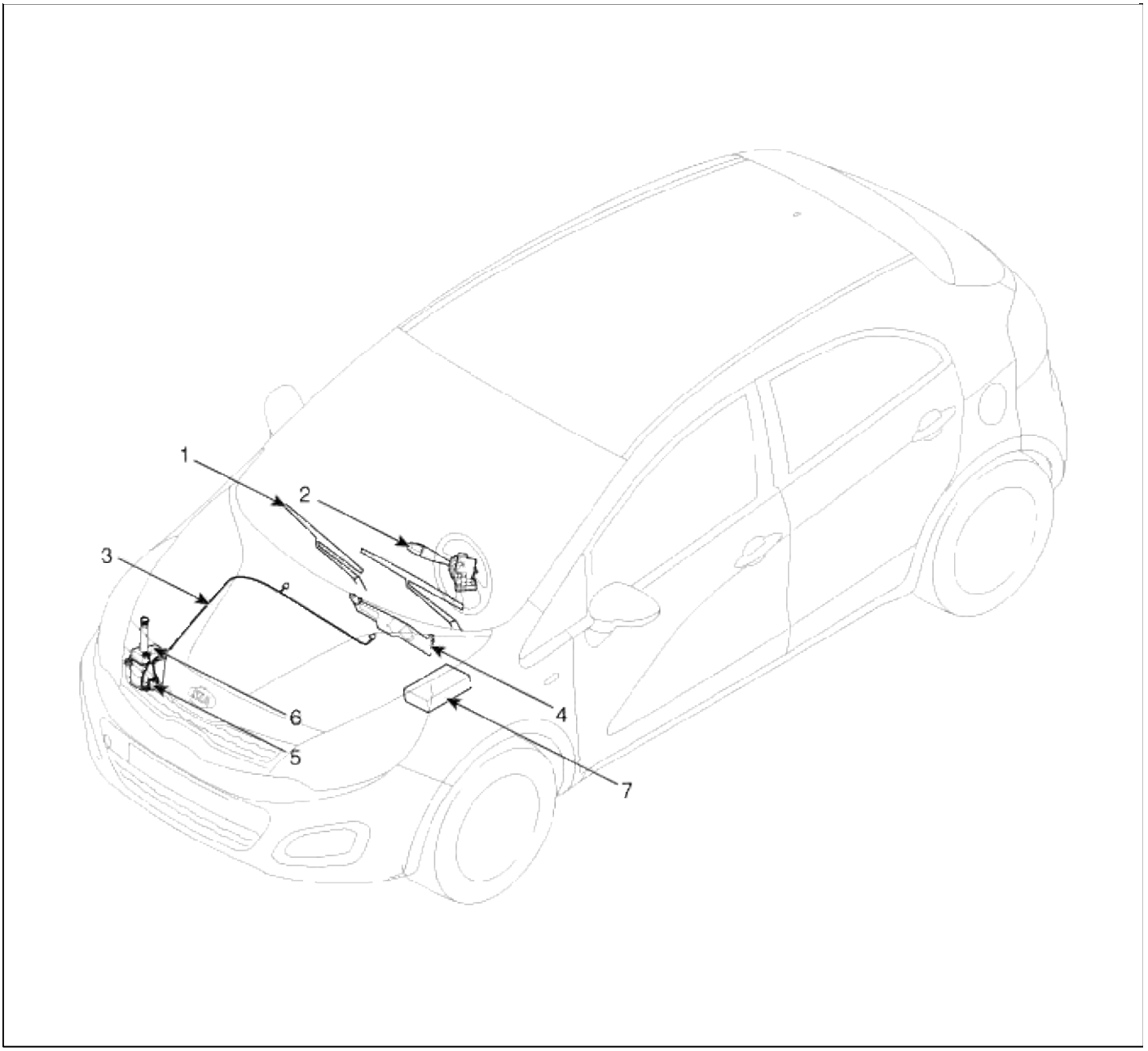


Installation

1. Connect the connector and hose.
2. Install the heater control unit.

Body Electrical System > Windshield Wiper/Washer > Components and Components Location

Component Location



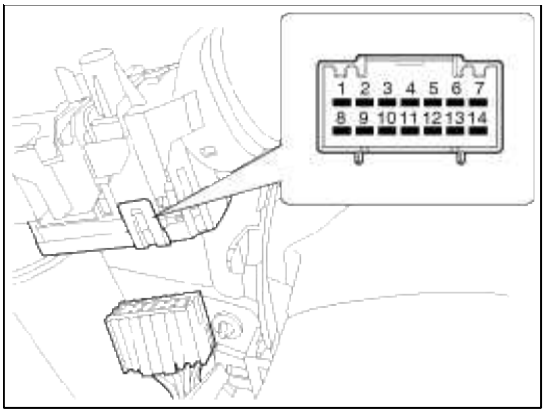
1. Windshield wiper arm & blade	5. Washer motor
2. Wiper & washer switch	6. Washer reservoir
3. Windshield washer hose	7. Wiper relay (Engine room relay box)
4. Windshield wiper motor & linkage	

Body Electrical System > Windshield Wiper/Washer > Windshield Wiper-Washer Switch > Repair procedures

Inspection

Wiper And Washer Switch Inspection

With the multifunction switch in each position, make sure that continuity exists between the terminals below. If continuity is not as specified, replace the multi-function switch.



Wiper Switch (Intermittent)

Position \ Terminal	3	9	2	8	10	1	12	13
MIST	○		○		○	○		
OFF	○		○					
INT	○		○	○	○		∿	○
LO	○				○			
HI		○			○			

Washer Switch

Position \ Terminal	11	10
OFF		
ON	○	○

Rear wiper switch

Position \ Terminal	6	7	14
OFF			
INT	○	○	
ON	○		○

Rear washer switch

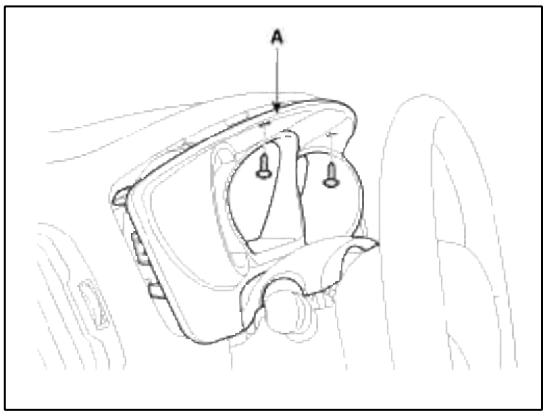
Position \ Terminal	6	5
OFF		
ON	○	○

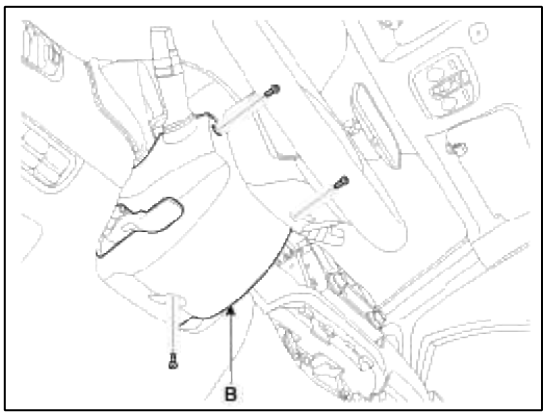
Removal

Wiper and Washer Switch

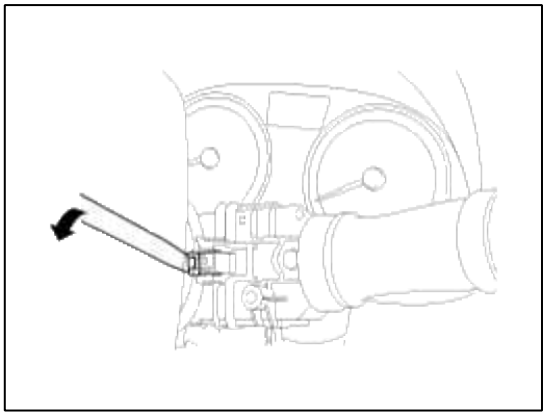
1. Disconnect the negative (-) battery terminal.
2. Remove the steering wheel.
   (Refer to the ST group - "Steering column & shaft")

3. Remove the steering column upper (A) and lower (B) shrouds after removing the screw.





4. Disconnect the connector(A). Release the lock of wiper switch using tool without removing the steering wheel and the clock spring.
   Remove the wiper and washer switch.

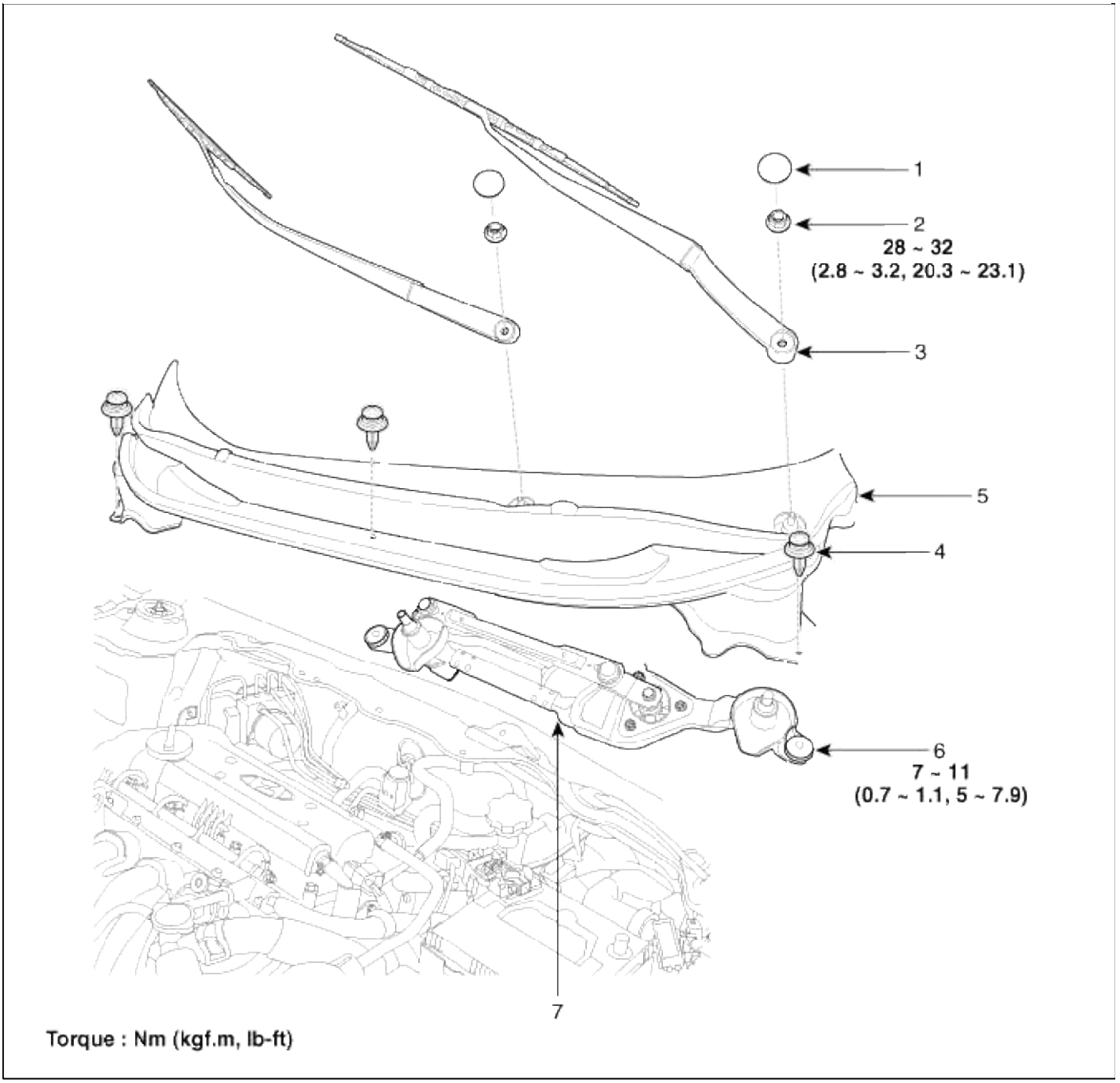


Installation

1. Install the wiper switch.
2. Install the steering column upper and lower shrouds.

Body Electrical System > Windshield Wiper/Washer > Front Wiper Motor > Components and Components Location

Component Location

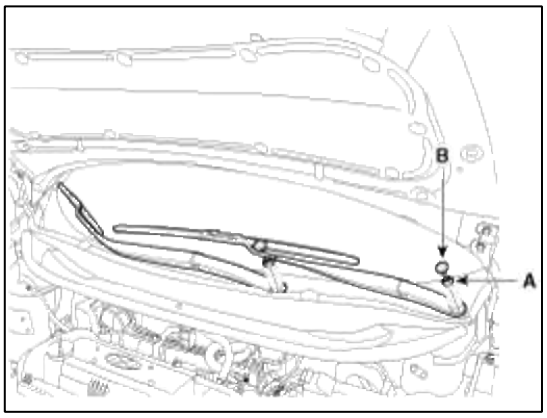


1. Cap 2. Nut 3. Wiper arm & blade 4. Rivet	5. Cowl top cover 6. Bolt 7. Wiper motor & linkage assembly

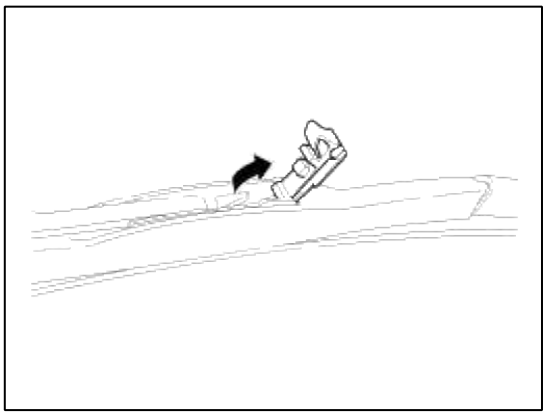
Body Electrical System > Windshield Wiper/Washer > Front Wiper Motor > Repair procedures

Removal

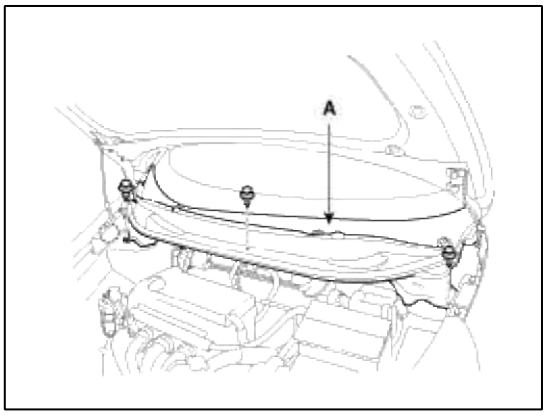
1. Loosen the windshield wiper arm nut (A) after removing a wiper cap (B).



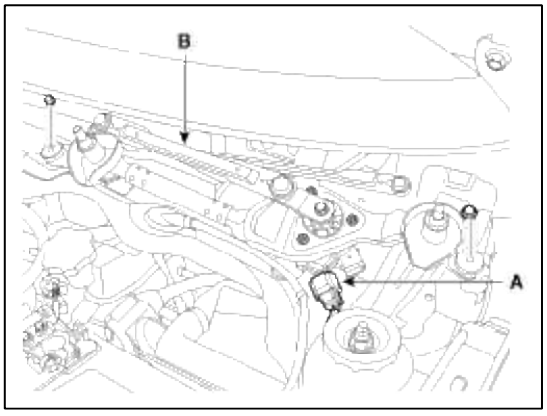
2. Remove the windshield wiper arm and blade.
3. If necessary, release the wiper blade fixing clip by pulling up and remove the wiper blade from the inside radius of wiper arm.



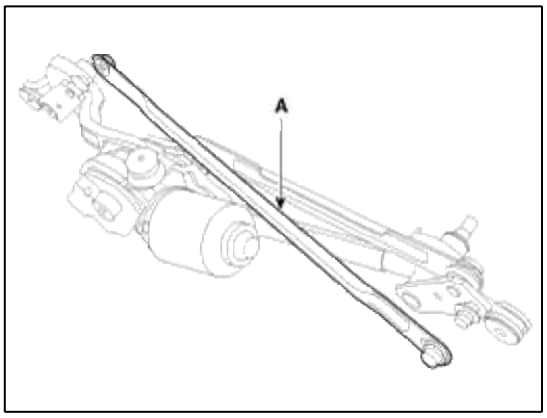
4. Disconnect the washer hose (A) connected to cowl top cover.
5. Remove the weather strip and the cowl top cover (B) after removing rivets.

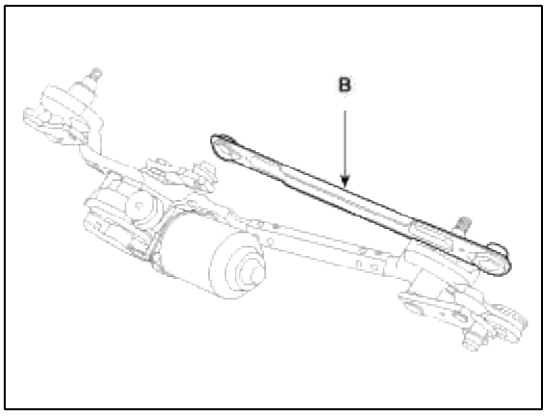


6. Disconnect the wiper motor connector (A) from the wiper motor & linkage assembly.
7. Remove the windshield wiper motor and linkage assembly (B) after removing 2 bolts.



8. Hold the wiper motor crank arm and remove the linkages (A) (B) from the wiper motor crank arm.

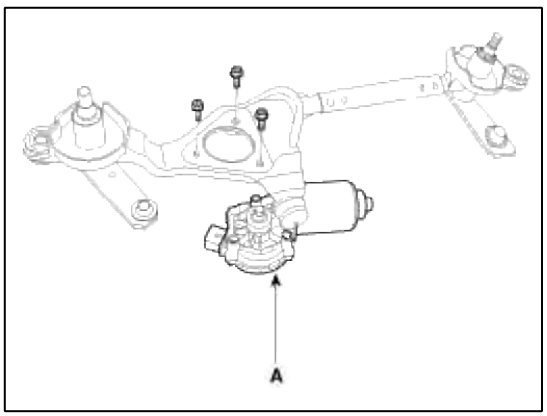




CAUTION

Before remving the wiper motor and linkage assembly, make sure that the linkage is stopped at auto stop position.
To install the wiper motor crank arm exactly, check that the linkage is aligned with the crank arm in straight line and the angle of each linkages.
Be careful not to bend the linkage.

9. Loosen 3 bolts and remove the wiper motor(A) from the wiper motor crank arm.



Installation

1. Install the wiper motor.
2. Install the crank arm.

3. Install the lower and upper linkage to the wiper motor crank arm.

> CAUTION
>
> To install the wiper motor crank arm, make sure that the linkage is aligned with the crank arm in straight line and set the angle of each linkage exactly.
> Be careful not to bend the linkage.

4. Install the wiper motor and linkage assembly and then connect the wiper motor connector.

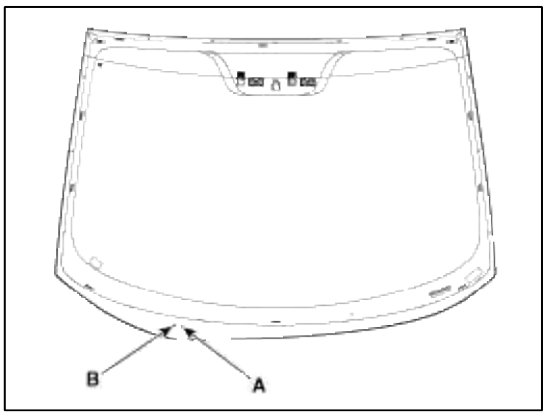
Tightening torque :
7 ~ 11Nm (0.7 ~ 1.1, kgf.m, 5.0 ~ 7.9 lb-ft)

5. Install the cowl top cover.
6. Install the windshield wiper arm and blade.

Tightening torque :
22.6 ~ 26.5 Nm (2.3 ~ 2.7 kgf.m, 16.7 ~ 19.6 lb-ft)

> NOTE
>
> - The windshield wiper motor must be cycled to make sure that it is in the auto stop position.
>   If necessary, adjust the wiper arm and blade.

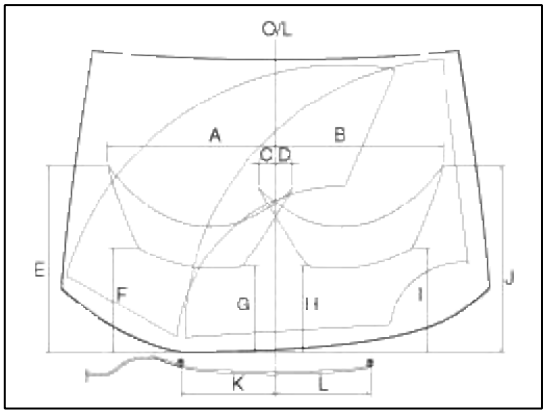
7. Install the wiper arm and blade to the auto stop position.
   A : Glass marking point (Driver)
   B : Glass marking point (Assistant)



8. Set the cowl top cover on the specified spray position.

NOTE

- When you turn on the washer, confirm 50% or more of washer fluid lands within the spray area.
- If the spray area is not within the standard positions, adjust the nozzle(s).



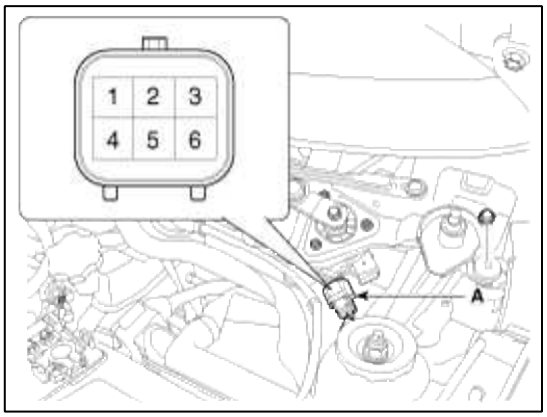
Specified position	Distance (in)	Distance ( )
A	20.8	528
B	20.8	528
C	2.0	51
D	2.0	51
E	23.1	586.5
F	12.8	325
G	10.6	269
H	10.6	269
I	12.8	325
J	23.1	586.5
K	11.8	299.5
L	11.8	299.5

Inspection

Speed Operation Check

1. Remove the connector (A) from the wiper motor.

1. - 2. IGN+ 3. Parking	4. High 5. GND 6. Low



2. Attach the positive (+) lead from the battery to terminal 6 and the negative (-) lead to terminal 5.
3. Check that the motor operates at low speed.
4. Connect the positive (+) lead from the battery to terminal 4 and the negative (-) lead to terminal 5.
5. Check that the motor operates at high speed.

> CAUTION
>
> Common sources of contamination are insects, tree sap, and hot wax treatments used by some commercial car washes. If the blades are not wiping properly, clean both the window and the blades with a good cleaner or mild detergent, and rinse thoroughly with clean water.

Body Electrical System > Windshield Wiper/Washer > Front Washer Motor > Repair procedures

Inspection

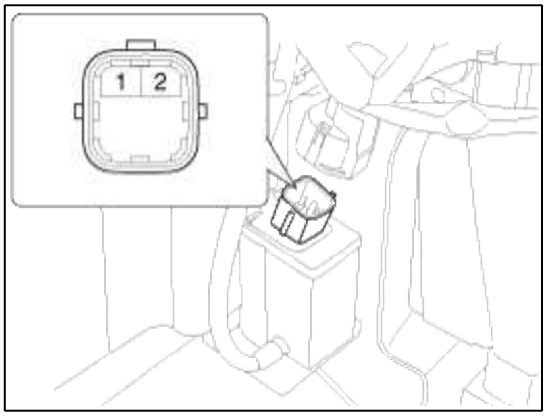
Front Washer Motor

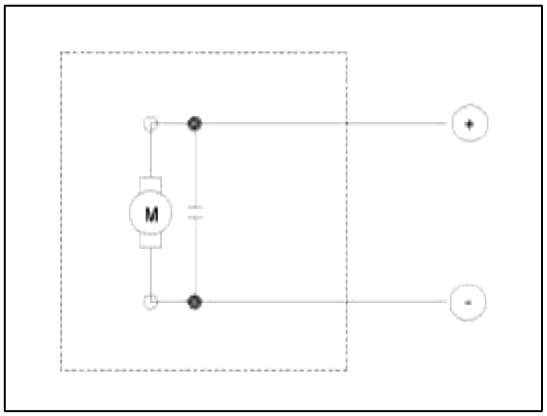
1. With the washer motor connected to the reservoir tank, fill the reservoir tank with water.

> NOTE
>
> Before filling the reservoir tank with water, check the filter for foreign material or contamination. if necessary, clean the filter.

2. Connect positive (+) battery cables to terminal 1 and negative (-) battery cables to terminal 2 respectively.
3. Check that the motor operates normally and the washer motor runs and water sprays from the front nozzles.

4. If they are abnormal, replace the washer motor.
   Connector No.1 : Windshield washer(+)
   2 : Ground



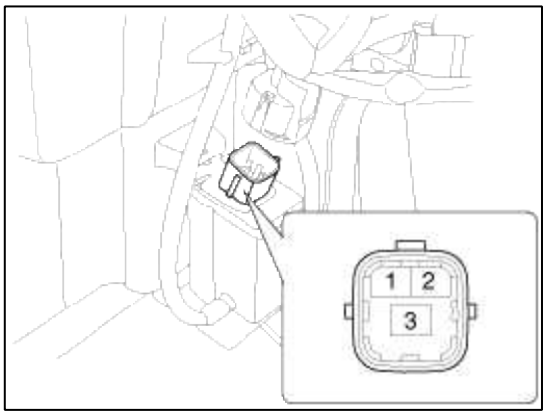


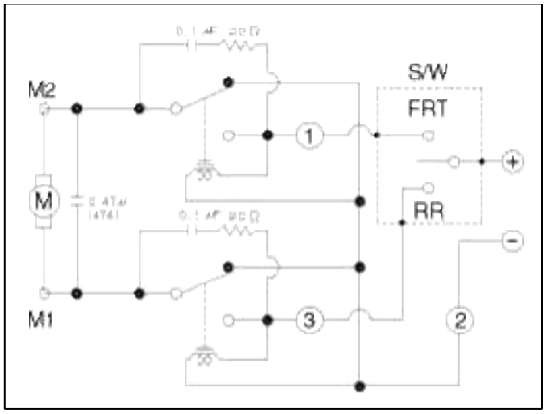
Front & Rear Washer Motor

1. With the washer motor connected to the reservoir tank, fill the reservoir tank with water.

> NOTE
>
> Before filling the reservoir tank with water, check the filter for foreign material or contamination. if necessary, clean the filter.

2. Connect positive (+) battery cables to terminal 1 and negative (-) battery cables to terminal 2 respectively.
3. Check that the motor operates normally and the washer motor runs and water sprays from the front nozzles.
4. If they are abnormal, replace the washer motor.
   Connector No.1 : Windshield washer(+)
   2 : Ground
   3 : Rear washer (+)



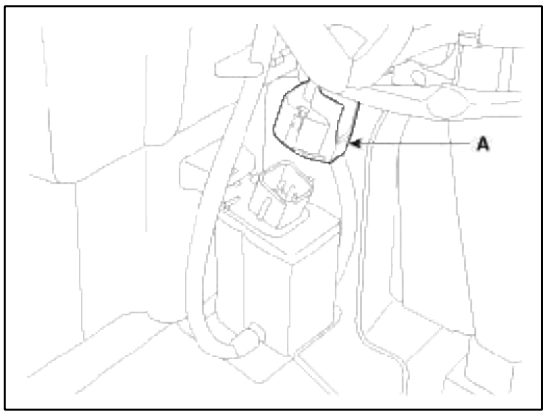


Removal

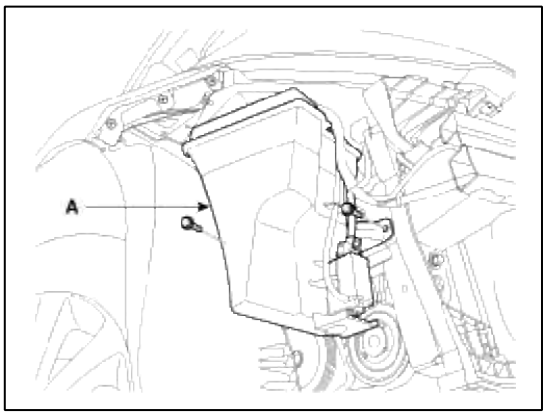
CAUTION

- When servicing the washer pump, be careful not to damage the washer pump seal.
- Do not operate the washer pump before filling the washer reservoir.
  Failure to do so could result in premature pump failure.

1. Disconnect the negative (-) battery terminal.
2. Remove the front wheel guard (RH).
   (Refer to the BD group - "Front wheel guard")
3. Remove the washer hose and disconnect the washer motor connector (A).



4. Remove the washer reservoir (A) after removing 2 bolts.



Installation

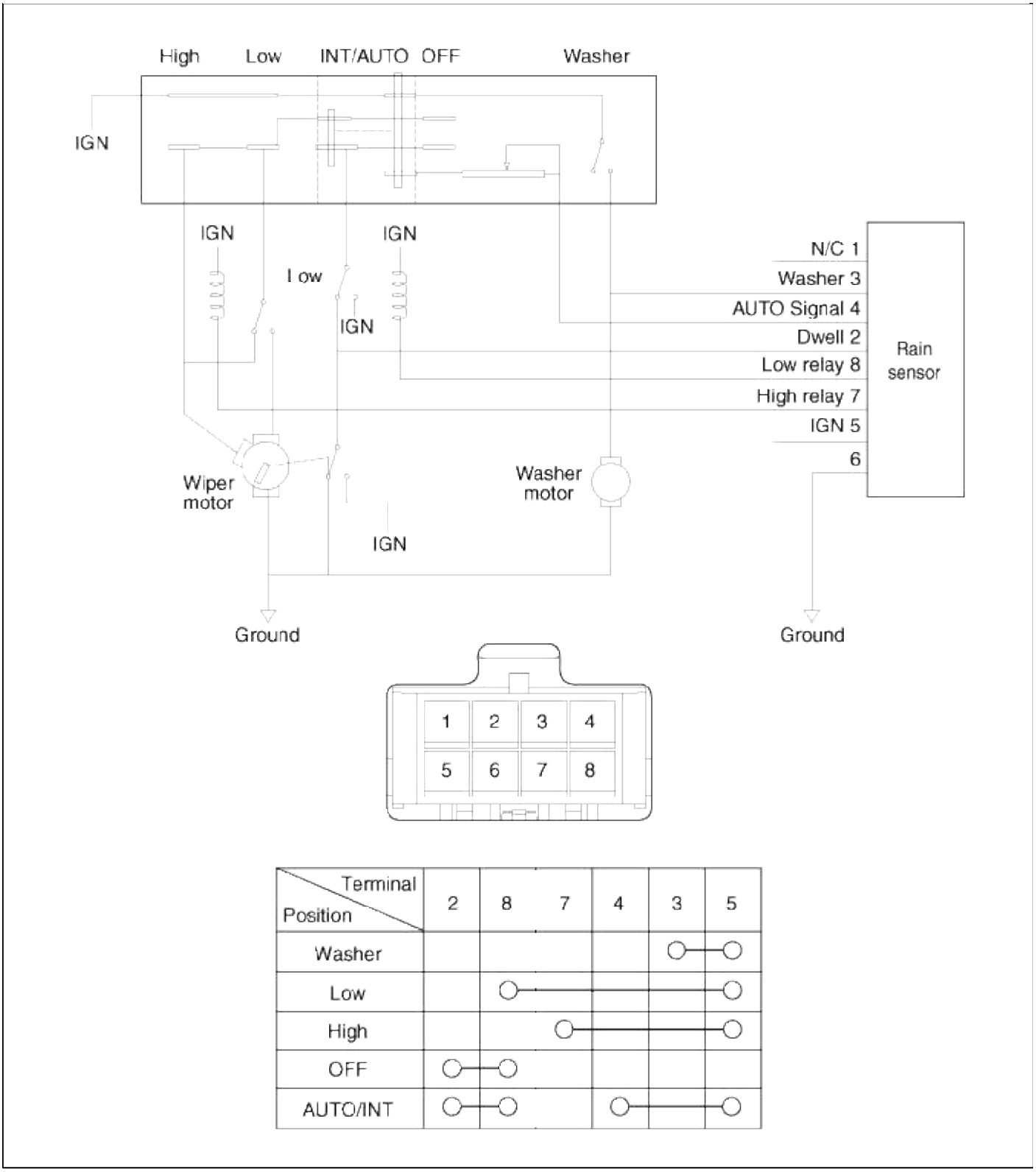
1. Install the washer reservoir.

> NOTE
>
> Before installing the pump motor, check the filter for foreign material or contamination. if necessary, clean the filter into the pump motor.

2. Install the washer motor.
3. Install the washer hose.
4. Connect the washer motor connector.
5. Install the front wheel guard (RH).
6. Check the washer motor operation.

Body Electrical System > Windshield Wiper/Washer > Rain Sensor > Schematic Diagrams

Circuit Diagram



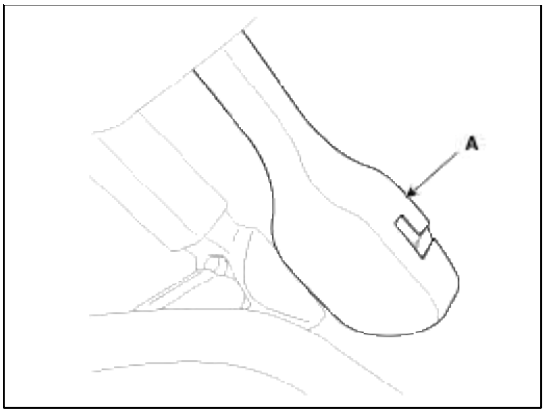
Terminal / Position	2	8	7	4	3	5
Washer					○	○
Low		○	—	—	—	○
High			○	—	—	○
OFF	○	○				
AUTO/INT	○	○		○	—	○

Body Electrical System > Windshield Wiper/Washer > Rain Sensor > Description and Operation

Description

The Rain sensing windshield wiper system is a wiper system that, in addition to providing normal wiper functions off, mist, manual low speed, manual high speed, and wash, provides automatic control of automatic intermittent automatic low, and automatic high speeds.

When the ignition key is in the ON position, the rain sensor (A) will be activated.



System Function

Basic Principle

Emitted Beam from luminosity diode is reflected entirely against the windshield exterior, and then turn into photo diode.

If there is water on the windshield exterior, beam separates optically, and the degree of remained beam is measured in the photo diode.

What there is water in the windshield, it means beam is not reflected all, so the degree of lost beam indicates the degree of glass surface wet.

NOTE

Rain sensor consist of two luminosity diode, two photo diode, optic fiber and coupling pad.

Operation Control

Wiper ECU transmits the signal as a rain sensor, and then the rain sensor perceives the rainwater to transmit to the wiping order wiper ECU, wiper ECU controls the wiper motor according to the signal.

Contact Influence

The rain sensor can malfunction due to following condition

- Contamination of the measurement surface.
- Air bubbles between the windshield and the coupling pad contact surface.
- The movement of coupling pad by vibration.
- Damaged wiper blade.

Operation Condition

In case that engine starts under wiper switch AUTO, rain sensor activates after once wiper operation to inform the driver that the system is under AUTO.

NOTE

In case that the rain sensor doesn't work or malfunction, it is needed manual wiper switch operation by the driver.

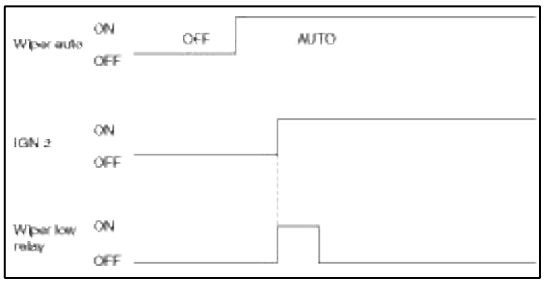
Body Electrical System > Windshield Wiper/Washer > Rain Sensor > Repair procedures

Inspection

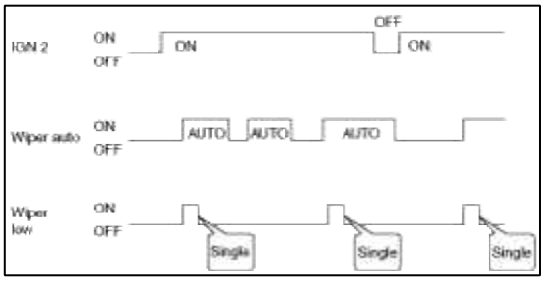
Rain Sensing Wiper

1. In IGN2 ON state, if auto switch input (LIN communication) is ON then both wiper low relay and wiper high relay outputs are controlled by the rain sensor input signal.

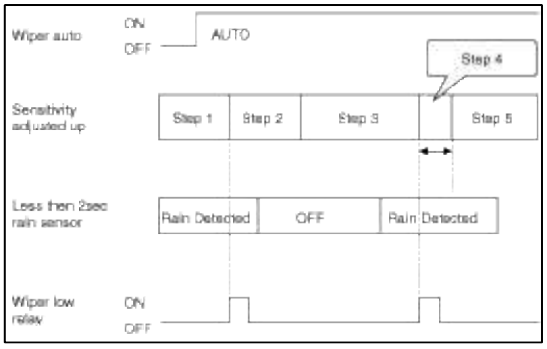
2. If the wiper switch has been left in automatic mode with the vehicle ignition OFF, and then the vehicle ignition switch is turned on, a single wipe will be performed.



3. A single wipe will be performed whenever rain has been detected (Rain Detected signal from Rain sensor) and the wiper switch is moved to the AUTO position. But a single wipe will not be performed when the wiper switch is moved to the AUTO position and OFF signal is being received from Rain sensor. But if the wiper switch is moved to AUTO position for the first time since vehicle ignition switch is turned on then a single wipe will be performed regardless of Rain Detected or OFF signal.



4. The drive may adjust the rain sensor performance by adjusting the sensitivity input. When in automatic mode, the BCM will perform a single wipe each time the sensitivity is adjusted upward to a more sensitive setting (downward more then one step). This single wipe will only be performed if Rain Detected signal is being received from the Rain sensor. If the sensitivity adjustment is adjusted upward more than one sensitivity, the BCM will only perform a single wipe unless the time between Increases is more than 2 seconds.

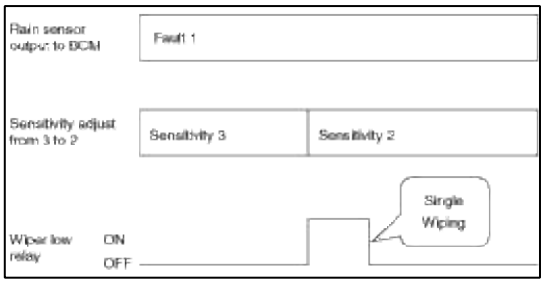


5. Fault strategy for the rain sensor

Rain Sensor Fault 1 - Internal Fault Detected

This failure is detected when the wiper is in automatic mode and the input faulty rain sensor from the rain sensor has a duty cycle corresponding to Fault 1. The confirmation delay for the failure is of 1 sec.

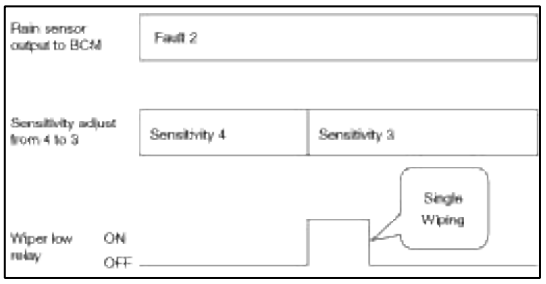
When this failure is detected, the wiper outputs are OFF and the wiper will also do a wipe in slow speed on the transition from sensitivity 3 to sensitivity 2 (Step 2 to 3) in order to signal the presence of this fault. If another sensitivity is set, the wiper won't make any additional wipe.



Rain Sensor Fault 2 - Glass Attachment Fault Detected

This failure is detected when the wiper is in automatic mode and the input faulty rain sensor from the rain sensor has a duty cycle corresponding to Fault 2. The confirmation delay for the failure is of 1 s.

When this failure is detected, the wiper outputs are OFF and the wiper will also do a wipe on the transition from sensitivity 4 to sensitivity 3 (Step 1 to 2) in order to signal the presence of this fault. If another sensitivity is set, the wiper won't make any additional wipe.



Rain Sensor Fault 3 - No Input Signal Present

This failure is detected when the wiper is in automatic mode and the input faulty rain sensor from the rain sensor has a duty cycle corresponding to Fault 3 or in case the duty cycle of the input faulty rain sensor is 0% or 100%. The confirmation delay for the failure is of 1 s.

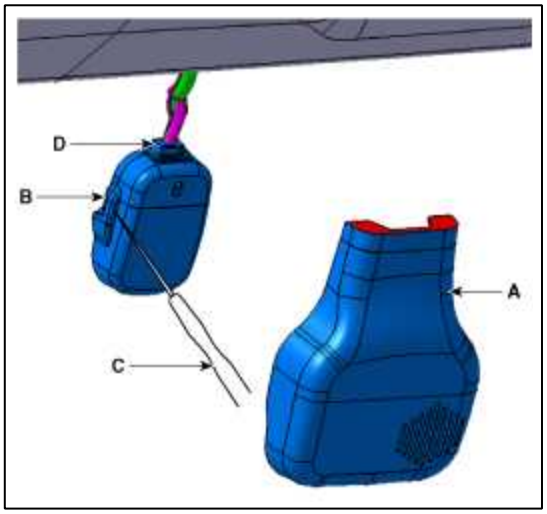
When this failure is detected, the wiper outputs are OFF.

Removal

CAUTION

The rain sensor may not operate properly if contaminated. Protect the rain sensor surface by not removing the cover until installation time. The coupling pad on the rain sensor surface has adhesive strength. Take care when installing the sensor. If the sensor is separated from the windshield by force, the sensor or windshield may be damaged. Take care when removing the sensor.

1. Remove the rain sensor cover (A) first.
   Be careful not to damage the cover latch by applying excessive force. To remove the latch, pull aside the latch using the cover hole (B) with the little (-) screwdriver (C).



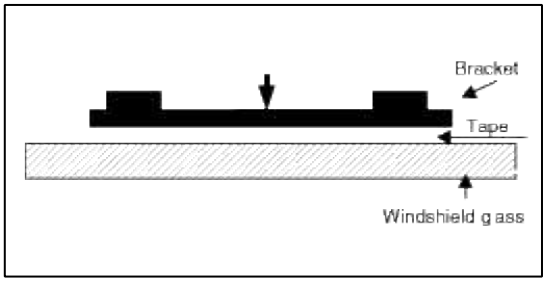
2. Remove the wiring harness connector (D) from sensor.
3. Rain sensor module is attached to the front windshield by glue replacing the front windshield, remove the rain sensor module from the existing front windshield and install on the new front windshield.

Installation

NOTE

- In case of the windshield with reflection layer which reflects the infrared rays in sensing field, remove the reflection layer from the rain sensor mounting position prior to installation.
- Avoid contamination of the sensor during installation.

1. Install the rain sensor bracket to the windshield glass using the tape.



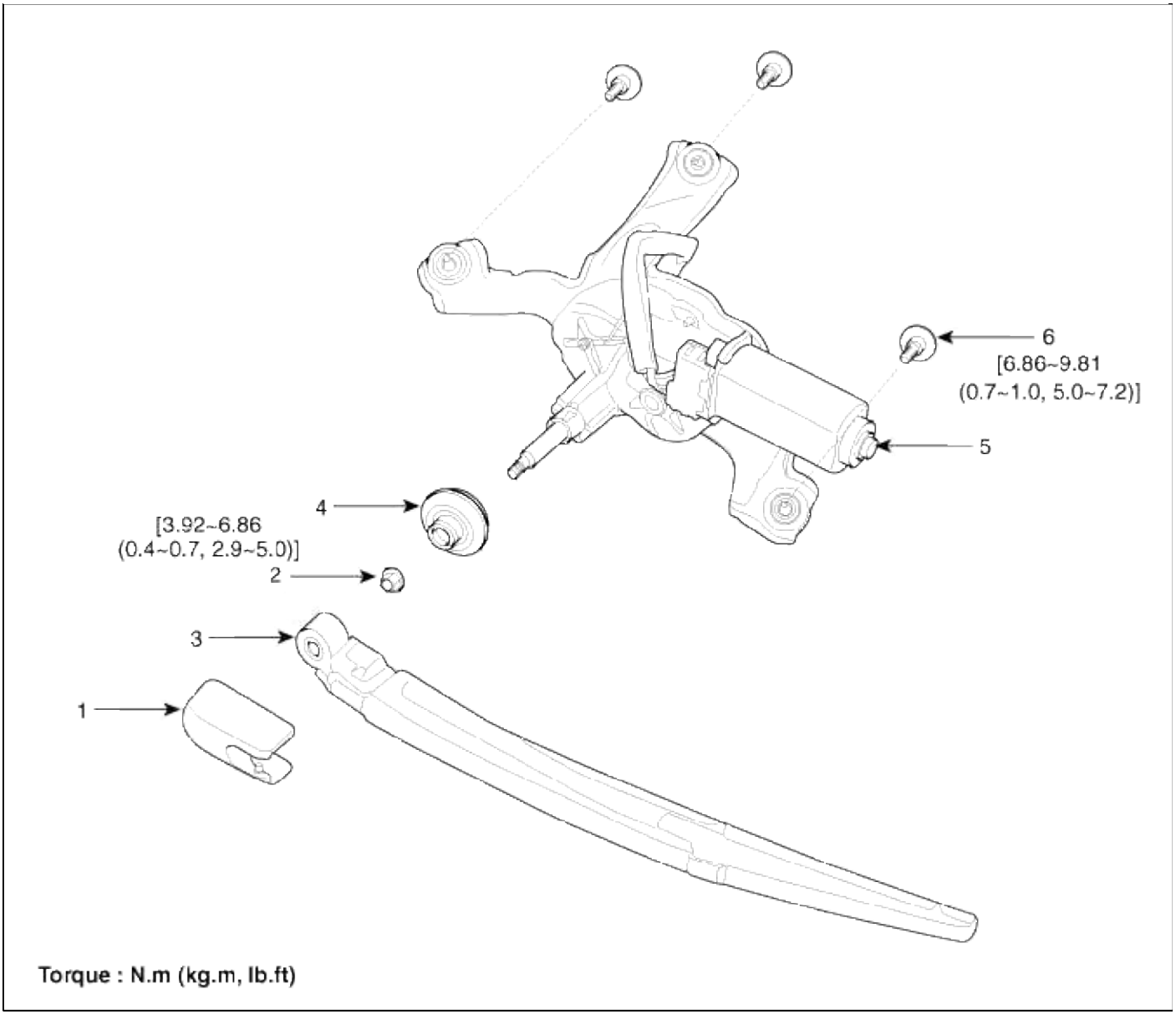
CAUTION

It is very important that the coupling pad pushes against the windshield completely to prevent bubbles from forming at the contact surface.

2. Connect the rain sensor connector, and then install the sensor cover.

Body Electrical System > Rear Wiper/Washer > Components and Components Location

Component Location

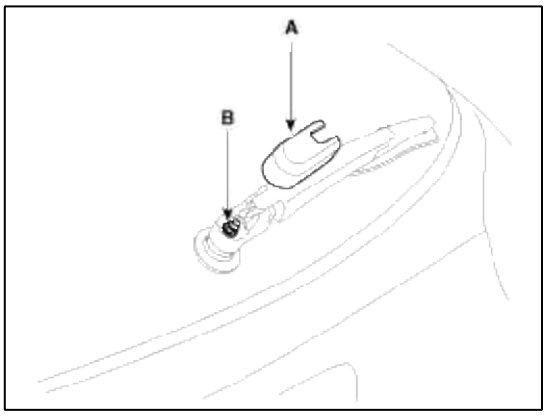


1. Head cap 2. Nut 3. Rear wiper arm & Blade	4. Packing (rubber) 5. Rear wiper motor assembly 6. Bolt

Body Electrical System > Rear Wiper/Washer > Rear Wiper Motor > Repair procedures

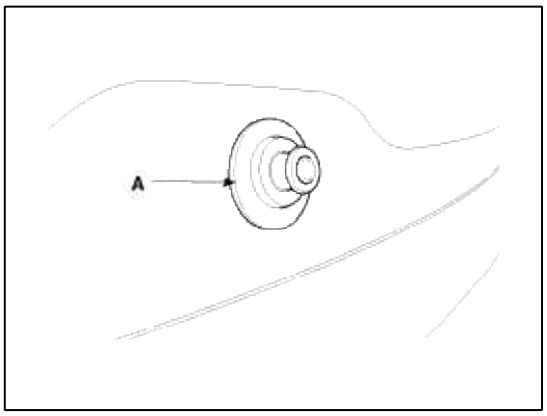
Removal

1. Detach the wiper cap (A) and remove a nut (B).



2. Remove the rear wiper arm & blade (A).

3. Remove the rubber packing (A).



4. Open the tailgate then remove the tailgate trim.
   (Refer to the BD group - "Tail gate")
5. Disconnect the rear wiper motor connector (A) then remove the rear wiper motor (B) after removing 3 bolts.

Installation

1. Install the rubber packing.
2. Install the rear wiper motor assembly.

Tightening torque :
6.86 ~ 9.81N.m (0.7 ~ 1.0kgf.m, 5.0 ~ 7.2lb-ft)

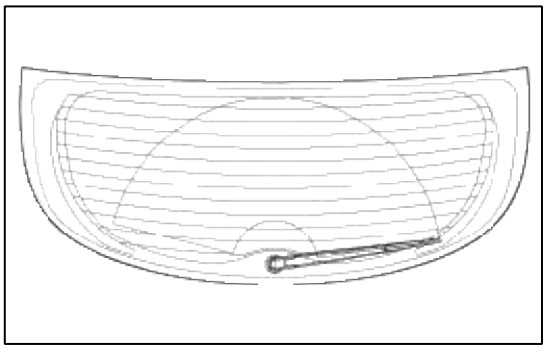
3. Intall the tailgate trim.
4. Install the rear wiper arm and rear wiper arm cap.

Tightening torque :
3.92 ~ 6.86N.m (0.4 ~ 0.7kgf.m, 2.9 ~ 5.0lb-ft)

NOTE

Before installation, be sure that the rear wiper motor is in the park position.
Turn the wiper switch ON and OFF to allow the rear wiper motor to cycle and stop in the park position.

5. Set the rear wiper blade to the lowest defogger heat line and tailgate glass.



Inspection

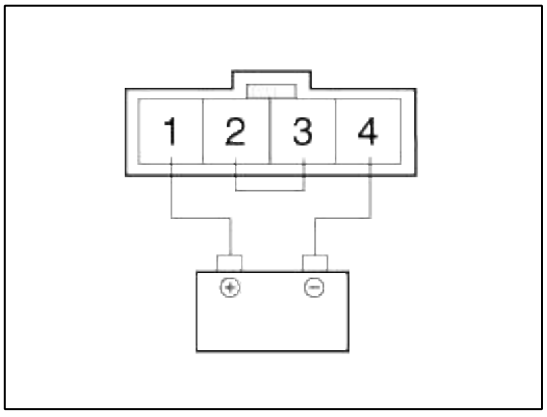
Rear Wiper Motor

1. Remove the 4P connector from the rear wiper motor.
2. Connect battery positive (+) and negative (-) cables to terminals 4 and 1 respectively.
3. Check that the motor operates normally. Replace the motor if it operates abnormally.

Pin No.	Description
1	Battery +
2	-
3	Switch
4	Ground

Automatic Stop Operation Check

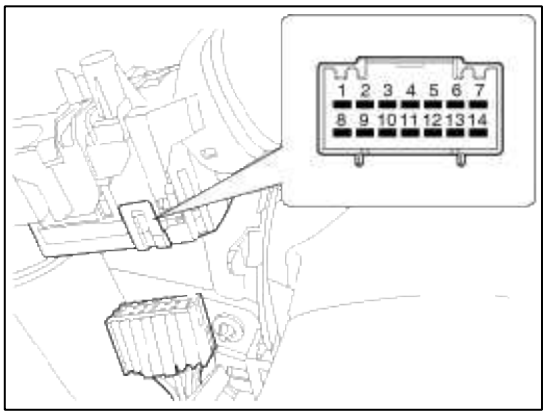
1. Operate the motor at low speed using the stalk control.
2. Stop the motor operation anywhere except at the off position by disconnecting terminal 3.
3. Connect terminals 2 and 3.
4. Connect the positive (+) lead from the battery to terminal 1 and the negative (-) lead to terminal 4.
5. Check that the motor stops running at the off position.



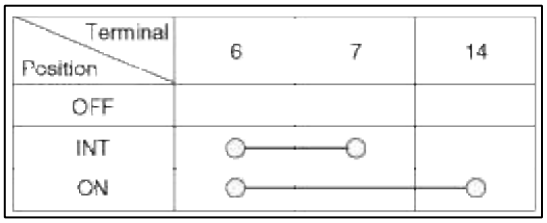
Body Electrical System > Rear Wiper/Washer > Rear Washer Switch > Repair procedures

Inspection

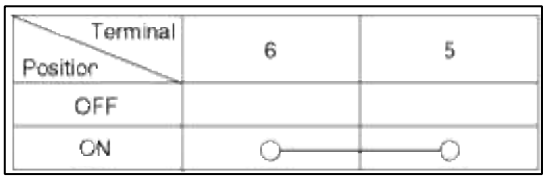
1. With the rear wiper & washer switch in each position, make sure that continuity exists between the terminals below. If continuity is not as specified, replace the multifunction switch.



Rear Wiper Switch



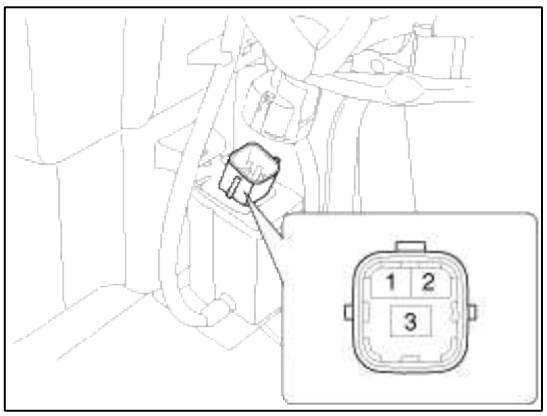
Rear Washer Switch

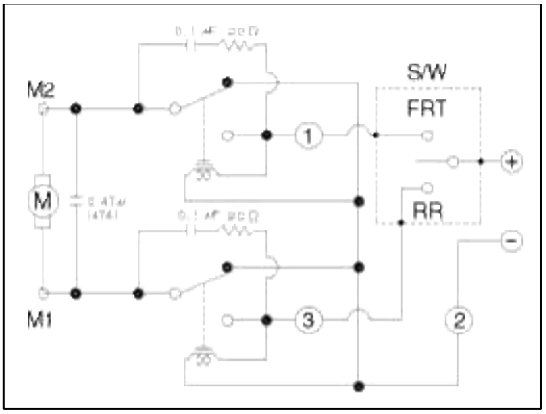


Body Electrical System > Rear Wiper/Washer > Rear Washer Motor > Repair procedures

Inspection

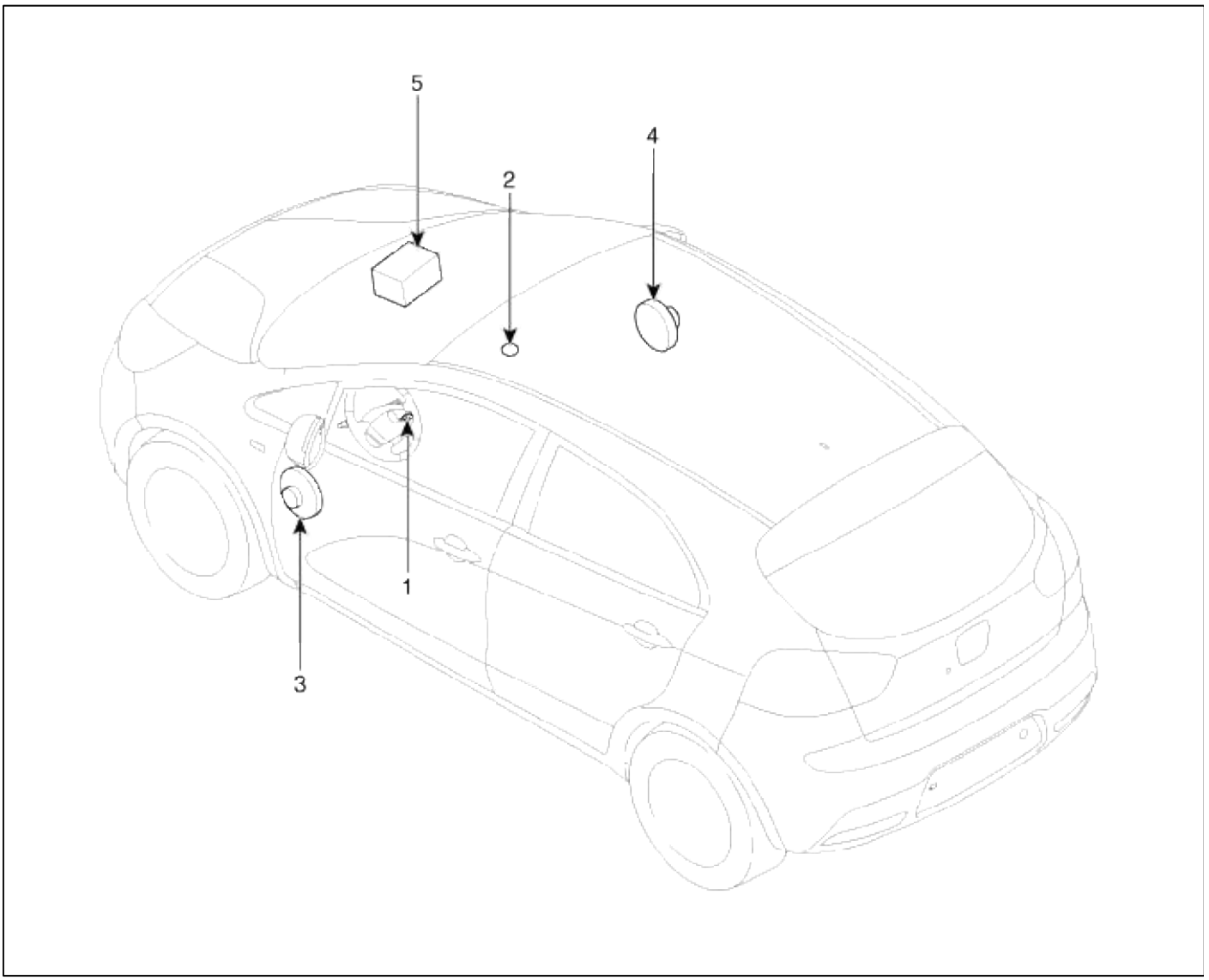
1. With the washer motor connected to the reservoir tank, fill the reservoir tank with water.
2. Remove the front bumper cover. (Refer to the Body group- Front bumper)
3. Connect positive (+) and negative (-) battery cables to terminals 3 and 2 respectively to see that the washer motor runs and water is pumped.
4. Check that the motor operates normally.
   Replace the motor if it operates abnormally.
   1. Front washer (+)
   2. Ground
   3. Rear washer (-)





Body Electrical System > Hands Free System > Components and Components Location

Components

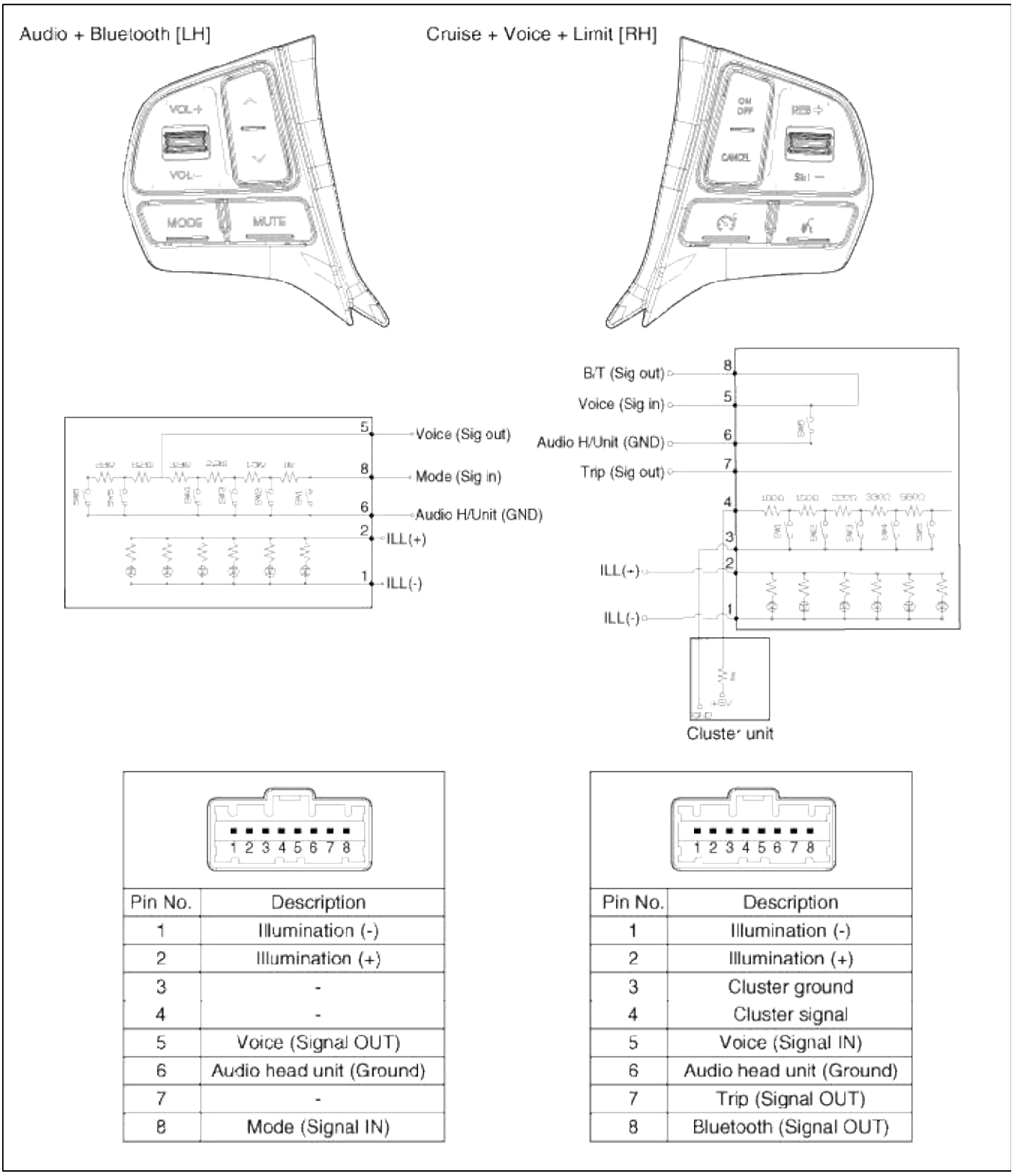


1. Hands free call switch 2. Mic 3. Front left speaker	4. Front right speaker 5. Audio head unit (hands free control)

There is no hands free jack. This system supports Bluetooth(wireless system).

Body Electrical System > Hands Free System > Hands free switch > Schematic Diagrams

Circuit Diagram(1)

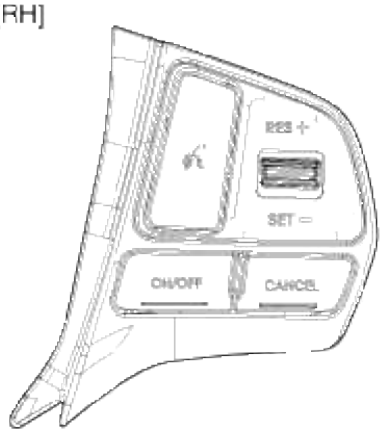


Pin No.	Description
1	Illumination (-)
2	Illumination (+)
3	-
4	-
5	Voice (Signal OUT)
6	Audio head unit (Ground)
7	-
8	Mode (Signal IN)

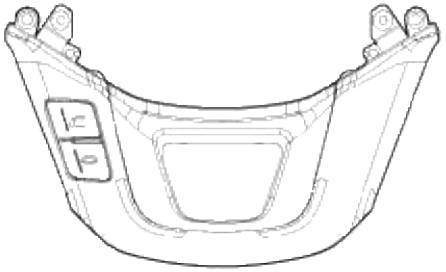
Pin No.	Description
1	Illumination (-)
2	Illumination (+)
3	Cluster ground
4	Cluster signal
5	Voice (Signal IN)
6	Audio head unit (Ground)
7	Trip (Signal OUT)
8	Bluetooth (Signal OUT)

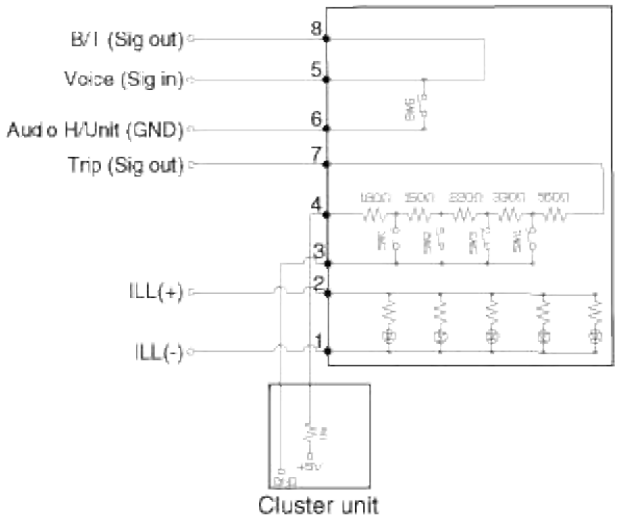
Circuit Diagram(2)

Cruise + Voice [RH]

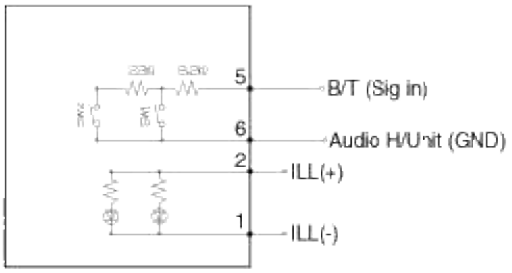


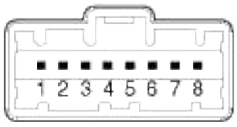
Bluetooth [Lower]



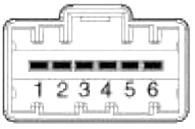


Cluster unit





Pin No.	Description
1	Illumination (-)
2	Illumination (+)
3	Cluster ground
4	Cluster signal
5	Voice (Signal IN)
6	Audio head unit (Ground)
7	Trip (Signal OUT)
8	Bluetooth (Signal OUT)



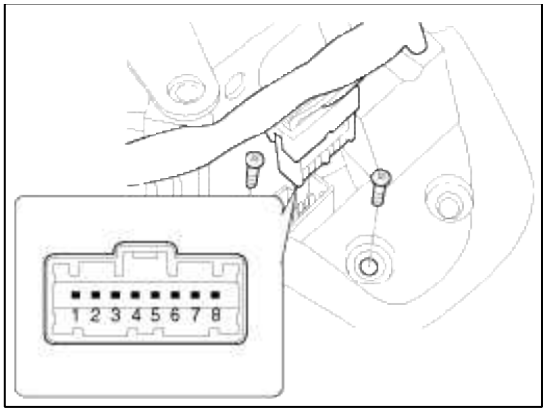
Pin No.	Description
1	Illumination (-)
2	Illumination (+)
3	-
4	-
5	Bluetooth (Signal IN)
6	Audio head unit (Ground)

Body Electrical System > Hands Free System > Hands free switch > Repair procedures

Inspection

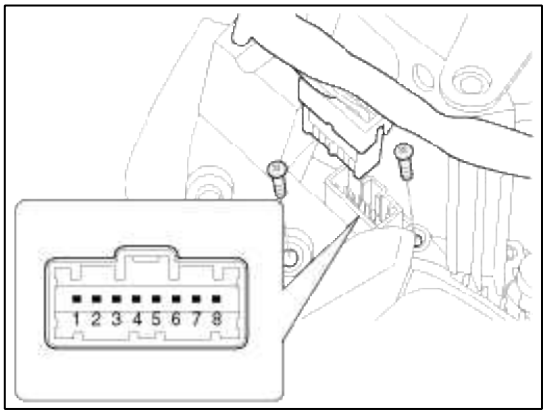
1. Check the hands free remote control switch for resistance between No.4 and No.5 terminals in each switch position.

Audio + Bluetooth [LH]



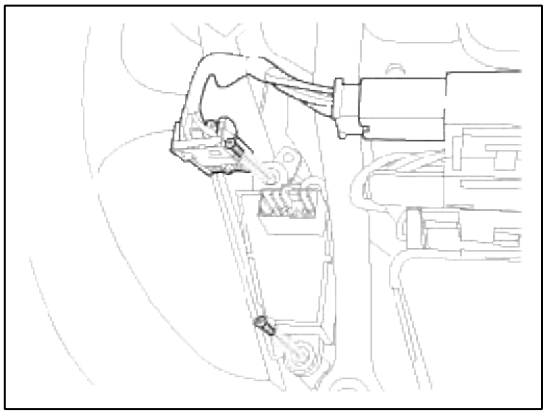
Switch	Connetor terminal	Resistance (±5%)
End of call	6-8	18.91 kΩ
Send	6-8	40.91 kΩ

Cruise + Voice + Limit [RH]/ Cruise + Voice [RH]



Switch	Connetor terminal	Resistance (±5%)
Voice	3-4	10.71 kΩ

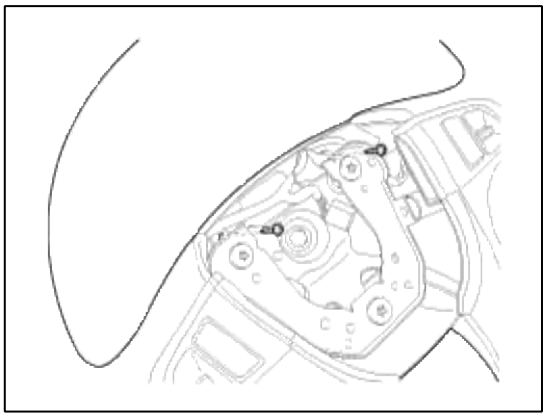
Bluetooth [Lower]



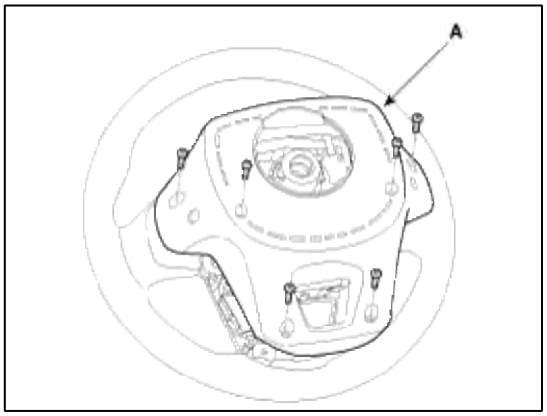
Switch	Connetor terminal	Resistance (±5%)
End of call	5-6	18.91 kΩ
Send	5-6	40.91 kΩ

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the driver airbag module.
   (Refer to the RT group - "DAB and Clock spring")
3. Remove the steering wheel.
   (Refer to the ST group - "Steering column & shaft")
4. Remove 2 screws on the steering wheel.



5. Remove the steering wheel cover (A) after loosening 6 screws.



6. Remove the hands free switch.

Installation

1. Reassemble the hands free switch after connecting the connector.
2. Reassemble the steering wheel.
3. Reassemble the driver airbag module.

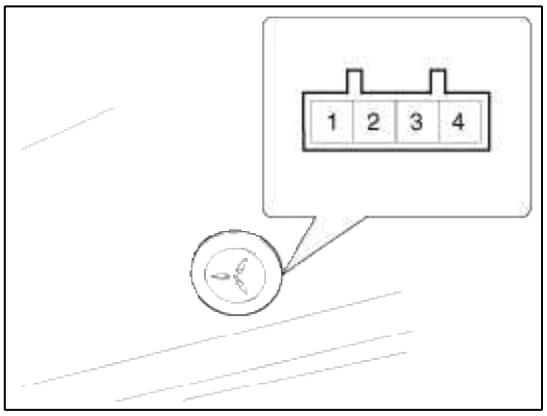
> NOTE
>
> Make sure the audio remote control switch and the airbag module connectors are plugged in properly.

Body Electrical System > Hands Free System > Hands free mic > Repair procedures

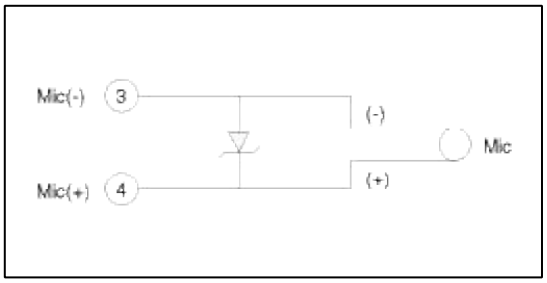
Inspection

1. Disconnect the negative(-) battery terminal.
2. Remove the roof trim.
   (Refer to the BD group - "Roof trim")

3. Remove the hands free mic after loosening the connector and screw(3EA) from roof top.

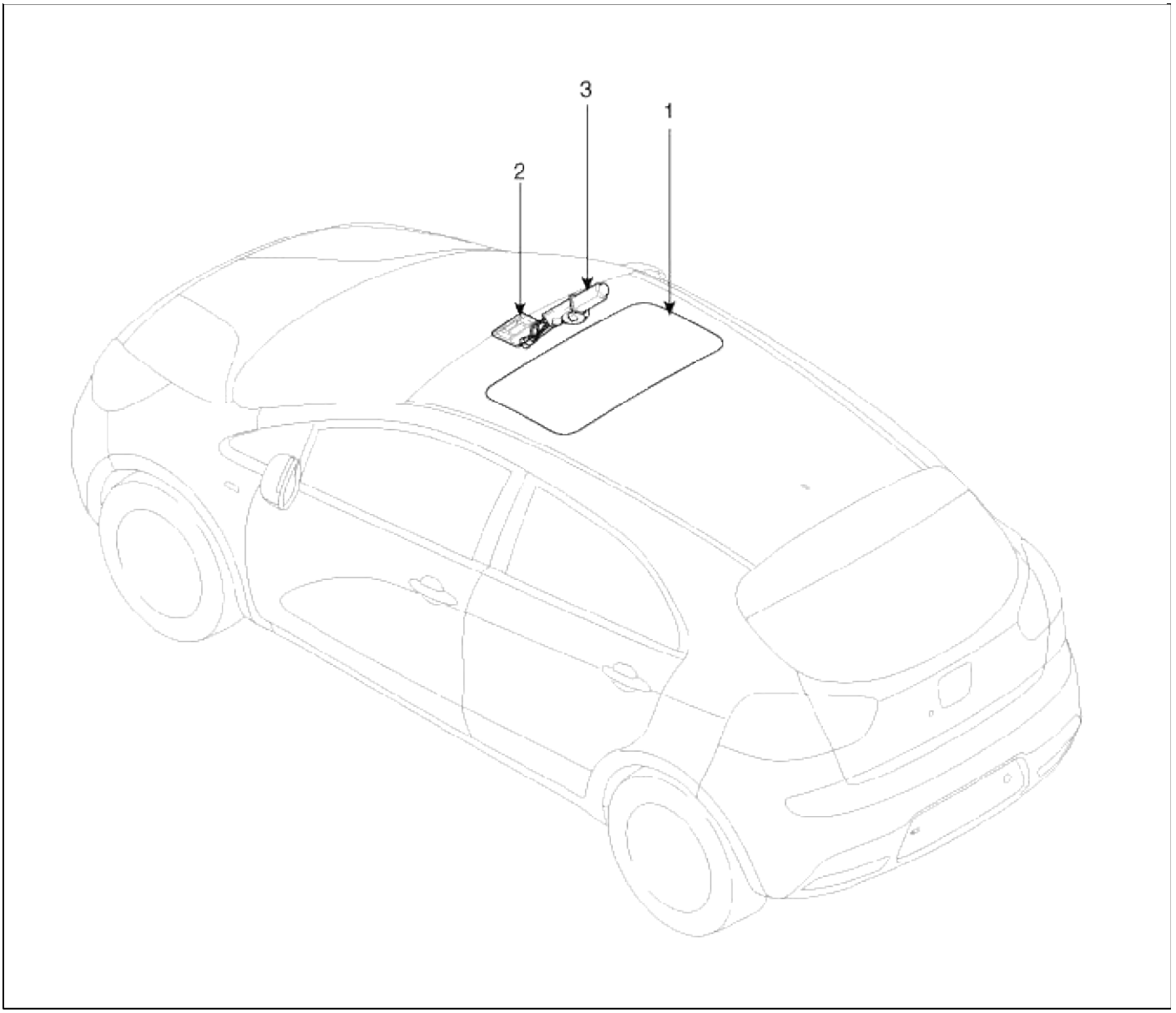


4. Check the continuity of Mic between terminals.



Body Electrical System > Sun Roof > Components and Components Location

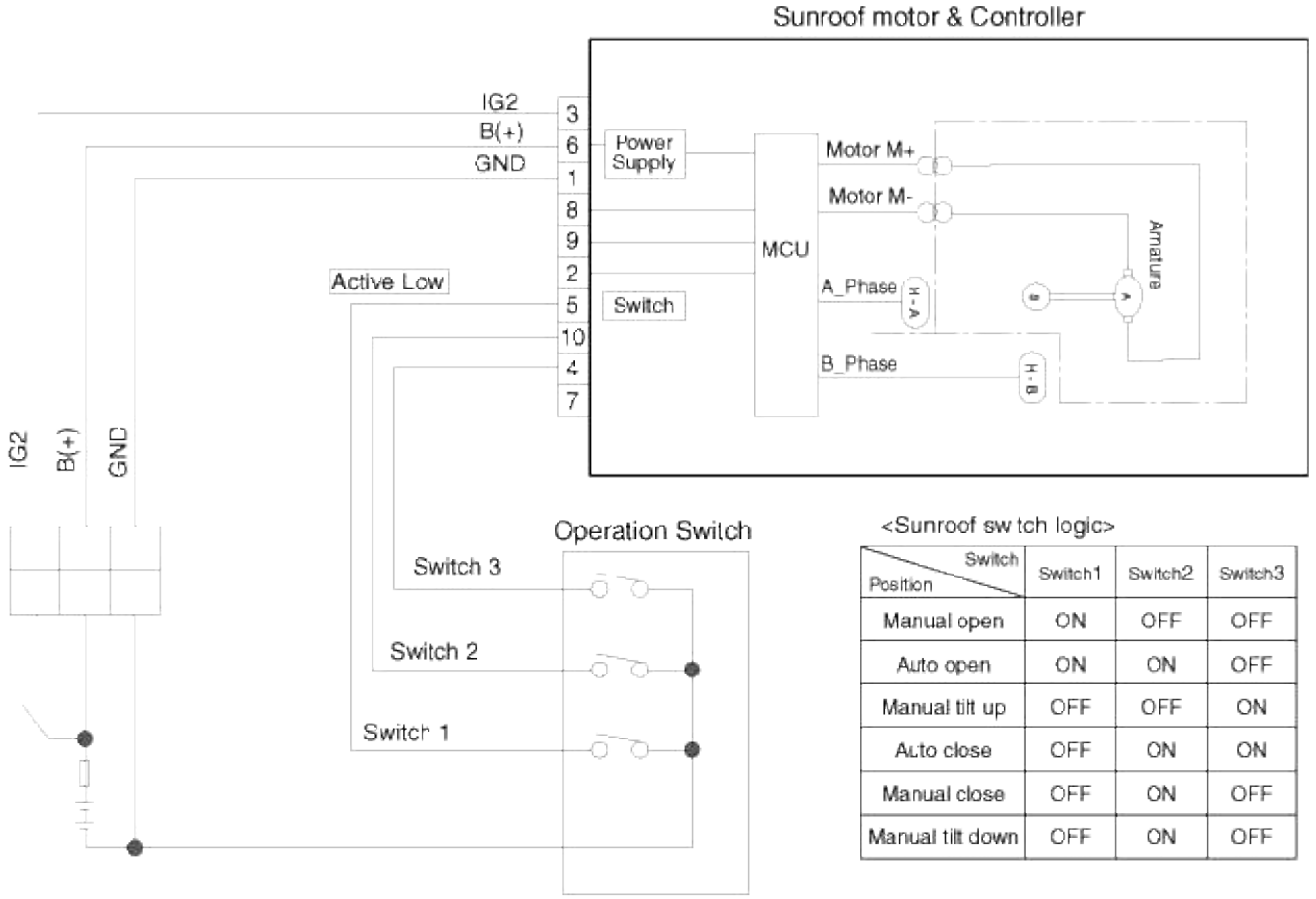
Component Location



1. Sunroof 2. Sunroof switch	3. Sunroof motor & controller

Body Electrical System > Sun Roof > Schematic Diagrams

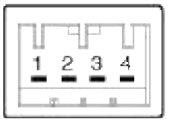
Circuit Diagram



<Sunroof sw tch logic>

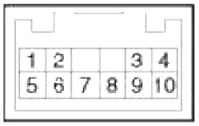
Switch / Position	Switch1	Switch2	Switch3
Manual open	ON	OFF	OFF
Auto open	ON	ON	OFF
Manual tilt up	OFF	OFF	ON
Auto close	OFF	ON	ON
Manual close	OFF	ON	OFF
Manual tilt down	OFF	ON	OFF

(Sunroof switch)



Pin No.	Description
1	Ground
2	Switch 1
3	Switch 2
4	Switch 3

(Motor)



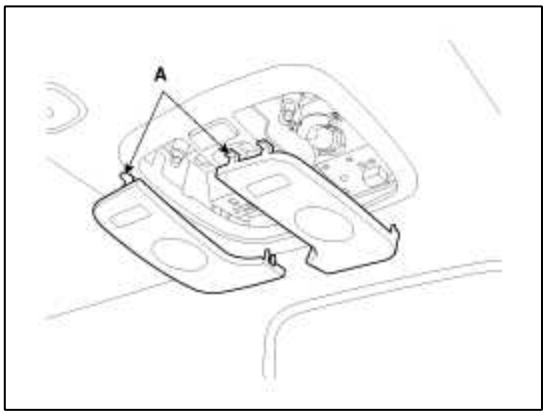
Pin No.	Description
1	Ground
2	-
3	Ignition 2
4	Switch 3
5	Switch 1
6	Battery +
7	-
8	-
9	-
10	Switch 2

Body Electrical System > Sun Roof > Sunroof Switch > Repair procedures

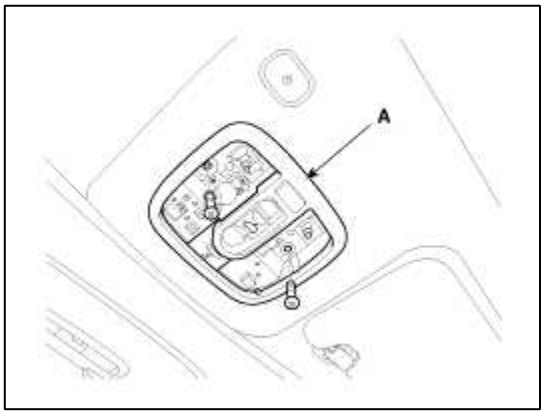
Inspection

1. Disconnect the negative (-) battery terminal.

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

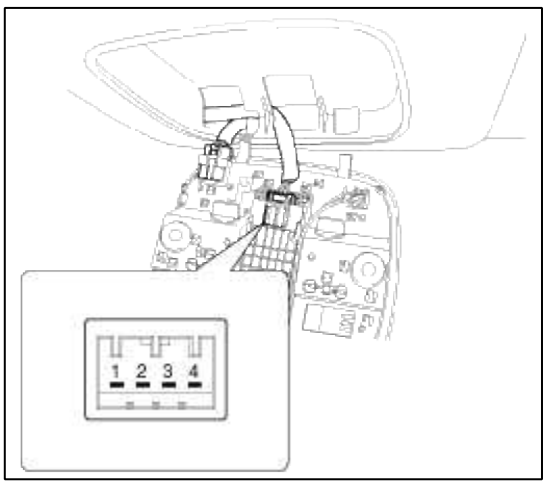


3. After loosening the mounting screws, then remove the overhead console assembly (A).



4. Check for continuity between the terminals. If the continuity is not as specified, replace the sunroof switch.

1. Ground 2. Switch A	3. Switch B 4. Switch C

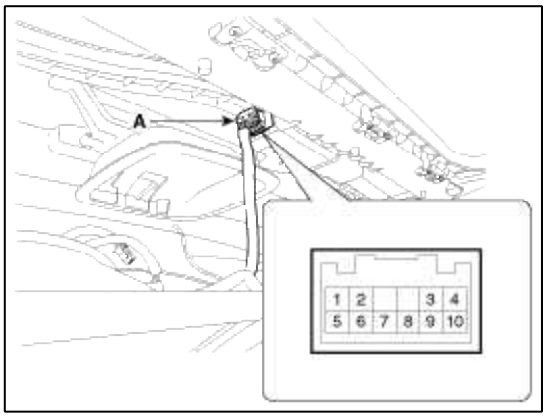


Terminal / Position	4	3	2	1
Manual open			○	○
Auto open		○	○	○
Manual tilt up	○			○
Auto close	○	○		○
Manual close		○		○
Manual tilt down		○		○

Body Electrical System > Sun Roof > Sunroof Motor > Repair procedures

Replacement

1. Disconnect the negative (-) battery terminal.
2. Remove the roof trim. (Refer to the BD group - " Roof trim")
3. Disconnect the connector and remove the sunroof motor (A) with loosening 2 screws.



4. Ground the terminals as below table, and check that the sunroof unit operates as below table.

Position \ Terminal	3	4	5	10
Manual Close	⊕			⊖
Tilt Up	⊕	⊖		
Manual Open	⊕		⊖	

5. Make these input tests at the connector.
   If any test indicates a problem, find and correct the cause, then recheck the system.
   If all the input tests prove OK, the sunroof motor must be faulty; replace it.

Terminal	Test condition	Test : Desired result
3	IG2 ON	Check for voltage to ground : There should be battery voltage
1	Under all conditions	Check for continuity to ground : There should be continuity.
6	Under all conditions	Check for voltage to ground : There should be battery voltage.

Resetting The Sunroof

Whenever the vehicle battery is disconnected or discharged, or you use the emergency handle to operate the sunroof, you have to reset your sunroof system as follows :

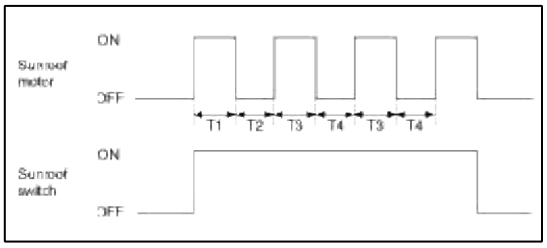
1. Turn the ignition key to the ON position and then close the sunroof completely.
2. Release the sunroof control lever.
3. Press and hold the CLOSE button for more than 10 seconds until the sunroof closed and it has moved slightly.
4. Release the sunroof control lever.
5. Press and hold the CLOSE button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

Protecting Motor From Overheating

In order to protect the sunroof motor from overheating from continuous motor operation, the sunroof ECU controls the Run-time and Cool-time of the motor as follows:

1. The sunroof ECU detects the Run- time of motor
2. Motor can be operated continuously for the 1st run-time(120 ± 10sec.).

3. The continuous operation of motor stops after the 1st Run-time(120 ± 10sec.).
4. Then Motor is not operated for the 1st Cool-time(18 ± 2sec.).
5. Motor is operated for the 2nd Run-time(10 ± 2sec.) at the continued motor operation after 1st Cool-time(18 ± 2sec.)
6. The continuous operation of motor stops operating after the 2nd Run-time(10 ± 2sec.)
7. Motor is not operated for the 2nd Cool-time(18 ± 2sec.).
8. Motor repeats the 2nd run-time and 2nd cool-time at the continued motor operation.
   A. In case that motor is not operated continuously, the run-time is increased.
   B. The Run-Time of motor is initialized to "0" if the battery or fuse is reconnected after being disconnected, discharged or blown.



T1 : 120 ± 10 sec., T2 : 18 ± 2 sec.,
T3 : 10 ± 2 sec., T4 : 18 ± 2 sec.

Body Electrical System > Lighting System > Specifications

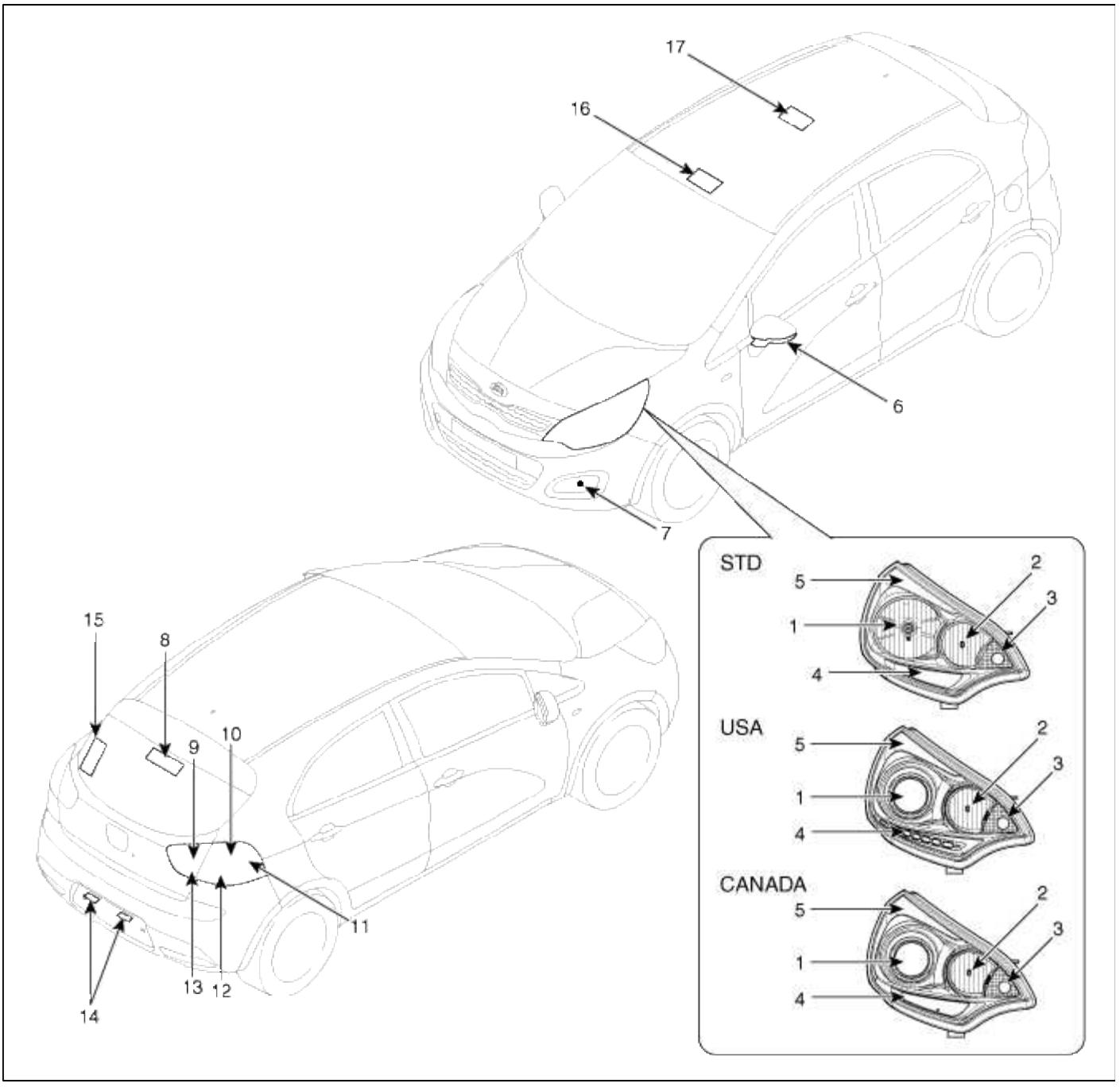
Specification

Item			Bulb Watt (W)	Bulb Type
Front	Head lamp (High)		60/55	H1
	Head lamp (Low)		60/55	H7
	Position lmap		5	P21/5W
			0.8	LED
	DRL		21	P21/5W
	Turn signal lamp		28	PY21W
	Fog lamp		55	9006
Rear	Tail lamp	Inside	5	W5W
			0.5	LED
		Outside	5	P21/5W
			0.5	LED
	Stop lamp	Inside	5	LED
		Outside	21	P21/5W
			5	LED
	Turn signal lamp		21	PY21W
	Back up lamp		16	W16W
	High mounted stop lamp		2.2	LED
	License plate lamp		5	W5W
	Map lamp		10	W10W

Interior	Room lamp	10	FESTOON 10W
	Luggage lamp	5	FESTOON 5W

Body Electrical System > Lighting System > Components and Components Location

Component Location (1)



1. Head lamp (Low/ High) 2. Head lamp (Low) 3. Head lamp (High) 4. Turn signal lamp	5. DRL/ Position lamp 6. Side marker lamp 7. Turn signal lamp (Door mirror) 8. Front fog lamp	9. Overhead console lamp 10. Room lamp

Component Location (2)

[4 Door]

1. Back up lamp 2. Turn signal lamp 3. Tail lamp/ Stop lamp	4. Tail lamp 5. Stop lamp 6. Side marker lamp	7. High mounted stop lamp 8. License plate lamp 9. Luggage lamp

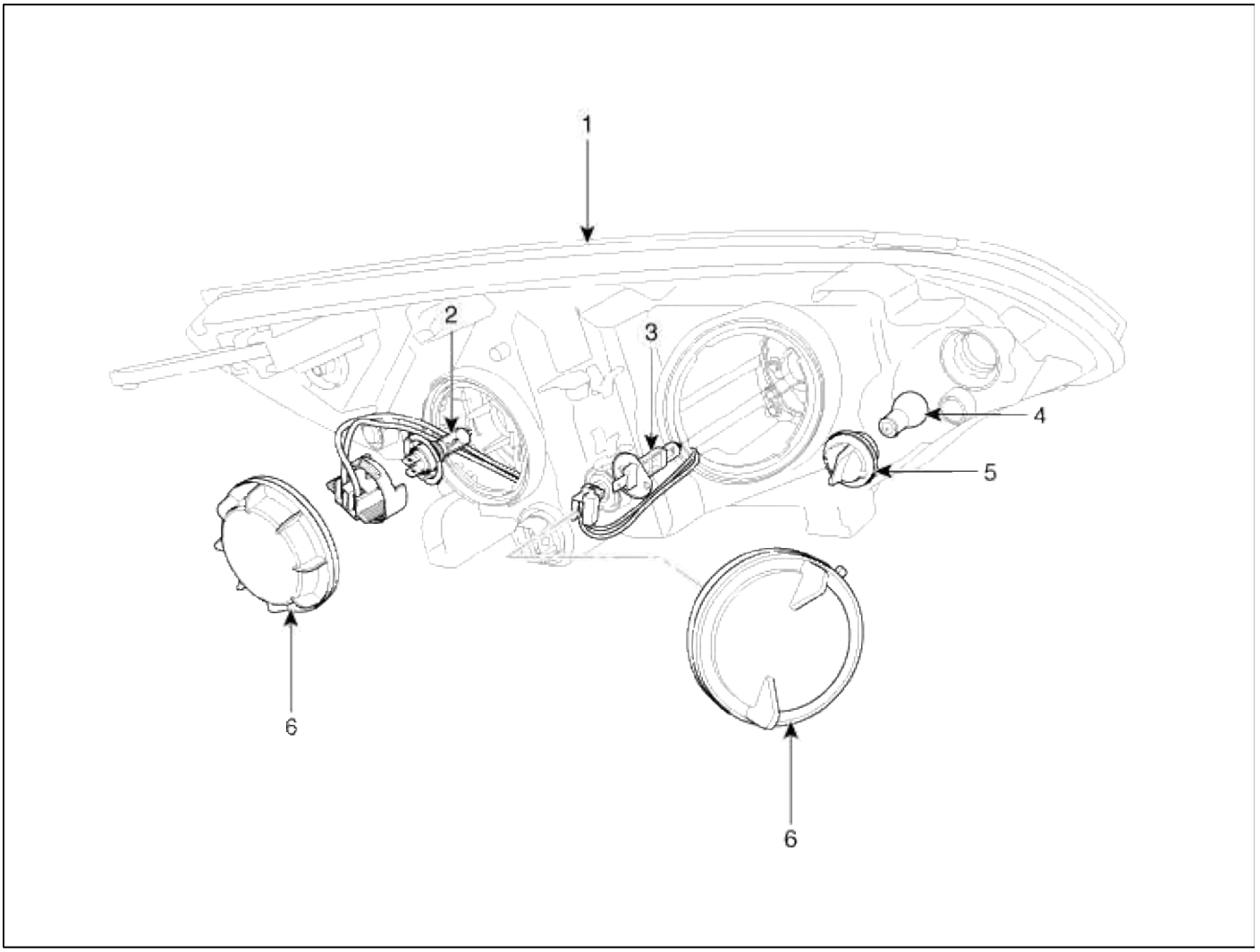
Component Location (3)

[5 Door]

1. Back up lamp 2. Turn signal lamp 3. Tail lamp/ Stop lamp	4. Tail lamp 5. Stop lamp 6. Side marker lamp	7. High mounted stop lamp 8. License plate lamp 9. Luggage lamp

Body Electrical System > Lighting System > Head Lamps > Components and Components Location

Component



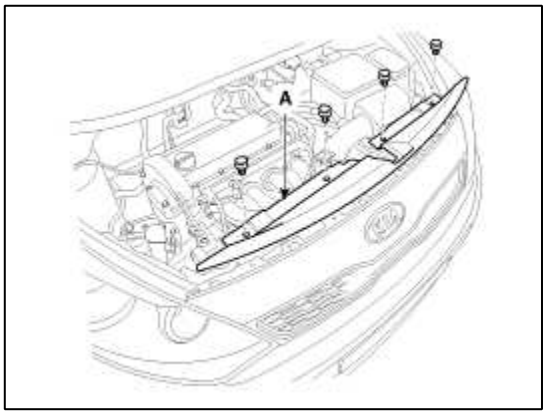
1. Head lamp assembly lens & housing 2. Head lamp bulb (Low) 3. Head lamp bulb (High)	4. Turn signal lamp bulb 5. Socket 6. Dust cover

Body Electrical System > Lighting System > Head Lamps > Repair procedures

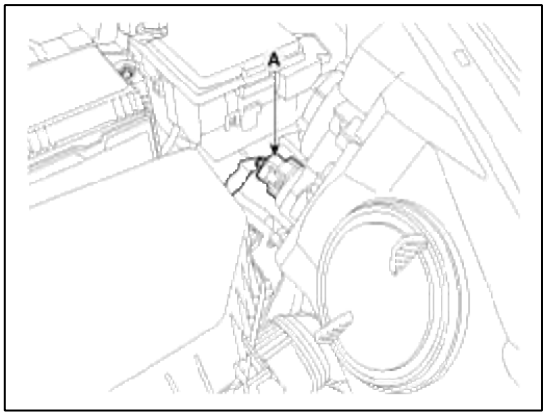
Removal

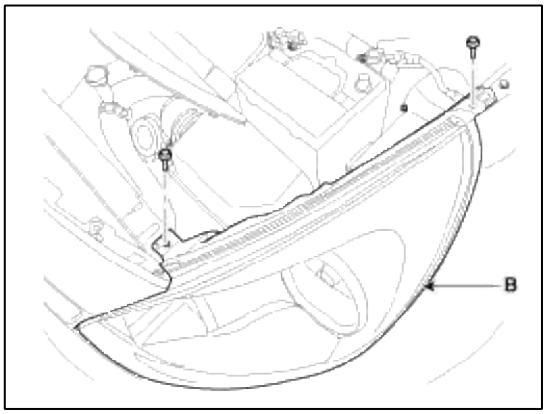
Head Lamp

1. Disconnect the negative (-) battery terminal.
2. Remove the radiator grille upper cover (A), after loosening the mounting clips.



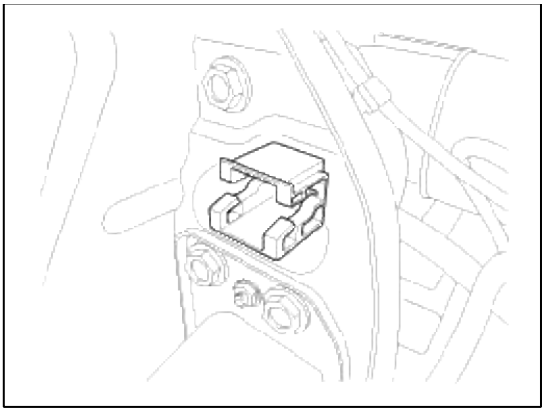
3. Loosening the head lamp mounting bolts (2EA) and disconnect the head lamp connector (A). Then, remove the head lamp assembly (B).



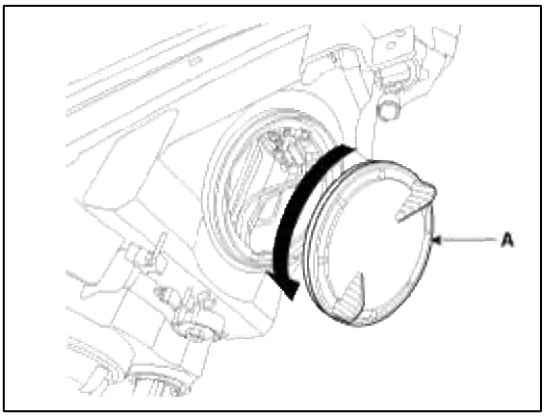


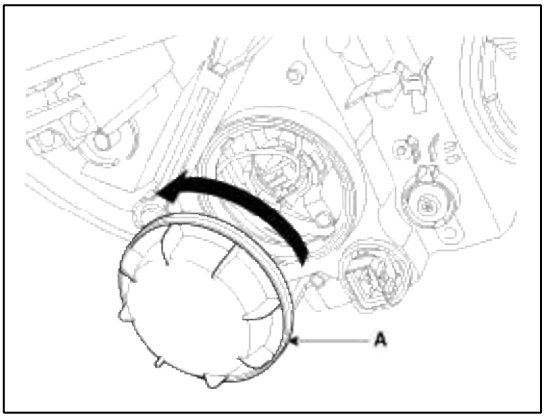
NOTE

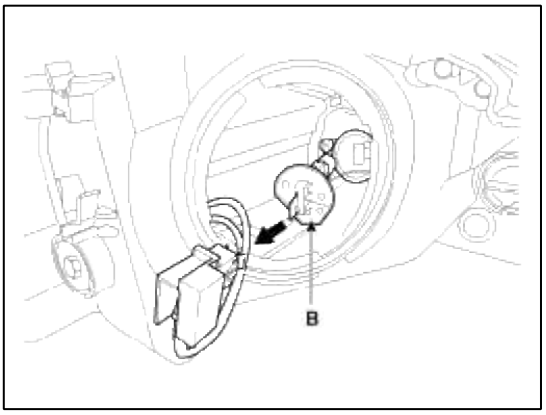
Take care not to scratch the head lamp lens or fender.

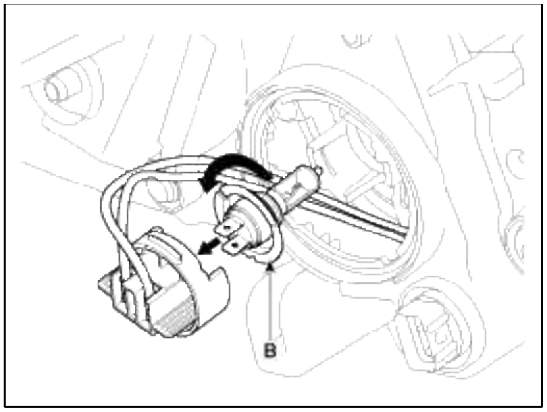


4. Remove the dust cap(A) and disconnect the connector. Then remove the head lamp (high / low) bulb(B).

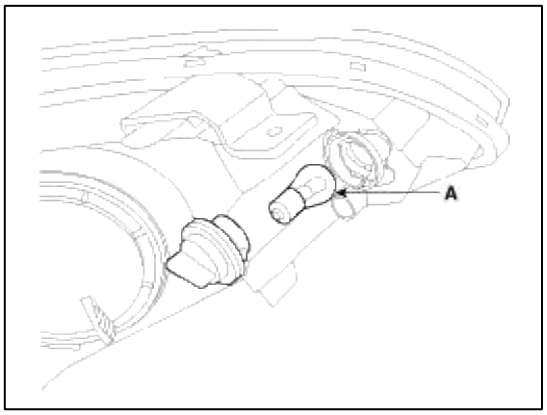








5. Remove the turn signal lamp bulb.



Installation

1. Install the head lamp assembly after connecting the connector.
2. Install the radiator grille upper cover.
3. Connect the negative (-) battery terminal.

Adjustment

Head Lamp Aiming Instructions

The head lamps should be aimed with the proper beam-setting equipment, and in accordance with the equipment manufacturer's instructions.

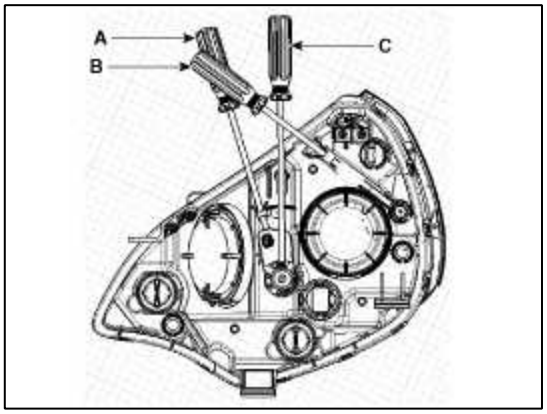
NOTE

If there are any regulations pertinent to the aiming of head lamps in the area where the vehicle is to be used, adjust so as to meet those requirements.

Alternately turn the adjusting gear to adjust the head lamp aiming. If beam-setting equipment is not available, proceed as follows:

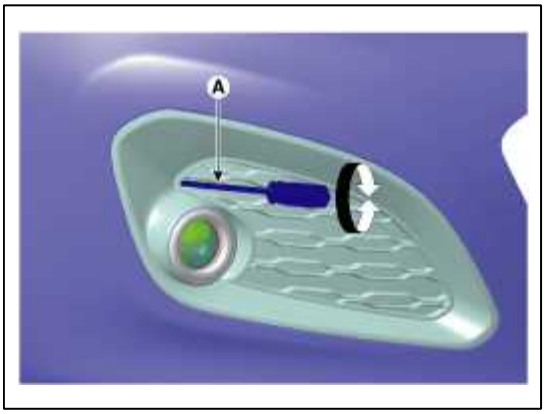
1. Inflate the tires to the specified pressure and remove any loads from the vehicle except the driver, spare tire, and tools.
2. The vehicle should be placed on a flat floor.
3. Draw vertical lines (Vertical lines passing through respective head lamp centers) and a horizontal line (Horizontal line passing through center of head lamps) on the screen.

4. With the head lamp and battery in normal condition, aim the head lamps so the brightest portion falls on the horizontal and vertical lines.
   A : Vertical
   B : Horizontal
   C : Vertical (HLLD type)

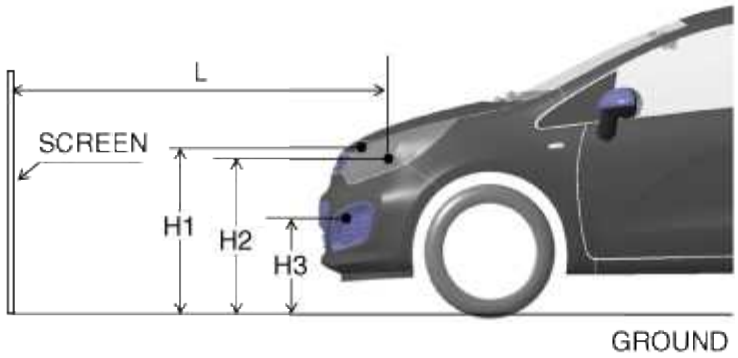


Front Fog Lamp Aiming

The front fog lamps should be aimed as the same manner of the head lamps aiming.
With the front fog lamps and battery normal condition, aim the front fog lamps by turning the adjusting screw (A) with a driver.



Head Lamp And Fog Lamp Aiming Point



H1 : Height between the head lamp bulb center and ground (Low beam)
H2 : Height between the head lamp bulb center and ground (High beam)
H3 : Height between the fog lamp bulb center and ground
W1 : Distance between the two head lamp bulbs centers (Low beam)
W2 : Distance between the two head lamp bulbs centers (High beam)
W3 : Distance between the two fog lamp bulbs centers
L : Distance between the head lamp bulb center and screen

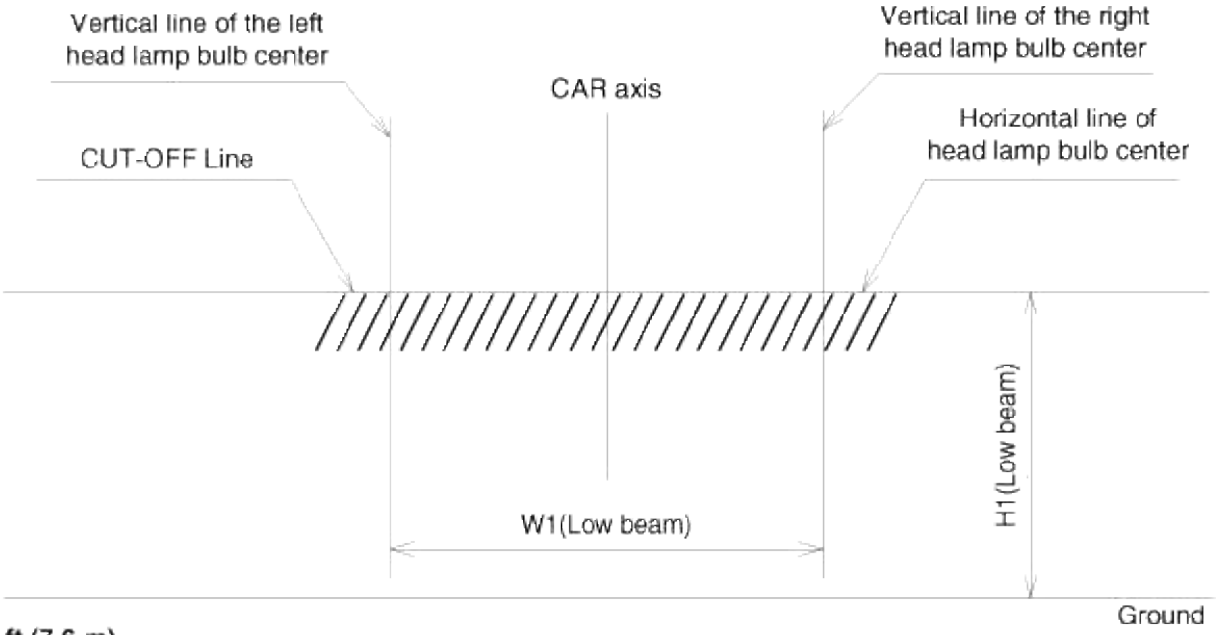
[Standard] Unit : in(mm)

Vehicle condition	H1	H2	H3	W1	W2	W3	L
Without driver	29.6(752)	28.2(716)	15.4(391)	49.7(1,262)	40.3(1,024)	53.4(1,356)	Refer to aiming condition
With driver	29.3(745)	27.9(709)	15.1(384)				

[Option] Unit : in(mm)

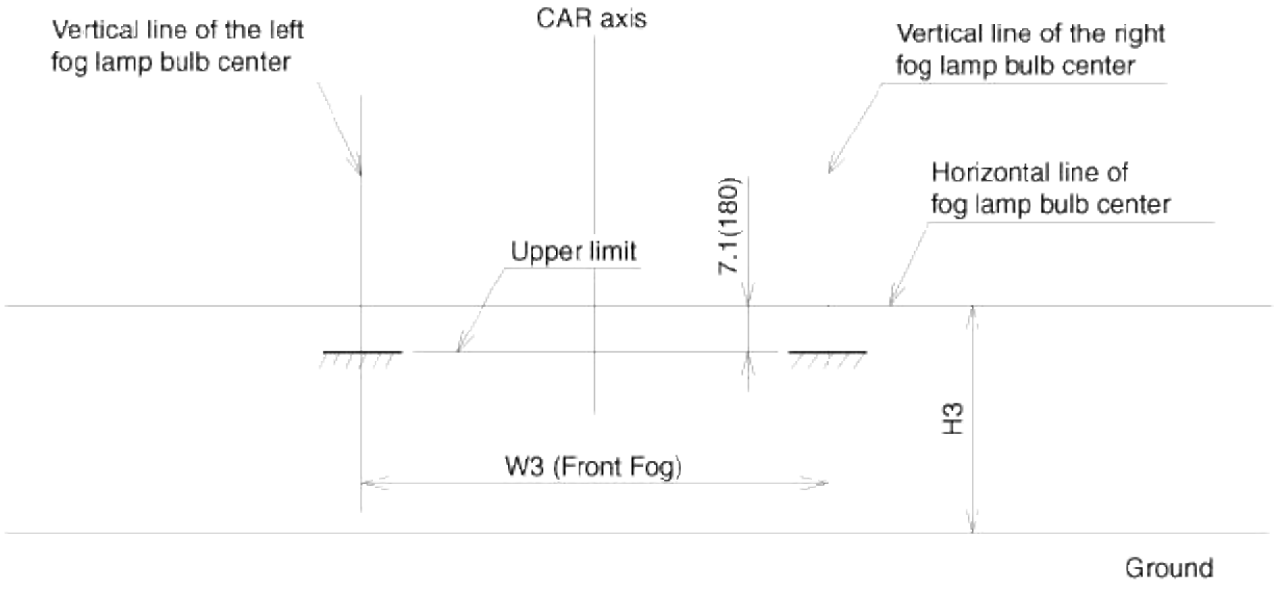
Vehicle condition	H1	H2	H3	W1	W2	W3	L
Without driver	29.4(747)	28.2(716)	15.4(391)	50.3(1,278)	40.3(1,024)	53.4(1,356)	Refer to aiming condition
With driver	29.1(740)	27.9(709)	15.1(384)				

1. Head Lamp (Low beam)
   A. Turn the low beam on without driver aboard.
   B. The cut-off line should be projected in the cut-off line shown in the picture.
   C. When aiming the low beam, vertical aiming should be adjusted after adjusting the horizontal aiming.
   D. If head lamp leveling device is equipped, adjust the head lamp leveling device switch with 0 positions.



L : 25 ft (7.6 m)
Unit : in.(mm)

2. Turn the front fog lamp on without the driver aboard.
   The cut-off line should be projected in the allowable range (shaded region)



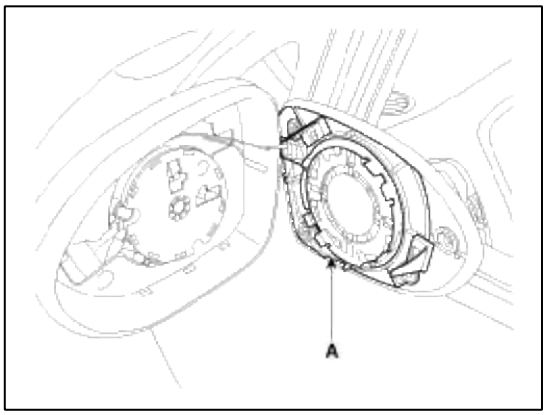
L : 32.8 ft (10 m)
Unit : in.(mm)

Body Electrical System > Lighting System > Turn Signal Lamp (Door mirror) > Repair procedures

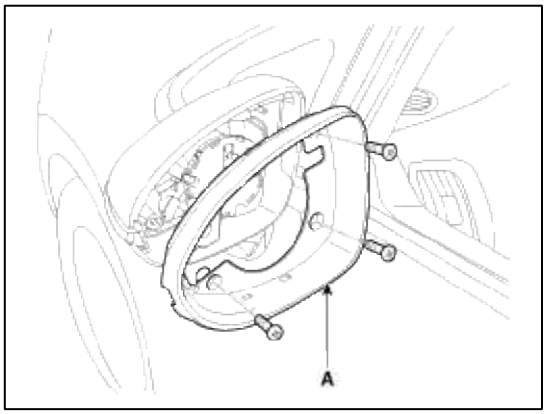
Removal

Door Mirror Turn Signal Lamp

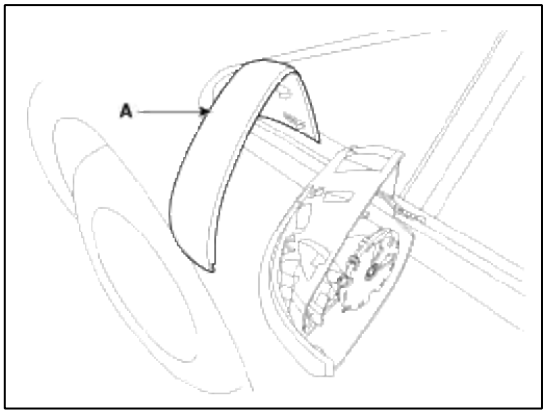
1. Using a screwdriver or remover, remove the mirror (A) from th mirror holder.
   Becareful not to damage to the clip.



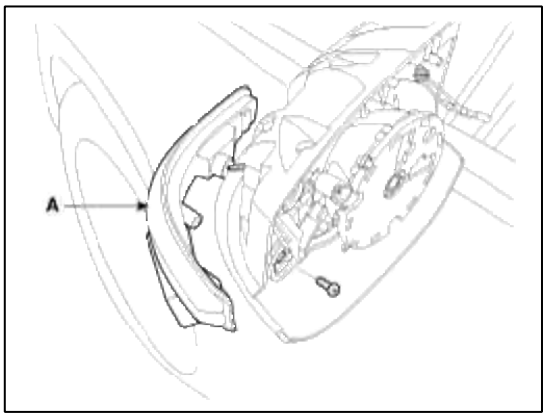
2. Remove the front cover (A), after loosening 3 screws.



3. Remove the rear cover (A).



4. Disconnect the mirror connector.Remove the door mirror turn signal lamp (A) after loosening screw.



Installation

Door Mirror Turn Signal Lamp

1. Install the door mirror turn signal lamp to the door mirror.

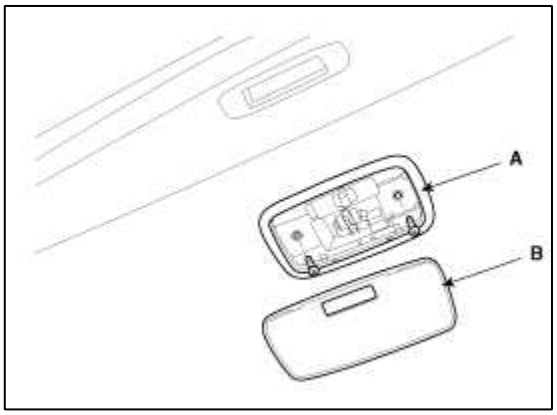
2. Install the door mirror.
3. Connect the negative (-) battery terminal.

Body Electrical System > Lighting System > Room Lamp > Repair procedures

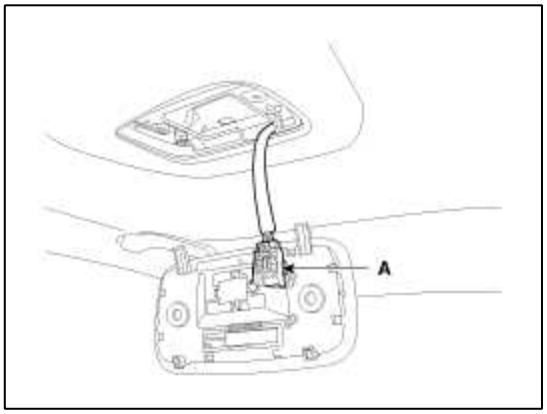
Inspection

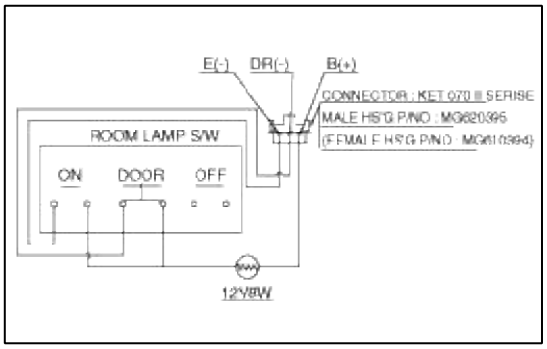
Room Lamp

1. Remove the overhead console lamp cover (B).
2. After loosening the mounting screws, then remove the room lamp (A).



3. Disconnect the connector (A), then check the switch operates properly

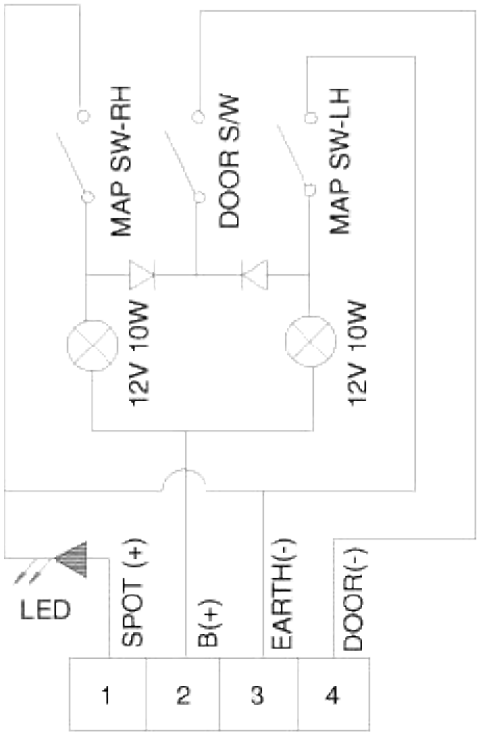


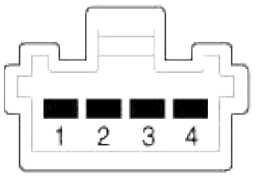


Terminal / Position	1	2	3
DOOR		○	○
ON	○	○	○
OFF			

Body Electrical System > Lighting System > Overhead Console Lamp > Schematic Diagrams

Circuit Diagram



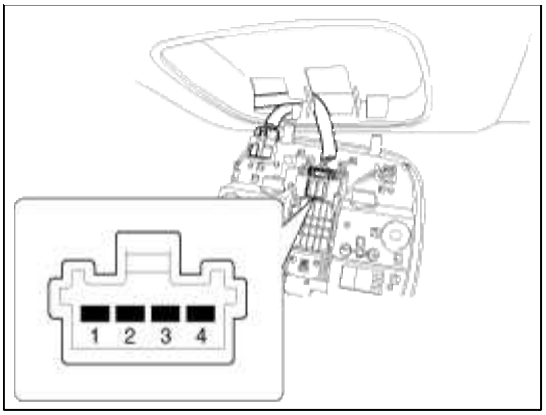


No.	Description
1	SPOT(+)
2	B+
3	Earth(-)
4	Door(+)

Body Electrical System > Lighting System > Overhead Console Lamp > Repair procedures

Inspection

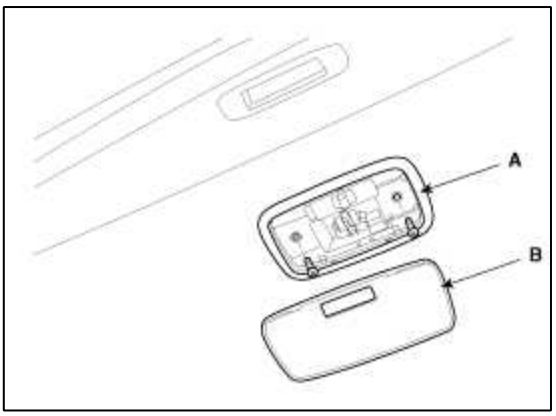
Remove the overhead console lamp assembly then check for continuity between terminals. If the continuity is not as specified, replace the map lamp switch.



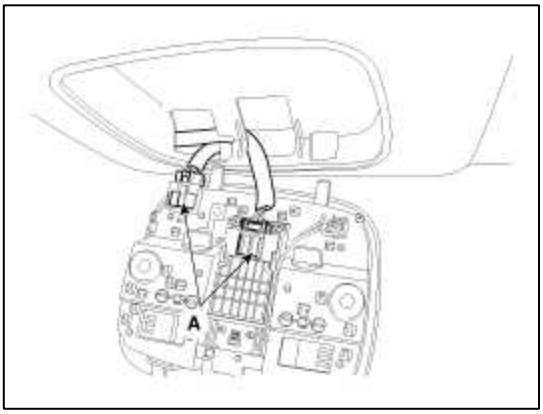
Sort / Position / Terminal	Map lamp switch				DOOR Switch	
	LH		RH			
	ON	OFF	ON	OFF	ON	OFF
2	●		●		○	
3	●		●		●	
4					○	

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the overhead console lamp cover (B).
3. After loosening the mounting screws, then remove the room lamp (A).



4. Disconnect the connectors (A) of sunroof switch and lamp switch then remove the overhead console lamp assembly.



5. If necessary to replace the bulb, replace the bulb after opening the overhead console lens.

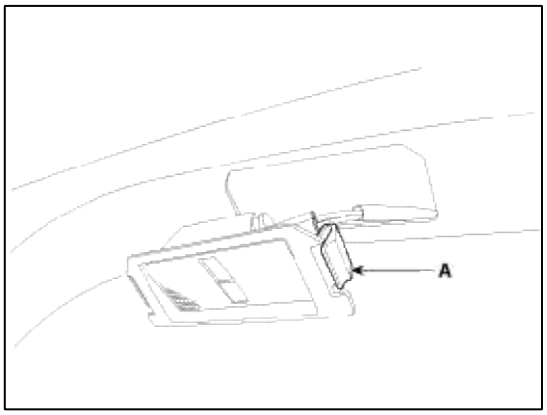
Installation

1. Install the overhead console lamp after connecting the sunroof switch connector and lamp connector.
2. Install the lens after tightening 2 screws.
3. Install the overhead console lamp cover.

Body Electrical System > Lighting System > License Lamp > Repair procedures

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the license lamp lens by pushing the clip (A).



3. Replace the lamp bulbs (B) after turning the socket in the counter clock-wise direction from lens (A).

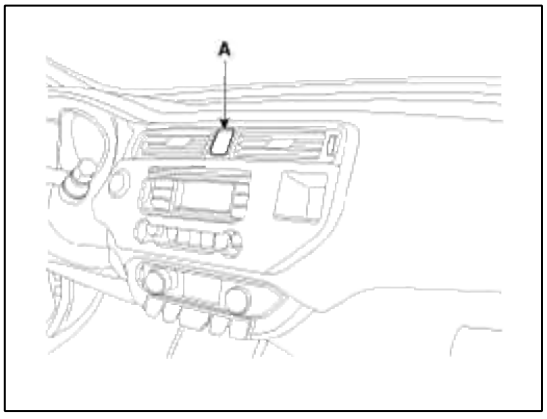
Installation

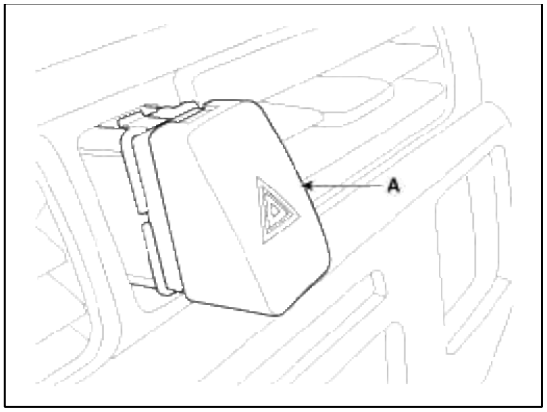
1. Install the bulb.
2. Connect the lens and license lamp.

Body Electrical System > Lighting System > Hazard Lamp Switch > Repair procedures

Removal

1. Disconnect the negative (-) battery terminal.
2. Using a screwdriver or trim remover, remove the hazard lamp switch (A).





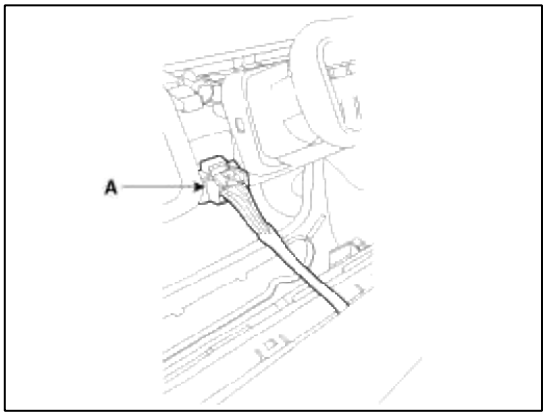
3. Disconnect the hazard lamp switch connector.

Installation

1. Connect the connectors.
2. Install the hazard lamp switch.
3. Connect the negative (-) battery terminal.

Inspection

1. Operate the switch and check for continuity between terminals.

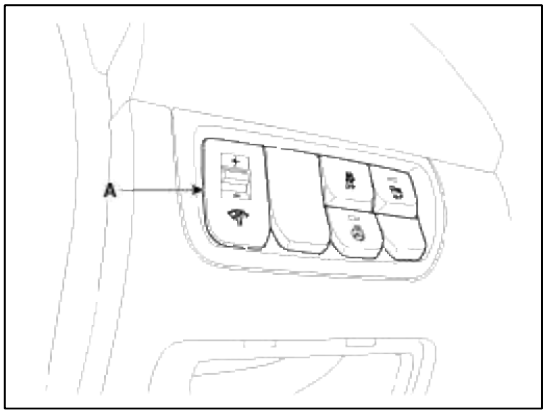


Terminal / Position	Off(Free)	On(Lock)
1		○
2		○

Body Electrical System > Lighting System > Rheostat > Repair procedures

Replacement

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad side switch assembly (A).

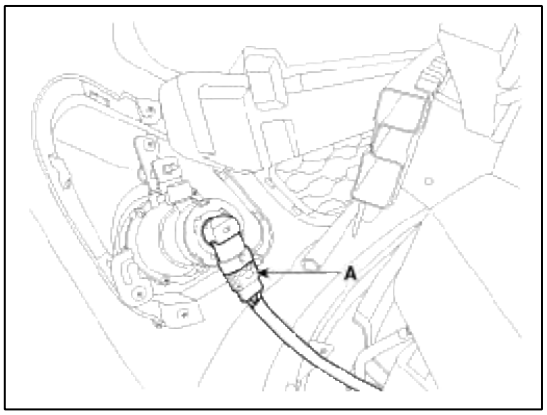


3. Disconnect the rheostat connector from lower crash pad switch.
4. Remove the rheostat switch.
5. The installation is the reverse of removal.

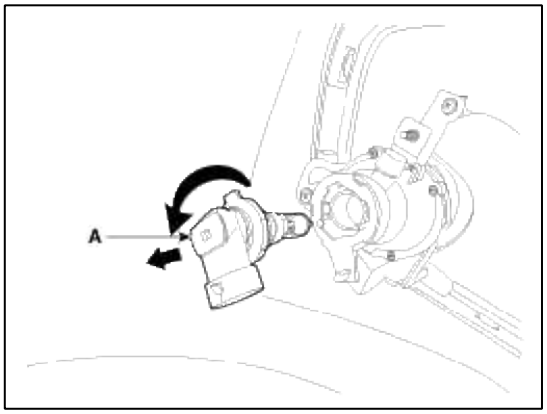
Body Electrical System > Lighting System > Front Fog Lamps > Repair procedures

Removal

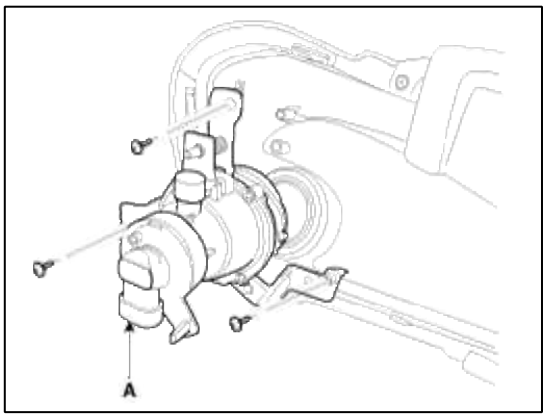
1. Disconnect the negative (-) battery terminal.
2. Disconnect the fog lamp connector (A).



3. Remove the fog lamp bulb (A) after turning in the counterclockwise direction.



4. Remove the fog lamp assembly (A) with loosening 3 screws.



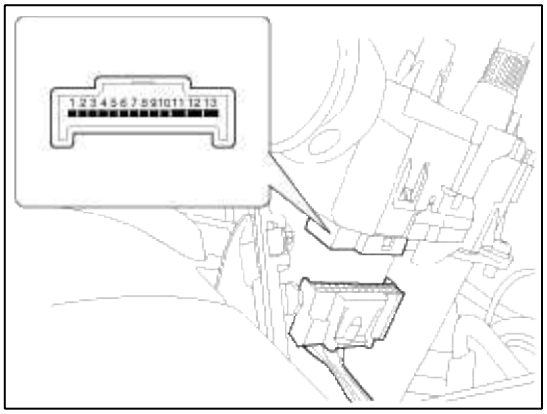
Installation

1. Install the fog lamp.
2. Reconnect the fog lamp connector.
3. Connect the negative (-) battery terminal.

Inspection

Multifunction Switch(Lighting)

1. Disconnect the negative(-) battery terminal.
2. Remove the lighting switch of the multi-function switch. (Refer to the multifunction switch)
3. With the front fog lamp switch, make sure that continuity exists between the terminals below.
   If continuity is not as specified, replace the multi-function switch.



Front Fog Lamp Switch

Terminal / Position	5	6
OFF		
Front	○	○

Body Electrical System > Lighting System > High Mounted stop lamp > Repair procedures

Removal

[4 Door]

1. Disconnect the negative (-) battery terminal.
2. Disconnect the connect (A).

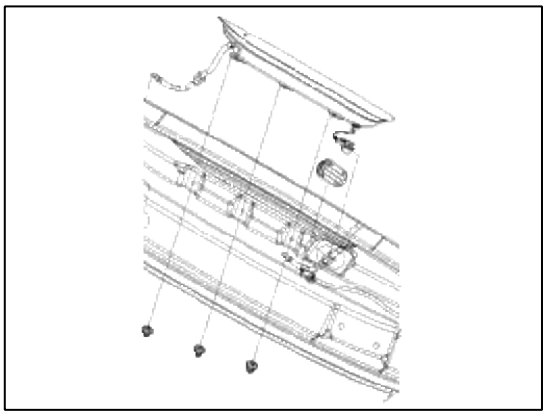
3. Remove the package tray trim.
   (Refer to the BD group - "Interior trim")
4. Remove the high mounted stop lamp assembly (A) after loosening 2 screws.

5. Remove the high mounted stop lamp bulb (A) after turning in the counter clockwise direction.

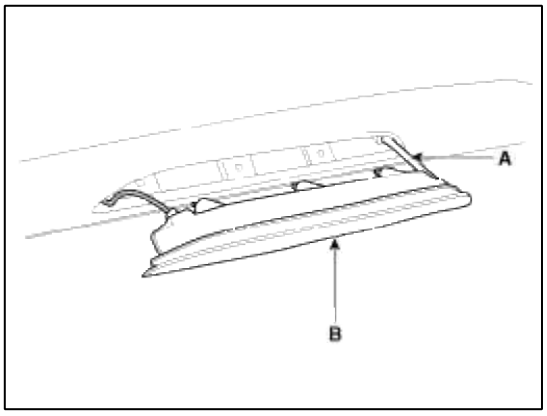
[5 Door]

1. Disconnect the negative (-) battery terminal.

2. Open the tailgate and remove the nuts. (3EA)



3. Remove the connector and the nozzle hose (A) from high mounted stop lamp assembly (B).



Installation

[4 Door]

1. Install the high mounted stop lamp assembly.
2. Install the package tray trim.
3. Connect the negative (-) battery terminal.

[5 Door]

1. Install the high mounted stop lamp assembly.
2. Install the negative (-) battery terminal.

Body Electrical System > Lighting System > Rear combination lamp > Repair procedures

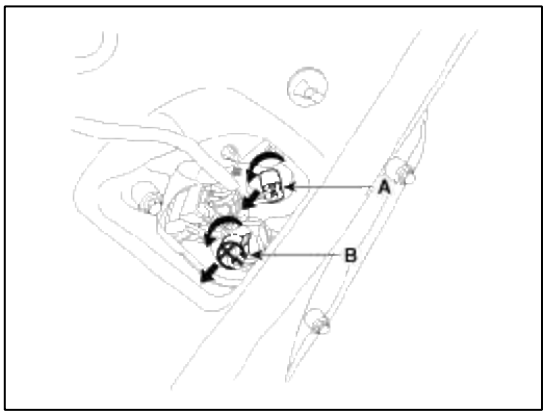
Removal

Rear combination lamp (Inside)

[4 Door]

1. Disconnect the negative (-) battery terminal.
2. Remove the trunk trim.
   (Refer to the BD group - "Trunk")
3. Remove rear combination lamp after removing the mounting nuts (4EA) and disconnecting the connector (A).

4. Remove the tail lamp bulb (A) and backup lamp bulb (B) after turning in the counterclockwise direction.



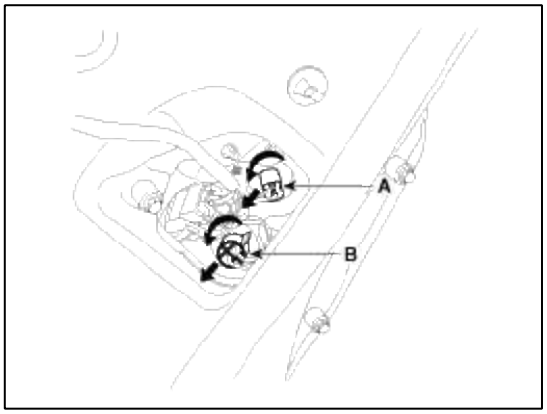
5. If necessay to remove the bulb, remove the bulb after removing the trunk trim

[5 Door]

1. Disconnect the negative (-) battery terminal.
2. Remove the lamp cover (A).

3. Remove rear combination lamp after removing the mounting nuts (3EA) and disconnecting the connector (A).

4. Remove the tail lamp bulb (A) and backup lamp bulb (B) after turning in the counterclockwise direction.



5. If necessay to remove the bulb, remove the bulb after removing the lamp cover.

Rear combination lamp (Outside)

[4 Door]

1. Disconnect the negative (-) battery terminal.
2. Remove rear combination lamp after removing the mounting nuts (4EA) and disconnecting the connector (A).

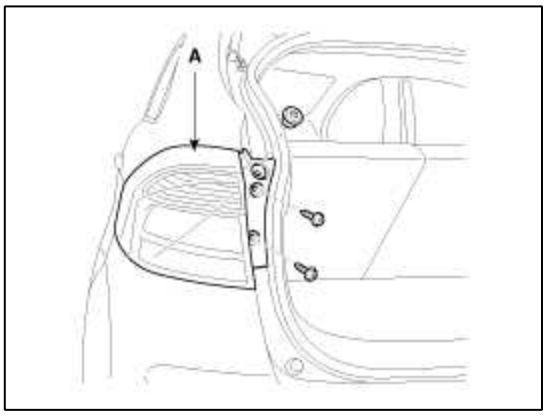
3. Remove the turn signal lamp bulb (A) and tail/ stop lamp bulb (B) after turning in the counterclockwise direction.

4. If necessary to remove the bulb, remove the bulb after pulling the trim cover aside.

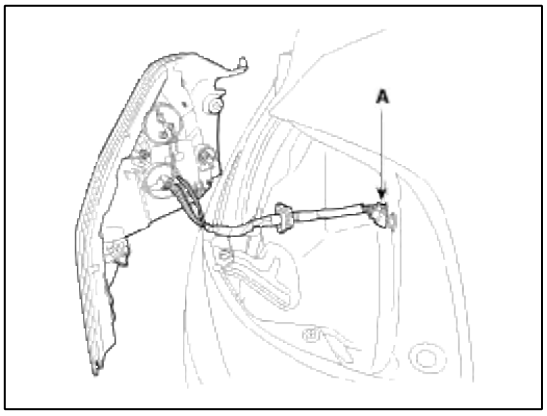
[5 Door]

1. Disconnect the negative (-) battery terminal.

2. Remove the rear combination lamp (A) after removing the mounting screws.



3. Disconnect the rear combination lamp connector (A).



4. Remove the turn signal lamp bulb (A) and tail/ stop lamp bulb (B) after turning in the counterclockwise direction.

5. If necessary to remove the bulb, remove the bulb after pulling the trim cover aside.

Installation

Rear combination lamp (Inside)

[4 Door]

1. Install the rear combination lamp assembly.
2. Connect the rear combination connector.
3. Install the trunk trim.
4. Connect the negative (-) battery terminal.

[5 Door]

1. Install the rear combination lamp assembly.
2. Connect the rear combination connector.
3. Connect the negative (-) battery terminal.

Rear combination lamp (Outside)

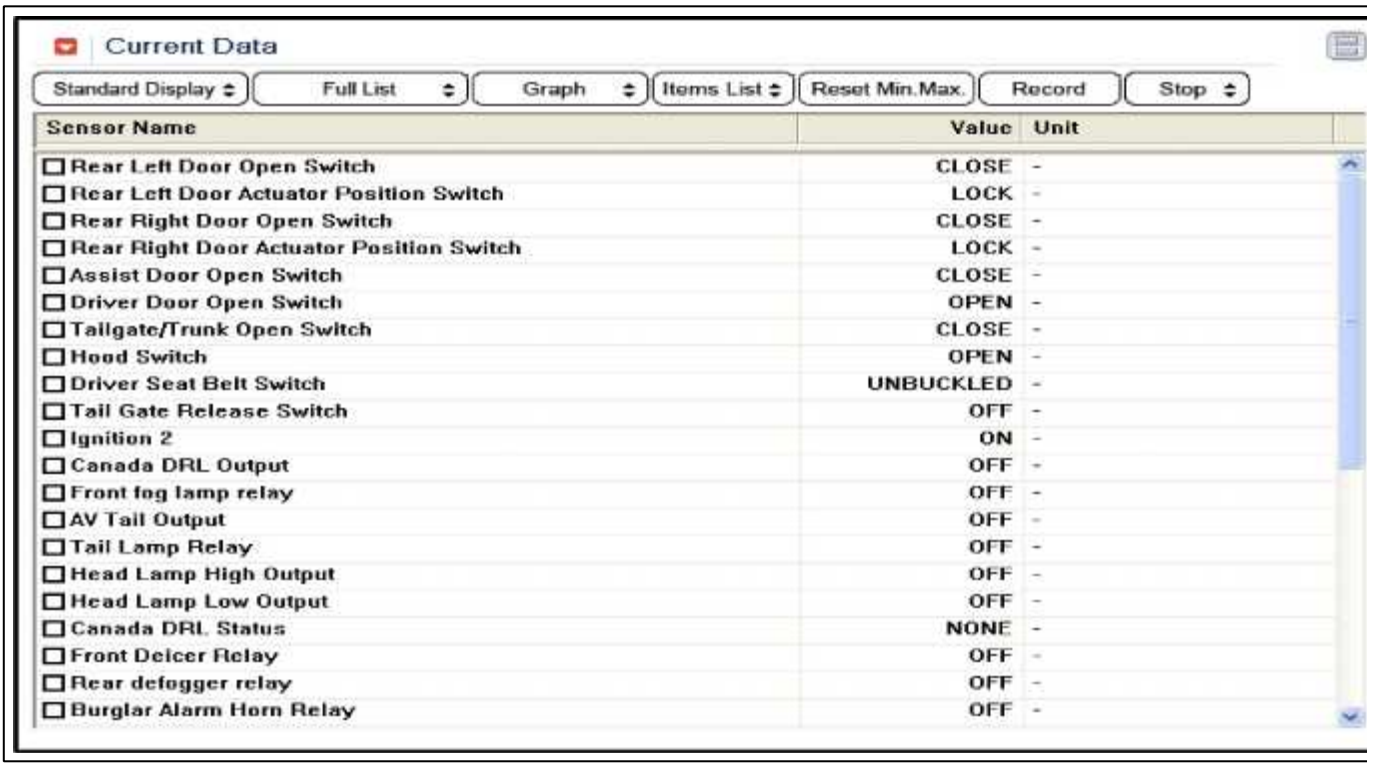
1. Install the rear combination lamp assembly.
2. Connect the rear combination lamp connector.
3. Connect the negative (-) battery terminal.

Body Electrical System > Lighting System > Troubleshooting

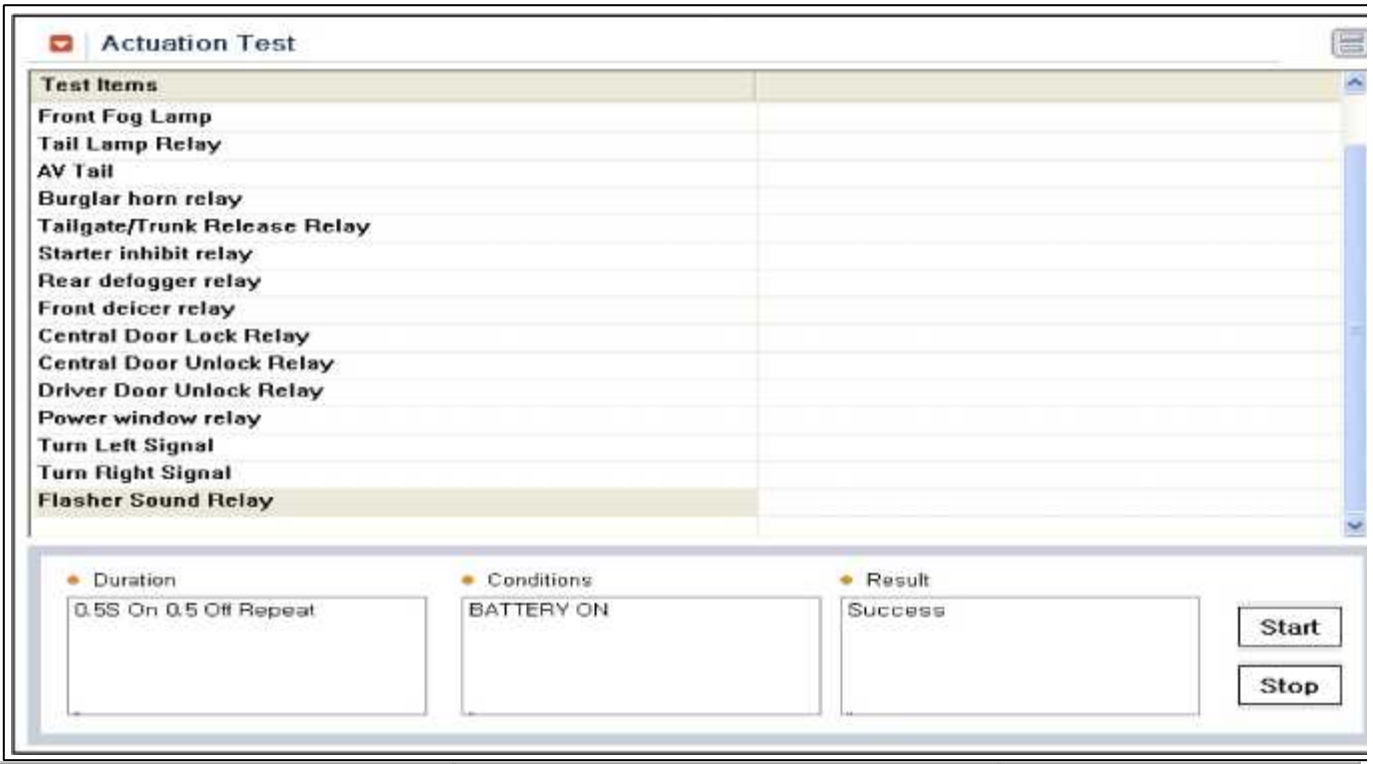
Troubleshooting

1. The lamp switch inputs can be checked using the GDS.
2. To check the input value of lamp switch, select option "Body Control Module".

3. To consult the present input/output value of BCM, "Current DATA". It provides information of BCM input/output conditions of door lock/unlock, lamp control and power window timer etc.



4. To check the input value of lamp switch in force mode, select option "Actuation Test of smart junction box".



Symptom	Possible cause	Remedy
One lamp does not light (all exterior)	Bulb burned out	Replace bulb
	Socket, wiring or ground faulty	Repair if necessary
Head lamps do not light	Bulb burned out	Replace bulb
	Head lamp relay faulty	Check relay
	Lighting switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary

Tail lamps and license plate lamps do not light	Bulb burned out	Replace bulb
	Tail lamp fuse (10A) blown	Check for short and replace fuse
	Tail lamp relay faulty	Check relay
	Lighting switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
DRL lamp does not light	Bulb burned out	Replace bulb
	Module 2 fuse (10A) blown	Check for short and replace fuse
	Wiring or ground faulty	Repair if necessary
Stop lamps do not light	Bulb burned out	Replace bulb
	Stop lamp fuse (15A) blown	Check for short and replace fuse
	Stop lamp switch faulty	Adjust or replace switch
	Wiring or ground faulty	Repair if necessary
Stop lamps do not turn off	Stop lamp switch faulty	Repair or replace switch
Instrument lamps do not light (Tail lamps light)	Wiring or ground faulty	Repair if necessary
Turn signal lamp does not flash on one side	Bulb burned out	Replace bulb
	Turn signal switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Turn signal lamps do not light	Bulb burned out	Replace bulb
	Turn signal lamp fuse (15A) blown	Check for short and replace fuse
	Flasher unit faulty	Check flasher unit
	Turn signal switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Hazard warning lamps do not light	Bulb burned out	Replace bulb
	Hazard warning lamp fuse (15A) blown	Check for short and replace fuse
	Hazard switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Flasher rate too slow or too fast	Lamps' wattages are smaller or larger than specified	Replace lamps
Back up lamps do not light	Bulb burned out	Replace bulb
	Back up lamp fuse (10A) blown	Check for short and replace fuse
	Back up lamp switch (M/T) faulty	Check switch
	Transaxle range switch (A/T) faulty	Check switch

	Wiring or ground faulty	Repair if necessary
Front fog lamps do not light	Bulb burned out	Replace bulb
	Front fog lamp fuse (10A) blown	Check for short and replace fuse
	Front fog lamp relay faulty	Check relay
	Front fog lamp switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Room lamp does not light	Bulb burned out	Replace bulb
	Room lamp fuse (10A) blown	Check for short and replace fuse
	Map lamp switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Luggage room lamp does not light	Bulb burned out	Replace bulb
	Room lamp fuse (10A) blown	Check for short and replace fuse
	Luggage room lamp switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary

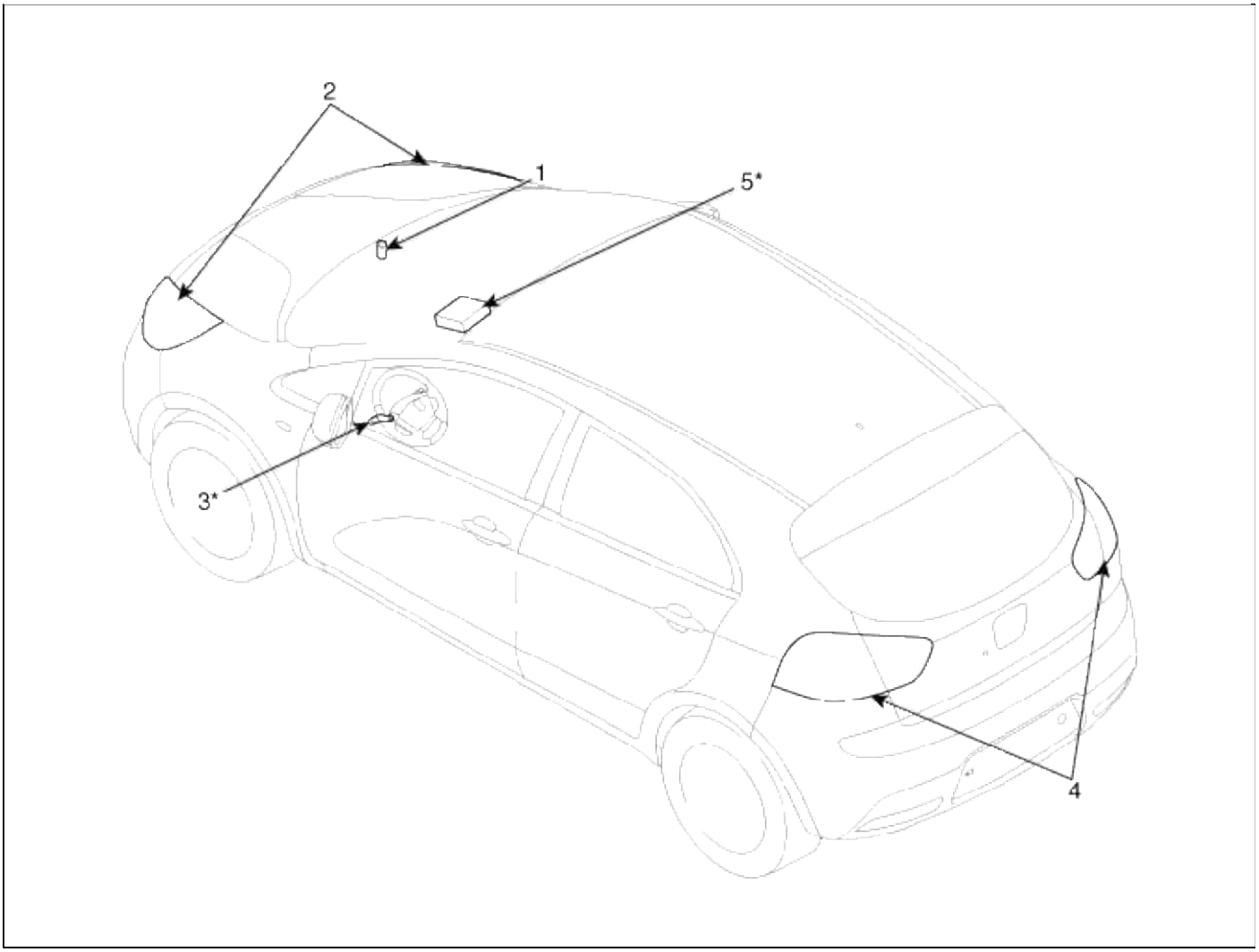
Body Electrical System > Auto Lighting Control System > Specifications

Specifications

Items		Specifications
Rated voltage		DC 5V
Load		Max. 1.5mA (When head lamp lighting)
Operating voltage range		DC 4.6 ~ 5.1V
Illuminations (LUX)	100	1.89 ± 0.42 (V)
	200	3.55 ± 0.78 (V)

Body Electrical System > Auto Lighting Control System > Components and Components Location

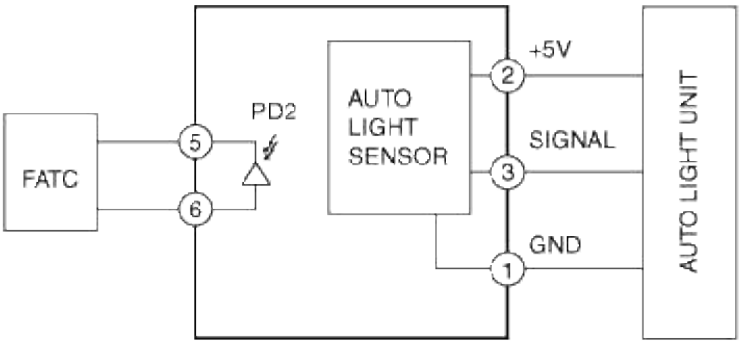
Component Location

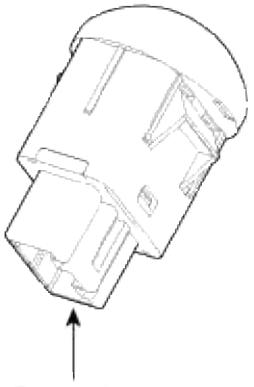


1. Auto light sensor 2. Head lamps 3. Lighting switch (Auto)	4. Tail lamps 5. BCM (Body Control Module)

Body Electrical System > Auto Lighting Control System > Schematic Diagrams

Circuit Diagram





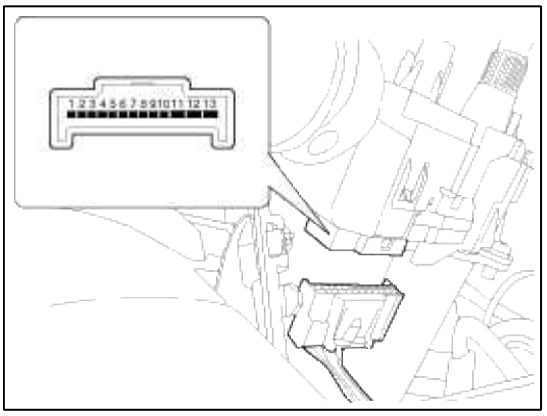
[Auto light connector]

Pin No.	Description
1	Ground
2	VCC
3	Photo signal
4	-
5	Photo (+)
6	Photo (-)

Body Electrical System > Auto Lighting Control System > Auto Light Switch > Repair procedures

Inspection

Operate the auto light switch, then check for continuity between terminals of multi-function switch connector.



Terminal / Position	1	2	4	3
OFF				
Tail	○	○		
H / Lamp	○	○	○	
AUTO	○			○

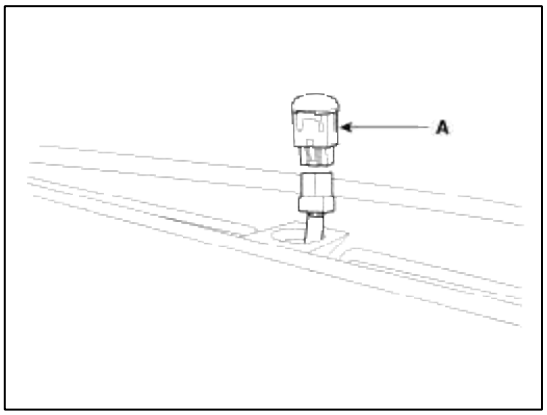
Body Electrical System > Auto Lighting Control System > Auto Light Sensor > Repair procedures

Inspection

In the state of IGN1 ON, when multi function switch module detects auto light switch on, tail lamp relay output and head lamp low relay output are controlled according to auto light sensor's input.
The auto light control doesn't work if the pin sunlight supply (5V regulated power from Ignition 1 power to sunlight sensor) is in short circuit with the ground.
If IGN1 ON, The BCM monitors the range of this supply and raises up a failure as soon as the supply's voltage is out of range. Then this failure occurs and as long as this is present, the head lamp must be turned on without taking care about the sunlight level provided by the sensor.
This is designed to prevent any head lamp cut off when the failure occurs during the night.

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the photo & auto light sensor (A) from crash pad upper side by using screw (-) driver.



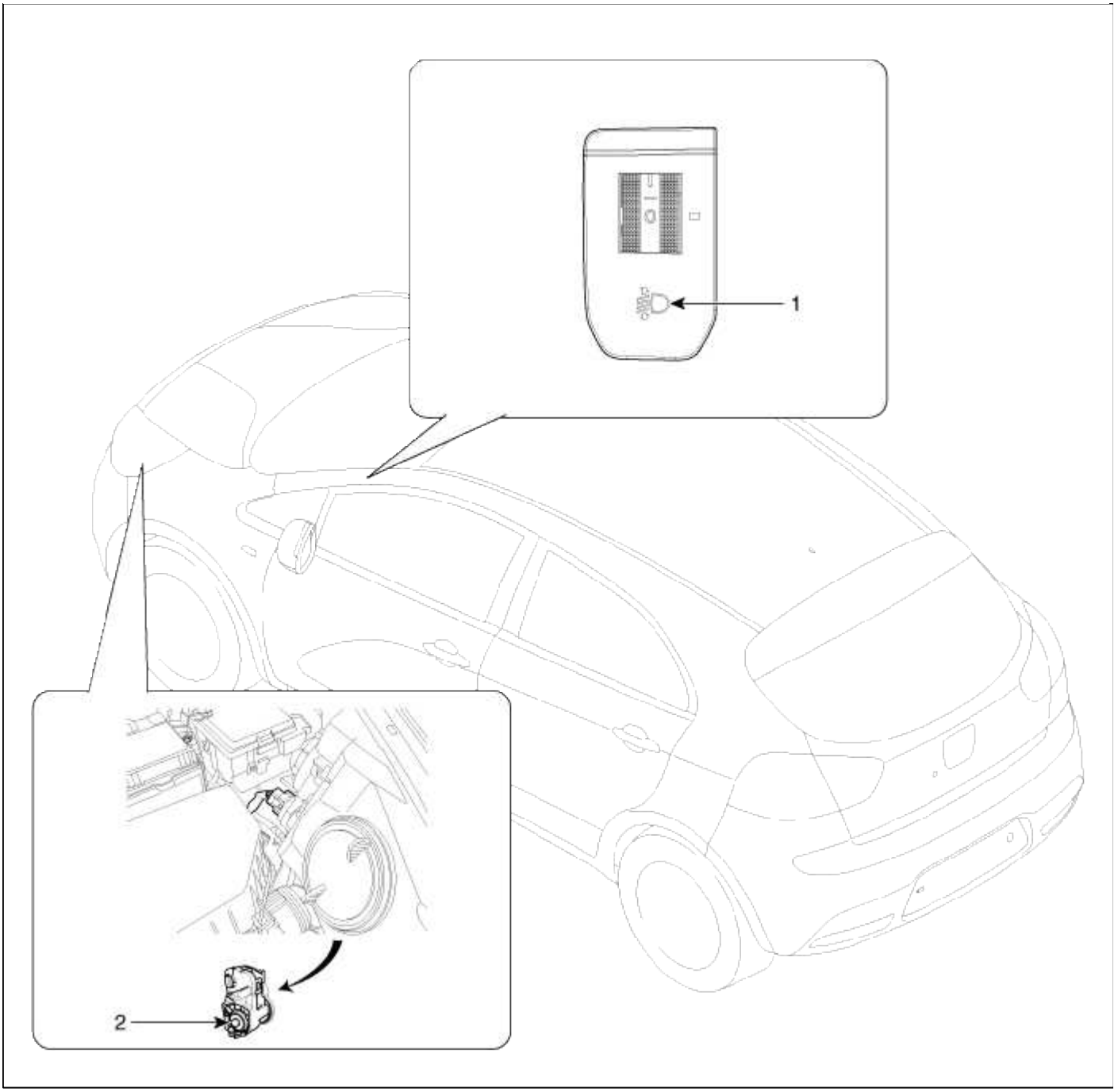
3. Remove the auto light connector.

Installation

1. Reconnect the auto light connector.
2. Install the auto light sensor.

Body Electrical System > Head lamp leveling Device > Components and Components Location

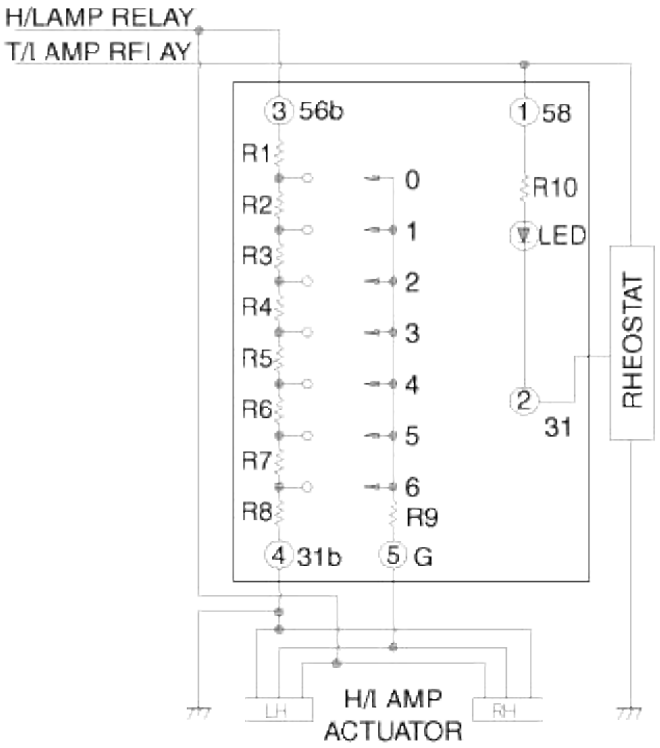
Component Location

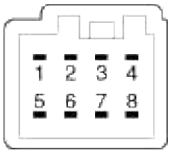


1. Headlamp leveling device	2. Headlamp leveling actuator

Body Electrical System > Head lamp leveling Device > Schematic Diagrams

Circuit Diagram





No	Description
1	Tail (+)
2	-
3	-
4	-
5	Illumination (-)
6	Ignition
7	Ground
8	Actuator (+)

Body Electrical System > Head lamp leveling Device > Head lamp leveling Actuator > Repair procedures

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the head lamp assembly (Refer to the head lamp).
3. Remove the head lamp leveling actuator by turning the adjusting gear in the hole using the adjusting wheel or screw driver.

Installation

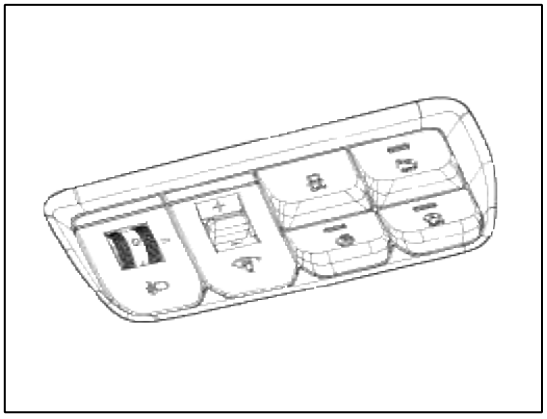
1. Install the head lamp leveling actuator by turning the adjusting gear.

2. Install the head lamp assembly.
3. Adjust the head lamp in accordance with the head lamp aiming instructions.

Body Electrical System > Head lamp leveling Device > Head Lamp Leveling Switch > Repair procedures

Removal

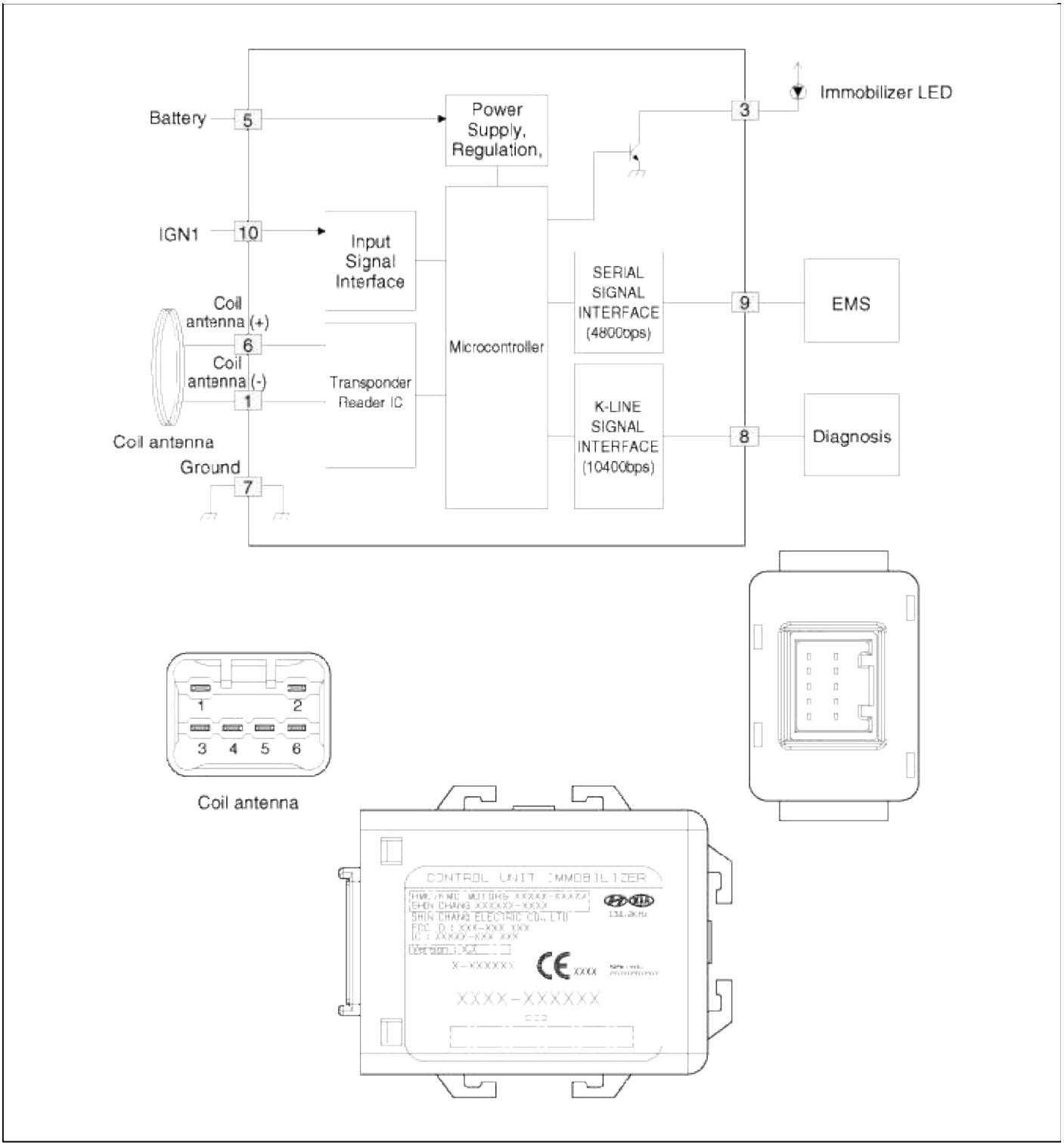
1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad lower panel.
   (Refer to the BD group - "Crash pad")
3. Remove the crash pad side switch assembly.



4. Disconnect the head lamp leveling switch connector from lower crash pad switch.
5. Remove the head lamp leveling switch.
6. The installation is the reverse of removal.

Body Electrical System > Immobilizer System > Components and Components Location

Components

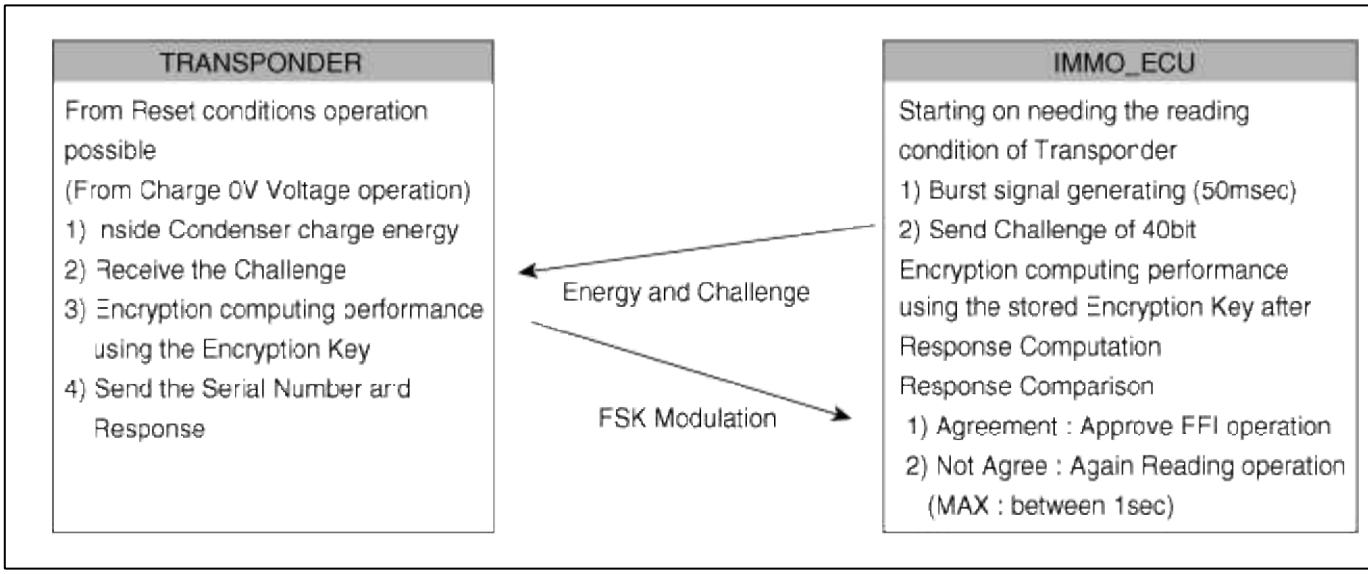


Body Electrical System > Immobilizer System > Description and Operation

Description

The immobilizer system will disable the vehicle unless the proper ignition key is used, in addition to the currently available anti-theft systems such as car alarms, the immobilizer system aims to drastically reduce the rate of auto theft.

1. Transponder (TP) – IMMO ECU Communication



TP Read Protocol

(1) IMMO_ECU after IGN on(or CPU Reset cancellation) is sent Challenge to TP and confirmed Serial Number and Signature.

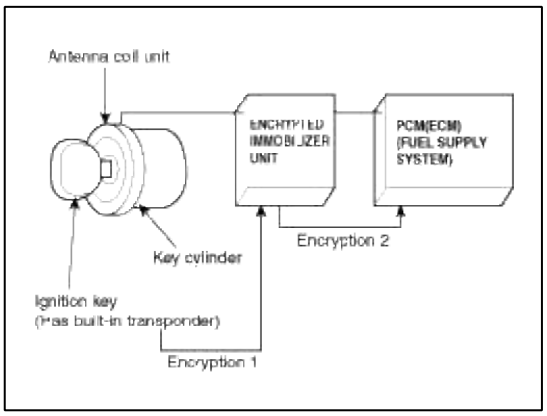
(2) When response of input transponder is not correct, input is retry.

(3) When response of input transponder is correct, The data that calculate Encryption operation in the EEPROM program compared with received data from TP.
When Codes is same, input is finished.
If the codes are not same, input are continued until when codes are same.

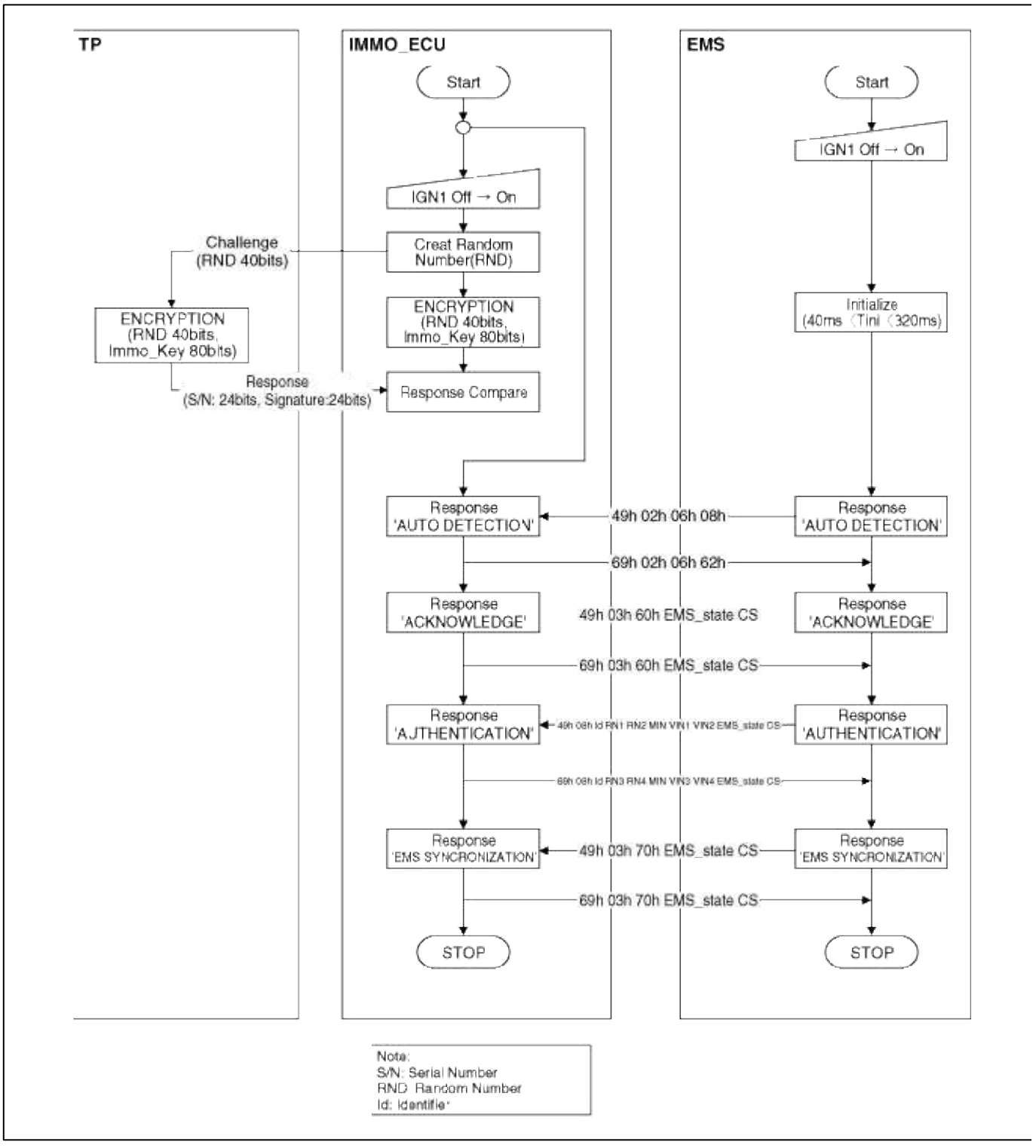
(4) If IMMO_ECU EEPROM code is not programming, when correct transponder is inputted (CRC Check OK input is finished.

(5) After IGN1 on(CPU Reset cancellation), IMMO_ECU is reading the maximum 5times Transponder Code

(6) In the IGN1 ON&EMS_state=Lock state, when received ANKNOWLEDGE, TP is re-authenticated



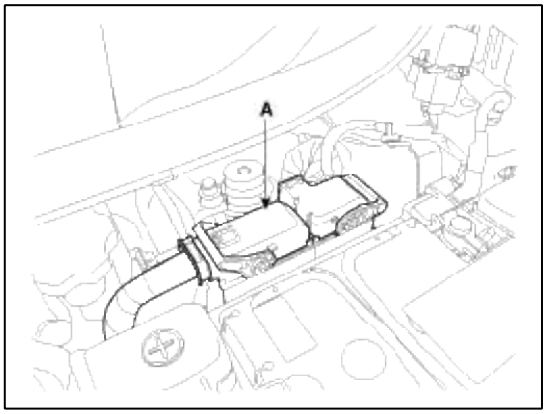
2. TP / IMMO ECU / EMS Authentication Flowchart



Components Operations

ECM (Engine Control Module)

1. The ECM(PCM) (A) carries out a check of the ignition key using a special encryption algorithm, which is programmed into the transponder as well as the ECM simultaneously. Only if the results are equal, the engine can be started. The data of all transponders, which are valid for the vehicle, are stored in the ECM.
   ERN (Encrypted Randorn Number) value between EMS and encrypted Immobilizer unit is checked and the validity of coded key is decided by EMS.



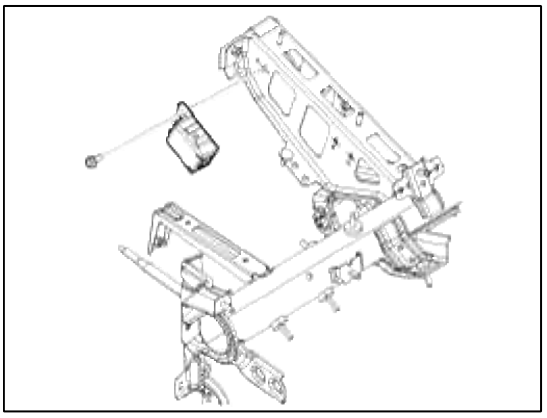
ENCRYPTED Immobilizer unit (A)

The Immobilizer carries out communication with the built-in transponder in the ignition key. This wireless communication runs on RF (Radio frequency of 125 kHz). The Immobilizer is mounted behind of the crash pad close to center cross bar.

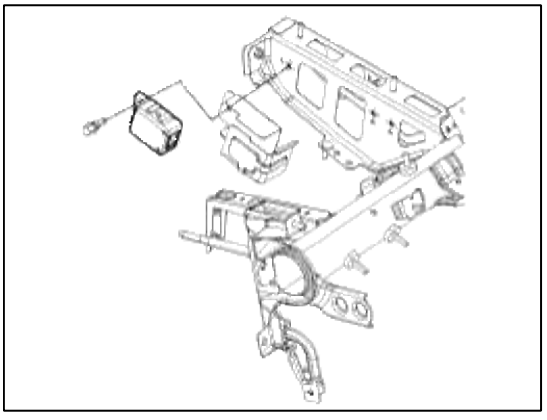
The RF signal from the transponder, received by the antenna coil, is converted into messages for serial communication by the Immobilizer device. And, the received messages from the PCM(ECM) are converted into an RF signal, which is transmitted to the transponder by the antenna.

The Immobilizer does not carry out the validity check of the transponder or the calculation of encryption algorithm. This device is only an advanced interface, which converts the RF data flow of the transponder into serial communication to the ECM and vice versa.

[USA]

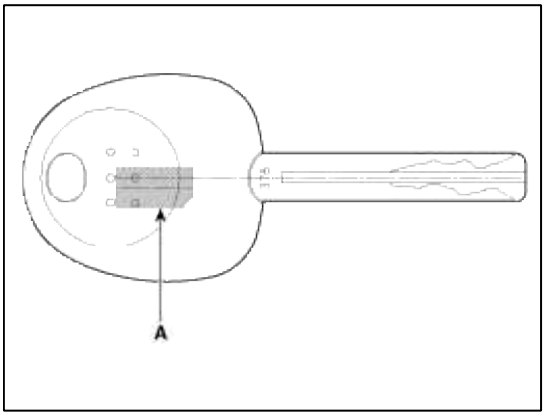


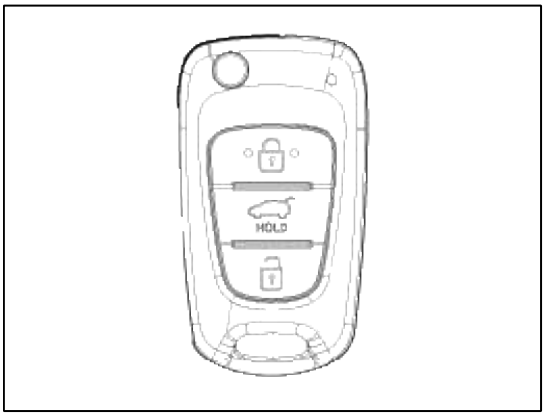
[CANADA]



TRANSPONDER

The transponder (A) has an advanced encryption algorithm. During the key teaching procedure, the transponder will be programmed with vehicle specific data. The vehicle specific data are written into the transponder memory. The write procedure is once only; therefore, the contents of the transponder can never be modified or changed.



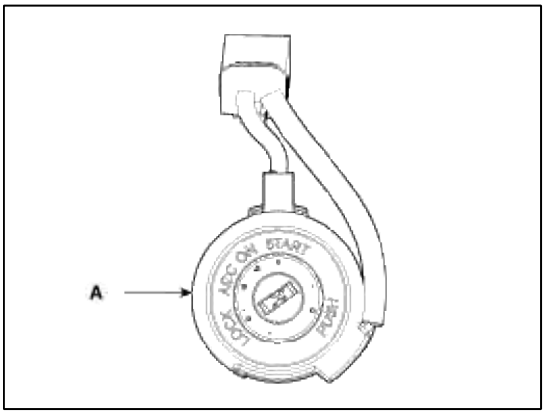


Antenna coil

The antenna coil (A) has the following functions.

- The antenna coil supplies energy to the transponder.
- The antenna coil receives signal from the transponder.
- The antenna coil sends transponder signal to the Immobilizer.

It is located directly on the shroud.



Body Electrical System > Immobilizer System > Repair procedures

Replacement

Problems And Replacement Parts:

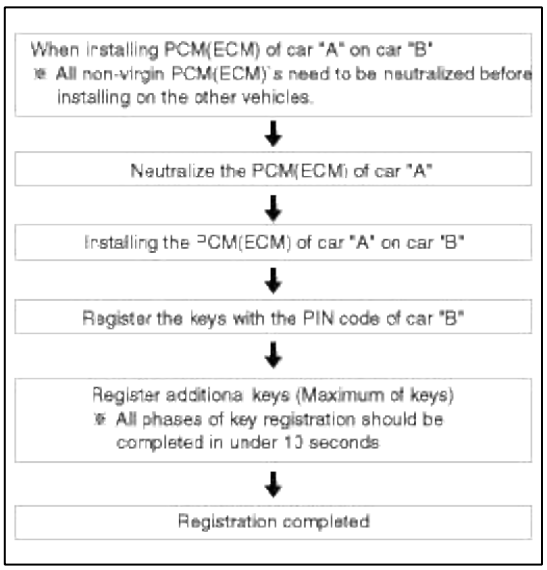
Problem	Part set	Scan tool required?
All keys have been lost	Blank key (4)	YES
Antenna coil unit does not work	Antenna coil unit	NO
ECM does not work	ECM	YES
Ignition switch does not work	Ignition switch with Antenna coil unit	YES
Unidentified vehicle specific data occurs	Key, ECM	YES
Immobilizer unit does not work	Immobilizer unit	YES

Replacement Of Ecm And Immobilizer

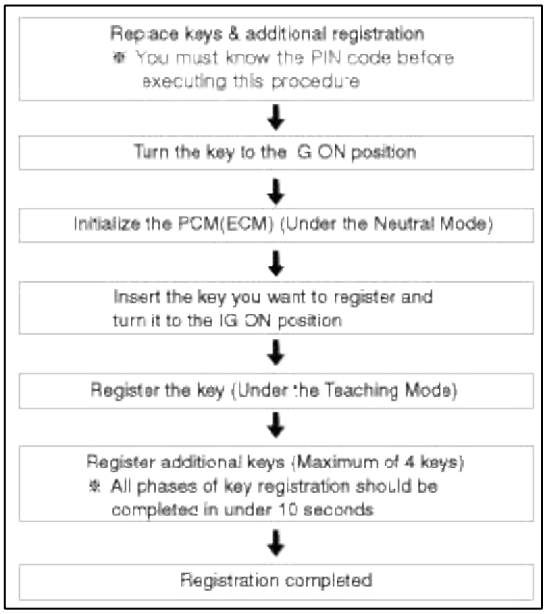
In case of a defective ECM, the unit has to be replaced with a "virgin" or "neutral" ECM. All keys have to be taught to the new ECM. Keys, which are not taught to the ECM, are invalid for the new ECM (Refer to key teaching procedure). The vehicle specific data have to be left unchanged due to the unique programming of transponder.

In case of a defective Immobilizer, it needs teaching the Immobilizer. A new Immobilizer device replaces the old one and Immobilizer need teaching.

1. Things to remember before a replacement (ECM)



2. Things to remember before a replacement (Keys & Additional registration)



NOTE

1. When there is only one key registered and you wish to register another key, you need to re-register the key which was already registered.
2. When the key #1 is registered and master key #2 is not registered, Put the key #1 in the IG/ON or the start position and remove it. The engine can be started with the unregistered key #2.
   (Note that key #2 must be used within 10 seconds of removing key #1)
3. When the key #1 is registered and key #2 is not registered, put the unregistered master key #2 in the IG/ON or the start position.
   The engine cannot be started even with the registered key #1.
4. When you inspect the immobilizer system, refer to the above paragraphs 1, 2 and 3.
   Always remember the 10 seconds zone.
5. If the pin code & password are entered incorrectly on three consecutive inputs, the system will be locked for one hour.
6. Be cautious not to overlap the transponder areas.
7. Problems can occur at key registration or vehicle starting if the transponders should overlap.

Neutralizing Of ECM

The ECM can be set to the "neutral" status by a tester.

A valid ignition key is inserted and after ignition on is recorded, the ECM requests the vehicle specific data from the tester. The communication messages are described at "Neutral Mode" After successfully receiving the data, the ECM is neutralized.

The ECM remains locked. Neither the limp home mode nor the "twice ignition on" function, is accepted by the ECM.

The teaching of keys follows the procedure described for the virgin ECM. The vehicle specific data have to be unchanged due to the unique programming of the transponder. If data should be changed, new keys with a virgin transponder are requested.

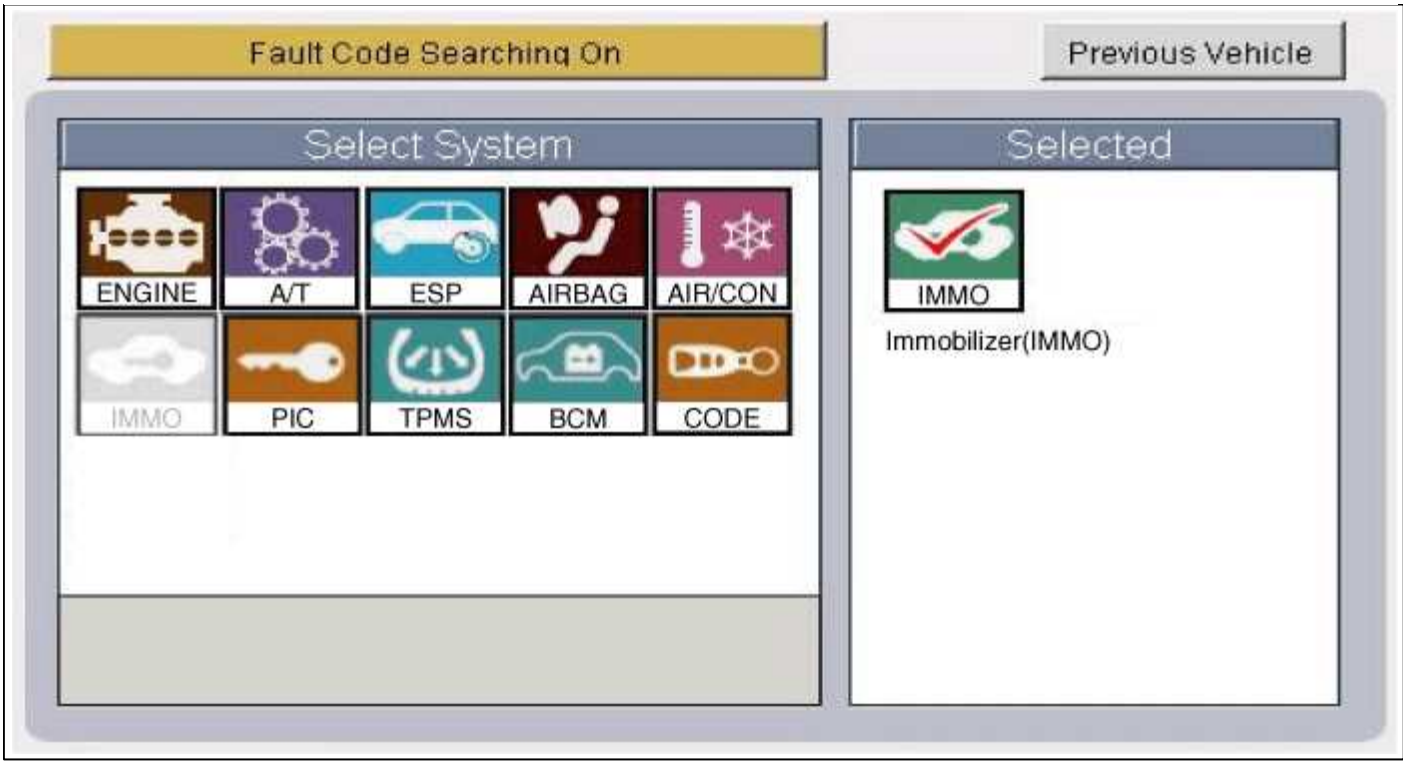
This function is for neutralizing the ECM and Key. Ex) when lost key, Neutralize the ECM then teach keys.

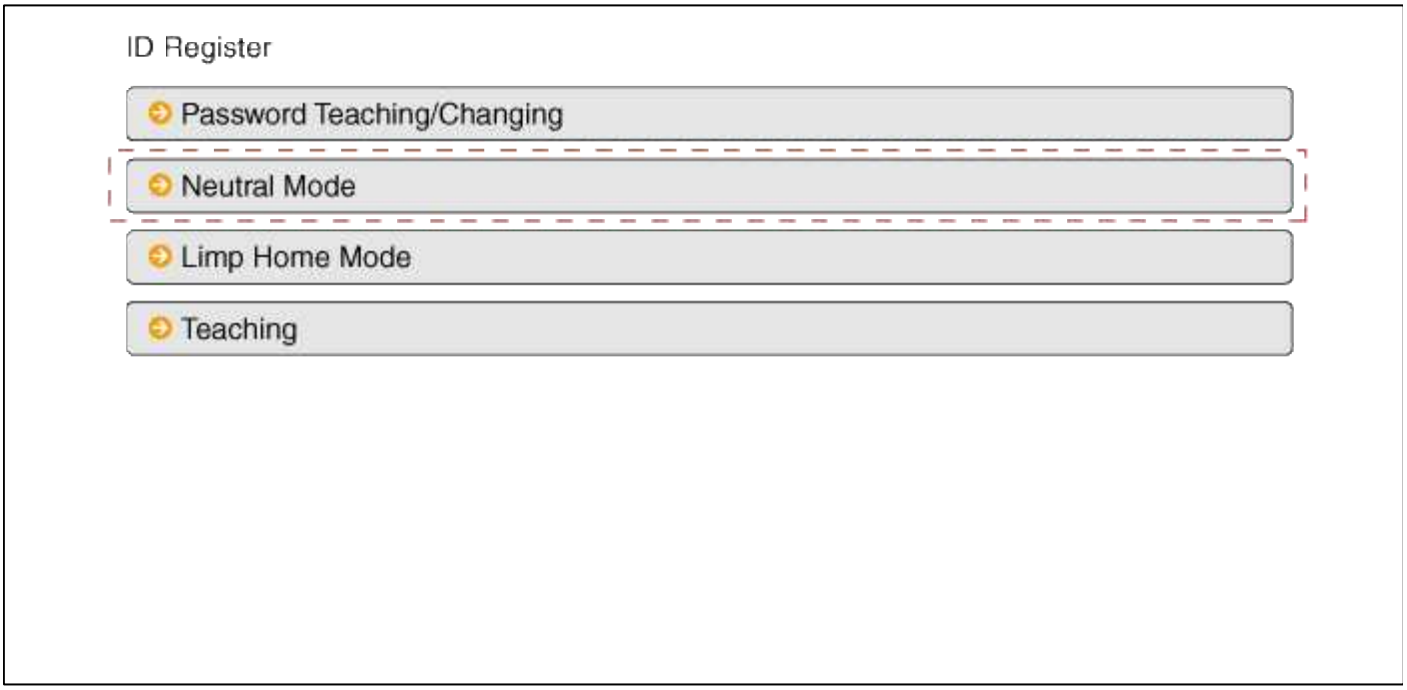
(Refer to the Things to do when Key & PIN Code the ECM can be set to the "neutral" status by a scanner. If wrong vehicle specific data have been sent to immobilizer three times continuously or intermittently, the immobilizer will reject the request to enter neutral mode for one hour. Disconnecting the battery or other manipulation cannot reduce this time. After connecting the battery the timer starts again for one hour.

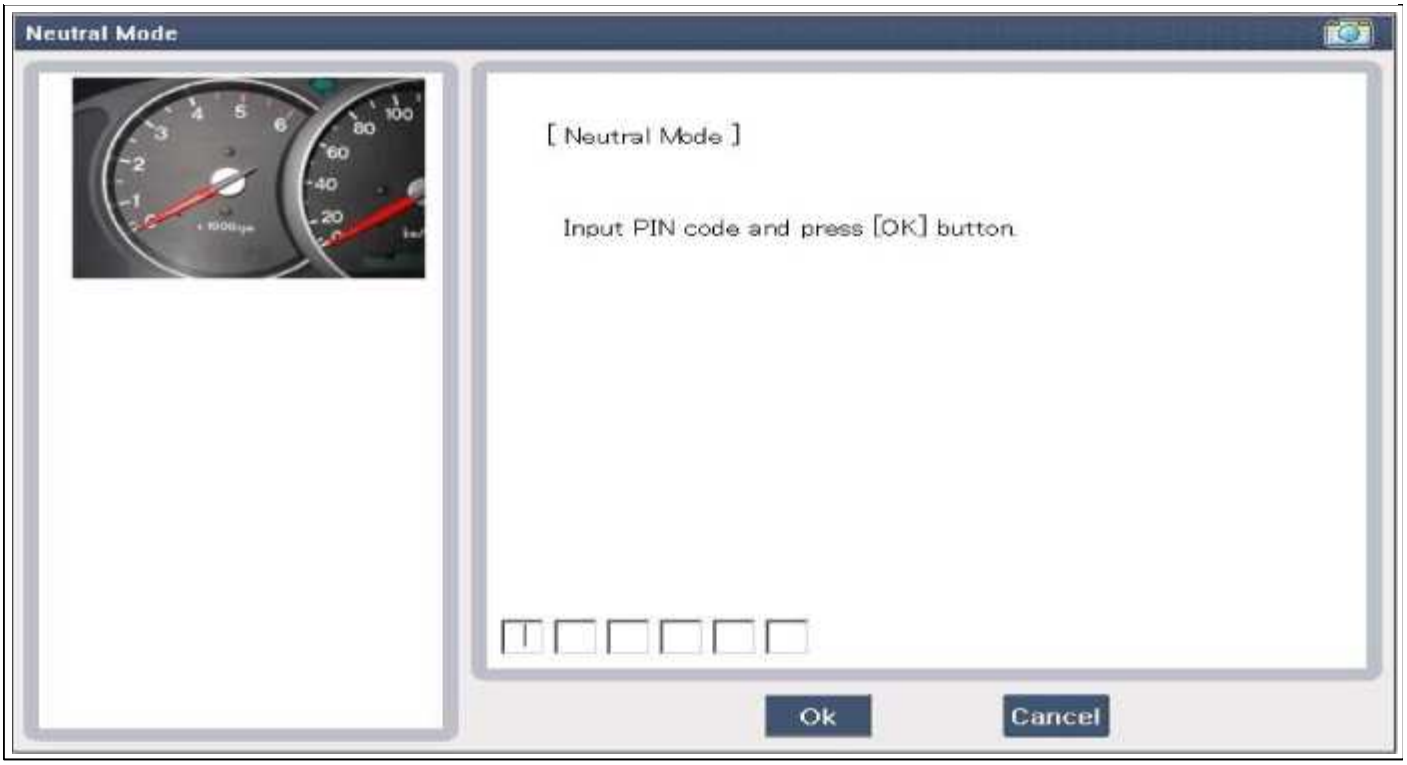
NOTE

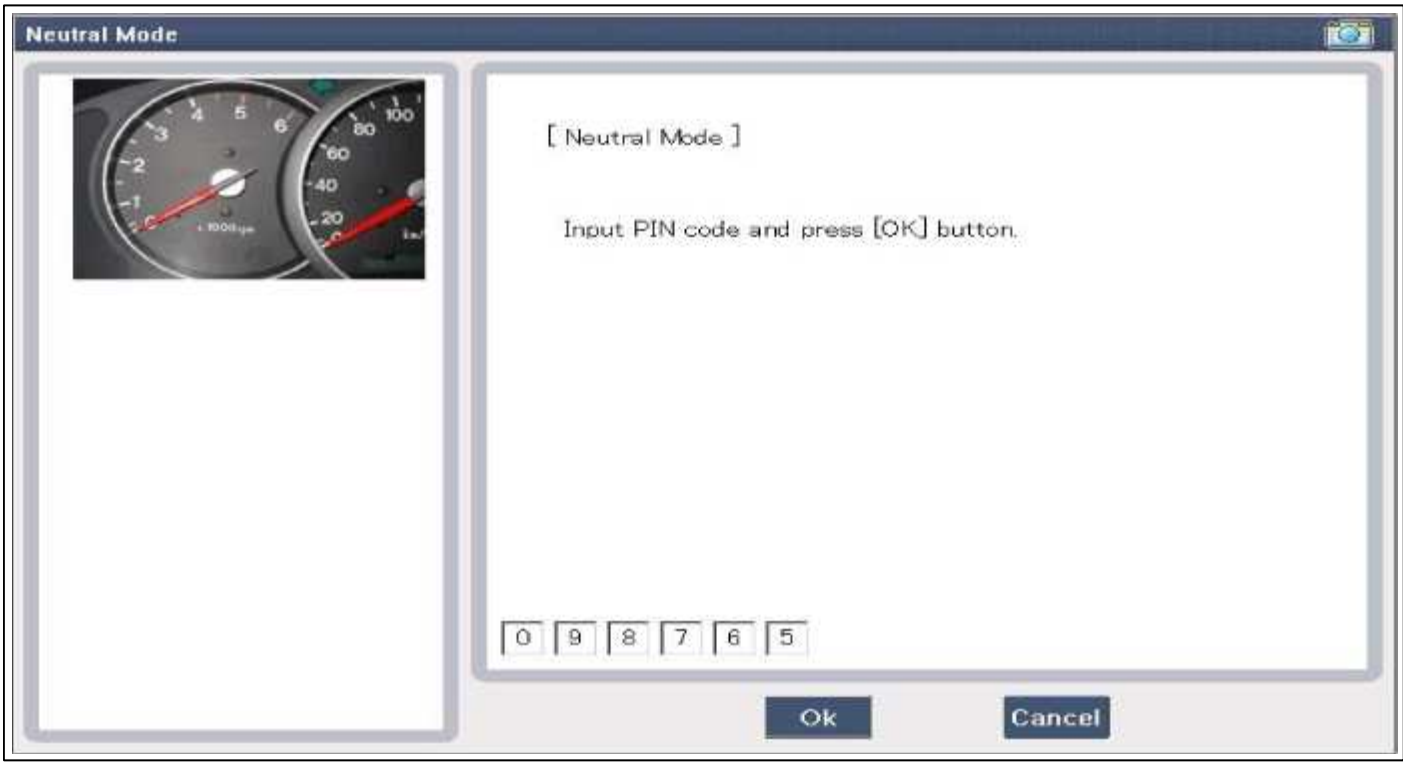
- Neutralizing setting condition
  - In case of ECM status "Learnt" regardless of user password "Virgin or Learnt"
  - Input correct PIN code by scanner.
  - Neutralizing meaning .
    : PIN code (6) & user password (4) deletion.
    : Locking of ECM (except key teaching permission)
- Neutralizing meaning:
  - PIN Code(6) & User P/Word(4) deletion
  - Locking of EMS(except Key Learning permission)

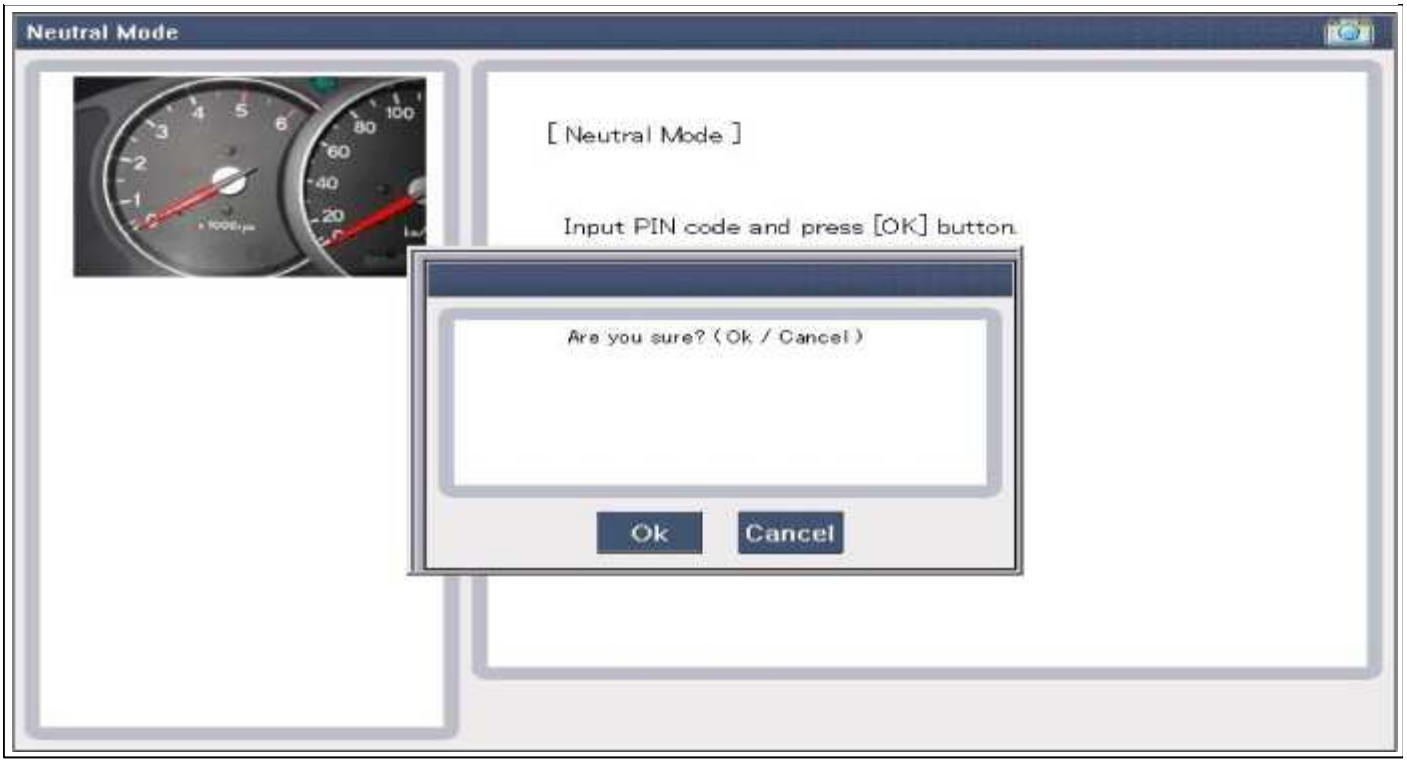
Function / EMS	Engine Running			Learning	
	Learnt Key	Limp home	Twice Ignition	Key	User Password
Neutral	No	No	No	Yes	No

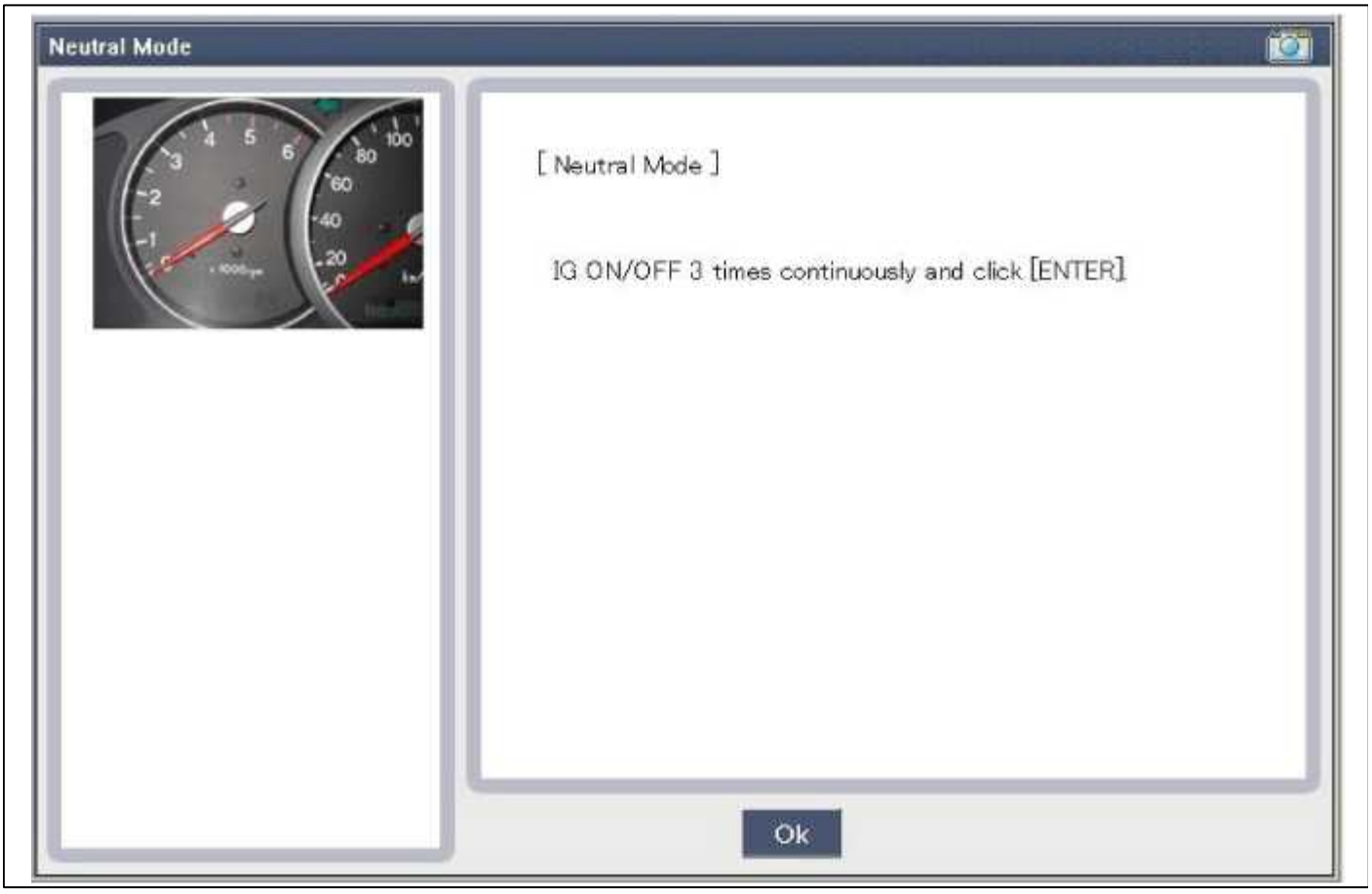

Fault Code Searching On
Previous Vehicle
Select System
ENGINE
A/T
ESP
AIRBAG
AIR/CON
IMMO
PIC
TPMS
BCM
CODE
Selected
IMMO
Immobilizer(IMMO)

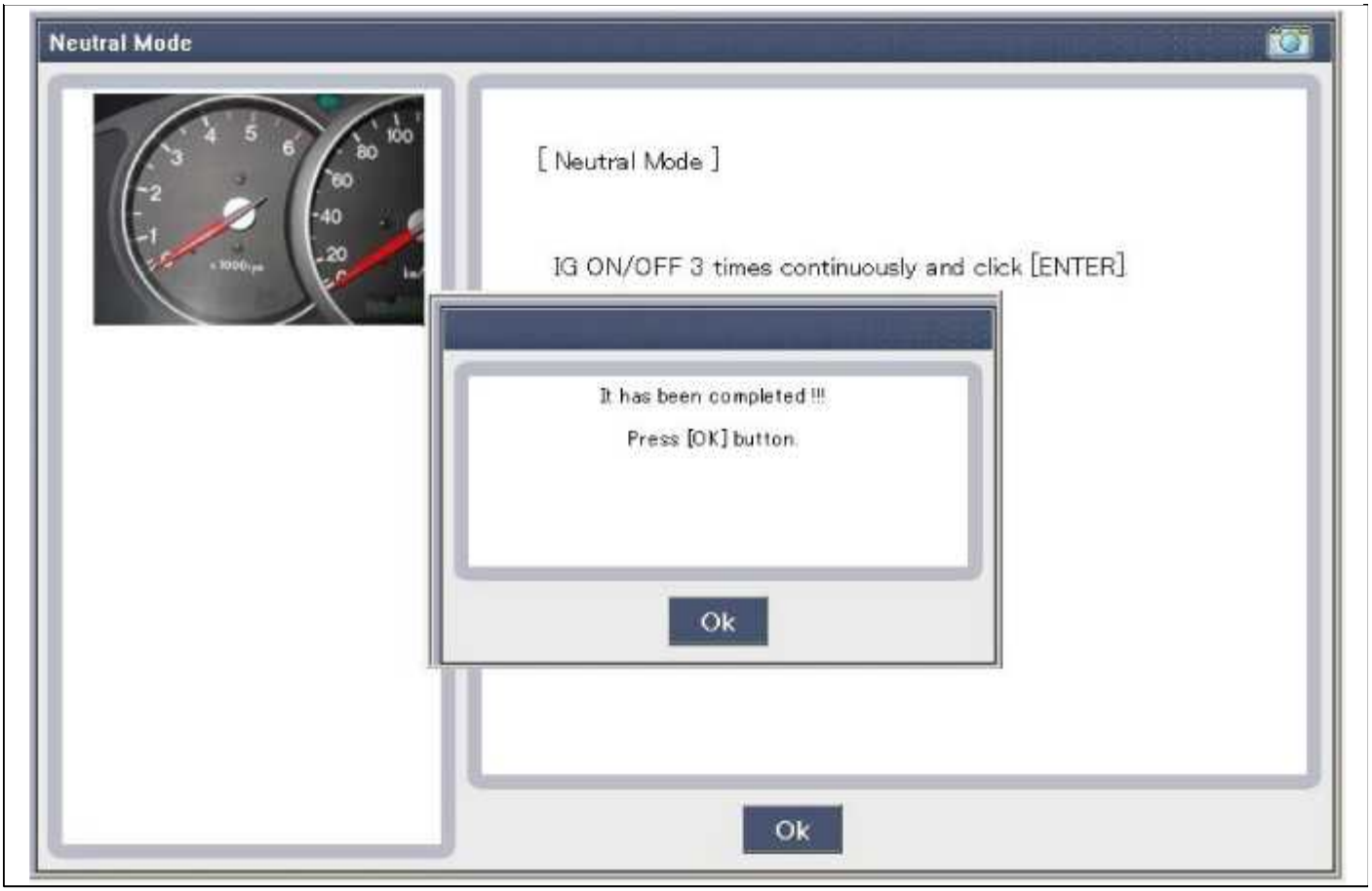

ID Register
Password Teaching/Changing
Neutral Mode
Limp Home Mode
Teaching

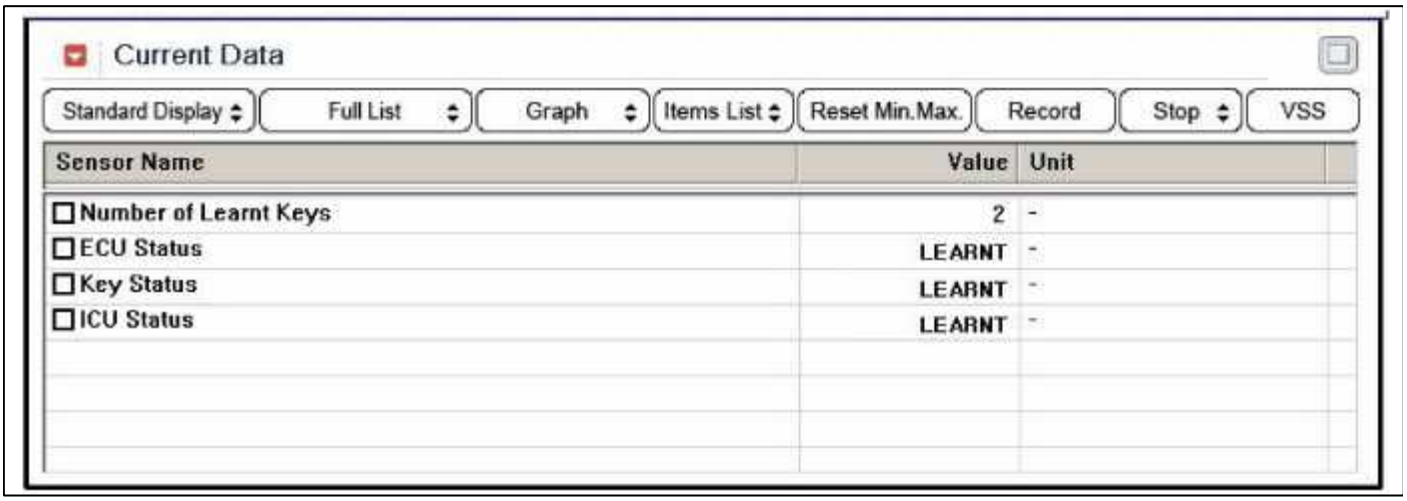

Neutral Mode
[Neutral Mode]
Input PIN code and press [OK] button.
Ok
Cancel


Neutral Mode
[Neutral Mode]
Input PIN code and press [OK] button.
0 9 8 7 6 5
Ok
Cancel


Neutral Mode
[Neutral Mode]
Input PIN code and press [OK] button
Are you sure? (Ok / Cancel)
Ok
Cancel


Neutral Mode
[Neutral Mode]
IG ON/OFF 3 times continuously and click [ENTER]
Ok





Teaching Procedures

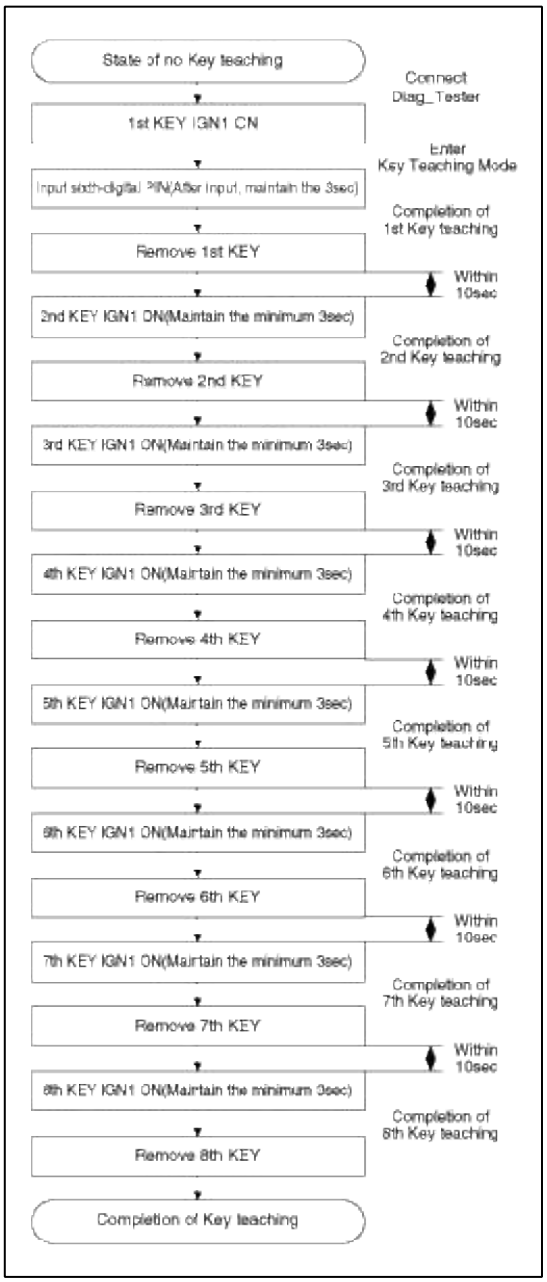
1. Key Teaching Procedure

Key teaching must be done after replacing a defective ECM or when providing additional keys to the vehicle own
The procedure starts with an ECM request for vehicle specific data (PIN code: 6digits) from the tester. The "virgi
ECM stores the vehicle specific data and the key teaching can be started. The "learnt" ECM compares the vehicle
specific data from the tester with the stored data. If the data are correct, the teaching can proceed.
If incorrect vehicle specific data have been sent to the ECM three times, the ECM will reject the request of key tea
for one hour. This time cannot be reduced by disconnecting the battery or any other manipulation. After reconnecti
battery, the timer starts again for one hour.
The key teaching is done by ignition on with the key and additional tester commands. The ECM stores the relevan
in the EEPROM and in the transponder. Then the ECM runs the authentication required for confirmation of the tea
process. The successful programming is then confirmed by a message to the tester.
If the key is already known to the ECM from a previous teaching, the authentication will be accepted and the EEP

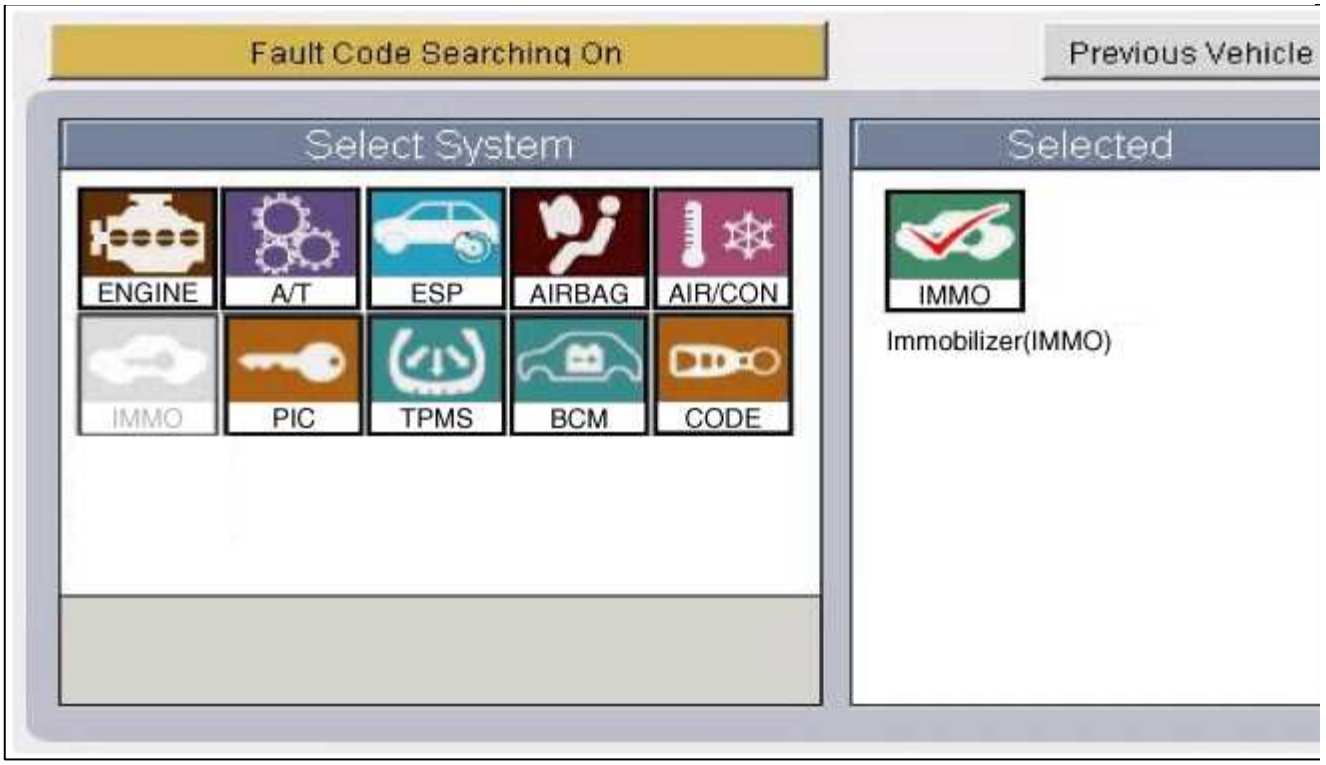
data are updated. There is no changed transponder content (this is impossible for a learnt transponder).
The attempt to repeatedly teach a key, which has been taught already during the same teaching cycle, is recognize the ECM. This rejects the key and a message is sent to the tester.
The ECM rejects invalid keys, which are presented for teaching. A message is sent to the tester. The key can be ir due to faults in the transponder or other reasons, which result from unsuccessful programming of data. If the ECM detects different authenticators of a transponder and an ECM, the key is considered to be invalid.
The maximum number of taught keys is 8
If an error occurs during the Immobilizer Service Menu, the ECM status remains unchanged and a specific fault co stored.
If the ECM status and the key status do not match for teaching of keys, the tester procedure will be stopped and a specific fault code will be stored at ECM.

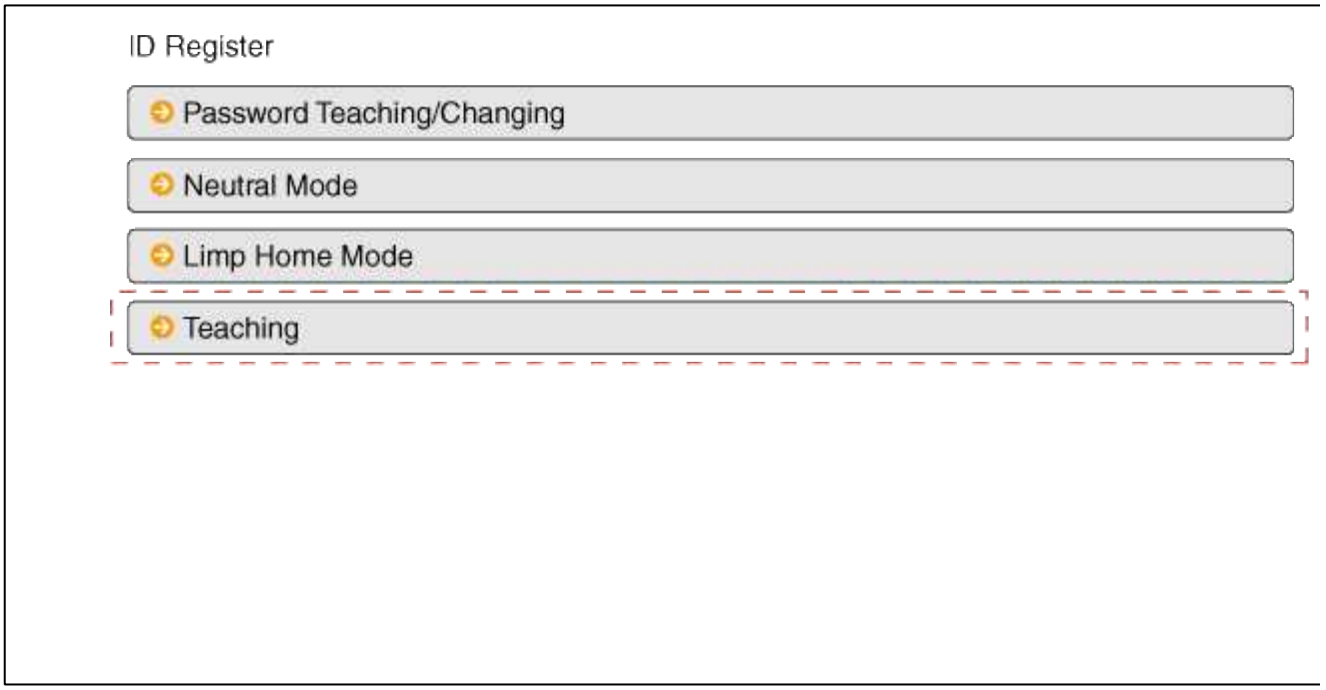
NOTE

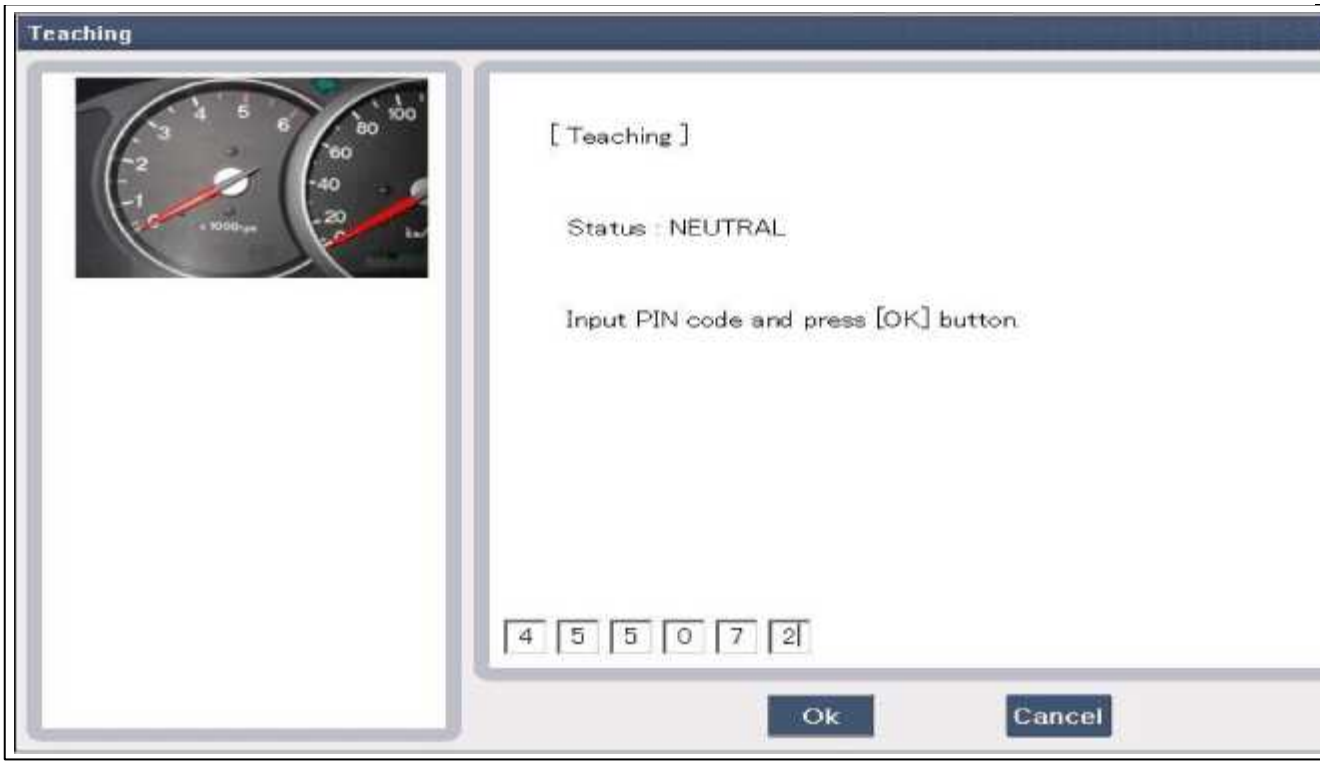
When teaching the 1st key, Immobilizer regists at the same time.

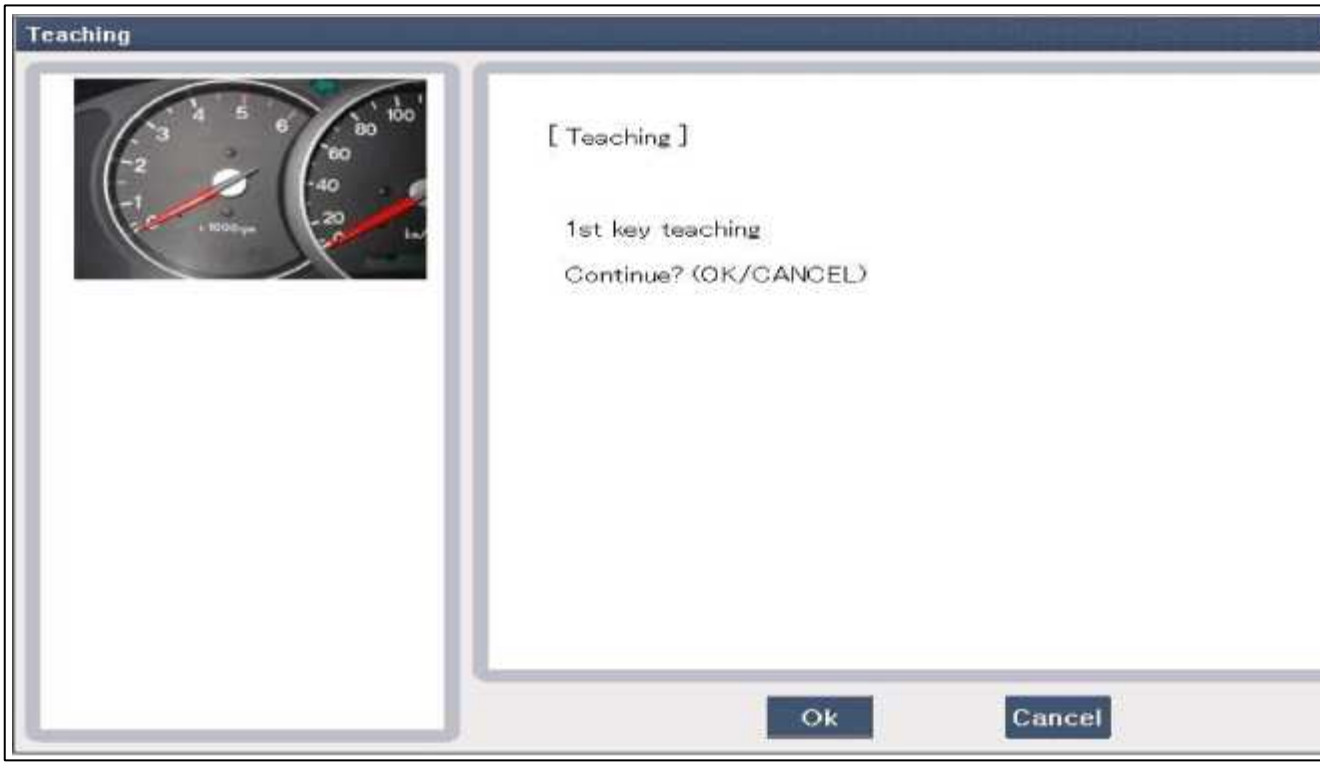


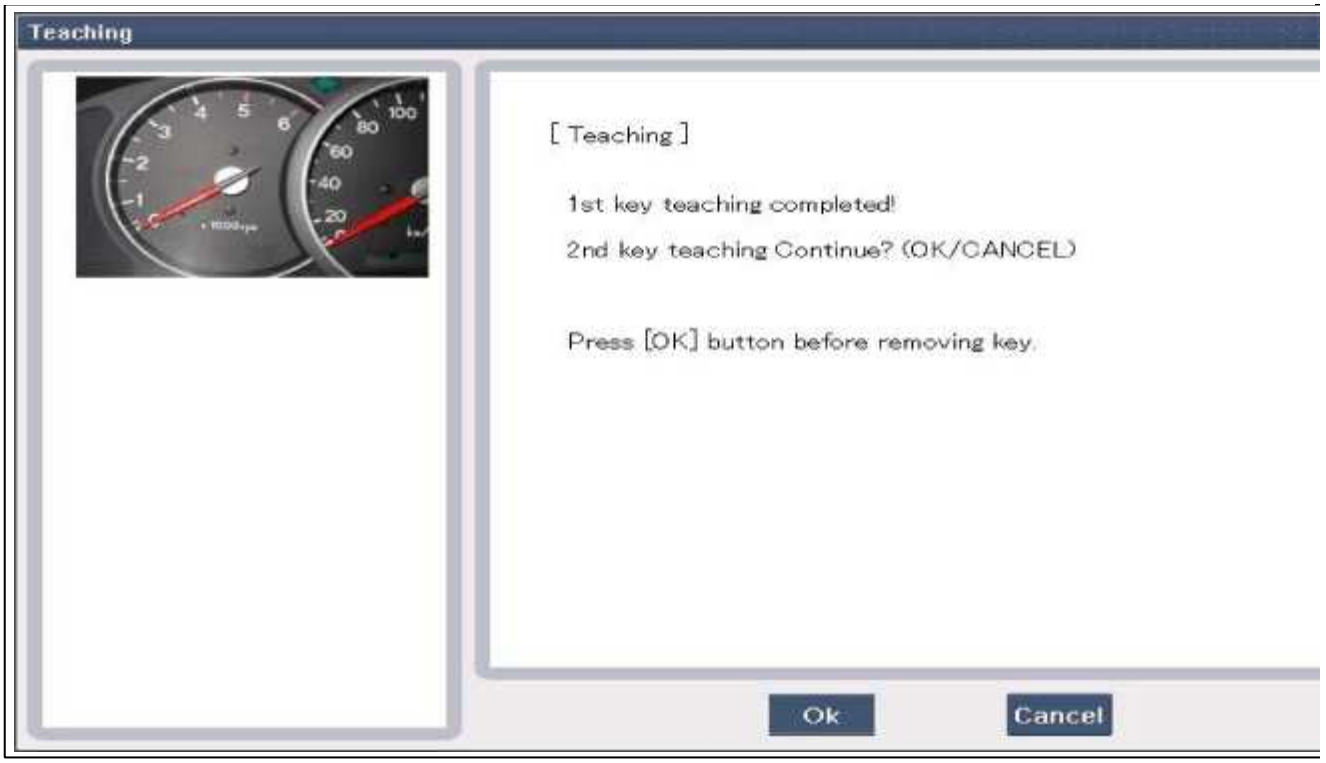
(1) ECM learnt status.

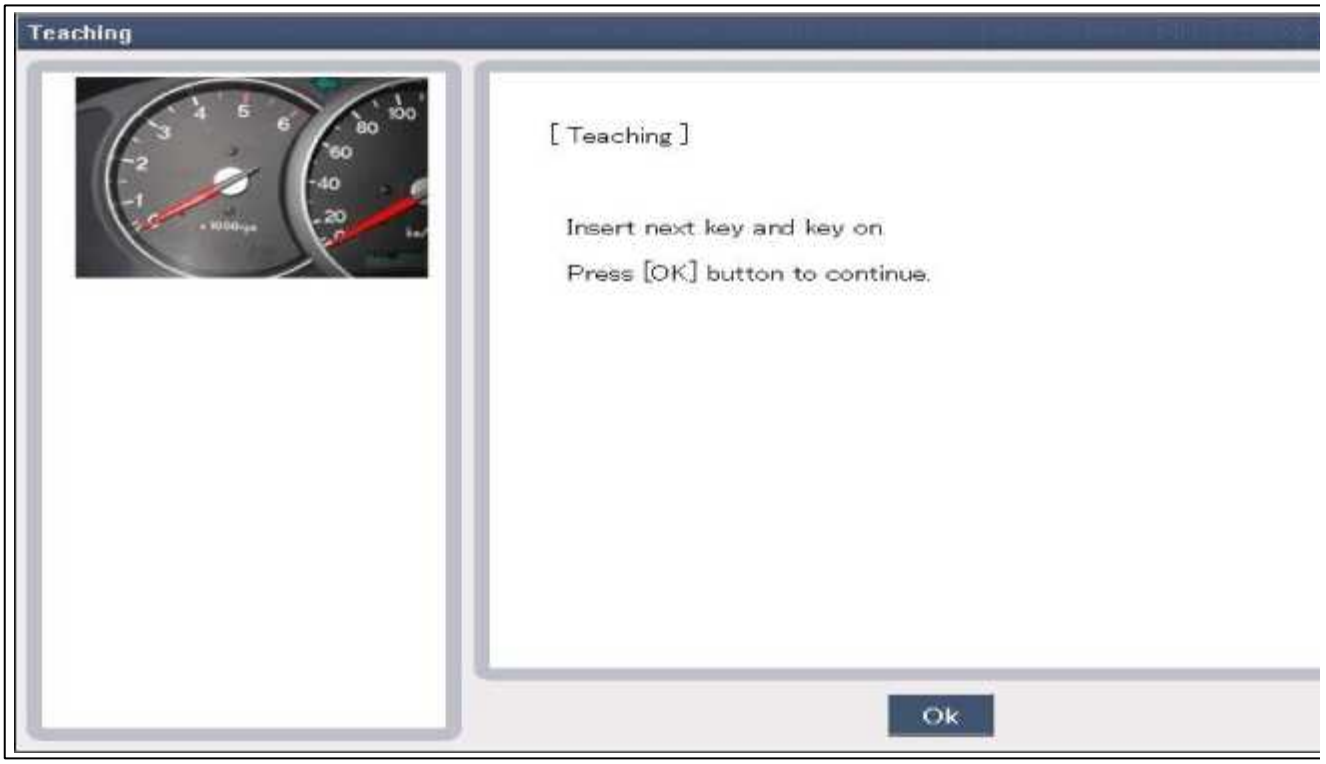

Fault Code Searching On
Previous Vehicle
Select System
ENGINE
A/T
ESP
AIRBAG
AIR/CON
IMMO
PIC
TPMS
BCM
CODE
Selected
IMMO
Immobilizer(IMMO)

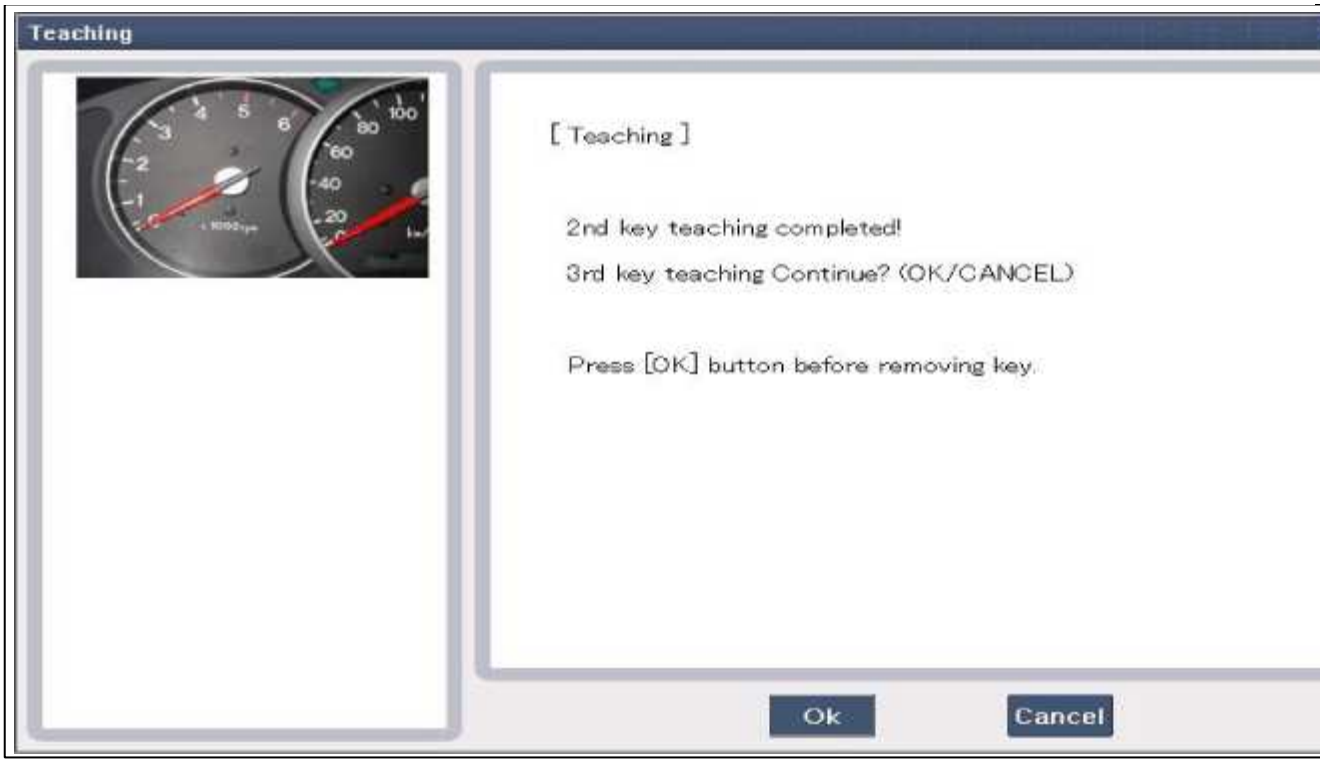

ID Register
Password Teaching/Changing
Neutral Mode
Limp Home Mode
Teaching

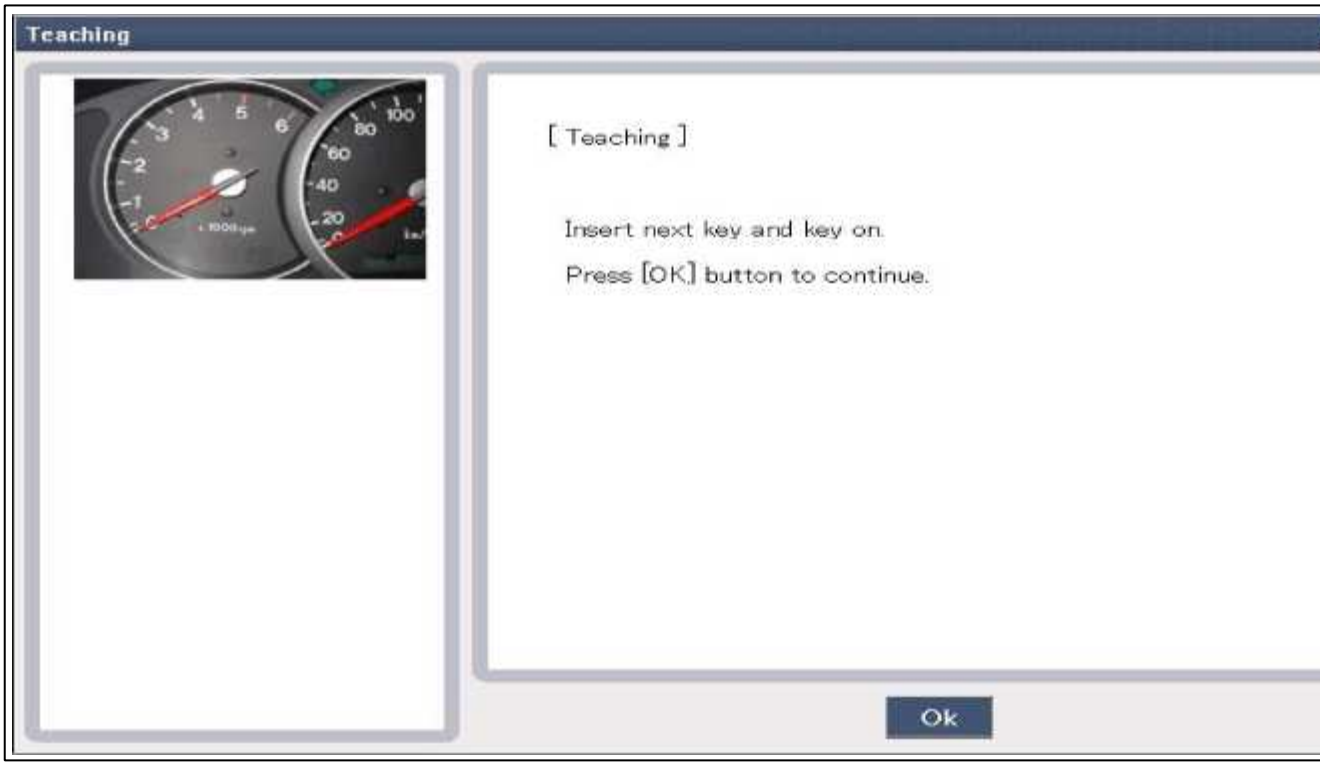

Teaching
[Teaching]
Status : NEUTRAL
Input PIN code and press [OK] button
4 5 5 0 7 2
Ok
Cancel

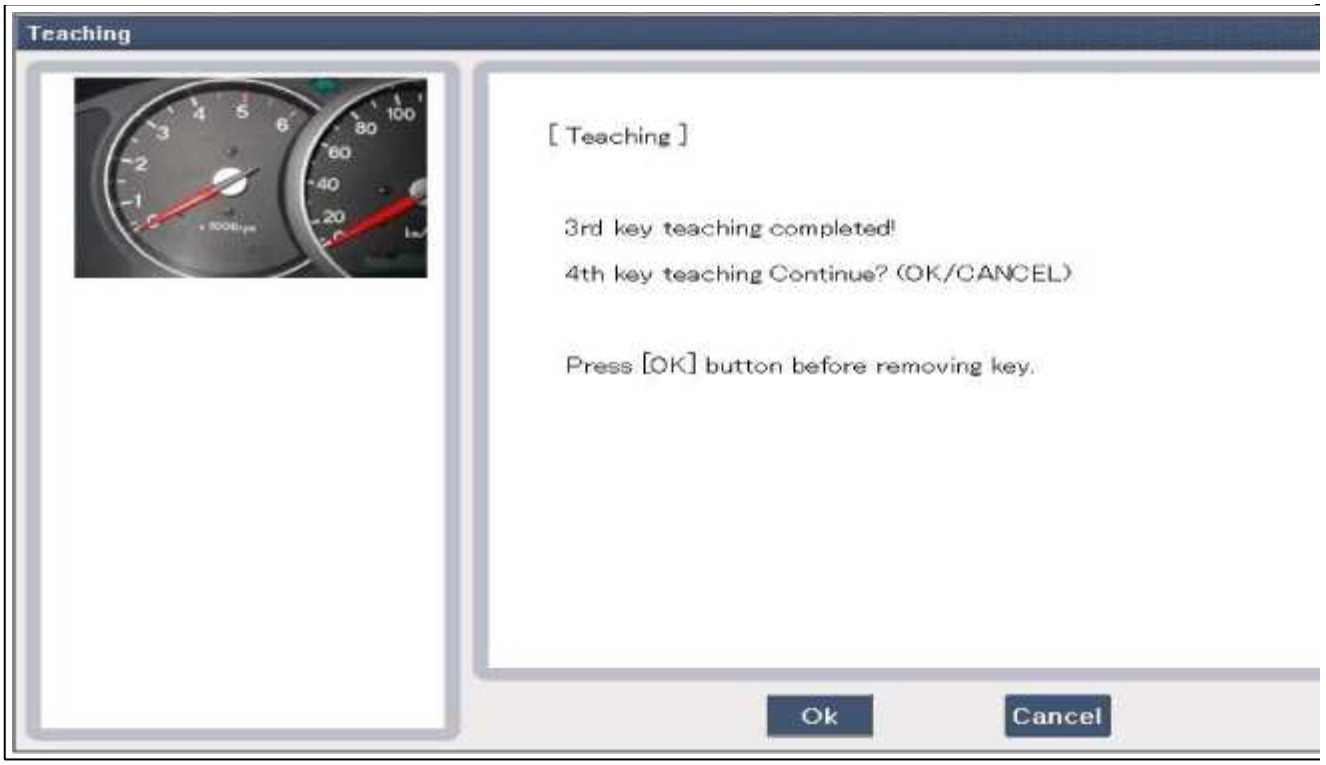

Teaching
[Teaching]
1st key teaching
Continue? (OK/CANCEL)
Ok
Cancel


Teaching
[Teaching]
1st key teaching completed!
2nd key teaching Continue? (OK/CANCEL)
Press [OK] button before removing key.
Ok
Cancel


Teaching
[Teaching]
Insert next key and key on
Press [OK] button to continue.
Ok


Teaching
[Teaching]
2nd key teaching completed!
3rd key teaching Continue? (OK/CANCEL)
Press [OK] button before removing key.
Ok
Cancel


Teaching
[Teaching]
Insert next key and key on.
Press [OK] button to continue.
Ok



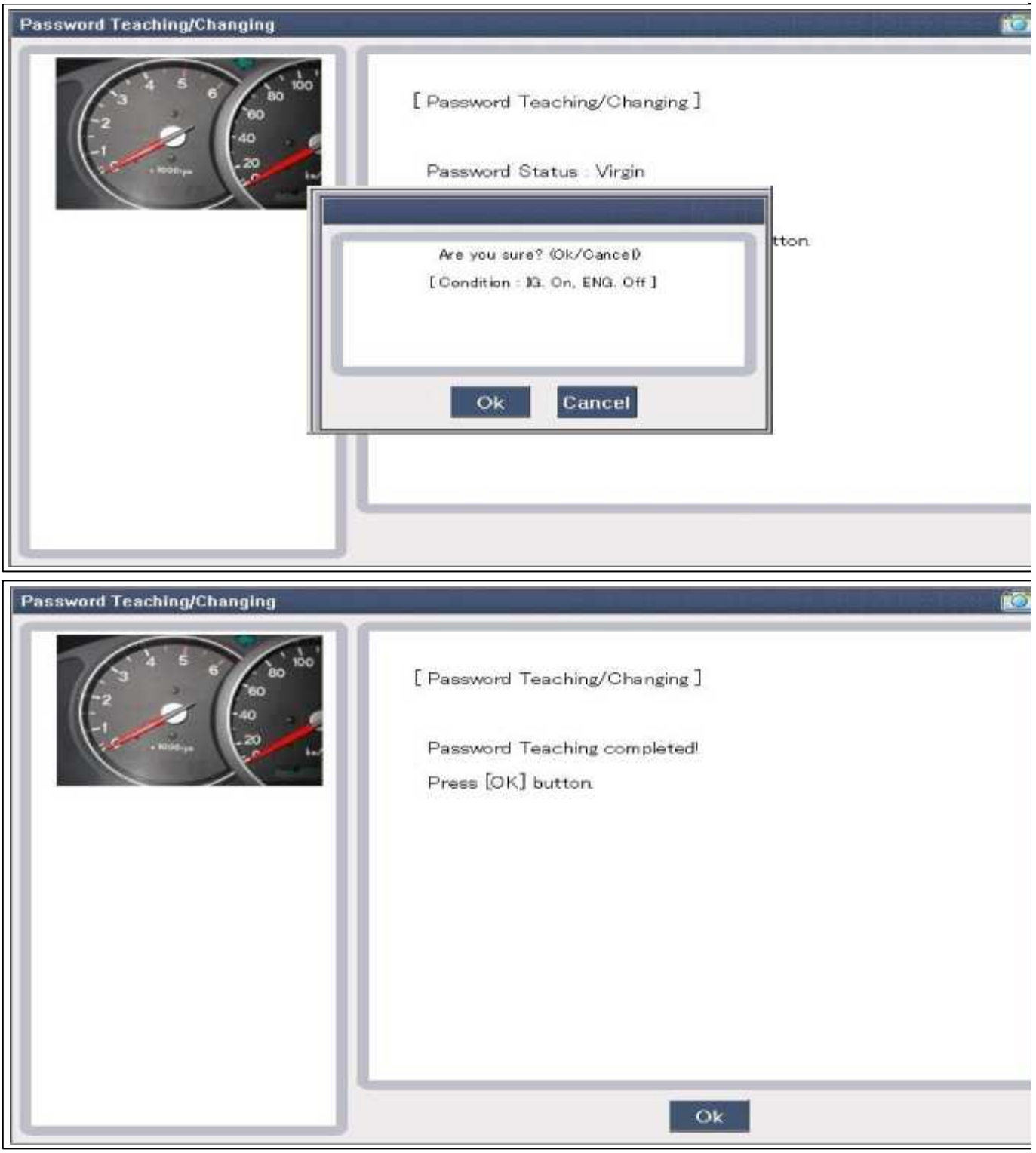
(2) ECM virgin status.
After replacing new "ECM" scan tool displays that ECM is virgin status in Key Teaching mode.
"VIRGIN" status means that ECM has not matched any PIN code before.

Password Teaching/changing

1. User Password Teaching Procedure
   The user password for limp home is taught at the service station. The owner of the vehicle can select a number with four digits.
   The user password teaching is only accepted by a "learnt" ECM. Before first teaching of user password to an ECM, the status of the password is "virgin" No limp home function is possible.
   The teaching is started by ignition on, with a valid key(learnt key) and sending the user password by tester. After successful teaching, the status of the user password changes from "virgin" to "learnt"
   The learnt user password can also be changed. This can be done if the user password status is "learnt" and the tester sends authorization of access, either the old user password or the vehicle specific data. After correct authorization, the ECM requests the new user password. The status remains "learnt" and the new user password will be valid for the next limp home mode.
   If wrong user passwords or wrong vehicle specific data have been sent to the ECM three times continuously or intermittently, the ECM will reject the request to change the password for one hour. This time cannot be reduced by disconnecting the battery or any other actions. After reconnecting the battery, the timer starts again for one hour.
2. User password teaching

ID Register

- Password Teaching/Changing
- Neutral Mode
- Limp Home Mode
- Teaching

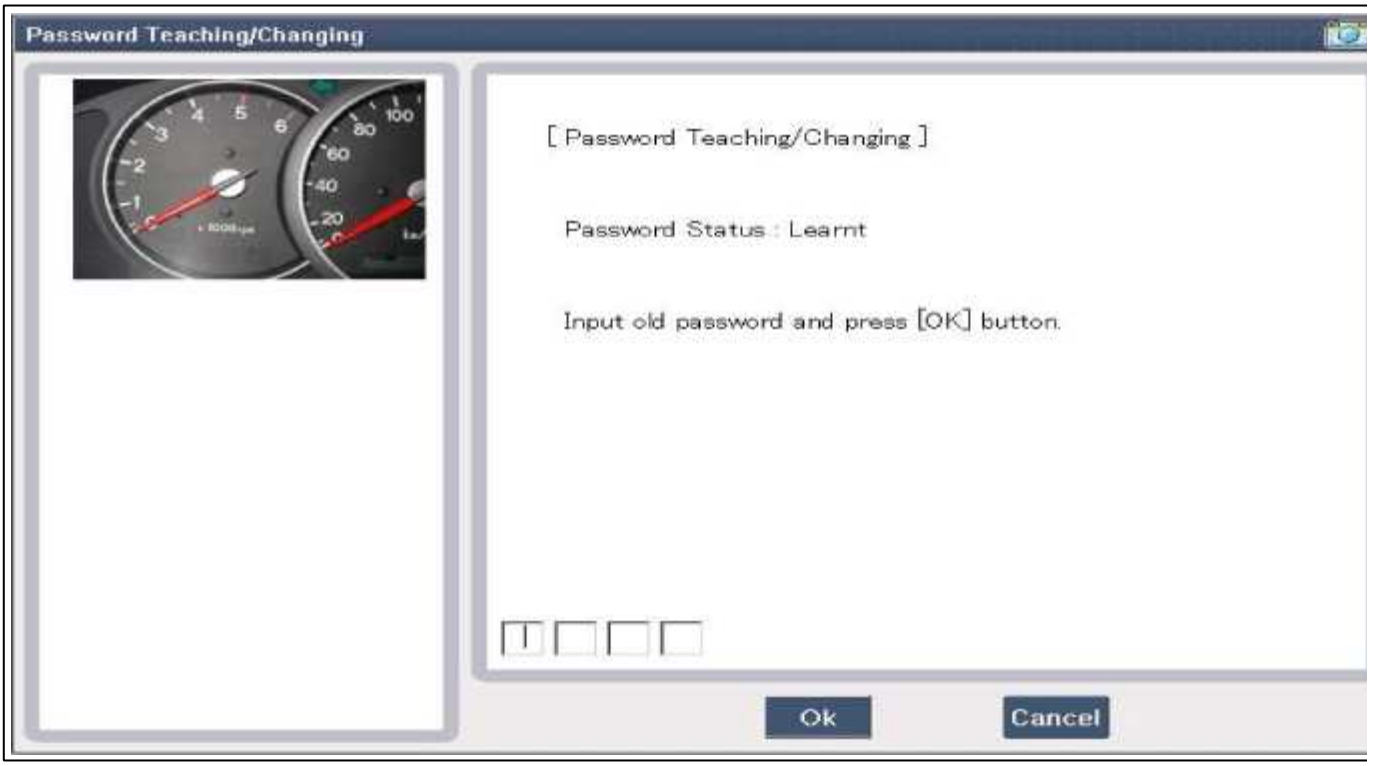


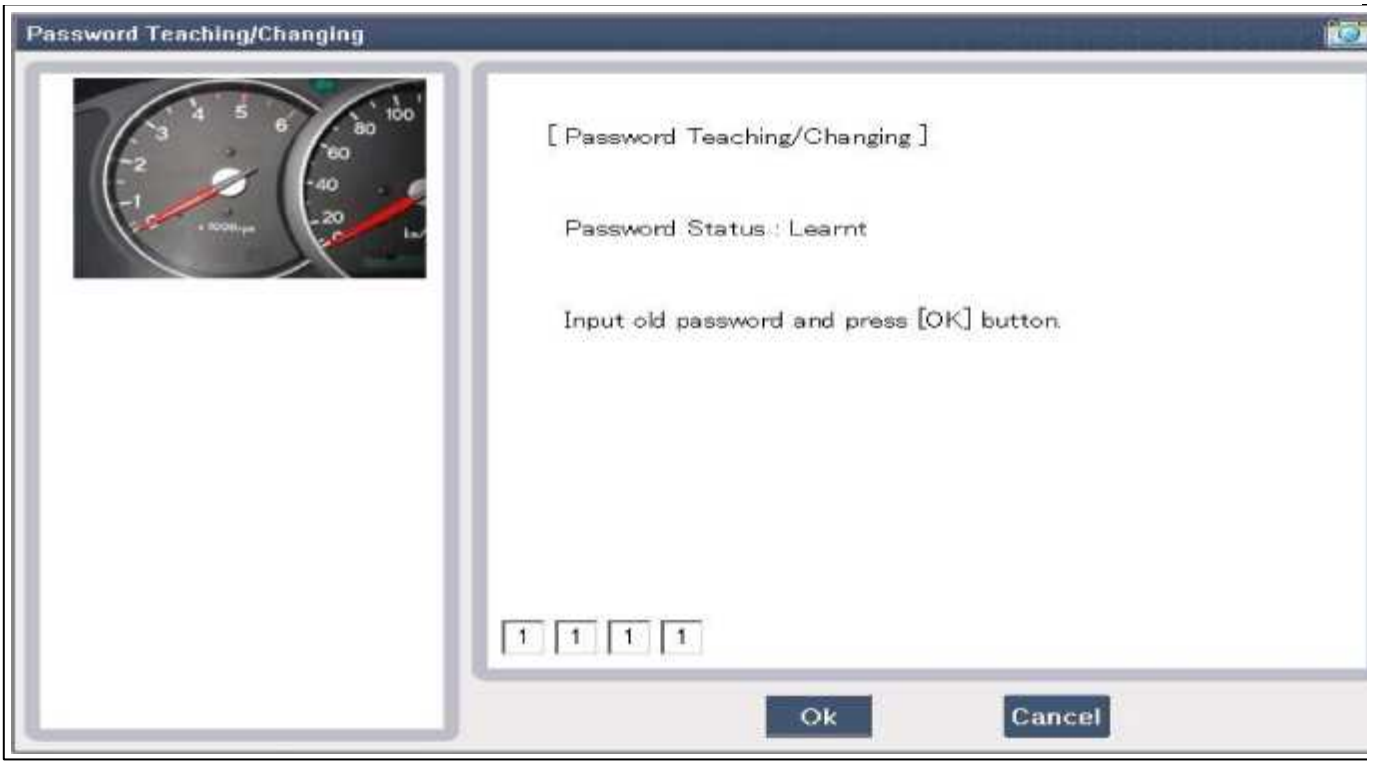
In case of putting wrong password, retry from first step after 10 seconds.

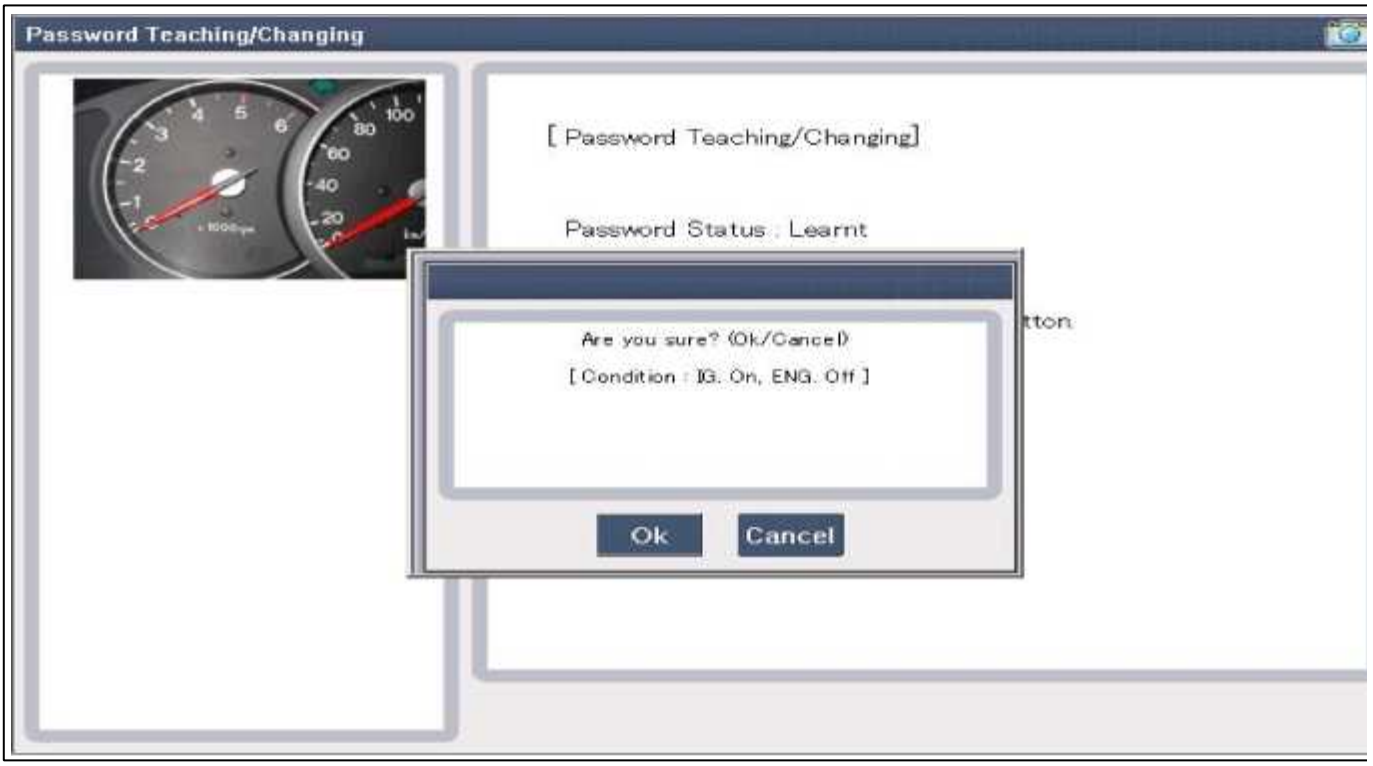
3. User password changing

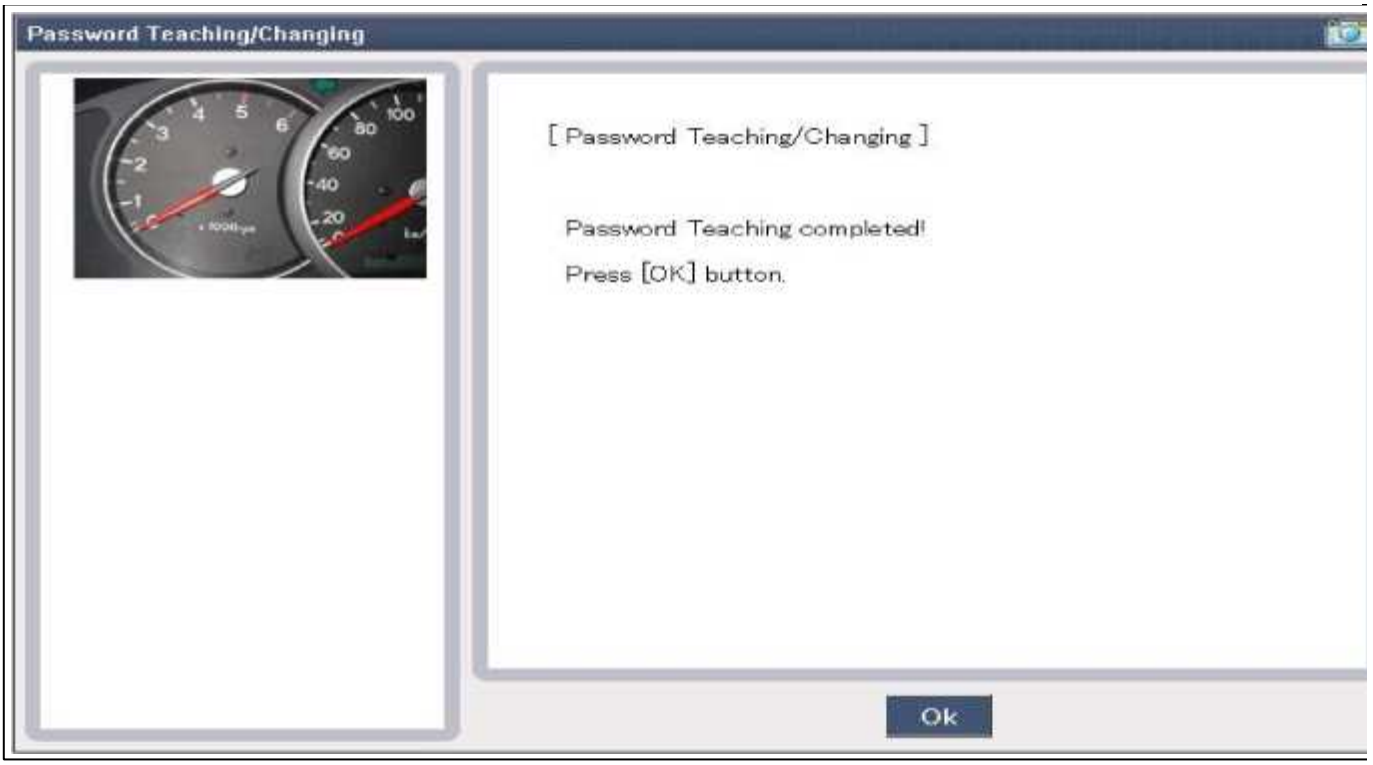
ID Register

- Password Teaching/Changing
- Neutral Mode
- Limp Home Mode
- Teaching




Password Teaching/Changing
[Password Teaching/Changing]
Password Status : Learnt
Input old password and press [OK] button.
1 1 1 1
Ok
Cancel


Password Teaching/Changing
[Password Teaching/Changing]
Password Status : Learnt
Are you sure? (Ok/Cancel)
[Condition : IG. On, ENG. Off]
Ok
Cancel



Limp Home Function

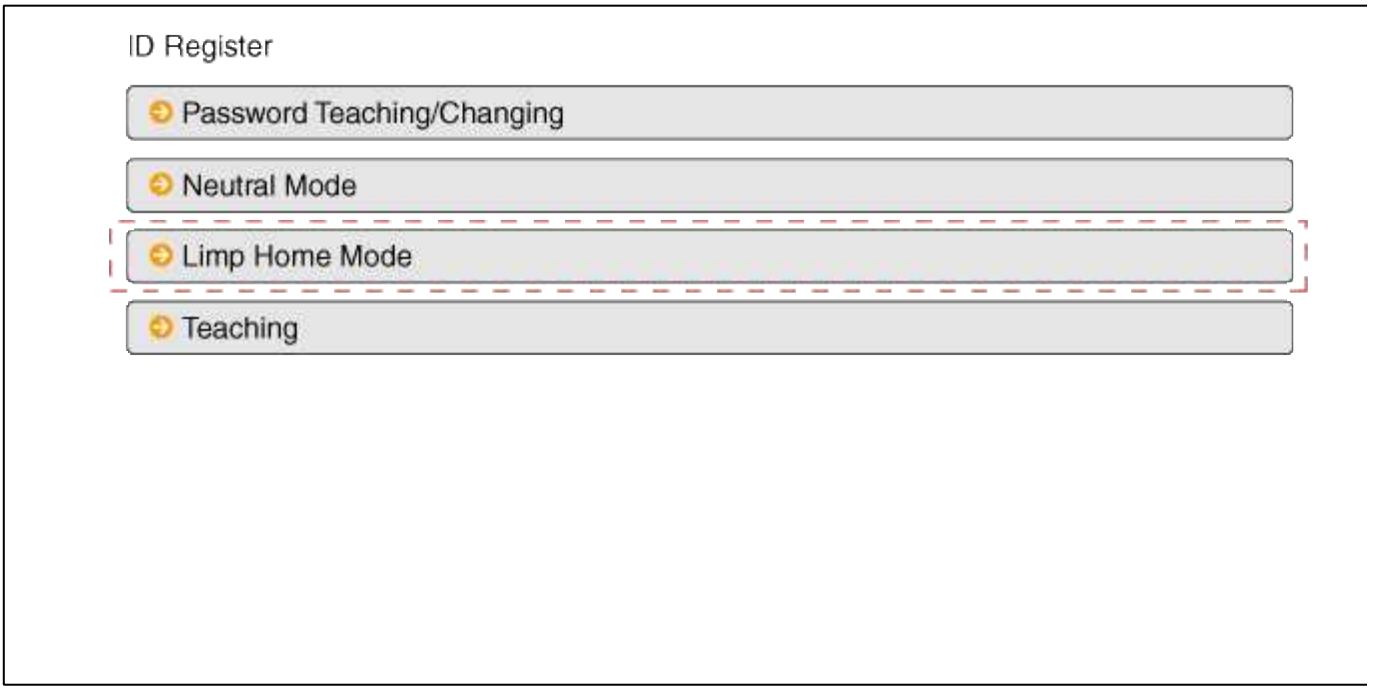
1. Limp Home By Tester

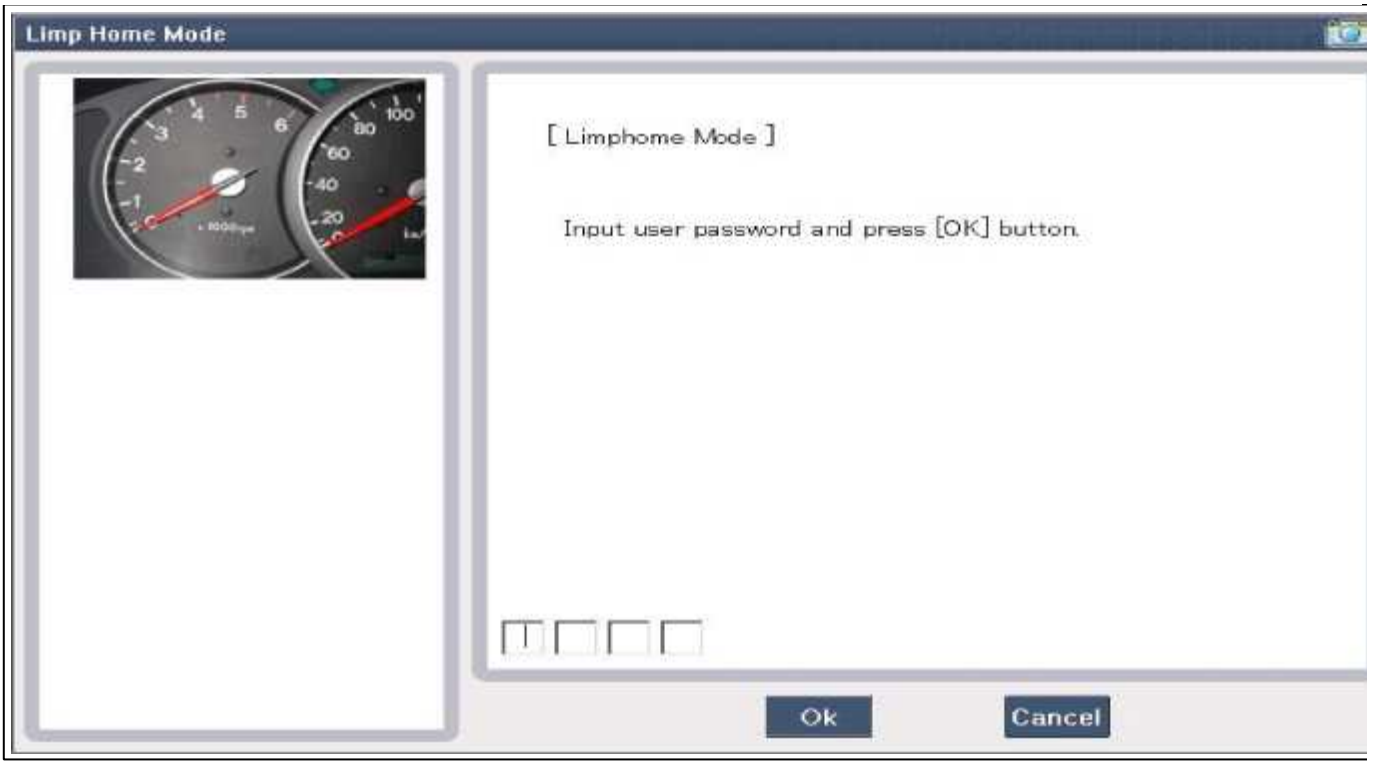
If the ECM detects the fault of the Immobilizer or transponder, the ECM will allow limp home function of the immobilizer. Limp home is only possible if the user password (4 digits) has been given to the ECM before. This password can be selected by the vehicle owner and is programmed at the service station.

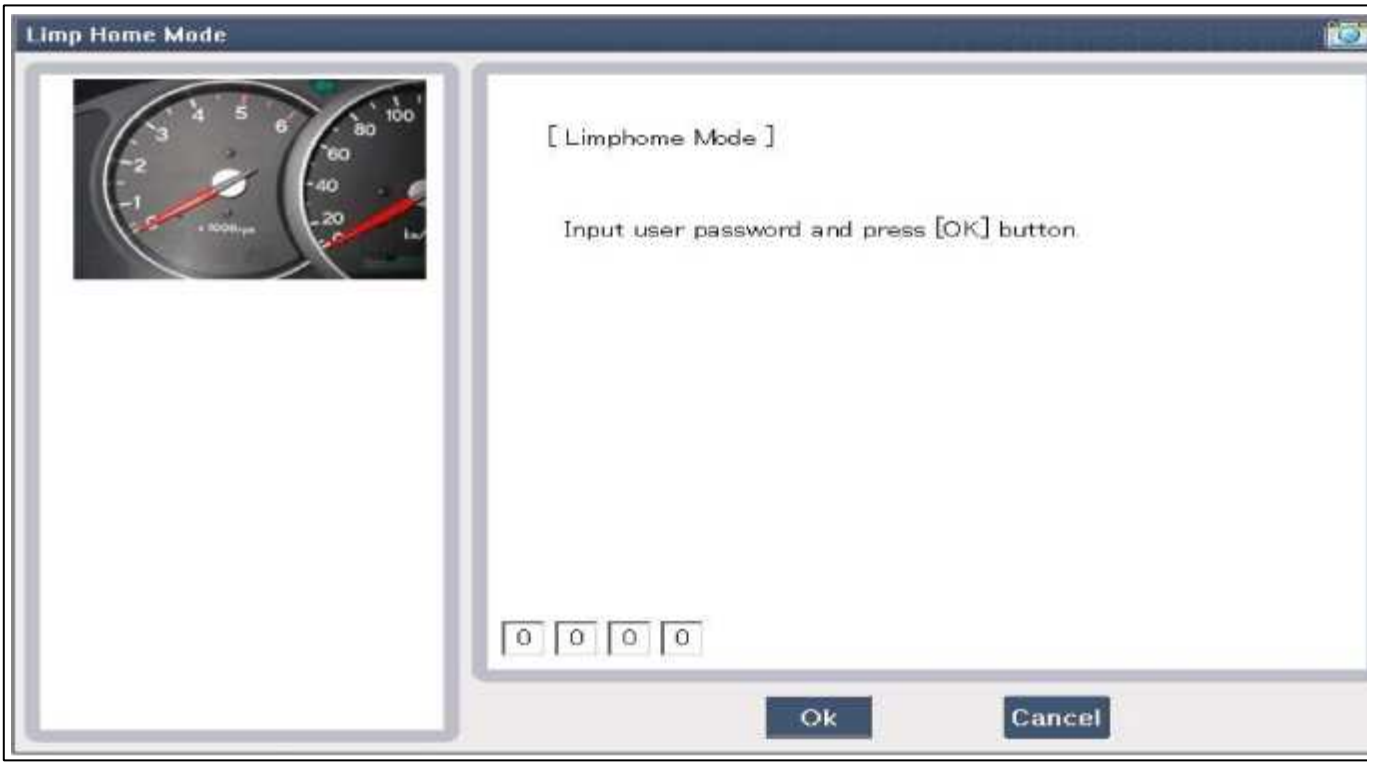
The user password can be sent to the ECM via the special tester menu.

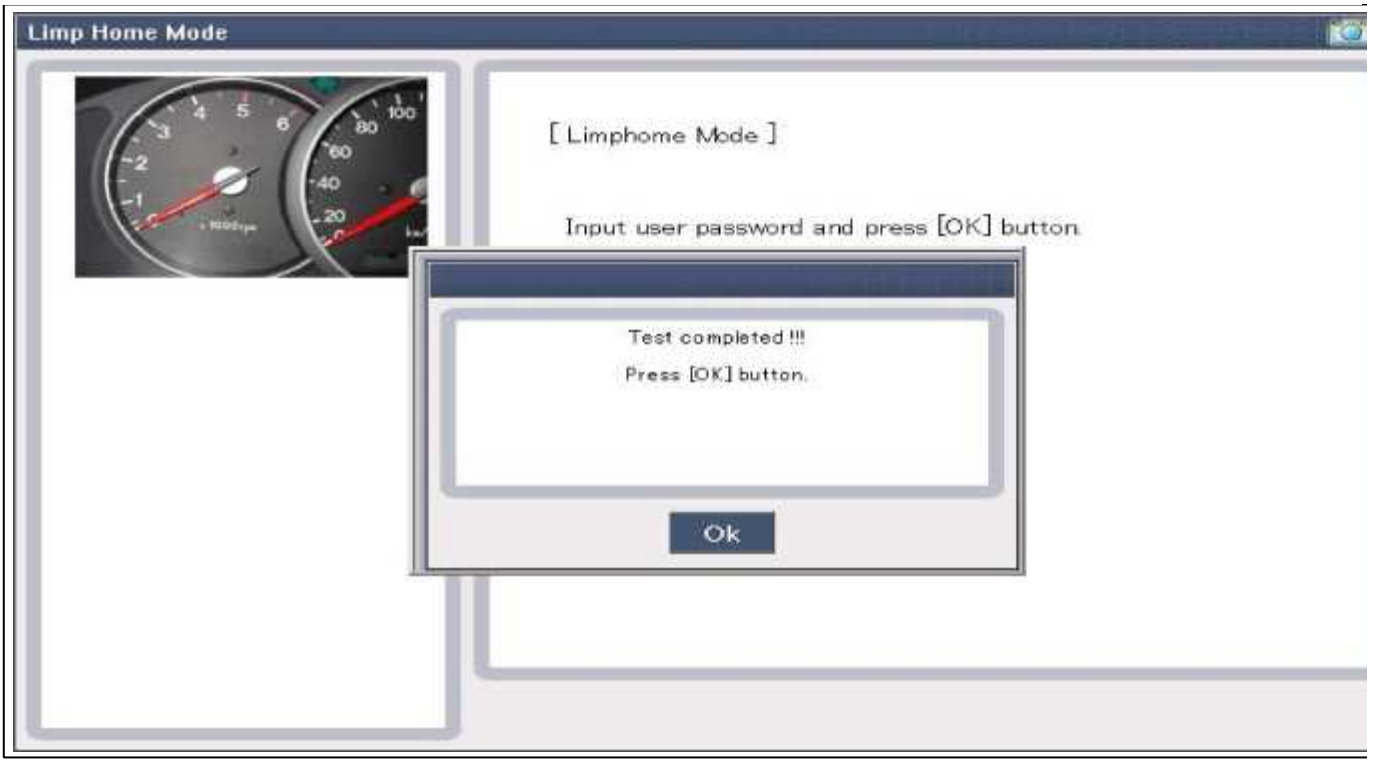
Only if the ECM is in status "learnt" and the user password status is "learnt" and the user password is correct, the ECM will be unlocked for a period of time (30 sec.). The engine can only be started during this time. After the tim has elapsed, engine start is not possible.

If the wrong user password is sent, the ECM will reject the request of limp home for one hour. Disconnecting the battery or any other action cannot reduce this time. After connecting the battery to the ECM, the timer starts again for one hour.




Limp Home Mode
[Limphome Mode]
Input user password and press [OK] button.
Ok
Cancel


Limp Home Mode
[Limphome Mode]
Input user password and press [OK] button.
0 0 0 0
Ok
Cancel



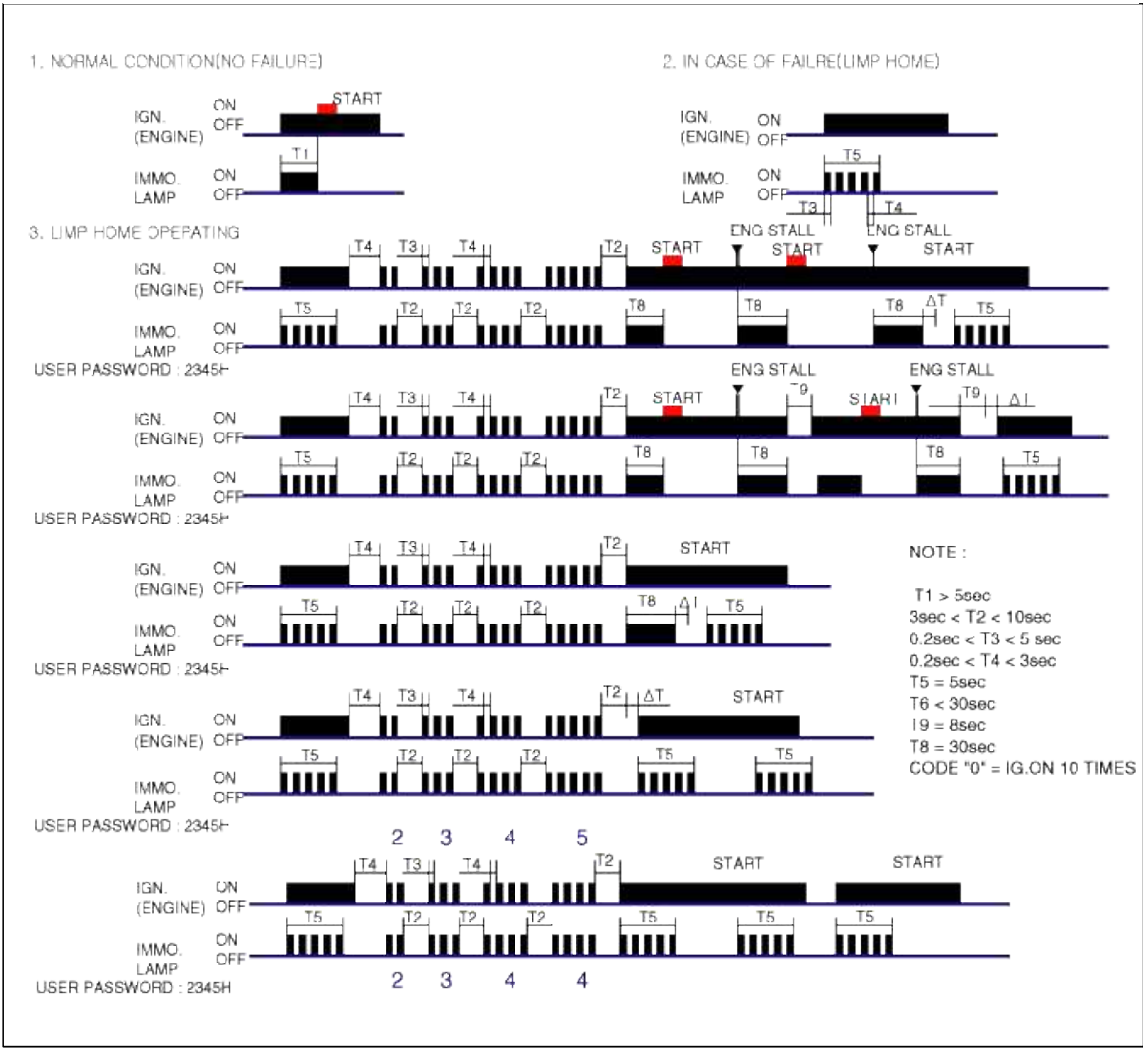
2. Limp Home By Ignition Key

The limp home can be activated also by the ignition key. The user password can be input to the ECM by a special sequence of ignition on/off.

Only if the ECM is in status "learnt" and the user password status is "learnt" and the user password is correct, the ECM will be unlocked for a period of time (30 sec.).

The engine can be started during this time. After the time has elapsed, engine start is not possible. After a new password has been input, the timer (30 sec.) will start again.

After ignition off, the ECM is locked if the timer has elapsed 8 seconds. For the next start, the input of the user password is requested again.



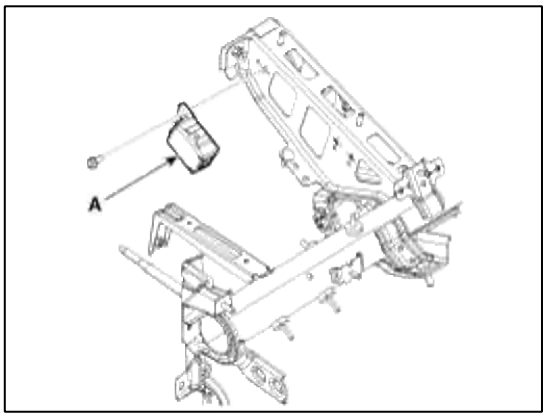
Body Electrical System > Immobilizer System > Immobilizer Control Unit > Repair procedures

Removal

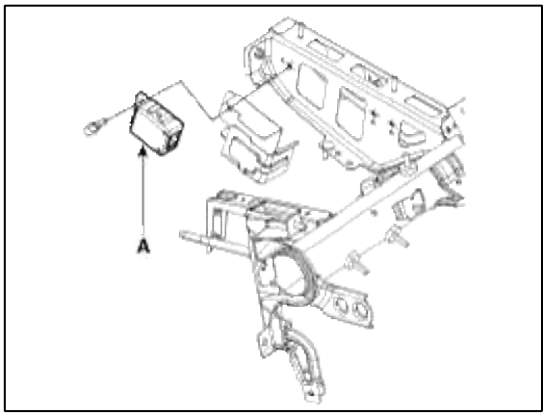
1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad lower panel.
   (Refer to the BD group - "Crash pad")

3. Disconnect the connector of the immobilizer unit and then remove the immobilizer unit (A) after loosening the bolt.

[USA]



[CANADA]



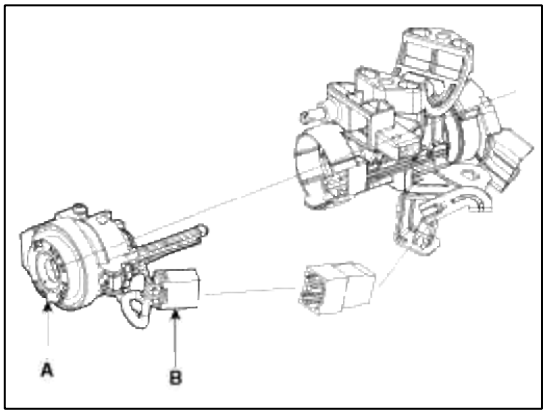
Installation

1. Install the immobilizer unit.
2. Connector the immobilizer unit.
3. Install the crash pad lower panel.

Body Electrical System > Immobilizer System > Antenna Coil > Repair procedures

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad lower panel.
   (Refer to the BD group - "Crash pad")
3. Disconnect the 6P connector (B) after loosening the screw and then remove the antenna coil (A).

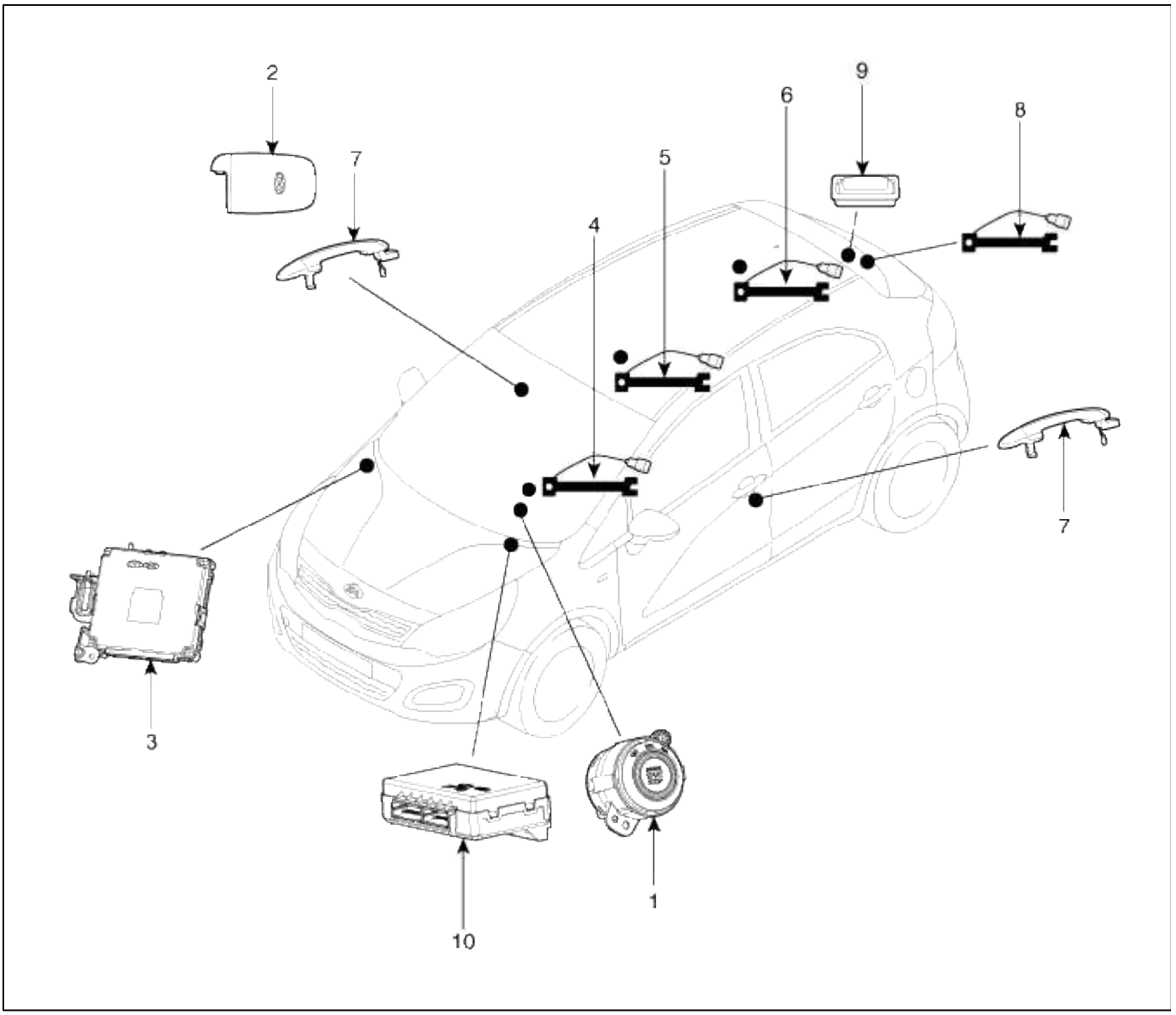


Installation

1. Install the antenna coil.
2. Connect the antenna coil connector.
3. Install the crash pad lower panel.

Body Electrical System > Button Engine Start System > Components and Components Location

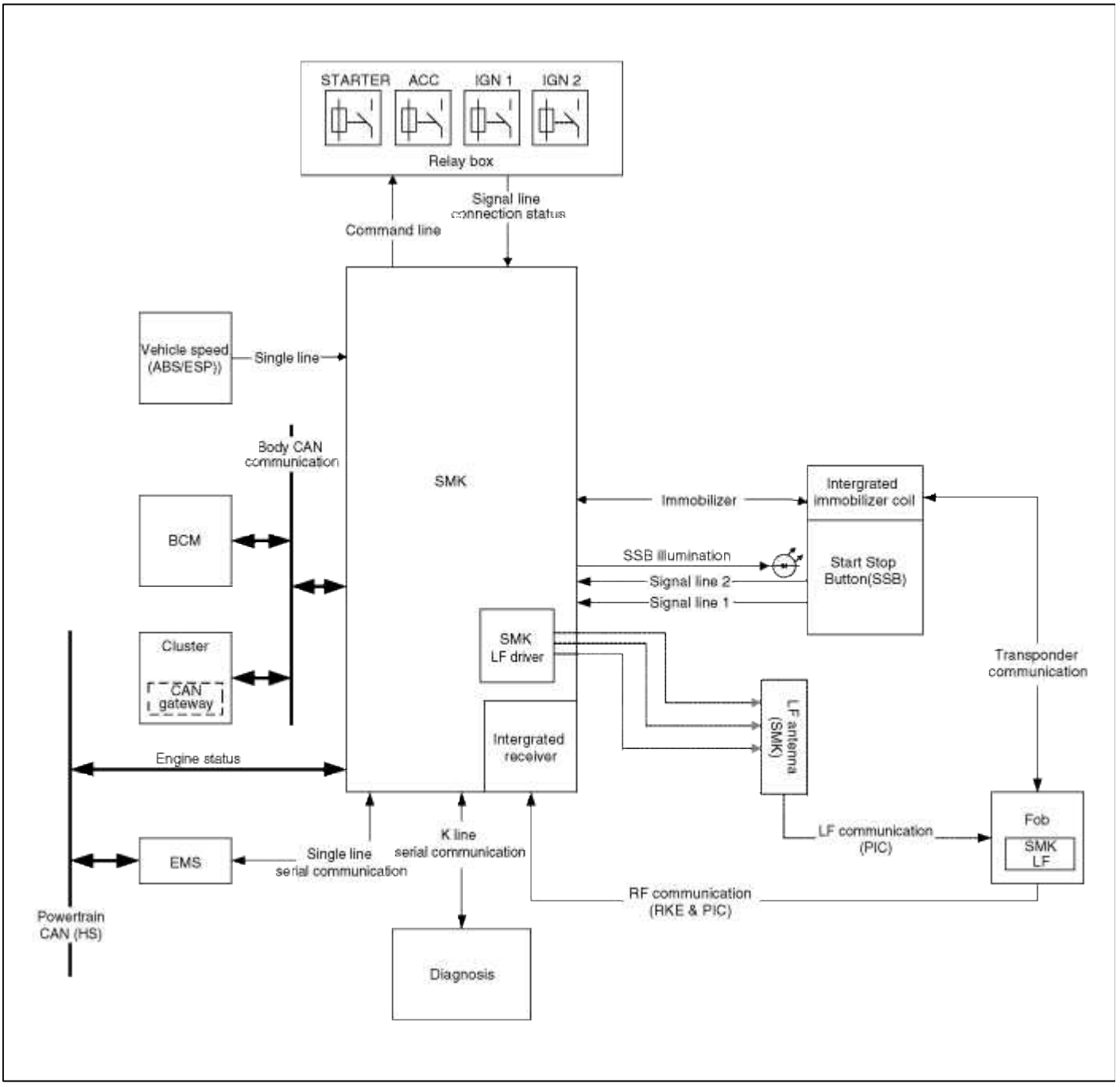
Component Location



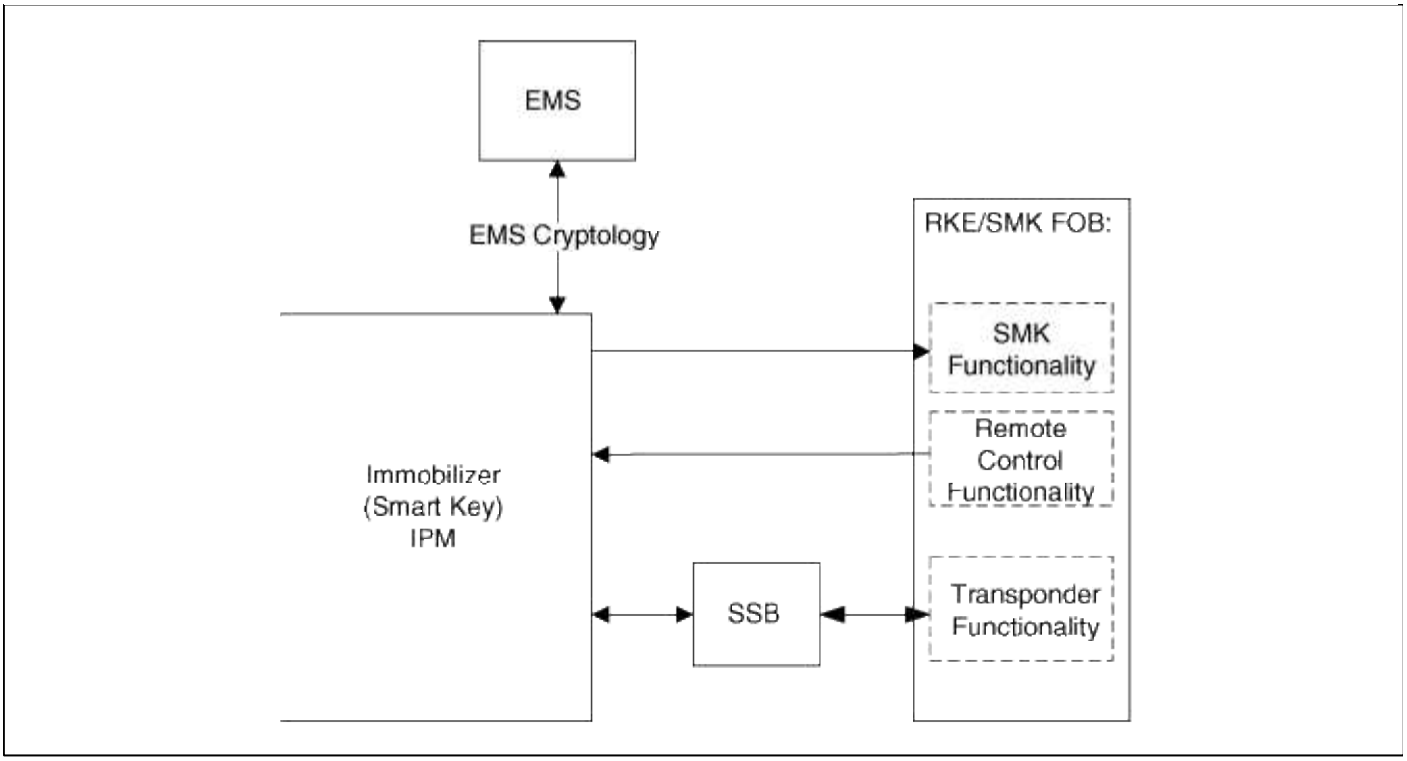
1. Start Stop Button(SSB) 2. FOB key 3. Smart key unit 4. Interior antenna 1 5. Interior antenna 2	6. Trunk antenna 7. Door handle & door antenna 8. Bumper antenna 9. Trunk lid open switch 10. Body control module (BCM)

Body Electrical System > Button Engine Start System > Schematic Diagrams

Circuit Diagram (1)



Circuit Diagram (2)



Body Electrical System > Button Engine Start System > Description and Operation

Description

System Overview

The System offers the following features:

- Human / machine interface through a 1-stage button, for terminal switching and engine start.
- Control of external relays for ACC / IGN1 / IGN2 terminal switching and STARTER, without use of mechanical ignition switch.
- Indication of vehicle status through LED or explicit messages on display.
- Immobilizer function by LF transponder communication between fob and fob holder.
- Redundant architecture for high system dependability .
- Interface with Low Speed CAN vehicle communication network.
- Interface with LIN vehicle communication network depending on platform .

The RKE and SMART KEY functions are not considered part of this Button Engine Start system and are specified in separated system.

System Main Function

- Switching of ACC / IGN1 / IGN2 terminals.
- Control of the STARTER relay BAT line (high side) based on communication with EMS ECU.
- Management of the Immobilizer function.
- Management of BES warning function.

Button Engine Start System

The Button Start System allows the driver to operate the vehicle by simply pressing a button (called as SSB) instead of using a standard mechanical key.

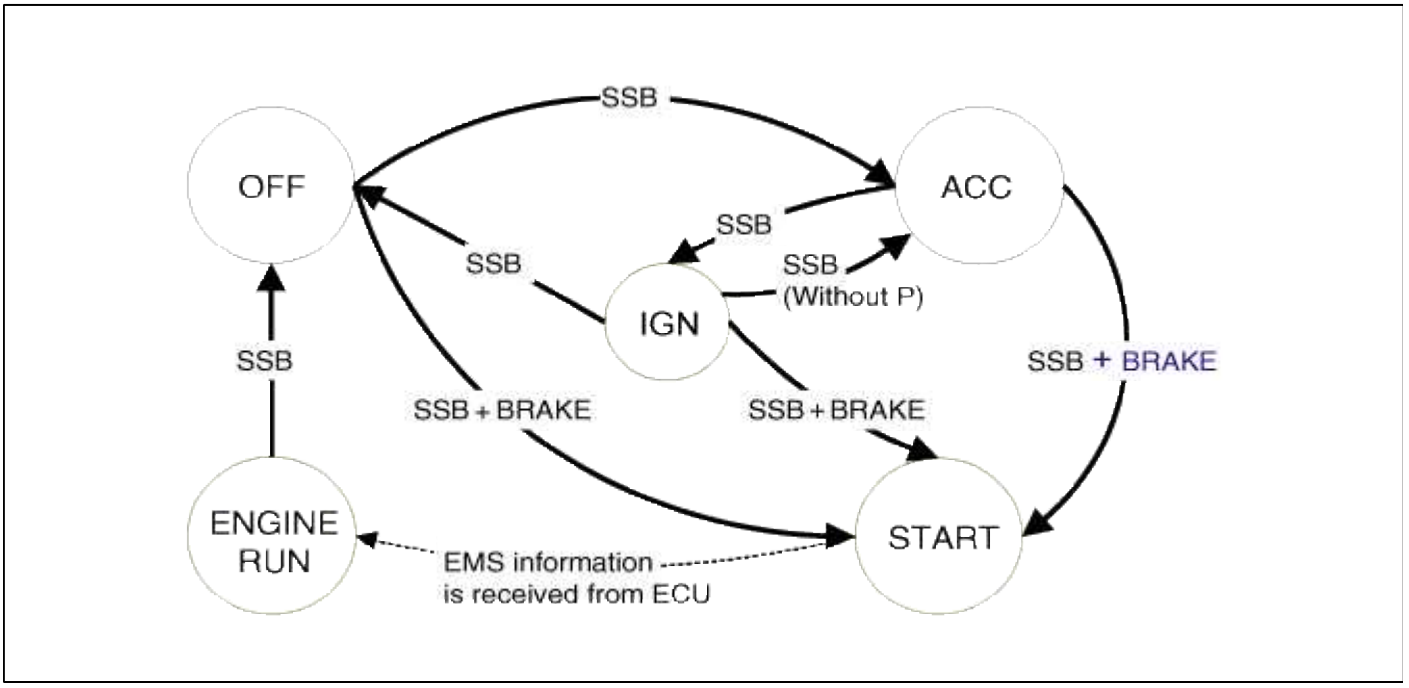
If the driver press the SSB while prerequisites on brakes, fob authentication and transmission status are satisfied, the BES System will proceed with the locking/unlocking of the steering column, the control of the terminal, and the cranking of the engine.

The driver can release the SSB as soon as this sequence initiated. After positive response from immobilizer interrogation, the system will activate the starter motor and communicate with the EMS to check the engine running status for starter release.

The driver will be able to stop the engine by a short push on the SSB if the vehicle is already in standstill. Emergency engine stop will be possible by a long press of the SSB or 3 consecutive presses in case the vehicle is in ENGINE RUNNING.

If the conditions for engine cranking are not satisfied while a push on the SSB is detected and a valid fob authenticated, the system will unlock the steering column and switch the terminals to IGN. Another push on the SSB will be necessary to start the engine.

In case of a vehicle equipped with SMART KEY system, fob authentication will not require any action from the driver. For limp home start or in case of vehicle without SMART KEY, the driver will have to insert the fob into the fob holder.



- Control Ignition and engine ON/OFF by Sending signal to IPM.
- Display status by LED Lamp ON/OFF. (Amber or Green)

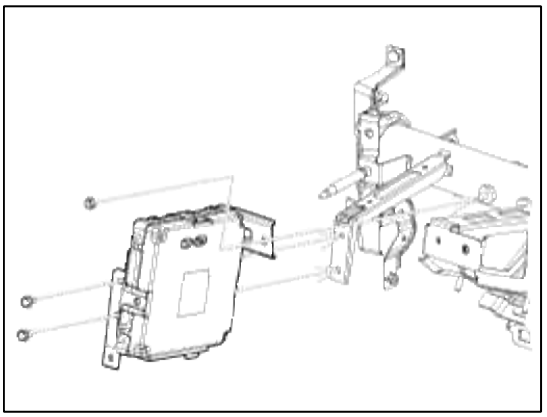
Indicator ON/OFF Condition At Ignition Key Off Condition

No.	Character lamp	Conditions
1	Indicator Lamp ON	Door open, Tail lamp ON, ACC, IG ON
2	Indicator Lamp 30sec ON → Lamp OFF	Door close, Tail lamp OFF, IG OFF
3	Indicator Lamp OFF	Remote LOCK, Passive LOCK
4	Rheostat at tail lamp ON (Illumination lamp)	

Indicator ON/OFF Condition According To Ignition Key's Position

No.	Ignition conditions	Start Button LED status
1	IG OFF	White color LED ON
2	IG ACC	Amber color LED ON
3	IG ON (Engine OFF)	Green color LED ON
4	Cranking	Maintain LED status before cranking
5	Engine running	LED OFF

Smart Key Unit



The SMK manages all function related to:

- "Start Stop Button (SSB) monitoring",
- "Immobilizer communication" (with Engine Management System unit for immobilizer release),
- "Authentication server" (Validity of Transponder and in case of Smart Key option Passive Fob authentication),
- "System consistency monitoring",
- "System diagnosis",
- Control of display message / warning buzzer .

The unit behaves as Master role in the whole system.
In case of SMART KEY application, for example “Passive Access”, “Passive Locking” and “Passive Authorization are integrated for Terminal switching Operations”.
It collects information about vehicle status from other modules (vehicle speed, alarm status, driver door open...), reads the inputs (e.g. SSB, Capacitive Sensor / Lock Button, PARK position Switch), controls the outputs (e.g. exterior and interior antennas), and communicates with others devices via the CAN network as well as a single line interfaces.
The diagnosis and learning of the components of the BES System are also handled by the SMK.
The SMK manages the functions related to the "terminal control" by activating external relays for ACC, IGN1 and IGN2. This unit is also responsible for the control of the STARTER relay.
The SMK is also controlling the illumination of the SSB as well as the "system status indicator", which consists of 2 LEDs of different color. The illumination of the fob holder is also managed by the SMK.
The SMK reads the inputs (Engine fob in, vehicle speed, relays contact status), controls the outputs (Engine relay output drivers), and communicates with others devices via the CAN.
The internal architecture of the SMK is defined in a way that the control of the terminal is secured even in case of failure of one of the two microcontrollers, system inconsistency or interruption of communication on the CAN network.
In case, failure of one of the two controllers, the remaining controller shall disable the starter relay. The IGN1 and IGN2 terminals relays shall be maintained in the state memorized before the failure and the driver shall be able to switch those IGN terminals off by pressing the SSB with EMERGENCY_STOP pressing sequence. However, engine restart will not be allowed. The state of the ACC relay will depend on the type of failure.
The main functions of the SMK are:

- Control of Terminal relays
- Monitoring of the Vehicle speed received from sensor or ABS/ESP ECU.
- Control of SSB LEDs (illumination, clamp state).
- Control of the base station located in SSB through direct serial interface.
- System consistency monitoring to diagnose SMK failure and to switch to relevant limp home mode.
- Providing vehicle speed information
- Start Stop Button (SSB) monitoring

- Starter power control

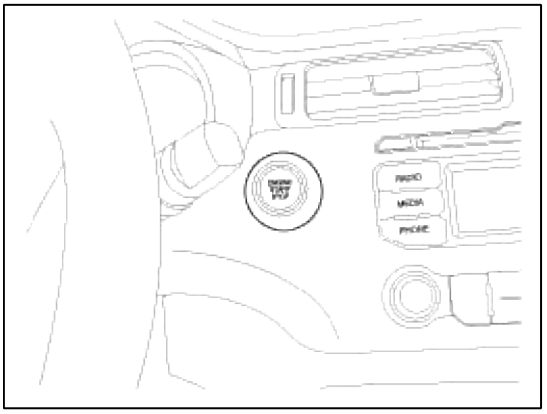
Start/Stop Button (SSB)

A single stage push button is used for the driver to operate the vehicle. Pressing this button allows:

- To activate the power modes ‘Off’, ’Accessory’, ‘Ignition’ and 'Start' by switching the corresponding terminals
- To start the engine
- To stop the engine

The contact will be insured by a micro-switch and a backlighting is provided to highlight the marking of the button whenever necessary.

Three (3) LED colors are located in the outside ring of the switch assy. They display the status of the system. They are OFF(White) / ACC(Amber) / ON(Green).



BES(Button Engine Start) System State Chart

System STATES in LEARNT MODE

In learnt mode, the BES System can be set in 6 different sates, depending on the status of the terminals and Engine status:

System State	Terminal Status	Engine status
1. OFF - Locked	OFF	Stopped
2. OFF - Unlocked	OFF	Stopped
3. ACC	ACC	Stopped
4. IGN	IGN1, IGN2, ACC	Stopped
5. Start	IGN1, Start	Cranking
6. IGN - Engine	IGN1, IGN2, ACC	Running (means "self-running")

Referring to the terminals, the system states described in the table above are same as those one found in a system based on a mechanical ignition switch.

The one of distinction with Mechanical-Ignition-Switch based system is that the BES system allows specific transition from [OFF] to [START] without going through [ACC] and [IGN] states.

System STATES IN VIRGIN MODE

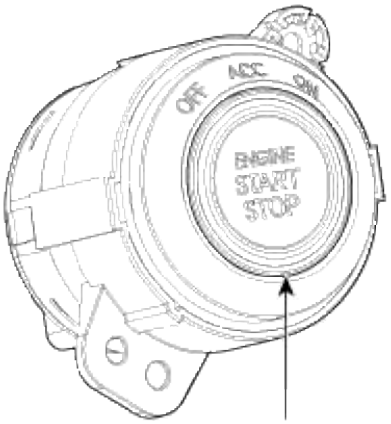
The BES System can be set in 5 different states (OFF LOCKED is not available in virgin mode), depending on the status of the terminals and Engine status :

System State	Terminal Status	Engine status
1. OFF - UNLOCKED	OFF	Stopped
2. ACC	ACC	Stopped
3. IGN	IGN1, IGN2, ACC	Stopped
4. Start	IGN1, START with special pattern of activation	Cranking
5. IGN - Engine	IGN1, IGN2, ACC	Running (means "self-running")

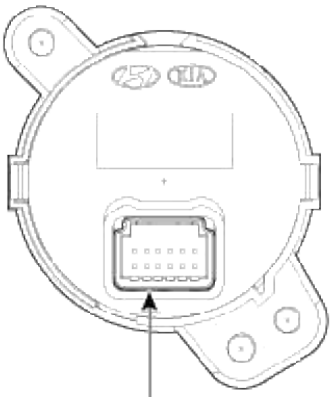
Referring to the terminals, the system states described in the table above are same as those one found in a system based on a mechanical ignition switch.
The one of distinction with Mechanical-Ignition-Switch based system is that the BES system allows specific transition from [OFF] to [START] without going through [ACC] and [IGN] states.

Body Electrical System > Button Engine Start System > Start/Stop Button > Components and Components Location

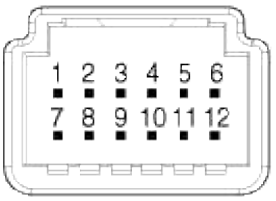
Component



Button



Connector



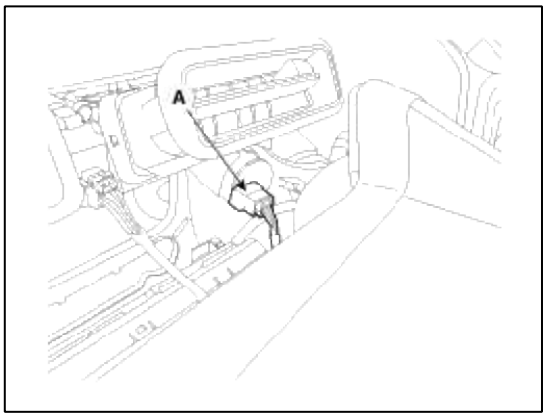
Pin No.	Description
1	Start/Stop button switch 1
2	LED illumination power
3	ACC LED (Amber)
4	Start/Stop button switch ground
5	Start/Stop button switch power
6	Immobilizer power
7	Ground
8	Start/Stop button switch 2
9	ON LED (Green)
10	Rheostat
11	OFF LED (White)
12	Immobilizer ground

Body Electrical System > Button Engine Start System > Start/Stop Button > Repair procedures

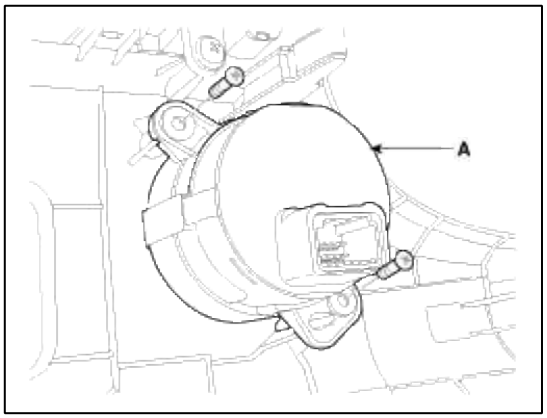
Removal

1. Disconnect the negative(-) battery terminal.
2. Remove the Audio.
   (Refer to the BE group - "Audio")

3. Disconnect the start/stop button connector (A).



4. Remove the start/stop button (A) after removing the screws.



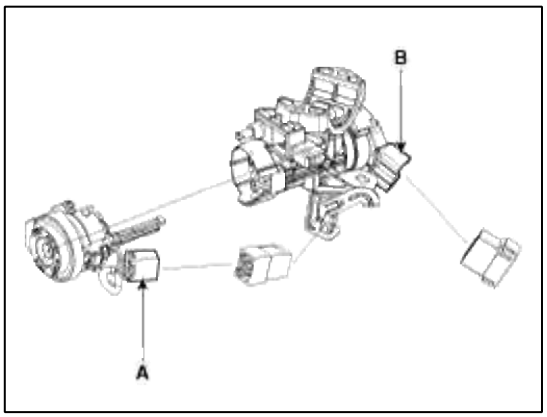
Installation

1. Install the start/stop button.
2. Install the Audio.

Body Electrical System > Ignition Switch Assembly > Repair procedures

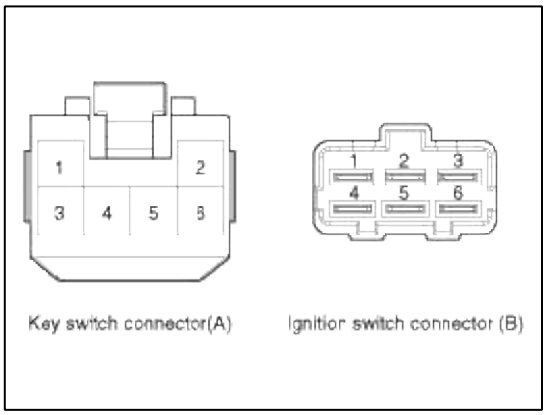
Inspection

1. Disconnect the ignition switch connector (B) and key switch connector (A) from under the steering column.



2. Check for continuity between the terminals.

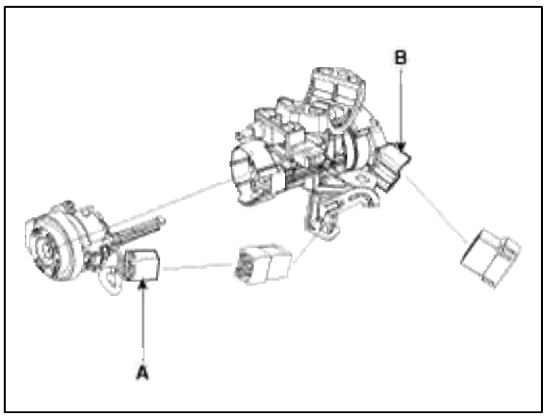
3. If continuity is not specified, replace the switch.



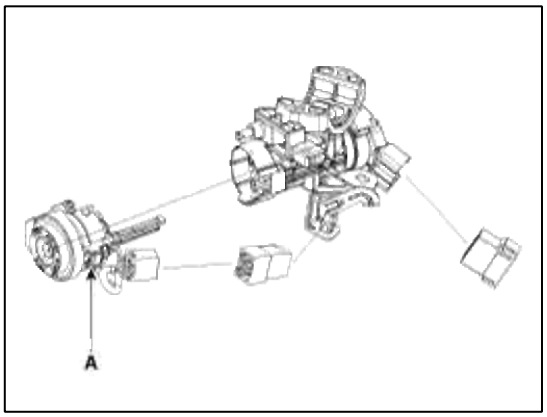
Position \ Terminal / Key		Ignition switch (B) 5 (B1)	6 (ACC)	4 (IG1)	1 (B2)	2 (IG2)	3 (ST)	Steering Travel	Travel	Key switch (A 5	6
Lock	Removal							Lock			
	Insert							Lock	Unlock		
ACC		○—○						Unlock			
ON		○—○	○	○—○							
Start		○		○	○		○				

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the steering column upper and lower shrouds.
   (Refer to the ST group - "Steering column")
3. Disconnect the ignition switch connector (B) and the key switch connector (A) from under the steering column.



4. If it is necessary to remove the key lock cylinder (A), remove the key lock cylinder after pushing lock pin with key ACC.



Installation

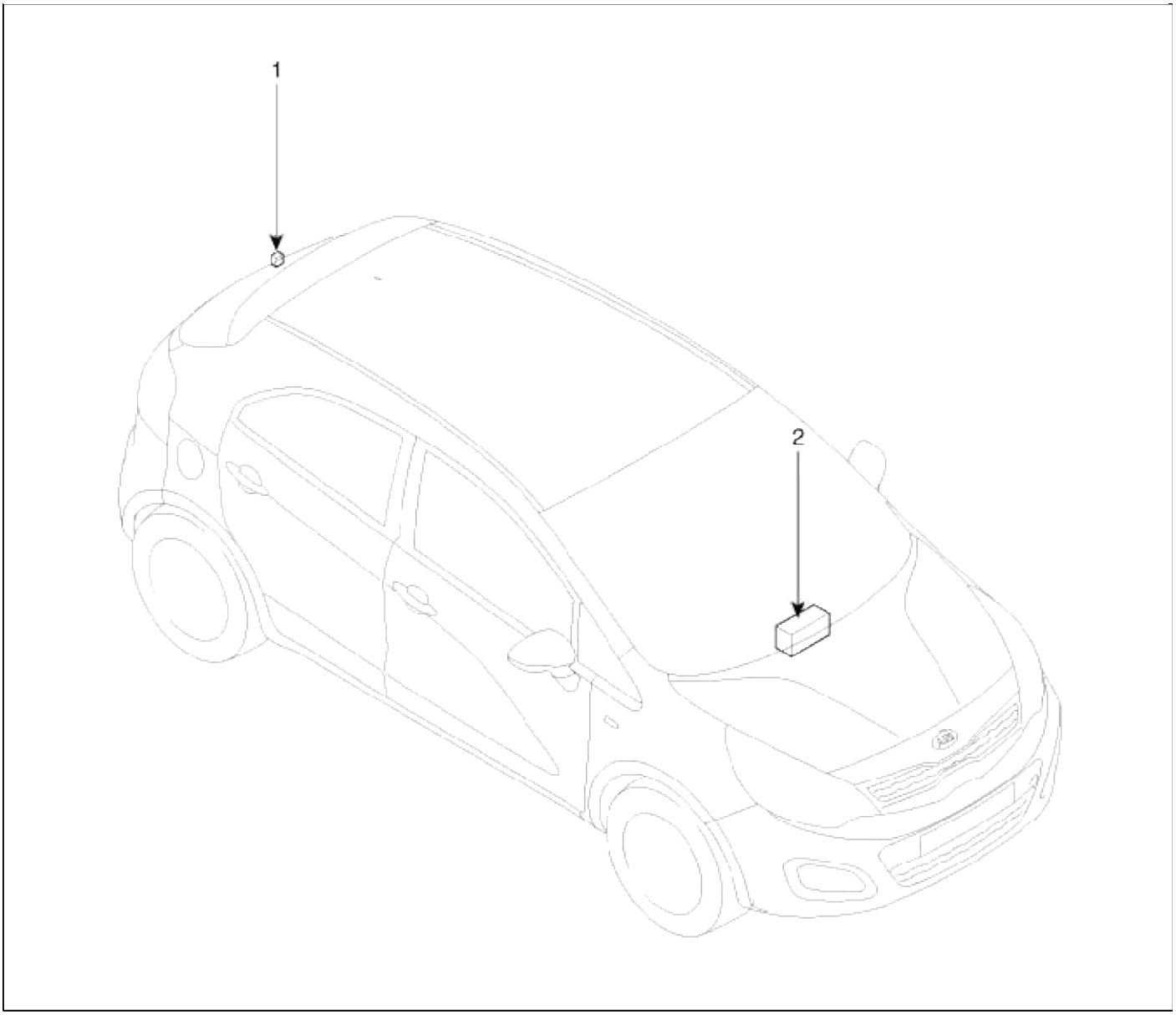
1. Install the key lock cylinder.

> NOTE
>
> When assembling, the key must be inserted at 'ACC' position.

2. Install the key warning and immobilizer connector.
3. Install the ignition switch.
4. Install the steering column shrouds and crash pad lower panel.

Body Electrical System > Back View Camera System > Components and Components Location

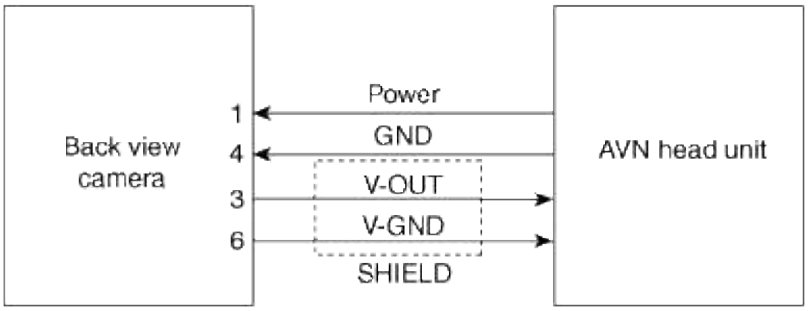
Component Location

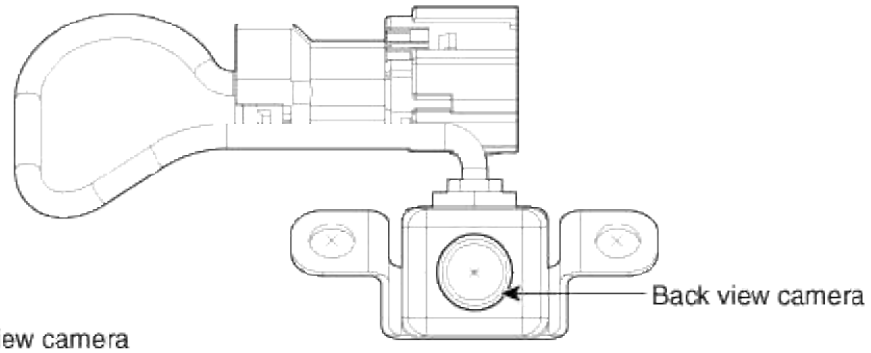


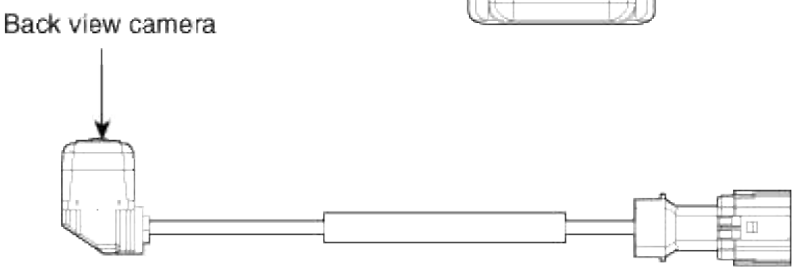
1. Back view camera	2. AVN (AV & Navigation) head unit

Body Electrical System > Back View Camera System > Schematic Diagrams

Circuit Diagram







Pin No.	Description
1	Power
2	-
3	V-OUT
4	GND
5	-
6	V-GND

Body Electrical System > Back View Camera System > Description and Operation

Description

Back view camera will activate when the backup light is ON with the ignition switch ON and the shift lever in the R position.

This system is a supplemental system that shows behind the vehicle through the ECM (Reverse Display Room Mirror) mirror or AVN head unit while backing-up.

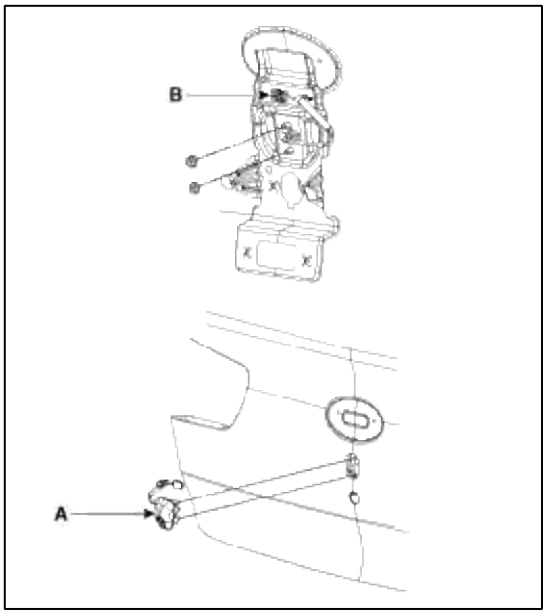
WARNING

This system is a supplementary function only. It is the responsibility of the driver or always check the inside/ outside rearview mirror and the area behind the vehicle before and while backing up because there is a dead zone that can't see through the camera.

Body Electrical System > Back View Camera System > Repair procedures

Removal

1. Remove the trunk trim in the trunk after removing the screws and clips.
   (Refer to the BD group - "Tailgate")
2. Remove the trunk garnish (A) after disconnecting the connector(B) and removing the nuts.



Installation

1. Install the back view camera.
2. Install the tailgate trim.

RIO(UB) > 2012 > G 1.6 GDI > Brake System

Brake System > General Information > Specifications

Specifications

Item		Specification	
Master cylinder	Type	Fixed	
	Cylinder I.D.	20.64 mm (0.813 in)	
	Piston stroke	36±1 mm (1.42±0.039 in)	
	Fluid level switch	Provided	
Brake booster	Type	10" Single	
	Boosting ratio	7 : 1	
Front Disc brake	Type	14" Disc	15" Disc
		Ventilated disc	Ventilated disc
	Disc O.D.	256 mm (10.08 in)	280 mm (11.02 in)
	Disc thickness	22 mm (0.87 in)	22 mm (0.87 in)
	Caliper piston	Single	Single
	Cylinder I.D.	Ø 54mm (2.13 in)	Ø 54mm (2.13 in)
Rear Disc brake	Type	Solid disc	
	Disc O.D.	262 mm (10.31 in)	
	Disc thickness	10 mm (0.39 in)	
	Caliper piston	Single	
	Cylinder I.D.	Ø 34 mm(1.34 in)	
Rear brake (Drum)	Type	Leading trailing	
	Drum I.D	203.2 mm (8 in)	
	Brake lining thickness	4.5 mm (0.18 in)	
	Clearance adjustment	Automatic	
Parking brake (Disc)	Type	BIR (Ball-in-Ramp)	
	actuation	Lever	

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
	Type	Motor, valve relay integrated type	(ABS, EBD, TCS, ESC)
	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	48 teeth	
	Air gap	0.4 ~ 1.0 mm	
Yaw rate& Lateral G sensor (CAN TYPE)	Operating Voltage	10 ~ 16 V	
	Current Consumption	Max. 140 mA	
	Yaw rate sensor measurement range	-75 ~ +75 °/sec	
	Lateral G sensor measurement range	-14.715 ~ 14.715 m/s²	

Service Standard

Items	Standard value
Brake pedal height	174.2 mm (6.86 in)
Brake pedal Full stroke	108 mm (4.25 in)
Stop lamp clearance	1.0 ~ 2.0 mm (0.04 ~ 0.08 in)
Front brake disc thickness	22 mm (0.87 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

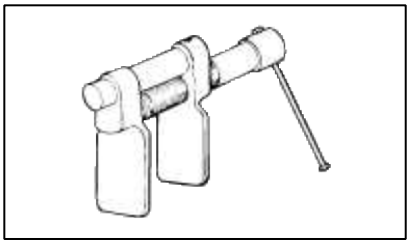
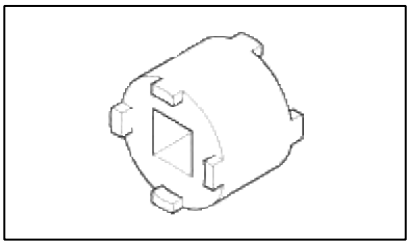
Items	N.m	kgf.m	lb-ft
Hub nut	88.3 ~ 107.9	9.0 ~ 11.0	65.1 ~ 79.6
Master cylinder to brake booster	12.7 ~ 16.7	1.3 ~ 1.7	9.4 ~ 12.3
Brake booster mounting nuts	16.7 ~ 25.5	1.7 ~ 2.6	12.3 ~ 18.8
Air bleeding screw	6.9 ~ 12.7	0.7 ~ 1.3	5.1 ~ 9.4
Brake tube flare nuts	12.7 ~ 16.7	1.3 ~ 1.7	9.4 ~ 12.3
Front 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	49.0 ~ 58.8	5.0 ~ 6.0	36.2 ~ 43.4
Brake hose to caliper	24.5 ~ 29.4	2.5 ~ 3.0	18.1 ~ 21.7
Brake pedal member bracket bolts	9.8 ~ 14.7	1.0 ~ 1.5	7.2 ~ 10.8
Brake pedal shaft nut	24.5 ~ 34.3	2.5 ~ 3.5	18.0 ~ 25.3
Wheel speed sensor mounting bolt	7.8 ~ 11.8	0.8 ~ 1.2	5.8 ~ 8.7
HECU bracket mounting nut	16.7 ~ 25.5	1.7 ~ 2.6	12.3 ~ 18.8

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
Front caliper guide rod and boot	MES4-3-614	1.2 ~ 1.7 g, 1.0 ~ 1.5 g
Rear caliper guide rod and boot	MES4-3-614 (SB 1063)	0.8 ~ 1.3 g

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
09580 - 0U000 Brake piston adjuster		Removal and installation of the rear disc brake piston.

Brake System > General Information > Troubleshooting

Troubleshooting

Problem Symptoms Table

Use the table below to help you find the cause of theproblem. The numbers indicate the priority of the likecause 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 bleeding 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	1. Brake system (Fluid leaks) 2. Brake system (Air in)	repair Air

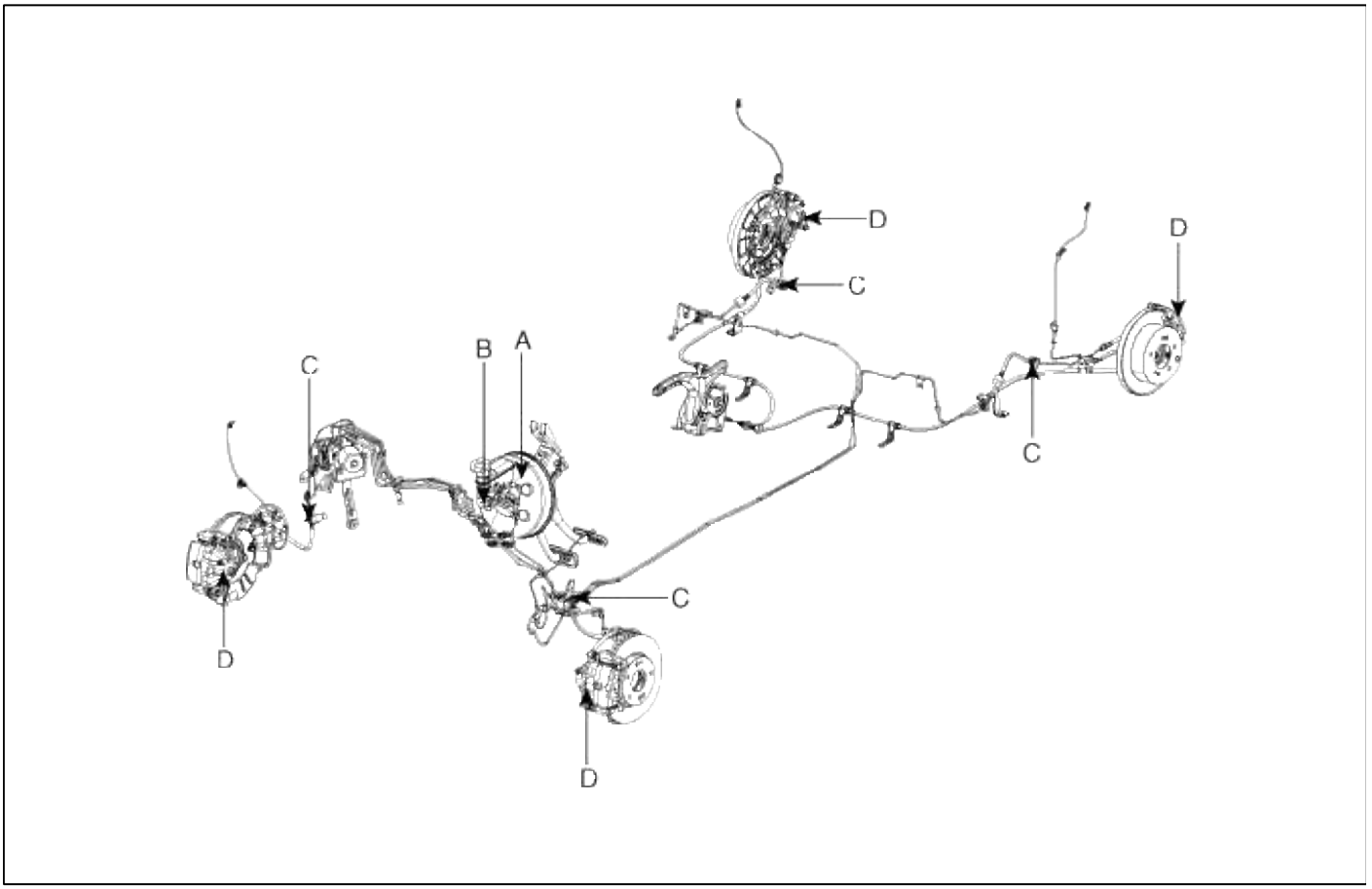
inefficient	3. Pad or lining (Worn) 4. Pad or lining (Cracked or distorted) 5. Rear brake shoe clearance(Out of adjustment) 6. Pad or lining (Oily) 7. Pad or lining (Glazed) 8. Disc (Scored) 9. Booster system (Vacuum leaks)	bleeding replace replace adjust replace replace replace repair
Noise from brake	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	replace
Brake vibration, pulsation	1. brake booster 2. pedal free play 3. master cylinder 4. caliper 5. master cylinder cap seal 6. damaged brake lines	replace adjust replace replace replace replace
Brake chatter	Brake chatter is usually caused by loose or worn components, or glazed or burnt linings. Rotors with hard spots can also contribute to brake chatter. Additional causes of chatter are out-of-tolerance rotors, brake lining not securely attached to the shoes, loose wheel bearings and contaminated brake lining.	

Brake System > Brake System > Description and Operation

Operation and Leakage Check

Check all of the following items:

Component	Procedure
Brake Booster (A)	Check brake operation by applying the brakes during a test drive. If the brakes do not work properly, check the brake booster. Replace the brake booster as an assembly if it does not work properly or if there are signs of leakage.
Piston cup and pressure cup inspection (B)	• Check brake operation by applying the brakes. Look for damage or signs of fluid leakage. Replace the master cylinder as an assembly if the pedal does not work properly or if there is damage or signs of fluid leakage. • Check for a difference in brake pedal stroke between quick and slow brake applications. Replace the master cylinder if there is a difference in pedal stroke.
Brake hoses (C)	Look for damage or signs of fluid leakage. Replace the brake hose with a new one if it is damaged or leaking.
Caliper piston seal and piston boots (D)	Check brake operation by applying the brakes. Look for damage or signs of fluid leakage. If the pedal does not work properly, the brakes drag, or there is damage or signs of fluid leakage, disassemble and inspect the brake caliper. Replace the boots and seals with new ones whenever the brake caliper is disassembled.



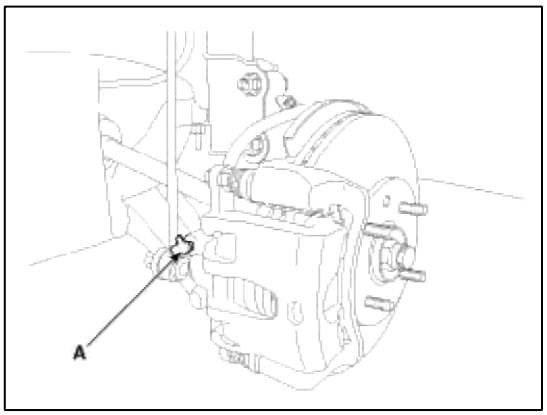
Brake System Bleeding

CAUTION

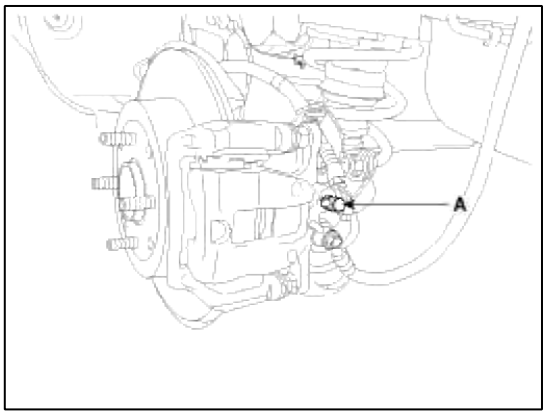
- Do not reuse the drained fluid.
- Always use genuine DOT3/DOT4 brake Fluid.
  Using a non-genuine DOT3/DOT4 brake fluid can cause corrosion and decrease the life of the system.
- Make sure no dirt or other foreign matter is allowed to contaminate the brake fluid.
- Do not spill brake fluid on the vehicle, 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.

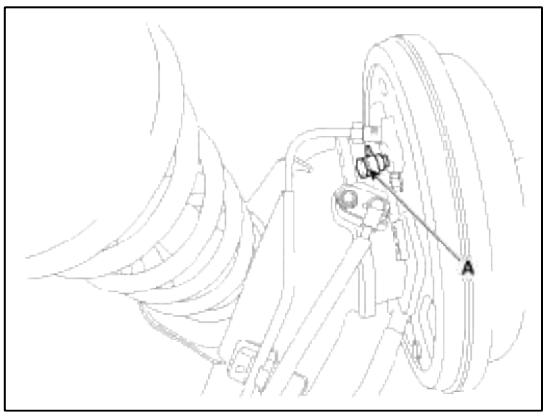
[Front disc brake]



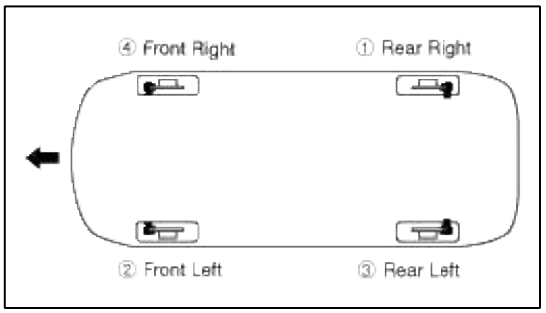
[Rear disc brake]



[Rear drum brake]



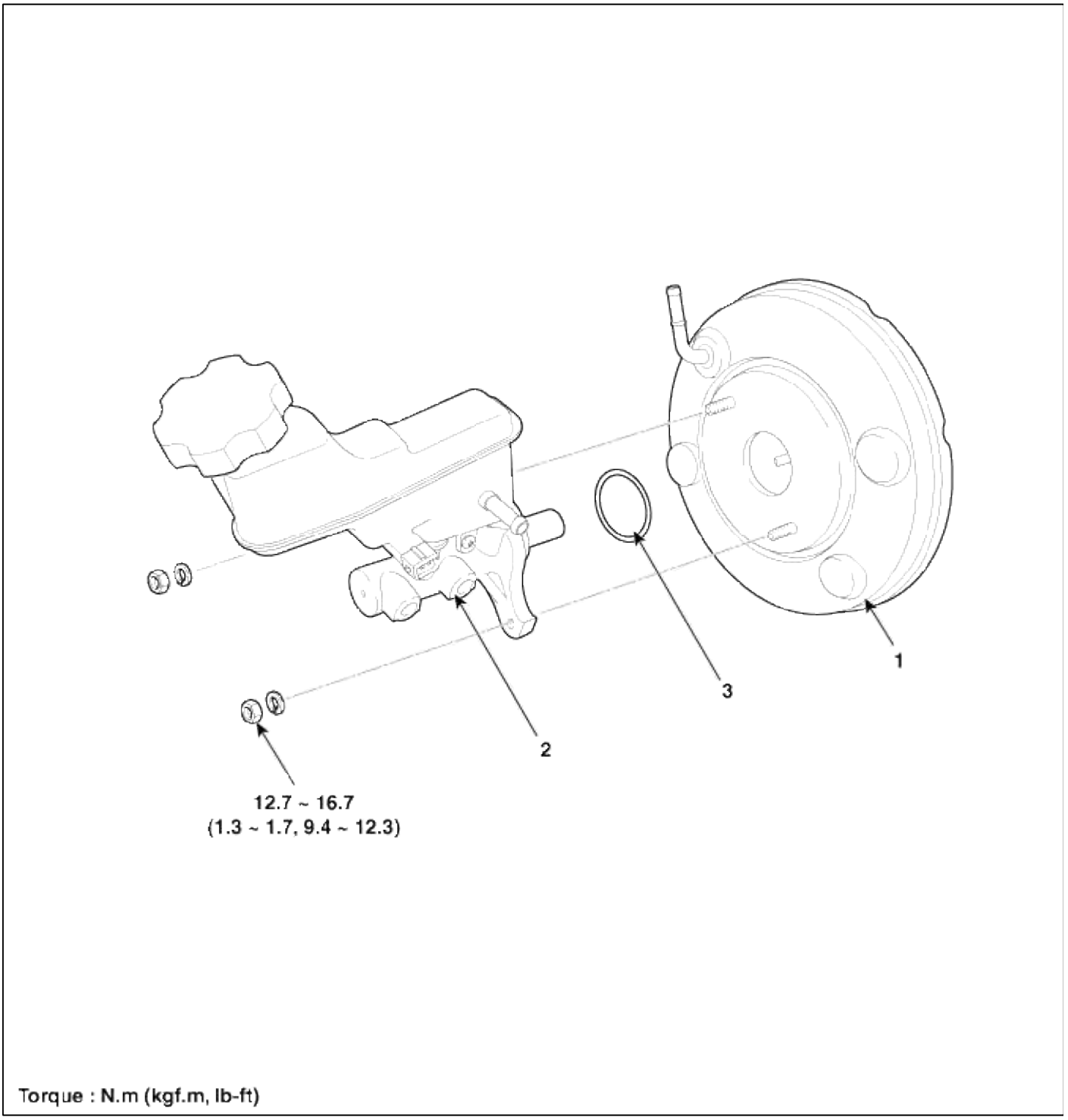
4. Repeat the procedure for wheel in the sequence shown below until air bubbles no longer appear in the fluid.



5. Refill the master cylinder reservoir to MAX(upper) level line.

Brake System > Brake System > Brake Booster > Components and Components Location

Components



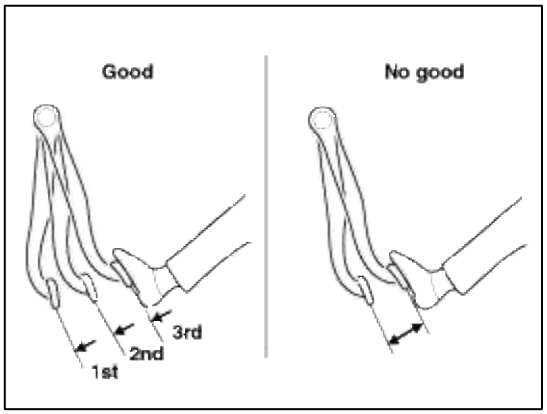
1. Brake booster 2. Master cylinder assembly	3. O-ring

Brake System > Brake System > Brake Booster > Repair procedures

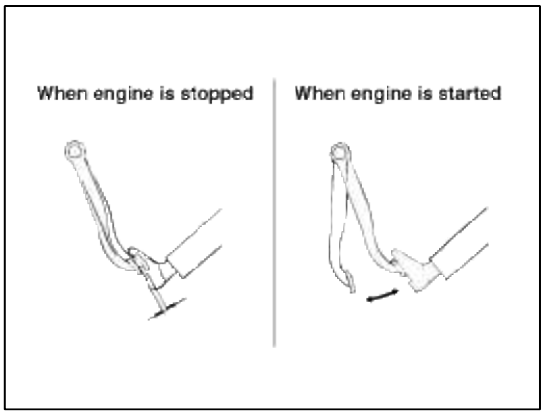
Brake Booster Operating Test

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

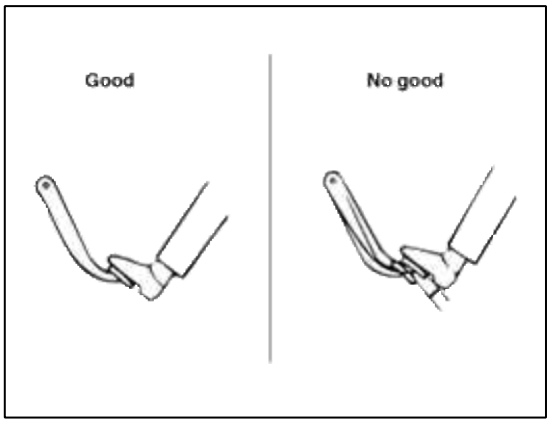
1. Run the engine for one or two minutes, and then stop it. If the pedal depresses fully the first time but gradually becomes higher when depressed succeeding times, the booster is operating properly, if the pedal height remains unchanged, the booster is inoperative.



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

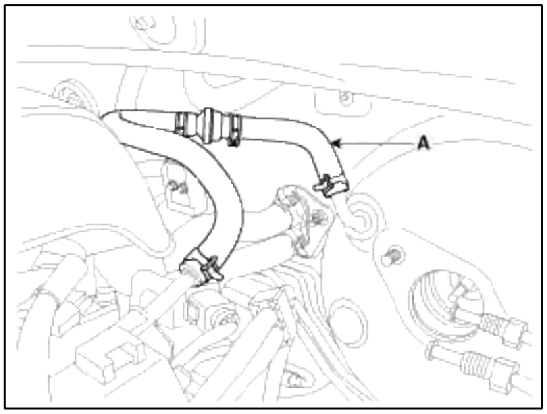


3. With the engine running, step on the brake pedal and then stop the engine.
   Hold the pedal depressed for 30 seconds. If the pedal height does not change, the booster is in good condition, if the pedal rises, the booster is inoperative.
   If the above three tests are okay, the booster performance can be determined as good.
   Even if one of the above three tests is not okay, check the check valve, vacuum hose and booster for malfunction.

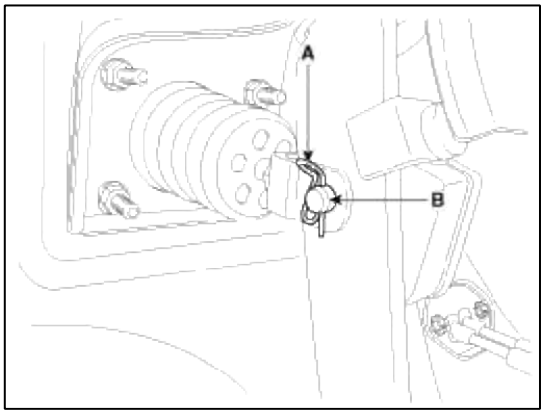


Removal

1. Turn ignition switch OFF, and disconnect the negative (-) battery cable.
2. Remove the battery and ECM.
   (Refer to Engine Electrical group - "Battery")
3. Remove the master cylinder.
   (Refer to Master cylinder.)
4. Disconnect the vacuum hose (A) from the brake booster.

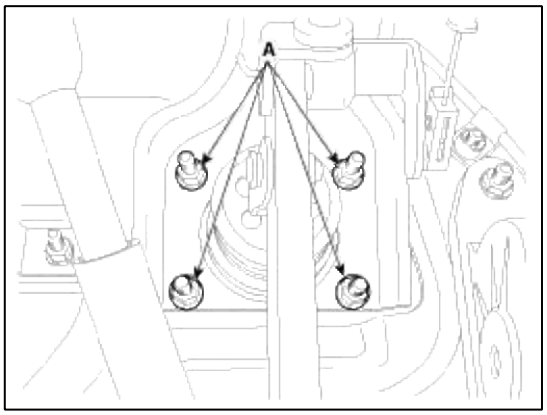


5. Remove the snap pin (A) and clevis pin (B).



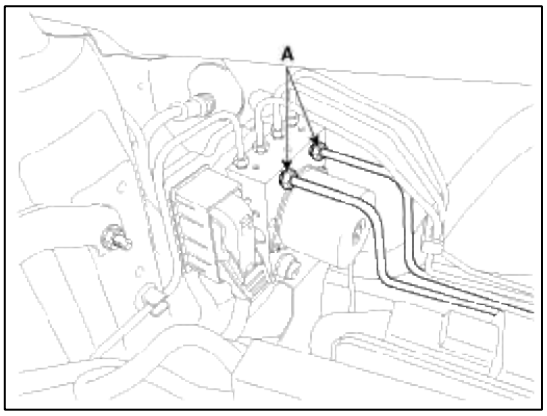
6. Remove the brake booster mounting nuts (A).

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

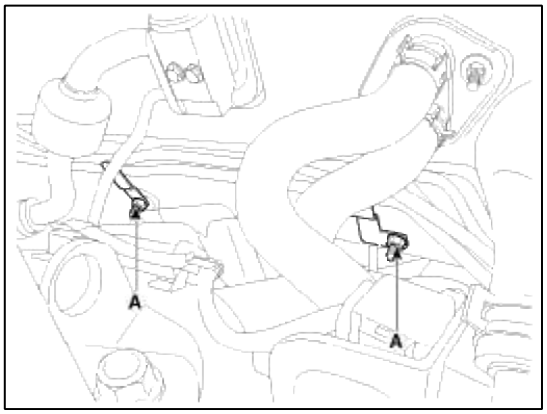


7. Disconnect the brake tubes (A) from the HECU by unlocking the nuts counterclockwise with a spanner.

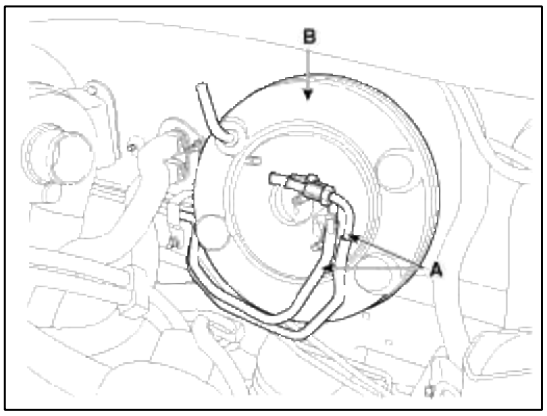
Tightening torque:
ABS: 12.7 ~ 16.7 N.m (1.3 ~ 1.7 kgf.m, 9.4 ~ 12.3 lb-ft)
ESP: 18.6 ~ 22.6 N.m (1.9 ~ 2.3 kgf.m, 13.7 ~ 16.6 lb-ft)



8. Loosen the brake tube bracket mounting nuts (B).



9. Pivot the brake tubes (A) down out of the way.



10. Remove the brake booster (B).

Inspection

1. Inspect the check valve in the vacuum hose.

> CAUTION
>
> Do not remove the check valve from the vacuum hose.

2. Check the boot for damage.

Installation

1. Installation is the reverse of removal.

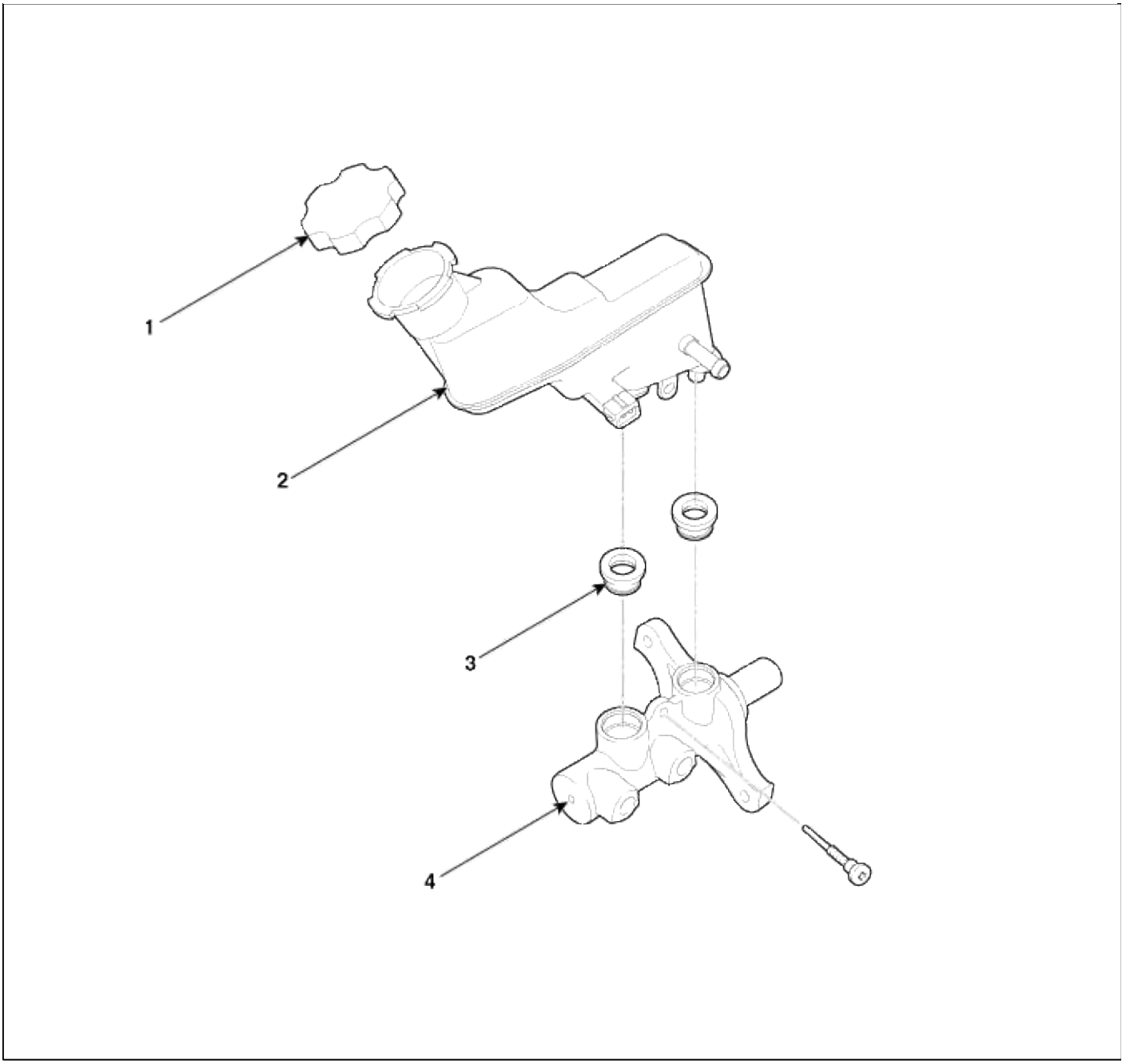
> CAUTION

A. **Before installing the pin, apply the grease to the joint pin.**
B. **Use a new snap pin whenever installing.**

2. After installing, bleed the brake system.
   (Refer to Brake system bleeding)
3. Adjust the brake pedal height and free play.
   (Refer to Brake pedal height and free play adjustment)

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

Components



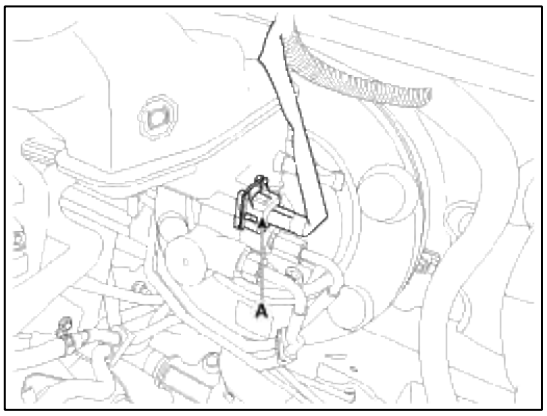
1. Reservoir cap 2. Reservoir	3. Grommet 4. Master cylinder assembly

Brake System > Brake System > Master Cylinder > Repair procedures

Removal

1. Turn ignition switch OFF, and disconnect the negative (-) battery cable.
2. Remove the battery and ECM.
   (Refer to the Engine Electrical group - "Battery")

3. Disconnect the brake fluid level switch connector (A) from the reservoir.



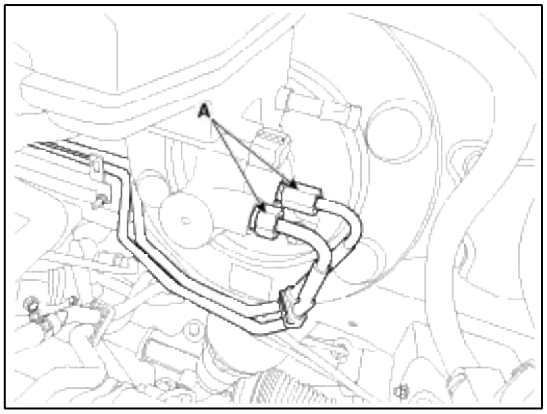
4. Remove the brake fluid from the master cylinder reservoir with a syringe.

CAUTION

- Be sure to completely remove foreign substances from around brake fluid reservoir and cap before opening the reservoir cap. If not, it may cause contamination of brake fluid and deterioration in braking performance.
- Do not spill brake fluid on the vehicle, it may damage the paint; if brake fluid does contact the paint, wash it off immediately with water.

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

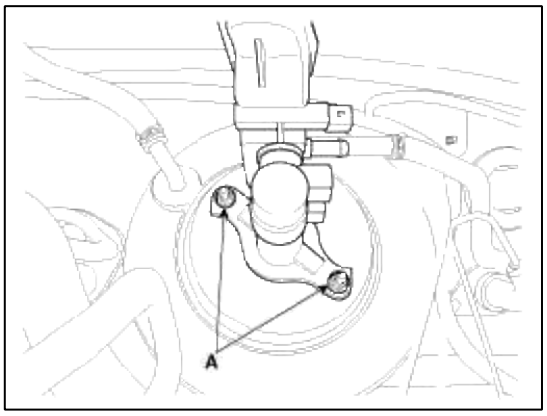
Tightening torque:
18.6 ~ 22.6 N.m (1.9 ~ 2.3 kgf.m, 13.7 ~ 16.6 lb-ft)



6. Remove the clutch hose. [MT Only]

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

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

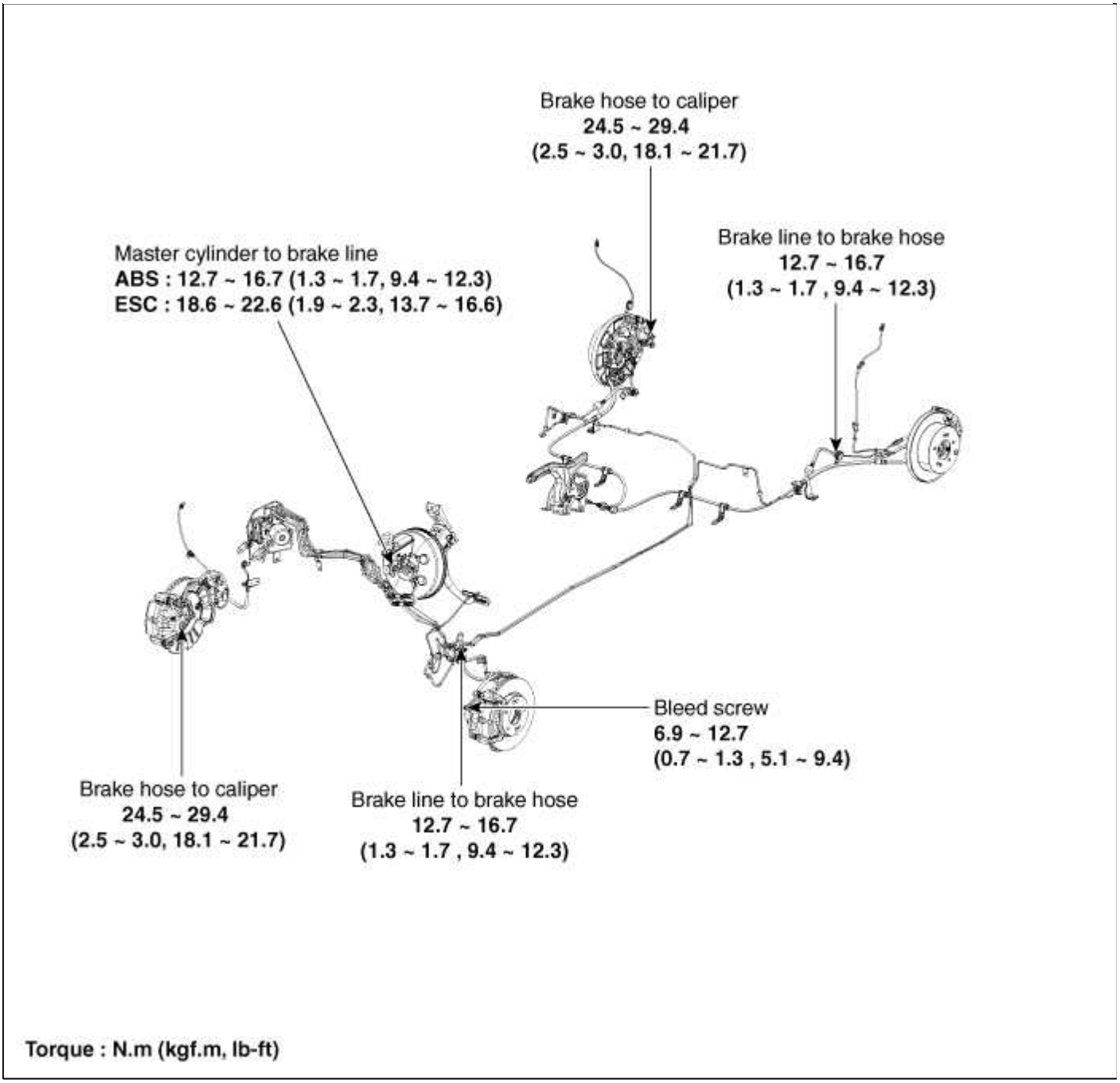


Installation

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



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.

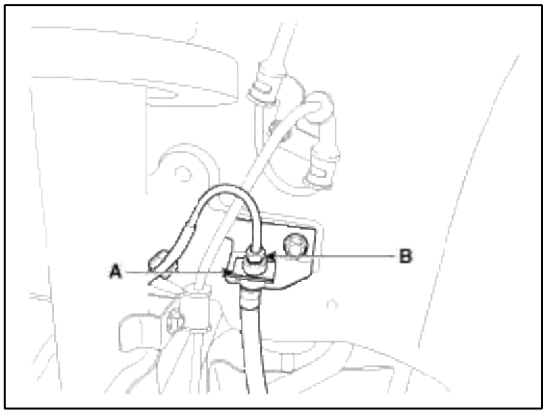
> CAUTION
>
> Do not spill brake fluid on the vehicle, it may damage the paint; if brake fluid does contact the paint, wash it off immediately with water.

3. Remove the wheel & tire.

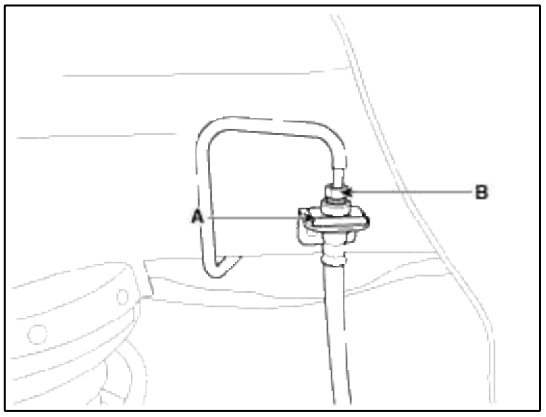
4. Loosening the tube flare nut (B).

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

[Front]



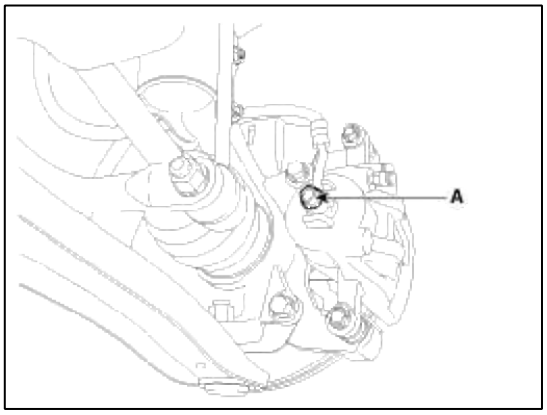
[Rear]



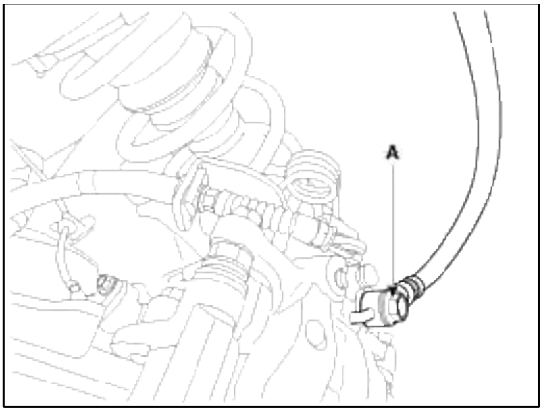
5. Disconnect the brake tube by remove the brake hose clip (A).
6. Disconnect the brake hose from the brake caliper by loosening the bolt (A).

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

[Front disc brake]



[Rear Disc brake]



Inspection

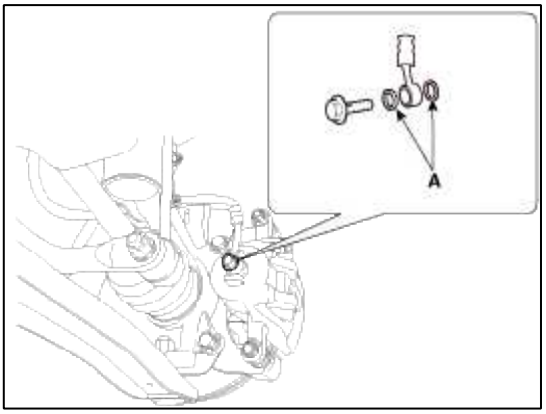
1. Check the brake tubes for cracks, crimps and corrosion.
2. Check the brake hoses for cracks, damage and fluid leakage.
3. Check the brake tube flare nuts for damage and fluid leakage.
4. Check brake hose mounting bracket for crack or deformation.

Installation

1. Installation is the reverse of removal.

CAUTION

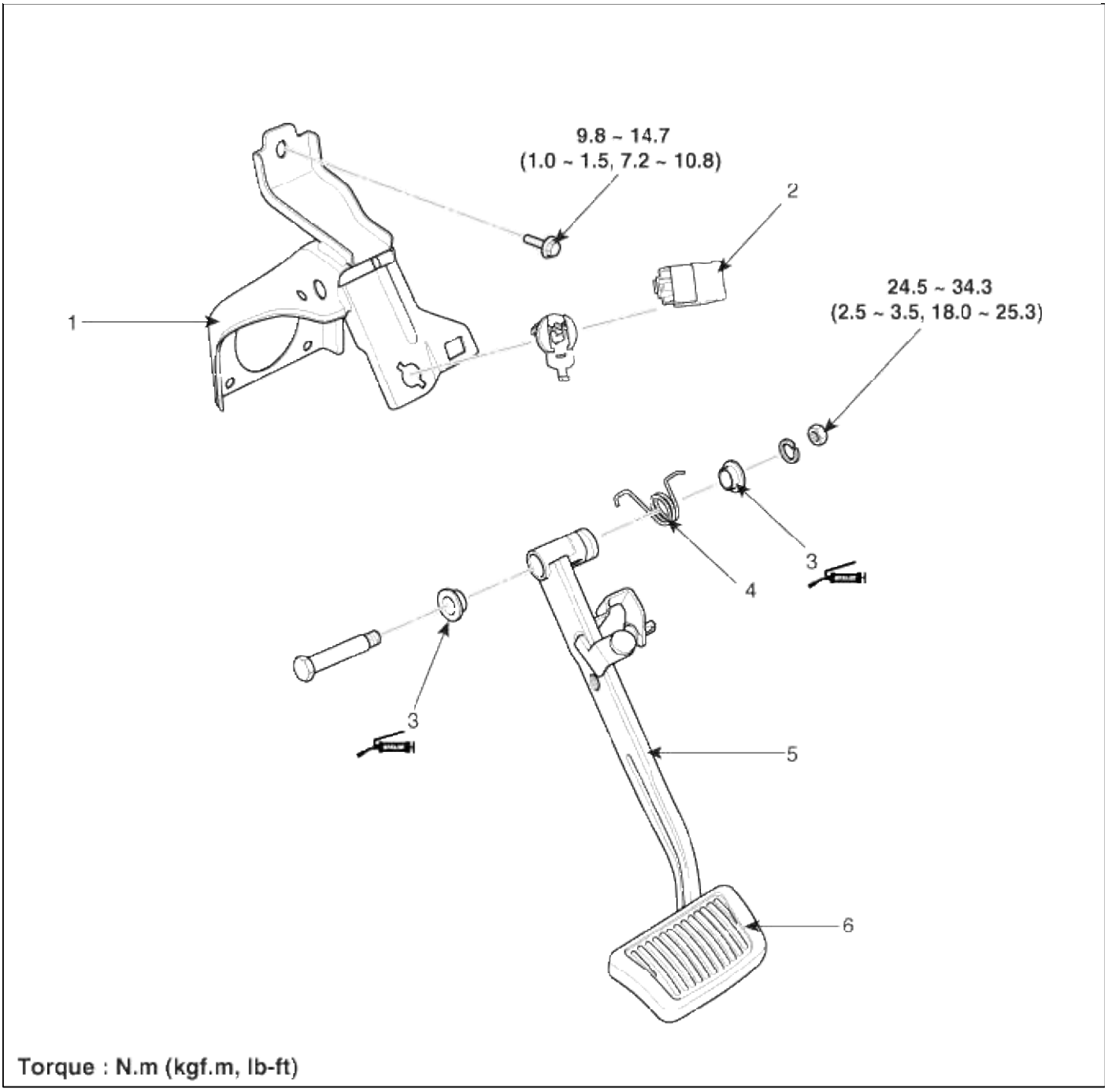
Use a new washer (A) whenever installing.



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



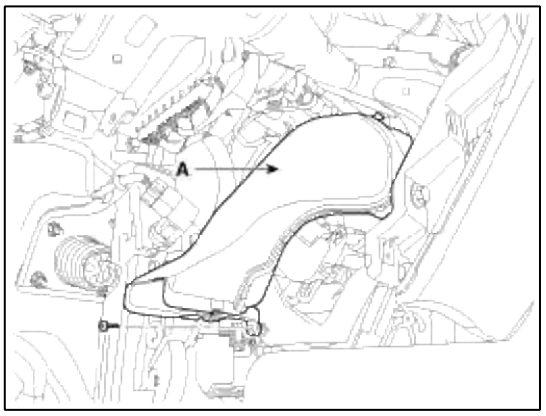
1. Brake pedal member assembly 2. Stop lamp switch 3. Pedal bushing	4. Return spring 5. Brake pedal 6. Brake pedal pad

Brake System > Brake System > Brake Pedal > Repair procedures

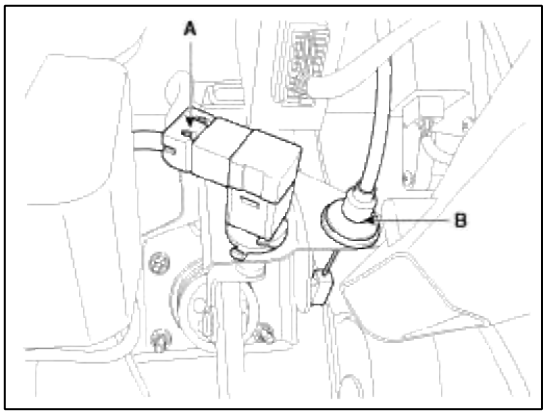
Removal

1. Turn ignition switch OFF.
2. Remove the crash pad lower panel.
   (Refer to the Body group - "Crash pad")

3. Remove the shower duct (A).

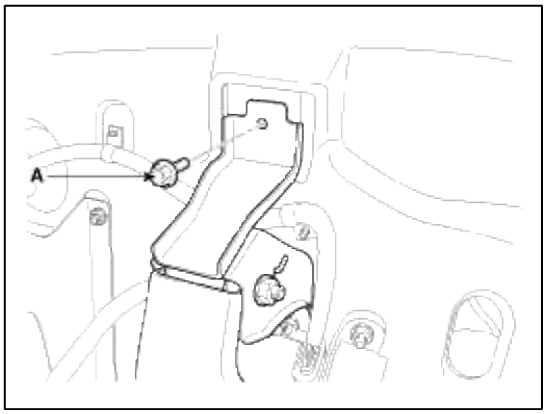


4. Disconnect the stop lamp switch connector (A).

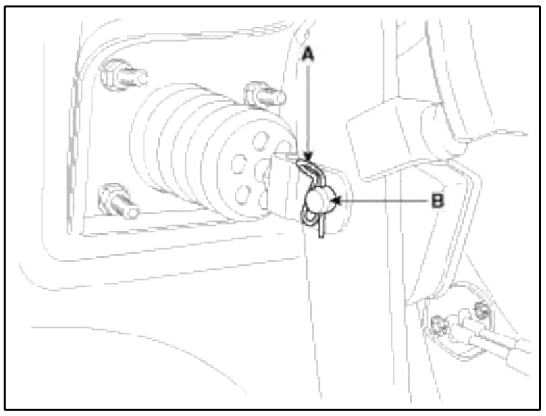


5. Remove the shift lock cable (B) after removing the snap pin and the clip.
6. Remove the BCM.
   (Refer to the Body Electrical group - "BCM")
7. Remove the mounting bracket bolts (A).

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

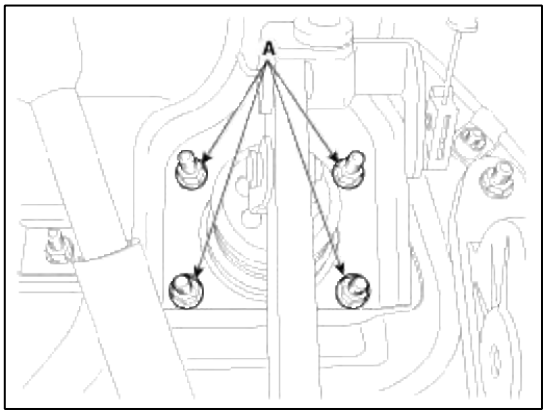


8. Remove the snap pin (A) and clevis pin (B).



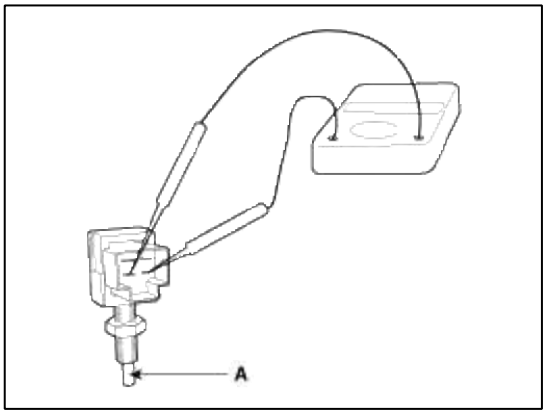
9. Remove the brake pedal member assembly mounting nuts (A) and then remove the brake pedal assembly.

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



Inspection

1. Check the bushing for wear.
2. Check the brake pedal for bending or twisting.
3. Check the brake pedal return spring for damage.
4. Check the stop lamp switch.
   (1) Connect a circuit tester to the connector of stop lamp switch, and check whether or not there is continuity when the plunger of the stop lamp switch is pushed in and when it is released.
   (2) The stop lamp switch is in good condition if there is no continuity when plunger (A) is pushed.



Installation

1. Installation is the reverse of removal.

CAUTION

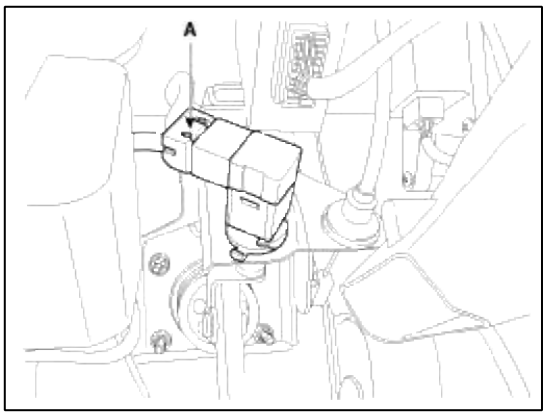
- Before installing the pin, apply the grease to the clevis pin.
- Use a new snap pin whenever installing.

2. Check the brake pedal operation.

Adjustment

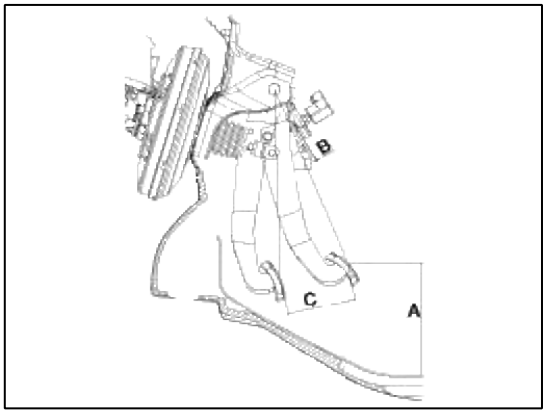
Brake Pedal Height and Free Play

1. Disconnect the stop lamp switch connector (A).



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

Pedal height (A): 174.2 mm (6.86 in)
Full stroke (C): 108 mm (4.25 in)



3. Adjust the stop lamp switch clearance (B).

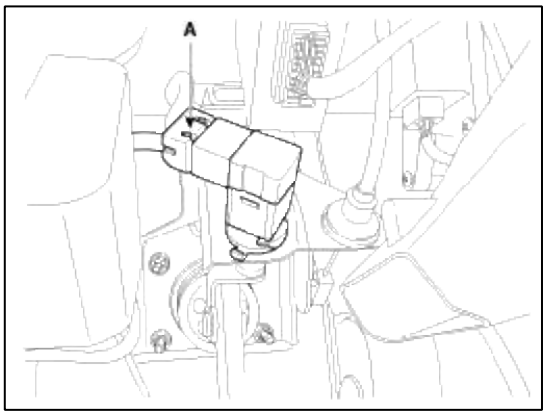
Stop lamp clearance (B):
1.0 ~ 2.0 mm (0.04 ~ 0.08 in)

4. Connect the stop lamp switch connector.

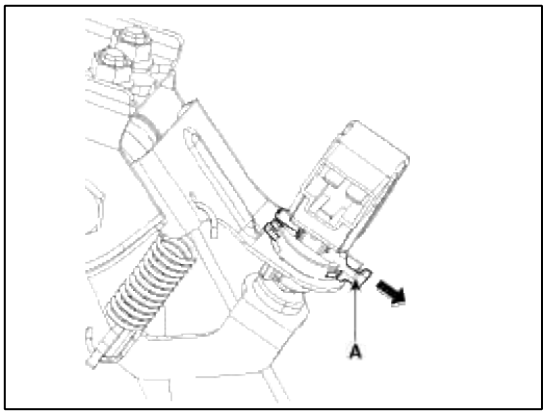
Stop lamp switch clearance adjustment

If the gap between stop lamp switch and bracket is not 1.0 ~ 2.0mm(0.04~ 0.08in), conform to below.

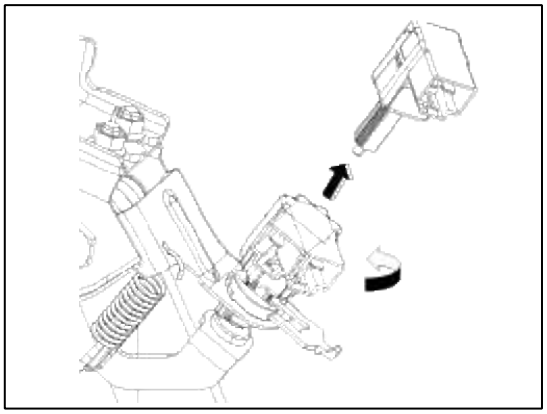
1. Disconnect the stop lamp switch connector (A).



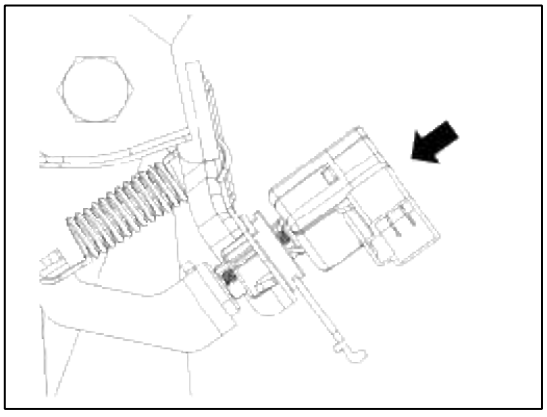
2. Pull the locking plate (A) as indicated by the arrow.



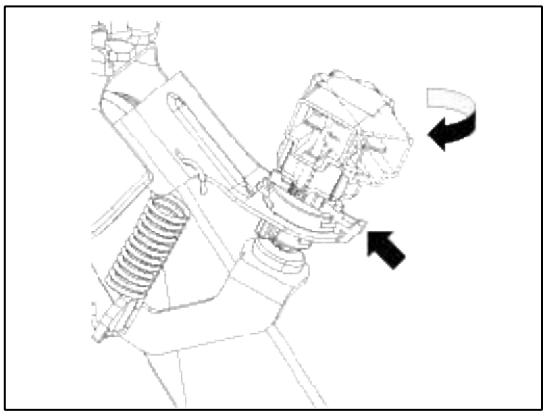
3. Turn stop lamp switch 45° counterclockwise and remove it.



4. Fix the brake pedal arm and insert fully the stop lamp switch as hiding contact part.

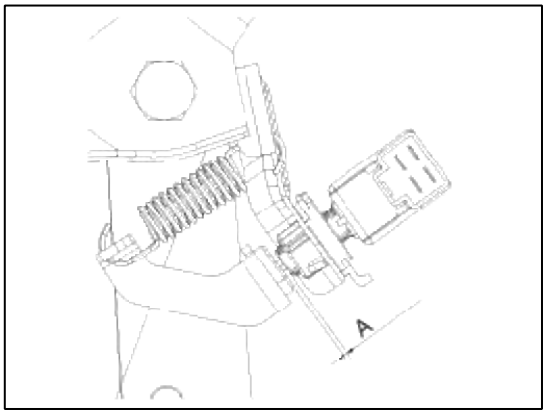


5. After inserting, turn the stop switch (A) 45° clockwise, and then assemble locking plate (B) by pushing.



6. Confirm the gap between stop lamp switch and bracket.

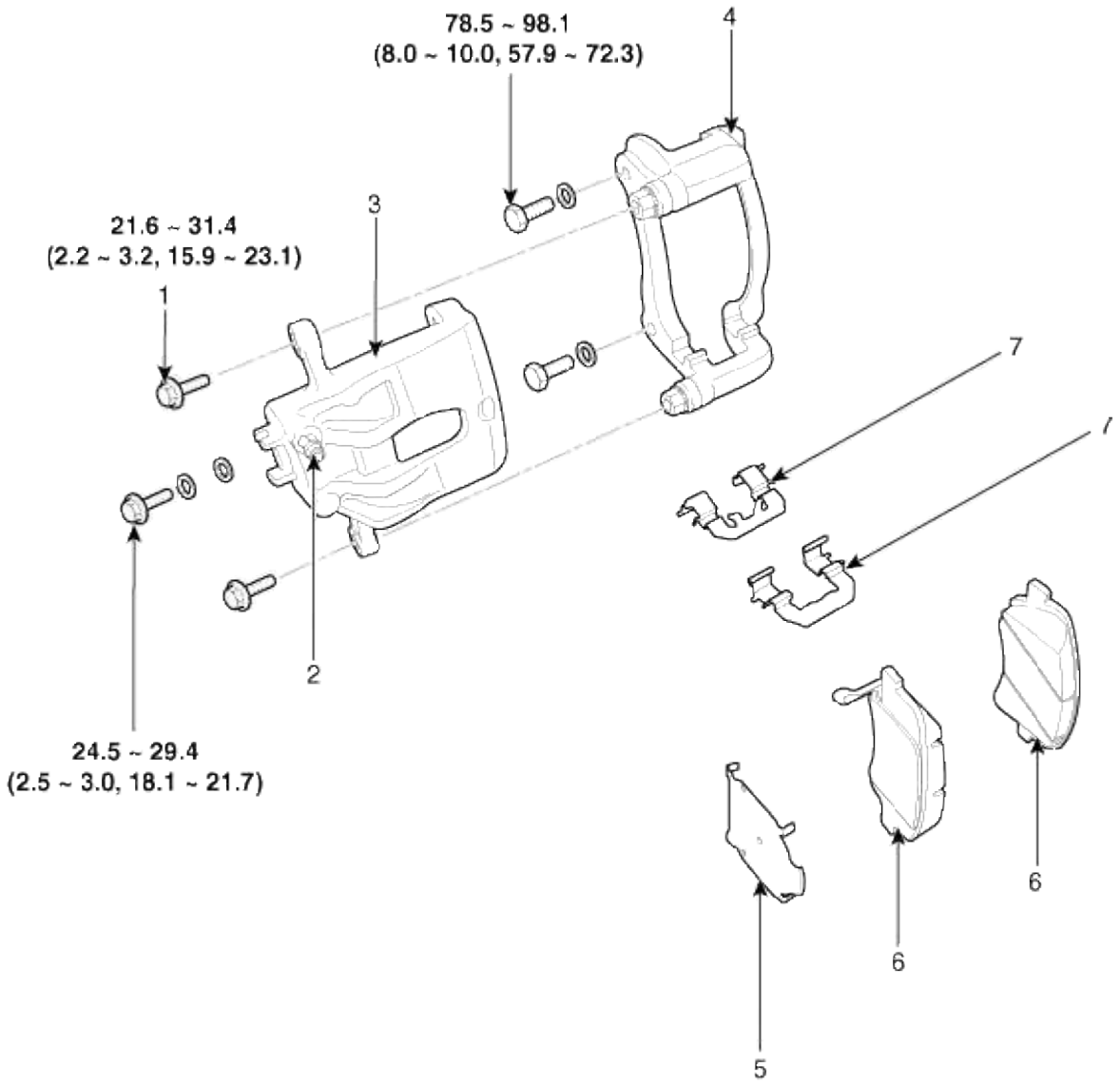
Stop lamp clearance:
1.0 ~ 2.0 mm (0.04~ 0.08 in.)



7. 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
2. Bleed screw	shim
3. Caliper body	6. Brake pad
4. Caliper carrier	7. Pad retainer

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

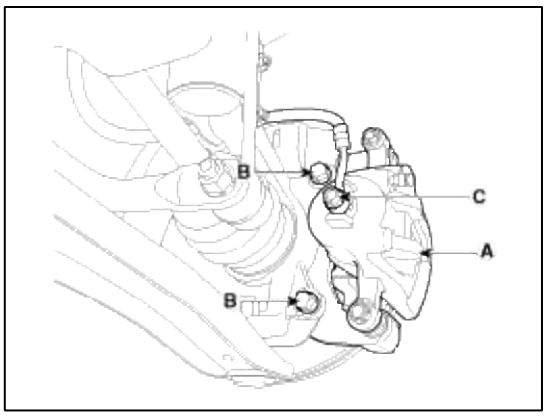
Removal

1. Remove the front wheel & tire.

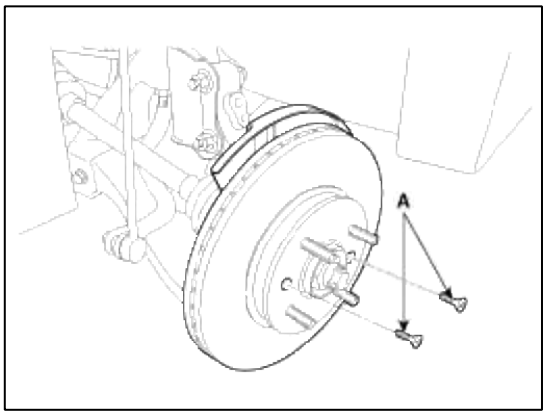
Tightening torque:
88.3 ~ 107.9 N.m (9.0 ~ 11.0 kgf.m, 65.1 ~79.6 lb-ft)

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

Tightening torque:
Brake hose to caliper (C):
24.5 ~ 29.4 N.m (2.5 ~ 3.0 kgf.m, 18.1 ~ 21.7 lb-ft)
Caliper assembly to knuckle (B):
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).

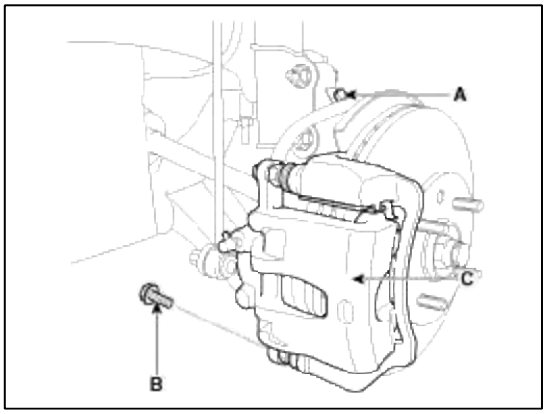


Replacement

Front Brake Pads

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

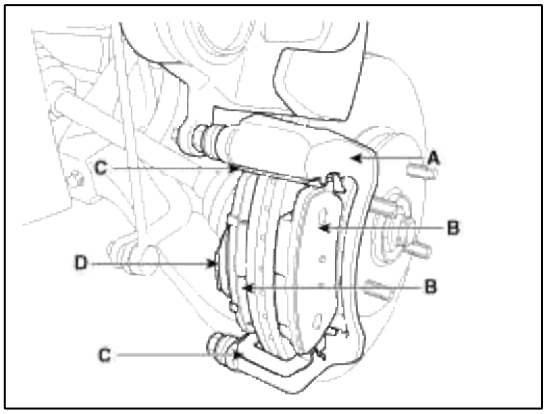
Tightening torque:
7.8 ~ 11.8 N.m (0.8 ~ 1.2 kgf.m, 5.8 ~ 8.7 lb-ft)



2. Loosen the guide rod bolt (B) and pivot the caliper (C) 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 carrier (A).

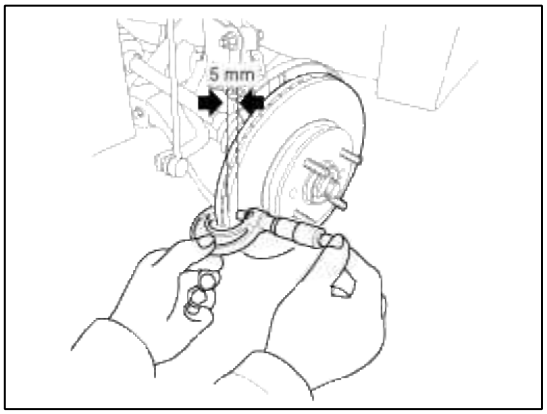


Inspection

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 12 points, at least, of same distance (5mm) from the brake disc outer circle.

Brake disc thickness
Standard: 22 mm (0.866 in)
Service limit:
- 14 Inch Disc : 20 mm (0.787 in)
- 15 Inch Disc : 19.4 mm (0.764 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.

Front Brake Pad Check

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

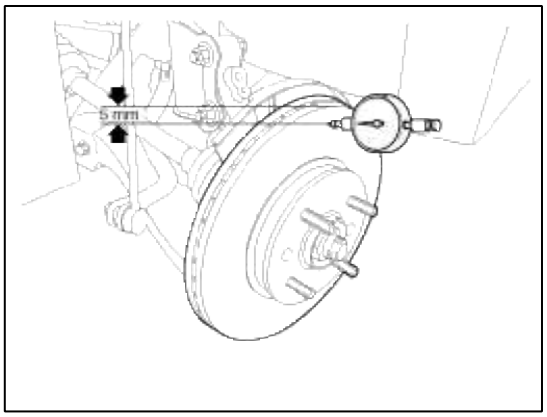
Pad thickness
Standard value: 11 mm (0.433 in)
Service limit: 2.0 mm (0.0787 in)

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

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.

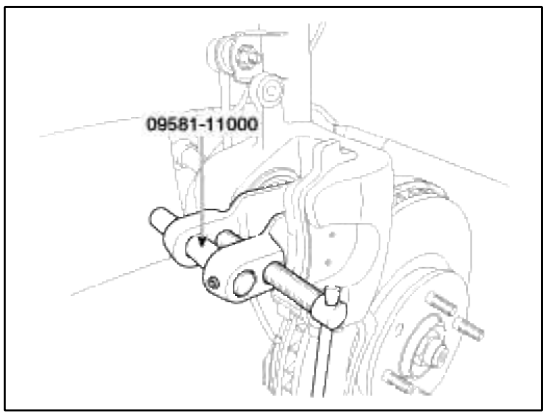
Brake disc runout
Limit: 0.04 mm (0.0016 in.) or less (new one)



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

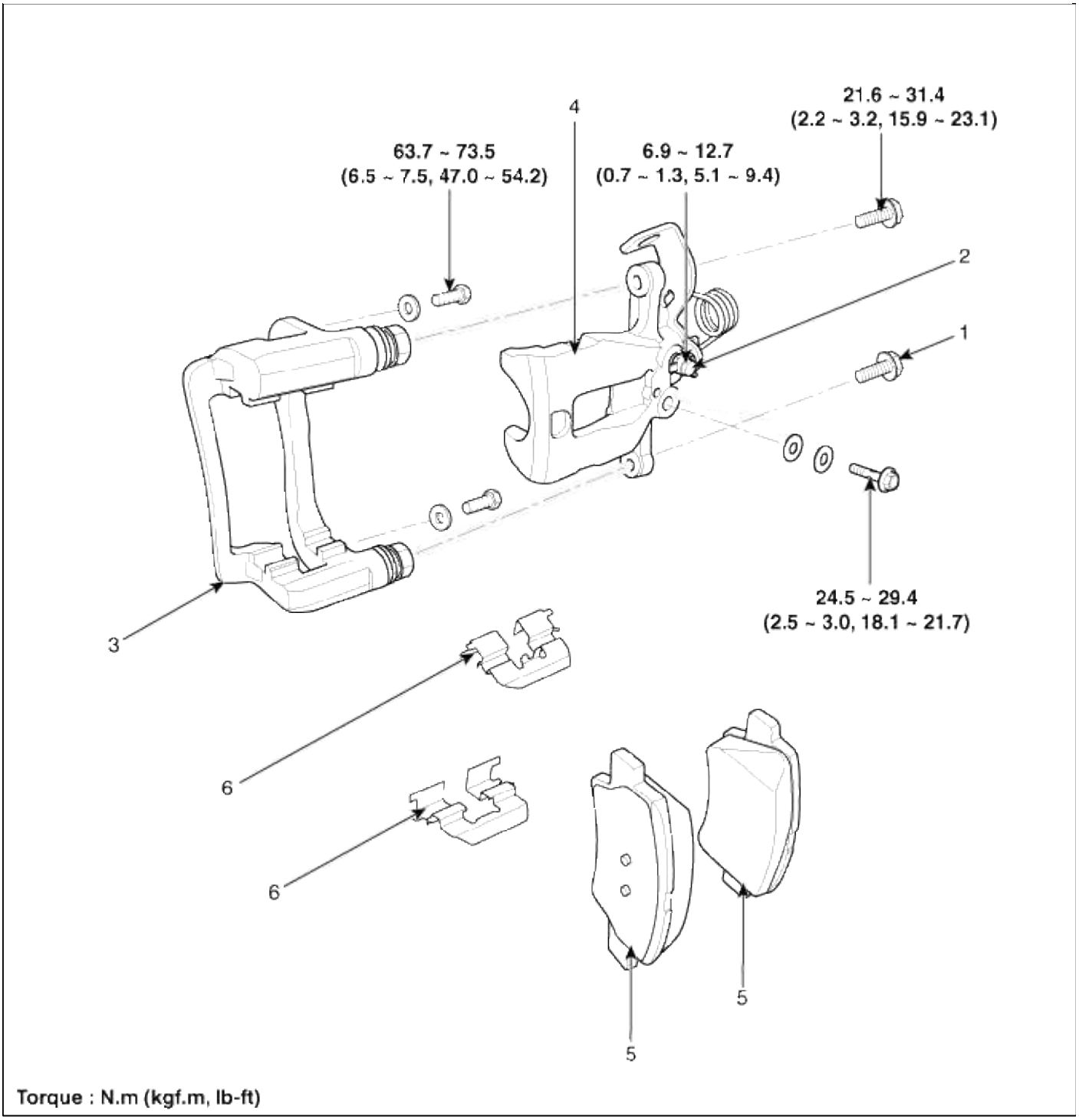
1. Installation is the reverse of removal.
2. Use a SST (09581-11000) when installing the brake caliper assembly.



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

Brake System > Brake System > Rear Disc Brake > Components and Components Location

Components



1. Guide rod bolt 2. Bleed screw 3. Caliper carrier	4. Caliper body 5. Brake pad 6. Pad retainer

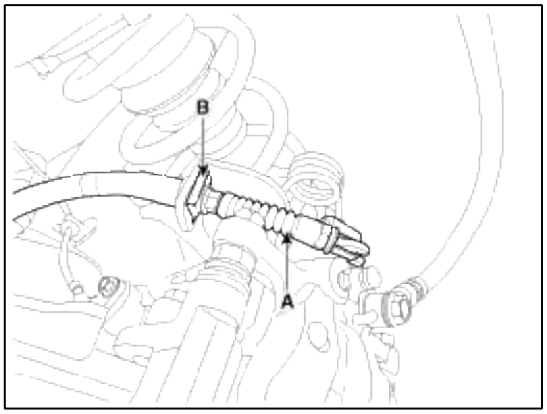
Brake System > Brake System > Rear Disc Brake > Repair procedures

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 parking brake cable (A), after removing the clip (B).

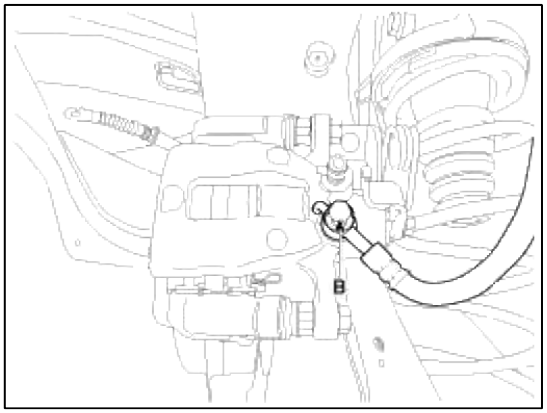


NOTE

Parking brake lever in the car must be in fully loosened position.

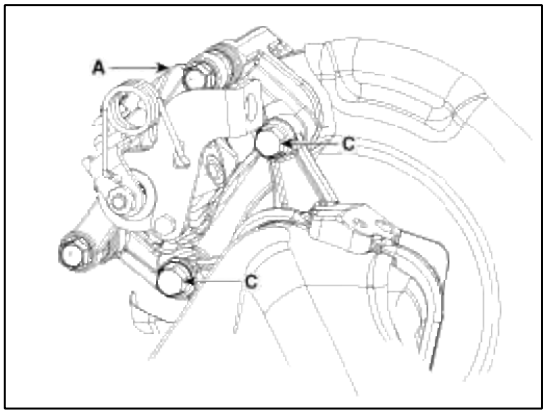
3. Remove the hose eyebolt (B).

Tightening torque:
Brake hose to caliper:
24.5 ~ 29.4 N.m (2.5 ~ 3.0 kgf.m, 18.1 ~ 21.7 lb-ft)

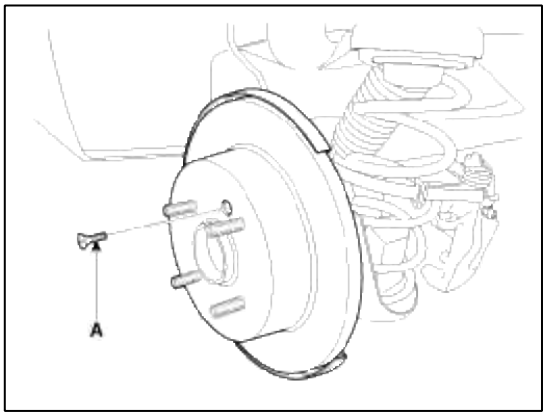


4. Loosen the caliper mounting bolts (C), then remove the rear caliper assembly (A).

Tightening torque:
Caliper assembly to carrier:
49.0 ~ 58.8 N.m (5.0 ~ 6.0 kgf.m, 36.2 ~ 43.4 lb-ft)



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

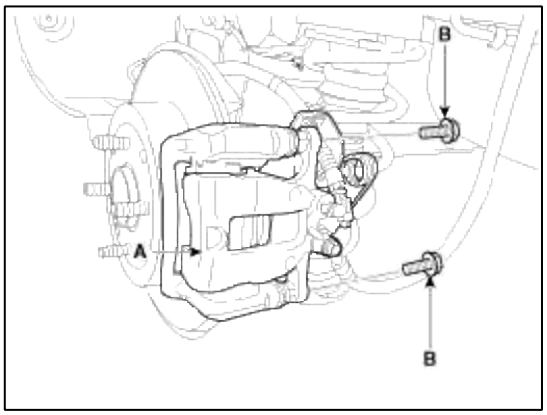


Replacement

Rear Brake Pads

1. Loosen the guide rod bolt (B) and then remove the rear caliper body (A).

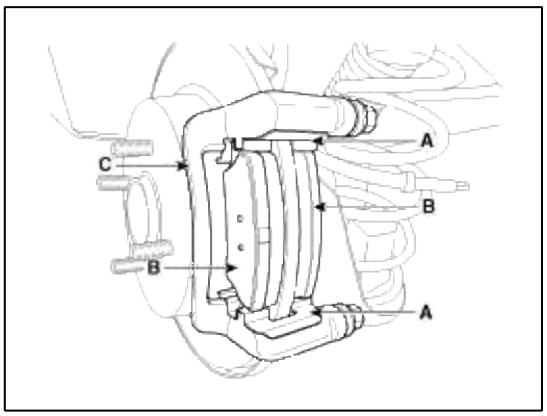
Tightening torque:
21.6 ~ 31.4 N.m (2.2 ~ 3.2 kgf.m, 15.9 ~23.1 lb-ft)



NOTE

- Where necessary prevent the guide rods from rotating with an appropriate wrench.
- Be careful not to damage the dust covers.

2. Replace pad retainers (A) and brake pads (B) in the caliper carrier (C).



NOTE

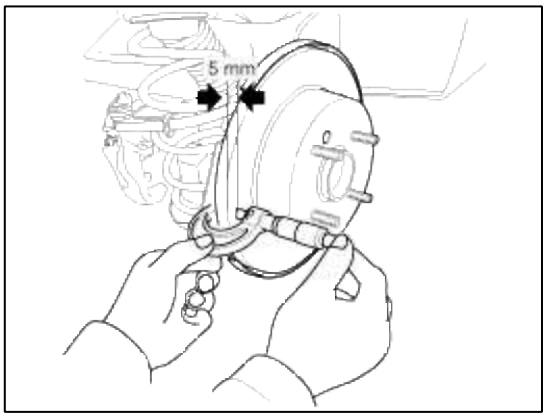
- Clean the pad retainer surface at the caliper bracket.
- Inspect the piston boots for damage and replace if necessary.
- Check the smooth action of the guide rods, and their dust covers for damage.

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 12 points, at least, of same distance (5mm) from the brake disc outer circle.

Brake disc thickness
Standard: 10 mm (0.394 in)
Service limit: 8.4 mm (0.331 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

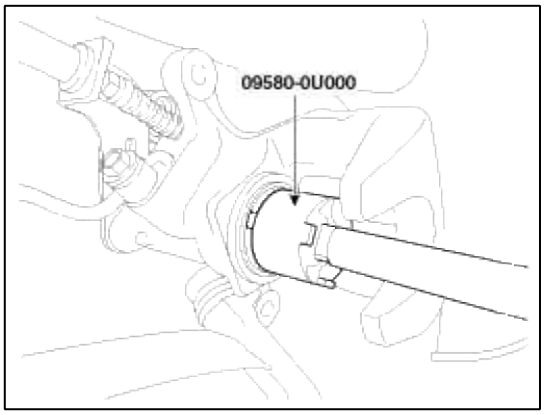
1. Check the pad wear. Measure the pad thickness and replace it, if it is less than the specified value.

Pad thickness
Standard value: 10 mm (0.394 in)
Service limit: 2.0 mm (0.0787 in)

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

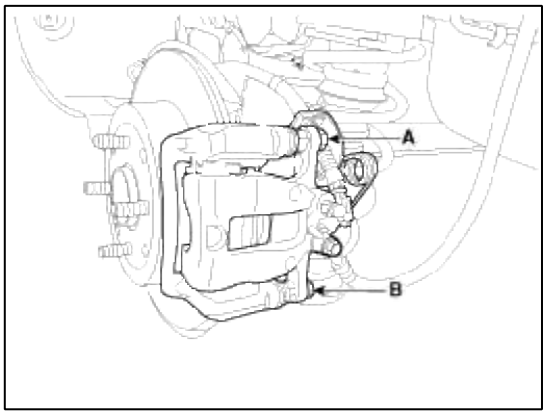
Installation

1. Installation is the reverse of removal.
2. Use a SST (09580-0U000) when installing the brake caliper assembly.



NOTE

- Wind the piston into the caliper body until it is fully retracted.
- Do not use any power assisted tools for this task.
- Manually insert new screws from the brake pad and tighten the leading-pin bolt(A) first with specified torque, following this tighten the trailing-pin bolt(B) in the same manner.



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

NOTE

- Bring the brake pads in their operating position by pressing the brake pedal down (half of normal pedal travel) several times until there is resistance.
- In order to bed the brake pads to the brake disc and ensure performance and endurance, the vehicle user must be instructed to avoid heavy braking or sustained periods with the brakes applied, for the first 200km(124mile) after installing new pads.
- Re-setting of the parking brake is necessary after overhauling the caliper body, or if the brake calipers, caliper body, parking brake cable or brake discs have been changed.

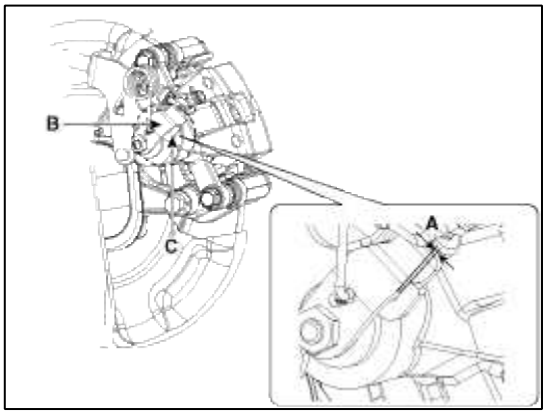
Parking Brake Adjustment

NOTE

- Re-setting of the parking brake is necessary after overhauling the caliper body, or if the brake calipers, housing, parking brake cable or brake discs have been changed.

1. Remove the floor console to reach the adjusting nut.
2. Loosen the parking brake cable until both operating levers rest in fully off position.
3. Bring the brake pads in their operating position by pressing the brake pedal down several times until there is resistance.
4. Tension the parking brake cable by tightening the adjusting nut, until the operating levers on both calipers lift from the stop, up to a distance of (A) between operating lever (B) and stopper (C).

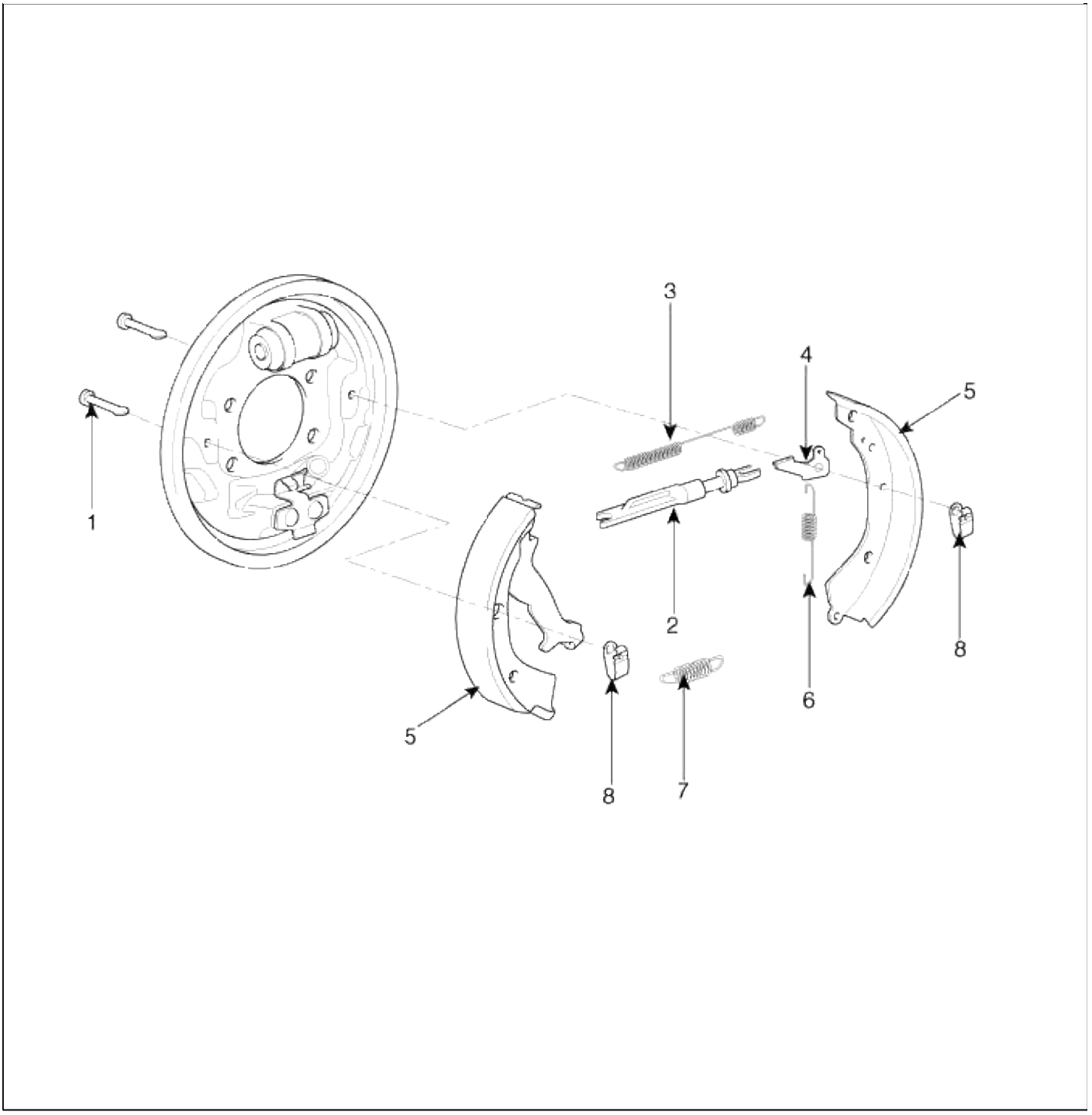
Distance (A): Max. 1.5 mm (0.06 in)



5. Parking brake lever in the car must be in fully loosened position.
6. If the handbrake cables where changed, actuate the parking brake a few times with maximum force to stretch the parking brake cables, and then control adjusting as above.
7. Check the wheels of their free operation.
8. Install the floor console.
9. Test drive.

Brake System > Brake System > Rear Drum Brake > Components and Components Location

Components



1. Shoe hold down pin 2. Shoe adjuster 3. Upper return spring 4. Adjusting lever	5. Shoe 6. Adjusting spring 7. Lower return spring 8. Shoe hold spring

Brake System > Brake System > Rear Drum Brake > Repair procedures

Removal

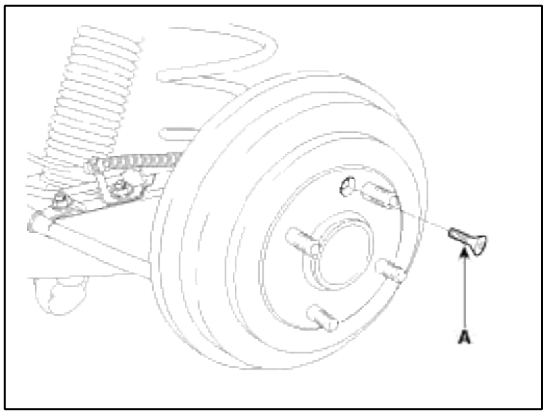
CAUTION

- Frequent inhalation of brake pad dust, regardless of material composition, could be hazardous to your health.
- Avoid breathing dust particles.
- Never use an air hose or brush to clean brake assemblies.

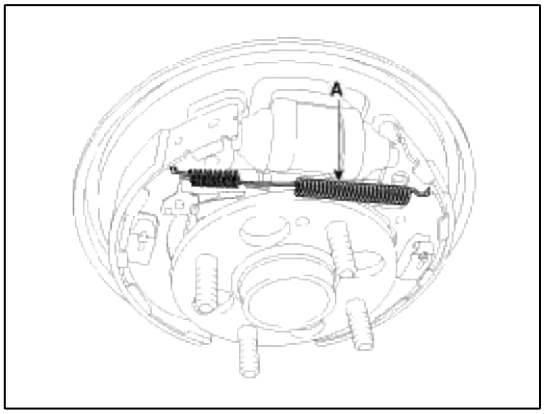
1. Release the parking brake.
2. Remove the rear wheel & tire.

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

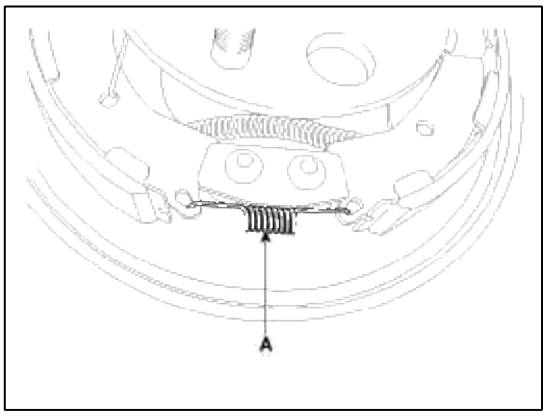
3. Remove the rear brake drum (A).



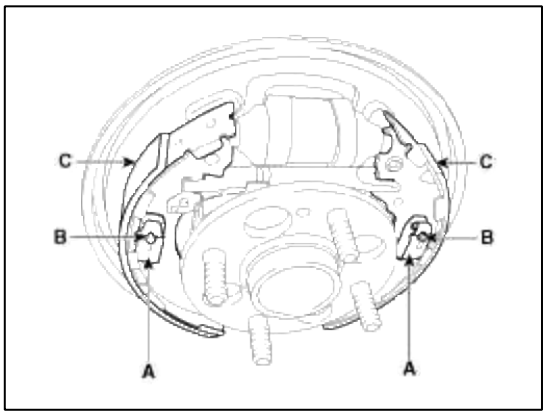
4. Remove the upper return spring (A).



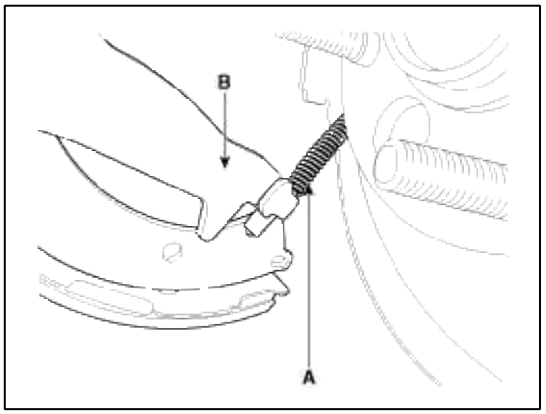
5. Remove the lower return spring (B).



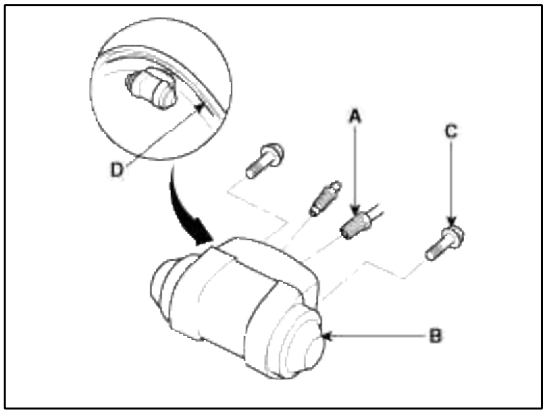
6. Remove the shoe hold springs (A) and shoe hold pins (B) and then remove brake shoe (C). Make sure not to damage the dust cover on the wheel cylinder.



7. Remove the parking brake cable (A) and then remove brake shoe (B).



8. Disconnect brake tubes (A) from the wheel cylinder (B).



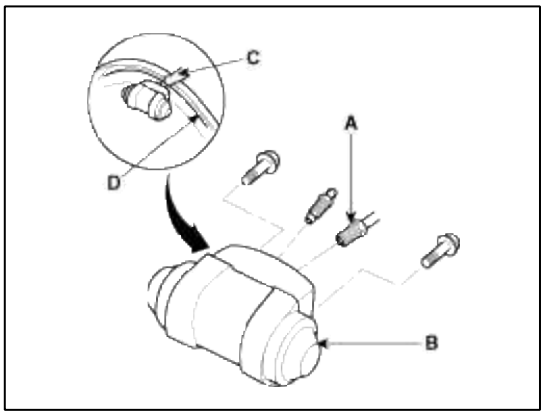
9. Remove the bolt (C) and the wheel cylinder (B) from the backing plate (D).

Installation

NOTE

- Do not spill brake fluid on the vehicle: it may damage the paint; if brake fluid does contact the paint. Wash it off immediately with water.
- To prevent spills, cover the hose joints with rags or shop towels.
- Use only a genuine wheel cylinder special bolt.

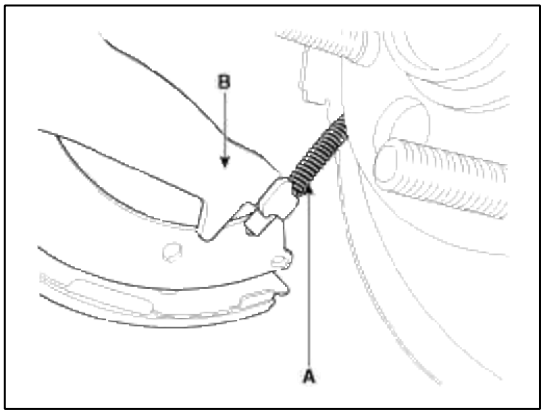
1. Apply sealant (C) between the wheel cylinder (B) and backing plate (D), and install the wheel cylinder.



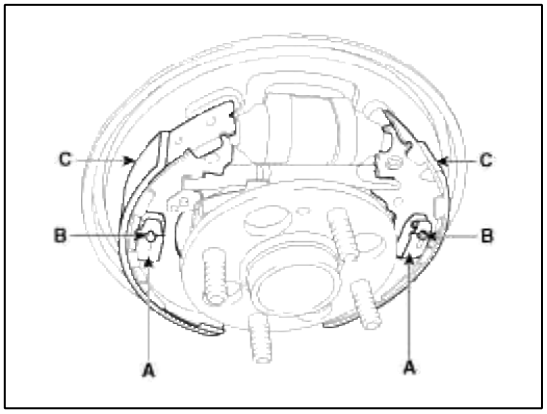
2. Connect the brake tubes (A) to the wheel cylinder.

Tightening torque:
6.9 ~ 9.8 N.m (0.7 ~ 1.0 kgf.m, 5.1 ~ 7.2 lb-ft)

3. Connect the parking brake cable (A) to the brake shoe.

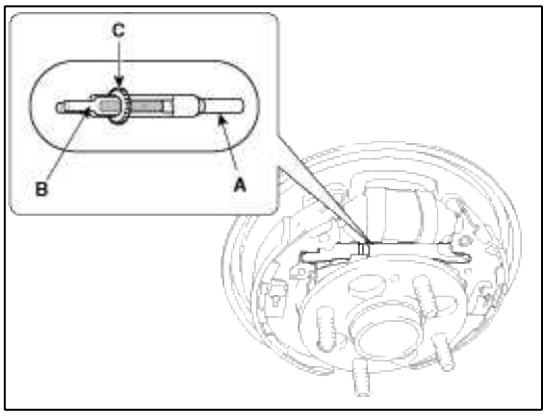


4. Install the brake shoes (C) onto the backing plate. Be careful not to damage the wheel cylinder dust covers.

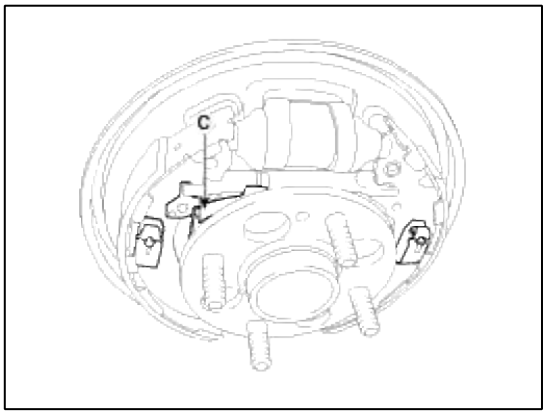


5. Install the shoe hole down pins (B) and the shoe hole down springs (A).

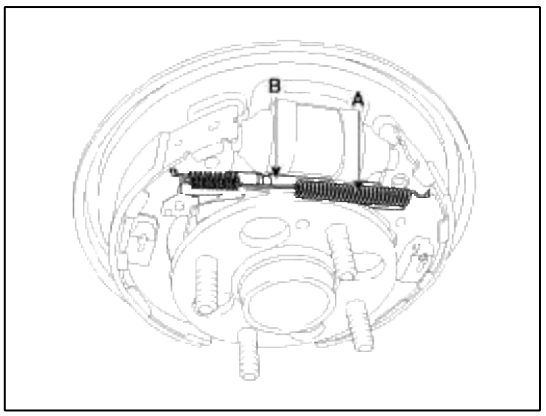
6. Clean the threaded portions of adjuster sleeve (A) and push rod female (B). Coat the threads of the adjuster assembly with grease. To shorten the clevises, turn the adjuster bolt (C).



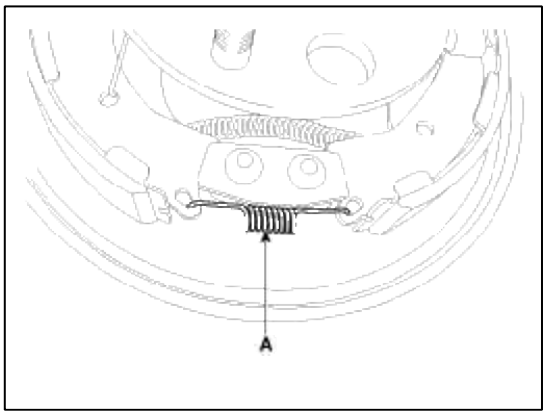
7. Hook the shoe adjuster lever (C), then install it to the brake shoe.



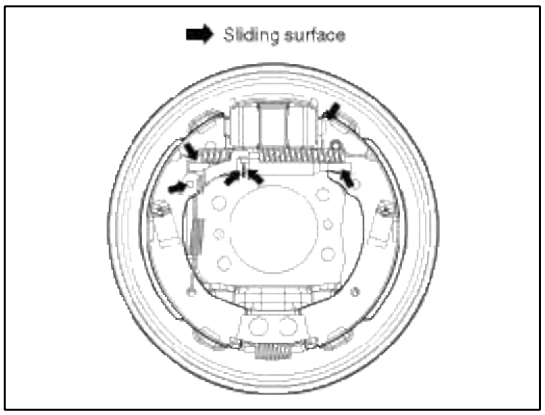
8. Install the adjuster assembly (B) and upper return spring (A) as right direction. Be careful not to damage the wheel cylinder dust covers.



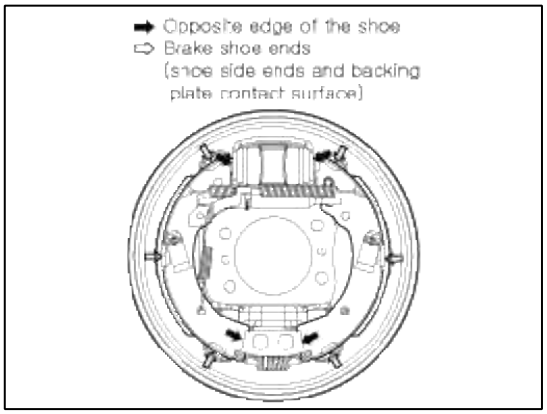
9. Install the lower return spring (B).



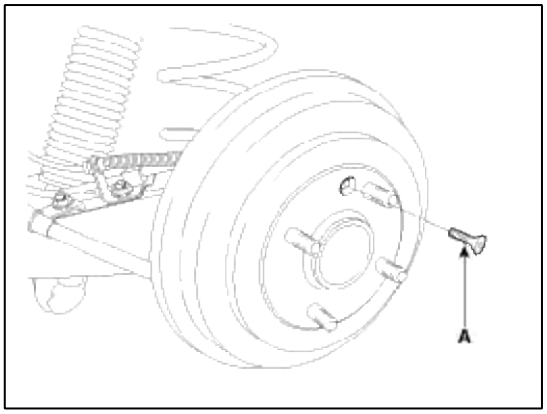
10. Apply brake cylinder grease or equivalent rubber grease to the sliding surfaces shown. Don't get grease on the brake linings.



11. Apply brake cylinder grease or equivalent rubber grease to the brake shoe ends and opposite edges of the shoes shown. Don't get grease on the brake linings.



12. Install the rear brake drum (A).



13. If the wheel cylinder has been removed, bleed the brake system.
14. Depress the brake pedal several times to set the self-adjusting brake.
15. Adjust the parking brake.

Inspection

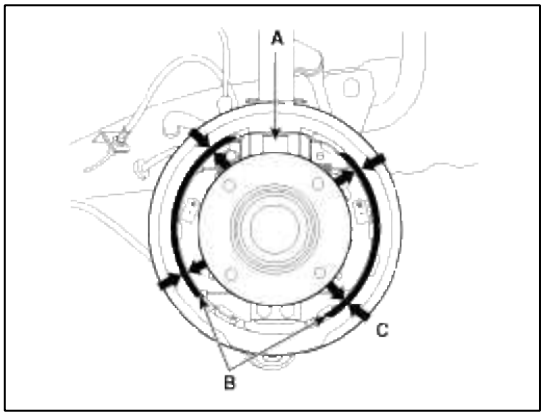
CAUTION

- Frequent inhalation of brake pad dust, regardless of material composition, could be hazardous to your health.
- Avoid breathing dust particles.
- Never use an air hose or brush to clean brake assemblies.

NOTE

- Contaminated brake linings or drums reduce stopping ability.
- Block the front wheels before jacking up the rear of the vehicle.

1. Raise the rear of the vehicle, and make sure it is securely supported.
2. Release the parking brake, and remove the rear brake drum.
3. Check the wheel cylinder (A) for leakage.

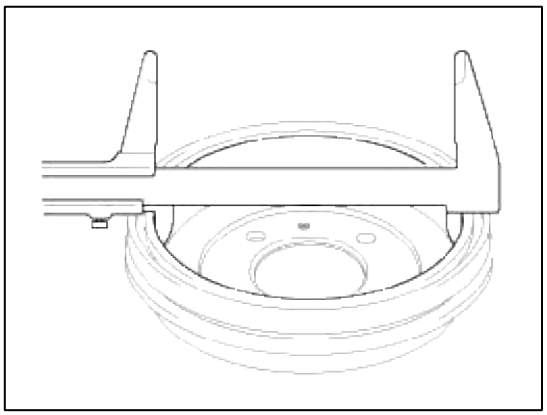


4. Check the brake linings (B) for cracking, glazing, wear, and contamination.
5. Measure the brake lining thickness (C).Measurement does not include brake shoe thickness.

Brake lining thickness
Standard: 4.5 mm (0.177 in)
Service limit: 1.0 mm (0.039 in)

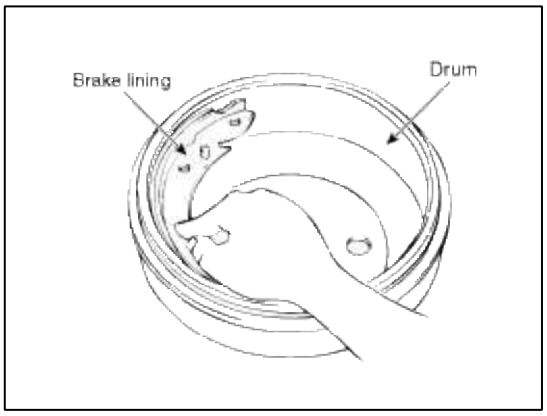
6. If the brake lining thickness is less than the service limit, replace the brake shoes as a set.
7. Check the bearings in the hub unit for smooth operation. If it requires servicing, replace it.
8. Measure the inside diameter of the brake drum with inside vernier calipers.

Drum inside diameter
Standard: 203.2 mm (8.0 in)
Service limit: 205.2 mm (8.079 in)
Drum roundness
Service limit: 0.06 mm (0.00236 in)



9. If the inside diameter of the brake drum is more than the service limit, replace the brake drum.
10. Check the brake drum for scoring, grooves, and cracks.

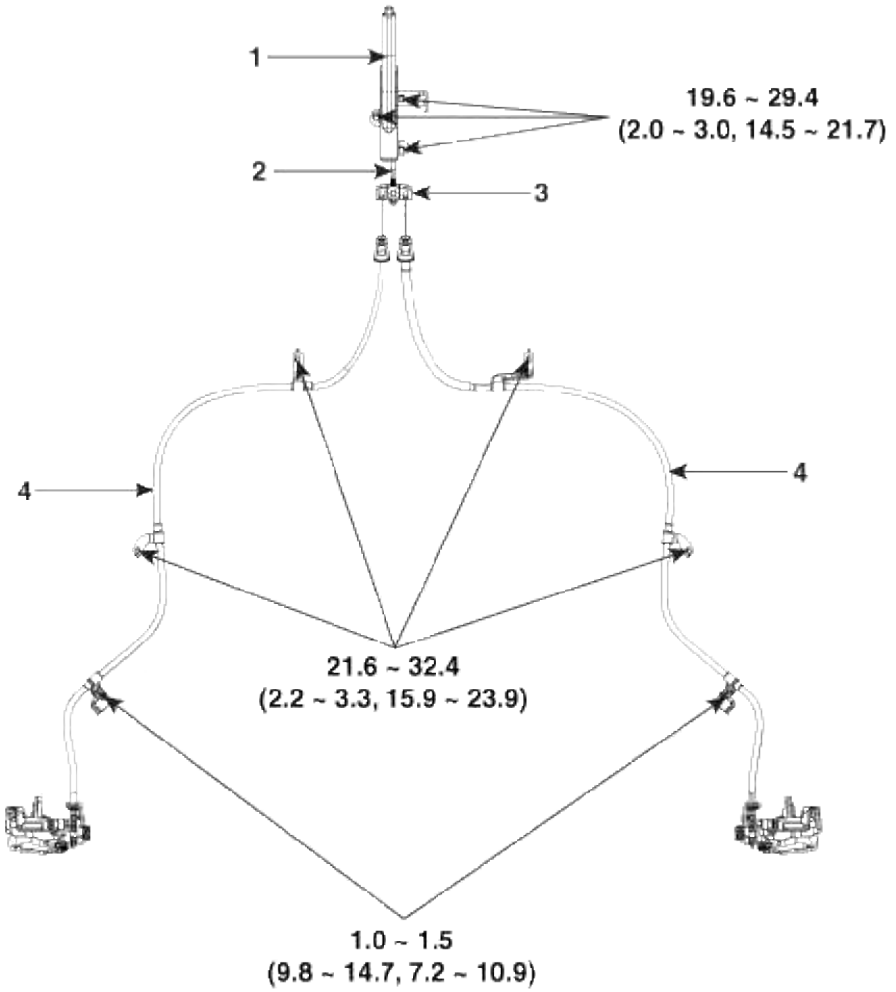
11. Inspect the brake lining and drum for proper contact.



12. Inspect the wheel cylinder outside for excessive wear and damage.
13. Inspect the backing plate for wear or damage.

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

Components



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

1. Parking brake lever 2. Adjuster cable	3. Equalizer assembly 4. Parking brake cable

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

Removal

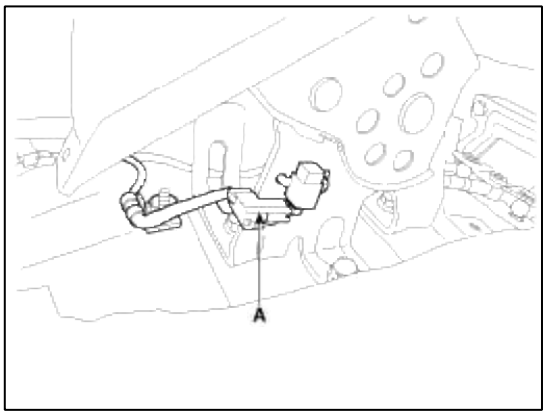
Rear Disc Brake Type

NOTE

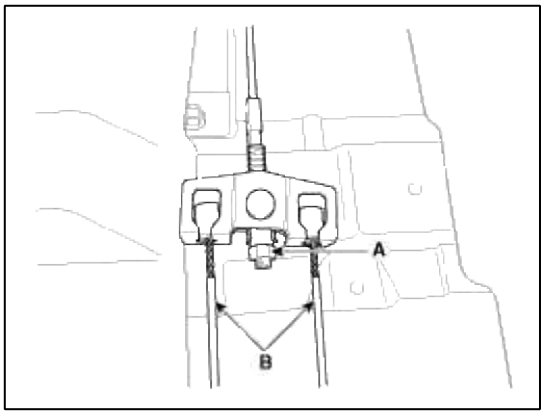
The parking brake cables must not be bent or distorted. This will lead to stiff operation and premature failure.

1. Remove the floor console.
   (Refer to Body group - "Floor console")

2. Disconnect the connector (A) of parking brake switch.



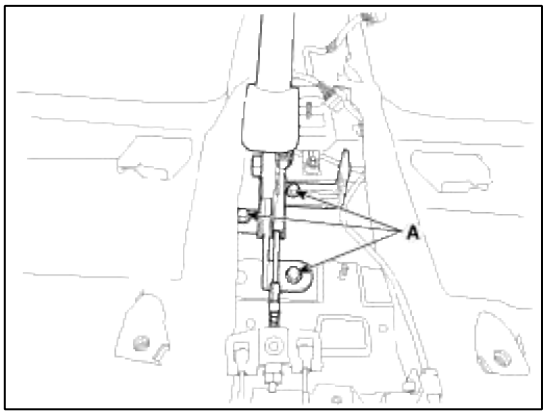
3. Loosen the adjusting nut (A) and the parking brake cables (B).



NOTE

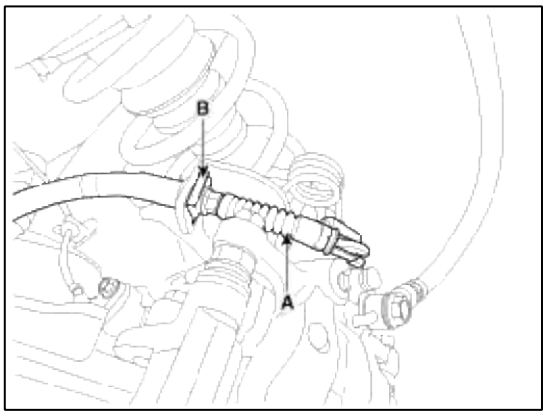
Parking brake lever in the car must be in fully loosened position.

4. Remove the parking brake lever assembly after removing the bolts (A).



5. Raise the vehicle, and make sure it is securely supported.
6. Remove the rear tire and wheel.

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



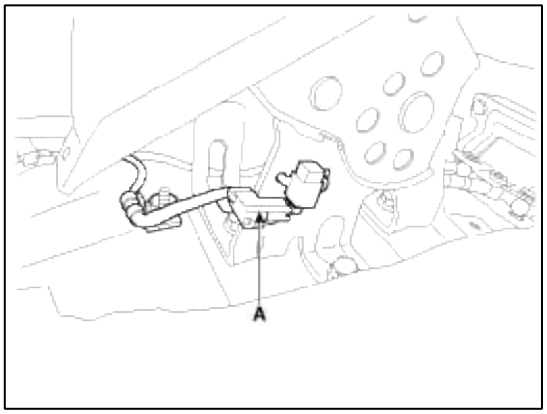
8. Loosen the parking brake cable bracket bolts and remove the parking brake cable.

Rear Drum Brake Type

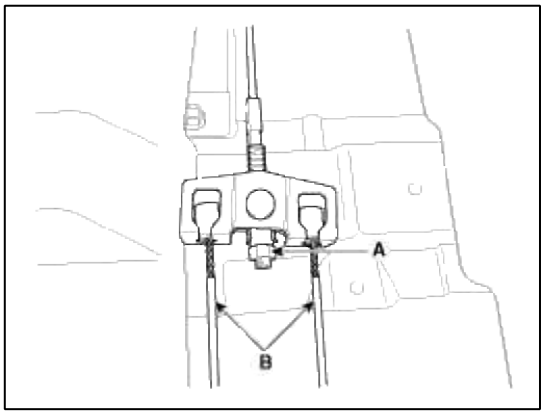
NOTE

The parking brake cables must not be bent or distorted. This will lead to stiff operation and premature failure.

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



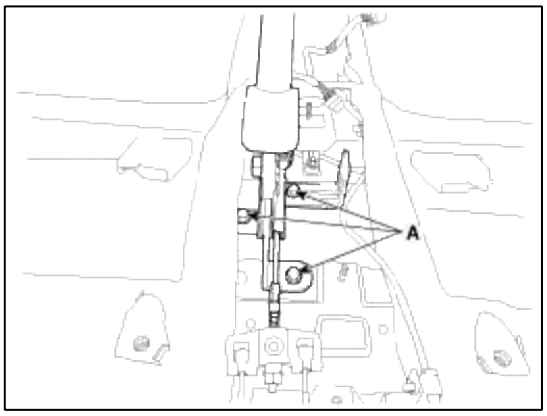
3. Loosen the adjusting nut (A) and the parking brake cables (B).



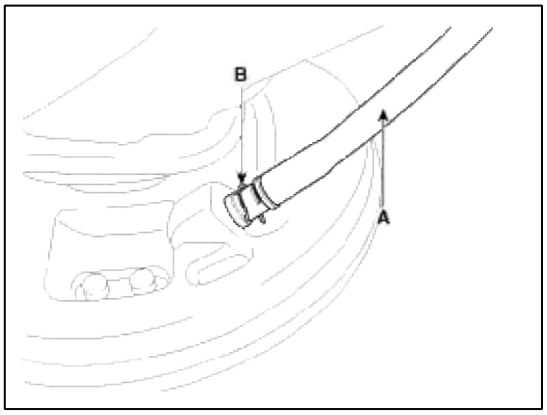
NOTE

Parking brake lever in the car must be in fully loosened position.

4. Remove the parking brake lever assembly after removing the bolts (A).



5. Raise the vehicle, and make sure it is securely supported.
6. Remove the rear tire and wheel.
7. Remove the parking brake cable from the brake shoe. (Refer to the rear drum brake)
8. Remove the parking brake cable (A), after removing the clip (B).

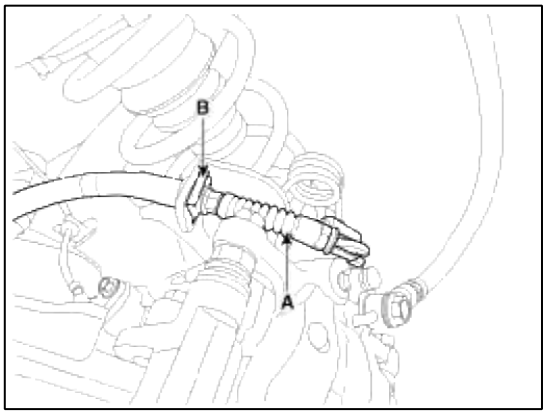


9. Loosen the parking brake cable bracket bolts and remove the parking brake cable.

Installation

Rear Disc Brake Type

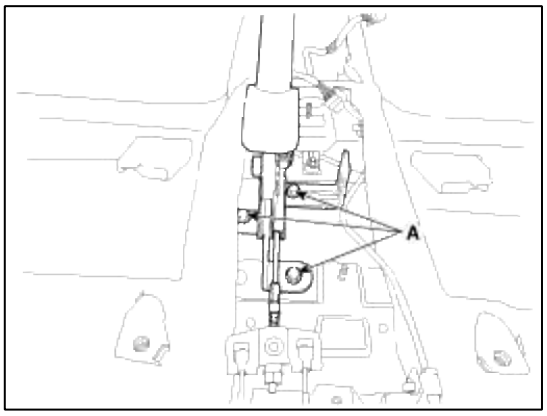
1. Install the parking brake cable.
2. Install the parking brake cable (A), and then install the clip (B).



3. Install the rear tire and wheel.

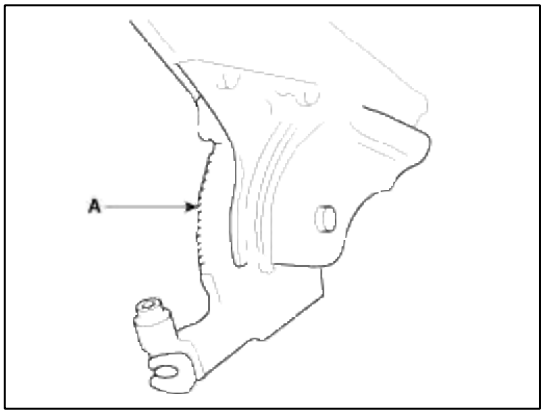
4. Install the parking brake lever assembly.

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



5. 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

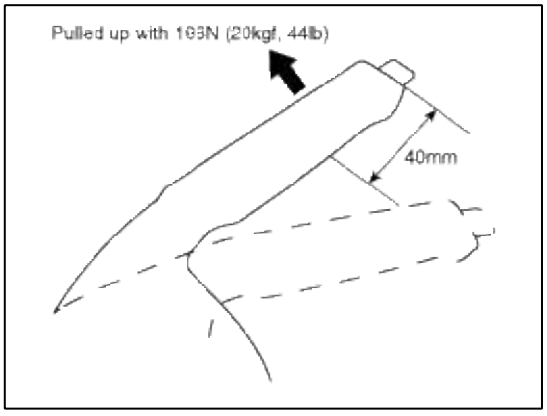


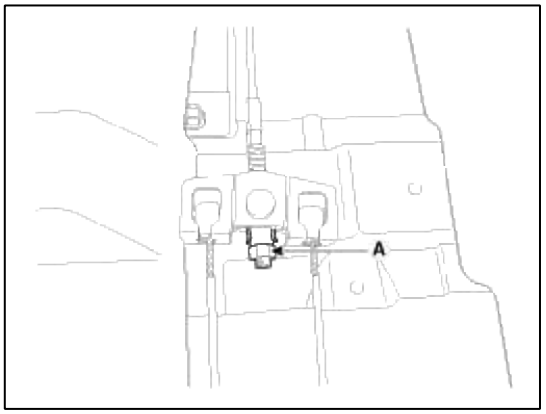
6. Install the parking brake cable adjuster, then adjust the parking brake lever stroke by turning adjusting nut (A).

Parking brake lever stroke:
5 ~ 7 clicks (Pull the lever with 196N (20 kgf, 44 lbf))

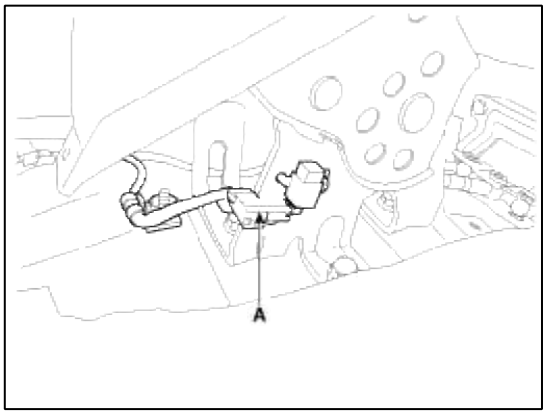
NOTE

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")





7. Release the parking brake lever fully, and check that parking brakes do not drag when the rear wheels are turned. Readjust if necessary.
8. Make sure that the parking brakes are fully applied when the parking brake lever is pulled up fully.
9. Reconnect the connector (A) of parking brake switch.



NOTE

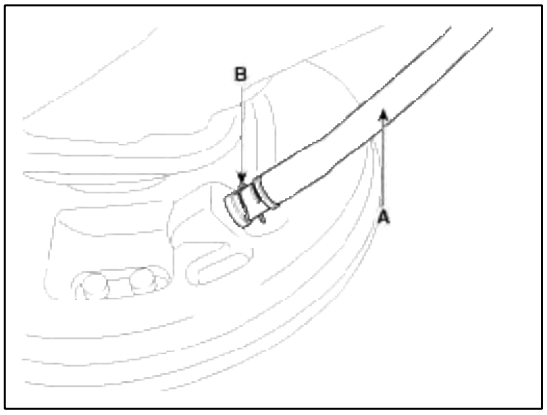
Inspect the continuity of parking brake switch.

When the brake lever is pulled: continuity
When the brake lever is released: no continuity

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

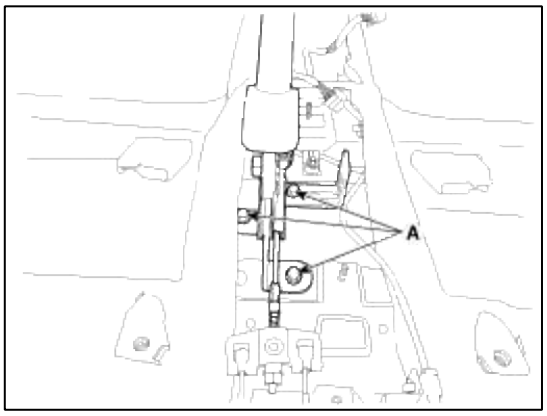
Rear Drum Brake Type

1. Install the parking brake cable.
2. Install the parking brake cable (A), and then install the clip (B).



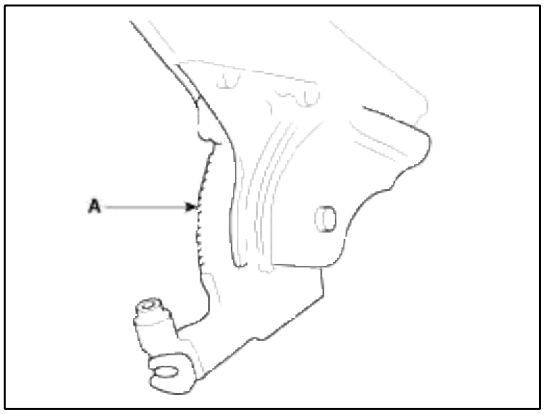
3. Remove the brake shoe.
   (Refer to the rear drum brake)

4. Install the rear tire and wheel.
5. Install the parking brake lever assembly.



6. 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

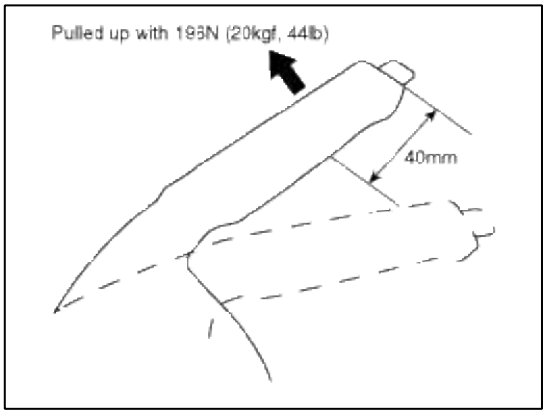


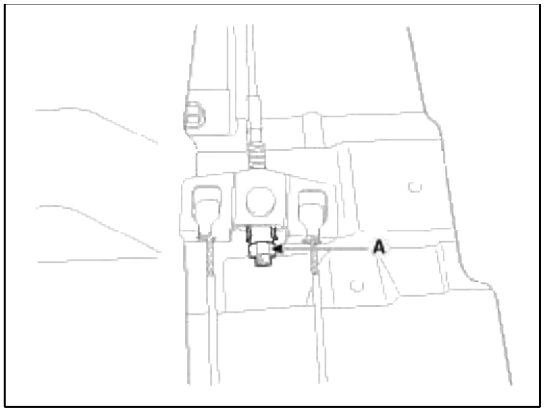
7. Install the parking brake cable adjuster, then adjust the parking brake lever stroke by turning adjusting nut (A).

Parking brake lever stroke:
5 ~ 7 clicks (Pull the lever with 196N (20 kgf, 44 lbf))

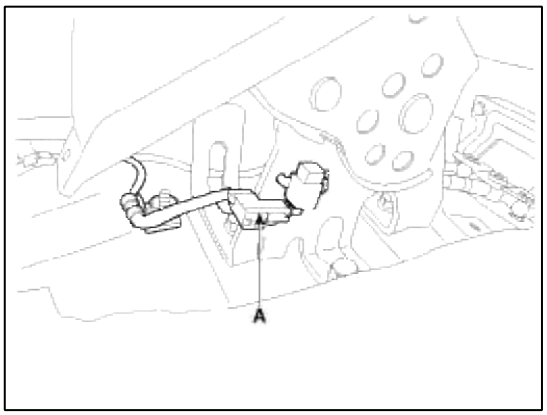
NOTE

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")





8. Release the parking brake lever fully, and check that parking brakes do not drag when the rear wheels are turned. Readjust if necessary.
9. Make sure that the parking brakes are fully applied when the parking brake lever is pulled up fully.
10. Reconnect the connector (A) of parking brake switch.



NOTE

Inspect the continuity of parking brake switch.

When the brake lever is pulled: continuity
When the brake lever is released: no continuity

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

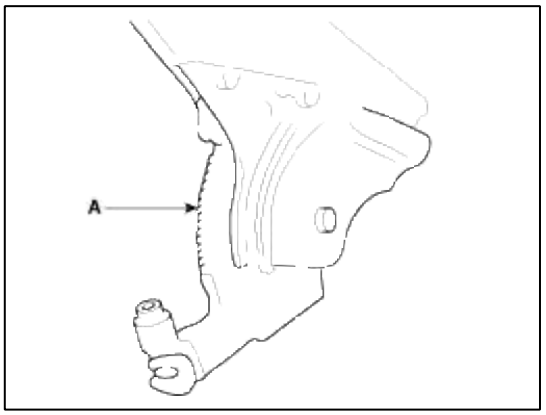
Adjustment

Parking Brake Lever Stroke Adjustment

1. Remove the floor console.
(Refer to Body group - "Floor console")

2. Apply a coating of the specified grease to each sliding parts (A) of the ratchet plate or the ratchet pawl.

Specified grease:
Multi purpose grease SAE J310, NLGI No.2

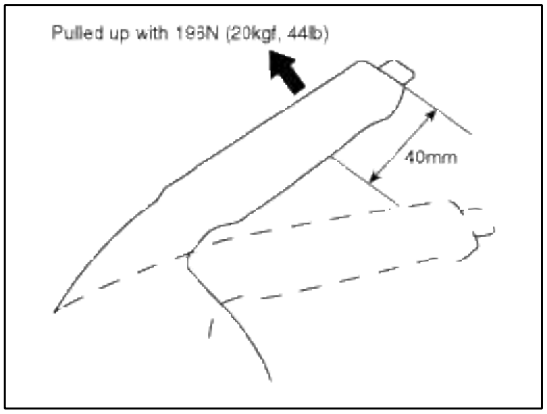


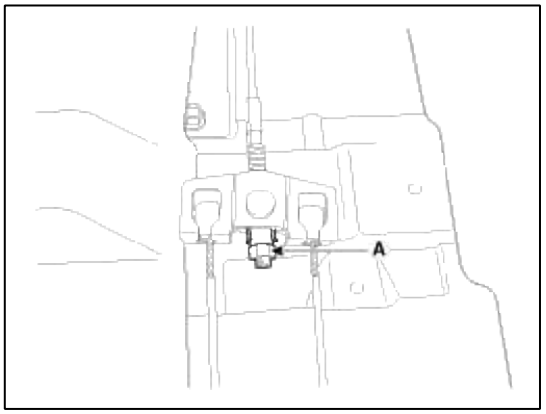
3. Install the parking brake cable adjuster, then adjust the parking brake lever stroke by turning adjusting nut (A).

Parking brake lever stroke:
5 ~ 7 clicks (Pull the lever with 196N (20 kgf, 44 lbf))

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

Parking Brake Shoe Clearance Adjustment

Rear Drum Brake Type

1. Depress the brake pedal several times to set the self-adjusting brake.

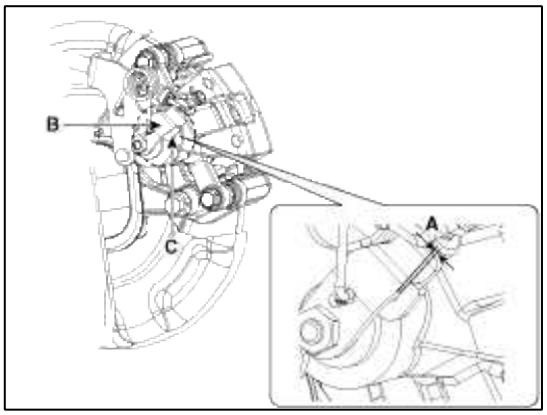
> NOTE
>
> For Drum Brake type, shoe clearance is automatically adjusted by the adjuster and adjusting lever.

Rear Disc Brake Type

> NOTE
>
> Re-setting of the parking brake is necessary after overhauling the caliper body, or if the brake calipers, housing, parking brake cable or brake discs have been changed.

1. Remove the floor console to reach the adjusting nut.
2. Loosen the parking brake cable until both operating levers rest in fully off position.
3. Bring the brake pads in their operating position by pressing the brake pedal down several times until there is resistance.
4. Tension the parking brake cable by tightening the adjusting nut, until the operating levers on both calipers lift from the stop, up to a distance of (A) between operating lever (B) and stopper (C).

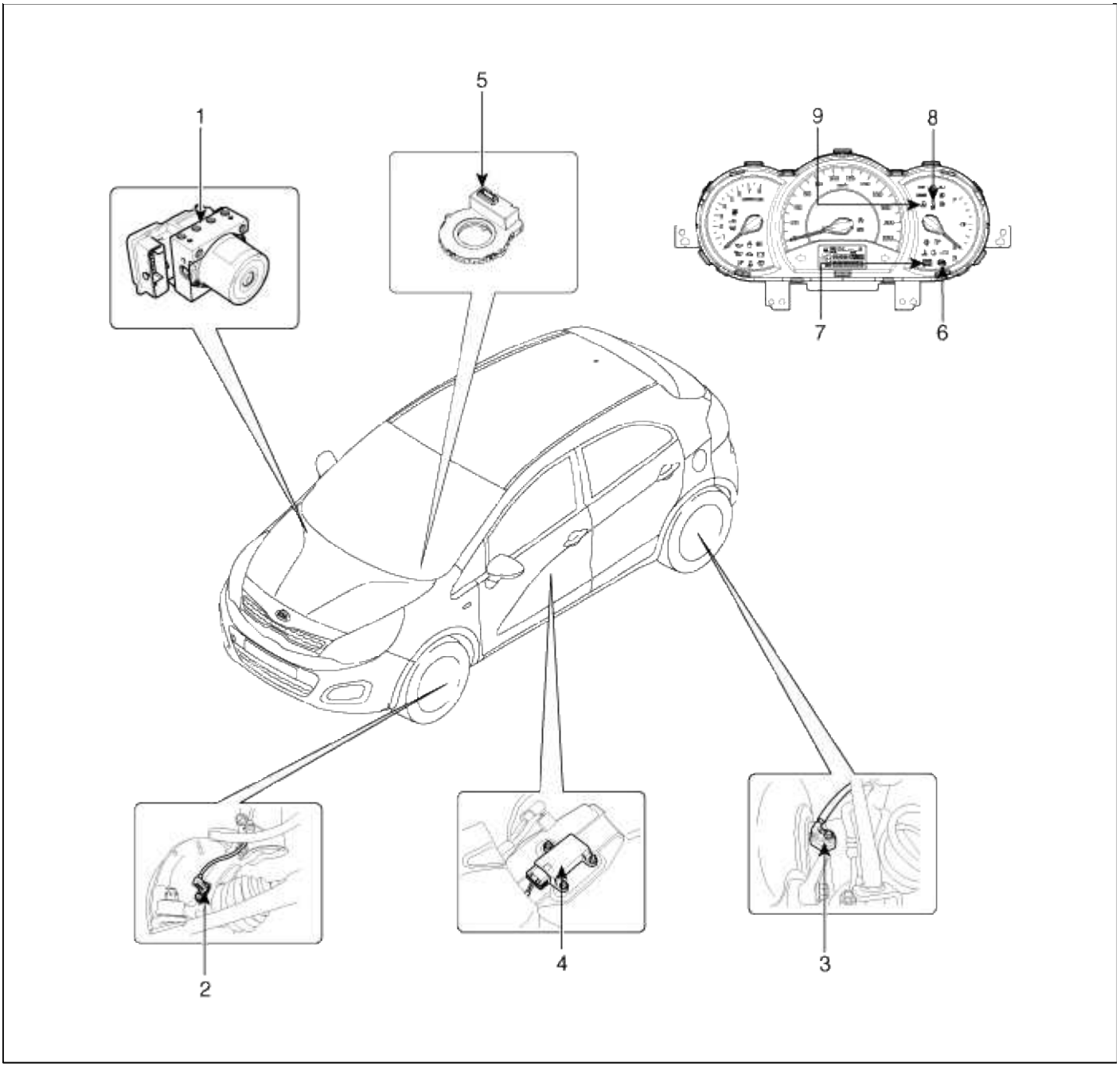
Distance (A): Max. 1.5 mm (0.06 in)



5. Parking brake lever in the car must be in fully loosened position.
6. If the handbrake cables where changed, actuate the parking brake a few times with maximum force to stretch the parking brake cables, and then control adjusting as above.
7. Check the wheels of their free operation.
8. Install the floor console.
9. Test drive.

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

Components



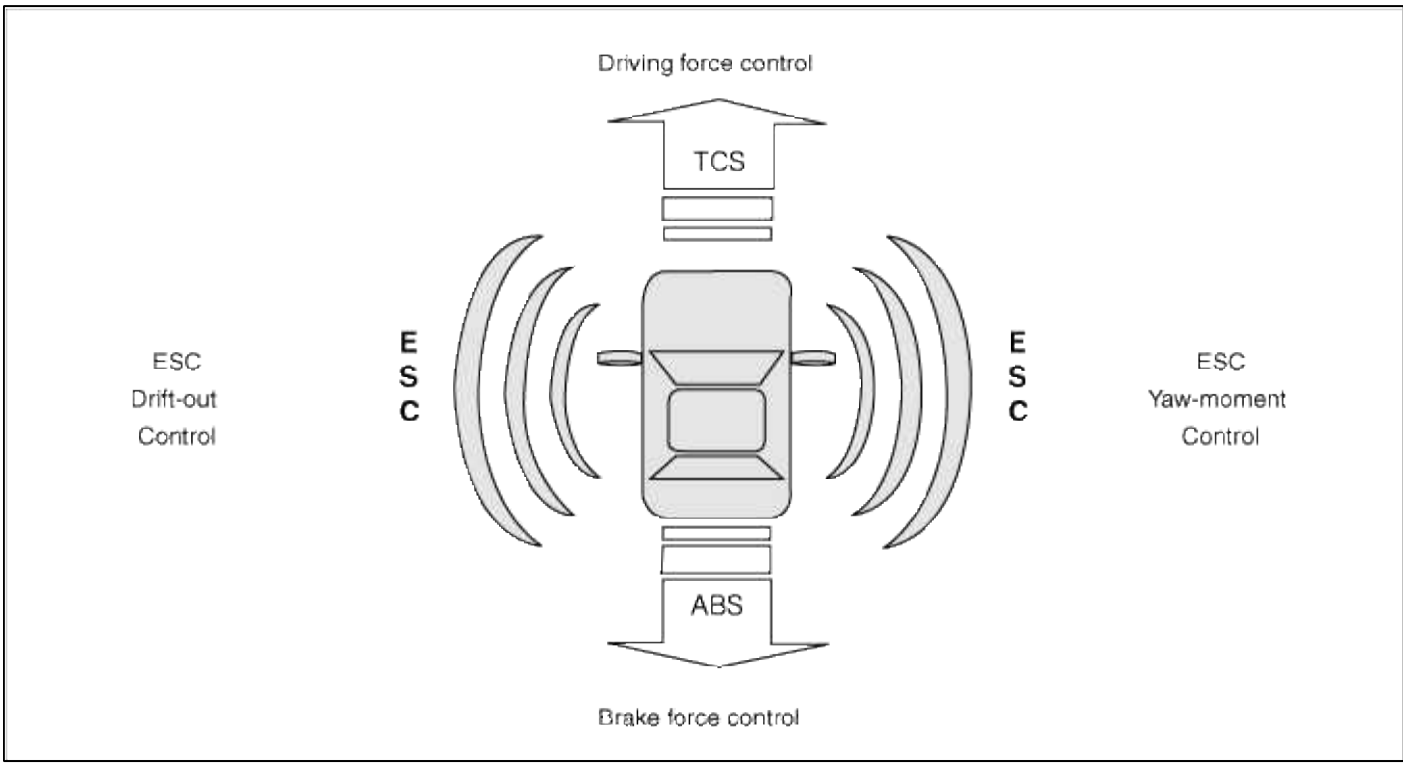
1. HECU module	6. ABS Warning lamp
2. Front wheel speed sensor	7. Parking brake/EBD warning lamp
3. Rear wheel speed sensor	8. ESC OFF lamp
4. Yaw rate & G sensor	9. ESC Function/Warning lamp
5. Steering angle sensor	

Brake System > ESC(Electronic Stability Control) System > Description and Operation

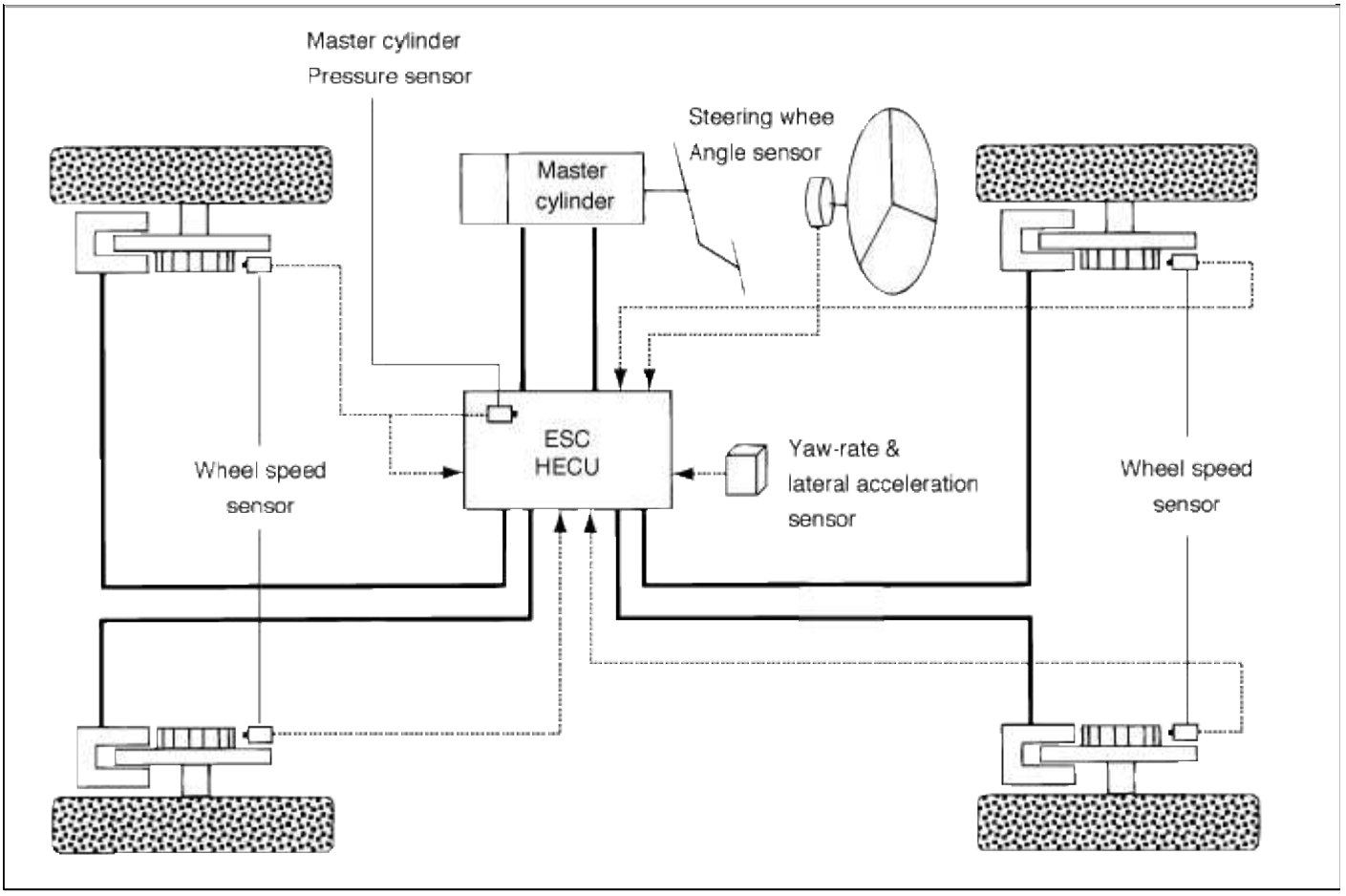
Description of ESC

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.

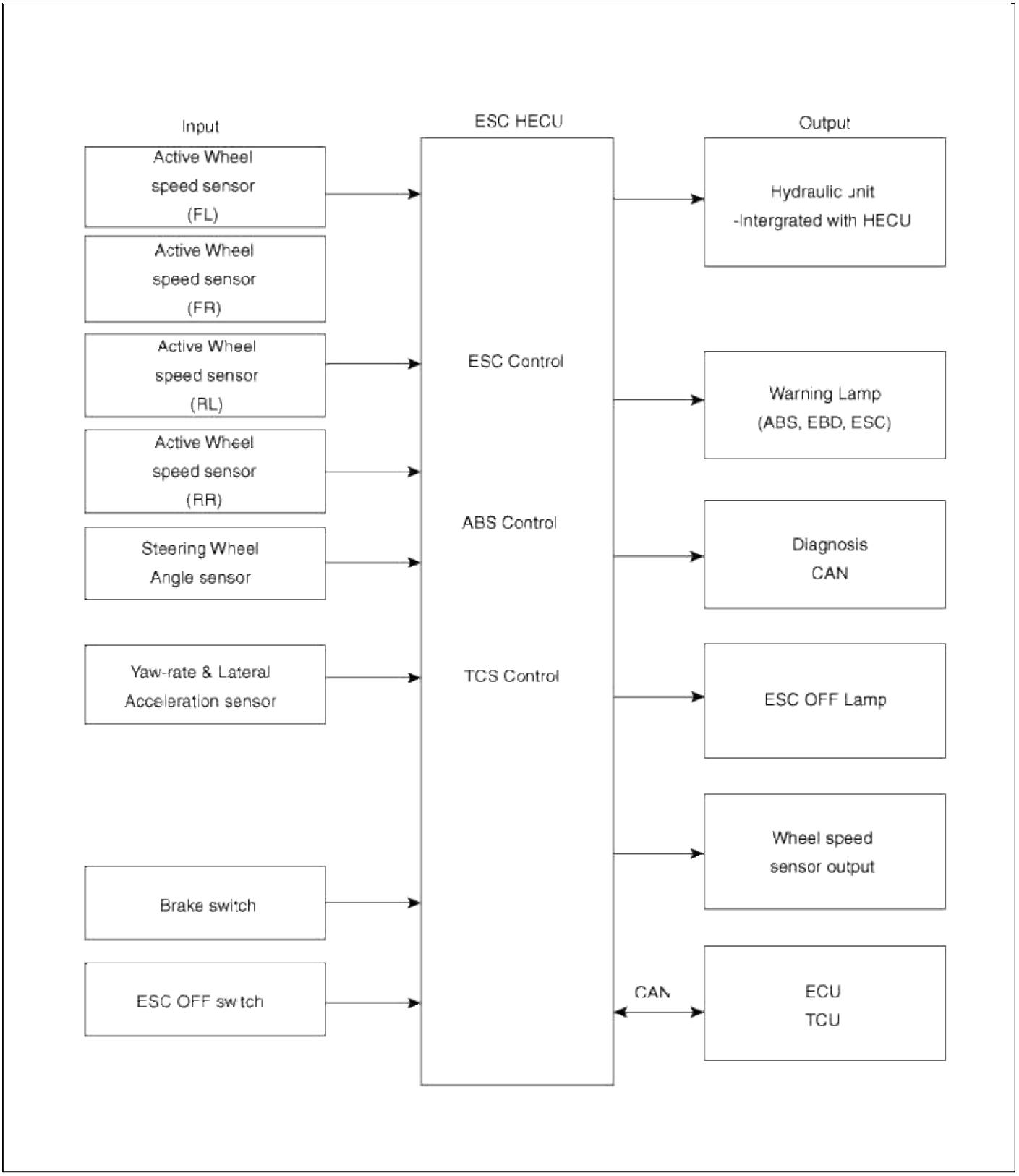
This is achieved by wheel individual brake intervention and adaptation of the momentary engine torque with no need for any action to be taken by the driver.
ESC essentially consists of three assemblies : the sensors, the electronic control unit and the actuators.
The stability control feature works under 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)

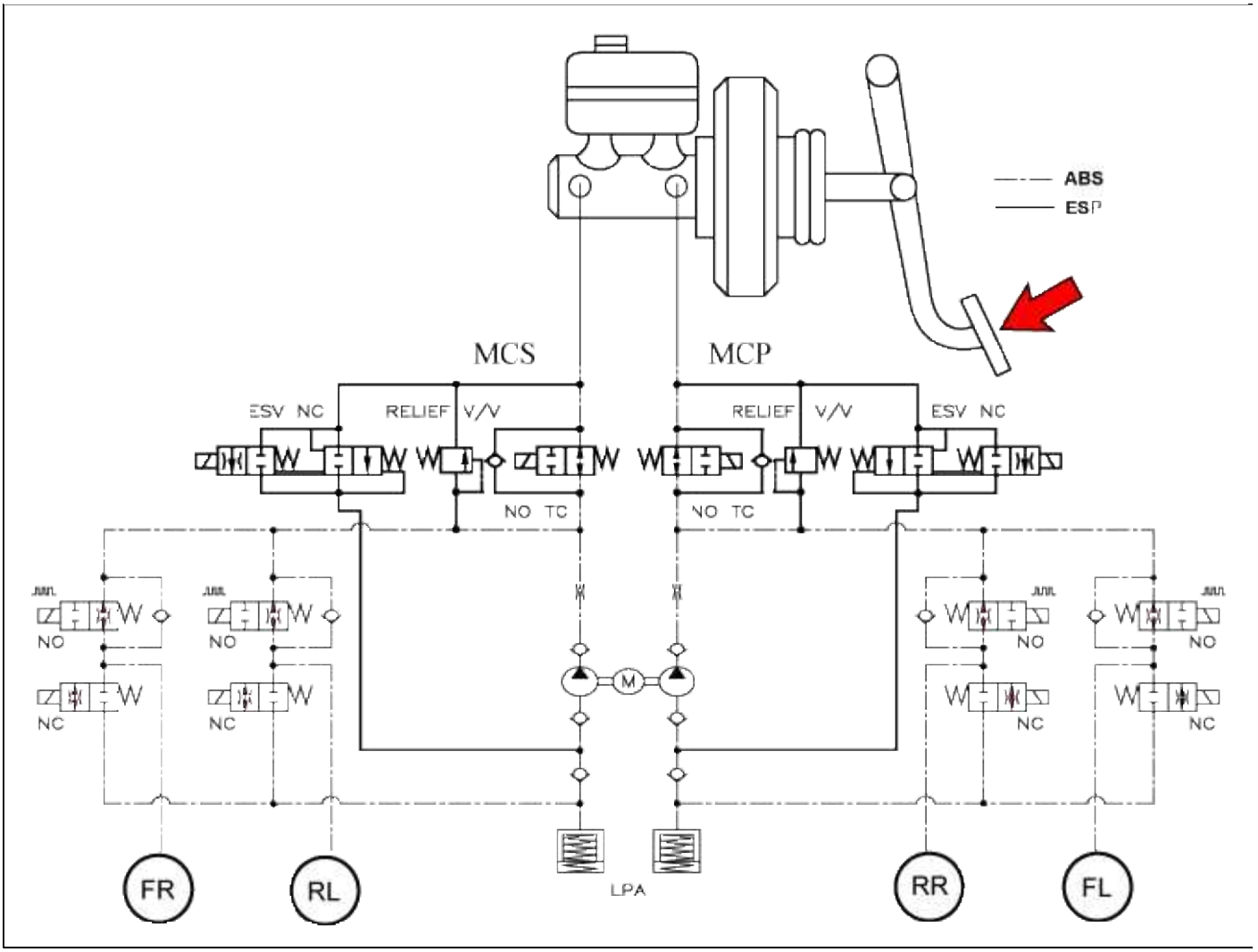


Input and Output Diagram



ESC Operation Mode

ESC Hydraulic System Diagram

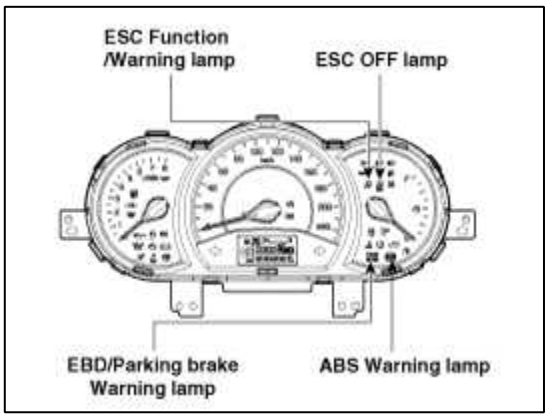


1. ESC Non-operation : Normal braking.

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/warning lamp (ESC system)

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

The ESC function/warning 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)

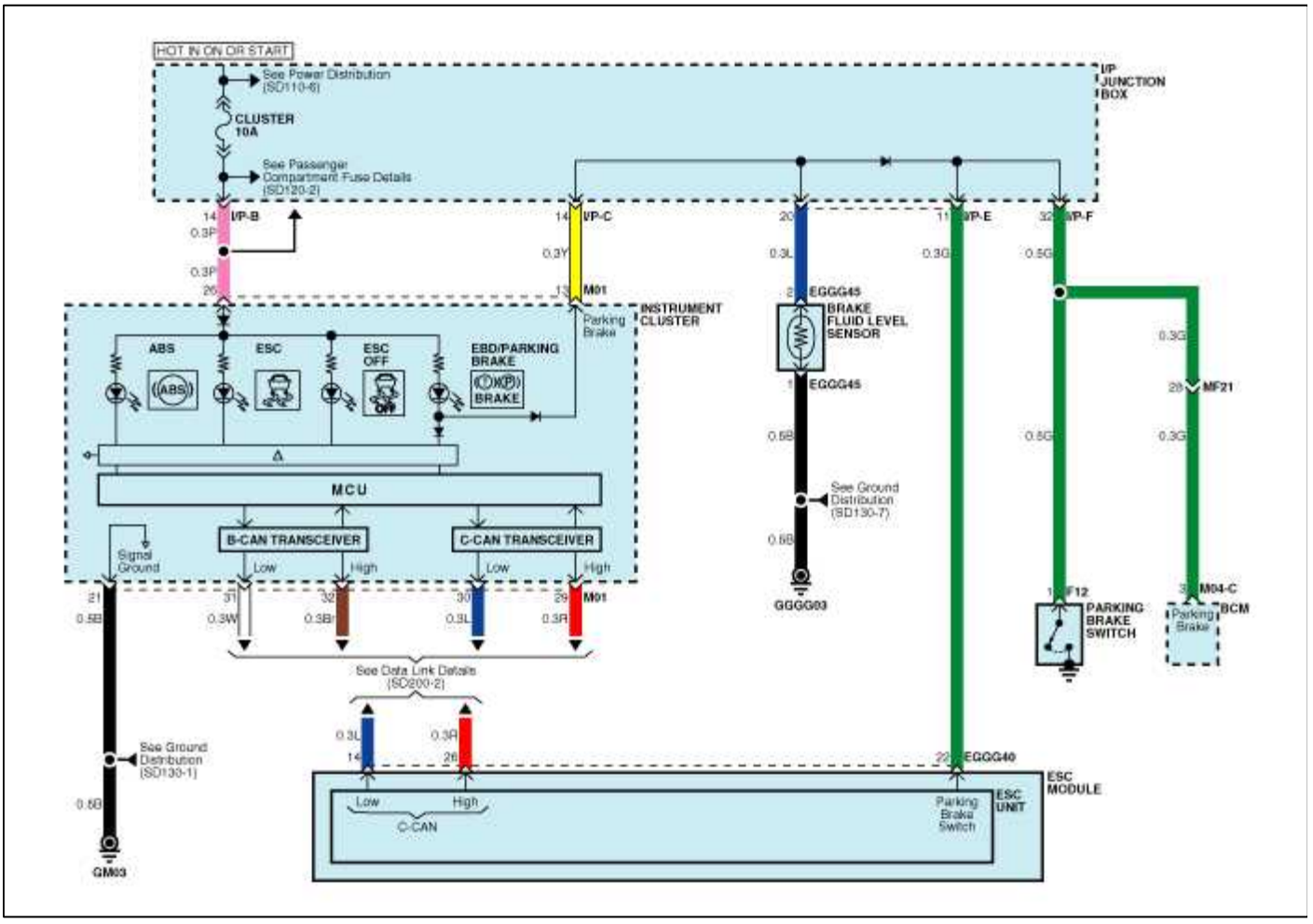
The ESC Off lamp indicates the self-test and operating status of the ESC.
The ESC Off lamp operates under the following conditions :

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

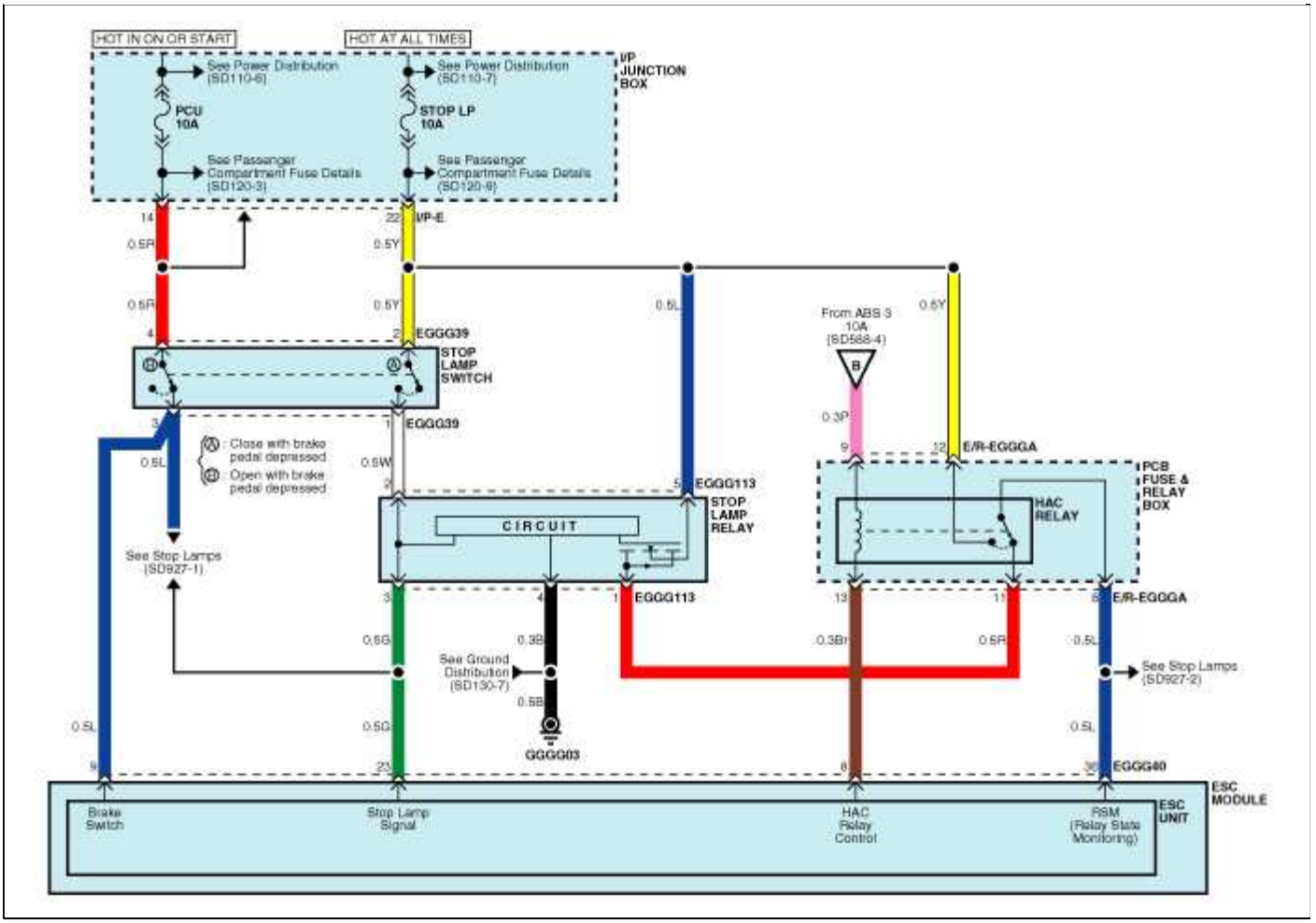
ESC On/Off Switch (ESC system)
The ESC On/Off Switch shall be used to toggle the ESC function between On/Off states based upon driver input. The On/Off switch shall be a normally open, momentary contact switch. Closed contacts switch the circuit to ignition.
Initial status of the ESC function is on and switch toggle the state.

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

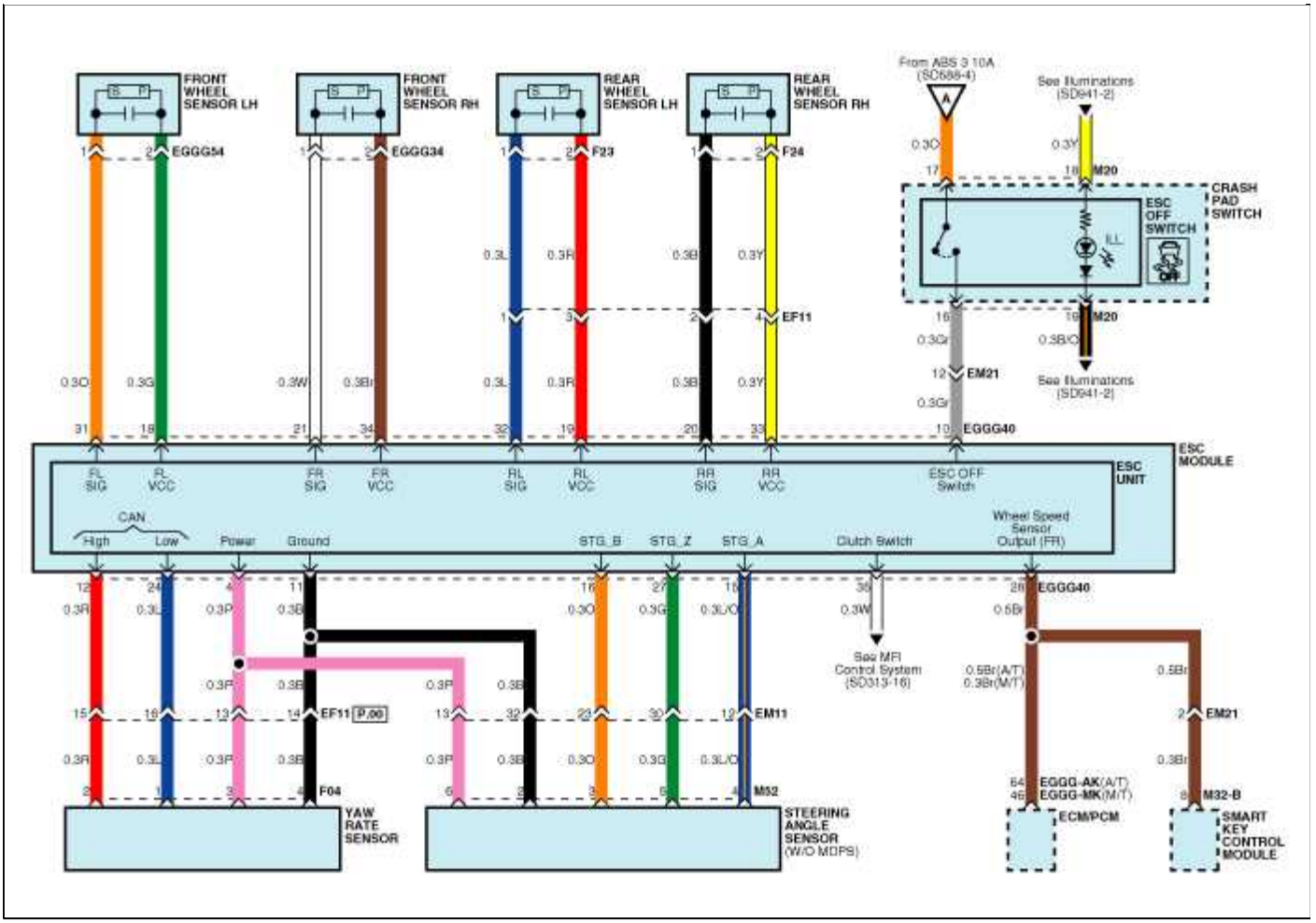
Circuit Diagram - ESC (1)



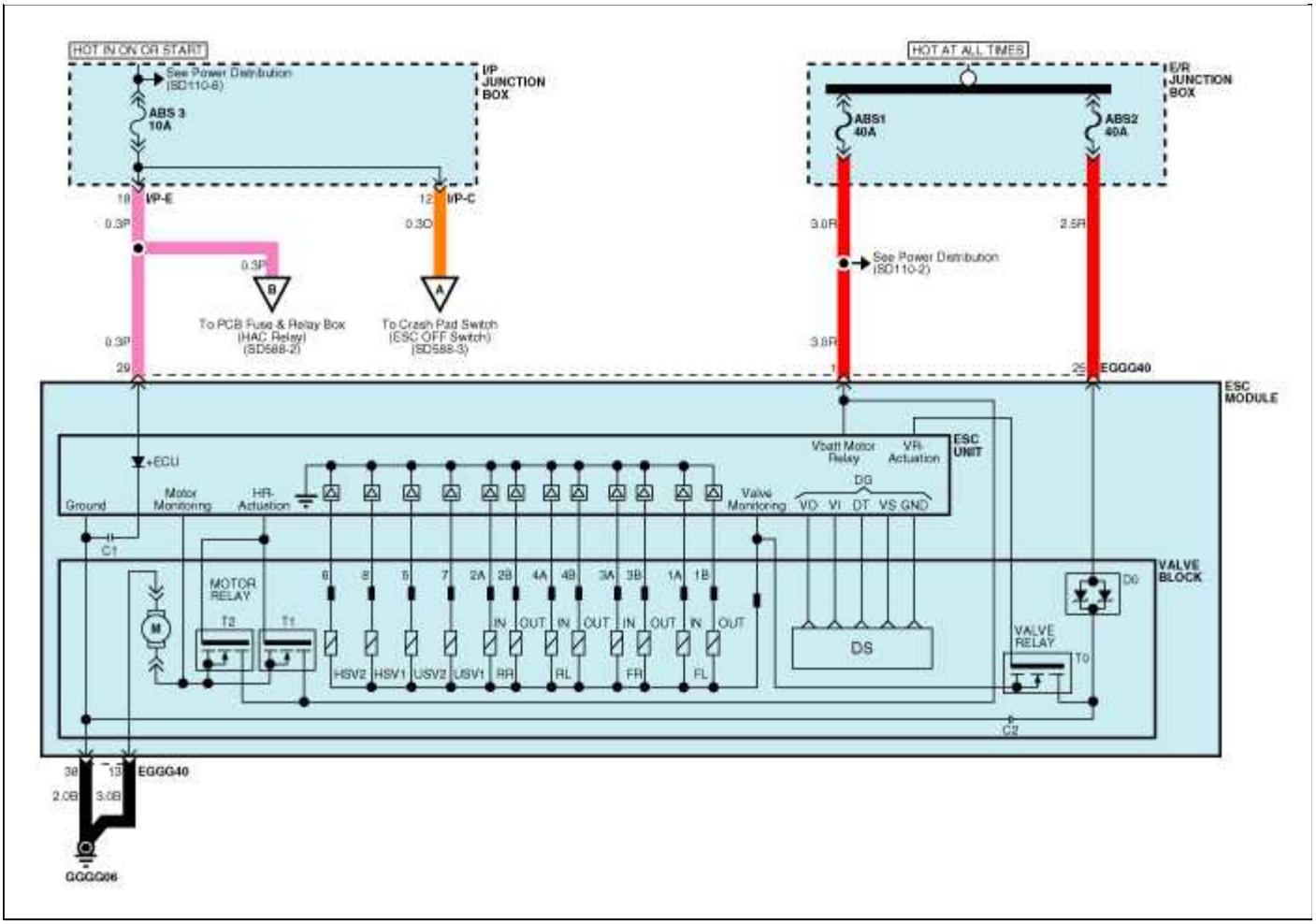
Circuit Diagram - ESC (2)



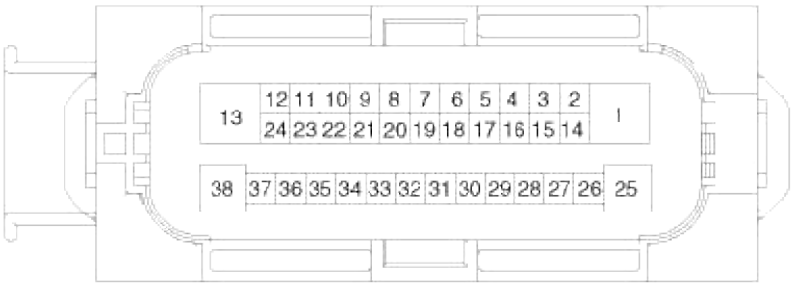
Circuit Diagram - ESC (3)



Circuit Diagram - ESC (4)



ESC connector input/output



Connector Terminal		Specification	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	
		Over voltage range : 17.0 ± 0.5V Operating voltage range :	

25	POS. BATTERY 1.(SOLENOID)	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 < 2.0V Input voltage (High) : V > 6.0V Max. Input current : I < 3mA (@12.8V)	
10	ESC ON/OFF SWITCH		
9	BRAKE SWITCH		
22	PARKING BRAKE SWITCH	Input voltage (Low) : V < 2.0V Input voltage (High) : V > 6.0V Max input current : I < 5mA (@12.8V)	
35	CLUTCH SWITCH		
28	SENSOR FRONT RIGHT OUTPUT	External pull up resistance :1 KΩ < R Output duty : 50 ± 20%	
14	CAN BUS LINE(LOW)	Max. Input current : I < 10mA	
26	CAN BUS LINE(HIGH)		
18	SENSOR FRONT LEFT POWER	Output voltage : V_BAT1 -0.6V ~ V_BAT1 -1.1V Output current : Max 30mA	
34	SENSOR FRONT RIGHT POWER		
19	SENSOR REAR LEFT POWER		
33	SENSOR REAR RIGHT POWER		
31	SENSOR FRONT LEFT SIGNAL	Input current LOW : 5.9 ~ 8.4mA Input current HIGH : 11.8 ~ 16.8mA Frequency range : 1 ~ 2,500Hz Input duty : 50 ± 10%	
21	SENSOR FRONT RIGHT SIGNAL		
32	SENSOR REAR LEFT SIGNAL		
20	SENSOR REAR RIGHT SIGNAL		
12	CAN SENSOR LINE (HIGH)	Max. input current : I < 10mA	
24	CAN SENSOR LINE (LOW)		
8	HAC RELAY DRIVE	Max. current : I < 180mA Max output voltage : V< 1.2V	

36	HAC RELAY STATE MONITORING	Input voltage (Low) : V < 2V Input voltage (High) : V > 6V Max input current : I < 10mA (@12.8V)	
11	STEERING ANGLE SENSOR PHASE A	Input duty (STG A, STG B) : 50 ± 10% Phase Difference (STG A, STG B) : 2 ± 0.6 deg High voltage : 3.0V < V_H < 4.1V Low voltage : 1.3V < V_L < 2.0V	without MDPS
1	STEERING ANGLE SENSOR PHASE B		
27	STEERING ANGLE SENSOR PHASE Z		

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

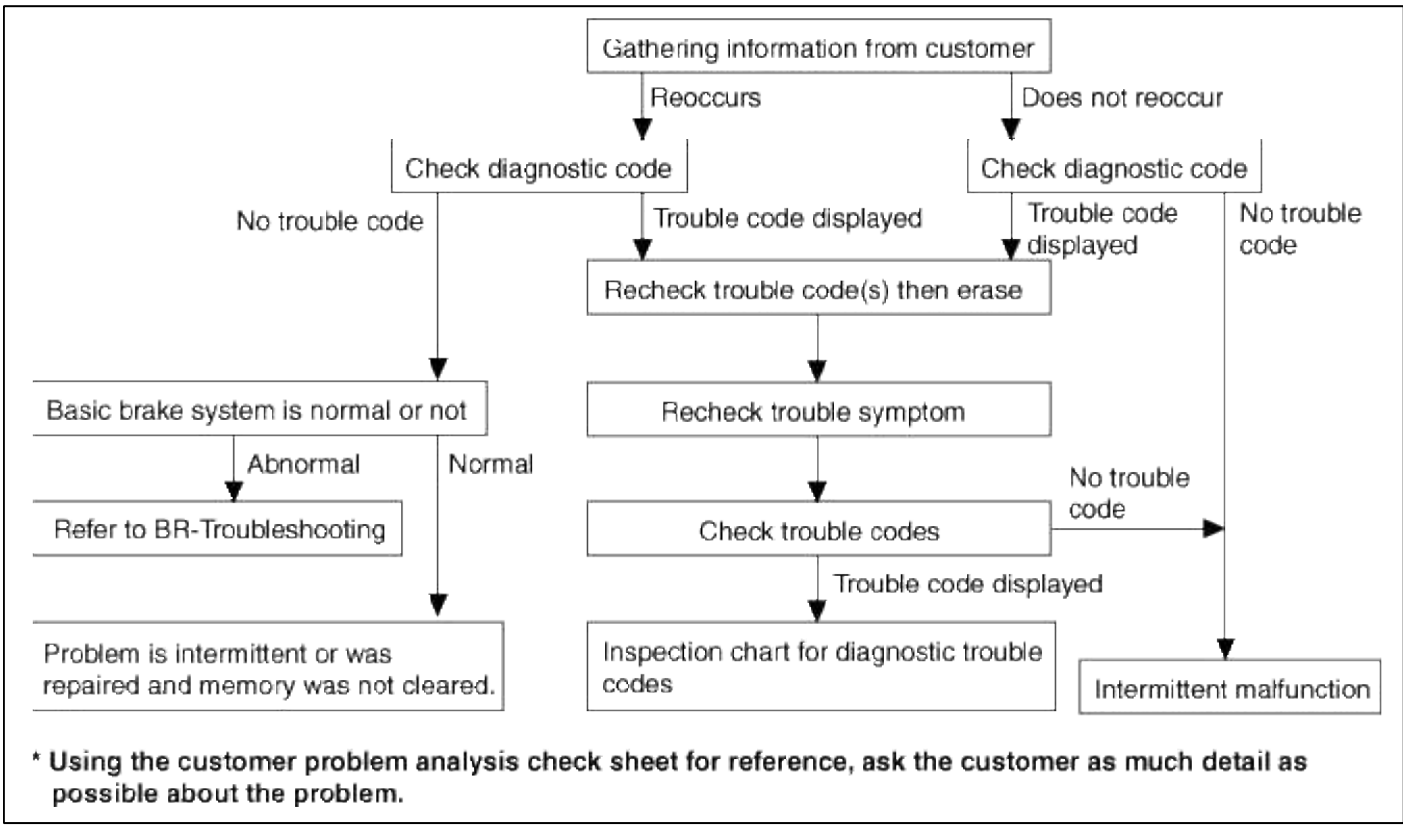
1. Turn the system down and perform the following actions and wait for HECU power OFF.
2. Turn the valve relay off.
3. Stop the control during the operation and do not execute any until the normal condition recovers.

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 occured, 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	1. Sound of the motor inside the ABS hydraulic unit operation (whine). 2. Sound is generated along with vibration of the brake pedal (scraping). 3. When ABS operates, sound is generated from the vehicle chassis due to repeated brake application and release (Thump : suspension; squeak: tires)
ABS operation (Long braking distance)	For road surfaces such as snow-covered and gravel roads, the braking distance for vehicles with ABS can sometimes be longer than that for other vehicles. Accordingly, advise the customer to drive safely on such roads by lowering the vehicle speed.
Diagnosis detection conditions can vary depending on the diagnosis code. When checking the trouble symptom after the diagnosis code has been erased, ensure that the requirements listed in "Comment" are met.	

ABS Check Sheet

ABS Check Sheet

Inspector's Name

Customer's Name		Registration No.	
		Registration Year	/ /
		VIN.	
Date Vehicle Brought In	/ /	Odometer	Km Miles

Date the Problem First Occurred	/ /
Frequency of Occurence of Problem	☐ Continuous ☐ Intermittent (times a day)

Symptoms	☐ ABS does not operate.	
	☐ ABS does not operate efficiently.	☐ Intermittent (times a day)
	ABS Warning Light Abnormal	☐ Remains ON ☐ Does not light up

Diagnostic Trouble Code Check	1st Time	☐ Normal Code	☐ Malfunction Code (Code)
	2nd Time	☐ Normal Code	☐ Malfunction Code (Code)

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, replace the ESC control module.	- Faulty power source circuit - Faulty wheel speed sensor circuit - Faulty hydraulic circuit for leakage - Faulty HECU

Inspection procedures

DTC Inspection

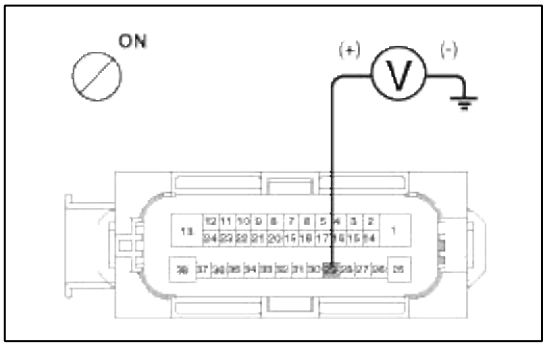
1. Connect the GDS with the data link connector and turn the ignition switch ON.
2. Verify that the DTC code is output.
3. Is the DTC code output?

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

Specification: approximately B+

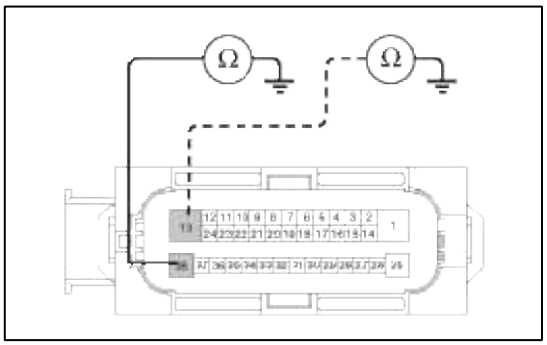


3. Is the voltage within specification?

YES	Check the ground circuit.
NO	Check the harness or connector between the fuse (10A) in the engine compartment junction block and the ESC control module. Repair if necessary.

Check the ground circuit

1. Disconnect the connector from the ESC control module.
2. Check for continuity between terminals 13, 38 of the ESC 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 ESC control module.
NO	Repair the hydraulic lines for leakage.

ABS Does Not Opterate (Intermittently).

Detecting condition

Trouble Symptoms	Possible Cause
Brake operation varies depending on driving conditions and road surface conditions, so diagnosis can be difficult. However if a normal DTC is displayed, check the following probable cause. When the problem is still occurring, replace the ESC 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 DTC code is output.
3. Is the DTC 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?

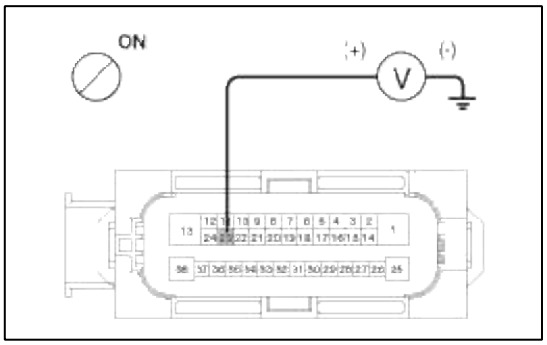
YES	Check the stop lamp switch circuit.
NO	Repair or replace the wheel speed sensor.

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 ESC 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 ESC 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 ESC control module.
NO	Repair the hydraulic lines for leakage.

Communication with GDS is not possible.
(Communication with any system in not possible.)

Detecting condition

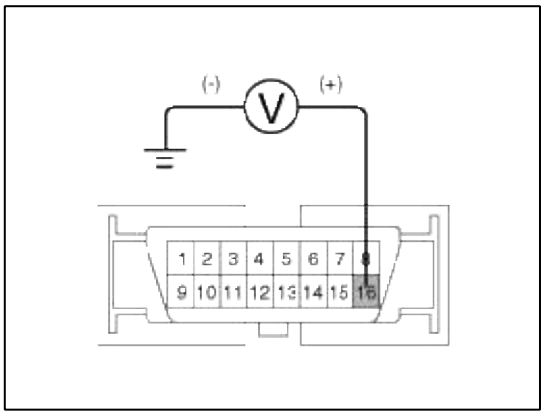
Trouble Symptoms	Possible Cause
Possible defect in the power supply system (including ground) for the diagnosis line.	- An open in the wire - Poor ground - Faulty power source circuit

Inspection procedures

Check The Power Supply Circuit For The Diagnosis

1. Measure the voltage between terminal 16 of the data link connector and body ground.

Specification : approximately B+

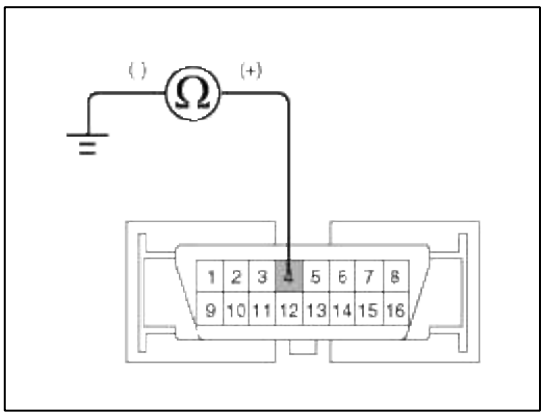


2. Is voltage within specification?

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

Check the ground circuit for the diagnosis

1. Check for continuity between terminal 4 of the data link connector and body ground.



2. Is there continuity?

NO	Repair an open in the wire between terminal 4 of the data link connector and ground point.

Communication with GDS is not possible.
(Communication with ABS only is not possible.)

Detecting condition

Trouble Symptoms	Possible Cause
When communication with GDS is not possible, the cause may be probably an open in the HECU power circuit or an open in the diagnosis output circuit.	- An open in the wire - Faulty HECU - Faulty power source circuit

Inspection procedures

Check for Continuity in the CAN Line

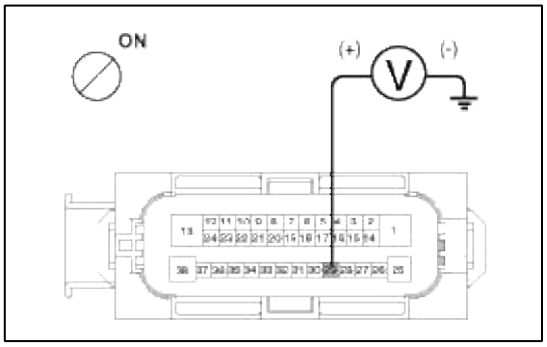
1. Disconnect the connector from the ESC control module.
2. Check for continuity between terminals 26, 14 of the ESC control module connector and 6, 14 of the data link connector.
3. Is there continuity?

YES	Check the power source of ESC control module.
NO	Repair an open in the wire.

Check the power source of ESC control module

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

Specification : approximately B+

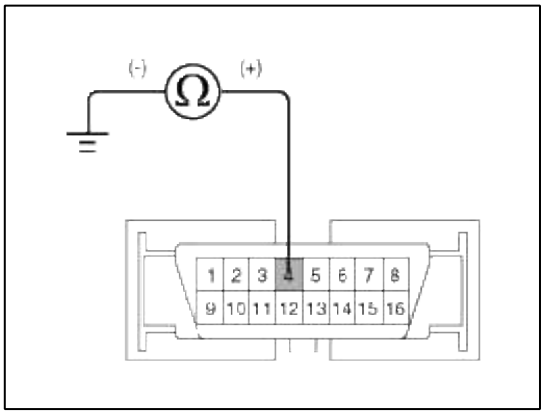


3. Is voltage within specification?

YES	Check for poor ground.
NO	Check the harness or connector between the fuse (10A) in the engine compartment junction block and the ESC control module.Repair if necessary.

Check for poor ground

1. Check for continuity between terminal 4 of the data link connector and ground point.



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

When Ignition Key Is Turned ON (engine OFF), The ABS Warning Lamp Does Not Light Up.

Detecting condition

Trouble Symptoms	Possible Cause
When current flows in the HECU the ABS warning lamp turns from ON to OFF as the initial check. Therefore if the lamp does not light up, the cause may be an open in the lamp power supply circuit, a blown bulb, an open in the both circuits between the ABS warning lamp and the HECU, and the faulty HECU.	- Faulty ABS warning lamp bulb - Blown fuse is related to ABS in the engine compartment junction block - Faulty ABS warning lamp module - Faulty HECU

Inspection procedures

Problem verification

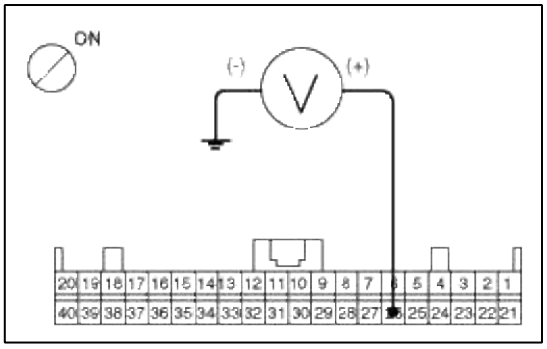
1. Disconnect the connector from the ESC control module and turn the ignition switch ON.
2. Does the ABS warning lamp light up?

YES	Inspectagain after replacing the ESC HECU.
NO	Check the power source for the ABS warning lamp.

Check the power source for the ABS warning lamp

1. Disconnect the instrument cluster connector (M01) and turn the ignition switch ON.
2. Measure the voltage between terminal (M01) 26 of the cluster harness side connector and body ground.

Specification : approximately B+



3. Is voltage within specification?

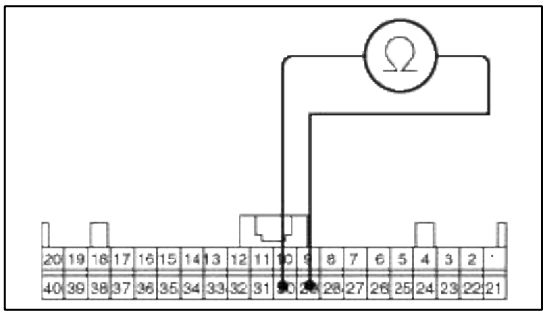
YES	Check the CAN circuit resistance for ABS warning lamp.
NO	Check for blown fuse.

Check the CAN circuit resistance for ABS warning lamp

1. Disconnect the instrument cluster connector (M01) and turn the ignition switch OFF.

2. Measure the resistance between terminal (M01) 29 and 30 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. Disconnect the instrument cluster connector (M01) and ESC HECU connector, and then turn the ignition switch OFF.
2. Check for continuity between terminal (M01) 29 of the cluster harness side connector and terminal 26 of ESC HECU harness side.
   Check for continuity between terminal (M01) 30 of the cluster harness side connector and terminal 14 of ESC HECU harness side.

Specification : Below 1Ω

3. Is resistance within specification?

YES	Repair short of wiring between terminal 26, 14 of ESC HECU harness connector and ABS warning lamp module.
NO	Repair open of wiring between terminal 26, 14 of ESC 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 while at the same time prohibiting ABS control. At this time, the HECU records a DTC in memory. Even though the normal code is output, the ABS warning lamp remains ON, then the cause may be probably an open or short in the ABS warning lamp circuit.	- An open in the wire - Faulty instrument cluster assembly - Faulty ABS warning lamp module - Faulty HECU

Inspection procedures

Check DTC Output

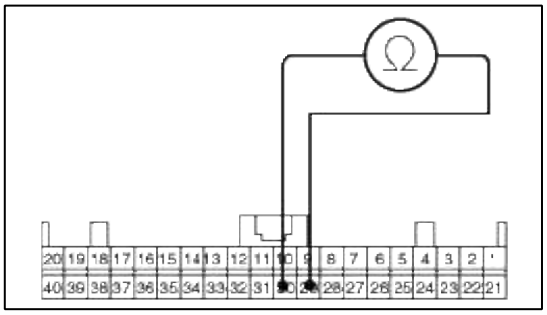
1. Connect the GDS to the 16P data link connector located behind the driver's side kick panel.
2. Check the DTC output using GDS.
3. Is DTC output?

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. Disconnect the instrument cluster connector (M01) and turn the ignition switch OFF.
2. Measure the resistance between terminal (M01) 29 and 30 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. Disconnect the instrument cluster connector (M01) and ESC HECU connector, and then turn the ignition switch OFF.
2. Check for continuity between terminal (M01) 29 of the cluster harness side connector and terminal 26 of ESC HECU harness side.
   Check for continuity between terminal (M01) 30 of the cluster harness side connector and terminal 14 of ESC HECU harness side.

Specification : Below 1Ω

3. Is resistance within specification?

YES	Repair short of wiring between terminal 26, 14 of ESC HECU harness connector and ABS warning lamp module.
NO	Repair open of wiring between terminal 26, 14 of ESC HECU harness connector and ABS warning lamp module.

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

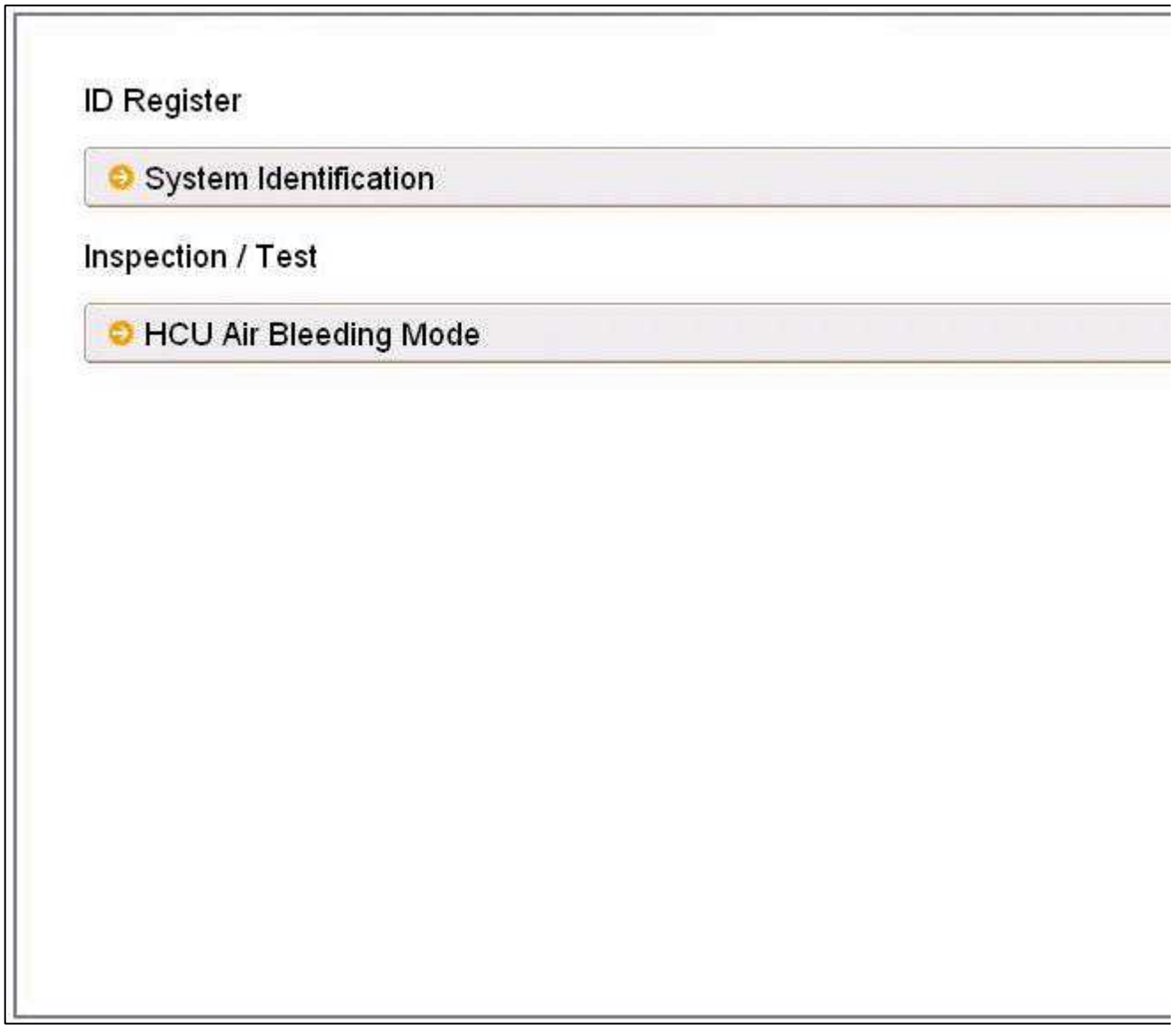
2. Connect a clear plastic tube to the wheel cylinder bleeder plug and insert the other end of the tube into a half filled clear plastic bottle.
3. Connect the GDS to the data link connector located underneath the dash panel.
4. Select and operate according to the instructions on the GDS screen.

> CAUTION
>
> You must obey the maximum operating time of the ABS motor with the GDS to prevent the motor pump from c

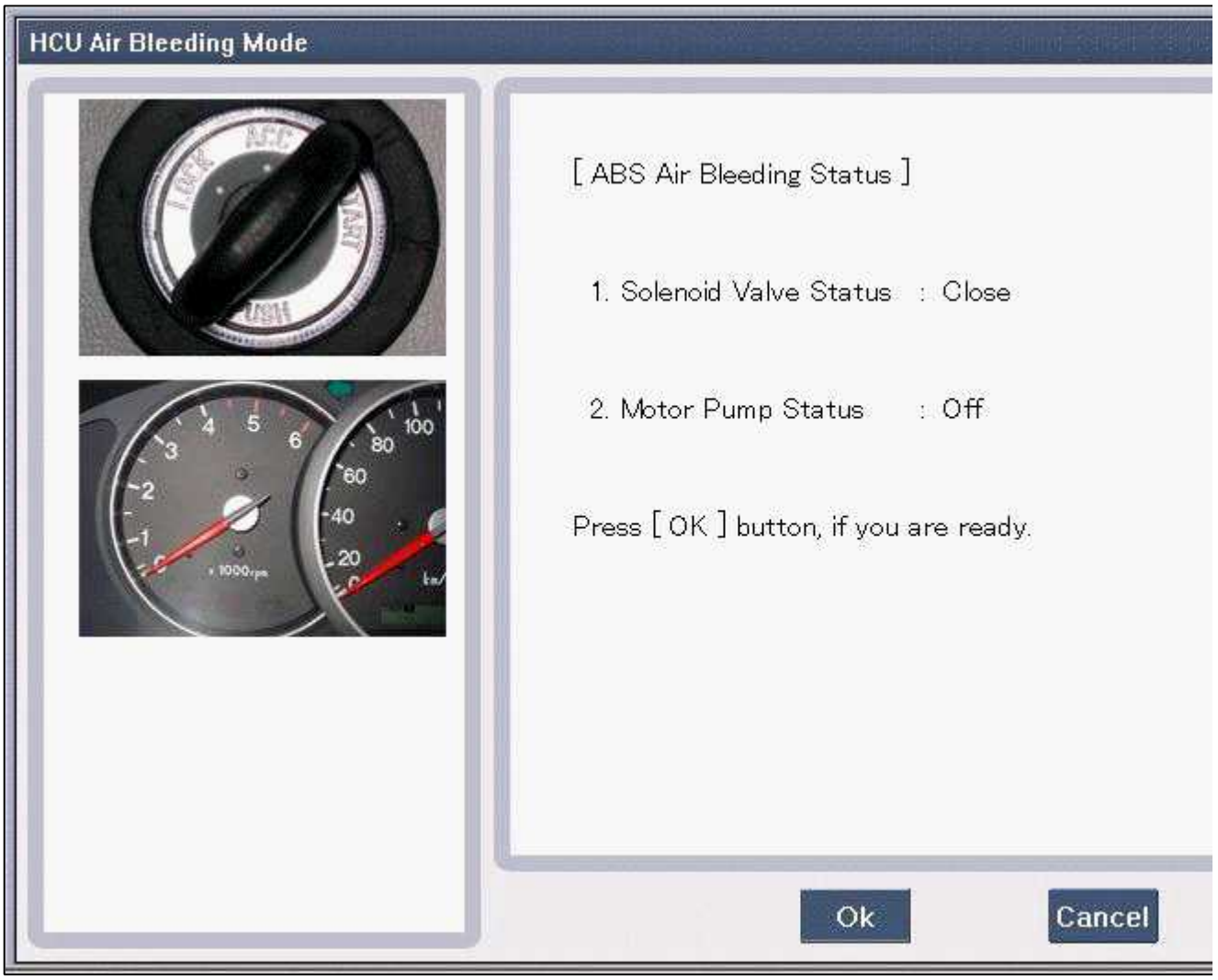
(1) Select vehicle name.

(2) Select Anti-Lock Brake system.

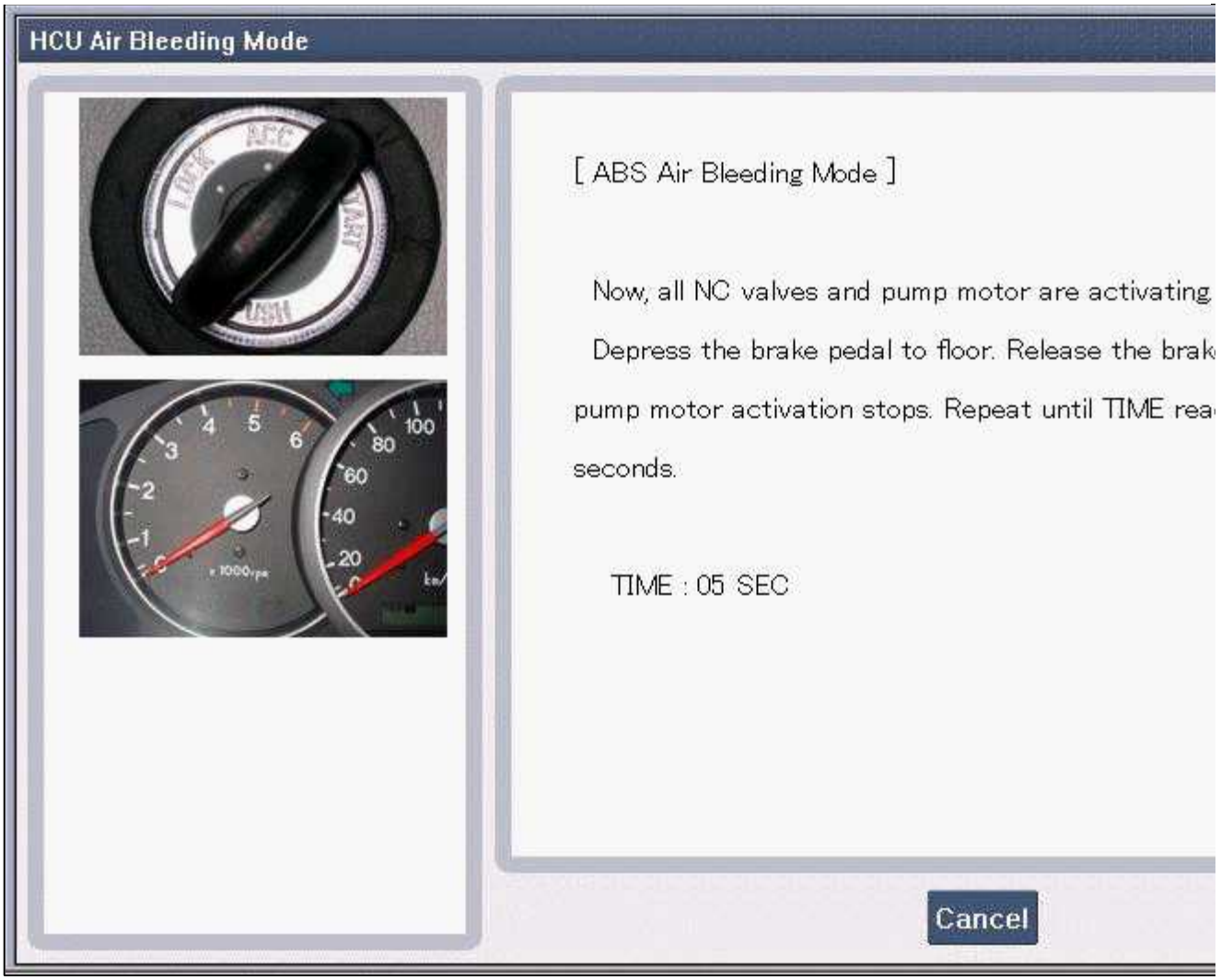
(3) Select HCU air bleeding mode.



(4) Press "OK" to operate motor pump and solenoid valve.



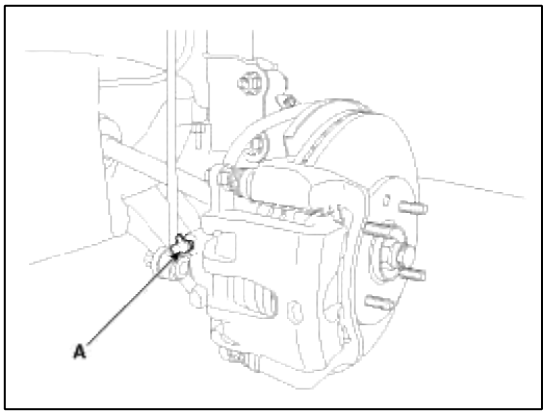
(5) Wait 60 sec. before operating the air bleeding.
(If not, you may damage the motor.)



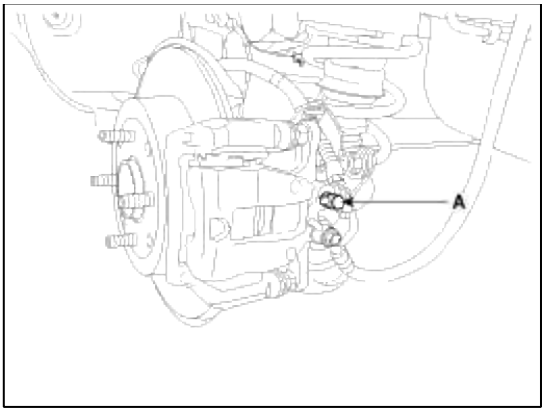
(6) Perform the air bleeding.

5. Pump the brake pedal several times, and then loosen the bleeder screw until fluid starts to run out without bubbles. Then close the bleeder screw (A).

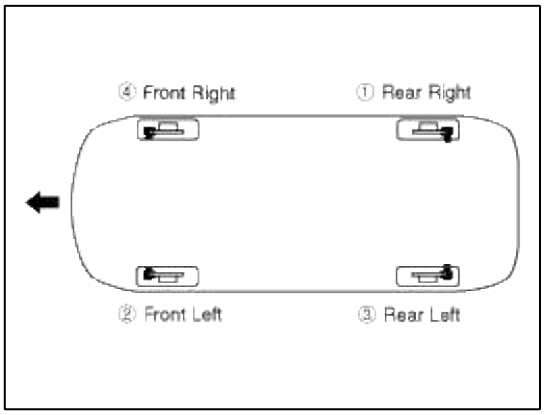
Front



Rear



6. Repeat step 5 until there are no more bubbles in the fluid for each wheel.



7. Tighten the bleeder screw.

Bleed screw tightening torque:
7 ~ 13 N.m (0.7 ~ 1.3 kgf.m, 5.4 ~ 9.5 lb-ft)

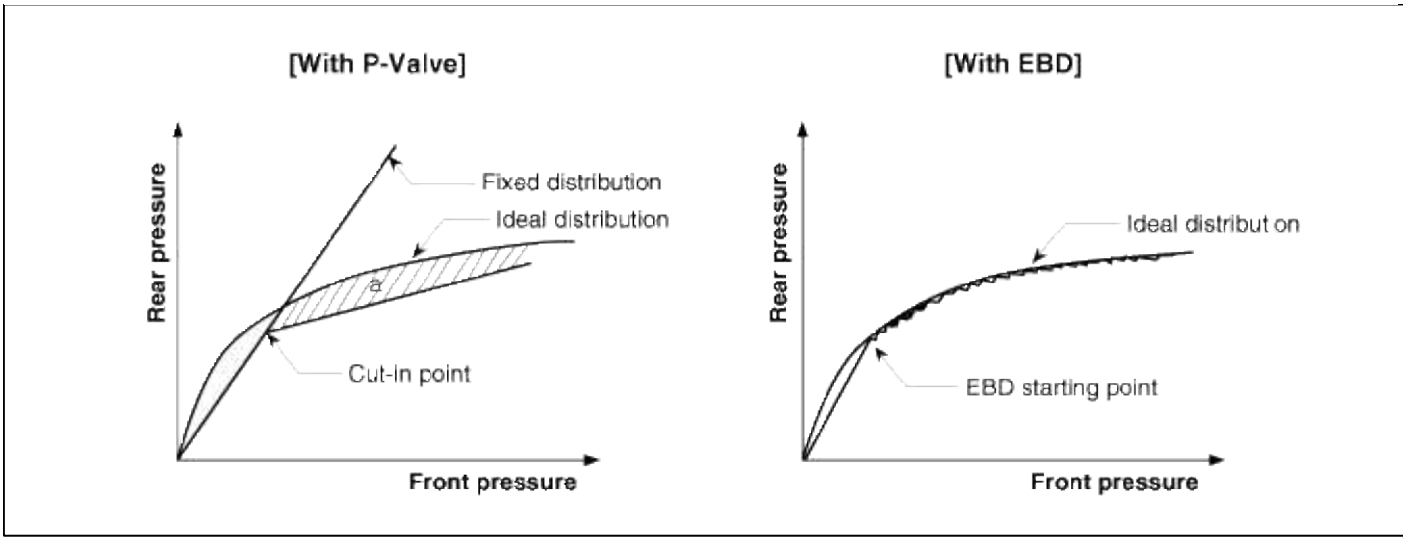
Brake System > ESC(Electronic Stability Control) System > EBD(Electronic Brake-force Distribution) > Description and Operation

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

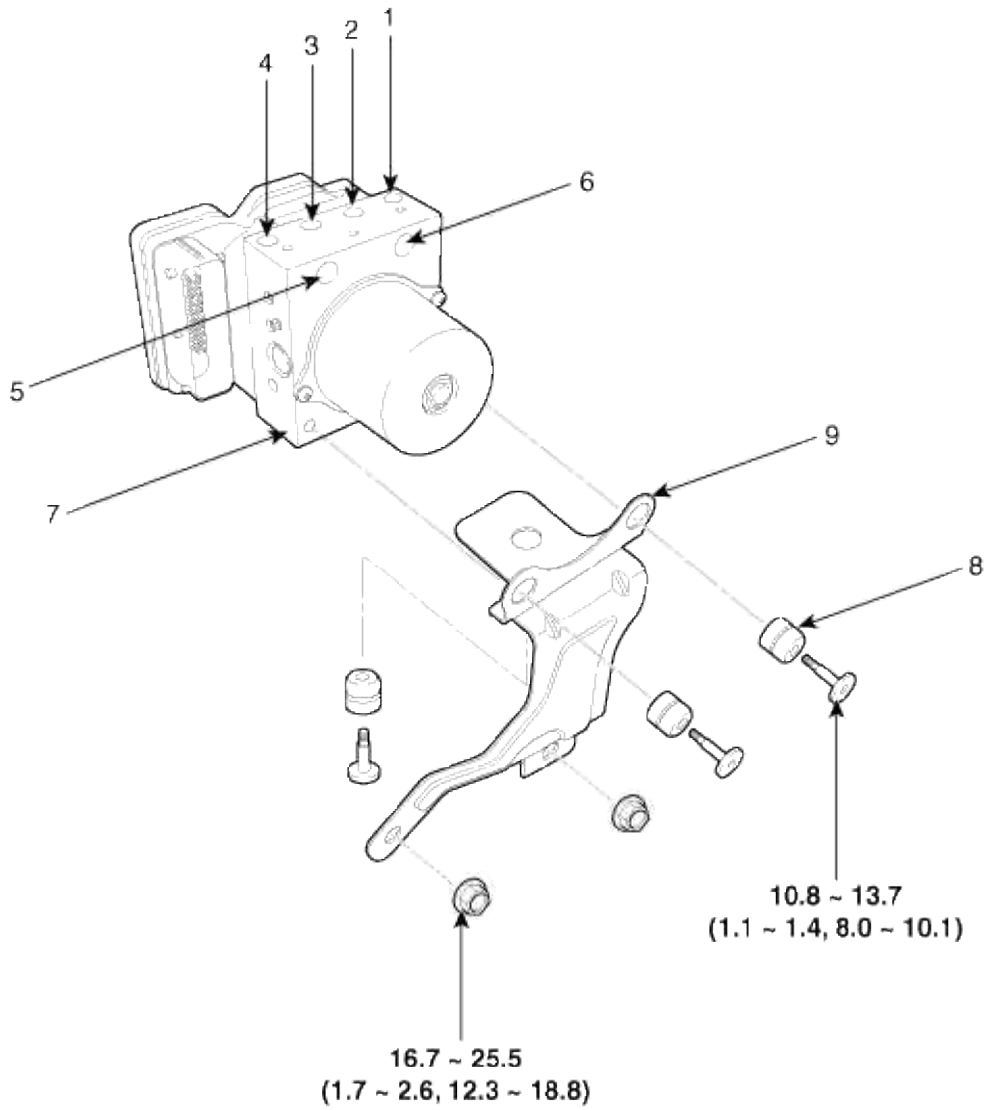
- Function improvement of the base-brake system.
- Compensation for the different friction coefficients.
- Elimination of the proportioning valve.
- Failure recognition by the warning lamp.

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)

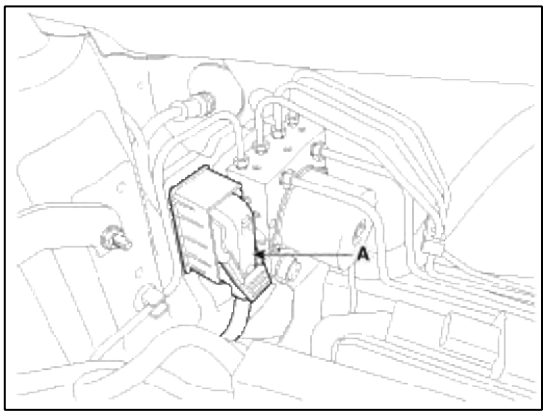
1. Front - left tube 2. Rear - right tube 3. Rear - left tube 4. Front - right tube 5. MC2	6. MC1 7. ESC control module (HECU) 8. Damper 9. Bracket

Brake System > ESC(Electronic Stability Control) System > ESC Control Module > Repair procedures

Removal

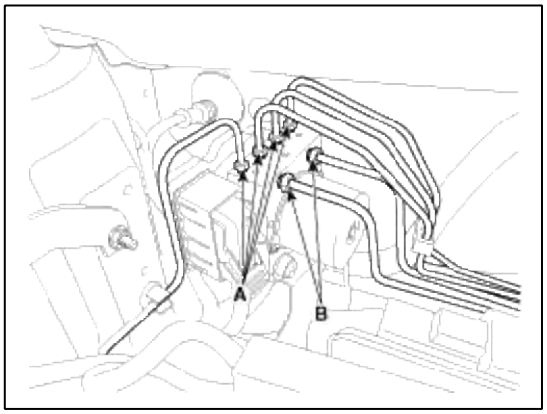
1. Turn ignition switch OFF.

2. Pull up the lock of the HECU connector (A), and then disconnect the connector.



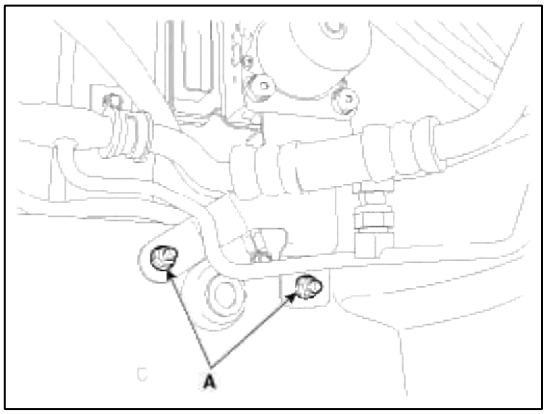
3. Disconnect the brake tubes from the HECU by unlocking the nuts counterclockwise with a spanner.

Tightening torque:
A : 12.7 ~ 16.7 N.m (1.3 ~ 1.7 kgf.m, 9.4 ~ 12.3 lb-ft)
B : 18.6 ~ 22.6 N.m (1.9 ~ 2.3 kgf.m, 13.7 ~ 16.6 lb-ft)



4. Loosen the HECU bracket nuts (A), then remove HECU and bracket.

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



CAUTION

- Never attempt to disassemble the HECU.
- The HECU must be transported and stored in.
- Never shock to the HECU.

5. Remove the 3 bolts, and then remove the bracket from HECU.

Tightening torque:
11 ~ 14 N.m (1.1 ~ 1.4 kgf.m, 8.1 ~ 10.3 lb-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)

NOTE

In a case of replacing ESP HECU, operate following functions. (Hillstart assist control only)

1. "Steering Angle Sensor Calibration" for steering angle sensor offset correction.
2. "Longituginal Sensor Calibration" for Longituginal sensor offset correction.

Brake System > ESC(Electronic Stability Control) System > Front Wheel Speed Sensor > Components and Components Location

Components

1. Front wheel speed sensor connector
2. Front wheel speed sensor

Brake System > ESC(Electronic Stability Control) System > Front Wheel Speed Sensor > Repair procedures

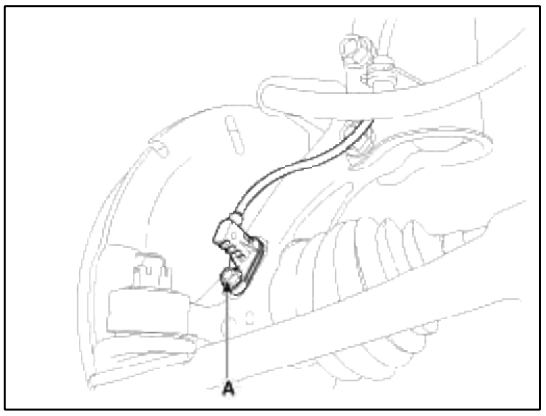
Removal

1. Remove the front wheel and tire.

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

2. Remove the front wheel speed sensor mounting bolt (A).

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



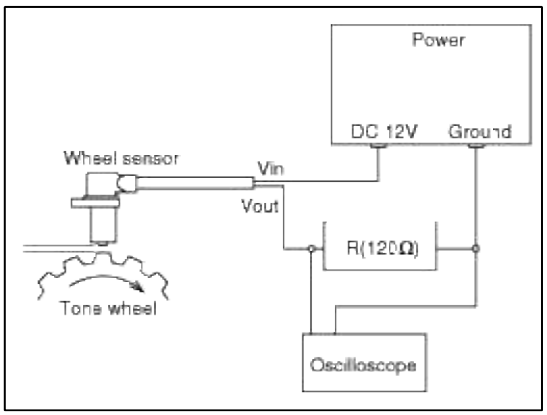
3. Remove the front wheel guard.
4. Remove the front wheel speed sensor cable mounting bolt.
5. Disconnect the front wheel speed sensor connector, and then remove the front wheel speed sensor.
6. Installation is the reverse of removal.

Inspection

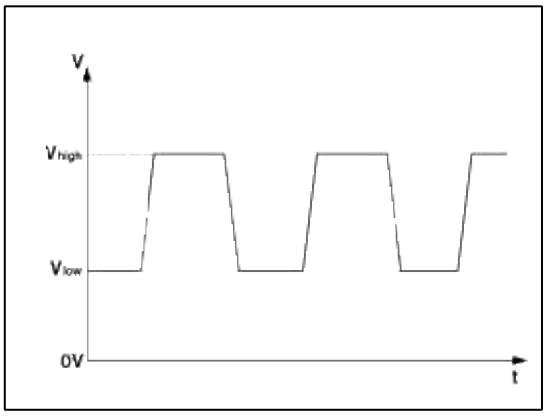
1. Measure the output voltage between the terminal of the wheel speed sensor and the body ground.

CAUTION

- In order to protect the wheel speed sensor, when measuring output voltage, a 120 Ω resister must be used as shown.



2. Compare the change of the output voltage of the wheel speed sensor to the normal change of the output voltage as shown below.



V_low: 0.7 V ~ 1.0 V
V_high: 1.4 V ~ 2.0 V
Frequency range: 1 ~ 2,500Hz

Brake System > ESC(Electronic Stability Control) System > Rear Wheel Speed Sensor > Components and Components Location

Components

1. Rear wheel speed sensor connector 2. Rear wheel speed sensor

Brake System > ESC(Electronic Stability Control) System > Rear Wheel Speed Sensor > Repair procedures

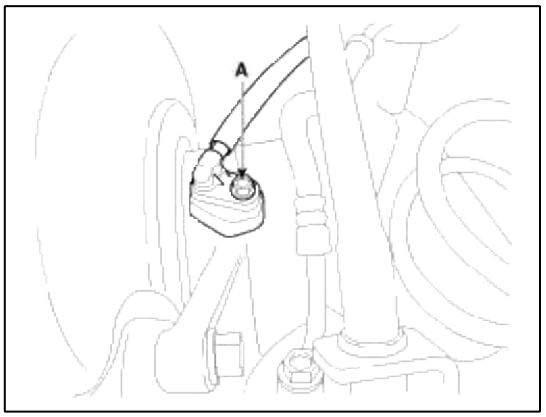
Removal

1. Remove the rear wheel and 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 wheel speed sensor mounting bolt (A).

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



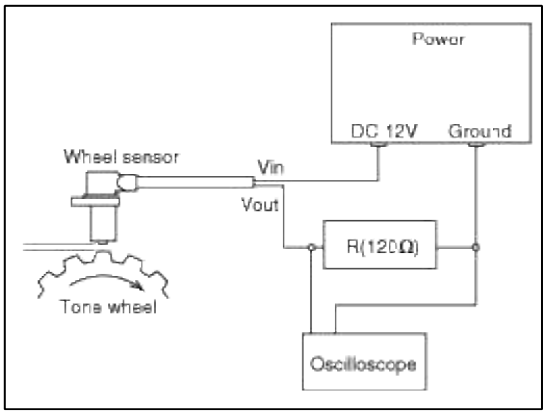
3. Remove the rear seat back.
   (Refer to the Body group - "Seat")
4. Remove the rear wheel housing trim.
   (Refer to the Body group – "Interior trim")
5. Disconnect the rear wheel speed sensor connector.
6. Installation is the reverse of removal.

Inspection

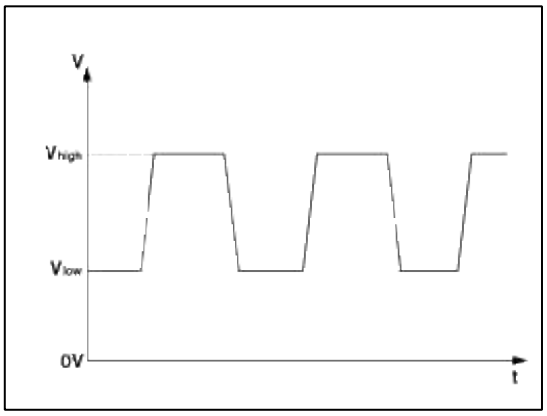
1. Measure the output voltage between the terminal of the wheel speed sensor and the body ground.

CAUTION

- In order to protect the wheel speed sensor, when measuring output voltage, a 120 Ω resister must be used as shown.



2. Compare the change of the output voltage of the wheel speed sensor to the normal change of the output voltage as shown below.

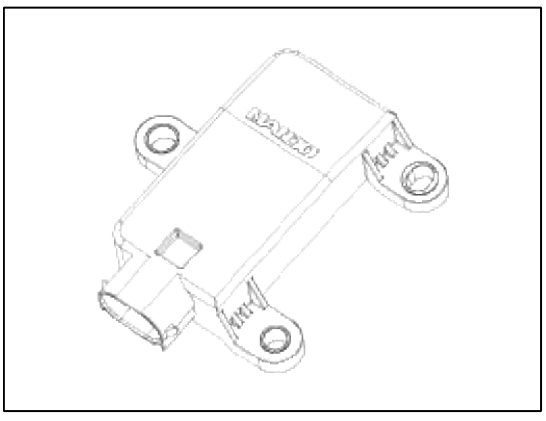


V_low: 0.7 V ~ 1.0 V
V_high: 1.4 V ~ 2.0 V
Frequency range: 1 ~ 2,500Hz

Brake System > ESC(Electronic Stability Control) System > Yaw-rate and G Sensor > Description and Operation

Description

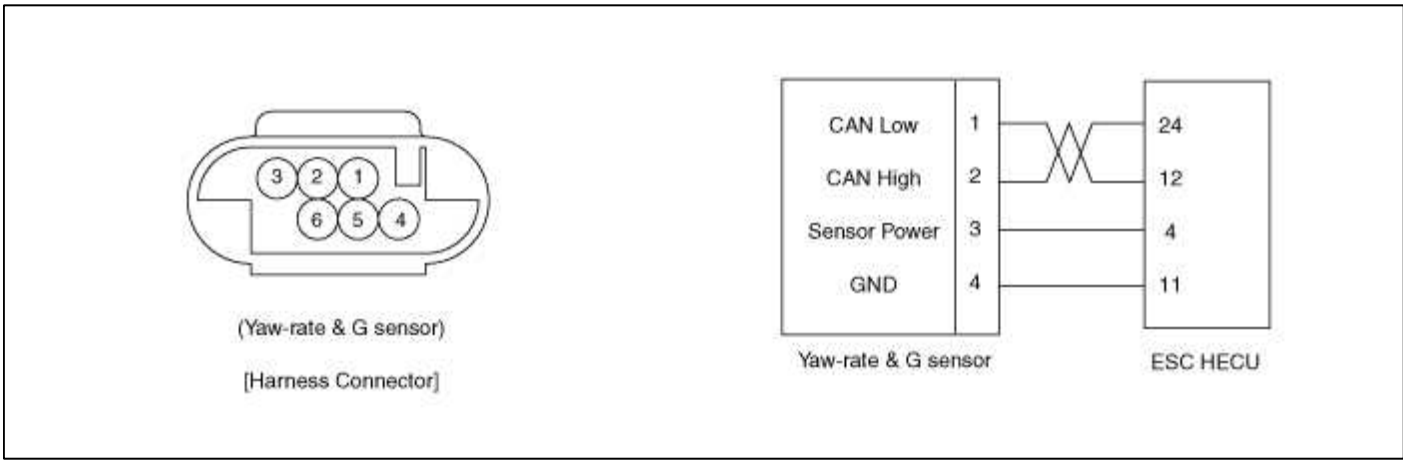
When the vehicle is turning with respect to a vertical axis the yaw rate sensor detects the yaw rate electronicly by the vibration change of plate fork inside the yaw rate sensor.
If yaw velocity reaches the specific velocity after it detects the vehicle'yawing, the ESC control is reactivated.
The later G sensor senses vehicle's lateral G. A small element inside the sensor is attached to a deflectable leverarm by later G.
Direction and magnitude of lateral G loaded to vehicle can be known with electrostatic capacity changing according to lateral G.
The longitudinal G sensor is installed in the yaw-rate sensor.
This longitudinal G sensor detects vertical acceleration of the vehicle, while the lateral G sensor detects lateral acceleration of the vehicle. The HECU uses these signals for the Hill start Assist Control function.



Specifications

Description		Specification	Remarks
Operating voltage		10 ~ 16V	
Output signal		CAN Interface	
Current Consumption		Max.140mA	
Operating temperature		-40 ~ 85°C (-40 ~ 185°F)	
Yaw-rate sensor	Measurement range	-75 ~ 75°/sec	
	Frequency response	15 ~ 45Hz	
G sensor	Measurement range	-14.715 ~ 14.715m/s²	
	Frequency response	50Hz ± 60% (±3dB)	

External Diagram

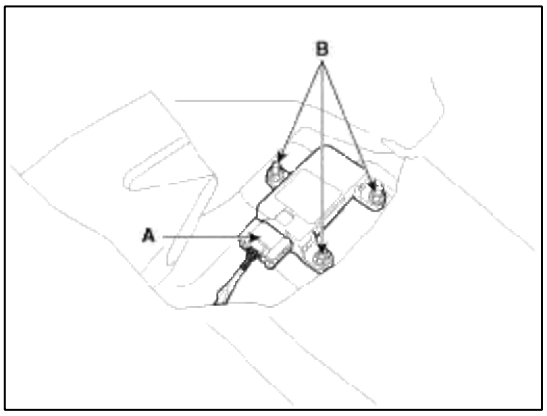


Brake System > ESC(Electronic Stability Control) System > Yaw-rate and G Sensor > Repair procedures

Removal

1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Remove the front seat (LH) assembly.
   (Refer to the Body group - "Seat")

3. Disconnect the yaw rate & G sensor connector (A).



4. Remove the mounting nuts (B).

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

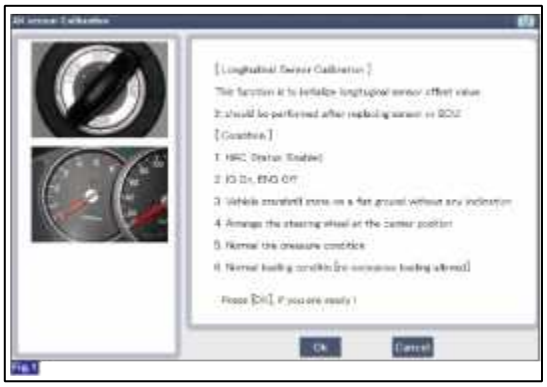
5. Installation is the reverse of removal.

NOTE

In a case of replacing the Yaw rate sensor, operate "Longitudinal G Sensor Calibration" by GDS. (HAC only)

■ longitudinal G sensor Calibration

1. IG ON, ENG OFF
2. Stand the vehicle on a flat ground without any inclination.
3. Set the steering wheel at the center position.
4. Keep the vehicle under normal tire pressure condition and normal loading condition.
5. Connect GDS to Data Link Connector(DLC).
6. Perform Longitudinal G Sensor Calibration.(figure 1).



7. Confirm success or failure of calibration.

Brake System > ESC(Electronic Stability Control) System > ESC OFF Switch > Description and Operation

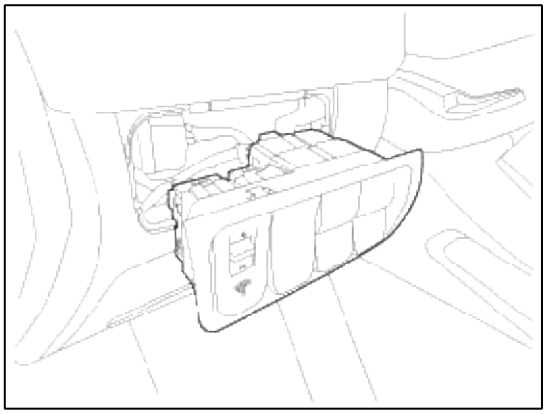
Description

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.

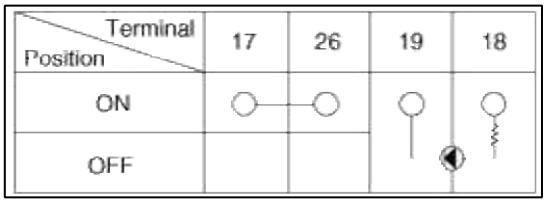
Brake System > ESC(Electronic Stability Control) System > ESC OFF Switch > Repair procedures

Inspection

1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Remove the crash pad lower panel.
   (Refer to the Body group - "Crash pad")
3. Remove the crash pad side switch assembly (A).



4. Check the continuity between the switch terminals as the ESC OFF switch is engaged.



Brake System > ESC(Electronic Stability Control) System > Steering Angle Sensor (MDPS Only) > Description and Operation

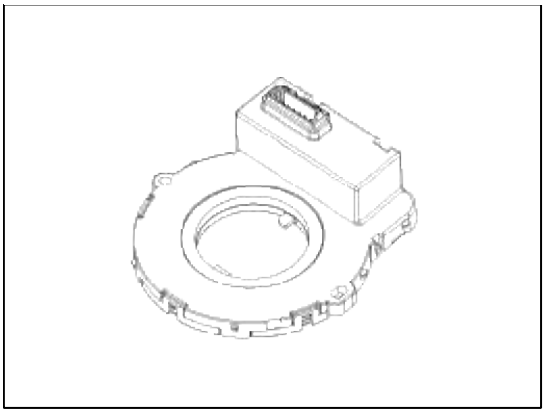
Description

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 ESP-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 disassembled to be inspected. They must be replaced. (Refer to “ST (Steering system) Gr.”)

Brake System > ESC(Electronic Stability Control) System > Steering Angle Sensor (Except MDPS) > Description and Operation

Description

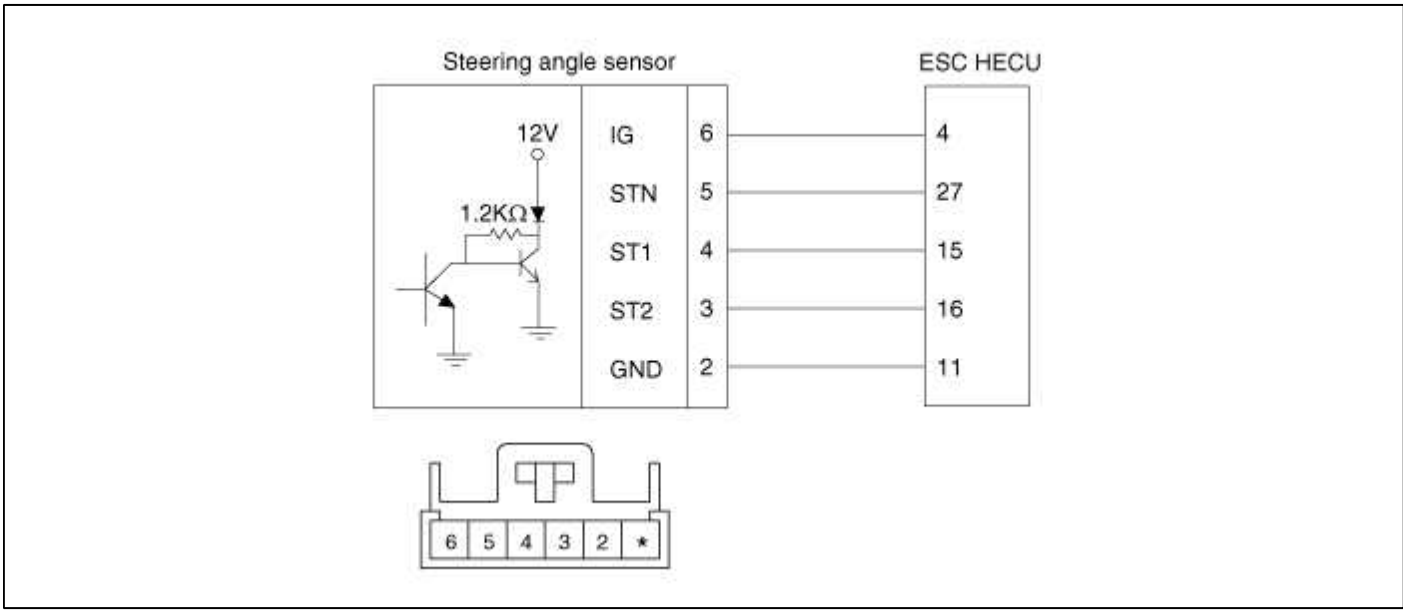
The steering angle speed sensor detects the angle of the steering wheel in order to which direction a user chooses.The sensor is detached on the MPS(Mutil-Function Switch) under the steering wheel.
Measureing Principle
The split of the steering angle sensor detects a steering angle of the steering wheel by a ON/OFF pulse caused by whether or not the LED lights go through the hole of the split, rotating as the steering wheel revolves. There are three LEDs, two(ST1, ST2) for detecting a steering direction, and the other for the neutral position.The HECU calculates the steering angle by the pulse from the steering angle sensor.



Specification

Description	Specification
Operating voltage	9 ~ 16 V
Operating temperature	-30 ~ 75 °C
Current consumption	Max.100 mA
Steering angle velocity	Max. ± 1500 °/sec
Voltage(high)	3.0 V ~ 4.1 V
Voltage(low)	1.3 V ~ 2.0 V
Pulse duty	40 ~ 60 %

Circuit Diagram (Steering Wheel Speed Angle Sensor)



Calibration (Setting up the zero angle)

Steering Wheel Angle Sensor of a absolute angle type (CAN type) measures the angle under the standard of the zero angle set.

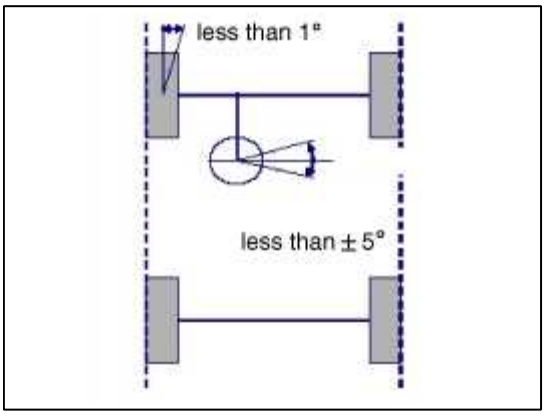
Calibration must be performed as following cases.

- Replacement of the Steering Wheel Angle Speed Sensor
- Replacement or repair of the Steering column
- Detection of DTC codes (C1260, C1261)

- Replacement of the yaw-rate and G sensor
- Replacement of HECU

Calibration procedure

Perform wheel alignment and stand the steering wheel in a line within ±5°error.



1. Connect the GDS.(CAN line or OBD connector)
2. Turn ignition switch on.
3. Press calibration button of the Steering Wheel Angle Sensor.
4. HECU calibration procedure is performed.
   (Calibration records, DTC codes erasure)

5. Turn ignition switch off after calibration procedure.
6. Confirm success or failure of calibration.
   A. Warning lamp must not be lighted when driving test (Turning left and right).
   B. ESC lights ESC OFF warning lamp when making an error in comparison with values of other sensors.

RIO(UB) > 2012 > G 1.6 GDI > Clutch System

Clutch System > General Information > Specifications

Specifications

Items		Specifications
Clutch operation method		Hydraulic type
Clutch cover	Type	Diaphragm spring strap
Clutch disc Type	Type	Single dry with diaphragm
	Faling diameter (Outer × inner)	Ø210 × Ø145 (Ø8.2677 × Ø5.7087)
Clutch release cylinder	inner diameter	20.64 mm (0.8126 in.)
Clutch master cylinder	inner diameter	15.87 mm (0.6248 in.)

Service Standard

Item	Specification
Clutch disc thickness [When free]	8.3 ± 0.3 mm (0.3268 ± 0.0118 in.)
Clutch pedal height [With carpet]	178 mm (7.0079 in.)
Clutch pedal free play	6 ~ 13 mm (0.2362 ~ 0.5118 in.)
Clutch pedal stroke	140 mm (5.5118 in.)
Clutch disc rivet depth	1.1 mm (0.0433 in.)
Diaphragm spring end height difference	0.5 mm (0.0197 in.)
Clutch master cylinder clearance to piston	15.87 mm (0.6248 in.)

Tightening Torques

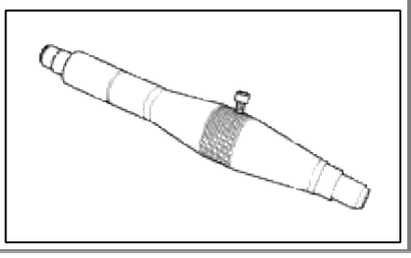
Item	N.m	kgf.m	lb-ft
Clutch pedal mounting nuts	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Clutch release cylinder mounting bolt	14.7 ~ 21.6	1.5 ~ 2.2	10.8 ~ 15.9
Clutch release cylinder union bolt	24.5 ~ 34.3	2.5 ~ 3.5	18.1 ~ 25.3
Clutch release cylinder bleed plug	6.8 ~ 9.8	0.7 ~ 1.0	9.2 ~ 13.3
Clutch cover mounting bolt	14.7 ~ 21.6	1.5 ~ 2.2	10.8 ~ 15.9

Lubricants

Items	Specified lubricants	Quantity
Input shaft spline	CASMOLY L9508	0.2g
Clutch release cylinder assembly	Brake fluid DOT 3 or DOT	As required
Clutch pedal shaft and bushings	Chassis grease SAE J310a, NLGI No.1	

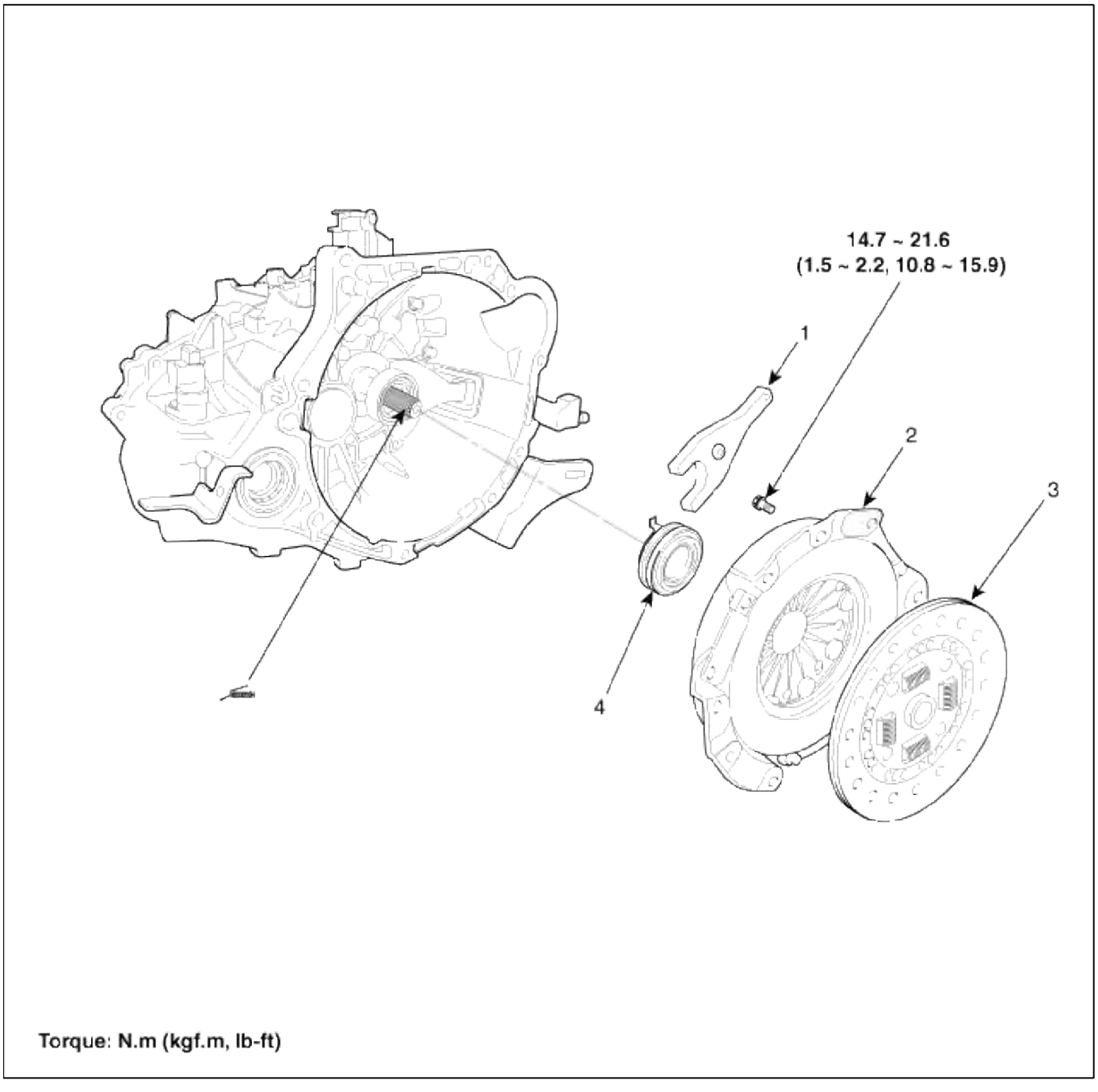
Clutch System > General Information > Special Service Tools

Special Service Tools

Tool (Number and name)	Illustration	Use
09411-1P000 Clutch disc guide		Installation of the clutch disc.

Clutch System > Clutch System > Clutch Cover And Disc > Components and Components Location

Components

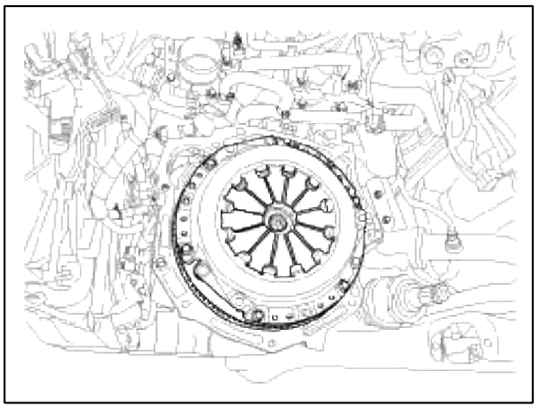


1. Clutch release fork 2. Clutch cover assembly	3. Clutch disk assembly 4. Clutch release bearing

Clutch System > Clutch System > Clutch Cover And Disc > Repair procedures

Removal

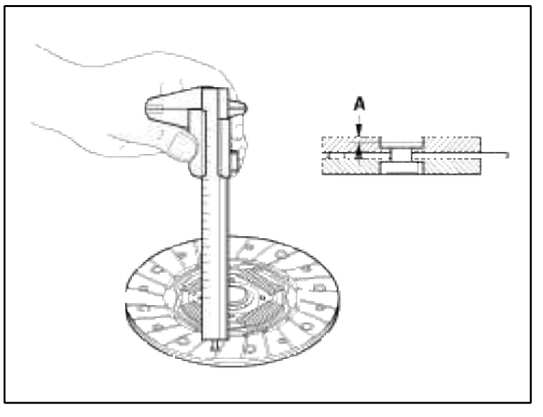
1. Remove the transaxle assembly.
   (Refer to "Manual transaxle system" in MT group)
2. Remove the clutch cover bolts. Be careful not to be bent ortwist bolts. Loosen bolts in diagonal directions.



Inspection

1. Inspect diaphragm spring wear which is in contact with a concentric slave cylinder bearing.
2. Check the clutch cover and disc surface for wear or cracks.
3. Check the clutch disc lining for slipping or oil marks.
4. Measure the depth from a clutch lining surface to a rivet. If the measured value is less than the specification below, replace it.

Clutch disc rivet depth (A): 0.3 mm (0.0118 in.)



Installation

1. Replace a clutch cover and disc as a set.

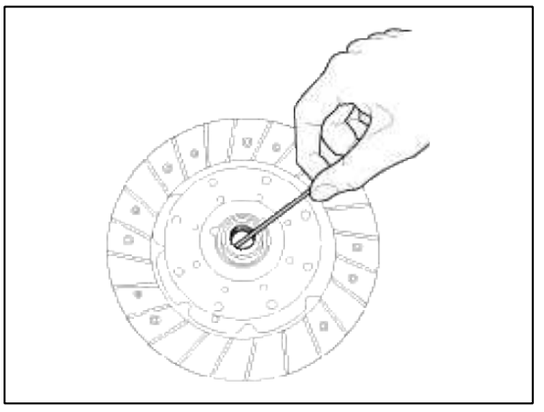
NOTE

- 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

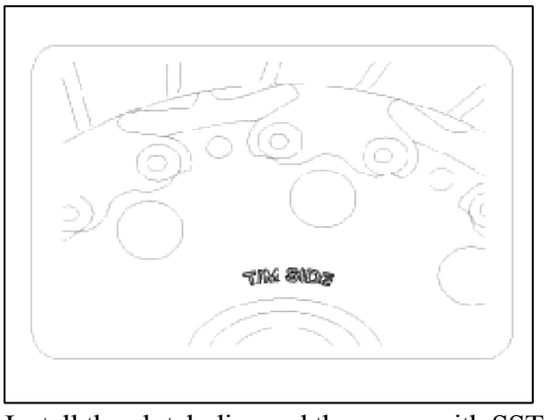
* Possible problems when not following
  - When not applying: Excessive wear of splines and bad clutch operation can occur.
  - When excessively applying: Grease can be scattered bycentrifugal force which can conteminate the clutch disc. This can cause a loss of friction force causing a slip.



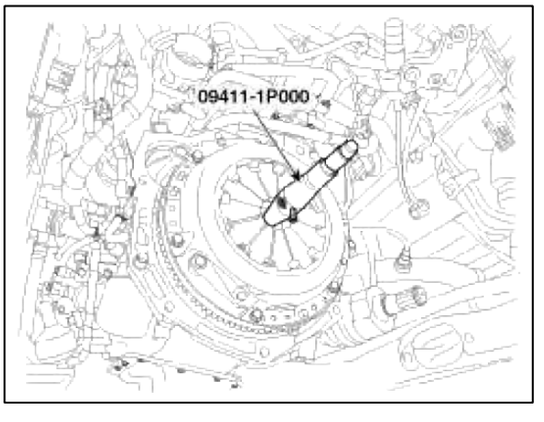
3. The 'T/M SIDE' marked surface should face the transmission.

CAUTION

* 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 errror or a strangesound 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 : 09411-1P000).

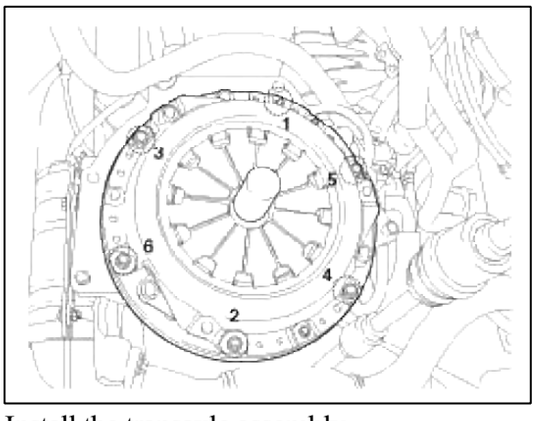


5. Install the clutch cover bolts. Not to be bent or twisted, Tighten them in diagonal directions.

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

CAUTION

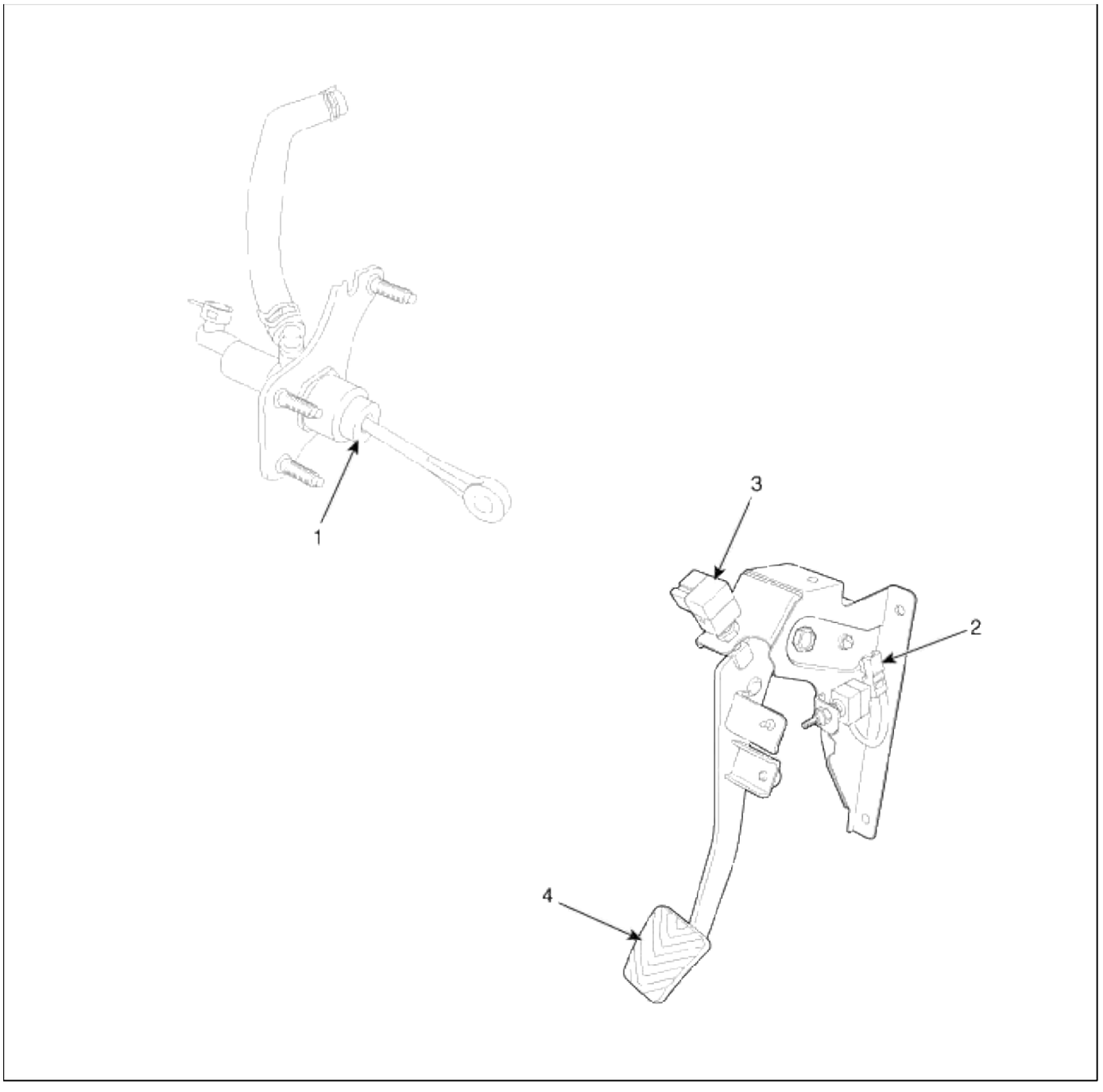
- Loosely tighten every clutch cover bolts, then torque to specifications in a diagonal direction. This can prevent twisting, vibration of the cover, and the lifting of the pressure plate.
- Install the all the components with the specified torques. If not, the clutch torque transmission may have concerns or the mounting bolt can loosen.



6. Install the transaxle assembly.
(Refer to "Manual transaxle system" in MT group.)

Clutch System > Clutch System > Clutch Pedal > Components and Components Location

Components



1. Master cylinder 2. Ignition lock switch	3. Clutch switch 4. Pedal pad

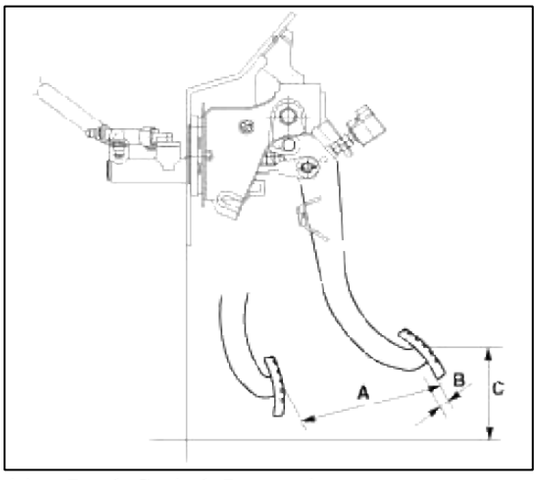
Clutch System > Clutch System > Clutch Pedal > Repair procedures

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): 140 mm (5.5118 in.)
Free play (B): 6 ~ 13 mm (0.2362 ~ 0.5118 in.)
Height (C): 178 mm (7.0079 in.)



Ignition Lock Switch Inspection

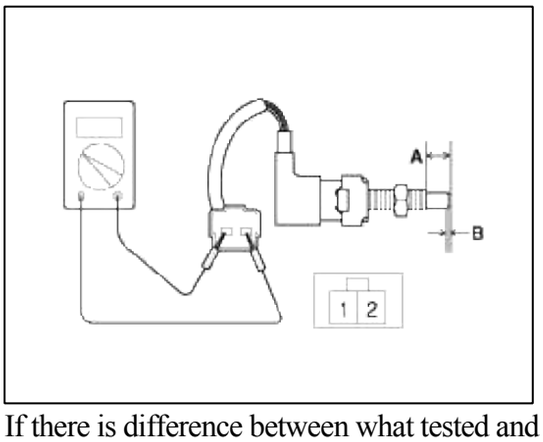
1. Disconnect 2P-connector from a ignition lock switch.
2. Disconnect the ignition lock switch. (if you can install a tester with the switch fixed, this step can be omissible)
3. Check for continuity between terminals. (refer to the table below)

NOTE

- If there is difference between what tested and the table above, replace the ignition lock switch with a new one.

Pedal position	Clutch switch	Ignition lock switch
Released	Pressed (Continuity)	Released (Open)
Fully pressed	Released (Open)	Pressed (Continuity)

Standard value
Full stroke (A): 12.0 ± 0.3mm (0.4724 ± 0.0118 in.)
ON-OFF point (B): 2.0 ± 0.3mm (0.0787 ± 0.0118 in)



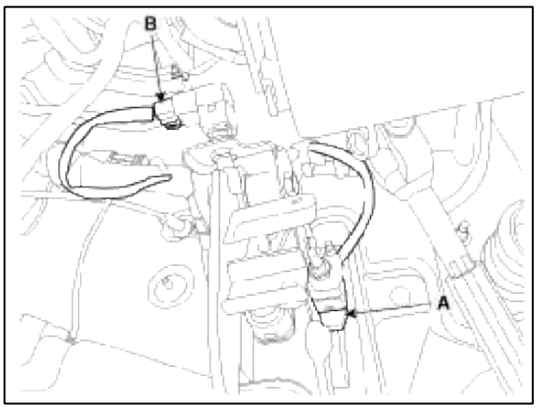
4. If there is difference between what tested and the table above, replace the ignition lock switch with a new one.

Removal

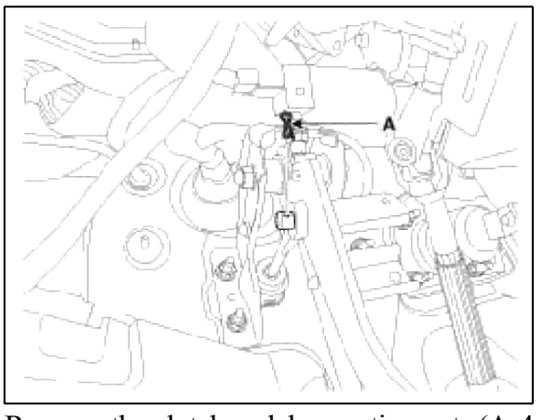
NOTE

- 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. Disconnect the ignition lock switch connector (A) and clutch switch (B).

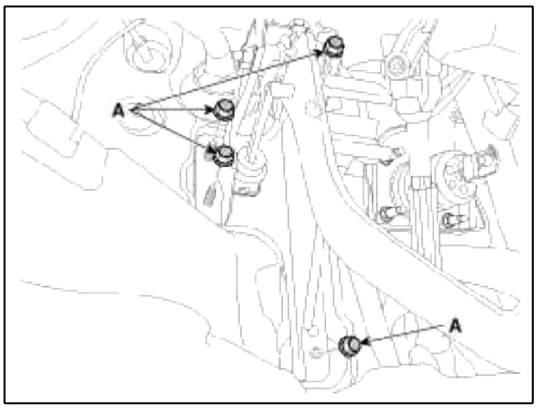


2. Disconnect the push rod from the clutch pedal by removing the snap pin (A) and washer.

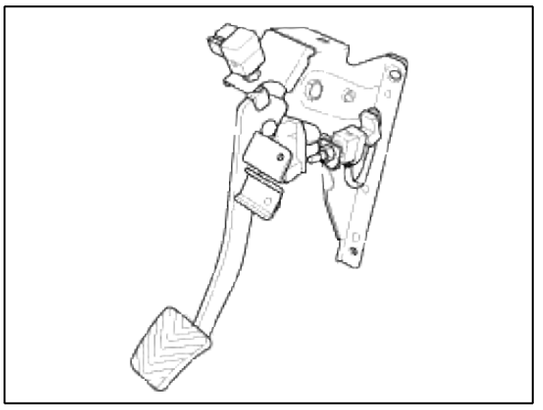


3. Remove the clutch pedal mounting nuts (A-4ea).

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



4. Remove the clutch pedal assembly.

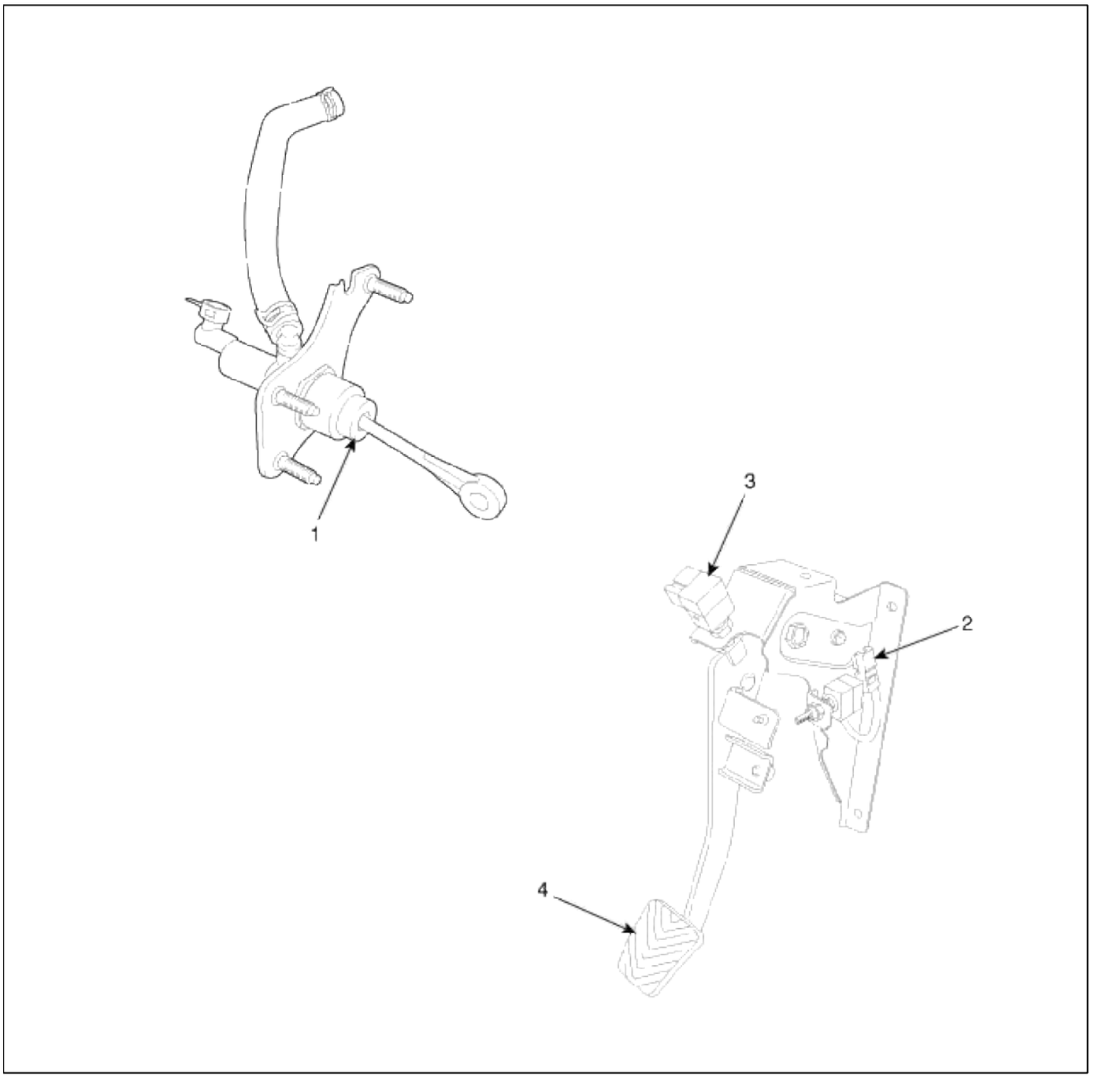


Installation

1. Installation is in reverse order of removal.

Clutch System > Clutch System > Clutch Master Cylinder > Components and Components Location

Components



1. Master cylinder 2. Ignition lock switch	3. Clutch switch 4. Pedal pad

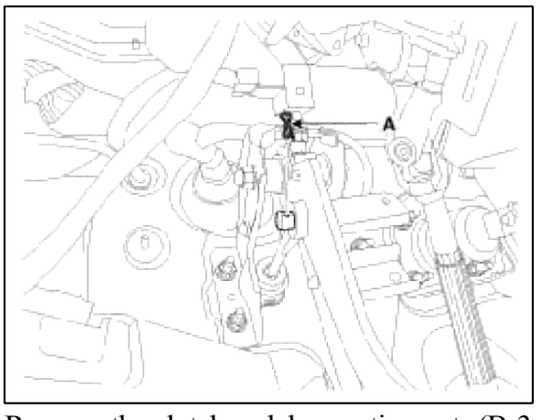
Clutch System > Clutch System > Clutch Master Cylinder > Repair procedures

Removal

NOTE

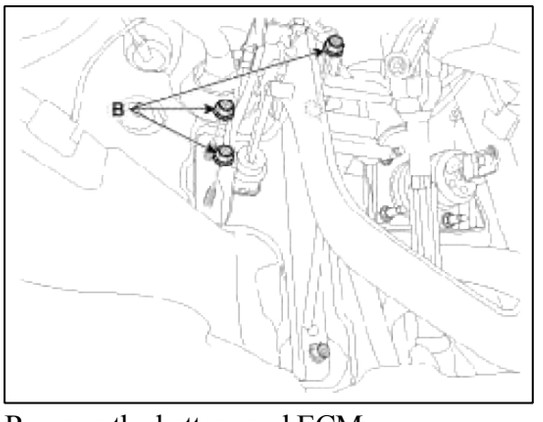
- Do not spill brake fluid on the vehicle; it may damage the paint if brake fluid does contact the paint, wash it off immediately with water.

1. Disconnect the push rod from the master cylinder by removing the snap pin (A) and washer.

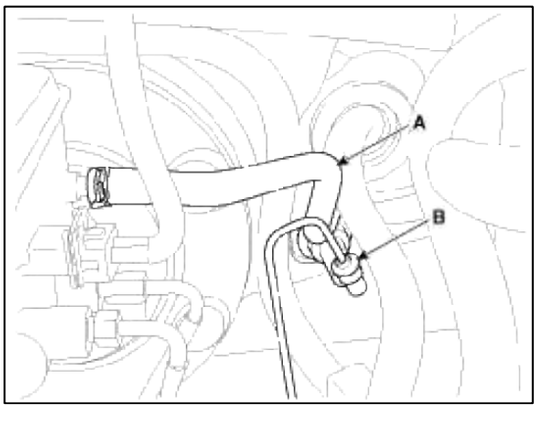


2. Remove the clutch pedal mounting nuts (B-3ea).

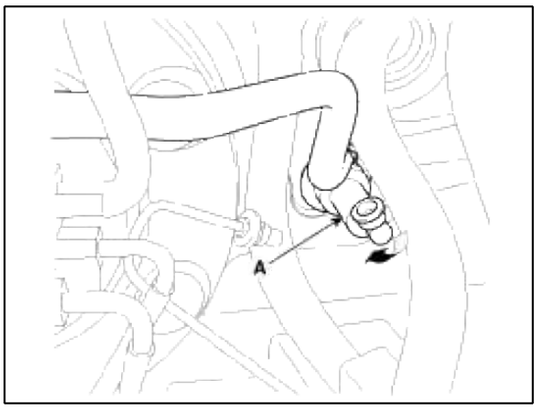
Tightening torque:
12.7 ~ 15.7 Nm (1.3 ~ 1.6 kgf.m, 9.4 ~ 11.6 lb-ft)



3. Remove the battery and ECM.
(Refer to "Manual transaxle system" in MT group)
4. Disconnect the clutch tube (B) and reservoir hose (A) from the clutch master cylinder.



5. Remove the clutch master cylinder by turning it clockwise (A).



Installation

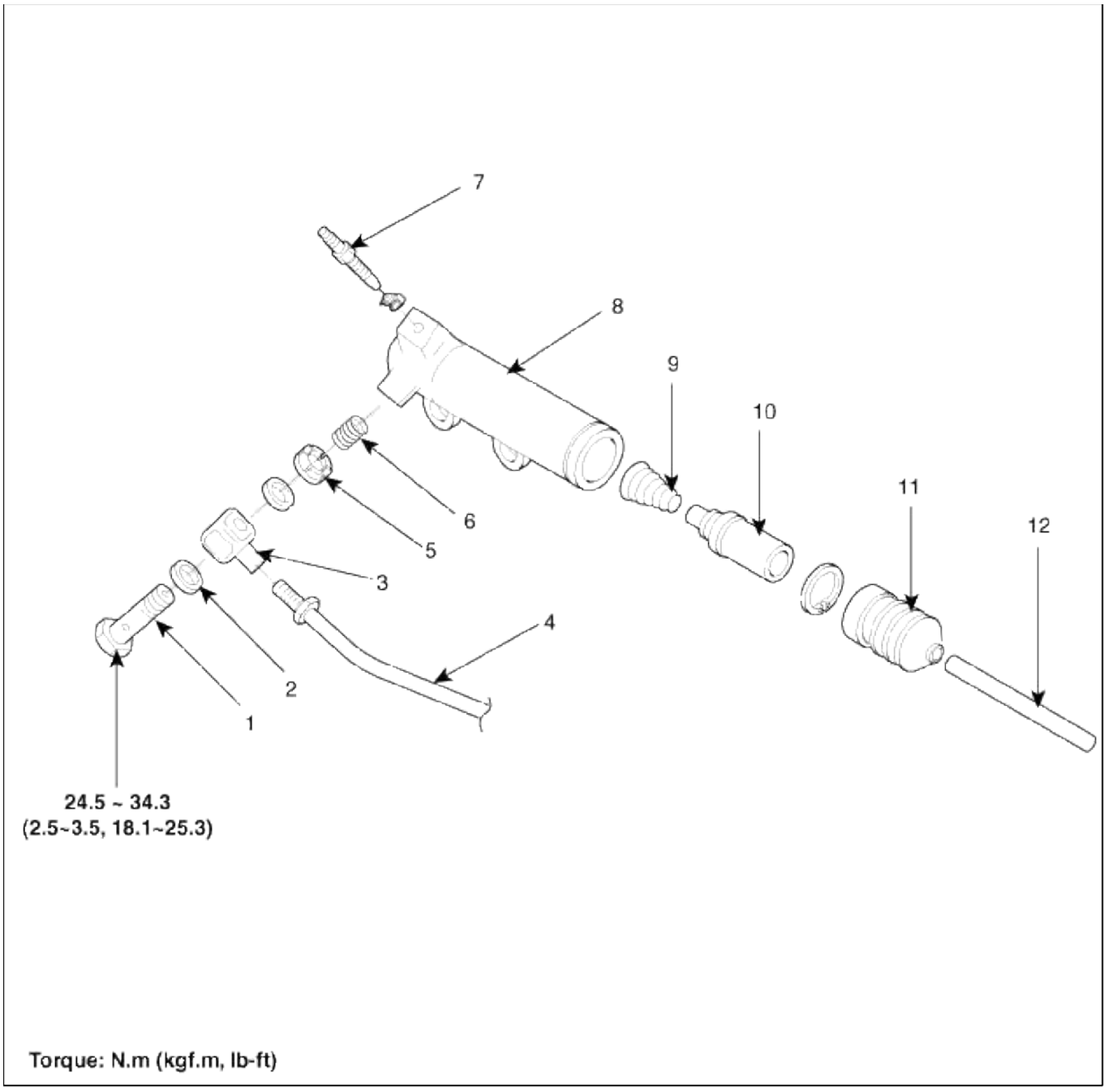
1. Installation is the reverse of removal.

NOTE

- Perform bleeding air procedure in clutch release cylinder after pouring the brake fluid.
  (Refer to "clutch release cylinder" in CH group.)

Clutch System > Clutch System > Clutch Release Cylinder > Components and Components Location

Components

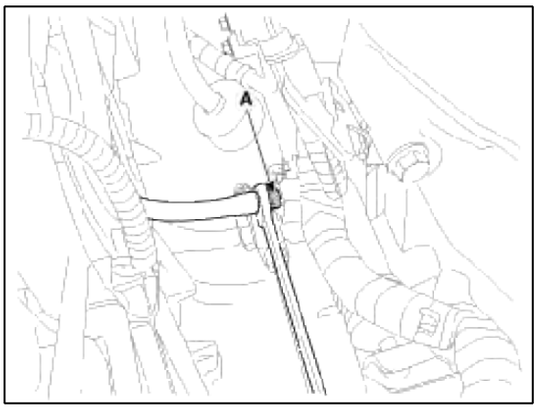


1. Union bolt 2. Gasket 3. Tube joint 4. Clutch tube 5. Valve plate 6. Valve spring	7. Bleeder screw 8. Release cylinder 9. Return spring 10. Piston 11. Boot 12. Push rod

Clutch System > Clutch System > Clutch Release Cylinder > Repair procedures

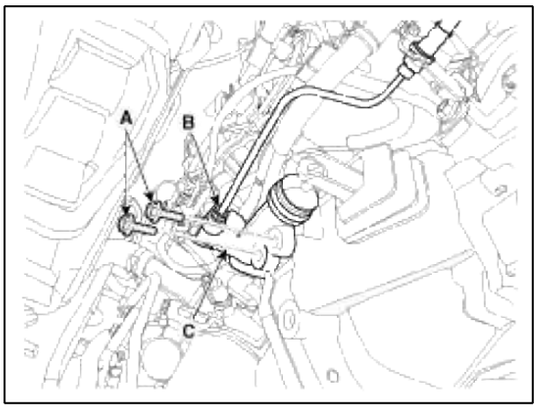
Removal

1. Drain the brake fluid through the bleed plug (A).



2. Remove the clutch release cylinder assembly (C) after removing the tube (B) and bolts (A-2ea).

Tightening torque:
14.7 ~ 21.6 N.m (1.5 ~ 2.2 kgf.m, 10.9 ~ 15.9 lb-ft)



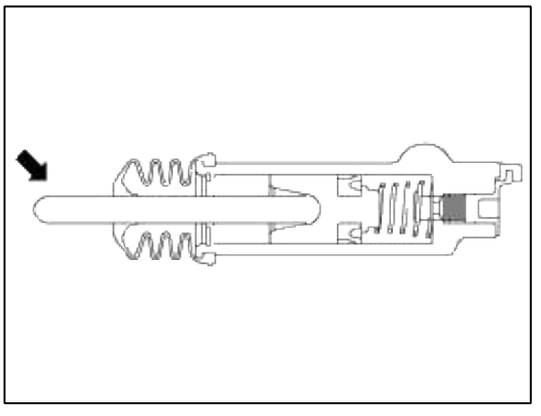
Installation

1. Installation is the reverse of removal.

NOTE

Coat the clutch clevis push rod specified grease.

Specified grease: CASMOLY L9508



Adjustment

Clutch Release Cylinder Air Bleeding Procedure

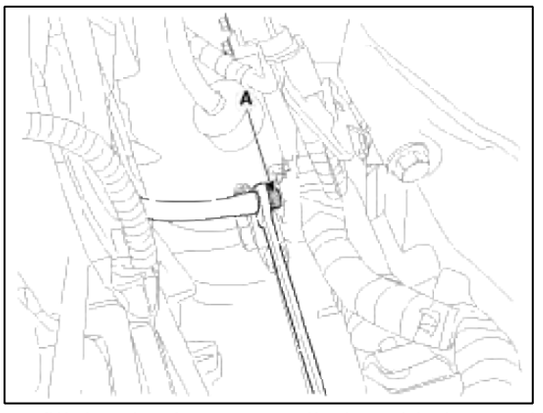
CAUTION

Use the specified fluid. Avoid mixing different brands of fluid.

Specified fluid: SAE J1703 (DOT 3 or DOT 4)

1. After disconnecting a cap from the clutch release cylinder air bleeder, insert a vinyl hose in the plug.
2. Loosening the plug screw, press and release the clutch pedal about 10 times.
3. Tighten the plug (A) during the clutch pedal pressed. Afterwards, raise the pedal with a hand.
4. After pressing the clutch pedal 3 times more, loosen the plug (A) and retighten it with the pedal pressed. Raise it again, then.
5. Repeat the step 4 two or three times. (until there is no bubble in the fluid)

Tightening torque:
6.8 ~ 9.8 N.m (0.7 ~ 1.0 kgf.m, 9.2 ~ 13.3 lb-ft)



6. Refill the clutch master cylinder with the specified fluid.

RIO(UB) > 2012 > G 1.6 GDI > Driveshaft and axle

Driveshaft and axle > General Information > Specifications

Specification

Engine	T/M	Joint type		Max. permissible angle	
		Outer	Inner	Outer	Inner
Gasoline 1.6	MT, AT	BJ#82	TJ#82	46.5°	21°

Tightening torque

Item	N.m	kgf.m	lb-ft
Hub nuts	88.2 ~ 107.8	9.0 ~ 11.0	65.0 ~ 79.5
Driveshaft lock nut	196.1 ~ 274.5	20.0 ~28.0	144.6 ~ 202.5
Strut assembly to knuckle	98.1 ~ 117.7	10.0 ~ 12.0	72.3 ~ 86.8
Lower arm to knuckle	58.8 ~ 70.6	6.0 ~ 7.2	43.3 ~ 52.0
Tie rod end castle nut	23.5 ~ 33.3	2.4 ~ 3.4	19.4 ~ 24.5
Front caliper to knuckle	78.4 ~ 98.0	8.0 ~ 10.0	57.8 ~ 72.3
Rear caliper to carrier	63.7 ~ 73.5	6.5 ~ 7.5	47.0 ~ 54.2
Rear carrier to torsion axle	49.0 ~ 58.8	5.0 ~ 6.0	36.1 ~ 43.3

CAUTION

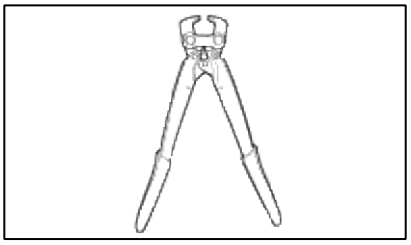
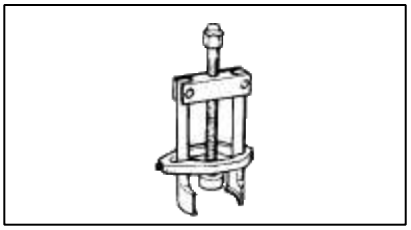
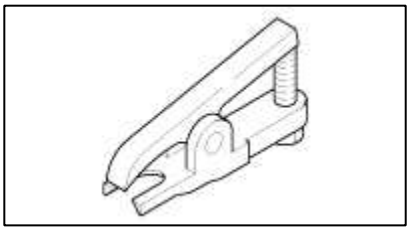
Replace self-locking nuts with new ones after removal.

Lubricants

Engine		Lubricants	Quantity
Gasoline 1.6(MT)	BJ	GRB006	80g
	TJ	SH06 - VX21	LH:130g, RH:115g

Driveshaft and axle > General Information > Special Service Tools

Special Service Tools

Tool(Number and Name)	Illustration	Use
09495-3K000 Band installer		Installation of ear type boot band
09495-33000 Puller		Remove the spider assembly
09568-34000 Ball joint puller		Saperate the ball joint from the front axle.

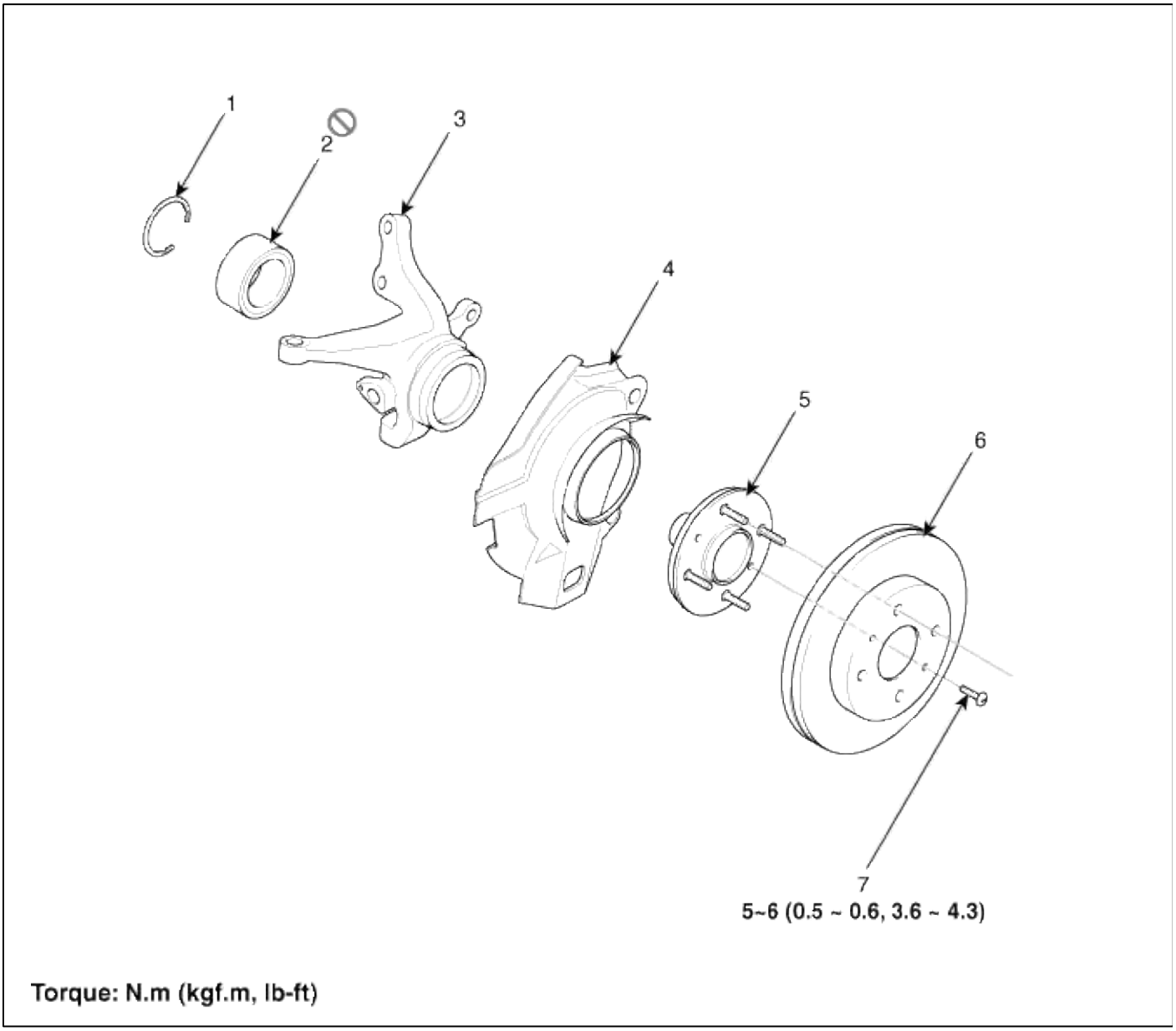
Driveshaft and axle > General Information > Troubleshooting

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 > Components and Components Location

Components



1. Snap ring 2. Bearing 3. Axle assembly 4. Brake disc dust cover	5. Wheel hub assembly 6. Wheel brake disc 7. Brake disc fixing screw

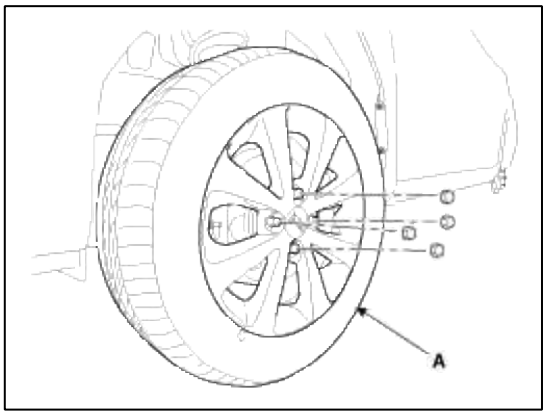
Driveshaft and axle > Front Axle Assembly > Front Hub / Knuckle > Repair procedures

Replacement

1. Loosen the wheel nuts slightly.
   Raise the vehicle, and make sure it is securely supported.

2. Remove the front wheel and tire (A) from front hub .

Tightening torque:
88.2 ~ 107.8 N.m (9.0 ~ 11.0 kgf.m, 65.0 ~ 79.5 lb-ft)

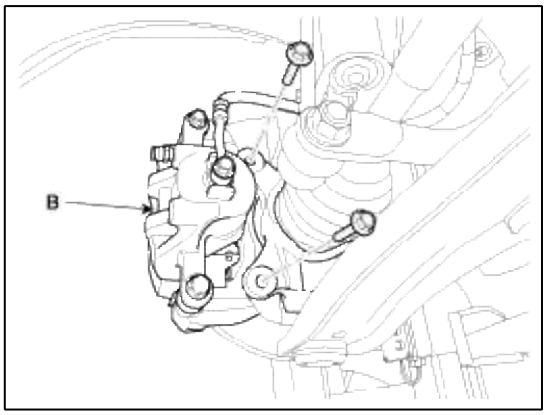


CAUTION

Be careful not to damage to the hub bolts when removing the front wheel and tire (A).

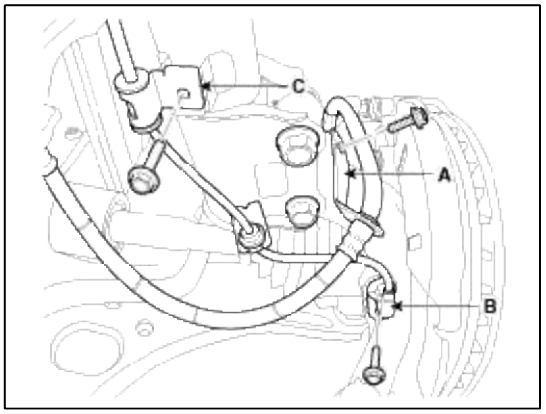
3. Remove the brake caliper mounting bolts , and then hold the brake caliper assembly (B) with wire.

Tightening torque:
78.4 ~ 98.0 N.m (8.0 ~ 10.0 kgf.m, 57.8 ~ 72.3 lb-ft)



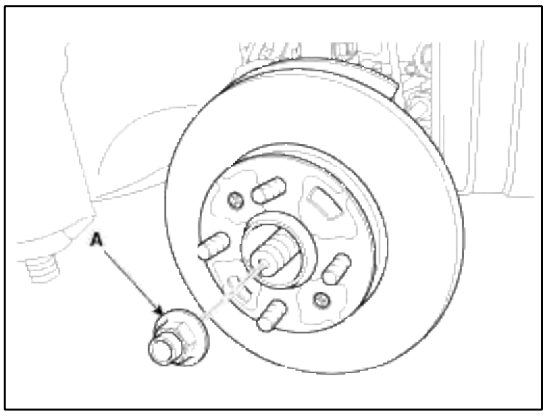
4. Remove the brake hose mounting bracket (A) & wheel speed sensor (B) & bracket (C).

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



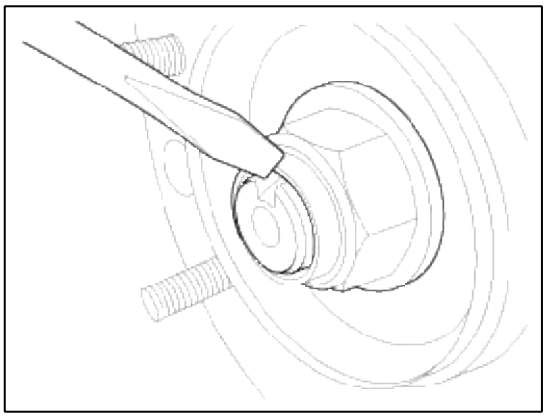
5. Remove driveshaft nut (A) from the front hub under applying the brake.

Tightening torque:
196.1 ~ 274.5 N.m (20.0 ~ 28.0 kgf.m, 144.6 ~ 202.5 lb-ft)



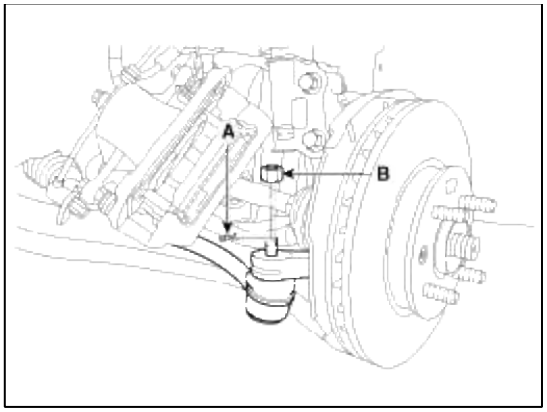
CAUTION

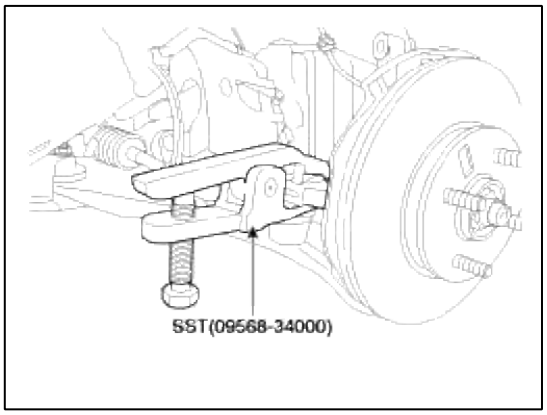
- The driveshaft lock nut should be replaced with new ones.
- After installation driveshaft lock nut, stake the lock nut using a chisel and hammer as shown in the illustration below.



6. Remove the tie rod end ball joint from the knuckle.
   (1) Remove the split pin (A).
   (2) Remove the castle nut (B).
   (3) Use the SST(09568-34000).

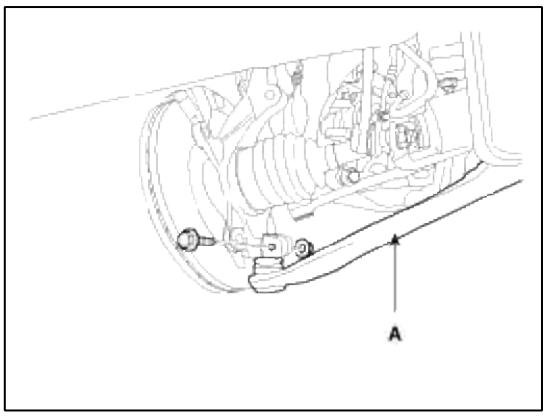
Tightening torque:
23.5 ~ 33.3 N.m (2.4 ~ 3.4 kgf.m, 19.4 ~ 24.5 lb-ft)



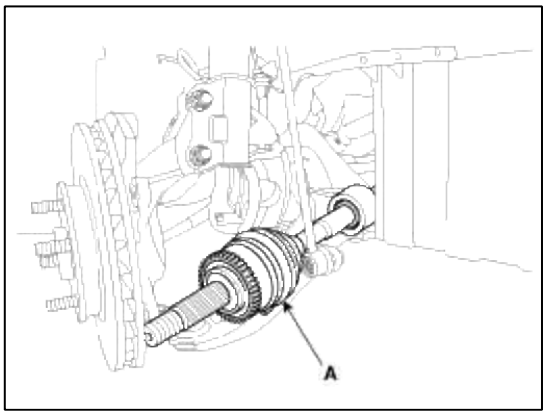


7. Remove the lower arm (A) from the knuckle.

Tightening torque:
196.1 ~ 274.5 N.m (6.0 ~ 7.2 kgf.m, 144.6 ~ 202.5 lb-ft)

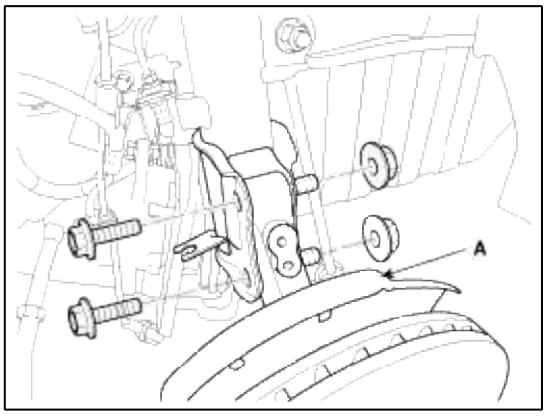


8. Disconnect the driveshaft (A) from the front hub assembly.



9. Loosen the strut mounting bolts and then remove the knuckle assembly (A).

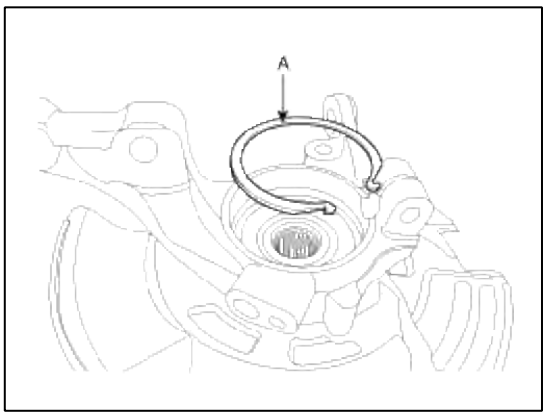
Tightening torque:
137.3 ~ 156.9 N.m (14.0 ~ 16.0 kgf.m, 101.3 ~ 115.7 lb-ft)



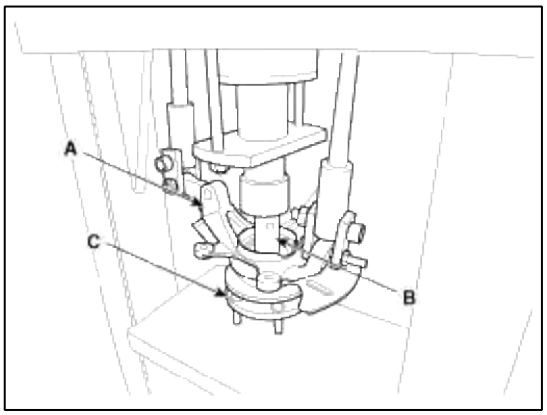
10. Install in the reverse order of removal.

Disassembly

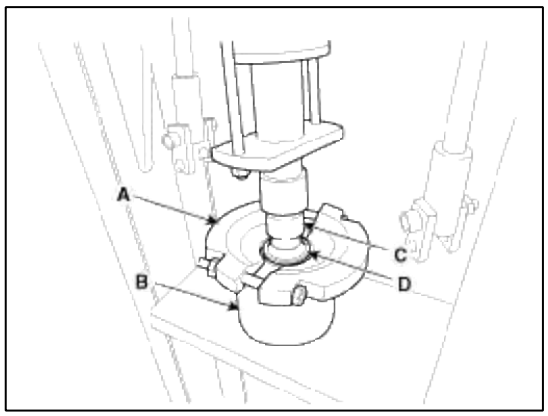
1. Remove the snap ring (A).



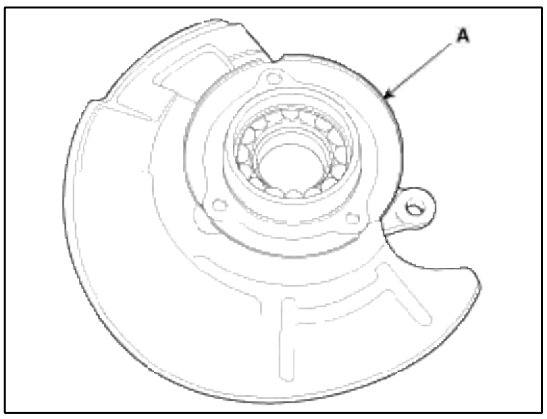
2. Remove the hub assembly from the knuckle assembly.
   (1) Install the front knuckle assembly (A) on press.
   (2) Lay a suitable adapter (B) upon the hub assembly shaft.
   (3) Remove the hub assembly (C) from the knuckle assembly (A) by using press.



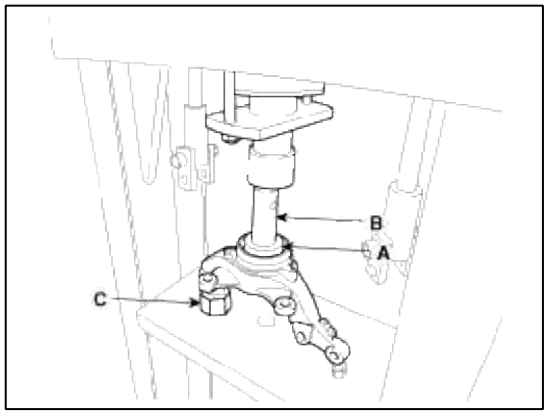
3. Remove the hub bearing inner race from the hub assembly.
   (1) Install a suitable tool (A) for removing the hub bearing inner race on the hub assembly.
   (2) Lay the hub assembly and tool (A) upon a suitable adapter (B).
   (3) Lay a suitable adapter (C) upon the hub assembly shaft.
   (4) Remove the hub bearing inner race (D) from the hub assembly by using press.



4. Remove the dust cover (A).



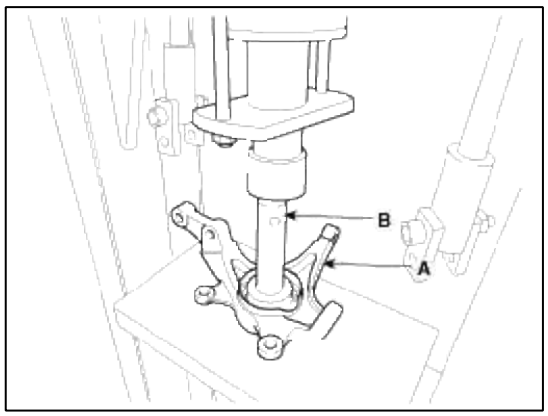
5. Remove the hub bearing outer race from the knuckle assembly.
   (1) Lay the hub assembly (A) upon a suitable adapter (B).
   (2) Lay a suitable adapter (C) upon the hub bearing outer race.
   (3) Remove the hub bearing outer race from the knuckle assembly by using press.



6. Replace hub bearing with a new one.

Reassembly

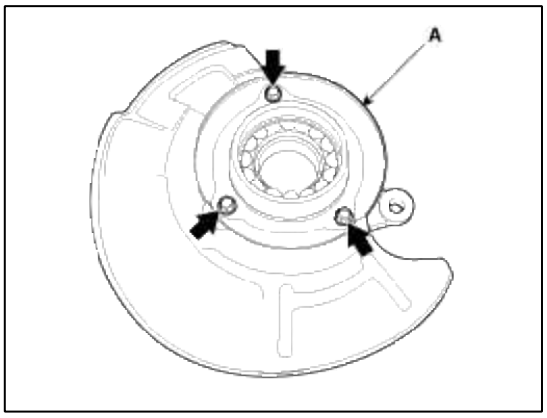
1. Install the hub bearing to the knuckle assembly.
   (1) Lay the knuckle assembly (A) on press.
   (2) Lay a new hub bearing upon the knuckle assembly (A).
   (3) Lay a suitable adapter (B) upon the hub bearing.
   (4) Install the hub bearing to the knuckle assembly by using press.



CAUTION

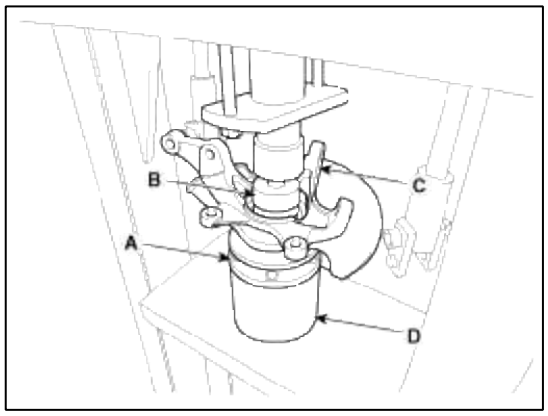
- Do not press against the inner race of the hub bearing because that can cause damage to the bearing assembly.
- Always use a new wheel bearing assembly.

2. Install the dust cover (A).



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.

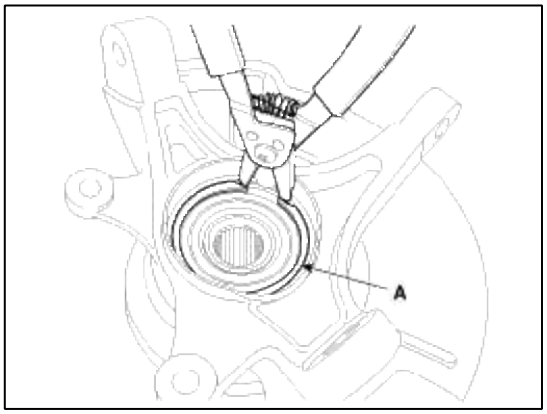
(4) Install the hub assembly (A) to the knuckle assembly (C) by using press.



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).

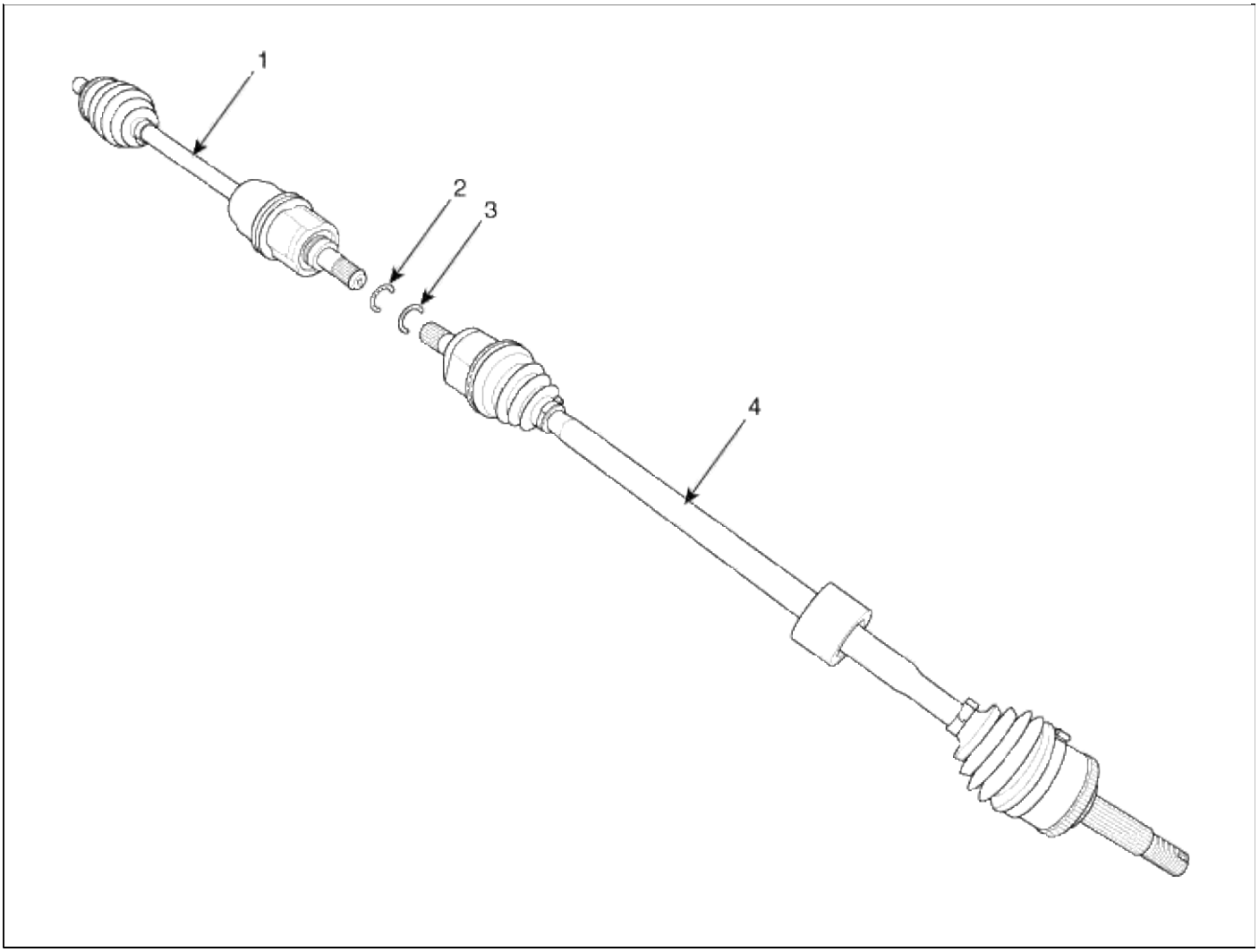


Inspection

1. Check the hub for cracks and the splines for wear.
2. Check the brake disc for scoring and damage.
3. Check the knuckle for cracks.
4. Check the bearing for cracks or damage.

Driveshaft and axle > Driveshaft Assembly > Front Driveshaft > Components and Components Location

Component



1. Driveshaft (LH) 2. Circlip	3. Circlip 4. Driveshaft (RH)

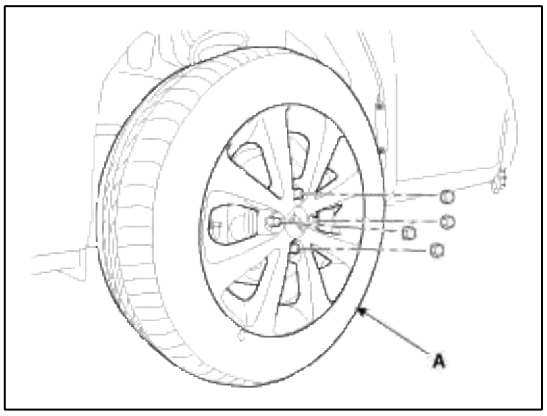
Driveshaft and axle > Driveshaft Assembly > Front Driveshaft > Repair procedures

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:
88.2 ~ 107.8 N.m (9.0 ~ 11.0 kgf.m, 65.0 ~ 79.5 lb-ft)

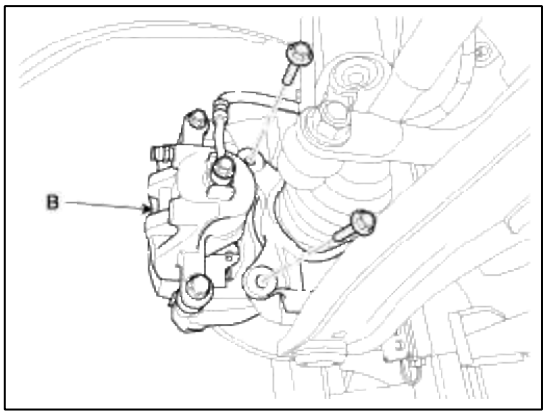


CAUTION

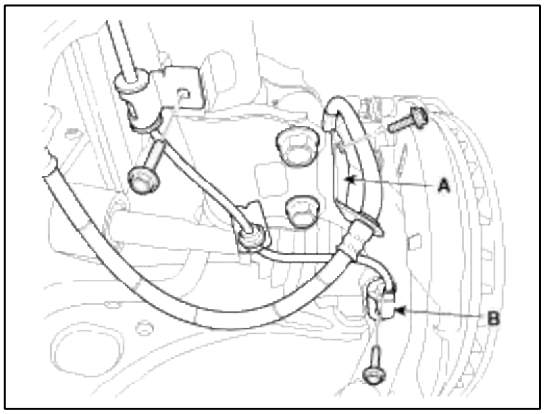
Be careful not to damage to the hub bolts when removing the front wheel and tire (A).

3. Remove the brake caliper mounting bolts, and then hold the brake caliper assembly (B) with wire.

Tightening torque:
78.4 ~ 98.0 N.m (8.0 ~ 10.0 kgf.m, 57.8 ~ 72.3 lb-ft)

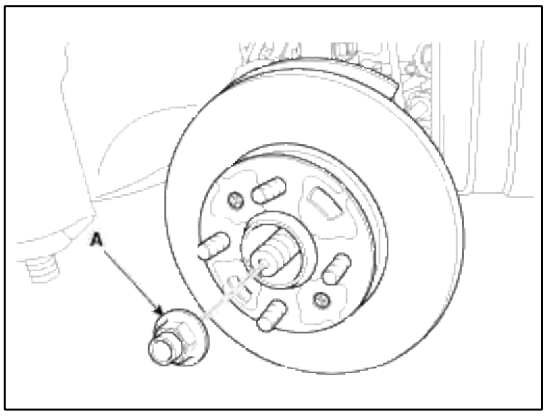


4. Remove the brake hose bracket (A) & wheel speed sensor (B).



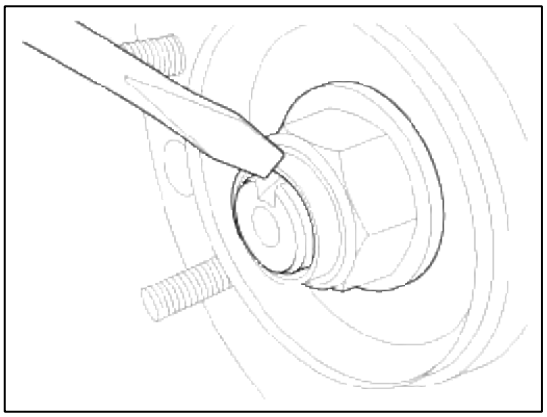
5. Remove driveshaft nut (A) from the front hub after applying the brake.

Tightening torque:
196.1 ~ 274.5 N.m (20.0 ~ 28.0 kgf.m, 144.6 ~ 202.5 lb-ft)

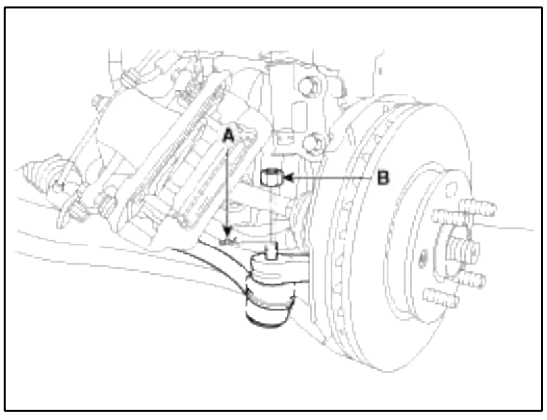


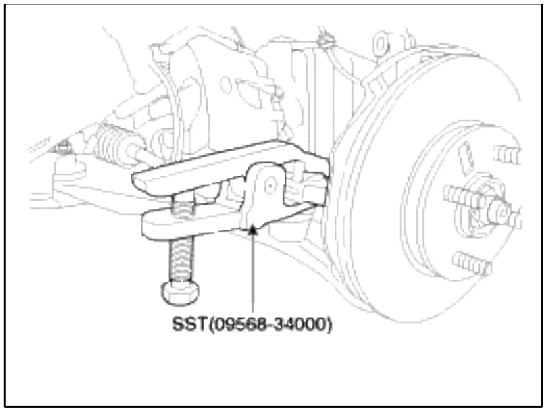
CAUTION

- The driveshaft lock nut should be replaced with new ones.
- After installation driveshaft lock nut, stake the lock nut using a chisel and hammer as shown in the illustration below.



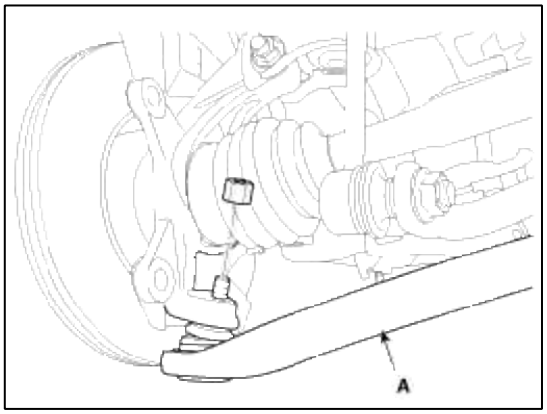
6. Remove the tie rod end ball joint from the knuckle by using the SST(09568-34000).
   (1) Remove the split pin (A).
   (2) Remove the castle nut (B).
   (3) Use the SST(09568-34000).



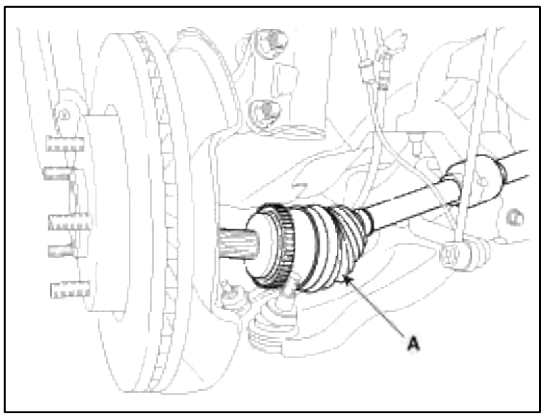


7. Remove the lower arm (A) from the knuckle.
   (1) Loosen the nut.
   (2) Use the SST (09568-34000)

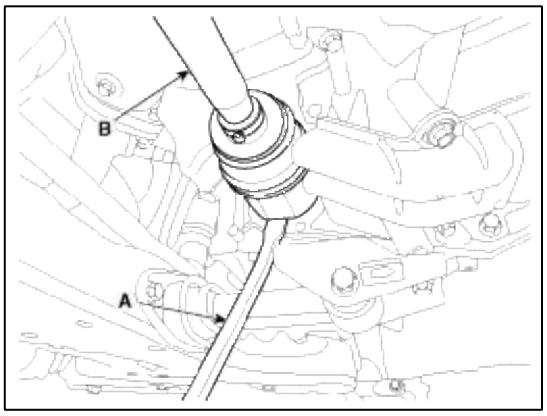
Tightening torque:
196.1 ~ 274.5 N.m (6.0 ~ 7.2 kgf.m, 144.6 ~ 202.5 lb-ft)



8. Disconnect the driveshaft (A) from the front hub assembly.



9. Insert a pry bar (A) between the transaxle case and joint case, and separate the drive shaft (B) from the transaxle case.



10. Install in the reverse order of removal.

CAUTION

- Use a pry bar (A) being careful not to damage the transaxle and joint.
- Do not insert the pry bar (A) too deep, as this may cause damage to the oil seal.
- Do not pull the driveshaft by excessive force it may cause components inside the joint kit to dislodge resulting in a torn boot or a damaged bearing.
- Plug the hole of the transaxle case with the oil seal cap to prevent contamination.
- Support the driveshaft properly.
- Replace the retainer ring whenever the driveshaft is removed from the transaxle case.

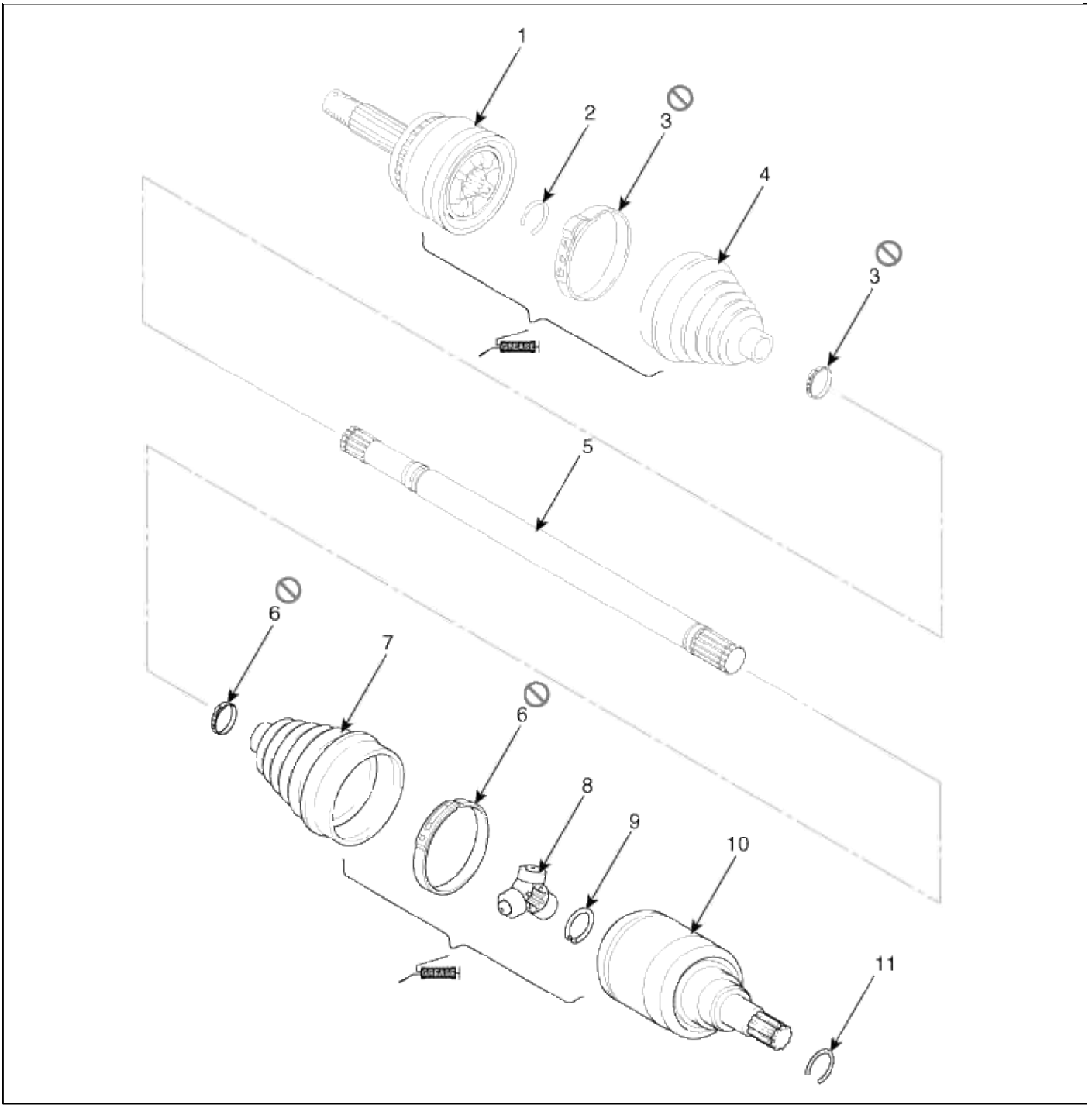
Inspection

1. Check the driveshaft boots for damage and deterioration.
2. Check the driveshaft spline for wear or damage.
3. Check that there is no water or foreign material in the joint.
4. Check the dynamic damper for damage or cracks.

Driveshaft and axle > Driveshaft Assembly > TJ Joint > Components and Components Location

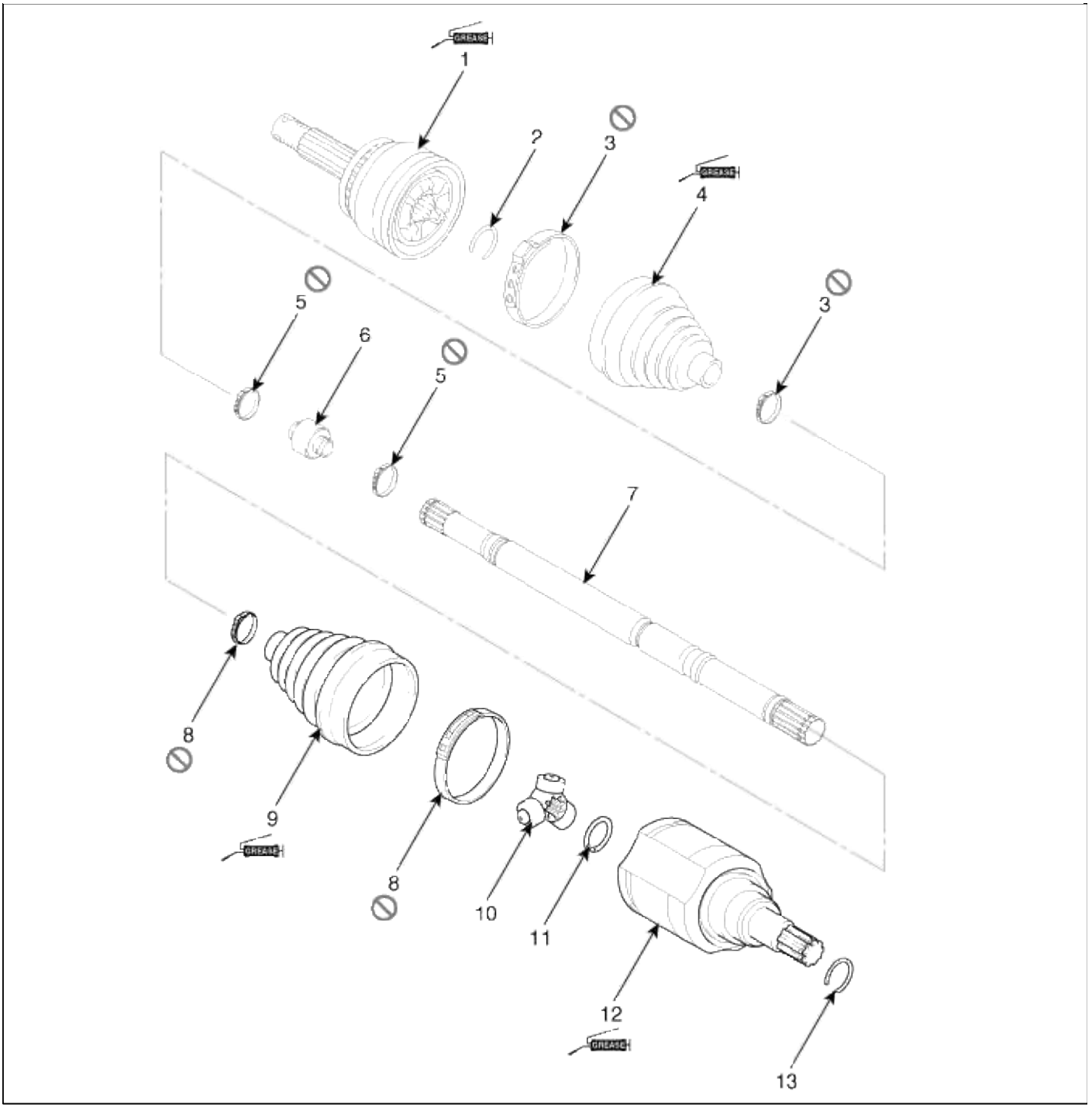
Components

[LH]



1. BJ assembly	5. Shaft	9. Snap ring
2. BJ circlip	6. TJ boot band	10. TJ case
3. BJ boot band	7. TJ boot	11. Snap ring
4. BJ boot	8. Spider assembly	

[RH]



1. BJ assembly 2. Circlip 3. BJ boot band 4. BJ boot	5. Dynamic damper band 6. Dynamic damper 7. Shaft 8. TJ boot band	9. TJ boot 10. Spider assembly 11. Snap ring 12. TJ case	13. Circlip

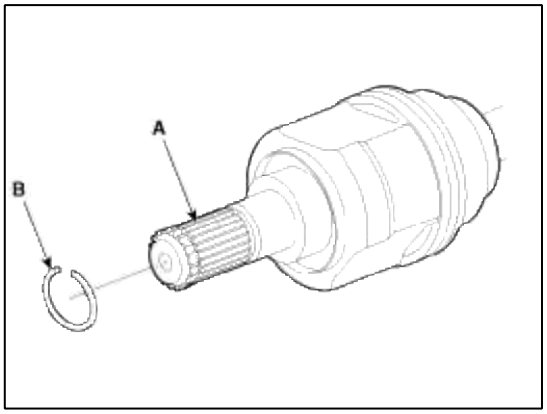
Driveshaft and axle > Driveshaft Assembly > TJ Joint > Repair procedures

Replacement

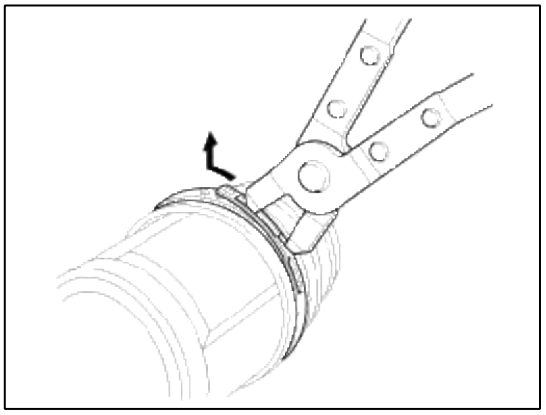
CAUTION

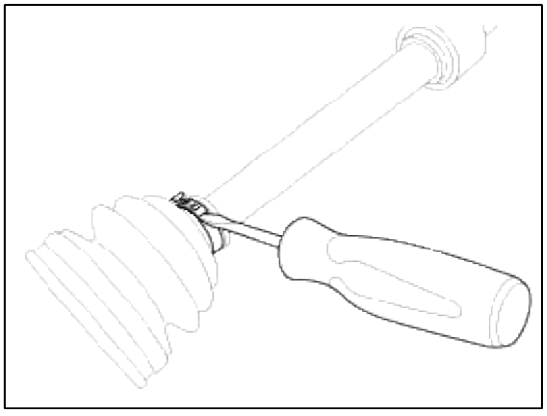
- Special grease must be applied to the driveshaft joint. Do not substitute with another type of grease.
- The boot band should be replaced with a new one.

1. Remove the Front Driveshaft. (Refer to DS group - “Front Driveshaft”)
2. Remove the circlip (B) from the driveshaft spline (A).

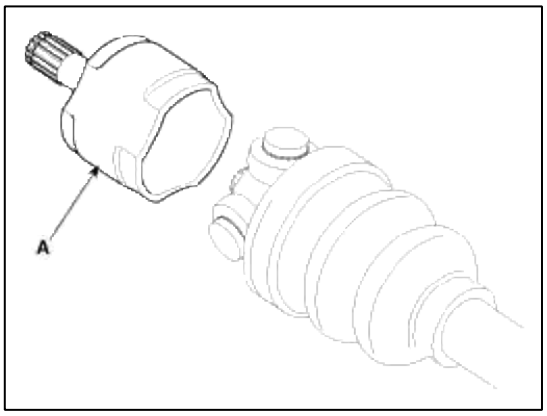


3. Remove both boot bands from the TJ case.



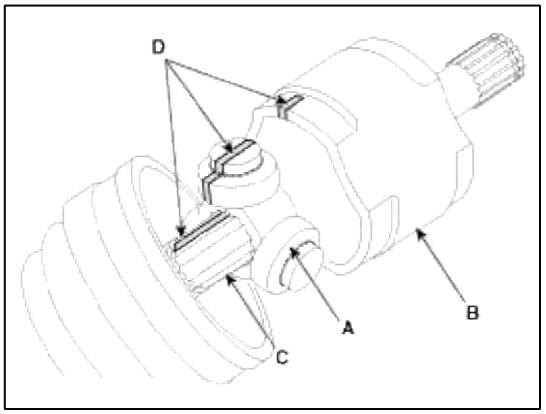


4. Remove the TJ case (A).

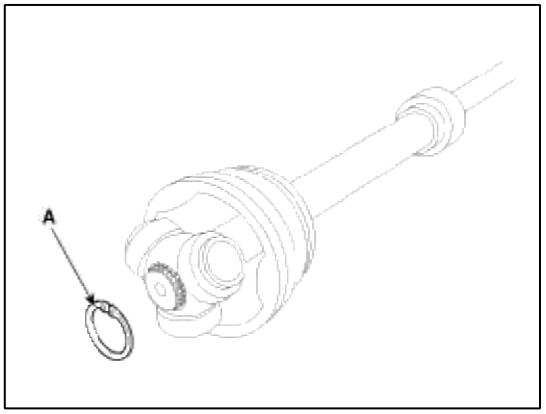


CAUTION

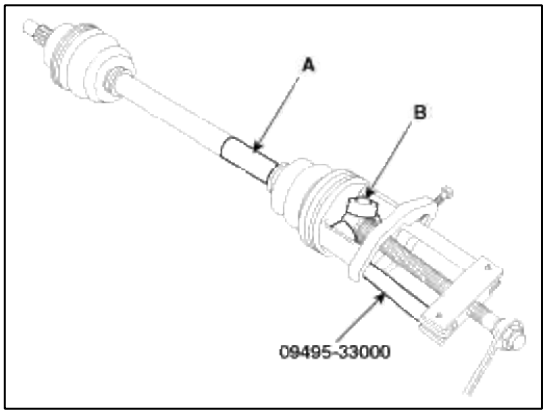
- Make alignment marks on spider roller assembly (A), joint case (B), and shaft spline (C) to aid reassembly.



5. Remove the snap ring (A) from the shaft.



6. Remove the spider assembly (B) from the driveshaft (A) using the special tool (09495-33000).

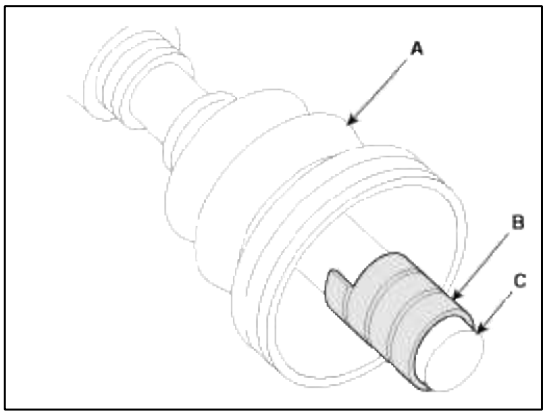


7. Clean the spider assembly.

8. Remove the TJ boot (A).

CAUTION

- For reusing the boot (A), wrap tape (B) around the driveshaft splines (C) to protect the boot (A).

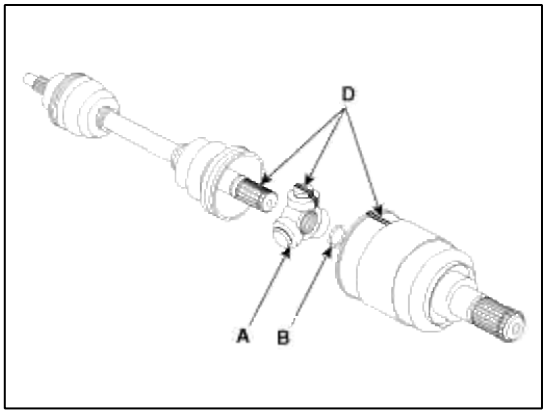


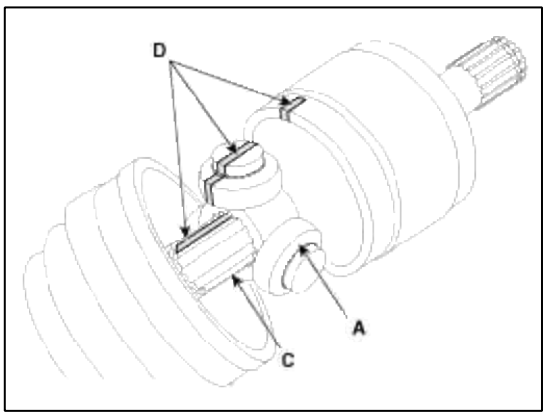
Inspection

1. Check the spider assembly for roller rotation, wear or corrosion.
2. Check the groove inside the joint case for wear or corrosion
3. Check the TJ boots for damage and deterioration.

Installation

1. Wrap tape around the driveshaft spline(TJ) to prevent damage to the boot.
2. Using the alignment marks (D) made during disassembly as a guide, install the spider assembly (A) and snap ring (B) on the driveshaft splines (C).

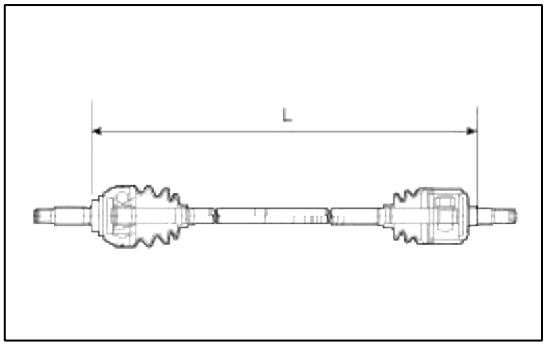




3. Add specified grease to the joint boot as much as it was wiped away at inspection.
4. Install the both boot band.

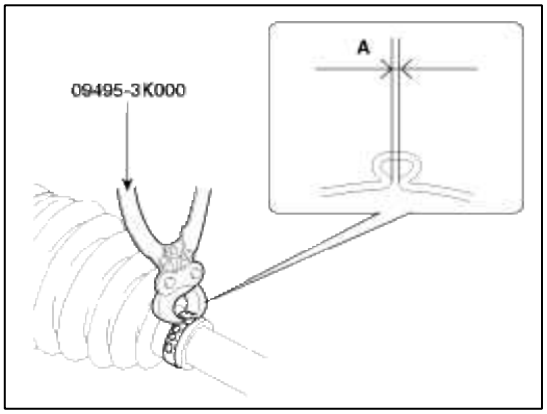
5. To control the air in the TJ boot, keep the specified distance between the boot bands when they are tightened.

Engine& T/M	Distance(L) mm(in)	
	LH side	RH side
Gasoline 1.6 & M/T	512.5(20.2)	792.9(31.2)
Gasoline 1.6 & A/T	489.6(19.3)	781.3(30.8)



6. Using the SST(09495-3K000), secure the TJ boot bands.

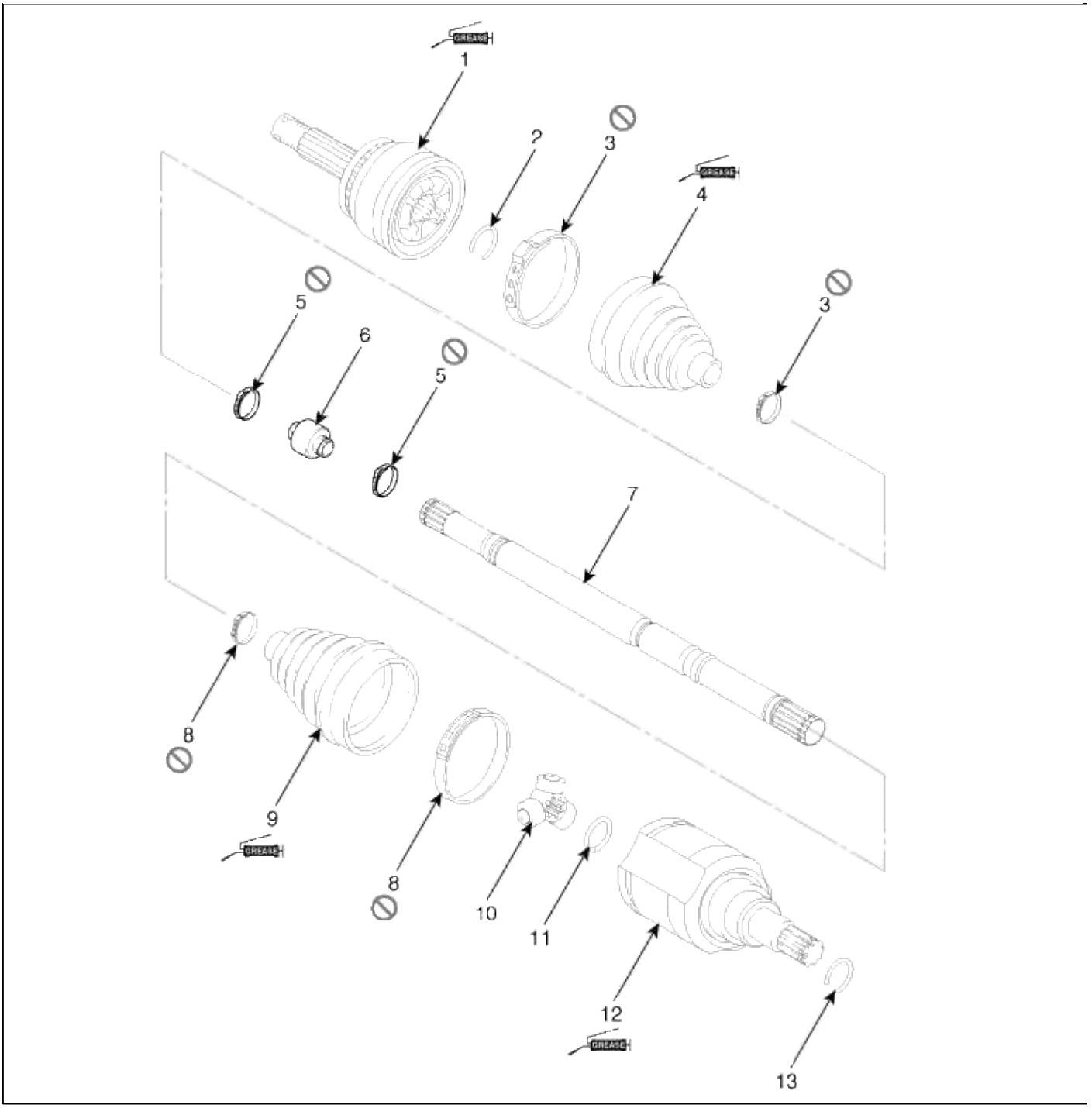
Clearance (A): 2.0 mm (0.079 in) or less



7. Install the Front Driveshaft. (Refer to DS group - “Front Driveshaft”)

Driveshaft and axle > Driveshaft Assembly > Dynamic Damper > Components and Components Location

Components



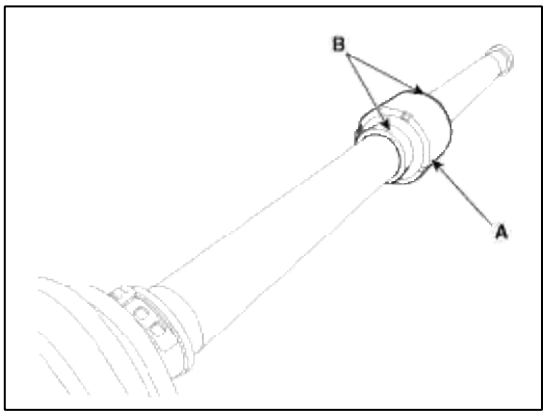
1. BJ assembly 2. Circlip 3. BJ boot band 4. BJ boot	5. Dynamic damper band 6. Dynamic damper 7. Shaft 8. TJ boot band	9. TJ boot 10. Spider assembly 11. Snap ring 12. TJ case	13. Circlip

Driveshaft and axle > Driveshaft Assembly > Dynamic Damper > Repair procedures

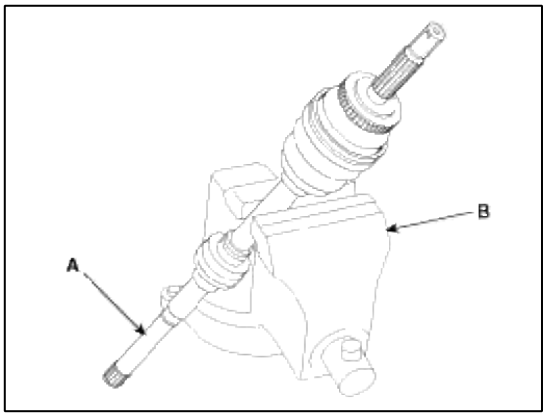
Replacement

1. Remove the front driveshaft. (Refer to DS group - “Front Driveshaft”)
2. Remove the TJ joint assembly. (Refer to DS group - “TJ joint”)

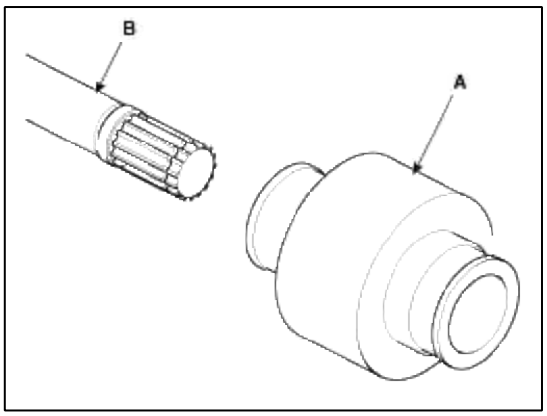
3. Remove the remove the both side of band (B) of the dynamic damper (A).



4. Fix the driveshaft (A) with a vice (B) as illustrated.



5. Apply soap powder on the shaft to prevent being damaged between the shaft spline and the dynamic damper when the dynamic damper is removed.
6. Seperate the dynamic damper (A) from the shaft (B) carefully.

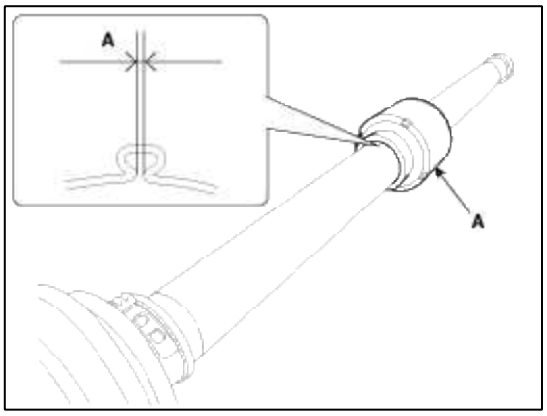


Installation

1. Apply soap powder on the shaft to prevent being damaged between the shaft spline and the dynamic damper.
2. Install the dynamic damper.
3. Install the dynamic damper band.

4. Using the SST(09495-3K000), secure the TJ boot bands (A).

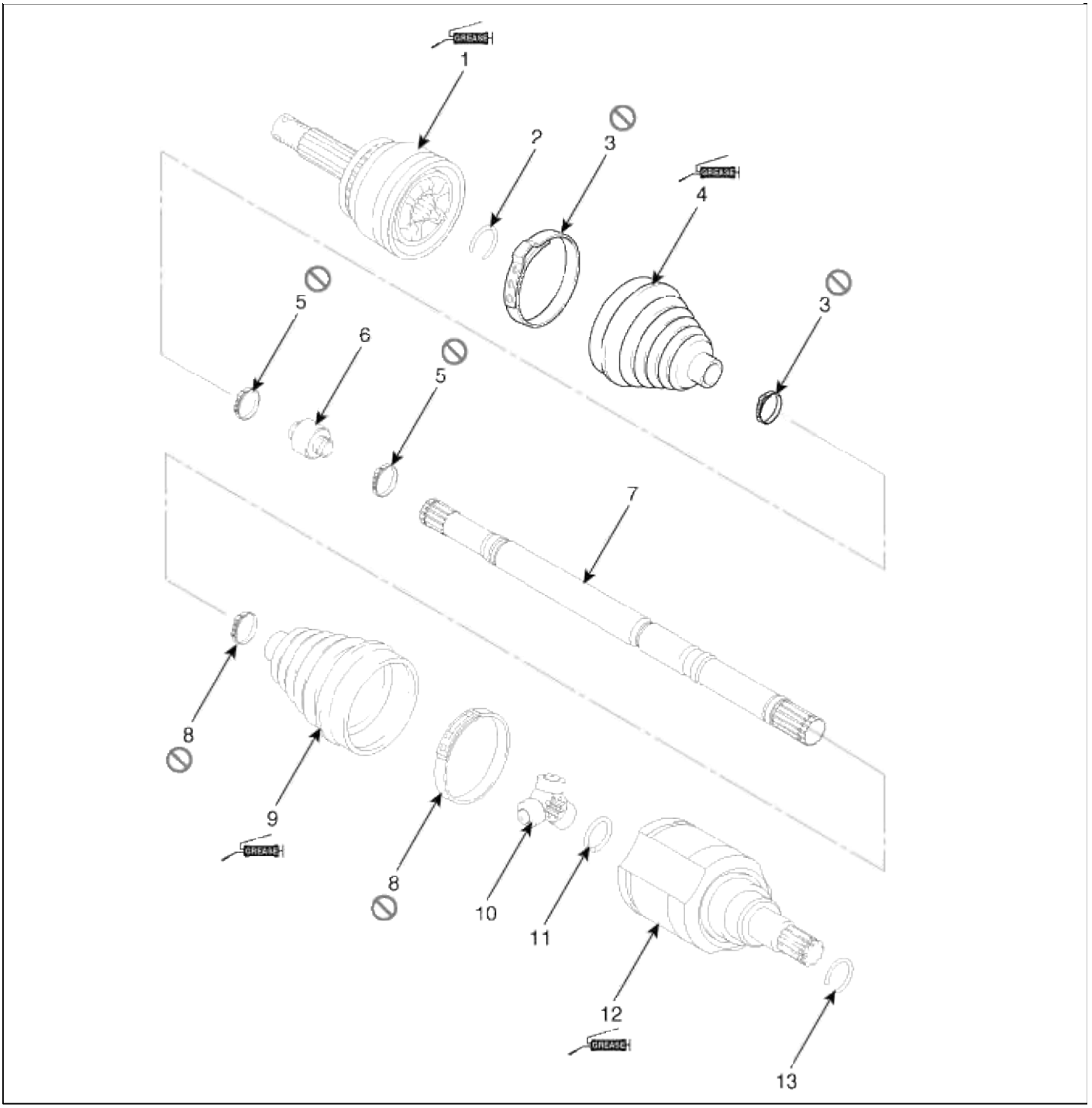
Clearance (A): 2.0 mm (0.079 in) or less



5. Install the TJ joint assembly. (Refer to DS group - “TJ joint”)
6. Install the front driveshaft. (Refer to DS group - “Front Driveshaft”)

Driveshaft and axle > Driveshaft Assembly > BJ Boot > Components and Components Location

Components



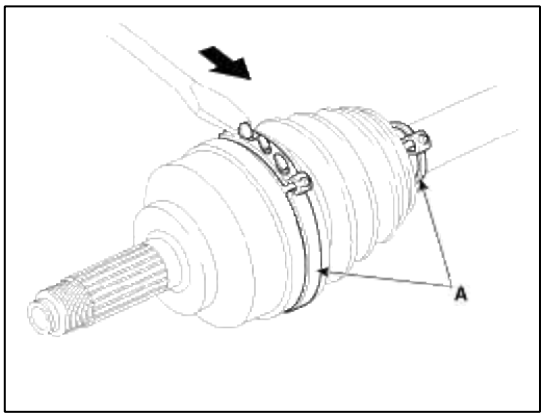
1. BJ assembly 2. Circlip 3. BJ boot band 4. BJ boot	5. Dynamic damper band 6. Dynamic damper 7. Shaft 8. TJ boot band	9. TJ boot 10. Spider assembly 11. Snap ring 12. TJ case	13. Circlip

Driveshaft and axle > Driveshaft Assembly > BJ Boot > Repair procedures

Replacement

1. Remove the front driveshaft. (Refer to DS group - “Front Driveshaft”)
2. Remove the TJ joint assembly. (Refer to DS group - “TJ Joint”)
3. Remove the Dynamic damper. (Refer to DS group - “Dynamic Damper”)

4. Using a plier or flat-tipped (-) screwdriver, remove the BJ boot bands (A).



5. Remove the BJ boot.
6. Install in the reverse order of removal.

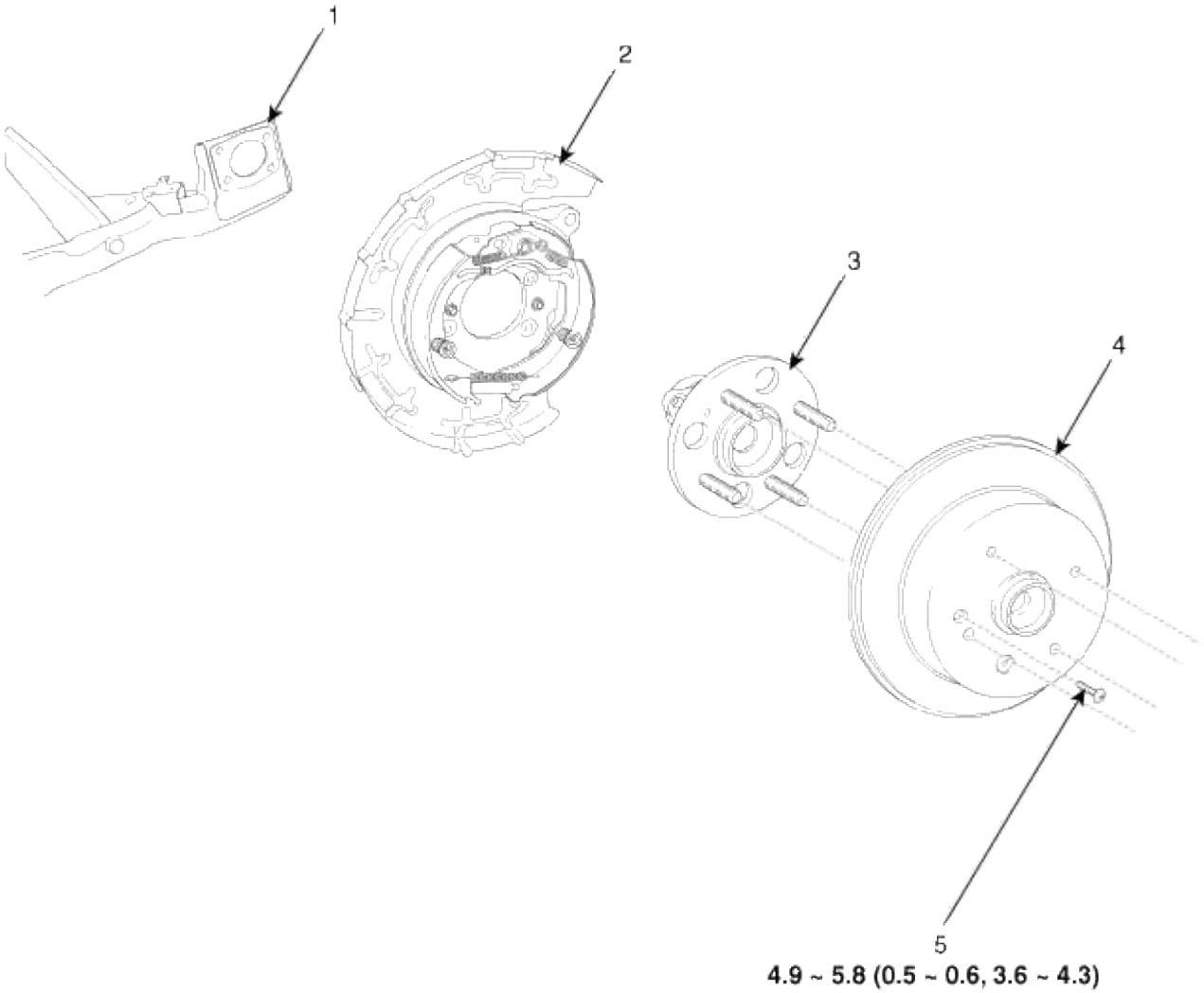
CAUTION

- 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.

Driveshaft and axle > Rear Axle Assembly > Rear Hub - Carrier > Components and Components Location

Components

[Drum Type]

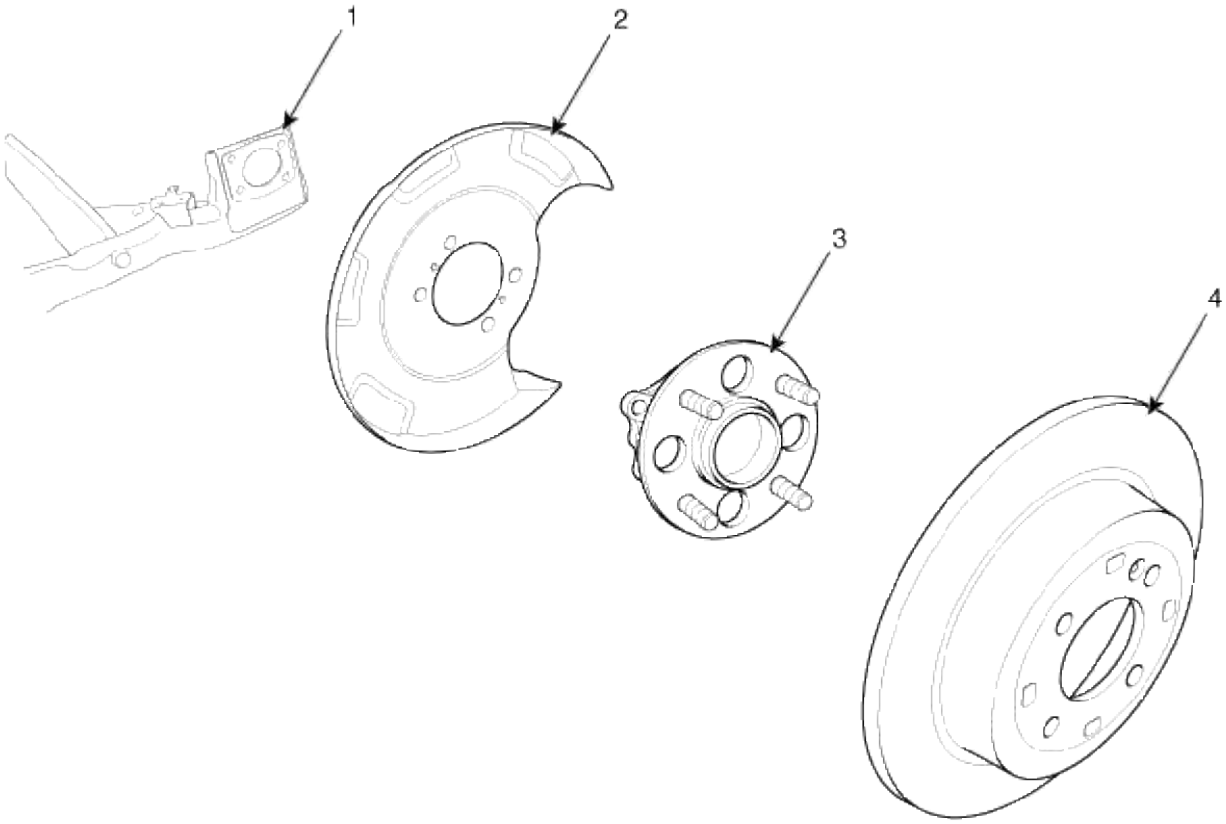


CAUTION
The right and the left bearing must be made in the same company.

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

1. Rear torsion beam assembly 2. Brake assembly 3. Rear wheel hub assembly	4. Rear brake disc 5. Rear brake disc mounting screw

[Disc Type]



CAUTION
The right and the left bearing must be made in the same company.

1. Rear torsion beam assembly 2. Dust cover	3. Rear wheel hub assembly 4. Rear brake disc

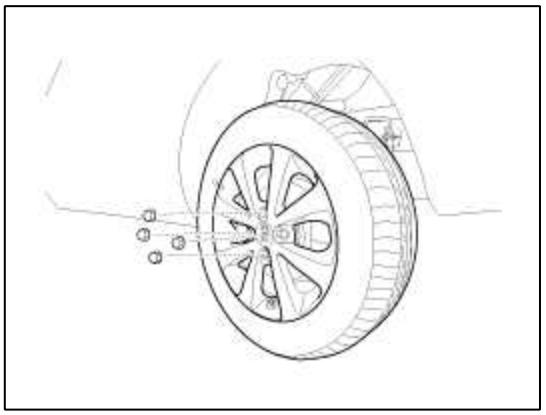
Driveshaft and axle > Rear Axle Assembly > Rear Hub - Carrier > Repair procedures

Replacement

[Drum Type]

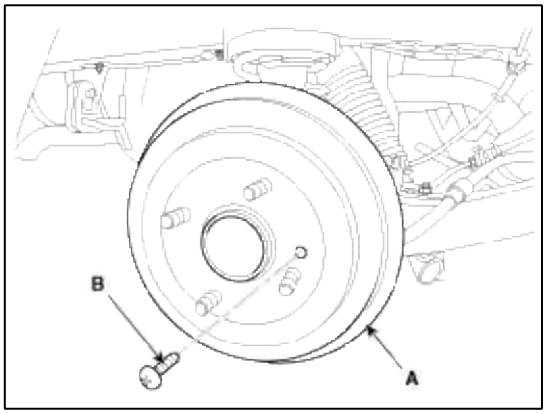
1. Remove the rear wheel & tire.

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

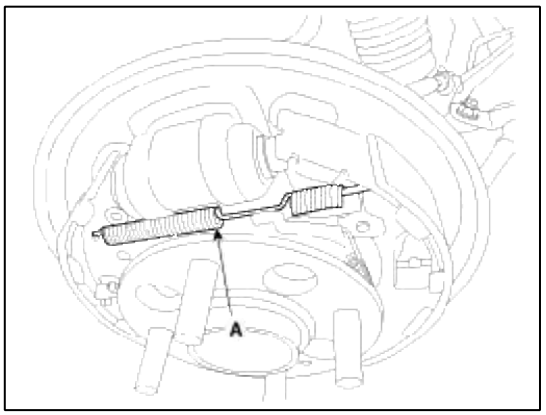


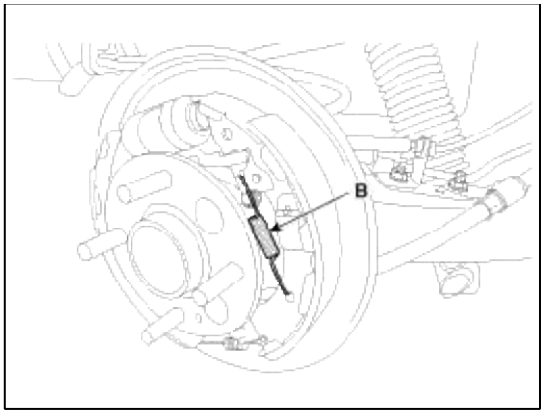
2. Loosen the screw (A) and then remove the disc (B).

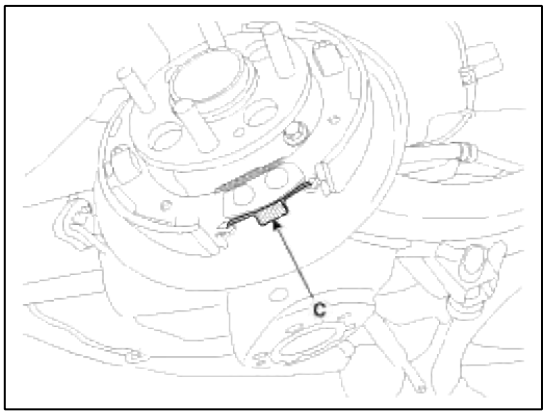
Tightening torque:
4.9 ~ 5.8 N.m (0.5 ~ 0.6 kgf.m, 3.6 ~ 4.3 lb-ft)



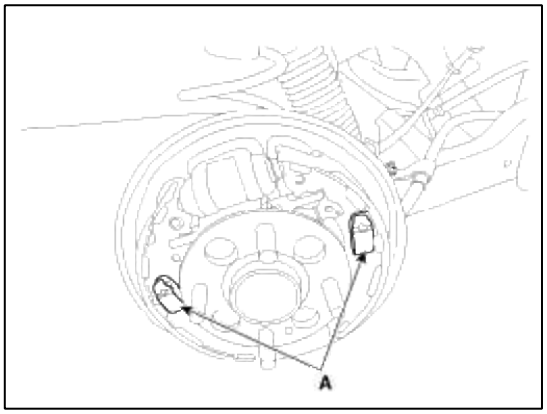
3. Remove the spring (A, B, C).



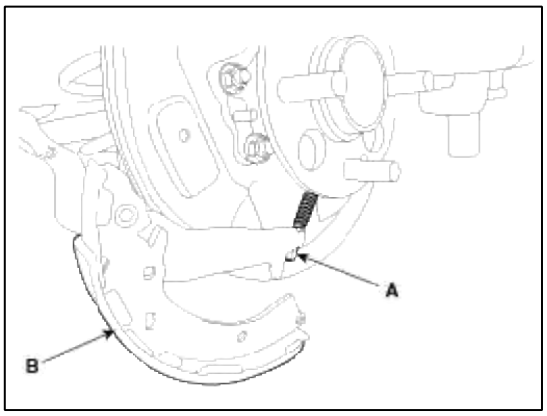




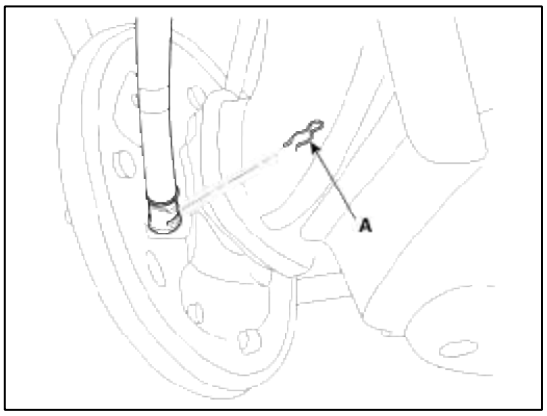
4. Remove the shoe (A).



5. Disconnect the parking brake cable (A) from lining (B).

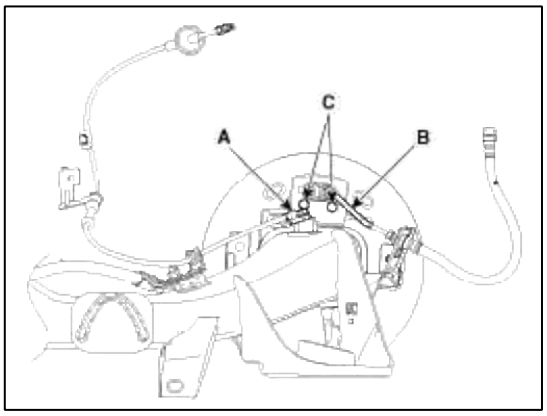


6. Remove the clip (A).



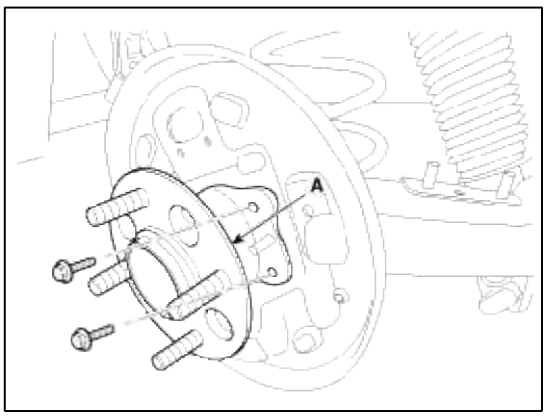
7. Remove the wheel speed sensor (A) & brake hose (B) from the rear axle aseembly and then loosen the cylinder bolts (C).

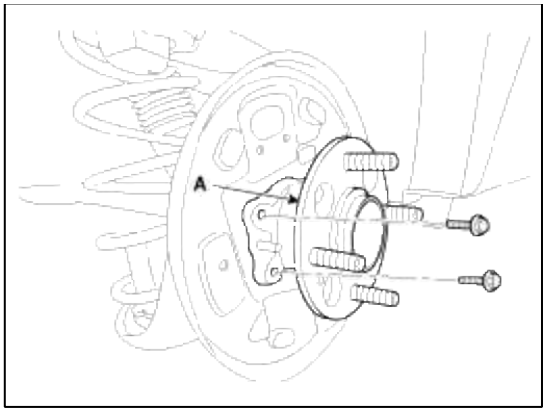
Tightening torque:
A: 6.9 ~ 10.8 N.m (0.7 ~ 1.1 kgf.m, 5.1 ~ 8.0 lb-ft)
B: 12.7 ~16.7 N.m (1.3 ~ 1.7 kgf.m, 9.4 ~ 12.3 lb-ft)



8. Loosen the hub mounting bolt and then remove the hub (A) from the torsion beam.

Tightening torque:
49.0 ~ 58.8 N.m (5.0 ~ 6.0 kgf.m, 36.2 ~ 43.4 lb-ft)



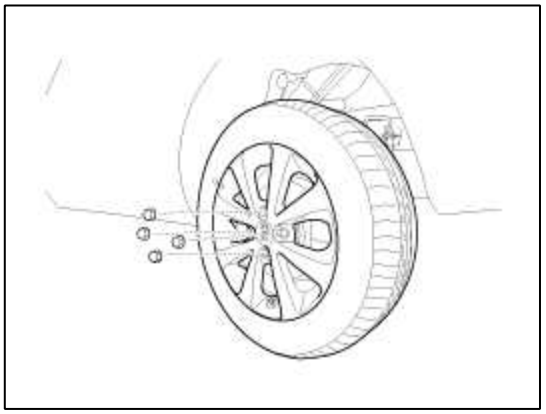


9. Install in the reverse order of removal.

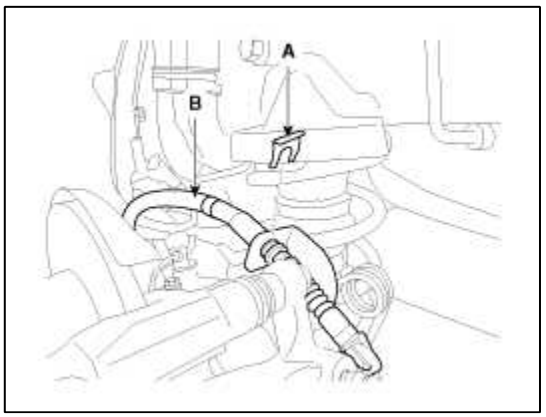
[Disc Type]

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)

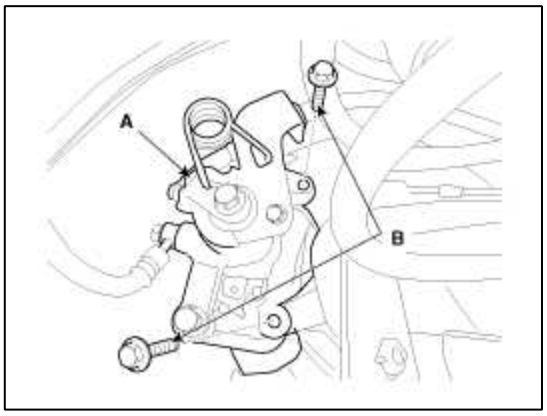


2. Remove the clip (A) and then remove the parking brake cable (B).



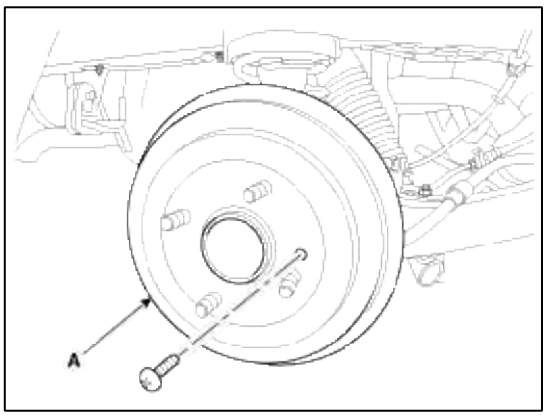
3. Remove the brake caliper assembly (A) from the torsion beam axle by loosening the bolts (B).

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



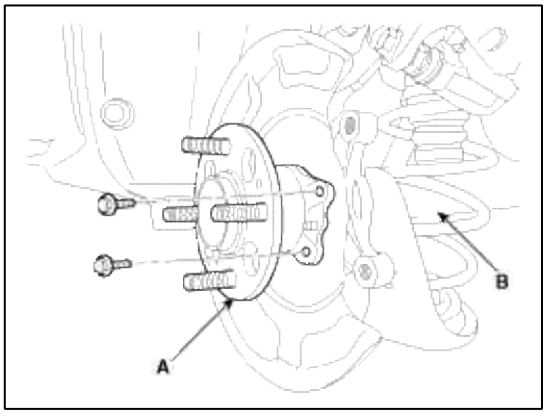
4. Loosen the screw and remove the disc (A).

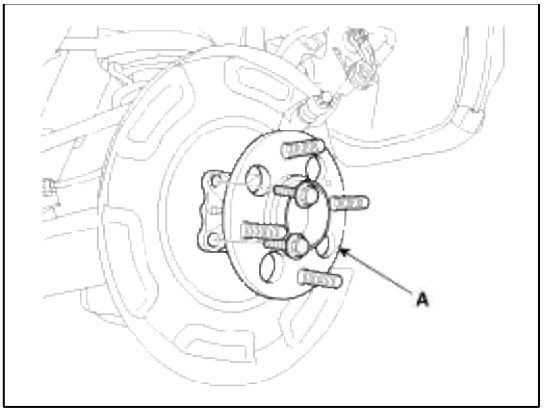
Tightening torque:
4.9 ~ 5.8 N.m (0.5 ~ 0.6 kgf.m, 3.6 ~ 4.3 lb-ft)



5. Loosen the hub mounting bolt and then remove the hub (A) from the torsion beam (B).

Tightening torque:
49.0 ~ 58.8 N.m (5.0 ~ 6.0 kgf.m, 36.2 ~ 43.4 lb-ft)





6. 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.

RIO(UB) > 2012 > G 1.6 GDI > 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)	22.0 ~ 26.0 [20°C(68°F)]

Fuel Tank Pressure Sensor (FTPS)

Type: Piezo-Resistive Pressure Sensor

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

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	0.8 ~ 1.2	7.8 ~ 11.8	5.8 ~ 8.7
Canister installation bolt/nut	2.0 ~ 3.0	19.6 ~ 29.4	14.5 ~ 21.7
Fuel tank air filter installation bolt	0.4 ~ 0.6	3.9 ~ 5.9	2.9 ~ 4.3

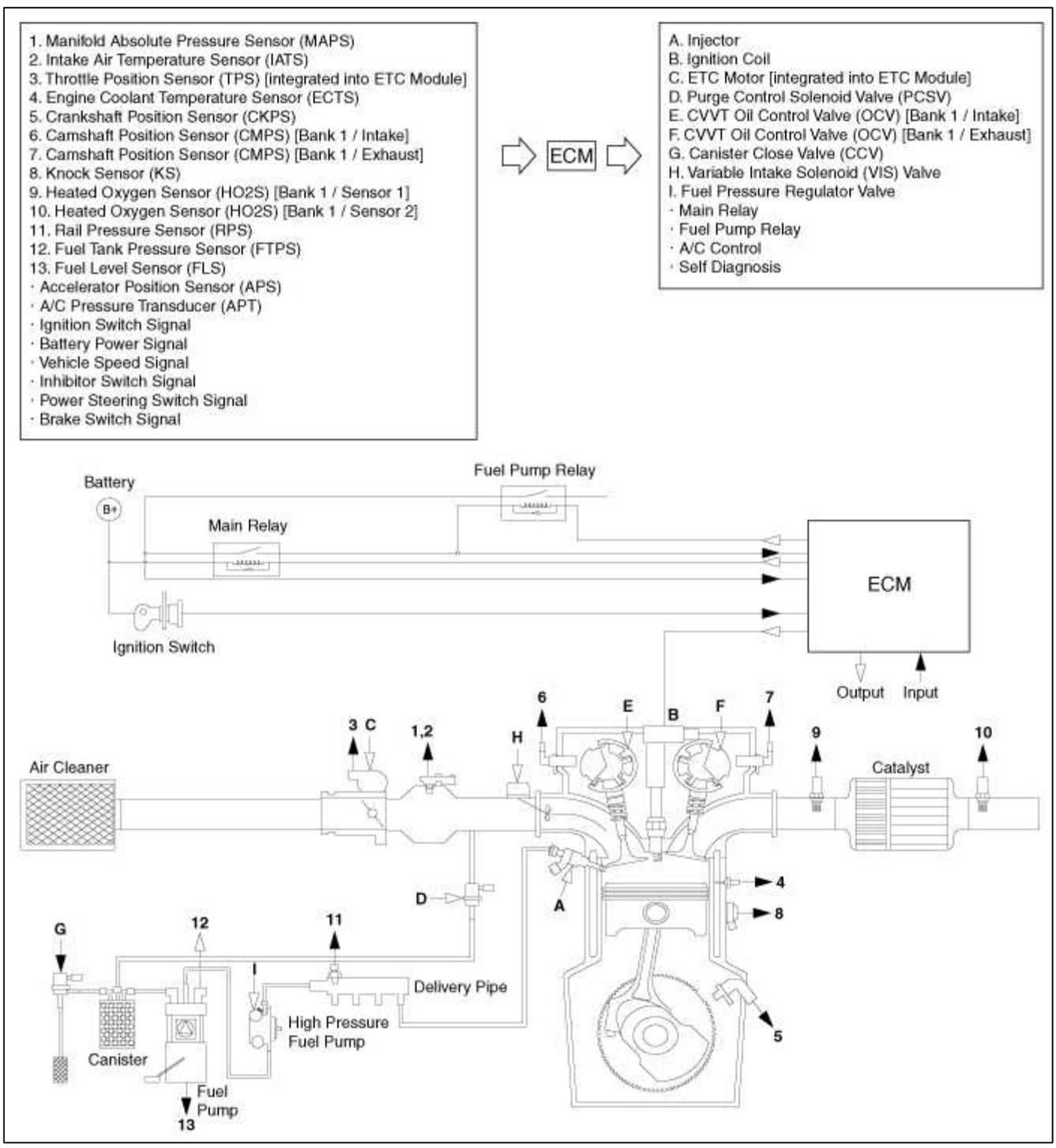
Emission Control System > General Information > Troubleshooting

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

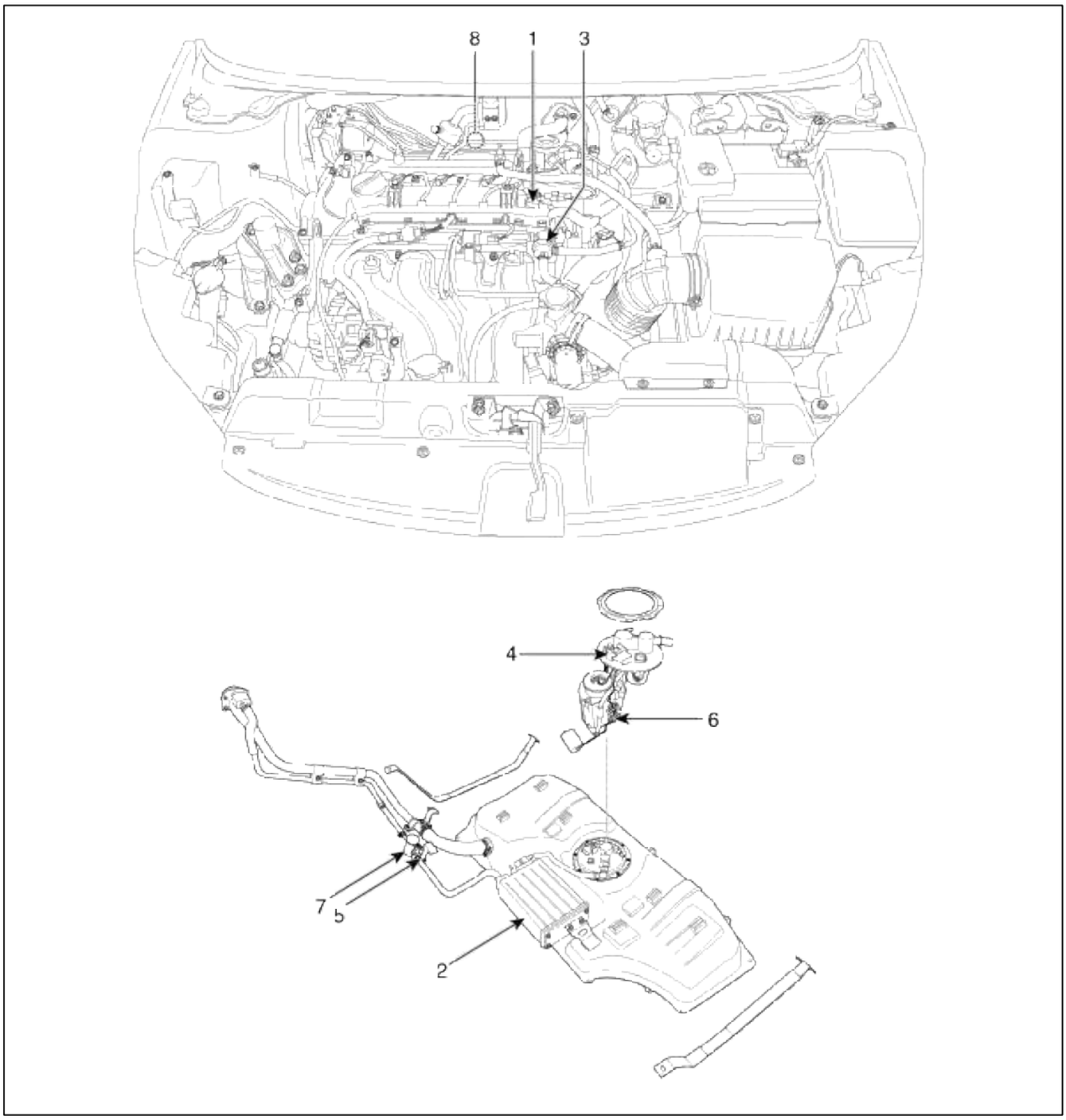
Emission Control System > General Information > Schematic Diagrams

Schematic Diagram

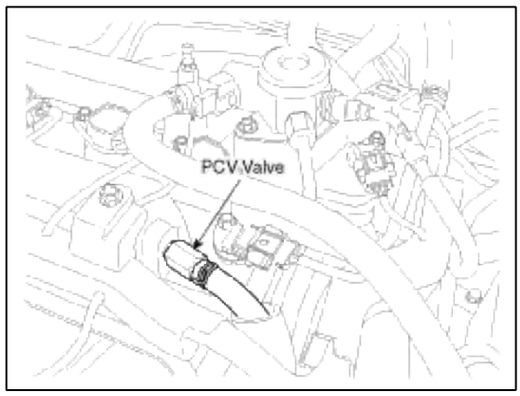
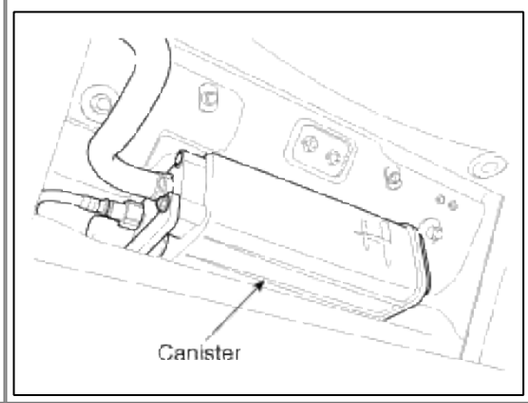
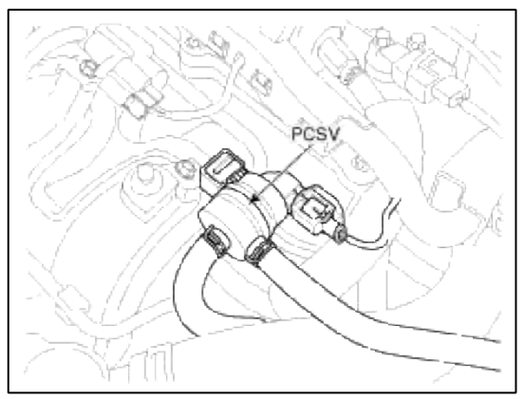
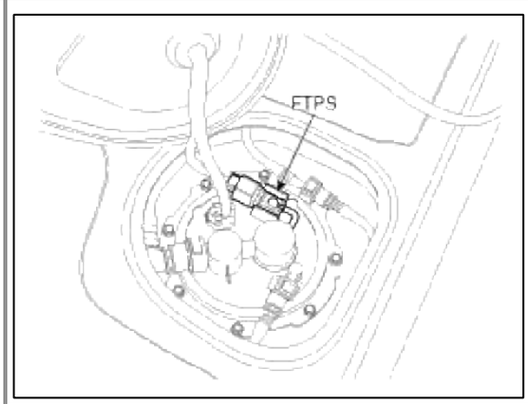
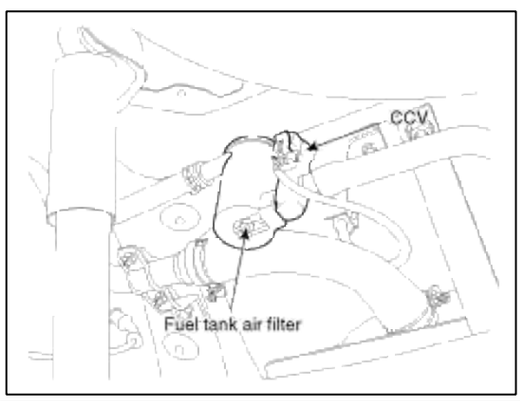
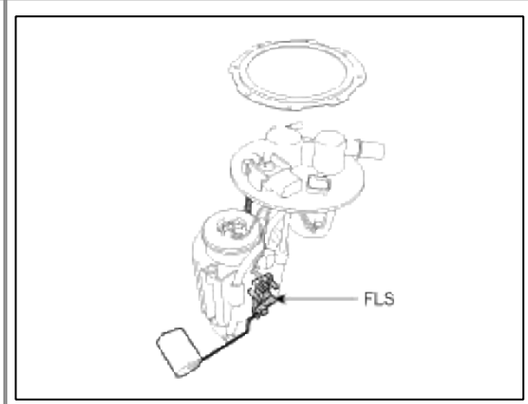
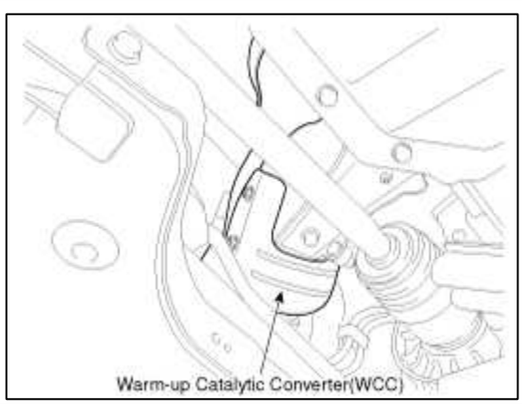
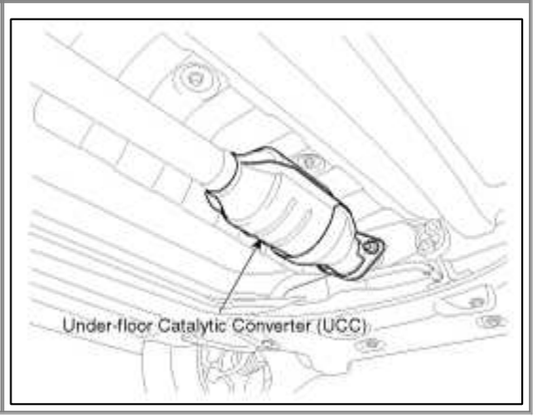


Emission Control System > General Information > Components and Components Location

Components Location

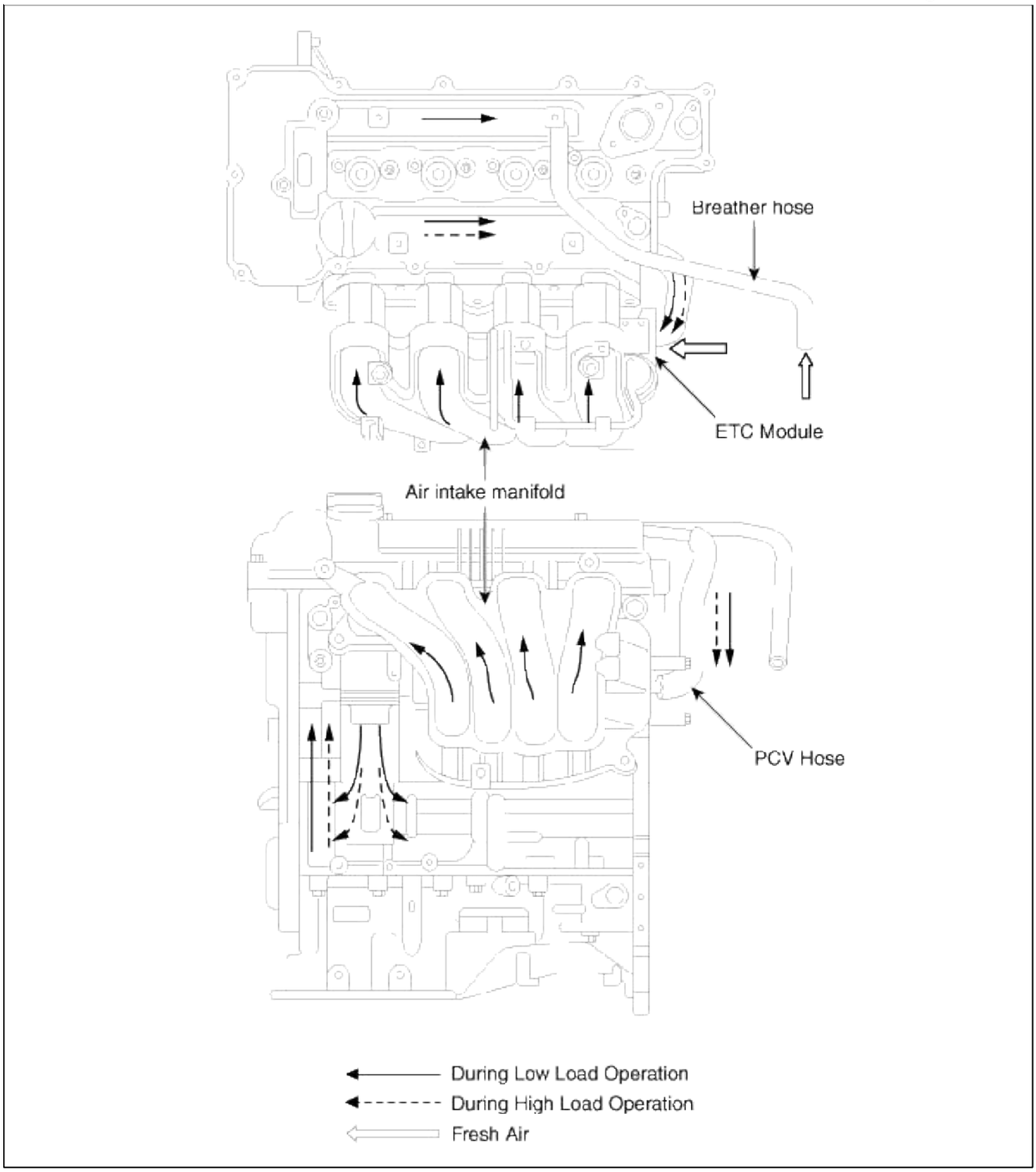


1. PCV valve 2. Canister 3. Purge control solenoid valve (PCSV) 4. Fuel tank pressure sensor (FTPS)	5. Canister close valve (CCV) 6. Fuel level sensor (FLS) 7. Fuel tank air filter 8. Catalytic converter

1. PCV valve	2. Canister
	
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 (WCC)	8. Catalytic converter (UCC)
	

Emission Control System > Crankcase Emission Control System > Schematic Diagrams

Schematic Diagram



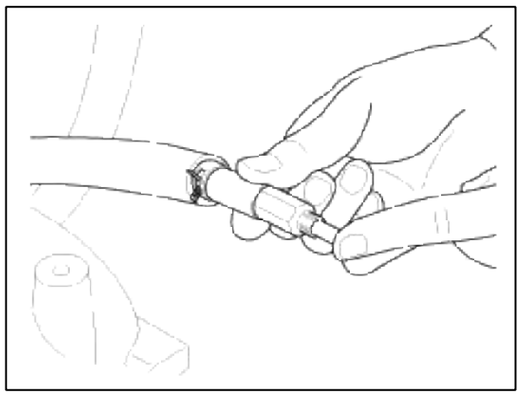
Emission Control System > Crankcase Emission Control System > Repair procedures

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.

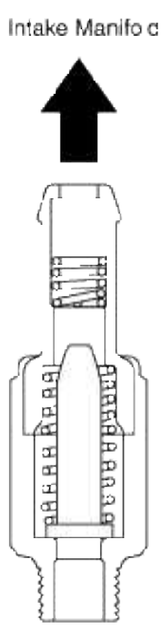
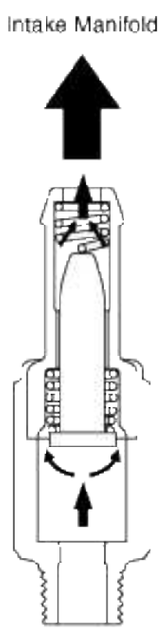
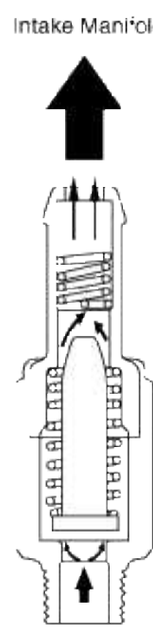
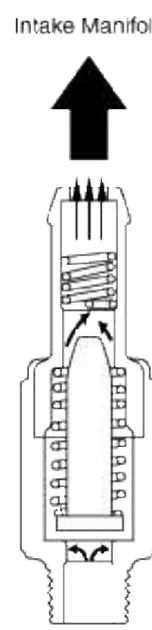
> NOTE
>
> The plunger inside the PCV valve will move back and forth at vacuum.



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

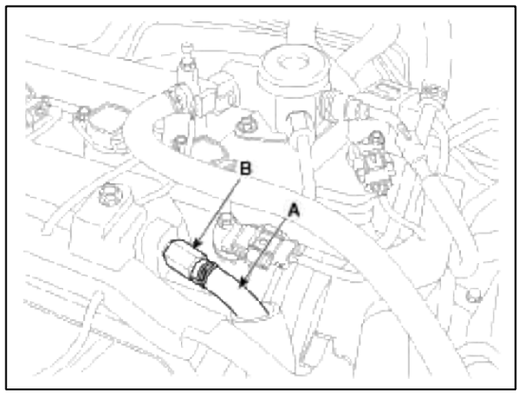
Engine Condition	Not Running	Idling or Decelerating	Normal Operation	Accelerating and High Load
Vacuum in Intake Manifold	0	High	Moderate	Low
PCV Valve	Closed	Slightly Open	Partially Open	Fully Open
Blow-by Gas Flow	0	Small	Medium	Large
Schematic Diagram				

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

Removal

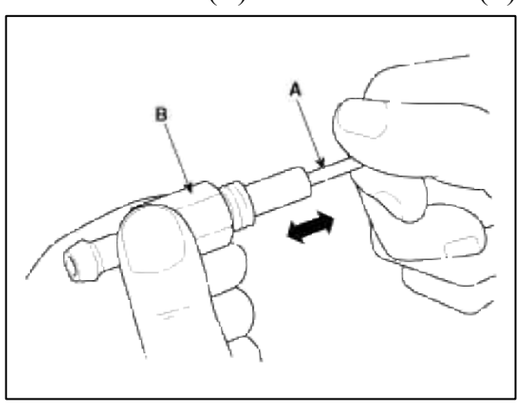
1. Disconnect the vapor hose (A).

2. Remove the PCV valve (B).



Inspection

1. Insert a thin stick (A) into the PCV valve (B) from the threaded side to check that the plunger 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:
7.8 ~ 11.8 N.m (0.8 ~ 1.2 kgf.m, 5.8 ~ 8.7 lb-ft)

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

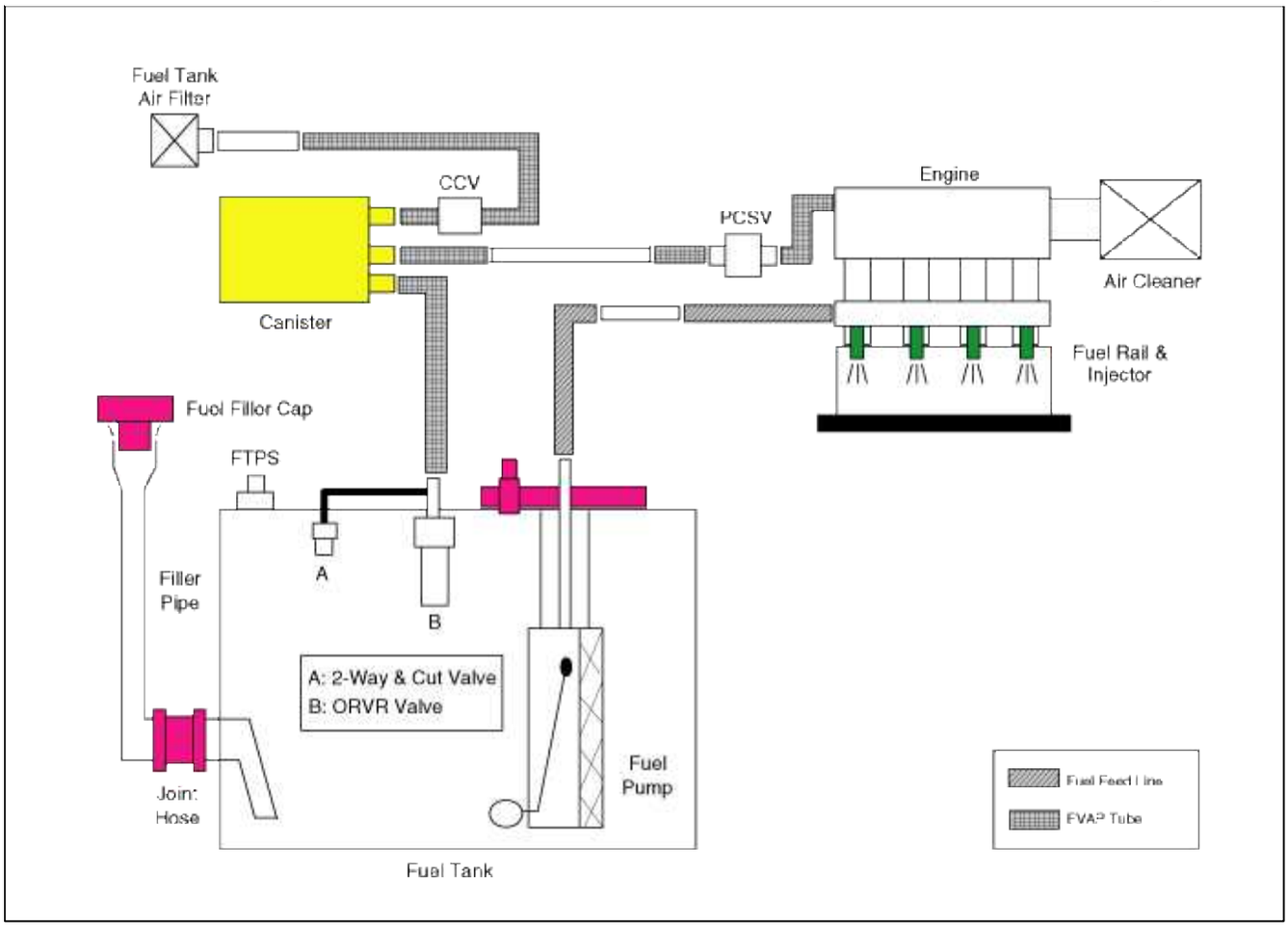
Description

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.

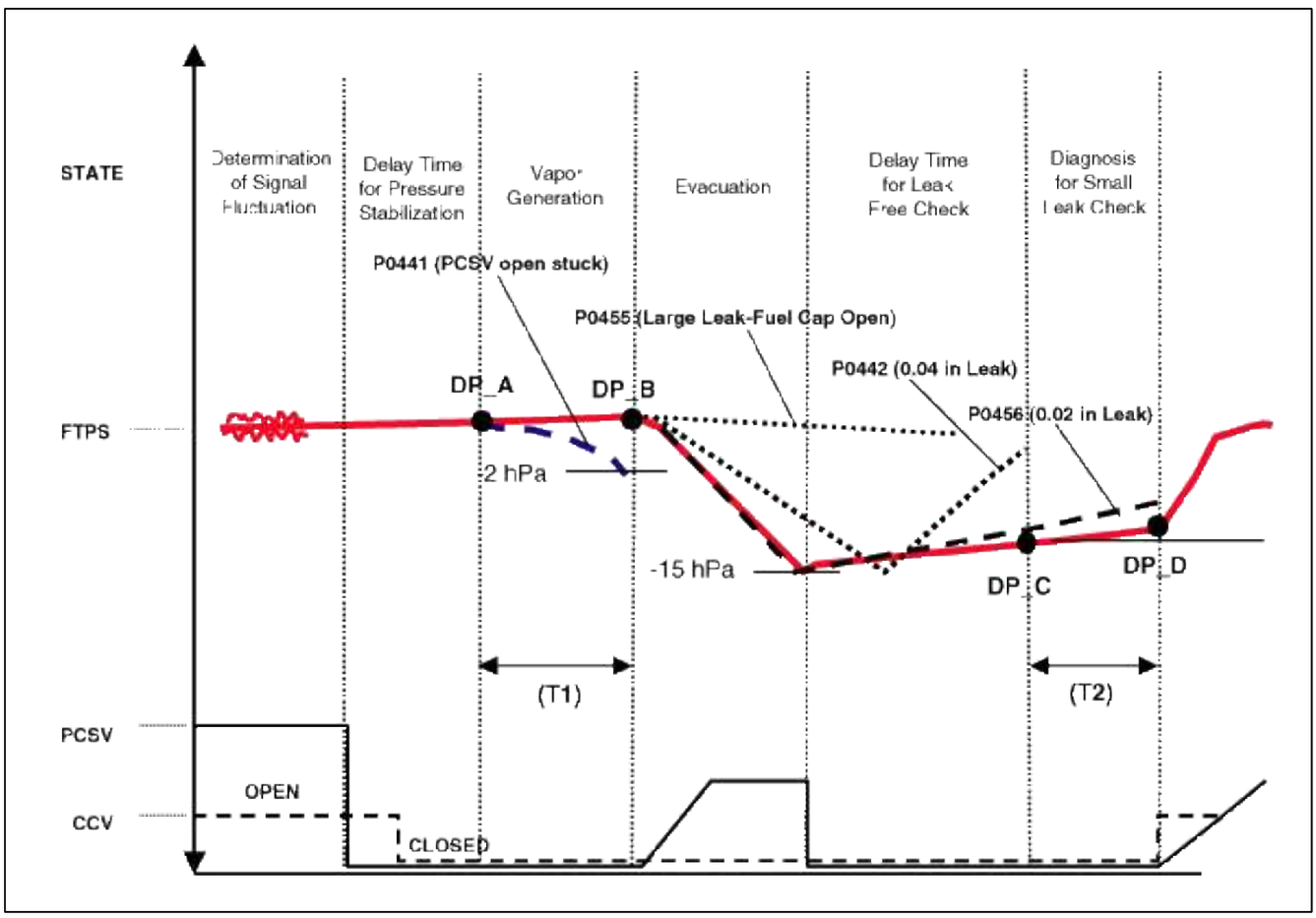
Large EVAP Leak Detection

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

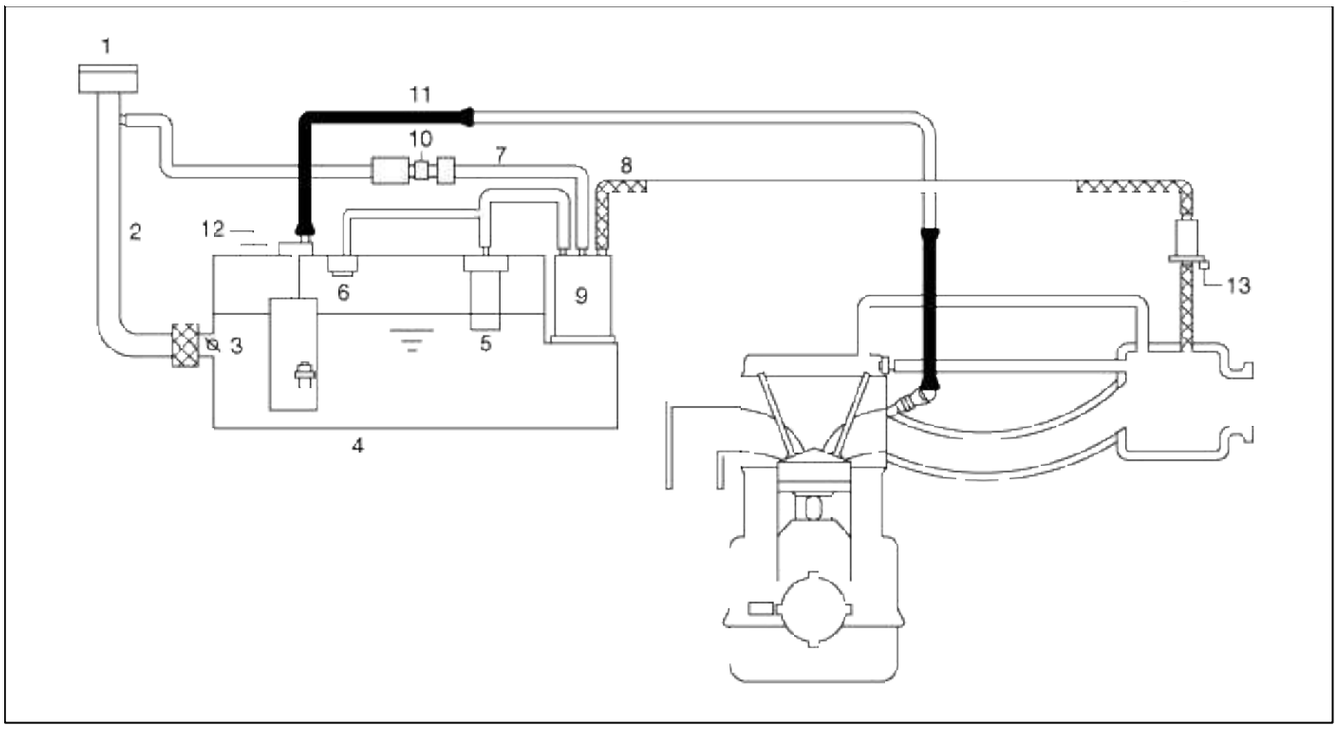


Evaporative And ORVR Emission Control System

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

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

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



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

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)]

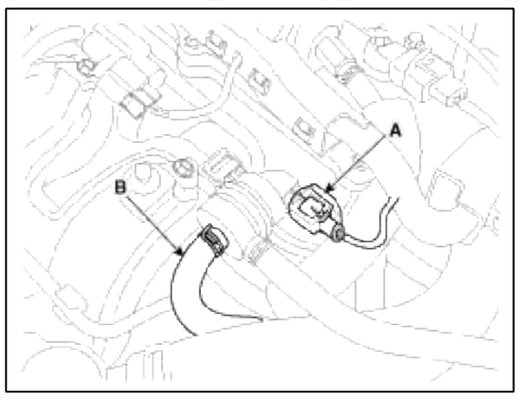
Engine Operating Condition	Applied Vacuum	Result
Idle	Min. 20 inHg (Min. 0.7 kgf/cm², Min. 67.7 kPa)	Vacuum is held
3,000rpm		

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/cm², 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/cm², 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).

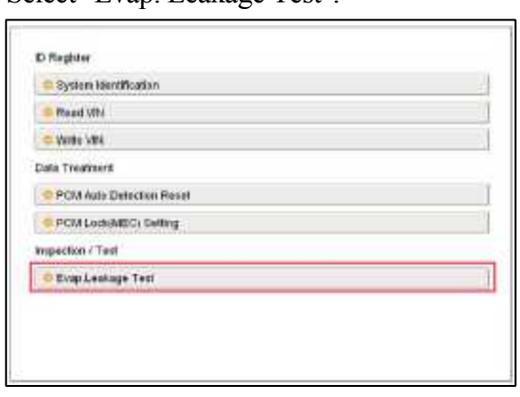
Battery Voltage	Valve	Vacuum
Connected	Open	Released
Disconnected	Close	Maintained

6. Measure the coil resistance of the PCSV.

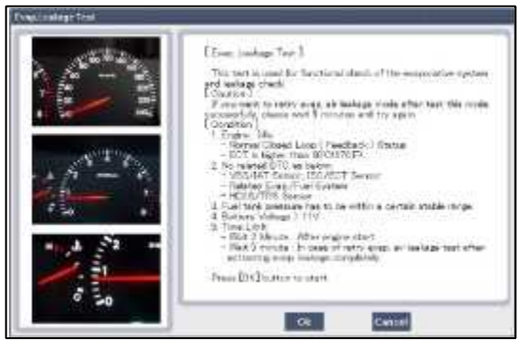
Specifications:
22.0 ~ 26.0Ω [20°C(68°F)]

[EVAP. Leakage Test]

1. Select "Evap. Leakage Test".



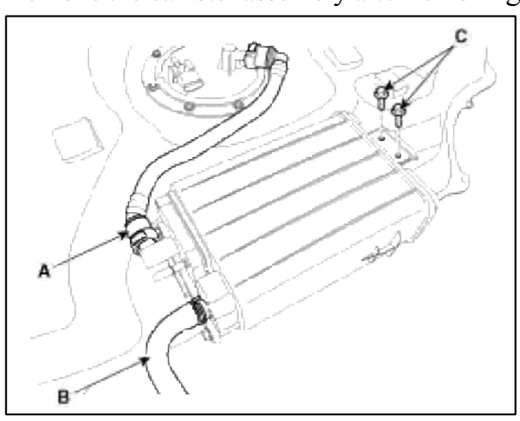
2. Proceed with the test according to the screen introductions.



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

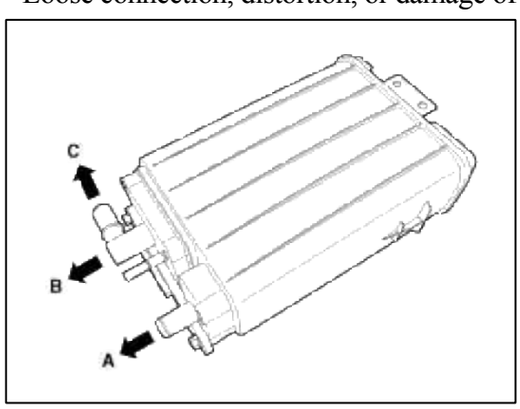
Removal

1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Lift the vehicle.
3. Remove the fuel tank. (Refer to "Fuel Tank" in this group.)
4. Disconnect the vapor tube quick-connector (A) and the vapor hose (B).
5. Remove the canister assembly after removing installation bolts (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 (Fuel tank air filter)
B: Canister ↔ Intake manifold
C: Canister ↔ Fuel tank

Installation

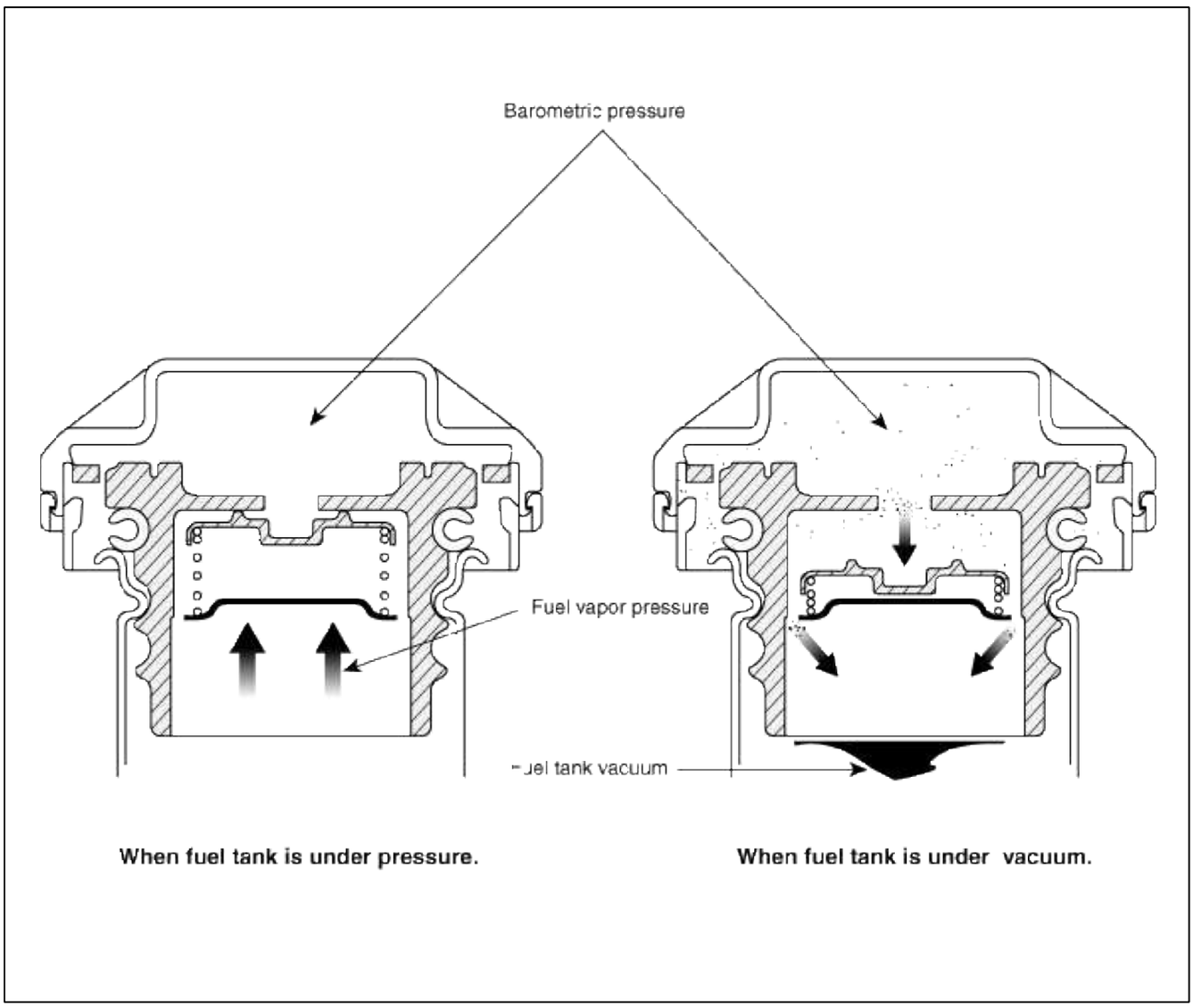
Installation is the reverse of removal.

Canister installation bolt/nut:
19.6 ~ 29.4 N.m (2.0 ~ 3.0 kgf.m, 14.5 ~ 21.7 lb-ft)

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

Description

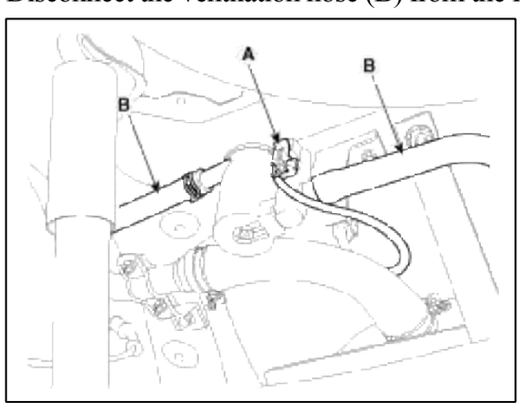
A ratchet tightening device on the threaded fuel filler cap reduces the chances of incorrect installation, which seals the fuel filler. After the gasket on the fuel filler cap and the filler neck flange contact each other, the ratchet produces a loud clicking noise indicating the seal has been set.



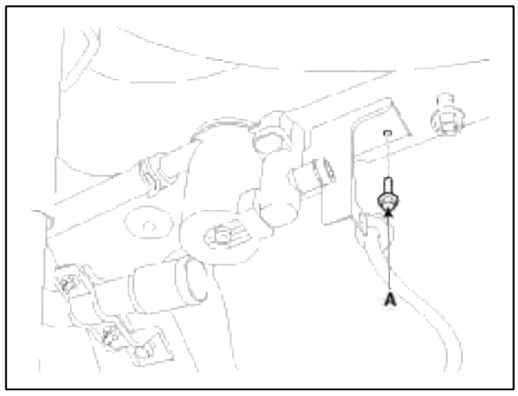
Emission Control System > Evaporative Emission Control System > Fuel Tank Air Filter > Repair procedures

Removal

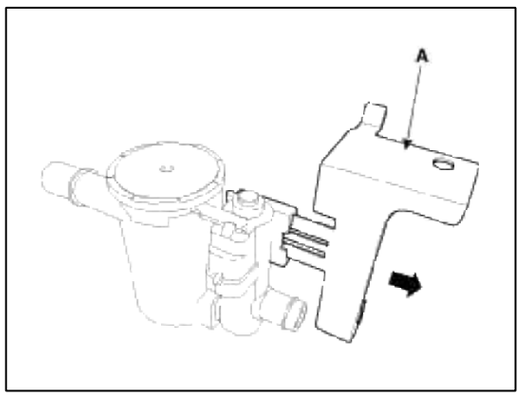
1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Lift the vehicle.
3. Disconnect the canister close valve connector (A).
4. Disconnect the ventilation hose (B) from the fuel tank air filter and canister close valve.



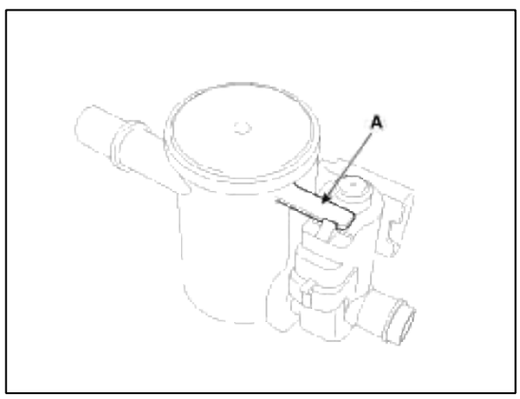
5. Remove the fuel tank air filter assembly after removing a bolt (A).

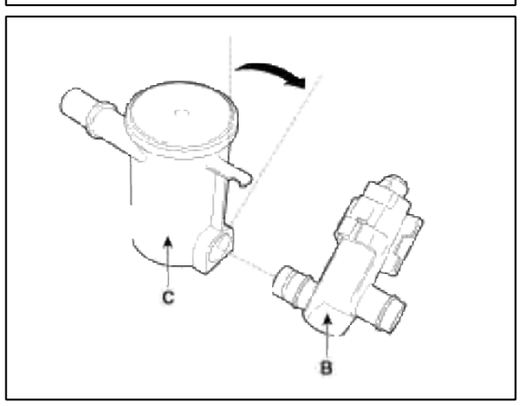


6. Remove the bracket (A) after pulling it.



7. 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.

1. Installation is reverse of removal.

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.

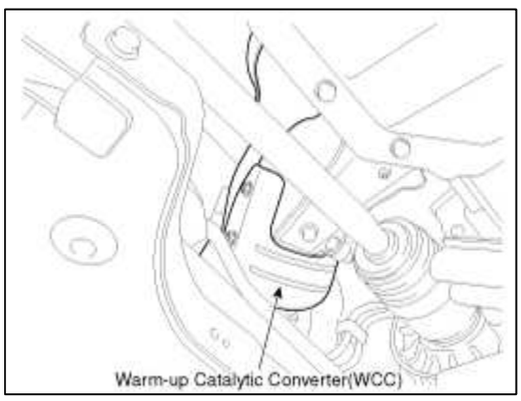
Modifications to the combustion chamber, intake manifold, camshaft and ignition system form the basic control system.
These items have been integrated into a highly effective system which controls exhaust emissions while maintaining good drivability and fuel economy.
Air/Fuel Mixture Control System [Gasoline Direct Injection (GDI) System]
The GDI 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 GDI system.

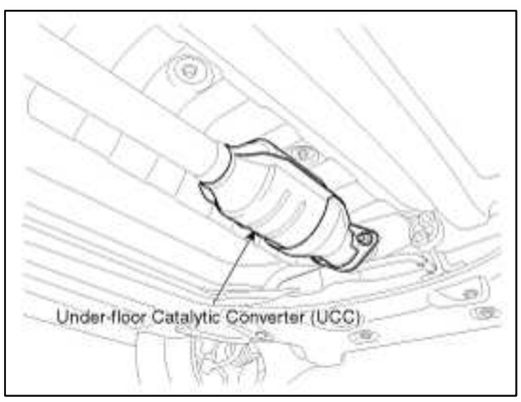
1. Open Loop air/fuel ratio is controlled by information pre-programmed into the ECM.
2. Closed Loop air/fuel ratio is constantly adjusted by the ECM based on information supplied by the oxygen sensor.

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).





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

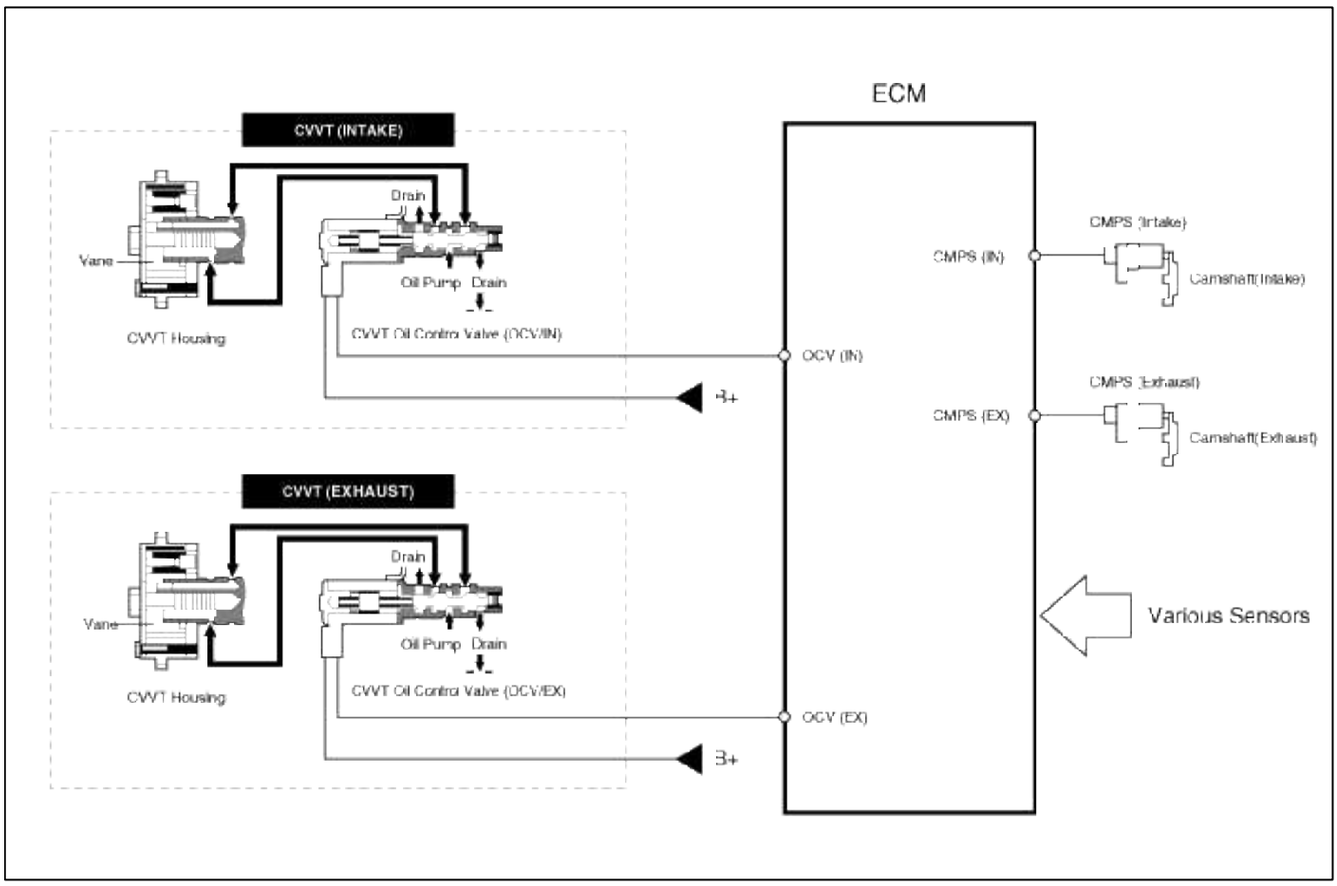
Description

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 regulates engine oil to and 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.

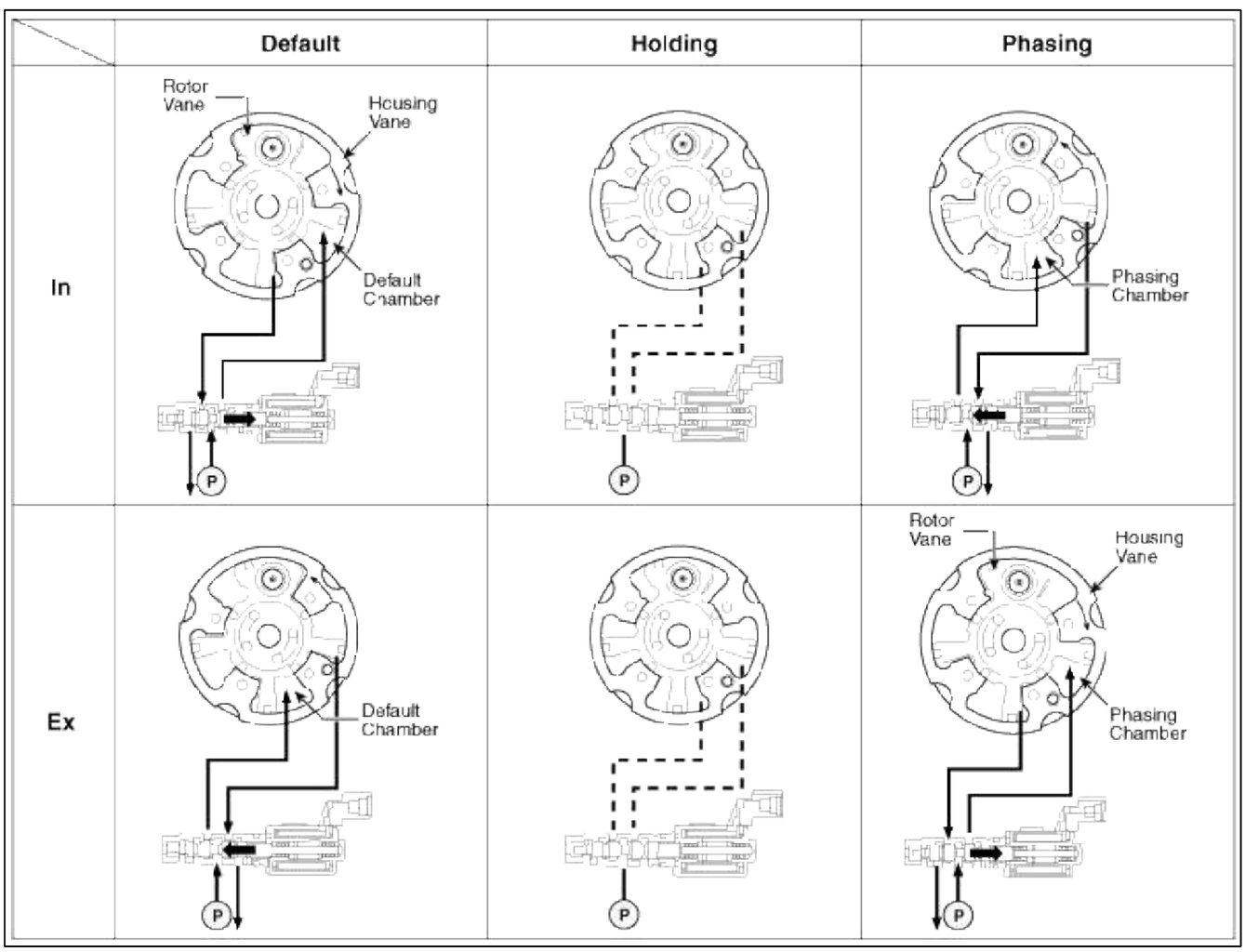
The engine oil getting out of the CVVT oil control valve varies the cam phase in the direction (Intake Advance/Exhaust Retard) or opposite direction (Intake Retard/Exhaust Advance) of the engine rotation by rotating

the rotor connected with the camshaft inside the cam phaser.

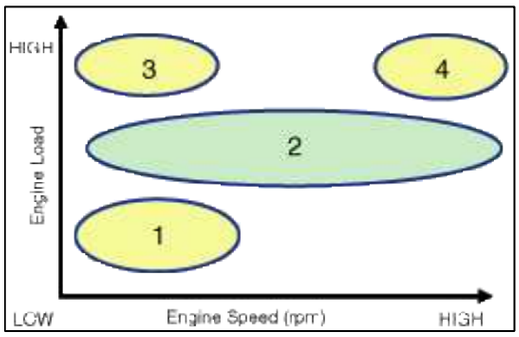


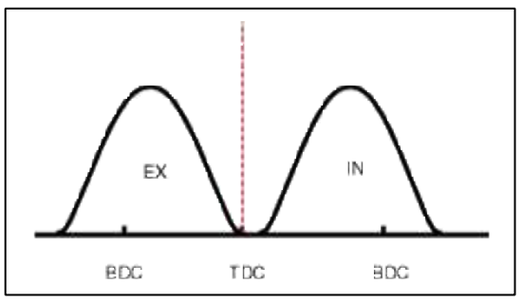
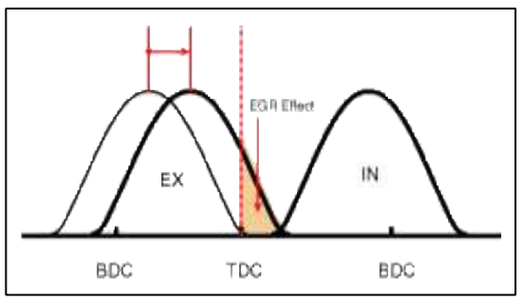
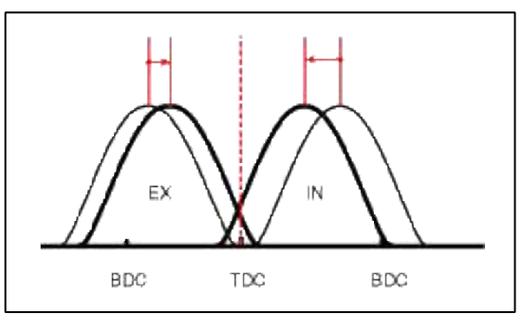
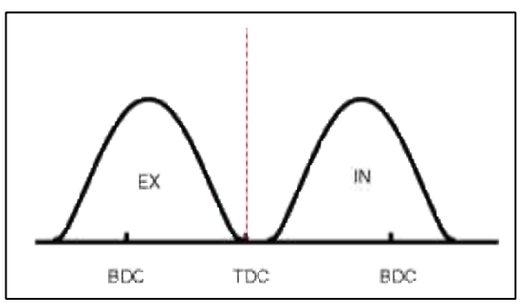
Operation Principle

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

RIO(UB) > 2012 > G 1.6 GDI > Engine Electrical System

Engine Electrical System > General Information > Specifications

Specifications

Ignition System

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

Starting System

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

Charging System

Items			Specifications	
Alternator (AMS)	Rate voltage		13.5V, 100A	
	Speed in use		1,000 ~ 18,000 rpm	
	Voltage regulator		IC regulator built-in type	
	Regulator setting voltage	External mode	ECU control	
		Internal mode	14.55 ± 0.3V	
	Temperature compensation	External mode	ECU control	
		Internal mode	-3.5 ± 2mV / °C	
Alternator (Non-AMS)	Rate voltage		13.5V, 90A	
	Speed in use		1,000 ~ 18,000rpm	
	Voltage regulator		IC regulator built-in type	
	Regulator setting voltage		14.55±0.2V	
	Temperature compensation		-7 ± 3mV / °C	
Items			**Non-ISG**	**ISG**
Battery	Type		36-20GL	56-28GL(AGM)
	Cold cranking amperage [at -18°C(-0.4°F)]		410 A	760 A

Battery	Reserve capacity	80 min	120 min
	Specific gravity [at 25°C(77°F)]	1.280 ± 0.01	1.310 ± 0.01

CAUTION

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

NOTE

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

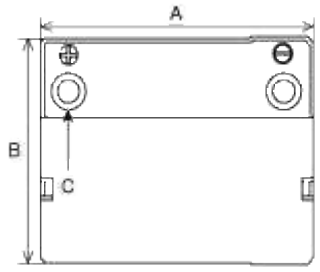
① : Battery type
- MF : Maintenance Free

② : Battery capacity (5HR)
- 48 : 48A-H

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

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

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



Engine Electrical System > General Information > Troubleshooting

Troubleshooting

Ignition System

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

Charging System

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

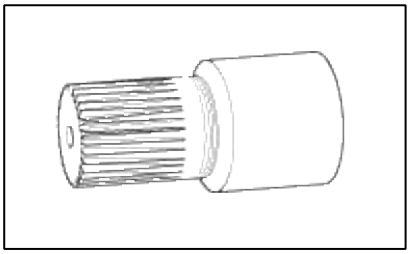
	Electronic voltage regulator or alternator	Disconnect the voltage regulator or alternator to see if light turns off. If light turns off, replace voltage regulator.
	Poor grounding	Inspect ground or repair
	Worn battery	Replace battery

Starting System

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

Engine Electrical System > General Information > Special Service Tools

Special Service Tools

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

Engine Electrical System > Ignition System > Description and Operation

Descrition

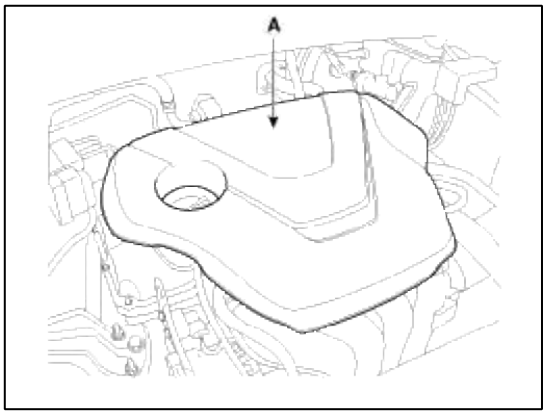
Ignition timing is controlled by the electronic control ignition timing system. The standard reference ignition timing data for the engine operating conditions are preprogrammed in the memory of the ECM (Engine Control Module). The engine operating conditions (speed, load, warm-up condition, etc.) are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

Engine Electrical System > Ignition System > Repair procedures

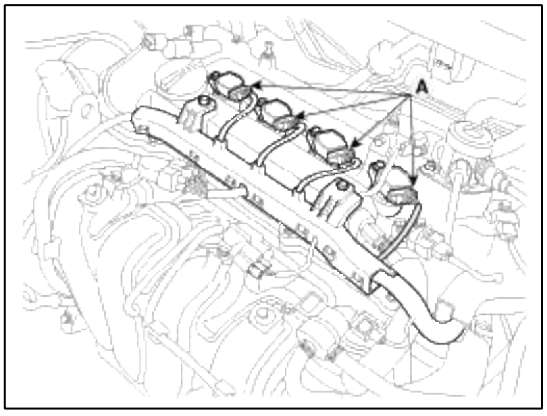
On-vehicle Inspection

Spark Test

1. Remove the engine cover (A).

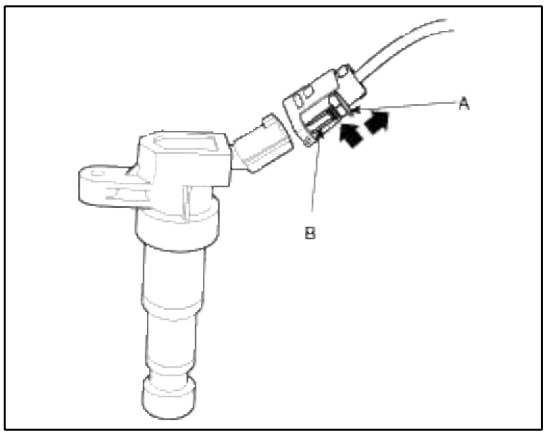


2. Disconnect the ignition coil connectors (A).

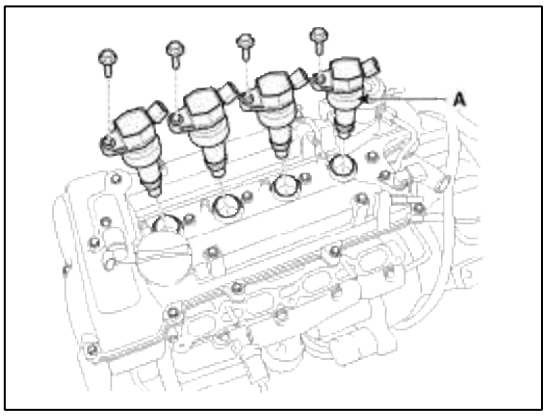


NOTE

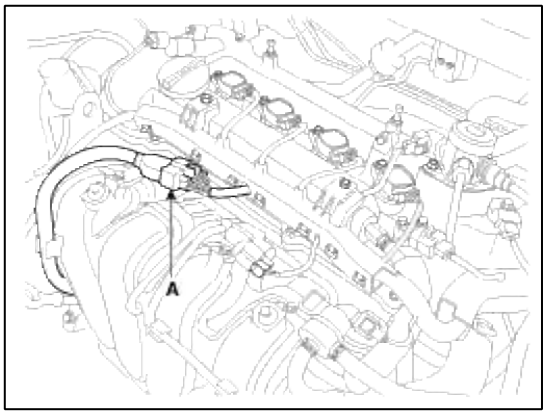
When removing the ignition coil connector, pull the lock pin (A) and push the clip (B).



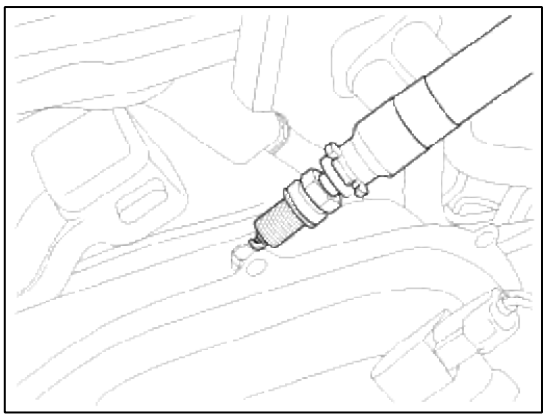
3. Remove the ignition coils (A).



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



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



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

NOTE

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

9. Inspect all the spark plugs.
10. Using a spark plug socket, install the spark plug.

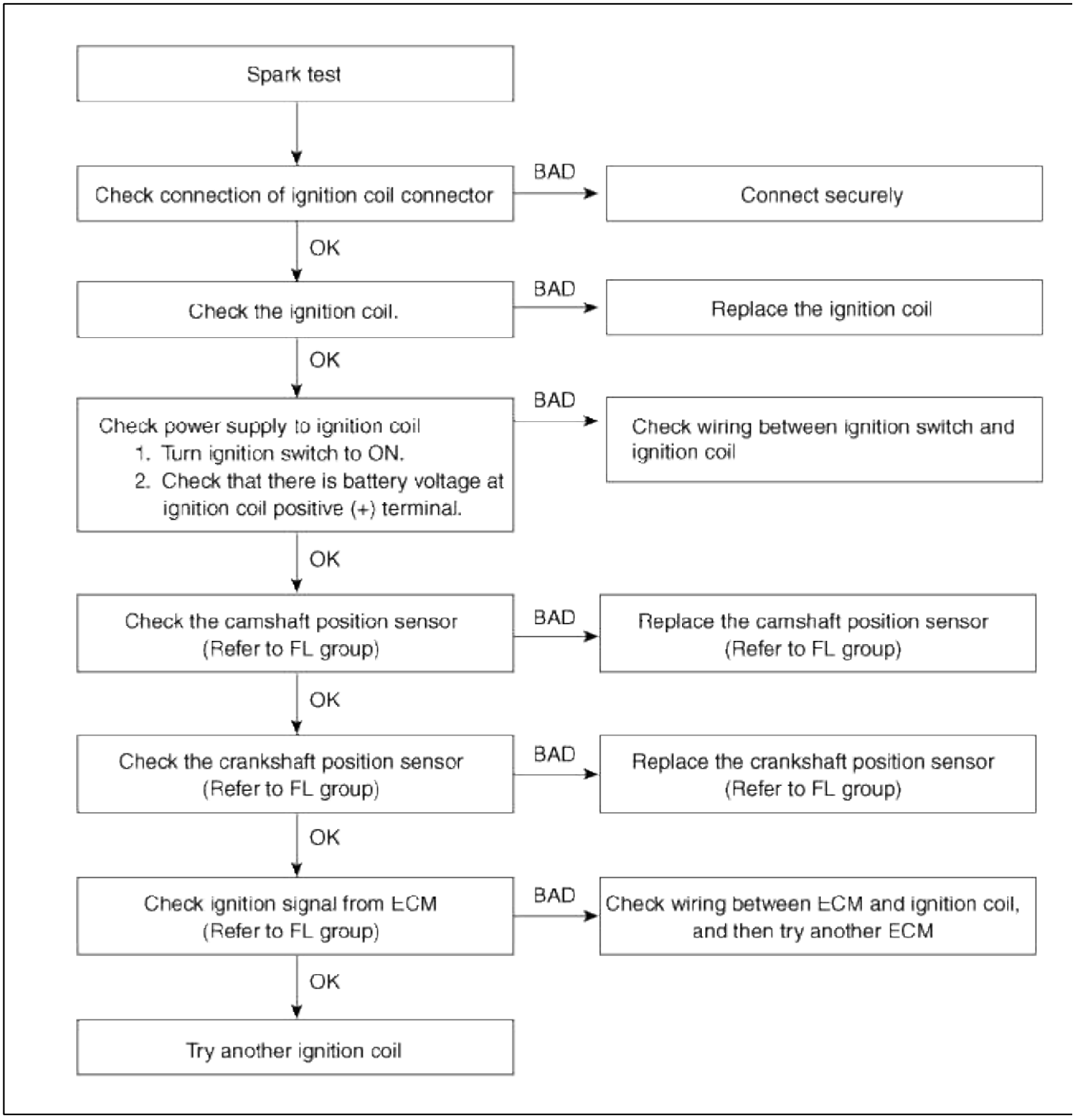
11. Install the ignition coil.

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

NOTE

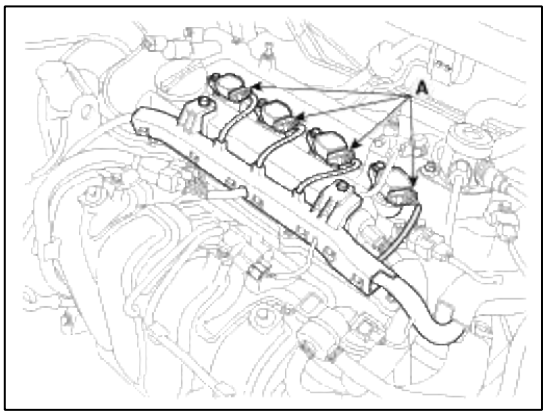
When inserting ignition coil into the cylinder head cover for spark plug to be inserting ignition coil, the sealing cap of ignition coil must be mated totally with inner side of cylinder head.

12. Reconnect the ignition coil connectors.



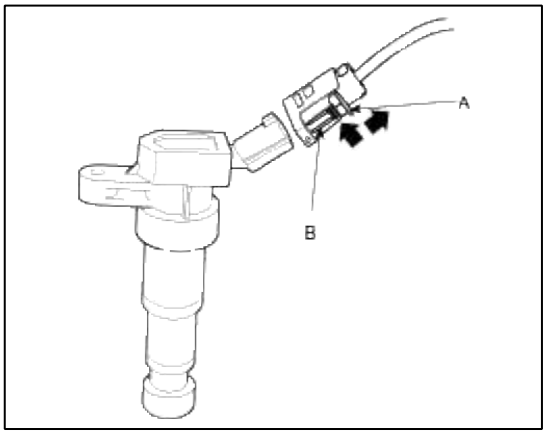
Inspect Spark Plug

1. Disconnect the ignition coil connectors (A).



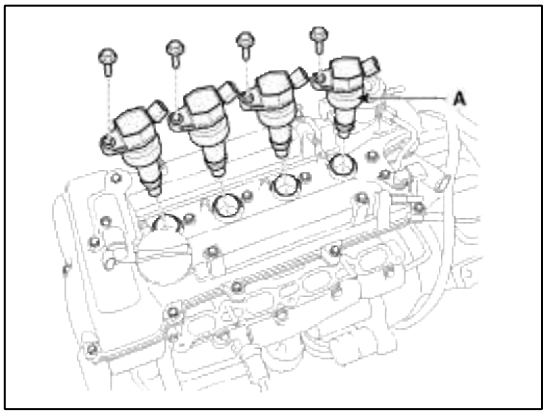
NOTE

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



2. Remove the ignition coils (A).

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

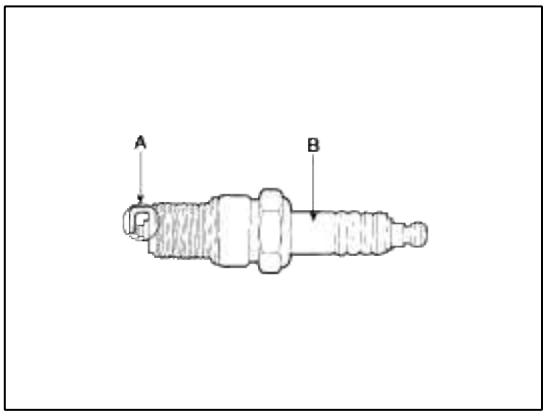


3. Using a spark plug socket, remove the spark plug.

CAUTION

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

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

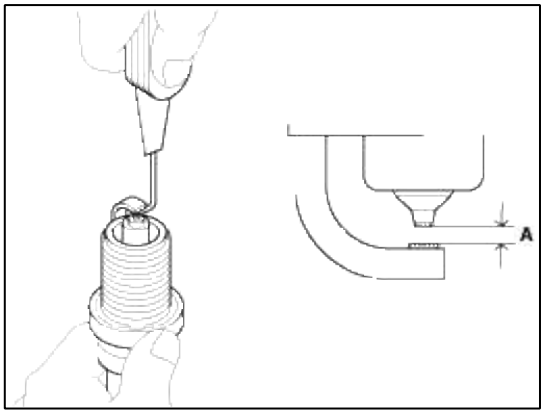


Inspection Of Electrodes

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

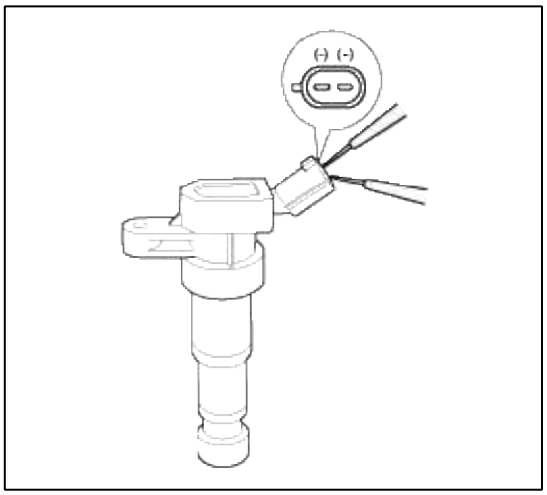
5. Check the electrode gap (A).

Standard:
0.9 ~ 1.0 mm (0.0354 ~ 0.0394 in.)



Inspect Ignition Coil

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



Standard value : 0.75Ω ± 15%

Engine Electrical System > Charging System > Description and Operation

Description

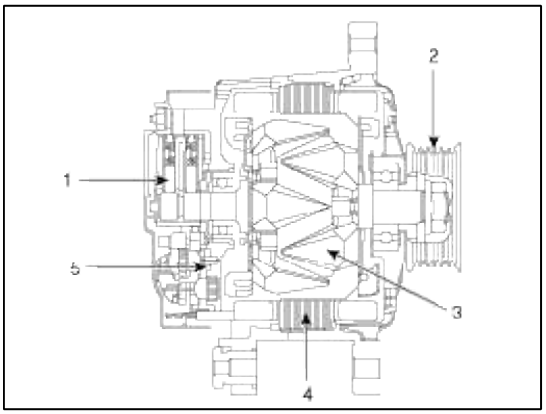
The charging system includes a battery, an alternator with a built-in regulator, and the charging indicator light and wire.

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

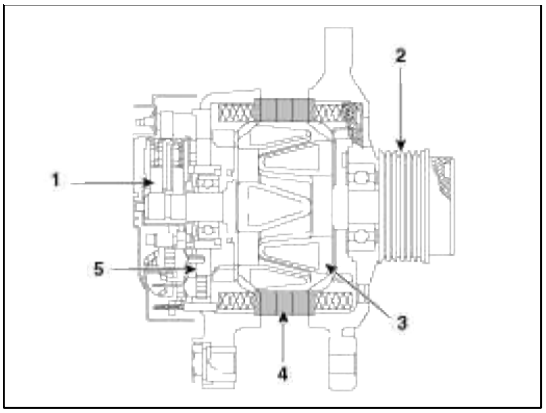
DC current appears at alternator "B" terminal. The charging voltage of this alternator is regulated by the battery voltage detection system (or ECM - with AMS).

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

[Without OAD]



[With OAD]



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

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

Engine Electrical System > Charging System > Repair procedures

On-vehicle Inspection

CAUTION

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

Check Battery Voltage

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

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

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

Check The Battery Terminals And Fuses

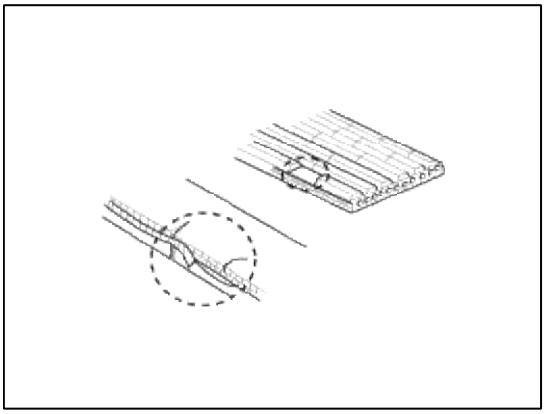
1. Check that the battery terminals are not loose or corroded.
2. Check the fuses for continuity.

Inspect Drive Belt

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

NOTE

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



Drive belt tension measurement and adjustment

Belt tension measurement

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

Tension

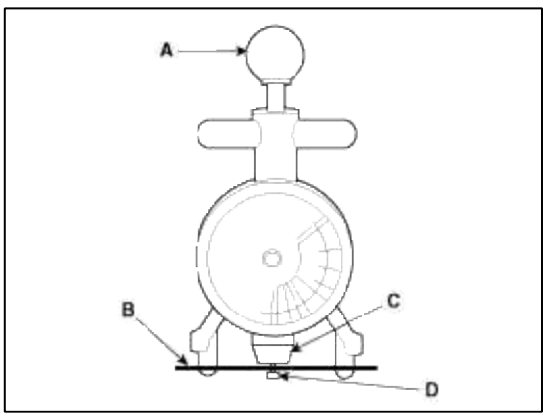
[Without OAD]
New belt: 882.6 ~ 980.7N (90 ~ 100kg, 198.4 ~ 220.5lb)
Used belt: 637.4 ~ 735.5N (65 ~ 75kg, 143.3 ~ 165.3lb)
[With OAD]
New belt: 686.5 ~ 784.5N (70 ~ 80kg, 154.3 ~ 176.4lb)
Used belt: 490.3 ~ 588.4N (50 ~ 60kg, 110.2 ~ 132.3lb)

CAUTION

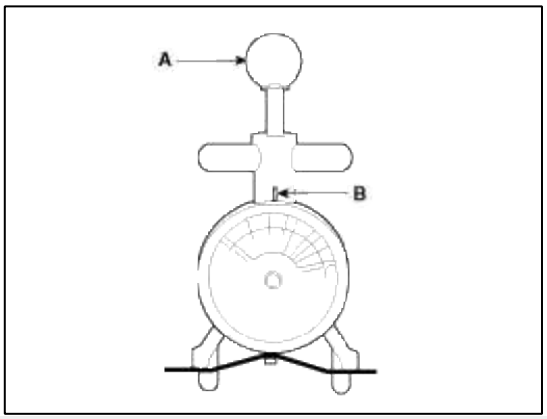
- If the engine has run for 5 minutes or more, the belt tension must be adjusted as a used belt.
- When installing the V-ribbed belt, all grooves on the pulley should be covered with belt ribs.
- A loose belt causes slip noise.
- Too tight belt cause bearing of alternator and water pump to damage.

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

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



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



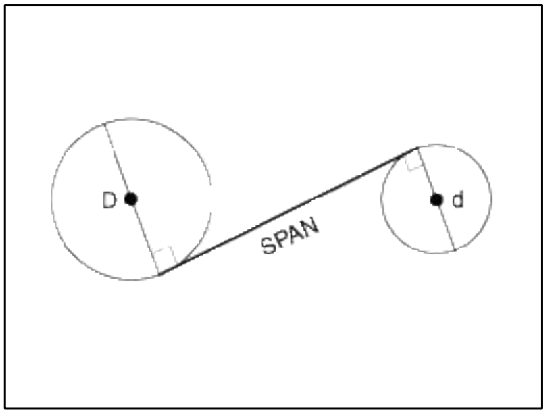
Using a sonic tension meter (U-505/507 type)

1. Input the belt specifications into the tension meter.

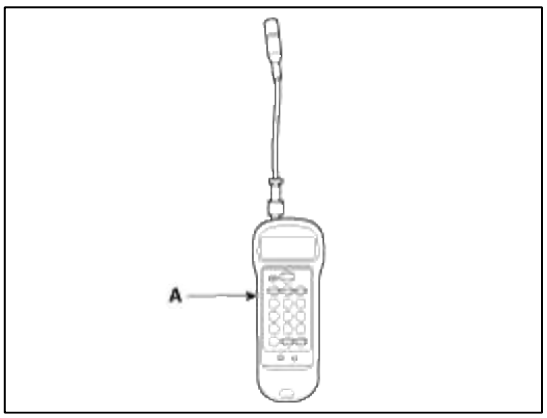
Belt type	Location of measurement	Input data		
		M (Mass, g/m.rib)	W (Width, rib)	S (Span, mm)
With A/C	Crankshaft pulley to A/C compressor pulley	013.4	006.0	178.9
Without A/C	Idler to alternator pulley	013.4	006.0	Actual measurement value

NOTE

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

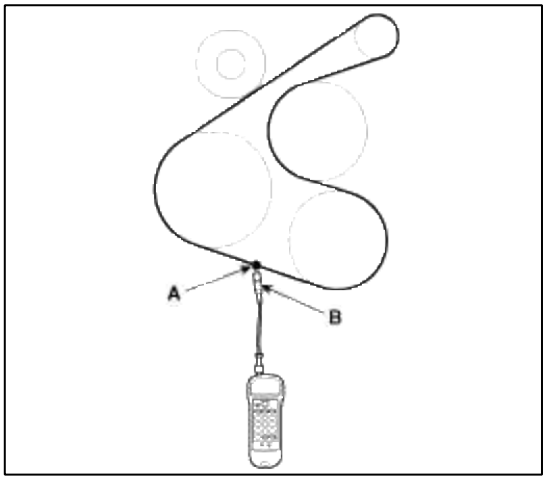


D : Idler
d : Alternator pulley

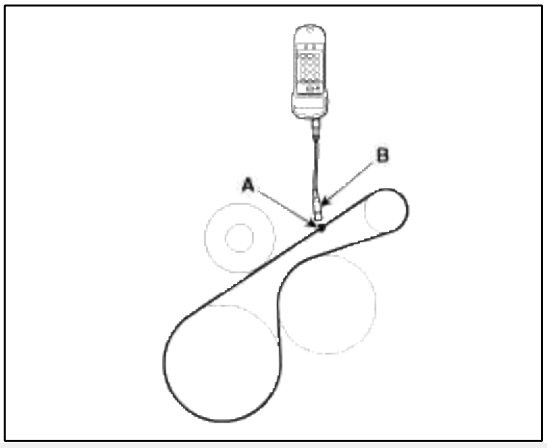


2. Locate the micro phone (B) close to the center of belt span (A) and bounce the belt by finger 2~3 times. Read a value on the display.

[With A/C]

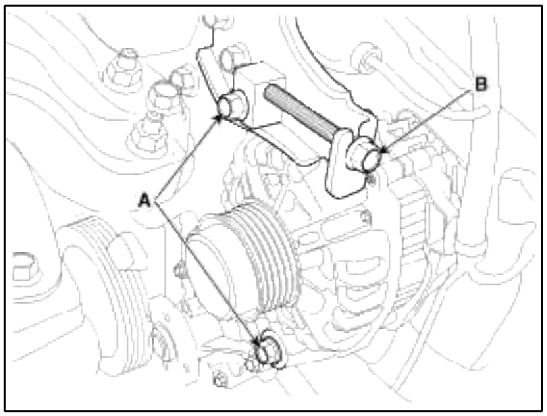


[Without A/C]



If adjustment is necessary:

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



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

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

Visually Check Alternator Wiring And Listen For Abnormal Noises

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

Check Discharge Warning Light Circuit

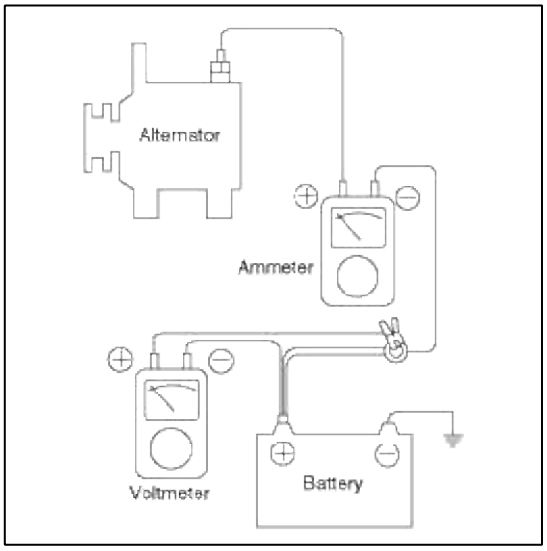
1. Warm up the engine and then turn it off.
2. Turn off all accessories.
3. Turn the ignition switch "ON". Check that the discharge warning light is lit.
4. Start the engine. Check that the light is lit.
   If the light does not go off as specified, troubleshoot the discharge light circuit.

Voltage Drop Test Of Alternator Output Wire

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

Preparation

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



Test

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

Result

1. The voltmeter may indicate the standard value.

   Standard value: 0.2V max

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

Output Current Test

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

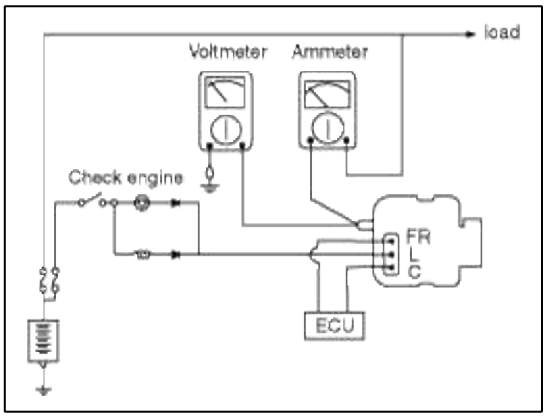
Preparation

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

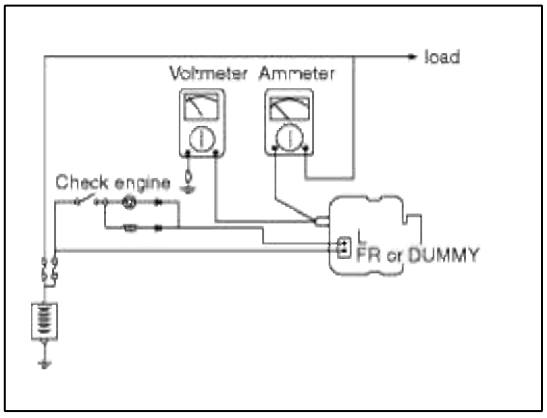
> NOTE
>
> Tighten each connection securely, as a heavy current will flow. Do not rely on clips.

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

[AMS]



[Non-AMS]



Test

1. Check to see that the voltmeter reads as the same value as the battery voltage. If the voltmeter reads 0V, and the open circuit in the wire between alternator "B" terminal and battery (+) terminal or poor grounding is suspected.
2. Start the engine and turn on the headlamps.

3. Set the headlamps to high beam and the heater blower switch to HIGH, quickly increase the engine speed to 2,500 rpm and read the maximum output current value indicated by the ammeter.

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

Result

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

Limit value : 60% of the voltage rate

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

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

Regulated Voltage Test

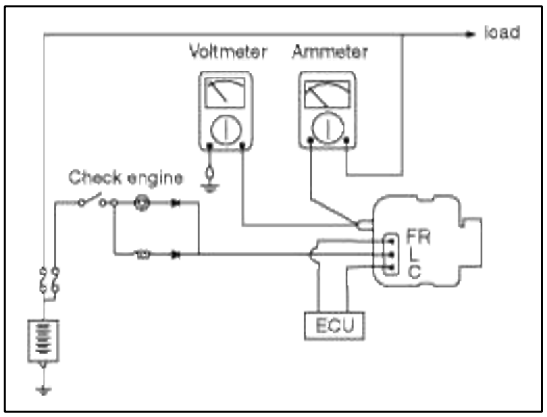
The purpose of this test is to check that the electronic voltage regulator controls voltage correctly.

Preparation

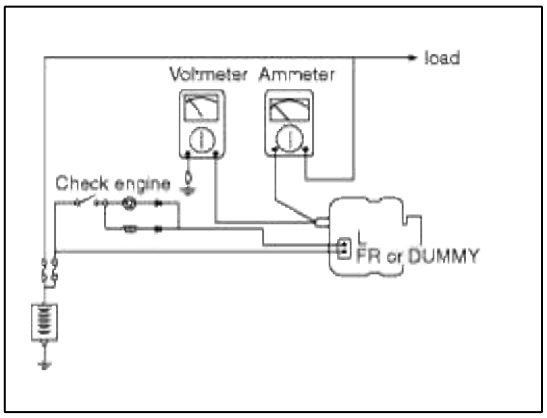
1. Prior to the test, check the following items and correct if necessary.
Check that the battery installed on the vehicle is fully charged. The battery checking method is described in the section "Battery".
Check the alternator drive belt tension. The belt tension check method is described in the section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

7. Attach the engine tachometer and connect the battery ground cable.

[AMS]



[Non-AMS]



Test

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

Voltage: Battery voltage

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

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

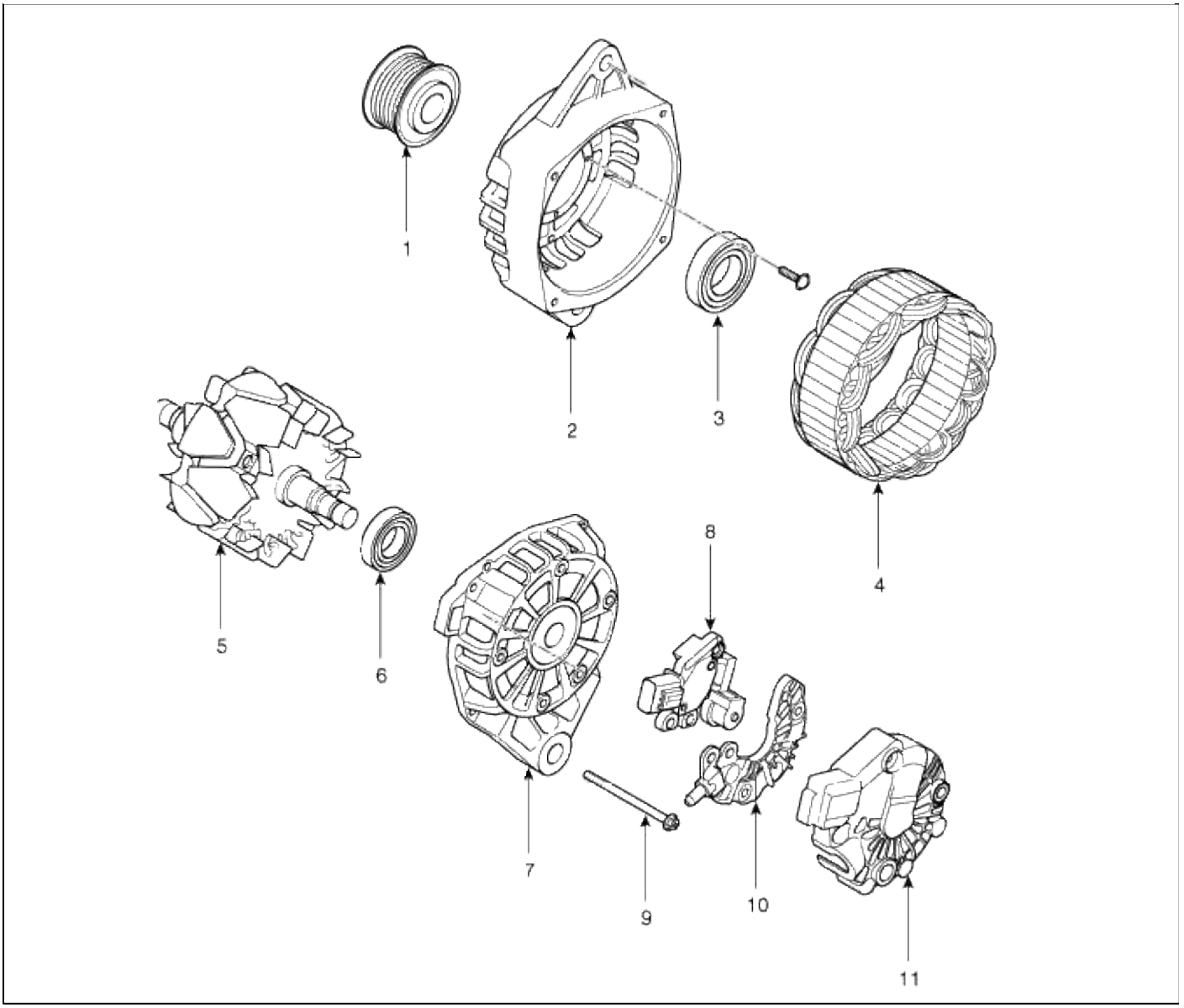
Result

1. If the voltmeter reading dosen't agree with the standard value, the voltage requlator or the alternator is faulty.
2. Upon completion of the test, reduce the engine speed to idle, and turn off the ignition switch.
3. Disconnect the battery ground cable.
4. Remove the voltmeter and ammeter and the engine tachometer.
5. Connect the alternator output wire to the alternator "B" terminal.
6. Connect the battery ground cable.

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

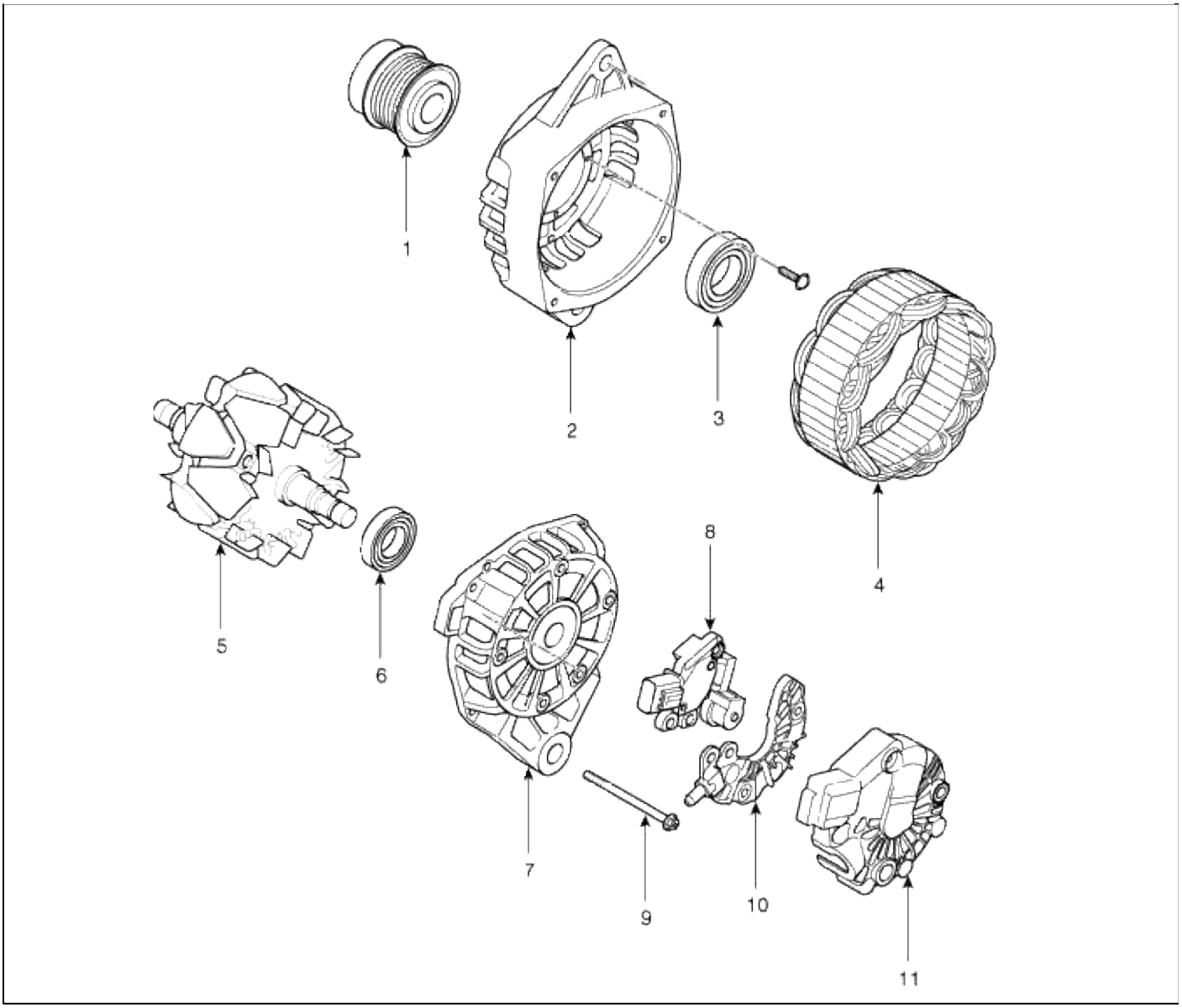
Components

[Without OAD]



1. Pulley 2. Front housing 3. Front bearing 4. Stator 5. Rotor	6. Rear bearing 7. Rear housing 8. Regulator assembly 9. Through bolt 10. Rectifier assembly 11. Rear cover

[With OAD]



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

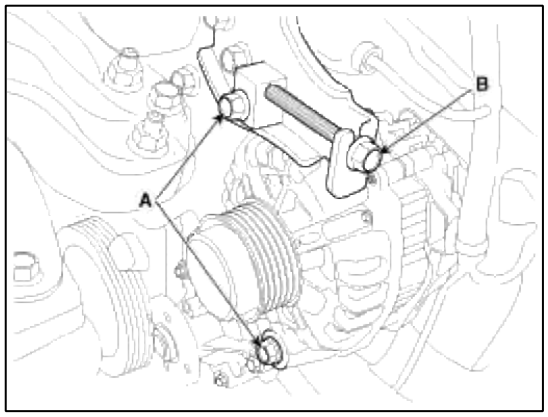
Engine Electrical System > Charging System > Alternator > Repair procedures

Removal and installation

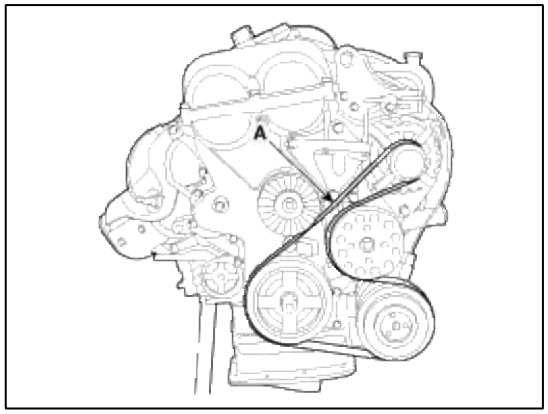
1. Disconnect the battery negative terminal first, then the positive terminal.

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

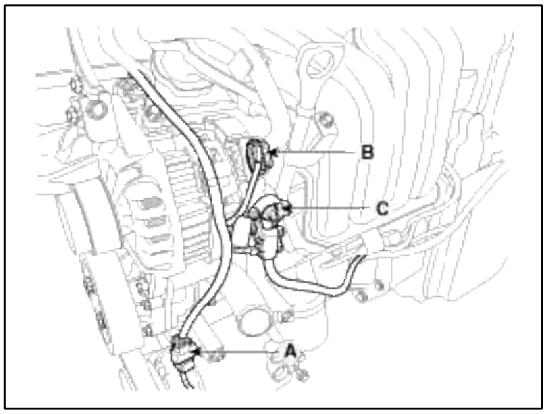
2. Remove the drive belt.
   (1) Loosen the through bolt (A).
   (2) Loosen the tension by turning the tension adjusting bolt (B).



   (3) Remove the drive belt (A).

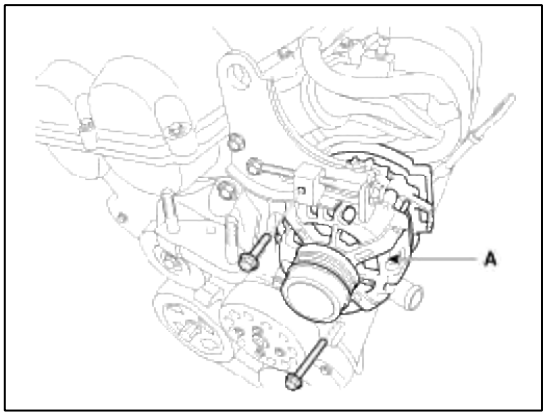


3. Disconnect the A/C compressor switch connector (A), the alternator connector (B) and the cable from the alternator "B" terminal (C).



4. Remove the alternator (A).

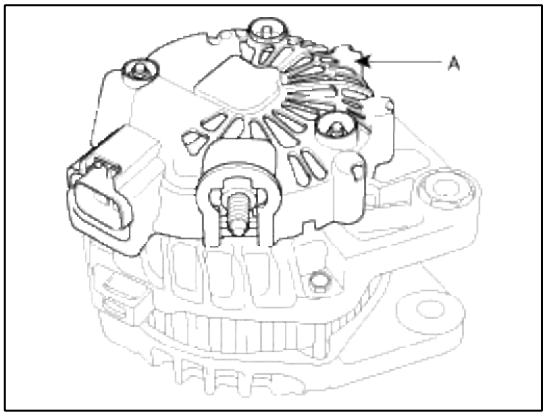
Tightening torque :
19.6~26.5 Nm (2.0~2.7 kgf.m, 14.5~19.5 Ib-ft)-12mm bolt
29.4~41.2 Nm (3.0~4.2 kgf.m, 21.7~30.4 Ib-ft)-14mm bolt



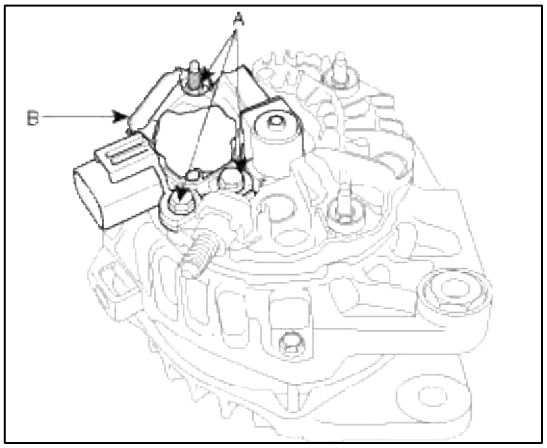
5. Installation is the reverse order of removal.
6. Adjust the alternator belt tension after installation.

Disassembly

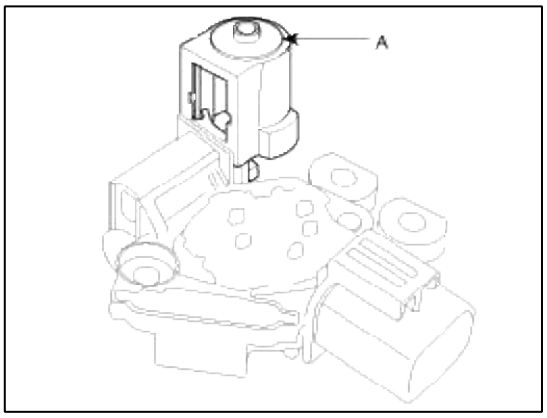
1. Remove the alternator cover(A).



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



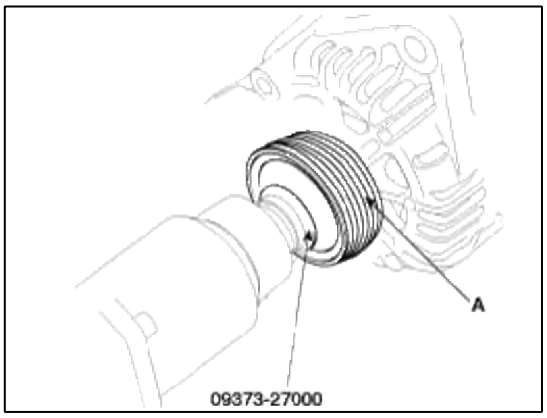
3. Remove the slip ring guide(A).



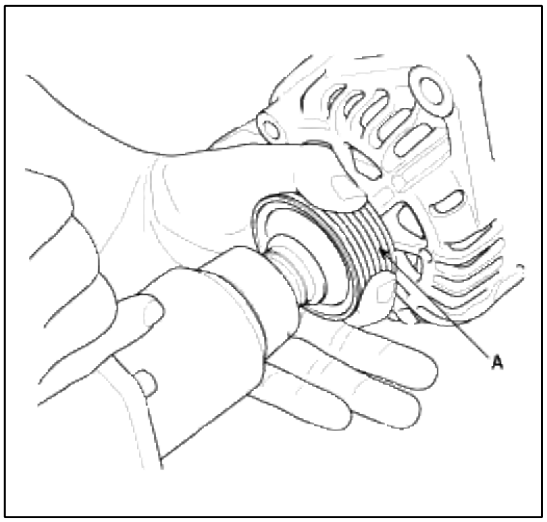
4. Remove the OAD (Overrunning Alternator Decoupler) cap. (With OAD)

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

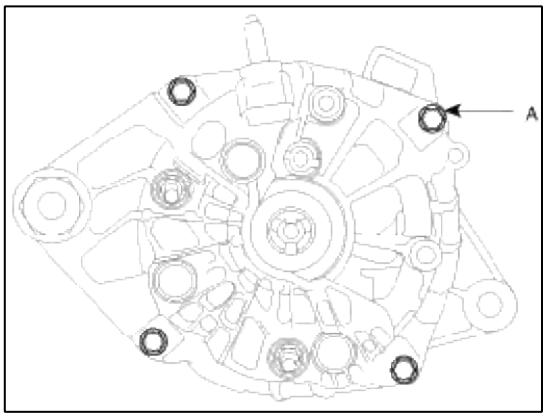
5. Remove the OAD (Overrunning Alternator Decoupler) pulley (A) using the special tool. (With OAD)



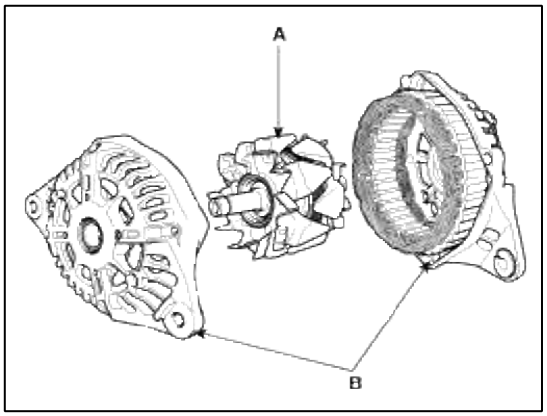
6. Remove the nut and pulley(A). (Without OAD)



7. Loosen the 4 through bolts(A).



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

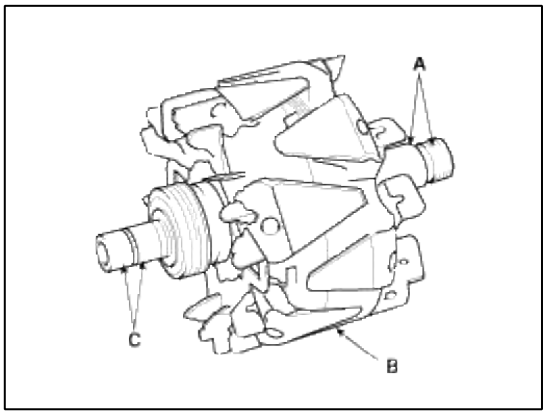


9. Reassembly is the reverse of disassembly.

Inspection

Inspect Rotor

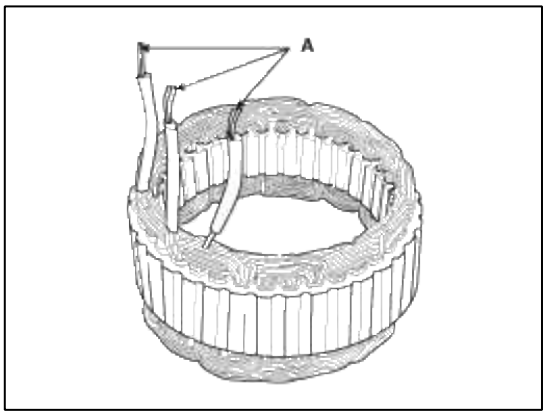
1. Check that there is continuity between the slip rings (C).
2. Check that there is no continuity between the slip rings and the rotor (B) or rotor shaft (A).



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

Inspect Stator

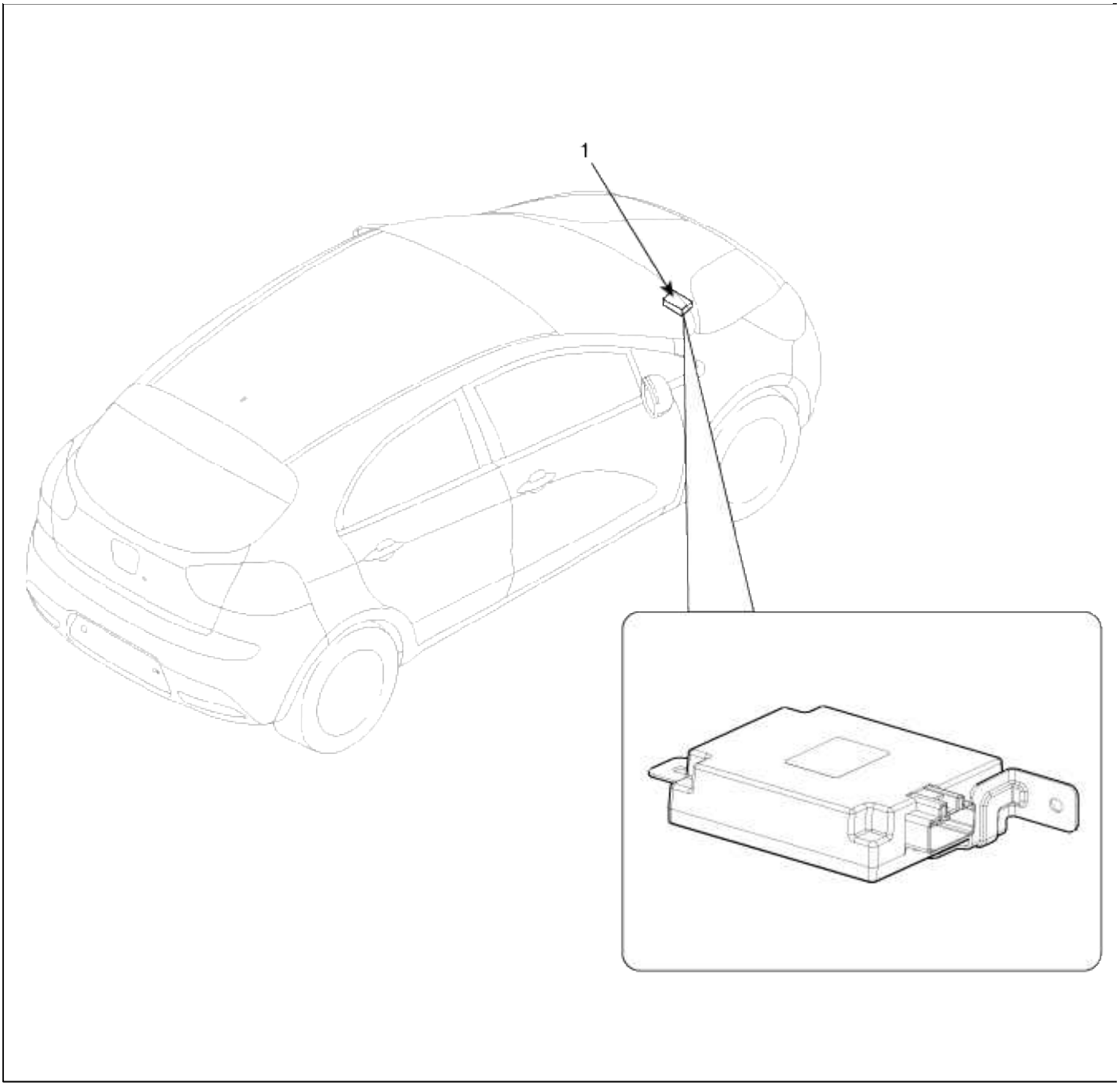
1. Check that there is continuity between each pair of leads (A).



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

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

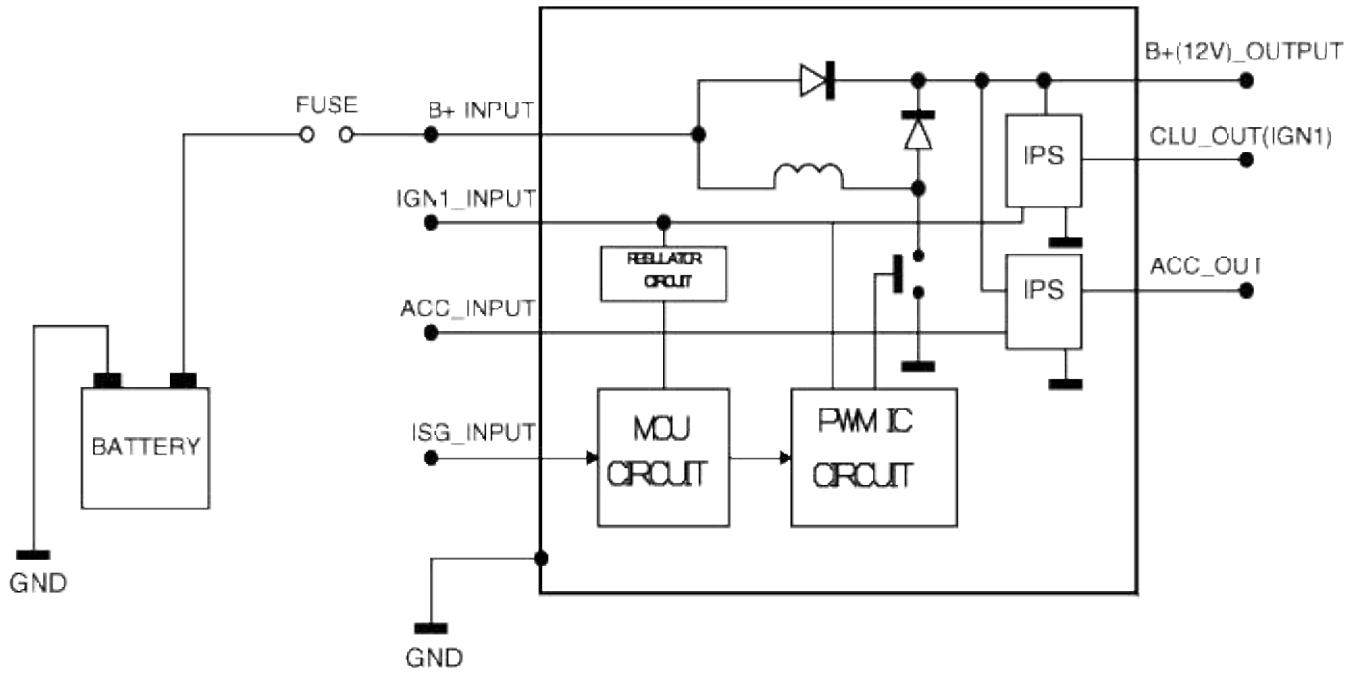
Component Location

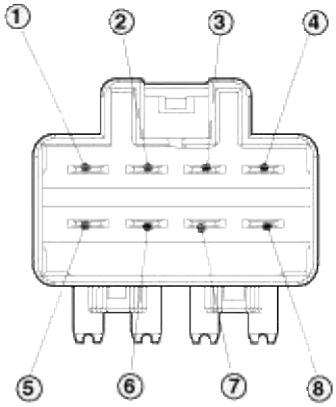


1. DC/DC Converter

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

Circuit Diagram





PIN NO.	DESCRIPTION
1	IGN 1_INPUT
2	GND
3	CLU-OUT(IGN1)
4	B+ INPUT
5	ACC-INPUT
6	ACC_OUT
7	ISG INPUT
8	B+(12V) OUTPUT

NOTE

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

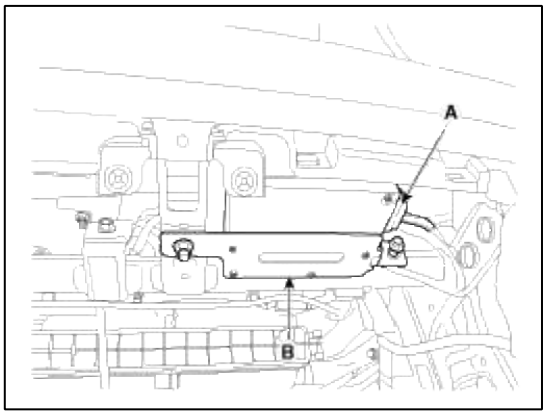
Engine Electrical System > Charging System > DC DC converter > Repair procedures

Removal and Installation

1. Disconnect the battery negative terminal.

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

2. Remove the glove box housing. (Refer to BD group)
3. Disconnect the connector (A) and then remove the DC/DC converter (B).



4. Installation is reverse order of removal.

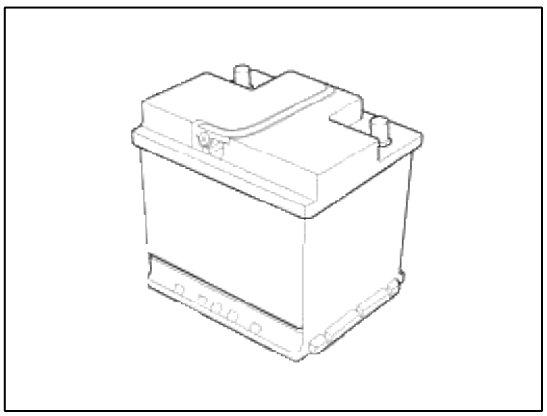
NOTE

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

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

Description

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



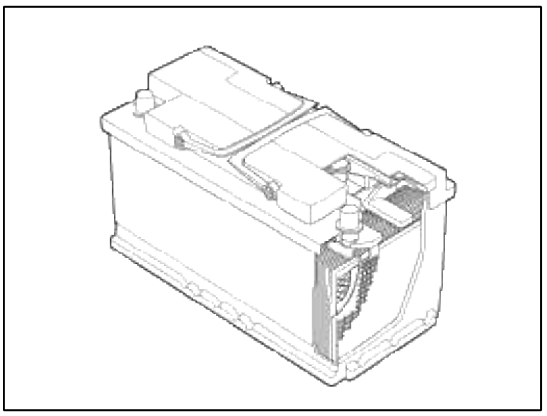
NOTE

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

[ISG Type]

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

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



Recharging [ISG Type]

Check the battery condition

The battery condition cannot be determined solely on the basis of the battery charge state. If there is a suspicion of a damaged battery, check the battery condition whit battery tester and investigate the cause by means of the test module. With a low battery charge state, recharge the battery.

Recharging the AGM battery

The battery may be charged using the battery chargers at a constant charge voltage of 14.8V.
If possible, the battery temperature during charging should be between 20°C(60°F) and 30°C(86°F).
Only chargers with voltage clamping (IU or WU curve) may be used or chargers with IUoU curve which have a trickle.

IU or WU charging technique
Optimized charging voltage for IU or WU: 14.7V [at 20°C(60°F) ~ 30°C(86°F)] about 24 hours
Min. charging voltage at 20°C(60°F): 14.4V
Max. charging voltage at 20°C(60°F): 14.8V
10% of capacity is recommended as charging current (e.g. 60Ah : 10 = 6,0A charging current).

WARNING

Do not charge the AGM battery with>15.2V. No quick-charging routines.

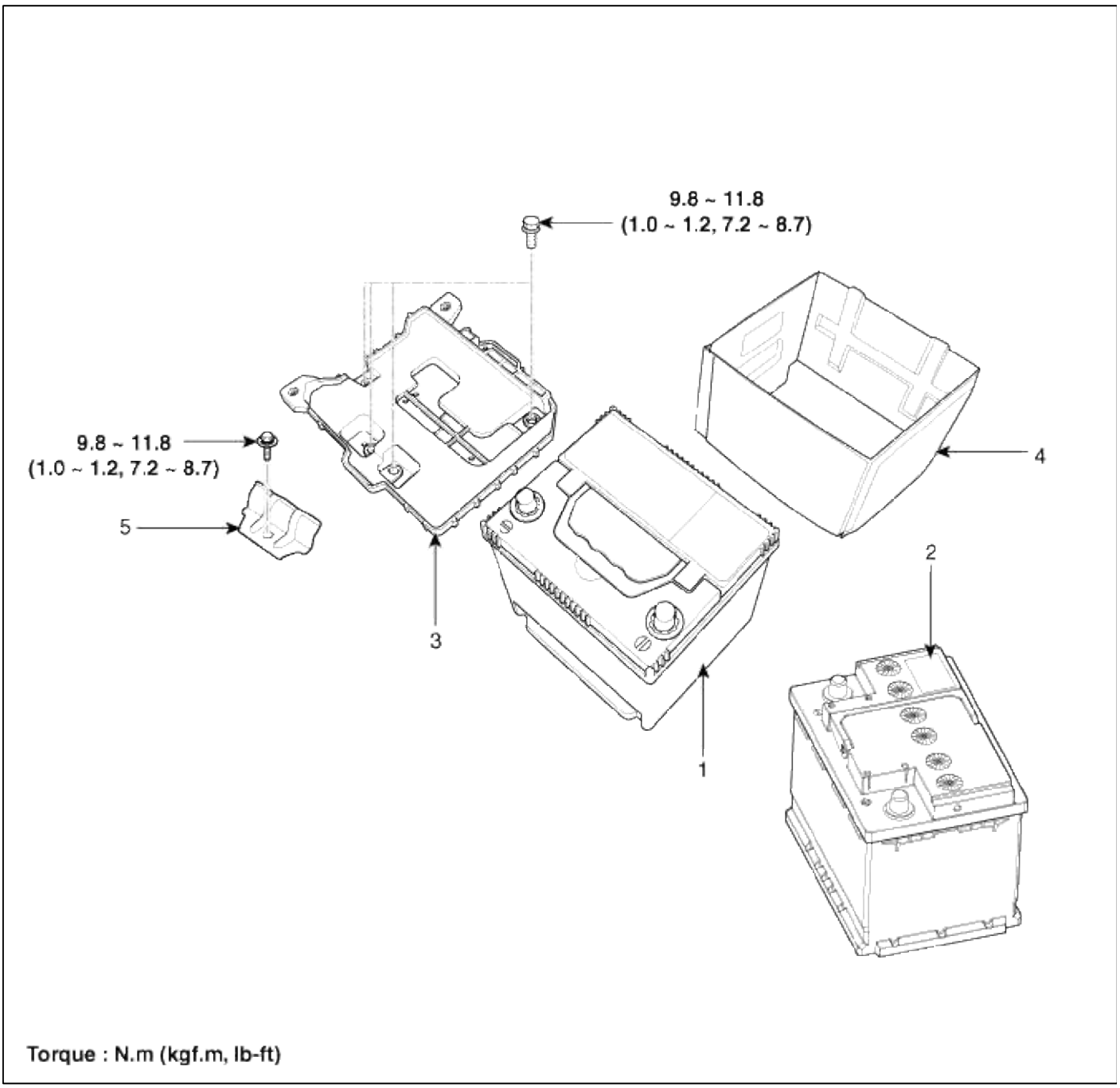
CAUTION

If the battery is charged directly at the battery terminals on vehicles with battery sensor, misinterpretations of battery condition and under certain circumstances also unwanted Check Control messages or fault memory entire can occur.
After recharging finished, let the battery stand for over 10 hours with normal temperature for battery stabilization.

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

Components

[Non-ISG Type]



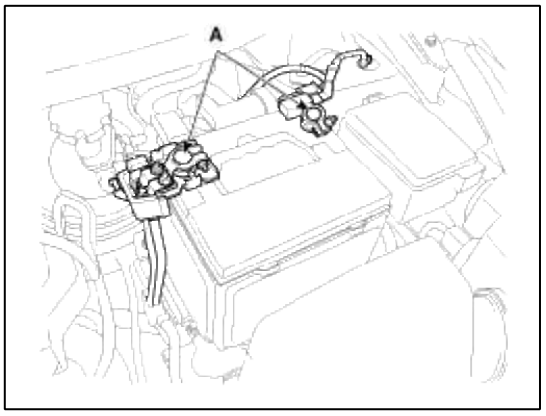
1. Battery insulation pad 2. Battery 3. Battery tray	4. Battery mounting bracket 5. ECM & bracket assembly

Engine Electrical System > Charging System > Battery > Repair procedures

Removal and Installation

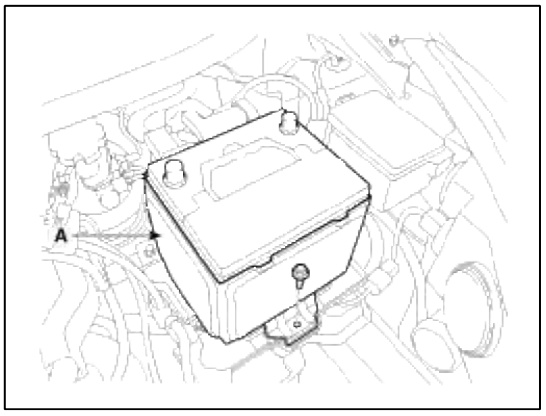
1. Remove the battery.
   (1) Disconnect the battery terminals (A).

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



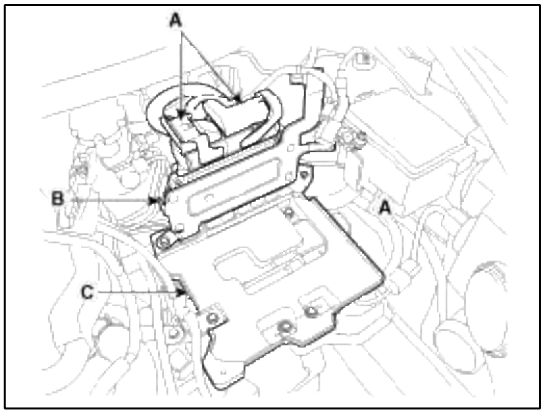
2. Remove the air duct and air cleaner assembly. (Refer to EM group).
3. Remove the battery insulation pad (A).
4. Remove the battery (B) after removing the mounting bracket.

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



5. Remove the ECM (B) and the battery tray (C) after disconnecting the ECM connector (A).

Tightening torque
ECM bracket bolts & nut :
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)
Battery tray bolts :
8.8 ~ 13.7N.m (0.9 ~ 1.4kgf.m, 6.5 ~ 10.1lb-ft)



6. Installation is the reverse order of removal.

CAUTION

When installing the battery, fix the mounting bracket on the tray correctly.

CAUTION

- ISG (Idle stop & go) system equipped vehicle always use the AGM battery only. If flooded battery has installed, this can potentially lead to engine electrical trouble or ISG system error.
- Replace same capacity of the AGM battery.

NOTE

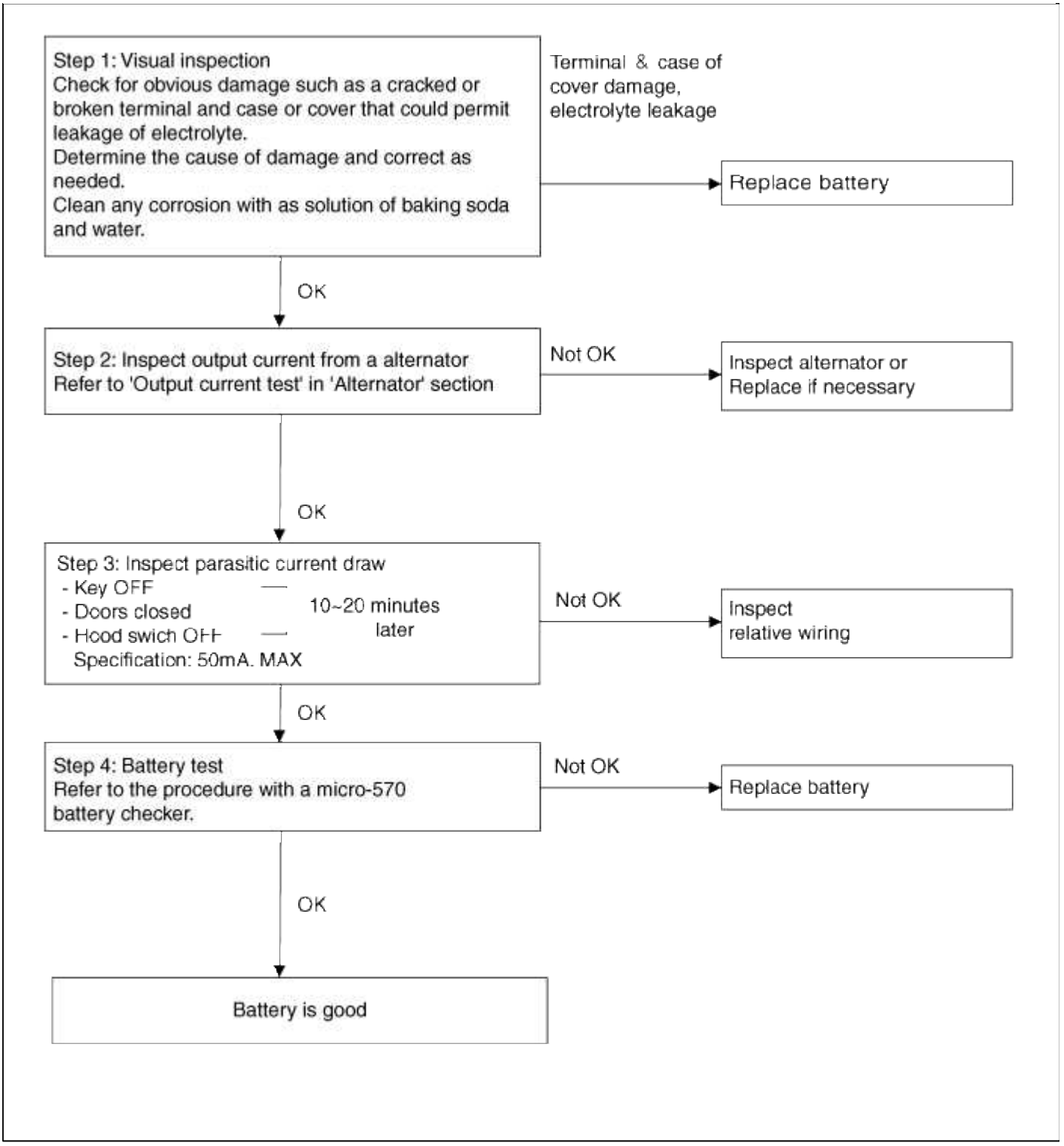
Ensure an AGM battery is fitted.
In all cases, an AGM battery must be installed and registered in the vehicle for the ISG function to work perfectly.
The vehicle with the new battery must be placed in the ignition switch OFF door closed, hood switch OFF state for at least 4 hours.
ISG system's stabilization may take 4 hours after new battery installation.
ISG function is operates about 4 hours later and 2 times cranking by user.
But first 25 times, the ISG function can operates regardless of ISG system stability for ISG function operating check.

WARNING

Do not open the AGM battery.
The AGM battery must not be opened under any circumstances as the introduction of oxygen from the air will cause the battery to lose its chemical equilibrium and rendered non-operational.

Inspection

Battery Diagnostic Flow



Vehicle parasitic current inspection

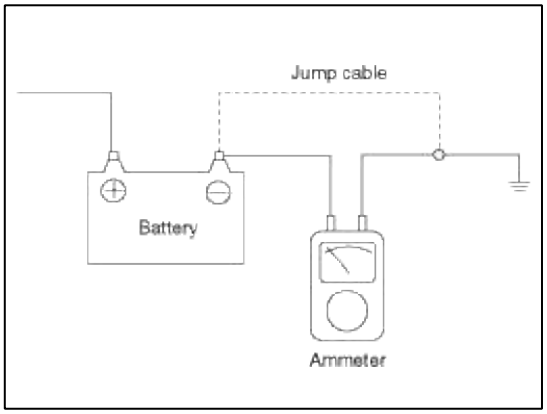
1. Turn all the electric devices OFF, and then turn the ignition switch OFF.
2. Close all doors except the engine hood, and then lock all doors.
   (1) Disconnect the hood switch connector.
   (2) Close the trunk lid.
   (3) Close the doors or remove the door switches.

3. Wait a few minutes until the vehicle's electrical systems go to sleep mode.

> NOTE
>
> For an accurate measurement of a vehicle parasitic current, all electrical systems should go to sleep mode. (It takes at least one hour or at most one day.) However, an approximate vehicle parasitic current can be measured after 10~20 minutes.

4. Connect an ammeter in series between the battery (-) terminal and the ground cable, and then disconnect the clamp from the battery (-) terminal slowly.

> CAUTION
>
> Be careful that the lead wires of an ammeter do not come off from the battery (-) terminal and the ground cable to prevent the battery from being reset. In case the battery is reset, connect the battery cable again, and then start the engine or turn the ignition switch ON for more than 10 sec. Repeat the procedure from No. 1.
>
> To prevent the battery from being reset during the inspection,
>
> 1) Connect a jump cable between the battery (-) terminal and the ground cable.
> 2) Disconnect the ground cable from the battery (-) terminal.
> 3) Connect an ammeter between the battery (-) terminal and the ground cable.
> 4) After disconnecting the jump cable, read the current value of the ammeter.



5. Read the current value of the ammeter.
   A. If the parasitic current is over the limit value, search for abnormal circuit by removing a fuse one by one and checking the parasitic current.
   B. Reconnect the suspected parasitic current draw circuit fuse only and search for suspected unit by removing a component connected with the circuit one by one until the parasitic draw drops below limit value.

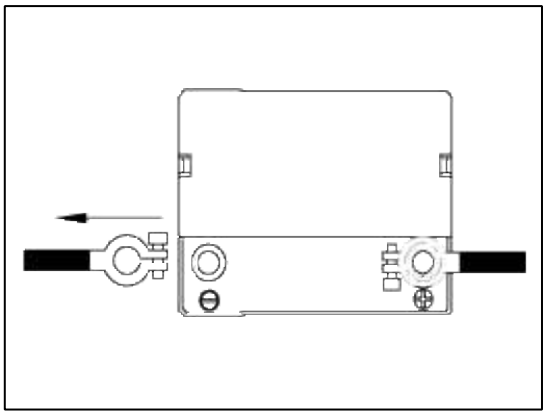
Limit value (after 10~20 min.) : Below 50mA

Cleaning

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

3. Remove the battery from the vehicle.

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



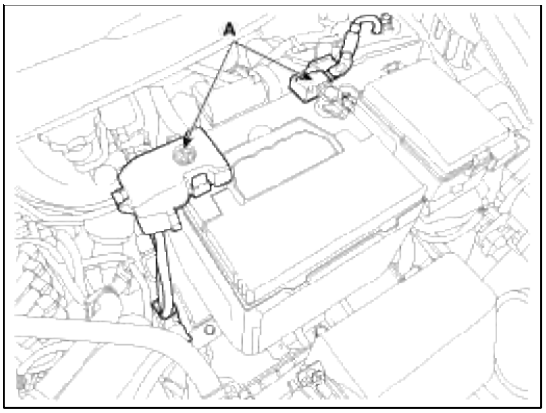
4. Inspect the battery tray for damage caused by the loss of electrolyte. If acid damage is present, it will be necessary to clean the area with a solution of clean warm water and baking soda. Scrub the area with a stiff brush and wipe off with a cloth moistened with baking soda and water.
5. Clean the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

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

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

Description

Vehicles have many control units that use more electricity. These units control their own system based on information from diverse sensors. It is important to have a stable power supply as there diverse sensors giving a variety of information. Battery sensor (A) is mounted on battery (-) terminal. It transmits battery voltage, current, temperature information to ECM. ECM controls generating voltage by duty cycle based on these signals.



CAUTION

When battery sensor signal fault occurs, inspect the vehicle parasitic draw in advance after inspectingthe sensor because the sensor signal will be abnormal when the parasitic draw is more than100mA. (Refer to vehicle parasitic current inspection)

NOTE

It takes a few hours for a new battery sensor to detect the battery state correctly.
Perform the following process after replacing the battery sensor.

1. Ignition switch ON/OFF.
2. Park the vehicle about 4 hours.
3. After 4 hours later, check that the SOC (State of charge) of battery is displayed on GDS properly.
4. After engine start ON/OFF 2 times or more, check the SOF (State of function) of battery using GDS.

CAUTION

For the vehicle equipped with a battery sensor, be careful not to damage the battery sensor when the battery is replaced or recharged.

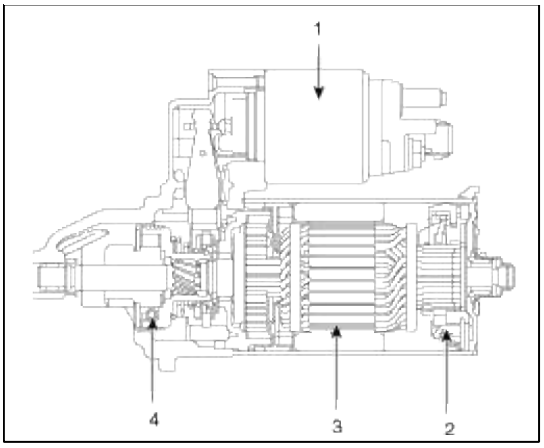
- When replacing the battery, it should be same one (type, capacity and brand) that is originally installed on your vehicle. If a battery of a different type is replaced, the battery sensor may recognize the battery to be abnormal.
- When installing the ground cable on the negative post of battery, tighten the clamp with specified torque of 4.0~6.0N.m (0.4~0.6kgf.m, 3.0~4.4lb-ft). An excessive tightening torque can damage the PCB internal circuit and the battery terminal.
- When recharging the battery, ground the negative terminal of the booster battery to the vehicle body.

Engine Electrical System > Starting System > Description and Operation

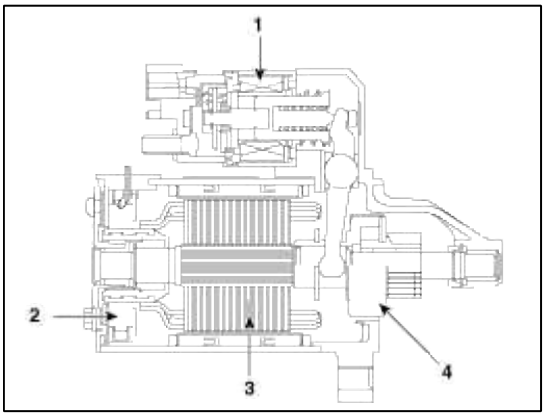
Description

The starting system includes the battery, starter, solenoid switch, ignition switch, inhibitor switch (A/T), ignition lock switch, connection wires and the battery cable.
When the ignition key is turned to the start position, current flows and energizes the starter motor's solenoid coil.
The solenoid plunger and clutch shift lever are activated, and the clutch pinion engages the ring gear.
The contacts close and the starter motor cranks. In order to prevent damage caused by excessive rotation of the starter armature when the engine starts, the clutch pinion gear overruns.

[ISG Type]



[Non-ISG Type]



1. Solenoid
2. Brush
3. Armature
4. Overrun clutch

[ISG Type]
In conjunction with the ISG function, the starter motor must do a great deal more work. The starter motor is therefore configured for a significantly higher number of start cycles. The components of the starter motor have been adapted to the higher requirements.

NOTE

There are two kinds of starter, ISG type starter and the other.
When replace the starter, confirm that the part number and connector shape.

CAUTION

ISG (Idle stop & go) system equipped vehicle always use the ISG type starter only. If the other starter has installed, this can potentially lead to engine electrical trouble or ISG system error.

WARNING

Do not disassemble the ISG type starter.
If the starter troubles occur, replace the starter.

Engine Electrical System > Starting System > Repair procedures

Troubleshooting Starter Circuit

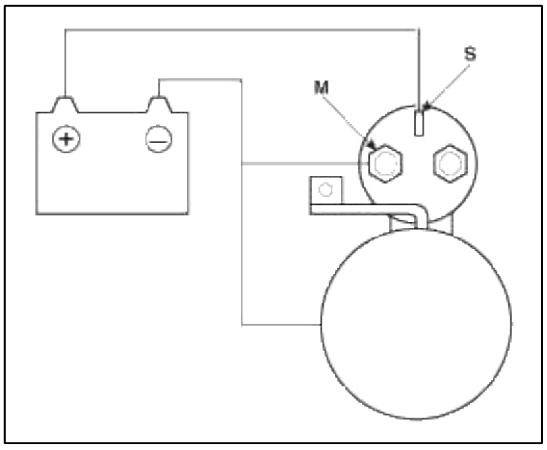
NOTE

The battery must be in good condition and fully charged.

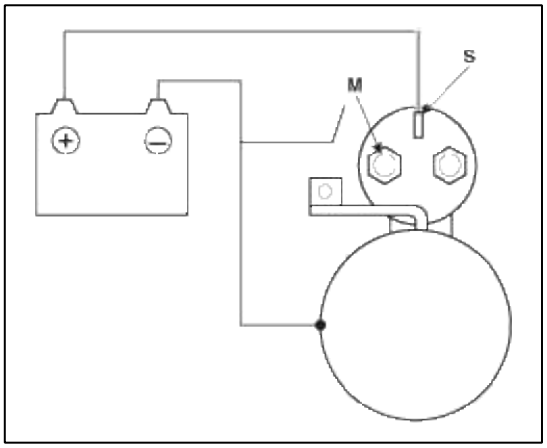
1. Disconnect the injector connector.
2. With the shift lever in N or P (A/T) or clutch pedal pressed (M/T), turn the ignition switch to "START".
   If the starter normally cranks the engine, starting system is OK. If the starter will not crank the engine at all, go to next step.
   If it won't disengage from the ring gear when you release key, check for the following until you find the cause.
   A. Solenoid plunger and switch malfunction.
   B. Dirty pinion gear or damaged overrunning clutch.
3. Check the battery condition. Check electrical connections at the battery, battery negative cable connected to the body, engine ground cables, and the starter for looseness and corrosion. Then try starting the engine again.
   If the starter cranks the engine normally, repairing the loose connection repaired the problem. The starting system is now OK.
   If the starter still does not crank the engine, go to next step.
4. Disconnect the connector from the S-terminal of solenoid. Connect a jumper wire from the B-terminal of solenoid to the S-terminal of solenoid.
   If the starter cranks the engine, go to next step.
   If the starter still does not crank the engine, remove the starter, and repair or replace as necessary.
5. Check the following items in the order listed until you find the open circuit.
   A. Check the wire and connectors between the driver's under-dash fuse/relay box and the ignition switch, and between the driver's under-dash fuse/relay box and the starter.
   B. Check the ignition switch (Refer to ignition system in BE Group).
   C. Check the transaxle range switch connector or ignition lock switch connector.
   D. Inspect the starter relay.

Starter Solenoid Test

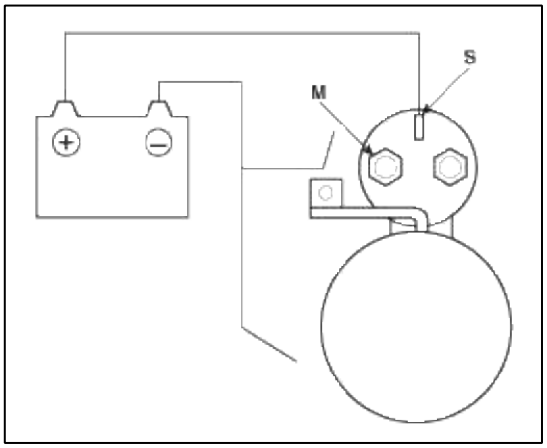
1. Disconnect the field coil wire from the M-terminal of solenoid switch.
2. Connect the battery as shown. If the starter pinion pops out (engages), it is working properly. To avoid damaging the starter, do not leave the battery connected for more than 10 seconds.



3. Disconnect the battery from the M terminal.
   If the pinion does not retract, the hold-in coil is working properly. To avoid damaging the starter, do not leave the battery connected for more than 10 seconds.

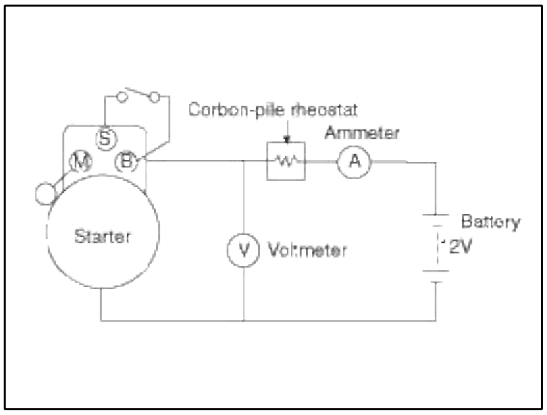


4. Disconnect the battery also from the body. If the pinion retracts immediately, it is working properly. To avoid damaging the starter, do not leave the battery connected for more than 10 seconds.



Free Running Test

1. Place the starter motor in a vise equipped with soft jaws and connect a fully-charged 12-volt battery to starter motor as follows.
2. Connect a test ammeter (150-ampere scale) and carbon pile rheostats as shown in the illustration.
3. Connect a voltmeter (15-volt scale) across starter motor.



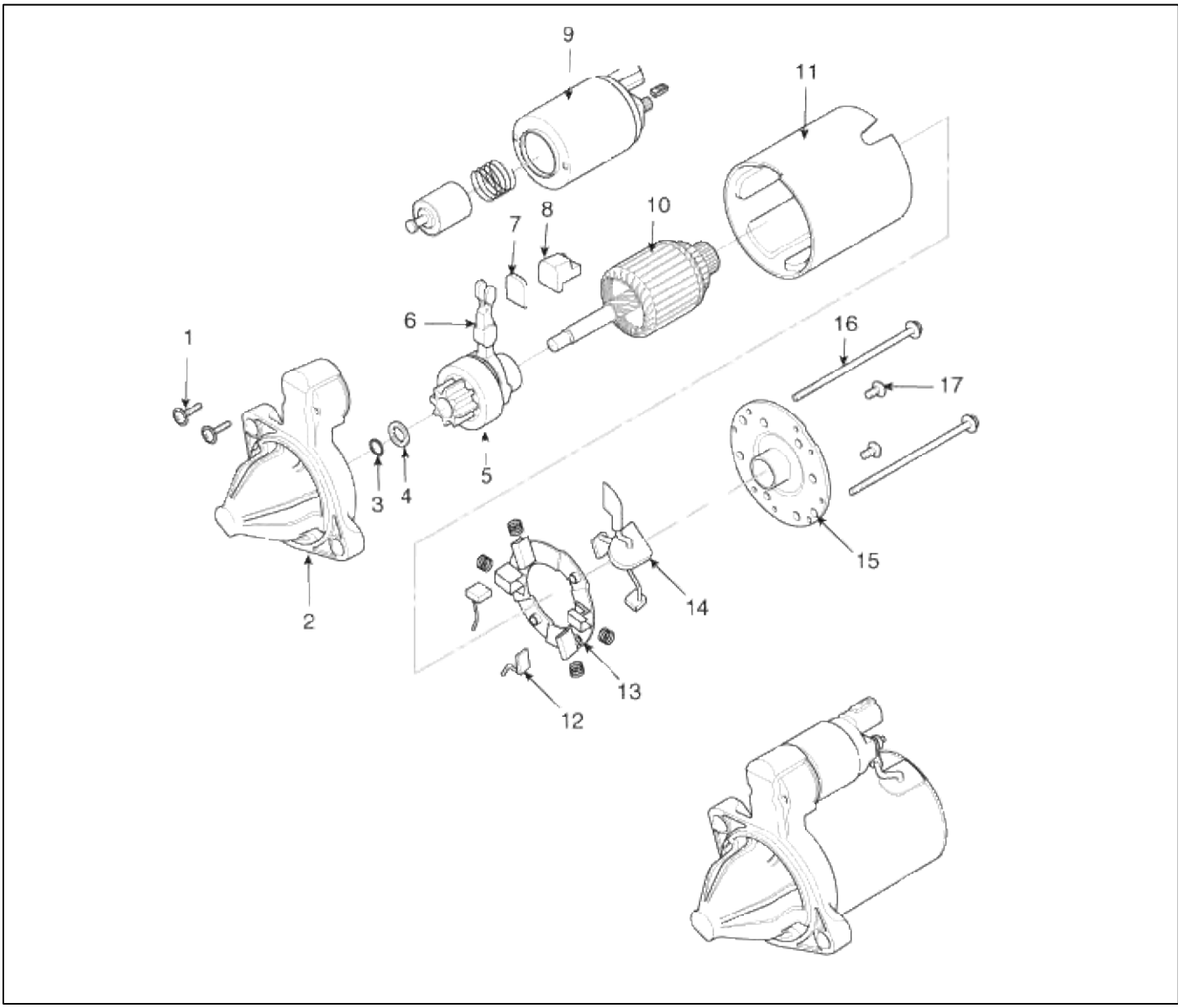
4. Rotate carbon pile to the off position.
5. Connect the battery cable from battery's negative post to the starter motor body.
6. Adjust until battery voltage shown on the voltmeter reads 11.5volts.

7. Confirm that the maximum amperage is within the specifications and that the starter motor turns smoothly and freely.

Max. Current :
Non-ISG : 60A
ISG :95A
Min. Speed :
Non-ISG : 5,500rpm
ISG : 3,500rpm

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

Components

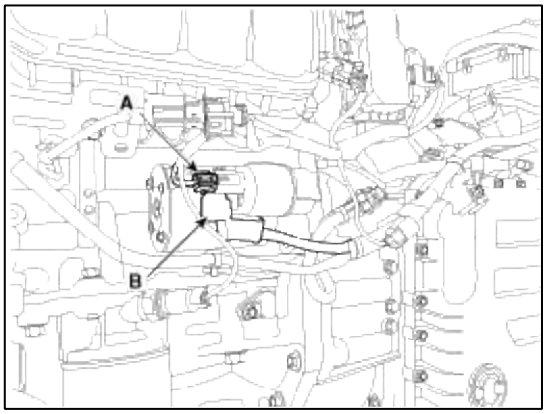


1. Screw	10. Armature
2. Front bracket	11. Yoke assembly
3. Stop ring	12. Brush (-)
4. Stopper	13. Brush holder
5. Overrun clutch	14. Brush (+)
6. Lever	15. Rear bracket
7. Lever plate	16. Through bolts
8. Lever packing	17. Screw
9. Magnet switch	

Engine Electrical System > Starting System > Starter > Repair procedures

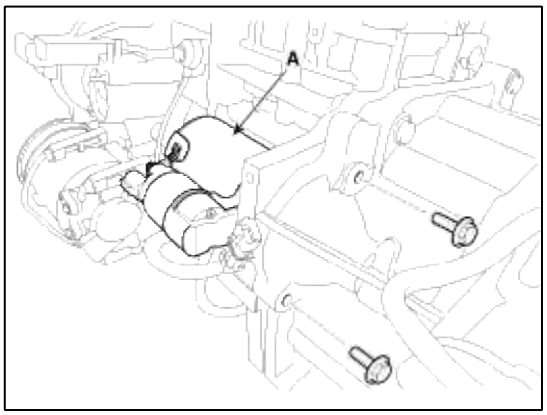
Removal and Installation

1. Disconnect the battery negative terminal.
2. Remove the air duct and air cleaner assembly. (Refer to EM group)
3. Disconnect the starter cable (B) from the B terminal on the solenoid then disconnect the connector (A) from the S terminal.



4. Remove the 2 bolts holding the starter, then remove the starter (A).

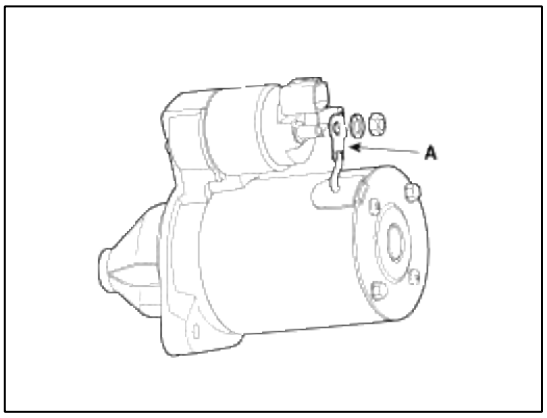
Tighting torque :
42.2 ~ 53.9 Nm (4.3 ~ 5.5 kgf.m, 31.1 ~ 39.8 lb-ft)



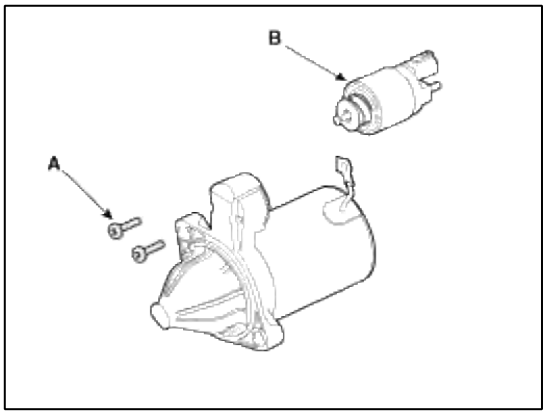
5. Installation is the reverse of removal.

Disassembly

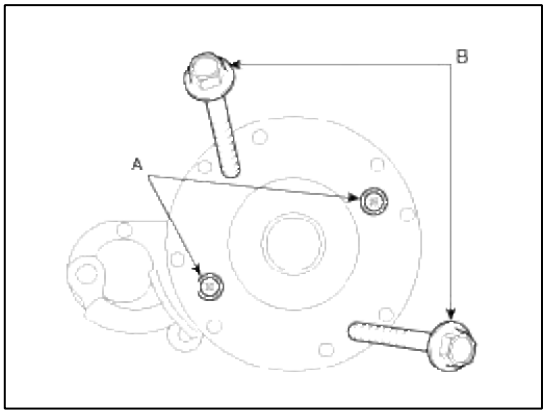
1. Disconnect the M-terminal (A) on the magnet switch assembly (B).



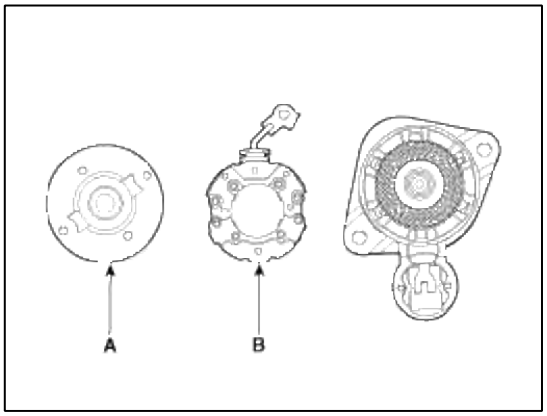
2. After loosening the 2 screws (A), detach the magnet switch assembly (B).



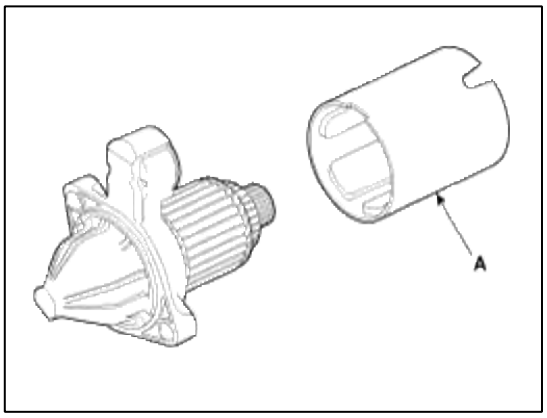
3. Loosen the brush holder mounting screw (A) and through bolts (B).



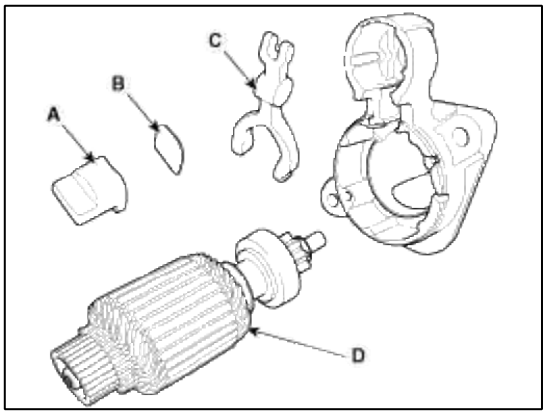
4. Remove the rear bracket (A) and brush holder assembly (B).



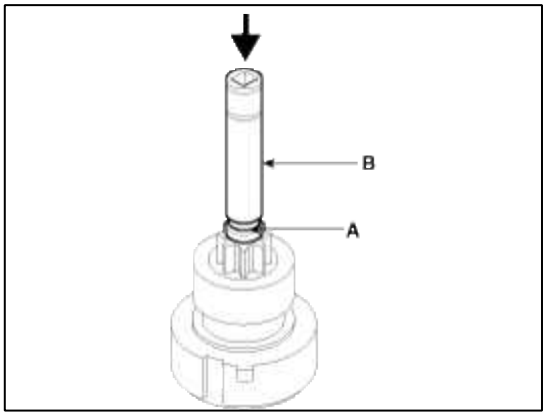
5. Remove the yoke (A).



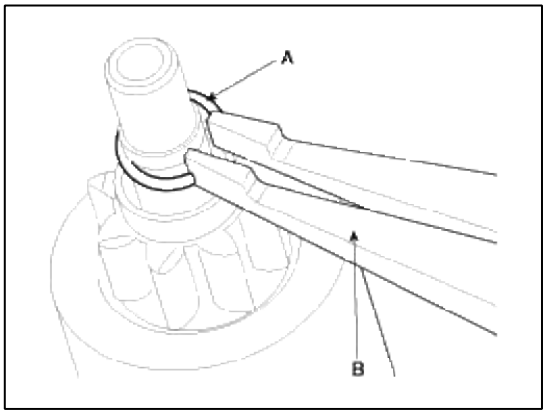
6. Remove the packing (A), lever plate (B), lever (C) and the armature (D).



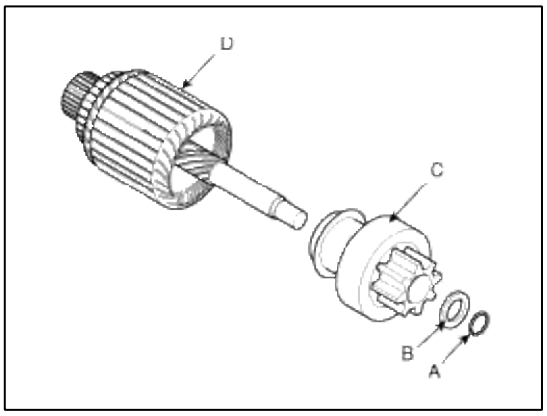
7. Press the stopper (A) using a socket (B).



8. Remove the stop ring (A) using stop ring pliers (B).



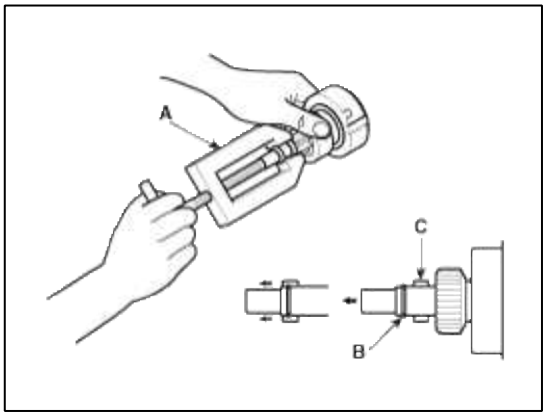
9. Remove the stop ring (B), stopper (A), overrunning clutch (C) and armature (D).



10. Reassembly is the reverse of disassembly.

NOTE

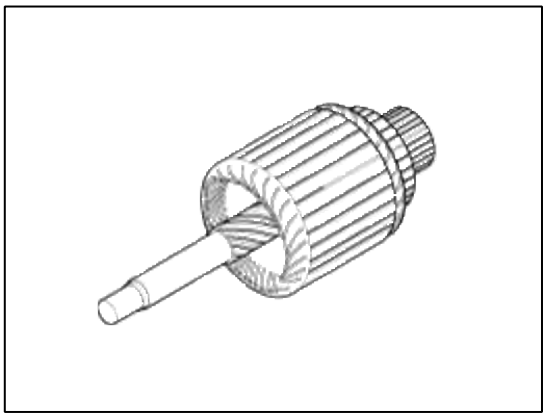
Using a suitable pulling tool (A), pull the overrunning clutch stopper (C) over the stop ring (B).



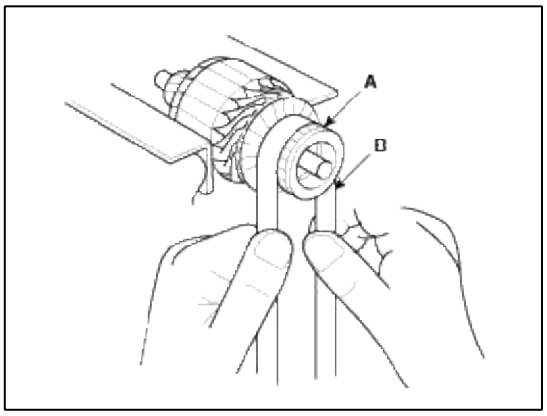
Inspection

Armature Inspection And Test

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

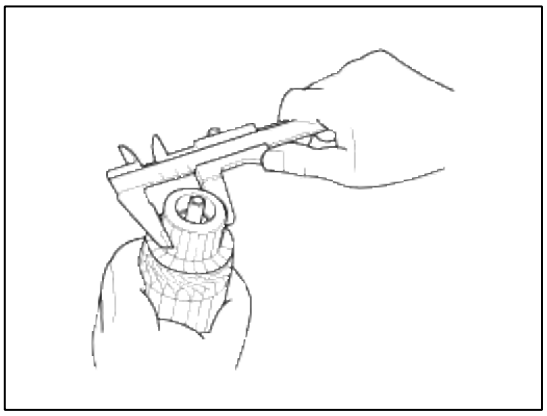


4. Check the commutator (A) surface. If the surface is dirty or burnt, resurface with emery cloth or a lathe within the following specifications, or recondition with #500 or #600 sandpaper (B).



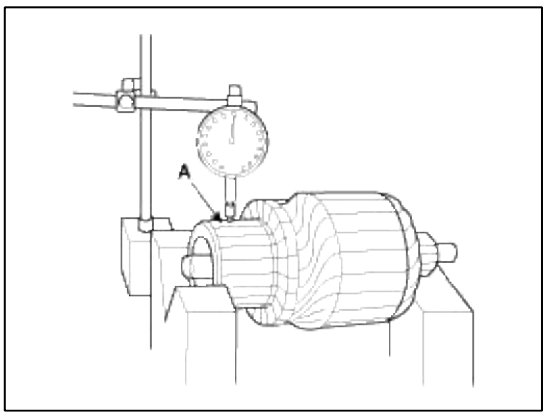
5. Check the commutator diameter. If the diameter is below the service limit, replace the armature.

Commutator diameter
Standard (New) : 29.4 mm (1.1575 in)
Service limit : 28.8 mm (1.1339 in)



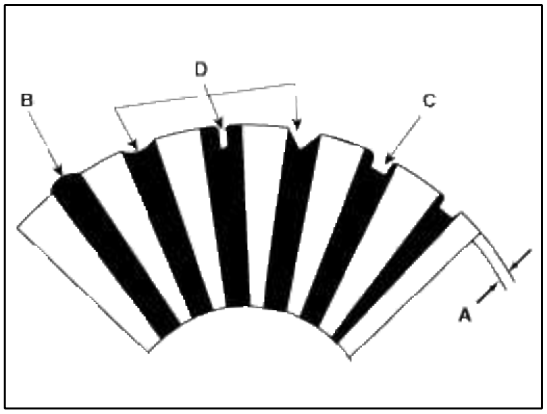
6. Measure the commutator (A) runout.
   A. If the commutator runout is within the service limit, check the commutator for carbon dust or brass chips between the segments.
   B. If the commutator run out is not within the service limit, replace the armature.

Commutator runout
Standard (New) : 0.05mm (0.0020in.) max
Service limit : 0.08mm (0.0031in.) max

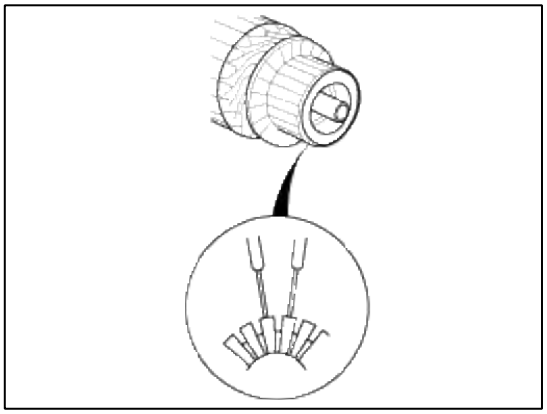


7. Check the mica depth (A). If the mica is too high (B), undercut the mica with a hacksaw blade to the proper depth. Cut away all the mica (C) between the commutator segments. The undercut should not be too shallow, too narrow, or v-shaped (D).

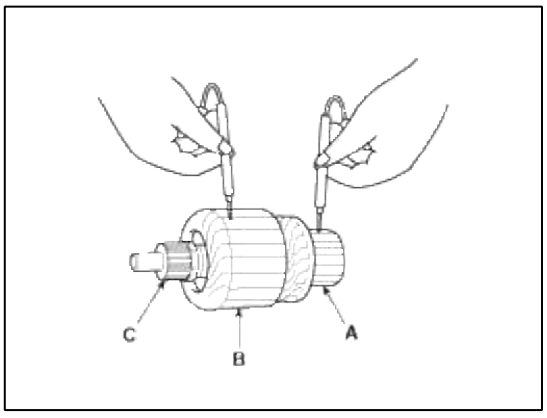
Commutator mica depth
Standard (New) : 0.5mm (0.0197in.)
Limit : 0.2mm (0.0079 in.)



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

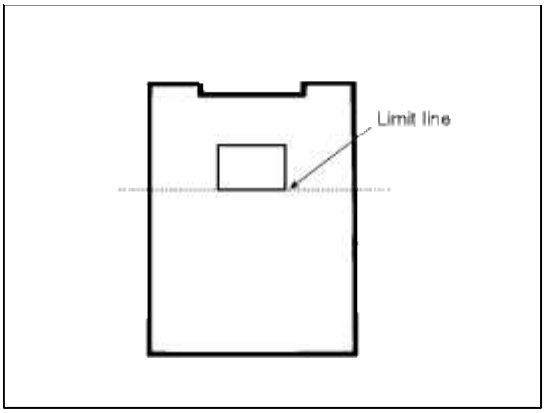


9. Check with an ohmmeter that no continuity exists between the commutator (A) and armature coil core (B), and between the commutator and armature shaft (C). If continuity exists, replace the armature.



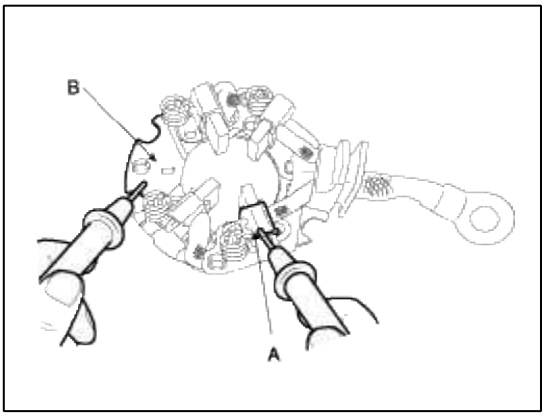
Inspect Starter Brush
Brushes that are worm out, or oil-soaked, should be replaced.

Bruch length
Standard : 12.3 mm (0.4843 in)
Service limit : 5.5 mm (0.2165 in)

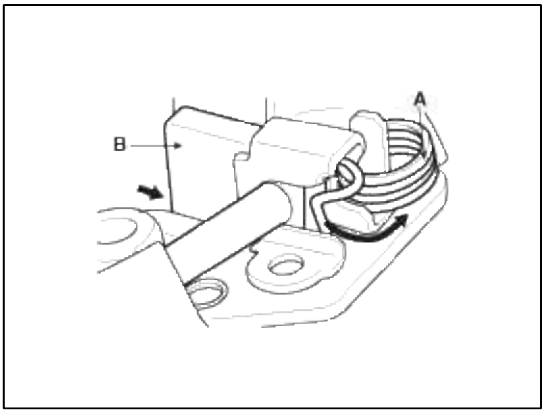


Starter Brush Holder Test

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



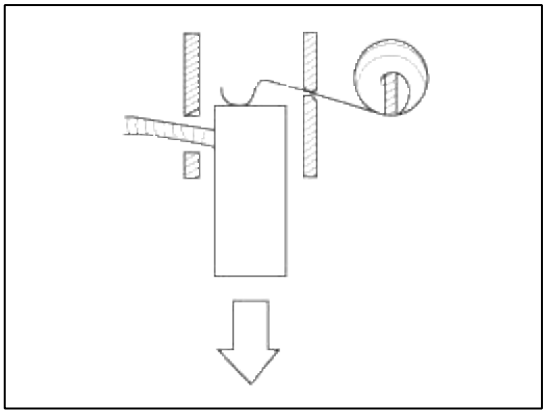
2. Pry back each brush spring (A) with a screwdriver, then position the brush (B) about halfway out of its holder, and release the spring to hold it there.



3. Install the armature in the housing, and install the brush holder. Next, pry back each brush spring again, and push the brush down until it seats against the commutator, then release the spring against the end of the brush.

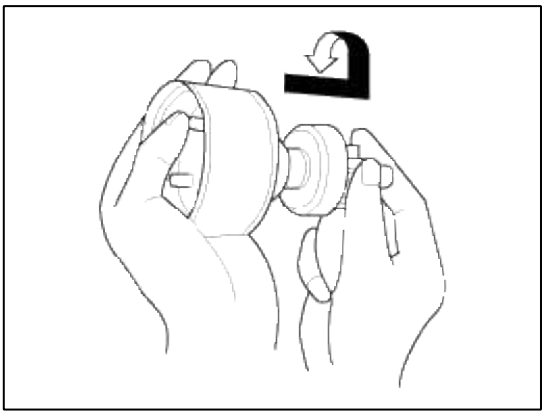
NOTE

To seat new brushes, slip a strip of #500 or #600 sandpaper, with the grit side up, between the commutator and each brush, and smoothly rotate the armature. The contact surface of the brushes will be sanded to the same contour as the commutator.



Overrunning Clutch

1. Slide the overrunning clutch along the shaft.
   Replace it if does not slide smoothly.
2. Rotate the overrunning clutch both ways.
   Does it lock in one direction and rotate smoothly in reverse? If it does not lock in either direction or it locks in both directions, replace it.



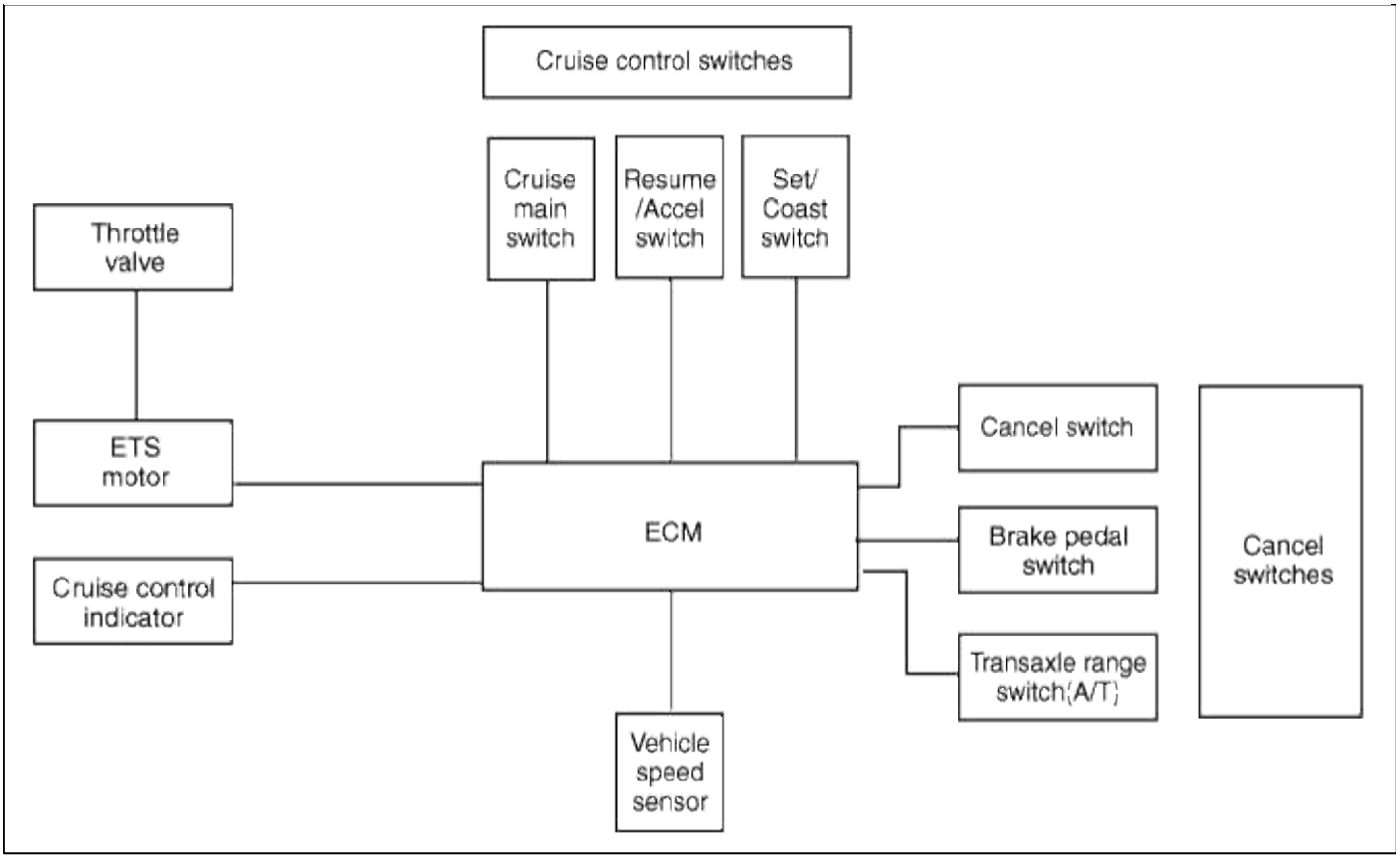
3. If the starter drive gear is worn or damaged, replace the overrunning clutch assembly. (the gear is not available separately).
   Check the condition of the flywheel or torque converter ring gear if the starter drive gear teeth are damaged.

Cleaning

1. Do not immerse parts in cleaning solvent. Immersing the yoke assembly and/or armature will damage the insulation. Wipe these parts with a cloth only.
2. Do not immerse the drive unit in cleaning solvent. The overrun clutch is pre-lubricated at the factory and solvent will wash lubrication from the clutch.
3. The drive unit may be cleaned with a brush moistened with cleaning solvent and wiped dry with a cloth.

Engine Electrical System > 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	Cruise main 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(Electronic Throttle System) motor		Regulates the throttle valve to the set opening by ECM.

Engine Electrical System > Cruise Control System > Description and Operation

Cruise Control

The cruise control system is engaged by the cruise "ON/OFF" main switch located on right of steering wheel column. The system has the capability to cruise, coast, accelerate and resume speed.
It also has a safety interrupt, engaged upon depressing brake or shifting select lever.
The ECM is the control module for this system. The main components of cruise control system are mode control switches, transmission range switch, brake switch, vehicle speed sensor, ECM and ETS motor that connect throttle

body.
The ECM contains a low speed limit which will prevent system engagement below a minimum speed of 40km/h (25mph).
The operation of the controller is controlled by mode control switches located on steering wheel.
Transmission range switch and brake switch are provided to disengage the cruise control system. The switches are on brake pedal bracket and transmission. When the brake pedal is depressed or select lever shifted, the cruise control system is electrically disengaged and the throttle is returned to the idle position.

Cruise main switch (ON/OFF)

The cruise control system is engaged by pressing the cruise "ON/OFF" main switch. Pressing the cruise "ON/OFF" main switch again releases throttle, clears cruise memory speed, and puts vehicle in a non-cruise mode.

Set/Coast switch (SET/–)

The "SET/–" switch located on right of steering wheel column has two functions.
The set function - Push the "SET/–" switch and release it at the desired speed. The SET indicator light in the instrument cluster will illuminate. Release the accelerator pedal. The desired speed will automatically be maintained.
The coast function - Push the "SET/–" switch and hold it when the cruise control is on. The vehicle will gradually slow down. Release the switch at the desired speed. The desired speed will be maintained.
Push the "SET/–" switch and release it quickly. The cruising speed will decrease by 2.0km/h (1.2mph) or 1.6km/h (1.0mph).

Resume/Accel switch (RES/+)

The "RES/+" switch located on right of steering wheel column has two functions.
The resume function - If any method other than the cruise “ON/OFF” main switch was used to cancel cruising speed temporarily and the system is still activated, the most recent set speed will automatically resume when the "RES/+" switch is pushed. It will not resume, however, if the vehicle speed has dropped below approximately 40km/h (25mph).
The accel function - Push the "RES/+" switch and hold it when the cruise control is on. The vehicle will gradually accelerate. Release the switch at the desired speed. The desired speed will be maintained.
Push the "RES/+" switch and release it quickly. The cruising speed will increase by 2.0km/h (1.2mph) or 1.6km/h (1.0mph).

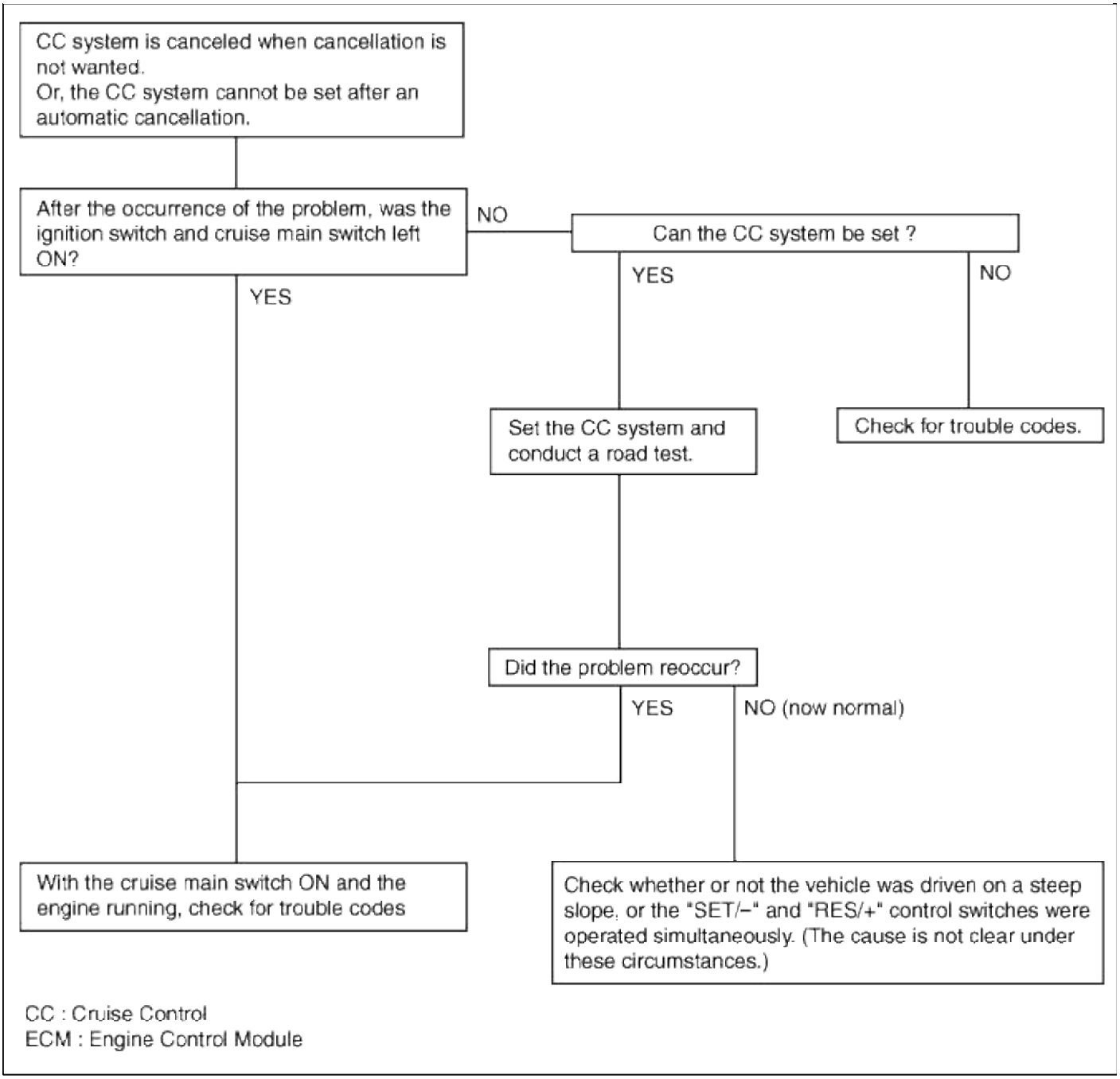
Cancel switch (CANCEL)

The cruise control system is temporarily disengaged by pushing the "CANCEL" switch.
Cruise speed canceled by this switch can be recovered by pushing the "RES/+" switch.

Engine Electrical System > Cruise Control System > Troubleshooting

Trouble Symptom Charts

Trouble Symptom 1



Trouble Symptom 2

Trouble symptom	Probable cause	Remedy
The set vehicle speed varies greatly upward or downward "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

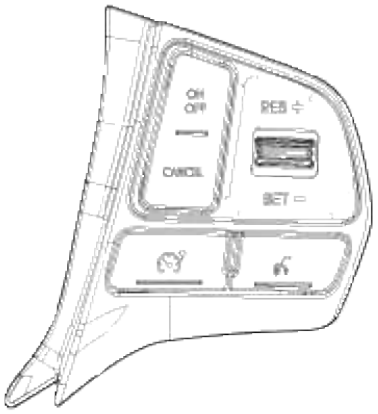
Trouble symptom	Probable cause	Remedy
CC system can be set while driving at a vehicle speed of less than 40km/h (25mph), or there is no automatic cancellation at that speed	Malfunction of the vehicle-speed sensor circuit	Repair the vehicle speed sensor system, or replace the part
	Malfunction of the ECM signals	Check input and output signals at ECM

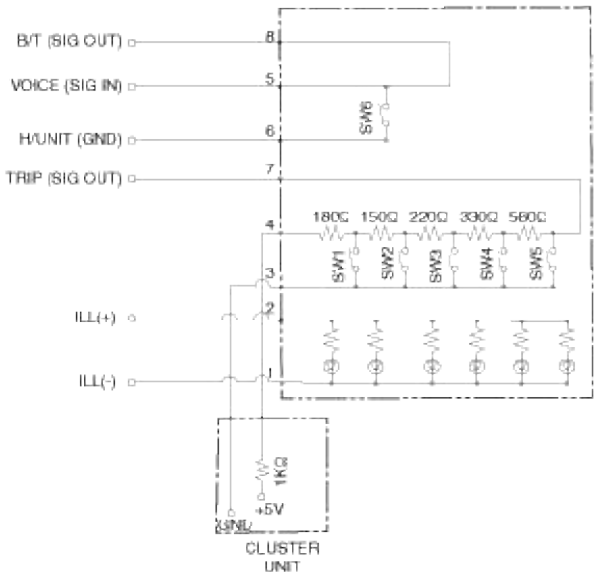
Trouble Symptom 8

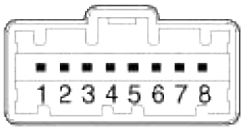
Trouble symptom	Probable cause	Remedy
The cruise main switch indicator lamp does not illuminate (But CC system is normal)	Damaged or disconnected bulb of cruise main switch indicator lamp	Repair the harness or replace the part.
	Harness damaged or disconnected	

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

Circuit Diagram





Cruise connector (RH)	
	
Pin No.	Description
1	Illumination (-)
2	Illumination (+)
3	Cluster ground
4	Cluster signal
5	Voice (Signal IN)
6	Audio head unit (Ground)
7	Trip (Signal OUT)
8	Bluetooth (Signal OUT)

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

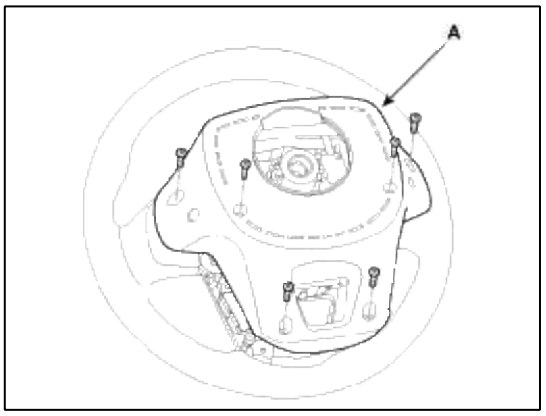
Removal and Installation

1. Disconnect the battery (-) terminal.

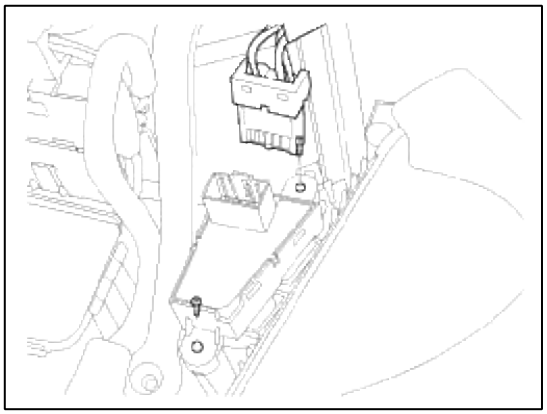
Tightening torque:
4.0 ~ 6.0N.m (0.4 ~ 0.6kgf.m, 3.0 ~ 4.4lb-ft)

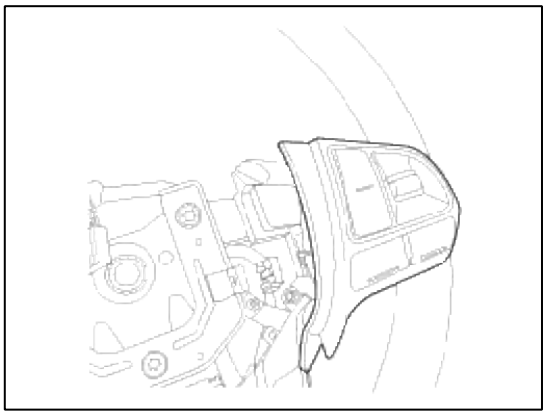
2. Remove the air-bag module from the steering wheel. (Refer to RT group)
3. Remove the steering wheel. (Refer to ST group)

4. Remove the steering wheel cover (A) after loosening 6 screws.



5. Remove the remote control switch after loosening 2 screws and disconnecting the connector.



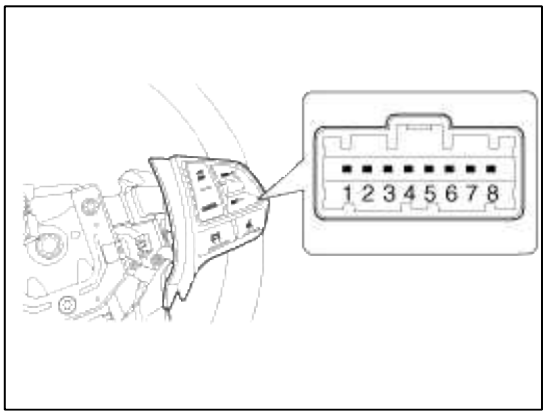


6. Installation is reverse order of removal.

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	3 - 4	180 Ω ± 5%
SET/–	3 - 4	330Ω ± 5%
RES/+	3 - 4	550Ω ± 5%
ON/OFF	3 - 4	880Ω ± 5%
SLD	3 - 4	1.44kΩ ± 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	3 - 4	0.76 ± 0.1V
SET/–	3 - 4	1.24 ± 0.15V
RES/+	3 - 4	1.77 ± 0.2V
ON/OFF	3 - 4	2.34 ± 0.1V
SLD	3 - 4	3.0 ± 0.22V

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.`

RIO(UB) > 2012 > G 1.6 GDI > Engine Mechanical System

Engine Mechanical System > General Information > Specifications

Specifications

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

Thickness of valve head (margin)	Intake	1.10mm (0.0433in)	0.8mm (0.0315in)
	Exhaust	1.26mm (0.0496in)	1.0mm (0.0394in)
Valve stem to valve guide clearance	Intake	0.020 ~ 0.047mm (0.0008 ~ 0.0019in)	0.10mm (0.0039in)
	Exhaust	0.030 ~ 0.054mm (0.0012 ~ 0.0021in)	0.15mm (0.0059in)
Valve guide			
Length	Intake	40.3 ~ 40.7mm (1.5866 ~ 1.6024in)	
	Exhaust	40.3 ~ 40.7mm (1.5866 ~ 1.6024in)	
Valve spring			
Free length		45.1mm (1.7756in)	
Out of squareness		Less than 1.5°	
Cylinder block			
Cylinder bore		77.00 ~ 77.03mm (3.0315 ~ 3.0327in)	
Flatness of gasket surface		Less than 0.05mm (0.0020in) for total area Less than 0.02mm (0.0008in) for a section of 100mm (3.9370in) X 100mm (3.9370in)	
Piston			
Piston outer diameter		76.97 ~ 77.00mm (3.0303 ~ 3.0315in)	
Piston to cylinder clearance		0.020 ~ 0.040mm (0.0008 ~ 0.0016in)	
Ring groove width	No. 1 ring groove	1.23 ~ 1.25mm (0.0484 ~ 0.0492in)	1.26mm (0.0496in)
	No. 2 ring groove	1.23 ~ 1.25mm (0.0484 ~ 0.0492in)	1.26mm (0.0496in)
	Oil ring groove	2.01 ~ 2.03mm (0.0791 ~ 0.0799in)	2.05mm (0.0807in)
Piston ring			
Side clearance	No.1 ring	0.04 ~ 0.08mm (0.0016 ~ 0.0031in)	0.1 mm (0.0039in)
	No.2 ring	0.04 ~ 0.08mm (0.0016 ~ 0.0031in)	0.1 mm (0.0039in)
	Oil ring	0.02 ~ 0.06mm (0.0008 ~ 0.0024in)	0.2 mm (0.0079in)
End gap	No. 1 ring	0.14 ~ 0.28mm (0.0055 ~ 0.0110in)	0.30mm (0.0118in)
	No. 2 ring	0.30 ~ 0.45mm (0.0118 ~ 0.0177in)	0.50mm (0.0197in)
	Oil ring	0.20 ~ 0.40mm (0.0079 ~ 0.0157in)	0.80mm (0.0315in)
Piston pin			
Piston pin outer diameter		18.001 ~ 18.006mm (0.7087 ~ 0.7089in)	
Piston pin hole inner diameter		18.016 ~ 18.021mm (0.7093 ~ 0.7095in)	
Piston pin hole clearance		0.010 ~ 0.020mm (0.0004 ~ 0.0008in)	
Connecting rod small end hole inner diameter		17.974 ~ 17.985mm (0.7076 ~ 0.7081in)	

Piston pin press-in load		500~1,500 kg (1,102 ~ 3,306 lb)	
Connecting rod			
Connecting rod big end inner diameter		45.000 ~ 45.018mm (1.7717 ~ 1.7724in)	
Connecting rod bearing oil clearance		0.032 ~ 0.052mm (0.0013 ~ 0.0020in)	0.060mm (0.0024in)
Side clearance		0.10 ~ 0.25mm (0.0039 ~ 0.0098in)	0.35m (0.0138in)
Crankshaft			
Main bearing oil clearance	No. 1, 2, 3, 4, 5	0.021 ~ 0.042mm (0.0008 ~ 0.0017in)	0.05mm (0.0020in)
End play		0.05 ~ 0.25mm (0.0020 ~ 0.0098in)	0.3mm (0.0118in)
Engine oil			
Oil quantity	Total	3.7L (3.91US qt, 3.25lmp qt)	When replacing a short engine or a block assembly
	Oil pan	3.0L (3.17US qt, 2.64lmp qt)	
	Drain and refill	3.3L (3.49US qt, 2.90lmp qt)	Including oil filter
Oil grade	Recommendation	API SM ILSAC GF-4 or above ACEA A5 or above	API SL/ ILSAC GF-3/ ACEA A3 class oil can be used if the recommended oil is not available
	SAE viscosity grade	Recommended SAE viscosity number	Refer to the "Lubrication System"
Oil pressure (at 1000rpm)		100kPa (1.0kg/cm², 14.5psi) or above	Oil temperature in oil pan : 110±2°C (230± 36°F)
Cooling system			
Cooling method		Forced circulation with cooling fan	
Coolant quantity		MT : 5.0L (1.32 U.S.gal., 5.28 U,S,qt., 4.40lmp.qt) AT : 5.2L (1.37 U.S.gal., 5.49 U,S,qt., 4.57lmp.qt)	
Thermostat	Type	Wax pellet type	
	Opening temperature	82 ± 1.5°C (179.6 ± 2.7°F)	
	Full opening temperature	95°C (203°F)	
Radiator cap	Main valve opening pressure	93.16 ~ 122.58kpa (0.95 ~ 1.25kgf/cm², 13.51 ~ 17.78psi)	
	Vacuum valve opening pressure	MAX. 6.86 kpa(0.07kgf/cm², 1.00 psi)	
Water temperature sensor			
Type		Thermister type	

Resistance	20°C (68°F)	2.45±0.14 kΩ	
	80°C (176°F)	0.3222 kΩ	

Tightening Torques

Item	Quantity	N.m	kgf.m	lb-ft
Engine mounting				
Engine mounting bracket to body fixing bolt	2	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0
Engine mounting bracket to body fixing nut	1	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0
Engine mounting support bracket to engine mounting insulator fixing nut	1	63.7 ~ 83.4	6.5 ~ 8.5	47.0 ~ 61.5
Engine mounting support bracket to engine support bracket fixing bolt	1	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0
Engine mounting support bracket to engine support bracket fixing nut	2	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0
Transaxle mounting bracket to body fixing bolt	2	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0
Transaxle mounting bracket to body fixing nut	1	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0
Transaxle mounting insulator to transaxle mounting support bracket fixing bolt	2	88.3 ~ 107.9	9.0 ~ 11.0	65.1 ~ 79.6
Roll rod bracket to sub frame fixing bolt	2	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0
Roll rod insulator to roll rod mounting support bracket fixing nut	1	107.9 ~ 127.5	11.0 ~ 13.0	79.6 ~ 94.0
Timing system				
Timing chain and oil pump assembly cover bolt (M6×20)	10	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain and oil pump assembly cover bolt (M6×38)	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain and oil pump assembly cover bolt (M6×70)	1	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain and oil pump assembly cover bolt (M8×22)	3	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Idler pulley assembly bolt	1	42.2 ~ 53.9	4.3 ~ 5.5	31.1 ~ 39.8
Timing chain tensioner arm bolt	1	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain guide bolt	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Crankshaft pulley bolt	1	127.5 ~ 137.3	13.0 ~ 14.0	94.0 ~ 101.3
Timing chain tensioner bolt	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Cylinder head				
Ignition coil bolt	4	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
High pressure fuel pipe nut	2	25.5 ~ 31.4	2.6 ~ 3.2	18.8 ~ 23.1
High pressure fuel pump bolt	2	12.7 ~ 14.7	1.3 ~ 1.5	9.4 ~ 10.8

Cylinder head cover bolt	19	[3.9~5.9] + [7.8~9.8]	[0.4~0.6] + [0.8~1.0]	[2.9~4.3] + [5.8~7.2]
Camshaft bearing cap bolt (M6)	18	[5.9] + [11.8~12.7]	[0.6] + [1.2~1.3]	[4.3] + [8.7~9.4]
Camshaft bearing cap bolt (M8)	4	[9.8] + [18.6~22.6]	[1.0] + [1.9~2.3]	[7.2] + [13.7~16.6]
Cylinder head bolt	10	[29.4] + [90°] + [90°]	[3.0] + [90°] + [90°]	[21.7] + [90°] + [90°]
Cylinder block				
Engine support bracket bolt	4	29.4 ~ 41.2	3.0 ~ 4.2	21.7 ~ 30.4
Ladder frame bolt	13	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Connecting rod cap bolt	8	[17.7~21.6] + [88~92°]	[1.8~2.2] + [88~92°]	[13.0~15.9] + [88~92°]
Crankshaft main bearing cap bolt	10	[19.6] + [90°]	[2.0] + [90°]	[14.5] + [90°]
Flywheel bolts (M/T)	6	71.6 ~ 75.5	7.3 ~ 7.7	52.8 ~ 55.7
Drive plate bolts (A/T)	6	71.6 ~ 75.5	7.3 ~ 7.7	52.8 ~ 55.7
Lubrication system				
Oil filter	1	11.8 ~ 15.7	1.2 ~ 1.6	8.7 ~ 11.6
Oil pan bolt	11	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Oil pan drain plug	1	34.3 ~ 44.1	3.5 ~ 4.5	25.3 ~ 32.5
Oil screen bolt	2	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Oil pressure switch	1	7.8 ~ 11.8	0.8 ~ 1.2	5.8 ~ 8.7
Oil level gauge assembly mounting bolt	1	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Cooling system				
Water pump pulley bolt	4	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Water pump bolt	5	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Water temperature control assembly mounting bolt	3	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Water inlet fitting nut	2	18.6 ~ 23.5	1.9~ 2.4	13.7 ~ 17.4
Heater pipe mounting bolt (M6)	1	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Heater pipe mounting nut	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Heater pipe mounting bolt (M8)	1	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Engine coolant temperature sensor (ECTS)	1	29.4 ~ 39.2	3.0 ~ 4.0	21.7 ~ 28.9
Intake and exhaust system				
Air intake hose clamp bolt	2	2.9 ~ 4.9	0.3 ~ 0.5	2.2 ~ 3.6
Air cleaner asembly bolt	2	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Electronic throttle control (ETC) module bolt	4	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Intake manifold nut	2	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4

Intake manifold bolt	3	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Exhaust manifold heat protector bolt	3	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Exhaust manifold stay bolt	3	39.2 ~ 49.0	4.0 ~ 5.0	28.9 ~ 36.2
Exhaust manifold nut	9	29.4 ~ 41.2	3.0 ~ 4.2	21.7 ~ 30.4
Oxygen sensor (Front/Rear)	2	39.2 ~ 49.0	4.0 ~ 5.0	28.9 ~ 36.2
Catalytic converter / muffler nut	6	39.2 ~ 58.8	4.0 ~ 6.0	28.9 ~ 43.4

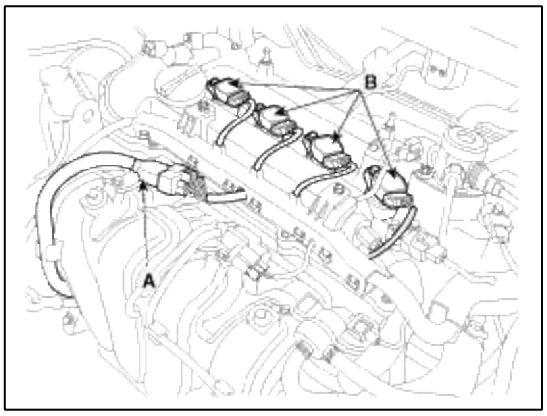
Engine Mechanical System > General Information > Repair procedures

Compression Pressure Inspection

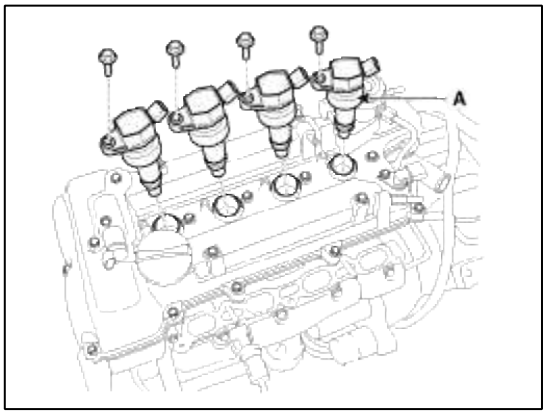
NOTE

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

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

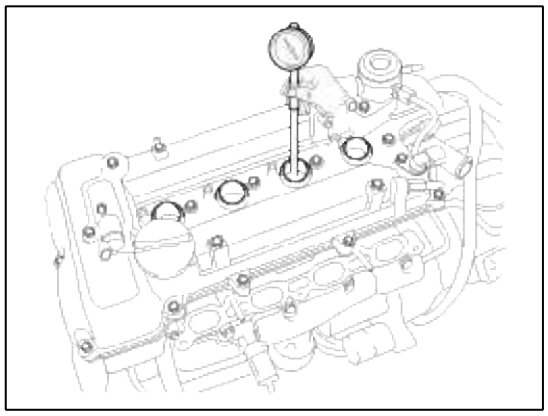


4. Remove the ignition coils (A).



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

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



   (2) Set the throttle plate in the wide-open position.
   (3) While cranking the engine, measure the compression pressure.

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

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

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

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

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

7. Install the spark plugs.

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

8. Install the ignition coil.

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

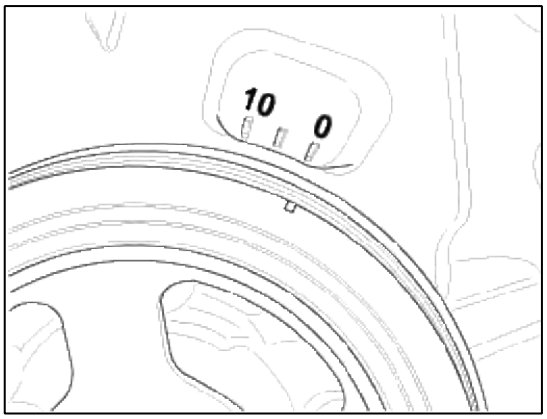
9. Connect the injector extension connector and the ignition coil connectors.
10. Install the engine cover.

Valve Clearance Inspection And Adjustment

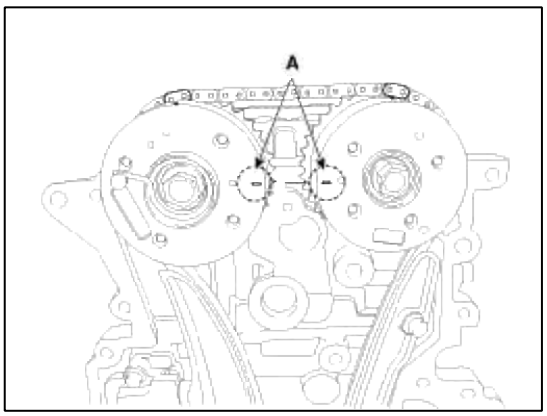
NOTE

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

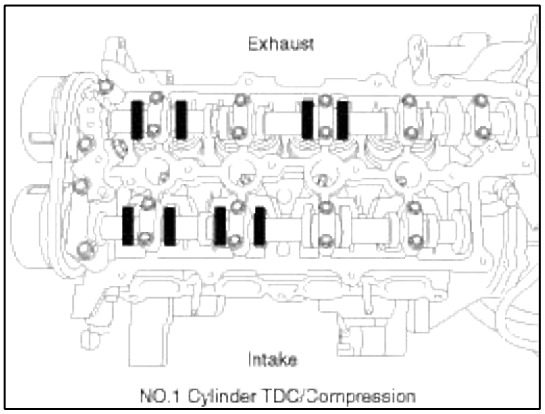
1. Remove the cylinder head cover. (Refer to Timing system)
2. Set No.1 cylinder to TDC/compression.
   (1) Turn the crankshaft pulley and align its groove with the timing mark of the timing chain cover.



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



3. Inspect the valve clearance.
   (1) Check only the intake valves of the 1st and 2nd cylinders and exhaust valves of the 1st and 3rd cylinders for their clearance.
      A. Using a thickness gauge, measure the clearance between the tappet and the base circle of camshaft.

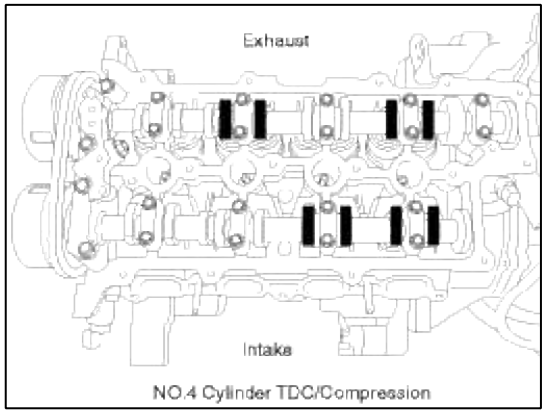


      B. Record the out-of-specification valve clearance measurements. They will be used later to determine the required tappet for adjusting.

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

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

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



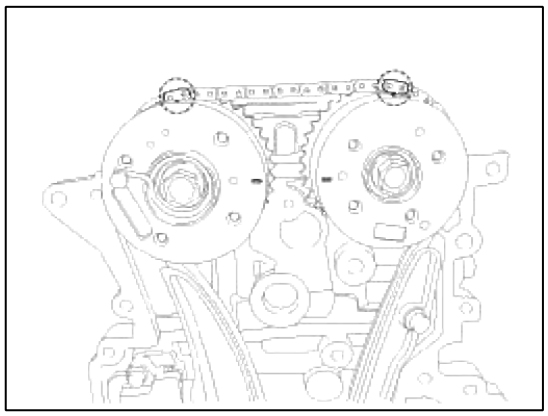
4. Adjust the intake and exhaust valve clearance.

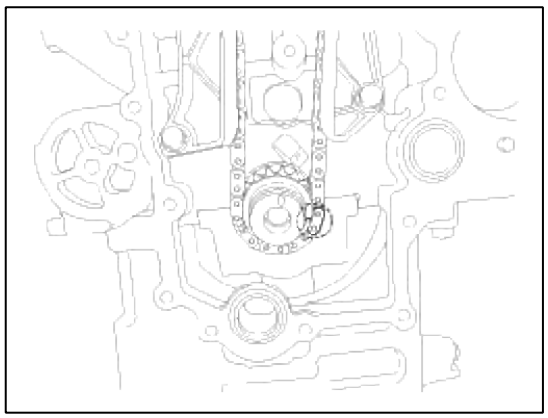
(1) Set the No.1 cylinder to the TDC/compression position.

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

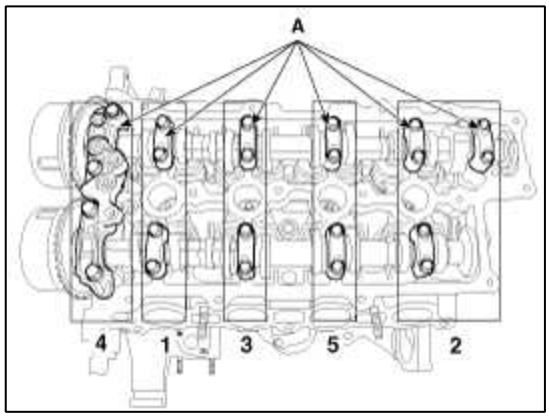
CAUTION

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





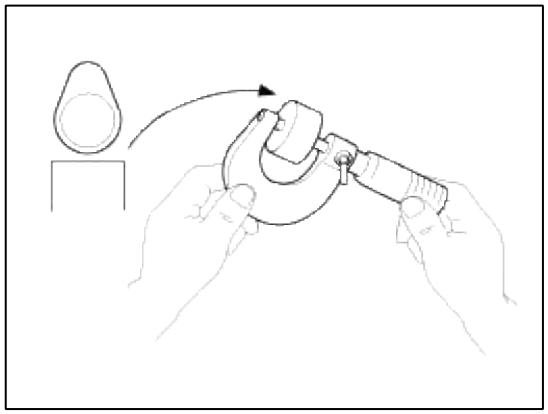
(3) Remove the camshaft bearing caps (A) with the order below.



(4) Remove the intake camshaft assembly.

(5) Remove the exhaust camshaft assembly.

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



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

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

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

NOTE

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

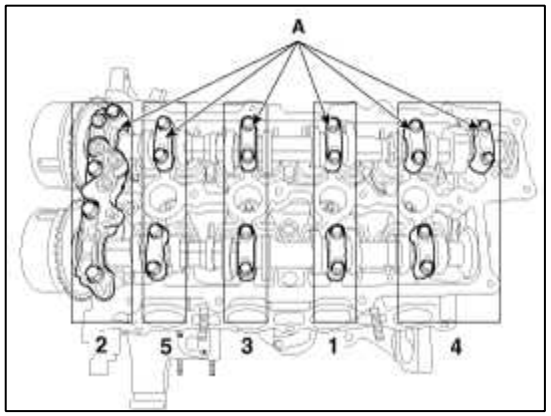
(9) Place a new tappet on the cylinder head.

(10) Install the exhaust camshaft assembly.

(11) Install the intake camshaft assembly.

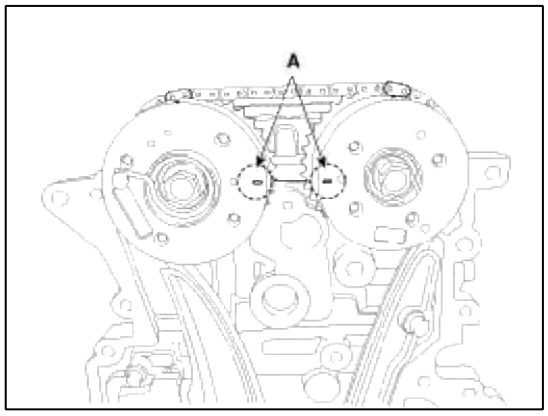
(12) Install the camshaft bearing caps with the order below.

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



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

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



(15) Recheck the valve clearance.

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

Engine Mechanical System > General Information > Troubleshooting

Troubleshooting

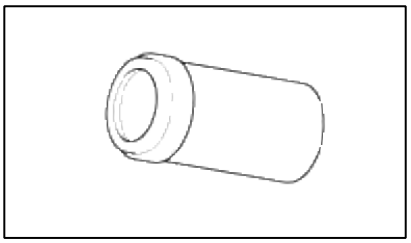
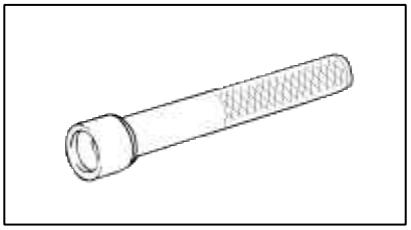
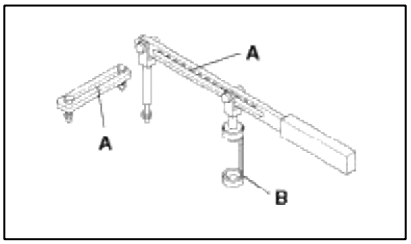
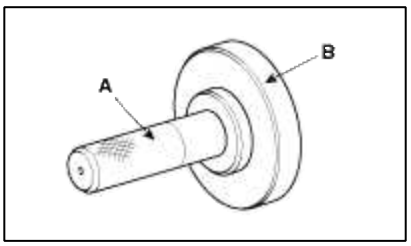
Symptom	Suspect area	Remedy
Engine misfire with abnormal internal lower engine noises.	Loose or improperly installed engine flywheel.	Repair or replace the flywheel as required.
	Worn piston rings. (Oil consumption may or may not cause the engine to misfire.)	Inspect the cylinder for a loss of compression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

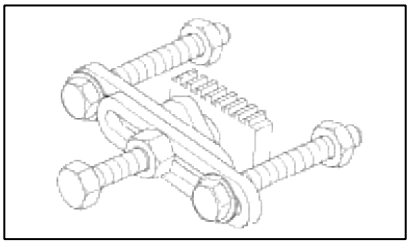
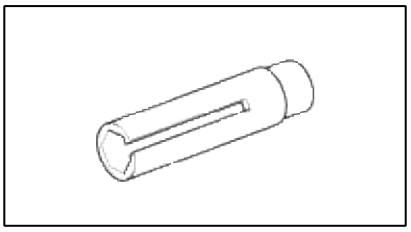
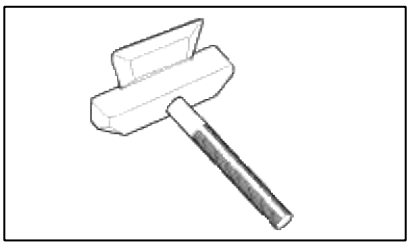
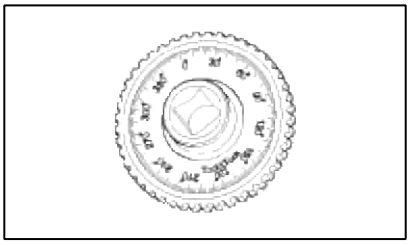
Lower engine noise, regardless of engine speed.	Low oil pressure.	Repair or replace damaged components as required.
	Loose or damaged flywheel.	Repair or replace the flywheel.
	Damaged oil pan, contacting the oil pump screen.	Inspect the oil pan. Inspect the oil pump screen. Repair or replace as required.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

	Broken timing chain and/or timing chain gears.	Inspect timing chain and gears. Repair as required.
	Foreign material in cylinder. • Broken valve. • Piston material. • Foreign material.	Inspect cylinder for damaged components and/or foreign materials. Repair or replace as required.
	Seized crankshaft or connecting rod bearings.	Inspect crankshaft and connecting rod bearing. Repair or replace as required.
	Bent or broken connecting rod.	Inspect connecting rods. Repair or replace as required.
	Broken crankshaft.	Inspect crankshaft. Repair or replace as required.

Engine Mechanical System > General Information > Special Service Tools

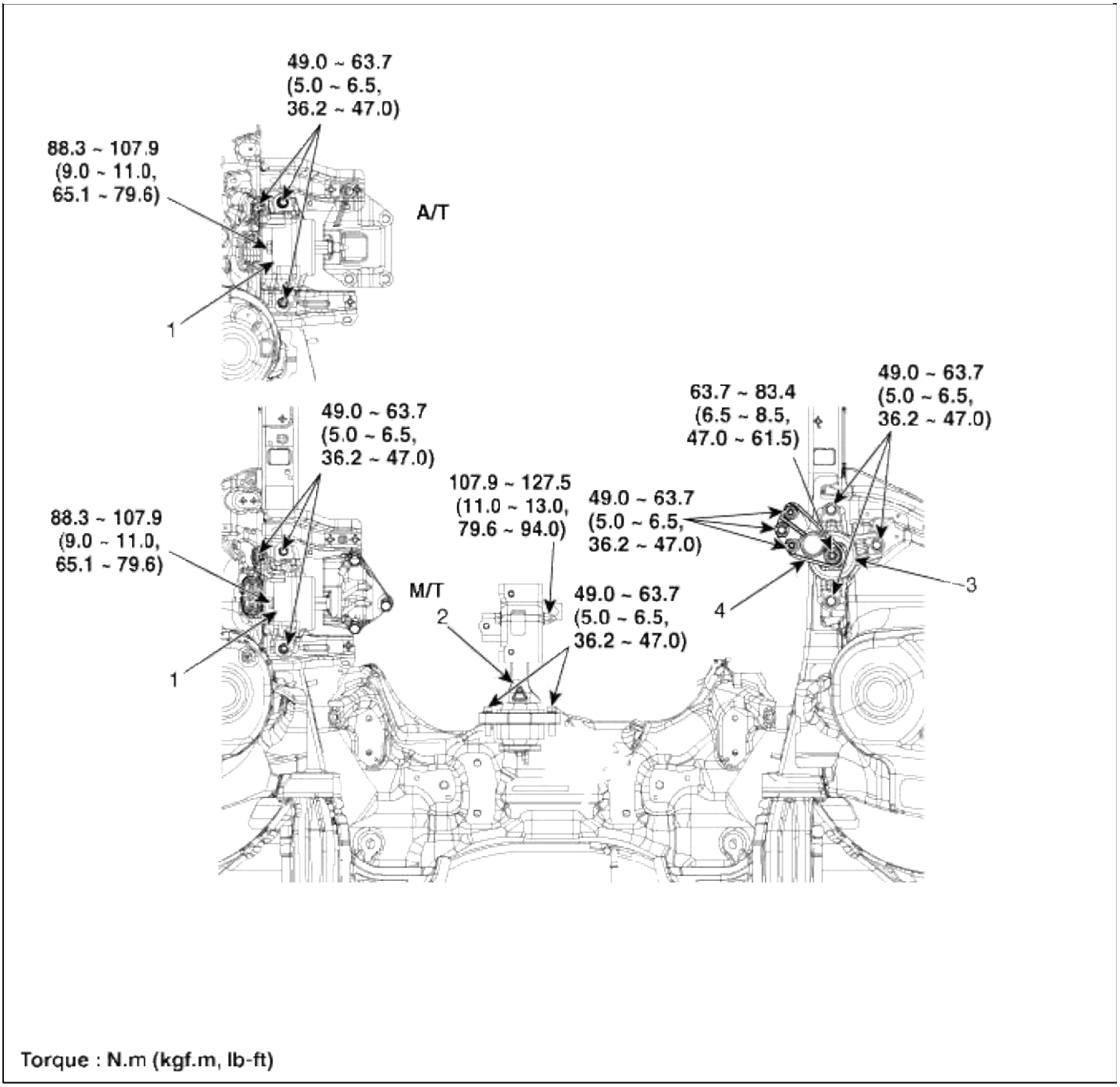
Special Service Tools

Tool (Number and name)	Illustration	Use
Crankshaft front oil seal installer (09455-21200)		Installation of the front oil seal
Valve stem oil seal installer (09222-2B100)		Installation of the valve stem oil seal
Valve spring compressor and holder A : (09222-3K000) B : (09222-3K100)		Removal and installation of the intake or exhaust valve
Crankshaft rear oil seal installer A : (09231-H1100) B : (09231-2B200)		Installation of the crankshaft rear oil seal

Ring gear stoppper (09231-2B100)		Installation of crankshaft pulley bolt
Engine coolant temperature sensor socket wrench (09221-25100)		Removal and installation of engine coolant sensor
Oil pan remover (09215-3C000)		Removal of oil pan
Torque angle adapter (09221-4A000)		Installation of bolts & nuts needing an angular method

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

Components



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

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

Removal

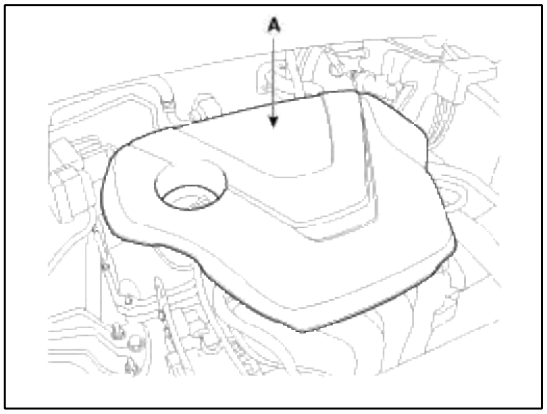
CAUTION

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

NOTE

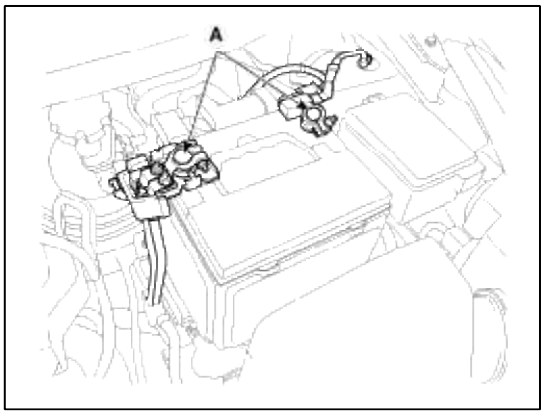
- Mark all wiring and hoses to avoid misconnection.
- To release the fuel system pressure before removing the engine assembly, start the engine with the fuel pump relay removed. And then turn off the ignition switch after engine stops.

1. Remove the engine cover (A).



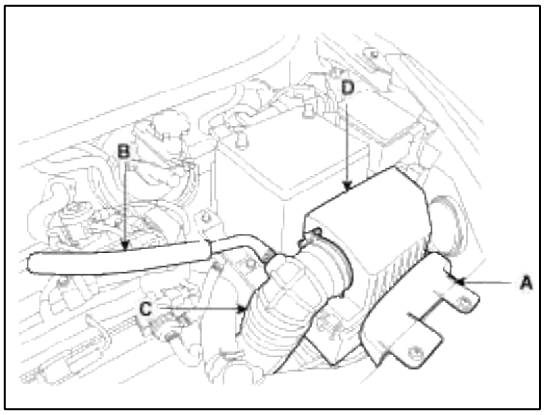
2. Disconnect the battery terminals (A). Disconnect the negative terminal first.

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



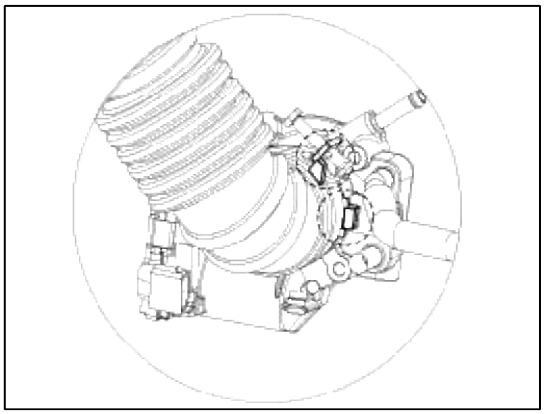
3. Remove the air cleaner assembly.
   (1) Remove the air duct (A).
   (2) Disconnect the breather hose (B).
   (3) Disconnect the air intake hose (C) and then remove the air cleaner assembly (D).

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



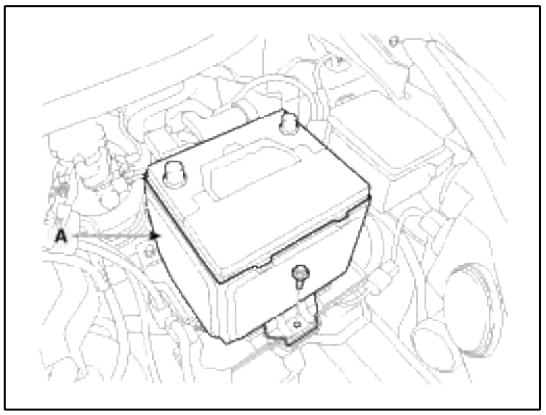
NOTE

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



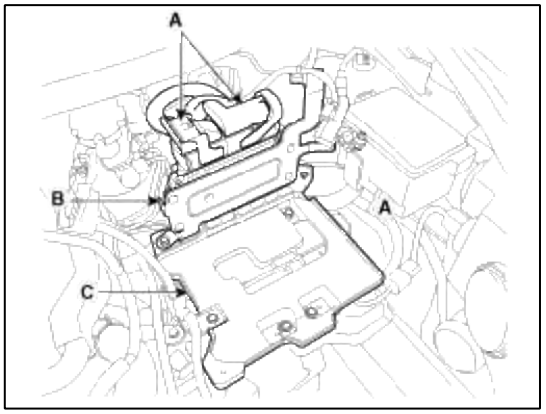
4. Remove the battery (A) after removing the mounting bracket.

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



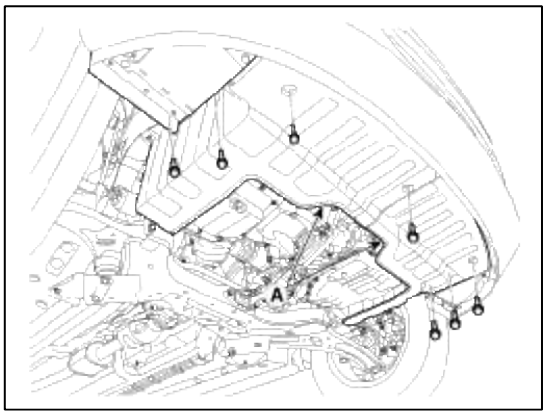
5. Disconnect the ECM connectors (A) and then remove the ECM (B) and the battery tray (C).

Tightening torque
ECM bracket bolts & nut :
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)
Battery tray bolts :
8.8 ~ 13.7N.m (0.9 ~ 1.4kgf.m, 6.5 ~ 10.1lb-ft)

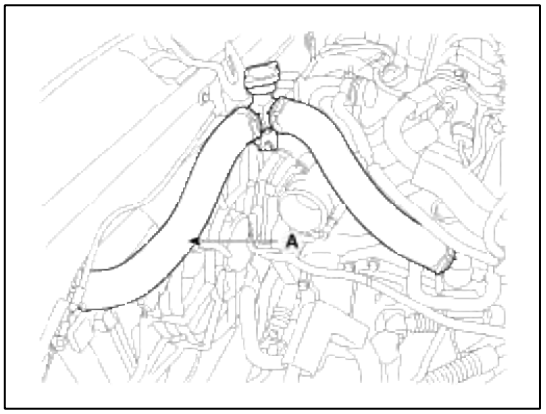


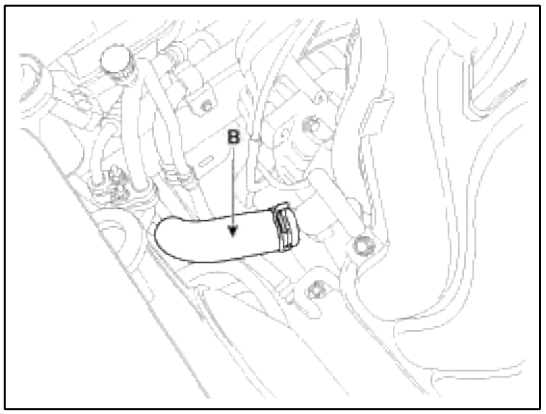
6. Remove the under cover (A).

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



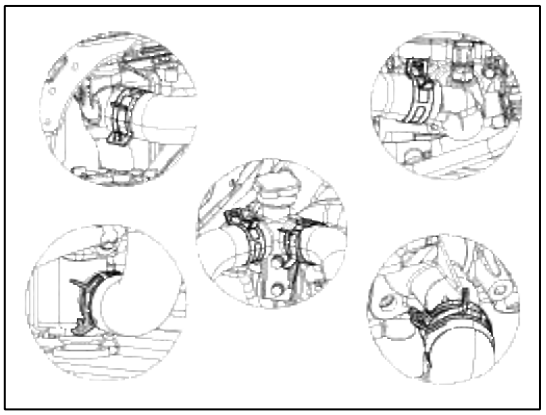
7. Loosen the drain plug, and drain the engine coolant. Remove the radiator cap to drain with speed. (Refer to Cooling system in this group)
8. Disconnect the radiator upper hose (A) and lower hose (B).



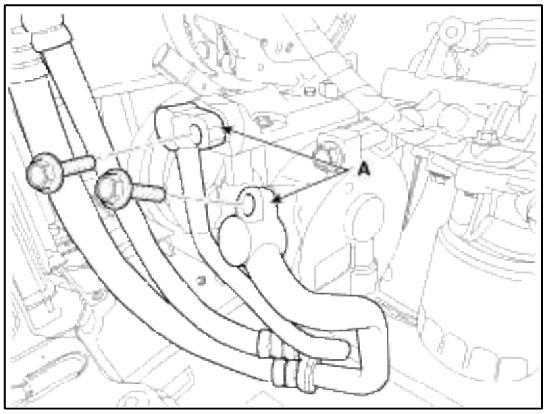


NOTE

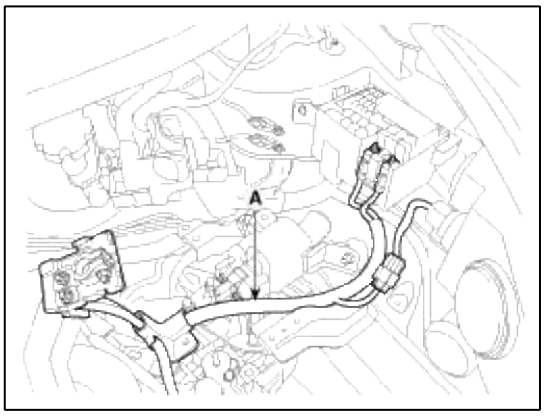
Install the radiator hoses as shown illustrations.



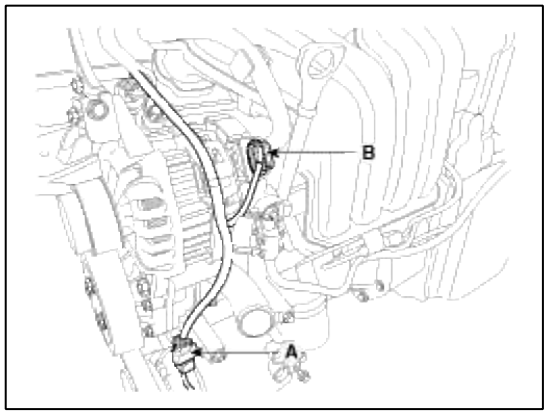
9. Recover the refrigerant and then remove the high pressure pipe and low pressure pipe (A). (Refer to Air conditioning system in HA Group.)



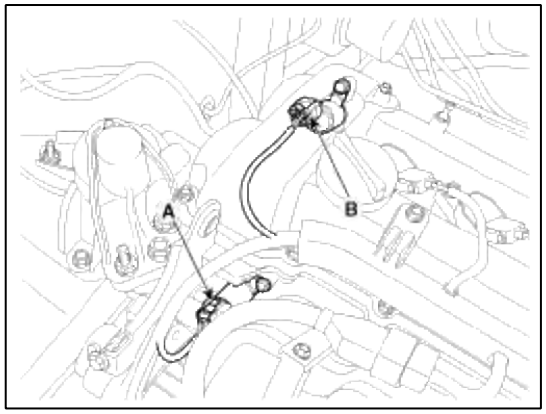
10. Disconnect the (+) cable (A) from the fuse/relay box.



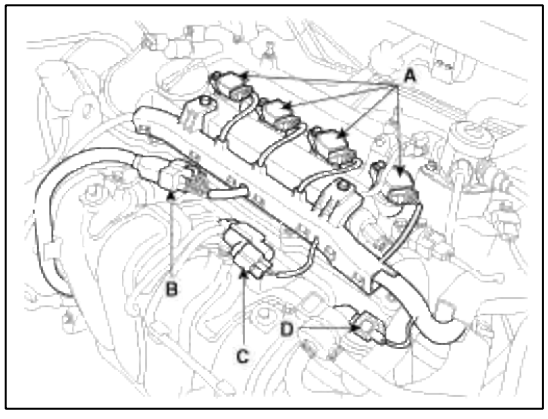
11. Disconnect the wiring connectors and harness clamps, and remove the wiring and protectors from the cylinder head and intake manifold.
    (1) The A/C compressor switch connector (A) and the alternator connector (B)



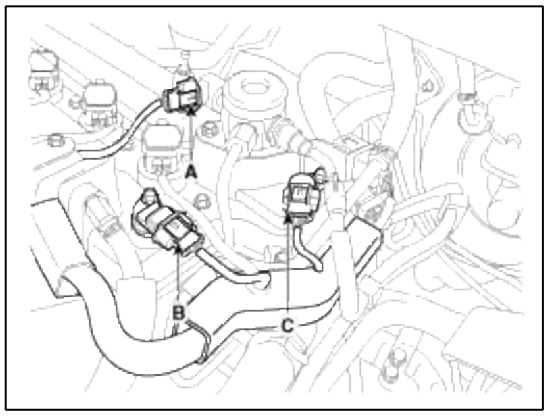
    (2) The intake OCV (Oil control valve) connector (A) and the exhaust OCV (Oil control valve) connector (B)



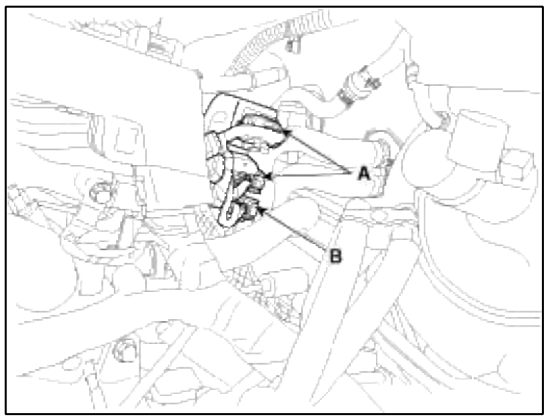
    (3) The ignition coil connectors (A), the injector extension connector (B), the VIS (Variable intake system) connector (C) and the PCSV (Purge control solenoid valve) connector (D)



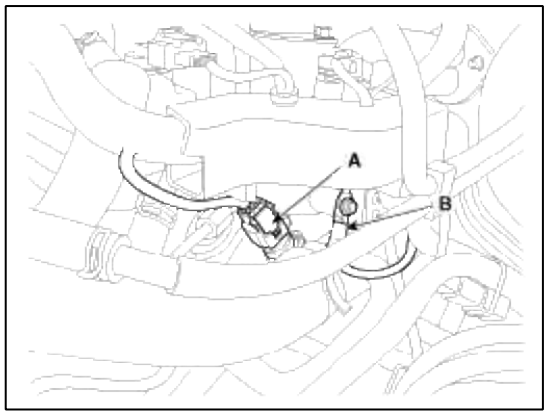
(4) The FPCV (Fuel pressure control valve) connector (A), the intake CMPS (Camshaft position sensor) connector (B) and the exhaust CMPS (Camshaft position sensor) connector (C)



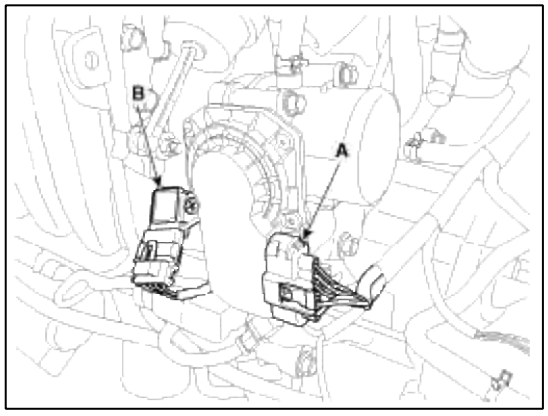
(5) The oxygen sensor connectors (A) and the condenser connector (B)



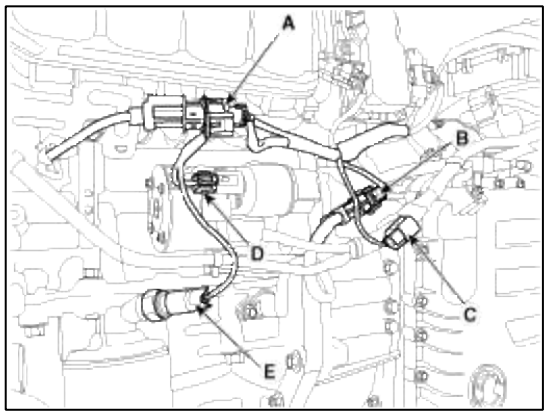
(6) The ECTS (Engine coolant temperature sensor) connector (A) and the ground line (B)



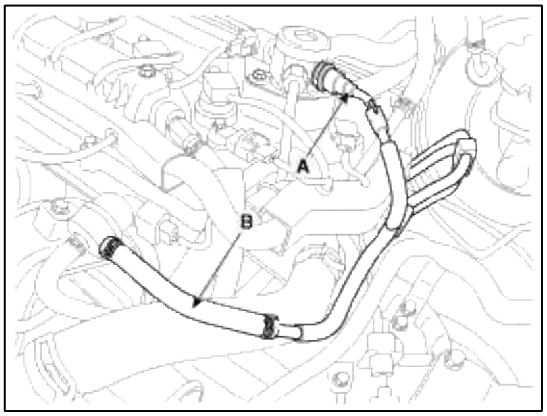
(7) The ETC (Electronic throttle control) connector (A) and the MAPS (Manifold absolute pressure sensor) & IATS (Intake air temperature sensor) connector (B)



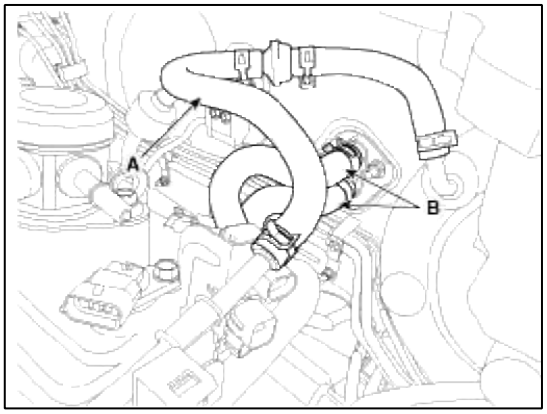
(8) The knock sensor connector (A), the CKPS (Crankshaft position sensor) connector (B), the front connector (C), the starter connector (D) and the oil pressure connector (E)



12. Remove the transaxle wire harness connectors and control cable from the transaxle. (Refer to AT or MT group).
13. Disconnect the fuel hose (A) and the PCSV (Purge control solenoid valve) hose (B).

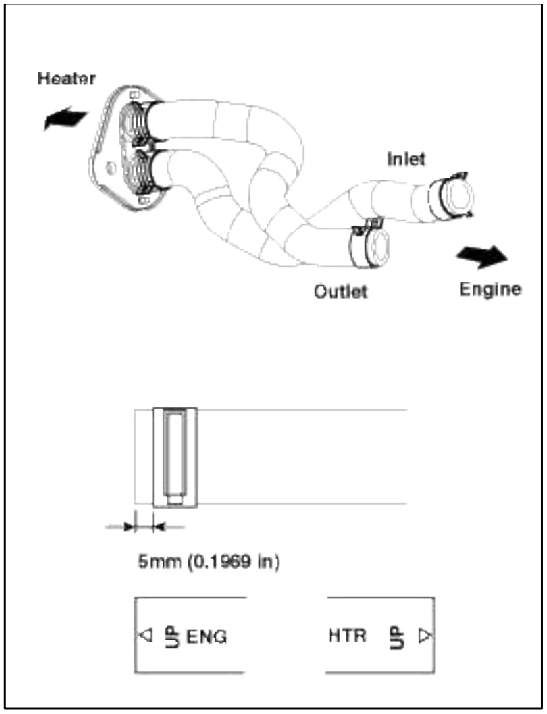


14. Disconnect the brake booster vacuum hose (A) and the heater hose (B).

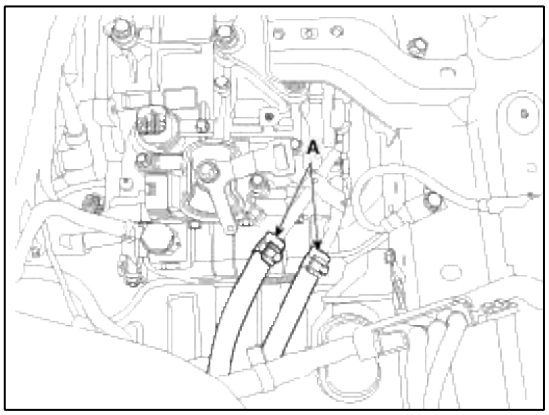


NOTE

Install the heater hoses as shown illustrations.

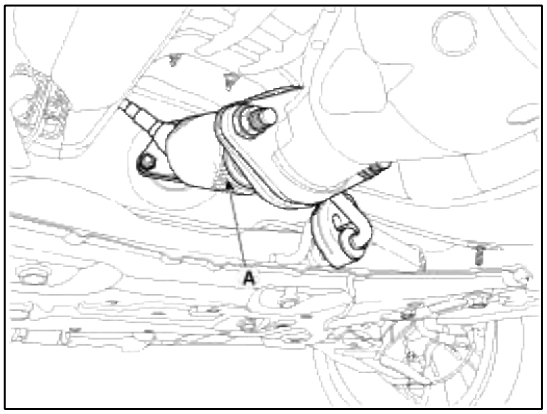


15. Disconnect the ATF cooler hoses (A). (Refer to AT group)

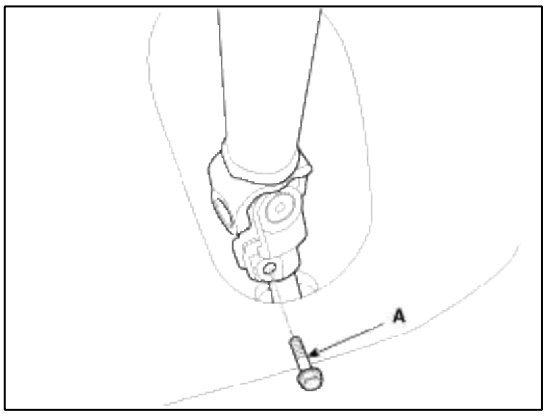


16. Remove the front muffler (A) after removing the rear oxygen sensor connector from the bracket.

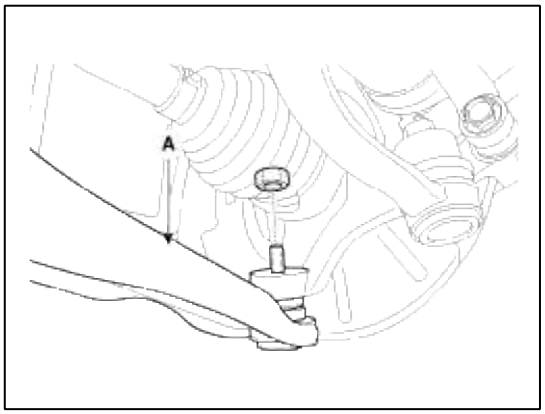
Tightening torque:
39.2 ~ 58.8 N.m (4.0 ~ 6.0 kgf.m, 28.9 ~ 43.4 lb-ft)



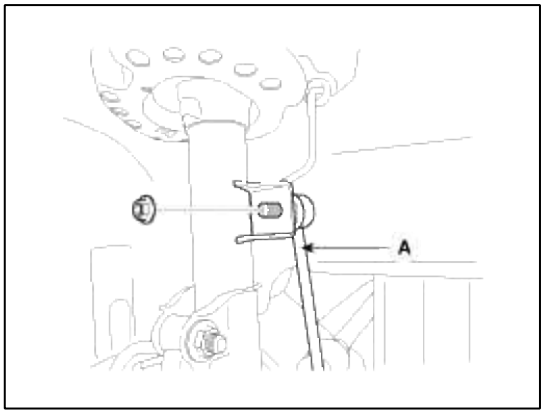
17. Remove the steering u-joint mounting bolt (A). (Refer to ST group)



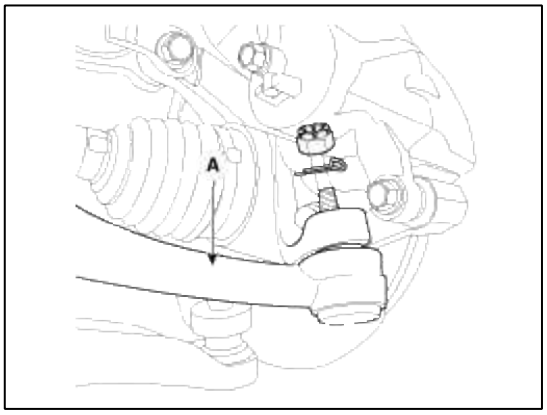
18. Remove the front wheels. (Refer to SS group)
19. Remove the lower arms (A). (Refer to SS group)



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



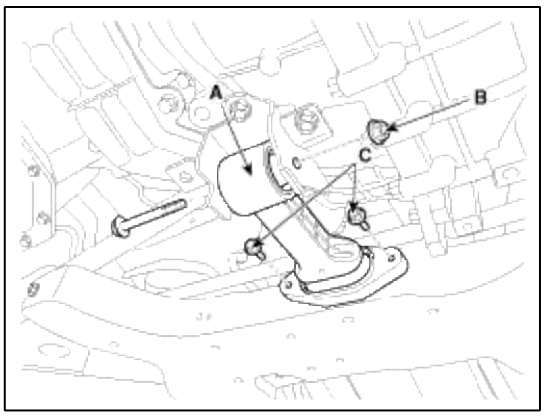
21. Remove the tie rod ends (A). (Refer to ST group)



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

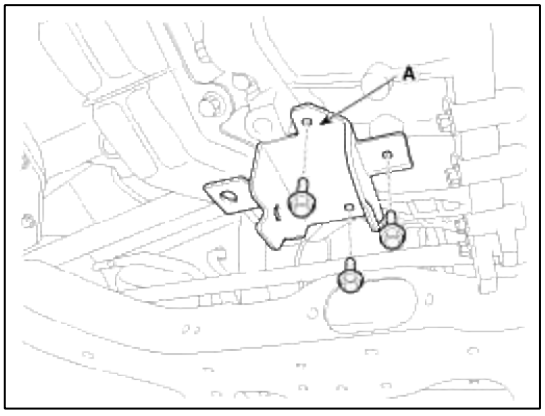
23. Remove the roll rod bracket (A).

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



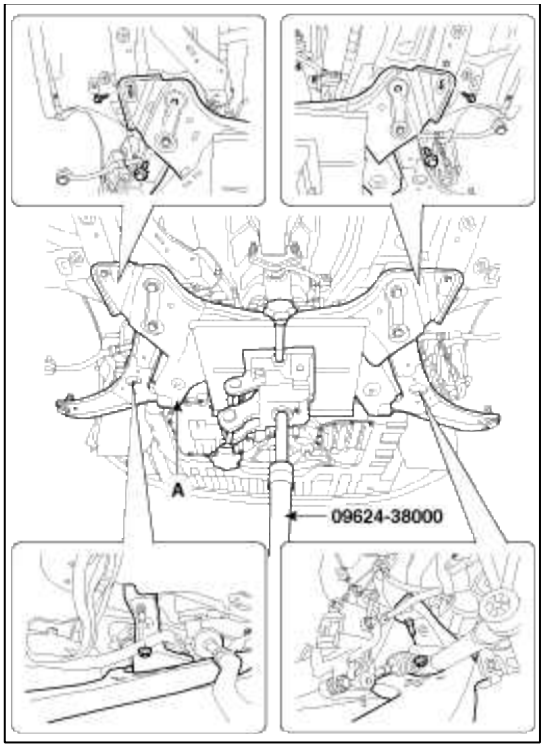
24. Remove the roll rod mounting support bracket (A).

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



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

Tightening torque
Sub frame mounting bolts & nuts :
156.9 ~ 176.5 N.m (16.0 ~ 18.0 kgf.m, 115.7 ~ 130.2 lb-ft)
Sub frame stay mounting bolts :
44.1 ~ 53.9 N.m (4.5 ~ 5.5 kgf.m, 32.5 ~ 39.8 lb-ft)

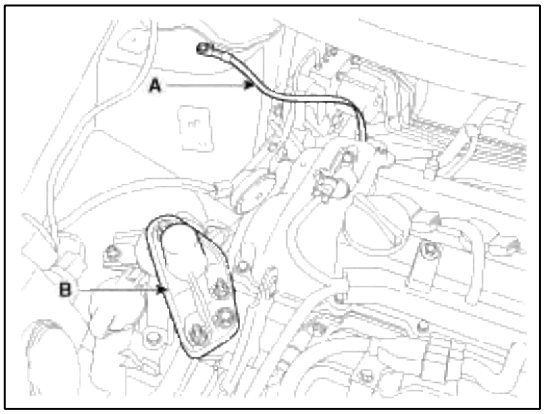


NOTE

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

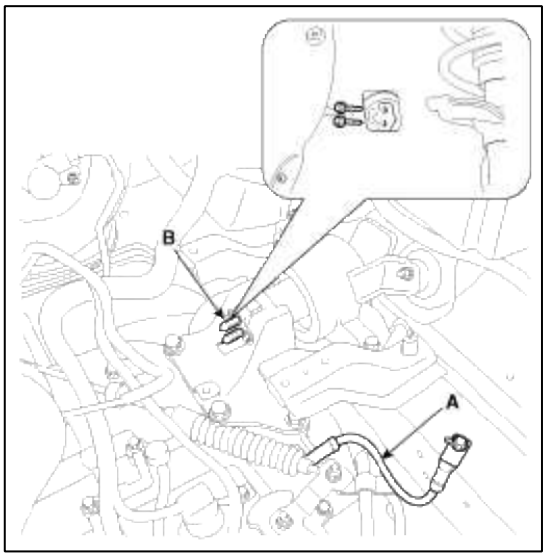
26. Disconnect the ground line (A) and then remove the engine mounting support bracket (B).

Tightening torque
Ground line bolt :
10.8 ~ 13.7 N.m (1.1 ~ 1.4 kgf.m, 8.0 ~ 10.1 lb-ft)
Nut (C) :
63.7 ~ 83.4 N.m (6.5 ~ 8.5 kgf.m, 47.0 ~ 61.5 lb-ft)
Bolt (D) and nuts (E) :
49.0 ~ 63.7 N.m (5.0 ~ 6.5 kgf.m, 36.2 ~ 47.0 lb-ft)

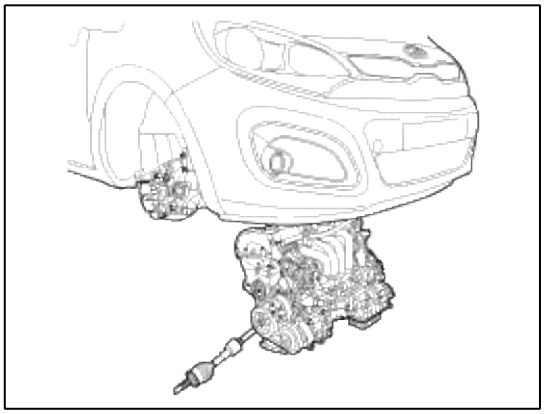


27. Disconnect the ground line (A), and then remove the transaxle mounting bracket bolts (B).

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



28. Remove the engine and transaxle assembly (A) by lifting vehicle.



CAUTION

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

Installation

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

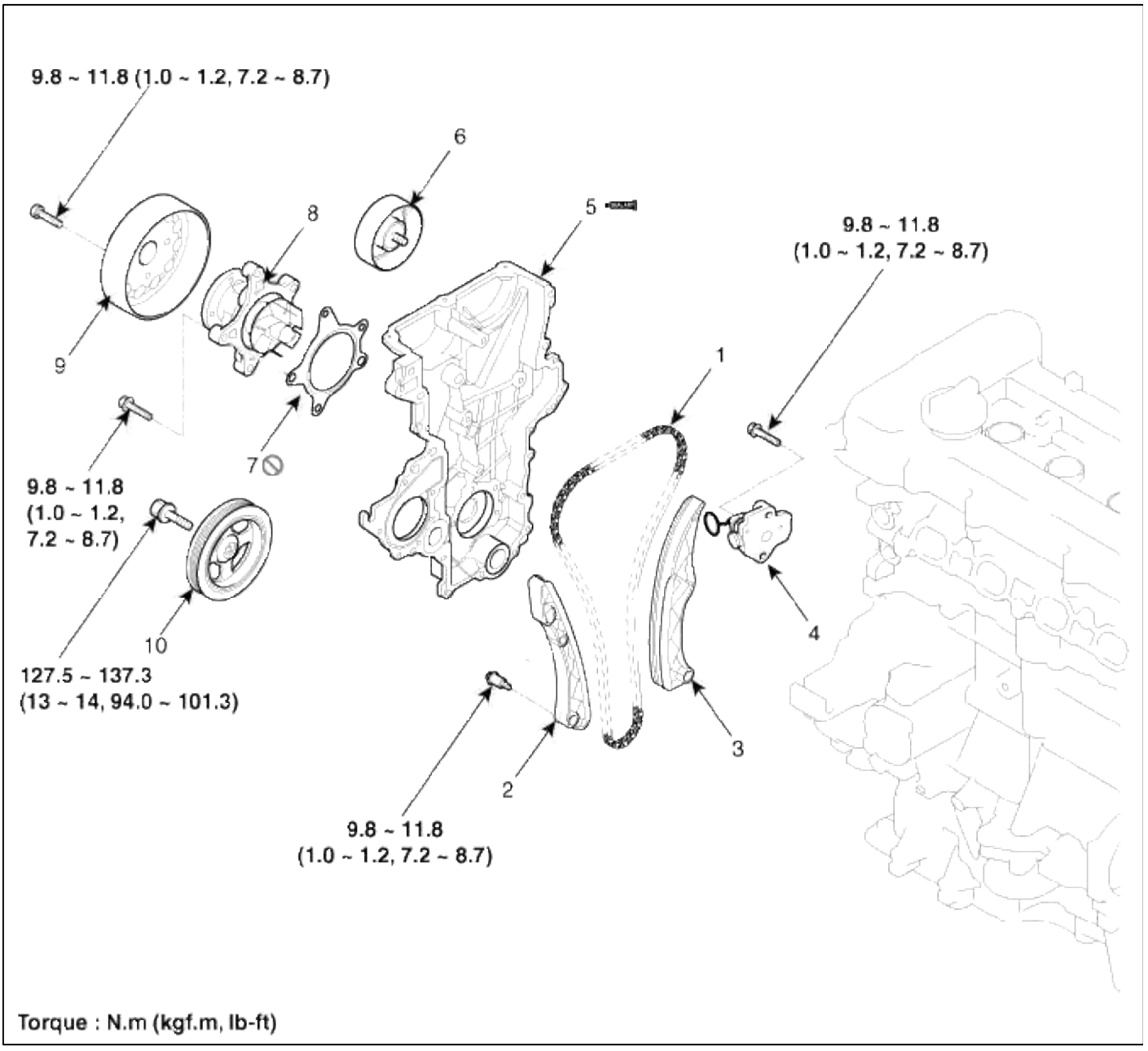
- Adjust a shift cable.
- Refill engine with engine oil.
- Refill a transaxle with fluid.
- Refill power steering fluid.
- Refill a radiator and a reservoir tank with engine coolant.
- Clean battery posts and cable terminals and assemble.
- Inspect for fuel leakage.

- After assemble the fuel line, turn on the ignition switch (do not operate the starter) so that the fuel pump runs for approximately two seconds and fuel line pressurizes.
- Repeat this operation two or three times, then check for fuel leakage at any point in the fuel line.

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

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

Components



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

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

Removal

Engine removal is not required for this procedure.

CAUTION

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

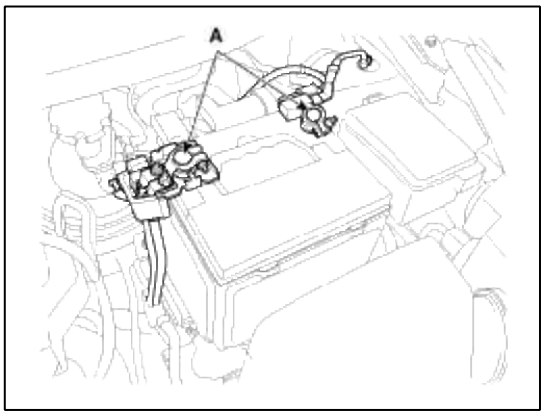
NOTE

Mark all wiring and hoses to avoid misconnection.

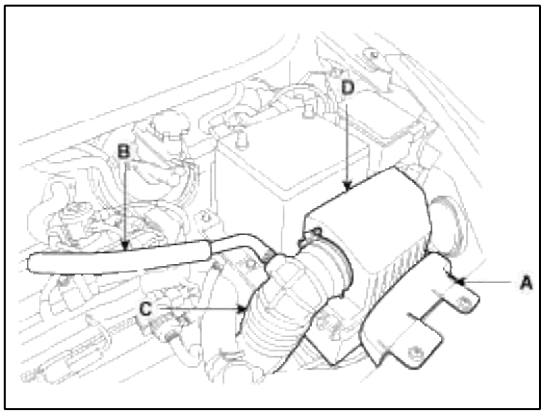
WARNING

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

1. Remove the engine cover.
2. Disconnect the battery negative terminal (A).

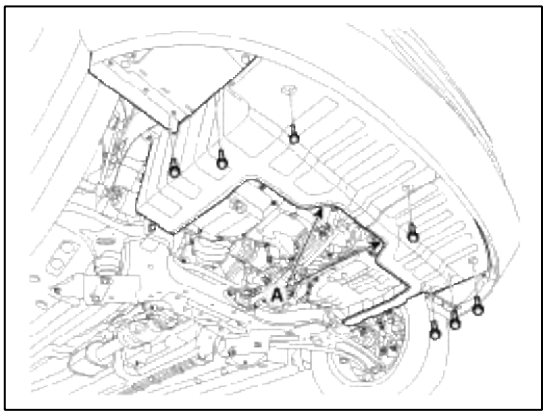


3. Remove the air cleaner assembly.
   (1) Remove the air duct (A).
   (2) Disconnect the breather hose (B).
   (3) Disconnect the air intake hose (C) and then remove the air cleaner assembly (D).

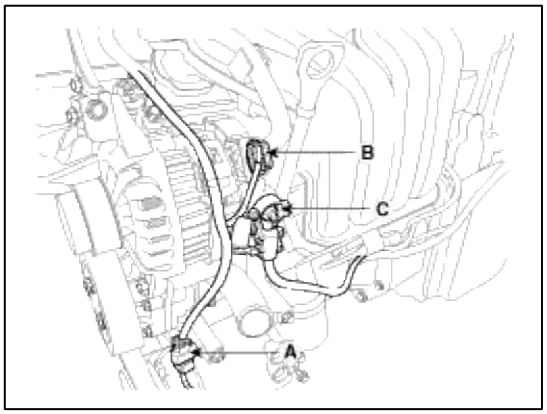


4. Remove the RH front wheel.

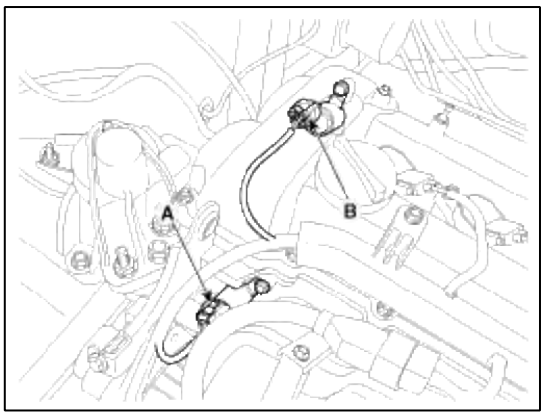
5. Remove the under covers (A).



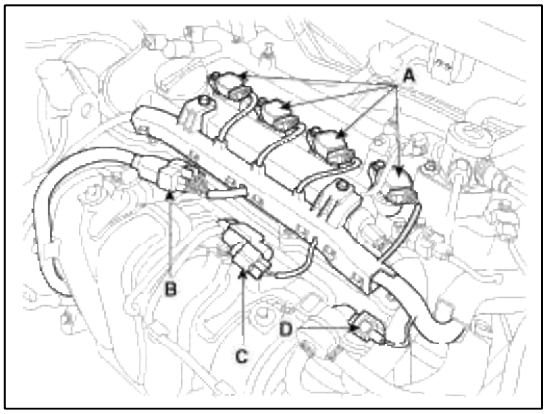
6. Disconnect the A/C compressor switch connector (A), the alternator connector (B) and the cable from the alternator “B” terminal (C).



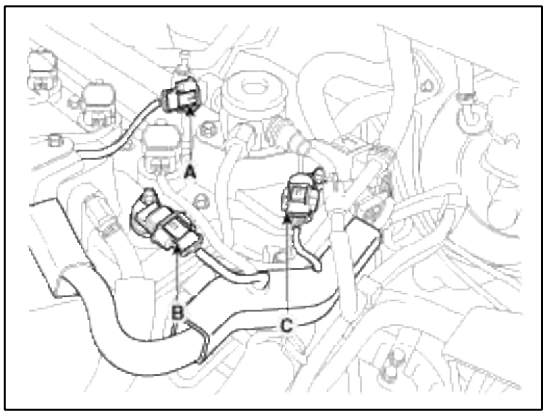
7. Disconnect the intake OCV (Oil control valve) connector (A) and the exhaust OCV (Oil control valve) connector (B).



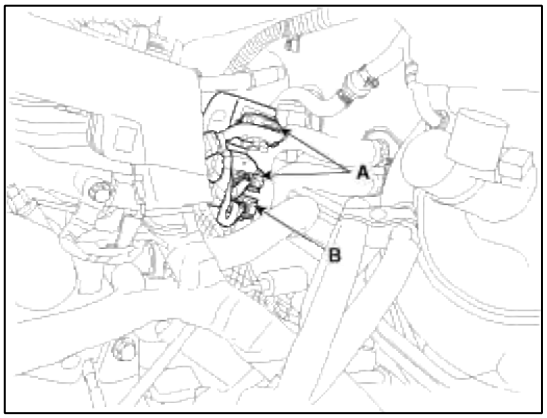
8. Disconnect the ignition coil connectors (A), the injector extension connector (B), the VIS (Variable intake system) connector (C) and the PCSV (Purge control solenoid valve) connector (D).



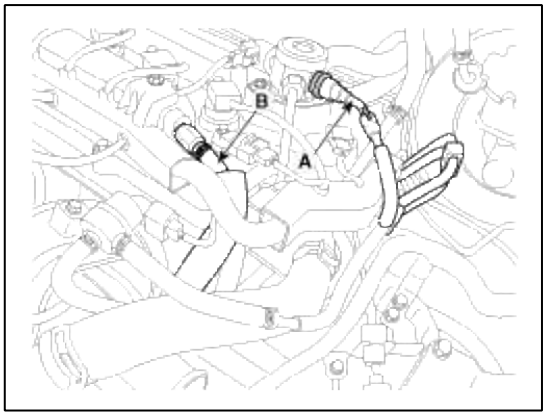
9. Disconnect the FPCV (Fuel pressure control valve) connector (A), the intake CMPS (Camshaft position sensor) connector (B) and the exhaust CMPS (Camshaft position sensor) connector (C).



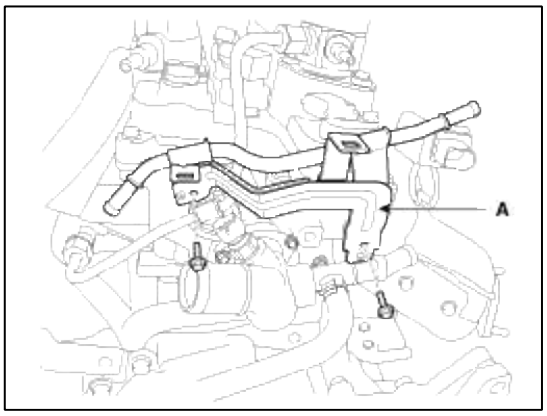
10. Disconnect the oxygen sensor connectors (A) and the condenser connector (B).



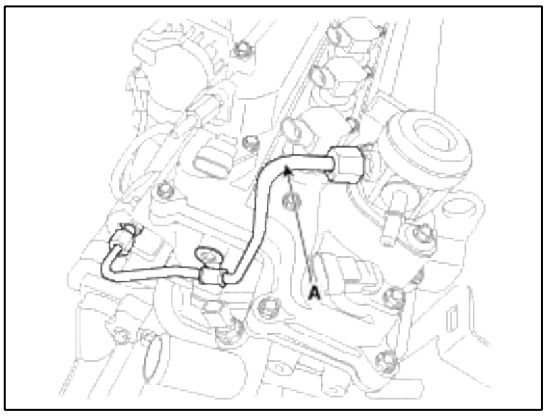
11. Disconnect the fuel hose (A) and the PCV (Positive crankcase ventilation) hose (B).



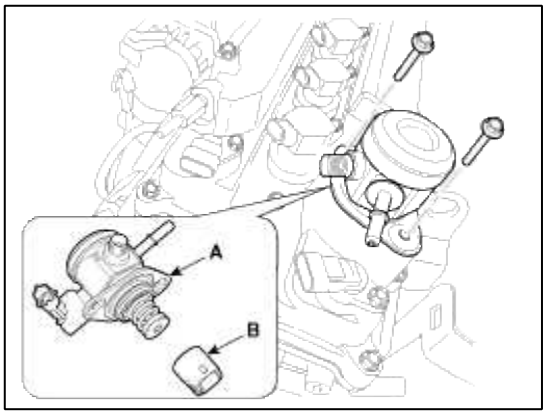
12. Remove the vacuum pipe assembly (A).



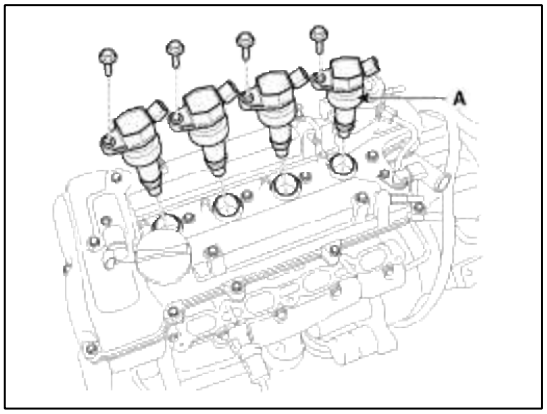
13. Remove the high pressure pipe (A). (Refer to FL group)



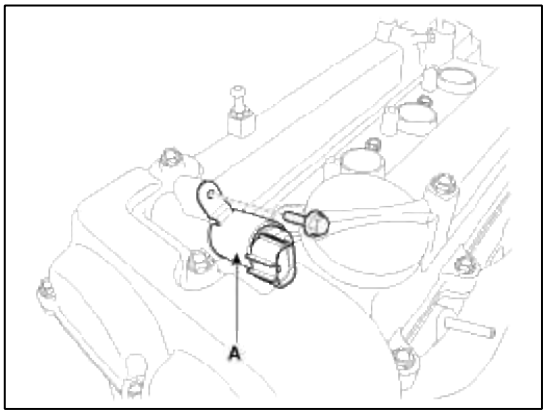
14. Remove the high pressure fuel pump (A) and the roller tappet (B). (Refer to FL group)



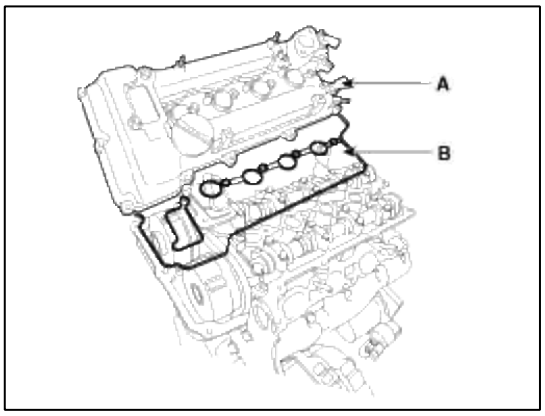
15. Remove the ignition coils (A).



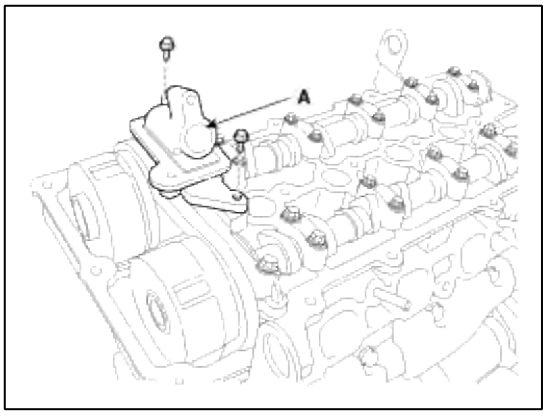
16. Remove the exhaust OCV (Oil control valve) (B).



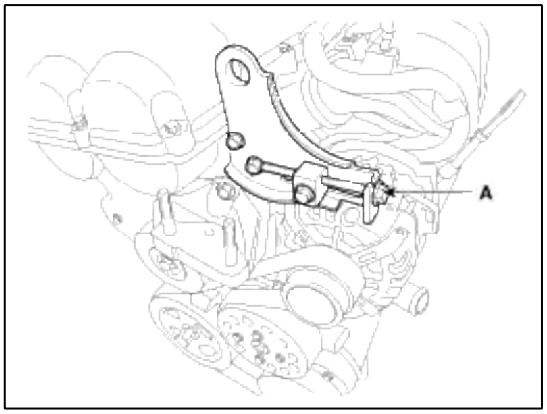
17. Remove the cylinder head cover (A) with gaskets (B).



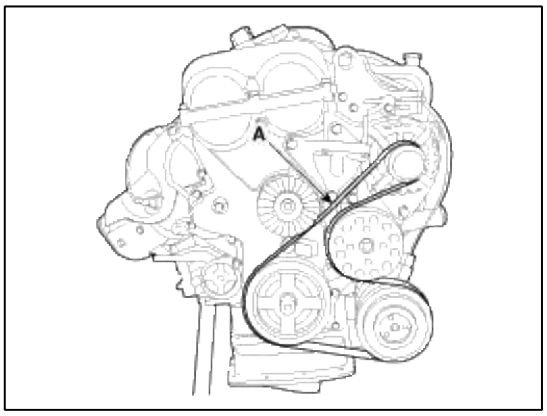
18. Remove the exhaust OCV (Oil control valve) adapter (A).



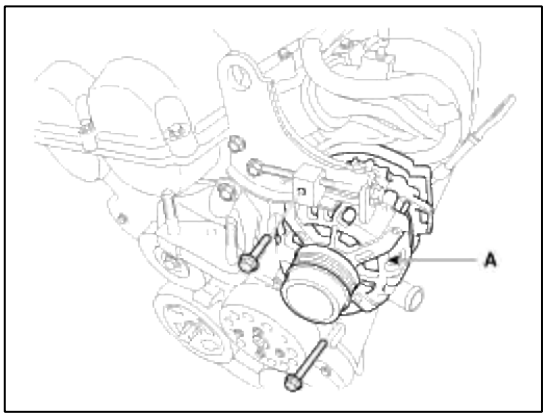
19. Loosen the water pump pulley bolt and the drive idler mounting bolt.
20. Loosen the alternator tension adjusting bolt (A) to loosen tension.



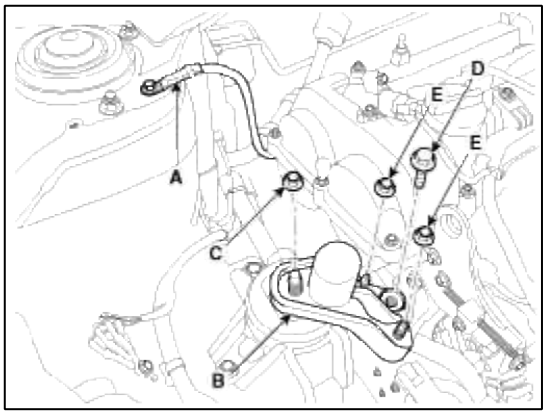
21. Remove the alternator drive belt (A).



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



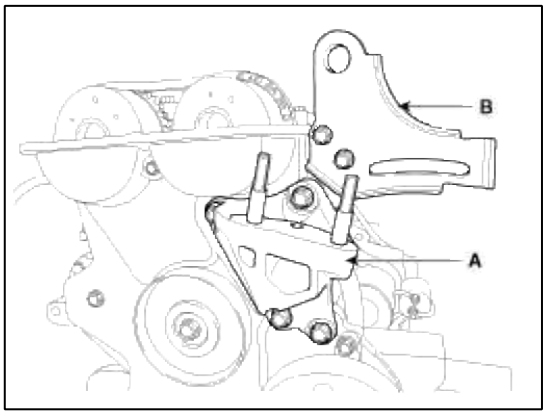
23. Disconnect the ground line (A) and then remove the engine mounting support bracket (A).



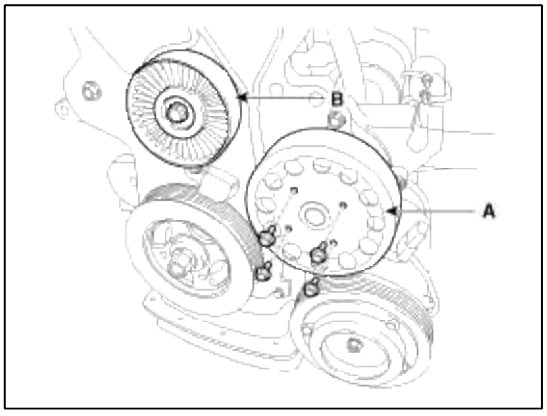
NOTE

Support the engine with a jack not to be tilted.

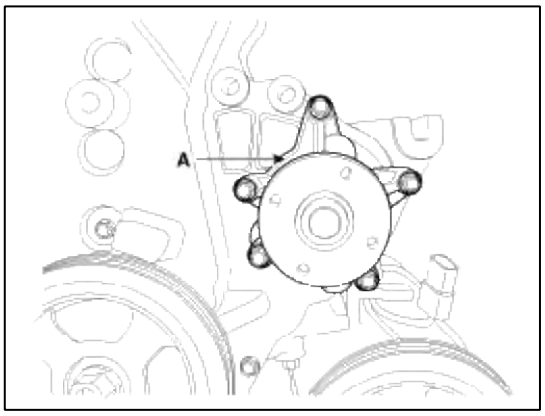
24. Remove the alternator bracket (B).
25. Remove the engine support bracket (A).



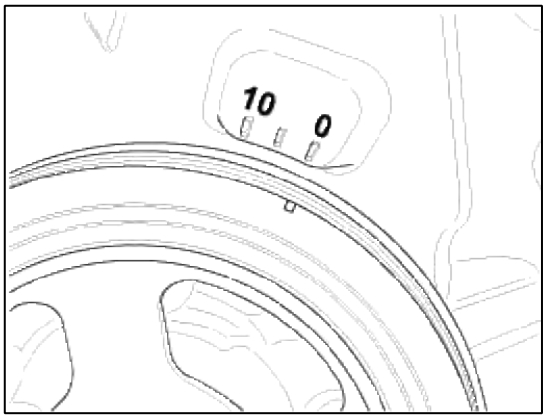
26. Remove the water pump pulley (A) and the drive belt idler (B).



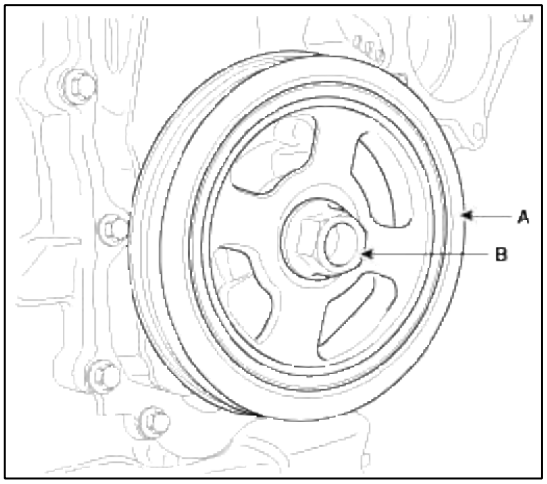
27. Remove the water pump (A).



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



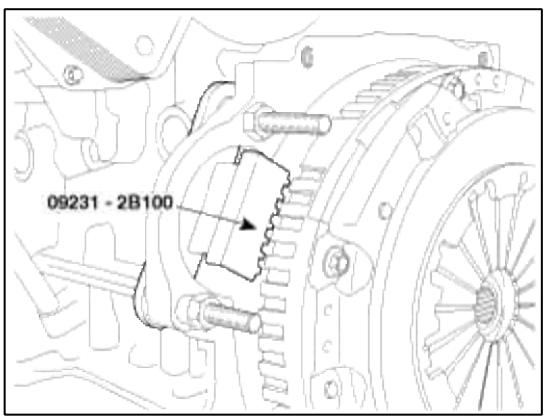
29. Remove the crankshaft bolt (B) and crankshaft pulley (A).



NOTE

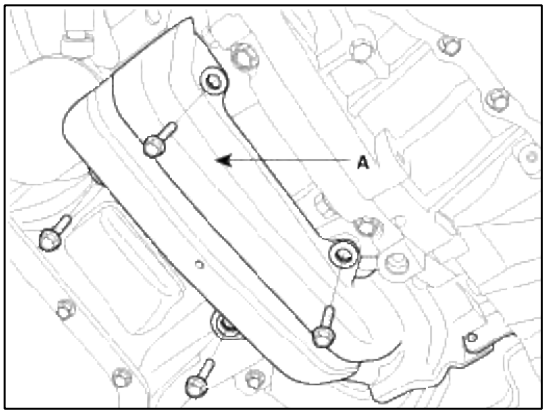
There are two methods to hold the ring gear when installing or removing the crankshaft damper pulley.

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

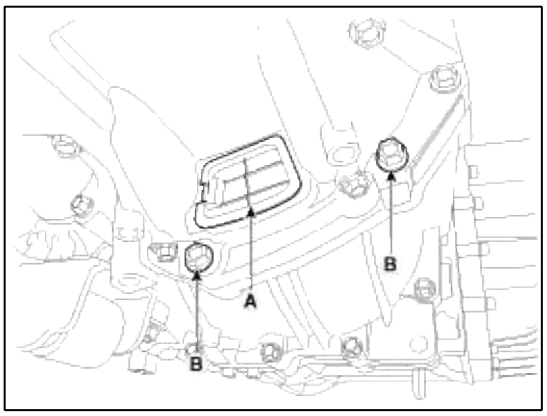


• Install the SST (09231-3D100) to hold the ring gear after removing the dust cover.

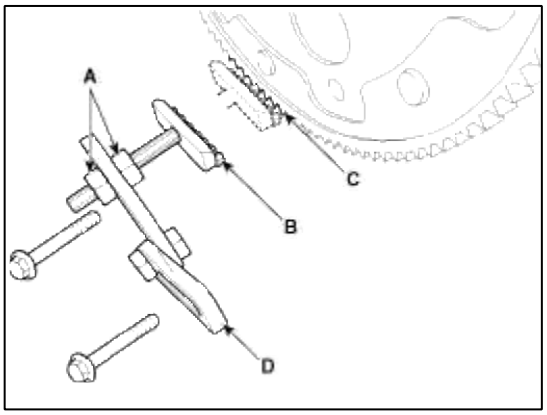
1. Remove the bracket (A).



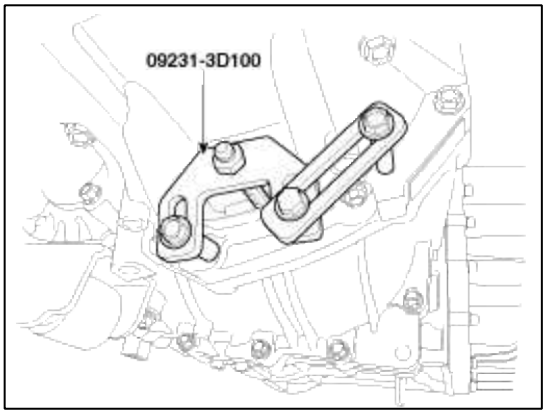
2. Remove the dust cover (A) and unfasten the transaxle mounting bolt (B).



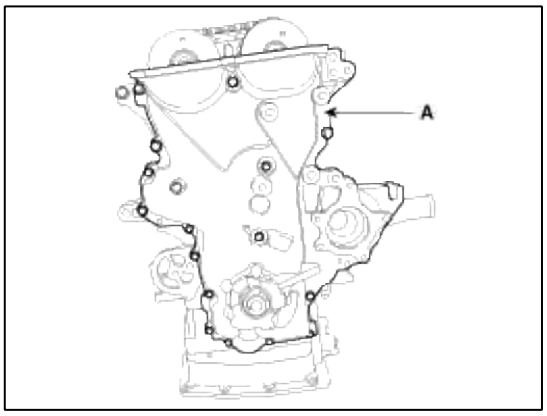
3. Adjust the length of the holder nuts (A) so that the front plate of the holder (B) puts in the ring gear (C) teeth.
4. Adjust the angle of the links (D), and fasten the bolt 70mm(2.7559in) in the original mounted hole.



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

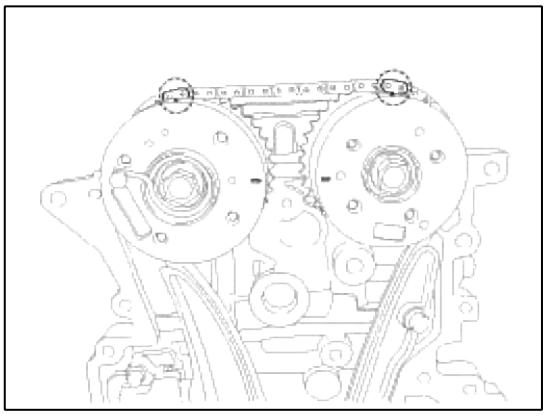


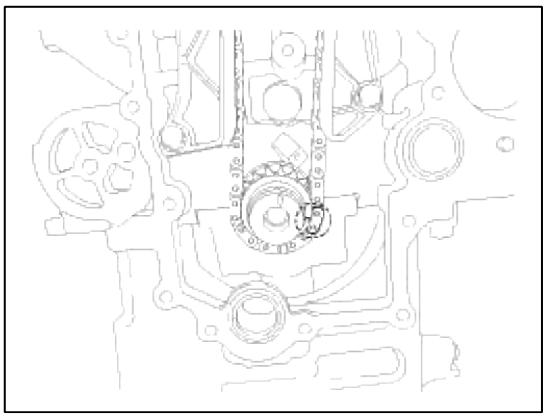
30. Remove the timing chain cover (A).



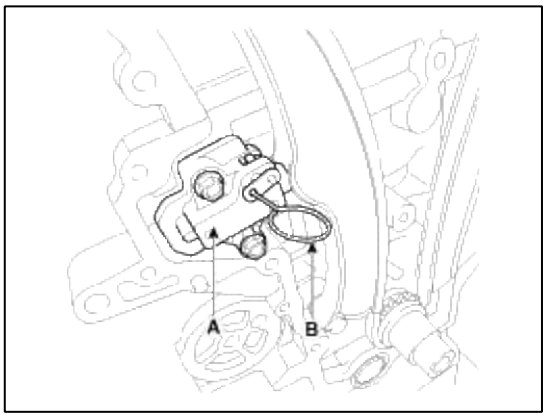
31. Align the timing marks of the CVVT sprockets with the upper surface of the cylinder head to make No.1 cylinder be positioned at TDC.
    (1) Check the dowel pin of the crankshaft for facing upside of the engine at this monent.

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





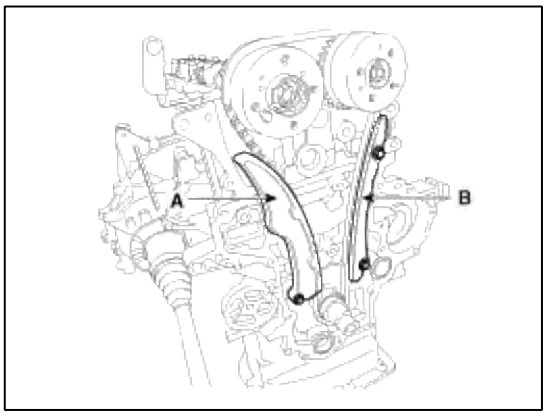
32. Remove the hydraulic tensioner (A).



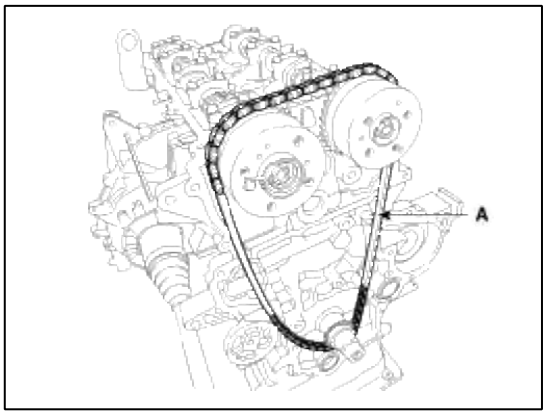
CAUTION

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

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



34. Remove the timing chain (A).



Inspection

Sprockets, Hydraulic Tensioner, Chain Guide, Tensioner Arm

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

Belt, Idler, Pulley

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

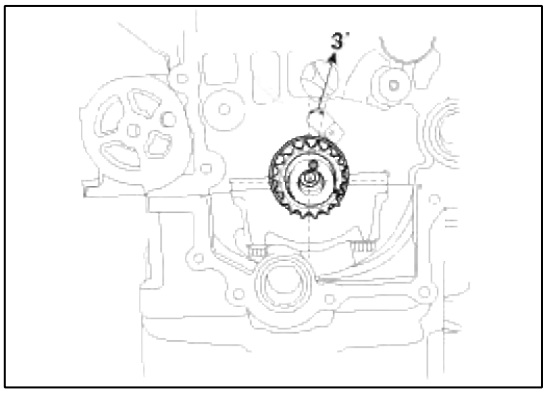
3. Check the pulleys for vibration in rotation, oil or dust deposit of V-ribbed part. Replace if necessary.

NOTE

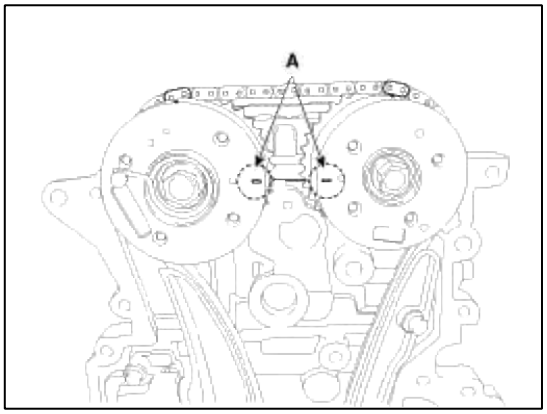
- Do not bend, twist or turn the timing chain inside out.
- Do not allow the timing chain to come into contact with oil, water and steam.

Installation

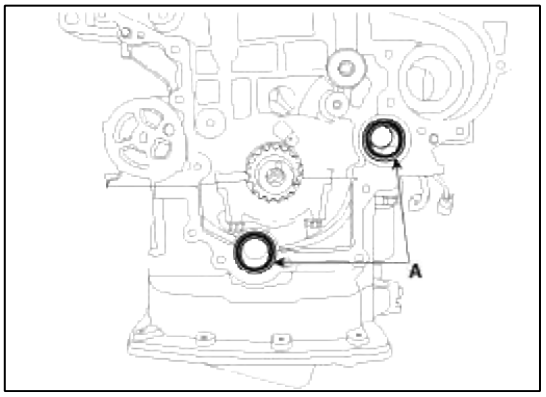
1. Dowel pin of crankshaft setted about 3° with vertical center line.



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

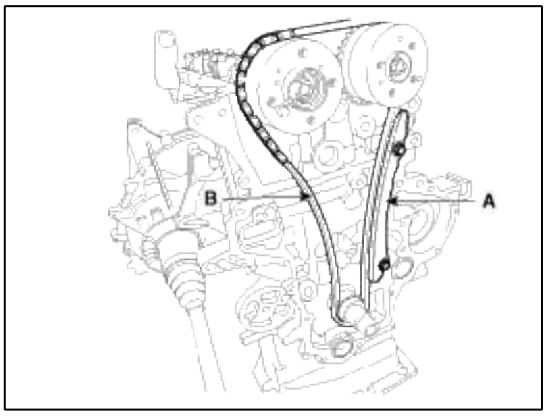


3. Install the new O-rings (A).



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

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

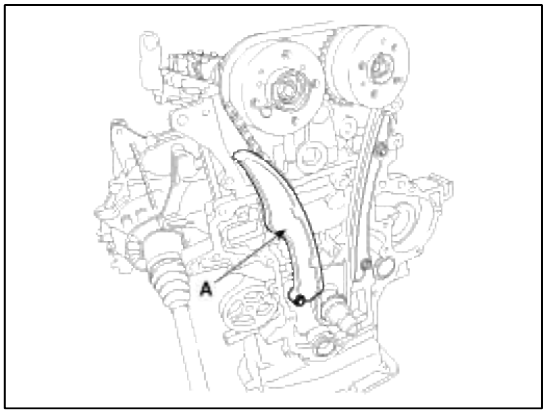


NOTE

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

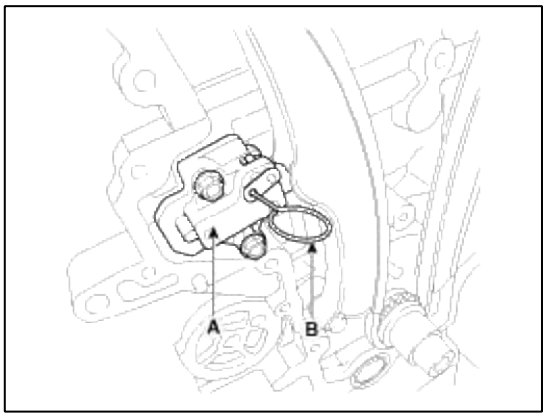
5. Install the chain tensioner arm (A).

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



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

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



NOTE

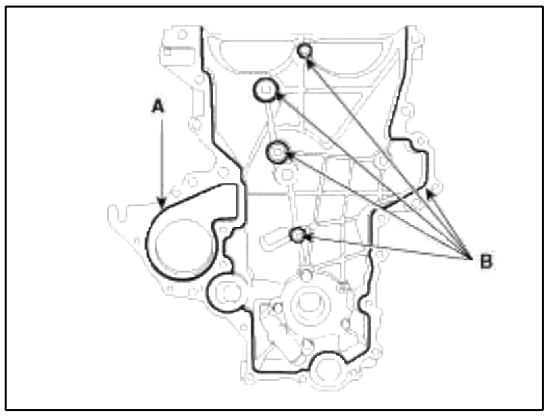
Recheck the top dead center (TDC) marks on the crankshaft and camshaft.

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

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

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

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



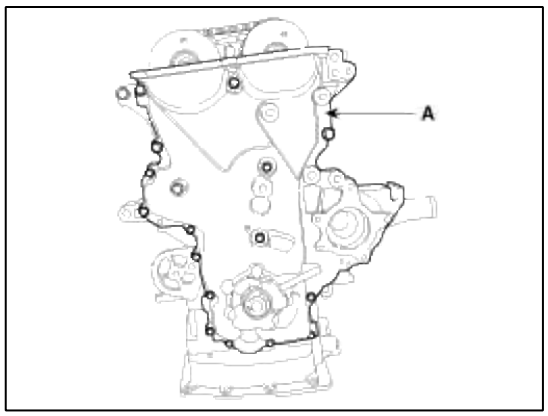
CAUTION

Remove oil or dust on the surface surely.

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

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

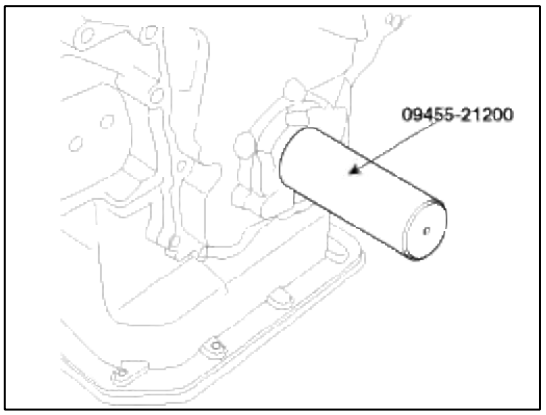
Tightening torque :
M8 bolts :
18.6 ~ 23.5 N.m (1.9 ~ 2.4 kgf.m, 13.7 ~ 17.4 lb-ft)
M6 bolts :
9.8 ~ 11.8 Nm (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)



CAUTION

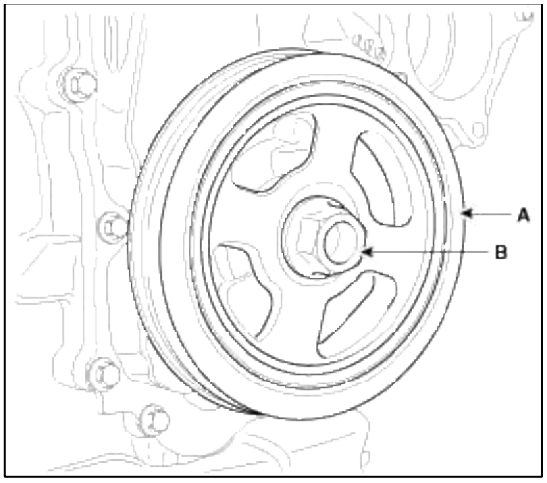
After the installation, do not crank engine or apply pressure on the cover for half an hour.

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



9. Install the crankshaft pulley (A).

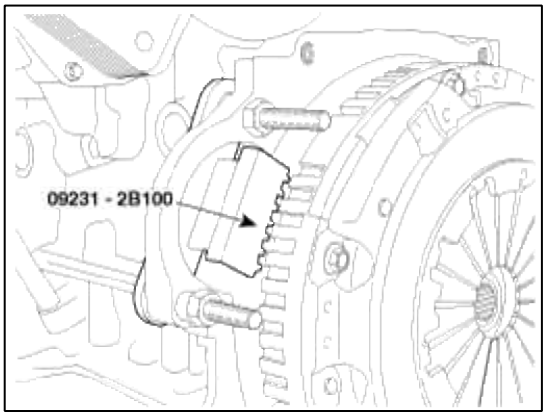
Tightening torque :
127.5 ~ 137.3 N.m (13.0 ~ 14.0 kgf.m, 94.0 ~ 101.3 lb-ft)



NOTE

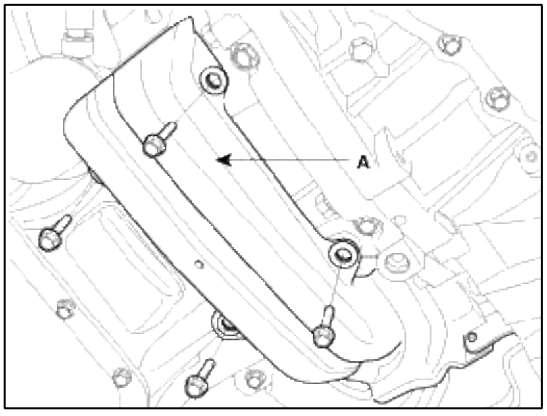
There are two methods to hold the ring gear when installing or removing the crankshaft damper pulley.

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

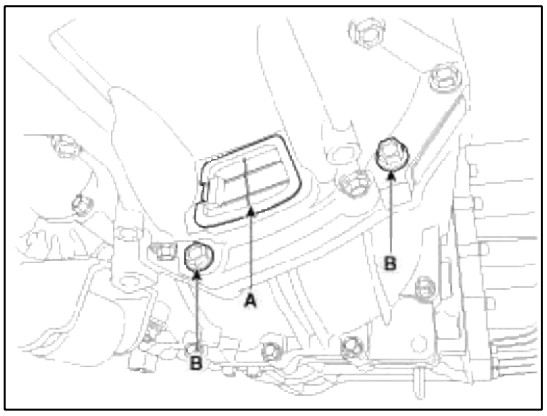


- Install the SST (09231-3D100) to hold the ring gear after removing the dust cover.

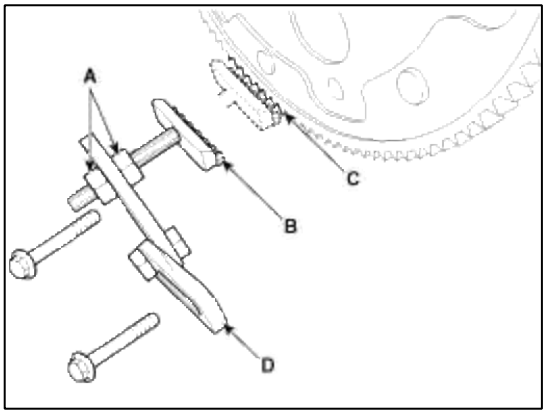
1. Remove the bracket (A).



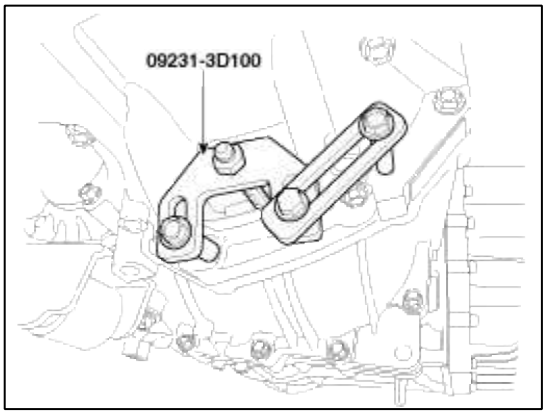
2. Remove the dust cover (A) and unfasten the transaxle mounting bolt (B).



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

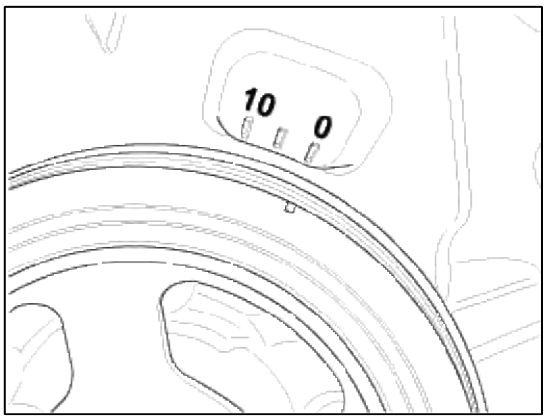


5. Tighten the bolts and nuts of the holder and links securely.



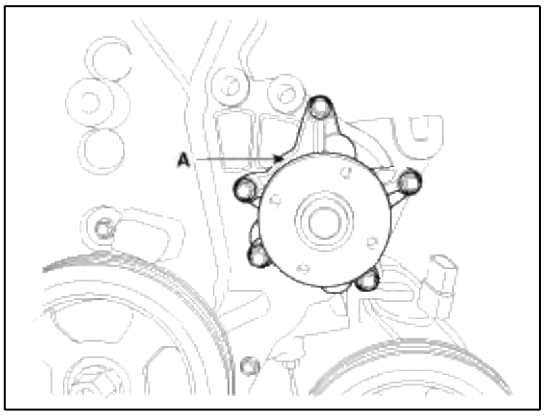
NOTE

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



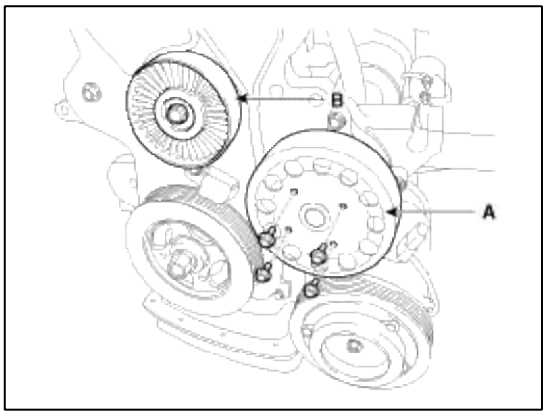
10. Install the water pump (A) with a gasket.

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



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

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



CAUTION

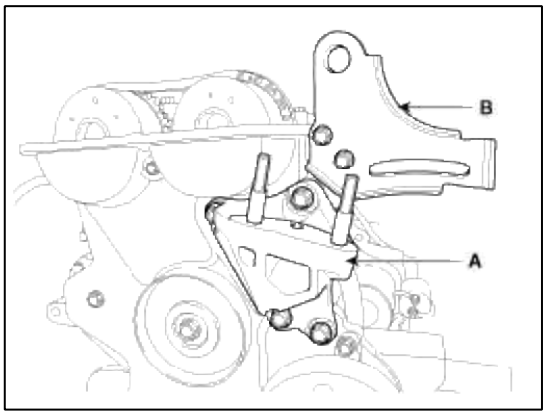
Tighten the bolts diagonally.

12. Install the engine support bracket (A).

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

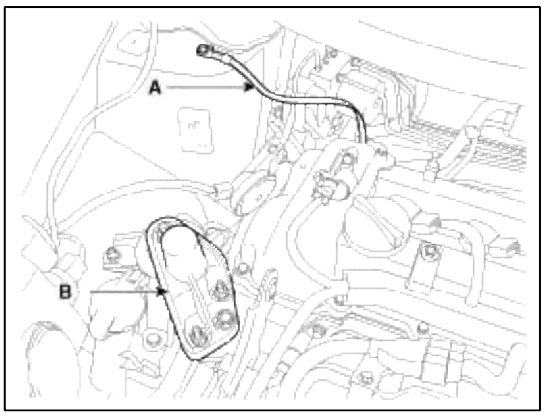
13. Install the alternator bracket (B).

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



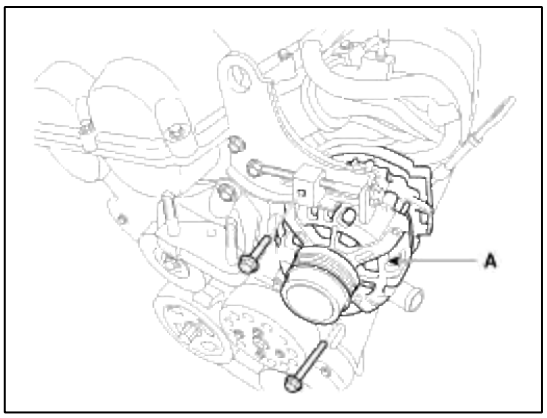
14. Install the engine mounting support bracket (B) and then connect the ground line (A).

Tightening torque
Ground line bolt :
10.8 ~ 13.7 N.m (1.1 ~ 1.4 kgf.m, 8.0 ~ 10.1 lb-ft)
Nut (C) :
63.7 ~ 83.4 N.m (6.5 ~ 8.5 kgf.m, 47.0 ~ 61.5 lb-ft)
Bolt (D) and nuts (E) :
49.0 ~ 63.7 N.m (5.0 ~ 6.5 kgf.m, 36.2 ~ 47.0 lb-ft)

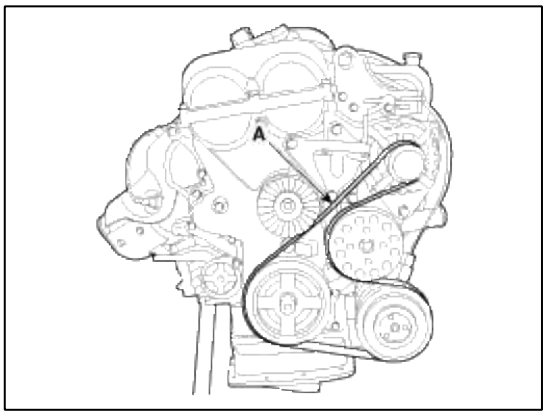


15. Install the alternator (A).

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

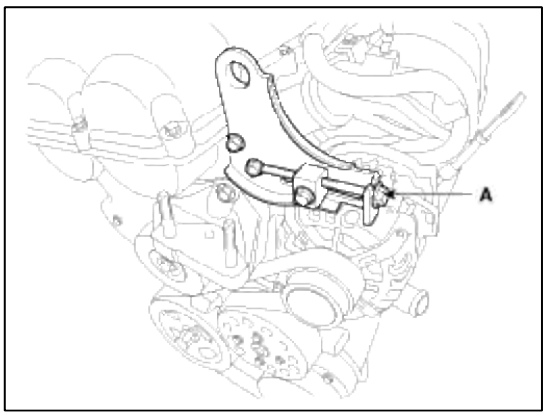


16. Install the drive belt (A).



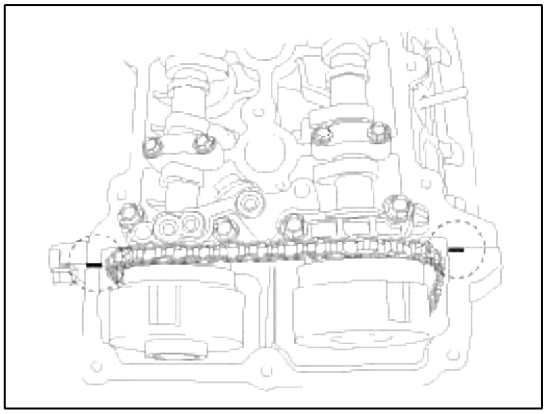
17. Adjust tension by tightening the alternator tension adjust bolt (A).(Refer to Charging system in EE Group).

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



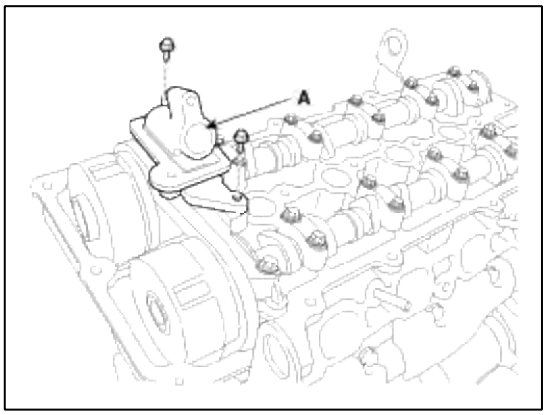
18. Before installing the cylinder head cover, remove oil, dust or hardened sealant from the timing chain cover and the cylinder head upper surface.
19. After applying the liquid gasket, THREE BOND 1217H or LOCTITE 5900H on the cylinder head cover, reassemble the cover within five minutes.

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



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

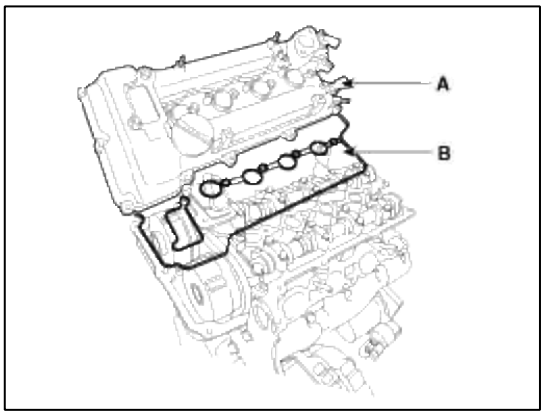
Tightening torque :
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)



CAUTION

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

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

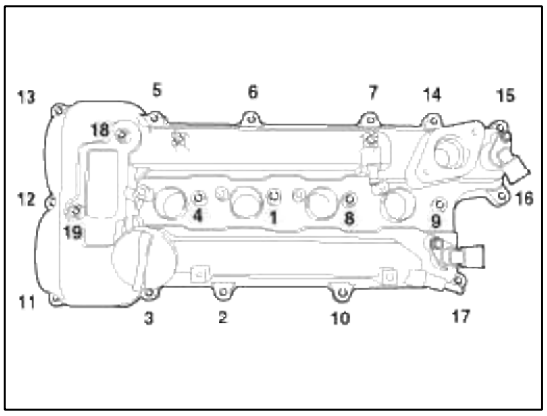


CAUTION

Do not reuse the disassembled gasket.

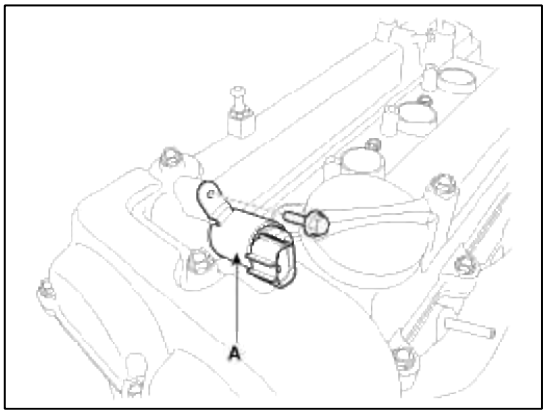
22. Tighten the cylinder head cover bolts with the order and steps.

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



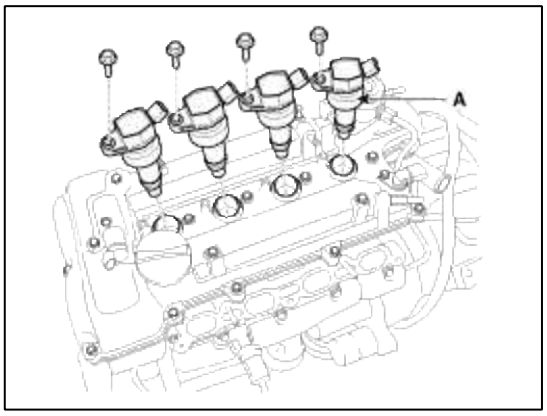
23. Install the exhaust OCV (Oil Control Valve) (A).

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



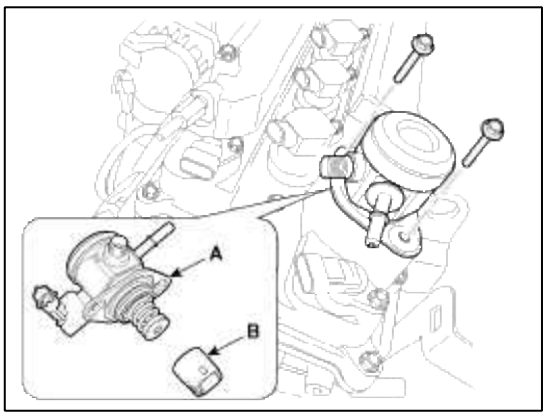
24. Install the ignition coils (A).

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



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

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



CAUTION

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

NOTE

Do not use already used bolt again.

NOTE

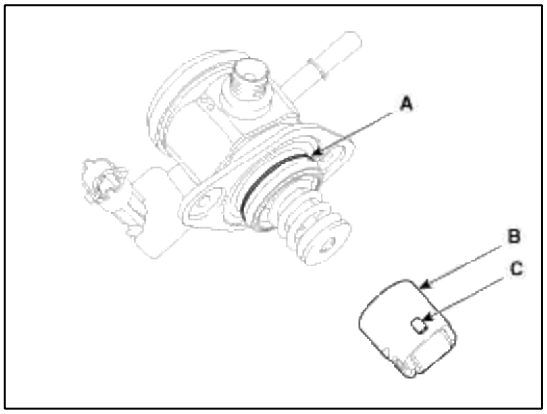
When tightening the installation bolts of the high pressure fuel pump, tighten in turn the bolts in small step (0.5 turns) after tightening them with hand-screwed torque.

CAUTION

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

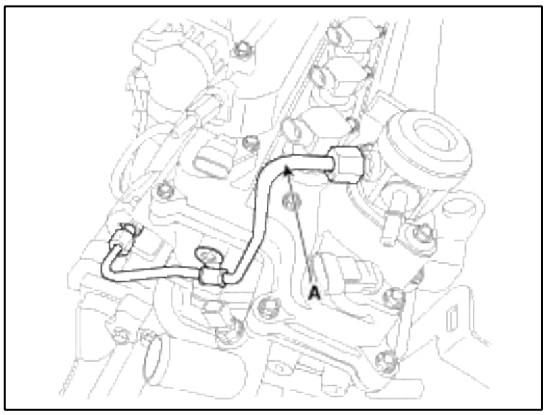
CAUTION

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



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

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

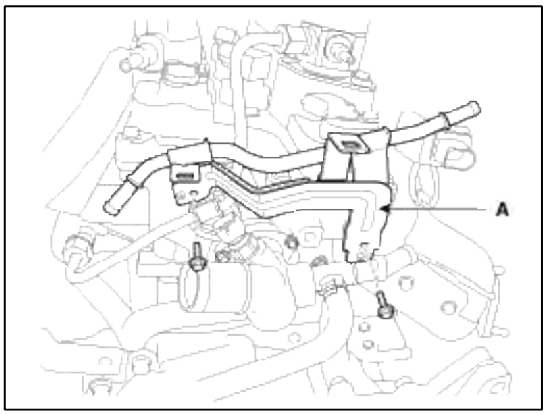


CAUTION

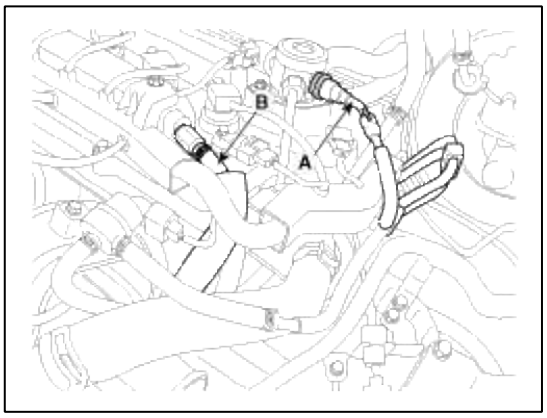
Do not reuse the high pressure pipe.

27. Install the vacuum pipe assembly (A).

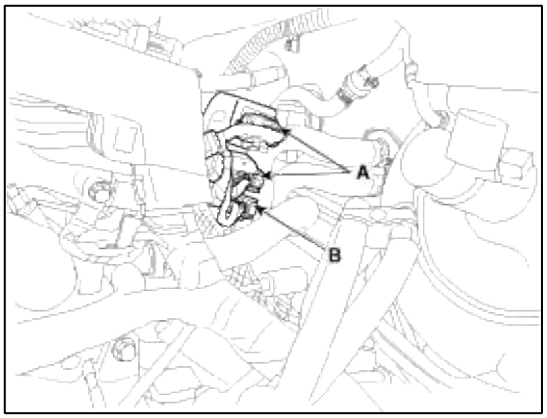
Tightening torque :
9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)



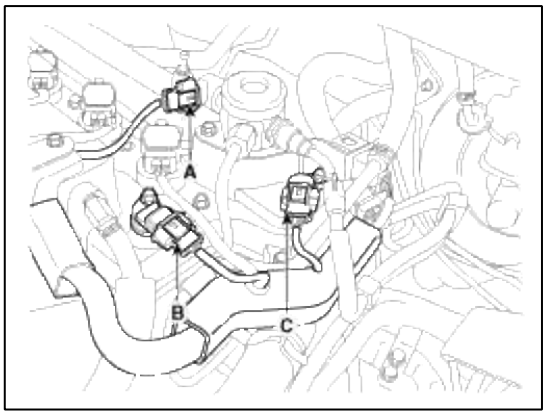
28. Connect the fuel hose (A) and the PCSV (Purge control solenoid valve) hose (B).



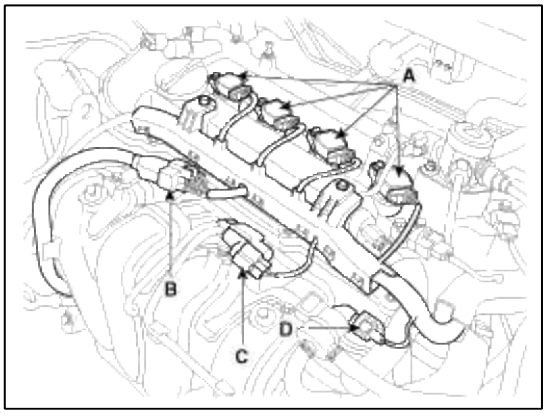
29. Connect the oxygen sensor connectors (A) and the condenser connector (B).



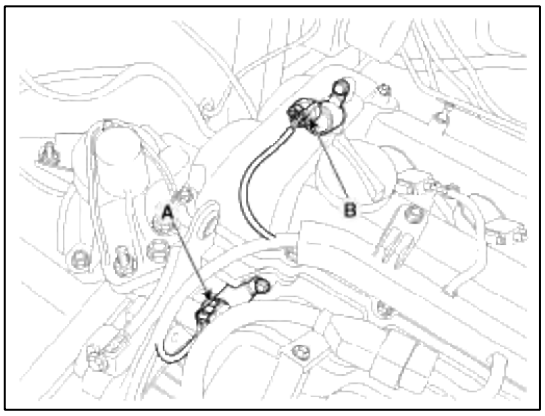
30. Connect the FPCV (Fuel pressure control valve) connector (A), the intake CMPS (Camshaft position sensor) connector (B) and the exhaust CMPS (Camshaft position sensor) connector (C).



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

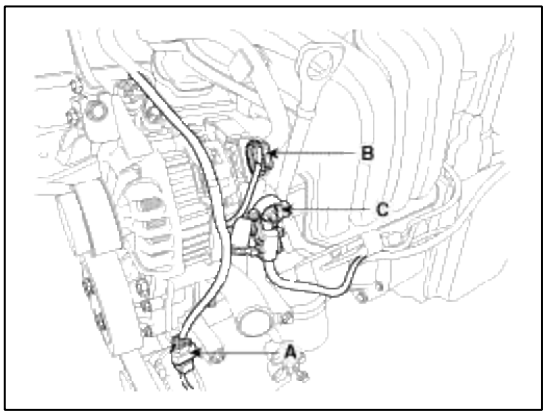


32. Connect the intake OCV (Oil control valve) connector (A) and the exhaust OCV (Oil control valve) connector (B).



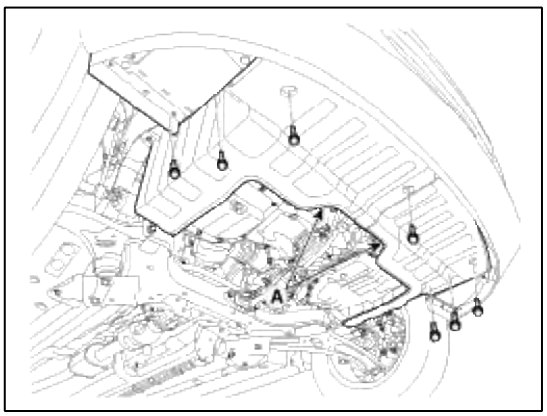
33. Connect the A/C compressor switch connector (A), the alternator connector (B) and the cable from the alternator “B” terminal (C).

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



34. Install the under covers (A).

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



35. Install the RH front wheel.

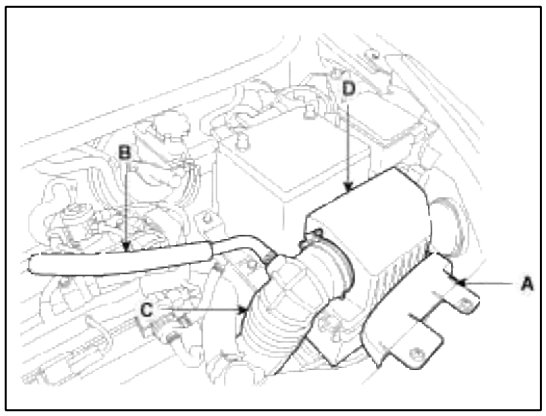
36. Install the air cleaner assembly.

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

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

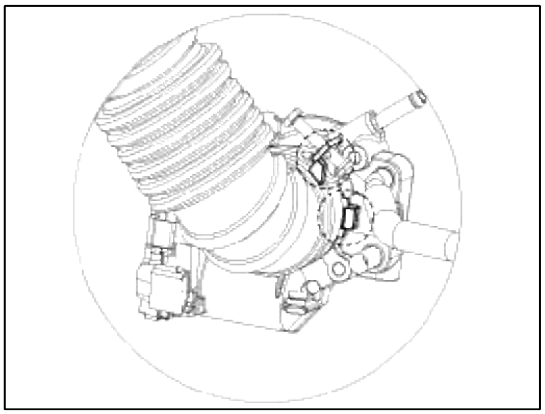
(2) Connect the breather hose (B).

(3) Install the air duct (A) .



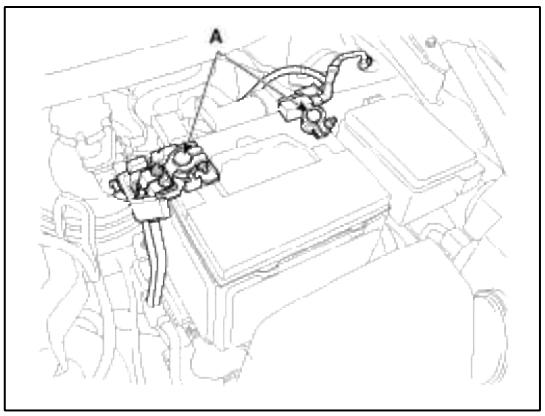
NOTE

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



37. Connect the battery negative terminal (A).

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



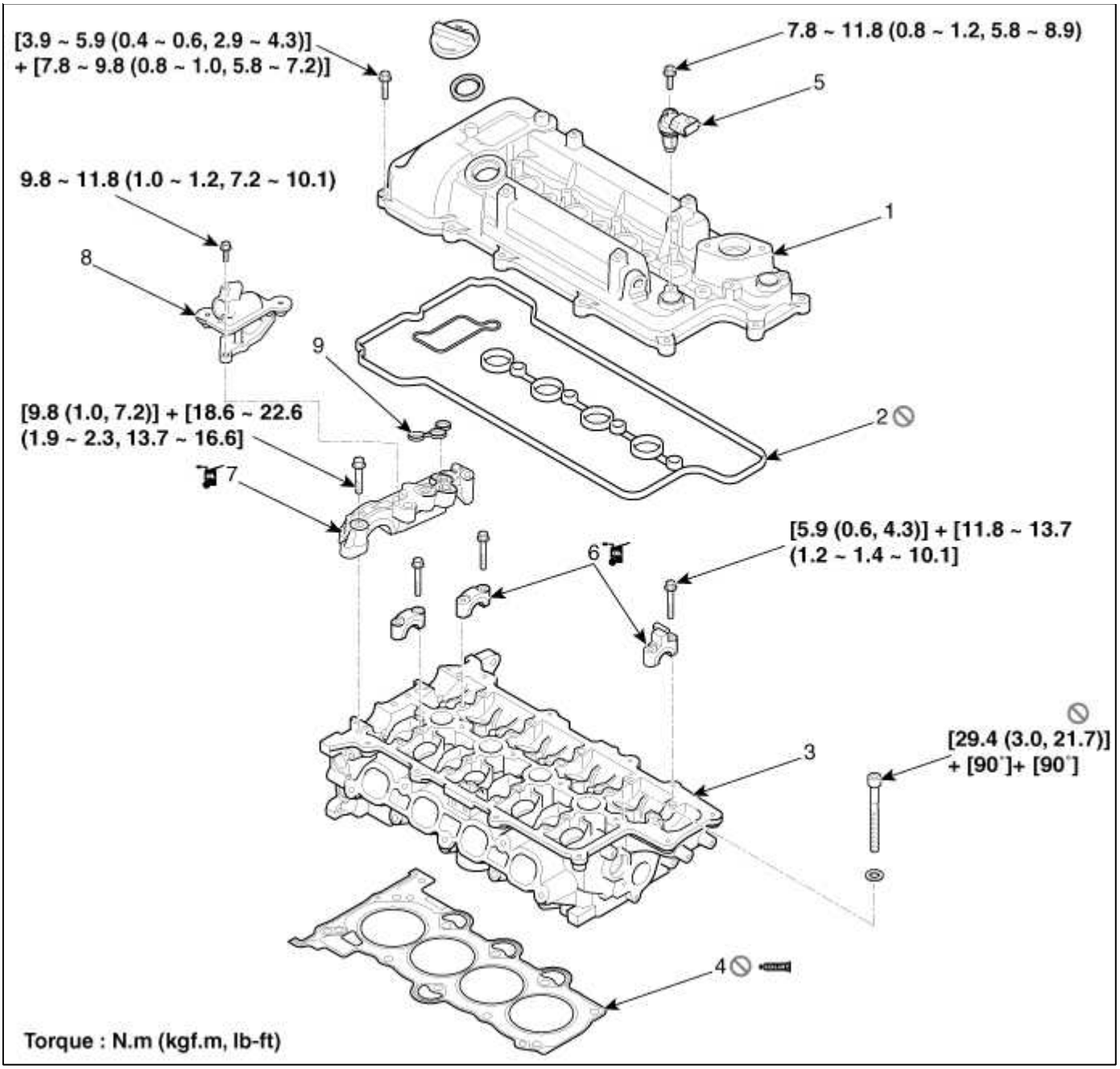
38. Install the engine cover.

CAUTION

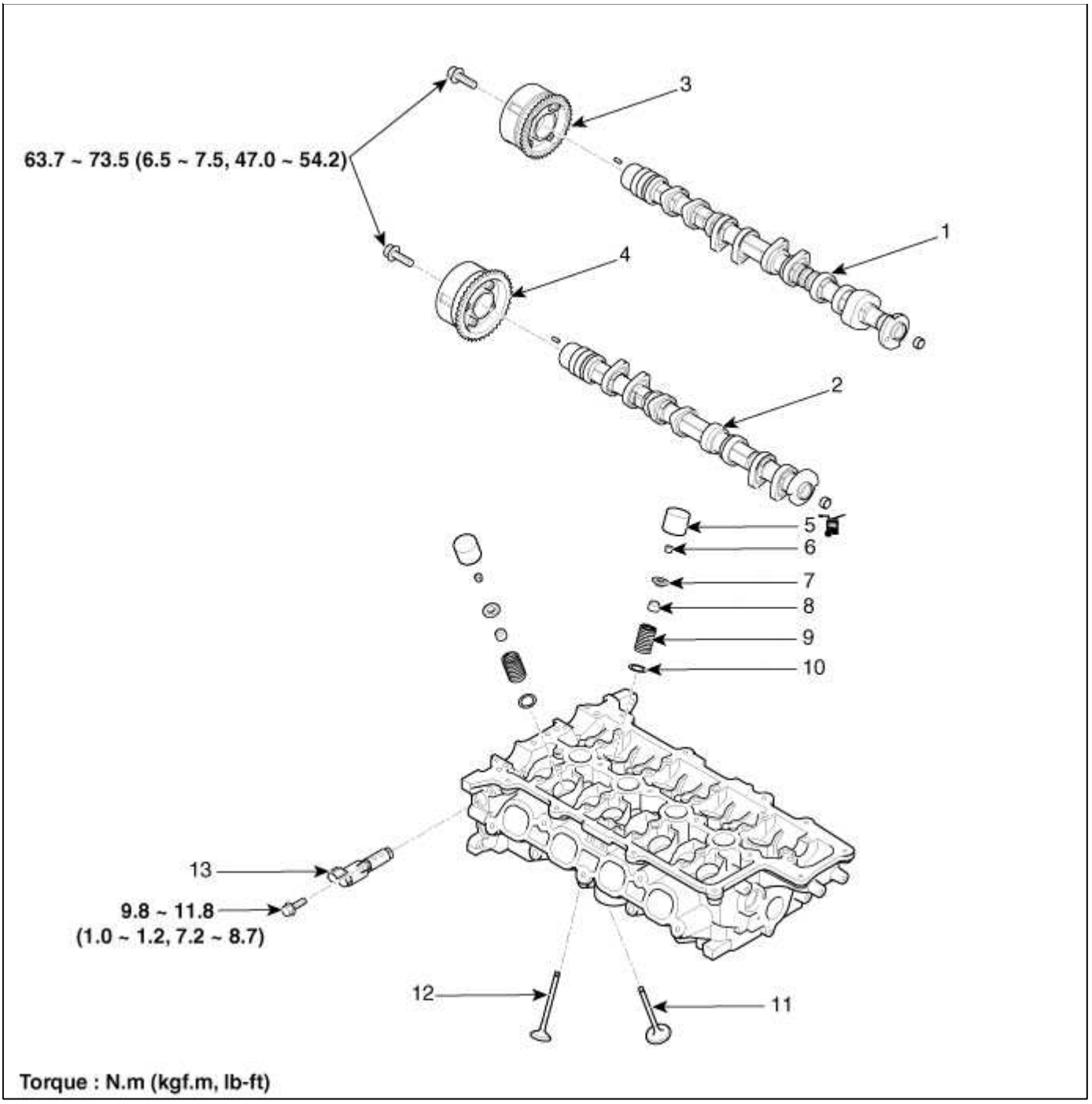
Make sure the engine cover is installed before driving.

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

Components



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



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

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

Removal

Engine removal is not required for this procedure.

CAUTION

- Use fender covers to avoid damaging painted surfaces.
- To avoid damaging the cylinder head, wait until the engine coolant temperature drops below normal temperature before removing it.
- When handling a metal gasket, take care not to fold the gasket or damage the contact surface of the gasket.
- To avoid damage, unplug the wiring connectors carefully while holding the connector portion.

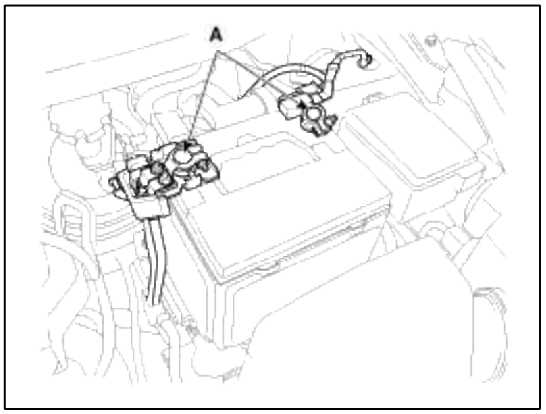
NOTE

Mark all wiring and hoses to avoid misconnection.

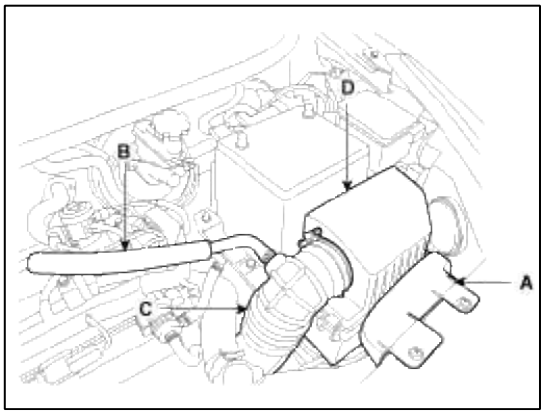
WARNING

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

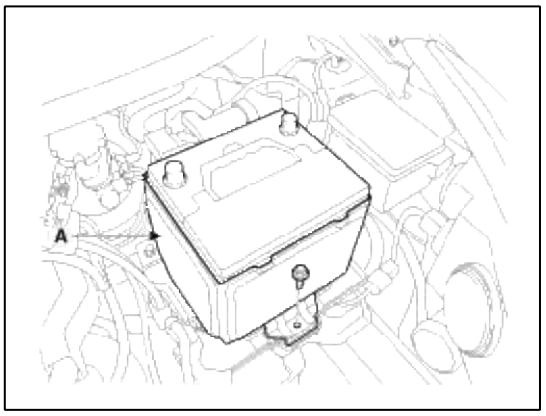
1. Remove the engine cover.
2. Disconnect the battery terminals (A).



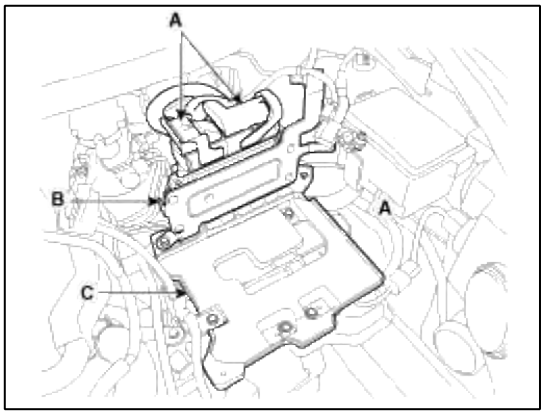
3. Remove the air cleaner assembly.
   (1) Remove the air duct (A)
   (2) Disconnect the breather hose (B) and the air intake hose (C)
   (3) Remove the air cleaner assembly (D)



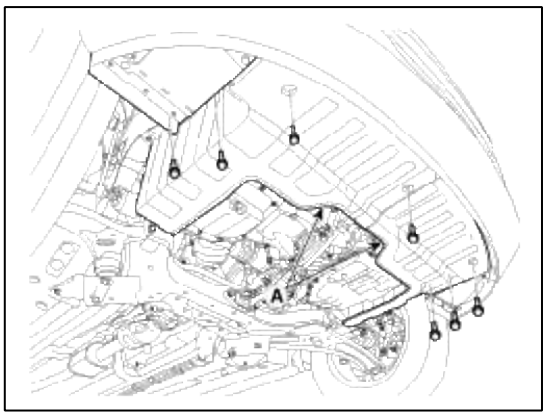
4. Remove the battery (A) after removing the mounting bracket.



5. Disconnect the ECM connectors (A) and then remove the ECM (B) and battery tray (C).

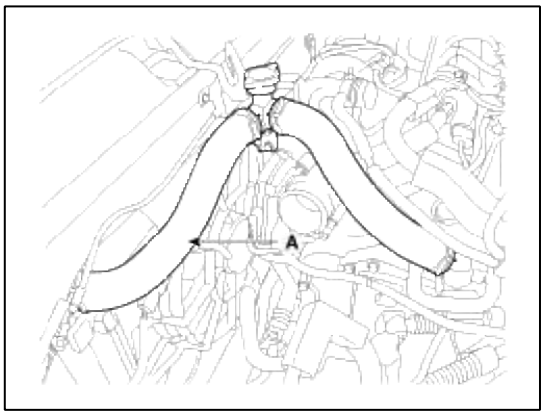


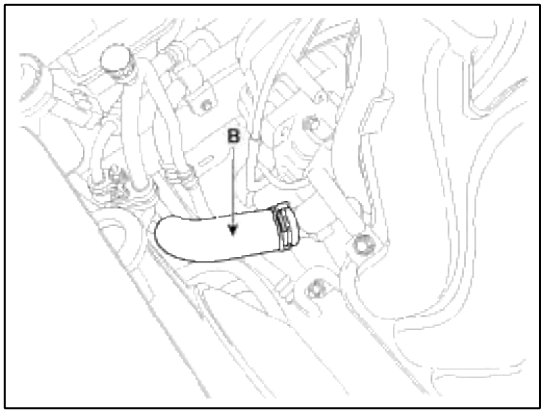
6. Remove the RH front wheel.
7. Remove the under covers (A).



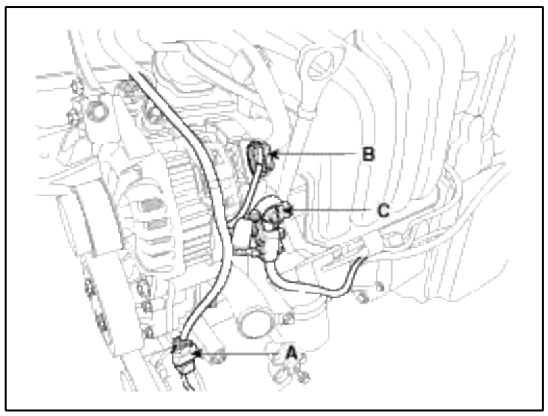
8. Loosen the drain plug, and drain the engine coolant. Remove the radiator cap to help drain the coolant faster. (Refer to Cooling system in this group)

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

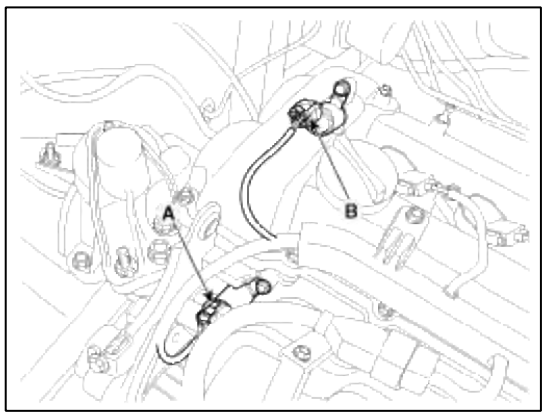




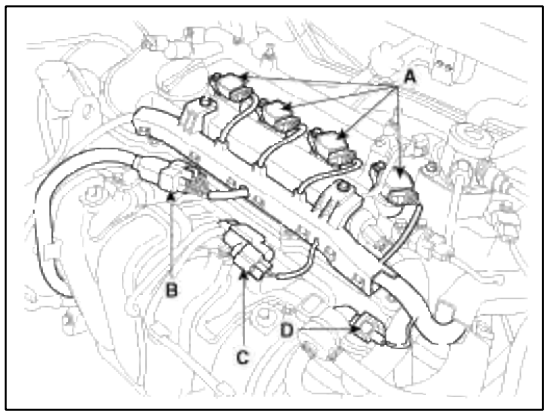
10. Disconnect the wiring connectors and harness clamps, and remove the wiring and protectors from the cylinder head and intake manifold.
    (1) The A/C compressor switch connector (A), the alternator connector (B) and the cable from the alternator "B" terminal (C)



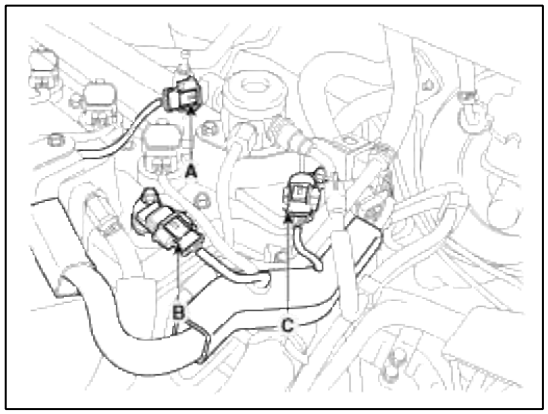
    (2) The intake OCV (Oil control valve) connector (A) and the exhaust OCV (Oil control valve) connector (B)



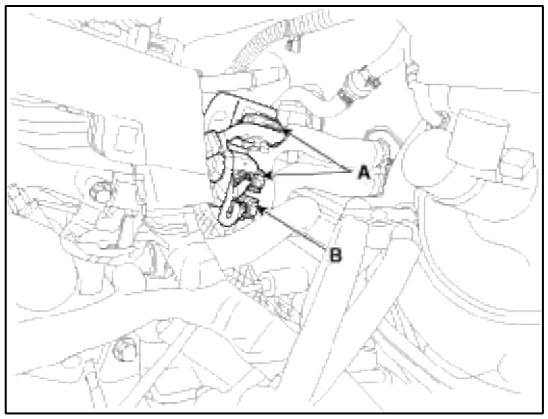
(3) The ignition coil connectors (A), the injector extension connector (B), the VIS (Variable intake system) connector (C) and the PCSV (Purge control solenoid valve) connector (D)



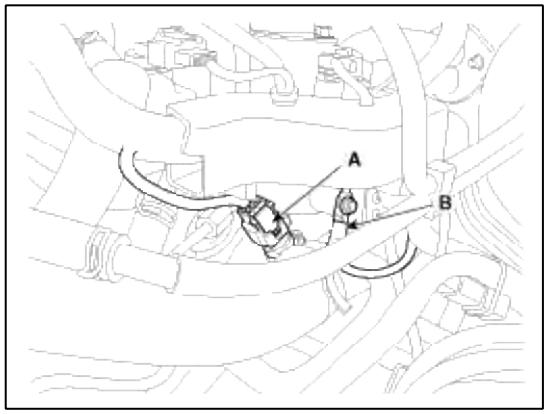
(4) The FPCV (Fuel pressure control valve) connector (A), the intake CMPS (Camshaft position sensor) connector (B) and the exhaust CMPS (Camshaft position sensor) connector (C)



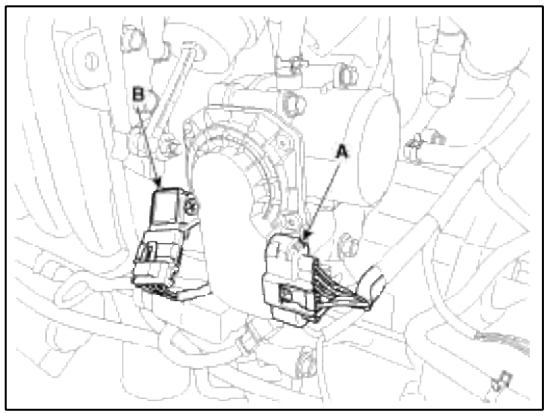
(5) Disconnect the oxygen sensor connectors (A) and the condenser connector (B)



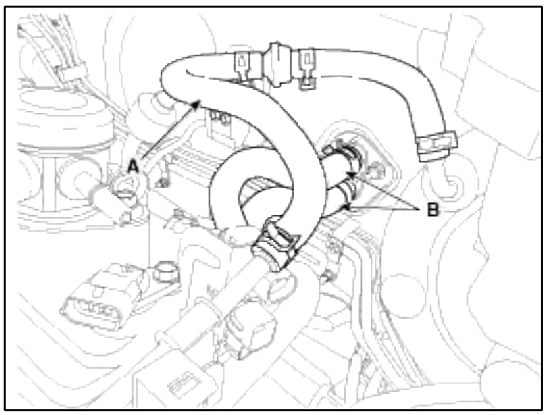
(6) The ECTS (Engine coolant temperature sensor) connector (A) and the ground line (B)



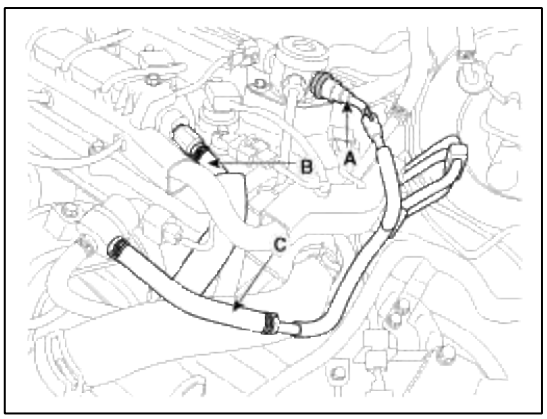
(7) The ETC (Electronic throttle control) connector (A) and the MAPS (Manifold absolute pressure sensor) & IATS (Intake air temperature sensor) connector (B)



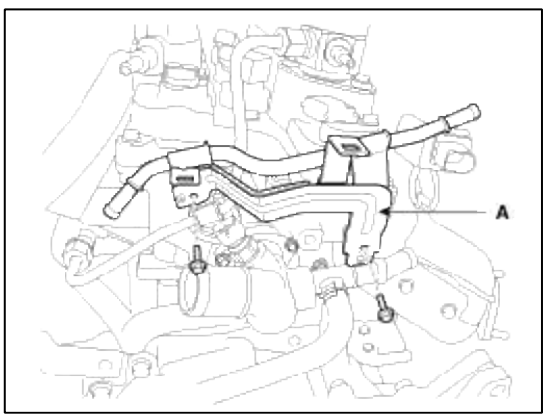
11. Disconnect the brake booster vacuum hose (A) and heater hose (B).



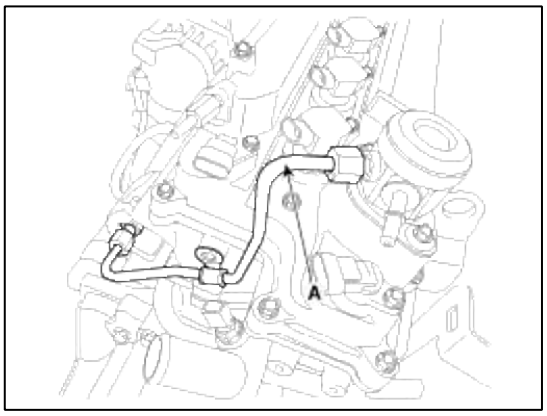
12. Disconnect the fuel hose (A), the PCV (Positive crankcase ventilation) hose (B) and the PCSV (Purge control solenoid valve) hose (C).



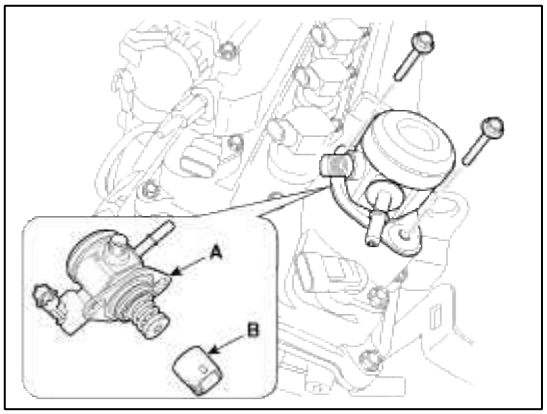
13. Remove the vacuum pipe assembly (A).



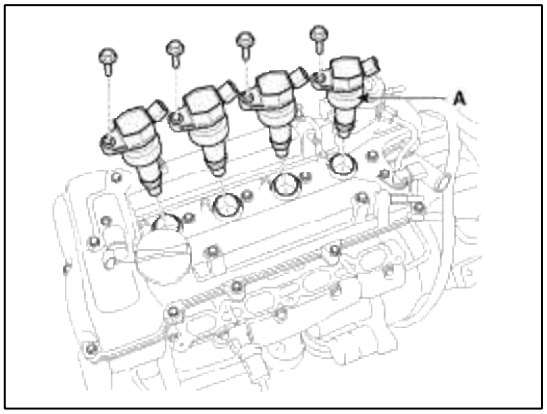
14. Remove the high pressure pipe (A). (Refer to FL group)



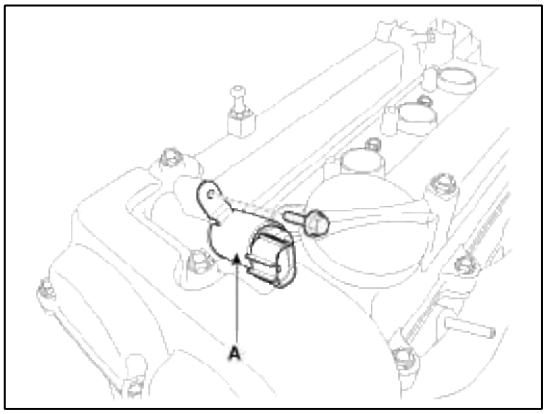
15. Remove the high pressure fuel pump (A) and the roller tappet (B). (Refer to FL group)



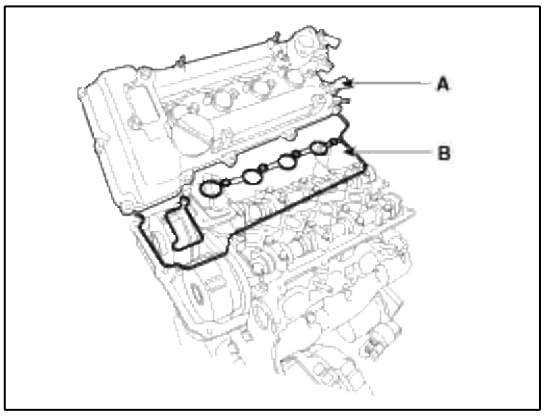
16. Remove the ignition coils (A).



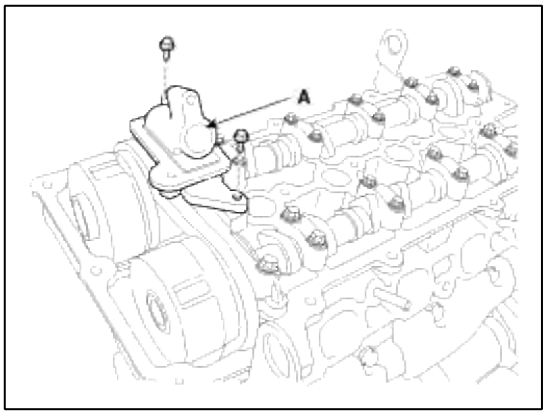
17. Remove the exhaust OCV (Oil control valve) (B).



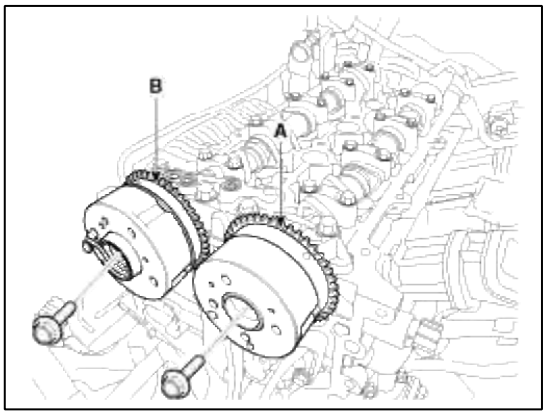
18. Remove the cylinder head cover (A) with gaskets (B).



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

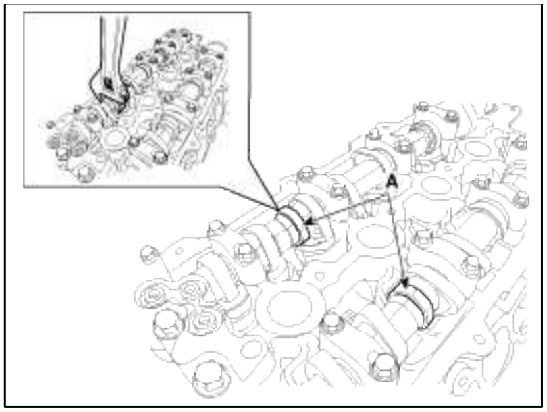


20. Remove the timing chain.
    (Refer to Timing system in this group)
21. Remove the exhaust manifold assembly. (Refer to Intake and exhaust system in this group)
22. Remove the intake manifold module assembly. (Refer to Intake and exhaust system in this group)
23. Remove the intake CVVT assembly (A) and exhaust CVVT assembly (B).

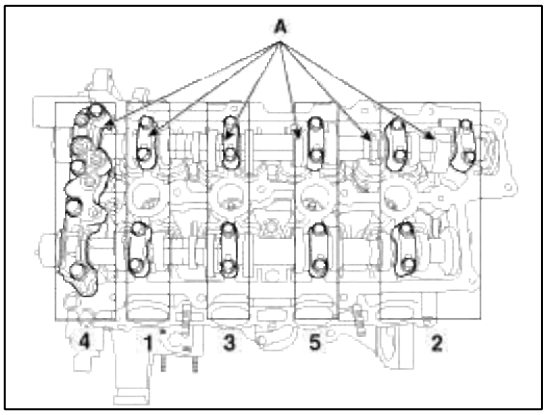


NOTE

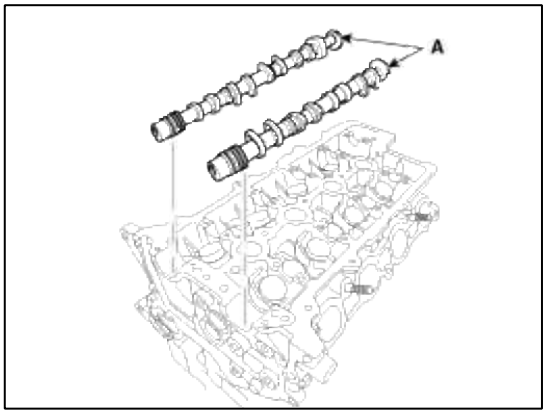
When removing the CVVT assembly bolt, prevent the camshaft from rotating by using a wrench at position (A).



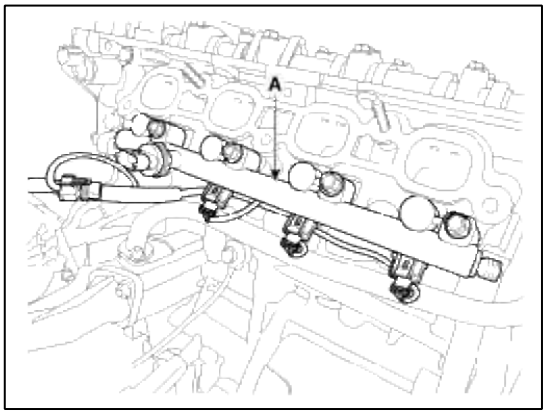
24. Remove the camshaft bearing caps (A) with the order below.



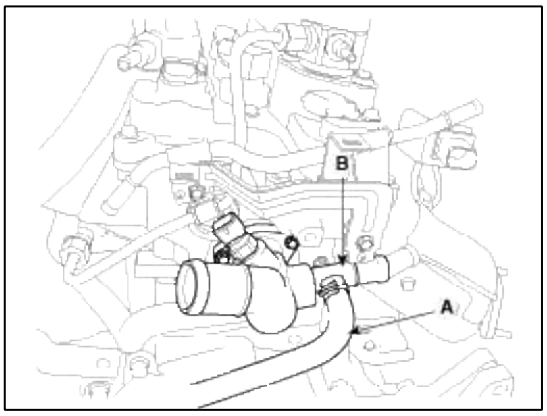
25. Remove the camshafts (A).



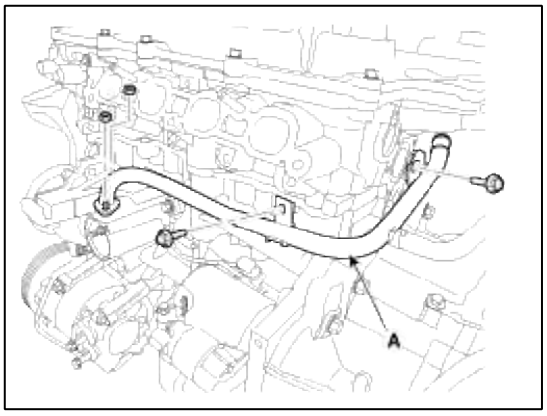
26. Remove the injector & rail assembly (A). (Refer to FL group)



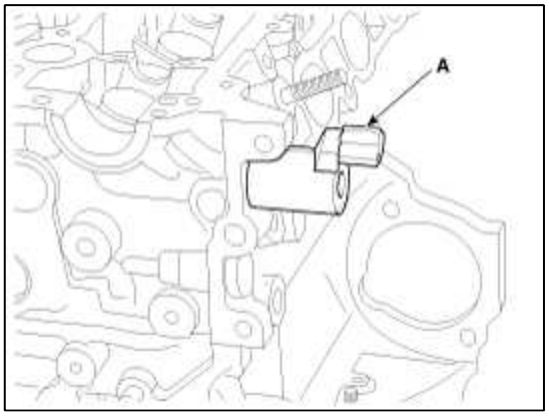
27. Remove the water temperature control assembly (B) after disconnecting the throttle body cooling hose (A).



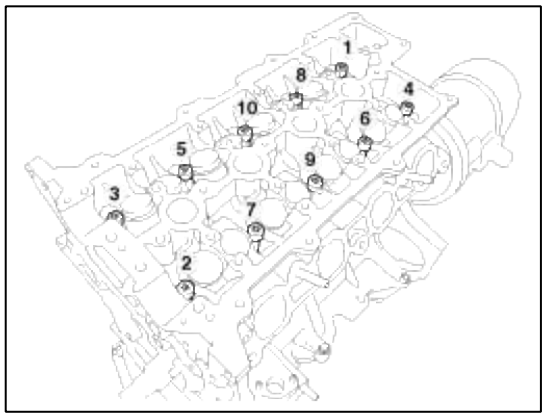
28. Remove the heater pipe (A).



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



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



CAUTION

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

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

CAUTION

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

Disassembly

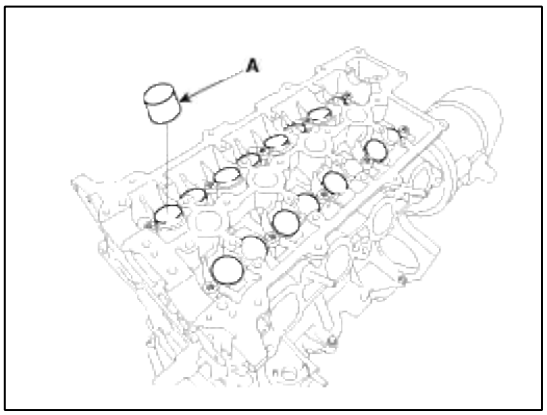
NOTE

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

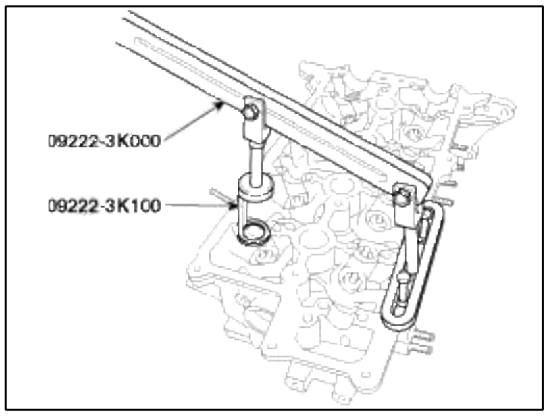
1. Remove the MLAs (A).

CAUTION

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



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



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

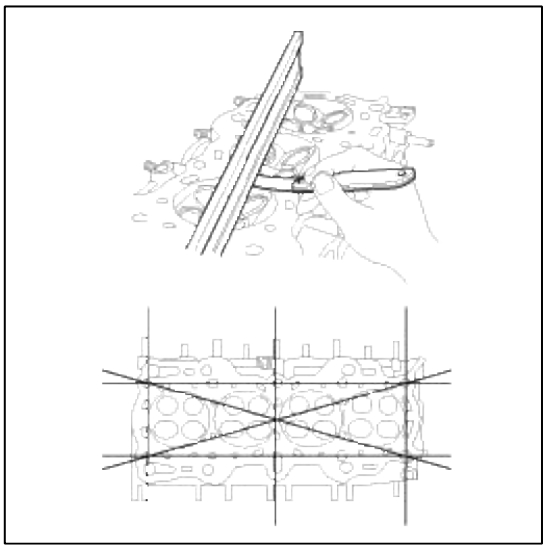
> CAUTION
>
> Do not reuse the valve stem seals.

Inspection

Cylinder Head

1. Inspect for flatness.
   Using a precision straight edge and feeler gauge, measure the surface the contacting the cylinder block and the manifolds for warpage.

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

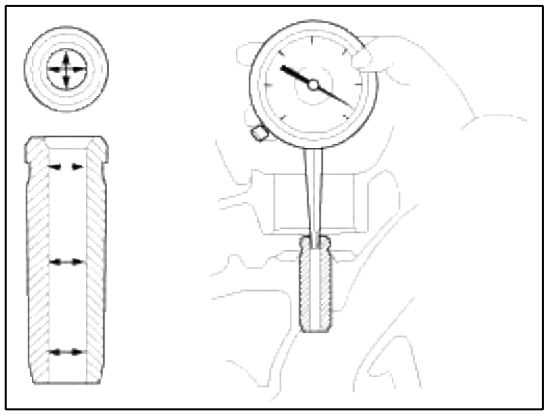


2. Inspect for cracks.
   Check the combustion chamber, intake ports, exhaust ports and cylinder block surface for cracks. If cracked, replace the cylinder head.

Valve And Valve Spring

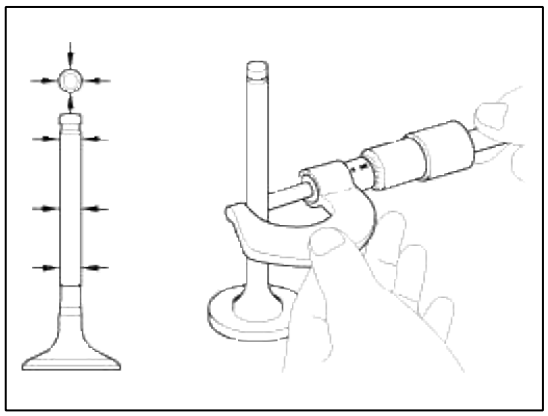
1. Inspect the valve stems and valve guides.
   (1) Using a caliper gauge, measure the inner diameter of valve guide.

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



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

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



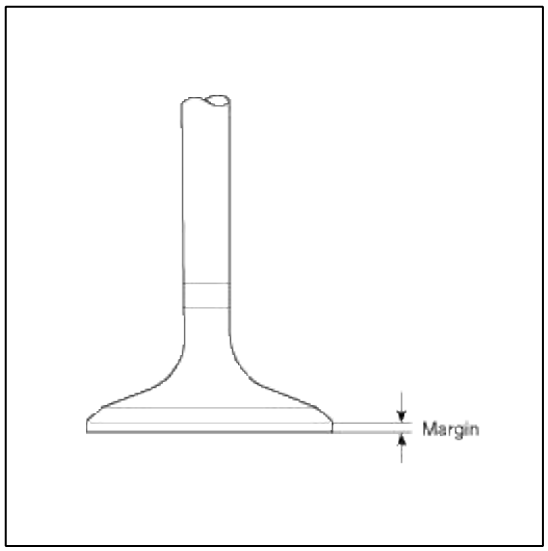
(3) Subtract the valve stem outer diameter measurement from the valve guide inner diameter measurement.

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

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

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

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



   (4) Check the length of valve.

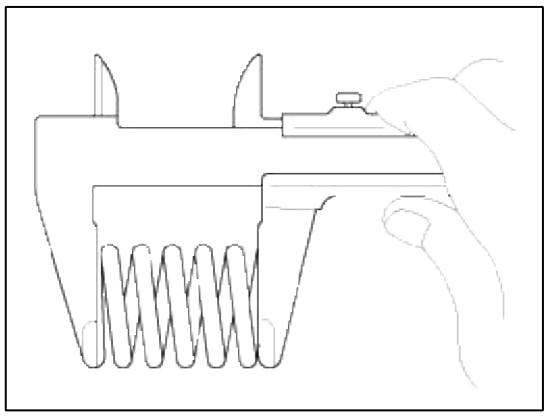
Valve length
Standard
Intake : 93.15mm (3.6673 in)
Exhaust : 92.60mm (3.6457 in)

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

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

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

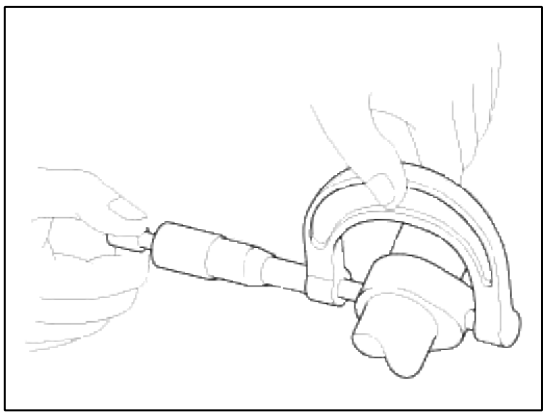
Valve spring
Standard
Free height : 45.1mm (1.7756in)
Out of square : Less than 1.5°



Camshaft

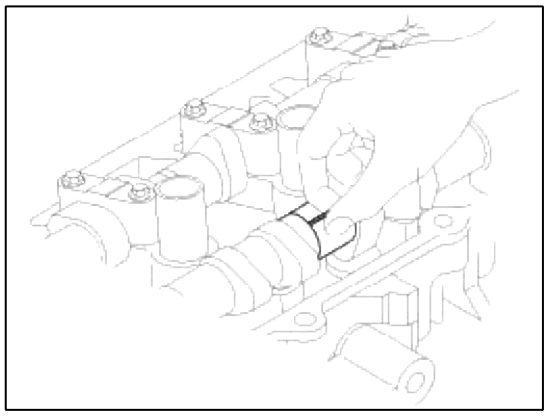
1. Inspect the cam height.
   Using a micrometer, measure the cam height.

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



   If the cam lobe height is less than specified, replace the camshaft.
2. Check the cranshaft journal for wear.
   If the journal is worn excessively, replace the camshaft.
3. Inspect the camshaft journal clearance.
   (1) Clean the bearing caps and camshaft journals.
   (2) Place the camshafts on the cylinder head.

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



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

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

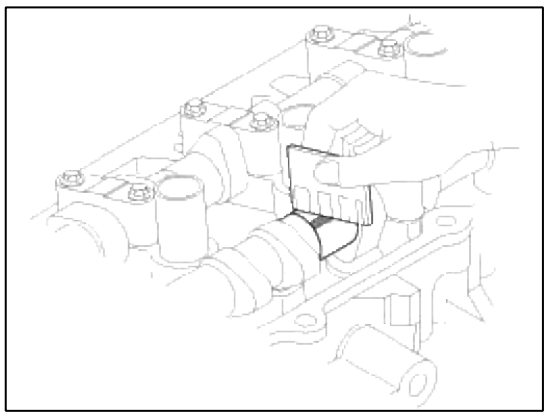
CAUTION

Do not turn the camshaft.

(5) Remove the bearing caps.

(6) Measure the plastigage at its widest point.

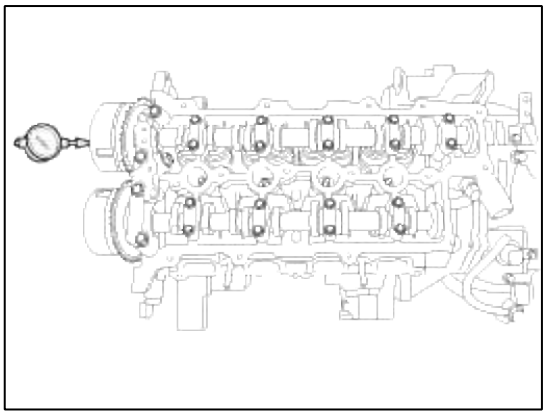
Bearing oil clearance
Standard : 0.027 ~ 0.058mm (0.0011 ~ 0.0023in)
Limit : 0.1mm (0.0039in)



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

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

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



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

   (3) Remove the camshafts.

Continuous Variable Valve Timing (CVVT) Assembly

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

NOTE

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

   (5) Under the condition of 3), turn the CVVT assembly to the advance angle side with your hand.
   Depending on the air pressure, the CVVT assembly will turn to the advance side.
   Also, under the condition that the pressure can be hardly applied because of the air leakage from the port, there may be the case that the lock pin could be hardly released.
   (6) Except the position where the lock pin meets at the maximum delay angle, let the CVVT assembly turn back and forth and check the movable range and that there is no disturbance.

Standard : Movable smoothly in the range about 25°

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

Reassembly

NOTE

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

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

NOTE

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

CAUTION

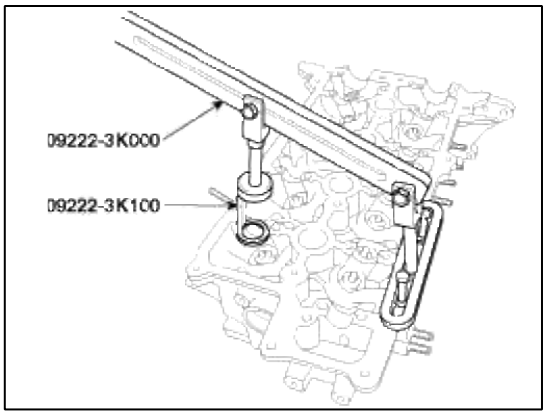
Intake valve stem seals are different from exhaust ones in type. Do not reassembly ones in the other's places.

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

NOTE

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

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

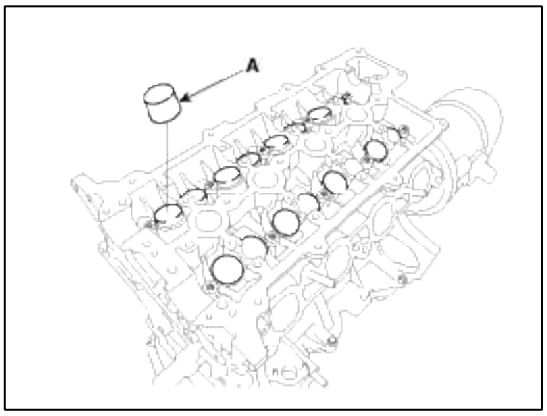


CAUTION

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

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

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



NOTE

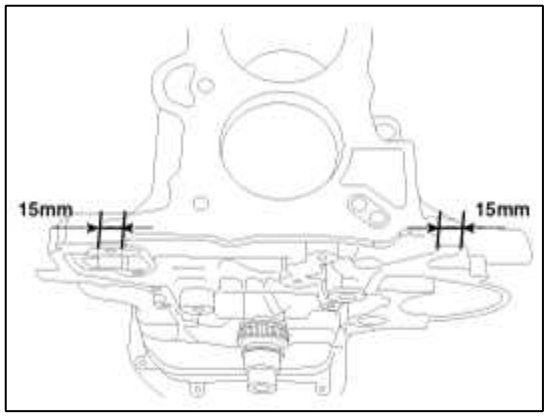
All the MLAs should be installed in its original position.

Installation

NOTE

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

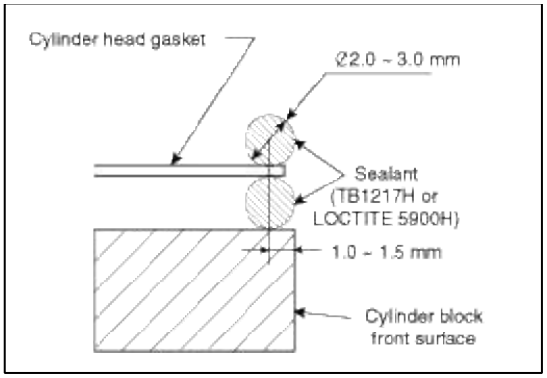
1. Install the cylinder head assembly.
   (1) Before installing, remove the hardened sealant from the cylinder block and cylinder head surface.
   (2) Before installing the cylinder head gasket, apply sealant on the upper surface of the cylinder block and reassemble the gasket within five minutes.



NOTE

Refer to the illustration for applying sealant.

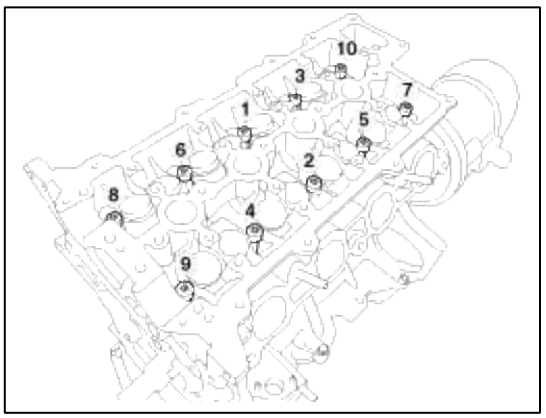
Width : 2.0 ~ 3.0mm(0.0787~0.1181in.)
Position : 1.0 ~ 1.5mm(0.0394~0.0591in.)
Specification : TB 1217H or LOCTITE 5900H



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

2. Place the cylinder head carefully not to damage the gasket.
3. Install the cylinder head bolts with washers.
   (1) Tighten the 10 cylinder head bolts, in several passes, in the sequence shown.

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

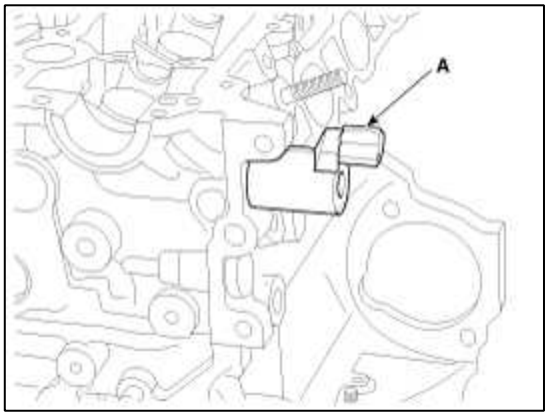


CAUTION

Always use new cylinder head bolts.

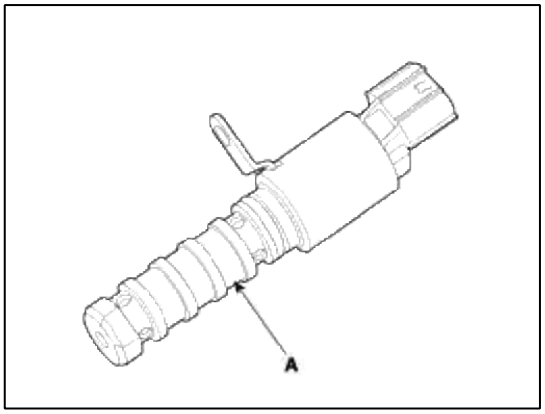
4. Install the oil control valve (OCV) (A).

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



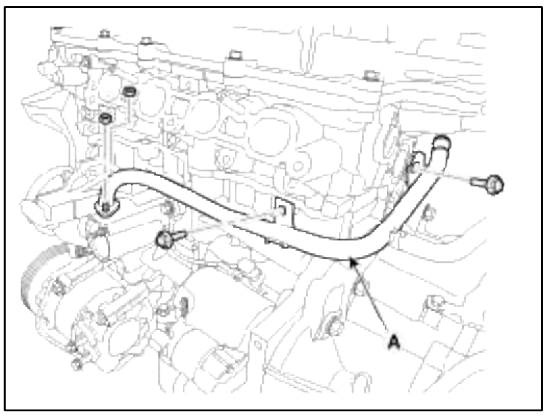
CAUTION

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



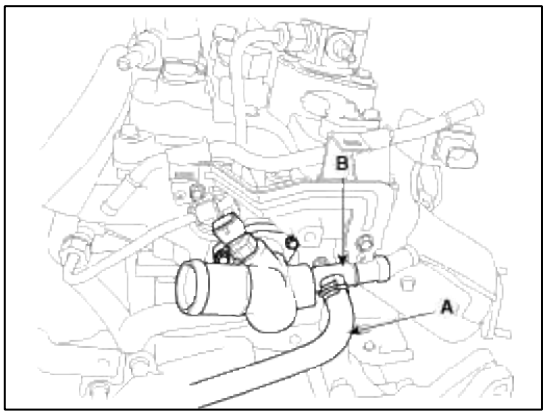
5. Install the heater pipe (A).

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



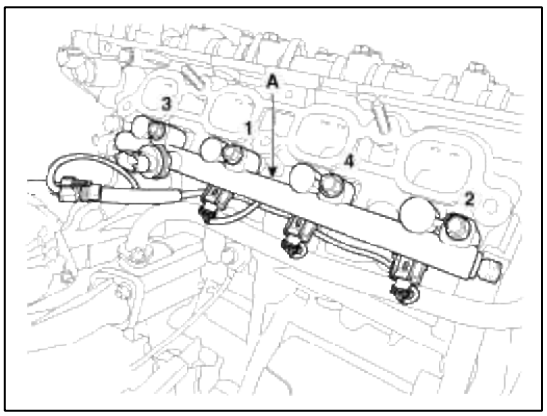
6. Install the water temperature control assembly (A) after connecting the throttle body cooling hose (A).

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



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

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

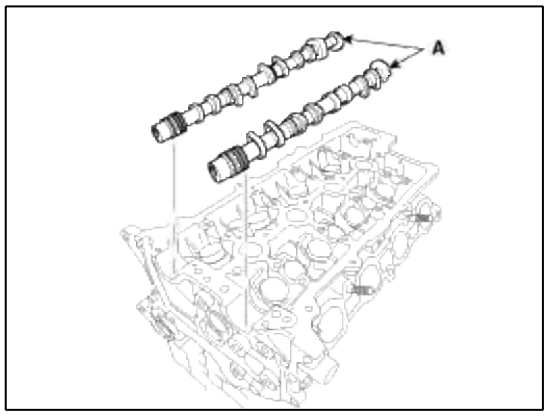


8. Install the intake and exhaust manifold.
(Refer to Intake and Exhaust system in this group)
9. Install the camshafts (A).
(1) Before installing, apply engine oil on journals.

CAUTION

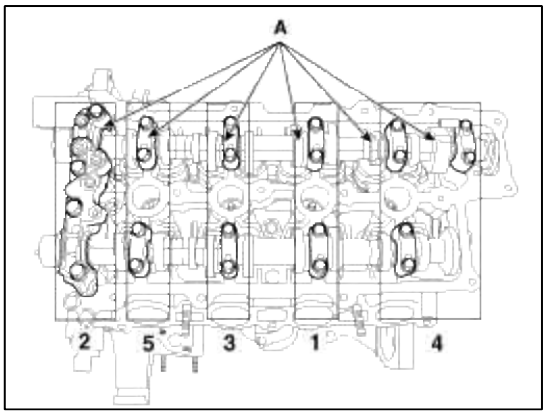
Do not make oil flow down to the front side of the cylinder head.

(2) After installing, check the valve clearance.



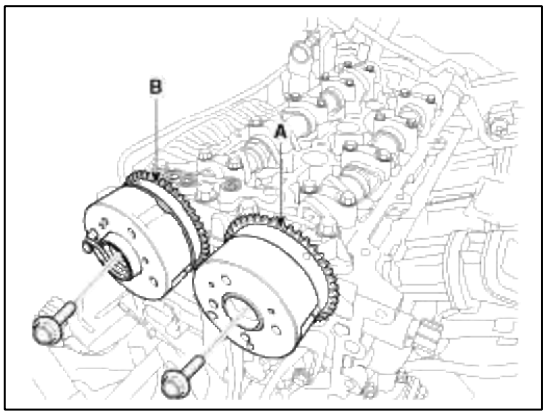
10. Install the camshaft bearing caps with the order below.

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



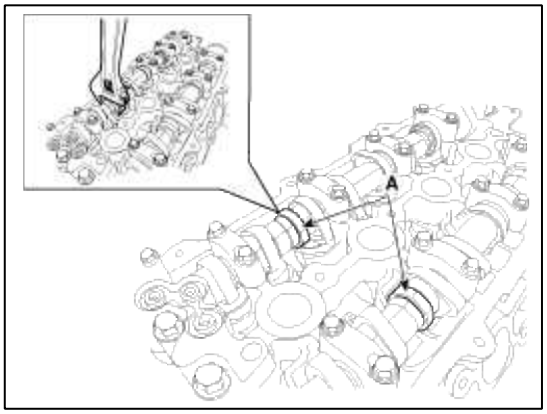
11. Install the intake CVVT assembly (A) and exhaust CVVT assembly (B).

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



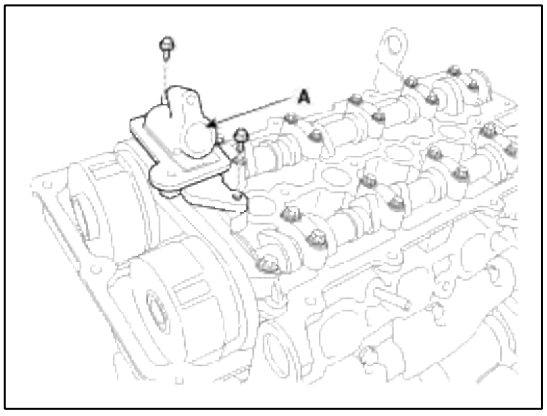
NOTE

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



12. Install the timing chain.
(Refer to Timing system in this group)
13. Install the OCV (Oil Control Valve) adapter (A).

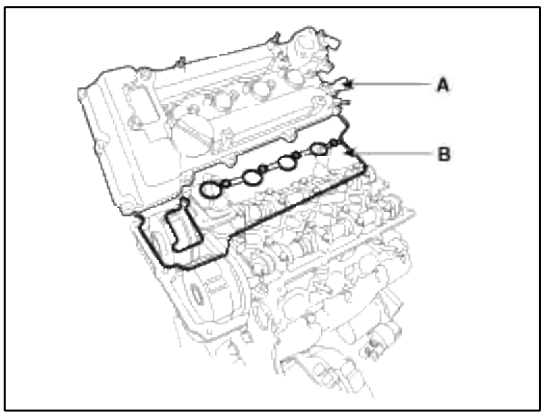
Tightening torque :
9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)



CAUTION

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

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

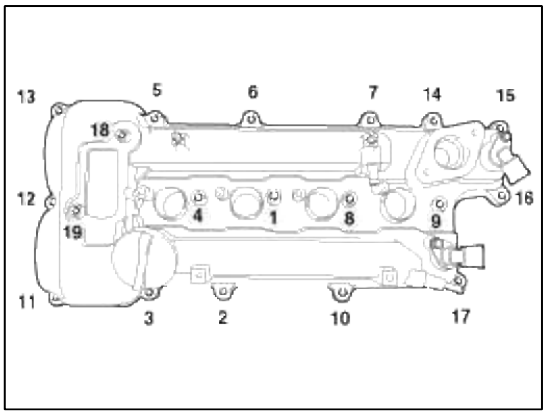


CAUTION

Do not reuse the disassembled gasket.

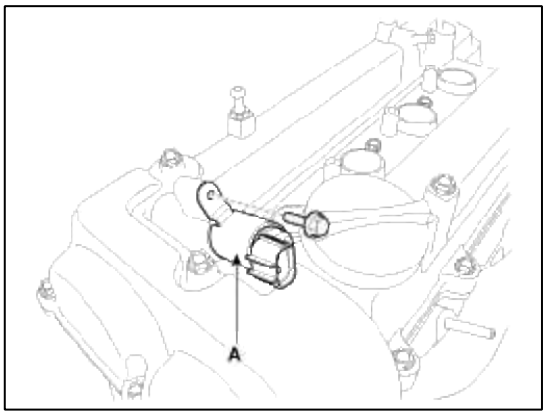
15. Tighten the cylinder head cover bolts (A) with the order and steps.

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



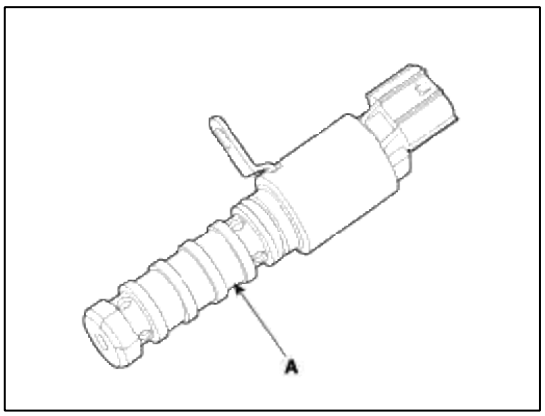
16. Install the exhaust OCV (Oil control valve) (A).

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



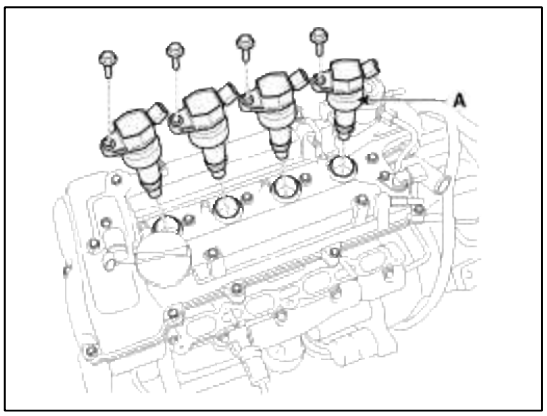
CAUTION

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



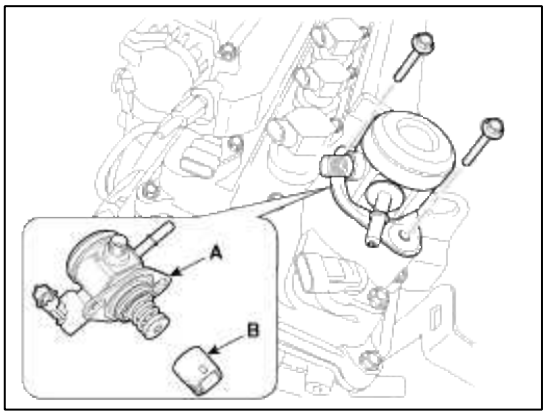
17. Install the ignition coils (A).

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



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

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



CAUTION

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

NOTE

Do not use already used bolt again.

NOTE

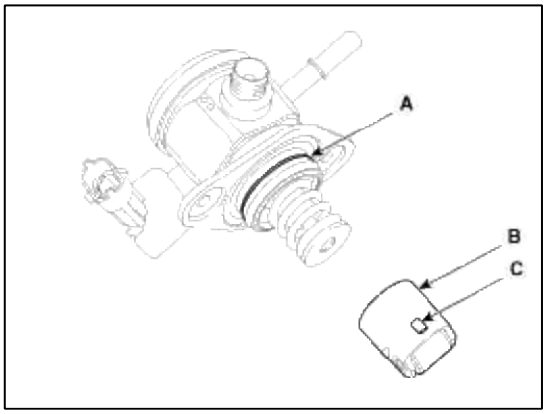
When tightening the installation bolts of the high pressure fuel pump, tighten in turn the bolts in small step (0.5 turns) after tightening them with hand-screwed torque.

CAUTION

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

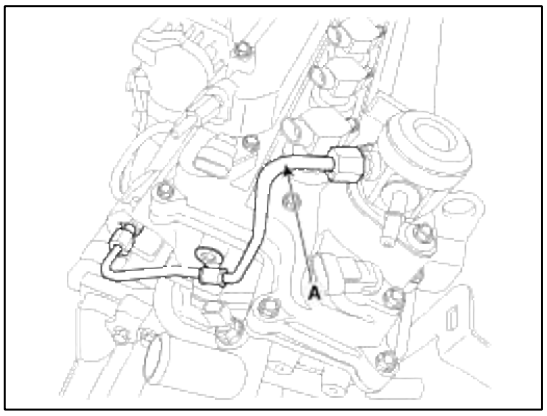
CAUTION

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



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

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

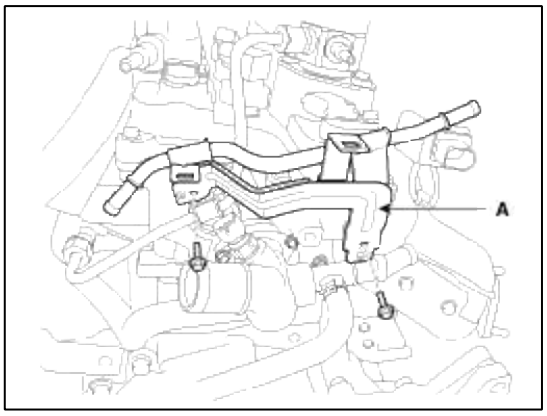


CAUTION

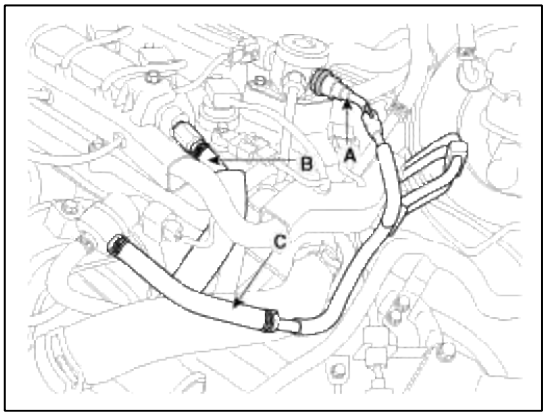
Do not reuse the high pressure pipe.

20. Install the vacuum pipe assembly (A).

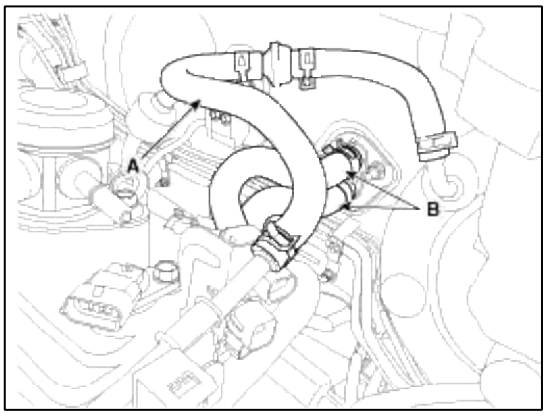
Tightening torque :
9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)



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

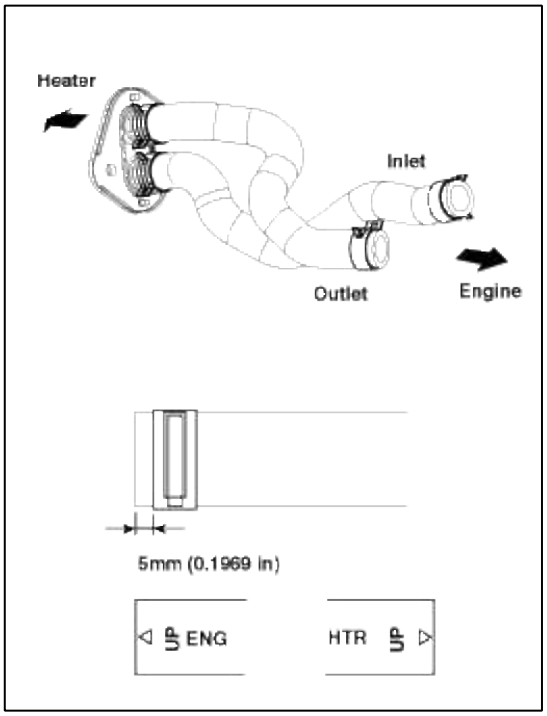


22. Connect the brake booster vacuum hose (A) and heater hose (B).



NOTE

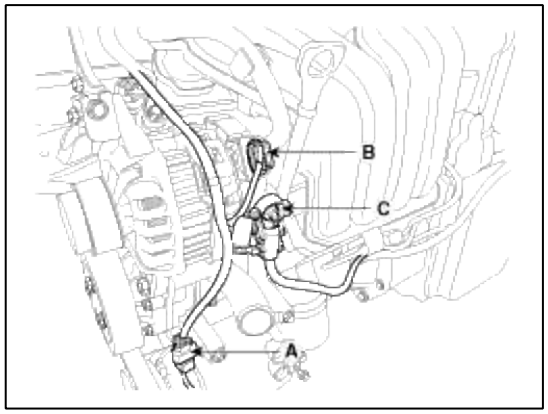
Install the heater hoses as shown illustrations.



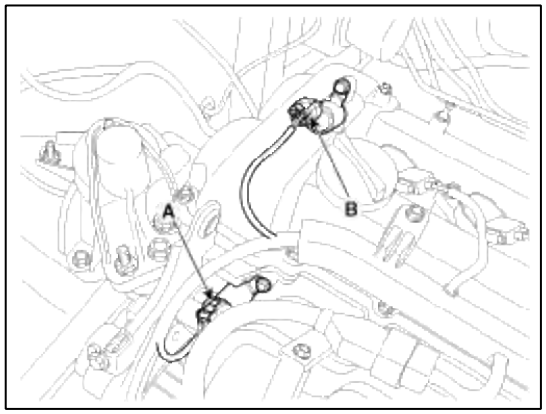
23. Connect the wiring connectors and harness clamps, and remove the wiring and protectors from the cylinder head and intake manifold.

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

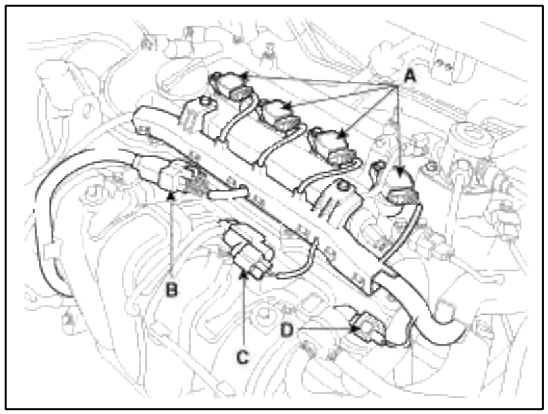
Tightening torque :
9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)



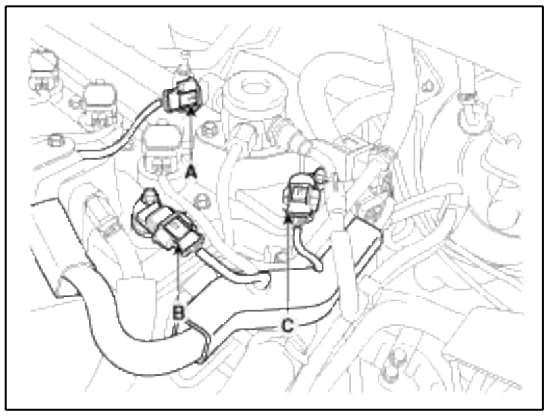
(2) The intake OCV (Oil control valve) connector (A) and the exhaust OCV (Oil control valve) connector (B)



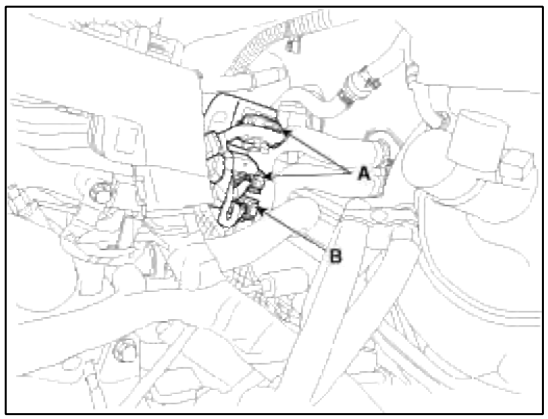
(3) The ignition coil connectors (A), the injector extension connector (B), the VIS (Variable intake system) connector (C) and the PCSV (Purge control solenoid valve) connector (D)



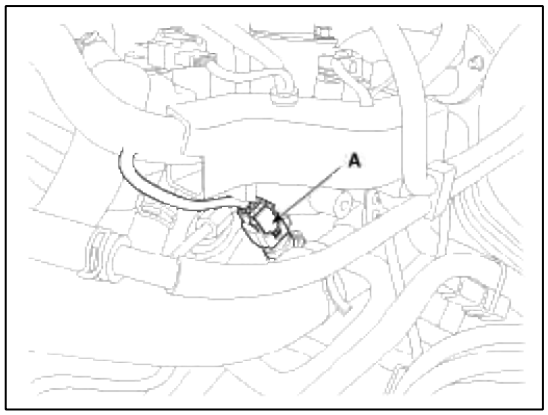
(4) The FPCV (Fuel pressure control valve) connector (A), the intake CMPS (Camshaft position sensor) connector (B) and the exhaust CMPS (Camshaft position sensor) connector (C)



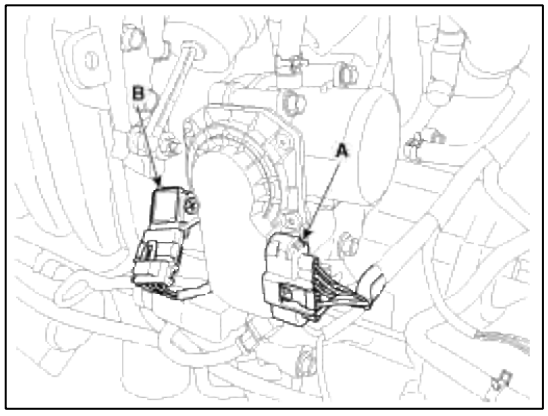
(5) The oxygen sensor connectors (A) and the condenser connector (B).



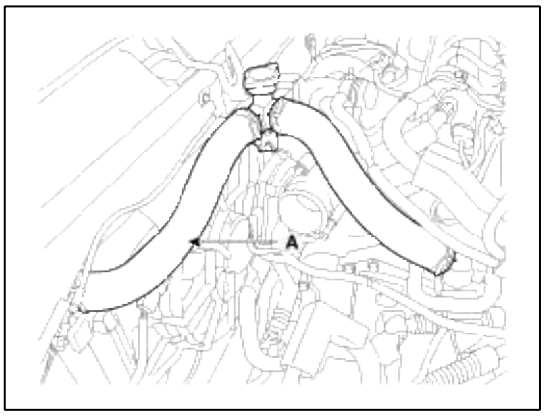
(6) The ECTS (Engine coolant temperature sensor) connector (A) and the ground line

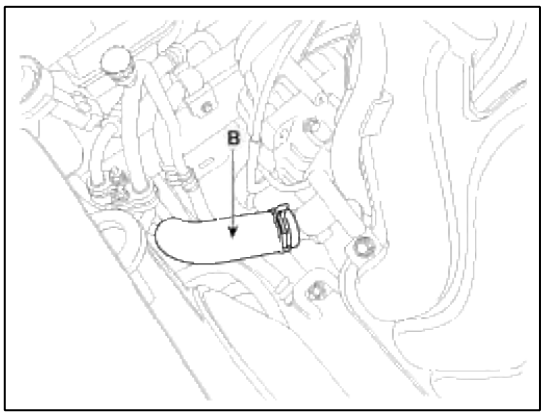


(7) The ETC (Electronic throttle control) connector (A) and the MAPS (Manifold absolute pressure sensor) & IATS (Intake air temperature sensor) connector (B)



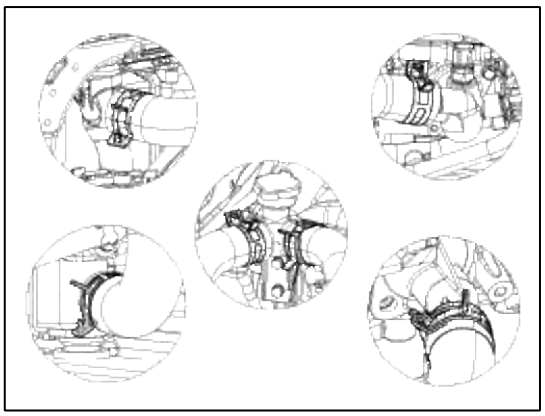
24. Connect the radiator upper hose (A) and lower hose (B).





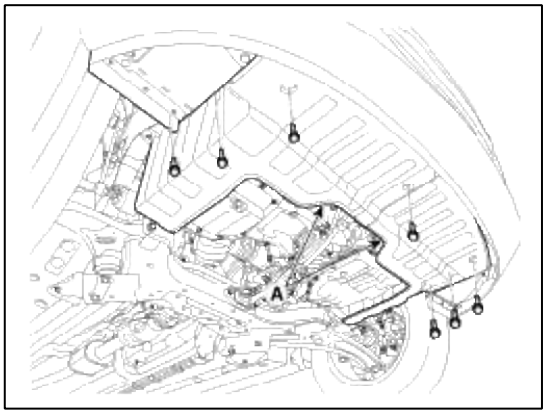
NOTE

Install the radiator hoses as shown illustrations.



25. Install the under covers (A).

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

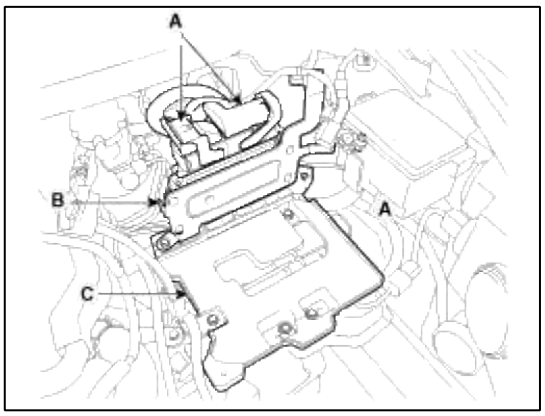


26. Install the battery tray (C).

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

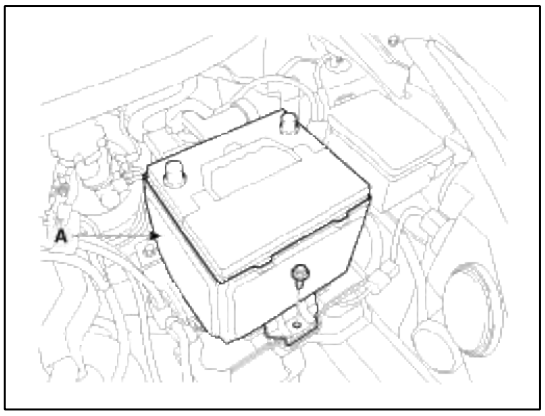
27. Install the ECM (B) and then connect the ECM connectors (A).

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



28. Install the battery (A) after removing the mounting bracket.

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



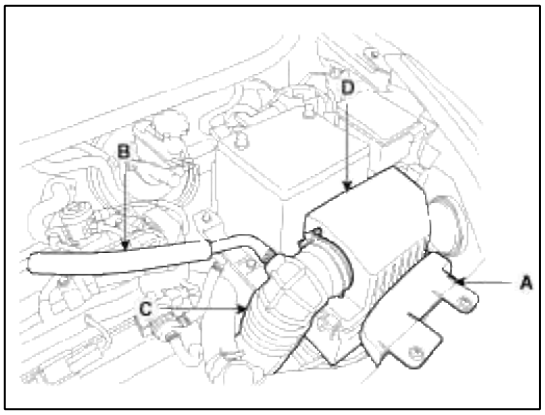
29. Install the RH front wheel.

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

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

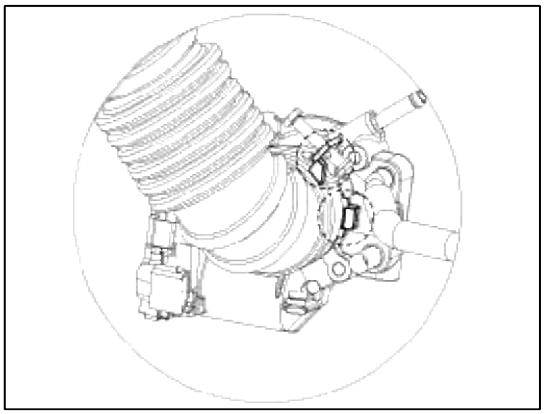
(2) Connect the breather hose (B).

(3) Install the air duct (A).



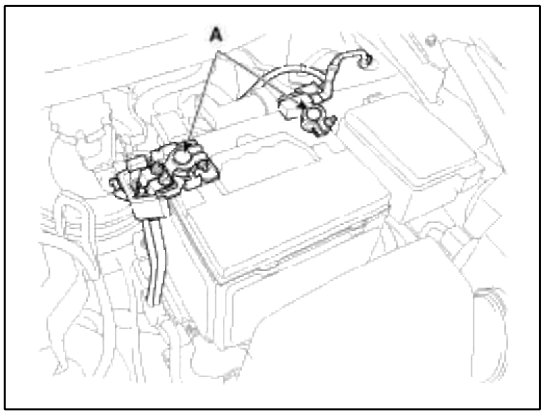
NOTE

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



31. Connect the battery negative terminals (A).

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



32. Install the engine cover.

CAUTION

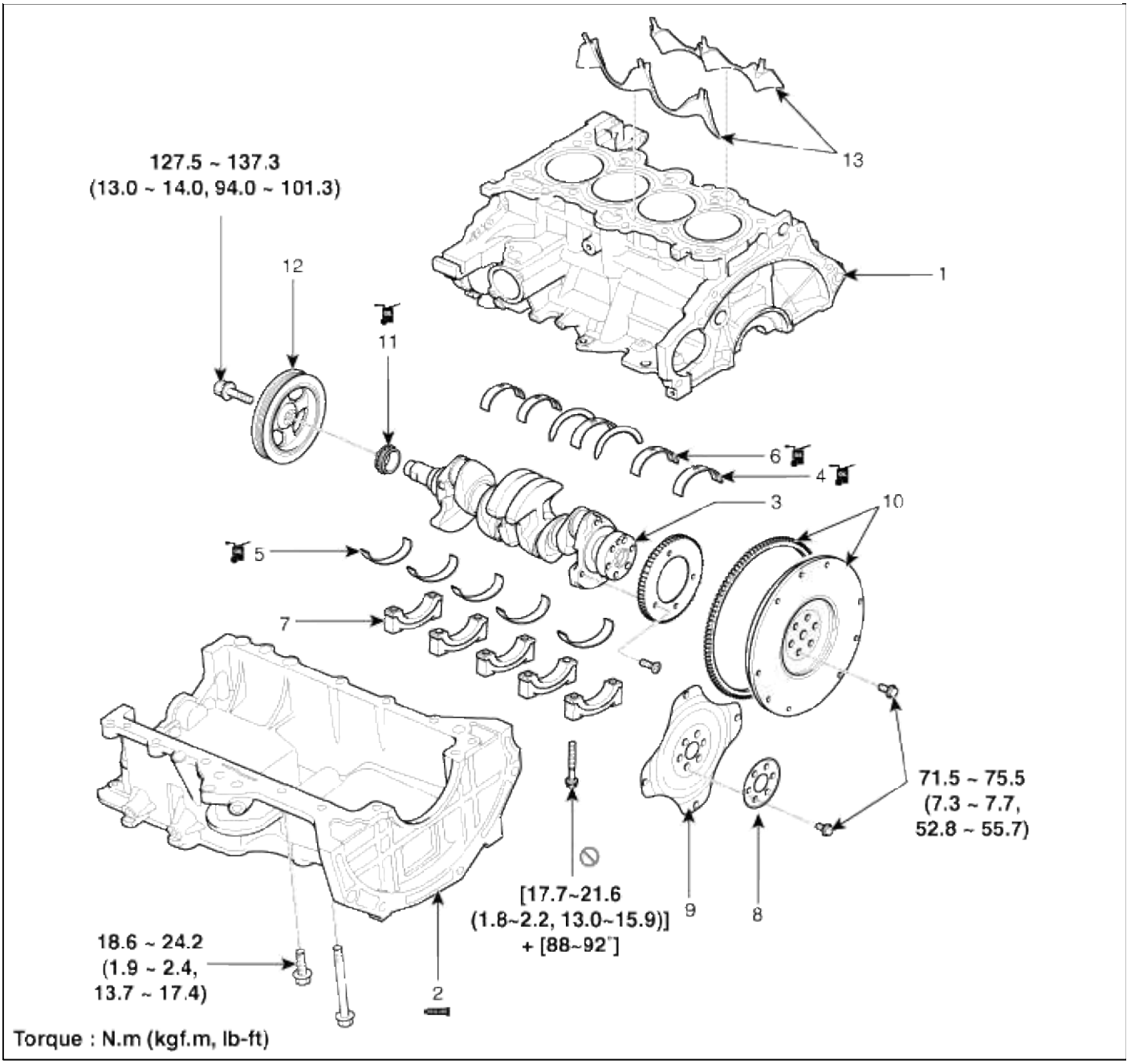
Install the engine cover.

NOTE

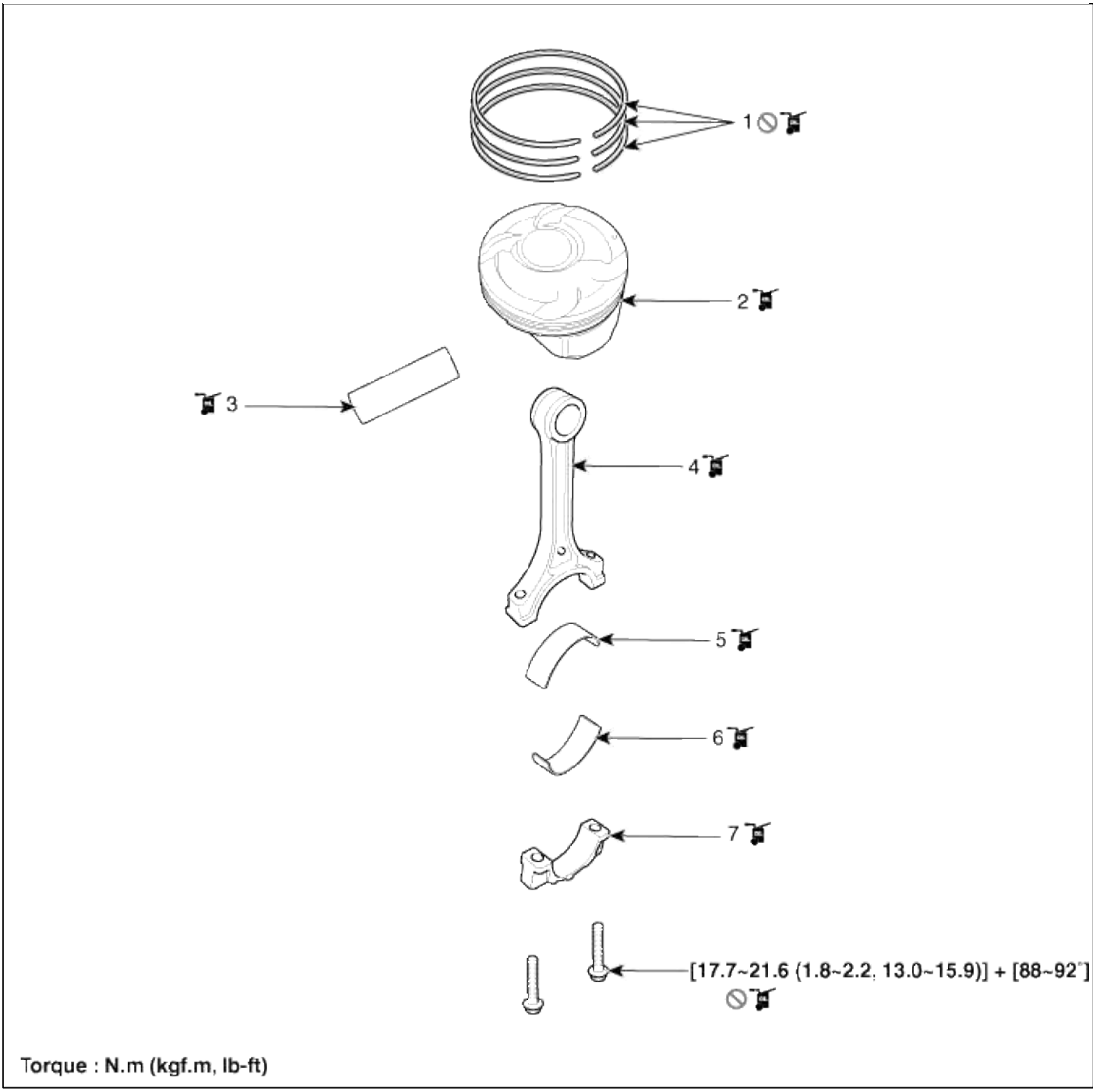
Perform the following :
- Adjust a shift cable.
- Refill engine with engine oil.
- Refill a transaxle with fluid.
- Refill a radiator and a reservoir tank with engine coolant.
- Clean battery posts and cable terminals and assemble.
- Inspect for fuel leakage.
- After assemble the fuel line, turn on the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

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

Components



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



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

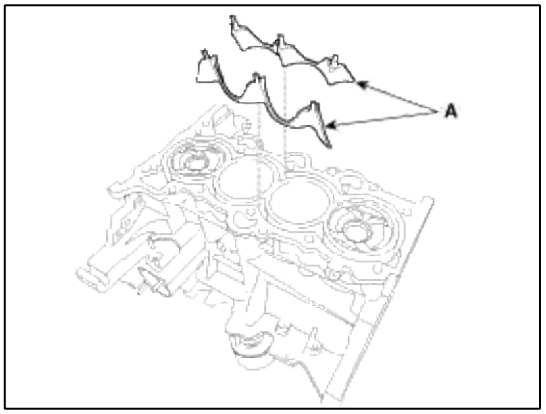
Engine Mechanical System > Cylinder Block > Cylinder Block > Repair procedures

Disassembly

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

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

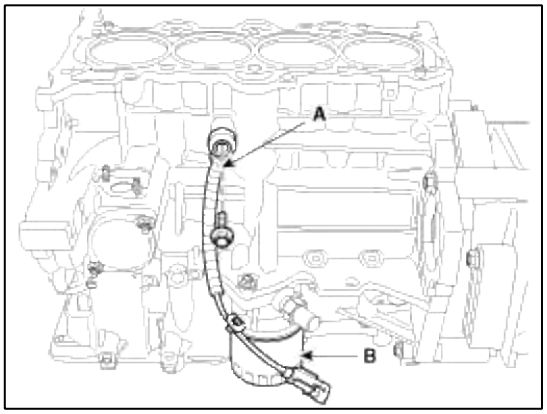
4. Remove the timing chain. (Refer to Timing chain in this group)
5. Remove the cylinder head. (Refer to Cylinder head in this group)
6. Remove the water jacket insert (A).



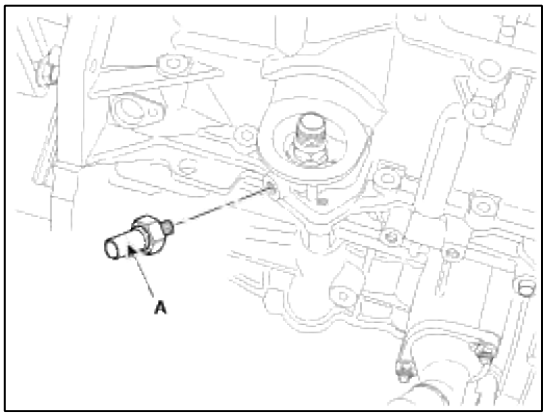
CAUTION

Be careful not to deform or damage it when removing.

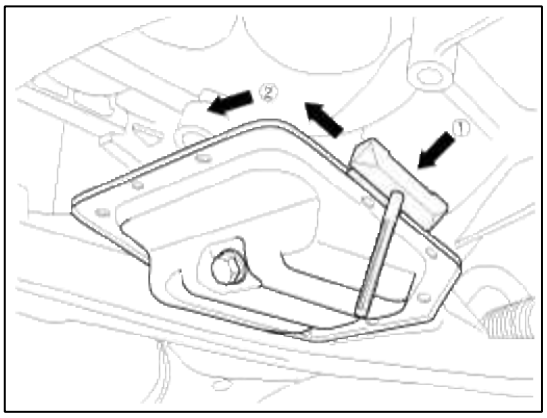
7. Remove the oil level gauge tube.
8. Remove the knock sensor (A) and the oil filter (B).



9. Remove the oil pressure switch (A).



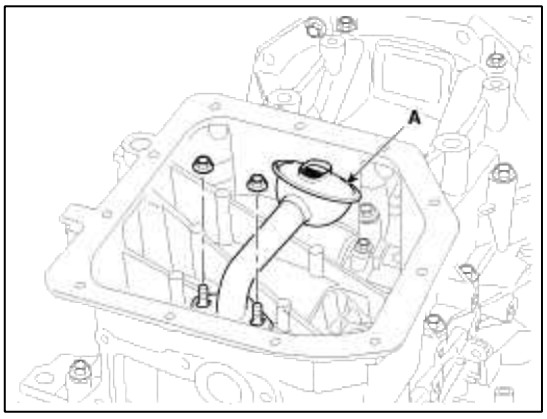
10. Using the SST (09215-3C000), remove the oil pan (A).



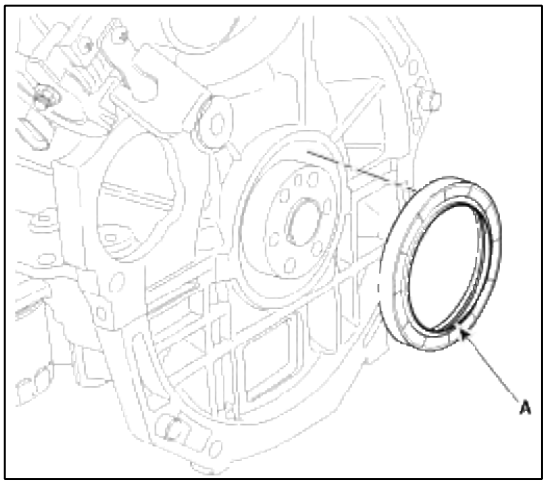
CAUTION

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

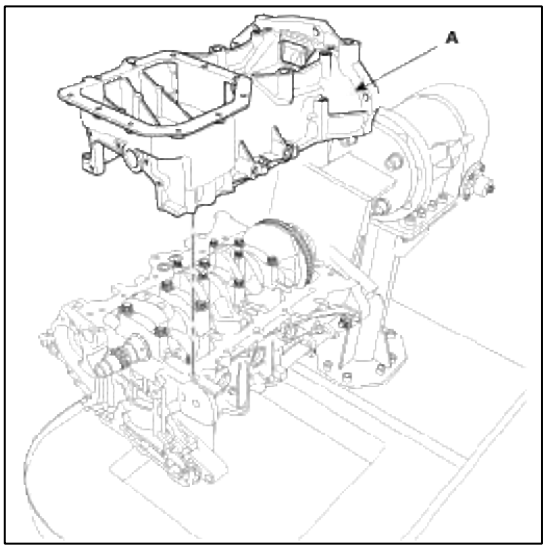
11. Remove the oil screen (A).



12. Remove the rear oil seal (A).



13. Remove the ladder frame (A).

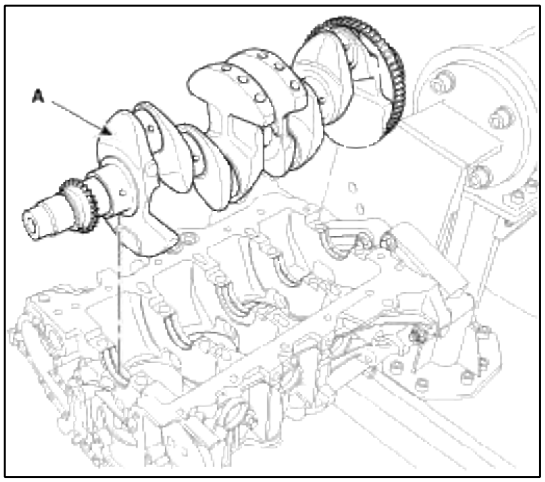


14. Check the connecting rod end play.
15. Remove the connecting rod caps and check oil clearance.
16. Remove the piston and connecting rod assemblies.
    (1) Using a ridge reamer, remove all the carbon from the top of the cylinder.
    (2) Push the piston, connecting rod assembly and upper bearing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

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

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

> NOTE
>
> Arrange the main bearings and thrust bearings in the correct order.



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

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

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

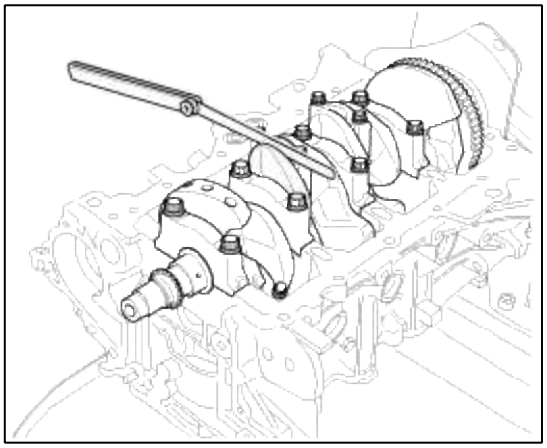
22. Remove the connecting rod from the piston.
    Using a press, remove the piston pin from piston.
    (Press-in load : 500 ~ 1,500kg(1,102 ~ 3,306lb))

Inspection

Connecting Rod And Crankshaft

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

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



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

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

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

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

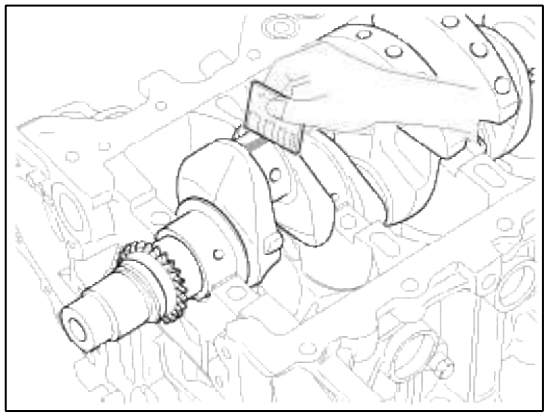
NOTE

Do not turn the crankshaft.

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

(8) Measure the plastigage at its widest point.

Standard oil clearance
0.032 ~ 0.052mm (0.0013 ~ 0.0020in)



(9) If the measurement from the plastigage is too wide or too narrow, remove the upper and lower bearing and then install a new bearings with the same color mark.
Recheck the oil clearance.

CAUTION

Do not file, shim, of scrape the bearings or the caps to adjust clearance.

(10) If the plastigage shows the clearance is still incorrect, try the next larger or smaller bearing.
Recheck the oil clearance.

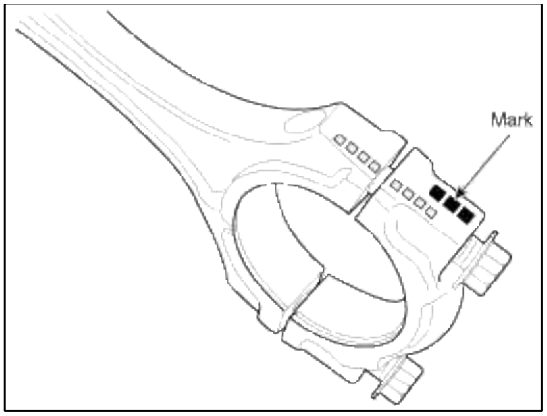
NOTE

If the proper clearance cannot be obtained by using the appropriate larger or smaller bearings, replace the crankshaft and restart over.

CAUTION

If the marks are indecipherable because of an accumulation of dirt and dust, do not scrub them with a wire brush or scraper. Clean them only with solvent or detergent.

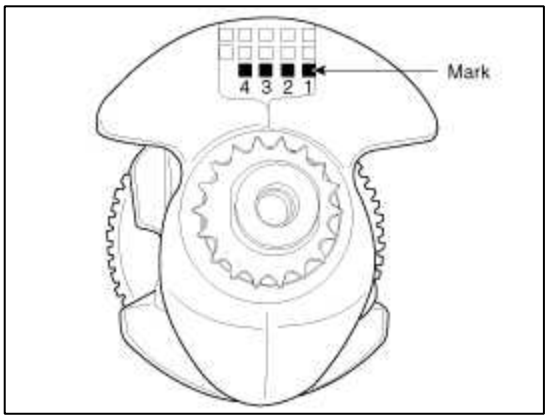
Connecting Rod Mark Location



Discrimination Of Connecting Rod

Mark	Connecting rod big-end inner diameter
A, 0	45.000 ~ 45.006mm (1.7717 ~ 1.7719in)
B, 00	45.006 ~ 45.012mm (1.7719 ~ 1.7721in)
C, 000	45.012 ~ 45.018mm (1.7721 ~ 1.7724in)

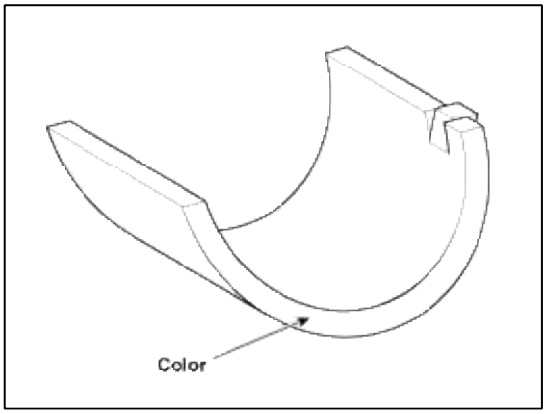
Crankshaft Pin Diameter Mark Location



Discrimination Of Crankshaft Pin Diameter

Mark	Crankshaft pin outer diameter
1	41.972 ~ 41.966mm (1.6524 ~ 1.6522in)
2	41.966 ~ 41.960mm (1.6522 ~ 1.6520in)
3	41.960 ~ 41.954mm (1.6520 ~ 1.6517in)

Connecting Rod Bearing Color Location



Discrimination Of Connecting Rod Bearing

Mark	Color	Connecting rod bearing thickness
A	Blue	1.514 ~ 1.517mm (0.0596 ~ 0.0597in)
B	Black	1.511 ~ 1.514mm (0.0595 ~ 0.0596in)
C	None	1.508 ~ 1.511mm (0.0594 ~ 0.0595in)
D	Green	1.505 ~ 1.508mm (0.0593 ~ 0.0594in)
E	Red	1.502 ~ 1.505mm (0.0591 ~ 0.0593in)

(11) Select the bearing by using selection table.

Connecting Rod Bearing Selection Table

		Connecting rod mark		
		A, 0	B, 00	C, 000
Crank shaft pin journal mark	1	E (Red)	D (Green)	C (None)
	2	D (Green)	C (None)	B (Black)
	3	C (None)	B (Black)	A (Blue)

3. Check the connecting rods.

(1) When reinstalling, make sure that cylinder numbers put on the connecting rod and cap at disassembly match. When a new connecting rod is installed, make sure that the notches for holding the bearing in place are on the same side.

(2) Replace the connecting rod if it is damaged on the thrust faces at either end. Also if step wear or a severely rough surface of the inside diameter of the small end is apparent, the rod must be replaced as well.

(3) Using a connecting rod aligning tool, check the rod for bend and twist. If the measured value is close to the repair limit, correct the rod by a press. Any connecting rod that has been severely bent or distorted should be replaced.

Allowable bend of connecting rod :
0.05mm / 100mm (0.0020in / 3.94in) or less
Allowable twist of connecting rod :
0.10mm / 100mm (0.0039in / 3.94in) or less

NOTE

When the connecting rods installed without bearings, there should be no difference on side surface.

4. Check the crankshaft bearing oil clearance.

(1) To check main bearing-to-journal oil clearance, remove the main bearing caps and lower bearings.

(2) Clean each main journal and lower bearing with a clean shop towel.

(3) Place one strip of plastigage across each main journal.

(4) Reinstall the lower bearings and caps, then tighten the bolts.

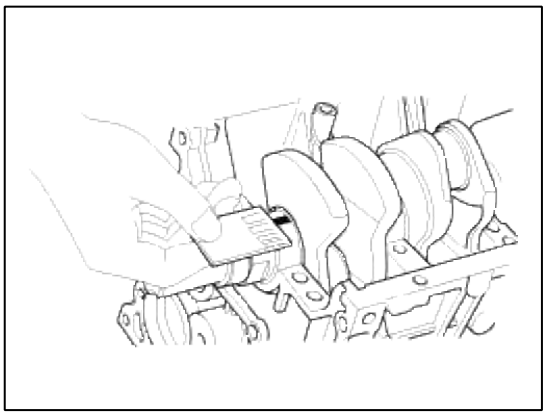
Tightening torque :
17.7~21.6Nm (1.8~2.2kgf.m, 13.0~15.9lb-ft) + 88~92°

NOTE

Do not turn the crankshaft.

(5) Remove the cap and lower bearing again, and measure the widest part of the plastigage.

Standard oil clearance :
No.1, 2, 3, 4, 5 : 0.021 ~ 0.042mm (0.0008 ~ 0.0017in)



(6) If the plastigage measures too wide or too narrow, remove the upper and lower bearing and then install a new bearings with the same color mark. (Refer to crankshaft main bearing selection table in this Group).
Recheck the oil clearance.

CAUTION

Do not file, shim, or scrape the bearings or the cap to adjust clearance.

(7) If the plastigage shows the clearance is still incorrect, try the next larger or smaller bearing. (Refer to crankshaft main bearing selection table in this Group).
Recheck the oil clearance.

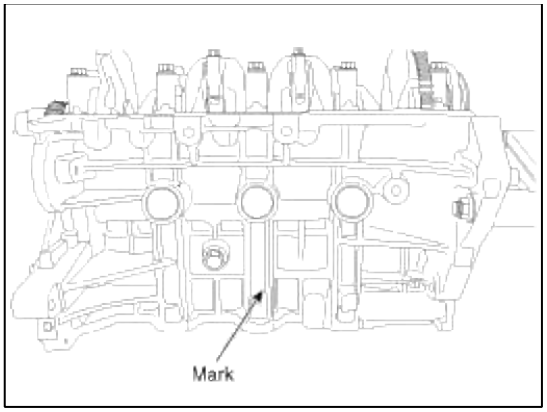
NOTE

If the proper clearance cannot be obtained by using the appropriate larger or smaller bearings, replace the crankshaft and start over.

CAUTION

If the marks are indecipherable because of an accumulation of dirt and dust, do not scrub them with a wire brush or scraper. Clean them only with solvent or detergent.

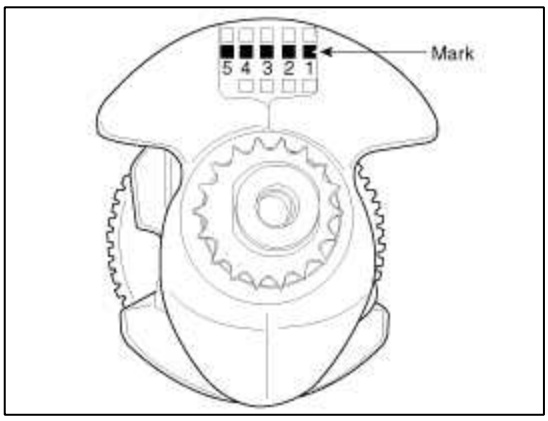
Cylinder block crankshaft journal bore mark location
Letters have been stamped on the side surface of the block as a mark for the size of each of the 5 main journal bores.
Use them, and the numbers or letters stamped on the crank (marks for main journal size), to choose the correct bearings.



Discrimination Of Cylinder Block Crankshaft Journal Bore

Mark	Cylinder block crankshaft journal bore inner diameter
A	52.000 ~ 52.006mm (2.0472 ~ 2.0475in)
B	52.006 ~ 52.012mm (2.0475 ~ 2.0477in)
C	52.012 ~ 52.018mm (2.0477 ~ 2.0479in)

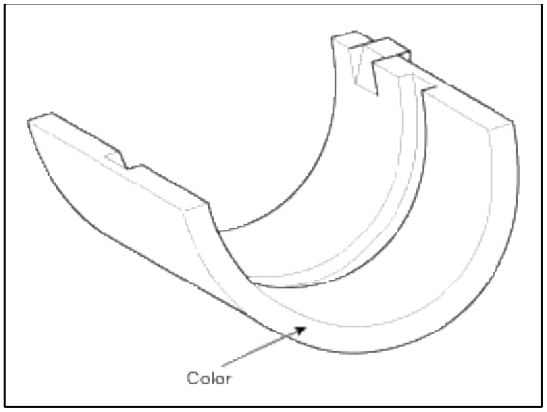
Crankshaft Main Journal Mark Location



Discrimination Of Crankshaft Main Journal

Mark	Crankshaft main journal outer diameter
1	47.960 ~ 47.954mm (1.8882 ~ 1.8879in)
2	47.954 ~ 47.948mm (1.8879 ~ 1.8877in)
3	47.948 ~ 47.942mm (1.8877 ~ 1.8875in)

Crankshaft Main Bearing Color Location



Discrimination Of Crankshaft Main Bearing

Mark	Color	Crankshaft main bearing thickness
		No.1, 2, 3, 4, 5
A	Blue	2.026 ~ 2.029mm (0.0798 ~ 0.0799in)
B	Black	2.023 ~ 2.026mm (0.0796 ~ 0.0798in)
C	None	2.020 ~ 2.023mm (0.0795 ~ 0.0796in)
D	Green	2.017 ~ 2.020mm (0.0794 ~ 0.0795in)
E	Red	2.014 ~ 2.017mm (0.0793 ~ 0.0794in)

(8) Select the bearing by using selection table.

Crankshaft Main Bearing Selection Table

		Cylinder block crankshaft journal bore mark		
		A	B	C
Crank shaft main journal mark	1	E (Red)	D (Green)	C (None)
	2	D (Green)	C (None)	B (Black)
	3	C (None)	B (Black)	A (Blue)

5. Check the crankshaft end play.
   Using a dial indicator, measure the thrust clearance while prying the crankshaft back and forth with a screwdriver.

End play
Standard: 0.05 ~ 0.25mm (0.0020 ~ 0.0098in)
Limit : 0.30mm (0.0118in)

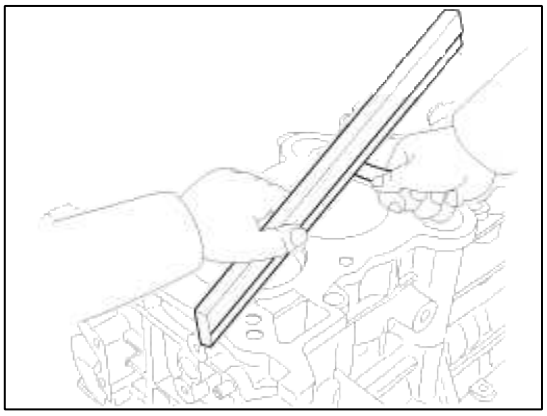
If the end play is greater than maximum, replace the center bearing.

Cylinder Block

1. Remove the gasket material.
   Using a gasket scraper, remove all the gasket material from the top surface of the cylinder block.
2. Clean the cylinder block
   Using a soft brush and solvent, thoroughly clean the cylinder block.

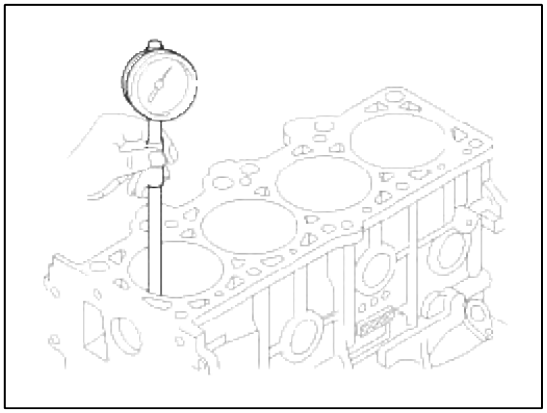
3. Inspect the top surface of cylinder block for flatness.
   Using a precision straight edge and feeler gauge, measure the surface contacting the cylinder head gasket for warpage.

Flatness of cylinder block gasket surface
Standard :
Less than 0.05mm (0.0020in) for total area
Less than 0.02mm (0.0008in) for a section of 100mm (3.9370in) X 100mm (3.9370in)

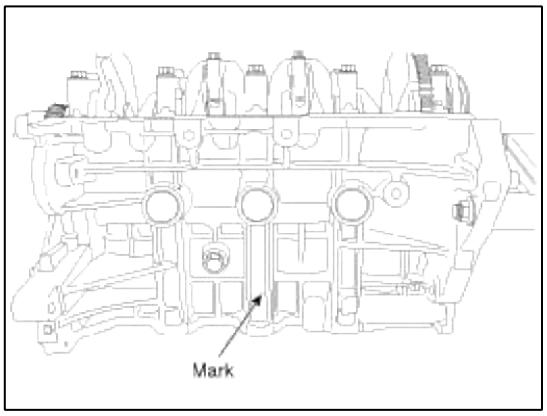


4. Inspect the cylinder bore.
   Visually check the cylinder for vertical scratchs.
   If deep scratchs are present, replace the cylinder block.
5. Inspect the cylinder bore diameter.
   Using a cylinder bore gauge, measure the cylinder bore diameter at position in the thrust and axial direction.

Standard diameter :
77.00 ~ 77.03mm (3.0315 ~ 3.0327in)



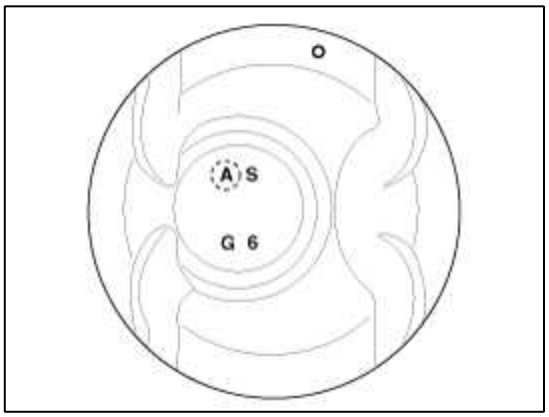
6. Check the cylinder bore size code on the cylinder block side surface.



Discrimination Of Cylinder Bore Size

Mark	Cylinder bore inner diameter
A	77.00 ~ 77.01mm (3.0315 ~ 3.0319in)
B	77.01 ~ 77.02mm (3.0319 ~ 3.0323in)
C	77.02 ~ 77.03mm (3.0323 ~ 3.0327in)

7. Check the piston size mark (A) on the piston top face.



A : Grade
S : ISG type
G : Gasoline engine
6 : 1.6L

Discrimination Of Piston Outer Diameter

Mark	Piston outer diameter
A	76.97 ~ 76.98mm (3.0303 ~ 3.0307in)
B	76.98 ~ 76.99mm (3.0307 ~ 3.0311in)
C	76.99 ~ 77.00mm (3.0311 ~ 3.0315in)

8. Select the piston related to cylinder bore class.

Piston -to-cylinder clearance :
0.02 ~ 0.04mm (0.0008 ~ 0.0016in)

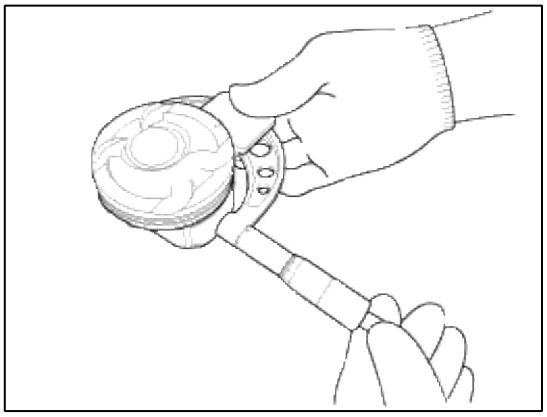
Piston And Piston Rings

1. Clean the piston.
   (1) Using a gasket scraper, remove the carbon from the piston top.
   (2) Using a groove cleaning tool or broken ring, clean the piston ring grooves.
   (3) Using solvent and a brush, thoroughly clean the piston.

   > NOTE
   >
   > Do not use a wire brush.

2. The standard measurement of the piston outside diameter is taken 12mm(0.4724in) from bottom land of the piston.

   Standard diameter :
   76.97 ~ 77.00mm (3.0303 ~ 3.0315in)

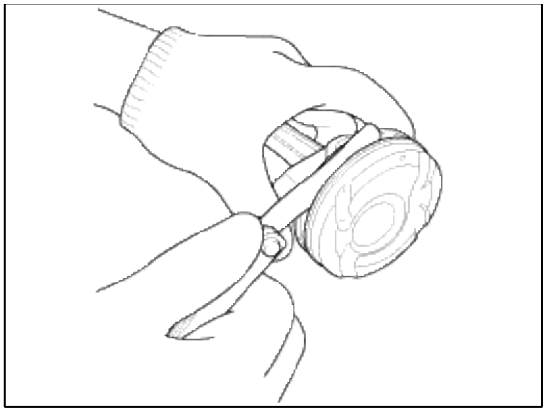


3. Calculate the difference between the cylinder bore inner diameter and the piston outer diameter.

   Piston-to-cylinder clearance :
   0.02 ~ 0.04mm (0.0008 ~ 0.0016in)

4. Inspect the piston ring side clearance.
   Using a feeler gauge, measure the clearance between new piston ring and the wall of ring groove.

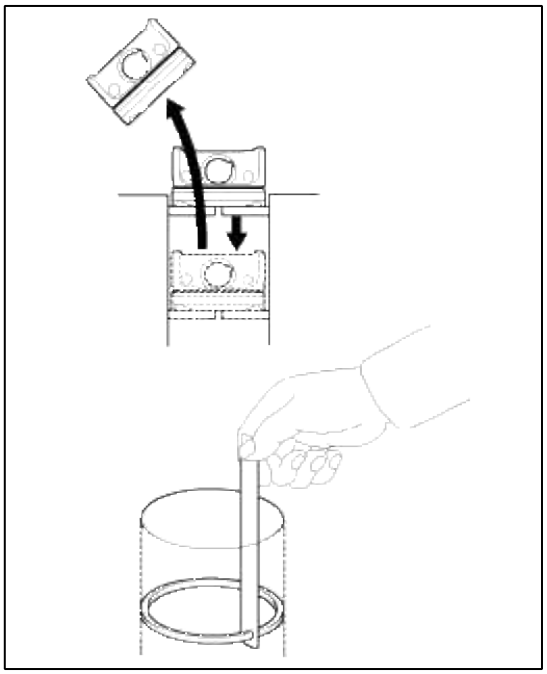
   Piston ring side clearance
   No.1 ring : 0.04 ~ 0.08mm (0.0016 ~ 0.0031in)
   No.2 ring : 0.04 ~ 0.08mm (0.0016 ~ 0.0031in)
   Oil ring : 0.02 ~ 0.06mm (0.0008 ~ 0.0024in)
   Limit
   No.1 ring : 0.1mm (0.0039in)
   No.2 ring : 0.1mm (0.0039in)
   Oil ring : 0.2mm (0.0079in)



If the clearance is greater than maximum, replace the piston.

5. Inspect the piston ring end gap.
   To measure the piston ring end gap, insert a piston ring into the cylinder bore. Position the ring at right angles to the cylinder wall by gently pressing it down with a piston. Measure the gap with a feeler gauge. If the gap exceeds the service limit, replace the piston rings. If the gap is too large, recheck the cylinder bore inner diameter. If the bore is over the service limit, the cylinder block must be rebored.

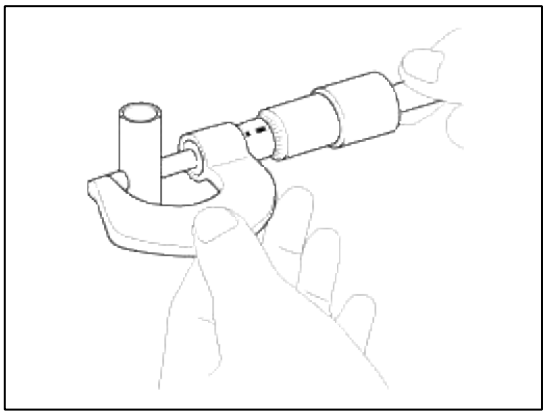
Piston ring end gap
Standard
No.1 ring : 0.14 ~ 0.28mm (0.0079 ~ 0.0138in)
No.2 ring : 0.30 ~ 0.45mm (0.0118 ~ 0.0177in)
Oil ring : 0.20 ~ 0.40mm(0.0079 ~ 0.0157in)
Limit
No.1 ring : 0.3mm(0.0118in)
No.2 ring : 0.5mm(0.0197in)
Oil ring : 0.8mm(0.0315in)



Piston Pins

1. Measure the outer diameter of piston pin

Piston pin diameter :
18.001 ~ 18.006mm (0.7087 ~ 0.7089in)



2. Measure the piston pin-to-piston clearance.

Piston pin-to-piston clearance :
0.010 ~ 0.020mm (0.0004 ~ 0.0008in)

3. Check the difference between the piston pin outer diameter and the connecting rod small end inner diameter.

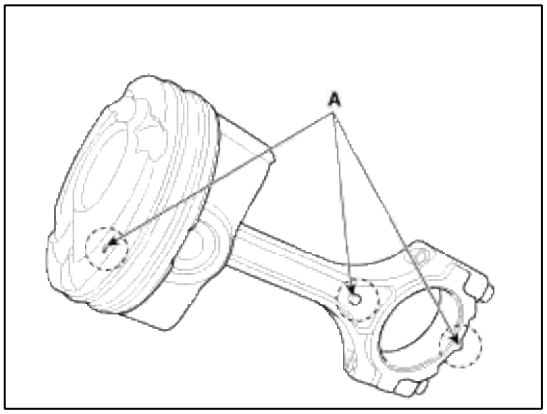
Piston pin-to-connecting rod interference :
-0.032 ~ -0.016mm (-0.0013 ~ -0.0006in)

Reassembly

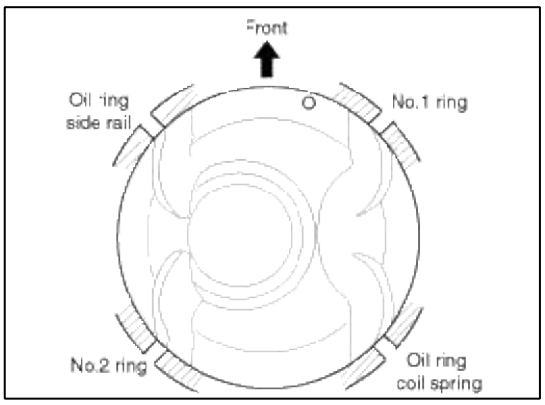
NOTE

- Thoroughly clean all parts to assembled.
- Before installing the parts, apply fresh engine oil to all sliding and rotating surfaces.
- Replace all gaskets, O-rings and oil seals with new parts.

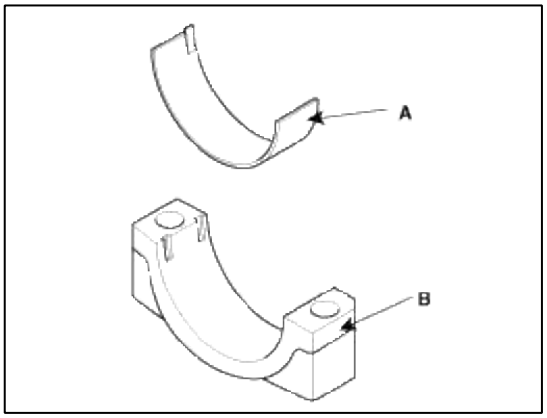
1. Assemble the piston and connecting rod.
   (1) Use a hydraulic press for installation
   (2) The piston front mark (A) and the connecting rod front mark (A) must face the timing chain side of the engine.



2. Install the piston rings.
   (1) Install the oil ring coil spring and 2 side rails by hand.
   (2) Using a piston ring expander, install the 2 compression rings with the code mark facing upward.
   (3) Position the piston rings so that the ring ends are as shown.



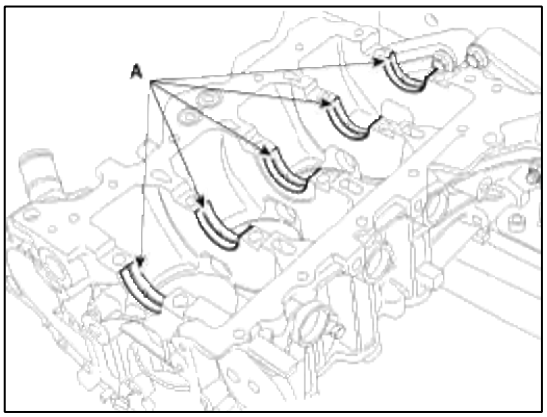
3. Install the connecting rod bearings.
   (1) Align the bearing (A) claw with the groove of the connecting rod or connecting rod cap (B).
   (2) Install the bearings (A) in the connecting rod and connecting rod cap (B).



4. Install the crankshaft main bearings.

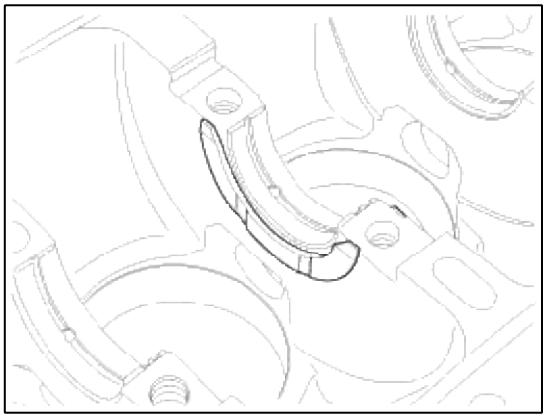
> NOTE
>
> Upper bearings have an oil groove of oil holes ; Lower bearings do not.

   (1) Align the bearing claw with the claw groove of the cylinder block, push in the five upper bearings(A).



   (2) Align the bearing claw with the claw groove of the main bearing cap, and push in the 5 lower bearings.

5. Install the thrust bearing.
   Install the thrust bearing (A) on the No.3 journal position of the cylinder block with the oil grooves facing outward.



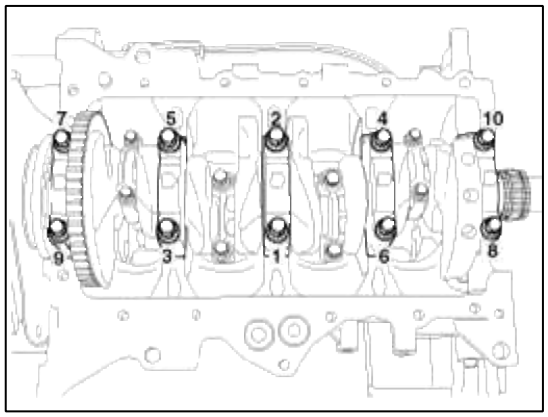
6. Place the crankshaft on the cylinder block.
7. Place the main bearing caps on the cylinder block.
8. Install the main bearing cap bolts.

> NOTE
>
> The main bearing cap bolts are tightened in 2 progressive steps.
> If any of the bearing cap bolts in broken or deformed, replace it.

(1) Apply a light coat of engine oil on the threads and under the bearing cap bolts.

(2) Install and uniformly tighten the 10 bearing cap bolts, in several passes, in the sequence shown.

Tightening torque :
17.7~21.6Nm (1.8~2.2kgf.m, 13.0~15.9lb-ft) + 88~92°



> CAUTION
>
> Do not reuse the main bearing cap bolts.

(3) Check that the crankshaft turns smoothly.

9. Check the crankshaft end play.

10. Install the piston and connecting rod assemblies.

NOTE

Before installing the piston, apply a coat of engine oil to the ring grooves and cylinder bores.

(1) Install the ring compressor, check that the rings are securely in place, then position the piston in the cylinder, and tap it in using the wooden handle of a hammer.

(2) Stop after the ring compressor pops free, and check the connecting rod-to-crank journal alignment before pushing the piston into place.

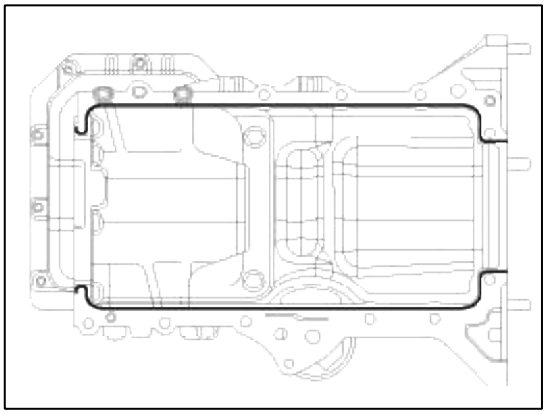
(3) Install the rod caps with bearings, and tighten the bolts.

Tightening torque :
17.7~21.8Nm (1.8~2.2kgf.m, 13.0~15.9lb-ft) + 88~92°

CAUTION

Do not reuse the connecting rod cap bolts.

11. Apply the sealant on the ladder frame.

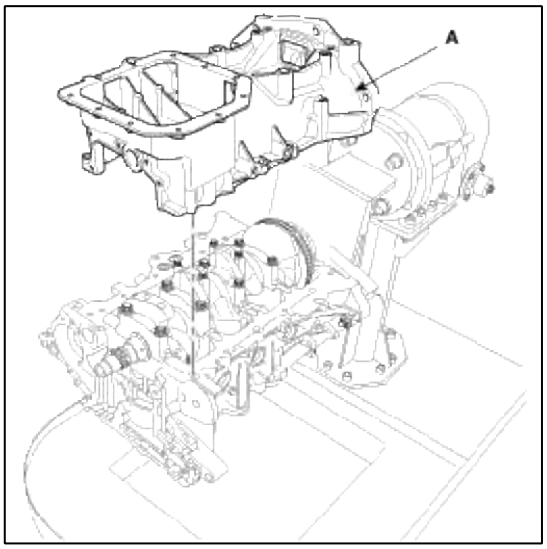


NOTE

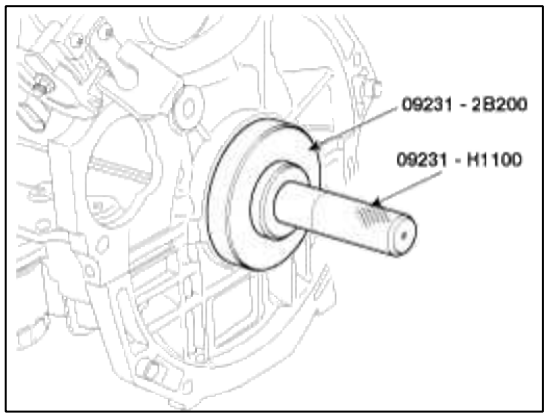
- Apply the sealant, THREE-BOND 1217H or LOCTITE 5900H on the ladder frame rail portion and install it with in five minutes.
  If when sealant is applied to cylinder block bottom position, sealant position to be same with positon that is applied to ladder frame rail position.
- Apply sealant along the inner line of the bolt holes.

12. Install the ladder frame (A).

Tightening torque :
18.6 ~ 24.2N.m (1.9 ~ 2.4kgf.m, 13.7 ~ 17.4lb-ft)

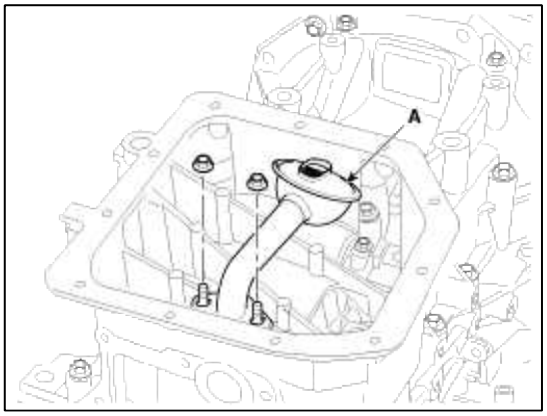


13. Install the rear oil seal.
    (1) Apply engine oil to a new oil seal lip.
    (2) Using the SST(09231-H1100, 09231-2B200) and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.



14. Install the oil screen (A).
    Install a new gasket and oil screen with 2 bolts.

Tightening torque :
19.6 ~ 26.5N.m (2.0 ~ 2.7kgf.m, 14.5 ~ 19.5lb-ft)



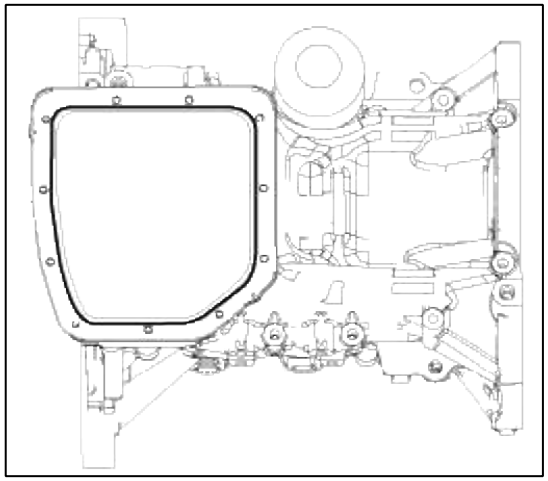
15. Install the oil pan.

(1) Using a razor blade and gasket scraper, remove all the old packing material from the gasket surfaces.

> NOTE
>
> Check that the mating surfaces are clean and dry before applying liquid gasket.

(2) Apply liquid gasket with the width of Ø3mm, starting 1mm-away position from the inner rounding of the oil pan rail.

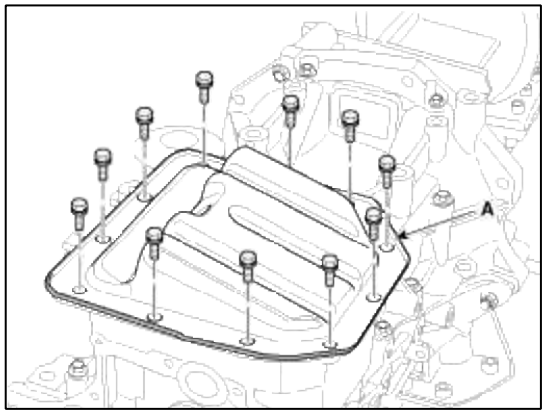
Liquid gasket : TB 1217H or LOCTITE 5900H



> NOTE
>
> - To prevent leakage of oil, apply liquid gasket to the inner threads of the bolt holes.
> - Do not install the parts if five minutes or more have elapsed since applying the liquid gasket. Instead, reapply liquid gasket after removing the residue.
> - After assembly, wait at least 30 minutes before filling the engine with oil.

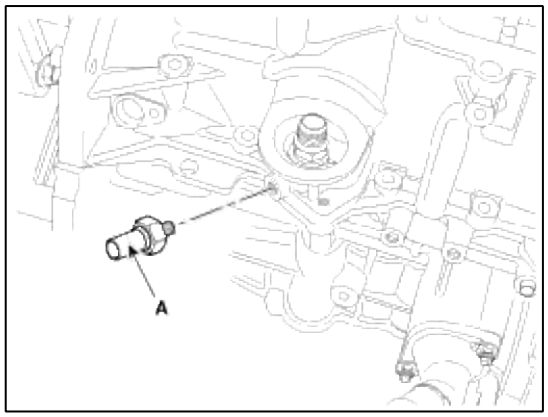
(3) Install the oil pan (A) with the bolts.
Uniformly tighten the bolts in several passes.

Tightening torque :
9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)



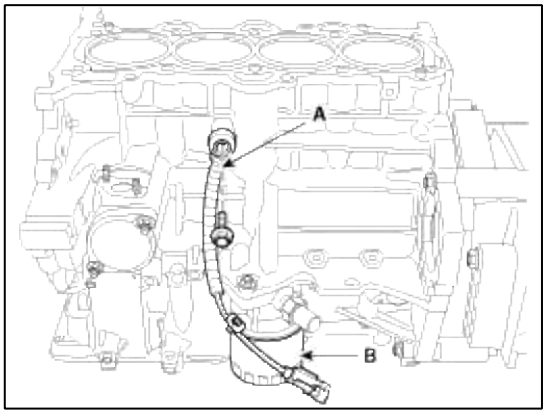
16. Install the oil pressure switch.
    (1) Apply adhesive to 2 or 3 threads.
    (2) Install the oil pressure switch (A).

Tightening torque :
7.8 ~ 11.8N.m (0.8 ~ 1.2kgf.m, 5.8 ~ 8.7lb-ft)



17. Install the knock sensor (A) and the oil filter (B).

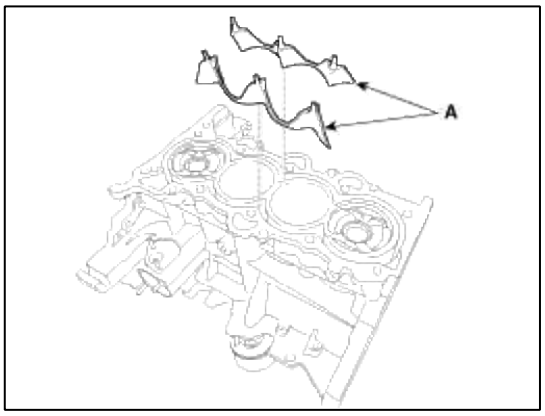
Tightening torque :
16.7 ~ 26.5N.m (1.7 ~ 2.7kgf.m, 12.3 ~ 19.5lb-ft)



18. Install the oil level gauge tube.
    (1) Install a new O-ring on the oil level gauge tube.
    (2) Apply engine oil on the O-ring.
    (3) Install the oil level gauge tube with the bolt.

Tightening torque :
9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)

19. Install the water jacket insert (A).

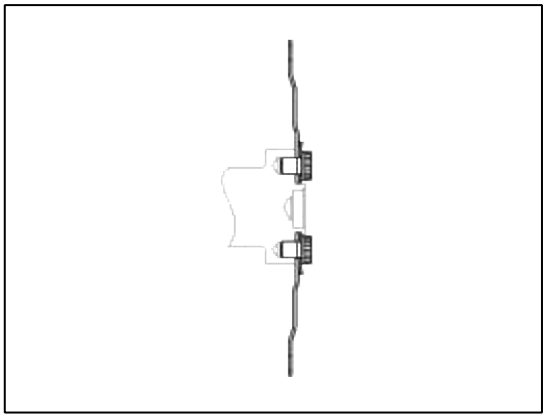


CAUTION

Maximum height of installed water jacket insert must be below top surface of cylinder block.

20. Install the cylinder head. (Refer to Cylinder head in this group)
21. Install the timing chain. (Refer to Timing chain in this group)
22. Remove the engine stand.
23. A/T :install the drive plate.

Tightening torque :
71.6 ~ 75.5N.m (7.3 ~ 7.7kgf.m, 52.8 ~ 55.7lb-ft)



24. M/T :install the fly wheel.

Tightening torque :
71.6 ~ 75.5N.m (7.3 ~ 7.7kgf.m, 52.8 ~ 55.7lb-ft)

25. Install the engine. (Refer to Engine and transaxle assembly in this group)

Engine Mechanical System > Cooling System > Coolant > Repair procedures

Refilling And Bleeding

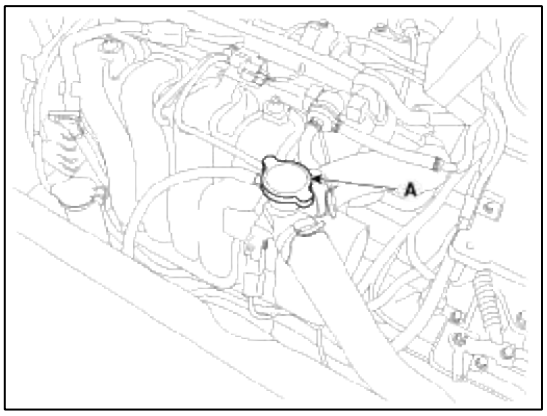
WARNING

Never remove the radiator cap when the engine is hot. Serious scalding could be caused by hot fluid under high pressure escaping from the radiator.

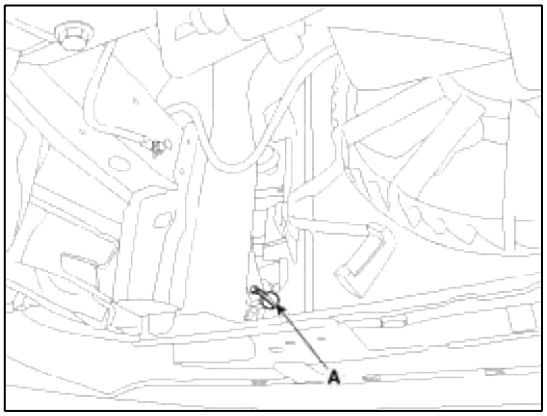
CAUTION

When pouring engine coolant, be sure to shut the relay box lid and not to let coolant spill on the electrical parts or the paint. If any coolant spills, rinse it off immediately.

1. Make sure the engine and radiator are cool to the touch.
2. Remove radiator cap (A).



3. Loosen the drain plug (A), and drain the coolant.



4. Tighten the radiator drain plug securely.
5. After draining engine coolant in the reservoir tank, clean the tank.
6. Fill the radiator with water through the radiator cap and tighten the cap.

NOTE

To most effectively bleed the air, pour the water slowly and press on the upper/lower radiator hoses.

7. Start the engine and allow to come to normal operating temperature. Wait for the cooling fans to turn on several times. Accelerate the engine to aid in purging trapped air. Shut engine off.
8. Wait until the engine is cool.
9. Repeat steps 1 to 8 until the drained water runs clear.

10. Fill fluid mixture with coolant and water (55~60%) (except for North America, Europe and China : 45~50%) slowly through the radiator cap. Push the upper/lower hoses of the radiator so as bleed air easily.

> NOTE
>
> • Use only genuine antifreeze/coolant.
> • For best corrosion protection, the coolant concentration must be maintained year-round at 55% (except for North America, Europe and China : 45%) minimum.
> Coolant concentrations less than 55% (except for North America, Europe and China : 45%) may not provide sufficient protection against corrosion or freezing.
> • Coolant concentrations greater then 60% will impair cooling efficiency and are not recommended.

> CAUTION
>
> • Do not mix different brands of antifreeze/coolants.
> • Do not use additional rust inhibitors or antirust products; they may not be compatible with the coolant.

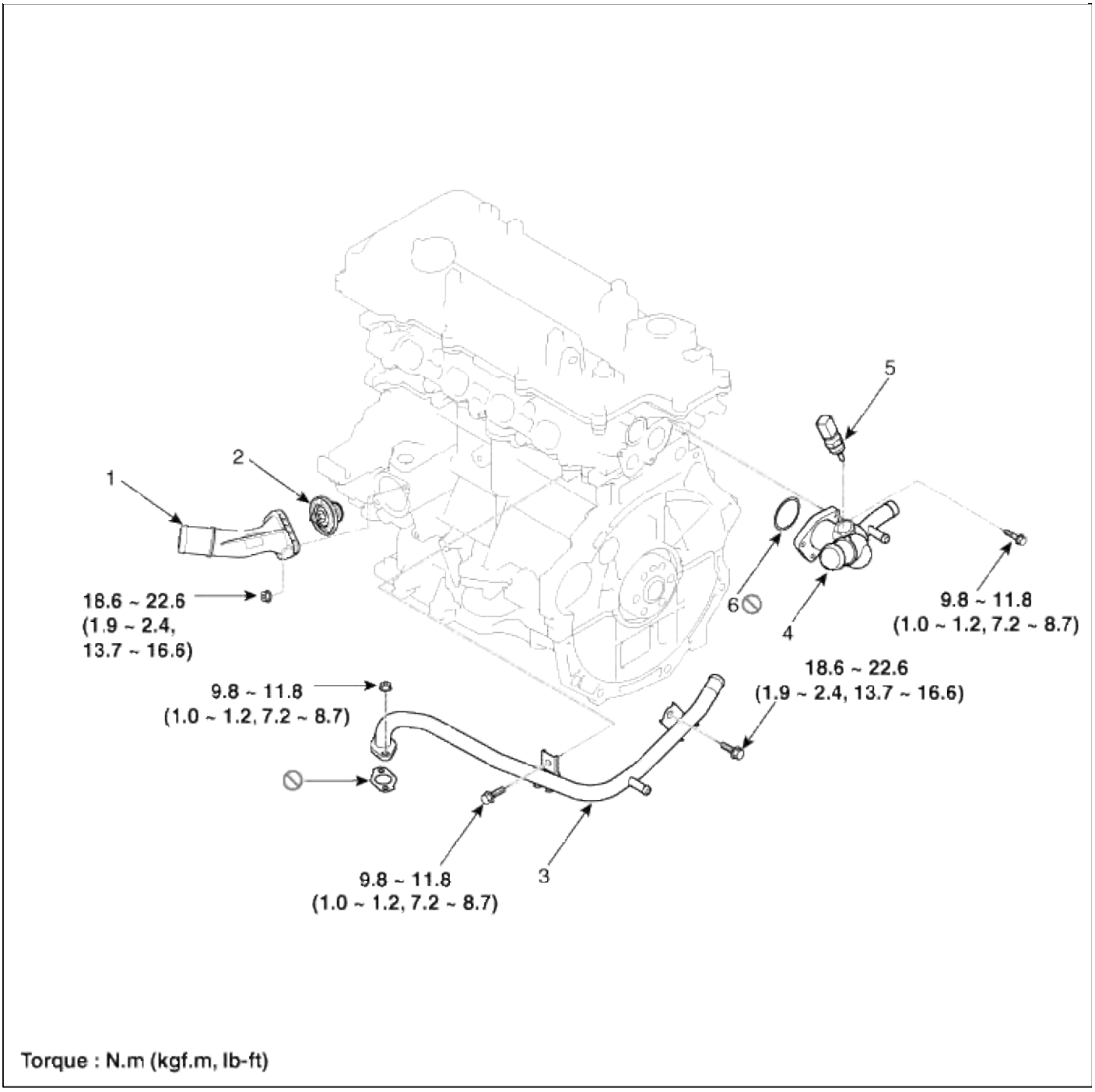
11. Start the engine and run until coolant circulates.
When the cooling fan operates and coolant circulates, refill coolant through the radiator cap.
12. Repeat 11 until the cooling fan 3 ~ 5 times and bleed air sufficiently out of the cooling system.
13. Install the radiator cap and fill the reservoir tank to the "MAX" (or "F") line with coolant.
14. Run the vehicle under idle until the cooling fan operates 2 ~ 3 times.
15. Stop the engine and wait coolant gets cool.
16. Repeat 10 to 15 until the coolant level doesn't fall any more, bleed air out of the cooling system.

> NOTE
>
> It takes time to bleed out all the air in the cooling system. Refill coolant when coolant gets cool completely, when recheck the coolant level in the reservoir tank for 2~3 days after replacing coolant.

Coolant capacity :
MT : 5.0L (1.32 U.S.gal., 5.28 U,S,qt., 4.40lmp.qt)
AT : 5.2L (1.37 U.S.gal., 5.49 U,S,qt., 4.57lmp.qt)

Engine Mechanical System > Cooling System > Thermostat > Components and Components Location

Components



1. Water inlet fitting 2. Thermostat 3. Heater pipe	4. Water temp control assembly 5. Water temperature sensor 6. Gasket

Engine Mechanical System > Cooling System > Thermostat > Repair procedures

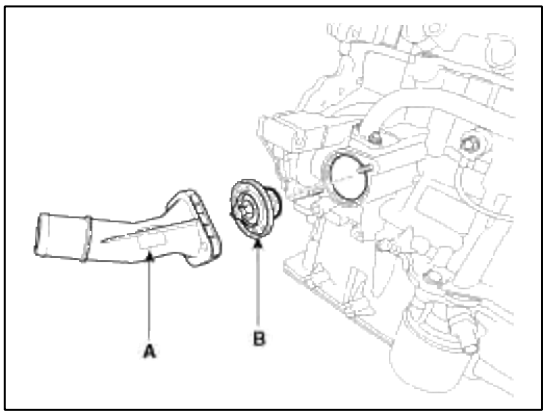
Removal

NOTE

Disassembly of the thermostat would have an adverse effect, causing a lowering of cooling efficiency.

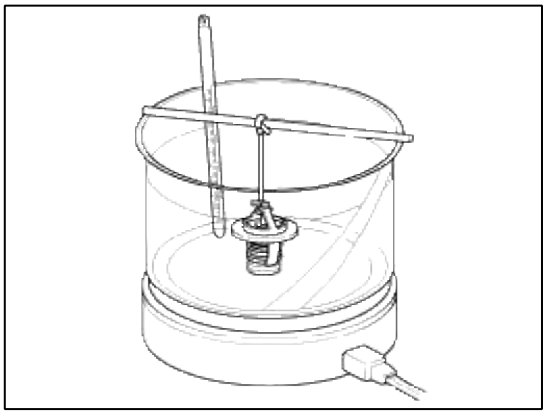
1. Drain engine coolant so that its level would be under the thermostat height.
2. Remove the radiator lower hose.

3. Remove the water inlet fitting (A) and thermostat (B).



Inspection

1. Immerse the thermostat in water and gradually heat the water.



2. Check the valve opening temperature.

Valve opening temperature : 82±1.5°C (179.6±2.7°F)
Full opening temperature : 95°C (203°F)

If the valve opening temperature is not as specified, replace the thermostat.

3. Check the valve lift.

Valve lift : 8mm(0.3in) or more at 95°C (203°F)

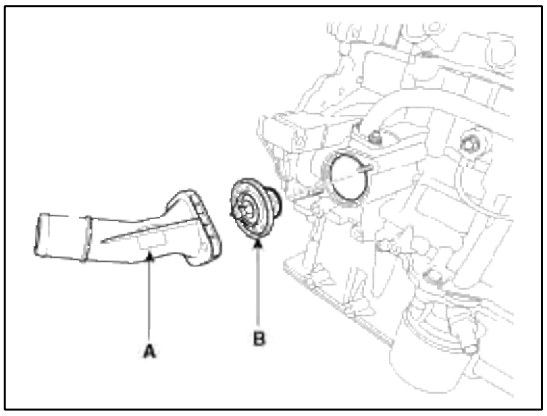
If the valve lift is not as specified, replace the thermostat.

Installation

1. Place the thermostat in the block.
   Install the thermostat (B) with the jiggle valve upward.

2. Install the water inlet fitting (A).

Tightening torque :
18.6 ~ 23.5N.m (1.9 ~ 2.4kgf.m, 13.7 ~ 17.4lb-ft)



3. Fill with engine coolant.
4. Start engine and check for leaks.

Engine Mechanical System > Cooling System > Thermostat > Troubleshooting

Troubleshooting

Symptoms		Possible Causes		Remedy
Coolant leakage	• From the thermostat gasket	Check the mounting bolts	• Check the torque of the mounting bolts	• Retighten the bolts and check leakage again.
		Check the gasket for damage	• Check gasket or seal for damage	• Replace gaskets and reuse the thermostat.
Cooled excessively	• Low heater performance (cool air blowed-out) • Thermogauge indicates 'LOW'	Visually check after removing the radiator cap.	• Insufficient coolant or leakage.	• After refilling coolant, recheck.
		GDS check&Starting engine	• Check DTCs • Check connection of the fan clutch or the fan motor. If the fan clutch is always connected, there will be a noise at idle.	• Check the engine coolant sensor, wiring and connectors. • Replace the componants.
		Remove the thermostat and inspect	• Check if there are dusts or chips in the thermostat valve. • Check adherence of the thermostat.	• Clean the thermostat valve and reuse the thermostat. • Replace the thermostat, if it doesn't work properly.

Heated excessively	• Engine overheated • Thermogauge indicates 'HI'	Visually check after removing the radiator cap.	• Insufficient coolant or leakage. Be careful when removing a radiator cap of the overheated vehicle. • Check air in cooling system.	• After refilling coolant, recheck. • Check the cylinder head gaskets for damage and the tightening torque of the mounting bolts.
		GDS check&Starting engine	• Check DTCs • Check the fan motor performance as temperature varies. • Check if the fan clutch slips. • Check the water pump adherence or impeller damaged.	• Check the engine coolant sensor, wiring and connectors. • Check the fan motor, the relay and the connector. • Replace the fan clutch, if it doesn't work properly. • Replace the water pump, if it doesn't work properly.
		Immerse the thermostat in boiling water and inspection.	• After removing the thermostat, check it works properly. Check the thermostat opens at the valve opening temperature.	• Replace the thermostat, if it doesn't work properly.

Engine Mechanical System > Cooling System > Water pump > Repair procedures

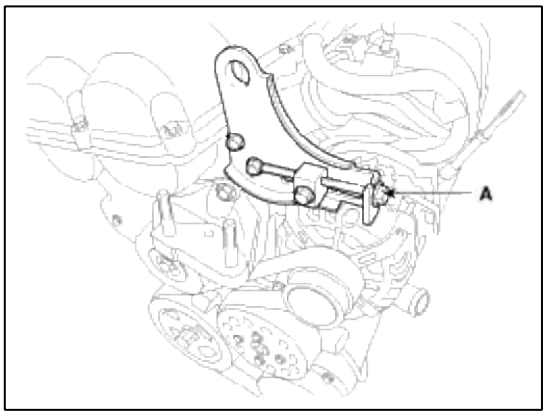
Removal and Installation

Water Pump

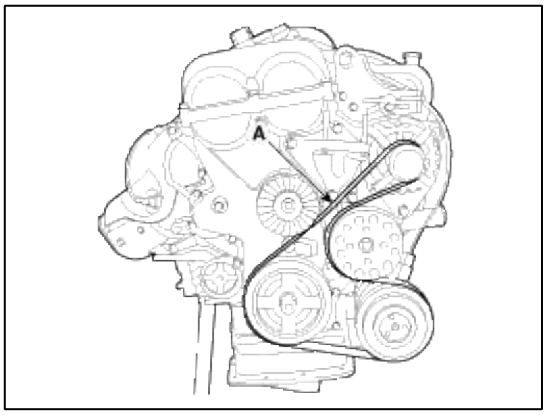
1. Drain engine coolant.

> WARNING
>
> System is under high pressure when the engine is hot.
> To avoid danger of releasing scalding engine coolant, remove the cap only when the engine is cool.

2. Loosen the alternator tension adjusting bolt (A) to loosen tension.

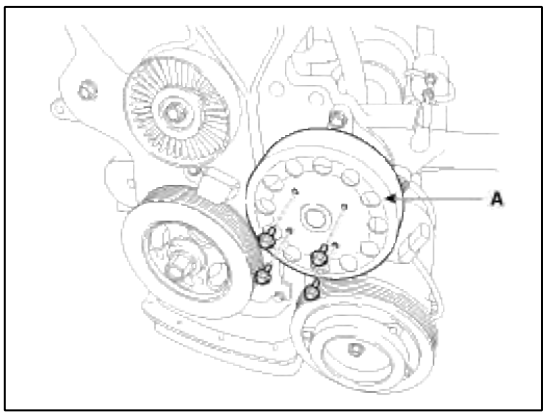


3. Remove the drive belt (A).



4. Remove the water pump pulley (A).

Tightening torque :
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)

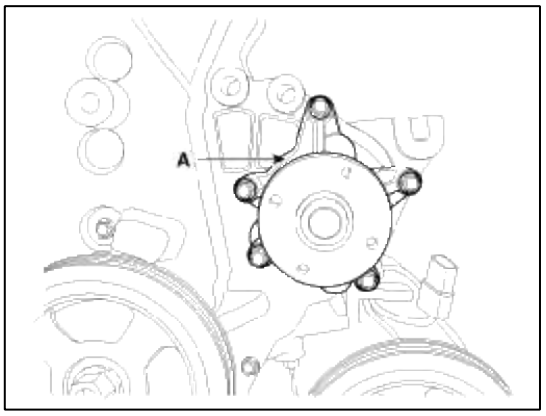


CAUTION

Tighten the bolts diagonally when installing.

5. Remove the water pump (A).

Tightening torque :
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)



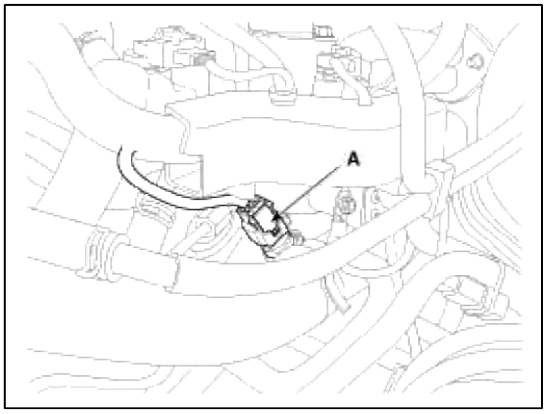
NOTE

Install the water pump with a new gasket.

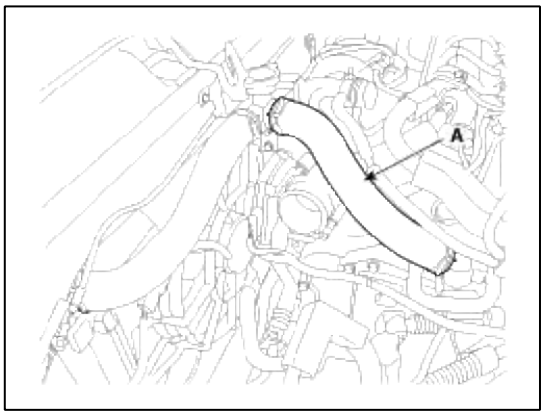
6. To install, reverse the removal orders.
7. Fill with engine coolant.
8. Start engine and check for leaks.
9. Recheck engine coolant level.

Water Temperature Control Assembly

1. Drain engine coolant.
2. Disconnect the battery negative terminal.
3. Remove the air duct and air cleaner assembly. (Refer to Engine and transaxle assembly)
4. Disconnect the engine coolant temperature sensor connector (A).

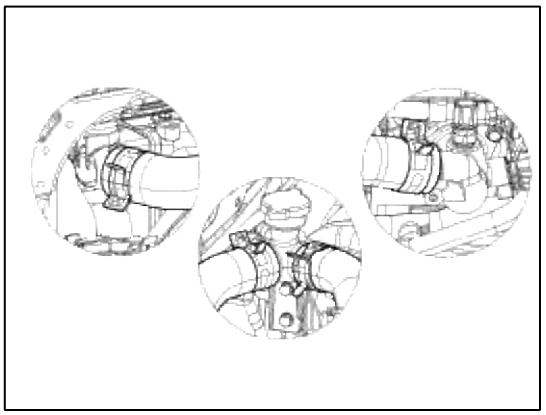


5. Disconnect the radiator upper hose (A).

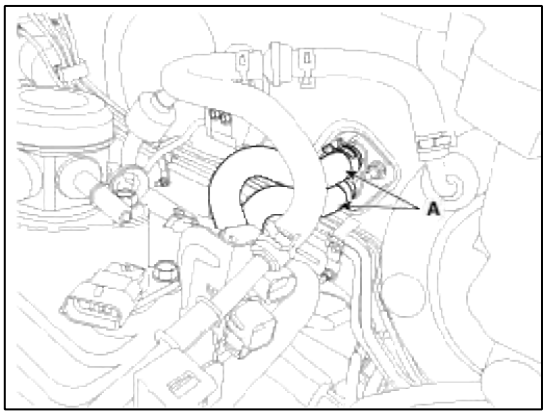


NOTE

Install the radiator hoses as shown illustrations.

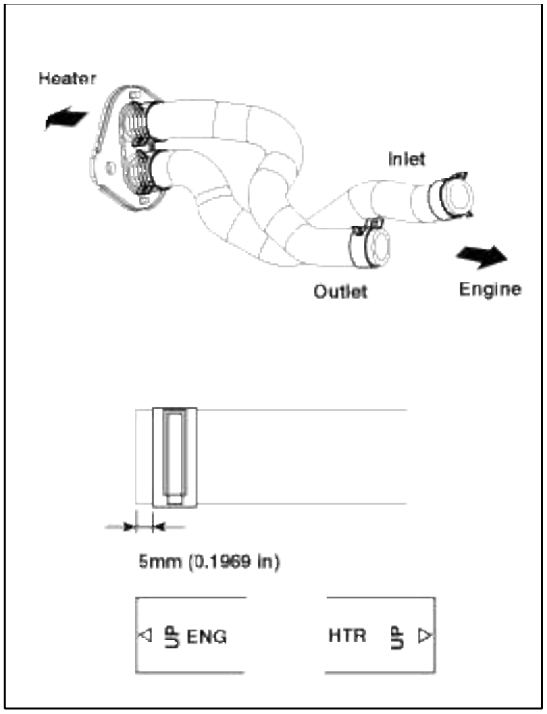


6. Disconnect the heater hoses (A).



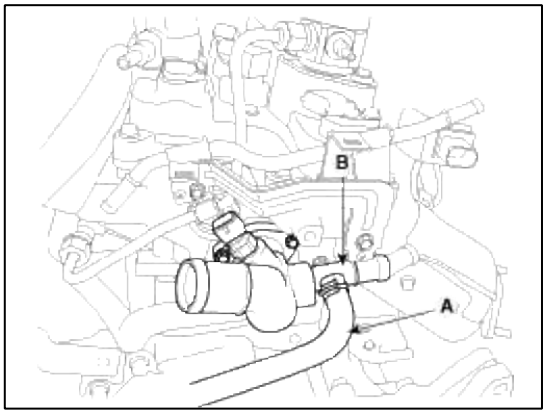
NOTE

Install the heater hoses as shown illustrations.



7. Remove the water temperature control assembly (B) after disconnecting the throttle body cooling hose (A).

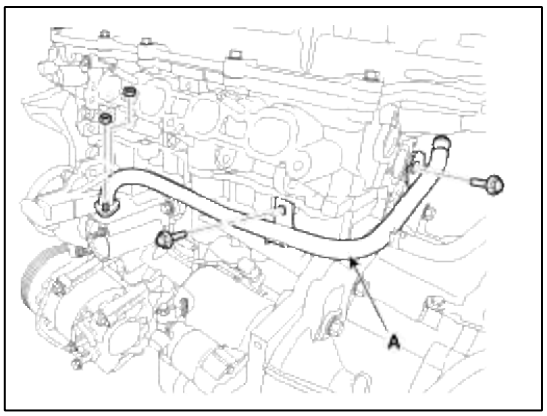
Tightening torque :
9.8 ~ 11.7N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)



8. Remove the intake manifold. (Refer to Intake and exhaust system)

9. Remove the heater pipe (A).

Tightening torque
M6 bolt and nuts :
9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)
M8 bolt :
18.6 ~ 23.5N.m (1.9 ~ 2.4kgf.m, 13.7 ~ 17.4lb-ft)



10. To install, reverse the removal orders.

CAUTION

Clean the surface of the water temperature control assembly before installing.

Inspection

1. Check each part for cracks, damage or wear, and replace the coolant pump assembly if necessary.
2. Check the bearing for damage, abnormal noise and sluggish rotation, and replace the coolant pump assembly if necessary.
3. Check for coolant leakage. If coolant leaks from hole, the seal is defective. Replace the coolant pump assembly and gasket.

NOTE

A small amount of "weeping" from the bleed hole is normal.

Engine Mechanical System > Cooling System > Water pump > Troubleshooting

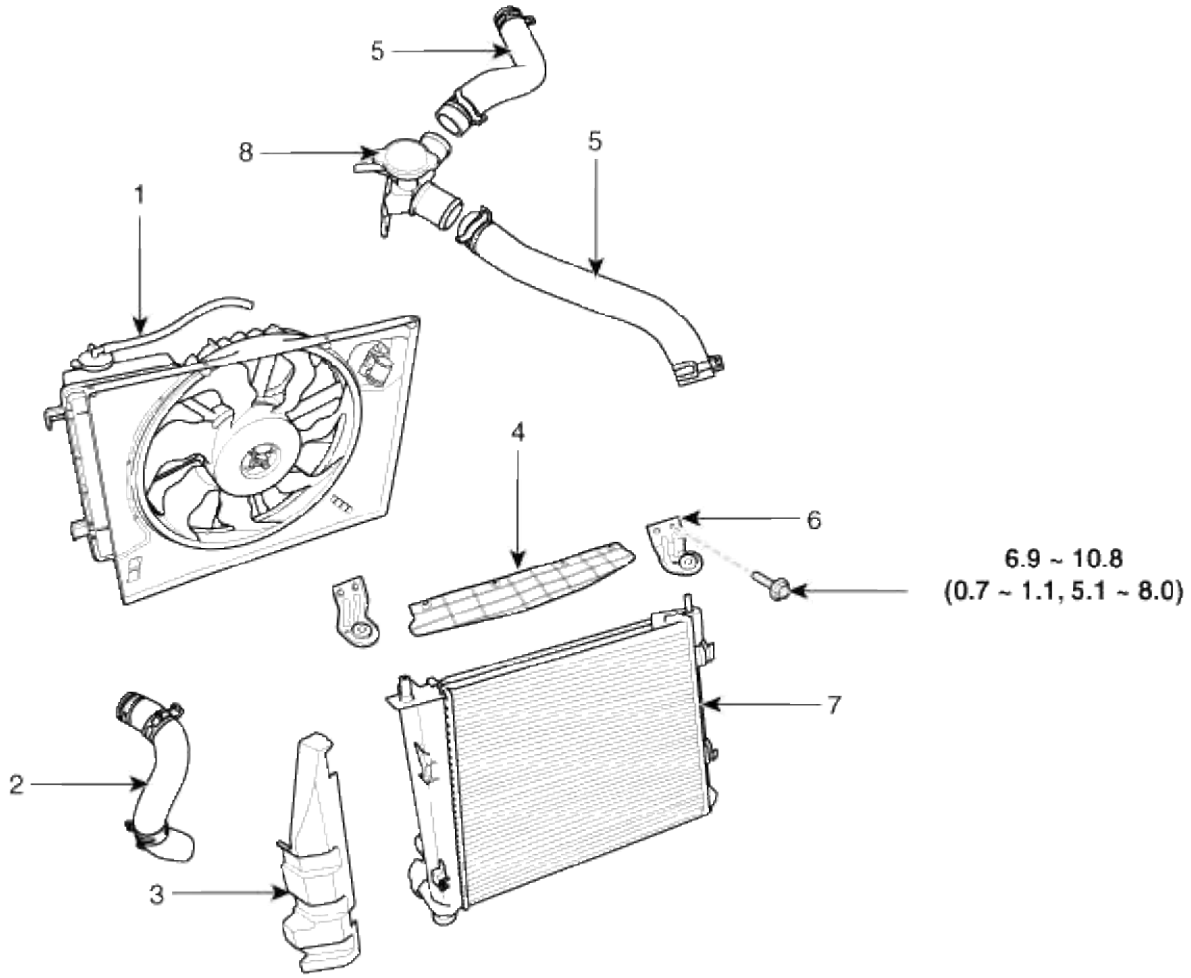
Troubleshooting

Water Pump

Symptoms		Possible Causes		Remedy
Coolant leakage	• From the bleed hole of the water pump	Visually check	• Check leaks after about ten-minute warming up.	• If coolant still leaks, replace a water pump.
				• If leakage stops, reuse the water pump (Do not replace the pump with a new one).
	• From gaskets or bolts		• Check the tightening of the water pump mounting bolts.	• Retighten the mounting bolts.
			• Check damage of gaskets or inflow of dust.	• Replace the gasket and clean dust off.
	• From outer surface of water pump		• Check the material or any cracks of the water pump.	• Poor material. If any crack found, replace the water pump.
Noise	• From bearings • From mechanical seals • Impeller interference	Inspection with a stethoscope	• After starting the engine, check noise with a stethoscope.	• If there is no noise, reuse the water pump(do not replace it).
				• If there is any noise from the water pump, remove the drive belt and recheck.
		Inspection after removing a drive belt	• After removing a water pump and a drive belt, check noise again.	• If there is noise, reuse the water pump. Check other drive line parts.
				• If there is no noise, replace the water pump with a new one.
		Inspection after removing a water pump	• After removing a water pump and a drive belt, check noise again.	• If there is any interference between them, replace the water pump with a new one.
Overheating	• Damaged impeller • Loosened impeller	Loosened impeller	• Corrosion of the impeller wing	• Check engine coolant. • Poor coolant quality / Maintenance check
			• Impeller seperation from the shaft	• Replace the water pump.

Engine Mechanical System > Cooling System > Radiator > Components and Components Location

Components



Torque : N.m (kgf.m, lb-ft)

1. Cooling fan & reservoir tank assembly 2. Radiator lower hose 3. Air guard 4. Upper cover 5. Radiator upper hose	6. Filler neck 7. Radiator mounting bracket 8. Radiator assembly 9. Mounting insulator

Engine Mechanical System > Cooling System > Radiator > Repair procedures

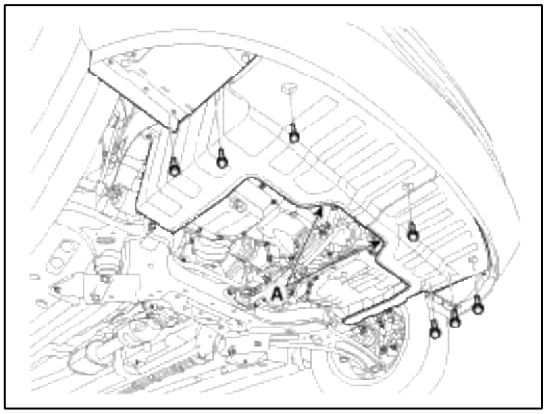
Removal and Installation

1. Disconnect the battery negative terminal.

Tightening torque
(-) terminal (without battery sensor):
7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)
(-) terminal (with battery sensor):
4.0 ~ 6.0N.m (0.4 ~ 0.6kgf.m, 3.0 ~ 4.4lb-ft)

2. Remove the air cleaner assembly. (Refer to Intake and exhaust system in this group)
3. Remove the under covers (A).

Tightening torque:
6.9 ~ 10.8 N.m (0.7 ~ 1.1 kgf.m, 5.1 ~ 8.0 lb-ft)

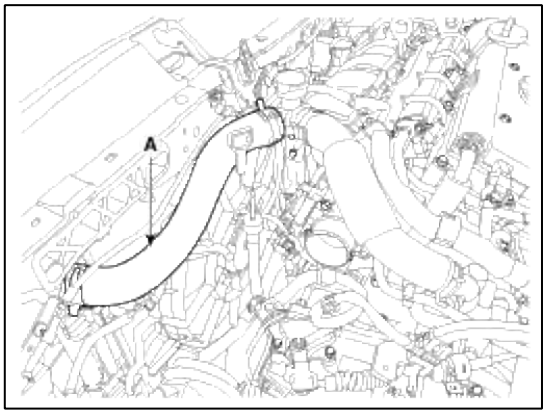


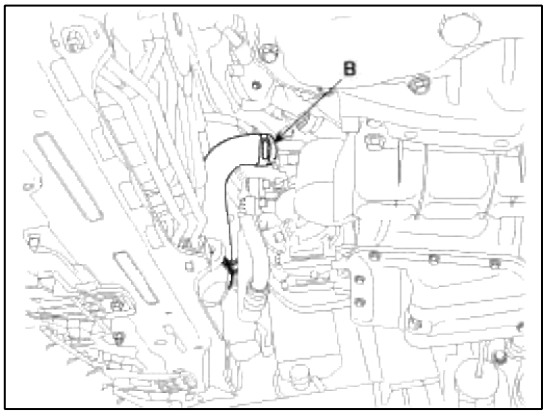
4. Loosen the drain plug and drain the coolant. Open the radiator cap to make rapid draining.

WARNING

Never remove the radiator cap when the engine is hot. Serious scalding could be caused by hot fluid under high pressure escaping from the radiator.

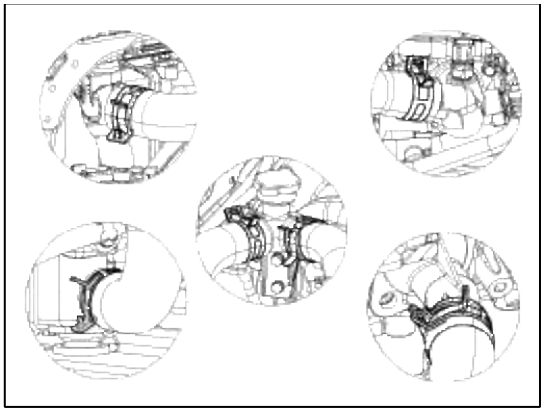
5. Remove the radiator upper hose (A) and lower hose (B).



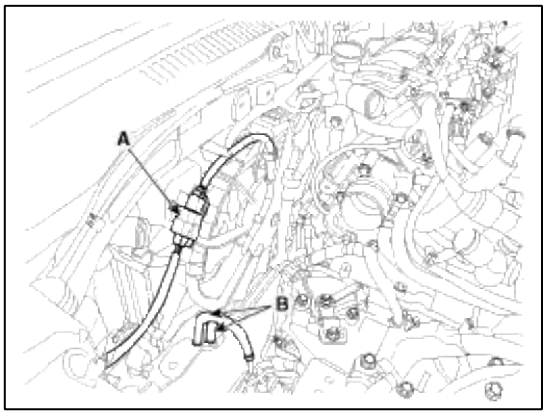


NOTE

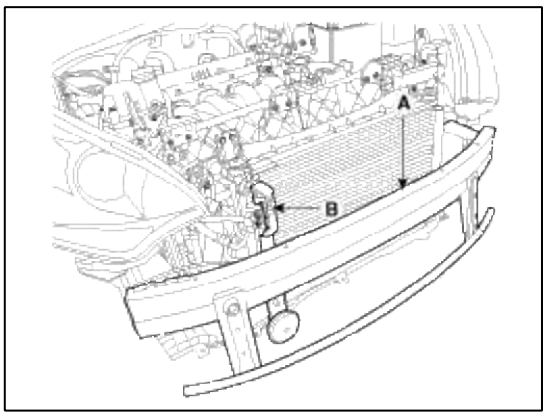
Install the radiator hoses as shown illustrations.



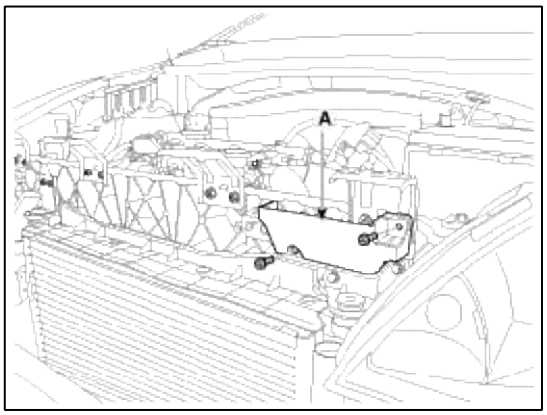
6. Disconnect the fan connector (A) and the ATF cooler hoses (B)(A/T only). (Refer to AT group)



7. Remove the front bumper. (Refer to BD group)
8. Remove the rail (A) and the air guard (B).

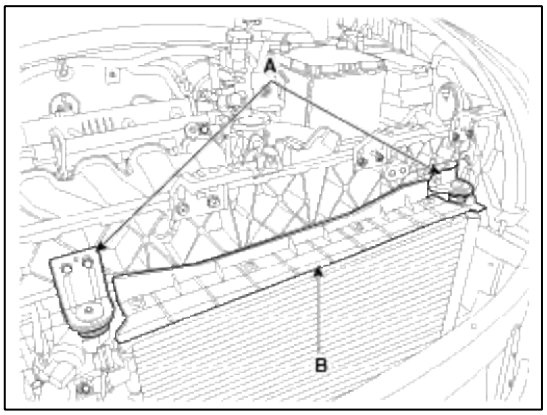


9. Remove the cover (A).

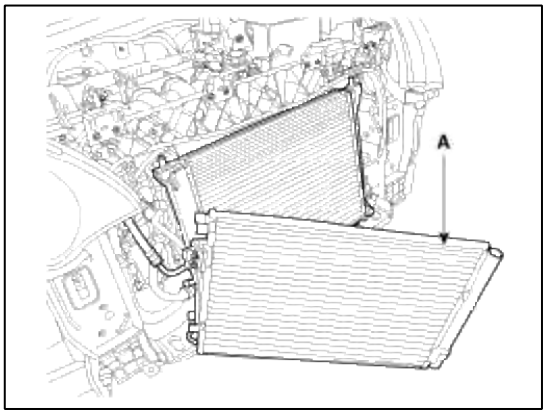


10. Remove the upper cover (A) and the radiator mounting brackets (B).

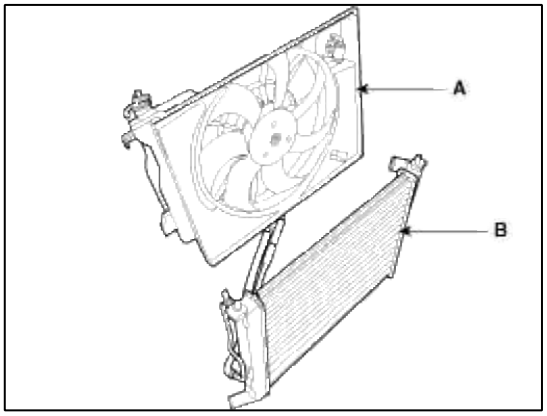
Tightening torque :
6.9 ~ 10.8N.m (0.7 ~ 1.1kgf.m, 5.1 ~ 8.0lb-ft)



11. Remove the A/C condenser (A) from the radiator assembly and then lift up the radiator assembly (B).



12. Remove the cooling fan (A) from the radiator (B).



13. Installation is reverse order of removal.

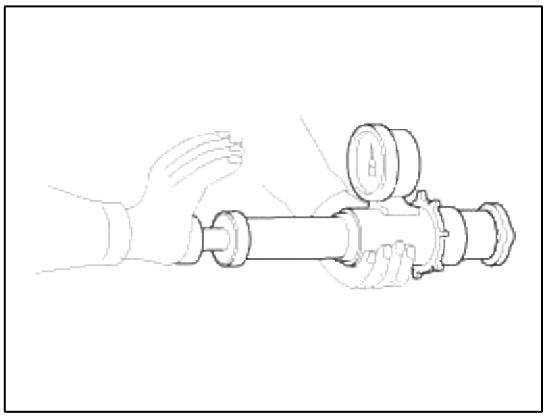
NOTE

- Bleed air from the cooling system.
- Start engine and let it run until it warms up. (Until the radiator fan operates 3 or 4 times.)
- Turn off engine. Check the coolant level and add coolant if needed. This will allow trapped air to be removed from the cooling system.
- Put the radiator cap on tightly, then run engine again and check for leaks.

Inspection

Radiator Cap Testing

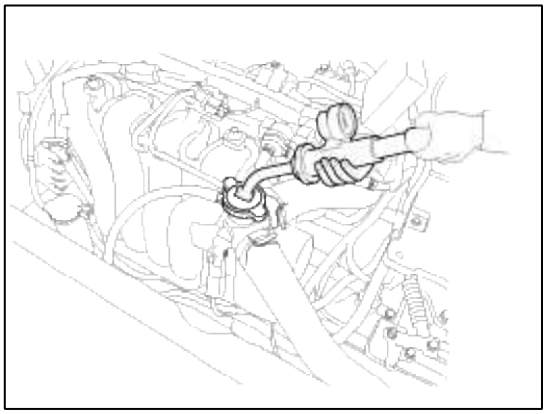
1. Remove the radiator cap, wet its seal with engine coolant, then install it to pressure tester.



2. Apply a pressure of 93 ~ 123kPa (0.95 ~ 1.25kgf/cm², 14 ~ 19psi).
3. Check for a drop in pressure.
4. If the pressure drops, replace the cap.

Radiator Leakage Test

1. Wait until engine is cool, then carefully remove the radiator cap and fill the radiator with engine coolant, then install a pressure tester on it.



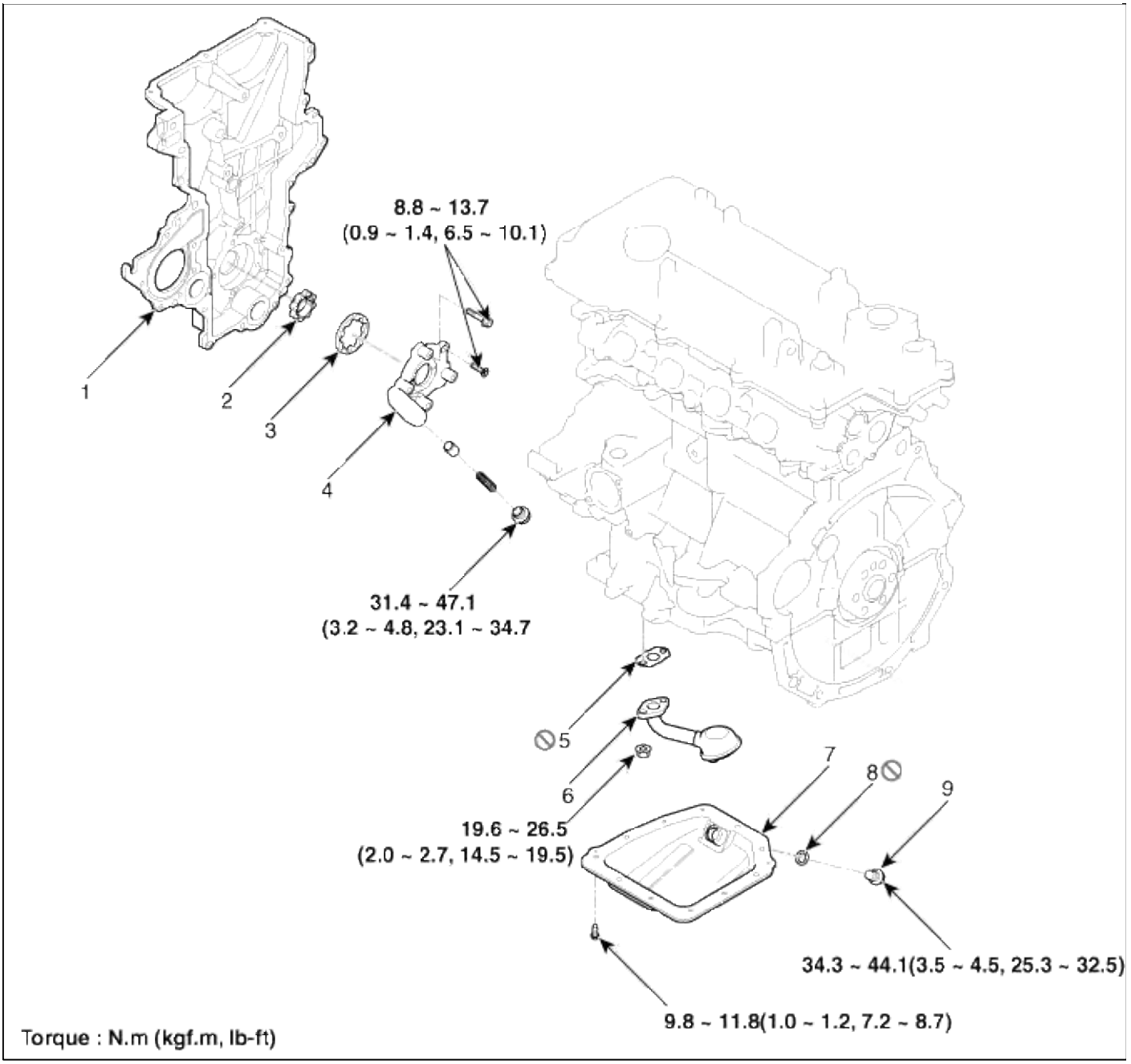
2. Apply a pressure of 93 ~ 123kPa (0.95 ~ 1.25kgf/cm², 14 ~ 19psi).
3. Inspect for engine coolant leaks and a drop in pressure.
4. If the pressure drops, check hoses, the radiator and the water pump for leakage. If there is no leakage, inspect the heater core, the cylinder block and the cylinder head.
5. Remove the tester and reinstall the radiator cap.

NOTE

Check for engine oil in coolant and/or coolant in engine oil.

Engine Mechanical System > Lubrication System > Oil Pump > Components and Components Location

Components



1. Timing chain cover 2. Inner roter 3. Outer roter 4. Pump cover 5. Gasket	6. Oil screen 7. Oil pan 8. Drain plug gasket 9. Oil drain plug

Engine Mechanical System > Lubrication System > Engine Oil > Repair procedures

Oil And Filter Replacement

CAUTION

- Prolonged and repeated contact with mineral oil will result in the removal of natural fats from the skin, leading to dryness, irritation and dermatitis. In addition, used engine oil contains potentially harmful contaminants which may cause skin cancer.
- Exercise caution in order to minimize the length and frequency of contact of your skin to used oil. Wear protective clothing and gloves. Wash your skin thoroughly with soap and water, or use water-less hand cleaner, to remove any used engine oil. Do not use gasoline, thinners, or solvents.
- In order to preserve the environment, used oil and used oil filter must be disposed of only at designated disposal sites.

1. Drain the engine oil.
   (1) Remove the oil filler cap.
   (2) Remove the oil drain plug, and drain the oil into a container.
2. Replace the oil filter.
   (1) Remove the oil filter.
   (2) Check and clean the oil filter installation surface.
   (3) Check the part number of the new oil filter is as same as old one.
   (4) Apply clean engine oil to the gasket of a new oil filter.
   (5) Lightly screw the oil filter into place, and tighten it until the gasket contacts the seat.
   (6) Tighten it with the torque below.

   Tightening torque :
   11.8 ~ 15.7N.m (1.2 ~ 1.6kgf.m, 8.7 ~ 11.6lb-ft)

3. Refill with engine oil.
   (1) Clean and install the oil drain plug with a new gasket.

   Tightening torque :
   34.3 ~ 44.1N.m (3.5 ~ 4.5kgf.m, 25.3 ~ 32.5lb-ft)

   (2) Fill with fresh engine oil.

   Capacity
   Total : 3.7L (3.91US qt, 3.25lmp qt)
   Oil pan : 3.0L (3.17US qt, 2.64lmp qt)
   Drain and refill in cluding oil filter :
   3.3 L (3.49US qt, 2.90lmp qt)

   (3) Install the oil filler cap.
4. Start engine and check for oil leaks.
5. Recheck the engine oil level.

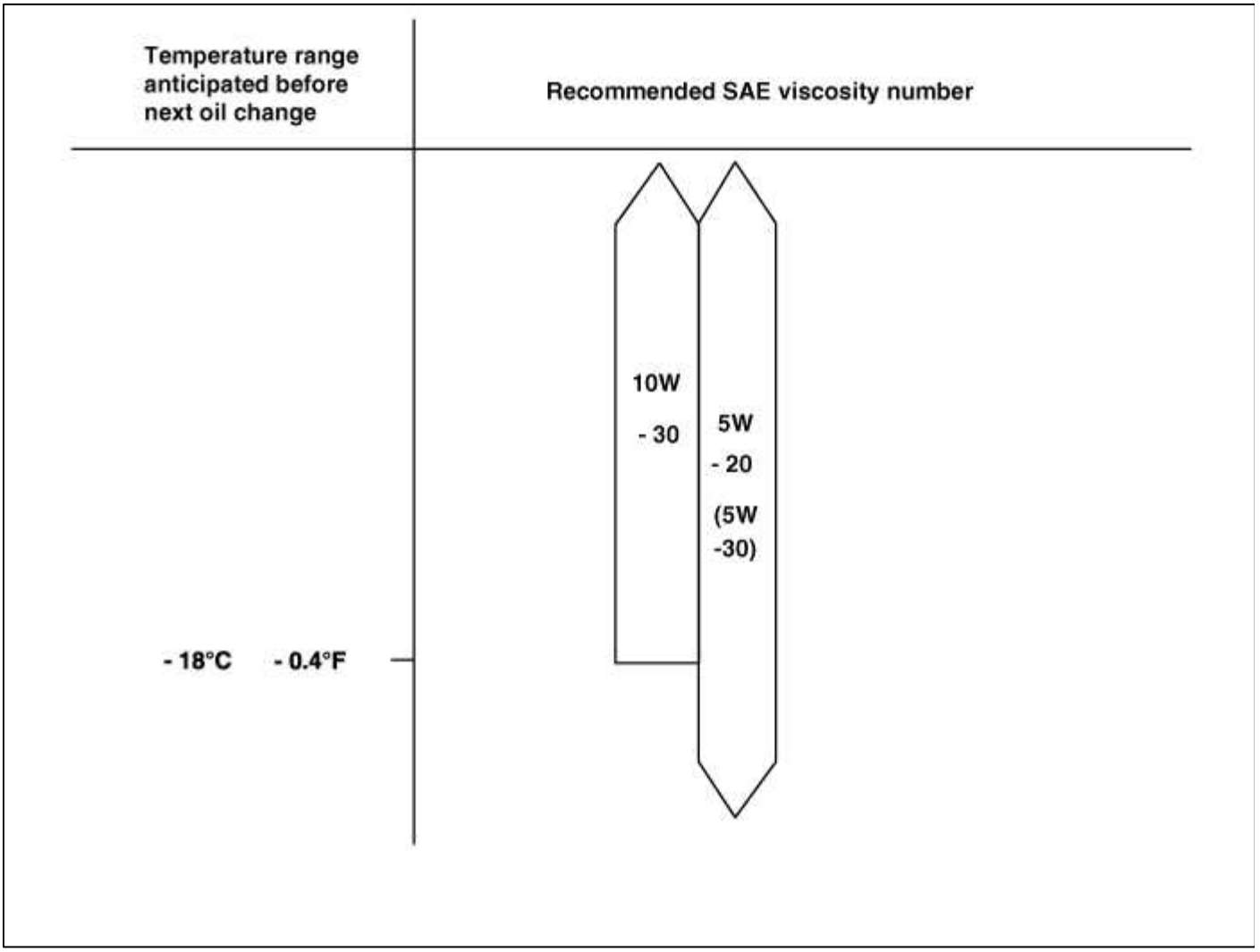
Inspection

1. Check the engine oil quality.
   Check the oil deterioration, entry of water, discoloring of thinning. If the quality is visibly poor, replace the oil.

2. Check the engine oil level.
   After engine warm up stop the engine wait 5 minutes then check the oil level. Oil level should be between the "L" and "F" marks on the dipstick. If low check for leakage and add oil up to the "F" mark.

> NOTE
>
> Do not fill with engine oil above the "F" mark.

Selection Of Engine Oil
Recommendation of oil classification : API SM, ILSAC GF-4, ACEA A5 (API SL/ ILSAC GF-3/ ACEA A3 class oil can be used if the recommended oil is not available)
SAE viscosity grade : Refer to the recommended SAE viscosity number



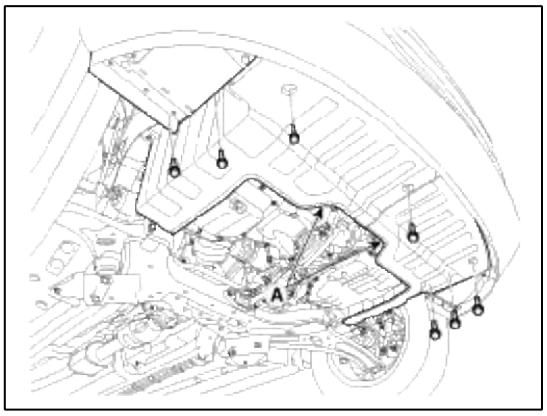
> NOTE
>
> For best performance and maximum protection of all types of operation, select only those lubricants which :
> 1. Satisfy the requirement of the API or ILSAC classification.
> 2. Have proper SAE grade number for expected ambient temperature range.
> 3. Lubricants that do not have both an SAE grade number and API or ILSAC service classification on the container should not be used.

Engine Mechanical System > Lubrication System > Oil Pan > Repair procedures

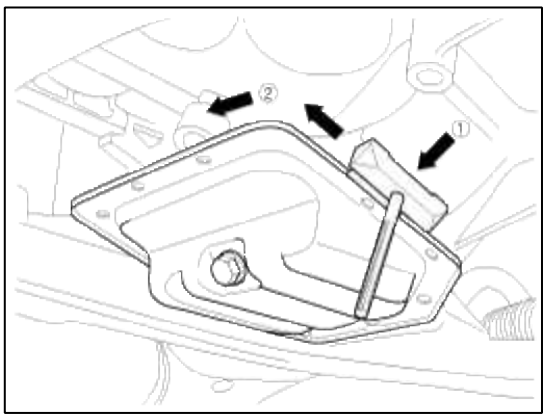
Removal

1. Remove the under covers (A).

Tightening torque:
6.9 ~ 10.8 N.m (0.7 ~ 1.1 kgf.m, 5.1 ~ 8.0 lb-ft)



2. Drain engine oil.
3. Using the SST(09215-3C000) and remove the oil pan.



CAUTION

- Insert the SST between the oil pan and the ladder frame by tapping it with a plastic hammer in the direction of ① arrow.
- After tapping the SST with a plastic hammer along the direction of ② arrow around more than 2/3 edge of the oil pan, remove it from the ladder frame.
- Do not turn over the SST abruptly without tapping. It be result in damage of the SST.

Installation

1. Install the oil pan.
   (1) Using a razor blade and gasket scraper, remove all the old packing material from the gasket surfaces.

> NOTE
>
> Check that the mating surfaces are clean and dry before applying liquid gasket.

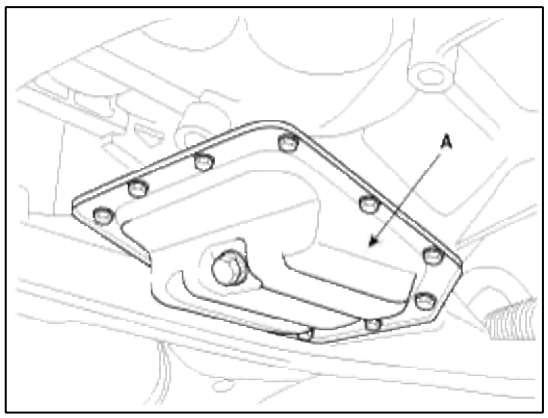
   (2) Apply liquid gasket as an even bead, centered between the edges of the mating surface.

Liquid gasket : TB 1217H or LOCTITE 5900H

> NOTE
>
> - To prevent leakage of oil, apply liquid gasket to the inner threads of the bolt holes.
> - Do not install the parts if five minutes or more have elapsed since applying the liquid gasket. Instead, reapply liquid gasket after removing the residue.
> - After assembly, wait at least 30 minutes before filling the engine with oil.

   (3) Install the oil pan (A) with the bolts.
   Uniformly tighten the bolts in several passes.

Tightening torque :
9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)

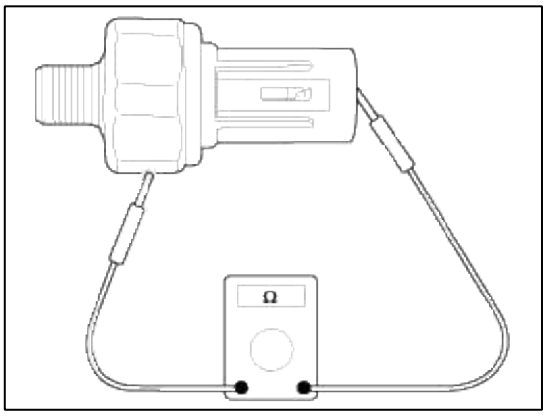


2. Refill engine oil.

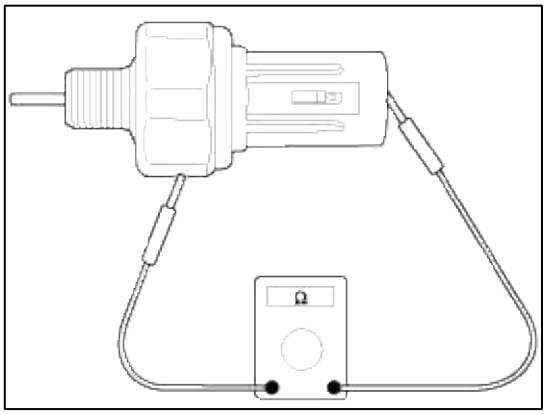
Engine Mechanical System > Lubrication System > Oil Pressure Switch > Repair procedures

Inspection

1. Check the continuity between the terminal and the body with an ohmmeter. If there is no continuity, replace the oil pressure switch.



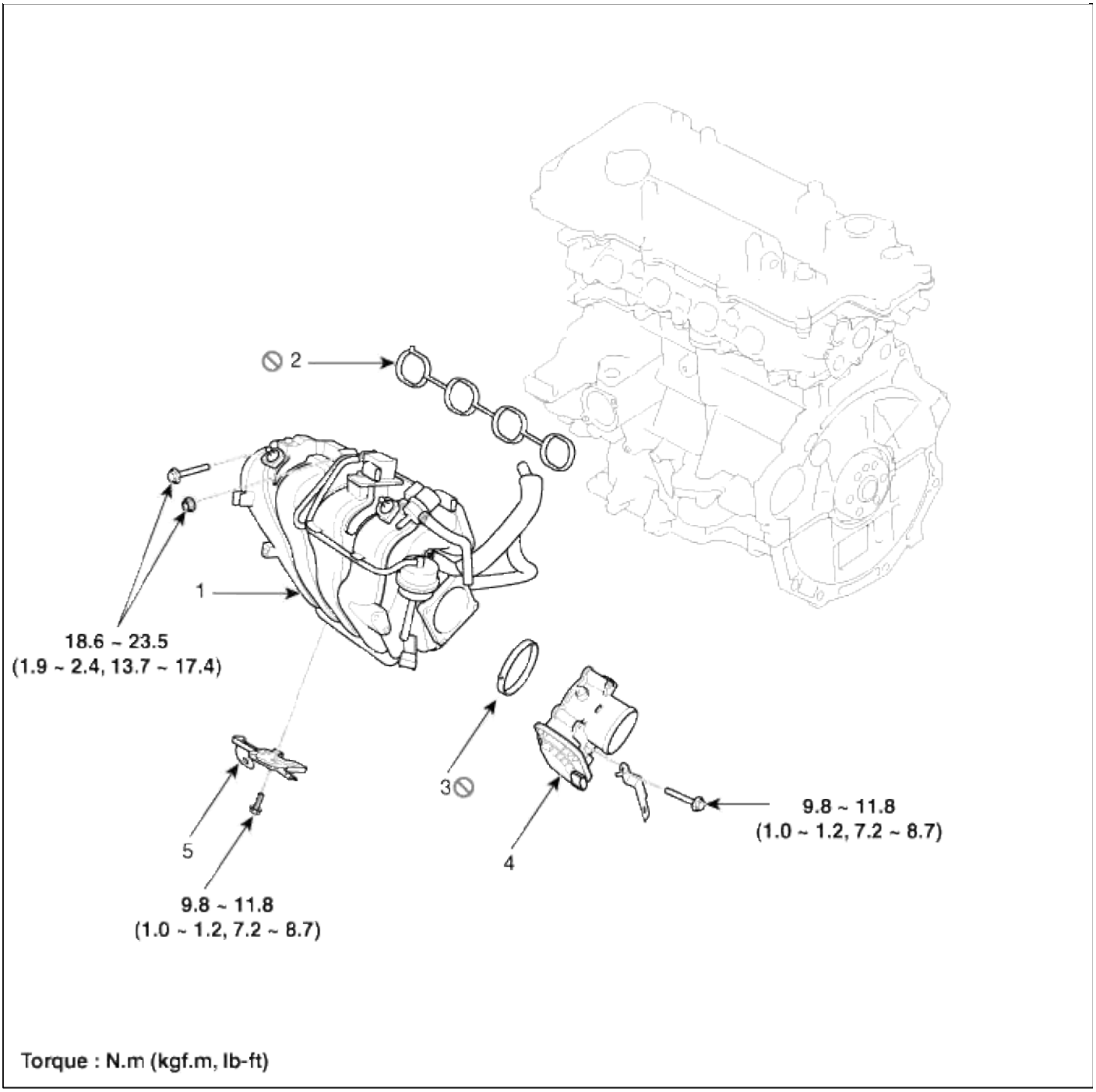
2. Check the continuity between the terminal and the body when the fine wire is pushed. If there is continuity even when the fine wire is pushed, replace the switch.



3. If there is no continuity when a 49.0kpa (0.5kg/cm², 7.1psi) is applied through the oil hole, the switch is operating properly.
   Check for air leakage. If air leaks, the diaphragm is broken. Replace it.

Engine Mechanical System > Intake And Exhaust System > Intake Manifold > Components and Components Location

Components



1. Intake manifold 2. Intake manifold gasket 3. Electronic throttle body gasket	4. Electronic throttle body 5. Bracket

Engine Mechanical System > Intake And Exhaust System > Intake Manifold > Repair procedures

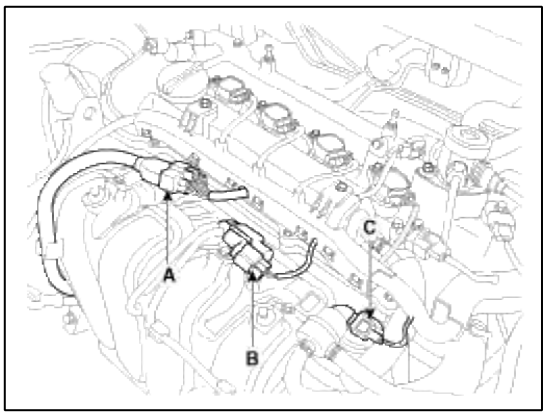
Removal and Installation

1. Remove the engine cover.

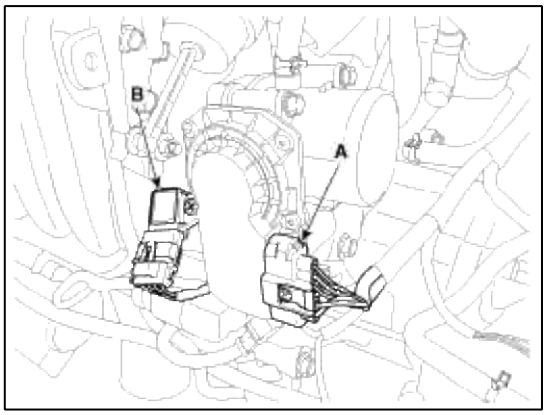
2. Disconnect the battery negative terminal.

Tightening torque :
Without battery sensor :
7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)
With battery sensor :
4.0 ~ 6.0N.m (0.4 ~ 0.6kgf.m, 3.0 ~ 4.4lb-ft)

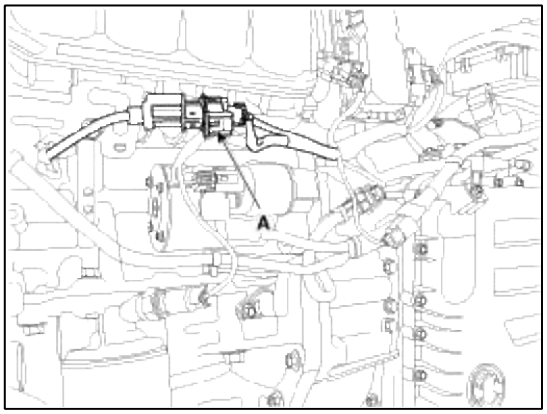
3. Remove the air duct and the air cleaner assembly.
(Refer to Engine and transaxle assembly)
4. Disconnect the injector extension connector (A), the VIS (Variable intake system) connector (B) and the PCSV (Purge control solenoid valve) connector (C).



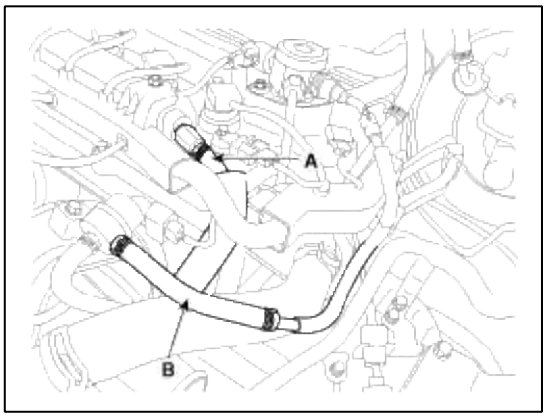
5. Disconnect the ETC (Electronic throttle control) connector (A) and the MAPS (Manifold absolute pressure sensor) & IATS (Intake air temperature sensor) connector (B).



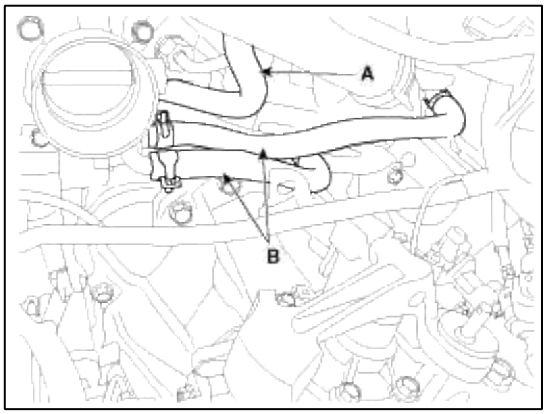
6. Disconnect the knock sensor connector (A).



7. Disconnect the PCV (Positive crankcase ventilation) hose (A) and the PCSV (Purge control solenoid valve) hose (B).

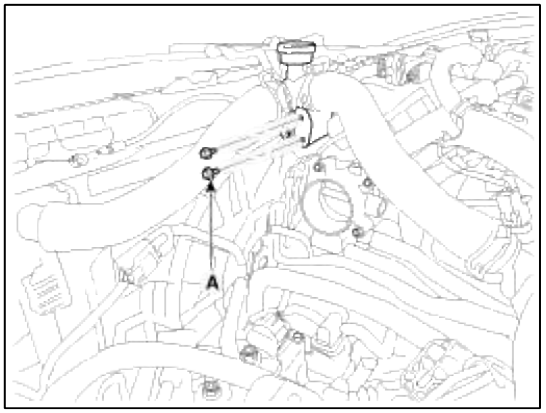


8. Disconnect the vacuum hose (A) and the throttle body coolant hoses (B).



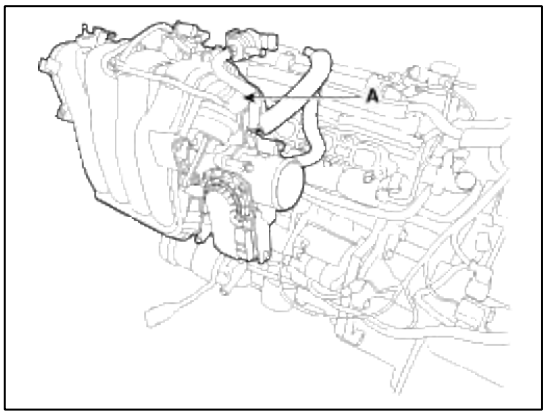
9. Unfasten the filler neck assembly mounting bolts (A).

Tightening torque :
6.9 ~ 10.8 N.m (0.7 ~ 1.1 kgf.m, 5.1 ~ 8.0 lb-ft)



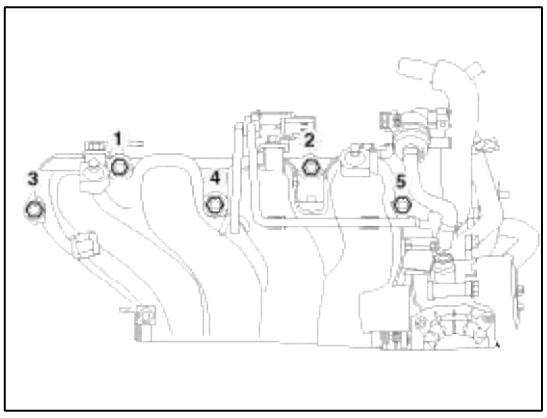
10. Remove the intake manifold (A) with the gasket (B).

Tightening torque :
18.6 ~ 23.5N.m (1.9 ~ 2.4kgf.m, 13.7 ~ 17.4lb-ft)



NOTE

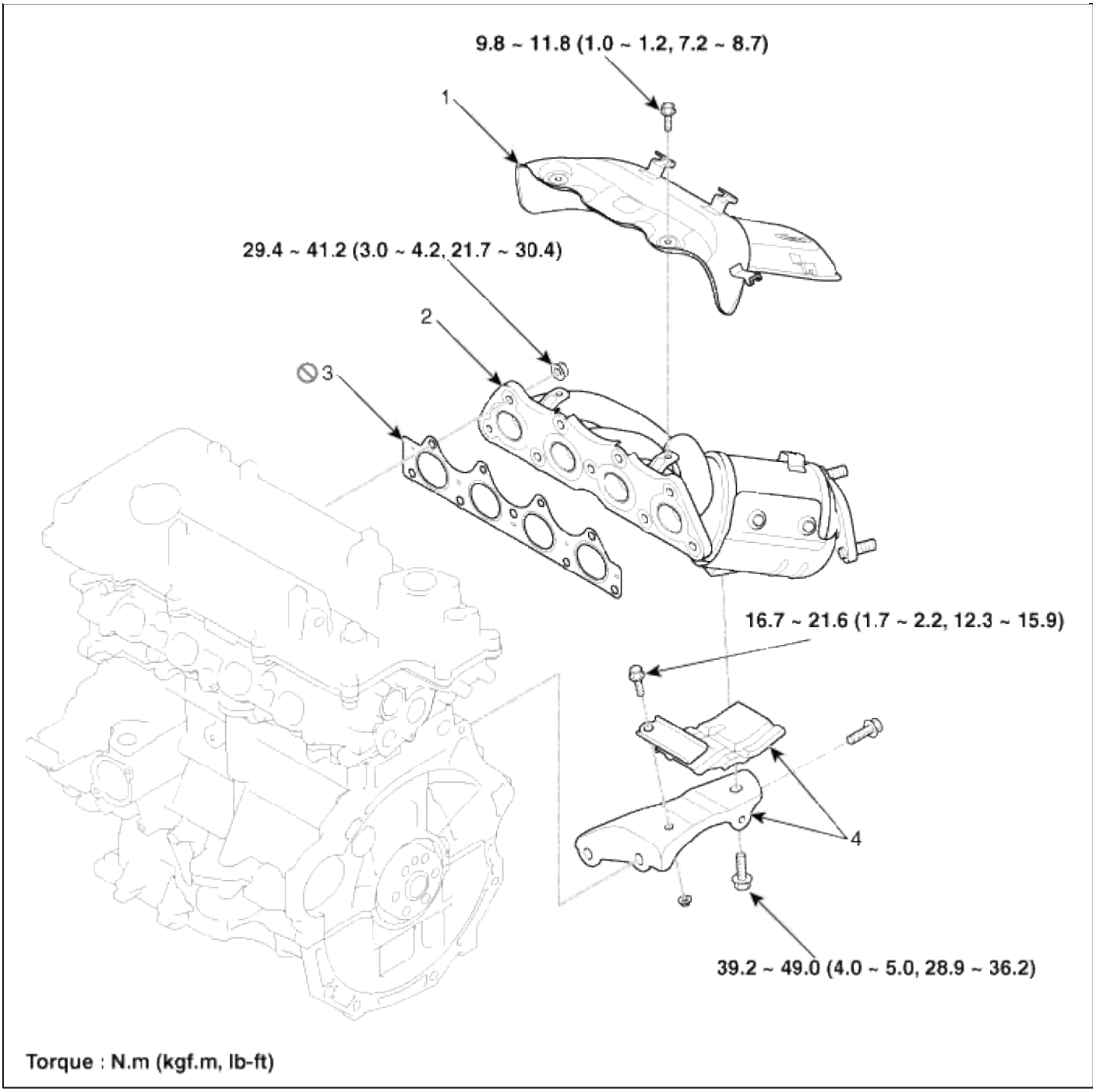
When installing, replace with new gaskets.
When installing the intake manifold, tighten the bolts and nuts with pre-torque first, and then tighten the bolts and nuts with specified torque in the sequence shown.



11. Installation is reverse order of removal.

Engine Mechanical System > Intake And Exhaust System > Exhaust Manifold > Components and Components Location

Components



1. Heat protector 2. Exhaust manifold	3. Exhaust manifold gasket 4. Exhaust manifold stay

Engine Mechanical System > Intake And Exhaust System > Exhaust Manifold > Repair procedures

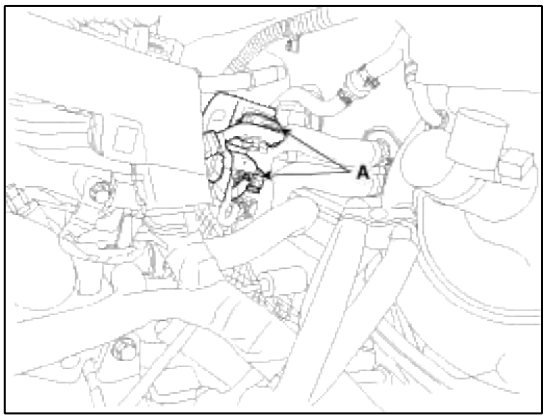
Removal and Installation

1. Remove the engine cover.

2. Disconnect the battery negative terminal.

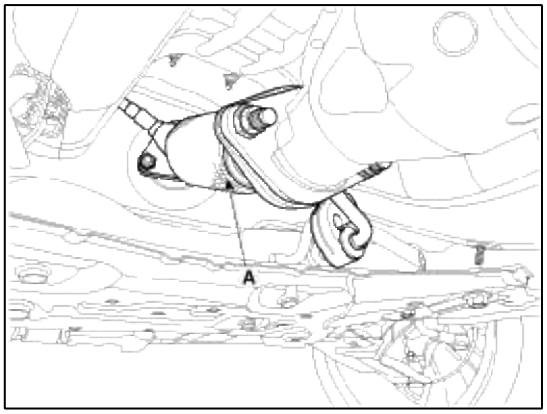
Tightening torque :
Without battery sensor :
7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)
With battery sensor :
4.0 ~ 6.0N.m (0.4 ~ 0.6kgf.m, 3.0 ~ 4.4lb-ft)

3. Disconnect the front and rear oxygen sensor connectors (A).



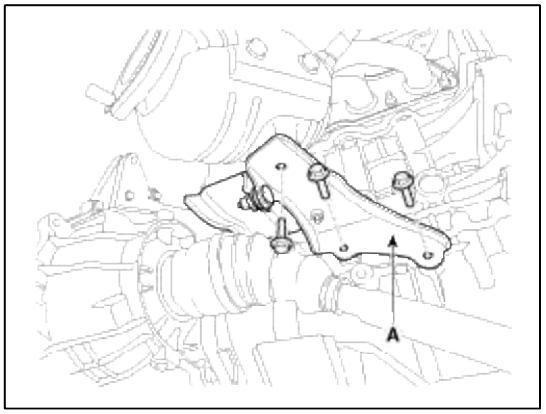
4. Remove the front muffler (A).

Tightening torque:
39.2 ~ 58.8 N.m (4.0 ~ 6.0 kgf.m, 28.9 ~ 43.4 lb-ft)



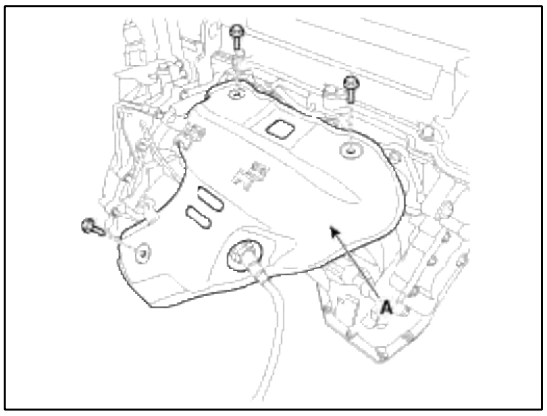
5. Remove the exhaust manifold stay (A).

Tightening torque:
39.2 ~ 49.0N.m (4.0 ~ 5.0kgf.m, 28.9 ~ 36.2lb-ft)



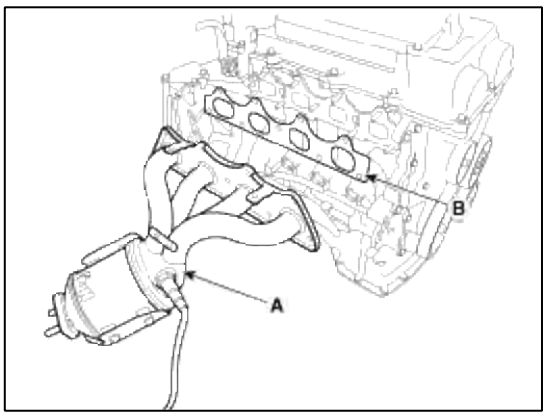
6. Remove the heat protector (A).

Tightening torque:
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)



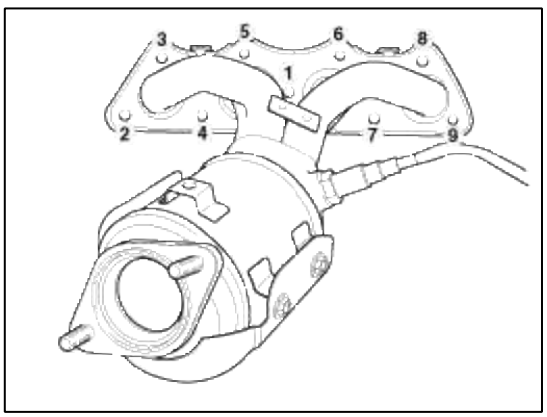
7. Remove the exhaust manifold (A).

Tightening torque:
29.4 ~ 41.2N.m (3.0 ~ 4.2kgf.m, 21.7 ~ 30.4lb-ft)



NOTE

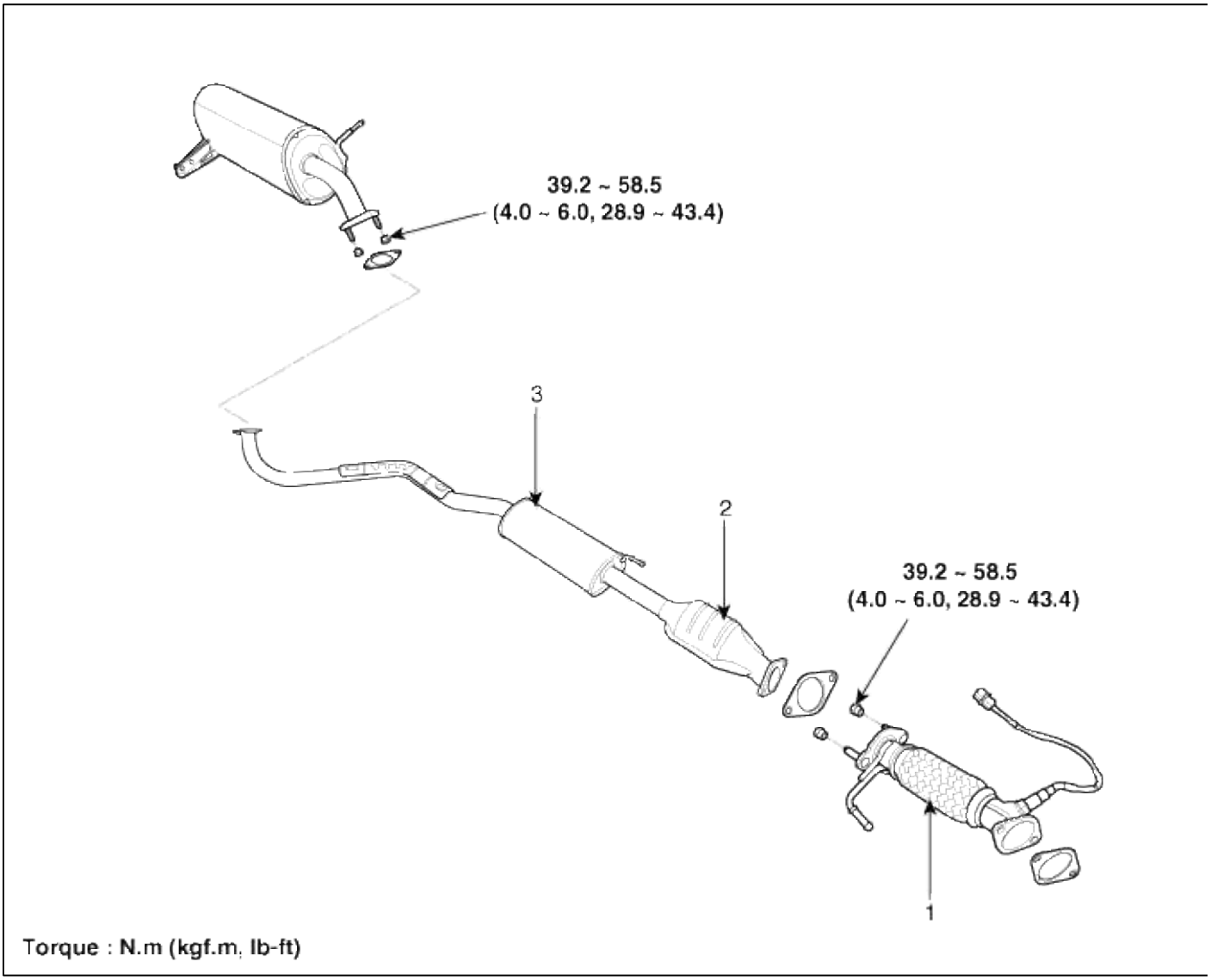
When installing, replace with a new gasket.
When installing the intake manifold, tighten the nuts with pre-torque first, and then tighten the nuts with specified torque in the sequence shown.



8. Installation is reverse order of removal.

Engine Mechanical System > Intake And Exhaust System > Muffler > Components and Components Location

Components



1. Front muffler 2. Catalytic converter & Center muffler assembly 3. Main muffler	4. Gasket 5. Hanger

Engine Mechanical System > Intake And Exhaust System > Muffler > Repair procedures

Removal and Installation

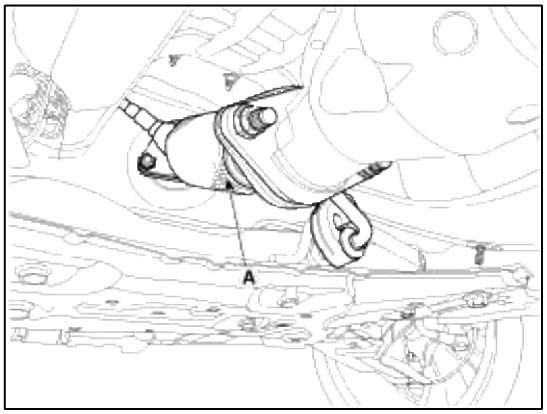
1. Disconnect the battery negative terminal.

Tightening torque
Without battery sensor :
7.8 ~ 9.8 N.m (0.8 ~ 1.0 kgf.m, 5.8 ~ 7.2 lb-ft)
With battery sensor :
4.0 ~ 6.0 N.m (0.4 ~ 0.6 kgf.m, 3.0 ~ 4.4 lb-ft)

2. Disconnect the rear oxygen sensor connector (A).

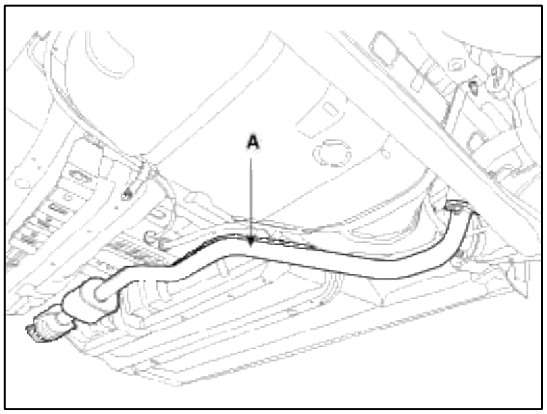
3. Remove the front muffler (A).

Tightening torque:
39.2 ~ 58.8 N.m (4.0 ~ 6.0 kgf.m, 28.9 ~ 43.4 lb-ft)

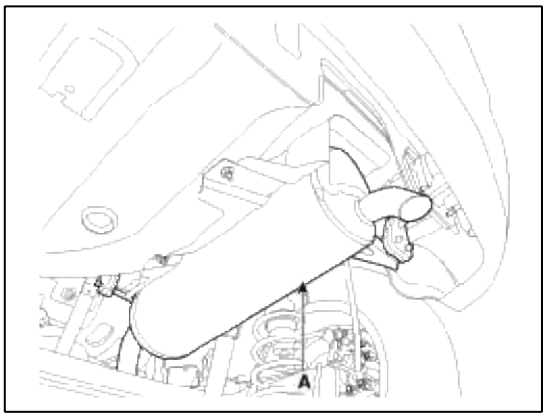


4. Remove the center muffler (A).

Tightening torque:
39.2 ~ 58.8 N.m (4.0 ~ 6.0 kgf.m, 28.9 ~ 43.4 lb-ft)



5. Remove the main muffler (A).



6. Installation is the reverse order of removal.

NOTE

When installing, replace with new gaskets.

RIO(UB) > 2012 > G 1.6 GDI > Fuel System

Fuel System > General Information > Specifications

Specifications

Fuel Delivery System

Items	Specification	
Fuel Tank	Capacity	43 lit. (11.4 U.S.gal., 45.4 U.S.qt., 37.8 Imp.qt.)
Fuel Filter	Type	Paper type
Fuel Pressure	Low Pressure Fuel Line	480 ~ 520 kPa (4.89 ~ 5.30 kgf/cm², 69.6 ~ 75.4 psi)
	High Pressure Fuel Line	5.0 ~ 12.0 MPa (51.0 ~ 122.4 kgf/cm², 725.2 ~ 1740.5 psi)
Fuel Pump	Type	Electrical, in-tank type
	Driven by	Electric motor
High Pressure Fuel Pump	Type	Mechanical type
	Driven by	Camshaft

Sensors

Manifold Absolute Pressure Sensor (MAPS)

Type: Piezo-resistive pressure sensor type

Specification

Pressure [kPa (kgf/cm², psi)]	Output Voltage (V)
20.0 (0.20, 2.9)	0.79
46.7 (0.47, 6.77)	1.84
101.3 (1.03, 14.7)	4.0

Intake Air Temperature Sensor (IATS)

Type: Thermistor type

Specification

Temperature		Resistance (kΩ)
°C	°F	
-40	-40	40.93 ~ 48.35
-20	-4	13.89 ~ 16.03
0	32	5.38 ~ 6.09
10	50	3.48 ~ 3.90
20	68	2.31 ~ 2.57
40	104	1.08 ~ 1.21
50	122	1.56 ~ 1.74
60	140	0.54 ~ 0.62
80	176	0.29 ~ 0.34

Engine Coolant Temperature Sensor (ECTS)

Type: Thermistor type

Specification

Temperature		Resistance (kΩ)
°C	°F	
-40	-40	48.14
-20	-4	14.13 ~ 16.83
0	32	5.79
20	68	2.31 ~ 2.59
40	104	1.15
60	140	0.59
80	176	0.32

Throttle Position Sensor (TPS) [integrated into ETC module]

Type: Hall IC Non-contact sensor type

Specification

Throttle angle(°)	Output Voltage (V)	
	TPS1	TPS2
0	0.5	4.5
10	0.96	4.05
20	1.41	3.59
30	1.87	3.14
40	2.32	2.68
50	2.78	2.23
60	3.23	1.77
70	3.69	1.32
80	4.14	0.86
90	4.6	0.41
98	4.65	0.35
C.T (0)	0.5	4.5
W.O.T (86)	4.41	0.59

Crankshaft Position Sensor (CKPS)

Type: Magnetic field sensitive Type

Specification

Item	Specification
Coil Resistance (Ω)	774 ~ 946 [20°C (68°F)]

Camshaft Position Sensor (CMPS)
Type: Hall effect type
Knock Sensor (KS)
Type: Piezo-electricity type
Specification

Item	Specification
Capacitance (pF)	950 ~ 1,350
Resistance(MΩ)	4.87

Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 1]
Type: Zirconia (ZrO2) [Linear] Type
Specification

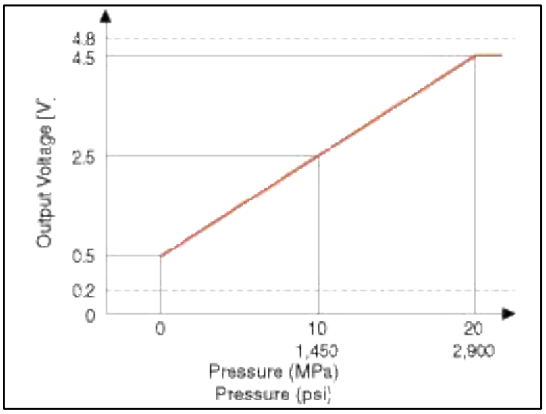
Item	Specification
Heater Resistance (Ω)	2.4 ~ 4.0 [20°C(69.8°F)]

Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2]
Type: Zirconia (ZrO2) [Binary] Type
Specification

A/F Ratio (λ)	Output Voltage(V)
RICH	0.6 ~ 1.0
LEAN	0 ~ 0.4

Item	Specification
Heater Resistance (Ω)	Approx. 9.0 [21°C(69.8°F)]

Rail Pressure Sensor (RPS)
Type: Piezo-electricity type
Specification



Accelerator Position Sensor (APS)
Type: Variable resistor type
Specification

Accelerator Position	Output Voltage (V)	
	APS1	APS2
C.T	0.7 ~ 0.8	0.275 ~ 0.475
W.O.T	3.8 ~ 4.4	1.75 ~ 2.35

Fuel Tank Pressure Sensor (FTPS)

Type: Piezo - Resistivity type

Specification

Pressure [kPa (kgf/cm², in H2O)	Output Voltage (V)
-6.67 (-0.068, -26.8)	0.5
0	2.5
+6.67 (0.068, 26.8)	4.5

Actuators

Injector

Specification

Item	Specification
Coil Resistance (Ω)	1.5 [20°C(68°F)]

ETC Motor [integrated into ETC Module]

Specification

Item	Specification
Coil Resistance (Ω)	0.3 ~ 100 [20°C(68°F)]

Purge Control Solenoid Valve (PCSV)

Specification

Item	Specification
Coil Resistance (Ω)	22.0 ~ 26.0 [20°C(68°F)]

CVVT Oil Control Valve (OCV)

Specification

Item	Specification
Coil Resistance (Ω)	6.9 ~ 7.9 [20°C(68°F)]

Variable Intake Solenoid (VIS) Valve

Specification

Item	Specification
Coil Resistance (Ω)	30.0 ~ 35.0 [20°C(68°F)]

Fuel Pressure Regulator Valve

Specification

Item	Specification
Coil Resistance (Ω)	0.5 [20°C(68°F)]

Ignition Coil

Type: Stick type

Specification

Item	Specification
Primary Coil Resistance (Ω)	0.75 ± 15 [20°C(68°F)]
Secendary Coil Resistance (kΩ)	5.9 [20°C(68°F)]

Canister Close Valve (CCV)

Specification

Item	Specification
Coil Resistance (Ω)	19.8 ~ 20.8 (20°C)

Service Standard

Item		Specification	
Ignition Timing (°)		BTDC 3 ± 10	
Idle Speed (rpm)	A/C OFF	Neutral, N, P-range	630 ± 100
		D-range	630 ± 100
	A/C ON	Neutral, N, P-range	700 ± 100
		D-range	700 ± 100

Tightening Torques

Engine Control System

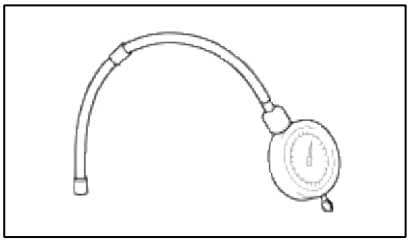
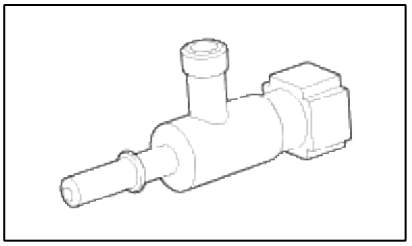
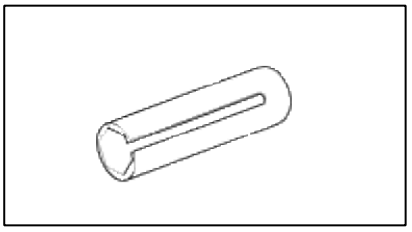
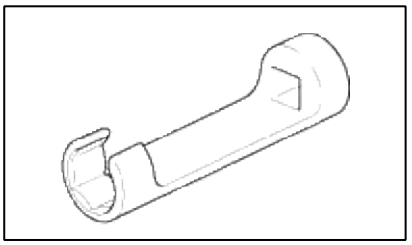
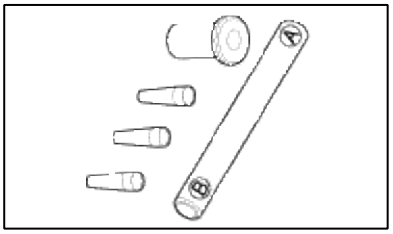
Item	kgf.m	N.m	lb-ft
ECM installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
ECM bracket installation bolt/nut	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.
Manifold absolute pressure sensor installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
Engine Coolant Temperature Sensor installation	3.0 ~ 4.0	29.4 ~ 39.2	21.7 ~ 28.9
Crankshaft position sensor installation bolt	0.8 ~ 1.2	7.8 ~ 11.8	5.8 ~ 8.7
Camshaft position sensor (Bank 1 / Intake) installation bolt	0.8 ~ 1.2	7.8 ~ 11.8	5.8 ~ 8.7
Camshaft position sensor (Bank 1 / Exhaust) installation bolt	0.8 ~ 1.2	7.8 ~ 11.8	5.8 ~ 8.7
Knock sensor installation bolt	1.9 ~ 2.5	18.6 ~ 24.5	13.7 ~ 18.1
Heated oxygen sensor (Bank 1 / sensor 1) installation	4.0 ~ 5.0	39.2 ~ 49.1	28.9 ~ 36.2
Heated oxygen sensor (Bank 1 / sensor 2) installation	4.0 ~ 5.0	39.2 ~ 49.1	28.9 ~ 36.2
Rail pressure sensor installation	3.0 ~ 3.5	29.4 ~ 34.3	21.7 ~ 25.3
Electronic throttle body installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
Purge control solenoid valve bracket installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
CVVT oil control valve (Bank 1 / Intake) installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
CVVT oil control valve (Bank 1 / Exhaust) installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
Ignition coil installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7

Fuel Delivery System

Item	kgf.m	N.m	lb-ft
Fuel tank installation nut	4.0 ~ 5.5	39.2 ~ 54.0	28.9 ~ 39.8
Fuel pump plate cover installation bolt	0.2 ~ 0.3	2.0 ~ 2.9	1.4 ~ 2.2
Filler-neck assembly bracket installation bolt	0.8 ~ 1.2	7.8 ~ 11.8	5.8 ~ 8.7
Filler-neck assembly installation bolt	0.8 ~ 1.2	7.8 ~ 11.8	5.8 ~ 8.7
Accelerator pedal module installation nut	1.3 ~ 1.6	12.8 ~ 15.7	9.4 ~ 11.6
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
High pressure fuel pump installation bolt	1.3 ~ 1.5	12.8 ~ 14.7	9.4 ~ 10.9
High pressure fuel pipe installation nut	2.7 ~ 3.3	26.5 ~ 32.4	19.5 ~ 23.9
High pressure fuel pipe function block installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7

Fuel System > General Information > Special Service Tools

Special Service Tools

Item	Illustration	Application
Fuel Pressure Gauge (09353-24100)		Measuring the fuel line pressure
Fuel Pressure Gauge Adapter (09353-02100)		Connection between the high pressure fuel pump and the fuel feed line
Heated Oxygen Sensor Socket Wrench (09392-2H100)		Removal and installation of the heated oxygen sensor
Torque Wrench Socket (09314-3Q100) or (09314-27130) (19mm)		Removal and installation of the high pressure fuel pipe
Injector Combustion Seal Guide & Sizing tool (09353-2B000)		Installation of the injector combustion seal

Fuel System > General Information > Troubleshooting

Basic Troubleshooting

Basic Troubleshooting Guide

1	**Bring Vehicle to Workshop**

2	**Analyze Customer's Problem**

- Ask the customer about the conditions and environment relative to the issue.
  (Use CUSTOMER PROBLEM ANALYSIS SHEET).

3	**Verify Symptom, and then Check DTC and Freeze Frame Data**

- Connect the GDS to Diagnostic Link Connector (DLC).
- Record the DTC and Freeze Frame Data.

NOTE

To erase DTC and Freeze Frame Data, refer to Step 5.

4	**Confirm the Inspection Procedure for the System or Part**

- Using the SYMPTOM TROUBLESHOOTING GUIDE CHART, choose the correct inspection procedure for the system or part to be checked.

5	**Erase the DTC and Freeze Frame Data**

WARNING

NEVER erase DTC and Freeze Frame Data before completing Step 2 : MIL/DTC in CUSTOMER PROBLEM ANALYSIS SHEET.

6	**Inspect Vehicle Visually**

- Go to Step 11, if you recognize the problem.

7	**Recreate (Simulate) Symptoms of the DTC**

- Try to recreate or simulate the symptoms and conditions of the malfunction as described by customer.
- If DTC(s) is/are displayed, simulate the condition according to troubleshooting procedure for the DTC.

8	**Confirm Symptoms of Problem**

- If DTC(s) is/are not displayed, go to Step 9.
- If DTC(s) is/are displayed, go to Step 11.

9	**Recreate (Simulate) Symptom**

- Try to recreate or simulate the condition of the malfunction as described by the customer.

10	**Check the DTC**

- If DTC(s) does(do) not occur, refer to INTERMITTENT PROBLEM PROCEDURE in BASIC INSPECTION PROCEDURE.
- If DTC(s) occur(s), go to Step 11.

11	**Perform Troubleshooting Procedure for DTC**

12	**Adjust or repair the vehicle**

13	**Confirmation test**

14	**END**

Customer Problem Analysis Sheet

1. VEHICLE INFORMAITON

VIN No.		Transmission	☐ M/T ☐ A/T ☐ CVT ☐ etc.
Production date		Driving type	☐ 2WD (FF) ☐ 2WD (FR) ☐ 4WD
Odometer Reading	_____km/mile	DPF (Diesel Engine)	☐ With DPF ☐ Without DPF

2. SYMPTOMS

☐ Unable to start	☐ Engine does not turn over ☐ Incomplete combustion ☐ Initial combustion does not occur
☐ Difficult to start	☐ Engine turns over slowly ☐ Other_____
☐ Poor idling	☐ Rough idling ☐ Incorrect idling ☐ Unstable idling (High:_____ rpm, Low: _____rpm) ☐ Other
☐ Engine stall	☐ Soon after starting ☐ After accelerator pedal depressed ☐ After accelerator pedal released ☐ During A/C ON ☐ Shifting from N to D-range ☐ Other_____
☐ Others	☐ Poor driving (Surge) ☐ Knocking ☐ Poor fuel economy ☐ Back fire ☐ After fire ☐ Other_____

3. ENVIRONMENT

Problem frequency	☐ Constant ☐ Sometimes (_____) ☐ Once only ☐ Other_____
Weather	☐ Fine ☐ Cloudy ☐ Rainy ☐ Snowy ☐ Other_____
Outdoor temperature	Approx. _____ °C/°F
Place	☐ Highway ☐ Suburbs ☐ Inner City ☐ Uphill ☐ Downhill ☐ Rough road ☐ Other_____
Engine temperature	☐ Cold ☐ Warming up ☐ After warming up ☐ Any temperature
Engine operation	☐ Starting ☐ Just after starting (____min) ☐ Idling ☐ Racing ☐ Driving ☐ Constant speed ☐ Acceleration ☐ Deceleration ☐ A/C switch ON/OFF ☐ Other_____

4. MIL/DTC

MIL (Malfunction Indicator Lamp)		☐ Remains ON ☐ Sometimes lights up ☐ Does not light
DTC	Normal check (Pre-check)	☐ Normal ☐ DTC (_____) ☐ Freeze Frame Data
	Check mode	☐ Normal ☐ DTC (_____) ☐ Freeze Frame Data

5. ECM/PCM INFORMATION

ECM/PCM Part No.	
ROM ID	

Basic Inspection Procedure

Measuring Condition of Electronic Parts' Resistance

The measured resistance at high temperature after vehicle running may be high or low. So all resistance must be measured at ambient temperature (20°C, 68°F), unless stated otherwise.

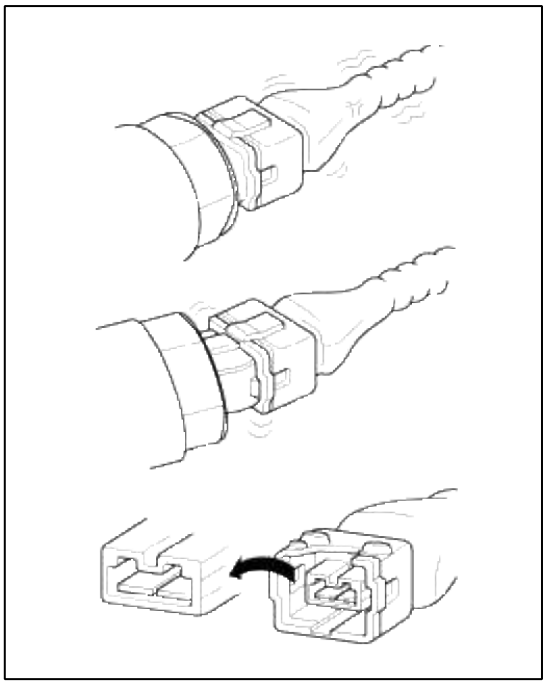
NOTE

The measured resistance in except for ambient temperature (20°C, 68°F) is reference value.

Intermittent Problem Inspection Procedure

Sometimes the most difficult case in troubleshooting is when a problem symptom occurs but does not occur again during testing. An example would be if a problem appears only when the vehicle is cold but has not appeared when warm. In this case, the technician should thoroughly make out a "Customer Problem Analysis Sheet" and recreate (simulate) the environment and condition which occurred when the vehicle was having the issue.

1. Clear Diagnostic Trouble Code (DTC).
2. Inspect connector connection, and check terminal for poor connections, loose wires, bent, broken or corroded pins, and then verify that the connectors are always securely fastened.



3. Slightly shake the connector and wiring harness vertically and horizontally.
4. Repair or replace the component that has a problem.
5. Verify that the problem has disappeared with the road test.

● Simulating Vibration

1) Sensors and Actuators
: Slightly vibrate sensors, actuators or relays with finger.

> WARNING
>
> Strong vibration may break sensors, actuators or relays

2) Connectors and Harness
: Lightly shake the connector and wiring harness vertically and then horizontally.

● Simulating Heat

1) Heat components suspected of causing the malfunction with a hair dryer or other heat source.

> WARNING
>
> • DO NOT heat components to the point where they may be damaged.
> • DO NOT heat the ECM directly.

● Simulating Water Sprinkling

1) Sprinkle water onto vehicle to simulate a rainy day or a high humidity condition.

> WARNING
>
> DO NOT sprinkle water directly into the engine compartment or electronic components.

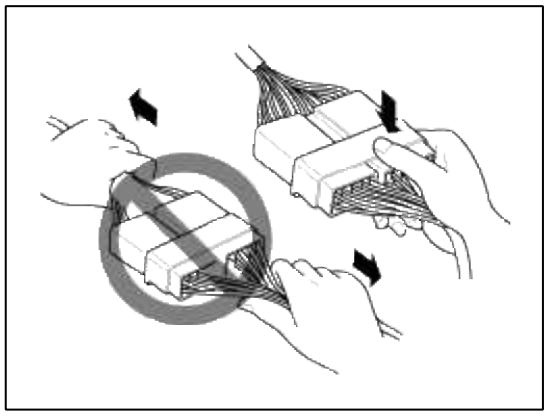
● Simulating Electrical Load

1) Turn on all electrical systems to simulate excessive electrical loads (Radios, fans, lights, rear window defogger, etc.).

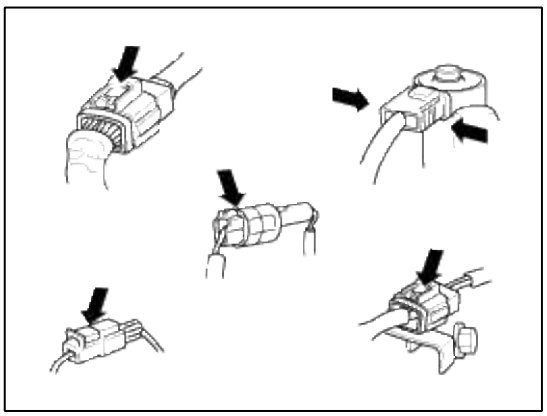
Connector Inspection Procedure

1. Handling of Connector

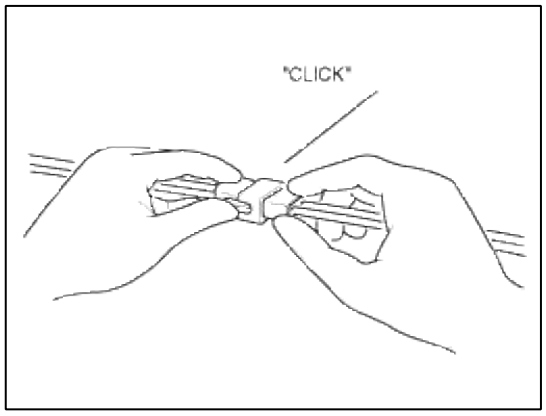
A. Never pull on the wiring harness when disconnecting connectors.



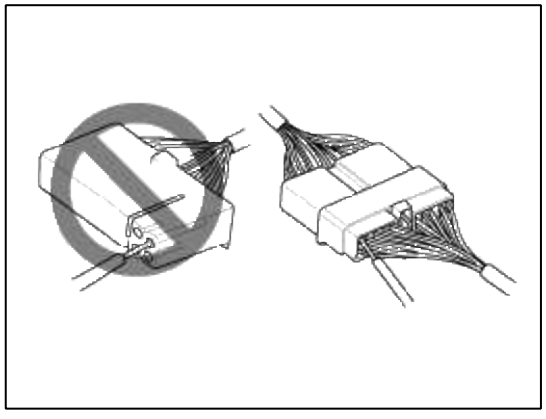
B. When removing the connector with a lock, press or pull locking lever.



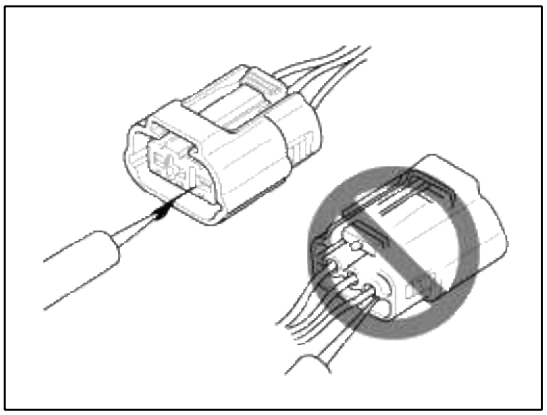
C. Listen for a click when locking connectors. This sound indicates that they are securely locked.



D. When a tester is used to check for continuity, or to measure voltage, always insert tester probe from wire harness side.



E. Check waterproof connector terminals from the connector side. Waterproof connectors cannot be accessed from harness side.



NOTE

- Use a fine wire to prevent damage to the terminal.
- Do not damage the terminal when inserting the tester lead.

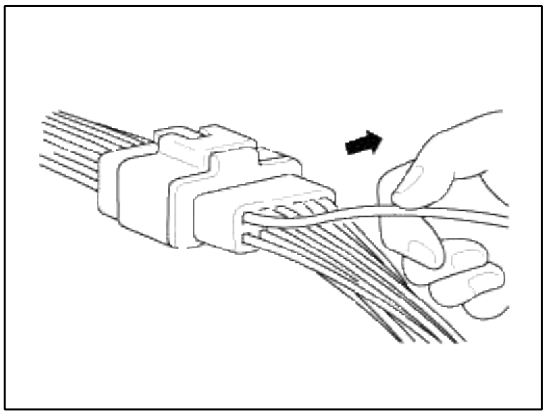
2. Checking Point for Connector

A. While the connector is connected:
Hold the connector, check connecting condition and locking efficiency.

B. When the connector is disconnected:
Check missed terminal, crimped terminal or broken core wire by slightly pulling the wire harness.
Visually check for rust, contamination, deformation and bend.

C. Check terminal tightening condition:
Insert a spare male terminal into a female terminal, and then check terminal tightening conditions.

D. Pull lightly on individual wires to ensure that each wire is secured in the terminal.



3. Repair Method of Connector Terminal

A. Clean the contact points using air gun and/or shop rag.

NOTE

Never use sand paper when polishing the contact points, otherwise the contact point may be damaged.

B. In case of abnormal contact pressure, replace the female terminal.

Wire Harness Inspection Procedure

1. Before removing the wire harness, check the wire harness position and crimping in order to restore it correctly.
2. Check whether the wire harness is twisted, pulled or loosened.
3. Check whether the temperature of the wire harness is abnormally high.
4. Check whether the wire harness is rotating, moving or vibrating against the sharp edge of a part.
5. Check the connection between the wire harness and any installed part.

6. If the covering of wire harness is damaged; secure, repair or replace the harness.

Electrical Circuit Inspection Procedure

● Check Open Circuit

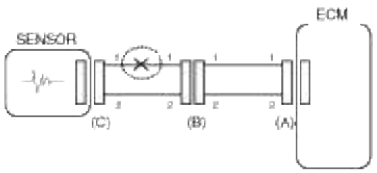
1. Procedures for Open Circuit

A. Continuity Check

B. Voltage Check

If an open circuit occurs (as seen in [FIG. 1]), it can be found by performing Step 2 (Continuity Check Method) or Step 3 (Voltage Check Method) as shown below.

FIG 1



2. Continuity Check Method

NOTE

When measuring for resistance, lightly shake the wire harness above and below or from side to side.

Specification (Resistance)

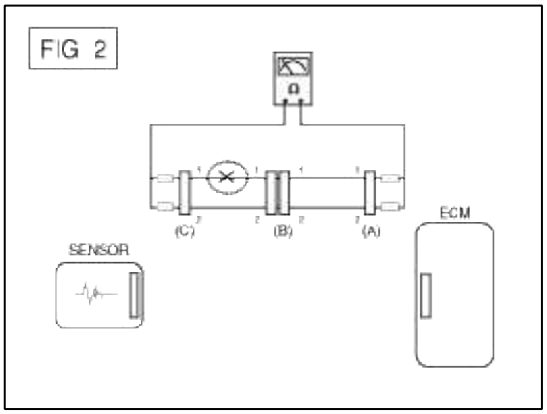
1Ω or less → Normal Circuit

1MΩ or Higher → Open Circuit

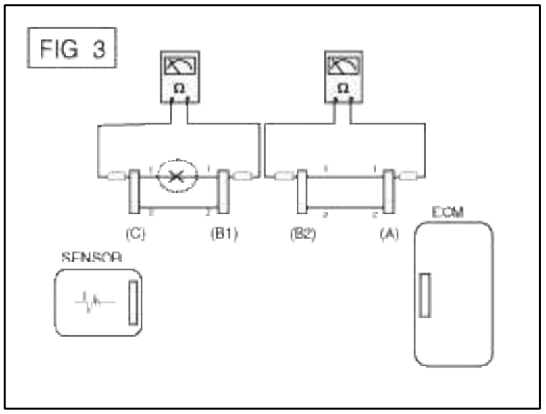
A. Disconnect connectors (A), (C) and measure resistance between connector (A) and (C) as shown in [FIG. 2].

In [FIG.2.] the measured resistance of line 1 and 2 is higher than 1MΩ and below 1 Ω respectively. Specifically the open circuit is line 1 (Line 2 is normal). To find exact break point, check sub line of line 1 as described in next step.

FIG 2

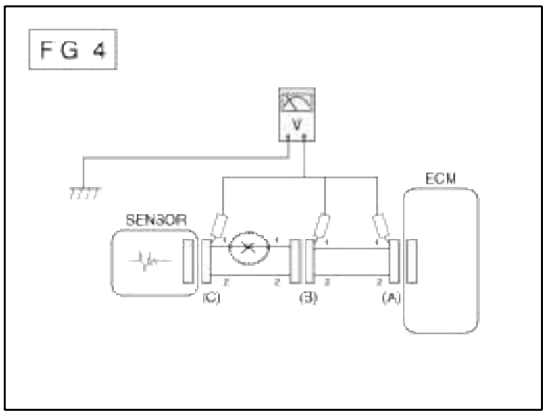


B. Disconnect connector (B), and measure for resistance between connector (C) and (B1) and between (B2) and (A) as shown in [FIG. 3].
In this case the measured resistance between connector (C) and (B1) is higher than 1MΩ and the open circuit is between terminal 1 of connector (C) and terminal 1 of connector (B1).



3. Voltage Check Method

A. With each connector still connected, measure the voltage between the chassis ground and terminal 1 of each connectors (A), (B) and (C) as shown in [FIG. 4].
The measured voltage of each connector is 5V, 5V and 0V respectively. So the open circuit is between connector (C) and (B).

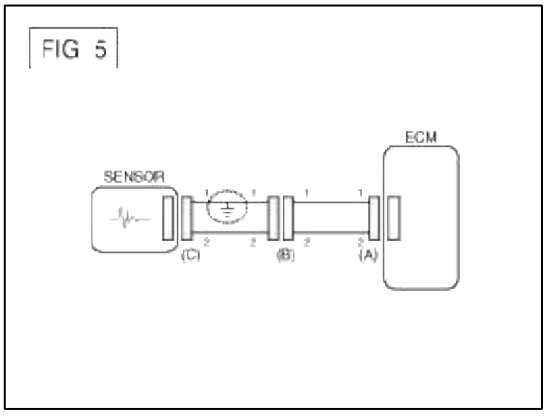


● Check Short Circuit

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.



2. Continuity Check Method (with Chassis Ground)

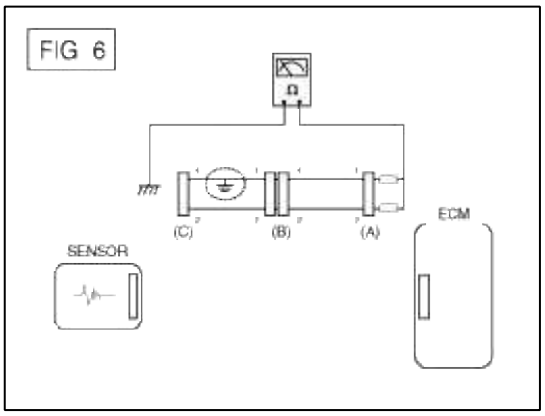
NOTE

Lightly shake the wire harness above and below, or from side to side when measuring the resistance.

Specification (Resistance)
1Ω or less → Short to Ground Circuit
1MΩ or Higher → Normal Circuit

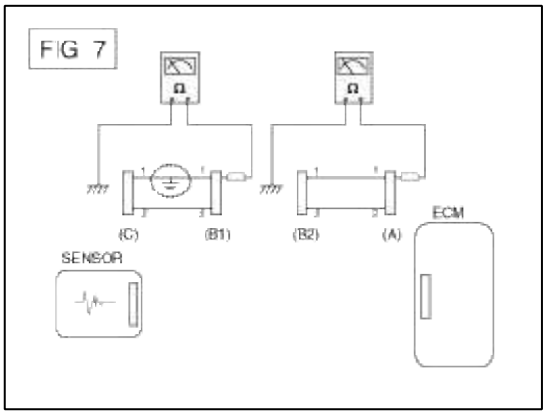
A. Disconnect connectors (A), (C) and measure for resistance between connector (A) and Chassis Ground as shown in [FIG. 6].
The measured resistance of line 1 and 2 in this example is below 1 Ω and higher than 1MΩ respectively. Specifically the short to ground circuit is line 1 (Line 2 is normal). To find exact broken point, check the sub line of line 1 as described in the following step.

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).

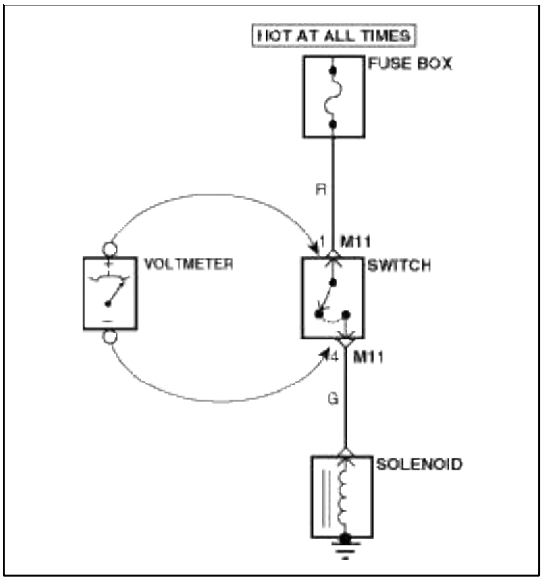
FIG 7



● Testing For Voltage Drop

This test checks for voltage drop along a wire, or through a connection orswitch.

1) Connect the positive lead of a voltmeter to the end of the wire (or to the side of the connector or switch) closest to the battery.
2) Connect the negative lead to the other end of the wire. (or the other side of the connector or switch)
3) Operate the circuit.
4) The voltmeter will show the difference in voltage between the two points. A difference, or drop of more than 0.1 volts (50mV in 5V circuits), may indicate a problem. Check the circuit for loose or dirty connections.



Symptom Troubleshooting Guide Chart

Main symptom	Diagnostic procedure	Also check for
Unable to start (Engine does not turn over)	1. Test the battery 2. Test the starter 3. Inhibitor switch (A/T) or clutch start switch (M/T)	
Unable to start (Incomplete combustion)	1. Test the battery 2. Check the fuel pressure 3. Check the ignition circuit 4. Troubleshooting the immobilizer system (In case of immobilizer lamp flashing)	• DTC • Low compression • Intake air leaks • Slipped or broken timing belt • Contaminated fuel
Difficult to start	1. Test the battery 2. Check the fuel pressure 3. Check the ECTS and circuit (Check DTC) 4. Check the ignition circuit	• DTC • Low compression • Intake air leaks • Contaminated fuel • Weak ignition spark
Poor idling (Rough, unstable or incorrect Idle)	1. Check the fuel pressure 2. Check the Injector 3. Check the long term fuel trim and short term fuel trim (Refer to CUSTOMER DATASTREAM) 4. Check the idle speed control circuit (Check DTC) 5. Inspect and test the Throttle Body 6. Check the ECTS and circuit (Check DTC)	• DTC • Low compression • Intake air leaks • Contaminated fuel • Weak ignition spark
Engine stall	1. Test the Battery 2. Check the fuel pressure 3. Check the idle speed control circuit (Check DTC) 4. Check the ignition circuit 5. Check the CKPS Circuit (Check DTC)	• DTC • Intake air leaks • Contaminated fuel • Weak ignition spark
Poor driving (Surge)	1. Check the fuel pressure 2. Inspect and test Throttle Body	• DTC

	3. Check the ignition circuit 4. Check the ECTS 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)	• Low compression • Intake air leaks • Contaminated fuel • Weak ignition spark
Knocking	1. Check the fuel pressure 2. Inspect the engine coolant 3. Inspect the radiator and the electric cooling fan 4. Check the spark plugs	• DTC • Contaminated fuel
Poor fuel economy	1. Check customer's driving habitsIs · A/C on full time or the defroster mode on? · Are tires at correct pressure? · Is excessively heavy load being carried? · Is acceleration too much, too often? 2. Check the fuel pressure 3. Check the injector 4. Test the exhaust system for a possible restriction 5. Check the ECTS and circuit	• DTC • Low compression • Intake air leaks • Contaminated fuel • Weak ignition spark
Hard to refuel (Overflow during refueling)	1. Test the canister close valve 2. Inspect the fuel filler hose/pipe · Pinched, kinked or blocked? · Filler hose is torn 3. Inspect the fuel tank vapor vent hose between the canister and fuel tank air filter 4. Check the canister	• Malfunctioning gas station filling nozzle (If this problem occurs at a specific gas station during refueling)

Fuel System > Engine Control System > Description and Operation

OBD-II review

1. Overview

The California Air Resources Board (CARB) began regulation of On Board Diagnostics (OBD) for vehicles sold in California beginning with the 1988 model year. The first phase, OBD-I, required monitoring of the fuel metering system, Exhaust Gas Recirculation (EGR) system and additional emission related components. The Malfunction Indicator Lamp (MIL) was required to light and alert the driver of the fault and the need for repair of the emission control system. Associated with the MIL was a fault code or Diagnostic Trouble Code (DTC) idenfying the specific area of the fault.

The OBD system was proposed by CARB to improve air quality by identifying vehicle exceeding emission standards. Passage of the Federal Clean Air Act Amendments in 1990 has also prompted the Environmental Protection Agency (EPA) to develop On Board Diagnostic requirements. CARB OBD-II regulations were followed until 1999 when the federal regulations were used.

The OBD-II system meets government regulations by monitoring the emission control system. When a system or component exceeds emission threshold or a component operates outside tolerance, a DTC will be stored and the MIL illuminated.

The diagnostic executive is a computer program in the Engine Control Module (ECM) or PowertrainControl Module (PCM) that coordinates the OBD-II self-monitoring system. This program controls all the monitors and interactions, DTC and MIL operation, freeze frame data and scan tool interface.

Freeze frame data describes stored engine conditions, such as state of the engine, state of fuel control, spark, RPM,

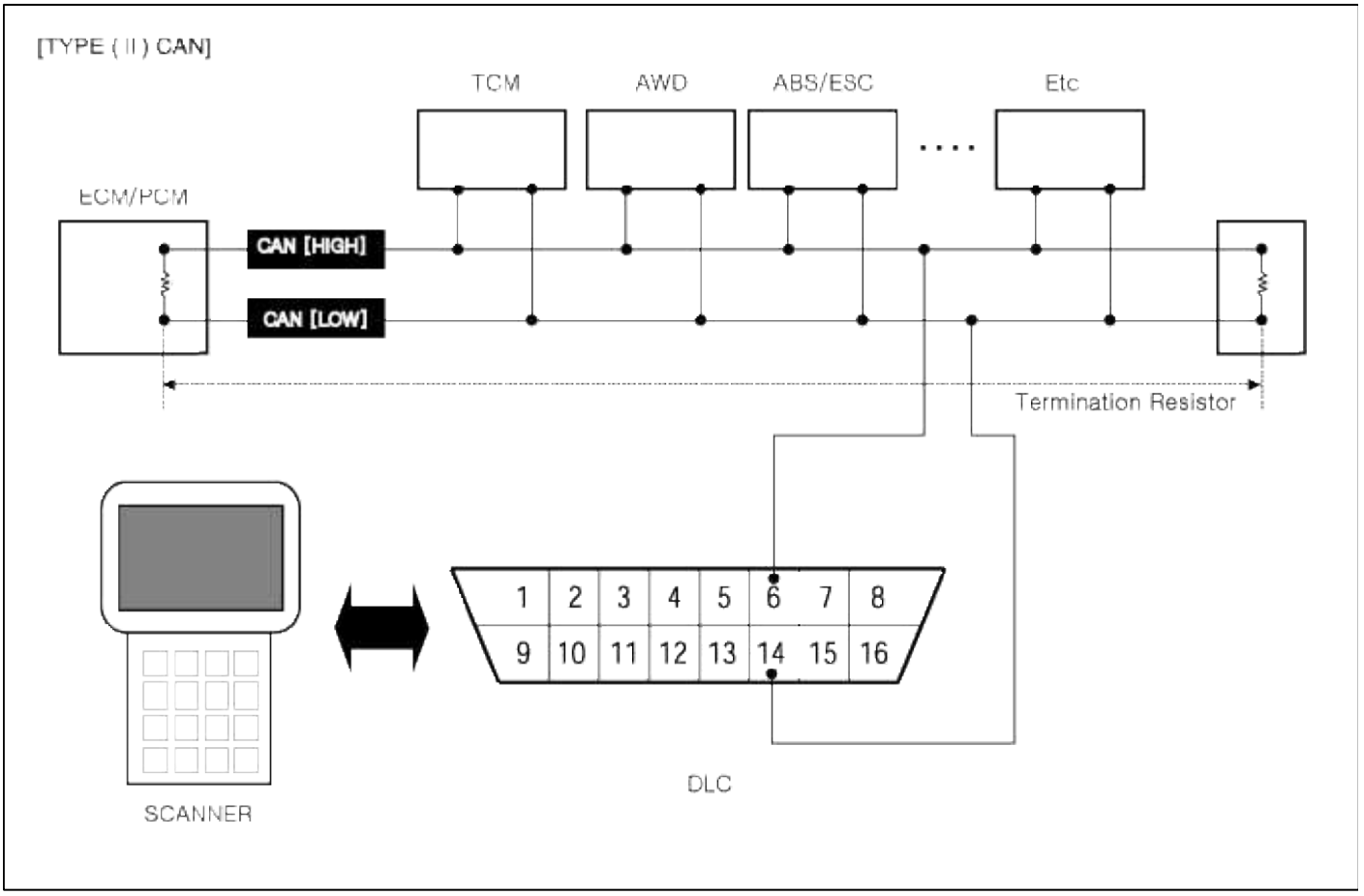
load and warm status at the point the first fault is detected. Previously stored conditions will be replaced only if a fuel or misfire fault is detected. This data is accessible with the scan tool to assist in repairing the vehicle.

The center of the OBD-II system is a microprocessor called the Engine Control Module (ECM) or Powertrain Control Module(PCM).

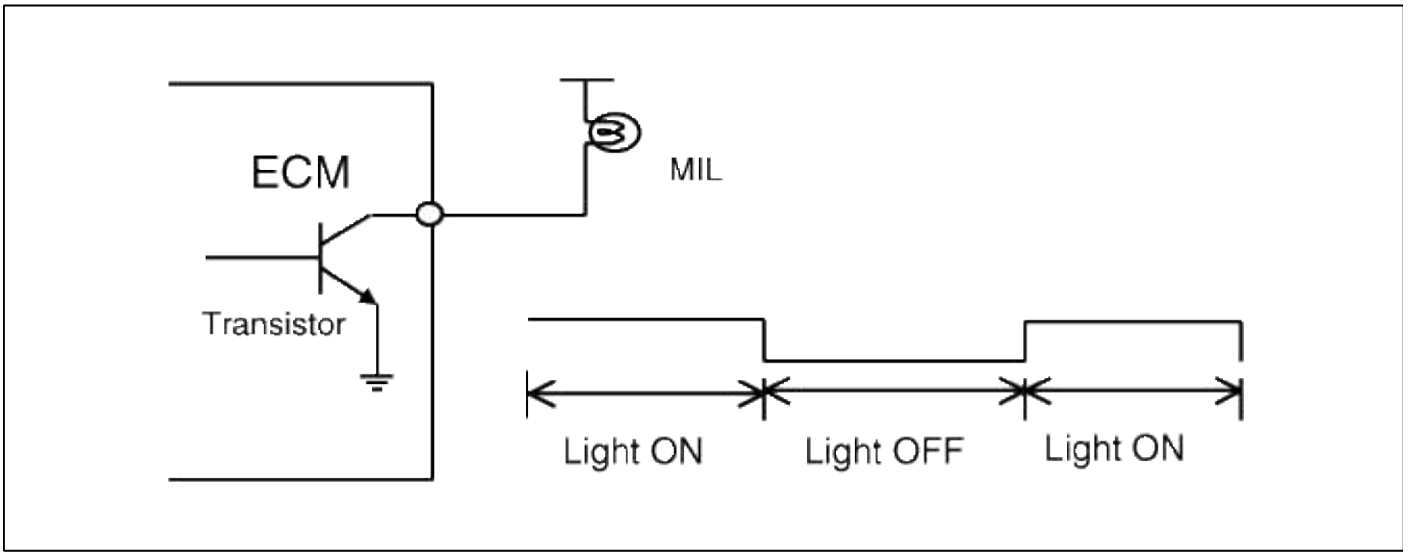
The ECM or PCM receives input from sensors and other electronic components (switches, relays, and others) based on information received and programmed into its memory (keep alive random access memory, and others), the ECM or PCM generates output signals to control various relays, solenoids and actuators.

2. Configuration of hardware and related terms

1) GST (Generic scan tool)



2) MIL (Malfunction indication lamp) - MIL activity by transistor



The Malfunction Indicator Lamp (MIL) is connected between ECM or PCM-terminal Malfunction Indicator Lamp

and battery supply (open collector amplifier).
In most cars, the MIL will be installed in the instrument panel. The lamp amplifier can not be damaged by a short circuit.
Lamps with a power dissipation much greater than total dissipation of the MIL and lamp in the tester may cause a fault indication.
At ignition ON and engine revolution (RPM)< MIN. RPM, the MIL is switched ON for an optical check by the driver.
3) MIL illumination
When the ECM or PCM detects a malfunction related emission during the first driving cycle, the DTC and engine data are stored in the freeze frame memory. The MIL is illuminated only when the ECM or PCM detects the same malfunction related to the DTC in two consecutive driving cycles.
4) MIL elimination
● Misfire and Fuel System Malfunctions:
For misfire or fuel system malfunctions, the MIL may be eliminated if the same fault does not reoccur during monitoring in three subsequent sequential driving cycles in which conditions are similar to those under which the malfunction was first detected.
● All Other Malfunctions:
For all other faults, the MIL may be extinguished after three subsequent sequential driving cycles during which the monitoring system responsible for illuminating the MIL functions without detecting the malfunction and if no other malfunction has been identified that would independently illuminate the MIL according to the requirements outlined above.
5) Erasing a fault code
The diagnostic system may erase a fault code if the same fault is not re-registered in at least 40 engine warm-up cycles, and the MIL is not illuminated for that fault code.
6) Communication line (CAN)
- Bus Topology : Line (bus) structure
- Wiring : Twisted pair wire
- Off Board DLC Cable Length : Max. 5m
- Data Transfer Rate
- Diagnostic : 500 kbps
- Service Mode (Upgrade, Writing VIN) : 500 or 1Mbps)

7) Drive cycle
A Drive Cycle is when a vehicle is operation (following an engine-off period) for a duration and driving mode such that all components and systems are monitored at least once by the diagnostic system except catalyst efficiency or evaporative system monitoring when a steady-speed check is used, subject to the limitation that the manufacturer-defined trip monitoring conditions shall all be encountered at least once during the first engine start portion of the applicable FTP cycle.
8) Warm-up cycle
A warm-up cycle means sufficient vehicle operation such that the engine coolant temperature has risen by at least 40 degrees Fahrenheit from engine starting and reaches a minimum temperature of at least 160 degrees Fahrenheit.
9) Trip cycle
A Trip Cycle is when a vehicle is driven under the conditions for one or more of the monitors is completed. After repairing the vehicle for an emission related fault, dirving the vehicle under the conditions to run the monitor for the system is concidered a Trip.
10) DTC format
- Diagnostic Trouble Code (SAE J2012)
- DTCs used in OBD-II vehicles will begin with a letter and are followed by four numbers.

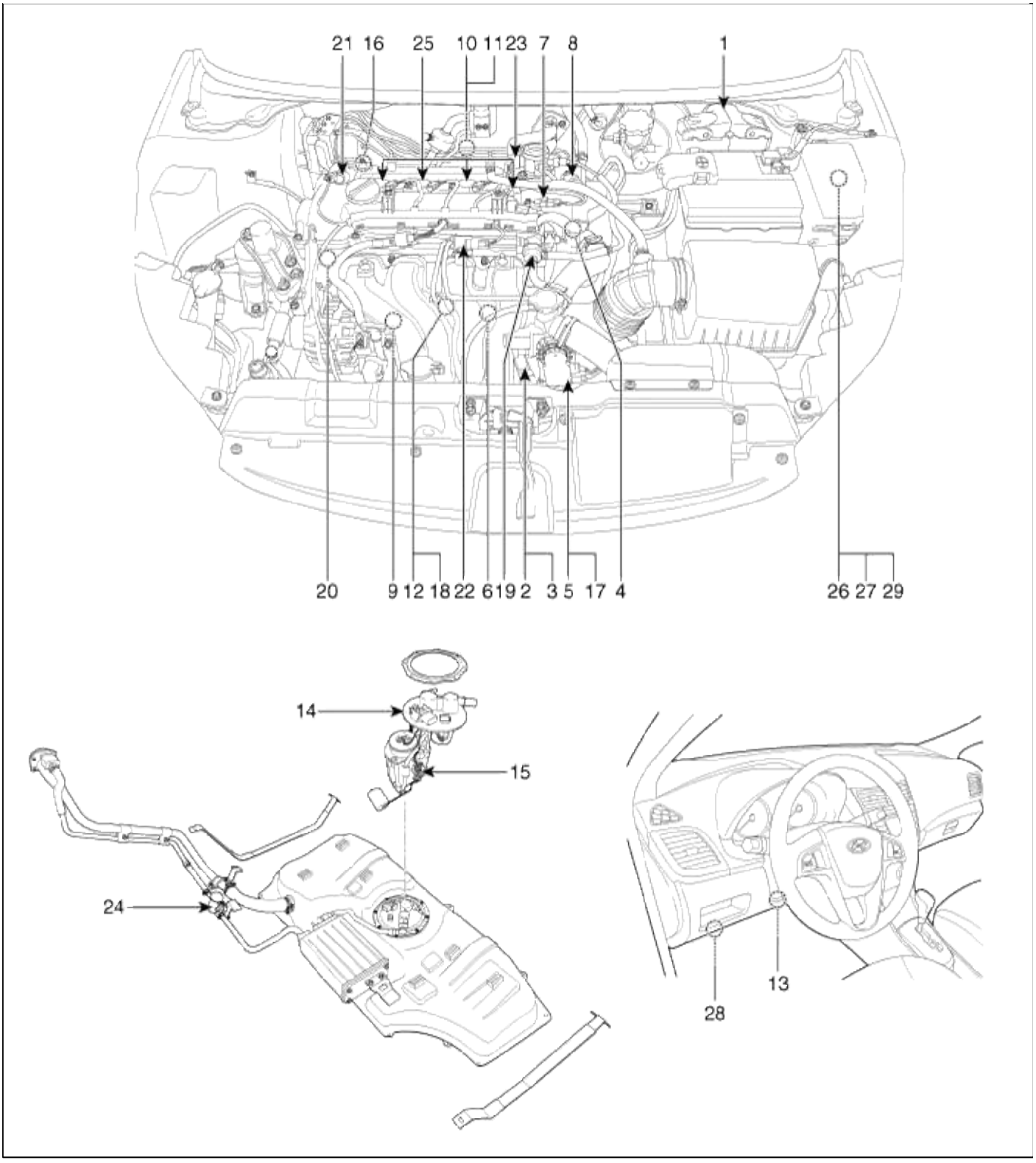
The letter of the beginning of the DTC identifies the function of the monitored device that has failed. A "P" indicates a powertrain device, "C" indicates a chassis device. "B" is for body device and "U" indicates a network or data link code. The first number indicates if the code is generic (common to all manufacturers) or if it is manufacturer specific.

A "0" & "2" indicates generic, "1" indicates manufacturer-specific. The second number indicates the system that is affected with a number between 1 and 7.
The following is a list showing what numbers are assigned to each system.
1. Fuel and air metering
2. Fuel and air metering(injector circuit malfunction only)
3. Ignition system or misfire
4. Auxiliary emission controls
5. Vehicle speed controls and idle control system
6. Computer output circuits
7. Transmission
The last two numbers of the DTC indicates the component or section of the system where the fault is located.
11) Freeze frame data
When a freeze frame event is triggered by an emission related DTC, the ECM or PCM stores various vehicle information as it existed the moment the fault ocurred. The DTC number along with the engine data can be useful in aiding a technician in locating the cause of the fault. Once the data from the 1st driving cycle DTC ocurrence is stored in the freeze frame memory, it will remain there even when the fault ocurrs again (2nd driving cycle) and the MIL is illuminated.
• Freeze Frame List
1) Calculated Load Value
2) Engine RPM
3) Fuel Trim
4) Fuel Pressure (if available)
5) Vehicle Speed (if available)
6) Coolant Temperature
7) Intake Manifold Pressure (if available)
8) Closed-or Open-loop operation
9) Fault code
3. OBD-II system readiness tests
1) Catalyst monitoring
The catalyst efficiency monitor is a self-test strategy within the ECM or PCM that uses the downstream Heated Oxygen Sensor (HO2S) to determine when a catalyst has fallen below the minimum level of effectiveness in its ability to control exhaust emission.
2) Misfire monitoring
Misfire is defined as the lack of proper combustion in the cylinder due to the absence of spark, poor fuel metering, or poor compression. Any combustion that does not occur within the cylinder at the proper time is also a misfire. The misfire detection monitor detects fuel, ignition or mechanically induced misfires. The intent is to protect the catalyst from permanent damage and to alert the customer of an emission failure or an inspection maintenance failure by illuminating the MIL . When a misfire is detected, special software called freeze frame data is enabled. The freeze frame data captures the operational state of the vehicle when a fault is detected from misfire detection monitor strategy.
3) Fuel system monitoring
The fuel system monitor is a self-test strategy within the ECM or PCM that monitors the adaptive fuel table The fuel control system uses the adaptive fuel table to compensate for normal variability of the fuel system components caused by wear or aging. During normal vehicle operation, if the fuel system appears biased lean or rich, the adaptive value table will shift the fuel delivery calculations to remove bias.
4) Engine cooling system monitoring
The cooling system monitoring is a self-test strategy within the ECM or PCM that monitors ECTS (Engine Coolant Temperature Sensor) and thermostat about circuit continuity, output range, rationality faults.
5) O2 sensor monitoring

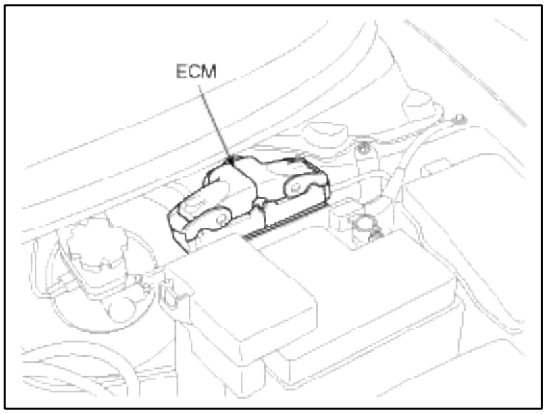
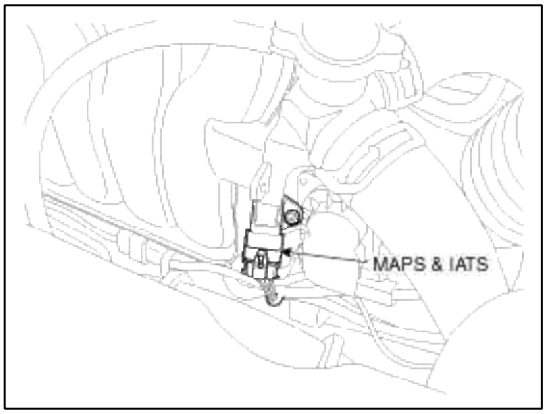
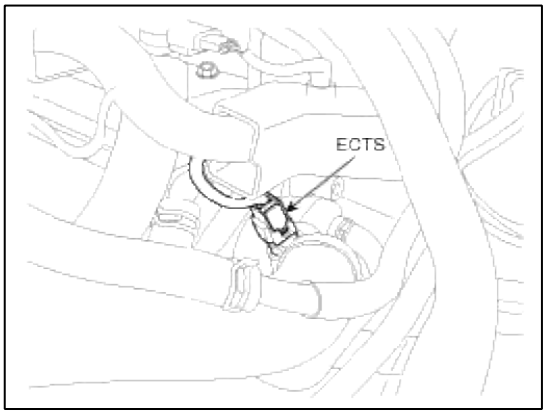
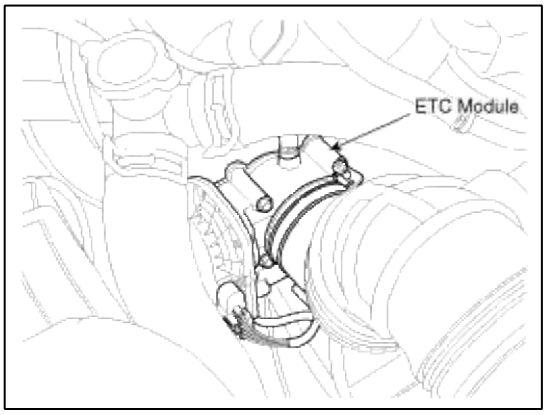
OBD-II regulations require monitoring of the upstream Heated O2 Sensor (H2OS) to detect if the deterioration of the sensor has exceeded thresholds. An additional HO2S is located downstream of the Warm-Up Three Way Catalytic Converter (WU-TWC) to determine the efficiency of the catalyst.
Although the downstream H2OS is similar to the type used for fuel control, it functions differently. The downstream HO2S is monitored to determine if a voltage is generated. That voltage is compared to a calibrated acceptable range.
6) Evaporative emission system monitoring
The EVAP. monitoring is a self-test strategy within the ECM or PCM that tests the integrity of the EVAP. system. The complete evaporative system detects a leak or leaks that cumulatively are greater than or equal to a leak caused by a 0.040 inch and 0.020 inch diameter orifice.
7) Air conditioning system monitoring
The A/C system monitoring is a self-test strategy within the ECM or PCM that monitors malfunction of all A/C system components at A/C ON.
8) Comprehensive components monitoring
The comprehensive components monitoring is a self-test strategy within the ECM or PCM that detects fault of any electronic powertrain components or system that provides input to the ECM or PCM and is not exclusively an input to any other OBD-II monitor.
9) A/C system component monitoring
Requirement:
If a vehicle incorporates an engine control strategy that alters off idle fuel and/or spark control when the A/C system is on, the OBD II system shall monitor all electronic air conditioning system components for malfunctions that cause the system to fail to invoke the alternate control while the A/C system is on or cause the system to invoke the alternate control while the A/C system is off.
Additionally, the OBD II system shall monitor for malfunction all electronic air conditioning system components that are used as part of the diagnostic strategy for any other monitored system or component.
Implementation plan:
No engine control strategy incorporated that alters offidle fuel and/or spark control when A/C system is on.
Malfuction of A/C system components is not used as a part of the diagnostic strategy for other monitored system or component.

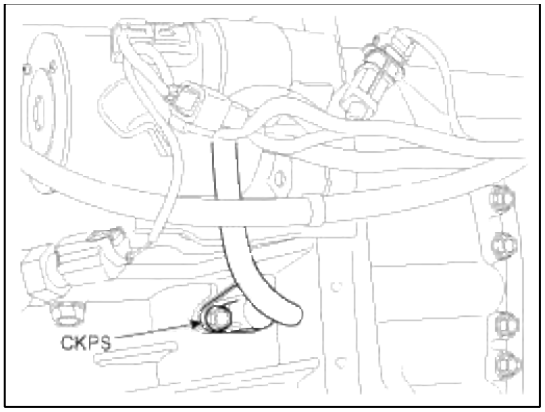
Fuel System > Engine Control System > Components and Components Location

Components Location

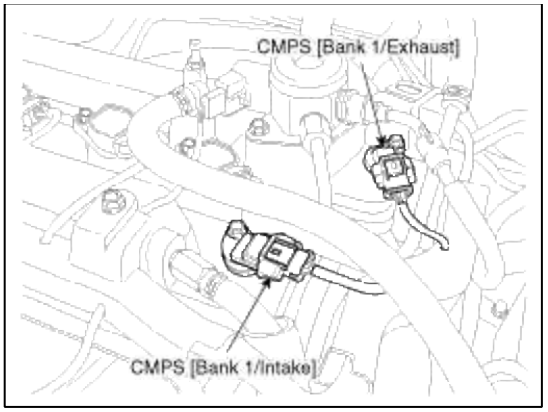

21 16 25 10 11 23 7 8 1
20 9 12 18 22 6 19 2 3 5 17 4 26 27 29
14
15
24
13
28

1. Engine Control Module (ECM) 2. Manifold Absolute Pressure Sensor (MAPS) 3. Intake Air Temperature Sensor (IATS) 4. Engine Coolant Temperature Sensor (ECTS) 5. Throttle Position Sensor (TPS) [integrated into ETC Module] 6. Crankshaft Position Sensor (CKPS) 7. Camshaft Position Sensor (CMPS) [Bank 1 / Intake] 8. Camshaft Position Sensor (CMPS) [Bank 1 / Exhaust] 9. Knock Sensor (KS) 10. Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 1] 11. Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2] 12. Rail Pressure Sensor (RPS) 13. Accelerator Position Sensor (APS) 14. Fuel Tank Pressure Sensor (FTPS) 15. Fuel Level Sender (FLS)	16. A/C Pressure Transducer (APT) 17. ETC Motor [integrated into ETC Module] 18. Injector 19. Purge Control Solenoid Valve (PCSV) 20. CVVT Oil Control Valve (OCV) [Bank 1 / Intake] 21. CVVT Oil Control Valve (OCV) [Bank 1 / Exhaust] 22. Variable Intake Solenoid (VIS) Valve 23. Fuel Pressure Control Valve (FPCV) 24. Canister Close Valve (CCV) 25. Ignition Coil 26. Main Relay 27. Fuel Pump Relay 28. Data Link Connector (DLC) [16-Pin] 29. Multi-Purpose Check Connector [20-Pin]

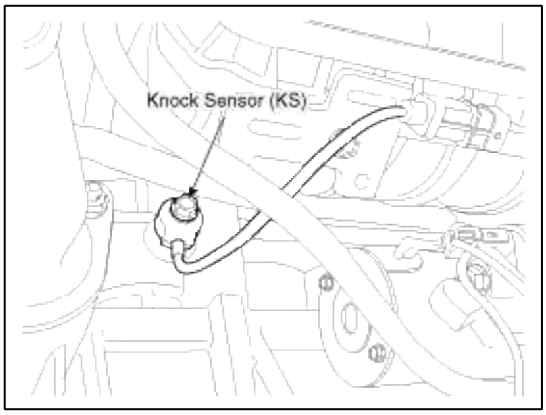
1. Engine Control Module (ECM)	2. Manifold Absolute Pressure Sensor (MAPS) 3. Intake Air Temperature Sensor (IATS)
	
4. Engine Coolant Temperature Sensor (ECTS)	5. Throttle Position Sensor (TPS) 17. ETC Motor
	
6. Crankshaft Position Sensor (CKPS)	7. Camshaft Position Sensor (CMPS) [Bank 1 / Intake] 8. Camshaft Position Sensor (CMPS) [Bank 1 / Exhaust]



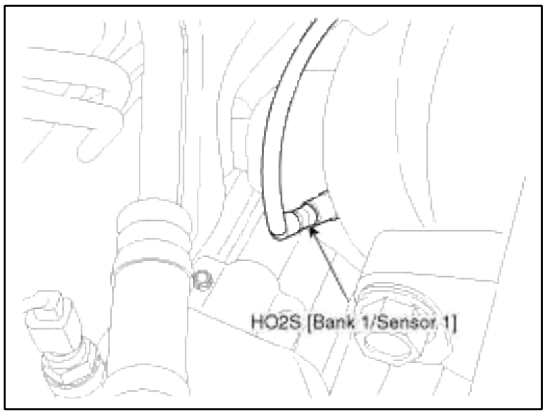
9. Knock Sensor (KS)



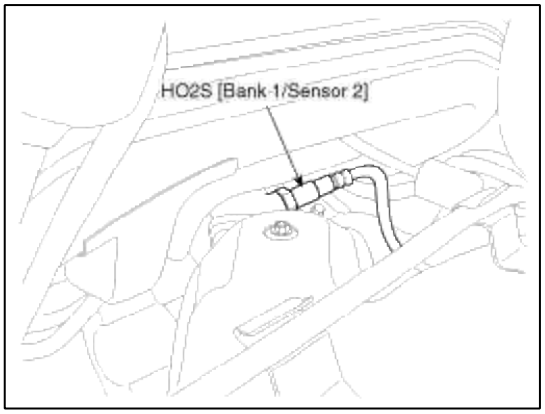
10. Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 1]



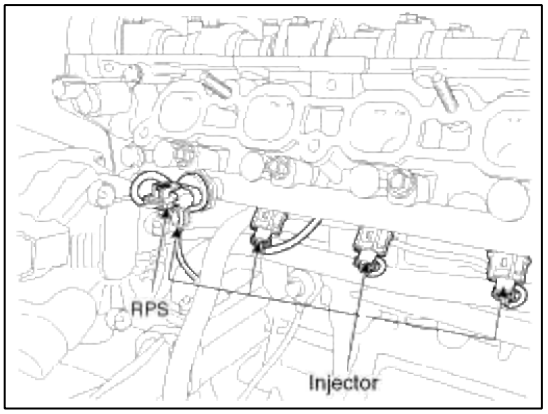
11. Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2]



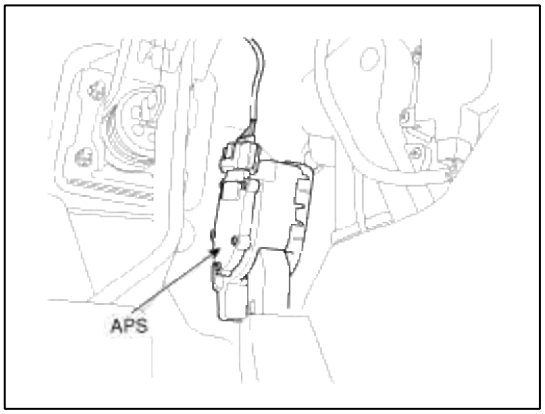
12. Rail Pressure Sensor (RPS)
18. Injector



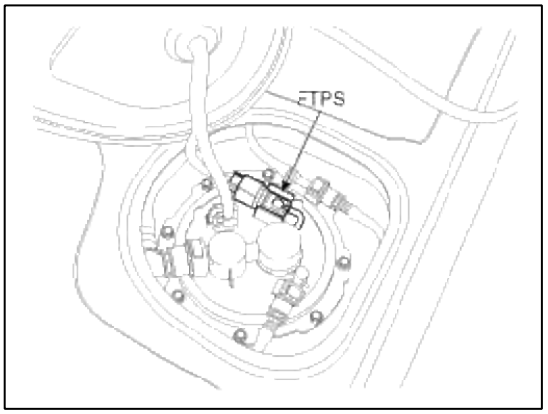
13. Accelerator Position Sensor (APS)



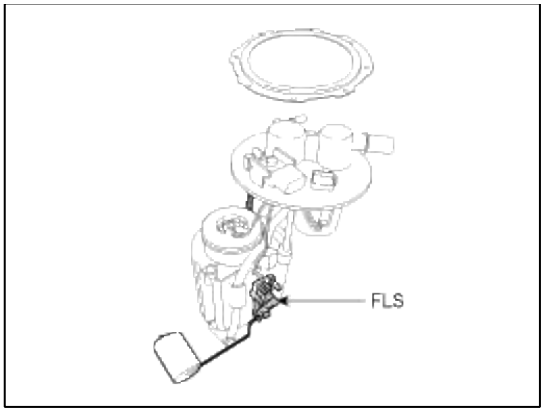
14. Fuel Tank Pressure Sensor (FTPS)



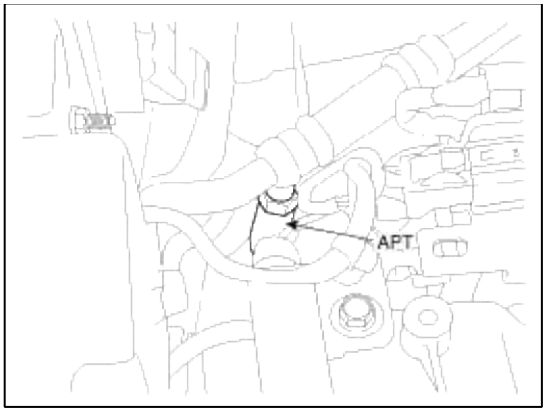
15. Fuel Level Sender (FLS)



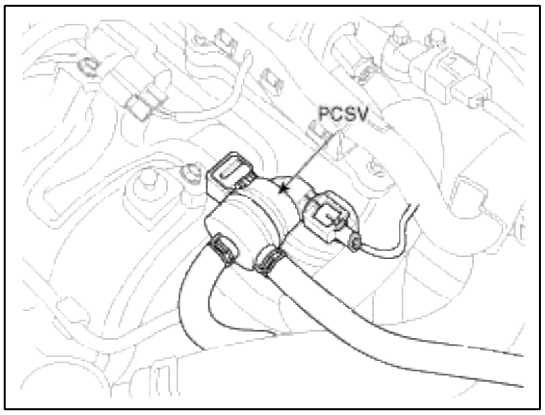
16. A/C Pressure Transducer (APT)



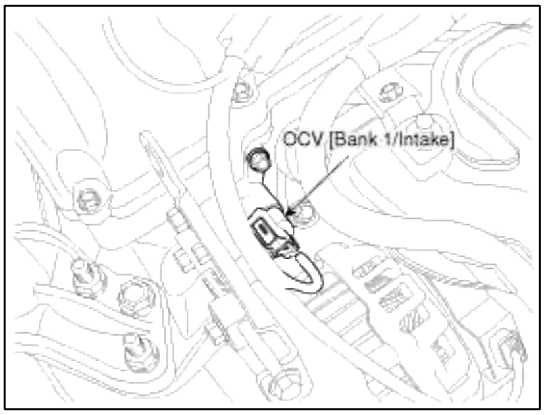
19. Purge Control Solenoid Valve (PCSV)



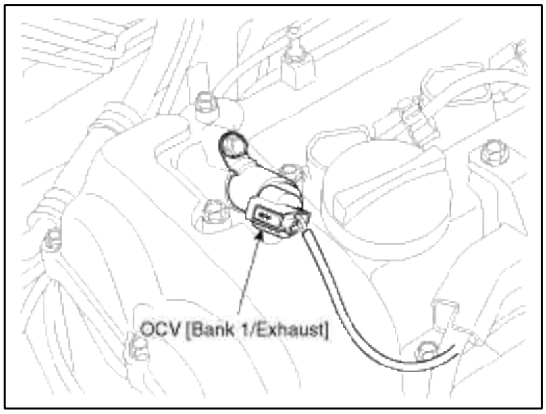
20. CVVT Oil Control Valve (OCV) [Bank 1 / Intake]



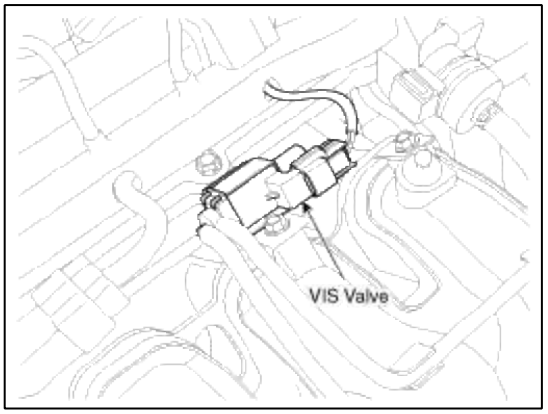
21. CVVT Oil Control Valve (OCV) [Bank 1 / Exhaust]



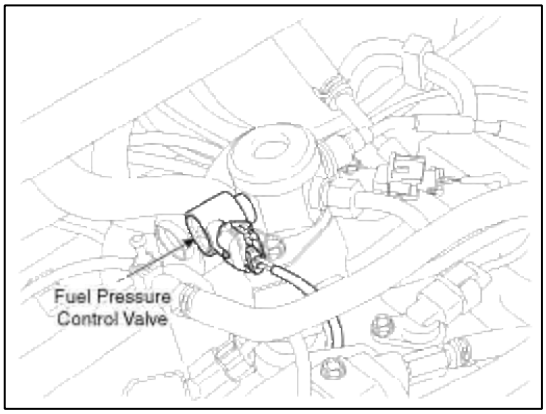
22. Variable Intake Solenoid (VIS) Valve



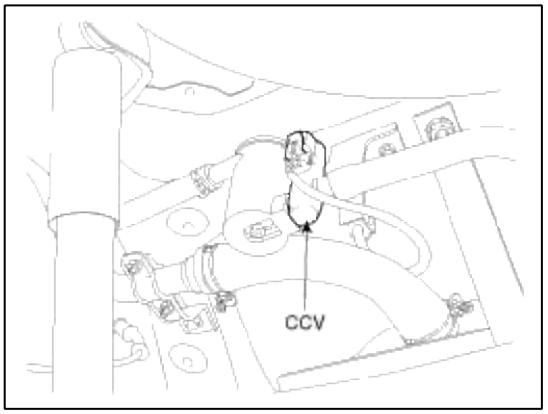
23. Fuel Pressure Control Valve (FPCV)



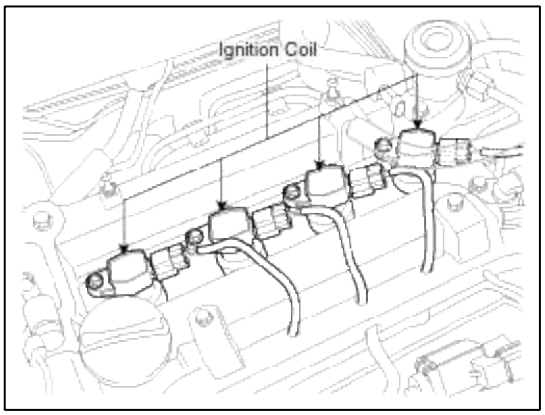
24. Canister Close Valve (CCV)

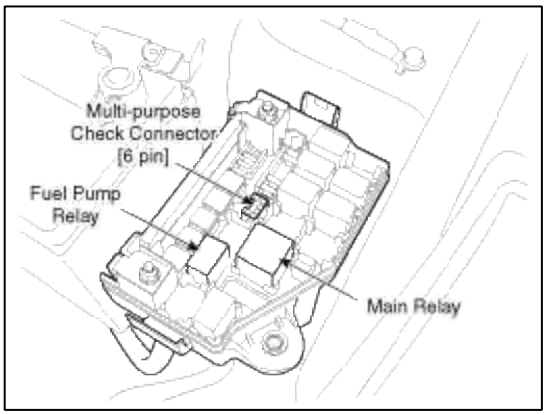


25. Ignition Coil

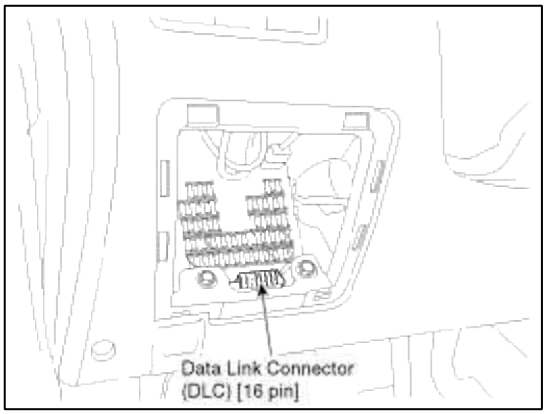


26. Main Relay
27. Fuel Pump Relay
29. Multi-Purpose Check Connector [20-Pin]



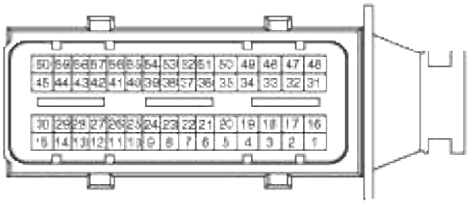


28. Data Link Connector (DLC) [16-Pin]

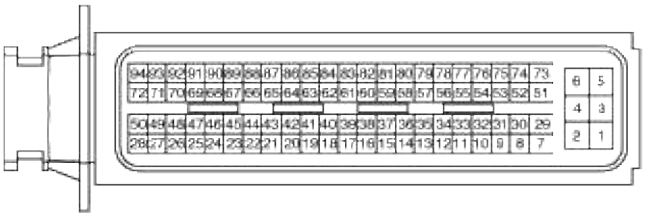


Fuel System > Engine Control System > Engine Control Module (ECM) > Schematic Diagrams

ECM Terminal And Input/Output signal [M/T]



Connector [EGGM-AG]



Connector [EGGM-KG]

ECM Terminal Function (M/T)

Connector [EGGM-AG]

Pin No.	Description	Connected to
1	Injector (Cylinder #3) [High] control output	Injector (Cylinder #3)
2	Injector (Cylinder #4) [High] control output	Injector (Cylinder #4)
3	Injector (Cylinder #2) [Low] control output	Injector (Cylinder #2)
4	-	
5	Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 1] heater control output	Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 1]
6	-	

7	Supply power (+5V)	Cruise control switch
8	-	
9	-	
10	-	
11	-	
12	Immobilizer indication lamp control output	Cluster
13	-	
14	Cooling fan relay [High] control output	Cooling fan relay [High]
15	CVVT Oil Control Valve (OCV) [Bank 1/Exhaust] control output	CVVT Oil Control Valve (OCV) [Bank 1/Exhaust]
16	Injector (Cylinder #2) [High] control output	Injector (Cylinder #2)
17	Injector (Cylinder #1) [High] control output	Injector (Cylinder #1)
18	Injector (Cylinder #3) [Low] control output	Injector (Cylinder #3)
19	-	
20	Heated Oxygen Sensor (HO2S) [Bank 1/Sensor2] heater control output	Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2]
21	-	
22	-	
23	Engine Coolant Temperature Sensor (ECTS) signal input	Engine Coolant Temperature Sensor (ECTS)
24	Sensor ground	Engine Coolant Temperature Sensor (ECTS)
25	-	
26	Fuel Tank Pressure Sensor (FTPS) signal input	Fuel Tank Pressure Sensor (FTPS)
27	Fuel pump relay control output (Without Immobilizer)	Fuel pump relay
	Canister Close Valve (CCV) control output (With Immobilizer)	Canister Close Valve (CCV)
28	-	
29	A/C compressor relay control output	A/C compressor relay
30	-	
31	Ignition coil (Cylinder #3) control output	Ignition coil (Cylinder #3)
32	Ignition coil (Cylinder #1) control output	Ignition coil (Cylinder #1)
33	Injector (Cylinder #1) [Low] control output	Injector (Cylinder #1)
34	Fuel Pressure Control Valve (FPCV) [High] control output	Fuel Pressure Control Valve (FPCV)
35	ETC motor [-] control output	ETC motor
36	-	
37	Knock Sensor (KS) signal input	Knock Sensor (KS)
38	Sensor ground	Knock Sensor (KS)

39	Blower switch Max. siganl input	Heater control module
40	Brake Light switch signal input	Brake switch
41	Wheel Speed Sensor [B] signal input [without ABS/ESC]	Wheel Speed Sensor (WSS)
42	Wheel Speed Sensor [A] signal input [without ABS/ESC]	Wheel Speed Sensor (WSS)
43	-	
44	-	
45	CVVT Oil Control Valve (OCV) [Bank 1/Intake] control output	CVVT Oil Control Valve (OCV) [Bank 1/Intake]
46	Ignition coil (Cylinder #4) control output	Ignition coil (Cylinder #4)
47	Ignition coil (Cylinder #2) control output	Ignition coil (Cylinder #2)
48	Injector (Cylinder #4) [Low] control output	Injector (Cylinder #4)
49	Fuel Pressure Control Valve (FPCV) [Low] control output	Fuel Pressure Control Valve (FPCV)
50	ETC motor [+] control output	ETC motor
51	-	
52	-	
53	Brake Test switch signal input	Brake switch
54	-	
55	Clutch switch signal input	Clutch switch
56	Electric load signal input [Defrost]	Alternator
57	Alternator COM signal output	Alternator
58	-	
59	Cooling fan relay [Low] control output	Cooling fan relay
60	Variable Intake Solenoid (VIS) valve control output	Variable Intake Solenoid (VIS) valve

Connector [EGGM-KG]

Pin No.	Description	Connected to
1	ECM ground	Chassis ground
2	ECM ground	Chassis ground
3	ECM ground	Chassis ground
4	Battery power (B+)	Main relay
5	Battery power (B+)	Battery
6	Battery power (B+)	Battery
7	Battery power (B+)	Main relay
8	Sensor ground	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2]
9	Accelerator Position Sensor (APS) 1 signal input	Accelerator Position Sensor (APS) 1
10	Sensor ground	Accelerator Position Sensor (APS) 2

11	-	
12	Sensor ground	Fuel Tank Pressure Sensor (FTPS)
13	-	
14	Throttle Position Sensor (TPS) 1 signal input	Throttle Position Sensor (TPS) 1
15	-	
16	-	
17	Fuel Level signal input	Fuel Level Sender (FLS)
18	Sensor power (+5V)	Accelerator Position Sensor (APS) 2
19	-	
20	Sensor power (+5V)	Rail Pressure Sensor (RPS)
		A/C Pressure Transducer (APT)
21	-	
22	Wiper switch signal input	Wiper switch
23	-	
24	Alternator PWM signal output	Alternator
25	-	
26	-	
27	-	
28	-	
29	Ignition switch signal input	
30	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2] signal input	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2]
31	Accelerator Position Sensor (APS) 2 signal input	Accelerator Position Sensor (APS) 2
32	Sensor ground	Accelerator Position Sensor (APS) 1
33	-	
34	-	
35	Sensor ground	Throttle Position Sensor (TPS)
36	Throttle Position Sensor (TPS) 2 signal input	Throttle Position Sensor (TPS) 2
37	-	
38	-	
39	Sensor power (+5V)	Throttle Position Sensor (TPS) 1,2
40	Sensor power (+5V)	Accelerator Position Sensor (APS) 1
41	Sensor power (+5V)	Manifold Absolute Pressure Sensor (MAPS)
		Fuel Tank Pressure Sensor (FTPS)
42	Sensor power (+5V)	Camshaft Position Sensor (CMPS) [Bank 1 / Intake]
		Camshaft Position Sensor (CMPS) [Bank 1 / Exhaust]

43	A/C switch input	A/C control module
44	A/C pressure switch	A/C control module
45	A/C Pressure Transducer (APT) signal input	A/C Pressure Transducer (APT)
46	Vehicle speed signal input	Vehicle Speed Sensor
47	-	
48	-	
49	-	
50	Malfunction Indicator Lamp (MIL) control output	Malfunction Indicator Lamp (MIL)
51	-	
52	VS-/IP- (Common Ground for VS, IP)	Heated Oxygen Sensor [Bank 1/Sensor 1]
53	Rc/Rp (Pump Cell Voltage)	Heated Oxygen Sensor [Bank 1/Sensor 1]
54	-	
55	-	
56	Ground	Cruise Control Switch
57	-	
58	Rail Pressure Sensor (RPS) signal input	Rail Pressure Sensor (RPS)
59	Cruise Control Switch signal input	Cruise Control Switch
60	Start signal input	PDM module
61	LIN communication signal input	Battery sensor
62	-	
63	CAN [Low]	Other control module, Data Link Connector (DLC), Multi-Purpose Check Connector
64	Sensor ground	Camshaft Position Sensor (CMPS) [Bank 1 / Exhaust]
65	Camshaft Position Sensor (CMPS) [Bank 1 / Exhaust] signal input	Camshaft Position Sensor (CMPS) [Bank 1 / Exhaust]
66	-	
67	Crankshaft Position Sensor (CKPS) [B] signal input	Crankshaft Position Sensor (CKPS)
68	-	
69	-	
70	-	
71	-	
72	Purge Control Solenoid Valve (PCSV) control output	Purge Control Solenoid Valve (PCSV)
73	-	
74	VS+ (NERNST Cell Voltage)	Heated Oxygen Sensor [Bank 1/Sensor 1]
75	Rc (Compensative Resistance)	Heated Oxygen Sensor [Bank 1/Sensor 1]

76	Sensor ground	Rail Pressure Sensor (RPS)
77	Sensor ground	A/C Pressure Transducer (APT)
78	Sensor ground	Manifold Absolute Pressure Sensor (MAPS)
79	Intake Temperature Sensor (IATS) signal input	Intake Temperature Sensor (IATS)
80	Manifold Absolute Pressure Sensor (MAPS) signal input	Manifold Absolute Pressure Sensor (MAPS)
81	-	
82	-	
83	Immobilizer communication line	Smart Key Control Module [With Button Engine Start System]
		Immobilizer Control Module [Without Button Engine Start System]
84	-	
85	CAN [High]	Other control module, Data Link Connector (DLC), Multi-Purpose Check Connector
86	Sensor ground	Camshaft Position Sensor (CMPS) [Bank 1 / Intake]
87	Camshaft Position Sensor (CMPS) [Bank 1 / Intake] signal input	Camshaft Position Sensor (CMPS) [Bank 1 / Intake]
88	Head lamp switch input	Multi-function switch
89	Crankshaft Position Sensor (CKPS) [A] signal input	Crankshaft Position Sensor (CKPS)
90	Canister Close Valve (CCV) control output (Without Immobilizer)	Canister Close Valve (CCV)
	Fuel pump relay control output (With Immobilizer)	Fuel pump relay
91	-	
92	-	
93	Main relay control output	Main relay
94	Start relay (Low) control output	Start relay

ECM Terminal Input/Output Signal (M/T)

Connector [EGGM-AG]

Pin No.	Description	Condition	Type	Level
1	Injector (Cylinder #3) [High] control output	Relay ON/OFF	DC voltage	71V
2	Injector (Cylinder #4) [High] control output	Relay ON/OFF	DC voltage	71V
3	Injector (Cylinder #2) [Low] control output	Relay OFF	DC voltage	71V
		Relay ON		Max. 1.0V

4	-			
5	Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 1] heater control output	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 1.65V
6	-			
7	Supply power (+5V)			
8	-			
9	-			
10	-			
11	-			
12	-			
13	Immobilizer indication lamp control output			
14	Cooling fan relay [High] control output	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 1.76V
15	CVVT Oil Control Valve (OCV) [Bank 1/Exhaust] control output	Idle	Pulse	High: Battery voltage
				Low: Max. 1.65V
16	Injector (Cylinder #2) [High] control output	Relay ON/OFF	DC voltage	71V
17	Injector (Cylinder #1) [High] control output	Relay ON/OFF	DC voltage	71V
18	Injector (Cylinder #3) [Low] control output	Relay OFF	DC voltage	71V
		Relay ON		Max. 1.0V
19	-			
20	Heated Oxygen Sensor (HO2S) [Bank 1/Sensor2] heater control output	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 1.65V
21	-			
22	-			
23	Engine Coolant Temperature Sensor (ECTS) signal input	Idle	Analog	0.270 ~ 4.77V
24	Sensor ground	Idle	DC voltage	Max. 50mV
25	-			
26	Fuel Tank Pressure Sensor (FTPS) signal input	Idle	Analog	0.3343 ~ 0.4667V
27	Canister Close Valve (CCV) control output (With Immobilizer)	Active	DC voltage	Battery voltage
		Inactive		Max. 1.76V
	Fuel pump relay control output (Without Immobilizer)	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 1.44V
28	-			

29	A/C compressor relay control output	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 1.0V
30	-			
31	Ignition coil (Cylinder #3) control output	Idle	Pulse	1st voltage: 370 ~ 430V
				ON voltage: Max. 2.2V
32	Ignition coil (Cylinder #1) control output	Idle	Pulse	1st voltage: 370 ~ 430V
				ON voltage: Max. 2.2V
33	Injector (Cylinder #1) [Low] control output	Relay OFF	DC voltage	71V
		Relay ON		Max. 1.0V
34	Fuel Pressure Control Valve (FPCV) [High] control output	Relay ON/OFF	DC voltage	16V
35	ETC motor [-] control output	Idle	Pulse	High: Battery voltage
				Low: Max. 1.0V
36	-			
37	Knock Sensor (KS) signal input	Knocking	Variable	
		Normal	Frequency	
38	Sensor ground	Knocking	Variable	
		Normal	Frequency	
39	Blower switch Max. siganl input			
40	Brake Light switch signal input	ON	DC voltage	Battery voltage
		OFF		Max. 2.25V
41	Wheel Speed Sensor [B] signal input [without ABS/ESC]			
42	Wheel Speed Sensor [A] signal input [without ABS/ESC]			
43	-			
44	-			
45	CVVT Oil Control Valve (OCV) [Bank 1/Intake] control output	Idle	Pulse	High: Battery voltage
				Low: Max. 1.65V
46	Ignition coil (Cylinder #4) control output	Idle	Pulse	1st voltage: 370 ~ 430V
				ON voltage: Max. 2.2V

47	Ignition coil (Cylinder #2) control output	Idle	Pulse	1st voltage: 370 ~ 430V
				ON voltage: Max. 2.2V
48	Injector (Cylinder #4) [Low] control output	Relay OFF	DC voltage	71V
		Relay ON		Max. 1.0V
49	Fuel Pressure Control Valve (FPCV) [Low] control output	Relay OFF	DC voltage	16V
		Relay ON		Max. 1.0V
50	ETC motor [+] control output	Idle	Pulse	High: Battery voltage
				Low: Max. 1.0V
51	-			
52	-			
53	Brake Test switch signal input	ON	DC voltage	Battery voltage
		OFF		Max. 2.25V
54	-			
55	Clutch switch signal input			
56	Electric load signal input [Defrost]	ON	DC voltage	Battery voltage
		OFF		Max. 2.25V
57	Alternator COM signal output	Idle	Pulse	High: Battery voltage
				Low: Max. 0.6V
58	-			
59	Cooling fan relay [Low] control output	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 1.76V
60	Variable Intake Solenoid (VIS) valve control output	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 1.65V

Connector [EGGM-KG]

Pin No.	Description	Condition	Type	Level
1	ECM ground	Idle	DC voltage	Max. 50mV
2	ECM ground	Idle	DC voltage	Max. 50mV
3	ECM ground	Idle	DC voltage	Max. 50mV
4	Battery power (B+)	IG OFF	DC voltage	Max. 1.0V
		IG ON		Battery voltage

5	Battery power (B+)	IG OFF	DC voltage	Max. 1.0V
		IG ON		Battery voltage
6	Battery power (B+)	IG OFF	DC voltage	Max. 1.0V
		IG ON		Battery voltage
7	Battery power (B+)	IG OFF	DC voltage	Max. 1.0V
		IG ON		Battery voltage
8	Sensor ground	Idle	DC voltage	Max. 50mV
9	Accelerator Position Sensor (APS) 1 signal input	Idle	Analog	0.674 ~ 4.379 V
10	Sensor ground	Idle	DC voltage	Max. 50mV
11	-			
12	Sensor ground	Idle	DC voltage	Max. 50mV
13	-			
14	Throttle Position Sensor (TPS) 1 signal input	Idle	Analog	0.33 ~ 4.72 V
15	-			
16	-			
17	Fuel Level signal input	Idle	Analog	0.193 ~ 4.0V
18	Sensor power (+5V)	IG OFF	DC voltage	Max. 0.5V
		IG ON		4.9 ~ 5.1V
19	-			
20	Sensor power (+5V)	IG OFF	DC voltage	Max. 0.5V
		IG ON		4.9 ~ 5.1V
21	-			
22	Wiper switch signal input	ON	DC voltage	Battery voltage
		OFF		Max. 2V
23	Neutral switch signal input			
24	Alternator PWM signal output	Idle	Pulse	High: Battery voltage
				Low: Max. 1.5V
25	-			
26	-			
27	Auto Stop Lamp output			
28	-			
29	Ignition switch signal input	IG OFF	DC voltage	Max. 1.0V
		IG ON		Battery voltage

30	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2] signal input	Engine	Analog	Rich: 0.6 ~ 1.0V
		Running		Lean: Max. 0.4V
31	Accelerator Position Sensor (APS) 2 signal input	Idle	Analog	0.261 ~ 2.204 V
32	Sensor ground	Idle	DC voltage	Max. 50mV
33	-			
34	-			
35	Sensor ground	Idle	DC voltage	Max. 50mV
36	Throttle Position Sensor (TPS) 2 signal input	Idle	Analog	0.55 ~ 4.37 V
37	-			
38				
39	Sensor power (+5V)	IG OFF	DC voltage	Max. 0.5V
		IG ON		4.9 ~ 5.1V
40	Sensor power (+5V)	IG OFF	DC voltage	Max. 0.5V
		IG ON		4.9 ~ 5.1V
41	Sensor power (+5V)	IG OFF	DC voltage	Max. 0.5V
		IG ON		4.9 ~ 5.1V
42	Sensor power (+5V)	IG OFF	DC voltage	Max. 0.5V
		IG ON		4.9 ~ 5.1V
43	A/C switch input			
44	A/C pressure switch			
45	A/C Pressure Transducer (APT) signal input	A/C ON	Analog	0.348 ~ 4.63 V
46	Vehicle speed signal input	Idle	Pulse	High: Min. 5.4V
				Low: Max. 2.25V
47	-			
48	-			
49	-			
50	Malfunction Indicator Lamp (MIL) control output			
51	-			
52	VS-/IP- (Common Ground for VS, IP)	Idle	DC voltage	Max. 50mV
53	Rc/Rp (Pump Cell Voltage)	Idle	Analog	0 ~ 5.1V
54	-			
55	-			
56	Ground			
57	-			

58	Rail Pressure Sensor (RPS) signal input	Idle	Analog	0.43 ~ 3.46V
59	Cruise Control Switch signal input			
60	Start signal input	ON	DC voltage	Battery voltage
		OFF		Max. 2V
61	LIN communication signal input	RECESSIVE	Pulse	max 5.6V (at 14V)
		DOMINANT		min 8.4V (at 14V)
62	-			
63	CAN [Low]	RECESSIVE	Pulse	2.0 ~ 3.0V
		DOMINANT		0.5 ~ 2.25V
64	Sensor ground	Idle	DC voltage	Max. 50mV
65	Camshaft Position Sensor (CMPS) [Bank 1 / Exhaust] signal input	Idle	Pulse	High: min. 4.8V
				Low: Max. 0.6V
66	-			
67	Crankshaft Position Sensor (CKPS) [B] signal input	Idle	Pulse	Vp_p: Min. 1.0V
68	-			
69	-			
70	-			
71	-			
72	Purge Control Solenoid Valve (PCSV) control output	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 1.76V
73	-			
74	VS+ (NERNST Cell Voltage)	Idle	Analog	0 ~ 5.1V
75	Rc (Compensative Resistance)	Idle	Analog	0 ~ 5.1V
76	Sensor ground	Idle	DC voltage	-
77	Sensor ground	Idle	DC voltage	Max. 50mV
78	Sensor ground	Idle	DC voltage	Max. 50mV
79	Intake Temperature Sensor (IATS) signal input	Idle	Analog	0.209 ~ 4.756V
80	Manifold Absolute Pressure Sensor (MAPS) signal input	Idle	Analog	0.6683 ~ 4.346V
81	-			
82	-			

83	Immobilizer communication line	When transmitting	Pulse	High: Min. 8.4V(at 14V)
				Low: Max. 6.44V(at 14V)
84	-			
85	CAN [High]	RECESSIVE	Pulse	2.0 ~ 3.0V
		DOMINANT		2.75 ~ 4.5V
86	Sensor ground	Idle	DC voltage	Max. 50mV
87	Camshaft Position Sensor (CMPS) [Bank 1 / Intake] signal input	Idle	Pulse	High: min. 4.8V
				Low: Max. 0.6V
88	Head lamp switch input			
89	Crankshaft Position Sensor (CKPS) [A] signal input	Idle	Pulse	Vp_p: Min. 1.0V
90	Canister Close Valve (CCV) control output (Without Immobilizer)	Active	DC voltage	Battery voltage
		Inactive		Max. 1.76V
	Fuel pump relay control output (With Immobilizer)	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 1.44V
91	-			
92	-			
93	Main relay control output	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 1.7V
94	Start relay control output	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 2.64V

ECM Terminal And Input/Output signal [A/T]

Connector [EGGA-AG]

Connector [EGGA-KG]

ECM Terminal Function (A/T)

Connector [EGGA-AG]

Pin No.	Description	Connected to
1	Injector (Cylinder #1) [High] control output	Injector (Cylinder #1)
2	Injector (Cylinder #4) [High] control output	Injector (Cylinder #4)
3	Injector (Cylinder #2) [High] control output	Injector (Cylinder #2)

4	Injector (Cylinder #3) [High] control output	Injector (Cylinder #3)
5	-	
6	-	
7	Purge Control Solenoid Valve (PCSV) control output	Purge Control Solenoid Valve (PCSV)
8	Start relay control output	Start relay
9	-	
10	-	
11	Sensor power (+5V)	Manifold Absolute Pressure Sensor (MAPS)
		Fuel Tank Pressure Sensor (FTPS)
12	Throttle Position Sensor (TPS) 1 signal input	Throttle Position Sensor (TPS) 1
13	Sensor ground	Engine Coolant Temperature Sensor (ECTS)
14	-	
15	Sensor power (+5V)	Accelerator Position Sensor (APS) 2
16	-	
17	-	
18	Sensor power (+5V)	Throttle Position Sensor (TPS) 1,2
19	Sensor power (+5V)	Accelerator Position Sensor (APS) 1
20	Ground	Cruise control switch
21	-	
22	-	
23	-	
24	Heated Oxygen Sensor [Bank 1/Sensor 1] heater control output	Heated Oxygen Sensor [Bank 1/Sensor 1]
25	Heated Oxygen Sensor [Bank 1/Sensor 2] heater control output	Heated Oxygen Sensor [Bank 1/Sensor 2]
26	-	
27	-	
28	-	
29	-	
30	A/C pressure switch signal input	A/C pressure switch
31	A/C switch signal input	A/C switch
32	Sensor ground	Throttle Position Sensor (TPS) 1,2
33	-	
34	Throttle Position Sensor (TPS) 2 signal input	Throttle Position Sensor (TPS) 2
35	-	

36	-	
37	-	
38	-	
39	-	
40	-	
41	Sensor ground	Heated Oxygen Sensor [Bank 1/Sensor 2]
42	-	
43	-	
44	-	
45	-	
46	-	
47	-	
48	-	
49	-	
50	-	
51	Alternator PWM signal output	Alternator
52	-	
53	Brake switch signal input	Brake switch
54	Accelerator Position Sensor (APS) 1 signal input	Accelerator Position Sensor (APS) 1
55	Blower switch Max. signal input	Heater & A/C control module
56	Accelerator Position Sensor (APS) 2 signal input	Accelerator Position Sensor (APS) 2
57	-	
58	-	
59	-	
60	Sensor ground	Knock Sensor (KS)
61	Knock Sensor (KS) signal input	Knock Sensor (KS)
62	Sensor ground	Accelerator Position Sensor (APS) 1
63	Sensor ground	Accelerator Position Sensor (APS) 2
64	Injector (Cylinder #1) [Low] control output	Injector (Cylinder #1)
65	Injector (Cylinder #4) [Low] control output	Injector (Cylinder #4)
66	Injector (Cylinder #2) [Low] control output	Injector (Cylinder #2)
67	Injector (Cylinder #3) [Low] control output	Injector (Cylinder #3)
68	-	
69	-	
70	-	
71	-	

72	-	
73	-	
74	-	
75	-	
76	-	
77	Fuel Tank Pressure Sensor (FTPS) signal input	Fuel Tank Pressure Sensor (FTPS)
78	Fuel Level Sender (FLS) signal input	Fuel Level Sender (FLS)
79	Cruise control switch signal	Cruise control switch
80	-	
81	-	
82	Engine Coolant Temperature Sensor (ECTS) signal input	Engine Coolant Temperature Sensor (ECTS)
83	VS-/IP- (Common Ground for VS, IP)	Heated Oxygen Sensor [Bank 1/Sensor 1]
84	VS+ (NERNST Cell Voltage)	Heated Oxygen Sensor [Bank 1/Sensor 1]
85	Fuel Pressure Control Valve (FPCV) [Low] control output	Fuel Pressure Control Valve (FPCV)
86	Fuel Pressure Control Valve (FPCV) [High] control output	Fuel Pressure Control Valve (FPCV)
87	-	
88	-	
89	-	
90	-	
91	-	
92	-	
93	-	
94	-	
95	-	
96	-	
97	-	
98	-	
99	-	
100	-	
101	-	
102	-	
103	Heated Oxygen Sensor [Bank 1/Sensor 2] signal input	Heated Oxygen Sensor [Bank 1/Sensor 2]
104	Rc/Rp (Pump Cell Voltage)	Heated Oxygen Sensor [Bank 1/Sensor 1]
105	Rc (Compensative Resistance)	Heated Oxygen Sensor [Bank 1/Sensor 1]

Connector [EGGA-KG]

Pin No.	Description	Connected to
1	ECM ground	Chassis ground
2	ECM ground	Chassis ground
3	Battery power (B+)	Ignition switch
4	ECM ground	Chassis ground
5	Battery power (B+)	Ignition switch
6	Battery power (B+)	Main relay
7	Sensor ground	Camshaft Position Sensor (CMPS) [Bank 1 / Exhaust]
8	Sensor ground	Manifold Absolute Pressure Sensor (MAPS)
9	-	
10	Sensor ground	Rail Pressure Sensor (RPS)
11	-	
12	-	
13	Sensor power (+5V)	Camshaft Position Sensor (CMPS) [Bank 1 / Intake]
		Camshaft Position Sensor (CMPS) [Bank 1 / Exhaust]
14	-	
15	Sensor power (+5V)	Rail Pressure Sensor (RPS)
		A/C Pressure Transducer (APT)
16	Alternator COM signal output	Alternator
17	-	
18	-	
19	-	
20	Cooling fan relay [Low] control output	Cooling fan relay
21	-	
22	ETC motor [-] control output	ETC motor
23	ETC motor [+] control output	ETC motor
24	-	
25	Sensor ground	A/C Pressure Transducer (APT)
26	Manifold Absolute Pressure Sensor (MAPS) signal input	Manifold Absolute Pressure Sensor (MAPS)
27	Rail Pressure Sensor (RPS) signal input	Rail Pressure Sensor (RPS)
28	Intake Air Temperature Sensor (IATS) signal input	Intake Air Temperature Sensor (IATS)
29	Electric load signal input [Defrost]	Alternator
30	Electric load signal input [Head lamp switch]	Alternator
31	-	

32	-	
33	-	
34	-	
35	-	
36	Cooling fan relay [High] control output	Cooling fan relay
37	Canister Close Valve (CCV) control output (Without Immobilizer)	Canister Close Valve (CCV)
	Fuel pump relay control output (With Immobilizer)	Fuel pump relay
38	-	
39	CVVT Oil Control Valve (OCV) [Bank 1/Exhaust] control output	CVVT Oil Control Valve (OCV) [Bank 1/Exhaust]
40	Ignition coil (Cylinder #2) control output	Ignition coil (Cylinder #2)
41	-	
42	Sensor ground	Fuel Tank Pressure Sensor (FTPS)
43	-	
44	A/C Pressure Transducer (APT) signal input	A/C Pressure Transducer (APT)
45	-	
46	Brake Light switch signal input	Brake switch
47	Camshaft Position Sensor (CMPS) [Bank 1 / Exhaust] signal input	Camshaft Position Sensor (CMPS) [Bank 1 / Exhaust]
48	-	
49	Wiper switch signal input	Wiper switch
50	Main relay control output	Main relay
51	Fuel pump relay control output (Without Immobilizer)	Fuel pump relay
	Canister Close Valve (CCV) control output (With Immobilizer)	Canister Close Valve (CCV)
52	-	
53	-	
54	Immobilizer indication lamp control output	Immobilizer indication lamp
55	-	
56	CVVT Oil Control Valve (OCV) [Bank 1/Intake] control output	CVVT Oil Control Valve (OCV) [Bank 1/Intake]
57	Ignition coil (Cylinder #1) control output	Ignition coil (Cylinder #1)
58	-	
59	-	

60	CAN [High]	Other control module, Data Link Connector (DLC), Multi-Purpose Check Connector
61	Immobilizer communication line	Smart Key Control Module [With Button Engine Start System]
		Immobilizer Control Module [Without Button Engine Start System]
62	LIN communication signal input	Battery sensor
63	-	
64	Vehicle speed signal input	Vehicle Speed Sensor
65	-	
66	Camshaft Position Sensor (CMPS) [Bank 1 / Intake] signal input	Camshaft Position Sensor (CMPS) [Bank 1 / Intake]
67	Start signal input	PDM module
68	Ignition switch signal input	Ignition switch
69	-	
70	-	
71	Start relay control output	Start relay
72	-	
73	-	
74	Ignition coil (Cylinder #4) control output	Ignition coil (Cylinder #4)
75	Battery power (B+)	Main relay
76	-	
77	CAN [Low]	Other control module, Data Link Connector (DLC), Multi-Purpose Check Connector
78	Sensor ground	Crankshaft Position Sensor (CKPS)
79	Crankshaft Position Sensor (CKPS) [A] signal input	Crankshaft Position Sensor (CKPS)
80	Sensor ground	Camshaft Position Sensor (CMPS) [Bank 1 / Intake]
81	Wheel Speed Sensor [B] signal input [without ABS/ESC]	Wheel Speed Sensor (WSS)
82	Wheel Speed Sensor [A] signal input [without ABS/ESC]	Wheel Speed Sensor (WSS)
83	A/C compressor relay control output	A/C compressor relay
84	-	
85	Variable Intake Solenoid (VIS) Valve control output	Variable Intake Solenoid (VIS) Valve
86	-	
87	-	

88	Malfunction Indiation Lamp (MIL) control output	Malfunction Indiation Lamp (MIL)
89	-	
90	-	
91	Ignition coil (Cylinder #3) control output	Ignition coil (Cylinder #3)

ECM Terminal Input/Output Signal (A/T)

Connector [EGGA-AG]

Pin No.	Description	Condition	Type	Level
1	Injector (Cylinder #1) [High] control output	Relay ON/OFF	DC voltage	71V
2	Injector (Cylinder #4) [High] control output	Relay ON/OFF	DC voltage	71V
3	Injector (Cylinder #2) [High] control output	Relay ON/OFF	DC voltage	71V
4	Injector (Cylinder #3) [High] control output	Relay ON/OFF	DC voltage	71V
5	-			
6	-			
7	Purge Control Solenoid Valve (PCSV) control output	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 1.76V
8	Start relay control output	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 2.64V
9	-			
10	-			
11	Sensor power (+5V)	IG OFF	DC voltage	Max. 0.5V
		IG ON		4.9 ~ 5.1V
12	Throttle Position Sensor (TPS) 1 signal input	Idle	Analog	0.33 ~ 4.72 V
13	Sensor ground	Idle	DC voltage	Max. 50mV
14	-			
15	Sensor power (+5V)	IG OFF	DC voltage	Max. 0.5V
		IG ON		4.9 ~ 5.1V
16	-			
17	-			
18	Sensor power (+5V)	IG OFF	DC voltage	Max. 0.5V
		IG ON		4.9 ~ 5.1V

19	Sensor power (+5V)	IG OFF	DC voltage	Max. 0.5V
		IG ON		4.9 ~ 5.1V
20	Ground	Idle	DC voltage	Max. 50mV
21	-			
22	-			
23	-			
24	Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 1] heater control output	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 1.65V
25	Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2] heater control output	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 1.65V
26	-			
27	-			
28	-			
29	-			
30	A/C pressure switch signal input	ON	DC voltage	Battery voltage
		OFF		Max. 2V
31	A/C switch signal input	ON	DC voltage	Battery voltage
		OFF		Max. 2V
32	Sensor ground	Idle	DC voltage	Max. 50mV
33	-			
34	Throttle Position Sensor (TPS) 2 signal input	Idle	Analog	0.55 ~ 4.37 V
35	-			
36	-			
37	-			
38	-			
39	-			
40	-			
41	Sensor ground	Idle	DC voltage	Max. 50mV
42	-			
43	-			
44	-			
45	-			
46	-			
47	-			

48	-			
49	-			
50	-			
51	Alternator PWM signal output	Idle	Pulse	High: Battery voltage
				Low: Max. 1.5V
52	-			
53	Brake switch signal input	ON	DC voltage	Battery voltage
		OFF		Max. 2.25V
54	Accelerator Position Sensor (APS) 1 signal input	Idle	Analog	0.674 ~ 4.379 V
55	Blower switch Max. signal input	ON	DC voltage	Max. 1.0V
		OFF		Battery voltage
56	Accelerator Position Sensor (APS) 2 signal input	Idle	Analog	0.261 ~ 2.204 V
57	-			
58	-			
59	-			
60	Sensor ground	Knocking	Variable	
		Normal	Frequency	
61	Knock Sensor (KS) signal input	Knocking	Variable	
		Normal	Frequency	
62	Sensor ground	Idle	DC voltage	Max. 50mV
63	Sensor ground	Idle	DC voltage	Max. 50mV
64	Injector (Cylinder #1) [Low] control output	Relay OFF	DC voltage	71V
		Relay ON		Max. 1.0V
65	Injector (Cylinder #4) [Low] control output	Relay OFF	DC voltage	71V
		Relay ON		Max. 1.0V
66	Injector (Cylinder #2) [Low] control output	Relay OFF	DC voltage	71V
		Relay ON		Max. 1.0V
67	Injector (Cylinder #3) [Low] control output	Relay OFF	DC voltage	71V
		Relay ON		Max. 1.0V
68	-			
69	-			
70	-			
71	-			
72	-			

73	-			
74	-			
75	-			
76	-			
77	Fuel Tank Pressure Sensor (FTPS) signal input	Idle	Analog	0.3343 ~ 0.4667V
78	Fuel Level signal input	Idle	Analog	0.193 ~ 4.0V
79	Cruise control switch signal			
80	-			
81	-			
82	Engine Coolant Temperature Sensor (ECTS) signal input	Idle	Analog	0.270 ~ 4.77V
83	VS-/IP- (Common Ground for VS, IP)	Idle	DC voltage	Max. 50mV
84	VS+ (NERNST Cell Voltage)	Idle	Analog	0 ~ 5.1V
85	Fuel Pressure Control Valve (FPCV) [Low] control output	Relay OFF	DC voltage	16V
		Relay ON		Max. 1.0V
86	Fuel Pressure Control Valve (FPCV) [High] control output	Relay ON/OFF	DC voltage	16V
87	-			
88	-			
89	-			
90	-			
91	-			
92	-			
93	-			
94	-			
95	-			
96	-			
97	-			
98	-			
99	-			
100	-			
101	-			
102	-			
103	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2] signal input	Engine	Analog	Rich: 0.6 ~ 1.0V
		Running		Lean: Max. 0.4V
104	Rc/Rp (Pump Cell Voltage)	Idle	Analog	0 ~ 5.1V

105	Rc (Compensative Resistance)	Idle	Analog	0 ~ 5.1V

Connector [EGGA-KG]

Pin No.	Description	Condition	Type	Level
1	ECM ground	Idle	DC voltage	Max. 50mV
2	ECM ground	Idle	DC voltage	Max. 50mV
3	Battery power (B+)	IG OFF	DC voltage	Max. 1.0V
		IG ON		Battery voltage
4	ECM ground	Idle	DC voltage	Max. 50mV
5	Battery power (B+)	IG OFF	DC voltage	Max. 1.0V
		IG ON		Battery voltage
6	Battery power (B+)	IG OFF	DC voltage	Max. 1.0V
		IG ON		Battery voltage
7	Sensor ground	Idle	DC voltage	Max. 50mV
8	Sensor ground	Idle	DC voltage	Max. 50mV
9	-			
10	Sensor ground	Idle	DC voltage	Max. 50mV
11	-			
12	-			
13	Sensor power (+5V)	IG OFF	DC voltage	Max. 0.5V
		IG ON		4.9 ~ 5.1V
14	-			
15	Sensor power (+5V)	IG OFF	DC voltage	Max. 0.5V
		IG ON		4.9 ~ 5.1V
16	Alternator COM signal output	Idle	Pulse	High: Battery voltage
				Low: Max. 0.6V
17	-			
18	-			
19	-			
20	Cooling fan relay [Low] control output	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 1.76V
21	-			
22	ETC motor [-] control output	Idle	Pulse	High: Battery voltage
				Low: Max. 1.0V
23	ETC motor [+] control output	Idle	Pulse	High: Battery voltage
				Low: Max. 1.0V

24	-			
25	Sensor ground	Idle	DC voltage	Max. 50mV
26	Manifold Absolute Pressure Sensor (MAPS) signal input	Idle	Analog	0.6683 ~ 4.346V
27	Rail Pressure Sensor (RPS) signal input	Idle	Analog	0.43 ~ 3.46V
28	Intake Temperature Sensor (IATS) signal input	Idle	Analog	0.209 ~ 4.756V
29	Electric load signal input [Defrost]	ON	DC voltage	Battery voltage
		OFF		Max. 2.25V
30	Electric load signal input [Head lamp switch]	ON	DC voltage	Max. 2.25V
		OFF		Battery voltage
31	-			
32	-			
33	-			
34	-			
35	-			
36	Cooling fan relay [High] control output	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 1.76V
37	Canister Close Valve (CCV) control output (Without Immobilizer)	Active	DC voltage	Battery voltage
		Inactive		Max. 1.76V
	Fuel pump relay control output (With Immobilizer)	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 1.44V
38	-			
39	CVVT Oil Control Valve (OCV) [Bank 1/Exhaust] control output	Idle	Pulse	High: Battery voltage
				Low: Max. 1.65V
40	Ignition coil (Cylinder #2) control output	Idle	Pulse	1st voltage: 370 ~ 430V
				ON voltage: Max. 2.2V
41	-			
42	Sensor ground	Idle	DC voltage	Max. 50mV
43	-			
44	A/C Pressure Transducer (APT) signal input	A/C ON	Analog	0.348 ~ 4.63 V
45	-			
46	Brake Light switch signal input	ON	DC voltage	Battery voltage
		OFF		Max. 2.25V
47	Camshaft Position Sensor (CMPS) [Bank 1 / Exhaust] signal input	Idle	Pulse	High: min. 4.8V
				Low: Max. 0.6V

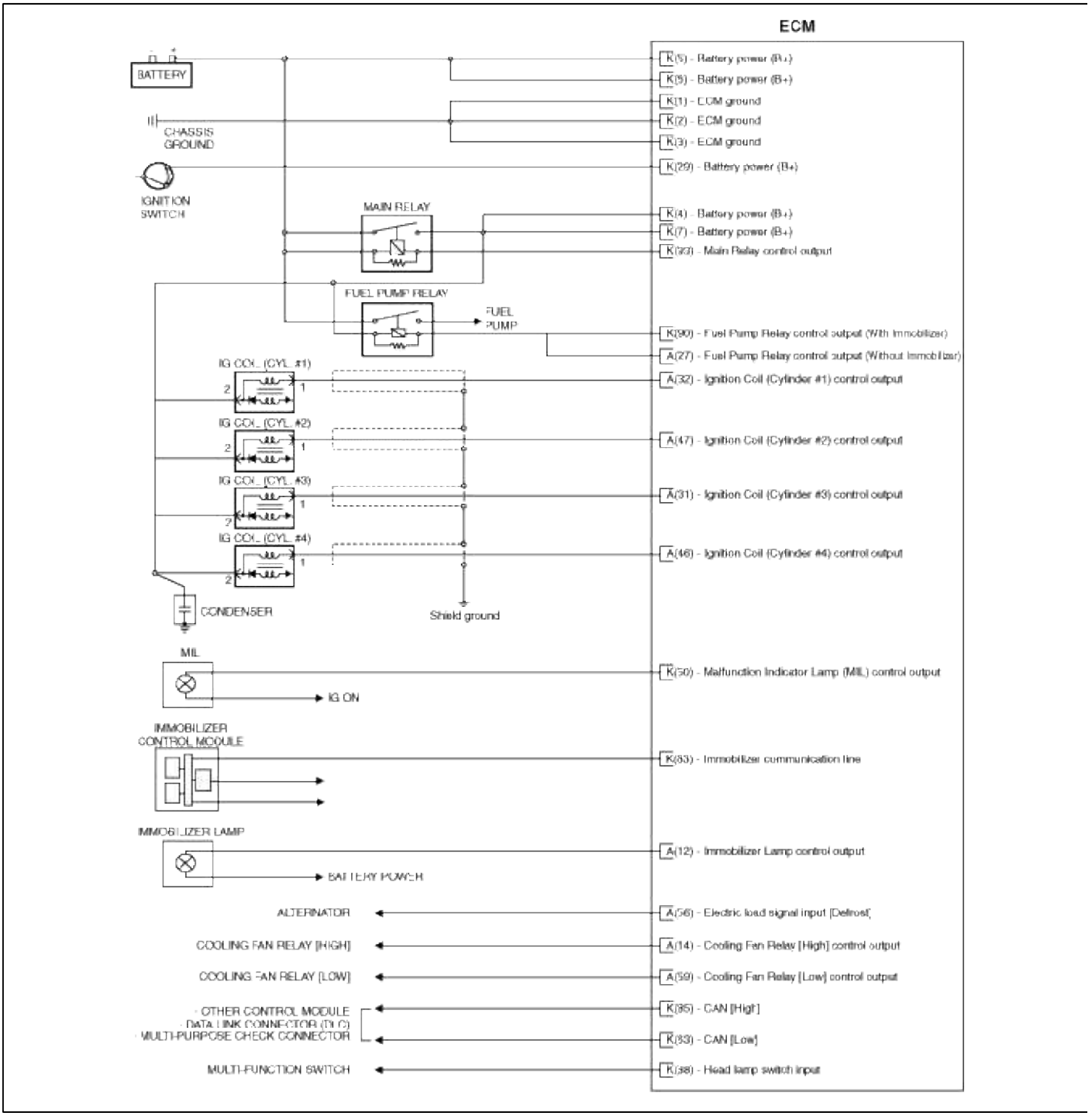
48	-			
49	Wiper switch signal input	ON	DC voltage	Battery voltage
		OFF		Max. 2V
50	Main relay control output	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 1.7V
51	Canister Close Valve (CCV) control output (With Immobilizer)	Active	DC voltage	Battery voltage
		Inactive		Max. 1.76V
	Fuel pump relay control output (Without Immobilizer)	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 1.44V
52	-			
53	-			
54	Malfunction Indiation Lamp (MIL) control			
55	-			
56	CVVT Oil Control Valve (OCV) [Bank 1/Intake] control output	Idle	Pulse	High: Battery voltage
				Low: Max. 1.65V
57	Ignition coil (Cylinder #1) control output	Idle	Pulse	1st voltage: 370 ~ 430V
				ON voltage: Max. 2.2V
58	-			
59	-			
60	CAN [High]	RECESSIVE	Pulse	2.0 ~ 3.0V
		DOMINANT		2.75 ~ 4.5V
61	Immobilizer communication line	When transmitting	Pulse	High: Min. 8.4V(at 14V)
				Low: Max. 6.44V(at 14V)
62	LIN communication signal input	RECESSIVE	Pulse	max 5.6V (at 14V)
		DOMINANT		min 8.4V (at 14V)
63	-			
64	Vehicle speed signal input	Idle	Pulse	High: Min. 5.4V
				Low: Max. 2.25V
65	-			
66	Camshaft Position Sensor (CMPS) [Bank 1 / Intake] signal input	Idle	Pulse	High: min. 4.8V
				Low: Max. 0.6V
67	Start signal input	ON	DC voltage	Battery voltage
		OFF		Max. 2V

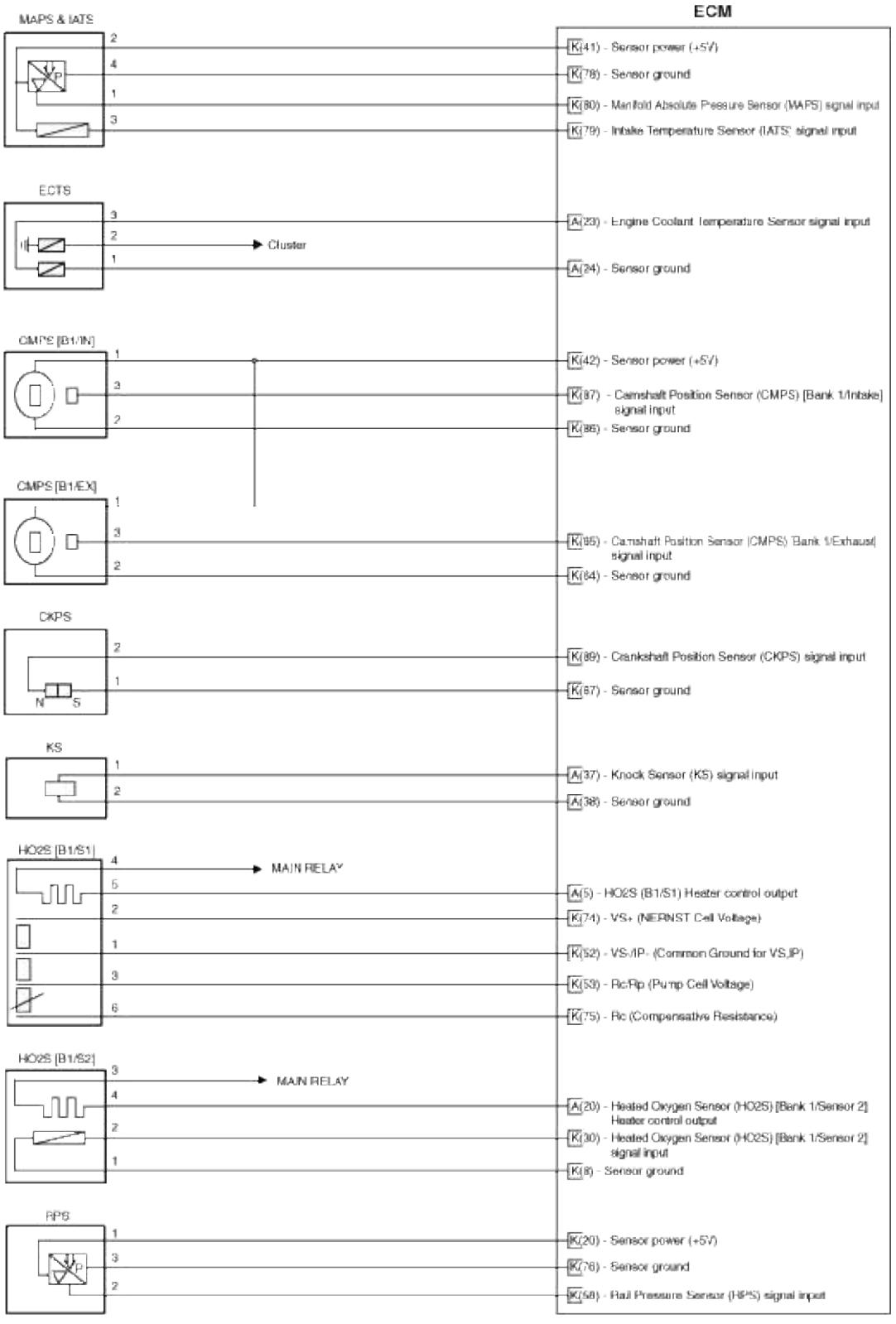
68	Ignition switch signal input	IG OFF	DC voltage	Max. 1.0V
		IG ON		Battery voltage
69	-			
70	-			
71	Start relay control output	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 2.64V
72	-			
73	-			
74	Ignition coil (Cylinder #4) control output	Idle	Pulse	1st voltage: 370 ~ 430V
				ON voltage: Max. 2.2V
75	Battery power (B+)	IG OFF	DC voltage	Max. 1.0V
		IG ON		Battery voltage
76	-			
77	CAN [Low]	RECESSIVE	Pulse	2.0 ~ 3.0V
		DOMINANT		0.5 ~ 2.25V
78	Sensor ground	Idle	DC voltage	Max. 50mV
79	Crankshaft Position Sensor (CKPS) [A] signal input	Idle	Pulse	Vp_p: Min. 1.0V
80	Sensor ground	Idle	DC voltage	Max. 50mV
81	Wheel speed sensor [B] signal input [without ABS/VDC]	Vehicle running	SINE waveform	Vp_p: Min. 0.2V
82	Wheel speed sensor [A] signal input [without ABS/VDC]	Vehicle running	SINE waveform	Vp_p: Min. 0.2V
83	A/C compressor relay control output	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 1.0V
84	-			
85	Variable Intake Solenoid (VIS) valve control output	Relay OFF	DC voltage	Battery voltage
		Relay ON		Max. 1.65V
86	-			
87	-			
88	Malfunction Indiation Lamp (MIL) control output			
89	-			
90	-			

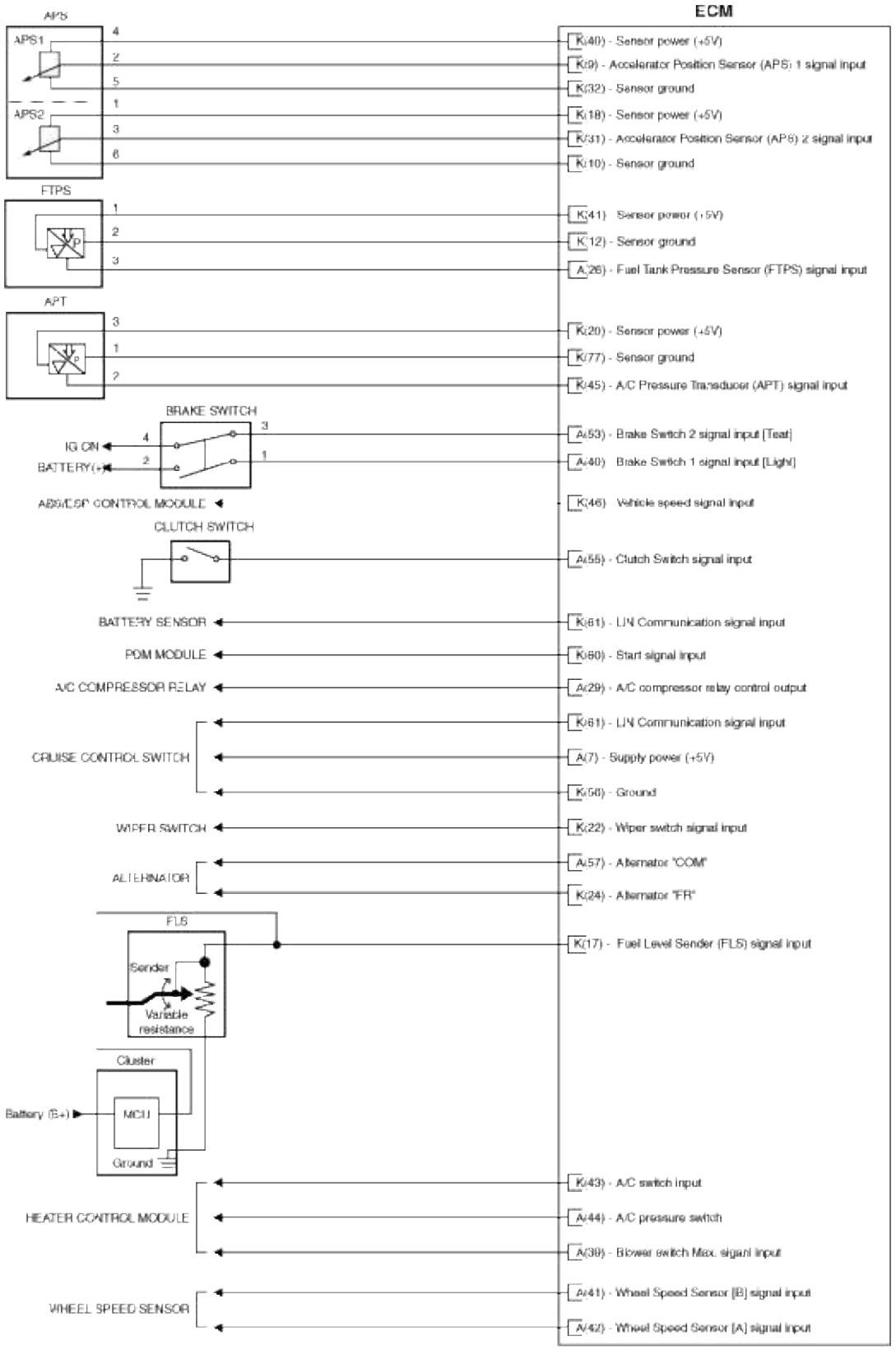
91	Ignition coil (Cylinder #3) control output	Idle	Pulse	1st voltage: 370 ~ 430V ON voltage: Max. 2.2V

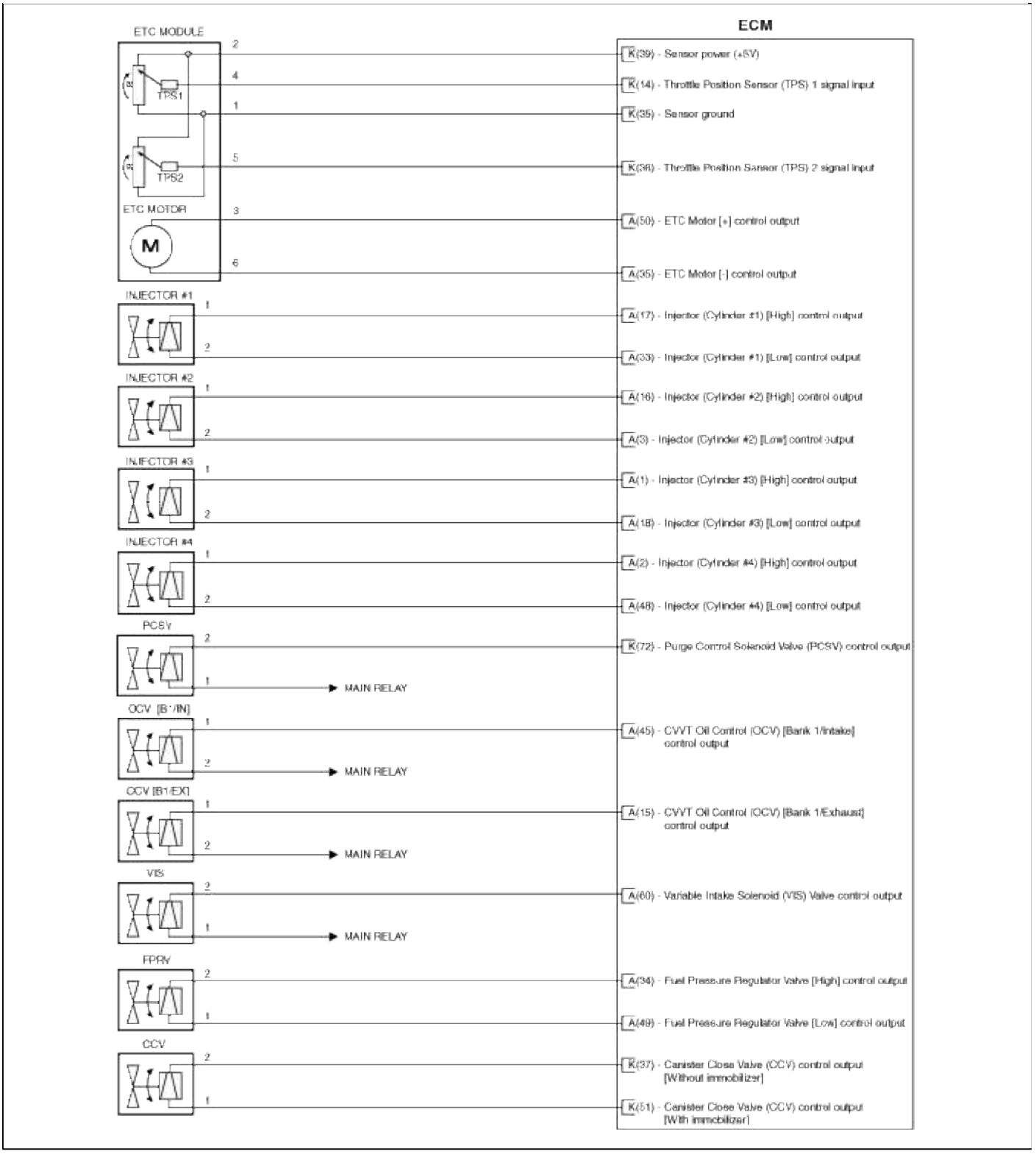
Circuit Diagram

(M/T)

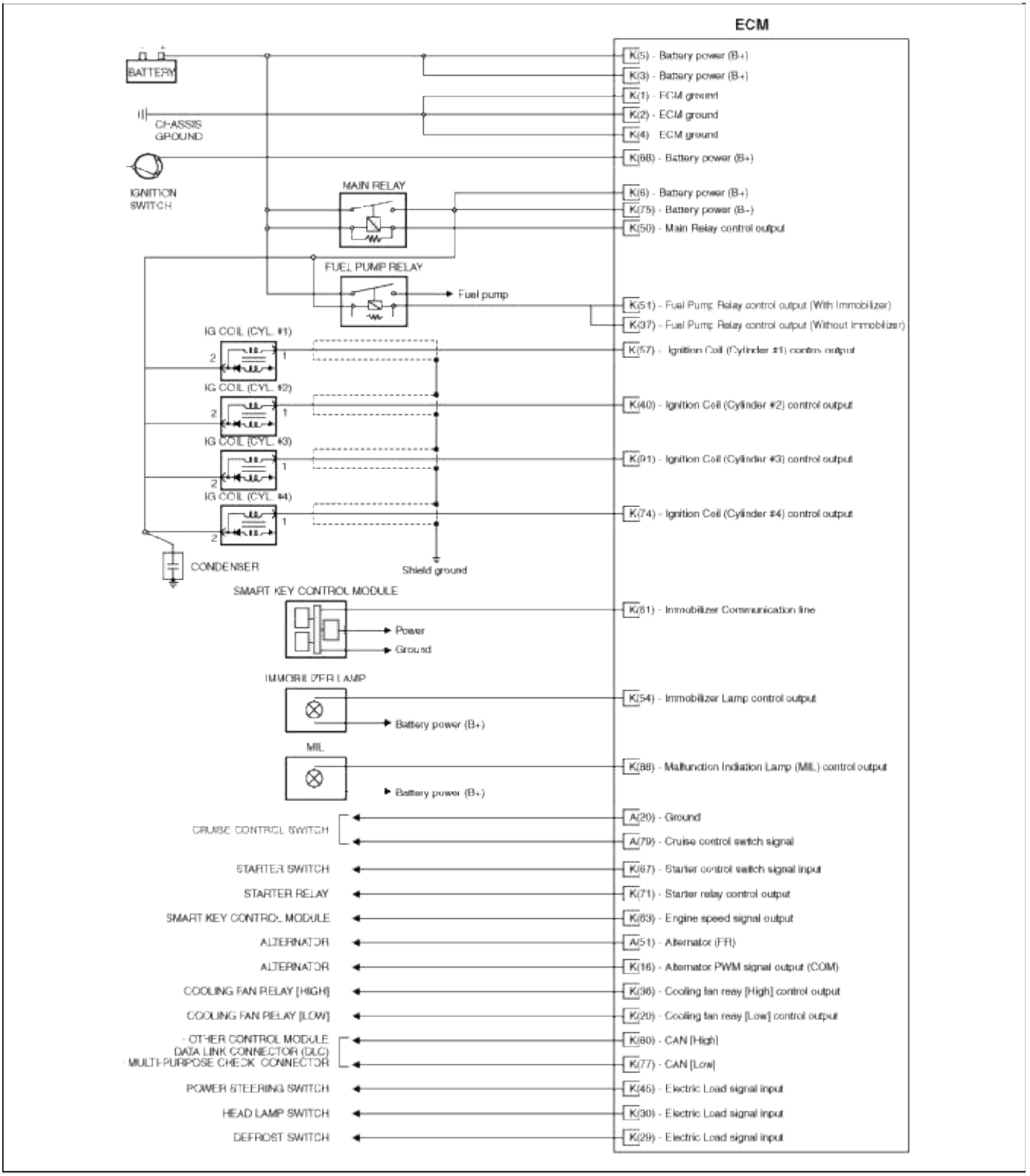


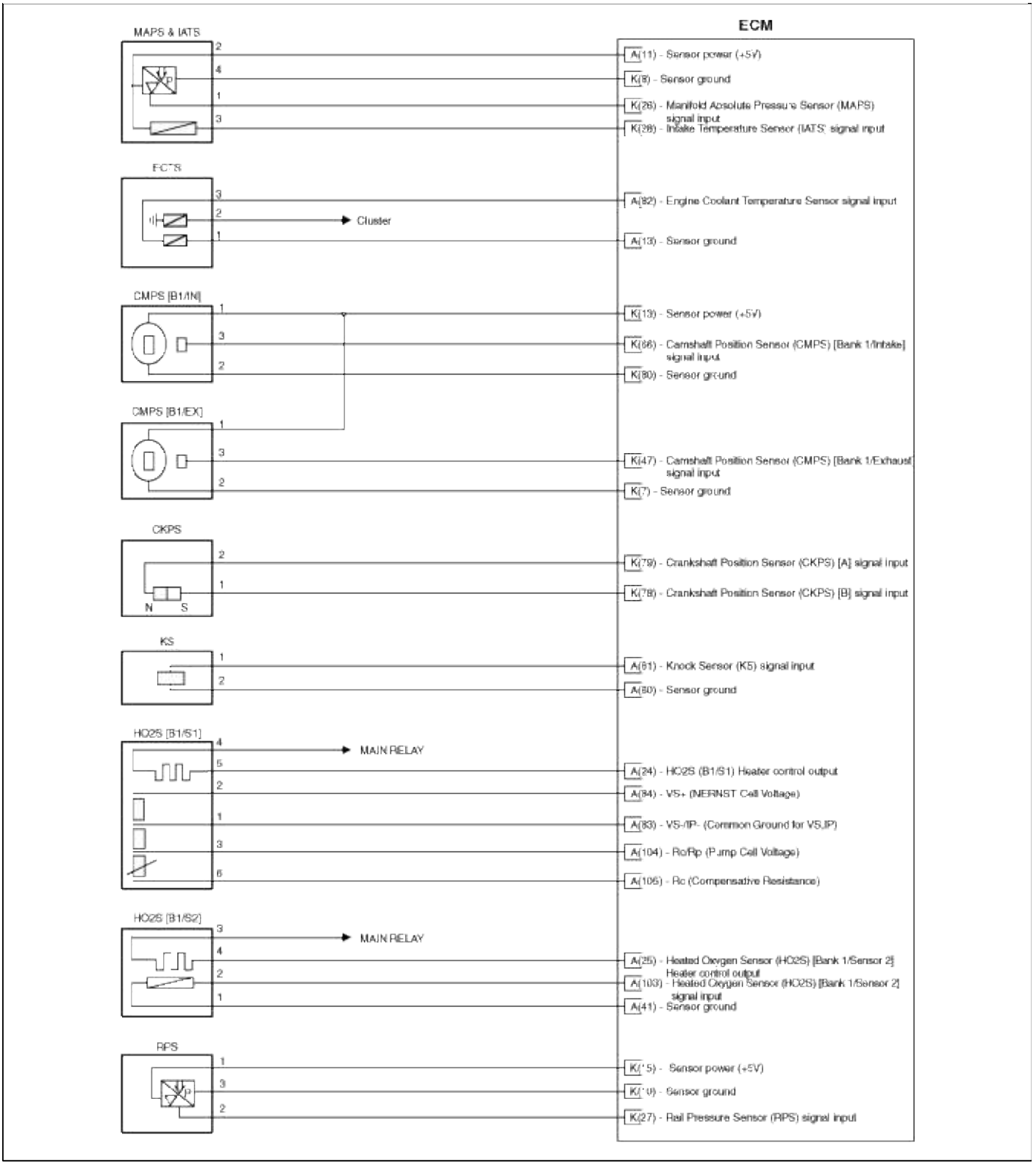

ECM
MAPS & IATS
2
4
1
3
K(41) - Sensor power (+5V)
K(78) - Sensor ground
K(80) - Manifold Absolute Pressure Sensor (MAPS) signal input
K(79) - Intake Temperature Sensor (IATS) signal input
ECTS
3
2
1
Cluster
A(23) - Engine Coolant Temperature Sensor signal input
A(24) - Sensor ground
CMPS [B1/IN]
1
3
2
K(42) - Sensor power (+5V)
K(87) - Camshaft Position Sensor (CMPS) [Bank 1/Intake] signal input
K(86) - Sensor ground
CMPS [B1/EX]
1
3
2
K(85) - Camshaft Position Sensor (CMPS) [Bank 1/Exhaust] signal input
K(84) - Sensor ground
CKPS
2
1
N
S
K(89) - Crankshaft Position Sensor (CKPS) signal input
K(67) - Sensor ground
KS
1
2
A(37) - Knock Sensor (KS) signal input
A(38) - Sensor ground
HO2S [B1/S1]
4
5
2
1
3
6
MAIN RELAY
A(5) - HO2S (B1/S1) Heater control output
K(74) - VS+ (NERNST Cell Voltage)
K(52) - VS-/IP- (Common Ground for VS,IP)
K(53) - Ric/Rp (Pump Cell Voltage)
K(75) - Ric (Compensative Resistance)
HO2S [B1/S2]
3
4
2
1
MAIN RELAY
A(20) - Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2] Heater control output
K(30) - Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2] signal input
K(8) - Sensor ground
RPS
1
3
2
K(20) - Sensor power (+5V)
K(76) - Sensor ground
K(58) - Rail Pressure Sensor (RPS) signal input

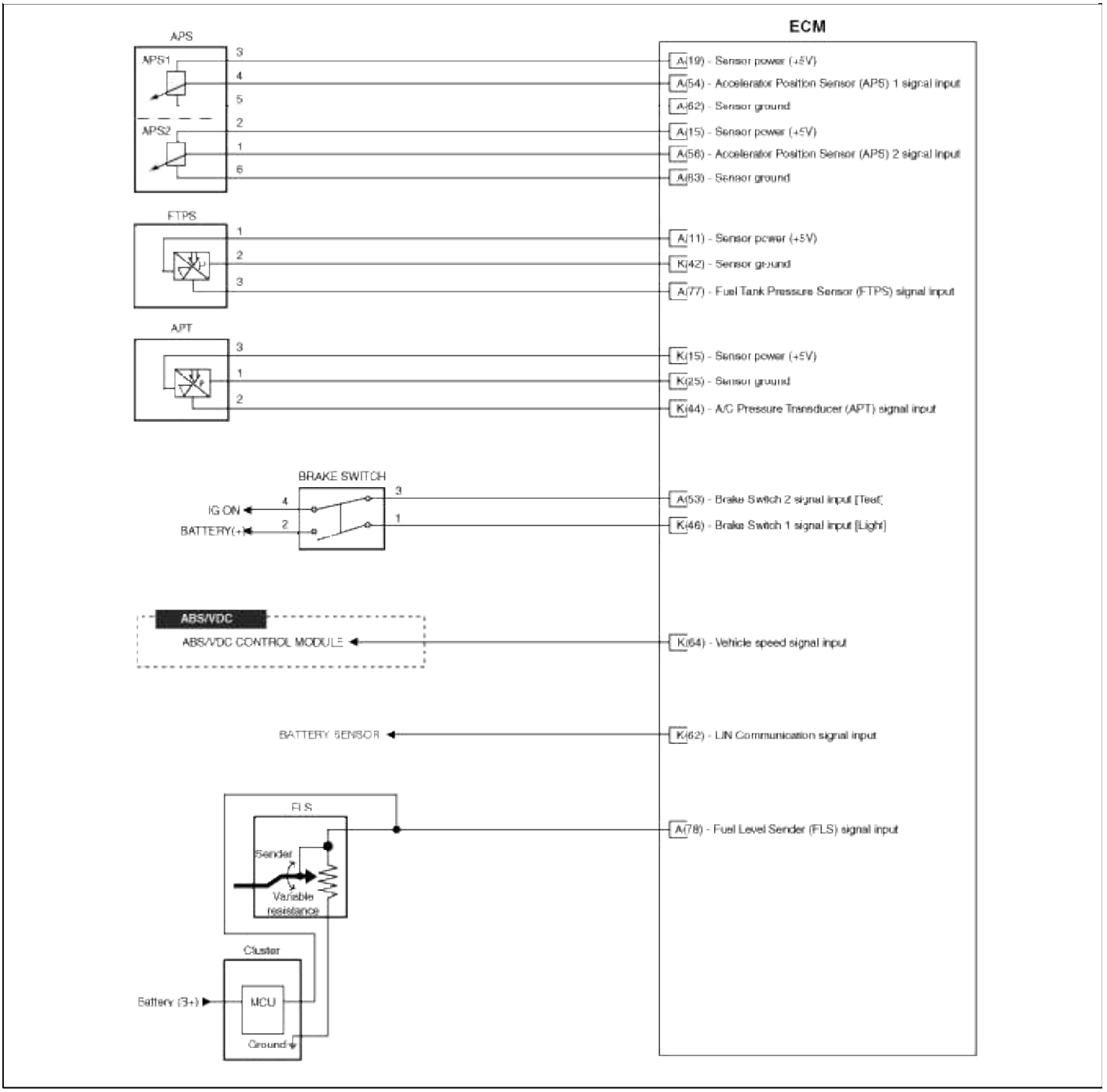

ECM
APS
APS1
APS2
4
2
5
1
3
6
K(40) - Sensor power (+5V)
K(9) - Accelerator Position Sensor (APS) 1 signal input
K(32) - Sensor ground
K(18) - Sensor power (+5V)
K(31) - Accelerator Position Sensor (APS) 2 signal input
K(10) - Sensor ground
FTPS
1
2
3
K(41) - Sensor power (+5V)
K(12) - Sensor ground
A(26) - Fuel Tank Pressure Sensor (FTPS) signal input
APT
3
1
2
K(20) - Sensor power (+5V)
K(77) - Sensor ground
K(45) - A/C Pressure Transducer (APT) signal input
BRAKE SWITCH
IG ON
BATTERY(+)
4
2
3
1
A(53) - Brake Switch 2 signal input [Test]
A(40) - Brake Switch 1 signal input [Light]
ABS/ESP CONTROL MODULE
K(46) - Vehicle speed signal input
CLUTCH SWITCH
A(55) - Clutch Switch signal input
BATTERY SENSOR
K(61) - LIN Communication signal input
PCM MODULE
K(60) - Start signal input
A/C COMPRESSOR RELAY
A(29) - A/C compressor relay control output
CRUISE CONTROL SWITCH
K(61) - LIN Communication signal input
A(7) - Supply power (+5V)
K(58) - Ground
WIPER SWITCH
K(22) - Wiper switch signal input
ALTERNATOR
A(57) - Alternator "COM"
K(24) - Alternator "FR"
FLS
Sender
Variable resistance
K(17) - Fuel Level Sender (FLS) signal input
Cluster
Battery (B+)
MCU
Ground
HEATER CONTROL MODULE
K(43) - A/C switch input
A(44) - A/C pressure switch
A(38) - Blower switch Max. signal input
WHEEL SPEED SENSOR
A(41) - Wheel Speed Sensor [B] signal input
A(42) - Wheel Speed Sensor [A] signal input

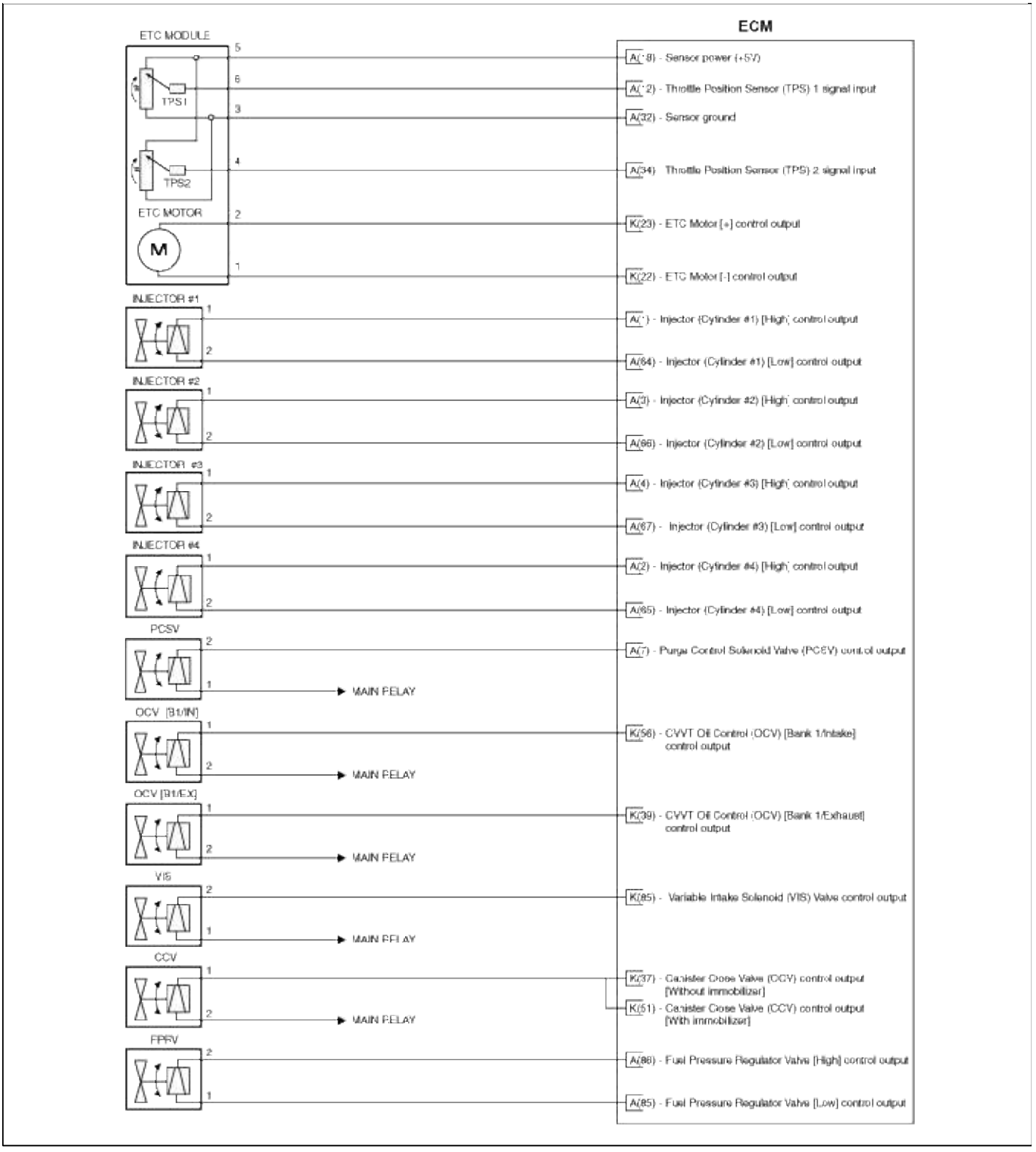

ECM
ETC MODULE
TPS1
TPS2
ETC MOTOR
M
INJECTOR #1
INJECTOR #2
INJECTOR #3
INJECTOR #4
PCSV
OCV [B1/IN]
OCV [B1/EX]
VIS
FPRV
CCV
MAIN RELAY
K(39) - Sensor power (+5V)
K(14) - Throttle Position Sensor (TPS) 1 signal input
K(35) - Sensor ground
K(36) - Throttle Position Sensor (TPS) 2 signal input
A(50) - ETC Motor [+] control output
A(35) - ETC Motor [-] control output
A(17) - Injector (Cylinder #1) [High] control output
A(33) - Injector (Cylinder #1) [Low] control output
A(16) - Injector (Cylinder #2) [High] control output
A(3) - Injector (Cylinder #2) [Low] control output
A(1) - Injector (Cylinder #3) [High] control output
A(18) - Injector (Cylinder #3) [Low] control output
A(2) - Injector (Cylinder #4) [High] control output
A(48) - Injector (Cylinder #4) [Low] control output
K(72) - Purge Control Solenoid Valve (PCSV) control output
A(45) - CVVT Oil Control (OCV) [Bank 1/Intake] control output
A(15) - CVVT Oil Control (OCV) [Bank 1/Exhaust] control output
A(60) - Variable Intake Solenoid (VIS) Valve control output
A(34) - Fuel Pressure Regulator Valve [High] control output
A(49) - Fuel Pressure Regulator Valve [Low] control output
K(37) - Canister Close Valve (CCV) control output [Without immobilizer]
K(51) - Canister Close Valve (CCV) control output [With immobilizer]

(A/T)


ECM
BATTERY
CHASSIS GROUND
IGNITION SWITCH
MAIN RELAY
FUEL PUMP RELAY
Fuel pump
IG COIL (CYL. #1)
IG COIL (CYL. #2)
IG COIL (CYL. #3)
IG COIL (CYL. #4)
CONDENSER
Shield ground
SMART KEY CONTROL MODULE
Power
Ground
IMMOBILIZER LAMP
Battery power (B+)
MIL
Battery power (B+)
CRUISE CONTROL SWITCH
STARTER SWITCH
STARTER RELAY
SMART KEY CONTROL MODULE
ALTERNATOR
ALTERNATOR
COOLING FAN RELAY [HIGH]
COOLING FAN RELAY [LOW]
OTHER CONTROL MODULE
DATA LINK CONNECTOR (DLC)
MULTI-PURPOSE CHECK CONNECTOR
POWER STEERING SWITCH
HEAD LAMP SWITCH
DEFROST SWITCH
K(5) - Battery power (B+)
K(3) - Battery power (B+)
K(1) - ECM ground
K(2) - ECM ground
K(4) - ECM ground
K(68) - Battery power (B+)
K(6) - Battery power (B+)
K(75) - Battery power (B-)
K(50) - Main Relay control output
K(51) - Fuel Pump Relay control output (With Immobilizer)
K(37) - Fuel Pump Relay control output (Without Immobilizer)
K(57) - Ignition Coil (Cylinder #1) control output
K(40) - Ignition Coil (Cylinder #2) control output
K(91) - Ignition Coil (Cylinder #3) control output
K(74) - Ignition Coil (Cylinder #4) control output
K(61) - Immobilizer Communication line
K(54) - Immobilizer Lamp control output
K(88) - Malfunction Indication Lamp (MIL) control output
A(20) - Ground
A(79) - Cruise control switch signal
K(67) - Starter control switch signal input
K(71) - Starter relay control output
K(63) - Engine speed signal output
A(51) - Alternator (FR)
K(16) - Alternator PWM signal output (COM)
K(36) - Cooling fan relay [High] control output
K(20) - Cooling fan relay [Low] control output
K(80) - CAN [High]
K(77) - CAN [Low]
K(45) - Electric Load signal input
K(30) - Electric Load signal input
K(29) - Electric Load signal input


ECM
MAPS & IATS
2
4
1
3
A(11) - Sensor power (+5V)
K(8) - Sensor ground
K(26) - Manifold Absolute Pressure Sensor (MAPS) signal input
K(28) - Intake Temperature Sensor (IATS) signal input
ECTS
3
2
1
Cluster
A(82) - Engine Coolant Temperature Sensor signal input
A(13) - Sensor ground
CMPS [B1/IN]
1
3
2
K(13) - Sensor power (+5V)
K(66) - Camshaft Position Sensor (CMPS) [Bank 1/Intake] signal input
K(80) - Sensor ground
CMPS [B1/EX]
1
3
2
K(47) - Camshaft Position Sensor (CMPS) [Bank 1/Exhaust] signal input
K(7) - Sensor ground
CKPS
2
1
N
S
K(79) - Crankshaft Position Sensor (CKPS) [A] signal input
K(78) - Crankshaft Position Sensor (CKPS) [B] signal input
KS
1
2
A(61) - Knock Sensor (KS) signal input
A(80) - Sensor ground
HO2S [B1/S1]
4
5
2
1
3
6
MAIN RELAY
A(24) - HO2S (B1/S1) Heater control output
A(84) - VS+ (NERNST Cell Voltage)
A(83) - VS-/IP- (Common Ground for VS/IP)
A(104) - Ro/Rp (Pump Cell Voltage)
A(106) - Rc (Compensative Resistance)
HO2S [B1/S2]
3
4
2
1
MAIN RELAY
A(25) - Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2] Heater control output
A(103) - Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2] signal input
A(41) - Sensor ground
RPS
1
3
2
K(15) - Sensor power (+5V)
K(10) - Sensor ground
K(27) - Rail Pressure Sensor (RPS) signal input


ECM
APS
APS1
APS2
3
4
5
2
1
6
A(19) - Sensor power (+5V)
A(54) - Accelerator Position Sensor (APS) 1 signal input
A(62) - Sensor ground
A(15) - Sensor power (+5V)
A(56) - Accelerator Position Sensor (APS) 2 signal input
A(63) - Sensor ground
FTPS
1
2
3
A(11) - Sensor power (+5V)
K(42) - Sensor ground
A(77) - Fuel Tank Pressure Sensor (FTPS) signal input
APT
3
1
2
K(15) - Sensor power (+5V)
K(25) - Sensor ground
K(44) - A/C Pressure Transducer (APT) signal input
BRAKE SWITCH
IG ON
BATTERY(+)
4
2
3
1
A(53) - Brake Switch 2 signal input [Test]
K(46) - Brake Switch 1 signal input [Light]
ABS/VDC
ABS/VDC CONTROL MODULE
K(64) - Vehicle speed signal input
BATTERY SENSOR
K(62) - LIN Communication signal input
FLS
Sender
Variable resistance
A(78) - Fuel Level Sender (FLS) signal input
Cluster
Battery (B+)
MCU
Ground



Fuel System > Engine Control System > Engine Control Module (ECM) > Repair procedures

Removal

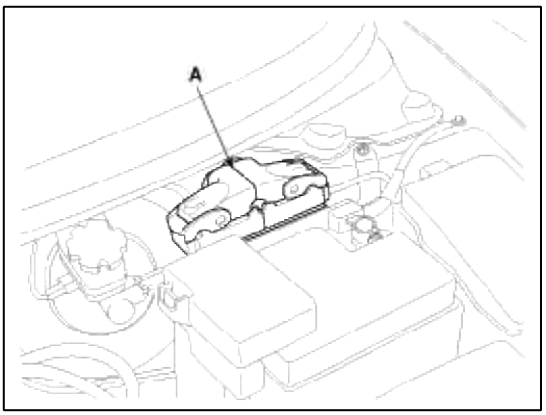
NOTE

When replacing the ECM, the vehicle equipped with immobilizer must be performed the procedure as below.
[In the case of installing used ECM]
1. Perform "Neutral mode" procedure with GDS. (Refer to "Immobilizer" in BE group)
2. Insert the key and turn it to the IGN ON and OFF position.

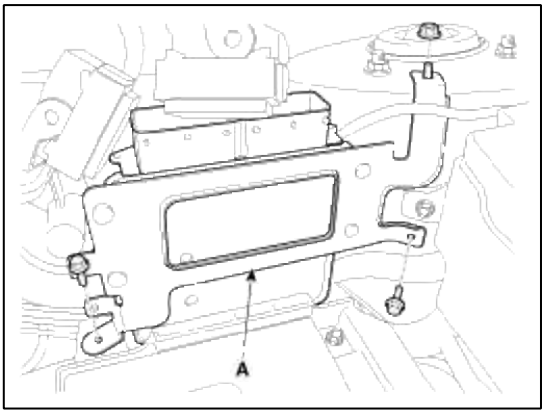
Then the ECM key register process is completed automatically.
[In the case of installing new ECM]
- Insert the key and turn it to the IGN ON and OFF position.

Then the ECM key register process is completed automatically.

1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Disconnect the ECM Connector (A).



3. Remove the battery (Refer to "Charging System" in EM group).
4. Remove the mounting bolts and nut, and then remove the ECM bracket assembly (A).



Installation

NOTE

When replacing the ECM, the vehicle equipped with immobilizer must be performed the procedure as below.
[In the case of installing used ECM]
1. Perform "Neutral mode" procedure with GDS. (Refer to "Immobilizer" in BE group)
2. Insert the key and turn it to the IGN ON and OFF position.

Then the ECM key register process is completed automatically.
[In the case of installing new ECM]
- Insert the key and turn it to the IGN ON and OFF position.

Then the ECM key register process is completed automatically.

1. Installation is reverse of removal.

ECM installation bolt:
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)
ECM bracket installation bolt:
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)

ECM Problem Inspection Procedure

1. TEST ECM GROUND CIRCUIT: Measure resistance between ECM and chassis ground using the backside of ECM harness connector as ECM side check point. If the problem is found, repair it.

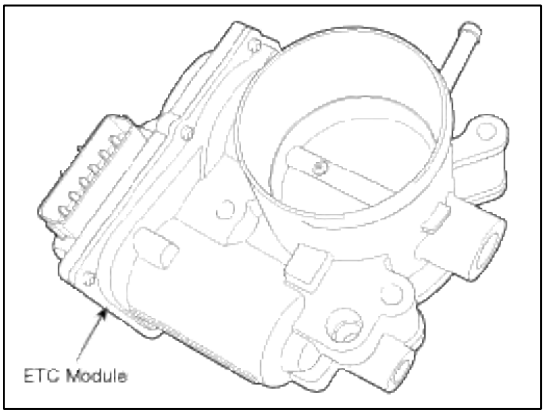
Specification: Below 1Ω

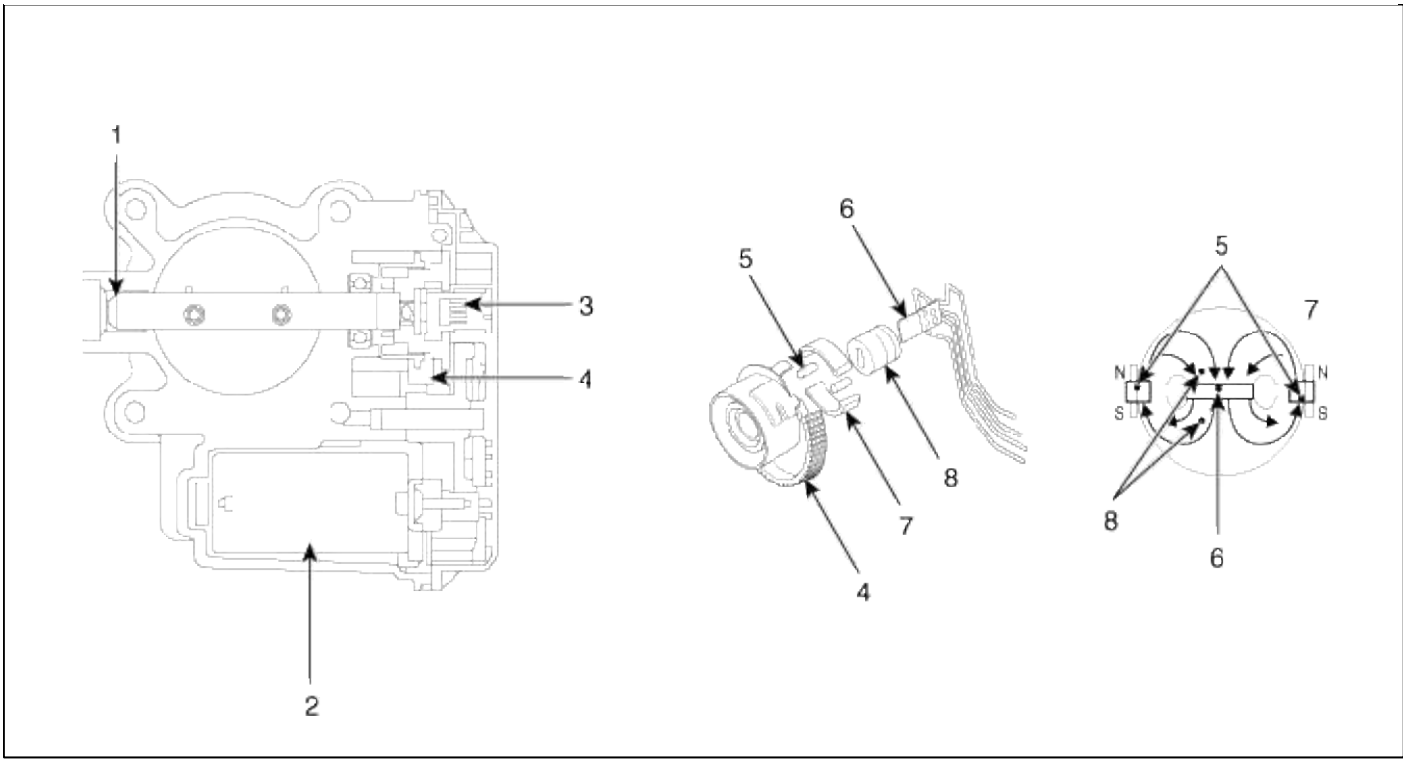
2. TEST ECM CONNECTOR: Disconnect the ECM connector and visually check the ground terminals on ECM side and harness side for bent pins or poor contact pressure. If the problem is found, repair it.
3. If problem is not found in Step 1 and 2, the ECM could be faulty. If so, make sure there were no DTC's before swapping the ECM with a new one, and then check the vehicle again. If DTC's were found, examine this first before swapping ECM.
4. RE-TEST THE ORIGINAL ECM: Install the original ECM (may be broken) into a known-good vehicle and check the vehicle. If the problem occurs again, replace the original ECM with a new one. If problem does not occur, this is intermittent problem (Refer to “Intermittent Problem Inspection Procedure” in Basic Inspection Procedure).

Fuel System > Engine Control System > ETC (Electronic Throttle Control) System > Description and Operation

Description

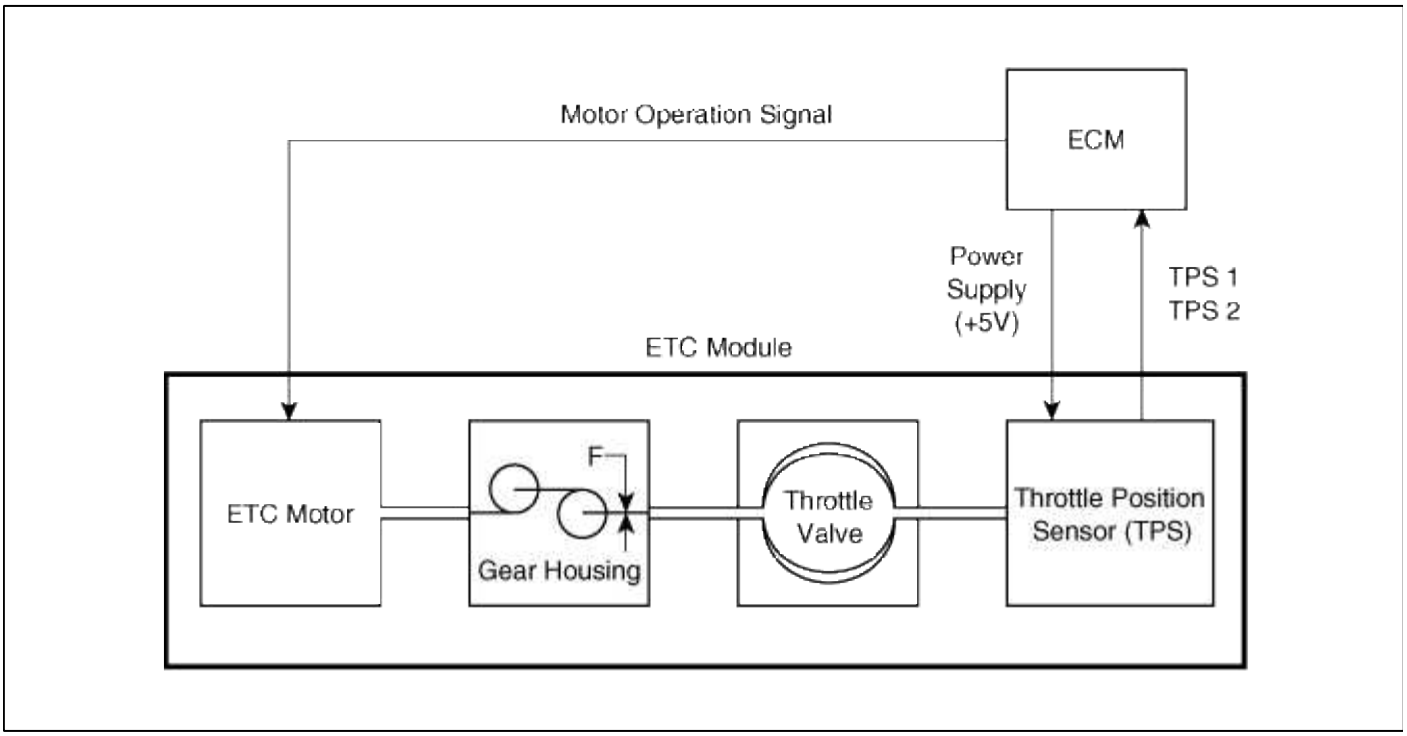
The Electronic Throttle Control (ETC) System consists of a throttle body with an integrated control motor and throttle position sensor (TPS). Instead of the traditional throttle cable, an Accelerator Position Sensor (APS) is used to receive driver input. The ECM uses the APS signal to calculate the target throttle angle; the position of the throttle is then adjusted via ECM control of the ETC motor. The TPS signal is used to provide feedback regarding throttle position to the ECM. Using ETC, precise control over throttle position is possible; the need for external cruise control modules/cables is eliminated.





1. Dry bearing 2. DC motor 3. Non-contact hall sensor 4. Gear	5. Magnet 6. Hall IC 7. Yoke 8. Stator

Schematic Diagram



Fuel System > Engine Control System > ETC (Electronic Throttle Control) System > Troubleshooting

Fail-Safe Mode

Item	Fail-Safe	
ETC Motor	Throttle valve stuck at 7°	
TPS	TPS 1 fault	ECM looks at TPS2
	TPS 2 fault	ECM looks at TPS1
	TPS 1,2 fault	Throttle valve stuck at 7°
APS	APS 1 fault	ECM looks at APS 2
	APS 2 fault	ECM looks at APS 1
	APS 1,2 fault	Engine idle state

NOTE

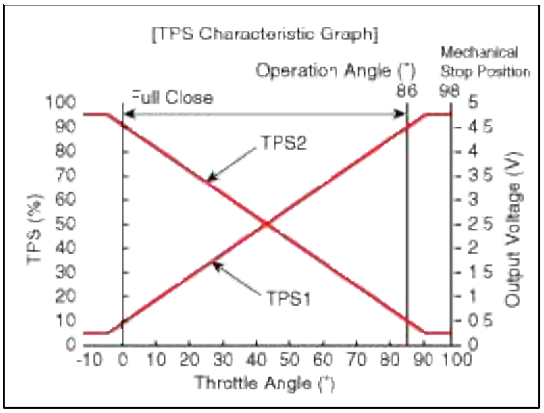
When throttle value is stuck at 7°, engine speed is limited at below 1,500rpm and vehicle speed at maximum 40 ~ 50 km/h (25 ~ 31 mph)

Fuel System > Engine Control System > ETC (Electronic Throttle Control) System > Specifications

Specification

[Throttle Position Sensor (TPS)]

Throttle angle(°)	Output Voltage (V)	
	TPS1	TPS2
0	0.5	4.5
10	0.96	4.05
20	1.41	3.59
30	1.87	3.14
40	2.32	2.68
50	2.78	2.23
60	3.23	1.77
70	3.69	1.32
80	4.14	0.86
90	4.6	0.41
98	4.65	0.35
C.T (0)	0.5	4.5
W.O.T (86)	4.41	0.59



[ETC Motor]

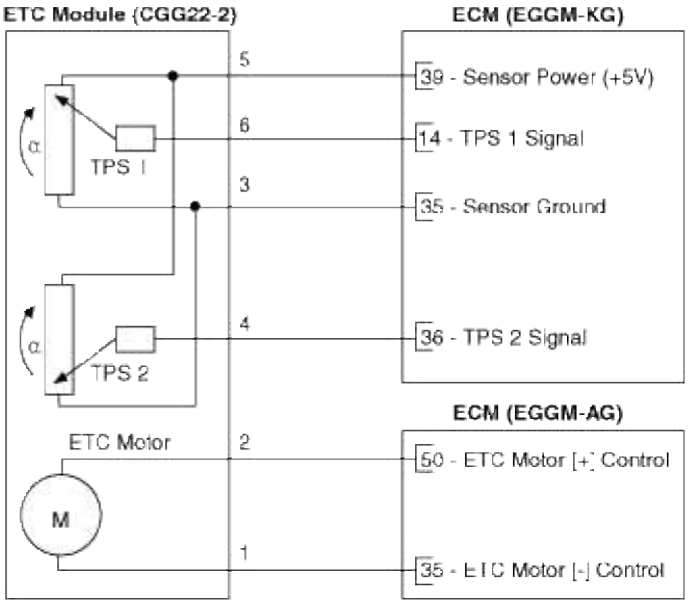
Item	Specification
Coil Resistance (Ω)	0.3 ~100 [20°C(68°F)]

Fuel System > Engine Control System > ETC (Electronic Throttle Control) System > Schematic Diagrams

Circuit Diagram

(M/T)

[Circuit Diagram]

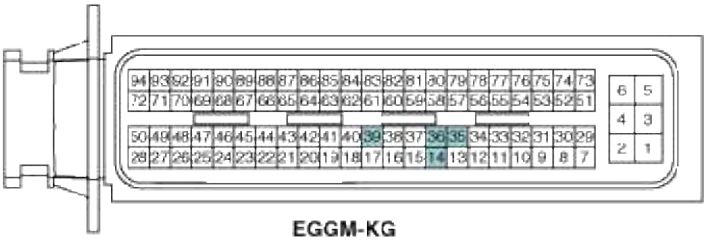


[Connection Information]

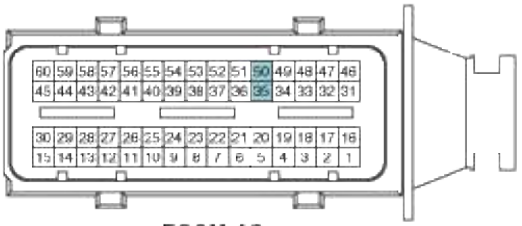
Terminal	Connected to	Function
1	ECM EGGM-AG (35)	ETC Motor [-] Control
2	ECM EGGM-AG (50)	ETC Motor [+] Control
3	ECM EGGM-KG (35)	Sensor Ground
4	ECM EGGM-KG (36)	TPS 2 Signal
5	ECM EGGM-KG (39)	Sensor Power (+5V)
6	ECM EGGM-KG (14)	TPS 1 Signal

[Harness Connector]

CGG22-2
ETC Module



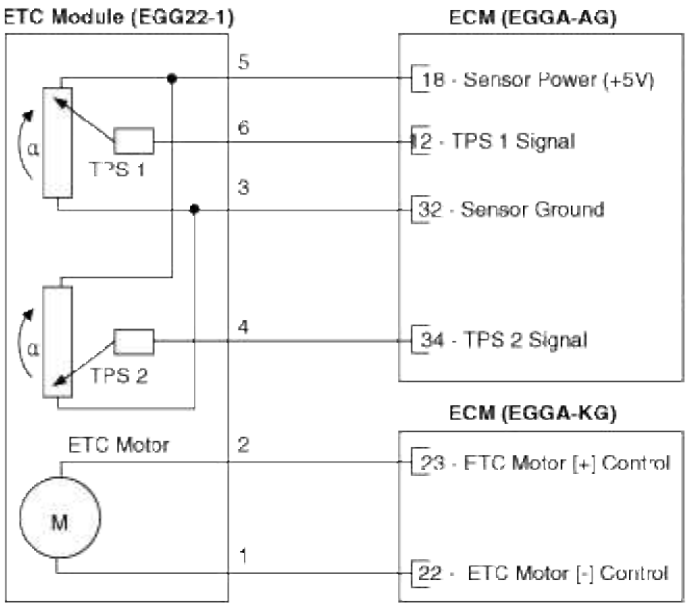
EGGM-KG



EGGM-AG
ECM

(A/T)

[Circuit Diagram]

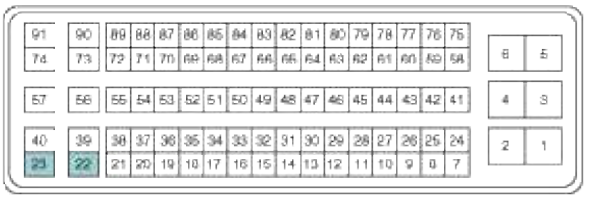


[Connection Information]

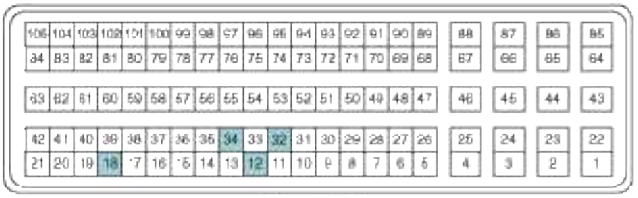
Terminal	Connected to	Function
1	ECM EGGA-KG (22)	ETC Motor [-] Control
2	ECM EGGA-KG (23)	ETC Motor [+] Control
3	ECM EGGA-AG (32)	Sensor Ground
4	ECM EGGA-AG (34)	TPS 2 Signal
5	ECM EGGA-AG (18)	Sensor Power (+5V)
6	ECM EGGA-AG (12)	TPS 1 Signal

[Harness Connector]

EGG22-1
ETC Module



EGGA-KG



EGGA-AG
ECM

Fuel System > Engine Control System > ETC (Electronic Throttle Control) System > Repair procedures

Inspection

Throttle Position Sensor (TPS)

1. Connect the GDS on the Data Link Connector (DLC).
2. Start the engine and measure the output voltage of TPS 1 and 2 at C.T. and W.O.T.

Specification: Refer to “Specification”

ETC Motor

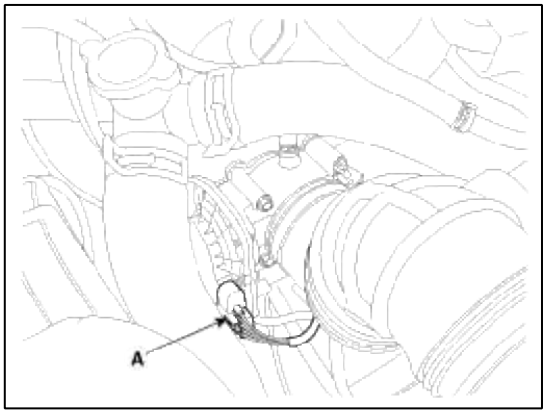
1. Turn the ignition switch OFF.
2. Disconnect the ETC module connector.
3. Measure resistance between the ETC module terminals 1 and 2.

4. Check that the resistance is within the specification.

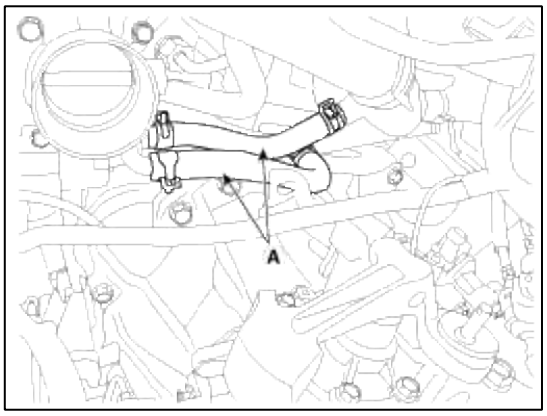
Specification: Refer to “Specification”

Removal

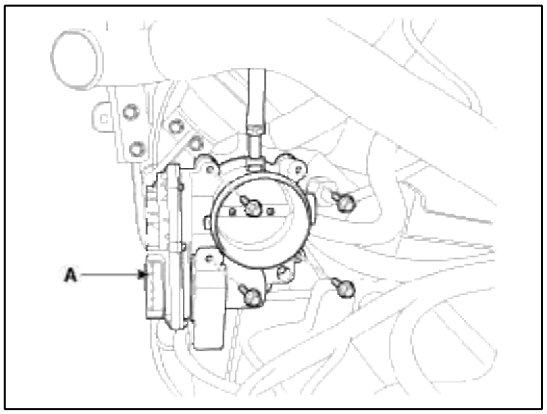
1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Remove the resonator and the air intake hose (Refer to “Intake And Exhaust System” in EM group).
3. Disconnect the ETC module connector (A).



4. Disconnect the coolant hoses (A).



5. Remove the installation bolts, and then remove the ETC module (A) from the engine.



Installation

CAUTION

- Install the component with the specified torques.
- Note that internal damage may occur when the component is dropped. If the component has been dropped, inspect before installing.

1. Installation is reverse of removal.

Electronic throttle body Installation bolt:
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)

Adjustment

ETC module learning procedure

When installing new ETC module or re-installing it, ETC module learning procedure must be performed.
1. Hold the ignition key or the start button at the IG ON position during 5 seconds.
2. Turn ignition swich OFF and then start the engine.

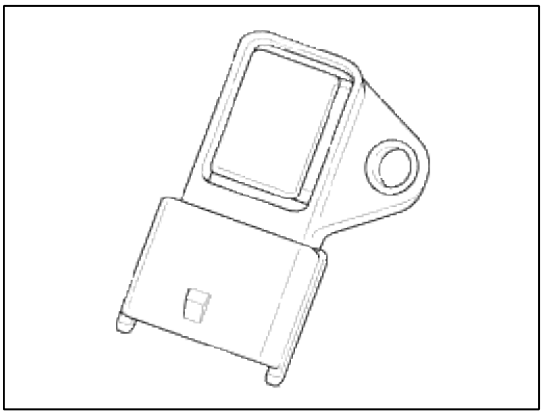
CAUTION

DTC codes (P0638, P2110) might be displayed if ETC module learning procedure does not performed after replacing ETC module.

Fuel System > Engine Control System > Manifold Absolute Pressure Sensor (MAPS) > Description and Operation

Description

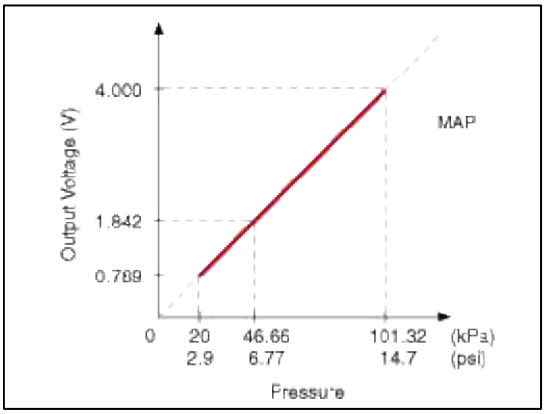
Manifold Absolute Pressure Sensor (MAPS) is a speed-density type sensor and is installed on the surge tank. It senses absolute pressure of the surge tank and transfers the analog signal proportional to the pressure to the ECM. By using this signal, the ECM calculates the intake air quantity and engine speed.
The MAPS consists of a piezo-electric element and a hybrid IC amplifying the element output signal. The element is silicon diaphragm type and adapts pressure sensitive variable resistor effect of semi-conductor. Because 100% vacuum and the manifold pressure apply to both sides of the sensor respectively, this sensor can output analog signal by using the silicon variation proportional to pressure change.



Fuel System > Engine Control System > Manifold Absolute Pressure Sensor (MAPS) > Specifications

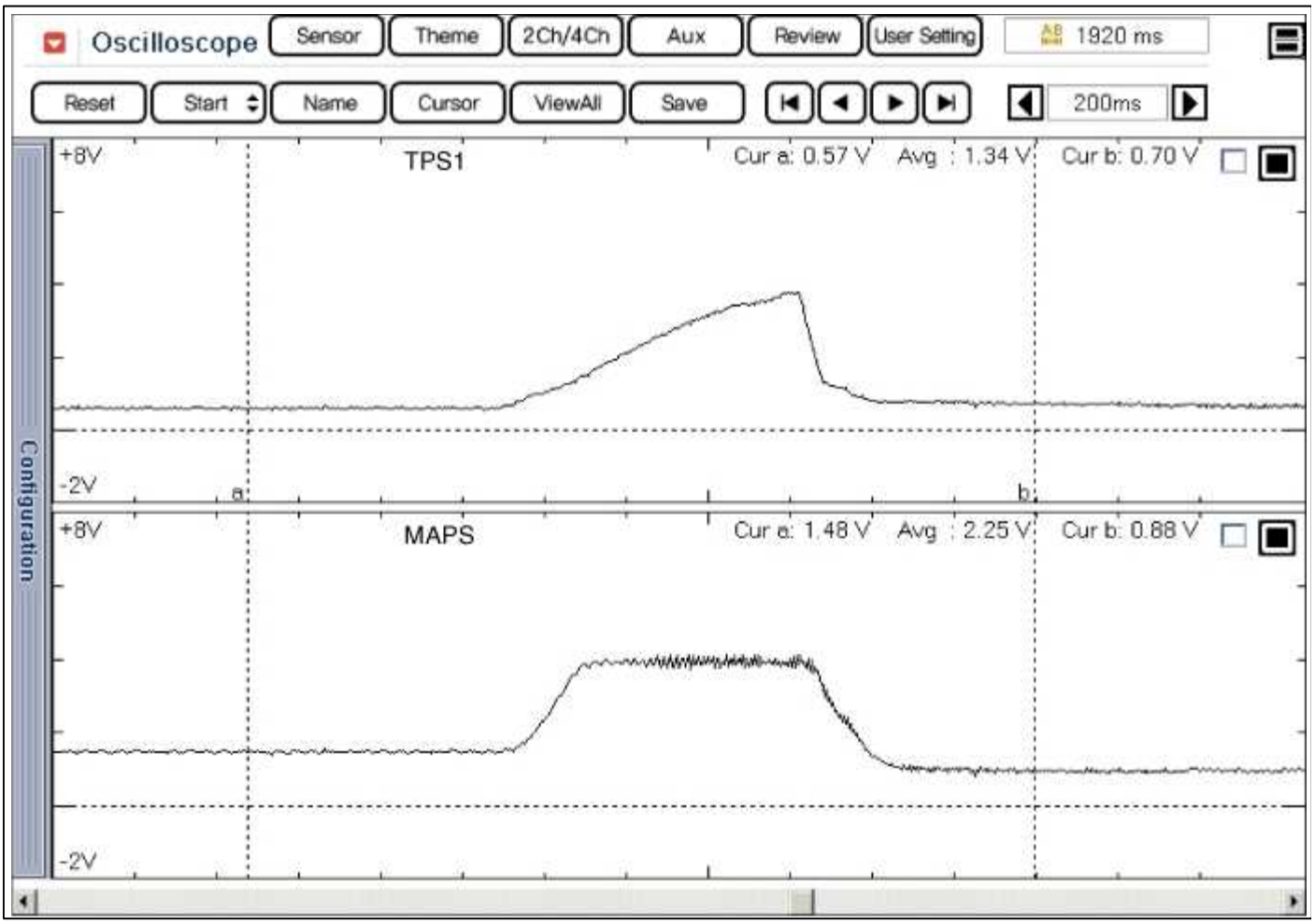
Specification

Pressure [kPa (kgf/cm², psi)]	Output Voltage (V)
20.0 (0.20, 2.9)	0.79
46.7 (0.47, 6.77)	1.84
101.3 (1.03, 14.7)	4.0



Fuel System > Engine Control System > Manifold Absolute Pressure Sensor (MAPS) > Troubleshooting

Signal Waveform

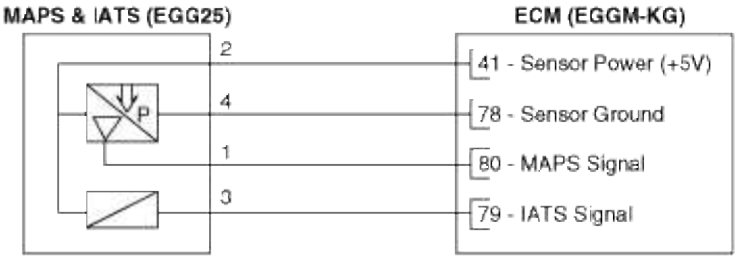


Fuel System > Engine Control System > Manifold Absolute Pressure Sensor (MAPS) > Schematic Diagrams

Circuit Diagram

(M/T)

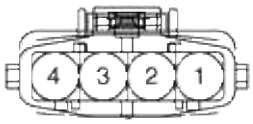
[Circuit Diagram]



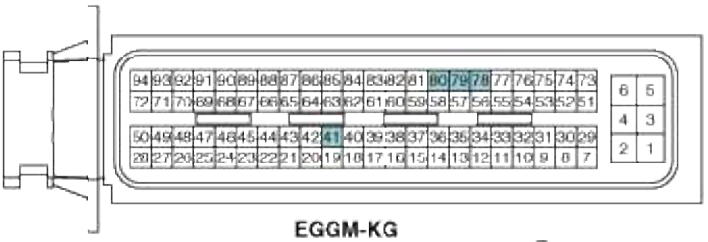
[Connection Information]

Terminal	Connected to	Function
1	ECM EGGM-KG (80)	MAPS Signal
2	ECM EGGM-KG (41)	Sensor Power (+5V)
3	ECM EGGM-KG (79)	IATS Signal
4	ECM EGGM-KG (78)	Sensor Ground

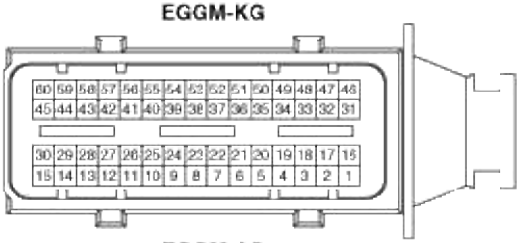
[Harness Connector]



EGG25
MAPS & IATS



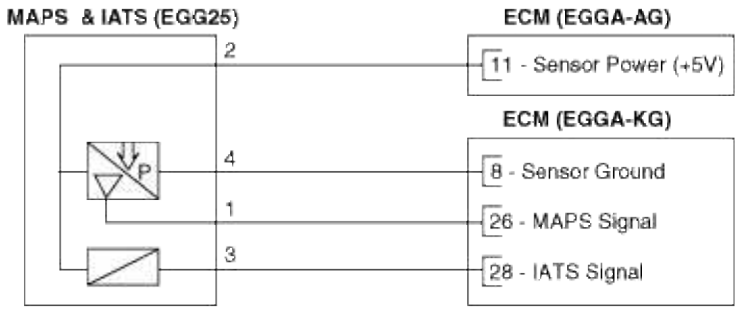
EGGM-KG



EGGM-AG
ECM

(A/T)

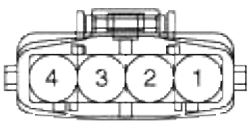
[Circuit Diagram]



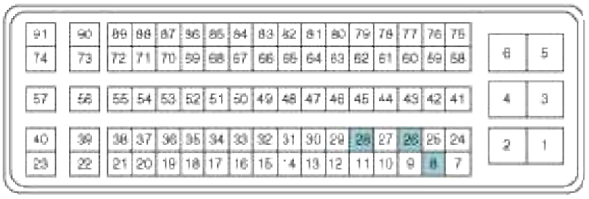
[Connection Information]

Terminal	Connected to	Function
1	ECM EGGA-KG (26)	MAPS Signal
2	ECM EGGA-AG (11)	Sensor Power (+5V)
3	ECM EGGA-KG (28)	IATS Signal
4	ECM EGGA-KG (8)	Sensor Ground

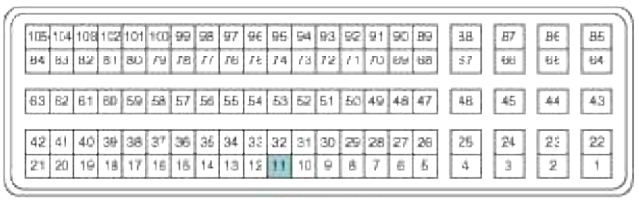
[Harness Connector]



EGG25
MAPS & IATS



EGGA-KG



EGGA-AG
ECM

Fuel System > Engine Control System > Manifold Absolute Pressure Sensor (MAPS) > Repair procedures

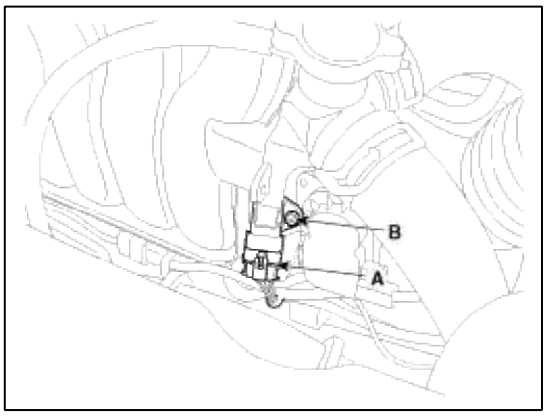
Inspection

1. Connect the GDS on the Data Link Connector (DLC).
2. Measure the output voltage of the MAPS at idle and IG ON.

Specification: Refer to "Specification"

Removal

1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Disconnect the manifold absolute pressure sensor connector (A).
3. Remove the installation bolt (B), and then remove the sensor from the surge tank.



Installation

CAUTION

- Install the component with the specified torques.
- Note that internal damage may occur when the component is dropped. If the component has been dropped, inspect before installing.

CAUTION

- Insert the sensor in the installation hole and be careful not to damage.

1. Installation is reverse of removal.

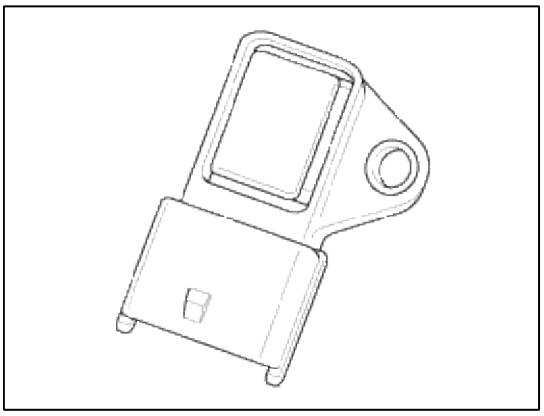
Manifold absolute pressure sensor installation bolt:
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)

Fuel System > Engine Control System > Intake Air Temperature Sensor (IATS) > Description and Operation

Description

Intake Air Temperature Sensor (IATS) is included inside Manifold Absolute Pressure Sensor and detects the intake air temperature.
To calculate precise air quantity, correction of the air temperature is needed because air density varies according to the temperature. So the ECM uses not only MAPS signal but also IATS signal. This sensor has a Negative

Temperature Coefficient (NTC) Thermister and it's resistance changes in reverse proportion to the temperature.



Fuel System > Engine Control System > Intake Air Temperature Sensor (IATS) > Specifications

Specification

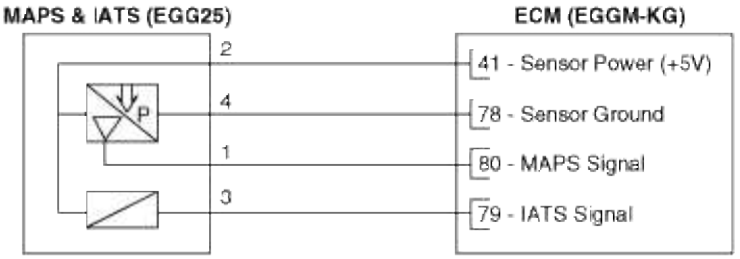
Temperature		Resistance (kΩ)
°C	°F	
-40	-40	40.93 ~ 48.35
-20	-4	13.89 ~ 16.03
0	32	5.38 ~ 6.09
10	50	3.48 ~ 3.90
20	68	2.31 ~ 2.57
40	104	1.08 ~ 1.21
50	122	1.56 ~ 1.74
60	140	0.54 ~ 0.62
80	176	0.29 ~ 0.34

Fuel System > Engine Control System > Intake Air Temperature Sensor (IATS) > Schematic Diagrams

Circuit Diagram

(M/T)

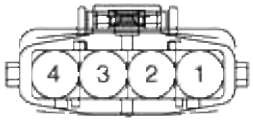
[Circuit Diagram]



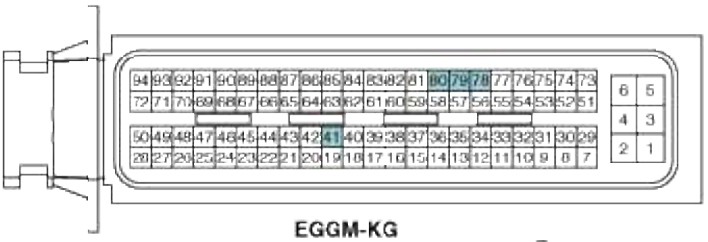
[Connection Information]

Terminal	Connected to	Function
1	ECM EGGM-KG (80)	MAPS Signal
2	ECM EGGM-KG (41)	Sensor Power (+5V)
3	ECM EGGM-KG (79)	IATS Signal
4	ECM EGGM-KG (78)	Sensor Ground

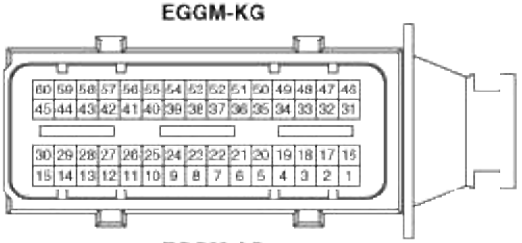
[Harness Connector]



EGG25
MAPS & IATS



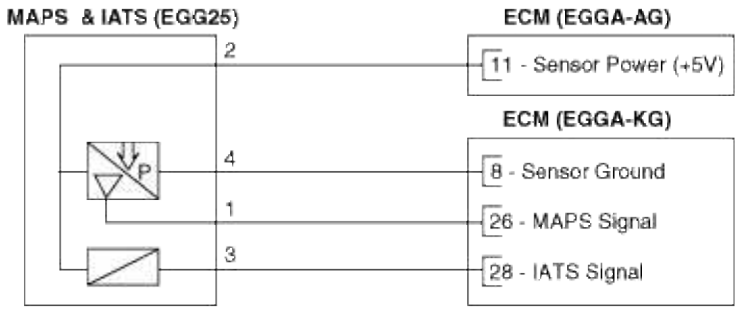
EGGM-KG



EGGM-AG
ECM

(A/T)

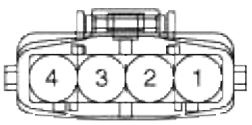
[Circuit Diagram]



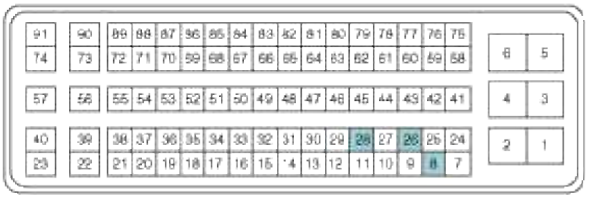
[Connection Information]

Terminal	Connected to	Function
1	ECM EGGA-KG (26)	MAPS Signal
2	ECM EGGA-AG (11)	Sensor Power (+5V)
3	ECM EGGA-KG (28)	IATS Signal
4	ECM EGGA-KG (8)	Sensor Ground

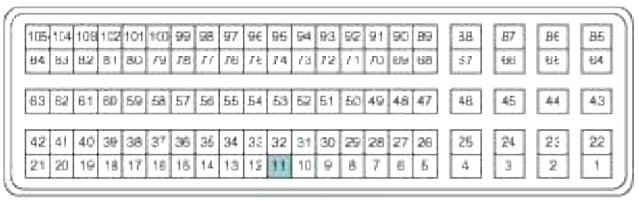
[Harness Connector]



EGG25
MAPS & IATS



EGGA-KG



EGGA-AG
ECM

Fuel System > Engine Control System > Intake Air Temperature Sensor (IATS) > Repair procedures

Inspection

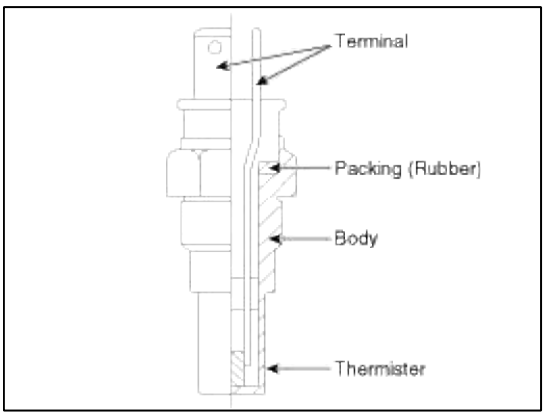
1. Turn the ignition switch OFF.
2. Disconnect the IATS connector.
3. Measure resistance between the IATS terminals 3 and 4.
4. Check that the resistance is within the specification.

Specification: Refer to “Specification”

Fuel System > Engine Control System > Engine Coolant Temperature Sensor (ECTS) > Description and Operation

Description

Engine Coolant Temperature Sensor (ECTS) is located in the engine coolant passage of the cylinder head for detecting the engine coolant temperature. The ECTS uses a thermistor that changes resistance with the temperature. The electrical resistance of the ECTS decreases as the temperature increases, and increases as the temperature decreases. The reference +5V is supplied to the ECTS via a resistor in the ECM. That is, the resistor in the ECM and the thermistor in the ECTS are connected in series. When the resistance value of the thermistor in the ECTS changes according to the engine coolant temperature, the output voltage also changes.
During cold engine operation, the ECM increases the fuel injection duration and controls the ignition timing using the information of engine coolant temperature to avoid engine stalling and improve drivability.



Fuel System > Engine Control System > Engine Coolant Temperature Sensor (ECTS) > Specifications

Specification

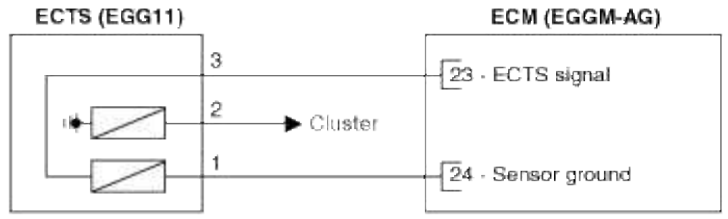
Temperature		Resistance (kΩ)
°C	°F	
-40	-40	48.14
-20	-4	14.13 ~ 16.83
0	32	5.79
20	68	2.31 ~ 2.59
40	104	1.15
60	140	0.59
80	176	0.32

Fuel System > Engine Control System > Engine Coolant Temperature Sensor (ECTS) > Schematic Diagrams

Circuit Diagram

(M/T)

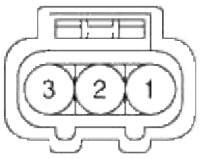
[Circuit Diagram]



[Connection Information]

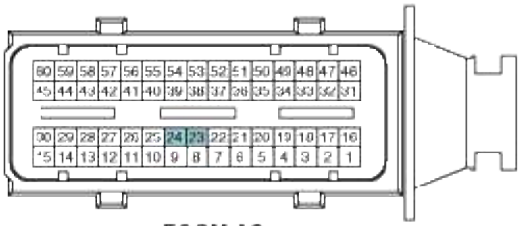
Terminal	Connected to	Function
1	ECM EGGM-AG (24)	Sensor ground
2	Cluster	-
3	ECM EGGM-AG (23)	ECTS signal

[Harness Connector]



EGG11
ECTS

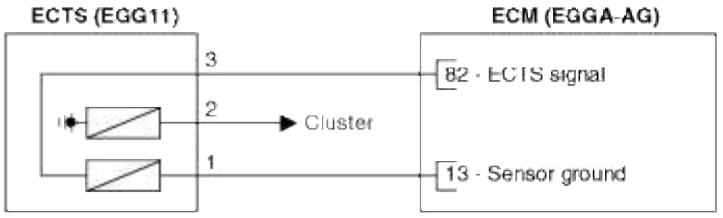
EGGM-KG



EGGM-AG
ECM

(A/T)

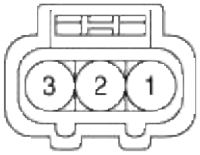
[Circuit Diagram]



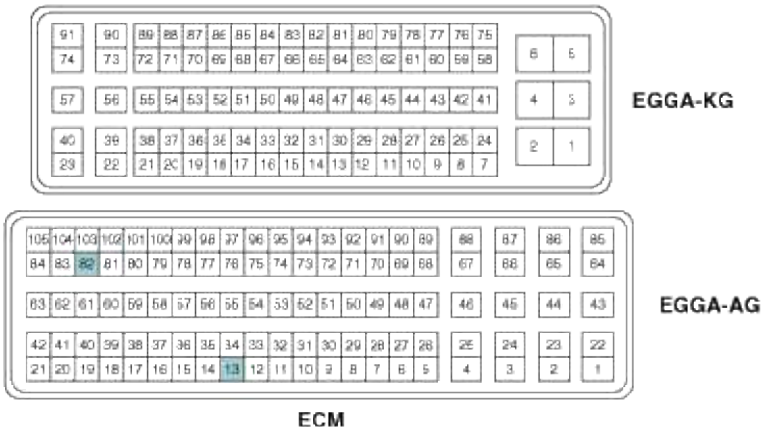
[Connection Information]

Terminal	Connected to	Function
1	ECM EGGA-AG (13)	Sensor ground
2	Cluster	-
3	ECM EGGA-AG (82)	ECTS signal

[Harness Connector]



EGG11
ECTS



Fuel System > Engine Control System > Engine Coolant Temperature Sensor (ECTS) > Repair procedures

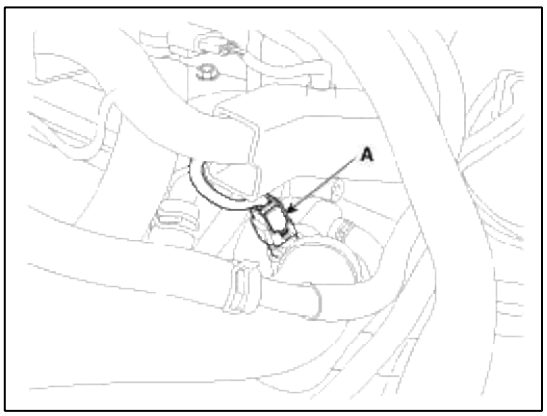
Inspection

1. Turn the ignition switch OFF.
2. Remove the ECTS (Refer to "Removal").
3. After immersing the thermistor of the sensor into engine coolant, measure resistance between the ECTS terminals 3 and 4.
4. Check that the resistance is within the specification.

Specification: Refer to “Specification”

Removal

1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Disconnect the engine coolant temperature sensor connector (A).



3. Supplement the engine coolant (Refer to “Cooling System” in EM group).

Installation

CAUTION

- Install the component with the specified torques.
- Note that internal damage may occur when the component is dropped. If the component has been dropped, inspect before installing.

CAUTION

- Apply the engine coolant to the O-ring.

CAUTION

- Insert the sensor in the installation hole and be careful not to damage.

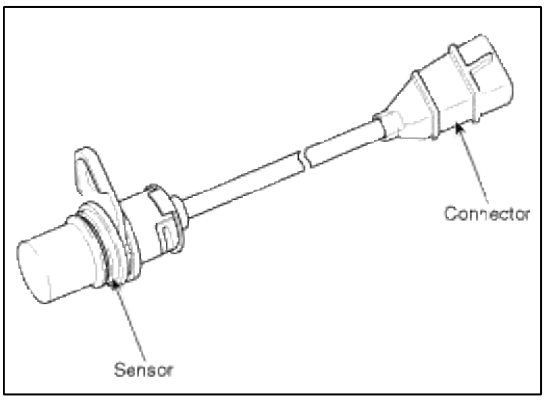
1. Installation is reverse of removal.

Engine Coolant Temperature Sensor installation :
29.4 ~ 39.2 N.m (3.0 ~ 4.0 kgf.m, 21.7 ~ 28.9 lb-ft)

Fuel System > Engine Control System > Crankshaft Position Sensor (CKPS) > Description and Operation

Description

Crankshaft Position Sensor (CKPS) detects the crankshaft position and is one of the most important sensors of the engine control system. If there is no CKPS signal input, the engine may stop because of CKPS signal missing.
This sensor is installed in ladder frame and generates alternating current by magnetic flux field which is made by the sensor and the target wheel when the engine rotates. The target wheel consists of 58 slots and 2 missing slots on 360 CA (Crank Angle).



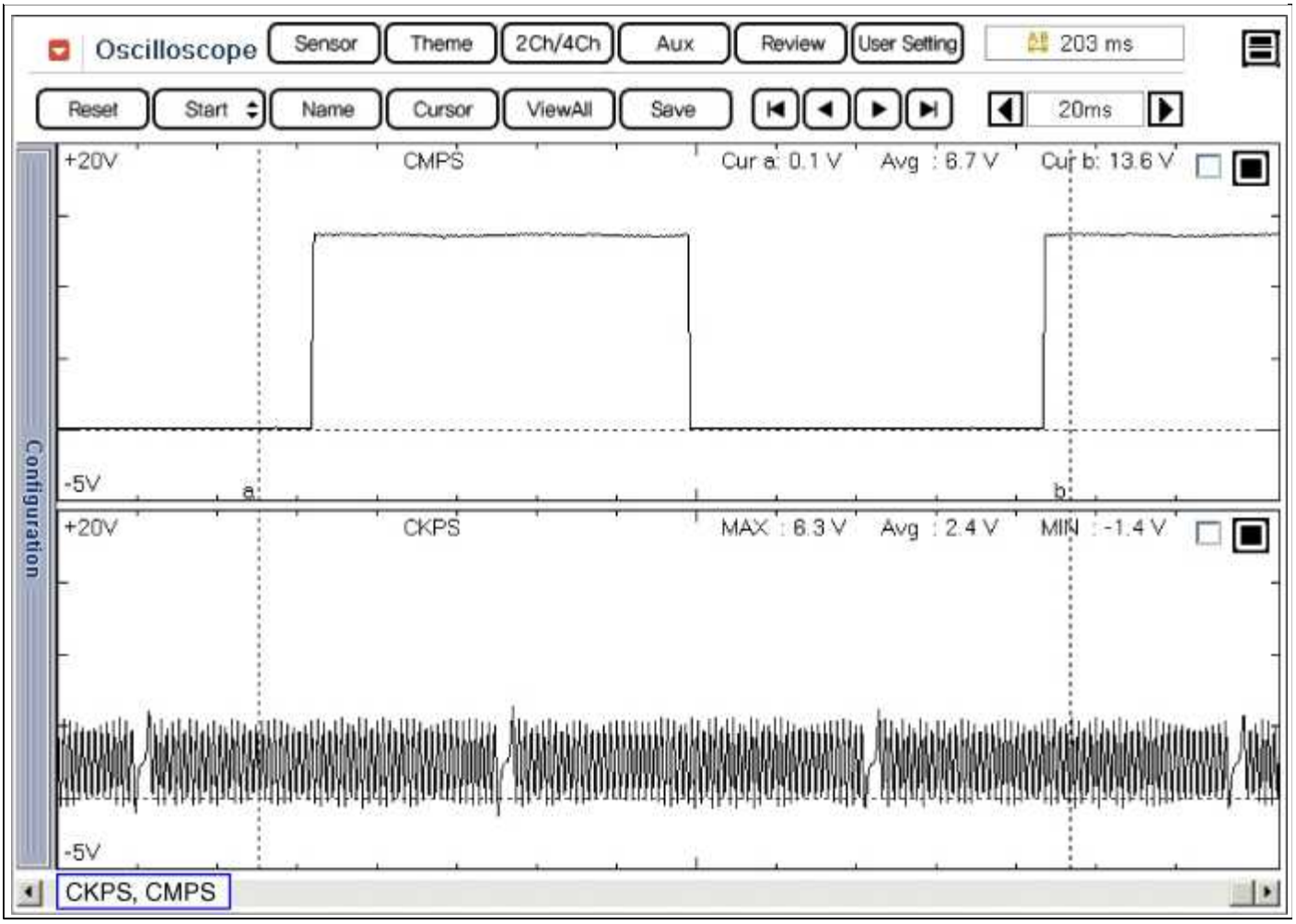
Fuel System > Engine Control System > Crankshaft Position Sensor (CKPS) > Specifications

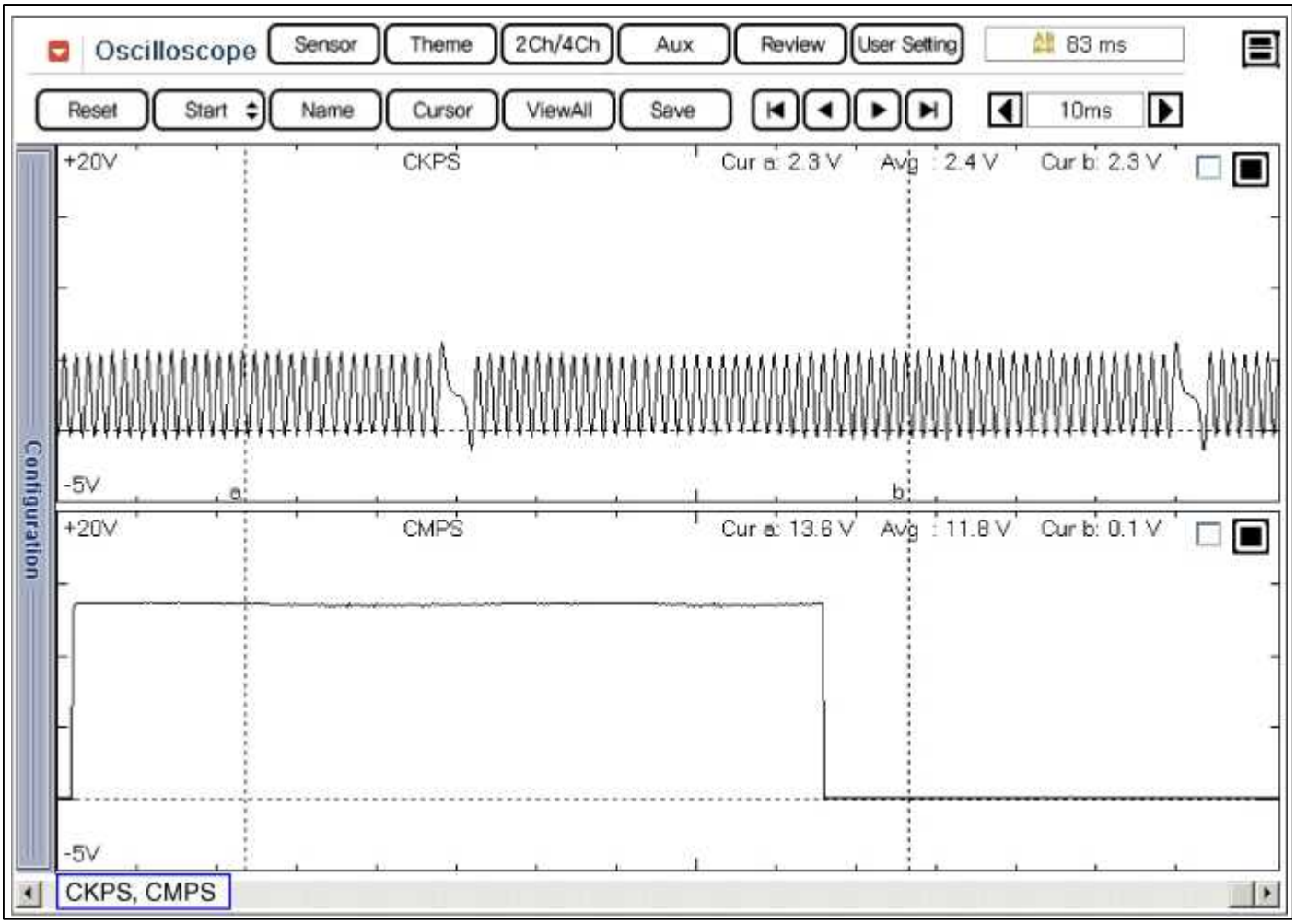
Specification

Item	Specification
Coil Resistance (Ω)	774 ~ 946 [20°C (68°F)]

Fuel System > Engine Control System > Crankshaft Position Sensor (CKPS) > Troubleshooting

Waveform


Oscilloscope
Sensor
Theme
2Ch/4Ch
Aux
Review
User Setting
203 ms
Reset
Start
Name
Cursor
ViewAll
Save
20ms
Configuration
+20V
CMPS
Cur a: 0.1 V
Avg : 6.7 V
Cur b: 13.6 V
-5V
a
b
+20V
CKPS
MAX : 6.3 V
Avg : 2.4 V
MIN : -1.4 V
-5V
CKPS, CMPS

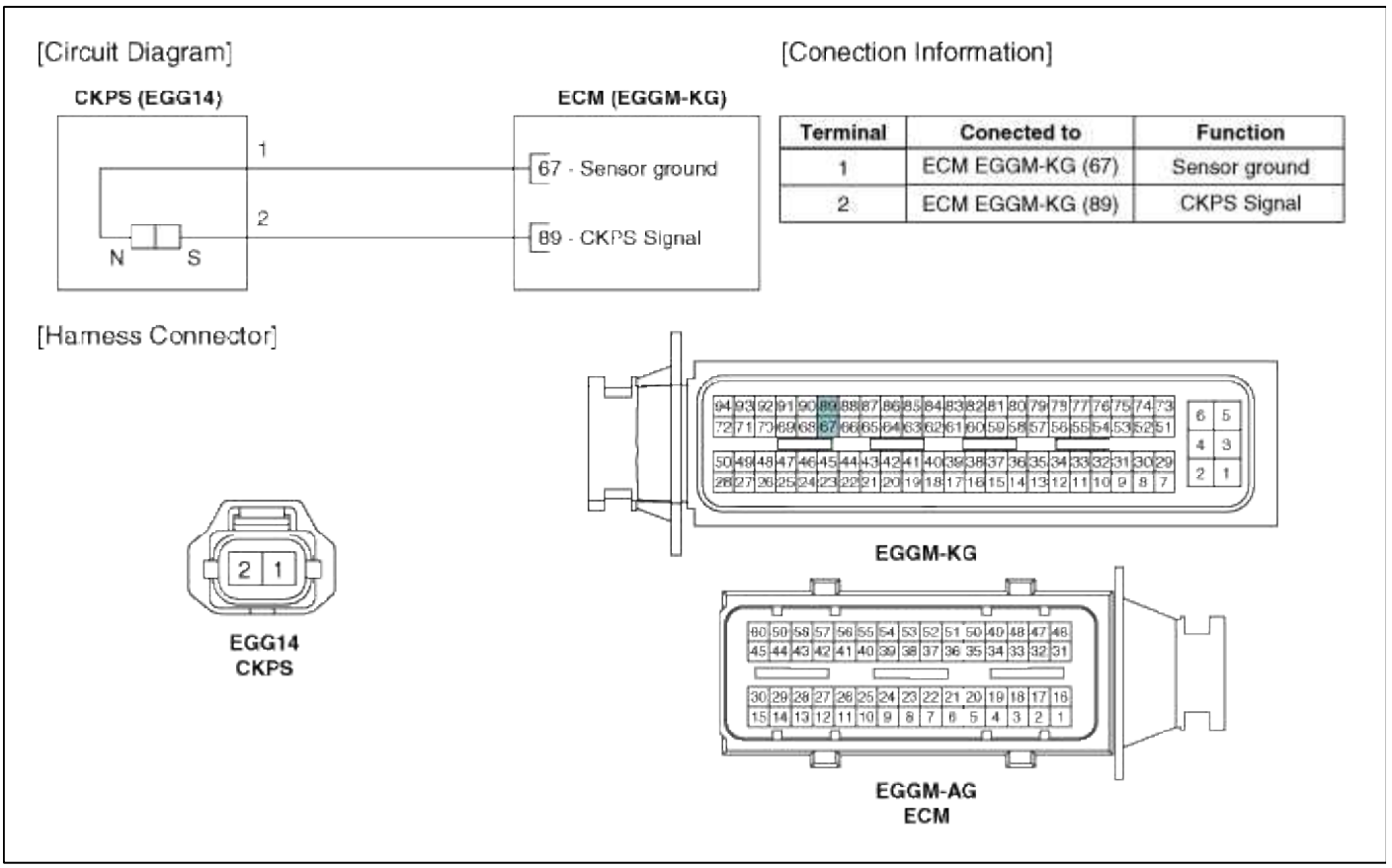

Oscilloscope
Sensor
Theme
2Ch/4Ch
Aux
Review
User Setting
83 ms
Reset
Start
Name
Cursor
ViewAll
Save
10ms
Configuration
+20V
CKPS
Cur a: 2.3 V
Avg : 2.4 V
Cur b: 2.3 V
-5V
a
b
+20V
CMPS
Cur a: 13.6 V
Avg : 11.8 V
Cur b: 0.1 V
-5V
CKPS, CMPS

This example shows a typical Crankshaft Position Sensor(CkPS) and Camshaft Position Sensor(CMPS) waveform at idle.The PCM controls the injection and ignition timing by using these signals.
Generally CkPS signal is used to detect the piston's position and CMPS signal is used to detect the Top Dead Center of each cylinder.

Fuel System > Engine Control System > Crankshaft Position Sensor (CKPS) > Schematic Diagrams

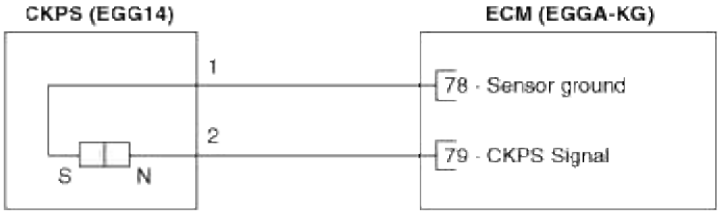
Circuit Diagram

(M/T)



(A/T)

[Circuit Diagram]

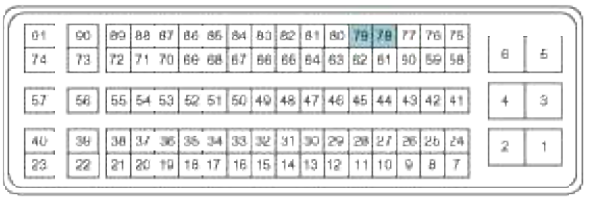


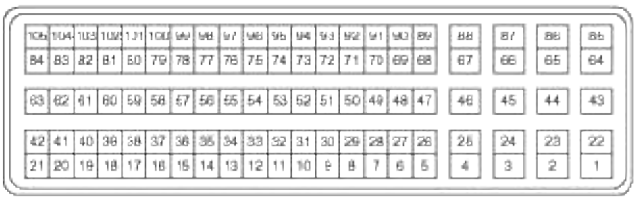
[Conection Information]

Terminal	Conected to	Function
1	ECM EGGA-KG (78)	Sensor ground
2	ECM EGGA-KG (79)	CKPS Signal

[Hamess Connector]

EGG14
CKPS





ECM

Fuel System > Engine Control System > Crankshaft Position Sensor (CKPS) > Repair procedures

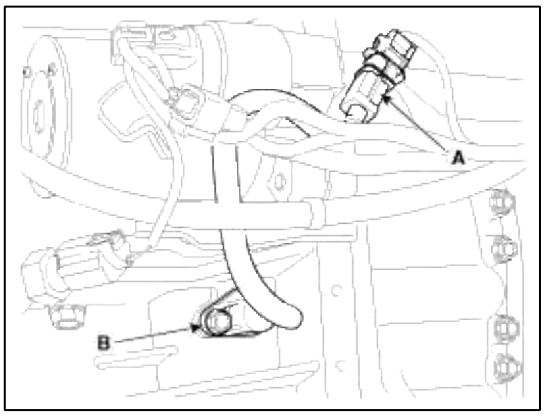
Inspection

1. Check signal waveform of CKPS and CMPS using a GDS.

Specification: Refer to “Waveform”

Removal

1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Disconnect the crankshaft position sensor connector (A) and remove the sensor (B) after removing the installation bolt.



Installation

CAUTION

- Install the component with the specified torques.
- Note that internal damage may occur when the component is dropped. If the component has been dropped, inspect before installing.

CAUTION

• Apply the engine oil to the O-ring.

CAUTION

• Insert the sensor in the installation hole and be careful not to damage.

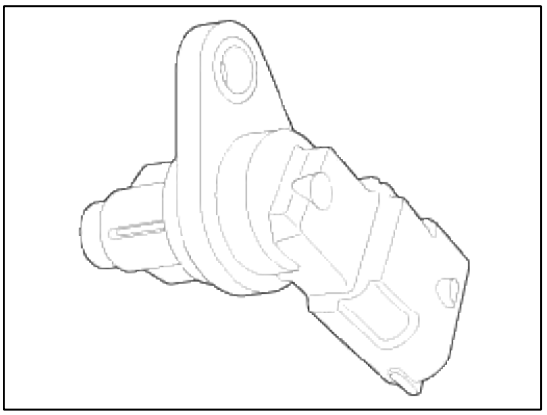
1. Installation is reverse of removal.

Crankshaft position sensor installation bolt:
7.8 ~ 11.8 N.m (0.8 ~ 1.2 kgf.m, 5.8 ~ 8.7 lb-ft)

Fuel System > Engine Control System > Camshaft Position Sensor (CMPS) > Description and Operation

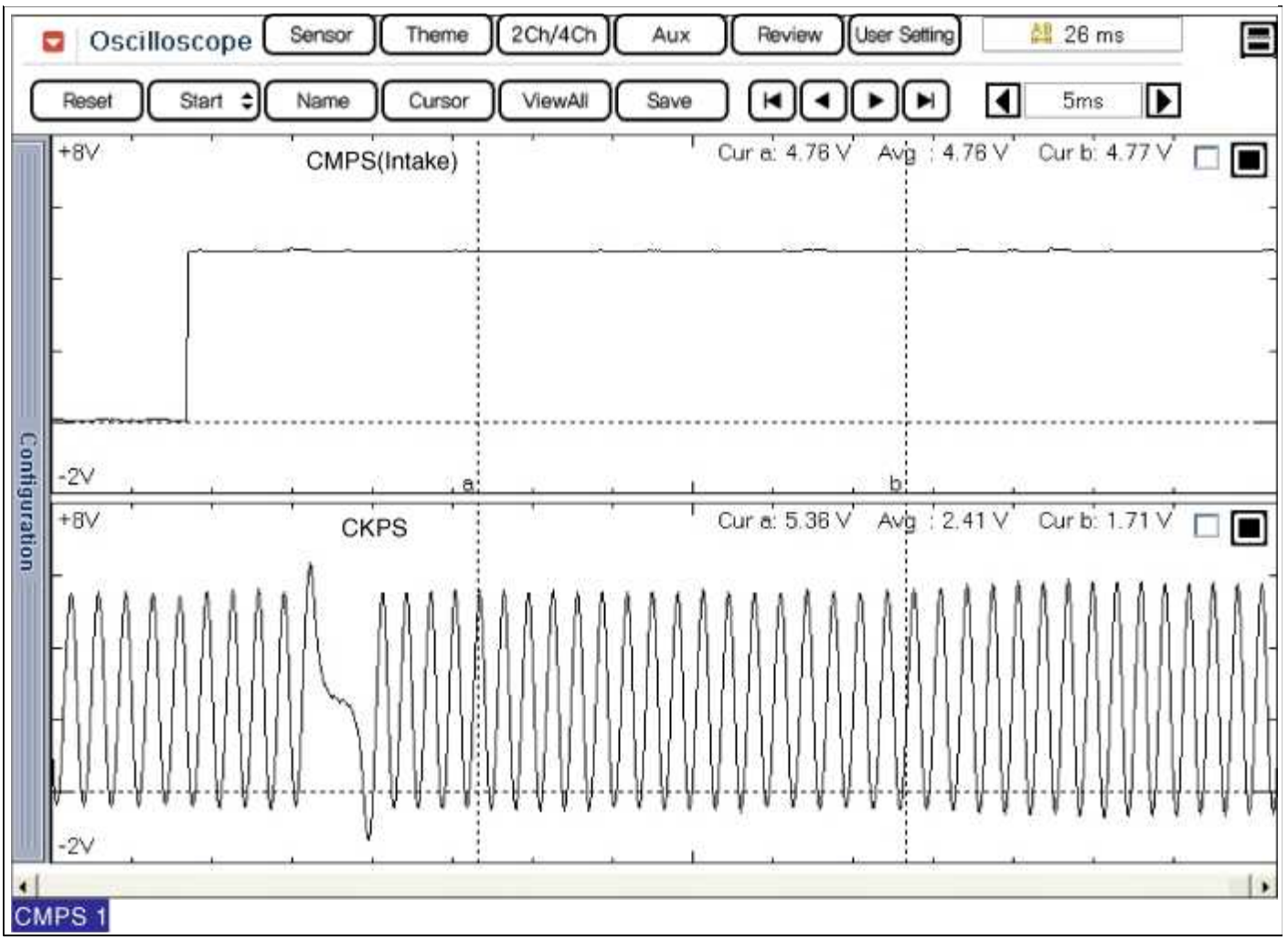
Description

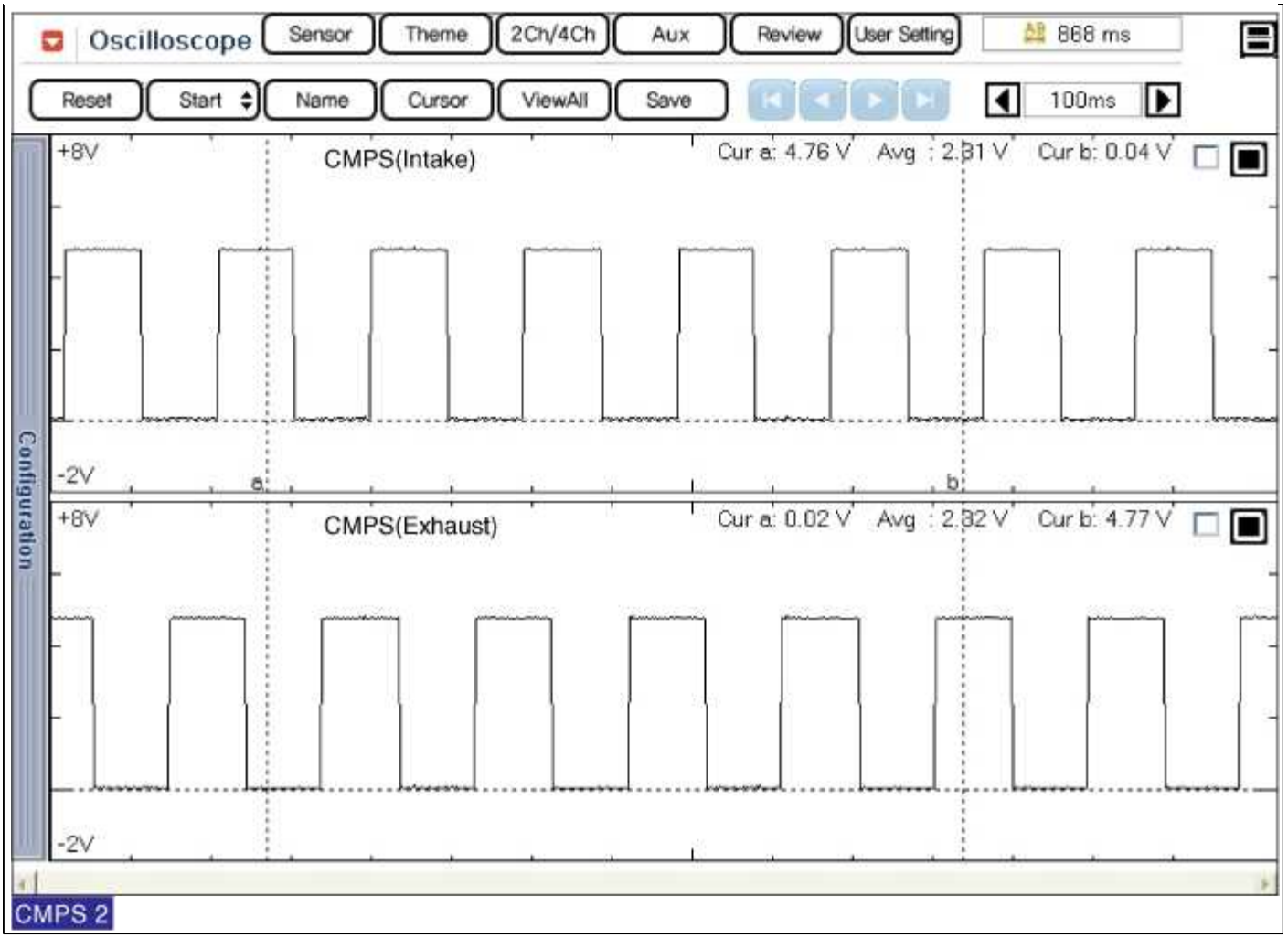
Camshaft Position Sensor (CMPS) is a hall sensor and detects the camshaft position by using a hall element.
It is related with Crankshaft Position Sensor (CKPS) and detects the piston position of each cylinder which the CKPS can't detect.
The CMPS is installed on engine head cover and uses a target wheel installed on the camshaft. The Cam Position sensor is a hall-effect type sensor. As the target wheel passes the Hall sensor, the magnetic field changes in the sensor. The sensor then switches a signal which creates a square wave.



Fuel System > Engine Control System > Camshaft Position Sensor (CMPS) > Troubleshooting

Wave Form


Oscilloscope
Sensor
Theme
2Ch/4Ch
Aux
Review
User Setting
26 ms
Reset
Start
Name
Cursor
ViewAll
Save
5ms
Configuration
+8V
CMPS(Intake)
Cur a: 4.76 V
Avg : 4.76 V
Cur b: 4.77 V
-2V
a
b
+8V
CKPS
Cur a: 5.36 V
Avg : 2.41 V
Cur b: 1.71 V
-2V
CMPS 1

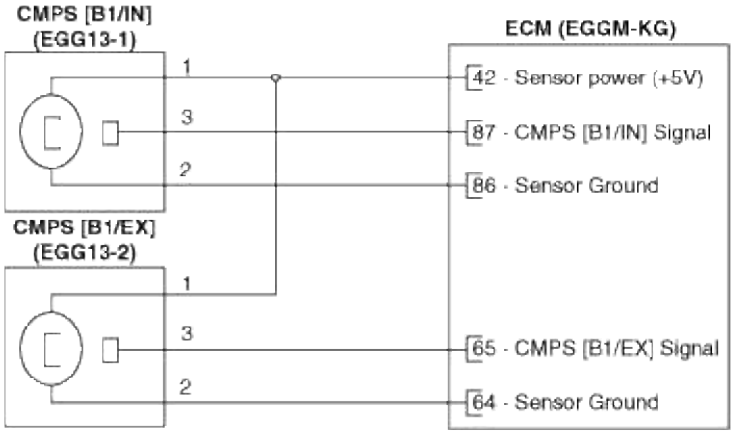


Fuel System > Engine Control System > Camshaft Position Sensor (CMPS) > Schematic Diagrams

Circuit Diagram

(M/T)

[Circuit Diagram]



[Connection Information]

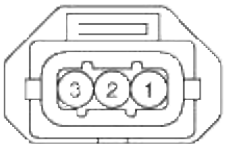
CMPS [B1/IN] (EGG13-1)

Terminal	Connected to	Function
1	Main Relay	Battery Power (B+)
2	ECM EGGM-KG (86)	Sensor Ground
3	ECM EGGM-KG (87)	CMPS [B1/IN] Signal

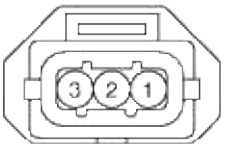
CMPS [B1/EX] (EGG13-2)

Terminal	Connected to	Function
1	Main Relay	Battery Power (B+)
2	ECM EGGM-KG (64)	Sensor Ground
3	ECM EGGM-KG (65)	CMPS [B1/EX] Signal

[Harness Connector]

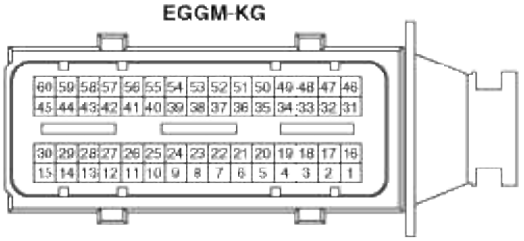


EGG13-1
CMPS [B1/IN]



EGG13-2
CMPS [B1/EX]

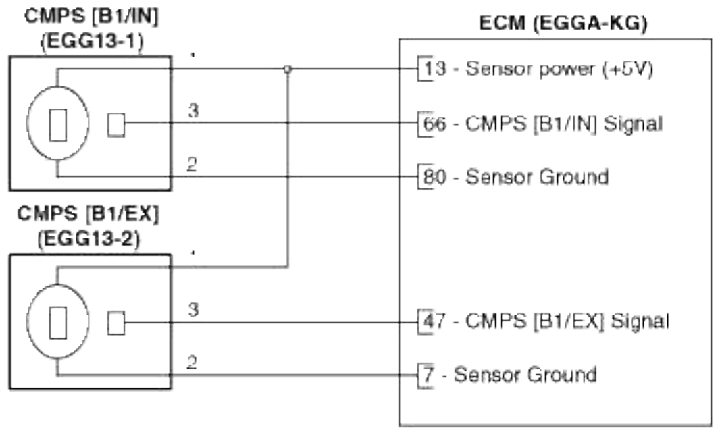
EGGM-KG



EGGM-AG
ECM

(A/T)

[Circuit Diagram]



[Connection Information]

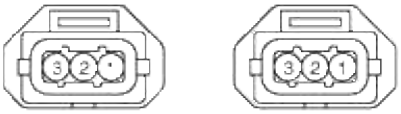
CMPS [B1/IN] (EGG13-1)

Terminal	Connected to	Function
1	Main Relay	Battery Power (B+)
2	ECM EGGA-KG (80)	Sensor Ground
3	ECM EGGA-KG (66)	CMPS [B1/IN] Signal

CMPS [B1/EX] (EGG13-2)

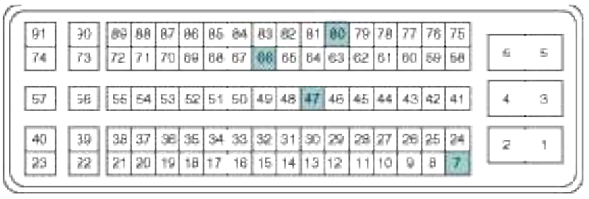
Terminal	Connected to	Function
1	Main Relay	Battery Power (B+)
2	ECM EGGA-KG (7)	Sensor Ground
3	ECM EGGA-KG (47)	CMPS [B1/EX] Signal

[Harness Connector]

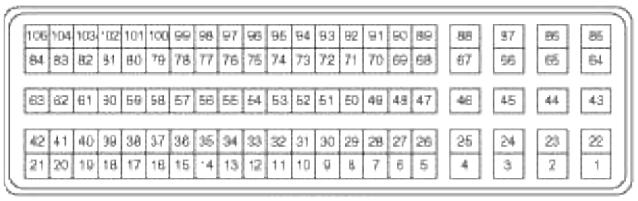


EGG13-1
CMPS [B1/IN]

EGG13-2
CMPS [B1/EX]



EGGA-KG



EGGA-AG
ECM

Fuel System > Engine Control System > Camshaft Position Sensor (CMPS) > Repair procedures

Inspection

1. Check the signal waveform of the CMPS and CKPS using the GDS.

Specification: Refer to “Wave Form”

Removal

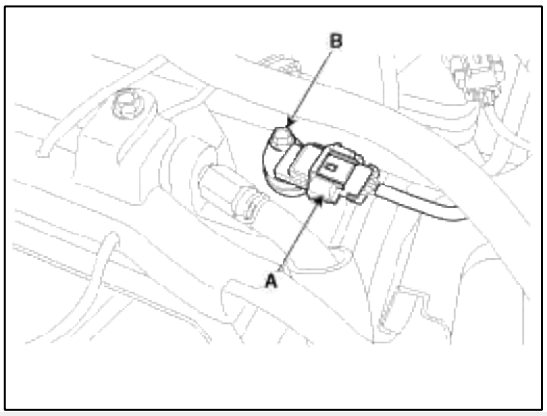
WARNING

- DON’T remove the camshaft position sensor while the engine is running or right after engine is turned off. The part and engine oil is hot and can cause burns.

[Bank 1 / Intake]

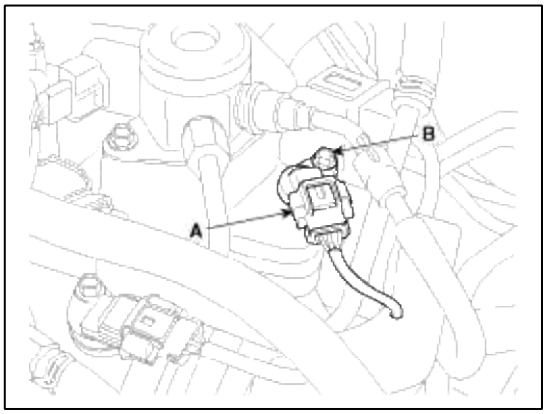
1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Disconnect the camshaft position sensor connector (A).

3. Remove the installation bolt (B), and then remove the sensor.



[Bank 1 / Exhaust]

1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Disconnect the camshaft position sensor connector (A).
3. Remove the hanger and the protector.
4. Remove the installation bolt (B), and then remove the sensor.



Installation

CAUTION

- Install the component with the specified torques.
- Note that internal damage may occur when the component is dropped. If the component has been dropped, inspect before installing.

CAUTION

- Apply the engine oil to the O-ring.

CAUTION

- Insert the sensor in the installation hole and be careful not to damage.

CAUTION

- Be careful not to damage the sensor housing and the connector.
- Be careful not to damage the O-ring.

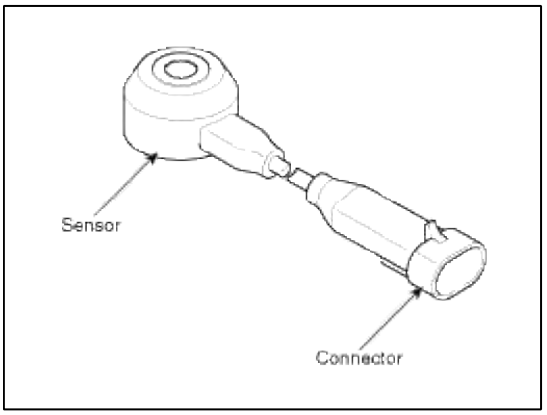
1. Installation is reverse of removal.

Camshaft position sensor installation bolt:
7.8 ~ 11.8 N.m (0.8 ~ 1.2 kgf.m, 5.8 ~ 8.7 lb-ft)

Fuel System > Engine Control System > Knock Sensor (KS) > Description and Operation

Description

Knocking is a phenomenon characterized by undesirable vibration and noise and can cause engine damage. Knock Sensor (KS) is installed on the cylinder block and senses engine knocking.
When knocking occurs, the vibration from the cylinder block is applied as pressure to the piezoelectric element. When a knock occurs, the sensor produces voltage signal. The ECM retards the ignition timing when knocking occurs. If the knocking disappears after retarding the ignition timing, the ECM will advance the ignition timing. This sequential control can improve engine power, torque and fuel economy.



Fuel System > Engine Control System > Knock Sensor (KS) > Specifications

Specification

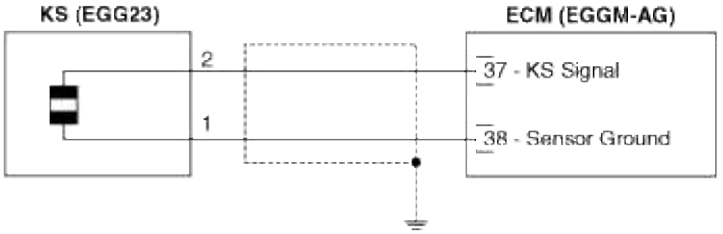
Item	Specification
Capacitance (pF)	950 ~ 1,350
Resistance (MΩ)	4.87

Fuel System > Engine Control System > Knock Sensor (KS) > Schematic Diagrams

Circuit Diagram

(M/T)

[Circuit Diagram]

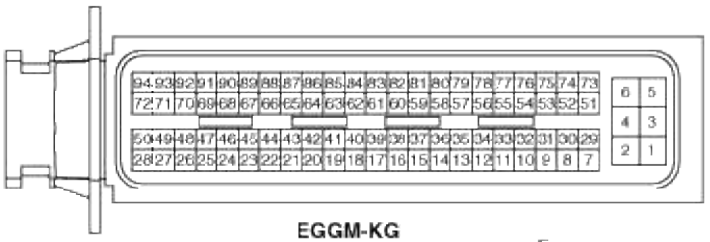


[Connection Information]

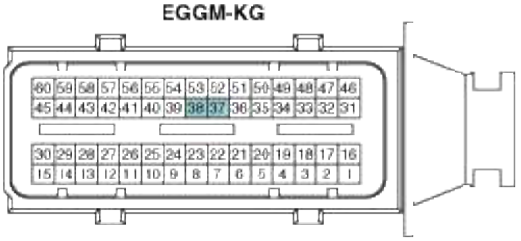
Terminal	Connected to	Function
1	ECM EGGM-AG (38)	Sensor Ground
2	ECM EGGM-AG (37)	KS Signal

[Harness Connector]

EGG23
Knock Sensor



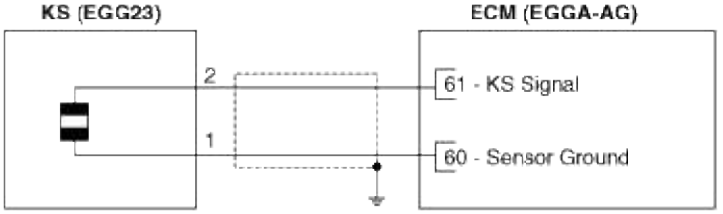
EGGM-KG



EGGM-AG
ECM

(A/T)

[Circuit Diagram]

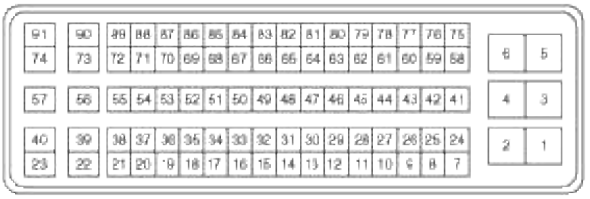


[Connection Information]

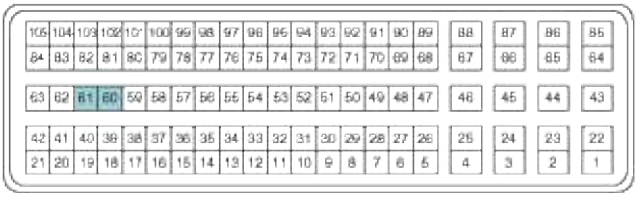
Terminal	Connected to	Function
1	ECM EGGA-AG (60)	Sensor Ground
2	ECM EGGA-AG (61)	KS Signal

[Harness Connector]

EGG23
Knock Sensor



EGGA-KG



EGGA-AG

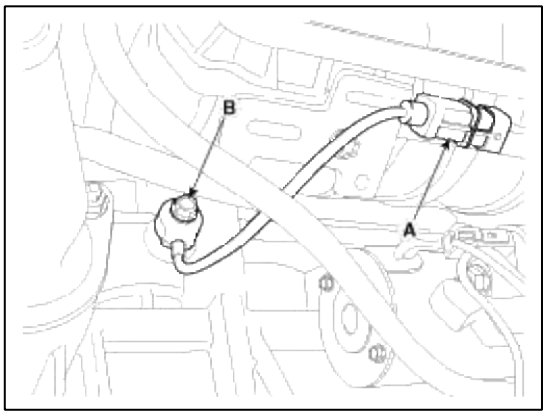
ECM

Fuel System > Engine Control System > Knock Sensor (KS) > Repair procedures

Removal

1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Remove the intake manifold (Refer to “Intake And Exhaust System” in EM group).

3. Disconnect the injector connector (A).
4. Remove the installation bolt (B), and then remove the sensor from the cylinder block.



Installation

CAUTION

- Install the component with the specified torques.
- Note that internal damage may occur when the component is dropped. If the component has been dropped, inspect before installing.

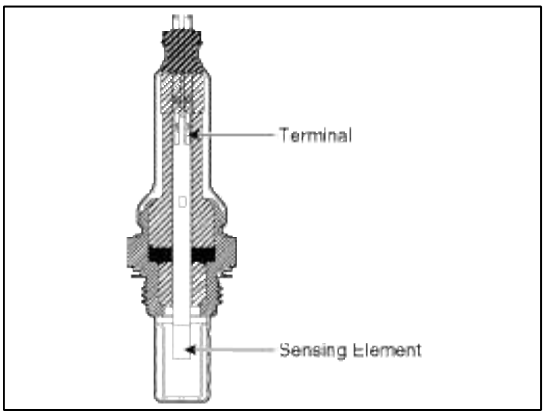
1. Installation is reverse of removal.

Knock sensor installation bolt:
18.6 ~ 24.5 N.m (1.9 ~ 2.5 kgf.m, 13.7 ~ 18.1 lb-ft)

Fuel System > Engine Control System > Heated Oxygen Sensor (HO2S) > Description and Operation

Description

Heated Oxygen Sensor (HO2S) consists of zirconium and alumina and is installed both upstream and downstream of the Manifold Catalytic Converter. The sensor output voltage varies in accordance with the air/fuel ratio.
The sensor must be hot in order to operate normally. To keep it hot, the sensor has a heater which is controlled by the ECM via a duty cycle signal. When the exhaust gas temperature is lower than the specified value, the heater warms the sensor tip.



Fuel System > Engine Control System > Heated Oxygen Sensor (HO2S) > Specifications

Specification

HO2S [Bank 1/Sensor 1]

Item	Specification
Heater Resistance (Ω)	2.4 ~ 4.0 [20°C(68°F)]

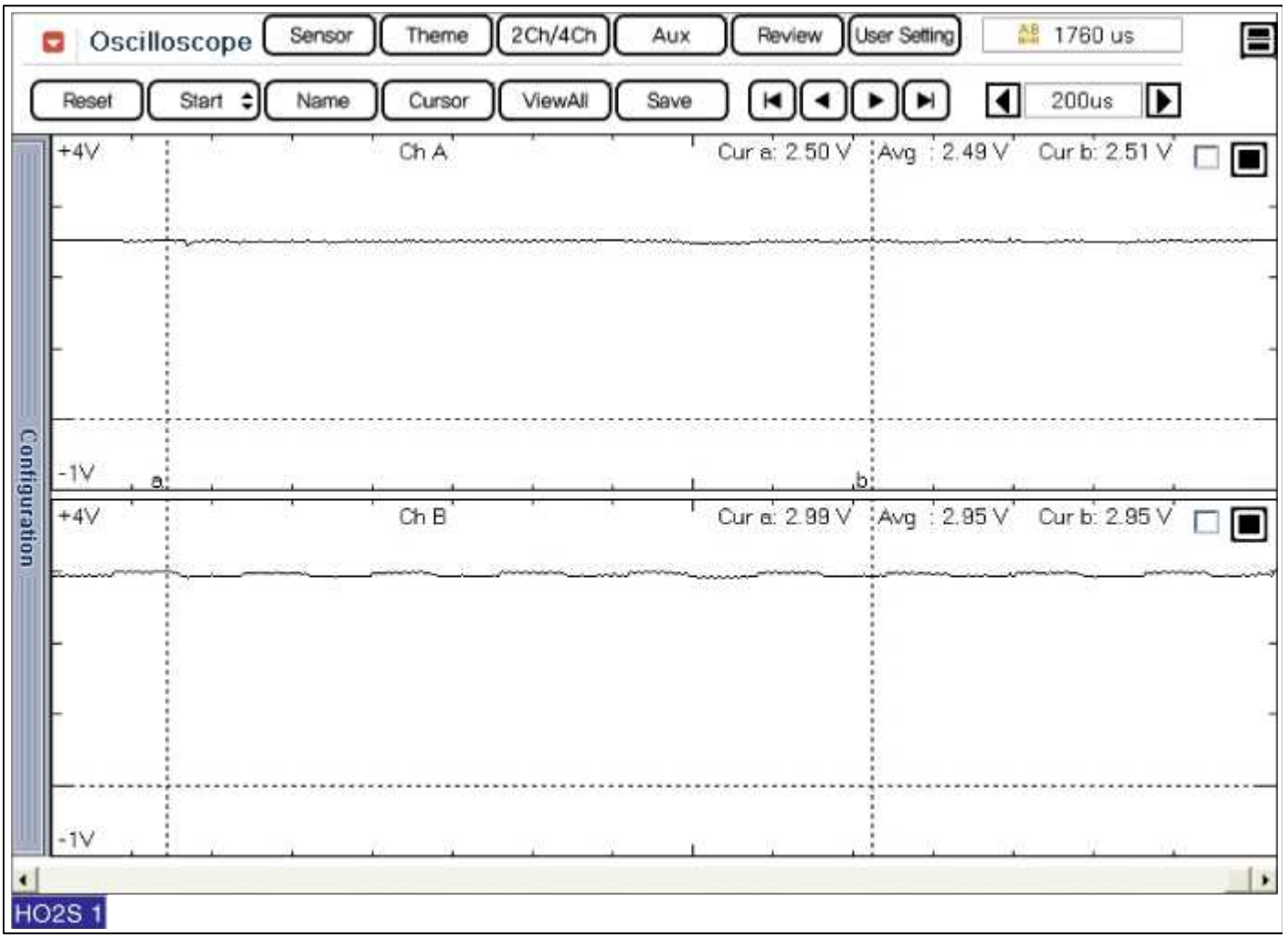
HO2S [Bank 1/Sensor 2]

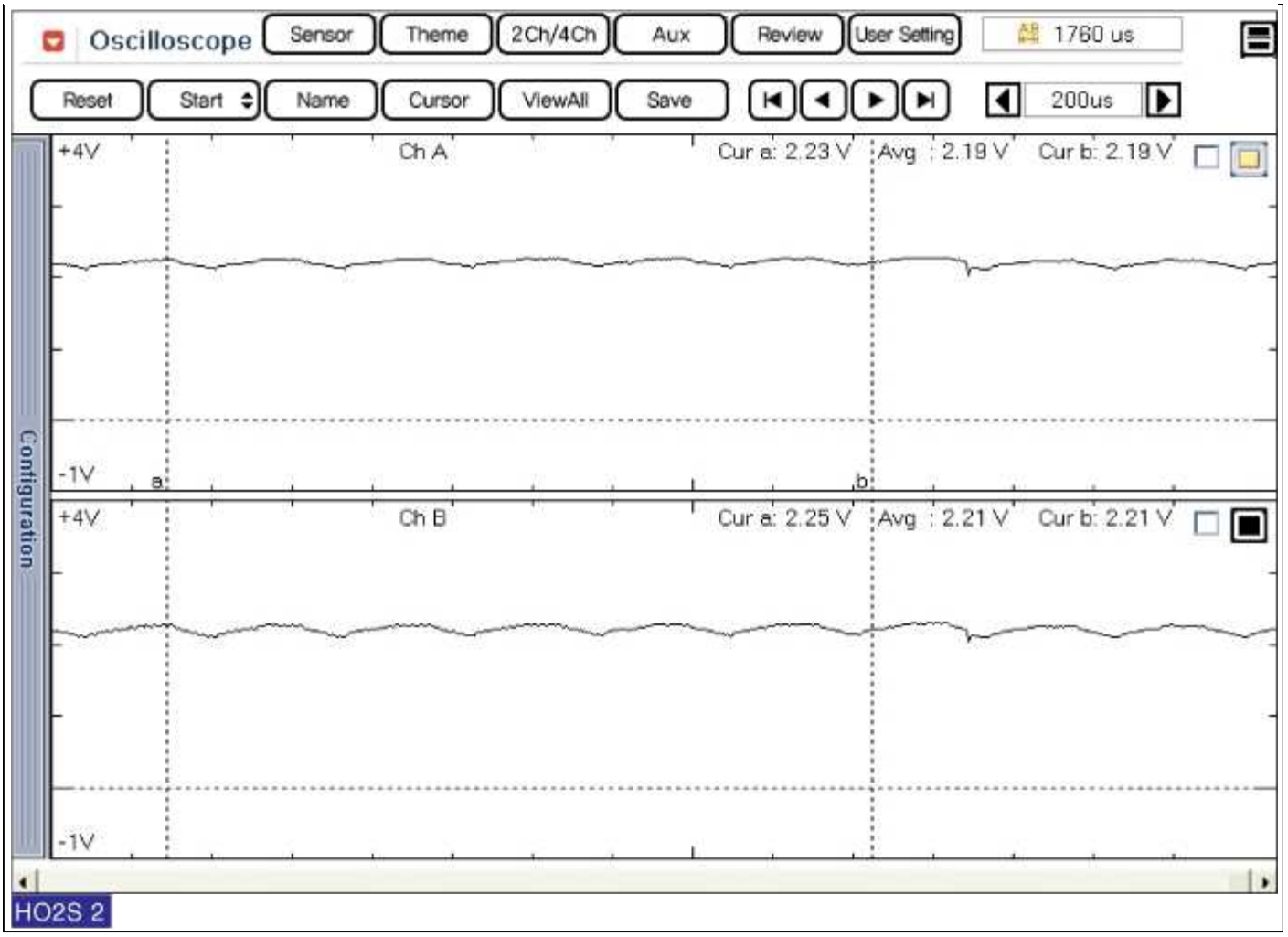
A/F Ratio (λ)	Output Voltage(V)
RICH	0.6 ~ 1.0
LEAN	0 ~ 0.4

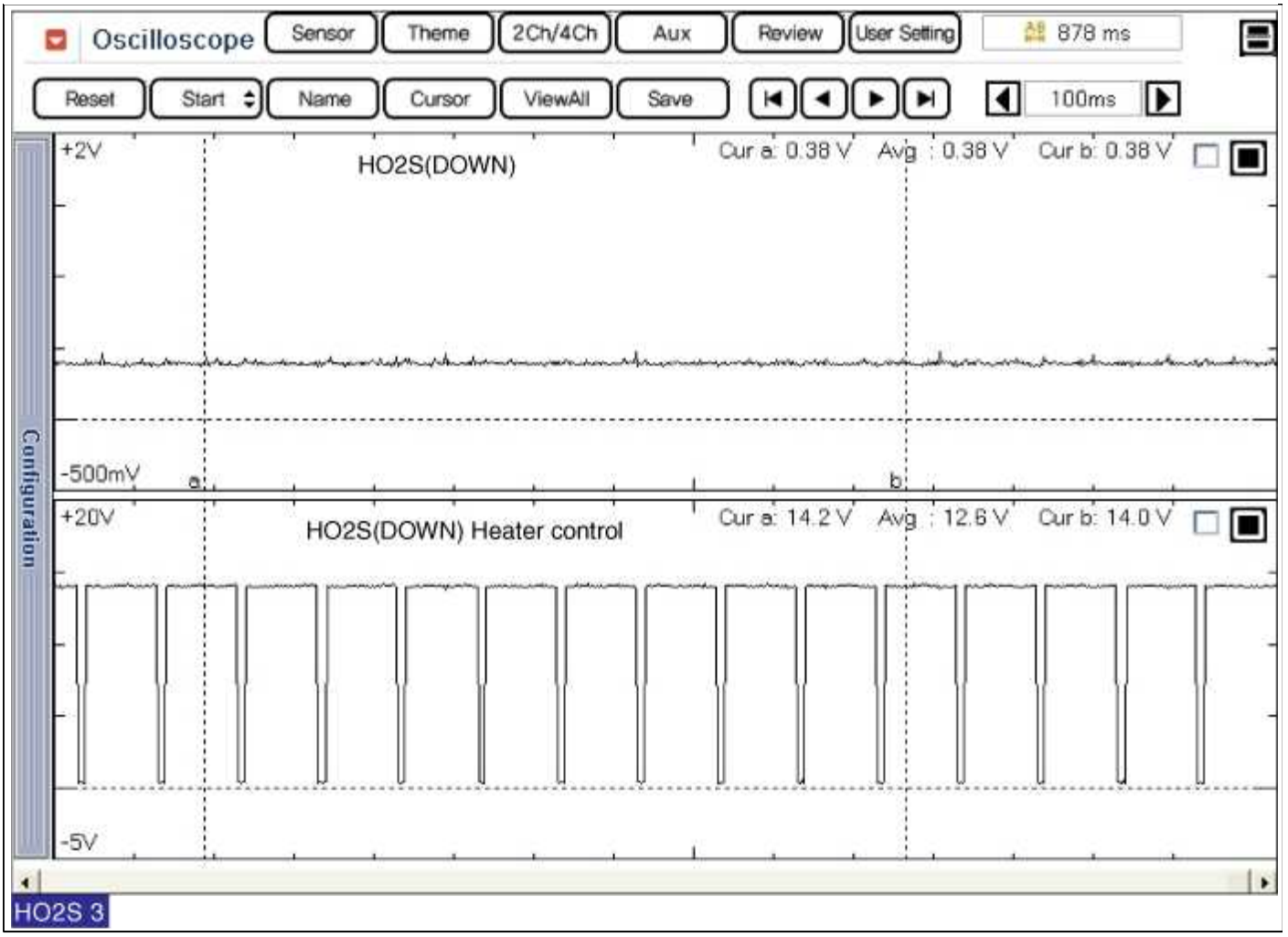
Item	Specification
Heater Resistance (Ω)	Approx. 9.0 [21°C(69.8°F)]

Fuel System > Engine Control System > Heated Oxygen Sensor (HO2S) > Troubleshooting

Signal Waveform




Oscilloscope
Sensor
Theme
2Ch/4Ch
Aux
Review
User Setting
1760 us
Reset
Start
Name
Cursor
ViewAll
Save
200us
Configuration
+4V
Ch A
Cur a: 2.23 V
Avg : 2.19 V
Cur b: 2.19 V
-1V
a
b
+4V
Ch B
Cur a: 2.25 V
Avg : 2.21 V
Cur b: 2.21 V
-1V
HO2S 2

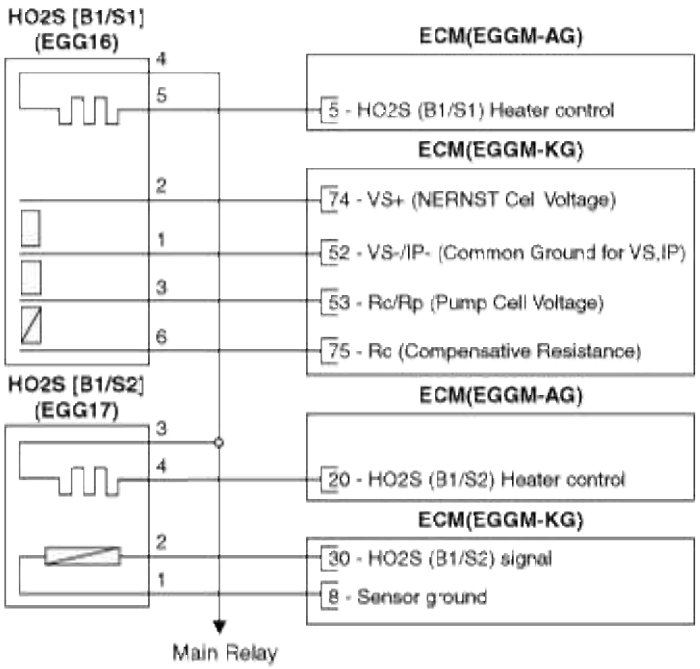


Fuel System > Engine Control System > Heated Oxygen Sensor (HO2S) > Schematic Diagrams

Circuit Diagram

(M/T)

[Circuit Diagram]



[Connection Information]

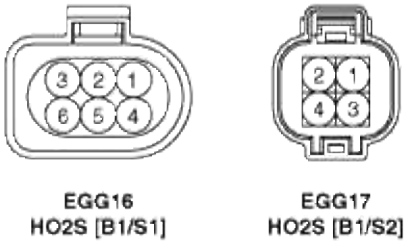
HO2S [B1/S1] (EGG16)

Terminal	Connected to	Function
1	ECM EGGM-KG (52)	VS-/IP- (Common Ground for VS,IP)
2	ECM EGGM-KG (74)	VS+ (NERNST Cell Voltage)
3	ECM EGGM-KG (53)	Rc/Rp (Pump Cell Voltage)
4	Main Relay	Power Supply (B+)
5	ECM EGGM-AG (5)	Heater control
6	ECM EGGM-KG (75)	Rc (Compensative Resistance)

HO2S [B1/S2] (EGG17)

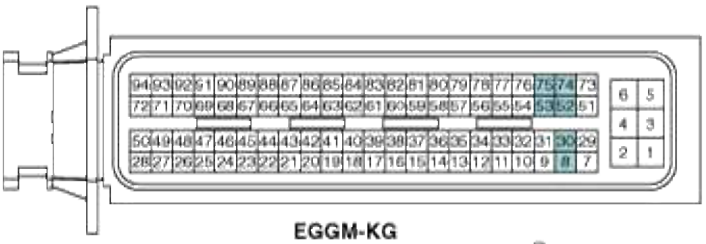
Terminal	Connected to	Function
1	ECM EGGM-KG (8)	Sensor Ground
2	ECM EGGM-KG (30)	HO2S (B1/S2) Signal
3	Main Relay	Power Supply (B+)
4	ECM EGGM-AG (20)	Heater control

[Harness Connector]

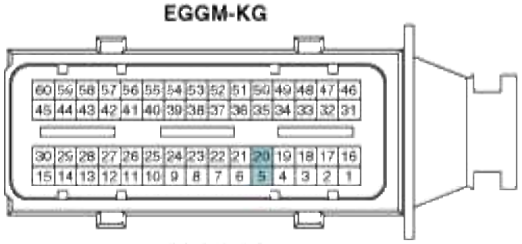


EGG16
HO2S [B1/S1]

EGG17
HO2S [B1/S2]



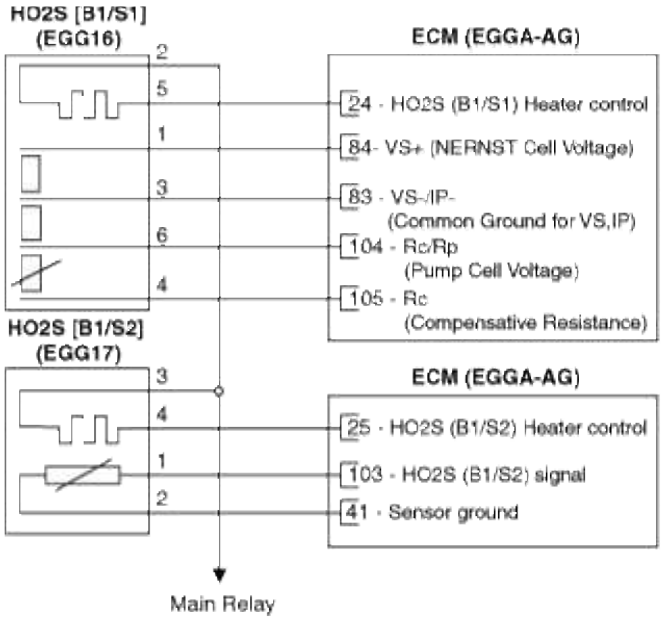
EGGM-KG



EGGM-AG
ECM

(A/T)

[Circuit Diagram]



[Connection Information]

HO2S [B1/S1](EGG16)

Terminal	Connected to	Function
1	ECM EGGA-AG (84)	VS+ (NERNST Cell Voltage)
2	Main Relay	Power Supply (B+)
3	ECM EGGA-AG (83)	VS-/IP- (Common Ground for VS,IP)
4	ECM EGGA-AG (105)	Rc (Compensative Resistance)
5	ECM EGGA-AG (24)	HO2S (B1/S1) Heater control
6	ECM EGGA-AG (104)	Rc/Rp (Pump Cell Voltage)

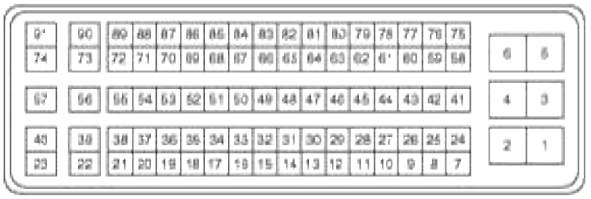
HO2S [B1/S2] (EGG17)

Terminal	Connected to	Function
1	ECM EGGA-AG (103)	HO2S (B1/S2) signal
2	ECM EGGA-AG (41)	Sensor Ground
3	Main Relay	Power Supply (B+)
4	ECM EGGA-AG (25)	HO2S (B1/S2) Heater control

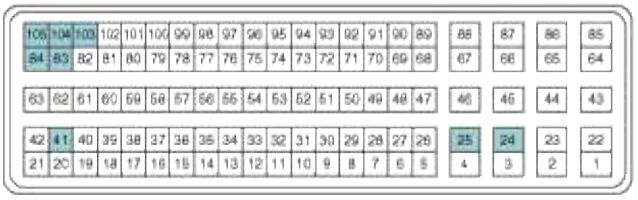
[Harness Connector]

EGG16
HO2S [B1/S1]

EGG17
HO2S [B1/S2]



EGGA-KG



EGGA-AG
ECM

Fuel System > Engine Control System > Heated Oxygen Sensor (HO2S) > Repair procedures

Inspection

1. Turn the ignition switch OFF.
2. Disconnect the HO2S connector.
3. Measure resistance between the HO2S terminals 4 and 5 [B1/S1].
4. Measure resistance between the HO2S terminals 3 and 4 [B1/S2].
5. Check that the resistance is within the specification.

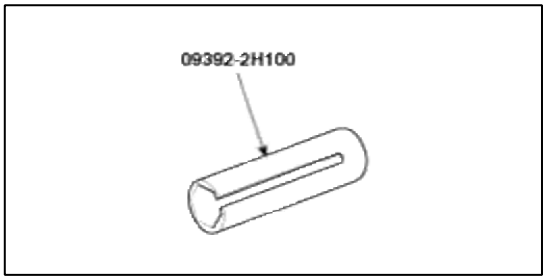
Specification: Refer to “Specification”

Removal

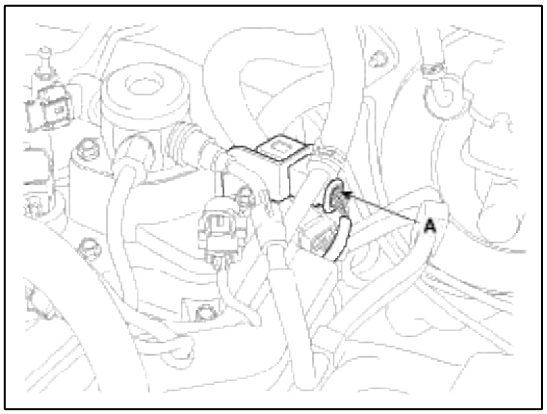
1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Disconnect the connector (A), and then remove the sensor (B).

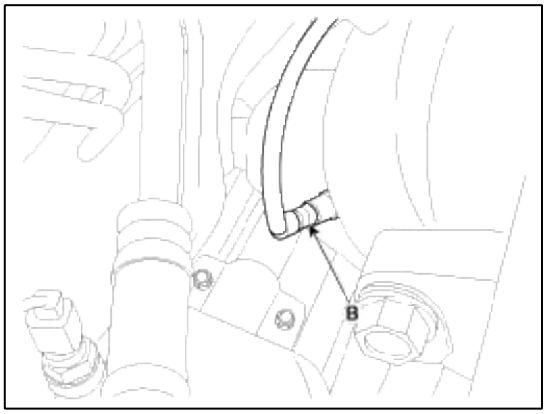
NOTE

Note that the SST (Part No.: 09392-2H100) is useful when removing the heated oxygen sensor.

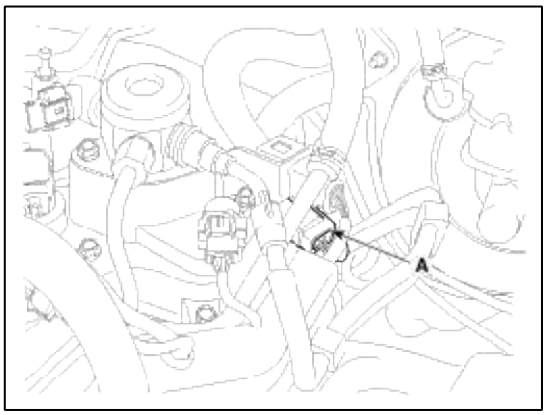


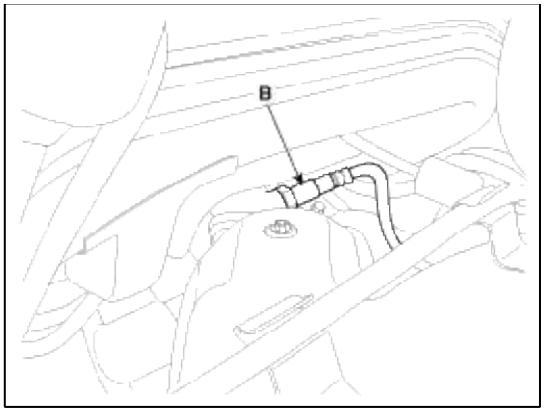
[Bank 1 / Sensor 1]





[Bank 1 / Sensor 2]





Installation

CAUTION

- Install the component with the specified torques.
- Note that internal damage may occur when the component is dropped. If the component has been dropped, inspect before installing.

CAUTION

- DON'T use a cleaner, spray, or grease to sensing element and connector of the sensor because oil component in them may malfunction the sensor performance.
- Sensor and its wiring may be damaged in case of contacting with the exhaust system (Exhaust Manifold, Catalytic Converter, and so on).

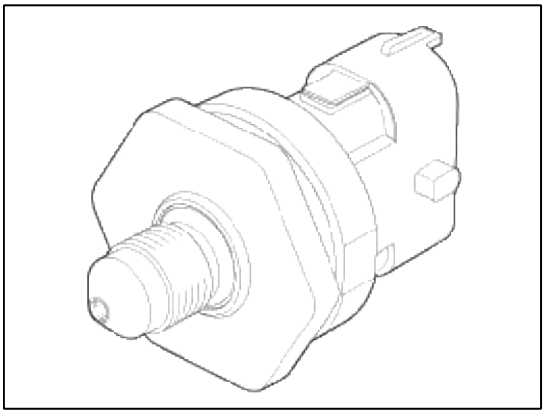
1. Installation is reverse of removal.

Heated oxygen sensor installation:
39.2 ~ 49.1 N.m (4.0 ~ 5.0 kgf.m, 28.9 ~ 36.2 lb-ft)

Fuel System > Engine Control System > Rail Pressure Sensor (RPS) > Description and Operation

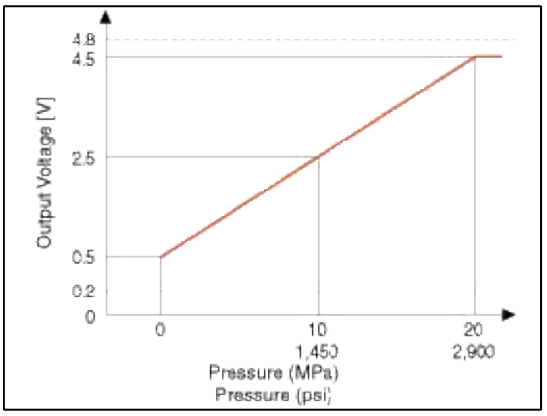
Description

Rail Pressure Sensor (RPS) is installed on the delivery pipe and measures the instantaneous fuel pressure in the delivery pipe. The sensing element (Semiconductor element) built in the sensor converts the pressure to voltage signal. By using this signal, the ECM can control correct injection amount and timing and adjusts the fuel pressure with the fuel pressure regulator valve if the target pressure and the actual pressure calculated by the RPS output signal are different.



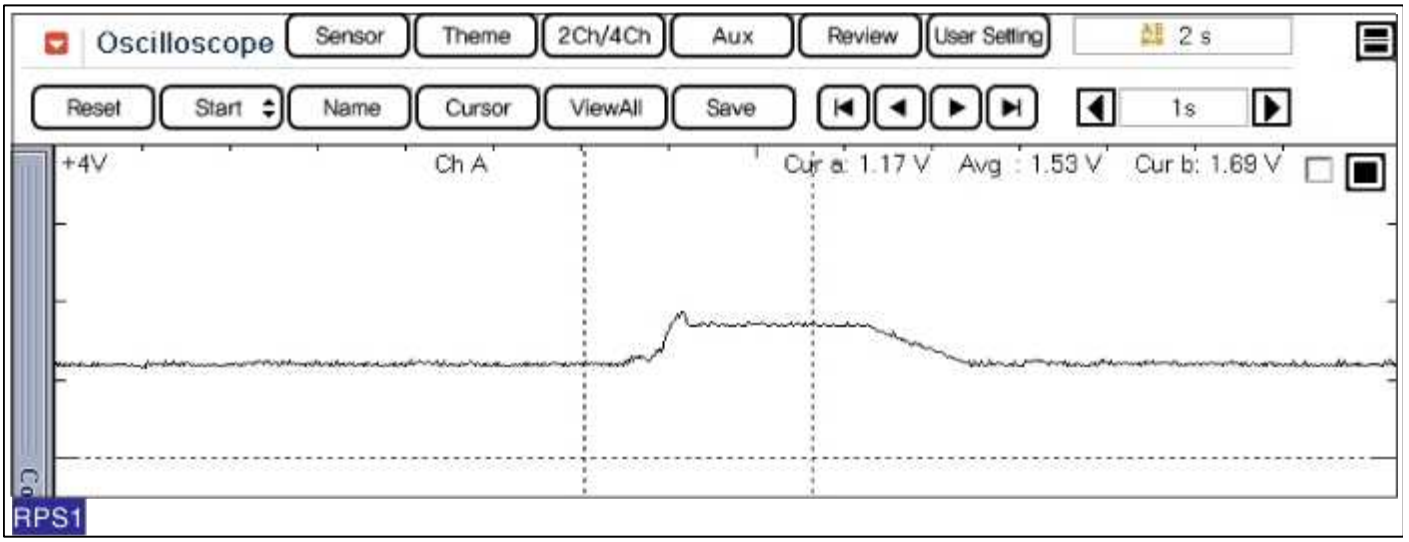
Fuel System > Engine Control System > Rail Pressure Sensor (RPS) > Specifications

Specification



Fuel System > Engine Control System > Rail Pressure Sensor (RPS) > Troubleshooting

Signal Waveform

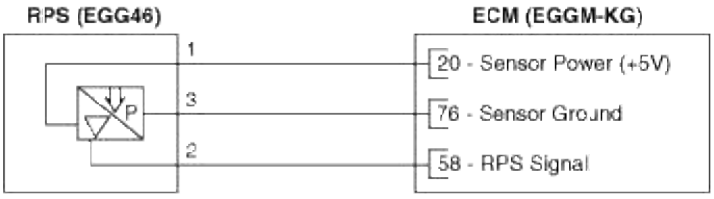


Fuel System > Engine Control System > Rail Pressure Sensor (RPS) > Schematic Diagrams

Circuit Diagram

(M/T)

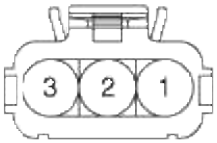
[Circuit Diagram]



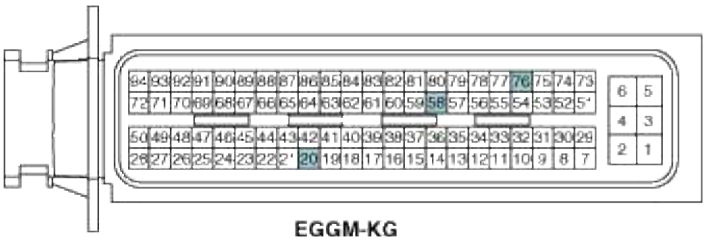
[Connection Information]

Terminal	Connected to	Function
1	ECM EGGM-KG (20)	Sensor Power (+5V)
2	ECM EGGM-KG (58)	RPS Signal
3	ECM EGGM-KG (76)	Sensor Ground

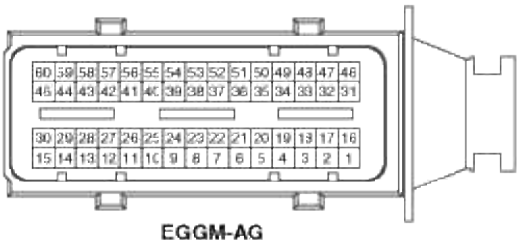
[Harness Connector]



EGG46
RPS



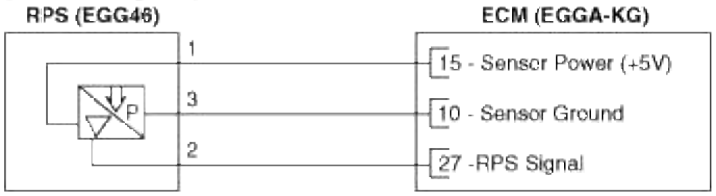
EGGM-KG



EGGM-AG
ECM

(A/T)

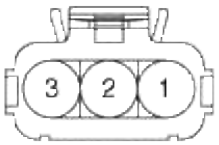
[Circuit Diagram]



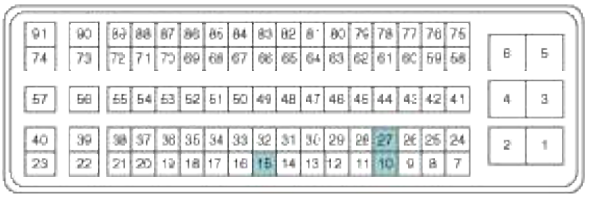
[Connection Information]

Terminal	Connected to	Function
1	ECM EGGA-KG (15)	Sensor Power (+5V)
2	ECM EGGA-KG (27)	RPS Signal
3	ECM EGGA-KG (10)	Sensor Ground

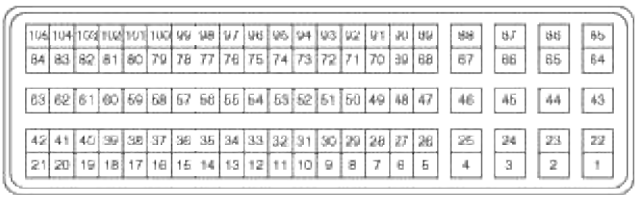
[Harness Connector]



EGG46
RPS



EGGA-KG



EGGA-AG
ECM

Fuel System > Engine Control System > Rail Pressure Sensor (RPS) > Repair procedures

Inspection

1. Connect the GDS on the Data Link Connector (DLC).

2. Measure the output voltage of the RPS at idle and various engine speed.

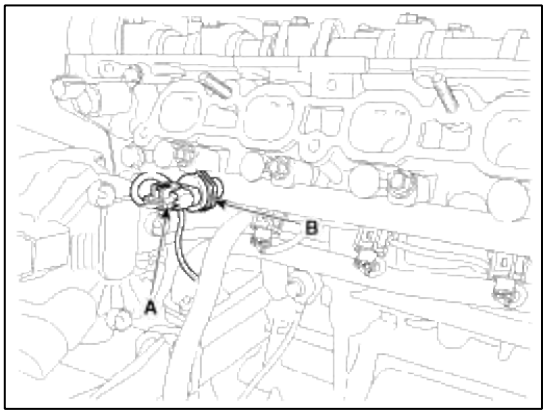
Condition	Output Voltage (V)
Idle	Approx. 1.2
1,500 rpm	2.2 ~ 2.5
6,300 rpm	Approx. 3.0

Removal

1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Release the residual pressure in fuel line (Refer to “Release Residual Pressure in Fuel Line” in this group).

> CAUTION
>
> When removing the fuel pump relay, a Diagnostic Trouble Code (DTC) may occur. Delete the code with the GDS after completion of “Release Residual Pressure in Fuel Line” work.

3. Remove the intake manifold (Refer to “Intake And Exhaust System” in EM group).
4. Disconnect the rail pressure sensor connector (A), and then remove the sensor (B) from the delivery pipe.



Installation

> CAUTION
>
> - Install the component with the specified torques.
> - Note that internal damage may occur when the component is dropped. If the component has been dropped, inspect before installing.

1. Installation is reverse of removal.

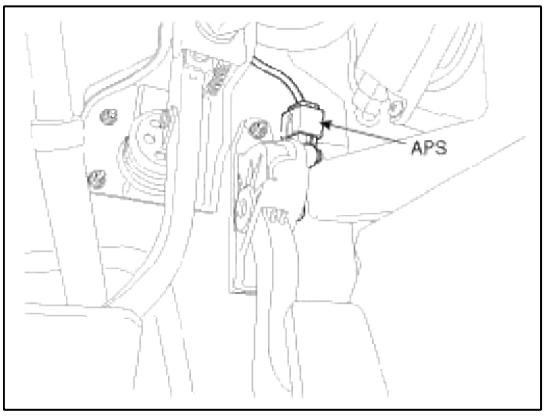
Rail Pressure Sensor Installation:
29.4 ~ 34.3 N.m (3.0 ~ 3.5 kgf.m, 21.7 ~ 25.3 lb-ft)

Fuel System > Engine Control System > Accelerator Position Sensor (APS) > Description and Operation

Description

Accelerator Position Sensor (APS) is installed on the accelerator pedal module and detects the rotation angle of the accelerator pedal. The APS is one of the most important sensors in engine control system, so it consists of the two sensors which adapt individual sensor power and ground line. The second sensor monitors the first sensor and its output voltage is half of the first one. If the ratio of the sensor 1 and 2 is out of the range (approximately 1/2), the

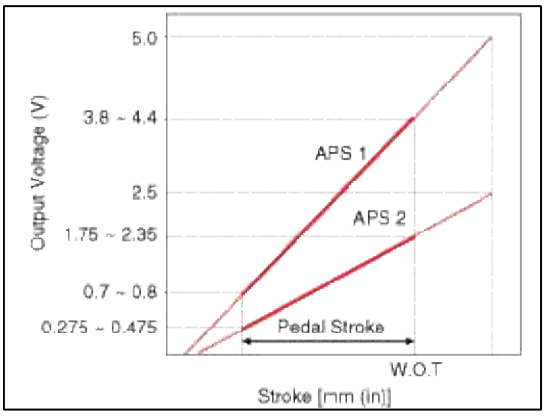
diagnostic system judges that it is abnormal.



Fuel System > Engine Control System > Accelerator Position Sensor (APS) > Specifications

Specification

Accelerator Position	Output Voltage (V)	
	APS1	APS2
C.T	0.7 ~ 0.8	0.275 ~ 0.475
W.O.T	3.8 ~ 4.4	1.75 ~ 2.35

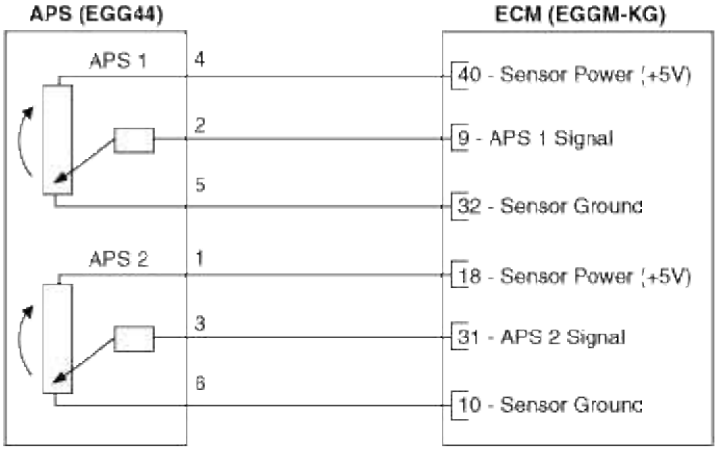


Fuel System > Engine Control System > Accelerator Position Sensor (APS) > Schematic Diagrams

Circuit Diagram

(M/T)

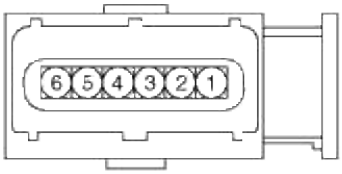
[Circuit Diagram]



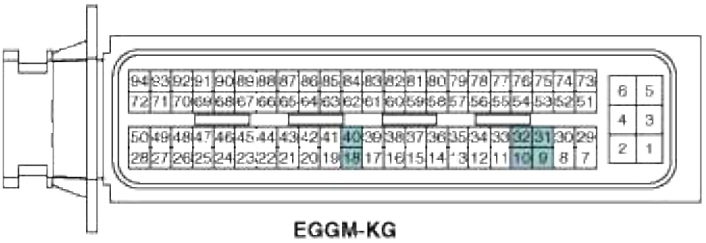
[Connection Information]

Terminal	Connected to	Function
1	ECM EGGM-KG (18)	APS 2 Sensor Power (+5V)
2	ECM EGGM-KG (9)	APS 1 Signal
3	ECM EGGM-KG (31)	APS 2 Signal
4	ECM EGGM-KG (40)	APS 1 Sensor Power (+5V)
5	ECM EGGM-KG (32)	APS 1 Sensor Ground
6	ECM EGGM-KG (10)	APS 2 Sensor Ground

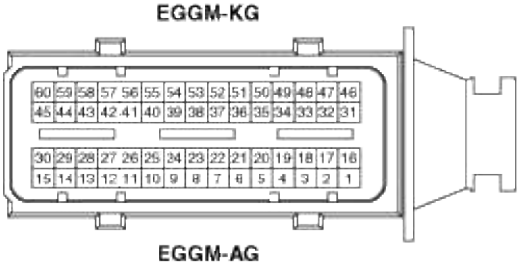
[Harness Connector]



EGG44
APS



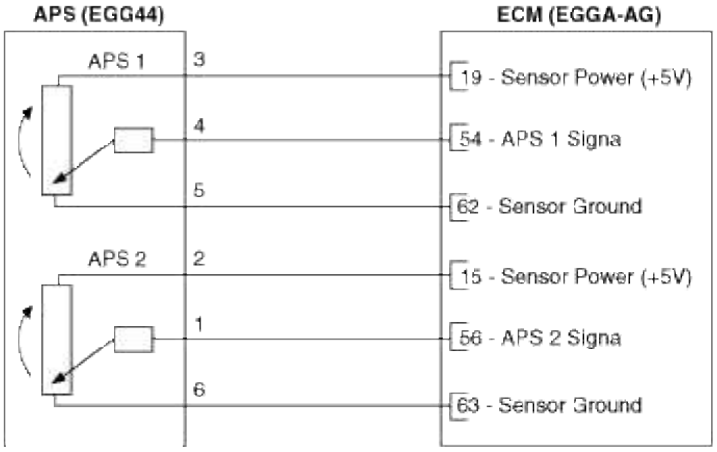
EGGM-KG



EGGM-AG
ECM

(A/T)

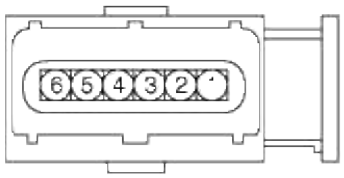
[Circuit Diagram]



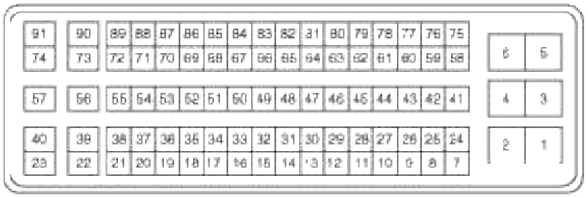
[Connection Information]

Terminal	Connected to	Function
1	ECM EGGA-AG (56)	APS 2 Signal
2	ECM EGGA-AG (15)	APS 2 Sensor Power (+5V)
3	ECM EGGA-AG (19)	APS 1 Sensor Power (+5V)
4	ECM EGGA-AG (54)	APS 1 Signal
5	ECM EGGA-AG (62)	APS 1 Sensor Ground
6	ECM EGGA-AG (63)	APS 2 Sensor Ground

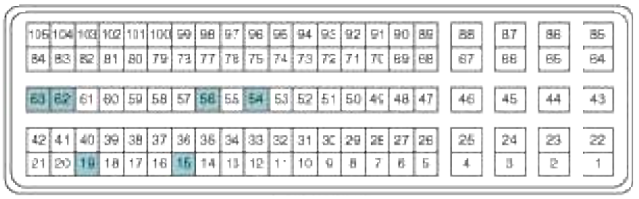
[Harness Connector]



EGG44
APS



EGGA-KG



EGGA-AG
ECM

Fuel System > Engine Control System > Accelerator Position Sensor (APS) > Repair procedures

Inspection

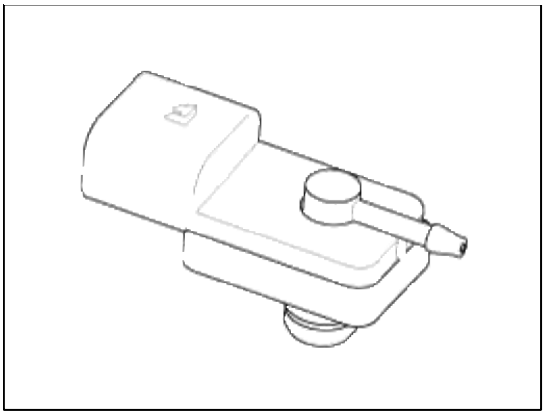
1. Connect the GDS on the Data Link Connector (DLC).
2. Turn the ignition switch ON.
3. Measure the output voltage of the APS 1 and 2 at C.T and W.O.T.

Specification: Refer to “Specification”

Fuel System > Engine Control System > Fuel Tank Pressure Sensor (FTPS) > Description and Operation

Description

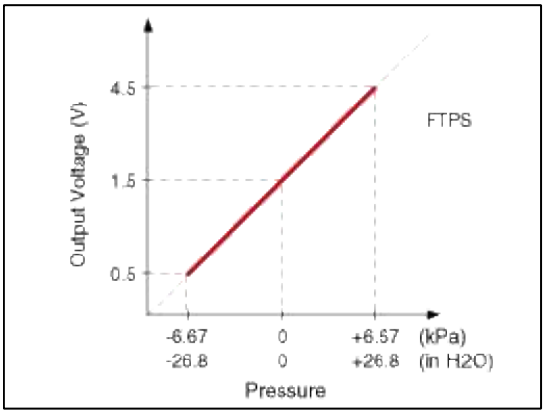
Fuel Tank Pressure Sensor (FTPS) is a component of the evaporative emission control system and is installed on the fuel tank, the fuel pump, or the canister. It checks the purge control solenoid valve operation and detects a leakage of the system.



Fuel System > Engine Control System > Fuel Tank Pressure Sensor (FTPS) > Specifications

Specification

Pressure [kPa (kgf/cm², in H2O)	Output Voltage (V)
-6.67 (-0.068, -26.8)	0.5
0	2.5
+6.67 (0.068, 26.8)	4.5

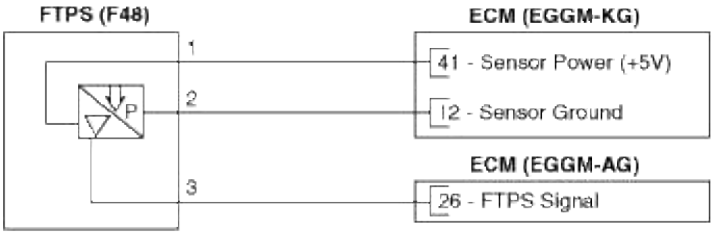


Fuel System > Engine Control System > Fuel Tank Pressure Sensor (FTPS) > Schematic Diagrams

Circuit Diagram

(M/T)

[Circuit Diagram]



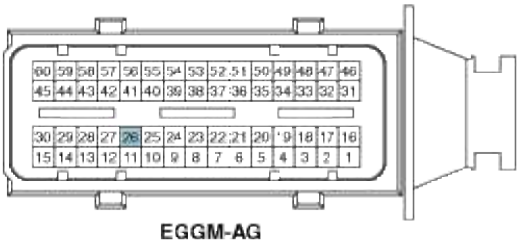
[Connection Information]

Terminal	Connected to	Function
1	ECM EGGM-KG (41)	Sensor Power (+5V)
2	ECM EGGM-KG (12)	Sensor Ground
3	ECM EGGM-AG (26)	FTPS Signal

[Harness Connector]

F48
FTPS

EGGM-KG



EGGM-AG
ECM

(A/T)

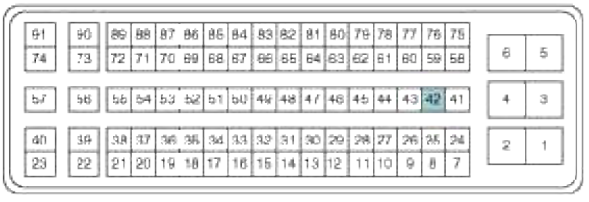
[Circuit Diagram]

[Connection Information]

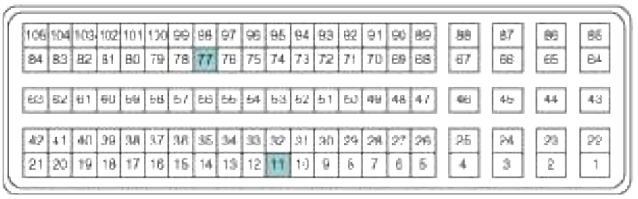
Terminal	Connected to	Function
1	ECM EGGA-AG (11)	Sensor Power (+5V)
2	ECM EGGA-KG (42)	Sensor Ground
3	ECM EGGA-AG (77)	FTPS Signal

[Harness Connector]

F48
FTPS



EGGA-KG



EGGA-AG
ECM

Fuel System > Engine Control System > Fuel Tank Pressure Sensor (FTPS) > Repair procedures

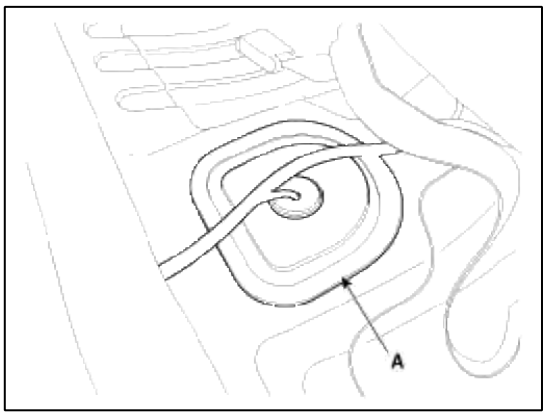
Inspection

1. Connect the GDS on the Data Link Connector (DLC).
2. Measure the output voltage of the FTPS.

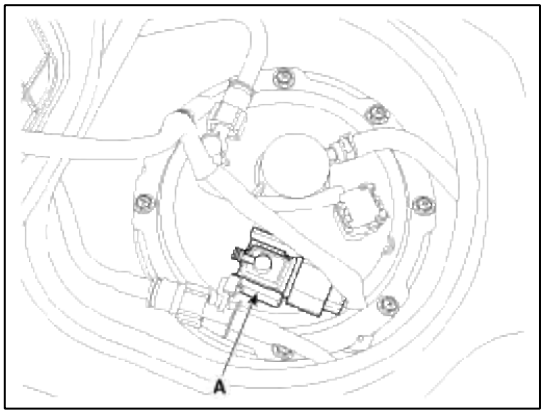
Specification: Refer to "Specification"

Removal

1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Remove the rear seat (Refer to "Seat" in BD group).
3. Remove the fuel pump service cover (A).



4. Disconnect the fuel tank pressure sensor connector.
5. Remove the fuel tank pressure sensor (A) after releasing the hooks vertically.



Installation

CAUTION

- Install the component with the specified torques.
- Note that internal damage may occur when the component is dropped. In this case, use it after inspecting.

CAUTION

- Insert the sensor in the installation hole and be careful not to damage when installation.

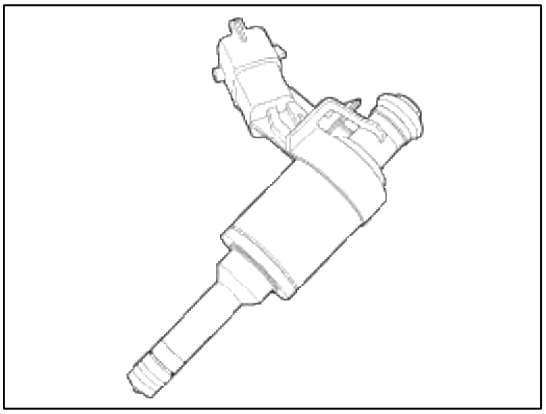
1. Installation is reverse of removal.

Fuel System > Engine Control System > Injector > Description and Operation

Description

Based on information from various sensors, the ECM can calculate the fuel amount to be injected. The fuel injector is a solenoid-operated valve and the fuel injection amount is controlled by length of injection time. The ECM controls each injector by grounding the control circuit. When the ECM energizes the injector by grounding the

control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the ECM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should momentarily peak, and then settle at system voltage.



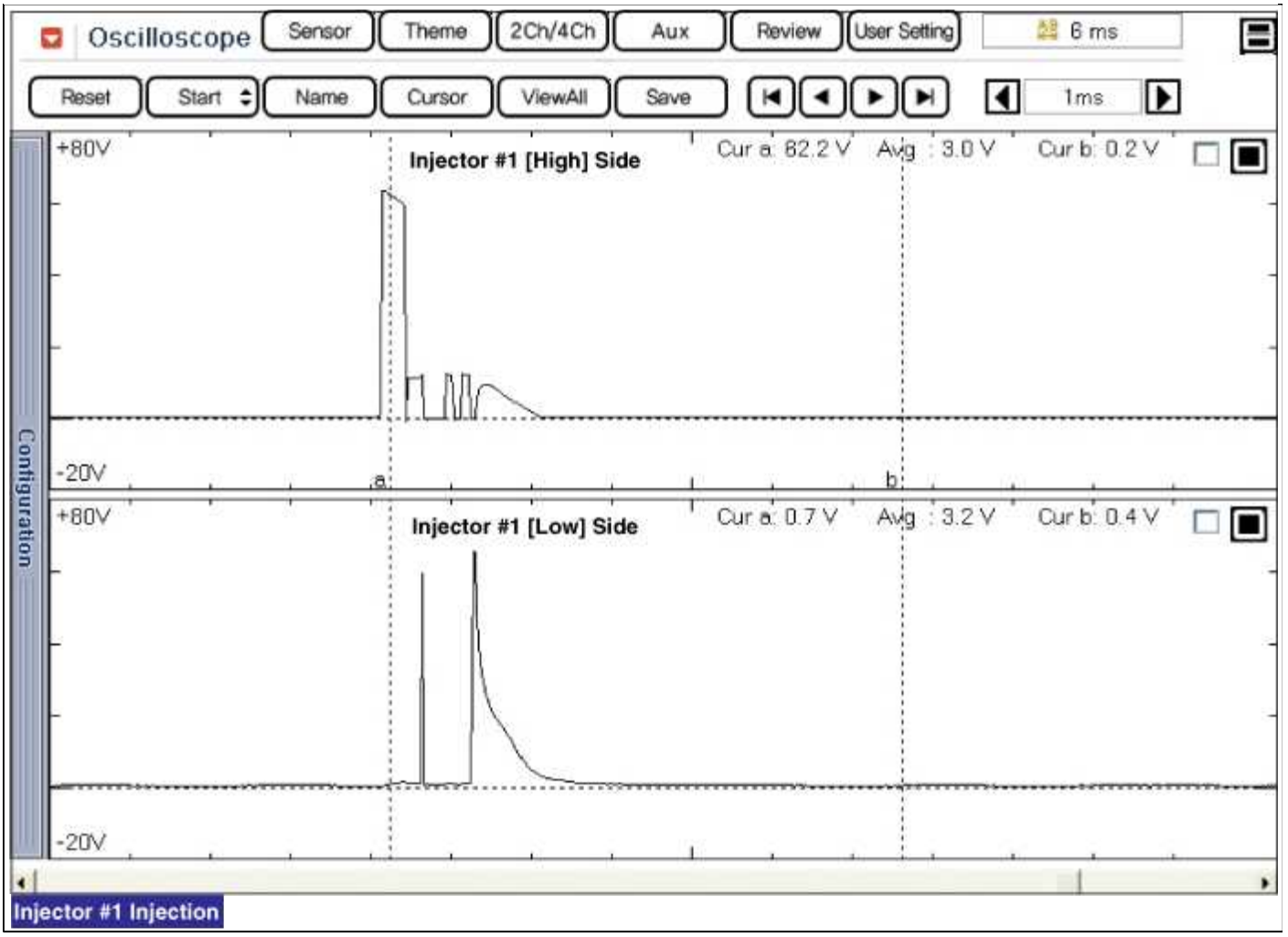
Fuel System > Engine Control System > Injector > Specifications

Specification

Item	Specification
Coil Resistance (Ω)	1.5 [20°C(68°F)]

Fuel System > Engine Control System > Injector > Troubleshooting

Signal Waveform

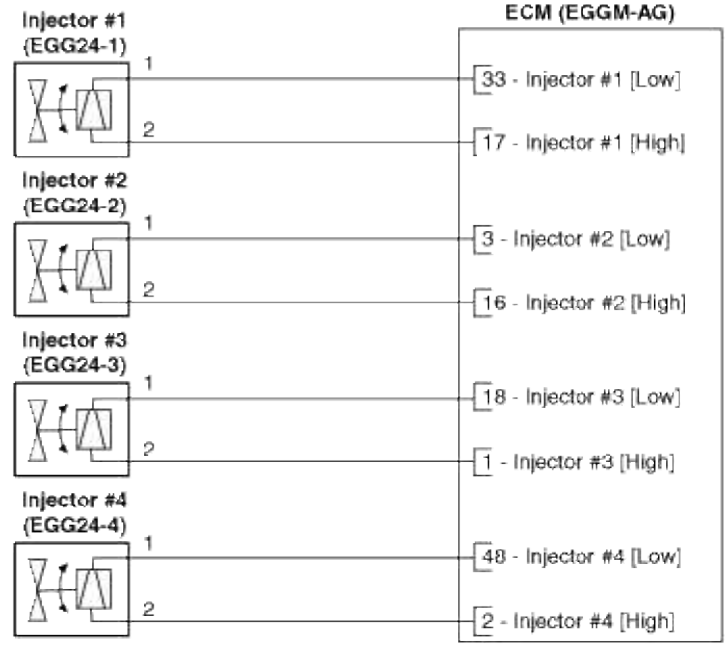


Fuel System > Engine Control System > Injector > Schematic Diagrams

Circuit Diagram

(M/T)

[Circuit Diagram]



[Connection Information]

Injector #1 (EGG24-1)

Terminal	Connected to	Function
1	ECM EGGM-AG (33)	Injector #1 [Low] Control
2	ECM EGGM-AG (17)	Injector #1 [High] Control

Injector #2 (EGG24-2)

Terminal	Connected to	Function
1	ECM EGGM-AG (3)	Injector #2 [Low] Control
2	ECM EGGM-AG (16)	Injector #2 [High] Control

Injector #3 (EGG24-3)

Terminal	Connected to	Function
1	ECM EGGM-AG (18)	Injector #3 [Low] Control
2	ECM EGGM-AG (1)	Injector #3 [High] Control

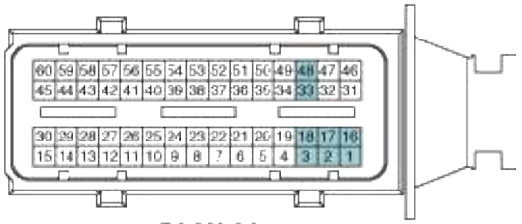
Injector #4 (EGG24-4)

Terminal	Connected to	Function
1	ECM EGGM-AG (48)	Injector #4 [Low] Control
2	ECM EGGM-AG (2)	Injector #4 [High] Control

[Harness Connector]

EGG24-1,2,3,4
Injector #1,2,3,4

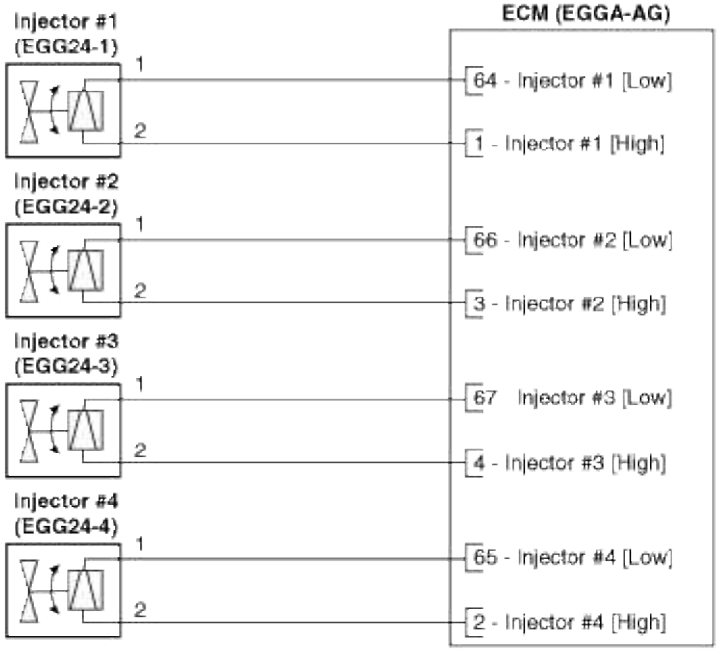
EGGM-KG



EGGM-AG
ECM

(A/T)

[Circuit Diagram]



[Connection Information]

Injector #1 (EGG24-1)

Terminal	Connected to	Function
1	ECM EGGA-AG (64)	Injector #1 [Low] Control
2	ECM EGGA-AG (1)	Injector #1 [High] Control

Injector #2 (EGG24-2)

Terminal	Connected to	Function
1	ECM EGGA-AG (66)	Injector #2 [Low] Control
2	ECM EGGA-AG (3)	Injector #2 [High] Control

Injector #3 (EGG24-3)

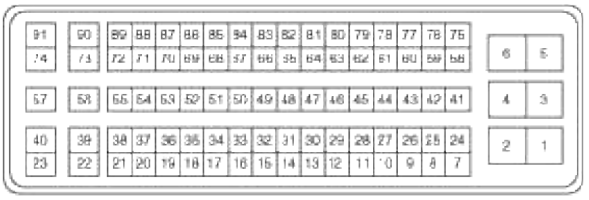
Terminal	Connected to	Function
1	ECM EGGA-AG (67)	Injector #3 [Low] Control
2	ECM EGGA-AG (4)	Injector #3 [High] Control

Injector #4 (EGG24-4)

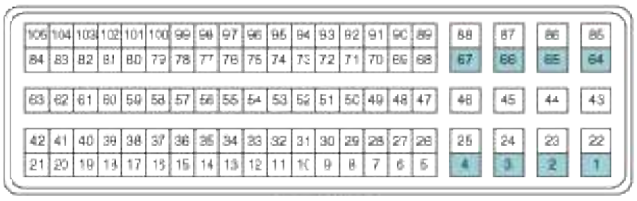
Terminal	Connected to	Function
1	ECM EGGA-AG (65)	Injector #4 [Low] Control
2	ECM EGGA-AG (2)	Injector #4 [High] Control

[Harness Connector]

EGG24-1,2,3,4
Injector #1,2,3,4



EGGA-KG



EGGA-AG
ECM

Fuel System > Engine Control System > Injector > Repair procedures

Inspection

1. Turn the ignition switch OFF.
2. Disconnect the injector connector.
3. Measure resistance between the injector terminals 1 and 2.
4. Check that the resistance is within the specification.

Specification: Refer to “Specification”

Removal

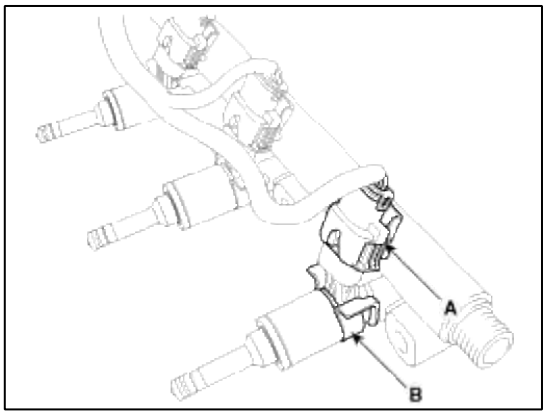
WARNING

In case of removing the high pressure fuel pump, high pressure fuel pipe, delivery pipe, and injector, there may be injury caused by leakage of the high pressure fuel. Before repairing the high pressure system, be sure to release the residual pressure in fuel line as step 2 in below procedure.

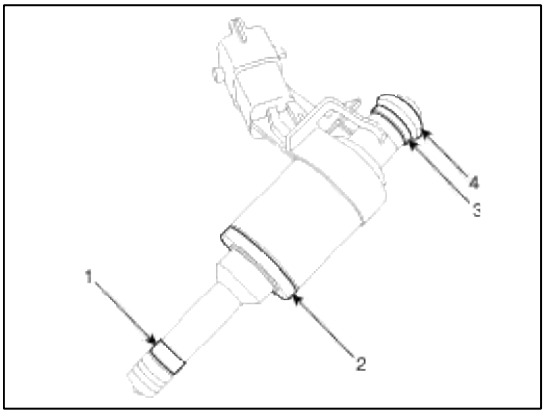
1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Release the residual pressure in fuel line (Refer to “Release Residual Pressure in Fuel Line” in this group).

> CAUTION
>
> When removing the fuel pump relay, a Diagnostic Trouble Code (DTC) may occur. Delete the code with the GDS after completion of “Release Residual Pressure in Fuel Line” work.

3. Remove the delivery pipe & injector assembly (Refer to "Delivery Pipe" in this group).
4. Remove the connector (A) and the fixing clip (B), and then separate the injector from the delivery pipe.



Installation



1. Combustion seal
2. Rubber washer
3. Support disc
4. O-ring

> CAUTION
>
> • Do not reuse the used injector fixing clip.

> CAUTION
>
> • Install the component with the specified torques.
> • Note that internal damage may occur when the component is dropped. If the component has been dropped, inspect before installing.

> CAUTION
>
> • Apply engine oil to the injector O-ring.
> • Do not reuse the used injector O-ring.

CAUTION

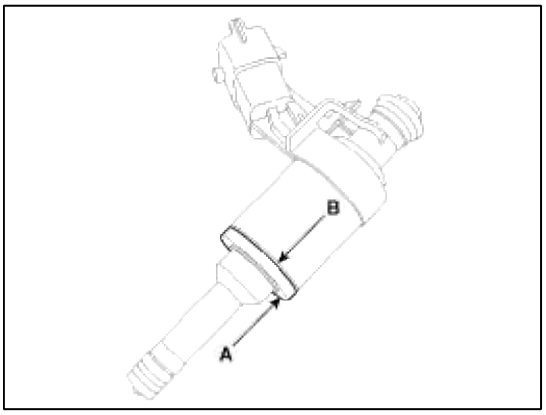
- Do not reuse the used bolt.

CAUTION

- When inserting the injector, be careful not to damage the injector tip.

CAUTION

- Do not reuse the support disc.
- Do not reuse the injector rubber washer.
- When replacing the rubber washer, the steal plate (A) part should be faced the cylinder installation part and the rubber plate (B) part should be faced the injector body part.



CAUTION

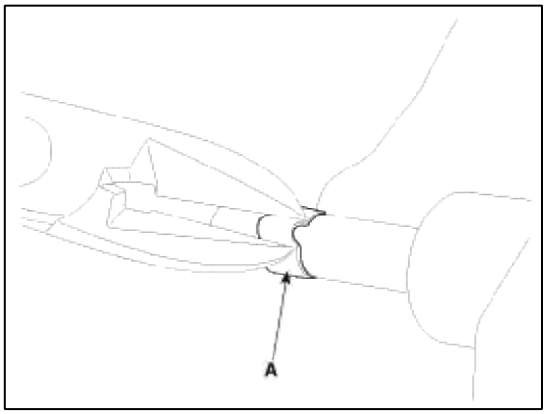
- Do not reuse the combustion seal.

1. Installation is reverse of removal.

Replacement

The injector combustion seal should be replaced new one to prevent leakage after removing the injector.

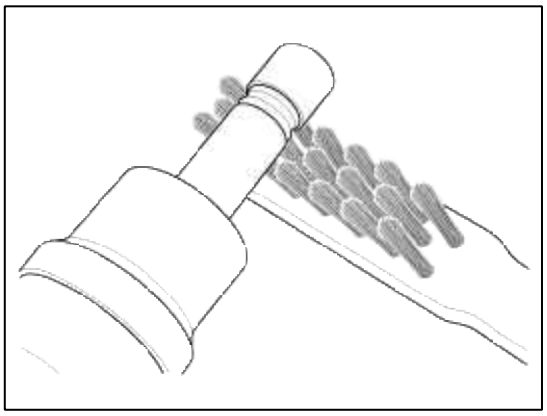
1. Remove the combustion seal (A) with a wire cutter.



CAUTION

Grip the sealing ring carefully, pull it to form a small loop and then cut it. Be careful not to damage the surface of the valve sleeve with the wire cutter.

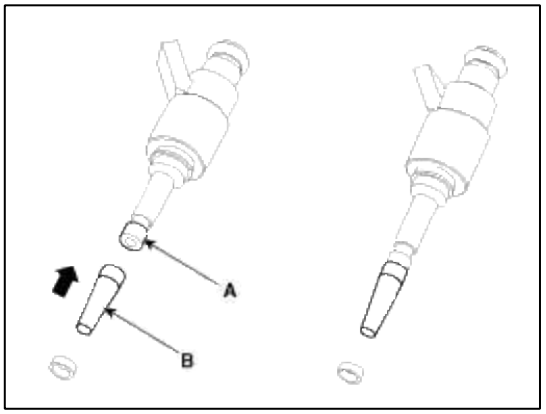
2. Before the assembly of the sealing ring the groove must be cleaned using a clean cloth.
   Any coking of the injector sealing surface must be carefully removed with a brass-wire brush.

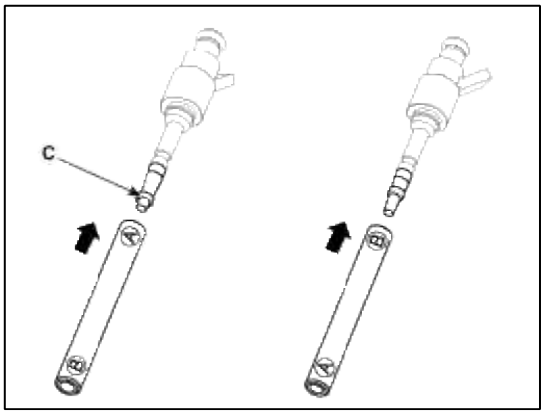


CAUTION

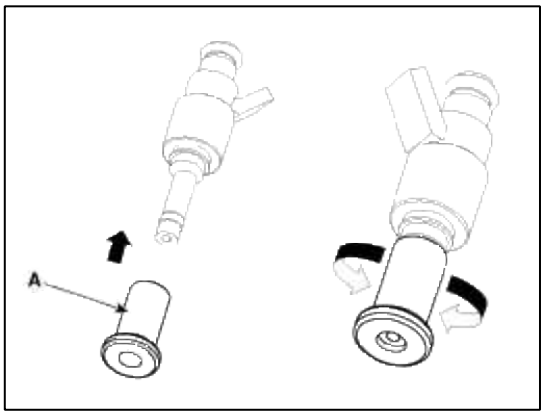
The surfaces of the new sealing ring must be clean and free of grease.

3. Place the seal installing guide (B) (SST No.: 09353-2B000) on the tip of the injector not to damage the injector tip (A).
   Push the sealing ring (C) with thumb and index finger over the conical assembly tool until it snaps into the groove.
   The complete assembly must not take longer than 2 to 3 seconds.





4. To size the sealing ring the injector is first introduced into the sizing tool (A) (SST No.: 09353-2B000) and then pressed and at the same time rotated 180° into the sizing tool.

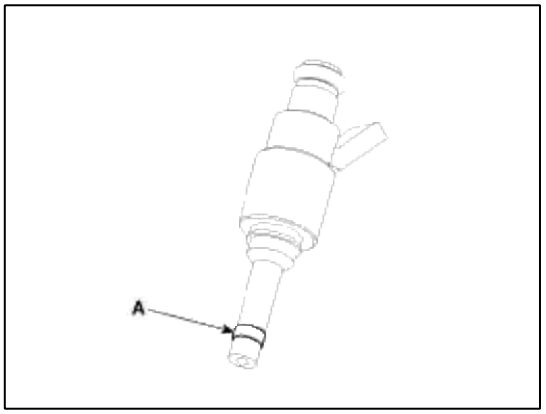


5. Pull the injector out of the sizing tool by turning it in the reverse direction to that used for the press-in process.

CAUTION

Check that the seal ring has not been damaged during assembly to the injector and that no circumferential scratches are present.
Do not reuse the combustion seal.
The seal must be completely free of grease and oil.

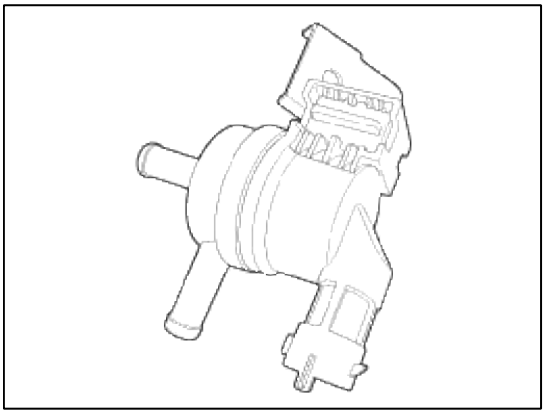
6. Check the combustion seal (A) installation.



Fuel System > Engine Control System > Purge Control Solenoid Valve (PCSV) > Description and Operation

Description

Purge Control Solenoid Valve (PCSV) is installed on the surge tank and controls the passage between the canister and the intake manifold. It is a solenoid valve and is open when the ECM grounds the valve control line. When the passage is open (PCSV ON), fuel vapor stored in the canister is transferred to the intake manifold.



Fuel System > Engine Control System > Purge Control Solenoid Valve (PCSV) > Specifications

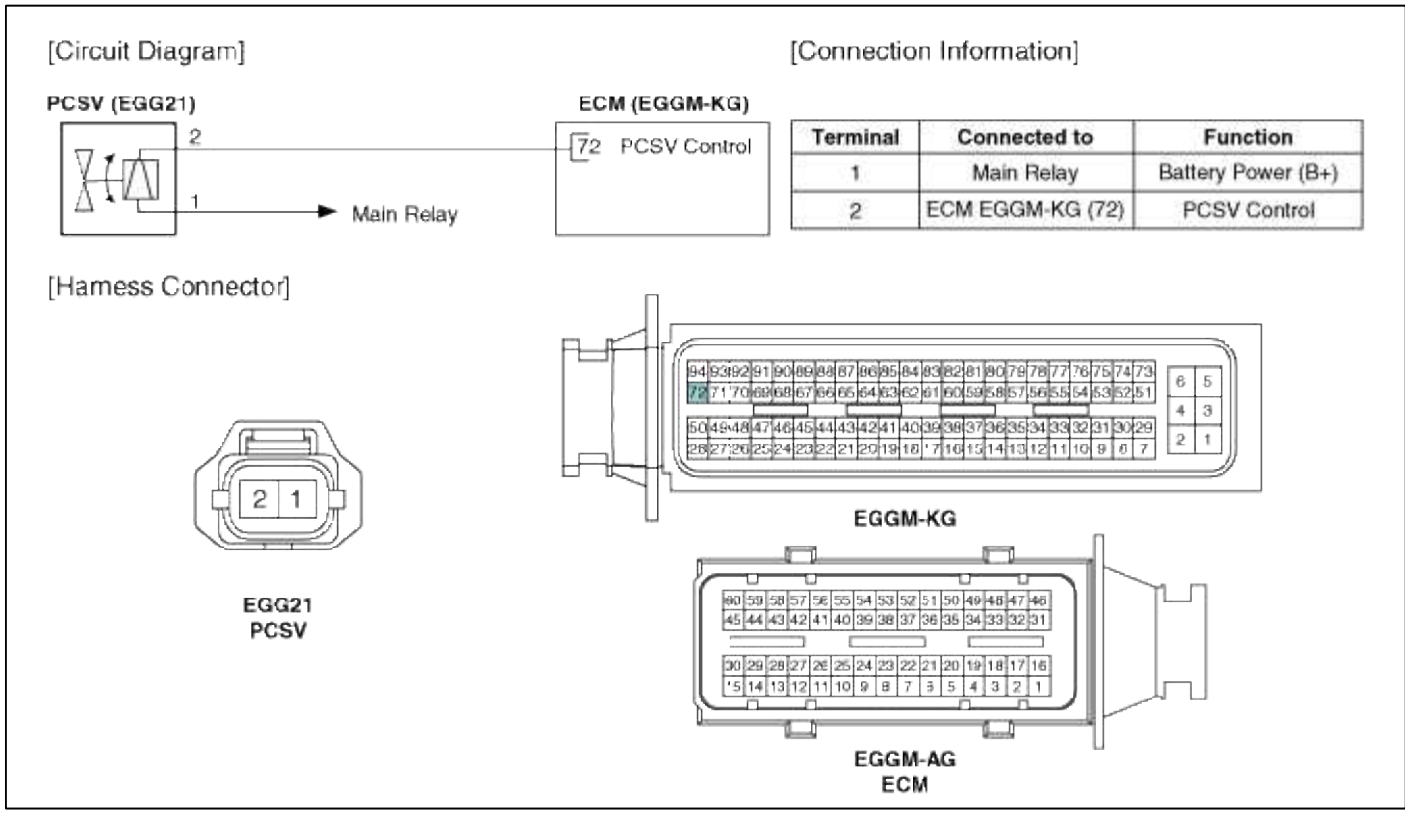
Specification

Item	Specification
Coil Resistance (Ω)	22.0 ~ 26.0 [20°C(68°F)]

Fuel System > Engine Control System > Purge Control Solenoid Valve (PCSV) > Schematic Diagrams

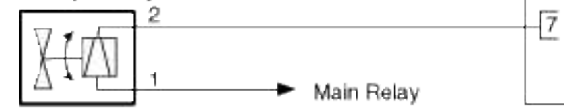
Circuit Diagram

(M/T)



(A/T)

[Circuit Diagram]

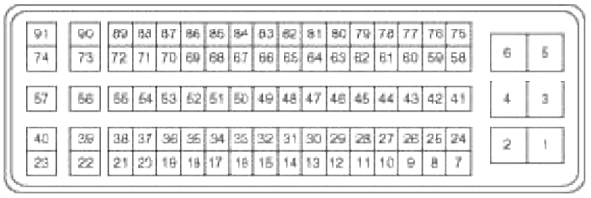


[Harness Connector]

EGG21
PCSV

[Connection Information]

Terminal	Connected to	Function
1	Main Relay	Battery Power (B+)
2	ECM EGGA-AG (7)	PCSV Control



EGGA-KG

EGGA-AG
ECM

Fuel System > Engine Control System > Purge Control Solenoid Valve (PCSV) > Repair procedures

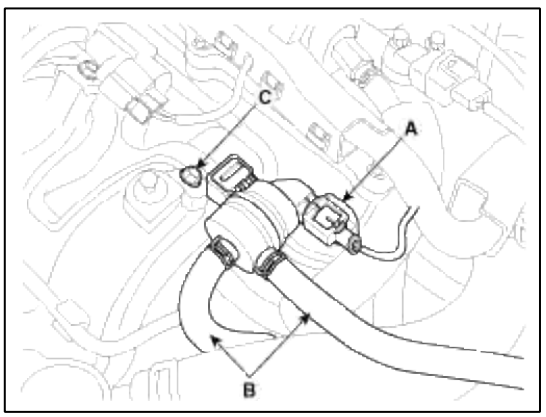
Inspection

1. Turn the ignition switch OFF.
2. Disconnect the PCSV connector.
3. Measure resistance between the PCSV terminals 1 and 2.
4. Check that the resistance is within the specification.

Specification: Refer to “Specification”

Removal

1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Disconnect the purge control solenoid valve connector (A).
3. Disconnect the vapor hoses (B) from the purge control solenoid valve.
4. Remove the valve after removing the bolt (C).



Installation

CAUTION

- Install the component with the specified torques.
- Note that internal damage may occur when the component is dropped. If the component has been dropped, inspect before installing.

CAUTION

- Use care to keep foreign material out of the valve.

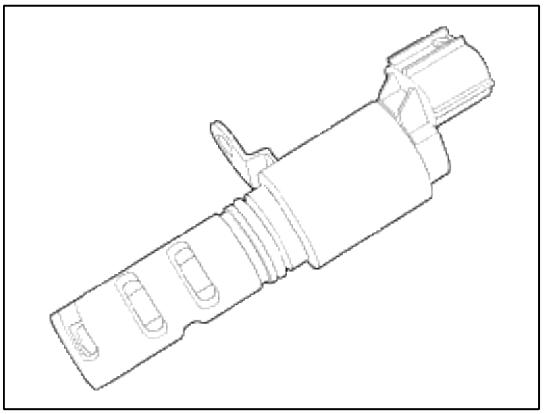
1. Installation is reverse of removal.

Purge control solenoid valve bracket installation bolt: 9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)

Fuel System > Engine Control System > CVVT Oil Control Valve (OCV) > Description and Operation

Description

Continuous Variable Valve Timing (CVVT) system advances or retards the valve timing of the intake and exhaust valve in accordance with the ECM control signal which is calculated by the engine speed and load.
By controlling CVVT, the valve over-lap or under-lap occurs, which makes better fuel economy and reduces exhaust gases (NOx, HC) and improves engine performance through reduction of pumping loss, internal EGR effect, improvement of combustion stability, improvement of volumetric efficiency, and increase of expansion work.
This system consist of
-the CVVT Oil Control Valve (OCV) which supplies the engine oil to the cam phaser or cuts the engine oil from the cam phaser in accordance with the ECM PWM (Pulse With Modulation) control signal,
- the CVVT Oil Temperature Sensor (OTS) which measures the engine oil temperature,
-and the Cam Phaser which varies the cam phase by using the hydraulic force of the engine oil.
The engine oil getting out of the CVVT oil control valve varies the cam phase in the direction (Intake Advance/Exhaust Retard) or opposite direction (Intake Retard/Exhaust Advance) of the engine rotation by rotating the rotor connected with the camshaft inside the cam phaser.



Fuel System > Engine Control System > CVVT Oil Control Valve (OCV) > Specifications

Specification

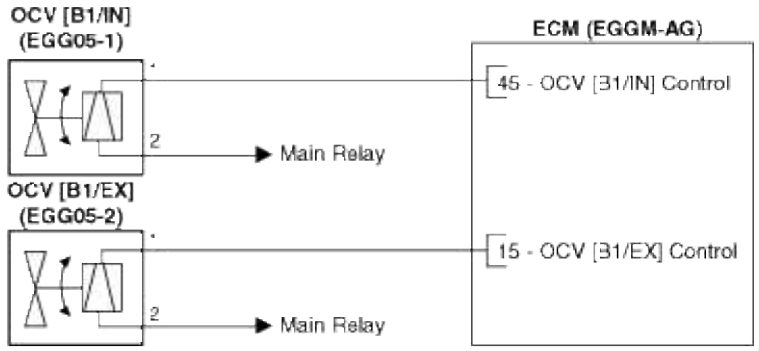
Item	Specification
Coil Resistance (Ω)	6.9 ~ 7.9 [20°C(68°F)]

Fuel System > Engine Control System > CVVT Oil Control Valve (OCV) > Schematic Diagrams

Circuit Diagram

(M/T)

[Circuit Diagram]



[Connection Information]

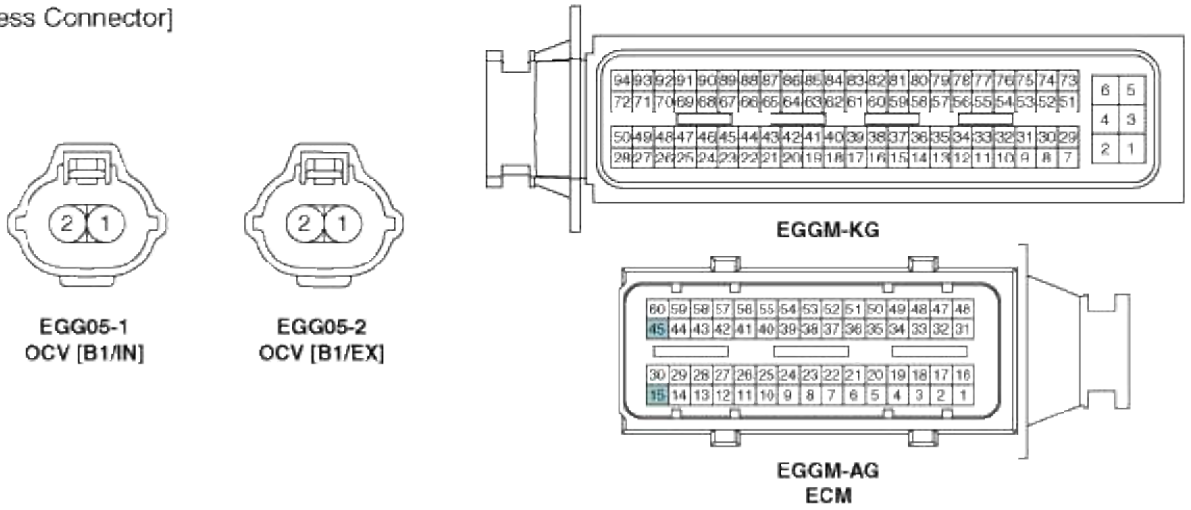
OCV [B1/IN] (EGG05-1)

Terminal	Connected to	Function
1	ECM EGGM-AG (45)	OCV [B1/IN] Control
2	Main Relay	Battery Power (B+)

OCV [B1/EX] (EGG05-2)

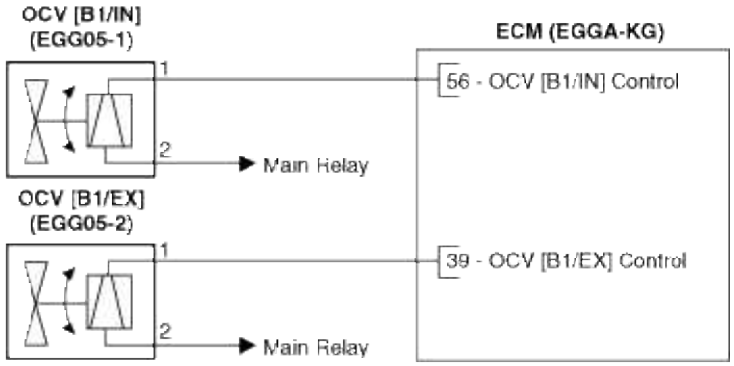
Terminal	Connected to	Function
1	ECM EGGM-AG (15)	OCV [B1/EX] Control
2	Main Relay	Battery Power (B+)

[Harness Connector]



(A/T)

[Circuit Diagram]



[Connection Information]

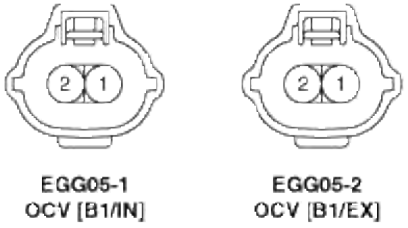
OCV [B1/IN] (EGG05-1)

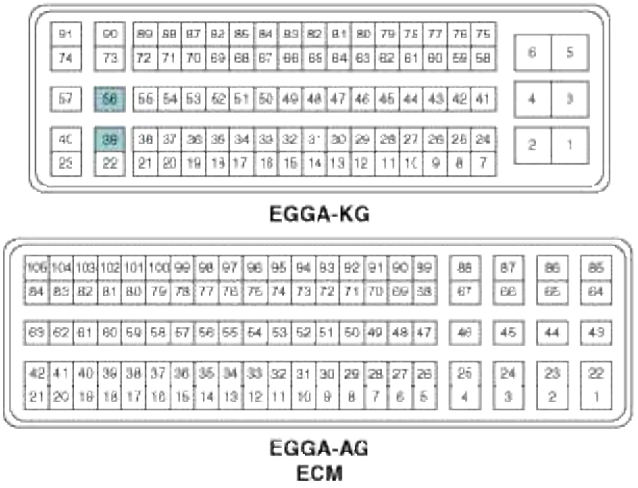
Terminal	Connected to	Function
1	ECM EGGA-KG (56)	OCV [B1/IN] Control
2	Main Relay	Battery Power (B+)

OCV [B1/EX] (EGG05-2)

Terminal	Connected to	Function
1	ECM EGGA-KG (39)	OCV [B1/EX] Control
2	Main Relay	Battery Power (B+)

[Harness Connector]





Fuel System > Engine Control System > CVVT Oil Control Valve (OCV) > Repair procedures

Inspection

1. Turn the ignition switch OFF.
2. Disconnect the OCV connector.
3. Measure resistance between the OCV terminals 1 and 2.
4. Check that the resistance is within the specification.

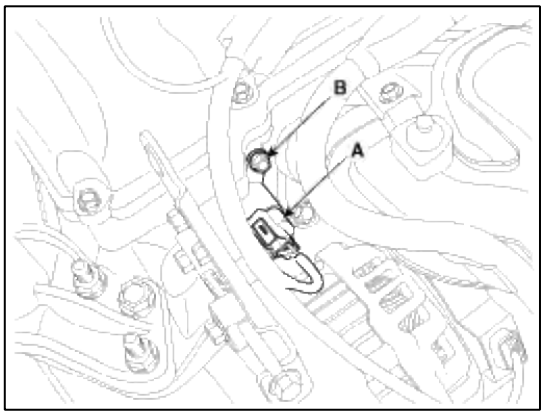
Specification: Refer to “Specification”

Removal

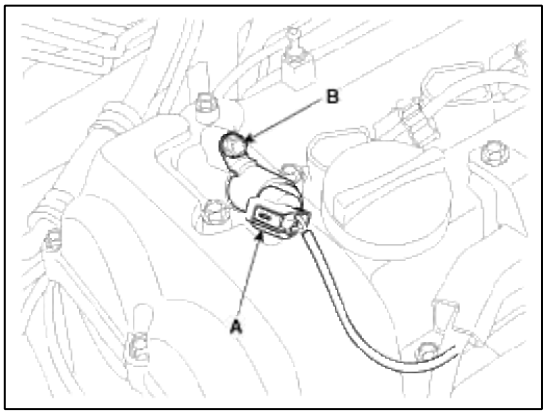
1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Disconnect the CVVT oil control valve connector (A).

3. Remove the installation bolt (B), and then remove the valve from the engine.

[Bank 1 / Intake]



[Bank 1 / Exhaust]



Installation

CAUTION

- Install the component with the specified torques.
- Note that internal damage may occur when the component is dropped. If the component has been dropped, inspect before installing.

CAUTION

- Apply engine oil to the valve O-ring.

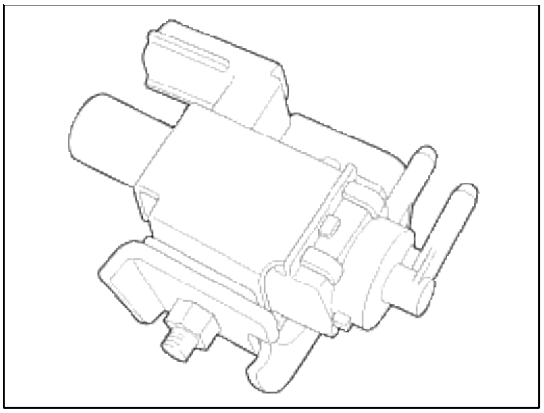
1. Installation is reverse of removal.

CVVT oil control valve installation bolt:
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)

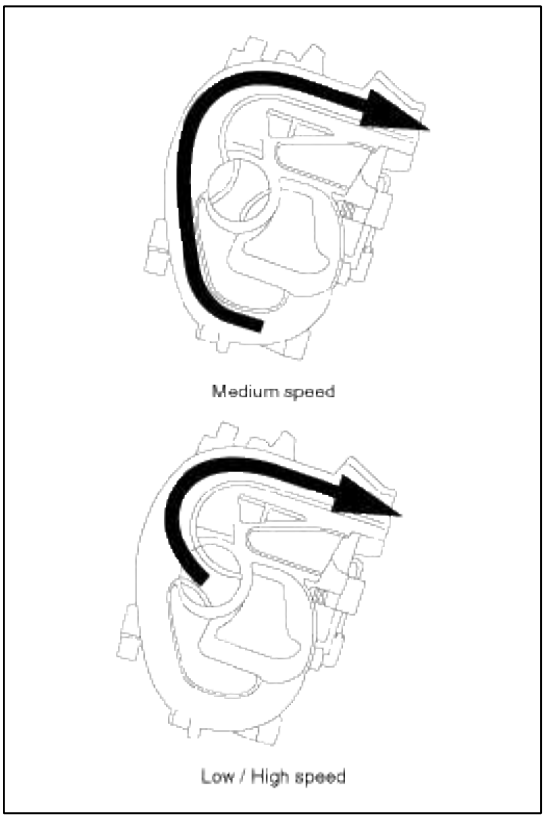
Fuel System > Engine Control System > Variable Intake Solenoid (VIS) Valve > Description and Operation

Description

Variable Intake manifold Solenoid (VIS) valve is installed on the intake manifold. The VIS valve controls the vacuum modulator which activates a valve in the intake manifold. The ECM opens or closes this valve according to engine condition (Refer to below table).



Engine condition	VIS valve	Operation
Medium speed	Closed	Increasing engine performance in low engine speed by reducing intake interference among cylinders
Low / High speed	Open	Minimizing intake resistance by shortening intake manifold length and increasing area of air entrance



Fuel System > Engine Control System > Variable Intake Solenoid (VIS) Valve > Specifications

Specification

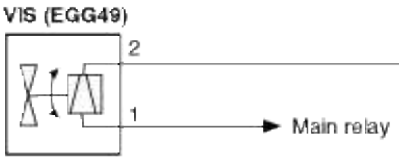
Item	Specification
Coil resistance (Ω)	30.0 ~ 35.0 [20°C(68°F)]

Fuel System > Engine Control System > Variable Intake Solenoid (VIS) Valve > Schematic Diagrams

Circuit Diagram

(M/T)

[Circuit Diagram]



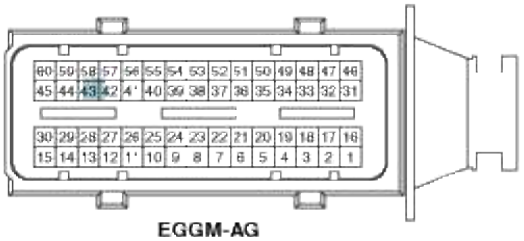
[Connection Information]

Terminal	Connected to	Function
1	Main relay	Power supply (B+)
2	ECM EGGM-AG (60)	VIS valve control

[Harness Connector]

EGG49
VIS Valve

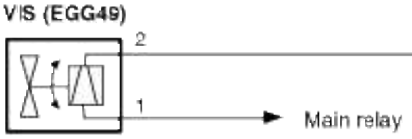
EGGM-KG



EGGM-AG
ECM

(A/T)

[Circuit Diagram]

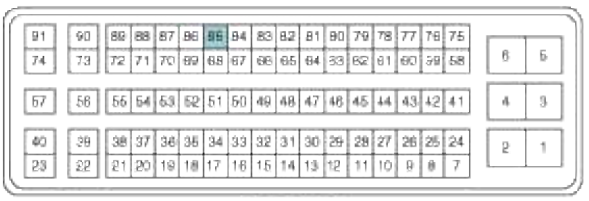


[Connection Information]

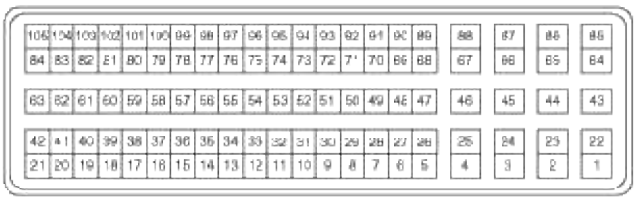
Terminal	Connected to	Function
1	Main relay	Power supply (B+)
2	ECM EGGA-KG (85)	VIS valve control

[Harness Connector]

EGG49
VIS Valve



EGGA-KG



EGGA-AG
ECM

Fuel System > Engine Control System > Variable Intake Solenoid (VIS) Valve > Repair procedures

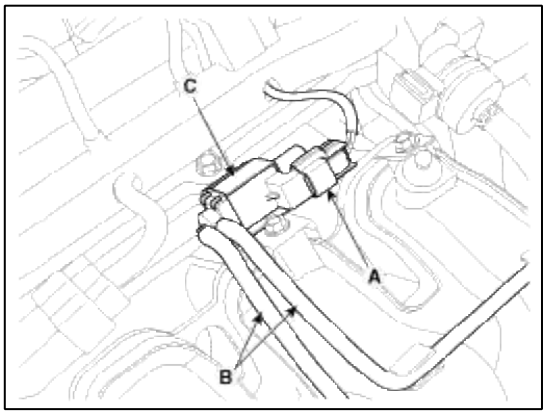
Inspection

1. Turn the ignition switch OFF.
2. Disconnect the VIS valve connector.
3. Measure resistance between VIS valve terminals 1 and 2.

Specification: Refer to "Specification"

Removal

1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Disconnect the variable intake solenoid valve connector (A).
3. Disconnect the vacuum hoses (B) from the valve.
4. Remove the installation bolt, and then remove the valve (C) from the surge tank.



Installation

CAUTION

- Install the component with the specified torques.
- Note that internal damage may occur when the component is dropped. If the component has been dropped, inspect before installing.

CAUTION

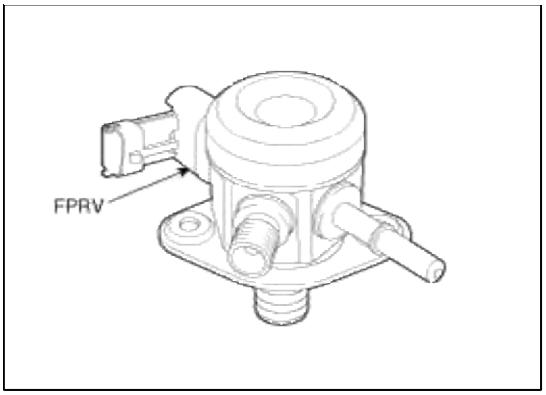
- Use care to keep foreign material out of the valve.

1. Installation is reverse of removal.

Fuel System > Engine Control System > Fuel Pressure Control Valve > Description and Operation

Description

Fuel Pressure Regulator Valve is installed on the high pressure fuel pump and controls fuel flow flowing into the injectors in accordance with the ECM signal calculated based on various engine condition.



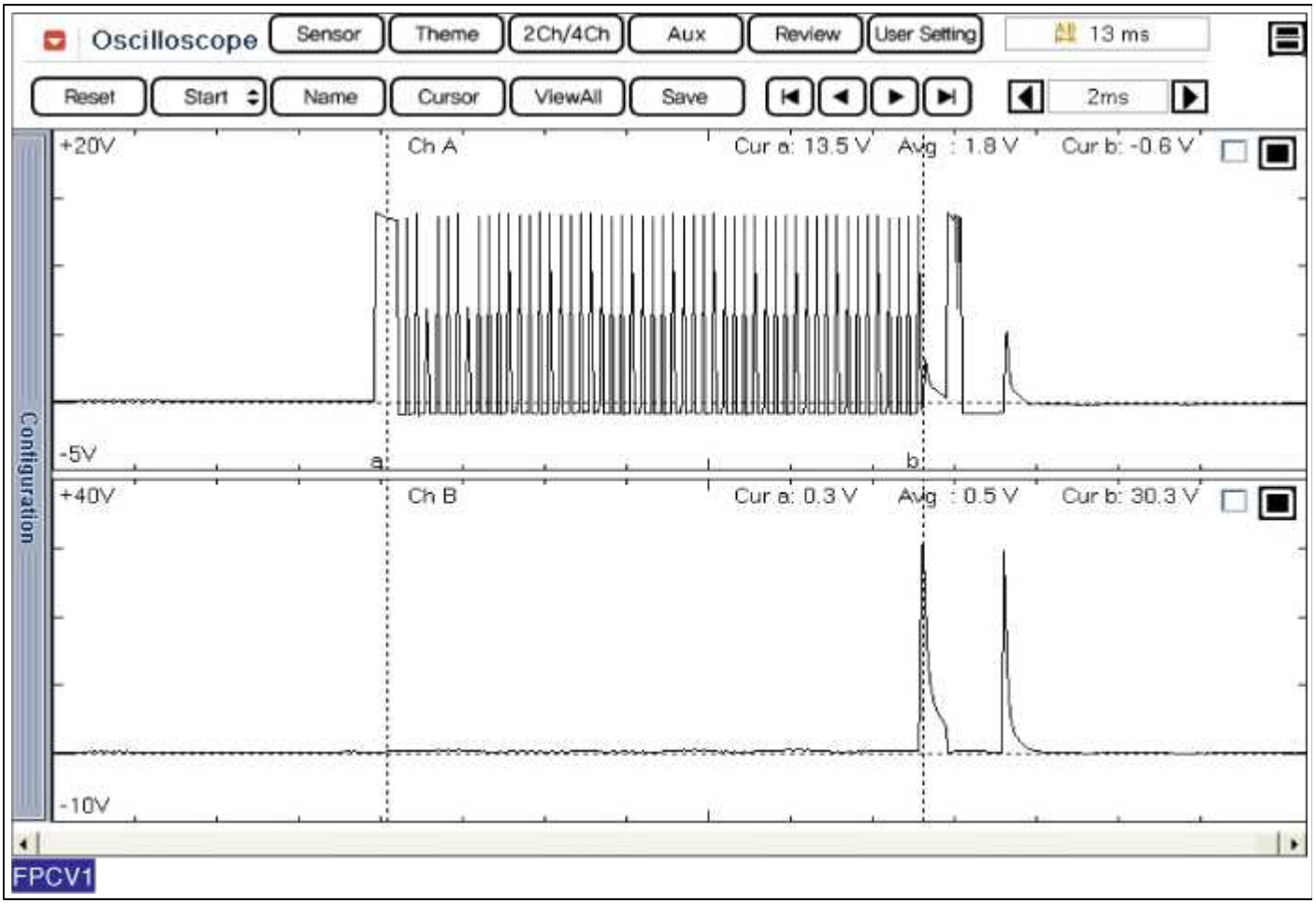
Fuel System > Engine Control System > Fuel Pressure Control Valve > Specifications

Specification

Item	Specification
Coil Resistance (Ω)	0.5 [20°C(68°F)

Fuel System > Engine Control System > Fuel Pressure Control Valve > Troubleshooting

Signal Waveform



Fuel System > Engine Control System > Fuel Pressure Control Valve > Schematic Diagrams

Circuit Diagram

(M/T)

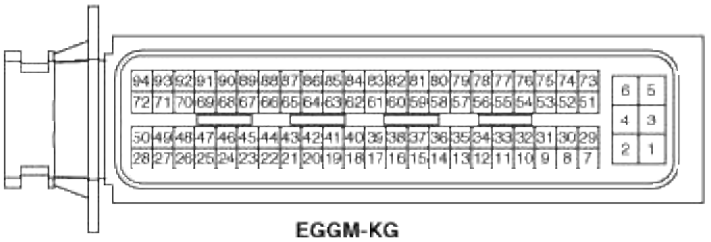
[Circuit Diagram]

[Connection Information]

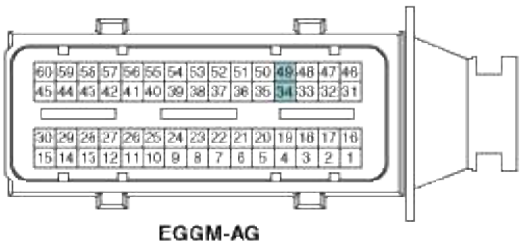
Terminal	Connected to	Function
1	ECM EGGM-AG (49)	FPRV [Low]
2	ECM EGGM-AG (34)	FPRV [High]

[Harness Connector]

EGG10
FPRV



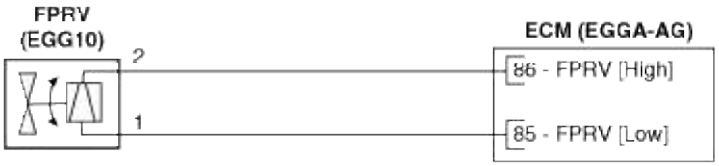
EGGM-KG



EGGM-AG
ECM

(A/T)

[Circuit Diagram]

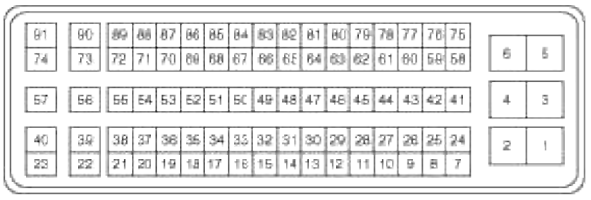


[Connection Information]

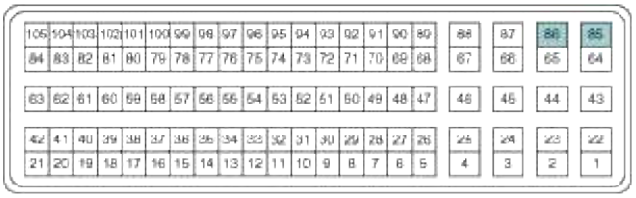
Terminal	Connected to	Function
1	ECM EGGA-AG (85)	FPRV [Low]
2	ECM EGGA-AG (86)	FPRV [High]

[Harness Connector]

EGG10
FPRV



EGGA-KG



EGGA-AG
ECM

Fuel System > Engine Control System > Fuel Pressure Control Valve > Repair procedures

Inspection

1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.

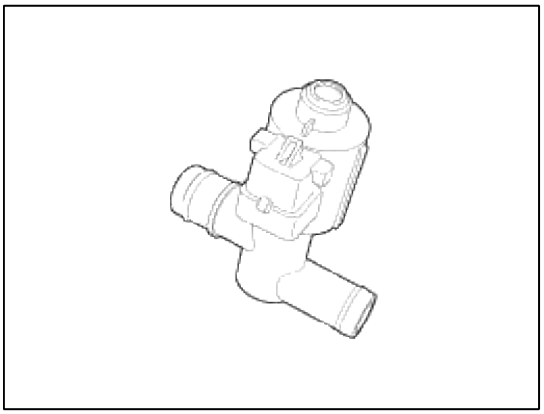
2. Disconnect the fuel pressure regulator valve connector.
3. Measure resistance between the fuel pressure regulator valve terminals 1 and 2.
4. Check that the resistance is within the specification.

Specification: Refer to “Specification”

Fuel System > Engine Control System > Canister Close Valve (CCV) > Description and Operation

Description

Canister Close Valve (CCV) is normally open and is installed on the canister ventilation line. It seals evaporative emission control system by shutting the canister from the atmosphere during EVAP leak detection process.



Fuel System > Engine Control System > Canister Close Valve (CCV) > Specifications

Specification

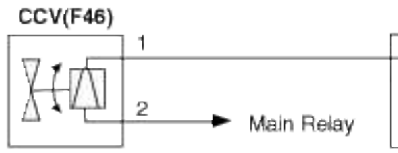
Item	Specification
Coil Resistance (Ω)	19.8 ~ 20.8 [20°C(68°F)

Fuel System > Engine Control System > Canister Close Valve (CCV) > Schematic Diagrams

Circuit Diagram

(M/T)

[Circuit Diagram]

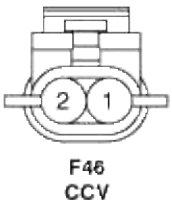


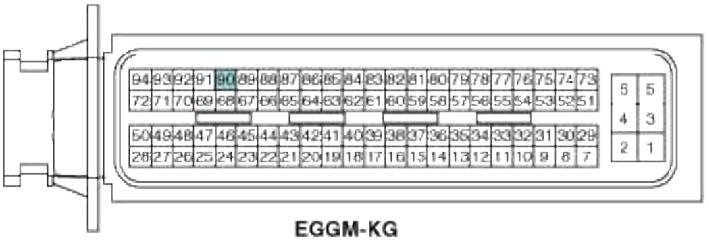
• [ ] : With immobilizer

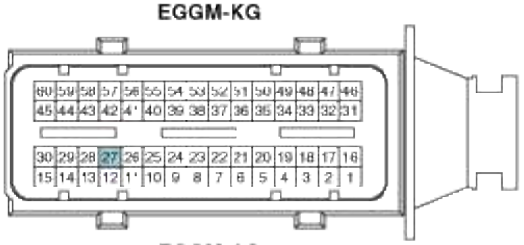
[Connection Information]

Terminal	Connected to	Function
1	ECM EGGM-AG(27) [KG(90)]	CCV Control
2	Main Relay	Battery Power (B+)

[Harness Connector]

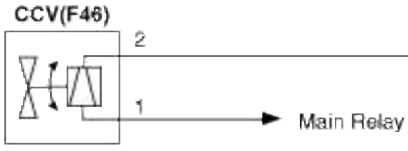






(A/T)

[Circuit Diagram]

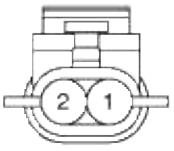


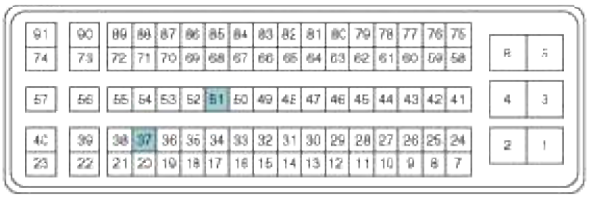
• [ ] : With immobilizer

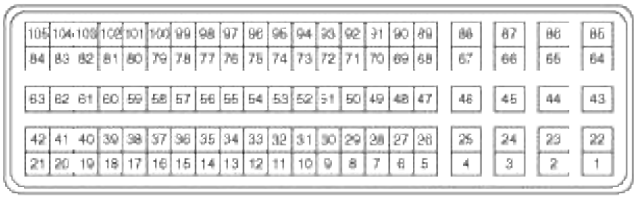
[Connection Information]

Terminal	Connected to	Function
1	Main Relay	Battery Power (B+)
2	ECM EGGA-KG (37) [51]	CCV Control

[Harness Connector]







Fuel System > Engine Control System > Canister Close Valve (CCV) > Repair procedures

Inspection

1. Turn the ignition switch OFF.
2. Disconnect the CCV connector.
3. Measure resistance between the CCV terminal 1 and 2.

4. Check that the resistance is within the specification.

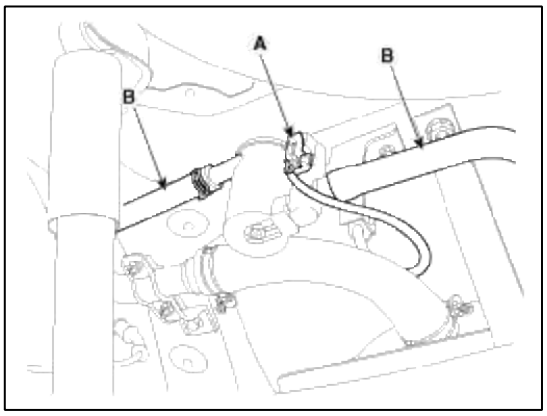
Specification: Refer to "Specification"

5. Disconnect the vapor hose connected with the canister from the CCV.
6. Connect a vacuum pump to the nipple.
7. Ground the CCV control line and apply battery voltage to the CCV power supply line.
8. Apply vacuum and check the valve operation.

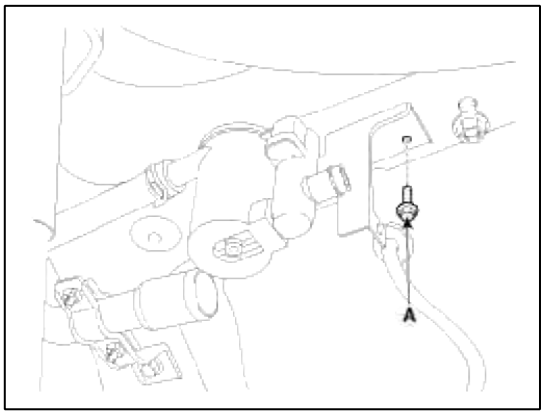
Specification: Vacuum maintained

Removal

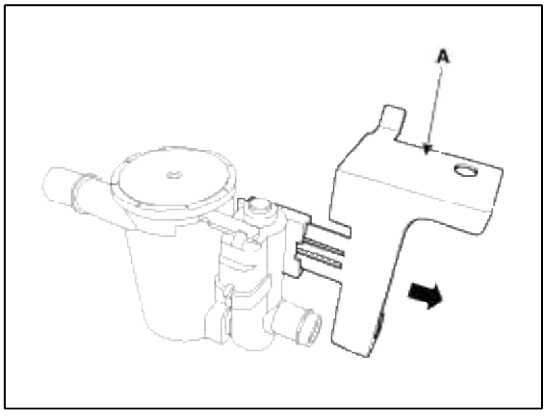
1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Lift the vehicle.
3. Disconnect the canister close valve connector (A).
4. Disconnect the ventilation hose (B) from the fuel tank air filter and canister close valve.



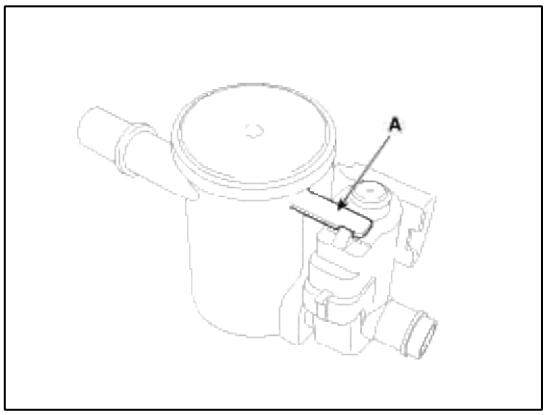
5. Remove the fuel tank air filter assembly after removing a bolt (A).

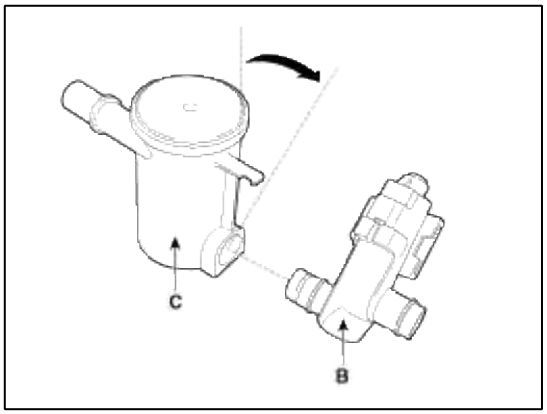


6. Remove the bracket (A) after pulling it.



7. 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.

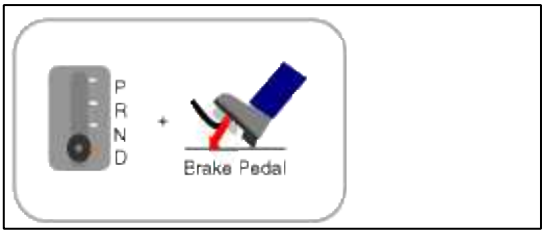
1. Installation is reverse of removal.

Fuel System > ISG (Idle Stop & Go) System > Description and Operation

Description

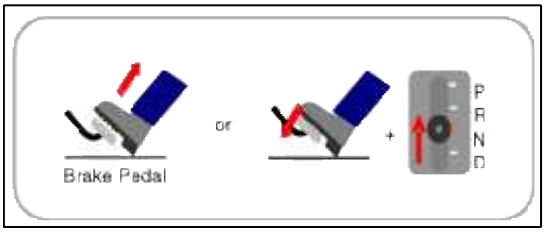
Idle Stop & Go (ISG) function automatically switches off the engine when the car is at a standstill if the and starts it again as soon as the brake pedal is released. This not only reduces fuel consumption, it also lowers emissions. Idle Stop & Go (ISG) function also has a built-in sensitivity to driving safety and comfort.
The engine is not switched off if certain conditions relating to safety and comfort have not been fulfilled (For example, when the engine oil is still cold, when the battery is running low or when the outside temperature is below 3°C). It can be deactivated by pressing the ISG OFF switch on the crash pad lower panel.
Sample scenario: switching off the engine at a standstill at a red traffic light or in stop-and-go traffic.
How to use:

1. Engine Auto-Stop: D-range + brake pedal is pressed.

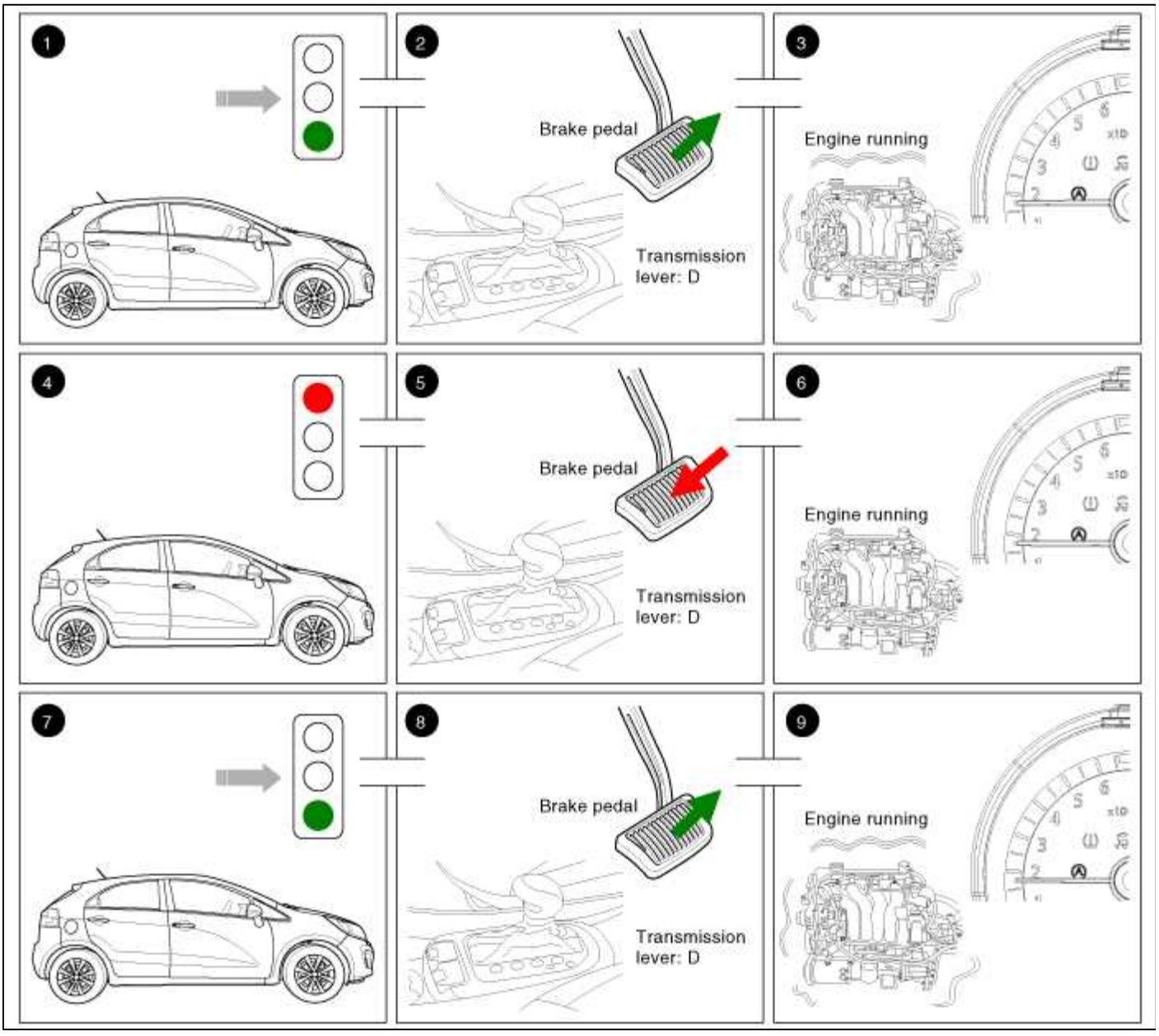


2. Engine Auto-Start:

- Brake pedal is released.
- N-range + brake pedal is pressed.



Operation



1. Vehicle moving.
2. The transmission lever position is D-range. The brake pedal is released.
3. The engine is running. (Vehicle moving).
4. The driver brakes until the vehicle comes to a standstill.
5. The transmission lever position is D-range. The brake pedal is pressed
6. The engine stops. The symbol "AUTO STOP" lights up in the instrument cluster.
7. The driver wants to continue the journey.

8. The transmission lever position is D-range. The brake pedal is released.
9. The engine is running again. The symbol goes out.

Operation Condition for the ISG function

1. Auto stop or Auto start condition (If all of the below condition are satisfied)

Items		State	Remark
Driving conditions	ISG OFF Switch	off	
	Switch (seat/door/hood)	Closed	
	Lever position	D or N range	Prohibit operation on gear ‘P, R’
	Brake pedal	Pressed	Auto Stop
		Released	Auto Start
	Vehicle speed	Vehicle speed = 0 Mph	After driving higher than 8kph (5 Mph)
	Air conditioning system	Ambient temperature is between -2 ~ 35 °C (28.4 ~ 95 °F)	
	Engine Coolant Temperature (ECT)	Over 78 °C (172.4 °F)	
	Brake Pressure	Below -35kpa	
Battery conditions	SOC	Over 77%	To protect Battery
	Temperature	2 ~ 55 °C (35.6 ~ 131 °F)	
Steering wheel	Operating angle	Below 180°	
Parking condition	Slope	Up hill <12%, Down hill < 8%	
ISG related part error		Sensor Error	Brake Booster Pressure Sensor
			Brake Master Cylinder Pressure
			Sensor, Brake Pedal Sensor,
			APS, Battery Sensor
		Related System Error	TM Electronic Auxiliary Pump
			ESC System Defect Mode
			CAN Communication Error
			Engine Limp Home Mode

2. Forced re-start conditions (If any of the below condition is not satisfied)

Component	Conditions	State	Remark
Conditions for safety	Low pressure for braking system	Over -35kpa	
	Low battery voltage	Below 12.1V for 180 sec	
	Active defroster of front glass	On	
	When inertial speed reach 1Mph with (down hill)	Over 1Mph (Kph)	Inertial Speed
	Open the door or unfasten driver's seat belt	Open	Brake Pedal Pressed
	Elapsed much of stop time		
	On the steep slope way		
Conditions for convenience	Turn on the air-conditioner or max blower speed or bad performance of air conditioning and heating		
	Active 'ISG OFF' button		
Sign of forced auto re-start	Blinking of lamp for 5 second and indicating on cluster		

3. Restriction conditions for Auto-Stop operation

To protect system and safety auto-stop system is restricted below the conditions

Large steering angle when car is stop
Low brake operating pressure
Turn on the air conditioner with max blower
When battery Condition is poor (low SOC)
Active defroster of front or rear glass
Unfasten driver's seat belt or open the door and hood
On the steep slope way
With ISG system errors, and other diagnosis

4. Restriction condition for auto Re-Start operation

Open hood (have to restart by key for repairman's safety)

5. Restriction condition for OBD Check & Emission control

Auto Stop system will be limited	During Canister purge monitoring
	During OBD check
To restrict continuous Cranking (for Emission Control)	Start Motor can operate for two seconds at the longest (just once)

CAUTION

The ISG system is strongly networked with the power management. In the event of battery replacement, disconnection of the battery terminal or after changing the engine management system, the reference data regarding the battery charge state and battery condition can be lost.
They are only available again a closed-circuit current measurement of approximate 4 hours in which the vehicle may not be wakened. In this time, the ISG system is inactive.

CAUTION

ISG system deactivation by fault.
- Fault in communication line (LIN/CAN)
  Fault Electric oil pump
  Fault ESC System
  Fault Limp home mode
- Fault brake booster vacuum pressure sensor
  Fault Brake master cylinder pressure sensor
  Fault Brake pedal switch
  Fault Battery sensor

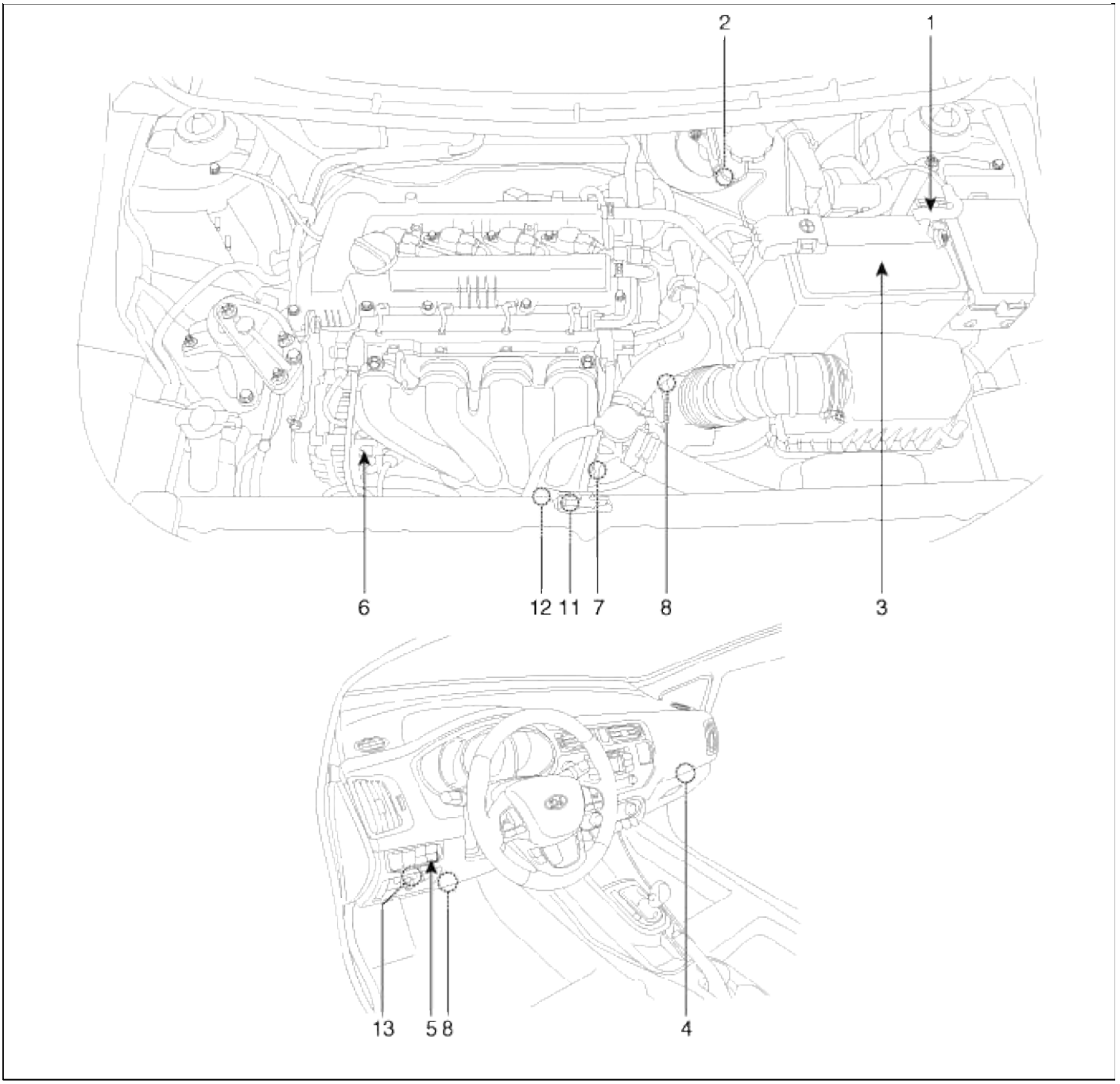
When the ISG related sensors or system error occurs, the ISG OFF switch lights up. Especially when the battery sensor is replaced or reinstalled, the vehicle must be placed in the ignition switch OFF for about 4 hours for recalibration.
The ISG function is operated about 4 hours later normally. But in the case of first 25 times, the ISG function can be operated regardless of recalibration.

WARNING

When the engine is in Idle stop mode, it's possible to restart the engine without the driver taking any action. Before leaving the car or doing anything in the engine room area, stop the engine by turning the ignition key to the LOCK position or removing it.

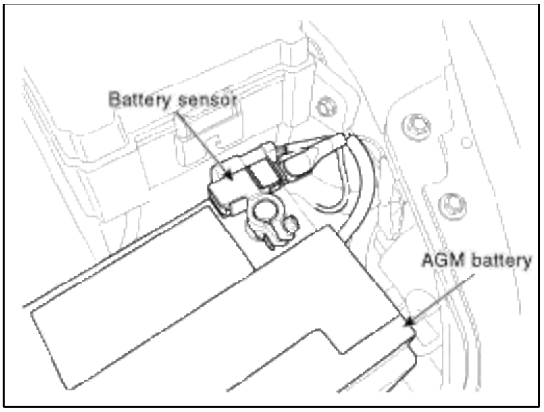
Fuel System > ISG (Idle Stop & Go) System > Components and Components Location

Components Location

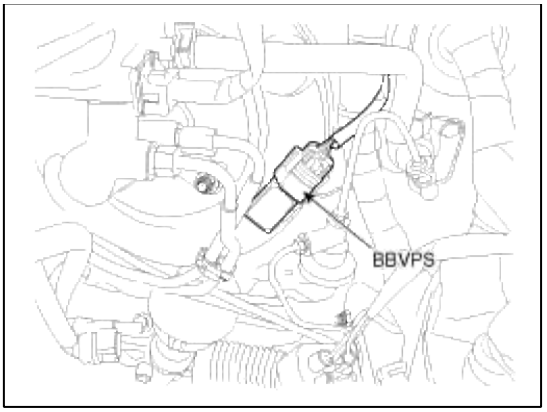


1. Battery sensor 2. Brake Booster Vacuum Pressure Sensor (BBVPS) 3. AGM battery 4. DC/ DC Converter (LDC) 5. ISG OFF Switch 6. Alternator 7. Starter	8. Brake switch 9. Door switch 10. Seat belt switch 11. Hood switch 12. Electric Oil Pump (EOP) 13. Oil Pump Unit (OPU)

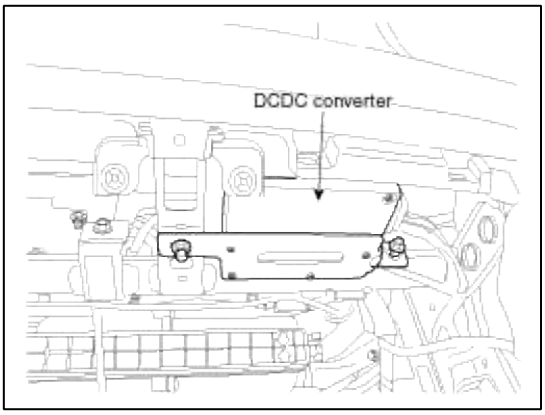
1. Battery sensor 3. AGM battery	2. Brake Booster Vacuum Pressure Sensor (BBVPS)



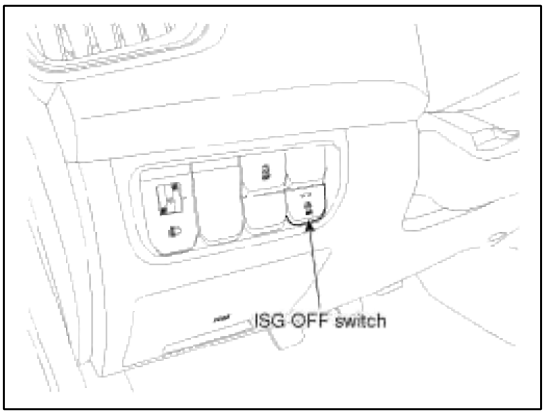
4. DC/ DC Converter (LDC)



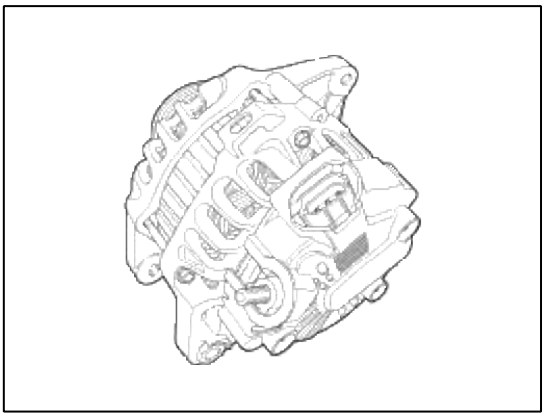
5. ISG OFF Switch



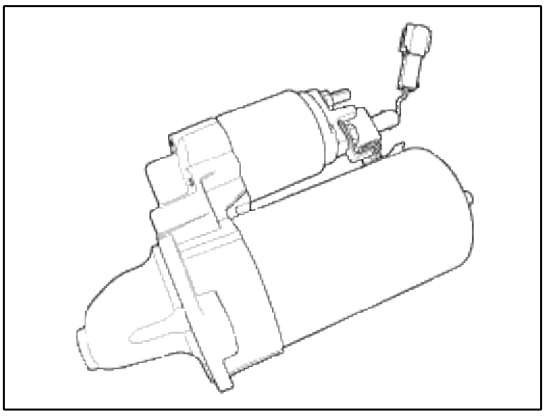
6. Alternator



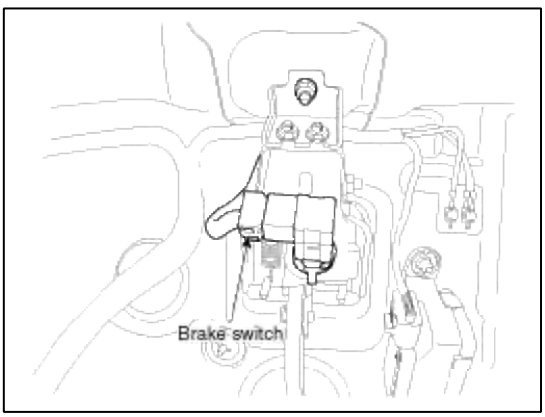
7. Starter



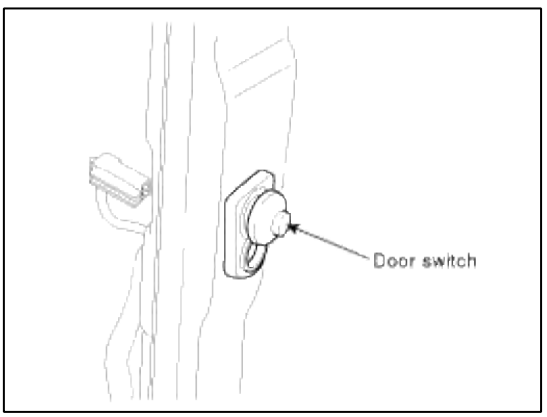
8. Brake switch



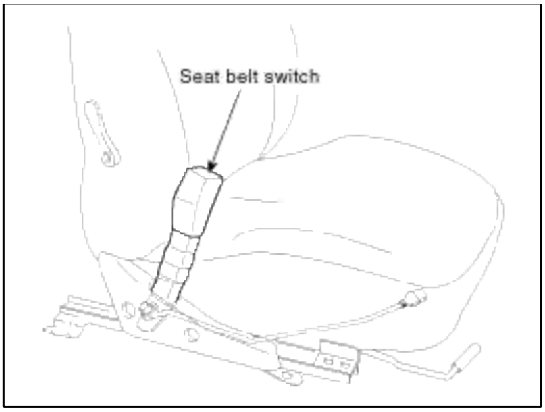
9. Door switch

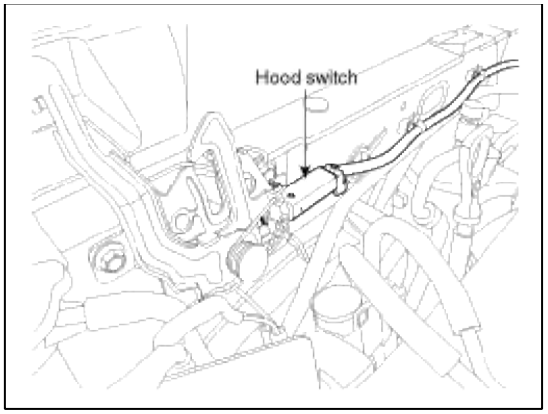


10. Seat belt switch



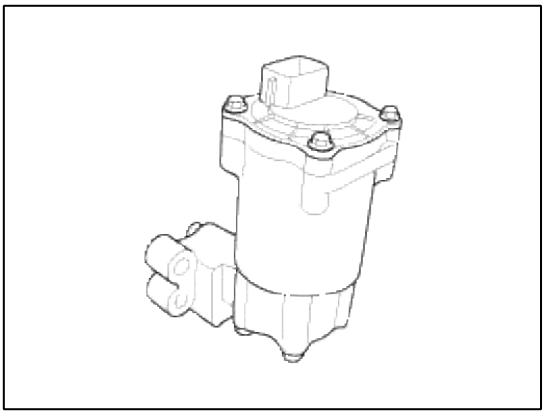
11. Hood switch

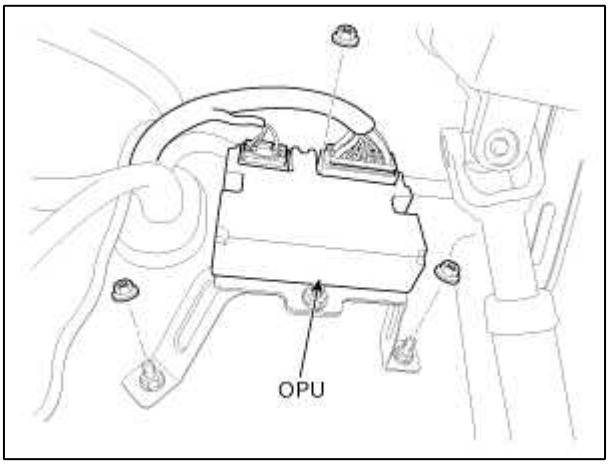




12. Electric Oil Pump (EOP)

13. Oil Pump Unit (OPU)

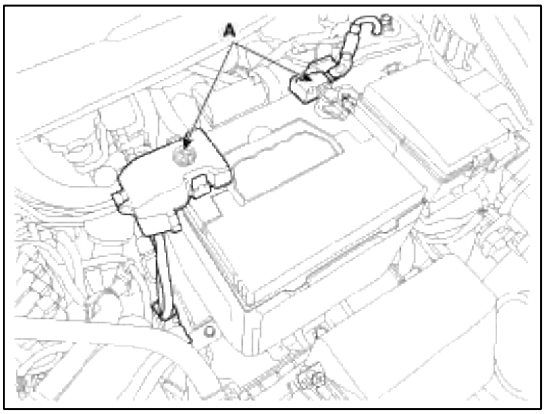




Fuel System > ISG (Idle Stop & Go) System > Battery Sensor > Description and Operation

Description

Vehicles have many control units that use more electricity. These units control their own system based on information from diverse sensors. It is important to have a stable power supply as there diverse sensors giving a variety of information. Battery sensor (A) is mounted on battery (-) terminal. It transmits battery voltage, current, temperature information to ECM. ECM controls generating voltage by duty cycle based on these signals.



CAUTION

When battery sensor signal fault occurs, inspect the vehicle parasitic draw in advance after inspecting the sensor because the sensor will behave abnormally when the parasitic draw is more than 100mA. (Refer to vehicle parasitic current inspection)

NOTE

It takes a few hours for a new battery sensor to detect the battery state correctly.
Perform the following process after replacing the battery sensor.

1. Ignition switch ON/OFF.
2. Park the vehicle about 4 hours.
3. After 4 hours later, check that the SOC (State of charge) of battery is displayed on GDS properly.
4. After engine start ON/OFF 2 times or more, check the SOF (State of function) of battery using GDS.

CAUTION

For the vehicle equipped with a battery sensor, be careful not to damage the battery sensor when the battery is replaced or recharged.

- When replacing the battery, it should be same one (type, capacity and brand) that is originally installed on your vehicle. If a battery of a different type is replaced, the battery sensor may recognize the battery to be abnormal.
- When installing the ground cable on the negative post of battery, tighten the clamp with specified torque of 4.0 ~ 6.0 N.m (0.4 ~ 0.6 kgf.m, 3.0 ~ 4.4 lb-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.

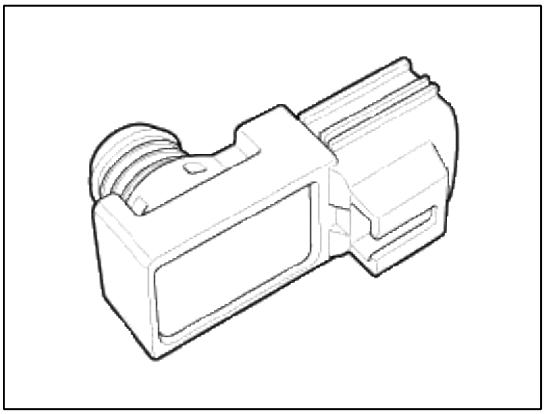
NOTE

- Refer to DTC manual code “U1111, U1112” to inspect the battery sensor.
- Must replace the engine wiring assembly to replace the battery sensor. Battery sensor doesn’t be replaced as a part only.

Fuel System > ISG (Idle Stop & Go) System > Brake Booster Vacuum Pressure Sensor > Description and Operation

Description

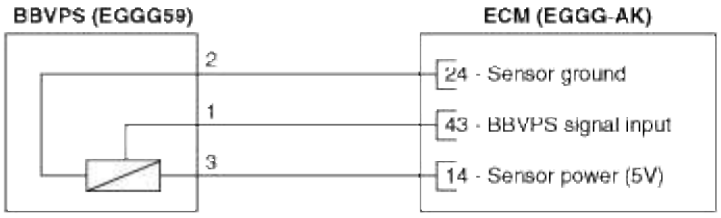
In order to ensure adequate brake power assistance in every situation, the brake booster is equipped with a partial vacuum sensor. The brake booster vacuum pressure sensor is located beside the brake booster.



Fuel System > ISG (Idle Stop & Go) System > Brake Booster Vacuum Pressure Sensor > Schematic Diagrams

Circuit Diagram

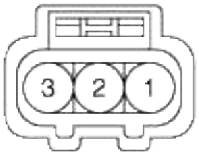
[Circuit Diagram]



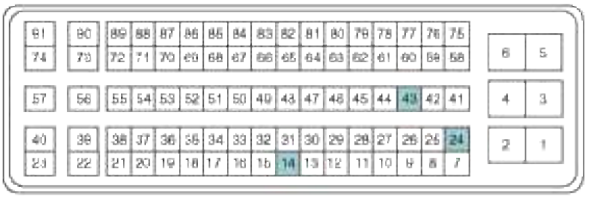
[Connection Information]

Terminal	Connected to	Function
1	ECM EGGG-AK (43)	BBVPS signal input
2	ECM EGGG-AK (24)	Sensor ground
3	ECM EGGG-AK (14)	Sensor power (5V)

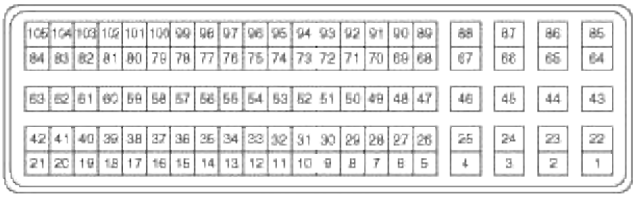
[Harness Connector]



EGGG59
BBVPS



EGGG-AK



EGGG-AA
ECM

Fuel System > ISG (Idle Stop & Go) System > Brake Booster Vacuum Pressure Sensor > Repair procedures

Inspection

1. Check installation status of BBVPS and Vacuum hose or damage of vacuum hose.
2. Connect GDS to DLC (Data Link Cable).
3. Warm up the engine to normal operating temperature.
4. Monitor "BBVPS" parameter on GDS.

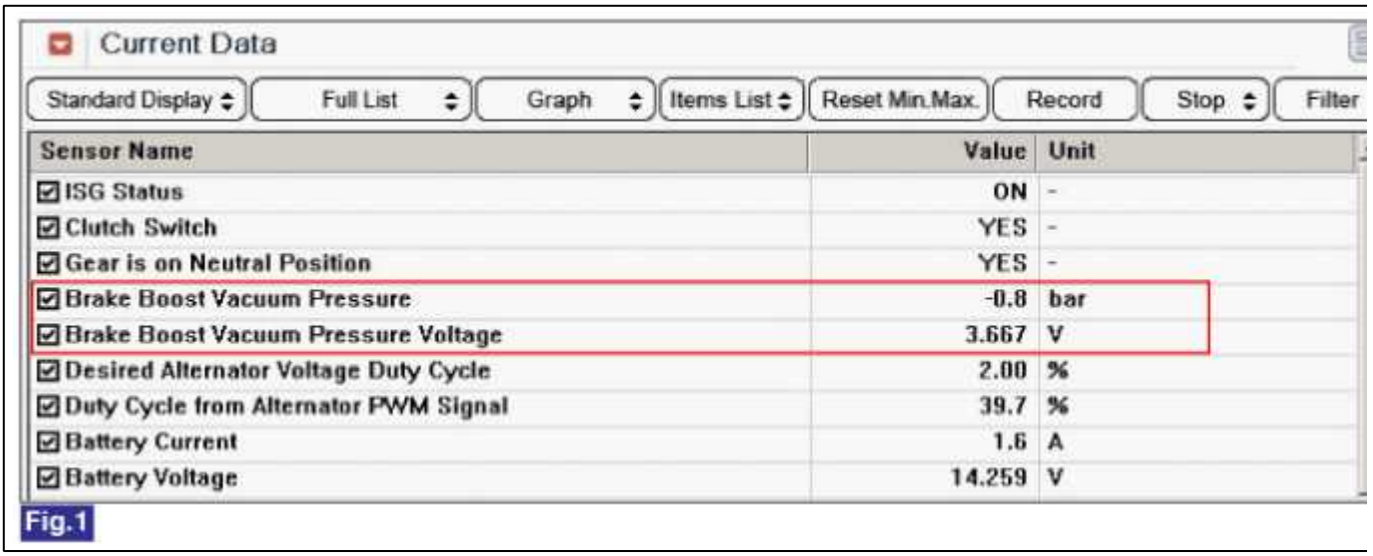


Fig.1

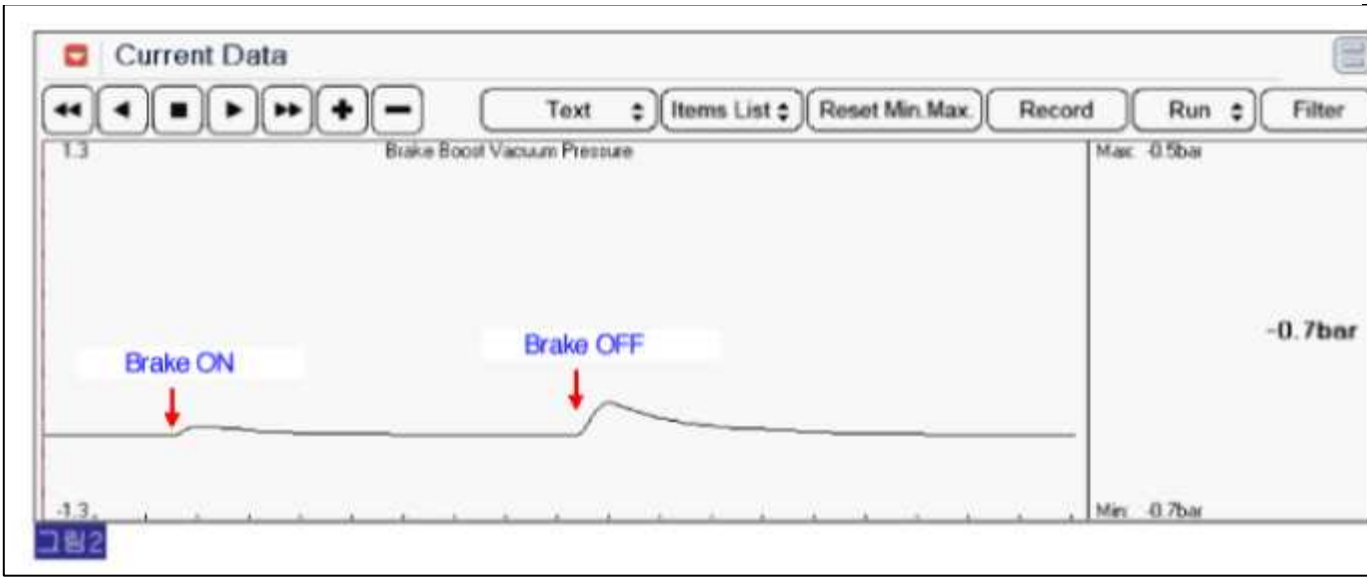


Fig.1) Idle Status
Fig.2) Brake pressure signal

NOTE

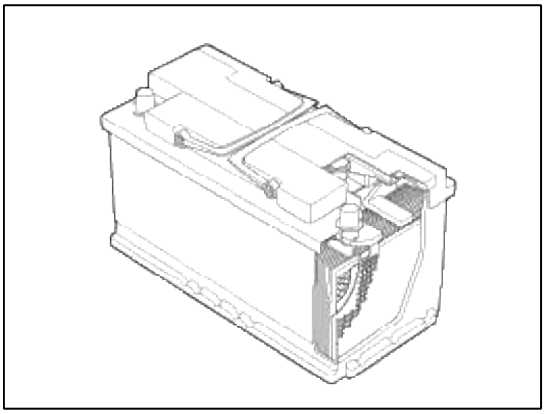
With a brake partial vacuum that is too low, the ISG function also starts without activity on the part of the driver.
Insufficient brake partial vacuum can lead to safety risks during braking manoeuvres, when rolling on an incline. To prevent this, the engine is started.
(Refer to “DTC P0557, P0558” in DTC manual)

Fuel System > ISG (Idle Stop & Go) System > AGM Battery > Description and Operation

Description

AGM battery is used for especially heavy load on the vehicle network depending on equipment and requirements. AGM stands for Absorbent Glass Material Battery; that is absorbent glass fibre fleece. AGM batteries are fitted in models with electrical loads/consumers which have a high energy demand.
The constantly increasing energy demand of modern vehicle electrical systems calls for ever more powerful battery solutions.
The power consumption is considerable even when the vehicle is parked.
The somewhat higher price compared with a battery of similar size is fully balanced by the following benefits:

- Significantly longer service life
- Increased starting reliability at low temperatures
- 100 % freedom from maintenance
- Low risk in event of an accident (reduced risk to the environment)



Recharging

Check the battery condition

The battery condition cannot be determined solely on the basis of the battery charge state. If there is a suspicion of a damaged battery, check the battery condition with the GR8 battery tester. With a low battery charge state, recharge the battery.

Recharging the AGM battery

The battery may be charged using the battery chargers at a constant charge voltage of 14.8V.
If possible, the battery temperature during charging should be between 68°F and 86°F.
Only chargers with voltage clamping (IU or WU curve) may be used or chargers with IUoU curve which have a trickle.

IU or WU charging technique
Optimized charging voltage for IU or WU: 14.7V (at 68°F ~ 86°F.) about 24 hours
Min. charging voltage at 68°F: 14.4V
Max. charging voltage at 68°F: 14.8V
10% of capacity is recommended as charging current (e.g. 60Ah : 10 = 6,0A charging current).

WARNING

Do not charge the AGM battery with>15.2V. No quick-charging routines.

CAUTION

If the battery is charged directly at the battery terminals on vehicles with battery sensor, misinterpretations of battery condition and under certain circumstances also unwanted Check Control messages or fault memory entire can occur.
After recharging finished, let the battery stand for over 10 hours with normal temperature for battery stabilization.

Fuel System > ISG (Idle Stop & Go) System > AGM Battery > Specifications

Specification

Items		Specification
AGM Battery	Type	48 - 24 GL
		(AGM Battery - 60Ah)
	Cold cranking amperage [at -18°C (-0.4°F)]	680 (EN)
	Reserve capacity	100 min
	Specific gravity [at 25°C(77°F)]	1.310 ± 0.01

CAUTION

- COLD CRANKING AMPERAGE is the amperage a battery can deliver for 30 seconds and maintain a terminal voltage of 7.2V or greater at a specified temperature.
- RESERVE CAPACITY RATING is amount of time a battery can deliver 25A and maintain a minimum terminal voltage of 10.5V at 26.7°C(80.1°F).

NOTE

- Battery type notation : MF 48 - 23 G L
  ① ② ③ ④ ⑤

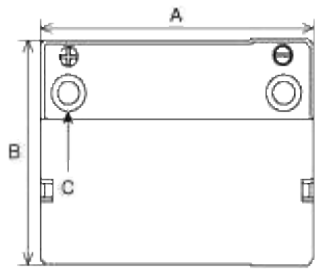
① : Battery type
- MF : Maintenance Free

② : Battery capacity (5HR)
- 48 : 48A·H

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

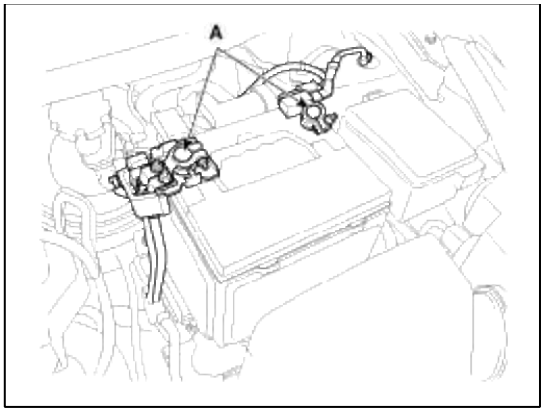


Fuel System > ISG (Idle Stop & Go) System > AGM Battery > Repair procedures

Removal and Installation

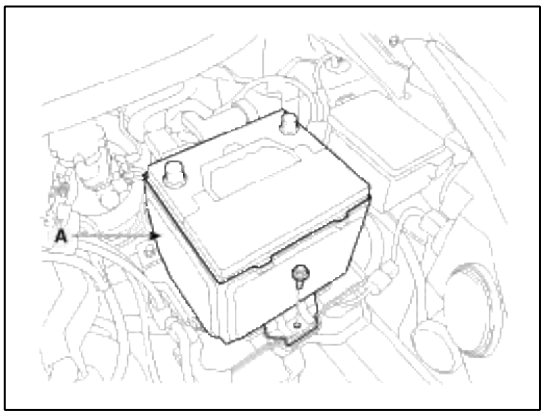
1. Remove the battery.
   (1) Disconnect the battery terminals (A).

Tightening torque
(+) terminal :
7.8 ~ 9.8 N.m (0.8 ~ 1.0 kgf.m, 5.8 ~ 7.2 lb-ft)
(-) terminal (without battery sensor) :
7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)
(-) terminal (with battery sensor) :
4.0 ~ 6.0N.m (0.4 ~ 0.6kgf.m, 3.0 ~ 4.4lb-ft)



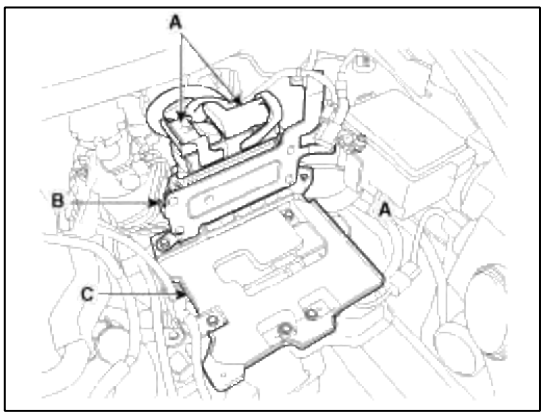
2. Remove the air duct and air cleaner assembly. (Refer to EM group).
3. Remove the battery insulation pad (A).
4. Remove the battery (B) after removing the mounting bracket.

Tightening torque :
8.8 ~ 13.7 N.m (0.9 ~ 1.4 kgf.m, 6.5 ~ 10.1 lb-ft)



5. Remove the ECM (B) and the battery tray (C) after disconnecting the ECM connector (A).

Tightening torque
ECM bracket bolts & nut :
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)
Battery tray bolts :
8.8 ~ 13.7N.m (0.9 ~ 1.4kgf.m, 6.5 ~ 10.1lb-ft)



6. Installation is the reverse order of removal.

CAUTION

When installing the battery, fix the mounting bracket on the tray correctly.

CAUTION

- ISG (Idle stop & go) system equipped vehicle always use the AGM battery only. If flooded battery has installed, this can potentially lead to engine electrical trouble or ISG system error.
- Replace same capacity of the AGM battery.

NOTE

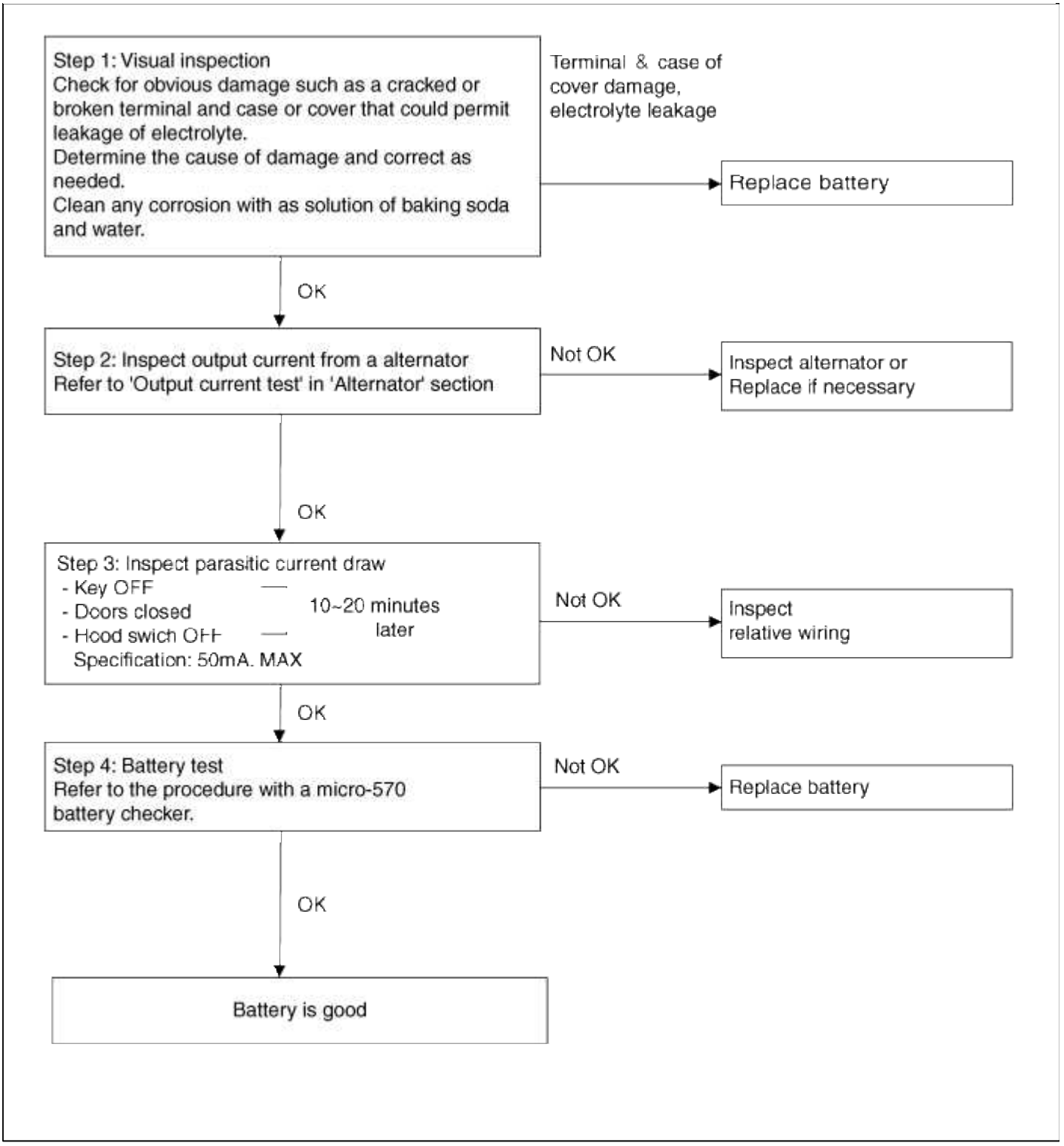
Ensure the AGM battery is placed correctly on the battery tray. In all cases, an AGM battery must be installed and the battery sensor calibrated for the ISG system to function. After the battery has been changed or disconnected, the battery sensor must be calibrated. After connecting the battery, start the engine at least once. Then park the car for at least 4 hours with the ignition off. After the 4 hours, the engine should be started two times. At this time the battery sensor will be calibrated.

WARNING

Do not open the AGM battery.
The AGM battery must not be opened under any circumstances as the introduction of oxygen from the air will cause the battery to lose its chemical equilibrium and rendered non-operational.

Inspection

Battery Diagnostic Flow



Vehicle parasitic current inspection

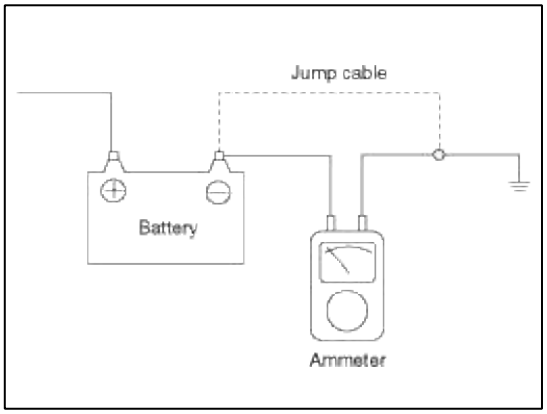
1. Turn all the electric devices OFF, and then turn the ignition switch OFF.
2. Close all doors except the engine hood, and then lock all doors.
   (1) Disconnect the hood switch connector.
   (2) Close the trunk lid.
   (3) Close the doors or remove the door switches.

3. Wait a few minutes until the vehicle's electrical systems go to sleep mode.

> NOTE
>
> For an accurate measurement of a vehicle parasitic current, all electrical systems should go to sleep mode. (It takes at least one hour or at most one day.) However, an approximate vehicle parasitic current can be measured after 10~20 minutes.

4. Connect an ammeter in series between the battery (-) terminal and the ground cable, and then disconnect the clamp from the battery (-) terminal slowly.

> CAUTION
>
> Be careful that the lead wires of an ammeter do not come off from the battery (-) terminal and the ground cable to prevent the battery from being reset. In case the battery is reset, connect the battery cable again, and then start the engine or turn the ignition switch ON for more than 10 sec. Repeat the procedure from No. 1.
> To prevent the battery from being reset during the inspection,
> 1) Connect a jump cable between the battery (-) terminal and the ground cable.
> 2) Disconnect the ground cable from the battery (-) terminal.
> 3) Connect an ammeter between the battery (-) terminal and the ground cable.
> 4) After disconnecting the jump cable, read the current value of the ammeter.



5. Read the current value of the ammeter.
   A. If the parasitic current is over the limit value, search for abnormal circuit by removing a fuse one by one and checking the parasitic current.
   B. Reconnect the suspected parasitic current draw circuit fuse only and search for suspected unit by removing a component connected with the circuit one by one until the parasitic draw drops below limit value.

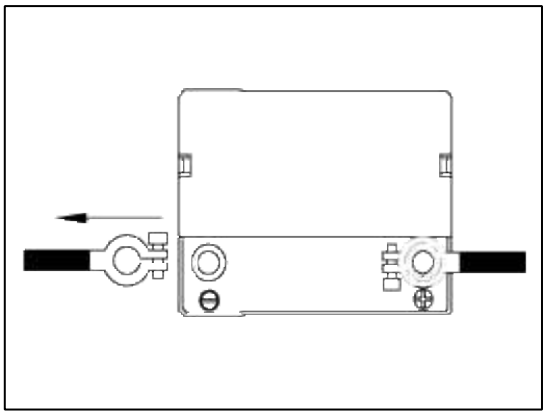
Limit value (after 10~20 min.) : Below 50mA

Cleaning

1. Make sure the ignition switch and all accessories are in the OFF position.
2. Disconnect the battery cables (negative first).

3. Remove the battery from the vehicle.

> CAUTION
>
> Care should be taken in the event the battery case is cracked or leaking, to protect your skin from the electrolyte.
> Heavy rubber gloves (not the household type) should be wore when removing the battery.

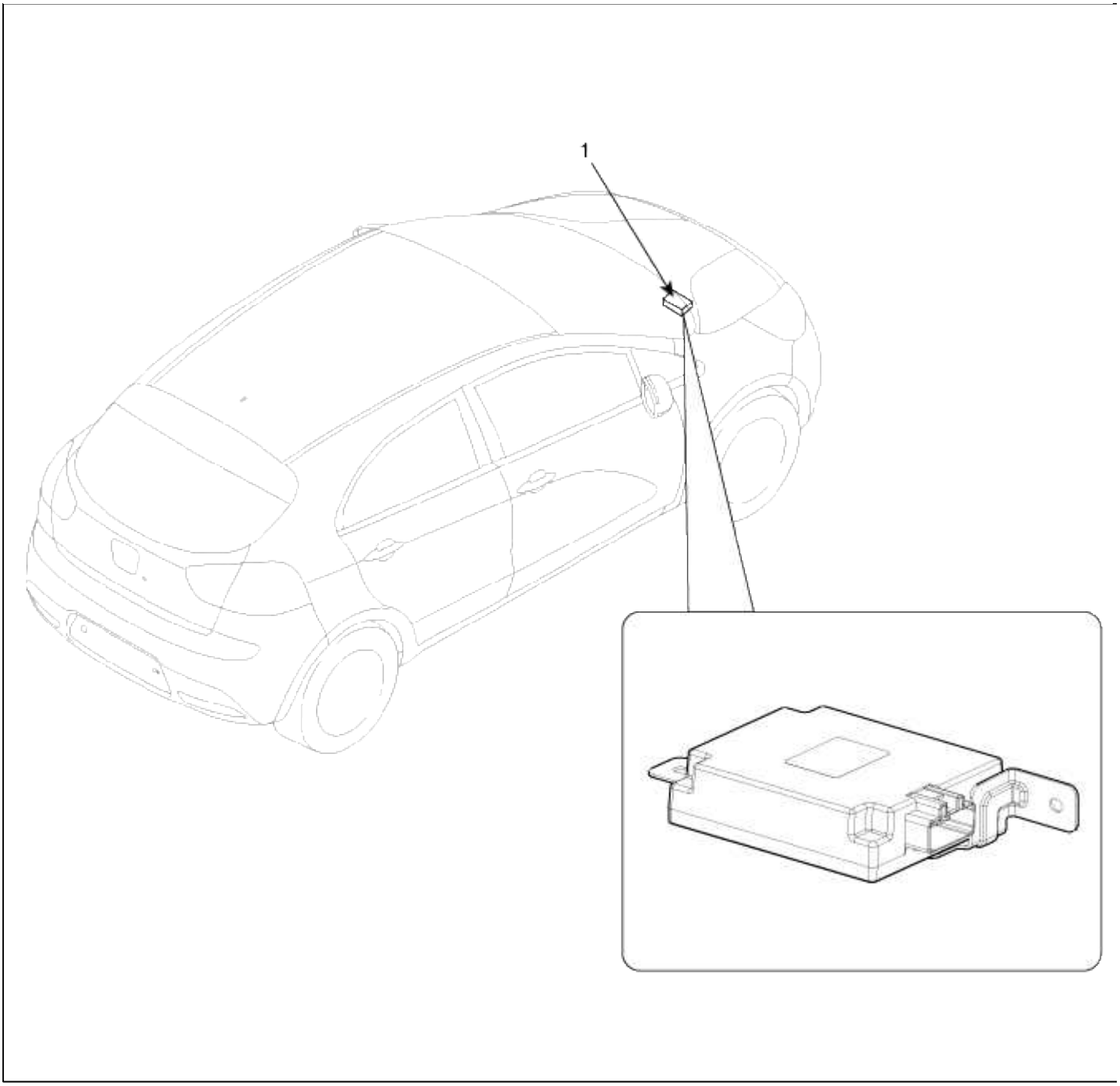


4. Inspect the battery tray for damage caused by the loss of electrolyte. If acid damage is present, it will be necessary to clean the area with a solution of clean warm water and baking soda. Scrub the area with a stiff brush and wipe off with a cloth moistened with baking soda and water.
5. Clean the top of the battery with the same solution as described above.
6. Inspect the battery case and cover for cracks. If cracks are present, the battery must be replaced.
7. Clean the battery posts with a suitable battery post tool.
8. Clean the inside surface of the terminal clamps with a suitable battery cleaning tool. Replace damaged or frayed cables and broken terminal clamps.
9. Install the battery in the vehicle.
10. Connect the cable terminals to the battery post, making sure tops of the terminals are flush with the tops of the posts.
11. Tighten the terminal nuts securely.
12. Coat all connections with light mineral grease after tightening.

> CAUTION
>
> When batteries are being charged, an explosive gas forms beneath the cover of each cell. Do not smoke near batteries being charged or which have recently been charged. Do not break live circuit at the terminals of batteries being charged.
> A spark will occur when the circuit is broken. Keep open flames away from battery.

Fuel System > ISG (Idle Stop & Go) System > DC/DC Converter > Components and Components Location

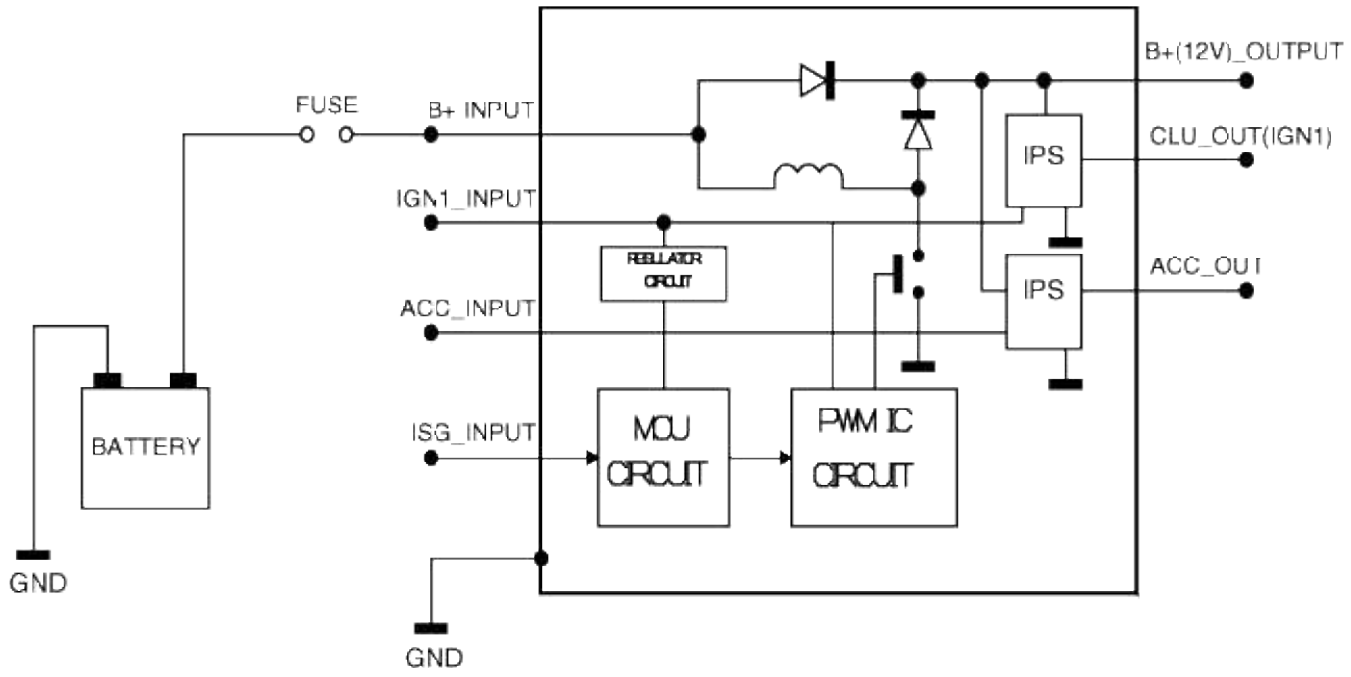
Component Location

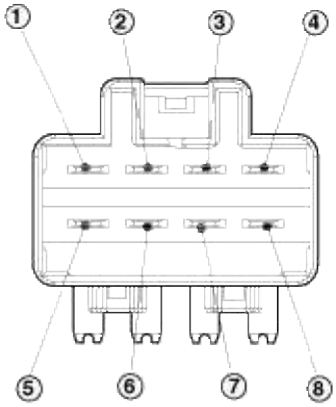


1. DC/DC Converter

Fuel System > ISG (Idle Stop & Go) System > DC/DC Converter > Schematic Diagrams

Circuit Diagram





PIN NO.	DESCRIPTION
1	IGN 1_INPUT
2	GND
3	CLU-OUT(IGN1)
4	B+ INPUT
5	ACC-INPUT
6	ACC_OUT
7	ISG INPUT
8	B+(12V) OUTPUT

NOTE

In the ISG mode, if the power of an audio system turnsOFF by drawdown while “Auto Starting” or “Idle Starting”function operates, replace the DC/DC converter.

Fuel System > ISG (Idle Stop & Go) System > DC/DC Converter > Repair procedures

Removal and Installation

1. Disconnect the battery negative terminal.

Tightening torque

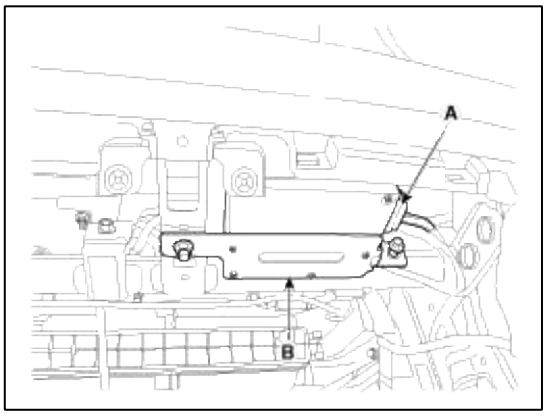
Without battery sensor :

7.8 ~ 9.8 N.m (0.8 ~ 1.0 kgf.m, 5.8 ~ 7.2 lb-ft)

With battery sensor :

4.0 ~ 6.0 N.m (0.4 ~ 0.6 kgf.m, 3.0 ~ 4.4 lb-ft)

2. Remove the glove box housing. (Refer to BD group)
3. Disconnect the connector (A) and then remove the DC/DC converter (B).



4. Installation is reverse order of removal.

> NOTE
>
> After disconnecting then reconnecting the battery negative cable, the ISG function dose not operates until the system is stabilized, about 4 hours.

Fuel System > ISG (Idle Stop & Go) System > ISG OFF Switch > Description and Operation

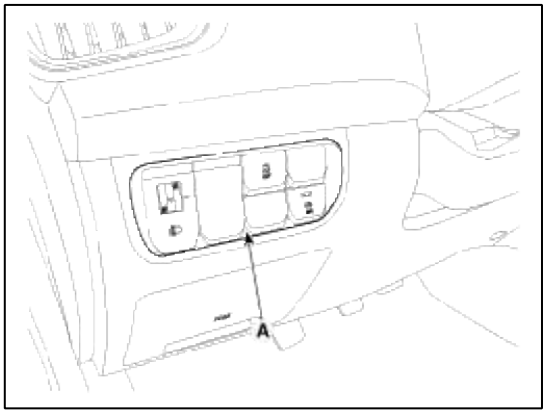
Description

The ISG OFF switch on the crash pad lower panel can be used to deactivate the ISG function.

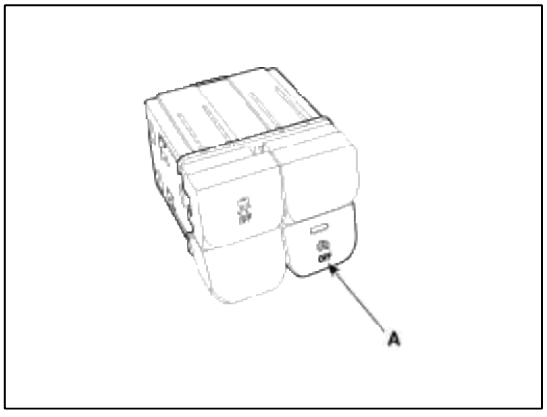
Fuel System > ISG (Idle Stop & Go) System > ISG OFF Switch > Repair procedures

Inspection

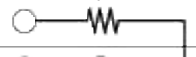
1. Remove the crash pad side switch assembly (A) from the switch panel on the crach pad of the driver's side.



2. Remove the ISG switch (A) from the switch assembly.



3. Check the continuity between the switch 2 and 3 terminals as the ISG OFF switch is engaged.

Position / Terminal	ON	OFF	Remark
4			Indicator
5			Indicator
2			Switch
3			Switch

Fuel System > ISG (Idle Stop & Go) System > Alternator > Description and Operation

Description

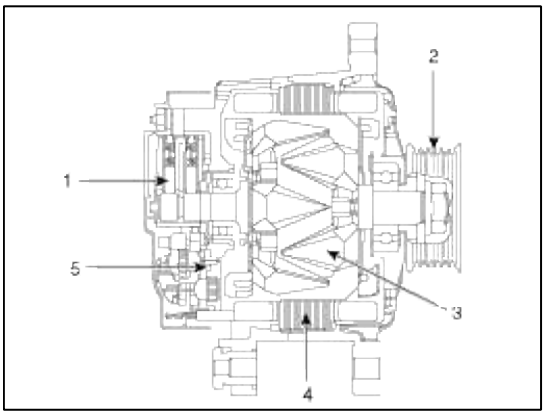
The charging system included a battery, an alternator with a built-in regulator, and the charging indicator light and wire.

The Alternator has eight built-in diodes, each rectifying AC current to DC current.

Therefore, DC current appears at alternator "B" terminal.

In addition, the charging voltage of this alternator is regulated by the battery voltage detection system.

The alternator is regulated by the battery voltage detection system. The main components of the alternator are the rotor, stator, rectifier, capacitor brushes, bearings and OAD (Overrunning Alternator Decoupler) pulley. The brush holder contains a built-in electronic voltage regulator.



1. Brush
2. OAD (Overrunning Alternator Decoupler) pulley
3. Rotor
4. Ststor
5. Rectifier

Alternator Management System

Alternator management system controls the charging voltage set point in order to improve fuel economy, manage alternator load under various operating conditions, keep the battery charged, and protect the battery from over-charging. ECM controls generating voltage by duty cycle (charging control, discharging control, normal control) based on the battery conditions and vehicle operating conditions.

The system conducts discharging control when accelerating a vehicle. Vehicle reduces an alternator load and consumes an electric power form a battery.

The system conducts charging control when decelerating a vehicle. Vehicle increases an alternator load and charges a battery.

Fuel System > ISG (Idle Stop & Go) System > Alternator > Specifications

Specification

Items			Specification
ISG Alternator	Rated voltage		13.5V, 110A
	Speed in use		1,000 ~ 18,000rpm
	Voltage regulator		IC Regulator built-in type
	Regulator setting voltage	External mode	ECU control
		Internal mode	14.55 ± 0.3V
	Temperature compensation	External mode	ECU control
		Internal mode	-3.5 ± 2mV / °C

Fuel System > ISG (Idle Stop & Go) System > Alternator > Repair procedures

On-vehicle Inpection

CAUTION

- Check that the battery cables are connected to the correct terminals.
- Disconnect the battery cables when the battery is given a quick charge.
- Never disconnect the battery while the engine is running.

Check The Battery Terminals And Fuses

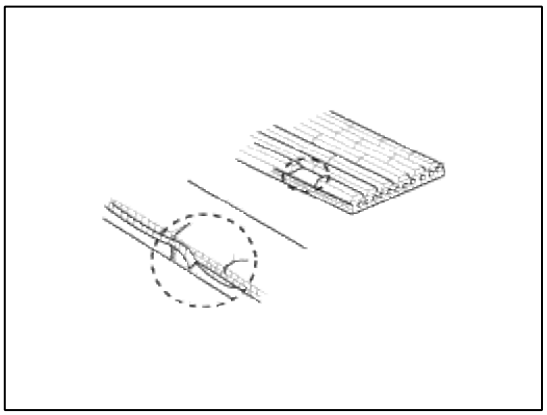
1. Check that the battery terminals are not loose or corroded.
2. Check the fuses for continuity.

Inspect Drive Belt

1. Visually check the belt for excessive wear, frayed cords etc.
   If any defect has been found, replace the drive belt.

NOTE

Cracks on the rib side of a belt are considered acceptable. If the belt has chunks missing from the ribs, it should be replaced.



Drive belt tension measurement and adjustment

Belt tension measurement

Measure the belt tension using a mechanical tension gauge or a sonic tension meter.

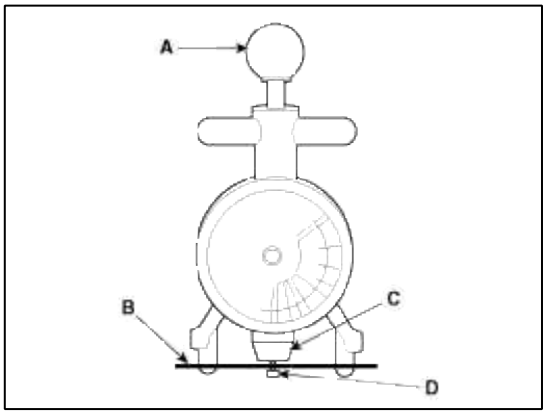
Tension
New belt: 637.4 ~ 735.5N (65 ~ 75kg, 143.3 ~ 165.3lb)
Used belt: 490.3 ~ 588.4N (50 ~ 60kg, 110.2 ~ 132.3lb)

CAUTION

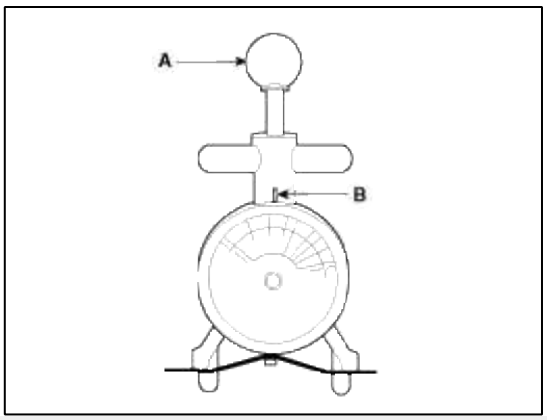
- If the engine has run for 5 minutes or more, the belt tension must be adjusted as a used belt.
- When installing the V-ribbed belt, all grooves on the pulley should be covered with belt ribs.
- A loose belt causes slip noise.
- Too tight belt cause bearing of alternator and water pump to damage.

Using a mechanical tension gauge (BT-33-73F, BTG-2 type)

1. While pressing the handle (A) of the gauge, insert the belt (B) between pulley and pulley (or idler) into the gap between spindle (C) and hook (D).



2. After releasing the handle (A), read a value on the dial pointed by the indicator (B).



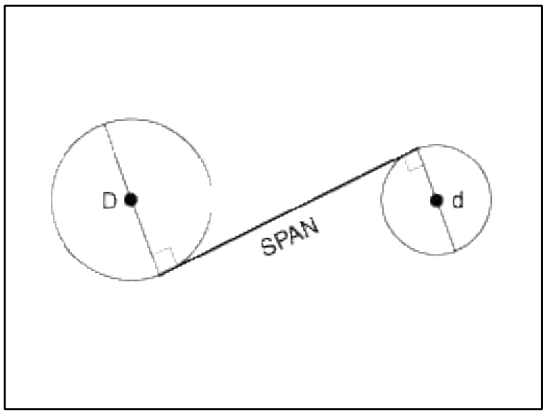
Using a sonic tension meter (U-505/507 type)

1. Input the belt specifications into the tension meter.

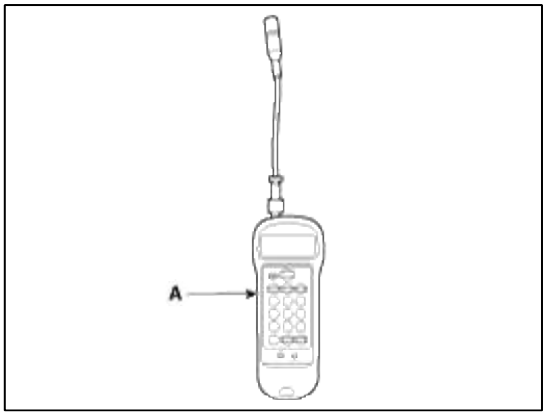
Belt type	Location of measurement	Input data		
		M (Mass, g/m.rib)	W (Width, rib)	S (Span, mm)
With A/C	Crankshaft pulley to A/C compressor pulley	013.4	006.0	178.9
Without A/C	Idler to alternator pulley	013.4	006.0	Actual measurement value

NOTE

Measurement of S (Span) : Caculate average value after measuring the distance 3~4 times.

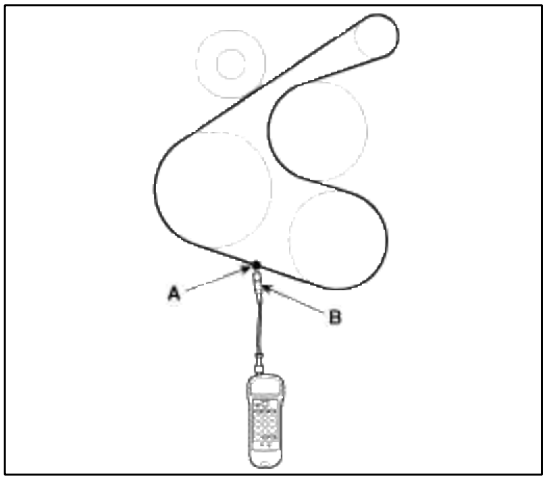


D : Idler
d : Alternator pulley

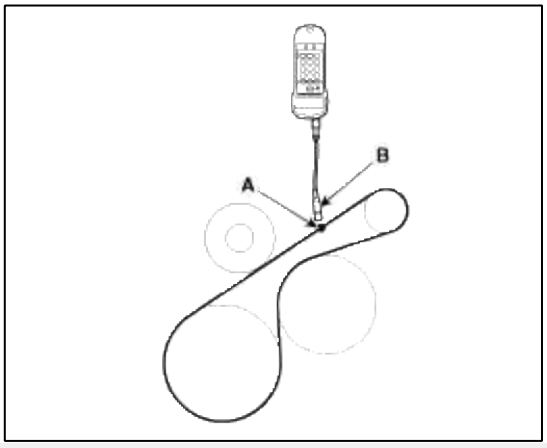


2. Locate the micro phone (B) close to the center of belt span (A) and bounce the belt by finger 2~3 times. Read a value on the display.

[With A/C]

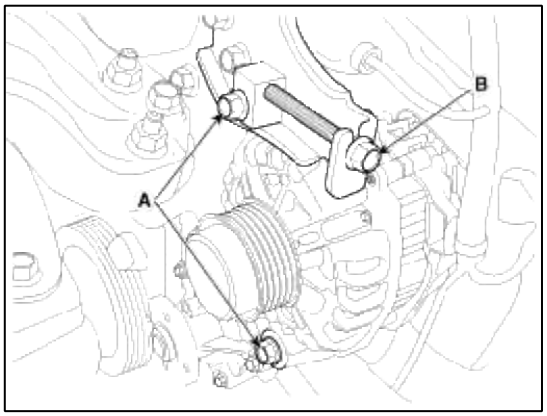


[Without A/C]



If adjustment is necessary :

1. Loosen the mounting bolts (A).
2. Tighten the adjusting bolt(B) clockwise in loose tension ; loosen the bolt counterclockwise in high tension.



3. Recheck tension of the belt.
4. After adjusting tension, tighten the through bolts.

Tightening torque

12mm (0.47in) bolt : 19.6 ~ 26.5 Nm (2.0 ~ 2.7 kgf.m, 14.5 ~ 19.5 Ib-ft)
14mm (0.55in) bolt : 29.4 ~ 41.2 Nm (3.0 ~ 4.2 kgf.m, 21.7 ~ 30.4 Ib-ft)

Visually Check Alternator Wiring And Listen For Abnormal Noises

1. Check that the wiring is in good condition.

2. Check that there is no abnormal noise from the alternator while the engine is running.

Check Discharge Warning Light Circuit

1. Warm up the engine and then turn it off.
2. Turn off all accessories.
3. Turn the ignition switch "ON". Check that the discharge warning light is lit.
4. Start the engine. Check that the light is lit.
   If the light does not go off as specified, troubleshoot the discharge light circuit.

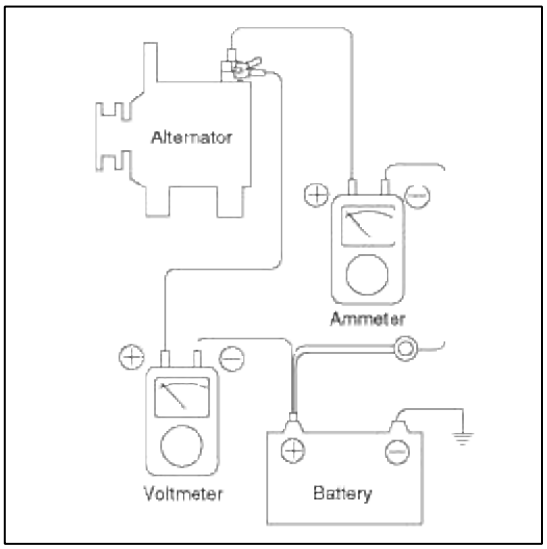
Inspect Charging System

Voltage Drop Test Of Alternator Output Wire

This test determines whether or not the wiring between the alternator "B" terminal and the battery (+) terminal is good by the voltage drop method.

Preparation

1. Turn the ignition switch to "OFF".
2. Disconnect the output wire from the alternator "B" terminal. Connect the (+) lead wire of ammeter to the "B" terminal of alternator and the (-) lead wire of ammeter to the output wire. Connect the (+) lead wire of voltmeter to the "B" terminal of alternator and the (-) lead wire of voltmeter to the (+) terminal of battery.



Test

1. Start the engine.
2. Turn on the headlamps and blower motor, and set the engine speed until the ammeter indicates 20A.
   And then, read the voltmeter at this time.

Result

1. The voltmeter may indicate the standard value.

Standard value : 0.2V max

2. If the value of the voltmeter is higher than expected (above 0.2V max.), poor wiring is suspected. In this case check th e wiring from the alternator "B" terminal to the battery (+) terminal. Check for loose connections, color change due to an over-heated harness, etc. Correct them before testing again.
3. Upon completion of the test, set the engine speed at idle.
   Turn off the headlamps, blower motor and the ignition switch.

Output Current Test

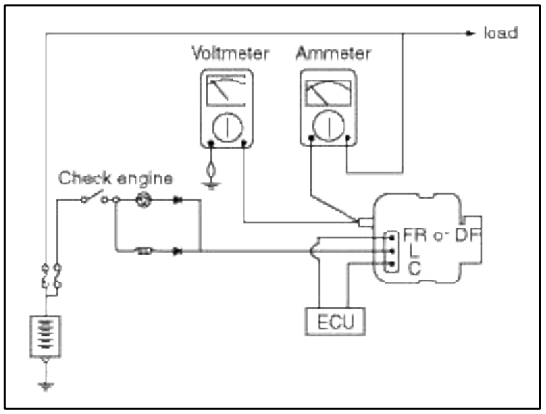
This test determines whether or not the alternator gives an output current that is equivalent to the normal output.

Preparation

1. Prior to the test, check the following items and correct as necessary.
   Check the battery installed in the vehicle to ensure that it is good condition. The battery checking method is described in the section "Battery".
   The battery that is used to test the output current should be one that has been partially discharged. With a fully charged battery, the test may not be conducted correctly due to an insufficient load.
   Check the tension of the alternator drive belt. The belt tension check method is described in the section "Inspect drive belt".
2. Turn off the ignition switch.
3. Disconnect the battery ground cable.
4. Disconnect the alternator output wire from the alternator "B" terminal.
5. Connect a DC ammeter (0 to 150A) in series between the "B" terminal and the disconnected output wire. Be sure to connect the (-) lead wire of the ammeter to the disconnected output wire.

> NOTE
>
> Tighten each connection securely, as a heavy current will flow. Do not rely on clips.

6. Connect a voltmeter (0 to 20V) between the "B" terminal and ground. Connect the (+) lead wire to the alternator "B" terminal and (-) lead wire to a good ground.
7. Attach an engine tachometer and connect the battery ground cable.
8. Leave the engine hood open.



Test

1. Check to see that the voltmeter reads as the same value as the battery voltage. If the voltmeter reads 0V, and the open circuit in the wire between alternator "B" terminal and battery (+) terminal or poor grounding is suspected.
2. Start the engine and turn on the headlamps.
3. Set the headlamps to high beam and the heater blower switch to HIGH, quickly increase the engine speed to 2,500 rpm and read the maximum output current value indicated by the ammeter.

> NOTE
>
> After the engine start up, the charging current quickly drops. Therefore, the above operation must be done quickly to read the maximum current value correctly.

Result

1. The ammeter reading must be higher than the limit value. If it is lower but the alternator output wire is in good condition, remove the alternator from the vehicle and test it.

Limit value : 60% of the voltage rate

NOTE

- The nominal output current value is shown on the nameplate affixed to the alternator body.
- The output current value changes with the electrical load and the temperature of the alternator itself. Therefore, the nominal output current may not be obtained. If such is the case, keep the headlamps on the cause discharge of the battery, or use the lights of another vehicle to increase the electrical load. The nominal output current may not be obtained if the temperature of the alternator itself or ambient temperature is too high. In such a case, reduce the temperature before testing again.

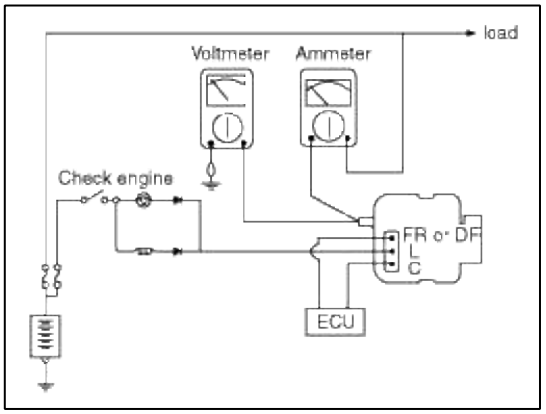
2. Upon completion of the output current test, lower the engine speed to idle and turn off the ignition switch.
3. Disconnect the battery ground cable.
4. Remove the ammeter and voltmeter and the engine tachometer.
5. Connect the alternator output wire to the alternator "B" terminal.
6. Connect the battery ground cable.

Regulated Voltage Test

The purpose of this test is to check that the electronic voltage regulator controls voltage correctly.

Preparation

1. Prior to the test, check the following items and correct if necessary.
   Check that the battery installed on the vehicle is fully charged. The battery checking method is described in the section "Battery".
   Check the alternator drive belt tension. The belt tension check method is described in the section "Inspect drive belt".
2. Turn ignition switch to "OFF".
3. Disconnect the battery ground cable.
4. Connect a digital voltmeter between the "B" terminal of the alternator and ground. Connect the (+) lead of the voltmeter to the "B" terminal of the alternator. Connect the (-) lead to good ground or the battery (-) terminal.
5. Disconnect the alternator output wire from the alternator "B" terminal.
6. Connect a DC ammeter (0 to 150A) in series between the "B" terminal and the disconnected output wire. Connect the (-) lead wire of the ammeter to the disconnected output wire.
7. Attach the engine tachometer and connect the battery ground cable.



Test

1. Turn on the ignition switch and check to see that the voltmeter indicates the following value.

Voltage: Battery voltage

If it reads 0V, there is an open circuit in the wire between the alternator "B" terminal and the battery and the battery (-) terminal.

2. Start the engine. Keep all lights and accessories off.
3. Run the engine at a speed of about 2,500 rpm and read the voltmeter when the alternator output current drops to 10A or less

Result

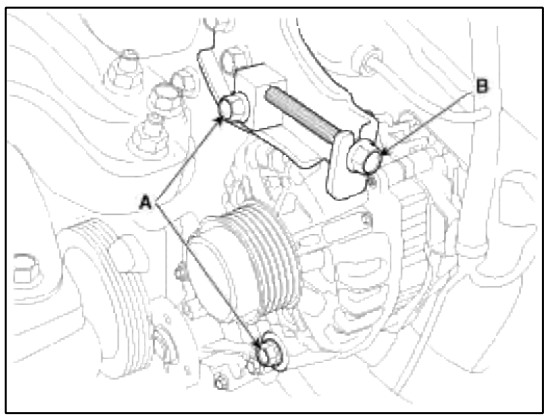
1. If the voltmeter reading dosen't agree with the standard value, the voltage regulator or the alternator is faulty.
2. Upon completion of the test, reduce the engine speed to idle, and turn off the ignition switch.
3. Disconnect the battery ground cable.
4. Remove the voltmeter and ammeter and the engine tachometer.
5. Connect the alternator output wire to the alternator "B" terminal.
6. Connect the battery ground cable.

Removal and installation

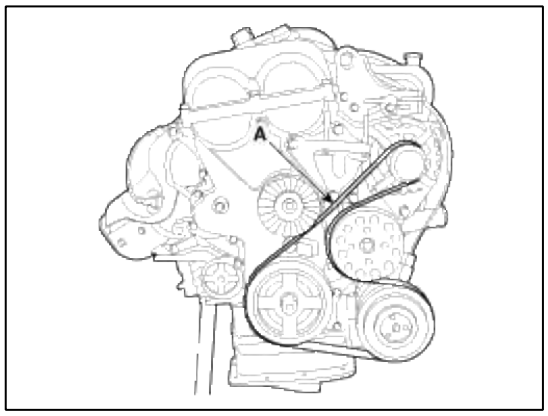
1. Disconnect the battery negative terminal first, then the positive terminal.

Tightening torque
(+) terminal :
7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)
(-) terminal (without battery sensor):
7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)
(-) terminal (with battery sensor):
4.0 ~ 6.0N.m (0.4 ~ 0.6kgf.m, 3.0 ~ 4.4lb-ft)

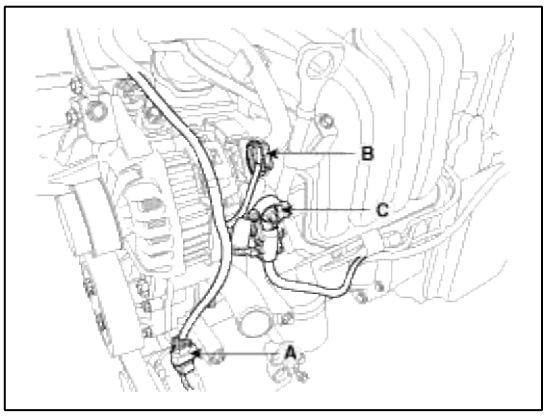
2. Remove the drive belt.
   (1) Loosen the through bolt (A).
   (2) Loosen the tension by turning the tension adjusting bolt (B).



(3) Remove the drive belt (A).

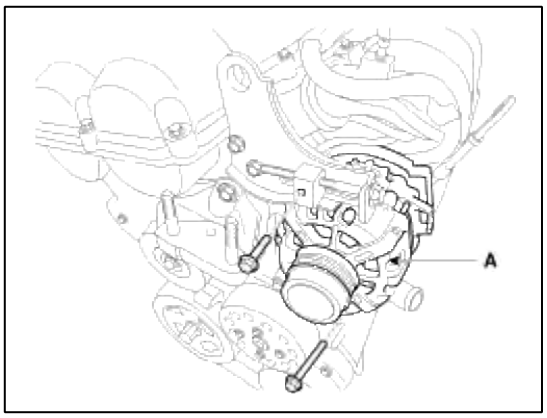


3. Disconnect the A/C compressor switch connector (A), the alternator connector (B) and the cable from the alternator "B" terminal (C).



4. Remove the alternator (A).

Tightening torque :
19.6~26.5 Nm (2.0~2.7 kgf.m, 14.5~19.5 Ib-ft)-12mm bolt
29.4~41.2 Nm (3.0~4.2 kgf.m, 21.7~30.4 Ib-ft)-14mm bolt



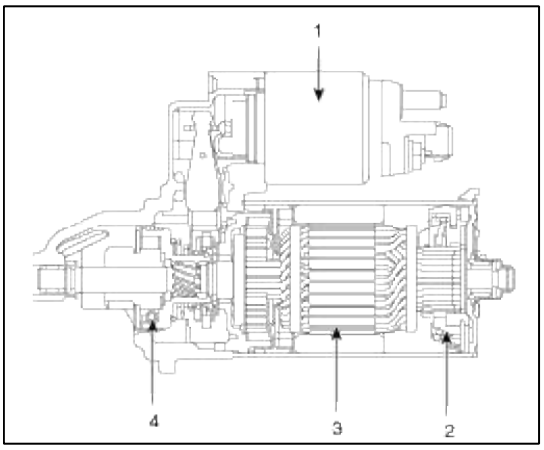
5. Installation is the reverse order of removal.
6. Adjust the alternator belt tension after installation.

Fuel System > ISG (Idle Stop & Go) System > Starter > Description and Operation

Description

The starting system includes the battery, starter, solenoid switch, inhibitor switch (A/T), ignition switch, ignition lock switch, connection wires and the battery cable.
When the ignition key is turned to the start position, current flows and energizes the starter motor's solenoid coil. The solenoid plunger and clutch shift lever are activated, and the clutch pinion engages the ring gear.

The contacts close and the starter motor cranks. In order to prevent damage caused by excessive rotation of the starter armature when the engine starts, the clutch pinion gear overruns.



In conjunction with the ISG function, the starter motor must do a great deal more work. The starter motor is therefore configured for a significantly higher number of start cycles. The components of the starter motor have been adapted to the higher requirements.

NOTE

There are two kinds of starter, ISG type starter and the other.
When replace the starter, confirm that the part number and connector shape.

CAUTION

ISG (Idle stop & go) system equipped vehicle always use the ISG type starter only. If the other starter has installed, this can potentially lead to engine electrical trouble or ISG system error.

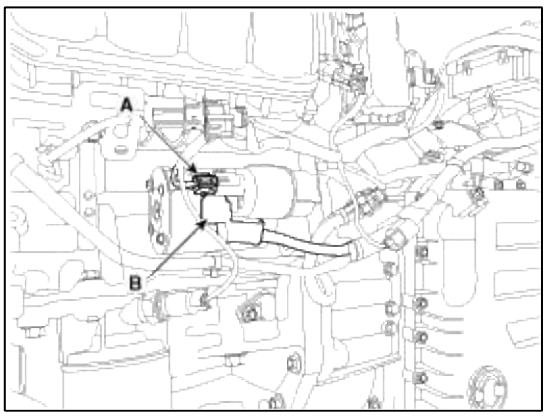
WARNING

Do not disassemble the ISG type starter.
If the starter troubles occur, replace the starter.

Fuel System > ISG (Idle Stop & Go) System > Starter > Repair procedures

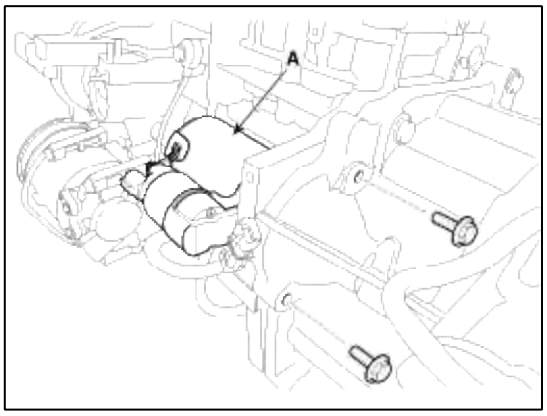
Removal and Installation

1. Disconnect the battery negative terminal.
2. Remove the air duct and air cleaner assembly. (Refer to EM group)
3. Disconnect the starter cable (B) from the B terminal on the solenoid then disconnect the connector (A) from the S terminal.



4. Remove the 2 bolts holding the starter, then remove the starter (A).

Tighting torque :
42.2 ~ 53.9 Nm (4.3 ~ 5.5 kgf.m, 31.1 ~ 39.8 lb-ft)

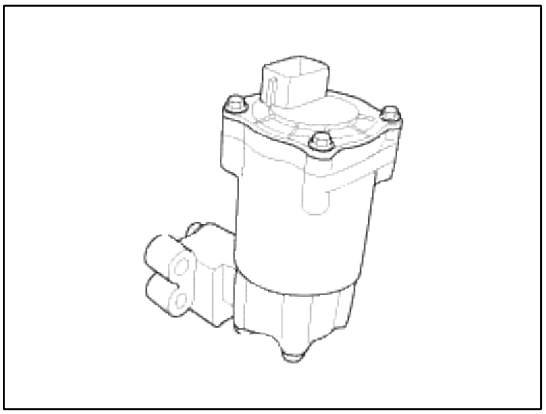


5. Installation is the reverse of removal.

Fuel System > ISG (Idle Stop & Go) System > Electric Oil Pump > Description and Operation

Description

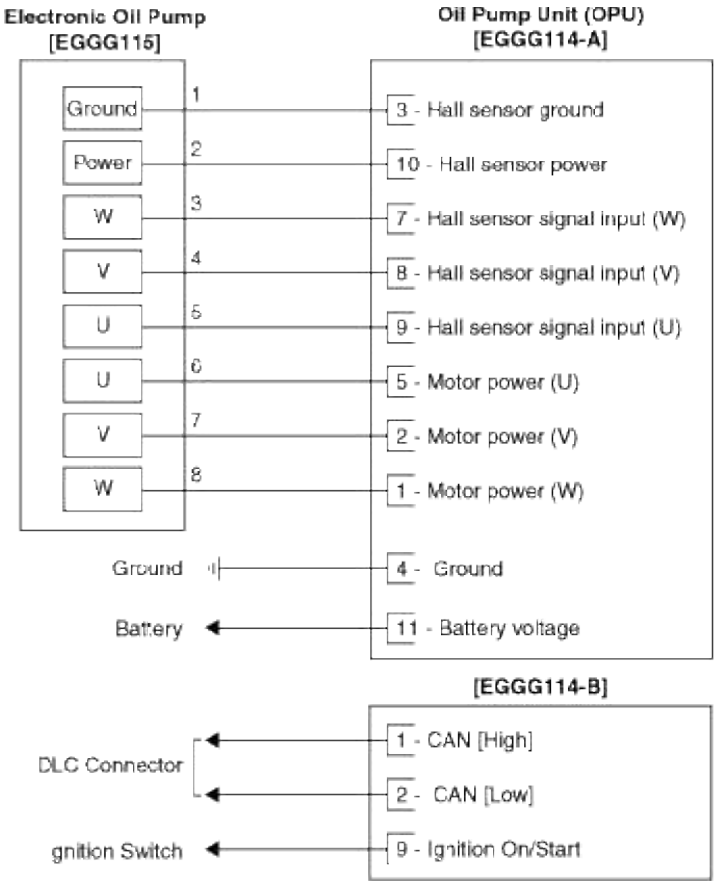
This transaxle has a standard Mechanical Oil Pump (MOP) linked to the input shaft to generates oil pressure when input shaft rotates.
But, this transaxle equipped with ISG system also has an Electric Oil Pump (EOP). Because the ISG system features Auto-Stop which starts and stops the engine as needed. The Auto-Stop feature prevents the Mechanical Oil Pump (MOP) from operating and building enough pressure for the transaxle to operate. When the vehicle comes to a stop with the engine off, Mechanical Oil Pump (MOP) cannot generate sufficient oil pressure during the initial startup or during low speed driving.
For these reasons, the Electric Oil Pump (EOP) takes on this role as an additional device that can generate the required oil pressure when the vehicle comes to a stop or during low speed driving. The Electric Oil Pump (EOP) supplies oil pressure to the Under Drive Brake (UD/B).



Fuel System > ISG (Idle Stop & Go) System > Electric Oil Pump > Schematic Diagrams

Circuit Diagram

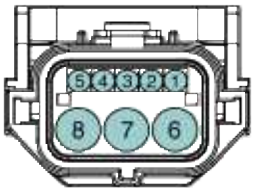
[Circuit Diagram]



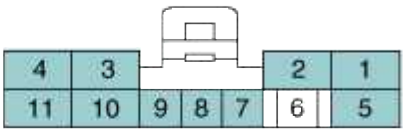
[Connection Information]

Termianl	Connected to	Function
1	OPI CGG68-A (3)	Hall sensor ground
2	OPI CGG68-A (10)	Hall sensor power
3	OPI CGG68-A (7)	Hall sensor signal input (W)
4	OPI CGG68-A (8)	Hall sensor signal input (V)
5	OPI CGG68-A (9)	Hall sensor signal input (U)
6	OPI CGG68-A (5)	Motor power (U)
7	OPI CGG68-A (2)	Motor power (V)
8	OPI CGG68-A (1)	Motor power (W)

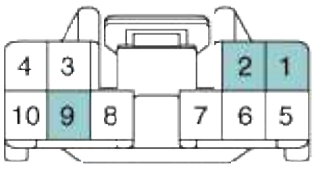
[Harness Connector]



EGGG115
Electronic Oil Pump



EGGG114-A



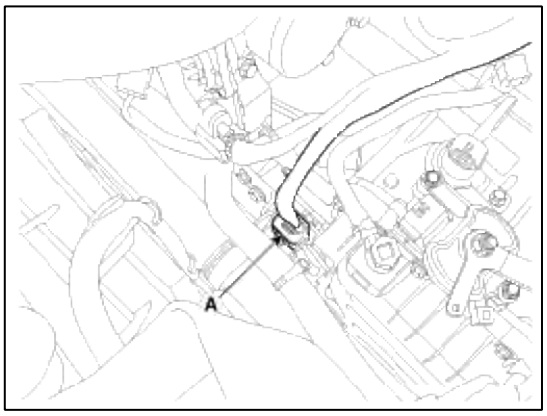
EGGG114-B
OPU

Fuel System > ISG (Idle Stop & Go) System > Electric Oil Pump > Repair procedures

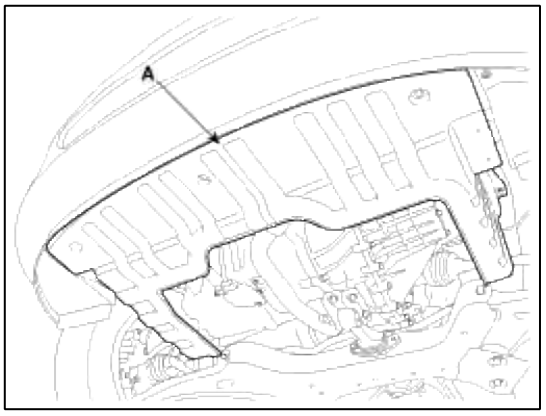
Removal

1. Disconnect the negative (-) battery terminal.

2. Disconnect the Electric Oil Pump (EOP) connector (A).

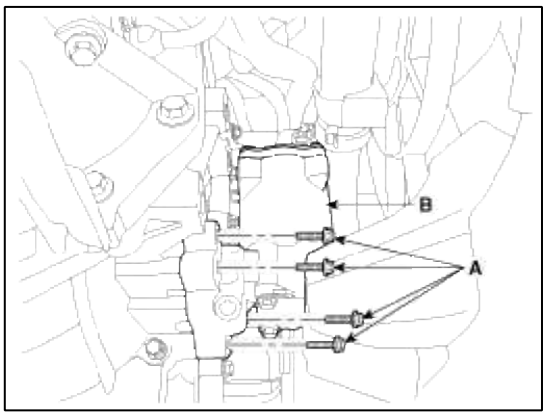


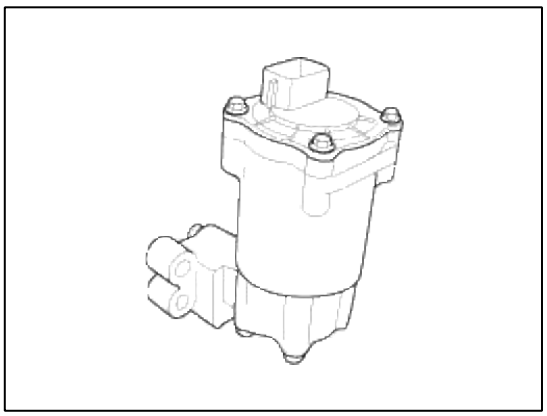
3. Remove the under cover (A) after lifting the vehicle with lift.



4. Remove the Electric Oil Pump (B) after removing the bolts (A-4ea).

Tightening torque:
19.6 ~ 25.5 N.m (2.0 ~ 2.6 kgf.m, 14.4 ~ 18.8 lb-ft)



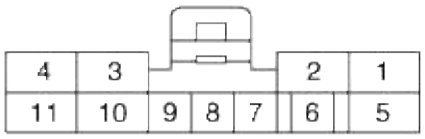


Installation

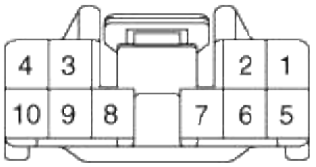
1. Installation is the reverse of removal.

Fuel System > ISG (Idle Stop & Go) System > Oil Pump Unit (OPU) > Schematic Diagrams

Oil Pump Unit (OPU) Connector



[EGGG114-A]



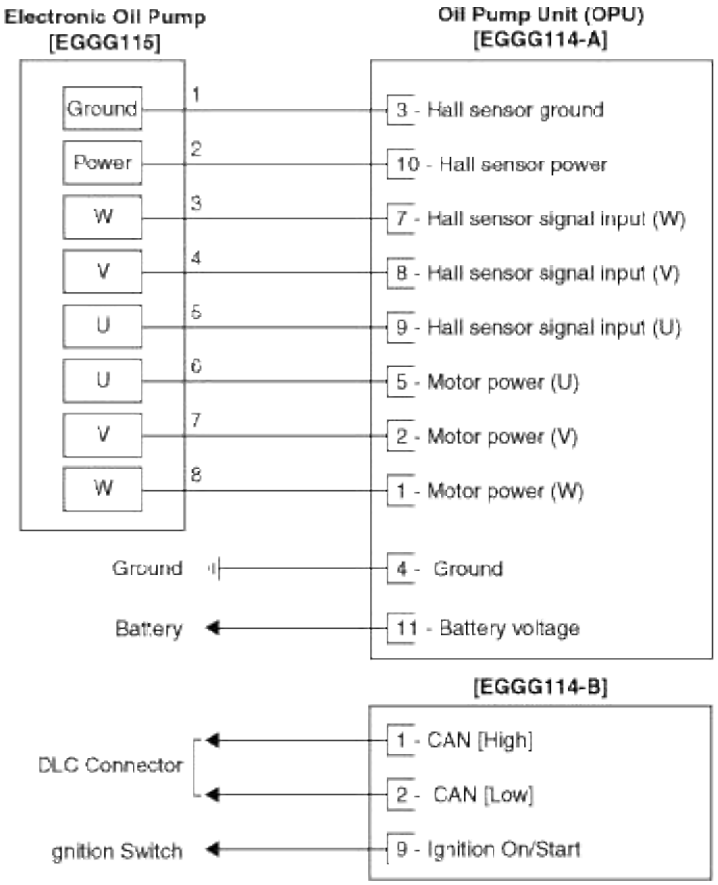
[EGGG114-B]

Opu Connector Terminal Function

EGGG114-A		EGGG114-B	
Pin No.	**Description**	**Pin No.**	**Description**
1	Motor power(W)	1	CAN communication (High)
2	Motor power(V)	2	CAN communication (Low)
3	Hall sensor(Ground)	3	-
4	Ground	4	-
5	Motor power(U)	5	-
6	Shield ground	6	-
7	Hall sensor signal input (W)	7	-
8	Hall sensor signal input (V)	8	-
9	Hall sensor signal input (U)	9	Ignition ON / Start
10	Hall sensor power	10	-
11	Battery voltage		

Circuit diagram

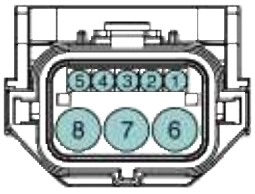
[Circuit Diagram]



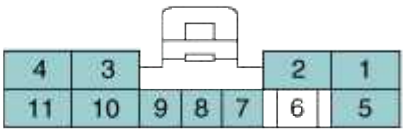
[Connection Information]

Termianl	Connected to	Function
1	OPI CGG68-A (3)	Hall sensor ground
2	OPI CGG68-A (10)	Hall sensor power
3	OPI CGG68-A (7)	Hall sensor signal input (W)
4	OPI CGG68-A (8)	Hall sensor signal input (V)
5	OPI CGG68-A (9)	Hall sensor signal input (U)
6	OPI CGG68-A (5)	Motor power (U)
7	OPI CGG68-A (2)	Motor power (V)
8	OPI CGG68-A (1)	Motor power (W)

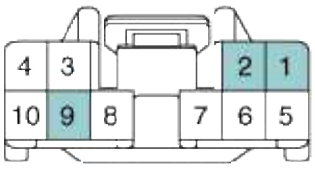
[Harness Connector]



EGGG115
Electronic Oil Pump



EGGG114-A



EGGG114-B
OPU

Fuel System > ISG (Idle Stop & Go) System > Oil Pump Unit (OPU) > Repair procedures

Removal

1. Remove the negative (-) battery terminal.
2. Remove the crash pad lower panel. (Refer to “Crash pad” in BD group.)
3. Remove the oil pump unit connector to the left side of the brake pedal.
4. Remove the oil pump unit (A) after removing the nuts (3ea).

Installation

1. Installation is the reverse of removal.

Inspection

OPU Problem Inspection Procedure

1. TEST OPU GROUND CIRCUIT: Measure resistance between OPU and chassis ground using the backside of OPU harness connector as OPU side check point. If the problem is found, repair it.

   Specification: Below 1Ω

2. TEST OPU CONNECTOR: Disconnect the OPU connector and visually check the ground terminals on OPU side and harness side for bent pins or poor contact pressure. If the problem is found, repair it.
3. If problem is not found in Step 1 and 2, the OPU could be faulty. If so, make sure there were no DTC's before swapping the OPU with a new one, and then check the vehicle again. If DTC's were found, examine this first before swapping OPU.
4. RE-TEST THE ORIGINAL OPU: Install the original OPU (may be broken) into a known-good vehicle and check the vehicle. If the problem occurs again, replace the original OPU with a new one. If problem does not occur, this is intermittent problem (Refer to “Intermittent Problem Inspection Procedure” in Basic Inspection Procedure

   NOTE

   Refer to DTC manual code “P1775, P1777” to inspect oil pump unit.

Fuel System > ISG (Idle Stop & Go) System > Brake Switch > Description and Operation

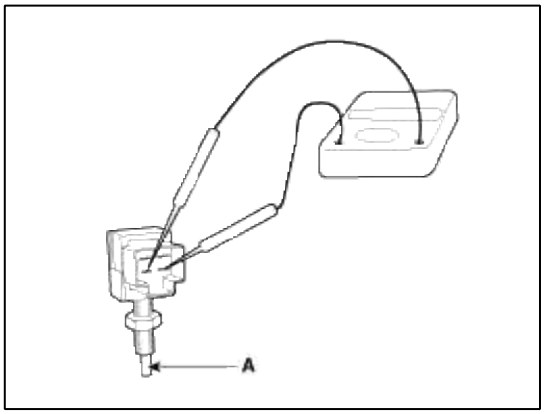
Description

The present brake switch is used as an input variable for the ISG function to detect bracke operation.

Fuel System > ISG (Idle Stop & Go) System > Brake Switch > Repair procedures

Inspection

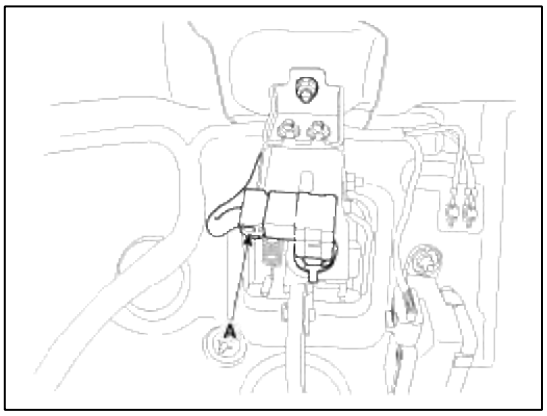
1. Connect a circuit tester to the connector of stop lamp switch, and check whether or not there is continuity when the plunger of the stop lamp switch is pushed in and when it is released.
2. The stop lamp switch is in good condition if there is no continuity when plunger (A) is pushed.



Removal

1. Turn ignition switch OFF.
2. Remove the crash pad lower panel. (Refer to the Body group-"crash pad")

3. Disconnect the stop lamp switch connector (A).



Installation

1. Install is reverse of removal.

Fuel System > ISG (Idle Stop & Go) System > Door Switch > Description and Operation

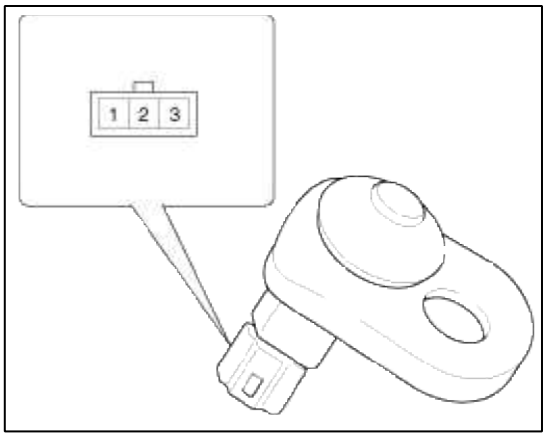
Description

Via the seat belt/Door switch, the ISG function can detect that the driver has fastened the seat belt/door. If the driver has not fastened the seat belt/door, the ISG function reacts as follows. If the seat belt or door is opened, the engine must not be started or stopped by the ISG function for safety reasons.

Fuel System > ISG (Idle Stop & Go) System > Door Switch > Repair procedures

Inspection

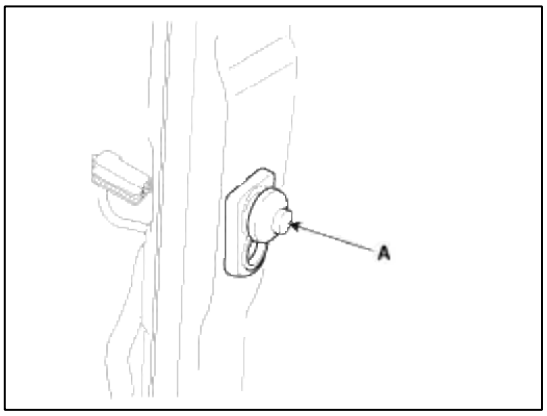
1. Remove the door switch and check for continuity between the terminals.



Terminal / Position	1	2	GND
Free(Door open)	○	○	○
Push(Door close)			

Removal

1. Remove the door switch (A) after loosening the bolt.



Installation

1. Install is reverse of removal.

Fuel System > ISG (Idle Stop & Go) System > Seat Belt Switch > Description and Operation

Description

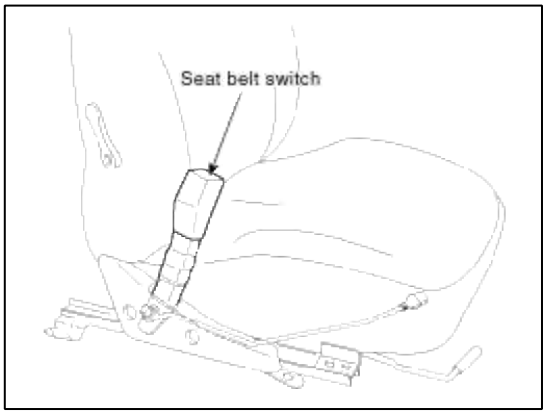
Via the seat belt/Door switch, the ISG function can detect that the driver has fastened the seat belt/door. If the driver has not fastened the seat belt/door, the ISG function reacts as follows. If the seat belt or door is opened, the engine must not be started or stopped by the ISG function for safety reasons.

Fuel System > ISG (Idle Stop & Go) System > Seat Belt Switch > Repair procedures

Inspection

1. Remove the connector from the switch.
2. Check for continuity between terminals.

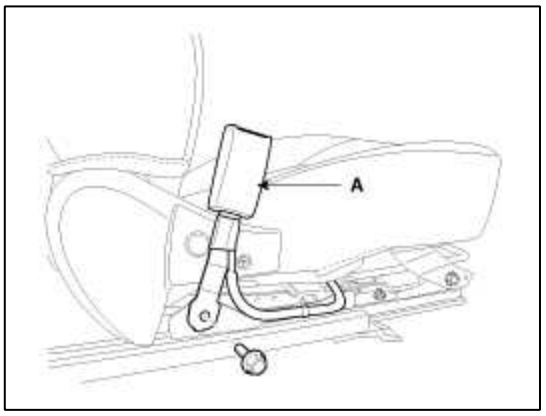
Seat belt condition	Continuity
Fastened	Non-conductive (∞Ω)
Not fastened	Conductive (Ω)



Removal

1. Remove the front seat.

2. After loosening the mounting bolt, then remove the front seat belt buckle (A).



Installation

1. Install is reverse of removal.

Fuel System > ISG (Idle Stop & Go) System > Hood switch > Description and Operation

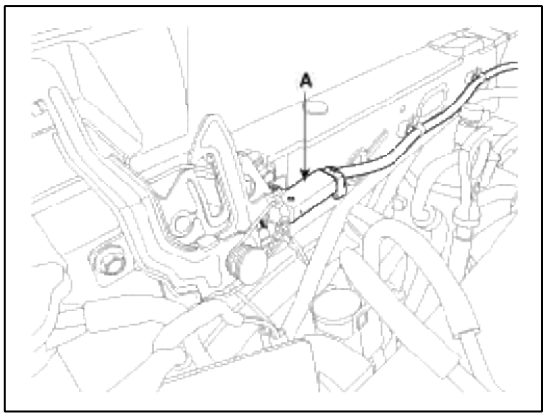
Description

The hood switch is included as the influencing factors in the calculation of the ISG function. If the hood is open, the engine must not be started or stopped by the ISG function for safety reasons.

Fuel System > ISG (Idle Stop & Go) System > Hood switch > Repair procedures

Inspection

1. Disconnect the hood switch connector (A).

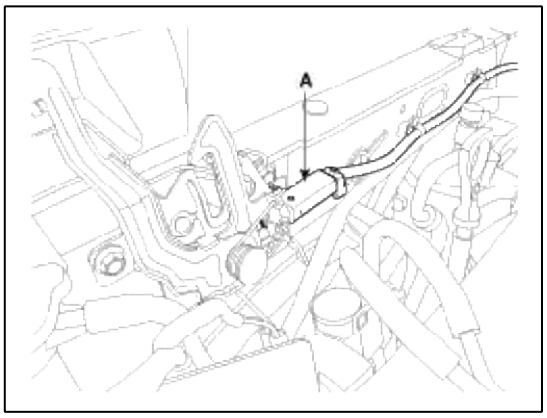


2. Check for continuity between terminals

Terminal / Position	1	2
Hood open (Free)	○	○
Hood close (Push)		

Removal

1. After loosening the mounting bolts and connector, then remove the hood switch (A).

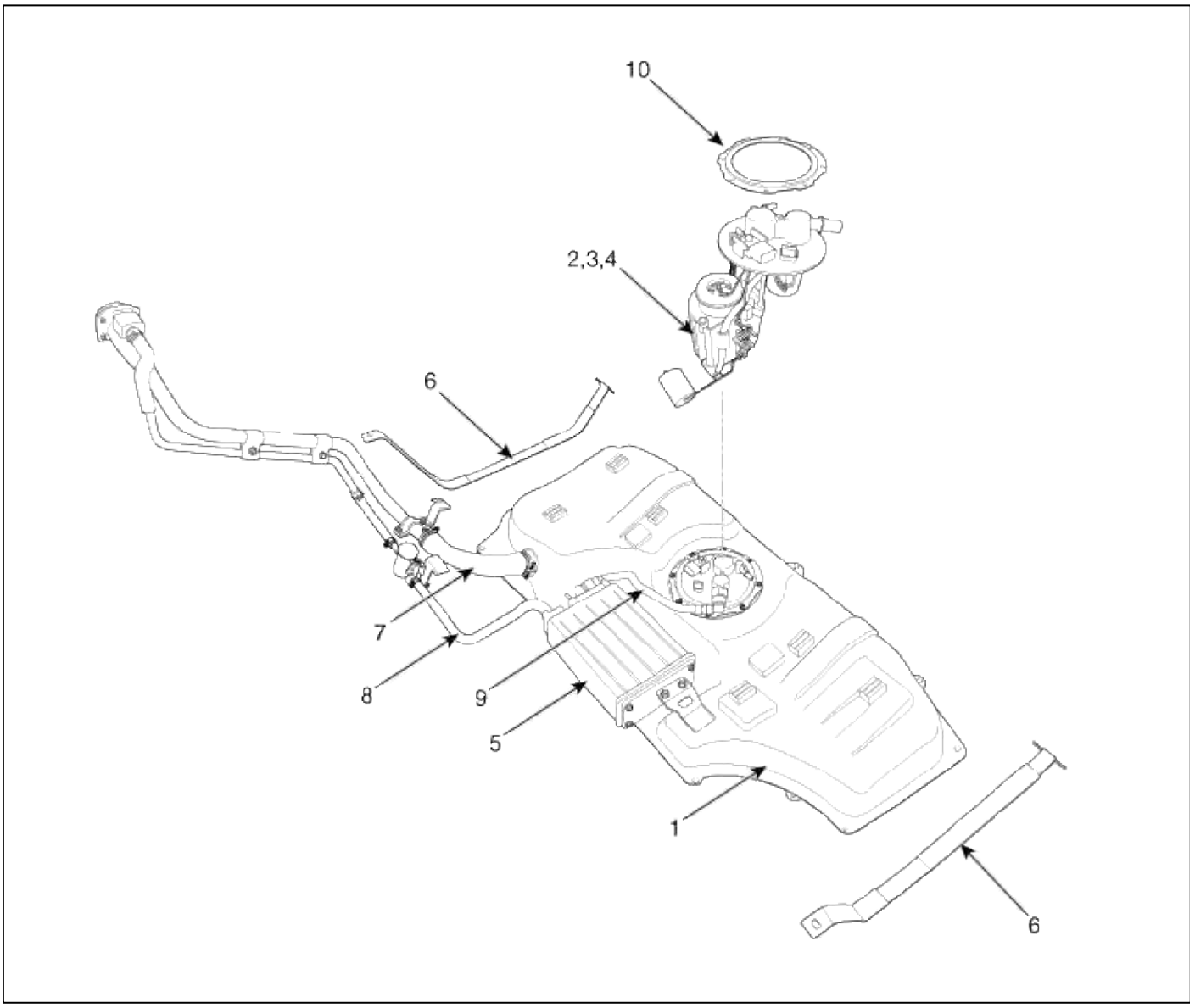


Installation

1. Install is reverse of removal.

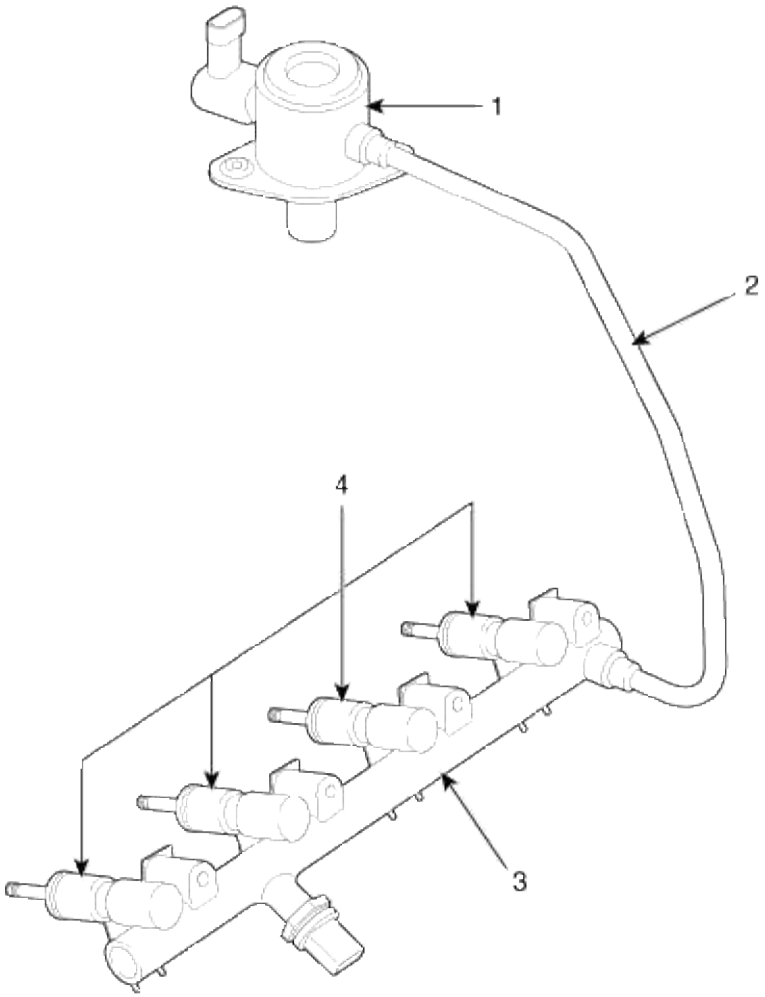
Fuel System > Fuel Delivery System > Components and Components Location

Components Location



1. Fuel Tank 2. Fuel Pump 3. Fuel Filter 4. Fuel Pressure Regulator 5. Canister	6. Fuel Tank Band 7. Fuel Filler Hose 8. Ventilation Hose 9. Vapor Tube 10. Fuel Pump Plate Cover

[High Pressure Fuel Line]



1. High Pressure Fuel Pump 2. High Pressure Fuel Pipe	3. Delivery Pipe 4. Injector

WARNING

In case of removing the high pressure fuel pump, high pressure fuel pipe, delivery pipe, and injector, there may be injury caused by leakage of the high pressure fuel. Before repairing the high pressure system, be sure to release the residual pressure in fuel line as step 2 in below procedure.

Fuel System > Fuel Delivery System > Repair procedures

Fuel Pressure Test

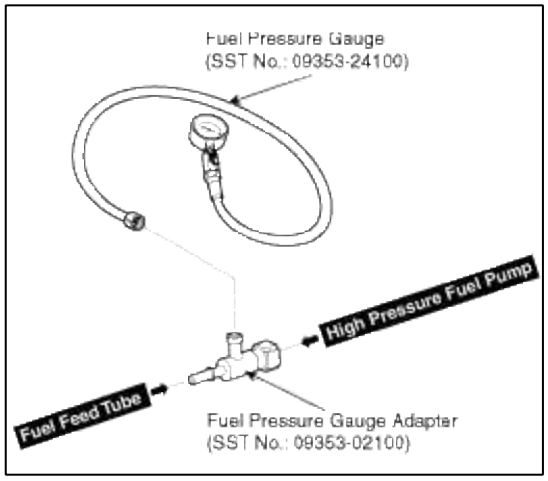
1. Release the residual pressure in fuel line (Refer to “Release Residual Pressure in Fuel Line” in this group).

> CAUTION
>
> When removing the fuel pump relay, a Diagnostic Trouble Code (DTC) may occur. Delete the code with the GDS after completion of “Release Residual Pressure in Fuel Line” work.

2. Install the Special Service Tool (SST).
   (1) Disconnect the fuel feed tube from the delivery pipe.

> CAUTION
>
> There may be some residual pressure even after “Release Residual Pressure in Fuel Line” work, so cover the hose connection with a shop towel to prevent residual fuel from spilling out before disconnecting any fuel connection.

   (2) Install the special service tool for measuring the fuel pressure in between the fuel feed tube and the fuel delivery pipe (Refer to the figure below).



3. Inspect fuel leakage on connections among the fuel feed tube, the delivery pipe, and the SST components with IG ON.
4. Measure Fuel Pressure.

(1) Start the engine and measure the fuel pressure at idle.

Fuel Pressure:
429 ~ 469 kPa (4.38 ~ 4.79 kgf/cm², 62.3 ~ 68.1 psi)

NOTE

If the fuel pressure differs from the standard value, repair or replace the related part (Refer to the table below).

Fuel Pressure	Cause	Related Part
Too Low	Fuel filter clogged	Fuel Filter
	Fuel leakage	Fuel Pressure Regulator
Too High	Fuel pressure regulator valve stuck	Fuel Pressure Regulator

(2) Stop the engine, and then check for the change in the fuel pressure gauge reading.

Standard Value: The gauge reading should hold for about 5 minutes after the engine stops

NOTE

If the gauge reading should not be held, repair or replace the related part (Refer to the table below).

Fuel Pressure (After Engine Stops)	Cause	Related Part
Fuel Pressure Drops Slowly	Leakage on injector	Injector
Fuel Pressure Drops Immediately	Check valve of fuel pump stuck open	Fuel Pump

(3) Turn the ignition switch OFF.

5. Release the residual pressure in fuel line (Refer to “Release Residual Pressure in Fuel Line”).
6. Test End
   (1) Remove the Special Service Tool (SST) from the fuel feed tube and the delivery pipe.
   (2) Connect the fuel feed tube and the delivery pipe.

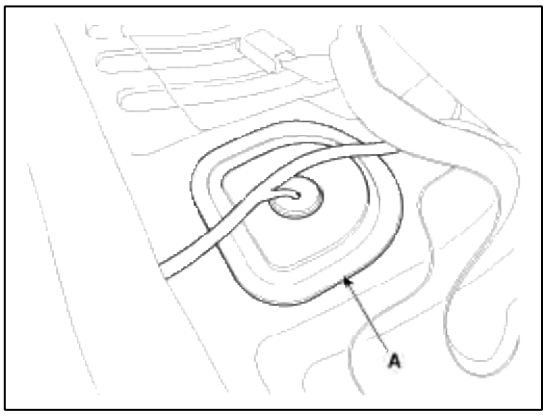
Release Residual Pressure in Fuel Line

CAUTION

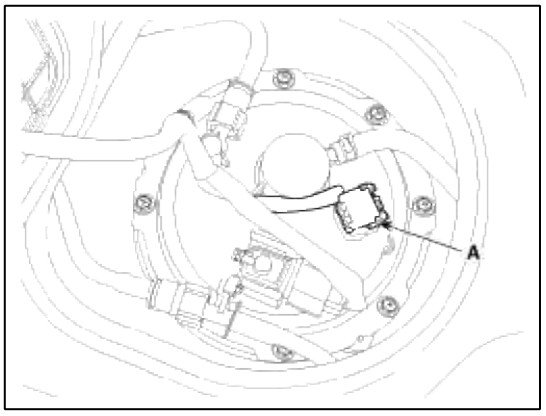
There may be some residual pressure even after “Release Residual Pressure in Fuel Line” work, so cover the hose connection with a shop towel to prevent residual fuel from spilling out before disconnecting any fuel connection.

1. Turn the ignition switch OFF and disconnect the battery (-) cable.
2. Remove the rear seat cushion. (Refer to seat in BD group.)

3. Remove the service cover (A).



4. Disconnect the fuel pump connector (A).

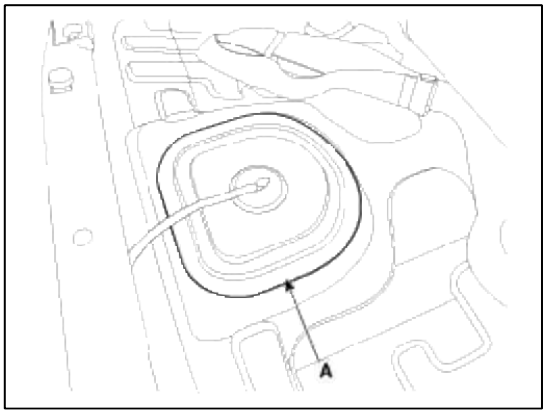


5. Reconnect the battery negative cable.
6. Run the engine for about 1 minutes to lower the pressure in the low pressure line.
7. Turn the engine off.
8. Disconnect the low pressure fuel line quick connector at the High Pressure Pump. Use rags to cover opening and catch spills while removing the fuel line.
9. Start the engine and let it idle until the engine stops. At this point the pressure should be under 30 psi.
10. Proceed with the service or repair. Use rags to cover opening and catch spills when opening up the high pressure system.
11. Reinstall / re-connect all components in reverse order of removal. Start engine and confirm proper operation, and make sure there are no fuel leaks.
12. After completing, clear DTC(s) using GDS scan tool (the procedure described above will cause DTC to set).

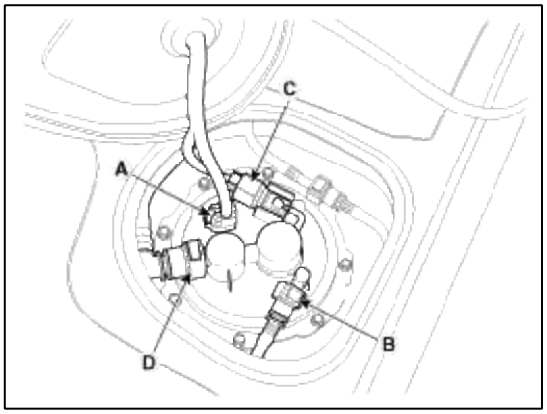
Fuel System > Fuel Delivery System > Fuel Tank > Repair procedures

Removal

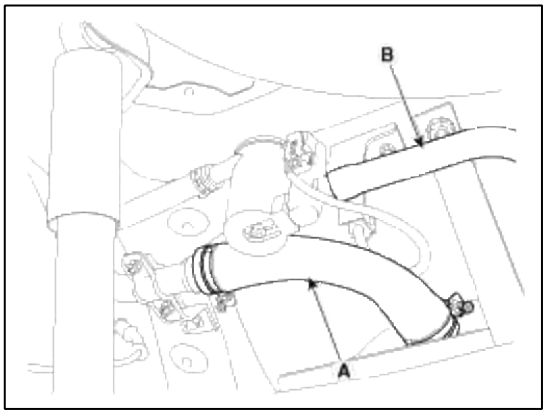
1. Release the residual pressure in fuel line (Refer to “Release Residual Pressure in Fuel Line” in this group).
2. Remove the rear seat [LH] (Refer to “Seat” in BD group).
3. Remove the fuel pump service cover (A).



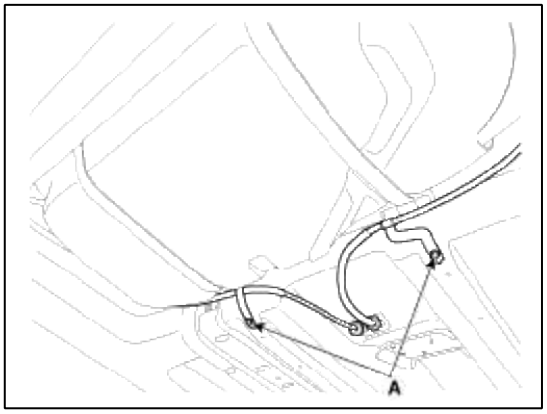
4. Disconnect the fuel pump connector (A).
5. Disconnect the fuel feed tube quick connector (B).
6. Disconnect the fuel tank pressure sensor connector (C).
7. Disconnect the vapor tube (D).



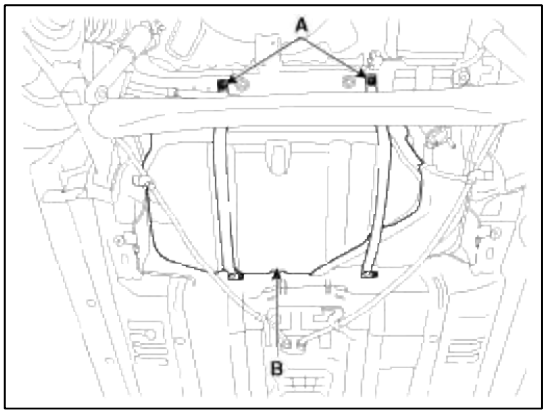
8. Lift the vehicle and support the fuel tank with a jack.
9. Remove the center muffler assembly (Refer to “Intake And Exhaust System” in EM group).
10. Disconnect the fuel filler hose (A) and the vapor hose (B).



11. Remove the parking brake line installation bolt (A).



12. Remove the fuel tank from the vehicle after removing the fuel tank band (A).



Installation

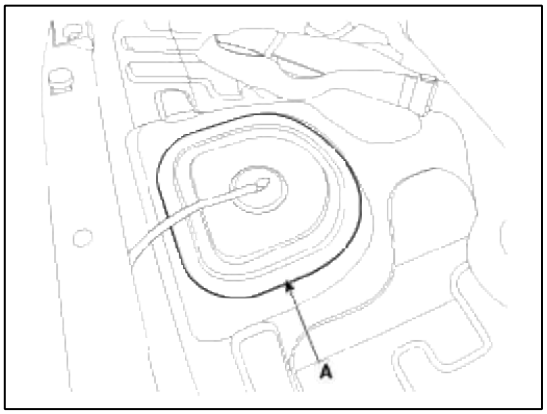
1. Installation is reverse of removal.

Fuel tank band installation nut:
39.2 ~ 54.0 N.m (4.0 ~ 5.5 kgf.m, 28.9 ~ 39.8 lb-ft)

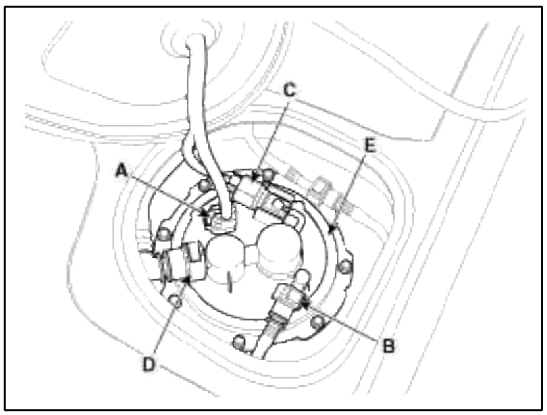
Fuel System > Fuel Delivery System > Fuel Pump > Repair procedures

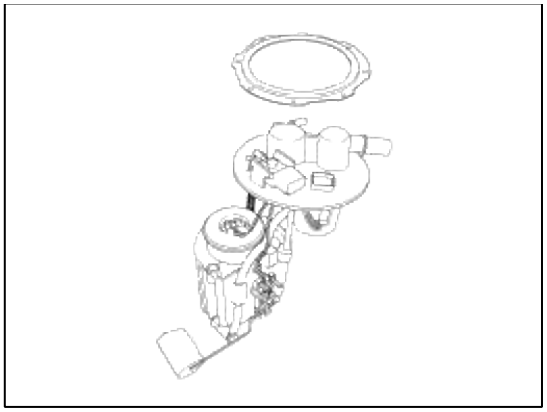
Removal

1. Release the residual pressure in fuel line (Refer to “Release Residual Pressure in Fuel Line” in this group).
2. Remove the rear seat [LH] (Refer to “Seat” in BD group).
3. Remove the fuel pump service cover (A).



4. Disconnect the fuel pump connector (A).
5. Disconnect the fuel feed tube quick connector (B).
6. Disconnect the fuel tank pressure sensor connector (C).
7. Disconnect the vapor tube quick-connector (D).
8. Remove the plate cover (E) after removing the installation bolts, and then remove the fuel pump from the fuel tank.





Installation

1. Installation is reverse of removal.

Fuel pump plate cover installation bolt :
1.96 ~ 2.94 N.m (0.2 ~ 0.3 kgf.m, 1.44 ~ 2.17 lb-ft)

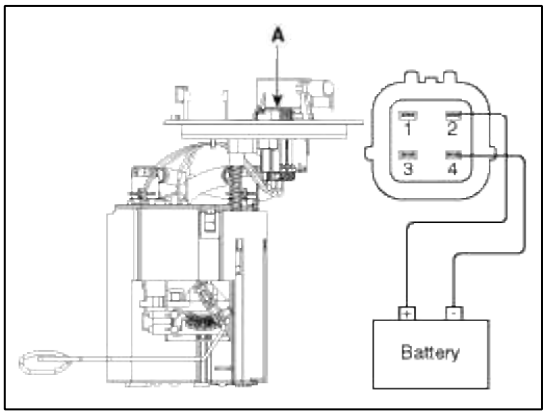
CAUTION

Be careful of fuel pump direction when installing.

Inspection

[Fuel pump]

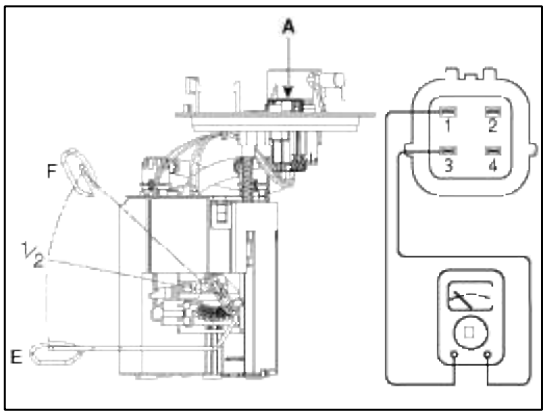
1. Turn ignition switch OFF and disconnect the negative (-)battery cable.
2. Remove the fuel pump assembly.
3. Check motor operation by fuel pump connector (A) connecting power(No.2) and ground(No.4)



Pin No.	discription
1	Fuel sender signal
2	Fuel pump (+)
3	Fuel sender ground
4	Fuel pump (-)

[Fuel sender]

1. Using an ohmmeter, measure the resistance between terminals 1 and 3 of sender connector (A) at each float level.



Pin No.	discription
1	Fuel sender signal
2	Fuel pump (+)
3	Fuel sender ground
4	Fuel pump (-)

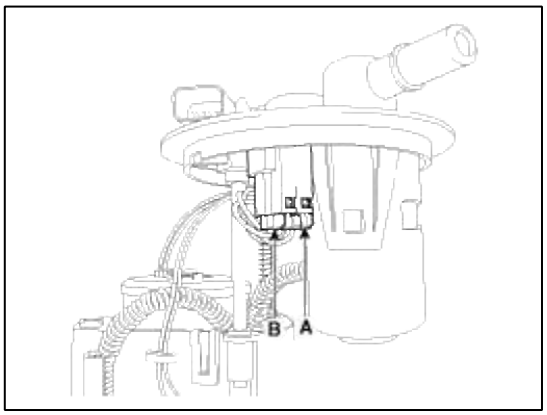
2. Also check that the resistance changes smoothly when the float is moved from "E" to "F".

Position	Resistance (Ω)	Capacity (ℓ)
E	197 ~ 203	2.8
1/2	64.2 ~ 68.2	22.3
F	6 ~ 10	41.8

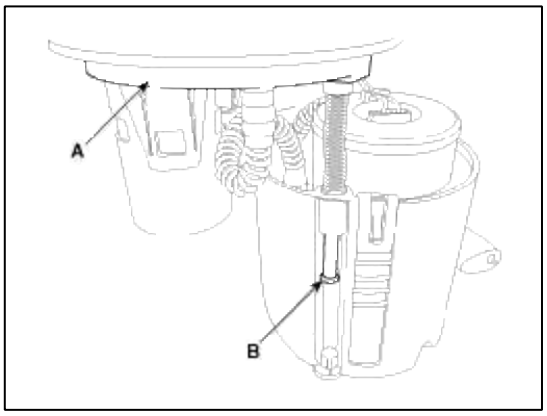
Fuel System > Fuel Delivery System > Fuel Filter > Repair procedures

Replacement

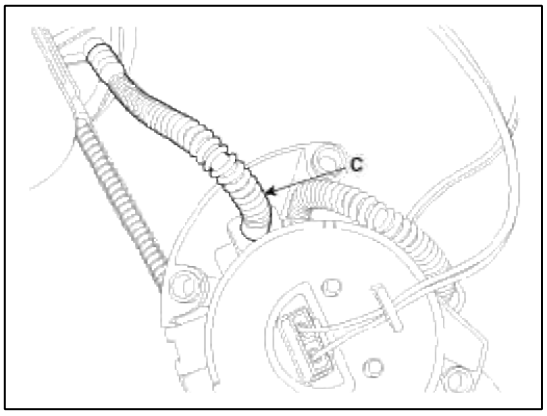
1. Remove the fuel pump (Refer to “Fuel Pump” in this group).
2. Disconnect the electric pump wiring connector (A) and the fuel sender connector (B).



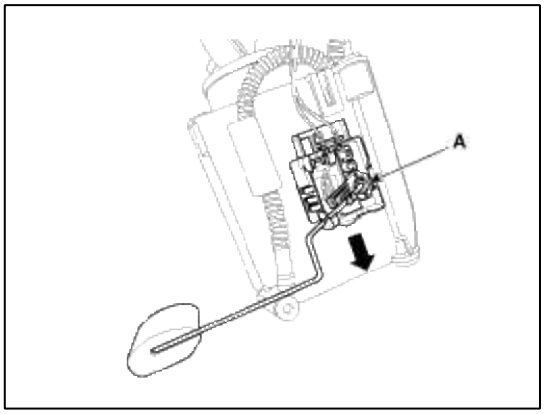
3. Remove the head assembly (A) after releasing the cushion fixing clip (B).



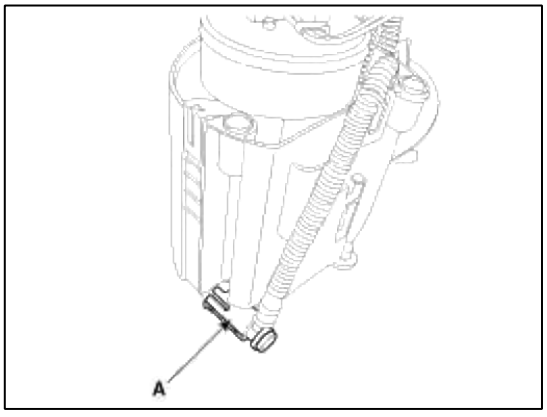
4. Disconnect the fuel tube quick-connectors (C).



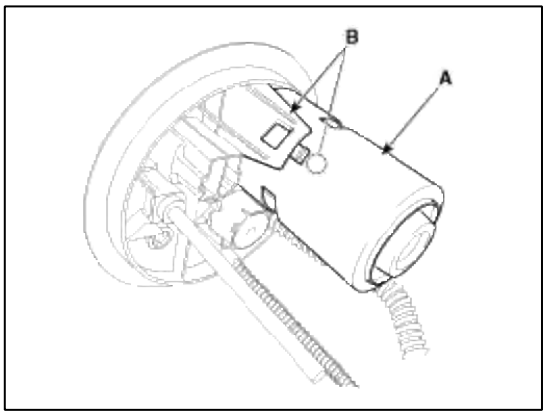
5. Remove the fuel sender (A) in the direction of an arrow.



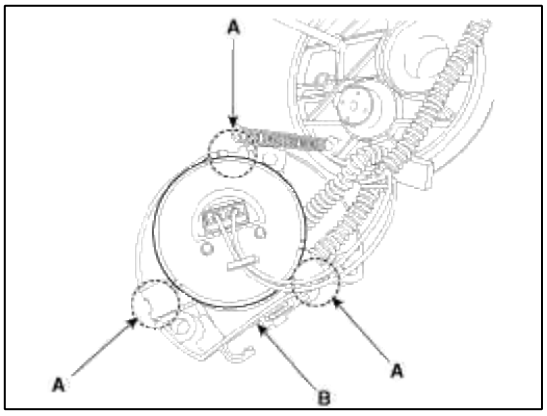
6. Disconnect the fuel tube connector (A).



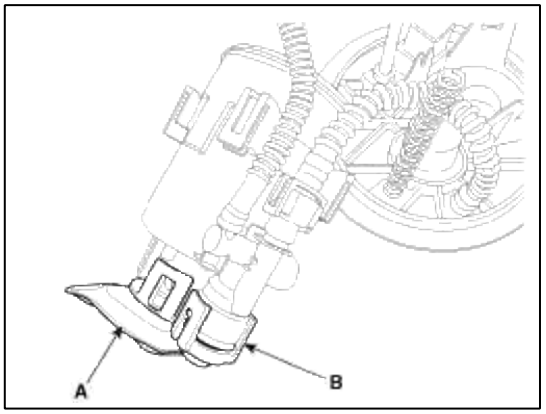
7. Remove the cut valve (A) after releasing hooks (B).



8. Remove the reservior-cup (B) after releasing the fixing hooks (A).



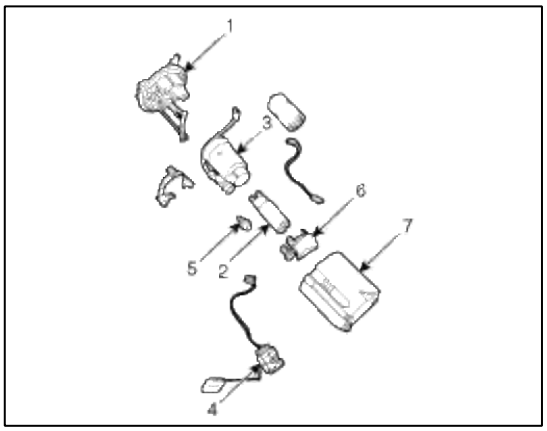
9. Release the fixing hooks, and then remove the pre-filter (A) and the fuel pressure regulator (B).



CAUTION

Be careful of O-ring.

10. Replace new fuel filter.

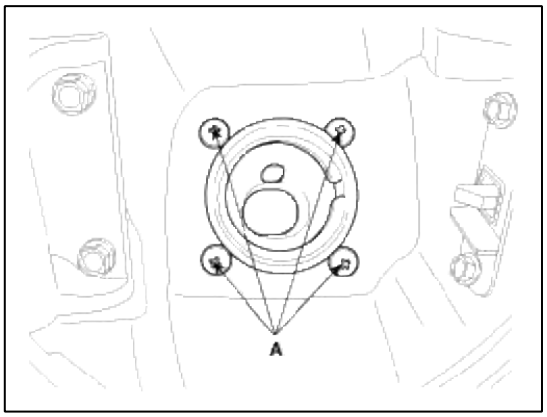


1. Head Assembly
2. Electric Pump Motor
3. Fuel Filter
4. Fuel Sender
5. Fuel Pressure Regulator
6. Pre-filter
7. Reservoir cup

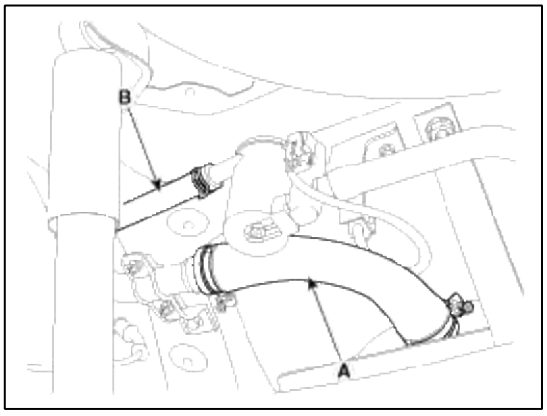
Fuel System > Fuel Delivery System > Filler-Neck Assembly > Repair procedures

Removal

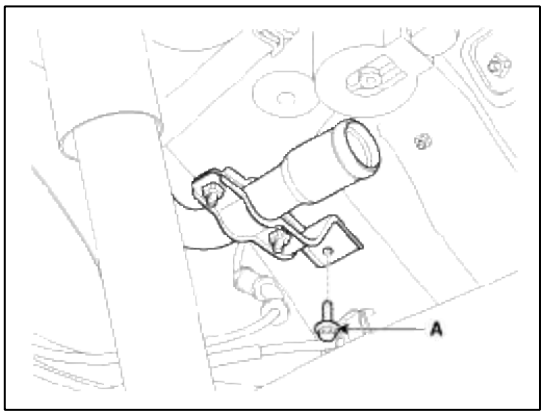
1. Open the fuel filler door, and then remove the filler-neck assembly mounting screws (A).



2. Disconnect the fuel filler hose (A) and the vapor hose (B).



3. Remove the filler-neck assembly from the vehicle after removing the bracket mounting bolt (A).



Installation

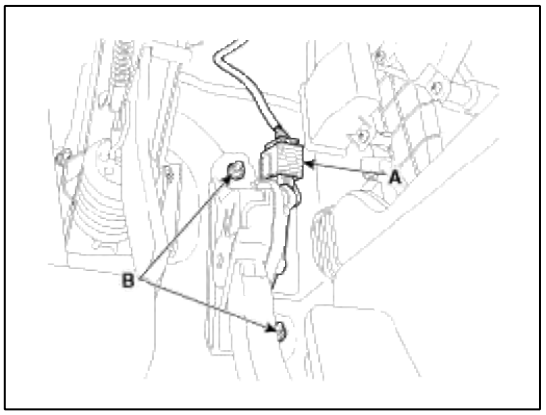
1. Installation is reverse of removal.

Filler-neck assembly bracket installation nut :
7.8 ~ 11.8 N.m (0.8 ~ 1.2 kgf.m, 5.8 ~ 8.7 lb-ft)
Filler-neck assembly installation screw :
7.8 ~ 11.8 N.m (0.8 ~ 1.2 kgf.m, 5.8 ~ 8.7 lb-ft)

Fuel System > Fuel Delivery System > Accelerator Pedal > Repair procedures

Removal

1. Turn the ignition switch OFF and disconnect the negative (-) battery cable.
2. Disconnect the accelerator position sensor connector (A).
3. Remove the installation nuts (B), and then remove the accelerator pedal module.



Installation

1. Installation is reverse of removal.

Accelerator pedal module installation nut:
12.7 ~ 15.7 N.m (1.3 ~ 1.6 kgf.m, 9.4 ~ 11.6 lb-ft)

Fuel System > Fuel Delivery System > Delivery Pipe > Repair procedures

Removal

WARNING

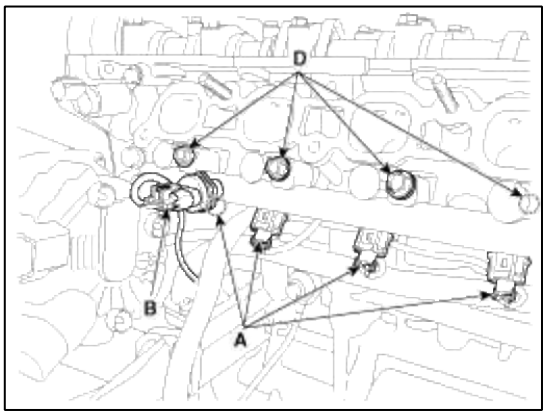
In case of removing the high pressure fuel pump, high pressure fuel pipe, delivery pipe, and injector, there may be injury caused by leakage of the high pressure fuel. Before repairing the high pressure system, be sure to release the residual pressure in fuel line as step 2 in below procedure.

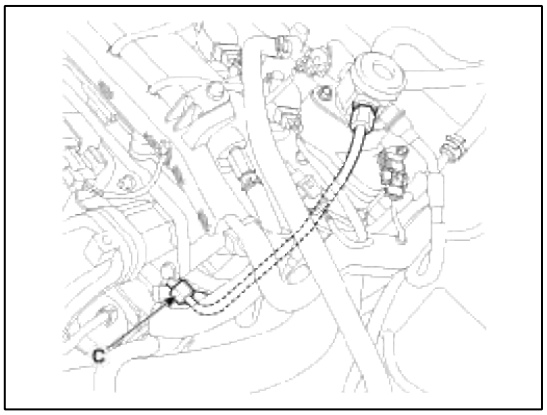
1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Release the residual pressure in fuel line (Refer to “Release Residual Pressure in Fuel Line” in this group).

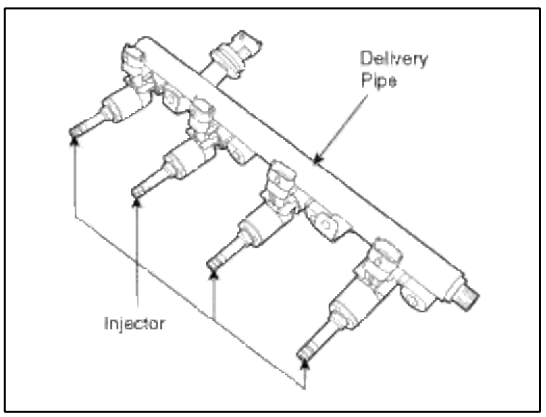
CAUTION

When removing the fuel pump relay, a Diagnostic Trouble Code (DTC) may occur. Delete the code with the GDS after completion of “Release Residual Pressure in Fuel Line” work.

3. Remove the intake manifold (Refer to "Intake And Exhaust System" in EM group).
4. Disconnect the injector connectors (A) and the rail pressure sensor connector (B).
5. Remove the high pressure fuel pipe (C).
6. Remove the engine oil gauge.
7. Remove the installation bolt (D), and then remove the delivery pipe and injector assembly from the engine.







Installation

CAUTION

- Do not use already used injector fixing clip again.

CAUTION

Do not reuse the support disc.
Do not reuse the injector rubber washer.
Do not reuse the combustion seal.

CAUTION

- Install the component with the specified torques.
- Note that internal damage may occur when the component is dropped. In this case, use it after inspecting.

CAUTION

- Apply engine oil to the injector O-ring.
- Do not use already used injector O-ring again.

CAUTION

- Do not use already used bolt again.

CAUTION

- When insert the injector, be careful not to damage the injector tip.

1. Installation is reverse of removal.

Delivery pipe installation bolt:
18.6 ~ 23.5 N.m (1.9 ~ 2.4 kgf.m, 13.7 ~ 17.4 lb-ft)
High pressure fuel pipe installation nut:
26.5 ~ 32.4 N.m (2.7 ~ 3.3 kgf.m, 19.5 ~ 23.9 lb-ft)

Fuel System > Fuel Delivery System > High Pressure Fuel Pump > Repair procedures

Removal

WARNING

In case of removing the high pressure fuel pump, high pressure fuel pipe, delivery pipe, and injector, there may be injury caused by leakage of the high pressure fuel. Before repairing the high pressure system, be sure to release the residual pressure in fuel line as step 2 in below procedure.

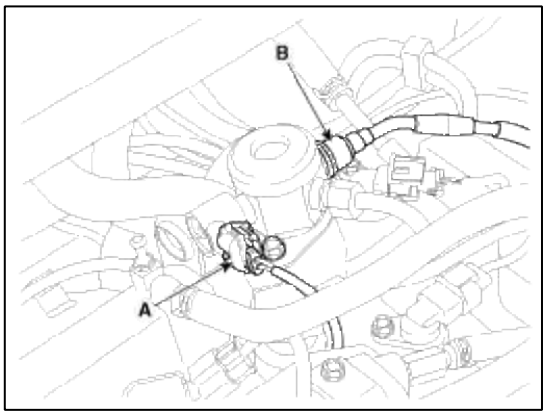
1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Release the residual pressure in fuel line (Refer to “Release Residual Pressure in Fuel Line” in this group).

CAUTION

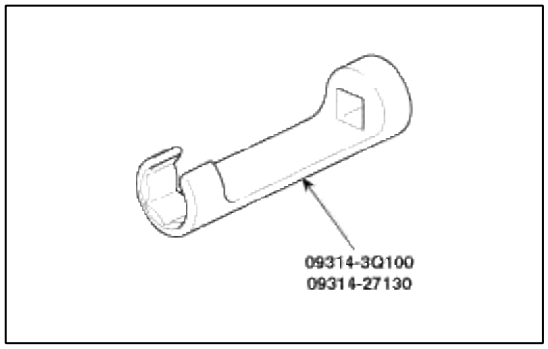
When removing the fuel pump relay, a Diagnostic Trouble Code (DTC) may occur.
Delete the code with the GDS after completion of “Release Residual Pressure in Fuel Line” work.

3. Remove the air cleaner and the air intake hose (Refer to “Intake And Exhaust System” in EM group).
4. Disconnect the fuel pressure regulator valve connector (A).

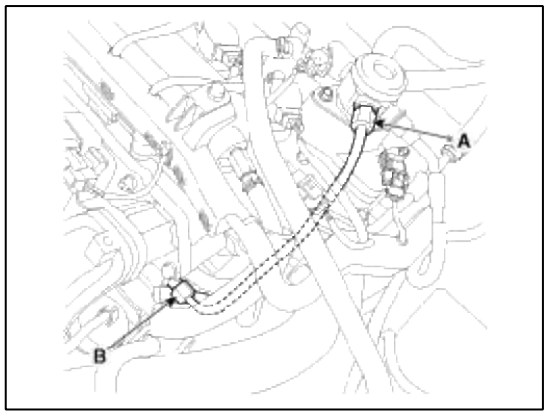
5. Disconnect the fuel feed tube quick-connector (B).



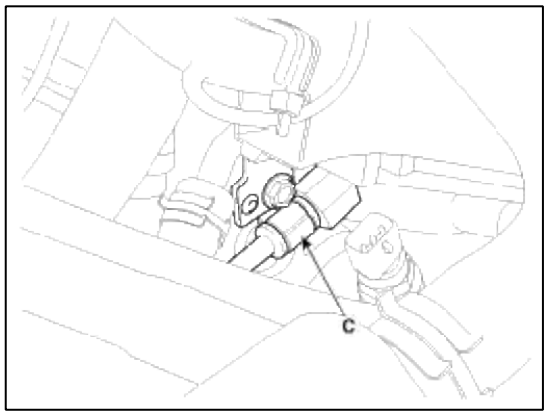
6. Remove the high pressure fuel pipe.
   (1) Remove the installation nut (A) from the high pressure fuel pump with the special service tool [SST No.: 09314-3Q100 or 09314-27130]



   (2) Remove the installation nut (B) from the delivery pipe with the special service tool [SST No.: 09314-3Q100 or 09314-27130]



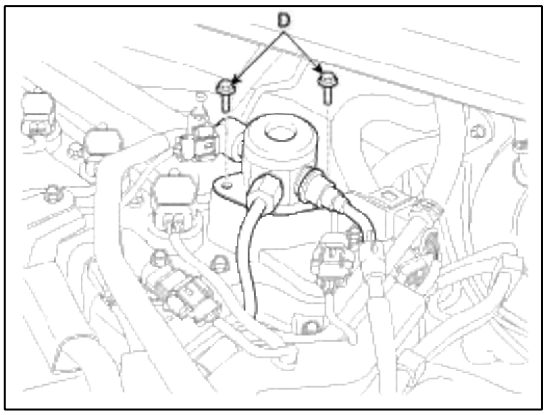
   (3) Disconnect the engine coolant temperature sensor connector.
   (4) Remove the function block (C), and then remove the high pressure fuel pipe.



7. Remove the installation bolts (D), and then remove the high pressure fuel pump from the cylinder head assembly.

CAUTION

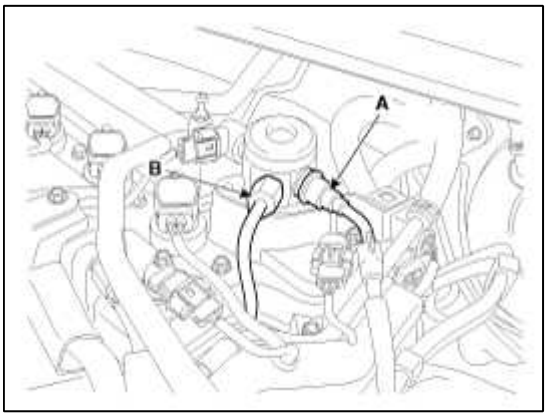
Unscrew in turn the two bolts in small step (0.5 turns). In case of fully unscrewing one of the two bolts with the other bolt installed, the housing surface of the cylinder head may be broken because of tension of the pump spring.



Installation

WARNING

- Be sure to check the low pressure fuel hose quick-connector (A) is completely connected to the high pressure fuel pump until a confirmation 'click' sound is heard.
- Be sure to re-check the low pressure fuel hose is completely connected to the high pressure fuel pump by pulling it after connecting.
- Be sure to install the high pressure fuel pipe (B) with the specified torques.
- Because fuel leak may cause fire, securely Inspect leakage of all fuel line connection parts at engine start condition.



CAUTION

- Before installing the high pressure fuel pump, position the roller tappet in the lowest position by rotating the crankshaft. Otherwise the installation bolts may be broken because of tension of the pump spring.

CAUTION

- Be careful to be free from foreign materials when assembling.

CAUTION

- Do not reuse the used bolt.

CAUTION

- Do not reuse the used high pressure fuel pipe.

CAUTION

- When tightening the installation bolts of the high pressure fuel pump, tighten in turn the bolts in small step (0.5 turns) after tightening them with hand-screwed torque.

CAUTION

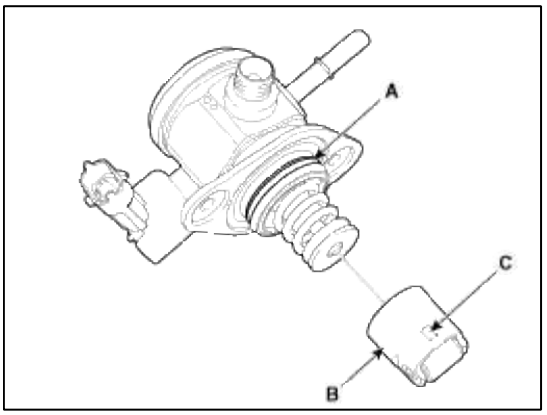
- Install the component with the specified torques.
- First hand-tighten the fasteners fully until they are not fastened any more in orderto have them inserted in place and then completely tighten to the specified torque using a torque wrench.
  If not tightening the bolts or nuts in a straight line with the mating bolt holes or fittings, it may cause a fuelleak due to broken threads.

CAUTION

- Note that internal damage may occur when the component is dropped. In this case, use it after inspecting.

CAUTION

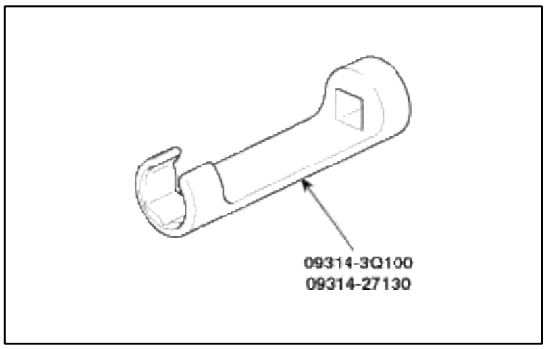
- Apply engine oil to the O-ring (A) of the high pressure fuel pump, the roller tappet (B), and the protrusion (C). Also apply engine oil to the groove on the location where the protrusion (C) is installed.



1. Installation is reverse of removal.

NOTE

Use the special service tool [SST No.: 09314-3Q100 or 09314-27130] to install the high pressure fuel pipe.



High pressure fuel pump installation bolt:
12.8 ~ 14.7 N.m (1.3 ~ 1.5 kgf.m, 9.4 ~ 10.9 lb-ft)
High pressure fuel pipe installation nut:
26.5 ~ 32.4 N.m (2.7 ~ 3.3 kgf.m, 19.5 ~ 23.9 lb-ft)
High pressure fuel pipe function block installation bolt: 9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)

RIO(UB) > 2012 > G 1.6 GDI > Heating,Ventilation, Air Conditioning

Heating,Ventilation, Air Conditioning > General Information > Specifications

Specification

Air Conditioner

Item		Specification
Compressor	Type	DVE12 (Externally Controlled Variable Swash Plate Type)
	Oil type & Capacity	PAG OIL, 120±10 cc
	Displacement	122 cc/rev
Condenser	Heat Rejection	11,900 - 3% kcal/h
Expansion valve	Type	Block type
Refrigerant	Type	R-134a
	Capacity	420 ± 25 g (14.8 ± 0.88 oz.)

Blower Unit

Item		Specification
Intake	Control Type	Actuator
Blower	Type	Sirocco
	Speed Step	FATC: Auto or 1~8 speed, MANUAL: 1~4 speed
	Speed Control	FATC: Power mosfet, MANUAL: Blower resistor
Air filter	Type	Particle filter

Heater And Evaporator Unit

Item		Specification
Heater	Type	Pin & Tube type
	Heating Capacity	4,650 - 5% kcal/hr
	Mode Control Type	Actuator
	Temperature Control Type	Actuator
Evaporator	Cooling Capacity	4,500 - 5% kcal/hr
	Temperature Control Type	Evaporator temperature sensor
	A/C ON/OFF	ON: 0 ± 0.3°C (32.0 ± 0.5°F) OFF: -2.0 ± 0.3°C (28.4 ± 0.5°F)

Tightening Torques

Items	N.m	kgf.m	lb-ft
Compressor	19.6 ~ 33.3	2.0 ~ 3.4	14.5 ~ 24.6
Condenser - Discharge hose	4.9 ~ 5.9	0.5 ~ 0.6	3.6 ~ 4.3
Condenser - Liquid tube			
Compressor - Discharge hose	4.9 ~ 5.9	0.5 ~ 0.6	3.6 ~ 4.3
Compressor - Suction hose			
Expansion valve - Evaporator	11.8 ~ 14.7	1.2 ~ 1.5	8.7 ~ 10.9

Heating,Ventilation, Air Conditioning > General Information > Special Service Tools

Special Service Tools

Tool (Number and name)	Illustration	Use
09977-25100 Disc & hub assembly bolt remover		Removal and installation of disc & hub assembly.

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 relay
	3. Blower motor
	4. Blower resistor, Power mosfet or PWM blower module
	5. Blower speed control switch or knob
	6. Wire harness

No air temperature control	1. Engine coolant capacity
	2. Heater control assembly
	3. Temperature control actuator or cable
No compressor operation	1. Refrigerant capacity
	2. A/C Fuse
	3. Compressor
	4. A/C pressure transducer
	5. A/C switch
	6. Evaporator temperature sensor
	7. Wire harness
	8. High CAN
No cool comes out	1. Refrigerant capacity
	2. Refrigerant pressure
	3. Drive belt
	4. Compressor
	5. A/C pressure transducer
	6. Evaporator temperature sensor
	7. A/C switch
	8. Heater control assembly
	9. Wire harness
	10. High CAN
	11. Temperature control actuator or cable
Insufficient cooling	1. Refrigerant capacity
	2. Drive belt
	3. Compressor
	4. Condenser
	5. Expansion valve
	6. Evaporator
	7. Refrigerant lines
	8. A/C pressure transducer
	9. Heater control assembly
	10. High CAN
No engine idle-up when A/C switch ON	1. Engine ECM
	2. Wire harness
No air inlet control	1. Heater control assembly
	2. Intake actuator

No mode control	1. Heater control assembly
	2. Mode control actuator or cable
No cooling fan operation	1. Cooling fan fuse
	2. Fan motor
	3. Blower resistor, Power mosfet or PWM blower module
	4. Engine ECM
	5. Wire harness

Heating,Ventilation, Air Conditioning > Air Conditioning System > General Safety Information and Caution

Instructions

When Handling Refrigerant

1. R-134a liquid refrigerant is highly volatile. A drop on the skin of your hand could result in localized frostbite. When handling the refrigerant, be sure to wear gloves.
2. It is standard practice to wear goggles or glasses to protect your eyes, and gloves to protect your hands. If the refrigerant splashes into your eyes, wash them with clean water immediately.
3. The R-134a container is highly pressurized. Never leave it in a hot place, and check storage temperature is below 52°C (126°F).
4. An electronic leak detector should be used to check the system for refrigerant leakage. Bear in mind that the R-134a, upon coming into contact with flame, produces phosgene, a highly toxic gas.
5. Use only recommended lubricant for R-134a systems. If lubricants other than the recommended one used, system failure may occur.
6. PAG lubricant absorbs moisture from the atmosphere at a rapid rate, therefore the following precautions must be observed :
   A. When removing refrigerant components from a vehicle, cap the components immediately to prevent entry of moisture.
   B. When installing refrigerant components to a vehicle, do not remove the cap until just before connecting the components.
   C. Complete the connection of all refrigerant tubes and hoses without delay to prevent the A/C system from taking on moisture.
   D. Use the recommended lubricant from a sealed container only.
7. If an accidental discharge in the system occurs, ventilate the work area before resume of service.

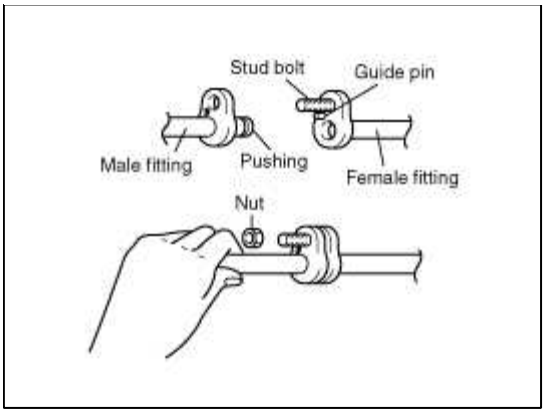
When Replacing Parts On A/C System

1. Never open or loosen a connection before discharging the system.
2. Seal the open fittings of components with a cap or plug immediately to prevent intrusion of moisture or dust.
3. Do not remove the sealing caps from a replacement component until it is ready to be installed.
4. Before connecting an open fitting, always install a new sealing ring. Coat the fitting and seal with refrigerant oil before making the connection.

When Installing Connecting Parts

Flange With Guide Pin

Check the new O-ring for damage (use only the specified) and lubricate by using compressor oil. Tighten the nut to specified torque.



Handling Tubing And Fittings

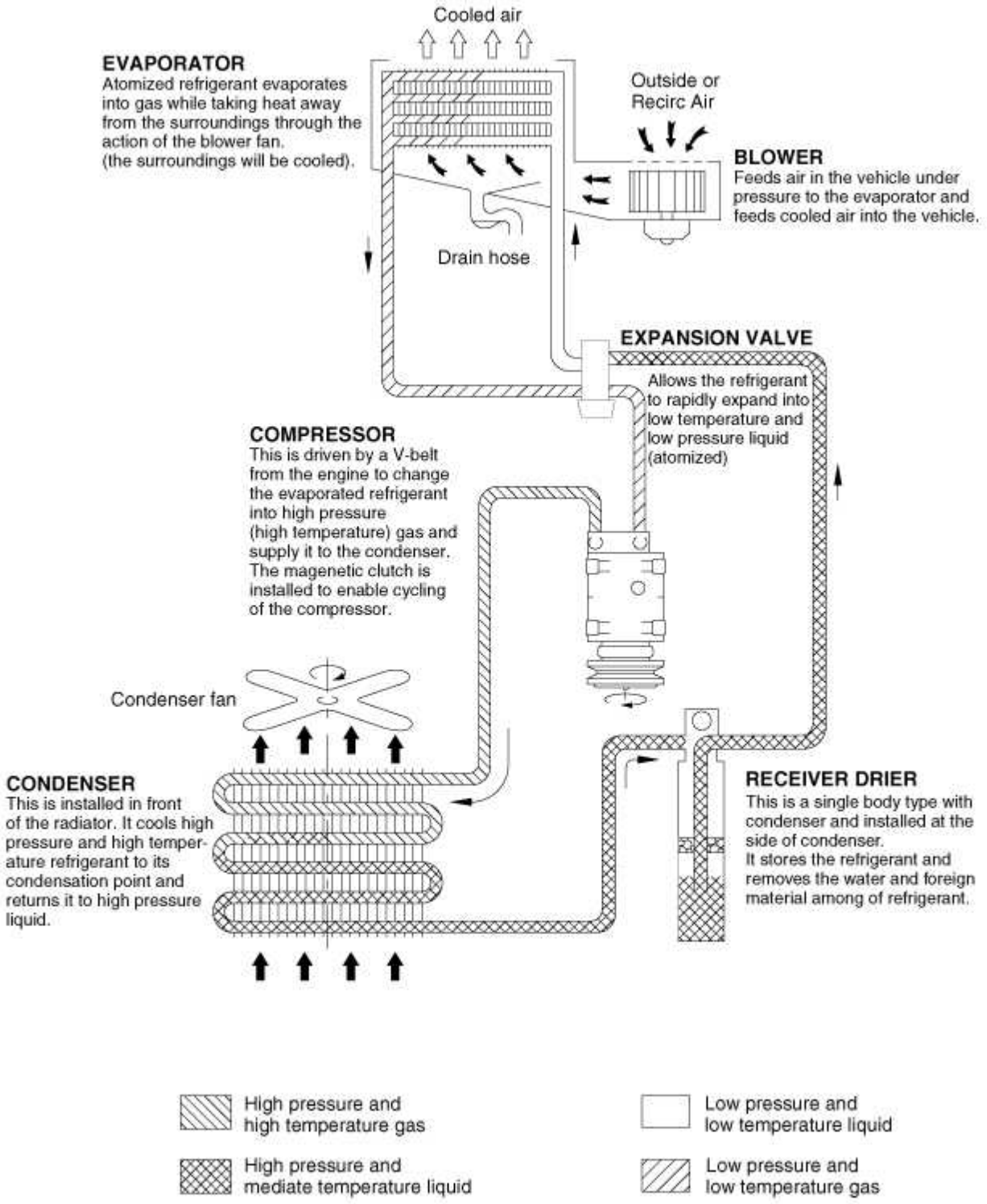
The internal parts of the refrigeration system will remain in a state of chemical stability as long as pure moisture-free refrigerant and refrigerant oil are used. Abnormal amounts of dirt, moisture or air can upset the chemical stability and cause problems or serious damage.

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

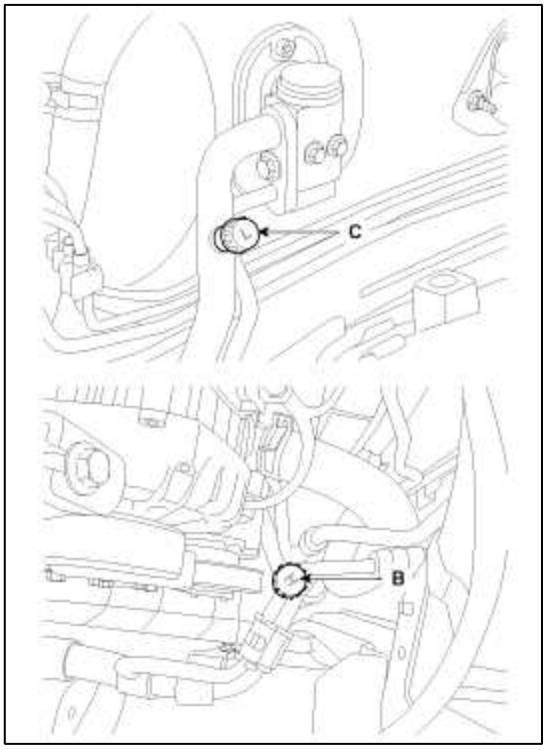
Use only service equipment that is U.L-listed and is certified to meet the requirements of SAE J2210 to remove HFC-134a (R-134a) from the air conditioning system.

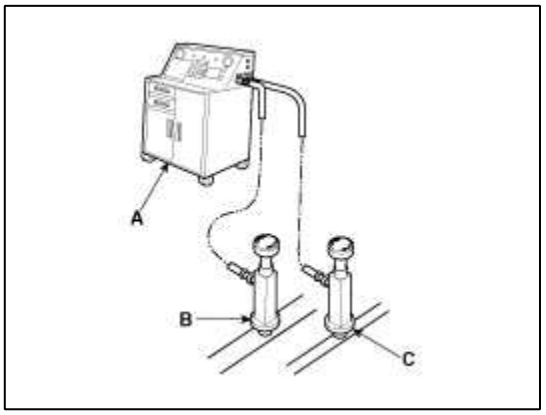
CAUTION

- 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.

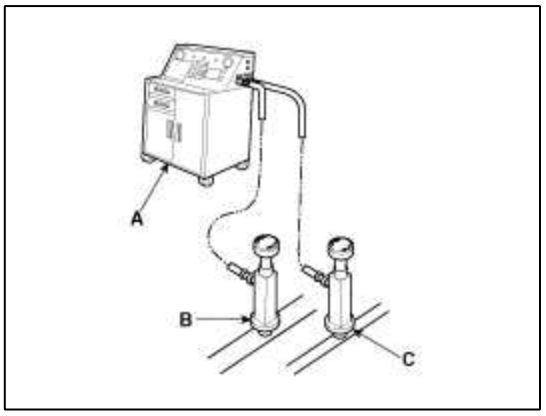
CAUTION

- 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 “Refrigerant 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.

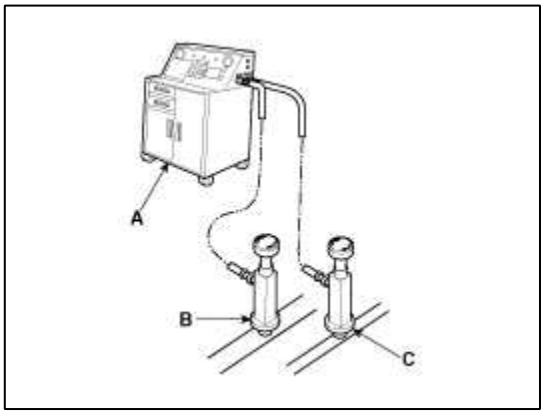
CAUTION

- 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 420 ± 25g (14.8 ± 0.88 oz.) of R-134a refrigerant. Do not overcharge the system the compressor will be damaged.

Refrigerant Leak Test

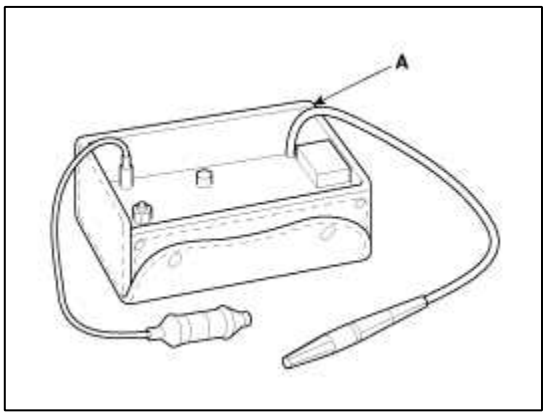
Always conduct a leak test with an electronic leak detector whenever leakage or refrigerant is suspected and when conducting service operations which are accompanied by disassembly or loosening or connection fittings.

NOTE

In order to use the leak detector properly, read the manual supplied by the manufacturer.

If a gas leak is detected, proceed as follows :

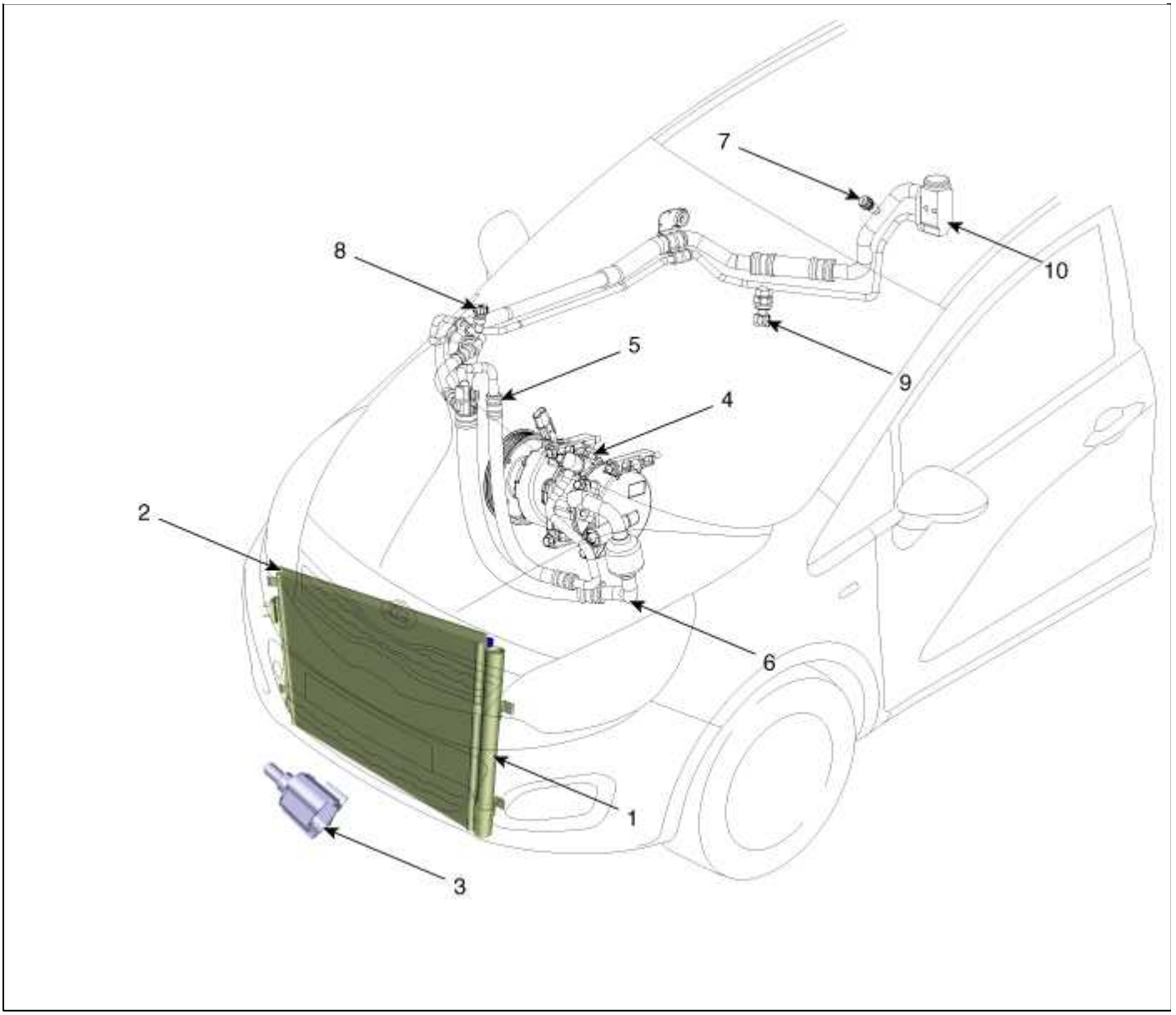
1. Check the torque on the connection fittings and, if too loose, tighten to the proper torque. Check for gas leakage with a leak detector (A).
2. If leakage continues even after the fitting has been tightened, discharge the refrigerant from the system, disconnect the fittings, and check their seating faces for damage. Always replace, even if the damage is slight.
3. Check the compressor oil and add oil if required.
4. Charge the system and recheck for gas leaks. If no leaks are found, evacuate and charge the system again.



Heating,Ventilation, Air Conditioning > Air Conditioning System > Components and Components Location

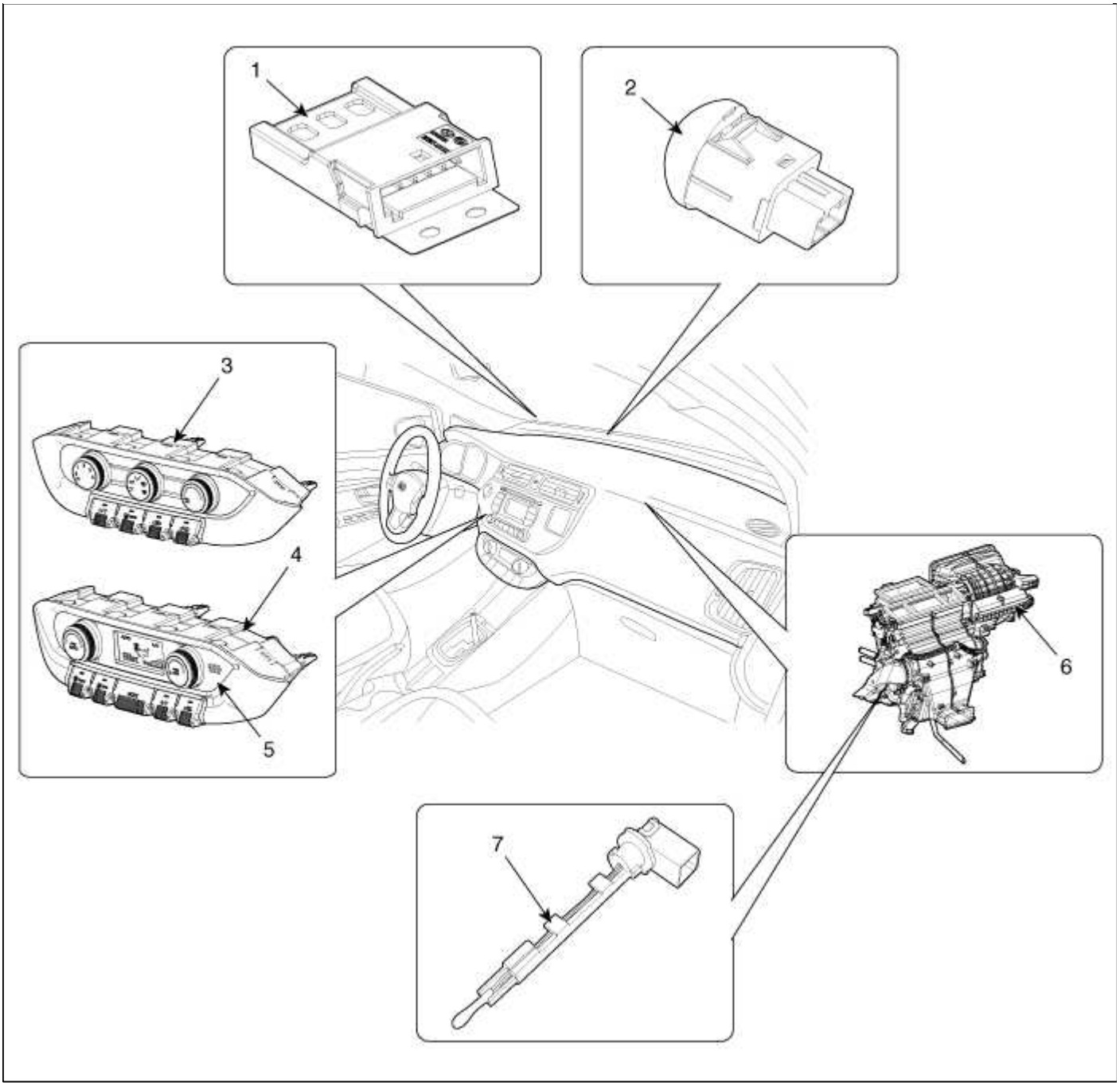
Component Location Index

Engine Room



1. Receiver Drier 2. Condenser 3. Ambient Temperature Sensor 4. Compressor 5. Discharge Hose	6. Suction & Liquid Tube Assembly 7. Service Port (Low Pressure) 8. Service Port (High Pressure) 9. A/C Pressure Transducer (APT) 10. Expansion Valve

Interior



1. Auto Defogging Sensor 2. Photo Sensor 3. Heater & A/C controller (MANUAL) 4. Heater & A/C controller (FATC)	5. In-car Sensor 6. Heater & Blower Unit 7. Evaporator Temperature Sensor

Heating,Ventilation, Air Conditioning > Air Conditioning System > Compressor Oil > Repair procedures

Oil Specification

1. The HFC-134a system requires synthetic compressor oil (PAG) whereas the R-12 system requires mineral compressor oil. The two oils must never be mixed.
2. Compressor oil (PAG) 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.

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.

4. Evacuate air in refrigeration system and charge system with refrigerant.

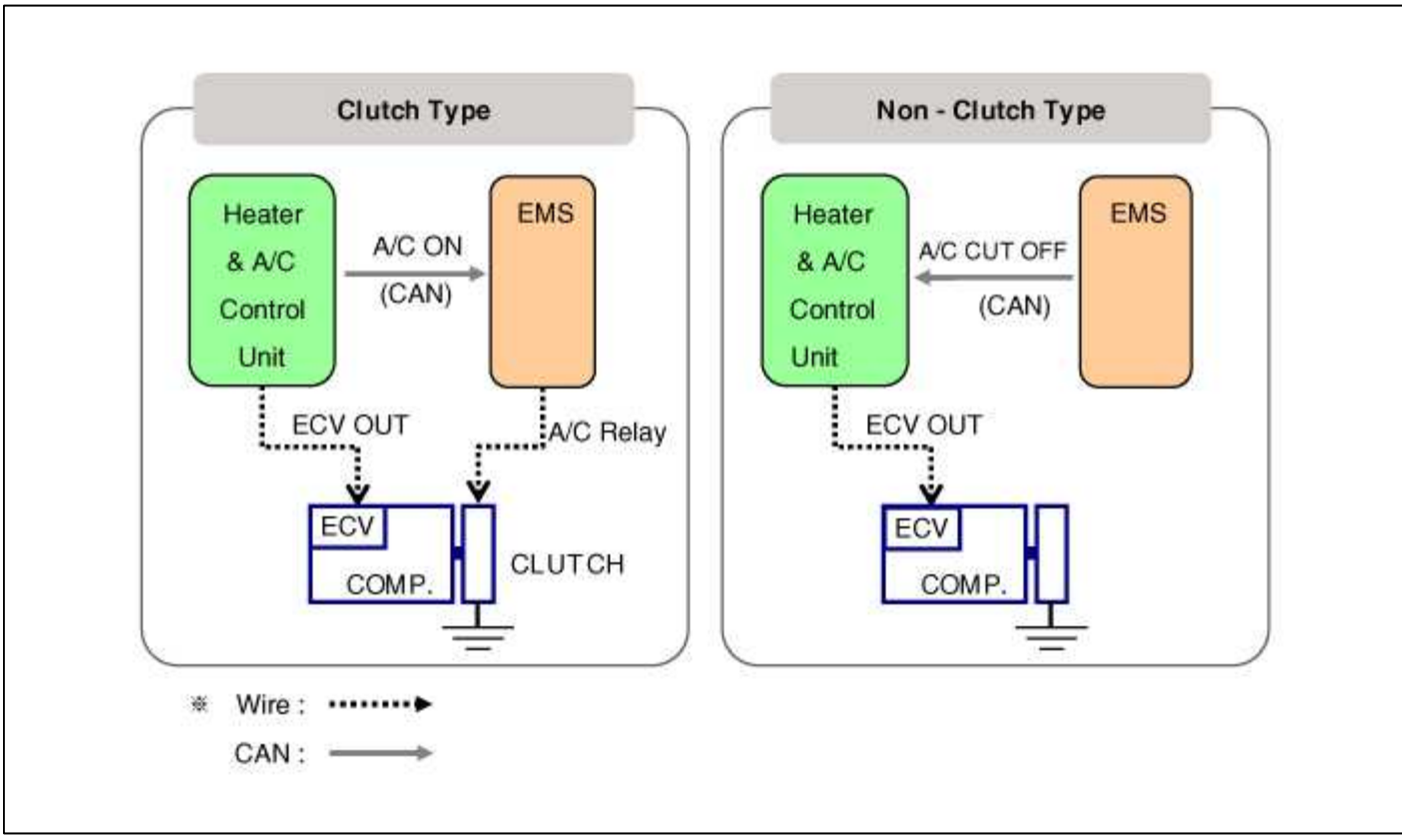
   Specified amount : 420 ± 25 g (14.8 ± 0.88 oz.)

5. Inspect for leakage of refrigerant.
   Using a gas leak detector, check for leakage of refrigerant.
6. Inspect A/C operation.

Heating,Ventilation, Air Conditioning > Air Conditioning System > Compressor > Description and Operation

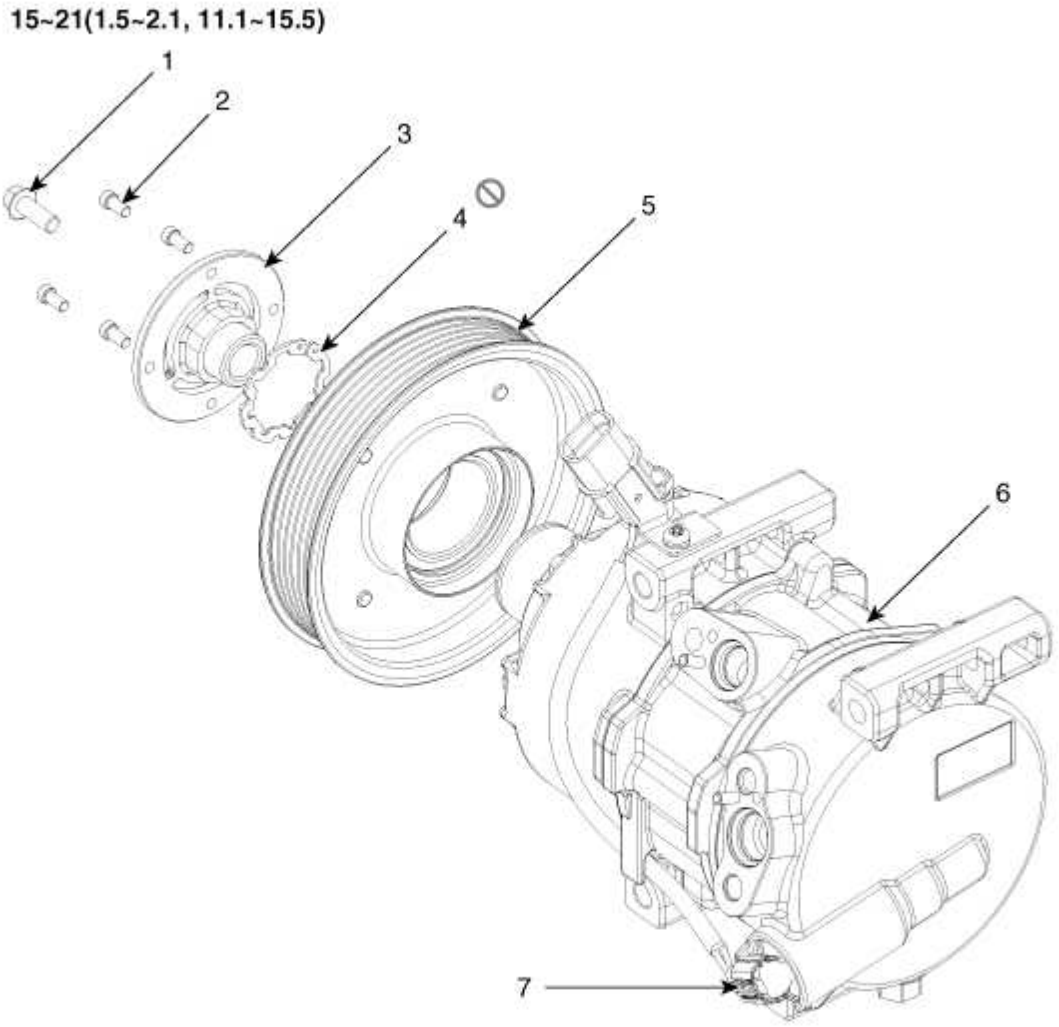
Description

The compressor is the power unit of the A/C system.
It is located on the side of engine block and driven by a V-belt of engine.
The compressor changes the low pressure and low temperature refrigerant gas into the high pressure and high temperature refrigerant gas.
Variable Swash Plate Compressor
The compressor has a swash plate that rotates to reciprocate pistons, which compress refrigerant.
The variable swash plate compressor controls the swash plate angle to change the refrigerant displacement. It achieves precise cooling capability control in accordance with vehicle interior and driving conditions.
The internally controlled variable swash plate compressor changes the swash plate angle by a MCV (Mechanical Control Valve) in accordance with fluctuation of a suction pressure.
The externally controlled variable swash plate compressor changes the swash plate angle by an ECV (Electric Control Valve) in accordance with an electrical signal from the heater & A/C control unit.
This enables stable temperature control and improved driving feeling.
ECV control diagram



Heating,Ventilation, Air Conditioning > Air Conditioning System > Compressor > Components and Components Location

Components



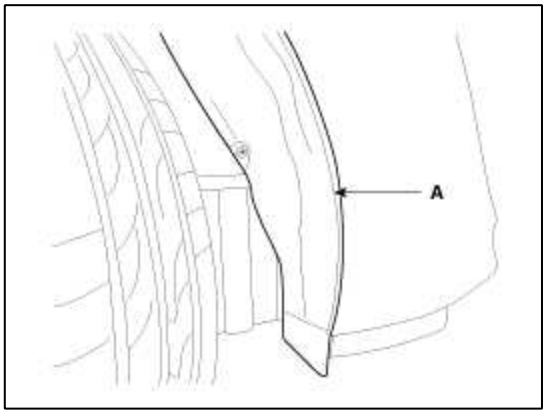
1. Center Bolt 2. Hub Bolt 3. Hub Assembly 4. Snap Ring	5. Pulley 6. Compressor Assembly 7. Electric Control Valve (ECV)

Heating,Ventilation, Air Conditioning > Air Conditioning System > Compressor > Repair procedures

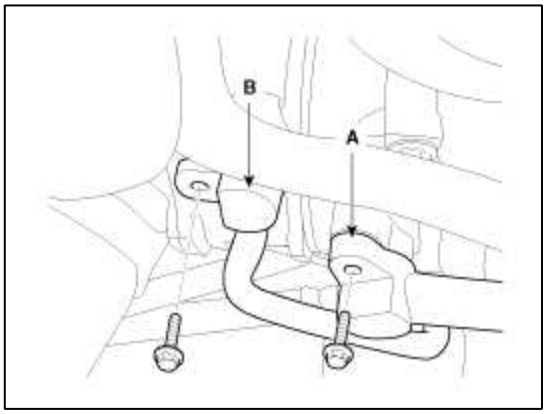
Removal

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. Remove the RH front tire.
   (Refer to SS group - “Front Tire”)
5. Remove the engine room RH side under cover.
   (Refer to EM group - “Engine and Transaxle Assembly”)
6. Separate the front portion of the front wheel guard (A) from the wheel house.



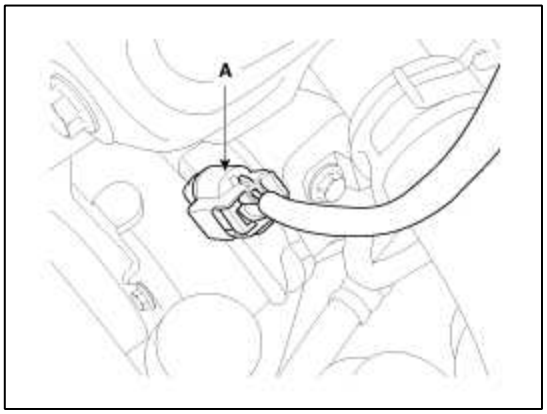
7. Loosen the drive belt.
   (Refer to EM group - “Timing Chain”)
8. Disconnect the suction line (A) and discharge line (B) from the compressor.



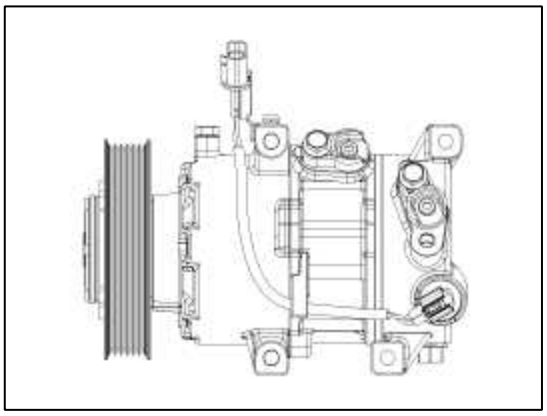
NOTE

Plug or cap the lines immediately after disconnecting them to avoid moisture and dust contamination.

9. Disconnect the compressor switch connector (A).



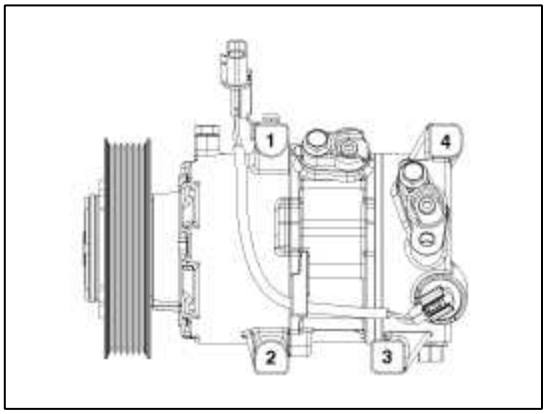
10. Remove the compressor by loosening the mounting bolts.



Installation

1. Make sure of the length of compressor mounting bolts, and then tighten it with the specified tightening order.

Tightening torque :
22~33 N.m (2.04~3.36 kgf.m, 14.8~24.3 lb-ft)

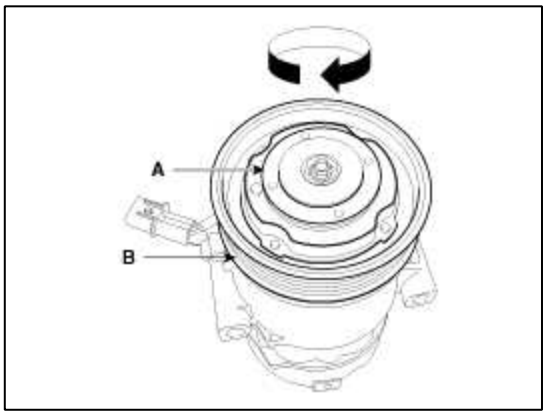


2. Installation is the reverse order of removal.
   A. If you install a new compressor, drain all the refrigerant oil from the removed compressor and measure its volume. Subtract the volume of drained oil from the original compressor oil capacity (120 cc). The result is the amount of oil you should drain 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.

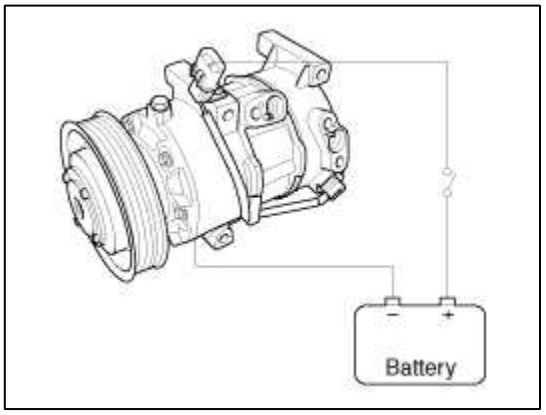
Inspection

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.

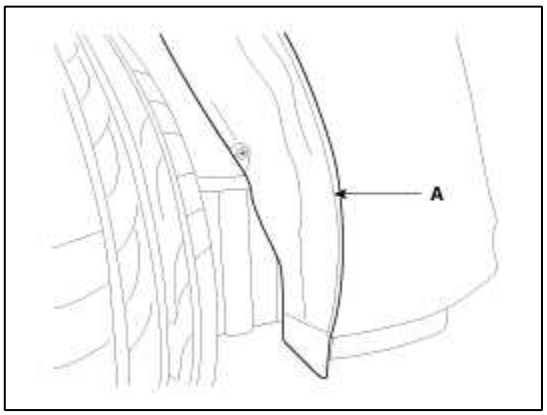


3. Check operation of the magnetic clutch.
   Connect the compressor side terminals to the battery (+) terminal and the ground battery (-) terminal to the compressor body. Check the magnetic clutch operating noise to determine the condition.



Disassembly

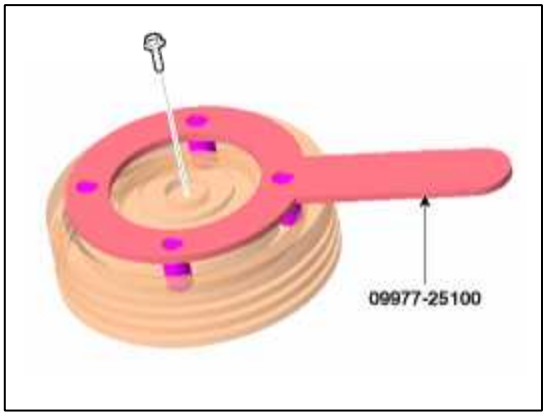
1. Remove the RH front tire.
   (Refer to SS group - “Front Tire”)
2. Remove the engine room RH side under cover.
   (Refer to EM group - “Engine and Transaxle Assembly”)
3. Separate the front portion of the front wheel guard (A) from the wheel house.



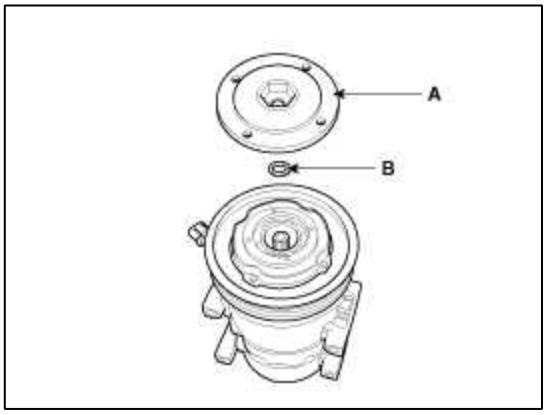
4. Loosen the drive belt.
   (Refer to EM group - “Timing Chain”)

5. Remove the center bolt (A) and the hub bolts (B) while holding the pulley with a disc & hub assembly bolt remover (09977-25100).

Tightening torque :
15~21 N.m (1.5~2.1 kgf.m, 11.1~15.5 lb-ft)



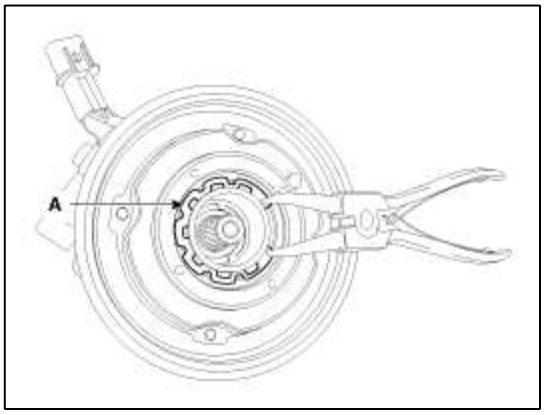
6. Remove the hub assembly (A) and shim (gap washer) (B), taking care not to lose the shim.

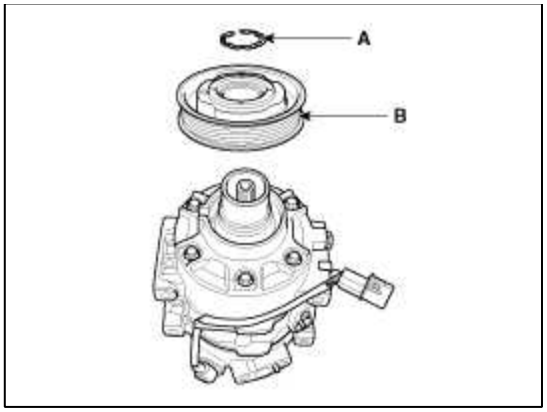


7. Remove the pulley (B) after removing the snap ring (A) with snap ring pliers.

NOTE

- Be careful not to damage the pulley and compressor during disassembly/reassembly.
- Once snap ring is removed, replace it with a new one.





8. Reassembly is the reverse order of disassembly.

NOTE

- Clean the pulley and compressor sliding surfaces with non-petroleum solvent.
- Install new snap ring, and make sure they are fully seated in the groove.
- Make sure that the pulley turns smoothly after reassembly.

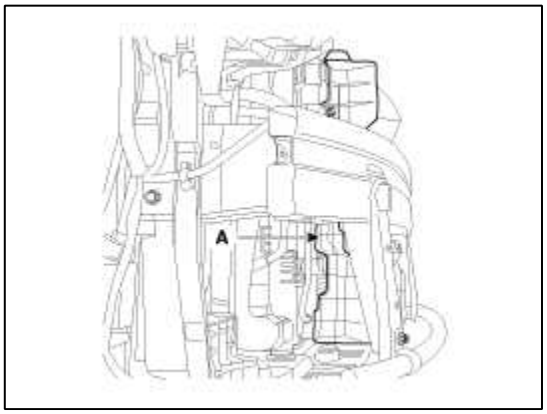
Heating,Ventilation, Air Conditioning > Air Conditioning System > Condenser > Repair procedures

Inspection

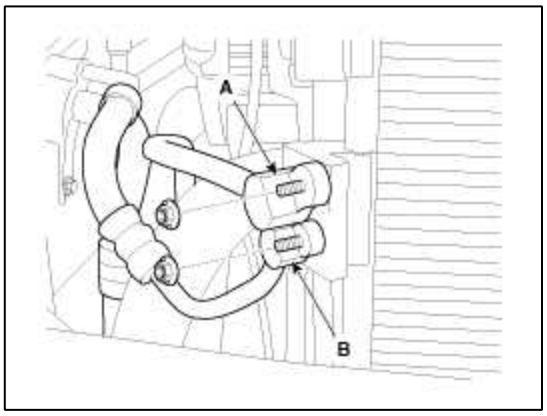
1. Check the condenser fins for clogging and damage. If clogged, clean them with water, and blow them with compressed air. If bent, gently bend them using a screwdriver or pliers.
2. Check the condenser connections for leakage, and repair or replace it, if required.

Replacement

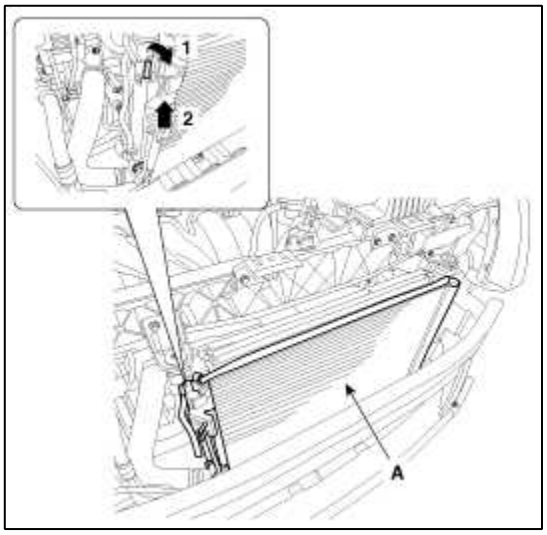
1. Recover the refrigerant with a recovery/recycling/charging station.
2. Disconnect the negative (-) battery terminal.
3. Remove the front bumper.
   (Refer to BD group - “Front Bumper”)
4. Remove the air guard (A).



5. Disconnect the discharge line (A) and liquid line (B) from the condenser.



6. Remove the condenser (A) from the radiator.



7. Installation is the reverse order of removal.

NOTE

- If you're installing a new condenser, add refrigerant oil (PAG OIL).
- 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.
- Charge the system, and test its performance.

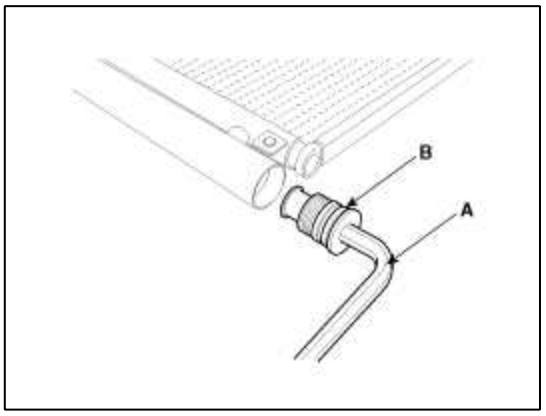
Heating,Ventilation, Air Conditioning > Air Conditioning System > Receiver-Drier > Repair procedures

Replacement

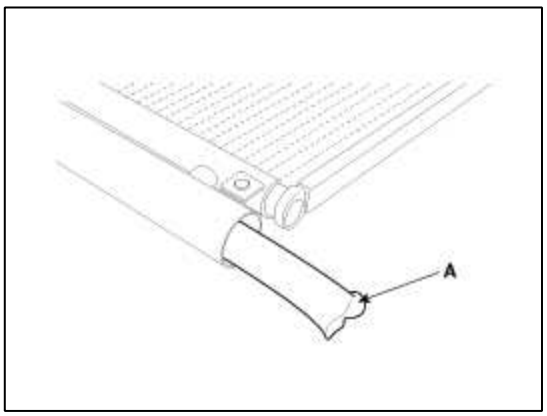
1. Remove the condenser.

2. Remove the cap (B) on the bottom of the condenser with L wrench (A).

Tightening torque :
2.7~3.2 N.m (0.28~0.33 kgf.m, 2.0~2.4 lb-ft)



3. Remove the desiccant (A) from condenser using a long nose plier. Check for crumbled desiccant and clogged bottom cap filter.



4. Apply air conditioning compressor oil along the O-rings and threads of the new bottom cap.
5. Insert the new desiccant into the receiver drier tank. The desiccant must be sealed in vacuum before it is exposed to air for use.
6. Install the new bottom cap to the condenser.

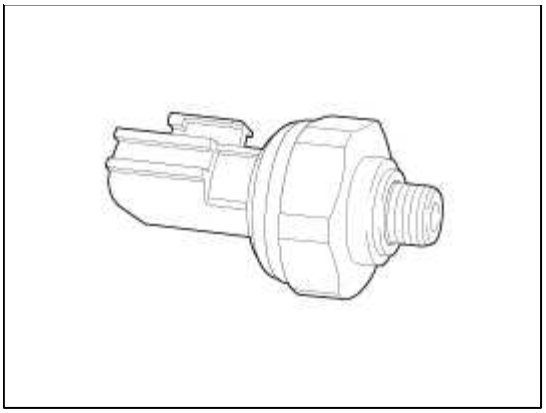
NOTE

- 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 > Description and Operation

Description

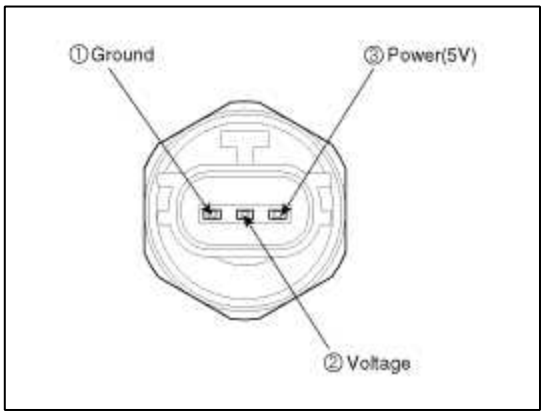
The A/C Pressure Transducer (APT) convert the pressure value of high pressure line into voltage value after measure it. By converted voltage value, engine ECU controls cooling fan by operating it high speed or low speed. Engine ECU stop the operation of compressor when the temperature of refrigerant line is so high or so low irregularly to optimize air conditioning system.



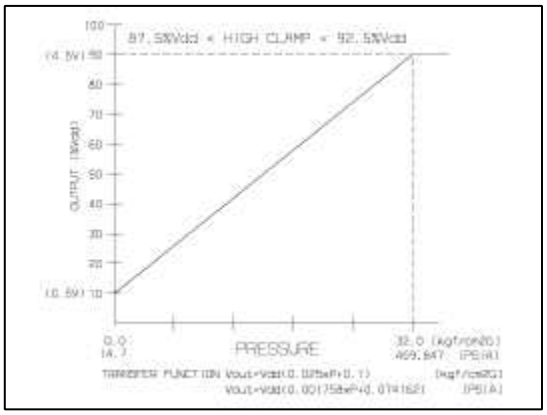
Heating,Ventilation, Air Conditioning > Air Conditioning System > A/C Pressure Transducer > Repair procedures

Inspection

1. Measure the pressure of high pressure line by measuring voltage output between terminal “1” and “2”.



2. Inspect the voltage value whether it is sufficient to be regular value or not.

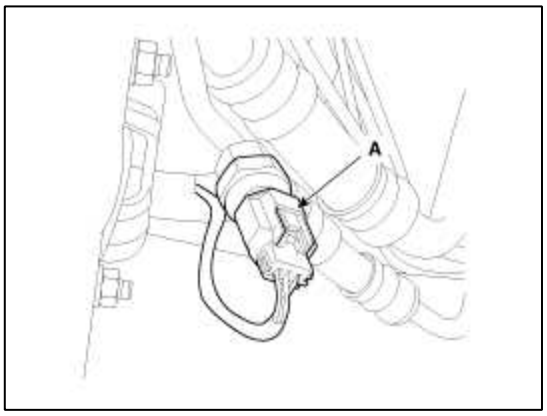


3. If the measured voltage value is not specification, replace the A/C pressure transducer.

Replacement

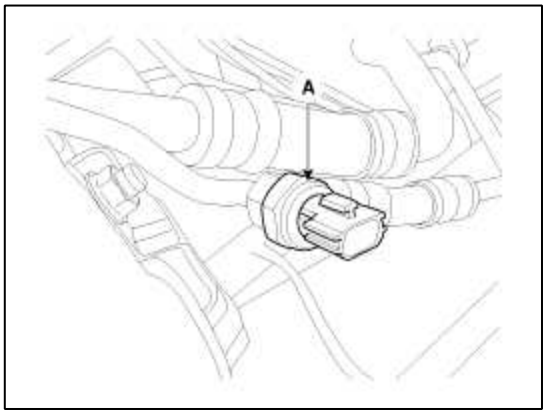
1. Disconnect the negative (-) battery terminal.
2. Recover the refrigerant with a recovery/charging station.

3. Disconnect the A/C pressure transducer connector (A).



4. Remove the A/C pressure transducer (A).

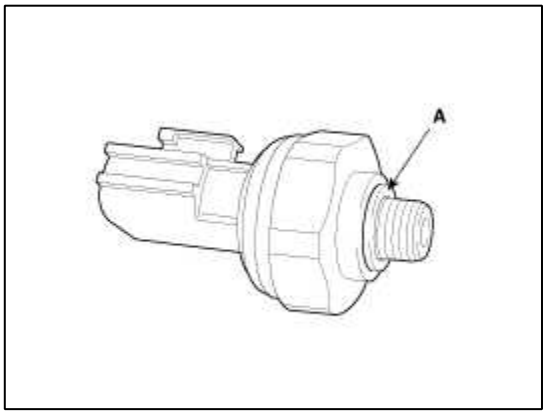
Tightening torque:
10~12 N.m (1.02~1.22 kgf.m, 7.4~8.8 lb-ft)



CAUTION

Take care that liquid & suction pipe are not bent.

5. Installation is the reverse order of removal.



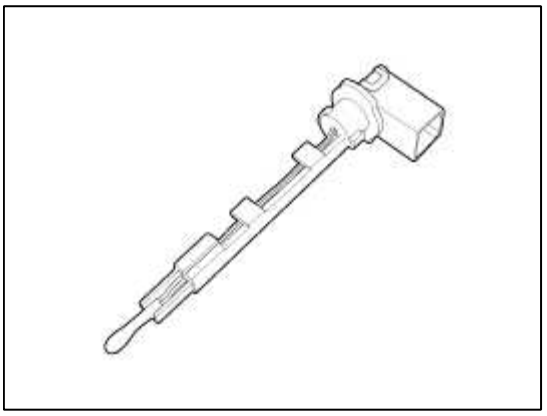
NOTE

When installing, replace with new O-ring (A).

Heating,Ventilation, Air Conditioning > Air Conditioning System > Evaporator Temperature Sensor > Description and Operation

Description

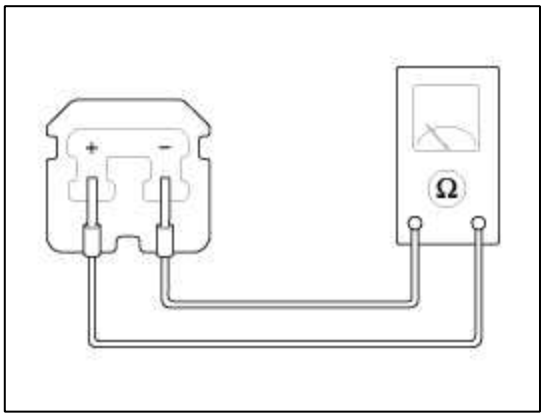
The evaporator temperature sensor will detect the evaporator core temperature and interrupt compressor relay power in order to prevent evaporator freezing by excessive cooling.



Heating,Ventilation, Air Conditioning > Air Conditioning System > Evaporator Temperature Sensor > Repair procedures

Inspection

1. Turn the ignition switch OFF.
2. Disconnect the evaporator temperature sensor connector.
3. Measure resistance between terminal “+” and “-” of evaporator temperature sensor.



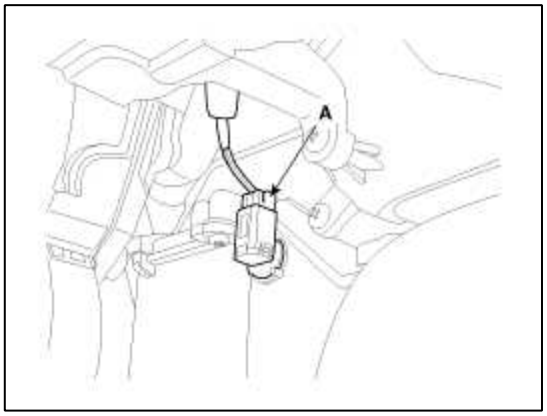
4. Connect the evaporator temperature sensor connector.
5. Run the engine and turn the A/C switch ON, then measure the voltage between the terminals of harness connector.

Specification

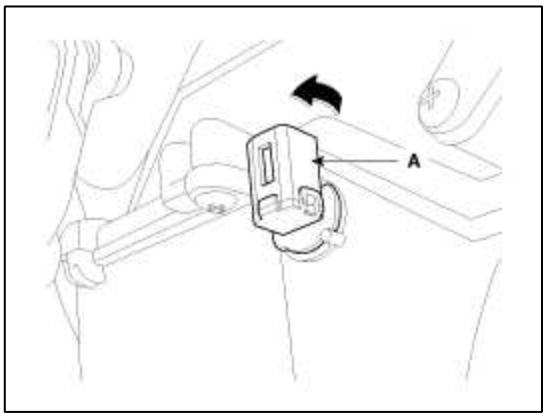
Evaporator core temperature [°C(°F)]	Resistance [kΩ]	Voltage [V]
-20(-4)	29.42	3.732
-10(14)	18.01	3.215
0(32)	11.36	2.659
10(50)	7.362	2.12
20(68)	4.892	1.642
30(86)	3.326	1.248
40(104)	2.309	0.938
50(122)	1.635	0.700

Replacement

1. Disconnect the negative (-) battery terminal.
2. Disconnect the evaporator temperature sensor connector (A).



3. Remove the evaporator temperature sensor (A) by pulling it out after rotating 90° in a counterclockwise direction.

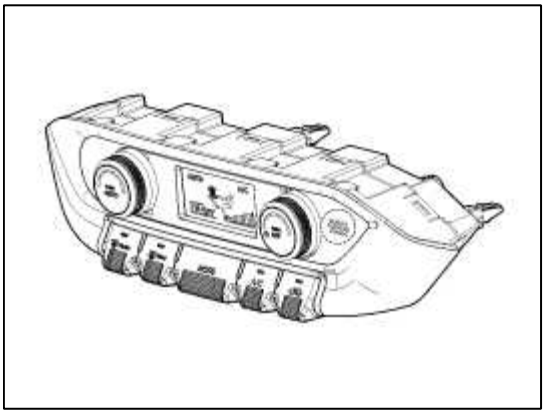


4. Installation is the reverse order of removal.

Heating,Ventilation, Air Conditioning > Air Conditioning System > In car sensor (FATC only) > Description and Operation

Description

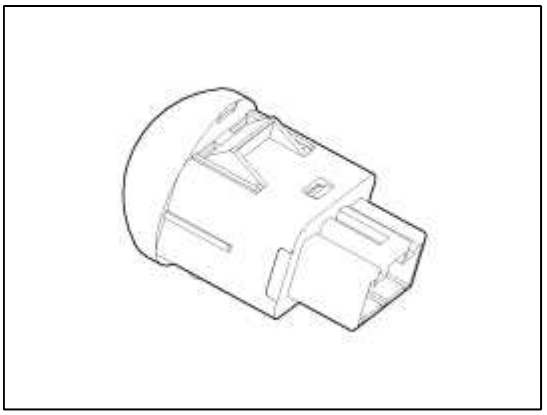
The In-car air temperature sensor is built in the heater & A/C control unit.
The sensor contains a thermistor which measures the temperature of the inside. The signal decided by the resistance value which changes in accordance with perceived inside temperature, is delivered to heater control unit and according to this signal the control unit regulates in-car temperature to intended value.



Heating,Ventilation, Air Conditioning > Air Conditioning System > Photo Sensor (FATC only) > Description and Operation

Description

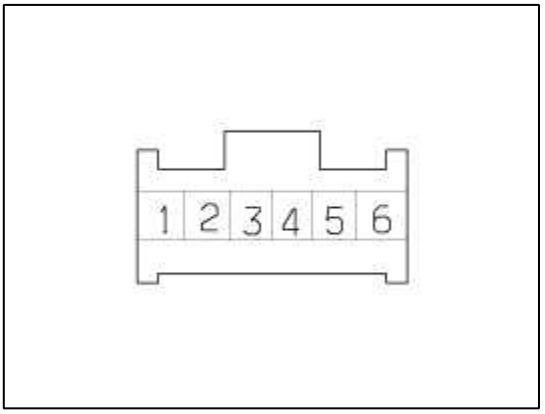
The photo sensor is located at the center of defrost nozzles.
The photo sensor contains a photovoltaic (sensitive to sunlight) diode. The solar radiation received by its light receiving portion, generates an electromotive force in proportion to the amount of radiation received which is transferred to the automatic temperature control module so that the solar radiation compensation will be performed.



Heating,Ventilation, Air Conditioning > Air Conditioning System > Photo Sensor (FATC only) > Repair procedures

Inspection

1. Turn the ignition switch ON.
2. Connect the GDS.
3. Emit intensive light toward photo sensor using a lamp, and check the output voltage change.
4. The voltage will rise with higher intensive light and reduce with lower intensive light.

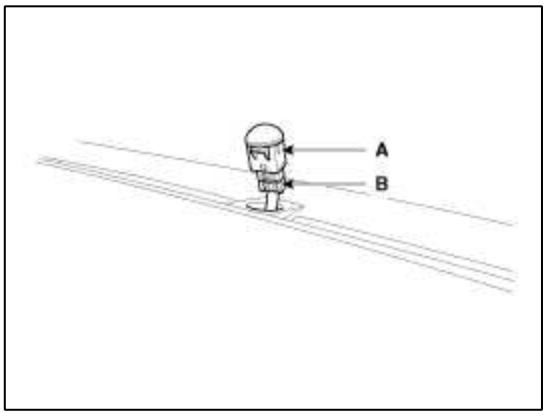


1. Ground 2. Vcc (+5V) 3. Signal	4. - 5. Photo (+) 6. Photo (-)

Replacement

1. Disconnect the negative (-) battery terminal.

2. With a flat-head screwdriver, remove the photo sensor (A) from the center of defrost nozzle after disconnecting the connector (B).

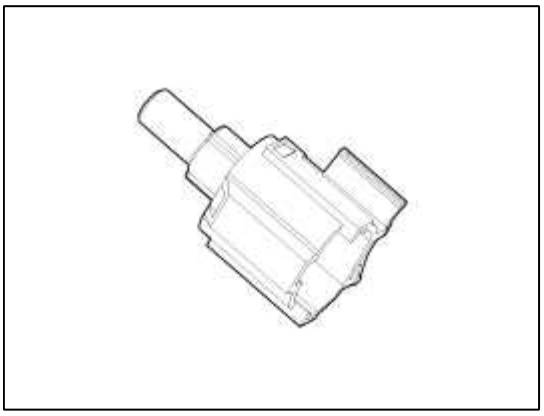


3. Install in the reverse order of removal.

Heating,Ventilation, Air Conditioning > Air Conditioning System > Ambient Temperature Sensor > Description and Operation

Description

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 temperature. 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

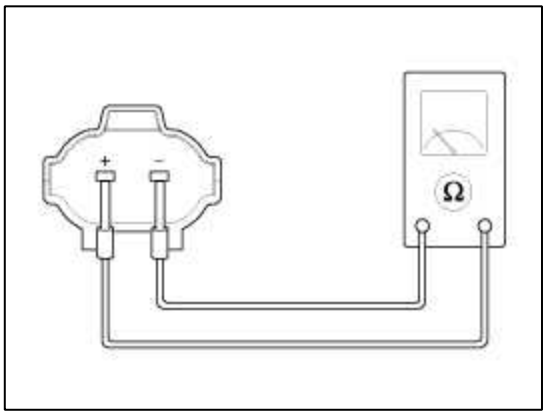
If the ambient temperature is below 1.0°C (33.8°F), the A/C compressor will be stopped.The compressor will be operated by manual operating.

Heating,Ventilation, Air Conditioning > Air Conditioning System > Ambient Temperature Sensor > Repair procedures

Inspection

1. Turn the ignition switch OFF.
2. Disconnect ambient temperature sensor.

3. Check the resistance of ambient temperature sensor between terminal “+” and “-” whether it is changed by changing of the ambient temperature.



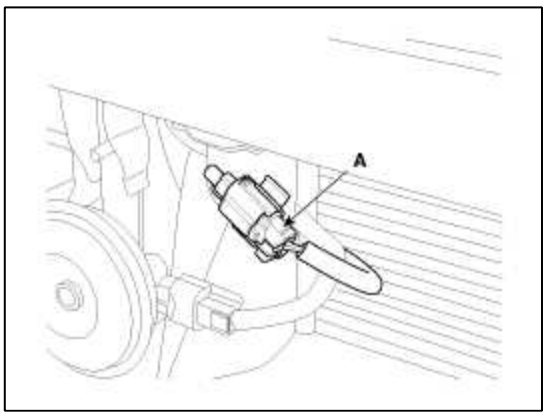
Specification

Ambient temperature [°C(°F)]	Resistance [kΩ]	Voltage [V]
-30(-22)	507	4.720
-20(-4)	284.5	4.522
-10(14)	164.2	4.225
0 (32)	97.5	3.821
10 (50)	59.6	3.322
20 (68)	37.46	2.772
30(86)	24.18	2.227
40(104)	16	1.735
50(122)	10.83	1.323

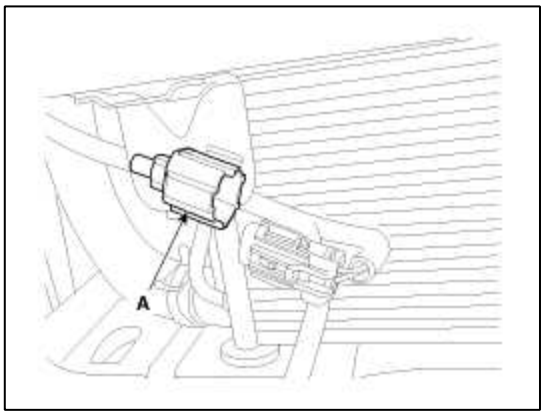
4. If the measured resistance is not specification, substitute with a known-good ambient temperature sensor and check for proper operation.
5. If the problem is corrected, replace the ambient temperature sensor.

Replacement

1. Disconnect the negative (-) battery terminal.
2. Remove the engine room RH side under cover.
   (Refer to EM group - “Engine and Transaxle Assembly”)
3. Disconnect the ambient temperature sensor connector (A).



4. Remove the ambient temperature sensor (A).

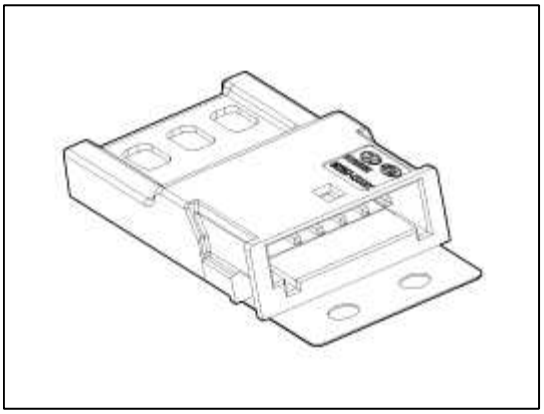


5. Installation is the reverse order of removal.

Heating,Ventilation, Air Conditioning > Air Conditioning System > Auto Defogging Sensor (FATC only) > Description and Operation

Description

The Auto Defogging Sensor is installed on front windshild glass. The Auto Defogging Sensor senses moisture on the windshild. The air conditioner control module receives the signal from the sensor and eliminate the fog by controlling the intake actuator, A/C, auto defogging actuator, blower motor rpm, and mode actuator.



Heating,Ventilation, Air Conditioning > Air Conditioning System > Auto Defogging Sensor (FATC only) > Repair procedures

Inspection

1. Press the MODE switch more then 4 times within 2 seconds while pressing the OFF switch.

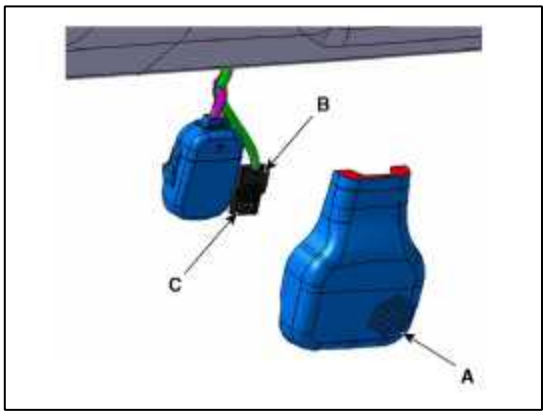
Display	Fail description
00	Normal
51	Auto defogging sensor communication and sensor input fault

* For diagnostic procedure, refer to DTC guide.

Replacement

1. Remove the auto defogging sensor cover (A).

2. Disconnect the connector (B) and then remove the auto defogging sensor (C).



3. Installation is the reverse order of removal.

Heating,Ventilation, Air Conditioning > Air Conditioning System > Cluster Ionizer (FATC only) > Description and Operation

Description

The cluster ionizer helps to clean up odors in the vehicle or from the air-conditioner system.
When the ignition switch ON, the inoizer runs a "CLEAN" mode and then a "ION" mode, switching every about 15 minutes.
In the “CLEAN” mode, the cluster ionizer generates negative and positive ions to help clean smells from the air
In the "ION" mode, the cluster generates negative ions and cleans inside air of a vehicle.

Heating,Ventilation, Air Conditioning > Air Conditioning System > Cluster Ionizer (FATC only) > Repair procedures

Inspection

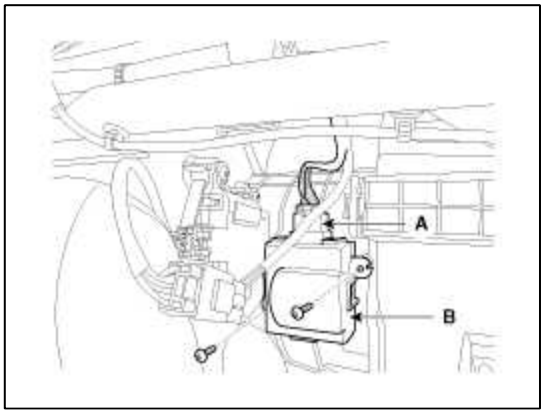
1. Press the MODE switch more then 4 times within 2 seconds while pressing the OFF switch.

Display	Fail description
00	Normal
50	Cluster ion generator fault

* For diagnostic procedure, refer to DTC guide.

Replacement

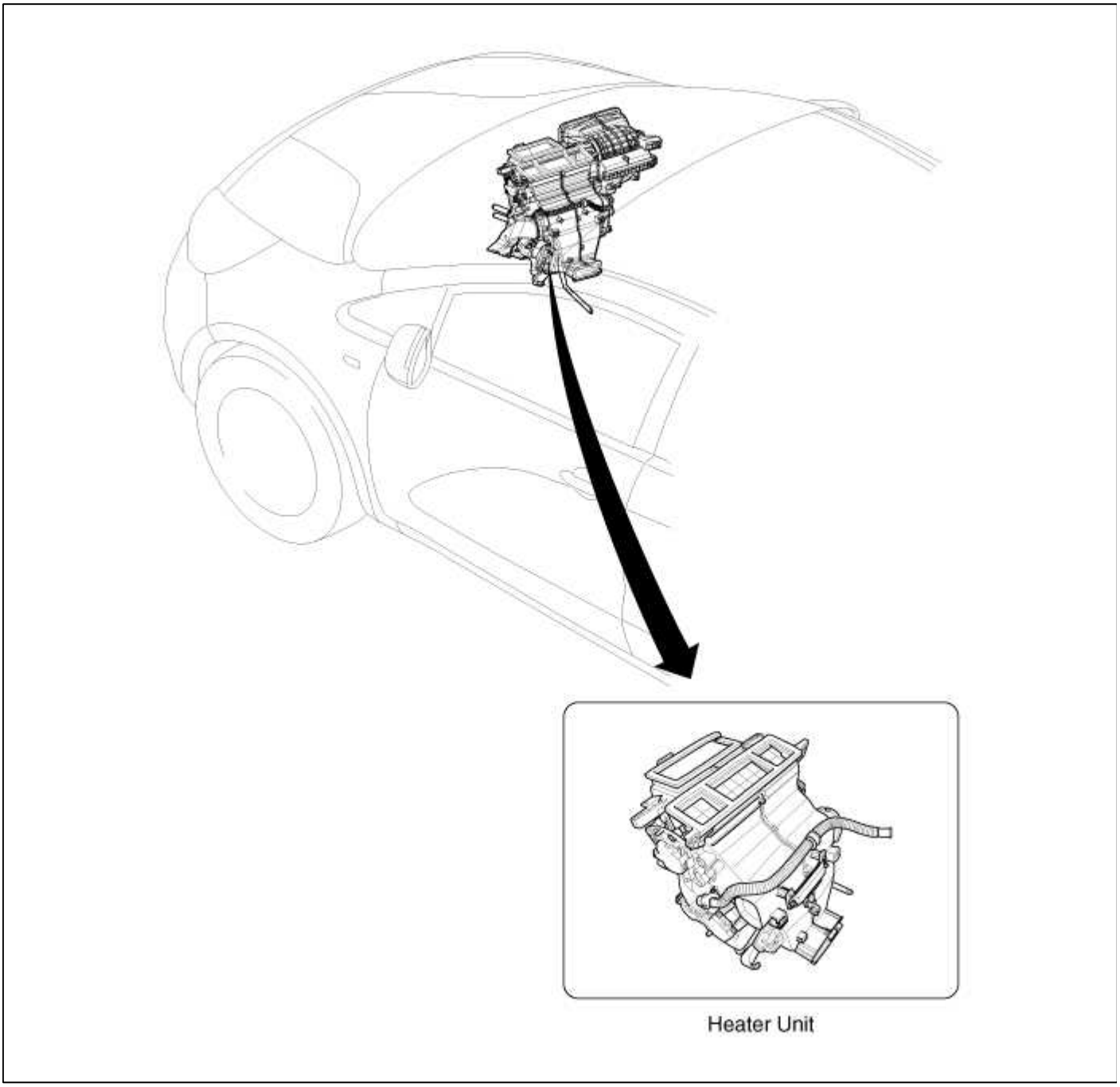
1. Disconnect the negative (-) battery terminal.
2. Remove the glove box.
   (Refer to BD group - "Crash Pad")
3. Disconnect the connector (A) and then remove the cluster ionizer (B) after loosening the mounting screws.



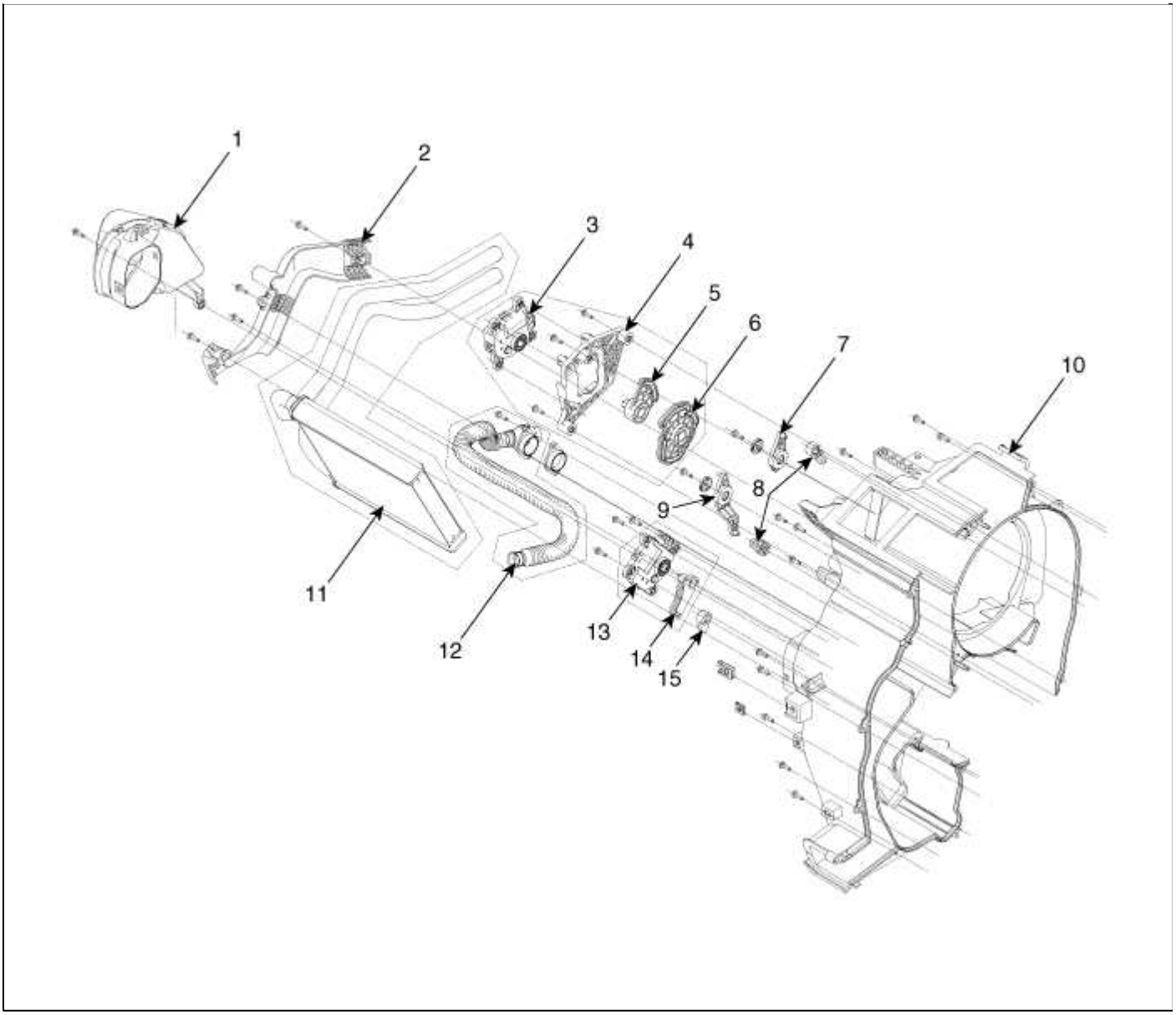
4. Installation is the reverse order of removal.

Heating,Ventilation, Air Conditioning > Heater > Heater Unit > Components and Components Location

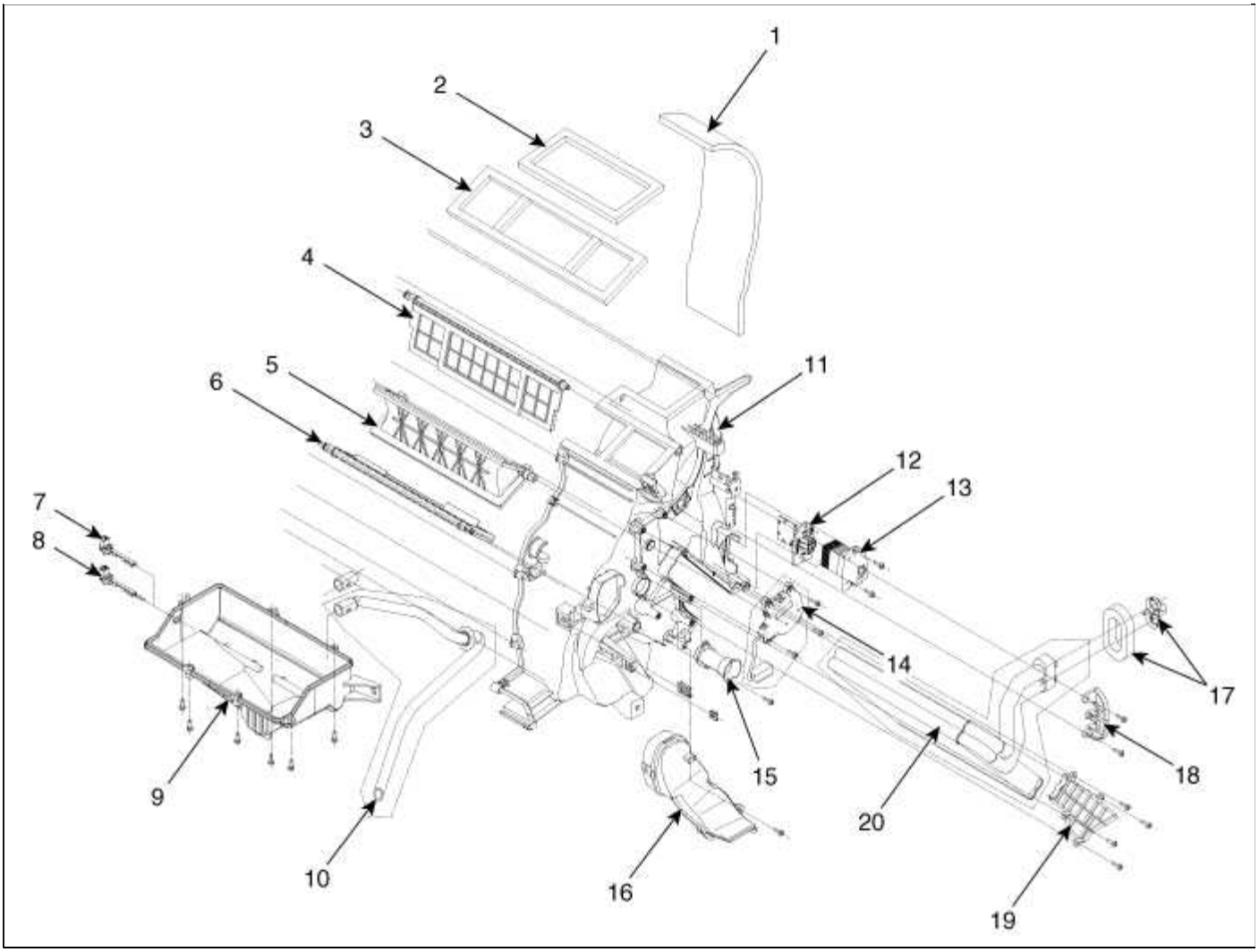
Component Location



Components



1. Shower Duct (LH) 2. Heater Pipe Cover 3. Mode Control Actuator 4. Mode Control Actuator Bracket 5. Defog mode lever (FATC) 6. Mode Control Main Lever (MANUAL) 7. Vent Sub lever 8. Vent Door Lever	9. Foot Sub Lever 10. Heat Case (LH) 11. Heater Core Assembly 12. Aspirator Hose 13.Temperature Control Actuator 14. Temperature Control Actuator Lever 15. Temperature Door Lever



1. NVH Pad	11. Heater Case (RH)
2. Defog Seal	12. Blower Resistor (MANUAL)
3. Vent Seal	13. Power Mosfet (FATC)
4. Vent/Defog Door	14. Foot Actuator (with auto defogging system)
5. Foot Door	15. Cool Box Hose
6. Temperature Door	16. Shower Duct (LH)
7. Evaporator Temperature Sensor Hole Cover	17. Flange Seal
8. Evaporator Temperature Sensor	18. Evaporator Flange Clip
9. Heater Lower Case	19. Evaporator Core Cover
10. Drain Hose	20. Evaporator Core

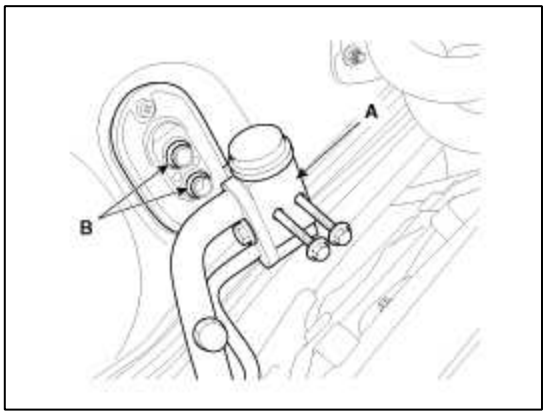
Heating,Ventilation, Air Conditioning > Heater > Heater Unit > Repair procedures

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. (Refer to EM group - “Coolant”)

4. Remove the expansion valve (A) from the evaporator core.

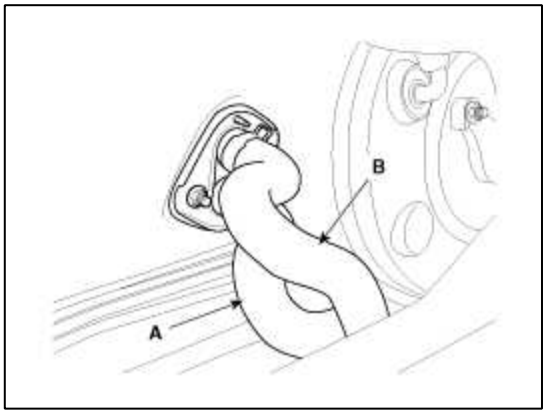
Tightening torque :
8.8 ~ 13.7 N.m (0.9 ~ 1.4 kgf.m, 6.5 ~ 10.1 Ib-ft)



NOTE

- Plug or cap the lines immediately after disconnecting them to avoid moisture and dust contamination.
- When installing, replace with a new O-ring (B).

5. Disconnect the inlet (A) and outlet (B) heater hoses from the heater unit.

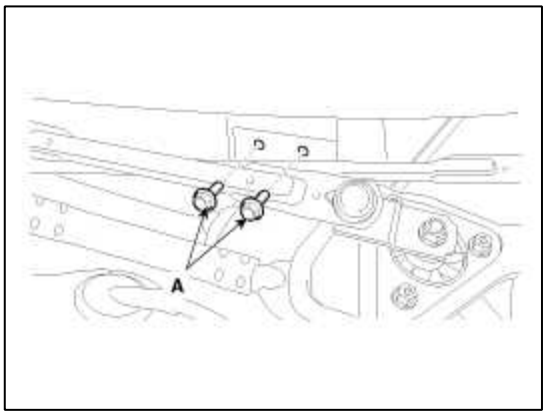


CAUTION

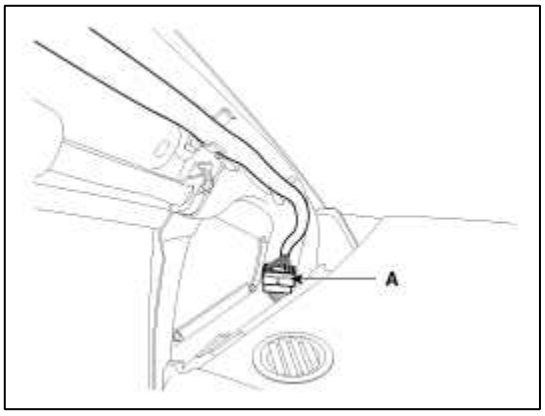
Engine coolant will run out when the hoses are disconnected; drain it into a clean drip pan. Be sure not to let coolant spill on electrical parts or painted surfaces. If any coolant spills, rinse it off immediately.

6. Remove the center console assembly.
   (Refer to BD group - "Center Console")
7. Remove the shift lever assembly.
   (Refer to TM group - "Shift Lever")
8. Lower the steering column after loosening the mounting bolts and nuts.
   (Refer to ST group - "Steering Column")
9. Remove the cowl top cover.
   (Refer to BD group - "Cowl Top Cover")

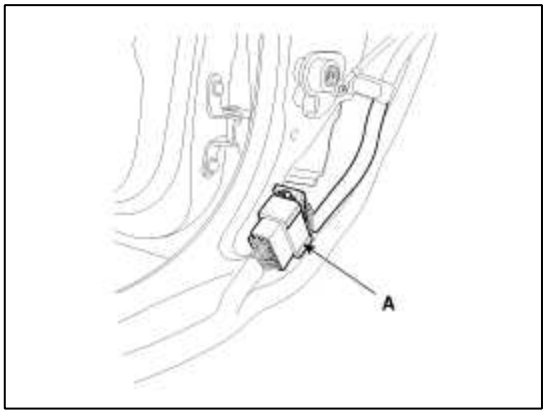
10. Loosen the cowl cross member mounting bolts (A).

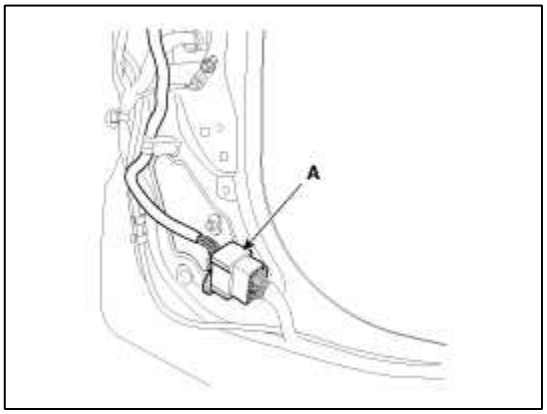


11. Remove the left front filler trim and disconnect the connector (A).

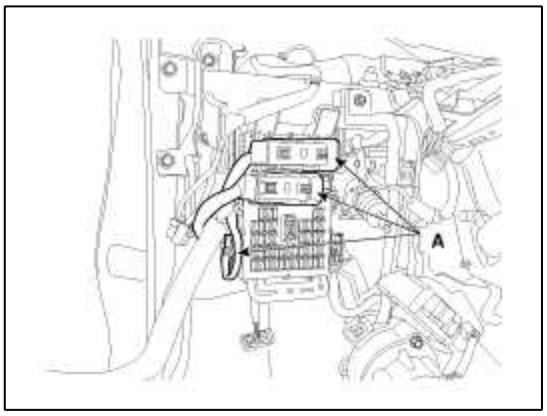


12. Remove the right and left lower cover and then disconnect connectors (A).

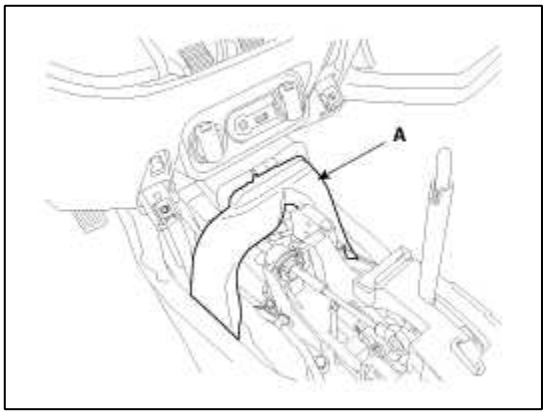




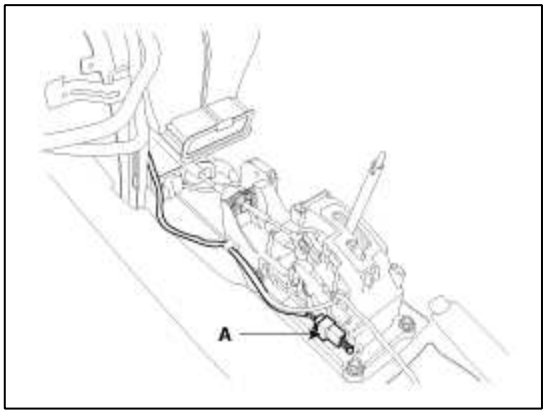
13. Disconnect the fuse box connectors (A).



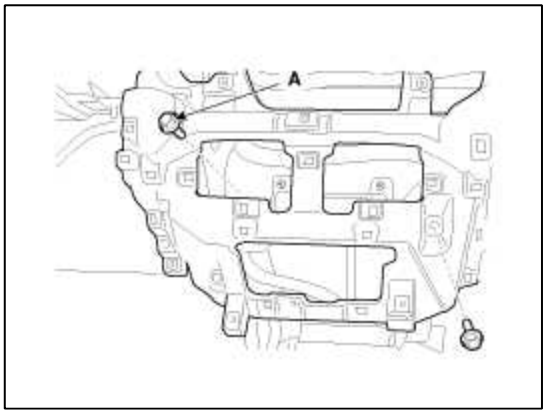
14. Remove the air duct (A).



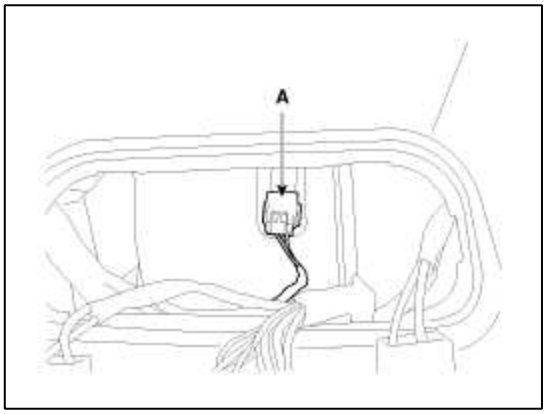
15. Disconnect the airbag connector (A).



16. Remove the photo sensor.
    (Refer to HA group - "Photo Sensor")
17. Remove the heater & A/C control unit.
    (Refer to HA group - " Heater & A/C Control Unit ")
18. Loosen the heater & blower unit mounting bolts (A).



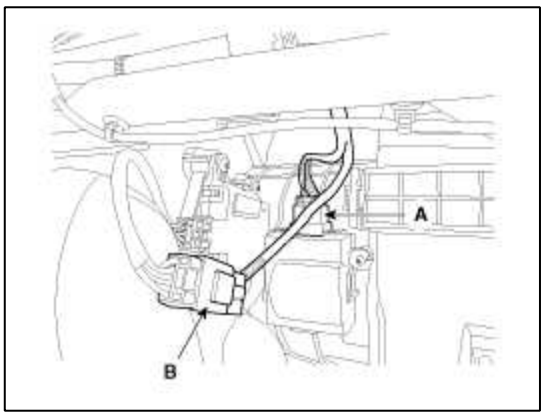
19. Remove the AUX unit.
    (Refer to BE group - "Multimedia Jack")
20. Disconnect the smart key antenna connector (A).



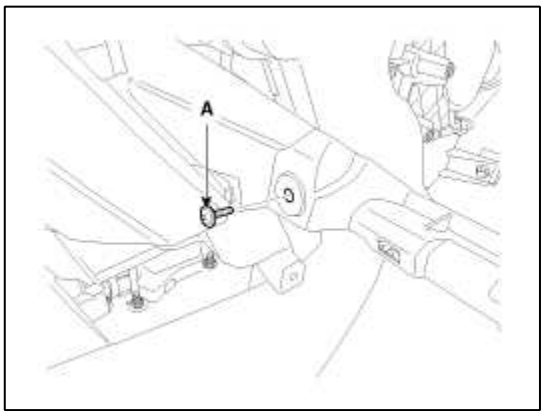
NOTE

Be careful that the inlet and outlet pipe are not bent during heater core and evaporator core removal/installation.

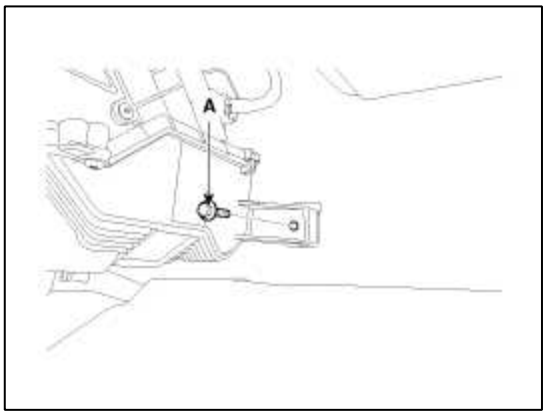
21. Remove the glove box.
    (Refer to BD group - "Crash Pad")
22. Disconnect the cluster ionizer connector (A) and the foot actuator connector (B).



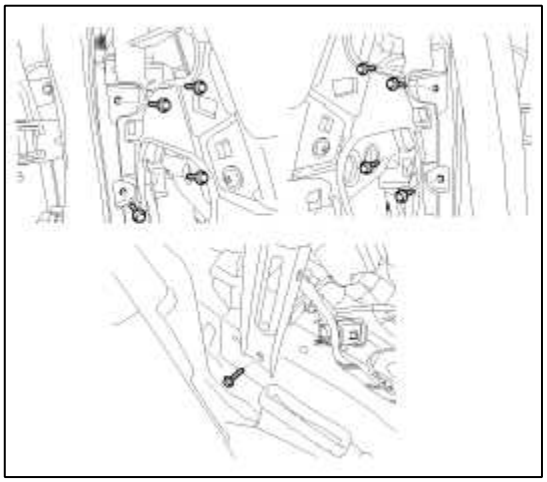
23. Loosen the crash pad to heater unit mounting screw (A).



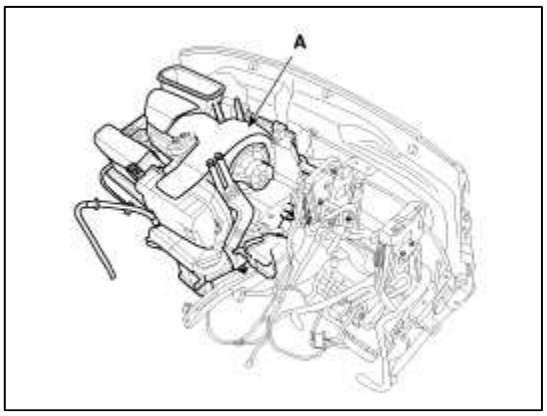
24. Remove the heater & blower unit after loosening mounting bolt (A).



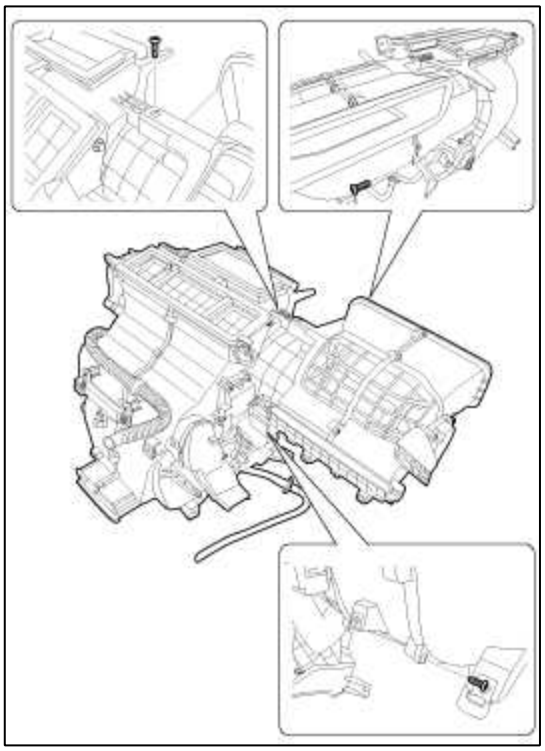
25. Loosen the cowl cross member mounting bolts and than remove the crash pad and heater & blower unit assembly.



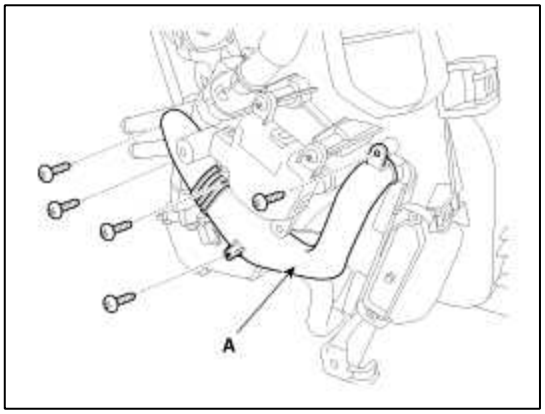
26. Loosen the drain hose fixing clip under the vehicle.
27. Disconnect the heater unit connectors.
28. Remove the heater & blower unit (A) from the crash pad after loosening the mounting nuts.



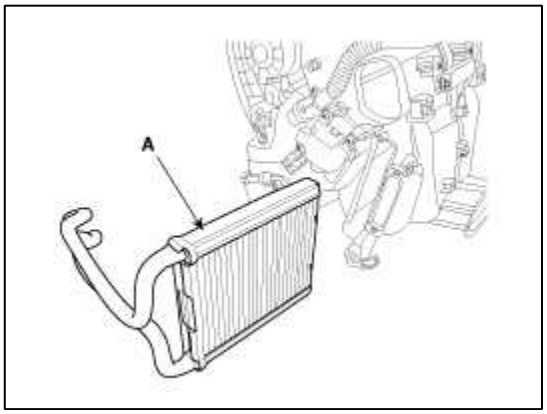
29. Separate the blower unit from the heater unit after loosening the screws.



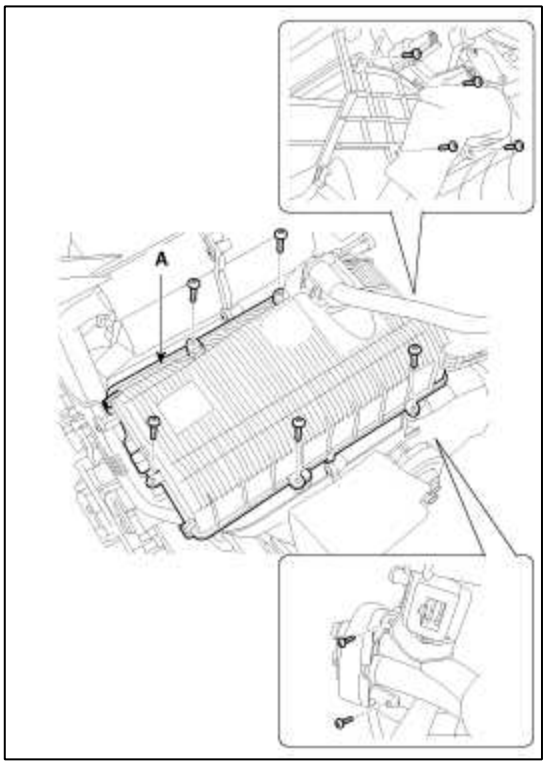
30. Remove the heater core cover (A) after loosening the mounting screws.



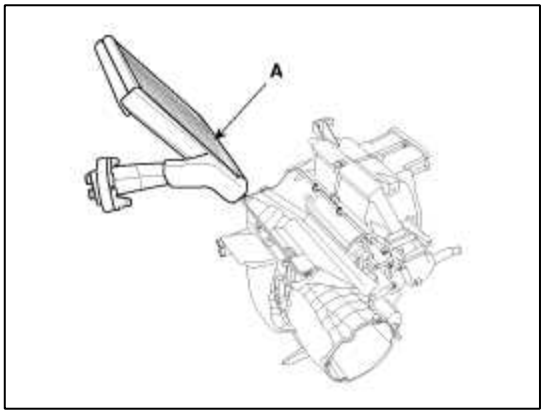
31. Pull out the heater core (A) from heater unit.



32. Remove the heater unit lower case (A) after loosening the mount screws.



33. Pull out the evaporator core (A) from heater unit.



NOTE

Be careful that the inlet and outlet pipe are not bent during heater core and evaporator core removal/installation.

34. Installation is the reverse order of removal.
    A. If you're installing a new evaporator, add refrigerant oil (PAG OIL).
    B. Replace the O-rings with new ones at each fitting, and apply a thin coat of refrigerant oil before installing them. Be sure to use the right O-rings for R-134a to avoid leakage.
    C. Immediately after using the oil, replace the cap on the container, and seal it to avoid moisture absorption.
    D. Do not spill the refrigerant oil on the vehicle; it may damage the paint; if the refrigerant oil contacts the paint, wash it off immediately
    E. Apply sealant to the grommets.
    F. Make sure that there is no air leakage.
    G. Charge the system and test its performance.
    H. Do not interchange the inlet and outlet heater hoses and install the hose clamps securely.
    I. Refill the cooling system with engine coolant

Heating,Ventilation, Air Conditioning > Heater > Temperature Control Actuator > Description and Operation

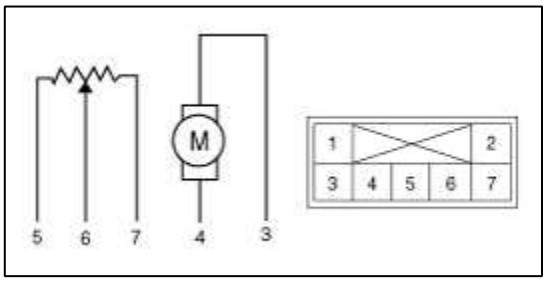
Description

The heater unit includes mode control actuator and temperature control actuator.
The 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. Turn the ignition switch OFF.
2. Disconnect the temperature control actuator connector.
3. Verify that the temperature control actuator operates to the warm 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.



1. - 2. - 3. Warm position 4. Cool position	5. Sensor ground 6. Feedback signal 7. Sensor (+ 5V)

4. Connect the temperature control actuator connector.
5. Turn the ignition switch ON.
6. Check the voltage between terminal 6 and 5.
   Specification

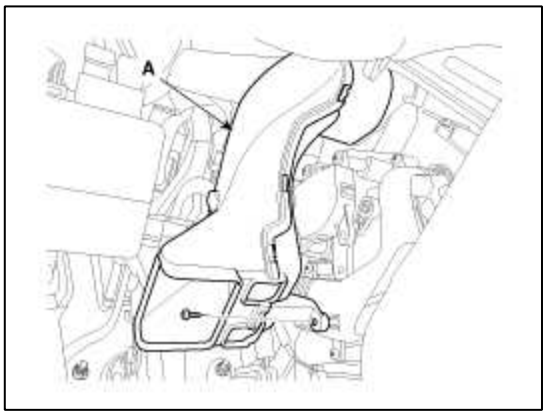
Door position	Voltage (V)	Error detecting
Max. cooling	0.4	Low voltage : 0.1V or less
Max. heating	4.6	High voltage : 4.9V or more

   It will feedback current position of actuator to controls.
7. If the measured voltage is not specification, substitute with a known-good temperature control actuator and check for proper operation.
8. If the problem is corrected, replace the temperature control actuator.

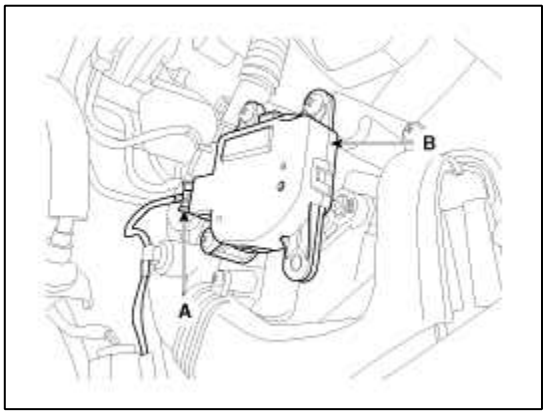
Replacement

1. Disconnect the negative (-) battery terminal.

2. Remove the driver side shower duct (A) after loosening the screw.



3. Disconnect the connector (A) and then remove the temperature control actuator (B) after loosening the mounting screws.



4. Installation is the reverse order of removal.

Heating,Ventilation, Air Conditioning > Heater > Mode Control Actuator > Description and Operation

Description

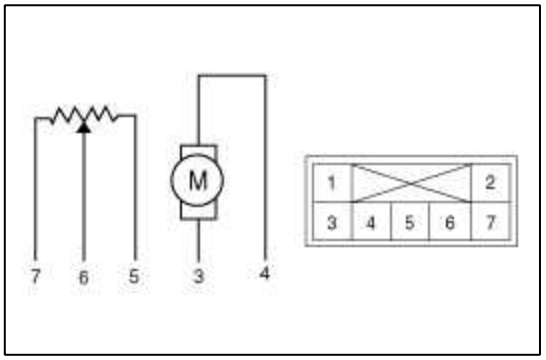
The mode control actuator is located at the heater unit.
It adjusts position of mode door by operating mode control actuator based on signal of A/C control unit. Pressing mode select switch makes the mode control actuator shift in order of Vent → Bi-Level → Floor → Mix.

Heating,Ventilation, Air Conditioning > Heater > Mode Control Actuator > Repair procedures

Inspection

1. Turn the ignition switch OFF.
2. Disconnect the mode control actuator connector.

3. Verify that the mode control actuator operates to the defog mode when connecting 12V to the terminal 4 and grounding terminal 3.
   Verify that the mode control actuator operates to the vent mode when connecting in the reverse.



1. - 2. - 3. Vent mode 4. Defog mode	5. Sensor (+ 5V) 6. Feedback signal 7. Sensor ground

4. Connect the mode control actuator connector.
5. Turn the ignition switch ON.
6. Check the voltage between terminal 6 and 7.
   Specification
   With auto defogging activated

Door position	Voltage (V)	Error detecting
Vent	0.9 ± 0.3	Low voltage: 0.1V or less
Bi-Level	0.9 ± 0.3	
Floor	4.1 ± 0.3	
Mix	4.1 ± 0.3	
Defog	4.1 ± 0.3	High voltage: 4.9V or more

   With auto defogging deactivated

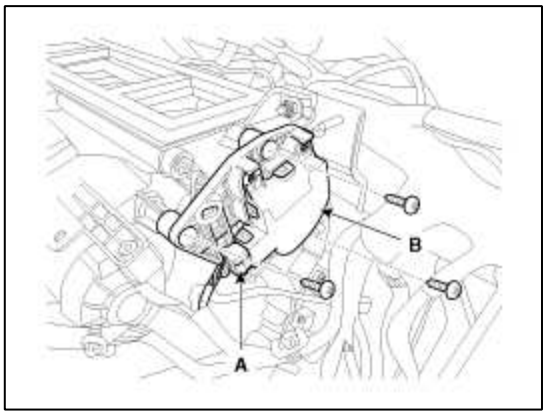
Door position	Voltage (V)	Error detecting
Vent	2.5 ± 0.3	Low voltage: 0.1V or less
Bi-Level	2.5 ± 0.3	
Floor	4.1 ± 0.3	
Mix	4.1 ± 0.3	
Defog	4.1 ± 0.3	High voltage: 4.9V or more

   It will feedback current position of actuator to controls.
7. If the measured voltage is not specification, substitute with a known-good mode control actuator and check for proper operation.
8. If the problem is corrected, replace the mode control actuator.

Replacement

1. Disconnect the negative (-) battery terminal.

2. Remove the crash pad.
   (Refer to BD group - "Crash Pad")
3. Remove the BCM unit.
   (Refer to BE group - "BCM")
4. Disconnect the connector (A) and then remove the mode control actuator (B) after loosening the mounting screws.



5. Installation is the reverse order of removal.

Heating,Ventilation, Air Conditioning > Heater > Foot Actuator (With Auto Defogging System) > Description and Operation

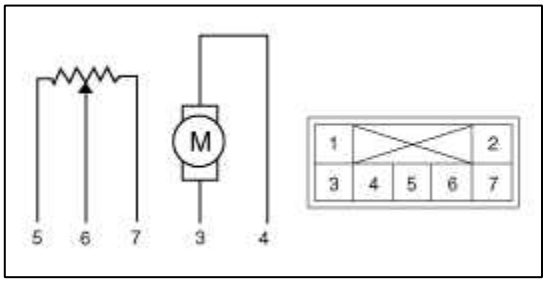
Description

The foot actuator is located at the heater unit. It adjusts position of the foot door in heater unit of the vehicle equipped with the auto defogging system.

Heating,Ventilation, Air Conditioning > Heater > Foot Actuator (With Auto Defogging System) > Repair procedures

Inspection

1. Turn the ignition switch OFF.
2. Disconnect the foot connector.
3. Verify that the foot actuator operates to the open position when connecting 12V to the terminal 3 and grounding terminal 4.
   Verify that the foot actuator operates to the close position when connecting in the reverse.



1. - 2. - 3. Open 4. Close	5. Sensor ground 6. Feedback signal 7. Sensor (+ 5V)

4. Connect the foot actuator connector.
5. Turn the ignition switch ON.

6. Check the voltage between terminals 6 and 5.

Specification

With auto defogging activated

Door position	Voltage (V)	Error detecting
Vent	0.9 ± 0.3	Low voltage: 0.1V or less
Bi-Level	3.0 ± 0.3	
Floor	3.9 ± 0.3	
Mix	3.25 ± 0.3	
Defog	0.9 ± 0.3	High voltage: 4.9V or more

With auto defogging deactivated

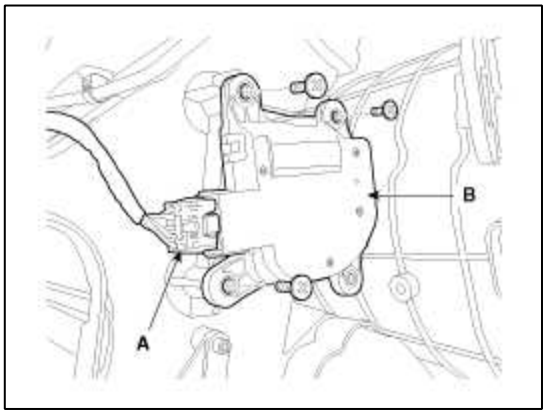
Door position	Voltage (V)	Error detecting
Vent	0.9 ± 0.3	Low voltage: 0.1V or less
Bi-Level	3.0 ± 0.3	
Floor	2.5 ± 0.3	
Mix	2.5 ± 0.3	
Defog	0.9 ± 0.3	High voltage: 4.9V or more

It will feedback current position of actuator to controls.

7. If the measured voltage is not specification, substitute with a known-good foot actuator and check for proper operation.
8. If the problem is corrected, replace the foot actuator.

Replacement

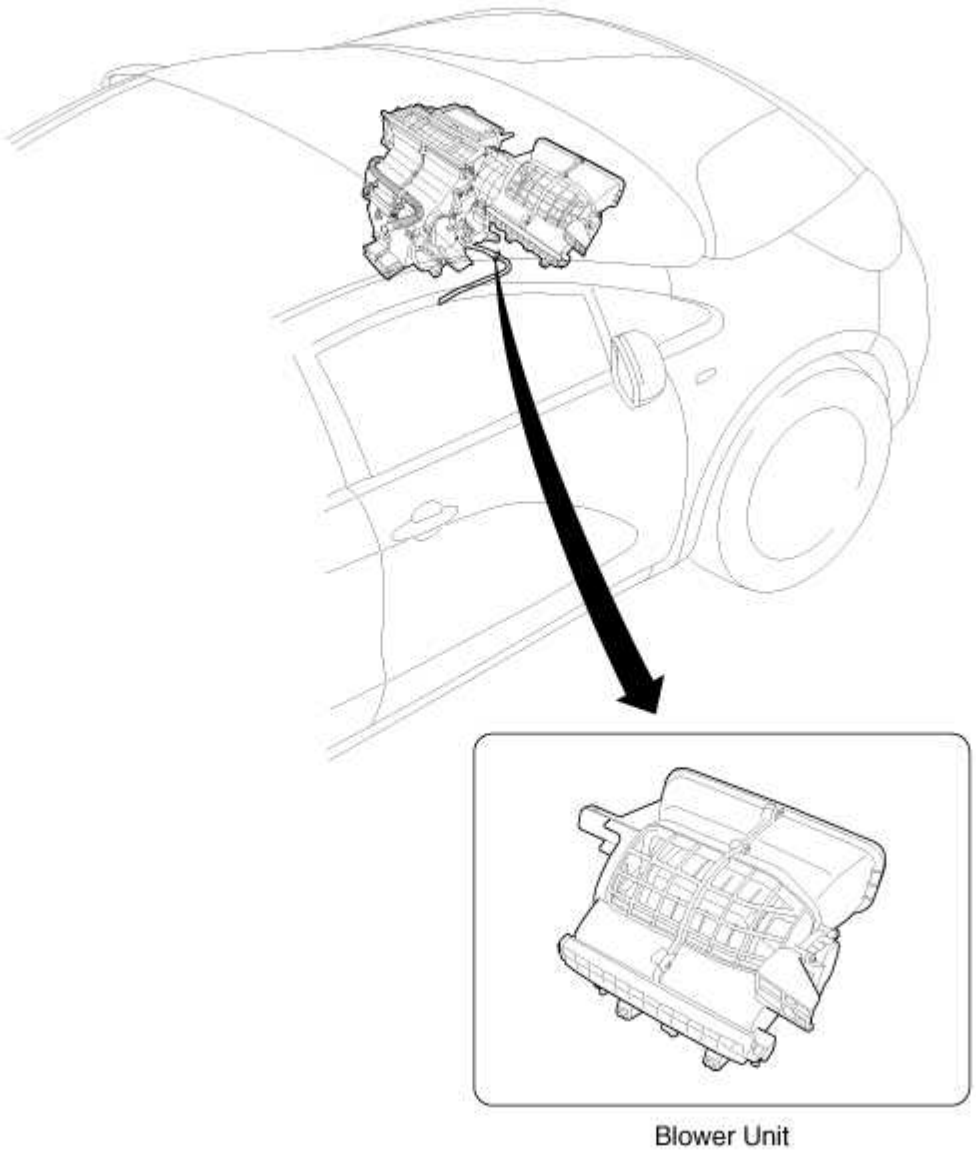
1. Disconnect the negative (-) battery terminal.
2. Remove the glove box housing.
   (Refer to BD group - “Crash pad”)
3. Remove the cluster ionizer.
   (Refer to HA group - “Cluster Ionizer”)
4. Disconnect the connector (A) and then remove the foot actuator (B) after loosening the mounting screws.



5. Installation is the reverse order of removal.

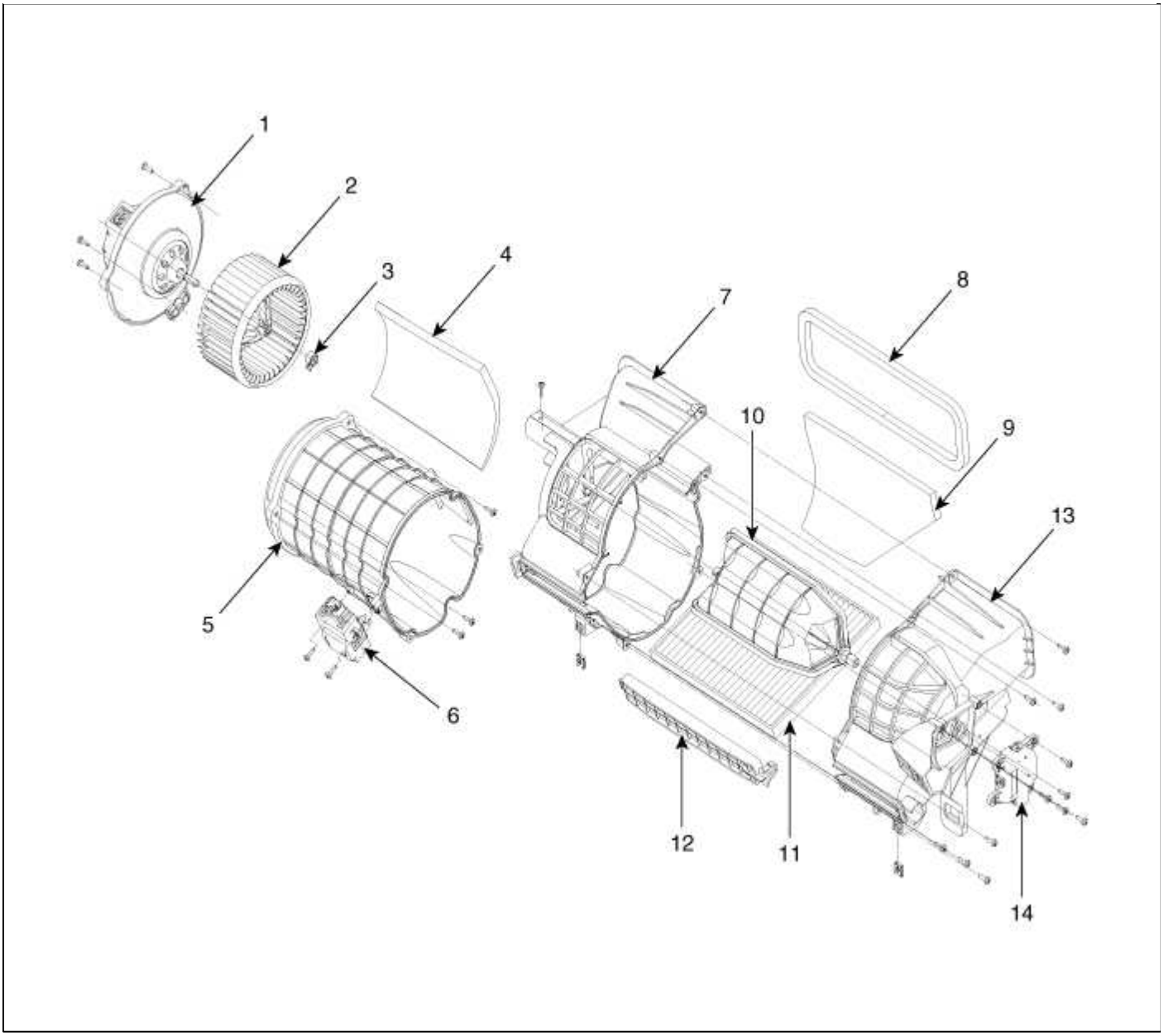
Heating,Ventilation, Air Conditioning > Blower > Blower Unit > Components and Components Location

Component Location



Blower Unit

Components



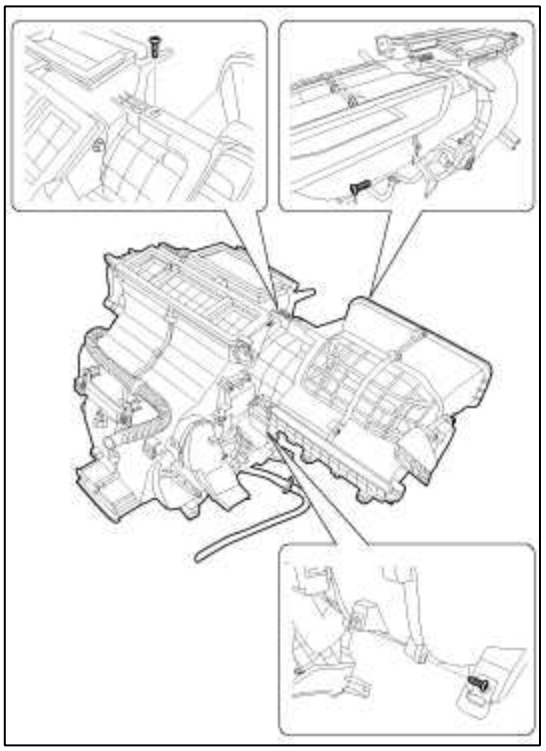
1. Blower Motor 2. Blower Fan 3. Clamp 4. NVH Pad 5. Connection Case 6. Cluster Ionizer (FATC only) 7. Intake Case (LH)	8. Intake Seal 9. NVH Pad 10. Intake Door 11. Climate Control Air Filter 12. Climate Control Air Filter Cover 13. Intake Case (RH) 14. Intake Actuator

Heating,Ventilation, Air Conditioning > Blower > Blower Unit > Repair procedures

Replacement

1. Remove the heater & blower unit.
   (Refer to HA group - "Heater Unit")

2. Separate the blower unit from the heater unit after loosening the screws.



NOTE

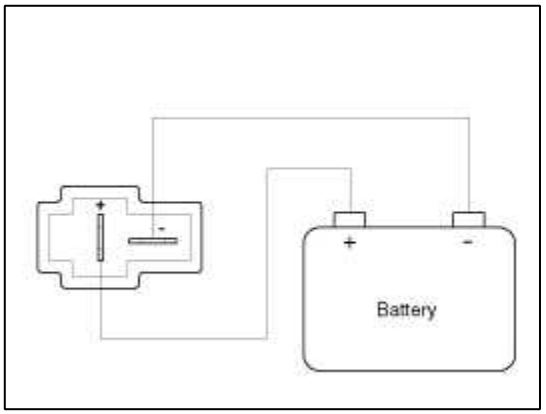
Make sure that there is no air leaking out of the blower and duct joints.

3. 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.

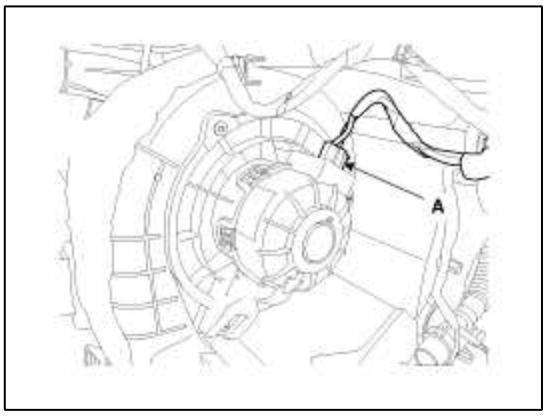


2. If the blower motor does not operate well, substitute with a known-good blower motor and check for proper operation.
3. If the problem is corrected, replace the blower motor.

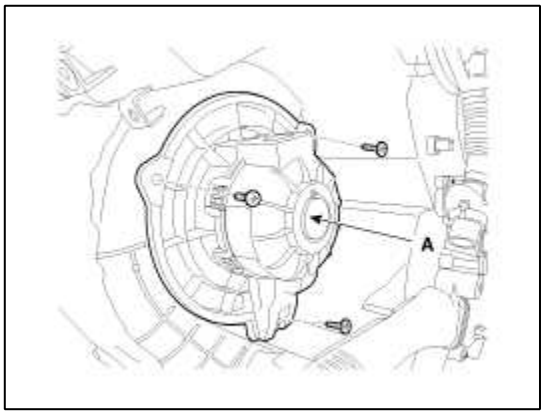
Replacement

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad and heater & blower unit assembly.
   (Refer to HA group – "Heater Unit")

3. Disconnect the blower motor connector (A).



4. Remove the blower motor (A) after loosening the screws.

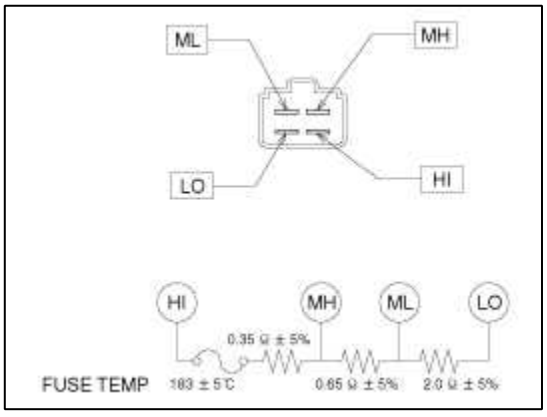


5. Installation is the reverse order of removal.

Heating,Ventilation, Air Conditioning > Blower > Blower Resistor (MANUAL) > Repair procedures

Inspection

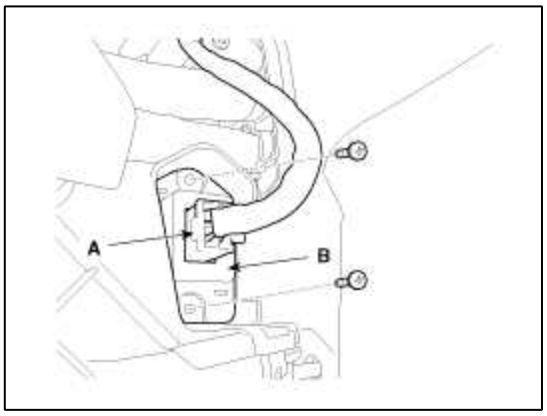
1. Measure the resistance between the terminals.
2. The measured resistance is not within specification, the blower resistor must be replaced. (After removing the resistor)



Replacement

1. Disconnect the negative (-) battery terminal.

2. Disconnect the connector (A) and then remove the blower resistor (B) after loosening the mounting screws.

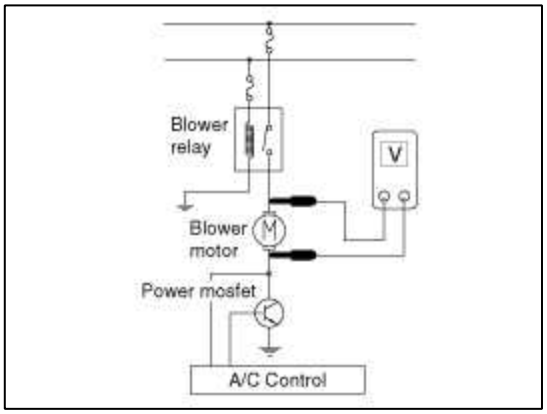


3. Installation is the reverse order of removal.

Heating,Ventilation, Air Conditioning > Blower > Power Mosfet (FATC) > Repair procedures

Inspection

1. Turn the ignition switch 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.



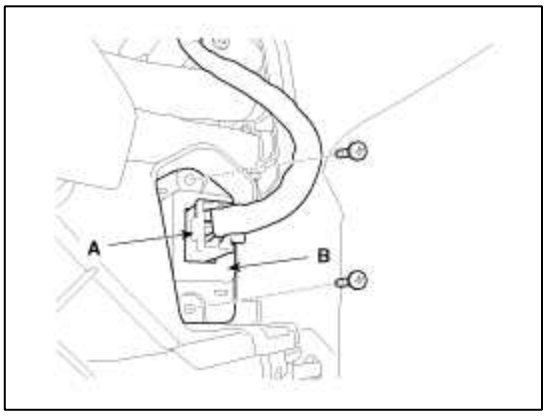
Specification

Fan Speed (Manual)	Motor Voltage (V)
1	3.75 ± 0.5
2	4.76 ± 0.5
3	6.87 ± 0.5
4	6.99 ± 0.5
5	8.11 ± 0.5
6	9.23 ± 0.5
7	10.63 ± 0.5
8	Battery

4. If the measured voltage is not specification, substitute with a known-good power mosfet and check for proper operation.
5. If the problem is corrected, replace the power mosfet.

Replacement

1. Disconnect the negative (-) battery terminal.
2. Disconnect the 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 > Climate Control Air Filtar > Description and Operation

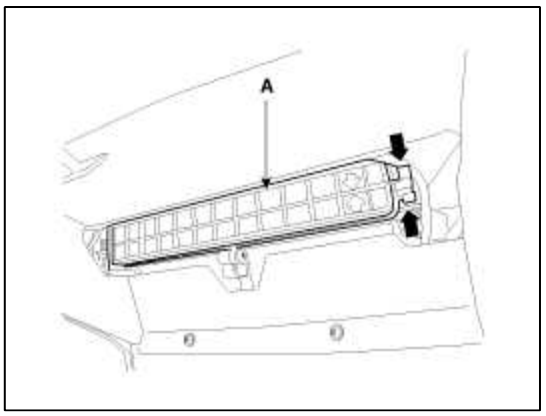
Description

The climate control air filter is located in the bower unit. It eliminates foreign materials and odor. The particle filter performs a role as an odor filter as well as a conventional dust filter to ensure comfortable interior environment.

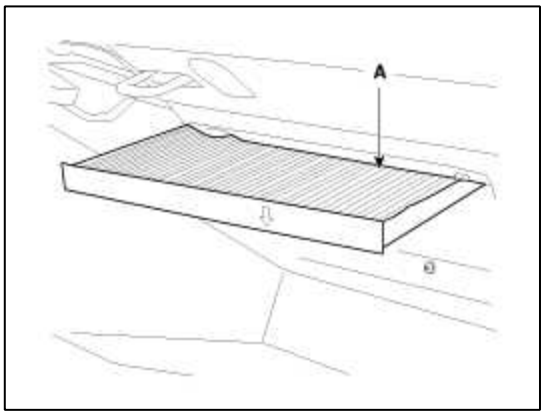
Heating,Ventilation, Air Conditioning > Blower > Climate Control Air Filtar > Repair procedures

Replacement

1. Open the glove box.
2. Remove the filter cover (A) by pressing the knob.



3. Replace the air filter (A) with a new one according to the direction of air filter.



NOTE

- To remove the filter easily, press the right side inward then pull out the filter.
- 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 > Description and Operation

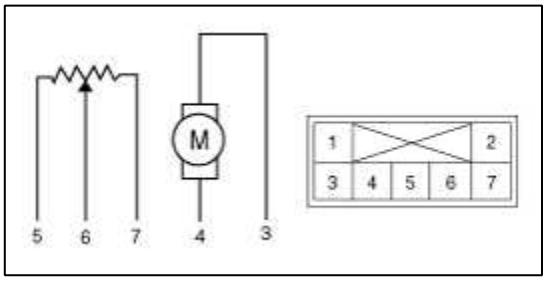
Description

The intake actuator is located at the blower unit. It regulates the intake door by signal from control unit. Pressing the intake selection switch will shift between recirculation and fresh air modes.

Heating,Ventilation, Air Conditioning > Blower > Intake Actuator > Repair procedures

Inspection

1. Turn the ignition switch OFF.
2. Disconnect the intake actuator connector.
3. Verify that the intake actuator operates to the fresh position when connecting 12V to the terminal 4 and grounding terminal 3.
   Verify that the intake actuator operates to the recirculation position when connecting in the reverse.



1. - 2. – 3. Recirculation 4. Fresh	5. Sensor Ground 6. Feedback Signal 7. Sensor (+ 5V)

4. Connect the intake actuator connector.
5. Turn the ignition switch ON.

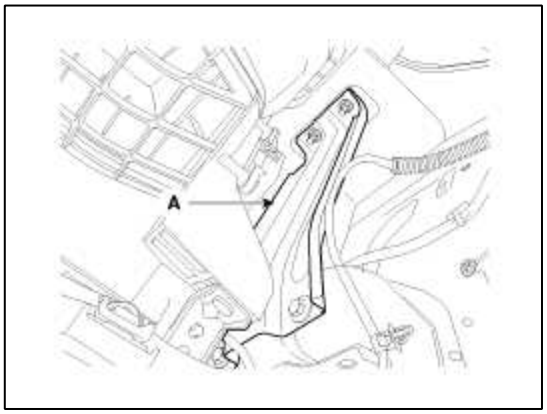
6. Check the voltage between terminal 6 and 5.
   Specification

Door position	Voltage (V)	Error detecting
Fresh	0.5	Low voltage : 0.1V or less
Recirculation	4.5	High voltage : 4.9V or more

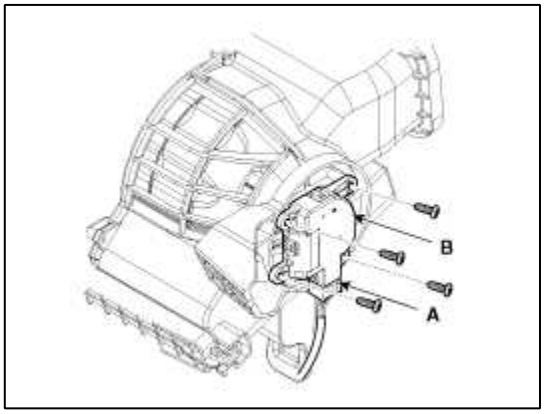
7. If the intake actuator is not operated well, substitute with a known-good intake actuator and check for proper operation.
8. If the problem is corrected, replace the intake actuator.

Replacement

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad.
   (Refer to BD group - "Crash Pad")
3. Remove the side bracket (A).



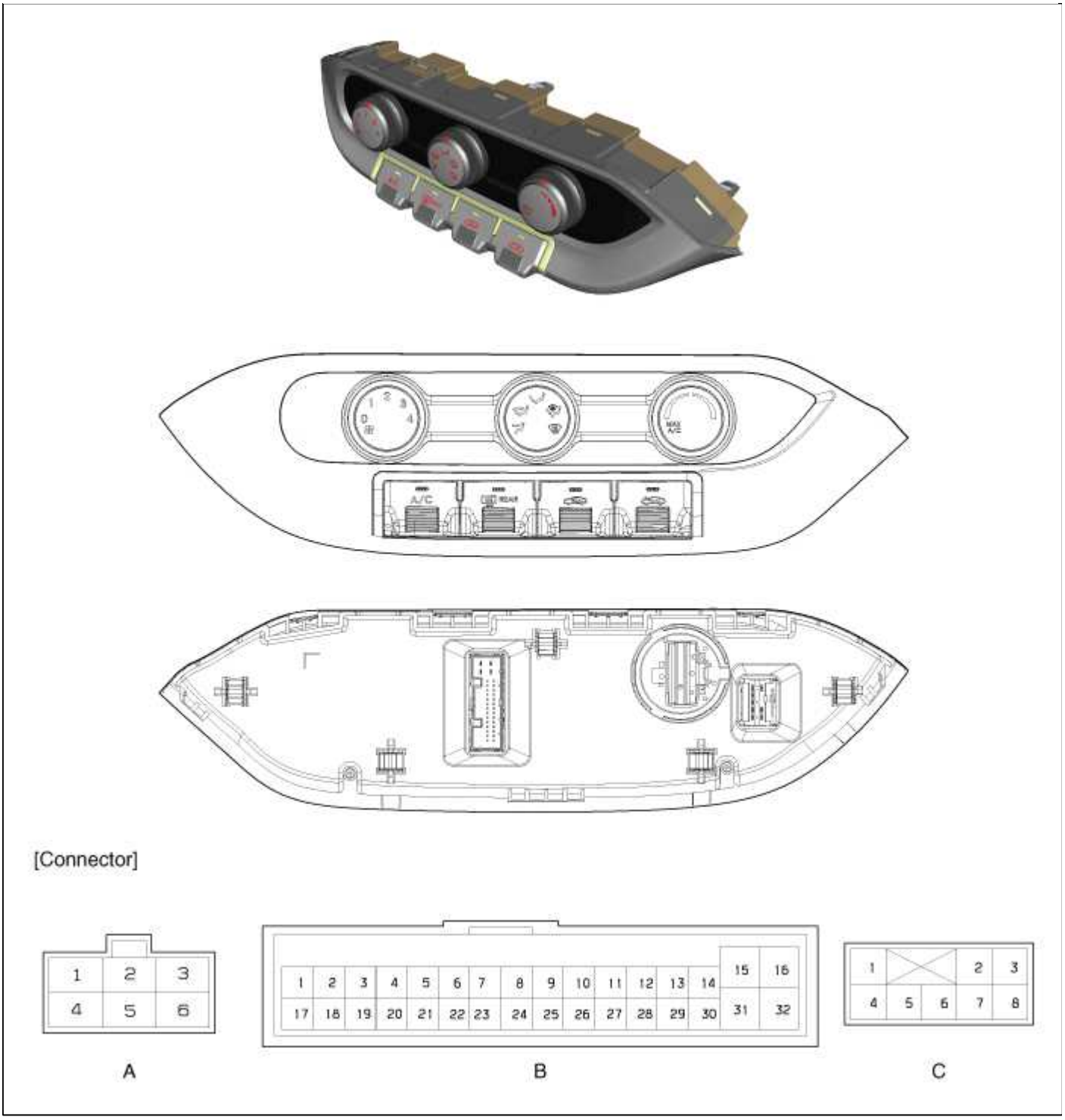
4. Disconnect the connector (A) and then remove the intake actuator (B) after loosening the mounting screws.



5. Installation is the reverse order of removal.

Heating,Ventilation, Air Conditioning > Controller > Heater & A/C Control Unit (MANUAL) > Components and Components Location

Components

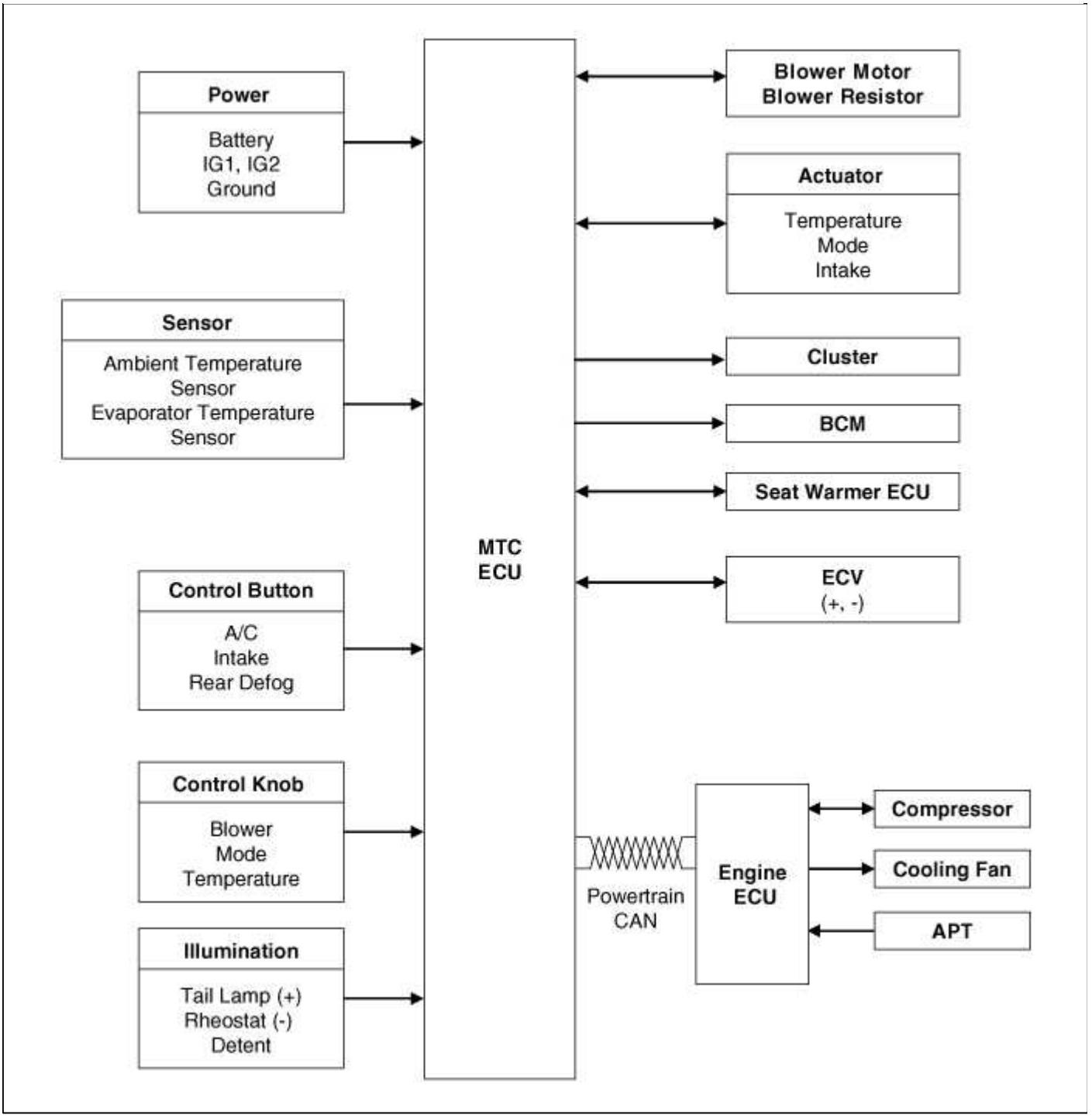


Connector pin function

Connector	Pin No	Function	Connector	Pin No	Function
A	1	Ground	B	18	Intake Actuator Feedback
	2	Middle High		19	Temperature Actuator Feedback
	3	Middle Low		20	Vref (5V)
	4	High		21	-
	5	Low		22	-
	6	-		23	Rear Defrost Switch (Low)
B	1	Mode Actuator (Vent)		24	HTD (Rear Defrost Indicator)
	2	Mode Actuator (Defog)		25	Detent Out (+)
	3	Intake Actuator (Fresh)		26	-
	4	Intake Actuator (Recirculation)		27	Evaporator Temperature Sensor
	5	Temperature Actuator (Cool)		28	Ambient Temperature Sensor
	6	Temperature Actuator (Warm)		29	-
	7	PTC On Signal		30	-
	8	PTC Relay #2		31	ECV IN
	9	PTC Relay #3		32	ECV OUT
	10	Seat Warmer Signal (Low) - Driver	C	1	IGN 2
	11	Seat Warmer Signal (High) - Driver		2	Rheostat (ILL-)
	12	-		3	Sensor Ground
	13	CAN (Low)		4	Battery (+)
	14	CAN (High)		5	Tail Lamp (+)
	15	Blower Feedback		6	Blower Common Signal (-)
	16	Ground		7	IGN 1
	17	Mode Actuator Feedback		8	Ground

Heating,Ventilation, Air Conditioning > Controller > Heater & A/C Control Unit (MANUAL) > Schematic Diagrams

Schematic Diagram

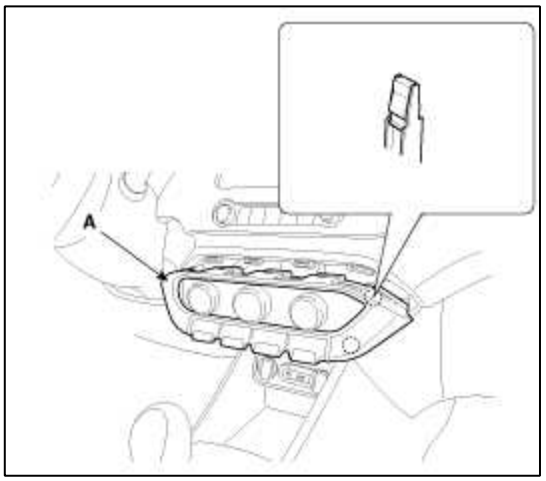


Heating,Ventilation, Air Conditioning > Controller > Heater & A/C Control Unit (MANUAL) > Repair procedures

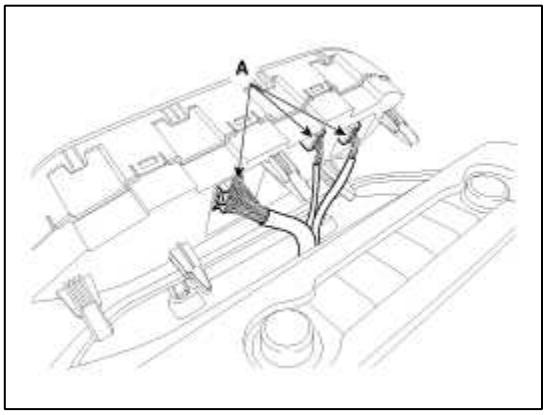
Replacement

1. Disconnect the negative (-) battery terminal.

2. Remove the heater & A/C controller (A) from the center facia using a flat-head screwdriver or remover.



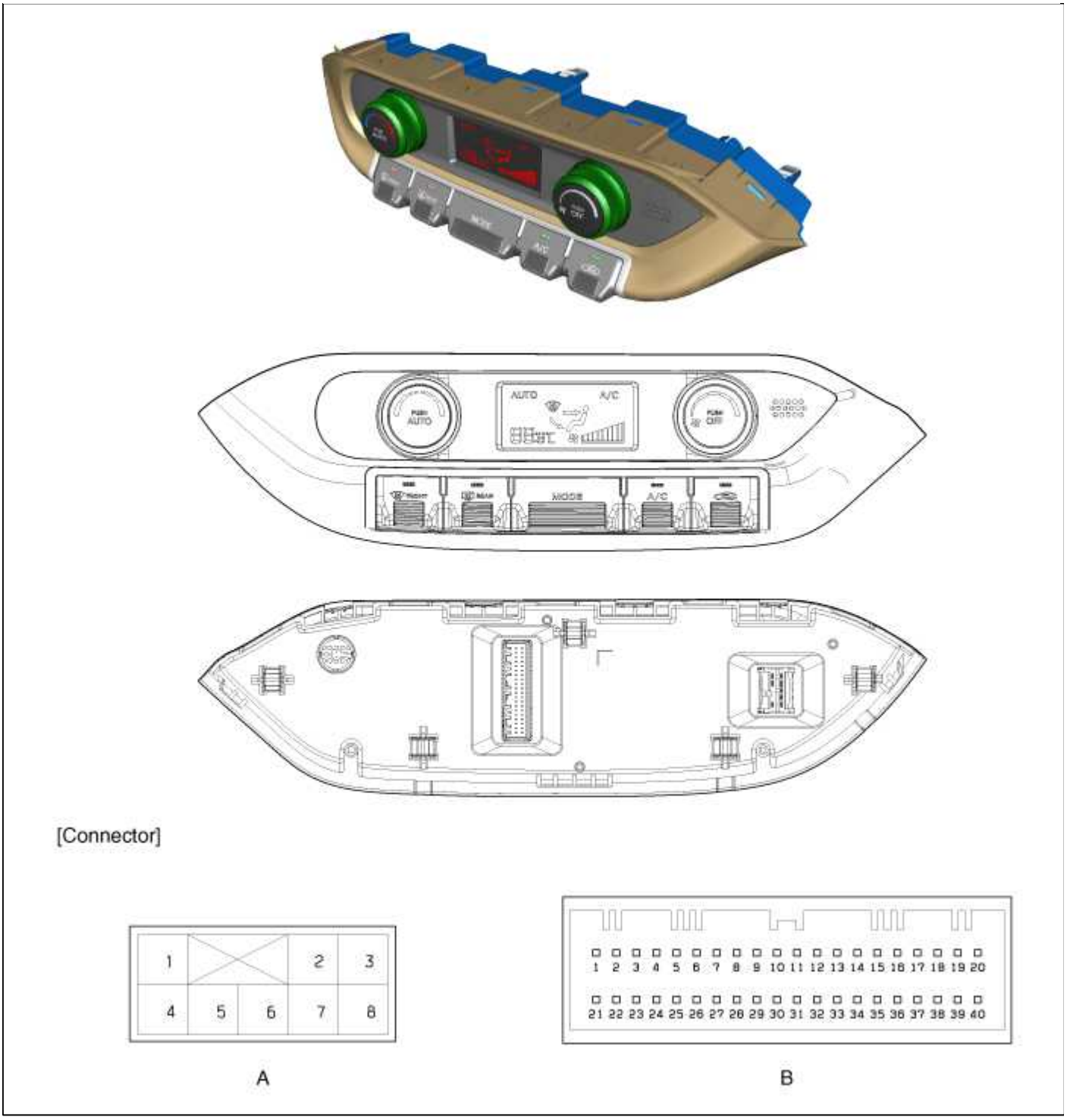
3. Disconnect the connectors (A).



4. Installation is the reverse order of removal.

Heating,Ventilation, Air Conditioning > Controller > Heater & A/C Control Unit (FATC) > Components and Components Location

Components

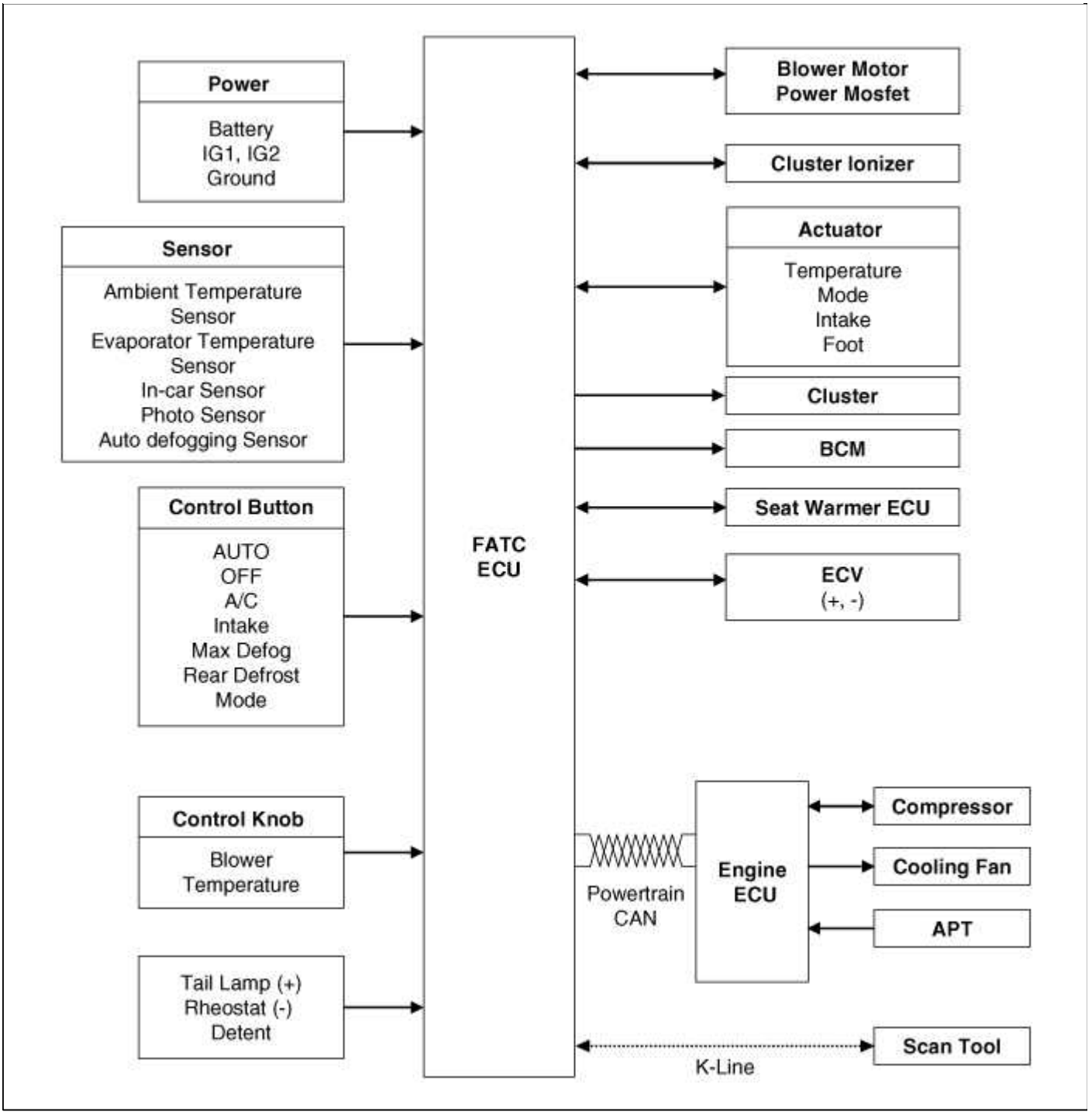


Connector Pin Function

Connector	Pin No	Function	Connector	Pin No	Function
A	1	IGN 2	B	17	HI-SCAN (K-LINE)
	2	Rheostat (ILL-)		18	CAN (Low)
	3	Sensor Ground		19	CAN (High)
	4	Battery (+)		20	Ground
	5	Tail Lamp (+)		21	Temperature Actuator Feedback
	6	Blower Motor (+)		22	Mode Actuator Feedbac
	7	IGN 1		23	Intake Actuator Feedback
	8	Ground		24	Foot Actuator Feedback
B	1	Temperature Actuator (Cool)		25	Seat Warmer Signal (Low) - Driver
	2	Temperature Actuator (Warm)		26	Seat Warmer Signal (High) - Driver
	3	Mode Actuator (Vent)		27	Ionizer Signal
	4	Mode Actuator (Defog)		28	Clean Signal
	5	Intake Actuator (Fresh)		29	Diagnosis
	6	Intake Actuator (Recirculation)		30	-
	7	Foot Actuator (Open)		31	-
	8	Foot Actuator (Close)		32	Rear Defrost Switch (Low)
	9	-		33	HTD (Rear Defrost Indicator)
	10	-		34	Detent Out (+)
	11	-		35	Vref (+5V)
	12	Defog SCK		36	Photo Sensor (-)
	13	Defog Data		37	Evaporator Temperature Sensor (+)
	14	Defog Temperature		38	Ambient Temperature Sensor (+)
	15	Power Mosfet (Gate)		39	ECV IN
	16	Power Mosfet (Drain Feedback)		40	ECV OUT

Heating,Ventilation, Air Conditioning > Controller > Heater & A/C Control Unit (FATC) > Schematic Diagrams

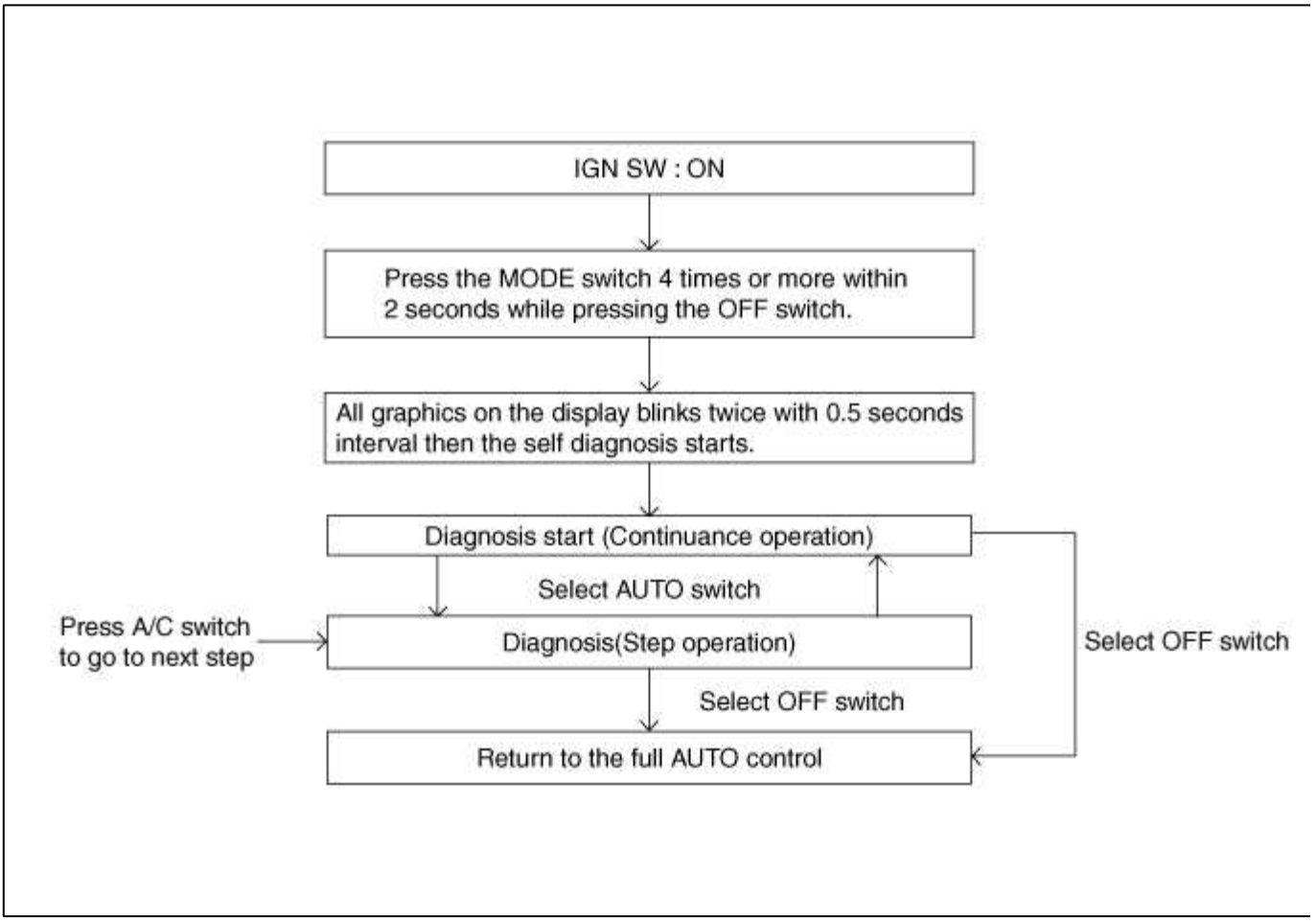
Schematic Diagrams



Heating,Ventilation, Air Conditioning > Controller > Heater & A/C Control Unit (FATC) > Repair procedures

Self Diagnosis

1. Self-diagnosis process



2. How to read self-diagnostic code

During the self-diagnosis, the corresponding fault code flickers on the setup temperature display panel every 0.5 second and will show two figures.

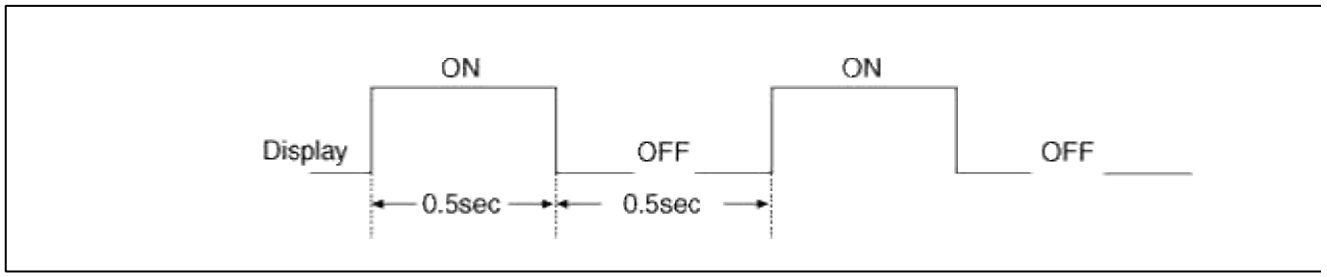
Fault codes are displayed in numerical format.

Display	Fail description
00	Normal
11	In-car sensor open
12	In-car sensor short
13	Ambient temperature sensor open
14	Ambient temperature sensor short
17	Evaporator temperature sensor open
18	Evaporator temperature sensor short
19	Temperature door potentiometer open/short
20	Temperature door potentiometer fault
21	Mode door potentiometer open/short
22	Mode door potentiometer fault
25	Intake door potentiometer open/short
26	Intake door potentiometer fault
43	Foot door potentiometer open/short
44	Foot door potentiometer fault

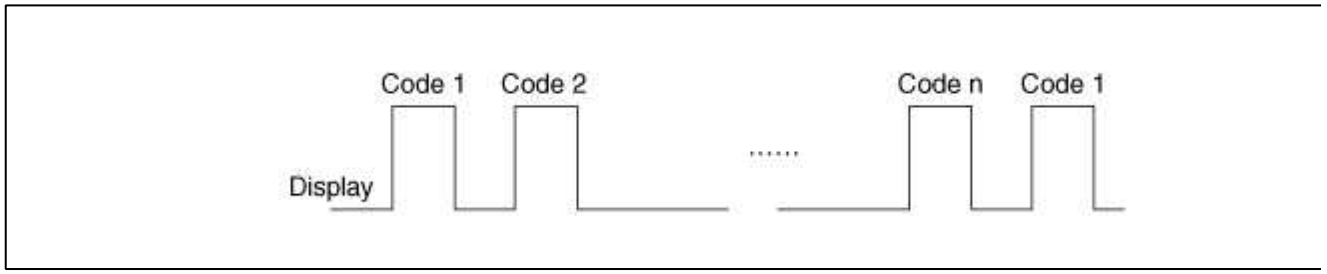
45	APT (A/C Pressure Transducer) CAN signal fault
47	RPM CAN signal fault
48	Vehicle speed CAN signal fault
49	Engine coolant temperature CAN signal fault
50	Cluster ionizer fault
51	Auto defogging sensor communication and sensor input fault

3. Fault code display

(1) Continuance operation: DTC code is none or one.



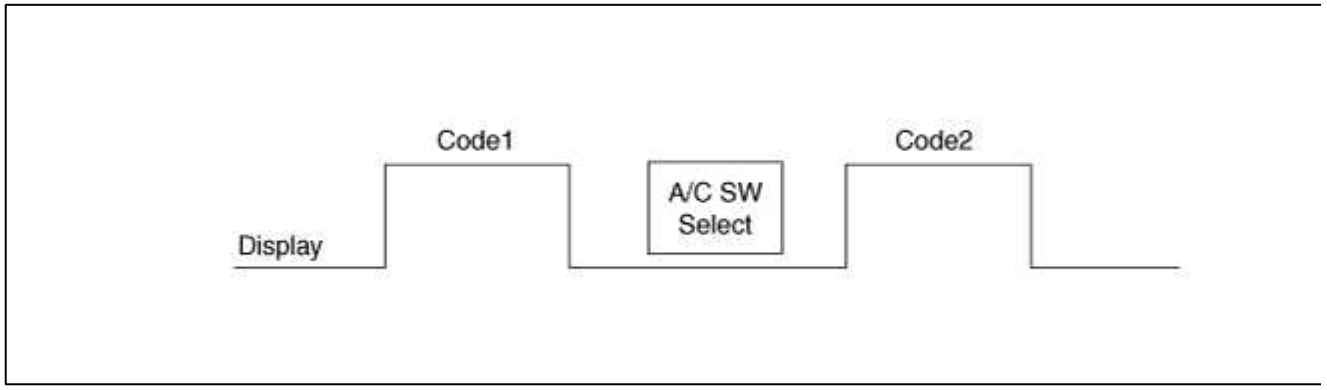
(2) Continuance operation: DTC code is two or more.



(3) STEP operation

A. Normal or one fault code is same as a continuance operation.

B. DTC code is two or more.



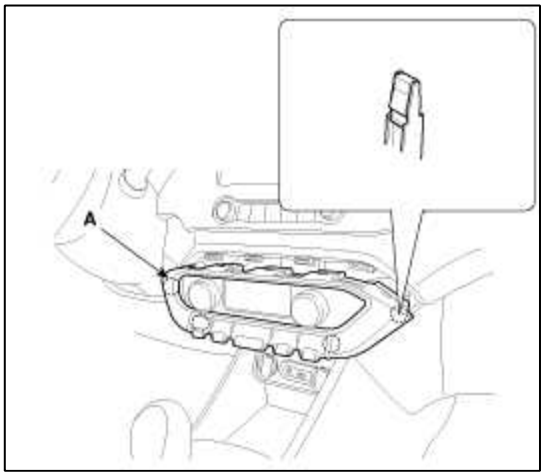
4. If fault codes are displayed during the check, inspect malfunction causes by referring to fault codes table.

5. Fail safe

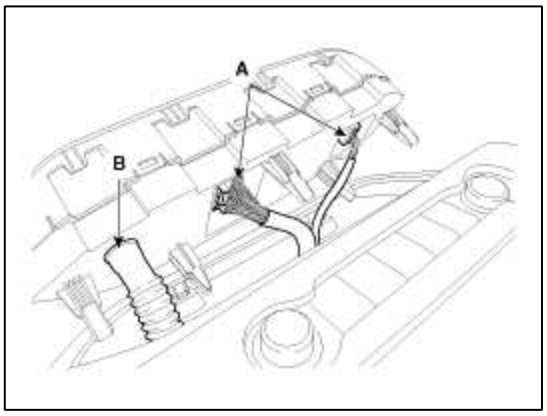
No	Sensor	Fail condition	Fail safe function
1	In-car sensor	< 0.1V or > 4.9V	23°C (73.4°F)
2	Ambient temperature sensor	< 0.1V or > 4.9V	20°C (68°F)
3	Evaporator temperature sensor	< 0.1V or > 4.9V	-2°C (28.4°F)
4	Temperature control actuator feedback	< 0.1V or > 4.9V	• Setting temperature is 24.5°C (76.1°F) or below: Max cool • Setting temperature is 25.0°C (77°F) or above: Max hot
5	Mode control actuator feedback	< 0.5V or > 4.5V	• Vent: Vent • Others: Defog
6	Intake actuator feedback	< 0.1V or > 4.9V	• Recirculation: Recirculation • Others: Fresh
7	Foot actuator feedback	< 0.5V or > 4.5V	• Vent: Open • Others: Close
8	Auto defogging sensor (Relative humidity)	Communication fail	• Relative humidity: 60%, • Surrounding temperature : 23°C (73.4°F)
9	Auto defogging sensor (Glass temperature)	< 0.1V or > 4.9V	Glass temperature : 23°C(73.4°F)
10	Engine coolant temperature	Communication fail	85°C (185°F)
11	ECV feedback	No input of ECV feedback signal	• ECV fault signal : 1 • PWM control output : maintain • Torgue : 0

Replacement

1. Disconnect the negative (-) battery terminal.
2. Remove the heater & A/C controller (A) from the center facia using a flat-head screwdriver or remover.



3. Disconnect the connectors (A) and the air hose (B).



4. Installation is the reverse order of removal.

RIO(UB) > 2012 > G 1.6 GDI > Manual Transaxle System

Manual Transaxle System > General Information > Specifications

Specifications

Transaxle type		M6CF1
Engine type		Gasoline 1.6 GDI
Gear ratio	1st	3.769
	2nd	2.045
	3rd	1.286
	4th	1.036
	5th	0.893
	6th	0.774
	Reverse	3.700
Final gear ratio		3.833

Tightening Torques

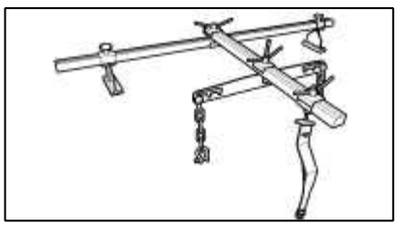
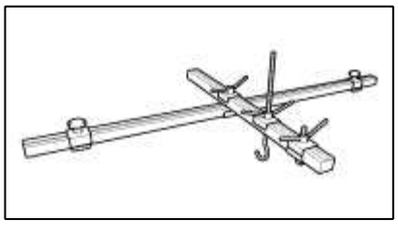
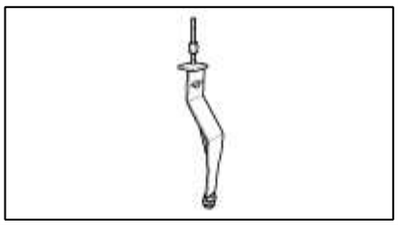
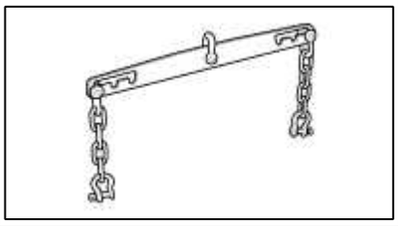
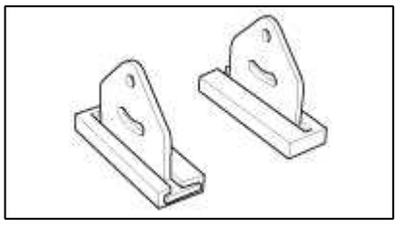
Items	N.m	kgf.m	lb-ft
Oil drain plug	58.9 ~ 78.5	6.0 ~ 8.0	43.4 ~ 57.8
Oil filler plug	58.9 ~ 78.5	6.0 ~ 8.0	43.4 ~ 57.8
Shift lever assembly bolt	8.8 ~ 13.7	0.9 ~ 1.4	6.5 ~ 10.1
Back up lamp switch	29.4 ~ 34.3	3.0 ~ 3.5	21.7 ~ 25.3
Transaxle support bracket bolt	58.8 ~ 78.5	6.0 ~ 8.0	43.4 ~ 57.9
Start motor installation bolt	42.2 ~ 53.9	4.3 ~ 5.5	31.1 ~ 39.8
Roll rod bracket bolt	(A) 49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0
	(B) 107.9 ~ 127.5	11.0 ~ 13.0	79.6 ~ 94.1
Transaxle upper mounting bolt (TM=>ENG)	42.2 ~ 53.9	4.3 ~ 5.5	31.1 ~ 39.8
Transaxle lower mounting bolt (ENG=>TM)	(A) 42.2 ~ 48.1	4.3 ~ 4.9	31.1 ~ 35.4
	(B) 42.2 ~ 53.9	4.3 ~ 5.5	31.1 ~ 39.8
Clutch lelease cylinder mounting bolt	14.7 ~ 21.6	1.5 ~ 2.2	10.8 ~ 15.9

Lubricants

Items	Recommnend lubricant	Quantity
Transaxle gear oil	SAE 75W/85	1.8 ~1.9L (0.48 ~0.50 U.S.gal., 1.90 ~ 2.0 U.S. qt., 1.58 ~ 1.67 lmp qt.)
	API GL-4	
	TGO-7(MS517-14)	
Air breather	MS721-38	As requried
Transaxle housing	MS721-40 or MS721-38	As requried
Surface of release fork and bearing	Grease (CASMOLY L9508)	As requried

Manual Transaxle System > General Information > Special Service Tools

Special Service Tools

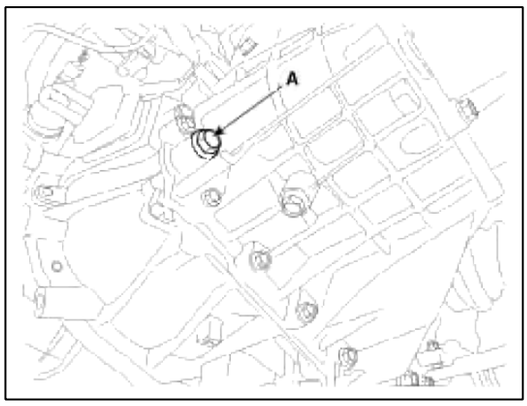
Tool (Number and Name)	Illustration	Use
09200-38001,3N000 (Beam) 09200-1P100, 4X000 (Adapter) 09200-2S200 (Supporter) Engine support assembly		Removal and installation of the transaxle. Use assembling 09200-1P100, 4X000 (Adapter) and 09200-2S200 (Supporter) on 09200-38001, 3N000(Beam).
09200-3N000 Engine support fixture (Beam)		Removal and installation of the transaxle. Use this adapter (SST No. : 09200-1P100, 4X000) with the supporter (SST No. : 09200-2S200). Permit operating with 09200-38001.
09200-1P100 Engine support fixture (Adapter)		Removal and installation of the transaxle. Use this beam (SST No. : 09200-38001/09200-3N000) with the supporter (SST No. : 09200-2S200) and adapter (SST No. : 09200-4X000)
09200-4X000 Engine support fixture (Adapter)		Removal and installation of the transaxle. Use this beam (SST No. : 09200-38001/3N000) with the supporter (SST No. : 09200-2S200) and adapter (SST No. : 09200-1P100)
09200-2S200 Engine support fixture (Supporter)		Removal and installation of the transaxle. Use this beam (SST No. : 09200-38001/09200-3N000) with the adapter (SST No. : 09200-1P100, 4X000)

Manual Transaxle System > Manual Transaxle System > Repair procedures

Inspection

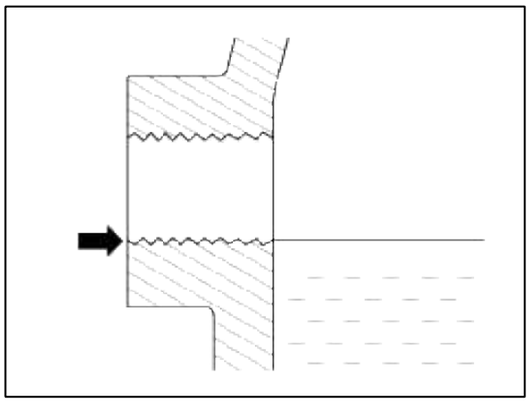
Manual Transaxle Oil Inspection

1. Park the vehicle on a level ground and stop the engine.
2. Retighten the oil filler plug (A) with a new washer.



3. Check level with finger.

> NOTE
>
> Oil level must be up to fill the hole, if not, add oil until it runs over.

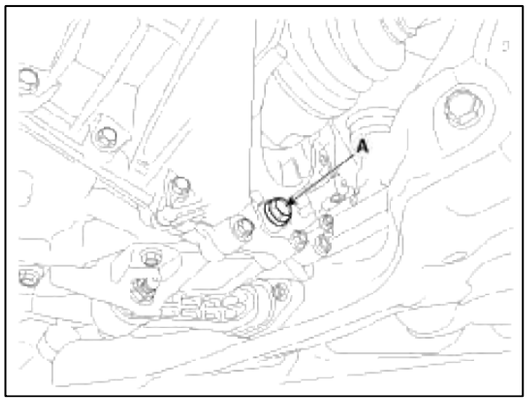


4. Install filler plug.

Tightening torque:
58.9 ~ 78.5 N.m (6.0 ~ 8.0 kgf.m, 43.4 ~ 57.8 lb-ft)

Manual Transaxle Oil Replacement

1. Park the vehicle on a level ground and stop the engine.
2. Drain the manual transaxle oil after loosening the drain plug (A).



3. Install the drain plug with new gasket.

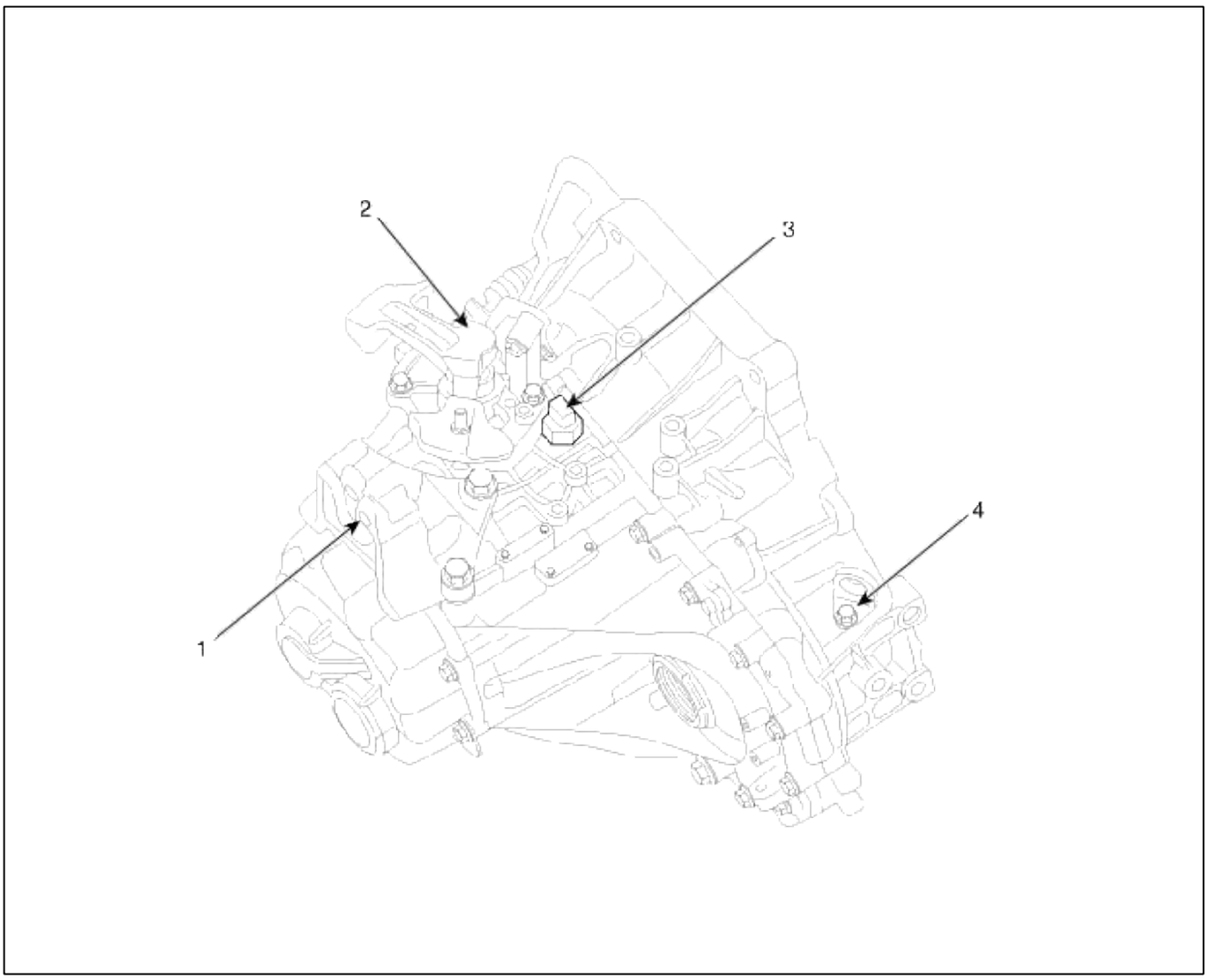
Tightening torque:
58.9 ~ 78.5 N.m (6.0 ~ 8.0kgf.m, 43.4 ~ 57.9 lb-ft)

4. Add new oil through the filler plug hole and, fill it just below the plug opening.

Standard oil: SAE 75W/85, API GL-4
Oil capacity: 1.8 ~1.9L (0.48 ~0.50 U.S.gal., 1.90 ~ 2.0 U.S. qt., 1.58 ~ 1.67 lmp qt.)

Manual Transaxle System > Manual Transaxle System > Manual Transaxle > Components and Components Location

Components

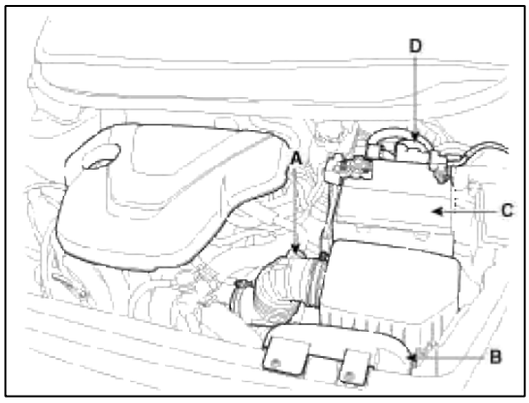


1. Transaxle support mounting bracket 2. Control shaft complete	3. Back up lamp switch 4. Vehicle speed sensor

Manual Transaxle System > Manual Transaxle System > Manual Transaxle > Repair procedures

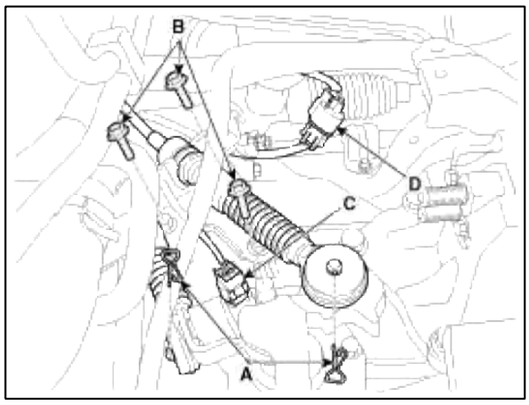
Removal

1. Remove the following items;
   A. Air cleaner assembly (A) and air duct (B) .
      (Refer to "Intake and Exhaust system" in EM group)
   B. Battery and battery tray (C).
      (Refer to "Charging system" in EE group)
   C. ECM (D).
      (Refer to "Engine Control System" in FL group)



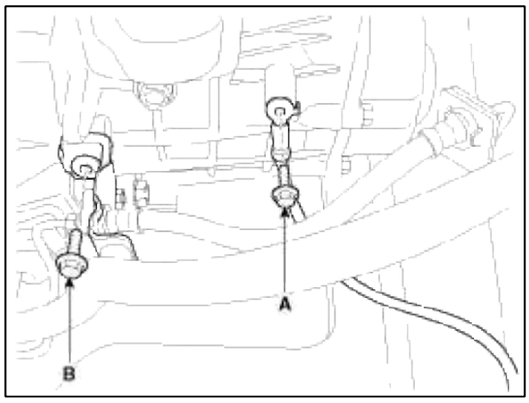
2. Disconnect the shift cable bracket bolts (B-3ea) after removing the washer and pin (A) and then disconnect the back up lamp switch connector (C) and the vehicle speed sensor connector (D).

Tightening torque:
14.7 ~ 21.6 N.m (1.5 ~ 2.2 kgf.m, 10.8 ~ 15.9 lb-ft)



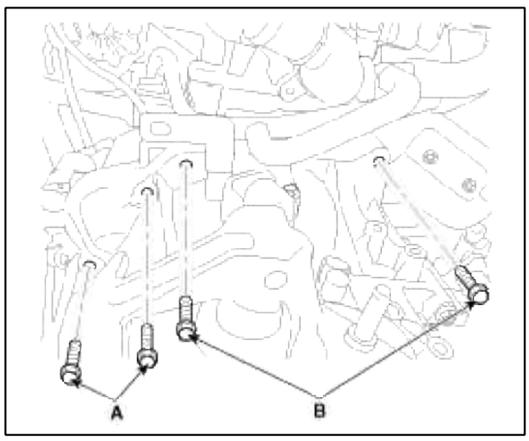
3. Remove the ground cable bolt (A) and tube bracket bolt (B).

Tightening torque:
14.7 ~ 21.6 N.m (1.5 ~ 2.2 kgf.m, 10.8 ~ 15.9 lb-ft)

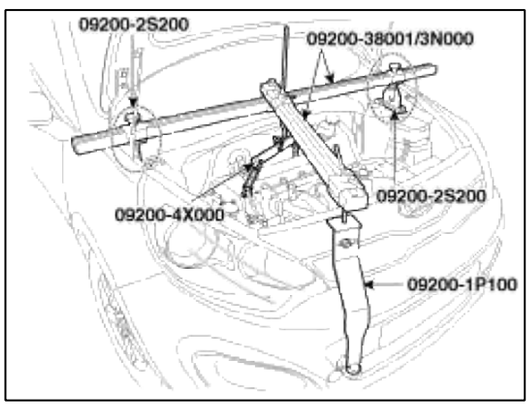


4. Remove the transaxle upper mounting bolt (B-2ea) and the start motor mounting bolt (A-2ea).

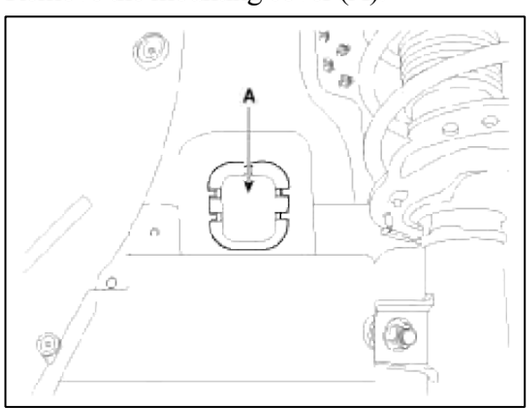
Tightening torque:
(A,B) 42.2 ~ 54.0 N.m (4.3 ~ 5.5 kgf.m, 31.1 ~ 39.8 lb-ft)



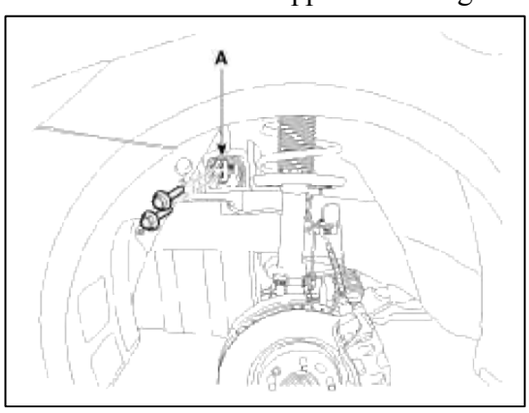
5. Remove the cowl top cover.
(Refer to BD group.)
6. Using the engine support fixture (Support SST No.: 09200-2S200, Adapter SST No.: 09200-1P000, 4X000, Beam SST No.: 09200-38001/3N000), hold the engine and transaxle assembly safely.



7. Remove the mounting cover (A).

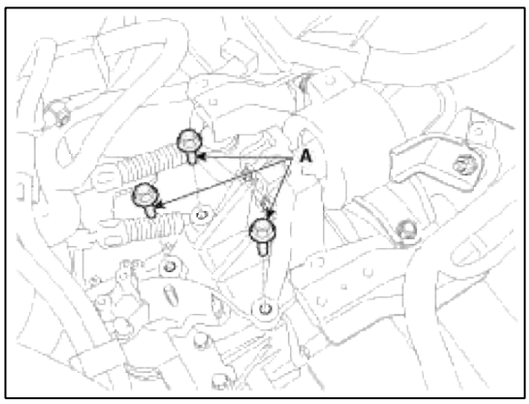


8. Remove the transaxle support mounting bracket bolts (A-2ea).

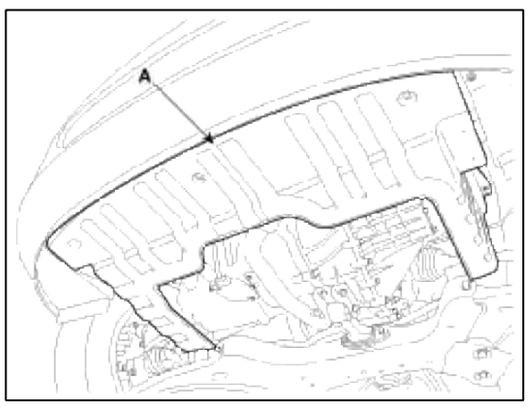


9. Remove the transaxle support mounting bracket bolts (A-3ea).

Tightening torque:
58.8 ~ 78.5 N.m (6.0 ~ 8.0 kgf.m, 43.4 ~ 57.9 lb-ft)

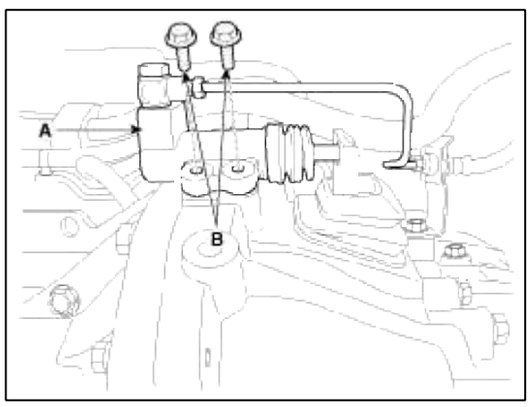


10. Lifting up the vehicle.
11. Remove the under cover (A).



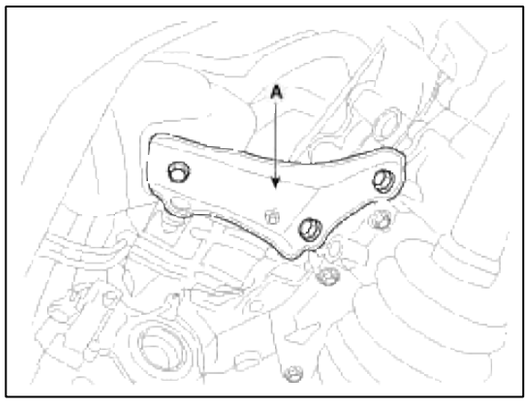
12. Remove the clutch release cylinder assembly (A) by removing bolts (B-2ea).

Tightening torque:
14.7 ~ 21.6 N.m (1.5 ~ 2.2 kgf.m, 10.8 ~ 15.9 lb-ft)

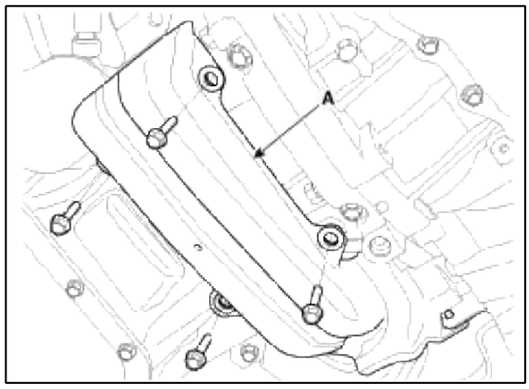


13. Remove the drive shaft assembly.
(Refer to "Drive shaft assembly" in DS group.)

14. Remove the drive shaft cover (A).

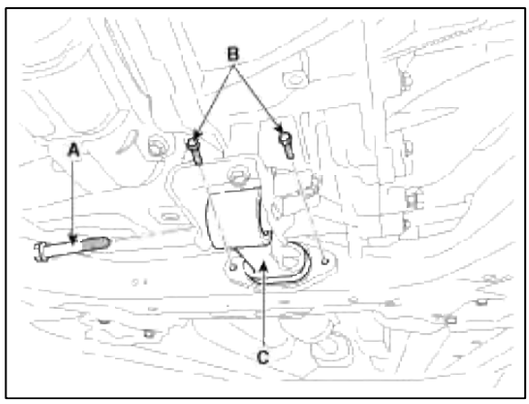


15. Remove the brackets (A).



16. Remove the roll rod bracket (C) after removing bolt (A,B).

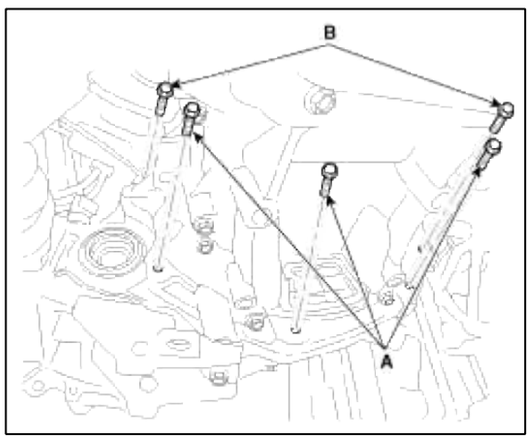
Tightening torque:
(A) 49.0 ~ 63.7 N.m (5.0 ~ 6.5 kgf.m, 36.2 ~ 47.0 lb-ft)
(B) 107.9 ~ 127.5 N.m (11.0 ~ 13.0 kgf.m, 79.6 ~ 94.1 lb-ft)



17. Remove the mounting bolts (A-3ea, B-2ea) of lower part of the transaxle, and the left side cover and remove the transaxle assembly by supporting it with a jack.

> CAUTION
>
> Be careful not to damage other system or parts near by when removing the engine and transaxle assembly.

Tightening torque:
(A) 43 ~ 49 N.m (4.3 ~ 4.9 kgf.m, 31.1 ~ 35.4 lb-ft)
(B) 42.2 ~ 53.9 N.m (4.3 ~ 5.5 kgf.m, 31.1 ~ 39.8 lb-ft)



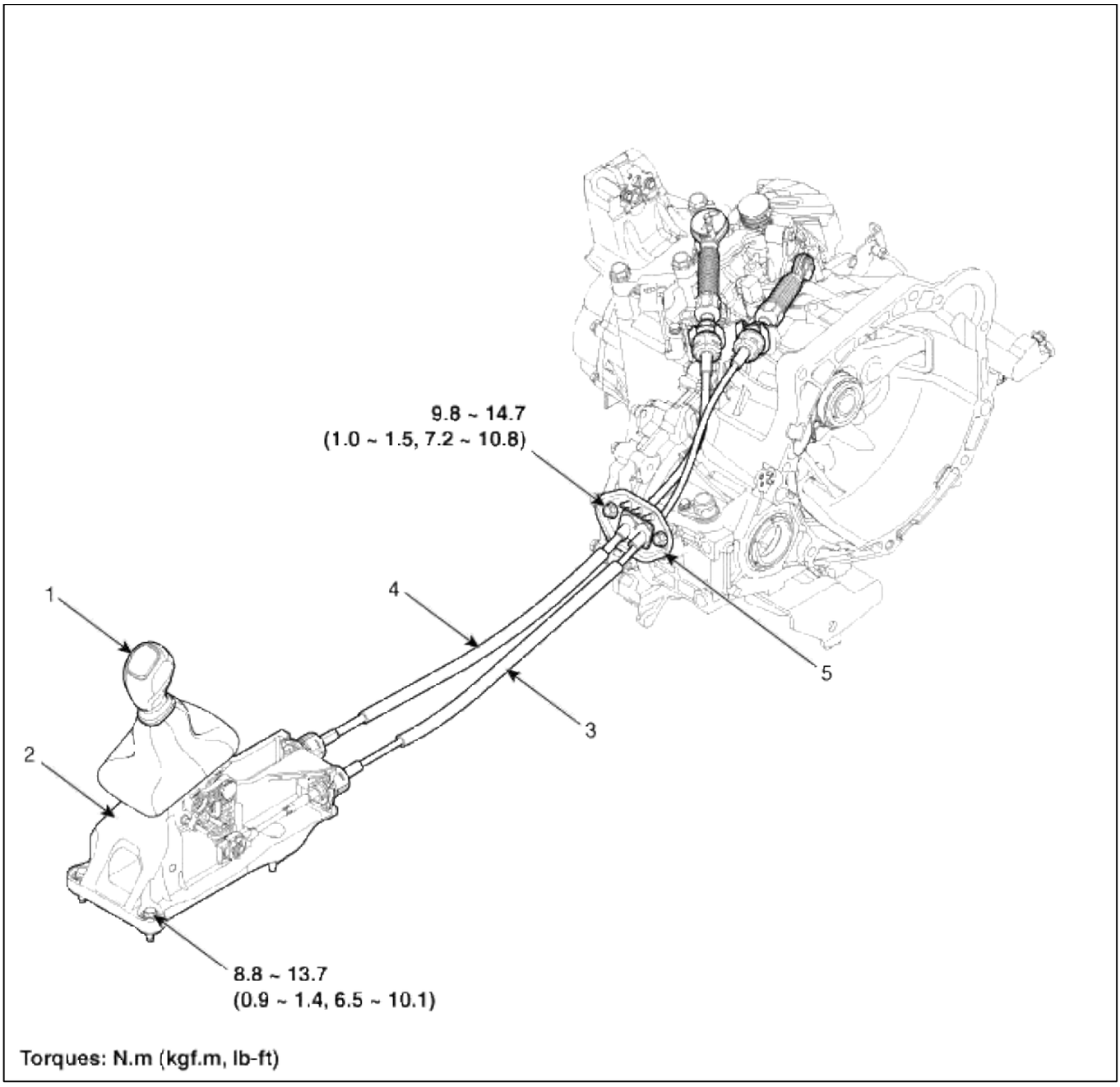
Installation

1. Installation is the reverse of removal.

> NOTE
>
> • Adding Manual transaxle fluid.
> (Refer to "Manual transaxle system" in this group.)

Manual Transaxle System > Manual Transaxle Control System > Shift Lever > Components and Components Location

Components



1. Shift lever knob 2. Shift lever assembly 3. Select cable assembly	4. Shift cable assembly 5. Retainer

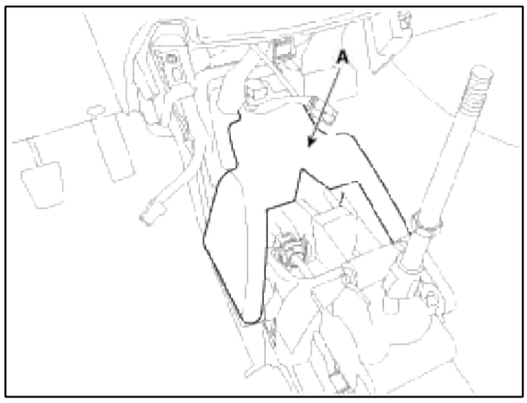
Manual Transaxle System > Manual Transaxle Control System > Shift Lever > Repair procedures

Removal

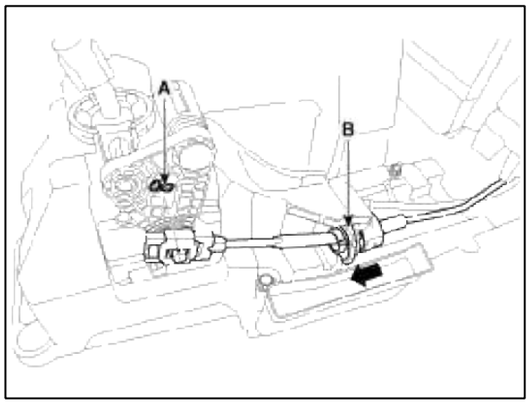
Shift Lever Assembly Replacement

1. Remove the floor Interior console assembly.
   (Refer to "Interior (Console)" in BD group)

2. Remove the heater duct (A).

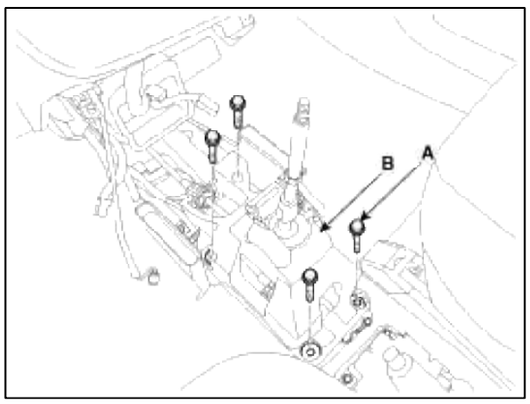


3. Remove the select cable assembly after removing select cable snap pin (A) and clip (B).



4. Remove the shift lever assembly (B) by removing the bolts (A-4ea).

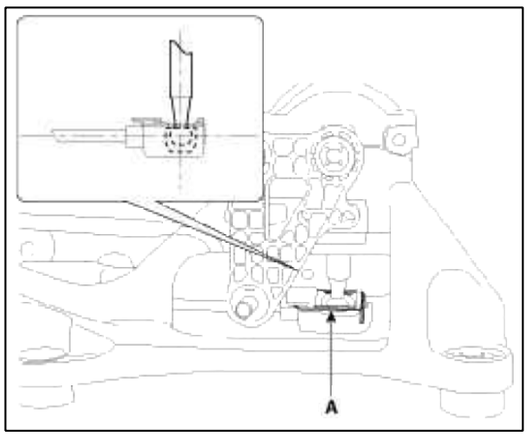
Tightening torque:
8.8 ~ 13.7 N.m (0.9 ~ 1.4 kgf.m, 6.5 ~ 10.1 lb-ft)

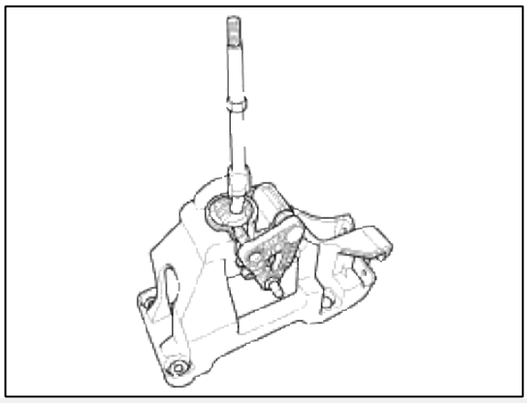


5. Remove the shift lever assembly (B) by removing the clip (A).

CAUTION

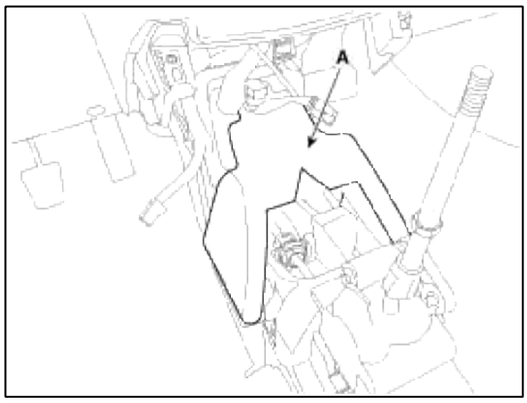
- Set securely.



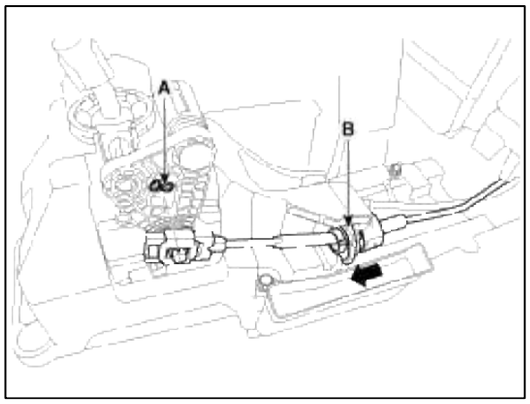


Select / Shift Cable Replacement

1. Remove the floor Interior console assembly.
   (Refer to "Interior (Console)" in BD group)
2. Remove the heater duct (A).

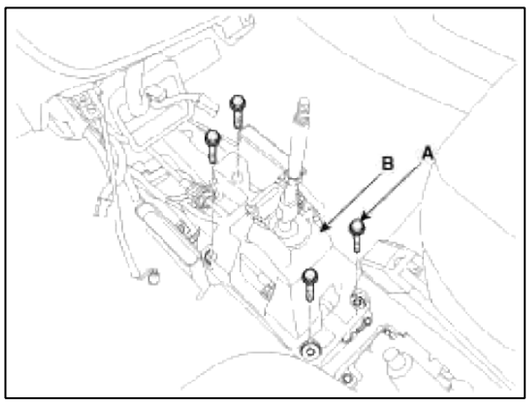


3. Remove the select cable assembly after removing select cable snap pin (A) and clip (B).



4. Remove the shift lever assembly (B) by removing the bolts (A-4ea).

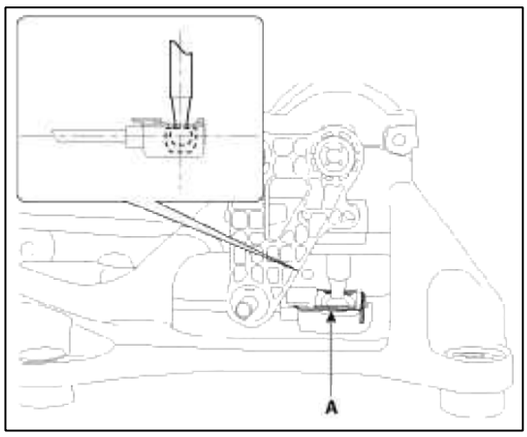
Tightening torque:
8.8 ~ 13.7 N.m (0.9 ~ 1.4 kgf.m, 6.5 ~ 10.1 lb-ft)

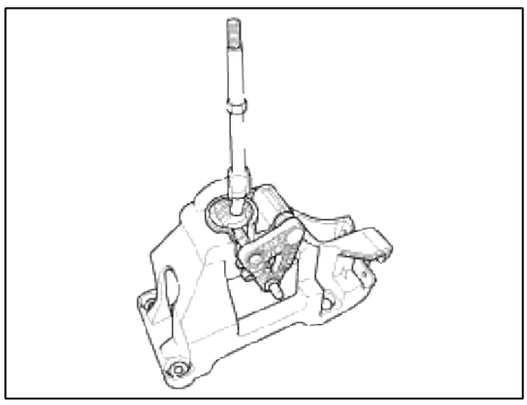


5. Remove the clip (A) from the shift cable assembly.

CAUTION

- Set securely.

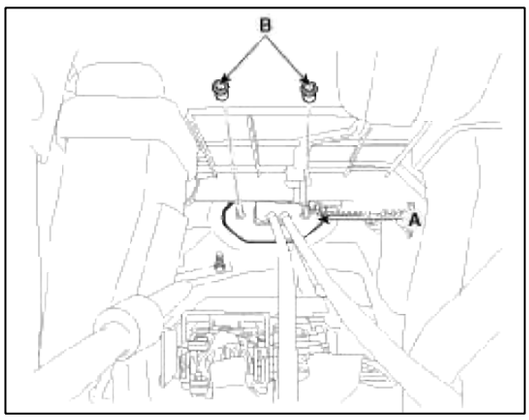


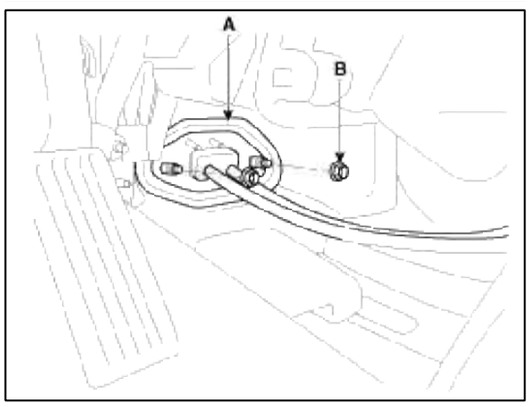


6. Remove the crash pad.
(Refer to "Interior (Crash pad)" in BD group.)
7. Remove the heater unit.
(Refer to "Heater (Heater unit)" in HA group.)

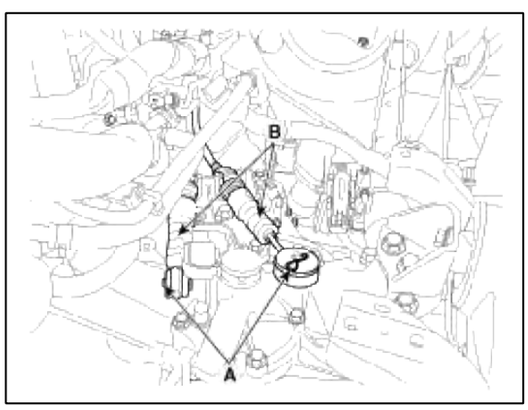
8. Remove the retainer (A) and nuts (B-2ea).

Tightening torque:
11.8 ~ 14.7 N.m (1.2 ~ 1.5 kgf.m, 8.7 ~ 10.8 lb-ft)





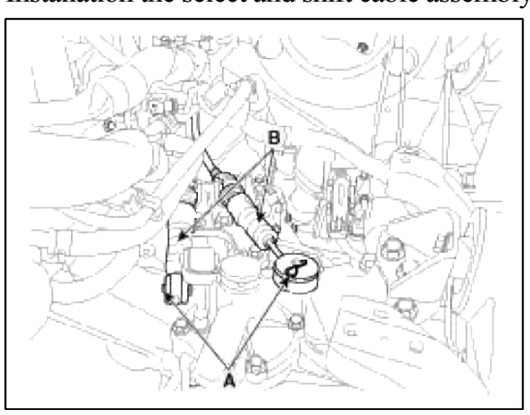
9. Remove the pins (A).
10. Remove the cable (B) from the cable bracket at manual transaxle assembly side.
11. Remove the shift cable and select cable at cabin room.



12. Installation is the reverse of removal.

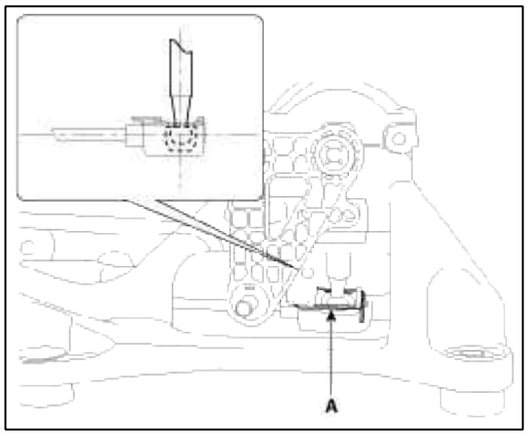
[Shift / Select Cable Installation Tips]

1. Installation the select and shift cable assembly (B) after removing the pin (A).



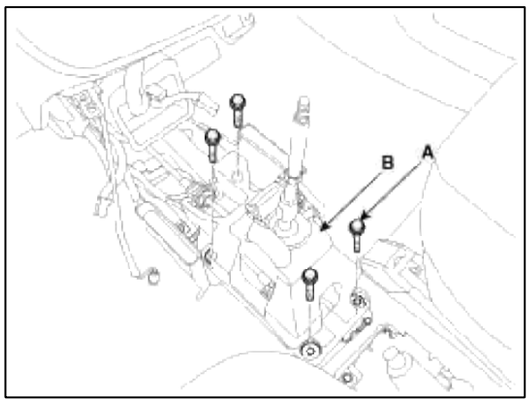
2. Installation is the shift cable (A).

> CAUTION
>
> At this time, have to disconnect select cable.

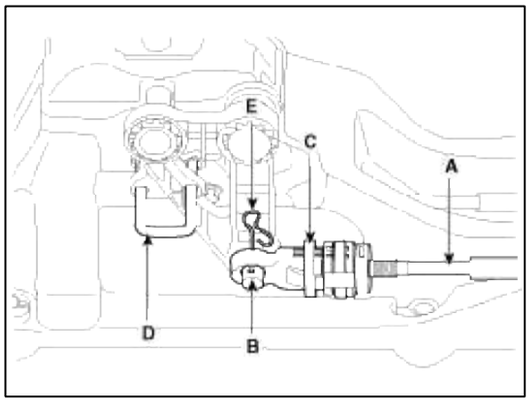


3. Installation is the shift lever assembly (A).

Tightening torque:
8.8 ~ 13.7 N.m (0.9 ~ 1.4 kgf.m, 6.5 ~ 10.1 lb-ft)



4. Shift to the 3th gear position.
5. Insert the selected cable (A) to the shift lever assembly pin (B).
6. You have to push in the adjuster (C).
7. Remove the neutral position pin (D).
8. Install the snap pin (E).

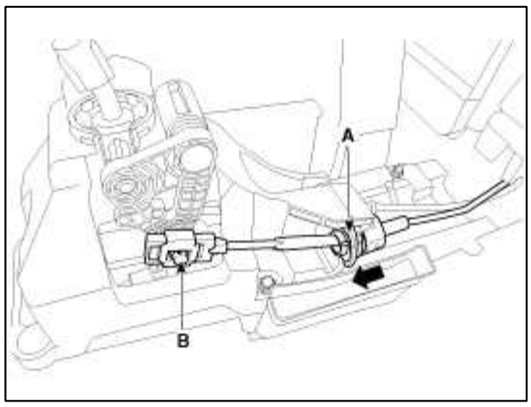


Inspection

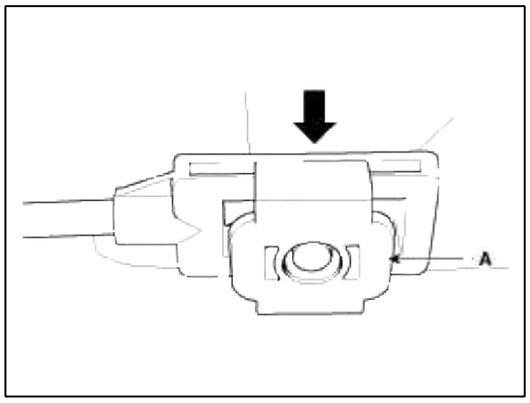
1. Check the select cable for proper operation and for damage.
2. Check the shift cable for proper operation and for damage.
3. Check the boots for damage.
4. Check the boots for wear abrasion sticking, restricted movement or damage.
5. Check for the weak or damaged spring.

Adjustment

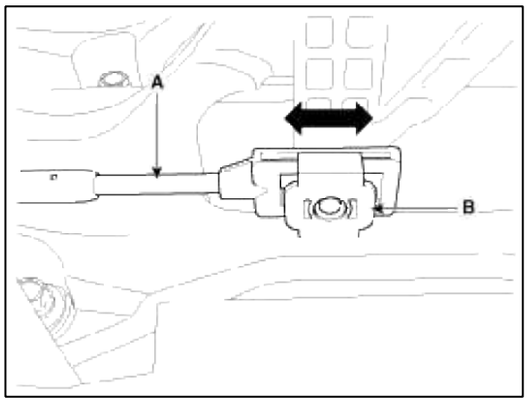
1. In neutral position, disjoin select cable (A) from shift lever assembly pin (B).



2. Disconnect select adjuster (A) to an arrow.



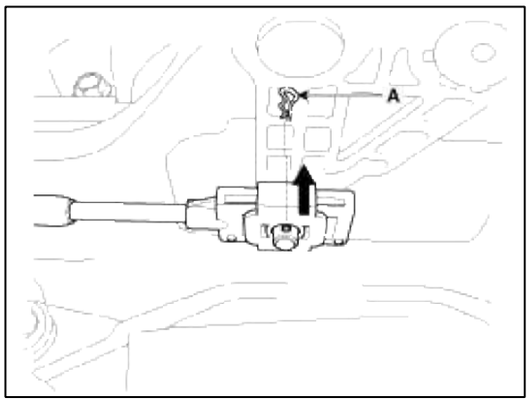
3. Shift to the 3th gear position.
4. Adjustment adjuster (B) on select cable (A) as rolling from side to side.



5. Insert on free load and press the adjuster.
6. After shifting 2nd gear, cheking the left select gap about 1mm(if not, loop no, 1~5)

> NOTE
>
> If there are still gate blocking in spite of re-adjustment, shift lever assembly stopper stoke must be cheked.

7. In neutral position, jion by clip (A).



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

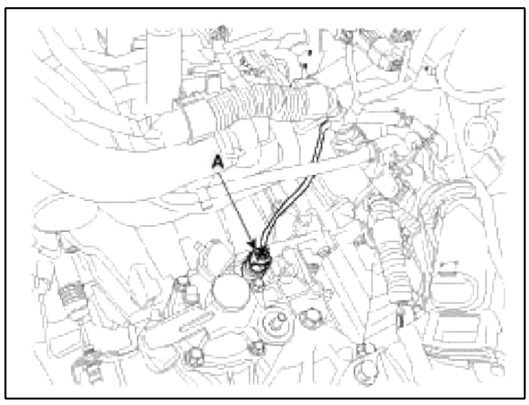
Specifications

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]

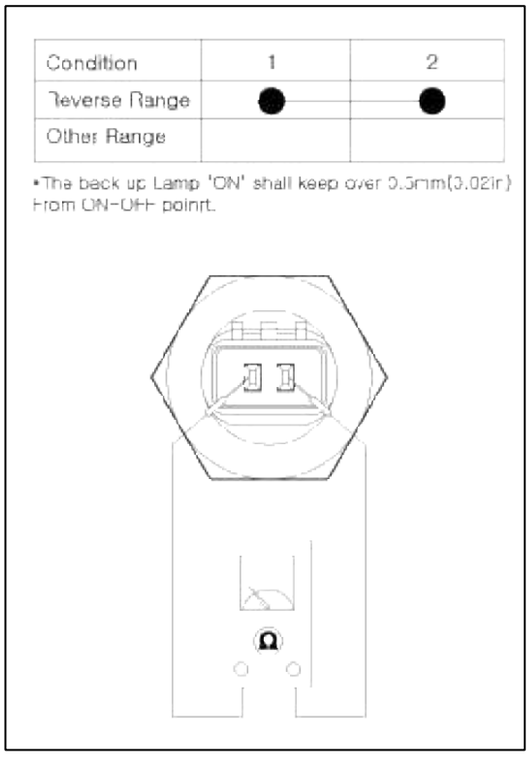
Manual Transaxle System > Manual Transaxle Control System > Back-up Lamp Switch > Repair procedures

Inspection

1. Disconnect the back up lamp switch connector (A).

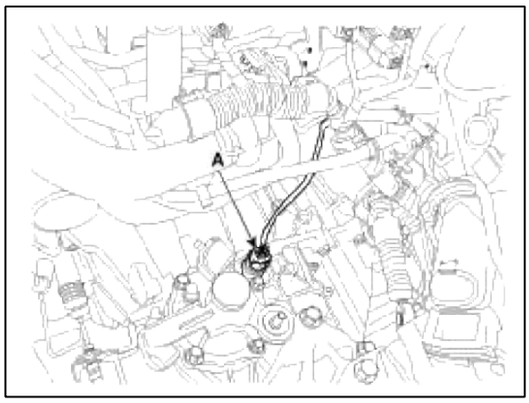


2. Check the continuity between no. 1 and 2 terminals of backup lamp switch. When the shift lever is in reverse, there should be continuity.
3. If necessary, repair or replace the backup lamp switch.

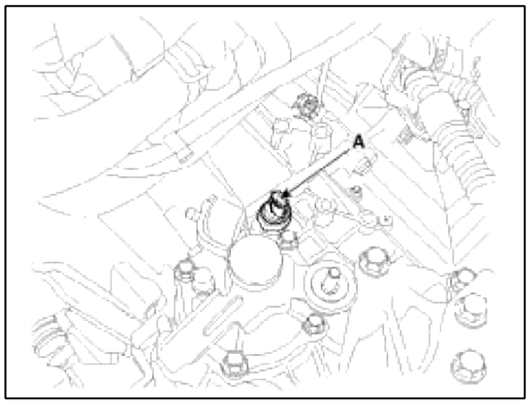


Replacement

1. Disconnect the back up lamp switch connector (A).



2. Remove the back up lamp switch (A).



3. Replace a new one and install the back up lamp switch.

Tightening torque:
29.4 ~ 34.3 N.m (3.0 ~ 3.5 kgf.m, 21.7 ~ 25.3 lb-ft)

RIO(UB) > 2012 > G 1.6 GDI > 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 sensors and internal acceleration sensors inside of SRSCM. For side impact, SRSCM will detect the side impact with 4 side impact sensors, 2 conventional acceleration sensors in Center pillar inner locations and 2 pressure sensing sensors in side of front door module, and internal acceleration sensor inside of SRSCM.

SRSCM is designed to issue corresponding airbag module(s) deployment(s) using above described sensor inputs.

1. DC/DC converter: DC/DC converter in power supply unit includes up/down transformer converter, and provides ignition voltage for all firing circuits, implemented as ASICs and the internal operation voltage of the SRSCM itself. if the internal operation voltage is below critical value setting, it will perform resetting.
2. Back up power supply: SRSCM has separate back up power supply, that will supply deployment energy instantly in low voltage condition or upon power failure by front crash.
3. Self diagnosis: SRSCM will constantly monitor current SRS operation status and detect system failure while vehicle power supply is on, system failure may be checked with trouble codes using 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 to the driver that there is an 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 active or if a crash is recorded the fault clearing cannot be performed.
6. Self diagnostic connector: Data stored in SRSCM memory will be output to GDS or other external output devices through a 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 fasten the 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.

Restraint > General Information > Specifications

Specification

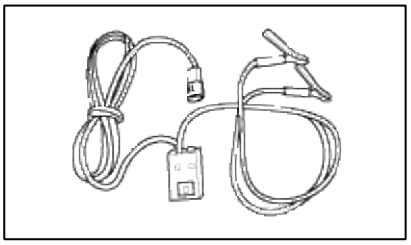
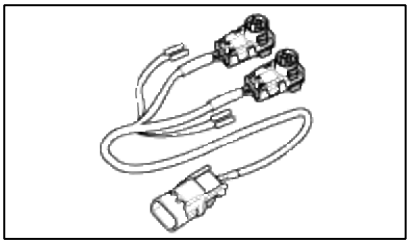
Item	Resistance (Ω)
Driver Airbag (DAB)	1.7 ~ 2.3
Passenger Airbag (PAB)	1.7 ~ 2.3
Side Airbag (SAB)	2.0 ~ 2.4
Curtain Airbag (CAB)	1.7 ~ 2.3
Seat Belt Pretensioner (BPT)	1.8 ~ 2.5
Anchor Pretensioner (APT)	1.8 ~ 2.5

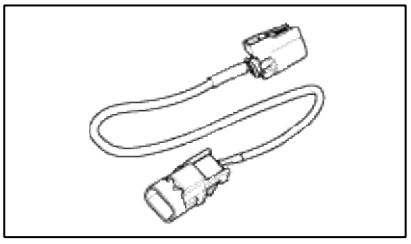
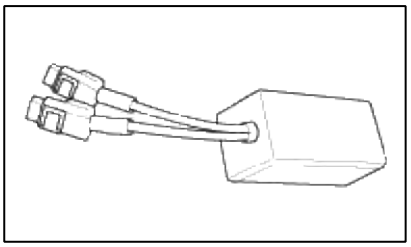
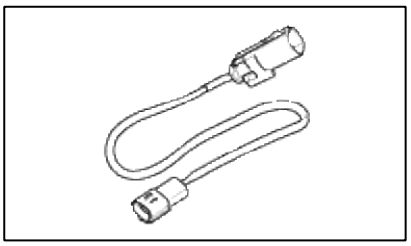
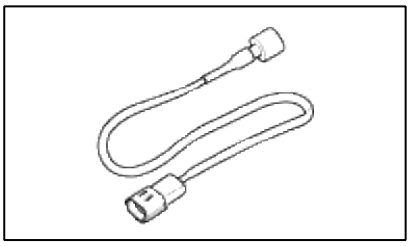
Tightening Torques

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)	7.8 ~ 11.8	0.8 ~ 1.2	5.8 ~ 8.7
Seat Belt Anchor Bolt	39.2 ~ 53.9	4.0 ~5.5	28.9 ~ 39.8
SRSCM	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Front Impact Sensor (FIS) Mounting Nut	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Pressure Side Impact Sensor (PSIS) Mounting Screw	2.5 ~ 3.5	0.25 ~ 0.36	1.8 ~ 2.6
Side Impact Sensor (SIS) Mounting Bolt	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2

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-3Q100		Use with deployment tool. (DAB, PAB, CAB, BPT, APT)

Deployment adapter 0957A-3F100		Use with deployment tool. (SAB)
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.

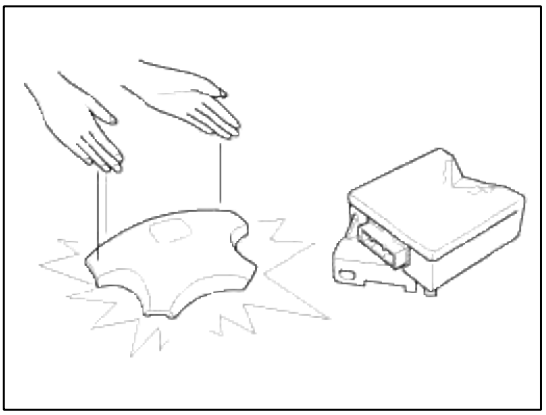
- Except when performing electrical inspections, always turn the ignition switch OFF and disconnect the negative cable from the battery, and wait at least three minutes before beginning work.

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.



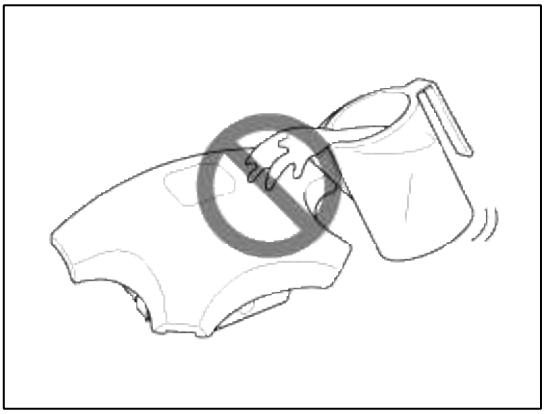
- Before removing any of the SRSCM parts (including the disconnection of the connectors), always disconnect the SRSCM connector.

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.



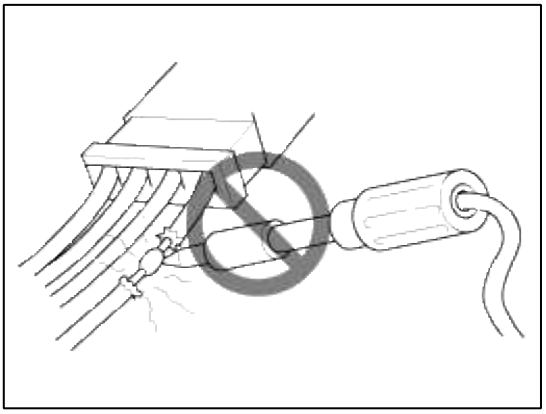
- Store the removed airbag on secure, flat surface away from any high heat source (exceeding 85 C/185 F).
- Never perform electrical inspections to the airbags, such as measuring resistance.
- Do not position yourself in front of the airbag assembly during removal, inspection, or replacement.
- Refer 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 the front airbag is deployed. 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.

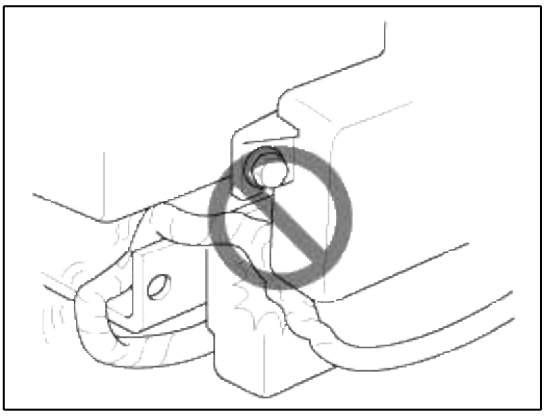
Wiring Precautions

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.



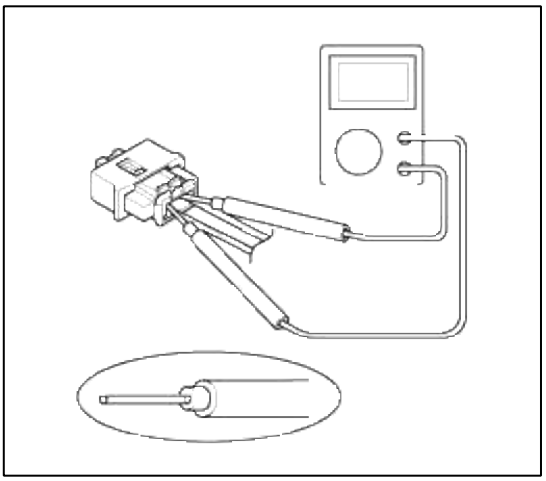
- Be sure to install the harness wires so that they are not pinched, or interfere with other parts.



- 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-loaded Lock Connector

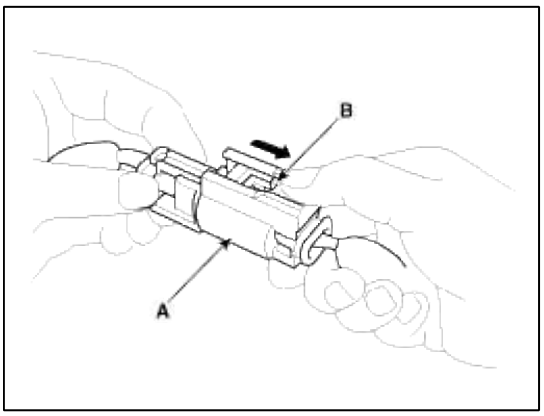
Some SRS system connectors have a spring-loaded lock.

Airbag Connector

Disconnecting

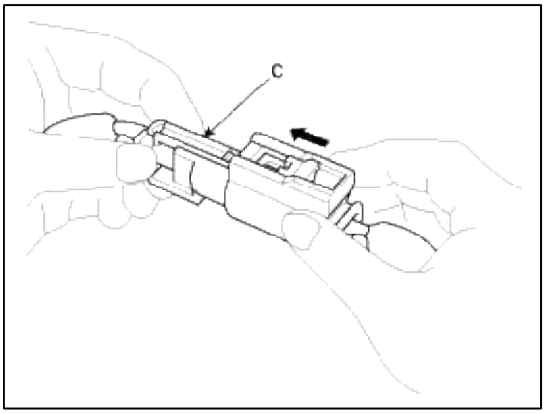
To release the lock, pull the spring-loaded sleeve (A) and the slider (B), while holding the opposite half of the connector.

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

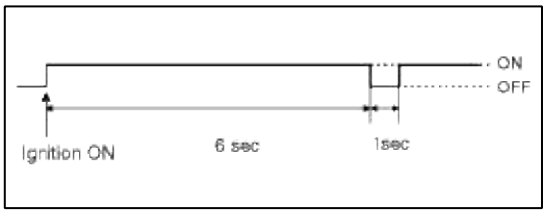
Warning Lamp Behavior after Ignition On

As soon as the operating voltage is applied to the SRSCM ignition input, the SRSCM activates the warning lamp for a LED lamp check.

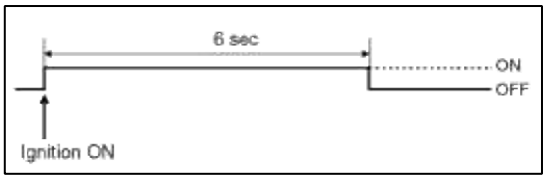
The lamp shall turn on for 6 seconds during the initialization phase and be turned off afterward.

To alert the driver, the warning lamp shall turn on for 6 seconds and off for one second then on continuously after the operating voltage is applied if any active fault exists.

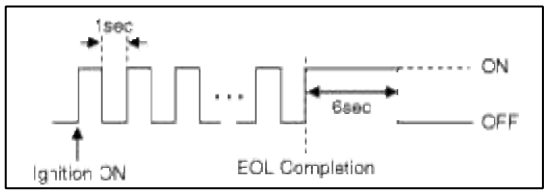
1. Active fault or historical fault counter is greater or equal to 10.



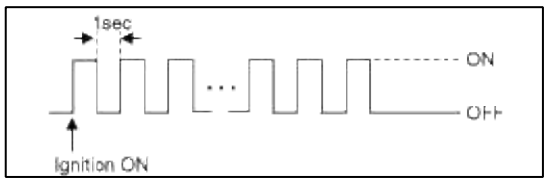
2. Normal or historical fault counter is less than 10.



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.
   If the variant coding is completed normally, the airbag warning lamp will turn 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) cannot be completed. In this case, perform the variant coding (EOL) procedure again after troubleshooting with the GDS.

SRSCM Independent Warning Lamp Activation

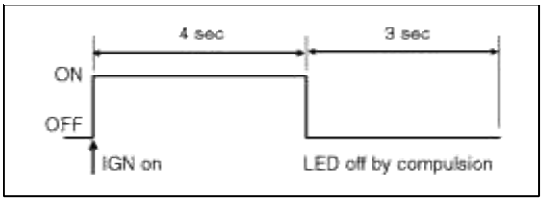
There are certain fault conditions in which the SRSCM cannot function and thus cannot control the operation of the standard warning lamp. In these cases, the standard warning lamp is directly activated by appropriate circuitry that operates independently of the SRSCM. These cases are:

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. ODS (Occupant Detection System) 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 ODS 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. Check and repair all DTC's before replacing a faulty or one whose airbag system has been deployed SRSCM.

When the front airbag(s) deployed after a collision, replace the following items. Make sure all DTC's are repaired befor replacing with new SRSCM.

- SRSCM
- Deployed airbag(s)
- Seat belt pretensioner(s)
- Anchor 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.

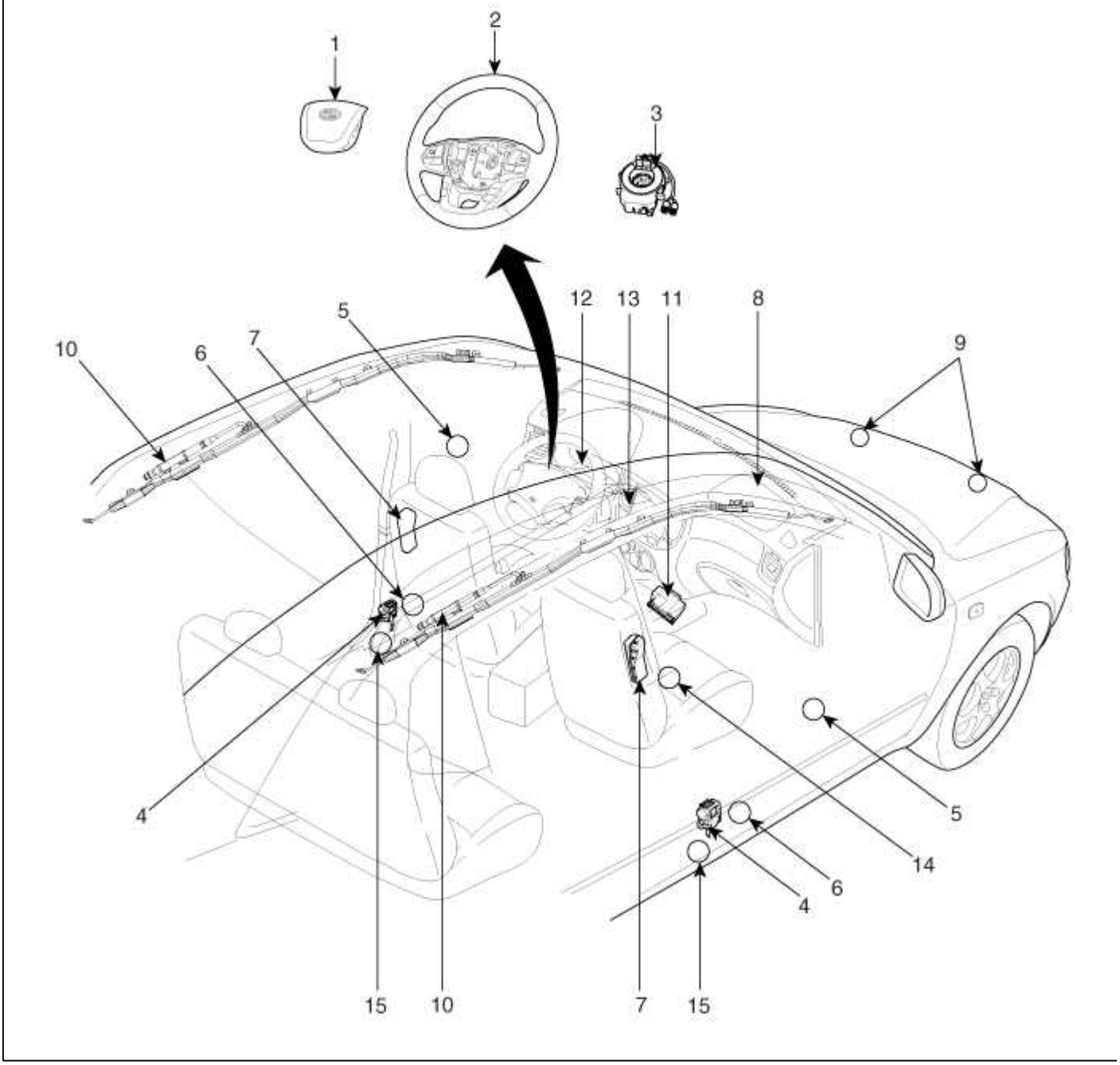
- SRSCM
- Deployed airbag(s)
- Side impact sensor(s) for the deployed side(s)
- SRS wiring harnesses

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

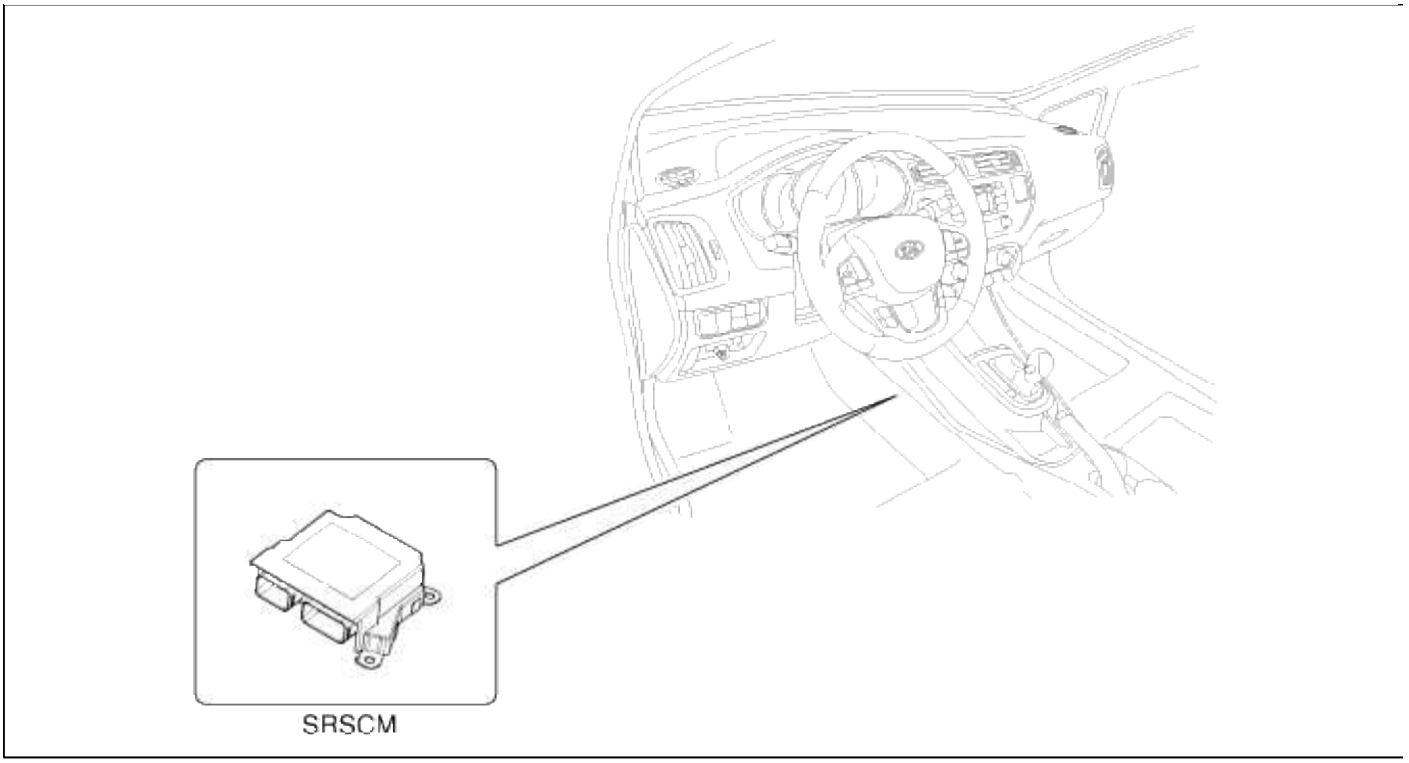
Components



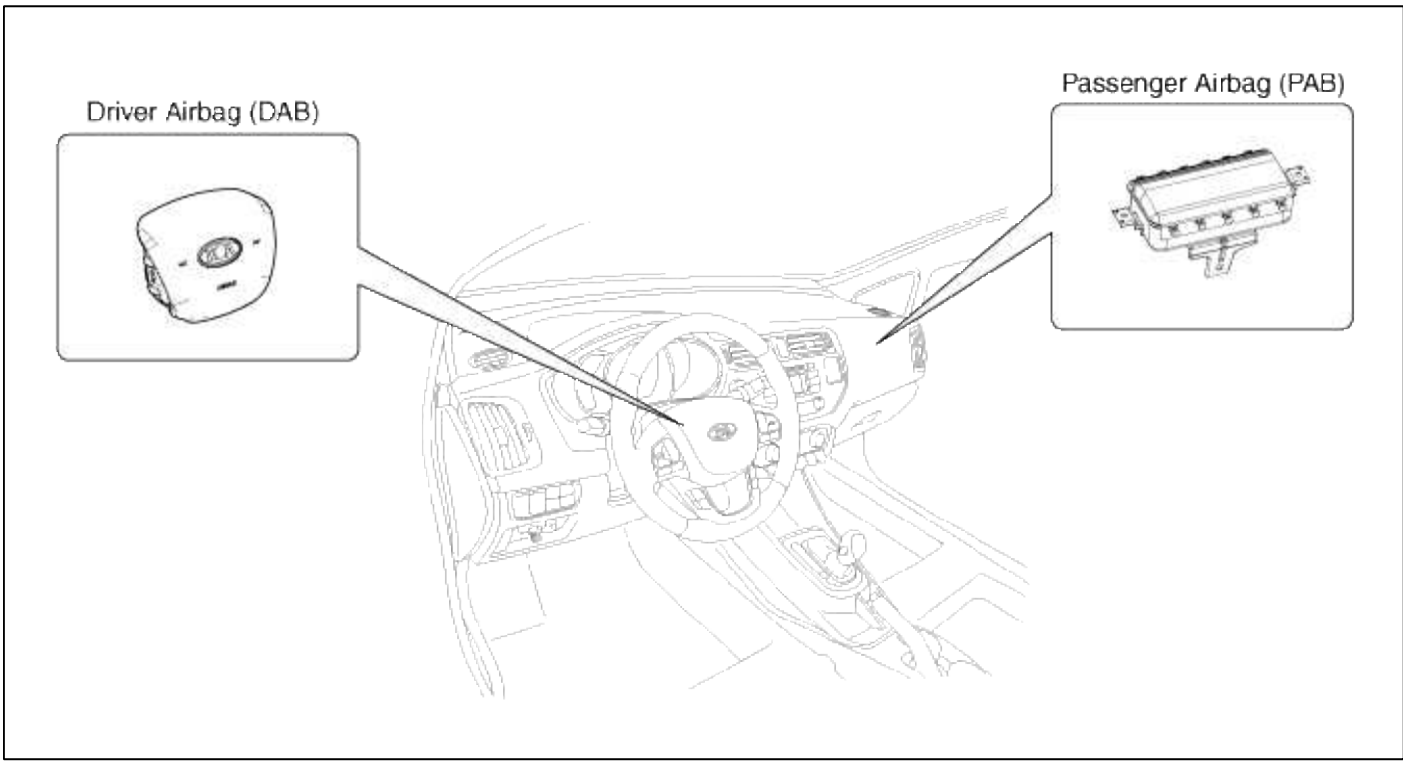
1. Driver Airbag (DAB)	9. Front Impact Sensor (FIS)
2. Steering Wheel	10. Curtain Airbag (CAB)
3. Clock Spring	11. Supplemental Restraint System Control Module(SRSCM)
4. Seat Belt Pretensioner (BPT)	12. Airbag Warning Lamp
5. Pressure Side Impact Sensor (P-SIS)	13. Telltale Lamp
6. Side Impact Sensor (SIS)	14. Weight Classification System (WCS) Module
7. Side Airbag (SAB)	15. Anchor Pretensioner (APT)
8. Passenger Airbag (PAB)	

Components Location

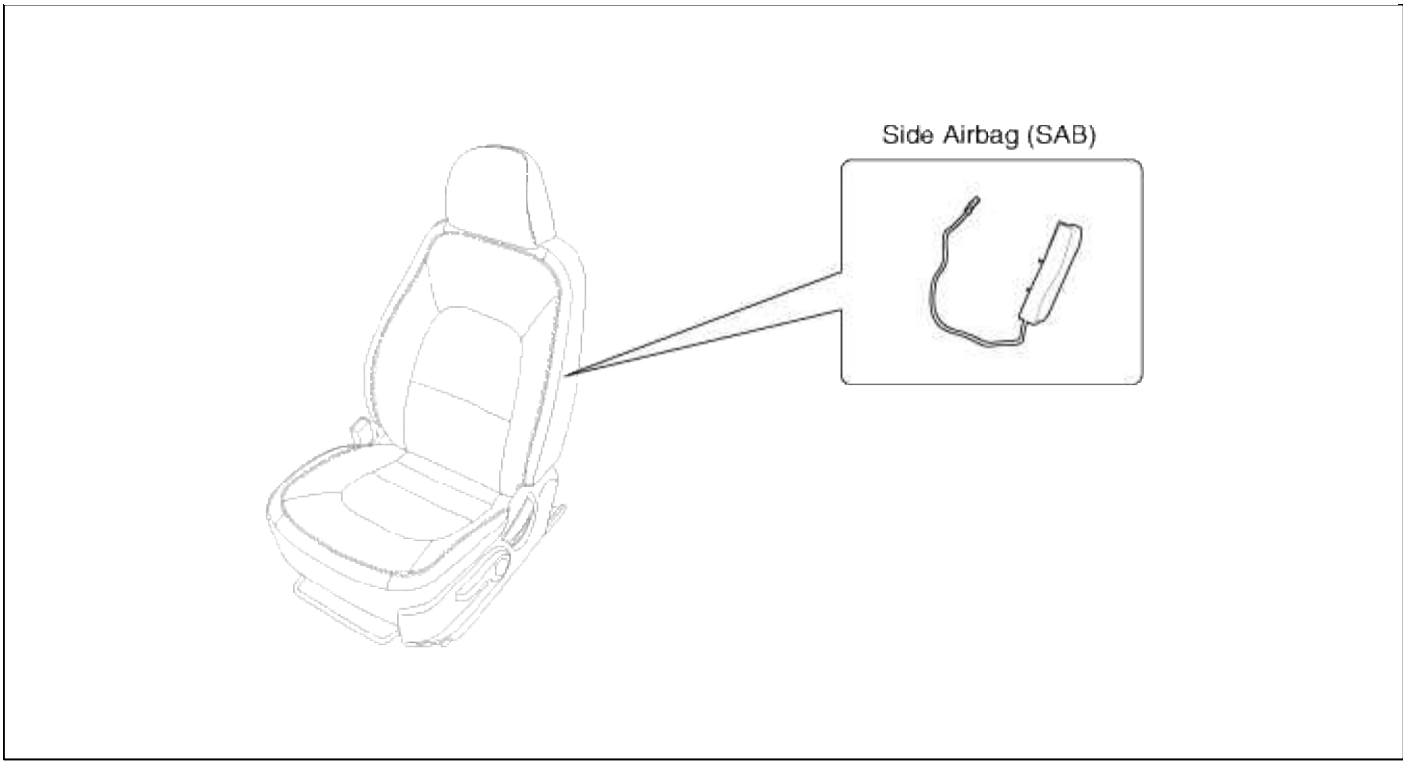
Supplemental Restraint System Control Module (SRSCM)



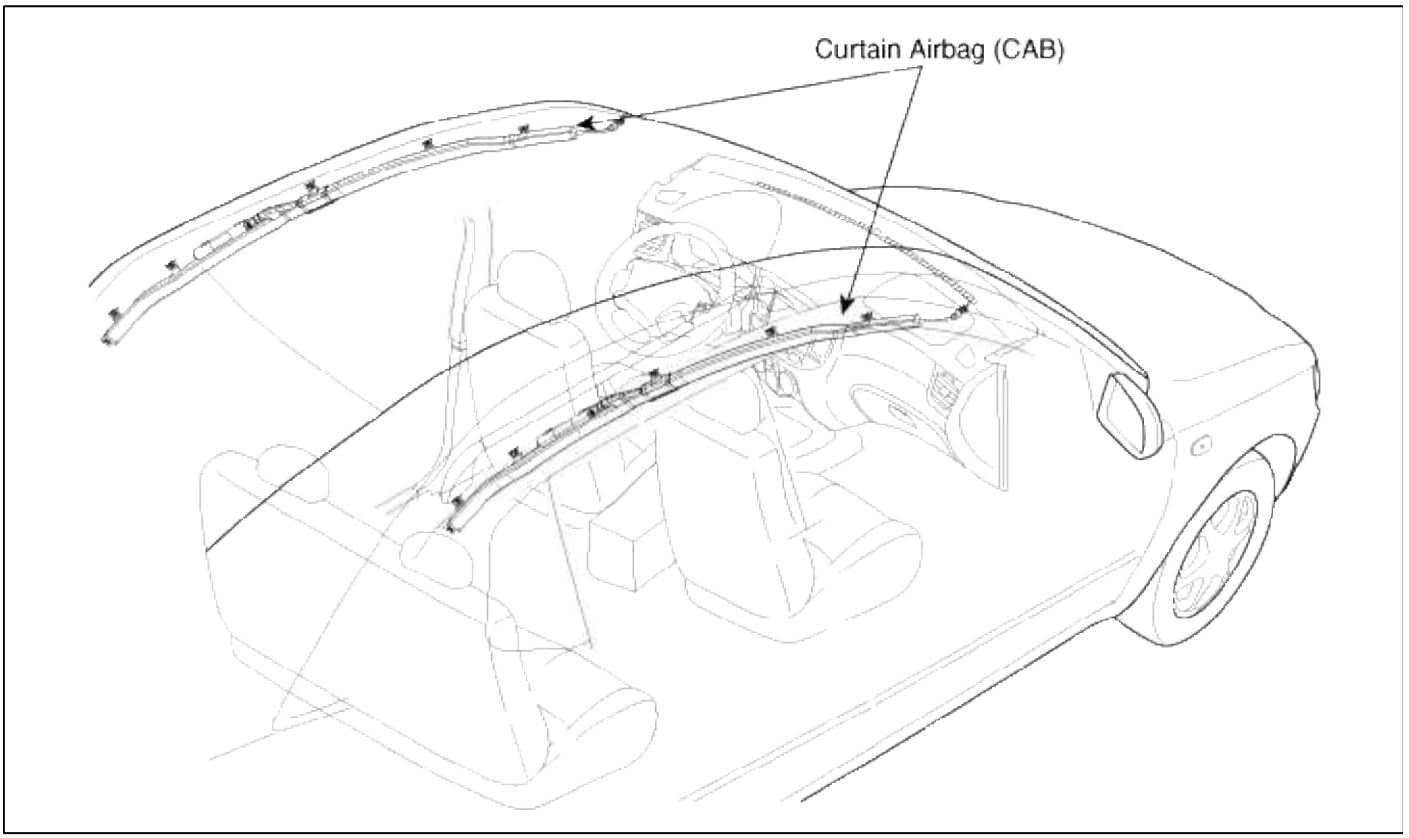
Driver Airbag (DAB) / Passenger Airbag (PAB)



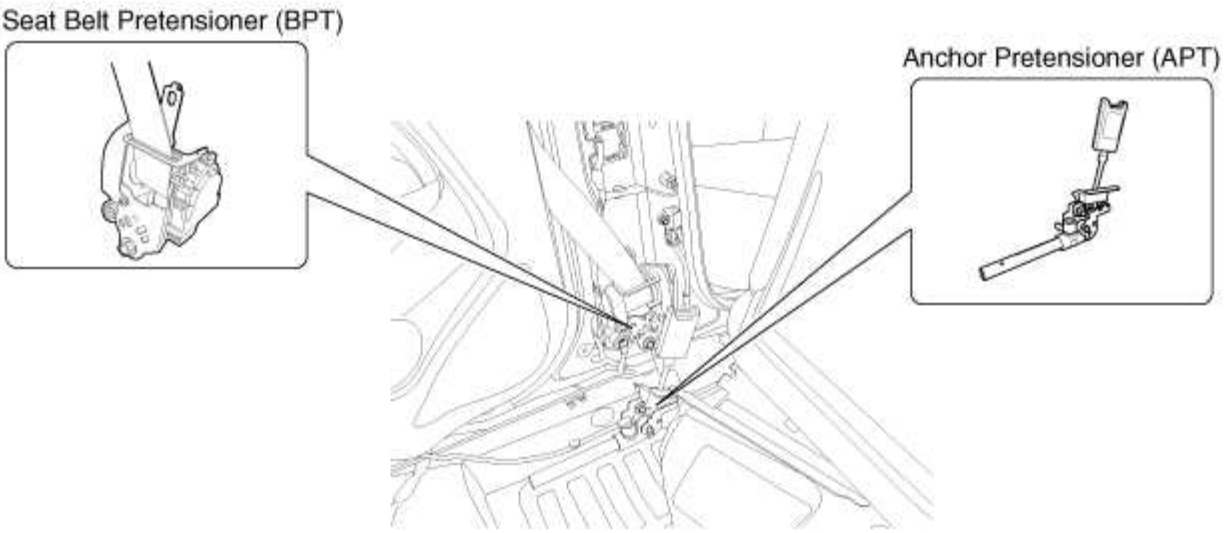
Side Airbag (SAB)



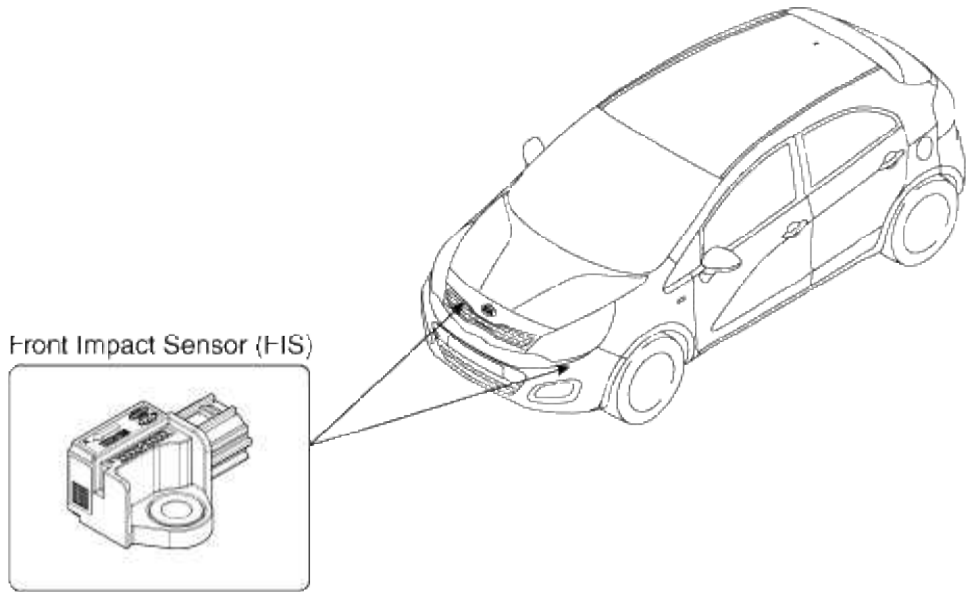
Curtain Airbag (CAB)



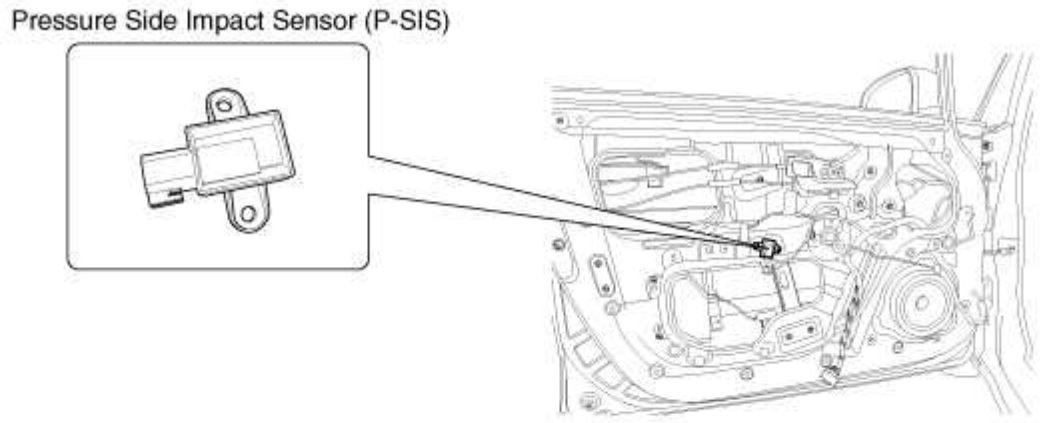
Seat Belt Pretensioner (BPT) / Anchor Pretensioner(APT)

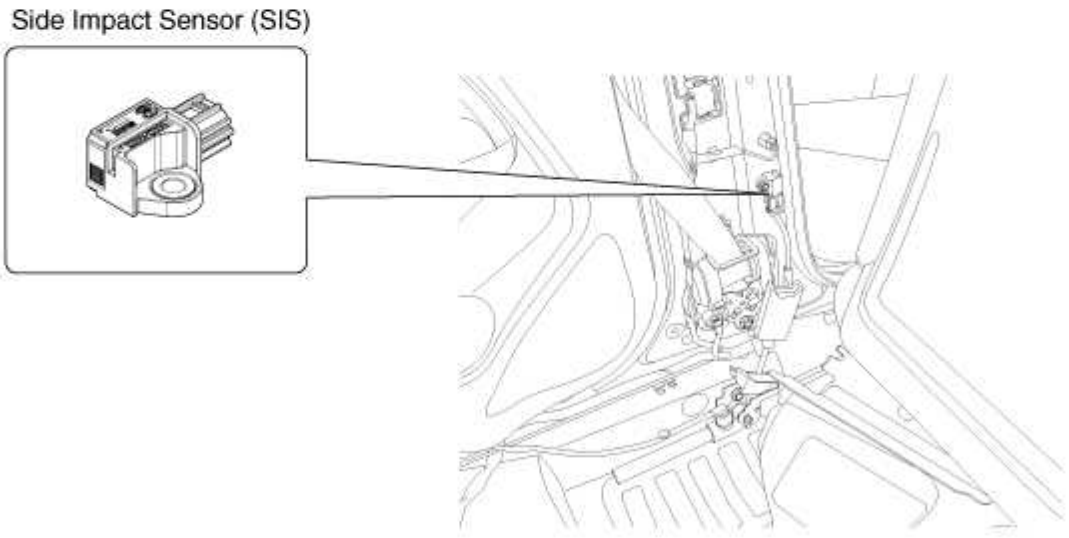


Front Impact Sensor (FIS)



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.

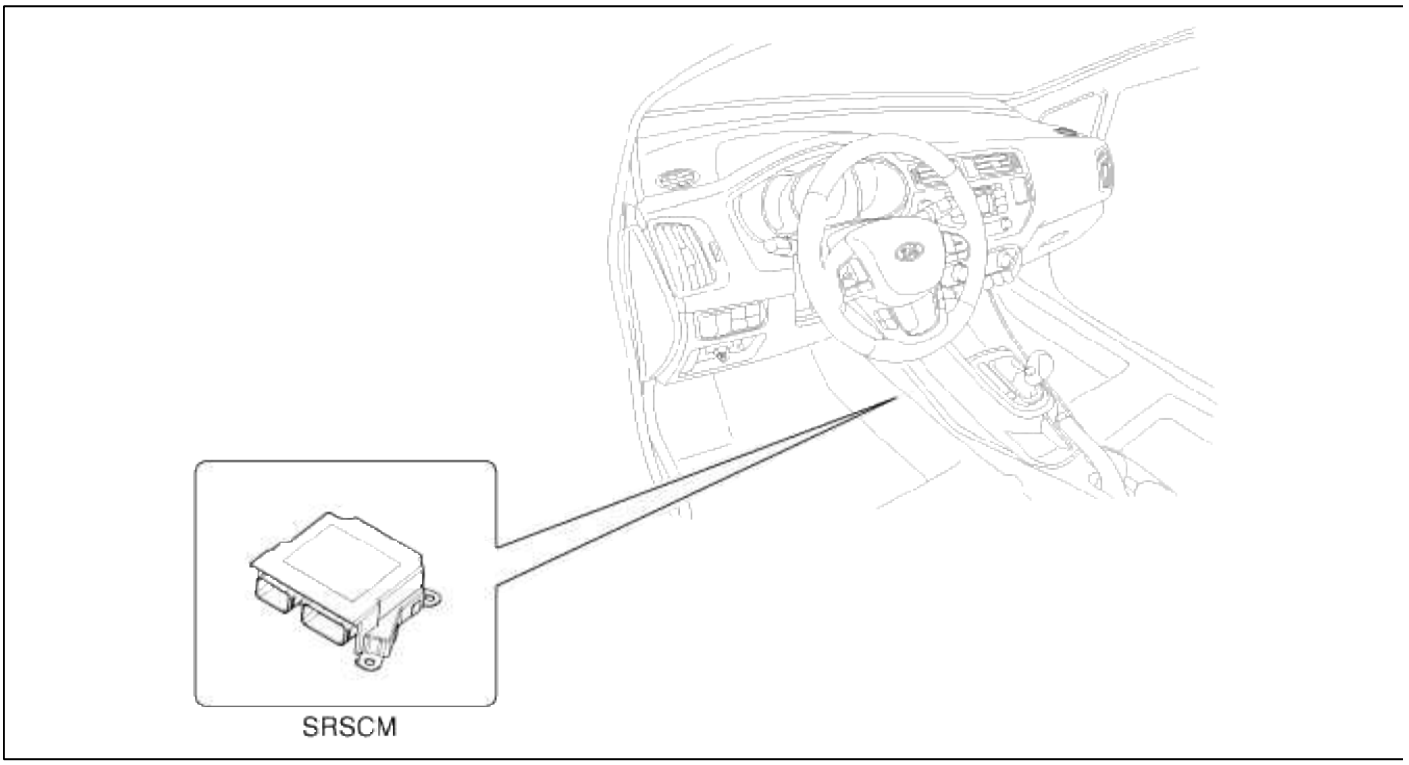
The SRSCM will not be ready to detect a crash or to activate the restraint system devices until the signals in the SRSCM circuitry stabilize.

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

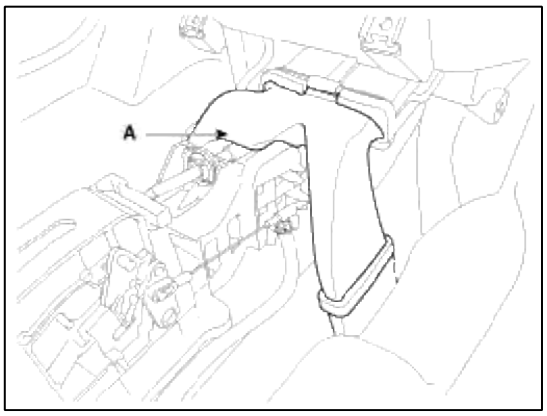
Components



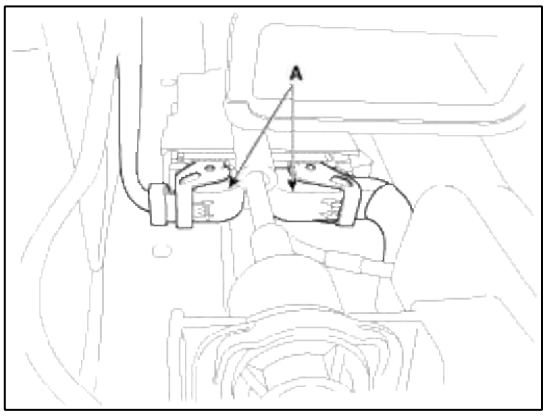
Restraint > SRSCM > SRS Control Module (SRSCM) > Repair procedures

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. Remove the floor console.
   (Refer to the Body group - "Console")
4. Remove the rear heating joint duct (A).



5. Pull up the lock, of the SRSCM connector, the disconnect the connector (A).

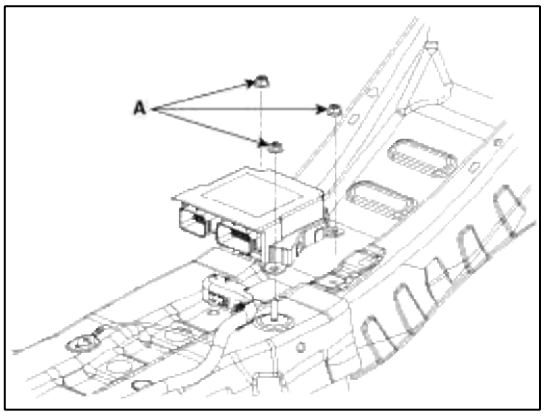


6. Remove the SRSCM mounting nuts (3EA) from the SRSCM, then remove the SRSCM.

Installation

1. Remove the ignition key from the vehicle.
2. Disconnect the battery negative cable and wait for at least three minutes before beginning work.
3. Install the SRSCM with the SRSCM mounting nuts (A).

Tightening torque
9.8 ~ 13.7 N.m (0.8 ~ 1.0 kgf.m, 7.2 ~ 10.1 lb-ft)



NOTE

Use new mounting nuts when replacing the SRSCM after a collision.

4. Connect the SRSCM harness connector.
5. Install the rear heating joint duct and floor console. (Refer to the Body group - "Console")
6. Reconnect the battery negative cable.
7. After installing the SRSCM, confirm proper system operation:
   A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

Variant coding

After replacing the SRSCM with a new unit, the “Variant Coding” procedure must be performed.

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 display 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 performing the variant coding procedure.
   DTC B1762 (ACU Coding Error) and B1102 (Battery Voltage Low) may be displayed simultaneously.

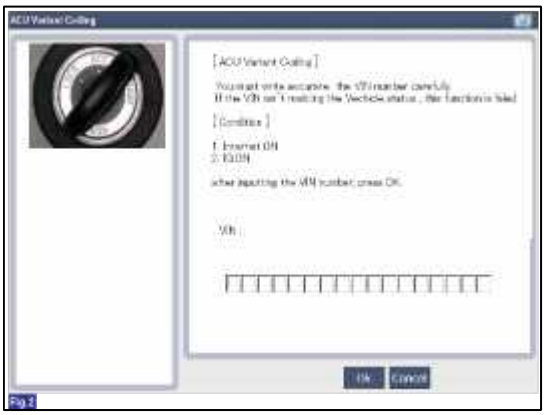
Variant coding Procedure

■ On-Line type on GDS

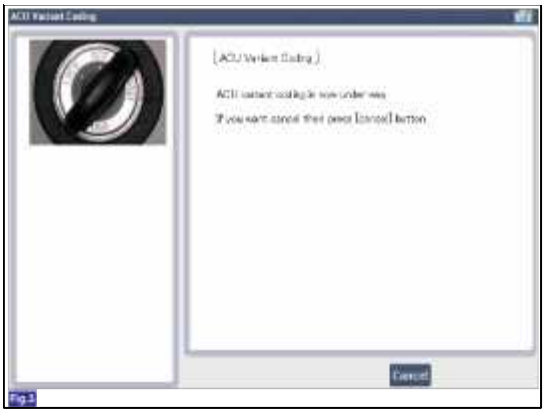
1. With the ignition "OFF", connect GDS.
2. Ignition "ON" & Engine "OFF" select vehicle name and airbag system.
3. Select Variant coding mode.
4. Follow steps on the screen as below.

1) Initial ACU Variant Coding screen

2) VIN Code entering screen



3) Variant coding's proceeding screen-1



4) Variant coding's proceeding screen-2

5) Variant coding is completed

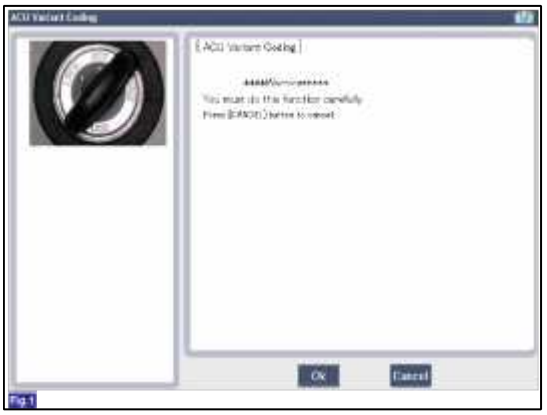
NOTE

1) This screen is opened when you try the variant coding again on the SRSCM that already has the variant coding performed.

2) If communication fails, the following screen will appear.

■ Off-line type on GDS (This can be used when not connecting to internet)

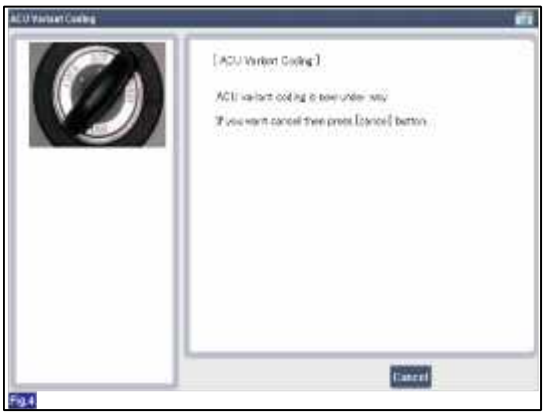
1) Initial ACU Variant Coding screen



2) ACU Coding Code entering screen

3) Screen of rechecking ACU Coding code's entering

4) Variant coding's proceeding screen-1



5) Variant coding's proceeding screen-2

6) Variant coding is completed

NOTE

1) This screen is opened when you try the variant coding again on the SRSCM that already has the variant coding performed.

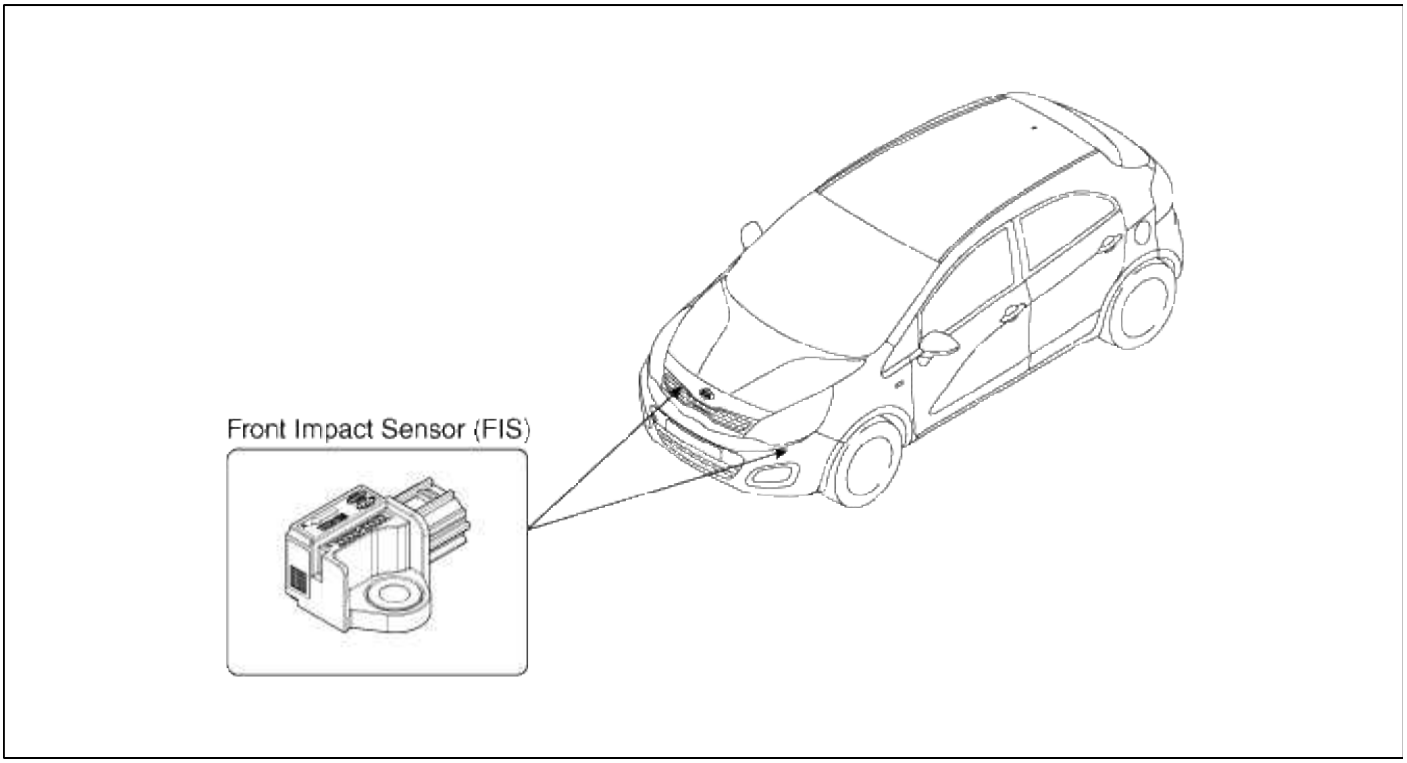
Restraint > SRSCM > Front Impact Sensor (FIS) > Description and Operation

Description

The front impact sensor (FIS) is installed in the front side member. 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



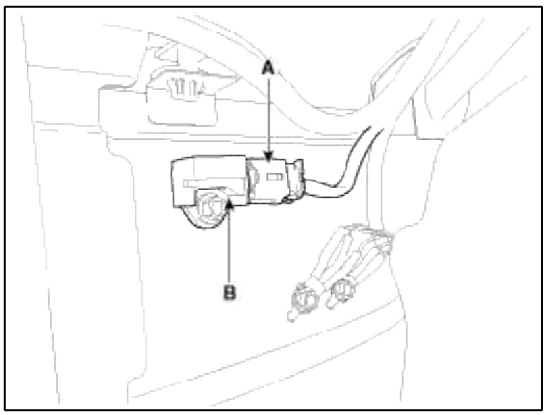
Restraint > SRSCM > Front Impact Sensor (FIS) > Repair procedures

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 front wheel guard.
   (Refer to the Body group - "Exterior")
3. Left side - Remove the air duct assembly.
   Right side - Remove the washer reservoir.
   (Refer to the Body Electrical group - "Washer motor")
4. Remove the front impact sensor (B) mounting bolt.



5. Disconnect the front impact sensor connector (A).
6. 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 nut.

Tightening torque :
7.8 ~ 9.8 N.m (0.8 ~ 1.0 kgf.m, 5.8 ~ 7.2 lb-ft)

3. Connect the front impact sensor connector.
4. Left side - Install the air duct assembly.
   Right side - Install the washer reservoir.
   (Refer to the Body Electrical group - "Washer motor")
5. Install the front wheel guard.
6. Reconnect the battery negative cable.
7. After installing the Front Impact Sensor, confirm proper system operation:
   A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

Restraint > SRSCM > Side Impact Sensor (SIS) > Description and Operation

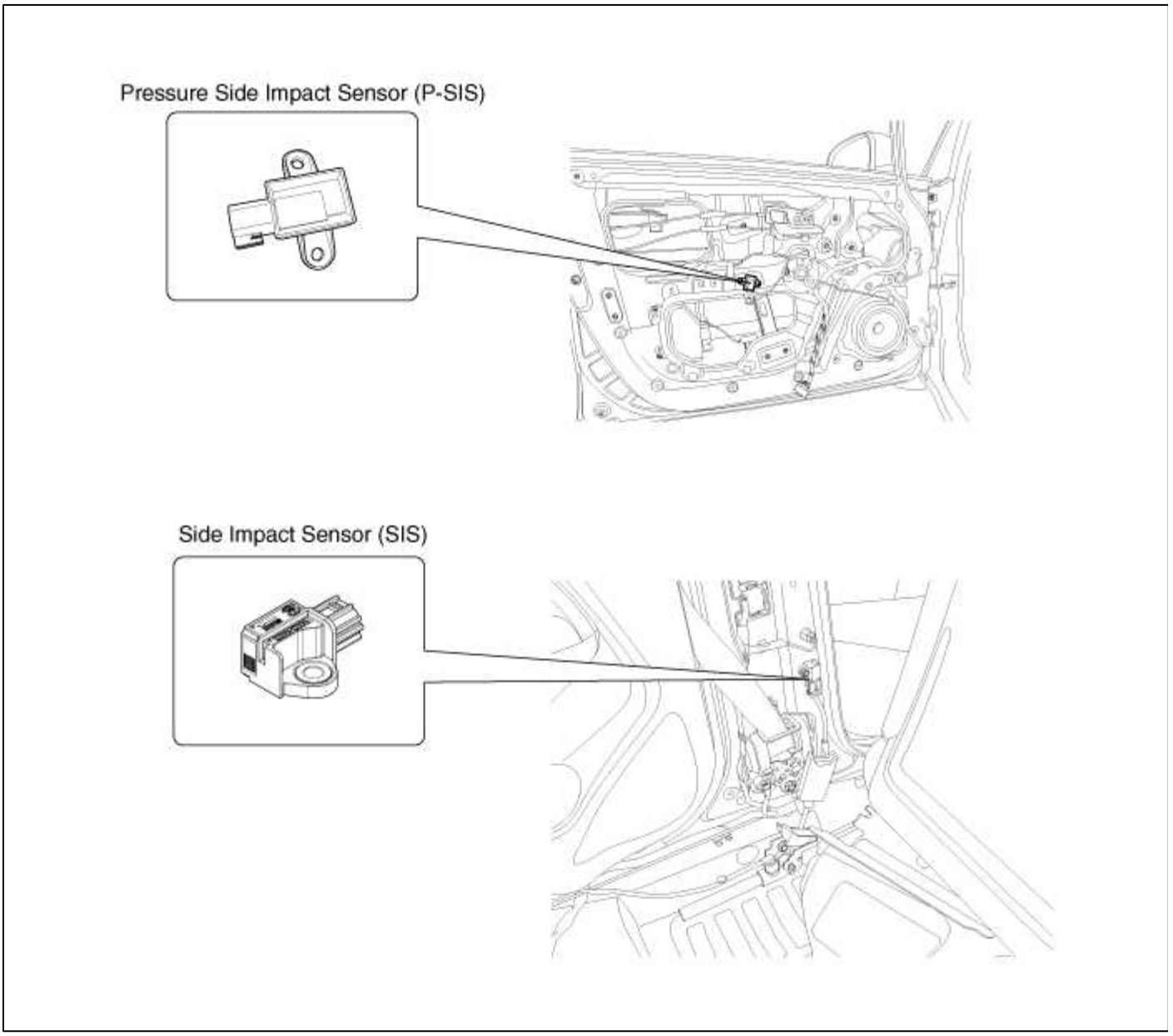
Description

Side Impact Sensor (SIS) system consists of two P-SIS which are installed at each center of the front door module

(LH and RH) and two SIS which are installed at each center pillar nearby (LH and RH).
Side Pressure Sensor is also called P-SIS because it detects pressure due to collision at its mounting location.
Side Impact Sensor is also called A-SIS because it detects acceleration.
SRSCM decides deployment of the airbag and the time of deployment through the collision signal of the SIS when the collision occurred.

Restraint > SRSCM > Side Impact Sensor (SIS) > Components and Components Location

Components



Restraint > SRSCM > Side Impact Sensor (SIS) > Repair procedures

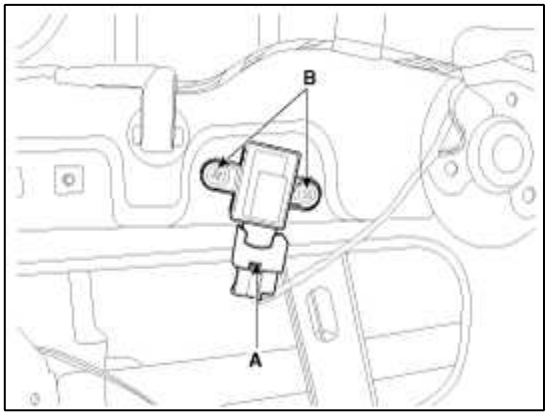
Removal

Pressure Side Impact Sensor

CAUTION

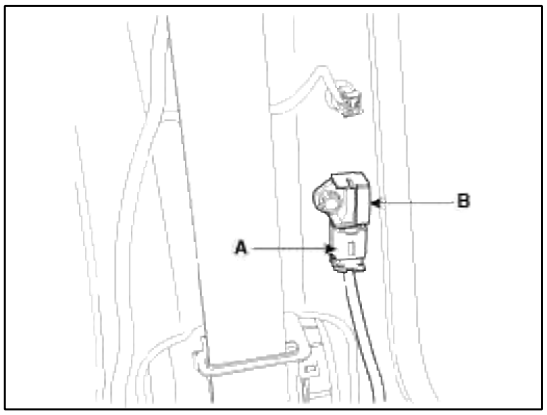
- Removal of the airbag must be performed according to the precautions/procedures described previously.
- Before disconnecting the side impact sensor connector(s), disconnect the side airbag connector(s).
- Do not turn the ignition switch ON and do not connect the battery cable while replacing the side impact sensor.

1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
2. Remove the front door trim.
   (Refer to the Body group - "Front door")
3. Disconnect the pressure side impact sensor connector (A) and remove the pressure side impact sensor mounting screws (B).



Side Impact Sensor

1. Disconnect the battery negative cable and wait for at least three minutes before beginning work.
2. Remove the door scuff trim.
   (Refer to the Body group - "Interior trim")
3. Remove the center pillar trim.
   (Refer to the Body group - "Interior trim")
4. Disconnect the side impact sensor connector (A).



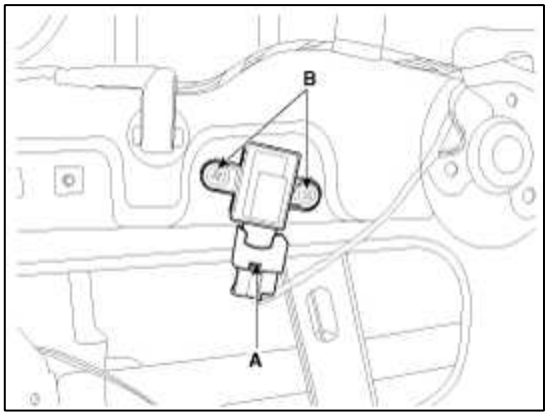
5. Loosen the side impact sensor mounting bolt and remove the side impact sensor (B).

Installation

Pressure Side Impact Sensor

1. Install the new pressure side impact sensor with the screws (B) then connect the pressure side impact sensor connector (A).

Tightening torque :
2.5 ~ 3.5 N.m (0.25 ~ 0.36 kgf.m, 1.8 ~ 2.6 lb-ft)



CAUTION

- Use the specified screws.

2. Install the front door trim.
(Refer to the Body group - "Front door")
3. Reconnect the battery negative cable.
4. After installing the pressure side impact sensor, confirm proper system operation:
   A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

CAUTION

- You must comply with the specified tightening torques with the tool specified because Pressure – Side Impact Sensors (P-SIS) may be broken or POP-NUT may be rotated.
- Problems may occur in the durability of P-SIS or the impact sensing performance may depreciat if POP-NUT is rotated.
- The door module must not be modified because SRSCM judges an impact through the pressure sensor in the door module.

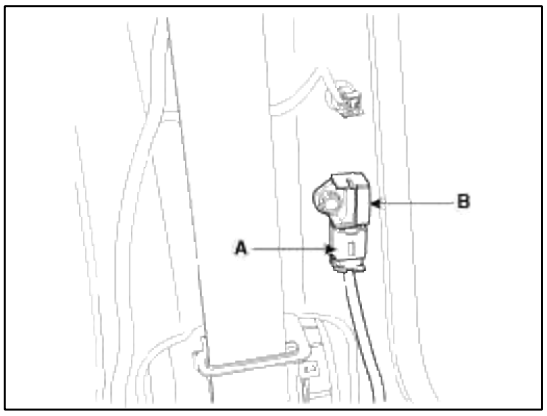
Side Impact Sensor

CAUTION

- Do not turn the ignition switch ON and do not connect the battery cable while replacing the side impact sensor.

1. Install the new side impact sensor (B) with the bolt and then connect the side impact sensor connector (A).

Tightening torque:
7.8 ~ 9.8 N.m (0.8 ~ 1.0 kgf.m, 5.8 ~ 7.2 lb-ft)



2. Install the center pillar trim.
   (Refer to the Body group - "Interior tirm")
3. Install the door scuff trim.
   (Refer to the Body group - "Interior tirm")
4. Reconnect the battery negative cable.
5. After installing the Side Impact Sensor, confirm proper system operation:
   A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

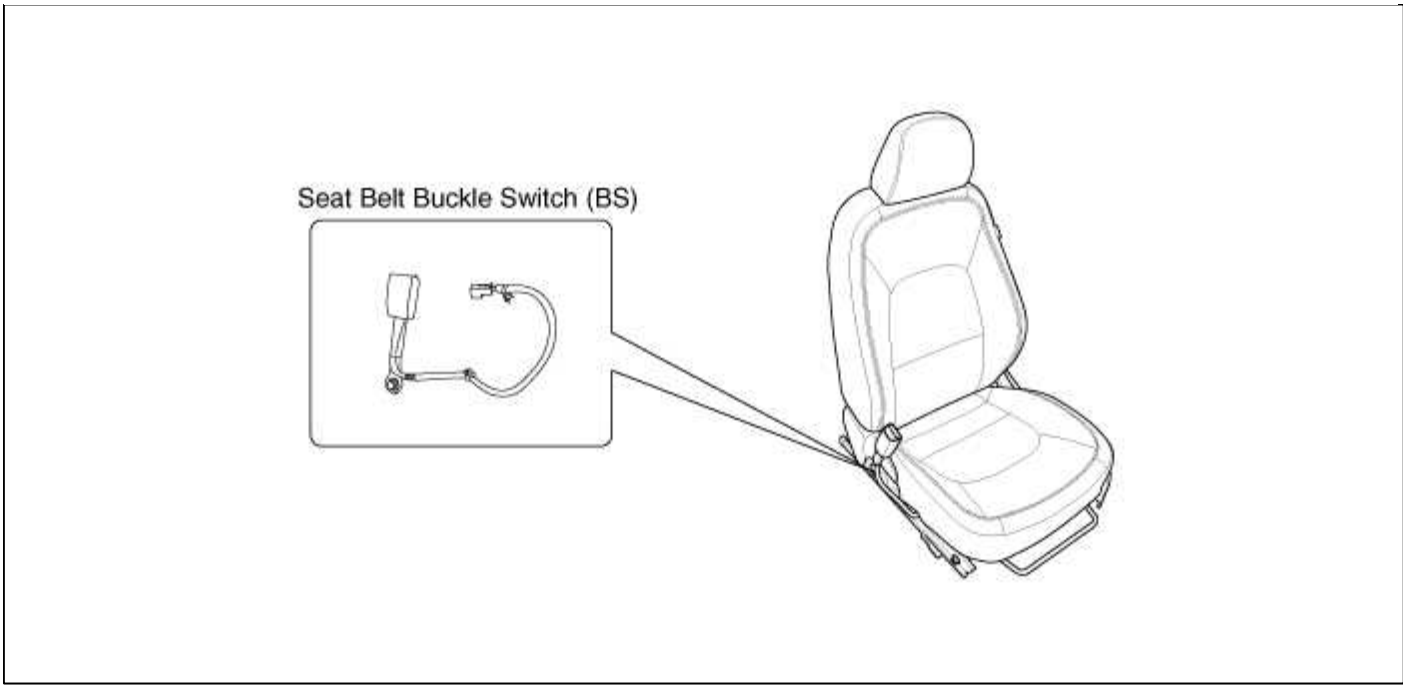
Restraint > SRSCM > Seat Belt Buckle Switch (BS) > Description and Operation

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

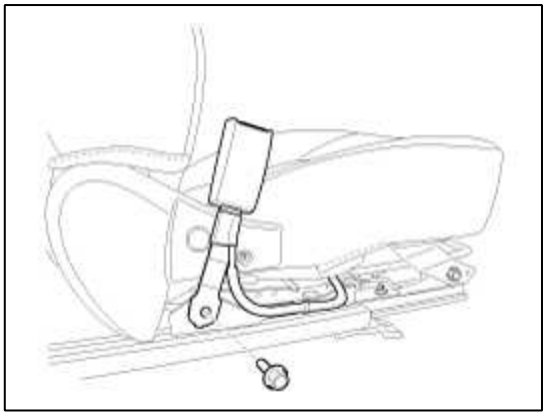
Components



Restraint > SRSCM > Seat Belt Buckle Switch (BS) > Repair procedures

Removal

1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
2. Remove the front seat assembly.
   (Refer to the Body group - "Front seat")
3. Loosen the seat belt buckle mounting bolt and remove the seat belt buckle switch.



Installation

CAUTION

Be sure to install the harness wires so they will not pinch or interfere 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 > Weight Classification System (WCS) > Description and Operation

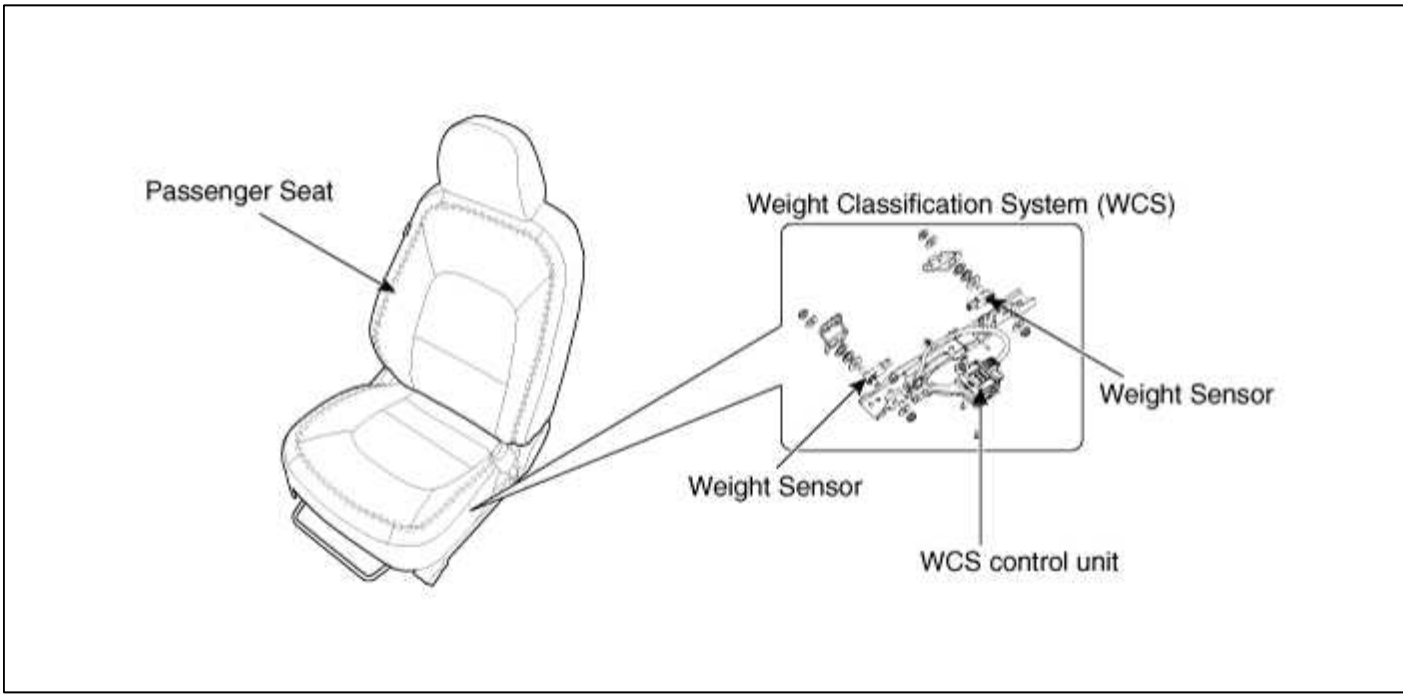
Description

In contrast to the initial one-stage airbag systems, newer restraint systems involve complex logic to select, or alternatively suppress, various levels of safety system deployment. Inherent to an Advanced Restraint System is the ability to discern information regarding passenger occupancy. It is intended that these inputs be provided through the WCS.

The object of such safety system is to reduce the risk and level of injuries by automatically adapting the airbag(s) and seat belt pretensioner to the driving status of the vehicle, its occupants, and the crash severity. The current WCS covered in this specification continually senses and classifies the front passenger side seat. The Weight Classification System described in this section is Weight Classification System (WCS) of strain gauge type. It consist of 2 weight sensors and ECU which is classifying weight of occupant. It is installed on the seat track assembly.

Restraint > SRSCM > Weight Classification System (WCS) > Components and Components Location

Components



Restraint > SRSCM > Weight Classification System (WCS) > 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 WCS assembly.
   (Refer to the Body group - "Seat")

Installation

NOTE

WCS(Weight Classification System) is utilizing a robust weight measuring technology. Thus, if any of the following conditions occur, WCS reset and accuracy check should be performed.

- The WCS ECU or any of the sensors is replaced.
- The vehicle is brought to the repair shop due to an accident or a crash even though the severity seems to be minor.
- The telltale lamp is not illuminated when the passenger seat is not occupied.
- The telltale lamp is delayed more than 10 seconds to be turned off when an adult passenger seats in.
- The passenger seat is removed from the vehicle and reassembled.
- Any accessories (side table, seatback table and seat cover, etc) are replaced or installed.

1. Install the WCS in the front passenger seat assembly.
   (Refer to the Body group - "Seat")
2. Install the front passenger seat assembly.
   (Refer to the Body group - "Seat")
3. Reconnect the battery negative cable.
4. After installing WCS, perform the WCS reset and accuracy check with the GDS.

NOTE

Check that seat is not occupied and empty before performing the operation. Make sure that the back pocket is empty. In order to perform the accuracy check, the command zero operation should be finished normally. Make sure the procedure be finished normally.

(1) Adjust the seat position according to the table below.

Item	Remark
Seat track position	Rearmost position
Seat recliner angle	Normal (upright)
Head rest position	Lowest position
Lifter position	Lowest position

Make sure seat belt not to be buckled, and the belt tension be normal.

(2) Connect the GDS connector to the data link connector located under the crash pad.

(3) Turn the ignition switch on and power on the GDS.

(4) Perform the WCS reset by using the GDS.
[System selection screen]
Vehicle Selection_Airbag_Weight Classification System _WCS RESET_ENTER
(then, Completed is displayed)

(5) Perform the accuracy check by using the GDS.
[System selection screen]
Vehicle Selection_Airbag_Weight Classification System_WCS RESET_ESC

(6) Confirm the measured weight is within the standard value. And then press "ESC".

Specification : -6kg ~ 6kg (-13.23lb ~ 13.23lb)

(7) Place a 37kg (81.57lb) weight on the passenger front seat.

(8) Confirm that the result of accuracy check is within the standard value.

specification : 31kg ~ 43kg (68.34lb ~ 94.79lb)

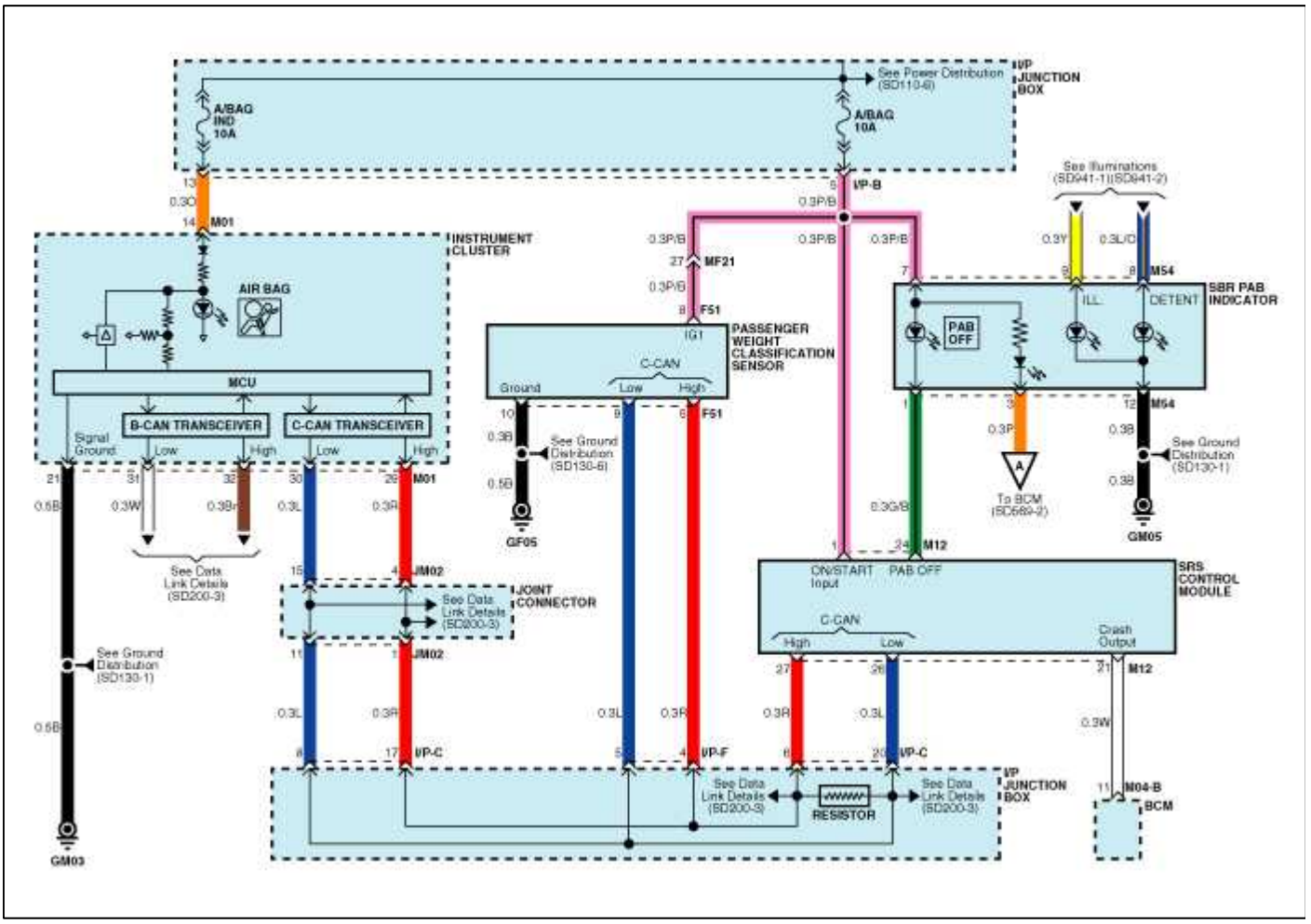
NOTE

- When performing the accuracy check, use a solid metal weight and place it at the center of the seat. If the weight made from liquid is used or the weight slides, the check result may not accurate, and could result in unwanted fail
- When the measured weight deviates from the standard value, check again all the fastening bolts are tightened properly. And make sure there is no interference. During the tightening, be careful not to deform the seat rail or seat structure. If the accuracy check is still not inside the standard value, replace the seat leg assembly.
- If the WCS reset operation not completed normally, replace the seat leg assembly.

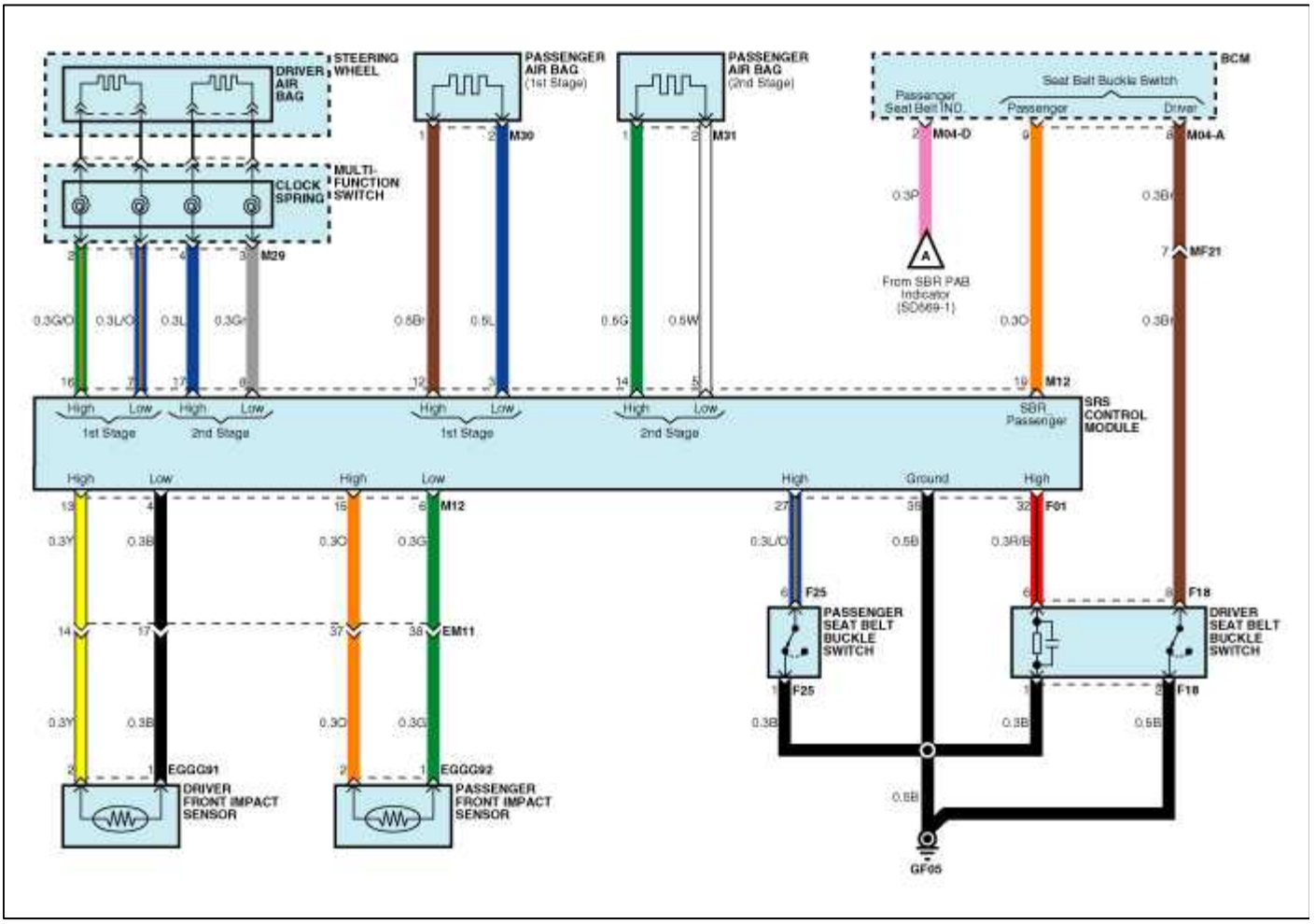
5. After installing the WCS, confirm proper system operation:
   A. Turn the ignition switch ON, the SRS indicator should be turned on for about six seconds and then go off.
   B. Telltale lamp will turn on for 4 seconds and be turned off for 3 seconds. After the 7 seconds, it shall remain off if the WCS does not require suppression and the passenger airbag is enabled.

Restraint > SRSCM > Schematic Diagrams

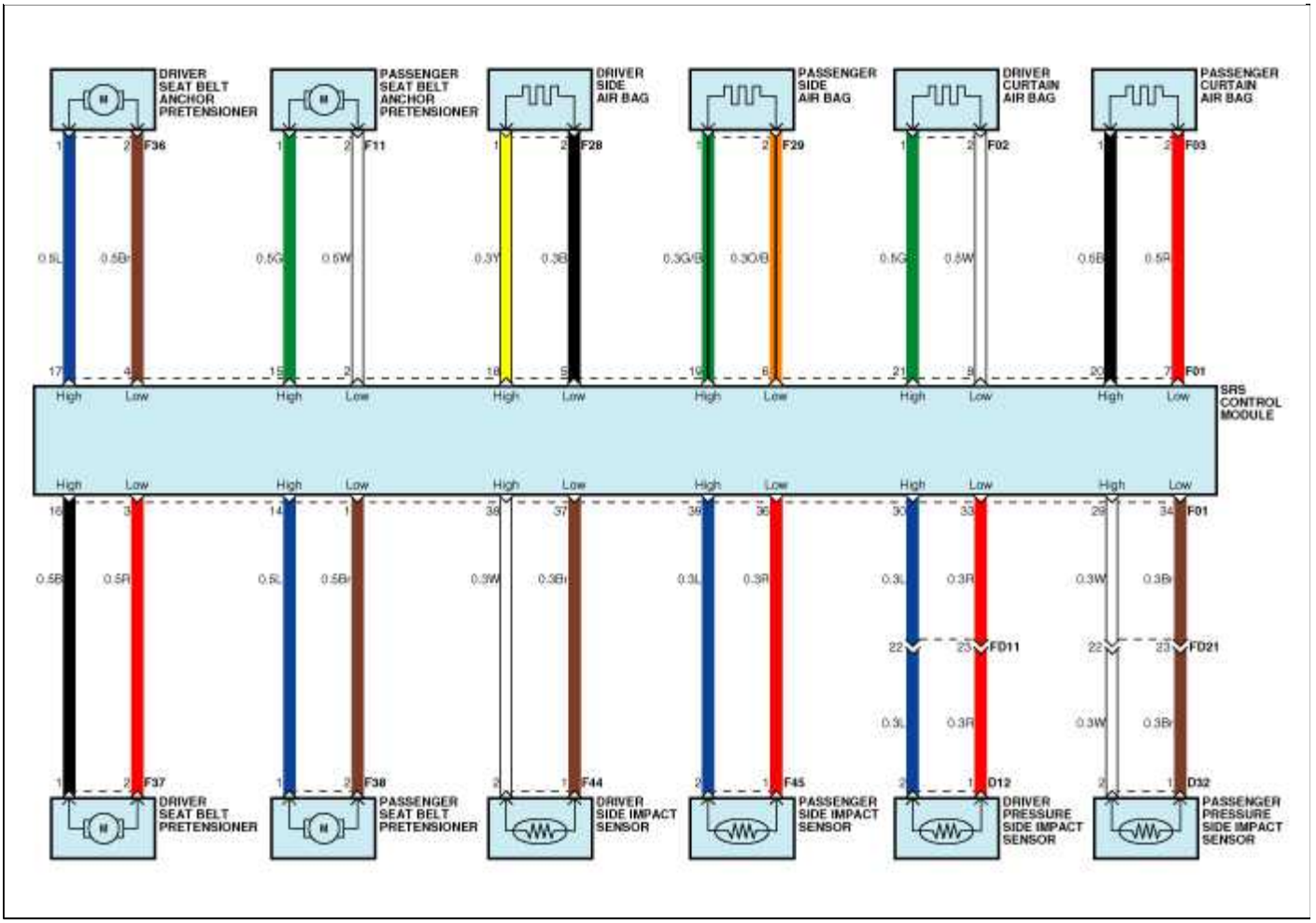
Circuit Diagram (1)



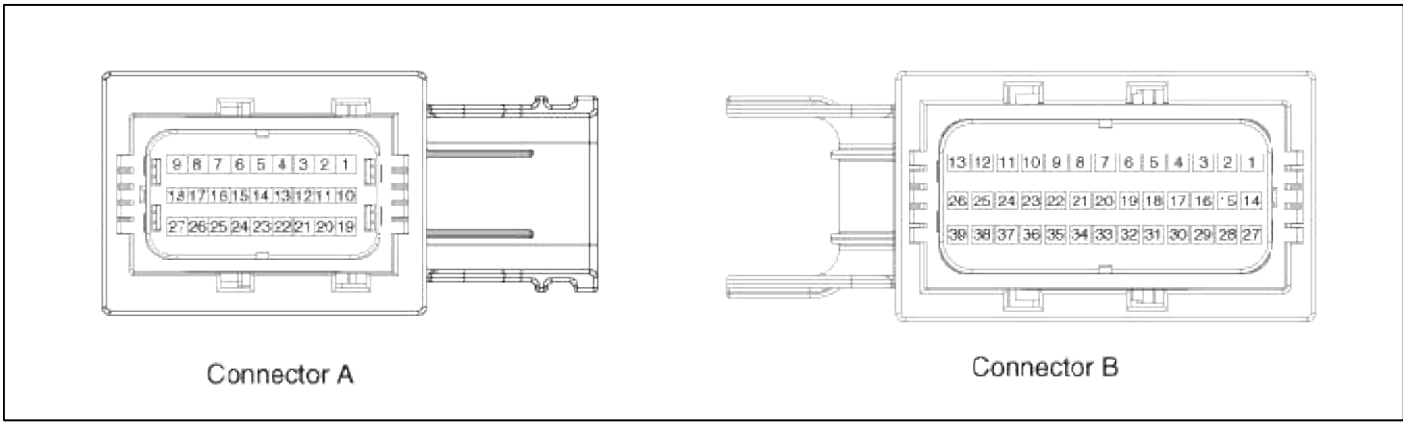
Circuit Diagram (2)



Circuit Diagram (3)



SRSCM Connector Terminal



Pin	Function (Connector A)	Pin	Function (Connector B)
1	Ignition	1	Seat belt pretensioner [Passenger] Low
2	-	2	Anchor Pretensioner [Passenger] Low
3	(1st stage) Passenger airbag Low	3	Seat belt pretensioner [Driver] Low
4	Front impact sensor [Driver] Low	4	Anchor Pretensioner [Driver] Low
5	(2nd stage) Passenger airbag Low	5	Side airbag [Driver] Low
6	Front impact sensor [Passenger] Low	6	Side airbag [Passenger] Low
7	(1st stage) Driver airbag Low	7	Curtain airbag [Passenger] Low

8	(2nd stage) Driver airbag Low	8	Curtain airbag [Driver] Low
9	-	9	-
10	-	10	-
11	-	11	-
12	(1st stage) Passenger airbag High	12	-
13	Front impact sensor [Driver] High	13	-
14	(2nd stage) Passenger airbag High	14	Seat belt pretensioner [Passenger] High
15	Front impact sensor [Passenger] High	15	Anchor Pretensioner [Passenger] High
16	(1st stage) Driver airbag High	16	Seat belt pretensioner [Driver] High
17	(2nd stage) Driver airbag High	17	Anchor Pretensioner [Driver] High
18	-	18	Side airbag [Driver] High
19	Seat belt reminder	19	Side airbag [Passenger] High
20	-	20	Curtain airbag [Passenger] High
21	Crash Output	21	Curtain airbag [Driver] High
22	-	22	-
23	-	23	-
24	Telltale lamp	24	-
25	-	25	-
26	CAN_Low	26	-
27	CAN_High	27	Seat belt buckle switch [Passenger]
		28	-
		29	Pressure side impact sensor [Passenger] High
		30	Pressure side impact sensor [Driver] High
		31	-
		32	Seat belt buckle switch [Driver]
		33	Pressure side impact sensor [Driver] Low
		34	Pressure side impact sensor [Passenger] Low
		35	Ground
		36	Side impact sensor [Passenger] Low
		37	Side impact sensor [Driver] Low
		38	Side impact sensor [Driver] High
		39	Side impact sensor [Passenger] High

Restraint > Airbag Module > Driver Airbag (DAB) Module and Clock Spring > Description and Operation

Description

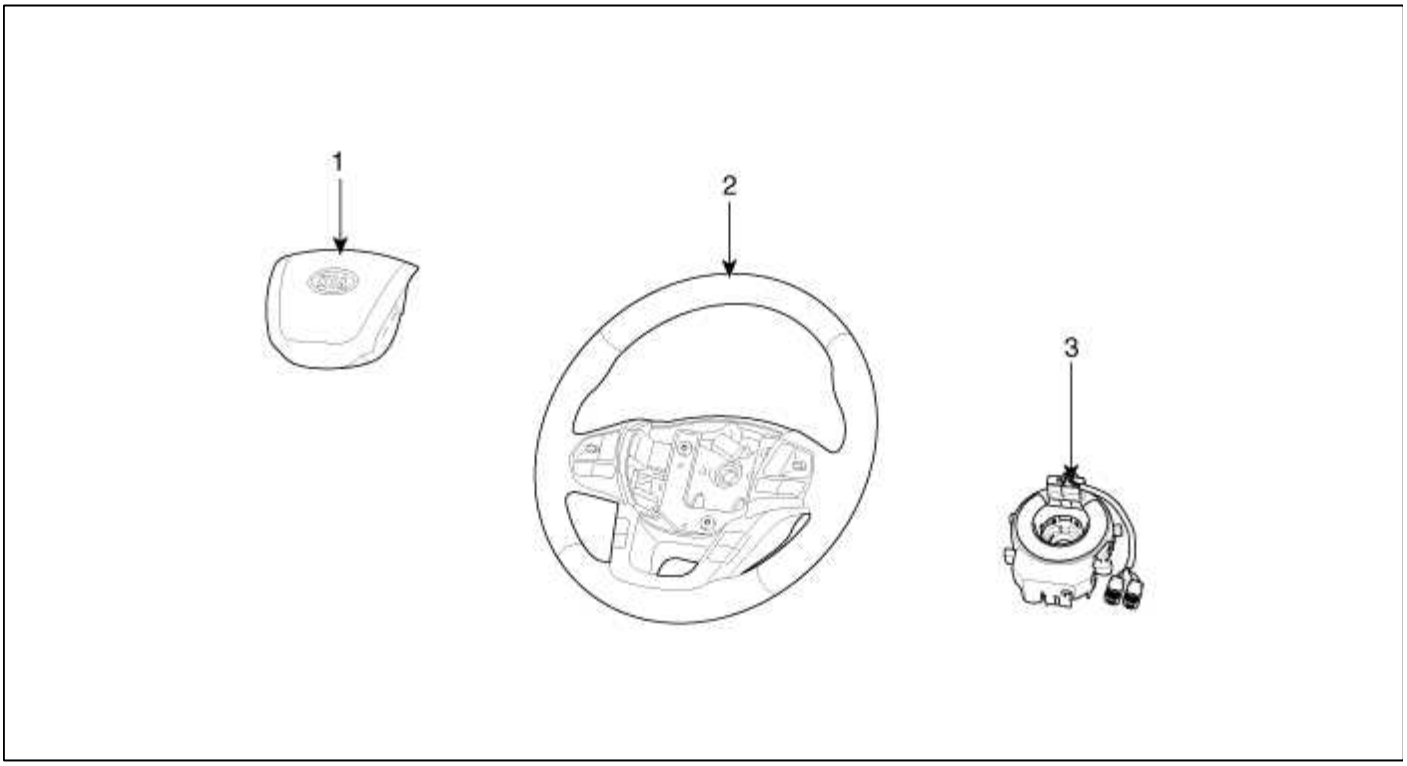
Driver Airbag (DAB) is installed in the steering wheel and electrically connected to SRSCM via the clock spring. It protects the driver by deploying the airbag when frontal crash occurs. The SRSCM determines deployment of the Driver Airbag (DAB).

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



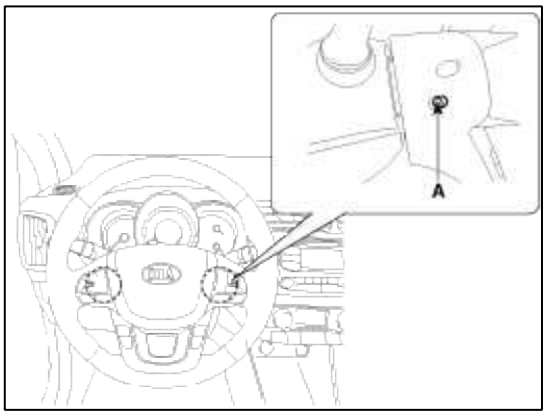
1. Driver Airbag (DAB) 2. Steering Wheel	3. Clock Spring

Restraint > Airbag Module > Driver Airbag (DAB) Module and Clock Spring > Repair procedures

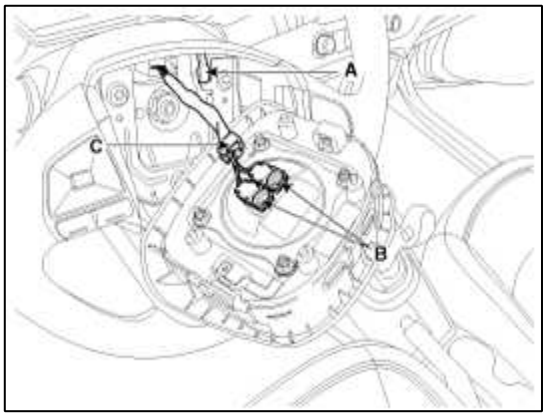
Removal

1. Disconnect the battery negative cable and wait for at least three minutes before beginning work.

2. Remove the driver airbag module mounting bolts (A).



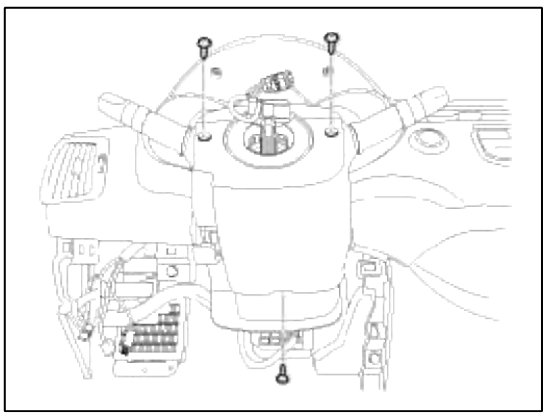
3. Remove the wiring fixing clip (C) and disconnect the horn connector (A).



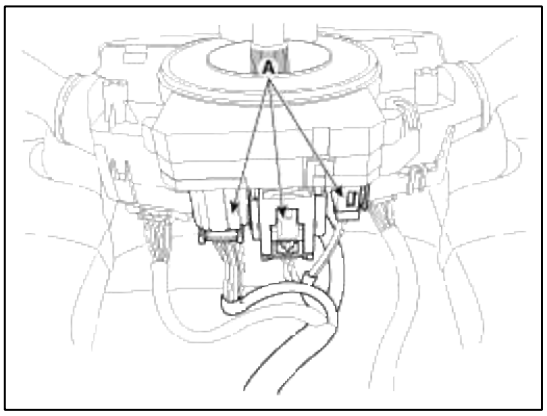
4. Release the connector locking pin, then disconnect the driver airbag module connector (B).

> CAUTION
>
> The removed airbag module should be stored in a clean, dry place with the pad cover facing up.

5. Remove the steering wheel and steering wheel column shroud. (Refer to the Steering System group - "Steering Column and Shaft")



6. Disconnect the clock spring and horn connector (A), then remove the clock spring.



Inspection

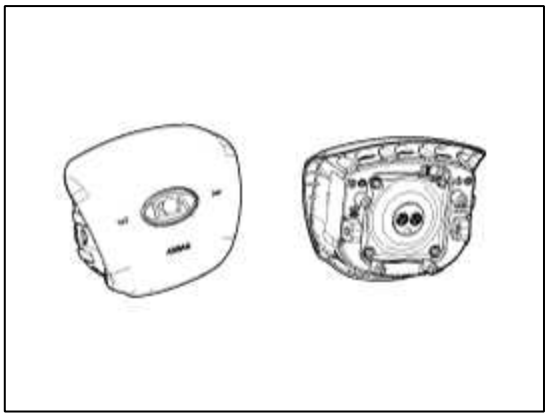
Driver Airbag (DAB)

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.

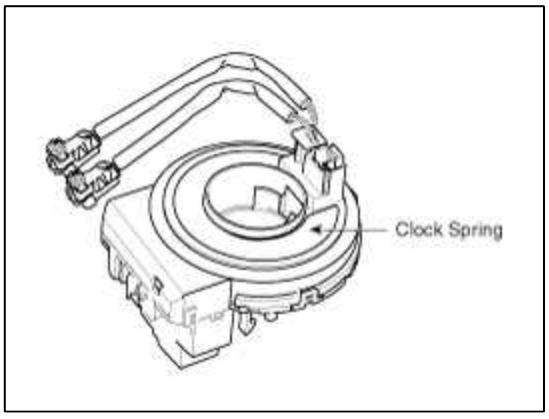
1. Check pad cover for dents, cracks or deformities.
2. Check the airbag module for denting, cracking or deformation.
3. Check hooks and connectors for damage, terminals for deformities, and harness for binds.
4. Check airbag inflator case for dents, cracks or deformities.



5. Install the airbag module to the steering wheel to check for fit or alignment with the wheel.

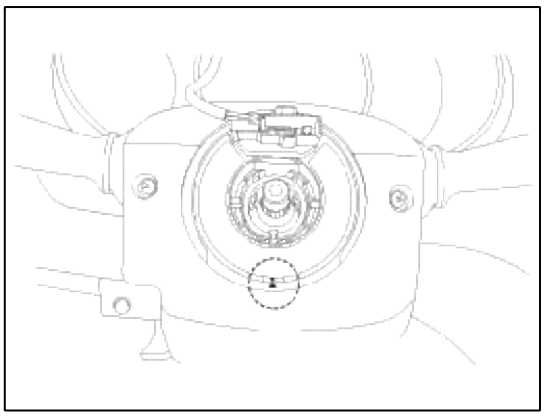
Clock Spring

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. The mark ( ) should be matched by turning the clock spring clockwise to the stop and then 2.0 revolutions counterclockwise.



5. Install the steering wheel column shroud and the steering wheel. (Refer to the Steering System group - "Steering Column and Shaft")
6. Connect the Driver Airbag (DAB) module connector and horn connector, and then install the Driver Airbag (DAB) module on the steering wheel.
7. Secure driver airbag (DAB) with the new mounting bolts.

Tightening torque :
7.8 ~ 10.8 N.m (0.8 ~ 1.1 kgf.m, 5.8 ~ 8.0 lb-ft)

8. Connect the battery negative cable.
9. After installing the airbag, confirm proper system operation:
   A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.
   B. Make sure horn button works.

Restraint > Airbag Module > Passenger Airbag (PAB) Module > Description and Operation

Description

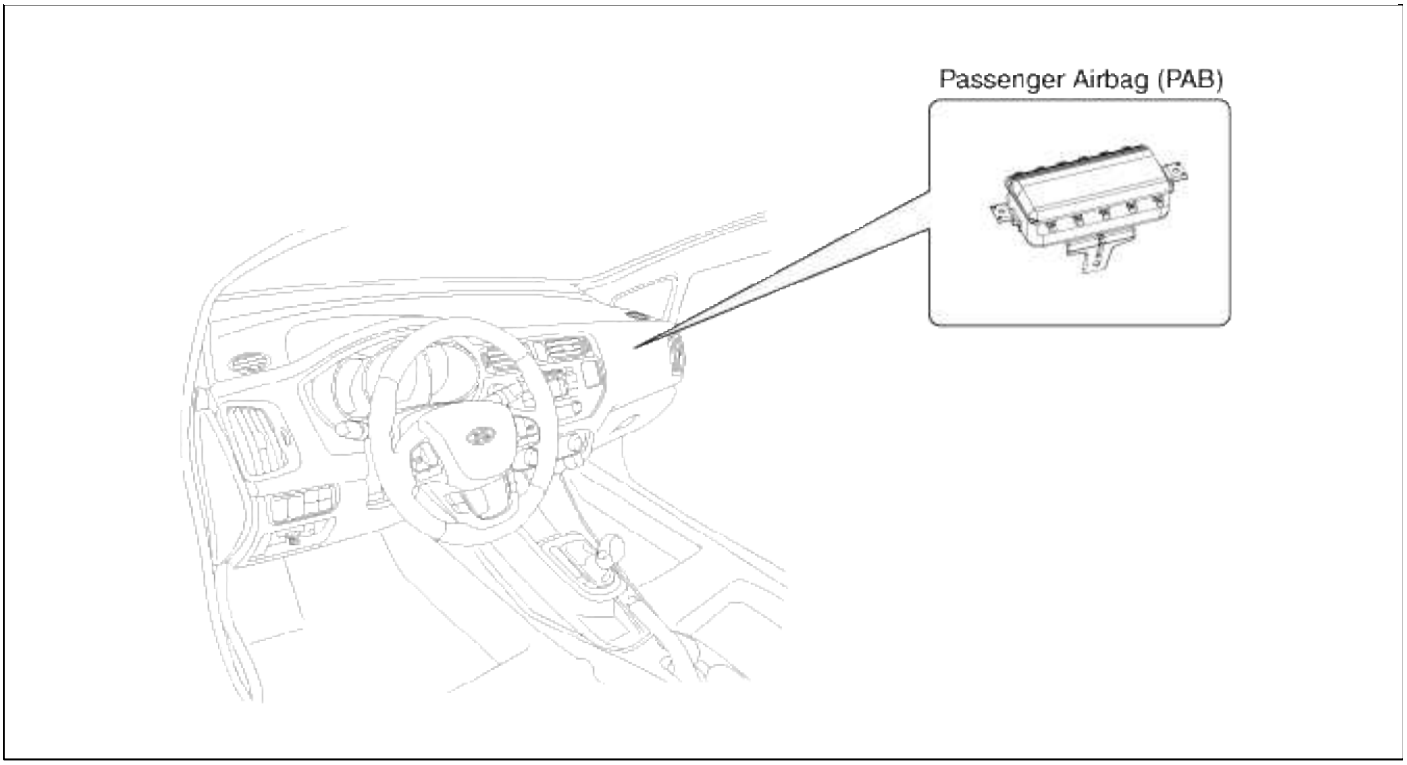
The passenger airbag (PAB) is installed inside the crash pad and protects the front passenger in the event of a frontal crash. The SRSCM determines if and when to deploy the PAB.

CAUTION

Never attempt to measure the circuit resistance of the airbag module (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment will result in serious personal injury.

Restraint > Airbag Module > Passenger Airbag (PAB) Module > Components and Components Location

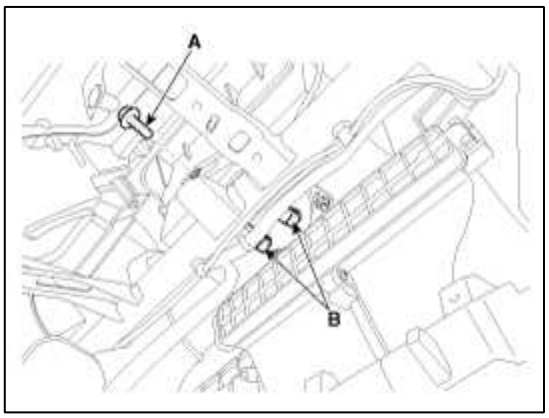
Components



Restraint > Airbag Module > Passenger Airbag (PAB) Module > Repair procedures

Removal

1. Disconnect the battery negative cable and wait for at least three minutes before beginning work.
2. Remove the glove box housing.
   (Refer to the Body group - "Crash pad")
3. Disconnect the passenger airbag connector (B) and remove the PAB mounting bolt (A).



4. Remove the crash pad.
   (Refer to the Body group - "Crash pad")

> NOTE
>
> If the PAB has been deployed, replace the damaged crash pad.

5. Remove the heater duct from the crash pad.

6. Remove the mounting bolts from the crash pad. And 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 the passenger airbag on the crash pad and tighten the passenger airbag mounting bolts.

Tightening torque:
7.8 ~ 11.8 N.m (0.8 ~ 1.2 kgf.m, 5.8 ~ 8.7 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 crash pad mounting bolt.

Tightening torque:
7.8 ~ 11.8 N.m (0.8 ~ 1.2 kgf.m, 5.8 ~ 8.7 lb-ft)

7. Connect the passenger airbag harness connector to the SRS main harness connector.
8. Reinstall the glove box.
   (Refer to the Body group - "Crash pad")
9. Reconnect the battery negative cable.
10. After installing the passenger airbag (PAB), confirm proper system operation:
    A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

Restraint > Airbag Module > Side Airbag (SAB) Module > Description and Operation

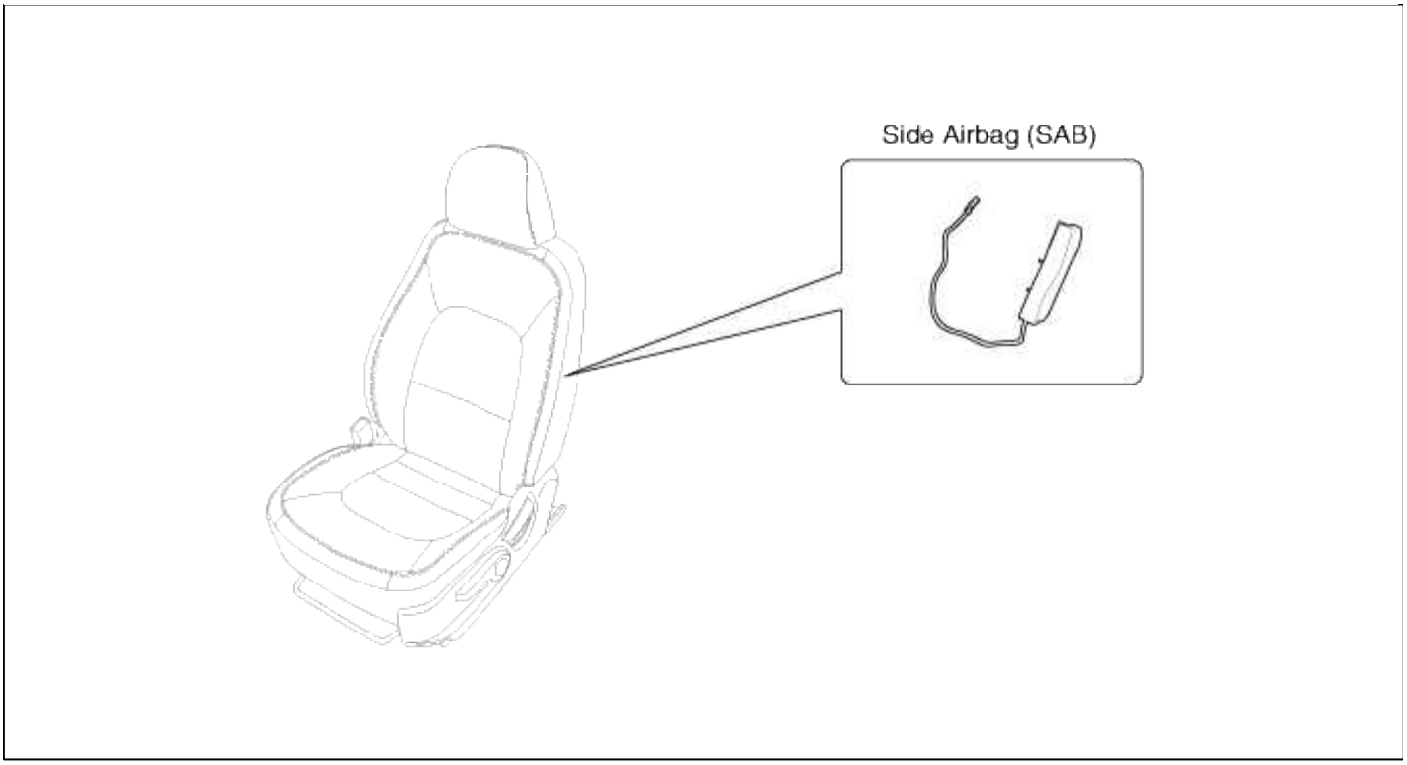
Description

The Side Airbags (SAB) are installed inside the front seat and 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 the seat back 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 so they will not pinch or interfere 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 of interfere 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

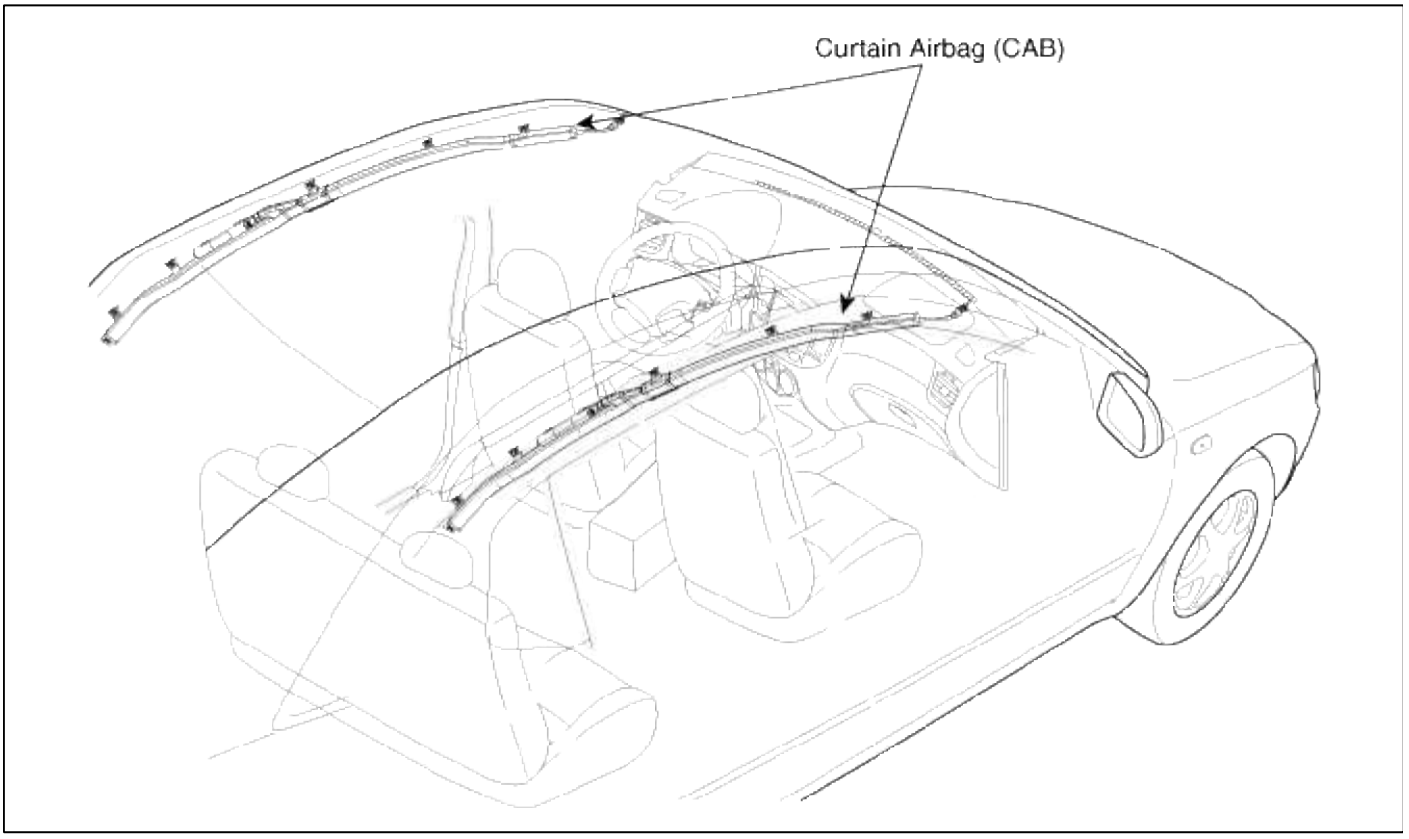
Curtain airbags are installed inside the headliner (LH and RH) and protect the driver and passenger from danger when side crash occurs. The SRSCM determines deployment of curtain airbag by using side impact sensor (SIS) signal.

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

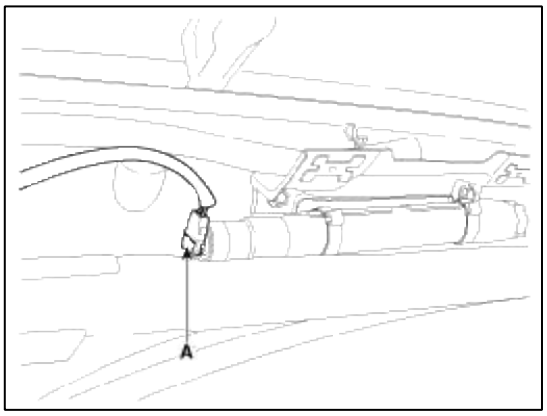


Restraint > Airbag Module > Curtain Airbag (CAB) Module > Repair procedures

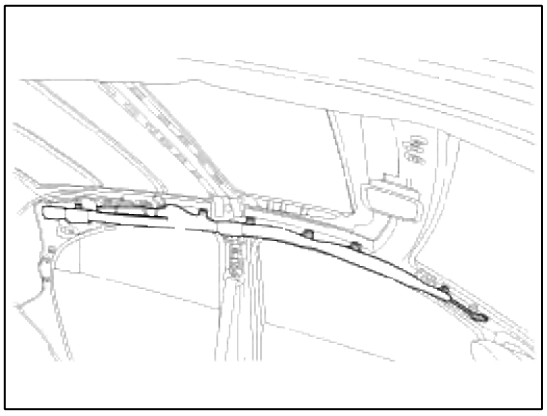
Removal

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).



4. After loosening the mounting bolts remove the curtain airbag.



Installation

1. Remove the ignition key from the vehicle.
2. Disconnect the battery negative cable and wait for at least three minutes.
3. Tighten the curtain airbag mounting bolts.

Tightening torque:
7.8 ~ 11.8 N.m (0.8 ~ 1.2 kgf.m, 5.8 ~ 8.7 lb-ft)

CAUTION

- Never twist the airbag module during installation. If the airbag module is twisted, it may not operate as designed.

4. Connect the curtain airbag connector.
5. Install the roof trim.
   (Refer to the Body group- "Interior")
6. Reconnect the battery negative cable.
7. After installing the curtain airbag (CAB), confirm proper system operation:
   A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

Restraint > 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 installed in vehicle to be scrapped), the airbags or side airbags must be deployed. If the vehicle is still within the warranty period, before deploying the airbags or side airbags, the Technical Manager must give approval and/or special instruction. Only after the airbags or side airbags have been deployed (as the result of vehicle collision, for example), can they be scrapped. If the airbags or side airbags appear intact (not deployed), treat them with extreme caution. Follow these procedures:

Deploying airbags in the vehicle

If an SRS equipped vehicle is to be entirely scrapped, the airbags or side airbags should be deployed while still in the vehicle. The airbags or side airbags should not be considered as salvageable parts and should never be installed in another vehicle.

1. Turn the ignition switch OFF, and disconnect the battery negative cable and wait at least three minutes.
2. Confirm that each airbag or side airbag is securely mounted.
3. Confirm that the special tool is functioning properly by following the check procedure.
   (1) Driver's Airbag :
      A. Remove the driver's airbag and install the SST (0957A-3Q100).
      B. Install the driver's airbag on the steering wheel.
   (2) Front Passenger's Airbag :
      A. Remove the glove box housing, and then disconnect the connector between the front passenger's airbag and SRS main harness.
      B. Install the SST(0957A-3Q100).

      CAUTION

      Deploying the passenger airbag in the vehicle may break the windshield.

   (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-3Q100).
   (5) Seat Belt Pretensioner :
      A. Disconnect the 2P connector from the seat belt pretensioner.
      B. Install the SST (0957A-3Q100).
   (6) Anchor Pretensioner :
      A. Disconnect the 2P connector from the anchor pretensioner.
      B. Install the SST (0957A-3Q100).
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 tool is functioning properly by following the check procedure on this page.
2. Position the airbag facing 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 came in.

Restraint > Seat Belt Pretensioner > Seat Belt Pretensioner (BPT) > Description and Operation

Description

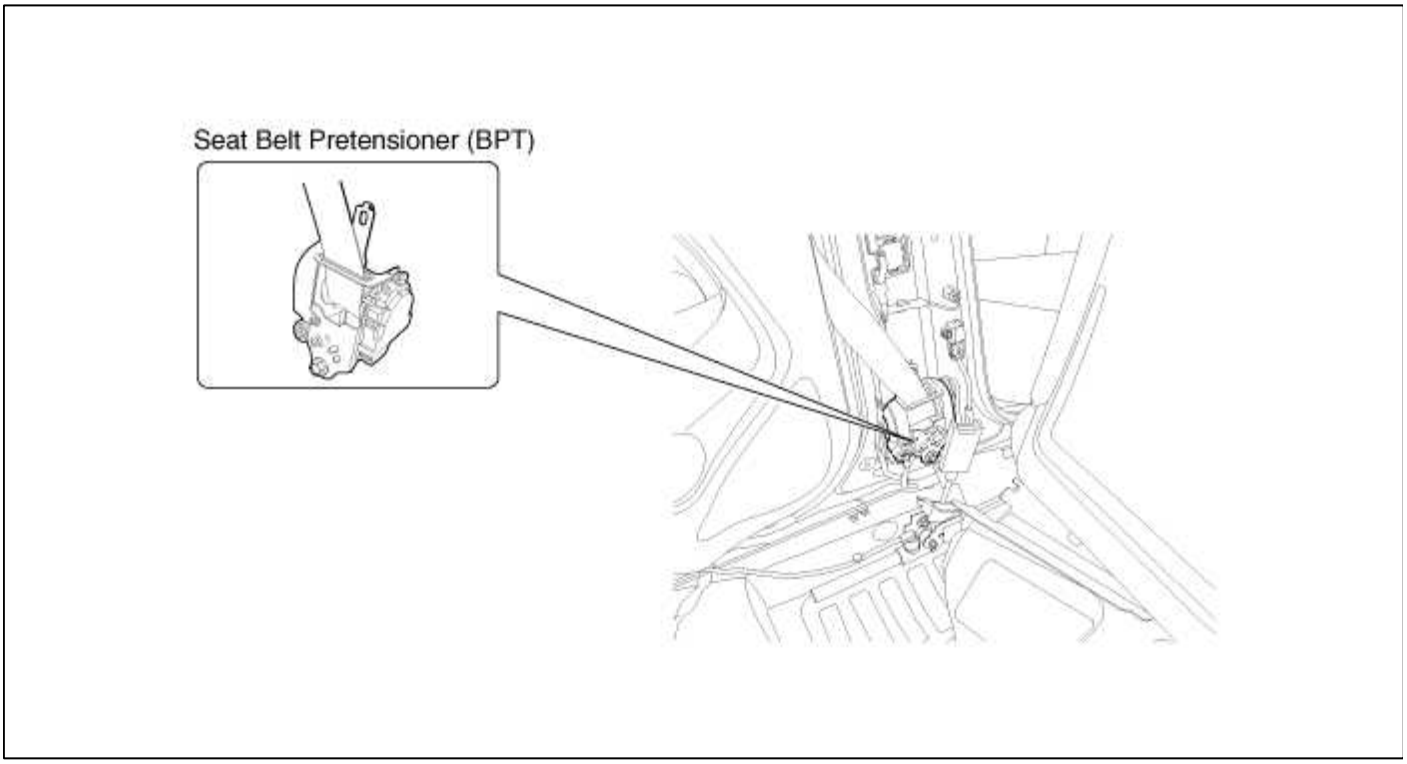
The Seat Belt Pretensioners (BPT) are installed inside Center Pillar (LH & RH). When a vehicle crashes with a certain degree of frontal impact, the pretensioner seat belt helps to reduce the severity of injury to the front seat occupants by retracting the seat belt webbing. This prevents the front occupants from thrusting forward and hitting the steering wheel or the instrument panel when the vehicle crashes.

CAUTION

Never attempt to measure the circuit resistance of the Seat Belt Pretensioner (BPT) even if you are using the specified tester. If the circuit resistance is measured with a tester, the pretensioner will be ignited accidentally. This will result in serious personal injury.

Restraint > Seat Belt Pretensioner > Seat Belt Pretensioner (BPT) > Components and Components Location

Components

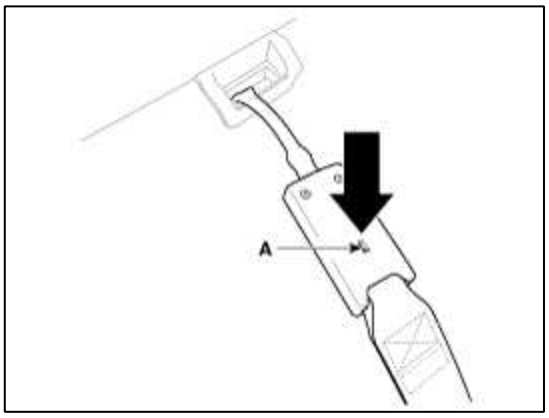


Restraint > Seat Belt Pretensioner > Seat Belt Pretensioner (BPT) > Repair procedures

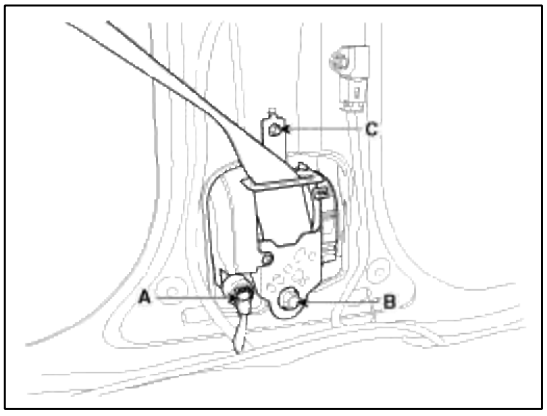
Removal

1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.

2. Remove the seat belt after pushing the lock pin (A).



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. Remove the upper anchor bolt.
6. Disconnect the seat belt pretensioner connector (A).

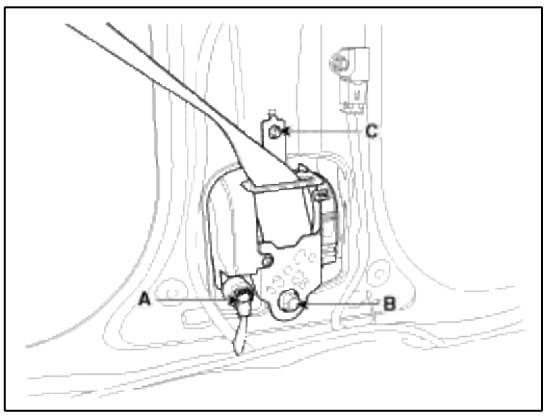


7. Loosen the seat belt pretensioner mounting bolts (B, C) and remove the seat belt pretensioner.

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 with bolts (B, C).

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 connector (A).

5. Install the upper anchor bolt.

Tightening torque:
39.2 ~ 53.9 N.m (4.0 ~ 5.5 kgf.m, 28.9 ~ 39.8 lb-ft)

6. Install the center pillar trim.
   (Refer to the Body group - "Interior trim")
7. Install the door scuff trim.
   (Refer to the Body group - "Interior trim")
8. Insert the seat belt to the anchor pretensioner.

NOTE

Make sure the lock pin is connected in properly.

9. Reconnect the battery negative cable.
10. After installing the seat belt 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.

Restraint > Seat Belt Pretensioner > Anchor Pretensioner (APT) > Description and Operation

Description

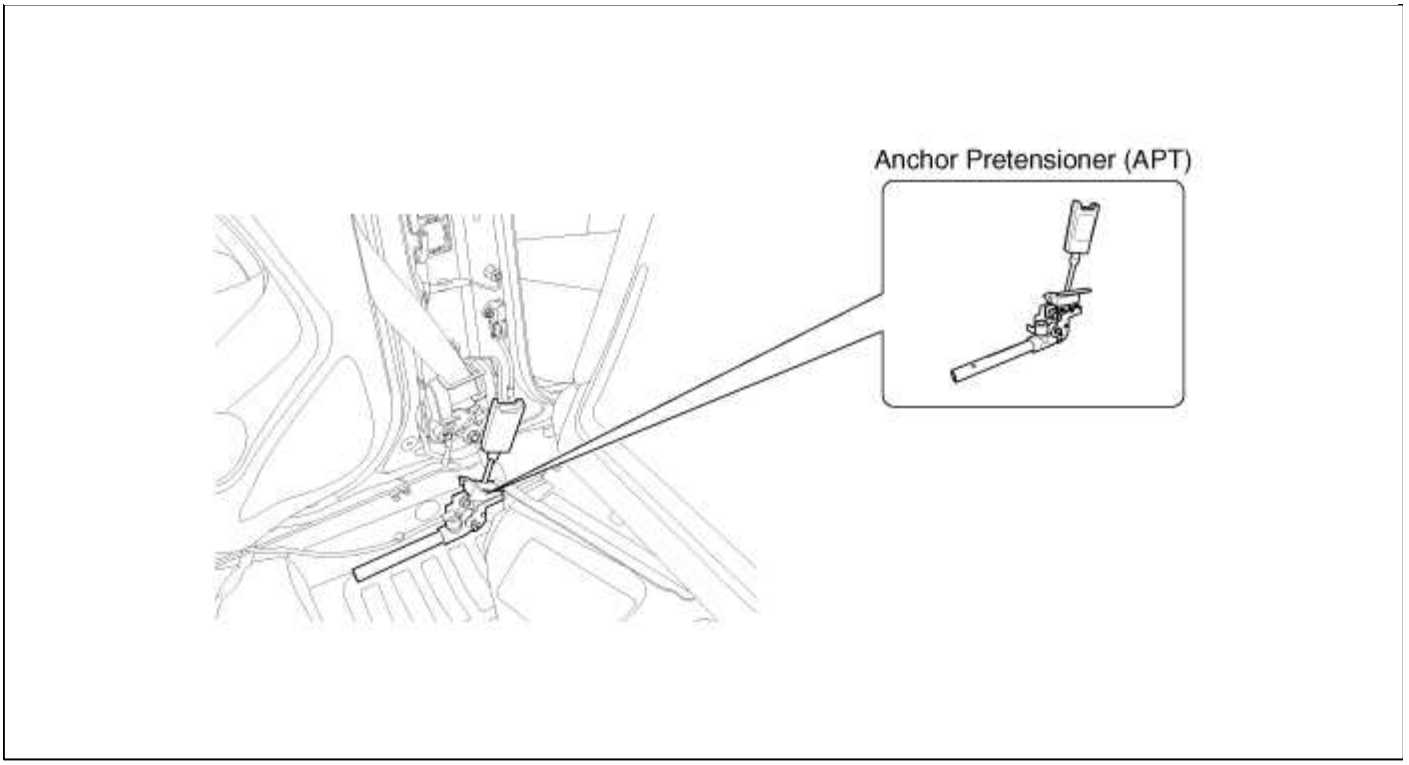
Front seat belt anchor pretensioner operates as well as belt pretensioner at the same time If it gets into its deploy condition after a collision. It is located at near anchor on front seat and it is an equipment to make up for the existing short stroke. Front seat belt anchor pretensioner is an auxiliary equipment to prevent the driver and passenger from breaking away doubly as seat belt is being pulled toward anchor side after a collision.

CAUTION

Never measure resistance of anchor pretensioner directly, current of measuring device may cause unexpected airbag deploy.

Restraint > Seat Belt Pretensioner > Anchor Pretensioner (APT) > Components and Components Location

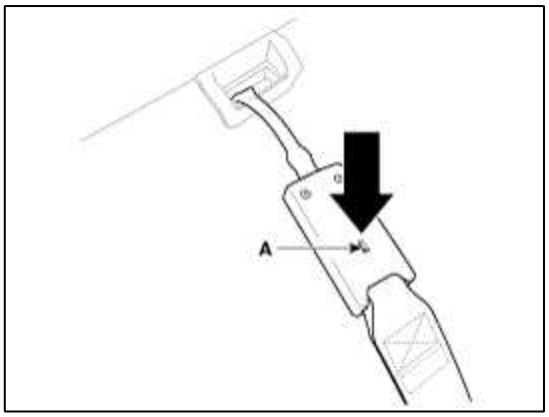
Components



Restraint > Seat Belt Pretensioner > Anchor Pretensioner (APT) > Repair procedures

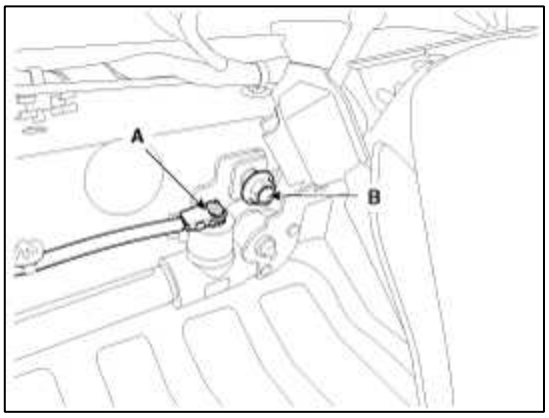
Removal

1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
2. Remove the seat belt after pushing the lock pin (A).



3. Remove the door scuff trim.
   (Refer to the Body group - "Interior trim")
4. Remove the center pillar trim.
   (Refer to the Body group - "Interior trim")

5. Disconnect the anchor pretensioner connector (A).



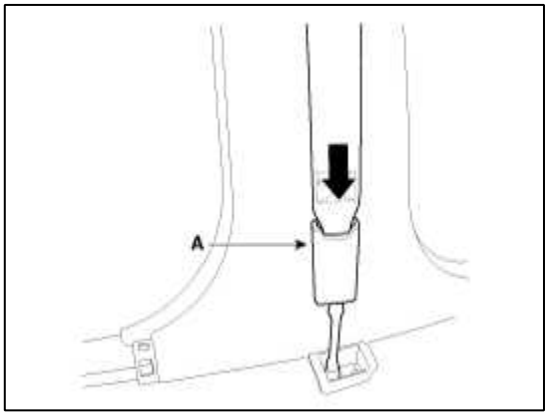
6. Loosen the anchor pretensioner mounting bolt (B) and remove the anchor pretensioner.

Installation

1. Remove ignition key from the vehicle.
2. Disconnect the negative (-) cable from battery and wait for at least three minutes.
3. Install the anchor pretensioner with a bolt.

Tightening torque :
39.2 ~ 53.9 N.m (4.0 ~ 5.5 kgf.m, 28.9 ~ 39.8 lb-ft)

4. Connect the anchor pretensioner connector.
5. Install the center pillar trim.
   (Refer to the Body group - "Interior trim")
6. Install the door scuff trim.
   (Refer to the Body group - "Interior trim")
7. Insert the seat belt to the anchor pretensioner (A).



NOTE

Make sure the lock pin is connected in properly.

8. Reconnect the battery negative cable.
9. After installing the anchor pretensioner, confirm proper system operation:
   A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

RIO(UB) > 2012 > G 1.6 GDI > Steering System

Steering System > General Information > Specifications

Specifications

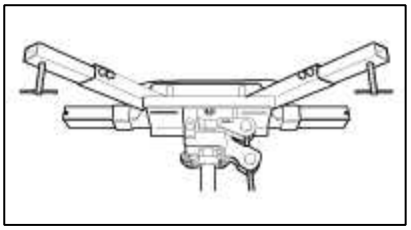
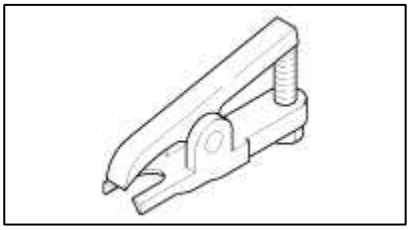
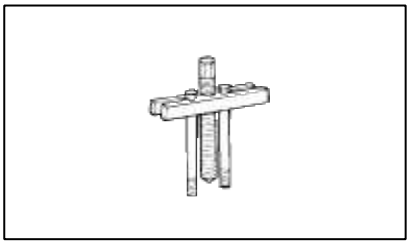
Item		Specification
Type		Electric Power Steering System
Steering gear	Type	Rack & Pinion
	Rack stroke	144mm (5.67in.)
Steering angle (Max.)	Inner	38.35° ± 2°
	Outer	30.81°

Tightening Torques

Item	Tightening torque (kgf.m)		
	Nm	kgf.m	lb-ft
Wheel Hub nuts	88.3 ~ 107.9	9.0 ~ 11.0	65.1 ~ 79.6
Steering wheel lock nut	39.2 ~ 44.1	4.0 ~ 4.5	28.9 ~ 32.5
Steering column & universal joint	29.4 ~ 34.3	3.0 ~ 3.5	21.7 ~ 25.3
Steering column mounting nuts	14.7 ~ 17.7	1.5 ~ 1.8	10.8 ~ 13.0
Steering column mounting bolt	44.1 ~ 49.0	4.5 ~ 5.0	32.5 ~ 36.2
Bolt connecting universal joint to pinion	32.4 ~ 38.3	3.3 ~ 3.8	23.9 ~ 27.5
Tie rod end castle nut	23.5 ~ 33.3	2.4 ~ 3.4	19.4 ~ 24.6
Lower arm to front axle	78.5 ~ 88.8	8.0 ~ 9.0	57.9 ~ 65.1
Steering gear box to sub frame	58.8 ~ 78.8	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	156.9 ~ 176.5	16.0 ~ 18.0	115.7 ~ 130.2
Sub frame stay bolts	44.1 ~ 53.9	4.5 ~ 5.5	32.5 ~ 39.8

Steering System > General Information > Special Service Tools

Special Service Tools

Tool (Number and Name)	Illustration	Use
09568-34000 Crossmember support		Supporting of the crossmember
09568-34000 Ball joint puller		Remove the ball joint from the front axle
0956-11001 Steering wheel puller		Remove the steering wheel

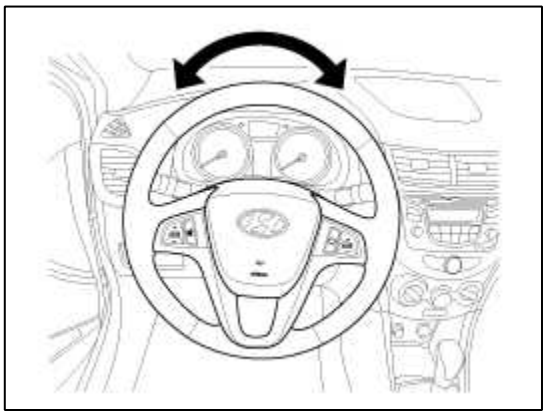
Steering System > General Information > Repair procedures

Inspection

Steering Wheel Play Inspection

1. Turn the steering wheel so that the front wheels can face straight ahead.
2. Measure the distance the steering wheel can be turned without moving the front wheels.

Standard value: 30mm (1.18in.) or less



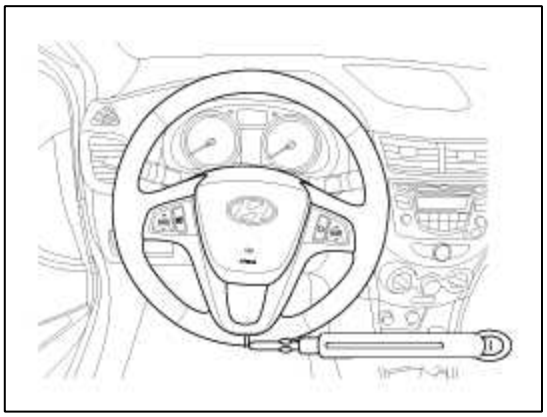
3. If the play exceeds standard value, inspect the steering column, shaft, and linkages.

Checking stationary steering effort

1. Position the vehicle on a level surface and place the steering wheel in the straight ahead position.

2. Attach a spring scale to the steering wheel. With the engine speed 900 ~ 1100rpm, pull the scale and read it as soon as the tires begin to turn.

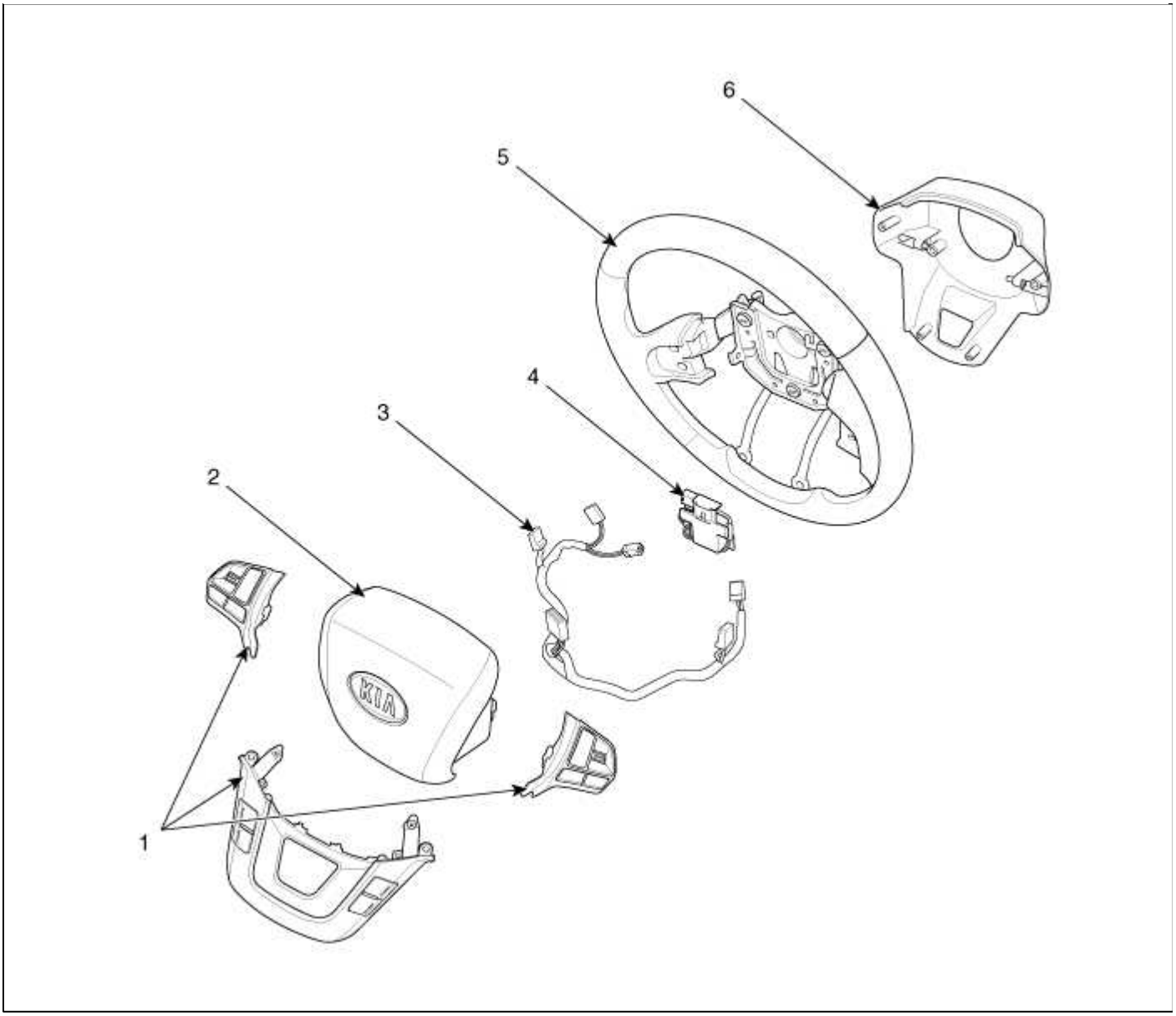
Standard value: 3.0kgf or less



3. If the measured value exceeds standard value, inspect the power steering gear box and MDPS system.

Steering System > Steering wheel > Components and Components Location

Component



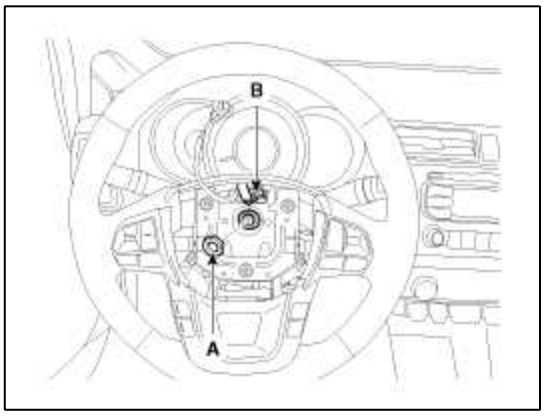
1. Remote control assembly 2. Airbag module 3. Wiring	4. Heated steering control unit 5. Steering wheel body 6. Lower cover

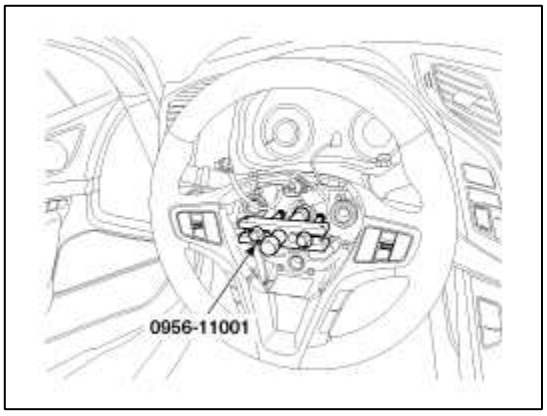
Steering System > Steering wheel > Repair procedures

Removal

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. (Refer to “Air bag module / DAB” in RT group)
   Remove the airbag module.

4. Disconnect the lock nut (A) & connector (B) and then remove the steering wheel by using special service tools. (09561-11001)





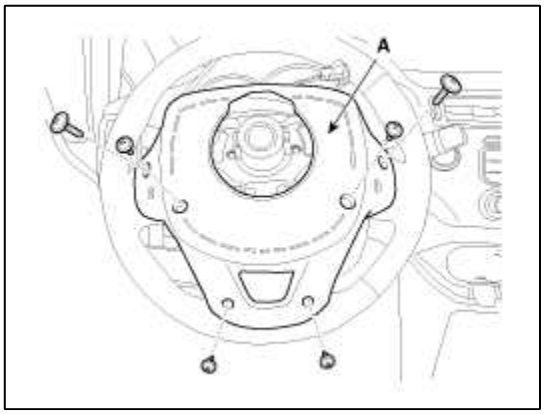
CAUTION

- Do not hammer on the steering wheel to remove it; it may damage the steering column.

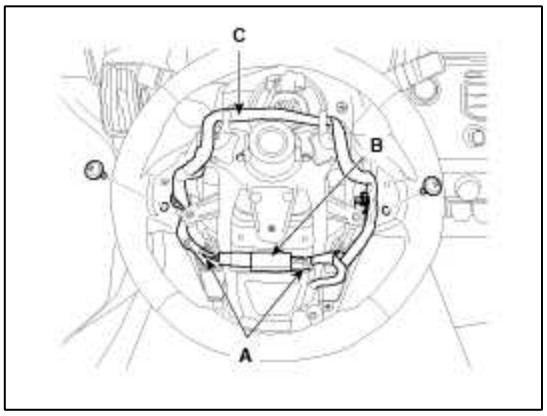
5. Installation is the reverse of the removal.

Disaseembly

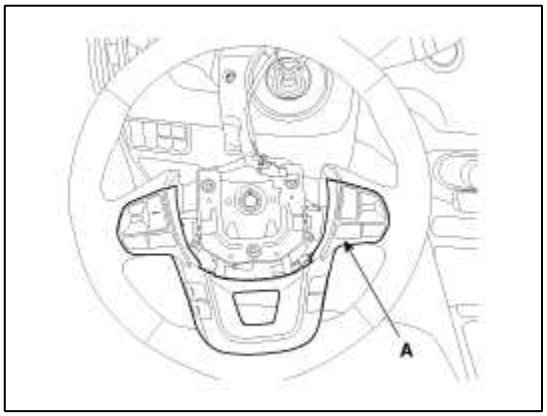
1. Loosen the screw(6ea) and remove the lower cover (A) from the steering wheel body.



2. Disconnect the heated steering wheel unit connector (A) and remove the heated steering wheel unit (B) and wiring (C) and then loosen the screw(2ea).



3. Remove the remote control assembly (A) from the steering wheel body.



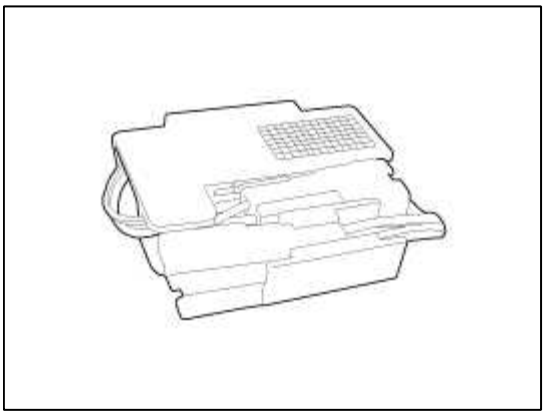
4. Installation is the reverse of the removal.

Steering System > Steering wheel > Heated Steering wheel > Description and Operation

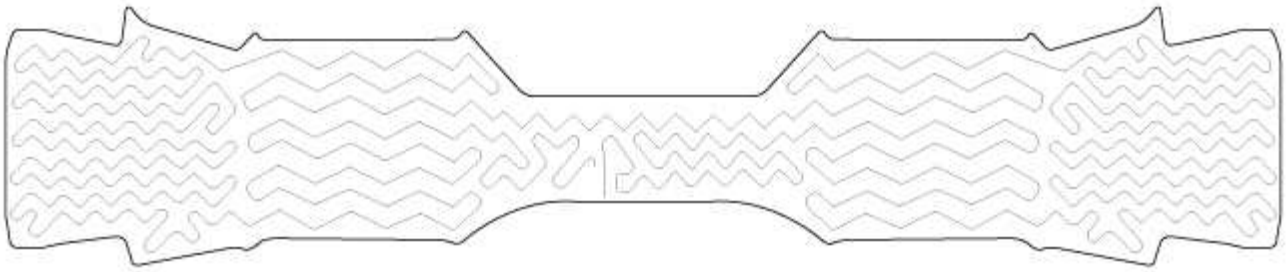
Description

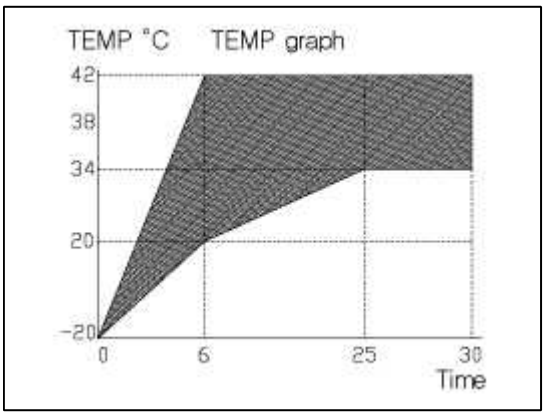
"The heated steering wheel features an internal heating element that maintains the steering wheel temperature to a consistent level during cold seasons. A heater element has been integrated into the steering handle to maximize driver comfort during cold seasons. The steering wheel heating system will not be active with an ambient temperature above the system set point temperature. The steering wheel heater element is connected through a wire harness and regulated through an electronic control module.The control module responds to a temperature sensor's (negative temperature coefficient - NTC thermistor) resistance change, which is in direct contact with the steering wheel heater element."

Heated control unit



Heated pad



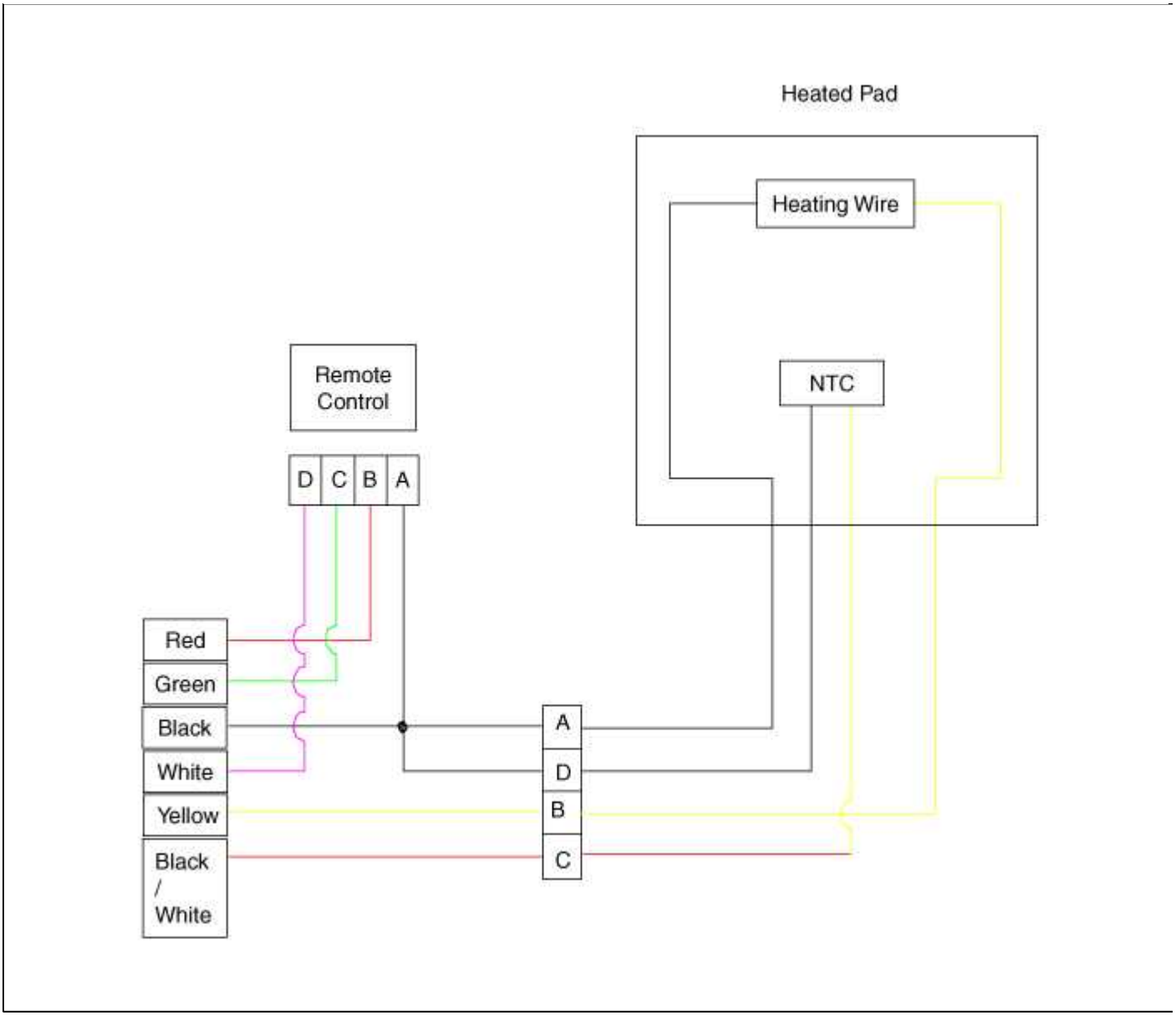


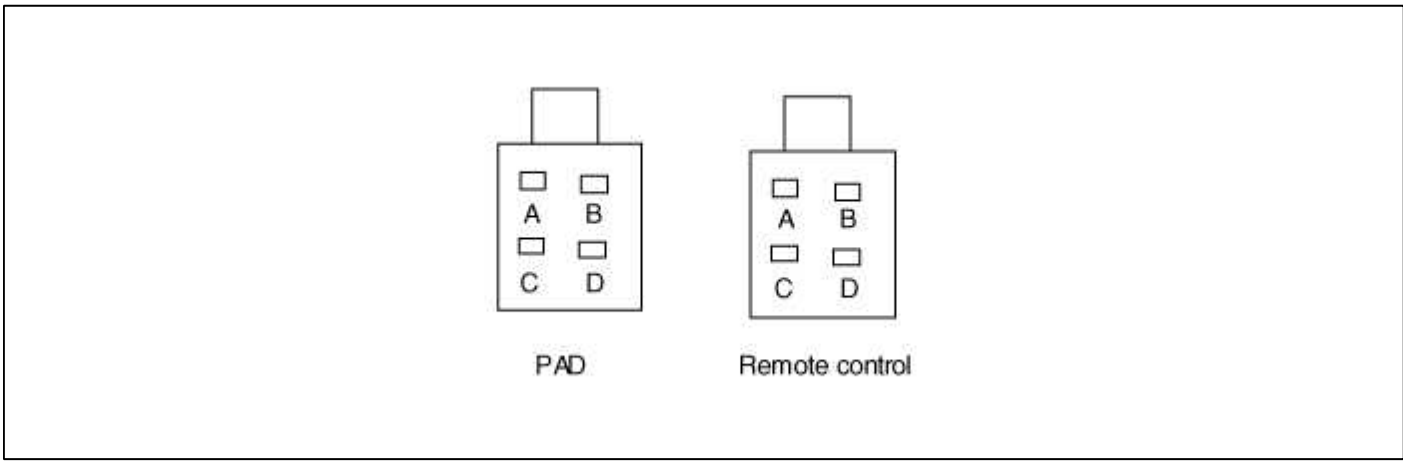
Specifications

Item	Specification
Voltage	13.5 V
Heated pad resistance	1.6 ~ 2.0 Ω ± 10%
NTC resistance	10.0 kΩ ± 10% (25°C)
Current	124A not over

Steering System > Steering wheel > Heated Steering wheel > Schematic Diagrams

System Circuit Diagram





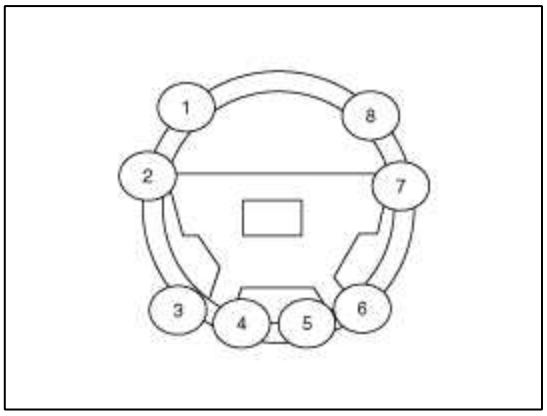
Terminal Function

Housing	Pin	Function	Wire color
Pad	A	GND	Back
	B	HEATER	Yellow
	C	NTC+	Back / Yellow
	D	NTC-	Back
Remote control	A	GND	Back
	B	BAT	Red
	C	LED	Green
	D	SWITCH	White

Steering System > Steering wheel > Heated Steering wheel > Repair procedures

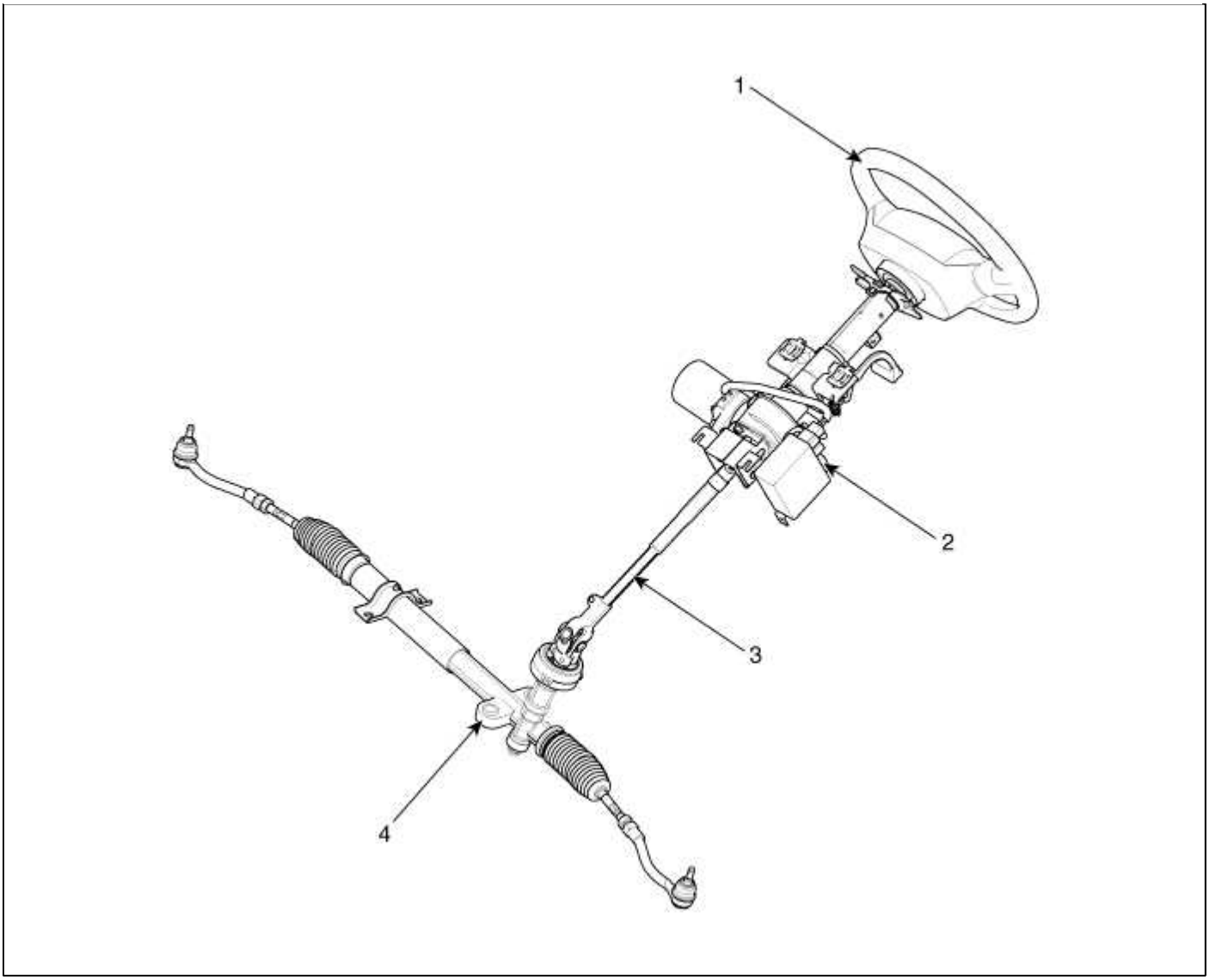
Inpection

1. Measure a resistance of NTC and Heated pad.
   A. NTC resistance(Black / Yellow, Black) - 10.0 kΩ ± 10% (25°C)
   B. Heated pad resistance (Yellow, Black) - 1.6 ~ 2.0 Ω ± 10%
2. Measure a temperature.
   A. The temperature of wheel surface grip must rise from -20°C to 20°C within 6 minute
   B. The temperature of wheel surface grip must keep 38°C ± 4°C after 25 minute
   C. At that time switch on, all measure point (1~8)



Steering System > Electric Power Steering > Components and Components Location

Components

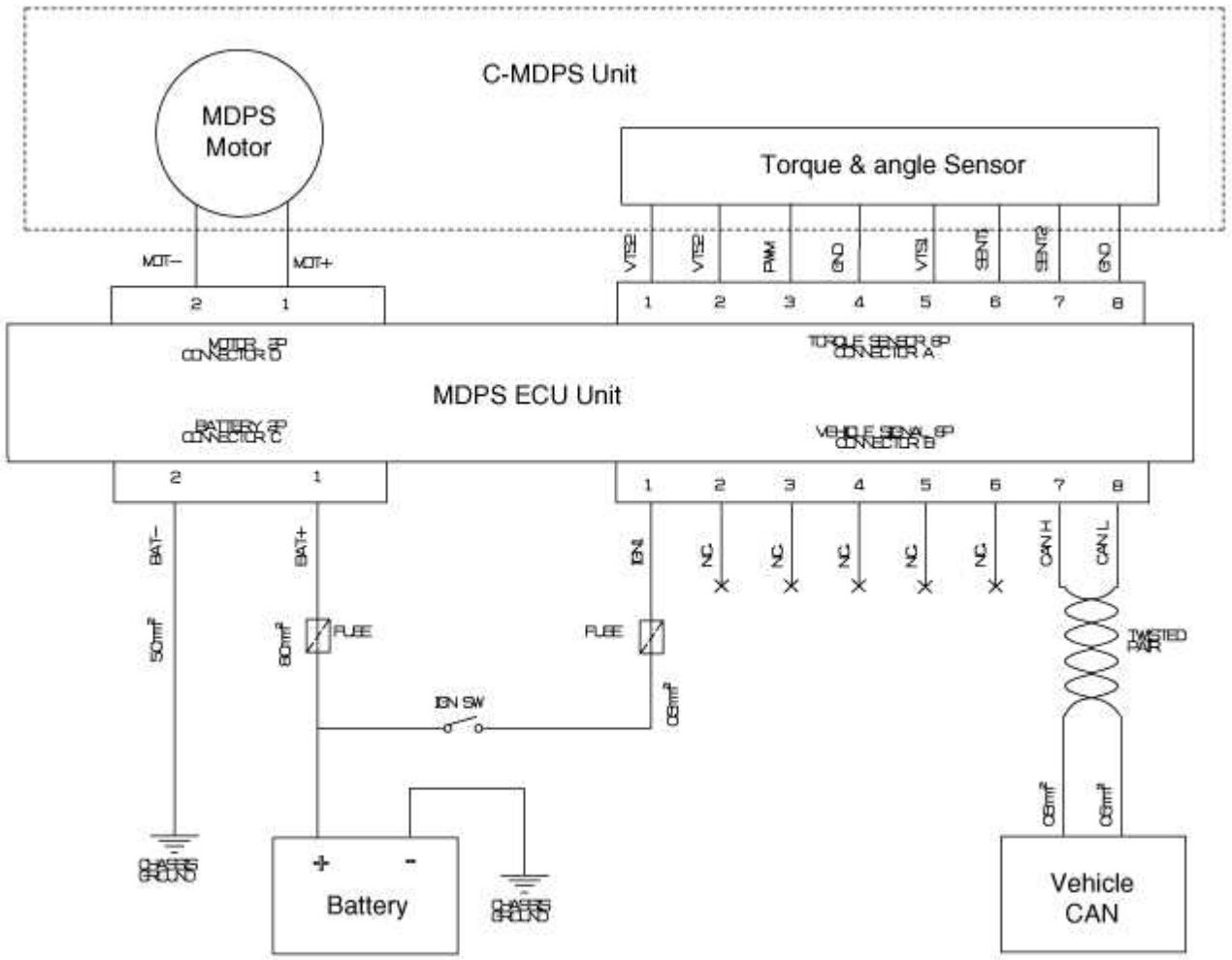


1. Steering wheel 2. Steering column & EPS unit assembly	3. Universal joint assembly 4. Steering gear box

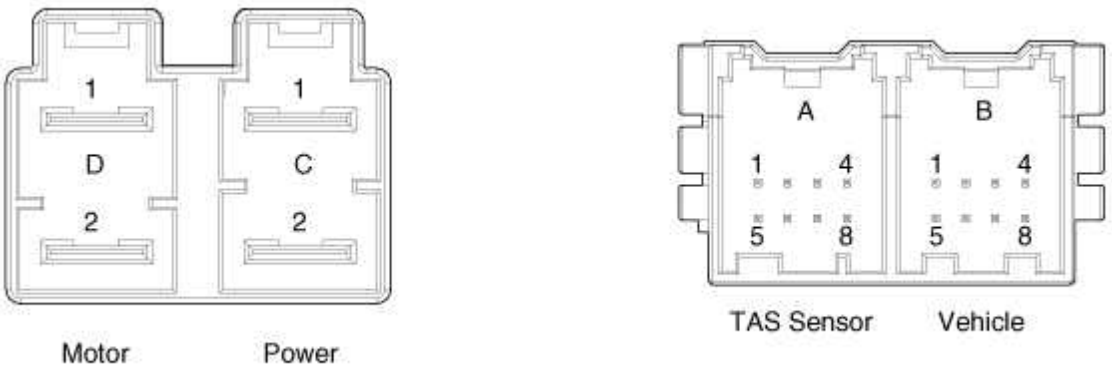
Steering System > Electric Power Steering > Schematic Diagrams

System Circuit Diagram

MDPS Circuit Diagram



Harness Connector



Connector	Pin no	Pin name	Descrption	Specifcation
TAS sensor signal 8P connector A	1	VTS2	SENT2 Supply vatage	-
	2	VTS2	PWM Supply vatage	-
	3	PWM	TAS PWM signal	-
	4	GND	VTS2 GND	-
	5	VTS1	SENT1 Supply vatage	-
	6	SENT1	TAS SENT1 signal	-
	7	SENT2	TAS SENT2 signal	-
	8	GND	VTS1 GND	-
Vehicle signal 8P connector B	1	IGN1	Ignition signal	ECU operating vatage : 90V ~ 160V
	2	NC	Nbt connected	-
	3	NC	Nbt connected	-
	4	NC	Nbt connected	-
	5	NC	Nbt connected	-
	6	NC	Nbt connected	-
	7	CAN H	CAN BUS High line	Reference to HMC ES96480-00
	8	CAN L	CAN BUS Low line	Reference to HMC ES96480-00
Battery 2P connector C	1	BAT +	Battery positive	ECU operating vatage : 9.0V ~16.0V Peak < I < 65A @ DC12V, MDPS Fu operation Leakage < I < 0.5mA @ DC12V, MDPS OFF
	2	BAT -	Cirassis ground	-
Motor 2P connector D	1	MOT +	Motor wire	-
	2	MOT -	Motor wire	-

Steering System > Electric Power Steering > Description and Operation

Description

EPS (Electric power steering, Column assist type) system uses an electric motor to assist the steering force and it is an engine operation independent steering system.

EPS control module controls the motor operation according to information received from the each sensor and CAN (Controller Area Network),

resulting in a more precise and timely control of steering assist than conventional engine-driven hydraulic systems.Components (Steering Angle Sensor, Torque Sensor, Fail-safe relay, etc.) of the EPS system are located

inside the steering column & EPS unit assembly and the steering column & EPS unit assembly must not be disassemble to inspect or replace them.

Note With Regard to diagnosis

Trouble factor	Check item	Trouble symtom	Explanation	Note
Drop, impact, and overload	Motor	Abnormal noise	- Visable or unvisable damage can occur.The steering wheel could pull to one side by using the dropped parts.- Precise parts of motor/ECU are sensitive to vibration and impact.- Overload can cause unexpected damage	- Do not use the impacted EPS.- Do not overload each parts.
	ECU	Circuit damage- Wrong welding point- Broken PCB- Damaged precise parts		
	Torque sensor	Insufficient steering effort	Overload to INPUT shaft can cause malfunction of the torque sensor	- Do not impact the connecting parts (When inserting and torquing)- Use the specified tool to remove the steering wheel. (Do not hammer on it)- Do not use the impacted EPS
	Angle sensor	Insufficient steering effort (Uneven between LH and RH)		Do not use the impacted EPS
Pull/Dent	Harness	- Malfunction- impossible power operation- Malfunction of EPS	Disconnection between harness connecting portion and harness	Do not overload the harness
Abnormal storage temperature	Motor/ECU	Abnormal steering effort by improper operation of the motor/ECU	- Waterproof at the normal condition- Even a little moisture can cause malfunction of the precise parts of the motor/ECU	- Keep the normal temperature and proper moisture, while storaging- Avoid drowning

1. Do not impact the electronic parts, if they are dropped or impacted, replace them with new ones.
2. Avoid heat and moisture to the electronic parts.
3. Do not contact the connect terminal to avoid deformation and static electricity.
4. Do not impact the motor and torque sensor parts, if they are dropped or impacted, replace them with new ones.
5. The connector should be disconnected or connected with IG OFF.

Steering System > Electric Power Steering > Repair procedures

General Inspection

After or before servicing the EPS system, perform the troubleshooting and test procedure as follows. Compare the system condition with normal condition in the table below and if abnormal symptom is detected, perform necessary remedy and inspection.

Test condition	Normal condition: Motor must not supply steering assist.		
	Symptom	Possible cause	Remedy
IG Off	Motor supplies steering assist.	ASP is not calibrated.	Perform the ASP calibration using a scan tool.
		IG power supplies	Inspect the IG power supply line.

Test condition	Normal condition: Motor must not supply steering assist, Warning lamp is illuminated.		
	Symptom	Possible cause	Remedy
IG On/Engine Off	Motor supplies steering assist.	ASP is not calibrated.	Perform the ASP calibration using a scan tool.
		EMS CAN signal is not received.	Inspect the CAN line.
	Warning lamp is not illuminated.	Cluster fault	Inspect the cluster and cluster harness

Test condition	Normal condition: Motor supplies steering assist, Warning lamp is not illuminated.		
	Symptom	Possible cause	Remedy
IG On/Engine On	Warning lamp is illuminated and Motor dose not supply steering assist.	EPS (Hot at all times) and IG power supply fault	Inspect the connector and harness for EPS (Hot at all times) and IG power supply line.
		DTC is detected by system.	Perform the self test using a scan tool and repair or replace.
	Warning lamp is illuminated and Motor supplies steering assist.	ASP is not calibrated.	Perform the ASP calibration using a scan tool.
		CAN communication between EPS and cluster is fault.	Inspect the CAN line.

ASP: Absolute Steering Position
CAN: Controller Area Network
EMS: Engine Management System

CAUTION

The following symptoms may occur during normal vehicle operation and if there is no EPS warning light illumination, it is not malfunction of EPS system.

- After turning the ignition switch on, the steering wheel becomes heavier while it performs EPS system diagnostics, for about 2 seconds, then it becomes normal steering condition.
- After turning the ignition switch on or off, EPS relay noise may occur but it is normal.
- When it is steered, while the vehicle is stopped or in low driving speed, motor noise may occur but it is normal operating one.

Caution when ASP (Absolute Steering Position) calibration or EPS type recognition

- Check if the battery is fully charged before ASP calibration or EPS type recognition.
- Be careful not to disconnect any cables connected to the vehicle or scan tool during ASP calibration or EPS type recognition.
- When the ASP calibration or EPS type recognition is completed, turn the ignition switch off and wait for several seconds, then start the engine to confirm normal operation of the vehicle.

ASP Calibration

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.

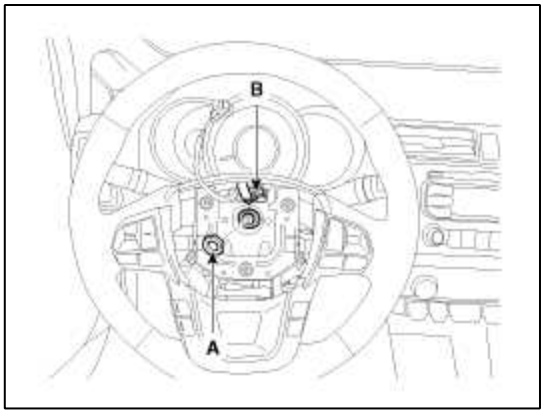
Steering System > Electric Power Steering > Steering Column and Shaft > Repair procedures

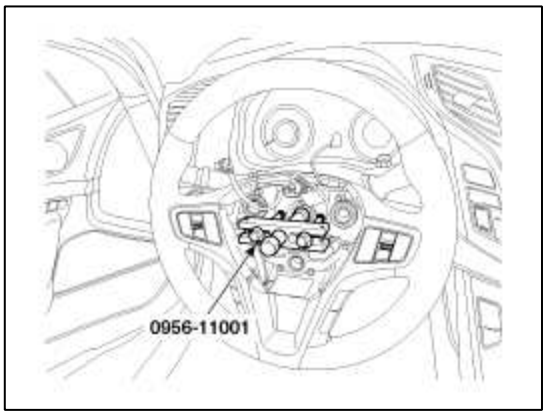
Replacement

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.
   (Refer to RT group - "Air Bag Module")
4. Loosen the lock nut (A), disconnect the connector (B) and then remove the steering wheel by using SST(0956-11001).

Tightening torque :
39.2 ~ 44.1N.m(4.0 ~ 4.5kgf.m, 28.9 ~ 32.5lb-ft)

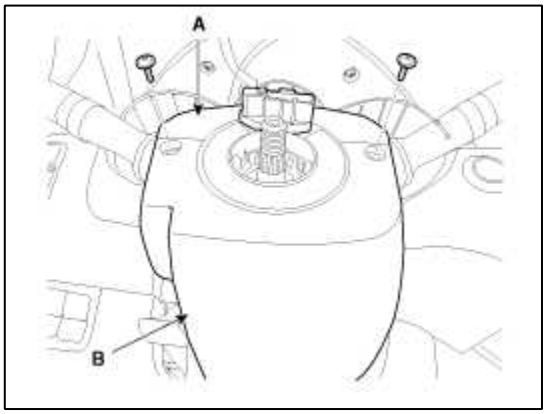


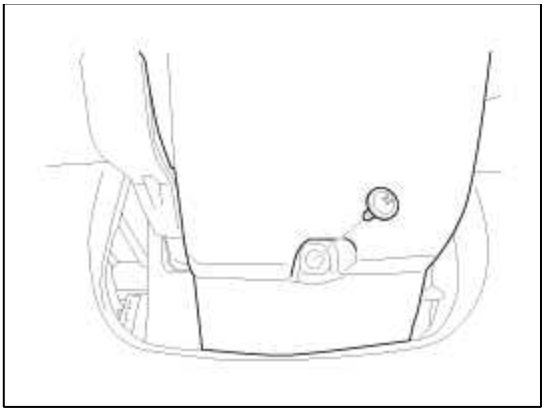


CAUTION

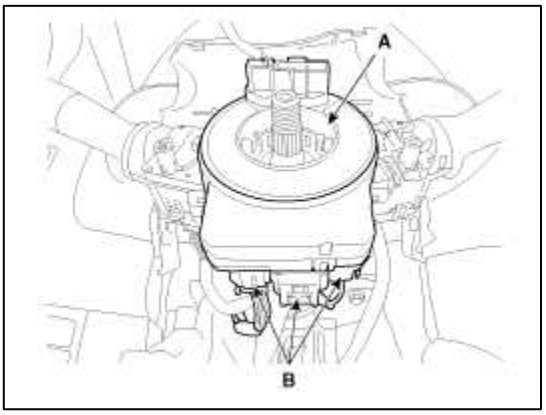
Do not hammer on the steering wheel to remove it; it may damage the steering column.

5. Loosen the screw and then remove the steering column upper (A) and lower shroud (B).





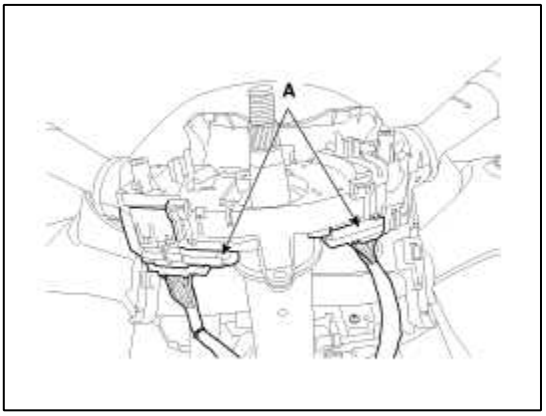
6. Disconnect the connector (B) and then remove the clock spring (A).



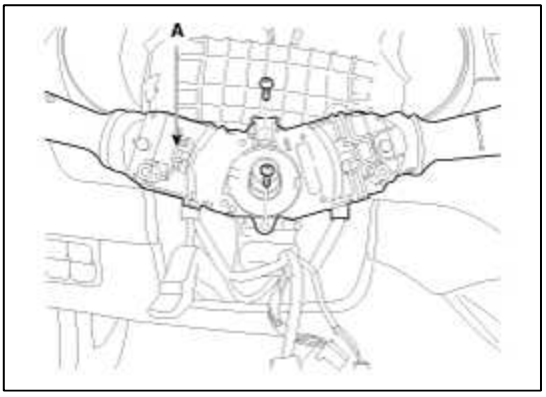
CAUTION

• When assembling 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.

7. Disconnect the connector (A).

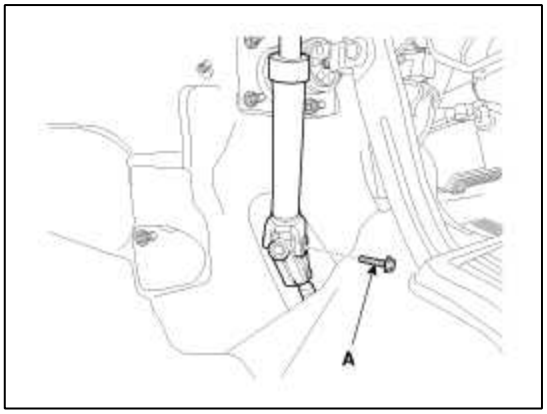


8. Loosen the screw and then remove the multifunction switches (A).



9. Remove the crash pad side cover, Fuse box cover and lower crash pad.
   (Refer to BD group - "Interior / Crash Pad")
10. 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)

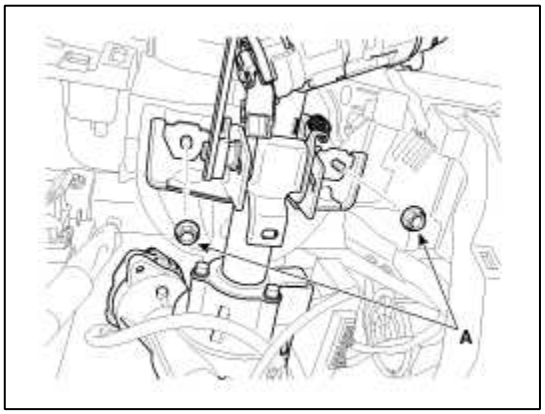


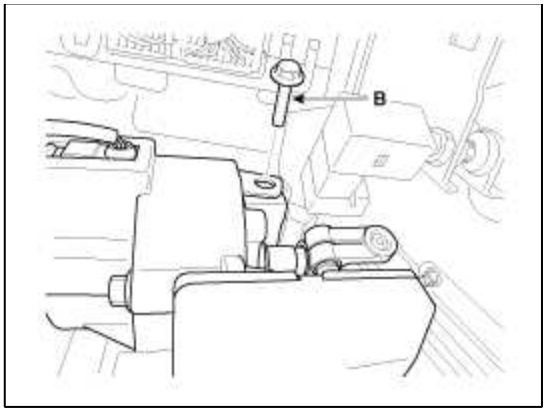
CAUTION

- Lock the steering wheel in the straight ahead position to prevent the damage of the clock spring inner cable when you handle the steering wheel.
- Must be replaced with new bolts when assembling. (SEAL-LOCK has been processed)
  SEAL-LOCK Specifications: MS721-39 "TYPE-D" Product: ND industries 1193S

11. Disconnect all connectors connected the steering column & EPS unit assembly.
12. Remove the steering column & EPS unit assembly by loosening the mounting bolt (B) and nuts (A).

Tightening torque :
Nut : 14.7 ~ 17.7N.m(1.5 ~ 1.8kgf.m, 10.8 ~ 13.0lb-ft)
Bolt : 44.1 ~ 49.0N.m(4.5 ~ 5.0kgf.m, 32.5 ~ 36.2lb-ft)





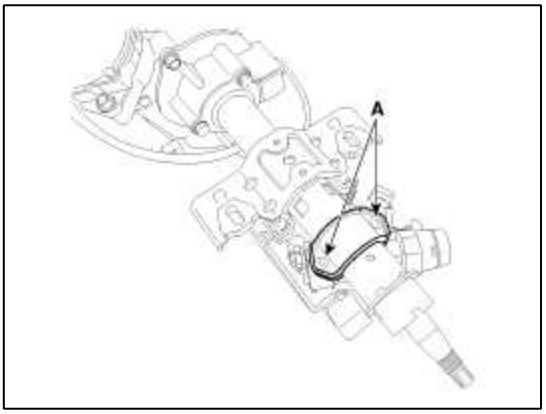
13. Installation is the reverse of the removal.

> **CAUTION**
>
> If MDPS type, you must be EPS type recognition
> (Refer to ST group - E.P.S/repair procedures)

Disassembly

Key lock assembly

1. Make a groove on the head of special bolts (A) with a chisel.

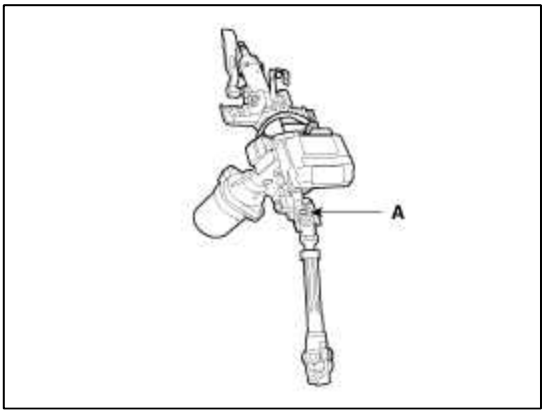


2. Loosen the special bolt using a screw driver and then remove the key lock assembly from the steering column assembly.
3. Reassembly is the reverse of the disassembly.

Universal joint assembly

1. Loosen the bolt (A) and then disconnect the universal joint assembly from the steering column assembly.

Tightening torque :
27.5 ~ 29.4N.m(2.8 ~ 3.0kgf.m, 20.3 ~ 21.7lb-ft)



2. Reassembly is the reverse of the disassembly.

CAUTION

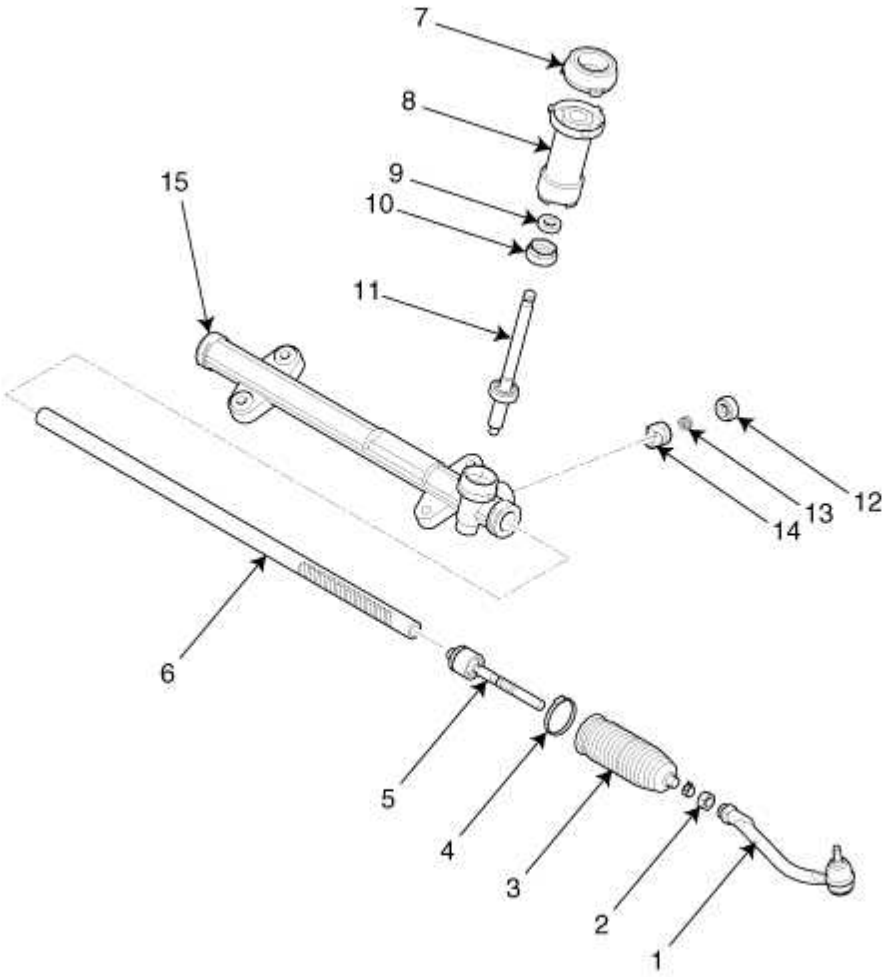
- Do not disassemble the EPS module from the column shaft.

Inspection

1. Check the steering column for damage and deformation.
2. Check the steering column for damage and deformation.
3. Check the join bearing for damage and wear.
4. Check the tilt bracket for damage and cracks.
5. Check the key lock assembly for proper operation and replace it if necessary.

Steering System > Electric Power Steering > Steering Gear box > Components and Components Location

Components



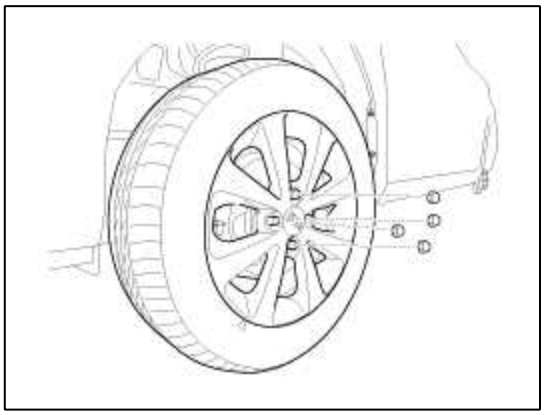
1. Tie-rod end	6. Rack bar	11. Pinion assembly
2. Lock nut	7. Dust packing	12. Yoke plug
3. Bellows clip	8. Dust cap	13. Yoke spring
4. Bellows	9. Oil seal	14. Support yoke assembly
5. Tie rod	10. Pinion plug	15. Rack housing

Steering System > Electric Power Steering > Steering Gear box > Repair procedures

Replacement

1. Remove the front wheel & tire.

Tightening torque :
88.3 ~ 107.9N.m(9.0 ~ 11.0kgf.m, 65.1 ~ 79.6lb-ft)

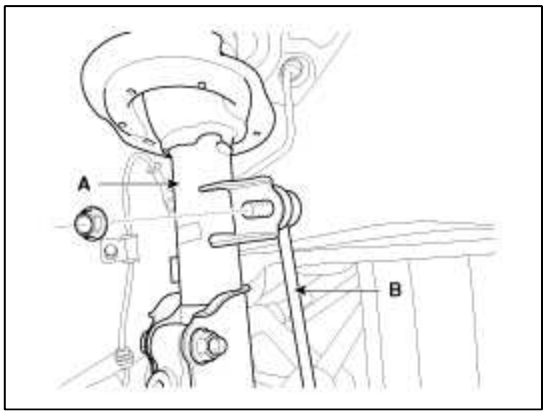


CAUTION

Be careful not to damage to the hub bolts when removing the front wheel & tire.

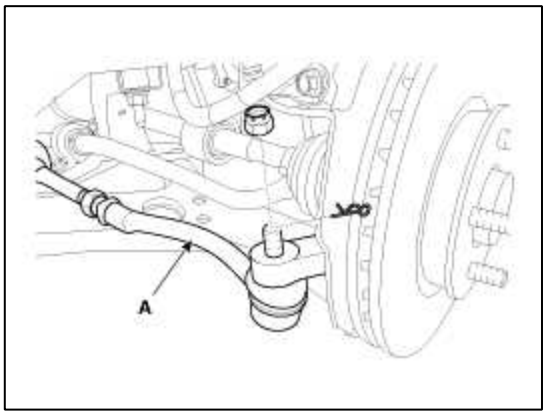
2. Disconnect the stabilizer link (B) with the front strut assembly (A) after loosening the nut.

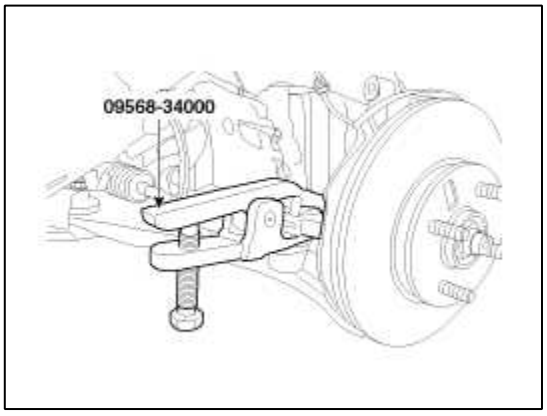
Tightening torque :
98.1 ~ 117.7N.m(10.0 ~ 12.0kgf.m, 72.3 ~ 86.8lb-ft)



3. Loosen the nut and then remove the tie-rod end (A) from the front axle by using SST(09568-34000).

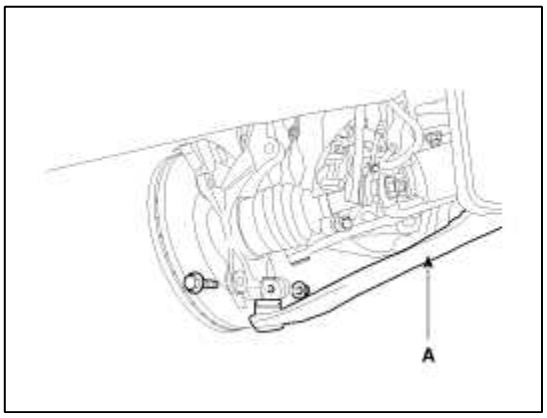
Tightening torque :
23.5 ~ 33.3N.m(2.4 ~ 3.4kgf.m, 19.4 ~ 24.6lb-ft)





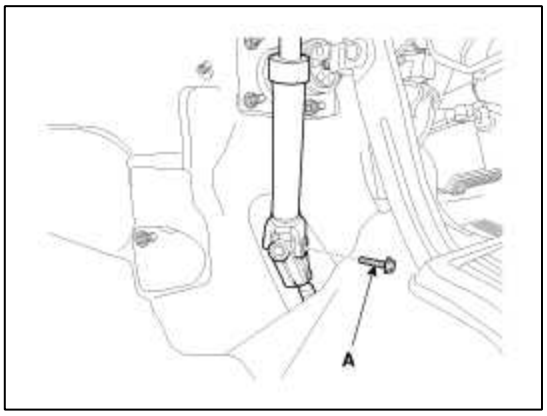
4. Loosen the nut and then remove the lower arm (A).

Tightening torque :
78.5 ~ 88.3N.m(8.0 ~ 9.0kgf.m, 57.9 ~ 65.1lb-ft)



5. Loosen the bolt (A) and then disconnect the universal joint assembly from the pinion of the steering gear box.

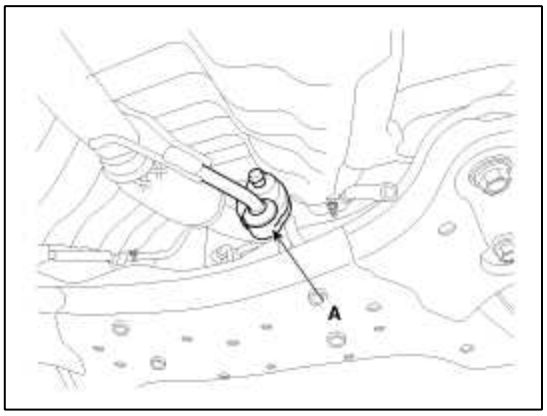
Tightening torque :
32.4 ~ 37.3N.m(3.3 ~ 3.8kgf.m, 23.9 ~ 27.5lb-ft)



CAUTION

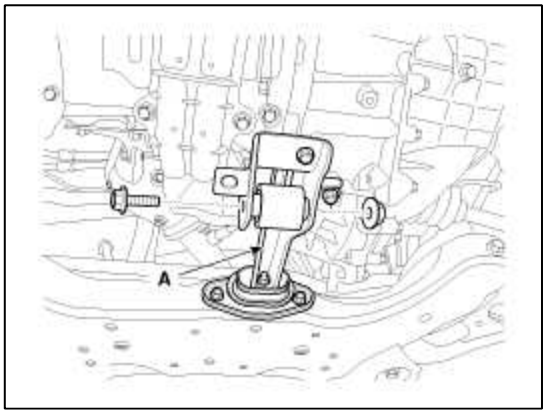
- Lock the steering wheel in the straight ahead position to prevent the damage of the clock spring inner cable when you handle the steering wheel.
- Must be replaced with new bolts when assembling. (SEAL-LOCK has been processed)
  SEAL-LOCK Specifications: MS721-39 "TYPE-D" Product: ND industries 1193S

6. Remove the rubber hanger (A).



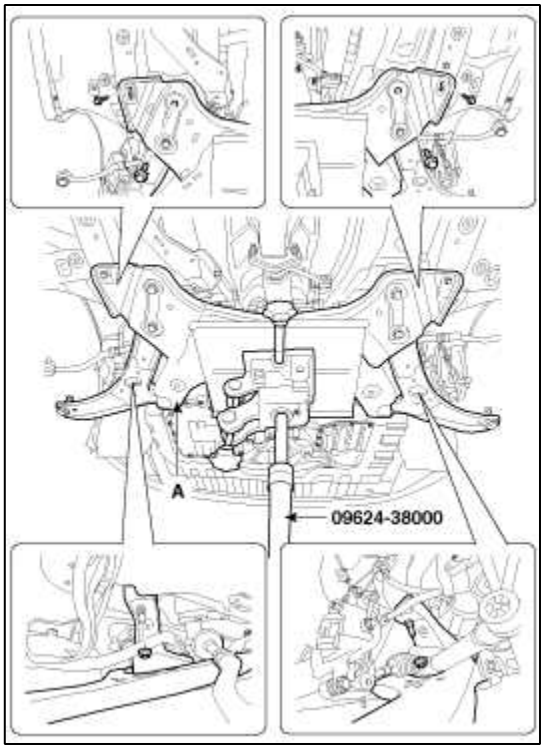
7. Loosening the roll rod (A) mounting bolts and nuts.

Tightening torque :
53.9 ~ 63.7N.m(5.5 ~ 6.5kgf.m, 39.8 ~ 47.0lb-ft)



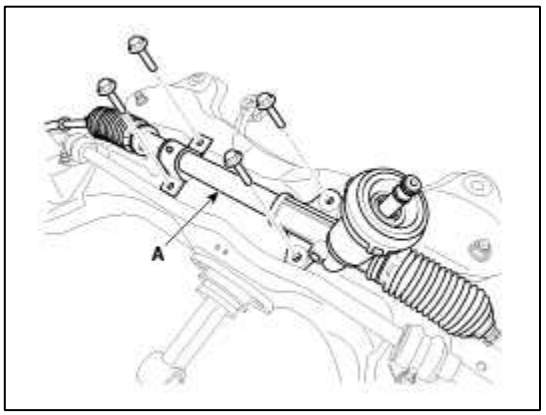
8. Loosen the bolts & nuts and then remove the front sub frame (A).

Tightening torque :
Sub frame mounting bolt & nut
156.9 ~ 176.5N.m(16.0 ~ 18.0kgf.m, 115.7 ~ 130.2lb-ft)
Sub frame stay mounting bolt
44.1 ~ 53.9N.m(4.5 ~ 5.5kgf.m, 32.5 ~ 39.8lb-ft)



9. Remove steering gearbox (A) from the front sub frame by loosening the mounting bolts.

Tightening torque :
58.8 ~ 78.8N.m (6.0 ~ 8.0kgf.m, 43.4 ~ 57.9lb-ft)



10. Installation is the reverse of the removal.

RIO(UB) > 2012 > G 1.6 GDI > Suspension System

Suspension System > General Information > Specifications

Specifications

Front Suspension

Item			Specification
Suspension type			MacPherson Strut
Shock absorber		Type	GAS
Coil spring	Free Height [I.D. color]	Gasoline 1.6 MT	319.3mm (12.6in)[Yellow / Blue-1]
		Gasoline 1.6 AT	325.9mm (12.8in)[Yellow / Green-1]

Rear Suspension

Item		Specification
Suspension type		Torsion Beam Axle
Shock absorber	Type	Monotube
Coil spring	Free Height [I.D. color]	304.9mm(12.0in)[Red / White-1]

Wheel & Tire

Item		Specification
Wheel	Aluminum	5.5J * 15
		6.5J * 17
	Steel	5.5J * 15
Tire		175/70 R14
		185/65 R15
		205/45 R17
Tire pressure		2.2kg/cm² + 0.07kg/cm² (32psi+1.0psi)

Wheel Alignment

Item			Specification
Front	Toe-in	Total	0°± 0.2°
		Individual	0° ± 0.1°
	Camber angle		-0.5° ± 0.5°
	Caster angle		4.1° ± 0.5°
	King-pin angle		13.8° ± 0.5°
Rear	Toe-in	Total	0.5° (+0.4°/ -0.5°)
		Individual	0.25°(+0.2°/ -0.25°)
	Camber angle		-1.5° ± 0.5°

Tightening Torques

Front Suspension

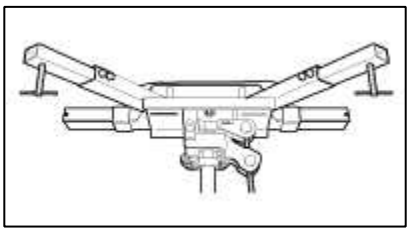
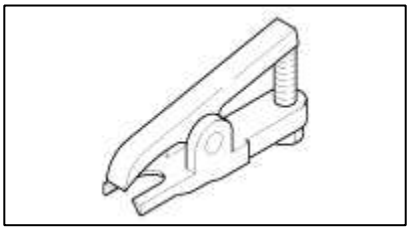
Item	Tightening torque (kgf.m)		
	Nm	kgf.m	lb-ft
Wheel Hub nuts	88.3 ~ 107.9	9.0 ~ 11.0	65.1 ~ 79.6
Lower arm to sub frame (A)	117.7~ 137.3	12.0 ~ 14.0	86.8 ~ 101.3
Lower arm to sub frame (B)	156.9 ~ 176.5	16.0 ~ 18.0	115.7 ~ 130.2
Lower arm to front axle	58.8 ~ 70.6	6.0 ~ 7.2	43.4 ~ 52.1
Tie rod end castle nut	23.5 ~ 33.3	2.4 ~ 3.4	19.4 ~ 24.6
Steering gear box to sub frame	58.8 ~ 78.8	6.0 ~ 8.0	43.4 ~ 57.9
Stabilizer bar to stabilizer link	98.1 ~ 117.7	10.0 ~ 12.0	72.3 ~ 86.8
Stabilizer bar to sub frame	44.1 ~ 53.9	4.5 ~ 5.5	32.5 ~ 39.8
Stabilizer link to front strut assembly	98.1 ~ 117.7	10.0 ~ 12.0	72.3 ~ 86.8
Sub frame mounting bolt (A)	156.9 ~ 176.5	16.0 ~ 18.0	115.7 ~ 130.2
Sub frame mounting bolt (B)	44.1 ~ 53.9	4.5 ~ 5.5	32.5 ~ 39.8
Bolt connecting universal joint to pinion	32.4 ~ 38.3	3.3 ~ 3.8	23.9 ~ 27.5
Strut assembly upper mounting nut	49.0 ~ 58.8	5.0 ~ 6.0	36.2 ~ 43.4
Strut assembly self lock nut	58.8 ~ 78.8	6.0 ~ 7.5	43.4 ~ 54.2
Strut assembly to front axle	137.3 ~ 156.9	14.0 ~ 16.0	101.3 ~ 115.7
Wheel speed sensor & braket	7.8 ~ 11.8	0.8 ~ 1.2	5.8 ~ 8.7

Rear Suspension

Item	Tightening torque (kgf.m)		
	Nm	kgf.m	lb-ft
Wheel Hub nuts	88.3 ~ 107.9	9.0 ~ 11.0	65.1 ~ 79.6
Shock absorber to body	98.1 ~ 117.7	10.0 ~ 12.0	72.3 ~ 86.8
Shock absorber to torsion beam axle	98.1 ~ 117.7	10.0 ~ 12.0	72.3 ~ 86.8
Torsion beam axle to body	98.1 ~ 117.7	10.0 ~ 12.0	72.3 ~ 86.8
Torsion beam axle to rear hub	49.0 ~ 58.8	5.0 ~ 6.0	36.2 ~ 43.4
Disc fixing screw	4.9 ~ 5.9	0.5 ~ 0.6	3.6 ~ 4.3
Wheel speed sensor mounting bolt	6.9 ~ 10.8	0.7 ~ 1.1	5.1 ~ 8.0
Parking brake hose & wheel speed sensor cable bracket	9.8 ~ 13.7	1.0 ~ 1.4	7.2 ~ 10.1

Suspension System > General Information > Special Service Tools

Special Service Tools

Tool (Number and Name)	Illustration	Use
09546-26000 Strut spring compressor		Compression of coli spring
09624-38000 Crossmember		Supporting of the crossmember
09568-34000 Ball joint puller		Remove the ball joint from front axle

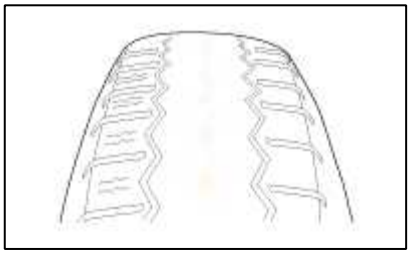
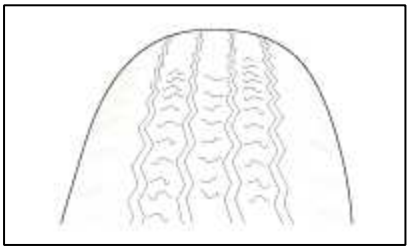
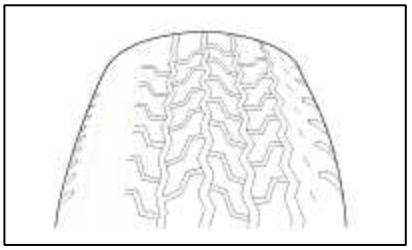
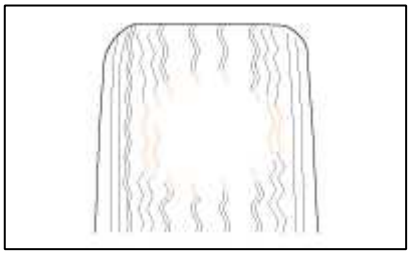
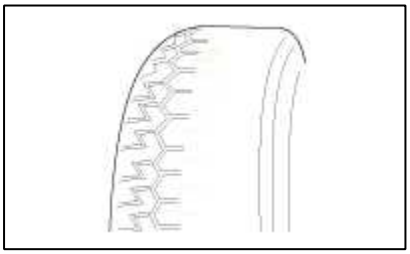
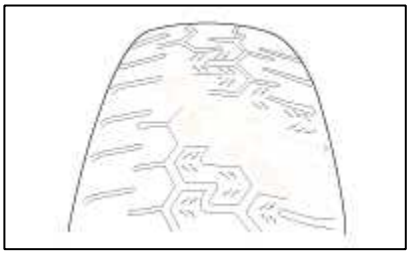
Suspension System > General Information > Troubleshooting

Troubleshooting

Symptom	Possible cause	Remedy
Hard steering	Improper front wheel alignment Excessive turning resistance of lower arm ball joint Low tire pressure No power assist	Correct Replace Adjust Repair and replace
Poor return of steering wheel to center	Improper front wheel alignment	Correct
Poor or rough ride	Improper front wheel alignment Malfunctioning shock absorber Broken or worn stabilizer Broken or worn coil spring Worn lower arm bushing	Correct Repair or replace Replace Replace Replace the lower arm assembly
Abnormal tire wear	Improper front wheel alignment Improper tire pressure Malfunctioning shock absorber	Correct Adjust Replace
Wandering	Improper front wheel alignment Poor turning resistance of lower arm ball joint Loose or worn lower arm bushing	Correct Repair Retighten or replace
Vehicle pulls to one side	Improper front wheel alignment Excessive turning resistance of lower arm ball joint Broken or worn coil spring Bent lower arm	Correct Replace Replace Repair
Steering wheel shimmy	Improper front wheel alignment Poor turning resistance of lower arm ball joint Broken or worn stabilizer Worn lower arm bushing Malfunctioning shock absorber Broken or worn coil spring	Correct Replace Replace Replace Replace Replace
Bottoming	Broken or worn coil spring Malfunctioning shock absorber	Replace Replace

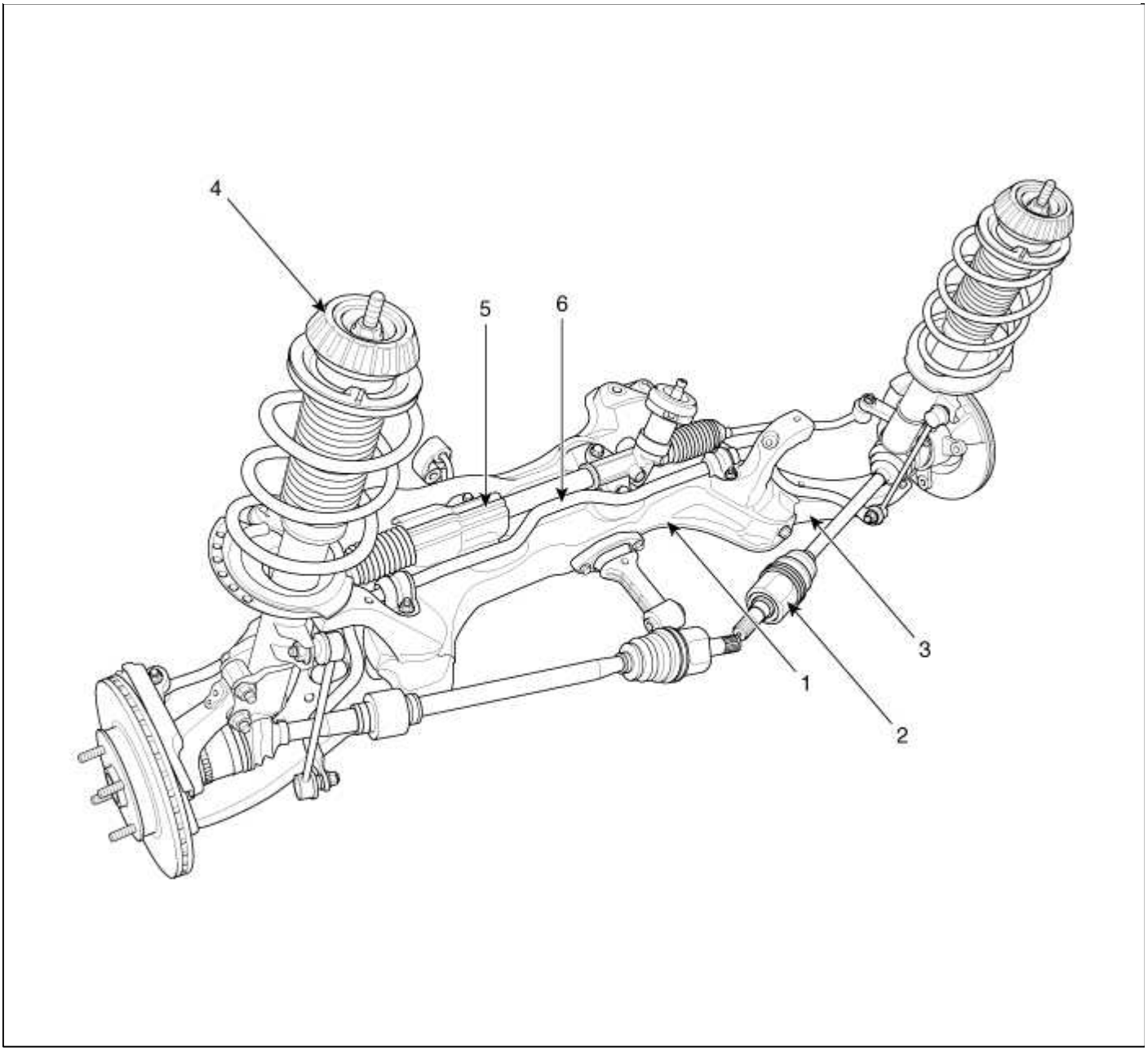
Wheel /tire noise, vibration and harshness concerns are directly related to vehicle speed and are not generally affected by acceleration, coasting or decelerating. Also, out-of-balance wheel and tires can vibrate at more than one speed. A vibration that is affected by the engine rpm, or is eliminated by placing the transmission in Neutral is not related to the tire and wheel. As a general rule, tire and wheel vibrations felt in the steering wheel are related to the front tire and wheel assemblies. Vibrations felt in the seat or floor are related to the rear tire and wheel assemblies. This can initially isolate a concern to the front or rear.

Careful attention must be paid to the tire and wheels. There are several symptoms that can be caused by damaged or worn tire and wheels. Perform a careful visual inspection of the tires and wheel assemblies. Spin the tires slowly and watch for signs of lateral or radial runout. Refer to the tire wear chart to determine the tire wear conditions and actions

Wheel and tire diagnosis		
Rapid wear at the center	Rapid wear at both shoulders	Wear at one shoulder
		
• Center-tread down to fabric due to excessive over inflated tires • Lack of rotation • Excessive toe on drive wheels • Heavy acceleration on drive	• Under-inflated tires • Worn suspension components • Excessive cornering speeds • Lack of rotation	• Toe adjustment out of specification • Camber out of specification • Damaged strut • Damaged lower arm
Partial wear	Feathered edge	Wear pattern
		
• Caused by irregular burrs on brake drums	• Toe adjustment out of specification • Damaged or worn tie rods • Damaged knuckle	• Excessive toe on non-drive wheels • Lack of rotation

Suspension System > Front Suspension System > Components and Components Location

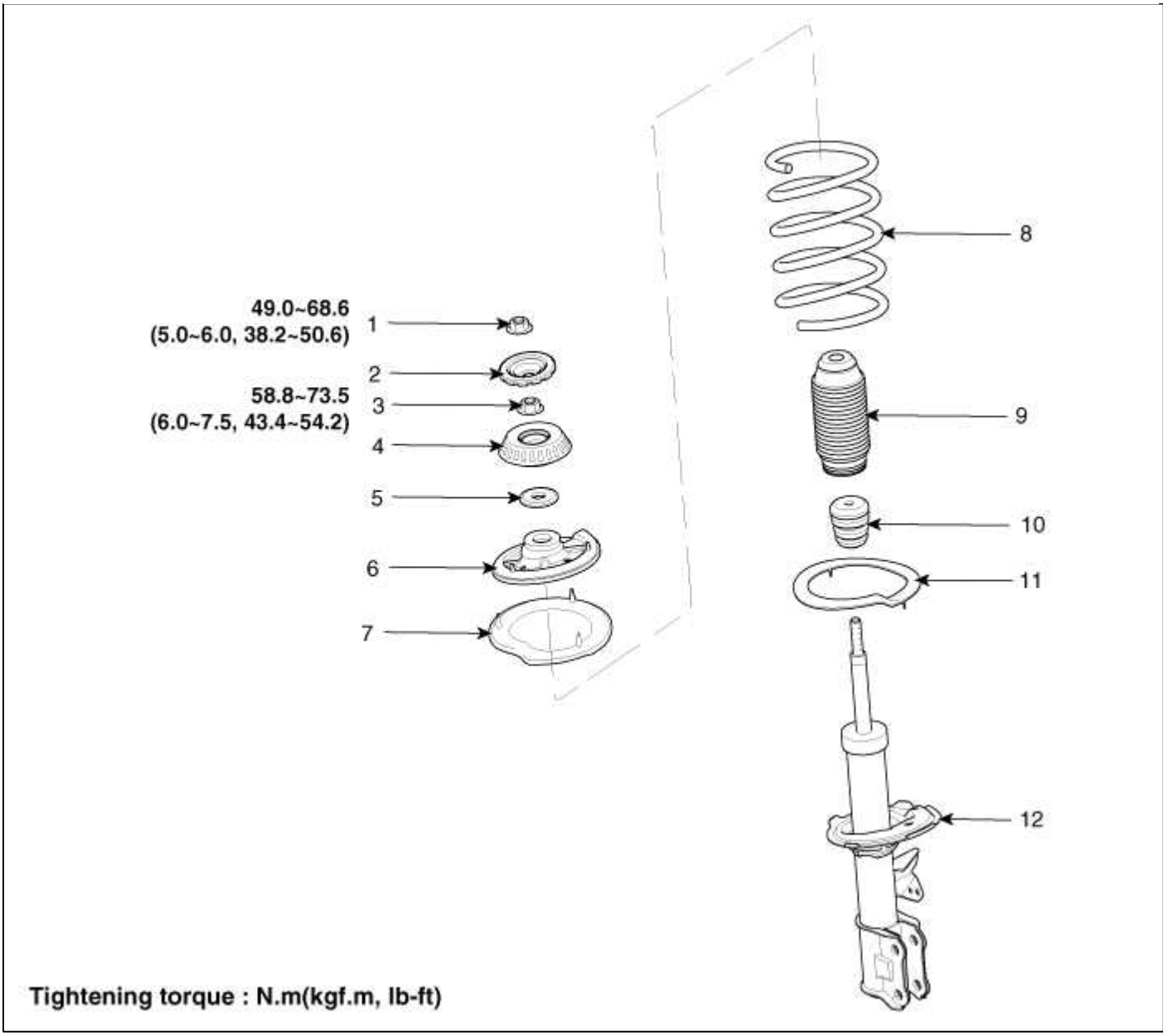
Components Location



1. Sub frame 2. Drive shaft 3. Lower arm	4. Strut assembly 5. Steering gearbox 6. Stabilizer bar

Suspension System > Front Suspension System > Front Strut Assembly > Components and Components Location

Components



CAUTION

- Tighten with specifed torque at curb position of vehicle
- Fix the strut rod end and tighten the nut

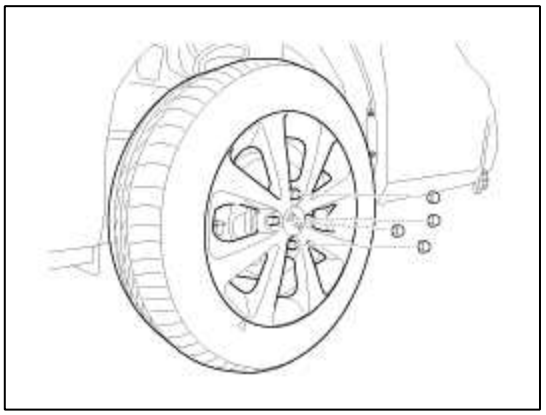
1. Lock nut 2. Insulator dust cap 3. Self lock nut 4. Strut insulator 5. Strut bearing 6. Spring upper seat	7. Spring upper pad 8. Coli spring 9. Dust cover 10. Bumper rubber 11. Spring lower pad 12. Shock absorber

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)

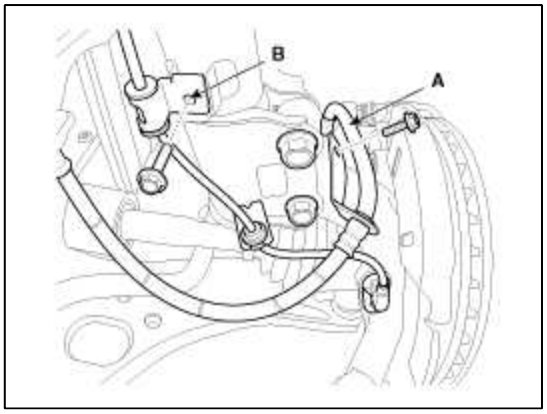


CAUTION

Be careful not to damage to the hub bolts when removing the front wheel & tire.

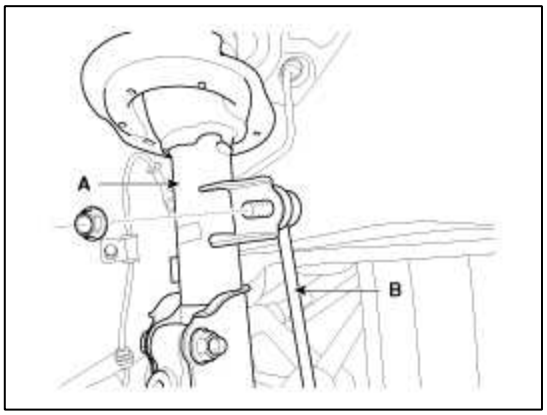
2. Remove the brake hose bracket (A) and the wheel speed sensor bracket (B) from the front strut assembly by loosening the mounting bolts.

Tightening torque :
(B,C) 7.8 ~ 11.8N.m(0.8 ~ 1.2kgf.m, 5.8 ~ 8.7lb-ft)



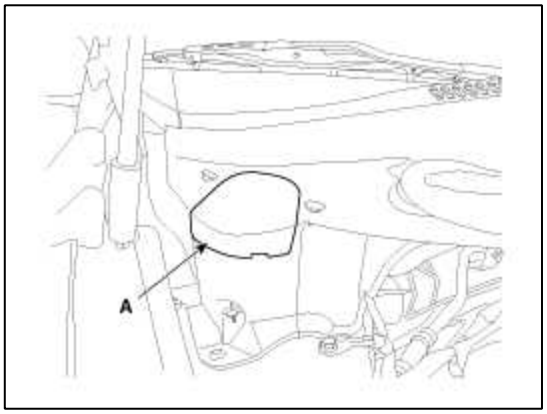
3. Disconnect the stabilizer link (B) with the front strut assembly (A) after loosening the nut.

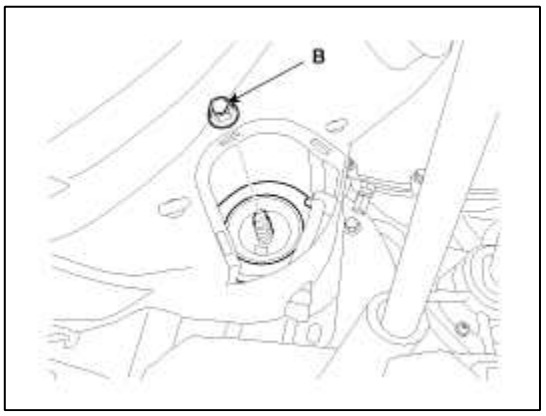
Tightening torque :
98.1 ~ 117.7N.m(10.0 ~ 12.0kgf.m, 72.3 ~ 86.8lb-ft)



4. Remove the cover (A) and loosen the strut mounting nut (B).

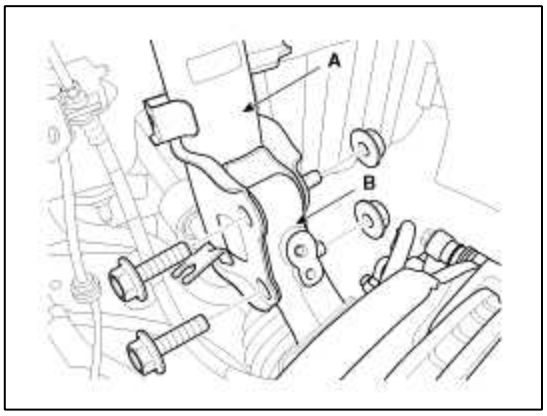
Tightening torque :
49.0 ~ 58.8N.m(5.0 ~ 6.0kgf.m, 36.2 ~ 43.4lb-ft)





5. Disconnect the front strut assembly (A) with the front axle (B) by loosening the bolt & nut.

Tightening torque :
137.3 ~ 156.9N.m(14.0 ~ 16.0kgf.m, 101.3 ~ 115.7lb-ft)



6. Installation is the reverse of removal.

CAUTION

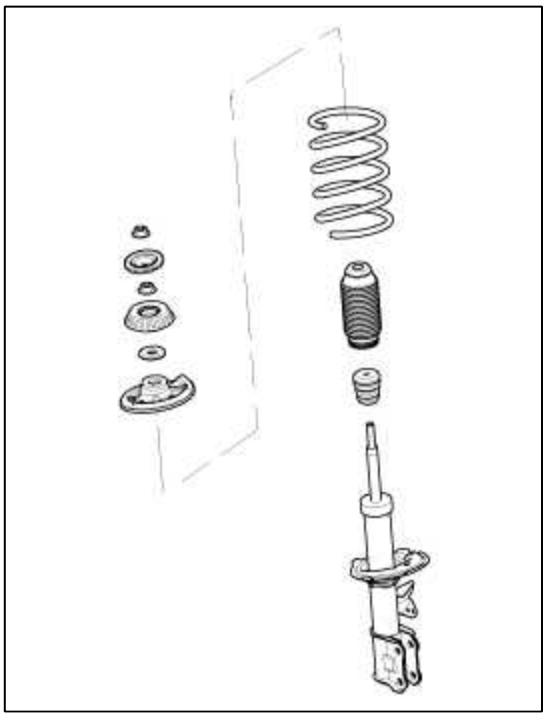
- Tighten with specifed torque at curb position of vehicle
- Fix the strut rod and tighten the nut

Disassembly and Reassembly

1. Compress the coil spring with a strut spring compressor. Do not compress the spring more than necessary.
2. Loosen the lock nut.

Tightening torque :
58.8 ~ 78.8N.m(6.0 ~ 7.5kgf.m, 43.4 ~ 54.2lb-ft)

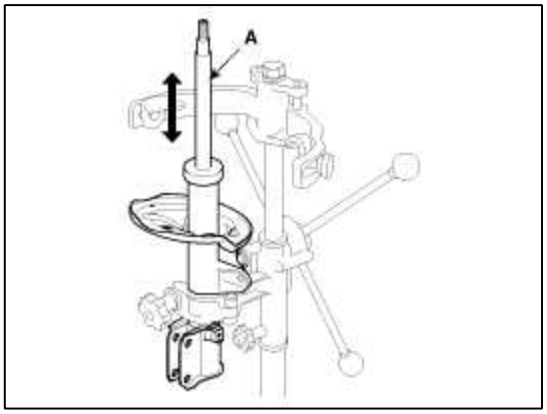
3. Disassemble the components of front strut assembly in sequence.
(Refer to Front strut assembly components)



4. Reassembly is the reverse of disassembly.

Inspection

1. Check the components for damage or deformation.
2. Compress and extend the piston rod (A) and check that there is no abnormal resistance or unusual sound during operation.

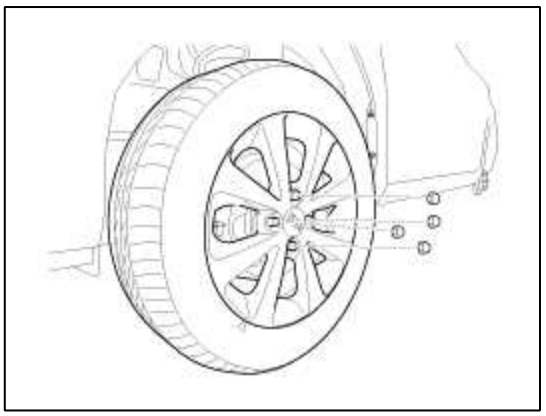


Suspension System > Front Suspension System > Front Lower Arm > Repair procedures

Replacement

1. Remove the front wheel & tire.

Tightening torque :
88.3 ~ 107.9N.m(9.0 ~ 11.0kgf.m, 65.1 ~ 79.6lb-ft)

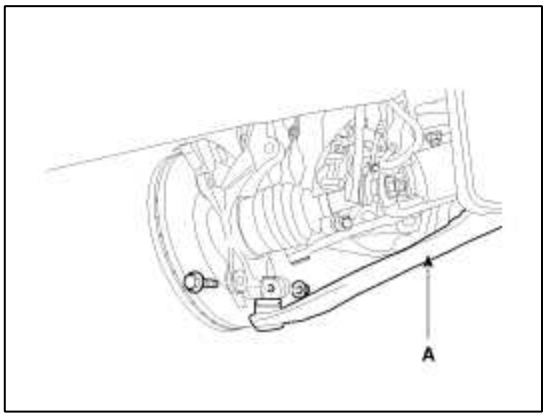


CAUTION

Be careful not to damage to the hub bolts when removing the front wheel & tire.

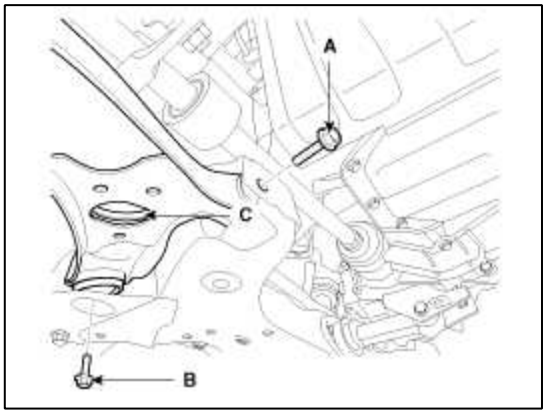
2. Loosen the nut and remove the lower arm (A).

Tightening torque :
58.8 ~ 70.6N.m(6.0 ~ 7.2kgf.m, 43.4 ~ 52.1lb-ft)



3. Remove the lower arm (C) by loosening the bolt (A) and (B).

Tightening torque :
(A)
98.1 ~ 117.7N.m(10.0 ~ 12.0kgf.m, 72.3 ~ 86.8lb-ft)
(B)
156.9 ~ 176.5N.m(16.0 ~ 18.0kgf.m, 115.7 ~ 130.2lb-ft)



4. Installation is the reverse of removal.

Inspection

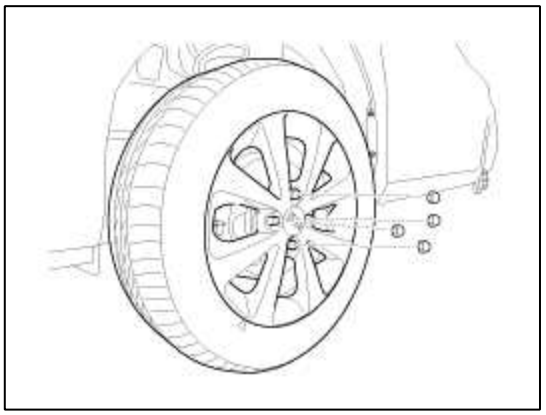
1. Check the bushing for wear and deterioration.
2. Check the lower arm for deformation.
3. Check the all bolts and nuts.

Suspension System > Front Suspension System > Front Stabilizer Link > Repair procedures

Replacement

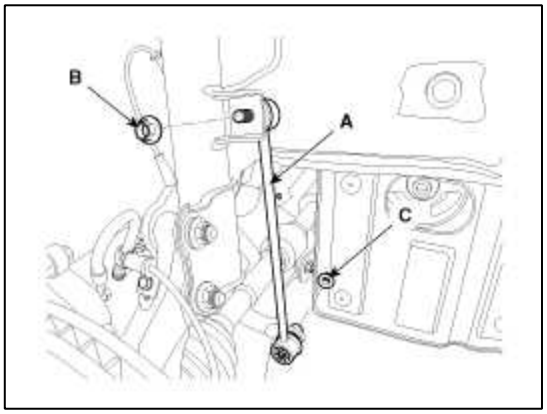
1. Remove the rear wheel & tire

Tightening torque :
88.3 ~ 107.9N.m(9.0 ~ 11.0kgf.m, 65.1 ~ 79.6lb-ft)



2. Remove the stabilizer link (A) loosening the nut (B) and (C).

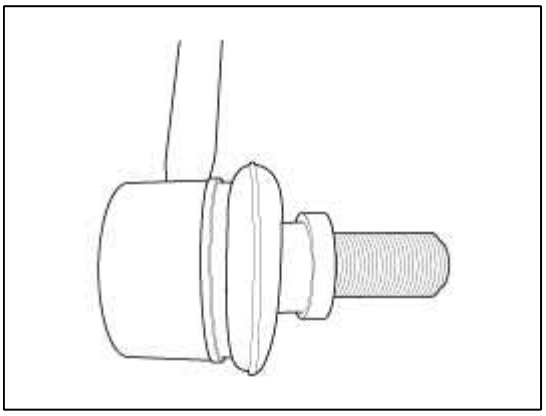
Tightening torque :
98.1 ~ 117.7N.m(10.0 ~ 12.0kgf.m, 72.3 ~ 86.8lb-ft)



Inpesction

Check the front stabilizer link ball joint for damage.

- Torn boot
- Opened boot
- Displaced ring
- Deformed clamp ring
- Externally forced shock

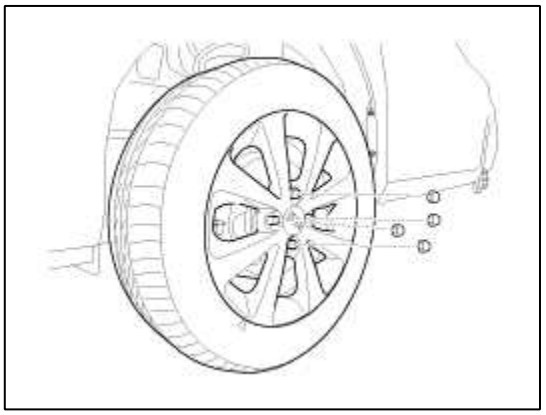


Suspension System > Front Suspension System > Front Stabilizer Bar > Repair procedures

Replacement

1. Remove the front wheel & tire.

Tightening torque :
88.3 ~ 107.9N.m(9.0 ~ 11.0kgf.m, 65.1 ~ 79.6lb-ft)

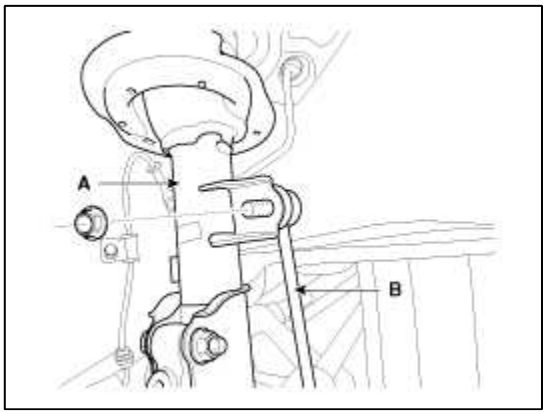


CAUTION

Be careful not to damage to the hub bolts when removing the front wheel & tire.

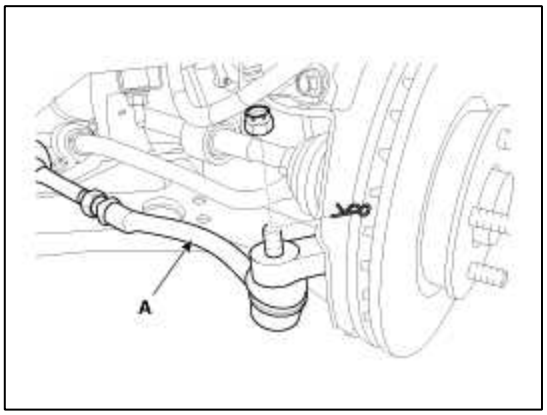
2. Disconnect the stabilizer link with the front strut assembly after loosening the nut.

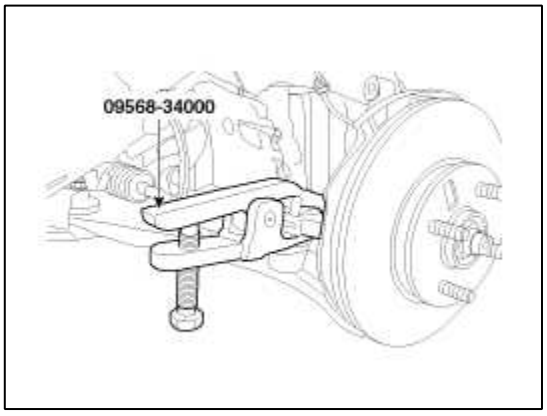
Tightening torque :
98.1 ~ 117.7N.m(10.0 ~ 12.0kgf.m, 72.3 ~ 86.8lb-ft)



3. Loosen the nut and then remove the tie-rod end (A) with the front axle by using SST(09568-34000).

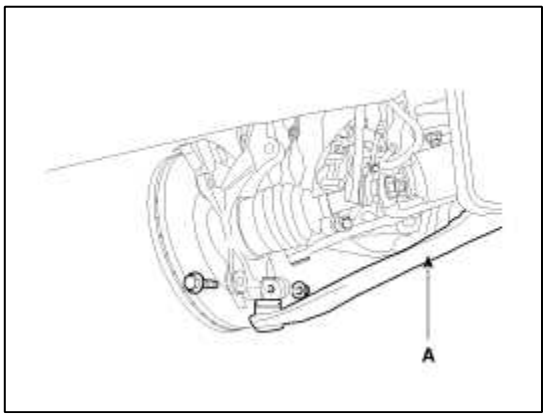
Tightening torque :
23.5 ~ 33.3N.m(2.4 ~ 3.4kgf.m, 19.4 ~ 24.6lb-ft)





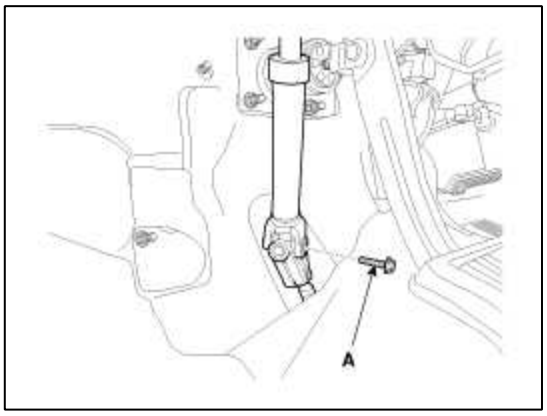
4. Loosen the nut and then remove the lower arm (A).

Tightening torque :
58.8 ~ 70.6N.m(6.0 ~ 7.2kgf.m, 43.4 ~ 52.1lb-ft)



5. Loosen the bolt (A) and then disconnect the universal joint assembly from the pinion of the steering gear box.

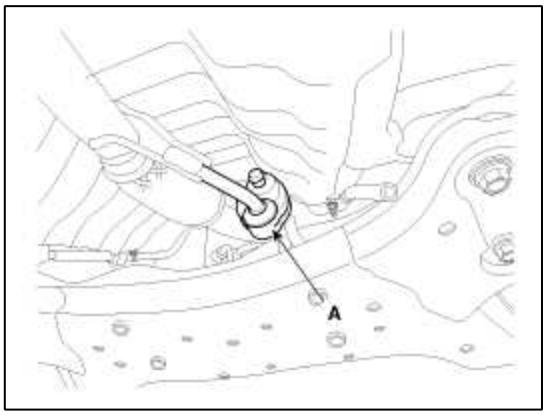
Tightening torque :
32.4 ~ 37.3 N.m(3.3 ~ 3.8 kgf.m, 23.9 ~ 27.5 lb-ft)



CAUTION

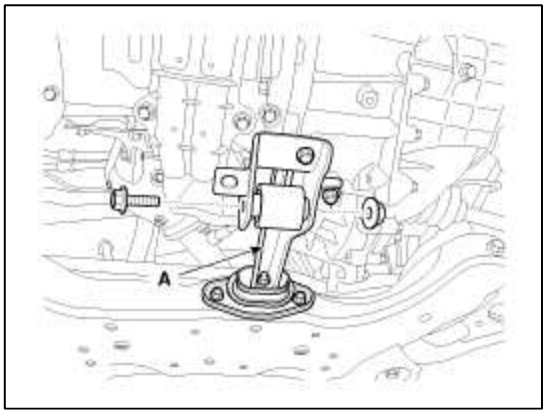
- Lock the steering wheel in the straight ahead position to prevent the damage of the clock spring inner cable when you handle the steering wheel.
- Must be replaced with new bolts when assembling. (SEAL-LOCK has been processed)
  SEAL-LOCK Specifications: MS721-39 "TYPE-D" Product: ND industries 1193S

6. Remove the rubber hanger (A).



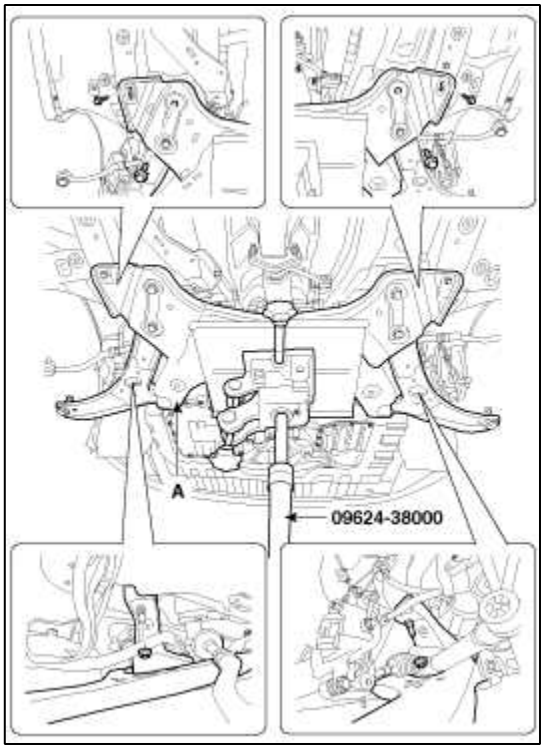
7. Loosening the roll rod (A) mounting bolts and nuts.

Tightening torque :
53.9 ~ 63.7N.m(5.5 ~ 6.5kgf.m, 39.8 ~ 47.0lb-ft)



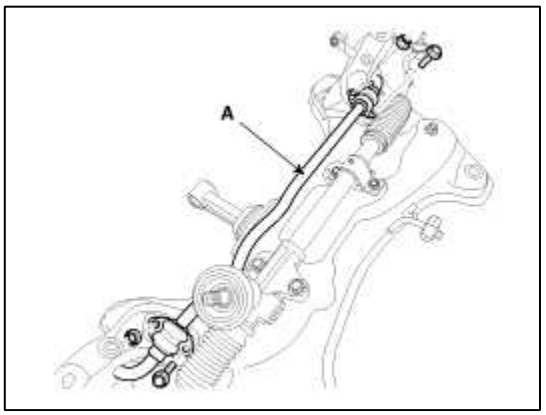
8. Loosen the bolts & nuts and then remove the front sub frame (A).

Tightening torque :
Sub frame mounting bolt & nut
156.9 ~ 176.5N.m(16.0 ~ 18.0kgf.m, 115.7 ~ 130.2lb-ft)
Sub frame stay mounting bolt
44.1 ~ 53.9N.m(4.5 ~ 5.5kgf.m, 32.5 ~ 39.8lb-ft)



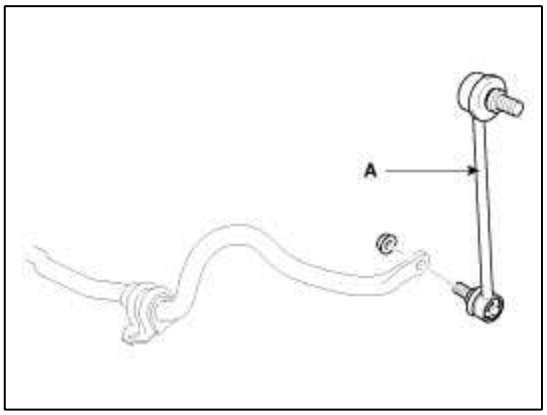
9. Remove the stabilizer (A) from the front sub frame by loosening the mounting bolts & nuts.

Tightening torque :
44.1 ~ 53.9N.m(4.5 ~ 5.5kgf.m, 32.5 ~ 39.8lb-ft)

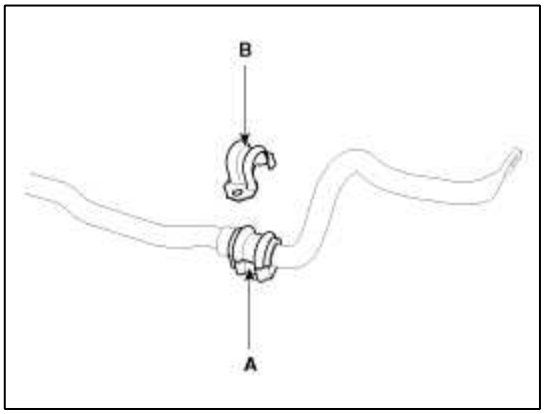


10. Disconnect the stabilizer link (A) with the stabilizer bar by loosening the nut.

Tightening torque :
98.1 ~ 117.7N.m(10.0 ~ 12.0kgf.m, 72.3 ~ 86.8lb-ft)



11. Remove the bushing (A) and the clamp (B) from the stabilizer bar.



12. Installation is the reverse of removal.

Inspection

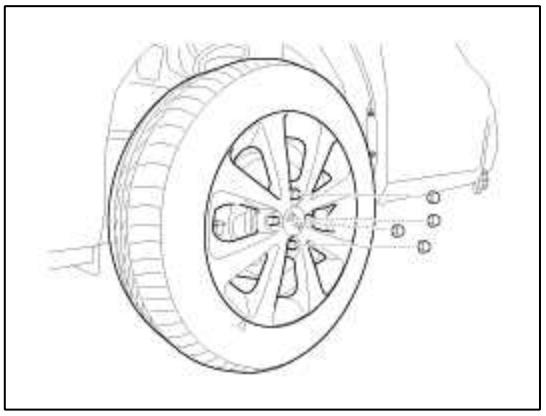
1. Check the bushing for wear and deterioration.
2. Check the front stabilizer bar for deformation.
3. Check the front stabilizer link ball joint for damage.

Suspension System > Front Suspension System > Sub Frame > 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)

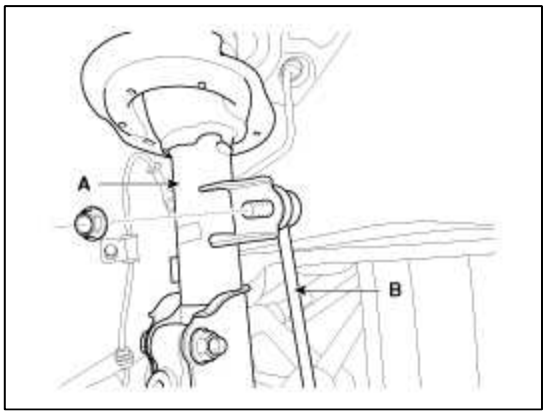


CAUTION

Be careful not to damage to the hub bolts when removing the front wheel & tire.

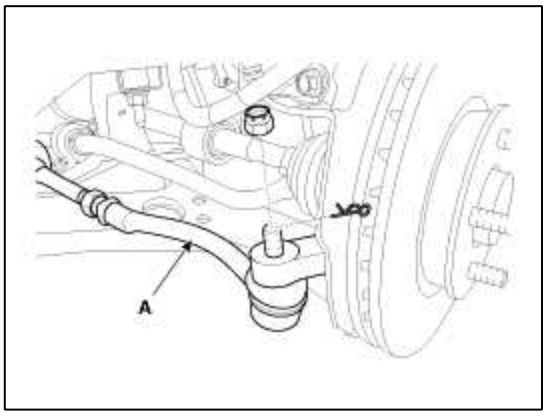
2. Disconnect the stabilizer link (B) with the front strut assembly (A) after loosening the nut.

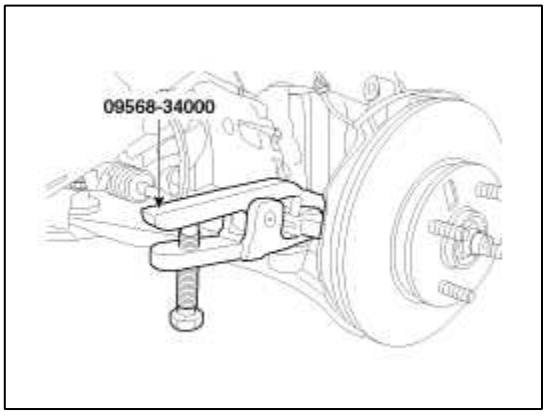
Tightening torque :
98.1 ~ 117.7N.m(10.0 ~ 12.0kgf.m, 72.3 ~ 86.8lb-ft)



3. Loosen the nut and then remove the tie-rod end (A) with the front axle (B) by using SST(09568-34000).

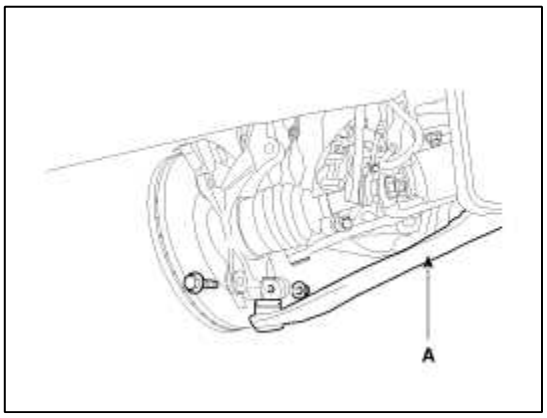
Tightening torque :
23.5 ~ 33.3N.m(2.5 ~ 3.4kgf.m, 19.4 ~ 24.6lb-ft)





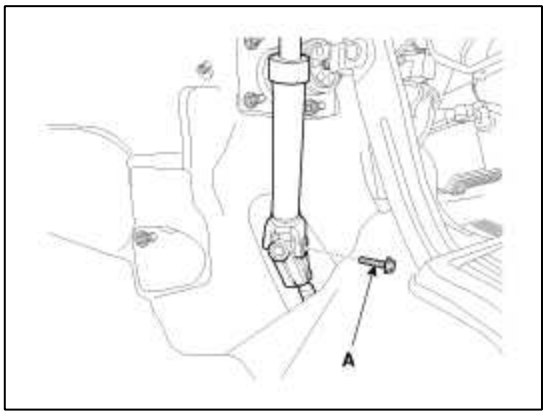
4. Loosen the nut and then remove the lower arm (A).

Tightening torque :
58.8 ~ 70.6N.m(6.0 ~ 7.2kgf.m, 43.4 ~ 52.1lb-ft)



5. Loosen the bolt (A) and then disconnect the universal joint assembly from the pinion of the steering gear box.

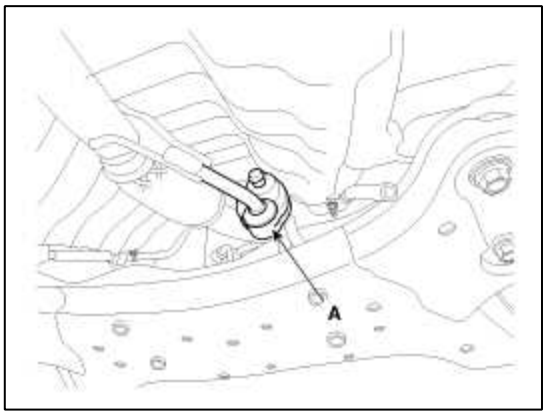
Tightening torque :
32.4 ~ 37.3N.m(3.3 ~ 3.8kgf.m, 23.9 ~ 27.5lb-ft)



CAUTION

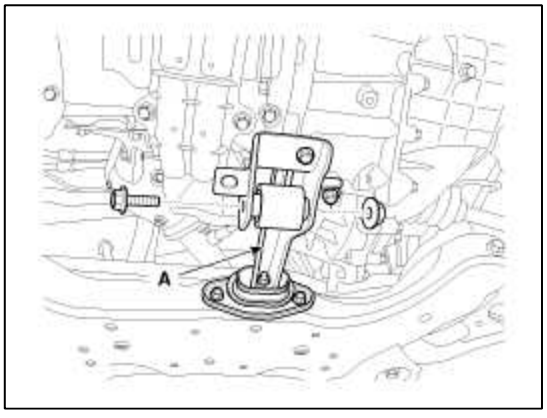
- Lock the steering wheel in the straight ahead position to prevent the damage of the clock spring inner cable when you handle the steering wheel.
- Must be replaced with new bolts when assembling. (SEAL-LOCK has been processed)
  SEAL-LOCK Specifications: MS721-39 "TYPE-D" Product: ND industries 1193S

6. Remove the rubber hanger (A).



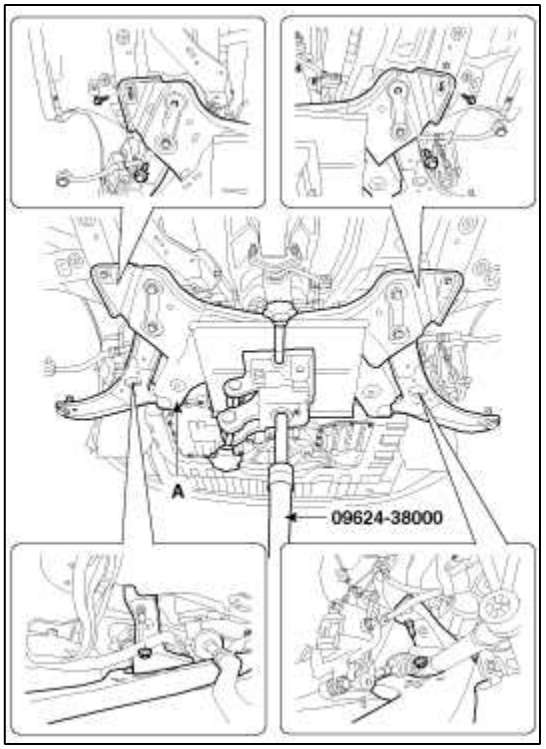
7. Loosening the roll rod (A) mounting bolts and nuts.

Tightening torque :
53.9 ~ 63.7N.m(5.5 ~ 6.5kgf.m, 39.8 ~ 47.0lb-ft)



8. Loosen the bolts & nuts and then remove the front sub frame (A).

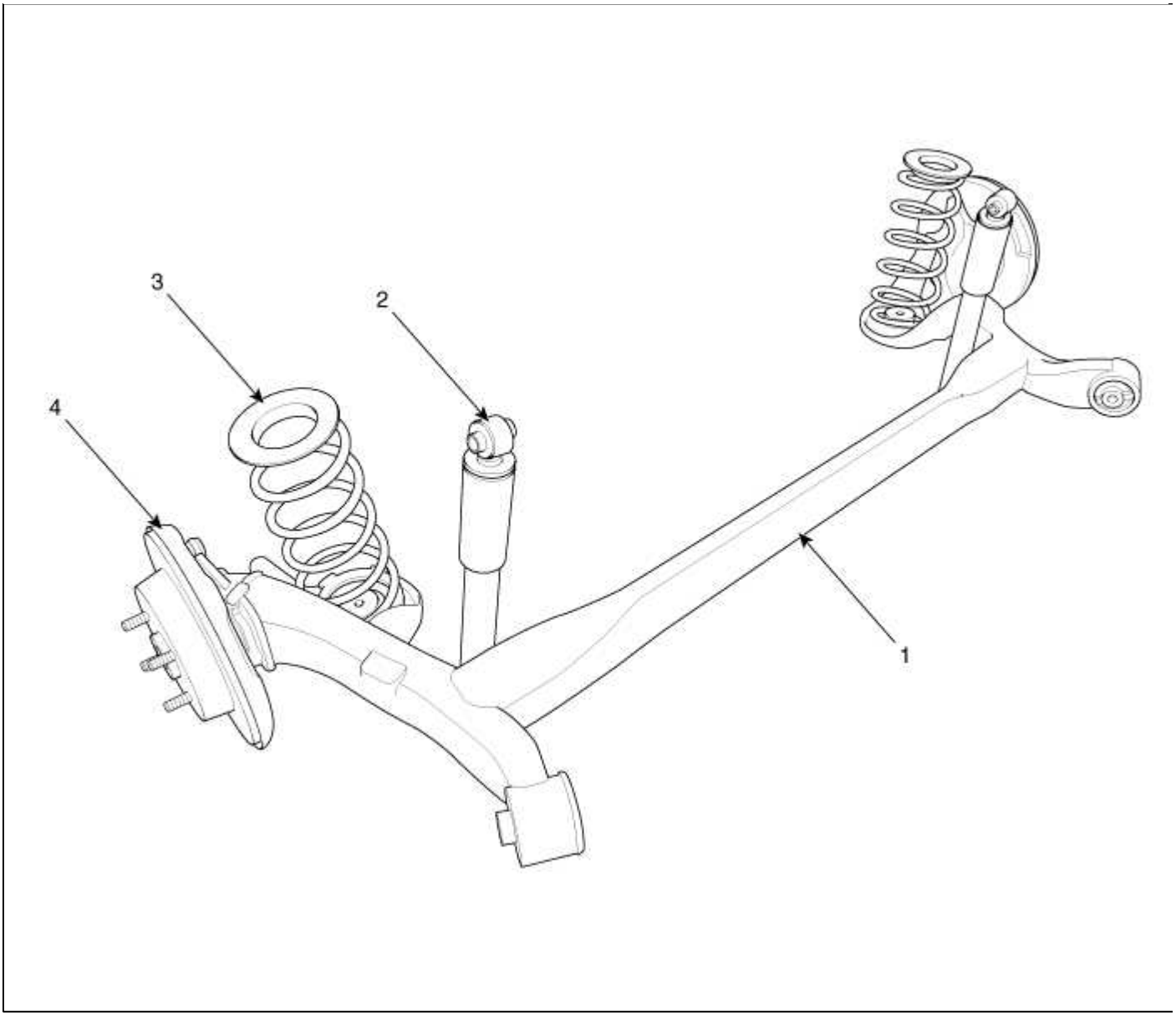
Tightening torque :
Sub frame mounting bolt & nut
156.9 ~ 176.5N.m(16.0 ~ 18.0kgf.m, 115.7 ~ 130.2lb-ft)
Sub frame stay mounting bolt
44.1 ~ 53.9N.m(4.5 ~ 5.5kgf.m, 32.5 ~ 39.8lb-ft)



9. Installation is the reverse of removal.

Suspension System > Rear Suspension System > Components and Components Location

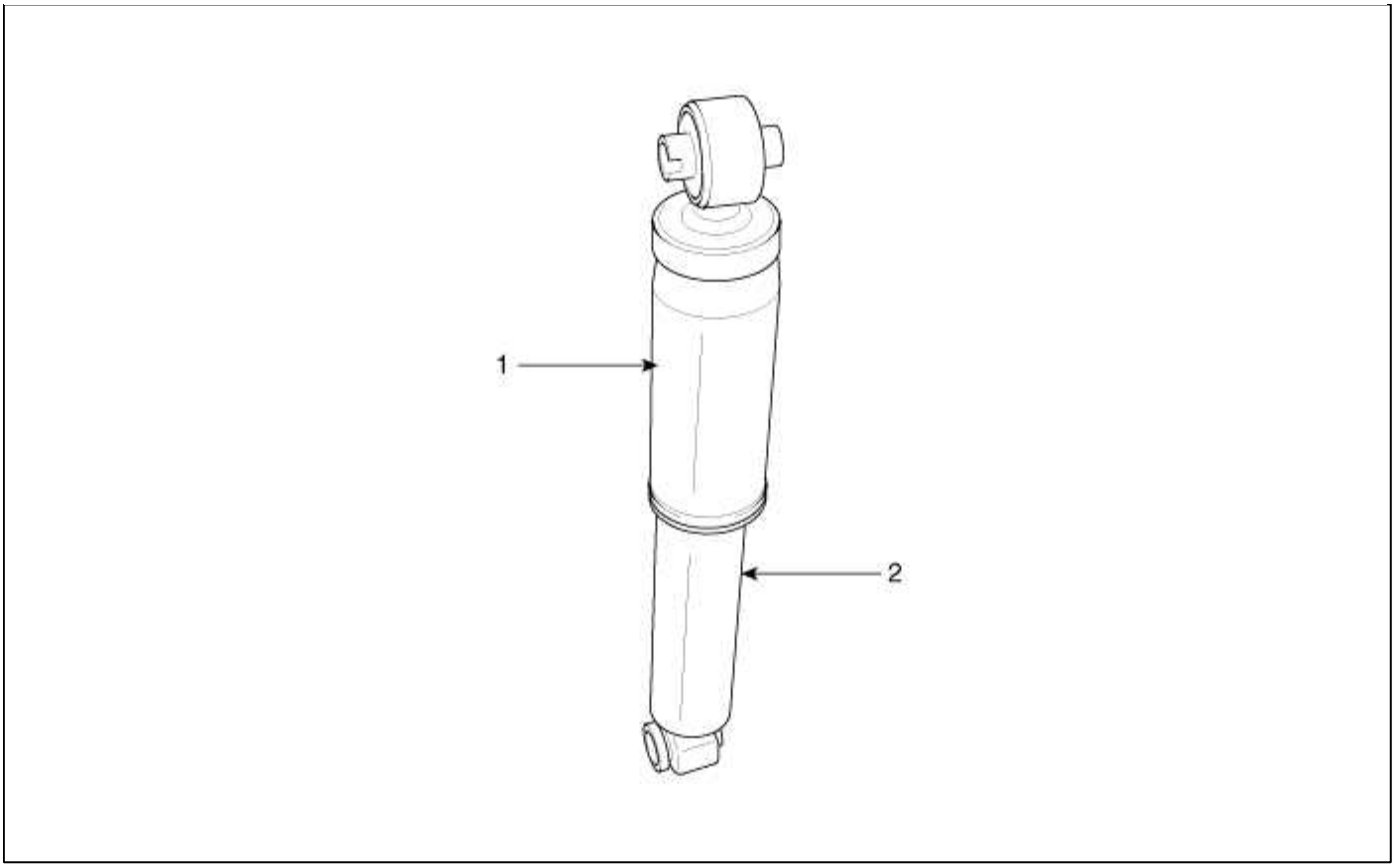
Components Location



1. Torsion beam axle 2. Shock absorber	3. Coil spring assembly 4. Rear disc

Suspension System > Rear Suspension System > Rear Shock Absorber > Components and Components Location

Components



CAUTION

• Must completely be tigtened at the curb position of vehicle when assemble shock absorber

1. Dust cover
2. Shock absorber

Suspension System > Rear Suspension System > Rear Shock Absorber > Repair procedures

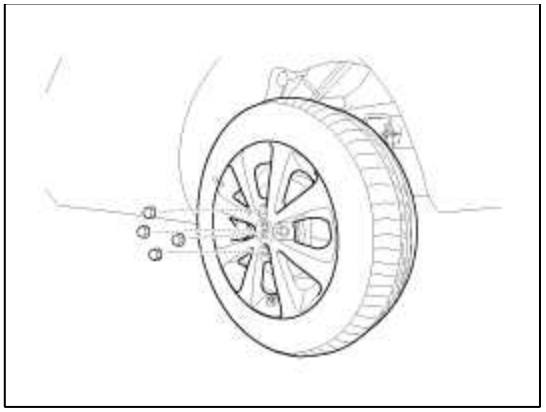
Replacement

1. Remove the rear wheel & tire.

Tightening torque :
88.3 ~ 107.9N.m (9.0 ~ 11.0kgf.m, 65.1 ~ 79.6lb-ft)

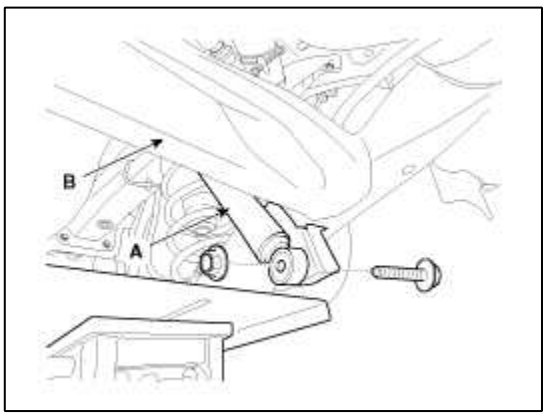
CAUTION

Be careful not to damage to the hub bolts when removing the rear wheel & tire.



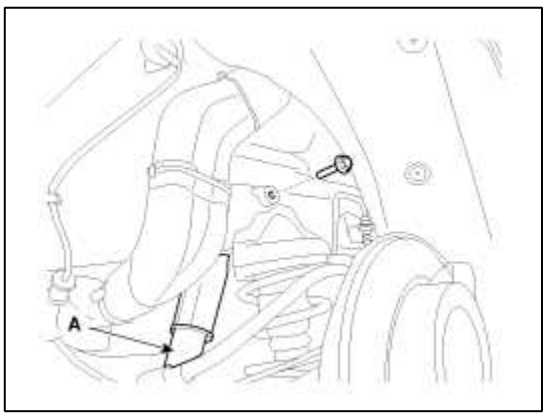
2. Loosen the bolt & nut and then remove the rear shock absorber (A) from the torsion beam axle (B).

Tightening torque :
98.1 ~ 117.7N.m (10.0 ~ 12.0kgf.m, 72.3 ~ 86.8lb-ft)



3. Remove the rear shock absorber (A) from the frame by loosening the bolt.

Tightening torque :
98.1 ~ 117.7N.m (10.0 ~ 12.0kgf.m, 72.3 ~ 86.8lb-ft)



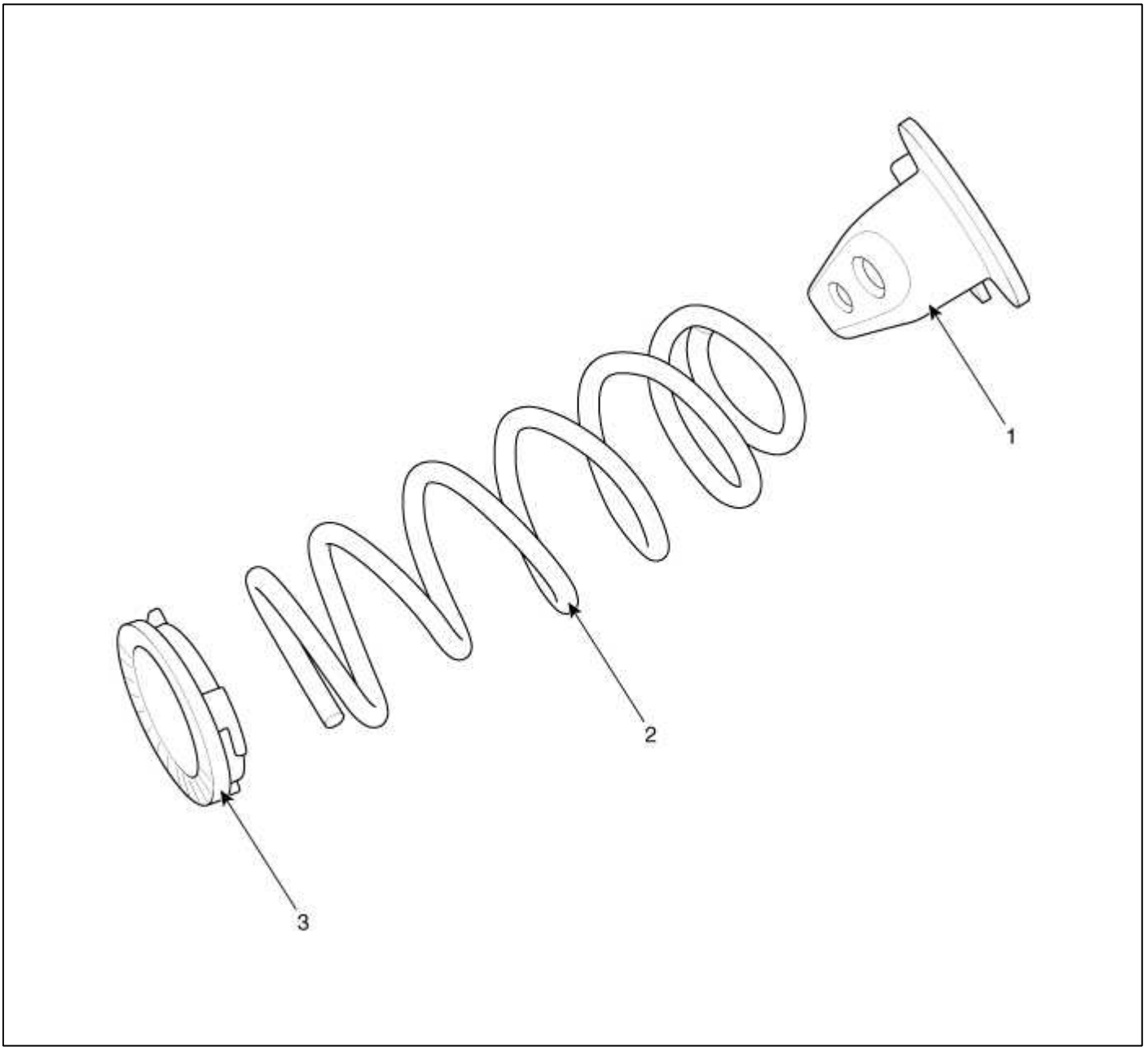
4. Installation is the reverse of removal.

Inspection

1. Check the components for damage or deformation.
2. Compress and extend the piston and check that there is no abnormal resistance or unusual sound during operation.

Suspension System > Rear Suspension System > Rear Coil Spring > Components and Components Location

Components



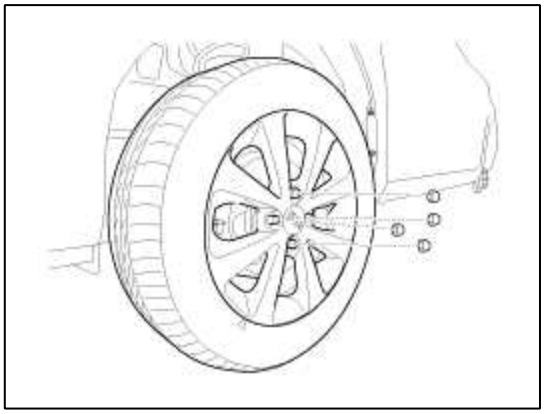
1. Spring upper pad
2. Spring
3. Spring lower pad

Suspension System > Rear Suspension System > Rear Coil Spring > Repair procedures

Replacement

1. Remove the rear wheel & tire.
   (Both RH side and LH side)

Tightening torque :
88.3 ~ 107.9N.m(9.0 ~ 11.0kgf.m, 65.1 ~ 79.6lb-ft)

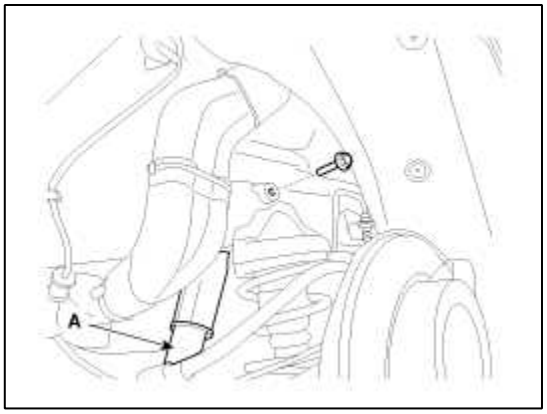


CAUTION

Be careful not to damage to the hub bolts when removing the rear wheel & tire.

2. Remove the rear shock absorber (A) from the frame by loosening the bolt.
   (Both RH side and LH side)

Tightening torque :
98.1 ~ 117.7N.m(10.0 ~ 12.0kgf.m, 72.3 ~ 86.8lb-ft)



3. Remove the coil spring.
4. Installation is the reverse of removal.

Inspection

1. Check the coil spring for crack and deformation.
2. Check the coil spring pad for damage and deformation.

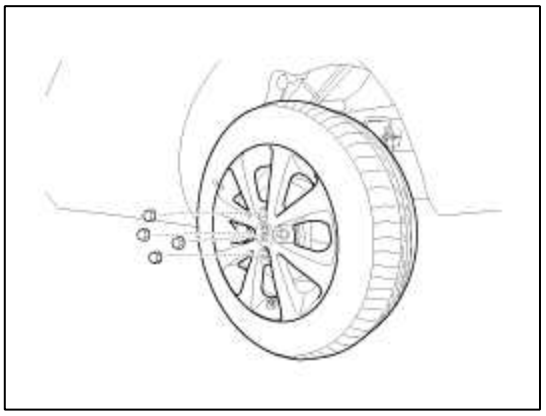
Suspension System > Rear Suspension System > Rear Torsion Beam Axle > Repair procedures

Replacement

[Disc Type]

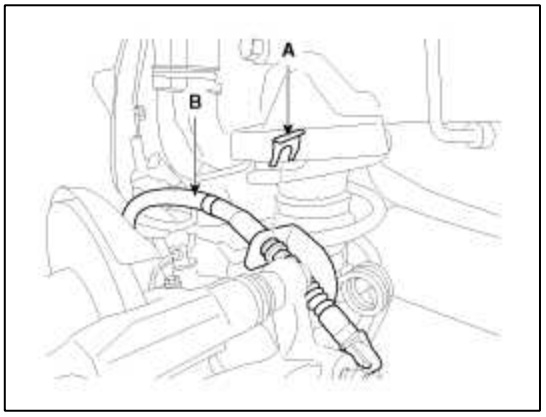
1. Remove the rear wheel & tire.

Tightening torque :
88.3 ~ 107.9N.m(9.0 ~ 11.0kgf.m, 65.1 ~ 79.6lb-ft)



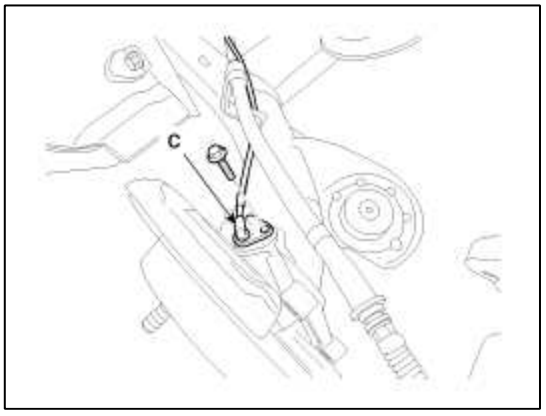
2. Remove the clip (A) and then remove the parking brake cable (B).

Tightening torque :
18.6 ~ 25.5 N.m(1.9 ~ 2.6kgf.m, 13.7 ~ 18.8 lb-ft)

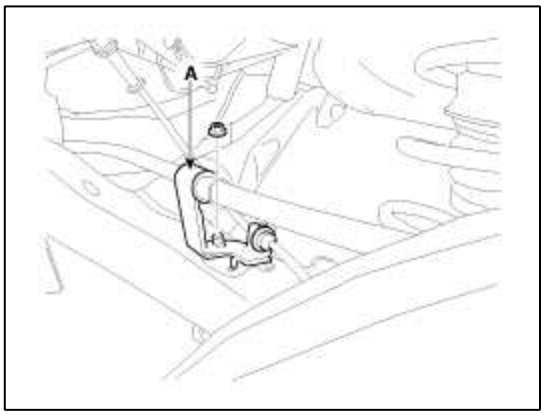


3. Remove the wheel speed sensor (A).

Tightening torque :
6.9 ~ 10.8 N.m(0.7 ~ 1.1kgf.m, 5.1 ~ 8.0 lb-ft)

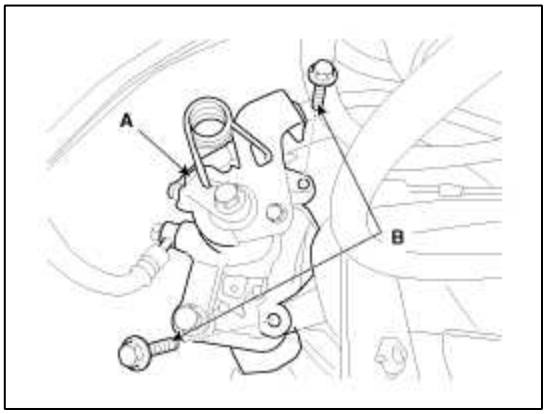


4. Remove the parking brake cable & wheel speed sensor cable bracket (A).



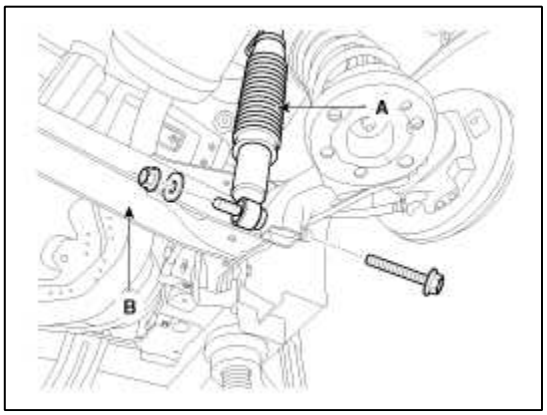
5. Remove the brake caliper assembly (B) from the torsion beam axle by loosening the bolts (A).

Tightening torque :
63.7 ~ 73.5N.m(6.5 ~ 7.5kgf.m, 47.0 ~ 54.2lb-ft)



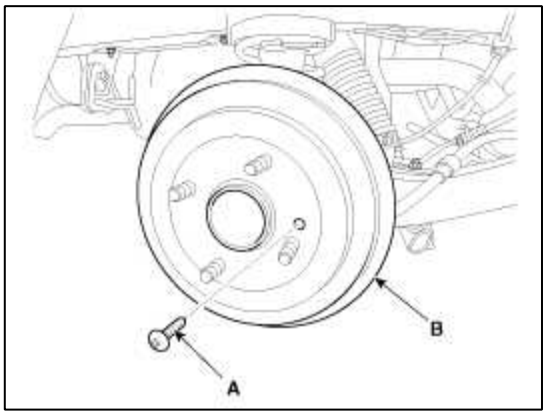
6. Loosen the bolt & nut and then remove the rear shock absorber (A) from the torsion beam axle (B).

Tightening torque :
98.1 ~ 117.7N.m (10.0 ~ 12.0kgf.m, 72.3 ~ 86.8lb-ft)



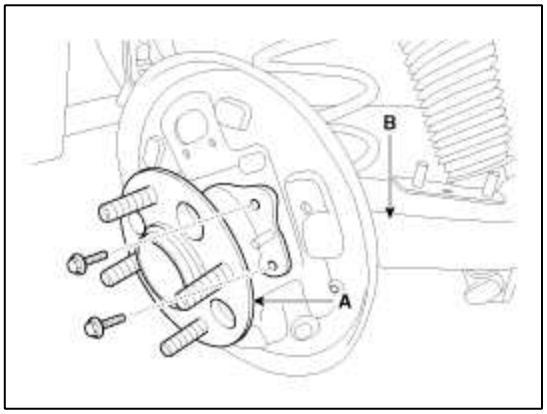
7. Loosen the screw (A) and then remove the disc (B).

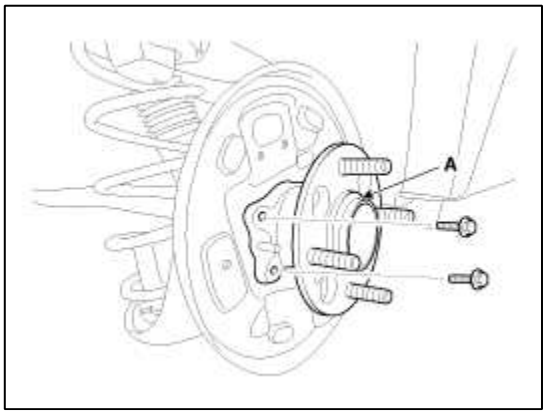
Tightening torque :
4.9 ~ 5.9N.m (0.5 ~ 0.6kgf.m, 3.6 ~ 4.3lb-ft)



8. Loosen the hub mounting bolt and then remove the hub (A) from the torsion beam (B).

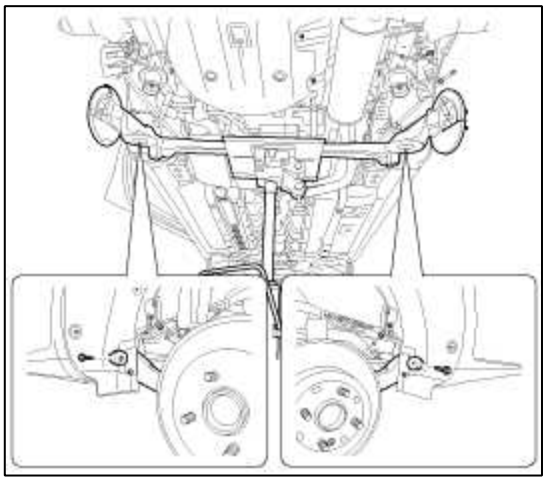
Tightening torque :
49.0 ~ 58.8N.m (5.0 ~ 6.0kgf.m, 36.2 ~ 43.4lb-ft)





9. Loosen the bolt and then remove the torsion beam axle (A) from the body.

Tightening torque :
98.1 ~ 117.7N.m (10.0 ~ 12.0kgf.m, 72.3 ~ 86.8lb-ft)

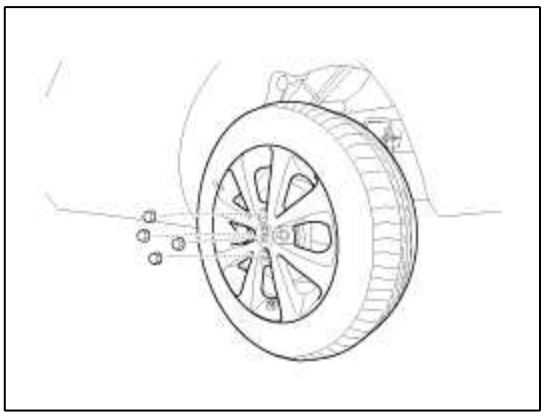


10. Installation is the reverse of removal.

[Drum Type]

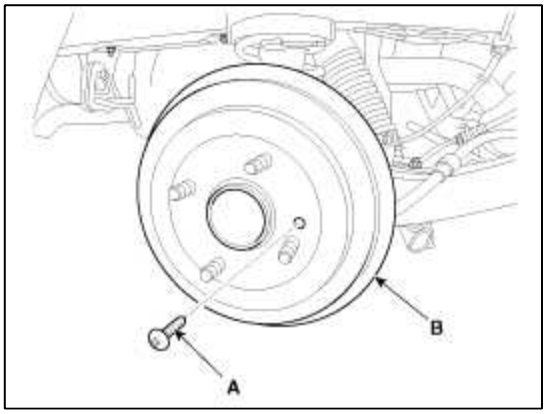
1. Remove the rear wheel & tire.

Tightening torque :
88.3 ~ 107.9N.m (9.0 ~ 11.0kgf.m, 65.1 ~ 79.6lb-ft)

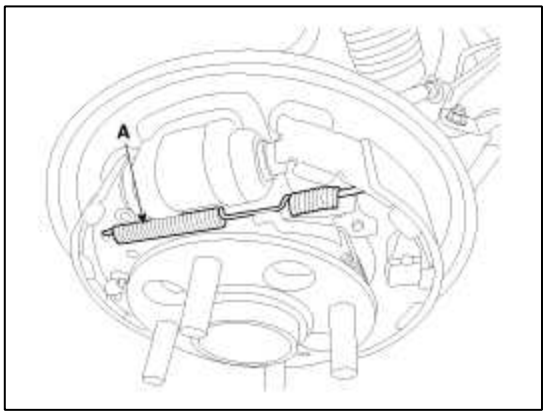


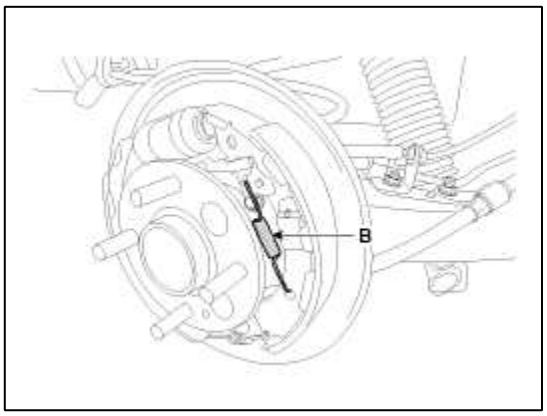
2. Loosen the screw (A) and then remove the disc (B).

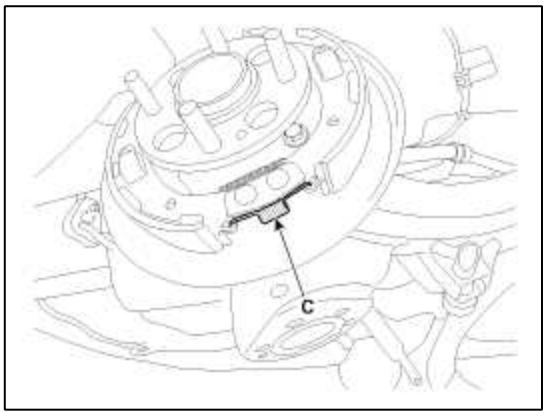
Tightening torque :
4.9 ~ 5.9N.m (0.5 ~ 0.6kgf.m, 3.6 ~ 4.3lb-ft)



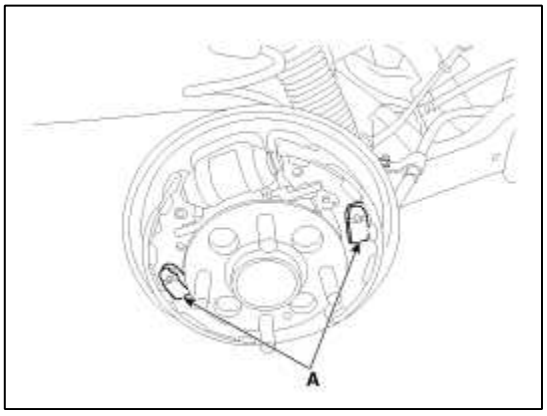
3. Remove the spring(A, B, C).



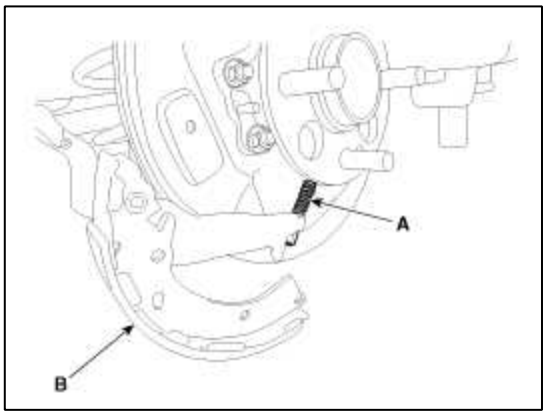




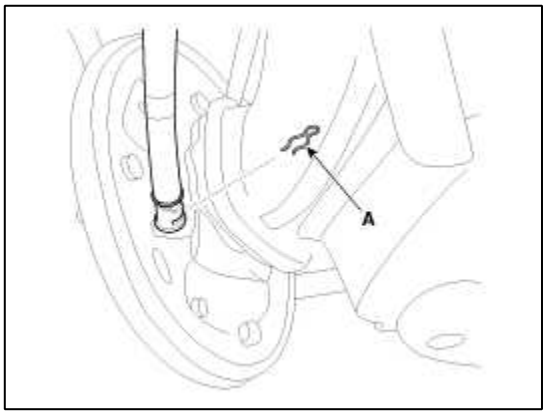
4. Remove the shoe (A).



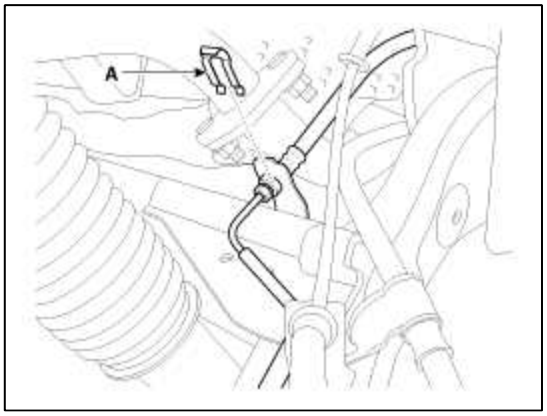
5. Disconnect the parking brake cable (A) from lining (B).



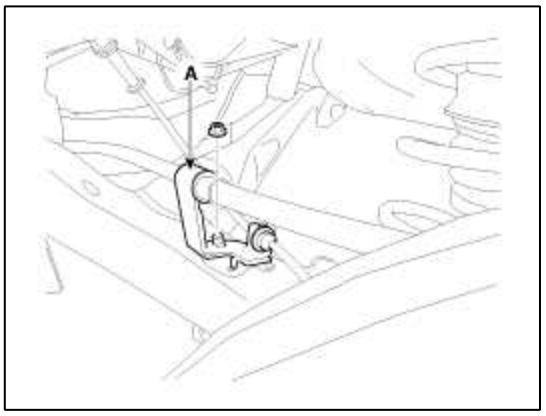
6. Remove the clip (A).

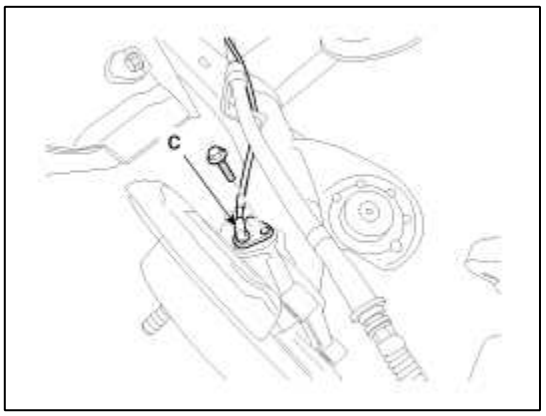


7. Remove the parking brake cable clip (A).

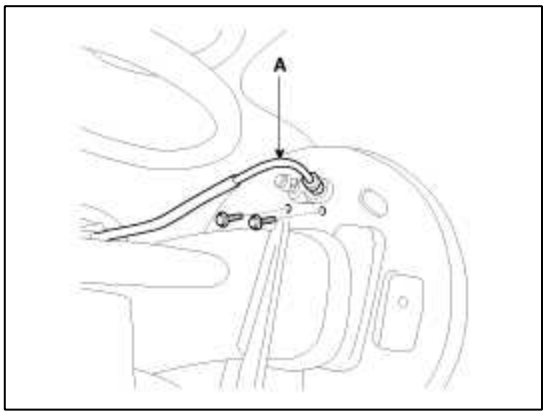


8. Remove the clip (A) and then remove the parking brake cable (B).



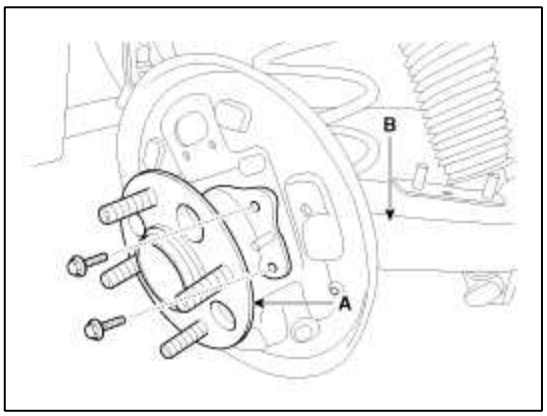


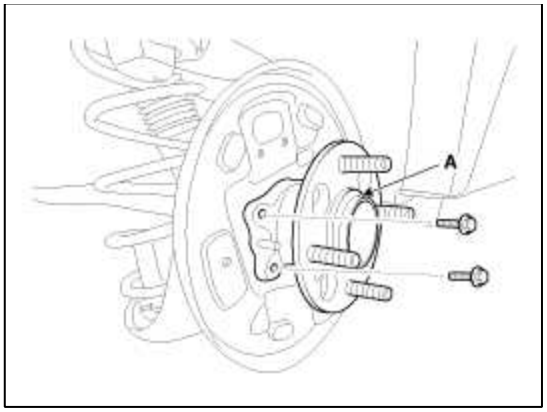
9. Remove the brake hose (A) and then loosen the cylinder bolt.



10. Loosen the hub mounting bolt and then remove the hub (A) from the torsion beam (B).

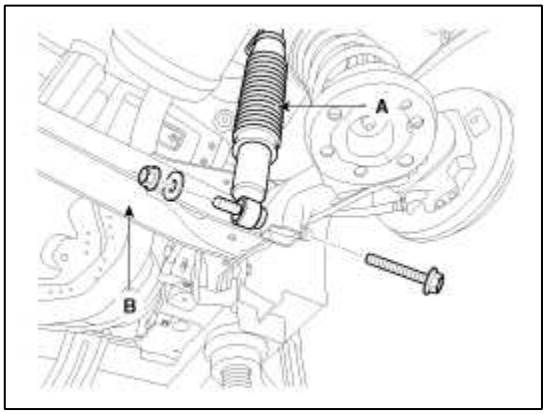
Tightening torque :
49.0 ~ 58.8N.m (5.0 ~ 6.0kgf.m, 36.2 ~ 43.4lb-ft)





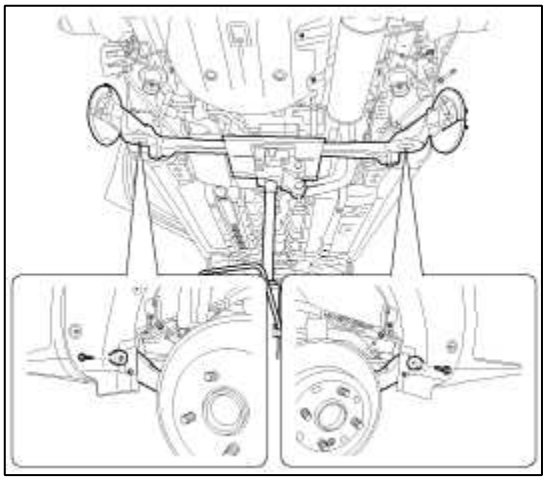
11. Loosen the bolt & nut and then remove the rear shock absorber (A) from the torsion beam axle (B).

Tightening torque :
98.1 ~ 117.7N.m (10.0 ~ 12.0kgf.m, 72.3 ~ 86.8lb-ft)



12. Loosen the bolt and then remove the torsion beam axle (A) from the body.

Tightening torque :
98.1 ~ 117.7N.m (10.0 ~ 12.0kgf.m, 72.3 ~ 86.8lb-ft)



13. Install in the reverse order of removal.

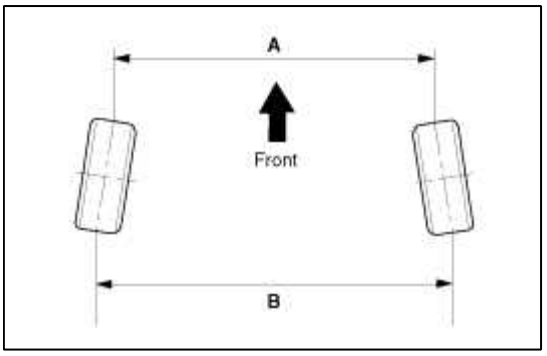
Suspension System > Tires/Wheels > Alignment > Repair procedures-Revised

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

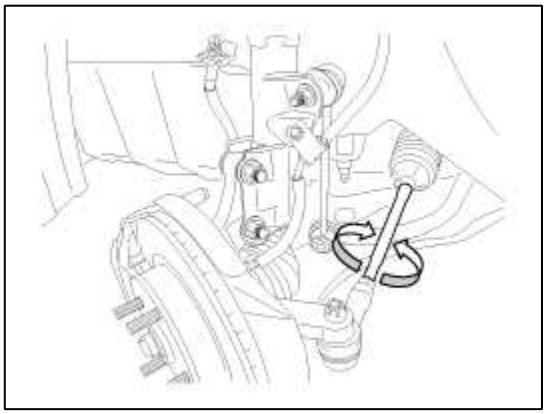


B - A > 0: Toe in (+)
B - A < 0: Toe out (-)

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°±0.2°
Individual : 0°±0.1°



4. When completing the toe adjustment, install the bellows clip and tighten the tie rod end lock nut to specified torque.

Tightening torque :
23.5 ~ 33.3N.m (2.4 ~ 3.4kgf.m, 17.4 ~ 24.6lb-ft)

Camber and Caster

Camber and Caster are pre-set at the factory, so they do not need to be adjusted. If the camber and caster are not within the standard value, replace or repair the damaged parts and then inspect again.

Camber angle : -0.5° ± 0.5°

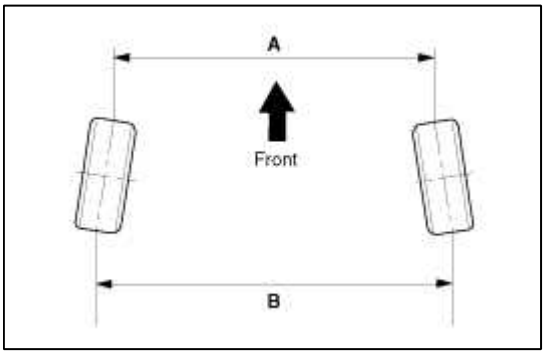
Caster angle : 4.1° ± 0.5°

Rear Wheel Alignment

CAUTION

When using a commercially available computerized wheel alignment equipment to inspect the rear wheel alignment, always position the vehicle on a level surface.
Prior to inspection, make sure that the rear suspension system is in normal operating condition and that the tires are inflated to the specified pressure.

Toe



B - A > 0: Toe in (+)
B - A < 0: Toe out (-)

Toe is pre-set at the factory, so it does not need to be adjusted. If the toe is not within the standard value, replace or repair the damaged parts and then inspect again.

Toe:
Total : 0.5° (+0.4°/ -0.5°)
Individual :0.25°(+0.2°/ -0.25°)

Camber
Camber is pre-set at the factory, so it does not need to be adjusted. If the camber is not within the standard value, replace or repair the damaged parts and then inspect again.

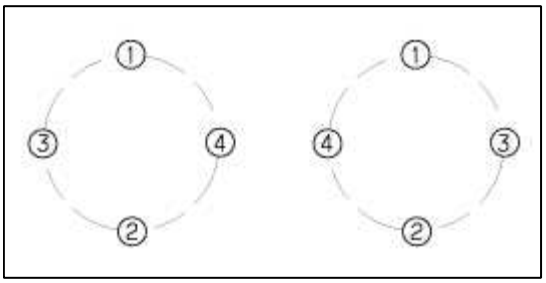
Camber : -1.5°±0.5°

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

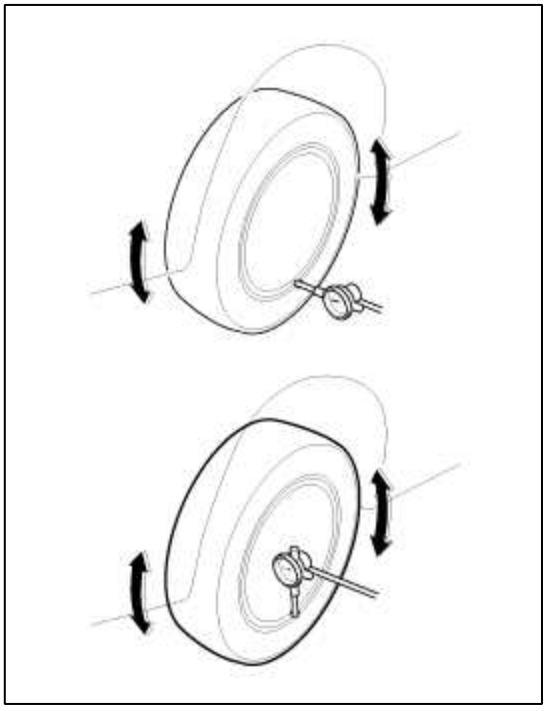
- When using an impact gun, final tightening torque should be checked using a torque wrench.
- A wheel that is not the correct size may adversely affect wheel and bearing life, braking and stopping abilities, handling characteristics, ground clearance, body-to-tire clearance, snow chain clearance, speedometer and odometer calibration, headlight aim and bumper height.

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 1.4(0.055)
Lateral mm(in.)	Below 0.3(0.012)	Below 0.9(0.035)

3. If measured value exceeds the standard value, replace the wheel.



Suspension System > Tires/Wheels > Tire > Repair procedures

CAUTION

- Using tires and wheel other than the recommended sizes could cause unusual handling characteristics and poor vehicle control, resulting in a serious accident.

Tire Wear

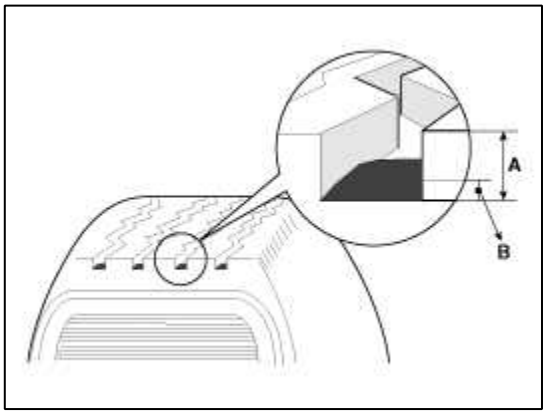
1. Measure the tread depth of the tires.

Tread depth [limit] : 1.6 mm (0.063 in)

2. If the remaining tread depth (A) is less than the limit, replace the tire.

NOTE

When the tread depth of the tires is less than 1.6 mm(0.063 in), the wear indicators (B) will appear.

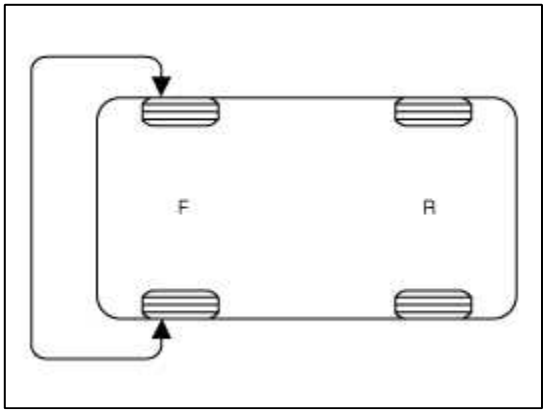


Tire Rotation

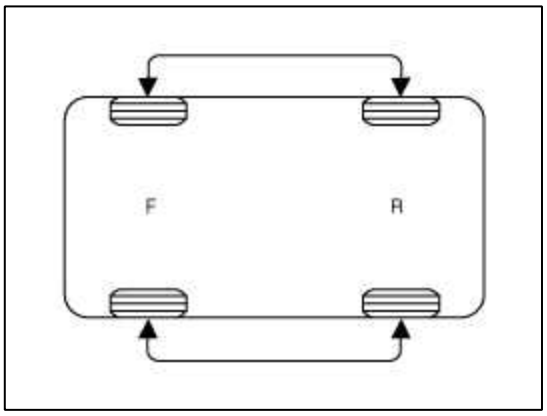
Checking For Pull And Wander

If the steering pulls to one side, rotate the tires according to the following wheel rotation procedure.

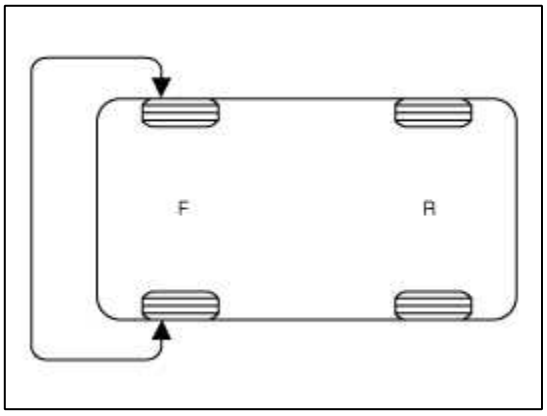
1. Rotate the front right and front left tires, and perform a road test in order to confirm vehicle stability.



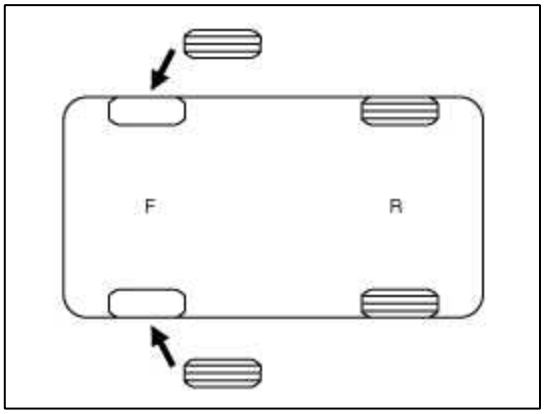
2. If the steering pulls to the opposite side, rotate the front and rear tires, and perform a road test again.



3. If the steering continues to pull to one side, rotate the front right and left tires again, and perform a road test.



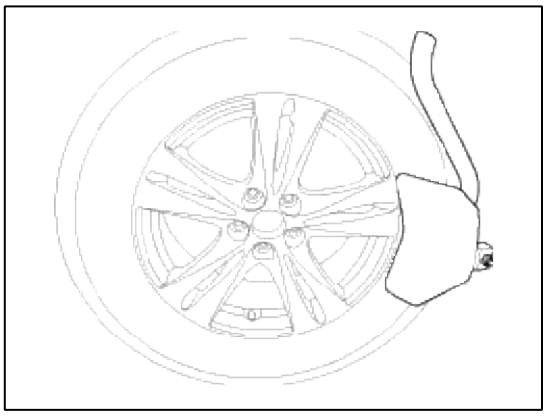
4. If the steering continues to pull to the opposite side, replace the front wheels with new ones.



Removal

1. Remove valve core and deflate the tire.

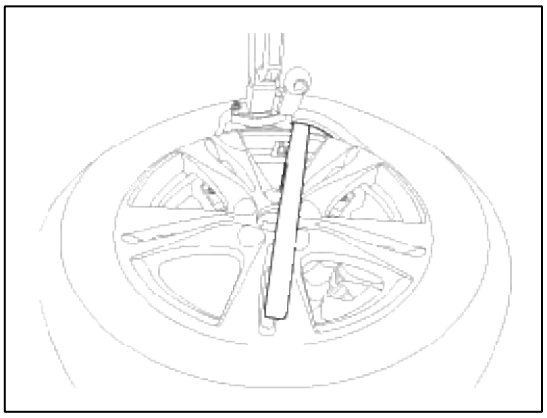
2. Remove the side of the tire bead area from the wheel using tire changing machine .

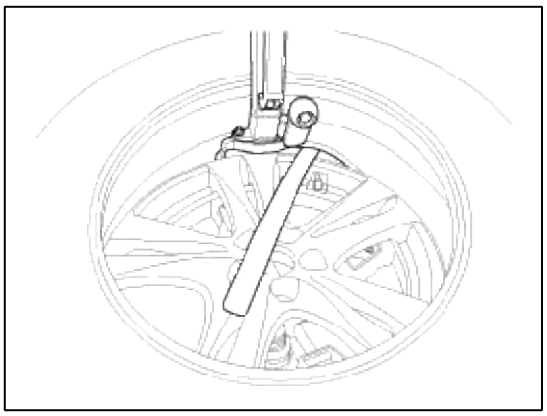


CAUTION

- 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.

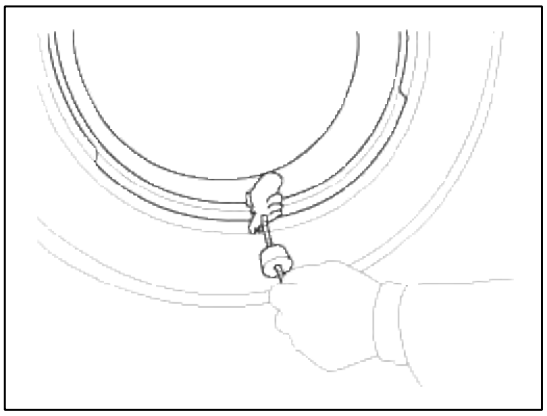
3. Rotate the wheel clockwise.



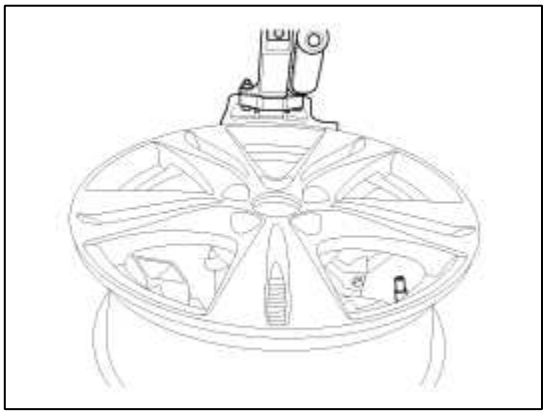


Installation

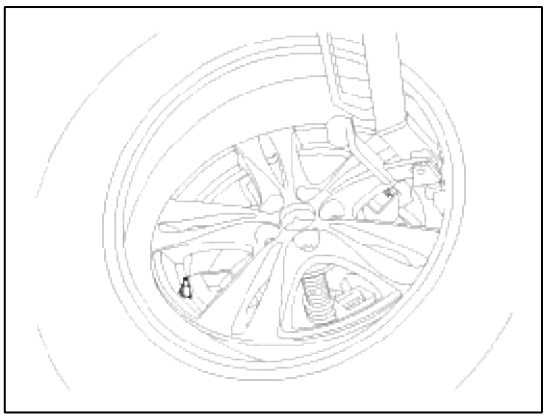
1. Apply tire soap or lubrication to the top and bottom tire beads.



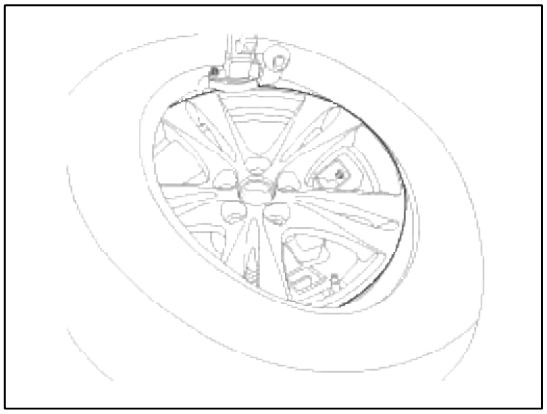
2. To fit the bottom bead, position the valve at the 5 o'clock position relative to the head on the tire changing machine.



3. Place the tire on the rim so the bottom bead touches the edge of the rim after the valve (6 o'clock). Rotate the rim clockwise, and push down on the tire at the 3 o'clock position to fit bottom bead.

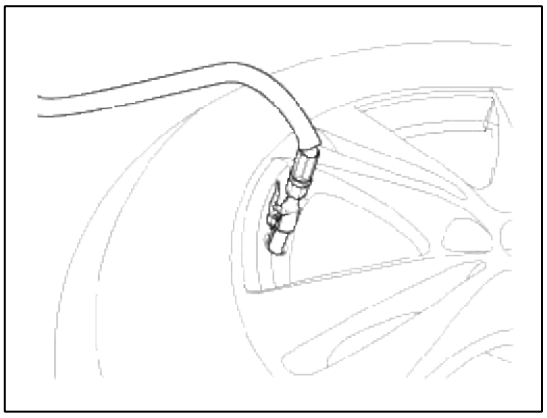


4. After bottom bead is on tire, rotate the rim until the valve is at the 5 o'clock position relative to the head on the tire changing machine. Push down on the tire at the 3 o'clock position and rotate the rim clockwise to fit the top bead.



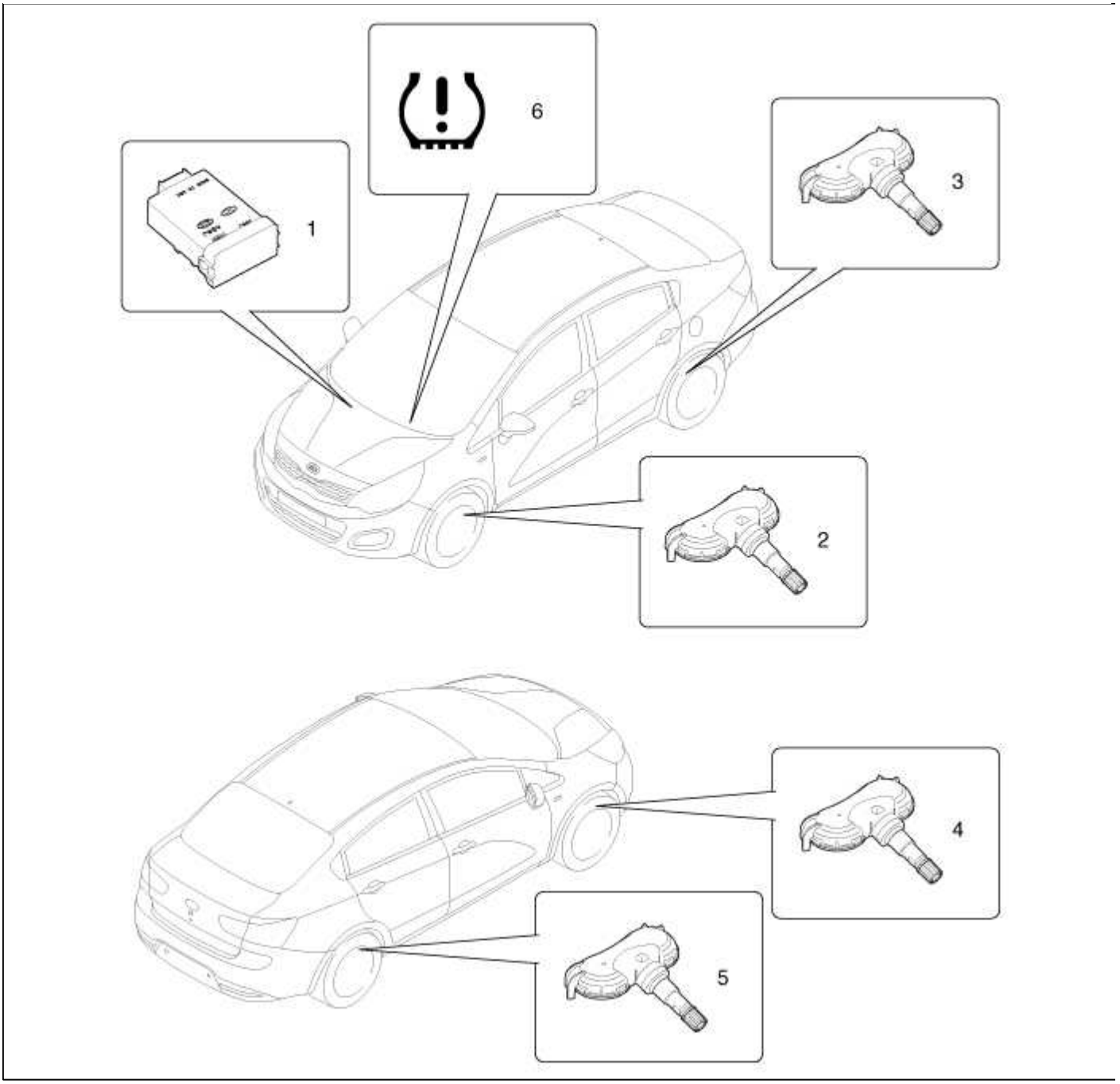
5. Inflate the tire until both beads seat.

Tire presuure : 2.2kg/cm² (32psi)



Suspension System > Tire Pressure Monitoring System > Components and Components Location

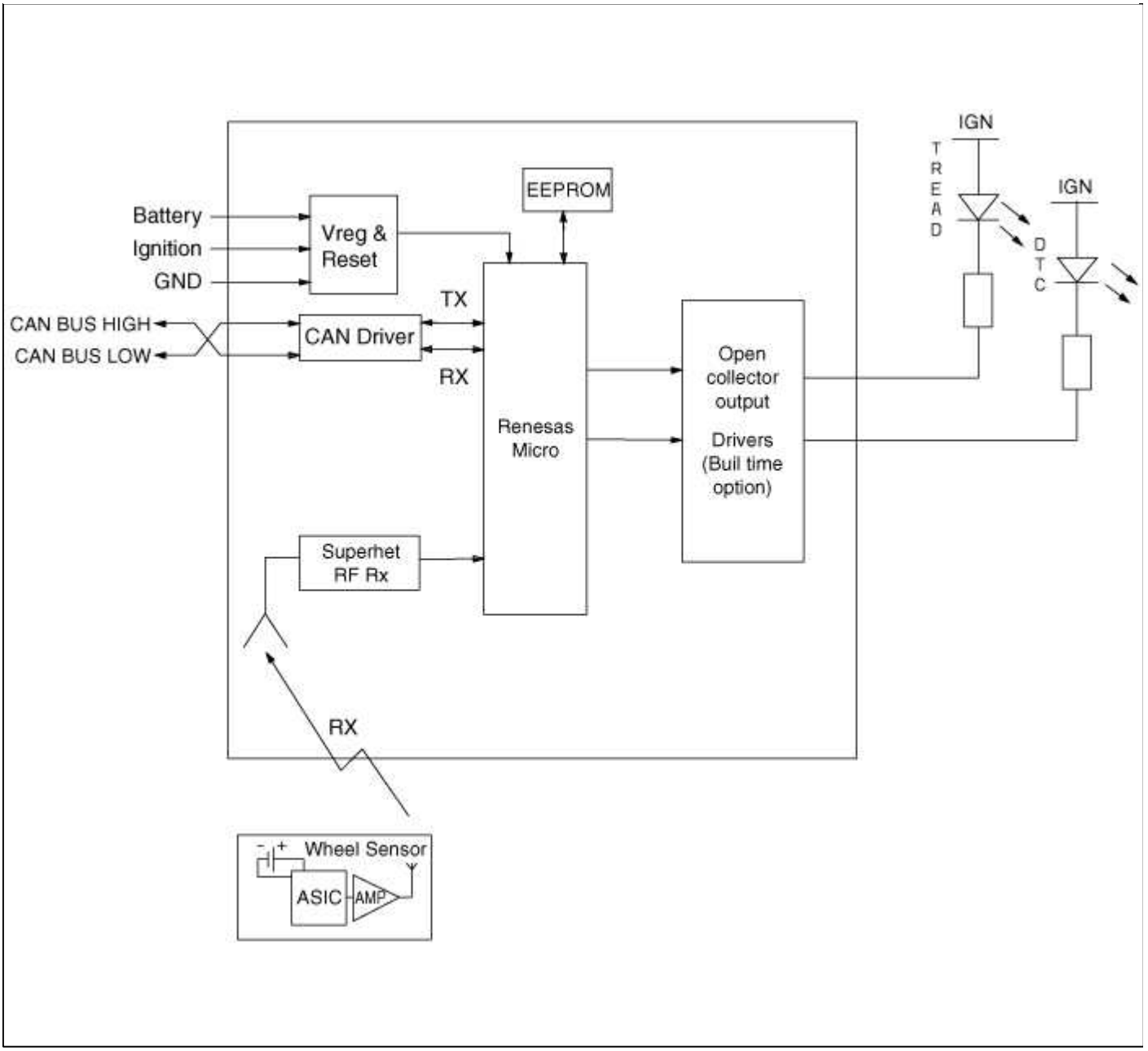
Components



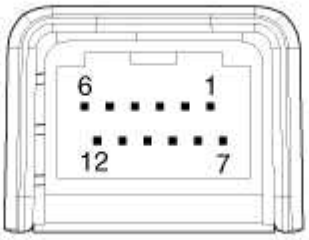
1. Receiver	4. TPMS Sensor (S2)
2. TPMS Sensor (S1)	5. TPMS Sensor (S3)
3. TPMS Sensor (S4)	6. Tread Lamp

Suspension System > Tire Pressure Monitoring System > Schematic Diagrams

Circuit Diagram



Hamess Connector



Pin No.	Discription	Remark
1	-	
2	-	
3	-	
4	Vehicle Ground	
5	CAN_HIGH	
6	Battery	
7	-	
8	-	
9	-	
10	-	
11	CAN_LOW	
12	Ignition	

Suspension System > Tire Pressure Monitoring System > Description and Operation

Description

TREAD Lamp

- Tire Under Inflation / Leak Warning.

1. Turn on condition
   A. When tire pressure is below allowed threshold
   B. When rapid leak is detected by the sensor.
   C. Indicates that tire needs to be re-inflated to placard pressure / repaired.
2. Turn off condition
   A. Under-inflation ; When tire pressure is above (warning threshold + hysteresis).
   B. Rapid Leak ; When tire pressure is above (leak warning threshold).

DTC Warning

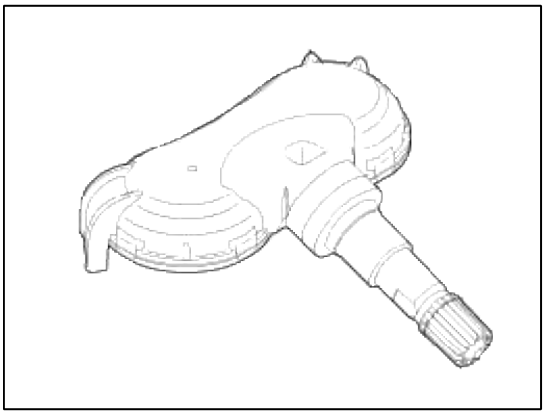
1. Turn on condition
   A. When the system detects a fault that is external to the receiver/ sensor.
   B. When the system detects a receiver fault.
   C. When the system detects a sensor fault.
2. Turn off condition
   A. If the fault is considered as 'critical', then the lamp is held on throughout the current Ignition cycle (even if the DTC has been demoted). This is because it is important to bring the problem to the drivers attention. On the following Ignition cycle, the demotion conditions will be re-checked. If the demotion conditions occur, the lamp will be turned off. It will be held on until DTC demotion checking is completed.
   B. 'Non critical' faults are those that can occur temporarily e.g. vehicle battery under voltage. The lamp is therefore turned off when the DTC demotion condition occurs.

System Fault

1. General Function
   A. The system monitors a number of inputs across time in order to determine that a fault exists.
   B. Faults are prioritized according to which has the most likely cause.
   C. Maximum fault store is equal to 15.
   D. Certain faults are not covered through DTC. The main ones are:
      1) Sensor thermal shutdown (over 257°F/125°C).
      2) Ignition Line stuck ; requires observation of lamps at Ignition ON to diagnose.

Suspension System > Tire Pressure Monitoring System > TPMS Sensor > Description and Operation

Description



1. Mode
   (1) Configuration State
      A. All sensors should be in the Low Line (Base) state.
      B. In Low Line (Base) configuration, sensor transmissions occur every 3 minutes 20 seconds (nominal) and pressure is measured every 20 seconds.
   (2) Normal Fixed Base State
      A. Sensor transmissions continue at the Low Line (Base) configuration defined rates until the state is either changed by LF command or by the sensor detecting a condition that requires a temporary change to another state.
      B. The LF command to this state must contain the sensors ID.
   (3) Storage Auto State:
      A. This state is a Low current consumption state.
      B. Sensors are in this state when they first arrive at the dealership (either on the vehicle or as replacement spares).
      C. In this state, the sensor does not measure pressure / temperature / battery level.
      D. The sensor will not transmit in this state unless requested to do so by the initiate command.

(4) Alert State:

A. The sensor automatically enters this state if the measured temperature exceeds 230 °F(110 °C) and over temperature shutdown is likely.

B. In this state, pressure is measured every 4 seconds and RF data transmitted every 4 seconds.

C. The state lasts for 1 minute if it is pressure triggered.

D. This state is alse entered when a 3 psi change in pressure from the last RF transmission occurs.

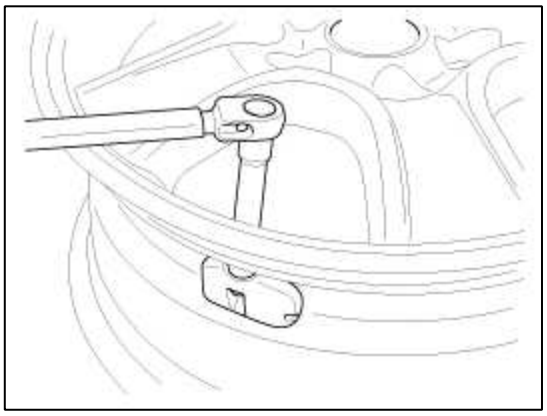
> NOTE
>
> Sensor mode is used to configure sensor between high line and low line system. TPMS sensor for UB should be set to low line.

Suspension System > Tire Pressure Monitoring System > TPMS Sensor > Repair procedures

Removal

> CAUTION
>
> Handle the sensor with care.

1. Remove the tire. (Refer to "Tire Removal")
2. Remove the valve nut.



> CAUTION
>
> The valve nut should not be re-used.

3. Discard the valve assembly.

Replacement

Repair tire after using the Tire Mobility Kit (TMK)

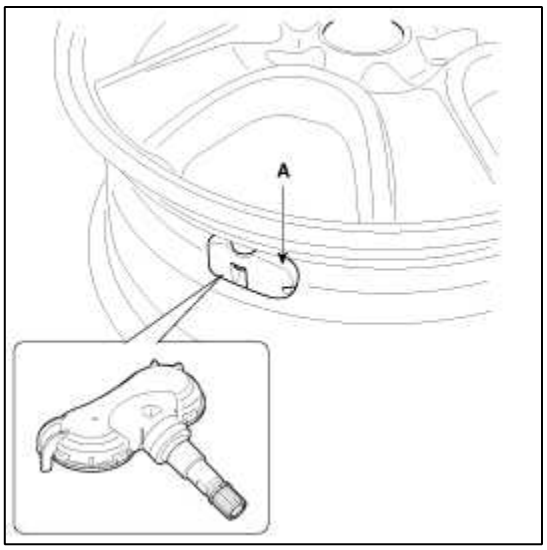
When the TPMS warning lamp OFF

1. Remove the TMK repaired tire, wheel and TPMS sensor.
   (Refer to "Tire removal")

2. Remove the sealant on the wheel and TPMS sensor (A) completely.

CAUTION

- Clean the sealant on the housing and sensing hole of TPMS sensor with clean cloth, gauze or air inhalers.
- To prevent the sensor and circuit board damage, do not use the pointed instrument and give a lot of impact.



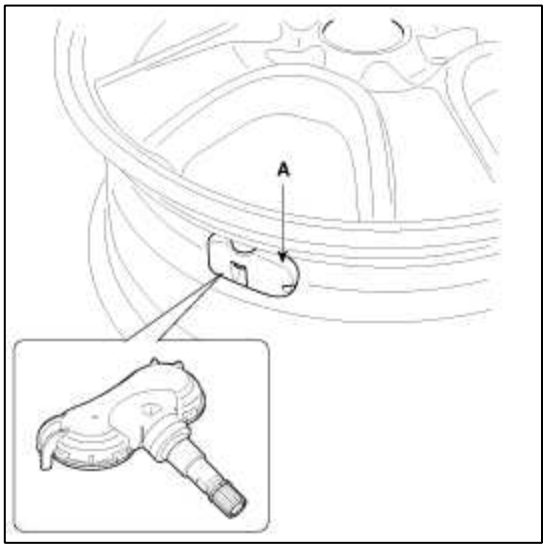
3. Install the TPMS sensor to the new tire.
4. Check that the normal operation of TPMS system.

When the TPMS warning lamp ON

1. Remove the TMK repaired tire, wheel and TPMS sensor.
   (Refer to "Tire removal")
2. Remove the sealant on the wheel and TPMS sensor (A) completely.

CAUTION

- Clean the sealant on the housing and sensing hole of TPMS sensor with clean cloth, gauze or air inhalers.
- To prevent the sensor and circuit board damage, do not use the pointed instrument and give a lot of impact.



3. Install the TPMS sensor to the new tire.
4. Check the tire pressure using the electrical tire pressure gauge.
5. Check the tire pressure of TPMS sensor using the GDS

6. If the difference between two checked pressures in the above is not more than 2 psi, TPMS sensor is normal. Reinstall it to new tire.
7. If the difference between two checked pressures in the above is more than 2 psi, TPMS sensor is abnormal. Install new TPMS sensor to new tire.
8. Check that the normal operation of TPMS system.

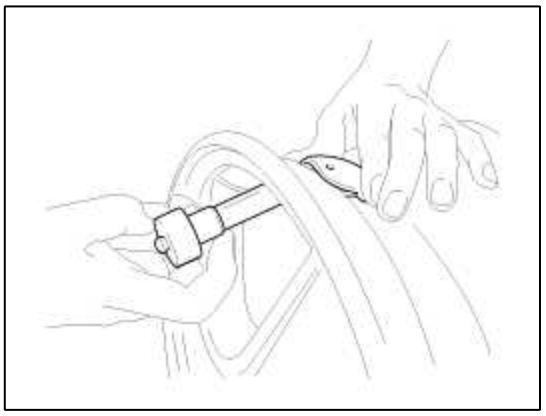
Installation

Sensor Fit

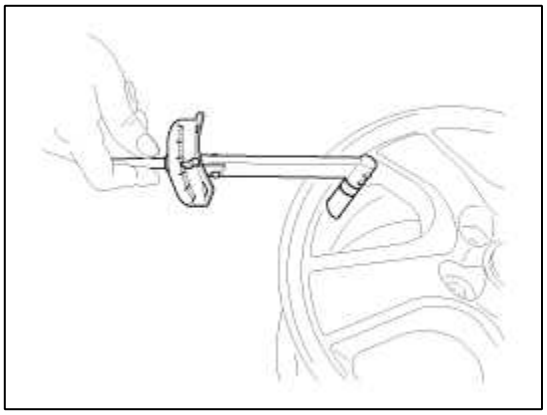
CAUTION

- Handle the sensor with care.
- Avoid lubricant contact.
- Ensure that the wheel to be fitted is designed for sensor mount. There should normally be a mark to indicate this.
- Ensure that the valve hole and mating face of the wheel are clean.

1. Slide the sensor-valve unit through the valve hole of the rim. Hold the sensor against the rim and the rubber grommet against the sealing surface.
2. Insert the nut over the valve stem and then tighten the nut.



3. Continue to tightening the nut until contact with the rim and then tighten to 3.5 ~ 4.5Nm.



CAUTION

- Tighten slowly with quarter turn steps until the final torque is reached.
- Do not exceed allowed torque.
- Do not use electric or pneumatic tools.

4. Check that the sensor is firmly attached to the rim.

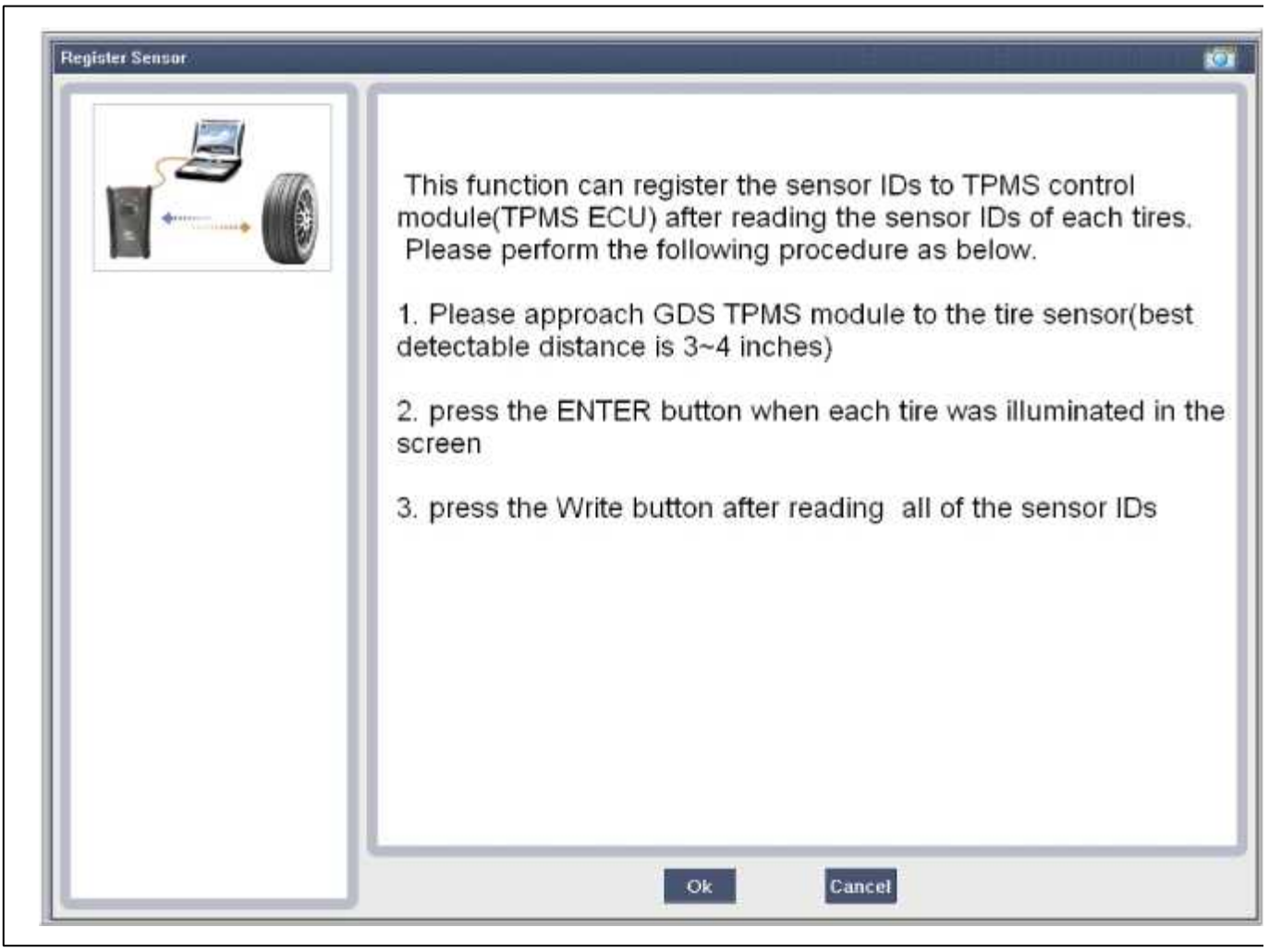
> CAUTION
>
> Risk of damage during the tire installation/ removal if the sensor is not firmly attached to the rim.

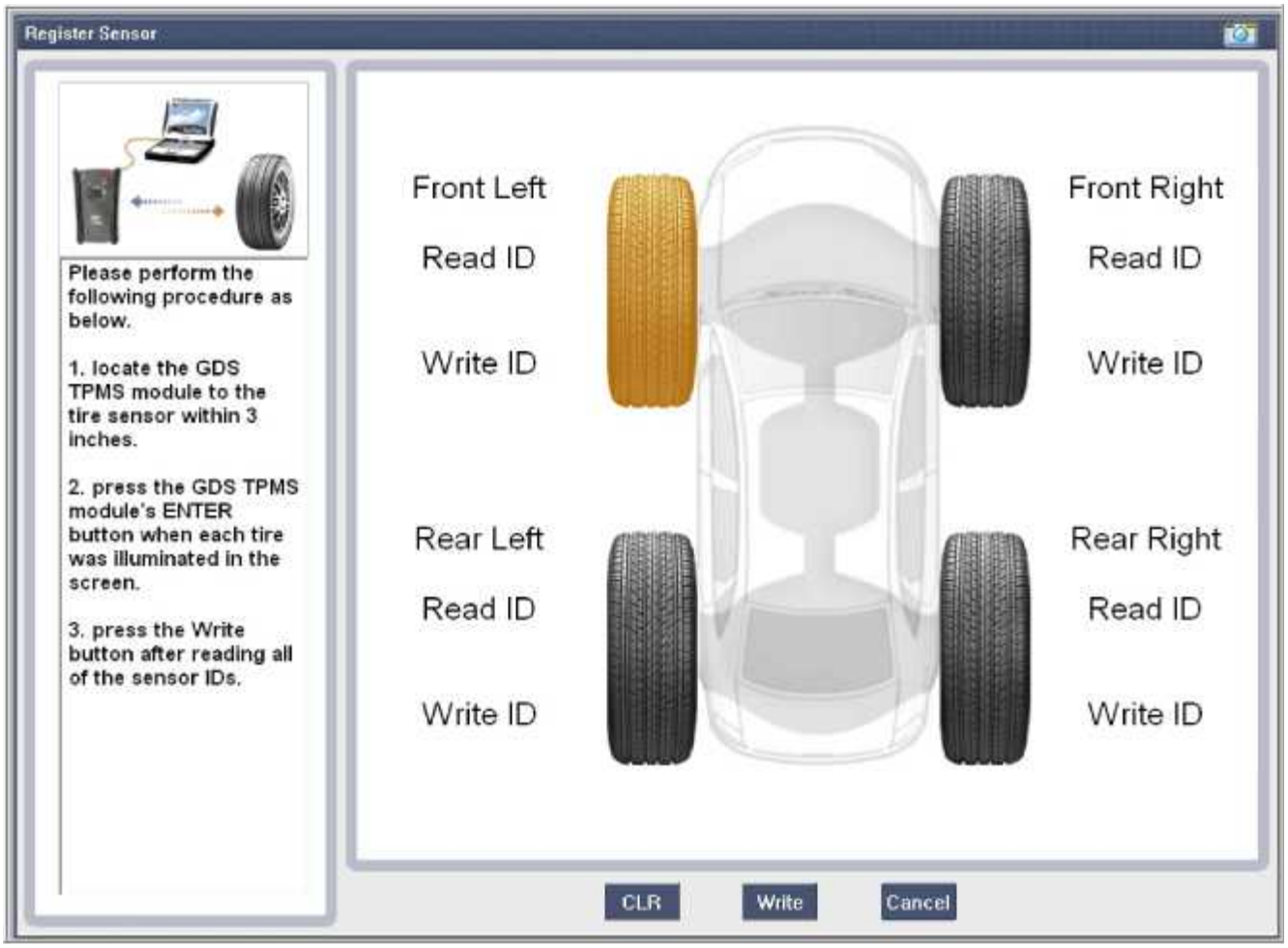
5. Carry out inflation / pressure correction and then fit valve cap.

> CAUTION
>
> Change the newly installed sensor mode to Normal Fixed Base(Low Line) with the 'GDS'. Mode (Status / option) of the sensor installed to the vehicle should be Normal Fixed Base (Low).

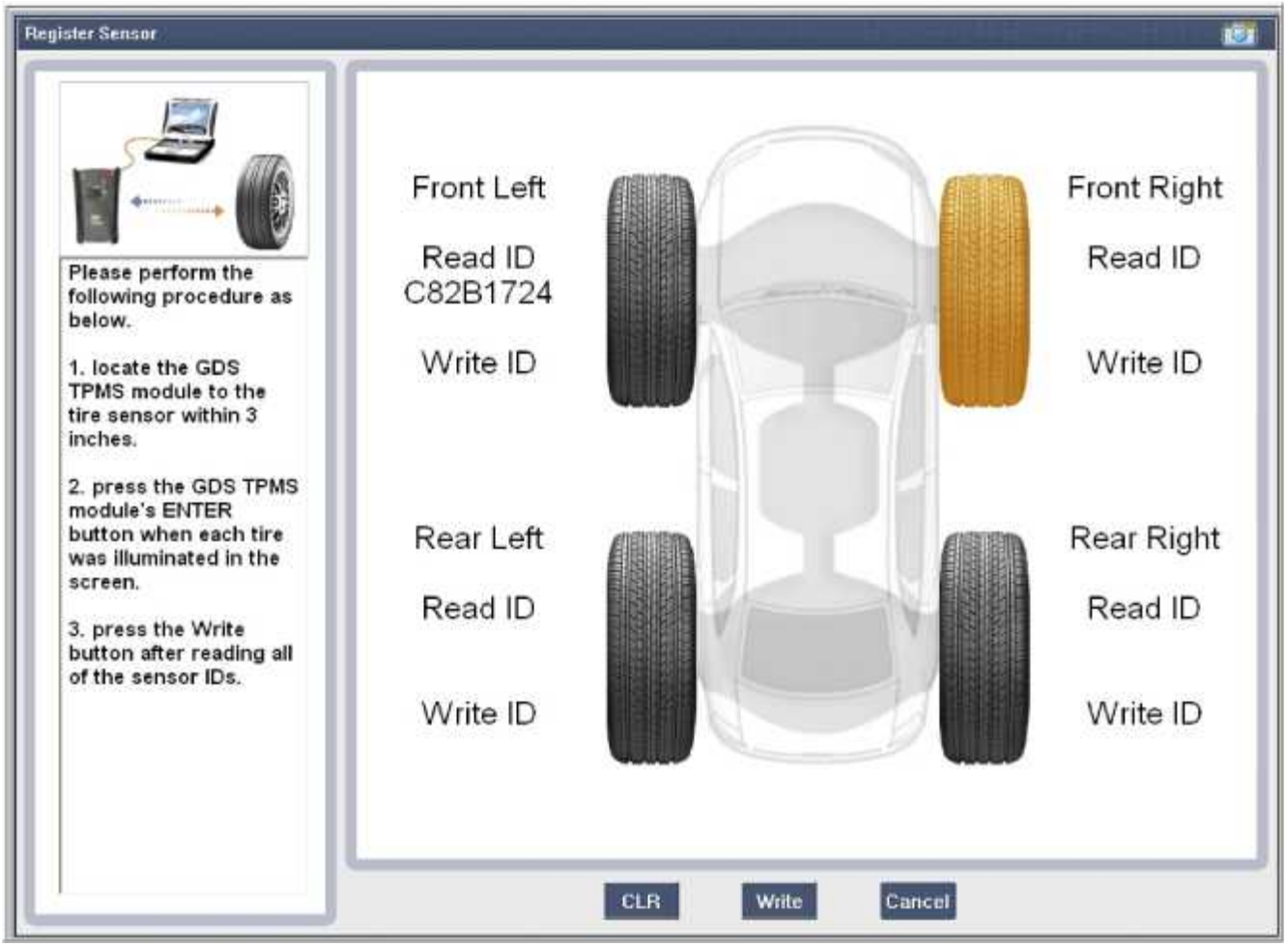
6. Install the tire. (Refer to "Tire Installation")

Sensor ID Writing (Wireless)

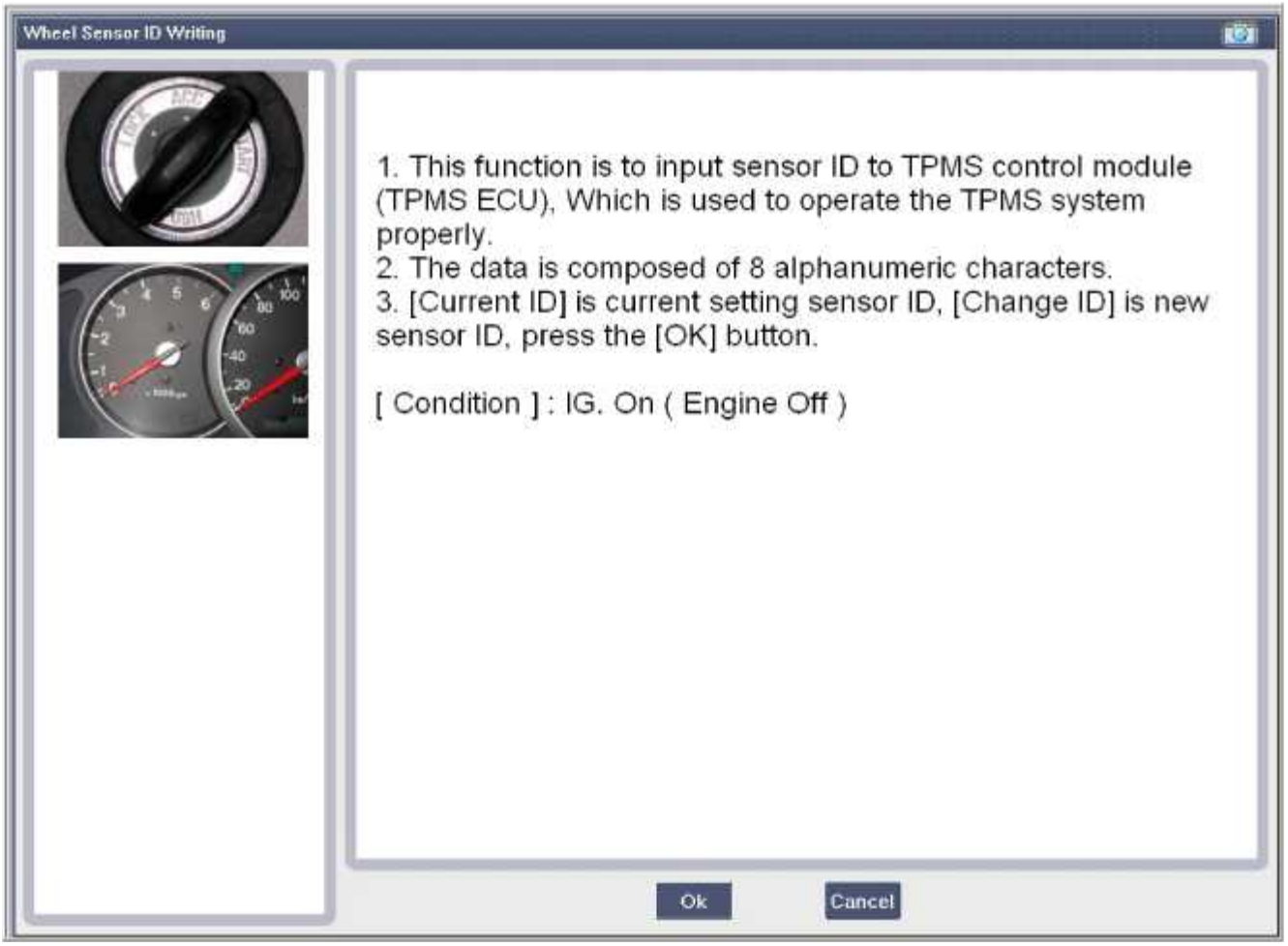


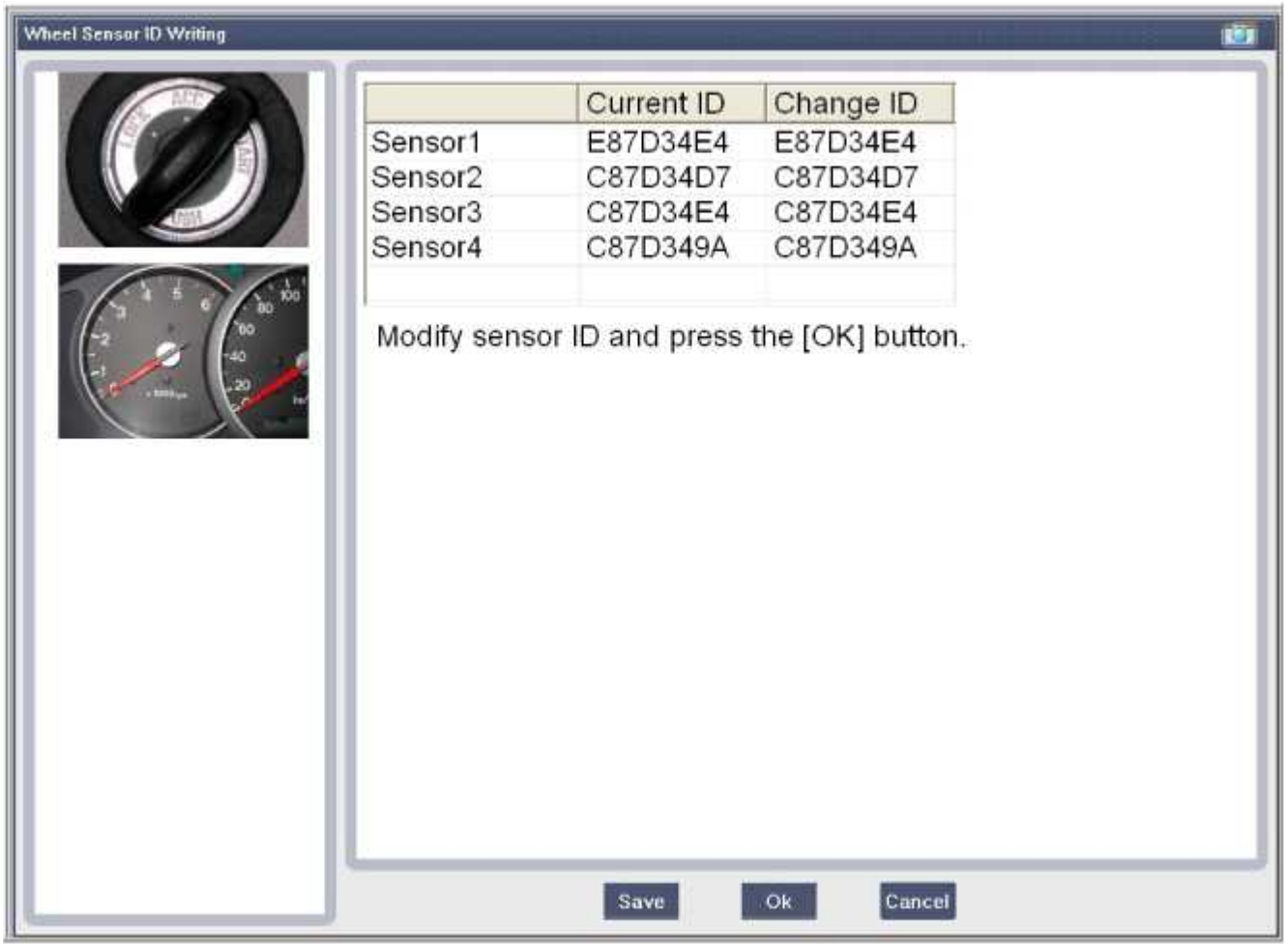

Register Sensor
Please perform the following procedure as below.
1. locate the GDS TPMS module to the tire sensor within 3 inches.
2. press the GDS TPMS module's ENTER button when each tire was illuminated in the screen.
3. press the Write button after reading all of the sensor IDs.
Front Left
Read ID
Write ID
Front Right
Read ID
Write ID
Rear Left
Read ID
Write ID
Rear Right
Read ID
Write ID
CLR
Write
Cancel

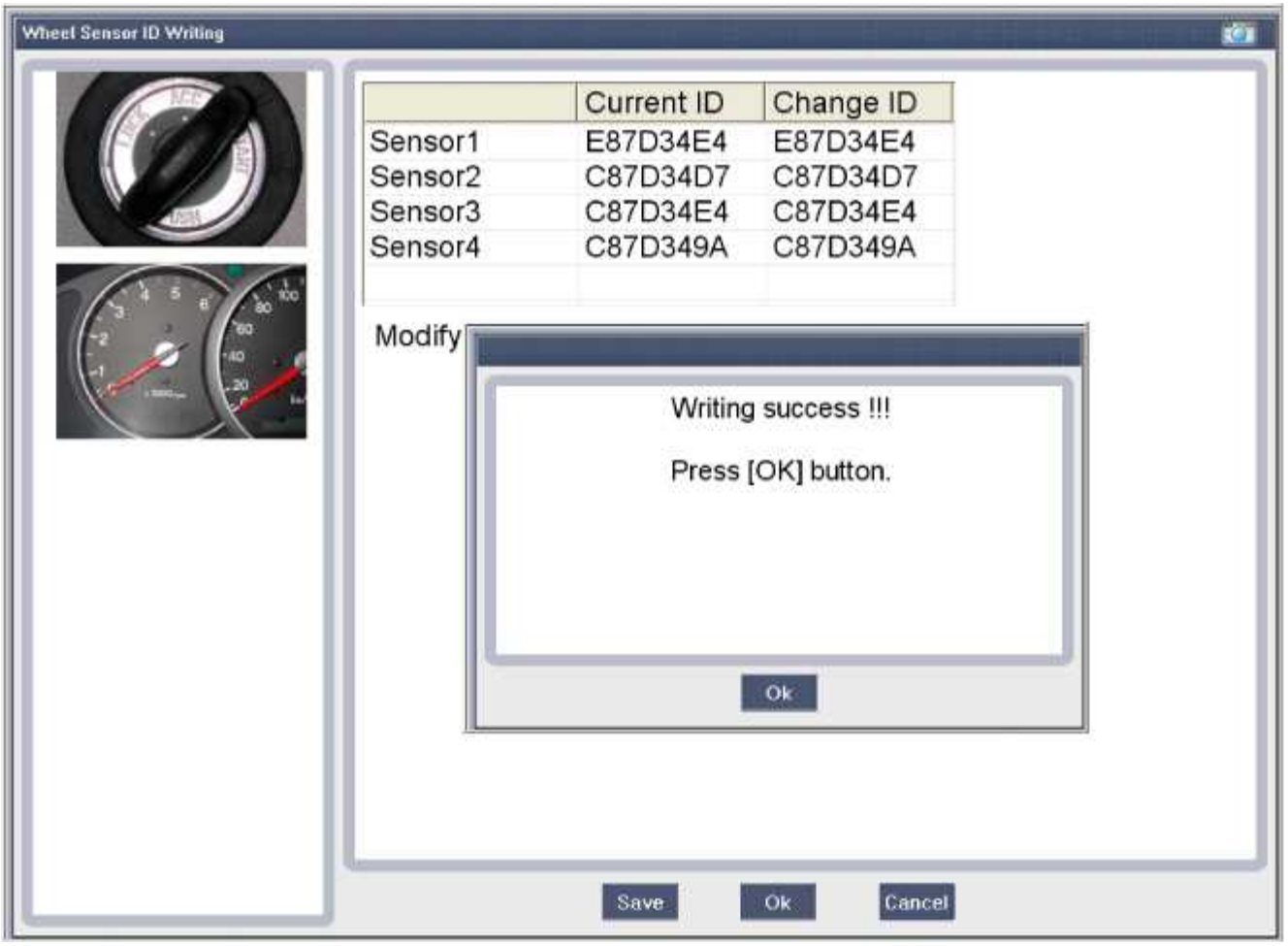

Register Sensor
Please perform the following procedure as below.
1. locate the GDS TPMS module to the tire sensor within 3 inches.
2. press the GDS TPMS module's ENTER button when each tire was illuminated in the screen.
3. press the Write button after reading all of the sensor IDs.
Front Left
Read ID
Write ID
Front Right
Read ID
Write ID
GDS TPMS
It takes Max. 30 Sec. Please, wait.....
Cancel
Rear Right
Read ID
Write ID
Write ID
CLR
Write
Cancel



Sensor ID Writing

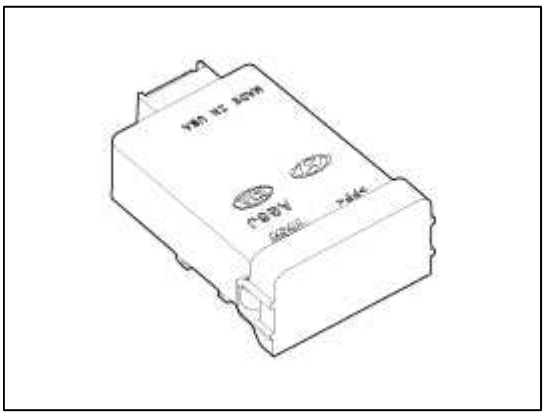

Wheel Sensor ID Writing
1. This function is to input sensor ID to TPMS control module (TPMS ECU), Which is used to operate the TPMS system properly.
2. The data is composed of 8 alphanumeric characters.
3. [Current ID] is current setting sensor ID, [Change ID] is new sensor ID, press the [OK] button.
[Condition] : IG. On (Engine Off)
Ok
Cancel


Wheel Sensor ID Writing
Current ID
Change ID
Sensor1 E87D34E4 E87D34E4
Sensor2 C87D34D7 C87D34D7
Sensor3 C87D34E4 C87D34E4
Sensor4 C87D349A C87D349A
Modify sensor ID and press the [OK] button.
Save
Ok
Cancel



Suspension System > Tire Pressure Monitoring System > TPMS Receiver > Description and Operation

Description



1. **Mode**
   (1) Virgin State
      A. The receiver as a sole part is shipped in this state. Replacement parts should therefore arrive in this state.
      B. In this state, there is no sensor monitoring and no DTC monitoring.
      C. The state indicates that platform specific parameters must be written to the receiver and that sensors are un-learned.
   (2) Normal State
      A. In order for tire inflation state and DTC monitoring to occur, the receiver must be in this state.
      B. In this state, automatic sensor learning is enabled.
   (3) Test State
      A. This state is only used in manufacturing plant to check RF transmission between sensor and receiver.
2. **Overview**
   A. Receives RF data from sensor.
   B. Uses sensor data to decide whether to turn on TREAD Lamp.
   C. Learn TPM sensor for under inflation monitoring automatically.
   D. Uses sensor information, distance travelled, background noise levels, Auto-learn status, short / open circuit output status, vehicle battery level, internal receiver states to determine if there is a system or a vehicle fault.

Operation
1. General Function
   A. Auto-learn takes place only once per Ignition cycle.
   B. On successful completion, 4 road wheel sensor ID's are latched into memory for monitoring.
   C. Until Auto-learn completes, previously learned sensors are monitored for under inflation / leak warnings.
2. General Conditions to Learn New Sensors:
   A. Receiver must determine that it is confident that sensor is not temporary:
      1) Uses vehicle speed.
      2) Uses confidence reduction of previously learned sensors.
   B. Typical time at driving continuously over 12.4 mph(20 kph) to learn a new sensor is up to 20 minutes.
3. General Conditions to Un-Learn a sensor that is removed:
   A. It takes less than 20 minutes at 12.4 ~ 18.6 mph(20 ~ 30kph).
   B. Confidence reduction is dependent on time which vehicle is driven at speed greater than or equal to 12.4 mph(20 kph).

Suspension System > Tire Pressure Monitoring System > TPMS Receiver > Repair procedures

Replacement

NOTE

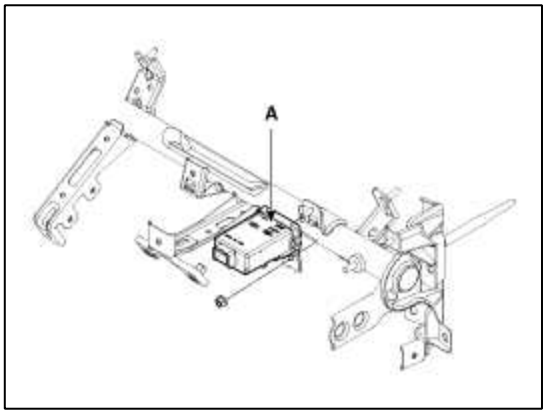
When the receiver first arrives for replacement:
1) It will be in Virgin State.
2) It will not be configured for any specific platform.
3) It will not have any sensor ID's memorized.

CAUTION

It is important to make sure that the correct receiver is used to replace the faulty part i.e. it must be Low Line and not High Line in order to have the correct inflation warning thresholds set.

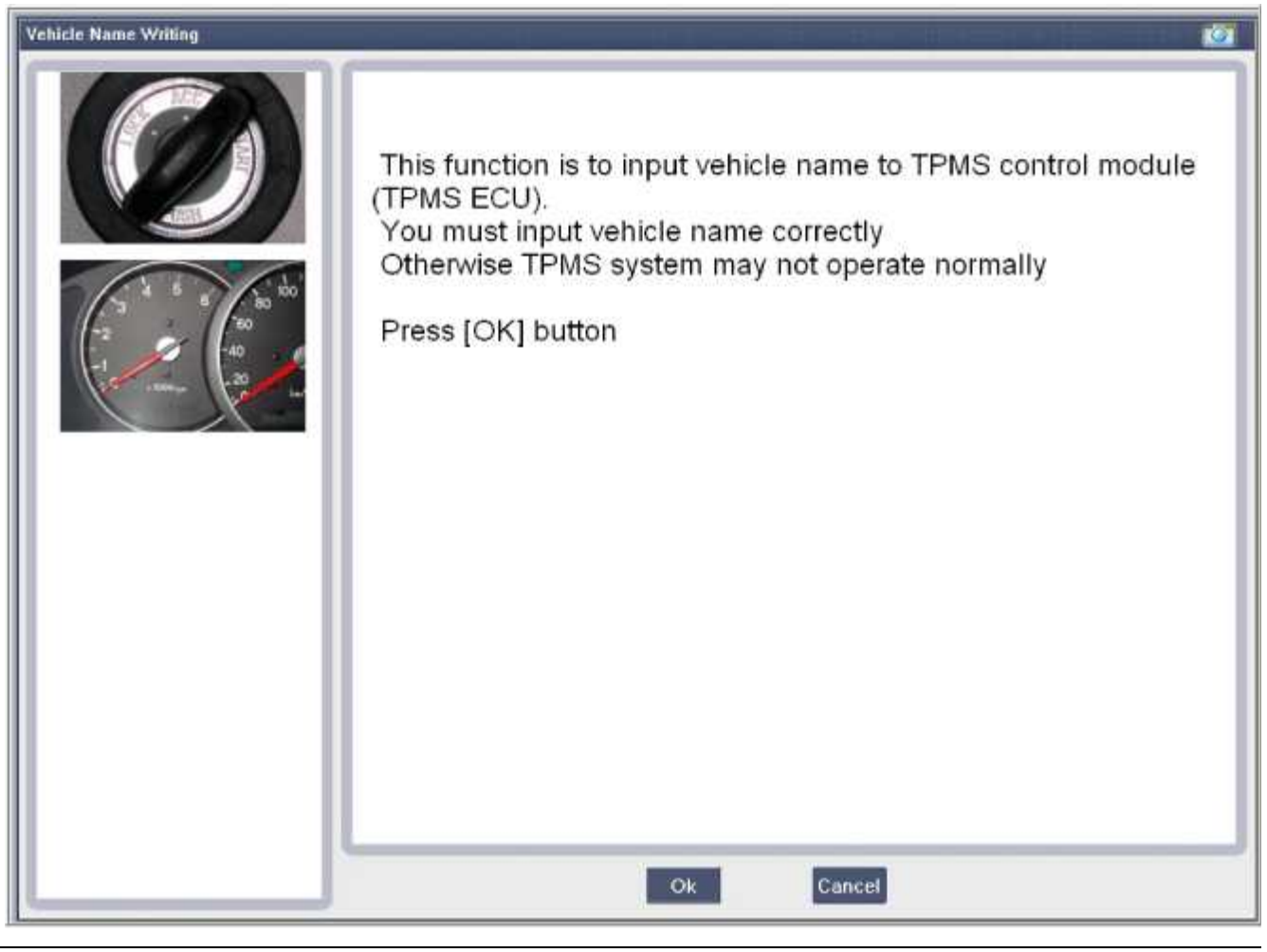
1. Disconnect vehicle battery.

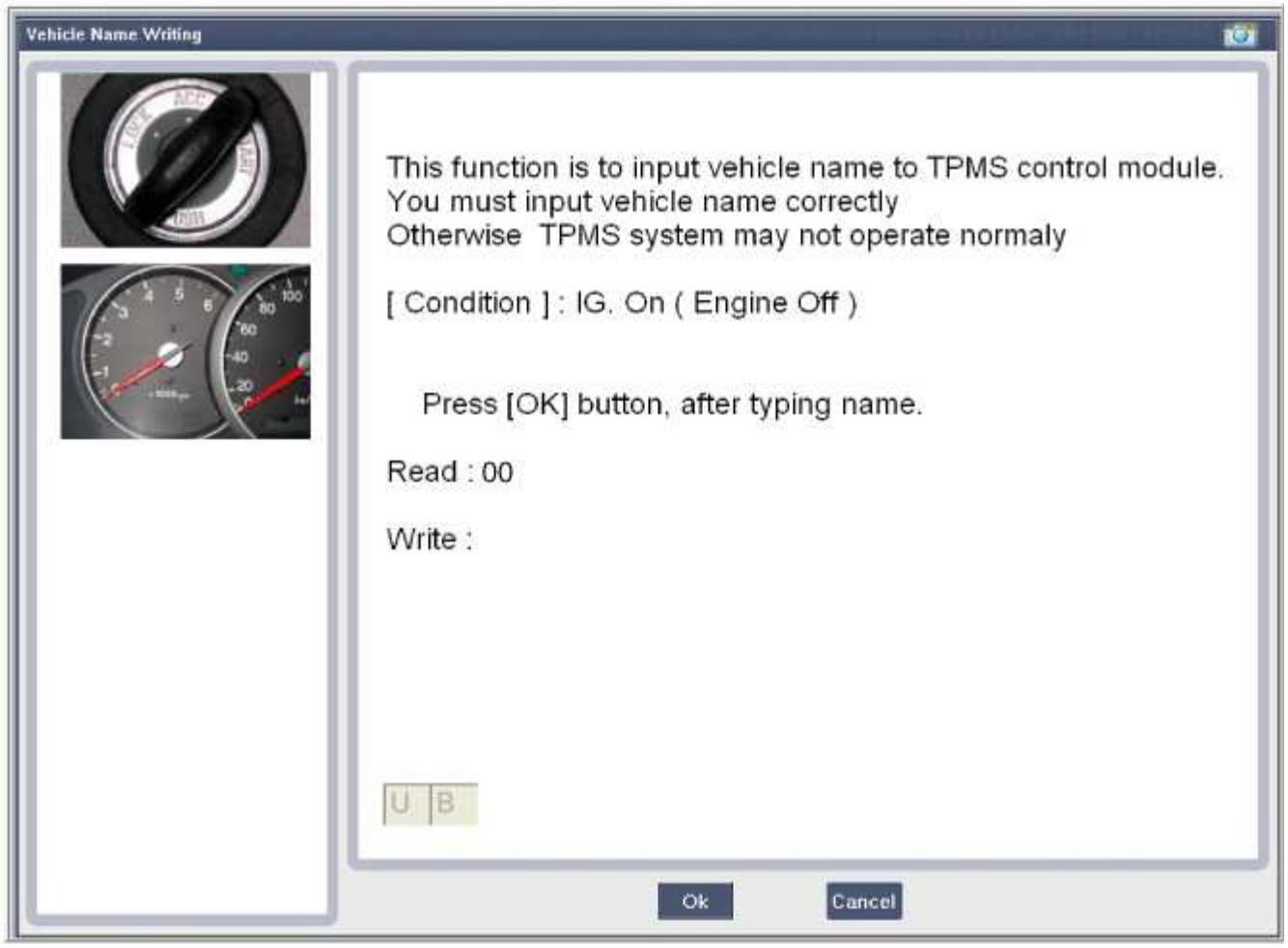
2. Remove the glove box.
   (Refer to BD group - "Crash Pad")
3. Remove the receiver (A) and fit bracket assembly to new part.

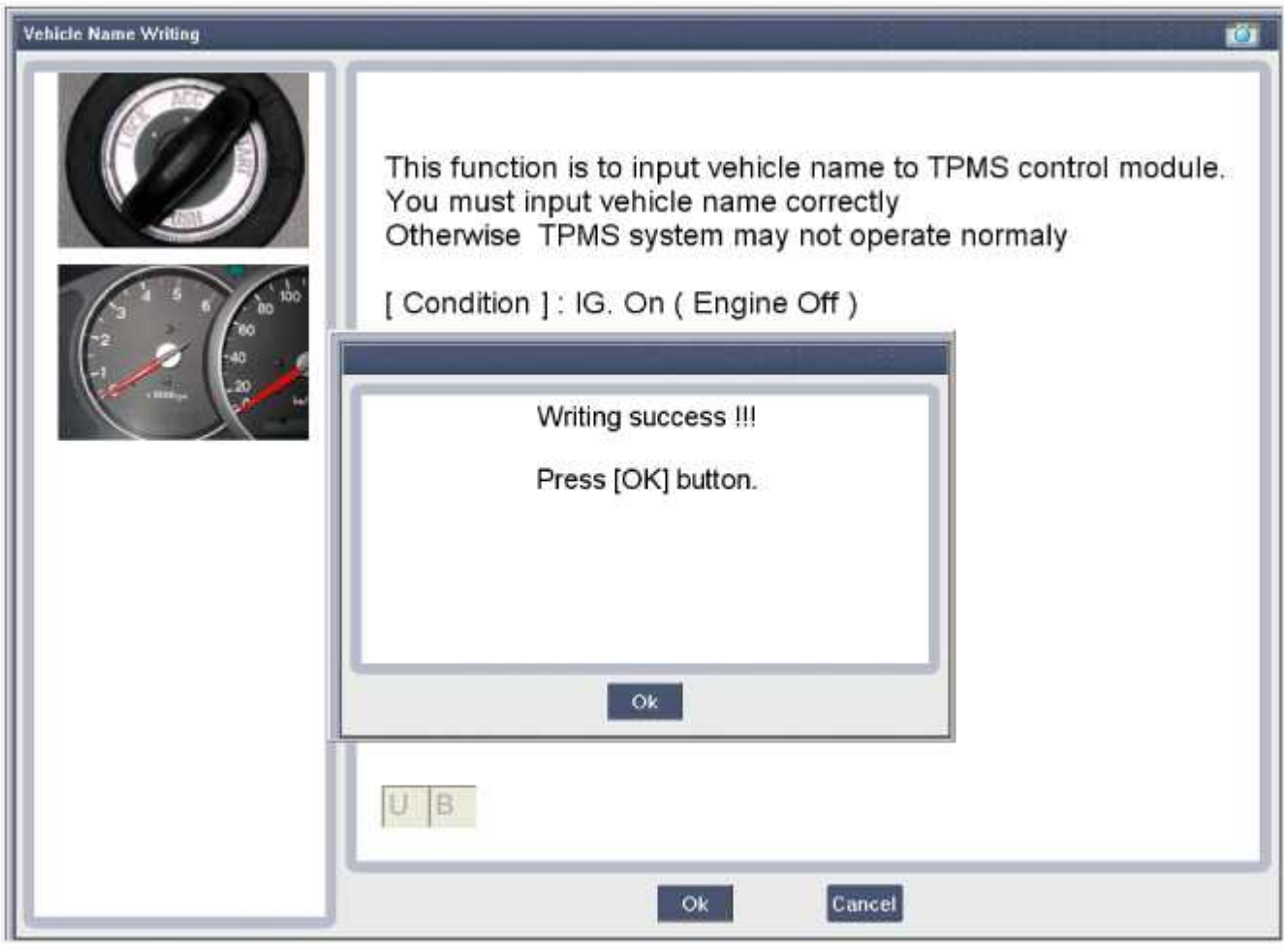


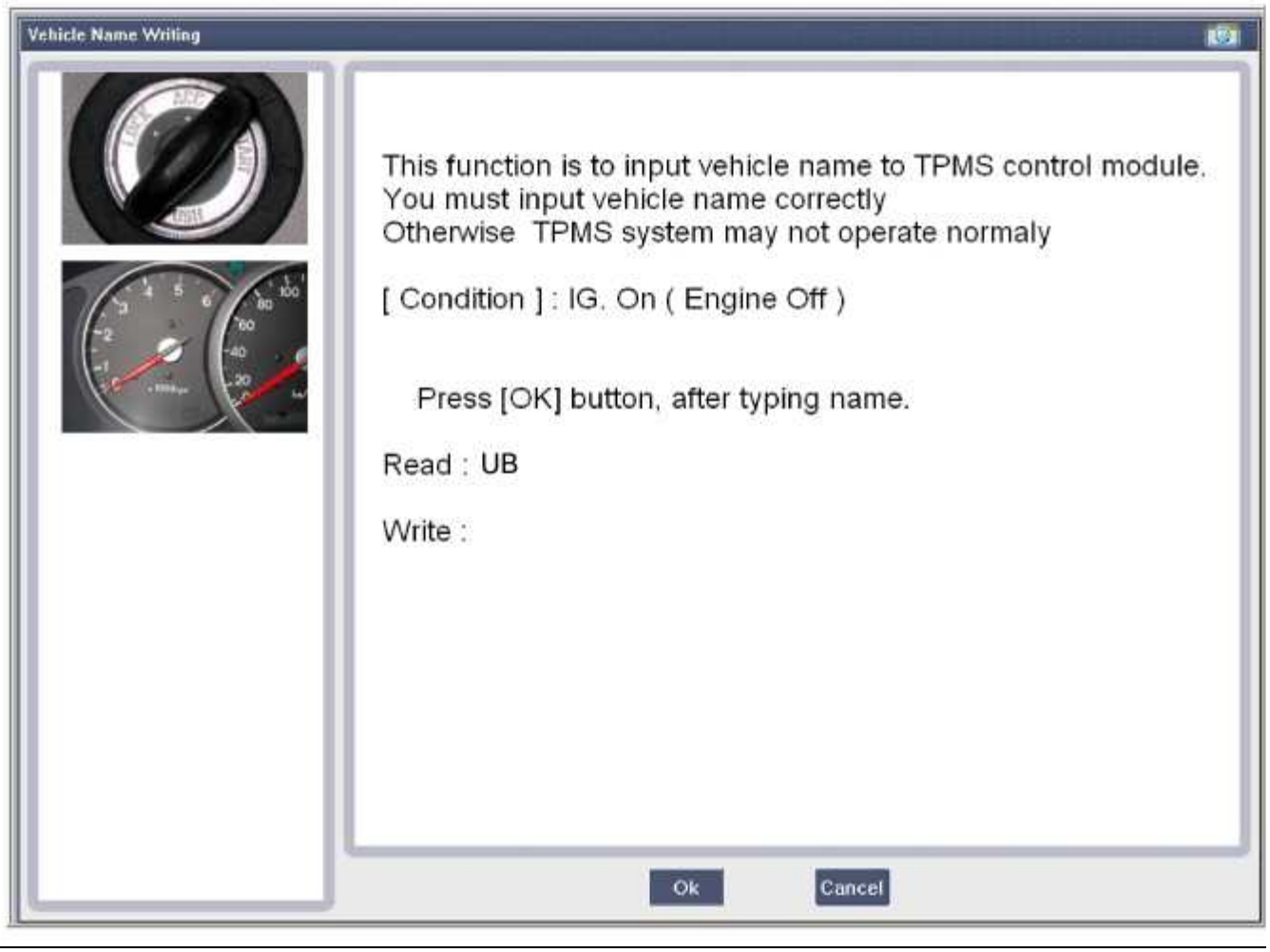
4. Secure new part to vehicle and fit connector.
5. Re-connect battery and turn Ignition on.
6. Check that TREAD Lamp flash rate matches Virgin State indication.

Vechicle Name Writing

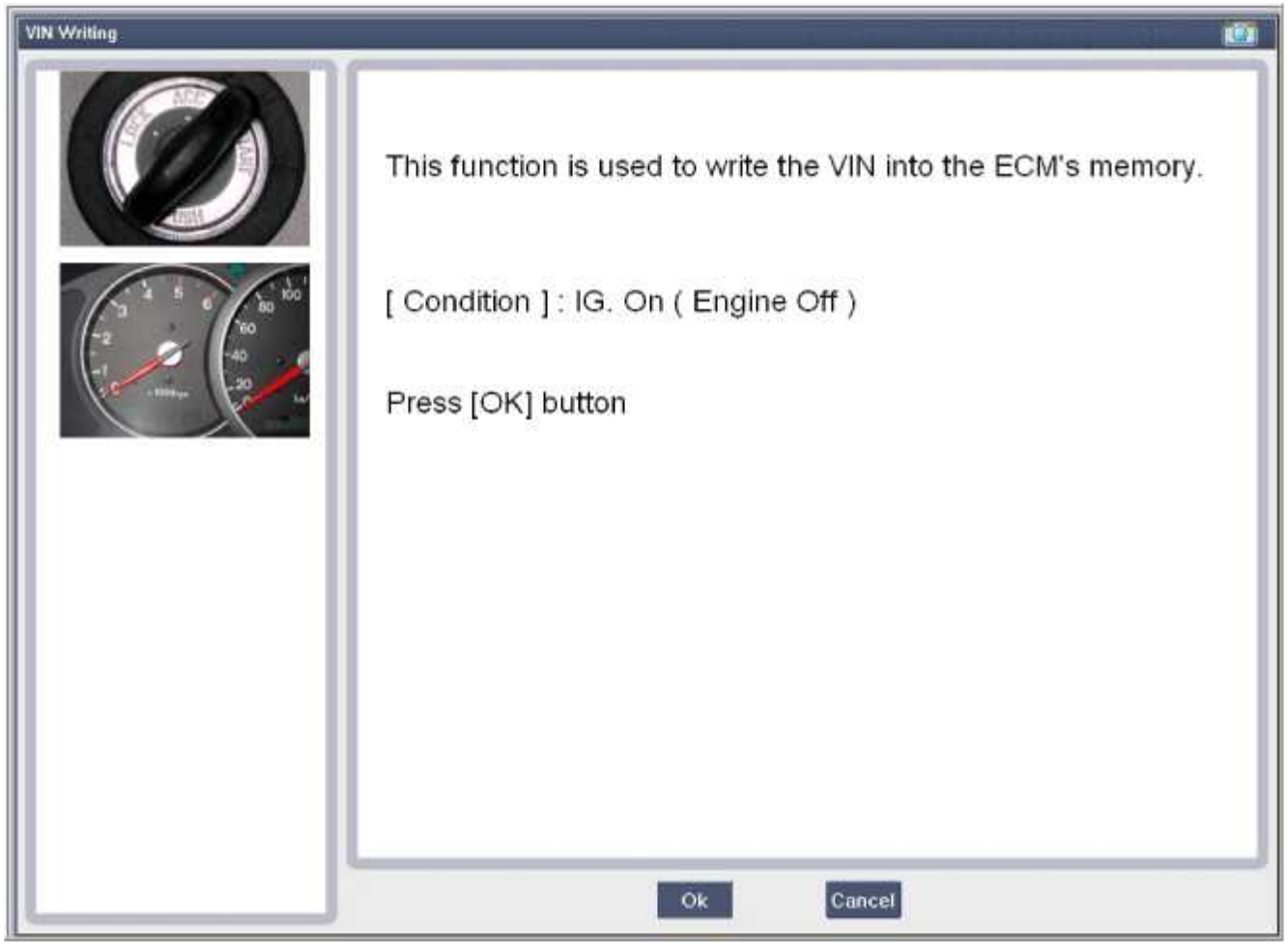


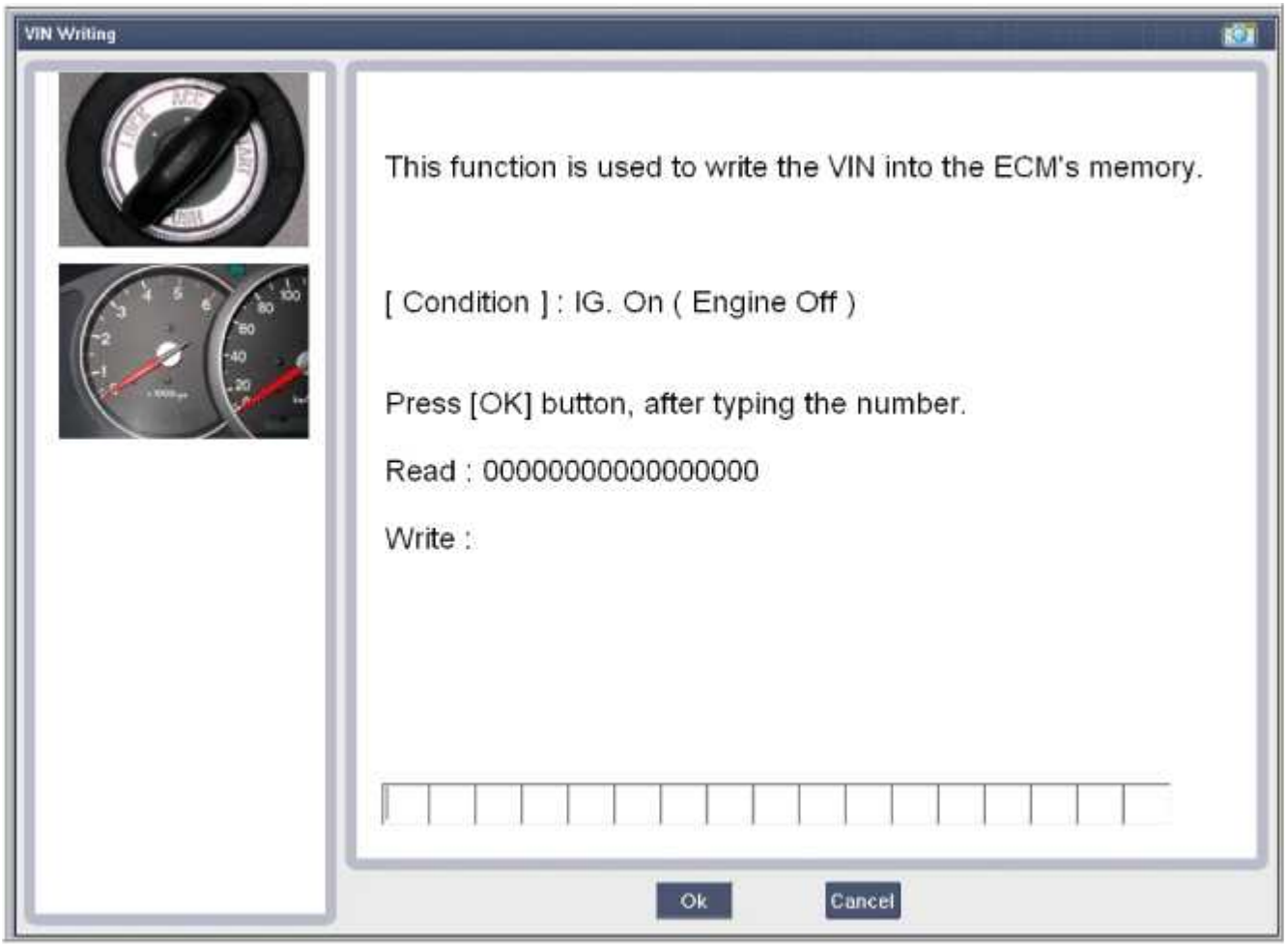

Vehicle Name Writing
This function is to input vehicle name to TPMS control module.
You must input vehicle name correctly
Otherwise TPMS system may not operate normaly
[Condition] : IG. On (Engine Off)
Press [OK] button, after typing name.
Read : 00
Write :
U
B
Ok
Cancel

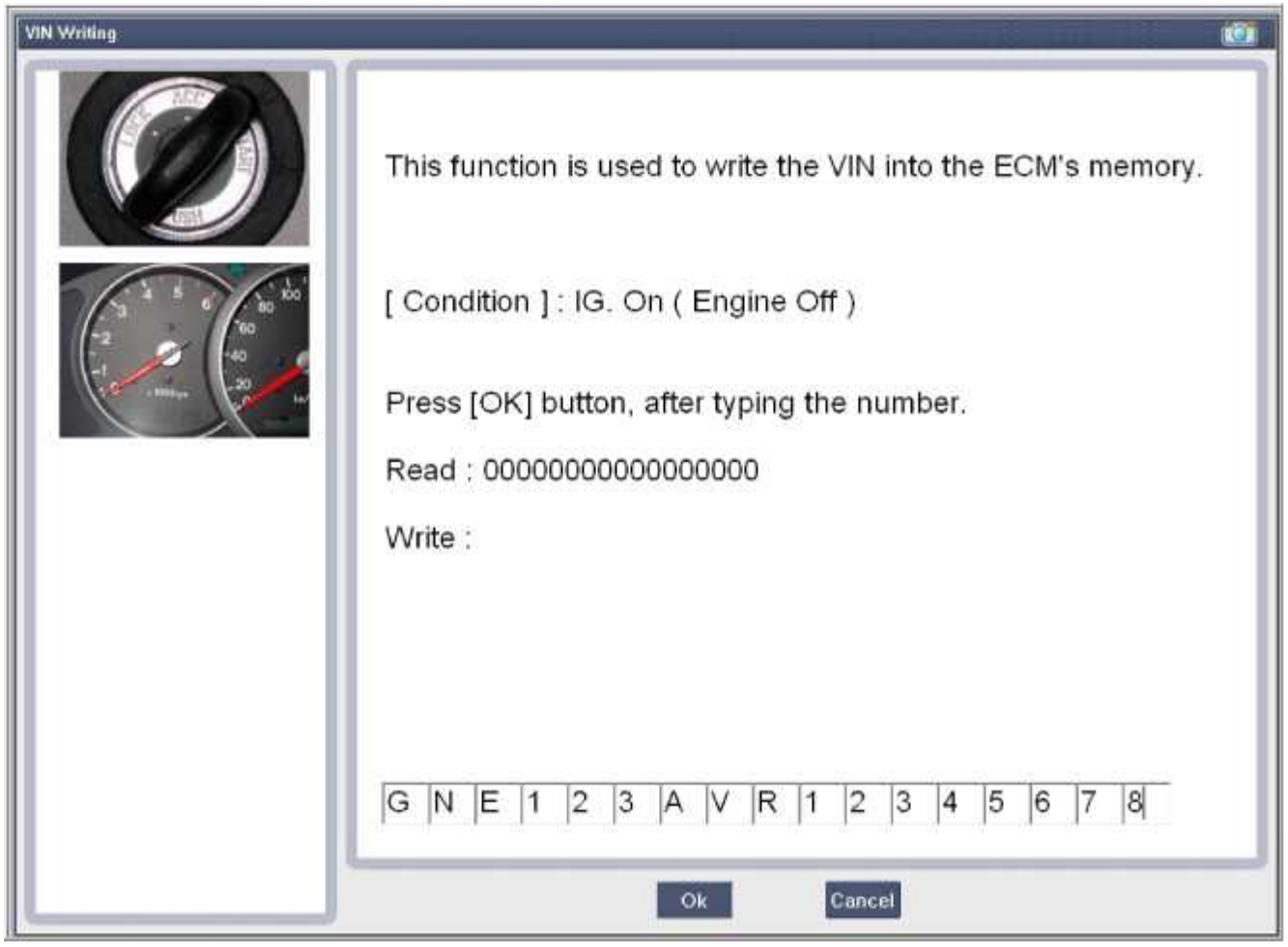

Vehicle Name Writing
This function is to input vehicle name to TPMS control module.
You must input vehicle name correctly
Otherwise TPMS system may not operate normaly
[Condition] : IG. On (Engine Off)
Writing success !!!
Press [OK] button.
Ok
U
B
Ok
Cancel

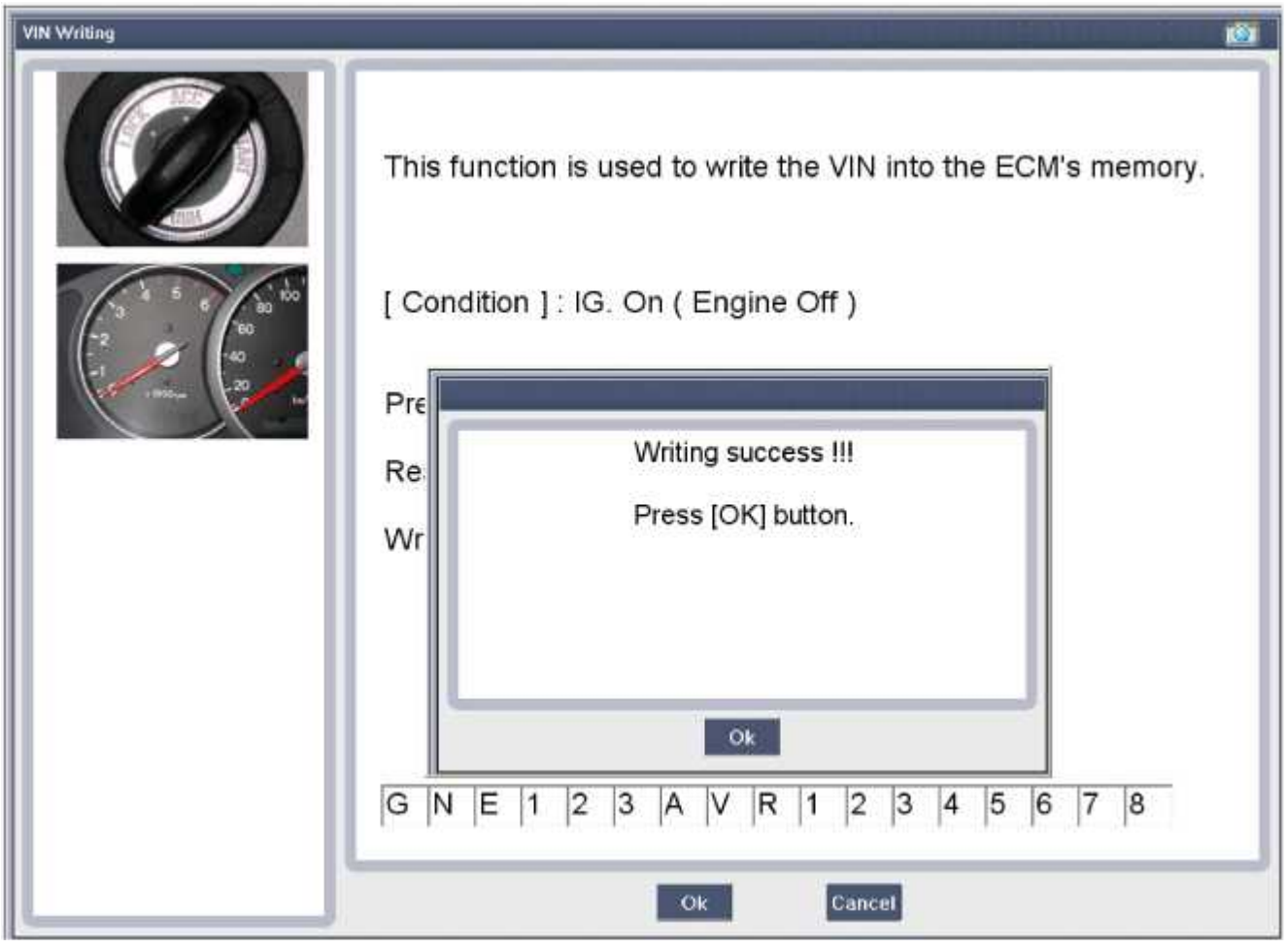

Vehicle Name Writing
This function is to input vehicle name to TPMS control module.
You must input vehicle name correctly
Otherwise TPMS system may not operate normaly
[Condition] : IG. On (Engine Off)
Press [OK] button, after typing name.
Read : UB
Write :
Ok
Cancel

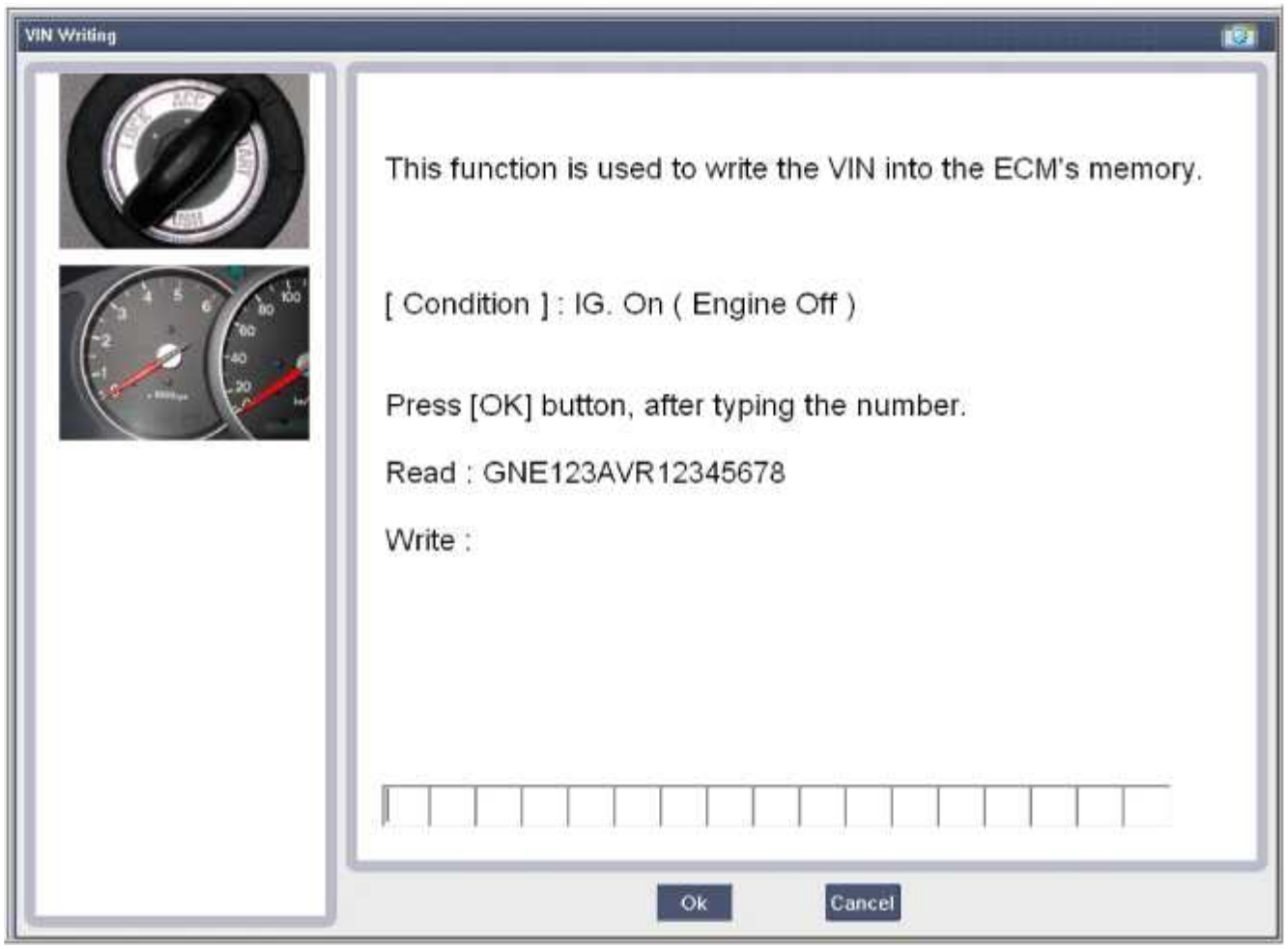
VIN Writing


VIN Writing
This function is used to write the VIN into the ECM's memory.
[Condition] : IG. On (Engine Off)
Press [OK] button
Ok
Cancel


VIN Writing
This function is used to write the VIN into the ECM's memory.
[Condition] : IG. On (Engine Off)
Press [OK] button, after typing the number.
Read : 00000000000000000
Write :
Ok
Cancel


VIN Writing
This function is used to write the VIN into the ECM's memory.
[Condition] : IG. On (Engine Off)
Press [OK] button, after typing the number.
Read : 00000000000000000
Write :
G N E 1 2 3 A V R 1 2 3 4 5 6 7 8
Ok
Cancel


VIN Writing
This function is used to write the VIN into the ECM's memory.
[Condition] : IG. On (Engine Off)
Writing success !!!
Press [OK] button.
Ok
G N E 1 2 3 A V R 1 2 3 4 5 6 7 8
Ok
Cancel


VIN Writing
This function is used to write the VIN into the ECM's memory.
[Condition] : IG. On (Engine Off)
Press [OK] button, after typing the number.
Read : GNE123AVR12345678
Write :
Ok
Cancel