

SHOP MANUAL HYUNDAI i20

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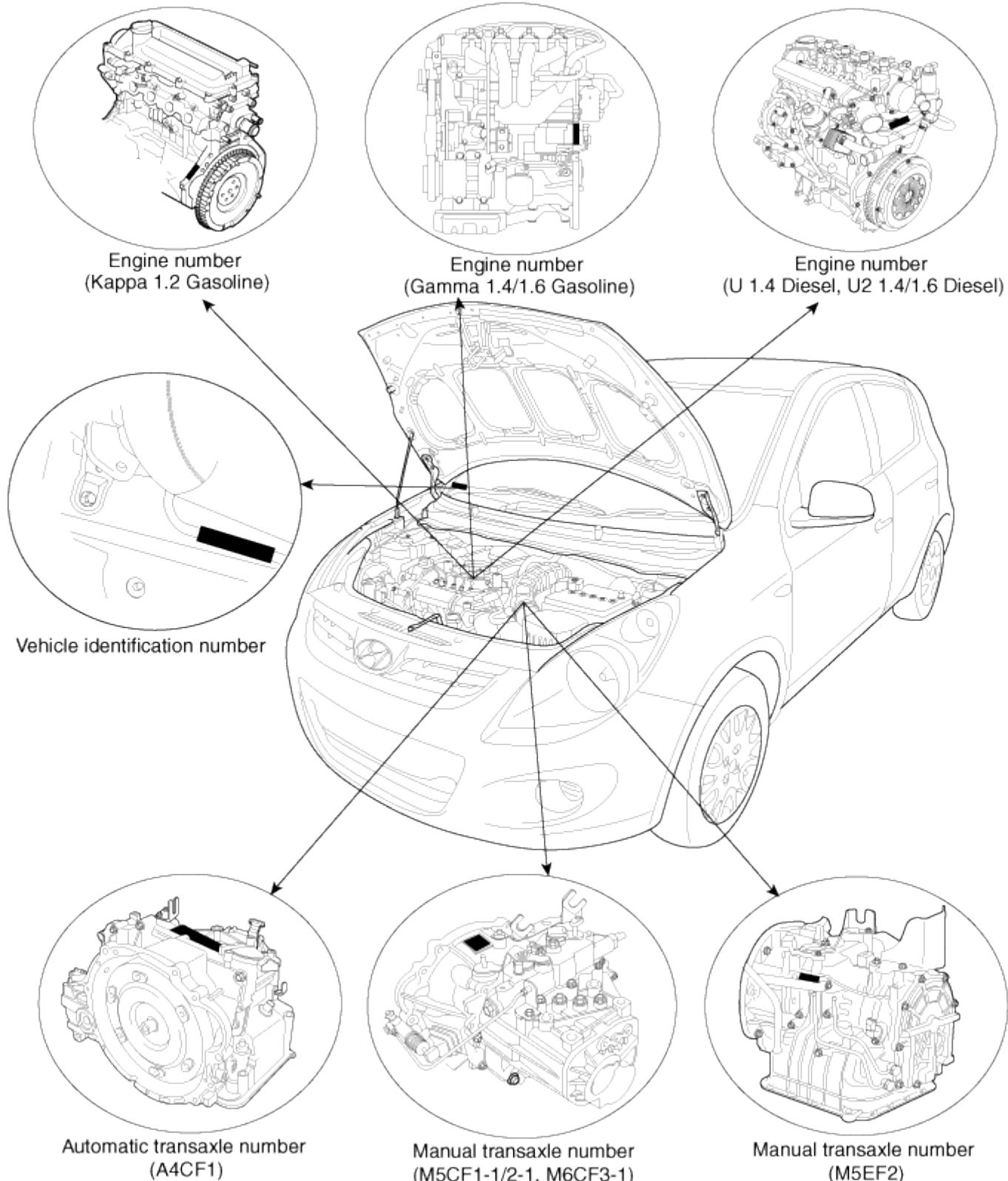
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1. General Information
1.1. General Information
1.1.1. General Information

Identification Number Locations



Identification Number Description
Vehicle Identification Number

MAL	B	A	3	1	C	A	A	M	000001
1	2	3	4	5	6	7	8	9	10

1. World Manufacturer Identifier (WMI)

- MAL :Passenger vehicle or MPV(Multipurpose Passenger Vehicle)/SUV(Sports Utility Vehicle)/RV(Recreational Vehicle)

2. Vehicle line

- B : i20

3. Model & Series

- A : Low grade (L)
- B : Middle-Low grade (GL)
- C : Middle grade (GLS, JSL, TAX)

4. Body/Cabin type, Gross Vehicle Weight Rating

- 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

5. Restraint system, Brake system

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

6. Engine type

- B : Gasoline engine 1.2
- C : Gasoline engine 1.4
- D : Gasoline engine 1.6
- R : Diesel engine 1.4 (TCI-U2)
- S : Diesel engine 1.4 (TCI-U)
- U : Diesel engine 1.6 (TCI-U2)

7. Check digit or Driver's side & Transmission

- 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

8. Production year

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

9. Plant of production

- M : Chennai (India)

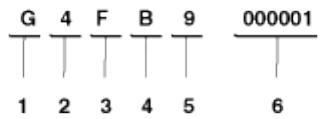
10. Vehicle production sequence number

- 000001 ~ 999999

Paint Code

Code	Color
GT	Crystal white
FR	Diamond black
FG	Sleek silver
BH	Electric red
WK	Champagne silver
TK	Electric Green
U6	Sparkle Blue
1F	Berry red
2E	Dark Gray
ZG	Ice

Engine Number



1. Engine fuel
 - G : Gasoline
 - D : Diesel
2. Engine range
 - 4 : 4 cycle 4 cylinder
- 3 - 4. Engine development order and capacity
 - LA : κ engine, 1197cc / 1248cc (Gasoline)
 - FB : U engine, 1582cc (Diesel)
 - FC : U engine, 1396cc (Diesel)
 - FA : γ engine, 1396cc (Gasoline)
 - FC : γ engine, 1591cc (Gasoline)
5. Production year
 - 9 : 2009, A : 2010, B : 2011, C : 2012, D : 2013 ...
6. Engine production sequence number
 - 000001 ~ 999999

Transaxle Number Manual



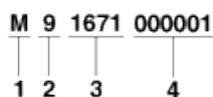
1. Model
 - T : M5CF1-1
 - V : M5CF2-1
 - W : M6CF3-1

2. Production year
- 9 : 2009, A : 2010, B : 2011, C : 2012, D : 2013 ...

3. Plant of production
- M : Chennai plant (India)

4. Gear ratio
- A : 3.471
- B : 3.833
- D : 4.059

5. Transaxle production sequence number
- 000001 ~ 999999



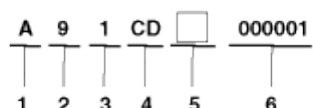
1. Model
- M : M5EF2

2. Production year
- 9 : 2009, A : 2010, B : 2011, C : 2012, D : 2013 ...

3. Gear ratio
- 1671 : 4.437
- 1569 : 4.600

4. Transaxle production sequence number
- 000001 ~ 999999

Automatic



1. Model
- E : A4CF1

2. Production year
- 9 : 2009, A : 2010, B : 2011, C : 2012, D : 2013 ...

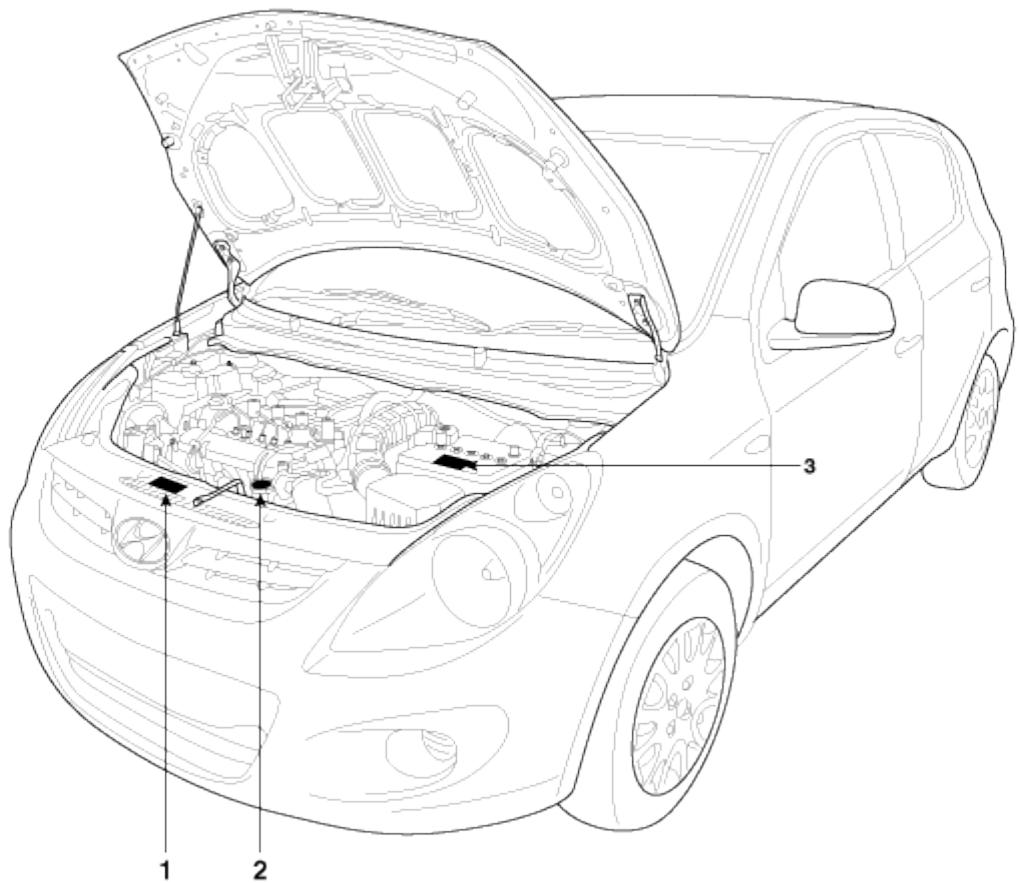
3. Gear ratio
- 1 : 4.121

4. Detailed classification
- CD : γ engine
- VU : γ engine (Slip)

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



[A]



[B]



[C]



[D]



[E]



[F]



[G]

Warning / Caution Label (Cont'd)

A.

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

B.

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

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

C.

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

D.

If any electrolyte gets into your eyes, flush your eyes with clean water for at least 15 minutes and get immediate medical attention. If possible, continue to apply water with a sponge or cloth until medical attention is received.

If electrolyte gets on your skin, thoroughly wash the contacted area. If you feel a pain or a burning sensation, get medical attention immediately.

E.

Always read the following instructions carefully when handling a battery.

F.

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

G.

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

Handling And Storage The Battery

Battery Itself	<ul style="list-style-type: none">Batteries should be stored in cool, dry (27 degrees Celsius) places and out of direct sunlight.MF batteries are tightly sealed to prevent acid leakage. However, tilting the battery to an angle of 45 degrees can cause acid to leak through the vents on the sides. Therefore, batteries should always be stored in their upright positions. Prevent placing any aqueous or solid (i.e. conductors) bodies on top of the battery.It is extremely dangerous to use tools, such as hammers, on the battery terminals when connecting cables to the mounted battery.
Battery on Vehicle	<ul style="list-style-type: none">When storing the vehicle for long periods of time, make sure to remove the memory fuse at junction box to prevent natural discharging.Also, run the engine for battery charging within 1 month if the memory fuse wasn't removed from the start of vehicle storing. If the memory fuse was removed, run the engine for battery charging within 3 months from the start of vehicle storing.

NOTE

After reconnecting or recharging a discharged battery, the ESP OFF indicator may illuminate.

In this case, turn the handle half way to the left and right whilst the ignition switch is in the ON position.

Then, restart the engine after the ignition is OFF.

The ESP OFF indicator may turn OFF.

If the ESP OFF indicator does not turn OFF, have the system checked referring to DTC. (Refer to the BR group.)

Lift And Support Points

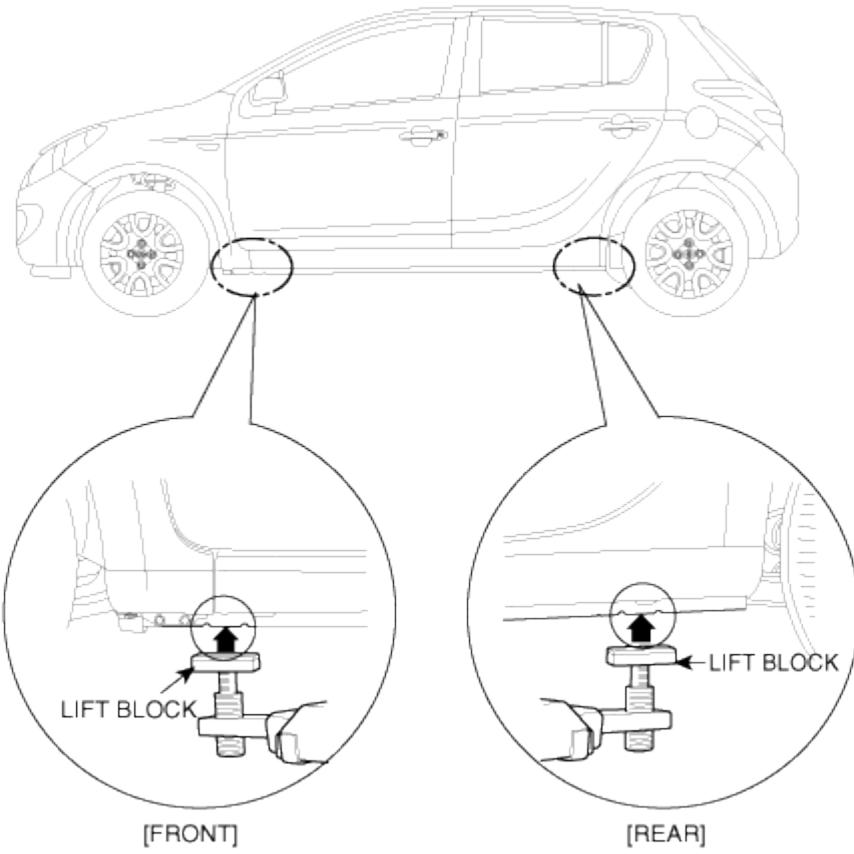
WARNING

When heavy rear components such as suspension, fuel tank, spare tire, tailgate and trunk lid are to be removed, place additional weight in the luggage area before hoisting. When 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

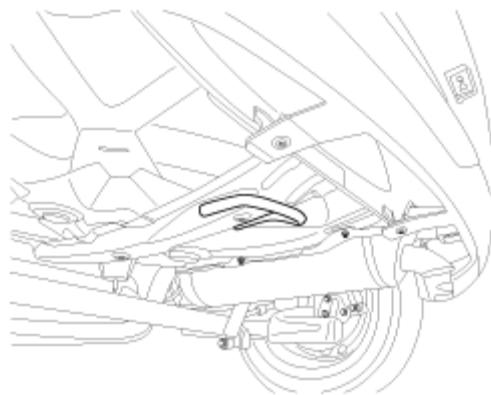
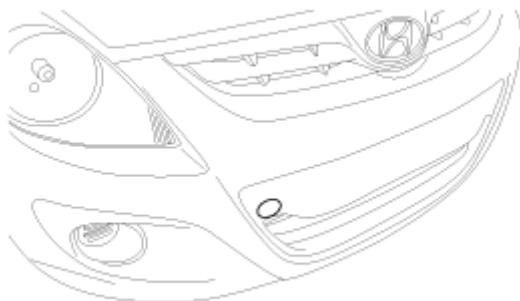
- Since each tire/wheel assembly weighs approximately 30lbs (14kg), placing the front wheels in the luggage area can assist with the weight distribution.
- Use the same support points to support the vehicle on safety stands.

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



Towing

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



Emergency Towing

There are three popular methods of towing a vehicle :

- The operator loads the vehicle on the back of truck. This is best way of transporting the vehicle.

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

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

Manual Transmission

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

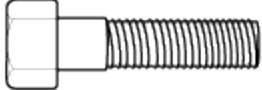
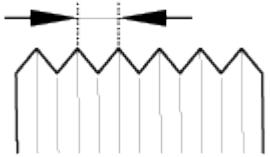
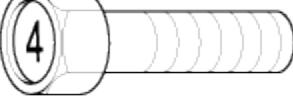
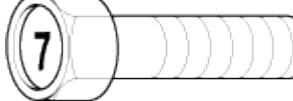
Automatic Transmission

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

CAUTION

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

Tightening Torque Table Of Standard Parts

Bolt 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 ~)	260 ~ 300 (2,600 ~ 3,000, 190 ~)

		130)	215)
M20	1.5	220 ~ 250 (2,200 ~ 2,500, 160 ~ 180)	360 ~ 420 (3,600 ~ 4,200, 260 ~ 300)
M22	1.5	290 ~ 330 (2,900 ~ 3,300, 210 ~ 240)	480 ~ 550 (4,800 ~ 5,500, 350 ~ 400)
M24	1.5	360 ~ 420 (3,600 ~ 4,200, 260 ~ 300)	610 ~ 700 (6,100 ~ 7,000, 440 ~ 505)

NOTE

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

General Service Information

Protection Of The Vehicle

Always be sure to cover fenders, seats, and floor areas before starting work.

CAUTION

The support rod must be inserted into the hole near the edge of the hood whenever you inspect the engine compartment to prevent the hood from falling and causing possible injury.

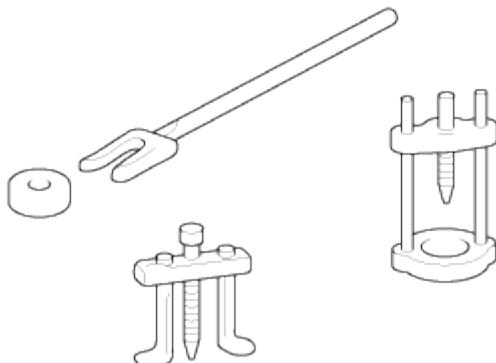
Make sure that the support rod has been released prior to closing the hood. Always check to be sure the hood is firmly latched before driving the vehicle.

Preparation Of Tools And Mesuring Equipment

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

Special Tools

Use special tools when they are required.



Removal Of Parts

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



Disassembly

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

1. Inspection of parts

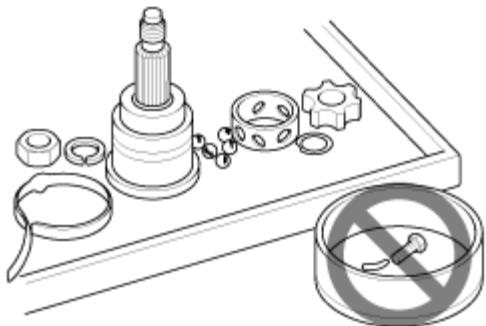
Each part, when removed, should be carefully inspected for malfunction, deformation, damage, and other problems.



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.



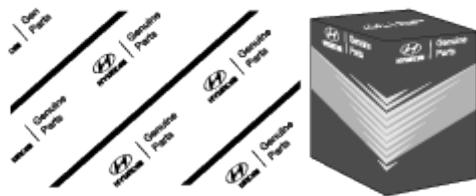
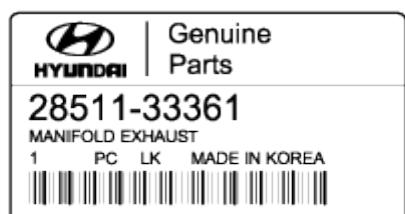
3. Cleaning parts for reuse

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



Parts

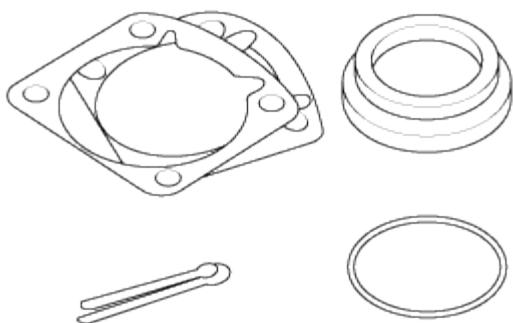
When replacing parts, use HYUNDAI genuine parts.



Replacement

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

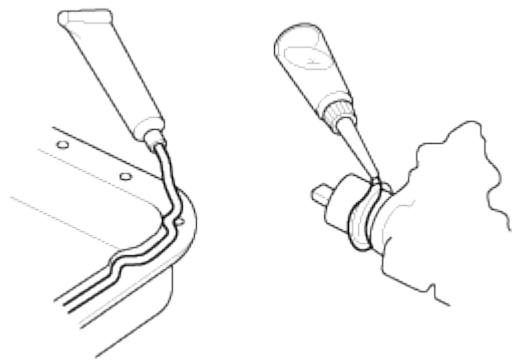
1. Oil seals
2. Gaskets
3. O-rings
4. Lock washers
5. Cotter pins (split pins)
6. Plastic nuts



Depending on their location.

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

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

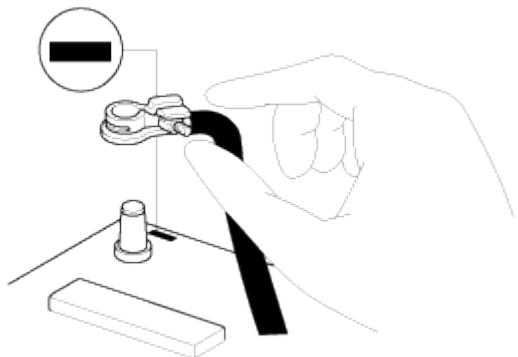


Adjustment

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

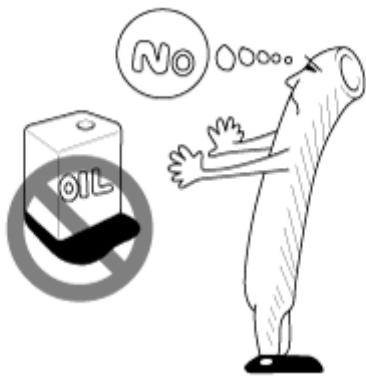
Electrical System

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



Rubber Parts And Tubes

Always prevent gasoline or from touching rubber parts or tubing.



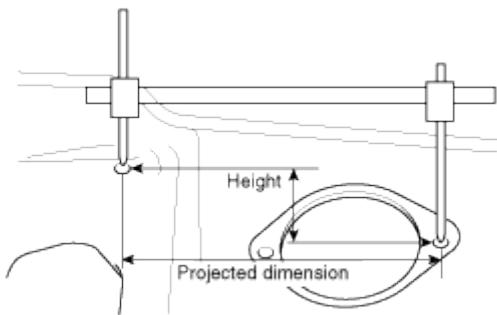
Measuring Body Dimensions

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

Dimensions Projected

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

different value in height of the two surface.

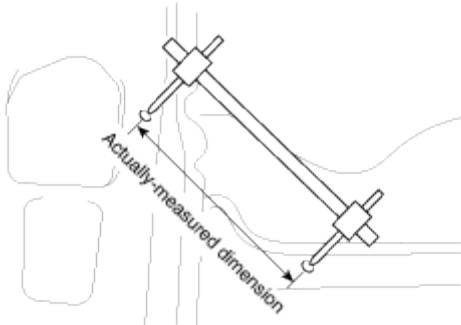


Measuring Actual Dimensions

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

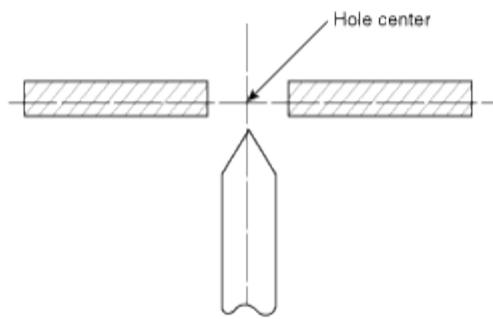
NOTE

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



Measurement Point

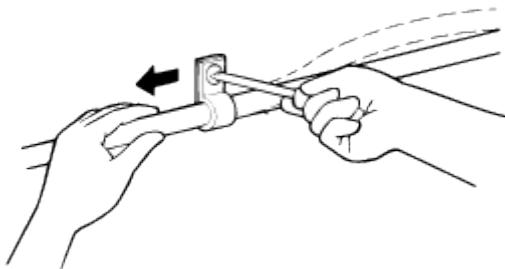
Measurements should be taken at the center of the hole.



Checking Cables And Wires

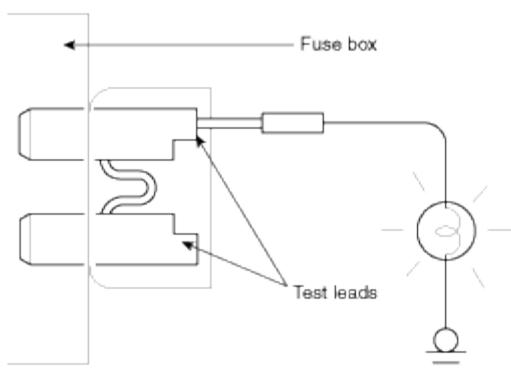
1. Check the terminal for tightness.
2. Check terminals and wires for corrosion from battery electrolyte, etc.
3. Check terminals and wires for open circuits.
4. Check wire insulation and coating for damage, cracks and degrading.
5. Check the conductive parts of terminals for contact with other metallic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

7. Check for incorrect wiring.
8. Check that the wiring is so clamped to the prevent contact with sharp corners of the vehicle body, etc. or hot parts (exhaust manifold, etc.)
9. Check that the wiring is clamped firmly to provide enough clearance from the fan pulley, fan belt and other rotating or moving parts.
10. Check that the wiring has a little space so that it can vibrate between fixed and moving parts such as the vehicle body and the engine.



Check Fuses

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

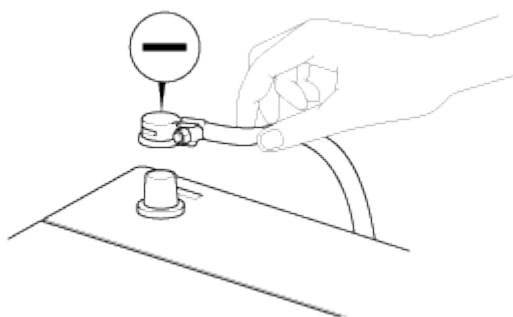


Servicing The Electrical System

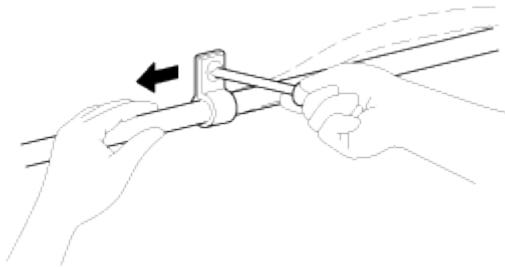
1. Prior to servicing the electrical system, be sure to turn off the ignition switch and disconnect the battery ground cable.

NOTE

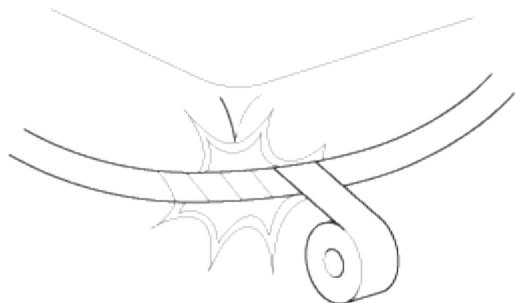
In the course of MFI or ELC system diagnosis, when the battery cable is removed, any diagnostic trouble code retained by the computer will be cleared. Therefore, if necessary, record the diagnostic data before removing the battery cable.



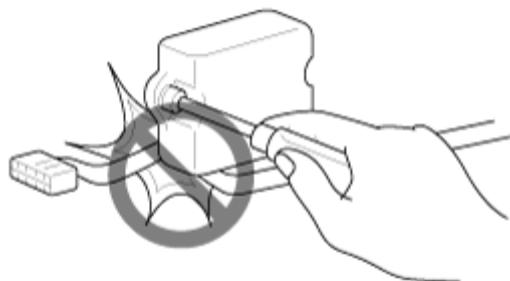
2. Attach the wiring harnesses with clamps so that there is no slack. However, for any harness which passes the engine or other vibrating parts of the vehicle, allow some slack within a range that does not allow the engine vibrations to cause the harness to come into contact with any of the surrounding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



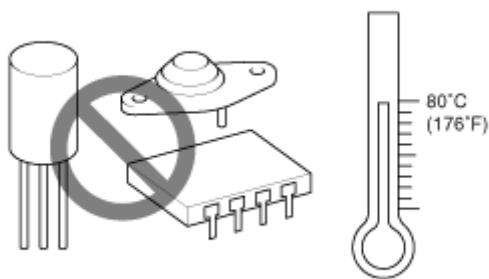
4. When installing any parts, be careful not to pinch or damage any of the wiring harness.



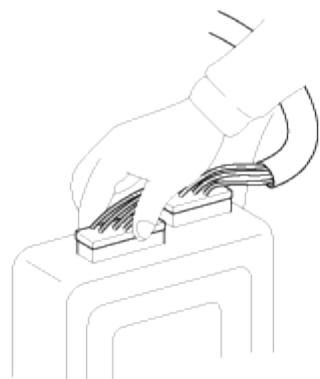
5. Never throw relays, sensors or electrical parts, or expose them to strong shock.



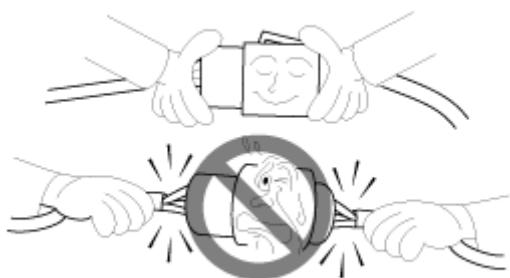
6. The electronic parts used in the computer, relays, etc. are readily damaged by heat. If there is a need for service operations that may cause the temperature to exceed 80°C (176°F), remove the electronic parts before hand.



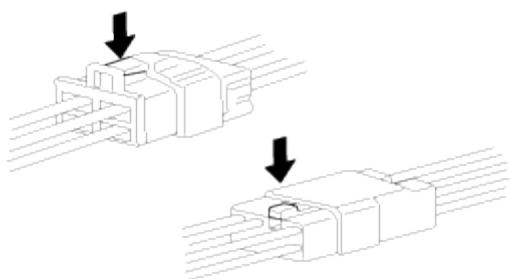
7. Loose connectors cause problems. Make sure that the connectors are always securely fastened.



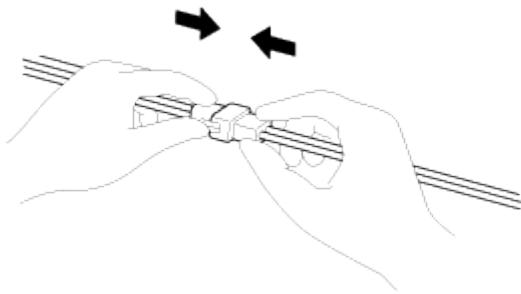
8. When disconnecting a connector, be sure to grip only the connector, not the wires.



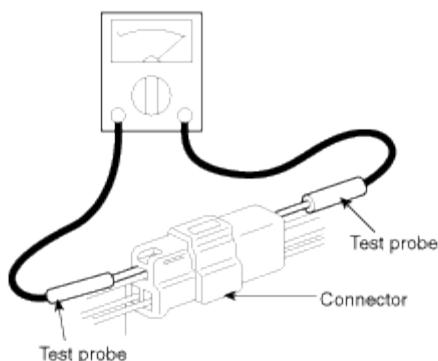
9. Disconnect connector which have catches by pressing in the direction of the arrows shown the illustration.



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



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



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

Nominal size	SAE gauge No.	Permissible current	
		In engine compartment	Other areas
0.3mm ²	AWG 22	-	5A
0.5mm ²	AWG 20	7A	13A
0.85mm ²	AWG 18	9A	17A
1.25mm ²	AWG 16	12A	22A
2.0mm ²	AWG 14	16A	30A
3.0mm ²	AWG 12	21A	40A
5.0mm ²	AWG 10	31A	54A

Precautions For Catalytic Converter

CAUTION

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

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

4. Do not dispose of used catalytic converter together with parts contaminated with gasoline or oil.

2. Heating, Ventilation, Air Conditioning

2.1. General Information 2.1.1. Specifications

Specification				
Item	Specification			
	k1.2	y1.6	u1.6	
Compressor	Type	DV9	DV12	DV12
	Oil type & Capacity	FD46XG(PAG) 120 ± 10cc		FD46XG(PAG) 120 ± 10cc
	Applicable belt type	POLY V5	POLY V6	POLY V5
	Displacement	90cc/rev	122cc/rev	122cc/rev
Condenser	Heat rejection	11,500 - 5% kcal/hr		11,000 - 5% kcal/hr
APT(A/C pressure transducer)	The method to measure the pressure	Voltage = 0.00878835 * Pressure + 0.5		
Expansion valve	Type	Block		
Refrigerant	Type	R-134a		
	Capacity [oz.(g)]	15.8 ± 0.88 (450 ± 25)		15.8 ± 0.88 (450 ± 25)

Blower unit

Item		Specification
Fresh and recirculation	Operating method	Actuator
Blower	Type	Sirocco
	Speed step	Auto + 8 speed (Automatic)
	Speed control	Power mosfet
Air filter	Type	Particle filter

Heater and evaporator unit

Item		Specification
Heater	Type	Laminate type
	Heating capacity	4,300 ± 5% kcal/hr
	Mode operating method	Actuator
	Temperature operating	Actuator

	method	
Evaporator	Temperature control type	Evaporator temperature sensor
	A/C ON/OFF [°C(°F)]	ON : 2.0 ± 0.5 (35.6 ± 32.9), OFF: 0 ± 0.5 (32 ± 32.9)

2.1.2. Troubleshooting

Problem symptoms table

Before replacing or repairing air conditioning components, first determine if the malfunction is due to the refrigerant charge, air flow or compressor.

Use the table below to help you find the cause of the problem. The numbers indicate the priority of the likely cause of the problem. Check each part in order. If necessary, replace these parts.

After correcting the malfunction, check the complete system to ensure that performance is satisfactory.

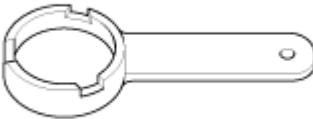
Standard:

Symptom	Suspect Area
No blower operation	1.Blower fuse 2.Blower relay 3.Blower motor 4.Power mosfet 5.Blower speed control switch 6.Wire harness
No air temperature control	1.Engine coolant capacity 2.Heater control assembly
No compressor operation	1.Refrigerant capacity 2.A/C Fuse 3.Magnetic clutch 4.Compressor 5.A/C pressure transducer 6.A/C switch 7.Evaporator temperature sensor 8.Wire harness
No cool air	1.Refrigerant capacity 2.Refrigerant pressure 3.Drive belt 4.Magnetic clutch 5.Compressor 6.A/C pressure transducer 7.Evaporator temperature sensor 8.A/C switch 9.Heater control assembly 10.Wire harness
Insufficient cooling	1.Refrigerant capacity 2.Drive belt 3.Magnetic clutch 4.Compressor 5.Condenser 6.7.8.Expansion valve 9.Evaporator 10.Refrigerant lines 11.A/C pressure transducer 12.Heater control assembly
No engine idle-up when A/C switch	1.Engine ECM

ON	2.Wire harness
No air inlet control	1. Heater control assembly
No mode control	1.Heater control assembly 2.Mode actuator
No cooling fan operation	1.Cooling fan fuse 2.Fan motor 3.Engine ECM 4.Wire harness

2.1.3. Special Service Tools

Special tools

Tool (Number and name)	Illustration	Use
09977-29000 Disc & hub assembly bolt remover		Removal and installation of disc & hub assembly

2.2. Air conditioning System

2.2.1. General Information

Instructions

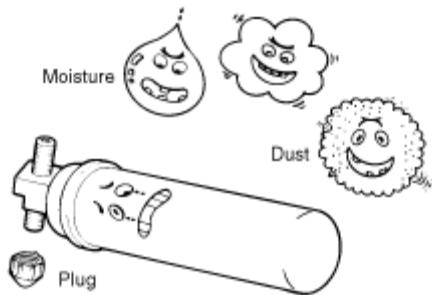
When Handling Refrigerant

1. R-134a liquid refrigerant is highly volatile. A drop on the skin of your hand could result in localized frostbite. When handling the refrigerant, be sure to wear gloves.
2. It is standard practice to wear goggles or glasses to protect your eyes, and gloves to protect your hands. If the refrigerant splashes into your eyes, wash them with clean water immediately.
3. The R-134a container is highly pressurized. Never leave it in a hot place, and check storage temperature is below 52°C (126°F)
4. An electronic leak detector should be used to check the system for refrigerant leakage. Bear in mind that the R-134a, upon coming into contact with flame, produces phosgene, a highly toxic gas.
5. Use only recommended lubricant for R-134a systems. If lubricants other than the recommended one used, system failure may occur.
6. PAG lubricant absorbs moisture from the atmosphere at a rapid rate, therefore the following precautions must be observed:
 - A. When removing refrigerant components from a vehicle, cap the components immediately to prevent entry of moisture.
 - B. When installing refrigerant components to a vehicle, do not remove the cap until just before connecting the components.
 - C. Complete the connection of all refrigerant tubes and hoses without delay to prevent the A/C system from taking on moisture.
 - D. Use the recommended lubricant from a sealed container only.
7. If an accidental discharge in the system occurs, ventilate the work area before resum of service.



When replacing parts ON A/C system

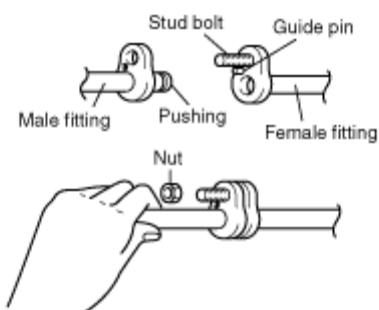
1. Never open or loosen a connection before discharging the system.
2. Seal the open fittings of components with a cap or plug immediately to prevent intrusion of moisture or dust.
3. Do not remove the sealing caps from a Replacement component until it is ready to be installed.
4. Before connecting an open fitting, always install a new sealing ring. Coat the fitting and seal with refrigerant oil before making the connection.



When Installing Connecting Parts

Flange with guide pin

Check the new O-ring for damage (use only the specified) and lubricate by using compressor oil. Tighten the nut to specified torque.



Size	Tightening torque [N.m (kg.m, lbf.ft)]	
	General bolt, nut	
	4T	7T
M6	5 - 6(0.5 - 0.6, 3.6 - 4.3)	9 - 11(0.9 - 1.1, 6.5 - 7.9)
M8	12 - 14(1.2 - 1.4, 8.7 - 10)	20 - 26(2.0 - 2.6, 14 - 18)
M10	25 - 28(2.5 - 2.8, 18 - 20)	45 - 55(4.5 - 5.5, 32 - 39)

Size	Flange bolt, nut	
	4T	7T
M6	5 - 7(0.5 - 0.7, 3.6 - 5.0)	8 - 12(0.8 - 1.2, 5.8 - 8.6)
M8	10 - 15(1.0 - 1.5, 7 - 10)	19 - 28(1.9 - 2.8, 14 - 20)
M10	21 - 31(2.1 - 3.1, 15 - 22)	39 - 60(3.9 - 6.0, 28 - 43)

NOTE

- T means tensile intensity, which is stamped on the head of bolt only numeral.

Handling tubing and fittings

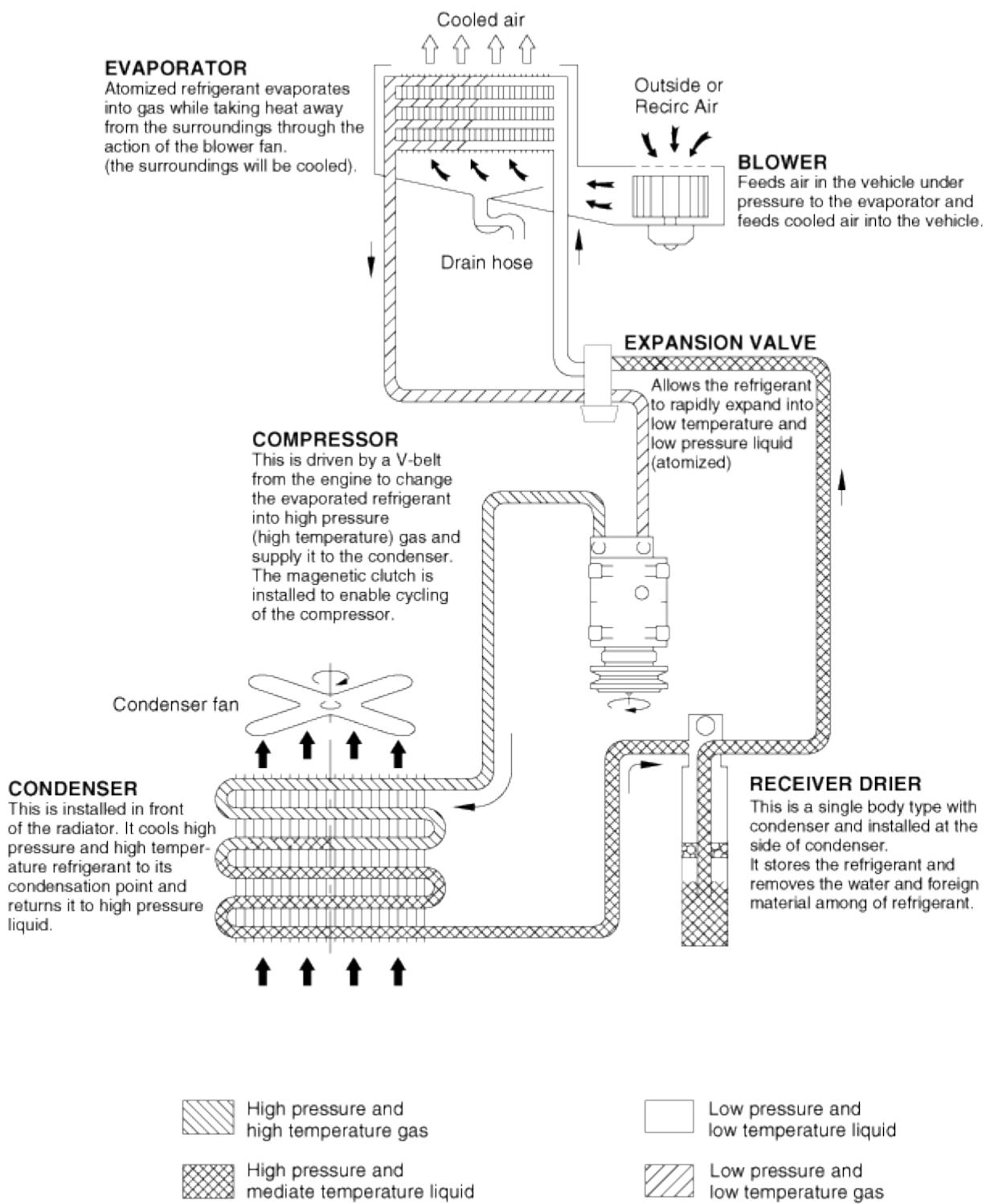
The internal parts of the refrigeration system will remain in a state of chemical stability as long as pure moisture-free refrigerant and refrigerant oil are used. Abnormal amounts of dirt, moisture or air can upset the chemical stability and cause problems or serious damage.

The Following precautions must be observed

1. When it is necessary to open the refrigeration system, have everything you will need to service the system ready so the system will not be left open any longer than necessary.
2. Cap or plug all lines and fittings as soon as they are opened to prevent the entrance of dirt and moisture.
3. All lines and components in parts stock should be capped or sealed until they are ready to be used.
4. Never attempt to rebind formed lines to fit. Use the correct line for the installation you are servicing.
5. All tools, including the refrigerant dispensing manifold, the gauge set manifold and test hoses, should be kept clean and dry.

2.2.2. Description and Operation

Refrigeration cycle



2.2.3. Repair procedures

Refrigerant system service basics

Refrigerant recovery

Use only service equipment that is U.L-listed and is certified to meet the requirements of SAE J2210 to remove HFC-134a(R-134a) from the air conditioning system.

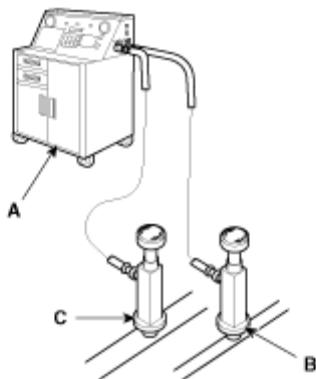
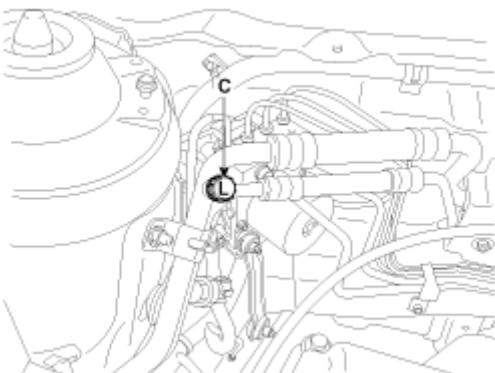
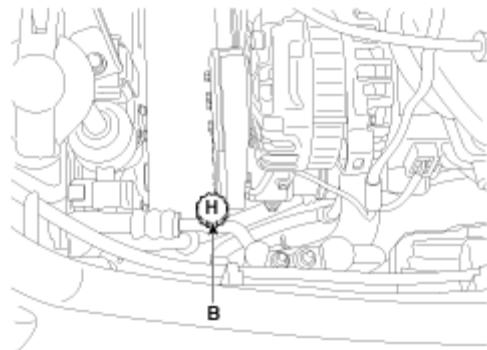
CAUTION

- Air conditioning refrigerant or lubricant vapor can irritate your eyes, nose, or throat.
- Be careful when connecting service equipment.
- Do not breathe refrigerant or vapor.

If accidental system discharge occurs, ventilate work area before resume of service.

Additional health and safety information may be obtained from the refrigerant and lubricant manufacturers.

1. Connect an R-134a refrigerant Recovery/Recycling/Charging System (A) to the high-pressure service port (B) and the low-pressure service port (C) as shown, following the equipment manufacturer's instructions.



2. Measure the amount of refrigerant oil removed from the A/C system after the recovery process is completed. Be sure to install the same amount of new refrigerant oil back into the A/C system before charging.

System evacuation

Use only service equipment that is U.L-listed and is certified to meet the requirements of SAE J2210 to remove HFC-134a(R-134a) from the air conditioning system.

CAUTION

- Air conditioning refrigerant or lubricant vapor can irritate your eyes, nose, or throat.
- Be careful when connecting service equipment.
- Do not breathe refrigerant or vapor.

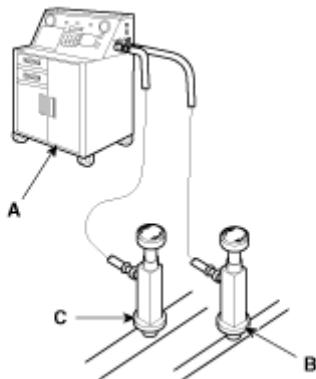
If accidental system discharge occurs, ventilate work area before resume of service.

Additional health and safety information may be obtained from the refrigerant and lubricant manufacturers.

1. When an A/C System has been opened to the atmosphere, such as during installation or repair, it must be evacuated

using an R-134a refrigerant Recovery/Recycling/Charging System. (If the system has been open for several days, the receiver/dryer should be replaced, and the system should be evacuated for several hours.)

2. Connect an R-134a refrigerant Recovery/Recycling/Charging System (A) to the high-pressure service port (B) and the low-pressure service port (C) as shown, following the equipment manufacturer's instructions.



3. If the low-pressure does not reach more than 93.3 kPa (700 mmHg, 27.6 in.Hg) in 10 minutes, there is probably a leak in the system. Partially charge the system, and check for leaks (see Leak Test.).

4. Remove the low pressure valve from the low-pressure service port.

System charging

Use only service equipment that is U.L-listed and is certified to meet the requirements of SAE J2210 to remove HFC-134a(R-134a) from the air conditioning system.

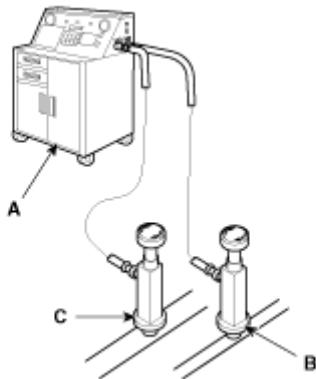
CAUTION

- Air conditioning refrigerant or lubricant vapor can irritate your eyes, nose, or throat.
- Be careful when connecting service equipment.
- Do not breathe refrigerant or vapor.

If accidental system discharge occurs, ventilate work area before resume of service.

Additional health and safety information may be obtained from the refrigerant and lubricant manufacturers.

1. Connect an R-134a refrigerant Recovery/Recycling/Charging System (A) to the high-pressure service port (B) as shown, following the equipment manufacturer's instructions.



2. Add the same amount of new refrigerant oil to system that was removed during recovery. Use only specified refrigerant oil. Charge the system with 15.8 ± 0.88 oz. (450 ± 25 g) of R-134a refrigerant. Do not overcharge the system the compressor will be damaged.

Refrigerant leak test

Always conduct a leak test with an electronic leak detector whenever leakage or refrigerant is suspected and when conducting service operations which are accompanied by disassembly or loosening or connection fittings.

NOTE

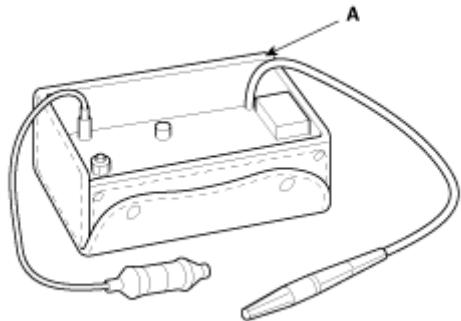
In order to use the leak detector properly, read the manual supplied by the manufacturer.

If a gas leak is detected, proceed as follows:

1. Check the torque on the connection fittings and, if too loose, tighten to the proper torque. Check for gas leakage with a

leak detector (A).

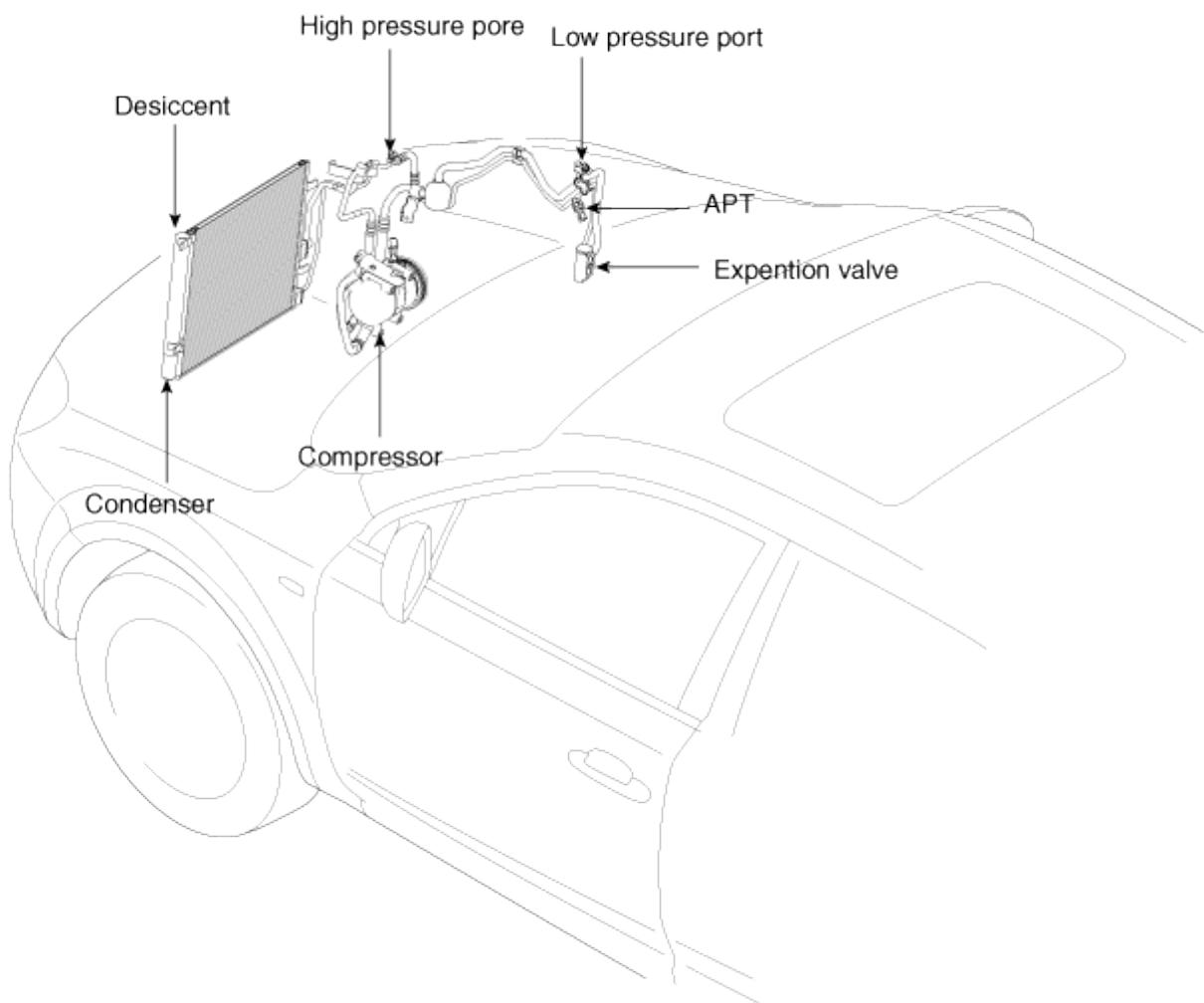
2. If leakage continues even after the fitting has been tightened, discharge the refrigerant from the system, disconnect the fittings, and check their seating faces for damage. Always replace, even if the damage is slight.
3. Check the compressor oil and add oil if required.
4. Charge the system and recheck for gas leaks. If no leaks are found, evacuate and charge the system again.



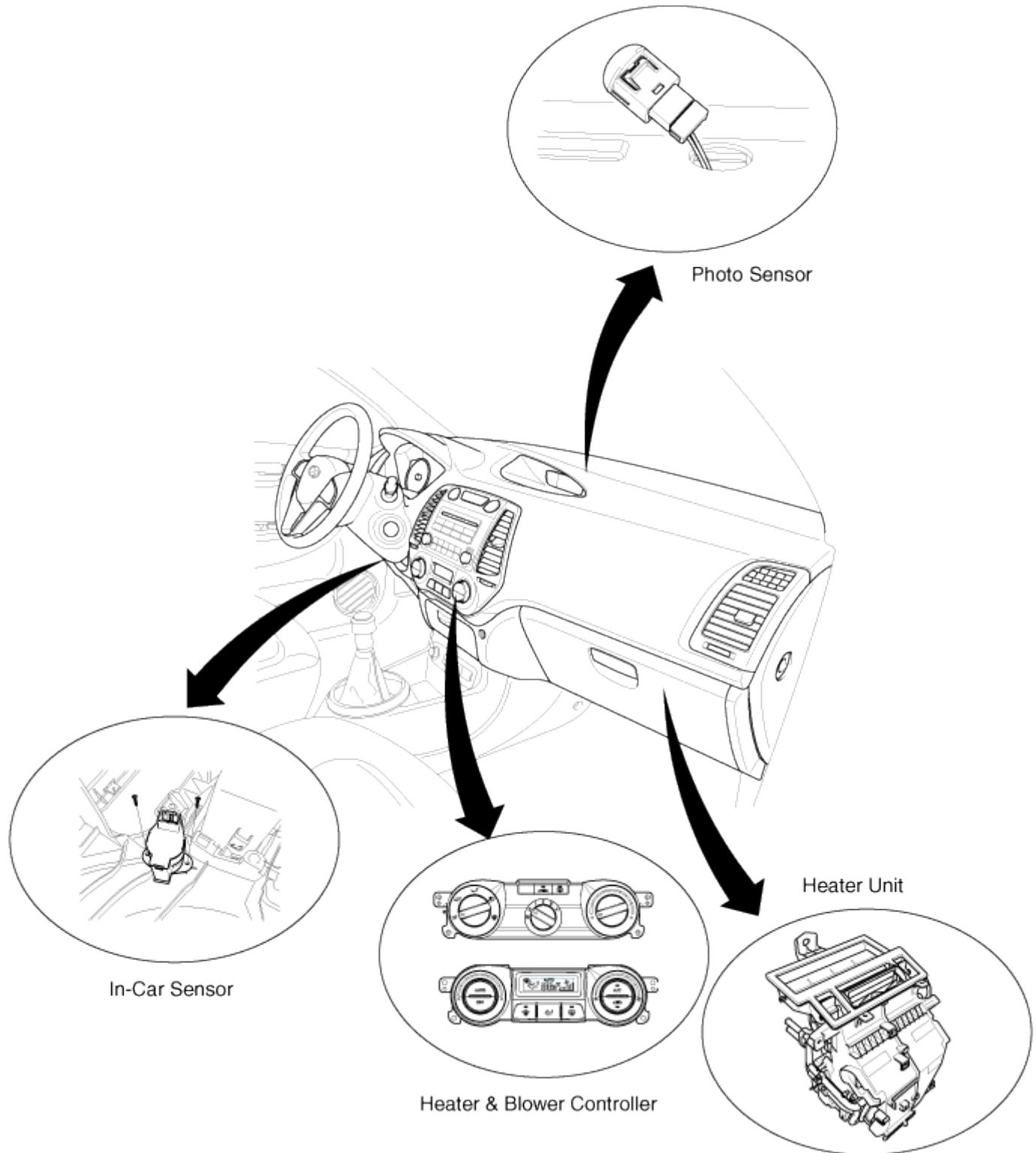
2.2.4. Component and Components Location

Component location index

Engine room



Interior



2.2.5. Compressor oil

2.2.5.1. Repair procedures

Oil Specification

1. The HFC-134a system requires synthetic (PAG) compressor oil whereas the R-12 system requires mineral compressor oil. The two oils must never be mixed.
2. Compressor (PAG) oil varies according to compressor model. Be sure to use oil specified for the model of compressor.

Handling of Oil

1. The oil should be free from moisture, dust, metal powder, etc.
2. Do not mix with other oil.
3. The water content in the oil increases when exposed to the air. After use, seal oil from air immediately. (HFC-134a Compressor Oil absorbs moisture very easily.)
4. The compressor oil must be stored in steel containers, not in plastic containers.

Compressor oil check

The oil used to lubricate the compressor is circulating with the refrigerant.

Whenever replacing any component of the system or a large amount of gas leakage occurs, add oil to maintain the original amount of oil.

Oil total volume in system : 120±10cc (4.05±0.34 fl.oz)

Oil Return Operation

There is close affinity between the oil and the refrigerant.

During normal operation, part of the oil recirculates with the refrigerant in the system. When checking the amount of oil in the system, or replacing any component of the system, the compressor must be run in advance for oil return operation.

The procedure is as follows:

1. Open all the doors and the engine hood.
2. Start the engine and air conditioning switch to "ON" and set the blower motor control knob at its highest position.
3. Run the compressor for more than 20 minutes between 800 and 1,000 rpm in order to operate the system.
4. Stop the engine.

Replacement of Component Parts

When replacing the system component parts, supply the following amount of oil to the component parts to be installed.

Component parts to be installed	Amount of Oil
Evaporator	50 cc (1.70 fl.oz)
Condenser	30 cc (1.02 fl.oz)
Receiver/dryer	30 cc (1.02 fl.oz)
Refrigerant line (One piece)	10 cc (0.34 fl.oz)

For compressor Replacement, subtract the volume of oil drained from the removed compressor from the specified volume, and drain the calculated volume of oil from the new compressor:

The specified volume - volume of removed compressor = volume to drain from the new compressor.

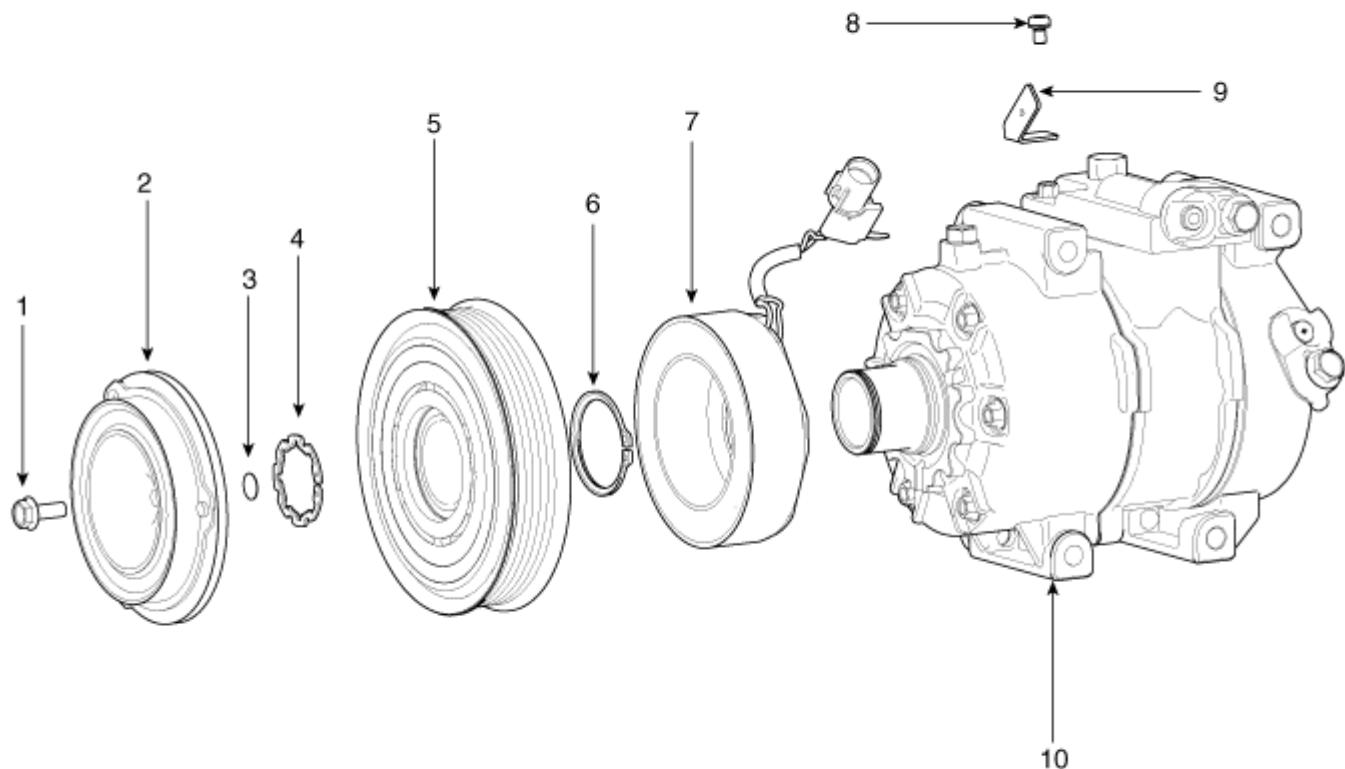
NOTE

- Even if no oil is drained from the removed compressor, don't drain more than 50cc from new compressor.

2.2.6. Compressor

2.2.6.1. Component and Components Location

Components

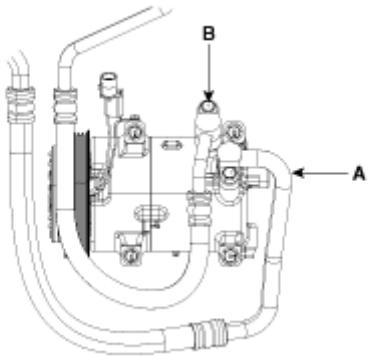


1. Bolt	6. Retainer ring
2. Disc & Hub assembly	7. Field coil
3. Shim	8. Screw
4. Retainer ring (Pulley)	9. Connector bracket
5. Pulley	10. Compressor assembly

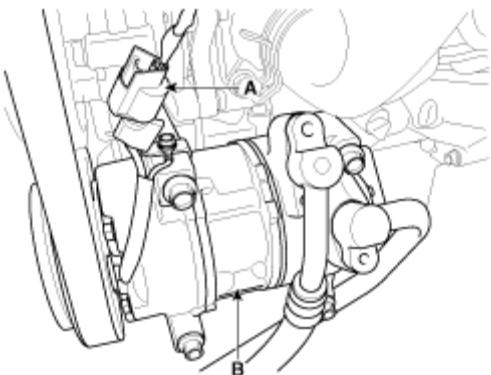
2.2.6.2. Repair procedures

Removal

1. If the compressor is marginally operable, run the engine at idle speed, and let the air conditioning work for a few minutes, then shut the engine off.
2. Disconnect the negative cable from the battery.
3. Recover the refrigerant with a recovery/charging station.
4. Loosen the drive belt.
5. Remove the bolts, then disconnect the suction line (A) and discharge line (B) from the compressor. Plug or cap the lines immediately after disconnecting them to avoid moisture and dust contamination.

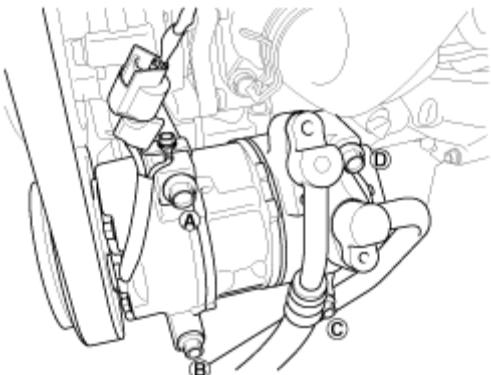


6. Disconnect the compressor clutch connector (A), and then remove 4 mounting bolts and the compressor (B).



Installation

1. Make sure of the length of compressor mounting bolts, and then tighten it A→B→C→D order.

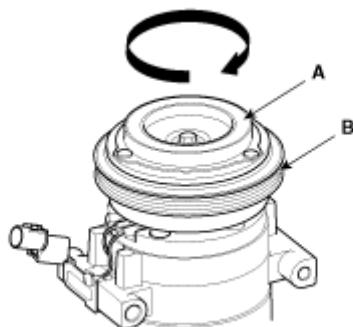


2. Install in the reverse order of removal, and note these items.

- If you're installing a new compressor, drain all the refrigerant oil from the removed compressor, and measure its volume. Subtract the volume of drained oil from 120cc(4.20 oz.) the result is the amount of oil you should drain from the new compressor (through the suction fitting).
- 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.
- To avoid contamination, do not return the oil to the container once dispensed, and never mix it with other refrigerant oils.
- Immediately after using the oil, replace the cap on the container and seal it to avoid moisture absorption.
- 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.
- Adjust the drive belt.
- Charge the system and test its performance.

Inspection

1. Check the plated parts of the disc & hub assembly (A) for color changes, peeling or other damage. If there is damage, replace the clutch set.
2. Check the pulley (B) bearing play and drag by rotating the pulley by hand. Replace the clutch set with a new one if it is noisy or has excessive play/drag.

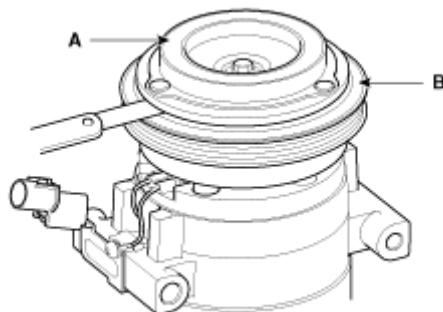


3. Measure the clearance between the pulley (B) and disc & hub assembly (A) all the way around. If the clearance is not within specified limits, remove the disc & hub assembly and add or remove shim (gap washer) as needed to increase or decrease clearance.

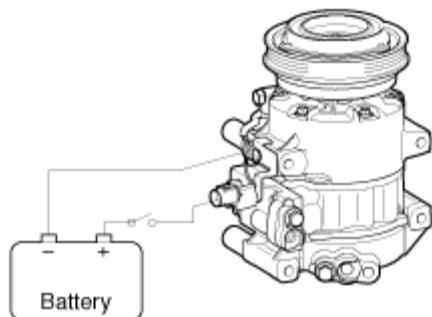
Clearance: $0.45 \pm 0.1\text{mm}$ ($0.018 \pm 0.004\text{ in.}$)

NOTE

The shims (gap washers) are available in seven thicknesses: 0.7mm, 0.8mm, 0.9mm, 1.0mm, 1.1mm, 1.2mm and 1.3mm.



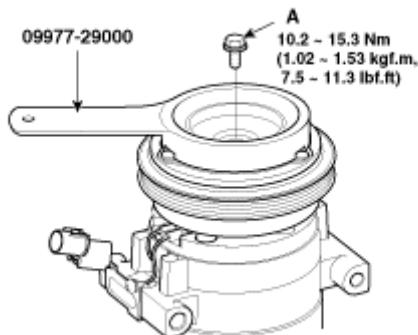
4. Check operation of the magnetic clutch. Connect the compressor side terminals to the battery (+) terminal and the ground battery (-) terminal to the compressor body. Check the magnetic clutch operating noise to determine the condition.



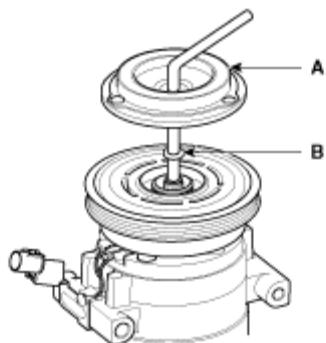
Disassembly

1. Remove the center bolt (A) while holding the disc & hub assembly with a commercially available disc & hub assembly bolt remover; Special tool number 09977-29000.

TORQUE : 10~15N.m (1.02~1.53kgf.m, 7.37~11lbf.ft)



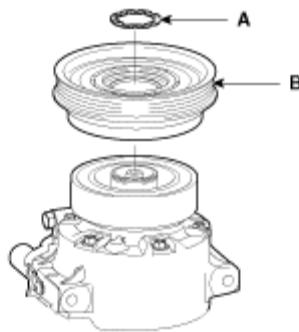
2. Remove the disc & hub assembly (A) and shim (gap washer) (B), taking care not to lose the shims. If the clutch needs adjustment, increase or decrease the number and thickness of shims as necessary, then reinstall the disc & hub assembly, and recheck its clearance.



3. If you remove the field coil, remove retainer ring (A) with retainer ring pliers.

NOTE

- Be careful not to damage the pulley (B) and compressor during removal/installation.
- Once retainer ring (A) is removed, replace it with a new one.



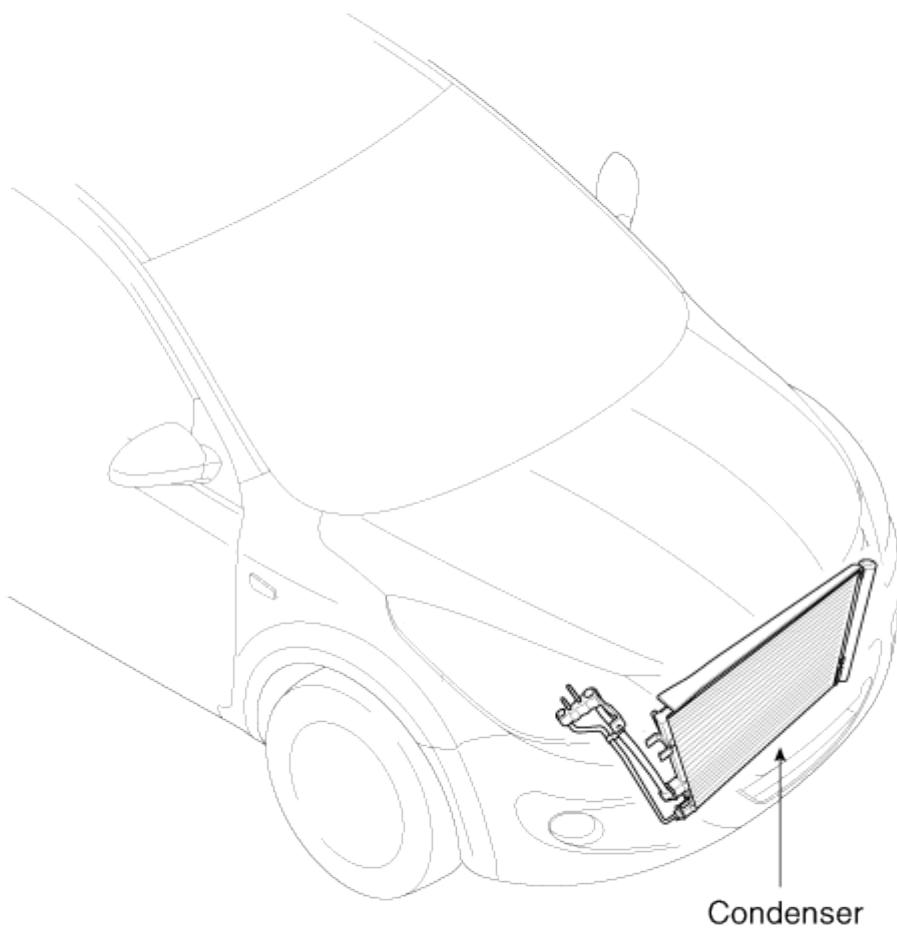
4. Reassemble the compressor clutch in the reverse order of disassembly, and note these items :

- A. Clean the pulley and compressor sliding surfaces with non-petroleum solvent.
- B. Install new retainer rings, and make sure they are fully seated in the groove.
- C. Make sure that the pulley turns smoothly after its reassembled.

2.2.7. Condenser

2.2.7.1. Component and components Location

Component location



2.2.7.2. Repair procedures

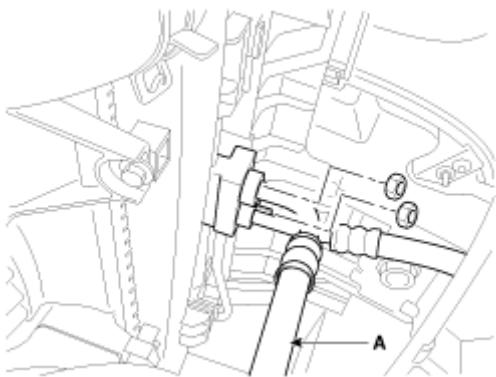
Inspection

1. Check the condenser fins for clogging and damage. If clogged, clean them with water, and blow them with compressed air. If bent, gently bend them using a screwdriver or pliers.
2. Check the condenser connections for leakage, and repair or replace it, if required.

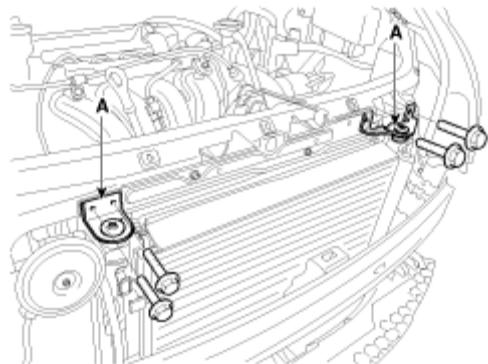
Replacement

Condenser Assembly

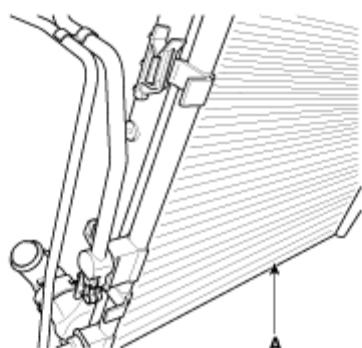
1. Recover the refrigerant with a recovery/ recycling/ charging station .
2. Disconnect the negative (-) battery terminal.
3. Remove the radiator. (Refer to BD group-front bumper)
4. Disconnect the refrigerant line(A).



5. Remove the radiator mount bracket (A).



6. Remove the condenser (A) by lifting it up. Be careful not to damage the radiator and condenser fins when removing the condenser.

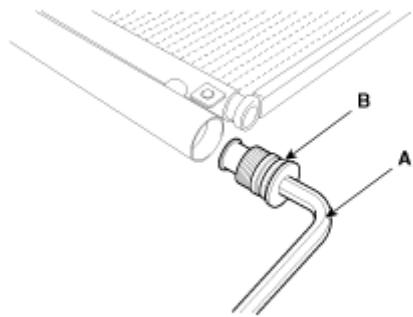


7. Install in the reverse order of removal, and note these items :

- A. If you're installing a new condenser, add refrigerant oil ND-OIL8.
- B. Replace the O-rings with new ones at each fitting, and apply a thin coat of refrigerant oil before installing them. Be sure to use the right O-rings for R-134a to avoid leakage.
- C. Be careful not to damage the radiator and condenser fins when installing the condenser.
- D. Be sure to install the lower mount cushions of condenser securely into the holes.
- E. Charge the system, and test its performance.

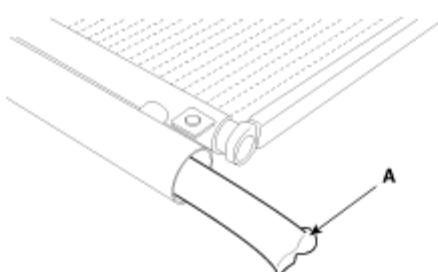
Desiccant Replacement

1. Remove the condenser, and then remove the bottom cap (B) with L wrench (A) from the condenser.



TORQUE : 20~25N.m (2.0~2.5kgf•m, 14.5~18.2lb-ft)

2. Remove the desiccant (A) from condenser using a long nose plier. Check for crumbled desiccant and clogged bottom cap filter.



3. Apply air conditioning compressor oil along the O-rings and threads of the new bottom cap.
4. Insert the new desiccant into the receiver drier tank. The desiccant must be sealed in vacuum before it is exposed to air for use.
5. Install the new bottom cap to the condenser.

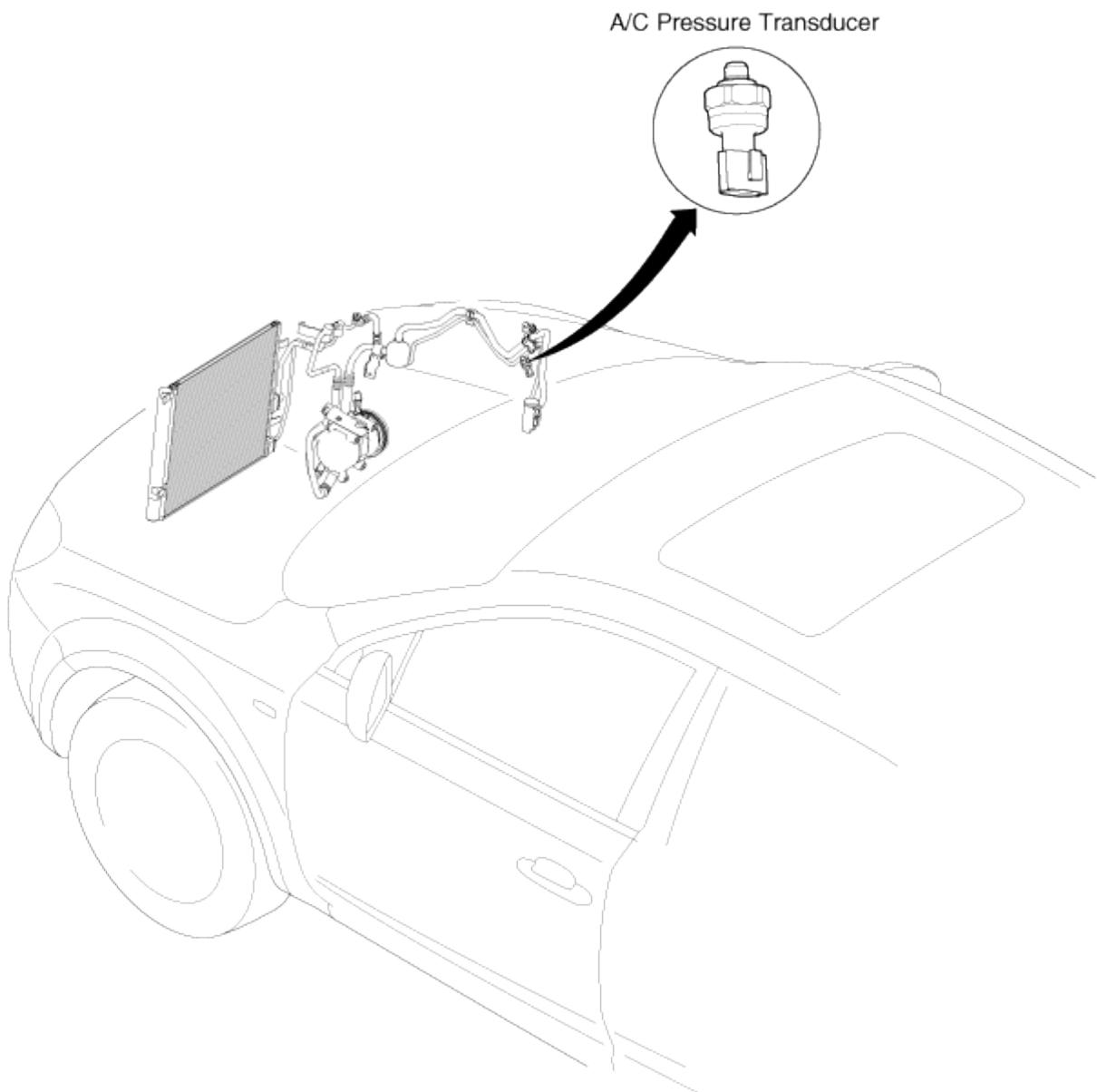
NOTE

- Always replace the desiccant and bottom cap at the same time.
- Replace the O-rings with new ones at each fitting, and apply a thin coat of refrigerant oil before installing them. Be sure to use the right O-rings for R-134a to avoid leakage.
- Be careful not to damage the radiator and condenser fins when installing the condenser.
- Be sure to install the lower mount cushions of condenser securely into the holes.
- Charge the system, and test its performance.

2.2.8. A/C pressure transducer

2.2.8.1. Component and Components Location

Component Location



2.2.8.2. Description and Operation

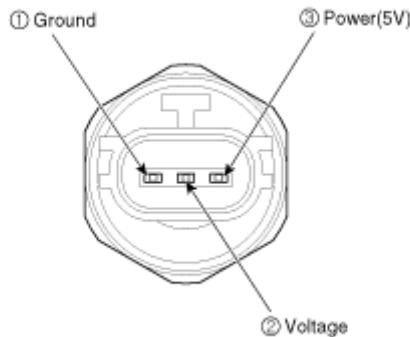
Description

A/C pressure transducer convert the pressure value of high pressure line into voltage value after measure. By converted voltage value, engine ECU controls cooling fan by operating high speed or low speed. Engine ECU stop the operation of compressor when the temperature of refrigerant line is too high or too low irregularly to optimize air conditioning system.

2.2.8.3. Repair procedures

Inspection

1. Measure the pressure of high pressure line by voltage output between NO.1 and NO.2 terminals



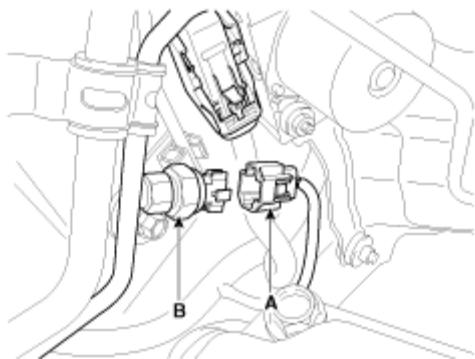
2. Inspect the voltage value whether it is sufficient to be regular value or not.

$$\text{Voltage} = 0.00878835 * \text{Pressure} + 0.37081095 \text{ [PSIA]}$$

3. If the measured voltage value is not specification, replace the A/C pressure transducer.

Replacement

1. Disconnect the negative (-) battery terminal.
2. Recover the refrigerant with a recovery/charging station.
3. Disconnect A/C pressure transducer connector (3P) (A).
4. Remove the A/C pressure transducer(B).



CAUTION

- Take care that liquid & suction pipe are not bent.

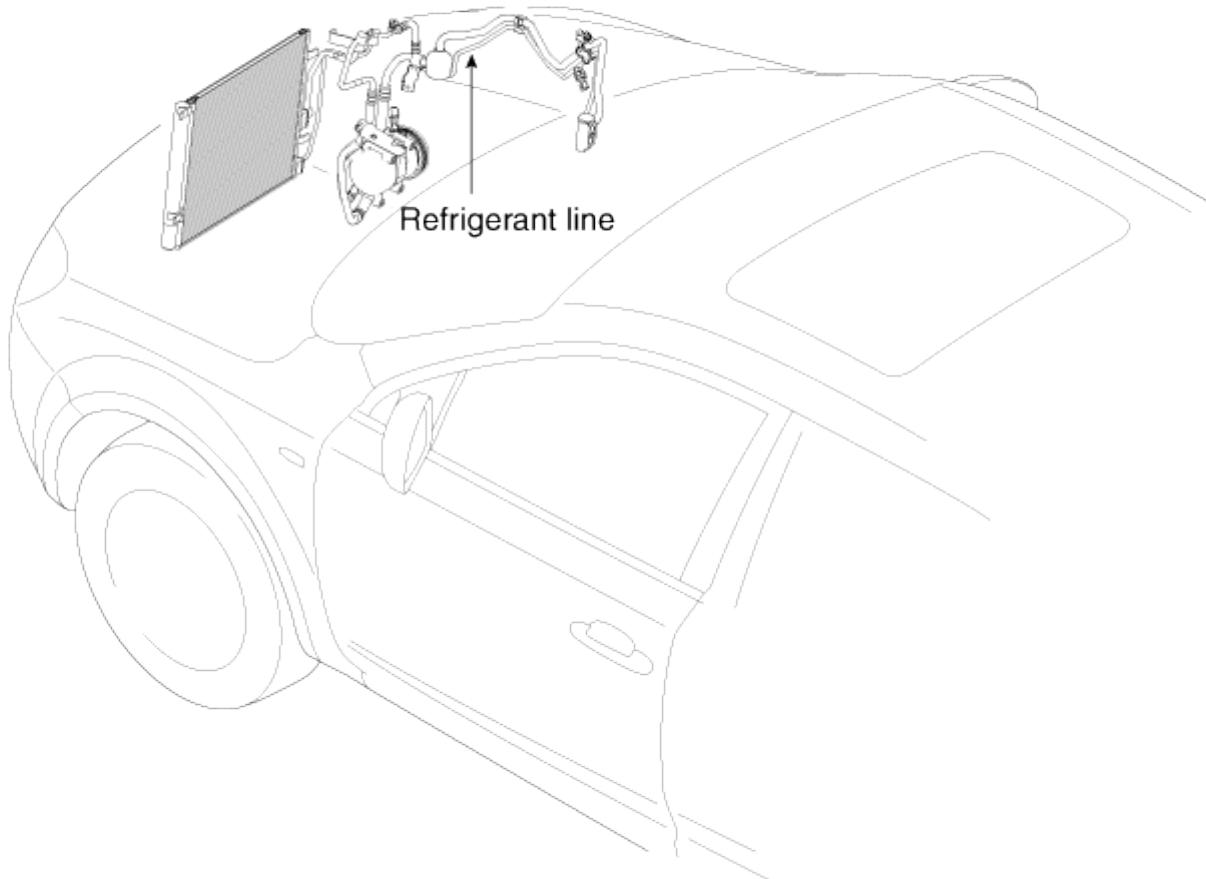
5. Installation is the reverse order of removal.

TORQUE : 10~12N.m (1.0~1.2kgf.m, 7.4~8.8lbf.ft)

2.2.9. Refrigerant line

2.2.9.1. Component and Components Location

Component location



2.2.9.2. Repair procedures

Replacement

1. Discharge refrigerant from refrigeration system .
2. Replace faulty tube or hose.

CAUTION

- Cap the open fittings immediately to keep moisture or dirt out of the system.

3. Tighten joint of bolt or nut to specified torque

CAUTION

- Connections should not be torque tighter than the specified torque.

Part tightened	N.m	Kgf.m	Ibf.ft
Condenser - Discharge hose	8 ~ 12	0.8~1.2	5.8 ~ 8.7
Condenser - Liquid tube			

Compressor - Discharge hose			
Compressor - Suction hose			
Expansion valve - Evaporator			

4. Evacuate air in refrigeration system and charge system with refrigerant.

Specified amount: $450 \pm 25\text{g}$ ($15.8 \pm 0.88\text{ oz.}$)

5. Inspect for leakage of refrigerant.

Using a gas leak detector, check for leakage of refrigerant .

6. Inspect A/C operation.

2.2.10. Evaporator temperature sensor

2.2.10.1. 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.

2.2.10.2. Repair procedures

Inspection

1. Ignition "OFF"
2. Disconnect evaporator temperature sensor.
3. Using the multi-tester, Measure resistance between terminal "1" and "2" of evaporator temperature sensor.

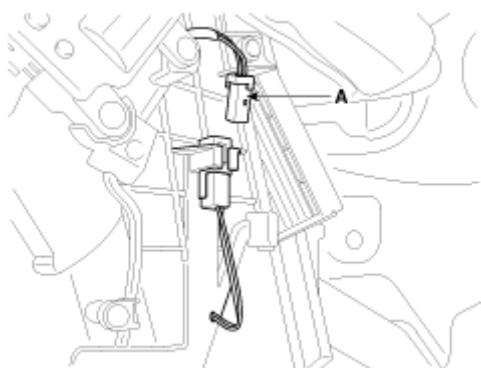
Specification

Evaporator core temperature[°C(°F)]	Resistance[KΩ]	Voltage[V]
-10(14)	17.93	3.21
0(32)	11.36	2.66
10(50)	7.4	2.13
20(68)	4.94	1.66
30(86)	3.37	1.26
40(104)	2.35	0.95
50(122)	1.67	0.72

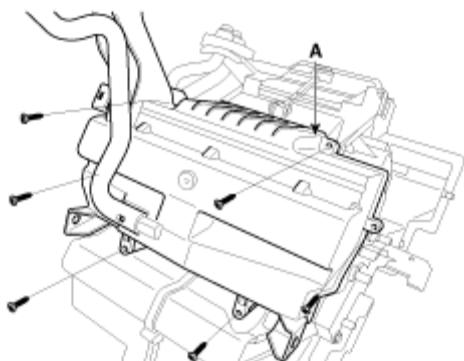
4. If the measured resistance is not specification, substitute with a known-good evaporator temperature sensor and check for proper operation.
5. If the problem is corrected, replace the evaporator temperature sensor.

Replacement

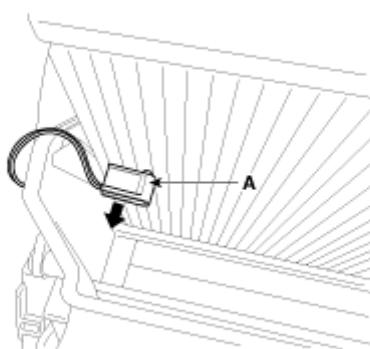
1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad. (refer to BD group-crash pad)
3. Remove the heater unit.
4. Disconnect the evaporator sensor connector (A).



5. Remove the heater unit lower cover (A).



6. Disconnect the evaporator sensor (A).



CAUTION

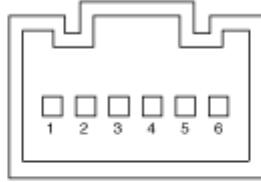
- Take care that evaporator core pins are not bent.

7. Installation is the reverse order of removal.

2.2.11. In-car sensor 2.2.11.1. Description and Operation

Description

1. In-car air temperature sensor is located at the center facia lower panel.
2. The sensor contains a thermistor which measures the temperature of the inside. The signal decided by the resistance value which changes in accordance with perceived inside temperature, is delivered to heater control unit and according to this signal the control unit regulates incar temperature to intended value.



- 1. Motor (-)
- 2. Sensor ground (-)
- 3. -
- 4. In-car sensor temp. signal
- 5. -
- 6. IGN 2 (Motor (+))

2.2.11.2. Repair procedures

Inspection

1. Ignition "ON"
2. Blow air with changing temperature to the in car sensor air inlet. Measure sensor resistance between 2 and 4 terminals.

Specification

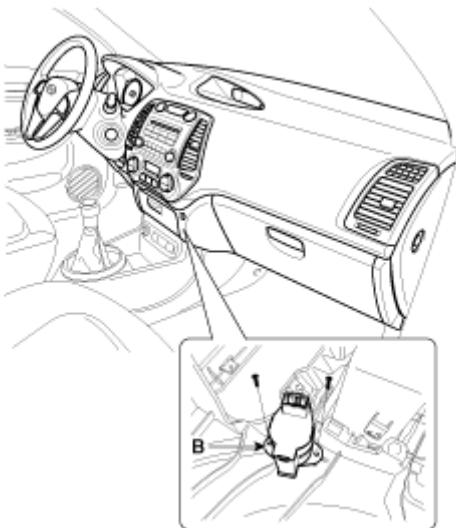
Temperature [°C(°F)]	Resistance between terminals 2and 4 (kΩ)
-20(-4)	285.61
-10 (14)	164.65
0 (32)	97.71
10 (50)	59.67
20(68)	37.48
30(86)	24.17
40(104)	15.98
50(122)	10.81

NOTE

In car sensor is negative type thermistor that resistance will rise with lower temperature, and reduce with higher temperature.

Replacement

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad.
3. Disconnect the connector of in-car sensor. Loosen the mounting 2 screws and then remove the in-car sensor (B).



4. Installation is the reverse order of removal.

2.2.12. Photo sensor

2.2.12.1. Description and Operation

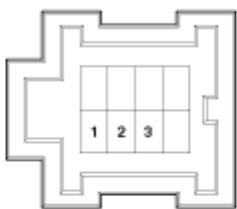
Description

1. The photo sensor is located at the center of defrost nozzle.
2. The photo sensor contains a photovoltaic (sensitive to sunlight) diode. The solar radiation received by its light receiving portion, generates an electromotive force in proportion to the amount of radiation received which is transferred to the automatic temperature control module so that the solar radiation compensation will be performed.

2.2.11.2. Repair procedures

Inspection

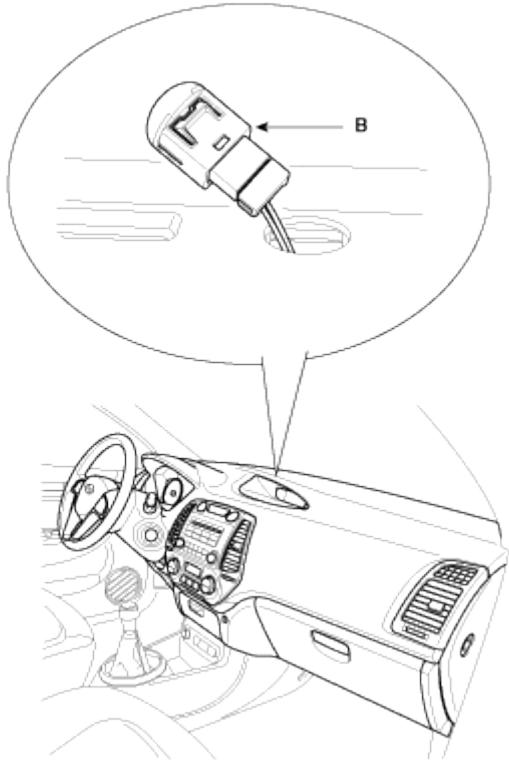
1. Ignition "ON"
2. Using the scan tool.
3. Emit intensive light toward photo sensor using a lamp, and check the output voltage change.
4. The voltage will rise with higher intensive light and reduce with lower intensive light.



1. Sensor REF (+5V)
2. Photo Sensor (-) Right
3. Photo Sensor (-) Left

Replacement

1. Disconnect the negative (-) battery terminal.
2. With the (-) driver, remove the photo sensor (B) from the center of defrost nozzle.



2.2.13. Ambient sensor

2.2.13.1. 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 temperatures.
- 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.

2.2.13.2. Repair procedures

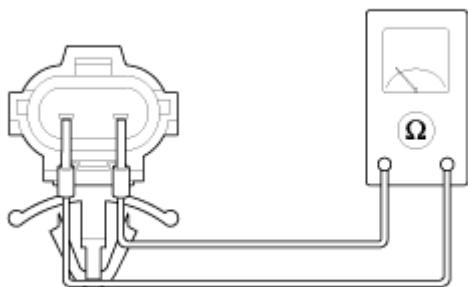
Inspection

- Ignition "OFF"
- Disconnect ambient temperature sensor.
- Check the resistance of ambient temperature sensor between terminals 1 and 2 whether it is changed by changing of the ambient temperature.

Specification

Ambient temperature [°C(°F)]	Resistance between terminals 1 and 2 (kΩ)
-30 (-22)	507
-20 (-4)	284.5

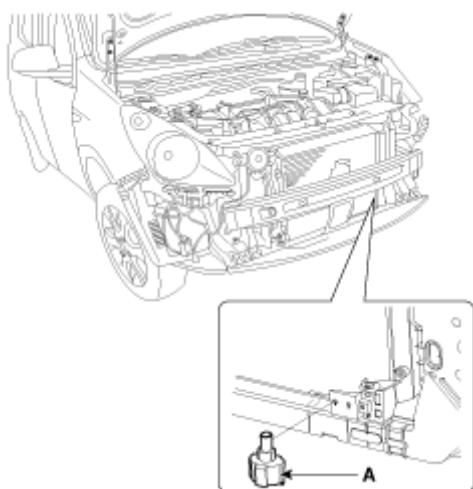
-10 (14)	164.2
0 (32)	97.5
10 (50)	59.6
20 (68)	37.46
30 (86)	24.18
40 (104)	16
50 (122)	10.83
60 (140)	7.48



4. If the measured resistance is not specification, substitute with a known-good ambient temperature sensor and check for proper operation.
5. If the problem is corrected, replace the ambient temperature sensor.

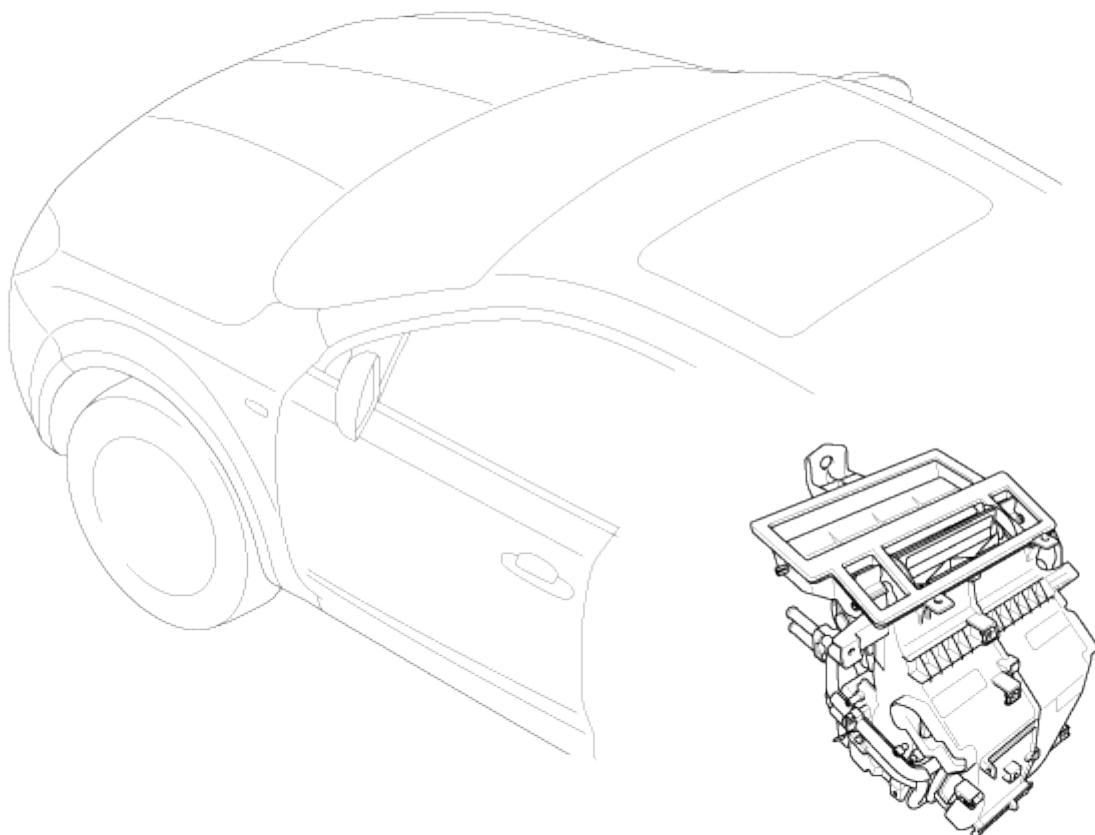
Replacement

1. Disconnect the negative (-) battery terminal.
2. Remove the front bumper. (Refer to BD group-Front bumper)
3. Remove the ambient temperature sensor (A).



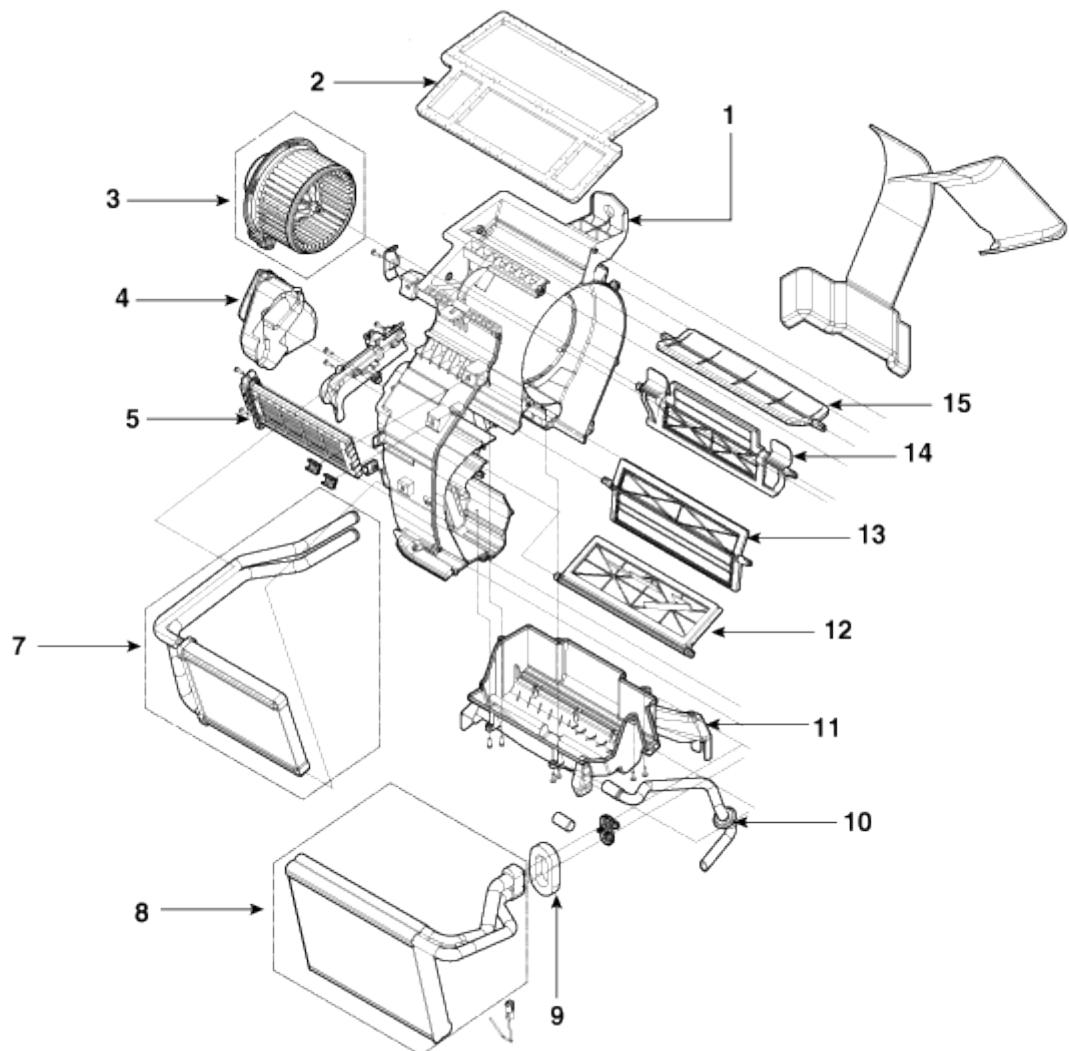
2.3. Heater 2.3.1. Heater unit 2.3.1.1. Component and Components Location

Component Location



Heater unit

Compoment



1. Heater case (LH)

2. Duct seal

3. Blower motor

4. Shower duct

5. PTC

6. Heater core cover

7. Heater core

8. Evaporator core

9. Flange seal

10. Drain hose

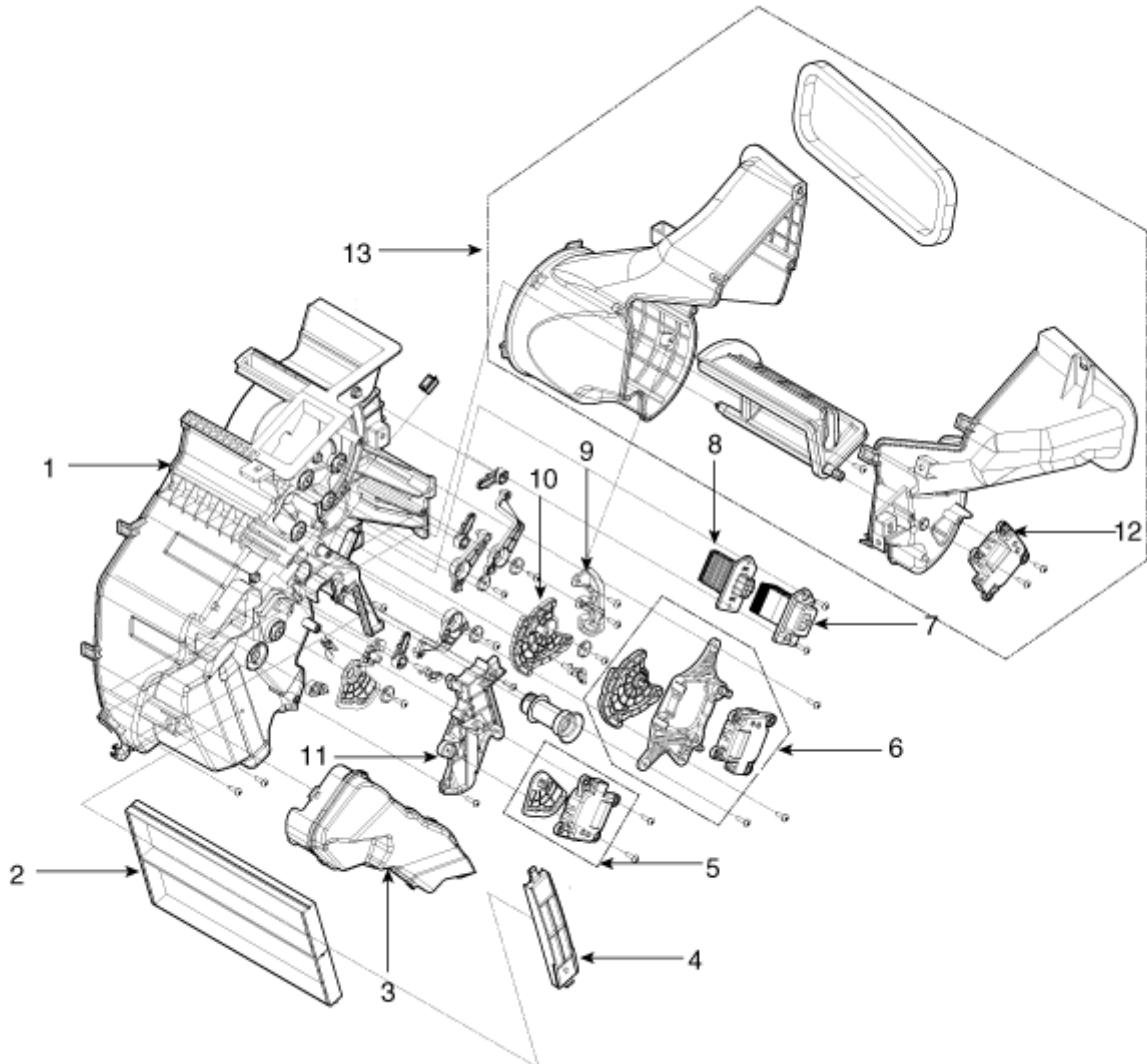
11. Lower case

12. Mix door

13. Foot door

14. Vent door

15. Def door

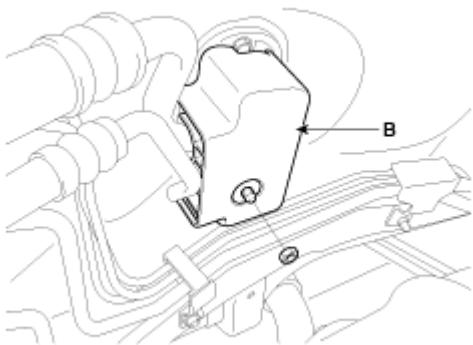


1. Heater case (RH)	5. Temp actuator	9. Evaporator flange clip
2. Climate control air filter	6. Mode actuator	10. Main mode lever
3. Shower duct	7. Power mosfet	11. Evaporator core cover
4. Cover	8. Blower resistor	12. Intake actuator
		13. Intake duct assembly

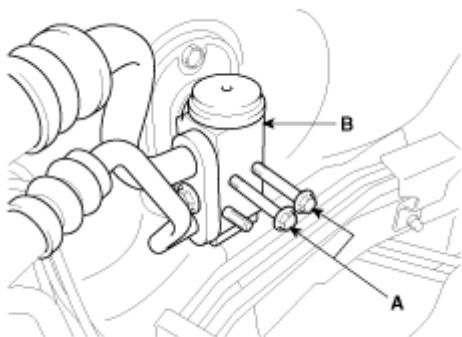
2.3.1.2. Repair procedures

Replacement

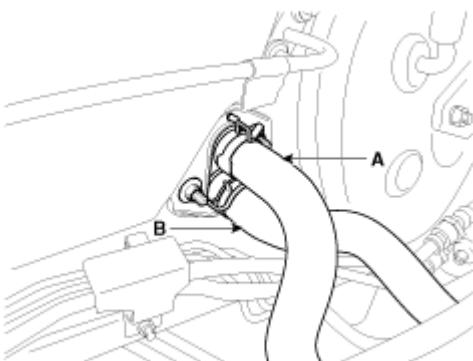
1. Disconnect the negative (-) battery terminal.
2. Recover the refrigerant with a recovery/ recycling/ charging station.
3. When the engine is cool, drain the engine coolant from the radiator.
4. Remove the expansion valve cover (B).



5. Remove the bolts (A) and the expansion valve (B) from the evaporator core.
Plug or cap the lines immediately after disconnecting them to avoid moisture and dust contamination.



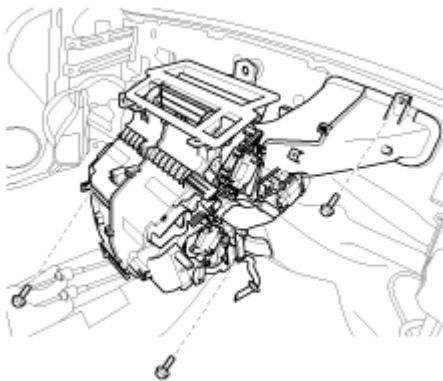
6. Disconnect the inlet (A) and outlet (B) heater hoses from the heater unit.



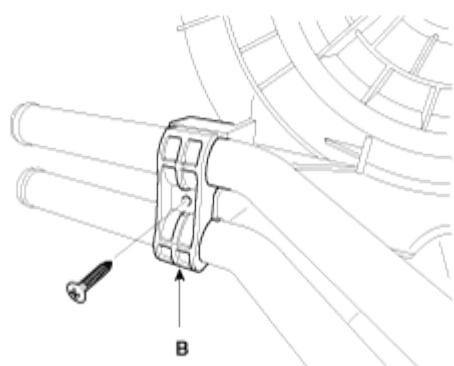
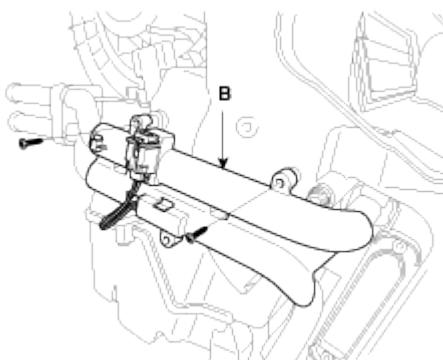
CAUTION

- Engine coolant will spill when the hoses are disconnected; drain it into a clean drip pan. Be sure not to let coolant spill on electrical parts or painted surfaces. If any coolant spills, rinse it off immediately.

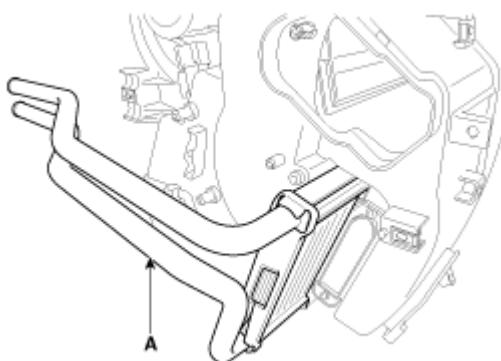
7. Remove the crash pad (Refer to BD group-Crash pad).
8. Remove the cowl cross bar assembly. (Refer to BD group-Crash pad)
9. Remove the heater & blower unit (A) after loosening mounting bolts.



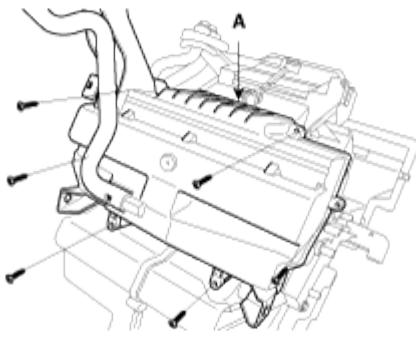
10. Remove the heater core cover (B) after remove the cover (A).



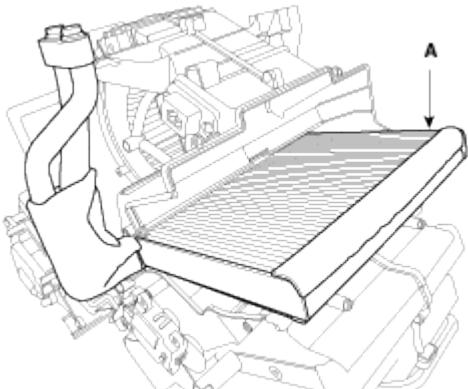
11. Be careful that the inlet and outlet pipe are not bent during heater core (A) removal, and pull out the heater core.



12. Remove the heater unit lower case (A).



13. Remove the evaporator core (A).



14. Be careful that the inlet and outlet pipe are not bent during heater core removal, and pull out the heater core.

15. Install the heater core in the reverse order of removal.

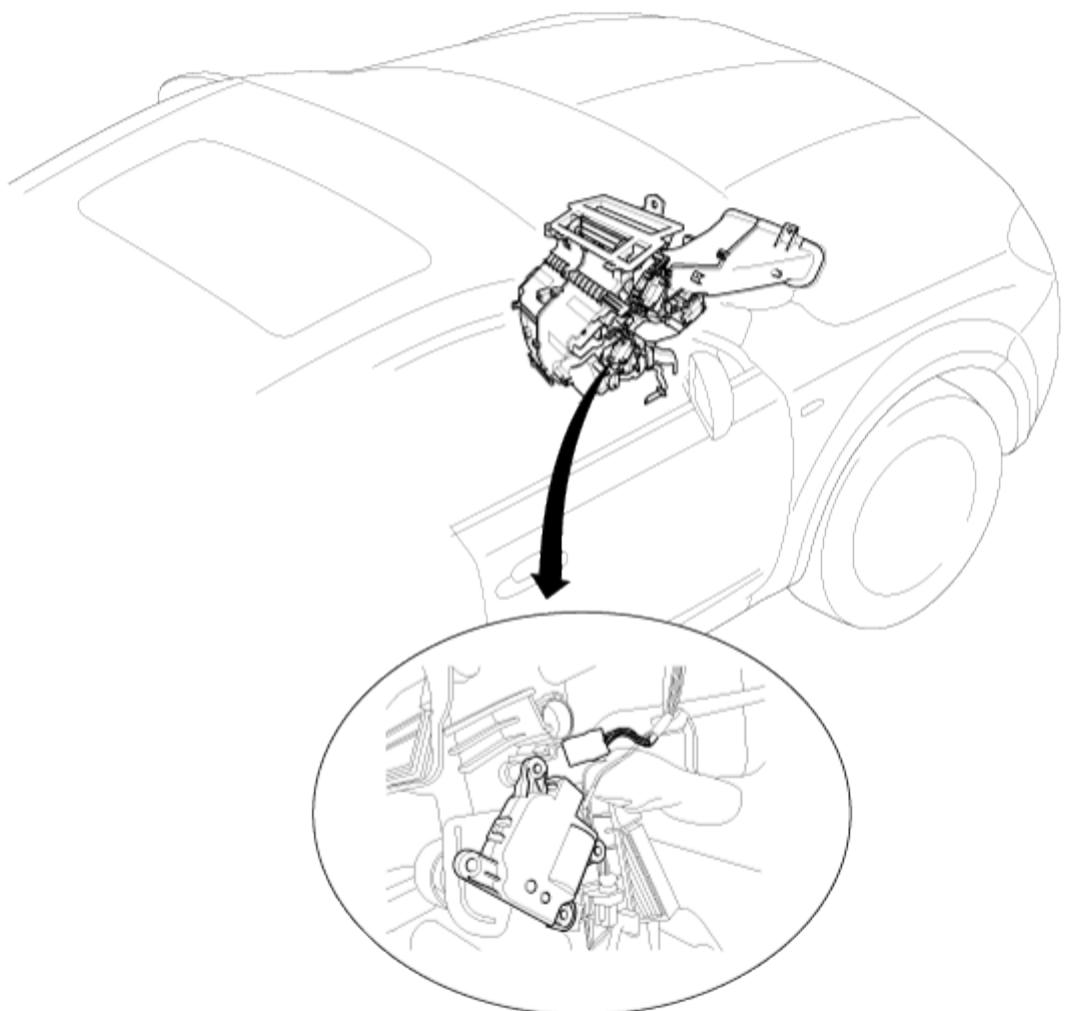
16. Installation is the reverse order of removal, and note these items :

- A. If you're installing a new evaporator, add refrigerant oil (ND-OIL8).
- B. Replace the O-rings with new ones at each fitting, and apply a thin coat of refrigerant oil before installing. Be sure to use the right O-rings for R-134a to avoid leakage.
- C. Immediately after using the oil, replace the cap on the container, and seal it to avoid moisture absorption.
- D. Do not spill the refrigerant oil on the vehicle ; it may damage paint ; if the refrigerant oil contacts the paint, wash off immediately.
- E. Apply sealant to the grommets.
- F. Make sure that there is no air leakage.
- G. Charge the system and test its performance.
- H. Do not interchange the inlet and outlet heater hoses and install the hose clamps securely.
- I. Refill the cooling system with engine coolant.

2.3.2. Temperature Control Actuator

2.3.2.1. Component and Components Location

Component Location



Temperature Control Actuator

2.3.2.2. Description and Operation

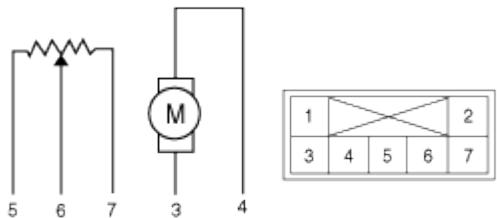
Description

1. Heater unit includes mode control actuator and temperature control actuator.
2. Temperature control actuator is located at the heater unit. It regulates the temperature by the procedure as follows. Signal from control unit adjusts position of temperature door by operating temperature switch and then temperature will be regulated by the hot/cold air ratio decided by position of temperature door

2.3.2.3. Repair procedures

Inspection

1. Ignition "OFF"
2. Disconnect the connector of temperature control actuator.
3. Verify that the temperature control actuator operates to the hot position when connecting 12V to the terminal 3 and grounding terminal 4.
Verify that the temperature control actuator operates to the cool position when connecting in the reverse.



1. - 5. 5V (VCC)
 2. - 6. Feedback signal
 3. Cool position 7. Sensor ground
 4. Hot position

4. Check the voltage between terminals 6 and 7.

Specification

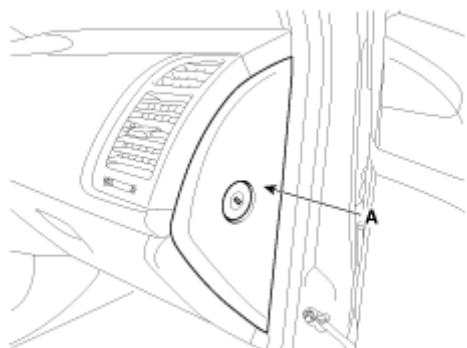
Door position	Voltage (6-7)	Error detecting
Max. cooling	$0.4 \pm 0.15V$	Low voltage :0.1V or less
Max. heating	$4.6 \pm 0.15V$	High voltage :4.9V or more

* It will feedback current position of actuator to controls.

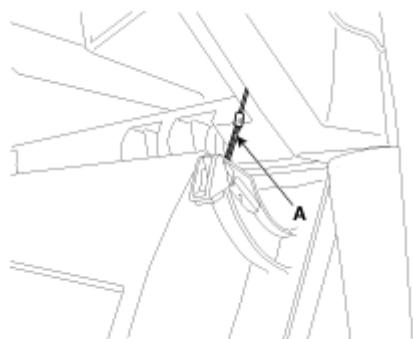
5. If the measured voltage is not specification, substitute with a known-good temperature control actuator and check for proper operation.
 6. If the problem is corrected, replace the temperature control actuator.

Replacement

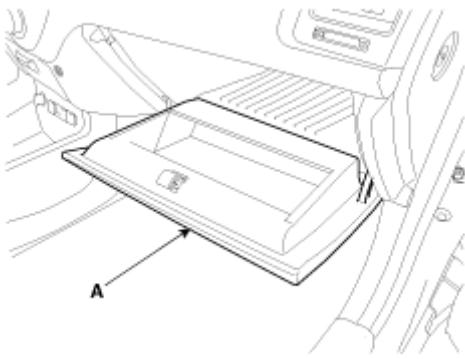
1. Disconnect the negative (-) battery terminal.
 2. Remove the crash pad side cover (A).



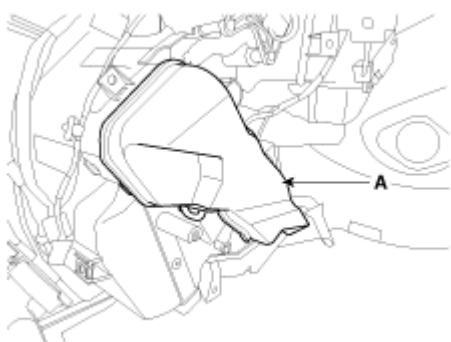
3. Disconnect the glove box wire (A).



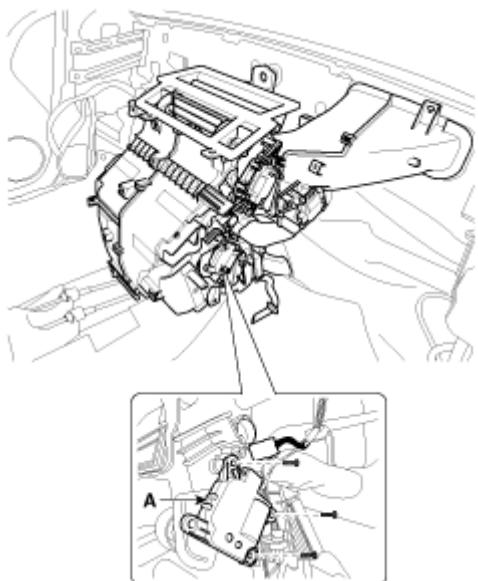
4. After loosening the mounting screws, then remove the glove box housing (A).



5. Remove the shower duct (A).



6. Loosen the mounting screw and then remove the temperature control actuator (B).

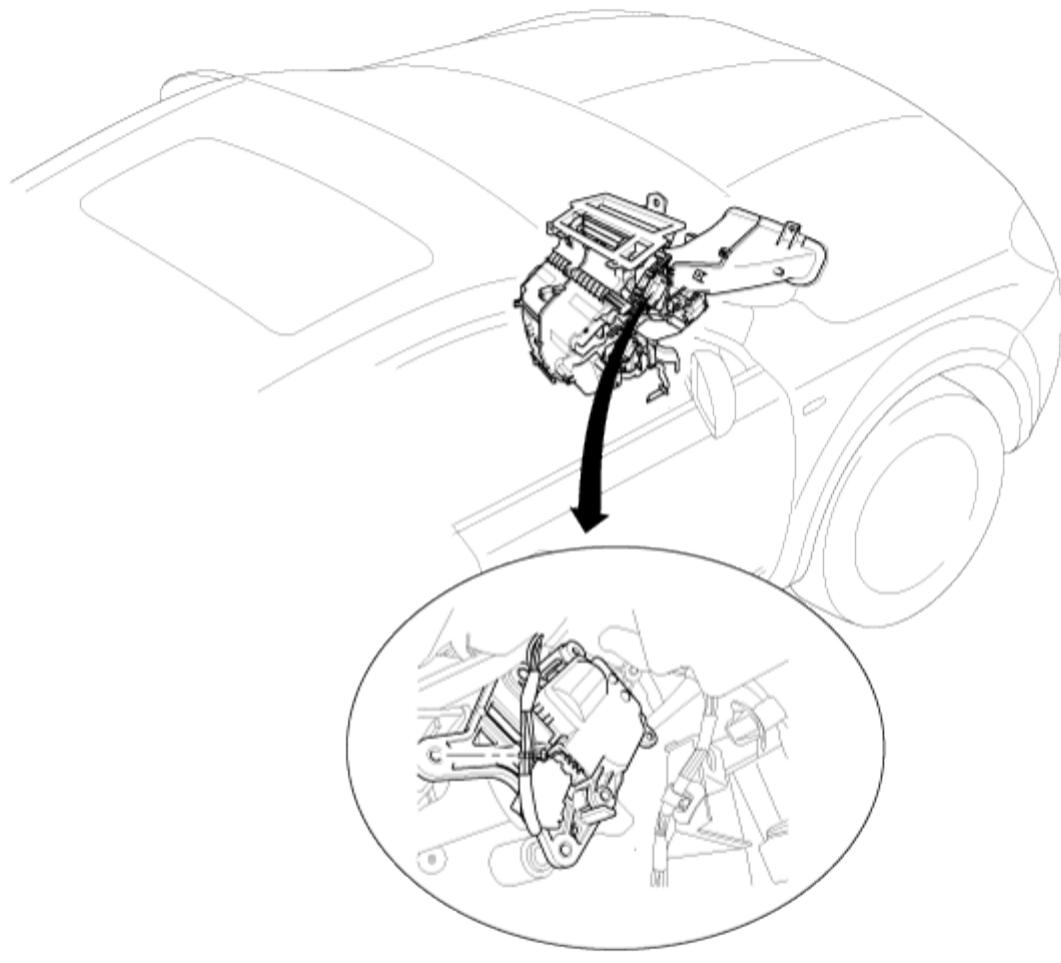


7. Installation is the reverse order of removal.

2.3.3. Mode Control Actuator

2.3.3.1. Component and Components Location

Component Location



Mode Control Actuator

2.3.3.2. Description and Operation

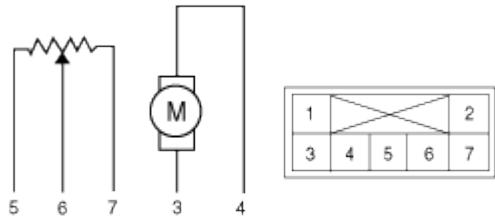
Description

The mode control actuator is located at the heater unit. It adjusts position of mode door by operating mode control actuator based on signal of A/C control unit. Pressing mode select switch makes the mode control actuator shift in order of vent→ B/L → floor → mix.

2.3.3.3. Repair procedures

Inspection

1. Ignition "OFF"
2. Disconnect the connector of mode control actuator.
3. Verify that the mode control actuator operates to the defrost mode when connecting 12V to the terminal 3 and grounding terminal 4.
4. Verify that the mode control actuator operates to the vent mode when connecting in the reverse.



1. -
2. -
3. Defrost mode
4. Vent mode
5. Sensor ground
6. Feedback signal
7. 5V (Vcc)

5. Check the voltage between terminals 5 and 6.

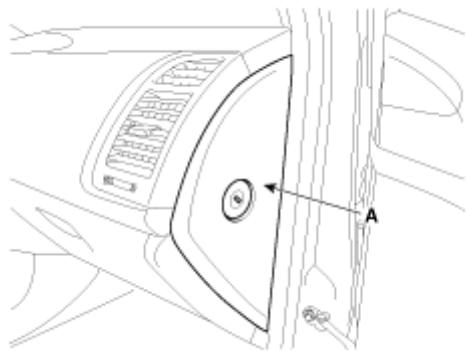
Door position	Voltage (5-6)	Error detecting
Vent	$0.4 \pm 0.15V$	Low voltage :0.1V or less
Defrost	$4.6 \pm 0.15V$	High voltage :4.9V or more

* It will feedback current position of actuator to controls.

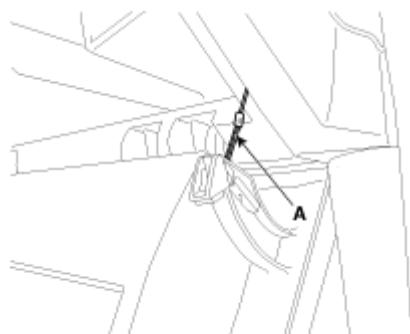
6. If the measured voltage is not specification, substitute with a known-good console temp control actuator and check for proper operation.
7. If the problem is corrected, replace the console temp control actuator.

Replacement

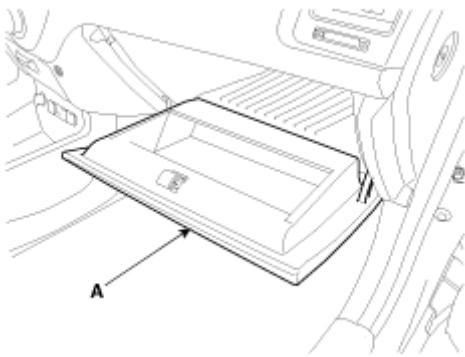
1. Remove the crash pad side cover (A).



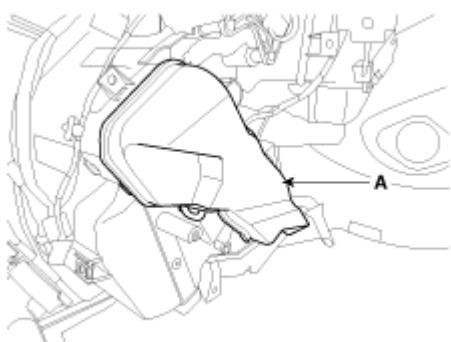
2. Disconnect the glove box wire (A).



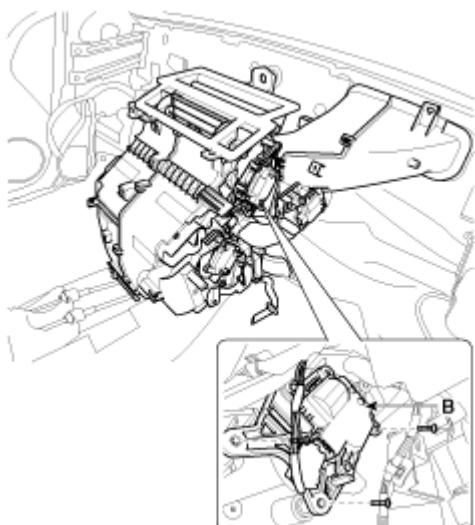
3. After loosening the mounting screws, then remove the glove box housing (A).



4. Remove the shower duct (A).



5. Loosen the mounting screw and then remove the mode control actuator (B).



6. Installation is the reverse order of removal.

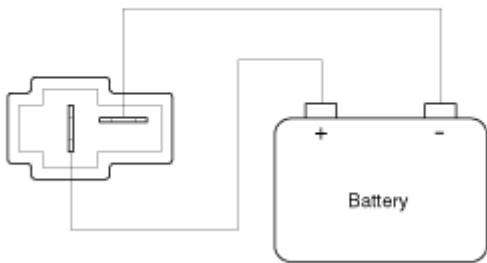
2.4. Blower

2.4.1. Blower motor

2.4.1.1. Repair procedures

Inspection

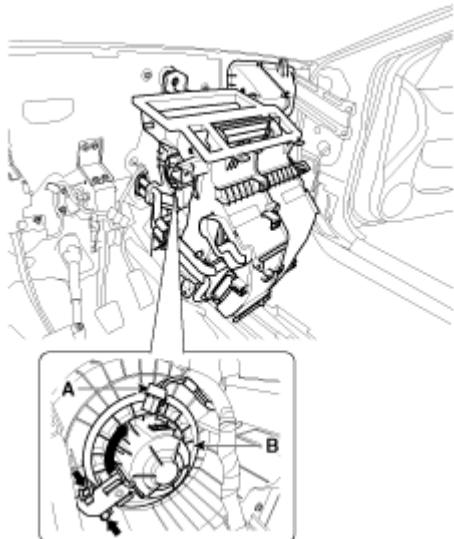
1. Connect the battery voltage and check the blower motor rotation.



2. If the blower motor voltage is not operated well, substitute with a known-good blower motor and check for proper operation.
3. If the problem is corrected, replace the blower motor.

Replacement

1. Disconnect the negative (-) battery terminal.
2. Remove the crashpad lower pannel (refer to BD group-crashpad)
3. Disconnect the connector (A) of the blower motor.
4. Remove the blower motor (B) removing the lock and pulling out (Turn the blower motor counter clock wise).



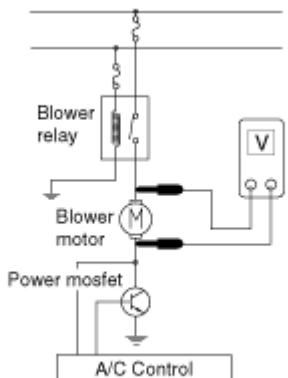
5. Installation is the reverse order of removal.

2.4.2. Power Mosfet

2.4.2.1. Repair procedures

Inspection

1. Ignition "ON"
2. Manually operate the control switch and measure the voltage of blower motor between pin 1 and 2.
3. Select the control switch to raise voltage until high speed.



Specification

Fan	Motor Voltage
	Manual
First	4.0 ±0.5V
Second	5.1 ±0.5V
Third	6.2 ±0.5V
Fourth	7.4 ±0.5V
Fifth	8.5 ±0.5V
Sixth	9.6 ±0.5V
Seventh	10.7 ±0.5V
eighth	Battery

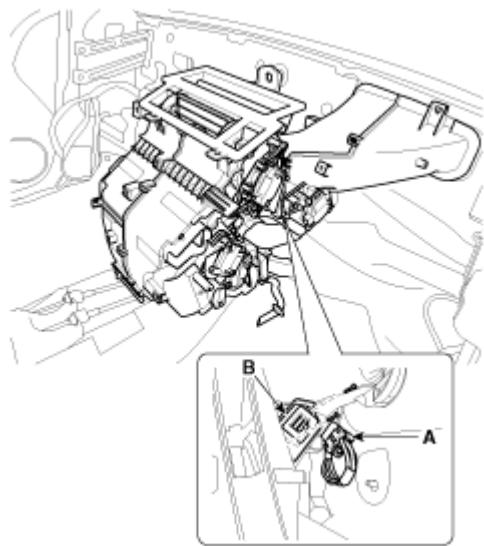
*AUTO COOLING: Auto speed (4.5V~B+)

*AUTO HEATING: Auto speed (4.5V~10.5V)

4. If the measured voltage is not specification, substitute with a known-good power mosfet and check for proper operation.
5. If the problem is corrected, replace the power mosfet.

Replacement

1. Disconnect the negative (-) battery terminal.
2. Remove the crashpad.(refer to BD group-crash pad)
3. Disconnect the power mosfet connector (A) at the connecting part between heater and blower unit.
4. Remove the power mosfet (B) after loosening the mounting screws.



5. Installation is the reverse order of removal.

2.4.3. Climate control air filter

2.4.3.1. Description and Operation

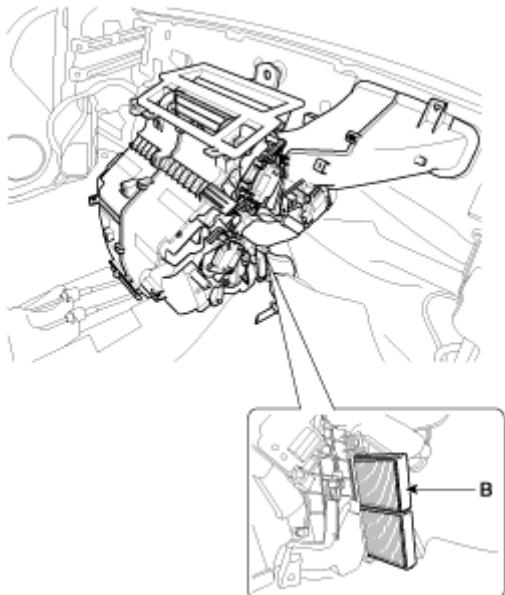
Description

This has particle filter which eliminates foreign materials and odor. The particle filter includes odor filter as well as conventional dust filter to ensure comfortable interior environment.

2.4.3.2. Repair procedures

Replacement

1. Disconnect the negative (-) battery terminal.
2. Remove the crashpad lower pannel. (refer to BD group-crash pad)
3. Replace the climate control air filter (B), install it after making sure of the direction of air filter.



4. Installation is the reverse order of removal.

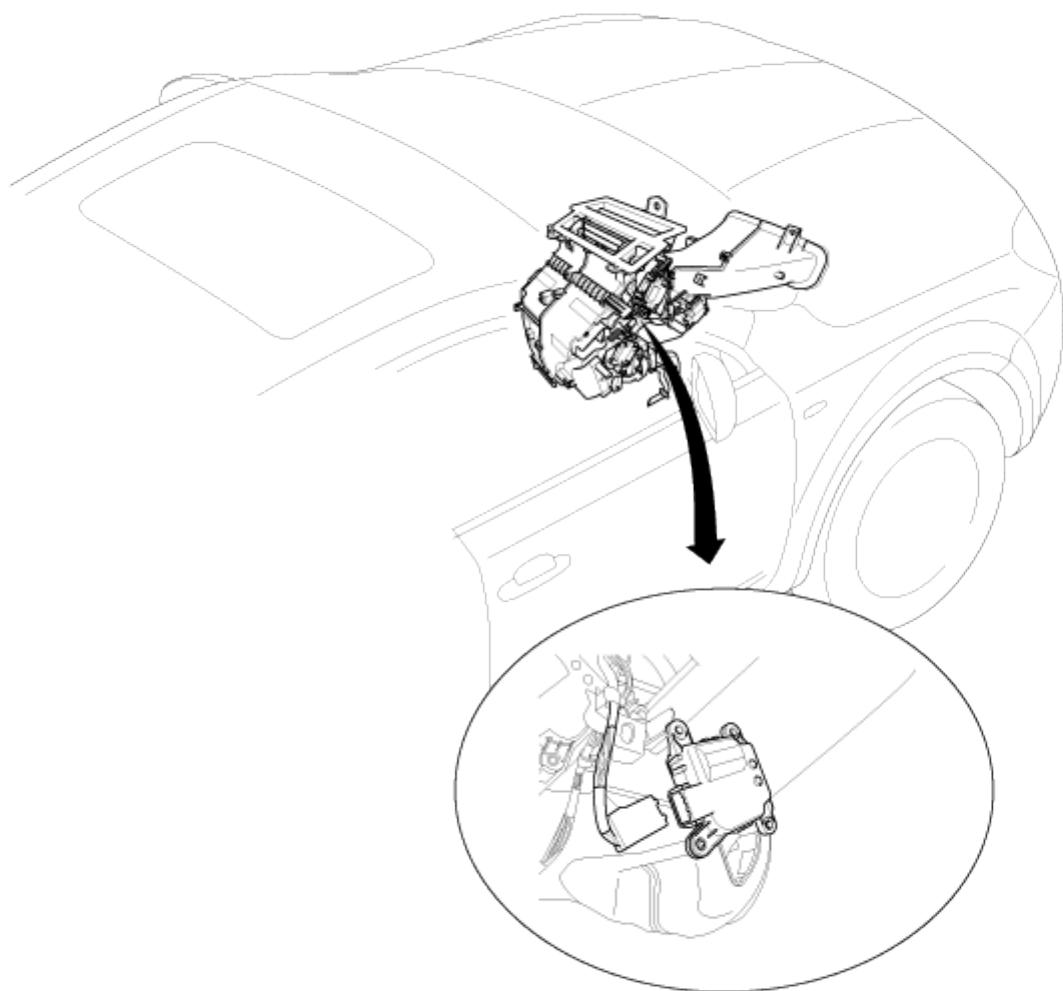
NOTE

In case of driving in an air-polluted area or rugged terrain, check and replace the air filter as frequently as possible.

2.4.4. Intake Actuator

2.4.4.1. Component and Components Location

Component Location



Intake Actuator

2.4.4.2. Description and Operation

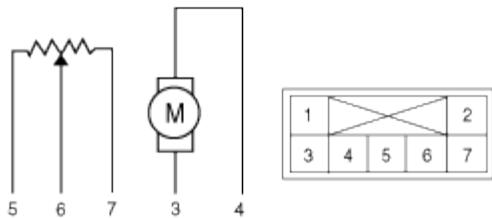
Description

1. The intake actuator is located at the blower unit.
2. It regulates the intake door by signal from control unit.
3. Pressing the intake selection switch will shift between recirculation and fresh air modes.

2.4.4.3. Repair procedures

Inspection

1. Ignition "OFF"
2. Disconnect the intake actuator connector.
3. Verify that the actuator operates to the recirculation position when connecting 12V to the terminal 3 and grounding terminal 4.
4. Verify that the intake actuator operates to the fresh position when connecting in the reverse.



1. -
2. -
3. Fre
4. Rec
5. Sensor ground
6. Feed back signal
7. 5V (VCC)

5. Check the voltage between terminals 6 and 7.

Specification

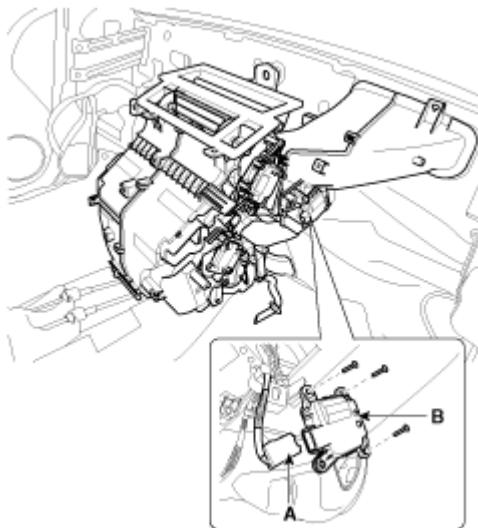
Door Position	Voltage (6-7)	Error detecting
Recirculation	0.4 ± 0.15V	Low voltage : 0.1V or less
Fresh	0.6 ± 0.15V	High voltage : 4.9V or more

6. If the intake actuator is not operated well, substitute with a known-good intake actuator and check for proper operation.

7. If the problem is corrected, replace the intake actuator.

Replacement

1. Disconnect the negative (-) battery terminal.
2. Remove the glove box (Refer to BD group-crash pad).
3. Disconnect the intake actuator connector (A).
4. Loosen the mounting screw and then remove the intake actuator (B) from the blower unit.

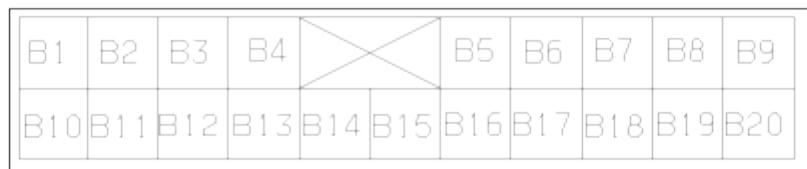
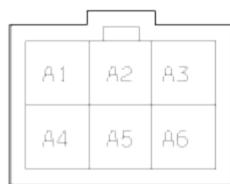
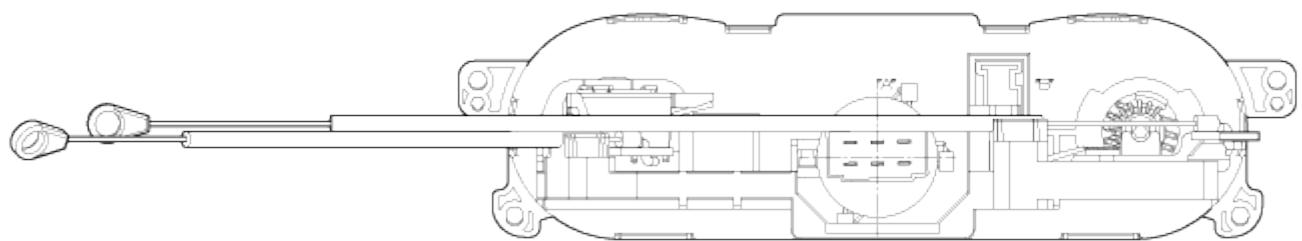
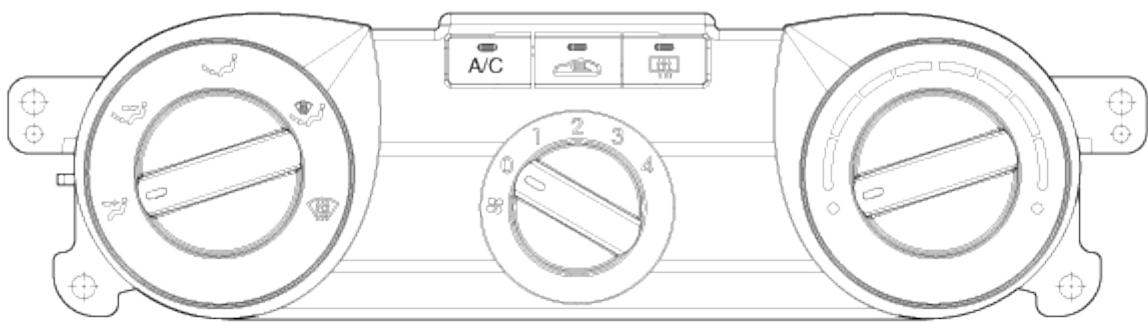


5. Installation is the reverse order of removal

2.5. Controller

- 2.5.1. Heater & A/C Control Unit (Manual)
- 2.5.1.1. Component and Components Location

Component



Connector Pin Function

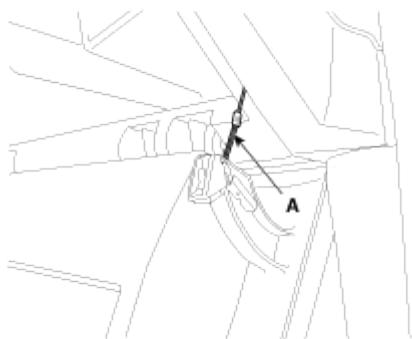
Connector	Pin no.	Funciton
Connector(A)	1	Middle High
	2	Blower common out
	3	GND
	4	High
	5	Middle Low
	6	Low
Connector(B)	1	Tail lamp(+)
	2	IGN 2
	3	A/C Output (High)

	4	A/C Select (High)
	5	HTD
	6	RR Degog switch (Low)
	7	Blower common IN
	8	Blower select (Low)
	9	Rheostat (-)
	10	Battery (+)
	11	PTC ON signal (Low)
	12	PTC relay 2
	13	PTC relay 3
	14	Vref (+5V)
	15	Intake actuator (Fre)
	16	Intake actuator (Rec)
	17	Intake F/B
	18	Evaporator sensor (+)
	19	Sensor GND
	20	GND

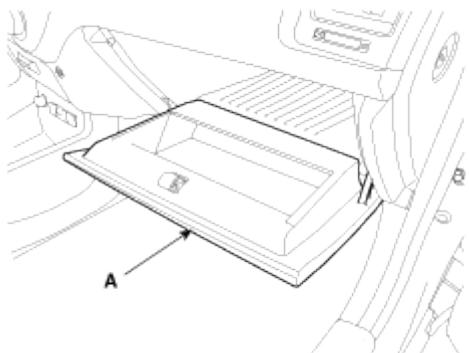
2.5.1.2. Repair procedures

Replacement

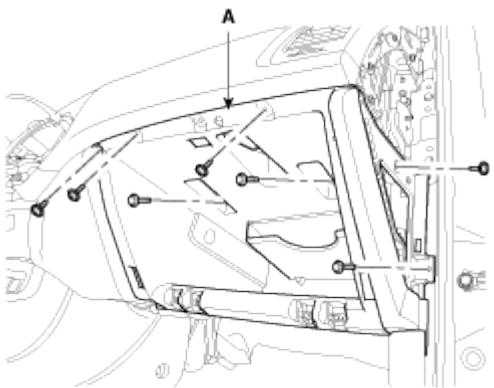
1. Disconnect the negative (-) battery terminal.
2. Disconnect the wire (A).



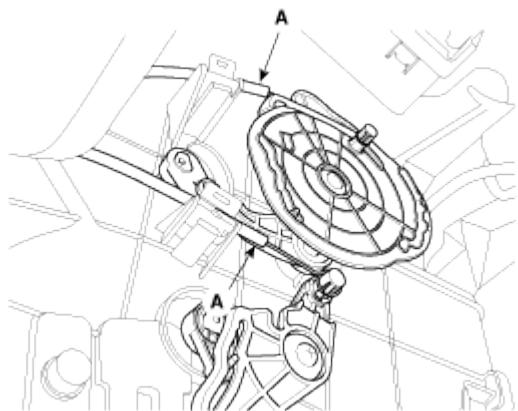
3. After loosening the mounting screws, then remove the glove box (A).



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



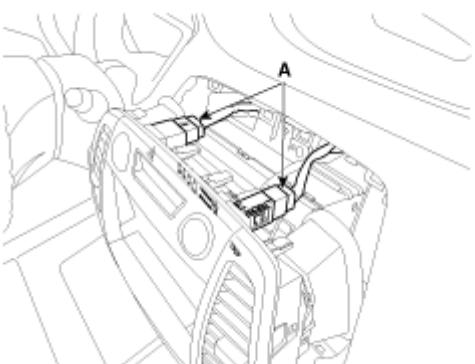
5. Remove the heater & A/C controller, then temperature control cable(A).

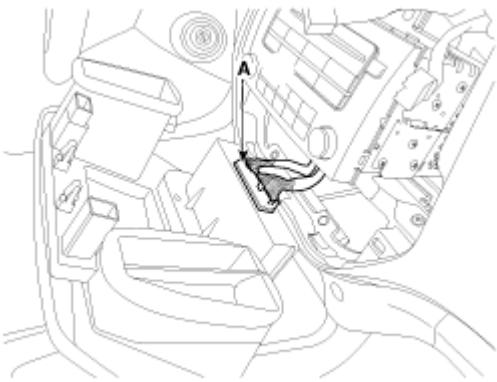


6. Remove the center facia panel (A).

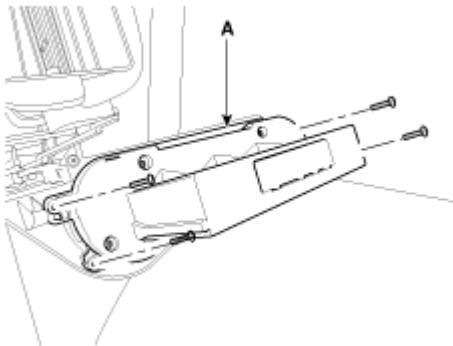


7. Disconnect the connectors (A).





8. Remove the heater & A/C controller (A) from center facia panel.

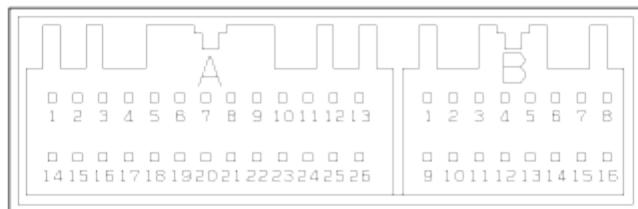
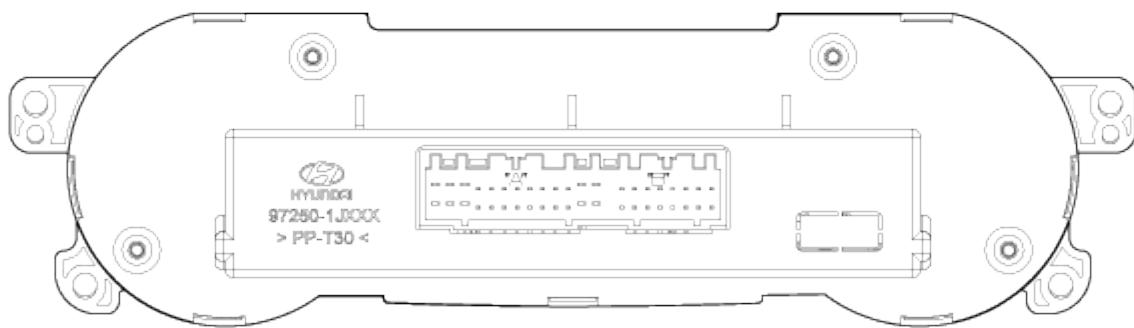


9. Installation is the reverse order of removal.

2.5.2. Heater & A/C Control Unit (Full Automatic)

2.5.2.1. Component and Components Location

Component



Connector Pin Function

Connector	Pin	Function	Connector	Pin	Function
Connector (A)	1	Tail lamp (+)	Connector (B)	1	-
	2	Battery (+)		2	Sensor REF (+5V)
	3	A/C Output		3	Photo sensor (+)
	4	A/C Select Signal		4	Hi - scan
	5	Blower (+)		5	Incar sensor
	6	HTD (RR def indicator)		6	Amb Sensor
	7	Temp actuator (Cool)		7	Evaporator Sensor
	8	Temp actuator (Warm)		8	Water temp sensor
	9	Incar motor(-)		9	Sensor GND

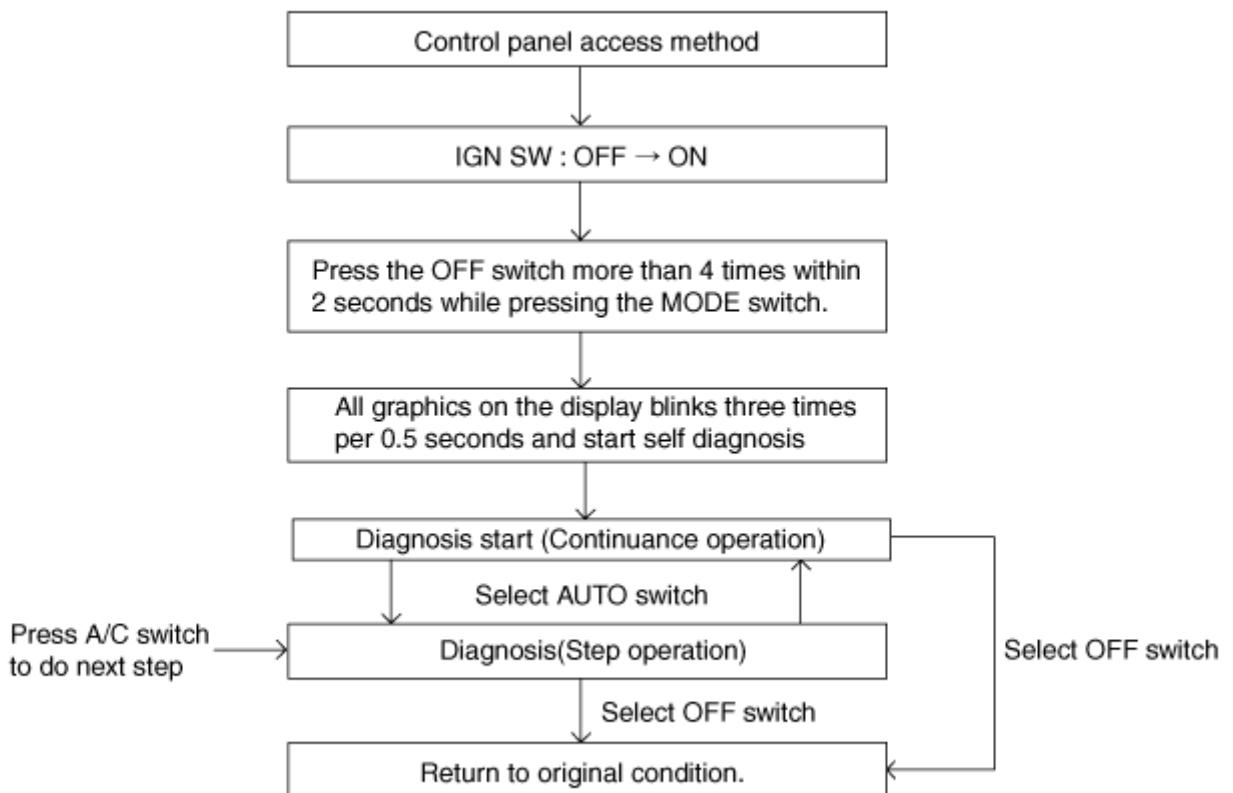
	10	PTC relay 2		10	-
	11	PTC relay 3		11	Intake F/B signal
	12	-		12	Temp F/B signal
	13	Rheostat		13	Mode F/B signal
	14	ING2		14	Speed sensor
	15	ING2		15	Photo sensor GND
	16	Mosfet (Drain F/B)		16	-
	17	Mosfet (Gate)			
	18	RR Defog switch (Low)			
	19	PTC ON signal			
	20	Mode actuator (Vent)			
	21	Mode actuator (Def)			
	22	Intake actuator (fre)			
	23	Intake actuator (rec)			
	24	Blower select signal			
	25	GND			
	26	GND			

2.5.2.2. Repair procedures

SELF-DIAGNOSIS

1. Self-diagnosis process

The F.A.T.C. module self test feature will detect electrical malfunction and provide error codes for system components with suspected failures.



NOTE

DTC data can be retrieved from the control panel directly or from the DLC using the Hi-Scan Pro.

2. How to read self-diagnostic code

After the display panel flickers three times every 0.5 second, the corresponding fault code flickers on the setup temperature display panel every 0.5 second and will show two figures. Codes are displayed in numerical format.

Fault code		Fail description
Control unit	DTC	
00	-	Normal
11	B1234	In-car temperature sensor open
12	B1233	In-car temperature sensor short
13	B1238	Ambient temperature sensor open
14	B1237	Ambient temperature sensor short
17	B1242	Evaporator temperature sensor open
18	B1241	Evaporator temperature sensor short
19	B1245	Temperature control actuator feed back open
19	B1246	Temperature control actuator feed back short
20	B2406	Temperature control actuator failure
21	B1249	Mode control actuator open
21	B1250	Mode control actuator short
22	B2409	Mode control actuator failure

25	B1208	Intake potentiometer open
25	B1209	Intake potentiometer short
26	B2408	Intake potentiometer failure

3 Fault code display

- (1 Continuance operation : DTC code is one)

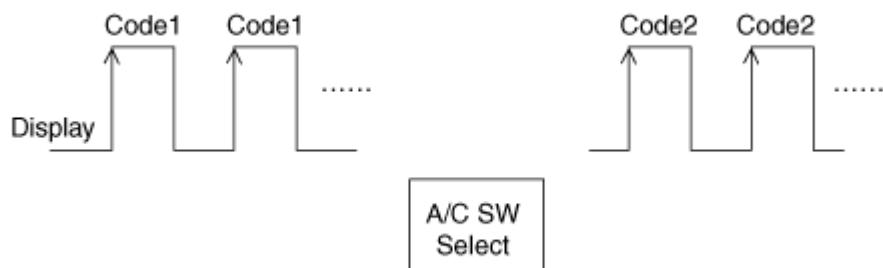


- (2 Continuance operation : DTC code is more two)



(3 Step operation

- A. Nomal or one fault code is same a continuance
- B. DTC code is more two



4. If fault codes are displayed during the check, Inspect malfunction causes by referring to fault codes.

5. Fail safe

- Incar sensor : Control with the value of 23°C(73.4°F)
- Ambient temperature sensor: Control with the value of 20°C(67°F)
- Evaporator temperature sensor: Control with the value of -2°C(28.4°F)
- Temperature control actuator (Air mix potentiometer):
 - If temperature setting 17°C-24.5°C, fix at maximum cooling position.
 - If temperature setting 25°C-32°C, fix at maximum heating position
- Mode control actuator (Direction potentiometer):
 - Fix vent position, while selecting vent mode.
 - Fix defrost position, while selecting all except vent mode.
- Intake control actuator :
 - Fix fresh position, while selecting fresh mode.
 - Fix recirculation position, while selecting recirculation mode.
- Photo sensor : Control with the value 0w/m2

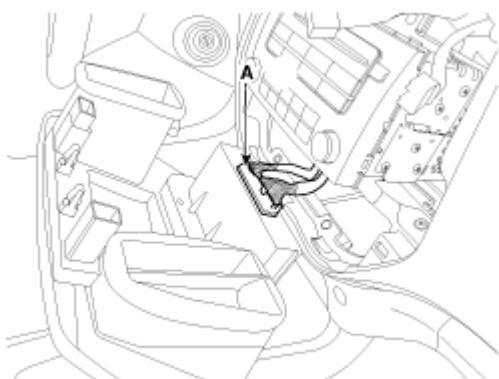
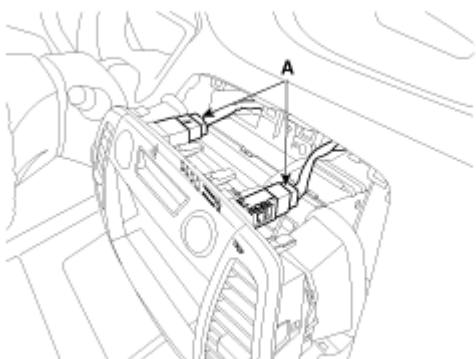
Replacement

1. Disconnect the negative (-) battery terminal.

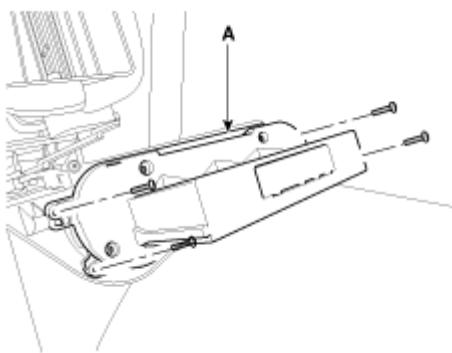
2. Remove the center facia panel (A).



3. Disconnect the connectors (A).



4. Remove the heater & A/C controller (A) from center facia panel.



5. Installation is the reverse order of removal.

3. Restraint

- 3.1. General Information
- 3.1.1. General Information

General

The supplemental restraint system (SRS) is designed to supplement the seat belt to help reduce the risk or severity of injury to the driver and passenger by activating and deploying the driver, passenger, side airbag and belt pretensioner in certain frontal or side collisions.

The SRS (Airbag) consists of : a driver side airbag module located in the center of the steering wheel, which contains the folded cushion and an inflator unit ; a passenger side airbag module located in the passenger side crash pad contains the folded cushion assembled with inflator unit ; side airbag modules located in the driver and passenger seat contain the folded cushion and an inflator unit ; curtain airbag modules located inside of the headliner which contains folded cushions and inflator units. The impact sensing function of the SRSCM is carried out by electronic accelerometer that continuously measure the vehicle's acceleration and delivers a corresponding signal through amplifying and filtering circuitry to the microprocessor.

SRSCM (SRS Control Module)

SRSCM will detect front impact with front impact sensor, and side impact with side impact sensor, and determine airbag module deployment.

1. DC/DC converter: DC/DC converter in power supply unit includes up/down transformer converter, and provide ignition voltage for 2 front airbag ignition circuits and the internal operation voltage of the SRSCM. If the internal operation voltage is below critical value setting, it will perform resetting.
2. Back up power supply: SRSCM has separate back up power supply, that will supply deployment energy instantly in low voltage condition or upon power failure by front crash.
3. Self diagnosis: SRSCM will constantly monitor current SRS operation status and detect system failure while vehicle power supply is on, system failure may be checked with trouble codes using scan tool. (Hi-Scan)
4. Airbag warning lamp on: Upon detecting error, the module will transmit signal to SRSCM indicator lamp located at cluster. MIL lamp will indicate driver SRS error. Upon ignition key on, SRS lamp will turn on for about six seconds.
5. Trouble code registration: Upon error occurrence in system, SRSCM will store DTC corresponding to the error. DTC can be cleared only by Hi-Scan. However, if an internal fault code is logged or if a crash is recorded the fault clearing should not happen.
6. Self diagnostic connector: Data stored in SRSCM memory will be output to Hi-Scan or other external output devices through connector located below driver side crash pad.
7. Once airbag is deployed, SRSCM should not be used again but replaced.
8. Side airbag deployment will be determined by SRSCM that will detect satellite sensor impact signal upon side crash, irrespective to seat belt condition.

3.1.2. Specifications

Specification

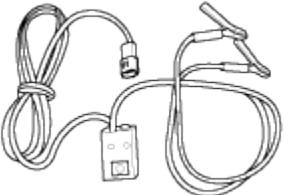
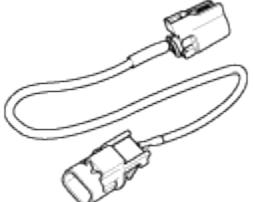
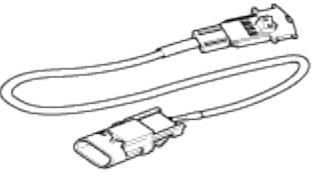
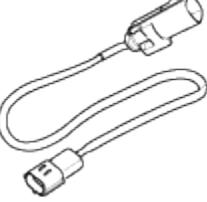
Item	Resistance (Ω)
Driver Airbag (DAB)	1.6 ~ 6.0
Passenger Airbag (PAB)	1.6 ~ 6.0
Side Airbag (SAB)	1.6 ~ 6.0
Curtain Airbag (CAB)	1.6 ~ 6.0
Seat Belt Pretensioner (BPT)	1.6 ~ 6.0

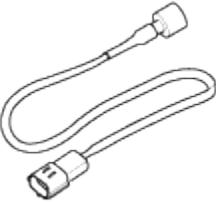
Tightening torques

Item	Nm	kgf·m	lb·ft
Driver Airbag (DAB)	7.9 ~ 10.8	0.8 ~ 1.1	5.8 ~ 8.0

Passenger Airbag (PAB)	8.0 ~ 9.0	0.8 ~ 0.9	5.9 ~ 6.6
Curtain Airbag (CAB)	11.7 ~ 14.7	1.2 ~ 1.5	8.7 ~ 10.8
Side Airbag (SAB)	4.9 ~ 6.8	0.5 ~ 0.7	3.6 ~ 5.0
Seat Belt Anchor Bolt (BPT)	39.2 ~ 53.9	4.0 ~ 5.5	28.9 ~ 39.8
SRSCM Mounting Bolt	8.0 ~ 10	0.8 ~ 1.0	5.9 ~ 7.4
Front Impact Sensor (FIS) Mounting Bolt	8.0 ~ 10	0.8 ~ 1.0	5.9 ~ 7.4
Side Impact Sensor (SIS) Mounting Bolt	8.0 ~ 10	0.8 ~ 1.0	5.9 ~ 7.4

3.1.3. Special Service Tools

Special service tools		
Tool(Number and Name)	Illustration	Use
Deployment tool 0957A-34100A		Airbag deployment tool
Deployment adapter 0957A-3F100		Use with deployment tool. (SAB)
Deployment adapter 0957A-38500		Use with deployment tool. (DAB, PAB, CAB, BPT)
Dummy 0957A-38200		Simulator to check the resistance of each wiring harness
Dummy adapter 0957A-3F000		Use with dummy (SAB)

Dummy adapter 0957A-2G000		Use with dummy (DAB, PAB, CAB, BPT)
------------------------------	---	--

DAB : Driver Airbag
 PAB : Passenger Airbag
 SAB : Side Airbag
 CAB : Curtain Airbag
 BPT : Belt Pretensioner

3.1.4. General Safety Information and Caution

Precautions

General precautions

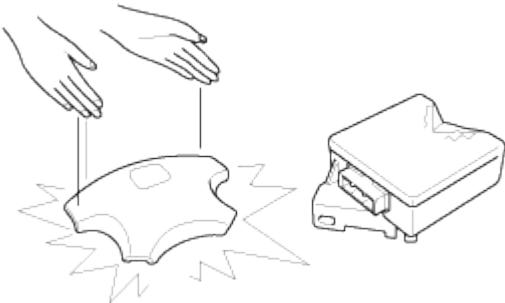
Please read the following precautions carefully before performing the airbag system service. Observe the instructions described in this manual, or the airbags could accidentally deploy and cause damage or injuries.

- Except when performing electrical inspections, always turn the ignition switch OFF and disconnect the negative cable from the battery, and wait at least three minutes before beginning work.

NOTE

The contents in the memory is not erased even if the ignition switch is turned OFF or the battery cables are disconnected from the battery.

- Use the replacement parts which are manufactured to the same standards as the original parts and quality.
 Do not install used SRS parts from another vehicle.
 Use only new parts when making SRS repairs.
- Carefully inspect any SRS part before you install it.
 Do not install any part that shows signs of being dropped or improperly handled, such as dents, cracks or deformation.



- Before removing any of the SRS parts (including the disconnection of the connectors), always disconnect the SRS connector.

Airbag handling and storage

Do not disassemble the airbags; it has no serviceable parts. Once an airbag has been deployed, it cannot be repaired or reused.

For temporary storage of the air bag during service, please observe the following precautions.

- Store the removed airbag with the pad surface up.
- Keep free from any oil, grease, detergent, or water to prevent damage to the airbag assembly.



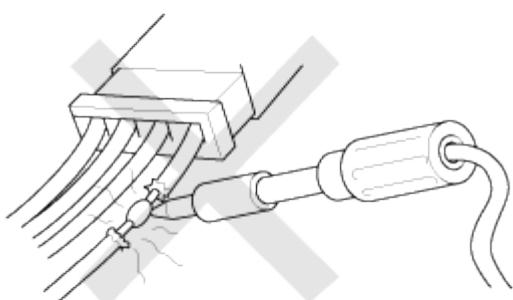
- Store the removed airbag on secure, flat surface away from any high heat source (exceeding 85°C/185°F).
- Never perform electrical inspections to the airbags, such as measuring resistance.
- Do not position yourself in front of the airbag assembly during removal, inspection, or replacement.
- Refer to the scrapping procedures for disposal of the damaged airbag.
- Be careful not to bump or impact the SRS unit or the side impact sensors whenever the ignition switch is ON, wait at least three minutes after the ignition switch is turned OFF before begin work.
- During installation or replacement, be careful not to bump (by impact wrench, hammer, etc.) the area around the SRS unit and the side impact sensor. The airbags could accidentally deploy and cause damage or injury.
- After a collision in which the airbags were deployed, replace the front airbags and the SRS unit. After a collision in which the side airbag was deployed, replace the side airbag, the front impact sensor and side impact sensor on the side where the side airbag deployed and the SRS unit. After a collision in which the airbags or the side air bags did not deploy, inspect for any damage or any deformation on the SRS unit and the side impact sensors. If there is any damage, replace the SRS unit, the front impact sensor and/or the side impact sensors.
- Do not disassemble the SRS unit, the front impact sensor or the side impact sensors
- Turn the ignition switch OFF, disconnect the battery negative cable and wait at least three minutes before beginning installation or replacement of the SRS unit.
- Be sure the SRS unit, the front impact sensor and side impact sensors are installed securely with the mounting bolts.
- Do not spill water or oil on the SRS unit, or the front impact sensor or the side impact sensors and keep them away from dust.
- Store the SRS unit, the front impact sensor and the side impact sensors in a cool (15 ~ 25°C/59 ~ 77°F) and dry (30% ~ 80% relative humidity, no moisture) area.

Wiring precautions

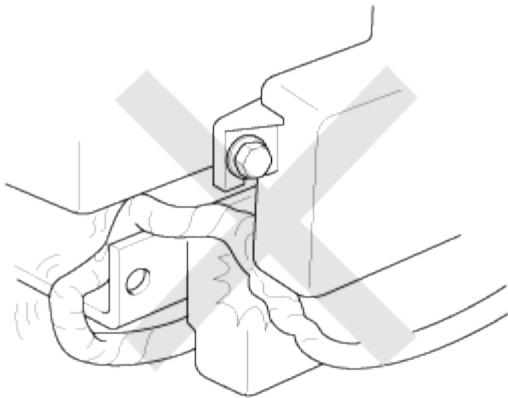
SRS wiring can be identified by special yellow outer covering.

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.



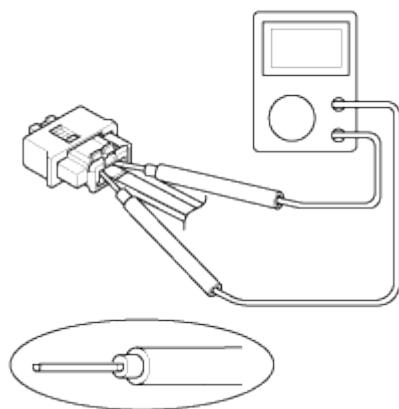
- Be sure to install the harness wires so that they are not pinched, or interfere with other parts.



- 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.

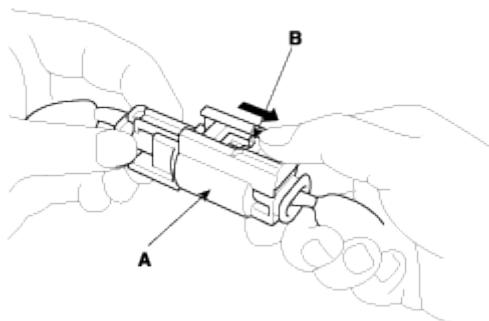
Spring-loaded lock connector

Some SRS system connectors have a spring-loaded lock.

Airbag connector

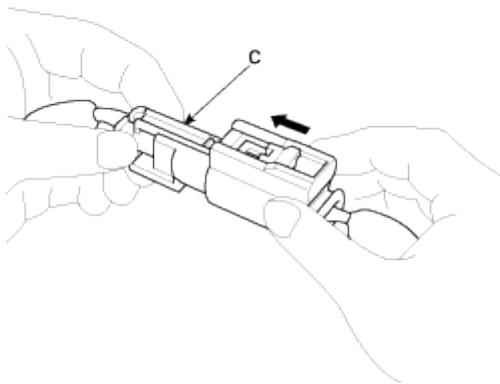
Disconnecting

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.



3.1.5. Description and Operation

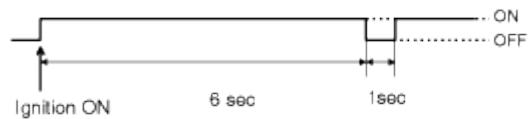
Warning lamp activation

Warning lamp behavior after ignition ON

As soon as the operating voltage is applied to the SRSCM ignition input, the SRSCM activates the warning lamp for a bulb check.

The lamp shall turn on for 6 seconds during the initialization phase and be turned off afterward. However, in order to indicate the driver, the warning lamp shall turn on for 6 seconds and off for one second then on continuously after the operating voltage is applied if any active fault exists.

1. Active fault or historical fault counter is greater or equal to 10



2. Normal or historical fault counter is less than 10



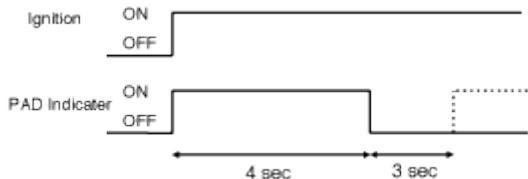
SRSCM Independent warning lamp activation

There are certain fault conditions in which the SRSCM cannot function and thus cannot control the operation of the standard warning lamp. In these cases, the standard warning lamp is directly activated by appropriate circuitry that operates independently of the SRSCM. These cases are:

1. Loss of battery supply to the SRSCM : warning lamp turned on continuously.
2. Loss of internal operating voltage : warning lamp turned on continuously.
3. Loss of Microprocessor operation : warning lamp turned on continuously.
4. SRSCM not connected : warning lamp turned on continuously through the shorting bar.

Passenger airbag deactivation (PAD) lamp operation

The SRSCM is designed with circuitry and software to drive a PAD lamp, which is used for depowered airbag system. For the PAD indicator circuitry to function properly, both the SRSCM and PAD indicator are sourced from the same ignition line. After ignition on, the PAD indicator will be turned on for 4 seconds and off for 3 seconds during the initialization phase. Thereafter the lamp will be turned on as long as the PAD switch is in the disabled position.



Passenger restraints activation with PAD ON/OFF switch

The PAD ON/OFF switch affects the activation of the front passenger airbag only and the switch is controlled manually. The PAD ON/OFF switch will be functioned as follows:

PAD ON/OFF Switch status	PAD Lamp	PAB
Phase-up	ON → OFF	Default
Enabled position	OFF	Enable
Disabled position	ON	Disable
Fault	Based on PAB	Default

3.1.6. Repair procedures

Component replacement after deployment

NOTE

Before doing any SRS repairs, use the Hi-Scan Pro to check for DTCs. Refer to the Diagnostic Trouble Code list for repairing of the related DTCs.

When the front airbag(s) deployed after a collision, replace the following items.

- SRSCM
- Deployed airbag(s)
- Seat belt pretensioner(s)
- Front impact sensors
- SRS wiring harnesses
- Inspect the clock spring for heat damage.
If any damage found, replace the clock spring.

When the 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)
- Deployed seat belt pretensioner(s) for the deployed side(s)
- SRS wiring harnesses

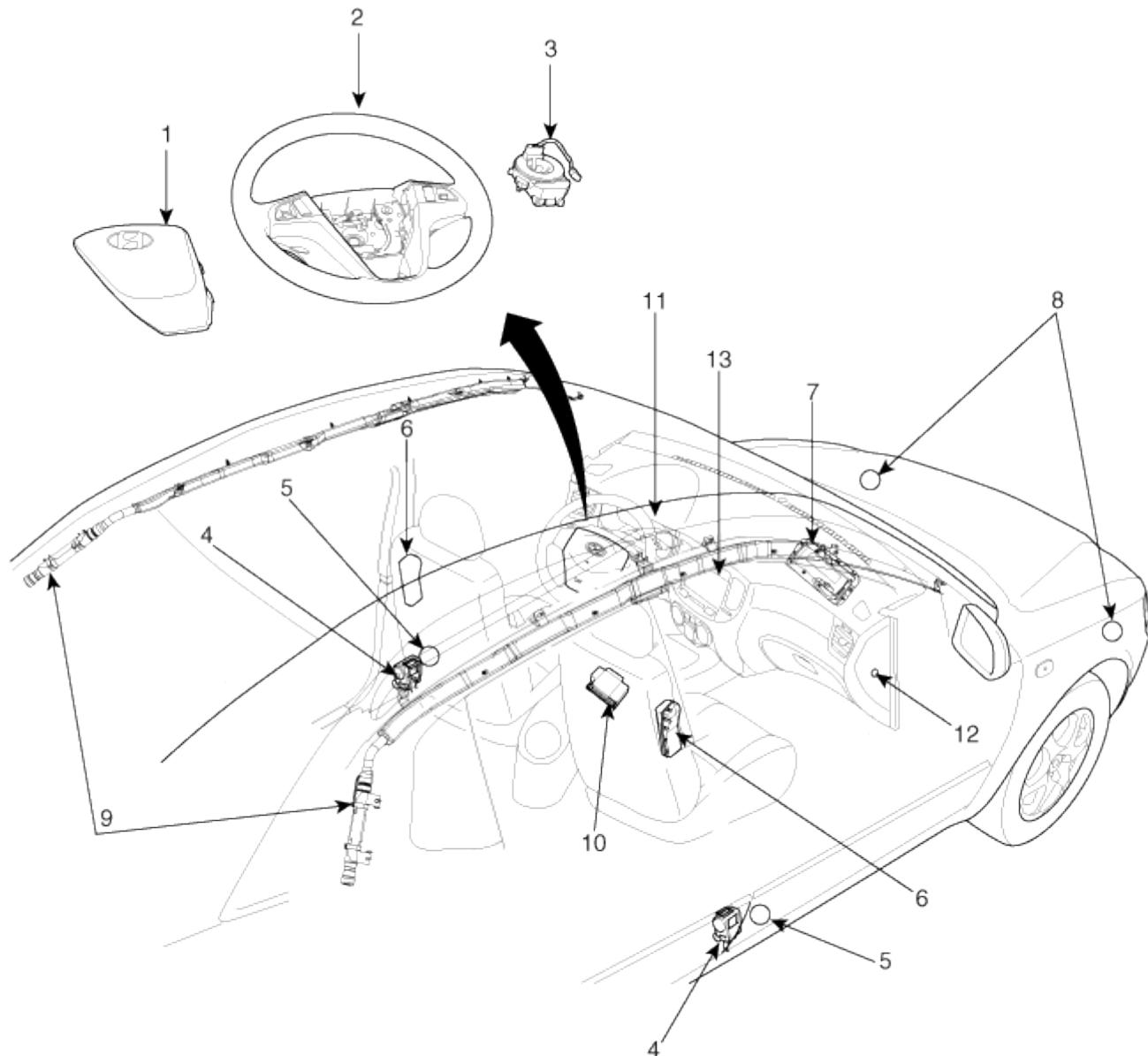
After the vehicle is completely repaired, confirm the SRS airbag system is OK.

- Turn the ignition switch ON, the SRS indicator should come on for about 6 seconds and then go off.

3.1.7. Component and Components Location

Components (1)

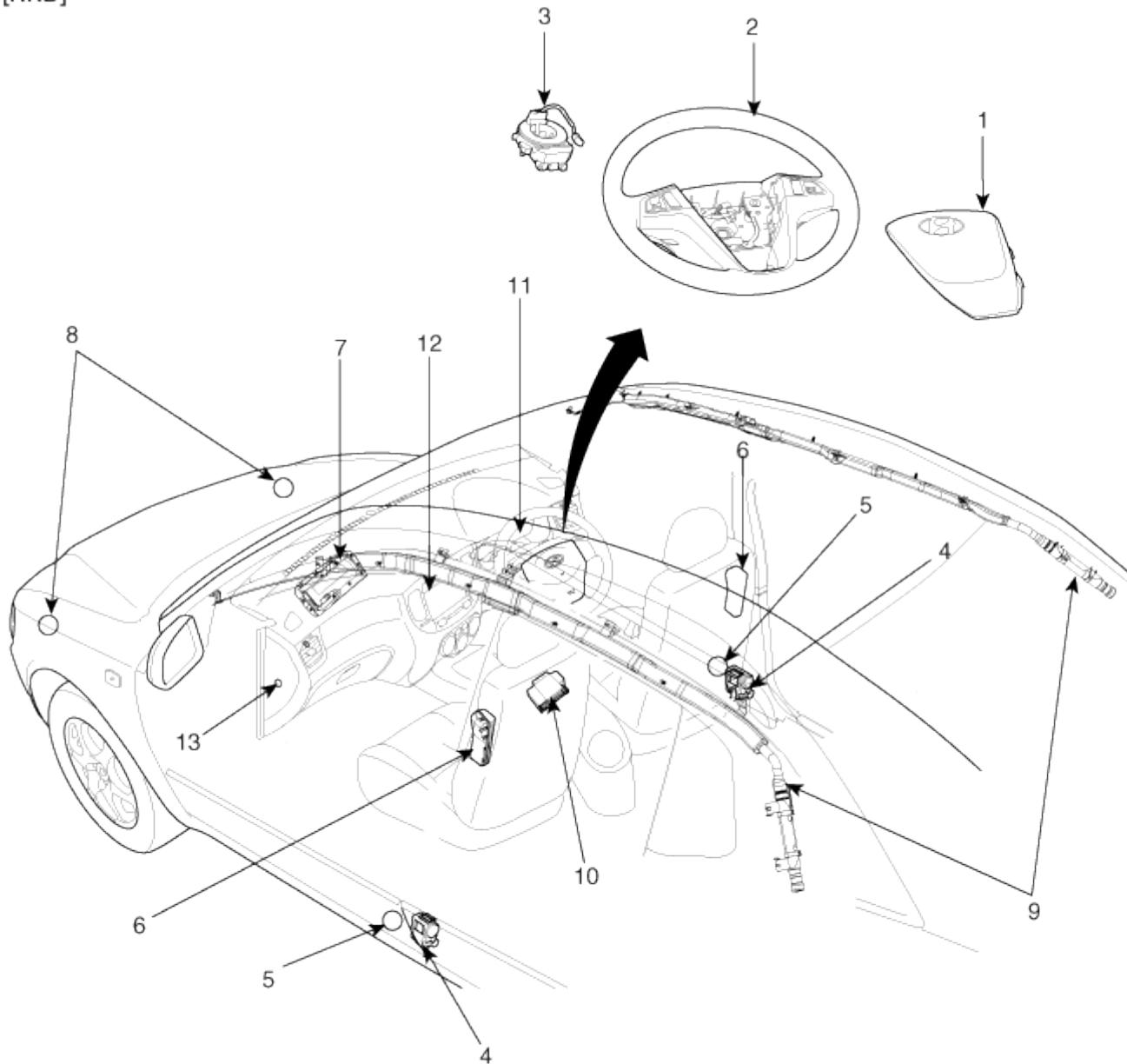
[LHD]



1. Driver Airbag (DAB)	8. Front Impact Sensor (FIS)
2. Steering Wheel	9. Curtain Airbag (CAB)
3. Clock Spring	10. Supplemental Restraint System Control Module (SRSCM)
4. Seat Belt Pretensioner (BPT)	11. Airbag Warning Lamp
5. Side Impact Sensor (SIS)	12. PAB ON/OFF Switch
6. Side Airbag (SAB)	13. PAB ON/OFF Lamp
7. Passenger Airbag (PAB)	

Components (2)

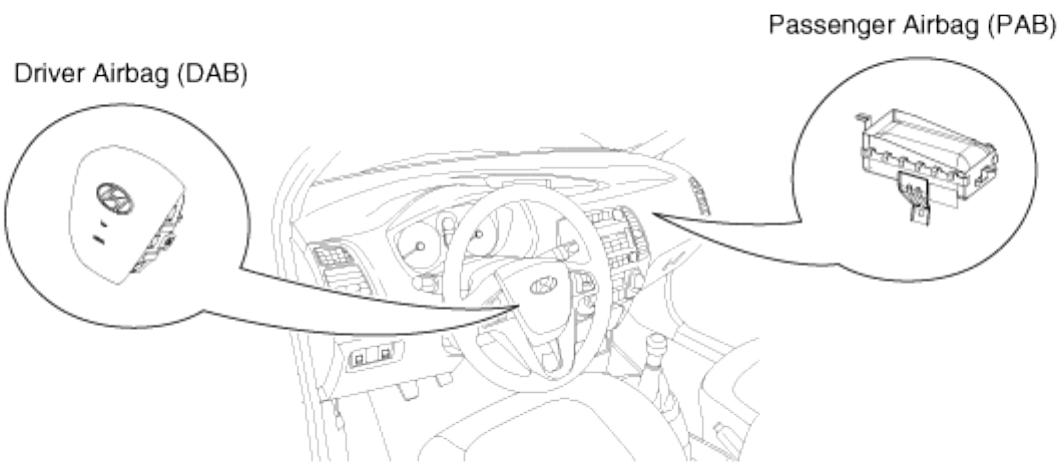
[RHD]



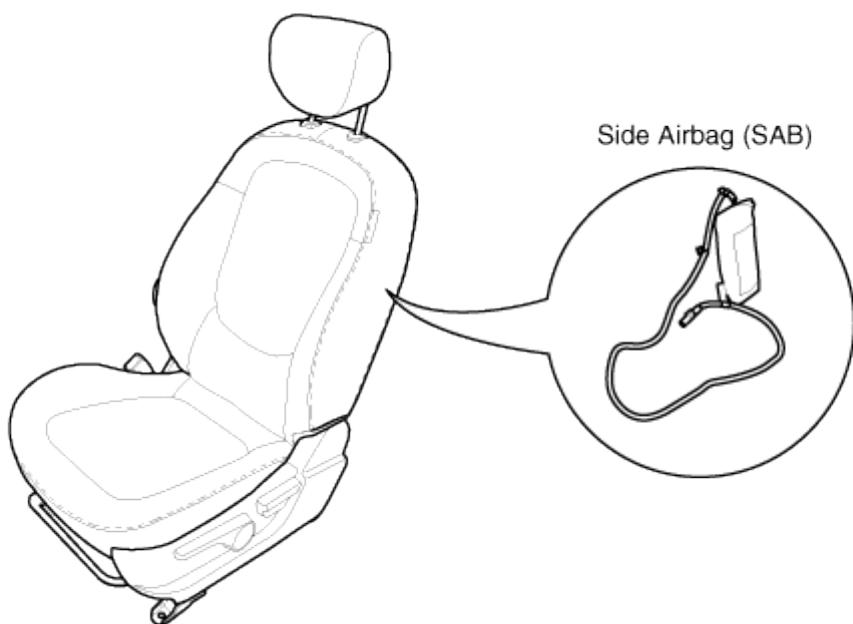
1. Driver Airbag (DAB)	8. Front Impact Sensor (FIS)
2. Steering Wheel	9. Curtain Airbag (CAB)
3. Clock Spring	10. Supplemental Restraint System Control Module (SRSCM)
4. Seat Belt Pretensioner (BPT)	11. Airbag Warning Lamp
5. Side Impact Sensor (SIS)	12. PAB ON/OFF Switch
6. Side Airbag (SAB)	13. PAB ON/OFF Lamp
7. Passenger Airbag (PAB)	

Component Locations

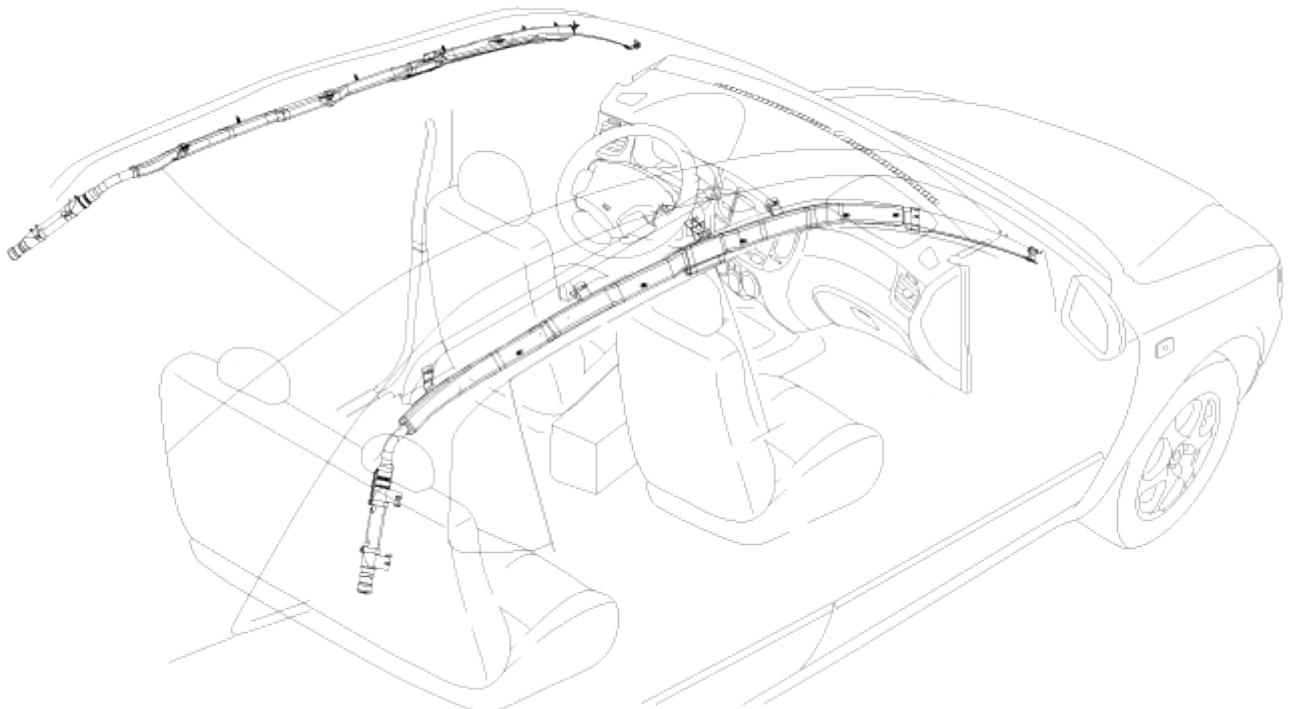
Driver Airbag (DAB) / Passenger Airbag (PAB)



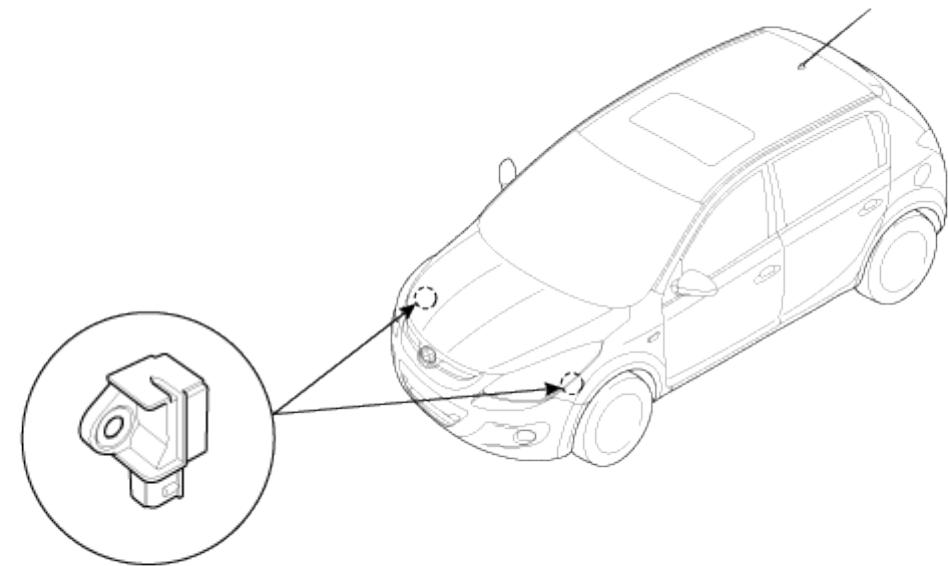
Side Airbag (SAB)



Curtain Airbag (CAB)

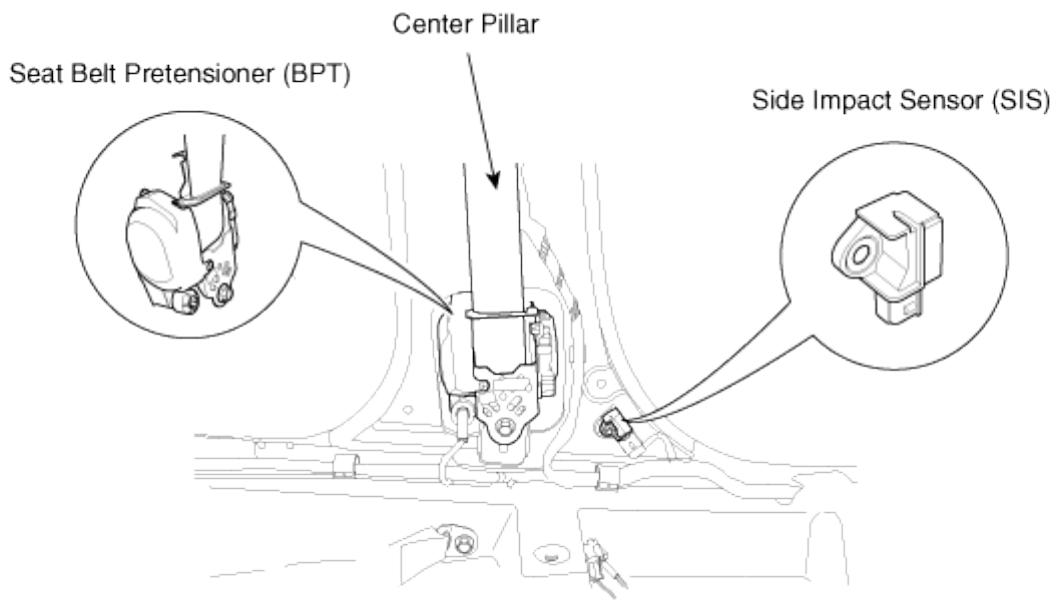


Front Impact Sensor (FIS)

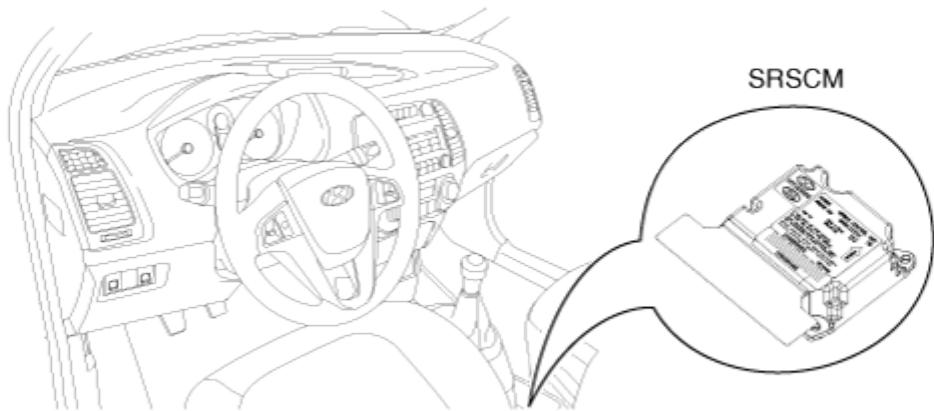


Front Impact Sensor (FIS)

Seat Belt Pretensioner (BPT) / Side Impact Sensor (SIS)



Supplemental Restraint System Control Module (SRSCM)



3.2. SRSCM

3.2.1. SRS Control Module (SRSCM)

3.2.1.1. Description and Operation

Description

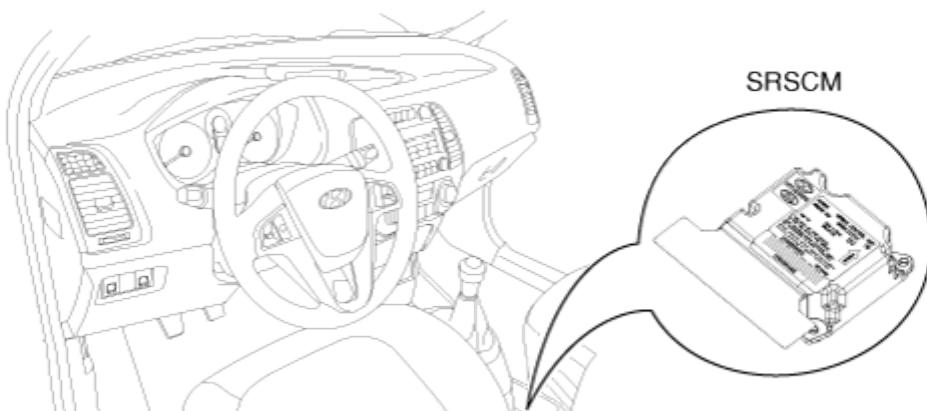
The primary purpose of the SRSCM (Supplemental Restraints System Control Module) is to discriminate between an event that warrants restraint system deployment and an event that does not. The SRSCM must decide whether to deploy the restraint system or not. After determining that pretensioners and/or airbag 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.

3.2.1.2. Component and Components Location

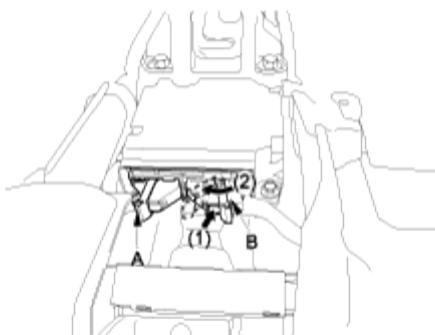
Components



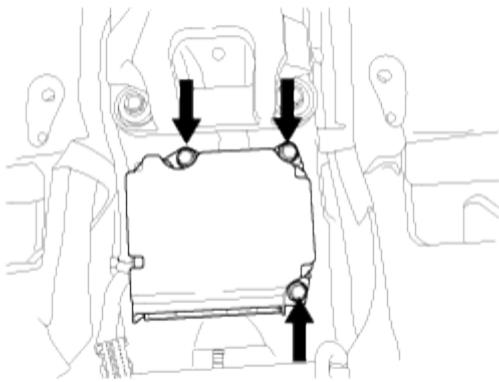
3.2.1.3. Repair procedures

Removal

1. Remove ignition key from the vehicle.
2. Disconnect the negative (-) cable from battery and wait for at least three minutes.
3. Disconnect the DAB, PAB, SAB, CAB and BPT connectors.
4. Remove the floor console. (Refer to the Body group-console)
5. Press the lock(1), then pull back the connector lever(2) until it clicks.



6. Disconnect the SRSCM harness connector(A) and (B) from the SRSCM.
7. Remove the SRSCM mounting nuts (3EA) from the SRSCM, then remove the SRSCM.



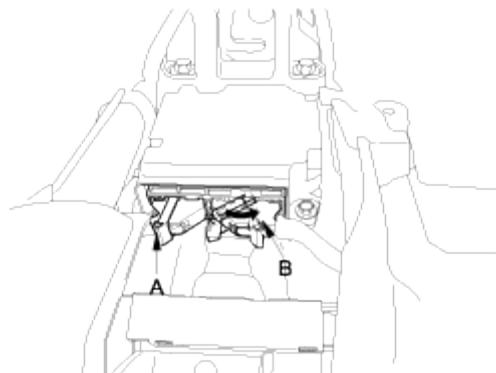
Installation

1. Remove ignition key from the vehicle.
2. Disconnect the negative (-) cable from battery and wait for at least three minutes.
3. Install the SRSCM with the SRSCM mounting nuts.

Tightening torque

: 8.0 ~ 10 Nm(0.8 ~ 1.0kgf.m, 5.9 ~ 7.4 lb·ft)

4. Connect the SRSCM harness connector.



5. Install the floor console. (Refer to the Body group-console)
6. Connect the DAB, PAB, SAB, CAB and BPT connectors.
7. Reconnect the battery negative cable.
8. After installing the SRSCM, confirm proper system operation:
 - A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

3.2.2. Front Impact Sensor (FIS) 3.2.2.1. Description and Operation

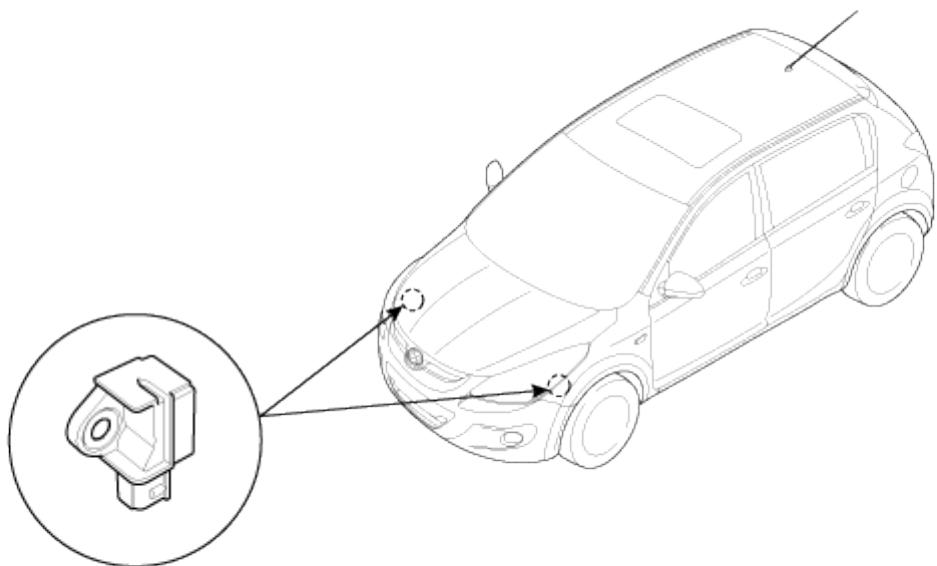
Description

The front impact sensors (FIS) are installed on the upper of the side panel in Front End Module(FEM). They are remote sensors that detect acceleration due to a collision at their mounting locations.

The primary purpose of the Front Impact Sensor (FIS) is to provide an indication of a collision. The Front Impact Sensor(FIS) sends acceleration data to the SRSCM.

3.2.2.2. Component and Components Location

Components



Front Impact Sensor (FIS)

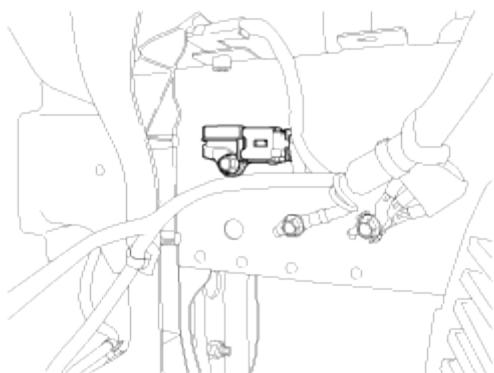
3.2.2.3. Repair procedures

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. Disconnect the front impact sensor connector.
4. Loosen the front impact sensor mounting bolt and remove the front impact sensor.



Installation

CAUTION

- Be sure to install the harness wire not to be pinched or interfere with other parts.
- Do not turn the ignition switch ON and do not contact the battery cable while replacing the front impact sensor.

1. Install the new Front Impact Sensor with bolt then connect the SRS harness connector to the Front Impact Sensor.

Tightening torque

: 8.0 ~ 10 Nm(0.8 ~ 1.0kgf.m, 5.9 ~ 7.4 lb·ft)

2. Install the front wheel guard.

3. Reconnect the negative battery cable.

4. After installing the Front Impact Sensor, confirm proper system operation:

Turn the ignition switch ON the SRS indicator light should be turned on for about six seconds and then go off.

3.2.3. Side Impact Sensor (SIS)

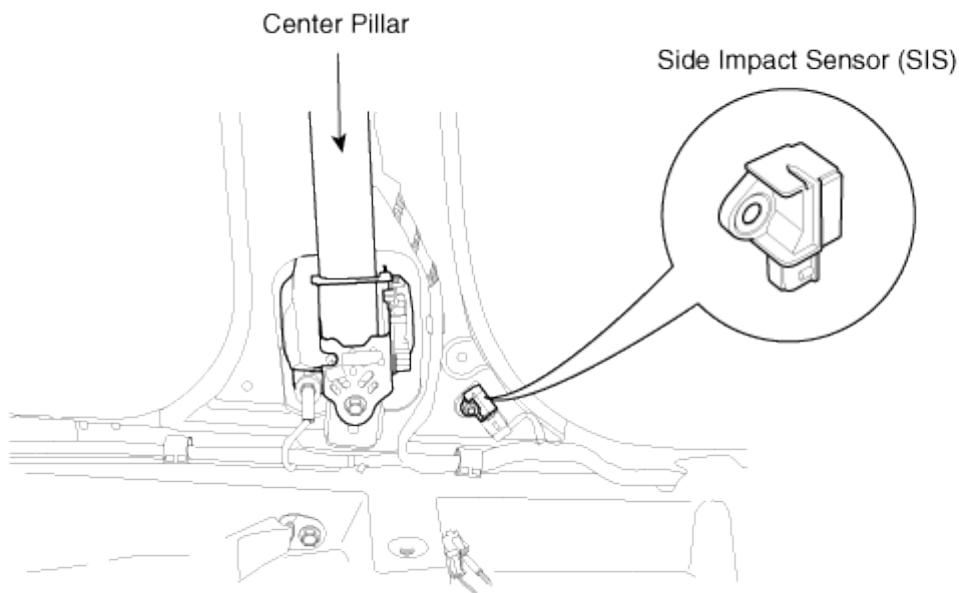
3.2.3.1. Description and Operation

Description

The Side Impact Sensor (SIS) system consists of two front SIS which are installed inside the Center Pillar (LH and RH). They are remote sensors that detect acceleration due to collision at their mounting locations. The primary purpose of the Side Impact Sensor (SIS) is to provide an indication of a collision. The Side Impact Sensor (SIS) sends acceleration data to the SRSCM.

3.2.3.2. Component and Components Location

Components



3.2.3.3. Repair procedures

Removal

CAUTION

- Removal of the airbag must be performed according to the precautions/procedures described previously.

- Before disconnecting the side impact sensor connector(s), disconnect the side airbag connector(s).
- Do not turn the ignition switch ON and do not connect the battery cable while replacing the side impact sensor.

1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
2. Remove the following parts. (Refer to the Body group-Interior trim)
 - A. Center pillar trim, Door scuff trim
3. Disconnect the Side Impact Sensor connector.
4. Loosen the SIS mounting bolt and remove the Side Impact Sensor.



Installation

CAUTION

- Be sure to install the harness wires not to be pinched or interfered with other parts.
- Do not turn the ignition switch ON and do not connect the battery cable while replacing the side impact sensor.

1. Install the new Side Impact Sensor with the bolt then connect the SRS harness connector to the Side Impact Sensor.

Tightening torque

: 8.0 ~ 10 Nm(0.8 ~ 1.0kgf.m, 5.9 ~ 7.4 lb-ft)

2. Install the following parts. (Refer to the Body group-Interior trim)
 - A. Door scuff trim, Center pillar trim
3. Reconnect the negative battery cable.
4. After installing the Side Impact Sensor, confirm proper system operation:
Turn the ignition switch ON, the SRS indicator light should be turned on for about six seconds and then go off.

3.2.4. PAB ON/OFF Switch

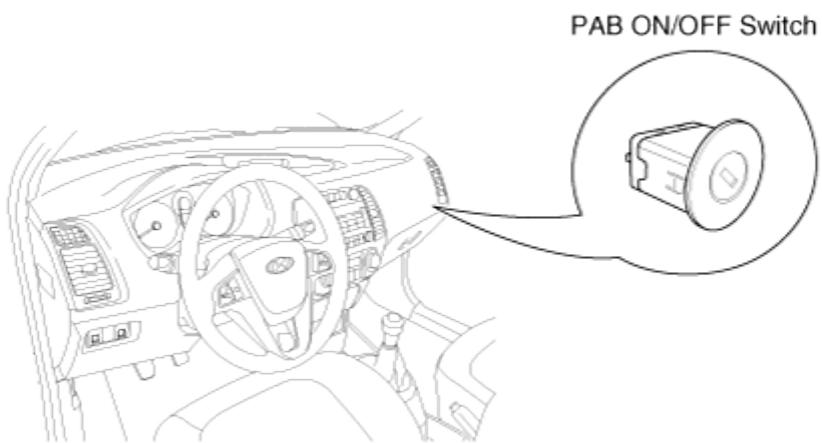
3.2.4.1. Description and Operation

Description

Driver can control the passenger airbag operating Condition (Enable or Disable) by using this PAB ON/OFF switch. Passenger Airbag (PAB) ON/OFF Switch is installed in the crash pad side cover.

3.2.4.2. Component and Components Location

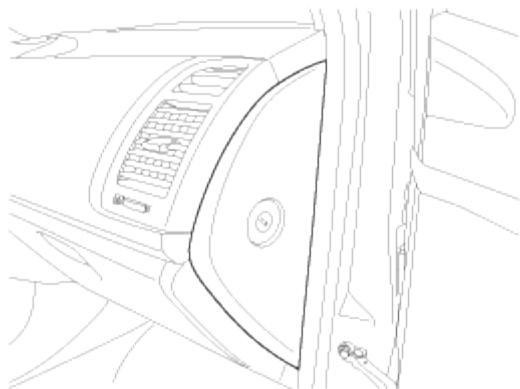
Components



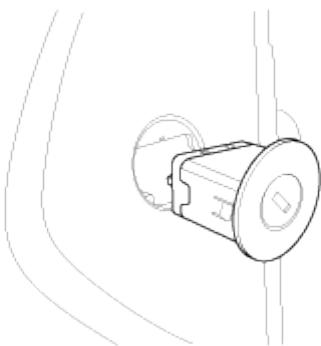
3.2.4.3. Repair procedures

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 crash pad side cover. (Refer to the Body group – crash pad)



4. Disconnect the PAB ON/OFF switch connector.
5. Remove the PAB ON/OFF switch.



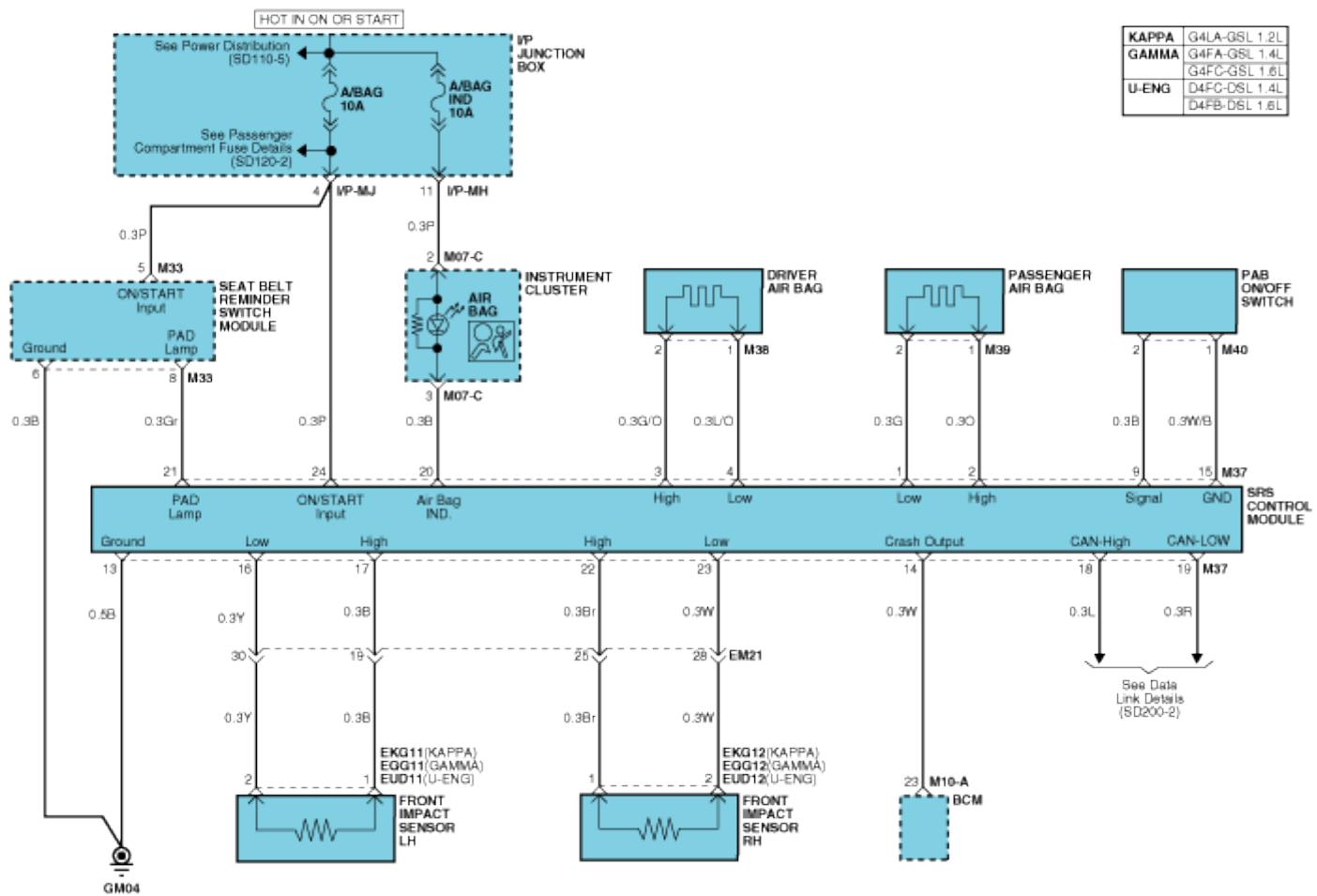
Installation

1. Remove the ignition key from the vehicle.

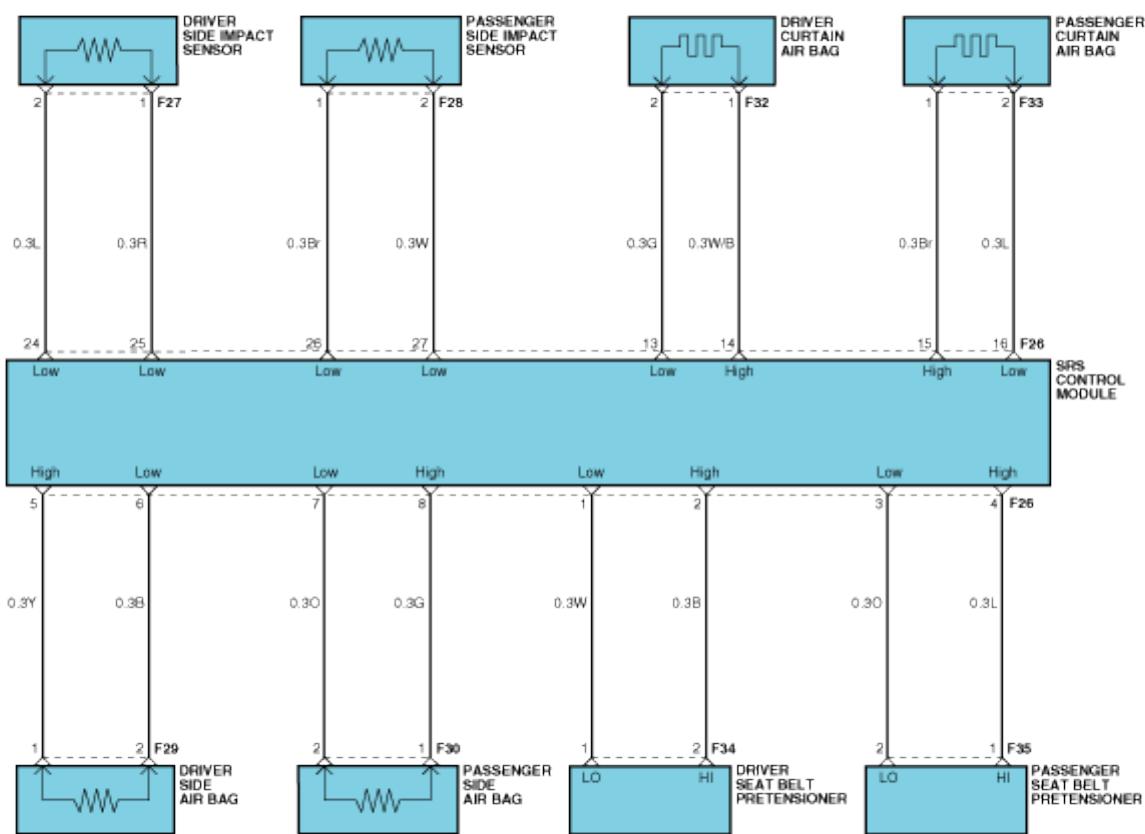
2. Disconnect the battery negative cable and wait for at least three minutes before beginning work.
 3. Install the PAB ON/OFF switch to the crash pad side cover.
 4. Connect the PAB ON/OFF switch connector to the crash pad side cover.
 5. Install the crash pad side cover. (Refer to the Body group – crash pad)
 6. 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.

3.2.5. Schematic Diagrams

Circuit Diagram (1)

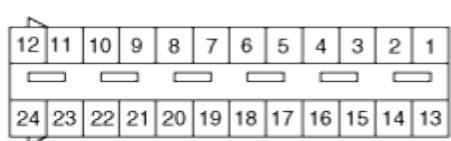


Circuit Diagram (2)

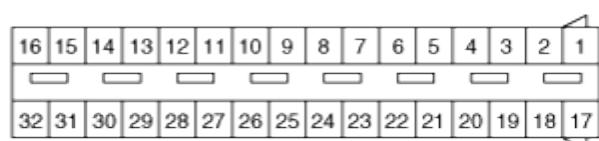


SRSCM Connector Terminal

SRSCM Harness Connector



CONNECTOR A



CONNECTOR B

Pin	Function (Connector A)	Pin	Function (Connector B)
1	Passeng Airbag Low	1	Driver Seat Belt Pretensioner High
2	Passeng Airbag High	2	Driver Seat Belt Pretensioner Low
3	Driver Airbag High	3	Passenger Seat Belt Pretensioner Low
4	Driver Airbag Low	4	Passenger Seat Belt Pretensioner High

5	-	5	Driver Side Airbag High
6	-	6	Driver Side Airbag Low
7	-	7	Passenger Side Airbag Low
8	-	8	Passenger Side Airbag High
9	PAB ON/OFF Switch Ground	9	-
10	-	10	-
11	-	11	-
12	-	12	-
13	Ground	13	Driver Curtain Airbag High
14	Crash Output	14	Driver Curtain Airbag Low
15	PAB ON/OFF Switch	15	Passenger Curtain Airbag Low
16	Driver Front Impact Sensor High	16	Passenger Curtain Airbag High
17	Driver Front Impact Sensor Low	17~23	-
18	CAN Low	24	Driver Side Impact Sensor High
19	CAN High	25	Driver Side Impact Sensor Low
20	Airbag Warning Lamp	26	Passenger Side Impact Sensor Low
21	PAB ON/OFF Lamp	27	Passenger Side Impact Sensor High
22	Passenger Front Impact Sensor Low	28~32	-
23	Passenger Front Impact Sensor High		
24	Ignition		

3.3. Airbag Module

3.3.1. Driver Airbag (DAB) Module and Clock Spring

3.3.1.1. Description and Operation

Description

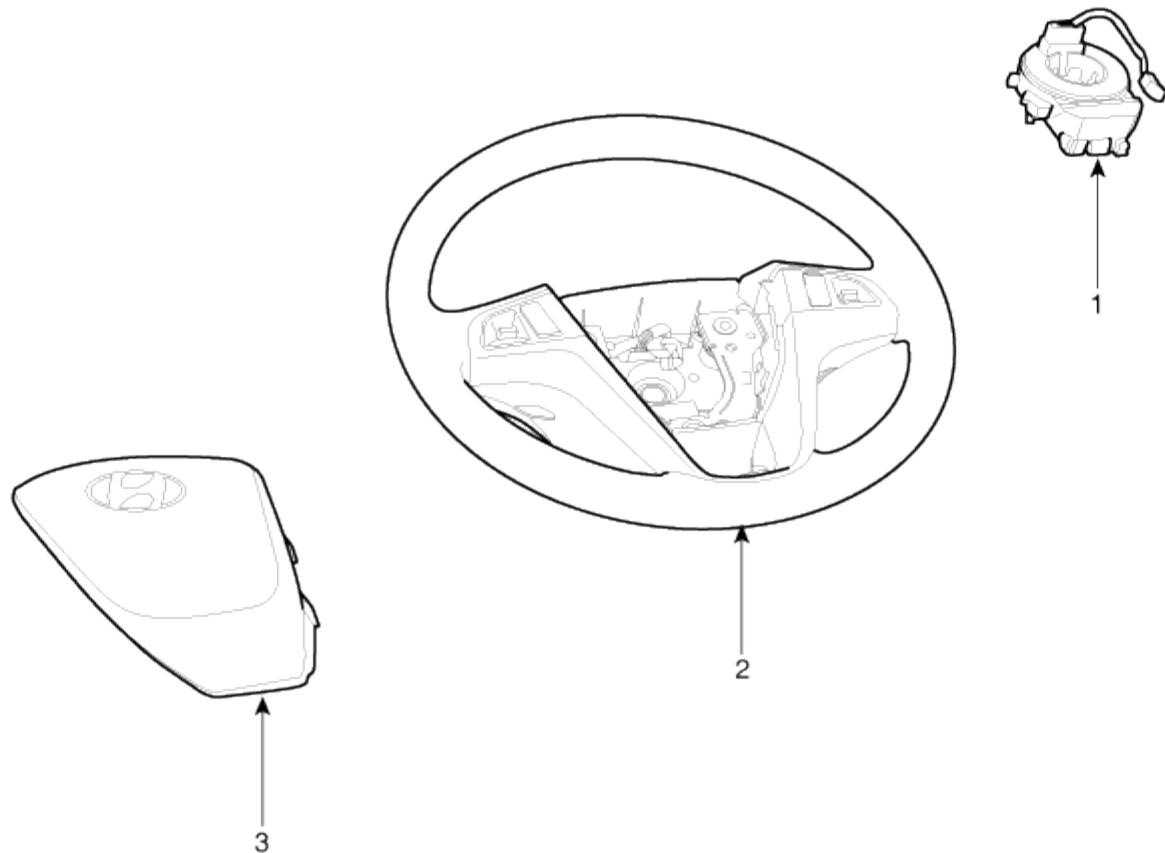
Driver Airbag (DAB) is installed in steering wheel and electrically connected to SRSCM via clockspring. It protects the driver from danger by deploying a bag when frontal crash occurs. The SRSCM determines deployment of Driver Airbag (DAB).

CAUTION

Never attempt to measure the circuit resistance of the airbag module (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment will result in serious personal injury.

3.3.1.2. Component and Components Location

Components



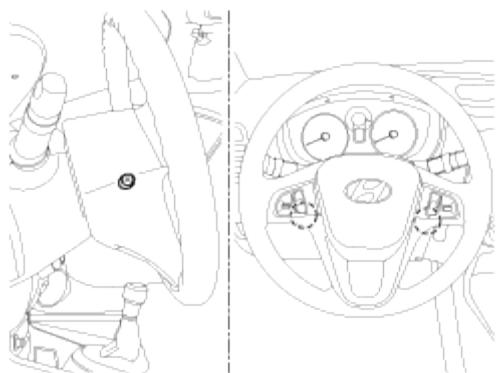
1. Clock Spring
2. Steering Wheel

3. Dirver Airbag (DAB)

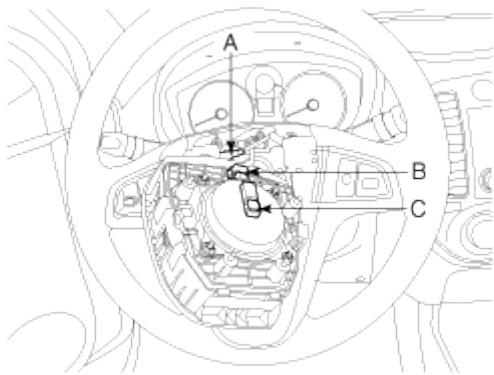
3.3.1.3. Repair procedures

Removal

1. Disconnect the battery negative cable and wait at least three minutes before beginning work.
2. Remove the two airbag module mounting bolts (2EA).



3. Separate the airbag module from the steering wheel after disconnecting the connector(C), with removing airbag module connector locking pin after removing the wiring fixing clip(B).

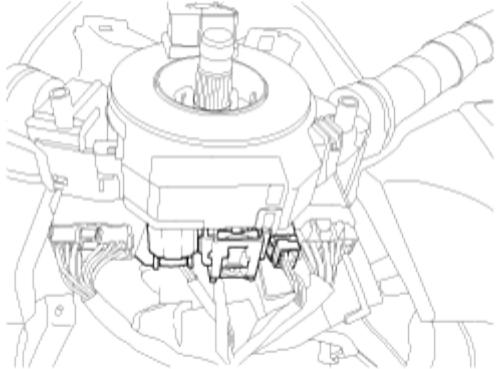


4. Disconnect the horn connector(A).

CAUTION

The removed airbag module should be stored in a clean, dry place with the pad cover face up.

5. Remove the steering wheel and steering wheel column cover. (Refer to the Steering System group-Steering column and shaft)
6. Disconnect the clock spring and steering remocon switch connector, then remove the clock spring.



Inspection

Driver Airbag (DAB)

If any improper parts are found during the following inspection, replace the airbag module with a new one.

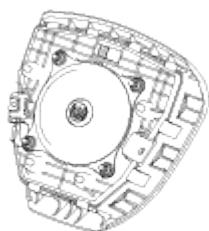
CAUTION

Never attempt to measure the circuit resistance of the airbag module (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment will result in serious personal injury.

1. Check pad cover for dents, cracks or deformities.
2. Check the airbag module for denting, cracking or deformation.
3. Check hooks and connectors for damage, terminals for deformities, and harness for binds.
4. Check airbag inflator case for dents, cracks or deformities.



(Front View)

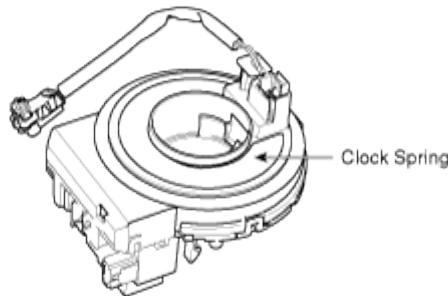


(Rear View)

5. Install the airbag module to the steering wheel to check for fit or alignment with the wheel.

Clockspring

1. If, as a result of the following checks, even one abnormal point is discovered, replace the clock spring with a new one.
2. Check connectors and protective tube for damage, and terminals for deformities.

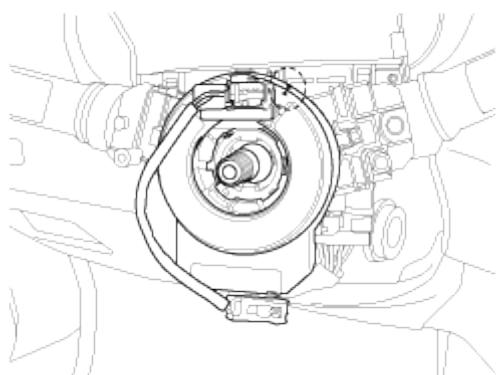


Installation

CAUTION

Center the front wheels and remove the ignition key. Failure to do so may damage SRS system inoperative, risking serious driver injury.

1. Remove ignition key from the vehicle.
2. Disconnect the negative (-) cable from battery and wait for at least three minutes.
3. Connect the clock spring harness connector and steering remocon switch harness connector to the clock spring.
4. Set the center position by getting marks between the clock spring and the cover into line. Make an array the mark (►◀) by turning the clock spring clockwise to the stop and then 3 revolutions counterclockwise.



5. Install the steering wheel column cover and the steering wheel. (Refer to the Steering System group-Steering column and shaft)

6. Connect the Driver Airbag (DAB) module connector and horn connector, then install the Driver Airbag (DAB) module on the steering wheel.
7. Secure the Driver Airbag (DAB) with the new mounting bolts.

Tightening torque

: 0.8 ~ 1.1 kgf.m (7.9 ~ 10.8 Nm, 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.

3.3.2. Passenger Airbag (PAB) Module

3.3.2.1. Description and Operation

Description

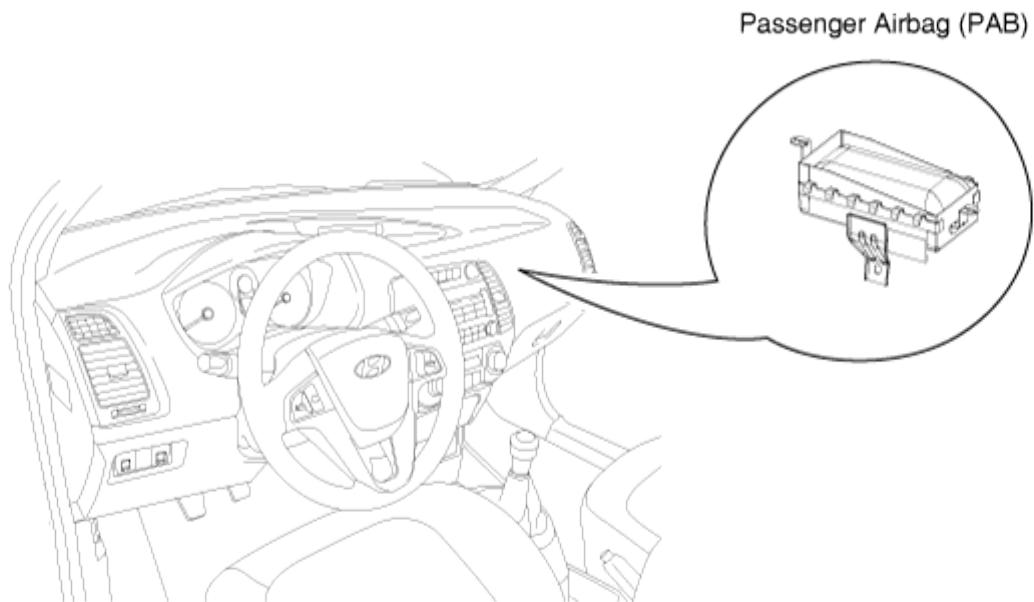
The passenger Airbag (PAB) is installed inside the crash pad and protects the front passenger in the event of a frontal crash. The SRSCM determines if and when to deploy the PAB.

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.

3.3.2.2. Component and Components Location

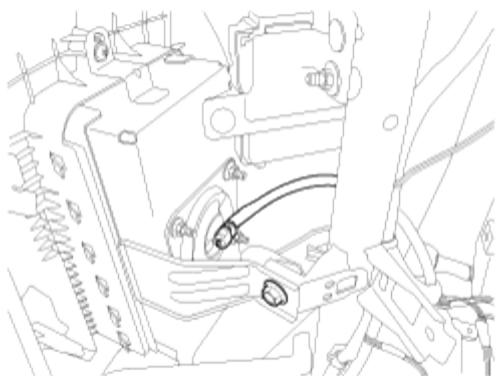
Components



3.3.2.3. Repair procedures

Removal

1. Disconnect the battery negative cable and wait for at least three minutes before beginning work.
2. Remove the glove box. (Refer to the Body group-Crash pad)
3. Disconnect the PAB connector and remove the PAB mounting bolts.



4. Remove the crash pad. (Refer to the Body group-Crash pad)

NOTE

Replace the crash pad which is damaged while PAB is deployed.

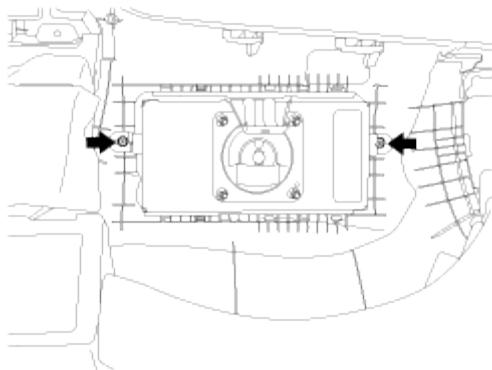
5. Remove the mounting screws from the crash pad. Then remove the passenger airbag.

CAUTION

The removed airbag module should be stored in a clean, dry place with the pad cover face up.

Installation

1. Remove ignition key from the vehicle.
2. Disconnect the negative (-) cable from battery and wait for at least three minutes.
3. Place a Passenger Airbag (PAB) on the crash pad and tighten the Passenger Airbag (PAB) mounting screws.



4. Install the crash pad. (Refer to the Body group-Crash pad)
5. Tighten the PAB mounting bolts.

Tightening torque

: 0.8 ~ 0.9 kgf.m (8.0 ~ 9.0 N.m, 5.9 ~ 6.6 lb- ft)

6. Connect the Passenger Airbag (PAB) harness connector to the SRS main harness connector.
7. Reinstall the glove box. (Refer to the Body group-Crash pad)
8. Reconnect the battery negative cable.

9. After installing the Passenger Airbag (PAB), confirm proper system operation:

- A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

3.3.3. Side Airbag (SAB) Module

3.3.3.1. Description and Operation\

Description

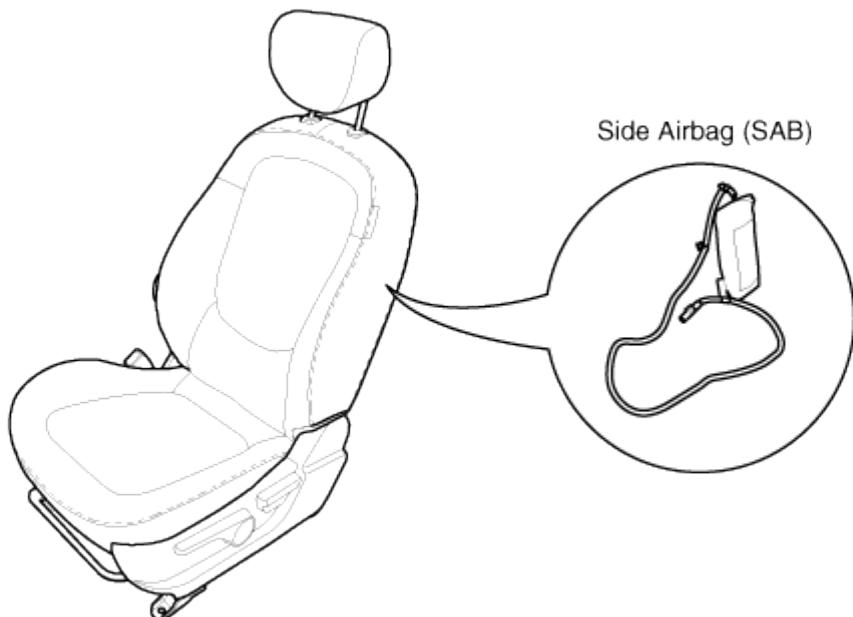
The two Side Airbags (SAB) are installed inside the driver and passenger seat and protects the driver and front passenger from danger when side crash occurs. The SRSCM determines deployment of side airbag by using Side Impact Sensor (SIS) signal.

CAUTION

Never attempt to measure the circuit resistance of the airbag module (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment will result in serious personal injury.

3.3.3.2. Component and Components Location

Components



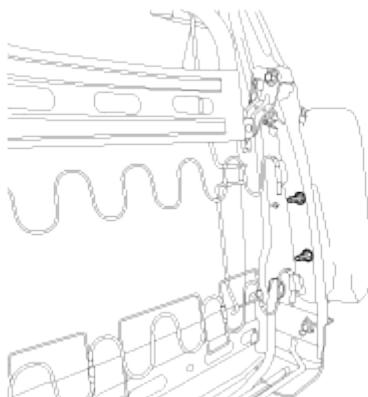
3.3.3.3. Repair procedures

Removal

1. Disconnect the battery negative cable and wait at least 3 minutes before beginning work.
2. Remove the front seat assembly. (Refer to the Body group-Seat)
3. Remove the seat-back cover. (Refer to the Body group-Seat)
4. Loosen the SAB mounting nuts and remove the SAB module.

CAUTION

The removed airbag module should be stored in a clean, dry place with the pad cover face up.



Installation

CAUTION

Be sure to install the harness wires not to be pinched or interfered with other parts.

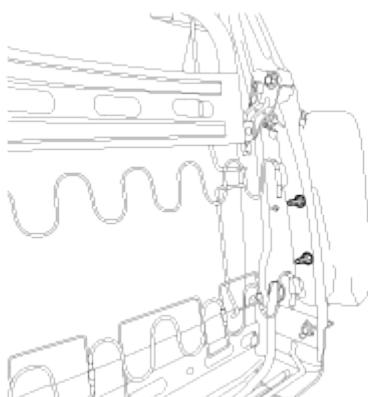
NOTE

- Do not open the lid of the side airbag cover.
- Use a new mounting nuts when you replace a side airbag.
- Make sure that the seat-back cover is installed properly. Improper installation may prevent the proper deployment.

1. Remove ignition key from the vehicle.
2. Disconnect the battery negative cable and wait for at least three minutes.
3. Place a Side Airbag (SAB) on the seat-back frame and tighten the side airbag mounting nuts.

Tightening torque

: 11.7 ~ 14.7 Nm(1.2 ~ 1.5 kgf.m, 8.7 ~ 10.8 lb-ft)



4. Install the new seat-back cover. (Refer to the Body group-Seat)
5. Install the seat assembly, then connect the Side Airbag (SAB) harness connector.
6. Recline and slide the front seat forward fully, make sure the harness wires are not pinched or interfering with other parts.
7. Reconnect the battery negative cable.
8. After installing the Side Airbag (SAB), confirm proper system operation:
 - A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

3.3.4. Curtain Airbag (CAB) Module

3.3.4.1. Description and Operation

Description

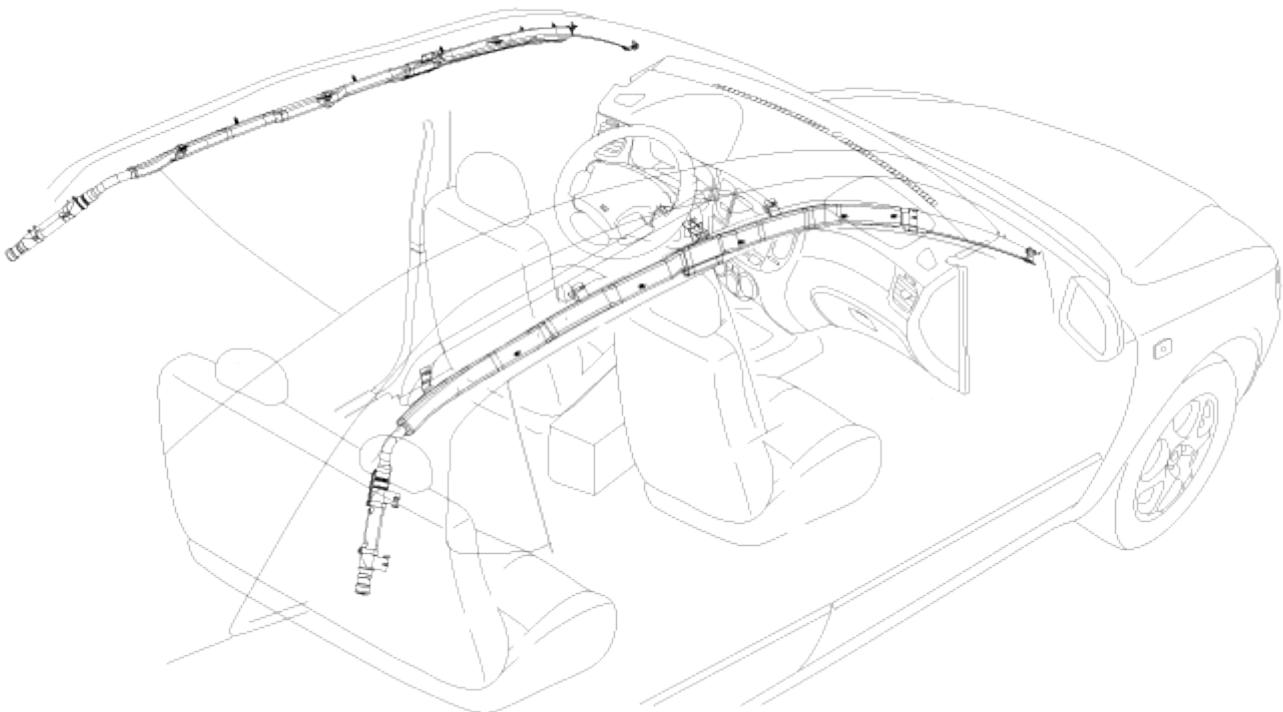
Curtain airbags are installed inside the headliner (LH and RH) and protect the driver and passenger from danger when side crash occurs. The SRSCM determines deployment of curtain airbag by using side impact sensor (SIS) signal.

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.

3.3.4.2. Component and Components Location

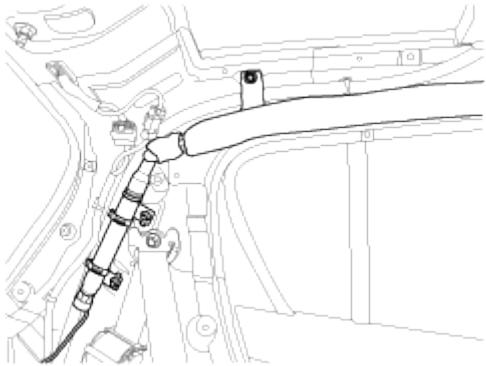
Components



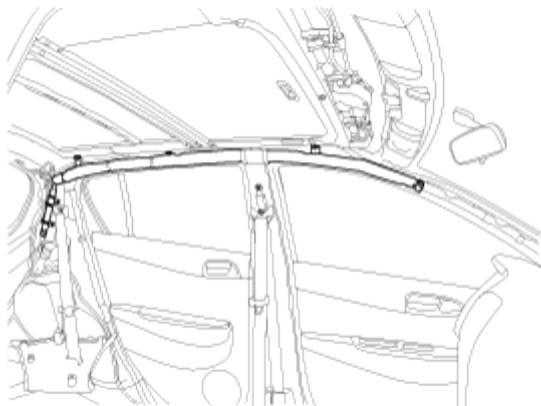
3.3.4.3. Repair procedures

removal

1. Disconnect the battery negative cable and wait for at least 3 minutes before beginning work.
2. Remove the following parts. (Refer to the Body group-Roof trim)
 - A. Side trim, Roof trim
3. Disconnect the Curtain Airbag harness connector.



- After loosening the mounting bolts, remove the curtain airbag.



Installation

CAUTION

- Be sure to install the harness wires not to be pinched or interfered with other parts.

- Remove ignition key from the vehicle.
- Disconnect the negative (-) cable from battery and wait for at least three minutes.
- Install a Curtain Airbag (CAB) on the mounting bracket.
- Tighten the CAB mounting bolts.

Tightening torque

: 1.1 ~ 1.3 kgf.m(10.8 ~ 12.7 Nm, 7.9 ~ 9.4 lb.ft)

CAUTION

- Never twist the airbag module when installing it. If the module is twisted, airbag module may operate abnormally.

- Connect the CAB connector.
- Install the following parts. (Refer to the Body group-Roof trim)
 - Side trim, Roof trim
- Reconnect the battery negative cable.
- After installing the Curtain Airbag (CAB), confirm proper system operation:
 - Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

3.3.5. Description and Operation

Airbag Disposal

Special Tool Required

Deployment tool 0957A-34100A

Before scrapping any airbags or side airbags (including those in a whole vehicle to be scrapped), the airbags or side airbags must be deployed. If the vehicle is still within the warranty period, before deploying the airbags or side airbags, the Technical Manager must give approval and/or special instruction. Only after the airbags or side airbags have been deployed (as the result of vehicle collision, for example), can they be scrapped.

If the airbags or side airbags appear intact (not deployed), treat them with extreme caution. Follow this procedure.

Deploying airbags in the vehicle

If an SRS equipped vehicle is to be entirely scrapped, its airbags or side airbags should be deployed while still in the vehicle. The airbags or side airbags should not be considered as salvageable parts and should never be installed in another vehicle.

1. Turn the ignition switch OFF, and disconnect the battery negative cable and wait at least three minutes.
2. Confirm that each airbag or side airbag is securely mounted.
3. Confirm that the special tool is functioning properly by following the check procedure.
 - (1) Driver's Airbag :
 - A. Remove the driver's airbag and install the SST(0957A-38500).
 - B. Install the driver's airbag on the steering wheel.
 - (2) Front Passenger's Airbag :
 - A. Remove the glove box, then disconnect the 2P connector between the front passenger's airbag and SRS main harness.
 - B. Install the SST(0957A-38500).
 - (3) Side Airbag :
 - A. Disconnect the 2P connector between the side airbag and side wire harness.
 - B. Install the SST (0957A-3F100).
 - (4) Curtain Airbag :
 - A. Disconnect the 2P connector between the curtain airbag and wire harness.
 - B. Install the SST(0957A-38500).
 - (5) Seat Belt Pretensioner :
 - A. Disconnect the 2P connector from the seat belt pretensioner.
 - B. Install the SST(0957A-38500).
4. Place the deployment tool at least thirty feet (10 meters) away from the airbag.
5. Connect a 12 volt battery to the tool.
6. Push the tool's deployment switch. The airbag should deploy (deployment is both highly audible and visible: a loud noise and rapid inflation of the bag, followed by slow deflection)
7. Dispose of the complete airbag. No part of it can be reused. Place it in a sturdy plastic bag and seal it securely.



Deploying the airbag out of the vehicle

If an intact airbag has been removed from a scrapped vehicle, or has been found defective or damage during transit, storage or service, it should be deployed as follows :

1. Confirm that the special is functioning properly by following the check procedure on this page.
2. Position the airbag face up, outdoors on flat ground at least thirty feet (10meters) from any obstacles or people.

Disposal of damaged airbag

1. If installed in a vehicle, follow the removal procedure of driver's airbag front passenger's and side airbag.
2. In all cases, make a short circuit by twisting together the two airbag inflator wires.
3. Package the airbag in exactly the same packing that the new replacement part come in.

3.4. Seat Belt Pretensioner

3.4.1. Seat Belt Pretensioner (BPT)

3.4.1.1. Description and Operation

Description

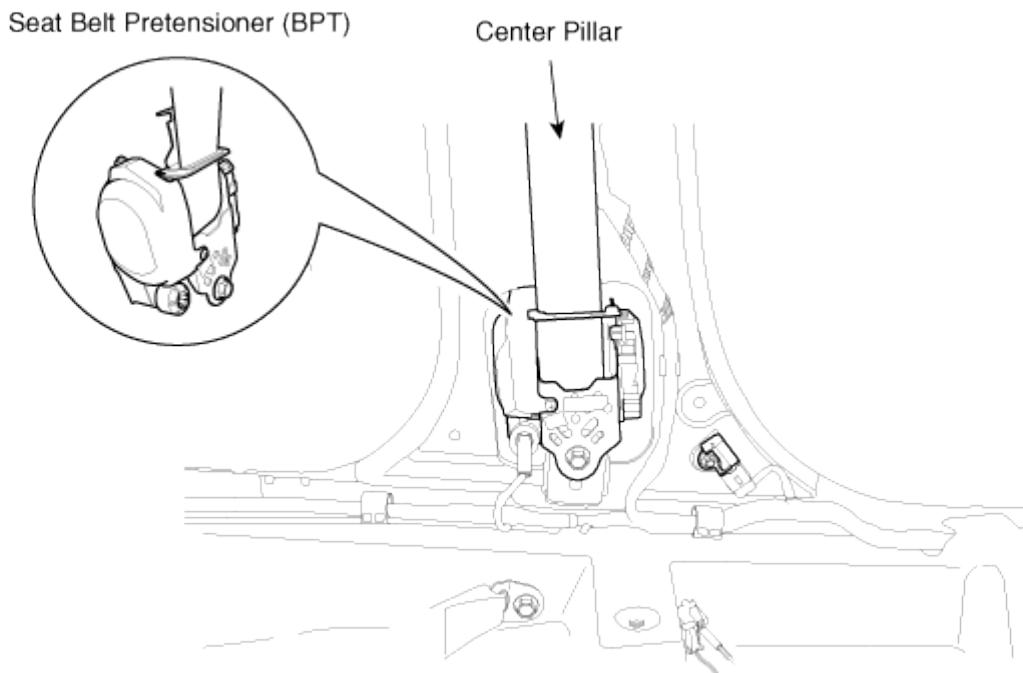
The Seat Belt Pretensioners (BPT) are installed inside Center Pillar (LH & RH). When a vehicle crashes with a certain degree of frontal impact, the pretensioner seat belt helps to reduce the severity of injury to the front seat occupants by retracting the seat belt webbing. This prevents the front occupants 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.

3.4.1.2. Component and Components Location

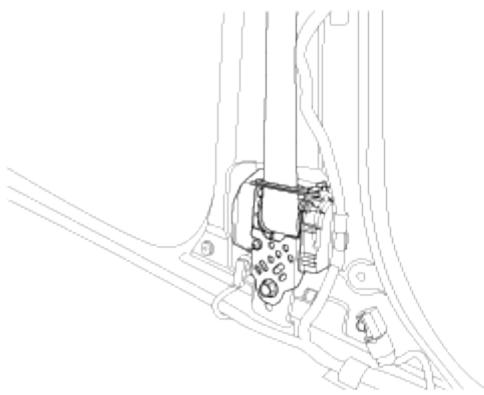
Components



3.4.1.3. Repair procedures

Removal

1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
2. Remove the following parts. (Refer to the Body group-Interior trim)
 - A. Center pillar trim, Door scuff trim.
3. Disconnect the Seat Belt Pretensioner connector.



4. Remove the lower anchor bolt.
5. Remove the upper anchor bolt.
6. Loosen the Seat Belt Pretensioner mounting bolt and remove the Seat Belt Pretensioner.

Installation

1. Remove ignition key from the vehicle.
2. Disconnect the negative (-) cable from battery and wait for at least three minutes.
3. Install the Seat Belt Pretensioner (BPT) with bolt.
4. Install the upper and lower anchor bolts.

Tightening torque

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

5. Install the following parts. (Refer to the Body group-Interior trim)
 - A. Center pillar trim, Door scuff trim
6. Install the front seat assembly.
7. Reconnect the negative battery cable.
8. After installing the Seat Belt Pretensioner (BPT), confirm proper system operation:
 - A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

4. Body (Interior and Exterior)

- 4.1. General Information
- 4.1.1. Specifications

Specifications

Hood	Type	Rear hinged, stay rod type
Front Door	Construction	Front hinged, full door construction
	Regulator system	X-arm type
	Locking system	Pin-fork system
Rear Door	Construction	Front hinged, full door construction
	Regulator system	I-arm type

	Locking system	Pin-fork system
Tailgate	Type	Inner hinged, gas lifter
Seat Belts	Front	3 point type with Emergency Locking Retractor (E.L.R)
	Rear	3 point type with Emergency Locking Retractor (E.L.R)

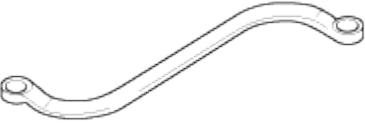
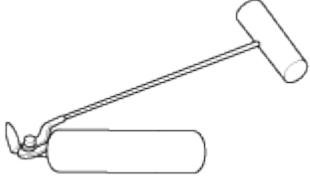
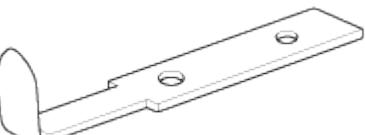
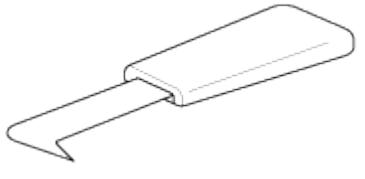
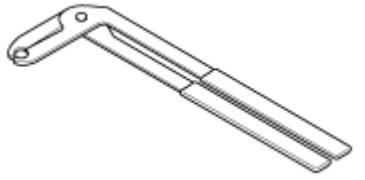
Tightening Torques

Items		N.m	Kgf.m	Lb·ft
Hood	Hood hinge to body	21.6~26.5	2.2~2.7	15.9~19.5
	Hood hinge to hood	21.6~26.5	2.2~2.7	15.9~19.5
	Hood latch to body	6.9~10.8	0.7~1.1	5.1~8.0
Tailgate	Tailgate hinge to body	38.2~58.8	3.9~6.0	28.2~43.4
	Tailgate hinge to tailgate	6.9~10.8	0.7~1.1	5.1~8.0
	Tailgate latch	8.8~13.7	0.9~1.4	6.5~10.1
Front and rear doors	Door hinge to body	33.3~41.2	3.4~4.2	24.6~30.4
	Door hinge to door	9.8~19.6	1.0~2.0	7.2~14.5
	Door striker	8.8~13.7	0.9~1.4	6.5~10.1
	Checker to body	21.6~22.6	2.2~2.3	15.9~16.6
	Checker to door	6.9~10.8	0.7~1.1	5.1~8.0
Seat	Front seat mounting bolts	34.3~53.9	3.5~5.5	25.3~39.8
	Rear seat mounting bolts	34.3~53.9	3.5~5.5	25.3~39.8
Seat belt	Front seat belt height adjuster	39.2~53.9	4.0~5.5	28.9~39.8
	Front seat belt buckle mounting bolt	39.2~53.9	4.0~5.5	28.9~39.8
	Front seat belt anchor mounting bolt	39.2~53.9	4.0~5.5	28.9~39.8
	Front seat belt lower anchor	39.2~53.9	4.0~5.5	28.9~39.8
	Front seat belt upper anchor	39.2~53.9	4.0~5.5	28.9~39.8
	Rear seat belt anchor attaching 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

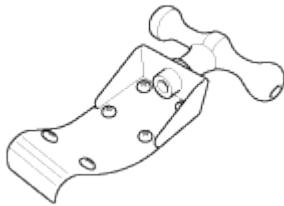
4.1.2. Special Service Tools

Special Service Tools

Tool (Number and name)	Illustration	Use
09793-21000 Door hinge adjusting wrench		Adjustment, removal and installation of the door hinge

		
09800-21000 Ornament remover		Trim removal
09853-31000 Headliner clip remover		Headliner clip removal
09861-31100 Sealant cut-out tool		Cutting windshield sealant (use with 09861-31200)
09861-31200 Sealant cutting blade		Cutting windshield sealant (use with 09861-31100)
09861-31000 Windshield molding remover		Windshield molding removal
09880-4F000 Hog ring clip installer		Hog ring clip installation

09840-1E100
Center fascia remover



Center fascia removal

4.1.3. Troubleshooting

Troubleshooting

Symptom	Suspect Area	Remedy (Refer to page)
Water leaks from sunroof	Dirt accumulation in drain tube	Remove dirt from drain
	Clogged drain tube	Blow air into drain to remove dirt
	Broken or dislocated drain tube, defective or cracked clip	Check tube installation and flange contact
	Deteriorated roof lid weatherstrip	Replace
	Excessive roof lid-to-body clearance and improperly fitted weatherstrip	Adjust
Wind noise around sunroof	Loose or deformed deflector, gaps in body work	Retighten adjust or replace
Noise heard when opening, closing sunroof	Foreign particles lodged in guide rail	Check drive cable and guide rails for foreign particles
	Loose guide rails and lid	Retighten
Motor runs but sunroof does not move or moves only partially	Foreign particles lodged in guide rail	Adjust or replace
	Incorrect engagement of motor pinion with drive cable	
	Decrease in motor's clutch slipping force	
	Increased sunroof sliding resistance or interference of sunroof with drive cables, weatherstrip, etc. due to mal adjustment of sunroof	
Noise in motor (clutch slipping noise from motor when sunroofs fully opened or closed is not an unusual noise	Incorrect engagement of motor pinion with drive cable	Check pinion installation and retighten motor
	Worn out or damaged motor pinion bearing	
	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

4.2. Exterior

4.2.1. Fender

4.2.1.1. Repair procedures

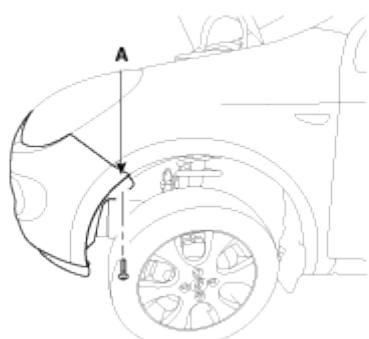
5Door, 3Door

Replacement

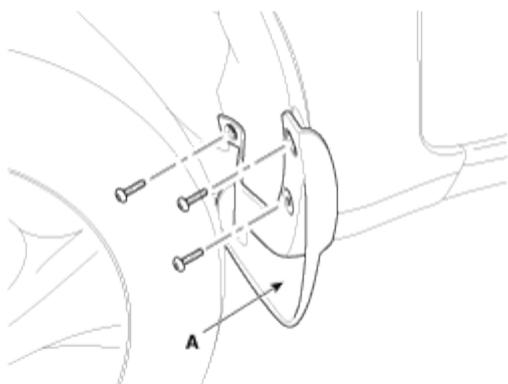
NOTE

- Be careful not to damage the hood and body.
- When removing the clips, use a clip remover.

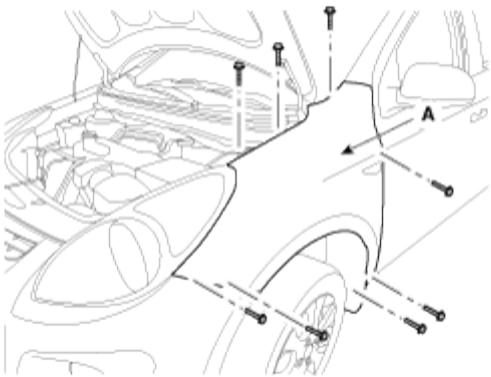
1. Remove the front bumper side mounting screw (A).



2. After loosening the fender mounting screws, remove the mud guard (A).



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



4. Installation is the reverse of removal.

4.2.2. Hood

4.2.2.1. Repair procedures

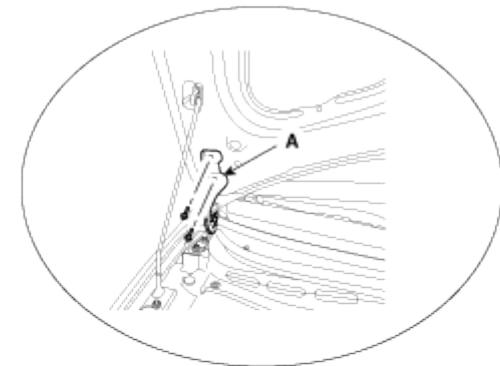
Replacement

Hood Assembly Replacement

NOTE

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

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



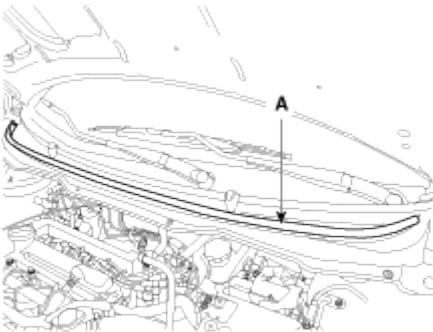
2. Installation is the reverse of removal.

NOTE

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

Hood Weatherstrip Replacement

1. Remove the hood weatherstrip (A).



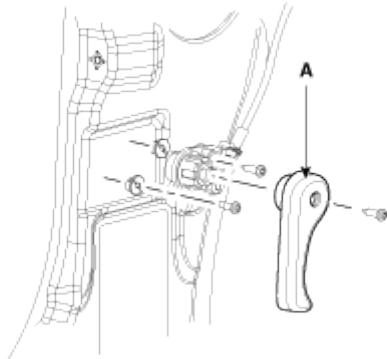
2. Installation is the reverse of removal.

NOTE

- Replace any damaged clips.

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

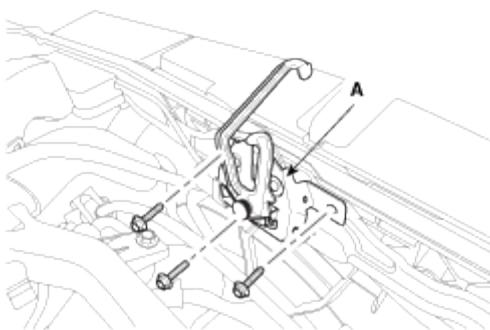
- Make sure the hood latch cable is connected properly.
- Make sure the hood locks securely.

Hood Latch Replacement

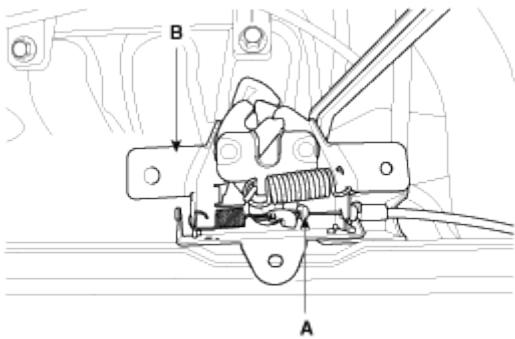
1. Remove the hood latch (A) mounting bolts.

Tightening torque:

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



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



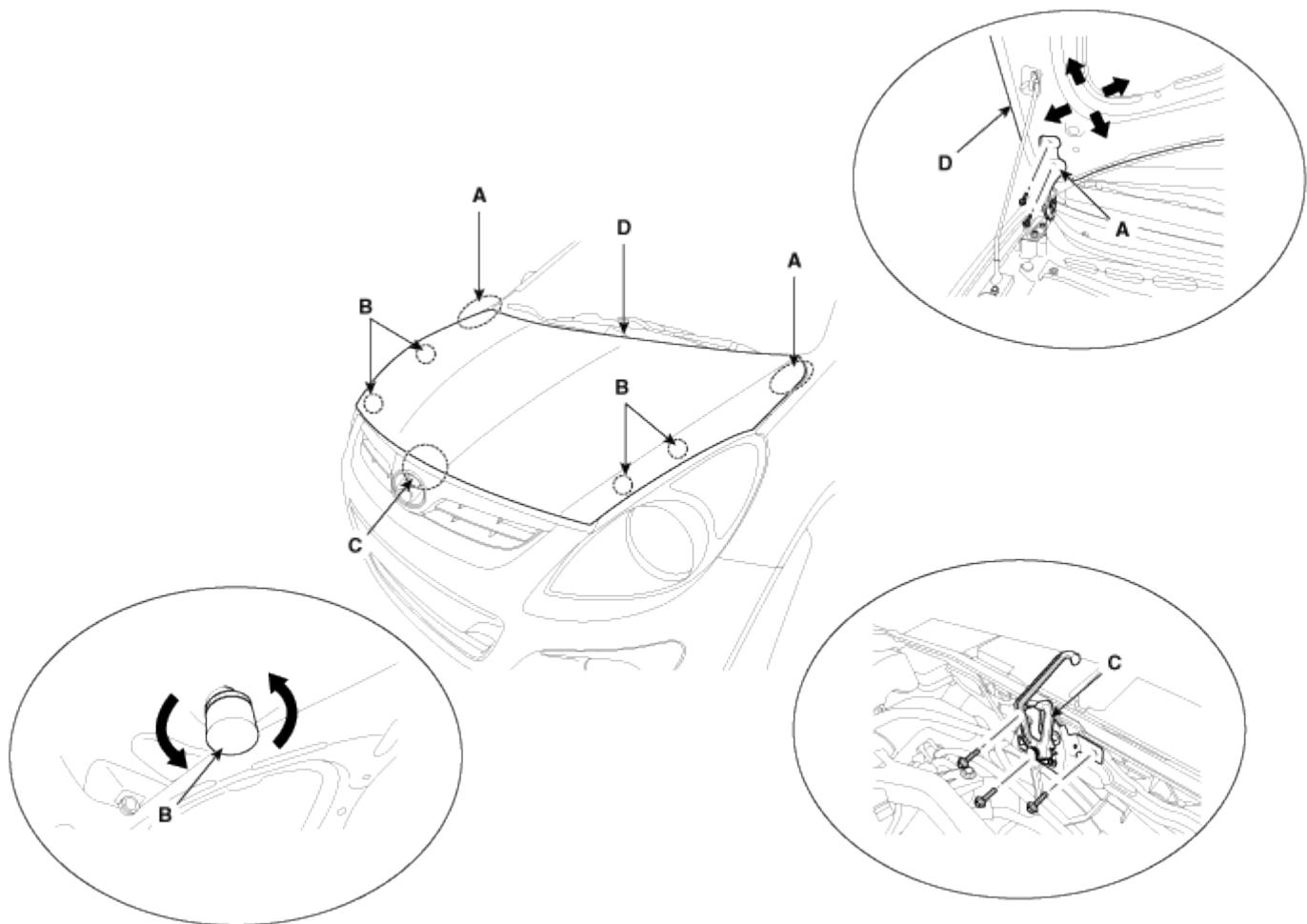
3. Installation is the reverse of removal.

NOTE

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

Adjustment

1. After loosening the hinge (A) mounting bolt, adjust the hood (D) by moving it up or down, or right or left.
2. Adjust the hood height by turning the hood overslam bumpers (B).
3. After loosening the hood latch (C) mounting bolts, adjust the latch by moving it up or down, or right or left.



4.2.3. Tailgate 4.2.3.1. Repair procedures

Replacement

Latch Assembly Replacement

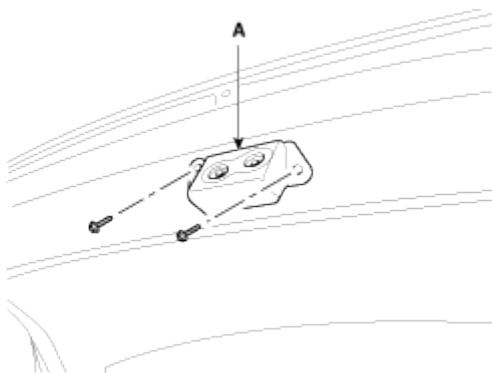
1. Remove the tailgate trim.
2. Disconnect the actuator rod (A).



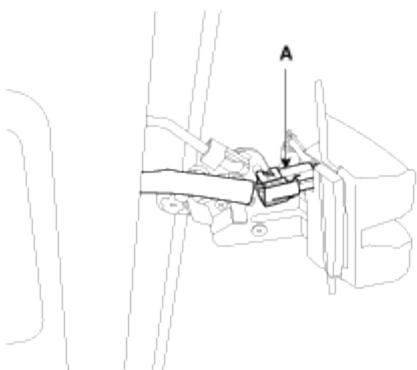
3. Disconnect the outside handle rod (A).



4. After loosening the mounting bolts, remove the latch assembly (A).



5. Disconnect the connector (A).



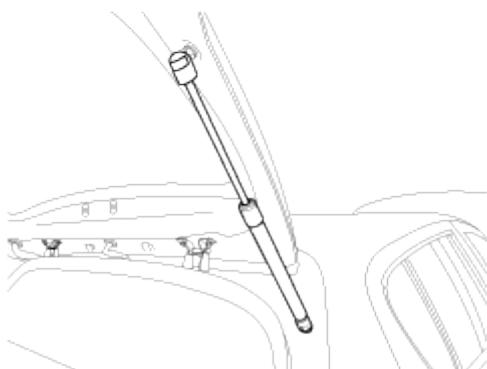
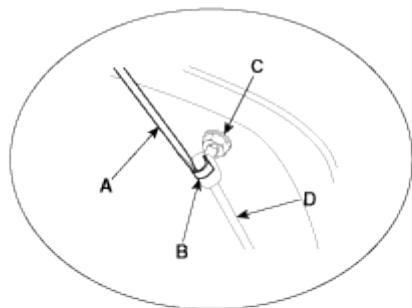
6. Installation is the reverse of removal.

NOTE

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

Lifter Replacement

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



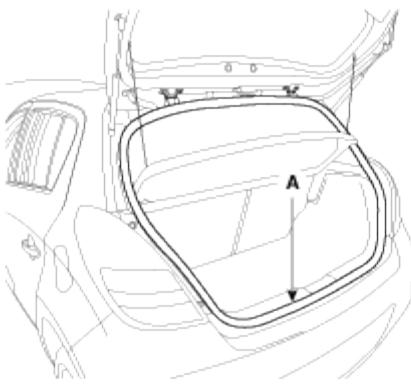
2. Push the socket of the lifter into the ball joint for installation.

Tailgate Weatherstrip Replacement

NOTE

- Do not apply sealant to the body.

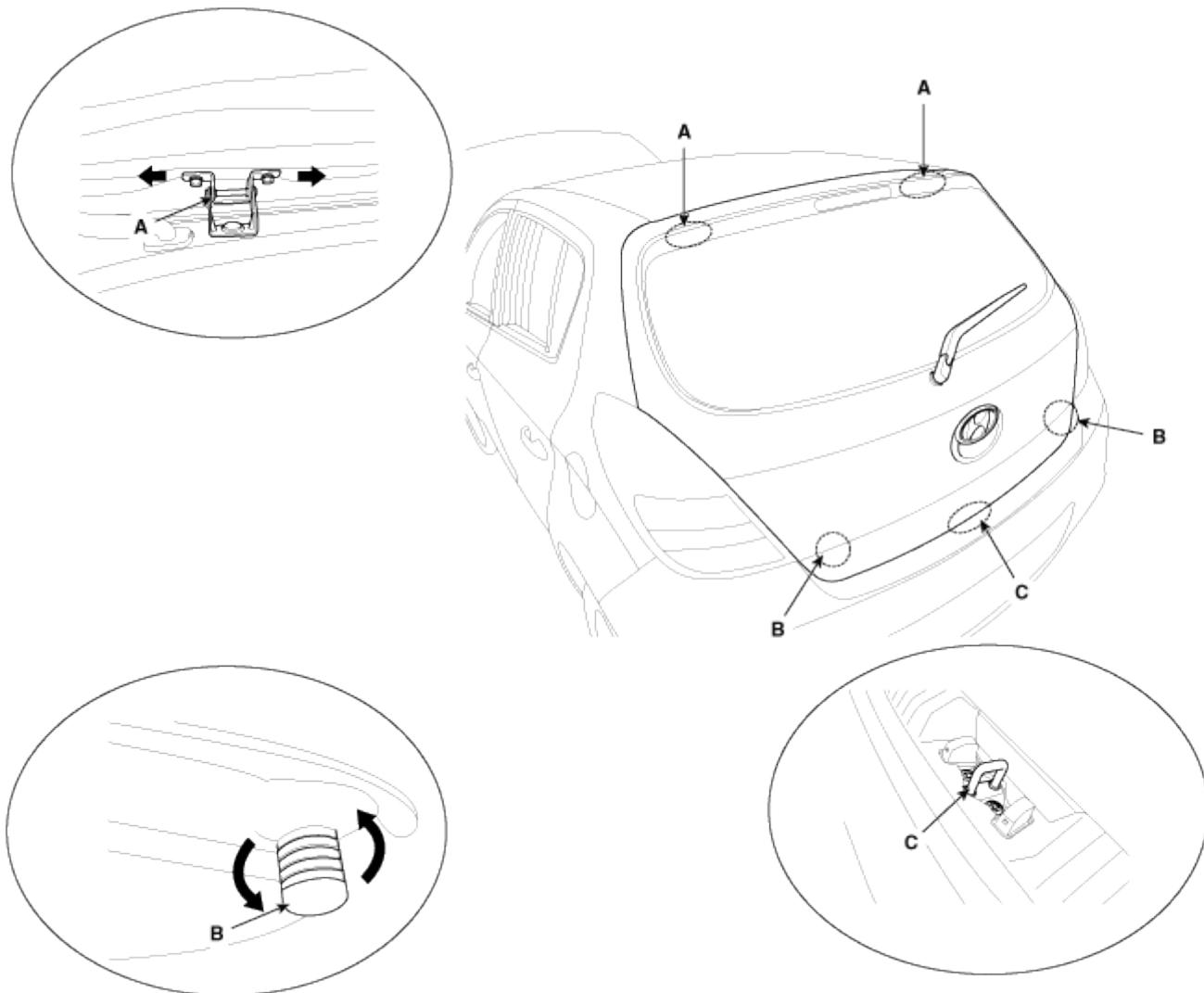
1. Remove the tailgate weather strip (A).



2. Installation is the reverse of removal.

Adjustment

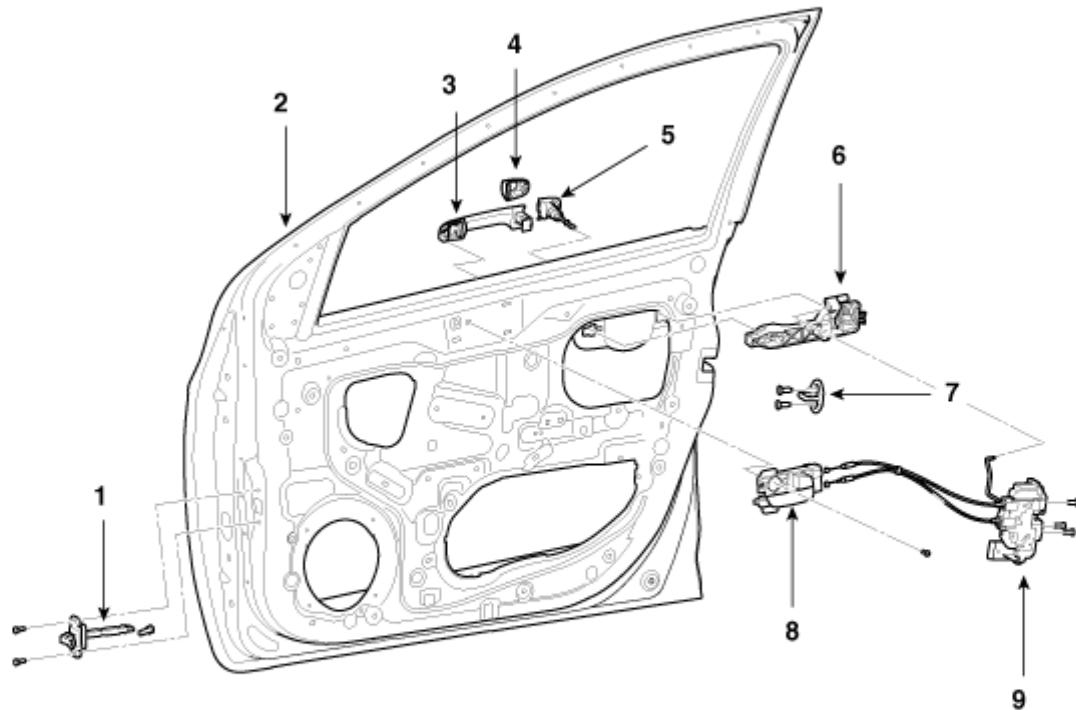
1. After loosening the tailgate hinge (A) mounting bolt, adjust the tailgate by moving it up or down, or right or left.
2. Adjust the tailgate fit by turning the tailgate over slam bumper and side bumper (B).
3. Adjust the striker (C) by moving it up or down, or right or left.



4.2.4. Front Door

4.2.4.1. Component and Components Location

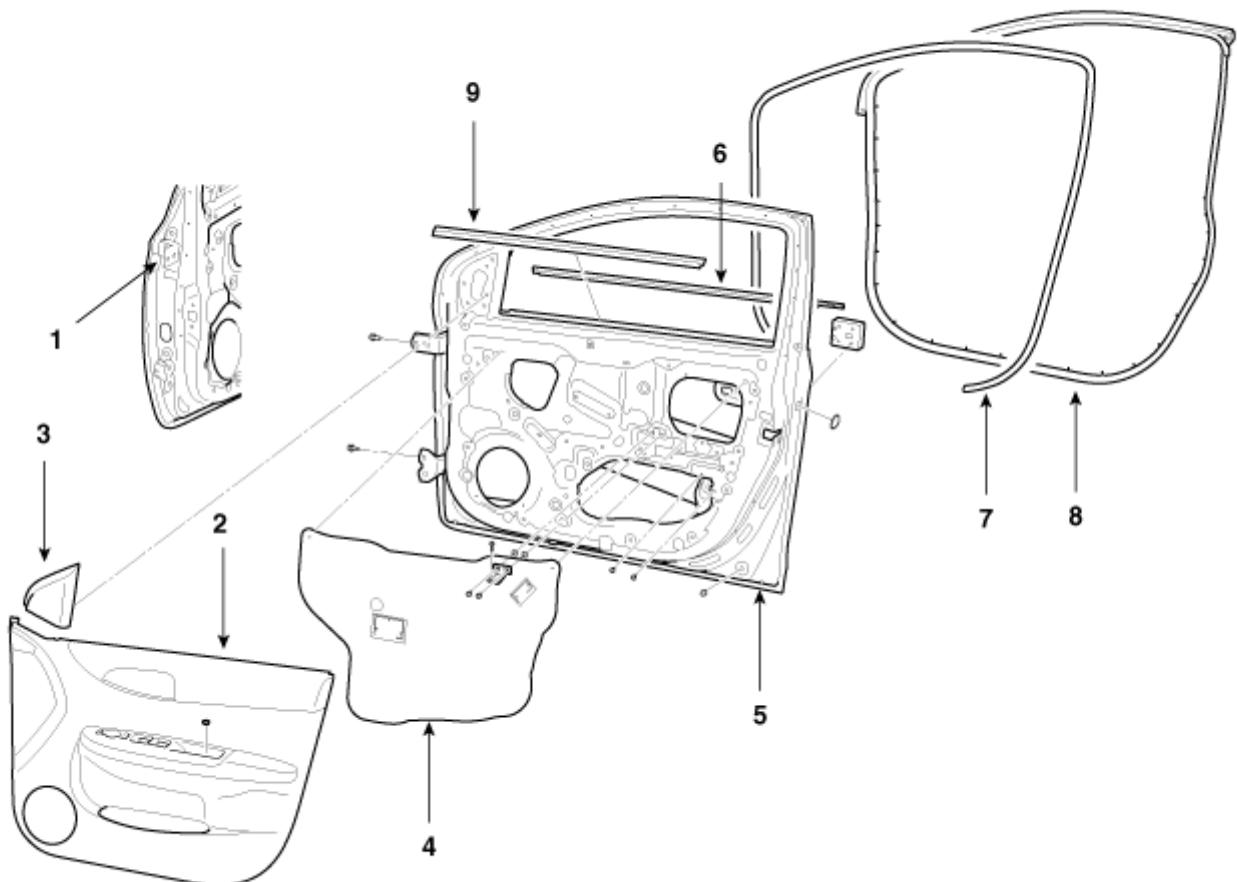
Components



1. Checker
2. Door panel
3. Outside handle

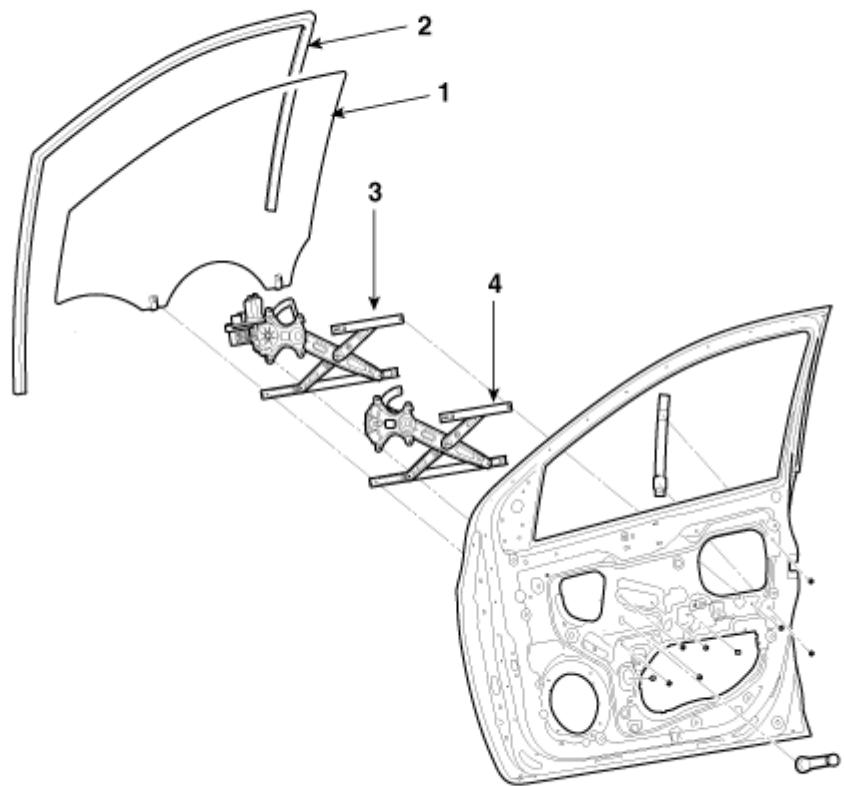
4. Outside handle cover
5. Key holder
6. Outside handle base

7. Striker
8. Inside handle
9. Door latch



- 1. Door hinge
- 2. Door trim
- 3. Quadrant inner cover
- 4. Door screen

- 5. Door panel
- 6. Door out side belt weatherstrip
- 7. Door weatherstrip
- 8. Body weatherstrip
- 9. Door inside belt weatherstrip



1. Grass
2. Grass run

3. Regulator (P/W)
4. Regulator

4.2.4.2. Repair procedures

5Door, 3Door

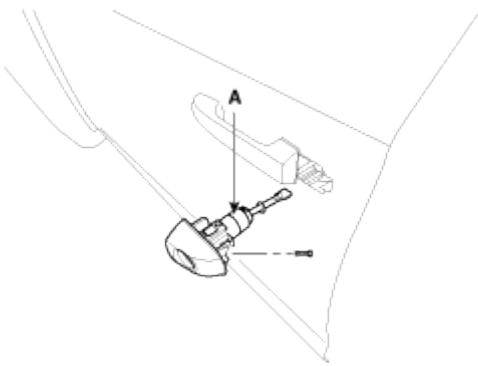
Replacements

Out Side Handle Replacement

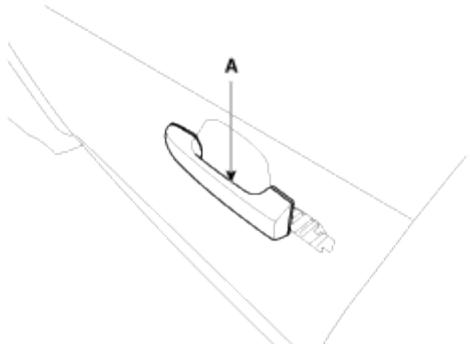
1. After loosening the mounting bolt, remove the key holder (A).

Tightening torque:

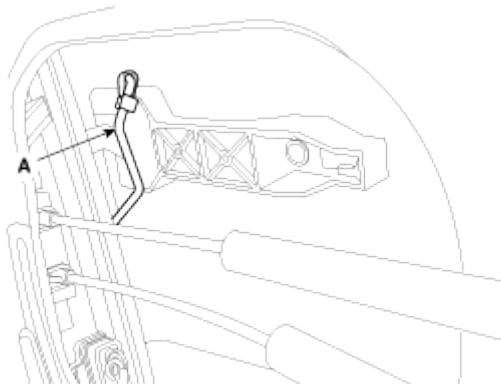
7.8~10.8 N.m (0.8~1.1 kgf.m, 5.8~8.0lb-ft)



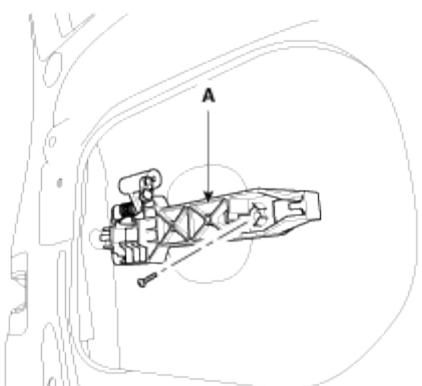
2. Remove the outside handle (A) by sliding it rearward.



3. Disconnect outside handle the rod (A).



4. After loosening the mounting bolt, remove the outside handle base (A).



5. Installation is the reverse of removal.

NOTE

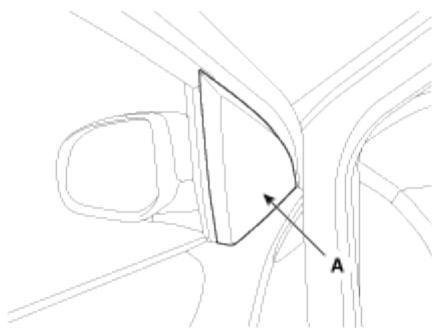
- Make sure the door lock and open properly.

Door Trim Replacement

NOTE

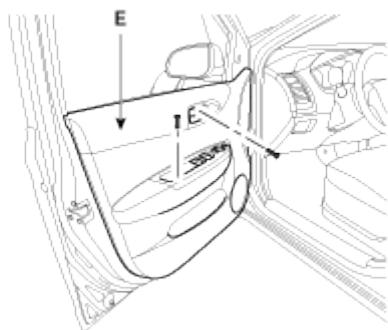
- Take care not to scratch the door trim and other parts.
- Put on gloves to protect your hands.

1. Remove the quadrant inner cover (A).

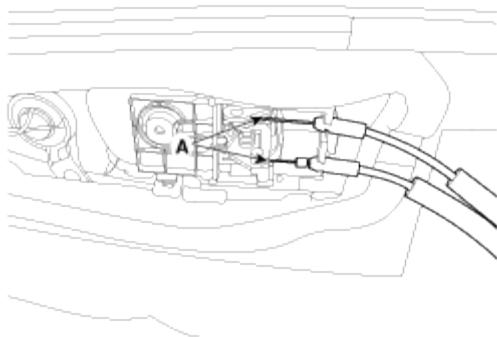


2. Loosen the door trim (E) mounting screws.

3. Release the clips that hold the door trim.



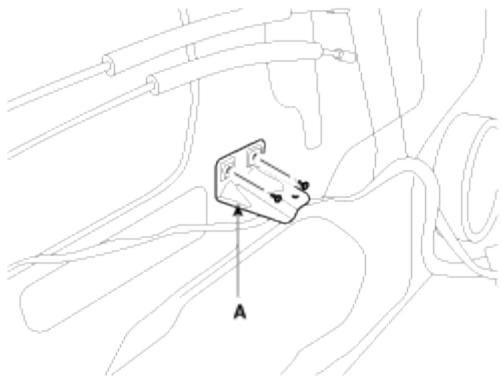
4. Remove the inside handle cable (A).



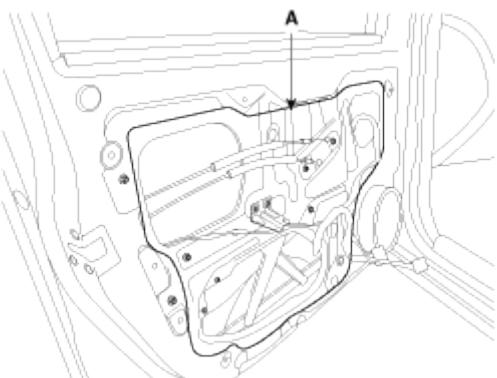
5. Disconnect the connectors (A).



6. Remove the bracket (A).



7. Remove the door screen (A).



8. Installation is the reverse of removal.

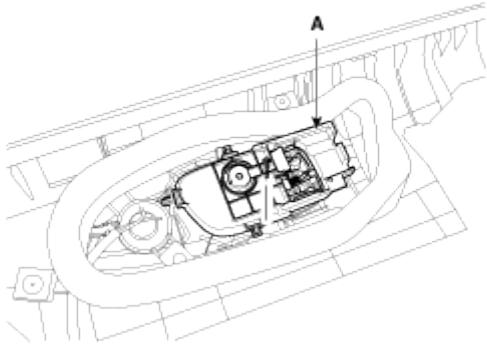
NOTE

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

Inside Handle Replacement

1. Remove the door trim.

2. Remove the inside handle (A).



3. Installation is the reverse of removal.

Glass Replacement

1. Remove the front door trim.

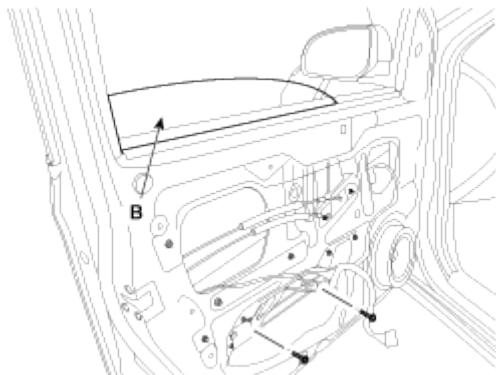
NOTE

- Using the door switch to align the mounting hole with the hole on the door glass.
- If it is impossible, align the hole by hand after removing the motor.
- Be careful not to drop to glass and scratch the glass surface.

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

Tightening torque:

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



3. Installation is the reverse of removal.

NOTE

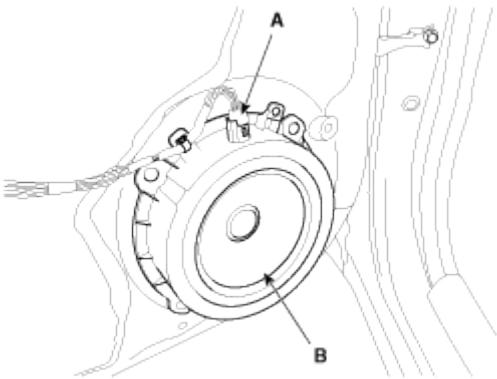
- Roll the glass up and down to see if it move freely without binding.
- Adjust glass position as needed.

Speaker Replacement

1. Remove the door trim.

2. Drill out the rivets to remove the speaker (B) from the door panel.

3. Disconnect the speaker connector (A).



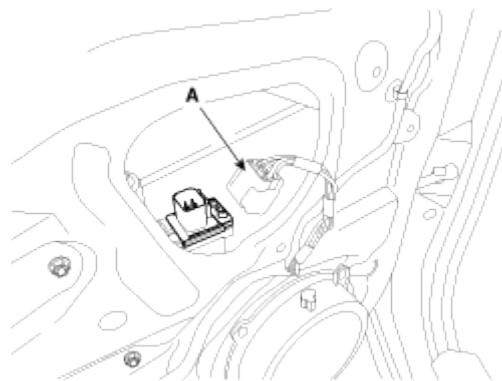
4. Installation is the reverse of removal.

NOTE

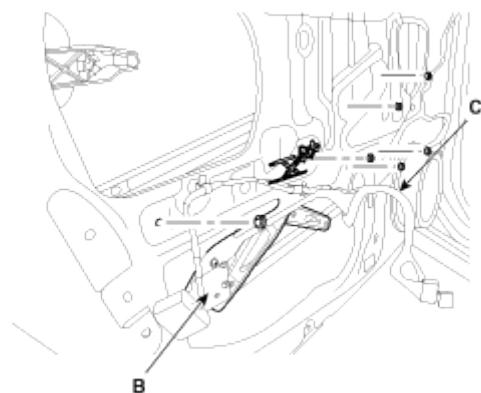
- Use sheet metal screws to secure the speaker.

Power Window Motor Replacement

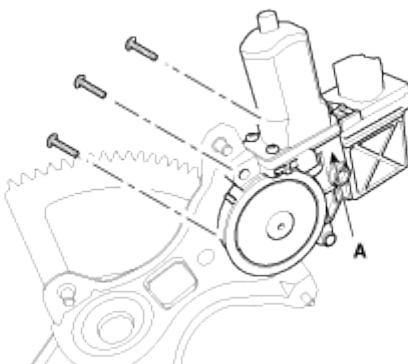
1. Remove the door trim.
2. Remove the door screen.
3. Disconnect the connector (A).



4. Loosen the door regulator mounting bolts, remove the door regulator (A).
5. Disconnect the door regulator wiring harness (B), remove the regulator.



6. Loosen the mounting screws, remove the power window motor (A).



7. Installation is the reverse of removal.

NOTE

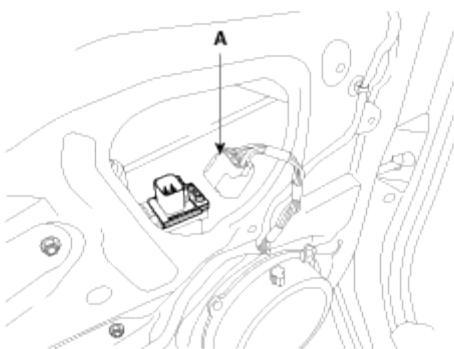
- Grease should be applied to areas where there is rotational parts and springs.
- Roll the glass up and down to see if it moves freely without binding.

Door Regulator Assembly Replacement

1. Remove the following parts.

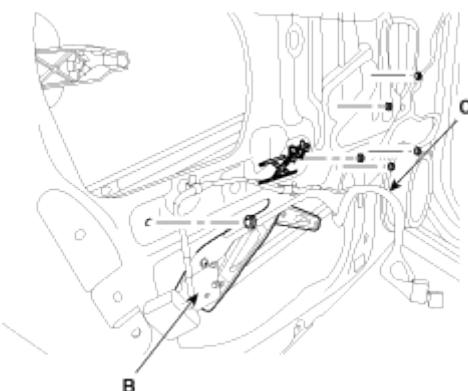
- A. Door trim
- B. Window glass

2. Disconnect the connector (A).



3. Loosen the door regulator mounting bolts, remove the door module (B).

4. Disconnect the door regulator wiring harness (C), remove the regulator.



5. Installation is the reverse of removal.

NOTE

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

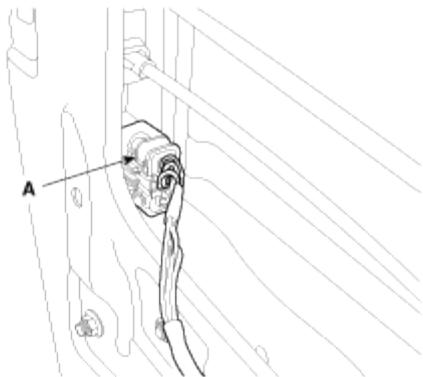
- Make sure door lock operates and door open/close properly.

Latch Assembly Replacement

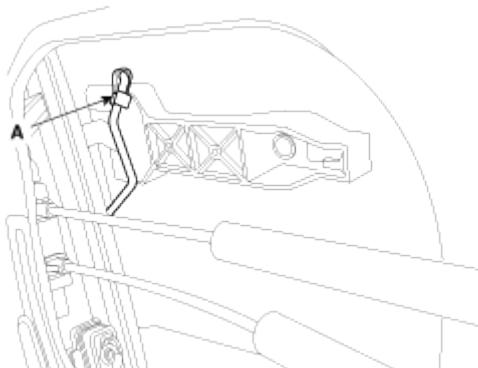
1. Remove the following parts.

- Door trim.
- Glass.

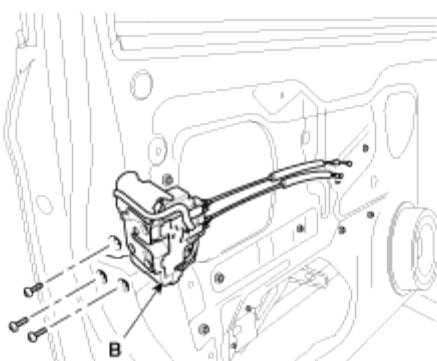
2. Disconnect the connector (A).



3. Disconnect the rod (A).



4. Disconnect the latch connector, remove the latch assembly (B).



5. Installation is the reverse the removal.

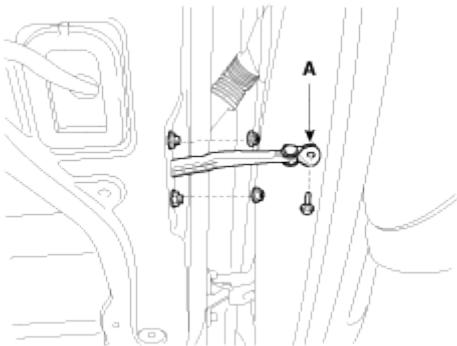
NOTE

- Make sure door lock operates and door open/close properly.

Door Checker Replacement

1. Remove the door trim.

2. After loosening the mounting bolts, remove the door checker (A).



3. Installation is the reverse of removal.

NOTE

- Make sure the door opens properly and locks securely.

Adjustment

Glass Adjustment

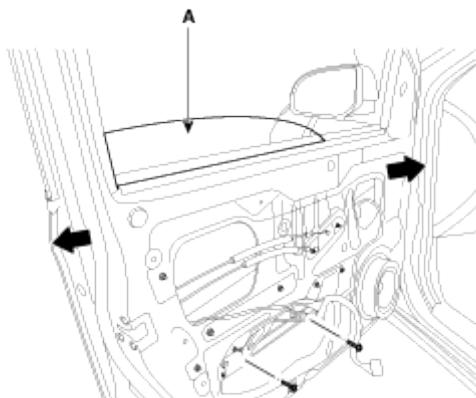
NOTE

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

1. Remove the following parts.

- A. Quadrant inner cover.
- B. Door trim.

2. Carefully move the glass (A) until you can see the glass mounting bolts, then loosen them.



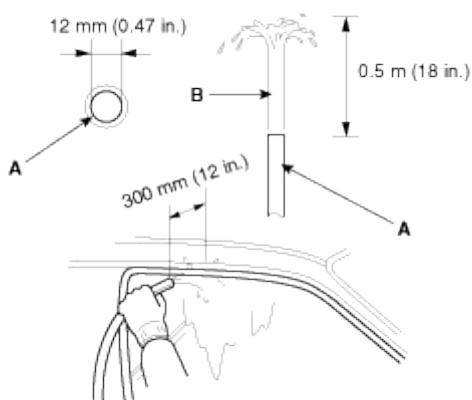
3. Check that the glass moves smoothly.

4. Raise the glass fully, and check for gaps.

Check that the glass contacts the glass run channel evenly.

5. Check for water leaks. Run water over the roof and on the sealing area as shown, and note these items:

- A. Use a 12mm (1/2in.) diameter hose.
- B. Adjust the rate of water flow as shown.
- C. Do not use a nozzle.
- D. Hold the hose about 300mm(12in.) away from



Door Position Adjustment

NOTE

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

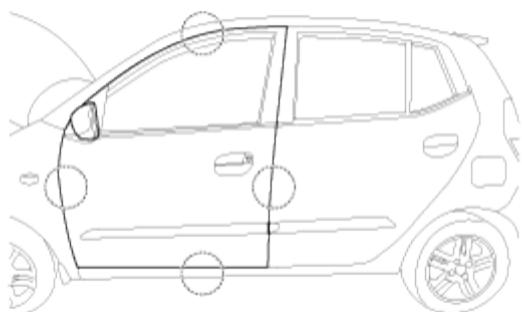
1. Place the vehicle on a firm, level surface when adjusting the doors.

2. Adjust at the hinges (A):

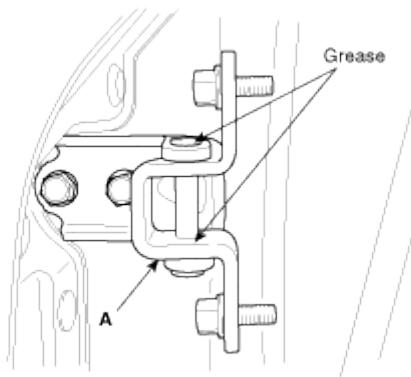
- Loosen the door mounting bolts slightly, and move the door IN or OUT until it aligns flush with the body.
- Loosen the hinge mounting bolts slightly, and move the door BACKWARD or FORWARD, UP or DOWN as necessary to equalize the gaps.
- Place a shop towel on the jack to prevent damage to the door when adjusting the door.



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



4. Grease the pivot portions of the hinges indicated by the arrows.



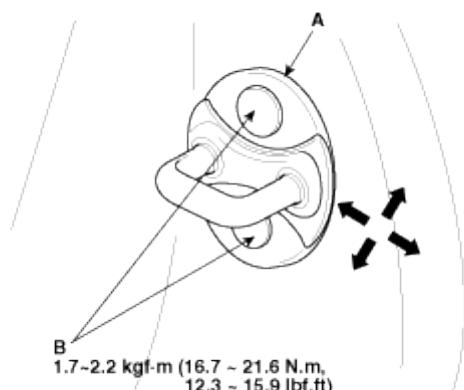
5. Check for water leaks.

Door Striker Adjustment

NOTE

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

1. Loosen the screws (B), then insert a shop towel between the body and striker.



2. Lightly tighten the screws.

3. Wrap the striker with a shop towel, then adjust the striker by tapping it with a plastic hammer.
Do not tap the striker too hard.

4. Loosen the screws and remove the shop towel.

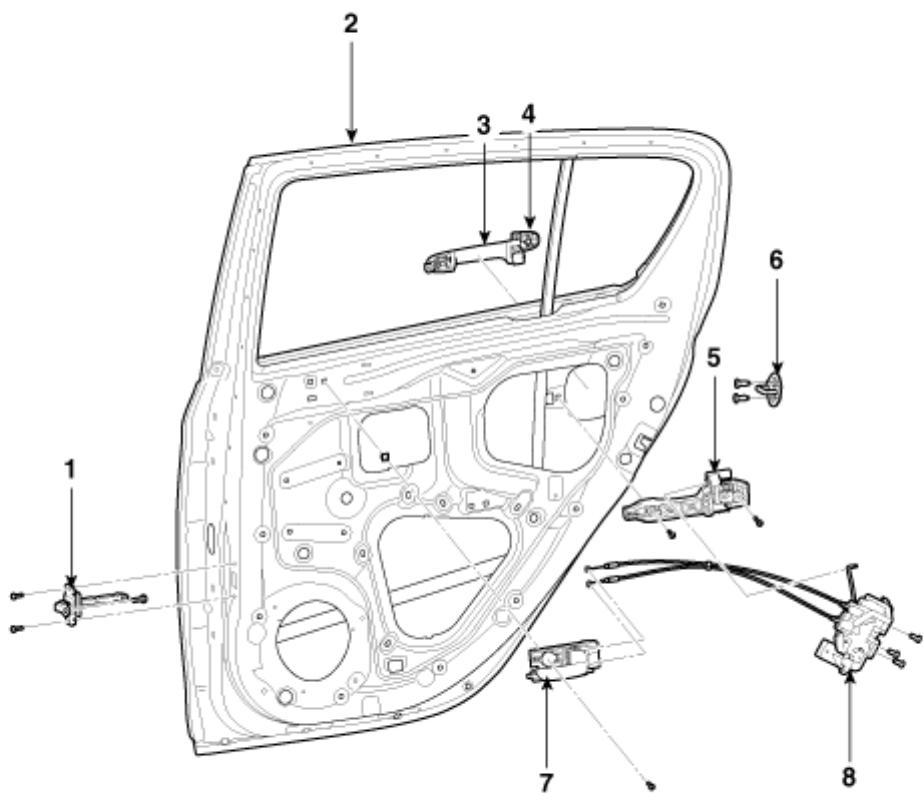
5. Lightly tighten the screws.

6. 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.

4.2.5. Rear Door 4.2.5.1. Component and Components Location

5Door

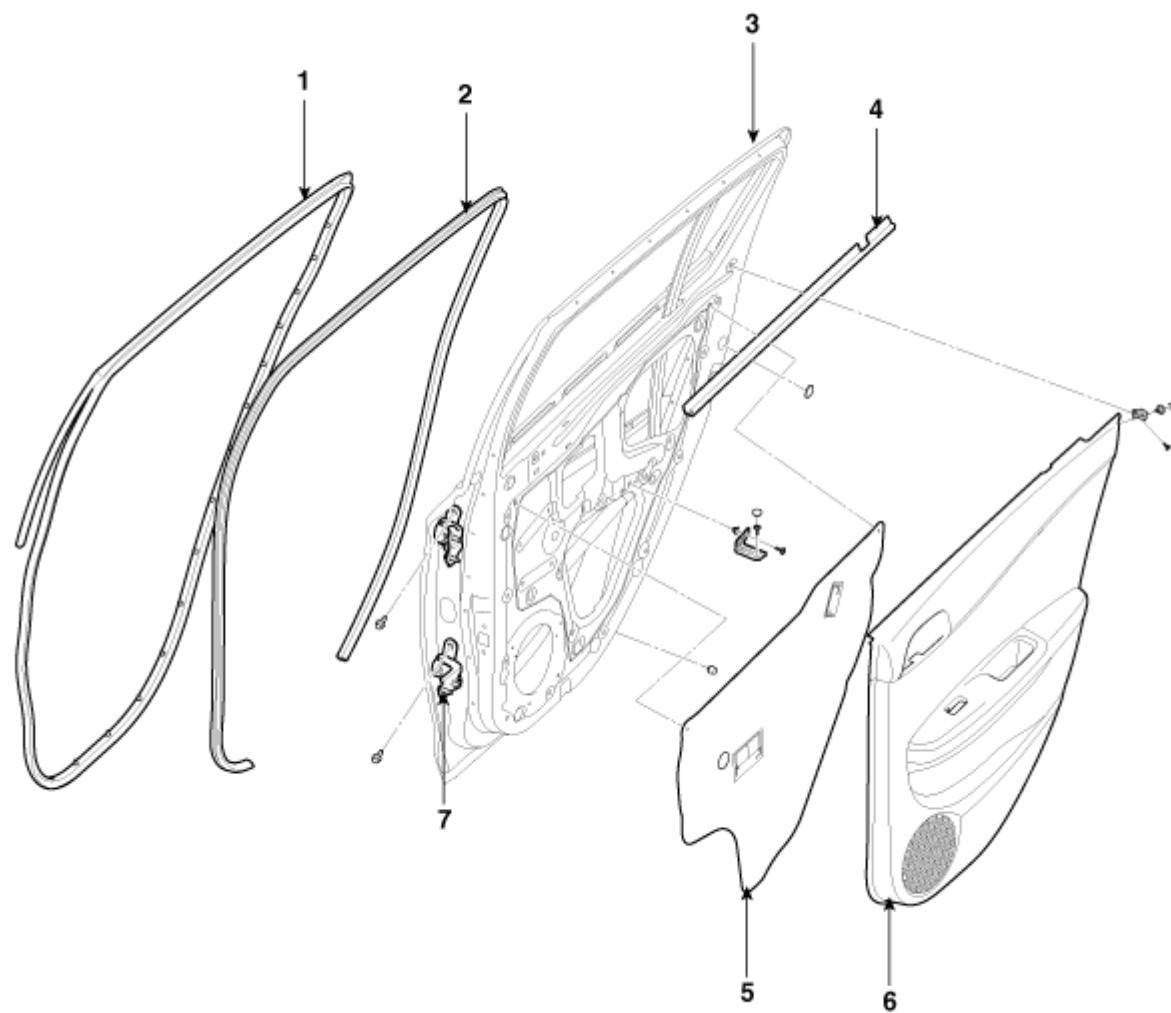
Components



1. Door checker
2. Door panel
3. Outside handle

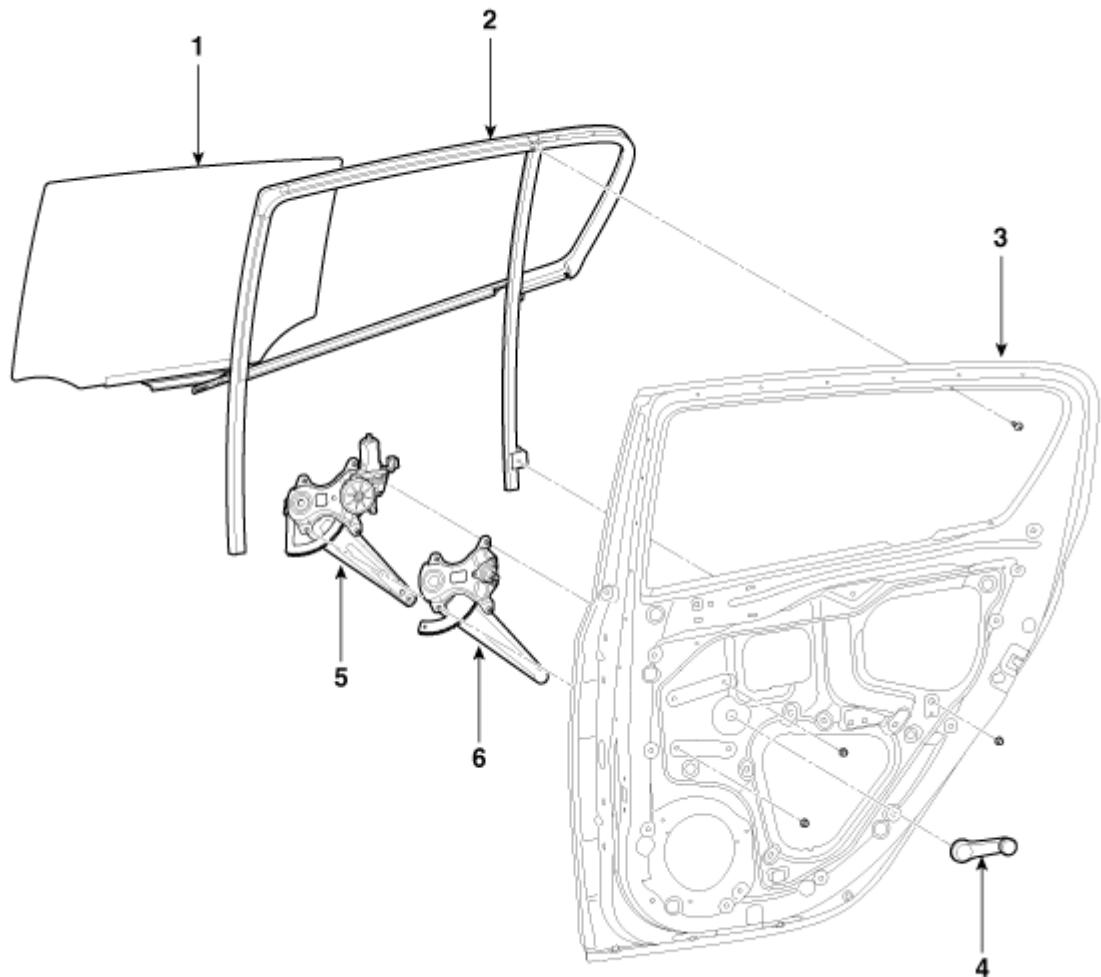
4. Outside handle cover
5. Out side handle base
6. Door striker

7. Inside handle
8. Door latch



1. Door weatherstrip
2. Body weatherstrip
3. Door panel

4. Door belt weatherstrip
5. Door screen
6. Door trim
7. Door hinge



1. Door grass
2. Door glass run chanel

3. Door panel
4. Inside handle

5. Regulator (P/W)
6. Regulator

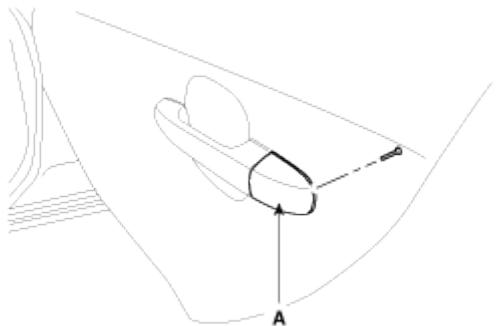
4.2.5.2. Repair procedures

5Door

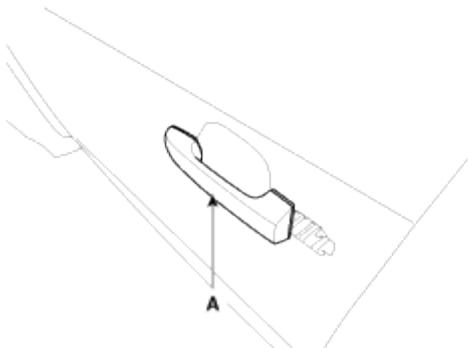
Replacement

Out Side Handle Replacement

- After loosening the mounting bolt, then remove the handle cover (A).

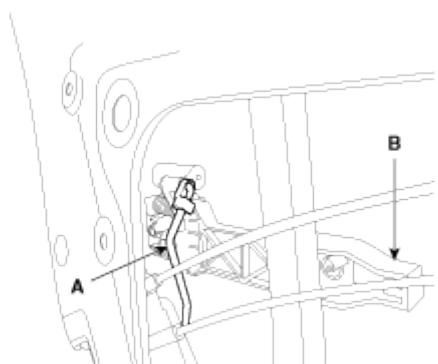


2. Remove the outside handle (A) by sliding it rearward.



3. Disconnect outside handle the rod (A).

4. After loosening the mounting bolt, remove the outside handle base (B).



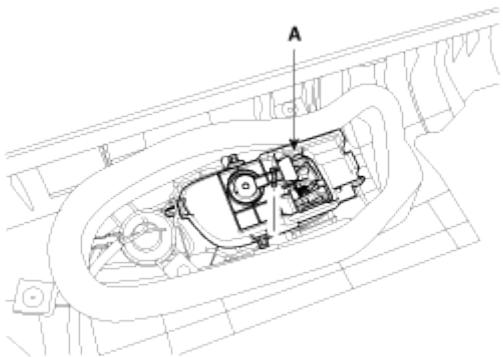
5. Installation is the reverse of removal.

NOTE

- Make sure door lock operates and door open/closes properly.

Inside Handle Replacement

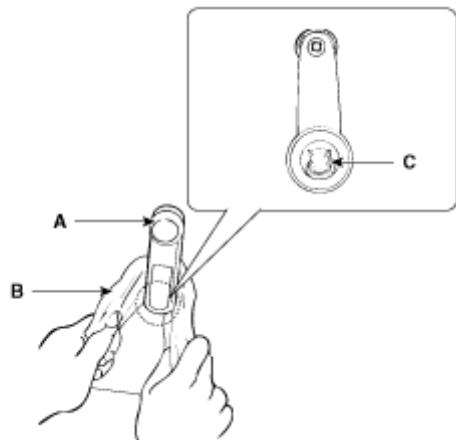
1. Remove the door trim.
2. Remove the inside handle (A).



3. Installation is the reverse of removal.

Door Window Regulator Handle Replacement

- Push the clip (C) using a piece of cloth (B), and then remove the door window regulator handle (A).
[Manual type only]



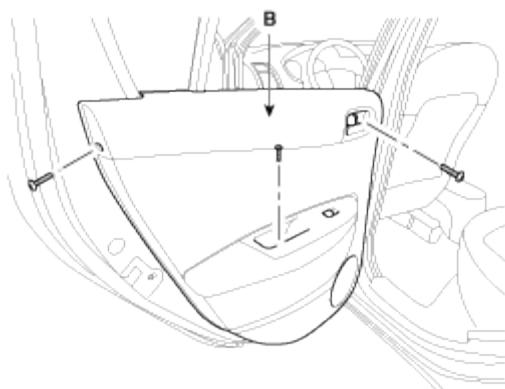
2. Installation is the reverse of removal.

Door Trim Replacement

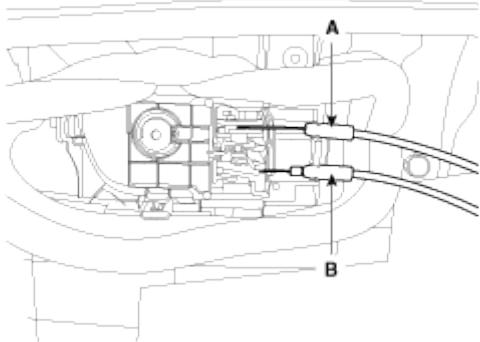
NOTE

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

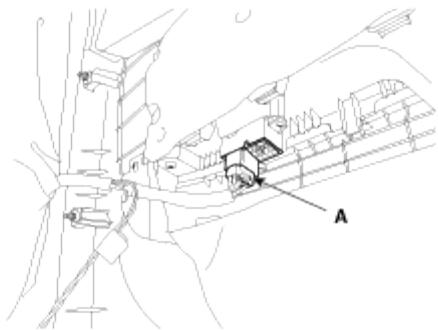
- Loosen the door trim (B) mounting screws. Release the clips that hold the door trim.



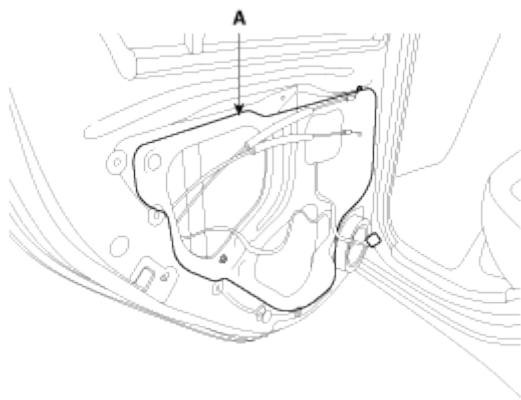
- Disconnect the lock cable and (A) inside connect cable (B).



3. Disconnect the connector (A).



4. Remove the door scree (A).



5. Installation is the reverse of removal.

NOTE

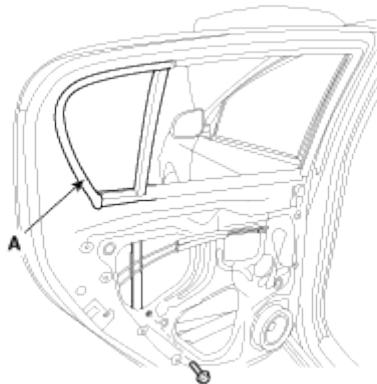
- Make sure of connectors is plugged in properly and each rod is connected securely.
- Make sure the door lock and opens properly.

Glass Replacement

NOTE

- Put on gloves to protect your hands.

1. Remove the door trim.
2. Remove the door belt weatherstrip.
3. Remove the dirison channel (A) mounting bolt.



4. Remove the dirison channel (A).



CAUTION

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

5. Carefully move the glass 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.

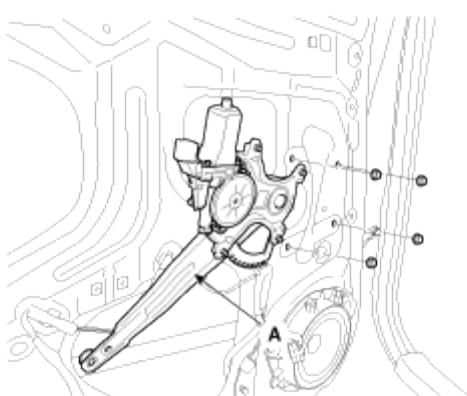
6. Installation is the reverse of removal.

NOTE

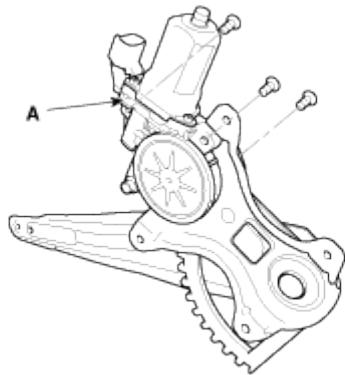
- Roll the glass up down to see if it move freely without binding.
- Adjust the position of the glass as necessary.

Power Window Motor Replacement

1. Remove the door trim.
2. Remove the window glass.
3. Loosen the door regulator mounting bolts, remove the door regulator (A).
4. Disconnect the door regulator wiring harness, remove the regulator.



5. Loosen the mounting screws, remove the power window motor (A).



6. Installation is the reverse of removal.

NOTE

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

Regulator Assembly Replacement

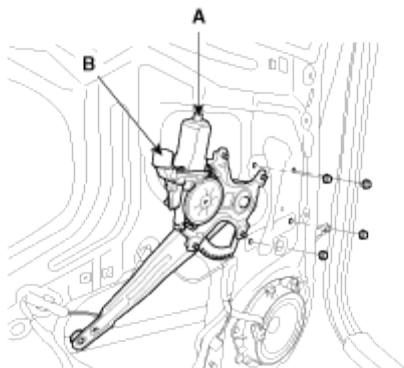
1. Remove the following parts.

- A. Door trim.
- B. Window glass.

2. After loosening the door regulator mounting bolts, remove the door regulator (A).

3. Disconnect the connector (B).

4. Detach the clips, then remove the wiring harness.



5. Installation is the reverse of removal.

NOTE

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

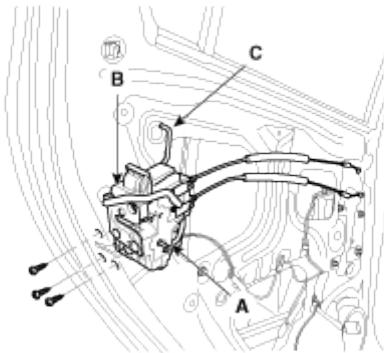
Latch Assembly Replacement

1. Remove the following parts.

- A. Door trim.
- B. Glass.

2. Disconnect the Iod (C).

3. Disconnect the latch connector (A), then remove the latch assembly (B).



4. Installation is the reverse the removal.

NOTE

- Make sure the door locks and opens properly.

Adjustment

Door Position Adjustment

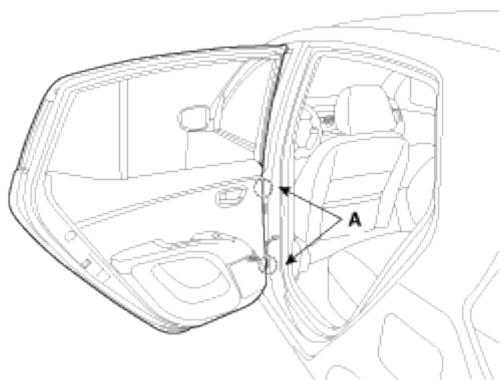
NOTE

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

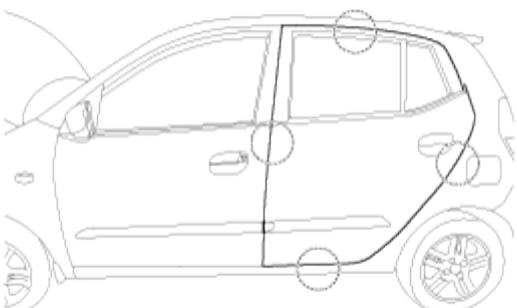
1. Place the vehicle on a firm, level surface when adjusting the doors.

2. Adjust at the hinges (A):

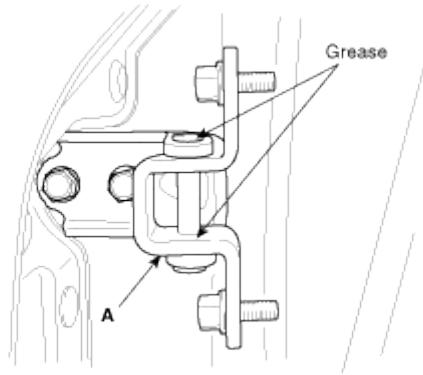
- A. Loosen the door mounting bolts slightly, and move the door IN or OUT until it aligns flush with the body.
- B. Loosen the hinge mounting bolts slightly, and move the door BACKWARD or FORWARD, UP or DOWN as necessary to equalize the gaps.
- C. Place a shop towel on the jack to prevent damage to the door when adjusting the door.



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



4. Grease the pivot portions of the hinges indicated by the arrows.



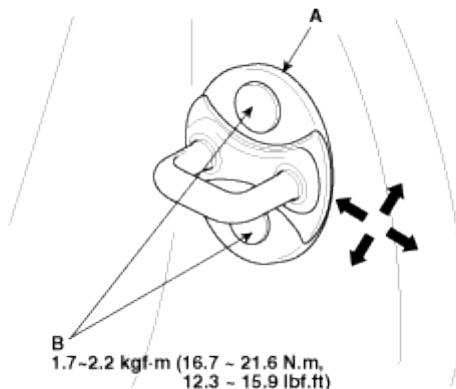
5. Check for water leaks.

Door Striker Adjustment

NOTE

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

1. Loosen the screws (B), then insert a shop towel between the body and striker.



2. Lightly tighten the screws.

3. Wrap the striker with a shop towel, then adjust the striker by tapping it with a plastic hammer.
Do not tap the striker too hard.

4. Loosen the screws and remove the shop towel.

5. Lightly tighten the screws.

6. 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.

4.2.6. Body Side Moldings

4.2.6.1. Repair procedures

5Door, 3Door

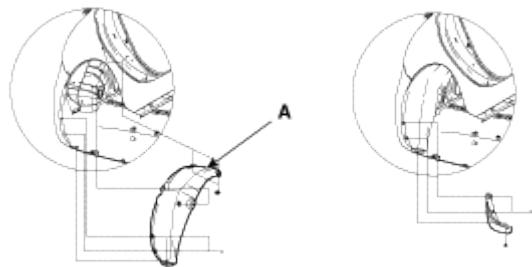
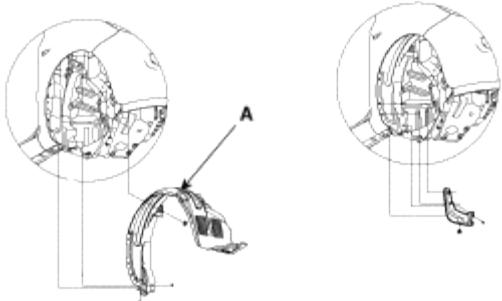
Replacement

Mud Guard And Wheel Guard Replacement

NOTE

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

1. Remove the wheel guard (A).



2. Installation is the reverse of removal.

Roof Molding Replacement

NOTE

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

1. Remove the roof molding(A).

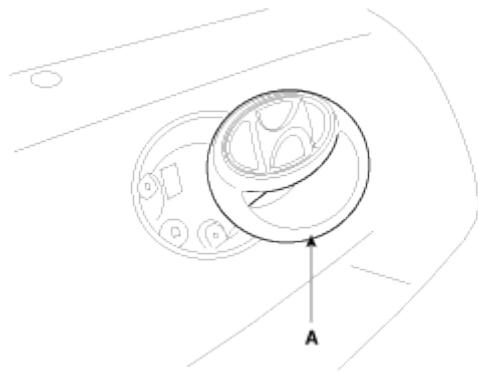


2. Installation is the reverse of removal.

Tailgate Garnish Replacement

1. Remove the tailgate trim.

2. Remove the tailgate garnish (A).

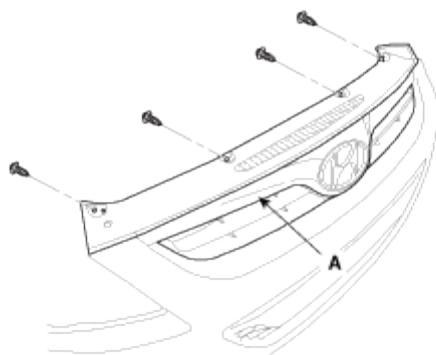


3. Installation is the reverse of removal.

Radiator Grille Replacement

1. Remove the front bumper.

2. Remove the radiator grille (A).

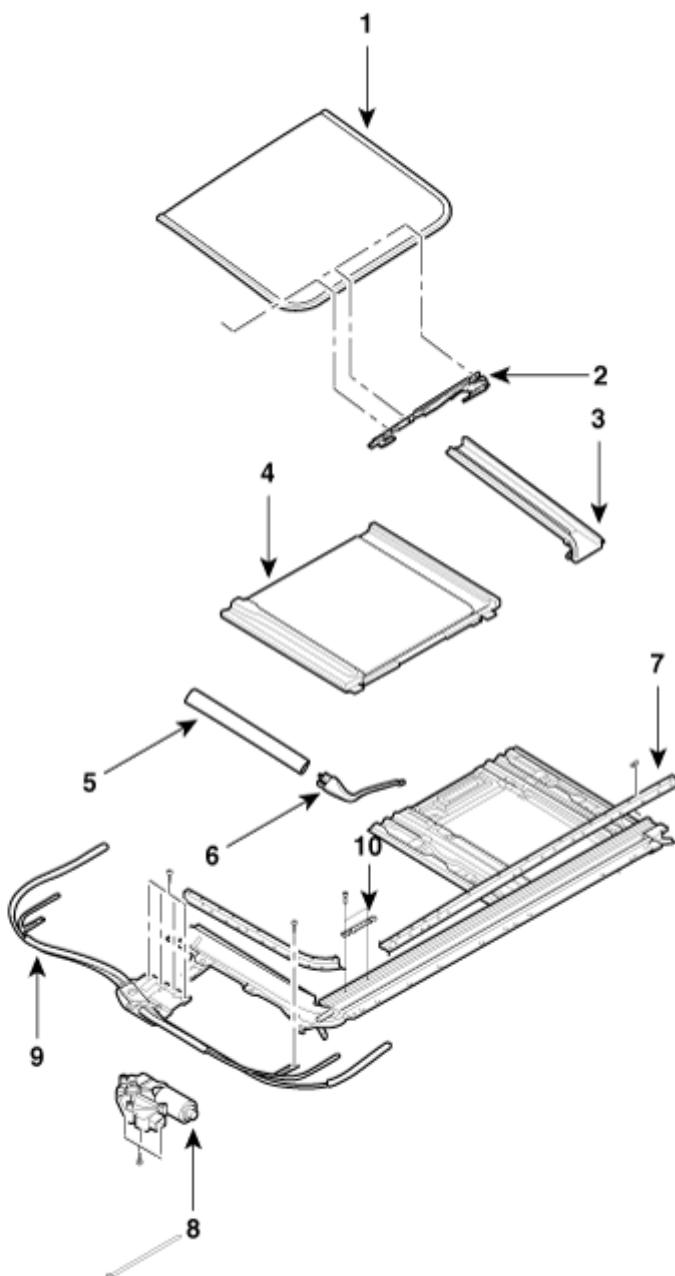


3. Installation is the reverse of removal.

4.2.7. Sunroof

4.2.7.1. Component and Components Location

Components



1. Glass
2. Drip link
3. Guide assembly
4. Drip rail

5. Sunshade
6. Defector
7. Deflector link
8. Seal tape

9. Motor
10. Drive unit
11. Set plate

4.2.7.2. Repair procedures

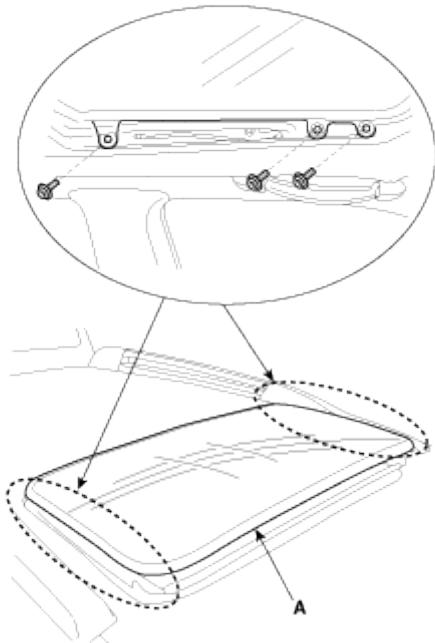
Replacements

Glass Replacement

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

NOTE

- Do not damage the roof panel.



2. Installation is the reverse of removal.

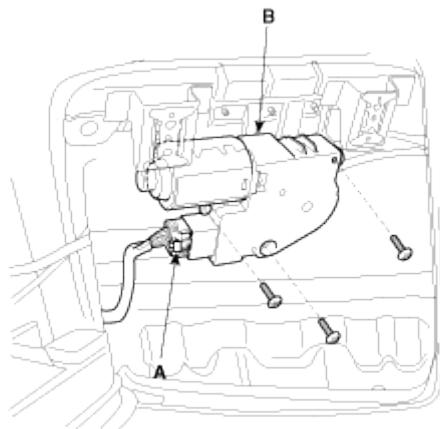
Motor Replacement

1. Remove the over head console.

NOTE

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

2. Disconnect the motor connector (A), remove the screws and then remove the motor (B).



3. Installation is the reverse of removal.

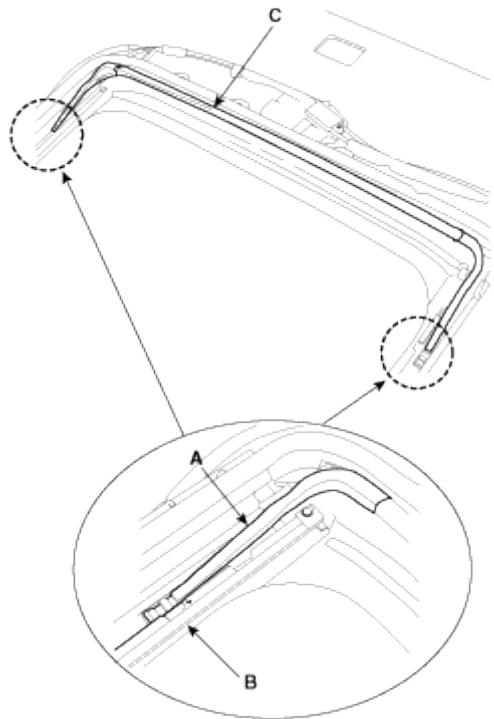
NOTE

- Make sure to initialize the motor.

Deflector Replacement

1. Open the glass fully.

2. Disconnect the deflector link (A) from the frame (B), and then remove the deflector (C).



3. Installation is the reverse of removal.

Sunroof Assembly Replacement

1. Remove the following parts :

- A. Door scuff trim
- B. Front pillar trim
- C. Center pillar trim
- D. Rear pillar trim
- E. Headlining
- F. Sunroof glass

2. Disconnect the drain tubes.

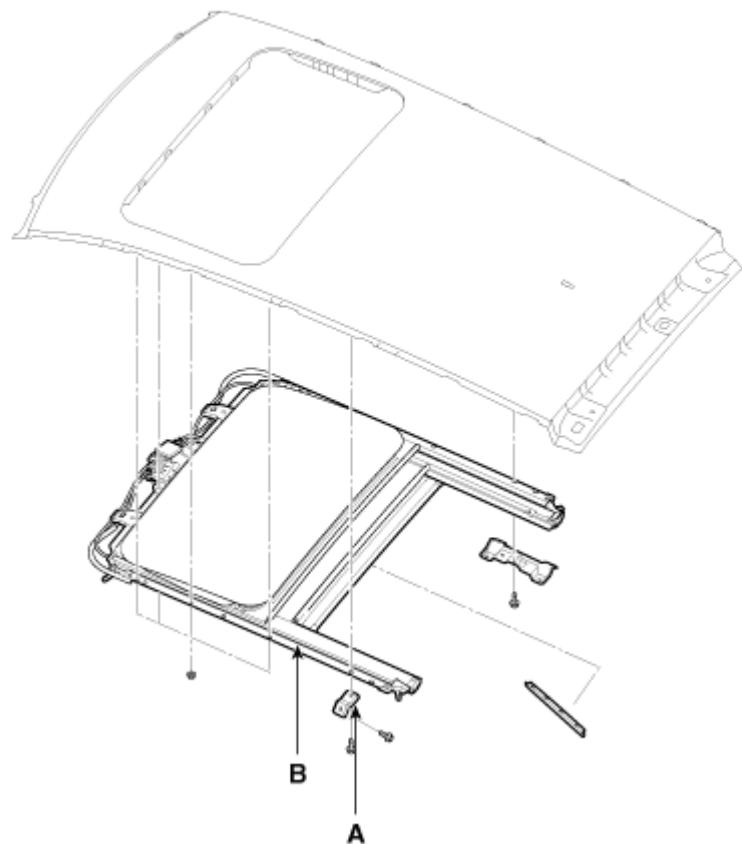
3. Remove the bracket (A).

4. After loosening the mounding bolts and nuts, remove the sunroof assembly (B).

NOTE

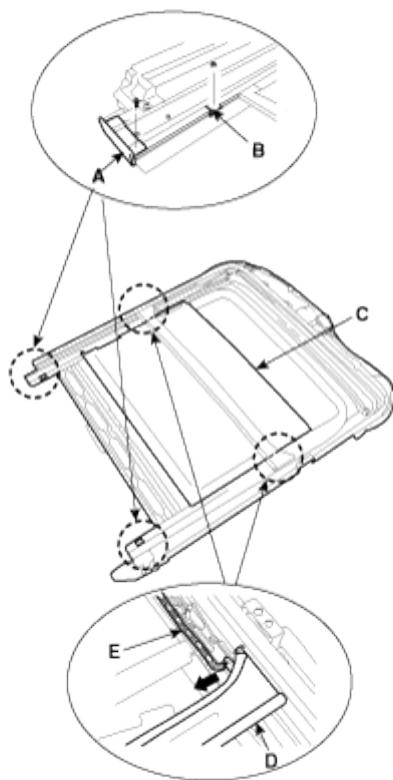
- Be careful not to scratch the interior trims and other parts.

5. Installation is the reverse of removal.



Sunshade And Drip Rail Replacement

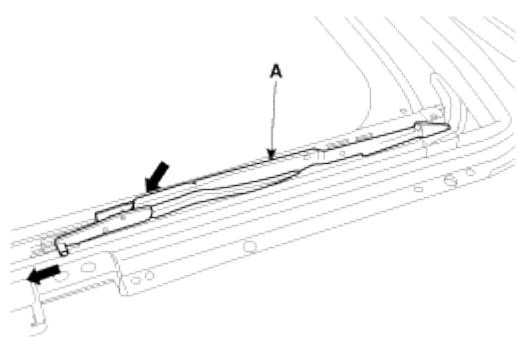
1. Remove the sunroof assembly.
2. Remove the drip link (A) and sunshade stopper (B).
3. Remove the sunshade (C) and drip rail (D).



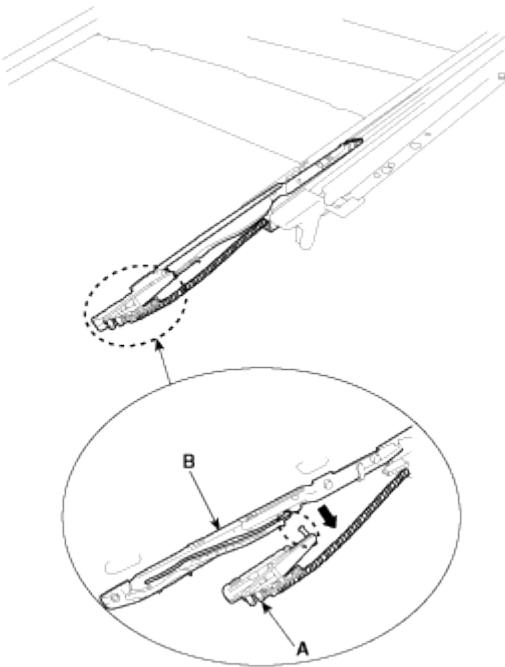
4. Installation is the reverse of removal.

Guide Assembly Replacement

1. Remove the sunroof assembly.
2. Lower and slide the guide assembly (A) to the rear to remove.



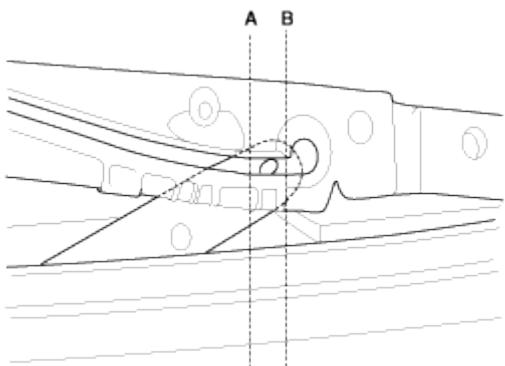
3. Remove the guide (A) and slide (B).



4. Installation is the reverse of removal.

NOTE

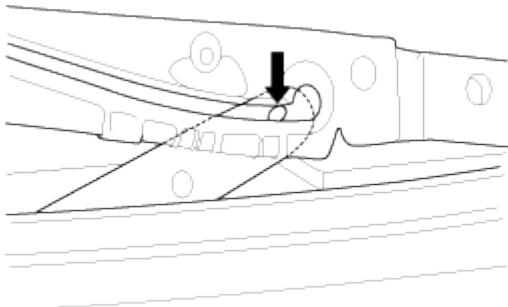
- Make sure to align the slide with the center of "A" and "B".
- Make sure to initialize the motor.



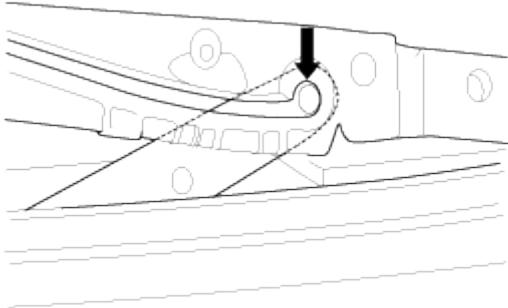
Adjustment

How To Initialize

1. Check that the glass has been installed.
 - A. Finished height adjustment.
2. Push and hold the up switch.
 - A. Until the slide moves forward 5mm (after approx 15 seconds), the release the switch.



Before moving the slide



After moving the slide

3. After moving the slide 5mm forward, turn OFF the switch and push the UP switch (Keeping on pushing the switch with continuous operation)
 - A. If the motor initialization is successful, the sunroof should fully side open and close once.
4. When the sunroof is closed completely, turn OFF the UP switch initialize the motor completely.

4.2.8. Mirror

4.2.8.1. Repair procedures

Replacement

Outside Rear View Mirror Replacement

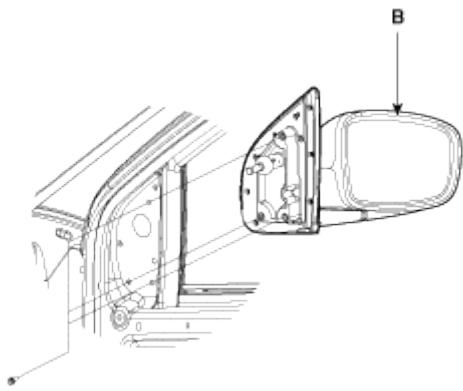
NOTE

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

1. Remove the quadrant inner cover.
2. After disconnecting the connector, remove the outside rear view mirror (B).

Tightening torque :

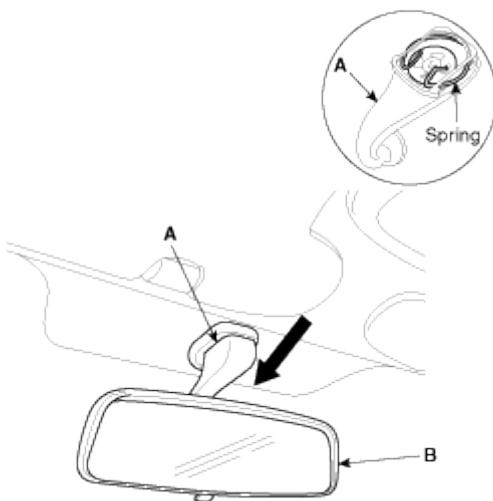
6.9~10.8N.m(0.7~1.1kgf.m, 5.1~8.0 lb-ft)



3. Installation is the reverse of removal.

Inside Rear View Mirror Replacement

1. Push the inside rear view mirror base (A) down to remove to inside rear view mirror assembly (B).



2. Installation is the reverse of removal.

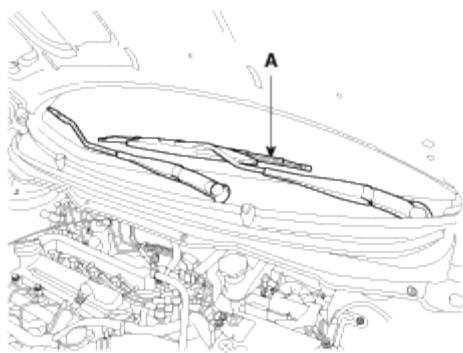
4.2.9. Cowl Top Cover

4.2.9.1. Repair procedures

Replacement

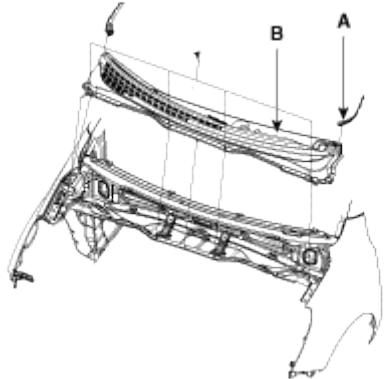
Cowl Top Cover Replacement

1. Remove the wiper (A).



2. Remove the side cover (A).

3. Detach the clips, remove the cowl top cover (B).



4. Installation is the reverse of removal.

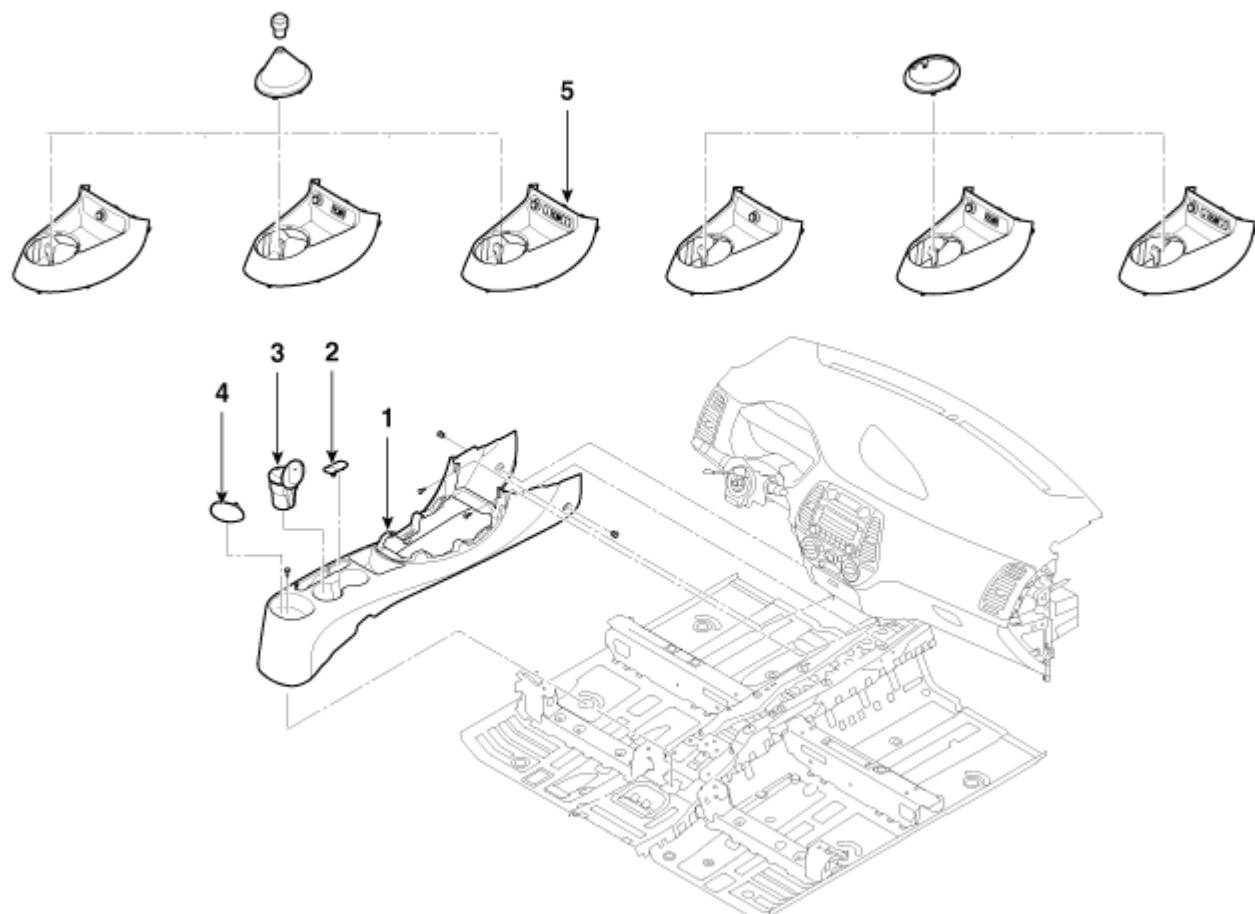
4.3. Interior

4.3.1. Console

4.3.1.1. Component and Components Location

5Door, 3Door

Components



- | | |
|------------------------|------------------------|
| 1. Floor console | 4. Pad |
| 2. Parking brake cover | 5. Console upper cover |
| 3. Ash tray | |

4.3.1.2. Repair procedures

5Door, 3Door

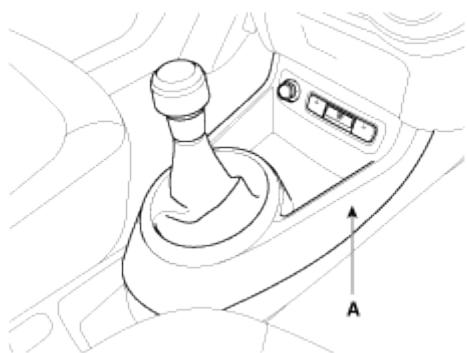
Replacement

Floor Console Replacement

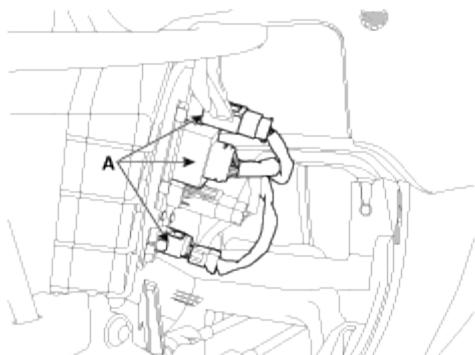
NOTE

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

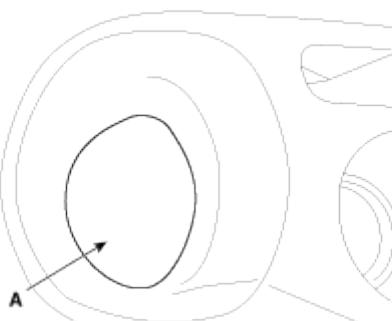
1. Remove the console upper cover (A).



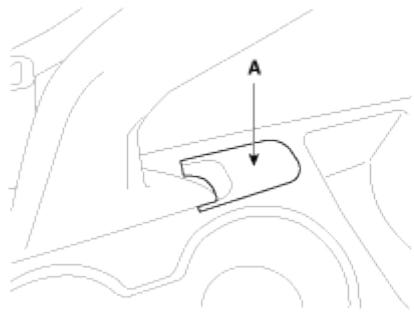
2. Disconnect the connectors (A).



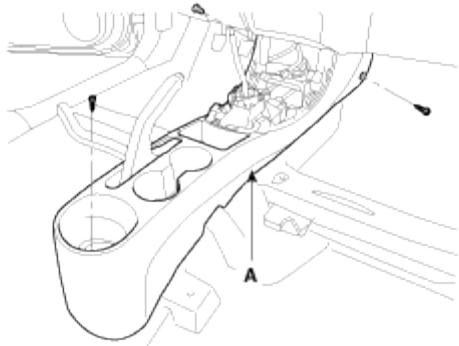
3. Remove the pad (A).



4. Remove the parking brake cover (A).



5. After loosening the console mounting screws, remove the floor console assembly (A).



6. Installation is the reverse of removal.

NOTE

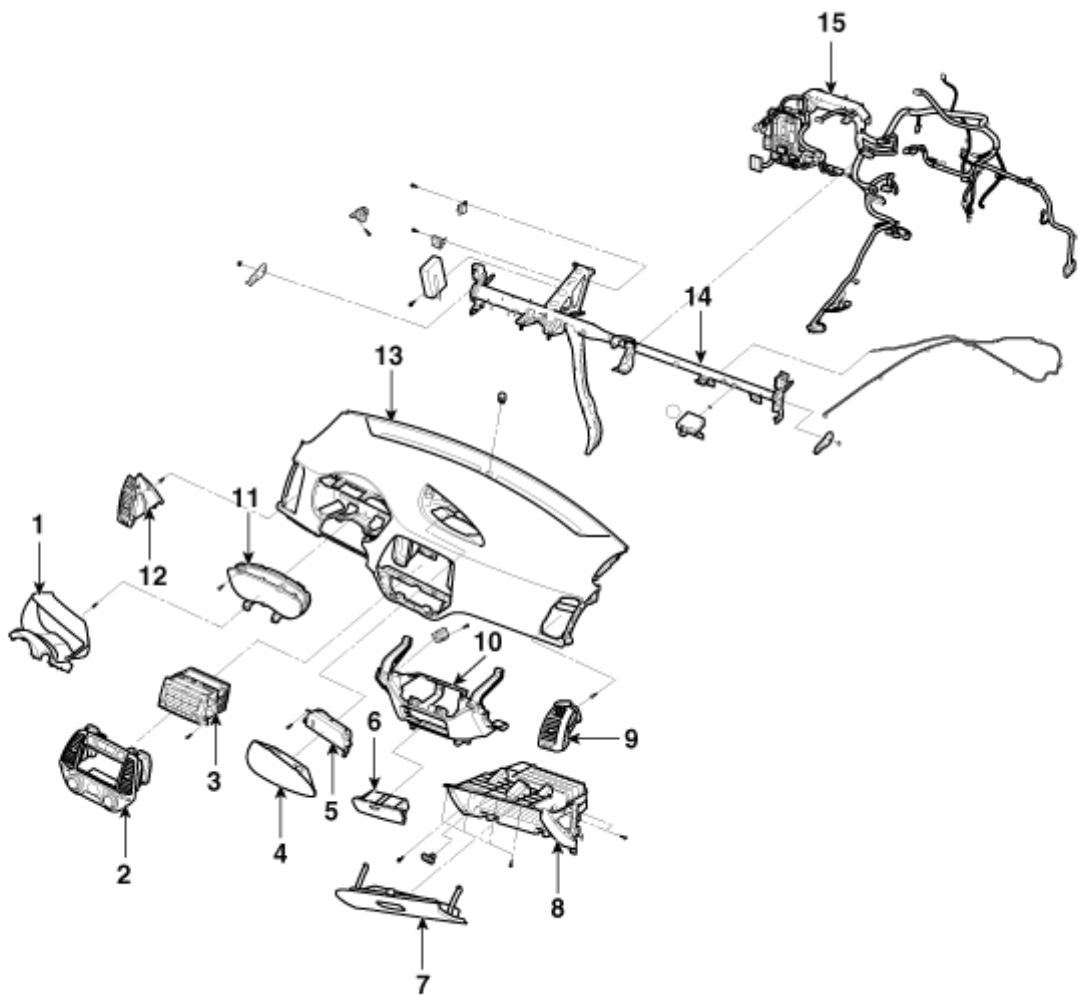
- Make sure the connector is plugged in properly.
- Replace any damage clips.

4.3.2. Crash Pad

4.3.2.1. Component and Components Location

5Door, 3Door

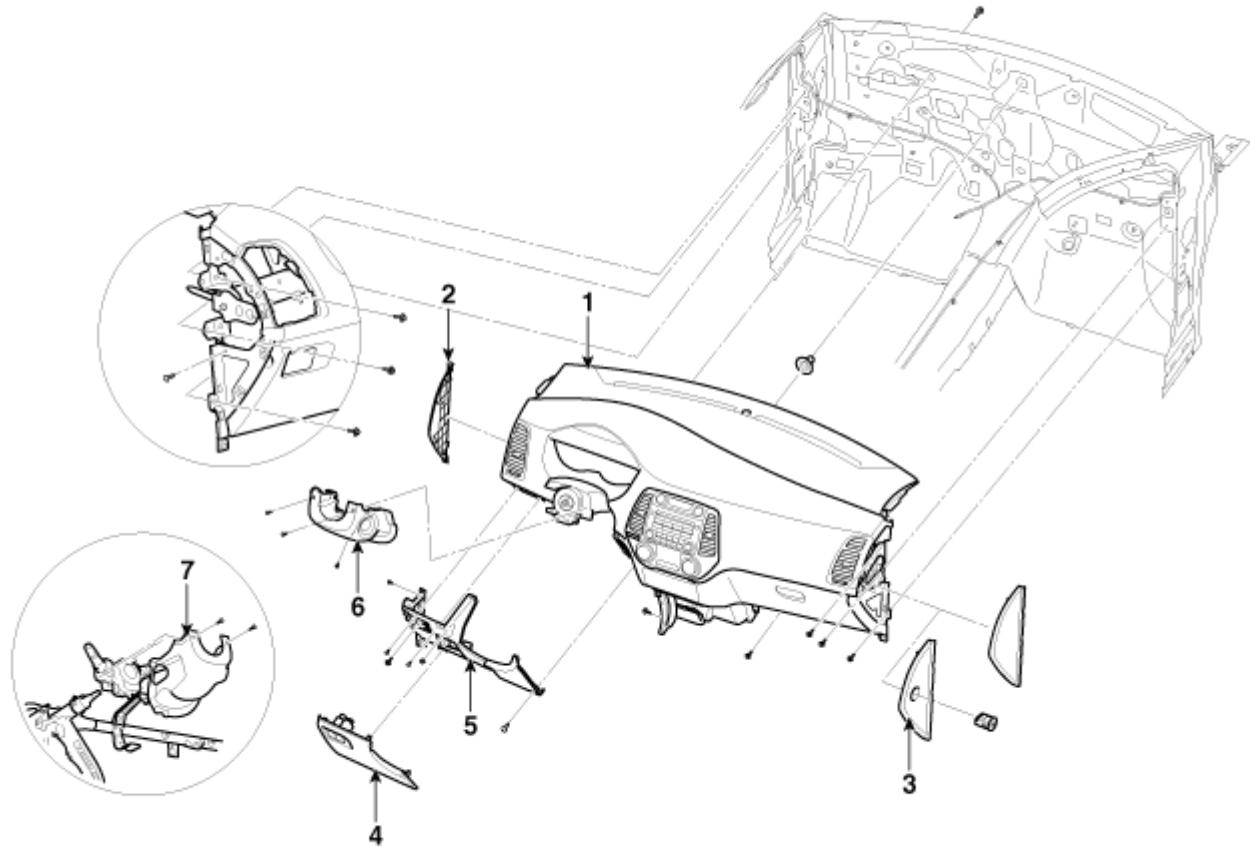
Components



1. Cluster fascia panel
2. Center fascia
3. Audio assembly
4. Cover
5. Unit
6. Tray

7. Glove box cover
8. Glove box
9. Air vent
10. Crash pad lower cover
11. Cluster
12. Air vent

13. Crash pad
14. Cowl cross bar
15. Harness



1. Main crash pad
 2. Crash pad side cover
 3. Crash pad side cover

4. Crash pad lower panel
 5. Reinforcing panel
 6. Shroud upper panel
 7. Shroud lower panel

4.3.2.2. Repair procedures

5Door, 3Door

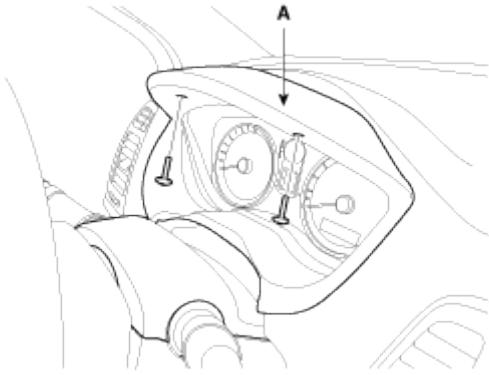
Replacement

Cluster Fascia Replacement

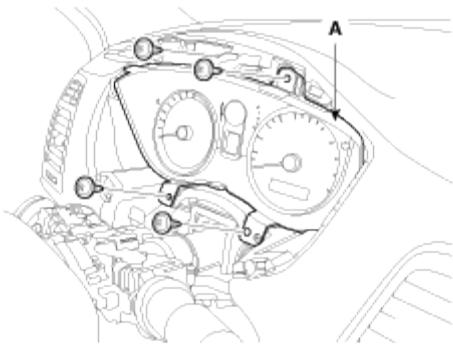
NOTE

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

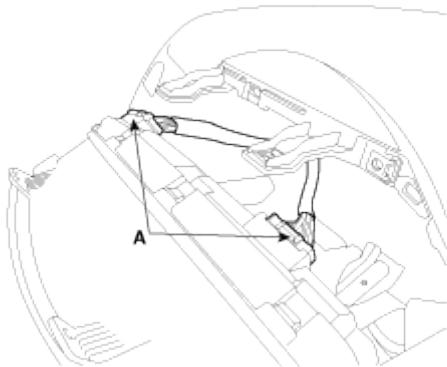
- Tilt the steering column down.
- Remove the cluster fascia panel (A).



3. After loosening the mounting screws, then remove the cluster fascia (A).



4. Disconnect the connector (A).



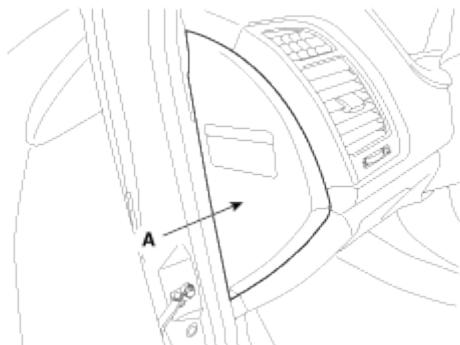
5. Installation is the reverse the removal.

NOTE

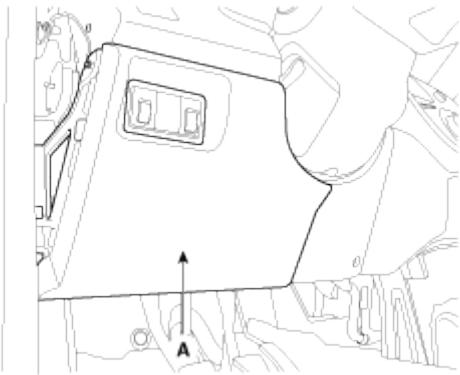
- Make sure the connector is plugged in properly.

Lower Panel Replacement

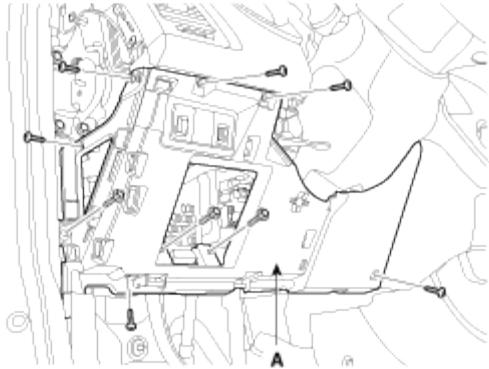
1. Remove the crash pad side cover (A).



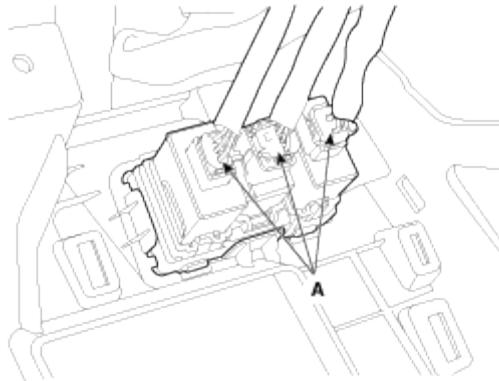
2. Remove the lower panel (A).



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



4. Disconnect the connector (A).



5. Installation is the reverse of removal.

Audio Assembly Replacement

1. Put the SST (09840-1E100) into the space between the center fascia and crash pad.

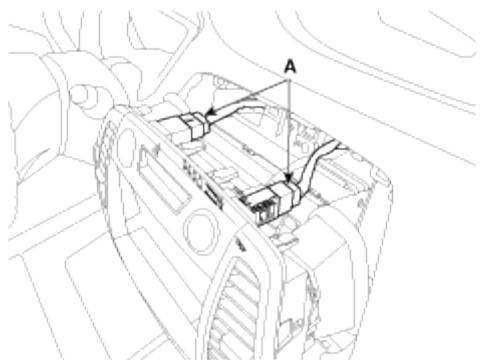
2. Separate the center fascia panel from the crash pad pulling the SST (09840-1E100).

NOTE

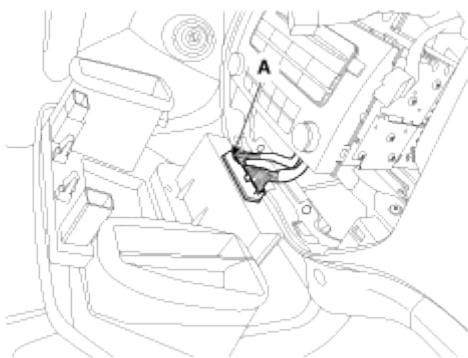
- Be care not to damage the center fascia and crash pad.



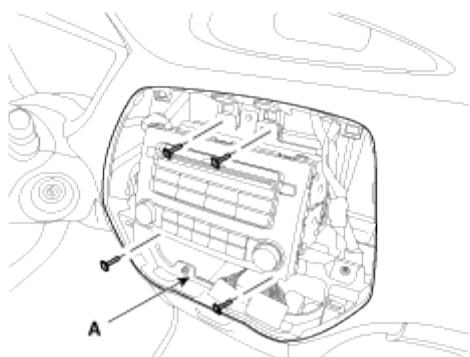
3. Disconnect the connectors (A).



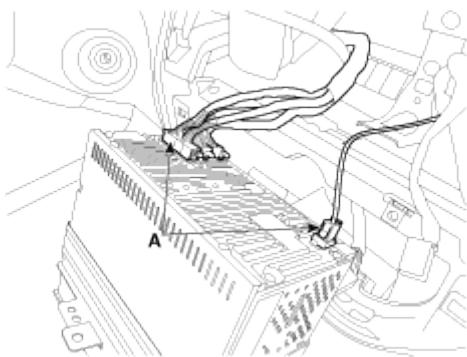
4. Disconnect the connectors (A).



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



6. Disconnect the connectors (A).



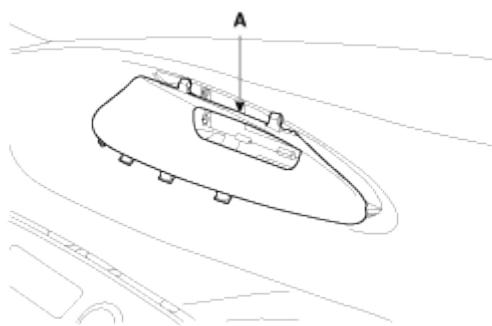
7. Installation is the reverse of removal.

NOTE

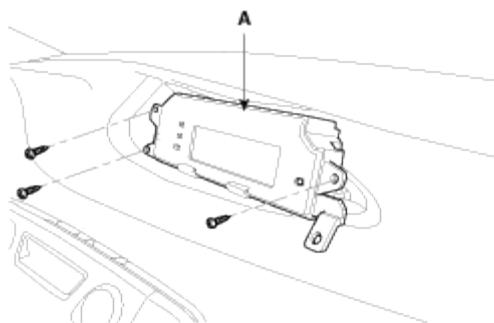
- Make sure the connector is plugged in properly.

Unit Replacement

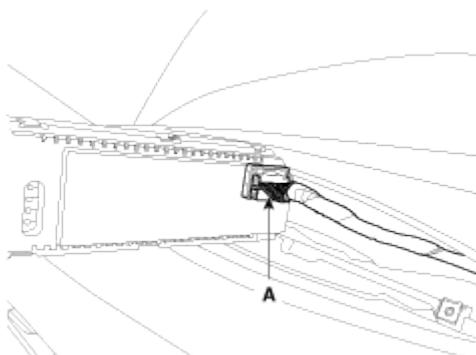
1. Remove the cover (A).



2. After loosening the unit assembly mounting screws, remove the unit assembly (A).



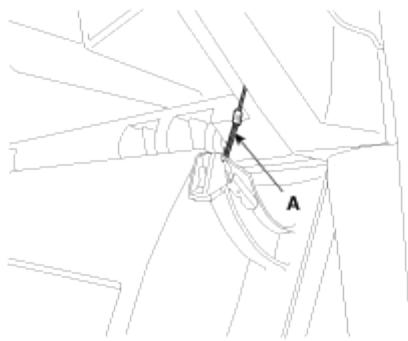
3. Disconnect the connector (A).



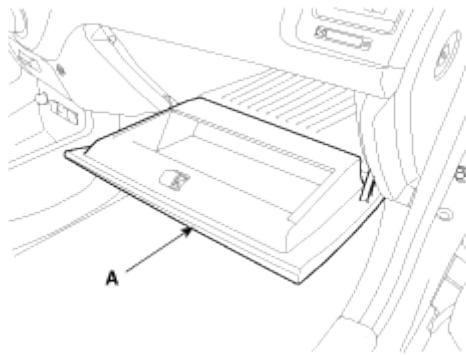
4. Installation is the reverse of removal.

Glove Box Replacement

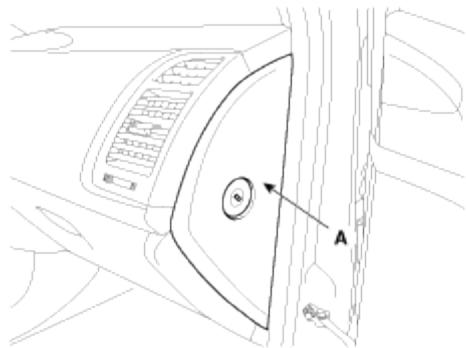
1. Disconnect the wire (A).



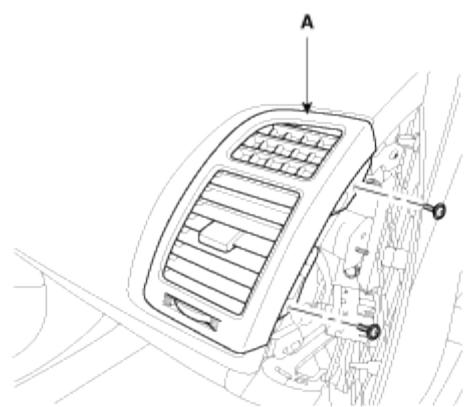
2. After loosening the mounting screws, then remove the glove box (A).



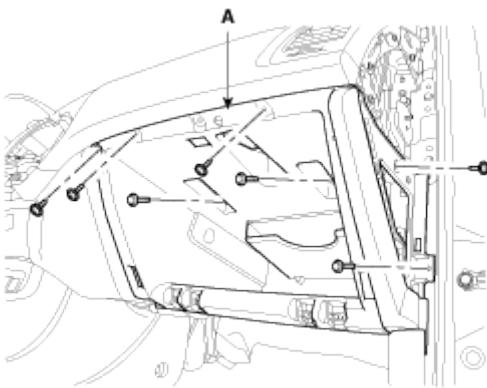
3. Remove the crash pad side cover (A).



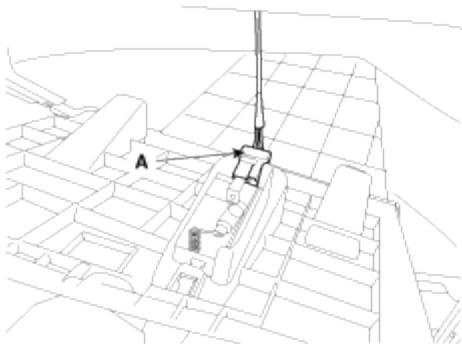
4. Remove the air vent (A).



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



6. Disconnect the connector (A).

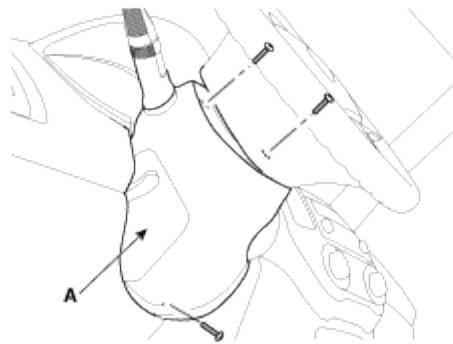


7. Installation is the reverse of removal.

Shroud Replacement

1. Loosen the screws.

2. Remove the shroud assembly (A).



3. Installation is the reverse of removal.

Crash Pad Replacement

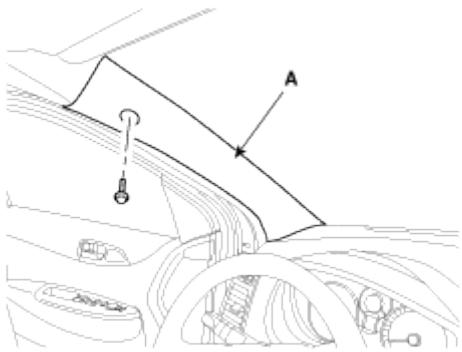
NOTE

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

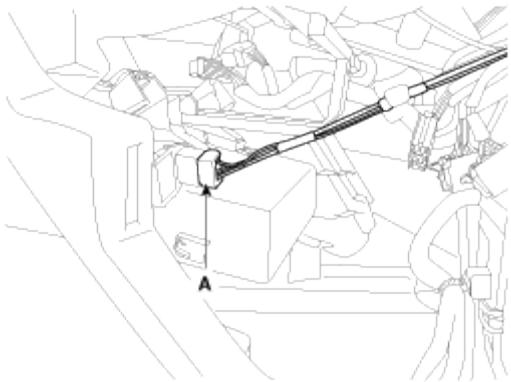
1. Remove the following items.

- A. Front seat
- B. Cluster fascia panel, cluster
- C. Audio assembly
- D. Glove box
- E. Crash pad side cover

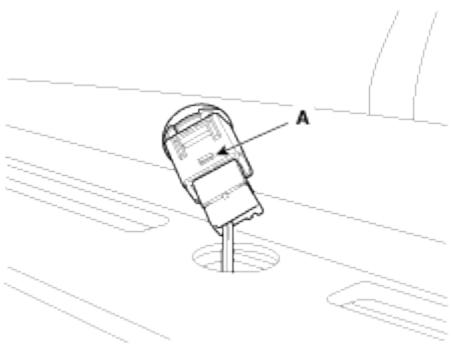
2. Remove the front pillar trim (A).



3. Disconnect the connector (A).

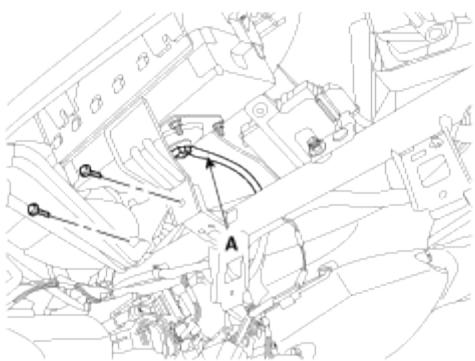


4. Remove the photo sensor (A).

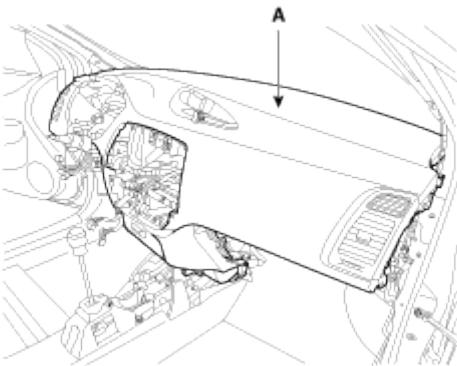


5. Disconnect the passenger's air bag connector (A).

6. Loosen the bolts and nuts.



7. Remove the crash pad (A).



8. 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.

4.3.3. Roof Trim

4.3.3.1. Repair procedures

5Door, 3Door

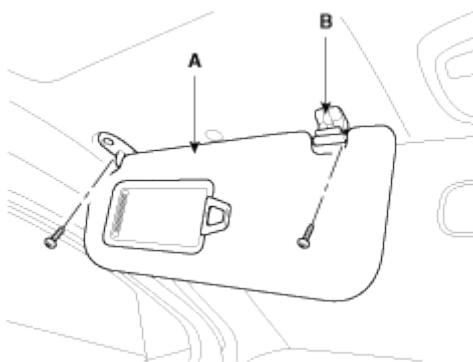
Replacement

Sunvisor Replacement

NOTE

- When prying with a flat-tip screwdriver, wrap it with protective tape to prevent damage.
- Put on gloves to protect your hands.

1. Remove the sunvisor (A) and holder (B) from each side.



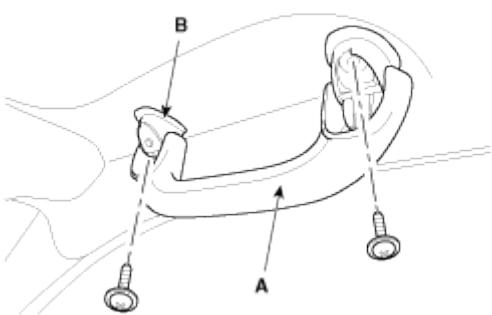
2. Installation is the reverse of removal.

Assist Handle Replacement

NOTE

- When prying with a flat-tip screwdriver, wrap it with protective tape to prevent damage.
- Put on gloves to protect your hands.

1. Remove the covers (B), and remove the screws, then remove the assist handle (A).



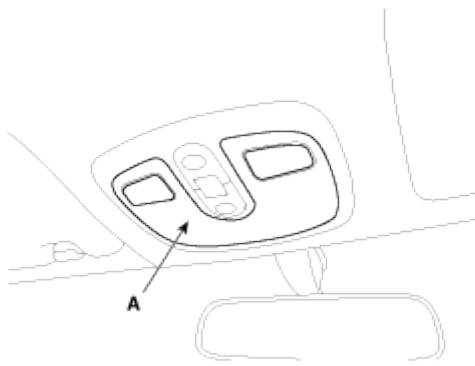
2. Installation is the reverse of removal.

Overhead Console Lamp Replacement

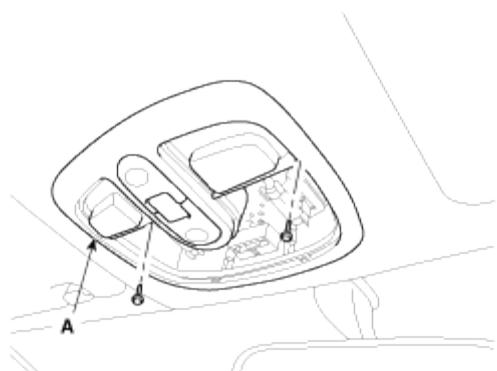
NOTE

- When prying with a flat-tip screwdriver, wrap it with protective tape to prevent damage.
- Put on gloves to protect your hands.

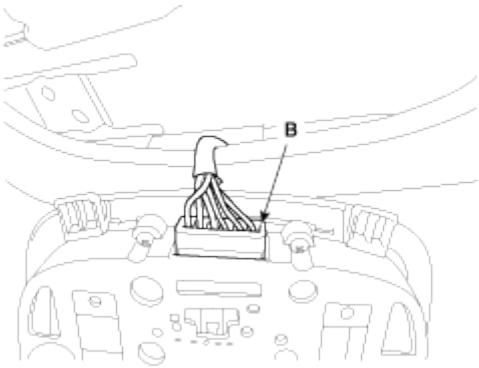
1. Remove the overhead console cover (A).



2. Pull out the roof console (A).



3. Disconnect the connector (B).



4. Installation is the reverse of removal.

Headliner Replacement

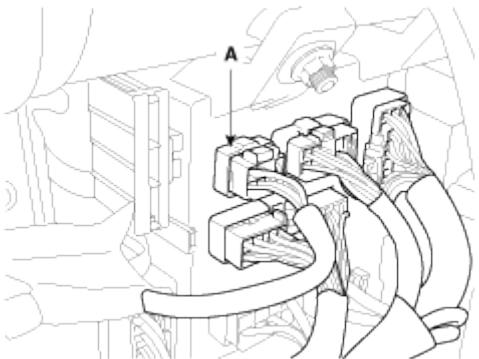
NOTE

- Put on gloves to protect your hands.
- When prying with a flat-tip screwdriver, wrap it with protective tape to prevent damage.
- Take care not to bend or scratch the trim and panels.

1. Remove the following items.

- A. Front seat assembly
- B. Rear seat assembly
- C. Door scuff trim
- D. Front pillar trim
- E. Center pillar trim
- F. Rear pillar trim
- G. Overhead console
- H. Room lamp
- I. Sunvisor
- J. Assist handle

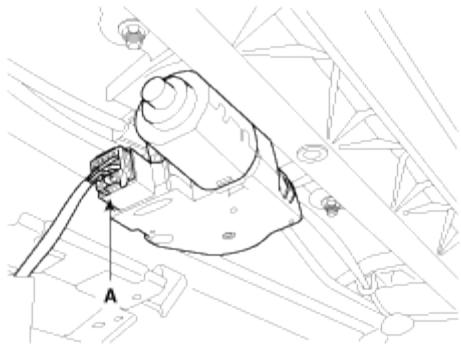
2. Disconnect the connector (A).



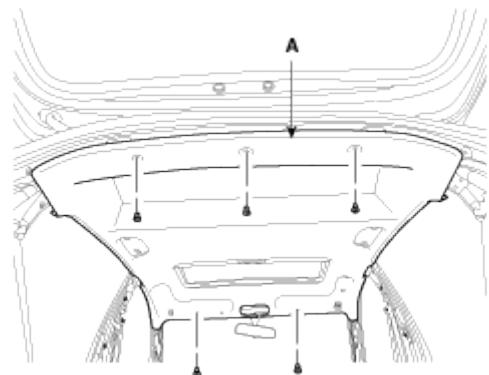
3. Disconnect the connector (A).



4. Disconnect the connector (A).



5. Remove the roof trim (A).



6. Installation is the reverse of removal.

NOTE

- Replace any damage clips.

4.3.4. Interior TRIM

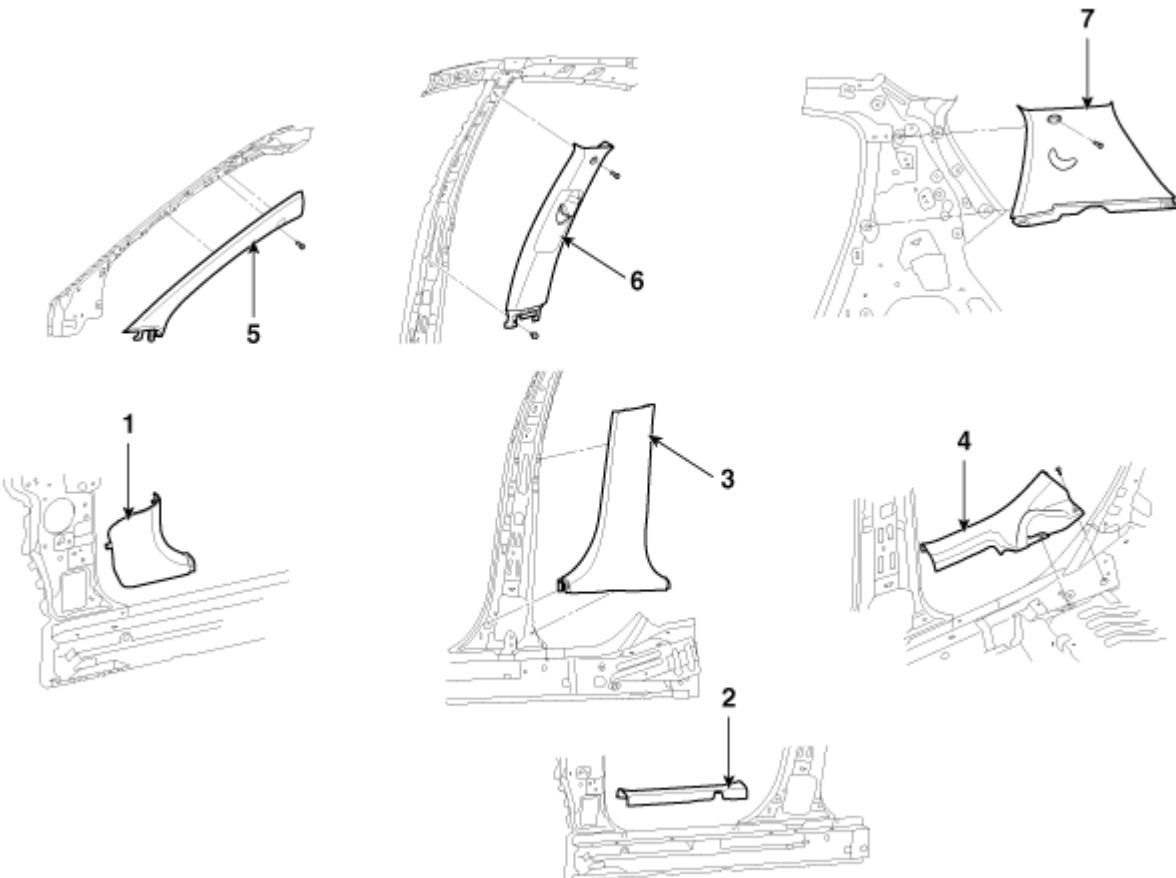
4.3.4.1. Repair procedures

Replacement

5Door

NOTE

- Put on gloves to protect your hands.
- When prying with a flat-tip screwdriver, wrap it with protective tape to prevent damage.
- Take care not to bend or scratch the trim and panels.



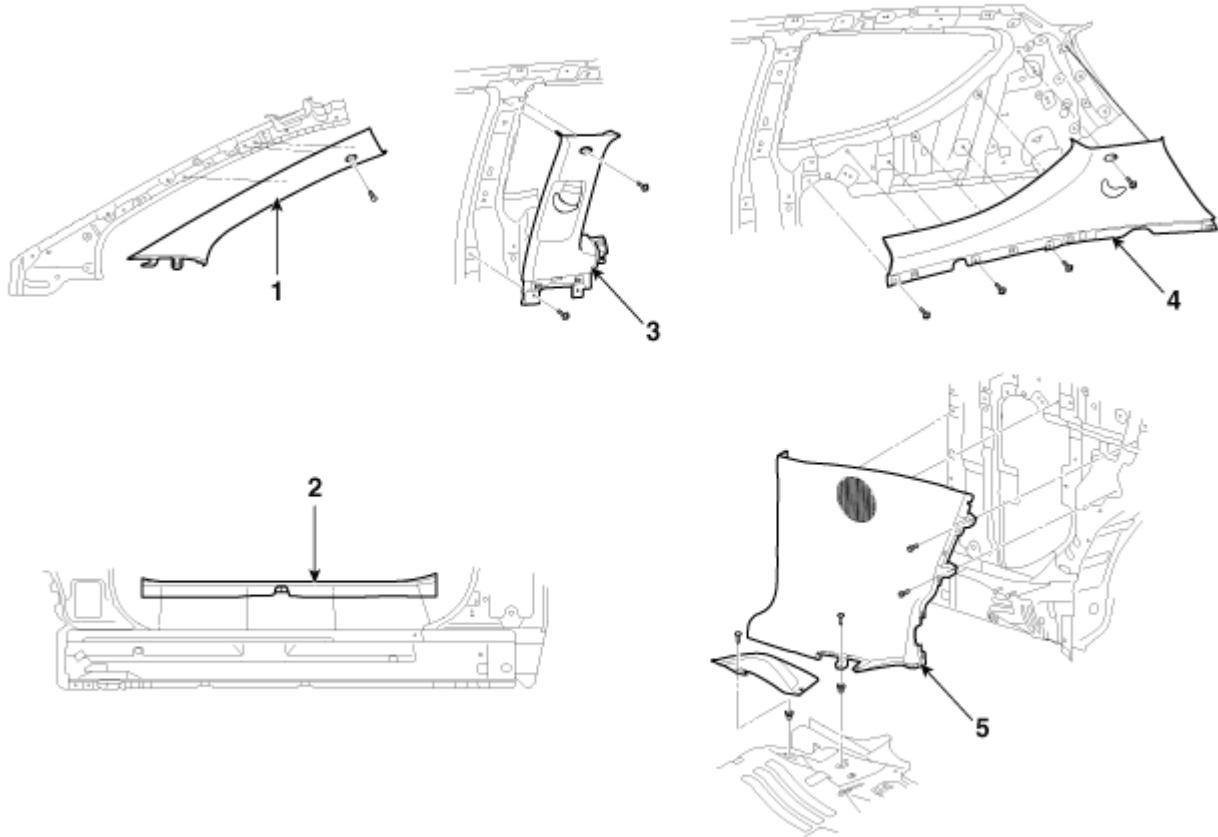
1. Cowl side trim
 2. Front door scuff trim
 3. Center lower pillar trim
 4. Rear door scuff trim

5. Front pillar trim
 6. Center upper pillar trim
 7. Rear pillar trim

3Door

NOTE

- Put on gloves to protect your hands.
- When prying with a flat-tip screwdriver, wrap it with protective tape to prevent damage.
- Take care not to bend or scratch the trim and panels.



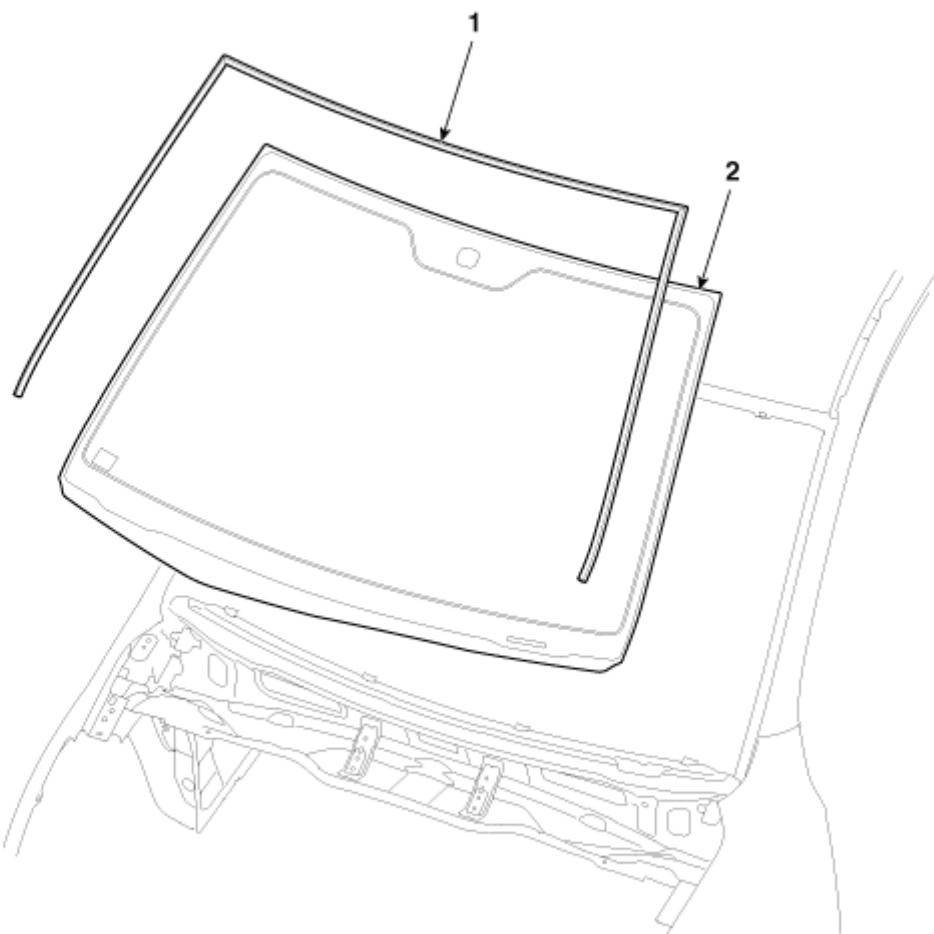
1. Front pillar trim
 2. Front door scuff trim
 3. Center pillar trim

4. Rear pillar upper trim
 5. Rear pillar lower trim

4.3.5. Windshield Glass

4.3.5.1. Component and Components Location

Components



1. Windshield molding

2. Windshield glass

4.3.5.2. Repair procedures

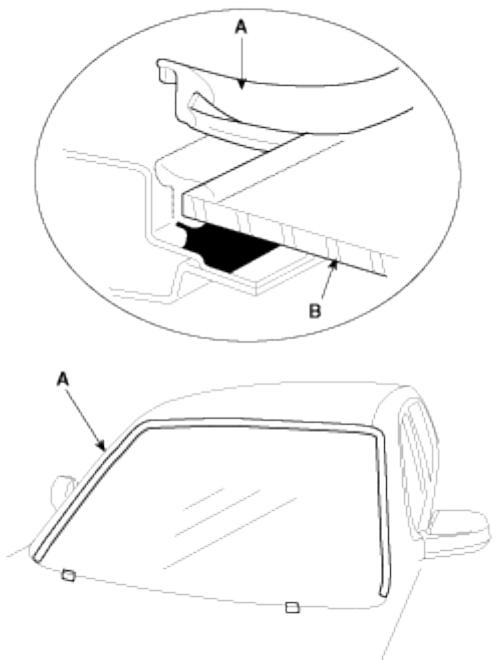
Replacement

Removal

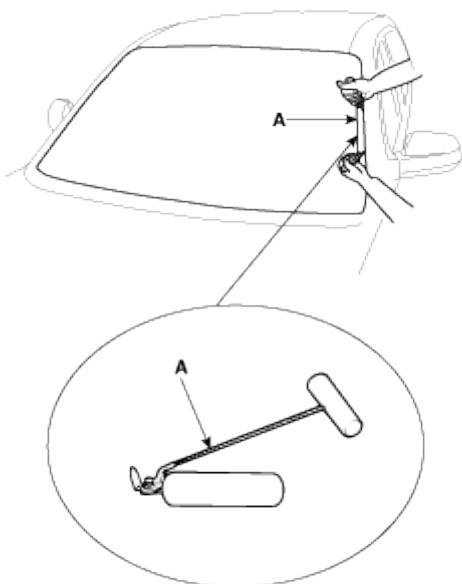
NOTE

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

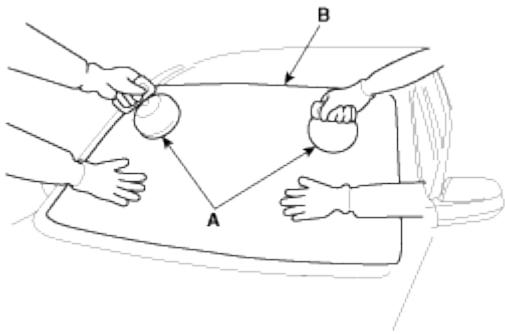
1. Remove the following items:
 - A. Inside rear view mirror.
 - B. Sunvisors and holders, both sides, overhead console, Grab handles, both sides.
 - C. Front pillar trim, both sides.
 - D. Windshield wiper arms and cowl cover. (See page BE- "Windshield wiper")
2. Remove the molding (A) from the edge of the windshield (B). If necessary, cut the molding with a utility knife.



3. Pull down the front portion of the headliner. Take care not to bend the headliner excessively, or you may crease or break it.
4. Cut out the sealant using the sealant cutting tool [A(09861-31100)].

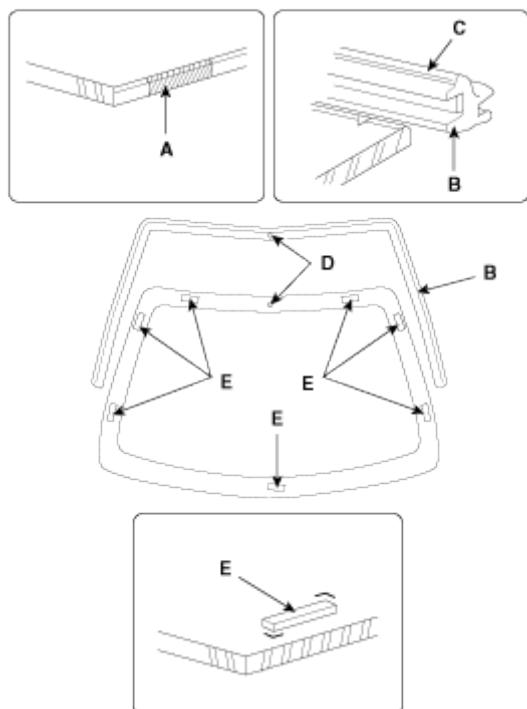


5. Remove the windshield (B) carefully using the glass holder [A].

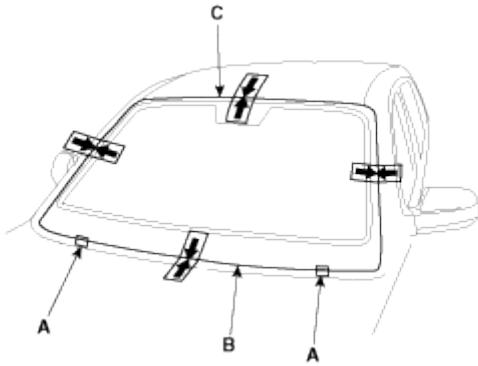


Installation

1. With a knife, scrape the old adhesive smooth to a thickness of about 2mm (0.08 in.) on the bonding surface around the entire windshield opening flange:
 - A. Do not scrape down to the painted surface of the body; damaged paint will interfere with proper bonding.
 - B. Remove the rubber dam and fasteners from the body.
 - C. Mask off surrounding surfaces before painting.
2. Clean the body bonding surface with a sponge dampened in alcohol. After cleaning, keep oil, grease and water from getting on the clean surface.
3. Apply the glass primer (A) to the side of the windshield glass edge and stick the both-sided adhesive tape (B) on the inside of molding (C).
4. When attaching the molding, make it in line (D) with the windshield glass and attach the windshield glass pad (E) to the designated place.



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

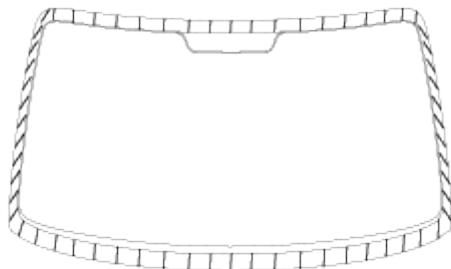


7. Apply a light coat of glass primer to the outside of the fasteners.

NOTE

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

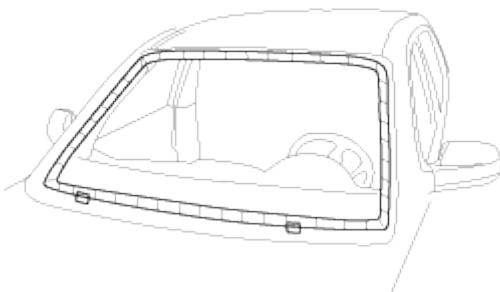
~~~~~ : Apply glass primer here.



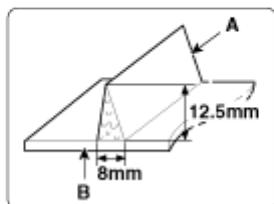
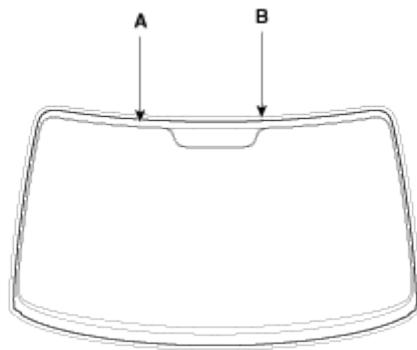
8. With a sponge, apply a light coat of body primer to the original adhesive remaining around the windshield opening flange. Let the body primer dry for at least 10 minutes:

- A. Do not apply glass primer to the body, and be careful not to mixup glass and body primer sponges.
- B. Never touch the primed surfaces with your hands.
- C. Mask off the dashboard before painting the flange.

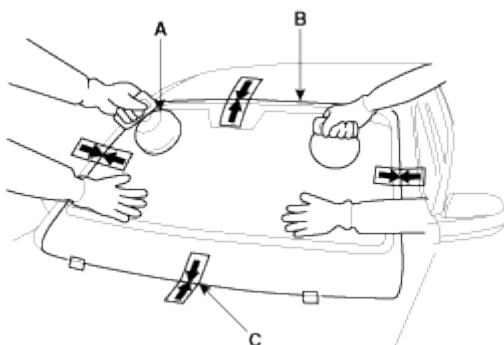
~~~~~ : primer



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



10. Use glass holder (A) to hold the windshield over the opening, align it with the alignment marks (B) made in step 15, and set it down on the adhesive. Lightly push on the windshield until its edges are fully seated on the adhesive all the way around. Do not open or close the doors until the adhesive is dry.



11. Scrape or wipe the excess adhesive off with a putty knife or towel. To remove adhesive from a painted surface or the windshield, wipe with a soft shop towel dampened with alcohol.
12. Let the adhesive dry for at least one hour, then spray water over the windshield and check for leaks. Make leaking areas, and let the windshield dry, then seal with sealant:
- 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.
 - Keep the windshield dry for the first hour after installation.
13. Reinstall all remaining removed parts. Install the rearview mirror after the adhesive has dried thoroughly. Advise the customer not to do the following things for two to three days:
- Slam the door with all the windows rolled up.
 - Twist the body excessively (such as when going in and out of driveways at an angle or driving over rough, uneven roads).

4.3.6. Quarter Fixed Glass

4.3.6.1. Repair procedures

Replacement

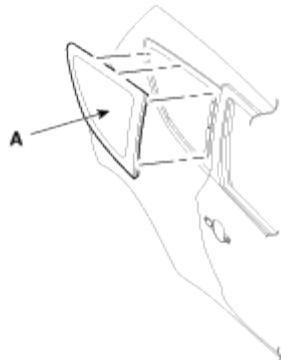
NOTE

- Put on gloves to protect your hands.
- Take care not to body surface and other parts.

1. Remove the following parts:

- A. Rear seat assembly
- B. Rear door scuff trim
- C. Self covering trim
- D. Luggage side trim
- E. Rear seat belt upper anchor bolt
- F. Rear pillar trim

2. Loosen the quarter fixed glass (A) mounting nut.



3. Remove the quarter fixed glass.

4. Reinstall all remaining removed parts.

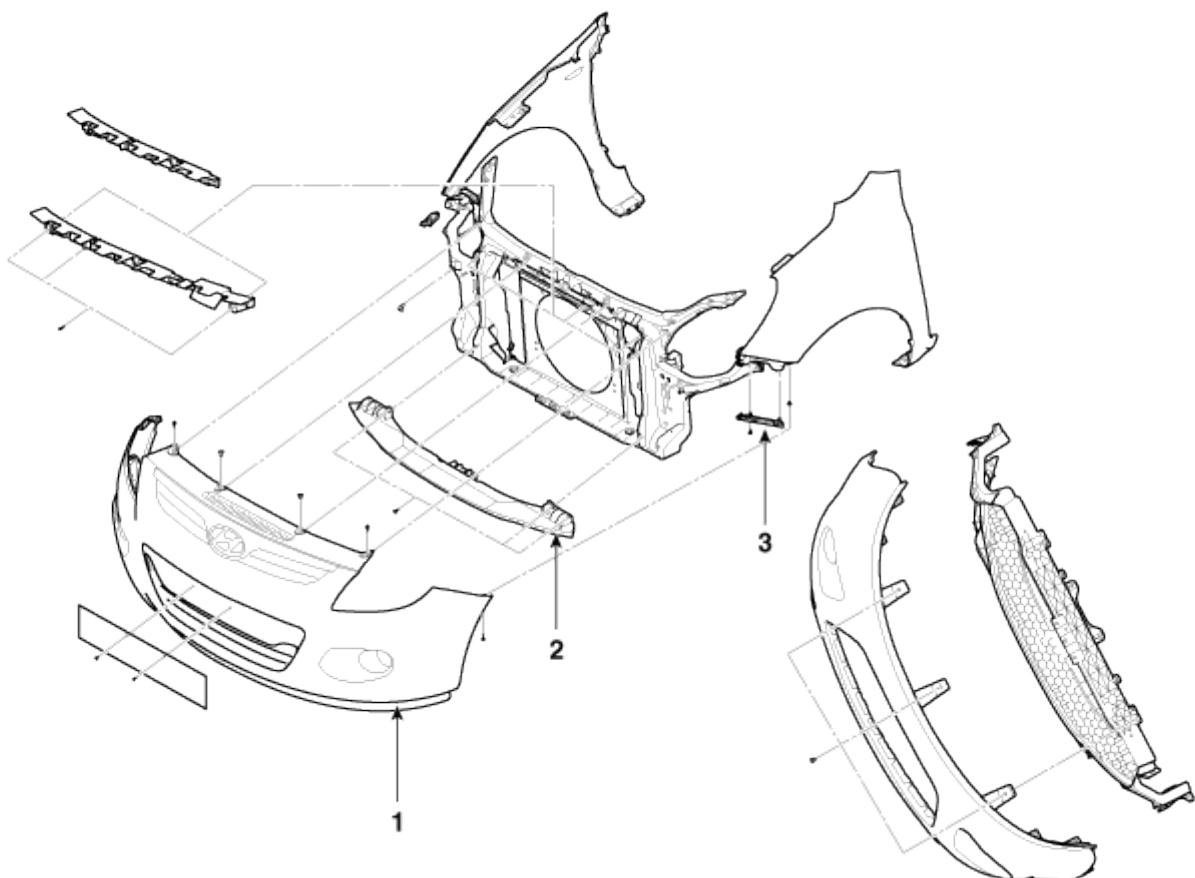
4.4. Bumper

4.4.1. Front Bumper

4.4.1.1. Component and Components Location

5Door, 3Door

Components



1. Front bumper
2. Radiator upper cover

3. Side mounting bracket

4.4.1.2. Repair procedures

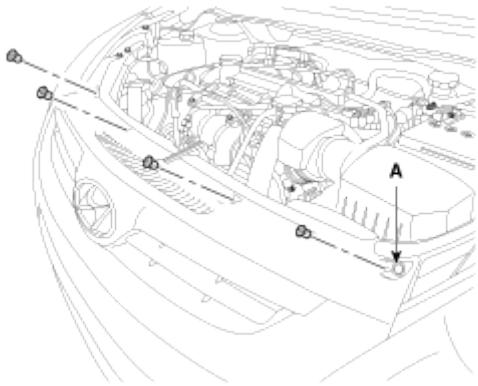
5Door, 3Door

Replacement

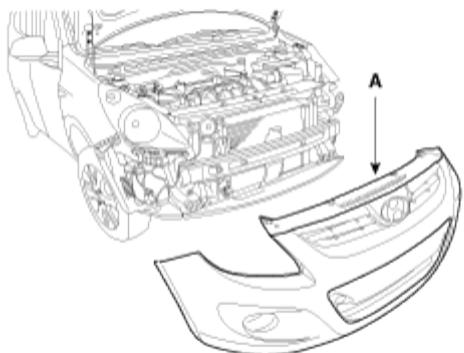
NOTE

- Put on gloves to protect your hands.
- When prying with a flat-tip screwdriver, wrap it with protective tape to prevent damage.
- Take care not bend or scratch the cover and other parts.

1. Remove the radiator upper cover mounting clips(A).



2. Remove the bolts and clips.
3. Remove the front bumper (A).



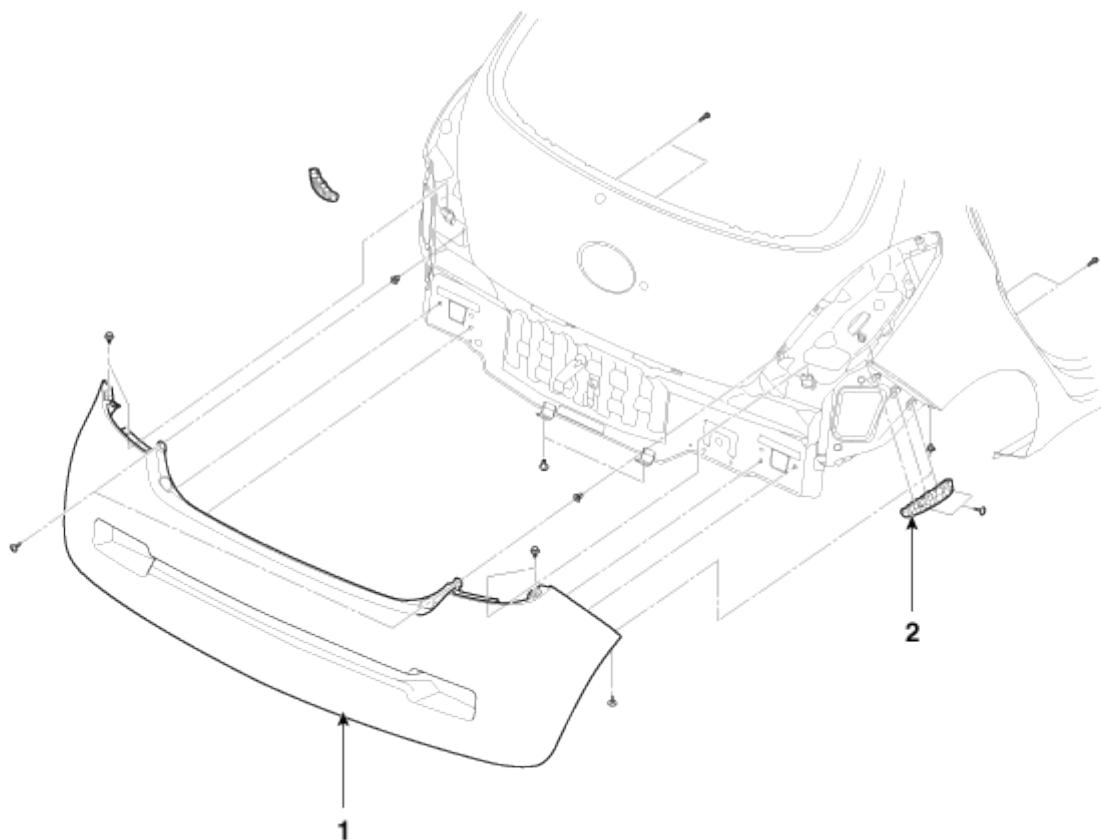
4. Disconnect the fog lamp connector.
5. Installation is the reverse of removal.

4.4.2. Rear Bumper

4.4.2.1. Component and Components Location

5Door, 3Door

Components



1. Rear bumper

2. Side mounting bracket

4.4.2.2. Repair procedures

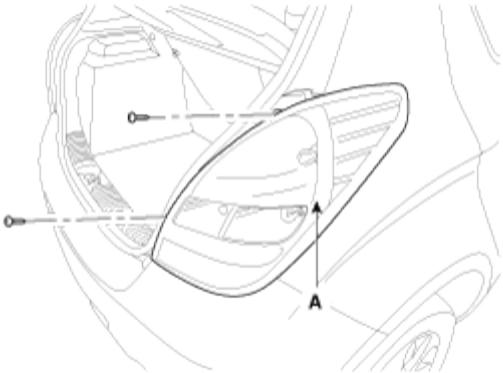
5Door, 3Door

Replacement

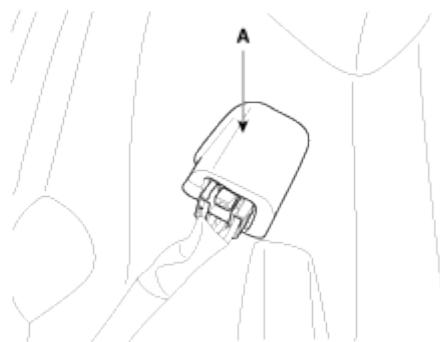
NOTE

- When prying with a flat-tip screwdriver, wrap it with protective tape, and apply protective tape around the related parts your hands.
- Put on gloves to protect your hands.
- Take care not bend or scratch the cover and other parts.

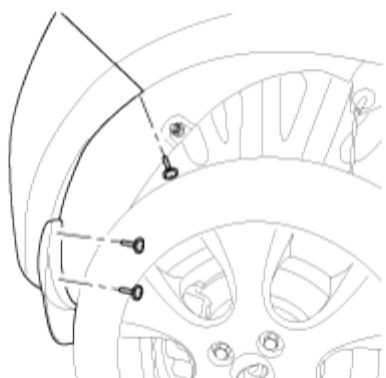
1. Remove the rear combination lamp (A).



2. Disconnect the connector (A).

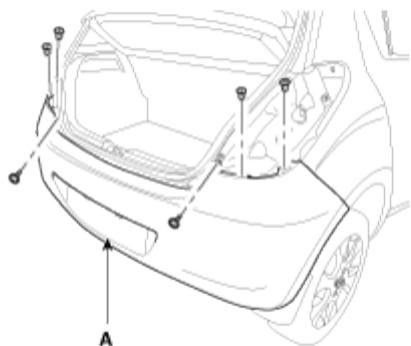


3. Remove the mounting screws.

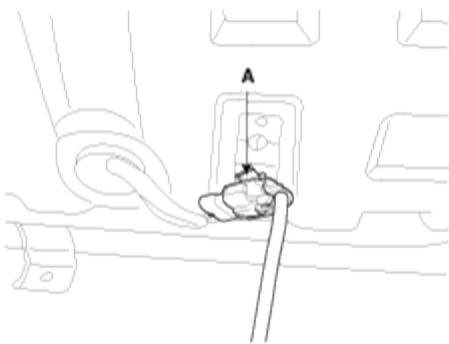


4. Loosen the rear bumper cover screws and clips.

5. Remove the rear bumper cover (A).



6. Disconnect the connector (A).



7. Installation is the reverse of removal.

NOTE

- Replace any damage clips.

4.5. Seat & Power Seat

4.5.1. Front Seat

4.5.1.1. Repair procedures

5Door, 3Door

Replacement

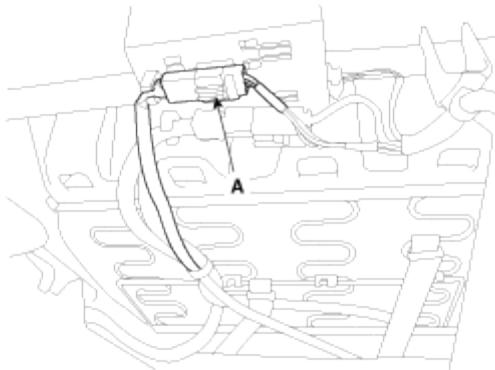
Seat Assembly Replacement

1. After loosening the seat assembly mounting bolts, remove the seat assembly.

Tightening torque:

39.2~53.9N.m(3.5~5.5kgf.m, 28.9~39.8lb-ft)

2. Disconnect the connectors (A), and remove the seat assembly.



3. Installation is the reverse of removal.

CAUTION

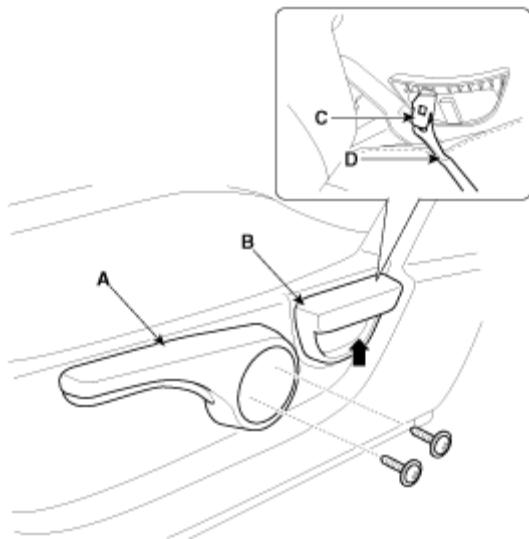
SEAT MOUNTING BOLT INSTALLATION PROCEDURE (manual seat only)

- Set the into the most rearward position. Check then each slide is locked, and then tighten the front mounting bolt temporarily.
- Set the seat into most forward position. Check that each slide is locked, and then tighten the rear mounting bolt completely.
- Set the seat into the most rearward position. Check the front mounting bolt completely.
- Check that the seat operates to and fro smoothly and the locking portion locks properly.

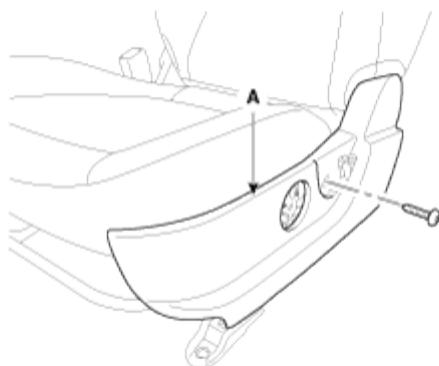
Recliner Cover Replacement

Driver's

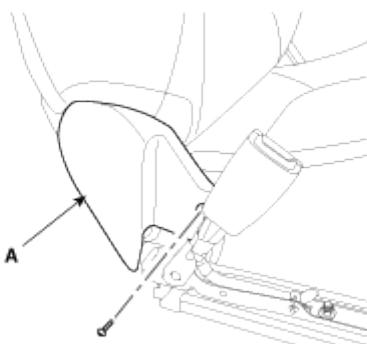
1. After loosening the mounting screws, then remove the height lever (A).
2. Unlock the lock pin (C) by pushing the pointed tool (D) between the recliner lever (B) and lock pin (C). And then remove the recliner lever (B) by pulling it as arrow direction.



3. After loosening the mounting screws, then remove the recliner cover (A).



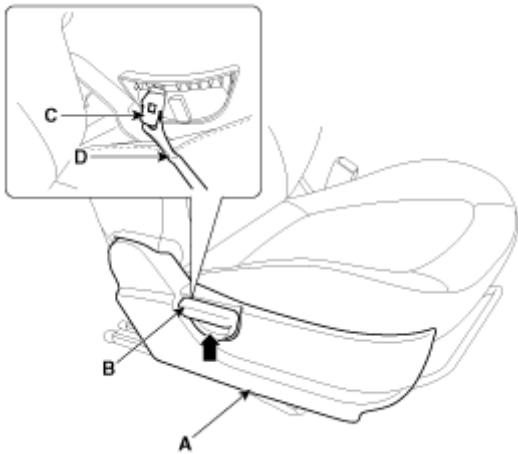
4. After loosening the mounting screws, then remove the recliner cover (A).



5. Installation is the reverse of removal.

Passenger's

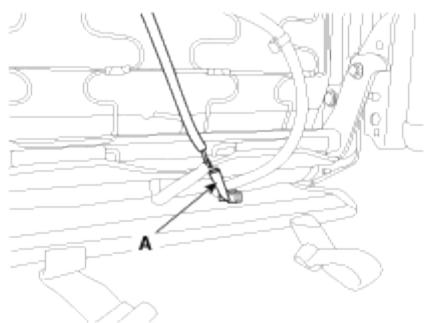
1. Unlock the lock pin (C) by pushing the pointed tool (D) between the recliner lever (B) and lock pin (C). And then remove the recliner lever (B) by pulling it as arrow direction.
2. After loosening the mounting screw, then remove the recliner cover (A).



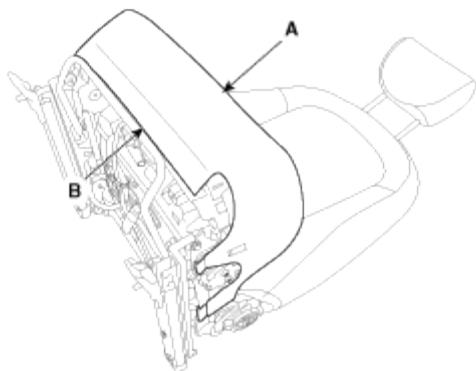
3. Installation is the reverse of removal.

Seat Cushion Cover Replacement

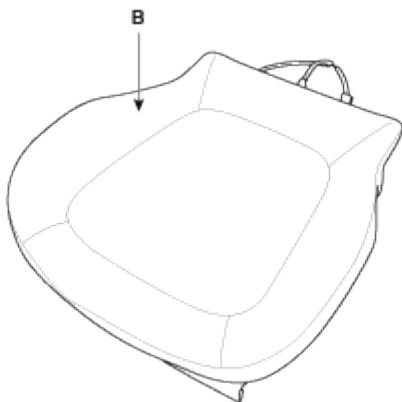
1. Remove front seat assembly.
2. Remove the recliner cover.
3. Disconnect the connector (A).



4. After disconnecting the protector (A), remove the seat cushion (B).



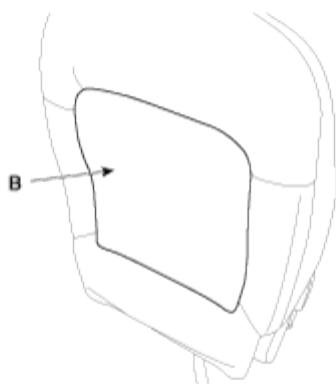
5. After removing the hog ring clips on the front of seat cushion and remove the seat cushion cover (B).



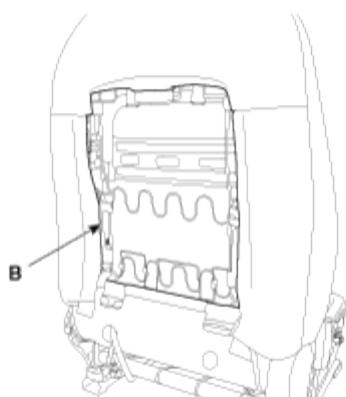
6. Installation is the reverse of removal.

Seat Back Cover Replacement

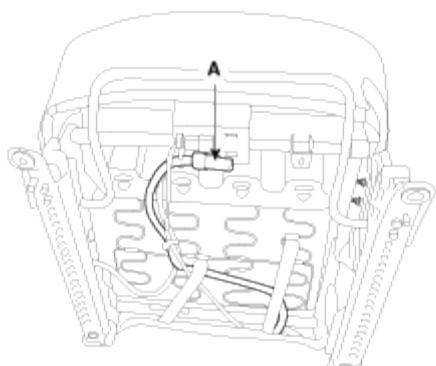
1. Remove front seat assembly.
2. Remove the headrest.
3. Remove the seat back panel (B).



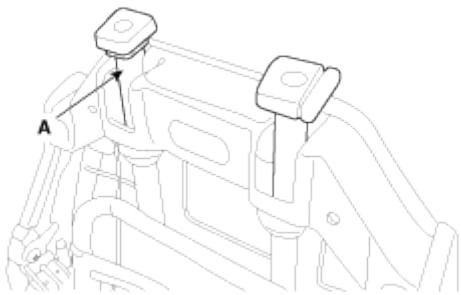
4. Disconnect the protector (A) from the back frame.



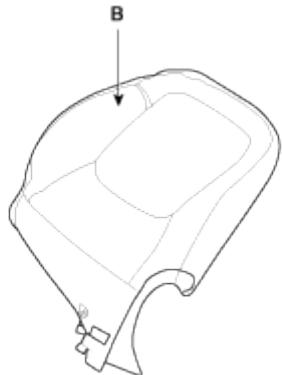
5. Disconnect the connector (A).



6. After removing the headrest and pull out the headrest guides (A) while pinching.



7. After removing the hogring clip on the front of seat back and remove the seat back cover (B).



8. Installation is the reverse of removal.

Seat Frame Replacement

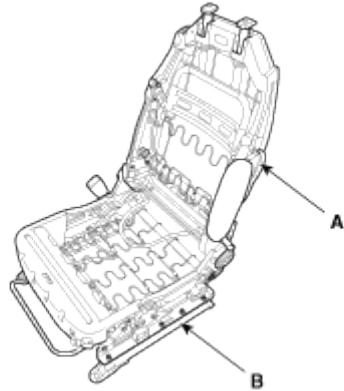
1. Remove the following items.

- A. Recliner cover.
- B. Seat back panel.
- C. Headrest guide.
- D. Seat back cover.

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

NOTE

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

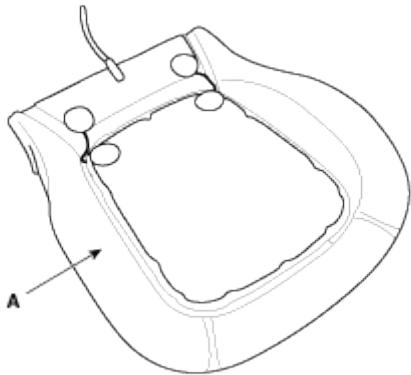


3. Installation is the reverse of removal.

Seat Cushion Heater Replacement

1. Remove the seat cushion cover.

2. Disconnect the pad (A) from the seat cushion assembly.



3. Cut the heater attached to the pad, as shown in the picture.

NOTE

- Take care not to damage the pad.

4. Install the seat cushion cover.

- A. Detach the paper from the back of the heater assembly.
- B. Attach the heater to the main part of the sponge.

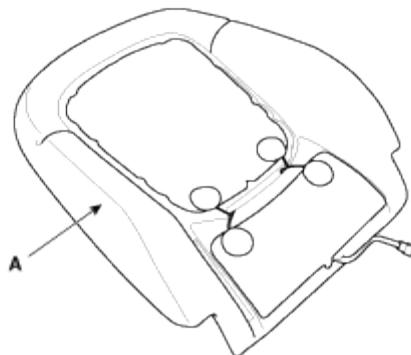
NOTE

- Be sure to match the heater with main appearance.

Seat Back Heater Replacement

1. Remove the seat back cover.

2. Disconnect the pad (A) from the seat back assembly.



3. Cut the heater attached to the pad, as shown in the picture.

NOTE

- Take care not to damage the pad.

4. Install the seat back cover.

- A. Detach the paper from the back of the heater assembly.
- B. Attach the heater to the main part of the sponge.

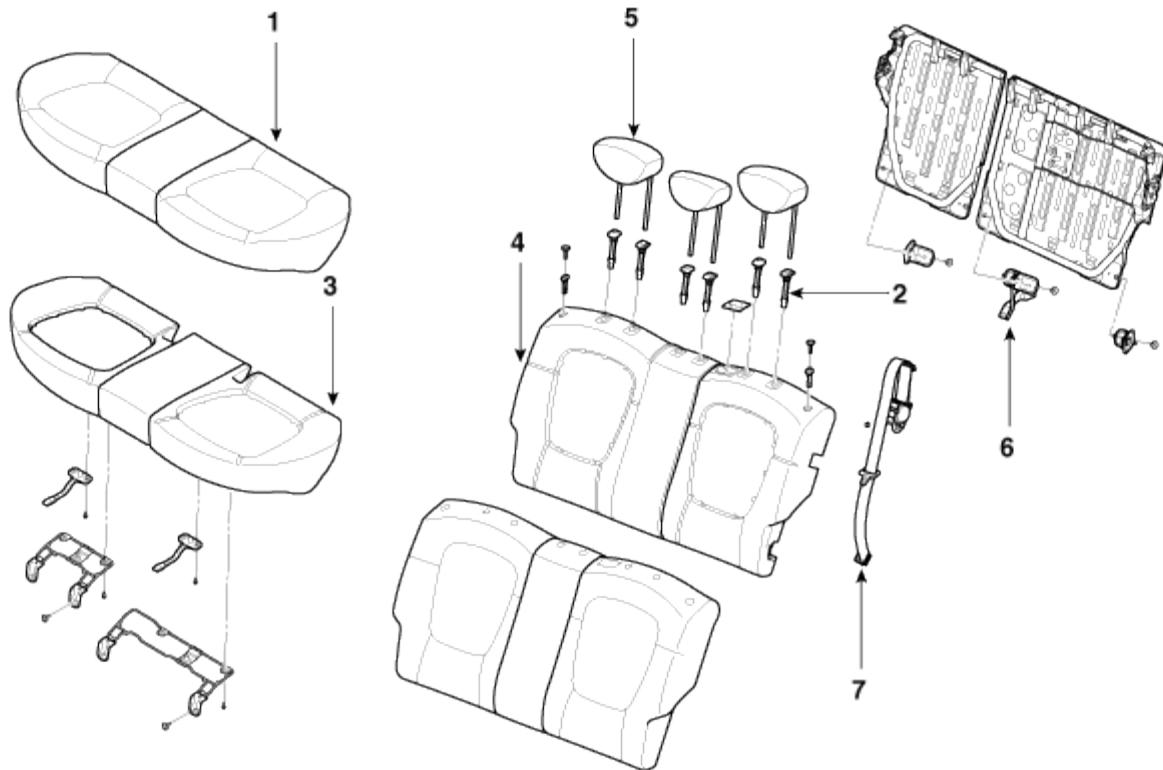
NOTE

- Be sure to match the heater with main appearance.

4.5.2. Rear Seat

4.5.2.1. Component and Components Location

Components



1. Rear seat cushion
2. Headrest guide
3. Rear seat cushion

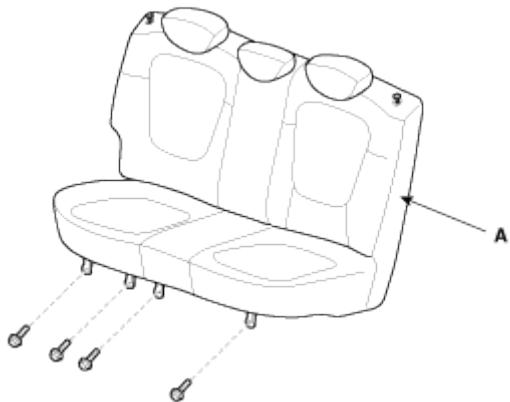
4. Rear seat back
5. Headrest
6. Center hinge assembly
7. Center seat belt

4.5.2.2. Repair procedures

Replacement

Seat Assembly Replacement

1. Loosen the mounting bolt, remove the rear seat assembly (A).



2. Installation is the reverse of removal

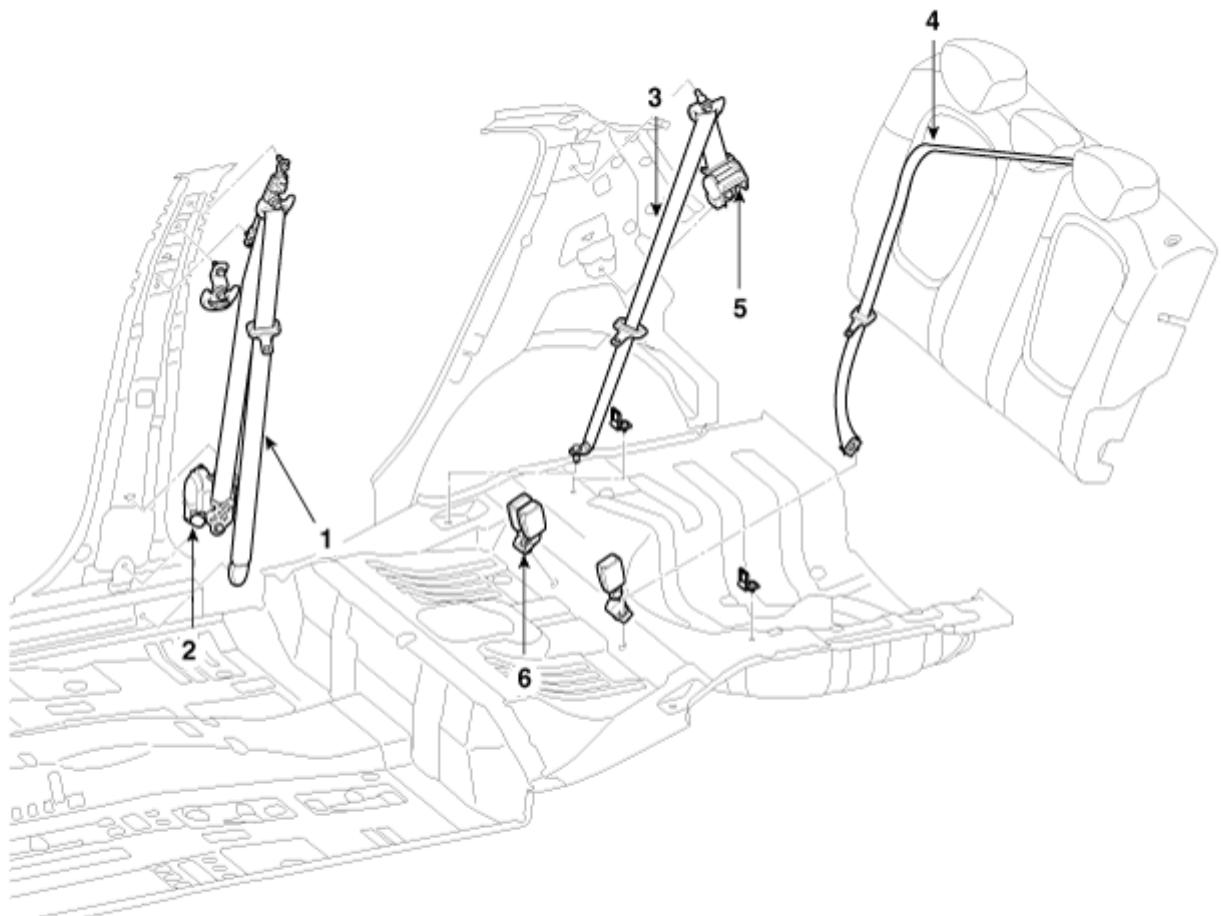
4.6. Seat Belt

4.6.1. Front Seat Belt

4.6.1.1. Component and Components Location

Components

5Door



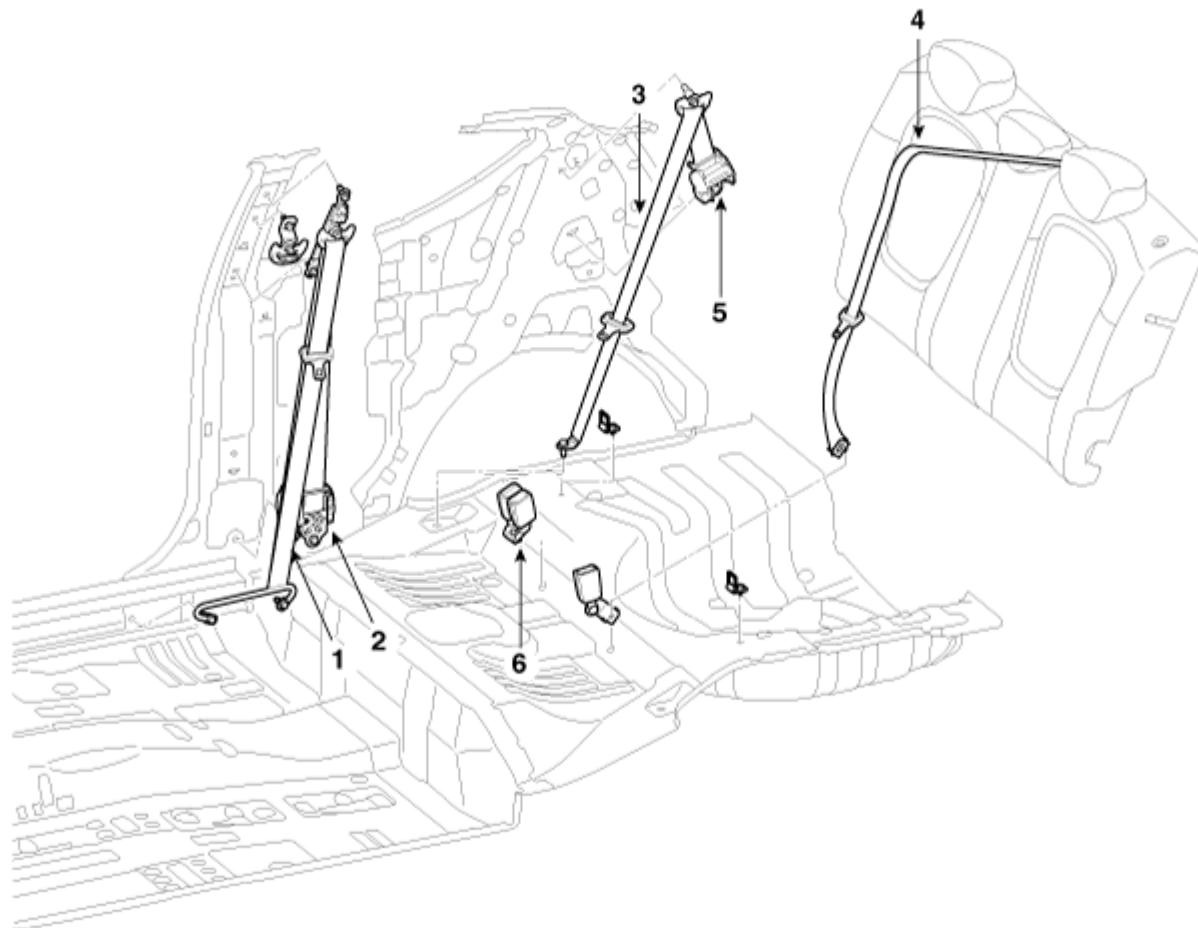
1. Front seat belt

4. Center seat belt

2. Front seat belt retractor
3. Rear seat belt

5. Rear seat belt retractor
6. Rear center seat buckle
7. Rear center seat belt

3Door



1. Front seat belt
2. Front seat belt retractor
3. Rear seat belt

4. Center seat belt
5. Rear seat belt retractor
6. Rear center seat buckle

4.6.1.2. Repair procedures

5Door

Replacement

Front Seat Belt Replacement

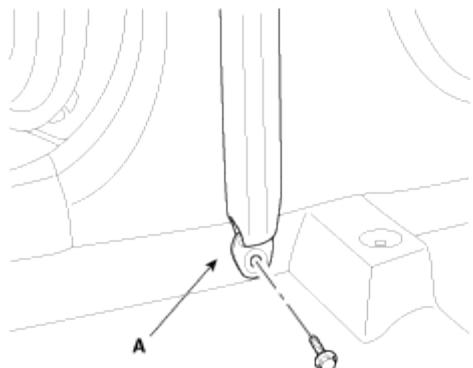
CAUTION

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

- Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
- Remove the following items first.

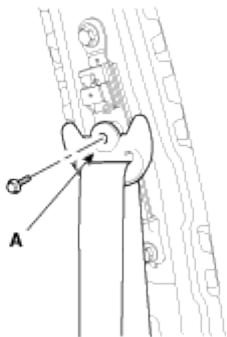
- A. Front seat assembly.
 - B. Door scuff trim.
3. Loosen the lower anchor mounting bolt (B).

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

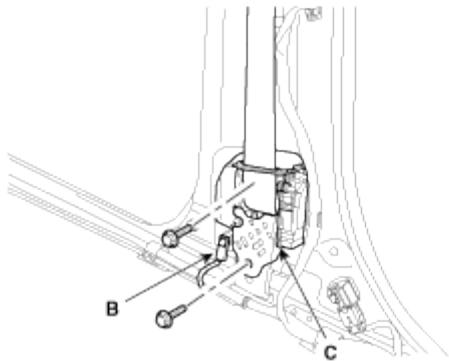


4. Remove the center pillar lower trim.
5. Remove the center pillar upper trim.
6. Remove the upper anchor (A).

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



7. After disconnecting the pretensioner connector lock pin, remove the SIS connector (B), Loosen the mounting bolt, then remove the pretensioner (C).



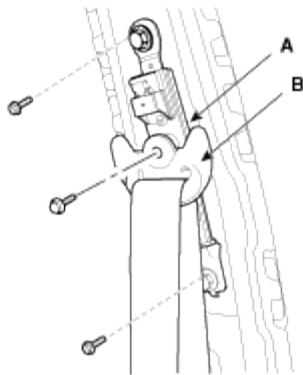
Hight Adjuster Replacement

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

- B. Door scuff trim.
 - C. Center pillar trim.
2. Remove the seat belt upper anchor (B).
3. After loosening the mounting bolt, then remove the height adjuster (A).

Tightening torque :

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



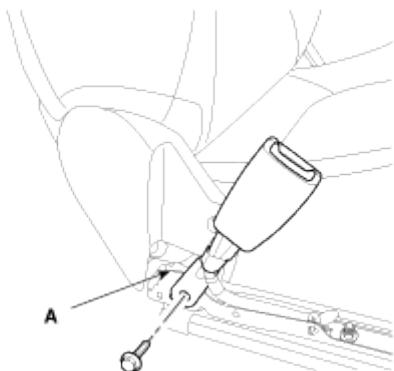
4. Installation is the reverse of removal.

Front Seat Belt Buckle Replacement

1. Remove the following items first.
2. Remove the wire harness of buckle from seat.
3. Remove the seat belt buckle (A).

Tightening torque :

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



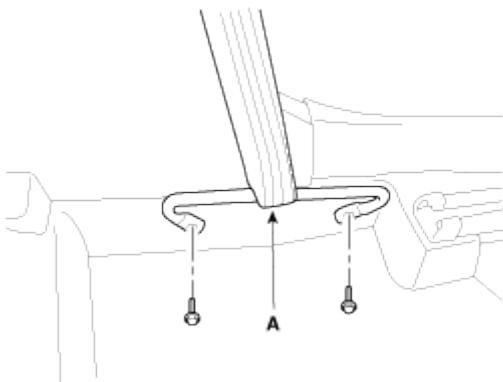
4. Installation is the reverse of removal.

3Door Front Seat Belt Replacement

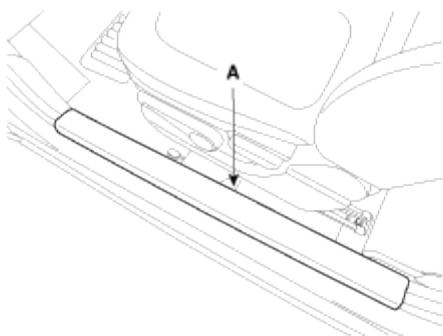
1. Remove the lower anchor (A).

Tightening torque :

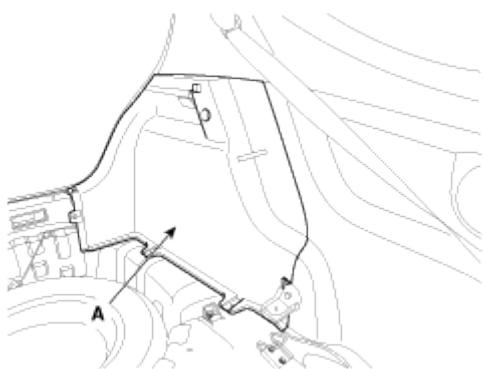
39.2 ~ 53.9 N.m (4.0 ~ 5.5 kgf.m, 28.9 ~39.8 lb-ft)



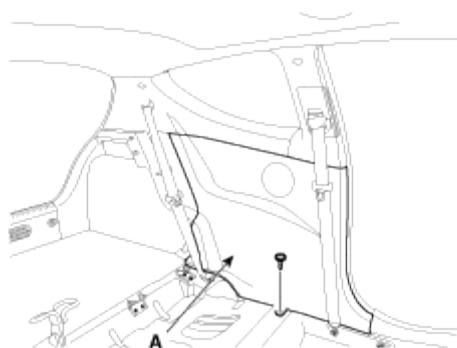
2. Remove the door scuff trim (A).



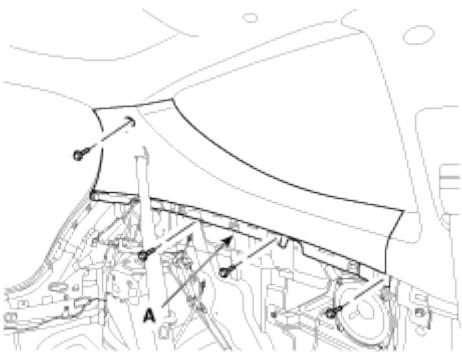
3. Remove the luggage side trim (A).



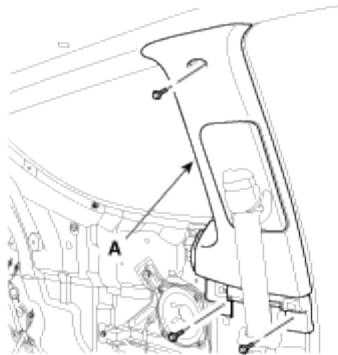
4. Remove the trim (A).



5. Remove the trim (A).



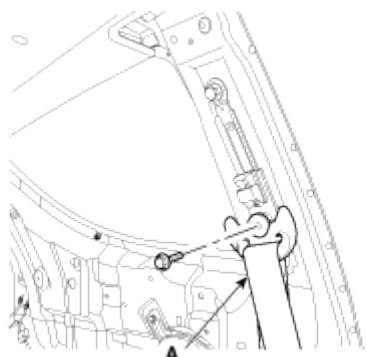
6. Remove the center upper trim (A).



7. Remove the upper anchor (A).

Tightening torque :

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



8. Installation is the reverse of removal.

4.6.2. Rear Seat Belt
4.6.2.1. Repair procedures

Replacement

5Door
Seat Belt Replacement

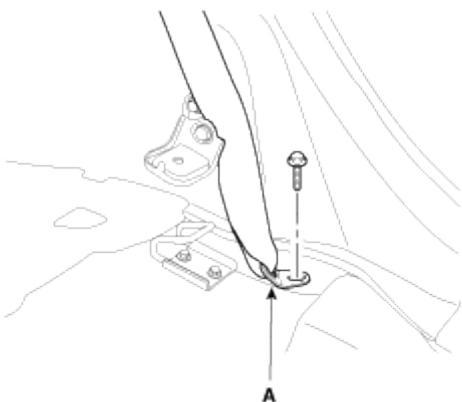
CAUTION

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

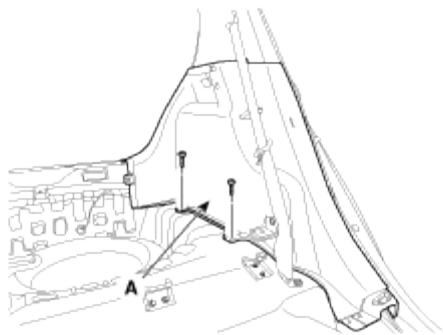
1. Remove the following items first.

- A. Rear seat assembly.
 - B. Rear door scuff trim.
2. Remove the lower anchor (A).

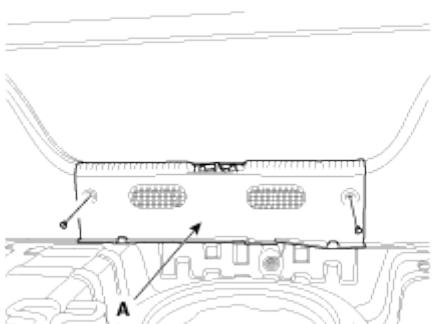
Tightening torque :
39.2 ~ 53.9 N.m (4.0 ~ 5.5 kgf.m, 28.9 ~ 39.8 lb-ft)



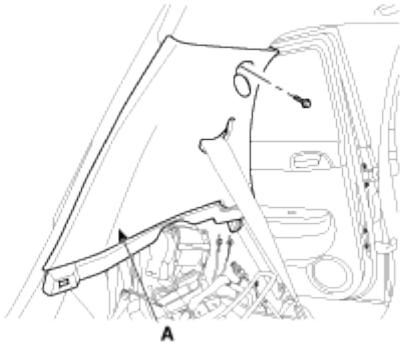
3. Remove the transverse trim (A).



4. Remove the luggage side trim (A).



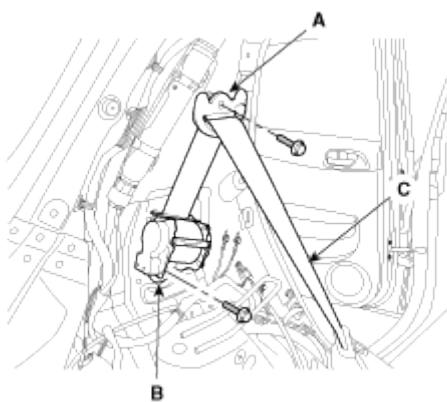
5. Remove the rear pillar trim (A).



6. After loosening the retractor (B) mounting bolt, remove the rear seat belt (C).
7. Remove the upper anchor (A).

Tightening torque :

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



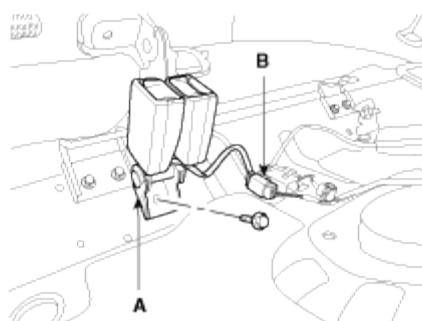
8. Installation is the reverse of removal.

Seat Belt Buckle Replacement

1. Remove the third seat assembly.
2. Remove the seat belt buckle (A).
3. Disconnect the connector (B).

Tightening torque :

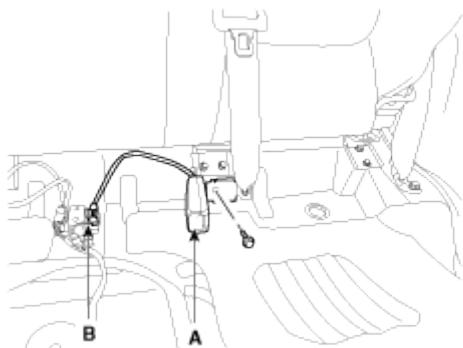
39.2 ~ 53.9 N.m (4.0 ~ 5.5 kgf.m, 28.9 ~ 39.8 lb-ft)



4. Remove the seat belt buckle (A).
5. Disconnect the connector (B).

Tightening torque :

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



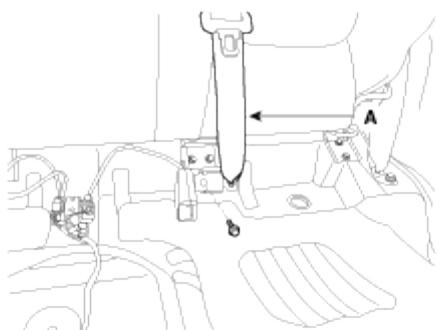
6. Installation is the reverse of removal.

Rear Center Seat Belt Replacement

1. Remove the center seat belt lower anchor (A).

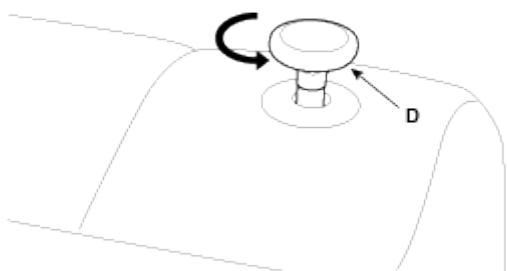
Tightening torque :

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



2. Remove the seat back.

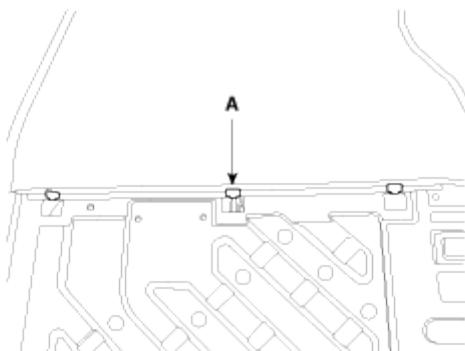
3. Remove the folding knob (D).



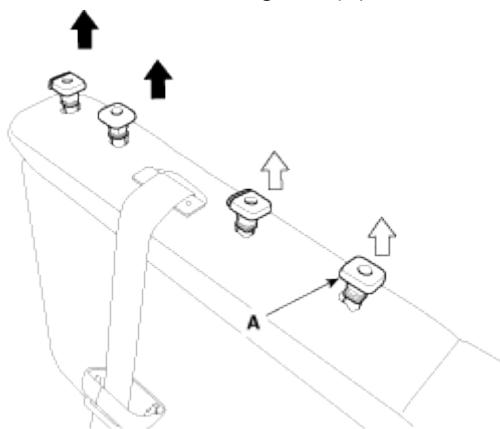
4. Disconnect the protector (A).



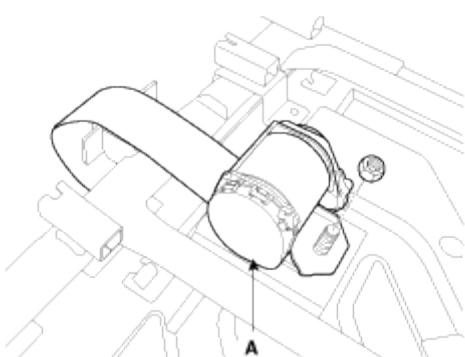
5. Disconnect the clip (A).



6. Remove the headrest guide (A).



7. After loosening the mounting bolt, remove the rear center seat belt (A).

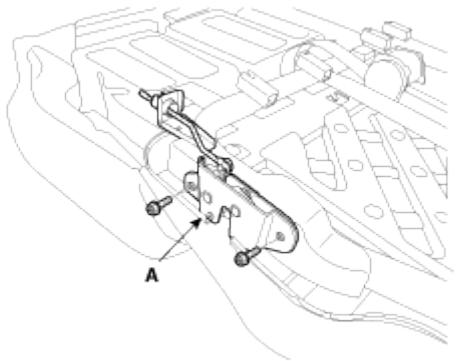


8. Installation is the reverse of removal.

Rear Seat Latch Replacement

1. Remove the rear seat.
2. Remove the rear seat cover.

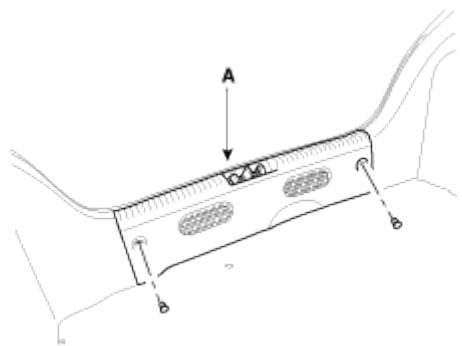
3. After loosening the latch mounting bolt, remove the latch (A).



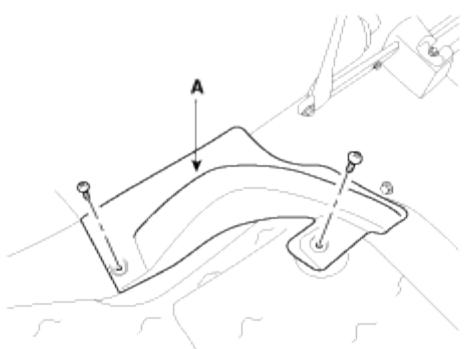
4. Installation is the reverse of removal.

3 Door Seat Belt Relacement

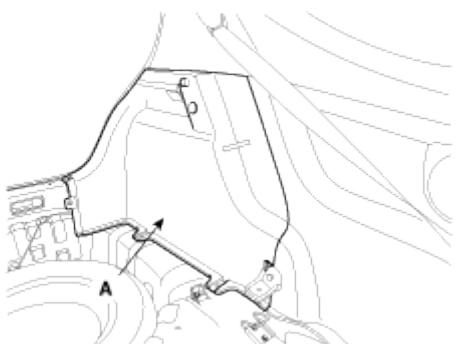
1. Remove the transverse trim (A).



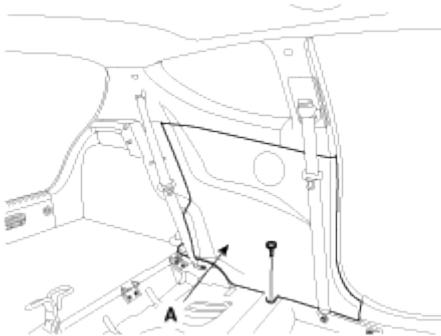
2. Remove the scuff trim (A).



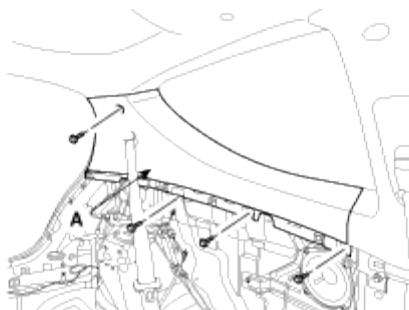
3. Remove the luggage side trim (A).



4. Remove the lower trim (A).



5. Remove the upper trim (A).

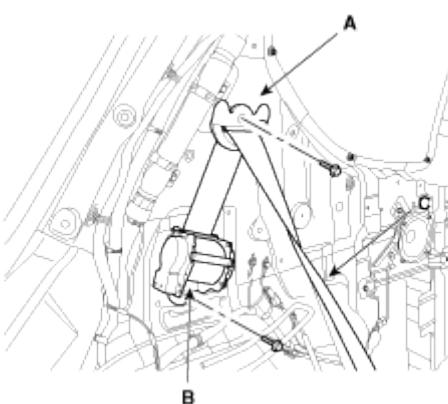


6. After loosening the retractor (B) mounting bolt, remove the rear seat belt (C).

7. Remove the upper anchor (A).

Tightening torque :

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



5. Brake System

5.1. General Information

5.1.1. Specifications

Specifications

| Item | Specification |
|---------------------------------|------------------------------------|
| Master cylinder
Type
I.D. | Tandem type
22.22 mm (0.875 in) |

| | | |
|---|--|--|
| Piston stroke
Fluid level warning sensor | 31 mm (1.22 in)
Provided | |
| Brake booster
Type
Boosting ratio | Vacuum
7 : 1 | |
| Front brake(Disc) | 1.4L, 1.6L | 1.2L |
| Type
Disc O.D.
Disc I.D.
Disc thickness
Pad thickness
Cylinder type
Cylinder I.D. | Floating type with ventilated disc
256 mm (10.07 in)
152 mm (5.98 in)
22 mm (0.87 in)
11 mm (0.43 in)
Single piston
Ø54.0 mm (2.13 in) | 256 mm(10.07 in)
164 mm (6.46 in)
18 mm (0.71 in)
10 mm (0.39 in)
Ø51.0 mm (2.01 in) |
| Rear brake(Disc) | Floating type with solid disc | |
| Type
Disc O.D.
Disc I.D.
Disc thickness
Pad thickness
Cylinder type
Cylinder I.D. | 262 mm (10.31 in)
185 mm (7.28 in)
10 mm (0.39 in)
9 mm (0.35 in)
Single piston
Ø30.225 mm (1.19in) | |
| Rear brake(Drum) | Leading trailing | |
| Type
Drum I.D.
Brake lining thickness
Clearance adjustment | Ø203 mm (7.99 in)
4.3 mm (0.17 in)
Automatic | |
| Parking brake
Actuation
Type
Drum I.D. | DIH (Drum in hat)
Lever
168 mm(6.61 in) | |

NOTE

ABS : Anti-lock Brake System

CBS : Conventional Brake System

Specification (ABS)

| Part | Item | Standard value | Remark |
|---|-----------------------|-------------------------------------|--|
| HECU(Hydraulic and Electronic Control Unit) | System | 4 channel 4 sensor (Solenoid) | ·ABS system:ABS & EBD control |
| | Type | Motor, valve relay intergrated type | |
| | Operating voltage | 10 V ~ 16 V(DC) | |
| | Operating temperature | -40 ~ 120 °C (-40 ~ 248 °F) | |
| Warning lamp | Operating voltage | 12 V | ·ABS W/L:ABS failure
·Brake W/L:Parking, brake oil, EBD failure |

| | | | |
|---------------------------|-----------------------|---|---------------------|
| | Current consumption | 80 mA | |
| Active wheel speed sensor | Supply voltage | DC 4.5 ~ 20 V | |
| | Operating temperature | -40 ~ 150 °C
(-40 ~ 302 °F) | |
| | Output current low | 5.9 ~ 8.4 mA | Typ.7 mA |
| | Output current High | 11.8 ~ 16.8 mA | Typ.14 mA |
| | Frequency range | 1 ~ 2500 HZ | |
| | Air gap | Front
0.7 mm
(0.027 in)
Rear
0.5 mm
(0.019 in) | Typ.0.7 mm(0.03 in) |
| | Tone wheel | 48 teeth | |
| | Output duty | 30~70 % | |

Specification(ESP)

| Part | Item | Standard Value | Remark |
|---|-----------------------|---|------------------------------------|
| HECU(Hydraulic and Electronic Control Unit) | System | 4 channel 4 sensor (Solenoid) | ·Total control(ABS, EBD, TCS, ESP) |
| | Type | Motor, valve relay intergrated type | |
| | Operating voltage | 10 V ~ 16 V(DC) | |
| | Operating temperature | -40 ~ 120 °C
(-40 ~ 248 °F) | |
| Warning lamp | Operating voltage | 12 V | ·ESP Lamp
·ESP OFF Lamp |
| | Current consumption | 80 mA | |
| Active wheel speed sensor | Supply voltage | DC 4.5 ~ 20V | |
| | Operating temperature | -40 ~ 150 °C
(-40 ~ 302 °F) | |
| | Output current low | 5.9 ~ 8.4 mA | |
| | Output current high | 11.8 ~ 16.8 mA | |
| | Tone wheel | 48 teeth | |
| | Frequency range | 1 ~ 2500 HZ | |
| | Airgap | Front
0.7 mm
(0.027 in)
Rear
0.5 mm
(0.019 in) | Typ.0.7 mm(0.03 in) |
| | Operating Voltage | 8V ~ 16 V | |
| | Current Consumption | Max 150 mA | |

| | | | |
|-----------------------------|----------------------------|---------------|--|
| | Operating Angular Range | -780 ~ 779.9° | |
| Yaw-rate & Lateral G sensor | Operating Voltage | 8 V ~ 16 V | |
| | Current Consumption | Max. 120 mA | |
| | Yaw Sensor Operating Range | ±100 ° /s | |
| | G Sensor Operating Range | ±1.8 G | |

Service Standard

| Item | Standard value |
|---|---|
| Brake pedal height | LHD : 169 mm (6.65 in)
RHD : 171 mm (6.73 in) |
| Brake pedal stroke | 102 mm (5.31 in) |
| Stop lamp switch outer case to pedal stopper clearance | 1.0 ~ 2.0 mm (0.04 ~ 0.08 in) |
| Brake pedal free play | 2 ~ 5 mm (0.08 ~ 0.20 in) |
| Booster push rod to master cylinder piston clearance | 0mm (at 500 mmHg vacuum) |
| Parking brake lever stroke when lever assembly is pulled with 196N (20Kg, 44lb force) | 6 ~ 8 clicks |
| Front disc brake pad thickness | 1.4L, 1.6L : 11 mm (0.43 in.)
1.2L : 10 mm (0.39 in) |
| Front disc thickness | 1.4L, 1.6L : 22 mm (0.87 in)
1.2L : 18 mm (0.71 in) |
| Rear disc brake pad thickness | 9 mm (0.35 in) |
| Rear disc brake disc thickness | 10 mm (0.39 in) |
| Rear brake lining thickness | 4.3 mm (0.17 in) |

Tightening Torques

| Item | N.m | kgf.m | lb·ft |
|--|-------------|------------|-------------|
| Master cylinder to booster mounting nut | 12.7 ~ 16.7 | 1.3 ~ 1.7 | 9.4 ~ 12.3 |
| Brake booster mounting nut | 12.7 ~ 15.7 | 1.3 ~ 1.6 | 9.4 ~ 11.6 |
| Bleeder screw | 6.9 ~ 12.7 | 0.7 ~ 1.3 | 5.1 ~ 9.4 |
| Brake tube to HECU(M12 nut)-ABS | 14.0 ~ 18.0 | 1.3 ~ 1.7 | 9.4 ~ 12.3 |
| Brake tube to HECU(M12 nut)-ESP | 18.6 ~ 22.6 | 1.9 ~ 2.3 | 13.7 ~ 16.6 |
| Caliper guide rod bolt | 21.6 ~ 31.4 | 2.2 ~ 3.2 | 15.9 ~ 23.1 |
| Caliper mounting bolt (Front) | 78.5 ~ 98.1 | 8.0 ~ 10.0 | 57.9 ~ 72.3 |
| Caliper mounting bolt (Rear) | 63.7 ~ 73.6 | 6.5 ~ 7.5 | 44.0 ~ 54.3 |
| Brake hose to caliper | 24.5 ~ 29.4 | 2.5 ~ 3.0 | 18.1 ~ 21.7 |
| Brake pedal member assembly bracket mounting nut
(cowl side upper mounting) | 16.7 ~ 25.5 | 1.7 ~ 2.6 | 12.3 ~ 18.8 |
| Brake pedal member bracket to booster mounting nut | 12.7 ~ 15.7 | 1.3 ~ 1.6 | 9.4 ~ 11.6 |
| Stop lamp switch mounting nut | 7.9 ~ 9.8 | 0.8 ~ 1.0 | 5.8 ~ 7.2 |
| Wheel speed sensor mounting bolt | 6.9 ~ 10.8 | 0.7 ~ 1.1 | 5.1 ~ 8.0 |
| HECU mounting bracket bolt | 16.7 ~ 25.5 | 1.7 ~ 2.6 | 12.3 ~ 18.8 |

| | | | |
|---|-----------|-------------|-----------|
| HECU bracket mounting nut | 5.9 ~ 9.8 | 0.6 ~ 1.0 | 4.3 ~ 7.2 |
| Yaw rate & Lateral G sensor mounting bolt | 5.0 ~ 8.0 | 0.51 ~ 0.81 | 3.7 ~ 5.8 |

Lubricant

| Item | Recommended lubricant | Quantity |
|---|-----------------------|---|
| Brake fluid | DOT 3 or DOT 4 | As required |
| Brake pedal bushing and brake pedal bolt | Chassis grease | As required |
| Parking brake shoe and backing plate contact surfaces | Bearing grease | As required |
| Front caliper guide rod bolt and boot | AI-11P grease | 1.2 ~ 2.2g |
| Rear caliper guide rod and boot | AI-11P grease | 1.0 ~ 2.0g (Trailing)
0.8 ~ 2.0g (Leading) |

5.1.2. Special Service Tools

Special Service Tools

| Tool (Number and Name) | Illustration | Use |
|----------------------------------|--------------|---|
| 09581 - 11000
Piston expander | | Pushing back of the front disc and rear disc brake piston |

5.1.3. Troubleshooting

Troubleshooting

Problem Symptoms Table

Use the table below to help you find the cause of the problem. The numbers indicate the priority of the likely cause of the problem. Check each part in order. If necessary, replace these parts.

| Symptom | Suspect Area | Remedy |
|-----------------------------|--|---|
| Lower pedal or spongy pedal | 1. Brake system (Fluid leaks)
2. Brake system (Air in)
3. Piston seals (Worn or damaged)
4. Master cylinder (Faulty) | Repair
Air bleeding
Replace
Replace |
| Brake drag | 1. Brake pedal free play (Minimum)
2. Parking brake lever travel (Out of adjustment)
3. Parking brake wire (Sticking)
4. Pad or lining (Cracked or distorted)
5. Piston (Stuck)
6. Piston (Frozen)
7. Return spring (Faulty)
8. Booster system (Vacuum leaks) | Adjust
Adjust
Repair
Replace
Replace
Replace
Replace
Replace |

| | | |
|----------------------------------|--|---|
| | 9. Master cylinder (Faulty) | Replace |
| Brake pull | 1. Piston (sticking)
2. Pad or lining (Oily)
3. Piston (Frozen)
4. Disc (Scored)
5. Pad or lining (Cracked or distorted) | Replace
Replace
Replace
Replace
Replace |
| Hard pedal but brake inefficient | 1. Brake system (Fluid leaks)
2. Brake system (Air in)
3. Pad or lining (Worn)
4. Pad or lining (Cracked or distorted)
5. Pad or lining (Oily)
6. Pad or lining (Glazed)
7. Disc (Scored)
8. Booster system (Vacuum leaks) | Repair
Air bleeding
Replace
Replace
Replace
Replace
Replace
Replace
Replace |
| Noise from brake | 1. Pad or lining (Cracked or distorted)
2. Installation bolt (Loosen)
3. Disc (Scored)
4. Sliding pin (Worn)
5. Pad or lining (Dirty)
6. Pad or lining (Glazed)
7. Return spring (Faulty)
8. Brake pad shim (Damage)
9. Shoe hold-down spring (Damage) | Replace
Retighten
Replace
Replace
Clean
Replace
Replace
Replace
Replace |
| Brake fades | 1. Master cylinder | Replace |
| Brake vibration, pulsation | 1. Disc (Excessive thickness variation)
2. Disc (Faulty run-out)
3. Disc (Uneven worn or crack)
4. Pad or lining (Uneven worn and contact)
5. Caliper (Faulty pad sliding) | Replace
Replace
Replace
Replace
Replace |
| Brake chatter | Brake chatter is usually caused by loose or worn components, or glazed or burnt linings. Rotors with hard spots can also contribute to brake chatter. Additional causes of chatter are out-of-tolerance rotors, brake lining not securely attached to the shoes, loose wheel bearings and contaminated brake lining. | |

5.2. Brake System

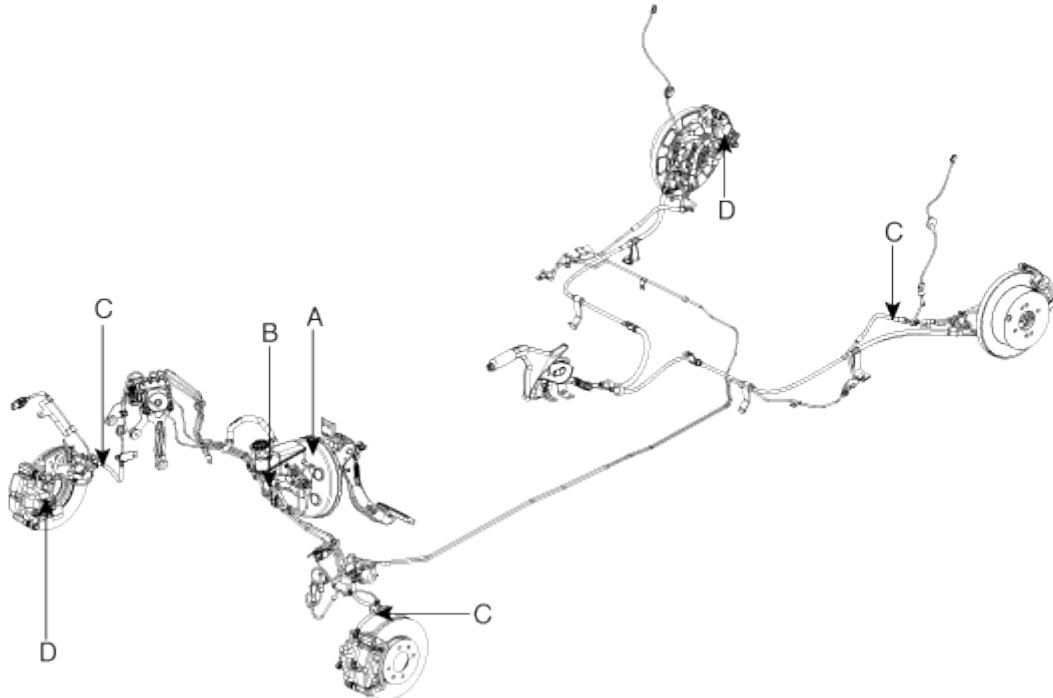
5.2.1. Repair procedures

Operation and Leakage Check

Check all of the following items

| Component | Procedure |
|--|---|
| Brake Booster (A) | Check brake operation by applying the brakes during a test drive. If the brakes do not work properly, check the brake booster. Replace the brake booster as an assembly if it does not work properly or if there are signs of leakage. |
| Piston cup and pressure cup inspection (B) | <ul style="list-style-type: none"> Check brake operation by applying the brakes. Look for damage or signs of fluid leakage. Replace the master cylinder as an assembly if the pedal does not work properly or if there is damage or signs of fluid leakage. Check for a difference in brake pedal stroke between quick and slow brake |

| | |
|--|--|
| | applications. Replace the master cylinder if there is a difference in pedal stroke. |
| Brake hoses (C) | Look for damage or signs of fluid leakage. Replace the brake hose with a new one if it is damaged or leaking. |
| Caliper piston seal and piston boots (D) | Check brake operation by applying the brakes.
Look for damage or signs of fluid leakage. If the pedal does not work properly, the brakes drag, or there is damage or signs of fluid leakage, disassemble and inspect the brake caliper. Replace the boots and seals with new ones whenever the brake caliper is disassembled. |



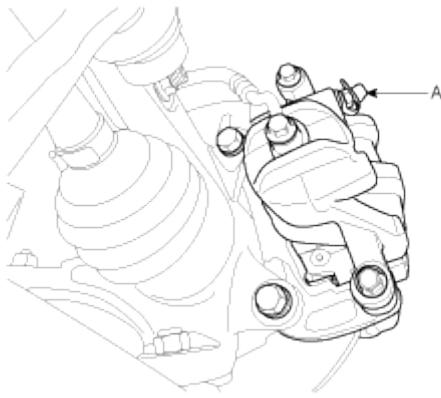
Brake System Bleeding

CAUTION

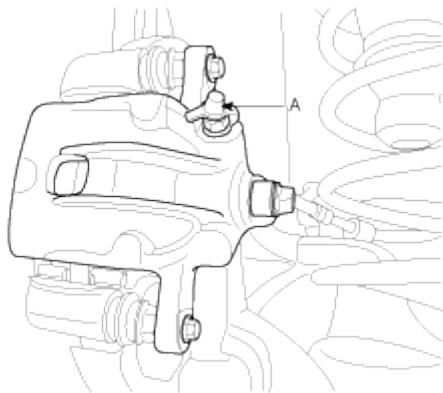
- Do not reuse the drained fluid.
- Always use genuine DOT3/DOT4 brake Fluid. Using a non-genuine DOT3/DOT4 brake fluid can cause corrosion and decrease the life of the system.
- Make sure no dirt or other foreign matter is allowed to contaminate the brake fluid.
- Do not spill brake fluid on the vehicle, it may damage the paint; if brake fluid does contact the paint, wash it off immediately with water.
- The reservoir on the master cylinder must be at the MAX (upper) level mark at the start of bleeding procedure and checked after bleeding each brake caliper. Add fluid as required.

1. Make sure the brake fluid in the reservoir is at the MAX(upper) level line.
2. Have someone slowly pump the brake pedal several times, and then apply pressure.
3. Loosen the right-rear brake bleed screw (A) to allow air to escape from the system. Then tighten the bleed screw securely.

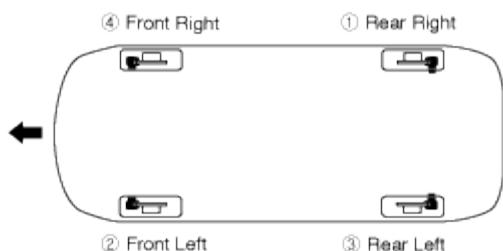
Front



Rear



4. Repeat the procedure for wheel in the sequence shown below until air bubbles no longer appear in the fluid.

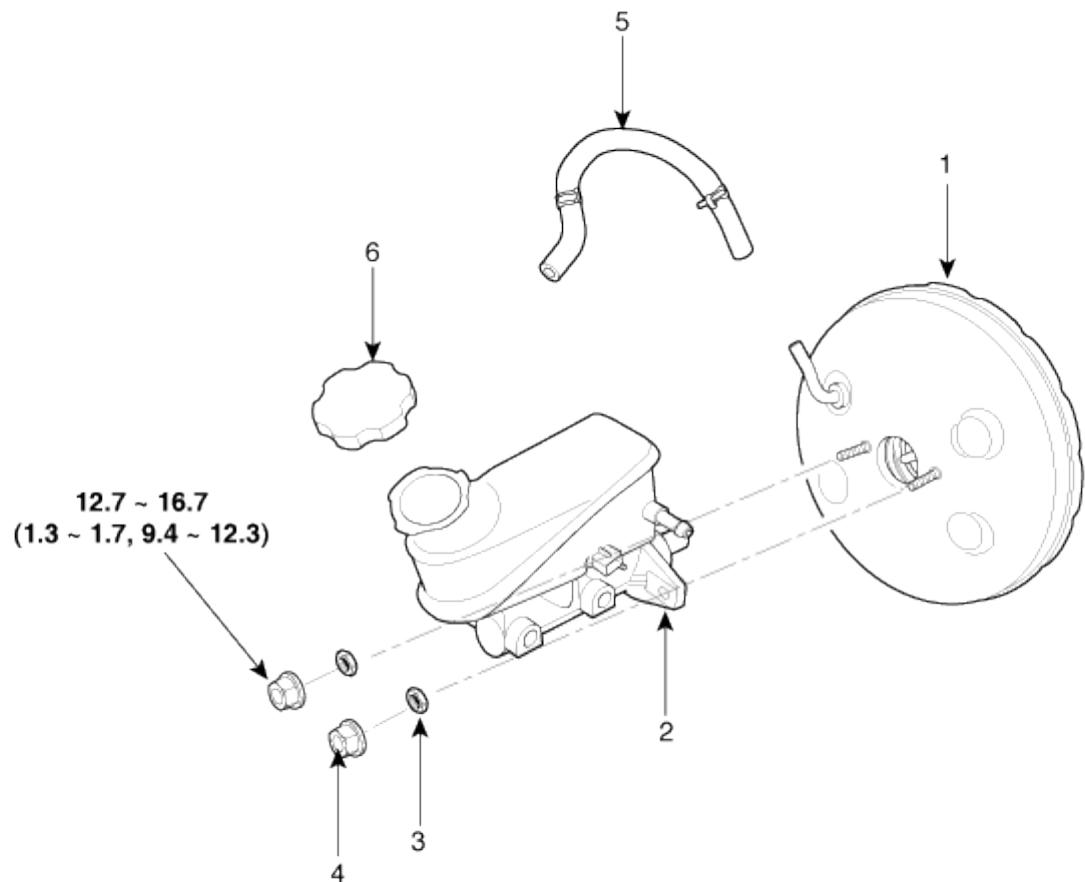


5. Refill the master cylinder reservoir to MAX(upper) level line.

5.2.2. Brake Booster

5.2.2.1. Component and Components Location

Components



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

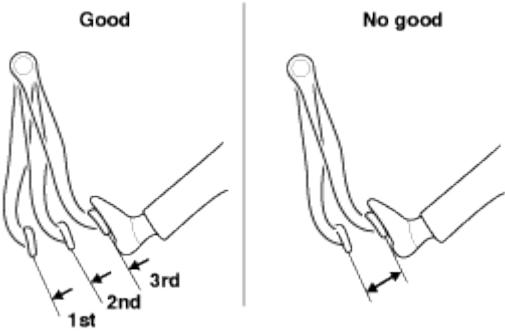
| | |
|-----------------------------|------------------|
| 1. Brake booster | 4. Nut |
| 2. Master cylinder assembly | 5. Vacuum hose |
| 3. Washer | 6. Reservoir cap |

5.2.2.2. Repair procedures

Brake Booster Operating Test

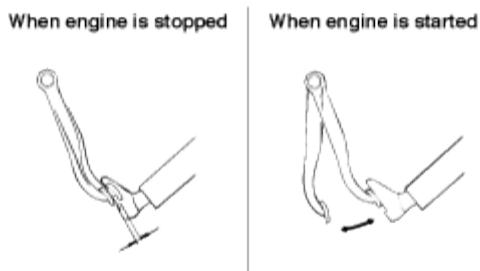
For simple checking of the brake booster operation, carry out the following tests.

- Run the engine for one or two minutes, and then stop it. If the pedal depresses fully the first time but gradually becomes higher when depressed succeeding times, the booster is operating properly, if the pedal height remains unchanged, the booster is inoperative.



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.

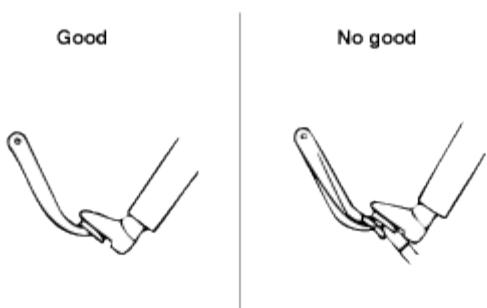


3. With the engine running, step on the brake pedal and then stop the engine.

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.

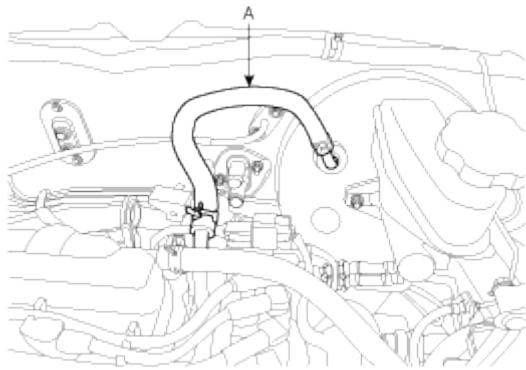
If the above three tests are okay, the booster performance can be determined as good.

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

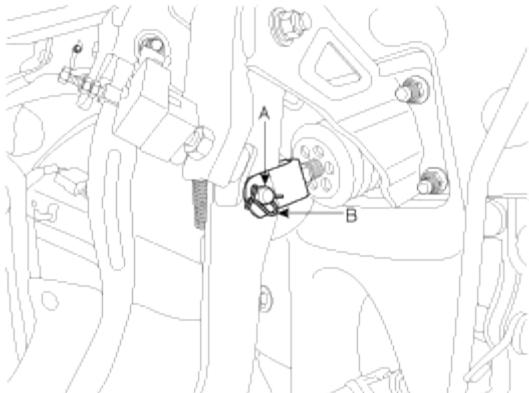


Removal

1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Remove the wiper motor assembly, cowl panel.
3. Disconnect the vacuum hose (A) from the brake booster.



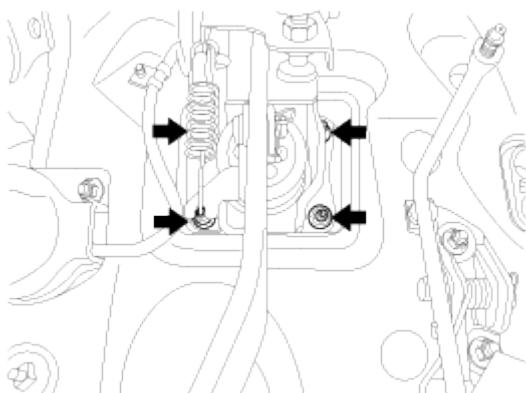
4. Remove the master cylinder. (Refer to Master cylinder)
5. Remove the snap pin (A) and clevis pin (B).



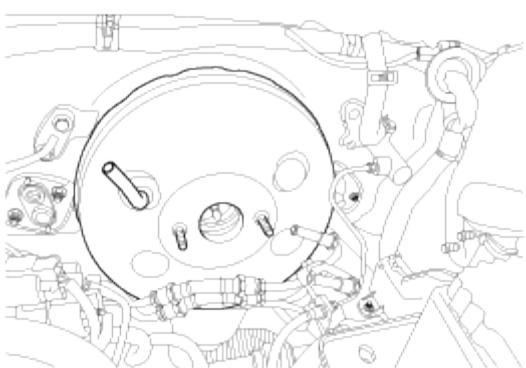
6. Remove the mounting nuts.

Tightening torque :

12.7 ~ 15.7N.m (1.3 ~ 1.6kgf.m, 9.4 ~ 11.6lb·ft)



7. Remove the brake booster.



Inspection

1. Inspect the check valve in the vacuum hose.

CAUTION

Do not remove the check valve from the vacuum hose.

2. Check the boot for damage.

Installation

1. Installation is the reverse of removal.

CAUTION

- Before installing the pin, apply the grease to the joint pin.
- Use a new snap pin whenever installing.

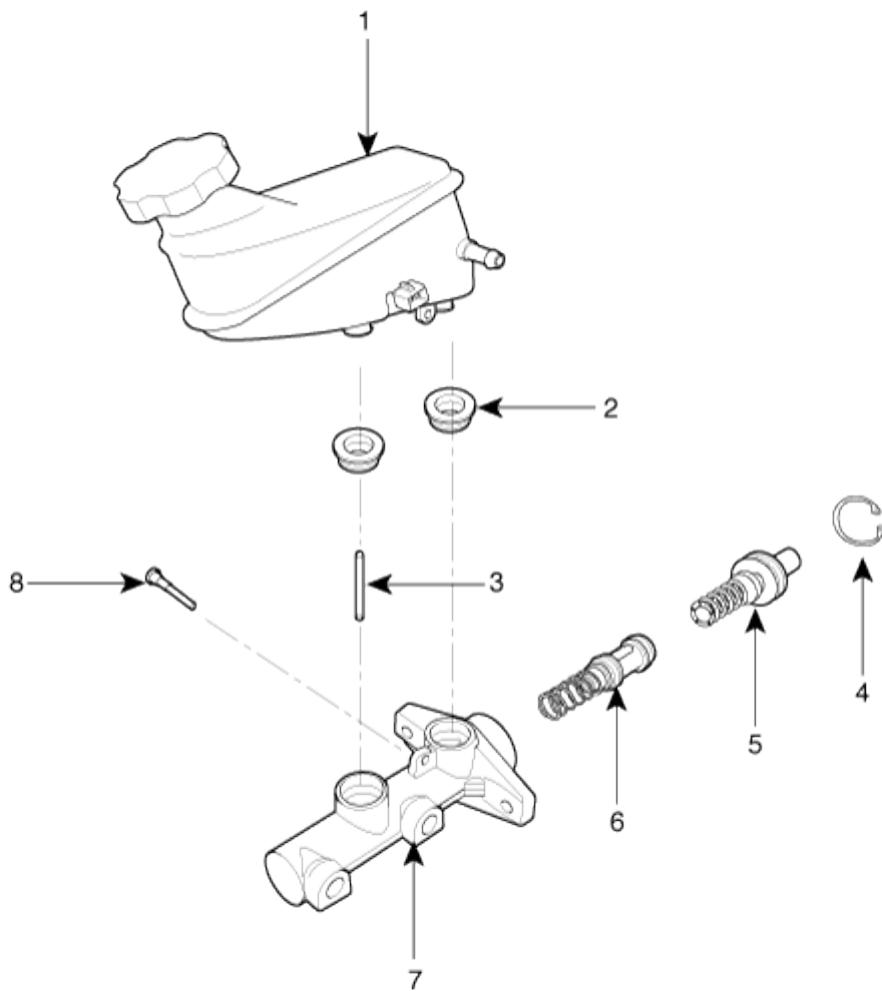
2. After installing, bleed the brake system. (Refer to Brake system bleeding)

3. Adjust the brake pedal height and free play.
(Refer to Brake pedal height and free play adjustment)

5.2.3. Master Cylinder

5.2.3.1. Component and Components Location

Components

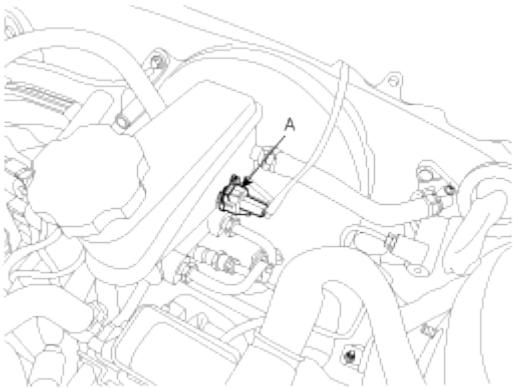


| | |
|-----------------|------------------------------|
| 1. Reservoir | 5. Primary piston assembly |
| 2. Grommet | 6. Secondary piston assembly |
| 3. Cylinder pin | 7. Master cylinder body |
| 4. Retainer | 8. Screw |

5.2.3.2. Repair procedures

Removal

1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Remove the ECM and battery. (Refer to the Fuel group-ECM)
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.

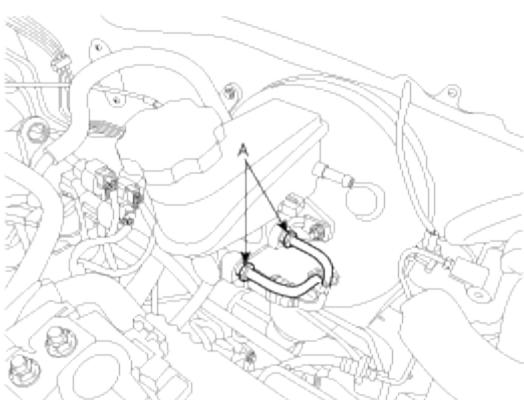
CAUTION

- 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 (B) from the master cylinder by loosening the tube flare nut.

Tightening torque :

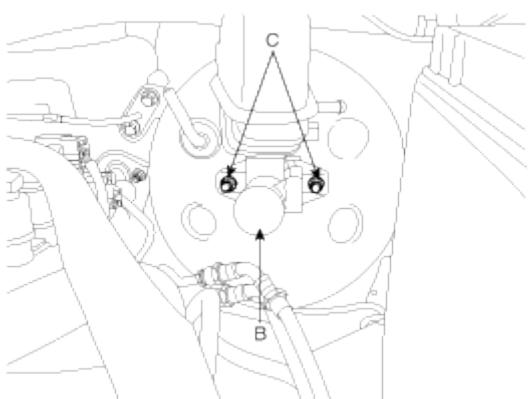
ABS : 12.7 ~ 16.7N.m (1.3 ~ 1.7kgf.m , 9.4 ~ 12.3lb-ft)
ESP : 18.6 ~ 22.6N.m (1.9 ~ 2.3kgf.m, 13.7 ~ 16.6lb-ft)



6. Remove the master cylinder (B) from the brake booster after loosening the mounting nuts (C).

Tightening torque :

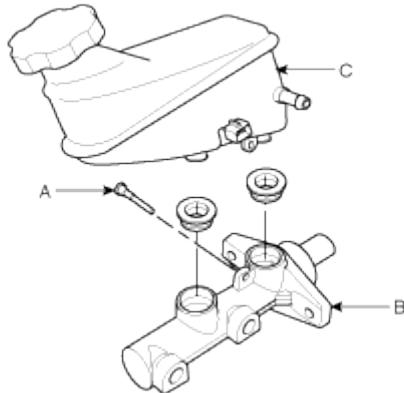
12.7 ~ 16.7N.m (1.3 ~ 1.7 kgf.m, 9.4 ~ 12.3lb-ft)



Disassembly

1. Remove the reservoir cap and drain the brake fluid into a suitable container.

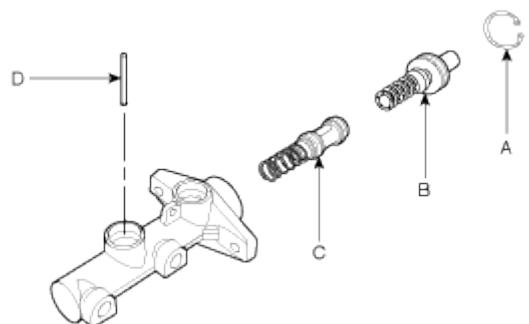
2. Remove the reservoir (C) from the master cylinder (B), after remove mounting screw (A).



3. Remove the retainer ring (A) by using the snap ring pliers.

4. Remove the primary piston assembly (B).

5. Remove the pin (D) with the secondary piston(C) pushed completely using a screwdriver. Remove the secondary piston assembly (C).



NOTE

Do not disassemble the primary and secondary piston assembly.

Inspection

1. Check the master cylinder bore for rust or scratching.

2. Check the master cylinder for wear or damage. If necessary, clean or replace the cylinder.

CAUTION

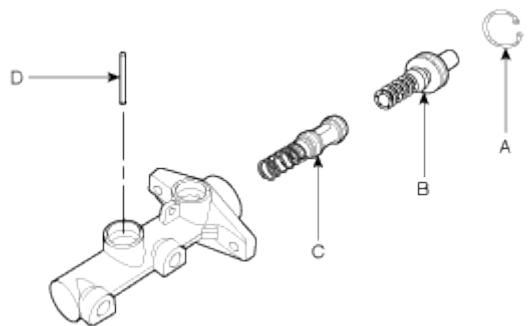
- If the cylinder bore is damaged, replace the master cylinder assembly.
- Wash the contaminated parts in alcohol.

Reassembly

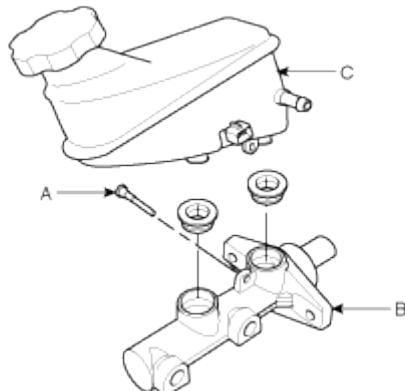
1. Apply genuine brake fluid to the rubber parts of the cylinder kit and grommets.

2. Carefully insert the springs and pistons in the proper direction.

3. Press the secondary piston (C) with a screwdriver and install the cylinder pin (D).



4. Install the retainer ring (A) after installing primary piston assembly (B).
5. Mount two grommets.
6. Install the reservoir (C) on the cylinder (B), and then install the mounting screw (A).



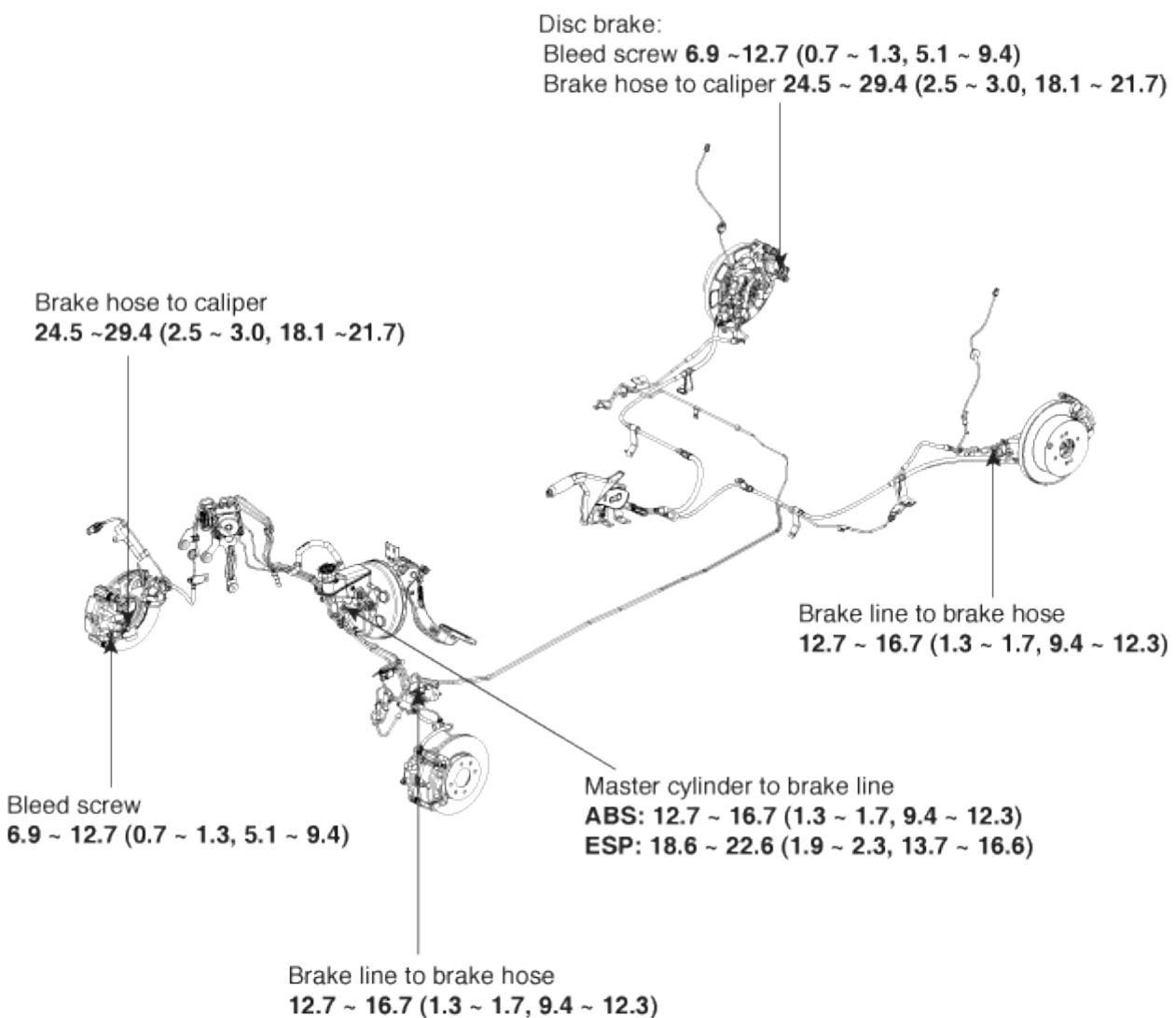
Installation

1. Installation is the reverse of removal.
2. After installation, bleed the brake system. (Refer to Brake system bleeding)

5.2.4. Brake Line

5.2.4.1. Component and Components Location

Components



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

WARNING

When installing brake hose, be sure to comply with the torque specification to prevent twisted hose.

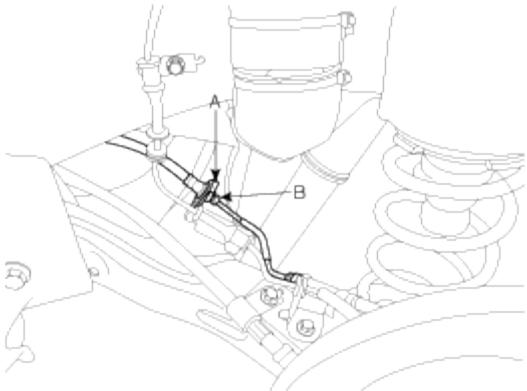
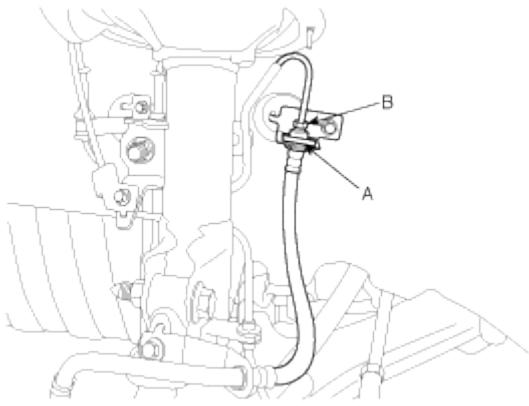
5.2.4.2. Repair procedures

Removal

1. Remove the wheel & tire.
2. Disconnect the brake tube by loosening the tube flare nut (B).

Tightening torque :

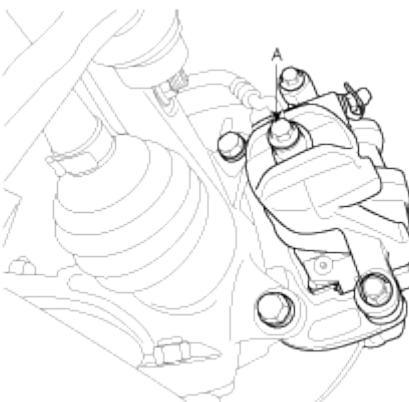
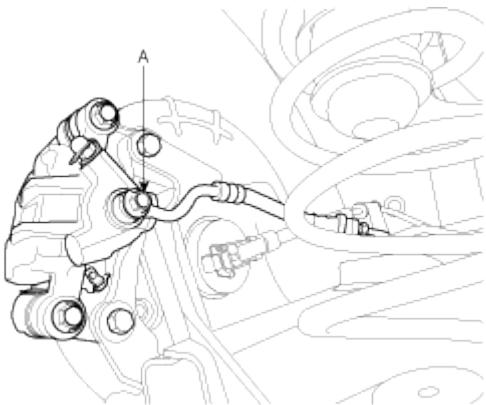
12.7 ~ 16.7N.m (1.3 ~ 1.7kgf.m, 9.4 ~ 12.3lb-ft)



3. Remove the brake hose clip (A).
4. Disconnect the brake hose from the brake caliper by loosening the bolt (A).

Tightening torque :

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

Front**Rear**

Inspection

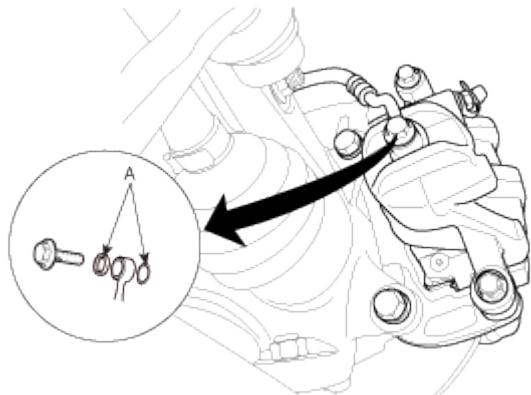
1. Check the brake tubes for cracks, crimps and corrosion.
2. Check the brake hoses for cracks, damage and fluid leakage.
3. Check the brake tube flare nuts for damage and fluid leakage.
4. Check the brake hose mounting bracket for crack or deformation.

Installation

1. Installation is the reverse of removal.

CAUTION

Use a new washer(A) whenever installing.



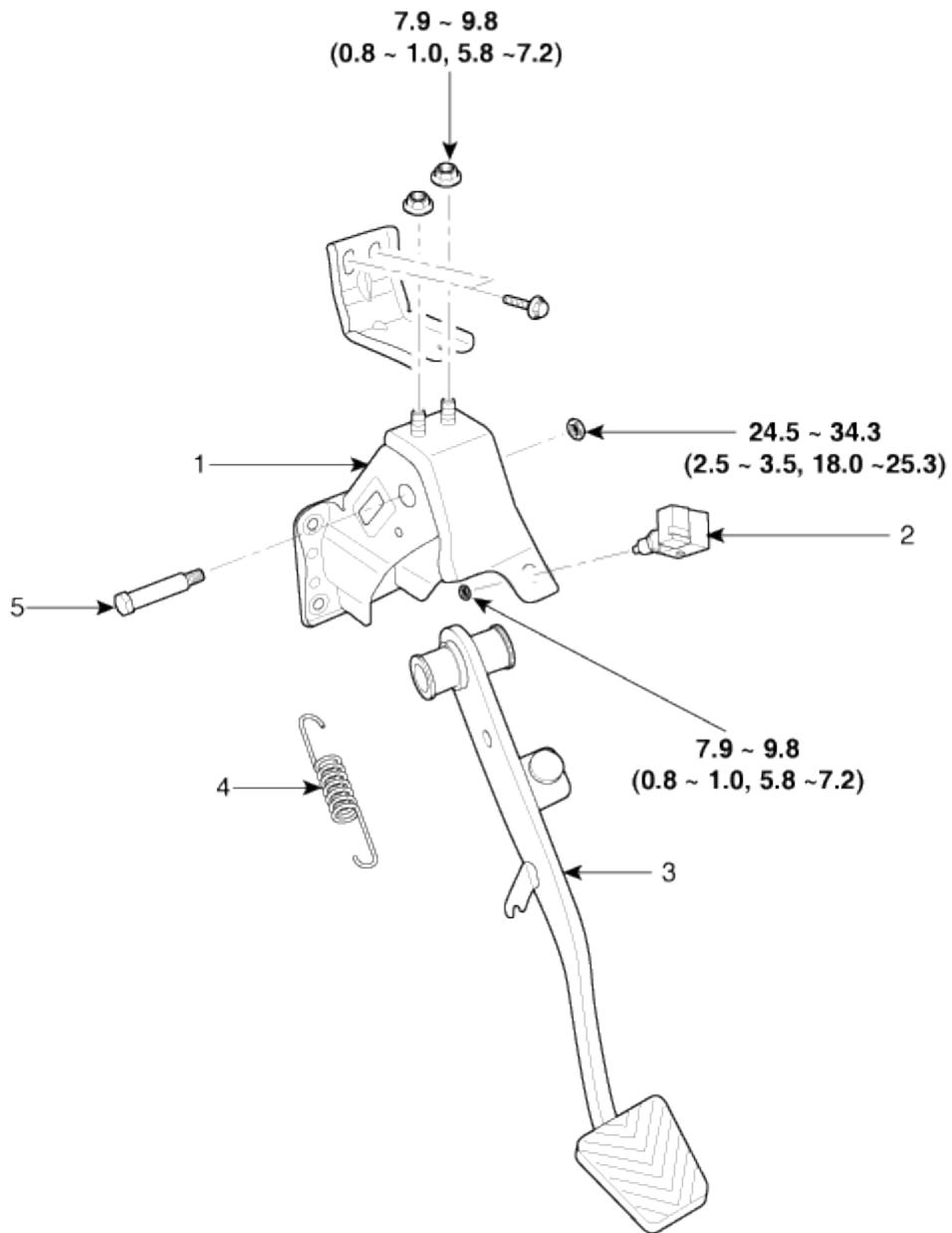
2. After installation, bleed the brake system. (Refer to Brake system bleeding)

3. Check the spilled brake oil.

5.2.5. Brake Pedal

5.2.5.1. Component and Components Location

Components



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

| | |
|---|-----------------------------|
| 1. Brake pedal member assembly
2. Stop lamp switch
3. Brake pedal | 4. Return spring
5. Bolt |
|---|-----------------------------|

5.2.5.2. Repair procedures

Removal

1. Remove the lower crash pad. (Refer to the Body group- crash pad).
2. Disconnect the stop lamp switch connector (A).

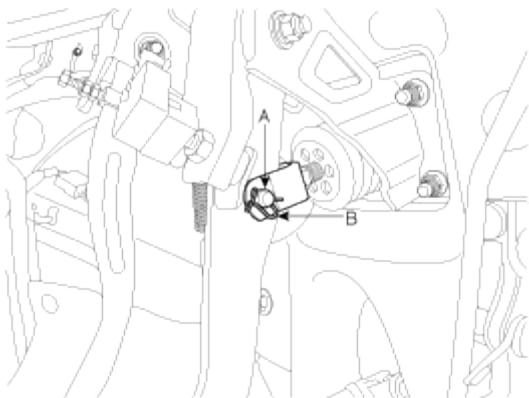


3. Remove the mounting bracket nut (B).

Tightening torque :

14.7 ~ 21.6N.m (1.5 ~ 2.2kgf.m, 10.9 ~ 15.9lb-ft)

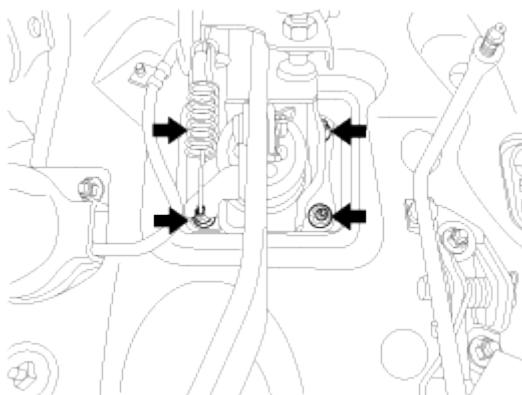
4. Remove the snap pin (A) and clevis pin (B).



5. Remove the brake pedal member assembly mounting nuts (C) and then remove the brake pedal assembly.

Tightening torque :

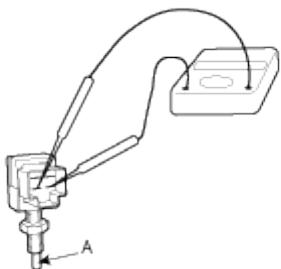
12.7 ~ 15.7N.m (1.3 ~ 1.6kgf.m, 9.4 ~ 11.6lb-ft)



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

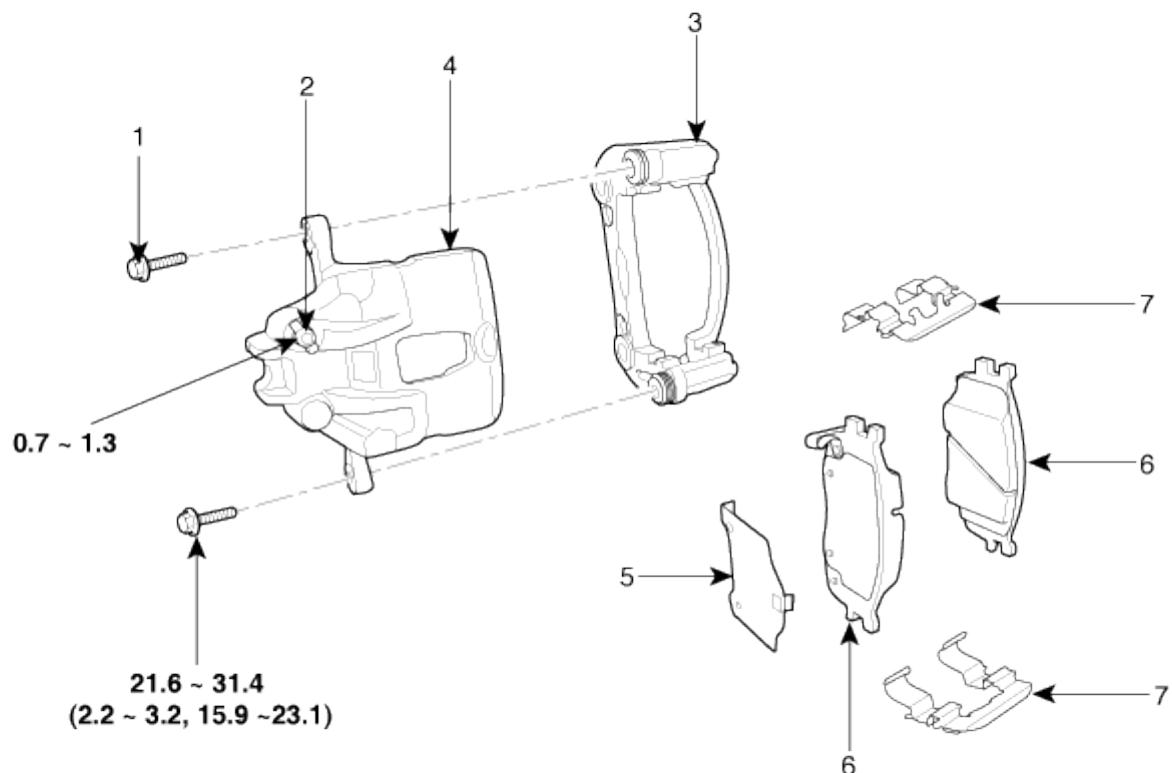
- Before installing the pin, apply the grease to the clevis pin.
- Use a new snap pin whenever installing.

2. Check the brake pedal operation.

5.2.6. Front Disc Brake

5.2.6.1. Component and Components Location

Components



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

1. Guide rod bolt
2. Bleed screw
3. Caliper bracket
4. Caliper body

5.2.6.2. Repair procedures

Removal

1. Remove the front wheel & tire.

Tightening torque :

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

2. Loosen the hose eye-bolt (B) and caliper mounting bolts (C), then remove the front caliper assembly (A).

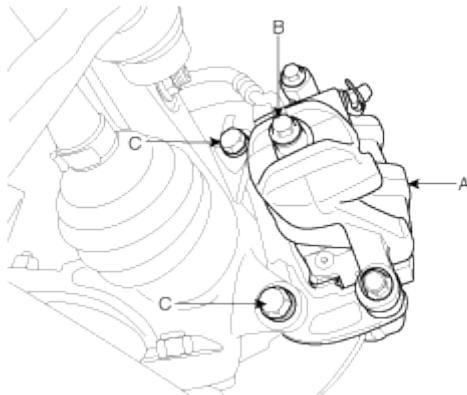
Tightening torque

Brake hose to caliper:

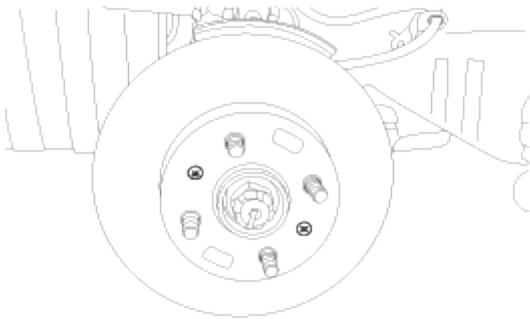
24.5 ~ 29.4N.m (2.5 ~ 3.0kgf.m, 18.1 ~ 21.7lb-ft)

Caliper assembly to knuckle:

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



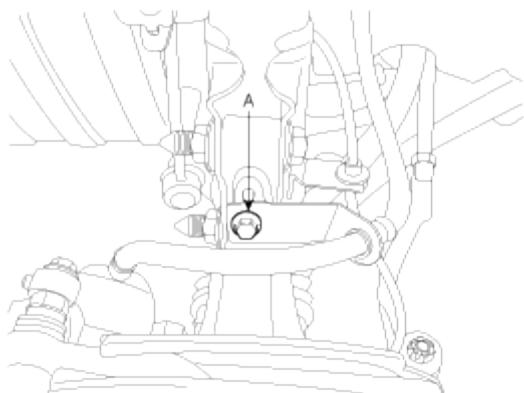
3. Remove the front brake disc by loosening the screws.



Replacement

Front Brake Pads

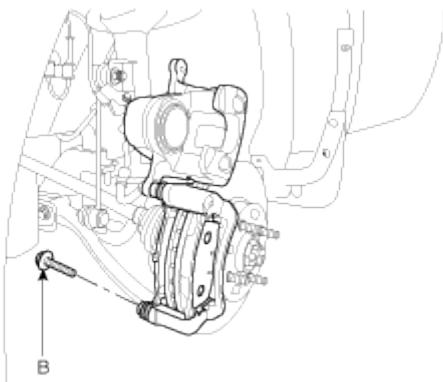
1. Remove the brake hose mounting bracket (knuckle mounting part : A).



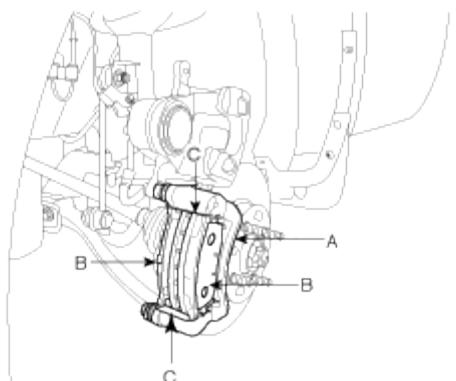
2. Loosen the guide rod bolt (B) and pivot the caliper up out of the way.

Tightening torque :

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



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



Inspection

Front Brake Disc Thickness Check

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

Brake disc thickness

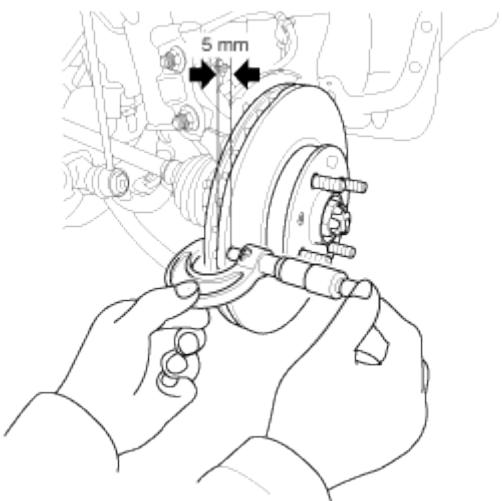
1.4L, 1.6L

- Standard: 22mm (0.87in)
- Service limit: 20mm (0.79in)

1.2L

- Standard: 18mm (0.71in)
- Service limit: 16mm (0.63in)

Deviation: Less than 0.005mm (0.0002in)



4. If wear exceeds the limit, replace the discs and pad assembly left and right of the vehicle.

Front Brake Pad Check

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

Pad thickness

Standard value : 11mm (0.43in)

Service limit : 2.0mm (0.0787in)

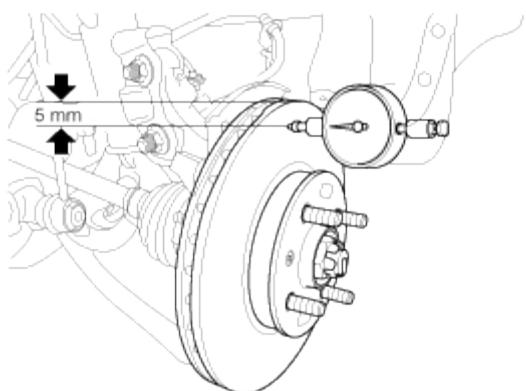
2. Check that grease is applied, to sliding contact points and the pad and backing metal for damage.

Front Brake Disc Runout Check

1. Place a dial gauge about 5mm (0.2 in.) from the outer circumference of the brake disc, and measure the runout of the disc.

Brake disc runout

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



2. If the run out of the brake disc exceeds the limit specification, replace the disc, and then measure the run out again.

3. If the run out does not exceed the limit specification, install the brake disc after turning it and then check the run out of the brake disc again.

4. If the run out cannot be corrected by changing the position of the brake disc, replace the brake disc.

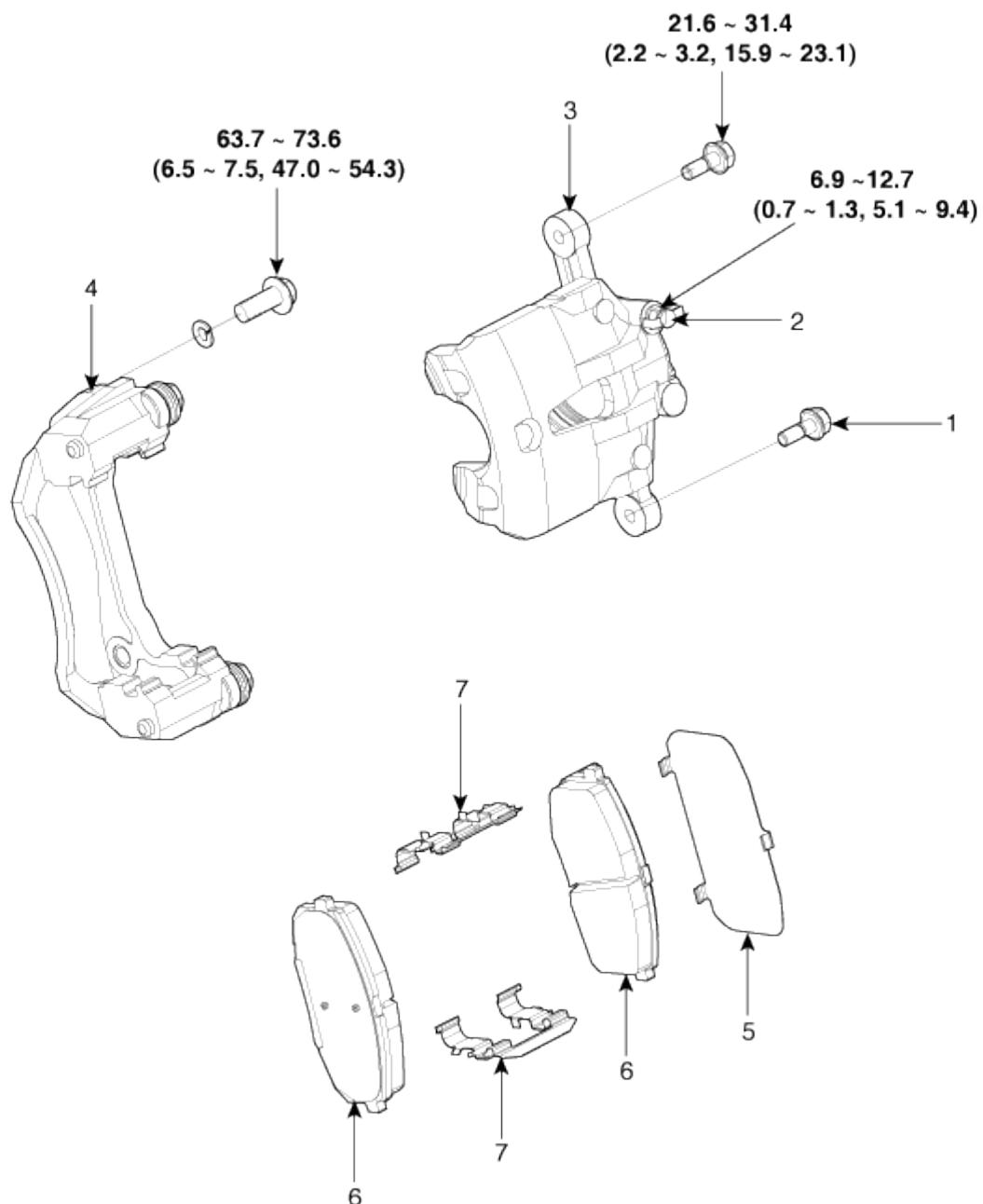
Installation

1. 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)

5.2.7. Rear Disc Brake

5.2.7.1. Component and Components Location

Components



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

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

5.2.7.2. Repair procedures

Removal

1. Remove the rear wheel & tire.

Tightening torque :

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

2. Loosen the hose eye-bolt (B) and caliper mounting bolts (C), then remove the rear caliper assembly (A).

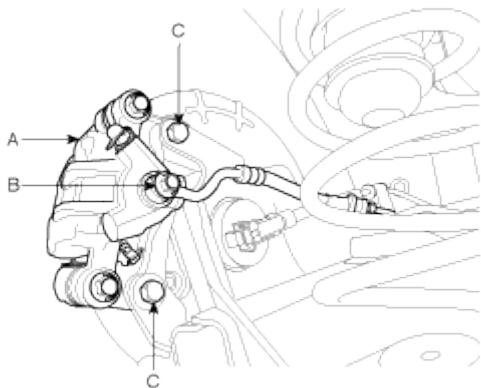
Tightening torque

Brake hose to caliper:

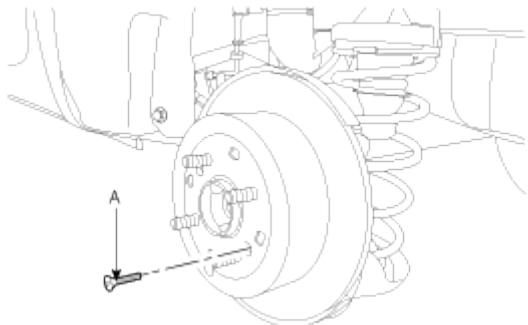
24.5 ~ 29.4N.m (2.5 ~ 3.0kgf.m, 18.1 ~ 21.7lb-ft)

Caliper assembly to carrier:

63.7 ~ 73.6N.m (6.5 ~ 7.5kgf.m, 47.0 ~ 54.3lb-ft)



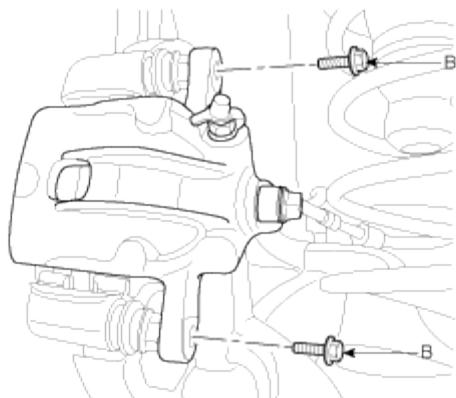
3. Remove the rear brake disc by loosening the screws (A).

**Replacement****Rear Brake Pads**

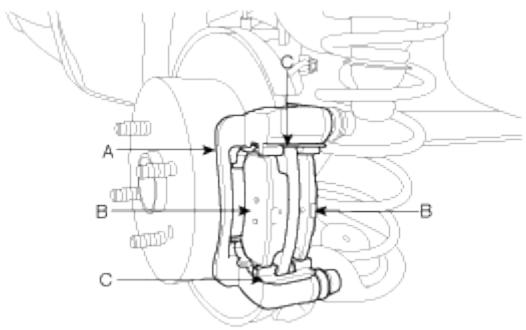
1. Loosen the guide rod bolt (B) and pivot the caliper up out of the way.

Tightening torque :

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



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



Inspection

Rear Brake Disc Thickness Check

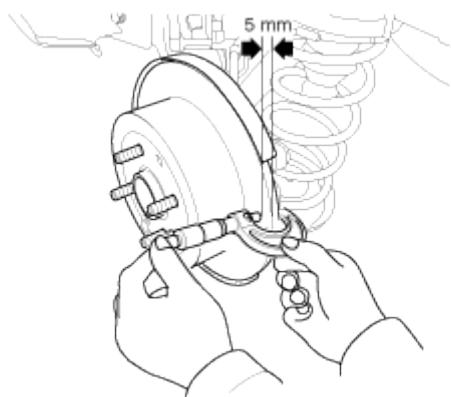
1. Check the brake pads for wear and fade.
2. Check the brake disc for damage and cracks.
3. Remove all rust and contamination from the surface, and measure the disc thickness at 8 points, at least, of same distance (5mm) from the brake disc outer circle.

Brake disc thickness

Standard: 10mm (0.39in)

Service limit: 8.4mm (0.33in)

Deviation: less than 0.01mm (0.00039in)



4. If wear exceeds the limit, replace the discs and pad assembly left and right of the vehicle.

Rear Brake Pad Check

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

Pad thickness

Standard value: 9mm (0.35 n)

Service limit: 2.0 mm (0.0787 in)

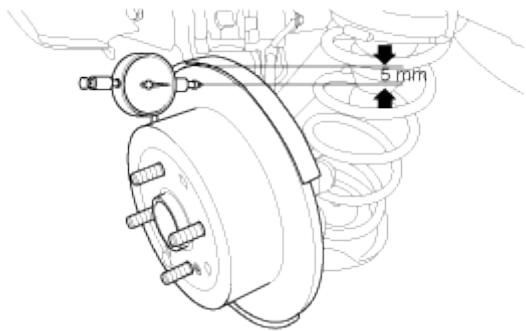
2. Check that grease is applied, to sliding contact points and the pad and backing metal for damage.

Rear Brake Disc Runout Check

1. Place a dial gauge about 5mm (0.2 in.) from the outer circumference of the brake disc, and measure the runout of the disc.

Brake disc runout

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



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

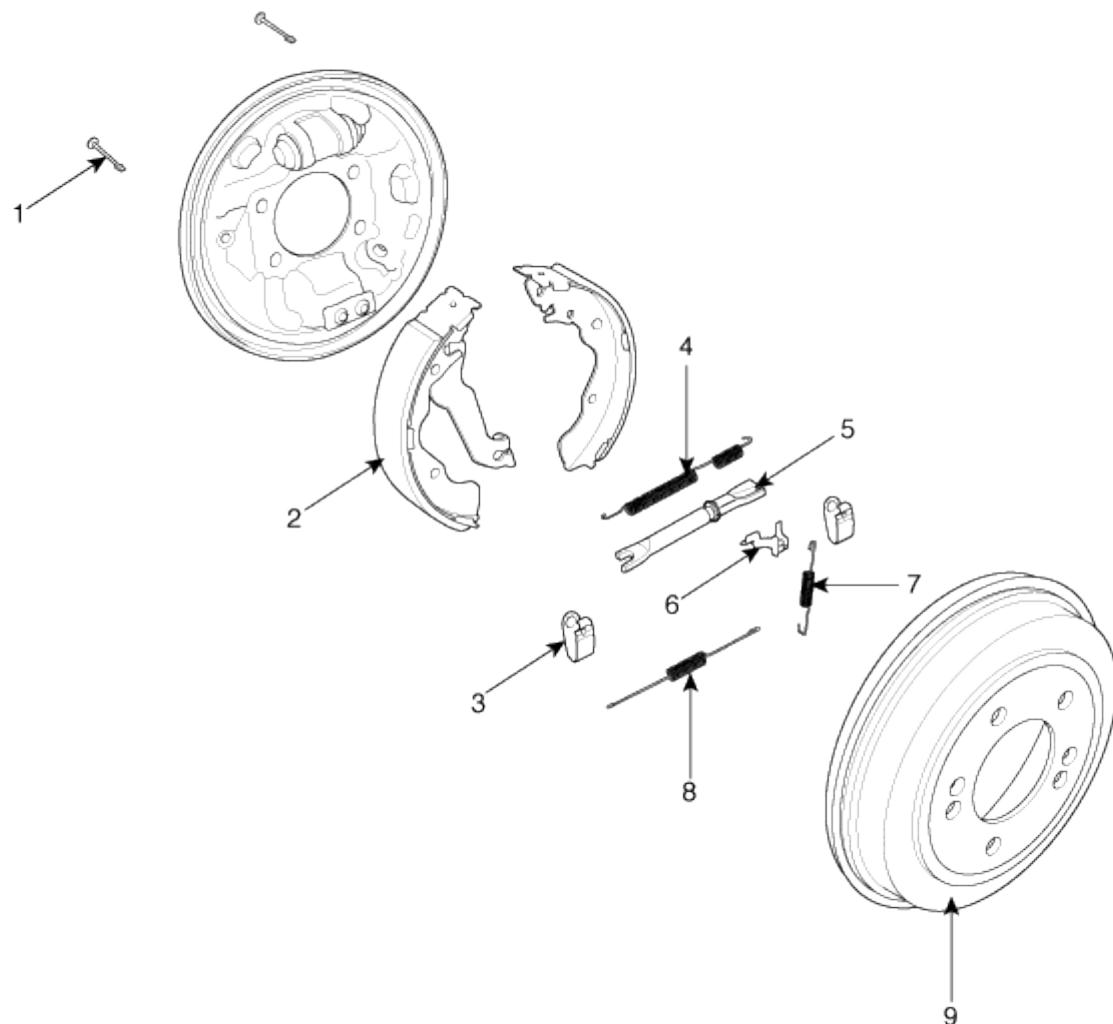
Installation

1. Installation is the reverse of removal.
2. Use a SST (09581-11000) when installing the brake caliper assembly.
3. After installation, bleed the brake system. (Refer to Brake system bleeding)

5.2.8. Rear Drum Brake

5.2.8.1. Component and Components Location

Components



| | |
|---|--|
| 1. Shoe hold down pin
2. Shoe
3. Shoe hold spring
4. Upper return spring
5. Shoe adjuster | 6. Adjusting lever
7. Adjusting lever spring
8. Lower return spring
9. Brake drum |
|---|--|

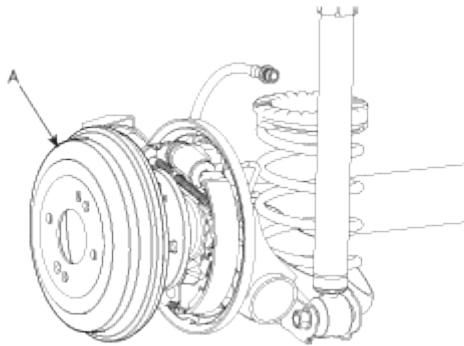
5.2.8.2. Repair procedures

Removal

CAUTION

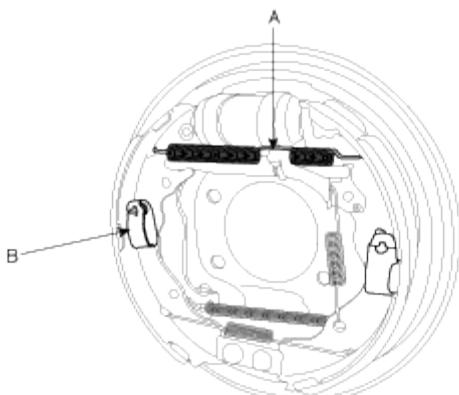
- Frequent inhalation of brake pad dust, regardless of material composition, could be hazardous to your health.
- Avoid breathing dust particles.
- Never use an air hose or brush to clean brake assemblies.

1. Release the parking brake.
2. Remove the rear tire and wheel.
3. Remove the rear brake drum (A).

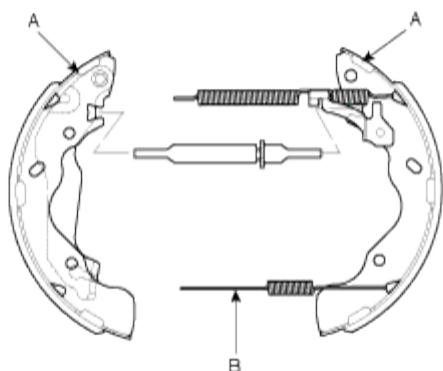


4. Remove the shoe hold spring and shoe hold pin (B).

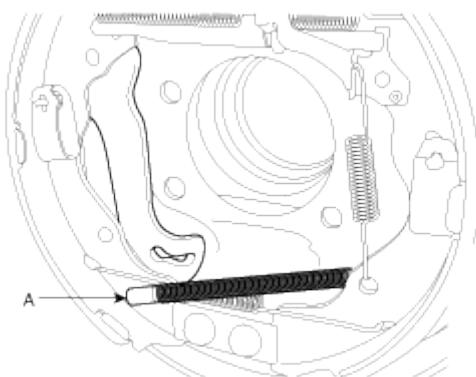
5. Remove the upper return spring (A).



6. Lower the brake shoe assembly (A), and remove the lower return spring (B). Make sure not to damage the dust cover on the wheel cylinder.



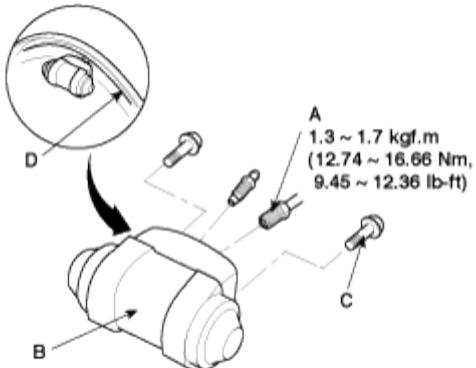
7. Remove the parking brake cable (A) from the brake assembly.



8. Remove the brake shoe assembly.

9. Disconnect brake tubes (A) from the wheel cylinder (B).

10. Remove the bolt (C) and the wheel cylinder (B) from the backing plate (D).

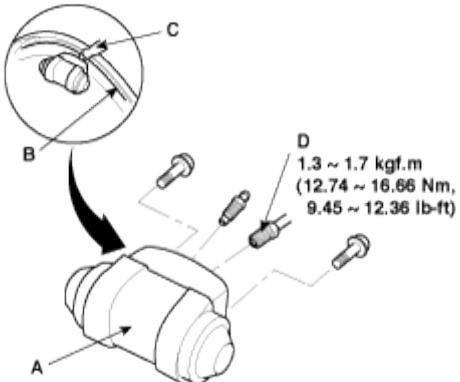


Installation

NOTE

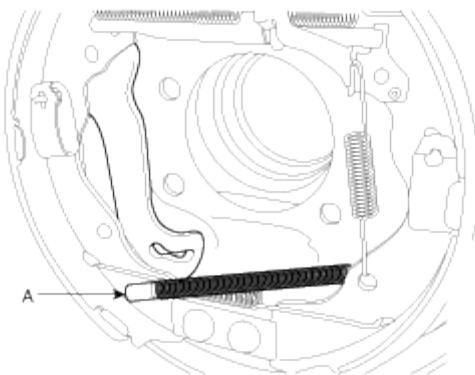
- Do not spill brake fluid on the vehicle: it may damage the paint; if brake fluid does contact the paint. Wash it off immediately with water.
- To prevent spills, cover the hose joints with rags or shop towels.
- Use only a genuine wheel cylinder special bolt.

1. Apply sealant (C) between the wheel cylinder (A) and backing plate (B), and install the wheel cylinder.

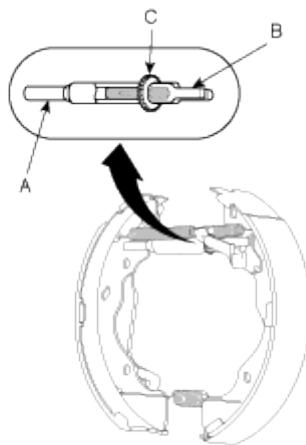


2. Connect the brake tubes (D) to the wheel cylinder.

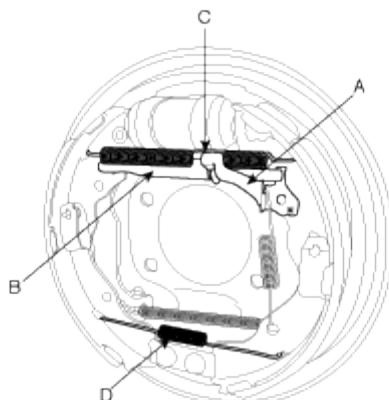
3. Connect the parking brake cable (A) to the brake assembly.



4. Clean the threaded portions of adjuster sleeve (A) and push rod female (B). Coat the threads of the adjuster assembly with grease. To shorten the clevises, turn the adjuster bolt (C).



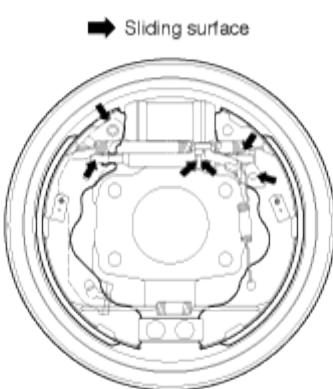
5. Hook the shoe adjuster lever (A), then install it to the brake shoe.



6. Install the adjuster assembly (B) and upper return spring (C) as right direction. Be careful not to damage the wheel cylinder dust covers.

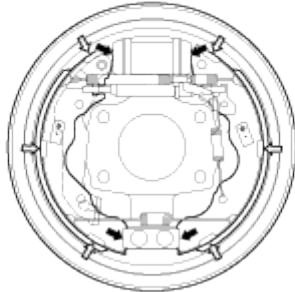
7. Install the lower return spring (D).

8. Apply brake cylinder grease or equivalent rubber grease to the sliding surfaces shown. Don't get grease on the brake linings.

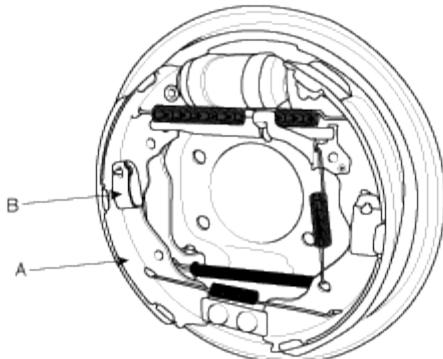


9. Apply brake cylinder grease or equivalent rubber grease to the brake shoe ends and opposite edges of the shoes shown. Don't get grease on the brake linings.

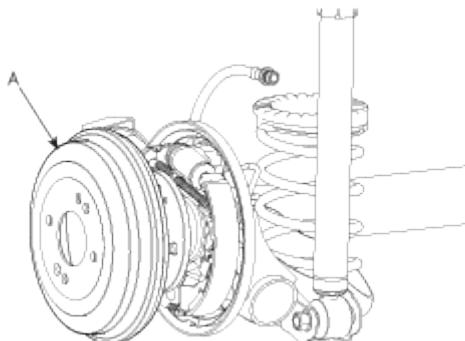
- ➡ Opposite edge of the shoe
- ➡ Brake shoe ends
(shoe side ends and backing plate contact surface)



10. Install the brake shoes (A) onto the backing plate. Be careful not to damage the wheel cylinder dust covers.
11. Install the shoe hole down pins (B) and the shoe hole down springs.



12. Install the rear brake drum (A).



13. If the wheel cylinder has been removed, bleed the brake system.
14. Depress the brake pedal several times to set the self-adjusting brake.
15. Adjust the parking brake.

Inspection

CAUTION

- Frequent inhalation of brake pad dust, regardless of material composition, could be hazardous to your health.
- Avoid breathing dust particles.
- Never use an air hose or brush to clean brake assemblies.

NOTE

- Contaminated brake linings or drums reduce stopping ability.
- Block the front wheels before jacking up the rear of the vehicle.

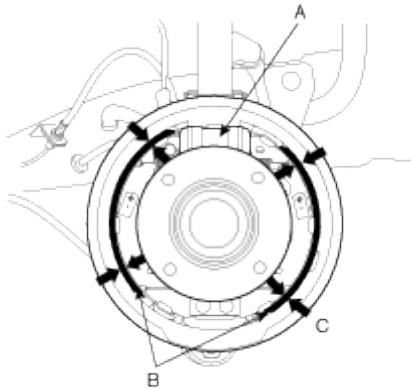
1. Raise the rear of the vehicle, and make sure it is securely supported.

2. Release the parking brake, and remove the rear brake drum.
3. Check the wheel cylinder (A) for leakage.
4. Check the brake linings (B) for cracking, glazing, wear, and contamination.
5. Measure the brake lining thickness (C).
Measurement does not include brake shoe thickness.

Brake lining thickness

Standard : 4.3 mm (0.17 in)

Service limit : 1.0 mm (0.039 in)



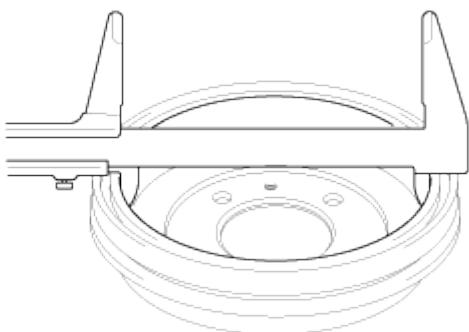
6. If the brake lining thickness is less than the service limit, replace the brake shoes as a set.
7. Check the bearings in the hub unit for smooth operation. If it requires servicing, replace it.
8. Measure the inside diameter of the brake drum with inside vernier calipers.

Drum inside diameter

Standard : 203.2 mm (8.0 in)

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.

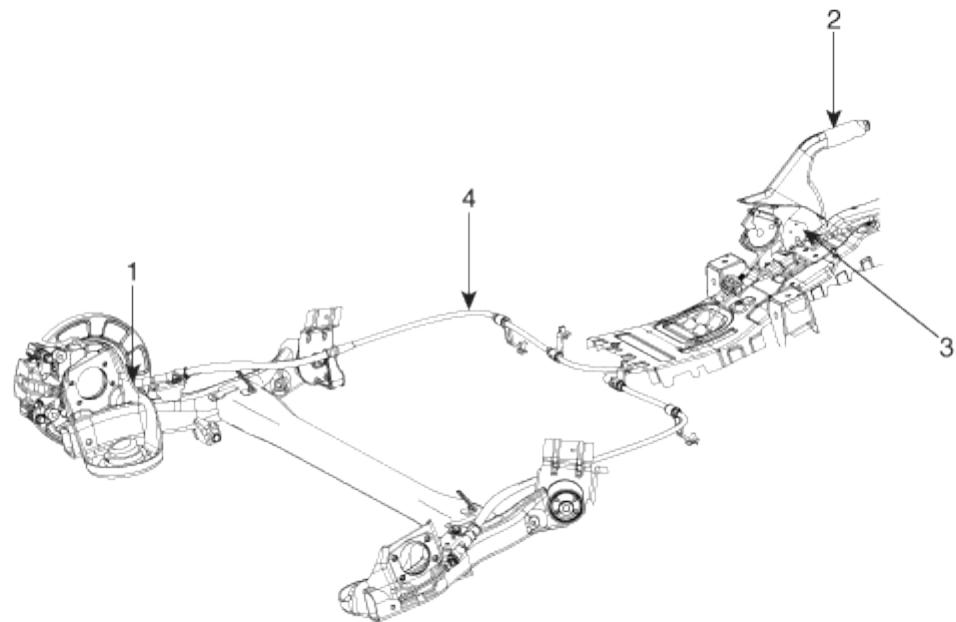
13. Inspect the backing plate for wear or damage.

5.3. Parking Brake System

5.3.1. Parking Brake Assembly

5.3.1.1. Component and Components Location

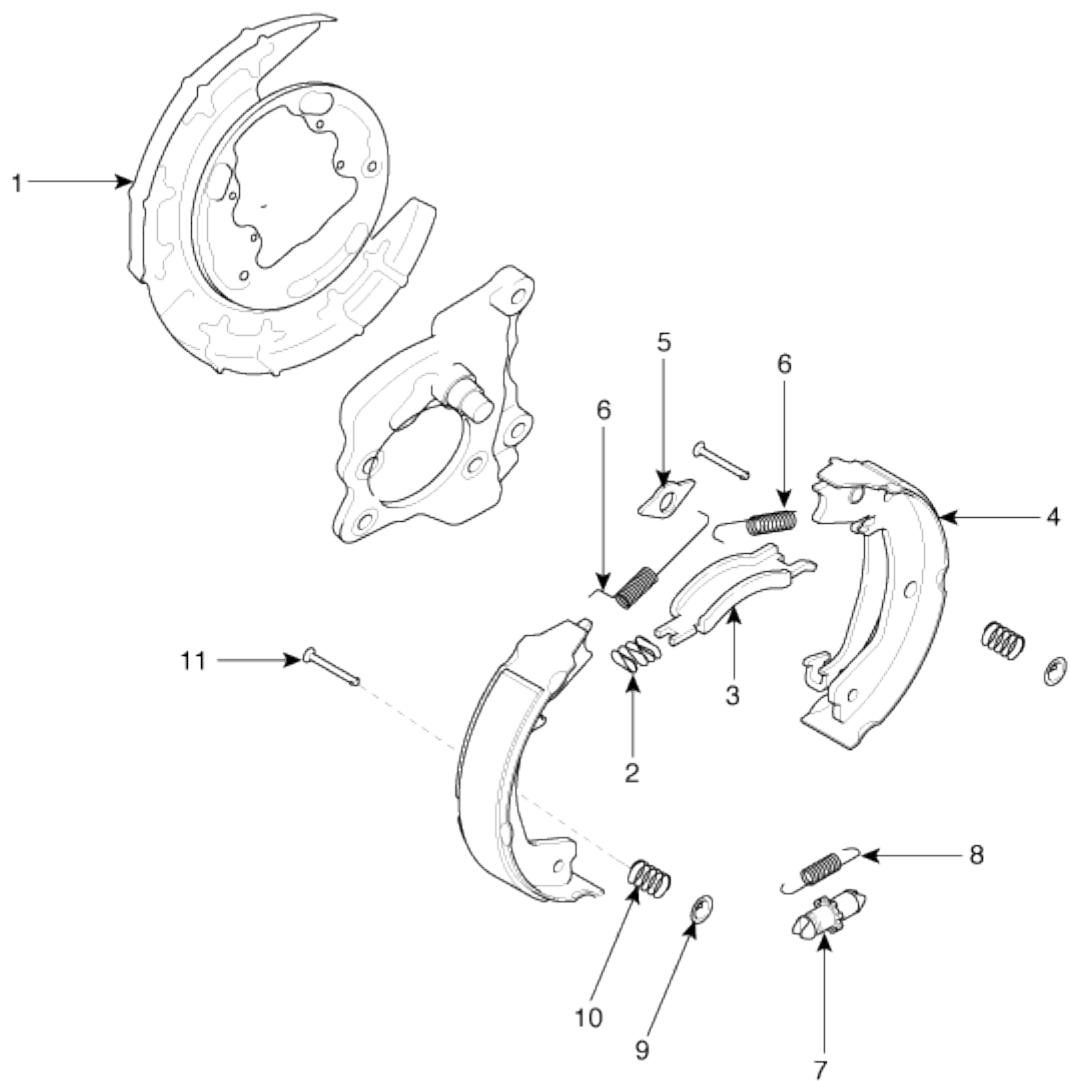
Component Location



- 1. Rear parking brake
- 2. Parking brake lever
- 3. Parking brake switch
- 4. Parking brake cable

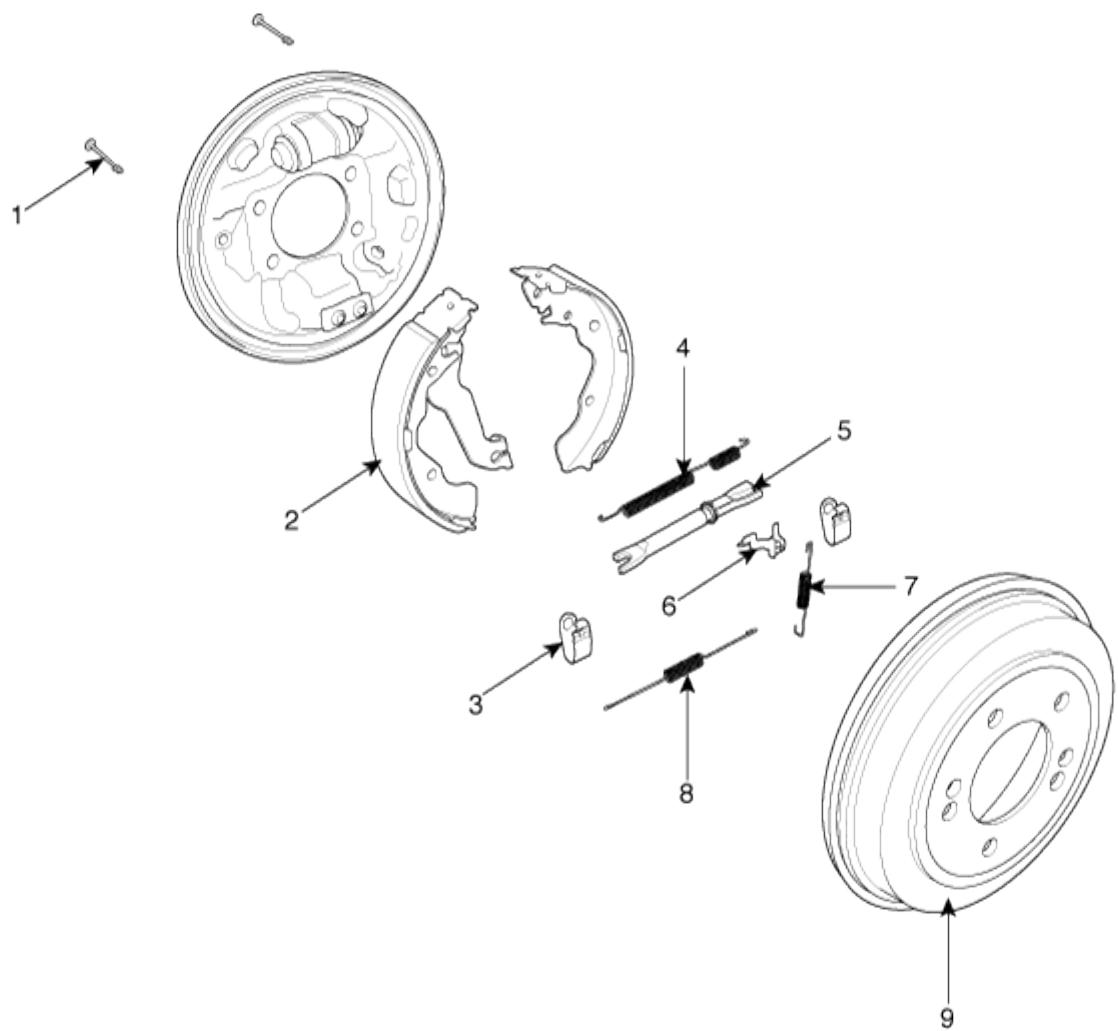
Component

Disc Brake Type



| | |
|------------------|---------------------------|
| 1. Back plate | 6. Return spring |
| 2. Strut spring | 7. Adjuster |
| 3. Strut | 8. Return spring |
| 4. Shoe & lining | 9. Cup washer |
| 5. Shoe guide | 10. Shoe hold down spring |

Drum Brake Type



1. Shoe hold down pin
 2. Shoe
 3. Shoe hold spring
 4. Upper return spring
 5. Shoe adjuster

6. Adjusting lever
 7. Adjusting lever spring
 8. Lower return spring
 9. Brake drum

5.3.1.2. Repair procedures

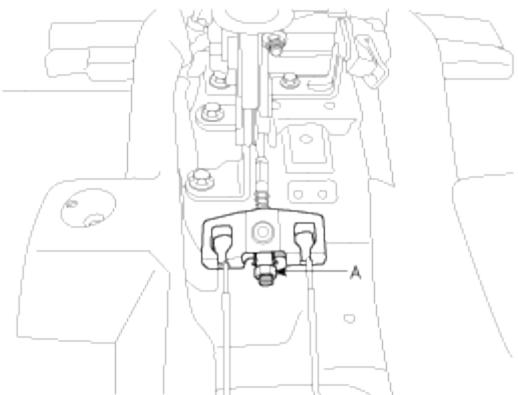
Removal

Parking Brake Lever

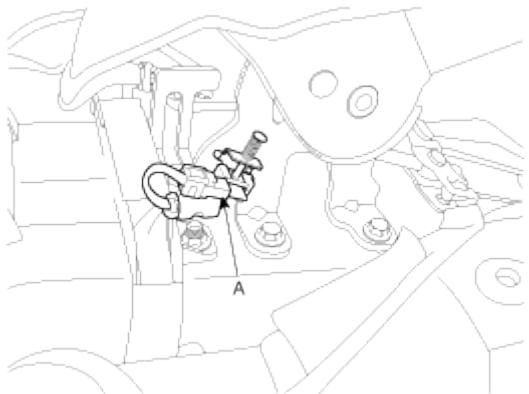
NOTE

The parking brake cables must not be bent or distorted. This will lead to stiff operation and premature failure.

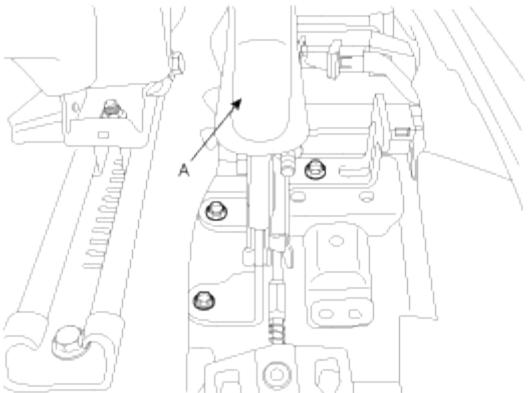
1. Remove the floor console. (Refer to Body group. -"Floor console")
2. Loosen the adjusting nut (A) and the parking brake cables.



3. Disconnect the connector (A) of parking brake switch.

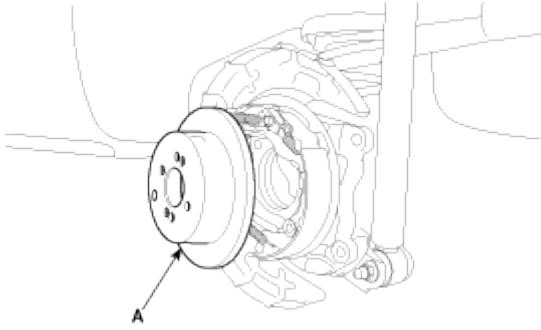


4. Remove the parking brake lever assembly (A) with loosening the bolts.

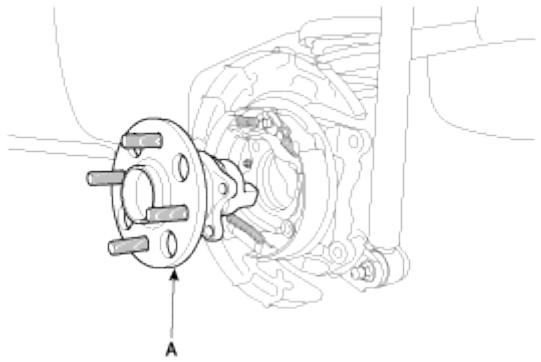


Parking Brake Shoe (Disc Brake Type)

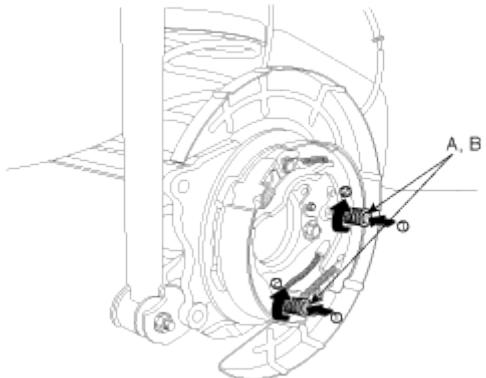
1. Raise the vehicle, and make sure it is securely supported.
2. Remove the rear tire and wheel, then remove the brake caliper. (Refer to "Rear disc brake removal")
3. Remove the brake drum (A).



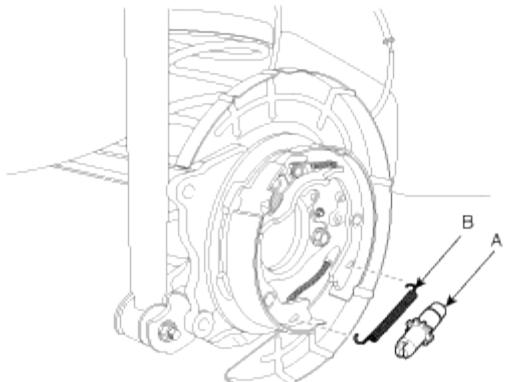
4. Remove the rear hub unit bearing (A).



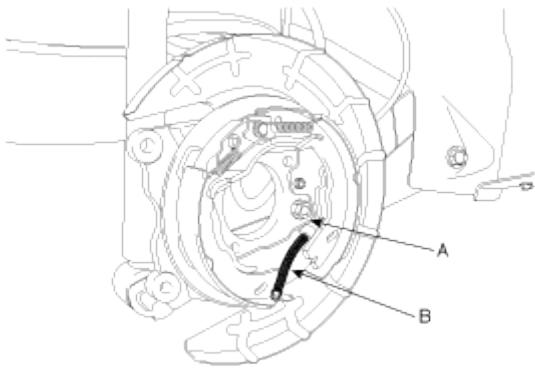
5. Remove the shoe hold down pin (A) and the spring (B) by pushing the retainer spring and turning the pin.



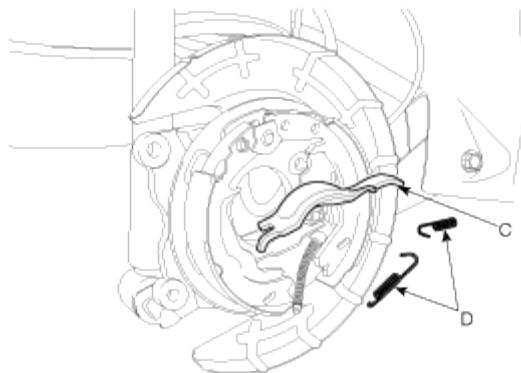
6. Remove the adjuster assembly (A) and the return spring (B).



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

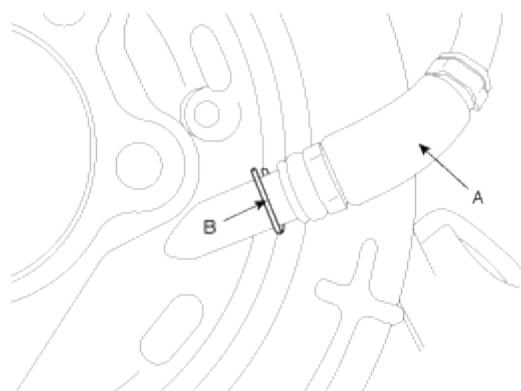


8. Remove the strut (C) and the strut spring (D).



9. Remove the brake shoe.

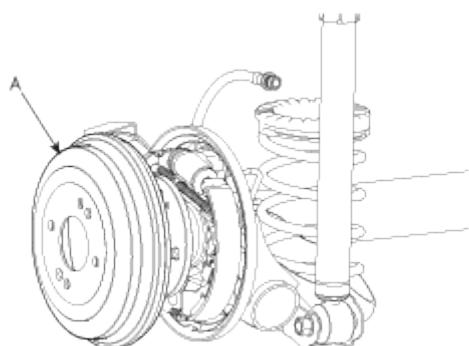
10. Remove the parking brake cable retaining (B), from the parking brake cable (A).



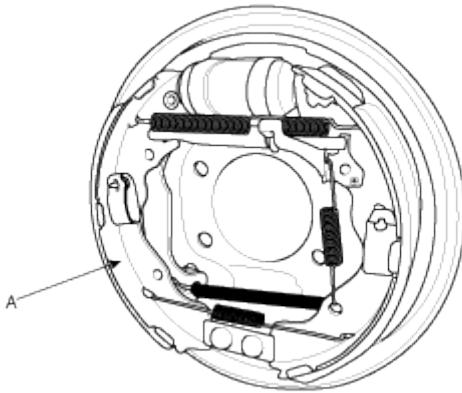
Parking Brake Shoe (Drum Brake Type)

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

2. Remove the rear tire and wheel, then remove the brake drum (A).



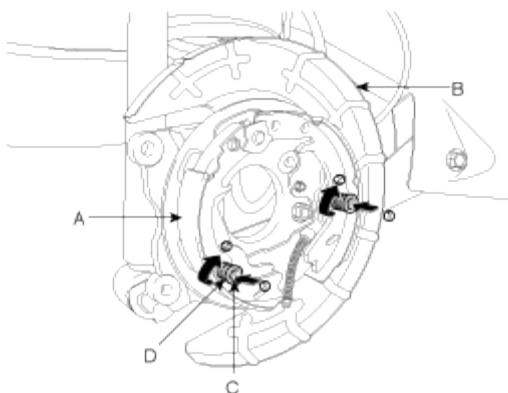
3. Remove the brake shoe (A). (Refer to "Rear drum brake removal")



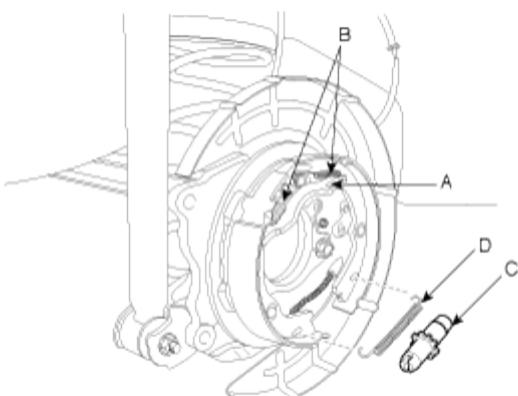
Installation

Parking Brake Shoe (Disc Brake Type)

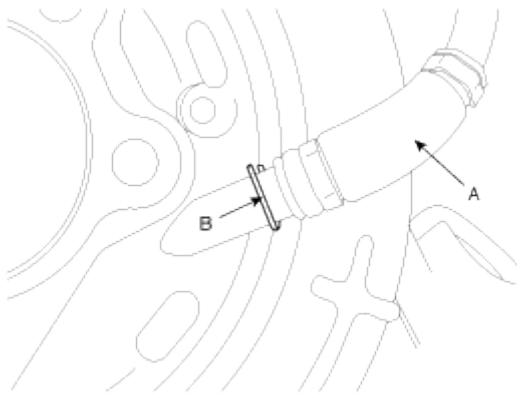
1. Install the brake shoe(A) to the back plate(B).



2. Install the shoe hold down pin(C) and the spring(D) by pushing the retainer spring (D) and turning the pins.
3. After installing the strut (A) and upper return spring (B), install the adjuster assembly (C) and the lower return spring (D).



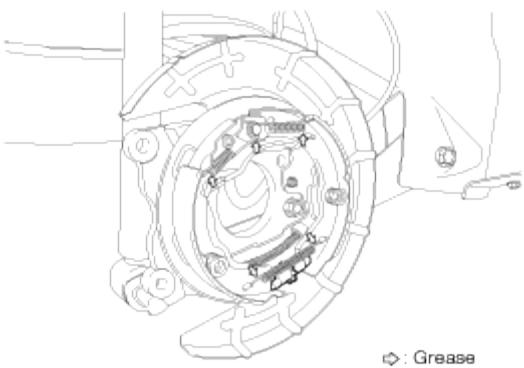
4. Install the parking brake cable (A), then install the retaining (B).



5. Apply a coating of the specified grease to each sliding parts of parking brake as shown.

Specified grease :

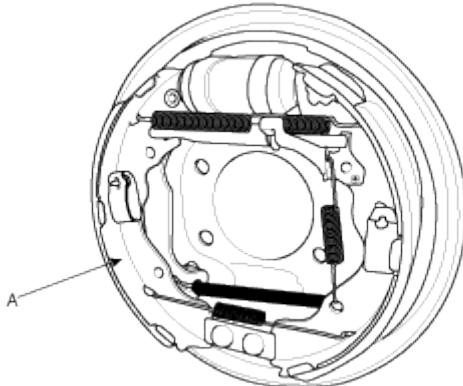
Multi purpose grease SAE J310, NLGI No.2



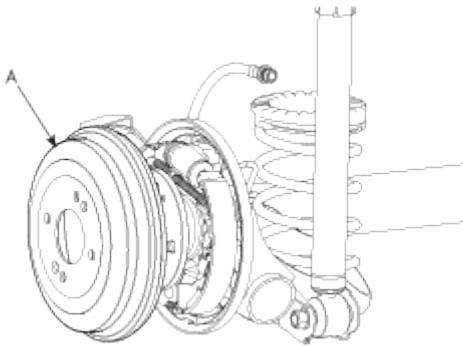
6. Install the rear brake disc and rear brake caliper.
7. After installing the cable adjuster, adjust the parking brake lever stroke.

Parking Brake Shoe (Drum Brake Type)

1. Install the brake shoe (A). (Refer to "Rear drum brake installation")



2. Install the brake drum (A).



3. Depress the brake pedal several times to set the self-adjusting brake.

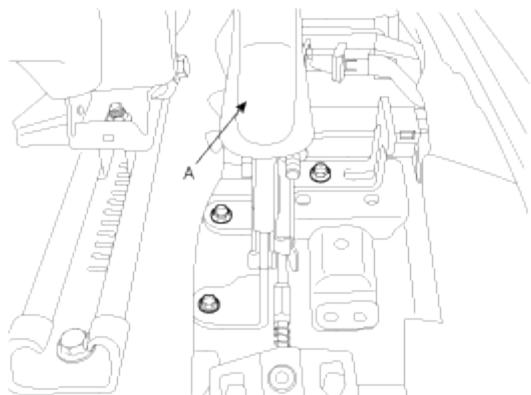
4. Adjust the parking brake lever.

Parking Brake Lever

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

Tightening torque :

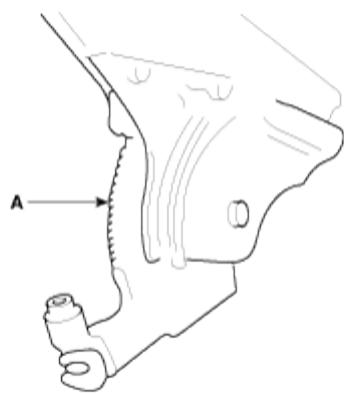
8.8 ~ 13.7N.m (0.9 ~ 1.4kgf.m, 6.5 ~ 10.1lb-ft)



2. Apply a coating of the specified grease to each sliding parts (A) of the ratchet plate or the ratchet pawl.

Specified grease :

Multi purpose grease SAE J310, NLGI No.2



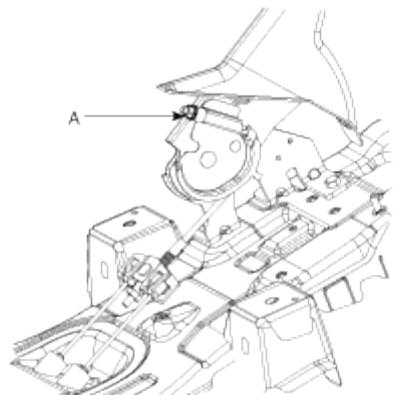
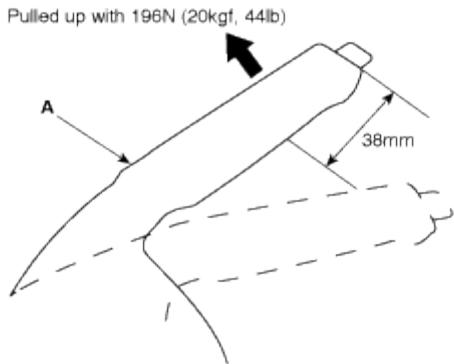
3. Install the parking brake cable adjuster, then adjust the parking brake lever stroke by turning adjusting nut (A).

Parking brake lever stroke :

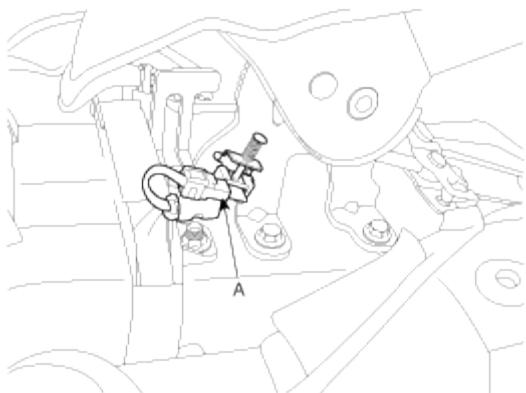
6 ~ 8 clicks (Pull the lever with 20kg)

NOTE

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



4. Release the parking brake lever fully, and check that parking brakes do not drag when the rear wheels are turned. Readjust if necessary.
5. Make sure that the parking brakes are fully applied when the parking brake lever is pulled up fully.
6. Reconnect the connector (A) of parking brake switch.



NOTE

Inspect the continuity of parking brake switch.

When the brake lever is pulled : continuity

When the brake lever is released : no continuity

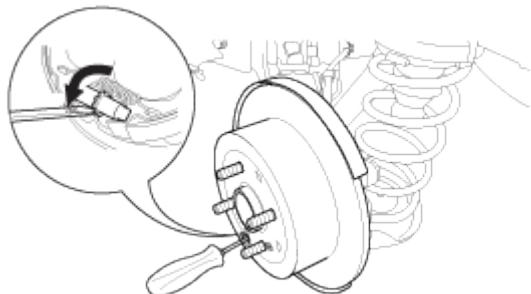
7. Install the floor console. (Refer to Body group - "Floor console")

Adjustment

Parking Brake Shoe Clearance Adjustment

Disc Brake Type

1. Raise the vehicle, and make sure it is securely supported.
2. Remove the rear tire and wheel.
3. Remove the plug from the disc.
4. Rotate the toothed wheel of adjuster by a screw driver until the disc is not moving, and then return it by 5 notches in the opposite direction.



Parking Brake Shoe Clearance Adjustment

Drum Brake Type

1. Depress the brake pedal several times to set the self-adjusting brake.

NOTE

For Drum Brake type, shoe clearance is automatically adjusted by the adjuster and adjusting lever.

Parking Brake Lever Stroke Adjustment

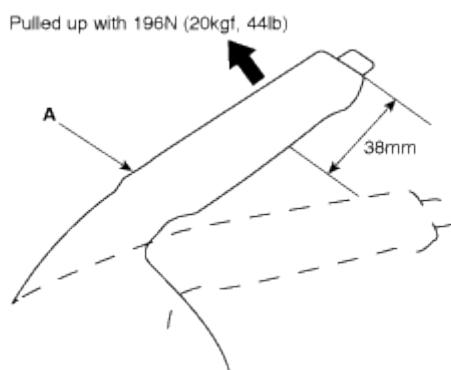
1. Raise the vehicle, and make sure it is securely supported.
2. Remove the floor console. (Refer to Body group - "Floor console")
3. Adjust the parking brake lever stroke by turning adjusting nut (A).

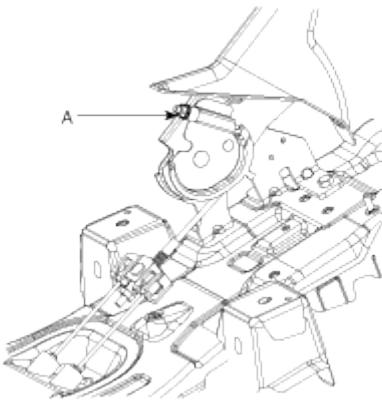
Parking brake lever stroke :

6~8 clicks (Pull the lever with 20kg)

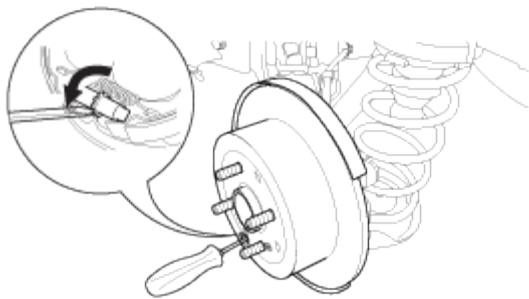
NOTE

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





4. Release the parking brake lever fully, and check that parking brakes do not drag when the rear wheels are turned. Readjust if necessary.
5. Make sure that the parking brakes are fully applied when the parking brake lever is pulled up fully.
6. Install the floor console. (Refer to Body group - "Floor console")
7. Install the rear brake disc, then adjust the rear brake shoe clearance.
 - (1) Remove the plug from the disc.
 - (2) Rotate the toothed wheel of adjuster by a screw driver until the disc is not moving, and then return it by 5 notches in the opposite direction.



8. Install the brake caliper. (Refer to "Rear brake installation")
9. Install the tire and wheel.
10. Adjust the parking brake lever.
11. If the parking brake shoe or the brake disc are replaced a newly one, perform the brake shoe bed-in procedure.
 - (1) While operating the parking brake lever for 69 N(7 kgf, 15 lb) effort, drive the vehicle 500 meters (0.31 miles) at the speed of 60 kph (37.3 mph).
 - (2) Repeat the above procedure more than two times.
 - (3) Must be held on at 30% uphill.

CAUTION

After adjusting parking brake, notice following matter;

1. Must be free from troubles when the parking lever is operated at 686N(70 kgf, 154 lb).
2. Check that all parts move smoothly.
3. The parking brake indicator lamp must be on after the parking lever is worked and must be off after the lever is released.

5.4.ABS (Anti-Lock Brake System)

5.4.1.Component and Components Location

Components



1. Front left wheel speed sensor
2. ABS control module(HECU)
3. Front right wheel speed sensor

4. Hydraulic line
5. Rear right wheel speed sensor
6. Rear left wheel speed sensor

5.4.2. Description and Operation

Description

This specification applies to HCU(Hydraulic Control Unit) and ECU(Electronic Control Unit) of the HECU.(Hydraulic and Electronic Control Unit)
This specification is for the wiring design and installation of ABS/TCS/ESC ECU.

This unit has the functions as follows.

- Input of signal from Pressure sensor, Steering angle sensor, Yaw & Lateral G sensor, the wheel speed sensors attached to each wheel.
- Control of braking force / traction force/ yaw moment.
- Failsafe function.
- Self diagnosis function.
- Interface with the external diagnosis tester.

Installation position : engine compartment

- Brake tube length from Master cylinder port to HECU inlet port should be max. 1m
- The position should not be close to the engine block and not lower than the wheel.

Operation

The ECU shall be put into operation by switching on the operating voltage (IGN).

On completion of the initialization phase, the ECU shall be ready for operation.

In the operating condition, the ECU shall be ready, within the specified limits (voltage and temperature), to process the signals offered by the various sensors and switches in accordance with the control algorithm defined by the software and to control the hydraulic and electrical actuators.

Wheel Sensor Signal Processing

The ECU shall receive wheel speed signal from the four active wheel sensors.

The wheel signals are converted to voltage signal by the signal conditioning circuit after receiving current signal from active wheel sensors and given as input to the MCU.

Solenoid Valve Control

When one side of the valve coil is connected to the positive voltage that is provided through the valve relay and the other side is connected to the ground by the semiconductor circuit, the solenoid valve goes into operation.

The electrical function of the coils are always monitored by the valve test pulse under normal operation conditions.

Voltage Limits

- Overvoltage

When overvoltage is detected(above 16.8 V), the ECU switches off the valve relay and shuts down the system.

When voltage is returned to operating range, the system goes back to the normal condition after the initialization phase.

- Undervoltage

In the event of undervoltage(below 9.3 V), ABS control shall be inhibited and the warning lamp shall be turned on.

When voltage is returned to operating range, the warning lamp is switched off and ECU returns to normal operating mode.

Pump Motor Checking

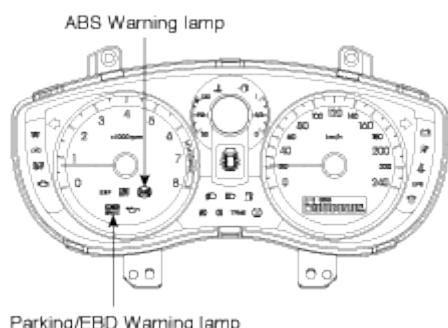
The ECU performs a pump motor test at a speed of 30km/h once after IGN is switched on.

Diagnostic Interface

Failures detected by the ECU are encoded on the ECU, stored in a EEPROM and read out by diagnostic equipment when the ignition switch is turned on.

The diagnosis interface can also be used for testing the ECU during production of the ECU and for actuating the HCU (Air-bleeding line or Roll and Brake Test line).

Warning Lamp module



1. ABS Warning Lamp Module

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

- A. During the initialization phase after IGN ON. (continuously 3 seconds).
- B. In the event of inhibition of ABS functions by failure.
- C. During diagnostic mode.
- D. When the ECU Connector is separated from ECU.

2. Parking/EBD Warning Lamp Module

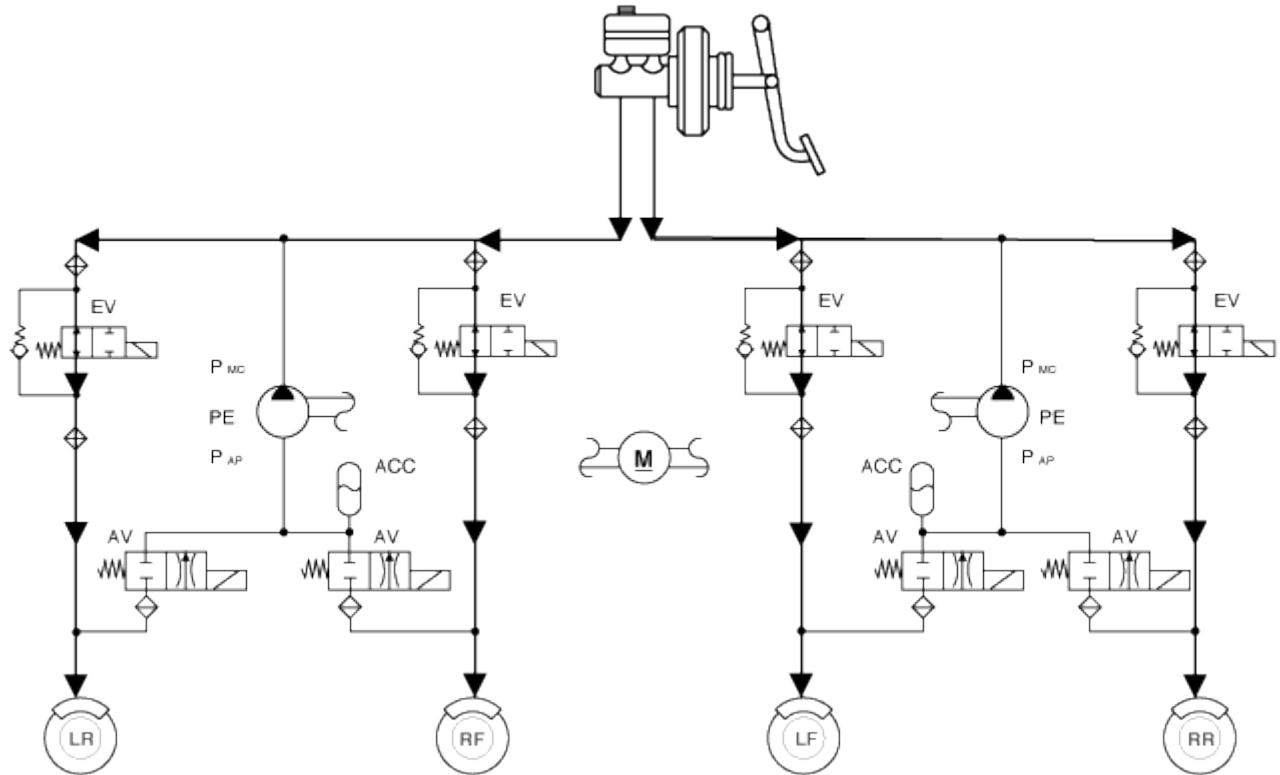
The active EBD warning lamp module indicates the selftest and failure status of the EBD. However, in case the Parking Brake Switch is turned on, the EBD warning lamp is always turned on regardless of EBD functions. The EBD warning lamp shall be on:

- A. During the initialization phase after IGN ON. (continuously 3 seconds).
- B. When the Parking Brake Switch is ON or brake fluid level is low.
- C. When the EBD function is out of order.
- D. During diagnostic mode.
- E. When the ECU Connector is separated from ECU.

ABS Control

1. Normal braking without ABS

| | Inlet valve(EV) | Outlet valve(AV) | Pump motor |
|-----------|-----------------|------------------|------------|
| Operation | Open | Close | OFF |

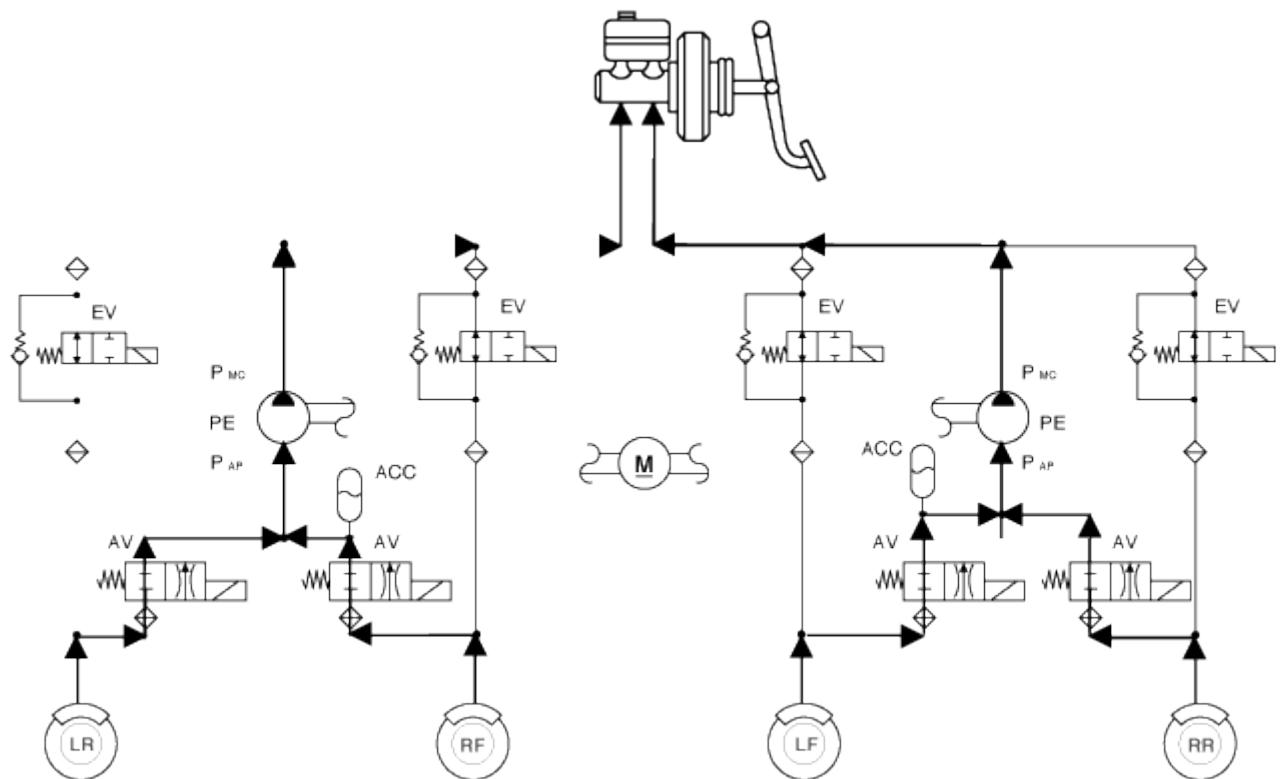


NOTE

EV : Inlet Valve
 AV : Outlet Valve
 LR : Rear left wheel
 RF : Front right wheel
 LF : Front left wheel
 RR : Rear right wheel
 PE : Pump motor

2. Decrease mode

| | Inlet valve(EV) | Outlet valve(AV) | Pump motor |
|-----------|-----------------|------------------|-------------------------|
| Operation | Close | Open | ON(Motor speed control) |



NOTE

EV : Inlet Valve

AV : Outlet Valve

LR : Rear left wheel

RF : Front right wheel

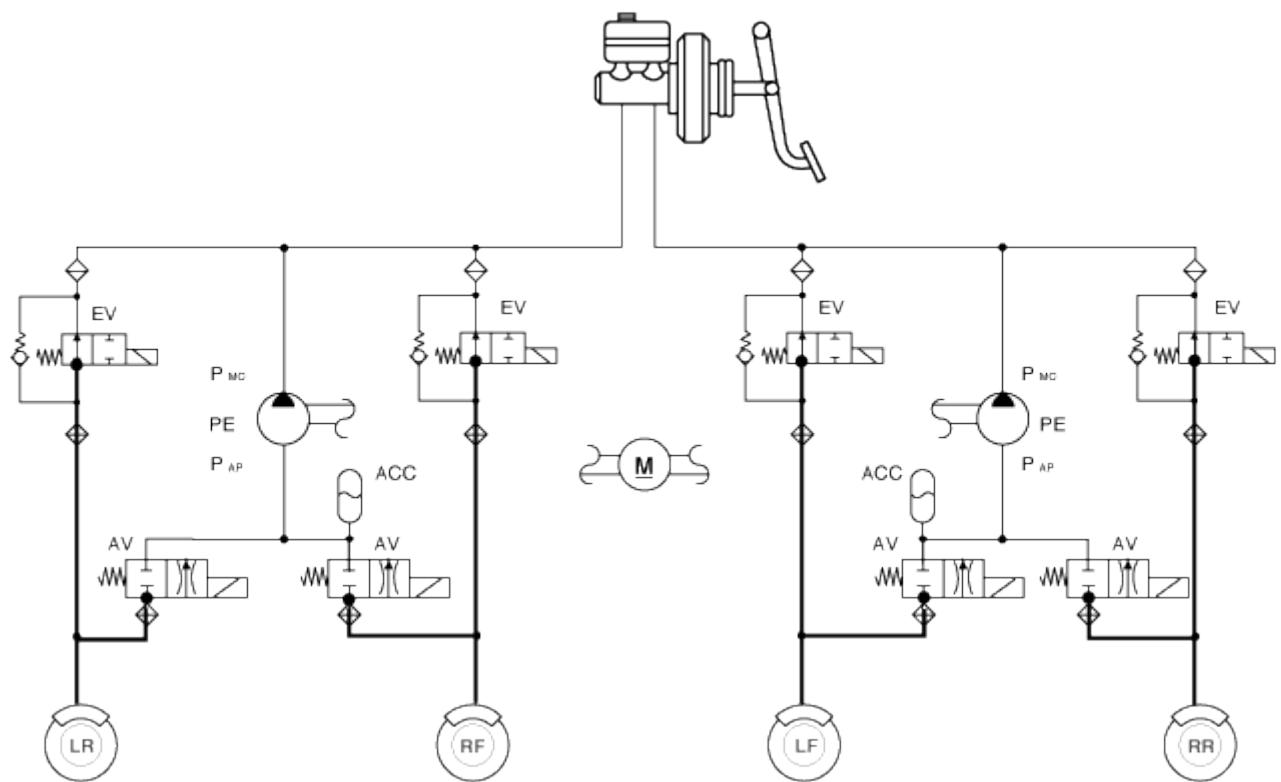
LF : Front left wheel

RR : Rear right wheel

PE : Pump motor

3. Hold mode

| | Inlet valve(EV) | Outlet valve(AV) | Pump motor |
|-----------|-----------------|------------------|------------|
| Operation | Close | Close | Off |



NOTE

EV : Inlet Valve

AV : Outlet Valve

LR : Rear left wheel

RF : Front right wheel

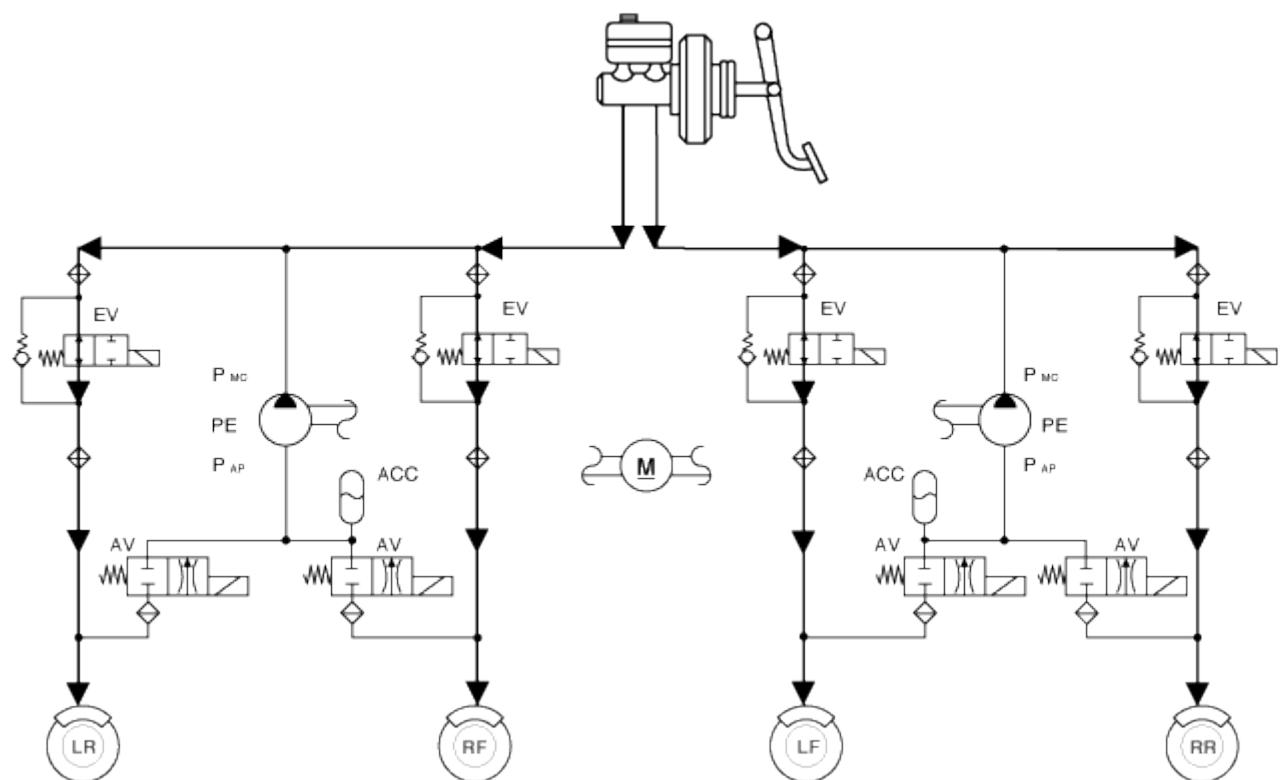
LF : Front left wheel

RR : Rear right wheel

PE : Pump motor

4. Increase mode

| | Inlet valve(EV) | Outlet valve(AV) | Pump motor |
|-----------|-----------------|------------------|-------------------------|
| Operation | Open | Close | ON(Motor speed control) |



NOTE

EV : Inlet Valve

AV : Outlet Valve

LR : Rear left wheel

RF : Front right wheel

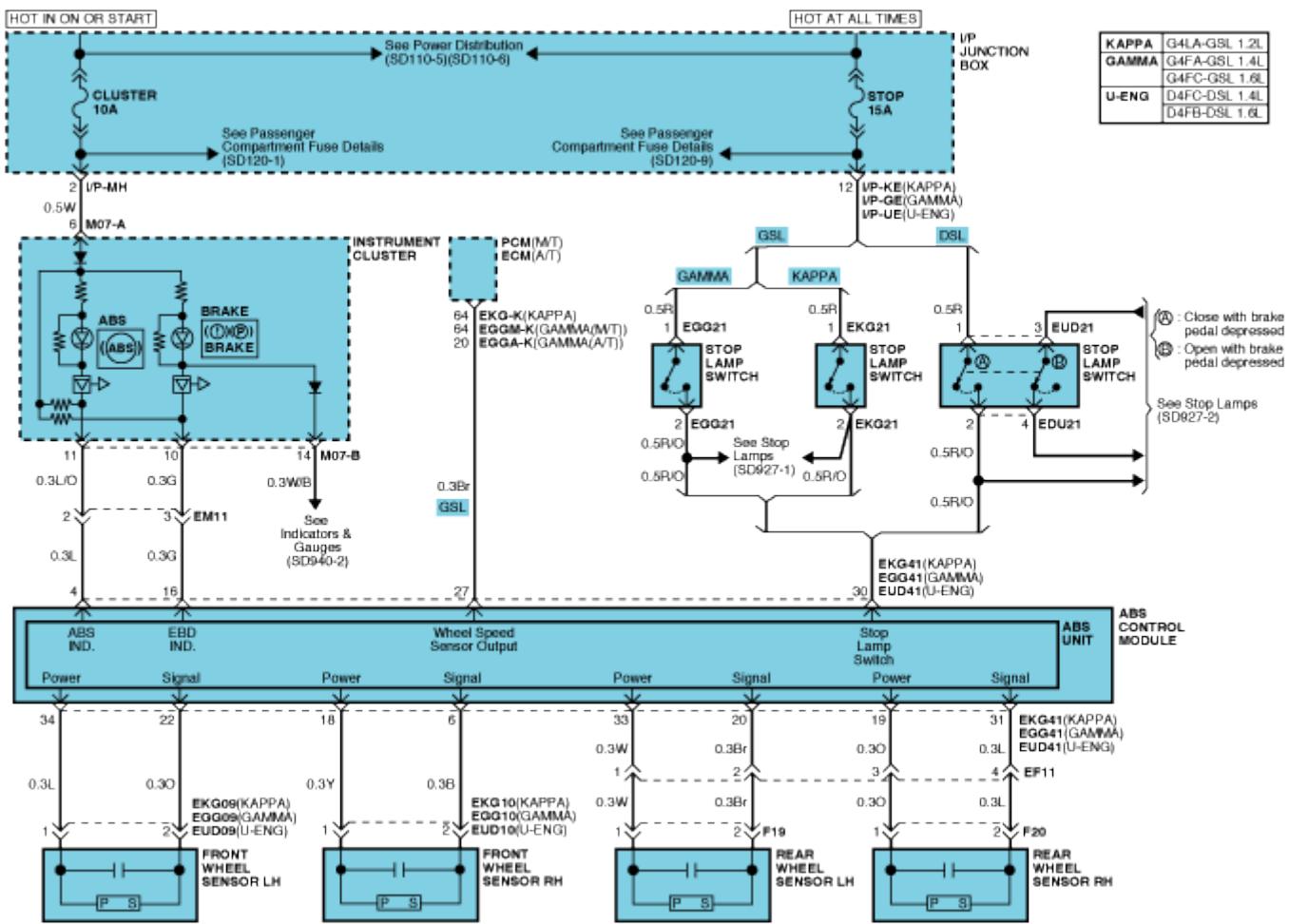
LF : Front left wheel

RR : Rear right wheel

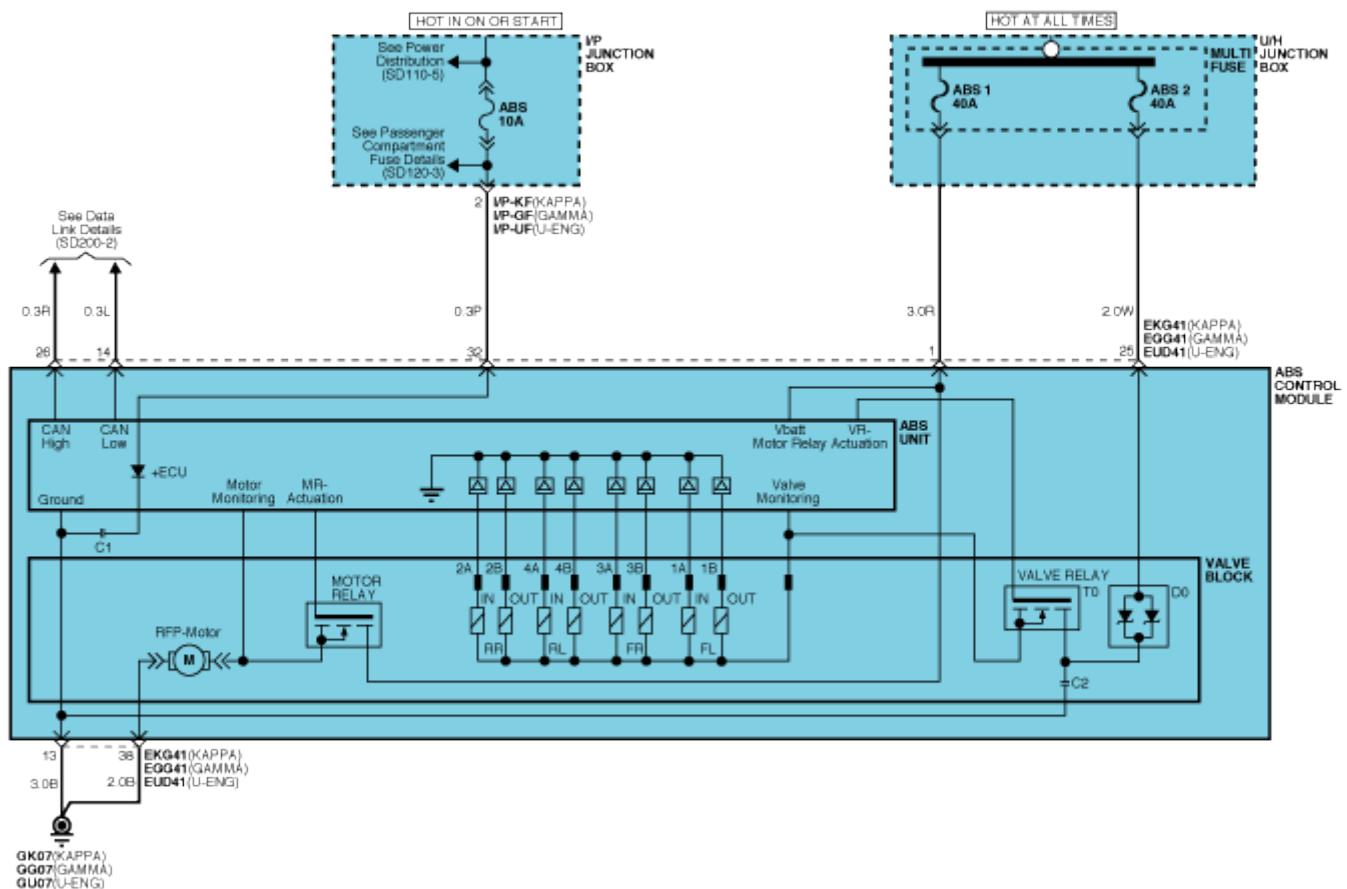
PE : Pump motor

5.4.3.Schematic Diagrams

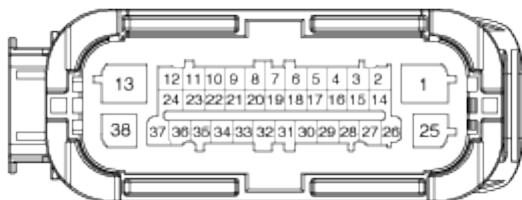
ABS Circuit Diagram(1)



ABS Circuit Diagram(2)



ECU Connector input/output(ABS)



| Wire No. | Designation | Current | | max.permissible wire resistance R_L (mΩ) | min.leakage resistance R_P (kΩ) |
|----------|------------------------------------|---------|--------|--|---------------------------------|
| | | max | min | | |
| 13 | Ground for recirculation pump | 20~39 A | 10 A | - | |
| 38 | Ground for solenoid valves and ECU | 5~15 A | 2.5 A | - | |
| 1 | Voltage supply for pump motor | 20~39 A | 10 A | - | 200 |
| 25 | Voltage supply for solenoid valves | 5~15 A | 2 A | - | 200 |
| 32 | Voltage for hybrid ECU | 1 A | 500 mA | 60 | 200 |

| | | | | | |
|-------------|--|-------|-------|-----|----------------------------|
| 22,6,20,31 | signal wheel speed sensor FL, FR, RL,RR | 16 mA | 6 mA | 250 | 200 to ground 1.5MΩ to bat |
| 34,18,33,19 | Voltage supply for the active wheel speed sensor FL,FR, RL, RR | 16 mA | 6 mA | 250 | 200 to ground 1.5MΩ to bat |
| 4 | ABS-warning lamp actuation | 30 mA | 5 mA | 250 | 200 |
| 16 | EBD-warning lamp actuation | 30 mA | 5 mA | 250 | 200 |
| 30 | brake light switch | 10 mA | 5 mA | 250 | 200 |
| 14 | CAN Low | 30 mA | 20 mA | 250 | 200 |
| 26 | CAN High | 30 mA | 20 mA | 250 | 200 |
| 27,3 | Wheel speed sensor output | 20 mA | 10 mA | 250 | 200 |

ABS HECU Connector

| Connector terminal | | Specification | Condition |
|--------------------|--|--|--------------|
| Number | Description | | |
| 13 | Ground for recirculation pump | Current range: Min.10A
Max.20~39A | Always |
| 38 | Ground for solenoid valves and ECU | Current range: Min.2.5A
Max.5~15A | Always |
| 1 | Voltage supply for pump motor | Battery voltage | Always |
| 25 | Voltage supply for solenoid valves | | |
| 34 | Voltage supply for the active wheel speed sensor FL,FR, RL, RR | Battery voltage | IG ON |
| 18 | | | |
| 33 | | | |
| 19 | | | |
| 22 | signal wheel speed sensor FL, FR, RL,RR | Voltage(High) : 0.26 ~ 0.37 V
Voltage (Low) : 0.13 ~ 0.18 V | On driving |
| 6 | | | |
| 20 | | | |
| 31 | | | |
| 32 | Voltage for hybrid ECU | Battery voltage | KEY ON/OFF |
| 30 | Brake light switch | Voltage (High) ≥ 4.5
Voltage (Low) ≤ 2.0 | BRAKE ON/OFF |

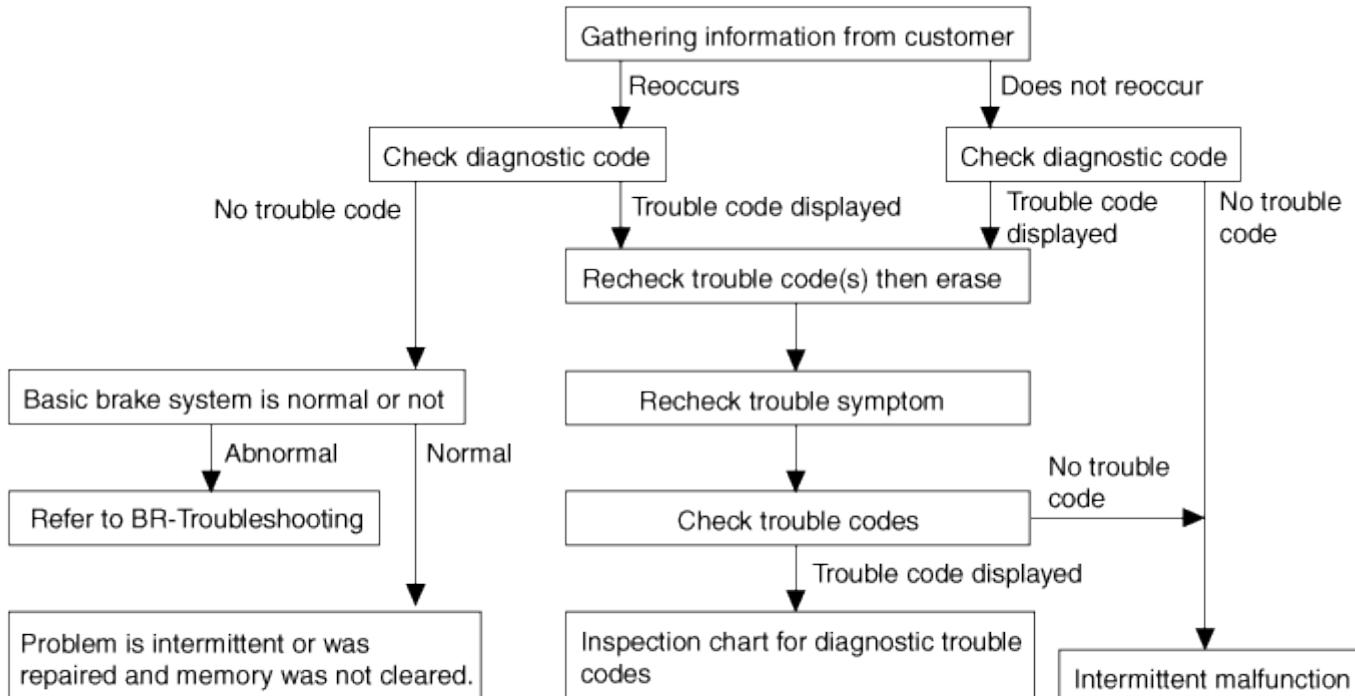
Sensor output on scan tool(ABS)

| | Description | Abbreviation | Unit | Remarks |
|---|-----------------------|--------------|------|---------|
| 1 | Vehicle speed sensor | VEH. SPD | Km/h | |
| 2 | Battery voltage | BATT. VOL | V | |
| 3 | FL Wheel speed sensor | FL WHEEL | Km/h | |
| 4 | FR Wheel speed sensor | FR WHEEL | Km/h | |
| 5 | RL Wheel speed sensor | RL WHEEL | Km/h | |
| 6 | RR Wheel speed sensor | RR WHEEL | Km/h | |
| 7 | ABS Warning lamp | ABS LAMP | - | |
| 8 | EBD Warning lamp | EBD LAMP | - | |

| | | | | |
|----|-------------------------|-----------|---|--|
| 9 | Brake Lamp | B/LAMP | - | |
| 10 | Pump relay state | PUMP RLY | - | |
| 11 | Valve relay state | VALVE RLY | - | |
| 12 | Motor | MOTOR | - | |
| 13 | Front Left valve(IN) | FL INLET | - | |
| 14 | Front Right valve (IN) | FR INLET | - | |
| 15 | Rear Left valve (IN) | RL INLET | - | |
| 16 | Rear Right valve (IN) | RR INLET | - | |
| 17 | Front Left valve (OUT) | FL OUTLET | - | |
| 18 | Front Right valve (OUT) | FR OUTLET | - | |
| 19 | Rear Left valve(OUT) | RL OUTLET | - | |
| 20 | Rear Right valve (OUT) | RR OUTLET | - | |

5.4.4.Troubleshooting

Standard flow of diagnostic troubleshooting



* Using the customer problem analysis check sheet for reference, ask the customer as much detail as possible about the problem.

Notes with regard to diagnosis

The phenomena listed in the following table are not abnormal.

| Phenomenon | Explanation |
|---------------------|---|
| System check sound | When starting the engine, a thudding sound can sometimes be heard coming from inside the engine compartment. This is because the system operation check is being performed. |
| ABS operation sound | 1. Sound of the motor inside the ABS hydraulic unit operation (whine).
2. Sound is generated along with vibration of the brake pedal (scrapping).
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 Occurrence of Problem | <input type="checkbox"/> Continuous <input type="checkbox"/> Intermittent (times a day) |

| | | |
|----------|--|--|
| Symptoms | <input type="checkbox"/> ABS does not operate. | |
| | <input type="checkbox"/> ABS does not operate efficiently. <input type="checkbox"/> Intermittent (times a day) | |
| | ABS Warning Light Abnormal | <input type="checkbox"/> Remains ON <input type="checkbox"/> Does not light up |

| | | |
|-------------------------------|----------|--|
| Diagnostic Trouble Code Check | 1st Time | <input type="checkbox"/> Normal Code <input type="checkbox"/> Malfunction Code (Code) |
| | 2nd Time | <input type="checkbox"/> Normal Code <input type="checkbox"/> Malfunction Code (Code) |

Problem symptoms table

If a normal code is displayed during the DTC check but the problem still occurs, check the circuits for each problem symptom in the order given in the table below and proceed to the relevant troubleshooting page.

| 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 Scan tool is not possible.
(Communication with any system is not possible) | 1. Power source circuit
2. Diagnosis line |
| Communication with Scan tool is not possible.
(Communication with ABS only is not possible) | 1. Power source circuit
2. Diagnosis line
3. HECU |
| When ignition key is turned ON (engine OFF), the ABS warning lamp does not light up. | 1. ABS warning lamp circuit
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 ABS control module. | - Inoperative power source circuit
- Inoperative wheel speed sensor circuit
- Inoperative hydraulic circuit for leakage
- Inoperative HECU |

Inspection procedures

DTC Inspection

1. Connect the Scan Tool with the data link connector and turn the ignition switch ON.
2. Verify that the system is operating to specifications.
3. Is the system operating to specifications?

| | |
|------------|--|
| NO | ► Check the power source circuit. |
| YES | ► Erase the DTC and recheck using scan tool. |

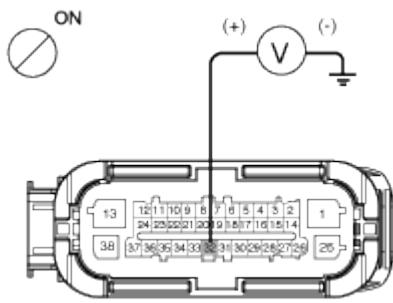
Check the power source circuit

1. Disconnect the connector from the ABS control module.
2. Turn the ignition switch ON, measure the voltage between terminal 32 of the ABS control module harness side connector and body ground.

Specification: approximately B+

3. Is the voltage within specification?

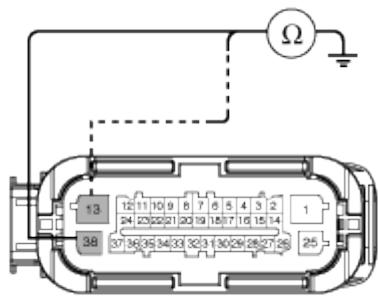
| | |
|------------|---|
| YES | ► Check the ground circuit. |
| NO | ► Check the harness or connector between the fuse (10A) in the engine compartment junction block and the ABS control module. Repair if necessary. |



Check the ground circuit

1. Disconnect the connector from the ABS control module.
2. Check for continuity between terminals 13,38 of the ABS control module harness side connector and ground point.
3. Is there continuity?

| | |
|------------|--|
| YES | ► Check the wheel speed sensor circuit. |
| NO | ► Repair an open in the wire and ground point. |



Check the wheel speed sensor circuit

1. Refer to the DTC troubleshooting procedures.
2. Is the system operating to specifications?

| | |
|------------|---|
| YES | ► Check the hydraulic circuit for leakage. |
| NO | ► Repair or replace the wheel speed sensor. |

Check the hydraulic circuit for leakage

1. Refer to the hydraulic lines.
2. Inspect leakage of the hydraulic lines.
3. Is the system operating to specifications?

| | |
|------------|---|
| YES | ► The problem is still occurring, replace the ABS control module. |
| NO | ► Replace the leaking hydraulic lines. |

ABS Does Not Operate (Intermittently).

Detecting condition

| Trouble symptoms | Possible cause |
|---|---|
| Brake operation varies depending on driving conditions and road surface conditions, so diagnosis can be difficult. However if a normal DTC is displayed, check the following probable cause. When the problem is still occurring, replace the ABS control module. | <ul style="list-style-type: none"> - Inoperative power source circuit - Inoperative wheel speed sensor circuit - Inoperative hydraulic circuit for leakage - Inoperative HECU |

Inspection procedures

DTC Inspection

1. Connect the Scan Tool with the data link connector and turn the ignition switch ON.
2. Verify that the system is operating to specifications.
3. Is the system operating to specifications?

| | |
|-----------|---|
| NO | ► Check the wheel speed sensor circuit. |
|-----------|---|

YES

- ▶ Erase the DTC and recheck using Scan Tool.

Check the wheel speed sensor circuit

1. Refer to the DTC troubleshooting procedures.

2. Is the system operating to specifications?

YES

- ▶ Check the stop lamp switch circuit.

NO

- ▶ Repair or replace the wheel speed sensor.

Check the stop lamp switch circuit

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

2. Measure the voltage between terminal 30 of the ABS control module harness side connector and body ground when brake pedal is depressed.

Specification : approximately B+

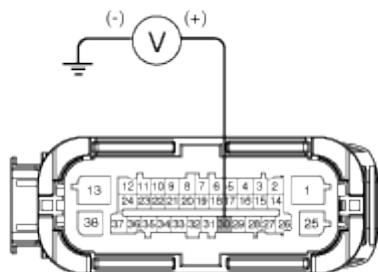
3. Is the voltage within specification?

YES

- ▶ Check the hydraulic circuit for leakage.

NO

- ▶ Repair the stop lamp switch. Repair an open in the wire between the ABS control module and the stop lamp switch.



Check the hydraulic circuit for leakage

1. Refer to the hydraulic lines.

2. Inspection leakage of the hydraulic lines.

3. Is the system operating to specifications?

YES

- ▶ The problem is still occurring, replace the ABS control module.

NO

- ▶ Replace the leaking hydraulic lines.

Communication with Scan-Tool is not possible. (Communication with any system is not possible)

Detecting condition

| Trouble symptoms | Possible cause |
|--|--|
| Possible malfunction in the power supply system (including ground) for the diagnosis line. | <ul style="list-style-type: none"> - An open in the wire - Poor ground - Inoperative power source circuit |

Inspection procedures

Check the power supply circuit for the diagnosis

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

Specification : approximately B+

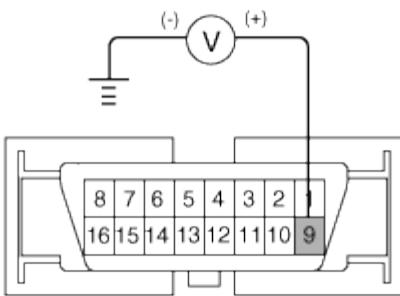
2. Is voltage within specification?

YES

- ▶ Check the ground circuit for the diagnosis.

NO

- ▶ Repair an open in the wire. Check and replace fuse (15A) from the engine compartment junction block.

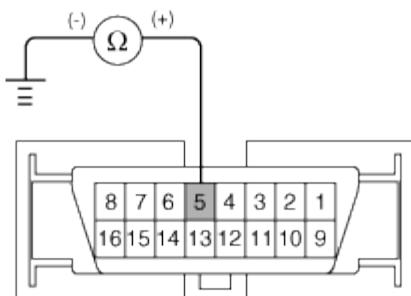


Check the ground circuit for the diagnosis

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

2. Is there continuity?

- | | |
|-----------|--|
| NO | ► Repair an open in the wire between terminal 5 of the data link connector and ground point. |
|-----------|--|



Communication with Scan Tool is not possible.

(Communication with ABS only is not possible)

Detecting condition

| Trouble symptoms | Possible cause |
|--|---|
| When communication with Scan Tool is not possible, the cause may be probably an open in the HECU power circuit or an open in the diagnosis output circuit. | <ul style="list-style-type: none"> - An open in the wire - Inoperative HECU - Inoperative power source circuit |

Inspection procedures

Check for continuity in the diagnosis line

1. Disconnect the connector from the ABS control module.
2. Check for continuity between terminals 26, 14 of the ABS control module connector and 3, 11 of the data link connector.
3. Is there continuity?

| | |
|------------|---|
| YES | ► Check the power source of ABS control module. |
| NO | ► Repair an open in the wire. |

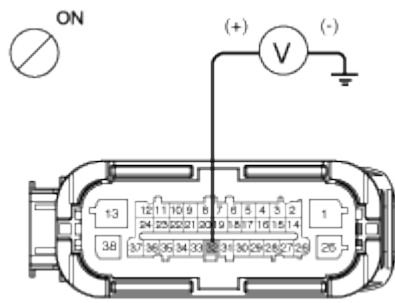
Check the power source of ABS control module

1. Disconnect the connector from the ABS control module.
2. Turn the ignition switch ON, measure the voltage between terminal 32 of the ABS control module harness side connector and body ground.

Specification : approximately B+

3. Is voltage within specification?

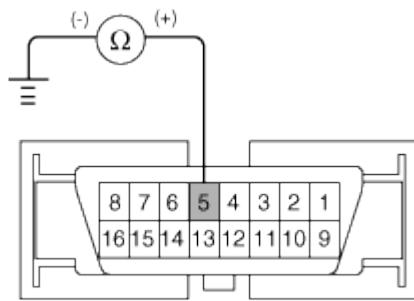
| | |
|------------|---|
| YES | ► Check for poor ground. |
| NO | ► Check the harness or connector between the fuse (10A) in the engine compartment junction block and the ABS control module. Repair if necessary. |



Check for poor ground

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

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



When Ignition Key Is Turned ON (engine OFF), The ABS Warning Lamp Does Not Light Up.

Detecting condition

| Trouble symptoms | Possible cause |
|--|--|
| When current flows in the HECU the ABS warning lamp turns from ON to OFF as the initial check. Therefore if the lamp does not light up, the cause may be an open in the lamp power supply circuit, a blown bulb, an open in the both circuits between the ABS warning lamp and the HECU, and the inoperative HECU. | <ul style="list-style-type: none"> - Inoperative ABS warning lamp bulb - Blown No.2 fuse (10A) in the engine compartment junction block - Inoperative ABS warning lamp module - Inoperative HECU |

Inspection procedures

Problem verification

1. Disconnect the connector from the ABS control module and turn the ignition switch ON.
2. Does the ABS warning lamp light up?

| | |
|------------|--|
| YES | ► It is normal. Recheck the ABS control module. |
| NO | ► Check the power source for the ABS warning lamp. |

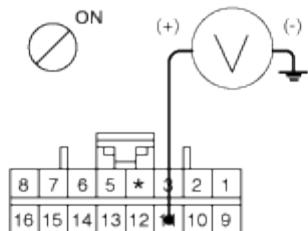
Check the power source for the ABS warning lamp

1. Disconnect the instrument cluster connector(M07-B) and turn the ignition switch ON.
2. Measure the voltage between terminal 11 of the cluster harness side connector(M07-B) and body ground.

Specification : approximately B+

3. Is voltage within specification?

| | |
|------------|---|
| YES | ► Repair bulb or instrument cluster assembly. |
| NO | ► Check for blown fuse. |



Check for blown fuse

1. Check continuity of fuse (10A) from the engine compartment junction block. Connect the instrument cluster connector (M07-B) and ABS HECU connector, and then turn the ignition switch OFF.

2. Is there continuity?

| | |
|------------|--|
| YES | ► Repair an open in the wire between cluster fuse and 6 of cluster connector(M07-A). |
| NO | ► Replace the blown fuse. |

Even After The Engine Is Started, The ABS Warning Lamp Remains ON.

Detecting condition

| Trouble symptoms | Possible cause |
|--|---|
| If the HECU detects trouble, it lights the ABS warning lamp while at the same time prohibiting ABS control. At this time, the HECU records a DTC in memory. Even though the normal code is output, the ABS warning lamp remains ON, then the cause may be probably an open or short in the ABS warning lamp circuit. | <ul style="list-style-type: none"> - An open in the wire - Inoperative instrument cluster assembly - Inoperative ABS warning lamp module - Inoperative HECU |

Inspection procedures

Check DTC output

1. Connect the Scan Tool to the 16P data link connector located behind the driver's side kick panel.

2. Check the DTC output using Scan Tool.

3. Is DTC output?

| | |
|------------|--|
| YES | ► Repair circuit indicated by code output. |
| NO | ► Check instrument cluster. |

Check instrument cluster

1. Disconnect the cluster connector and turn the ignition switch ON.

2. Does the ABS warning lamp remains ON?

| | |
|------------|-----------------------------------|
| YES | ► Replace the instrument cluster. |
| NO | ► Check for open the wire. |

Check for open in the wire

1. Check for continuity in the wire between cluster and ABS control module.

2. Is there continuity?

| | |
|------------|--|
| YES | ► Replace the ABS control module and recheck. |
| NO | ► Repair an open in the wire between cluster and ABS control module. |

Bleeding of brake system

This procedure should be followed to ensure adequate bleeding of air and filling of the ABS unit, brake lines and master cylinder with brake fluid.

1. Remove the reservoir cap and fill the brake reservoir with brake fluid.

CAUTION

If there is any brake fluid on any painted surface, wash it off immediately.

NOTE

When pressure bleeding, do not depress the brake pedal.

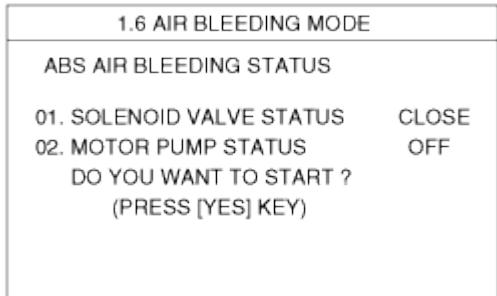
Recommended fluid..... DOT3 or DOT4

2. Connect a clear plastic tube to the brake caliper bleeder plug and insert the other end of the tube into a half filled clear plastic bottle.
3. Connect the scan tool to the data link connector located underneath the dash panel.
4. Select and operate according to the instructions on the scan tool screen.

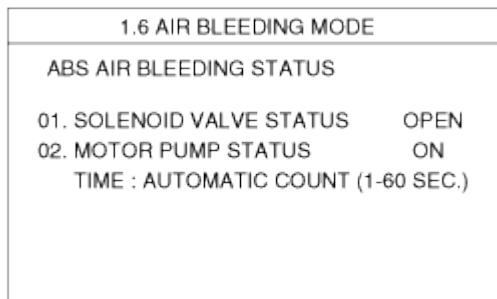
CAUTION

You must obey the maximum operating time of the ABS motor with the hi-scan (Pro) to prevent the motor pump from burning.

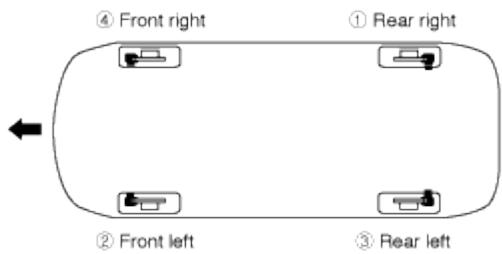
- (1) Select vehicle name.
- (2) Select Anti-Lock Brake system.
- (3) Select air bleeding mode.
- (4) Press "YES" to operate motor pump and solenoid valve.



- (5) Wait 60 sec. before operating the air bleeding. (If not, you may damage the motor.)



5. Pump the brake pedal several times, and then loosen the bleeder screw until fluid starts to run out without bubbles. Then close the bleeder screw.
6. Repeat step 5 until there are no more bubbles in the fluid for each wheel.



7. Tighten the bleeder screw.

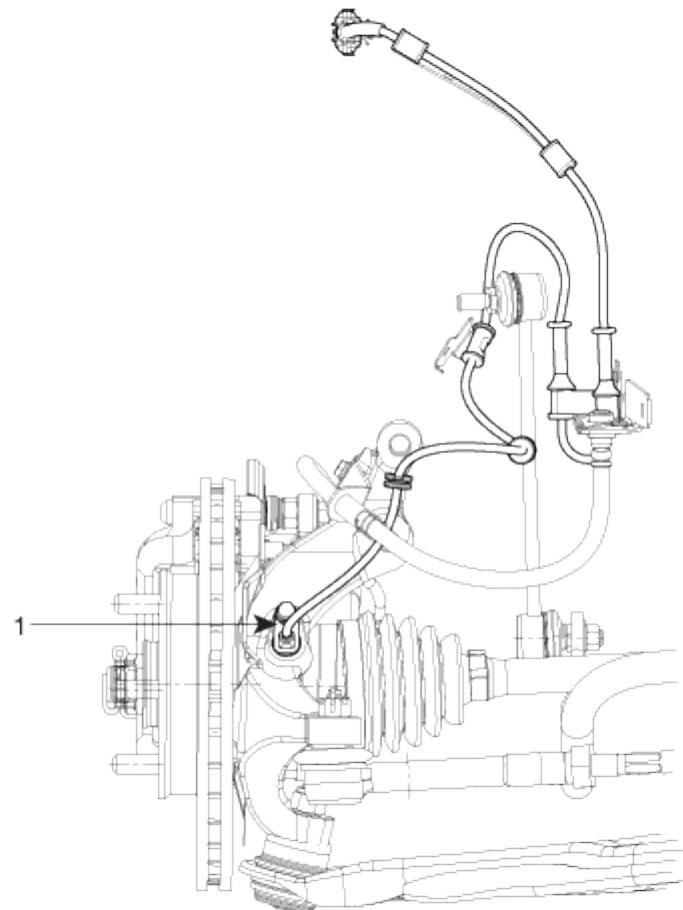
Bleed screw tightening torque:

7 ~ 13 N.m (0.7 ~ 1.3 kgf.m, 5.1 ~ 9.4 lb-ft)

5.4.5. Front Wheel Speed Sensor

5.4.5.1. Component and Components Location

Components

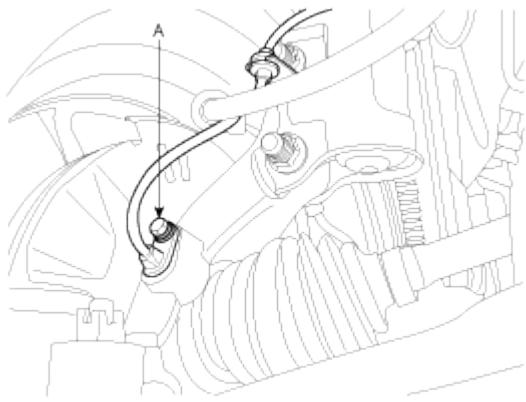


1. Front wheel speed sensor

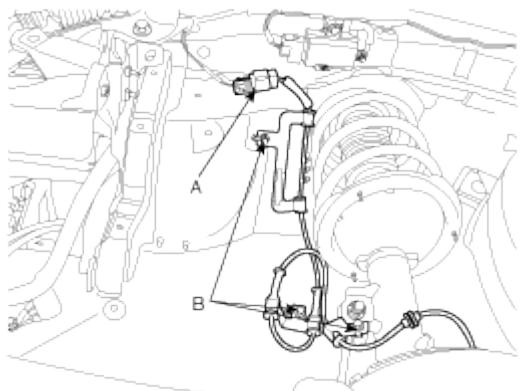
5.4.5.2. Repair procedures

Removal

1. Remove the front wheel speed sensor mounting bolt (A).



2. Remove the front wheel guard.
3. Remove the front wheel speed sensor bracket (B).



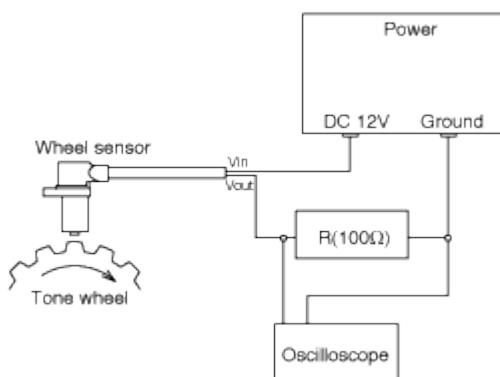
4. Disconnect the front wheel speed sensor connector (A), then remove the front wheel speed sensor.

Inspection

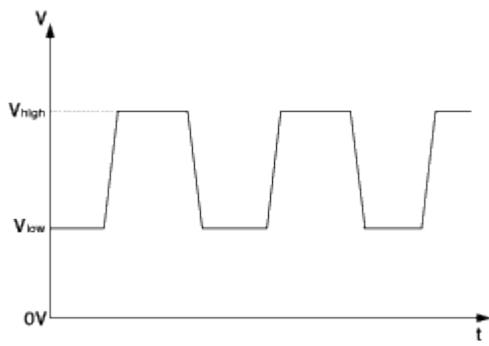
1. Measure the output voltage between the terminal of the wheel speed sensor and the body ground.

CAUTION

In order to protect the wheel speed sensor, when measuring output voltage, a 100Ω resistor must be used as shown.



2. Compare the change of the output voltage of the wheel speed sensor to the normal change of the output voltage as shown below.

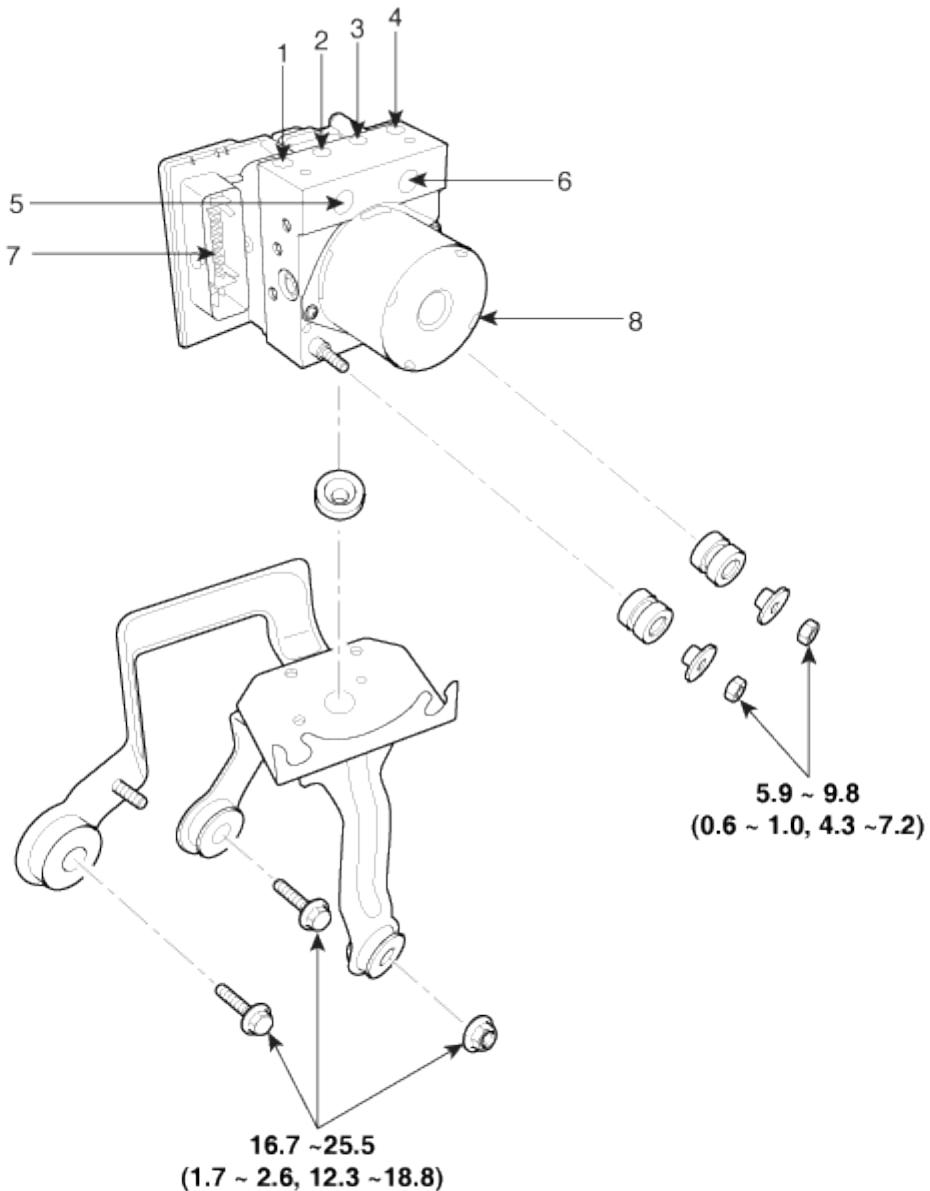


- A. V_{low} : 0.59 V ~ 0.84 V
- B. V_{high} : 1.185 V ~ 1.68 V
- C. Frequency range : 1~2,500 Hz

5.4.6.ABS Control Unit

5.4.6.1.Component and Components Location

Components



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

| | |
|-----------------------|---------------------------------------|
| 1. Front - right tube | 5. Master cylinder tube2 |
| 2. Rear - left tube | 6. Master cylinder tube1 |
| 3. Rear - right tube | 7. ABS control module connector (38P) |
| 4. Front - left tube | 8. ABS control module (HECU) |

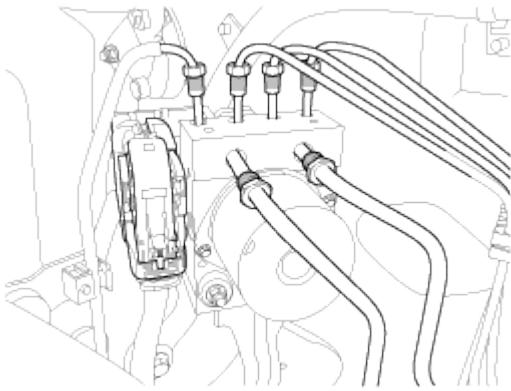
5.4.6.2. Repair procedures

Removal

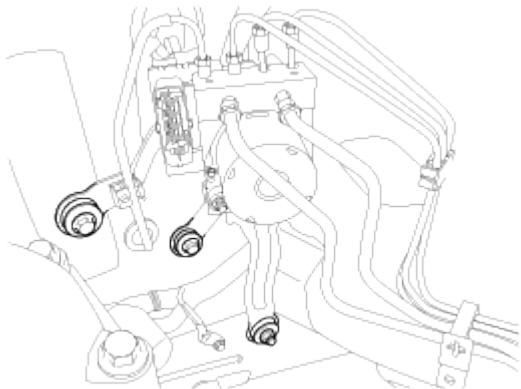
1. Disconnect the battery(-) terminal.
2. Disconnect the brake tubes from the HECU.

Tightening torque :

ABS : 12.7 ~ 16.7N.m (1.3 ~ 1.7kgf.m, 9.4 ~ 12.3lb-ft)
 ESP : 18.6 ~ 22.6N.m (1.9 ~ 2.3kgf.m, 13.7 ~ 16.6lb-ft)



3. Disconnect the HECU connector.



4. Remove the HECU by loosening the bracket mounting bolts and nut.

Tightening torque :

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

CAUTION

- Never attempt to disassemble the HECU.
- The HECU must be protected during storage and transport, and must not be subjected to excessive shock.

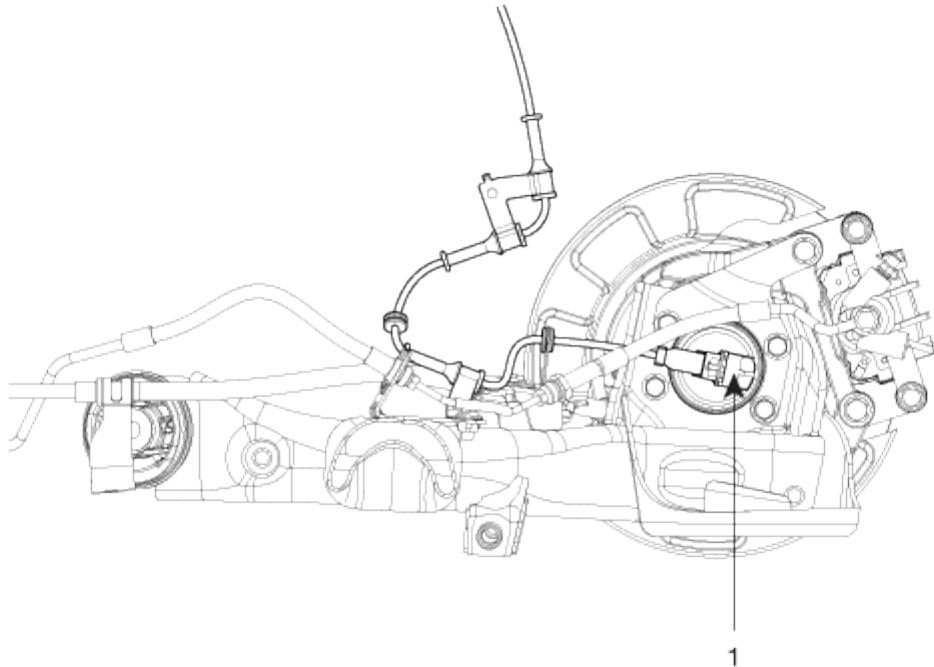
Installation

1. Installation is the reverse of removal.
2. After installation, bleed the brake system. (Refer to ABS bleeding)

5.4.7.Rear Wheel Speed Sensor

5.4.7.1.Component and Components Location

Components

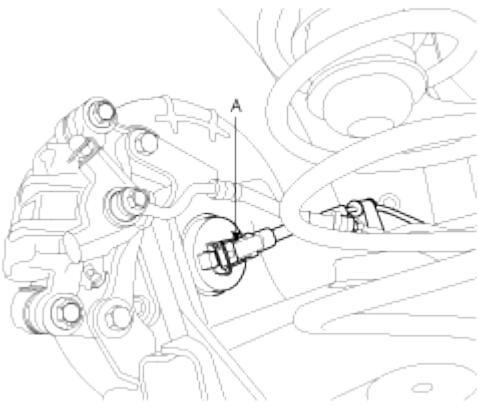


1. Rear wheel speed sensor

5.4.7.2. Repair procedures

Removal

1. Remove the rear wheel speed sensor connector (A).



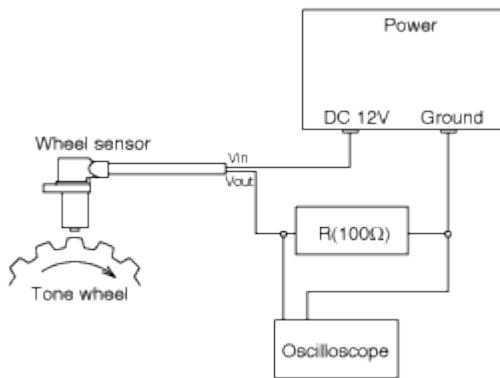
2. Remove the rear seat assembly. (Refer to Body group - "rear seat")
3. Remove the rear wheel speed house trim and rear pillar trim. Disconnect the rear wheel speed sensor connector.

Inspection

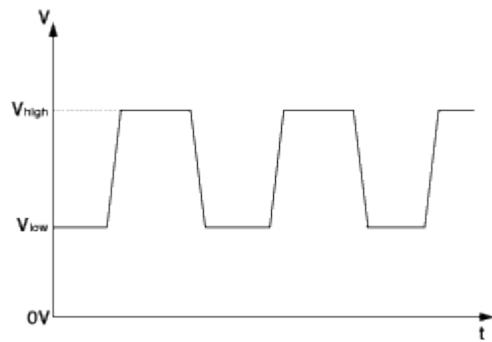
1. Measure the output voltage between the terminal of the wheel speed sensor and the body ground.

CAUTION

In order to protect the wheel speed sensor, when measuring output voltage, a 100Ω resistor must be used as shown.



2. Compare the change of the output voltage of the wheel speed sensor to the normal change of the output voltage as shown below.



- A. V_{low} : 0.59 V ~ 0.84 V
- B. V_{high} : 1.18 V ~ 1.68 V
- C. Frequency range : 1~2,500 Hz

5.4.8.EBD (Electronic Brake-force Distribution)

5.4.8.1.Description and Operation

Description

The EBD system (Electronic Brake force Distribution) as a sub-system of the ABS system is to control the effective adhesion utilization by the rear wheels.

It further utilizes the efficiency of highly developed ABS equipment by controlling the slip of the rear wheels in the partial braking range.

The brake force is moved even closer to the optimum and controlled electronically, thus dispensing with the need for the proportioning valve. The proportioning valve, because of a mechanical device, has limitations to achieve an ideal brake force distribution 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.

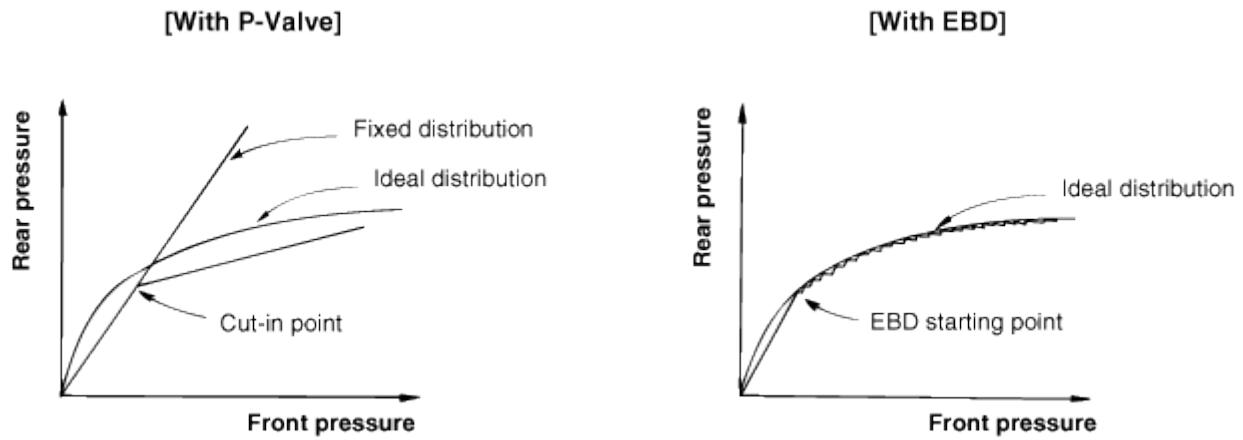
EBD controlled by the ABS Control Module, calculates the slip ratio of each wheel at all times and controls the brake pressure of the rear wheels not to exceed that of the front wheels.

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.

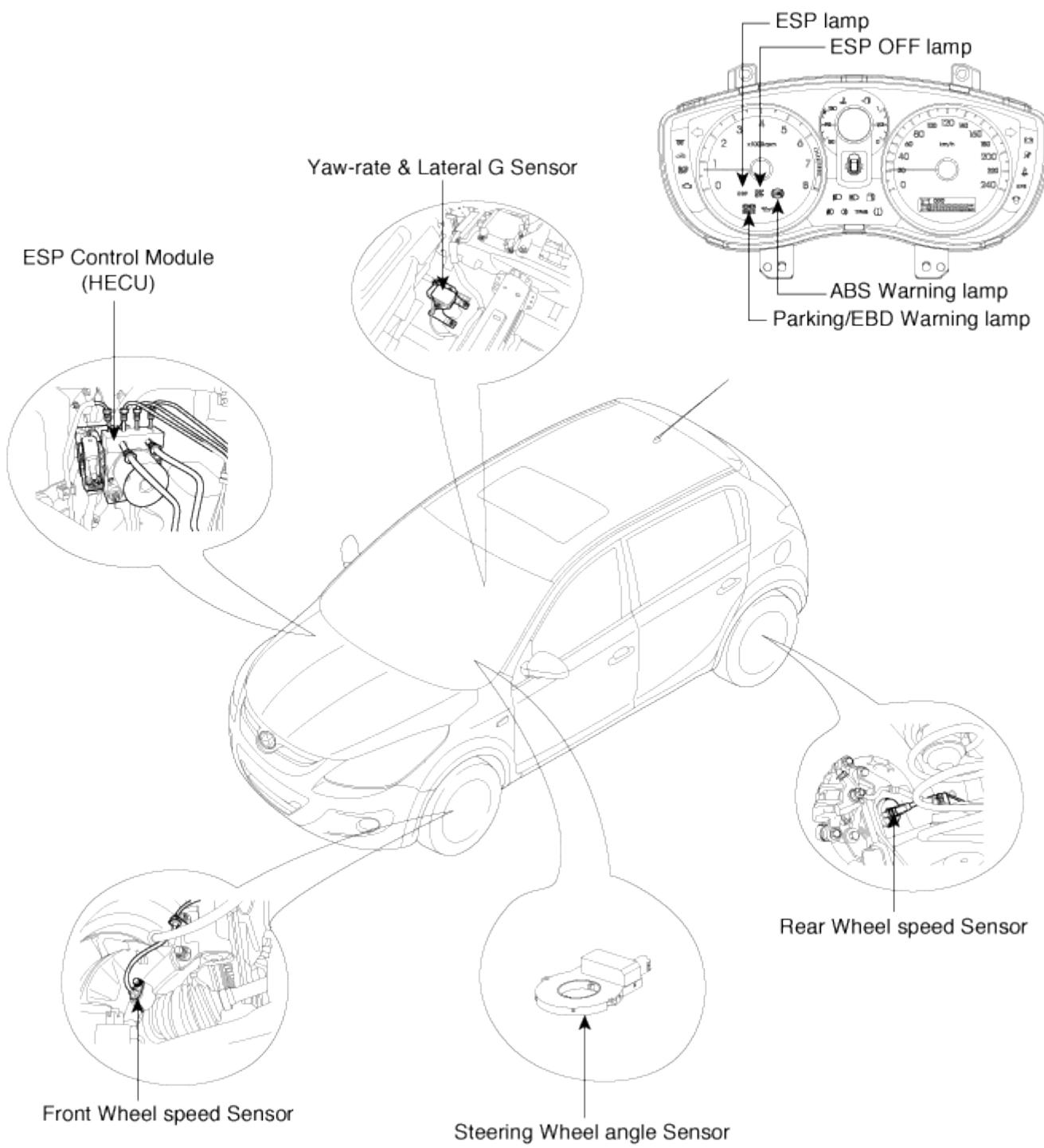
Comparison between Proportioning valve and EBD



5.5.ESP (Electronic Stability Program) System

5.5.1.Component and Components Location

Components



5.5.2. Description and Operation

Description of ESP

Optimum driving safety now has a name : ESP, the Electronic Stability Program.

ESP recognizes critical driving conditions, such as panic reactions in dangerous situations, and stabilizes the vehicle by wheel-individual braking and engine control intervention with no need for actuating the brake or the gas pedal.

ESP adds a further function known as Active Yaw Control (AYC) to the ABS, TCS, EBD and ESP 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.

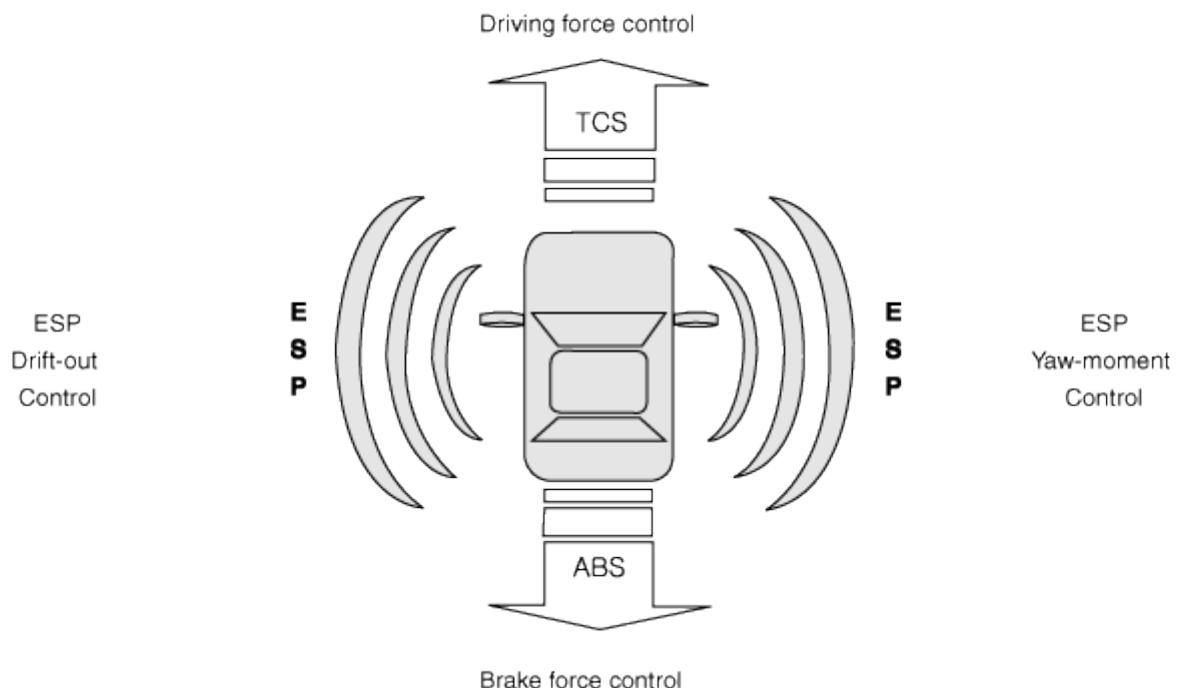
This is achieved by wheel individual brake intervention and adaptation of the momentary engine torque with no need for any action to be taken by the

driver.

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

Of course, the stability control feature works under all driving and operating conditions. Under certain driving conditions, the ABS/TCS function can be activated simultaneously with the ESP function in response to a command by the driver.

In the event of a failure of the stability control function, the basic safety function, ABS, is still maintained.



Description of ESP Control

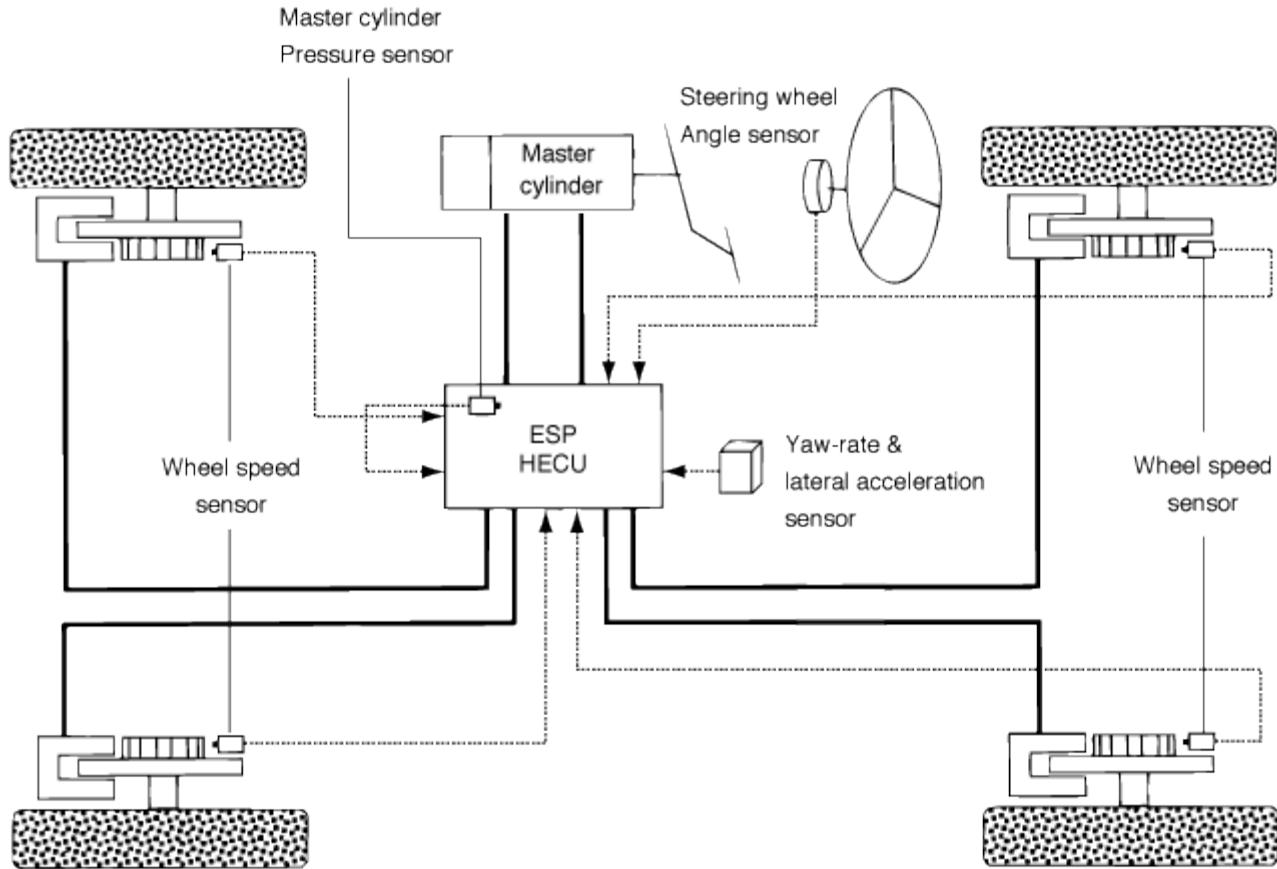
ESP system includes ABS/EBD, TCS and AYC (Active yaw control) function.

ABS/EBD function : The ECU changes the active sensor signal (current shift) coming from the four wheel sensors to the square waveform. By using the input of above signals, the ECU calculates the vehicle speed and the acceleration & deceleration of the four wheels. And, the ECU judges whether the ABS/EBD should be actuated or not.

TCS function prevents the wheel slip of drive direction by adding the brake pressure and engine torque reduction via CAN communication. TCS function uses the wheel speed sensor signal to determine the wheel slip as far as ABS function.

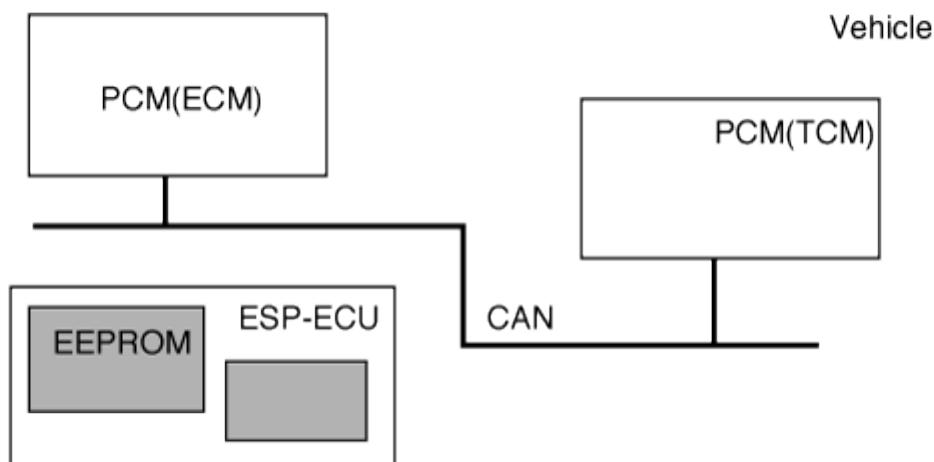
AYC function prevents unstable maneuver of the vehicle. To determine the vehicle maneuver, AYC function uses the maneuver sensor signals(Yaw Rate Sensor, Lateral Acceleration Sensor, Steering Wheel Angle Sensor). If vehicle maneuver is unstable (Over Steer or Under Steer), AYC function applies the brake pressure on certain wheel, and send engine torque reduction signal by CAN.

After the key-on, the ECU continually diagnoses the system failure. (self-diagnosis) If the system failure is detected, the ECU informs driver of the system failure through the BRAKE/ABS/ESP warning lamp. (fail-safe warning)



Variant Coding

The HECU is programmed with a variant code based on the vehicle powertrain configuration. This variant code is used to determine the appropriate ESP calculations. Variant code programming should be performed whenever an HECU is replaced.



Procedure of Variant Coding

1. Install a PCM(ECM & TCM)/ESP normally.
2. Connect the scan tool to the data link connector located underneath the dash panel.
3. Select vehicle name.
4. Select ANTI-LOCK BRAKE SYSTEM.
5. Select the variant coding.

| |
|-----------------------------------|
| 1. KIA VEHICLE DIAGNOSIS |
| MODEL : PB |
| SYSTEM : ANTI - LOCK BRAKE SYSTEM |
| |
| 04. ACTUATION TEST |
| 05. SIMU - SCAN |
| 06. AIR BLEEDING MODE |
| 07. SOLENOID VALVES TEST |
| 08. IDENTIFICATION CHECK |
| 09. STEERING ANGLE SENSOR |
| 10. VARIANT CODING |
| 11. DATA SETUP(UNIT CONV.) |

6. Follow the next procedure according to the comment .

| |
|--|
| 1. 10 .VARIANT CODING |
| ★ AIM
THIS FUNCTION RESET VARIANT CODE AND INPUT THE NEW ONE IN EST.
PERFORM THIS FUNCTION WHEN YOU REPLACE USED ESP FROM OTHER VEHICLE OR OCCUR C1702 WITH MIL ON.(ESP/EBD/ABS) |
| IF YOU READY, PRESS [ENTER] KEY. |
| |

7. Confirm the condition , and then push the "REST".

| |
|--|
| 1. 10 .VARIANT CODING |
| VARIANT CODING |
| CONDITION IG. KEY ON
ENGINE STOP |
| PRESS [REST], IF YOU ARE READY ! |
| REST |

8. If the procedure is finished, the screen is displayed as shown below.

| |
|---|
| 1.10 . VARIANT CODING |
| VARIANT CODING |
| IG. KEY ON
CALIBRATION COMPLETION!
TURN IG.KEY OFF AND ON 2TIMES. |
| PRESS [REST], IF YOU ARE READY ! |
| REST |

9. IGN off.

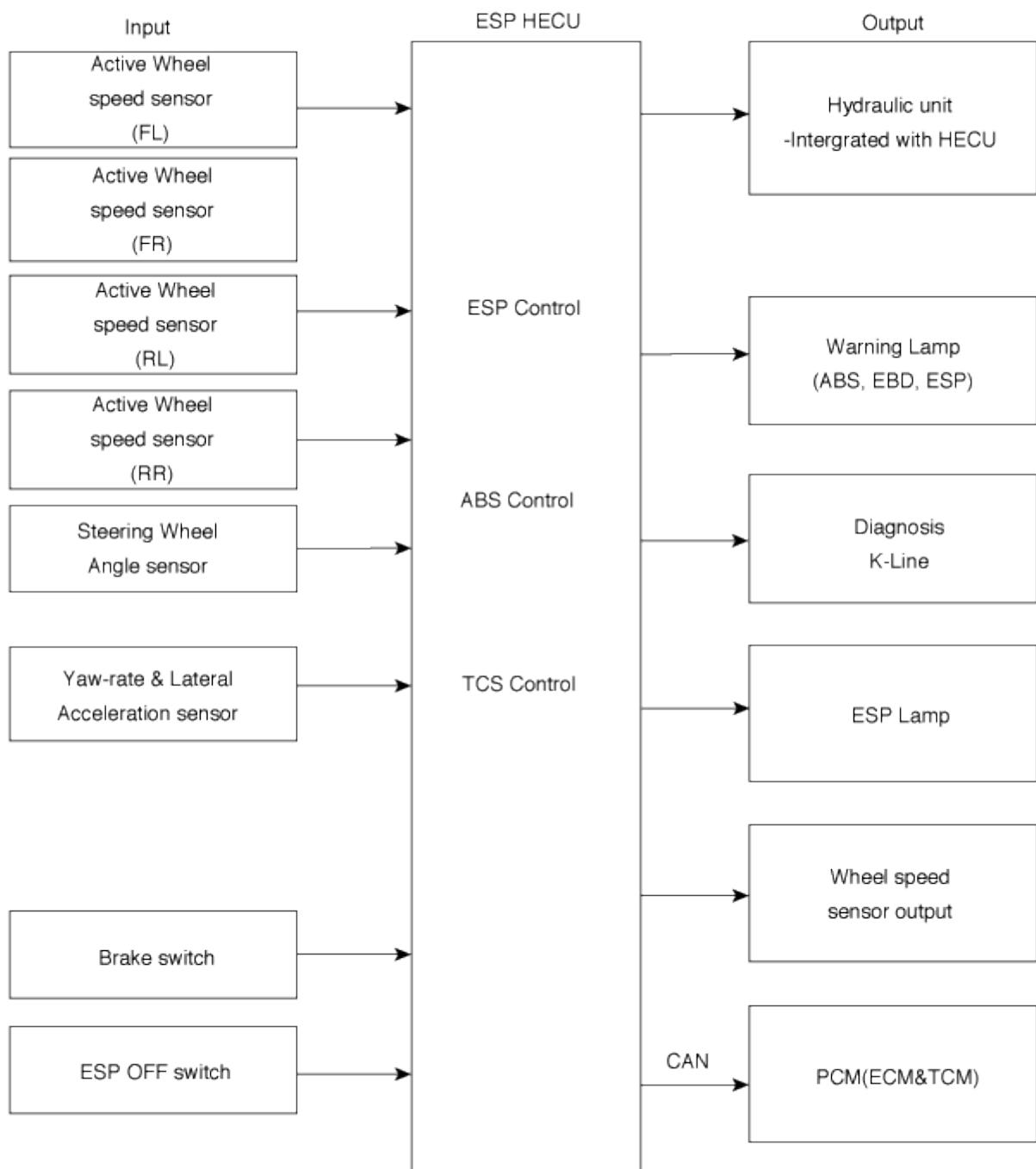
10. IGN on.

11. The variant coding is completed.

CAUTION

- If the warning lamp(ESP, EBD, ABS) is illuminated, follow the "Variant coding" again.

Input and Output Diagram



ESP Operation Mode

1. STEP 1

The ESP analyzes the intention of the driver.

Position of steering wheel
+ Vehicle speed
+ Acceleration pedal



ECU decides the intention of the driver.

2. STEP 2

It analyzes the movement of the ESP vehicle.

Vehicle rotation speed
+ Operated power to the side

ECU decides movement of the ESP vehicle.

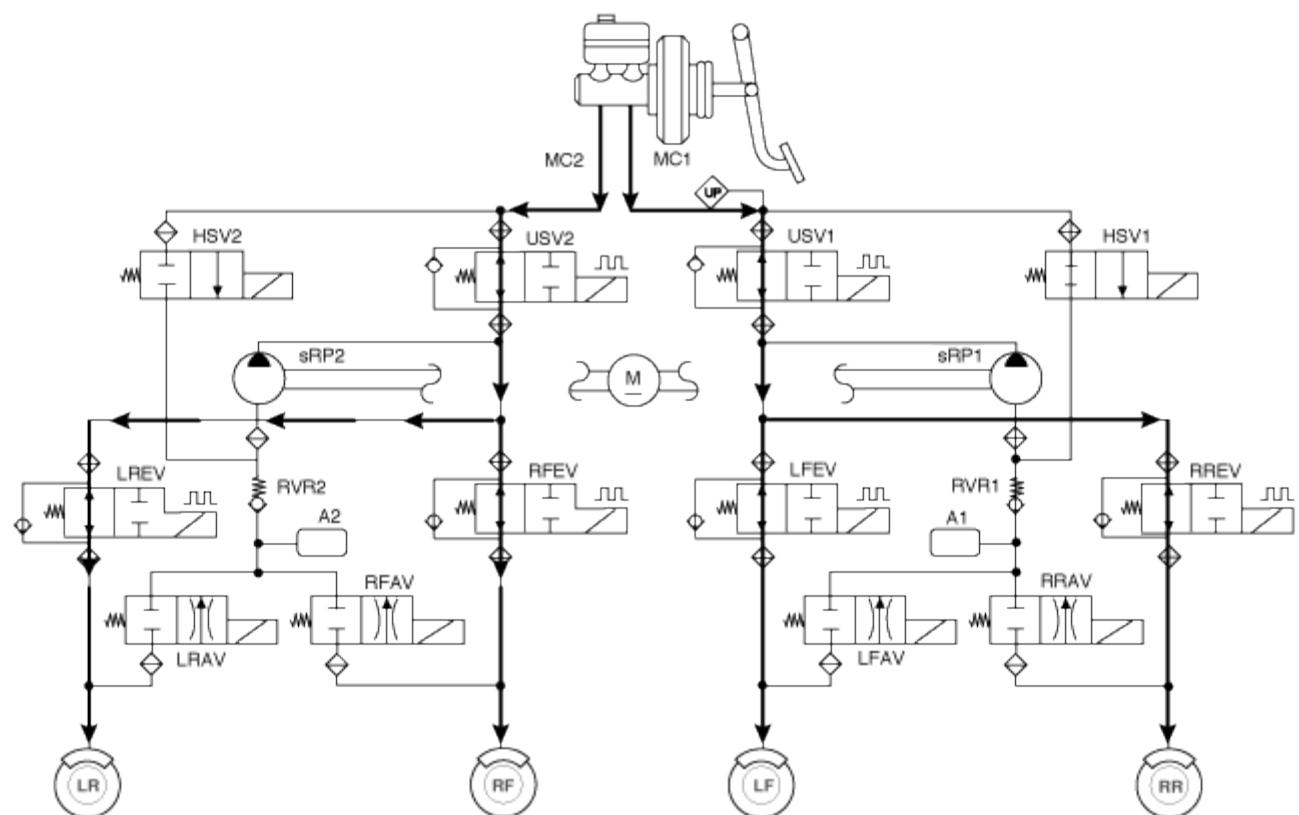
3. STEP 3

The HECU calculates the required strategy, then actuates the appropriate valves and sends torque control requests via CAN to maintain vehicle stability.

ESP Operation Mode

1. ESP Non-operation-Normal braking.

| | Inlet valve(EV) | Outlet valve(AV) | Pilot valve(USV) | High pressure switch valve(HSV) | Pump motor |
|----------------|-----------------|------------------|------------------|---------------------------------|------------|
| Normal braking | Open | Close | Open | Close | OFF |



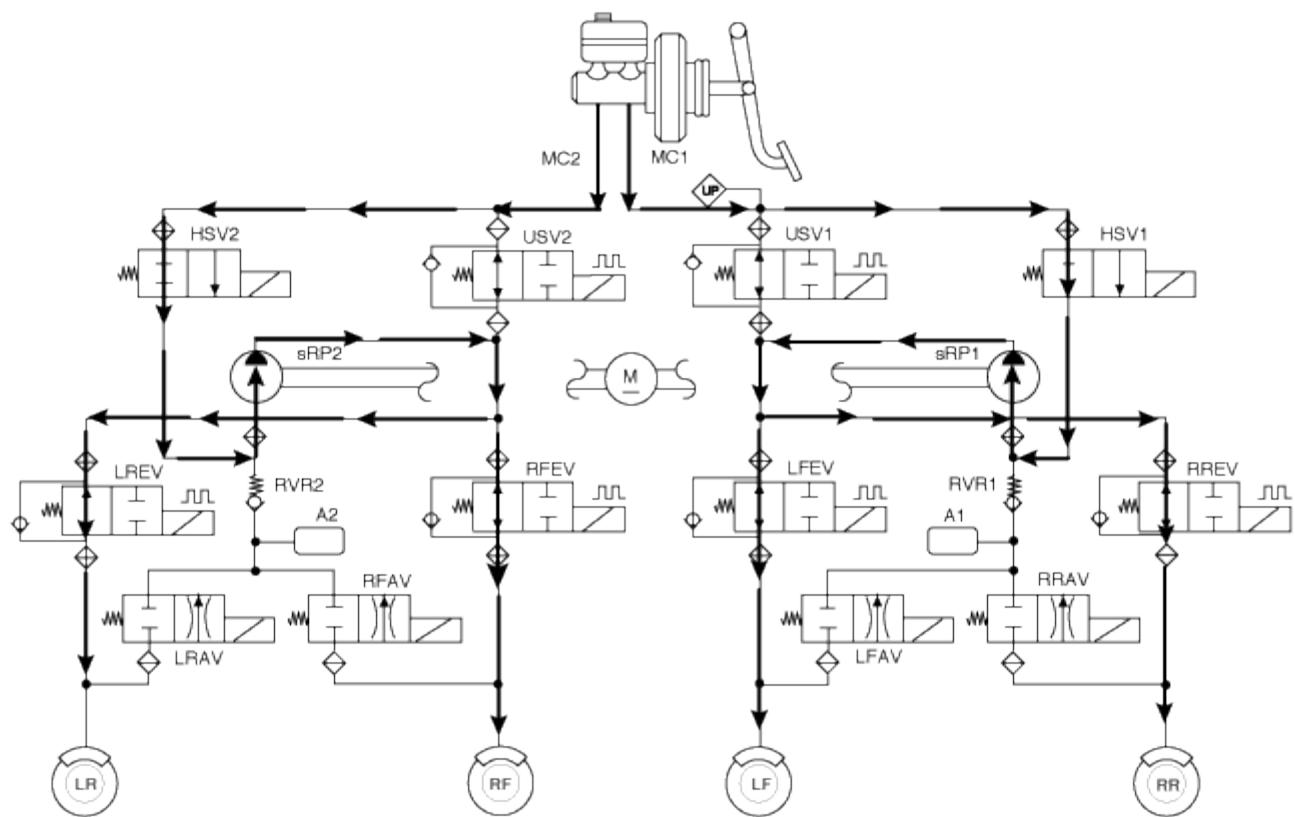
NOTE

- EV : Inlet Valve
- AV : Outlet Valve
- LR : Rear left wheel
- RF : Front right wheel
- LF : Front left wheel
- RR : Rear right wheel
- PE : Pump motor
- USV : Pilot Valve
- HSV : High pressure Switch Valve

2. ESP Increase Mode

| | Inlet valve(EV) | Outlet valve(AV) | Pilot valve(USV) | High pressure switch | Pump motor |
|--|-----------------|------------------|------------------|----------------------|------------|
| | | | | | |

| | | | | valve(HSV) | |
|----------------|------|-------|----------------|------------|-------------------------|
| Normal braking | Open | Close | Close(Partial) | Open | ON(Motor speed control) |

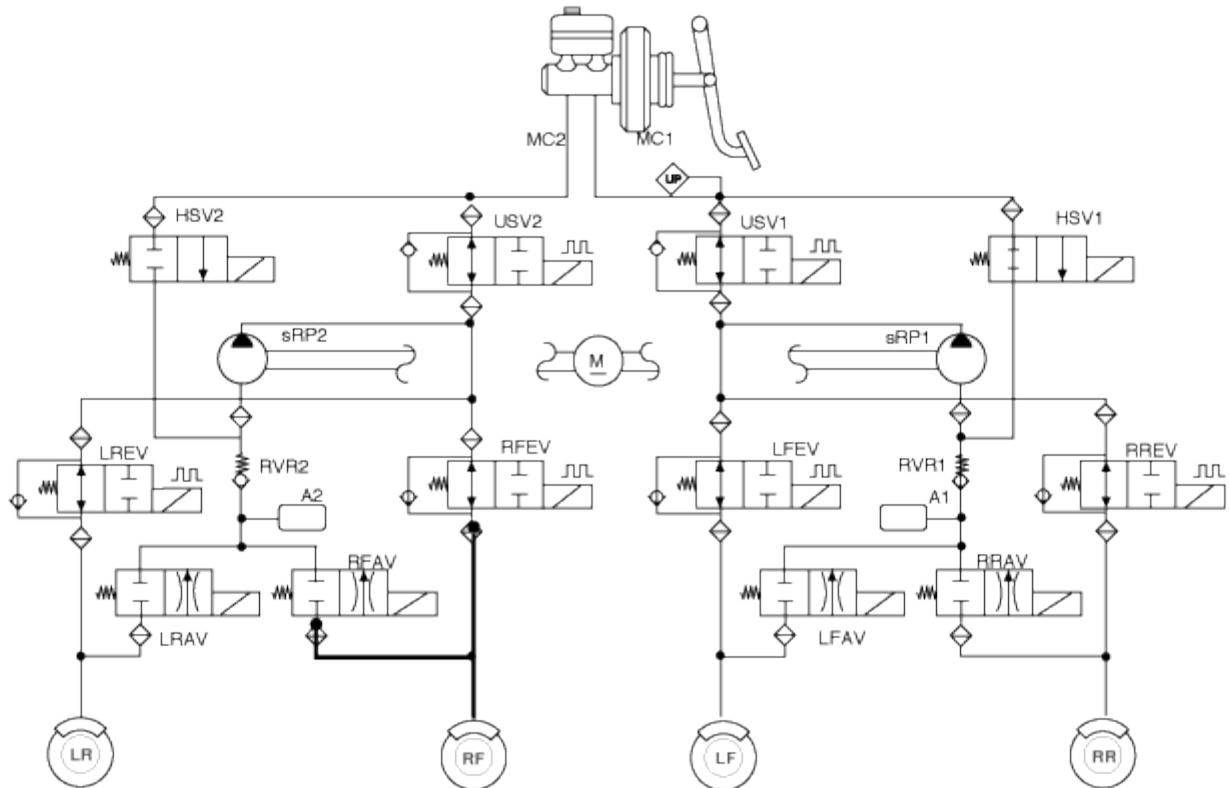


NOTE

EV : Inlet Valve
 AV : Outlet Valve
 LR : Rear left wheel
 RF : Front right wheel
 LF : Front left wheel
 RR : Rear right wheel
 PE : Pump motor
 USV : Pilot Valve
 HSV : High pressure Switch Valve

3. ESP Hold Mode (FR is only controlled.)

| | Inlet valve(EV) | Outlet valve(AV) | Pilot valve(USV) | High pressure switch valve(HSV) | Pump motor |
|----------------|-----------------|------------------|------------------|---------------------------------|------------|
| Normal braking | Close | Close | Close(Partial) | Open | OFF |

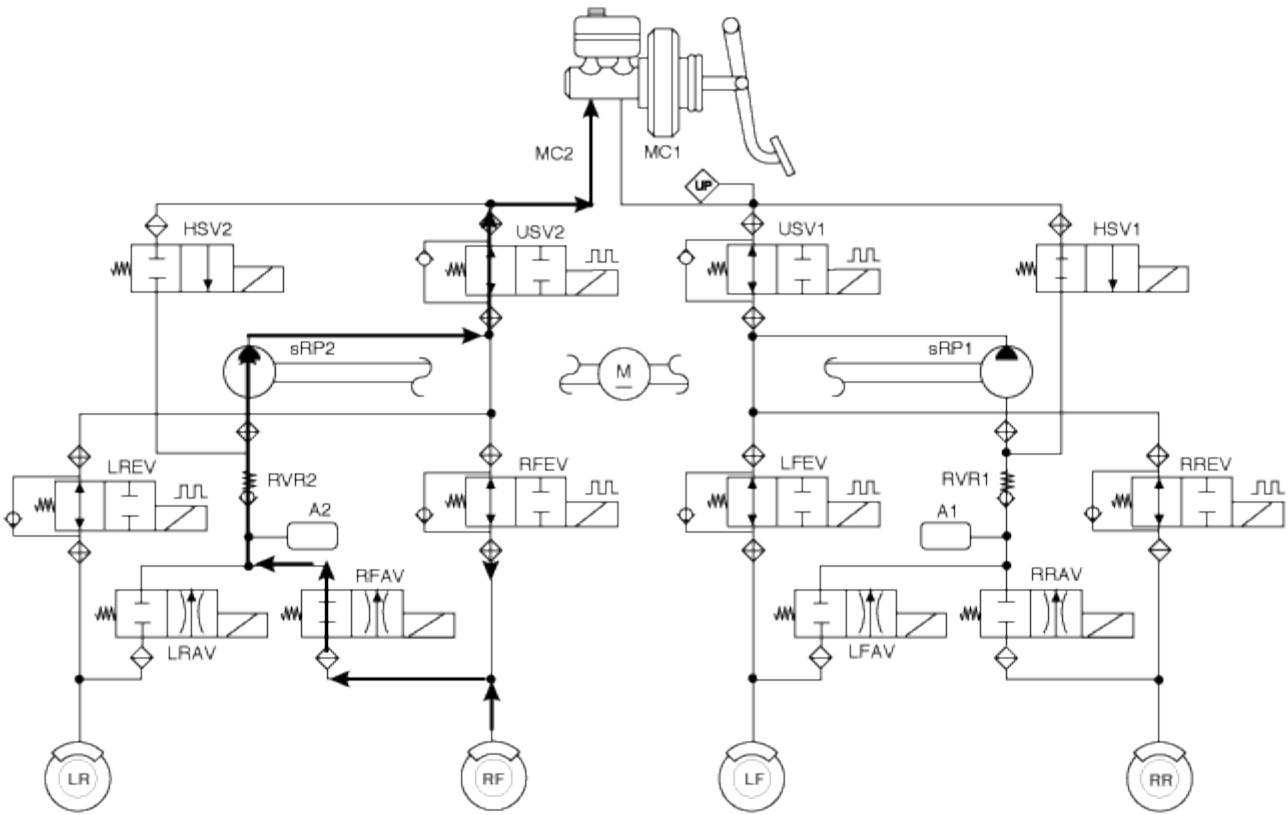


NOTE

EV : Inlet Valve
 AV : Outlet Valve
 LR : Rear left wheel
 RF : Front right wheel
 LF : Front left wheel
 RR : Rear right wheel
 PE : Pump motor
 USV : Pilot Valve
 HSV : High pressure Switch Valve

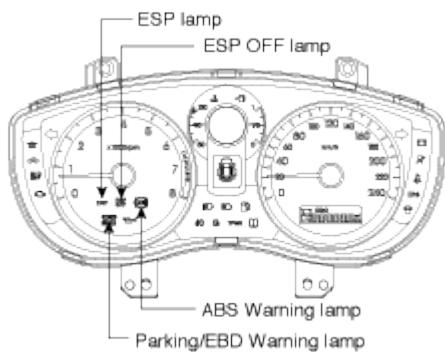
4. ESP Decrease Mode (FR is only controlled)

| | Inlet valve(EV) | Outlet valve(AV) | Pilot valve(USV) | High pressure switch valve(HSV) | Pump motor |
|----------------|-----------------|------------------|------------------|---------------------------------|-----------------------------|
| Normal braking | Close | Open | Close(Partial) | Open | ON(Motor speed low control) |



NOTE

EV : Inlet Valve
 AV : Outlet Valve
 LR : Rear left wheel
 RF : Front right wheel
 LF : Front left wheel
 RR : Rear right wheel
 PE : Pump motor
 USV : Pilot Valve
 HSV : High pressure Switch Valve



ABS Warning lamp

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

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

EBD/parking brake warning lamp

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

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

ESP OFF Lamp (ESP system)

The ESP OFF lamp indicates the self-test and ON/OFF status of the ESP.

The ESP OFF lamp operates under the following conditions :

- During the initialization phase after IGN ON. (continuously 3 seconds).
- When driver turn off the ESP function by on/off switch.

ESP Lamp (ESP system)

The ESP lamp indicates the self-test and failure status of the ESP and operating status of the ESP.

The ESP lamp is turned on under the following conditions :

- During the initialization phase after IGN ON. (continuously 3 seconds).
- In the event of inhibition of ESP functions by failure.
- During diagnostic mode.
- When the ESP control is operating. (Blinking - 2Hz)
- When the ECU connector is separated from ECU.

ESP On/Off Switch (ESP system)

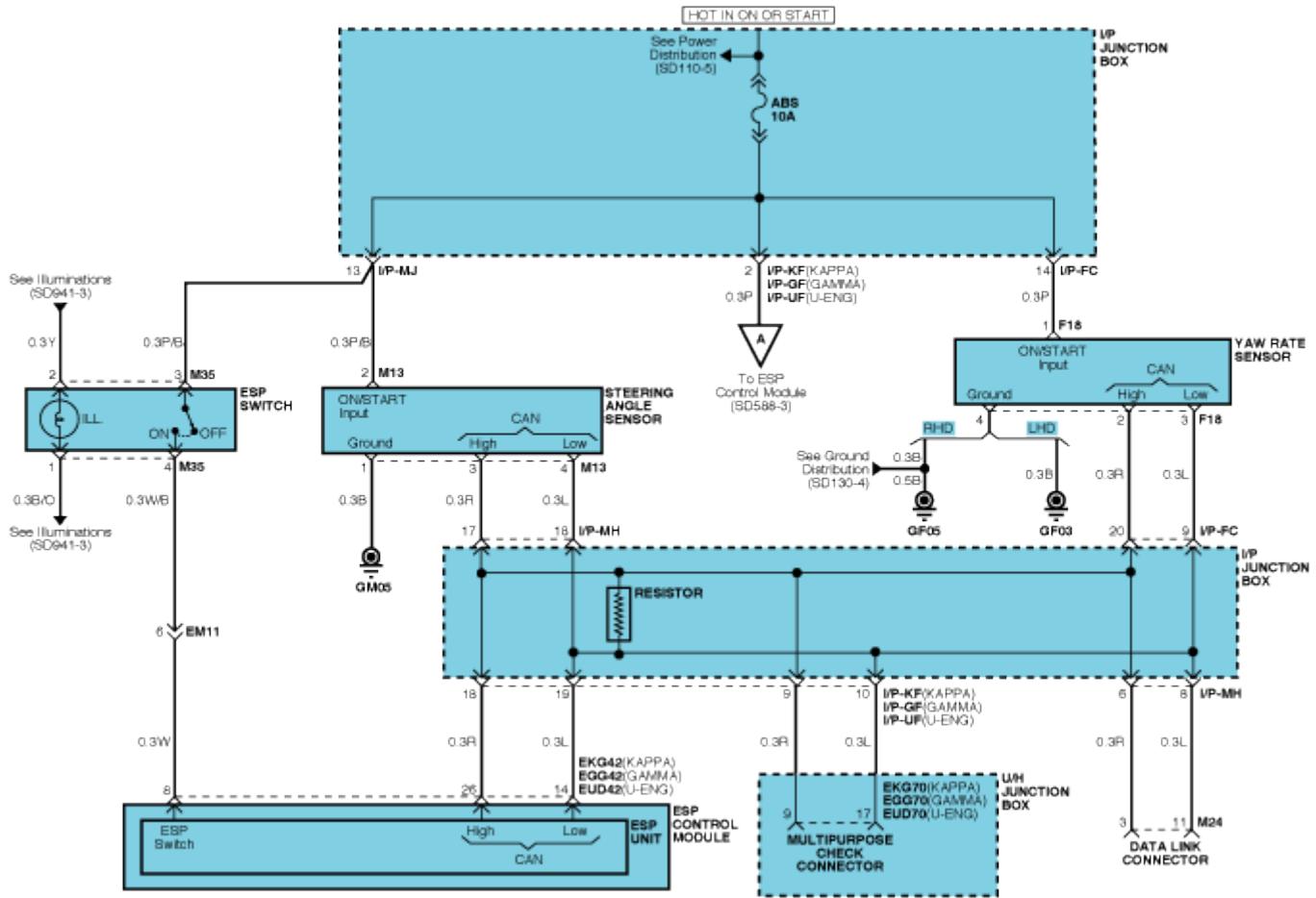
The ESP On/Off Switch shall be used to toggle the ESP function between On/Off states based upon driver input.

The On/Off switch shall be a normally open, momentary contact switch.

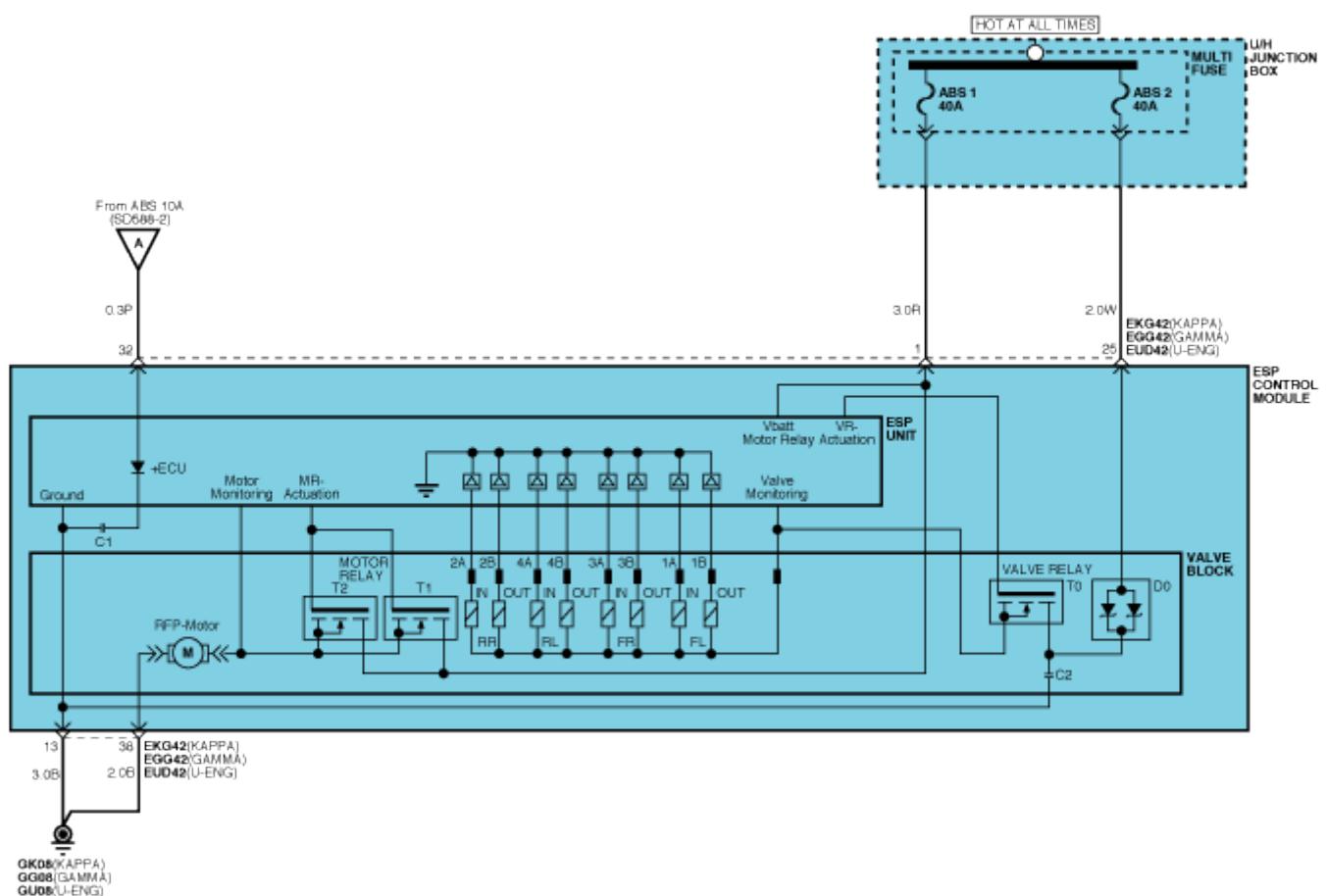
Initial status of the ESP function is on and the switch is used to request an ESC status change.

5.5.3.Schematic Diagrams

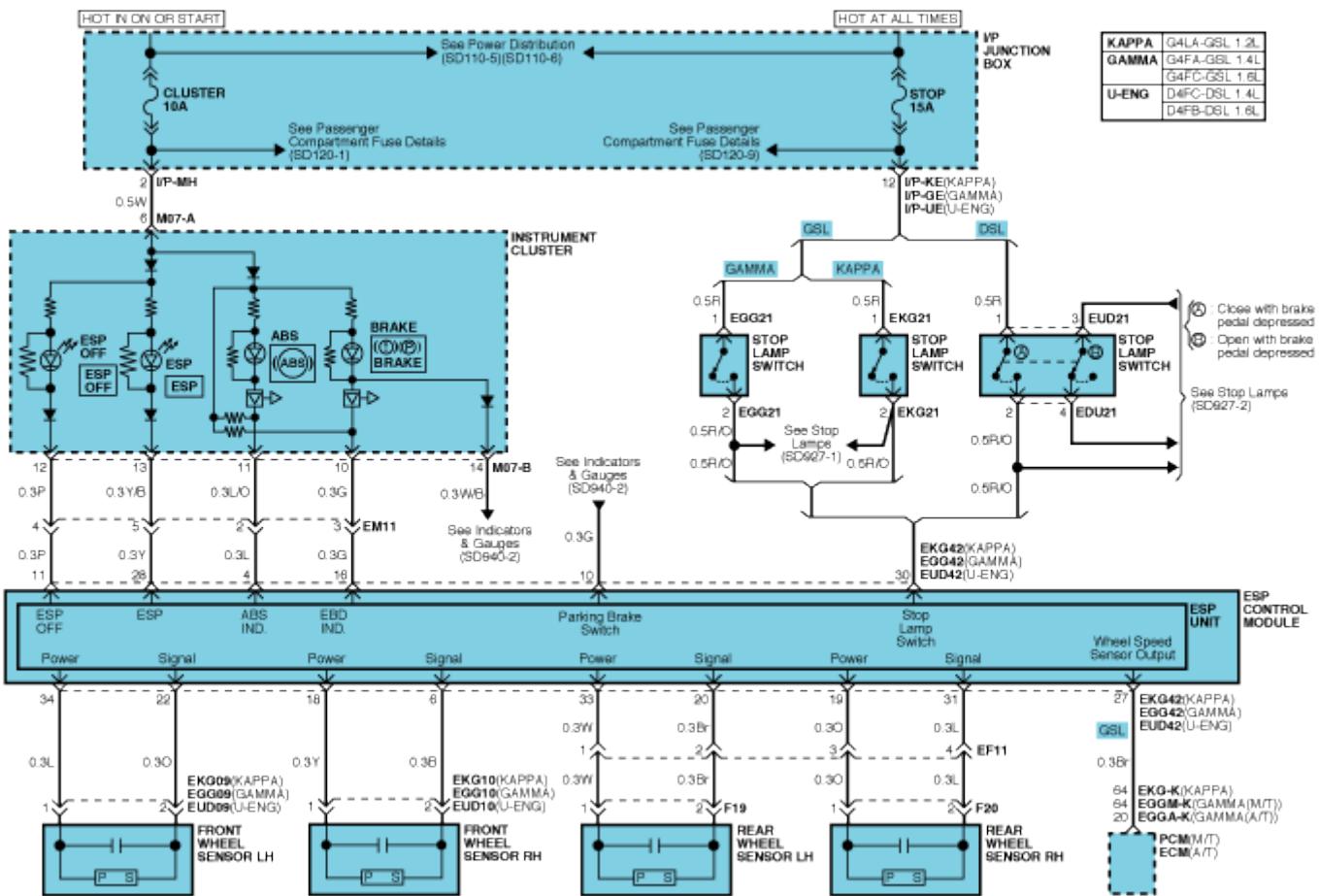
ESP Circuit Diagram(1)



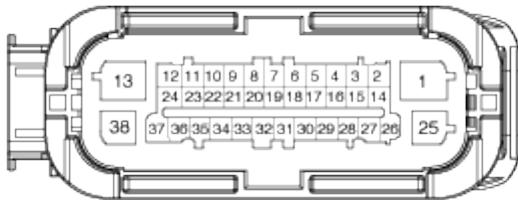
ESP Circuit Diagram(2)



ESP Circuit Diagram(3)



ESP HECU Connector input/output



| Connector Terminal | | Specifications | Conditions |
|--------------------|-----------------------|---|------------|
| No | Description | | |
| 13 | Ground(Pump) | Current range : Min-10 A
Max-20 ~ 39 A | Always |
| 38 | Ground(Valve,ECU) | Current range : Min-2.5 A
Max-5 ~ 15 A | Always |
| 1 | Supply voltage(Pump) | Battery voltage | Always |
| 25 | Supply voltage(Valve) | | |

| | | | |
|----|-------------------------------|--|---------------|
| 34 | Wheel sensor voltage(FL) | Battery voltage | IG ON |
| 18 | Wheel sensor voltage(FR) | | |
| 33 | Wheel sensor voltage(RL) | | |
| 19 | Wheel sensor voltage(RR) | | |
| 22 | Wheel sensor signal(FL) | Voltage(High) : 0.26 ~ 0.37 V
Voltage(Low) : 0.13 ~ 0.18 V | RUNNING |
| 6 | Wheel sensor signal(FR) | | |
| 20 | Wheel sensor signal(RL) | | |
| 31 | Wheel sensor signal(RR) | | |
| 32 | Ignition | Battery voltage | KEY ON/OFF |
| 8 | ESP Passive switch | Voltage(High) : 0.6 * IG ON more
Voltage(Low) : 0.4 * IG ON lower | Switch ON/OFF |
| 26 | CAN High | not communicating: 2.5 ± 0.5 V
communication : | IG ON |
| 14 | CAN Low | | |
| 30 | BRAKE LIGHT SWITCH | voltage(High) : ≥ 4.5 V
voltage(Low) : ≤ 2.0 V | BRAKE ON/OFF |
| 10 | Parking Brake Switch (Signal) | voltage(High) : ≥ 0.6 V * IG ON
voltage(Low) : ≤ 0.4 V * IG ON | |

5.5.4.Troubleshooting

Failure Diagnosis

1. In principle, ESP and TCS controls are prohibited in case of ABS failure.
2. When ESP or TCS fails, only the failed system control is prohibited.
3. However, when the solenoid valve relay should be turned off in case of ESP failure, refer to the ABS fail-safe.
4. Information on ABS fail-safe is identical to the fail-safe in systems where ESP is not installed.

Memory of fail code

1. It keeps the code as far as the backup lamp power is connected. (O)
2. It keeps the code as long as the HCU power is on. (X)

Failure Checkup

1. Initial checkup is performed immediately after the HECU power on.
2. Valve relay checkup is performed immediately after the IG2 ON.
3. It executes the checkup all the time while the IG2 power is on.

Countermeasures in fail

1. Shut the system down and perform the following actions and wait for HECU power OFF.
2. Turn the valve relay off.
3. Do not perform any ABS/TCS/ESC functions until normal operating condition is restored.

Warning lamp ON

1. ABS warning lamp turns on when ABS is malfunctioning.
2. ESP lamp turns on when ESP is malfunctioning.

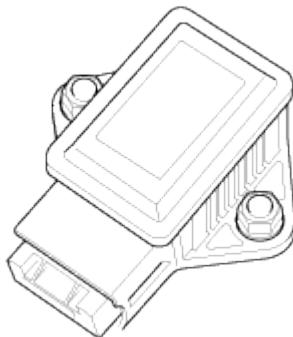
When power voltage and valve relay voltage are abnormal, input/output related failure judgment is not made.

5.5.5.Yaw-rate and Lateral G Sensor

5.5.5.1.Description and Operation

Description

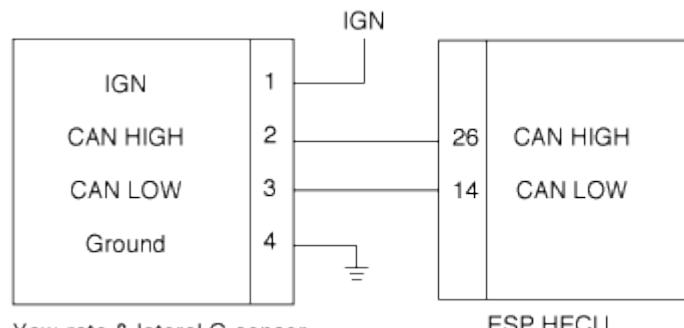
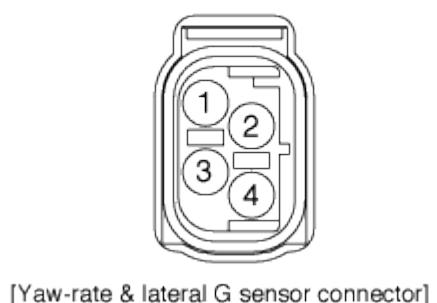
1. The yaw-rate & lateral G sensor is applied for the ESP system.
2. The yaw-rate is the angular velocity, when a vehicle turns a corner, and the lateral G is the acceleration to move a vehicle out of the way when cornering.
3. The sensor is located in the passenger seat lower floor on vehicle.



Specification

| Description | | Specification | Remark |
|-----------------------------|--|--------------------------|---------------|
| Nominal supply voltage | | 11.5 ~ 12.5 V | |
| Supply voltage range | | 8 ~ 16 V | |
| Supply current | | Max. 120 mA | |
| Operating temperature range | | -40 ~ 85°C | |
| Yaw-rate sensor | Measurement range | +w direction, left turn | Min. 100 °/s |
| | | -w direction, right turn | Min. -100 °/s |
| | Non-linearity | | -1 ~ 1 % |
| | Offset (within life, within operating temperature) | | 3.5 °/S |
| | Upper cut-off frequency | | Min. 45 Hz |
| Lateral G sensor | Measurement range | +y direction, left turn | Min. 1.8 g |
| | | -y direction, right turn | Min. -1.8 g |
| | Non-linearity | | -4 ~ 4 % |
| | Offset (within life, within operating temperature) | | -0.1 ~ 0.1 g |
| | Upper cut-off frequency | | Min. 15 Hz |

Circuit Diagram (Yaw-rate & Lateral G Sensor)



5.5.6.ESP OFF Switch

5.5.6.1.Description and Operation

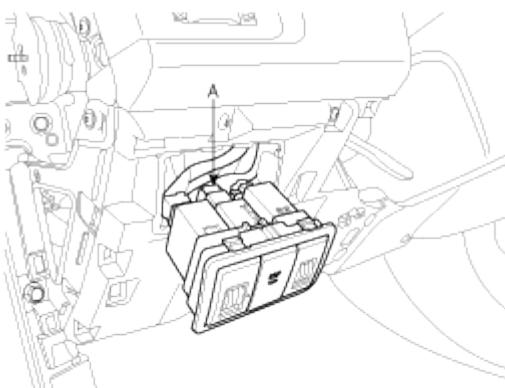
Description

1. The ESP OFF switch is for the user to turn off the ESP system.
2. The ESP OFF lamp is on when ESP OFF switch is engaged.

5.5.6.2. Repair procedures

Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the lower side crash pad swith assembly by using the trim remover tool.
3. Disconnect the "ESP OFF" switch connector (A).



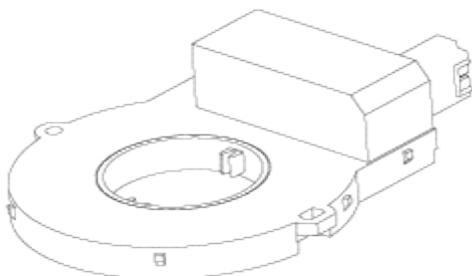
4. Check the continuity between the switch terminals as the ESP OFF switch is engaged. (Refer to circuit diagram)

5.5.7.Steering Angle Sensor

5.5.7.1.Description and Operation

Description

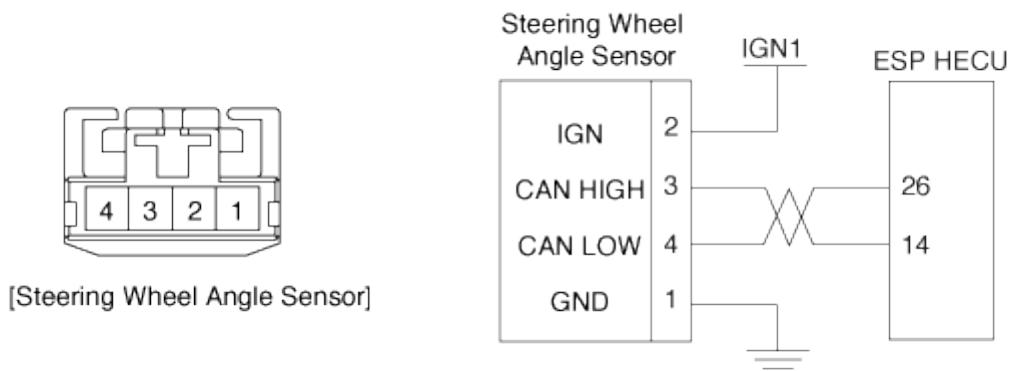
Steering Wheel Angle Sensor detects rotating direction of the vehicle. Rotating direction detected by the sensor is communicated with HECU as CAN signal involving information about the angle through CAN communication line.
HECU detects speed of the steering wheel handling and the angle with this CAN signal. HECU also uses this signal as the input signal to control anti-roll.



Specification

| Description | Specification |
|-----------------------|---------------|
| Operating voltage | 8 ~ 16V |
| Operating temperature | -40 ~ 85°C |
| Current consumption | Max.150mA |
| Measuring range | -780 ~ 779.9° |

Circuit Diagram



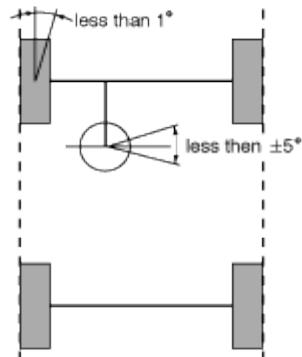
Calibration (Setting up the zero angle)

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 Sensor
- Replacement or repair of the Steering column
- Detection of DTC codes (C1260, C1261)
- Replacement of the sensor cluster
- Replacement of HECU

Calibration procedure

Perform wheel alignment and stand the steering wheel in a line within $\pm 5^\circ$ error.



1. Connect the scan tool.(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. ESP lights ESP warning lamp when making an error in comparison with values of other sensors. 50

6.Clutch System

6.1. General Information

6.1.1. Specifications

Specifications

Item

Specification

| | |
|--|---|
| Clutch operation method | Hydraulic type |
| Clutch disc
Type
Facing diameter (outside x inside)mm (in) | Single dry with diaphragm
• Gasoline 1.2 : Ø190 x Ø130 (Ø7.5 x Ø5.1)
• Gasoline 1.4/1.6 : Ø215 x Ø145 (Ø8.5 x Ø5.7)
• Diesel 1.4/1.6 : Ø240 x Ø155 (Ø9.4 x Ø6.1) |
| Clutch cover assembly
Type | Diaphragm spring strap |
| Clutch release cylinder
* I.D. mm (in) | 20.64 (0.81) |
| Clutch master cylinder
* I.D. mm(in) | 15.87 (0.62) |

* I.D: Inside diameter

Service Standard

| Item | Standard value |
|--|---|
| Clutch disc thickness [When free] | Gasoline 1.2 : 7.9 ± 0.3 mm (0.311 ± 0.012 in)
Gasoline 1.4/1.6 : 8.35 ± 0.3 mm (0.329 ± 0.012 in)
Diesel 1.4/1.6 : 8.3 ± 0.3 mm (0.327 ± 0.012 in) |
| Clutch pedal height [With carpet] | 173 mm (6.81 in) |
| Clutch pedal free play | 6 ~ 13 mm (0.24 ~ 0.51 in) |
| Clutch pedal stroke | Gasoline : 140 ± 3mm (5.5 ± 0.12 in)
Diesel : 150 ± 3mm (5.9 ± 0.12 in) |
| | Limit |
| Clutch disc rivet depth | 1.1 mm (0.043 in) |
| Diaphragm spring end height difference | 0.5 mm (0.02 in) |
| Clutch master cylinder clearance to piston | 0.15 mm (0.006 in) |

Tightening Torques

| Item | Nm | kgf.m | lb·ft |
|--|---------------|-----------|-------------|
| Clutch pedal to pedal support member
(Clutch pedal bracket) | 17 ~ 26 | 1.7 ~ 2.6 | 12.3 ~ 18.8 |
| Clutch pedal support member to master cylinder | 6 ~ 8 | 0.6 ~ 0.8 | 4.3 ~ 5.8 |
| Clutch tube flare nut | 13 ~ 17 | 1.3 ~ 1.7 | 9.4 ~ 12.3 |
| Clutch tube bracket | 8~ 10 | 0.8 ~ 1.0 | 5.8 ~ 7.2 |
| Clutch release cylinder | 15 ~ 22 | 1.5 ~ 2.2 | 10.8 ~ 15.9 |
| Clutch release cylinder union bolt | 25 ~ 35 | 2.5 ~ 3.5 | 18.1 ~ 25.3 |
| Clutch cover assembly | Gasoline(6ea) | 15 ~ 22 | 10.8 ~ 15.9 |
| | Diesel(9ea) | 12 ~ 15 | 8.7 ~ 10.8 |
| Ignition lock switch nut | 8 ~ 10 | 0.8 ~ 1.0 | 5.8 ~ 7.2 |

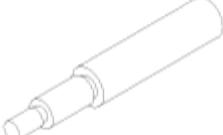
Lubricants

| Items | Specified lubricants | Quantity |
|---|----------------------|-------------|
| Contact surface of release bearing and fulcrum of clutch release fork | CASMOLY L9508 | As required |

| | | |
|--|---|-------------|
| Inner surface of clutch release bearing | CASMOLY L9508 | As required |
| Inner surface of clutch release cylinder and outer circumference of piston and cup | Brake fluid DOT 3 or DOT 4 | As required |
| Inner surface of clutch disc spline | CASMOLY L9508 | As required |
| Inner surface of clutch master cylinder and outer circumference of piston assembly | Brake fluid DOT 3 or DOT 4 | As required |
| Clutch master cylinder push rod, clevis pin and washer | Wheel bearing grease SAE J310, NLGI No.2V | As required |
| Clutch pedal shaft and bushings | Chassis grease SAE J310a, NLGI No.1 | As required |
| Contact portion of release fork to release cylinder push rod | CASMOLY L9508 | As required |
| Input shaft spline | CASMOLY L9508 | As required |

6.1.2. Special Service Tool

Special Service Tools

| Tool (Number and name) | Illustration | Use |
|----------------------------------|---|----------------------------------|
| 09411-11000
Clutch disc guide |  | Installation of the clutch disc. |

6.1.3. Troubleshooting

| Troubleshooting | | |
|---|--|--------------------------|
| Trouble symptom | Suspect area | Remedy |
| Clutch slipping <ul style="list-style-type: none"> • Car will not respond to engine speed during acceleration • Insufficient vehicle speed • Lack of power during uphill driving | Insufficient pedal free play | Adjust |
| | Clogged hydraulic system | Correct or replace parts |
| | Excessive wear of clutch disc facing | Replace |
| | Hardened clutch disc facing, or oil on surface | Replace |
| | Damaged pressure plate or flywheel | Replace |
| | Weak or broken pressure spring | Replace |
| Difficult gear shifting (gear noise during shifting) | Excessive pedal free play | Replace |
| | Hydraulic system fluid leaks, air trapping or clogging | Repair or replace parts |
| | Unusual wear or corrosion of the clutch disc spline | Replace |
| | Excessive vibration (distortion) of the clutch disc | Replace |
| Clutch noisy <ul style="list-style-type: none"> When the clutch is not used A noise is heard after the clutch is disengaged A noise is heard when the clutch is disengaged | Insufficient play of the clutch pedal | Adjust |
| | Excessive wear of the clutch disc facing | Replace |
| | Unusual wear and/ or damage of the release bearing | Replace |
| | Insufficient grease on the sliding surface of the bearing sleeve | Repair |
| | Improperly installed clutch assembly or bearing | Repair |

| | | |
|---------------------------------|--|----------------------------------|
| Hard pedal effort | Insufficient lubrication of the clutch pedal | Repair |
| | Insufficient lubrication of the spline part of clutch disc | Repair |
| | Insufficient lubrication of the clutch release lever shaft or fork | Repair |
| Hard to shift or will not shift | Excessive clutch pedal free play | Replace |
| | Faulty of the clutch release cylinder | Repair the release cylinder |
| | Clutch disc out of place, runout is excessive or lining broken | Inspect the clutch disc |
| | Spline on the input shaft or clutch disc dirty or burned | Repair as necessary |
| | Faulty of the clutch pressure plate | Replace the clutch cover |
| Clutch slips | Insufficient clutch pedal free play | Adjust the pedal free play |
| | Clogged of the hydraulic system | Repair or replace parts |
| | Clutch disc lining oily or worn out | Inspect the clutch disc |
| | Faulty pressure plate | Replace the clutch cover |
| | Binding of the release fork | Inspect the release fork |
| Clutch grabs/chatters | Clutch disc lining oily or worn out | Inspect the clutch disc |
| | Faulty the pressure plate | Replace the clutch cover |
| | Bent clutch diaphragm spring | Replace the clutch cover |
| | Worn or broken torsion spring | Replace the clutch disc |
| | Engine mounts loose | Repair as necessary |
| Clutch noisy | Damaged the clutch pedal bushing | Replace the clutch pedal bushing |
| | Loose part inside housing | Repair as necessary |
| | Worn or dirty release bearing | Replace the rerelease bearing |
| | Sticking release fork or linkage | Repair as necessary |

6.2. Clutch System

6.2.1. Repair procedures

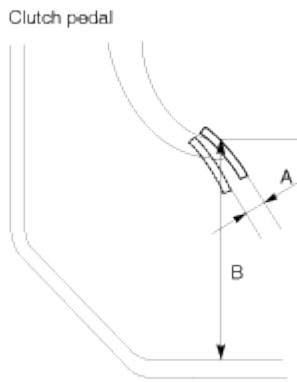
Service Adjustment Procedure

Clutch Pedal Inspection And Adjustment

1. Measure the clutch pedal height (from the face of the pedal pad to the floorboard) and the clutch pedal clevis pin play (measured at the face of the pedal pad.)

Standard value

Free play (A) : 6~13mm (0.24~0.51 in)
 Height (B) : 173mm (6.81 in)



Bleeding

Whenever the clutch tube, the clutch hose, and/or the clutch master cylinder have been removed, or if the clutch pedal is spongy, bleed the system.

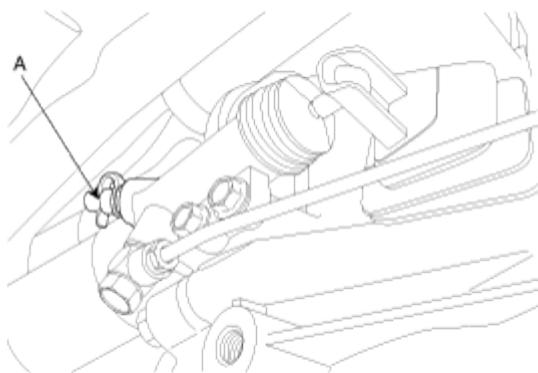
CAUTION

Use the specified fluid. Avoid mixing different brands of fluid.

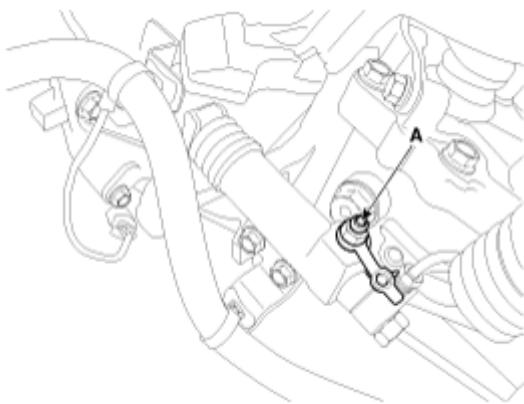
Specified fluid : SAE J1703 (DOT 3 or DOT 4)

1. Loosen the bleeder screw (A) at the clutch release cylinder.

[M5CF]



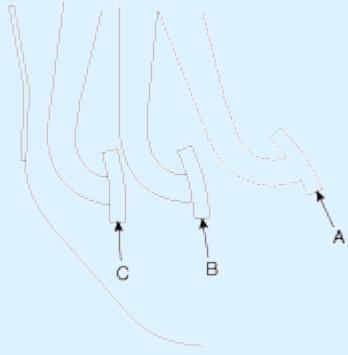
[M5EF2]



2. Depress the clutch pedal slowly until all air is expelled.
3. Hold the clutch pedal down until the bleeder is retightened.
4. Refill the clutch master cylinder with the specified fluid.

CAUTION

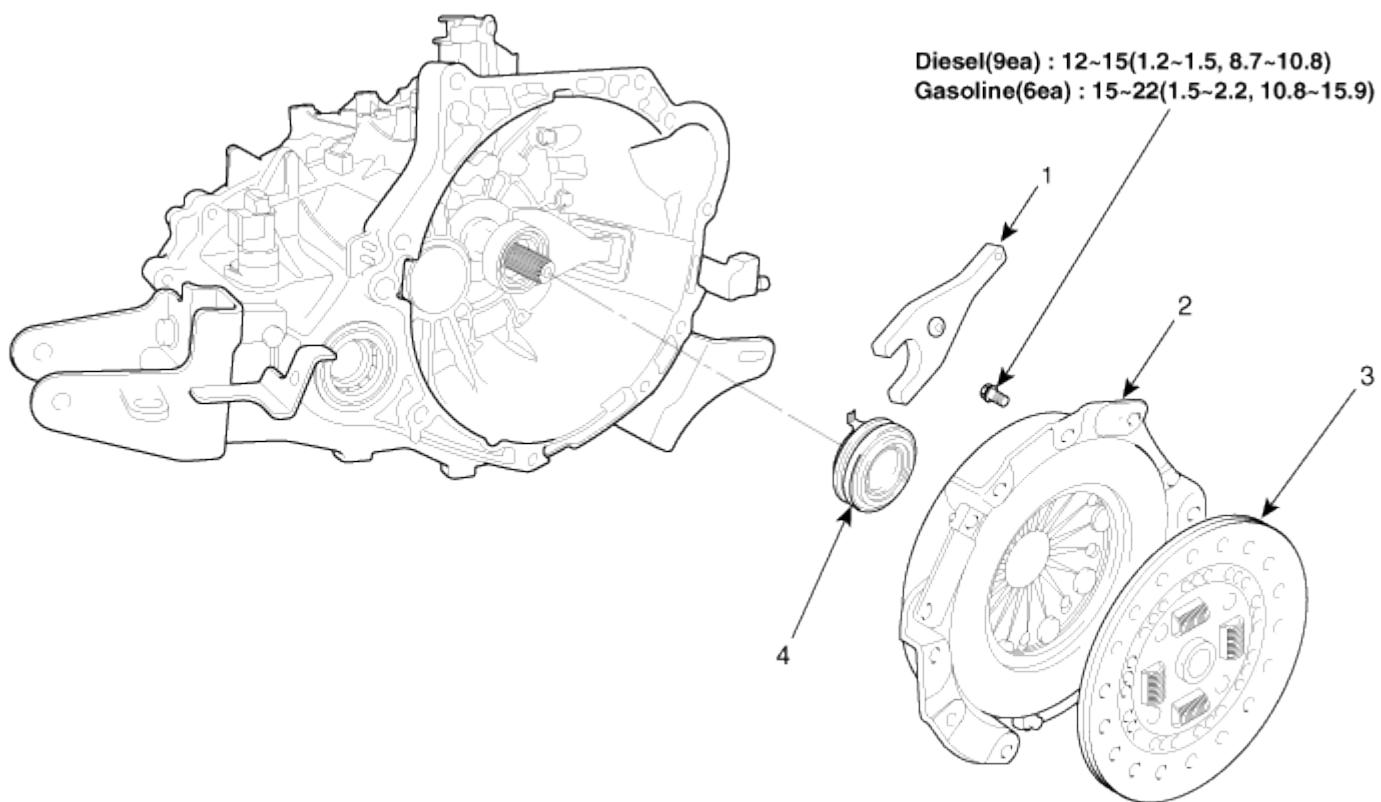
The rapidly-repeated operation of the clutch pedal in B-C range may disrupt the release cylinder's position. During the bleeding operation, press the clutch pedal to the floor after it returns to the "A" point.



6.2.2. Clutch Cover And Disc

6.2.2.1. Component and Components Location

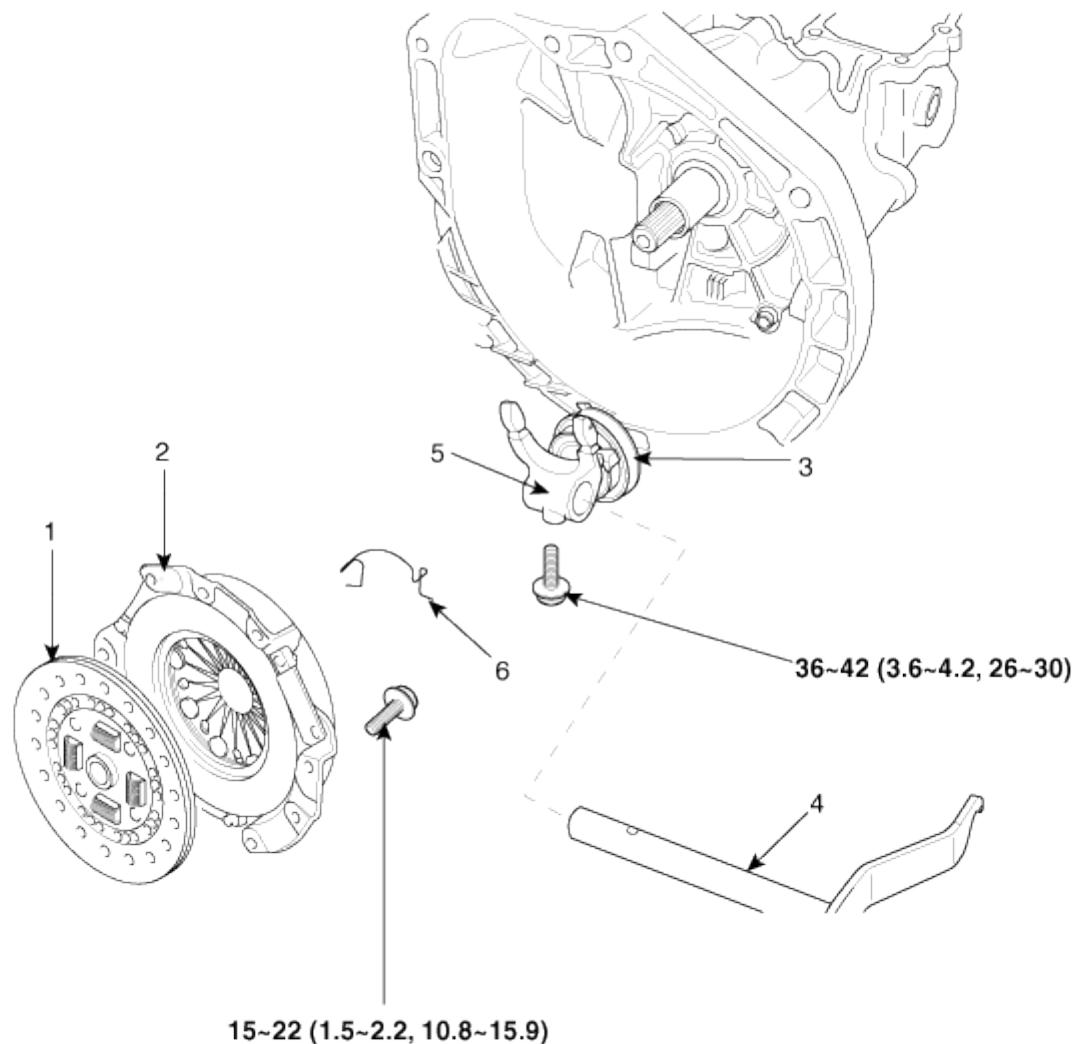
Components (1)



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

| | |
|--|--|
| 1. Clutch release fork
2. Clutch cover assembly | 3. Clutch disk assembly
4. Clutch release bearing |
|--|--|

Components (2)



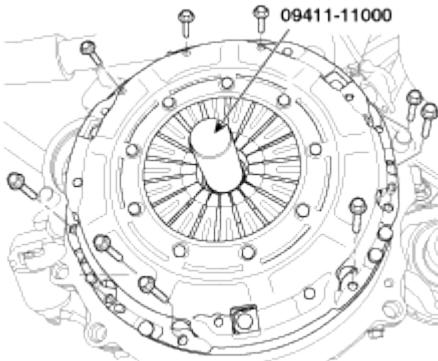
Torque : Nm (kgf.m, lb-ft)

| | |
|---------------------------|----------------------------------|
| 1. Clutch disc assembly | 4. Clutch release lever assembly |
| 2. Clutch cover assembly | 5. Clutch release fork |
| 3. Clutch release bearing | 6. Return clip |

6.2.2.2. Repair procedures

Removal

1. Remove the transaxle assembly. (Refer to Manual transaxle's removal in MT group)
2. Insert the special tool (09411-11000) in the clutch disc to prevent the disc from shifting.



3. Loosen the bolts(Gasoline : 6ea, Diesel : 9ea) which attach the clutch cover to the flywheel in a star pattern. Loosen the bolts in succession, one or two turns at a time, to avoid bending the cover.

NOTE

Do not clean the clutch disc or the release bearing with cleaning solvent.

Inspection

Clutch cover assembly

1. Check the diaphragm spring end for wear and uneven height.
2. Check the pressure plate surface for wear, cracks and color change.
3. Check the rivets for looseness and replace the clutch cover assembly if necessary.

Clutch disc

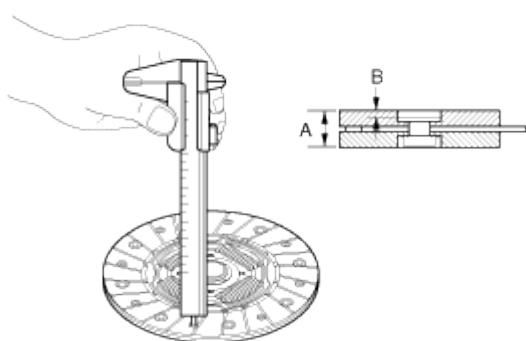
1. Check the clutch facing for loose rivets, uneven contact, deterioration due to seizure, adhesion of oil, or grease, and replace the clutch disc if defective.
2. Measure the thickness of the disc when free.

Standard value

Clutch disc thickness(A)[when free]

Clutch disc rivet depth(B)

: refer to 'SERVICE STANDARD' in GENERAL section.



3. Check for the torsion spring play and damage and if defective, replace the clutch disc.

4. Clean the splines on the input shaft and install the clutch disc.

If the disc does not slide smoothly or if play is excessive, replace the clutch disc and/or the input shaft.

Clutch release bearing

CAUTION

The release bearing is packed with grease. Do not use cleaning solvent or oil.

Standard grease : CASMOLY L9508

1. Check the bearing for seizure, damage or abnormal noise. Also check the diaphragm spring contacting points for wear.
2. Replace the bearing if the release fork contacting points are worn abnormally.

Clutch release fork

If there is abnormal wear at the point of contact with the bearing, replace the release fork assembly.

Installation

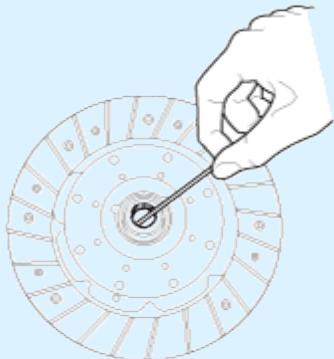
1. Apply multipurpose grease to the spline of the disc.

Grease: CASMOLY L 9508

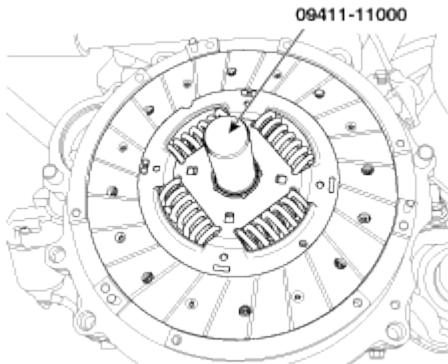
CAUTION

When installing the clutch, apply grease to each part, but be careful not to apply excessive grease.

It can cause clutch slippage and vibration (shudder).



2. Temporarily install the clutch disc assembly to the flywheel using the special tool (09411-11000).



3. Tighten the bolts one or two steps at a time in a star pattern.

[GASOLINE]

Tightening torque

: 15 ~ 22 Nm (1.5 ~ 2.2 kgf.m, 10.9 ~ 16.0 lb-ft)

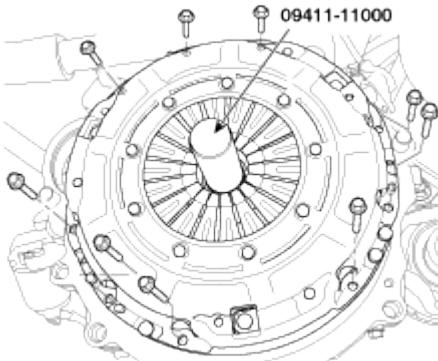
[DIESEL]

Tightening torque

: 12 ~ 15 Nm (1.2 ~ 1.5 kgf.m, 8.7 ~ 10.9 lb-ft)

Tightening torque

: 15 ~ 22 Nm (1.5 ~ 2.2 kgf.m, 10.9 ~ 16.0 lb-ft)

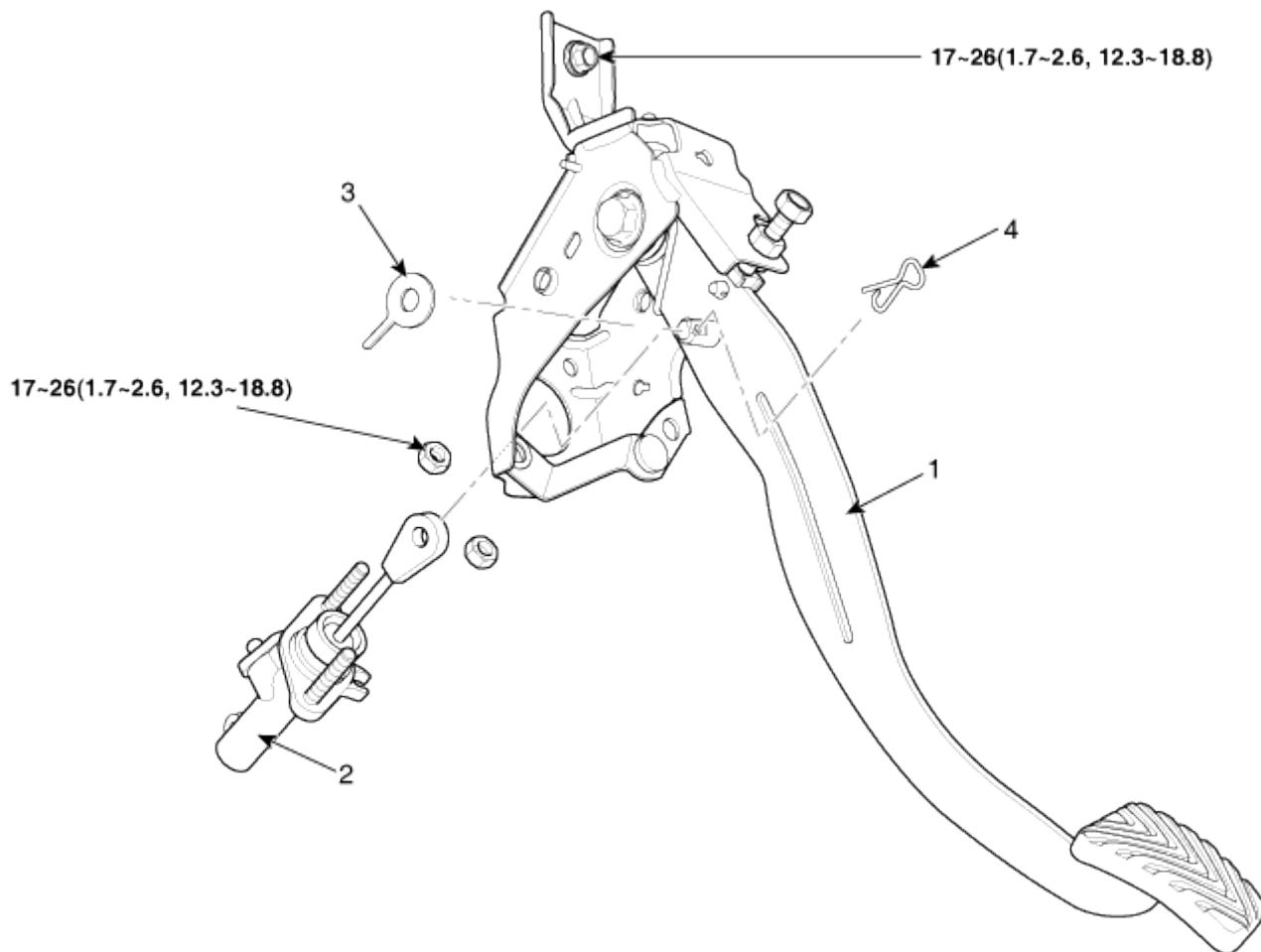


4. Remove the clutch disc guide (09411-11000).
5. Install the transaxle assembly to the engine. (Refer to Manual transaxle's installation in MT group)

6.2.3. Clutch Master Cylinder

6.2.3.1. Component and Components Location

Components



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

| | |
|--|--------------------------|
| 1. Clutch pedal assembly
2. Clutch master cylinder assembly | 3. Washer
4. Snap pin |
|--|--------------------------|

311

6.2.3.2. Repair procedures

Removal

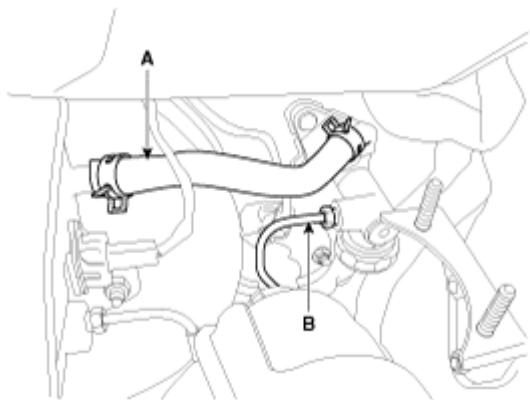
1. Remove the flexible hose (A) connected to brake reserve tank from the master cylinder.

[LHD]

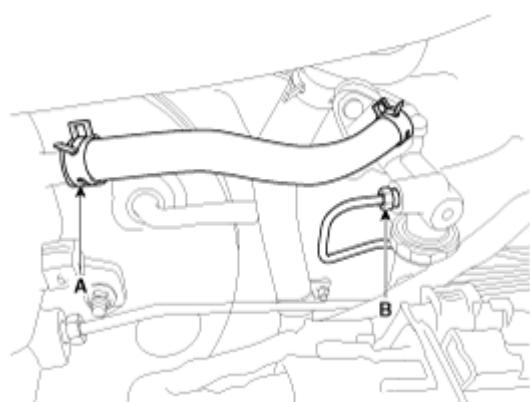
NOTE

In advance remove the ECU and battery.

Put aside the fuel pump by disconnecting the connectors and remove the mounting nuts.



[RHD]



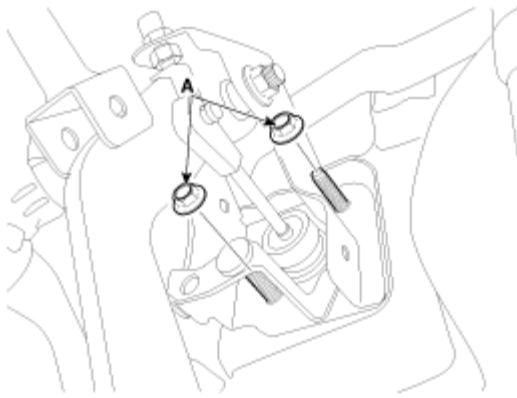
2. Disconnect the clutch tube (B) from the master cylinder.

3. Remove the clutch pedal mounting nuts (A-2ea).

[LHD]



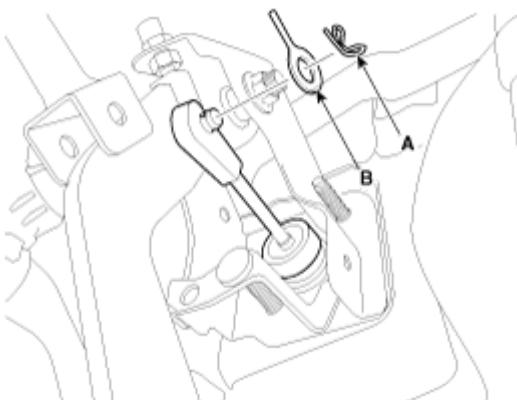
[RHD]



4. Disconnect the push rod from the master cylinder by removing the snap pin (A) and washer (B).
[LHD]



[RHD]



Disassembly

1. Remove the piston stop ring.
2. Pull out the push rod and piston assembly.
3. Remove the reserve tank band, reserve tank cap, and reserve tank.

NOTE

Use care not to damage the master cylinder body and piston assembly.

Do not disassemble the piston assembly.

Inspection

1. Check the inside of the cylinder body for rust, pitting or scoring.
2. Check the piston cup for wear or distortion.
3. Check the piston for rust, pitting or scoring.
4. Check to make sure the clutch line tube is not clogged or restricted in any way.
5. Measure the master cylinder inside diameter and the piston outside diameter with a cylinder gauge micrometer.

NOTE

Measure the inside diameter of the master cylinder at three places (bottom, middle, and top) in a perpendicular direction.

6. If the master cylinder-to-piston clearance exceeds the limit, replace the master cylinder and/or piston assembly.

Limit : 0.15 mm (0.006 in)

Reassembly

1. Apply the specified fluid to the inner surface of the master cylinder body and to the entire periphery of the piston assembly.

Specified fluid : Brake fluid DOT 3 or DOT 4

2. Install the piston assembly.
3. Install the piston snap ring.
4. Install the push rod assembly.

Installation

1. Apply the specified grease to the snap pin and washer.

Wheel bearing grease : SAE J310, NLGI No.2

2. Install the clutch pedal mounting nuts (A-2ea).

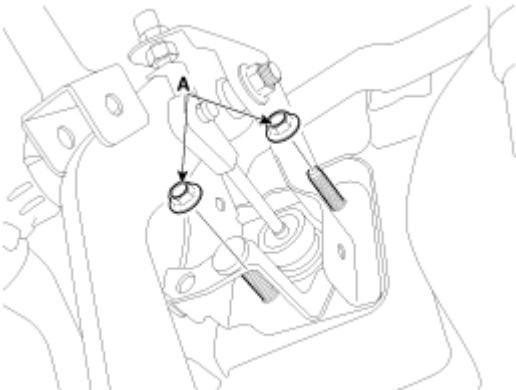
Tightening torque

: 17 ~ 26Nm (1.7 ~ 2.6kgf.m, 12.3 ~ 18.8lb-ft)

[LHD]

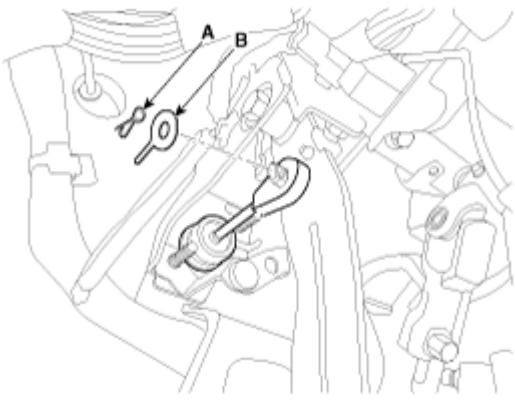


[RHD]

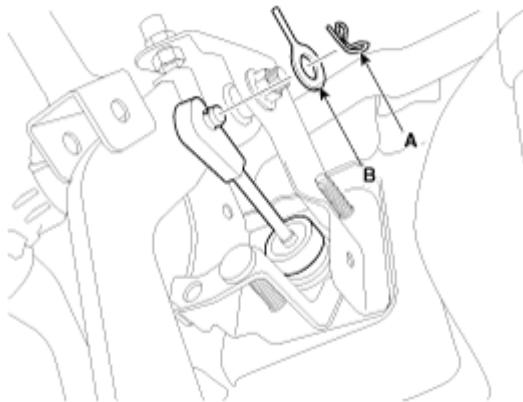


3. Connect the push rod to the clutch pedal by installing the snap pin (A) and washer (B).

[LHD]



[RHD]

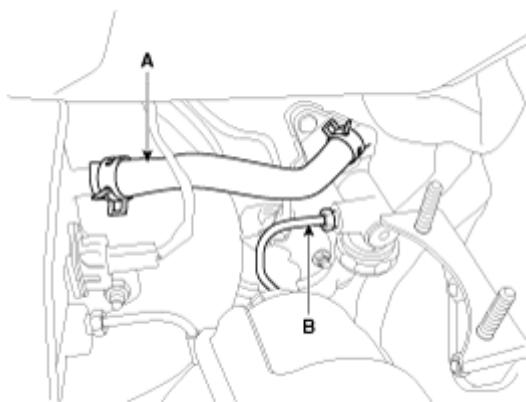


4. Connect the flexible hose (A) of the brake reserve tank to the master cylinder.

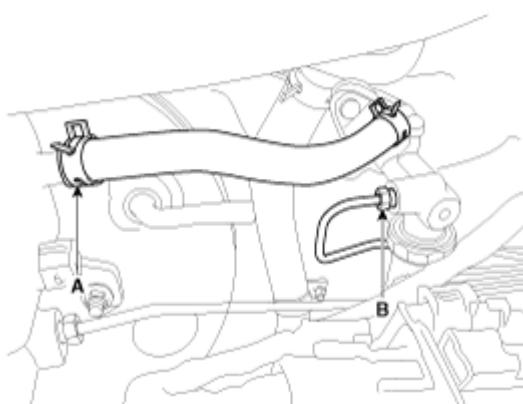
[LHD]

NOTE

Install the fuel pump, battery, and the ECU in order.



[RHD]



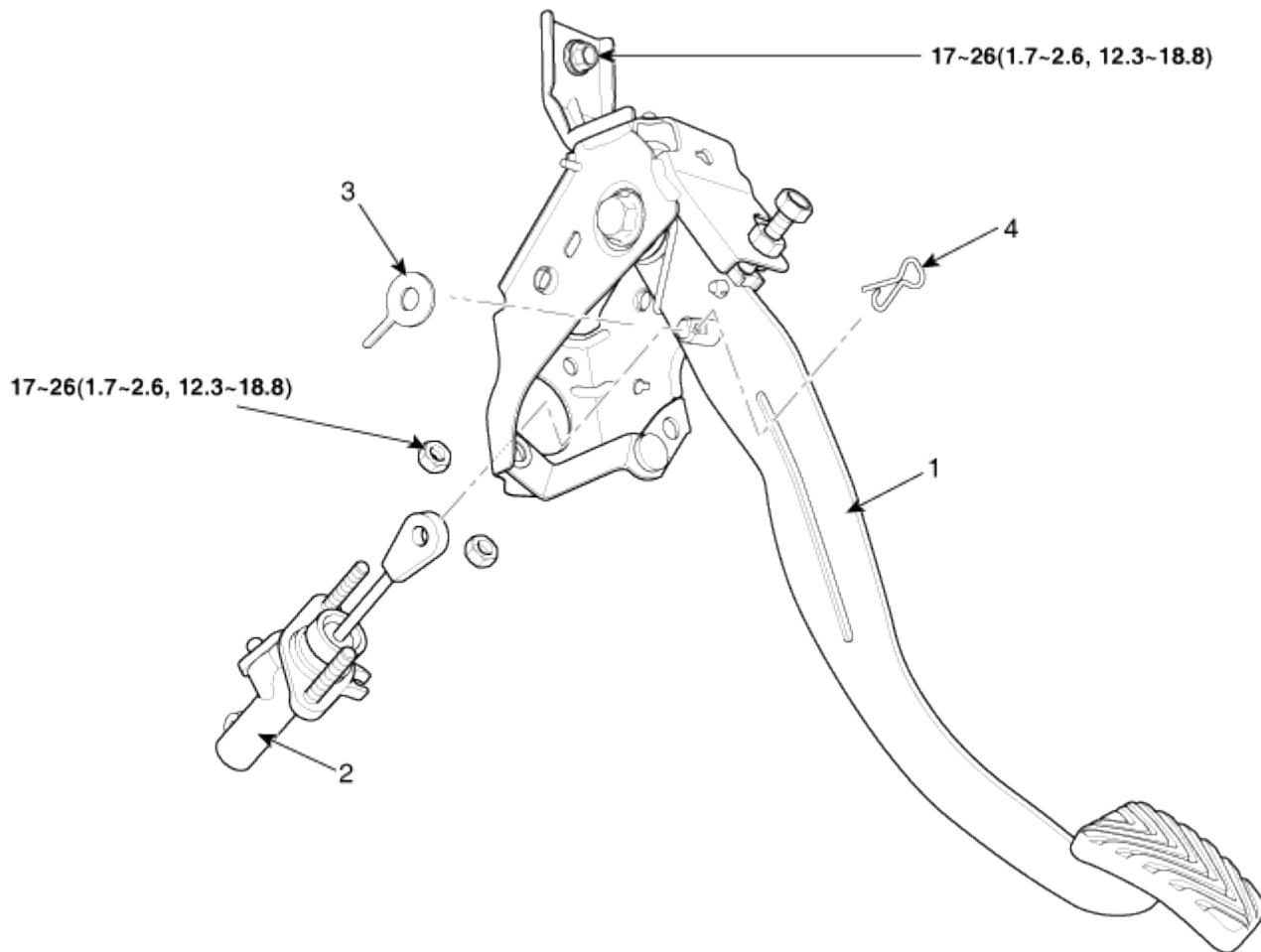
5. Connect the clutch tube (B) to the master cylinder.

6. Bleed the air in the clutch system.(refer to Bleeding in Servive Adjustment Procedure)

6.2.4. Clutch Pedal

6.2.4.1. Component and Components Location

Components



Torque : Nm (kgf.m, lb·ft)

| | |
|------------------------------------|-------------|
| 1. Clutch pedal assembly | 3. Washer |
| 2. Clutch master cylinder assembly | 4. Snap pin |

6.2.4.2. Repair procedures

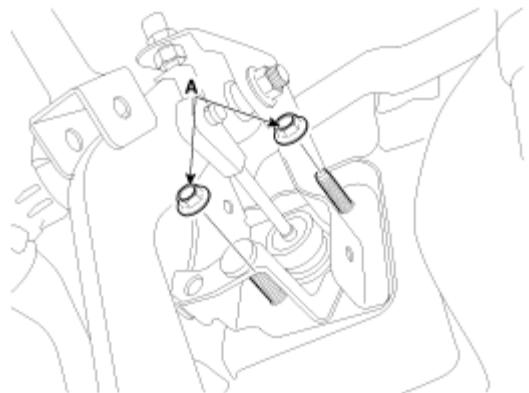
Removal

1. Remove the clutch pedal bracket bolt from the body.
2. Remove the clutch pedal mounting nuts (A-2ea).

[LHD]

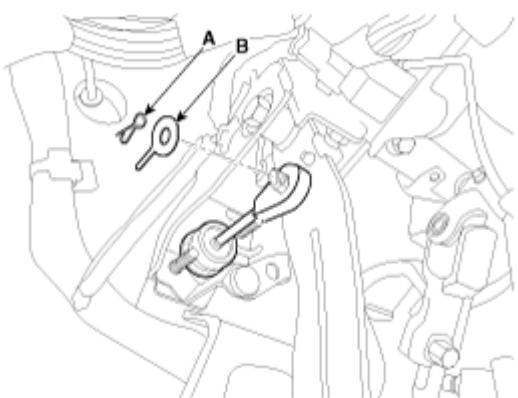


[RHD]

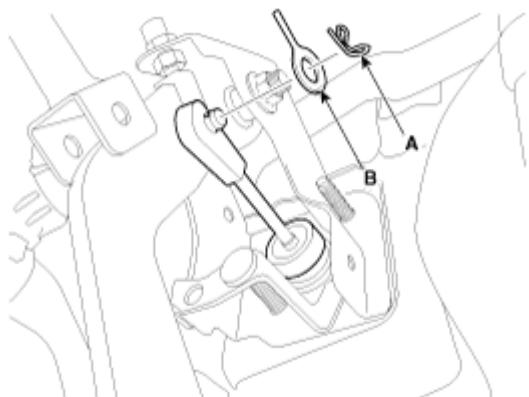


3. Disconnect the push rod from the master cylinder by removing the snap pin (A) and washer (B).

[LHD]



[RHD]



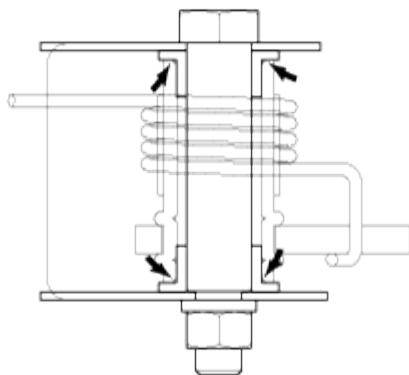
Inspection

1. Check the pedal shaft and bushing for wear.
2. Check the clutch pedal for bending or torsion.
3. Check the return spring for damage or deterioration.
4. Check the pedal pad for damage or wear.

Installation

1. Apply the specified grease to the clutch pedal and bushings.

Chassis grease : SAE J310a, NLGI No.1



2. Apply the specified grease to the snap pin and washer.

Wheel bearing grease : SAE J310, NLGI No.2

3. Install the clutch pedal mounting nuts (A-2ea).

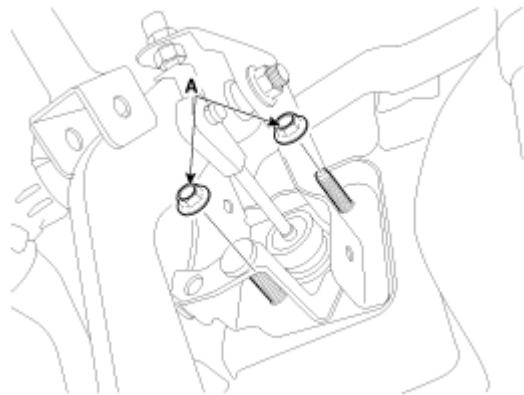
Tightening torque

: 17 ~ 26Nm (1.7 ~ 2.6kgf.m, 12.3 ~ 18.8lb-ft)

[LHD]

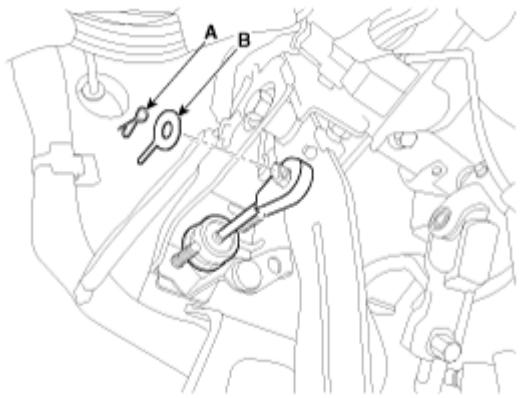


[RHD]

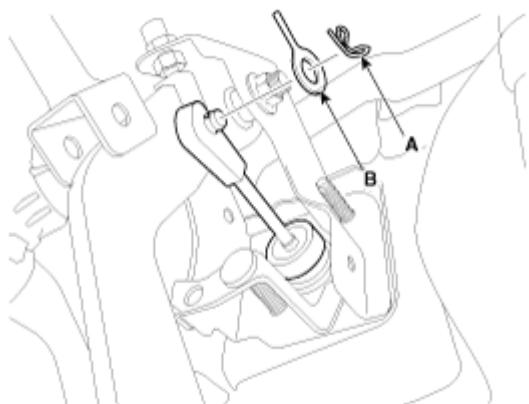


4. Connect the push rod to the clutch pedal by installing the snap pin (A) and washer (B).

[LHD]



[RHD]

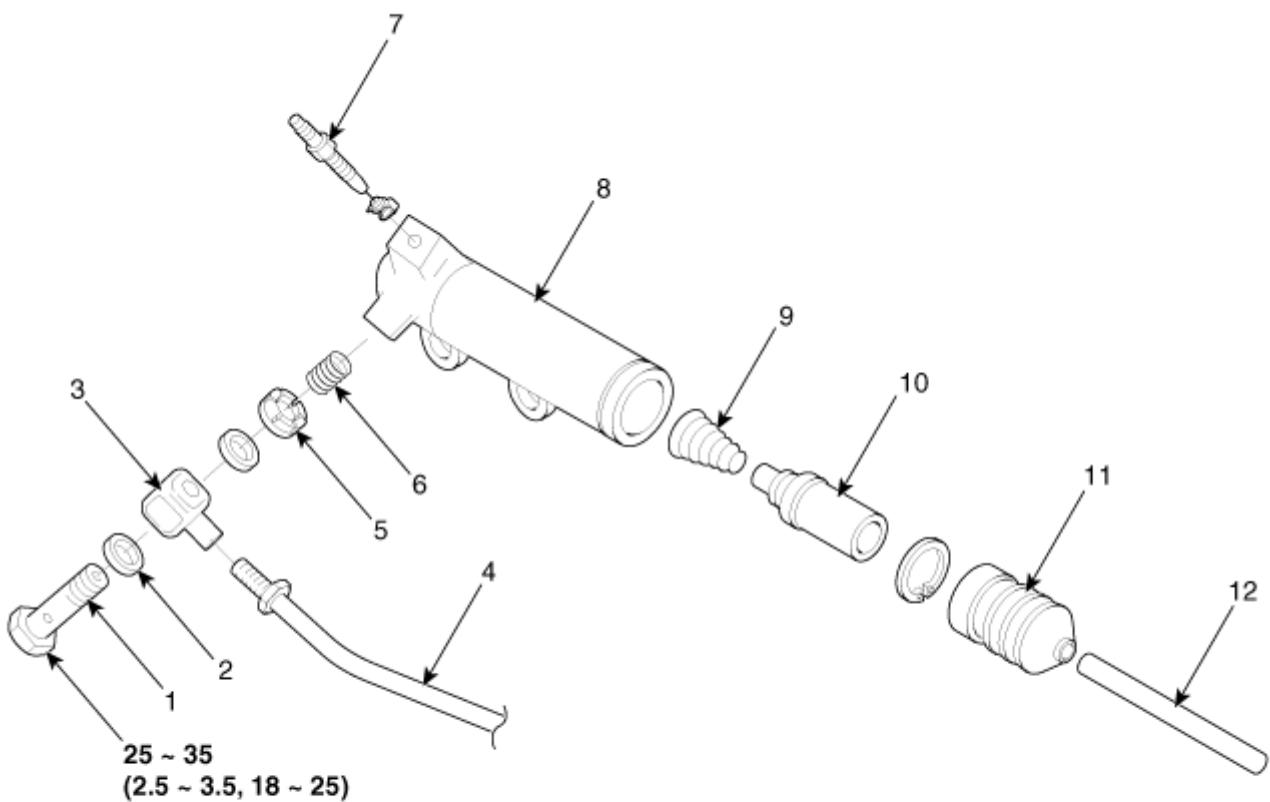


5. Install the clutch pedal bracket bolt to the body.

6.2.5. Clutch Release Cylinder

6.2.5.1. Component and Components Location

Components



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

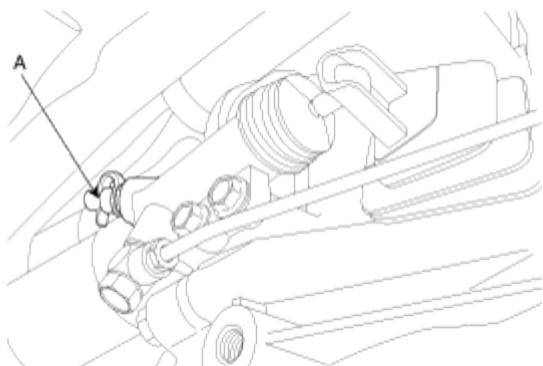
| | |
|-----------------|---------------------|
| 1. Union bolt | 7. Bleeder screw |
| 2. Gasket | 8. Release cylinder |
| 3. Tube joint | 9. Return spring |
| 4. Clutch tube | 10. Piston |
| 5. Valve plate | 11. Boot |
| 6. Valve spring | 12. Push rod |

6.2.5.2. Repair procedures

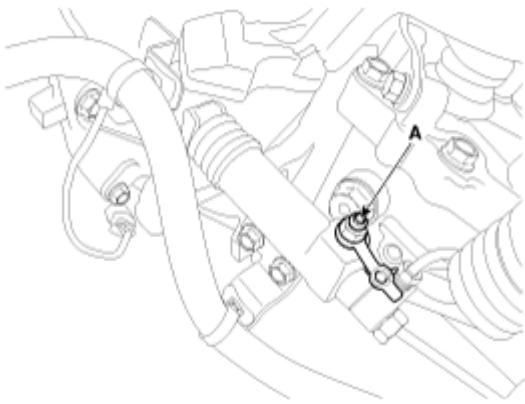
Removal

1. Drain the brake fluid through the bleed plug (A).

[M5CF]

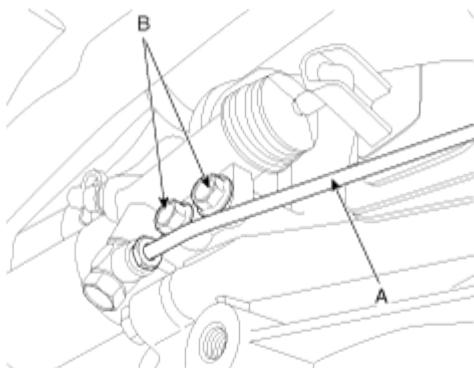


[M5EF2]

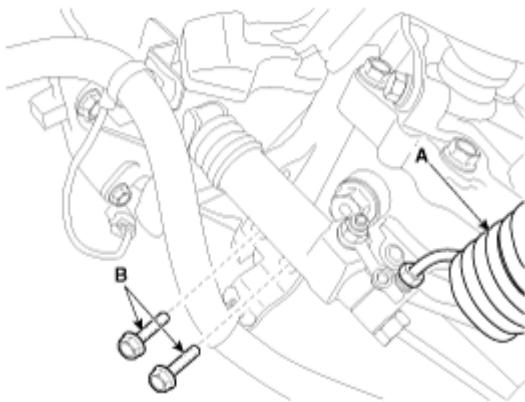


2. Disconnect the clutch tube (A).

[M5CF]



[M5EF2]



3. Remove the two clutch release cylinder mounting bolts (B-2ea).

Inspection

1. Check the release cylinder bore for rust and damage.
2. Check the clutch release cylinder for fluid leakage.
3. Check the clutch release cylinder boots for damage.

Installation

1. Coat the clutch clevis push rod specified grease.

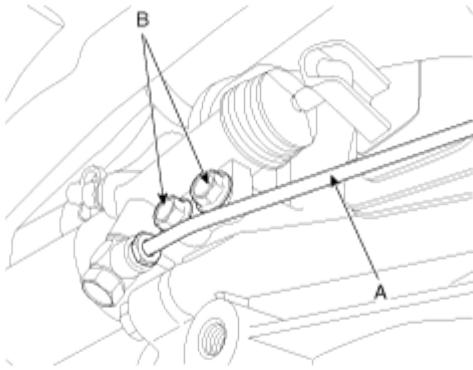
Specified grease : CASMOLY L9508

2. Install the release cylinder mounting bolts (B-2ea).

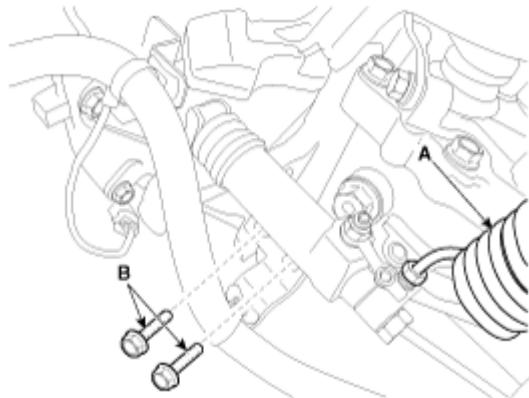
Tightening torque

: 15 ~ 22Nm (1.5 ~2.2 kgf.m, 10.8 ~ 15.9 lb-ft)

[M5CF]



[M5EF2]



3. Install the clutch tube (A).

4. Bleed the air in the clutch system. (Refer to Bleeding in Service Adjustment Procedure)

7. Driveshaft and axle

7.1. General Information

7.1.1. Specifications

Specification

| Engine | T/M | Joint Type | | Max. Permissible angle | |
|--------------|-------|------------|-------|------------------------|-------|
| | | Outer | Inner | Outer | Inner |
| K Engine | MT | BJ | TJ | 45° | 23° |
| Gamma Engine | MT/AT | BJ | TJ | 45° | 23° |
| U Engine | M/T | BJ | TJ | 45° | 23° |

Tightening torques

| Item | Nm | Kgf.m | lb·ft |
|---------------------------|---------------|-------------|---------------|
| Hub nuts | 90 ~ 110 | 9.0 ~ 11.0 | 65 ~ 80 |
| Driveshaft lock nut | 240.2 ~ 269.6 | 24.5 ~ 27.5 | 177.2 ~ 198.9 |
| Strut assembly to knuckle | 100 ~ 120 | 10.0 ~ 12.0 | 72 ~ 87 |
| Lower arm to knuckle | 60 ~ 72 | 6.0 ~ 7.2 | 43 ~ 52 |
| Tie rod end castle nut | 16 ~ 34 | 1.6 ~ 3.4 | 12 ~ 25 |
| Front caliper to knuckle | 80 ~ 100 | 8.0 ~ 10.0 | 58 ~ 72 |
| Rear caliper to carrier | 65 ~ 75 | 6.5 ~ 7.5 | 47 ~ 54 |

| | | | |
|------------------------------|---------|-----------|---------|
| Rear carrier to torsion axle | 70 ~ 90 | 7.0 ~ 9.0 | 51 ~ 65 |
|------------------------------|---------|-----------|---------|

CAUTION

Replace self-locking nuts with new ones after removal.

Lubricants

| Items | | Lubricants | Quantity |
|--------------|-----|------------|----------|
| K Engine | BJ | RBA | 90g |
| | TJ | CW-13TJ | 110g |
| Gamma Engine | BJ | RBA | 100g |
| | TRI | CW-13TJ | 125g |
| U Engine | BJ | RBA | 130g |
| | TJ | CW-13TJ | 145g |

7.1.2. Special Service Tools

Special Service Tools

| Tool(Number and Name) | Illustration | Use |
|-----------------------------------|---|---|
| 09568-4A000
Ball joint remover |  | Removal of the front lower arm and tie rod end ball joint |
| 09495-3K000
Band installer |  | Installation of ear type boot band |
| 09495-39100
Band installer |  | Installation of hook type boot band |

7.1.3. 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 |

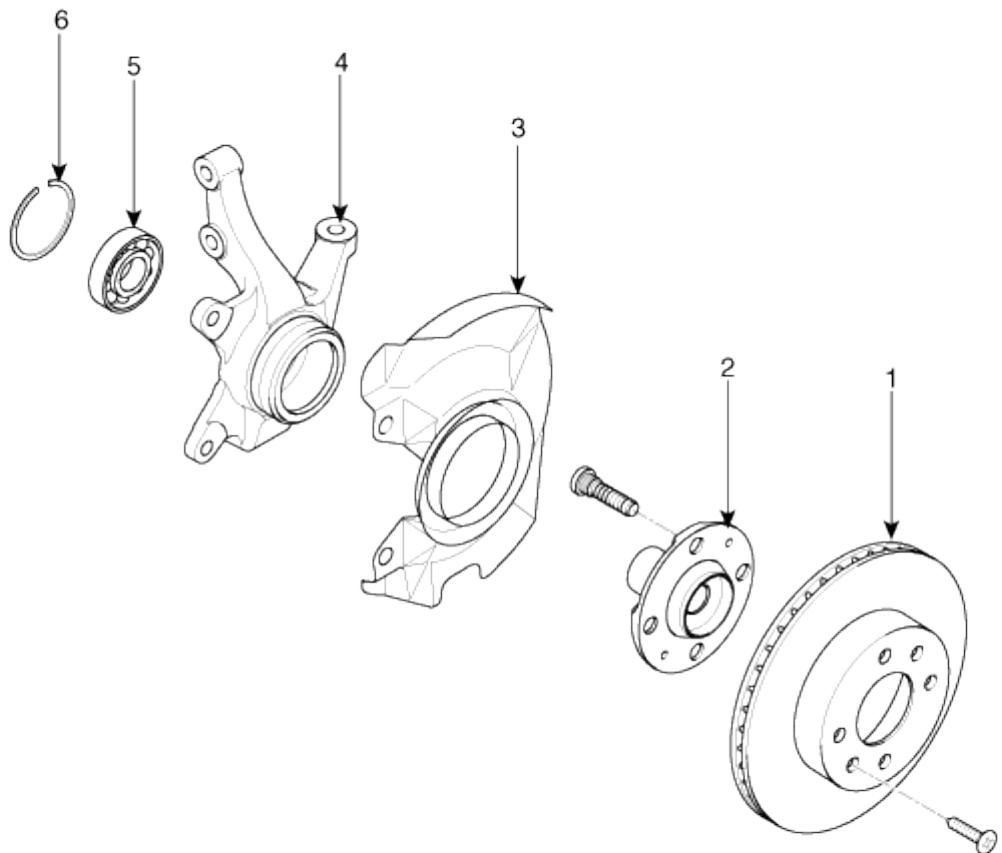
| | | |
|-----------------|---|-----------------------|
| Vibration | Wear, damage or bending of driveshaft | Replace |
| | Driveshaft rattle and hub serration | Replace |
| | Wear, rattle or scratching of wheel bearing | Replace |
| Shimmy | Defective wheel balance | Adjustment or Replace |
| | Defective 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 |

7.2. Front Axle Assembly

7.2.1. Front Hub / Knuckle / Tone Wheel

7.2.1.1. Component and Components Location

Components



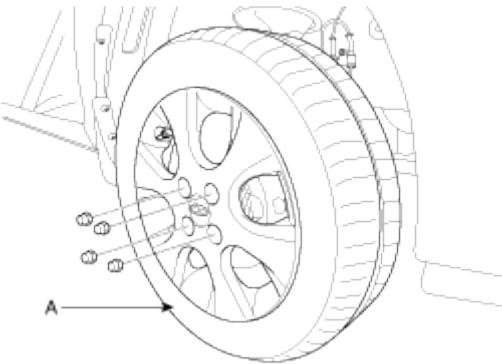
1. Brake disc
 2. Hub assembly
 3. Dust cover

4. Knuckle assembly
 5. Hub bearing
 6. Snap ring

7.2.1.2. 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 .



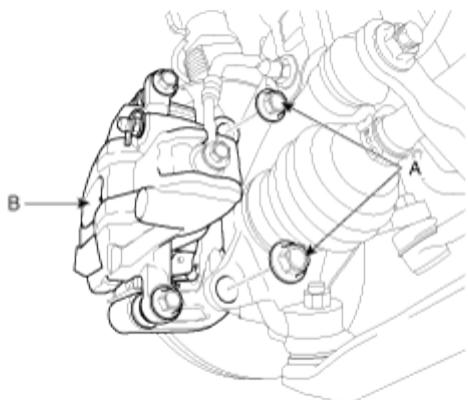
CAUTION

Be careful not to damage to the hub bolts when removing the front wheel and tire (A).

3. Remove the brake caliper mounting bolts (A), and then place the brake caliper assembly (B) with wire.

Tightening torque :

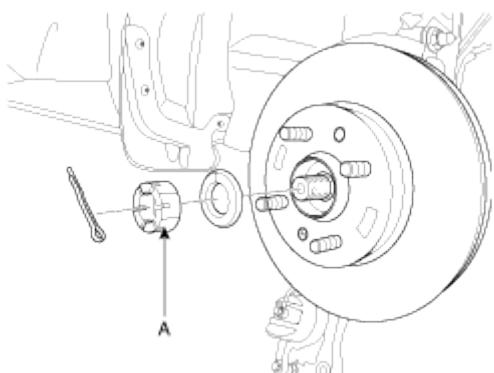
78.4~98.0N.m(8.0~10.0Kgf.m, 57.8~72.3lb·ft)



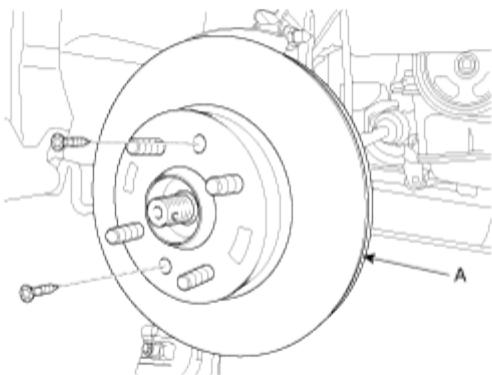
4. Remove castle nut(A) from the front hub.

Tightening torque :

240.2~269.6N.m(24.5~27.5Kgf.m, 177.2~198.9lb·ft)



5. Loosen the brake disc mount screw and then remove the brake disc(A).

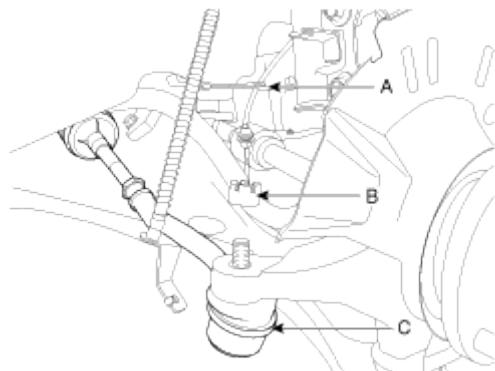


6. Remove the tie rod end ball joint from the knuckle.

- (1) Remove the split pin(A).
- (2) Remove the castle nut(B).
- (3) Disconnect the ball joint(C) from knuckle using the special tool (09568-4A000).

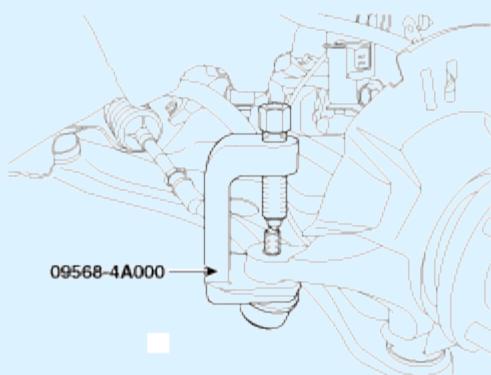
Tightening torque :

15.6~33.3N.m(1.6~3.4Kgf.m, 11.5~24.6lb·ft)



CAUTION

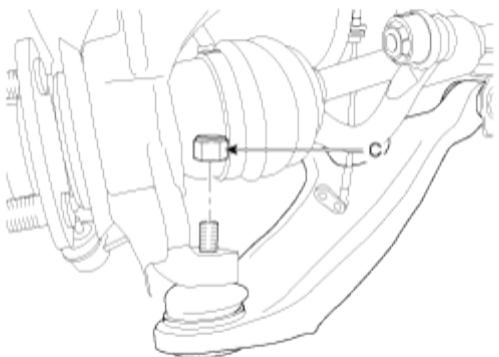
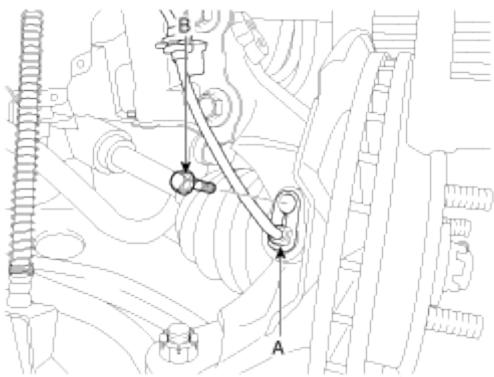
Apply a few drops of oil to the special tool. (Boot contact part)



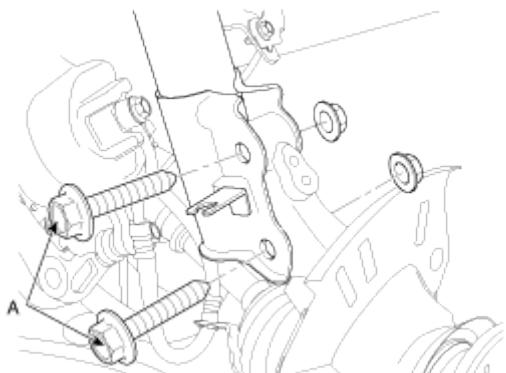
7. Remove the wheel speed sensor(A) and the lower arm mounting nut(C) from the knuckle.

Tightening torque :

6.8~10.8N.m(0.7~1.1Kgf.m, 5.1~7.9lb·ft)



8. Losen the strut mount bolt(A) and then remove the hub and knuckle assembly.



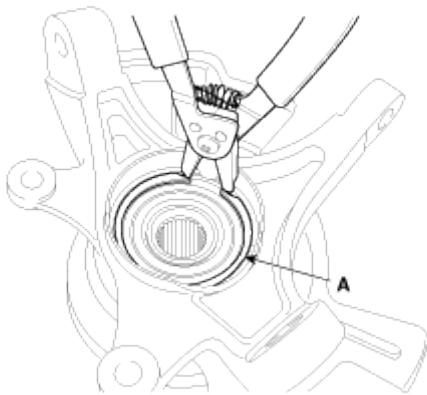
CAUTION

Be careful not to damage the boot and rotor teeth.

9. Install in the reverse order of removal.

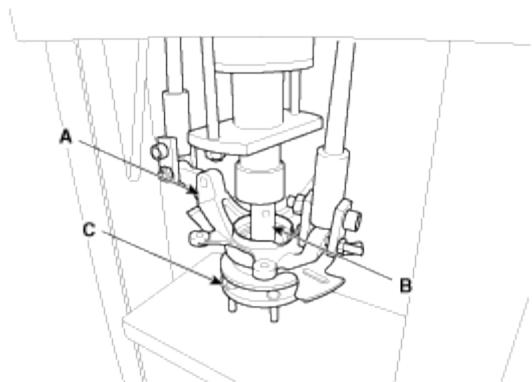
Disassembly

1. Remove the snap ring (A).



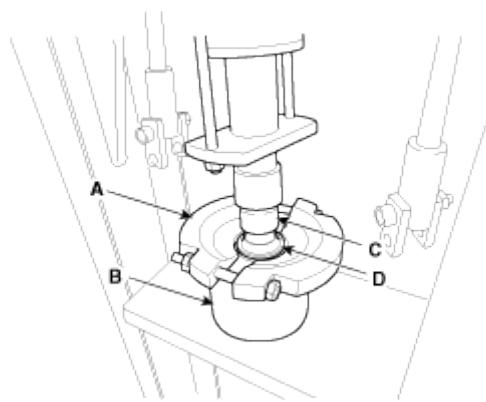
2. Remove the hub assembly from the knuckle assembly.

- (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.

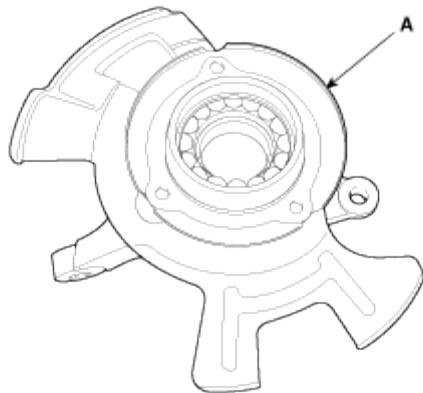


3. Remove the hub bearing inner race from the hub assembly.

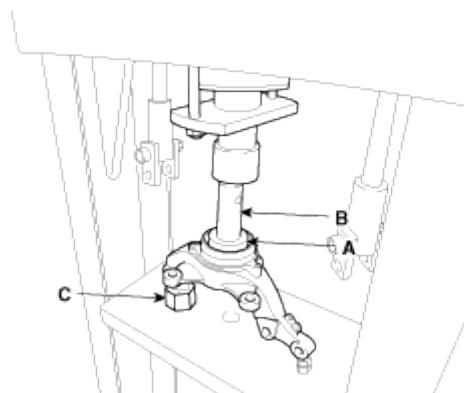
- (1) Install a suitable tool (A) for removing the hub bearing inner race on the hub assembly.
- (2) Lay the hub assembly and tool (A) upon a suitable adapter (B).
- (3) Lay a suitable adapter (C) upon the hub assembly shaft.
- (4) Remove the hub bearing inner race (D) from the hub assembly by using press.



4. Remove the dust cover (A).



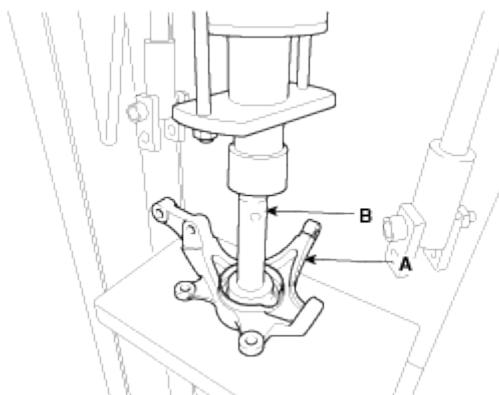
5. Remove the hub bearing outer race from the knuckle assembly.
 - (1) Lay the hub assembly (A) upon a suitable adapter (B).
 - (2) Lay a suitable adapter (C) upon the hub bearing outer race.
 - (3) Remove the hub bearing outer race from the knuckle assembly by using press.



6. Replace hub bearing with a new one.

Reassembly

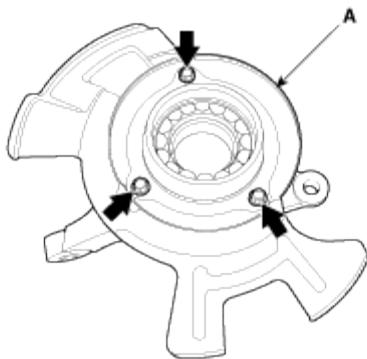
1. Install the hub bearing to the knuckle assembly.
 - (1) Lay the knuckle assembly (A) on press.
 - (2) Lay a new hub bearing upon the knuckle assembly (A).
 - (3) Lay a suitable adapter (B) upon the hub bearing.
 - (4) Install the hub bearing to the knuckle assembly by using press.



CAUTION

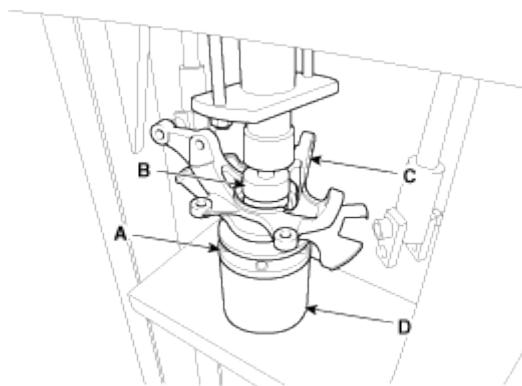
- Do not press against the inner race of the hub bearing because that can cause damage to the bearing assembly.
- Always use a new wheel bearing assembly.

2. Install the dust cover (A).



3. Install the hub assembly to the knuckle assembly.

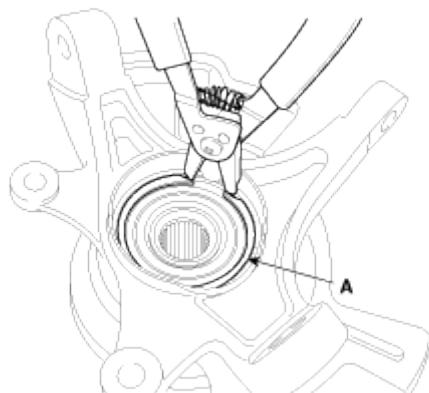
- (1) Lay the hub assembly (A) upon a suitable adapter (B).
- (2) Lay the knuckle assembly (C) upon the hub assembly (A).
- (3) Lay a suitable adapter (D) upon the hub bearing.
- (4) Install the hub assembly (A) to the knuckle assembly (C) by using press.



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).

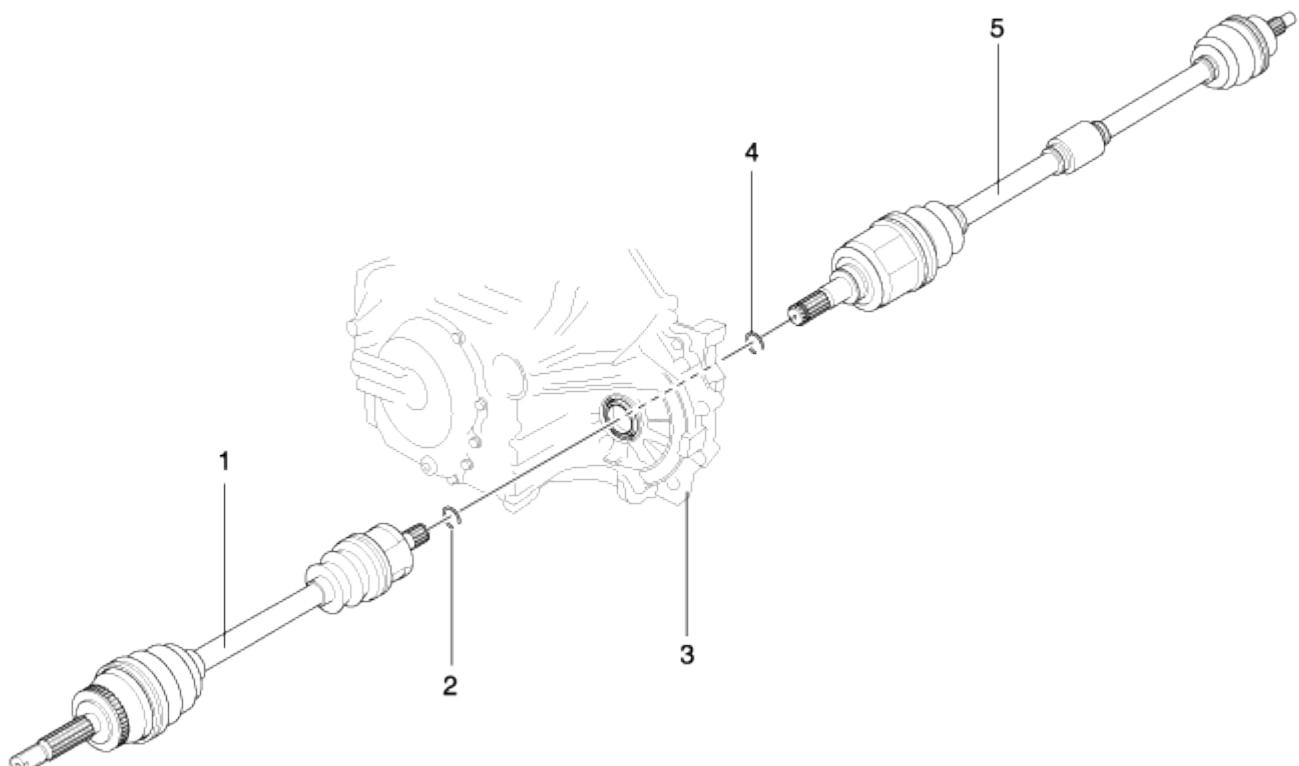


Inspection

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.

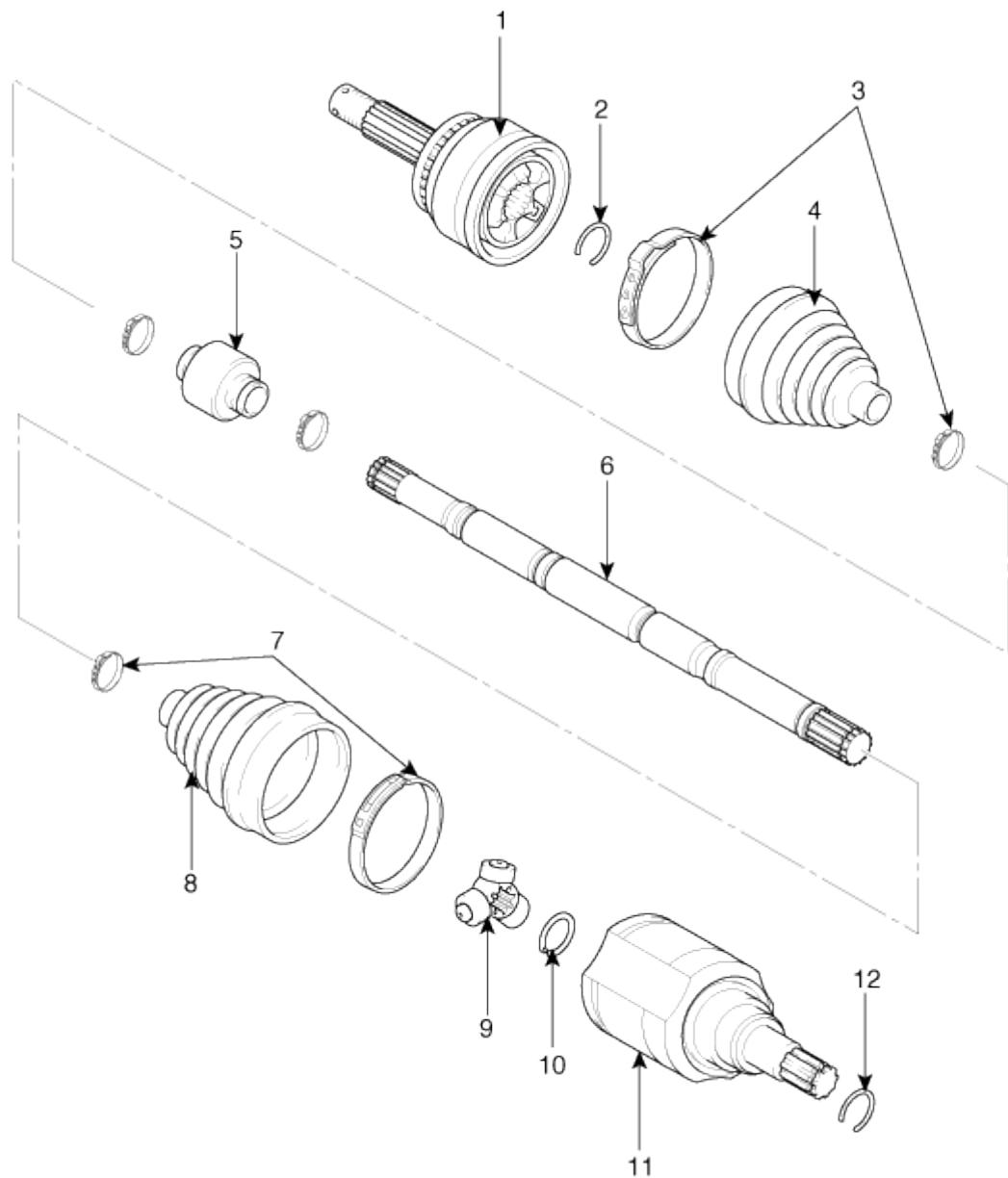
7.3. Driveshaft Assembly
7.3.1. Front Driveshaft
7.3.1.1. Component and Components Location

Component Location



| | |
|--|----------------------------------|
| 1. Driveshaft (LH)
2. Circlip
3. Transaxle | 4. Circlip
5. Driveshaft (RH) |
|--|----------------------------------|

Components

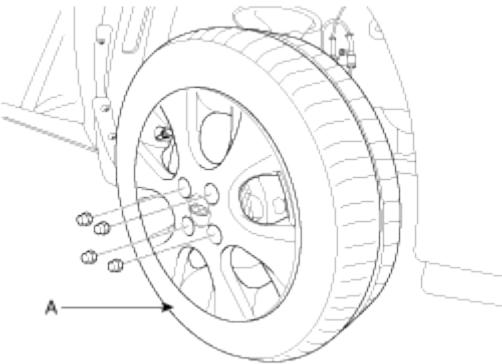


| | |
|-----------------------------------|------------------------------------|
| 1. Joint assembly (on wheel side) | 7. Boot band |
| 2. Clip | 8. Boot |
| 3. Boot band | 9. Spider assembly |
| 4. Boot | 10. Clip |
| 5. Dynamic damper | 11. Joint case (On transaxle side) |
| 6. Shaft | 12. Circlip |

7.3.1.2. 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 .



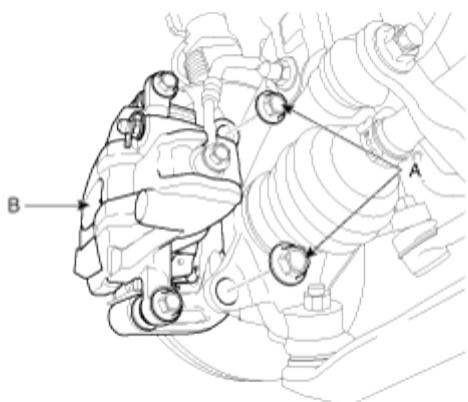
CAUTION

Be careful not to damage to the hub bolts when removing the front wheel and tire (A).

3. Remove the brake caliper mounting bolts (A), and then place the brake caliper assembly (B) with wire.

Tightening torque :

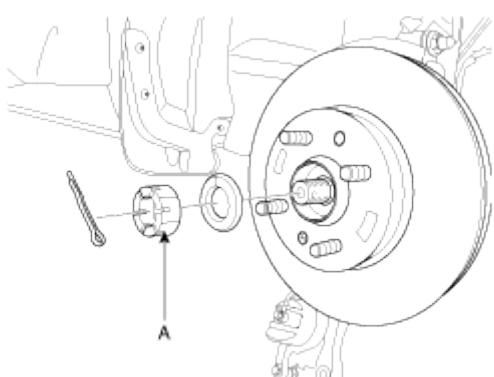
83.3~98.0N.m(8.5~10.0Kgf.m, 61.4~72.3lb-ft)



4. Remove castle nut(A) from the front hub.

Tightening torque :

240.2~269.6N.m(24.5~27.5Kgf.m, 177.2~198.9lb-ft)



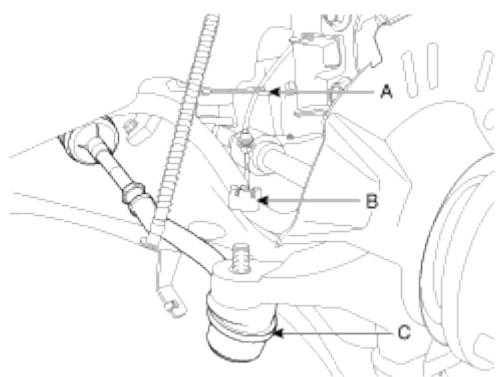
5. Remove the tie rod end ball joint from the knuckle.

(1) Remove the split pin(A).

(2) Remove the castle nut(B).

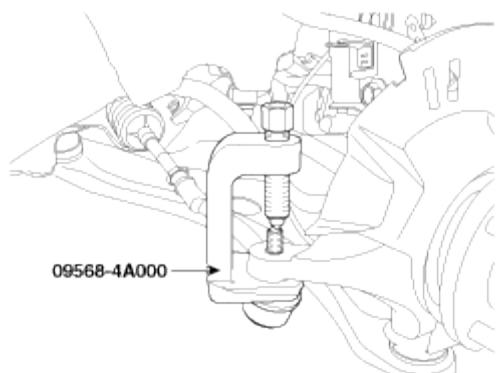
(3) Disconnect the ball joint(C) from knuckle using the special tool (09568-4A000).

Tightening torque :
15.6~33.3N.m(1.6~3.4Kgf.m, 11.5~24.6lb·ft)



CAUTION

Apply a few drops of oil to the special tool. (Boot contact part)



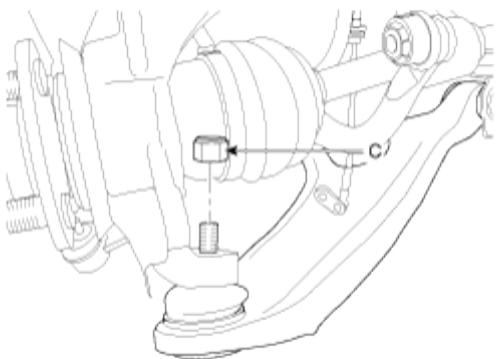
6. Remove the wheel speed sensor(A) and the lower arm mounting nut(C) from the knuckle.

Tightening torque :
6.8~10.8N.m(0.7~1.1Kgf.m,5.1~7.9lb·ft)

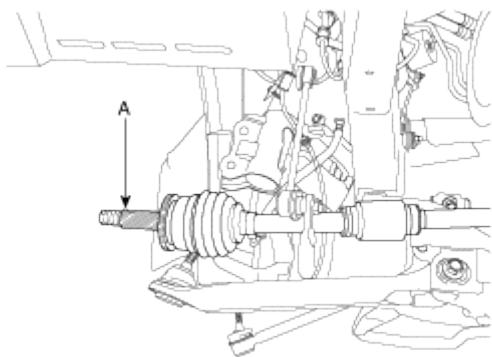


7. Loosen the brake disc mount screw and then remove the brake disc(A).

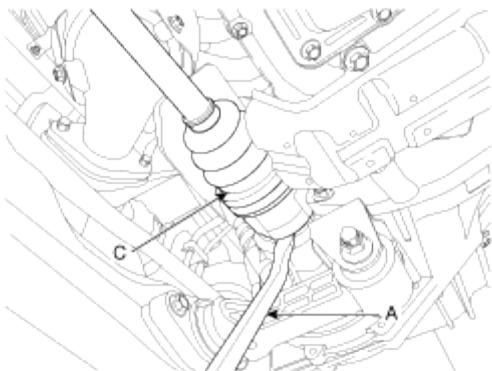
Tightening torque :
60~72N.m(6.0~7.2Kgf.m,43~52lb·ft)



8. Disconnect the drive shaft end(A).



9. Insert a pry bar(A) between the transaxle case and joint case(C), and separate the drive shaft from the transaxle case.



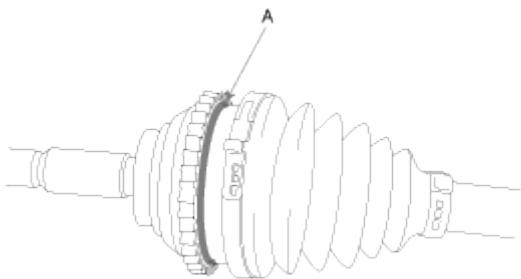
10. Install in the reverse order of removal.

CAUTION

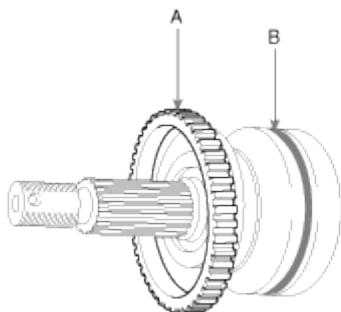
- Use a pry bar(A) being careful not to damage the transaxle and joint.
- Do not insert the pry bar(A) too deep, as this may cause damage to the oil seal.
- Do not pull the driveshaft by excessive force it may cause components inside the joint kit to dislodge resulting in a torn boot or a damaged bearing.
- 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.

Tone Wheel Replacement

1. Remove the driveshaft.
2. Matchmark (A) the driveshaft and remove the tone wheel from the driveshaft.



3. Clean the portion where new tone wheel is installed.
4. Heat a new tone wheel to 280 ~ 300°C for 10minutes and below using a hot plate or a heat gun. Do not heat it excessively over 350°C.
5. Put on the gloves and slide the heated tone wheel (A) to the machmark on the driveshaft.



6. Wait for the new tone wheel cools down and then reinstall the driveshaft.

Inspection

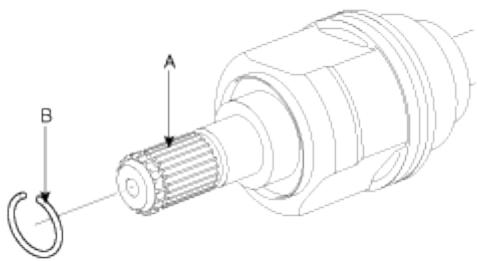
1. Check the driveshaft boots for damage and deterioration.
2. Check the driveshaft spline for wear or damage.
3. Check that there is no water or foreign material in the joint.
4. Check the spider assembly for roller rotation, wear or corrosion.
5. Check the groove inside the joint case for wear or corrosion.
6. Check the dynamic damper for damage or cracks.

Disassembly

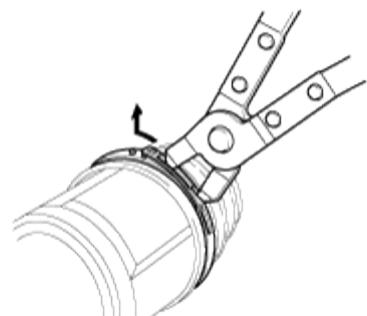
CAUTION

- Do not disassemble the BJ assembly.
- Special grease must be applied to the driveshaft joint. Do not substitute with another type of grease.
- The boot band should be replaced with a new one.

1. Remove the circlip (B) from the driveshaft spline (A).

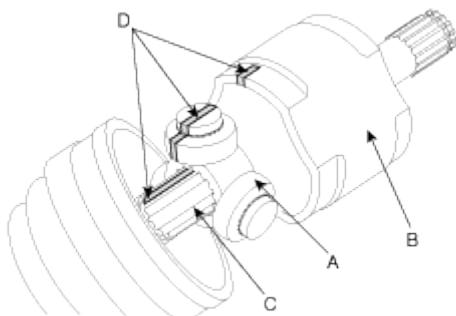


2. Remove both boot bands from the transaxle side joint case.

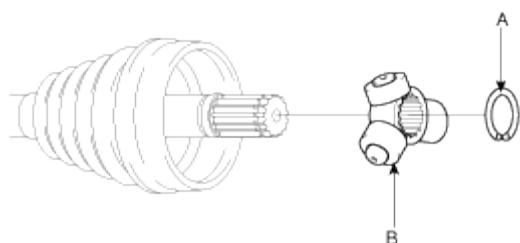


3. Pull out the boot from transaxle side joint case (B).

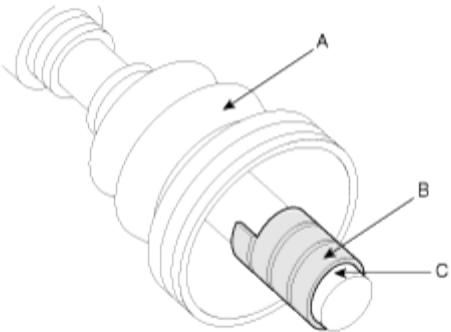
4. Make alignment marks on spider roller assembly (A), joint case (B), and shaft spline (C) to aid reassembly.



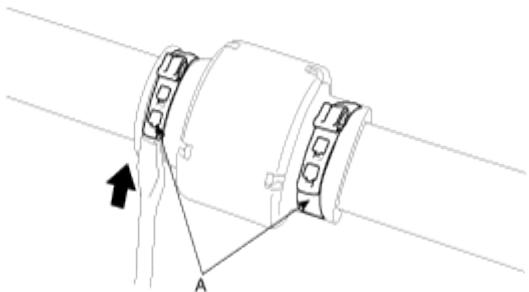
5. Remove the snap ring (A) and spider roller assembly (B) from the shaft.



6. Wrap tape (B) around the driveshaft spline (C) to protect the boot, and then pull boot (A) from the shaft.

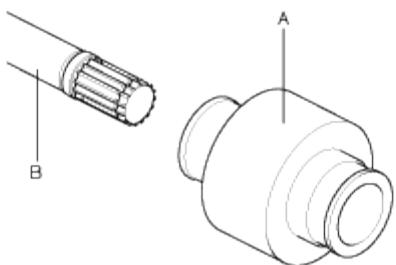


7. Remove the dynamic damper bands (A).

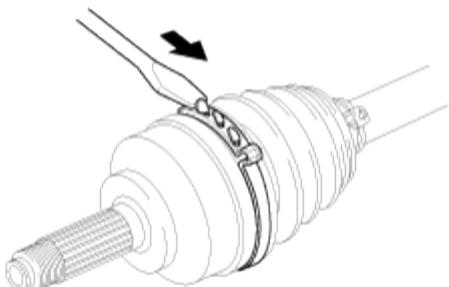


8. Fix the driveshaft (A) with a vice. Apply soap powder on the shaft to prevent the shaft spline and the dynamic damper when the dynamic damper is removed.

9. Separate dynamic damper (A) from the shaft (B) carefully.



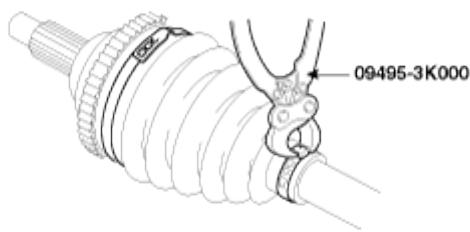
10. Remove the both bands on the side of wheel.



11. Pull out the joint boot on the side of wheel into the transaxle direction. Be careful not to damage the boot.

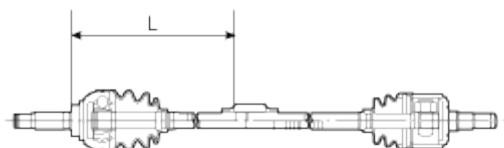
Reassembly

1. Wrap tape around the driveshaft spline to prevent damage to the boots.
2. Apply grease to the joint boot on the side of the wheel and install the boot.
3. Install the bands and then secure the bands by using a SST (09495-3K000).



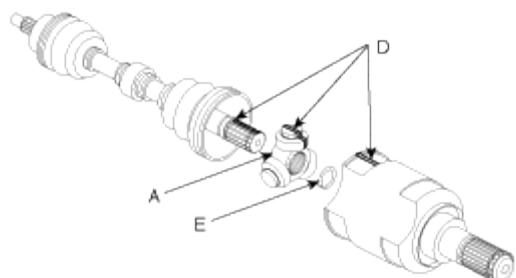
4. To install the dynamic damper, keep the shaft in a straight line and assemble the dynamic damper with the bands.

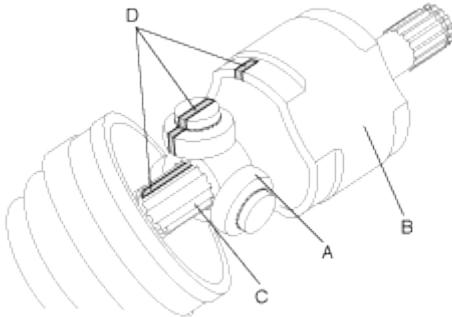
| Engine | Standard value (L) |
|-----------|---|
| GSL MT/AT | $241 \pm 2\text{mm} (9.48 \pm 0.08\text{in})$ |
| DSL MT | $241 \pm 2\text{mm} (9.48 \pm 0.08\text{in})$ |



5. Assemble the transaxle side joint boot and bands.

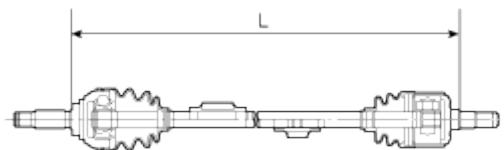
6. Using the alignment marks (D) made during disassembly as a guide, install the spider assembly (A) and snap ring (B) on the driveshaft splines (C).



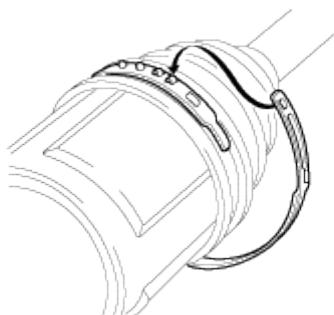


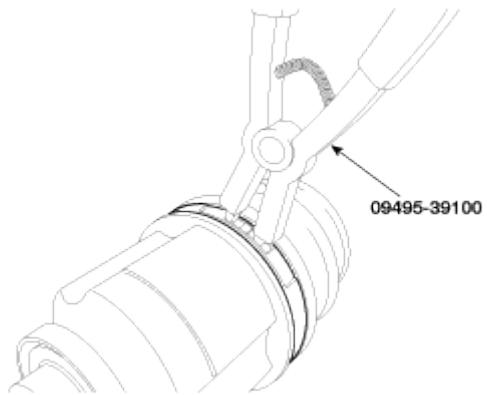
7. Add specified grease to the joint boot as much as it was wiped away at inspection.
8. Assemble the boot. To control the air in the transaxle side joint boot, keep the specified distance between the boot bands when they are tightened.

| Engine | Standard value (L) | |
|--------|--------------------|------------------|
| | LH | RH |
| K-M/T | 522.5mm (20.5in) | 800.1mm (31.5in) |
| G-M/T | 513.9mm (20.2in) | 794.1mm (31.2in) |
| G-A/T | 513.9mm (20.2in) | 794.1mm (31.2in) |
| U-M/T | 505.8mm (19.9in) | 802.0mm (31.5in) |



9. Install the both boot bands using SST (09495-39100, 09495-3K000)



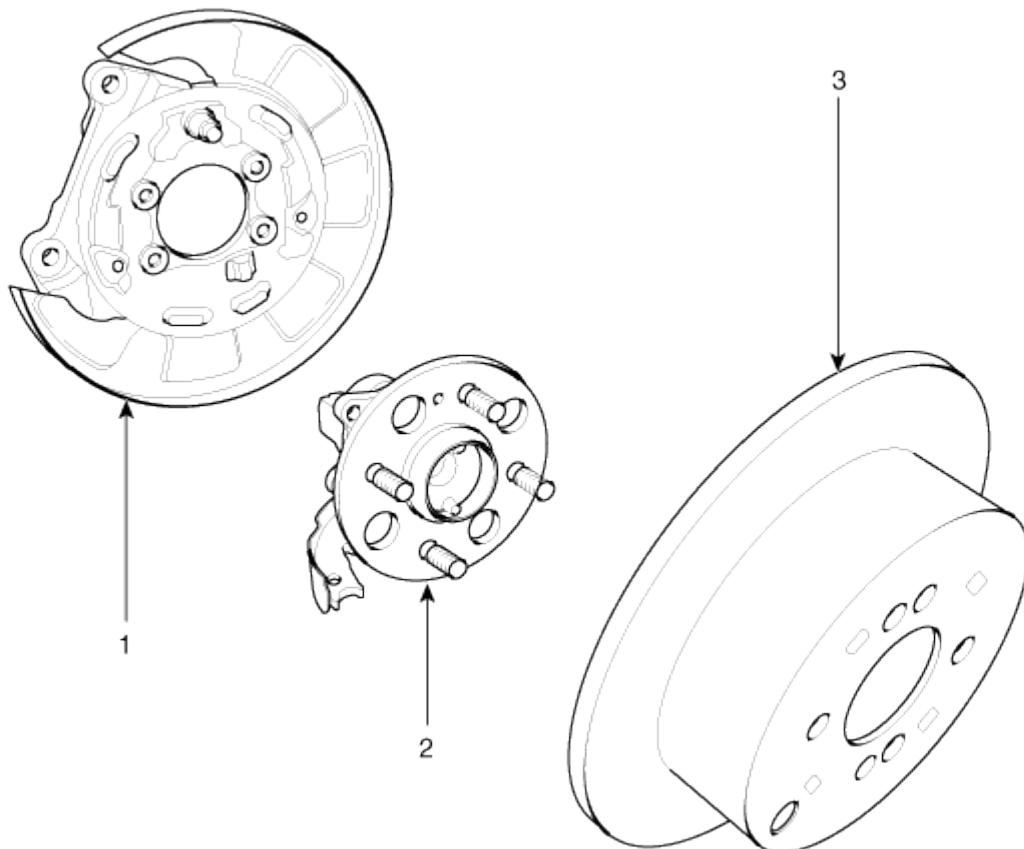


7.4. Rear Axle Assembly

7.4.1. Rear Hub – Axle

7.4.1.1. Component and Components Location

Components



1. Dust cover
2. Rear hub assembly

3. Rear brake disc

7.4.1.2. Repair procedures

Replacement

1. Loosen the wheel nuts slightly. Raise the vehicle, and make sure it is securely supported.
2. Remove the rear wheel and tire from rear hub.

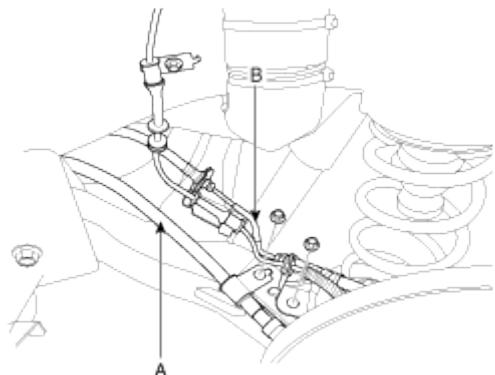
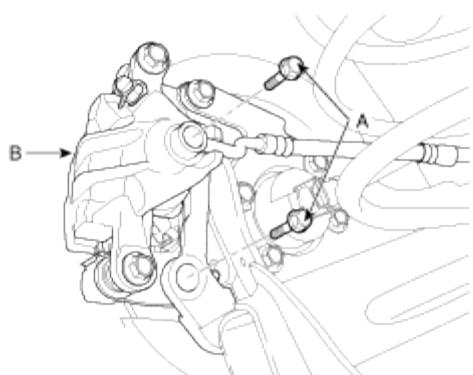
CAUTION

Be careful not to damage to the hub bolts when removing the rear wheel and tire.

3. Remove the brake caliper mounting bolts (A) and then place the brake caliper assembly (B).

Tightening torque :

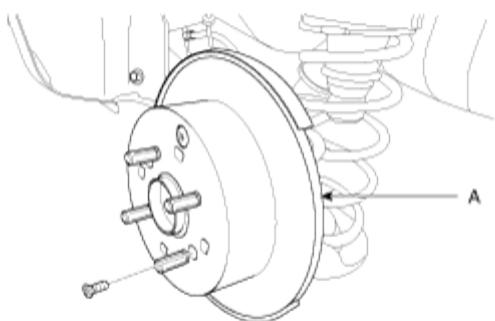
78.4~98.0N.m(8.0~10.0Kgf.m, 57.8~72.3lb-ft)



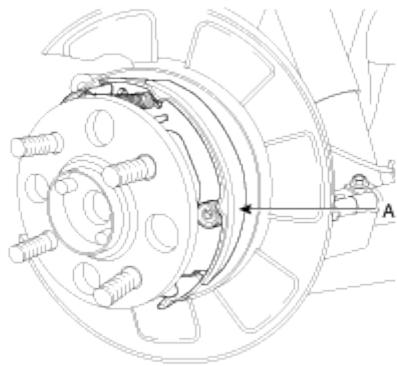
4. Remove the parking cable and brake hose(B).
5. Loosen the mount screw and then rear brake disc(A).

Tightening torque :

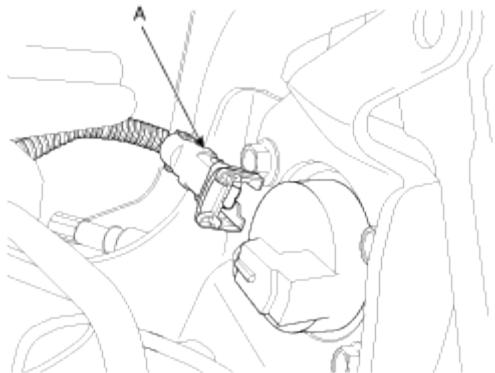
240.2~269.6N.m(24.5~27.5Kgf.m, 177.2~198.9lb-ft)



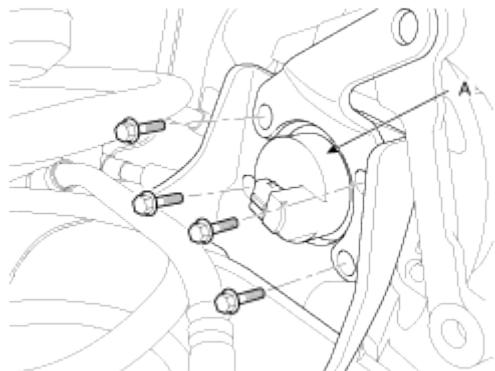
6. Remove the rear brake lining(A). (BR group-rear brake)



7. Disconnect the wheel speed sensor connector(A) and then remove the hub bearing.



8. Remove the rear hub & carrier assembly(A) by loosening the mounting bolts.



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.

8. Engine Electrical System

8.1. General Information

8.1.1. Specifications

Specifications

Ignition System

| Items | Specification |
|-------|---------------|
|-------|---------------|

| | | |
|---------------------------|----------------------|-----------------------------------|
| Ignition coil | Primary resistance | 0.7 ± 15 % (Ω) |
| | Secondary resistance | - |
| Spark plugs
(Unleaded) | Type | ZFR5F-11 |
| | Gap | 1.0 ~ 1.1 mm (0.0394 ~ 0.0433in.) |
| Spark plugs
(Leaded) | Type | ZFR5F |
| | Gap | 0.9 ~ 1.0 mm (0.0354 ~ 0.0394in.) |

Starting System

| Items | | Specification |
|---------|-------------------------|--|
| Starter | Rated voltage | 12.V, 0.9 kW |
| | No. of pinion teeth | 8 |
| | No-load characteristics | Voltage |
| | | Ampere |
| | | Speed |
| | Commutator diameter | Standard 32.9 ~ 33.0 mm (1.2953 ~ 1.2992in.) |
| | Under cut depth | Standard 0.7 ~ 0.9 mm (0.0275 ~ 0.0354in) |
| | | Limit 0.4 mm (0.0157in) |

Charging System

| Items | | Specification |
|------------|--|---|
| Alternator | Type | Battery voltage sensing |
| | Rate voltage | 13.5 V, 90A |
| | Speed in use | 1,000 ~ 18,000 rpm |
| | Voltage regulator | IC Regulator built-in type |
| | Regulator setting voltage | 14.55 ± 0.2 V (At 20°C full charged batt) |
| | Temperature compensation | -7 ± 3 mV / °C |
| Battery | Type | 36-20GL |
| | Cold cranking amperage
[at -18°C(-0.4°F)] | 410 A |
| | Reserve capacity | 80 min |
| | Specific gravity [at 20°C(68°F)] | 1.280 ± 0.01 |

CAUTION

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

• Battery type notation: 

- ① : 5HR capacity
- ② : Battery length
- ③ : Battery width
- ④ : Terminal location

8.1.2. Troubleshooting

Troubleshooting

Ignition system

| Symptom | Suspect area | Remedy |
|--|--|--|
| Engine will not start or is hard to start (Crank OK) | Ignition lock switch | Inspect ignition lock switch, or replace as required |
| | Ignition coil | Inspect ignition coil, or replace as required |
| | Spark plugs | Inspect spark plugs, or replace as required |
| | Ignition wiring disconnected or broken | Repair wiring, or replace as required |
| | Spark plugs cable | Inspect cable, 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 |
| | Spark plugs cable | Inspect cable, 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 | Replace voltage regulator |
| Charging warning indicator does not go out with engine running.
(Battery requires frequent recharging) | Drive belt loose or worn | Adjust belt tension or replace belt |
| | Battery cable loose, corroded or worn | Inspect cable connection, repair or replace cable |
| | Electronic voltage regulator or alternator | Replace voltage regulator or alternator |

| | | |
|------------|--|---|
| | Wiring | Repair or replace wiring |
| Overcharge | Electronic voltage regulator | 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 | Replace voltage regulator or alternator |
| | Poor grounding | Inspect ground or repair |
| | Worn battery | Replace battery |

Starting system

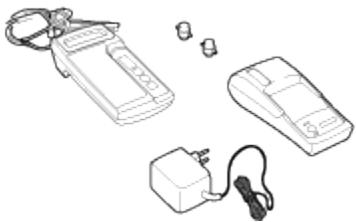
| Symptom | Suspect area | Remedy |
|---|--|---------------------------------------|
| Engine will not crank | Battery charge low | Charge or replace battery |
| | Battery cables loose, corroded or worn out | Repair or replace cables |
| | Transaxle range switch (Vehicle with automatic transaxle only) | 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 |

8.1.3. Special Service Tools

Special Service Tools

| Tool (Number and name) | Illustration | Use |
|------------------------|--------------|-----|
|------------------------|--------------|-----|

Micro-570
Battery checker



- Check the battery condition
- Check the charging and starting system

8.1.4. General Information

The Micro 570 Analyzer

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

CAUTION

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

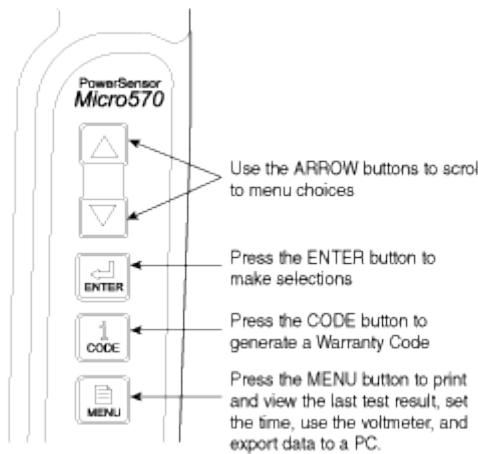
※ When charging battery by test result, Battery must be fully charged.

To get accurate test result, battery surface voltage must have subsided ahead before test when you test battery after charged. (See following Battery Test Results)



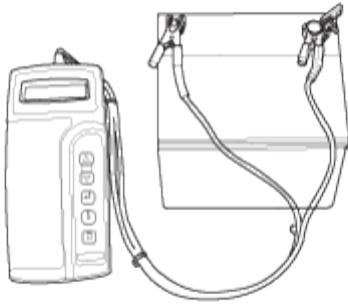
Keypad

The Micro 570 button on the key pad provide the following functions :



Battery Test Procedure

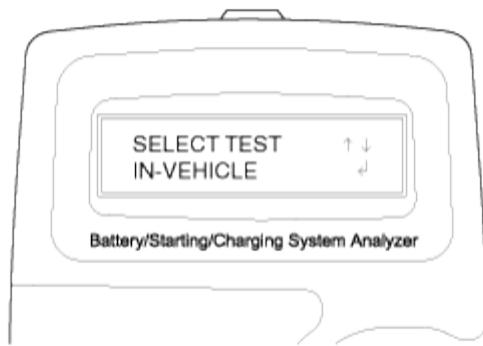
1. Connect the tester to the battery.
 - A. Red clamp to battery positive (+) terminal.
 - B. Black clamp to battery negative (-) terminal.



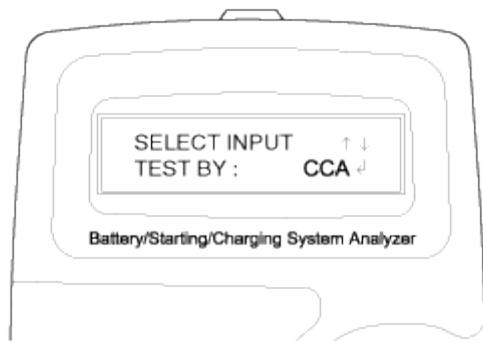
CAUTION

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

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



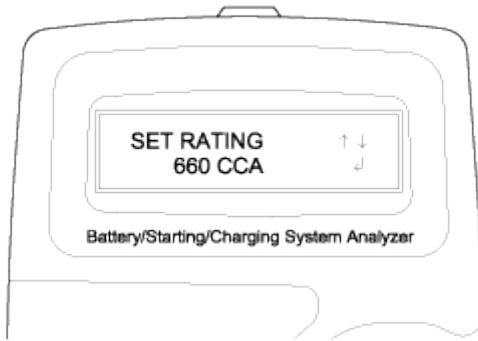
3. Select CCA and press the ENTER button.



NOTE

CCA : Cold cranking amps, is an SAE specification for cranking battery at -0.4°F (-18°C).

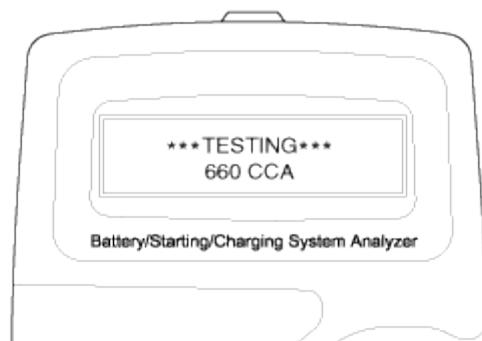
4. Set the CCA value displayed on the screen to the CCA value marked on the battery label by pressing up and down buttons and press ENTER.



NOTE

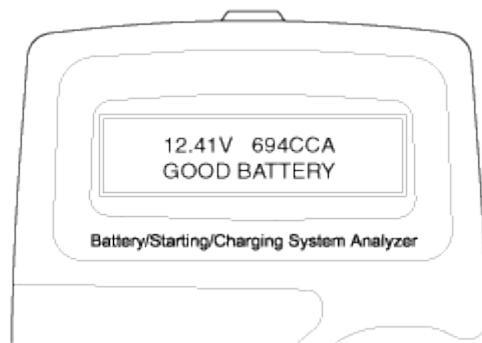
The battery ratings(CCA) displayed on the tester must be identical to the ratings marked on battery label.

5. The tester will conduct battery test.



6. The tester displays battery test results including voltage and battery ratings.

Refer to the following table and take the appropriate action as recommended by the Micro 570.



Battery Test Results

| Result On Printer | Remedy |
|-------------------|--|
| GOOD BATTERY | No action is required. |
| GOOD RECHARGE | <p>Battery is in a good state.
Recharge the battery and use.</p> <p>※ You have to follow instruction below when you charge battery and retest, otherwise test result can be inaccurate. (See 'Charge and Retest method after battery charge' below.)</p> |
| CHARGE & RETEST | <p>Battery is not charged properly.</p> <ul style="list-style-type: none">- Charge and test the battery again. |

| | |
|------------------|---|
| | ※ You have to follow instruction below when you charge battery and retest, otherwise test result can be inaccurate. (See 'Charge and Retest method after battery charge' below.) |
| REPLACE BATTERY | Replace battery and recheck the charging system.
- Improper connection between battery and vehicle cables may cause "REPLACE BATTERY". Retest the battery after removing cables and connecting the tester to the battery terminal directly prior to replacing the battery. |
| BAD CELL-REPLACE | Charge and retest the battery.
- If the Micro 570 recommends "REPLACE BATTERY", replace the battery and recheck the charging system. |

[Charge and Retest method after battery charge]

Battery charge

Set battery charger to 'Auto Mode' (The Mode that charging current drops as the battery charges.) and charge battery until charging current down close to zero or the charger alerts you with an alarm when charge is complete.
(Minimum charging time recommended: More than 3 hours with Auto Mode that explained above)

- A. If battery is not fully charged, battery surface voltage will be high while the amount of current charged (CCA) in battery is low. If you measure the battery under this condition, tester may misjudge that battery sulfation occurred because the amount of current in battery is too low in comparison with battery voltage.
- * Surface voltage: When battery is charged electrolyte temperature increases and chemical reaction become active resulting in an excessive increase of battery voltage.
- It is known that it takes approximate one day to subside this increased surface voltage completely.

Battery Test after charge

Do not test battery right after the charge. Test battery after battery surface voltage has subsided as instructed in the following procedure.

- (1) When battery charge is complete, install the battery in the vehicle.
- (2) Put IG key to ON position and turn on head lamp with low beam, and wait 5 minutes. (Discharge for 5 minutes)
- (3) Turn off the head lamp and IG key, and wait 5 minutes. (Waiting for 5 minutes)
- (4) Remove +, - cable from the battery and test battery.

WARNING

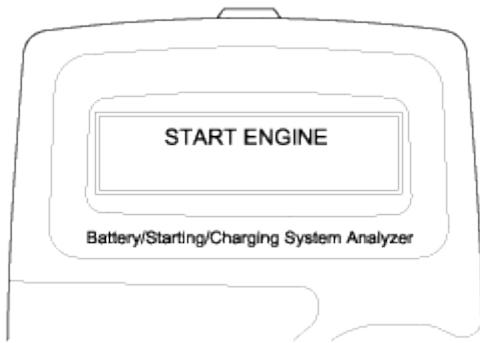
Whenever filing a claim for battery, the print out of the battery test results must be attached.

Starter Test Procedure

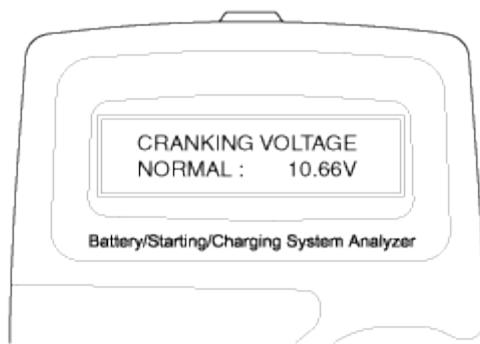
7. After the battery test, press ENTER immediately for the starter test.



8. Start the engine.



9. Cranking voltage and starter test results will be displayed on the screen.
Refer to the following table and take the appropriate action as recommended by the Micro 570.



Starter Test Results

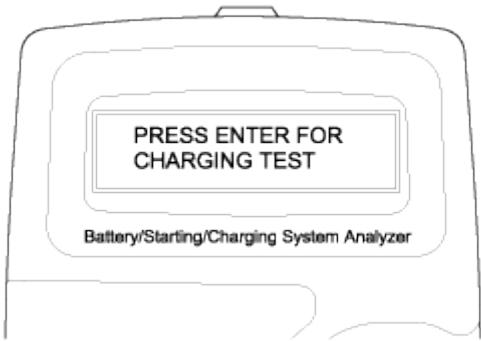
| Result On Printer | Remedy |
|----------------------------|---|
| CRANKING VOLTAGE
NORMAL | System shows a normal starter draw. |
| CRANKING VOLTAGE LOW | Cranking voltage is lower than normal level.
- Check starter. |
| CHARGE BATTERY | The state of battery charge is too low to test.
- Charge the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

NOTE

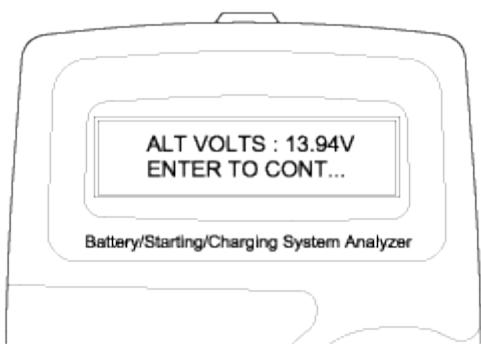
When testing the vehicle with old diesel engines, the test result will not be favorable if the glow plug is not heated. Conduct the test after warming up the engine for 5 minutes.

Charging System Test Procedure

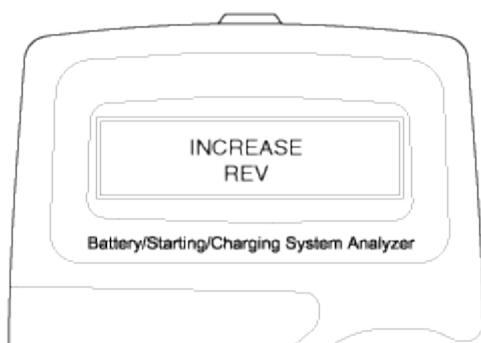
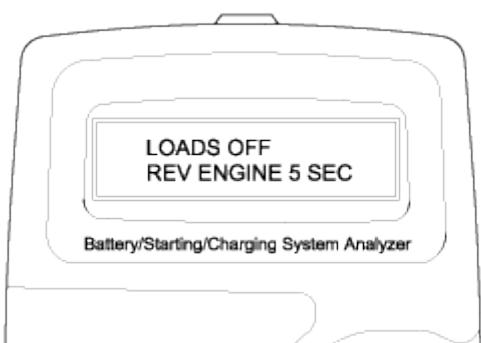
10. Press ENTER to begin charging system test.

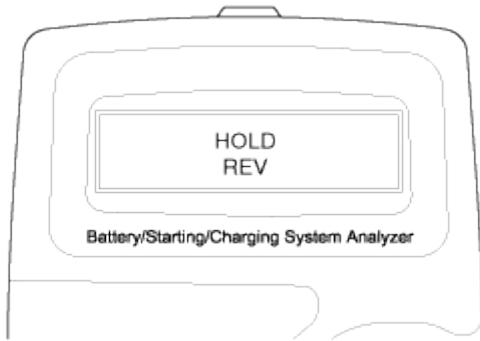


11. The tester displays the actual voltage of alternator.
Press ENTER to continue.

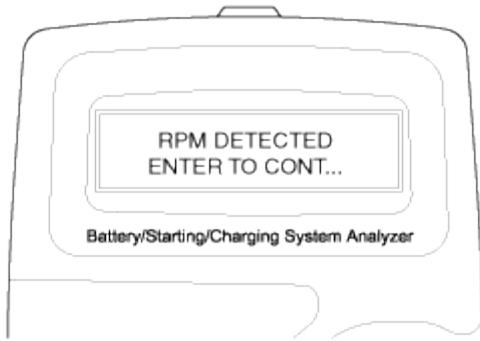


12. Turn off all electrical load and rev engine for 5 seconds with pressing the accelerator pedal. (Follow the instructions on the screen)

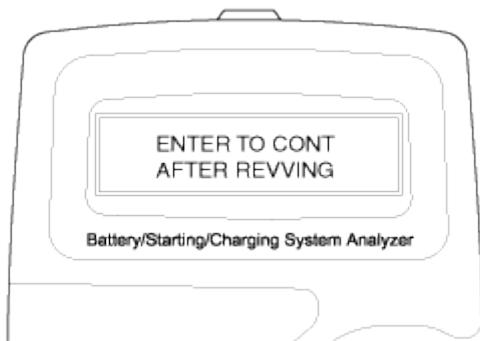




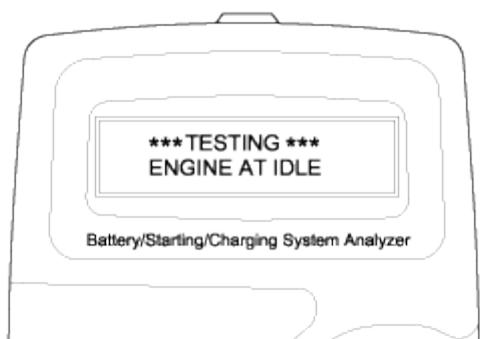
13. The message that engine RPM is detected will be displayed on the screen. Press ENTER to continue.

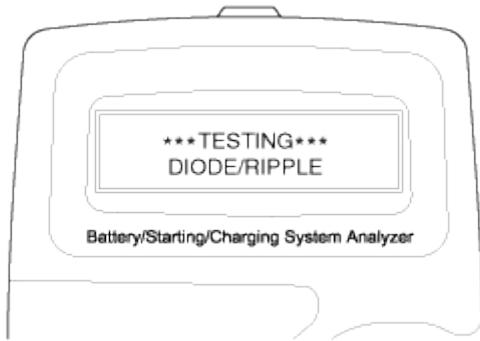


14. If the engine RPM is not detected, press ENTER after revving engine.

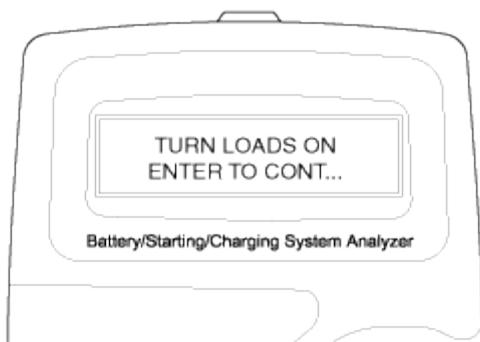


15. The tester will conduct charging system test during loads off.

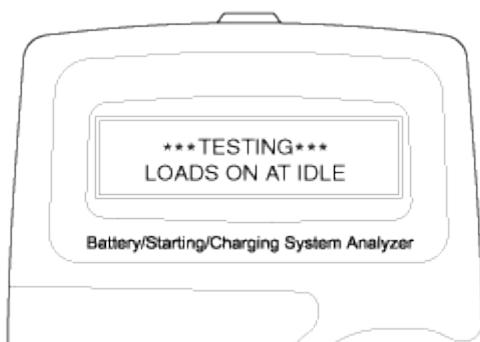




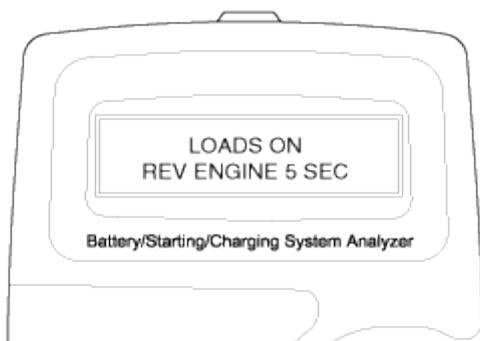
16. Turn on electrical loads (air conditioner, lamps, audio and etc). Press ENTER to continue.

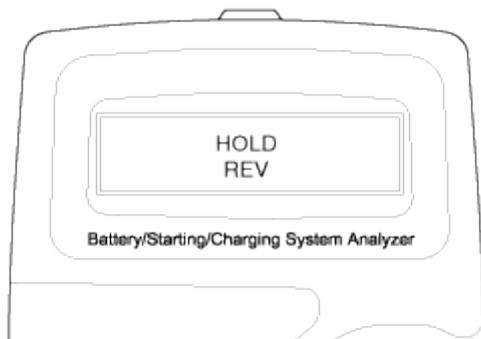
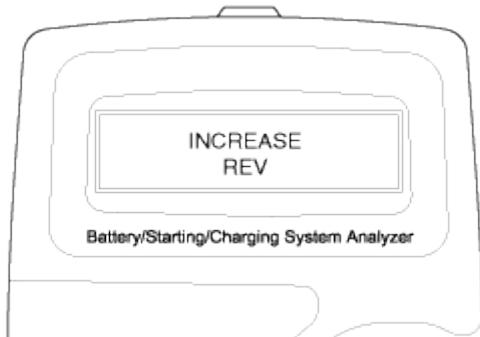


17. The tester will conduct charging system test during loads on.

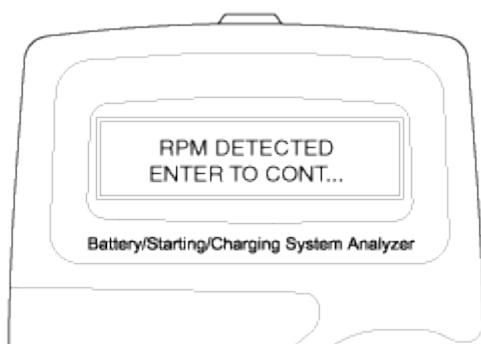


18. Rev engine for 5 seconds with pressing the accelerator pedal. (Follow the instructions on the screen)

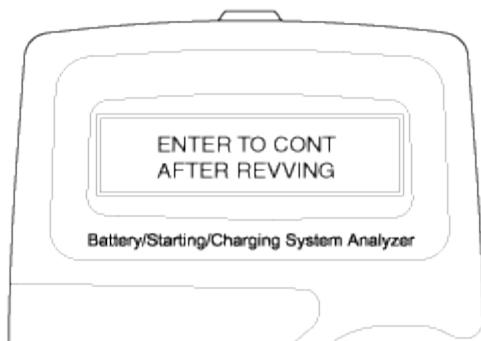




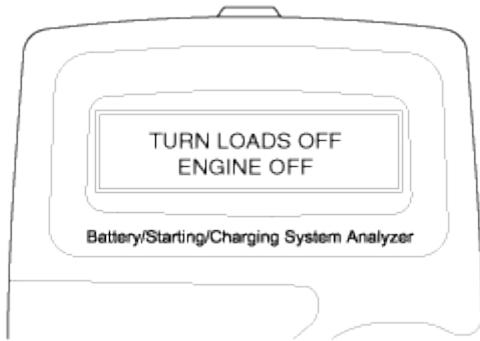
19. The message that engine RPM is detected will be displayed on the screen. Press ENTER to continue.



20. If the engine RPM is not detected, press ENTER after revving engine.

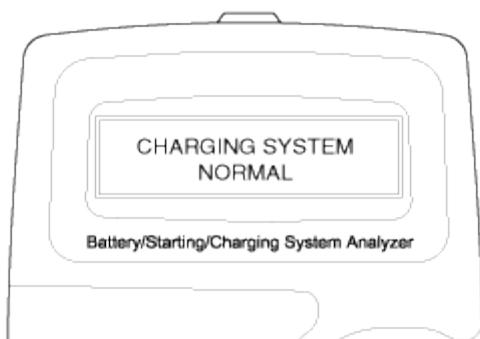
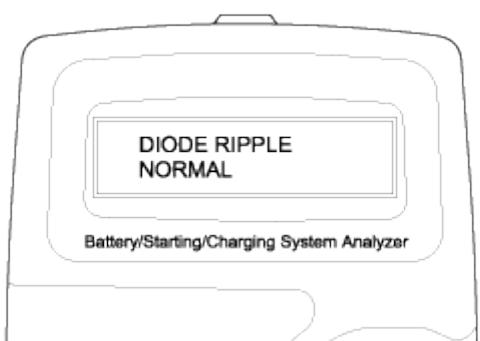
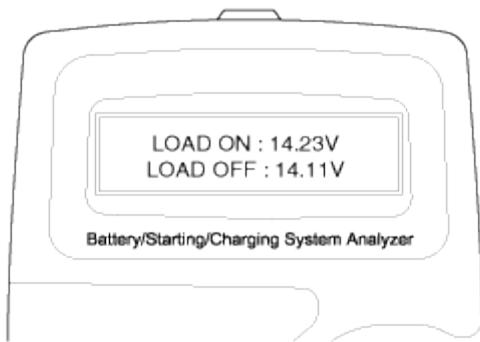


21. Turn off electrical loads (air conditioner, lamps, audio and etc). Turn the engine off.



22. Charging voltage and charging system test results will be displayed on the screen.

Shut off engine and disconnect the tester clamps from the battery. Refer to the following table and take the appropriate action as recommended by the Micro 570.



Charging System Test Results

| Result On Printer | Remedy |
|--|----------------------------|
| CHARGING SYSTEM
NORMAL / DIODE RIPPLE
NORMAL | Charging system is normal. |

| | |
|------------------------|---|
| NO CHARGING VOLTAGE | Alternator does not supply charging current to battery.
- Check belts, connection between alternator and battery and replace belts or cable or alternator as necessary. |
| LOW CHARGING VOLTAGE | Alternator does not supply charging current to battery and electrical load to system fully.
- Check belts and alternator and replace as necessary. |
| HIGH CHARGING VOLTAGE | The voltage from alternator to battery is higher than normal limit during voltage regulating.
- Check connection and ground and replace regulator as necessary.
- Check electrolyte level in the battery. |
| EXCESS RIPPLE DETECTED | One or more diodes in the alternator is not functioning properly.
- Check alternator mounting and belts and replace as necessary. |

8.2. Ignition System

8.2.1. Description and Operation

Description

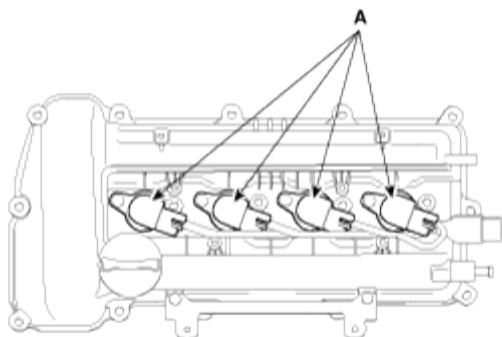
Ignition timing is controlled by the electronic control ignition timing system. The standard reference ignition timing data for the engine operating conditions are pre-programmed in the memory of the ECM (Engine Control Module). The engine operating conditions (speed, load, warm-up condition, etc.) are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

8.2.2. Repair procedures

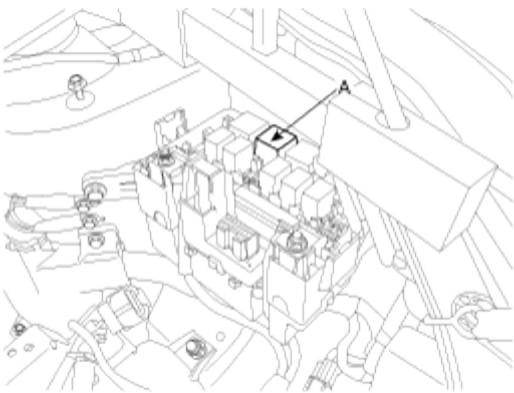
On-vehicle Inspection

Spark Test

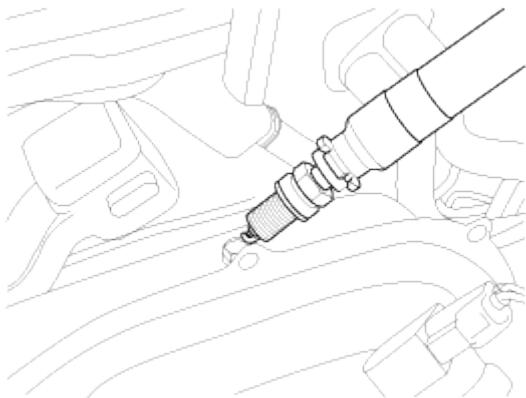
1. Remove the ignition coils(A).



2. Remove the fuel pump relay(A) from the fuse box for fuel not to be injected while checking.



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



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

NOTE

Do not crank engine for more than 5~10 seconds.

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

Tightening torque :

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

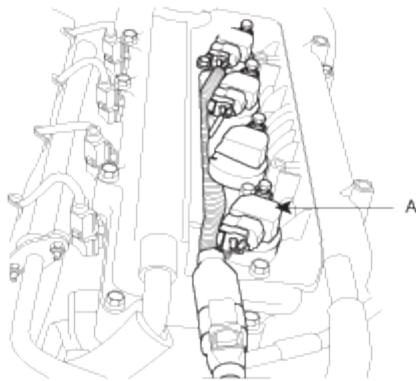
10. Install a engine center cover and a engine cover.

Tightening torque :

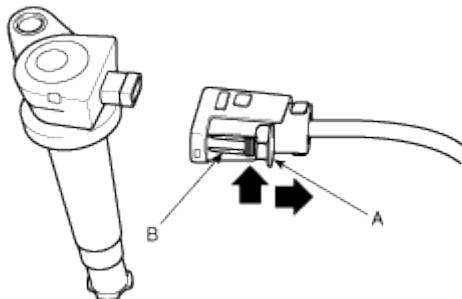
7.8 ~11.8 Nm (0.8~1.2 kgf.m, 5.8~8.7 lb-ft)

Inspect Spark Plug

1. Remove the ignition coil(A).

**NOTE**

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

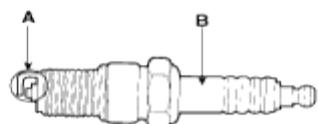


2. Using a spark plug socket, remove the spark plug.

CAUTION

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

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

**Inspection Of Electrodes**

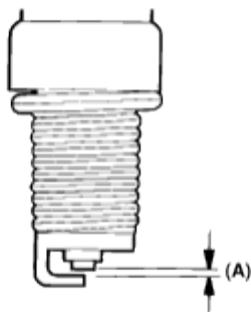
| Condition | Dark deposits | White deposits |
|-------------|---|--|
| Description | - Fuel mixture too rich
- Low air intake | - Fuel mixture too lean
- Advanced ignition timing
- Insufficient plug tightening torque |

4. Check the electrode gap (A).

Standard

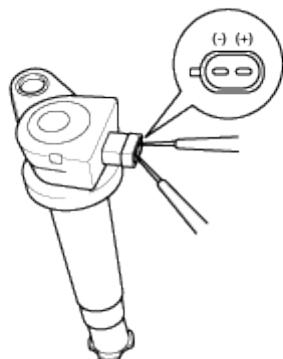
Unleaded : 1.0 ~ 1.1 mm (0.0394 ~ 0.0433 in.)

Leaded: 0.9 ~ 1.0 mm (0.0354 ~ 0.0394in.)



Inspect Ignition Coil

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



Standard value: $0.75\Omega \pm 15\%$

8.3. Charging System

8.3.1. Description and Operation

Description

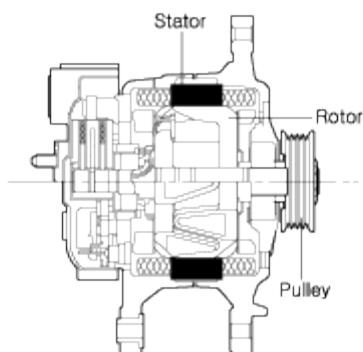
The charging system included a battery, an alternator with a built-in regulator, and the charging indicator light and wire.

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 V-ribbed belt pulley. The brush holder contains a built-in electronic voltage regulator.



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 The Battery Terminals And Fuses

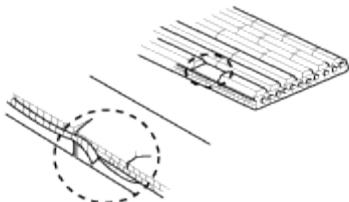
1. Check that the battery terminals are not loose or corroded.
2. Check the fuses for continuity.

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.



2. Measure drive belt tension and adjust it if necessary.

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: 882.6 ~ 980.7N (90 ~ 100kg, 198.4 ~ 220.5lb)

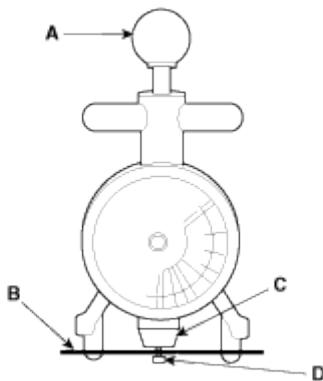
Used belt: 637.4 ~ 735.5N (65 ~ 75kg, 143.3 ~ 165.3lb)

CAUTION

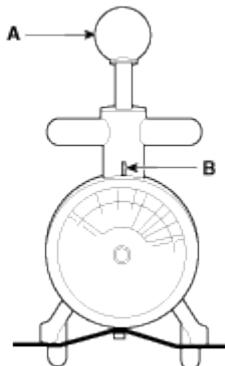
- If the engine has run for 5 minutes or more, the belt tension must be adjusted as a used belt.
- When installing the V-ribbed belt, all grooves on the pulley should be covered with belt ribs.
- A loose belt causes slip noise.
- Too tight belt cause bearing of alternator and water pump to damage.

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).



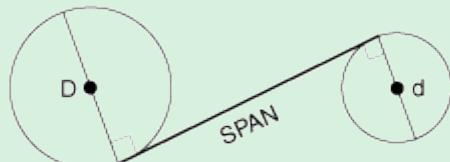
Using a sonic tension meter (U-505/507 type)

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) : Calculate average value after measuring the distance 3~4 times.



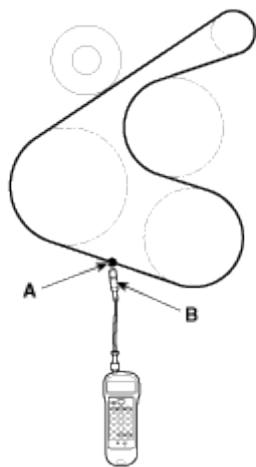
D : Idler

d : Alternator pulley

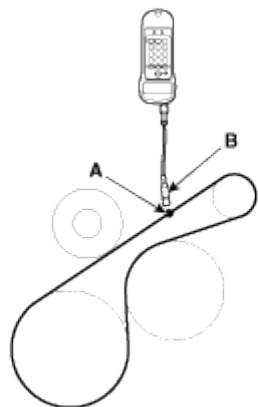


2. Locate the micro phone (B) close to the center of belt span (A) and bounce the belt by finger 2~3 times. Read a value on the display.

[With A/C]

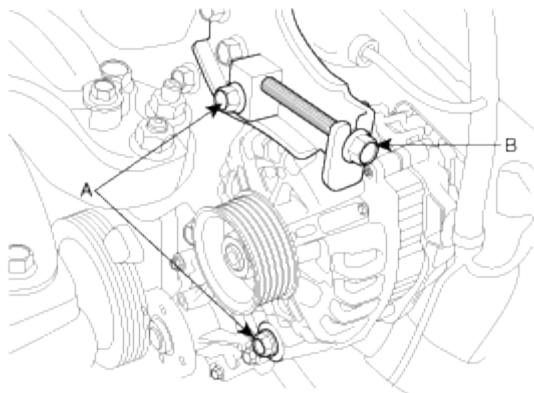


[Without A/C]



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 lb-ft)
 14mm (0.55in) bolt : 29.4 ~ 41.2 Nm (3.0 ~ 4.2 kgf.m, 21.7 ~ 30.4 lb-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.

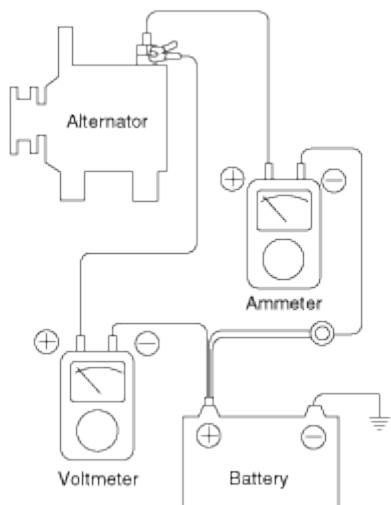
Inspect Charging System

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 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.

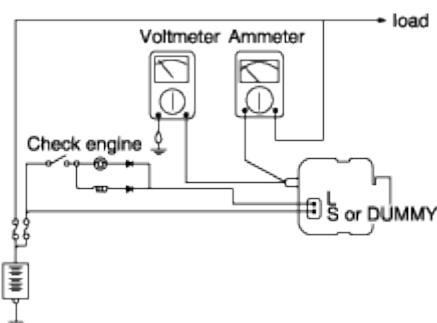
Preparation

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 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 : 50% of the rate current

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.

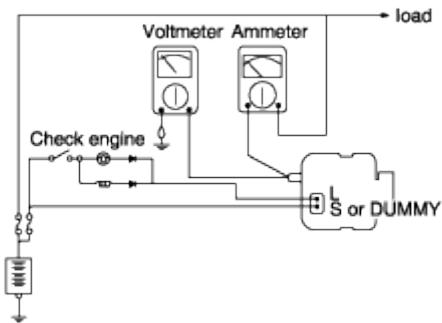
2. Upon completion of the output current test, lower the engine speed to idle and turn off the ignition switch.
3. Disconnect the battery ground cable.
4. Remove the ammeter and voltmeter and the engine tachometer.
5. Connect the alternator output wire to the alternator "B" terminal.
6. Connect the battery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

- 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.

- Start the engine. Keep all lights and accessories off.
- 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

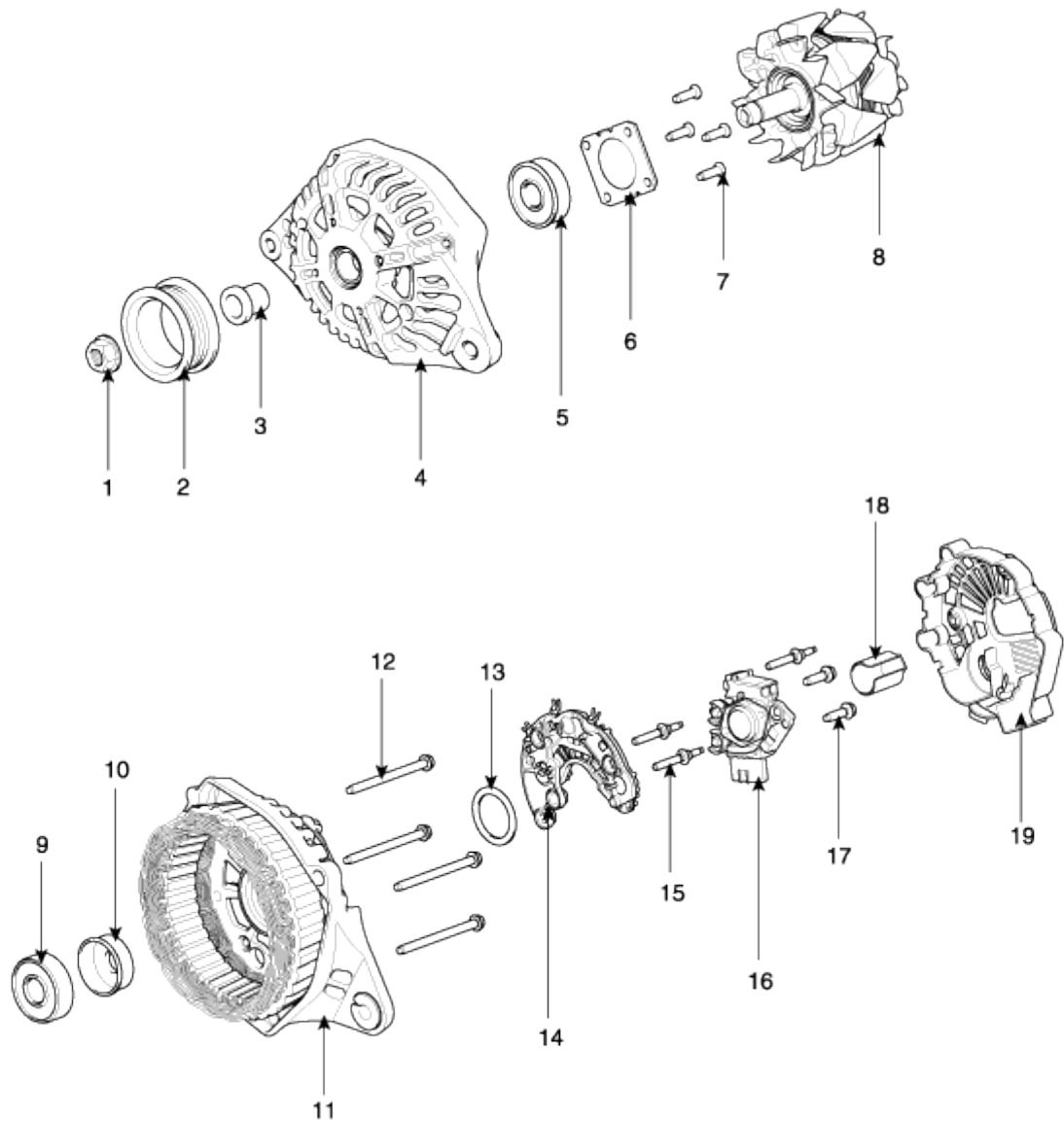
Result

- If the voltmeter reading is within 13.5 ~ 15.2V, the voltage regulator is functioning correctly. If the reading is other than the standard value, the voltage regulator or the alternator is faulty.
- Upon completion of the test, reduce the engine speed to idle, and turn off the ignition switch.
- Disconnect the battery ground cable.
- Remove the voltmeter and ammeter and the engine tachometer.
- Connect the alternator output wire to the alternator "B" terminal.
- Connect the battery ground cable.

8.3.3. Alternator

8.3.3.1. Component and Components Location

Components

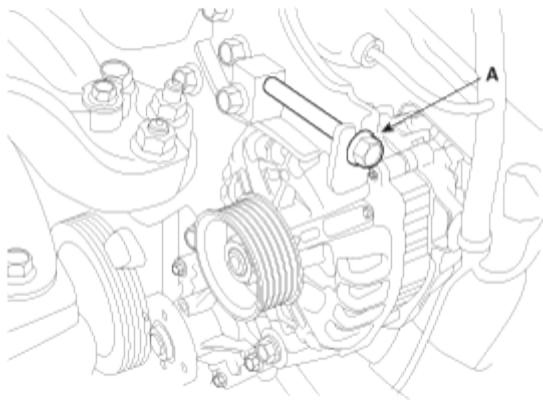


| | |
|-------------------------|---------------------------|
| 1. Nut | 11. Rear cover |
| 2. Pulley | 12. Bolts |
| 3. Spacer | 13. Seal |
| 4. Front cover assembly | 14. Rectifier assembly |
| 5. Front bearing | 15. Stud bolts |
| 6. Bearing cover | 16. Brush holder assembly |
| 7. Bearing cover bolt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

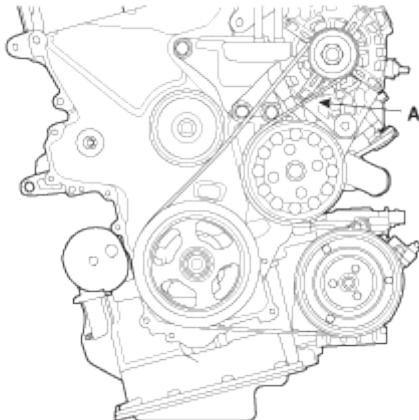
8.3.3.2. Repair procedures

Replacement

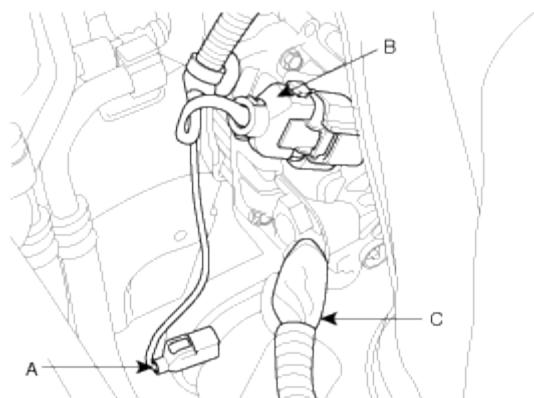
1. Disconnect the battery negative terminal first, then the positive terminal.
2. Loosen the drive belt tension adjusting bolt (A).



3. Remove the drive belt (A).



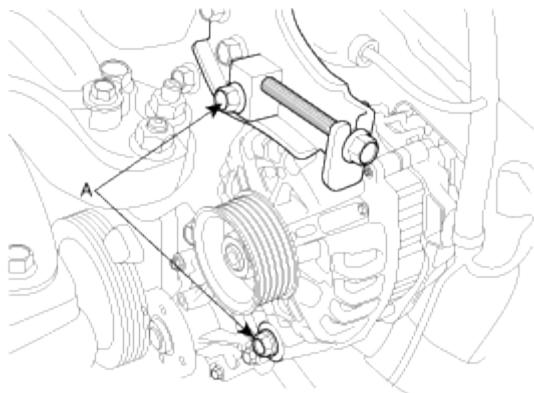
4. Disconnect the air compressor connector(A) and the alternator connector (B), and remove the cable (C) from alternator "B" terminal.



5. Pull out the through bolt (A) and then remove the alternator.

Tightening torque :

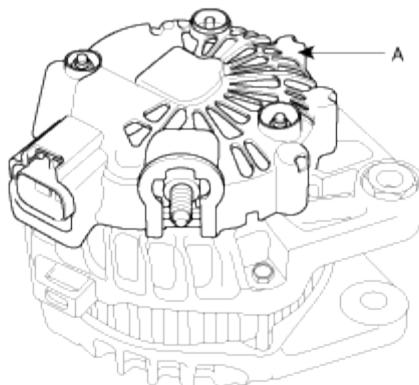
19.6~26.5 Nm (2.0~2.7 kgf.m, 14.5~19.5 lb-ft)-12mm bolt
29.4~41.2 Nm (3.0~4.2 kgf.m, 21.7~30.4 lb-ft)-14mm bolt



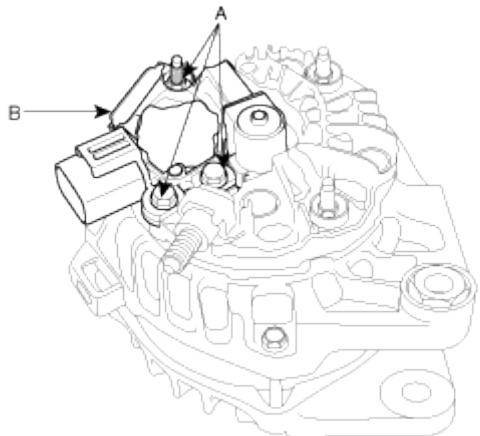
6. Installation is the reverse order of removal.
7. Adjust the alternator belt tension after installation.

Disassembly

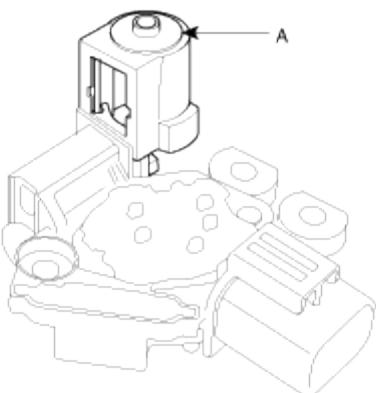
1. Remove the alternator cover(A).



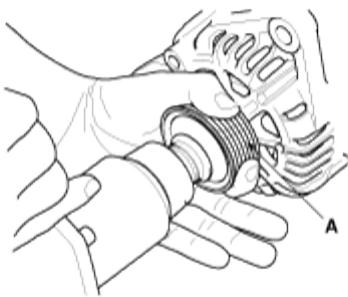
2. Loosen the mounting bolts(A) and disconnect the brush holder assembly(B).



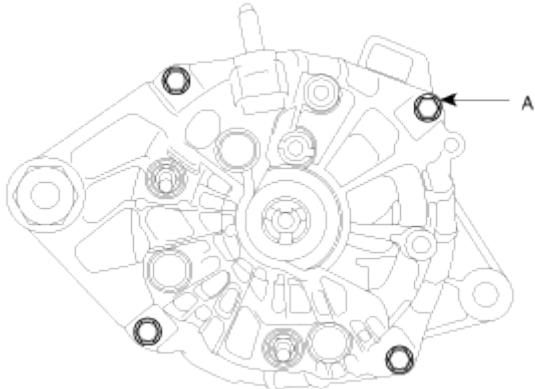
3. Remove the slip ring guide(A).



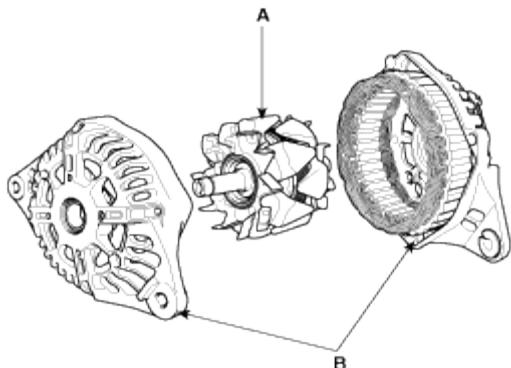
4. Remove the nut, pulley(A) and spacer.



5. Loosen the 4 through bolts(A).



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

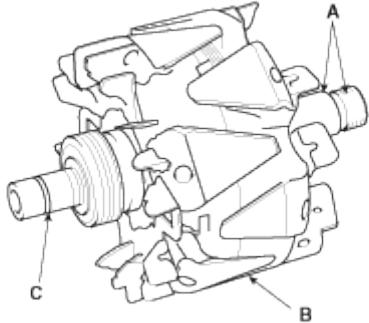


7. Reassembly is the reverse of disassembly.

Inspection

Rotor

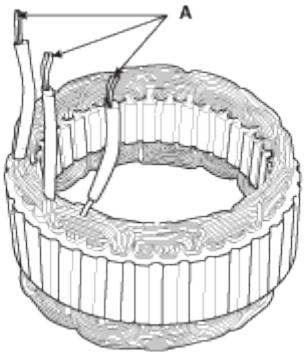
1. Check that there is continuity between the slip rings (C).



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.

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.

8.3.4. Battery

8.3.4.1. Description and Operation

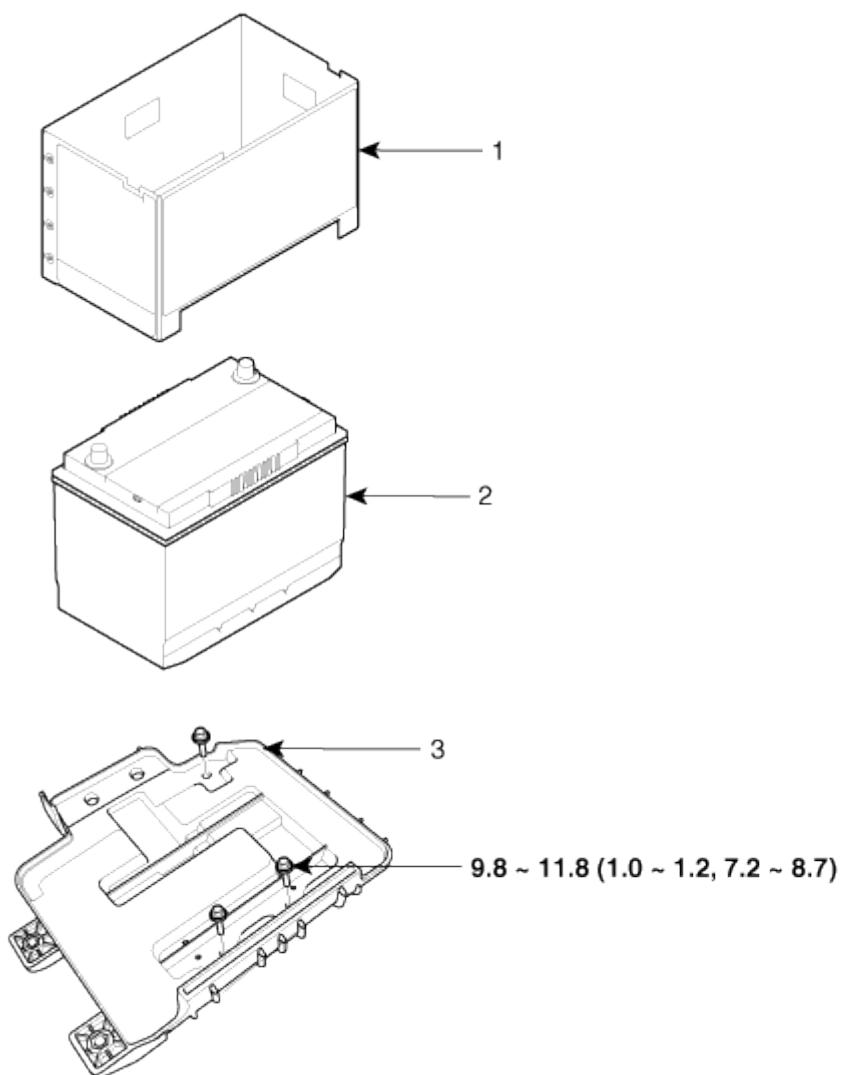
Description

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.



8.3.4.2. Component and Components Location

Components



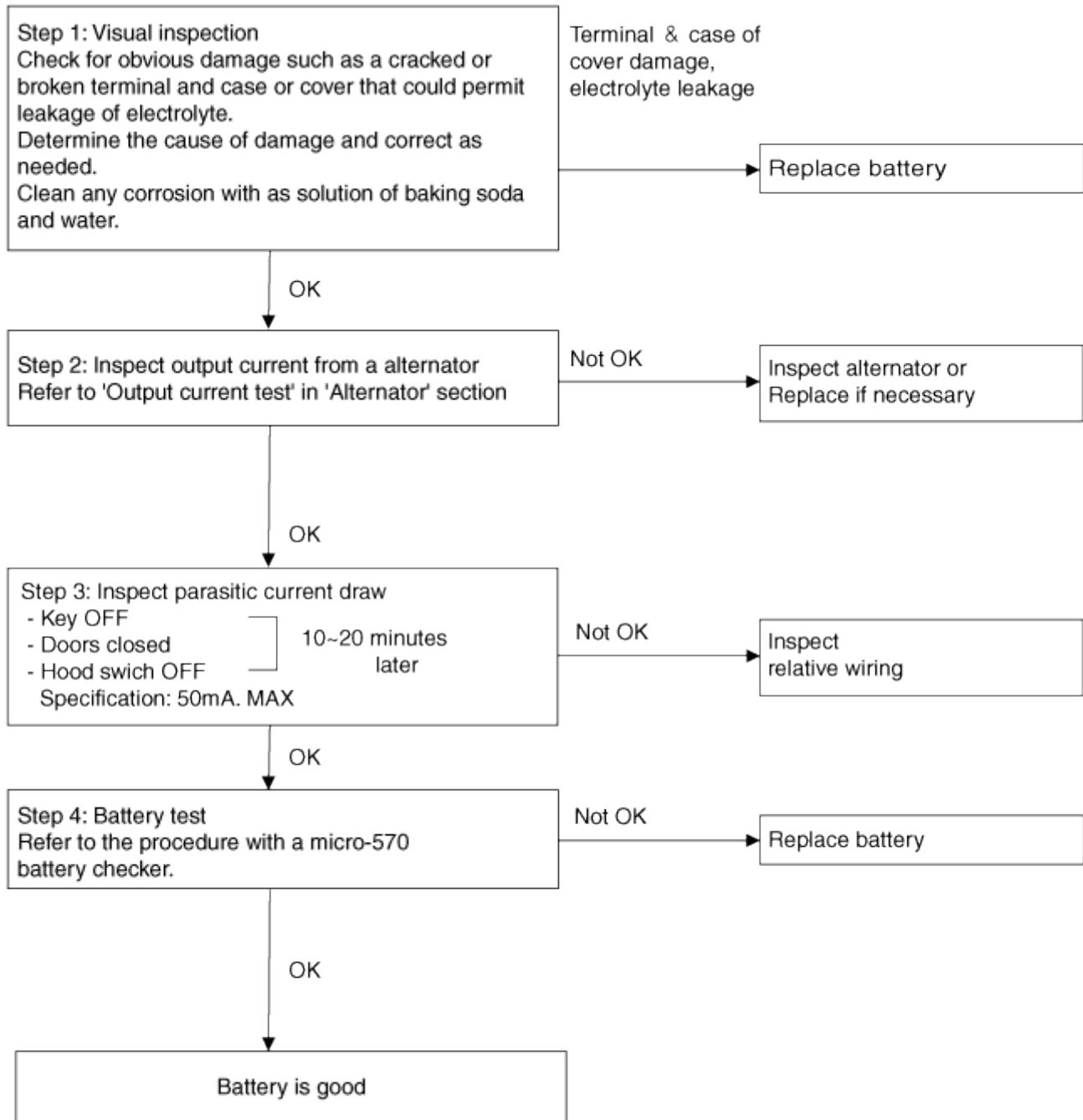
Tightening torque
N.m (kgf.m, lb-ft)

| | |
|---------------------------|-----------------|
| 1. Battery insulation pad | 3. Battery tray |
| 2. Battery | |

8.3.4.3. Repair procedures

Inspection

Battery Diagnostic Flow



Vehicle parasitic current inspection

1. Turn all 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.

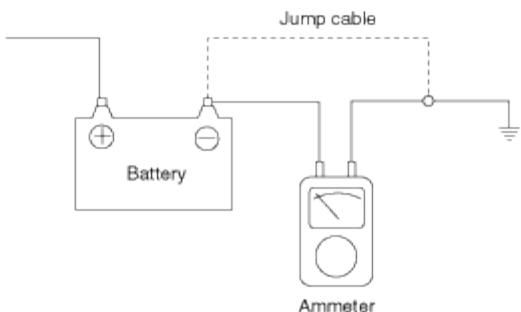
4. Connect an ammeter in series between the battery (-) terminal and the ground cable, and then disconnect the clamp from the battery (-) terminal slowly.

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. Check the parasitic current again, and search for suspected unit by removing a unit connected with the abnormal circuit one by one.

Limit value (after 10~20 min.) : Below 50mA

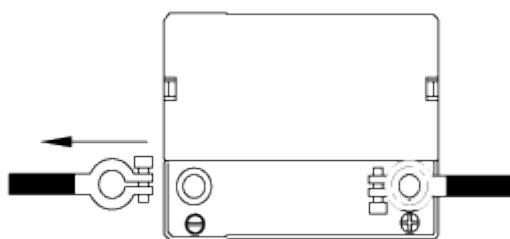
Cleaning

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

CAUTION

Care should be taken in the event the battery case is cracked or leaking, to protect your skin from the electrolyte.

Heavy rubber gloves (not the household type) should be worn when removing the battery.

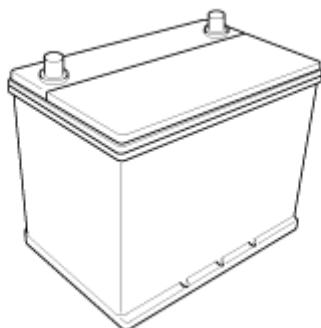


4. Inspect the battery tray for damage caused by the loss of electrolyte. If acid damage is present, it will be necessary to clean the area with a solution of clean warm water and baking soda. Scrub the area with a stiff brush and wipe off with a cloth moistened with baking soda and water.
5. Clean the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

CAUTION

When batteries are being charged, an explosive gas forms beneath the cover of each cell. Do not smoke near batteries being charged or which have recently been charged. Do not break live circuit at the terminals of batteries being charged.

A spark will occur when the circuit is broken. Keep open flames away from battery.



NOTE

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

8.4. Starting System

8.4.1. Description and Operation

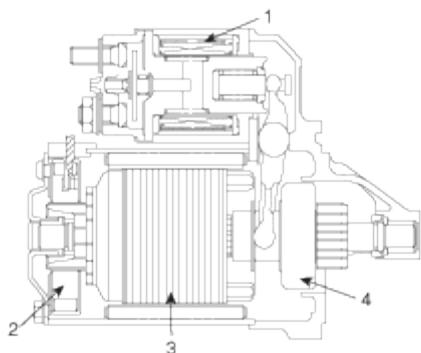
Description

The starting system includes the battery, starter, solenoid switch, ignition switch, inhibitor switch (A/T), ignition lock switch, connection wires and the battery cable.

When the ignition key is turned to the start position, current flows and energizes the starter motor's solenoid coil.

The solenoid plunger and clutch shift lever are activated, and the clutch pinion engages the ring gear.

The contacts close and the starter motor cranks. In order to prevent damage caused by excessive rotation of the starter armature when the engine starts, the clutch pinion gear overruns.



1. Solenoid

2. Brush

3. Armature

4. Over running clutch

8.4.2. Repair procedures

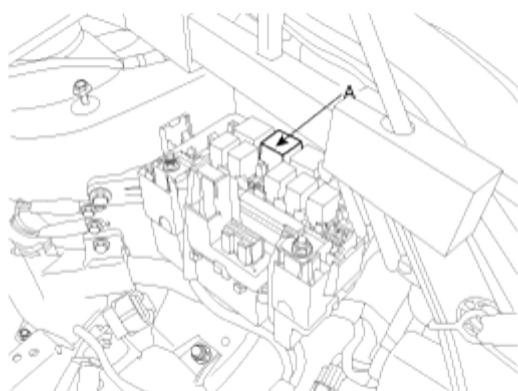
Troubleshooting

Starter Circuit

NOTE

The battery must be in good condition and fully charged.

1. Remove the fuel pump relay(A) from the fuse box.



2. With the shift lever in N or P (A/T) or clutch pedal pressed (M/T), turn the ignition switch to "START".

If the starter normally cranks the engine, starting system is OK. If the starter will not crank the engine at all, go to next step.

If it won't disengage from the ring gear when you release key, check for the following until you find the cause.

- A. Solenoid plunger and switch malfunction.
 - B. Dirty pinion gear or damaged overrunning clutch.
3. Check the battery condition. Check electrical connections at the battery, battery negative cable connected to the body, engine ground cables, and the starter for looseness and corrosion. Then try starting the engine again.

If the starter cranks normally the engine, 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 BE group - ignition system)
- C. Check the transaxle range switch connector or ignition lock switch connector.
- D. Inspect the starter relay.

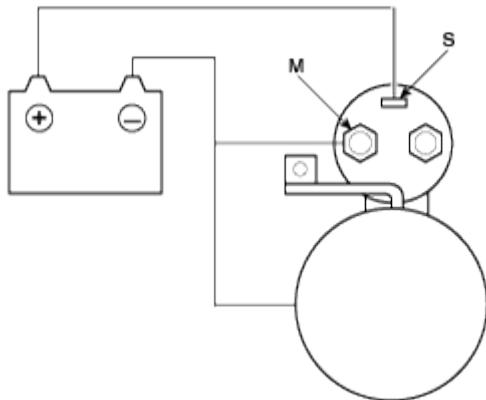
Starter Solenoid Test

1. Disconnect the field coil wire from the M-terminal of solenoid switch.

2. Connect the battery (+) line to the S-terminal and (-) line to the M-terminal and the stater body.

CAUTION

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



3. Connect the field coil wire to the M-terminal.

4. If the pinion moves out, the pull-in coil of solenoid is working properly.

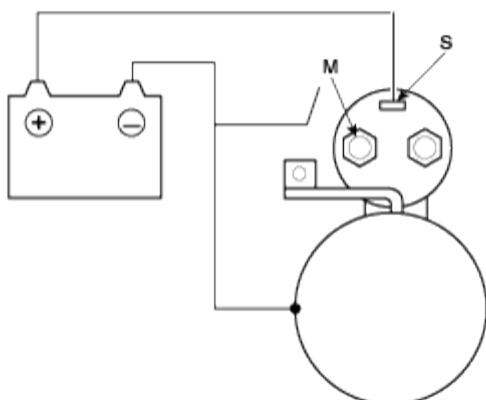
If the pinion does not move, replace the magnetic switch.

5. Disconnect the (-) line from the M-terminal.

6. If the pinion doesn't have moved, the hold-in coil of the solenoid is working properly.

CAUTION

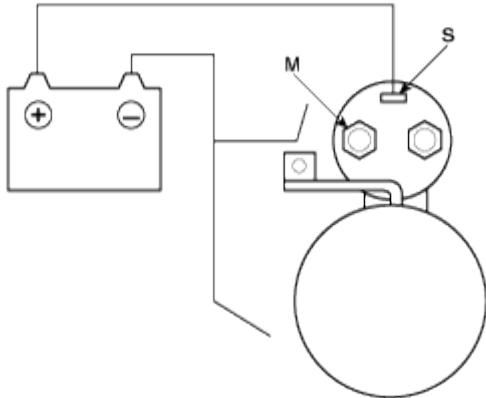
This test must be performed quickly (in less than 10 seconds) to prevent the coil from burning.



7. If the pinion goes back in its original position when you disconnecting the (-) line from the body, the system must be in good condition.

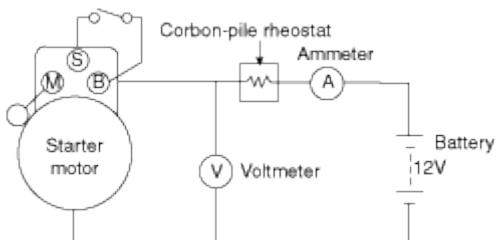
CAUTION

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



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 (100-ampere scale) and carbon pile rheostats 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 11volts.
7. Confirm that the maximum amperage is within the specifications and that the starter motor turns smoothly and freely.

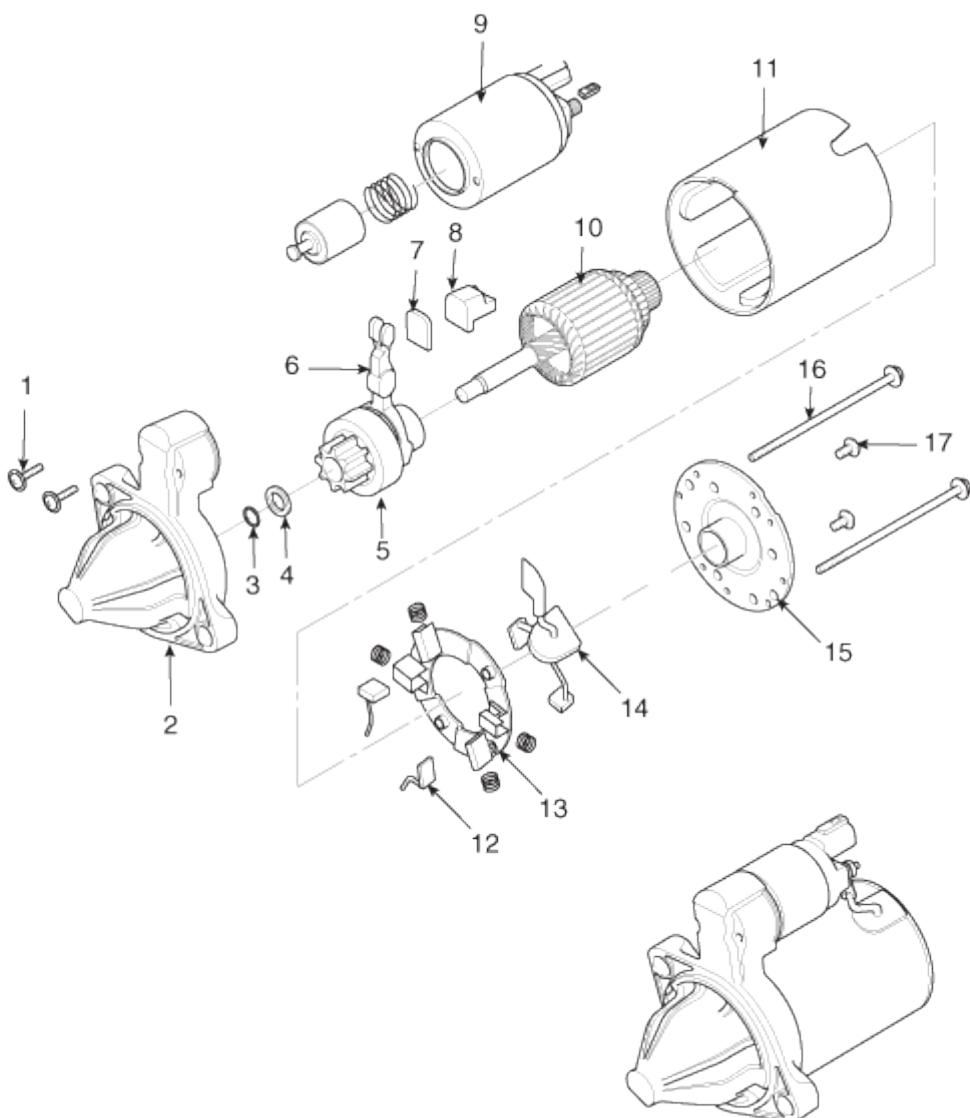
Current : 60A MAX

Speed : 5500 rpm. MIN

8.4.3. Starter

8.4.3.1. Component and Components Location

Components

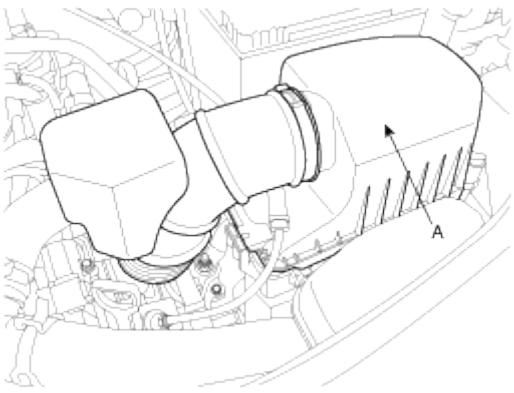


| | |
|--|---|
| 1. Screw (for solenoid)
2. Front bracket
3. Stop ring
4. Stopper
5. Overrun clutch
6. Lever
7. Lever plate
8. Lever packing
9. Magnet switch | 10. Armature
11. Yoke assembly
12. Brush (-)
13. Brush holder assembly
14. Brush (+)
15. Rear bracket
16. Through bolts
17. Screw (for brush holder) |
|--|---|

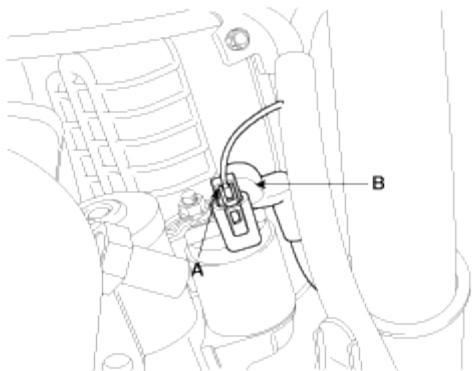
8.4.3.2. Repair procedures

Replacement

1. Disconnect the battery negative cable.
2. Remove the air cleaner assembly (A).



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.

Tightening torque :

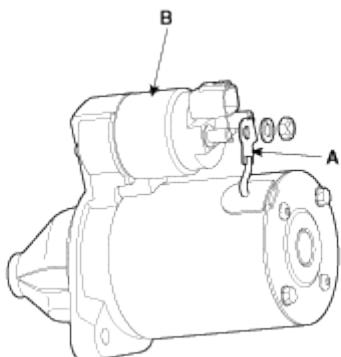
42.2~53.9 Nm (4.3~5.5 kgf.m, 31.1~39.8 lb-ft)

5. Installation is the reverse of removal.

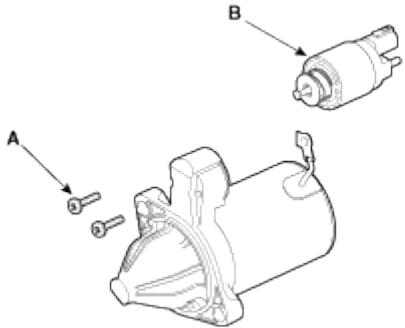
6. Connect the battery negative cable to the battery.

Disassembly

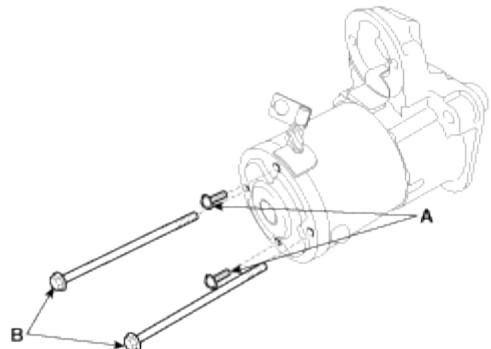
1. Disconnect the M-terminal (A) on the magnet switch assembly (B).



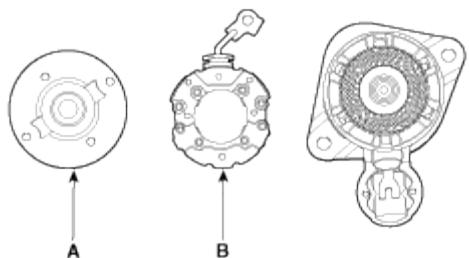
2. After loosening the 2 screws (A), detach the magnet switch assembly (B).



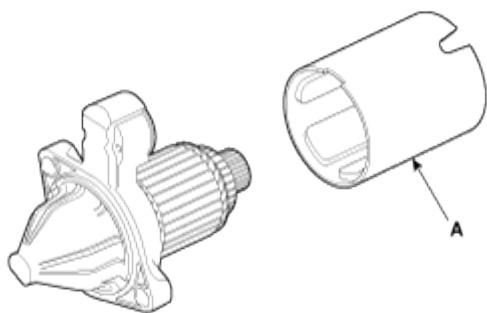
3. Loosen the brush holder mounting screw (A) and through bolts (B).



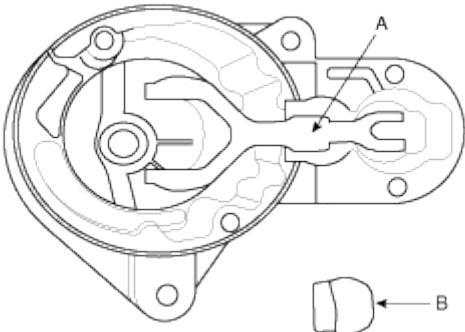
4. Remove the rear bracket (A) and brush holder assembly (B).



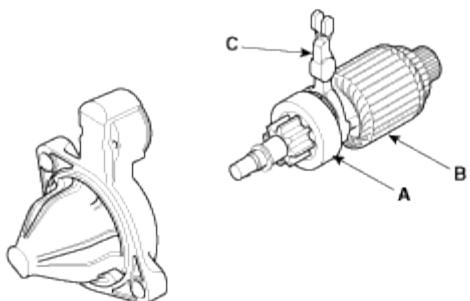
5. Remove the yoke (A).



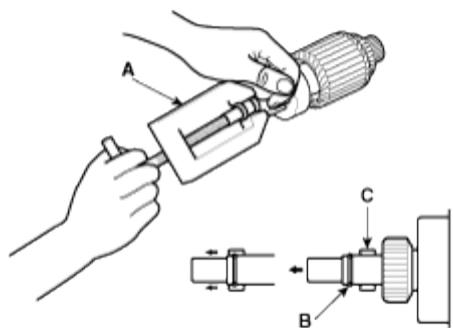
6. Remove the lever plate (A) and packing (B).



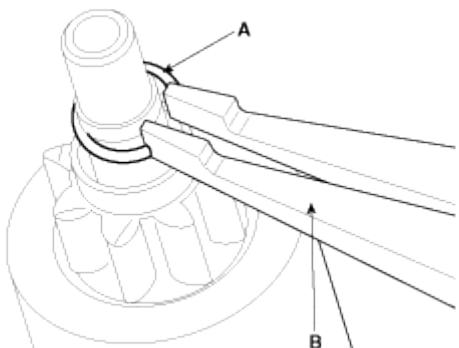
7. Remove the overrunning clutch (A), armature (B) and lever (C).



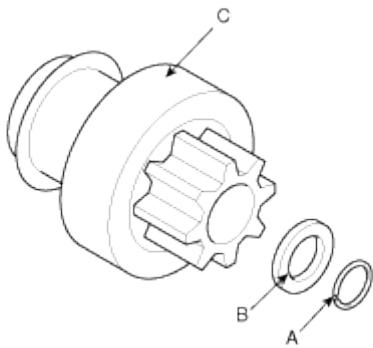
8. Press the stopper (A) using a socket (B).



9. After preparing to remove the stop ring (A) using stopper pliers (B).



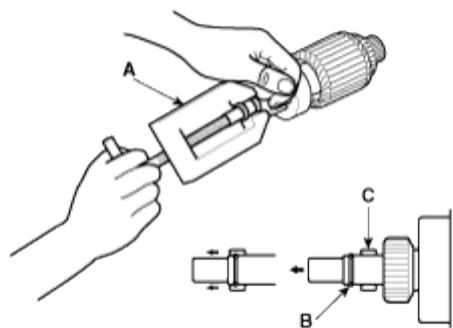
10. Remove the stop ring (A), stopper (B), overrunning clutch (C).



11. Reassembly is the reverse of disassembly.

NOTE

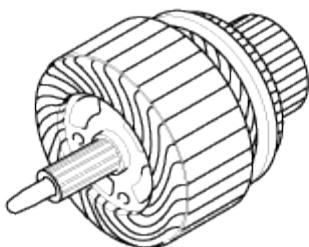
Using a suitable pulling tool (A), pull the stop ring (B) over the stopper (C).



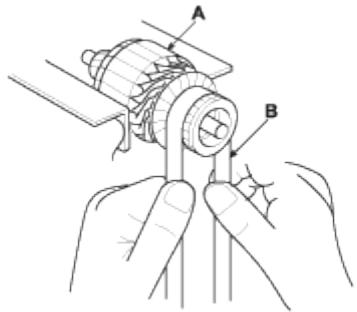
Inspection

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) : 32.9 ~ 33.0 mm (1.2953 ~ 1.2992in.)



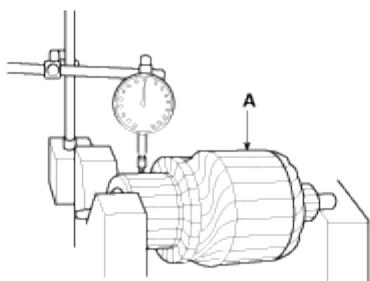
6. Measure the commutator (A) runout.

- 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

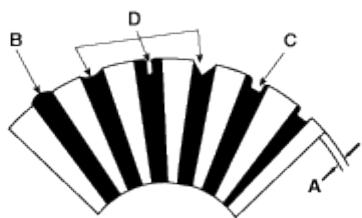
Service limit: 0.1mm (0.0039in.)



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

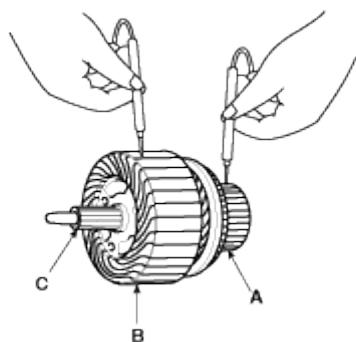
Standard (New) : 0.5 mm (0.0197 in.)



8. Check for continuity between the segments of the commutator. If an open circuit exists between any segments, replace the armature.



9. Check with an ohmmeter that no continuity exists between the commutator (A) and armature coil core (B), and between the commutator and armature shaft (C). If continuity exists, replace the armature.



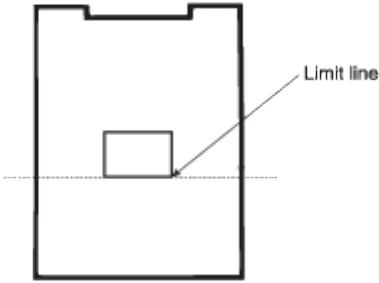
Inspect Starter Brush

Brushes that are worn out, or oil-soaked, should be replaced.

Brush length

Standard : 12.3 mm (0.4843 in)

Service limit : 5.5 mm (0.2165 in)

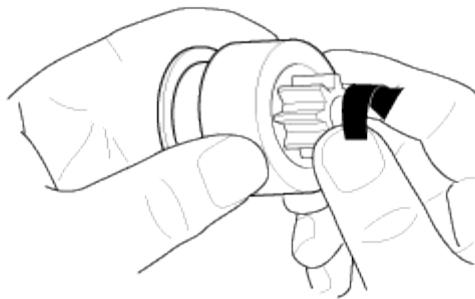


NOTE

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.

Inspect 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.

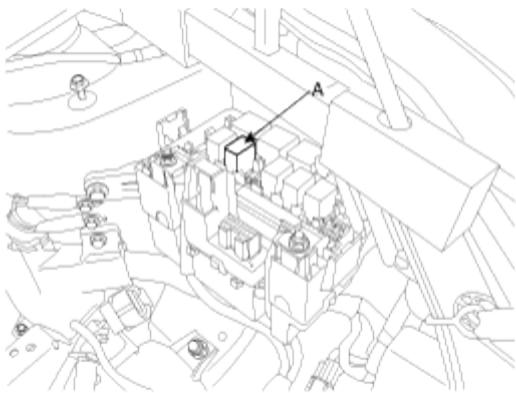
Cleaning

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 cloth or air.
Any solvent should not be used.

8.4.5. Starter Relay 8.4.5.1. Repair procedures

Inspection

1. Remove the fuse box cover.
2. Remove the starter relay (A).

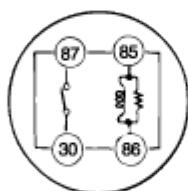
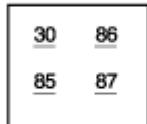


3. Using an ohmmeter, check that there is continuity between each terminal.

| Terminal | Continuity |
|----------|------------|
| 30 - 87 | NO |
| 85 - 86 | YES |

4. Apply 12V to terminal 85 and ground to terminal 86.

Check for continuity between terminals 30 and 87.



5. If there is no continuity, replace the starter relay.

6. Install the starter relay.

7. Install the fuse box cover.

9. Engine Mechanical System

9.1. General Information

9.1.1. Specifications

| Specifications | | | |
|---------------------|--|-----------------|-------|
| Description | Specifications | | Limit |
| | 1.4 | 1.6 | |
| General | | | |
| Type | In-line, DOHC | | |
| Number of cylinders | 4 | | |
| Bore | 77mm (3.0315in) | 77mm (3.0315in) | |
| Stroke | 74.99mm (2.9523in) 85.44mm (3.3638in) | | |

| | | | | |
|--|---------------------------------------|-------------------------------------|-------------------|--|
| Total displacement | 1,396 cc (85.19 cu.in) | 1,591 cc (97.09 cu.in) | | |
| Compression ratio | 10.5 : 1 | | | |
| Firing order | 1-3-4-2 | | | |
| Valve timing | | | | |
| Intake valve | Opens | ATDC 12°/BTDC 38° | ATDC 10°/BTDC 40° | |
| | Closes | ABDC 49°/BBDC 1° | ABDC 63°/ABDC 13° | |
| Exhaust valve | Opens | BBDC 28° | BBDC 40° | |
| | Closes | ATDC 7° | ATDC 3° | |
| Cylinder head | | | | |
| Flatness of gasket surface | Less than 0.05mm (0.0020in) | | | |
| Camshaft | | | | |
| Cam height | Intake | 42.85mm (1.687in) | 43.85mm (1.726in) | |
| | Exhaust | 42.85mm (1.687in) | 42.85mm (1.687in) | |
| 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 | 92.6mm (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 | 1.1mm (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 | 44.0mm (1.7323in) | | | |
| 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)
/ Less than 0.02mm (0.0008in) 100mm×100mm | |
| 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 | 1.22 ~ 1.24mm (0.0480 ~ 0.0488in) | 1.26mm (0.0496in) |
| | No. 2 ring groove | 1.22 ~ 1.24mm (0.0480 ~ 0.0488in) | 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 | 0.03 ~ 0.07mm (0.0012 ~ 0.0028in) | 0.1 mm (0.0039in) |
| | No.2 ring | 0.03 ~ 0.07mm (0.0012 ~ 0.0028in) | 0.1 mm (0.0039in) |
| | Oil ring | 0.06 ~ 0.15mm (0.0024 ~ 0.0059in) | 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 ~ 0.70mm (0.0079 ~ 0.0276in) | 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 | | 0.018 ~ 0.036mm (0.0007 ~ 0.0014in) | |
| Side clearance | | 0.10 ~ 0.25mm (0.0039 ~ 0.0098in) | |
| Crankshaft | | | |
| Main bearing oil clearance | No. 1, 2, 3, 4, 5 | 0.006 ~ 0.024mm (0.0002 ~ 0.0009in) | 0.05mm (0.0020in) |
| End play | | 0.05 ~ 0.25mm (0.0020 ~ 0.0098in) | |
| 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
(except Middle East) | 5W-20/GF4&SM | If not available, refer to the recommended API or ILSAC classification and SAE viscosity number. |
| | Classification | API SL, SM or above
ILSAC GF3, GF4 or above | Satisfy the requirement of the API or ILSAC classification. |
| | SAE viscosity grade | Recommended SAE viscosity number | Refer to the "Lubrication System" |
| Oil pressure (at 1000rpm) | | 100kPa (1.0kg/cm ² , 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 | 5.5 ~ 5.8L(5.81~6.13US qt., 4.84~5.10Imp 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/cm ² , 13.51 ~ 17.78psi) |
| | Vacuum valve opening pressure | MAX. 6.86 kpa(0.07kgf/cm ² , 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 |
|--|----------|---------------------------|-------------------------|---------------------------|
| Cylinder block | | | | |
| Engine support bracket bolts (engine side) | 4 | 29.4 ~ 41.2 | 3.0 ~ 4.2 | 21.7 ~ 30.4 |
| Ladder frame bolts | 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 | (17.7~21.6) +
(88~92°) | (1.8~2.2) +
(88~92°) | (13.0~15.9) +
(88~92°) |

| | | | | |
|--|---------|---|---|---|
| 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 |
| Timing chain 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) | 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 | | | | |
| Engine cover bolt | 4 | 7.8 ~ 11.8 | 0.8 ~ 1.2 | 5.8 ~ 8.7 |
| Cylinder head cover bolt | 16 | 7.8 ~ 9.8 | 0.8 ~ 1.0 | 5.8 ~ 7.2 |
| Camshaft bearing cap bolt(M6) | 16 | 11.8 ~ 13.7 | 1.2 ~ 1.4 | 8.7 ~ 10.1 |
| Camshaft bearing cap bolt(M8) | 4 | 18.6 ~ 22.6 | 1.9 ~ 2.3 | 13.7 ~ 16.6 |
| Cylinder head bolt | 10 | (17.7~21.6) +
(90~95°) +
(100~105°) | (1.8~2.2) +
(90~95°) +
(100~105°) | (13.0~15.9) +
(90~95°) +
(100~105°) |
| 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 bolts | 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 bolts/Nuts(M6) | B-1/N-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 |
| 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 |
| Intake and exhaust system | | | | |
| Intake manifold and cylinder head mounting nut | 5 | 18.6 ~ 23.5 | 1.9 ~ 2.4 | 13.7 ~ 17.4 |
| Exhaust manifold and cylinder head mounting nut | 9 | 29.4 ~ 41.2 | 3.0 ~ 4.2 | 21.7 ~ 30.4 |
| Oxygen sensor mounting | 2 | 39.2 ~ 49.0 | 4.0 ~ 5.0 | 28.9 ~ 36.2 |
| Exhaust manifold heat cover | 3 | 9.8 ~ 11.8 | 1.0 ~ 1.2 | 7.2 ~ 8.7 |
| Head cover protector and cylinder head mounting bolts | 2 | 9.8 ~ 11.8 | 1.0 ~ 1.2 | 7.2 ~ 8.7 |
| Exhaust manifold and cylinder block, ladder frame mounting bolts | 4 | 39.2 ~ 49.0 | 4.0 ~ 5.0 | 28.9 ~ 36.2 |
| Air cleaner lower cover mounting | 2 | 7.8 ~ 9.8 | 0.8 ~ 1.0 | 5.8 ~ 7.2 |
| Exhaust manifold and front muffler mounting nut | 2 | 39.2 ~ 49.0 | 4.0 ~ 5.0 | 28.9 ~ 36.2 |
| Front muffler and catalytic convertor mounting nut | 2 | 39.2 ~ 49.0 | 4.0 ~ 5.0 | 28.9 ~ 36.2 |
| Center muffler and main muffler mounting nut | 2 | 39.2 ~ 49.0 | 4.0 ~ 5.0 | 28.9 ~ 36.2 |

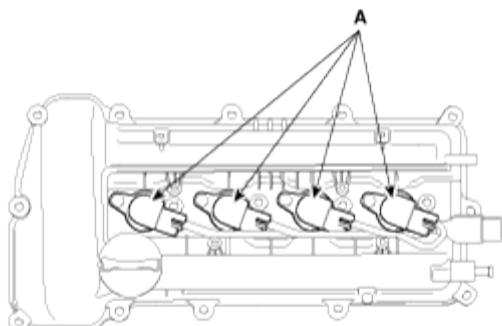
9.1.2. Repair procedures

Compession Pressure Inspection

NOTE

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

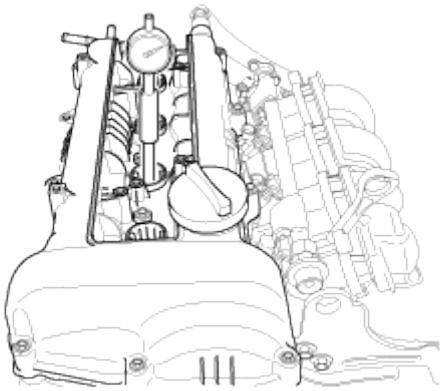
1. Make sure the oil in the crankcase is of the correct viscosity and at the correct level and that the battery is correctly charged. Operate the vehicle until the engine is at normal operating temperature. Turn the ignition switch to the OFF position.
2. Remove the engine center cover.
3. Remove the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



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

5. 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 :

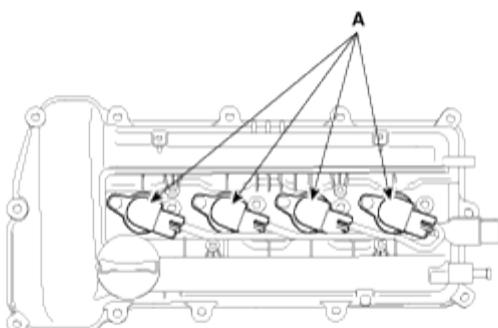
98kPa (1.0kg/cm², 14psi) or less

- (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.

6. Install the spark plugs.

7. Install the ignition coil(A).



8. Install the engine center cover.

Tightening torque :

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

9.1.3. Troubleshooting

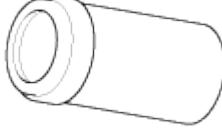
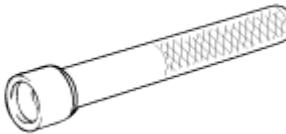
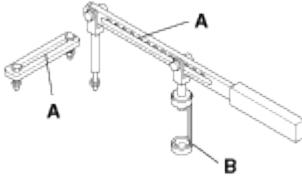
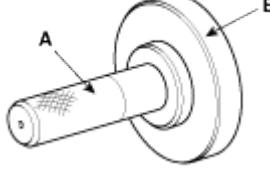
| Troubleshooting | | |
|--|---|--|
| Symptom | Suspect area | Remedy |
| Engine misfire with abnormal internal lower engine noises. | Loose or improperly installed engine flywheel. | Repair or replace the flywheel as required. |
| | Worn piston rings.
(Oil consumption may or may not cause the engine 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. | <ul style="list-style-type: none"> 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. | <ul style="list-style-type: none"> 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. |

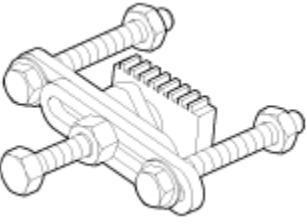
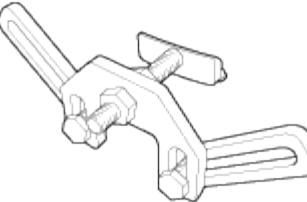
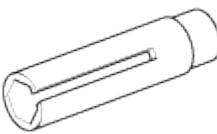
| | | |
|---|---|---|
| | Stuck valves. (Carbon on the valve stem or valve seat may cause the valve to stay open.) | Inspect the valves and valve guides, then repair as required. |
| Lower engine noise, regardless of engine speed. | Low oil pressure. | Repair or replace damaged components as required. |
| | 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. <ul style="list-style-type: none"> • The connecting rod bearings. • The connecting rods. • The crankshaft. • The crankshaft journal. |
| | Excessive crankshaft bearing clearance. | Inspect the following components and repair as required. <ul style="list-style-type: none"> • 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. <ul style="list-style-type: none"> • The connecting rod bearings. • The connecting rods. • The crankshaft. |
| | Excessive crankshaft bearing clearance. | Inspect the following components and repair as required. <ul style="list-style-type: none"> • The crankshaft bearings. • The crankshaft journals. • The cylinder block crankshaft bearing bore. |
| Engine will not crank. (crankshaft will not rotate) | Hydraulically locked cylinder. <ul style="list-style-type: none"> • 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. |

9.1.4. 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 |

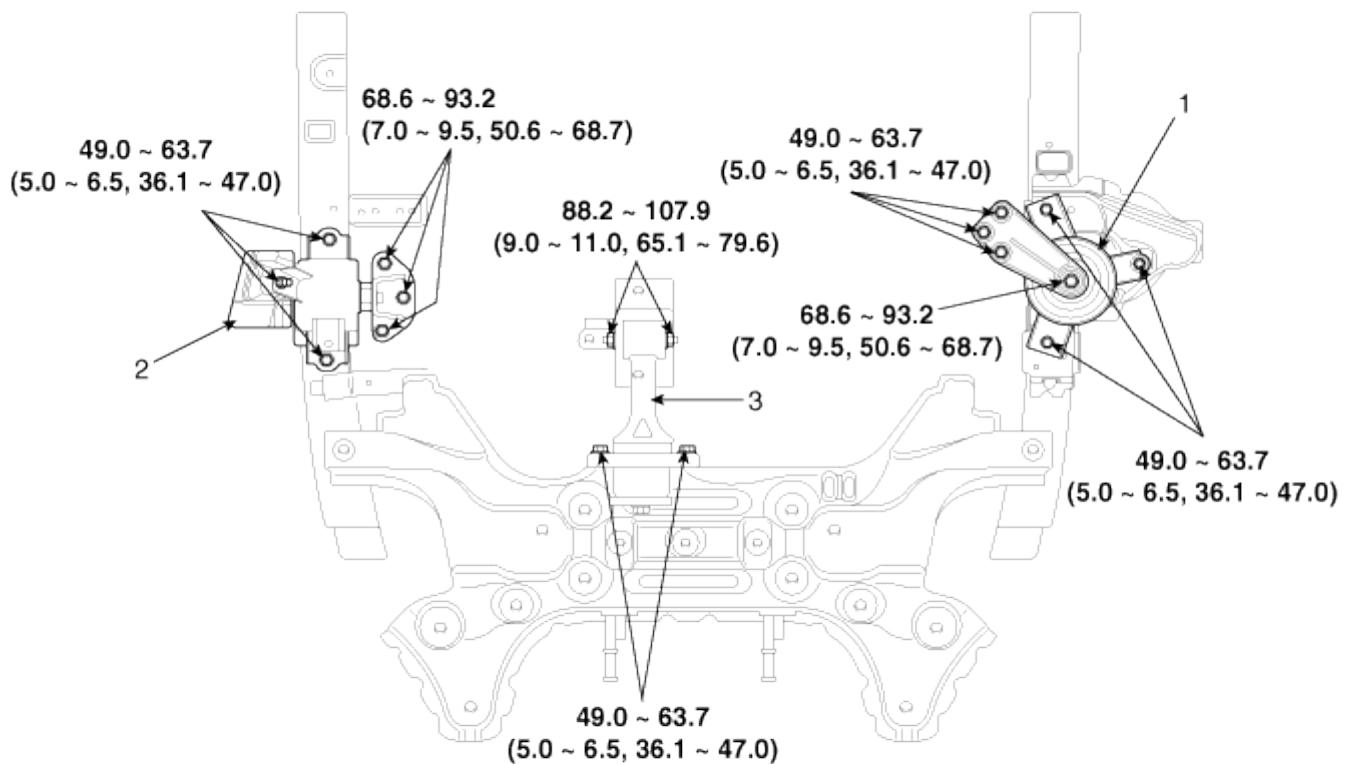
| | | |
|--|---|--|
| Ring gear stopper
(09231-2B100) |  | Removal and installation of crankshaft pulley bolt. |
| Ring gear stopper
(09231-3D100) |  | Removal and installation of crankshaft pulley bolt. |
| Engine coolant temperature sensor socket wrench
(09221-25100) |  | Removal and installation of 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 |

9.2. Engine and Transaxle Assembly

9.2.1. Engine Mounting

9.2.1.1. Component and Components Location

Components



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

| | |
|-------------------------------|----------------------|
| 1. Engine mounting bracket | 3. Rear roll stopper |
| 2. Transaxle mounting bracket | |

9.2.2. Engine and Transaxle Assembly

9.2.2.1. Repair procedures

Removal

CAUTION

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

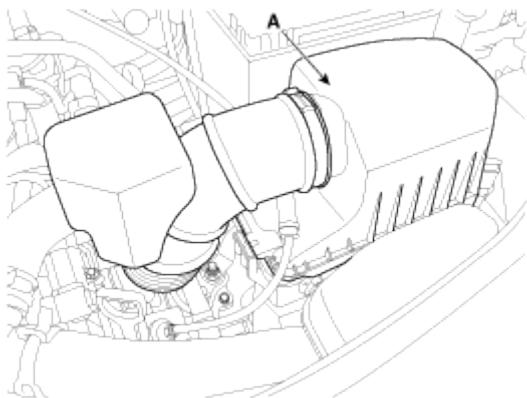
NOTE

- Mark all wiring and hoses to avoid misconnection.

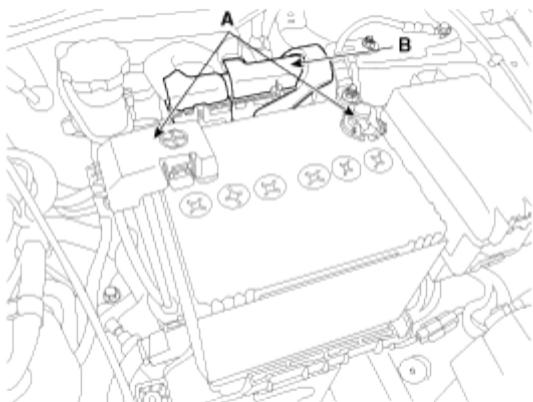
1. Remove the air cleaner assembly (A).

Tightening torque :

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



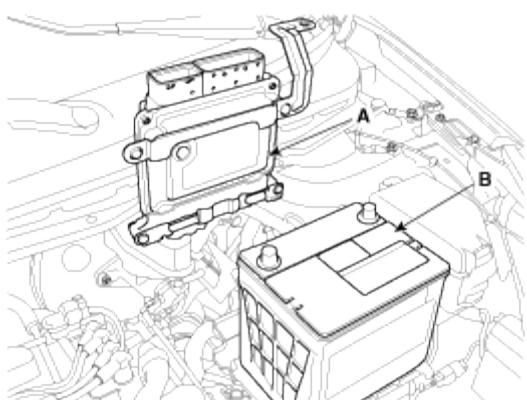
2. Disconnect the terminals (A) and the ECM connector (B).



3. Remove the ECM (A) and the battery (B).

Tightening torque :

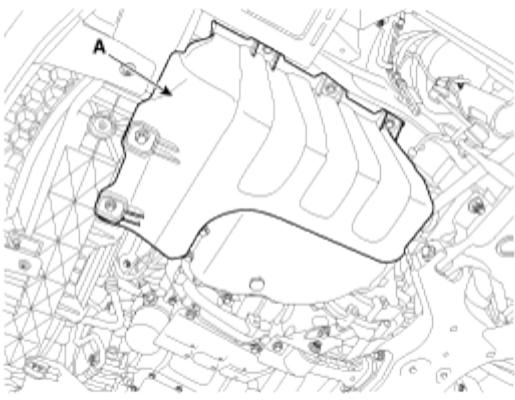
9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)



4. Remove the under cover(A).

Tightening torque :

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



5. Loosen the radiator drain plug and drain the engine coolant.

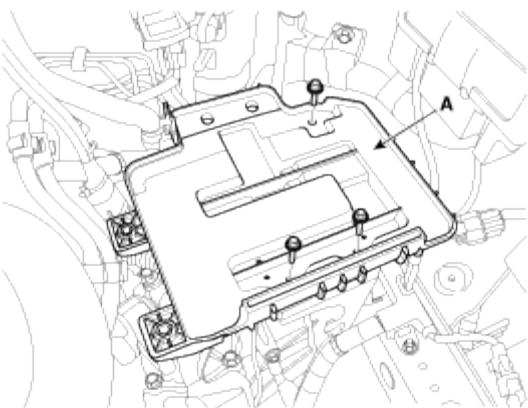
NOTE

Remove the radiator cap to speed draining

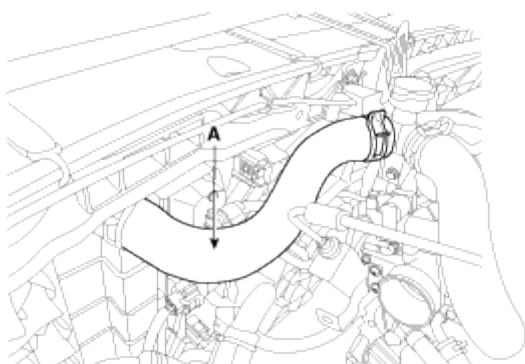
6. Remove the battery tray(A).

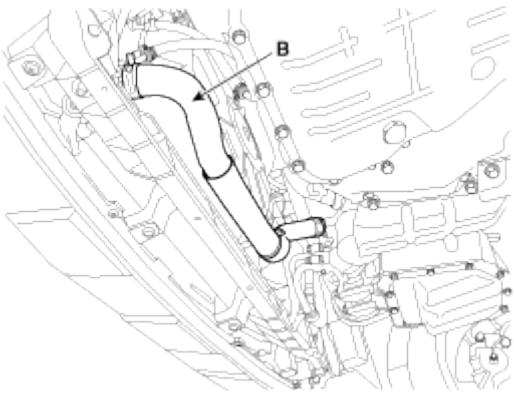
Tightening torque :

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

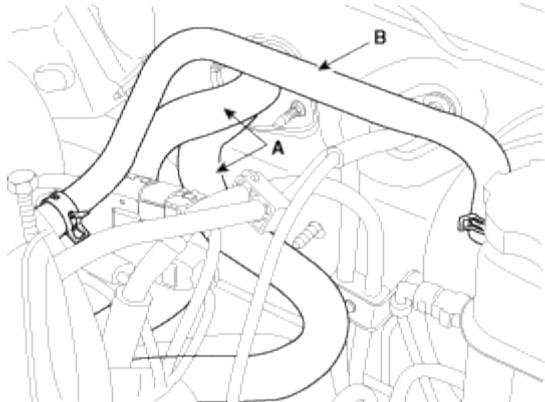


7. Remove the upper radiator hose(A) and lower radiator hose(B).

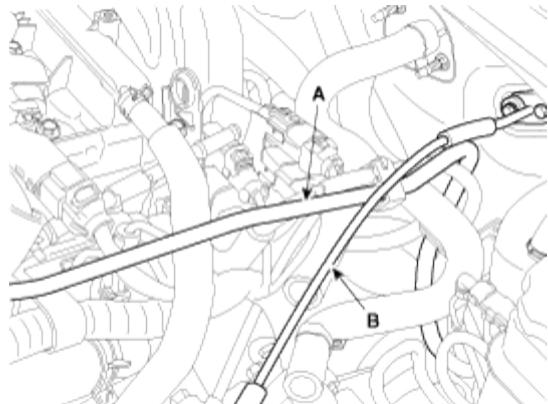




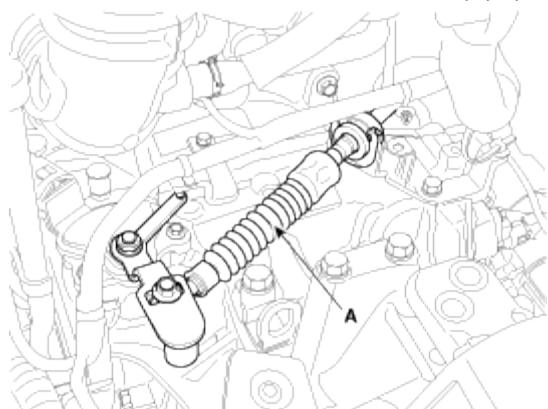
8. Remove the engine wiring harness connectors and clamps from the engine.
9. Remove the heater hoses(A) and brake booster hose(B).



10. Remove the fuel hose(A) and the accelerator cable(B).



11. Recover refrigerant and remove the high & low pressure pipe. (Refer to Air conditioner compressor in HA Group).
12. Disconnect the transaxle control cable(A). (Refer to Transaxle control system in MT or AT Group).



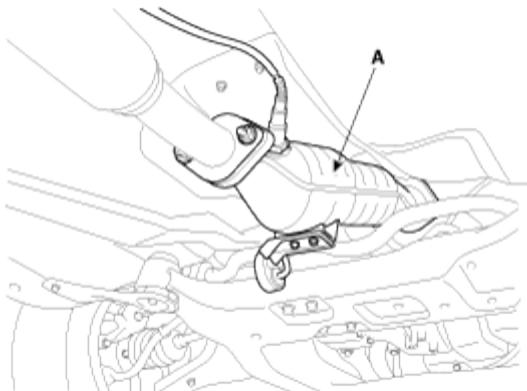
13. Remove the front wheels and tires.
14. Disconnect the stabilizer bar link and remove the mounting bolts from the lower arm and the front axles.

15. Remove the catalytic converter (A).

Tightening torque :

Bolts : 43.1 ~ 45.1N.m (4.4 ~ 4.6kgf.m, 31.8 ~ 33.3lb-ft)

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

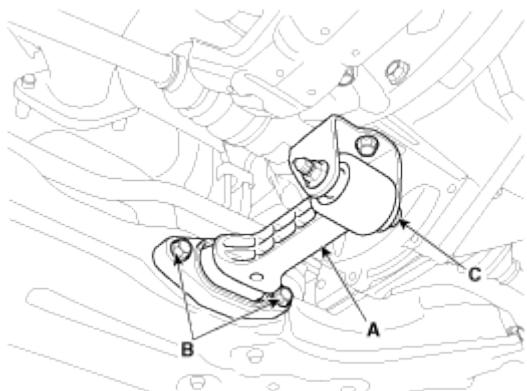


16. Remove the rear roll stopper (A).

Tightening torque :

B : 49.0 ~ 63.7N.m (5.0 ~ 6.5kgf.m, 28.9 ~ 47.0lb-ft)

C : 88.2 ~ 107.9N.m (9.0 ~ 11.0kgf.m, 65.1 ~ 79.6lb-ft)



NOTE

Mark the rear roll stopper direction for proper installation.

17. Using a floor jack, support the engine and transaxle assembly.

CAUTION

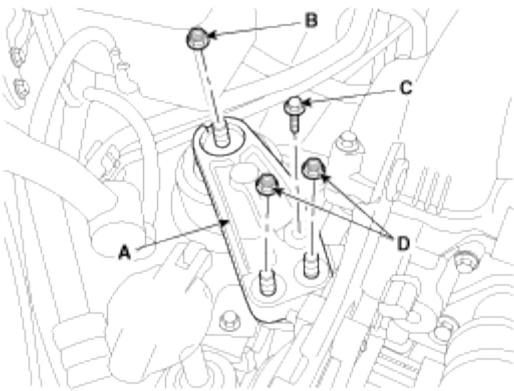
- After removing the mounting bolt (engine and transaxle), the engine and transaxle assembly may fall downward, and so support them securely with floor jack.
- Verify that the hoses and connectors are disconnected before removing the engine and transaxle assembly.

18. Remove the engine mounting bracket(A).

Tightening torque :

Nut(B) : 68.6 ~ 93.2N.m (7.0 ~ 9.5kgf.m, 50.6 ~ 68.7lb-ft)

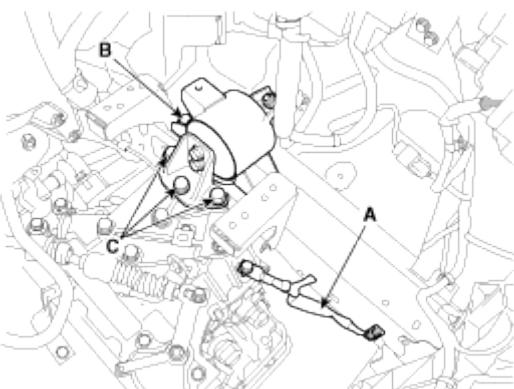
Bolt(C) and Nuts(D) : 49.0 ~ 63.7N.m (5.0 ~ 6.5kgf.m, 36.1 ~ 47.0lb-ft)



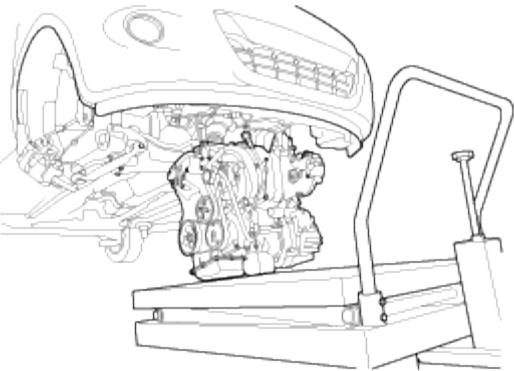
19. Disconnect the ground (A), and then remove the transaxle mounting bracket (B).

Tightening torque :

88.2 ~ 107.9N.m (9.0 ~ 11.0kgf.m, 65.1 ~ 79.6lb-ft)



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



CAUTION

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

Installation

Installation is in the reverse order of removal.

Perform the following :

- Adjust the shift cable.
- Adjust the throttle cable.
- Refill the engine with engine oil.
- Refill the transaxle with fluid.
- Refill the radiator and reservoir tank with engine coolant.

- 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.
- Clean the battery posts and cable terminals with sandpaper, assemble them and then apply grease to prevent corrosion.
- Inspect for fuel leakage.
- After assembling fuel line, turn on the ignition switch (do not operate the starter) so that the fuel pump could run for approximately two seconds and fuel line could be pressurized.
- Repeat this operation two or three times and check for fuel leakage at any point in the fuel line.

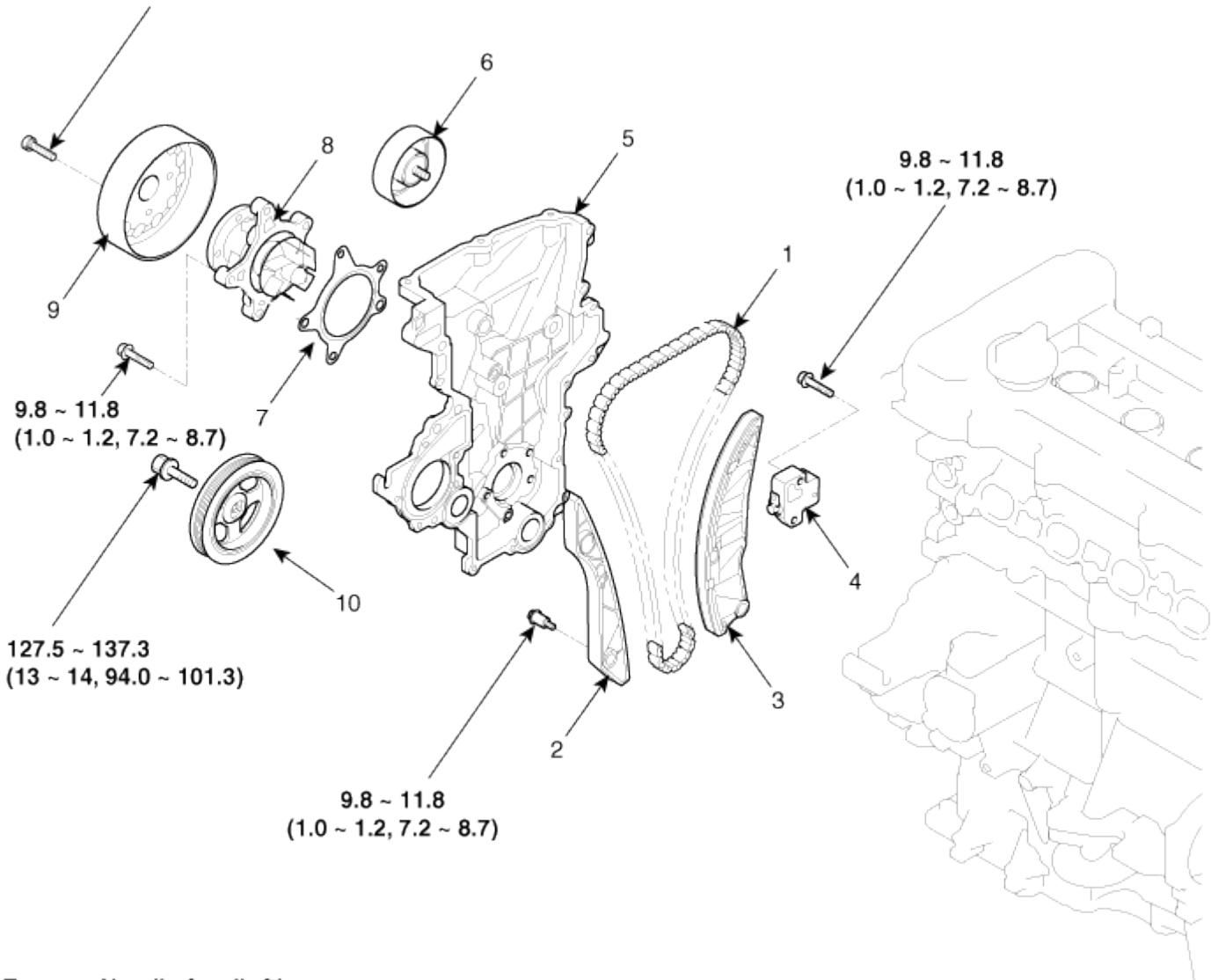
9.3. Timing System

9.3.1. Timing System

9.3.1.1. Component and Components Location

Components

9.8 ~ 11.8 (1.0 ~ 1.2, 7.2 ~ 8.7)



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

1. Timing chain

6. Drive belt idler

- 2. Timing chain guide
- 3. Timing chain arm
- 4. Timing chain auto tensionr
- 5. Timing chain cover

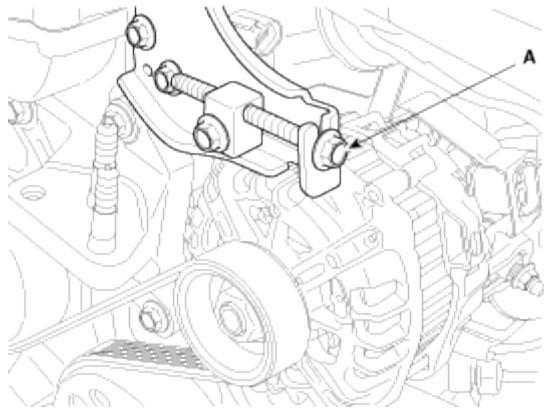
- 7. Water pump gasket
- 8. Water pump
- 9. Water pump pulley
- 10. Crank shaft pulley

9.3.1.2. Repair procedures

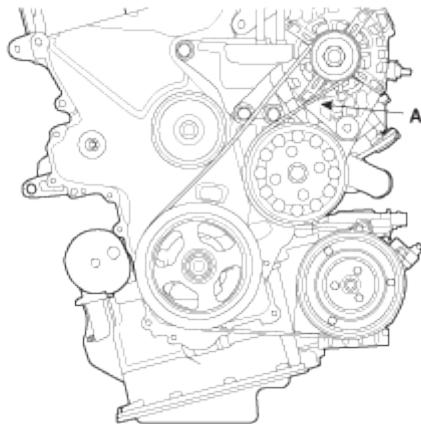
Removal

Engine removal is not required for this procedure.

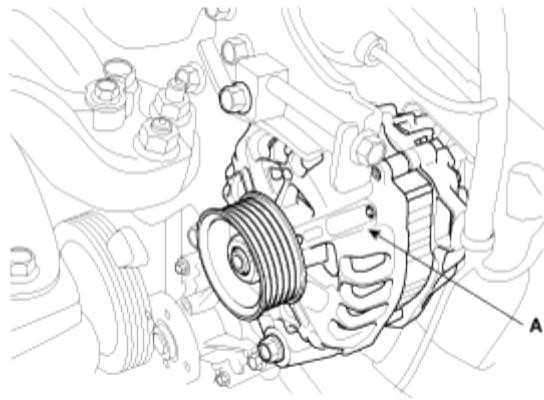
1. Loosen the water pump pulley bolt and the drive idler mounting bolt.
2. Loosen the alternator tension adjusting bolt(A) to loosen tension.



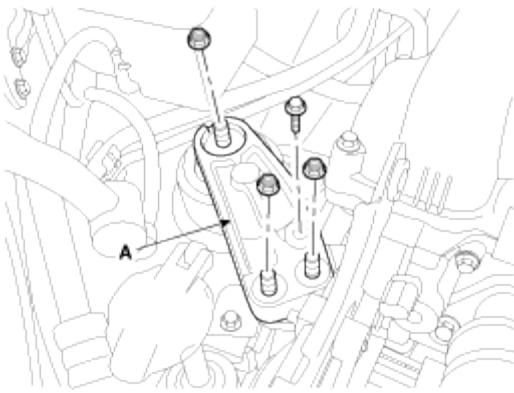
3. Remove the alternator drive belt(A).



4. Remove the alternator(A). (Refer to Alternator in EE Group).



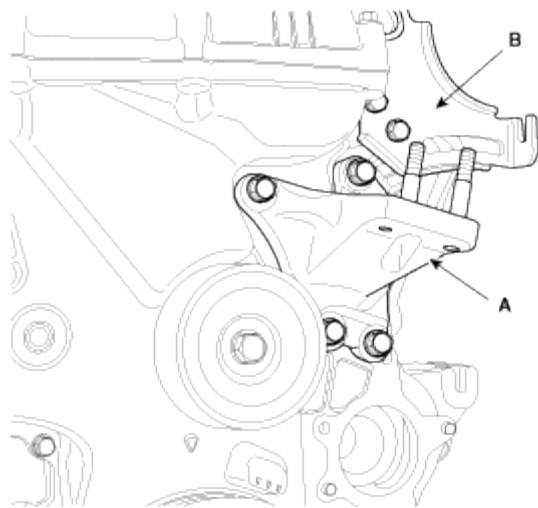
5. Remove the RH front wheel.
6. Remove the engine mounting bracket(A).



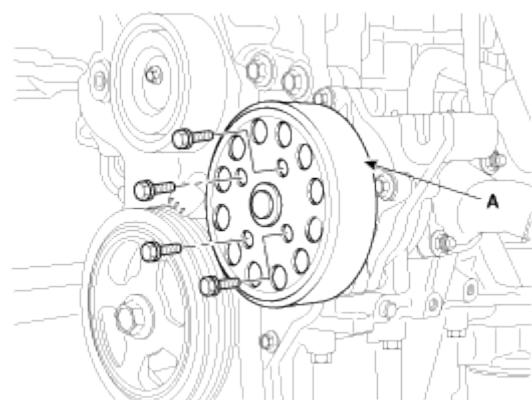
NOTE

Support the engine with a jack not to be tilted.

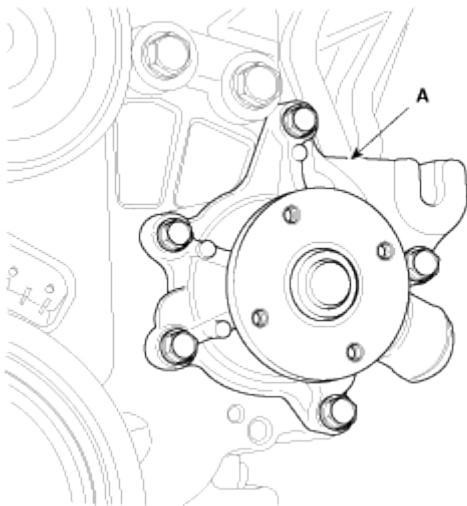
7. Remove the alternator bracket(B).
8. Remove the engine support bracket(A).



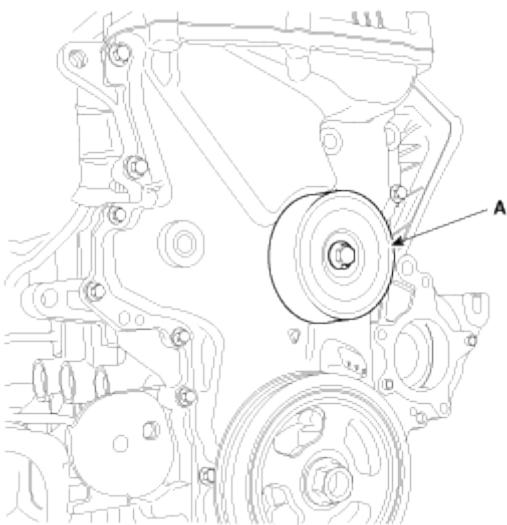
9. Remove the water pump pulley(A).



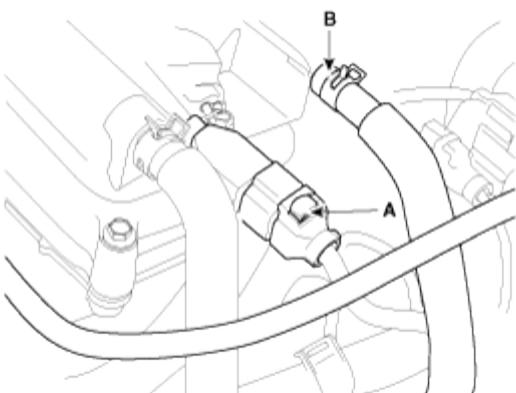
10. Remove the water pump(A).



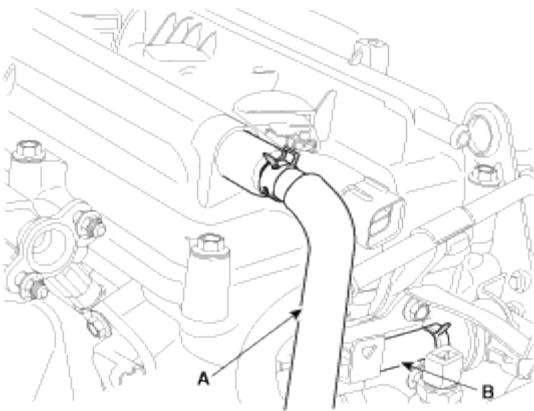
11. Remove the drive belt idler(A).



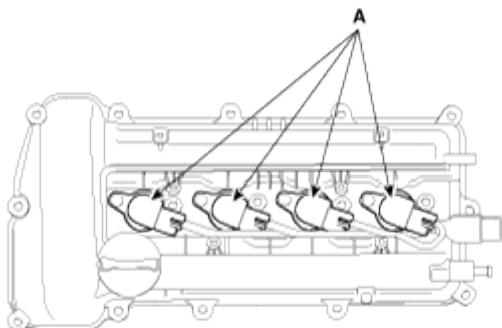
12. Disconnect the ignition coil connector(A) and the breather hose(B).



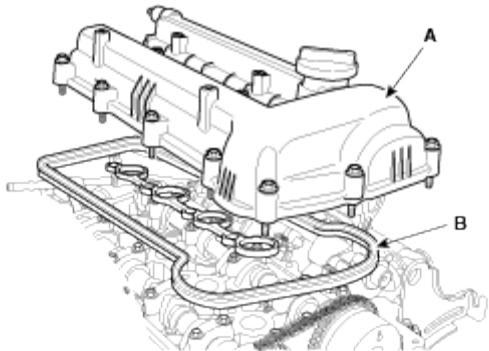
13. Disconnect the positive crankcase ventilation(PCV) hose(A) and PCSV hose(B).



14. Remove the ignition coils(A).

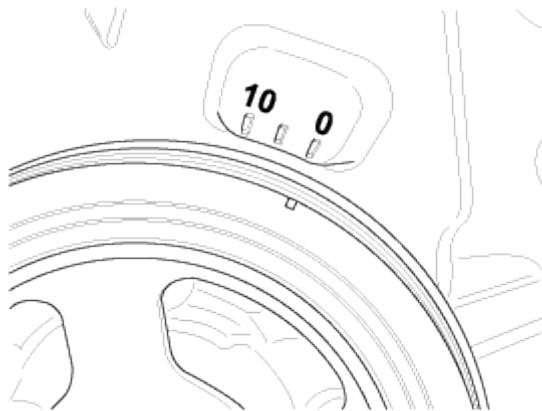


15. Remove the cylinder head cover(A) with its gasket(B).

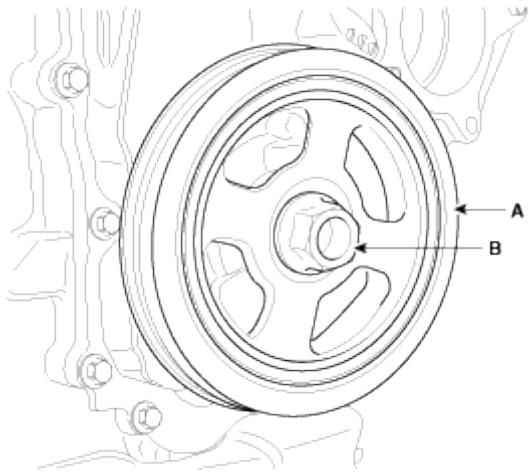


16. Remove side cover.

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



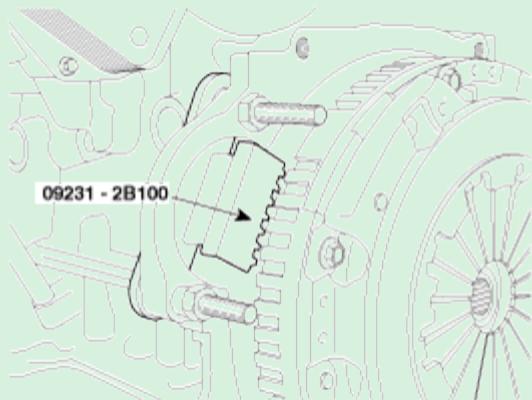
18. Remove the crankshaft bolt(B) and crankshaft pulley(A).



NOTE

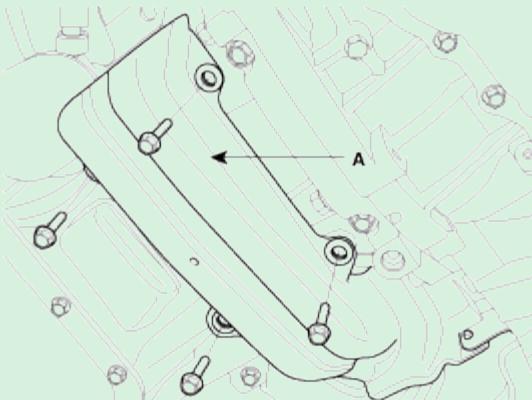
There are two methods to hold the ring gear when installing or removing the crankshaft damper pulley.

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

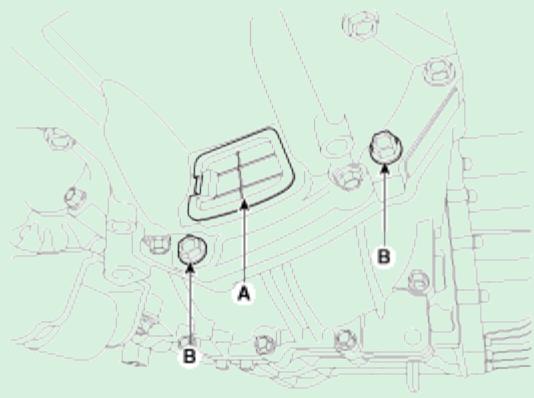


- Install the SST (09231-3D100) to hold the ring gear after removing the dust cover.

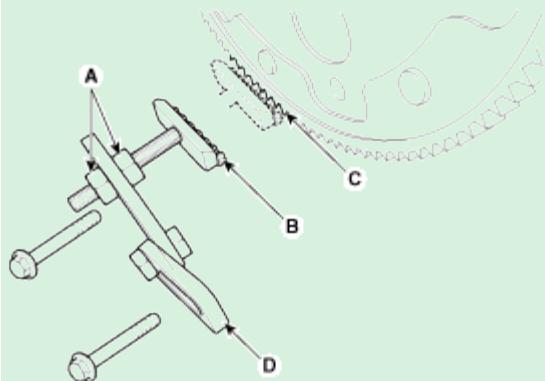
1. Remove the bracket (A).



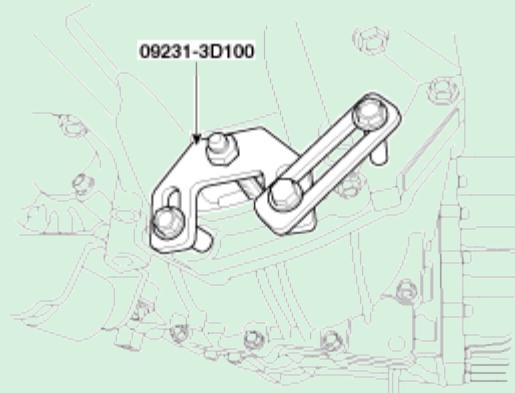
2. Remove the dust cover (A) on the bottom of the ladder frame and unfasten the transaxle mounting bolt (B).



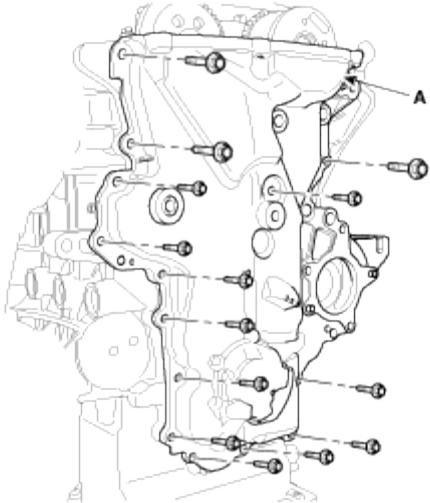
3. Adjust the length of the holder nuts (A) so that the front plate of the holder (B) puts in the ring gear (C) teeth.
4. Adjust the angle of the links (D) so that the bolt 70mm (2.7559in.) can be fastened to the original mounted hole.



5. Install the SST (09231-3D100) using the mounting bolts and spacers. Tighten the bolts and nuts of the holder and links securely.



19. Remove the timing chain cover(A).

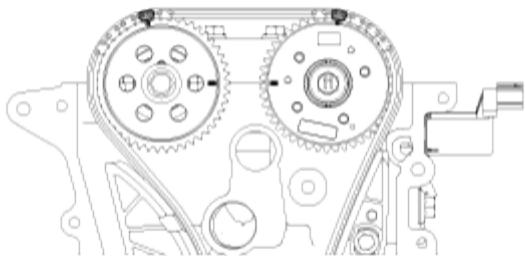


20. Align the timing marks of the camshaft sprocket with the upper surface of the cylinder head to make No.1 cylinder be positioned at TDC.

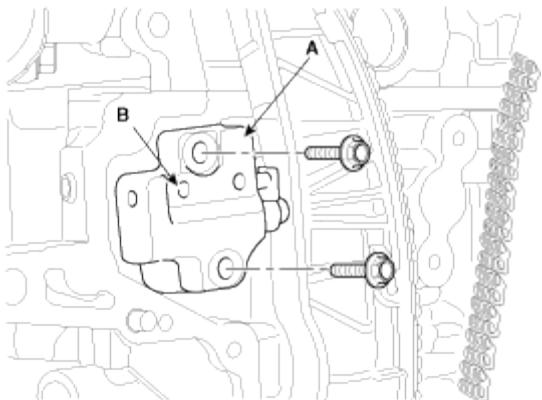
(1) Check the dowel pin of the crankshaft for facing upside of the engine at this moment.

CAUTION

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



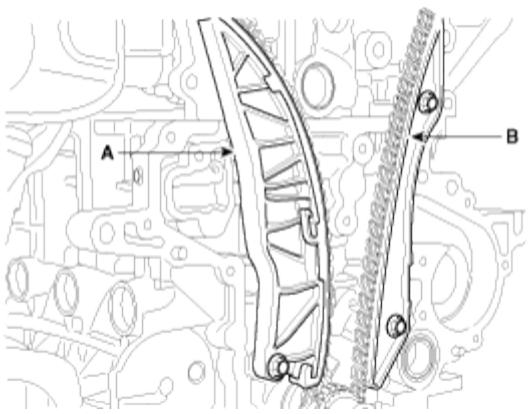
21. Remove the hydraulic tensioner(A).



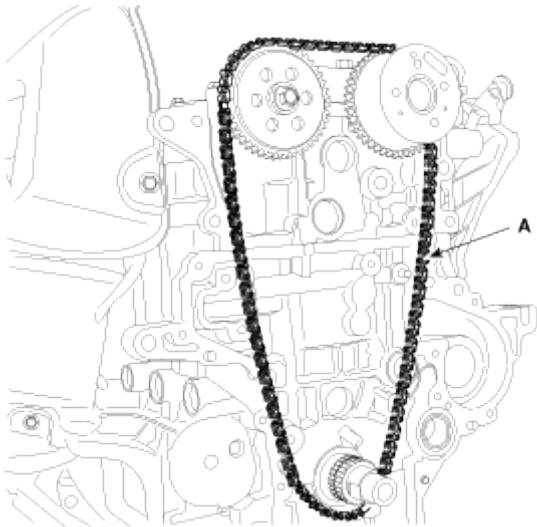
CAUTION

Before removing the tensioner, fix the piston of the tensioner with a pin through the hole(B) at TDC.

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



23. Remove the timing chain(A).



Inspection

Sprockets, Hydraulic Tensioner, Chain Guide, Tensioner Arm

1. Check the camshaft 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

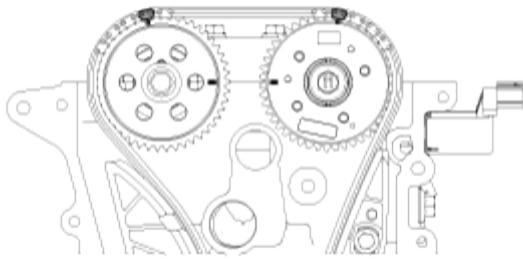
1. Check the idler for excessive oil leakage, abnormal rotation or vibration. Replace if necessary.
2. Check belt for maintenance and abnormal wear of V-ribbed part. Replace if necessary.
3. Check the pulleys for vibration in rotation, oil or dust deposit of V-ribbed part. Replace if necessary.

NOTE

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

Installation

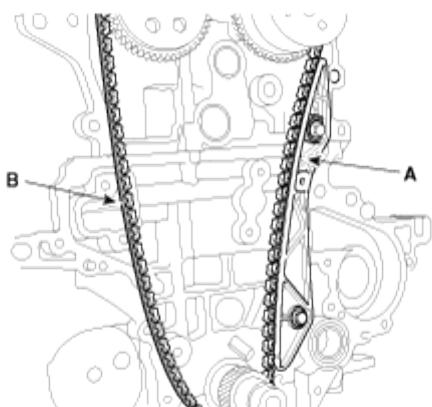
1. Align the timing marks of the camshaft sprocket with the upper surface of the cylinder head to make No.1 cylinder be positioned at TDC.



- (1) Check the dowel pin of the crankshaft for facing upside of the engine at this moment.
- (2) Install the timing chain guide(A).

Tightening torque :

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

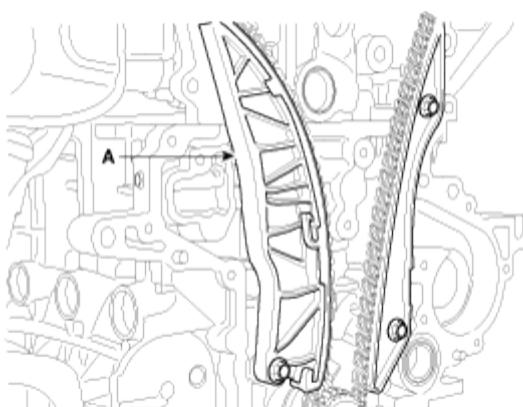


- (3) When installing a timing chain, align the timing marks on the sprockets with paint marks of the chain.
Order : Crankshaft sprocket → Timing chain guide → Intake camshaft sprocket → Exhaust camshaft sprocket.

2. Install the chain tensioner arm(A).

Tightening torque :

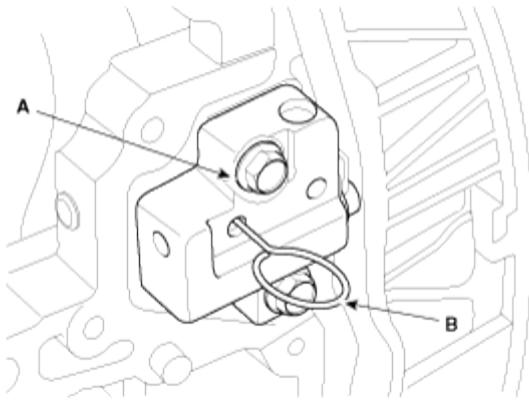
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)



3. 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)

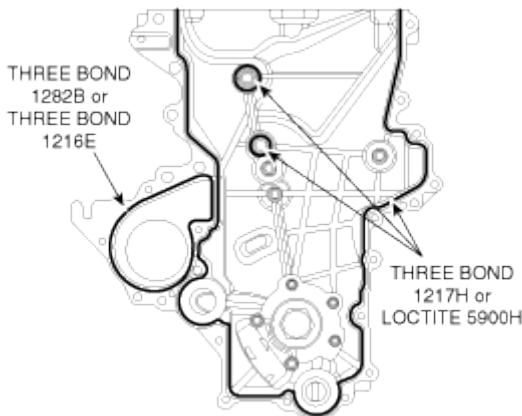
**NOTE**

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

4. Install the timing chain cover(A).

- (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 of the timing chain cover and THREE BOND 1217H or LOCTITE 5900H on the rest parts. Reassemble the cover(A) 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.

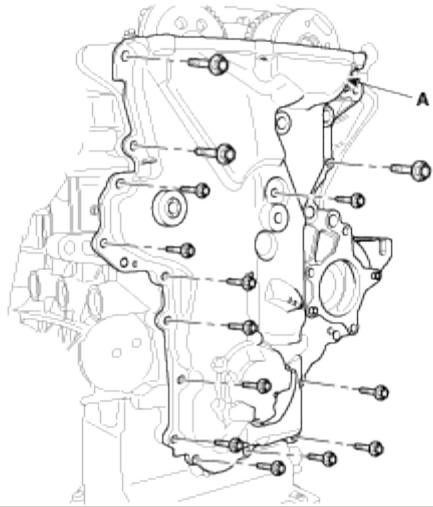
Tightening torque :

12mm bolts :

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

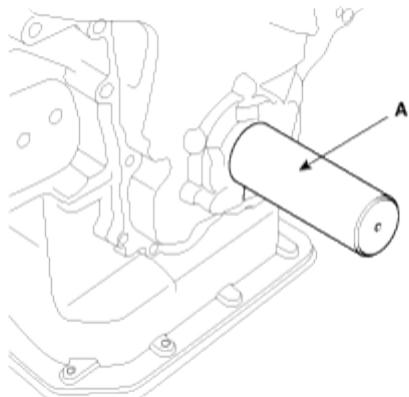
10mm bolts :

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.

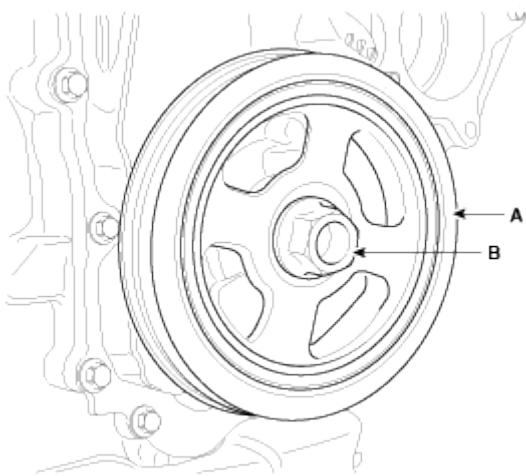
- Using the SST(09455-21200), reassemble the timing chain cover oil seal(A).



- Install the crankshaft pulley(A).

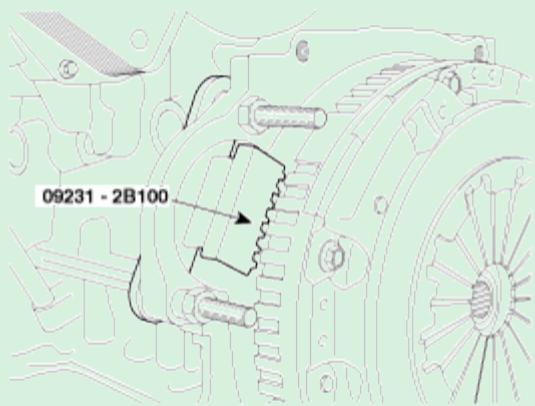
Tightening torque :

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

**NOTE**

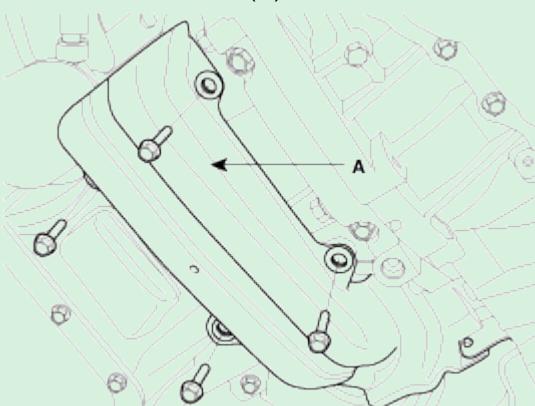
There are two methods to hold the ring gear when installing or removing the crankshaft damper pulley.

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

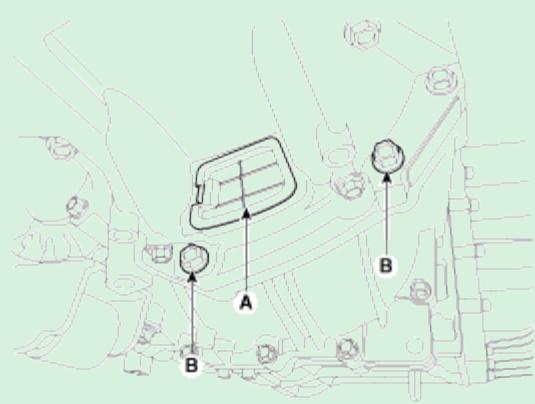


- Install the SST (09231-3D100) to hold the ring gear after removing the dust cover.

1. Remove the bracket (A).

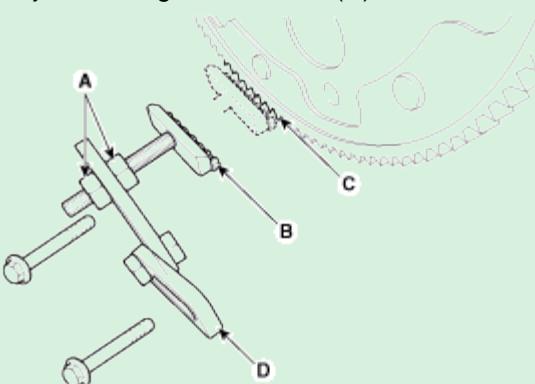


2. Remove the dust cover (A) on the bottom of the ladder frame and unfasten the transaxle mounting bolt (B).

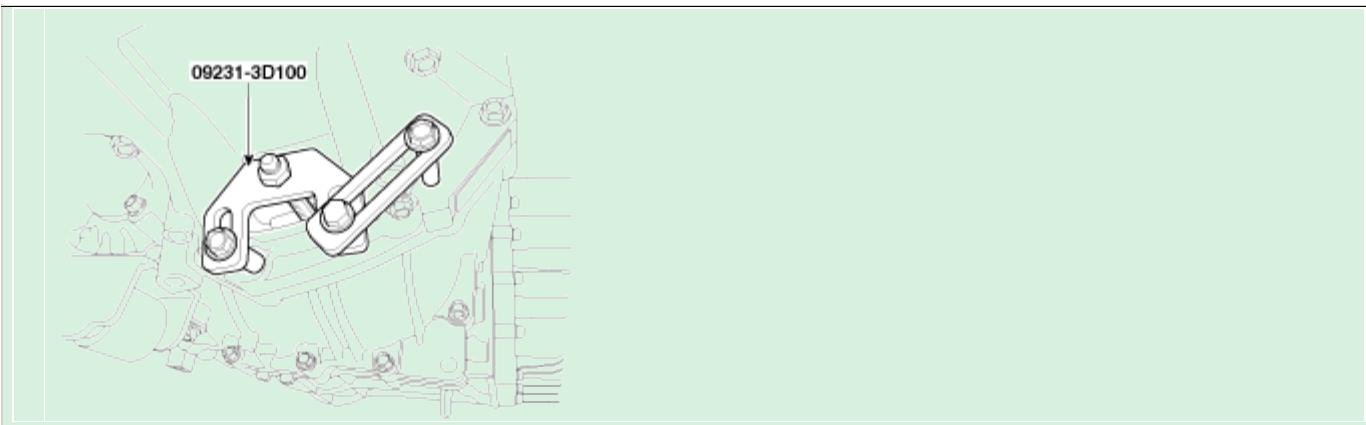


3. Adjust the length of the holder nuts (A) so that the front plate of the holder (B) puts in the ring gear (C) teeth.

4. Adjust the angle of the links (D) so that the bolt 70mm (2.7559in.) can be fastened to the original mounted hole.

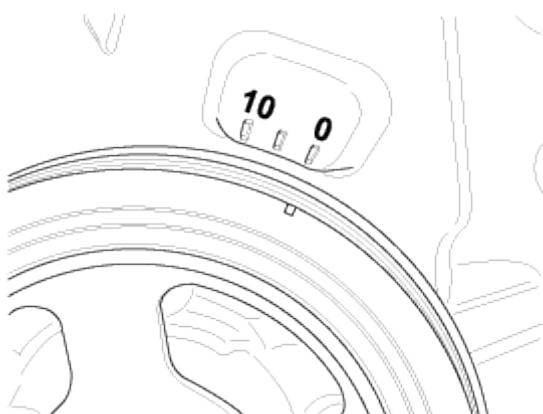


5. Install the SST (09231-3D100) using the mounting bolts and spacers. Tighten the bolts and nuts of the holder and links securely.



NOTE

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



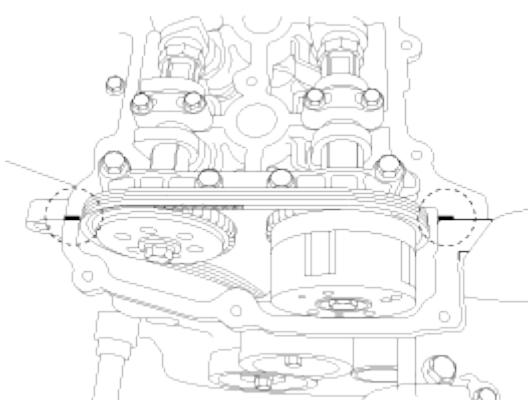
7. Install side cover.

Tightening torque :

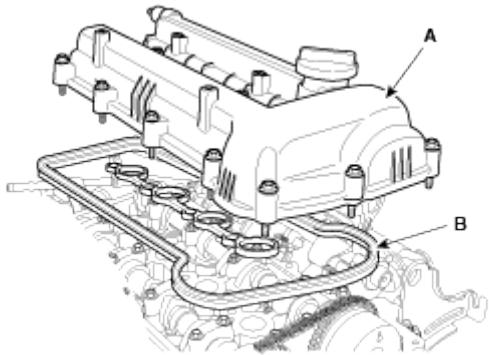
8.8 ~ 10.8 N.m (0.9 ~ 1.1 kgf.m, 6.5 ~ 8.0 lb-ft)

8. Install the front right wheel and tire.
9. Before installing the cylinder head cover, remove oil, dust or hardened sealant from the timing chain cover and the cylinder head upper surface.
10. 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.)



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



CAUTION

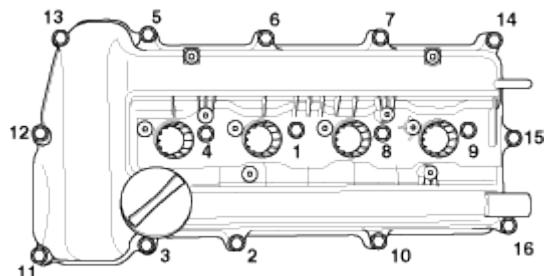
Do not reuse the disassembled gasket.

12. 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)

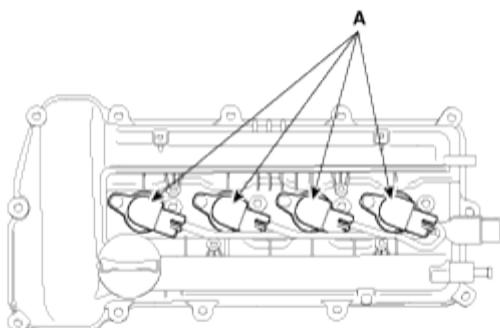
2nd step - 7.8 ~ 9.8 N.m (0.8 ~ 1.0 kgf.m, 5.8 ~ 7.2 lb-ft)



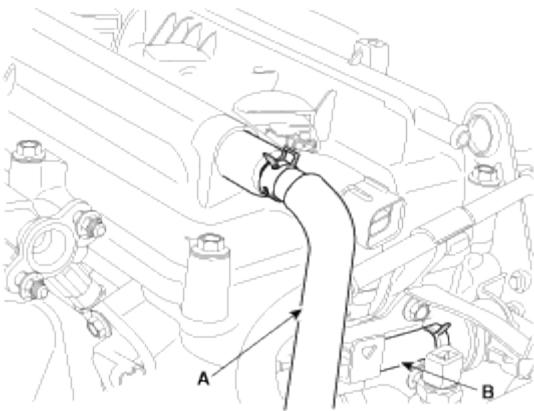
13. Install the ignition coils(A).

Tightening torque :

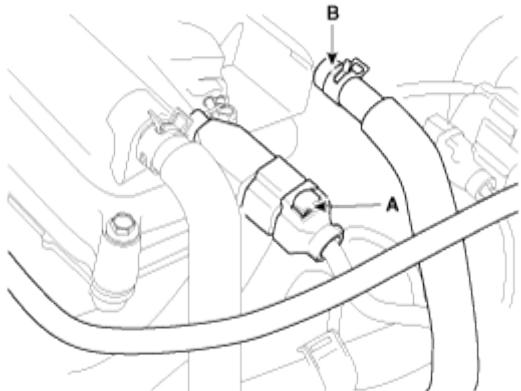
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)



14. Install the positive crankcase ventilation(PCV) hose(A) and the positive and PCSV hose(B).



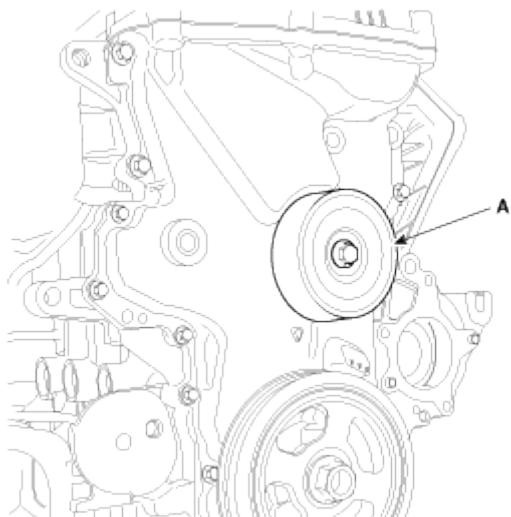
15. Connect the ignition coil connector(A) and the breather hose(B).



16. Install the drive belt idler(A).

Tightening torque :

42.2 ~ 53.9 N.m (4.3 ~ 5.5 kgf.m, 31.1 ~ 39.8 lb-ft)

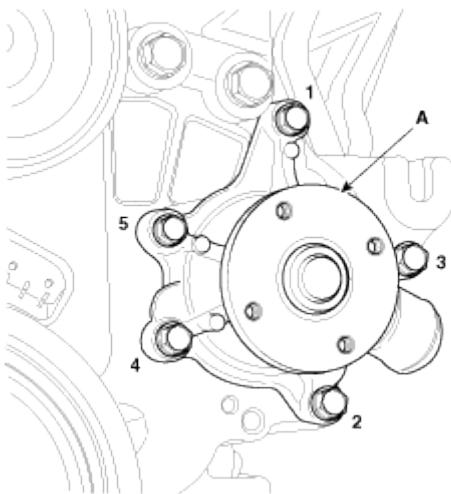


17. Install the water pump(A) with a gasket.

Tighten bolts with the order below.

Tightening torque :

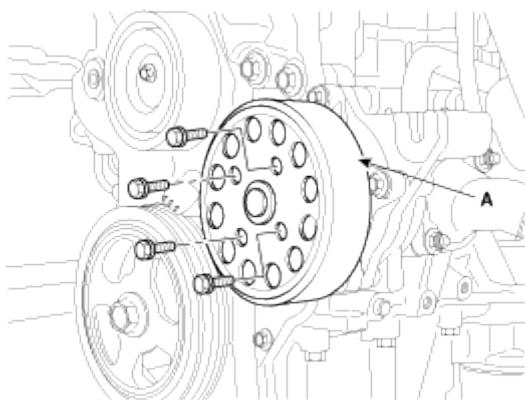
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)



18. Install 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.

19. Install the engine support bracket(A).

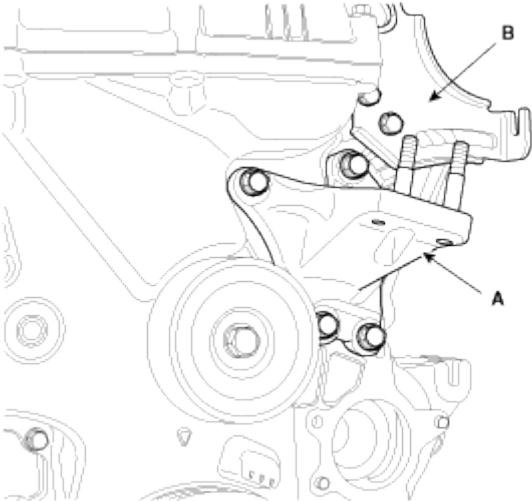
Tightening torque :

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

20. 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)

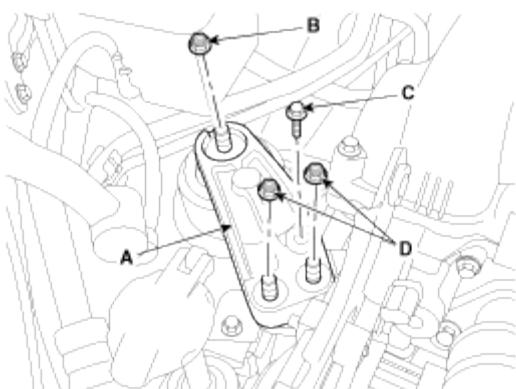


21. Install the engine mounting bracket(A).

Tightening torque :

Nut(B): 68.6 ~ 93.2 N.m (7.0 ~ 9.5 kgf.m, 50.6 ~ 68.7 lb-ft)

Bolt(C) and Nuts(D) : 49.0 ~ 63.7 N.m (5.0 ~ 6.5 kgf.m, 36.1 ~ 47.0 lb-ft)



22. Install the alternator(A).

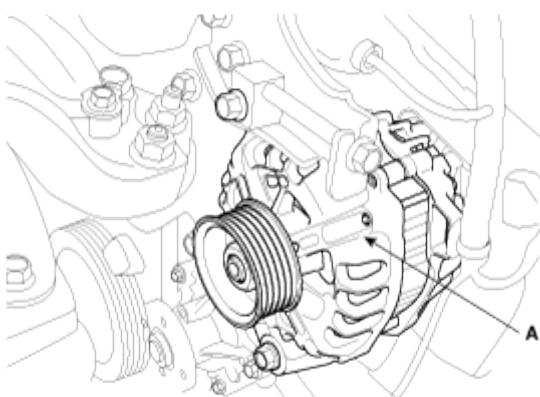
Tightening torque :

12mm bolt :

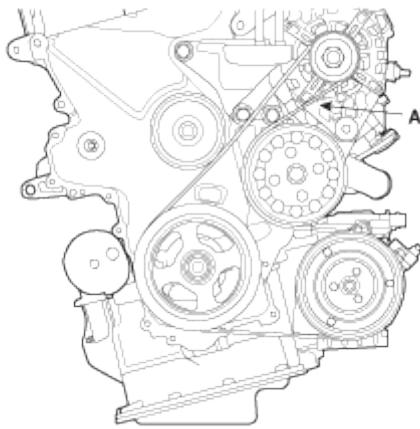
19.6 ~ 26.5 N.m (2.0 ~ 2.7 kgf.m, 14.5 ~ 19.5 lb-ft)

14mm bolt :

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



23. Install the drive belt(A).

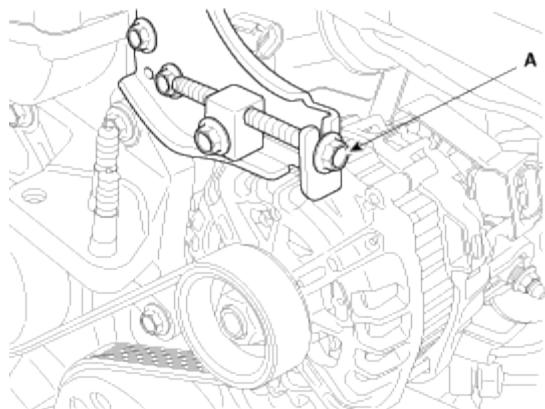


24. Adjust tension by tightening the alternator tension adjust bolt(A).(Refer to Charging system in EE Group).

Tension

New belt: 882.6 ~ 980.7N (90 ~ 100kg, 198.4 ~ 220.5lb)

Used belt: 637.4 ~ 735.5N (65 ~ 75kg, 143.3 ~ 165.3lb)



25. Install the engine cover.

Tightening torque :

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

9.4. Cylinder Head Assembly

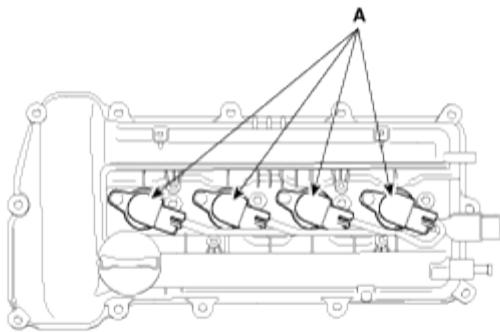
9.4.1. Repair procedures

Valve Clearance Inspection And Adjustment

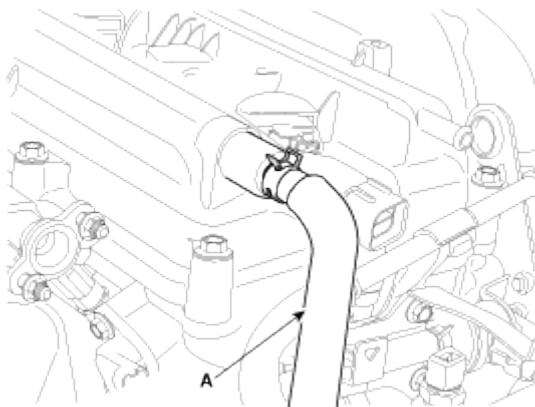
NOTE

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.

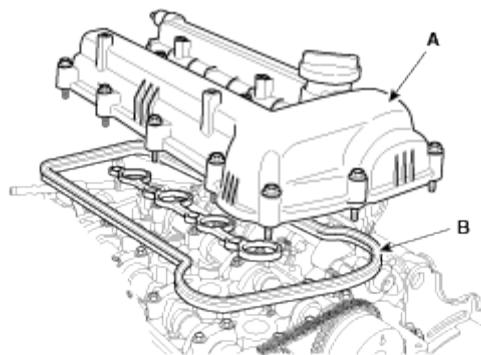
1. Remove the engine center cover.
2. Remove the cylinder head cover.
(1) Disconnect the ignition coil (A).



(2) Disconnect the P.C.V. hose(A).



(3) Loosen the cylinder head cover bolts and then remove the cover(A).

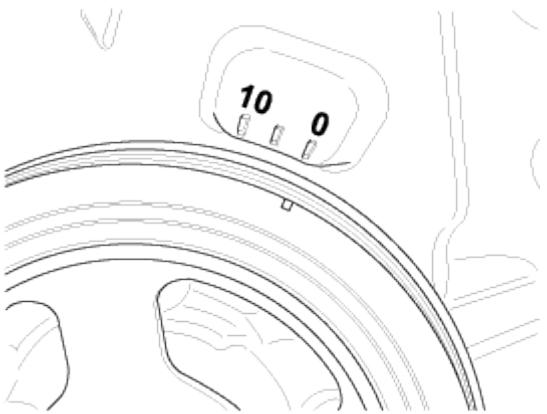


CAUTION

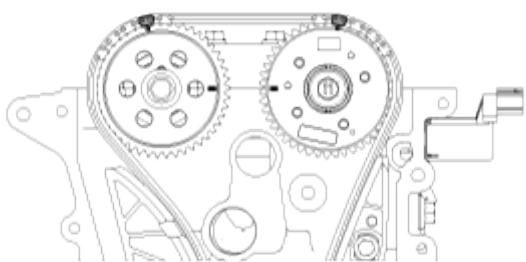
Do not reuse the disassembled gasket.

3. 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.

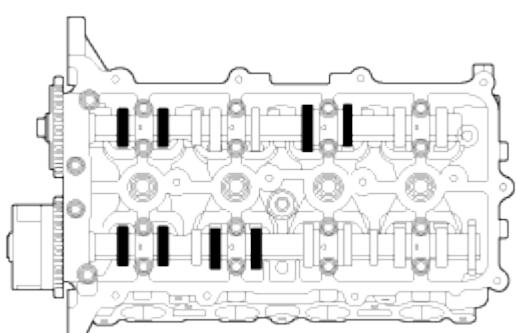


- (2) Check that the marks of the camshaft timing sprockets are in straight line on the cylinder head surface as shown in the illustration. If not, turn the crankshaft one revolution (360°).



4. 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.



NO.1 Cylinder TDC/Compression

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

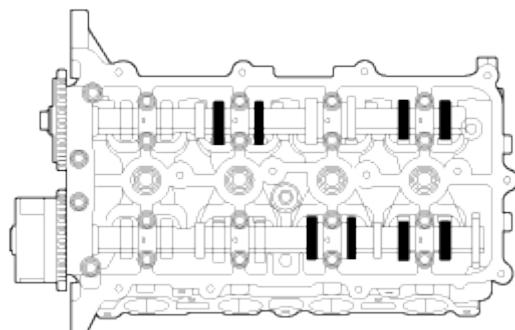
Valve clearance specification (Engine coolant temperature : 20°C [68°F])

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.



NO.4 Cylinder TDC/Compression

5. Adjust the intake and exhaust valve clearance.

- (1) Set the No.1 cylinder to the TDC/compression position.
- (2) Put paint marks on the timing chain links (2 places) that meet with the timing marks of the intake, exhaust camshaft sprockets.
- (3) Remove the exhaust camshaft sprocket bolt.
- (4) Remove the service hole bolt of the timing chain cover.

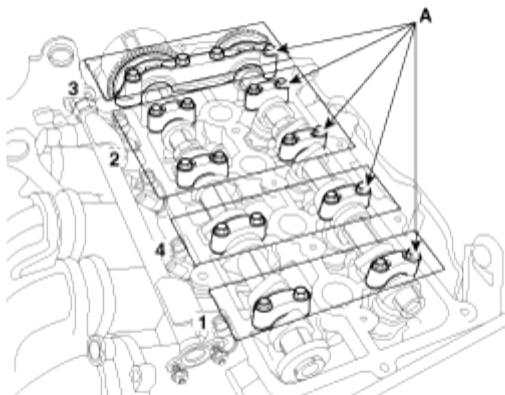
CAUTION

The bolt must not be reused once it has been assembled.

(5) Insert a thin rod in the service hole of the timing chain cover and release the ratchet.

(6) Remove the exhaust camshaft sprocket.

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



(8) Remove the exhaust camshaft.

(9) Remove the intake camshaft and CVVT module.

CAUTION

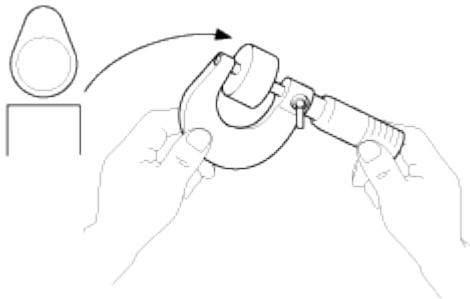
When disconnecting the timing chain from the camshaft timing sprocket, hold the timing chain.

(10) Tie a timing chain with a string.

CAUTION

Be careful not to drop anything inside timing chain cover.

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



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

Valve clearance (Engine coolant temperature : 20°C)

T : Thickness of removed tappet

A : Measured valve clearance

N : Thickness of new tappet

Intake : $N = T + [A - 0.20\text{mm}(0.0079\text{in.})]$

Exhaust : $N = T + [A - 0.25\text{mm} (0.0098\text{in.})]$

(13) 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 3.600mm (0.1417in.).

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

(15) Hold the timing chain, and place the intake camshaft and CVVT module assembly.

(16) Align the matchmarks on the timing chain and camshaft timing sprocket.

(17) Install the exhaust camshaft.

(18) Install the exhaust camshaft sprocket.

Tightening torque :

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

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

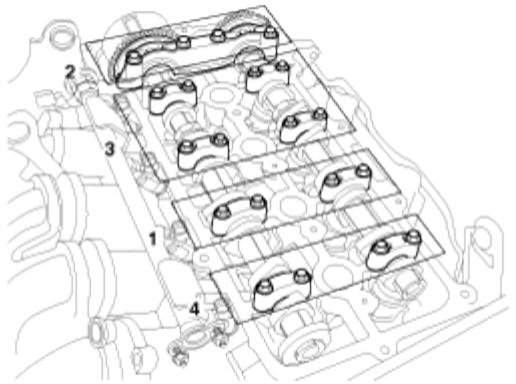
Tightening torque :

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)



(20) Install the service hole bolt.

Tightening torque :

11.8 ~ 14.7N.m (1.2 ~ 1.5kgf.m, 8.7 ~ 10.8lb-ft)

(21) Turn the crankshaft two turns in the operating direction(clockwise) and realign crankshaft sprocket and camshaft sprocket timing marks.

(22) Recheck the valve clearance.

Valve clearance (Engine coolant temperature : 20°C)

[Specification]

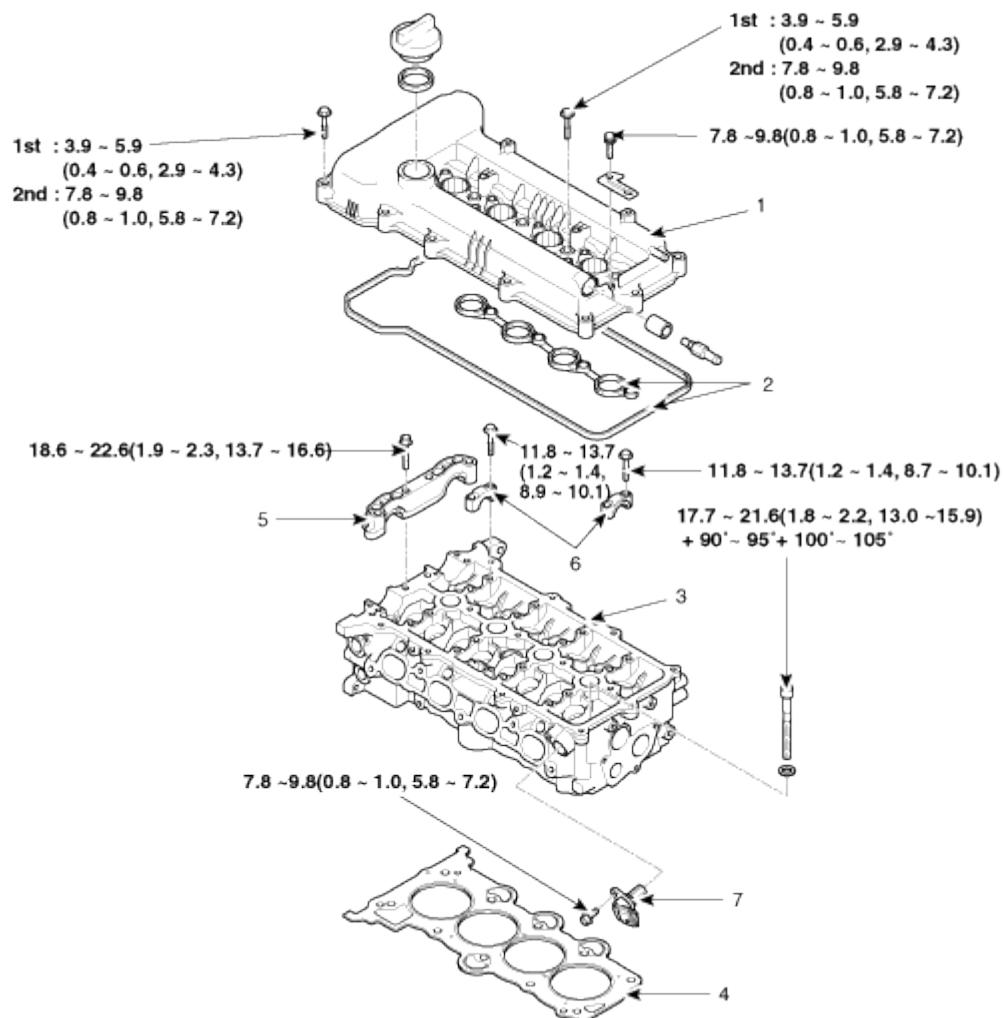
Intake : 0.17 ~ 0.23mm (0.0067 ~ 0.0091in.)

Exhaust : 0.22 ~ 0.28mm (0.0087 ~ 0.0110in.)

9.4.2. Cylinder Head

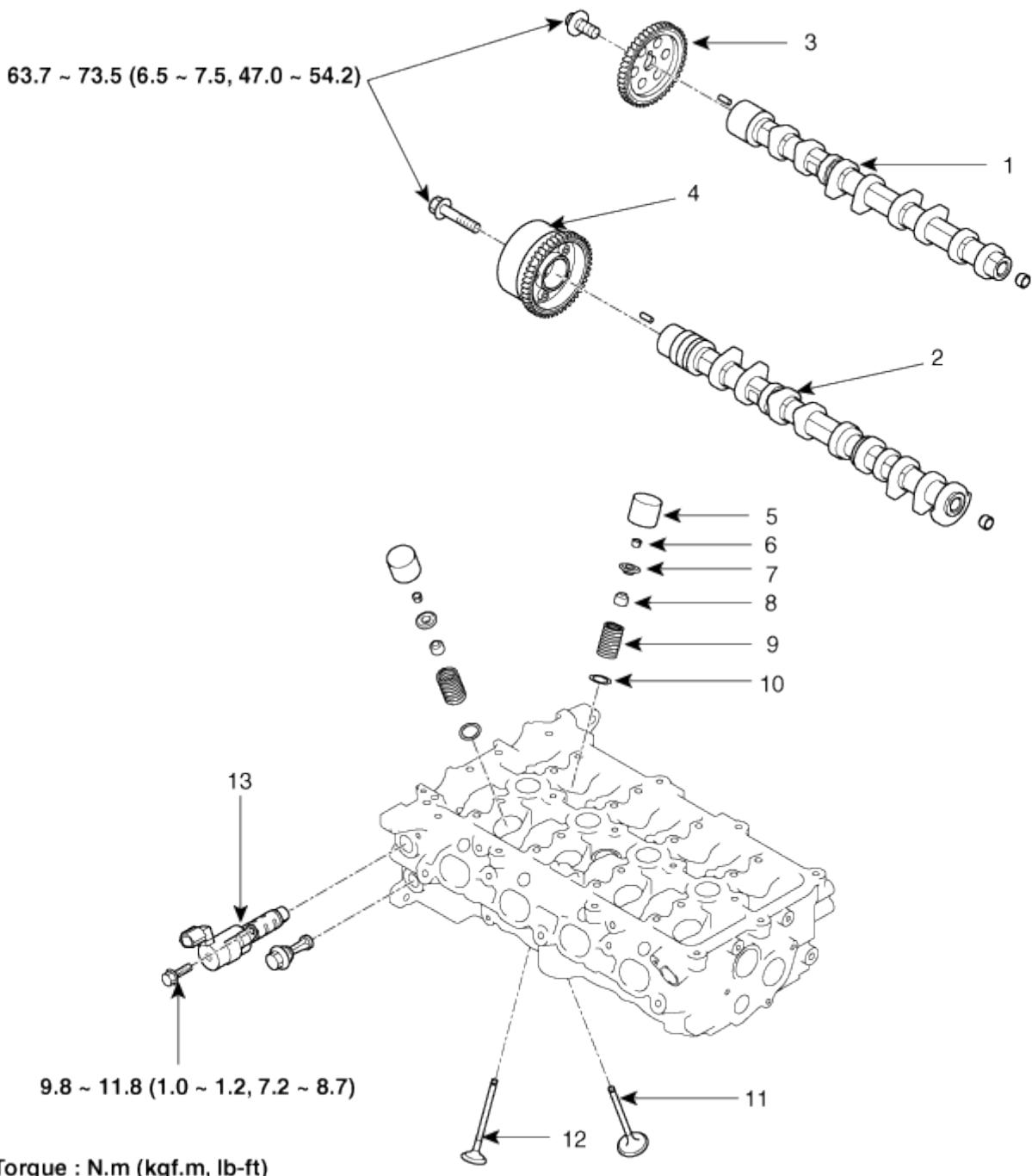
9.4.2.1. Component and Components Location

Components



Torque : N.m (kgf.m, lb·ft)

| | |
|-------------------------------|-------------------------------|
| 1. Cylinder head cover | 5. Camshaft front bearing cap |
| 2. Cylinder head cover gasket | 6. Camshaft bearing cap |
| 3. Cylinder head assembly | 7. Camshaft position sensor |
| 4. Cylinder head gasket | |



Torque : N·m (kgf·m, lb·ft)

| | |
|----------------------------------|----------------------------|
| 1. Exhaust camshaft | 8. Valve stem seal |
| 2. Intake camshaft | 9. Valve spring |
| 3. Exhaust camshaft sprocket | 10. Valve spring seat |
| 4. CVVT assembly | 11. Valve guide |
| 5. Mechanical Lash Adjuster(MLA) | 12. Intake valve |
| 6. Retainer lock | 13. Exhaust valve |
| 7. Retainer | 14. Oil Control Valve(OCV) |

9.4.2.2. Repair procedures

Removal

Engine removal is not required for this procedure.

CAUTION

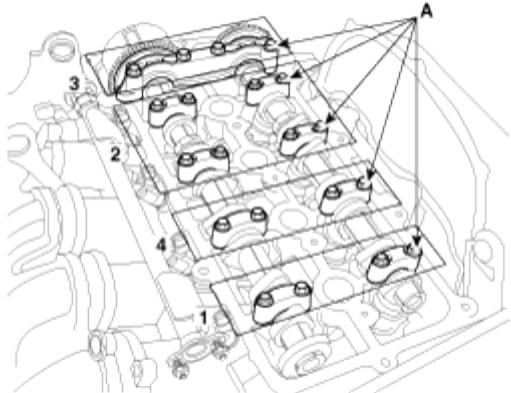
- Use Fender cover to avoid damaging painted surfaces.

- To avoid damaging the cylinder head, wait until the engine coolant temperature drops below normal temperature before removing it.
- When handling a metal gasket, take care not to fold the gasket or damage the contact surface of the gasket.
- To avoid damage, unplug the wiring connectors carefully while holding the connector portion.

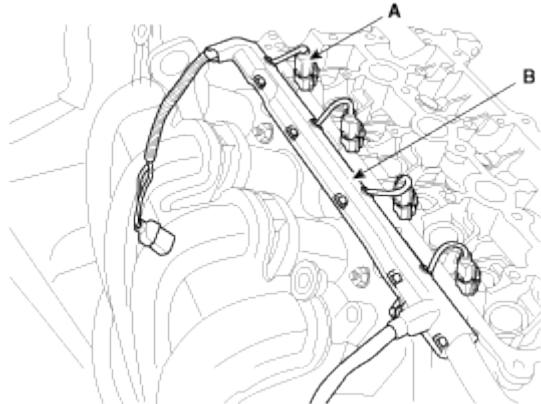
NOTE

- Mark all wiring and hoses to avoid misconnection.
- Turn the crankshaft pulley so that the No. 1 piston is at top dead center.

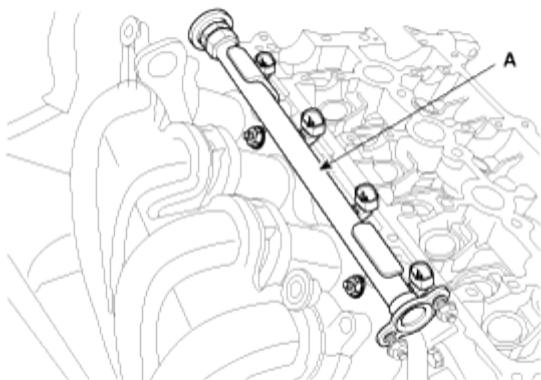
1. Remove the timing chain.
(Refer to Timing system in this group)
2. Remove the camshaft bearing caps(A) with the order below.



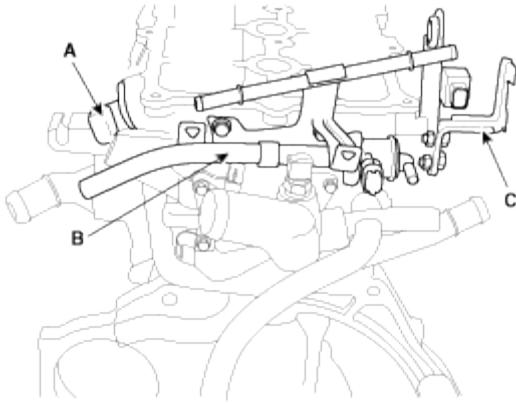
3. Remove the injector connectors(A) and the harness bracket(B).



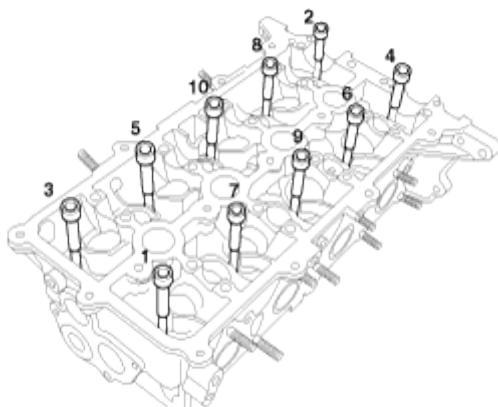
4. Remove the delivery pipe(A).



5. Remove the exhaust manifold assembly. (Refer to Intake and exhaust system in this group)
6. Remove the intake manifold module assembly. (Refer to Intake and exhaust system in this group)
7. Disconnect the camshaft position sensor(CMP) connector(A) and remove the purge control solenoid valve(PCSIV) bracket(B) and the module hanger bracket(C).



8. Remove the water temperature control assembly and the oil control valve(OCV).
9. 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

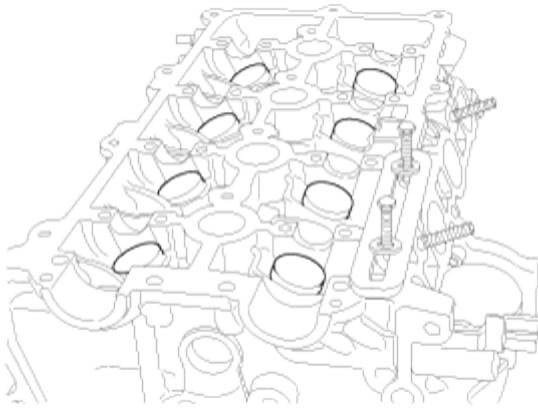
NOTE

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).

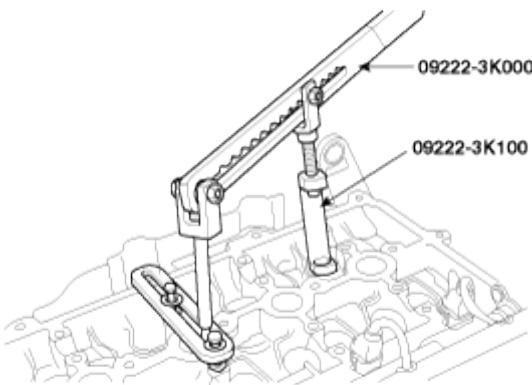
CAUTION

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

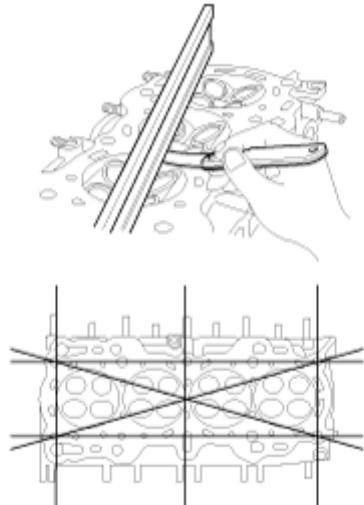
Cylinder Head

1. Inspect for flatness.

Using a precision straight edge and feeler gauge, measure the surface contacting the cylinder block and the manifolds for warpage.

Flatness of cylinder head gasket surface

Standard : Less than 0.05mm (0.0020in)



2. Inspect for cracks.

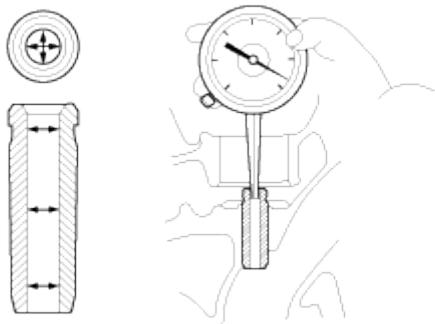
Check the combustion chamber, intake ports, exhaust ports and cylinder block surface for cracks. If cracked, replace the cylinder head.

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)

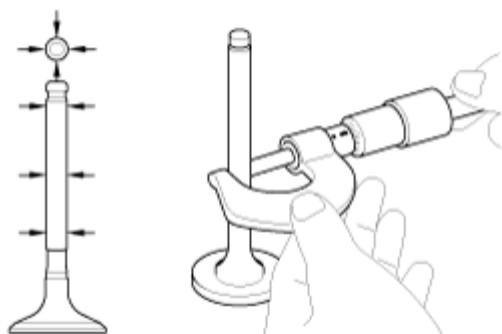


- (2) Using a micrometer, measure the outer diameter of valve stem.

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.

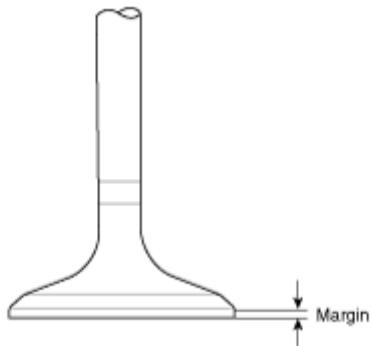
If the margin thickness is less than minimum, replace the valve.

Margin

Standard

Intake : 1.1mm (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.

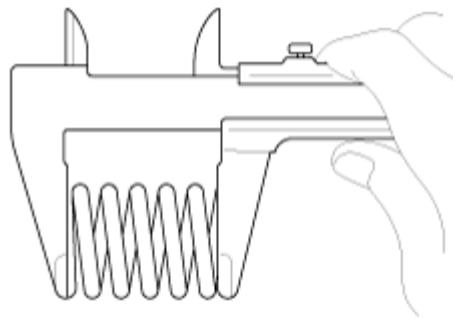
(2) Using a vernier calipers, measure the free length of valve spring.

Valve spring

Standard

Free height : 44mm (1.7323in)

Out of square : Less than 1.5°



Camshaft

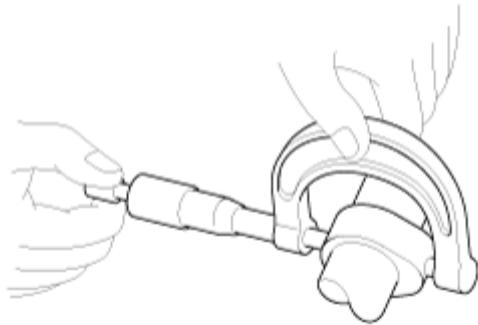
1. Inspect the cam height.

Using a micrometer, measure the cam height.

Cam height

Intake : 43.85mm (1.7264in)

Exhaust : 42.85mm (1.6870in)



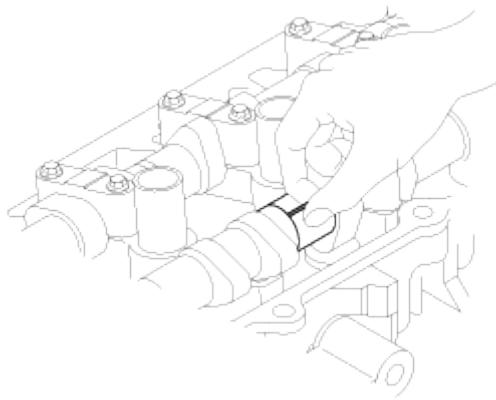
If the cam lobe height is less than specified, replace the camshaft.

2. Inspect the camshaft journal clearance.

(1) Clean the bearing caps and camshaft journals.

(2) Place the camshafts on the cylinder head.

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



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

Tightening torque :

M6 bolts :

11.8 ~ 13.7Nm (1.2 ~ 1.4kgf.m, 8.7 ~ 10.1lb-ft)

M8 bolts :

18.6 ~ 22.6Nm (1.9 ~ 2.3 kgf.m, 13.7 ~ 16.6lb-ft)

CAUTION

Do not turn the camshaft.

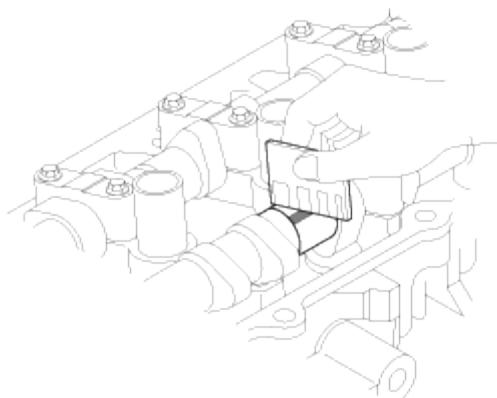
(5) Remove the bearing caps.

(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.

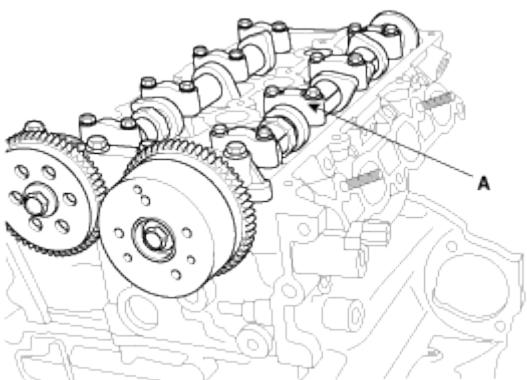
3. Inspect the camshaft end play.

(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.

A. Depending on the air pressure, the CVVT assembly will turn to the advance side.

B. 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 reassemble ones in the other's places.

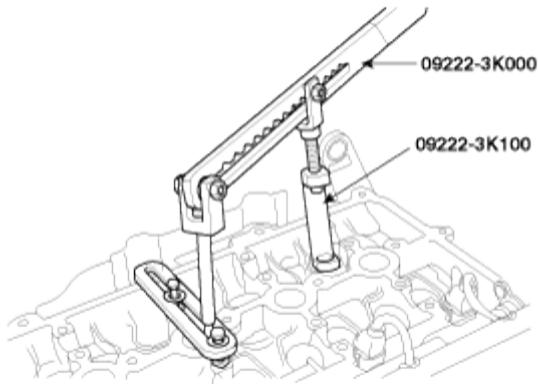
(3) Install the valve, valve spring and spring retainer, after applying engine oil at the end of each valve.

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.

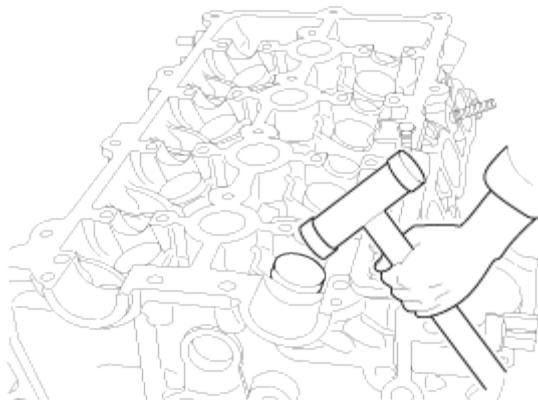
After installing the valves, ensure that the retainer locks are correctly in place before releasing the valve spring compressor.



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 rotates smoothly by hand.

NOTE

All the MLAs should be installed in its original position.

Installation

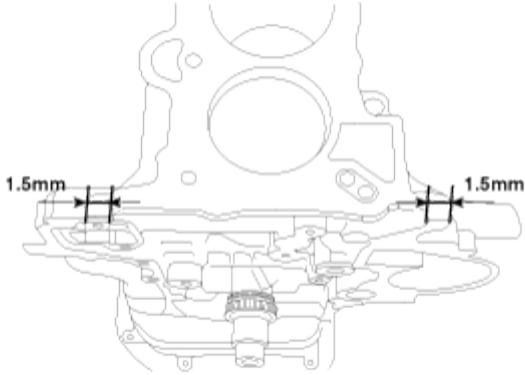
NOTE

- 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.



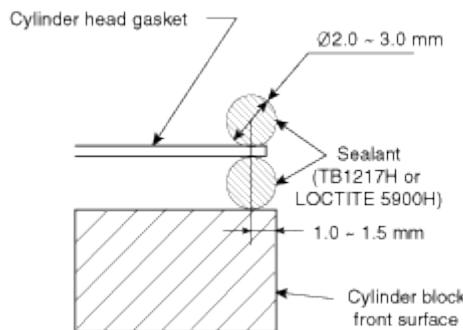
NOTE

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

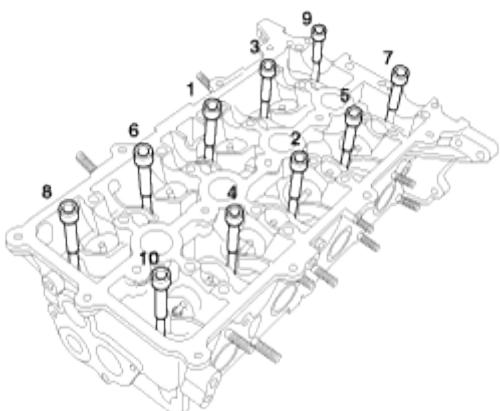


(3) After installing the cylinder head gasket on the cylinder block, apply sealant on the upper surface of the cylinder head gasket and reassemble in five minutes.

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 :

17.7~21.6Nm (1.8~2.2kgf.m, 13.0~15.9lb-ft) + 90~95° + 100~105°



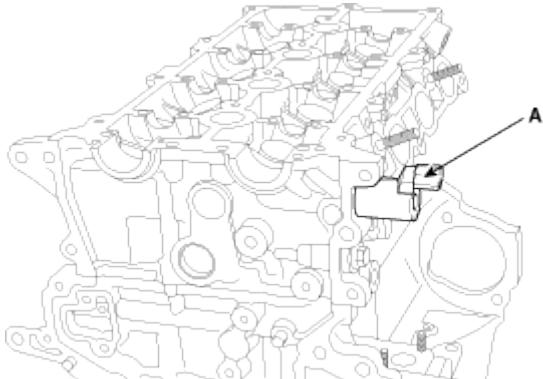
CAUTION

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)

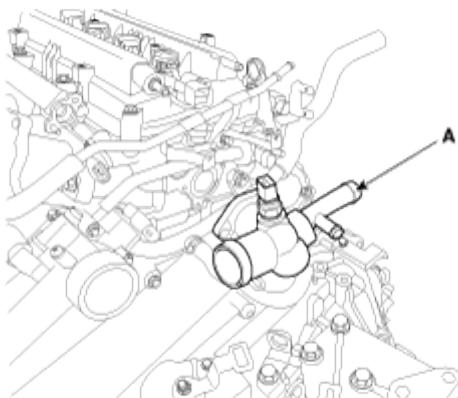


5. Tighten the mounting bolts for the water temperature control assembly(A) after installing the heater pipe.

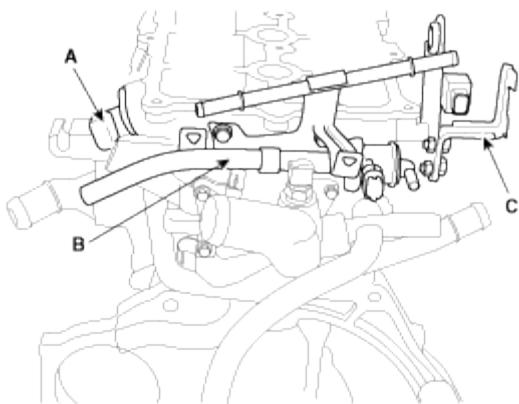
Tightening torque :

M6 bolts : 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. Connect the camshaft position sensor(CMP) connector(A) and install the purge control solenoid valve(PCSv) bracket(B) and the module hanger bracket(C).



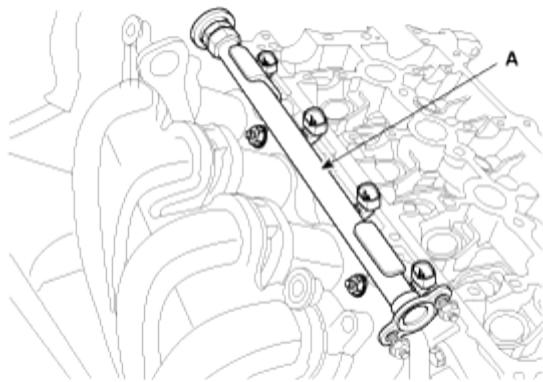
7. Install the intake manifold module assembly. (Refer to Intake and exhaust system in this group)

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

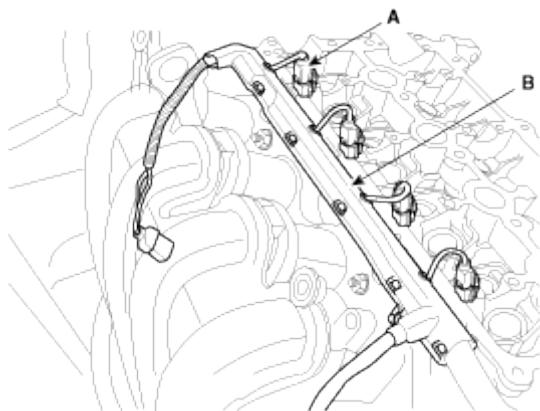
9. Install the delivery pipe assembly(A).

Tightening torque :

19.6 ~ 24.5N.m (2.0 ~ 2.5kgf.m, 14.4 ~ 18.0lb-ft)



10. Install the injector connector(A) and harness bracket(B).



11. Install the camshafts.

(1) Before installing, apply engine oil on journals.

CAUTION

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

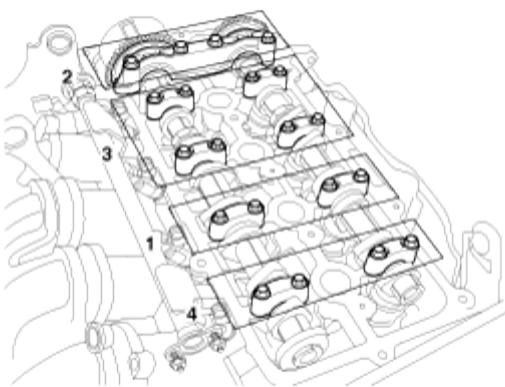
(2) After installing, check the valve clearance.

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

Tightening torque :

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 intake and exhaust manifold.

(Refer to Intake and Exhaust system in this group)

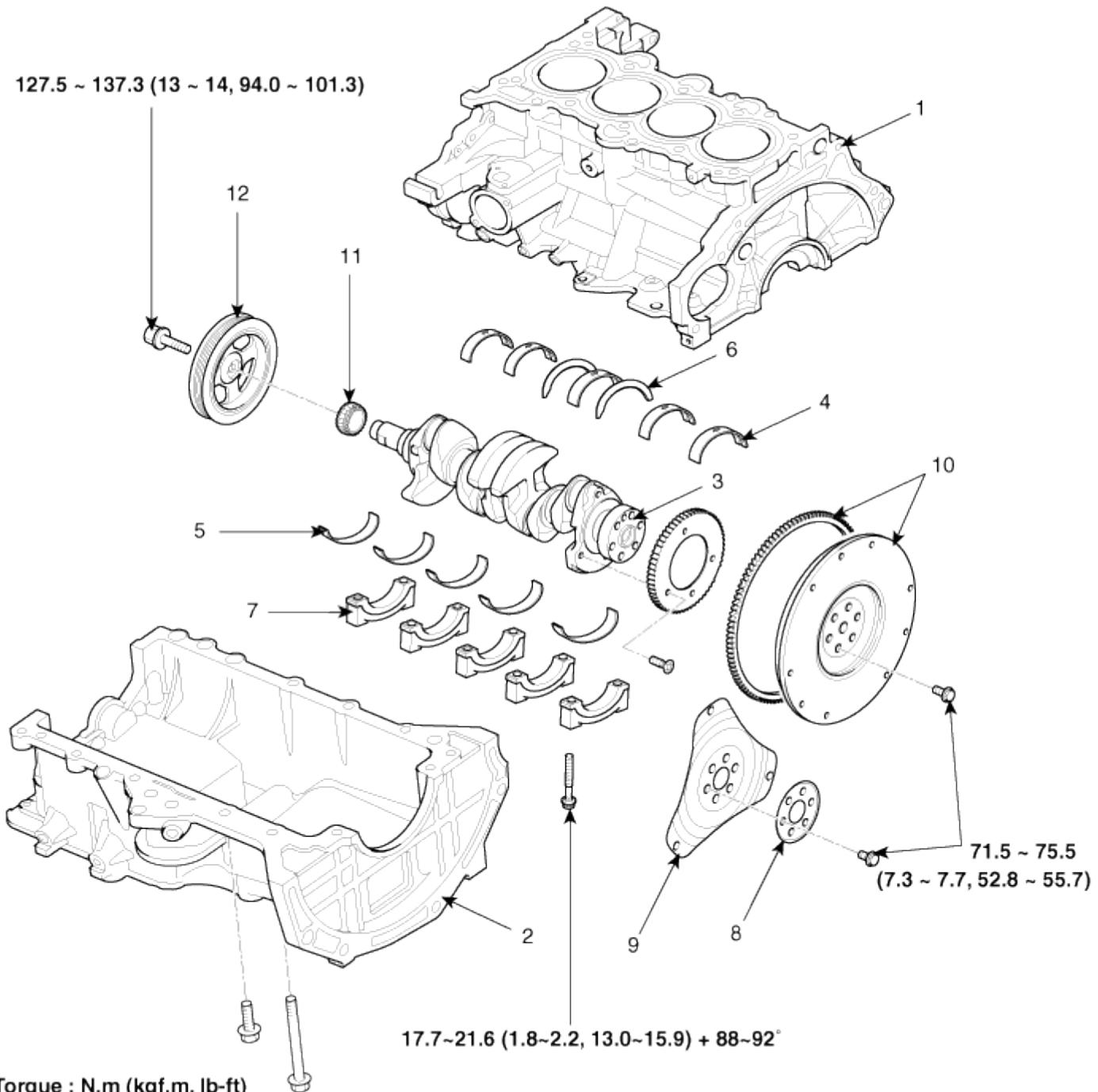
14. Install the timing chain.

(Refer to Timing system in this group)

9.5. Cylinder Block

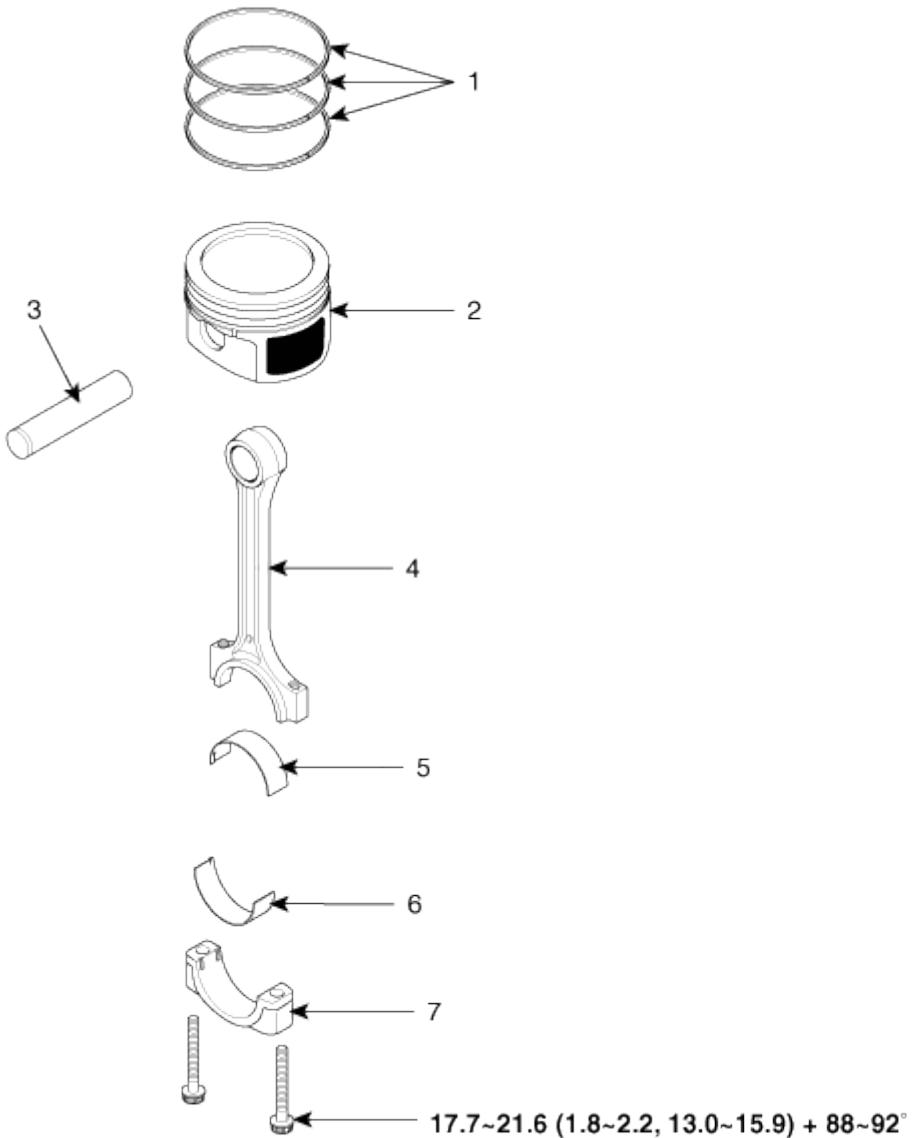
9.5.1. Component and Components Location

Components



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

| | | |
|-----------------------------|-----------------------------|---------------------------|
| 1. Cylinder block | 5. Crankshaft lower bearing | 9. Drive plate |
| 2. Ladder frame | 6. Thrust bearing | 10. Fly wheel & ring gear |
| 3. Crankshaft | 7. Main bearing cap | 11. Crankshaft sprocket |
| 4. Crankshaft upper bearing | 8. Adapter plate | 12. Crankshaft pulley |



Torque : N.m (kgf.m, lb·ft)

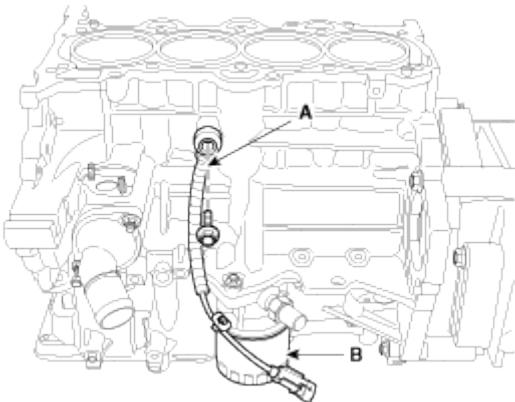
| | |
|---|---|
| 1. Piston ring
2. Piston
3. Piston pin
4. Connecting rod | 5. Connecting rod upper bearing
6. Connecting rod lower bearing
7. Connecting rod bearing cap |
|---|---|

9.5.2. Repair procedures

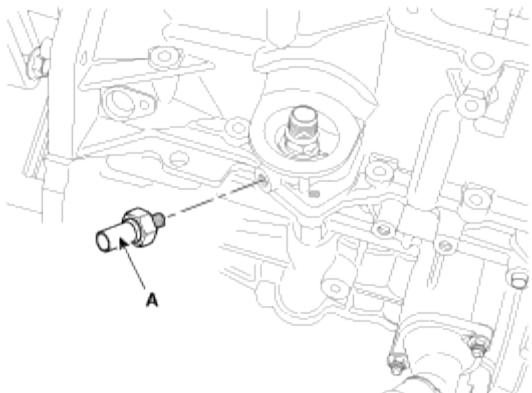
Disassembly

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

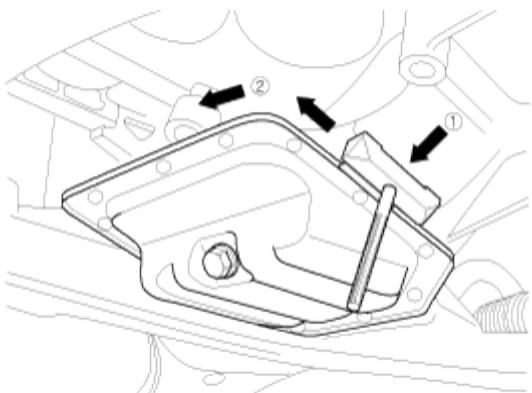
1. M/T : Remove the fly wheel.
2. A/T : Remove the drive plate.
3. Install the engine to engine stand for disassembly.
4. Remove the timing chain. (Refer to Timing chain in this group)
5. Remove the cylinder head. (Refer to Cylinder head in this group)
6. Remove the oil level gauge tube.
7. Remove the knock sensor(A) and the oil filter(B).



8. Remove the oil pressure switch(A).



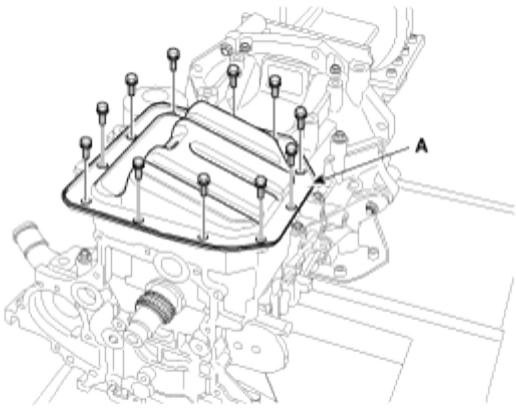
9. Using the SST (09215-3C000), remove the oil pan (A).



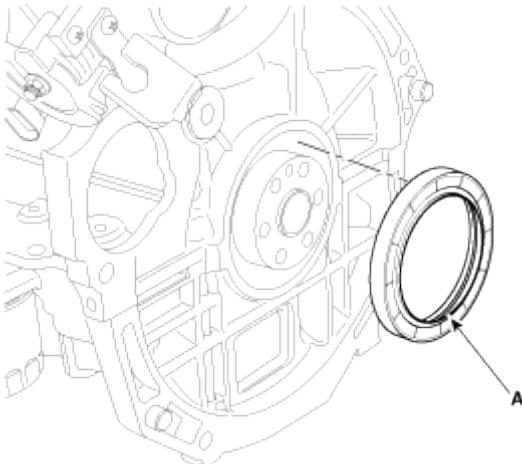
CAUTION

- Insert the SST between the oil pan and the ladder frame by tapping it with a plastic hammer in the direction of ①arrow.
- After tapping the SST with a plastic hammer along the direction of ②arrow 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.

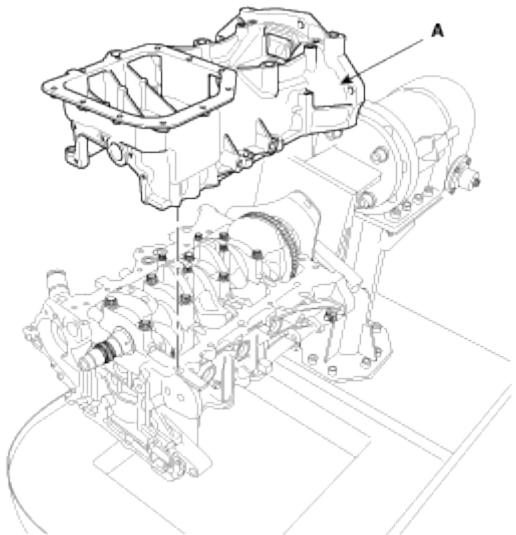
10. Remove the oil screen(A).



11. Remove the rear oil seal(A).



12. Remove the ladder frame(A).



13. Check the connecting rod end play.

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

15. 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

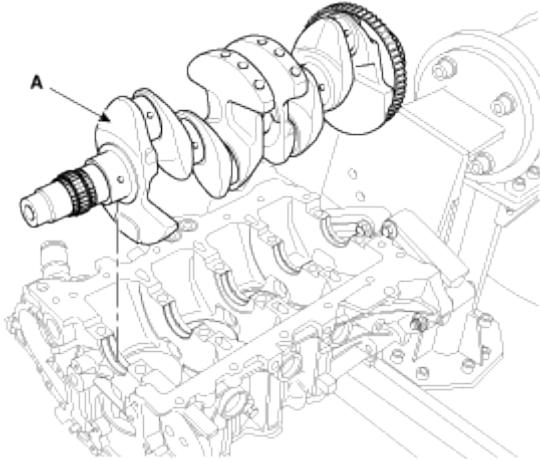
- Keep the bearings, connecting rod and cap together.
- Arrange the piston and connecting rod assemblies in the correct order.

16. Remove the crankshaft bearing cap and check oil clearance.

17. Check the crankshaft end play.
18. 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.



19. 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.
20. Remove the piston rings.
 - (1) Using a piston ring expander, remove the 2 compression rings.
 - (2) Remove the 2 side rails and oil ring by hand.

NOTE

Arrange the piston rings in the correct order only.

21. 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))

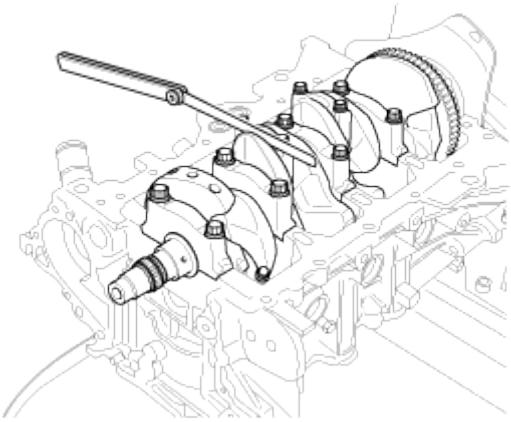
Inspection

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 : 0.1 ~ 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

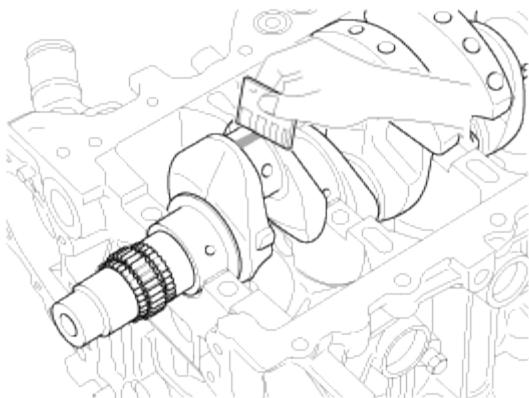
Do not turn the crankshaft.

(7) Remove the 2bolts, 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, or scrape the bearings or the caps to adjust clearance.

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

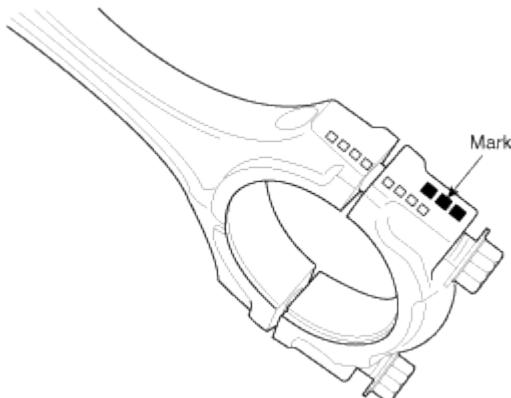
NOTE

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.

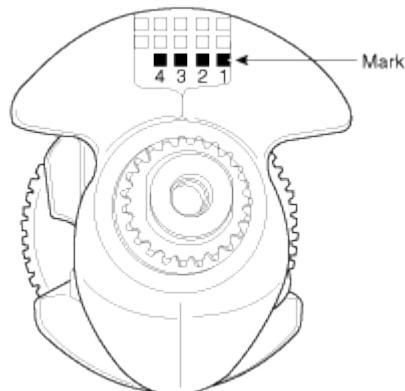
Connecting Rod Mark Location



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

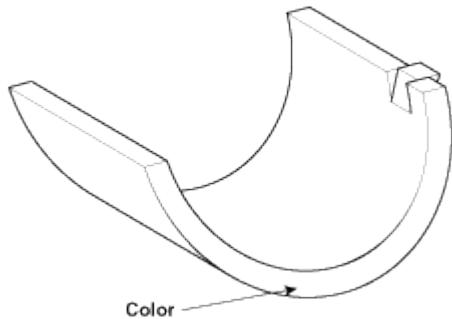


Discrimination Of Crankshaft Pin Diameter

| 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 :

0.1mm / 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°

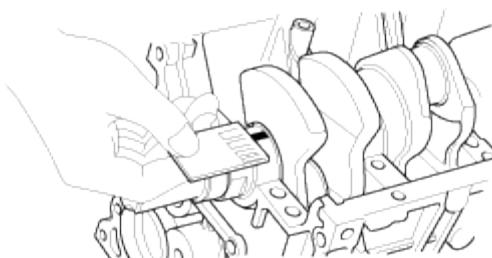
NOTE

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.

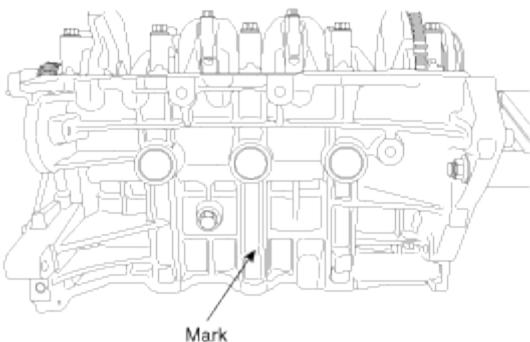
CAUTION

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.

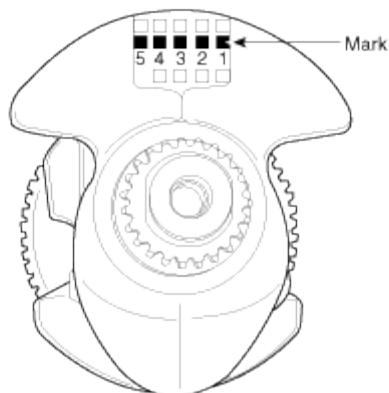
Use them, and the numbers or letters stamped on the crank (marks for main journal size), to choose the correct bearings.



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) |

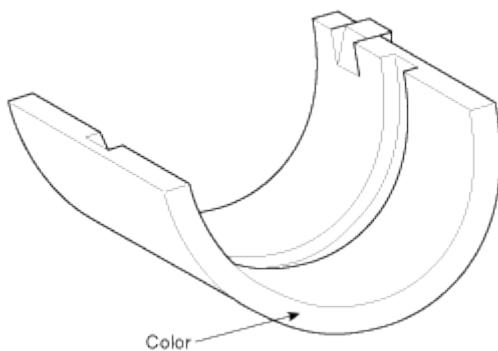
Crankshaft Main Journal Mark Location



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.

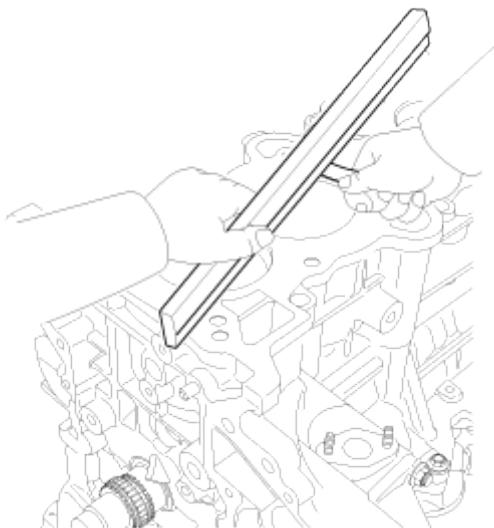
Using a precision straight edge and feeler gauge, measure the surface contacting the cylinder head gasket for warpage.

Flatness of cylinder block gasket surface

Standard :

Less than 0.05mm (0.0020in)

Less than 0.02mm (0.0008in) - 100mm × 100mm



4. Inspect the cylinder bore.

Visually check the cylinder for vertical scratches.

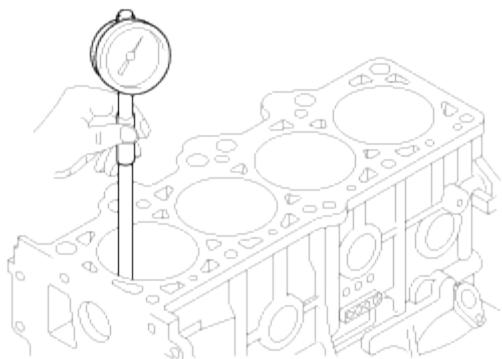
If deep scratches are present, replace the cylinder block.

5. Inspect the cylinder bore diameter.

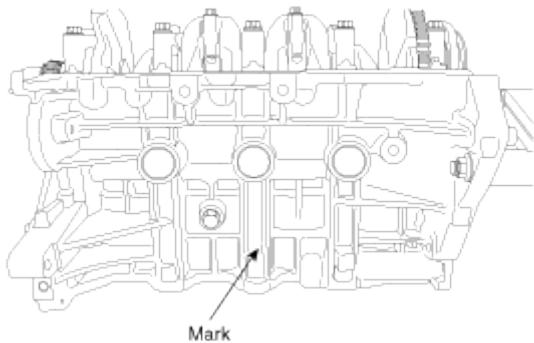
Using a cylinder bore gauge, measure the cylinder bore diameter at position in the thrust and axial direction.

Standard diameter :

77.00 ~ 77.03mm (3.0315 ~ 3.0327in)



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

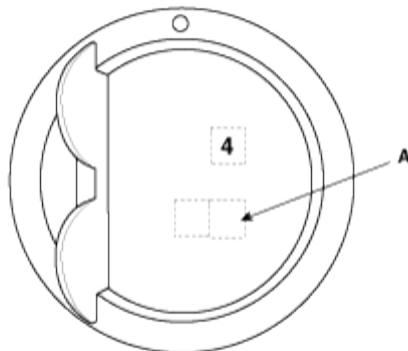


Discrimination Of Cylinder Bore Size

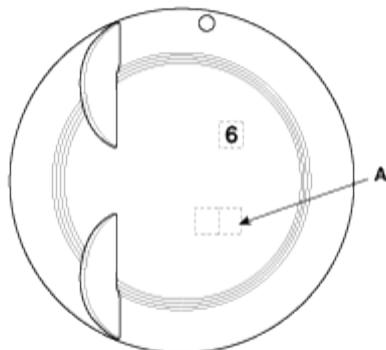
| Mark | Cylinder bore inner diameter |
|------|-------------------------------------|
| A | 77.00 ~ 77.01mm (3.0315 ~ 3.0319in) |
| B | 77.01 ~ 77.02mm (3.0319 ~ 3.0323in) |
| C | 77.02 ~ 77.03mm (3.0323 ~ 3.0327in) |

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

[1.4]



[1.6]



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

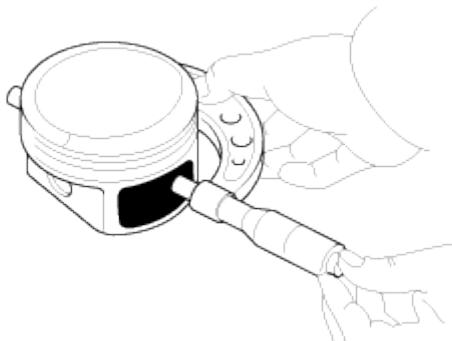
1. Clean the piston.
 - (1) Using a gasket scraper, remove the carbon from the piston top.
 - (2) Using a groove cleaning tool or broken ring, clean the piston ring grooves.
 - (3) Using solvent and a brush, thoroughly clean the piston.

NOTE

Do not use a wire brush.

2. The standard measurement of the piston outside diameter is taken 33.9mm(1.5697in) from top 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 : 0.03 ~ 0.07mm (0.0012 ~ 0.0028in)

No.2 ring : 0.03 ~ 0.07mm (0.0012 ~ 0.0028in)

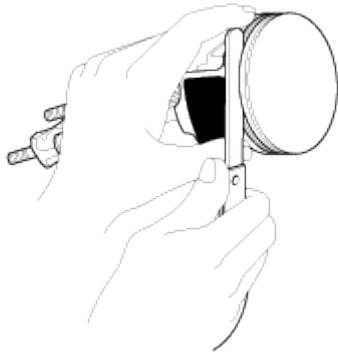
Oil ring : 0.06 ~ 0.15mm (0.0024 ~ 0.0059in)

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)

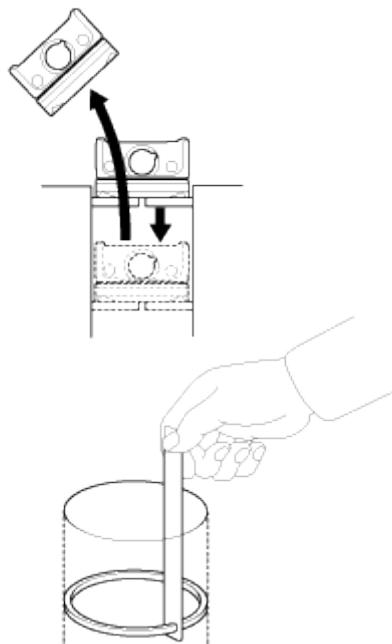
Oil ring : 0.20 ~ 0.70mm(0.0079 ~ 0.0276in)

Limit

No.1 ring : 0.3mm(0.0118in)

No.2 ring : 0.5mm(0.0197in)

Oil ring : 0.8mm(0.0315in)

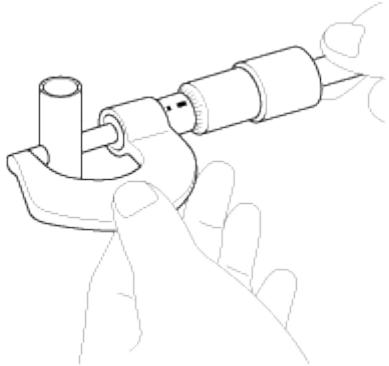


Piston Pins

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)

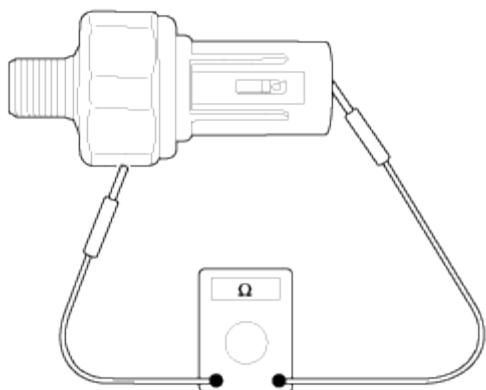
3. Check the difference between the piston pin outer diameter and the connecting rod small end inner diameter.

Piston pin-to-connecting rod interference :

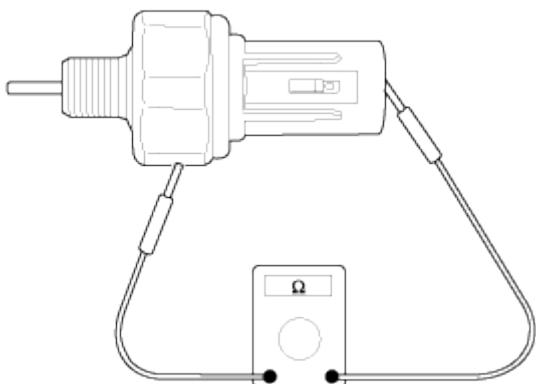
-0.032 ~ -0.016mm (-0.0013 ~ -0.0006in)

Oil Pressure Switch

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



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



3. If there is no continuity when a 49.0kpa (0.5kg/cm², 7.1psi) vacuum is applied through the oil hole, the switch is operating properly.

Check for air leakage. If air leaks, the diaphragm is broken. Replace it.

Reassembly

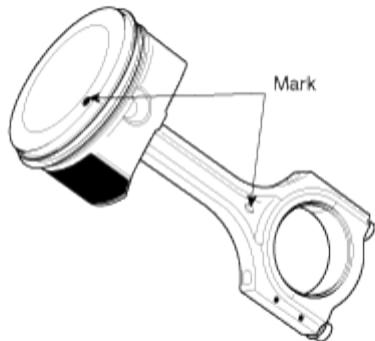
NOTE

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

1. Assemble the piston and connecting rod.

(1) Use a hydraulic press for installation

(2) The piston front mark and the connecting rod front mark must face the timing chain side of the engine.



2. Install the piston rings.

NOTE

The engine's piston ring sets are classified according to the displacement (1.4L, 1.6L), fuel type (Leaded, Unleaded) and application of the ISG(Idle Stop & Go) function.

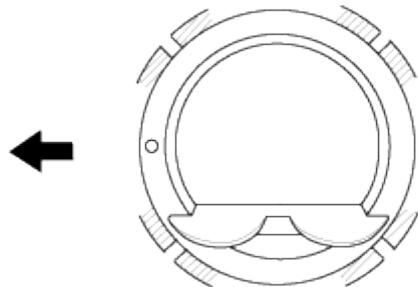
Identify the engine type before selecting the piston ring set.

(1) Install the oil ring expander and 2 side rails by hand.

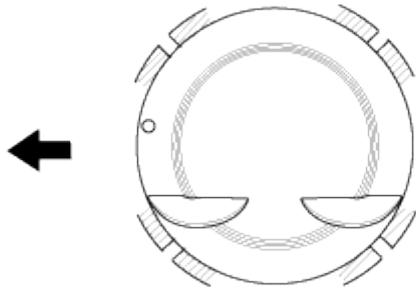
(2) Using a piston ring expander, install the 2 compression rings with the code mark facing upward.

(3) Position the piston rings so that the ring ends are as shown.

[1.4]

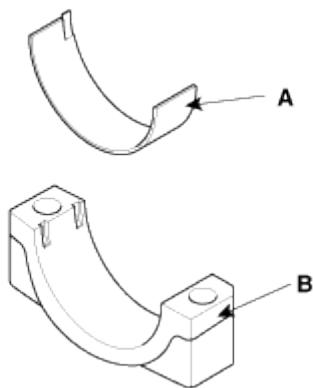


[1.6]



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).

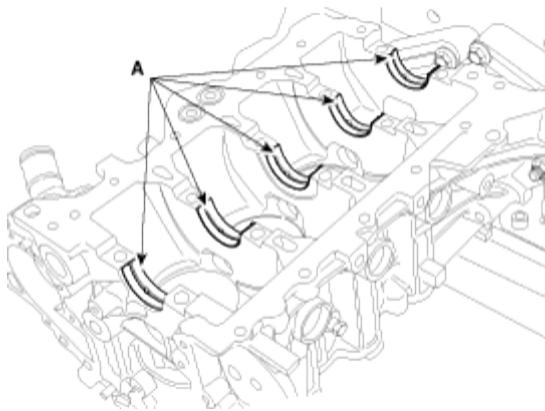


4. Install the crankshaft main bearings.

NOTE

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

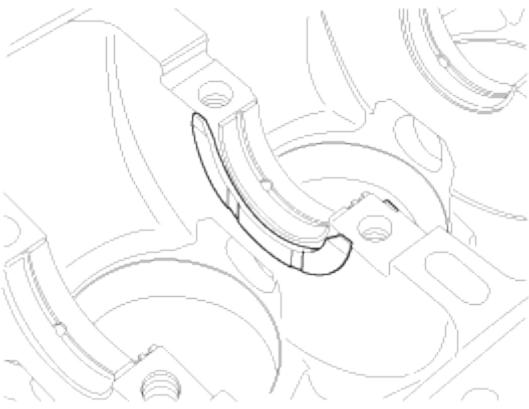
- (1) Align the bearing claw with the claw groove of the cylinder block, push in the five upper bearings(A).



- (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

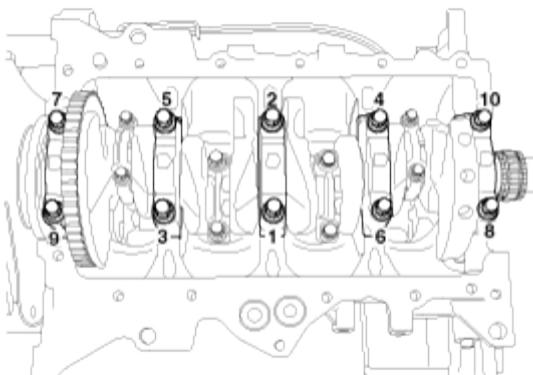
The main bearing cap bolts are tightened in 2 progressive steps.

If any of the bearing cap bolts are 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.

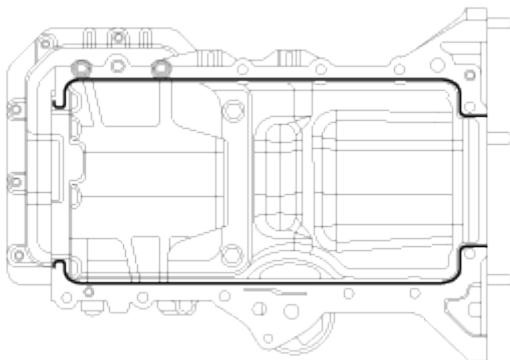
Tightening torque :

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.



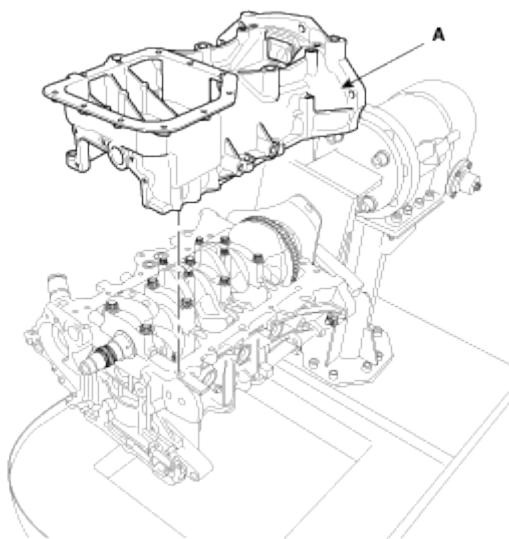
NOTE

- Apply the sealant, THREE-BOND 1217H or LOCTITE 5900H on the ladder frame rail portion and install it within five minutes.
If when sealant is applied to cylinder block bottom position, sealant position to be same with position 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)

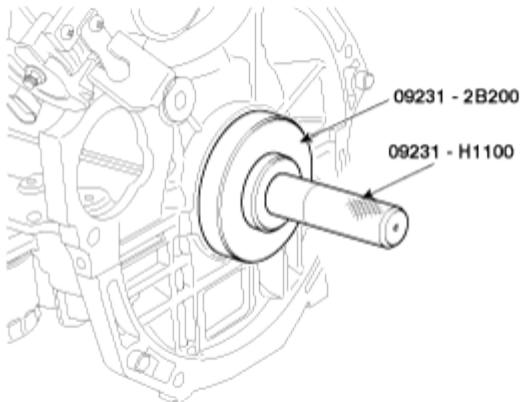


13. Install the rear oil seal.

(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.

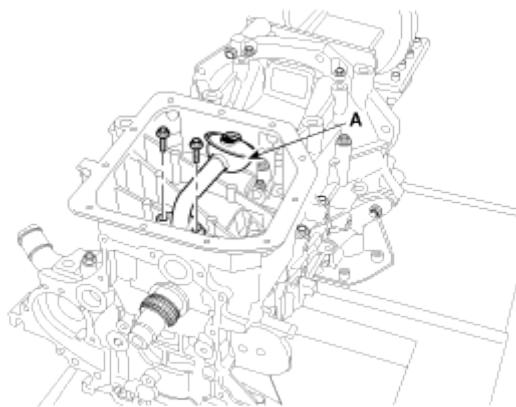


14. Install the oil screen.

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.

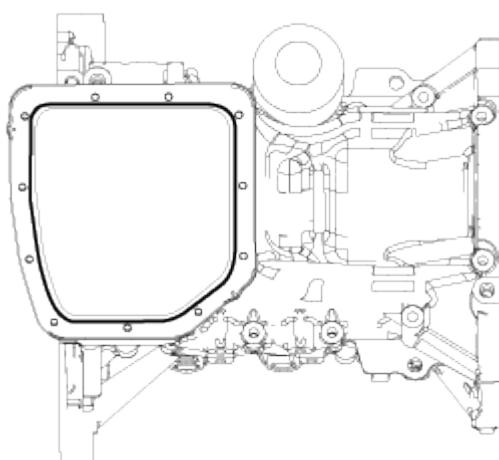
(1) Using a razor blade and gasket scraper, remove all the old packing material from the gasket surfaces.

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

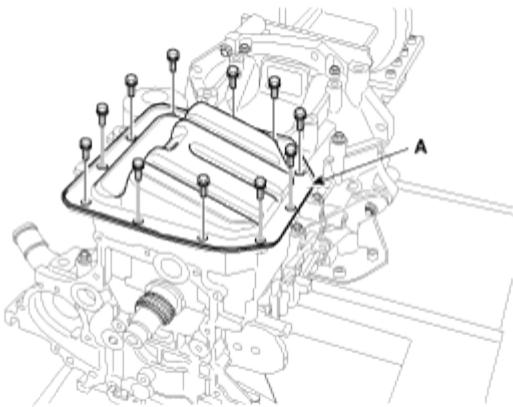
- To prevent leakage of oil, apply liquid gasket to the inner threads of the bolt holes.
- Do not install the parts if five minutes or more have elapsed since applying the liquid gasket. Instead, reapply liquid gasket after removing the residue.
- After assembly, wait at least 30 minutes before filling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



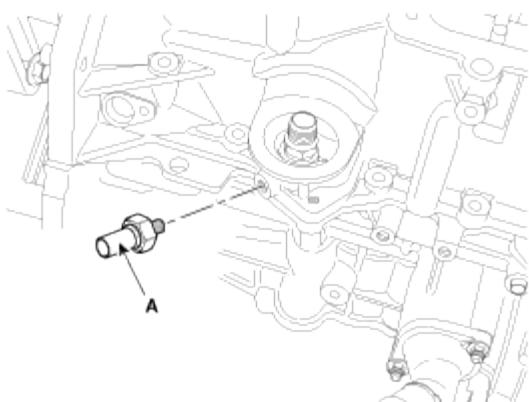
16. Install the oil pressure switch.

(1) Apply adhesive to 2 or 3 threads.

(2) Install the oil pressure switch(A).

Tightening torque :

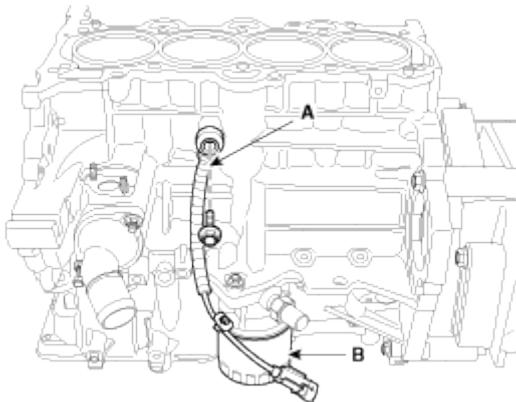
7.8 ~ 11.8N.m (0.8 ~ 1.2kgf.m, 5.8 ~ 8.7lb-ft)



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

Tightening torque :

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



23. M/T :install the fly wheel.

Tightening torque :

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

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

9.6. Cooling System

9.6.1. Coolant

9.6.1.1. Repair procedures

Engine Coolant Refilling And Bleeding

WARNING

Never remove the radiator cap when the engine is hot.

Serious scalding could be caused by hot fluid under high pressure escaping from the radiator.

CAUTION

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

1. Remove the radiator cap.
2. Loosen the drain plug, and drain coolant.
3. Tighten the radiator drain plug securely.
4. Remove the coolant reservoir tank. Drain the coolant and reinstall the coolant reservoir tank. Fill the coolant reservoir tank to the "F" mark with coolant mixture.(coolant 5 : water 5)
5. Fill coolant mixture into the radiator to the base of filler neck. Gently squeeze the upper/lower hoses of radiator so as to bleed air easily.

NOTE

- Mix the recommended antifreeze with an equal amount of water in a clean container.
- Use only genuine antifreeze/coolant.
- For best corrosion protection, the coolant concentration must be maintained year-round at 50% minimum. Coolant concentrations less than 50% may not provide sufficient protection against corrosion or freezing.
- Coolant concentration greater than 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.

6. Start engine and allow coolant mixture to circulate.

When the cooling fan operates and coolant circulates, refill coolant through the radiator filler neck.

7. Repeat 6 until the cooling fan 3~5 times and bleed air sufficiently out of the cooling system.

8. Install the radiator cap and fill the reservoir tank to the "F" line with coolant.

9. Run the vehicle under idle until the cooling fan operates 2~3 times.

10. Stop the engine and allow coolant to cool.

11. Repeat steps 6 to 11 until the coolant level stays constant and all air is bleed out of the cooling system.

NOTE

Recheck the coolant level in the reservoir tank for 2~3 days after replacing coolant.

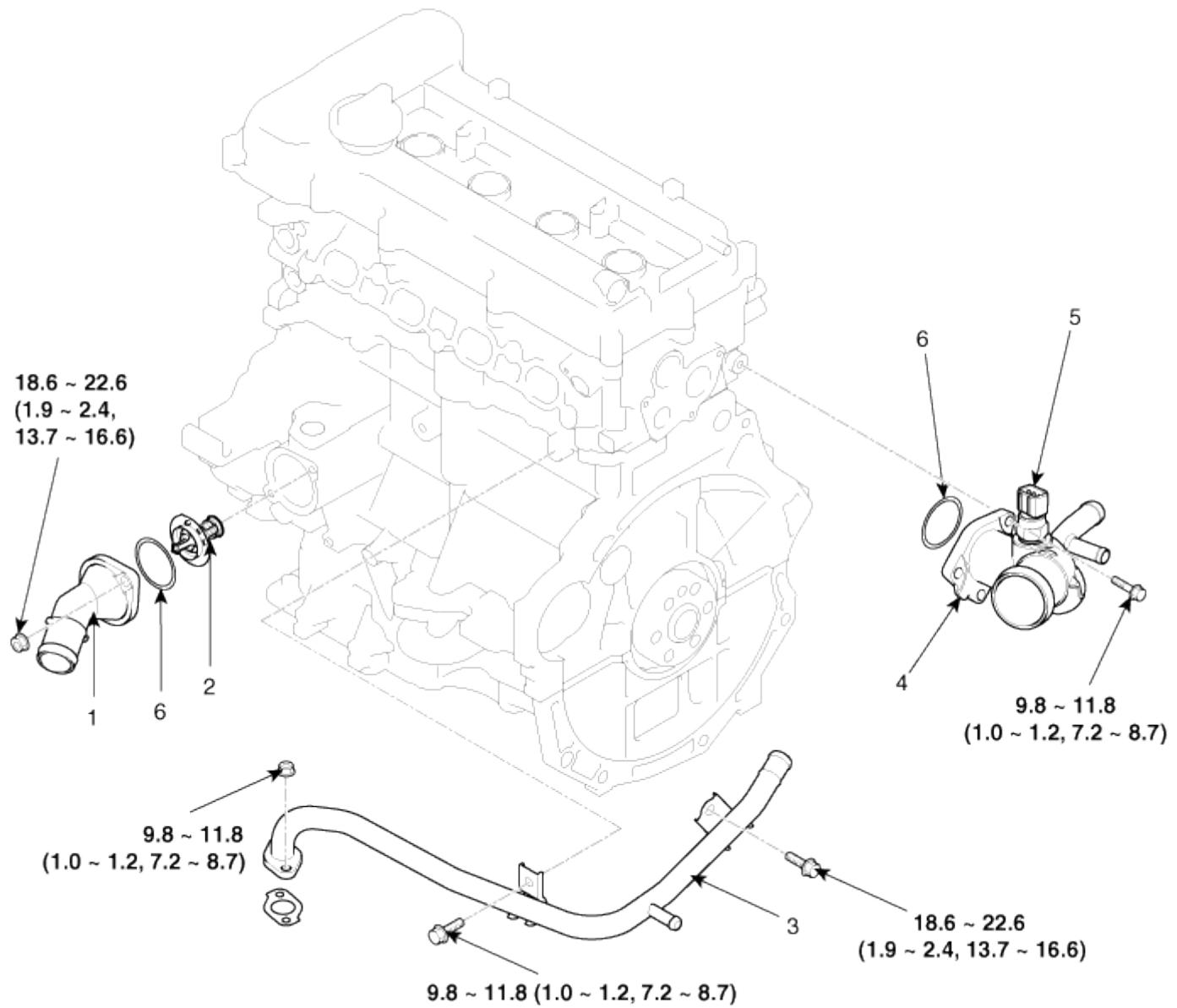
Coolant capacity :

5.5 ~ 5.8 liters(5.81 ~ 6.13 US qt, 4.84 ~ 5.10 Imp qt)

9.6.2. Thermostat

9.6.2.1. Component and Components Location

Components



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

| | |
|------------------------|--------------------------------|
| 1. Water inlet fitting | 4. Water temp control assembly |
| 2. Thermostat | 5. Water temperature sensor |
| 3. Heater pipe | 6. O-ring |

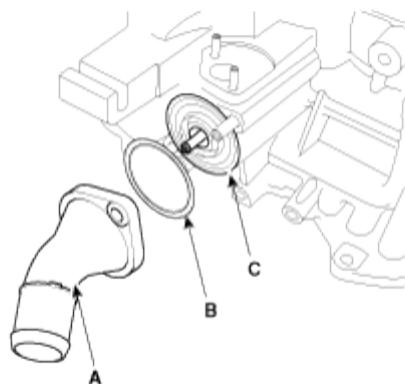
9.6.2.2. Repair procedures

Removal

NOTE

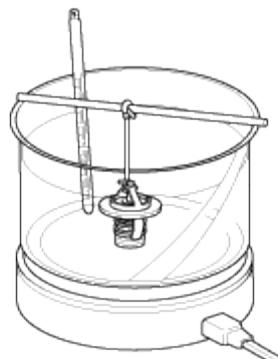
Disassembly of the thermostat would have an adverse effect, causing a lowering of cooling efficiency.

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), O-ring (B) and thermostat (C).



Inspection

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



2. Check the valve opening temperature.

Valve opening temperature : $82 \pm 1.5^{\circ}\text{C}$ ($179.6 \pm 2.7^{\circ}\text{F}$)

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.

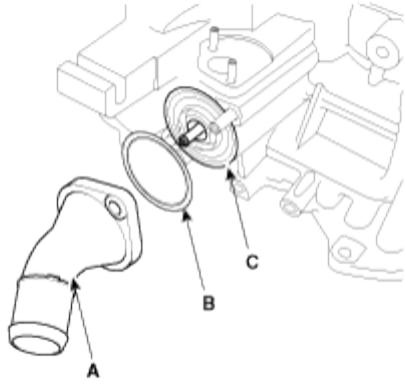
(1) Install the thermostat(B) with the jiggle valve upward.

(2) Install the new O-ring (B).

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.

9.6.2.3. Troubleshooting

Troubleshooting

| Symptoms | | Possible Causes | | Remedy |
|--------------------|--|---|---|--|
| Coolant leakage | <ul style="list-style-type: none"> • From the thermostat gasket | Check the mounting bolts | <ul style="list-style-type: none"> • Check the torque of the mounting bolts | <ul style="list-style-type: none"> • Retighten the bolts and check leakage again. |
| | | Check the gasket for damage | <ul style="list-style-type: none"> • Check gasket or seal for damage | <ul style="list-style-type: none"> • Replace gaskets and reuse the thermostat. |
| Cooled excessively | <ul style="list-style-type: none"> • Low heater performance (cool air blown-out) • Thermogauge indicates 'LOW' | Visually check after removing the radiator cap. | <ul style="list-style-type: none"> • Insufficient coolant or leakage. | <ul style="list-style-type: none"> • After refilling coolant, recheck. |
| | | GDS check&Starting engine | <ul style="list-style-type: none"> • Check DTCs • Check connection of the fan clutch or the fan motor. <p>※ If the fan clutch is always connected, there will be a noise at idle.</p> | <ul style="list-style-type: none"> • Check the engine coolant sensor, wiring and connectors. • Replace the components. |
| | | Remove the thermostat and inspect | <ul style="list-style-type: none"> • Check if there are dusts or chips in the thermostat valve. • Check adherence of the thermostat. | <ul style="list-style-type: none"> • Clean the thermostat valve and reuse the thermostat. • Replace the thermostat, if it doesn't work properly. |
| Heated excessively | <ul style="list-style-type: none"> • Engine overheated • Thermogauge indicates 'HI' | Visually check after removing the radiator cap. | <ul style="list-style-type: none"> • Insufficient coolant or leakage. <p>※ Be careful when removing a radiator cap of the overheated vehicle.</p> <ul style="list-style-type: none"> • Check air in cooling system. | <ul style="list-style-type: none"> • After refilling coolant, recheck. • Check the cylinder head gaskets for damage and the tightening torque of the mounting bolts. |
| | | GDS check&Starting engine | <ul style="list-style-type: none"> • Check DTCs • Check the fan motor performance as temperature varies. | <ul style="list-style-type: none"> • Check the engine coolant sensor, wiring and connectors. • Check the fan motor, the |

| | | | |
|--|---|---|--|
| | | <ul style="list-style-type: none"> • Check if the fan clutch slips. • Check the water pump adherence or impeller damaged. | 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. | <ul style="list-style-type: none"> • After removing the thermostat, check it works properly. <p>※ Check the thermostat opens at the valve opening temperature.</p> | • Replace the thermostat, if it doesn't work properly. |

9.6.3. Water Pump

9.6.3.1. Repair procedures

Removal

Water Pump

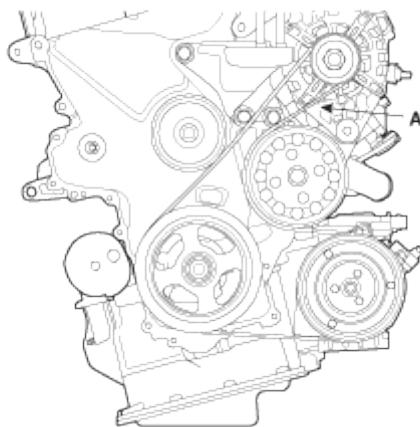
1. Drain engine coolant.

WARNING

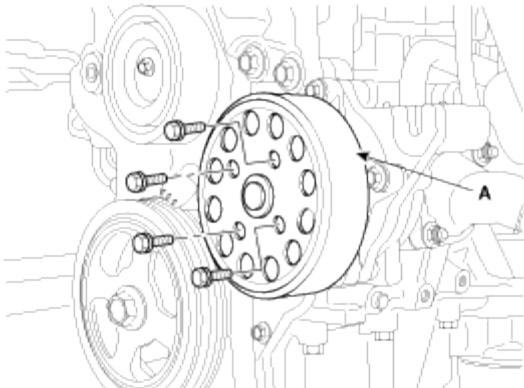
System is under high pressure when the engine is hot.

To avoid danger of releasing scalding engine coolant, remove the cap only when the engine is cool.

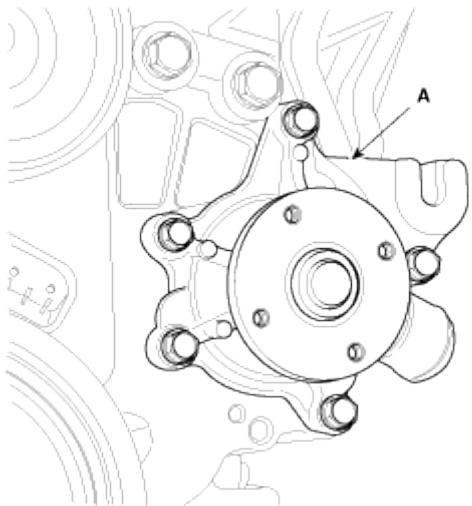
2. Remove the drive belt(A).



3. Remove the water pump pulley(A).

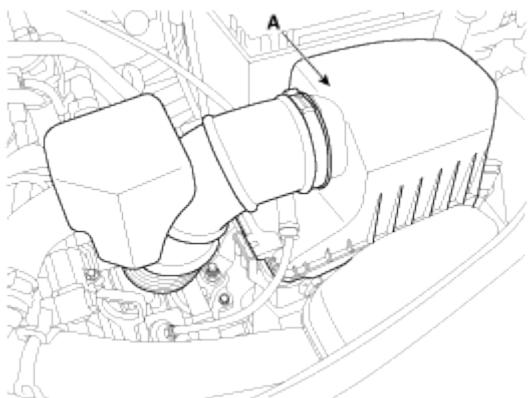


4. Remove the water pump(A).



Water Temperature Control Assembly

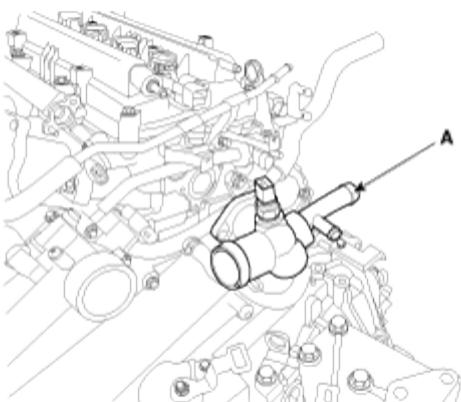
1. Drain engine coolant.
2. Remove the air cleaner assembly.



3. Remove the water temperature control assembly(A).

Tightening torque :

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



4. 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.

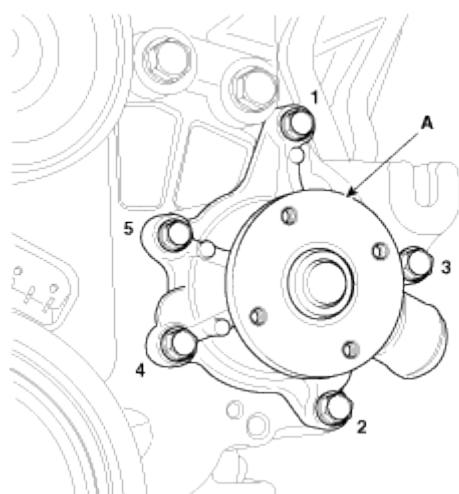
- Check the bearing for damage, abnormal noise and sluggish rotation, and replace the coolant pump assembly if necessary.
- Check for coolant leakage. If coolant leaks from hole, the seal is defective. Replace the coolant pump assembly and gasket.

NOTE

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

Installation

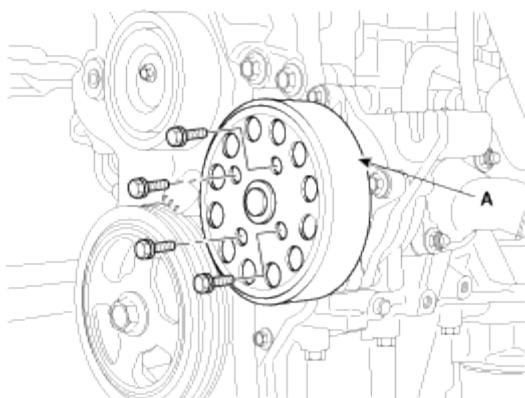
- Install the water pump.
 (1) Install the water pump(A) and a new gasket with the bolts.
 Tighten the bolts with the order blow.



- (2) Install the water pump pulley(A) with the four bolts.

Tightening torque :

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



CAUTION

Tighten the bolts diagonally.

- Install the drive belts.
- Fill with engine coolant.
- Start engine and check for leaks.
- Recheck engine coolant level.

9.6.3.2. 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. |
| | • From gaskets or bolts | | • 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 outer surface of water pump | | • Check the tightening of the water pump mounting bolts.
• Check damage of gaskets or inflow of dust.
• Replace the gasket and clean dust off. |
| 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
• Impeller separation from the shaft
• Check engine coolant.
• Poor coolant quality / Maintenance check
• Replace the water pump. |

9.6.4. Radiator

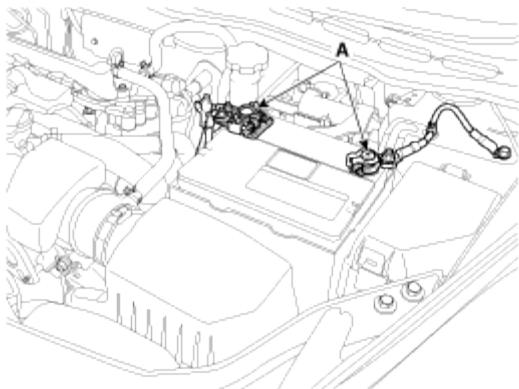
9.6.4.1. Repair procedures

Removal

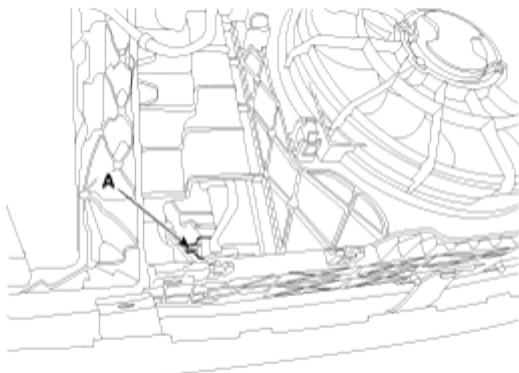
WARNING

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.

1. Disconnect the battery terminals (A).



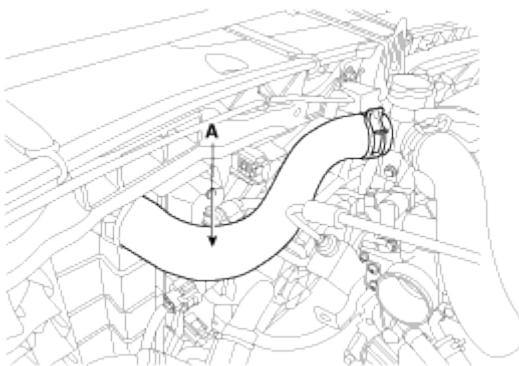
2. Loosen the drain plug (A), and then drain the coolant.

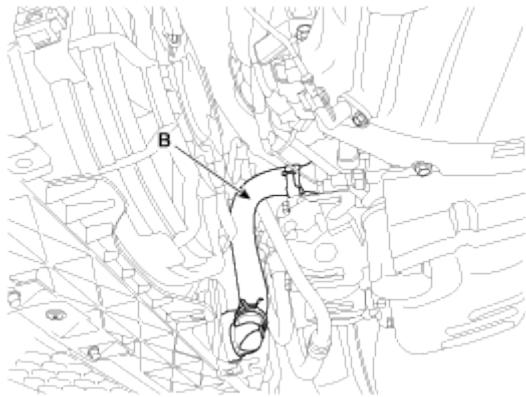


NOTE

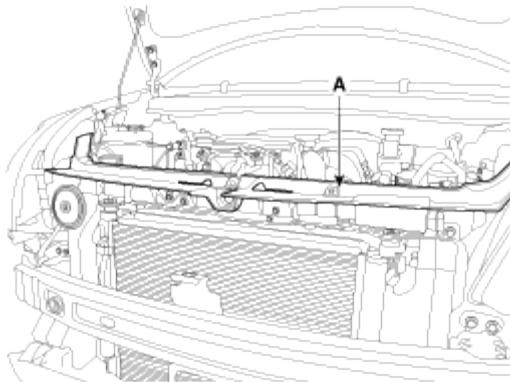
Remove the radiator cap to speed draining.

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





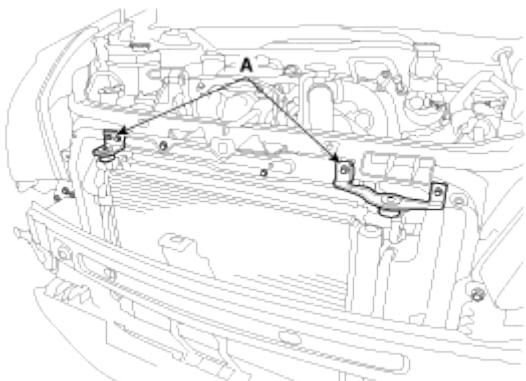
4. Remove the front bumper. (Refer to DB group)
5. Remove the front bumper mounting bracket (A).



6. Remove the radiator mounting brackets (A).

Tightening torque :

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

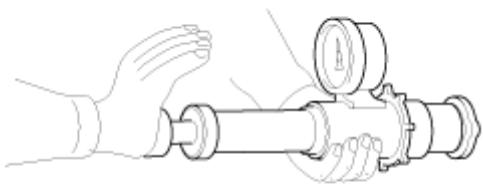


7. After pulling back the condenser fixing bracket, remove the radiator assembly.
8. Installation is reverse order of removal.
9. Fill with engine coolant.
10. Start the engine and check for leaks.
11. Recheck the engine coolant level.

Inspection

Radiator Cap Testing

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



2. Apply a pressure of 93.16 ~ 122.58kpa (0.95 ~ 1.25kg/cm², 13.51 ~ 17.78psi).
3. Check for a drop in pressure.
4. If the pressure drops, replace the cap.

Radiator Leakage Test

1. Wait until engine is cool, then carefully remove the radiator cap and fill the radiator with engine coolant, then install it on the pressure tester.
2. Apply a pressure tester to the radiator and apply a pressure of 93.16 ~ 122.58kpa (0.95 ~ 1.25kg/cm², 13.51 ~ 17.78psi).
3. Inspect for engine coolant leaks and a drop in pressure.
4. Remove the tester and reinstall the radiator cap.

NOTE

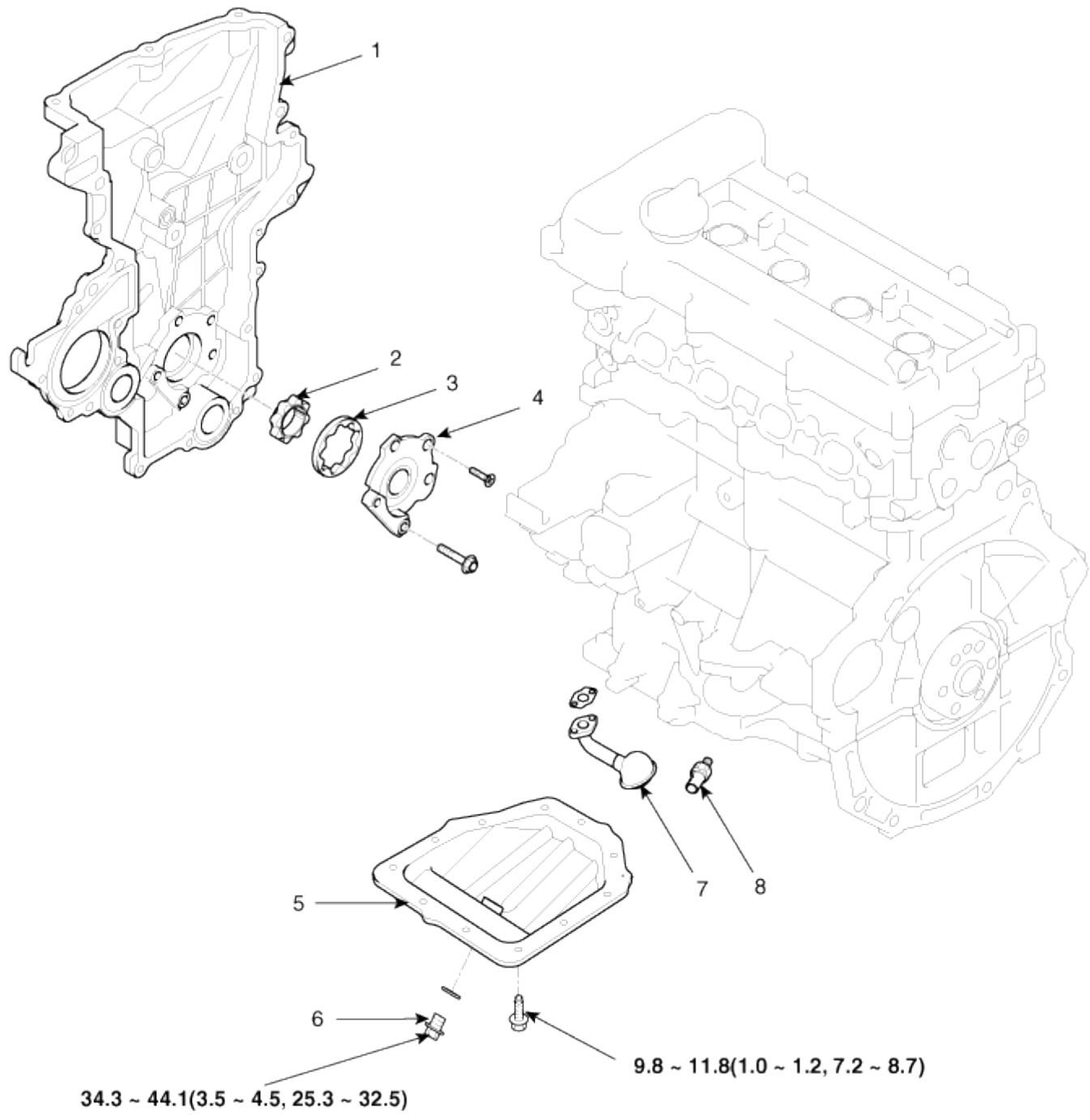
Check for engine oil in the coolant and/or coolant in the engine oil.

9.7. Lubrication System

9.7.1. Oil Pump

9.7.1.1. Component and Components Location

Components



TORQUE : N.m (kgf.m, lb·ft)

| | |
|-----------------------|-----------------------|
| 1. Timing chain cover | 5. Oil pan |
| 2. Inner roter | 6. Oil drain plug |
| 3. Outer roter | 7. Oil screen |
| 4. Pump cover | 8. Oil pressure gauge |

9.7.2. Engine Oil

9.7.2.1. 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, 3.25Imp qt)

Oil pan : 3.0L (3.17US qt, 2.64Imp qt)

Drain and refill including oil filter :

3.3 L (3.49US qt, 2.90Imp qt)

- (3) Install the oil filler cap.

4. Start engine and check for oil leaks.

5. Recheck the engine oil level.

Inspection

Engine Oil

1. Check the engine oil quality.

Check the oil deterioration, entry of water, discoloring or thinning.

If the quality is visibly poor, replace the oil.

2. Check the engine oil level.

After warming up the engine and then 5 minutes after the engine stop, oil level should be between the "L" and "F" marks in the dipstick.

If low, check for leakage and add oil up to the "F" mark.

NOTE

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

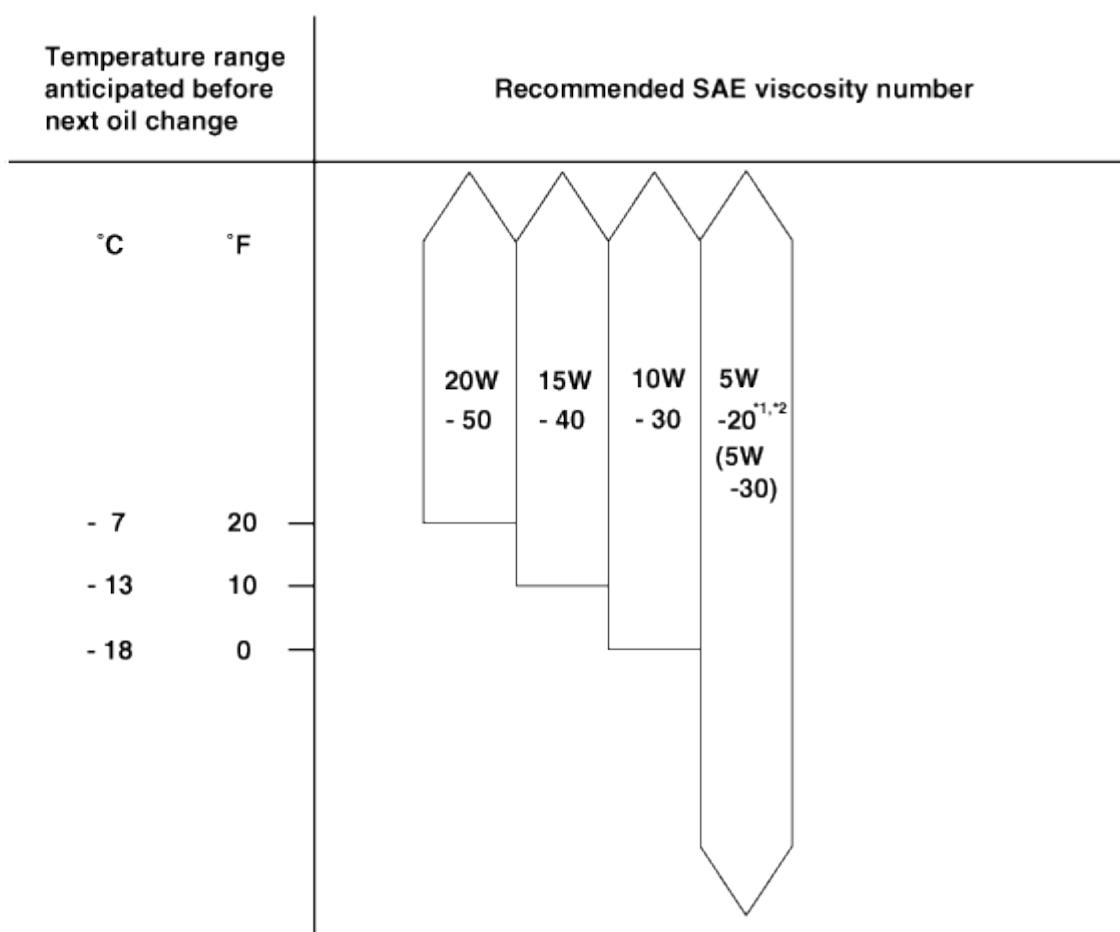
Selection Of Engine Oil

Recommendation (except Middle East) : 5W-20/GF4&SM (If not available, refer to the recommended API or ILSAC classification and SAE viscosity number.)

API classification : SL, SM or above

ILSAC classification : GF3, GF4 or above

SAE viscosity grade : Refer to the recommended SAE viscosity number.



*1 If 5W-20 / GF4 engine oil is not available, 5W-30 or secondary recommended engine oil for corresponding temperature range can be used.

*2 In Middle East, do not use the engine oil of viscosity grade SAE 5W-20.

NOTE

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

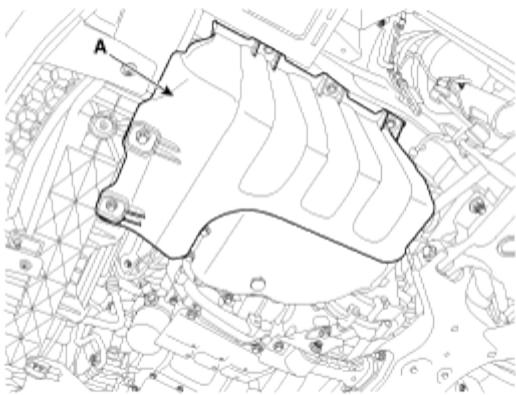
1. Satisfy the requirement of the API or ILSAC classification.
2. Have proper SAE grade number for expected ambient temperature range.
3. Lubricants that do not have both an SAE grade number and API or ILSAC service classification on the container should not be used.

9.7.3. Oil Pan

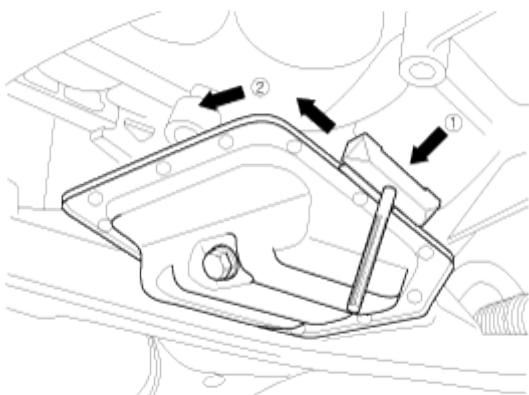
9.7.3.1. Repair procedures

Removal

1. Remove the under cover(A).



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 ①arrow.
- After tapping the SST with a plastic hammer along the direction of ②arrow 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

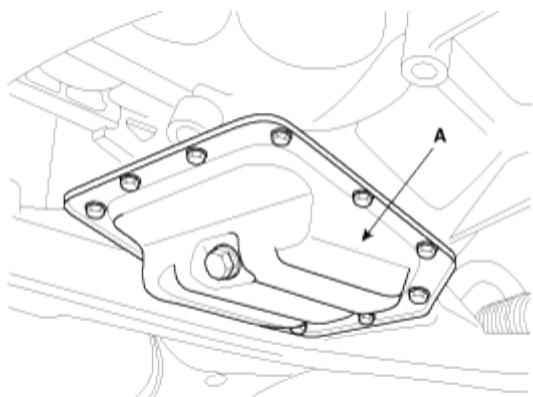
NOTE

- 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)



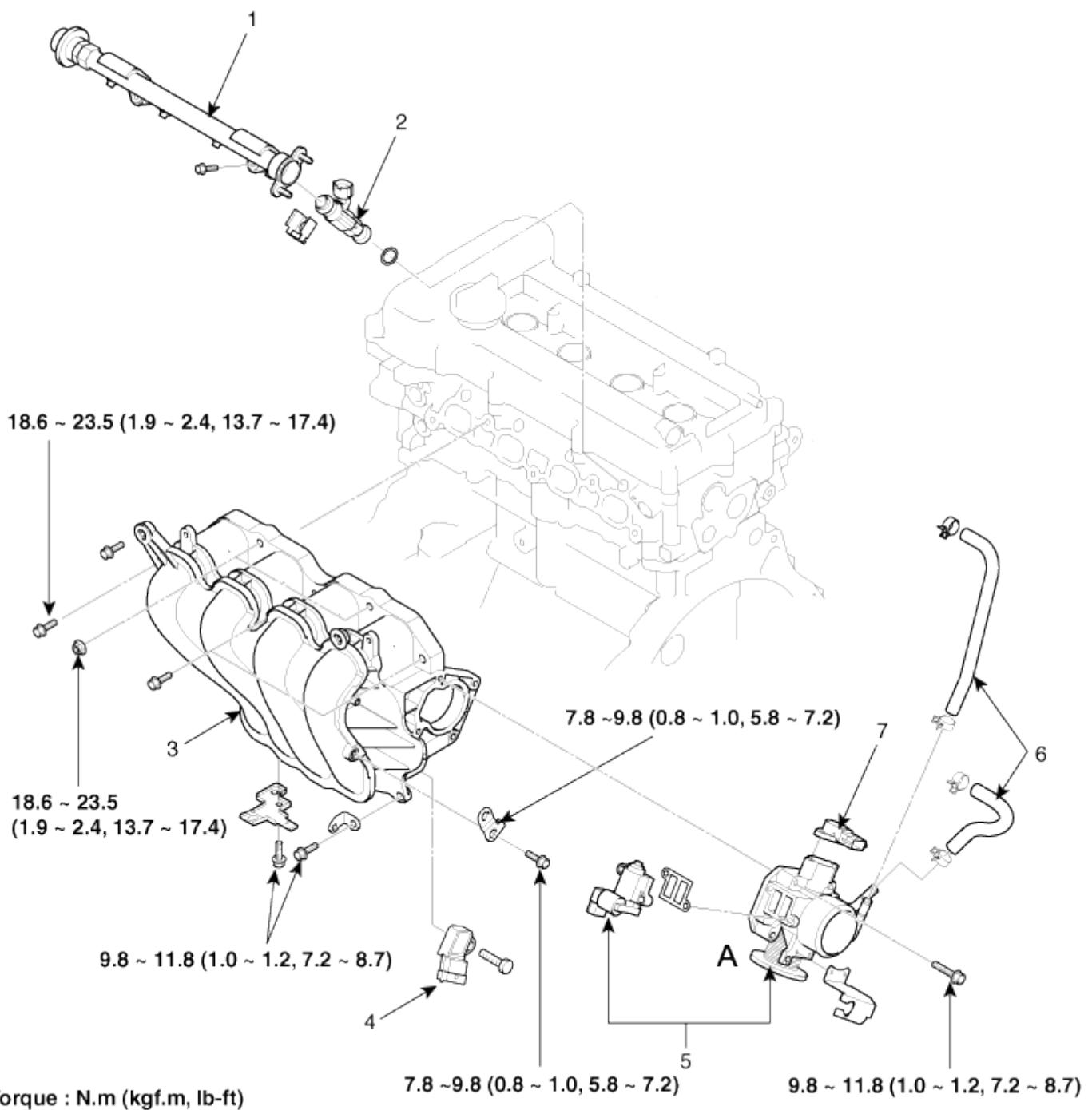
2. Refill engine oil.

9.8. Intake and Exhaust System

9.8.1. Intake Manifold

9.8.1.1. Component and Components Location

Components



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

| | |
|--------------------|----------------------------------|
| 1. Delivery pipe | 5. Throttle body |
| 2. Injector | 6. Water hose |
| 3. Intake manifold | 7. Throttle position sensor(TPS) |
| 4. MAP sensor | |

9.8.1.2. Repair procedures

Removal

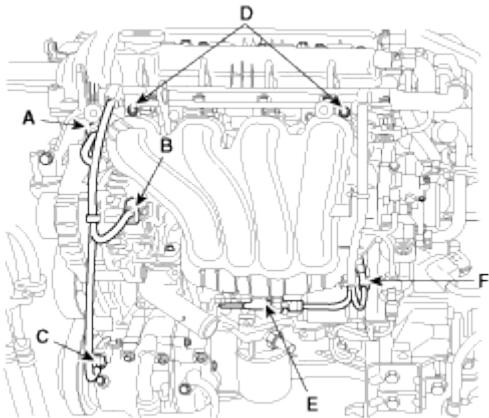
1. Remove the engine center cover.

Tightening torque :

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

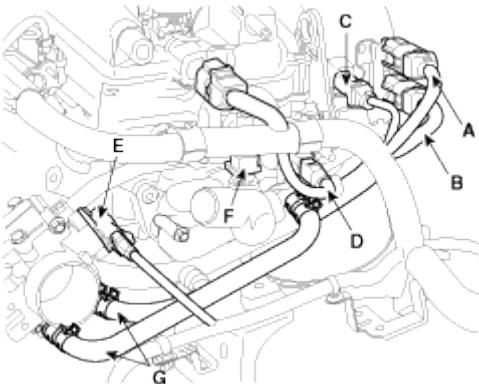
2. Disconnect the harness connectors over the cylinder head.

- (1) Disconnect the oil control valve(OCV) connector(A) and alternator connector(B).
- (2) Disconnect the air conditioning compressor connector(C).
- (3) Remove the ignition coil harness mounting bolts(D).
- (4) Disconnect the MAP sensor connector(F) and the knock sensor bracket(E).



3. Remove the engine wire harness connectors and wire harness clamps from cylinder head and the intake manifold.

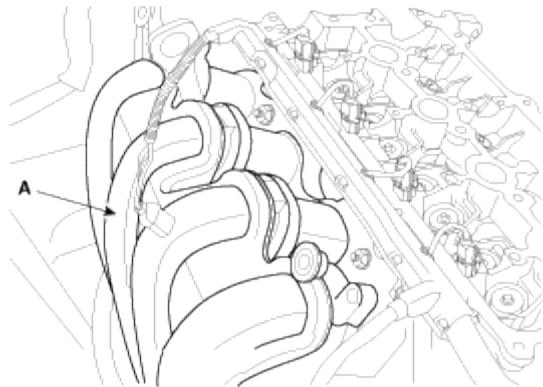
 - (1) Disconnect the front(A) and the rear(B) oxygen sensor connector.
 - (2) Disconnect the ignition coil condenser connector(C) and the purge control solenoid valve(PCS) connector(D).
 - (3) Disconnect the throttle position sensor(TPS) connector(E).
 - (4) Disconnect the engine coolant temperature sensor(ECTS) connector(F) and the water hose(G).



4. Remove the oil level gauge assembly.

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

5. Remove the intake manifold assembly(A).



Tightening torque :

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

6. To install, reverse the removal order.

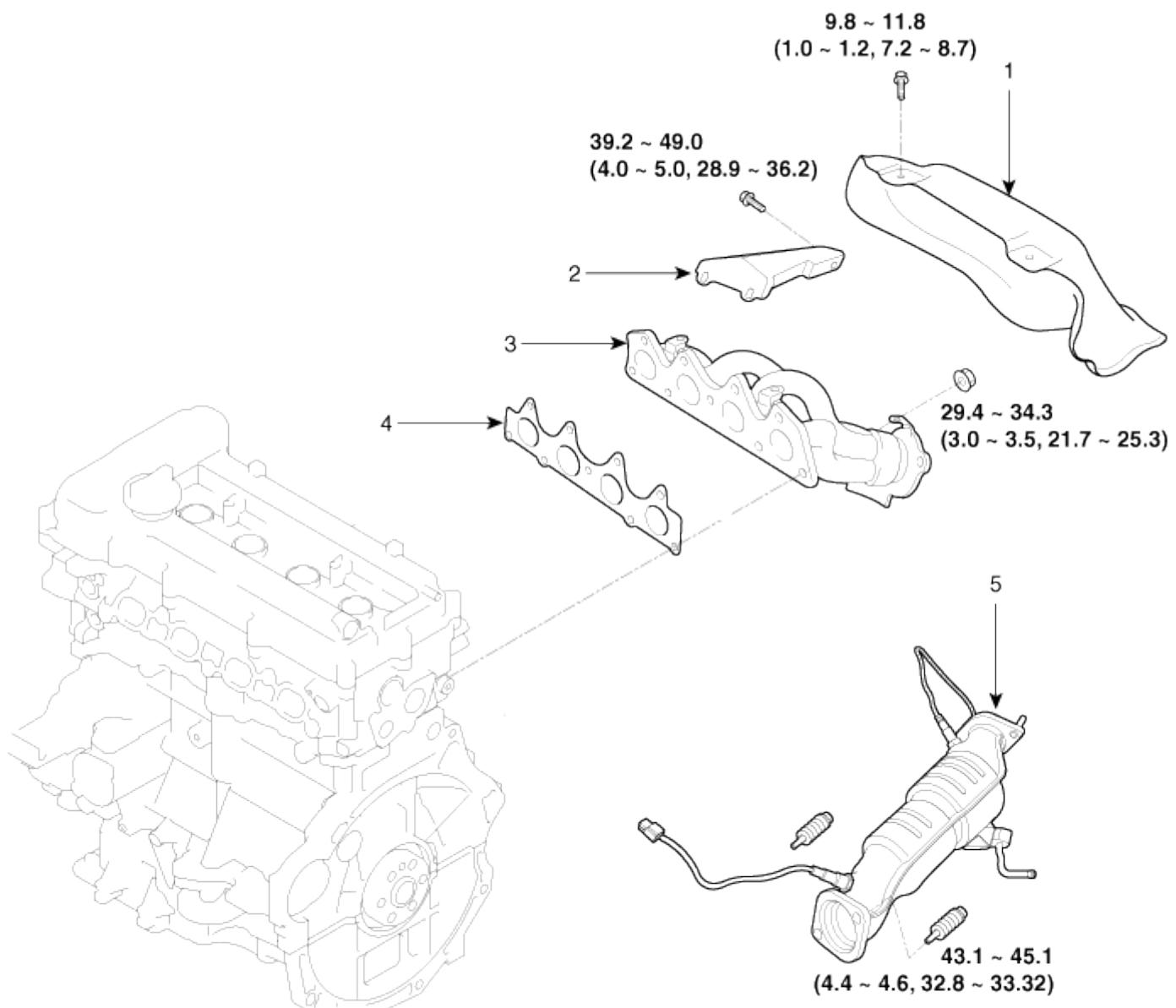
CAUTION

Install the engine cover surely before driving.

9.8.2. Exhaust Manifold

9.8.2.1. Component and Components Location

Components



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

- | | |
|--------------------------|------------------------|
| 1. Heat protector | 4. Gasket |
| 2. Exhaust manifold stay | 5. Catalytic convertor |
| 3. Exhaust manifold | |

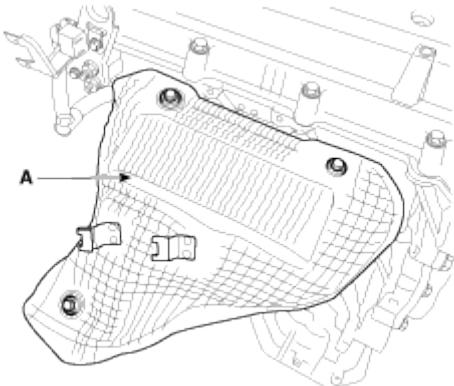
9.8.2.2. Repair procedures

Removal

1. Remove the heat protector(A).

Tightening torque :

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

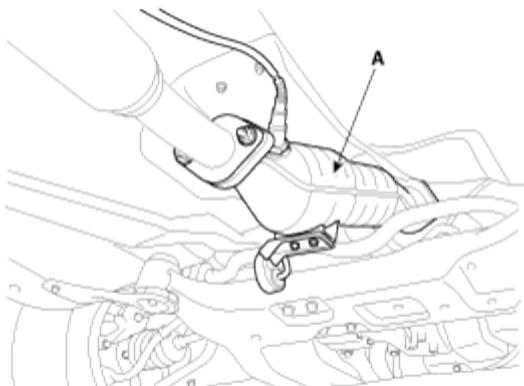


2. Remove the catalytic converter (A).

Tightening torque :

Bolts : 43.1 ~ 45.1N.m (4.4 ~ 4.6kgf.m, 31.8 ~ 33.3lb-ft)

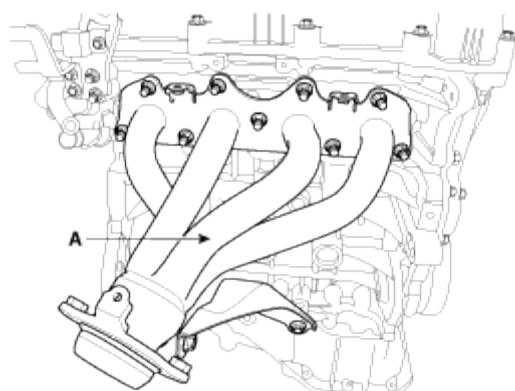
Nuts : 39.2 ~ 58.8N.m (4.0 ~ 6.0kgf.m, 28.9 ~ 43.4lb-ft)



3. Remove the exhaust manifold(A) with its gasket.

Tightening torque :

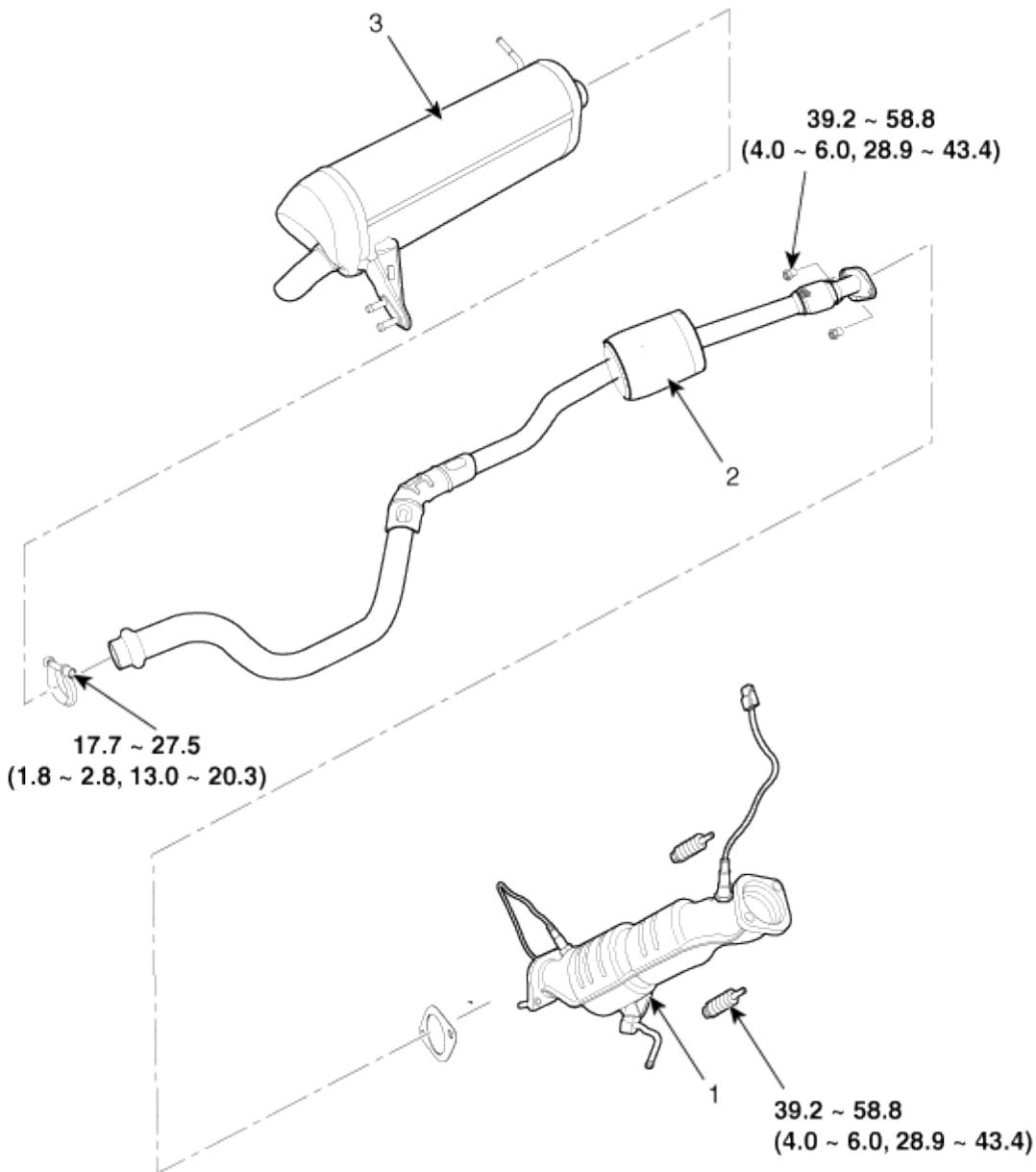
29.4~ 34.3N.m (3.0 ~ 3.5kgf.m, 21.7 ~ 25.3lb-ft)



9.8.3. Muffler

9.8.3.1. Component and Components Location

Components



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

| | |
|------------------------|-----------------|
| 1. Catalytic convertor | 3. Main Muffler |
| 2. Center muffler | |

9.8.3.2. Repair procedures

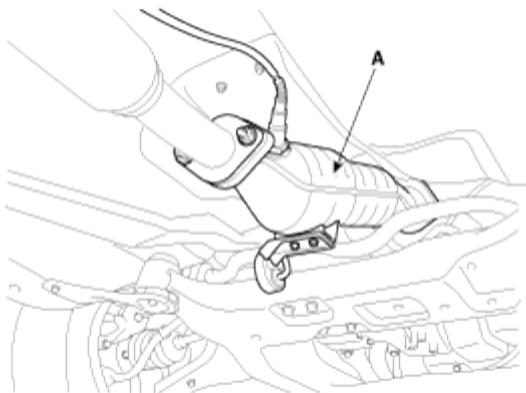
Removal

1. Remove the catalytic converter (A).

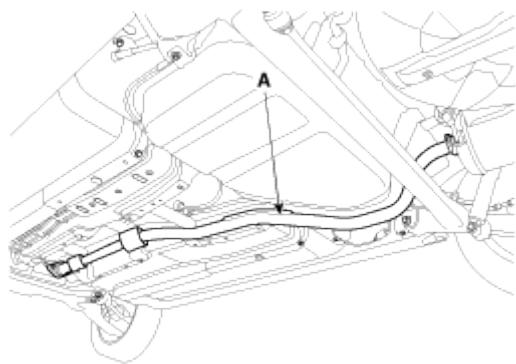
Tightening torque :

Bolts : 43.1 ~ 45.1N.m (4.4 ~ 4.6kgf.m, 31.8 ~33.3lb-ft)

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



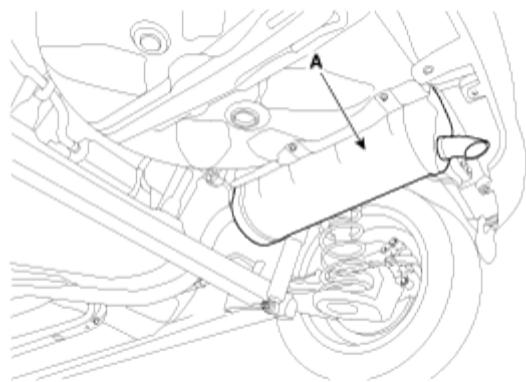
2. Remove the center muffler (A).



3. Remove the main muffler (A).

Tightening torque :

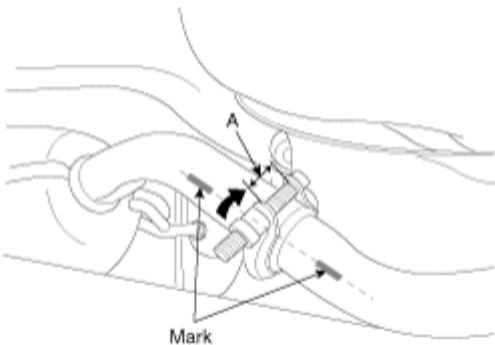
17.7~ 27.5Nm (1.8 ~ 2.8kgf.m, 13.0 ~ 20.3lb-ft)



4. Installation is in the reverse order of removal with new gasket.

5. Install the clamp in between the center pipe and main muffler pipe.

- (1) Align the marks on the center pipe and main muffler pipe as shown illustration.



(2) The clamp installing position (A) must be upper than the line virtually made by the two marks.

Tightening torque :

17.7~ 27.5Nm (1.8 ~ 2.8kgf.m, 13.0 ~ 20.3lb-ft)

CAUTION

Do not reuse the clamp.

10. Emission Control System

10.1. General Information

10.1.1. Description and Operation

Description

Emissions control system consists of the three major systems.

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

10.1.2. Specifications

Specifications

Purge Control Solenoid Valve (PCSV)

▷ Specification

| Item | Specification |
|------------------------------|-----------------|
| Coil Resistance (Ω) | 16 [20°C(68°F)] |

Tightening Torques

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

10.1.3. Troubleshooting

Troubleshooting

| Symptom | Suspect area |
|--|--|
| Engine will not start or hard to start | Vapor hose damaged or disconnected |
| Engine hard 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 |

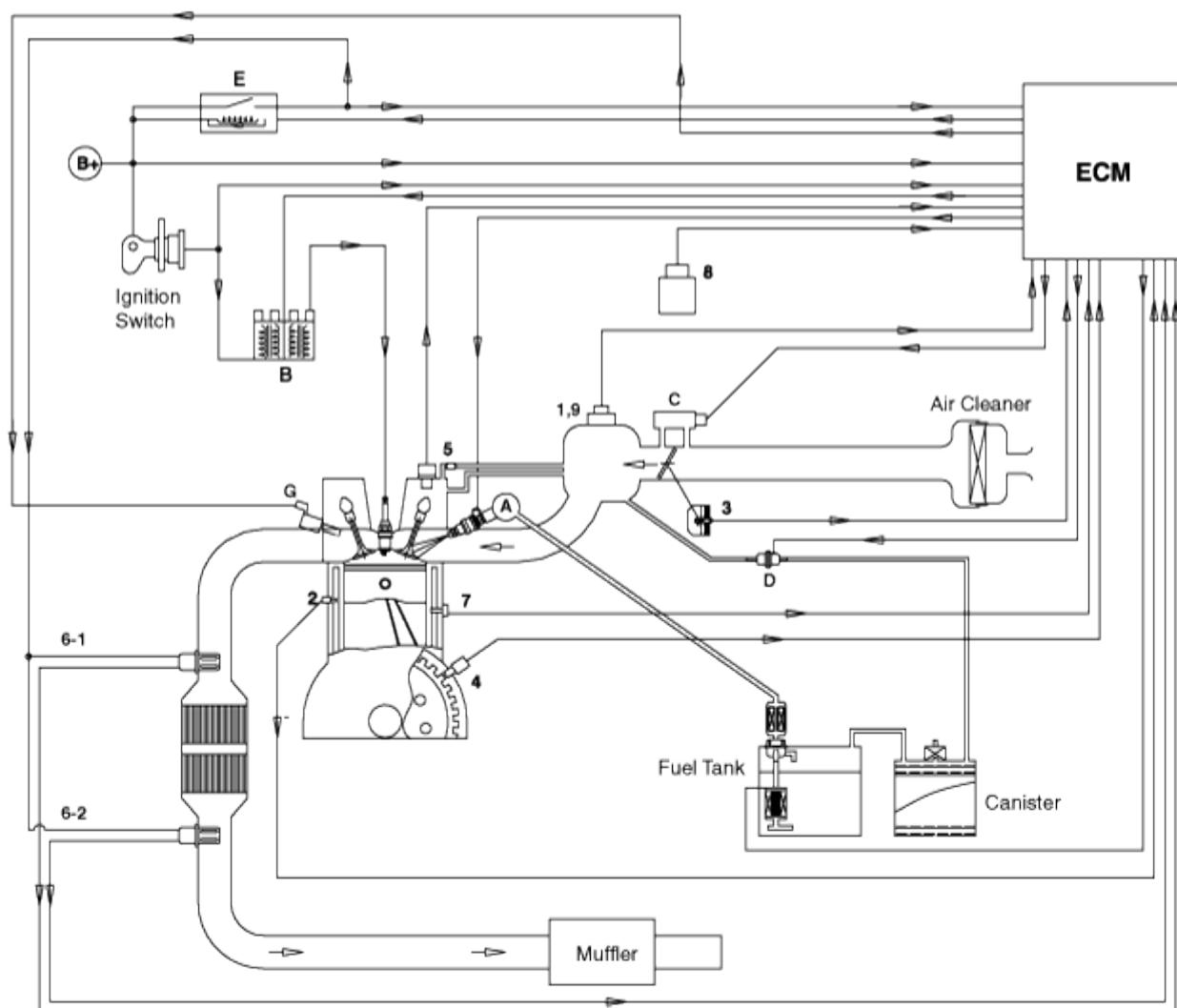
10.1.4. Schematic Diagrams

Schematic Diagram

1. Manifold Absolute Pressure Sensor (MAPS)
2. Engine Coolant Temperature Sensor (ECTS)
3. Throttle Position Sensor (TPS)
4. Crankshaft Position Sensor (CKPS)
5. Camshaft Position Sensor (CMPS)
- 6-1. Heated Oxygen Sensor (HO2S, Sensor 1)
- 6-2. Heated Oxygen Sensor (HO2S, Sensor 2)
7. Knock Sensor
8. Vehicle speed signal
9. Intake Air Temperature Sensor (IATS)
- Switch Input Signals

INPUT → ECM → OUTPUT

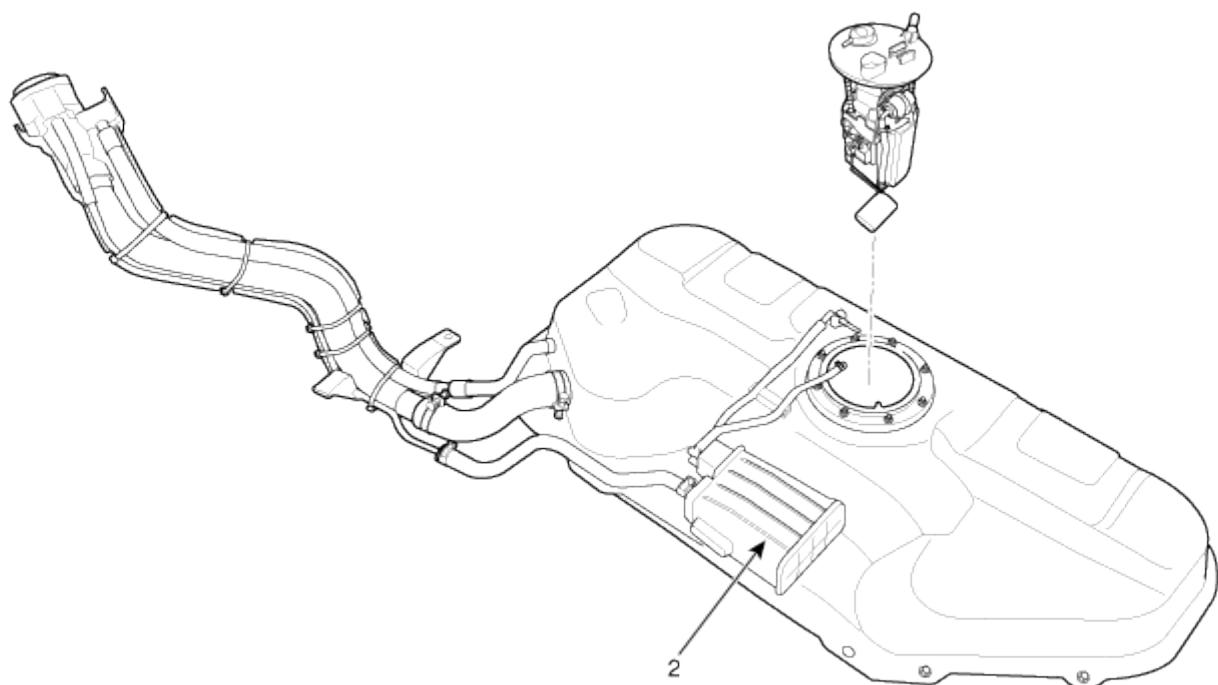
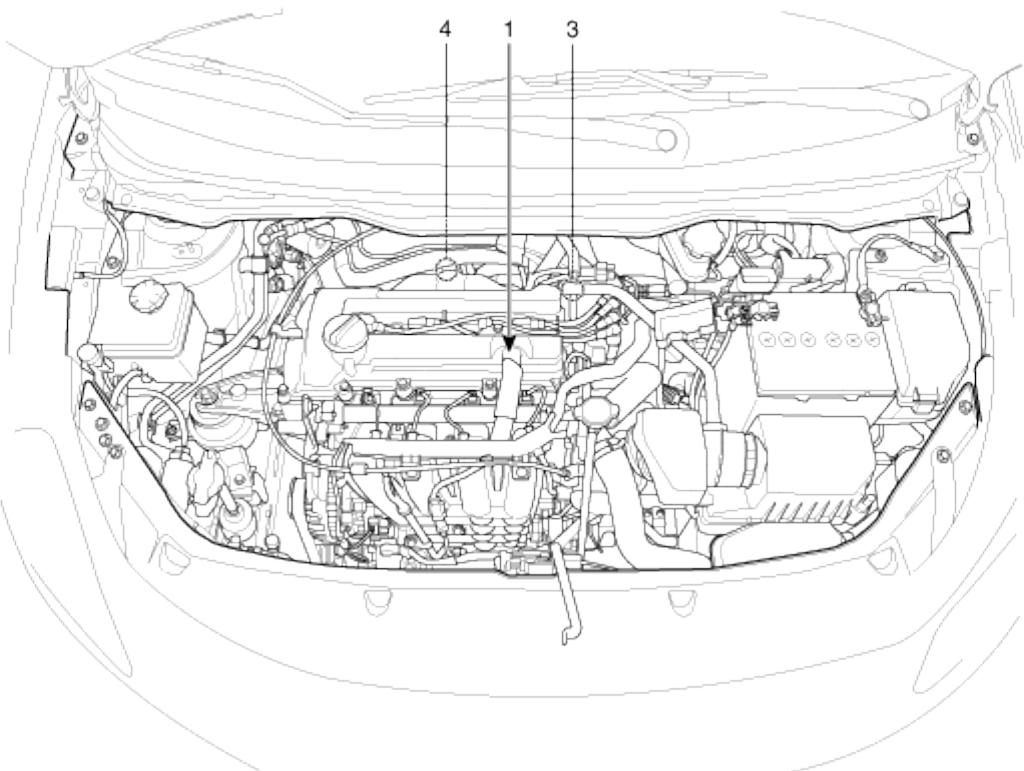
- A. Injector
- B. Ignition Coil
- C. Idle Speed Control Actuator (ISCA)
- D. Purge Control Solenoid Valve (PCSV)
- E. Main Relay
- F. Fuel Pump Relay
- G. CVVT Oil Control Valve (OCV) [1.4/1.6 DOHC]



10.1.5. Component and Components Location

Components Location

[1.2 DOHC]

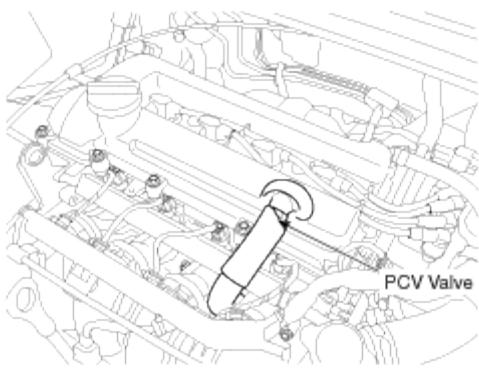


1. PCV Valve
2. Canister

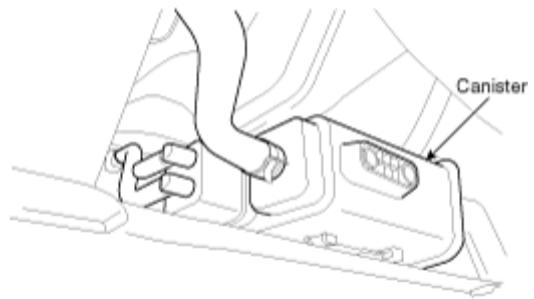
3. Purge Control Solenoid Valve (PCSV)
4. Catalytic Converter (MCC)

1. PCV Valve

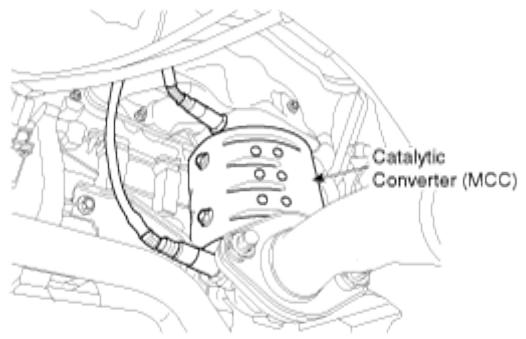
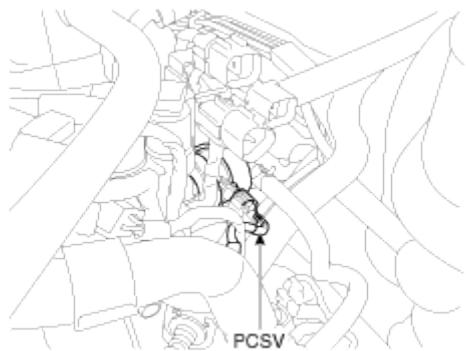
2. Canister



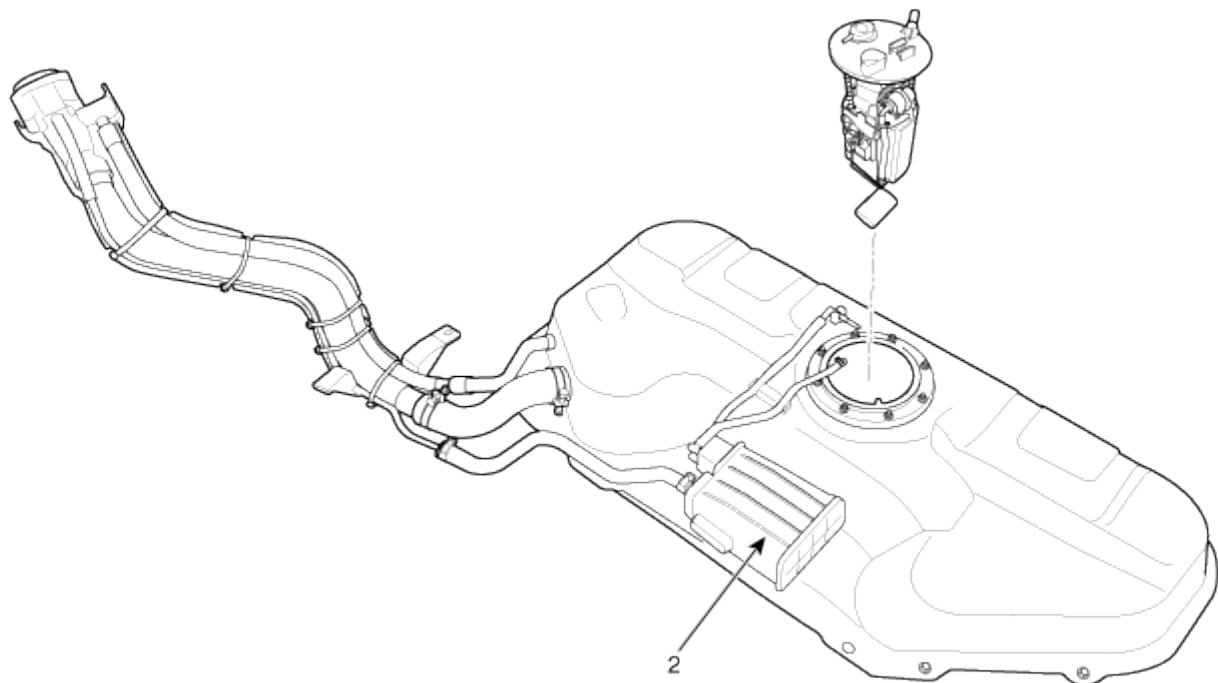
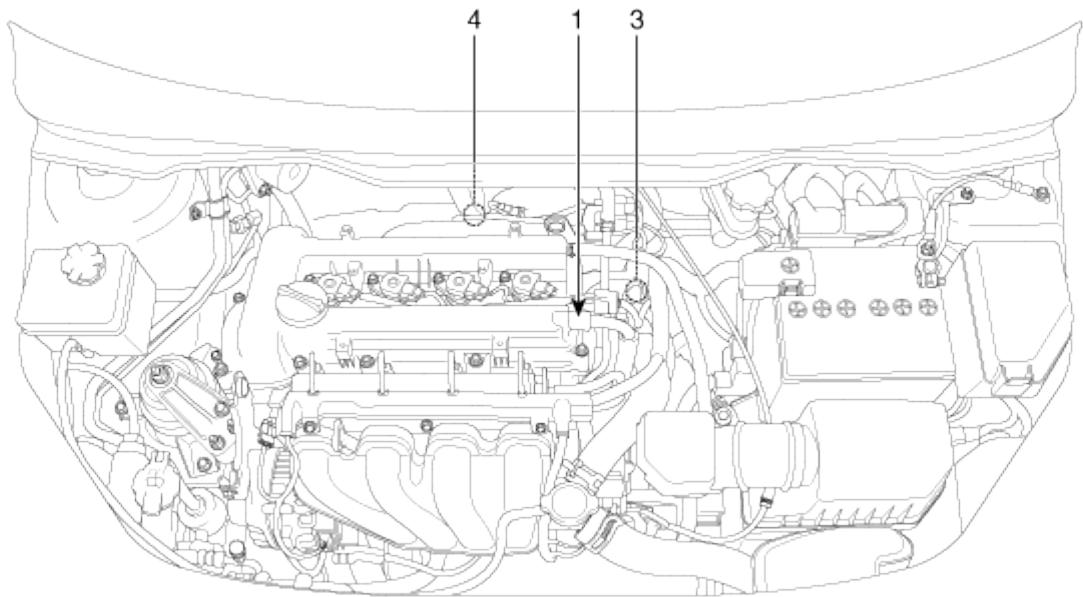
3. Purge Control Solenoid Valve (PCSV)



4. Catalytic Converter (MCC)



[1.4/1.6 DOHC]

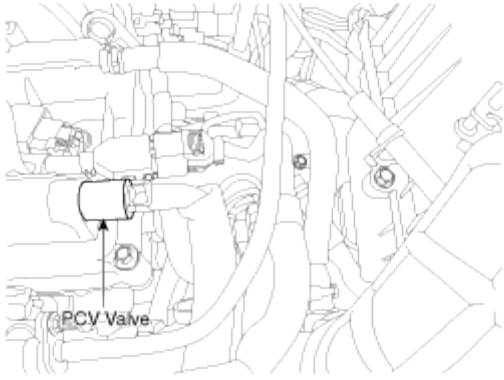


1. PCV Valve
2. Canister

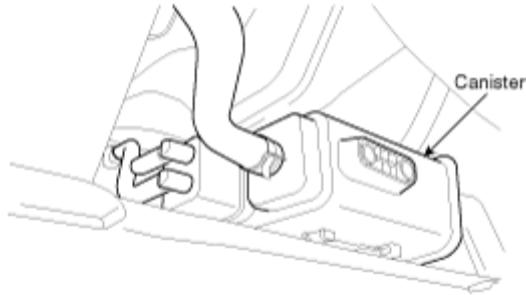
3. Purge Control Solenoid Valve (PCSV)
4. Catalytic Converter (MCC)

1. PCV Valve

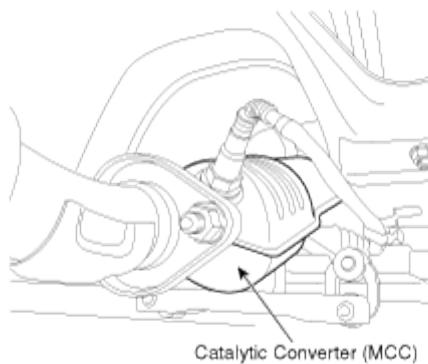
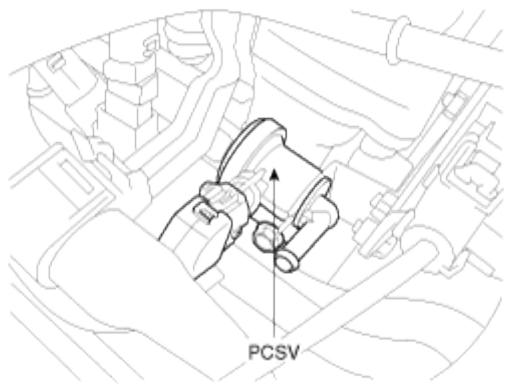
2. Canister



3. Purge Control Solenoid Valve (PCSV)



4. Catalytic Converter (MCC)

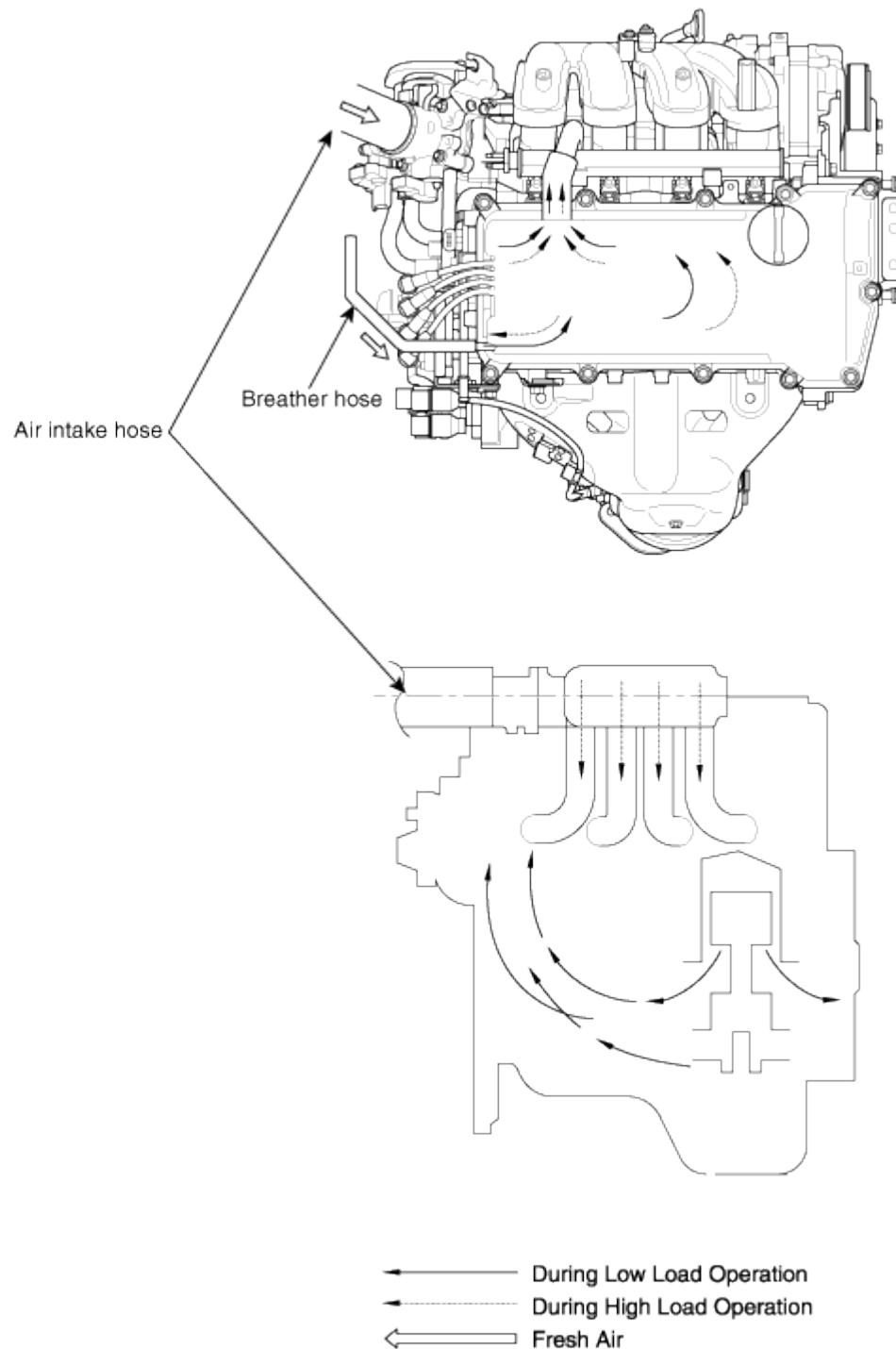


10.2. Crankcase Emission Control System

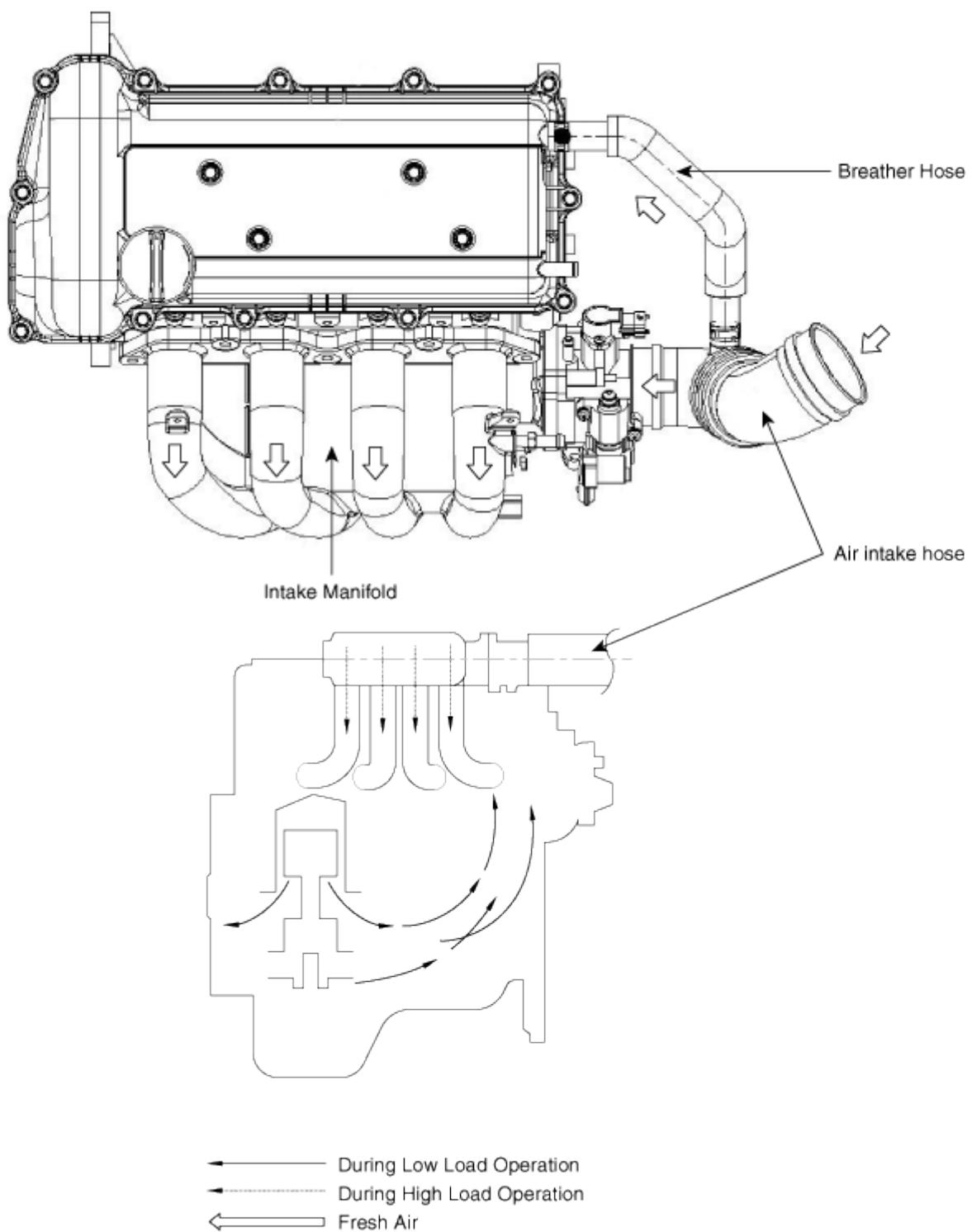
10.2.1. Schematic Diagrams

Schematic Diagram

[1.2 DOHC]



[1.4/1.6 DOHC]



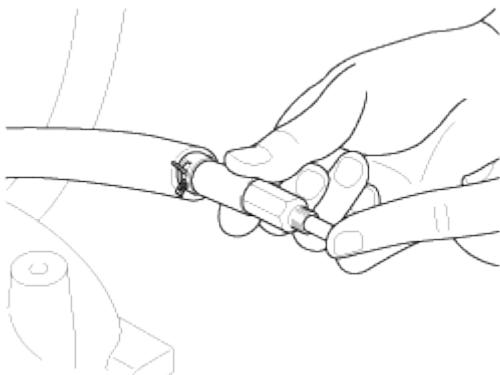
10.2.2. Repair procedures

Inspection

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

NOTE

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

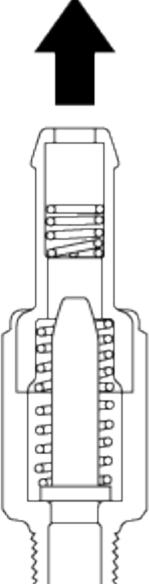
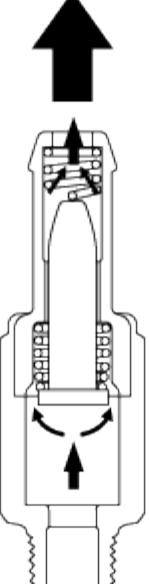
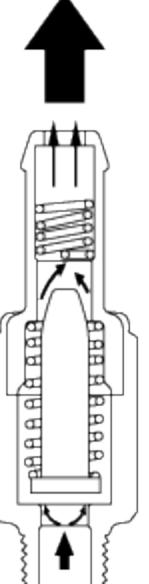
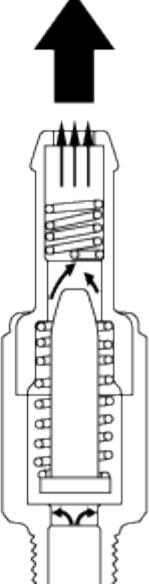


4. If the vacuum is not felt, clean or replace the vapor hose.

10.2.3. Positive Crankcase Ventilation (PCV) Valve

10.2.3.1. Description and Operation

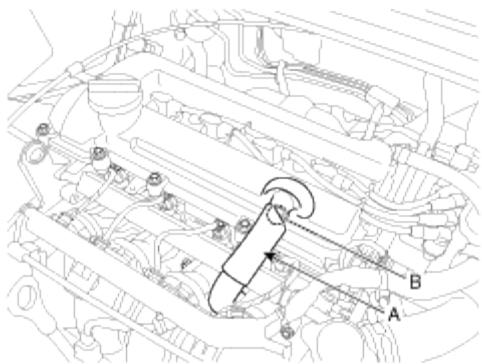
Operation Principle

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

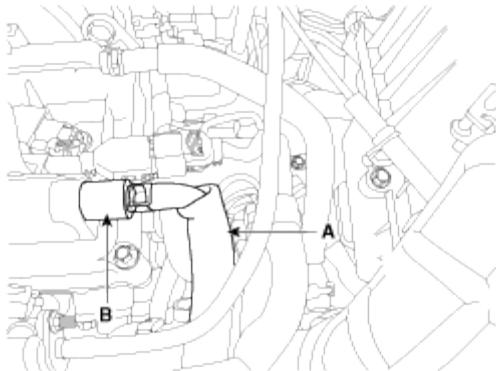
10.2.3.2. Repair procedures

Removal

1. Disconnect the vapor hose (A) and then remove the PCV valve (B).



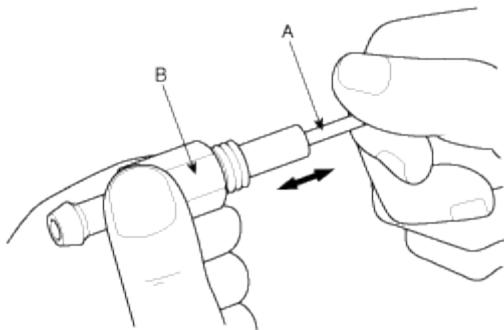
[1.2 DOHC]



[1.4/1.6 DOHC]

Inspection

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



NOTE

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

Installation

1. Installation is reverse of removal.

PCV Valve installation:

7.8 ~ 11.8 N·m (0.8 ~ 1.2 kgf·m, 5.8 ~ 8.7 lb·ft)

10.3. Evaporative Emission Control System

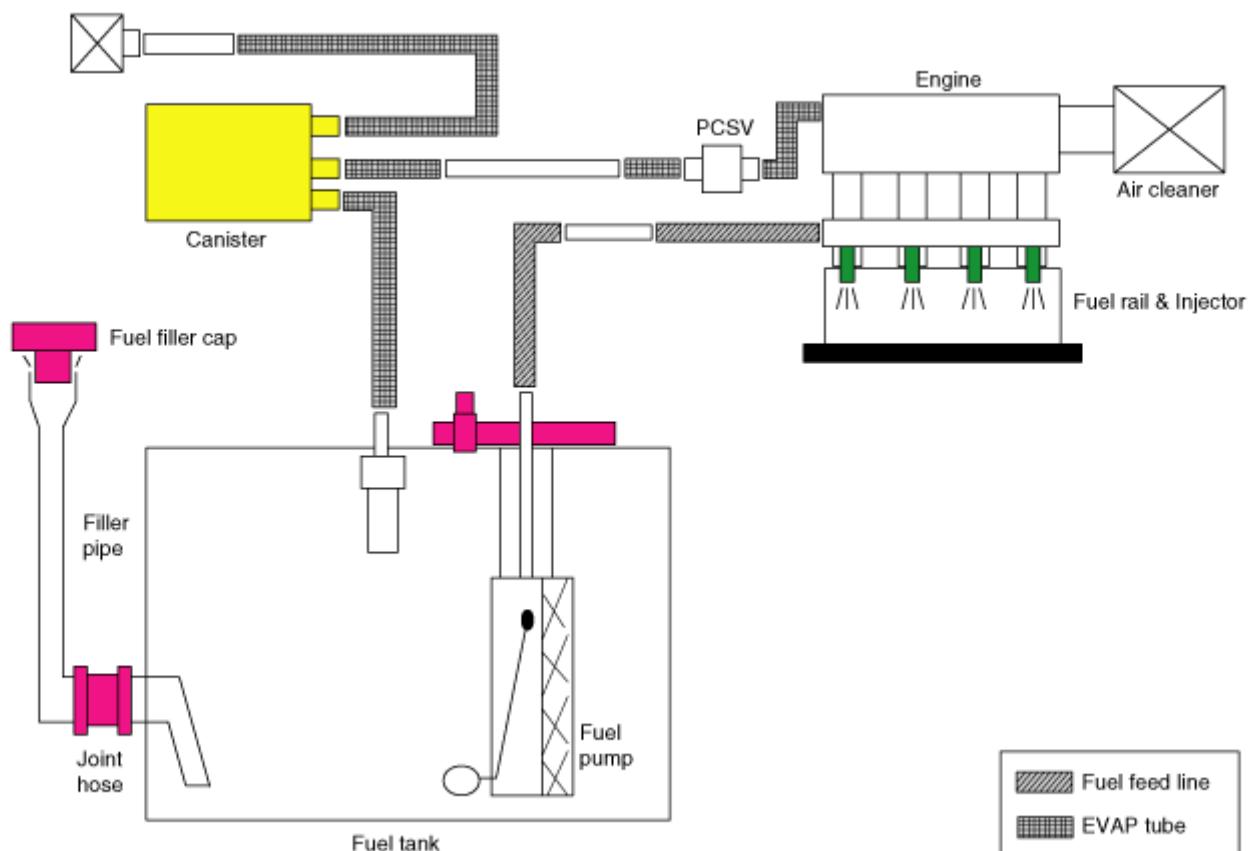
10.3.1. Description and Operation

Description

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

10.3.2. Schematic Diagrams

Schematic Diagram



Canister

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

Purge Control Solenoid Valve (PCSV)

Purge Control Solenoid Valve (PCSV) is installed in the passage connecting canister and intake manifold. It is a duty type solenoid valve and is operated by ECM/PCM signal.

To draw the absorbed vapor into the intake manifold, the ECM/PCM will open the PCSV, otherwise the passage remains closed.

Fuel Filler Cap

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

10.3.3. Repair procedures

Inspection

[System Inspection]

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

| Engine Operating Condition | Applied Vacuum | Result |
|----------------------------|--|----------------|
| Idle | 0.5kgf/cm ²
(50kPa,7.3psi) | Vacuum is held |
| 3,000rpm | | |

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

| Engine Operating Condition | Applied Vacuum | Result |
|--|--|---|
| Idle | 0.5kgf/cm ²
(50kPa,7.3psi) | Vacuum is held |
| Within 3 minutes after engine start at 3,000 rpm | Try to applyvacuum | Vacuum is released |
| In 3 minutes after engine start at 3,000 rpm | 0.5kgf/cm ²
(50kPa,7.3psi) | Vacuum will be held momentarily, after which, it will be released |

[PCSV Inspection]

1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Disconnect the PCSV connector.
3. Disconnect the vapor hose which is connected with the intake manifold from the PCSV.
4. After connecting a vacuum pump to the nipple, apply vacuum.
5. With the PCSV control line grounded, check valve operation when applying battery voltage to the PCSV or not.

| Battery Voltage | Valve | Vacuum |
|-----------------|-------|------------|
| Connected | Open | Released |
| Disconnected | Close | Maintained |

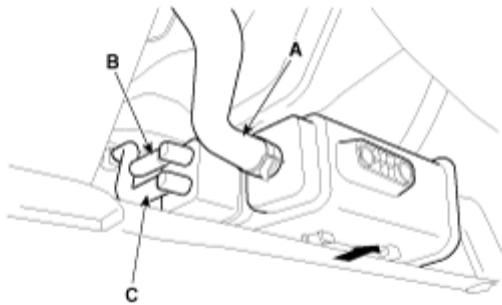
6. Measure the coil resistance of the PCSV.

Specification: 16Ω [20°C(68°F)]

10.3.4. Canister 10.3.4.1. Repair procedures

Removal

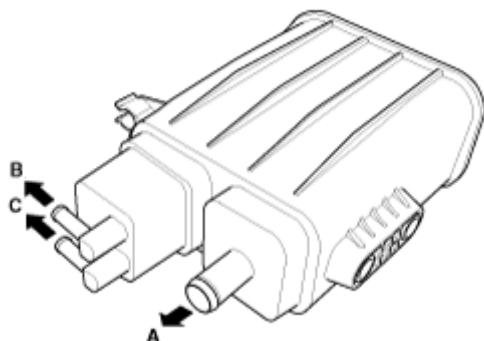
1. Turn the ignition switch OFF and disconnect the negative (-) battery cable.
2. Disconnect the vapor hoses (A,B,C).



3. Remove the canister by pulling from the fuel tank.

Inspection

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



A: Canister ↔ Atmosphere

B: Canister ↔ Fuel Tank

C: Canister ↔ Intake Manifold

Installation

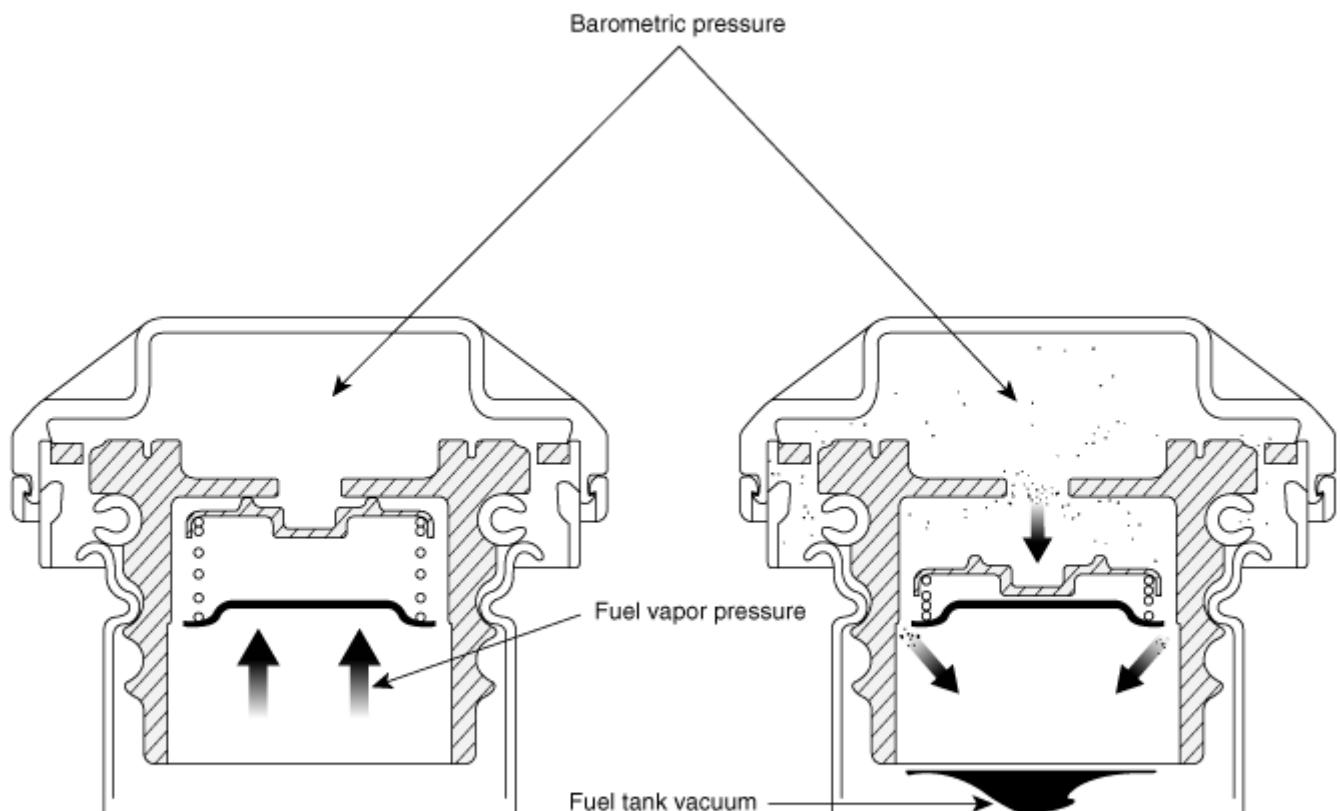
Installation is reverse of removal.

10.3.5. Fuel Filler Cap

10.3.5.1. Description and Operation

Description

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



When fuel tank is under pressure.

When fuel tank is under vacuum.

10.4. Exhaust Emission Control System

10.4.1. Description and Operation

Description

Exhaust emissions (CO, HC, NOx) are controlled by a combination of engine modifications and the addition of special control components.

Modifications to the combustion chamber, intake manifold, camshaft and ignition system form the basic control system. These items have been integrated into a highly effective system which controls exhaust emissions while maintaining good drivability and fuel economy.

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

The MFI system is a system which uses the 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 gases of the proper composition to permit the use of a three way catalyst. The three way catalyst is designed to convert the three pollutants (1) hydrocarbons (HC), (2) carbon monoxide (CO), and (3) oxides of nitrogen (NOx) into harmless substances. There are two operating modes in the MFI system.

1. Open Loop air/fuel ratio is controlled by information programmed into the ECM.

2. Closed Loop air/fuel ratio is adjusted by the ECM based on information supplied by the oxygen sensor.

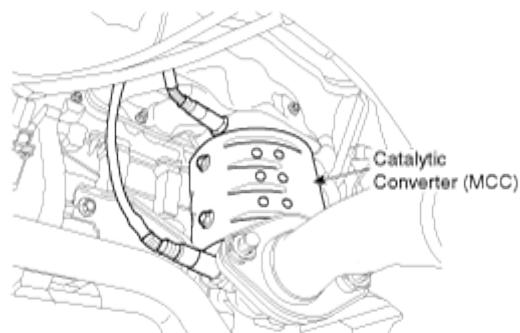
10.4.2. Catalytic Converter

10.4.2.1. Description and Operation

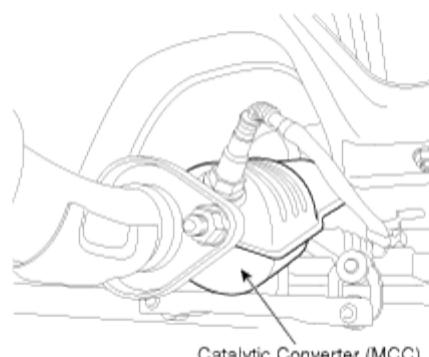
Description

The catalytic converter of the gasoline engine is a three way catalyst. It oxidizes carbon monoxide and hydrocarbons (HC), and separates oxygen from the oxides of nitrogen (NOx).

There are two types of three-way catalyst; Palette type and Monolith type.



[1.2 DOHC]

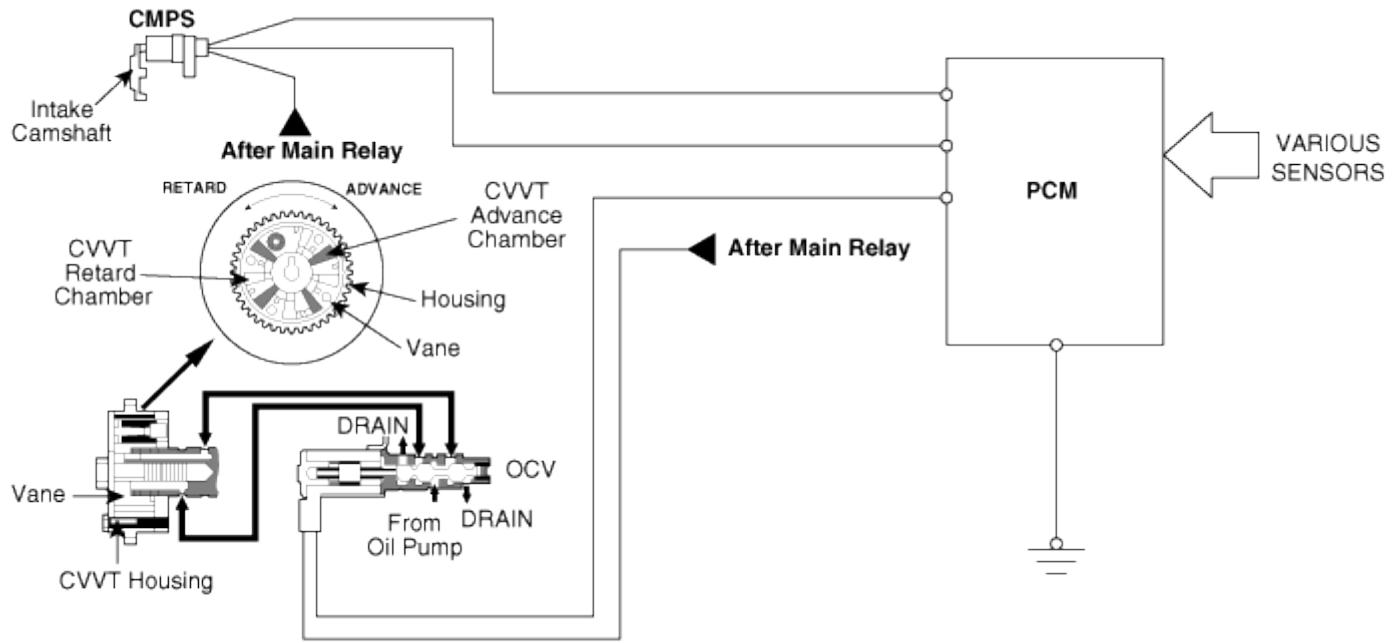


[1.4/1.6 DOHC]

10.4.3. CVVT (Continuously Variable Valve Timing) System

10.4.3.1. Description and Operation

Description



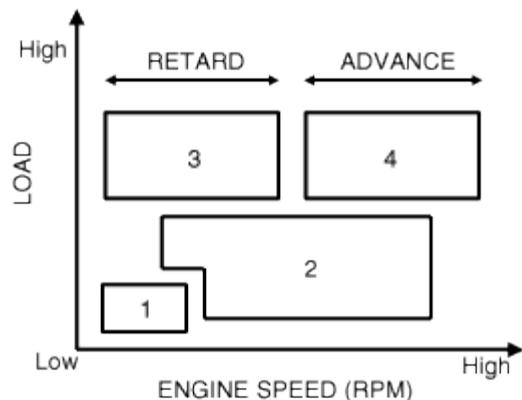
The CVVT (Continuously Variable Valve Timing) which is installed on the exhaust camshaft controls intake valve open and close timing in order to improve engine performance.

The intake valve timing is optimized by CVVT system depending on engine rpm.

This CVVT system improves fuel efficiency and reduces NOx emissions at all levels of engine speed, vehicle speed, and engine load by EGR effect because of valve over-lap optimization.

The CVVT changes the phase of the intake camshaft via oil pressure.

It changes the intake valve timing continuously.



| Driving Condition | Intake Valve Timing | Effect |
|-------------------------|---------------------|---|
| Light load (1) | Retard | Stable combustion |
| Part load (2) | Advance | Enhanced fuel economy and exhaust emissions |
| High load& Low rpm (3) | Advance | Enhanced torque |
| High load& High rpm (4) | Retard | Enhanced Power |

Operation Principle

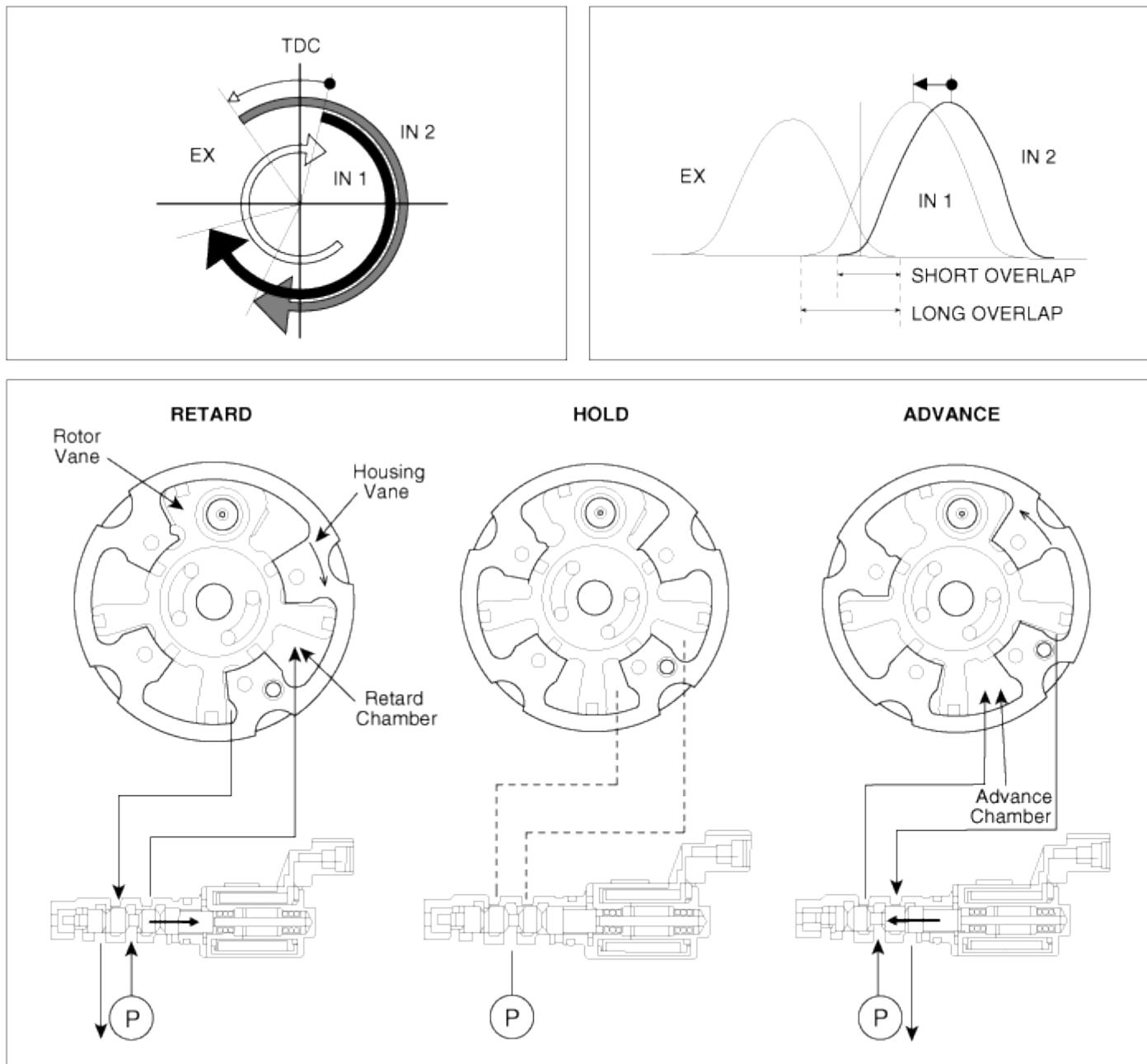
The CVVT system makes continuous intake valve timing changes based on operating conditions.

Intake valve timing is optimized to allow the engine to produce maximum power.

Cam angle is advanced to obtain the EGR effect and reduce pumping loss. The intake valve is closed quickly to reduce the entry of the air/fuel mixture into the intake port and improve the changing effect.

Reduces the cam advance at idle, stabilizes combustion, and reduces engine speed.

If a malfunction occurs, the CVVT system control is disabled and the valve timing is fixed at the fully retarded position.



1. The above figure shows the relative operation structures of the housing vane to the rotor vane.
2. If the CVVT is held a certain control angle, to hold this state, oil is replenished as much as oil leaks from the oil pump. The OCV (CVVT Oil Control Valve) spool location at this time is as follows.
Oil pump → Advance oil chamber (Little by little open the inflow side to the advance oil chamber) → Almost close the drain side
Be sure there might be a difference in the position according to the engine running state (rpm, oil temperature, and oil pressure).

11. Fuel System

11.1. General Information

11.1.1. Specifications

Specifications

Fuel Delivery System

| Items | Specification | |
|-----------|---------------|---|
| Fuel Tank | Capacity | 45 lit. (11.9 U.S gal., 47.6 U.S.qt., 39.6 Imp.qt.) |

| | | |
|-------------------------|-------------------------|---|
| Fuel Filter | Type | Paper type |
| Fuel Pressure Regulator | Regulated Fuel Pressure | 345 ~ 355kpa
(3.5 ~ 3.6 kgf / cm ² , 50.0 ~ 51.5 psi) |
| Fuel Pump | Type | Electrical, in-tank type |
| | Driven by | Electric motor |
| Fuel Return System | Type | Returnless |

Sensors

Manifold Absolute Pressure Sensor (MAPS)

- ▷ Type: Piezo-resistive pressure sensor type
- ▷ Specification

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

Intake Air Temperature Sensor (IATS)

- ▷ Type: Thermistor type
- ▷ Specification

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

Engine Coolant Temperature Sensor (ECTS)

- ▷ Type: Thermistor type
- ▷ Specification

| Temperature [°C(°F)] | Resistance (kΩ) |
|----------------------|-----------------|
| -40(-40) | 48.14 |
| -20(-4) | 14.13 ~ 16.83 |

| | |
|---------|-------------|
| 0(32) | 5.79 |
| 20(68) | 2.31 ~ 2.59 |
| 40(104) | 1.15 |
| 60(140) | 0.59 |
| 80(176) | 0.32 |

Throttle Position Sensor (TPS)

- ▷ Type: Variable resistor type
- ▷ Specification

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

| Items | Specification |
|------------------------|------------------------|
| Sensor Resistance (kΩ) | 1.6 ~ 2.4 [20°C(68°F)] |

Heated Oxygen Sensor (HO2S)

- ▷ Type: Zirconia (ZrO₂) type
- ▷ Specification

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

| Item | Specification |
|-----------------------|---------------------------|
| Heater Resistance (Ω) | Approx. 9.0 [20°C (68°F)] |

Camshaft Position Sensor (CMPS)

- ▷ Type: Hall effect type
- Crankshaft Position Sensor (CKPS)
- ▷ Type: Magnetic field sensitive Type

| Item | Specification |
|---------------------|-------------------------|
| Coil Resistance (Ω) | 774 ~ 946 [20°C (68°F)] |

Knock Sensor (KS)

- ▷ Type: Piezo-electricity type
- ▷ Specification

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

Actuators

Injector

- ▷ Number: 4

▷ Specification

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

Idle Speed Control Actuator (ISCA)

▷ Type: Double coil type

▷ Specification

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

| Duty (%) | Air Flow Rate (m³/h) |
|----------|----------------------|
| 15 | 0.5 ~ 1.4 |
| 35 | 4.6 ~ 8.0 |
| 70 | 25.0 ~ 32.0 |
| 96 | 33.0 ~ 40.0 |

Purge Control Solenoid Valve (PCSV)

▷ Specification

| Item | Specification |
|------------------------------|--------------------|
| Coil Resistance (Ω) | 16.0 [20°C (68°F)] |

CVVT Oil Control Valve (OCV)

▷ Specification

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

Ignition Coil

▷ Type: Stick type

▷ Specification

| Item | Specification |
|---|--------------------------------------|
| Primary Coil Resistance (Ω) | $0.75\Omega \pm 15\%$ [20°C (68°F)] |
| Secondary Coil Resistance ($k\Omega$) | $7.0 k\Omega \pm 15\%$ [20°C (68°F)] |

Service Standard

| Items | Specification | | |
|-----------------|---------------|-------------------|---------------|
| Ignition Timing | BTDC 0° ± 10° | | |
| Idle Speed | A/CON OFF | Neutral,N,P-range | 660 ± 100 rpm |

| | | | |
|--|----------|-------------------|---------------|
| | | D-range | 660 ± 100 rpm |
| | A/CON ON | Neutral,N,P-range | 660 ± 100 rpm |
| | | D-range | 690 ± 100 rpm |

Tightening Torques

Engine Control System

| Item | kgf.m | N.m | lb·ft |
|---|-------------|-------------|-------------|
| ECM installation nut | 1.0 ~ 1.2 | 9.8 ~ 11.8 | 7.2 ~ 8.7 |
| ECM bracket installation bolt | 2.0 ~ 3.0 | 19.6 ~ 29.4 | 14.5 ~ 21.7 |
| ECM bracket installation nut | 0.7 ~ 1.1 | 6.9 ~ 10.8 | 5.1 ~ 8.0 |
| Manifold absolute pressure sensor installation bolt | 0.8 ~ 1.2 | 7.8 ~ 11.8 | 5.8 ~ 8.7 |
| Engine coolant temperature sensor installation | 3.0 ~ 4.0 | 29.4 ~ 39.2 | 21.7 ~ 28.9 |
| Throttle position sensor installation screw | 0.15 ~ 0.25 | 1.5 ~ 2.5 | 1.1 ~ 1.8 |
| Crankshaft position sensor installation bolt | 0.8 ~ 1.2 | 7.8 ~ 11.8 | 5.8 ~ 8.7 |
| Camshaft position sensor 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 |
| Idle speed control actuator installation bolt | 0.6 ~ 0.8 | 5.9 ~ 7.8 | 4.3 ~ 5.8 |
| CVVT Oil control valve 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 |
| Throttle body installation bolt/nut | 1.0 ~ 1.2 | 9.8 ~ 11.8 | 7.2 ~ 8.7 |

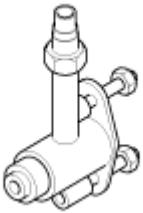
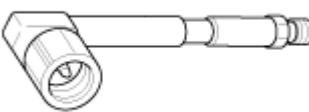
Fuel Delivery System

| Item | kgf.m | N.m | lb·ft |
|--|-----------|-------------|-------------|
| Fuel tank installation bolt/nut | 4.0 ~ 5.5 | 39.2 ~ 53.9 | 28.9 ~ 39.8 |
| Fuel pump installation nut | 0.2 ~ 0.3 | 2.0 ~ 2.9 | 1.4 ~ 2.2 |
| Filler-neck assembly installation bolt | 0.8 ~ 1.2 | 7.8 ~ 11.8 | 5.8 ~ 8.7 |
| Delivery pipe installation bolt | 2.0 ~ 2.5 | 19.6 ~ 24.5 | 14.5 ~ 18.1 |

11.1.2. Special Service Tools

Special Service Tools

| Tool(Number and name) | Illustration | Application |
|-----------------------|--------------|-------------|
|-----------------------|--------------|-------------|

| | | |
|--|---|--|
| 09353-24100
Fuel Pressure Gauge |  A circular fuel pressure gauge with a flexible hose attached to its side. | Measuring the fuel line pressure |
| 09353-38000
Fuel Pressure Gauge Adapter |  A mechanical adapter with a central vertical tube and two horizontal ports, designed to connect a gauge to a fuel line. | Connection between the delivery pipe and fuel feed line |
| 09353-24000
Fuel Pressure Gauge Connector |  A cylindrical metal connector with a flared end, used to join the gauge adapter to the fuel line. | Connection between Fuel Pressure Gauge (09353-24100) and Fuel Pressure Gauge Adapter (09353-38000) |

11.1.3. Troubleshooting

Basic Troubleshooting

Basic Troubleshooting Guide

| | |
|-----------|--|
| 1 | Bring Vehicle to Workshop |
| 2 | Analyze Customer's Problem <ul style="list-style-type: none"> Ask the customer about the conditions and environment relative to the issue
(Use CUSTOMER PROBLEM ANALYSIS SHEET). |
| 3 | Verify Symptom, and then Check DTC and Freeze Frame Data <ul style="list-style-type: none"> Connect Hi-Scan (Pro) to Diagnostic Link Connector (DLC). Record the DTC and freeze frame data. <p> NOTE
To erase DTC and freeze frame data, refer to Step 5.</p> |
| 4 | Confirm the Inspection Procedure for the System or Part <ul style="list-style-type: none"> Using the SYMPTOM TROUBLESHOOTING GUIDE CHART, choose the correct inspection procedure for the system or part to be checked. |
| 5 | Erase the DTC and Freeze Frame Data |
| |  WARNING
NEVER erase DTC and freeze frame data before completing Step 2 MIL/DTC in "CUSTOMER PROBLEM ANALYSIS SHEET". |
| 6 | Inspect Vehicle Visually <ul style="list-style-type: none"> Go to Step 11, if you recognize the problem. |
| 7 | Recreate (Simulate) Symptoms of the DTC <ul style="list-style-type: none"> Try to recreate or simulate the symptoms and conditions of the malfunction as described by customer. If DTC(s) is/are displayed, simulate the condition according to troubleshooting procedure for the DTC. |
| 8 | Confirm Symptoms of Problem <ul style="list-style-type: none"> If DTC(s) is/are not displayed, go to Step 9. If DTC(s) is/are displayed, go to Step 11. |
| 9 | Recreate (Simulate) Symptom <ul style="list-style-type: none"> Try to recreate or simulate the condition of the malfunction as described by the customer. |
| 10 | Check the DTC <ul style="list-style-type: none"> If DTC(s) does/do not occur, refer to INTERMITTENT PROBLEM PROCEDURE in BASIC INSPECTION PROCEDURE. If DTC(s) occur(s), go to Step 11. |
| 11 | Perform troubleshooting procedure for DTC |
| 12 | Adjust or repair the vehicle |
| 13 | Confirmation test |
| 14 | END |

Customer Problem Analysis Sheet

1. VEHICLEINFORMAITON

| | | | |
|---------------------|---------|------------------------|--|
| VIN No. | | Transmission | <input type="checkbox"/> M/T <input type="checkbox"/> A/T <input type="checkbox"/> CVT <input type="checkbox"/> etc. |
| Production date | | Driving type | <input type="checkbox"/> 2WD (FF) <input type="checkbox"/> 2WD (FR) <input type="checkbox"/> 4WD |
| Odometer
Reading | km/mile | CPF
(Diesel Engine) | <input type="checkbox"/> With CPF <input type="checkbox"/> Without CPF |

2. SYMPTOMS

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

3. ENVIRONMENT

| | |
|---------------------|---|
| Problem frequency | <input type="checkbox"/> Constant <input type="checkbox"/> Sometimes (_____) <input type="checkbox"/> Once only
<input type="checkbox"/> Other _____ |
| Weather | <input type="checkbox"/> Fine <input type="checkbox"/> Cloudy <input type="checkbox"/> Rainy <input type="checkbox"/> Snowy <input type="checkbox"/> Other _____ |
| Outdoor temperature | Approx. _____ °C/F |
| Place | <input type="checkbox"/> Highway <input type="checkbox"/> Suburbs <input type="checkbox"/> Inner City <input type="checkbox"/> Uphill <input type="checkbox"/> Downhill
<input type="checkbox"/> Rough road <input type="checkbox"/> Other _____ |
| Engine temperature | <input type="checkbox"/> Cold <input type="checkbox"/> Warming up <input type="checkbox"/> After warming up <input type="checkbox"/> Any temperature |
| Engine operation | <input type="checkbox"/> Starting <input type="checkbox"/> Just after starting (_____ min) <input type="checkbox"/> Idling <input type="checkbox"/> Racing
<input type="checkbox"/> Driving <input type="checkbox"/> Constant speed <input type="checkbox"/> Acceleration <input type="checkbox"/> Deceleration
<input type="checkbox"/> A/C switch ON/OFF <input type="checkbox"/> Other _____ |

4. MIL/DTC

| | |
|----------------------------------|--|
| MIL (Malfunction Indicator Lamp) | <input type="checkbox"/> Remains ON <input type="checkbox"/> Sometimes lights up <input type="checkbox"/> Does not light |
| DTC | <input type="checkbox"/> Normal <input type="checkbox"/> DTC (_____)
<input type="checkbox"/> Freeze Frame Data |
| | <input type="checkbox"/> Normal <input type="checkbox"/> DTC (_____)
<input type="checkbox"/> Freeze Frame Data |

5. ECM/PCM INFORMATION

| | |
|------------------|--|
| ECM/PCM Part No. | |
| ROM ID | |

Basic Inspection Procedure

Measuring Condition of Electronic Parts' Resistance

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

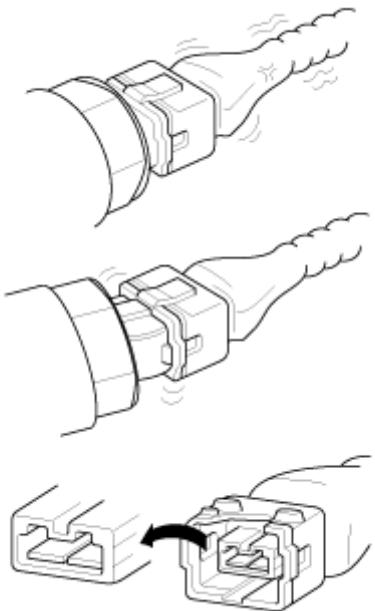
NOTE

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

Intermittent Problem Inspection Procedure

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

1. Clear Diagnostic Trouble Code (DTC).
2. Inspect connector connection, and check terminal for poor connections, loose wires, bent, broken or corroded pins, and then verify that the connectors are always securely fastened.



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

- Simulating Vibration

- 1) Sensors and Actuators

- : Slightly vibrate sensors, actuators or relays with finger.

WARNING

Strong vibration may break sensors, actuators or relays

- 2) Connectors and Harness

- : Lightly shake the connector and wiring harness vertically and then horizontally.

- Simulating Heat

- 1) Heat components suspected of causing the malfunction with a hair dryer or other heat source.

WARNING

- DO NOT heat components to the point where they may be damaged.
- DO NOT heat the ECM directly.

- Simulating Water Sprinkling

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

WARNING

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

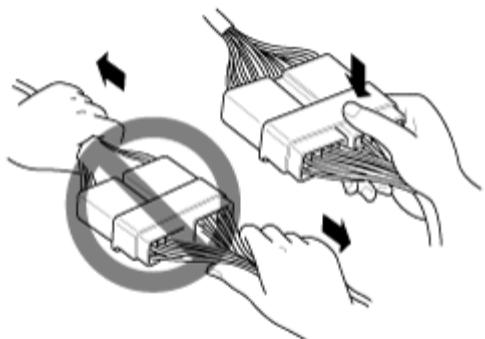
- Simulating Electrical Load

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

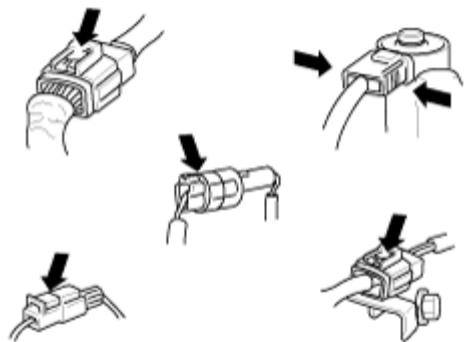
Connector Inspection Procedure

1. Handling of Connector

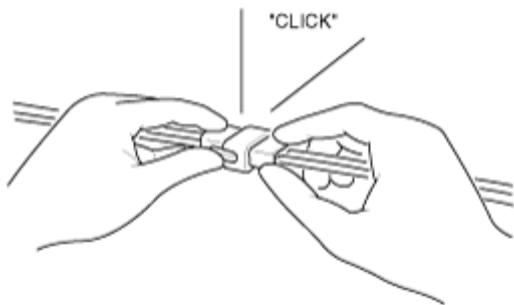
A. Never pull on the wiring harness when disconnecting connectors.



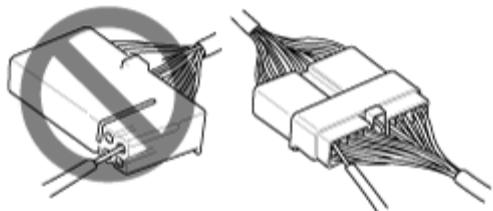
B. When removing the connector with a lock, press or pull locking lever.



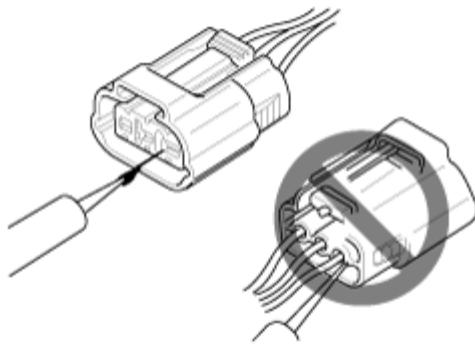
C. Listen for a click when locking connectors. This sound indicates that they are securely locked.



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



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



NOTE

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

2. Checking Point for Connector

A. While the connector is connected:

Hold the connector, check connecting condition and locking efficiency.

B. When the connector is disconnected:

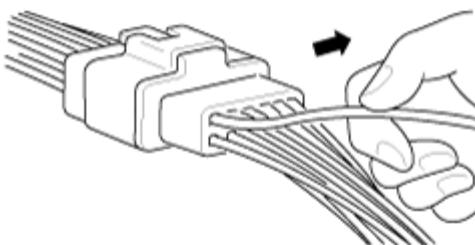
Check missed terminal, crimped terminal or broken core wire by slightly pulling the wire harness.

Visually check for rust, contamination, deformation and bend.

C. Check terminal tightening condition:

Insert a spare male terminal into a female terminal, and then check terminal tightening conditions.

D. Pull lightly on individual wires to ensure that each wire is secured in the terminal.



3. Repair Method of Connector Terminal

A. Clean the contact points using air gun and/or shop rag.

NOTE

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

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

Wire Harness Inspection Procedure

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

Electrical Circuit Inspection Procedure

- Check Open Circuit

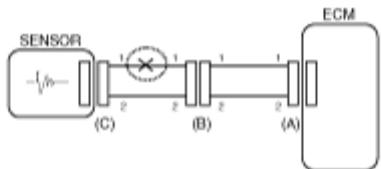
1. Procedures for Open Circuit

A. Continuity Check

B. Voltage Check

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

FIG 1



2. Continuity Check Method

NOTE

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

Specification (Resistance)

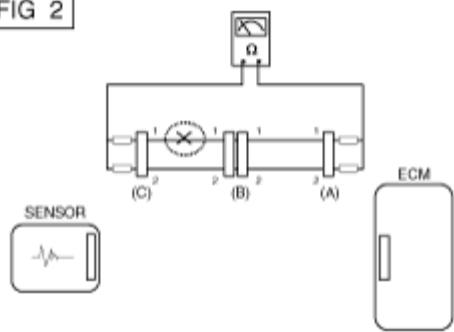
1Ω or less → Normal Circuit

1MΩ or Higher → Open Circuit

A. Disconnect connectors (A), (C) and measure resistance between connector (A) and (C) as shown in [FIG. 2].

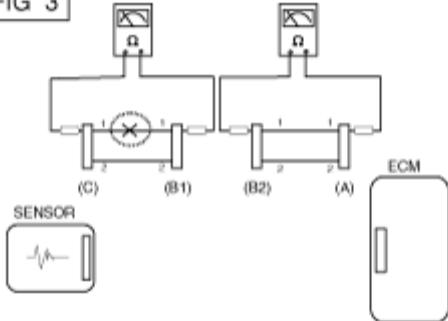
In [FIG. 2.] the measured resistance of line 1 and 2 is higher than 1MΩ and below 1 Ω respectively. Specifically the open circuit is line 1 (Line 2 is normal). To find exact break point, check sub line of line 1 as described in next step.

FIG 2



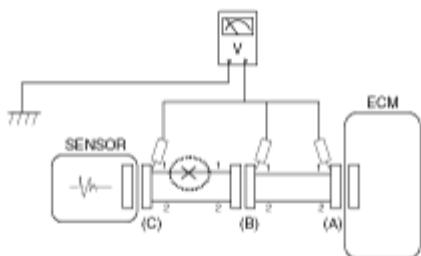
B. Disconnect connector (B), and measure for resistance between connector (C) and (B1) and between (B2) and (A) as shown in [FIG. 3].

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).

FIG 3

3. Voltage Check Method

- A. With each connector still connected, measure the voltage between the chassis ground and terminal 1 of each connectors (A), (B) and (C) as shown in [FIG. 4].
 The measured voltage of each connector is 5V, 5V and 0V respectively. So the open circuit is between connector (C) and (B).

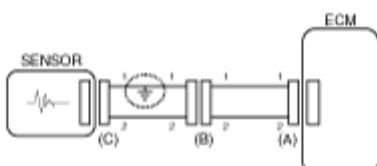
FIG 4

• Check Short Circuit

1. Test Method for Short to Ground Circuit

- A. Continuity Check with Chassis Ground

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

FIG 5

2. Continuity Check Method (with Chassis Ground)

NOTE

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

Specification (Resistance)

1Ω or less → Short to Ground Circuit

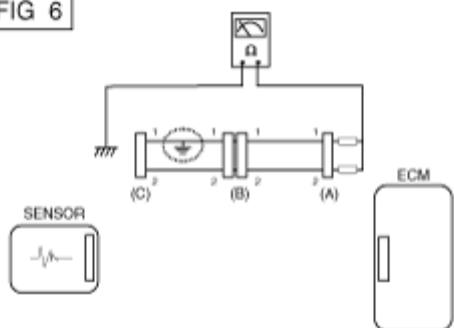
$1M\Omega$ or Higher → Normal Circuit

A. Disconnect connectors (A), (C) and measure for resistance between connector (A) and Chassis Ground as shown in [FIG. 6].

The measured resistance of line 1 and 2 in this example is below 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.

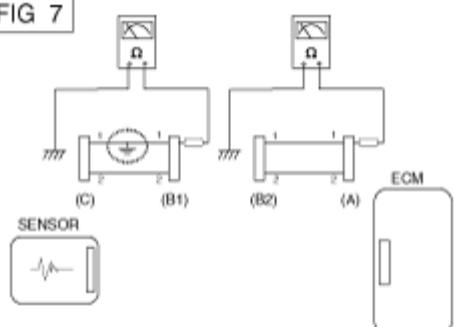
FIG 6



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



Symptom Troubleshooting Guide Chart

| Main symptom | Diagnostic procedure | Also check for |
|--|---|--|
| Unable to start
(Engine does not turn over) | 1. Test the battery
2. Test the starter
3. Inhibitor switch (A/T) or clutch start switch (M/T) | |
| Unable to start
(Incomplete combustion) | 1. Test the battery
2. Check the fuel pressure
3. Check the ignition circuit
4. Troubleshooting the immobilizer system
(In case of immobilizer lamp flashing) | <ul style="list-style-type: none"> • DTC • Low compression • Intake air leaks • Slipped or broken timing belt • Contaminated fuel |
| Difficult to start | 1. Test the battery
2. Check the fuel pressure
3. Check the ECT sensor and circuit (Check DTC)
4. Check the ignition circuit | <ul style="list-style-type: none"> • DTC • Low compression • Intake air leaks • Contaminated fuel • Weak ignition spark |
| Poor idling
(Rough, unstable or incorrect Idle) | 1. Check the fuel pressure
2. Check the Injector
3. Check the long term fuel trim and short term fuel trim
(Refer to CUSTOMER DATASTREAM) | <ul style="list-style-type: none"> • DTC • Low compression • Intake air leaks • Contaminated fuel |

| | | |
|--|---|--|
| | 4. Check the idle speed control circuit (Check DTC)
5. Inspect and test the Throttle Body
6. Check the ECT sensor and circuit (Check DTC) | <ul style="list-style-type: none"> • 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) | <ul style="list-style-type: none"> • DTC • Intake air leaks • Contaminated fuel • Weak ignition spark |
| Poor driving (Surge) | 1. Check the fuel pressure
2. Inspect and test Throttle Body
3. Check the ignition circuit
4. Check the ECT Sensor and Circuit (Check DTC)
5. Test the exhaust system for a possible restriction
6. Check the long term fuel trim and short term fuel trim (Refer to CUSTOMER DATASTREAM) | <ul style="list-style-type: none"> • DTC • Low compression • Intake air leaks • Contaminated fuel • Weak ignition spark |
| Knocking | 1. Check the fuel pressure
2. Inspect the engine coolant
3. Inspect the radiator and the electric cooling fan
4. Check the spark plugs | <ul style="list-style-type: none"> • DTC • Contaminated fuel |
| Poor fuel economy | 1. Check customer's driving habitsls <ul style="list-style-type: none"> • A/C on full time or the defroster mode on? • Are tires at correct pressure? • Is excessively heavy load being carried? • Is acceleration too much, too often? 2. Check the fuel pressure
3. Check the injector
4. Test the exhaust system for a possible restriction
5. Check the ECT sensor and circuit | <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • Pinched, kinked or blocked? • Filler hose is torn 3. Inspect the fuel tank vapor vent hose between the EVAP. canister and air filter
4. Check the EVAP. canister | <ul style="list-style-type: none"> • Malfunctioning gas station filling nozzle (If this problem occurs at a specific gas station during refueling) |

11.2. Engine Control System

11.2.1. Description and Operation

Description

If the Gasoline Engine Control system components (sensors, ECM, injector, etc.) fail, interruption to the fuel supply or failure to supply the proper amount of fuel for various engine operating conditions will result. The following situations may be encountered.

1. Engine is hard to start or does not start at all.
2. Unstable idle.
3. Poor driveability

If any of the above conditions are noted, first perform a routine diagnosis that includes basic engine checks (ignition system malfunction, incorrect engine adjustment, etc.). Then, inspect the Gasoline Engine Control system components with the HI-SCAN (Pro).

NOTE

- 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 ECM.
- The control harnesses between the ECM and heated oxygen sensor are shielded with the shielded ground wires to the body in order to prevent the influence of ignition noises and radio interference. When the shielded wire is faulty, the control harness must be replaced.
- 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 ECM.

Malfunction Indicator Lamp (MIL)

[EOBD]

A malfunction indicator lamp illuminates to notify the driver that there is a problem with the vehicle. However, the MIL will go off automatically after 3 subsequent sequential driving cycles without the same malfunction. Immediately after the ignition switch is turned on (ON position - do not start), the MIL will illuminate continuously to indicate that the MIL operates normally.

Faults with the following items will illuminate the MIL.

- Catalyst
- Fuel system
- Mass Air Flow Sensor (MAFS)
- Intake Air Temperature Sensor (IATS)
- Engine Coolant Temperature Sensor (ECTS)
- Throttle Position Sensor (TPS)
- Upstream Oxygen Sensor
- Upstream Oxygen Sensor Heater
- Downstream Oxygen Sensor
- Downstream Oxygen Sensor Heater
- Injector
- Misfire
- Crankshaft Position Sensor (CKPS)
- Camshaft Position Sensor (CMPS)
- Evaporative Emission Control System
- Vehicle Speed Sensor (VSS)
- Idle Speed Control Actuator (ISCA)
- Power Supply
- ECM/ PCM
- MT/AT Encoding
- Acceleration Sensor
- MIL-on Request Signal
- Power Stage

NOTE

Refer to "Inspection Chart For Diagnostic Trouble Codes (DTC)" for more information.

[NON-EOBD]

A malfunction indicator lamp illuminates to notify the driver that there is a problem with the vehicle. However, the MIL will go off automatically after 3 subsequent sequential driving cycles without the same malfunction. Immediately after the ignition switch is turned on (ON position - do not start), the MIL will illuminate continuously to indicate that the MIL operates normally.

Faults with the following items will illuminate the MIL

- Heated oxygen sensor (HO2S)

- Mass Air Flow sensor (MAFS)
- Throttle position sensor (TPS)
- Engine coolant temperature sensor (ECTS)
- Idle speed control actuator (ISCA)
- Injectors
- ECM

NOTE

Refer to "Inspection Chart For Diagnostic Trouble Codes (DTC)" for more information.

[INSPECTION]

1. After turning ON the ignition key, ensure that the light illuminates for about 5 seconds and then goes out.
2. If the light does not illuminate, check for an open circuit in the harness, a blown fuse or a blown bulb.

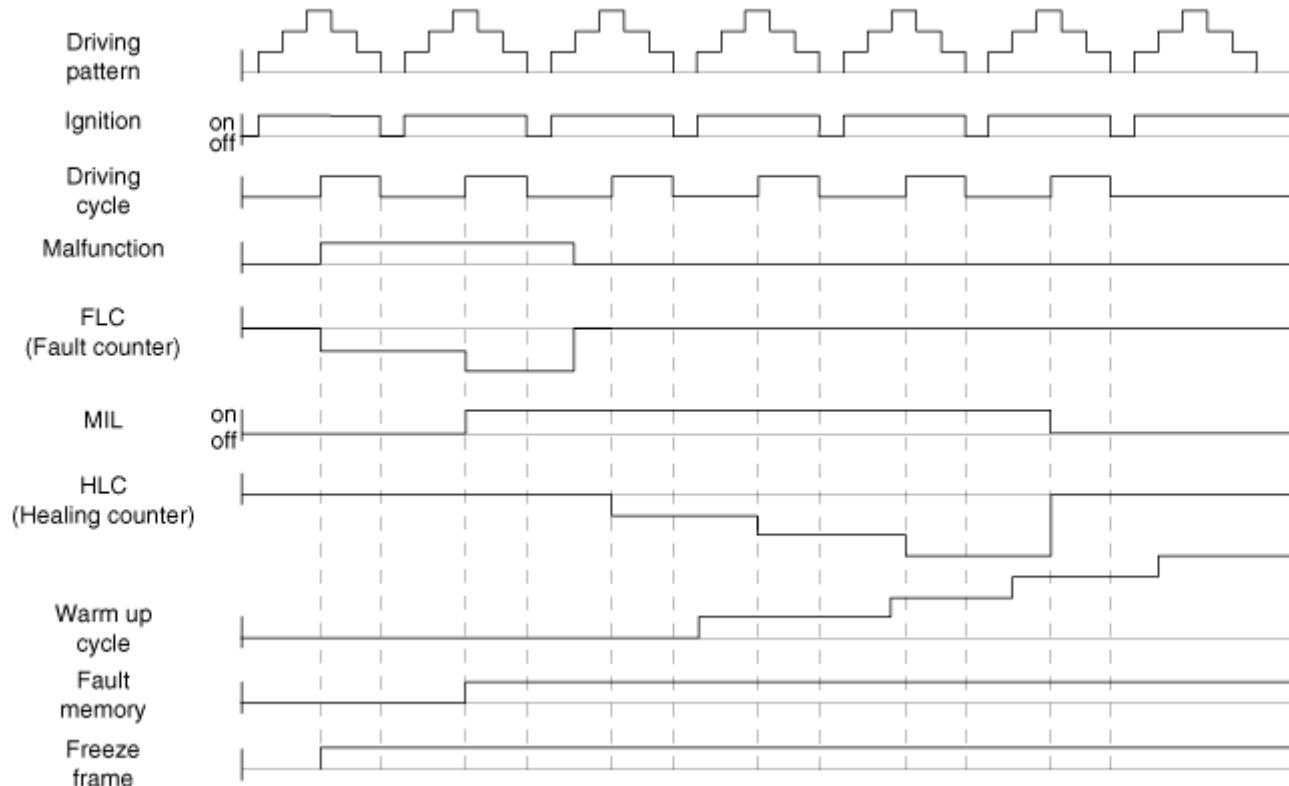
Self-Diagnosis

The ECM monitors the input/output signals (some signals at all times and the others under specified conditions). When the ECM detects an irregularity, it records the diagnostic trouble code, and outputs the signal to the Data Link connector. The diagnosis results can be read with the MIL or HI-SCAN (Pro). Diagnostic Trouble Codes (DTC) will remain in the ECM as long as battery power is maintained. The diagnostic trouble codes will, however, be erased when the battery terminal or ECM connector is disconnected, or by the HI-SCAN (Pro).

NOTE

If a sensor connector is disconnected with the ignition switch turned on, the diagnostic trouble code (DTC) is recorded. In this case, disconnect the battery negative terminal (-) for 15 seconds or more, and the diagnosis memory will be erased.

The relation between DTC and driving pattern in EOBD system



1. When the same malfunction is detected and maintained during two sequential driving cycles, the MIL will automatically illuminate.
2. The MIL will go off automatically if no fault is detected after 3 sequential driving cycles.
3. A Diagnostic Trouble Code(DTC) is recorded in ECM memory when a malfunction is detected after two sequential

driving cycles. The MIL will illuminate when the malfunction is detected on the second driving cycle.
If a misfire is detected, a DTC will be recorded, and the MIL will illuminate, immediately after a fault is first detected.

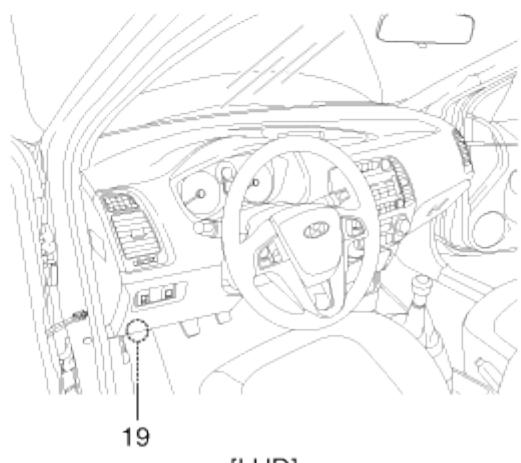
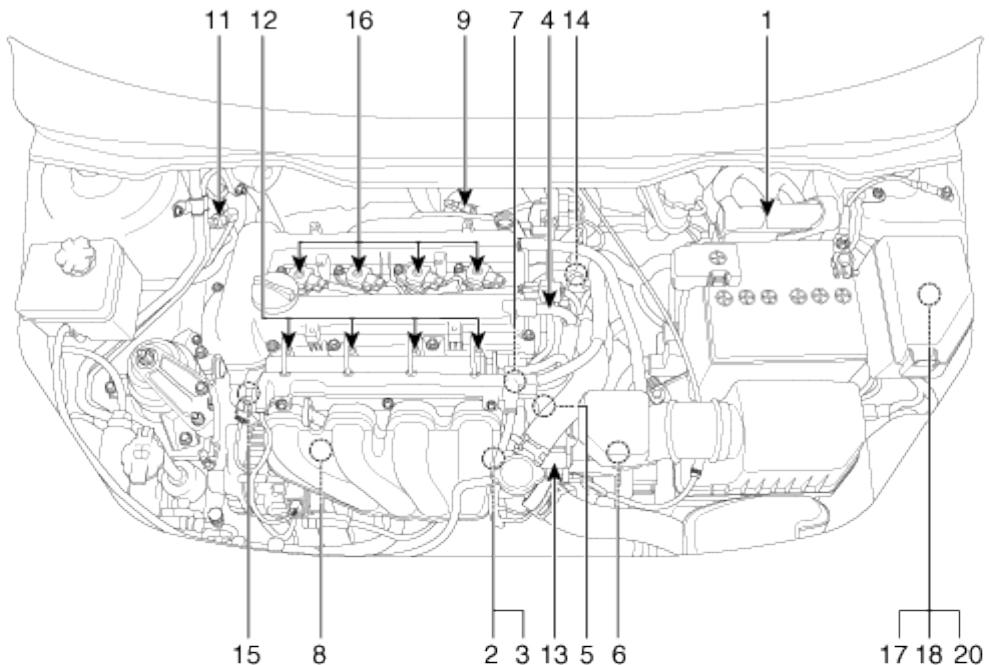
4. A Diagnostic Trouble Code(DTC) will automatically erase from ECM memory if the same malfunction is not detected for 40 driving cycles.

NOTE

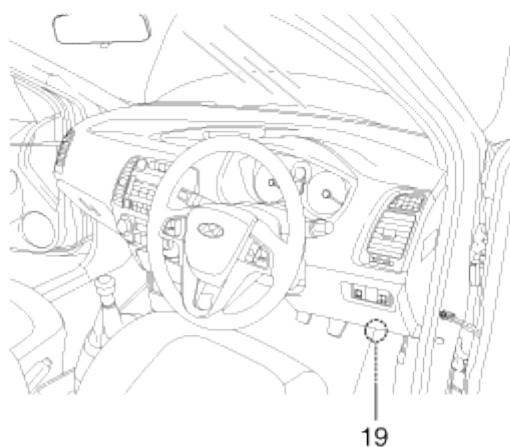
- A "warm-up cycle" means sufficient vehicle operation such that the coolant temperature has risen by at least 40 degrees Fahrenheit from engine starting and reaches a minimum temperature of 160 degrees Fahrenheit.
- A "driving cycle" consists of engine startup, vehicle operation beyond the beginning of closed loop operation.

11.2.2. Component and Components Location

Components Location



[LHD]

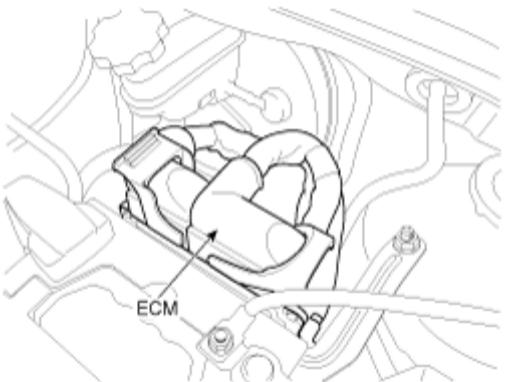
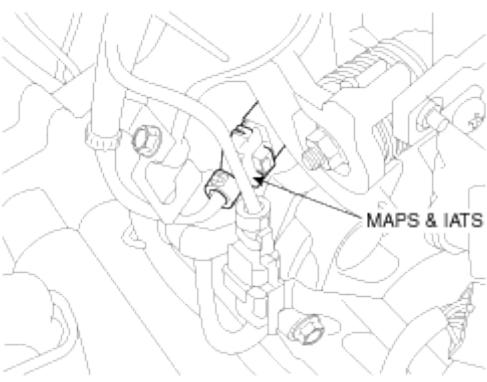
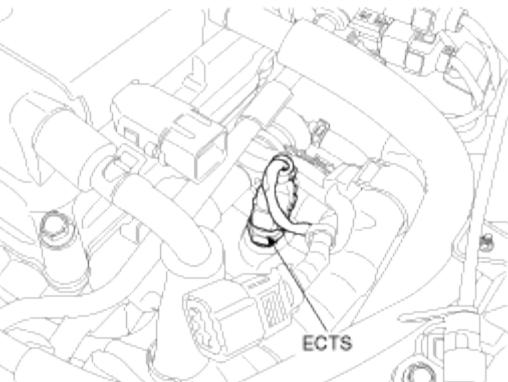
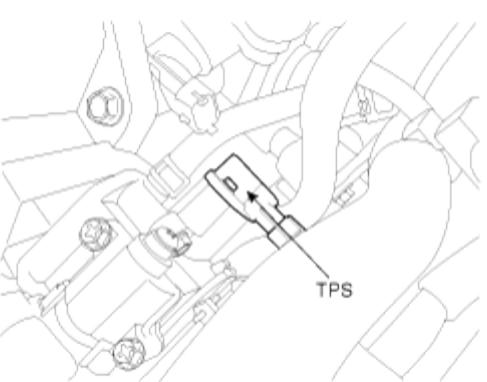
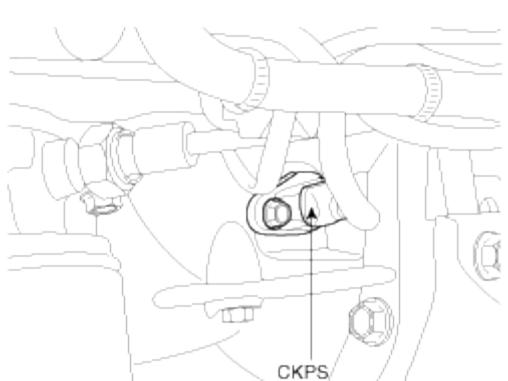
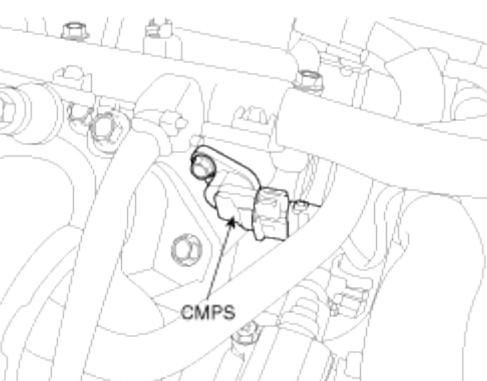


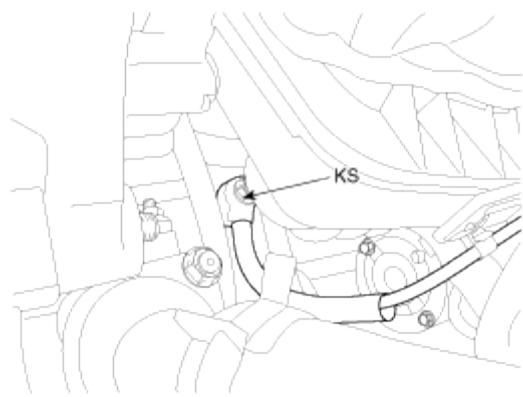
[RHD]

1. Engine Control Module (ECM)
2. Manifold Absolute Pressure Sensor (MAPS)

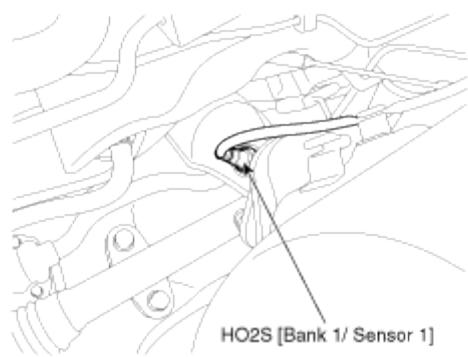
11. A/C Pressure Transducer (APT)
12. Injector

| | |
|---|---|
| 3. Intake Air Temperature Sensor (IATS) | 13. Idle Speed Control Actuator (ISCA) |
| 4. Engine Coolant Temperature Sensor (ECTS) | 14. Purge Control Solenoid Valve (PCSV) |
| 5. Throttle Position Sensor (TPS) | 15. CVVT Oil Control Valve (OCV) |
| 6. Crankshaft Position Sensor (CKPS) | 16. Ignition Coil |
| 7. Camshaft Position Sensor (CMPS) | 17. Main Relay |
| 8. Knock Sensor (KS) | 18. Fuel Pump Relay |
| 9. Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 1] | 19. Data Link Connector (DLC) |
| 10. Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2] | 20. Multi-Purpose Check Connector |

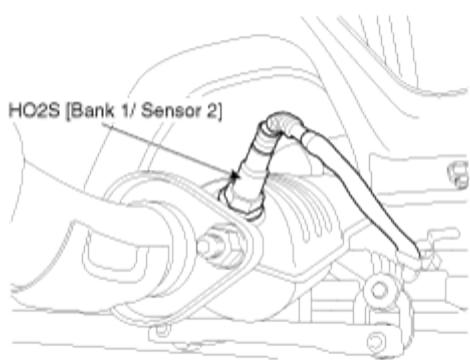
| | |
|--|--|
| 1. Engine Control Module (ECM) | 2. Manifold Absolute Pressure Sensor (MAPS)
3. Intake Air Temperature Sensor (IATS) |
|  |  |
| 4. Engine Coolant Temperature Sensor (ECTS) | 5. Throttle Position Sensor (TPS) |
|  |  |
| 6. Crankshaft Position Sensor (CKPS) | 7. Camshaft Position Sensor (CMPS) |
|  |  |
| 8. Knock Sensor (KS) | 9. Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 1] |



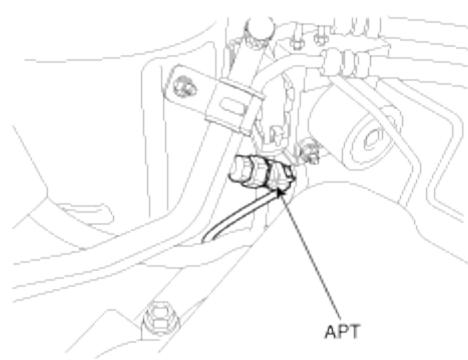
10. Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2]



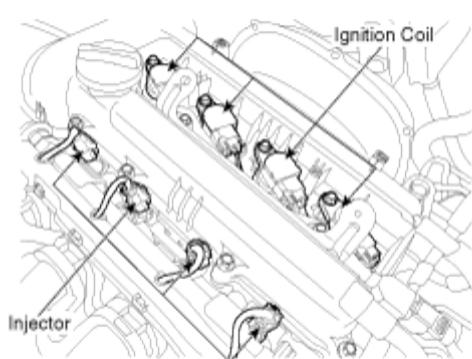
11. A/C Pressure Transducer (APT)



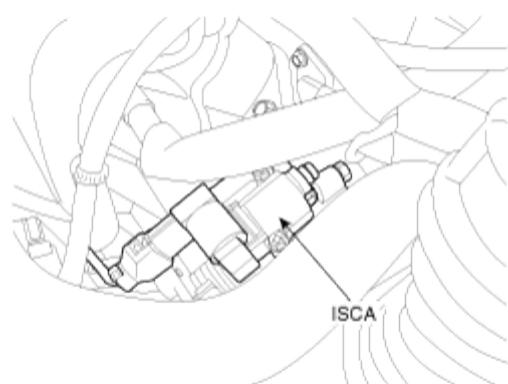
12. Injector
16. Ignition Coil



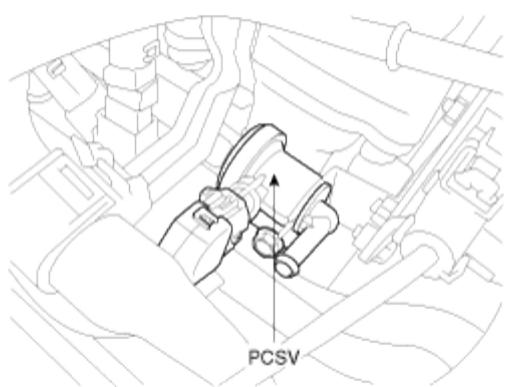
13. Idle Speed Control Actuator (ISCA)



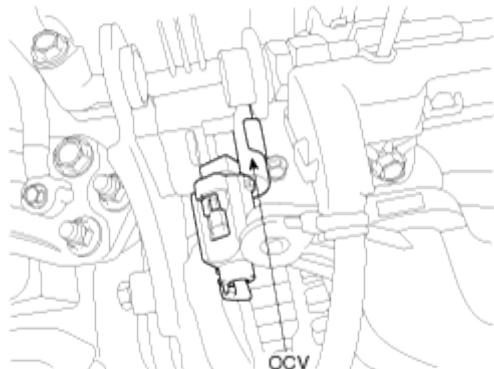
14. Purge Control Solenoid Valve (PCSV)



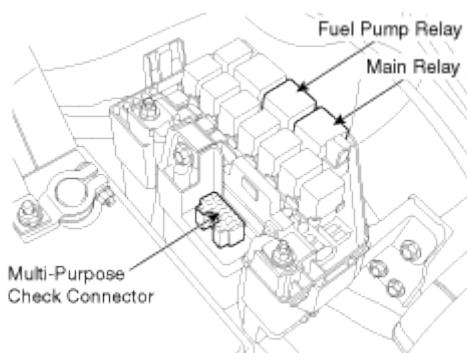
15. CVVT Oil Control Valve (OCV)



17. Main Relay
18. Fuel Pump Relay



20. Multi-Purpose Check Connotor

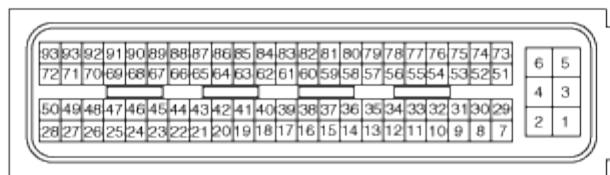


11.2.3. Engine Control Module (ECM)

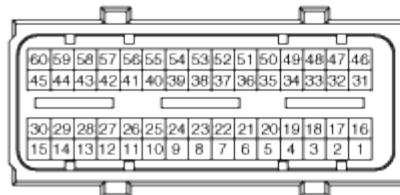
11.2.3.1. Schematic Diagrams

ECM Terminal And Input/Output signal

ECM Harness Connector (A/T)



Connector [EGGA-K]



Connector [EGGA-A]

ECM Terminal Function (A/T)

Connector [EGGA-K]

| Pin No. | Description | Connected to |
|---------|--|--|
| 1 | Power Ground | Chassis Ground |
| 2 | Power Ground | Chassis Ground |
| 3 | Power Ground | Chassis Ground |
| 4 | Battery voltage supply after main relay | Main Relay |
| 5 | Battery voltage supply after main relay | Main Relay |
| 6 | Battery voltage supply after main relay | Main Relay |
| 7 | - | |
| 8 | Sensor ground | Manifold Absolute Pressure Sensor (MAPS) |
| 9 | Sensor ground | Heated Oxygen Sensor (Sensor 2) |
| 10 | Manifold Absolute Pressure Sensor signal input | Manifold Absolute Pressure Sensor (MAPS) |
| 11 | - | |
| 12 | - | |
| 13 | Heated Oxygen Sensor (Sensor 2) signal input | Heated Oxygen Sensor (Sensor 2) |

| | | |
|----|--|---------------------------------------|
| 14 | - | |
| 15 | - | |
| 16 | - | |
| 17 | Alternator load signal input | Alternator |
| 18 | - | |
| 19 | - | |
| 20 | Vehicle speed signal input | ABS/ESP Control Module [With ABS/ESP] |
| 21 | - | |
| 22 | Electric Load signal input | Defrost |
| 23 | A/C Switch "ON" signal input | A/C Switch |
| 24 | For Autotransaxle Control | |
| 25 | For Autotransaxle Control | |
| 26 | For Autotransaxle Control | |
| 27 | For Autotransaxle Control | |
| 28 | For Autotransaxle Control | |
| 29 | - | |
| 30 | Sensor ground | A/C Pressure Transducer (APT) |
| 31 | Sensor ground | Heated Oxygen Sensor (Sensor 1) |
| 32 | Intake Air Temperature Sensor signal input | Intake Air Temperature Sensor (IATS) |
| 33 | - | |
| 34 | - | |
| 35 | Heated Oxygen Sensor (Sensor 1) signal input | Heated Oxygen Sensor (Sensor 1) |
| 36 | - | |
| 37 | - | |
| 38 | Sensor ground | Camshaft Position Sensor (CMPS) |
| 39 | - | |
| 40 | - | |
| 41 | Camshaft Position Sensor signal input | Camshaft Position Sensor (CMPS) |
| 42 | - | |
| 43 | - | |
| 44 | - | |
| 45 | - | |
| 46 | A/C thermal switch signal input | A/C Thermal Switch |
| 47 | For Autotransaxle Control | |

| | | |
|----|--|--|
| 48 | For Autotransaxle Control | |
| 49 | For Autotransaxle Control | |
| 50 | For Autotransaxle Control | |
| 51 | Sensor ground | Throttle Position Sensor (TPS) |
| 52 | - | |
| 53 | - | |
| 54 | - | |
| 55 | - | |
| 56 | - | |
| 57 | For Autotransaxle Control | |
| 58 | - | |
| 59 | - | |
| 60 | For Autotransaxle Control | |
| 61 | For Autotransaxle Control | |
| 62 | For Autotransaxle Control | |
| 63 | - | |
| 64 | For Autotransaxle Control | |
| 65 | For Autotransaxle Control | |
| 66 | For Autotransaxle Control | |
| 67 | For Autotransaxle Control | |
| 68 | For Autotransaxle Control | |
| 69 | - | |
| 70 | For Autotransaxle Control | |
| 71 | For Autotransaxle Control | |
| 72 | For Autotransaxle Control | |
| 73 | Sensor ground | Engine Coolant Temperature Sensor (ECTS) |
| 74 | - | |
| 75 | Throttle Position Sensor signal input | Throttle Position Sensor (TPS) |
| 76 | - | |
| 77 | Engine Coolant Temperature Sensor signal input | Engine Coolant Temperature Sensor (ECTS) |
| 78 | - | |
| 79 | A/C Pressure Transducer signal input | A/C Pressure Transducer (APT) |
| 80 | For Autotransaxle Control | |
| 81 | For Autotransaxle Control | |

| | | |
|----|---------------------------|--|
| 82 | For Autotransaxle Control | |
| 83 | For Autotransaxle Control | |
| 84 | For Autotransaxle Control | |
| 85 | - | |
| 86 | For Autotransaxle Control | |
| 87 | For Autotransaxle Control | |
| 88 | For Autotransaxle Control | |
| 89 | For Autotransaxle Control | |
| 90 | For Autotransaxle Control | |
| 91 | For Autotransaxle Control | |
| 92 | For Autotransaxle Control | |
| 93 | For Autotransaxle Control | |
| 94 | For Autotransaxle Control | |

Connector [EGGA-A]

| Pin No. | Description | Connected to |
|---------|---|--|
| 1 | Ignition Coil (Cylinder #2) control output | Ignition Coil (Cylinder #2) |
| 2 | Ignition Coil (Cylinder #4) control output | Ignition Coil (Cylinder #4) |
| 3 | - | |
| 4 | - | |
| 5 | - | |
| 6 | Idle Speed Control Actuator [OPEN] control output | Idle Speed Control Actuator (ISCA) |
| 7 | - | |
| 8 | Purge Control Solenoid Valve control output | Purge Control Solenoid Valve (PCSV) |
| 9 | Main Relay control output | Main Relay |
| 10 | - | |
| 11 | Battery voltage supply after ignition switch | Ignition Switch |
| 12 | CAN [HIGH] | Other control module, Data Link Connector (DLC), Multi-Purpose Check Connector |
| 13 | - | |
| 14 | - | |
| 15 | Knock Sensor signal input | Knock Sensor (KS) |
| 16 | Ignition Coil (Cylinder #3) control output | Ignition Coil (Cylinder #3) |
| 17 | Ignition Coil (Cylinder #1) control output | Ignition Coil (Cylinder #1) |

| | | |
|----|---|---|
| 18 | - | |
| 19 | - | |
| 20 | - | |
| 21 | Cooling Fan Relay [Low] control output | Cooling Fan Relay [Low] |
| 22 | Idle Speed Control Actuator [CLOSE] control output | Idle Speed Control Actuator (ISCA) |
| 23 | Cooling Fan Relay [High] control output | Cooling Fan Relay [High] |
| 24 | Fuel consumption signal output | Trip Computer |
| 25 | Engine speed signal output | Tachometer (Cluster) |
| 26 | - | |
| 27 | CAN [LOW] | Other control module, Data Link Connector (DLC),
Multi-Purpose Check Connector |
| 28 | - | |
| 29 | - | |
| 30 | Sensor ground | Knock Sensor (KS) |
| 31 | - | |
| 32 | Immobilizer lamp control output | Immobilizer Lamp |
| 33 | Heated Oxygen Sensor (Sensor 2) Heater control output | Heated Oxygen Sensor (Sensor 2) |
| 34 | Heated Oxygen Sensor (Sensor 1) Heater control output | Heated Oxygen Sensor (Sensor 1) |
| 35 | Fuel Pump Relay control output [With Immobilizer] | Fuel Pump Realy |
| 36 | Injector (Cylinder #3) control output | Injector (Cylinder #3) |
| 37 | Fuel Pump Relay control output [Without Immobilizer] | Fuel Pump Relay |
| 38 | A/C Compressor Relay control output | A/C Compressor Relay |
| 39 | - | |
| 40 | Crankshaft Position Sensor [A] signal input | Crankshaft Position Sensor (CKPS) |
| 41 | - | |
| 42 | - | |
| 43 | Sensor power (+5V) | Manifold Absolute Pressure Sensor (MAPS) |
| 44 | Immobilizer communication line | Immobilizer Control Module |
| 45 | Wheel Speed Sensor [A] signal input | Wheel Speed Sensor (WSS) [Without ABS/ESP] |
| 46 | - | |
| 47 | - | |
| 48 | Injector (Cylinder #4) control output | Injector (Cylinder #4) |
| 49 | CVVT Oil Control Valve control output | CVVT Oil Control Valve (OCV) |

| | | |
|----|---|---|
| 50 | Injector (Cylinder #1) control output | Injector (Cylinder #1) |
| 51 | Malfunction Indicator Lamp (MIL) control output | Cluster (Malfunction Indicator Lamp) |
| 52 | Injector (Cylinder #2) control output | Injector (Cylinder #2) |
| 53 | - | |
| 54 | - | |
| 55 | Crankshaft Position Sensor [B] signal input | Crankshaft Position Sensor (CKPS) |
| 56 | Battery Power (B+) | Battery |
| 57 | Sensor power (+5V) | A/C Pressure Transducer (APT) |
| 58 | Sensor power (+5V) | Throttle Position Sensor (TPS) |
| 59 | - | |
| 60 | Wheel Speed Sensor [B] signal input | Wheel Speed Sensor (WSS)[Without ABS/ESP] |

ECM Terminal Input/Output Signal (A/T)

Connector [EGGA-K]

| Pin No | Description | Condition | Type | Level | Test Result |
|--------|--|-----------|--------|------------------|-------------|
| 1 | Power Ground | Idle | DC | Max. 50mV | 0V |
| 2 | Power Ground | Idle | DC | Max. 50mV | 3.6mV |
| 3 | Power Ground | Idle | DC | Max. 50mV | 3.6mV |
| 4 | Battery voltage supply after main relay | IG OFF | DC | Max. 1.0V | 200mV |
| | | IG ON | | Battery Voltage | 12.9V |
| 5 | Battery voltage supply after main relay | IG OFF | DC | Max. 1.0V | 200mV |
| | | IG ON | | Battery Voltage | 12.9V |
| 6 | Battery voltage supply after main relay | IG OFF | DC | Max. 1.0V | 200mV |
| | | IG ON | | Battery Voltage | 12.9V |
| 7 | - | | | | |
| 8 | Sensor ground | Idle | DC | Max. 50mV | 16mV |
| 9 | Sensor ground | Idle | DC | Max. 50mV | 6.2mV |
| 10 | Manifold Absolute Pressure Sensor signal input | IG ON | DC | 3.9 ~ 4.1V | 4.09V |
| | | Idle | | 0.8 ~ 1.6V | 1.44V |
| 11 | - | | | | |
| 12 | - | | | | |
| 13 | Heated Oxygen Sensor (Sensor 2) signal input | Racing | Analog | Rich: 0.6 ~ 1.0V | 860mV |
| | | | | Lean: Max. 0.4V | 10mV |
| 14 | - | | | | |

| | | | | | |
|----|--|-------------------------|--------|---------------------|--------------|
| 15 | - | | | | |
| 16 | - | | | | |
| 17 | Alternator load signal input | Idle | Pulse | Hi: Battery Voltage | 13.2V |
| | | | | Lo: Max. 1.5V | 1.34V |
| 18 | - | | | | |
| 19 | - | | | | |
| 20 | Vehicle speed signal input | Idle | Pulse | Hi: Min. 4.5V | 12.2V |
| | | | | Lo: Max. 1.0V | 0V |
| | | | | | Freq: 72.2Hz |
| | | Vehicle Run
(30km/h) | Pulse | Hi: Min. 4.5V | 12.2V |
| | | | | Lo: Max. 1.0V | 0V |
| | | | | | Freq: 212Hz |
| 21 | - | | | | |
| 22 | Electric Load signal input | | | | |
| 23 | A/C Switch "ON" signal input | S/W OFF | DC | Max. 1.0V | 20mV |
| | | S/W ON | | Battery Voltage | 12.48V |
| 24 | For Autotransaxle Control | | | | |
| 25 | For Autotransaxle Control | | | | |
| 26 | For Autotransaxle Control | | | | |
| 27 | For Autotransaxle Control | | | | |
| 28 | For Autotransaxle Control | | | | |
| 29 | - | | | | |
| 30 | Sensor ground | Idle | DC | Max. 50mV | 6.2mV |
| 31 | Sensor ground | Idle | DC | Max. 50mV | 6.8mV |
| 32 | Intake Air Temperature Sensor signal input | Idle | DC | 0 ~ 5.0V | 1.89V |
| 33 | - | | | | |
| 34 | - | | | | |
| 35 | Heated Oxygen Sensor (Sensor 1) signal input | Racing | Analog | Rich: 0.6 ~ 1.0V | 884mV |
| | | | | Lean: Max. 0.4V | 8mV |
| 36 | - | | | | |
| 37 | - | | | | |
| 38 | Sensor ground | Idle | DC | Max. 50mV | 12mV |
| 39 | - | | | | |

| | | | | | |
|----|---------------------------------------|-------------|-------|---------------------|--------|
| 40 | - | | | | |
| 41 | Camshaft Position Sensor signal input | Idle | Pulse | Hi: Battery Voltage | 13.72V |
| | | | | Lo: Max. 0.5V | 200mV |
| 42 | - | | | | |
| 43 | - | | | | |
| 44 | - | | | | |
| 45 | - | | | | |
| 46 | A/C thermal switch signal input | A/C S/W OFF | DC | Max.1.0V | 200mV |
| | | A/C S/W ON | | Battery Voltage | 12.6V |
| 47 | For Autotransaxle Control | | | | |
| 48 | For Autotransaxle Control | | | | |
| 49 | For Autotransaxle Control | | | | |
| 50 | For Autotransaxle Control | | | | |
| 51 | Sensor ground | Idle | DC | Max. 50mV | 11.2mV |
| 52 | - | | | | |
| 53 | - | | | | |
| 54 | - | | | | |
| 55 | - | | | | |
| 56 | - | | | | |
| 57 | For Autotransaxle Control | | | | |
| 58 | - | | | | |
| 59 | - | | | | |
| 60 | For Autotransaxle Control | | | | |
| 61 | For Autotransaxle Control | | | | |
| 62 | For Autotransaxle Control | | | | |
| 63 | - | | | | |
| 64 | For Autotransaxle Control | | | | |
| 65 | For Autotransaxle Control | | | | |
| 66 | For Autotransaxle Control | | | | |
| 67 | For Autotransaxle Control | | | | |
| 68 | For Autotransaxle Control | | | | |
| 69 | - | | | | |
| 70 | For Autotransaxle Control | | | | |
| 71 | For Autotransaxle Control | | | | |

| | | | | | |
|----|--|--------|--------|-------------|--------|
| 72 | For Autotransaxle Control | | | | |
| 73 | Sensor ground | Idle | DC | Max. 50mV | 16.8mV |
| 74 | - | | | | |
| 75 | Throttle Position Sensor signal input | C.T | Analog | 0.25 ~ 0.9V | 0.34V |
| | | W.O.T | | Min. 4.0V | 4.43V |
| 76 | - | | | | |
| 77 | Engine Coolant Temperature Sensor signal input | Idle | Analog | 0.5 ~ 4.5V | 1.43V |
| 78 | - | | | | |
| 79 | A/C Pressure Transducer signal input | A/C ON | Analog | Max. 4.8V | 1.88V |
| 80 | For Autotransaxle Control | | | | |
| 81 | For Autotransaxle Control | | | | |
| 82 | For Autotransaxle Control | | | | |
| 83 | For Autotransaxle Control | | | | |
| 84 | For Autotransaxle Control | | | | |
| 85 | - | | | | |
| 86 | For Autotransaxle Control | | | | |
| 87 | For Autotransaxle Control | | | | |
| 88 | For Autotransaxle Control | | | | |
| 89 | For Autotransaxle Control | | | | |
| 90 | For Autotransaxle Control | | | | |
| 91 | For Autotransaxle Control | | | | |
| 92 | For Autotransaxle Control | | | | |
| 93 | For Autotransaxle Control | | | | |
| 94 | For Autotransaxle Control | | | | |

Connector [EGGA-A]

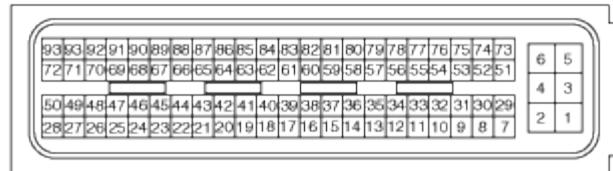
| Pin No. | Description | Condition | Type | Level | Test Result |
|---------|--|-----------|-------|-------------------------|-------------|
| 1 | Ignition Coil (Cylinder #2) control output | Idle | Pulse | 1st Voltage: 300 ~ 400V | 372V |
| | | | | ON Voltage: Max. 2.0V | 1.1V |
| 2 | Ignition Coil (Cylinder #4) control output | Idle | Pulse | 1st Voltage: 300 ~ 400V | 372V |
| | | | | ON Voltage: Max. 2.0V | 1.1V |
| 3 | - | | | | |
| 4 | - | | | | |

| | | | | | |
|----|--|-----------------------|-----------------------|-------------------------|--------|
| 5 | - | | | | |
| 6 | Idle Speed Control Actuator [OPEN] control output | Idle | Pulse | Hi: Battery Voltage | 13.8V |
| | | | | Lo: Max. 1.0V | 20mV |
| 7 | - | | | | |
| 8 | Purge Control Solenoid Valve control output | Active
Inactive | Pulse | Hi: Battery Voltage | 14.2V |
| | | | | Lo: Max. 1.0V | 120mV |
| 9 | Main Relay control output | Relay
OFF | DC | Battery Voltage | 12.78V |
| | | | | Max. 1.0V | 860mV |
| 10 | - | | | | |
| 11 | Battery voltage supply after ignition switch | IG OFF | DC | Max. 1.0V | 3.2mV |
| | | | | Battery Voltage | 12.68V |
| 12 | CAN [HIGH] | RECESSIVE
DOMINANT | Pulse | 2.0 ~ 3.0V | 2.5V |
| | | | | 2.75 ~ 4.5V | 3.58V |
| 13 | - | | | | |
| 14 | - | | | | |
| 15 | Knock Sensor signal input | Knocking
Normal | Variable
Frequency | | |
| | | | | | |
| 16 | Ignition Coil (Cylinder #3) control output | Idle | Pulse | 1st Voltage: 300 ~ 400V | 366V |
| | | | | ON Voltage: Max. 2.0V | 1.1V |
| 17 | Ignition Coil (Cylinder #1) control output | Idle | Pulse | 1st Voltage: 300 ~ 400V | 352V |
| | | | | ON Voltage: Max. 2.0V | 1.1V |
| 18 | - | | | | |
| 19 | - | | | | |
| 20 | - | | | | |
| 21 | Cooling Fan Relay [Low] control output | Relay
OFF | DC | Battery Voltage | 14.12V |
| | | | | Max. 1.0V | 61.6mV |
| 22 | Idle Speed Control Actuator [CLOSE] control output | Idle | Pulse | Hi: Battery Voltage | 13.8V |
| | | | | Lo: Max. 1.0V | 200mV |
| 23 | Cooling Fan Relay [High] control output | Relay
OFF | DC | Battery Voltage | 14.01V |
| | | | | Max. 1.0V | 52.6mV |
| 24 | Fuel consumption signal output | Idle | Pulse | Hi: Battery Voltage | 13.8V |
| | | | | Lo: Max. 0.5V | 200mV |

| | | | | | |
|----|---|------------|-------|------------------------------|--------|
| | | | | | |
| 25 | Engine speed signal output | Idle | Pulse | Hi: Battery Voltage | 14.0V |
| | | | | Lo: Max. 0.5V | 20mV |
| | | | | Freq.: 20 ~ 60Hz | 22Hz |
| 26 | - | | | | |
| 27 | CAN [LOW] | RECESSIVE | Pulse | 2.0 ~ 3.0V | 2.5V |
| | | DOMINANT | | 0.5 ~ 2.25V | 1.5V |
| 28 | - | | | | |
| 29 | - | | | | |
| 30 | Sensor ground | Idle | DC | Max. 50mV | |
| 31 | - | | | | |
| 32 | Immobilizer lamp control output | Lamp OFF | DC | Battery Voltage | 12.6V |
| | | Lamp ON | | Max. 1.0V | 20mV |
| 33 | Heated Oxygen Sensor (Sensor 2) Heater control output | Engine Run | Pulse | Hi: Battery Voltage | 14.2V |
| | | | | Lo: Max. 1.0V | 220mV |
| 34 | Heated Oxygen Sensor (Sensor 1) Heater control output | Engine Run | Pulse | Hi: Battery Voltage | 14.2V |
| | | | | Lo: Max. 1.0V | 220mV |
| 35 | Fuel Pump Relay control output [With Immobilizer] | Relay OFF | DC | Battery Voltage | 12.8V |
| | | Relay ON | | Max. 1.0V | 400mV |
| 36 | Injector (Cylinder #3) control output | Idle | Pulse | Hi: Battery Voltage | 14.2V |
| | | | | Lo: Max. 1.0V | 40mV |
| | | | | Vpeak: Max. 80V | 73.6V |
| 37 | Fuel Pump Relay control output [Without Immobilizer] | Relay OFF | DC | Battery Voltage | 12.8V |
| | | Relay ON | | Max. 1.0V | 400mV |
| 38 | A/C Compressor Relay control output | Relay OFF | DC | Battery Voltage | 14.1V |
| | | Relay ON | | Max. 1.0V | 400mV |
| 39 | - | | | | |
| 40 | Crankshaft Position Sensor [A] signal input | Idle | | V _{p_p} : Min. 1.0V | 6.48V |
| 41 | - | | | | |
| 42 | - | | | | |
| 43 | Sensor power (+5V) | IG OFF | DC | Max. 0.5V | 3.6mV |
| | | IG ON | | 4.8 ~ 5.2V | 5.02V |
| 44 | Immobilizer communication line | When | Pulse | Hi: Min. 8.5V | 12.51V |

| | | | | | |
|----|--|---------------------------------|--------------|------------------------------|--------|
| | | communicating
after
IG ON | | Lo: Max. 3.5V | 1.17V |
| 45 | Wheel Speed Sensor [A] signal input | Vehicle
Run | SINE
Wave | V _{p-p} : Min. 0.2V | |
| 46 | - | | | | |
| 47 | - | | | | |
| 48 | Injector (Cylinder #4) control output | Idle | Pulse | Hi: Battery Voltage | 13.6V |
| | | | | Lo: Max. 1.0V | 336mV |
| | | | | Vpeak: Max. 80V | 69.7V |
| 49 | CVVT Oil Control Valve control output | Idle | Pulse | Hi: Battery Voltage | 14.9V |
| | | | | Lo: Max. 1.0V | 36.2mV |
| 50 | Injector (Cylinder #1) control output | Idle | Pulse | Hi: Battery Voltage | 13.6V |
| | | | | Lo: Max. 1.0V | 336mV |
| | | | | Vpeak: Max. 80V | 69.7V |
| 51 | Malfunction Indicator Lamp (MIL) control
output | Lamp OFF | DC | Battery Voltage | 11.51V |
| | | Lamp ON | | Max. 1.0V | 663mV |
| 52 | Injector (Cylinder #2) control output | Idle | Pulse | Hi: Battery Voltage | 13.6V |
| | | | | Lo: Max. 1.0V | 336mV |
| | | | | Vpeak: Max. 80V | 69.7V |
| 53 | - | | | | |
| 54 | - | | | | |
| 55 | Crankshaft Position Sensor [B] signal input | Idle | SINE
Wave | V _{p-p} : Min. 1.0V | 6.48V |
| 56 | Battery Power (B+) | Always | DC | Battery Voltage | 12.23V |
| 57 | Sensor power (+5V) | IG OFF | DC | Max. 0.5V | 3.6mV |
| | | IG ON | | 4.9 ~ 5.1V | 5.02V |
| 58 | Sensor power (+5V) | IG OFF | DC | Max. 0.5V | 3.6mV |
| | | IG ON | | 4.9 ~ 5.1V | 5.02V |
| 59 | - | | | | |
| 60 | Wheel Speed Sensor [B] signal input | Vehicle
Run | SINE
Wave | V _{p-p} : Min. 0.2V | |

ECM Harness Connector (M/T)



Connector [EGGM-K]

ECM Terminal Function (M/T)

Connector [EGGM-K]

| Pin No. | Description | Connectedto |
|---------|--|--|
| 1 | Ignition Coil (Cylinder #1) control output | Ignition Coil (Cylinder #1) |
| 2 | Power Ground | Chassis Ground |
| 3 | Ignition Coil (Cylinder #3) control output | Ignition Coil (Cylinder #3) |
| 4 | - | |
| 5 | - | |
| 6 | Battery voltage supply after main relay | Main Relay |
| 7 | Ignition Coil (Cylinder #4) control output | Ignition Coil (Cylinder #4) |
| 8 | A/C thermal switch signal input | A/C Thermal Switch |
| 9 | - | |
| 10 | - | |
| 11 | Knock Sensor signal input | Knock Sensor (KS) |
| 12 | Sensor ground | Throttle Position Sensor (TPS) |
| 13 | - | |
| 14 | - | |
| 15 | Sensor ground | Manifold Absolute Pressure Sensor (MAPS) |
| 16 | Sensor ground | Heated Oxygen Sensor (Sensor 2) |
| 17 | Sensor ground | Camshaft Position Sensor (CMPS) |
| 18 | Immobilizer communication line | Immobilizer Control Module |
| 19 | Manifold Absolute Pressure Sensor signal input | Manifold Absolute Pressure Sensor (MAPS) |
| 20 | - | |
| 21 | - | |
| 22 | Main Relay control output | Main Relay |
| 23 | Cooling Fan Relay [High] control output | Cooling Fan Relay [High] |
| 24 | Injector (Cylinder #3) control output | Injector (Cylinder #3) |
| 25 | Idle Speed Control Actuator [CLOSE] control output | Idle Speed Control Actuator (ISCA) |
| 26 | - | |

| | | |
|----|--|---|
| 27 | - | |
| 28 | Cooling Fan Relay [Low] control output | Cooling Fan Relay [Low] |
| 29 | Ignition Coil (Cylinder #2) control output | Ignition Coil (Cylinder #2) |
| 30 | A/C Switch "ON" signal input | A/C Switch |
| 31 | Electric Load signal input | Defrost |
| 32 | Sensor ground | Knock Sensor (KS) |
| 33 | Sensor ground | A/C Pressure Transducer (APT) |
| 34 | - | |
| 35 | Sensor ground | Engine Coolant Temperature Sensor (ECTS) |
| 36 | Heated Oxygen Sensor (Sensor 2) signal input | Heated Oxygen Sensor (Sensor 2) |
| 37 | - | |
| 38 | Sensor ground | Heated Oxygen Sensor (Sensor 1) |
| 39 | Throttle Position Sensor signal input | Throttle Position Sensor (TPS) |
| 40 | A/C Pressure Transducer signal input | A/C Pressure Transducer (APT) |
| 41 | - | |
| 42 | - | |
| 43 | Intake Air Temperature Sensor signal input | Intake Air Temperature Sensor (IATS) |
| 44 | - | |
| 45 | A/C Compressor Relay control output | A/C Compressor Relay |
| 46 | Fuel Pump Relay control output [Without Immobilizer] | Fuel Pump Relay |
| 47 | Injector (Cylinder #2) control output | Injector (Cylinder #2) |
| 48 | Immobilizer lamp control output | Immobilizer Lamp |
| 49 | Fuel Pump Relay control output [With Immobilizer] | |
| 50 | - | |
| 51 | Power Ground | Chassis Ground |
| 52 | - | |
| 53 | - | |
| 54 | Heated Oxygen Sensor (Sensor 1) signal input | Heated Oxygen Sensor (Sensor 1) |
| 55 | - | |
| 56 | - | |
| 57 | - | |
| 58 | Wheel Speed Sensor [A] signal input | Wheel Speed Sensor (WSS)[Without ABS/ESP] |
| 59 | Sensor power (+5V) | A/C Pressure Transducer (APT) |
| 60 | Sensor power (+5V) | Throttle Position Sensor (TPS) |

| | | |
|----|---|--|
| 61 | - | |
| 62 | CAN [LOW] | Other control module, Data Link Connector (DLC), Multi-Purpose Check Connector |
| 63 | Camshaft Position Sensor signal input | Camshaft Position Sensor (CMPS) |
| 64 | Vehicle speed signal input | ABS/ESP Control Module [With ABS/ESP] |
| 65 | - | |
| 66 | Alternator load signal input | Alternator |
| 67 | Engine speed signal output | Tachometer (Cluster) |
| 68 | Injector (Cylinder #4) control output | Injector (Cylinder #4) |
| 69 | Purge Control Solenoid Valve control output | Purge Control Solenoid Valve (PCSV) |
| 70 | Malfunction Indicator Lamp (MIL) control output | Cluster (Malfunction Indicator Lamp) |
| 71 | Heated Oxygen Sensor (Sensor 2) Heater control output | Heated Oxygen Sensor (Sensor 2) |
| 72 | Heated Oxygen Sensor (Sensor 1) Heater control output | Heated Oxygen Sensor (Sensor 1) |
| 73 | Power Ground | Chassis Ground |
| 74 | - | |
| 75 | - | |
| 76 | - | |
| 77 | Engine Coolant Temperature Sensor signal input | Engine Coolant Temperature Sensor (ECTS) |
| 78 | - | |
| 79 | Wheel Speed Sensor [B] signal input | Wheel Speed Sensor (WSS)[Without ABS/ESP] |
| 80 | - | |
| 81 | Sensor power (+5V) | Manifold Absolute Pressure Sensor (MAPS) |
| 82 | Battery Power (B+) | Battery |
| 83 | Battery voltage supply after ignition switch | Ignition Switch |
| 84 | CAN [HIGH] | Other control module, Data Link Connector (DLC), Multi-Purpose Check Connector |
| 85 | - | |
| 86 | Crankshaft Position Sensor [B] signal input | Crankshaft Position Sensor (CKPS) |
| 87 | Crankshaft Position Sensor [A] signal input | Crankshaft Position Sensor (CKPS) |
| 88 | Fuel consumption signal output | Trip Computer |
| 89 | - | |
| 90 | Idle Speed Control Actuator [OPEN] control output | Idle Speed Control Actuator (ISCA) |
| 91 | Injector (Cylinder #1) control output | Injector (Cylinder #1) |

| | | | |
|----|---------------------------------------|--|------------------------------|
| 92 | CVVT Oil Control Valve control output | | CVVT Oil Control Valve (OCV) |
| 93 | - | | |
| 94 | - | | |

ECM Terminal Input/Output Signal (M/T)

CONNECTOR [EGGM-K]

| Pin No. | Description | Condition | Type | Level | Test Result |
|---------|--|--------------------------------|--------------------|-------------------------|-------------|
| 1 | Ignition Coil (Cylinder #1) control output | Idle | Pulse | 1st Voltage: 300 ~ 400V | 352V |
| | | | | ON Voltage: Max. 2.0V | 1.1V |
| 2 | Power Ground | Idle | DC | Max. 50mV | 0mV |
| 3 | Ignition Coil (Cylinder #3) control output | Idle | Pulse | 1st Voltage: 300 ~ 400V | 366V |
| | | | | ON Voltage: Max. 2.0V | 1.1V |
| 4 | - | | | | |
| 5 | - | | | | |
| 6 | Battery voltage supply after main relay | IG OFF | DC | Max. 1.0V | 200mV |
| | | | | Battery Voltage | 12.9V |
| 7 | Ignition Coil (Cylinder #4) control output | Idle | Pulse | 1st Voltage: 300 ~ 400V | 372V |
| | | | | ON Voltage: Max. 2.0V | 1.1V |
| 8 | A/C thermal switch signal input | A/C S/W OFF | DC | Max. 0.5V | 200mV |
| | | | | Battery Voltage | 12.6V |
| 9 | - | | | | |
| 10 | - | | | | |
| 11 | Knock Sensor signal input | Knocking | Variable Frequency | | |
| | | Normal | | | |
| 12 | Sensor ground | Idle | DC | Max. 50mV | 11.2mV |
| 13 | - | | | | |
| 14 | - | | | | |
| 15 | Sensor ground | Idle | DC | Max. 50mV | 16mV |
| 16 | Sensor ground | Idle | DC | Max. 50mV | 6.2mV |
| 17 | Sensor ground | Idle | DC | Max. 50mV | 12mV |
| 18 | Immobilizer communication line | When communicating after IG ON | Pulse | Hi: Min. 8.5V | 12.51V |
| | | | | Lo: Max. 3.5V | 1.17V |
| 19 | Manifold Absolute Pressure Sensor | IG ON | DC | 3.9 ~ 4.1V | 4.09V |

| | | | | | |
|----|--|-------------|--------|-------------------------|--------|
| | signal input | Idle | | 0.8 ~ 1.6V | 1.44V |
| 20 | - | | | | |
| 21 | - | | | | |
| 22 | Main Relay control output | Relay OFF | DC | Battery Voltage | 12.78V |
| | | Relay ON | | Max. 1.0V | 860mV |
| 23 | Cooling Fan Relay [High] control output | Relay OFF | DC | Battery Voltage | 14.01V |
| | | Relay ON | | Max. 1.0V | 52.6mV |
| 24 | Injector (Cylinder #3) control output | Idle | Pulse | Hi: Battery Voltage | 14.2V |
| | | | | Lo: Max. 1.0V | 40mV |
| | | | | Vpeak: Max. 80V | 73.6V |
| 25 | Idle Speed Control Actuator [CLOSE] control output | Idle | Pulse | Hi: Battery Voltage | 13.8V |
| | | | | Lo: Max. 1.0V | 200mV |
| 26 | - | | | | |
| 27 | - | | | | |
| 28 | Cooling Fan Relay [Low] control output | Relay OFF | DC | Battery Voltage | 14.12V |
| | | Relay ON | | Max. 1.0V | 61.6mV |
| 29 | Ignition Coil (Cylinder #2) control output | Idle | Pulse | 1st Voltage: 300 ~ 400V | 372V |
| | | | | ON Voltage: Max. 2.0V | 1.1V |
| 30 | A/C Switch "ON" signal input | A/C S/W OFF | DC | Max. 1.0V | 20mV |
| | | A/C S/W ON | | Battery Voltage | 12.48V |
| 31 | Electric Load signal input | | | | |
| 32 | Sensor ground | Idle | DC | Max. 50mV | |
| 33 | Sensor ground | Idle | DC | Max. 50mV | 6.2mV |
| 34 | - | | | | |
| 35 | Sensor ground | Idle | DC | Max. 50mV | 16.8mV |
| 36 | Heated Oxygen Sensor (Sensor 2) signal input | Racing | Analog | Rich: 0.6 ~ 1.0V | 860mV |
| | | | | Lean: Max. 0.4V | 10mV |
| 37 | - | | | | |
| 38 | Sensor ground | Idle | DC | Max. 50mV | 6.8mV |
| 39 | Throttle Position Sensor signal input | C.T | Analog | 0.2 ~ 0.7V | 0.34V |
| | | W.O.T | | Min. 4.0V | 4.43V |
| 40 | A/C Pressure Transducer signal input | A/C ON | Analog | Max. 4.8V | 1.88V |

| | | | | | |
|----|---|-------------|-----------|------------------------------|-------|
| 41 | - | | | | |
| 42 | - | | | | |
| 43 | Intake Air Temperature Sensor signal input | Idle | DC | 0.2 ~ 4.8V | 1.89V |
| 44 | - | | | | |
| 45 | A/C Compressor Relay control output | Relay OFF | DC | Battery Voltage | 14.1V |
| | | Relay ON | | Max. 1.0V | 400mV |
| 46 | Fuel Pump Relay control output
[Without Immobilizer] | Relay OFF | DC | Battery Voltage | 12.8V |
| | | Relay ON | | Max. 1.0V | 400mV |
| 47 | Injector (Cylinder #2) control output | Idle | Pulse | Hi: Battery Voltage | 13.6V |
| | | | | Lo: Max. 1.0V | 336mV |
| | | | | Vpeak: Max. 80V | 69.7V |
| 48 | Immobilizer lamp control output | Lamp OFF | DC | Battery Voltage | 12.6V |
| | | Lamp ON | | Max. 1.0V | 20mV |
| 49 | Fuel Pump Relay control output
[With Immobilizer] | Relay OFF | DC | Battery Voltage | 12.8V |
| | | Relay ON | | Max. 1.0V | 400mV |
| 50 | - | | | | |
| 51 | Power Ground | Idle | DC | Max. 50mV | 3.6mV |
| 52 | - | | | | |
| 53 | - | | | | |
| 54 | Heated Oxygen Sensor (Sensor 1) signal input | Racing | Analog | Rich: 0.6 ~ 1.0V | 884mV |
| | | | | Lean: Max. 0.4V | 8mV |
| 55 | - | | | | |
| 56 | - | | | | |
| 57 | - | | | | |
| 58 | Wheel Speed Sensor [A] signal input | Vehicle Run | SINE Wave | V _{p-p} : Min. 0.2V | |
| 59 | Sensor power (+5V) | IG OFF | DC | Max. 0.5V | 3.6mV |
| | | IG ON | | 4.9 ~ 5.1V | 5.02V |
| 60 | Sensor power (+5V) | IG OFF | DC | Max. 0.5V | 3.6mV |
| | | IG ON | | 4.9 ~ 5.1V | 5.02V |
| 61 | - | | | | |
| 62 | CAN [LOW] | RECESSIVE | Pulse | 2.0 ~ 3.0V | 2.5V |

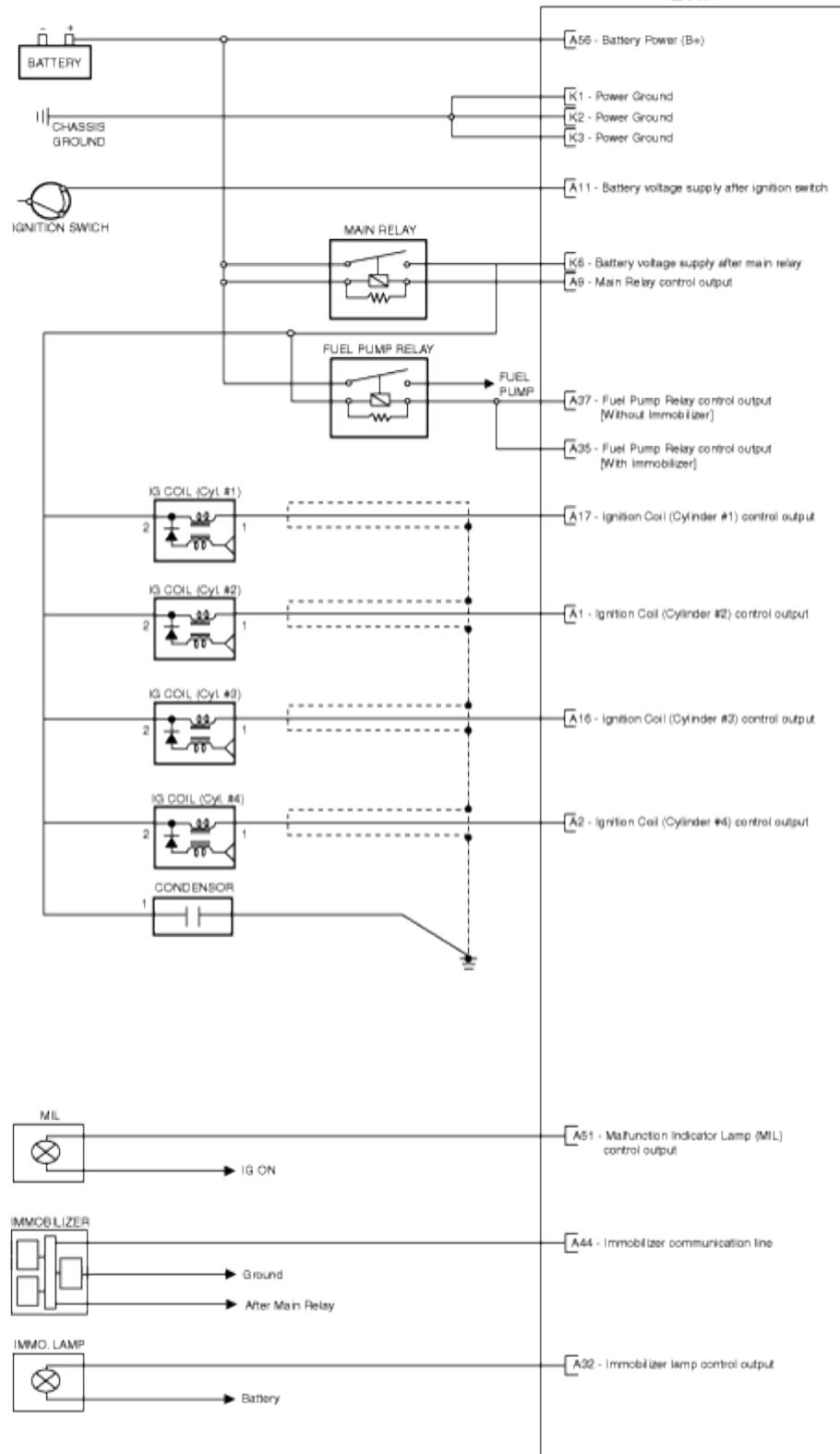
| | | DOMINANT | | 0.5 ~ 2.25V | 1.5V | |
|----|---|-----------------------|--------|------------------------------|--------------|--|
| 63 | Camshaft Position Sensor signal input | Idle | Pulse | Hi: Battery Voltage | 13.72V | |
| | | | | Lo: Max. 0.5V | 200mV | |
| 64 | Vehicle speed signal input | Idle | Pulse | Hi: Min. 4.5V | 12.2V | |
| | | | | Lo: Max. 1.0V | 0V | |
| | | Vehicle Run
(30km) | | Freq.: 72.2Hz | | |
| | | | | Hi: Min. 4.5V | 12.2V | |
| | | | | Lo: Max. 1.0V | 0V | |
| | | | | | Freq.: 212Hz | |
| 65 | - | | | | | |
| 66 | Alternator load signal input | Idle | Pulse | Hi: Battery Voltage | 13.2V | |
| | | | | Lo: Max. 1.5V | 1.34V | |
| 67 | Engine speed signal output | Idle | Pulse | Hi: Battery Voltage | 14.0V | |
| | | | | Lo: Max. 0.5V | 20mV | |
| | | | | Freq.: 20 ~ 26Hz | 22Hz | |
| 68 | Injector (Cylinder #4) control output | Idle | Pulse | Hi: Battery Voltage | 13.6V | |
| | | | | Lo: Max. 1.0V | 336mV | |
| | | | | Vpeak: Max. 80V | 69.7V | |
| 69 | Purge Control Solenoid Valve control output | Active/Inactive | Pulse | Hi: Battery Voltage | 14.2V | |
| | | | | Lo: Max. 1.0V | 120mV | |
| 70 | Malfunction Indicator Lamp (MIL) control output | Lamp OFF | DC | Battery Voltage | 11.51V | |
| | | | | Max. 1.0V | 663mV | |
| 71 | Heated Oxygen Sensor (Sensor 2) Heater control output | Engine Run | Pulse | Hi: Battery Voltage | 14.2V | |
| | | | | Lo: Max. 1.0V | 220mV | |
| 72 | Heated Oxygen Sensor (Sensor 1) Heater control output | Engine Run | Pulse | Hi: Battery Voltage | 14.2V | |
| | | | | Lo: Max. 1.0V | 220mV | |
| 73 | Power Ground | Idle | DC | Max. 50mV | 3.6mV | |
| 74 | - | | | | | |
| 75 | - | | | | | |
| 76 | - | | | | | |
| 77 | Engine Coolant Temperature Sensor signal input | Idle | Analog | 0.5 ~ 4.5V | 1.43V | |
| 78 | - | | | | | |
| 79 | Wheel Speed Sensor [B] signal input | Vehicle | SINE | V _{p-p} : Min. 0.2V | | |

| | | Run | Wave | | |
|----|---|-----------|-----------|------------------------------|--------|
| 80 | - | | | | |
| 81 | Sensor power (+5V) | IG OFF | DC | Max. 0.5V | 3.6mV |
| | | IG ON | | 4.8 ~ 5.2V | 5.02V |
| 82 | Battery Power (B+) | Always | DC | Battery Voltage | 12.23V |
| 83 | Battery voltage supply after ignition switch | IG OFF | DC | Max. 1.0V | 3.2mV |
| | | IG ON | | Battery Voltage | 12.68V |
| 84 | CAN [HIGH] | RECESSIVE | Pulse | 2.0 ~ 3.0V | 2.5V |
| | | DOMINANT | | 2.75 ~ 4.5V | 3.58V |
| 85 | - | | | | |
| 86 | Crankshaft Position Sensor [B] signal input | Idle | SINE Wave | V _{p-p} : Min. 1.0V | 6.48V |
| 87 | Crankshaft Position Sensor [A] signal input | Idle | SINE Wave | V _{p-p} : Min. 1.0V | 6.48V |
| 88 | Fuel consumption signal output | Idle | Pulse | Hi: Battery Voltage | 1.3.8V |
| | | | | Lo: Max. 0.5V | 20mV |
| 89 | - | | | | |
| 90 | Idle Speed Control Actuator [OPEN] control output | Idle | Pulse | Hi: Battery Voltage | 13.8V |
| | | | | Lo: Max. 1.0V | 20mV |
| 91 | Injector (Cylinder #1) control output | Idle | Pulse | Hi: Battery Voltage | 13.6V |
| | | | | Lo: Max. 1.0V | 336mV |
| | | | | V _{peak} : Max. 80V | 69.7V |
| 92 | CVVT Oil Control Valve control output | Idle | Pulse | Hi: Battery Voltage | 14.9V |
| | | | | Lo: Max. 1.0V | 36.2mV |
| 93 | - | | | | |
| 94 | - | | | | |

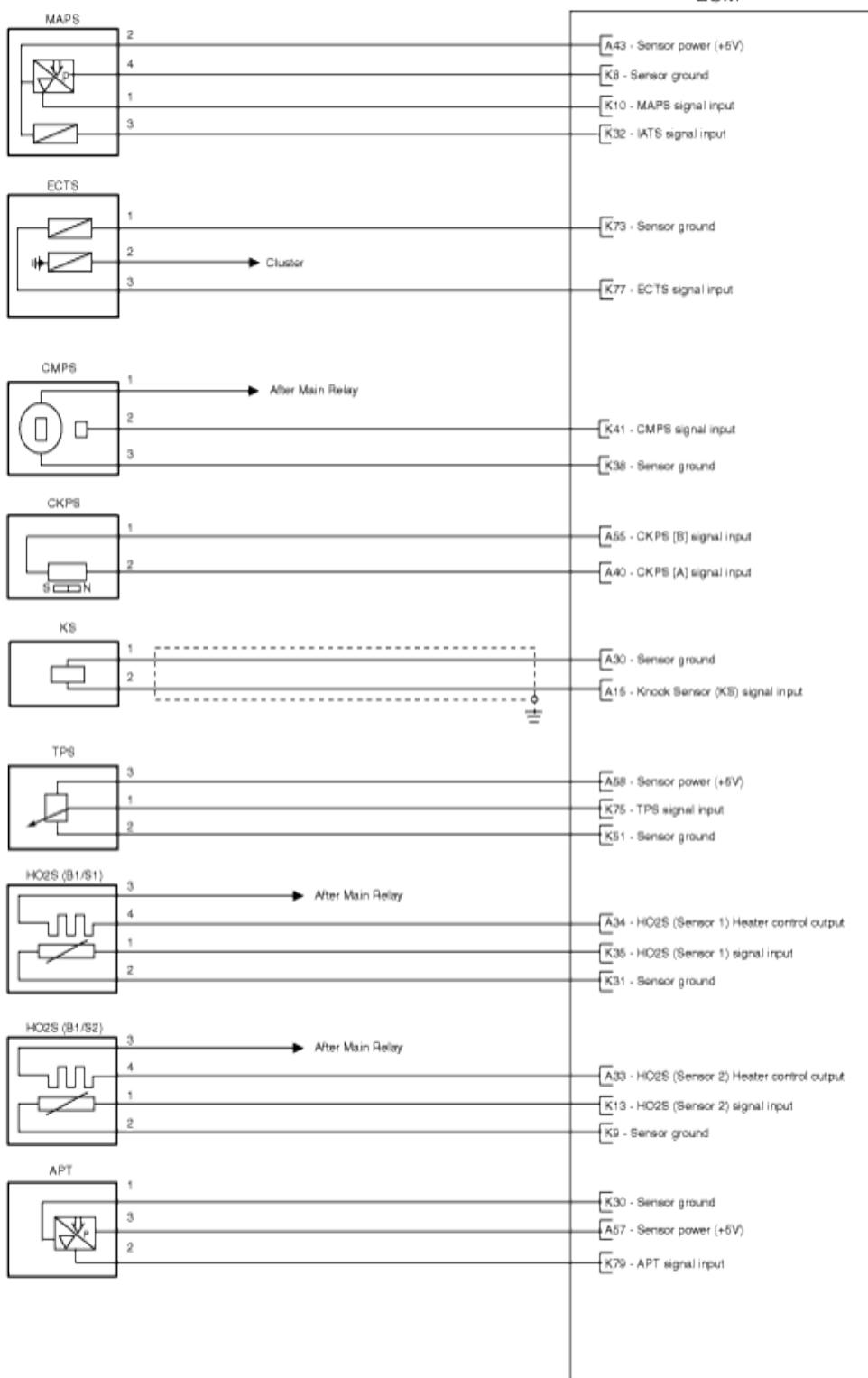
Circuit Diagram

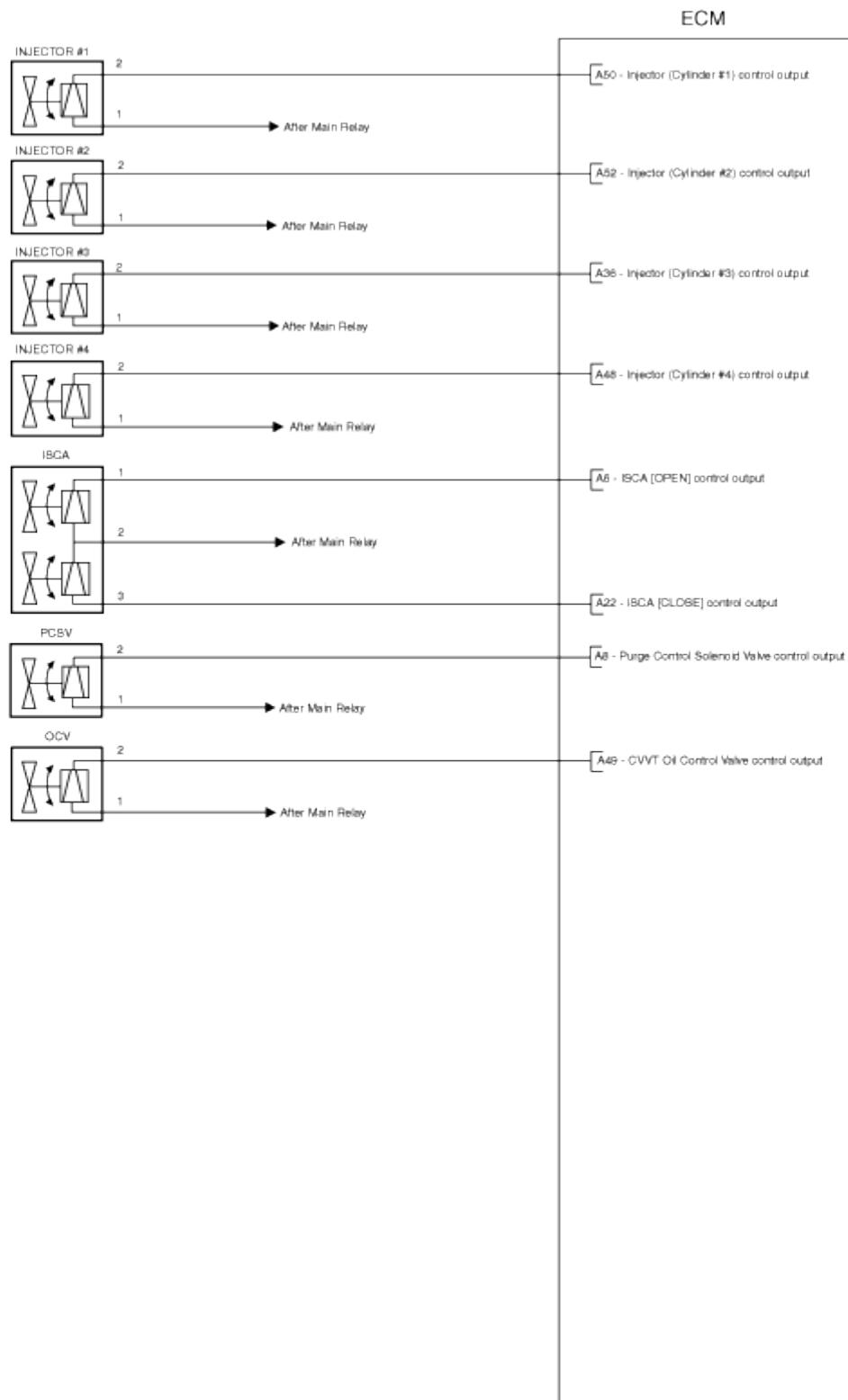
[A/T]

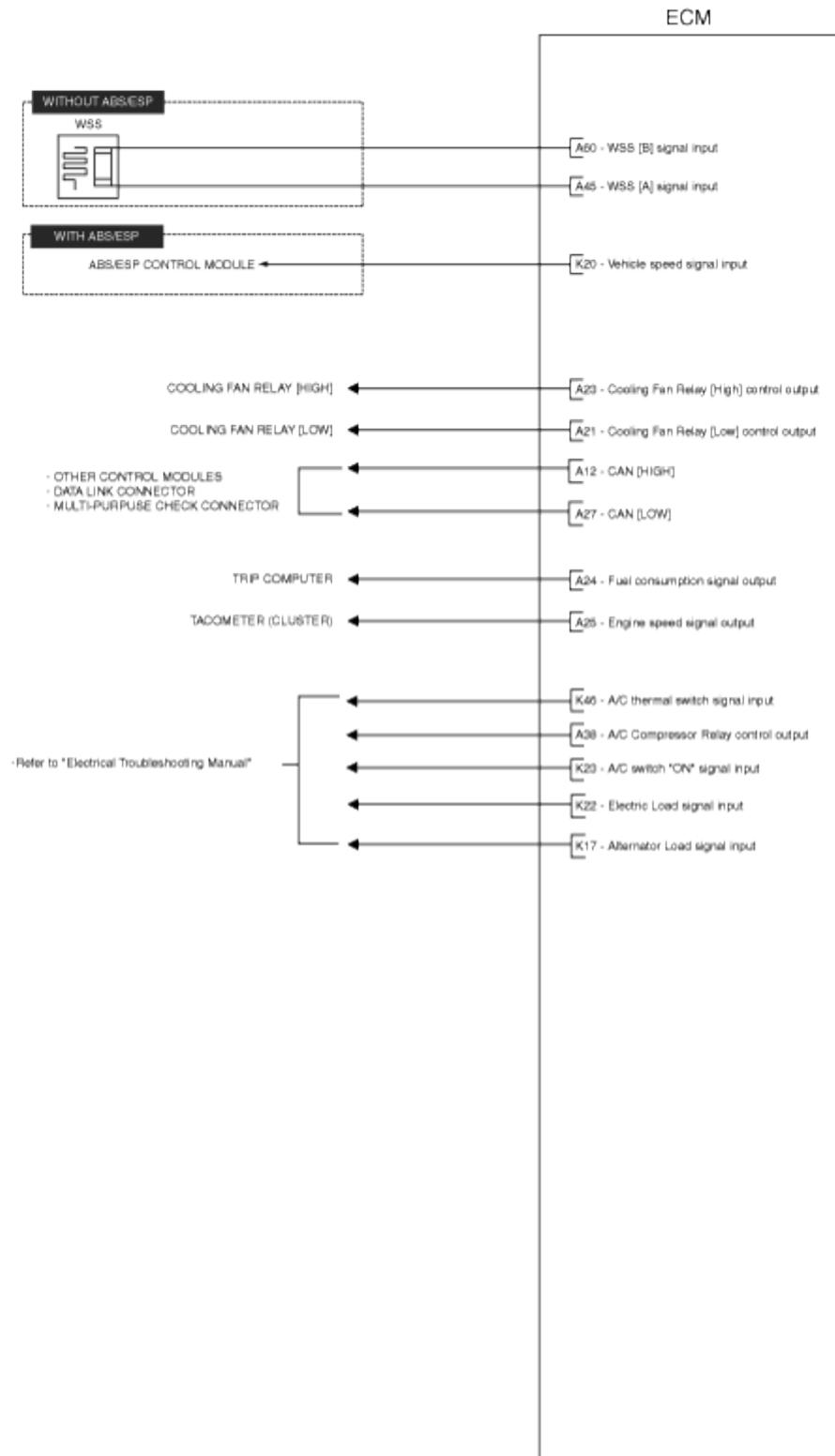
ECM



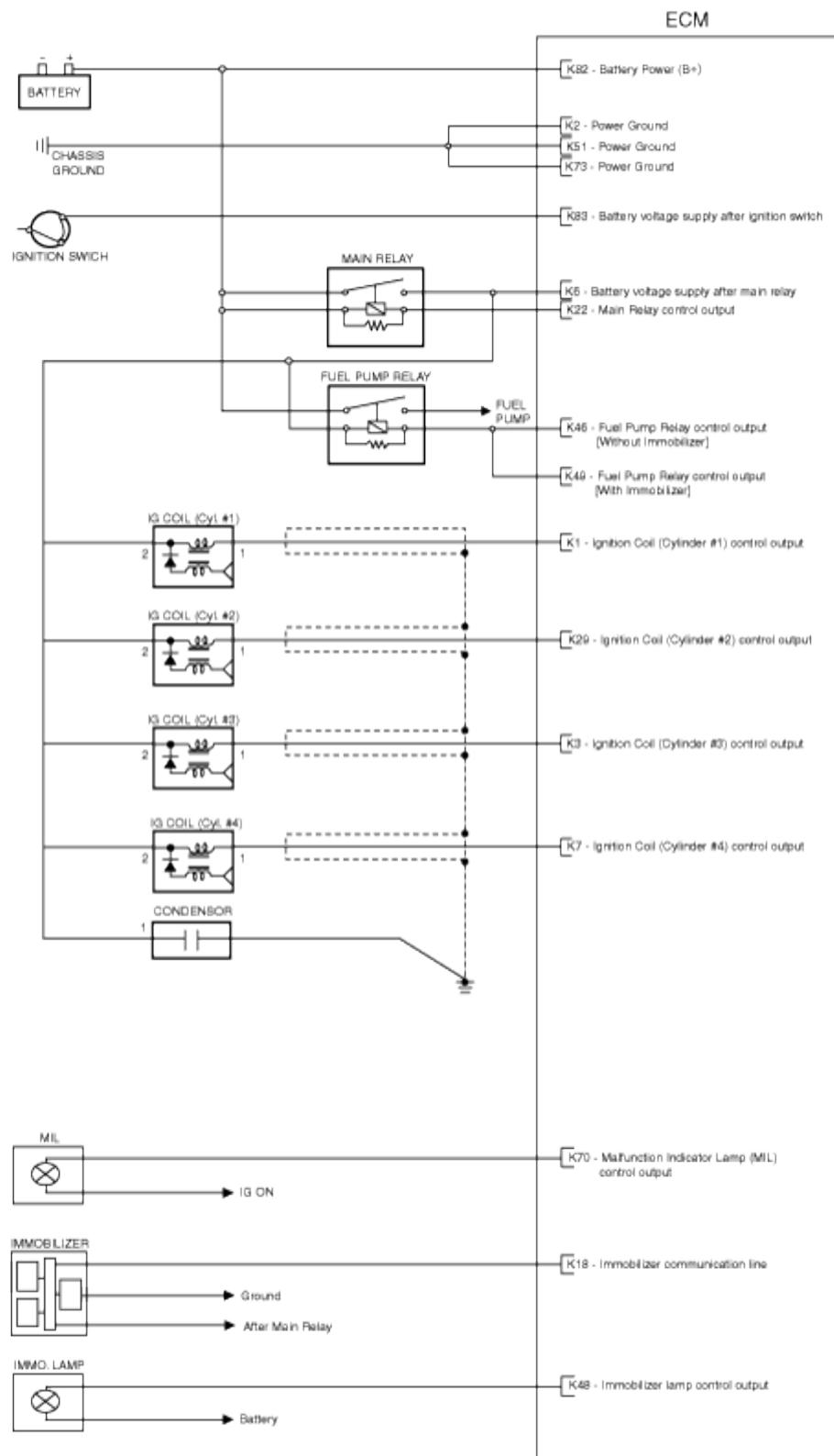
ECM



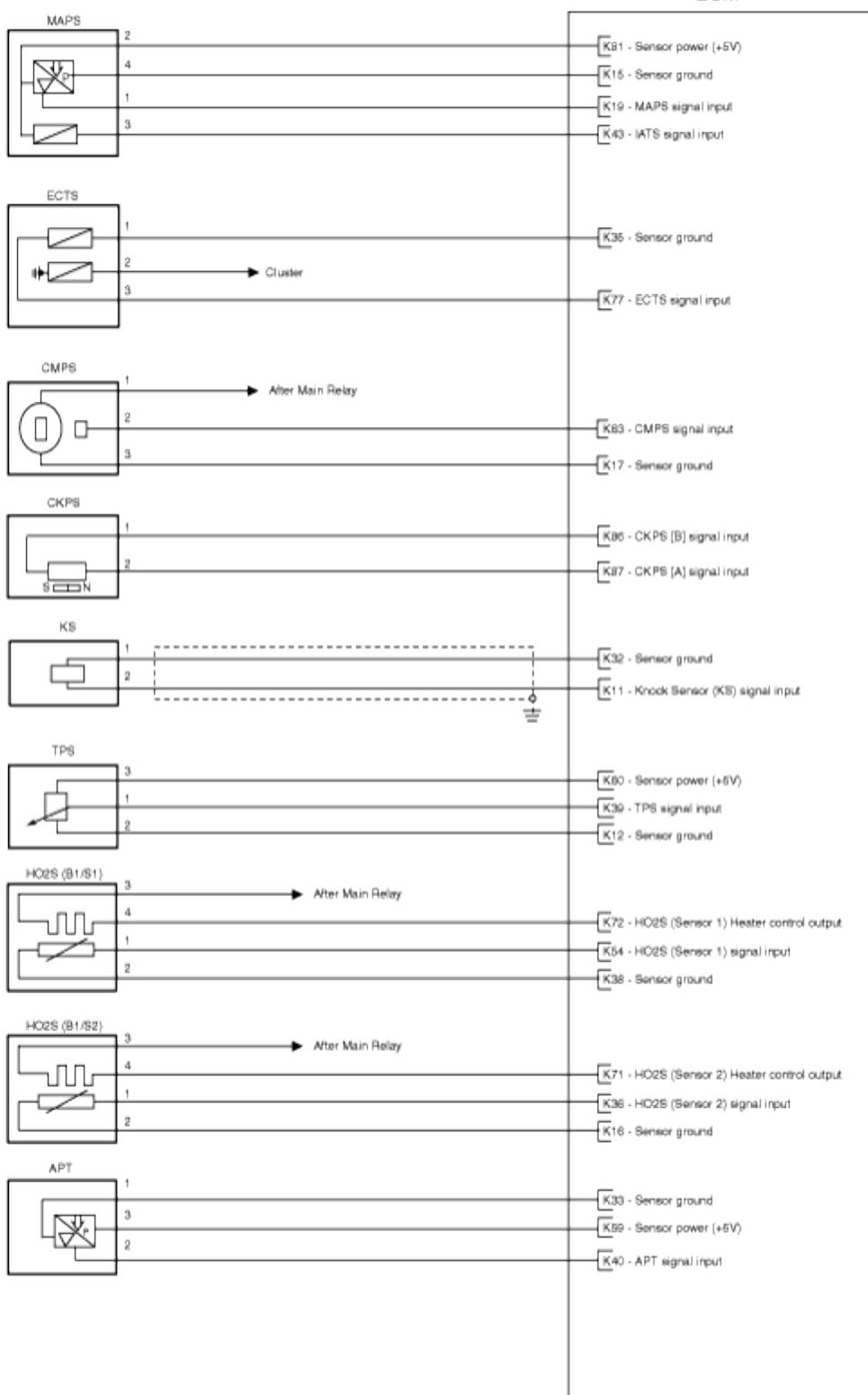


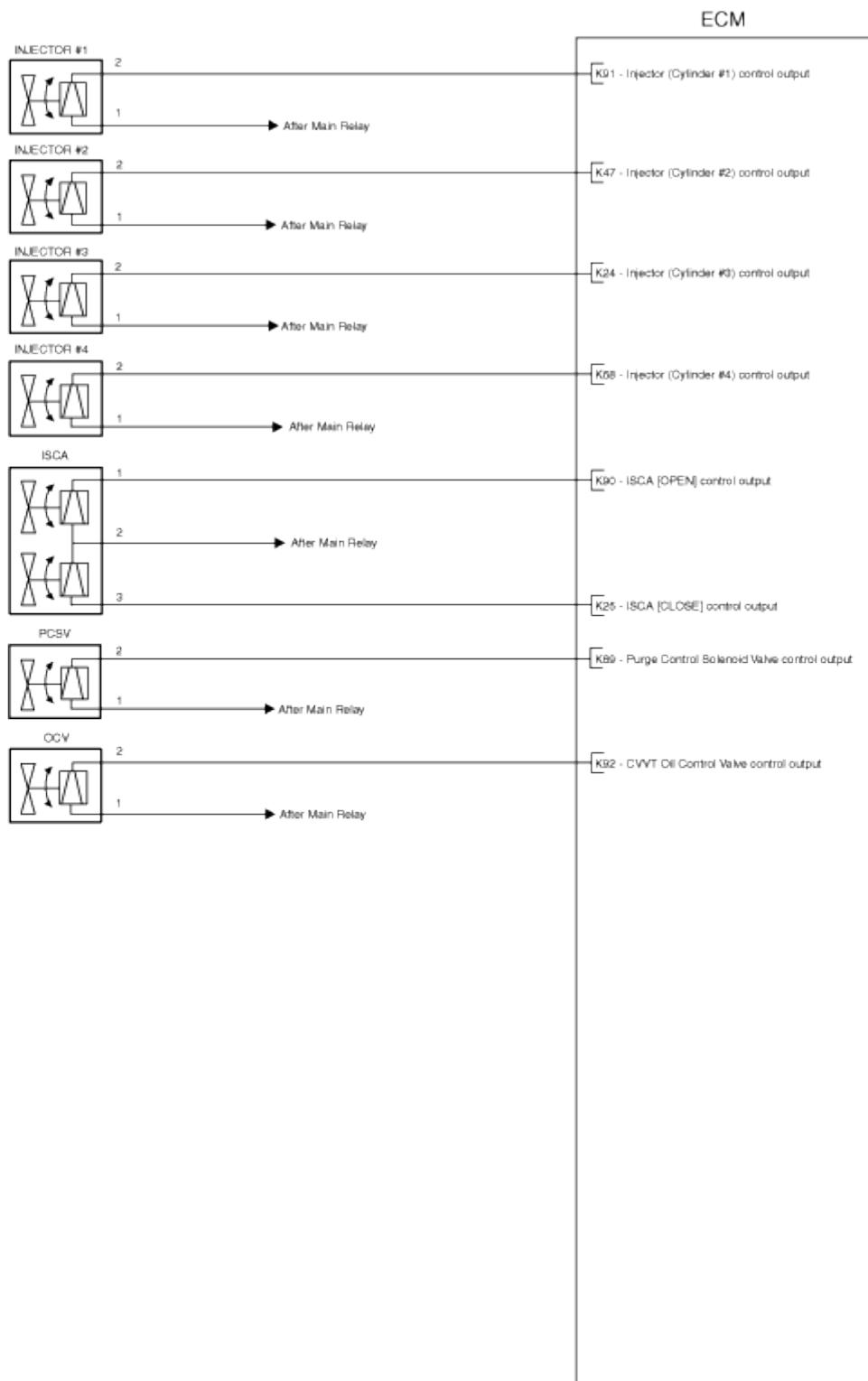


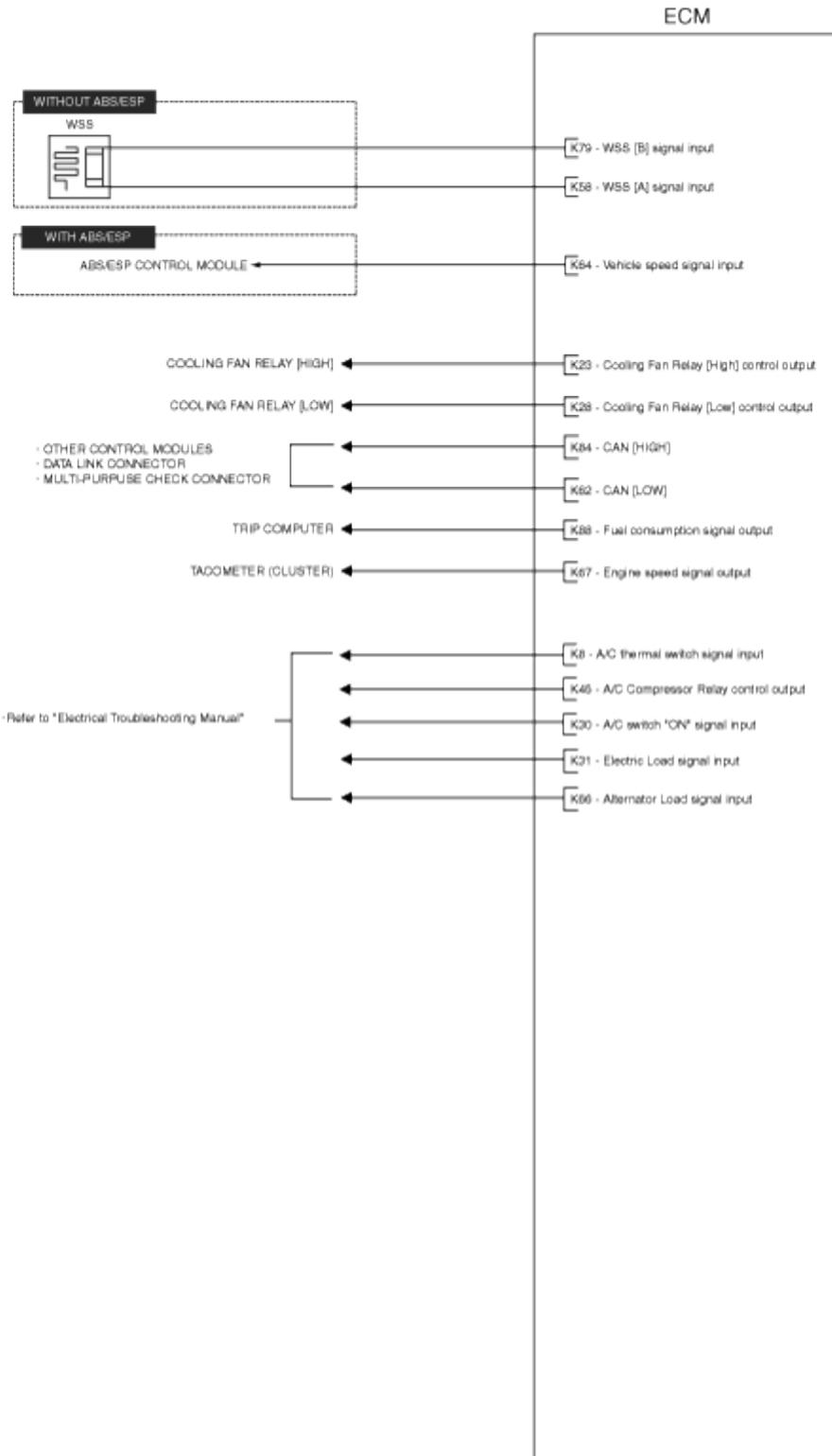
[M/T]



ECM







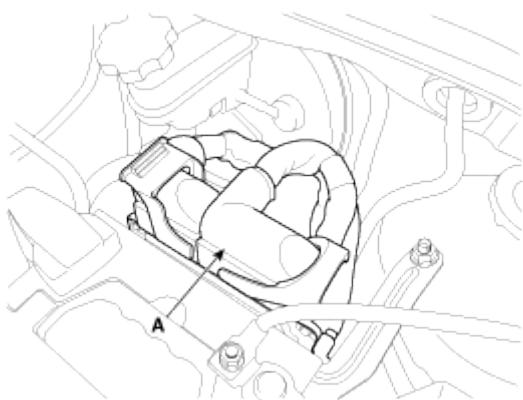
11.2.3.2. Repair procedures

Removal

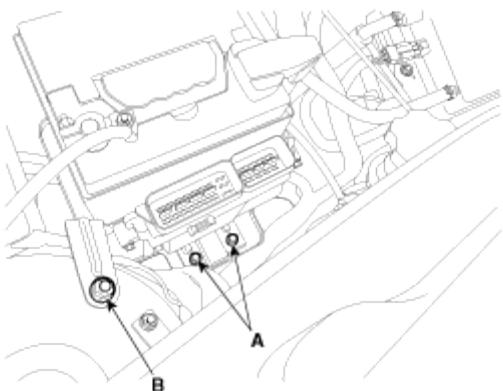
CAUTION

- In the case of the vehicle equipped with immobilizer, perform "Key Teaching" procedure together (Refer to "Immobilizer" in BE group).

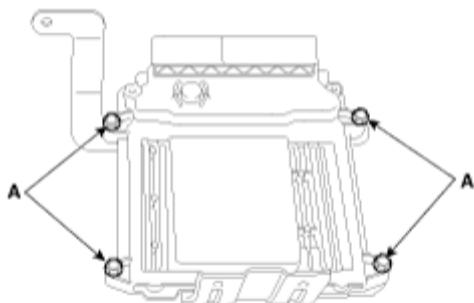
1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Disconnect the ECM connector (A).



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



4. Remove the installation bolts (A), and then remove the ECM from the bracket.



Installation

CAUTION

- In the case of the vehicle equipped with immobilizer, perform "Key Teaching" procedure together (Refer to "Immobilizer" in BE group).

Installation is reverse of removal.

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

ECM bracket installation bolt: 19.6 ~ 29.4 N.m (2.0 ~ 3.0 kgf.m, 14.5 ~ 21.7 lb-ft)

ECM bracket installation nut: 6.9 ~ 10.8 N.m (0.7 ~ 1.1 kgf.m, 5.1 ~ 8.0 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, replace the ECM with a new one, and then check the vehicle again. If the vehicle operates normally then the problem was likely with the ECM.
4. RE-TEST THE ORIGINAL ECM : Install the original ECM (may be broken) into a known-good vehicle and check the vehicle. If the problem occurs again, replace the original ECM with a new one. If problem does not occur, this is intermittent problem (Refer to Intermittent Problem Procedure in Basic Inspection Procedure)

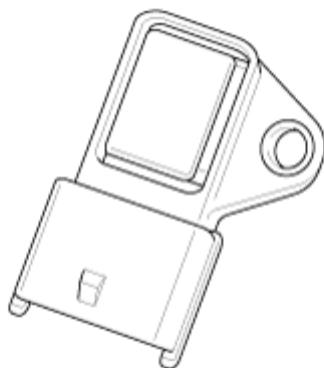
11.2.4. Manifold Absolute Pressure Sensor (MAP)

11.2.4.1. 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.

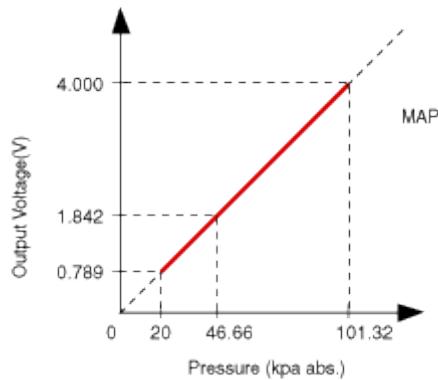
The MAPS consists of a piezo-electric element and a hybrid IC amplifying the element output signal. The element is silicon diaphragm type and adapts pressure sensitive variable resistor effect of semi-conductor. Because 100% vacuum and the manifold pressure apply to both sides of the sensor respectively, this sensor can output analog signal by using the silicon variation proportional to pressure change.



11.2.4.2. Specifications

Specification

| Pressure (kPa) | Output Voltage (V) |
|----------------|--------------------|
| 20.0 | 0.79 |
| 46.66 | 1.84 |
| 101.32 | 4.0 |

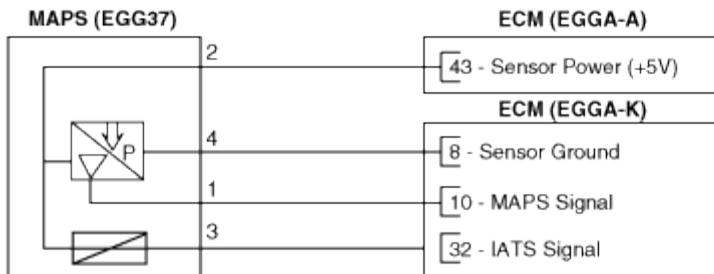


11.2.4.3. Schematic Diagrams

Circuit Diagram

[AT]

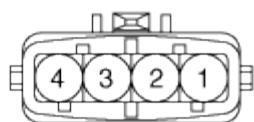
[CIRCUIT DIAGRAM]



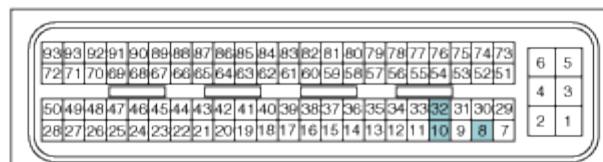
[CONNECTION INFORMATION]

| Terminal | Connected to | Function |
|----------|-----------------|--------------------|
| 1 | ECM EGGA-K (10) | MAPS Signal |
| 2 | ECM EGGA-A (43) | Sensor Power (+5V) |
| 3 | ECM EGGA-K (32) | IATS Signal |
| 4 | ECM EGGA-K (8) | Sensor Ground |

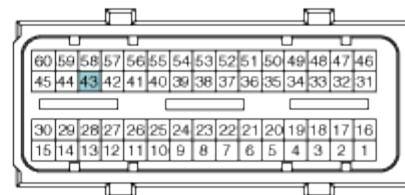
[HARNESS CONNECTOR]



EGG37
MAPS



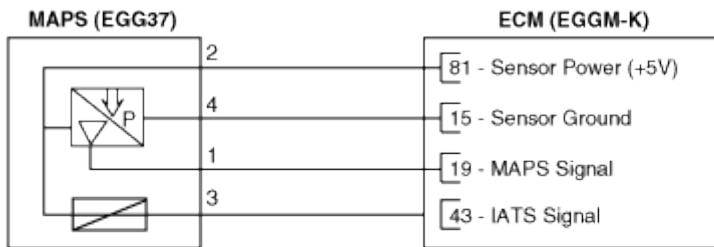
EGGA-K



EGGA-A

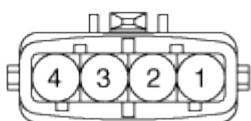
[M/T]

[CIRCUIT DIAGRAM]

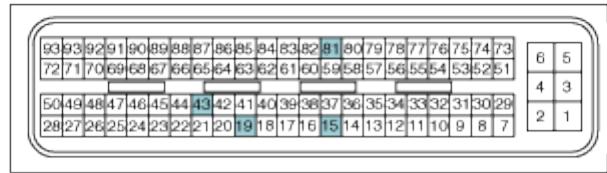


[CONNECTION INFORMATION]

[HARNESS CONNECTOR]



EGG37
MAPS



EGGM-K
ECM

11.2.4.4. Repair procedures

Inspection

1. Connect a scan tool on Data Link Connector (DLC).
2. Check MAPS output voltage at idle and IG ON.

| Condition | Output Voltage (V) |
|-----------|--------------------|
| IG ON | 3.9 ~ 4.1 |
| Idle | 0.8 ~ 1.6 |

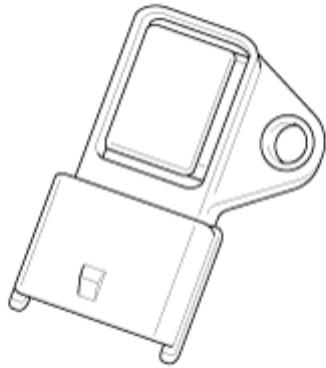
11.2.5. Intake Air Temperature Sensor (IATS)

11.2.5.1. Description and Operation

Description

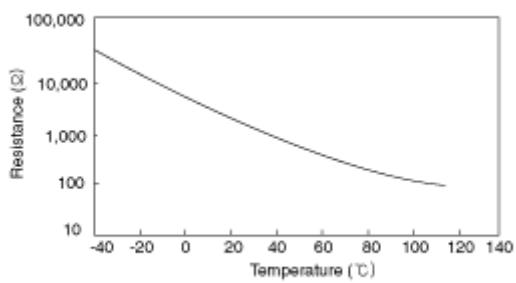
Intake Air Temperature Sensor (IATS) is included inside Manifold Absolute Pressure Sensor and detects the intake air temperature.

To calculate precise air quantity, correction of the air temperature is needed because air density varies according to the temperature. So the ECM uses not only MAPS signal but also IATS signal. This sensor has a Negative Temperature Coefficient (NTC) and its resistance is in inverse proportion to the temperature.



11.2.5.2. Specifications

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

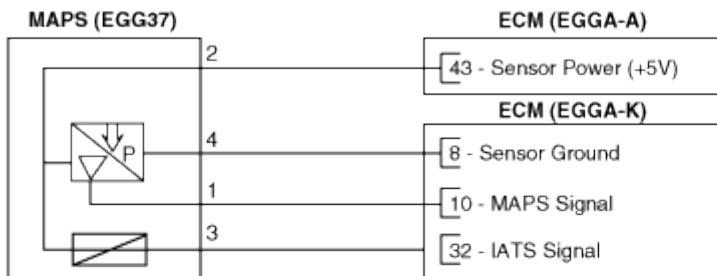


11.2.5.3. Schematic Diagrams

Circuit Diagram

[A/T]

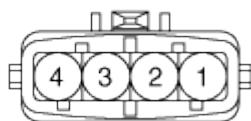
[CIRCUIT DIAGRAM]



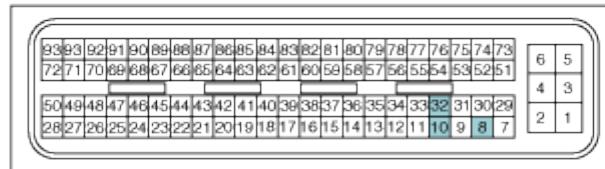
[CONNECTION INFORMATION]

| Terminal | Connected to | Function |
|----------|-----------------|--------------------|
| 1 | ECM EGGA-K (10) | MAPS Signal |
| 2 | ECM EGGA-A (43) | Sensor Power (+5V) |
| 3 | ECM EGGA-K (32) | IATS Signal |
| 4 | ECM EGGA-K (8) | Sensor Ground |

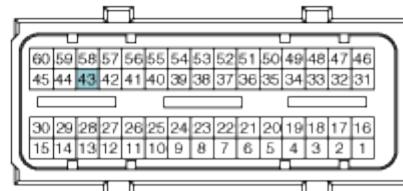
[HARNESS CONNECTOR]



EGG37
MAPS



EGGA-K

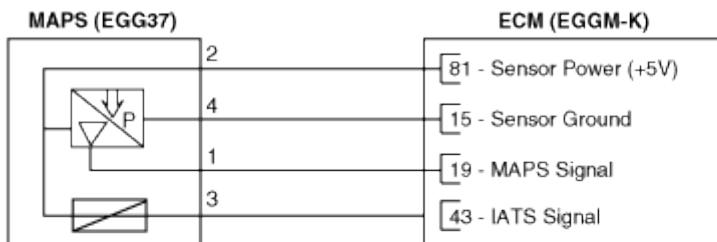


EGGA-A

ECM

[M/T]

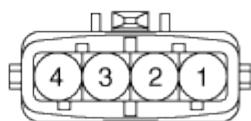
[CIRCUIT DIAGRAM]



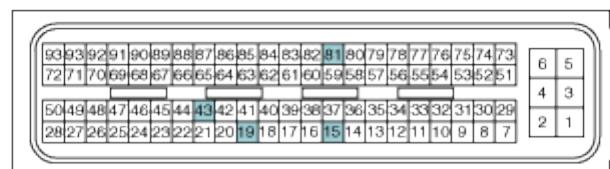
[CONNECTION INFORMATION]

| Terminal | Connected to | Function |
|----------|-----------------|--------------------|
| 1 | ECM EGGM-K (19) | MAPS Signal |
| 2 | ECM EGGM-K (81) | Sensor Power (+5V) |
| 3 | ECM EGGM-K (43) | IATS Signal |
| 4 | ECM EGGM-K (15) | Sensor Ground |

[HARNESS CONNECTOR]



EGG37
MAPS



EGGM-K
ECM

11.2.5.4. Repair procedures

Inspection

1. Turn ignition switch OFF.
2. Disconnect IATS connector.
3. Measure resistance between IATS terminals 3 and 4.
4. Check that the resistance is within the specification.

Specification: Refer to "Specification"

11.2.6. Engine Coolant Temperature Sensor (ECTS)

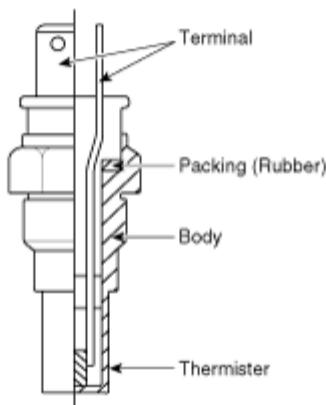
11.2.6.1. Description and Operation

Description

Engine Coolant Temperature Sensor (ECTS) is located in the engine coolant passage of the cylinder head for detecting the engine coolant temperature. The ECTS uses a thermistor whose resistance changes with the temperature.

The electrical resistance of the ECTS decreases as the temperature increases, and increases as the temperature decreases. The reference +5V is supplied to the ECTS via a resistor in the ECM. That is, the resistor in the ECM and the thermistor in the ECTS are connected in series. When the resistance value of the thermistor in the ECTS changes according to the engine coolant temperature, the output voltage also changes.

During cold engine operation, the ECM increases the fuel injection duration and controls the ignition timing using the information of engine coolant temperature to avoid engine stalling and improve drivability.



11.2.6.2. Specifications

Specification

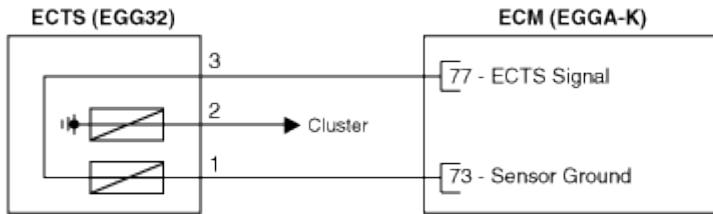
| Temperature [°C(°F)] | Resistance(kΩ) |
|----------------------|----------------|
| -40(-40) | 48.14 |
| -20(-4) | 14.13 ~ 16.83 |
| 0(32) | 5.79 |
| 20(68) | 2.31 ~ 2.59 |
| 40(104) | 1.15 |
| 60(140) | 0.59 |
| 80(176) | 0.32 |

11.2.6.3. Schematic Diagrams

Circuit Diagram

[A/T]

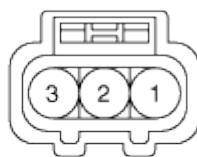
[CIRCUIT DIAGRAM]



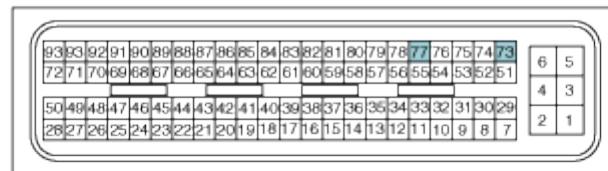
[CONNECTION INFORMATION]

| Terminal | Connected to | Function |
|----------|-----------------|---------------|
| 1 | ECM EGGA-K (73) | Sensor Ground |
| 2 | Cluster | |
| 3 | ECM EGGA-K (77) | ECTS Signal |

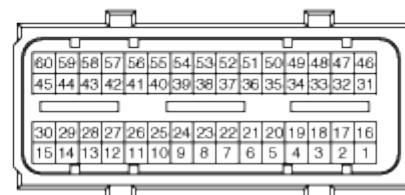
[HARNESS CONNECTOR]



EGG32
ECTS



EGGA-K

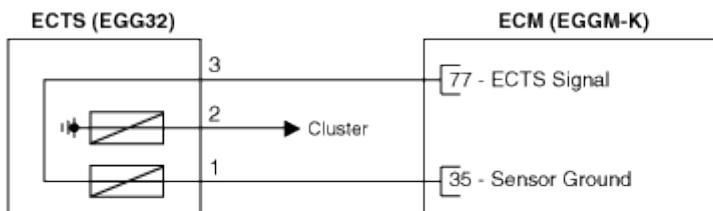


EGGA-A

ECM

[M/T]

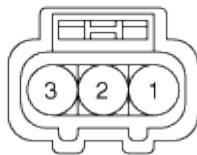
[CIRCUIT DIAGRAM]



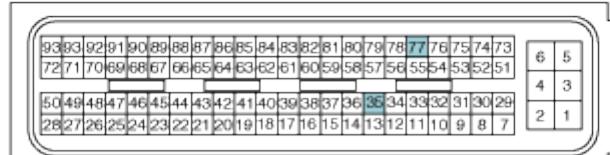
[CONNECTION INFORMATION]

| Terminal | Connected to | Function |
|----------|-----------------|---------------|
| 1 | ECM EGGM-K (35) | Sensor Ground |
| 2 | Cluster | |
| 3 | ECM EGGM-K (77) | ECTS Signal |

[HARNESS CONNECTOR]



EGG32
ECTS



EGGM-K

ECM

11.2.6.4. Repair procedures

Inspection

- Turn ignition switch OFF.
- Disconnect ECTS connector.

3. Remove the ECTS.
4. After immersing the thermistor of the sensor into engine coolant, measure resistance between ECTS terminals 1 and 3.
5. Check that the resistance is within the specification.

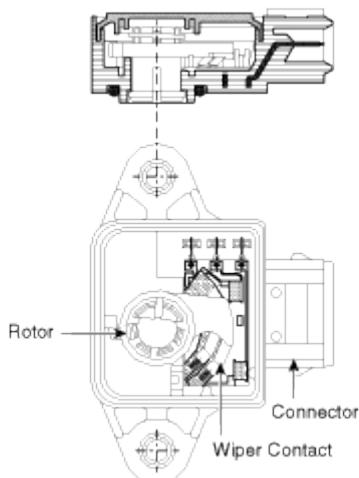
Specification: Refer to "Specification"

11.2.7. Throttle Position Sensor (TPS)

11.2.7.1. Description and Operation

Description

The Throttle Position Sensor (TPS) is mounted on the throttle body and detects the opening angle of the throttle plate. The TPS has a variable resistor (potentiometer) which is changed according to the throttle angle. During acceleration, the TPS resistance between the reference +5V and the signal terminal decreases and output voltage increases; during deceleration, the TPS resistance increases and TPS output voltage decreases. The TPS output voltage will vary from 0.25~0.9V at closed throttle to minimum 4.0V at wide-open throttle. The ECM determines operating conditions such as idle (closed throttle), part load, acceleration / deceleration, and wide-open throttle by using the TPS signal. Also the ECM uses the Manifold Absolute Pressure Sensor (MAPS) signal along with the TPS signal to adjust fuel injection duration and ignition timing.



11.2.7.2. Specifications

Specification

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

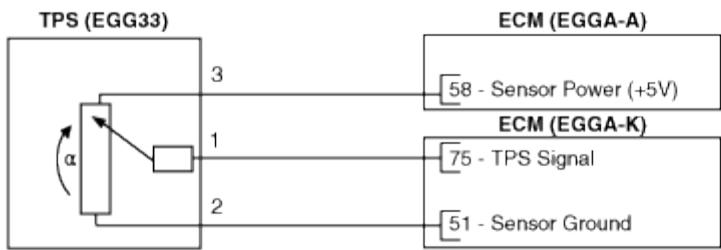
| Item | Specification |
|-----------------------|------------------------|
| Sensor Resistance(kΩ) | 1.6 ~ 2.4 [20°C(68°F)] |

11.2.7.3. Schematic Diagrams

Circuit Diagram

[A/T]

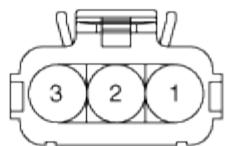
[CIRCUIT DIAGRAM]



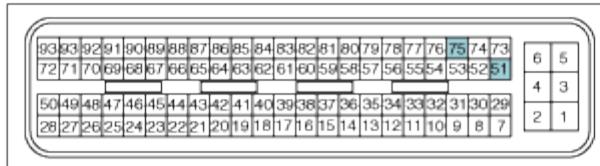
[CONNECTION INFORMATION]

| Terminal | Connected to | Function |
|----------|-----------------|--------------------|
| 1 | ECM EGGA-K (75) | TPS Signal |
| 2 | ECM EGGA-K (51) | Sensor Ground |
| 3 | ECM EGGA-A (58) | Sensor Power (+5V) |

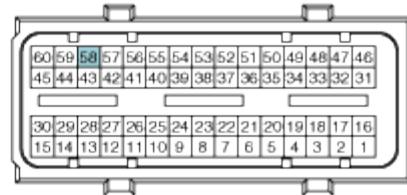
[HARNESS CONNECTOR]



EGG33
TPS



EGGA-K

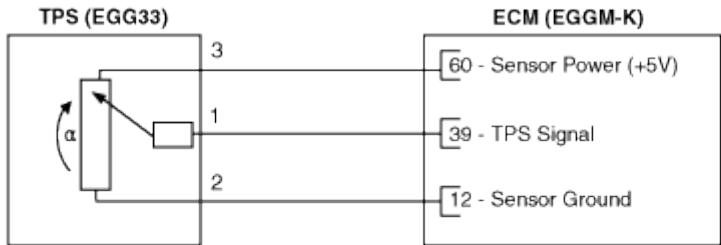


EGGA-A

ECM

[M/T]

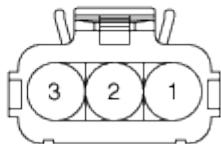
[CIRCUIT DIAGRAM]



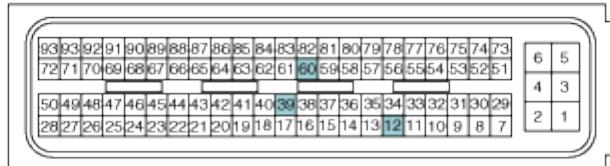
[CONNECTION INFORMATION]

| Terminal | Connected to | Function |
|----------|-----------------|--------------------|
| 1 | ECM EGGM-K (39) | TPS Signal |
| 2 | ECM EGGM-K (12) | Sensor Ground |
| 3 | ECM EGGM-K (60) | Sensor Power (+5V) |

[HARNESS CONNECTOR]



EGG33
TPS



EGGM-K
ECM

11.2.7.4. Repair procedures

Inspection

1. Connect a scan tool on the Data Link Connector (DLC).
2. Start engine and check output voltages of TPS at C.T and W.O.T.

Specification: Refer to “Specification”

3. Turn ignition switch OFF and disconnect the scan tool from the DLC.
4. Disconnect TPS connector and measure resistance between TPS terminals 2 and 3.

Specification: Refer to "Specification"

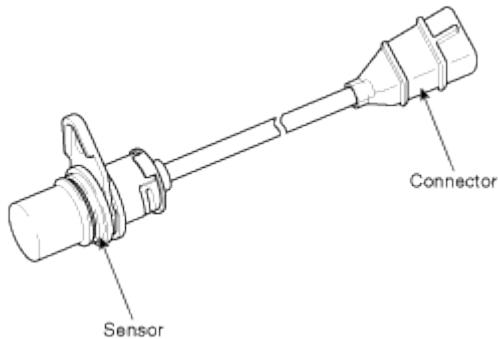
11.2.8. Crankshaft Position Sensor (CKPS)

11.2.8.1. Description and Operation

Description

Crankshaft Position Sensor (CKPS) detects the crankshaft position and is one of the most important sensors of the engine control system. If there is no CKPS signal input, the engine may stop because of CKPS signal missing. This sensor is installed on the cylinder block or the transaxle housing and generates alternating current by magnetic flux field which is made by the sensor and the target wheel when engine runs.

The target wheel consists of 58 slots and 2 missing slots on 360 degrees CA (Crank Angle).



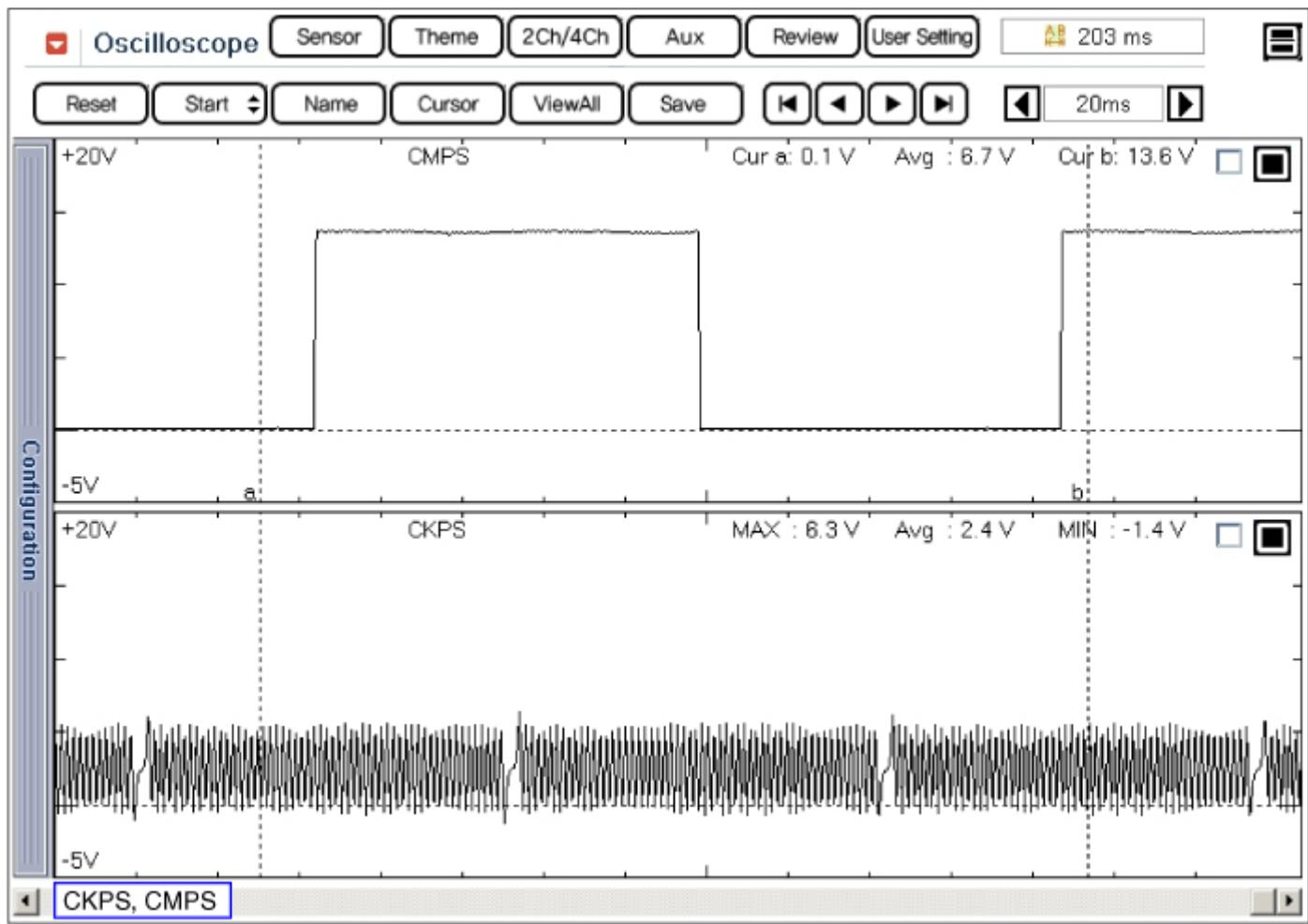
11.2.8.2. Specifications

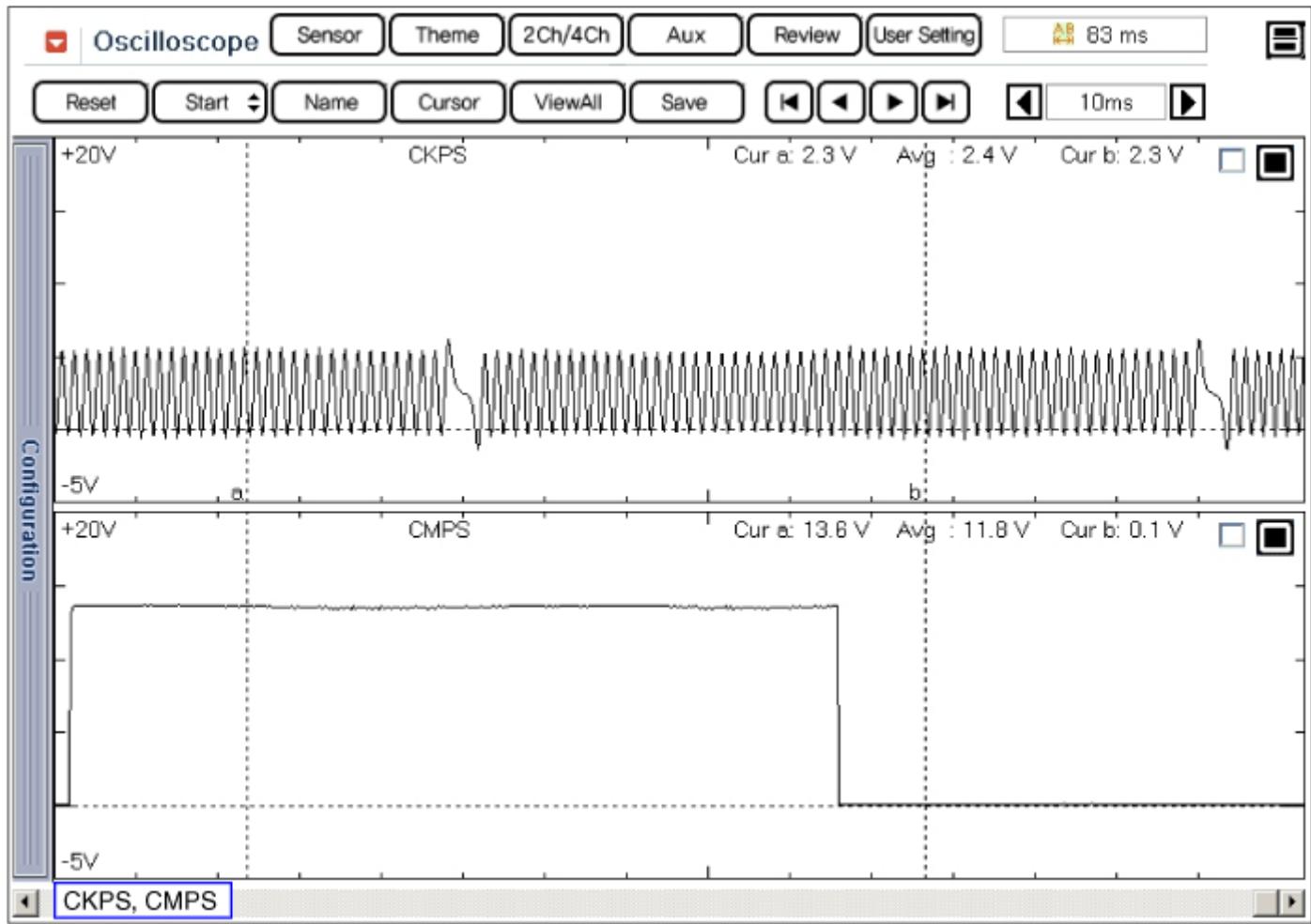
Specification

| Item | Specification |
|-----------------------------|-------------------------|
| Coil Resistance(Ω) | 774 ~ 946 [20°C (68°F)] |

11.2.8.3. Troubleshooting

Waveform



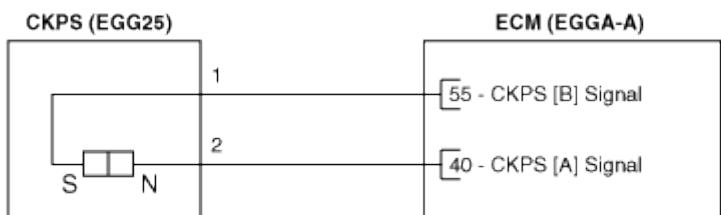


11.2.8.4. Schematic Diagrams

Circuit Diagram

[A/T]

[CIRCUIT DIAGRAM]



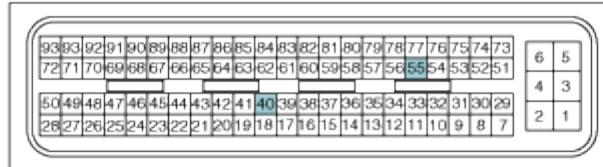
[CONNECTION INFORMATION]

| Terminal | Connected to | Function |
|----------|-----------------|-----------------|
| 1 | ECM EGGA-A (55) | CKPS [B] Signal |
| 2 | ECM EGGA-A (40) | CKPS [A] Signal |

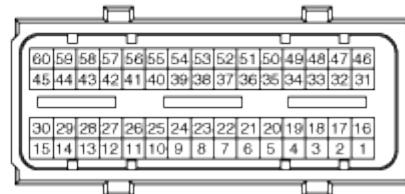
[HARNESS CONNECTOR]



EGG25
CKPS



EGGA-K

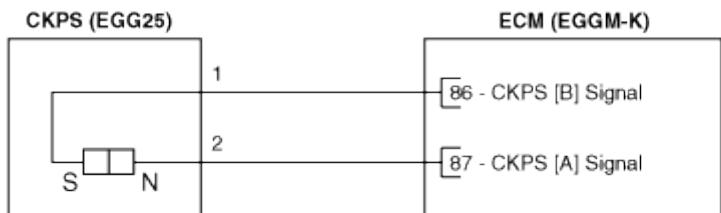


EGGA-A

ECM

[M/T]

[CIRCUIT DIAGRAM]



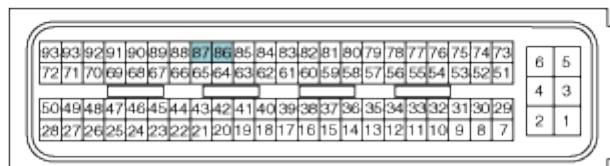
[CONNECTION INFORMATION]

| Terminal | Connected to | Function |
|----------|-----------------|-----------------|
| 1 | ECM EGGM-K (86) | CKPS [B] Signal |
| 2 | ECM EGGM-K (87) | CKPS [A] Signal |

[HARNESS CONNECTOR]



EGG25
CKPS



EGGM-K
ECM

11.2.8.5. Repair procedures

Inspection

- Check signal waveform of CKPS and CMPS using a scan tool.

Specification: Refer to "Waveform"

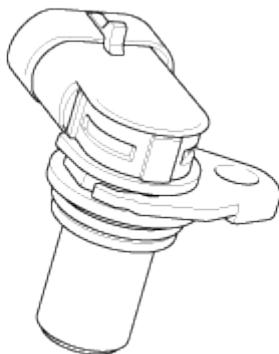
11.2.9. Camshaft Position Sensor (CMPS)

11.2.9.1. Description and Operation

Description

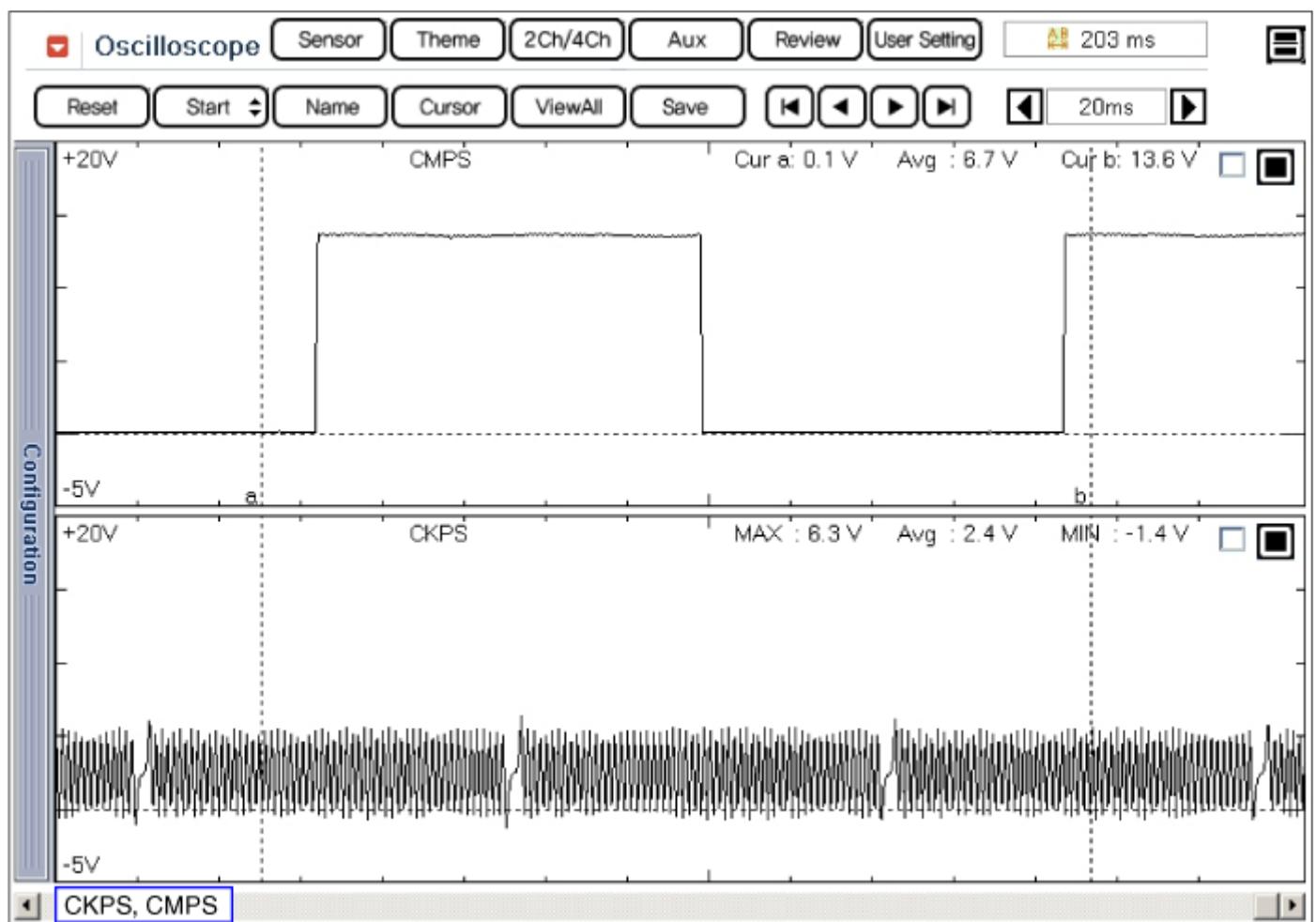
Camshaft Position Sensor (CMPS) is a hall sensor and detects the camshaft position by using a hall element. It is related with Crankshaft Position Sensor (CKPS) and detects the piston position of each cylinder which the CKPS can't detect.

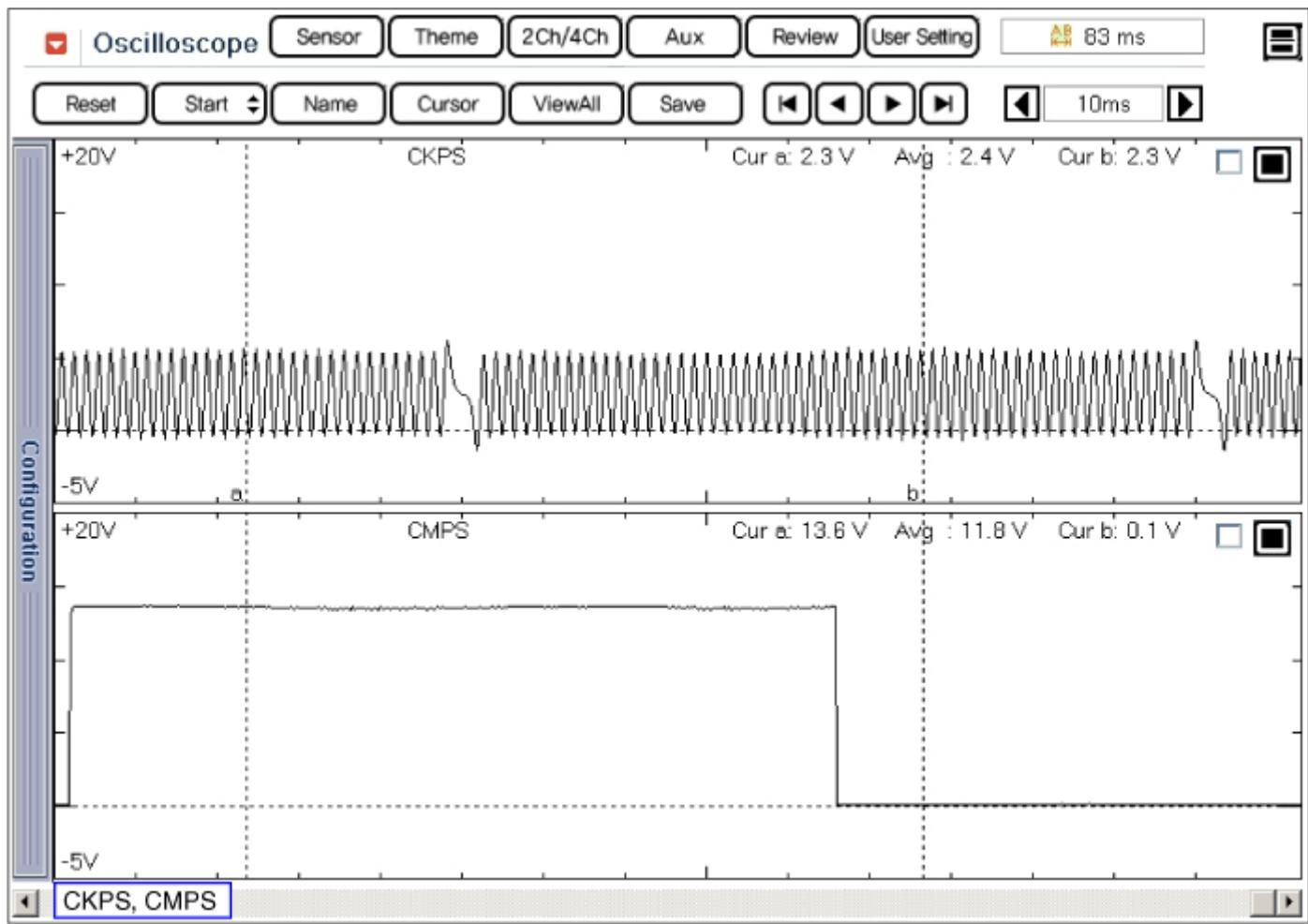
The CMPS is installed on engine head cover and uses a target wheel installed on the camshaft. This sensor has a hall-effect IC which output voltage changes when magnetic field is made on the IC with current flow.



11.2.9.2. Troubleshooting

Waveform



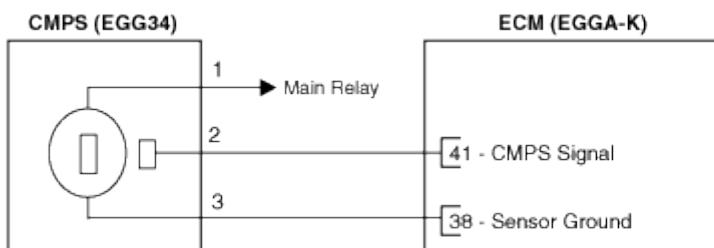


11.2.9.3. Schematic Diagrams

Circuit Diagram

[A/T]

[CIRCUIT DIAGRAM]



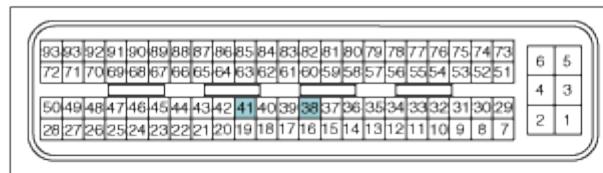
[CONNECTION INFORMATION]

| Terminal | Connected to | Function |
|----------|-----------------|--------------------|
| 1 | Main Relay | Battery Power (B+) |
| 2 | ECM EGGA-K (41) | CMPS Signal |
| 3 | ECM EGGA-K (38) | Sensor Ground |

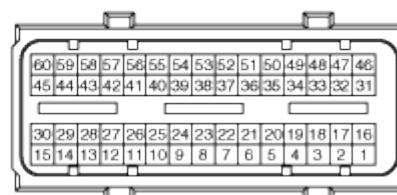
[HARNESS CONNECTOR]



EGG34
CMPS



EGGA-K

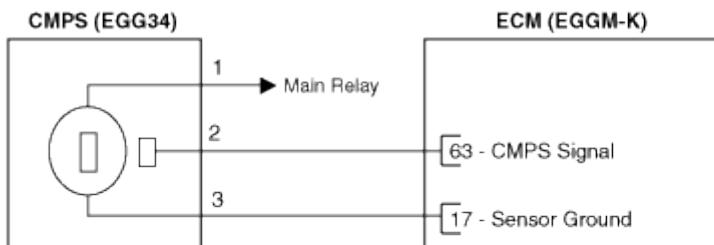


EGGA-A

ECM

[M/T]

[CIRCUIT DIAGRAM]



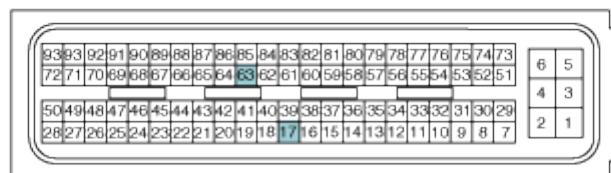
[CONNECTION INFORMATION]

| Terminal | Connected to | Function |
|----------|-----------------|--------------------|
| 1 | Main Relay | Battery Power (B+) |
| 2 | ECM EGGM-K (63) | CMPS Signal |
| 3 | ECM EGGM-K (17) | Sensor Ground |

[HARNESS CONNECTOR]



EGG34
CMPS



EGGM-K
ECM

11.2.9.4. Repair procedures

Inspection

- Check signal waveform of CKPS and CMPS using a scan tool.

Specification: Refer to "Waveform"

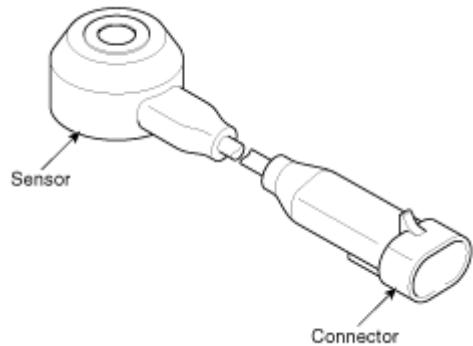
11.2.10. Knock Sensor (KS)

11.2.10.1. Description and Operation

Description

Knocking is a phenomenon characterized by undesirable vibration and noise and can cause engine damage. Knock Sensor (KS) is installed on the cylinder block and senses engine knocking.

When knocking occurs, the vibration from the cylinder block is applied as pressure to the piezoelectric element. At this time, this sensor transfers the voltage signal higher than the specified value to the ECM and the ECM retards the ignition timing. If the knocking disappears after retarding the ignition timing, the ECM will advance the ignition timing. This sequential control can improve engine power, torque and fuel economy.



11.2.10.2. Specifications

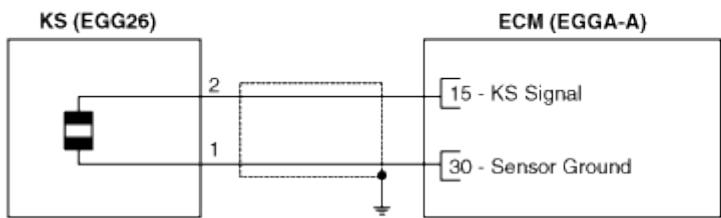
| Specification | |
|-----------------|---------------|
| Item | Specification |
| Capacitance(pF) | 950 ~ 1,350 |
| Resistance (MΩ) | 4.87 |

11.2.10.3. Schematic Diagrams

Circuit Diagram

[A/T]

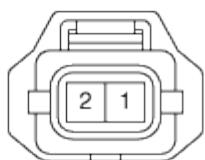
[CIRCUIT DIAGRAM]



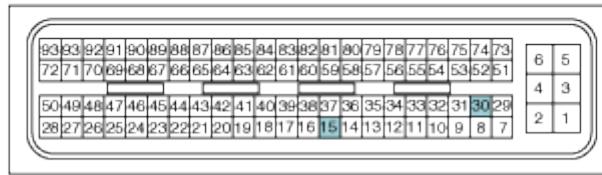
[CONNECTION INFORMATION]

| Terminal | Connected to | Function |
|----------|-----------------|---------------------|
| 1 | ECM EGGA-A (30) | Sensor Ground |
| 2 | ECM EGGA-A (15) | Knock Sensor Signal |

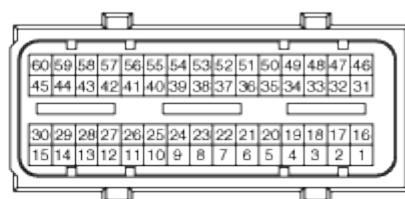
[HARNESS CONNECTOR]



EGG26
KNOCK SENSOR



EGGA-K

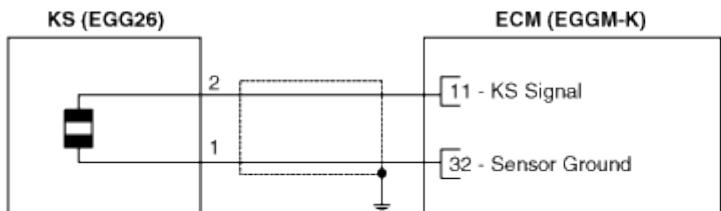


EGGA-A

ECM

[M/T]

[CIRCUIT DIAGRAM]



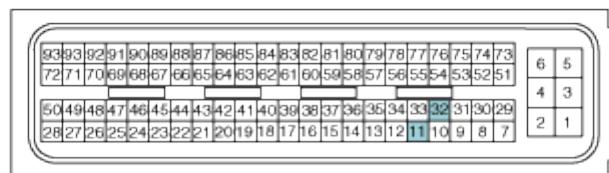
[CONNECTION INFORMATION]

| Terminal | Connected to | Function |
|----------|-----------------|---------------------|
| 1 | ECM EGGM-K (32) | Sensor Ground |
| 2 | ECM EGGM-K (11) | Knock Sensor Signal |

[HARNESS CONNECTOR]



EGG26
KNOCK SENSOR



EGGM-K
ECM

11.2.11. Heated Oxygen Sensor (HO2S)

11.2.11.1. Description and Operation

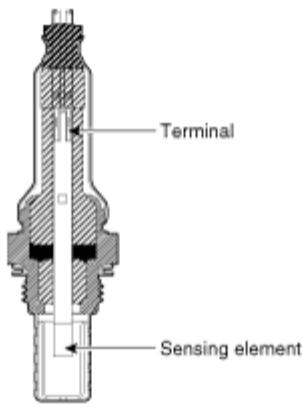
Description

Heated Oxygen Sensor (HO2S) consists of zirconium and alumina and is installed on upstream and downstream of the Manifold Catalytic Converter (MCC).

After it compares oxygen consistency of the atmosphere with the exhaust gas, it transfers the corresponding voltage signal to the ECM. When A/F ratio is rich or lean, it generates approximately +1V or 0V respectively.

In order that this sensor normally operates, the temperature of the sensor tip must be higher than predetermined

temperature. So it has a heater which is controlled by the ECM duty signal. When the exhaust gas temperature is lower than the specified value, the heater warms the sensor tip.



11.2.11.2. Specifications

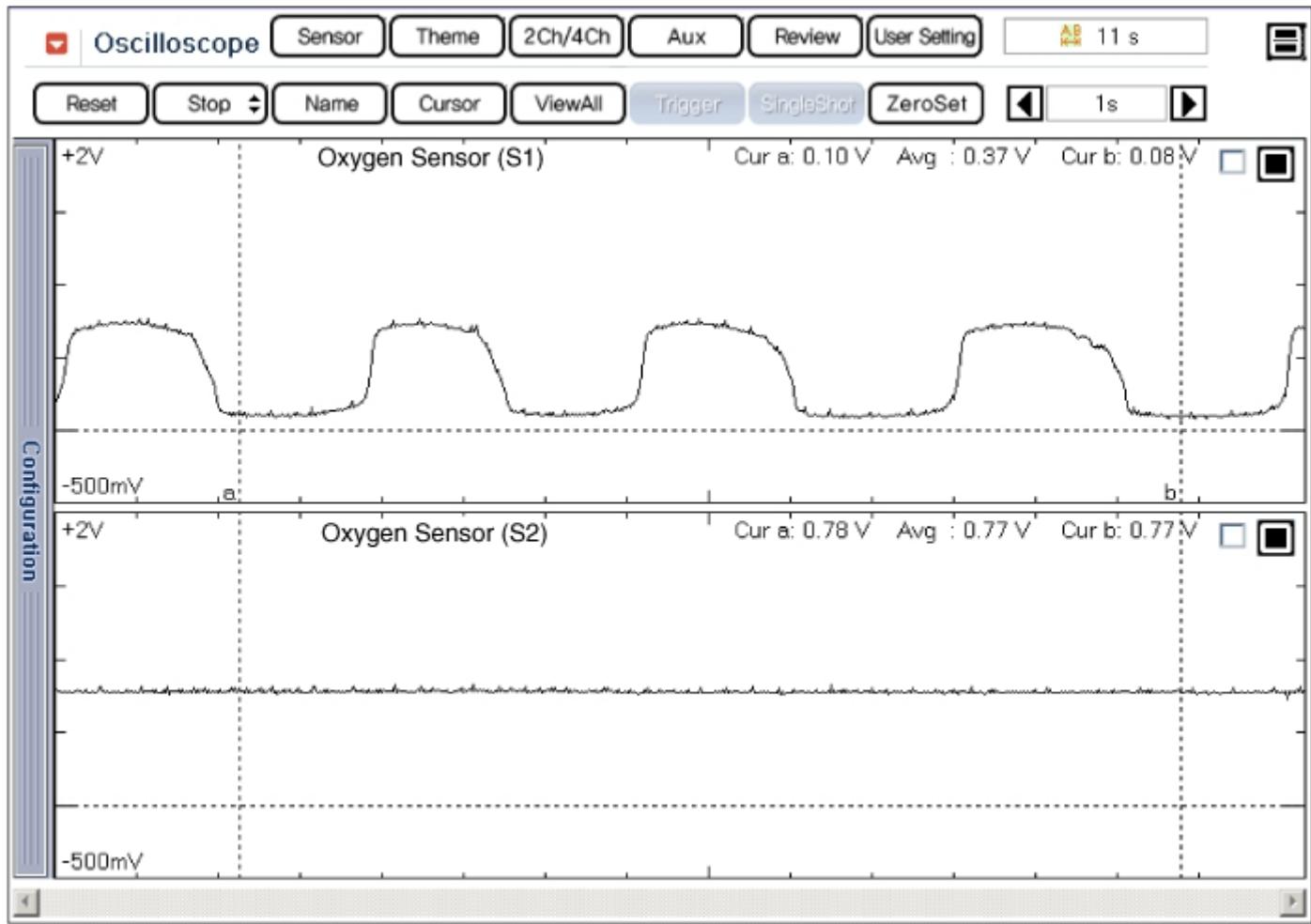
Specification

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

| Item | Specification |
|-------------------------------|---------------------------|
| Heater Resistance(Ω) | Approx. 9.0 [20°C (68°F)] |

11.2.11.3. Troubleshooting

Waveform

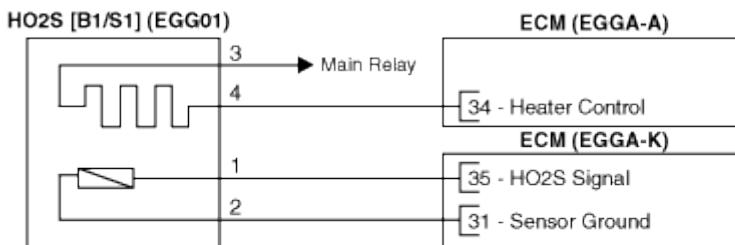


11.2.11.4. Schematic Diagrams

Circuit Diagram

[A/T]

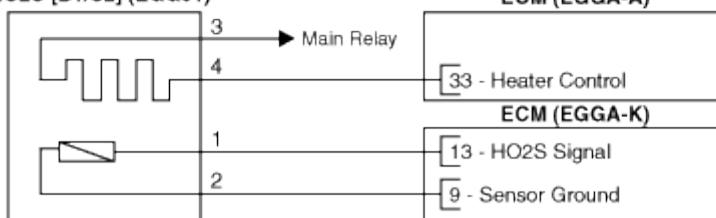
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

| Terminal | Connected to | Function |
|----------|-----------------|---------------------|
| 1 | ECM EGGA-K (35) | HO2S [B1/S1] Signal |
| 2 | ECM EGGA-K (31) | Sensor Ground |
| 3 | Main Relay | Battery Power (B+) |
| 4 | ECM EGGA-A (34) | Heater Control |

HO2S [B1/S2] (EGG31)



HO2S [B1/S2] (EGG31)

| Terminal | Connected to | Function |
|----------|-----------------|---------------------|
| 1 | ECM EGGA-K (13) | HO2S [B1/S2] Signal |
| 2 | ECM EGGA-K (9) | Sensor Ground |
| 3 | Main Relay | Battery Power (B+) |
| 4 | ECM EGGA-A (33) | Heater Control |

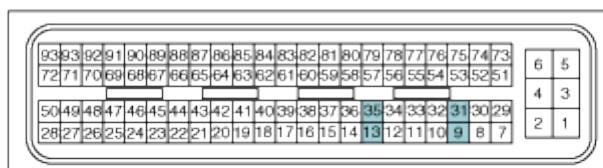
[HARNESS CONNECTOR]



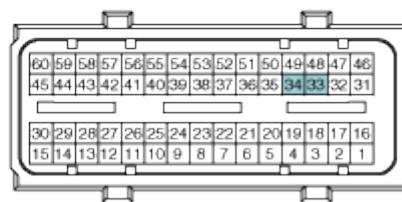
EGG01
HO2S [B1/S1]



EGG31
HO2S [B1/S2]



EGGA-K

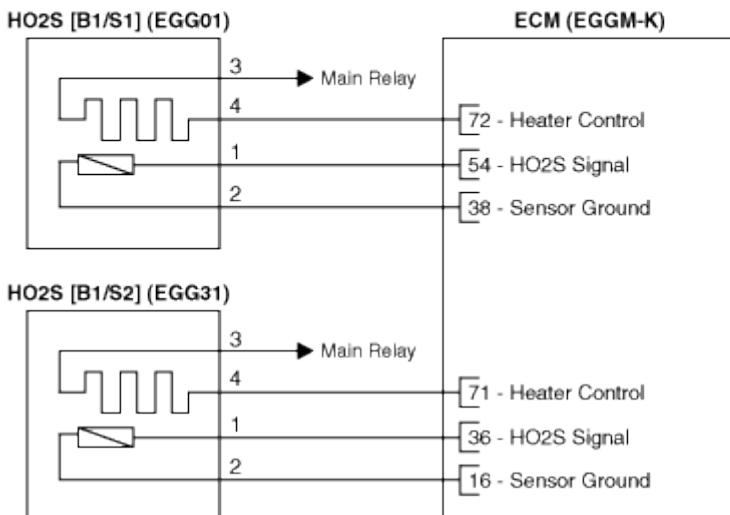


EGGA-A

ECM

[M/T]

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

| HO2S [B1/S1] (EGG01) | | |
|----------------------|-----------------|---------------------|
| Terminal | Connected to | Function |
| 1 | ECM EGGM-K (54) | HO2S [B1/S1] Signal |
| 2 | ECM EGGM-K (38) | Sensor Ground |
| 3 | Main Relay | Battery Power (B+) |
| 4 | ECM EGGM-K (72) | Heater Control |

HO2S [B1/S2] (EGG31)

| Terminal | Connected to | Function |
|----------|-----------------|---------------------|
| 1 | ECM EGGM-K (36) | HO2S [B1/S2] Signal |
| 2 | ECM EGGM-K (16) | Sensor Ground |
| 3 | Main Relay | Battery Power (B+) |
| 4 | ECM EGGM-K (71) | Heater Control |

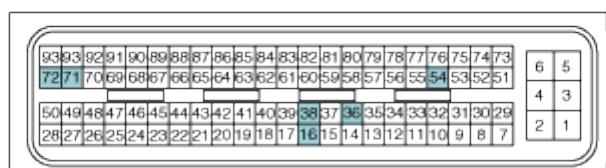
[HARNESS CONNECTOR]



EGG01
HO2S [B1/S1]



EGG31
HO2S [B1/S2]



EGGM-K
ECM

11.2.11.5. Repair procedures

Inspection

- Check signal waveform of HO2S using a scan tool.

Specification: Refer to "Waveform"

- Disconnect the HO2S connector.
- Measure resistance between HO2S heater terminals 3 and 4.
- Check that the resistance is within the specification.

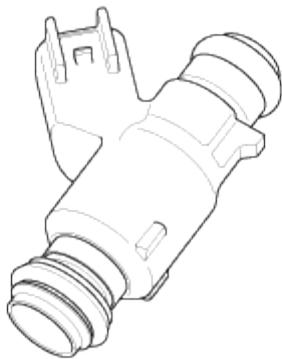
Specification: Refer to "Specification"

11.2.12. Injector

11.2.12.1. 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.



11.2.12.2. Specifications

Specification

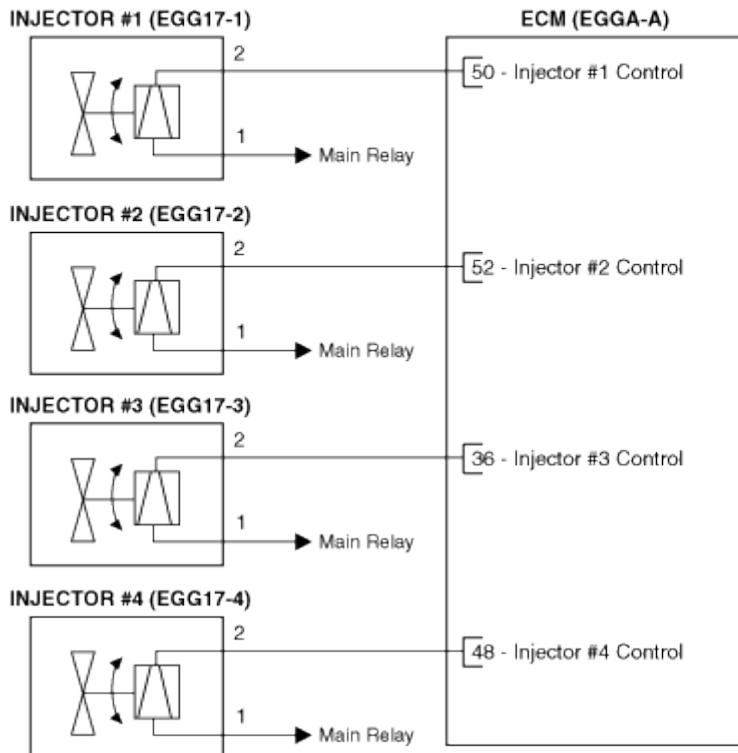
| Item | Specification |
|------------------------------|--------------------------|
| Coil Resistance (Ω) | 13.8 ~ 15.2 [20°C(68°F)] |

11.2.12.3. Schematic Diagrams

Circuit Diagram

[A/T]

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

| INJECTOR #1 (EGG17-1) | | |
|-----------------------|-----------------|---------------------|
| Terminal | Connected to | Function |
| 1 | Main Relay | Battery Power (B+) |
| 2 | ECM EGGA-A (50) | Injector #1 Control |

INJECTOR #2 (EGG17-2)

| Terminal | Connected to | Function |
|----------|-----------------|---------------------|
| 1 | Main Relay | Battery Power (B+) |
| 2 | ECM EGGA-A (52) | Injector #2 Control |

INJECTOR #3 (EGG17-3)

| Terminal | Connected to | Function |
|----------|-----------------|---------------------|
| 1 | Main Relay | Battery Power (B+) |
| 2 | ECM EGGA-A (36) | Injector #3 Control |

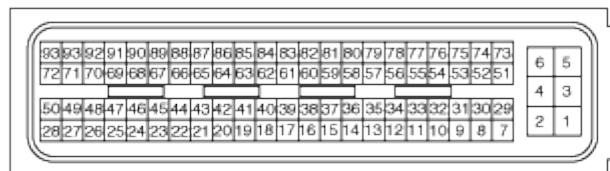
INJECTOR #4 (EGG17-4)

| Terminal | Connected to | Function |
|----------|-----------------|---------------------|
| 1 | Main Relay | Battery Power (B+) |
| 2 | ECM EGGA-A (48) | Injector #4 Control |

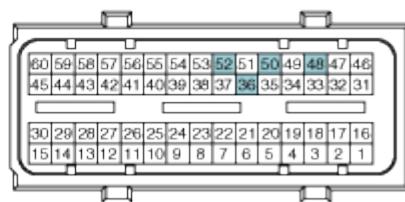
[HARNESS CONNECTOR]



EGG17-1,2,3,4
INJECTOR #1,2,3,4



EGGA-K

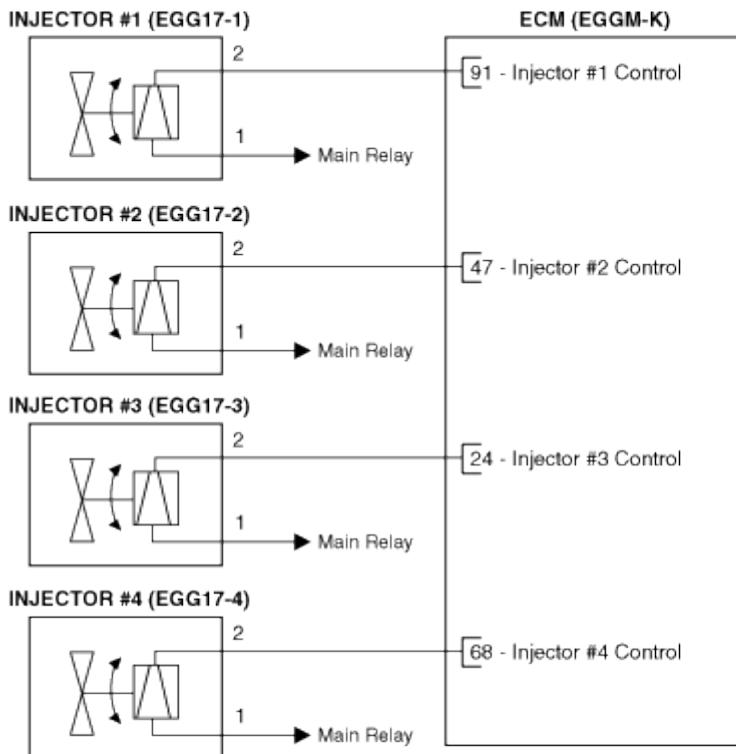


EGGA-A

ECM

[M/T]

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

INJECTOR #1 (EGG17-1)

| Terminal | Connected to | Function |
|----------|-----------------|---------------------|
| 1 | Main Relay | Battery Power (B+) |
| 2 | ECM EGGM-K (91) | Injector #1 Control |

INJECTOR #2 (EGG17-2)

| Terminal | Connected to | Function |
|----------|-----------------|---------------------|
| 1 | Main Relay | Battery Power (B+) |
| 2 | ECM EGGM-K (47) | Injector #2 Control |

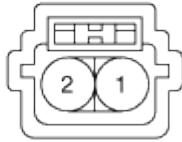
INJECTOR #3 (EGG17-3)

| Terminal | Connected to | Function |
|----------|-----------------|---------------------|
| 1 | Main Relay | Battery Power (B+) |
| 2 | ECM EGGM-K (24) | Injector #3 Control |

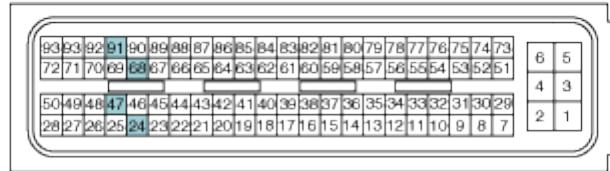
INJECTOR #4 (EGG17-4)

| Terminal | Connected to | Function |
|----------|-----------------|---------------------|
| 1 | Main Relay | Battery Power (B+) |
| 2 | ECM EGGM-K (68) | Injector #4 Control |

[HARNESS CONNECTOR]



EGG17-1,2,3,4
INJECTOR #1,2,3,4



EGGM-K
ECM

11.2.12.4. Repair procedures

Inspection

- Turn ignition switch OFF.
- Disconnect injector connector.
- Measure resistance between injector terminals 1 and 2.
- Check that the resistance is within the specification.

Specification: Refer to "Specification"

11.2.13. Idle Speed Control Actuator (ISCA)

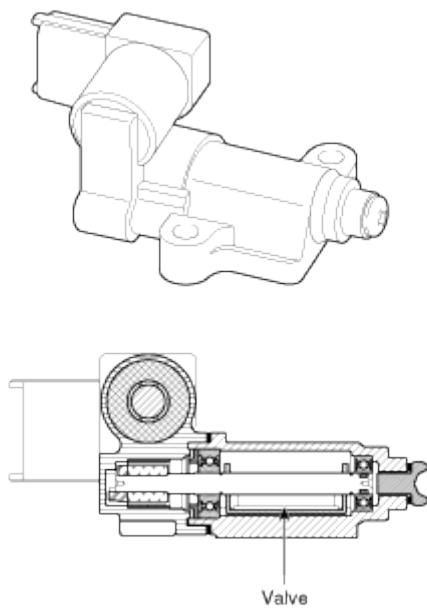
11.2.13.1. Description and Operation

Description

The Idle Speed Control Actuator (ISCA) is installed on the throttle body and controls the intake airflow that is bypassed around the throttle plate to keep constant engine speed when the throttle valve is closed.

The function of the ISCA is to maintain idle speed according to various engine loads and conditions, and also to provide additional air during starting.

The ISCA consists of an opening coil, a closing coil, and a permanent magnet. Based on information from various sensors, the ECM controls both coils by grounding their control circuits. According to the control signals from the ECM, the valve rotor rotates to control the by-pass airflow into the engine.



11.2.13.2. Specifications

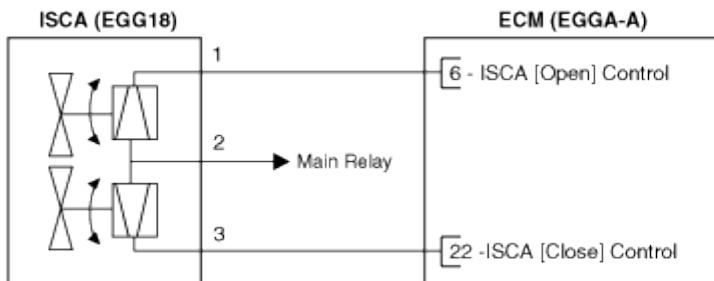
| Specification | |
|---|--------------------------|
| Item | Specification |
| Opening Coil Resistance
(Ω) | 14.6 ~ 16.2 [20°C(68°F)] |
| Closing Coil Resistance
(Ω) | 11.1 ~ 12.7 [20°C(68°F)] |

| Duty (%) | Air Flow Rate (m³/h) |
|----------|----------------------|
| 15 | 0.5 ~ 1.4 |
| 35 | 4.6 ~ 8.0 |
| 70 | 25.0 ~ 32.0 |
| 96 | 33.0 ~ 40.0 |

11.2.13.3. Schematic Diagrams

| Circuit Diagram |
|-----------------|
| [A/T] |

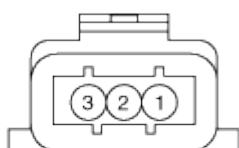
[CIRCUIT DIAGRAM]



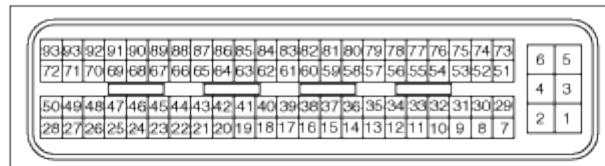
[CONNECTION INFORMATION]

| Terminal | Connected to | Function |
|----------|-----------------|----------------------|
| 1 | ECM EGGA-A (6) | ISCA [Open] Control |
| 2 | Main Relay | Battery Power (B+) |
| 3 | ECM EGGA-A (22) | ISCA [Close] Control |

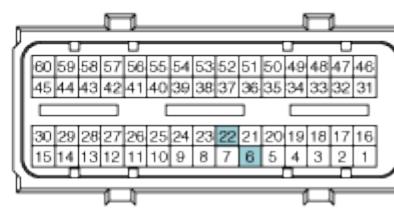
[HARNESS CONNECTOR]



EGG18
ISCA



EGGA-K

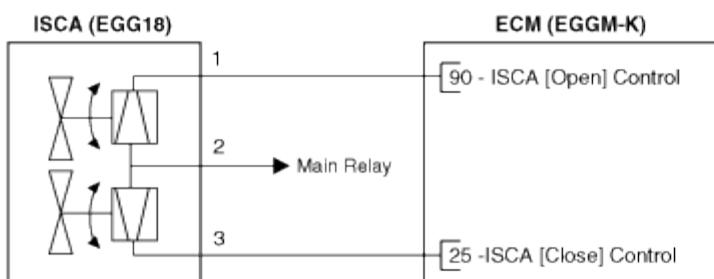


EGGA-A

ECM

[M/T]

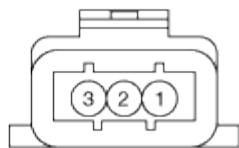
[CIRCUIT DIAGRAM]



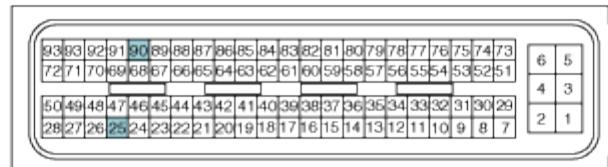
[CONNECTION INFORMATION]

| Terminal | Connected to | Function |
|----------|-----------------|----------------------|
| 1 | ECM EGGM-K (90) | ISCA [Open] Control |
| 2 | Main Relay | Battery Power (B+) |
| 3 | ECM EGGM-K (25) | ISCA [Close] Control |

[HARNESS CONNECTOR]



EGG18
ISCA



EGGM-K
ECM

11.2.13.4. Repair procedures

Inspection

1. Turn ignition switch OFF.
2. Disconnect ISCA connector.
3. Measure resistance between ISCA terminals 2 and 1 [Opening Coil].
4. Measure resistance between ISCA terminals 2 and 3 [Closing Coil].

5. Check that the resistance is within the specification.

Specification: Refer to "Specification"

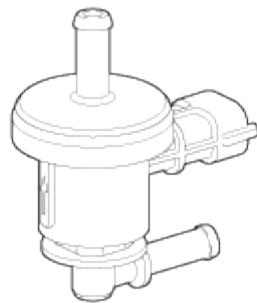
11.2.14. Purge Control Solenoid Valve (PCSV)

11.2.14.1. Description and Operation

Description

Purge Control Solenoid Valve (PCSV) is a solenoid valve and is installed on the surge tank and controls the passage between the canister and the intake manifold.

The evaporative gases gathered in the canister are delivered to the intake manifold when the PCSV is open by ECM control signal.



11.2.14.2. Specifications

Specification

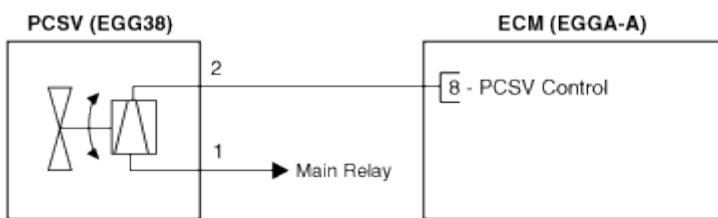
| Item | Specification |
|------------------------------|-------------------|
| Coil Resistance (Ω) | 16.0 [20°C(68°F)] |

11.2.14.3. Schematic Diagrams

Circuit Diagram

[A/T]

[CIRCUIT DIAGRAM]



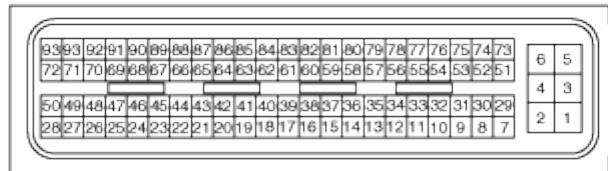
[CONNECTION INFORMATION]

| Terminal | Connected to | Function |
|----------|----------------|--------------------|
| 1 | Main Relay | Battery Power (B+) |
| 2 | ECM EGGA-A (8) | PCSV Control |

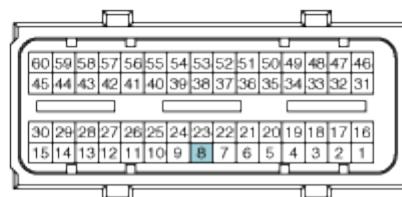
[HARNESS CONNECTOR]



EGG38
PCSV



EGGA-K

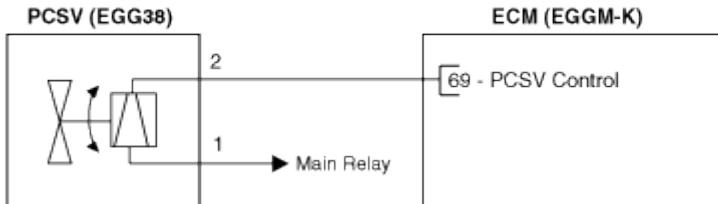


EGGA-A

ECM

[M/T]

[CIRCUIT DIAGRAM]



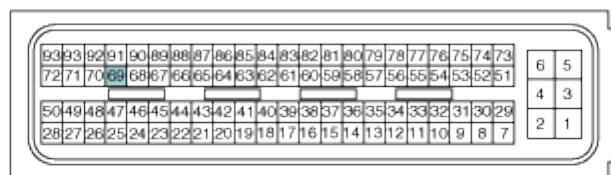
[CONNECTION INFORMATION]

| Terminal | Connected to | Function |
|----------|-----------------|--------------------|
| 1 | Main Relay | Battery Power (B+) |
| 2 | ECM EGGM-K (69) | PCSV Control |

[HARNESS CONNECTOR]



EGG38
PCSV



EGGM-K
ECM

11.2.14.4. Repair procedures

Inspection

1. Turn ignition switch OFF.
2. Disconnect PCSV connector.
3. Measure resistance between PCSV terminals 1 and 2.
4. Check that the resistance is within the specification.

Specification: Refer to "Specification"

11.2.15. CVVT Oil Control Valve (OCV)

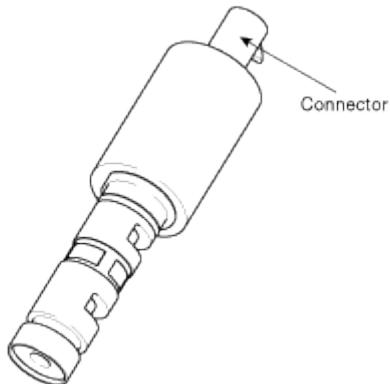
11.2.15.1. Description and Operation

Description

The Continuously Variable Valve Timing (CVVT) system controls the amount of valve overlap by varying the amount of oil flow into an assembly mounted on the intake camshaft through ECM control of an oil control valve.

As oil is directed into the chambers of the CVVT assembly, the cam phase is changed to suit various performance and emissions requirements.

1. When camshaft rotates engine rotation-wise: Intake-Advance / Exhaust-Retard
2. When camshaft rotates counter engine rotation-wise: Intake- Retard / Exhaust- Advance



11.2.15.2. Specifications

Specification

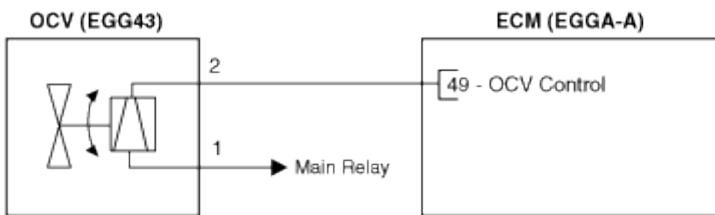
| Item | Specification |
|------------------------------|------------------------|
| Coil Resistance (Ω) | 6.9 ~ 7.9 [20°C(68°F)] |

11.2.15.3. Schematic Diagrams

Circuit Diagram

[A/T]

[CIRCUIT DIAGRAM]



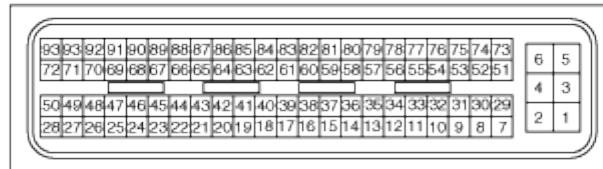
[CONNECTION INFORMATION]

| Terminal | Connected to | Function |
|----------|-----------------|--------------------|
| 1 | Main Relay | Battery Power (B+) |
| 2 | ECM EGGA-A (49) | OCV Control |

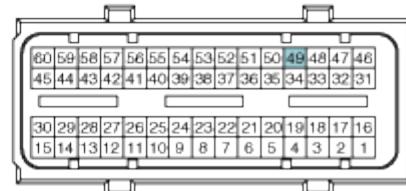
[HARNESS CONNECTOR]



EGG43
OCV



EGGA-K

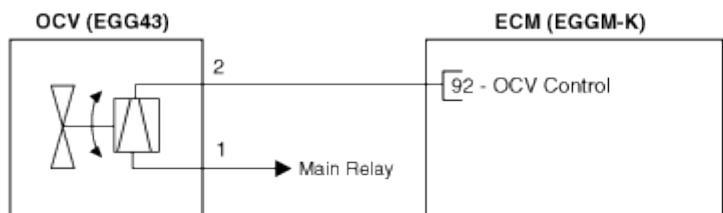


EGGA-A

ECM

[M/T]

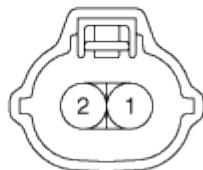
[CIRCUIT DIAGRAM]



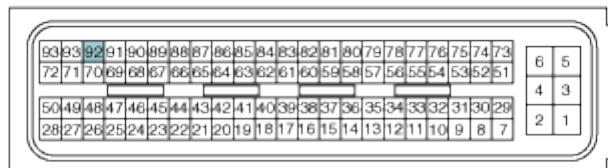
[CONNECTION INFORMATION]

| Terminal | Connected to | Function |
|----------|-----------------|--------------------|
| 1 | Main Relay | Battery Power (B+) |
| 2 | ECM EGGM-K (92) | OCV Control |

[HARNESS CONNECTOR]



EGG43
OCV



EGGM-K
ECM

11.2.15.4. Repair procedures

Inspection

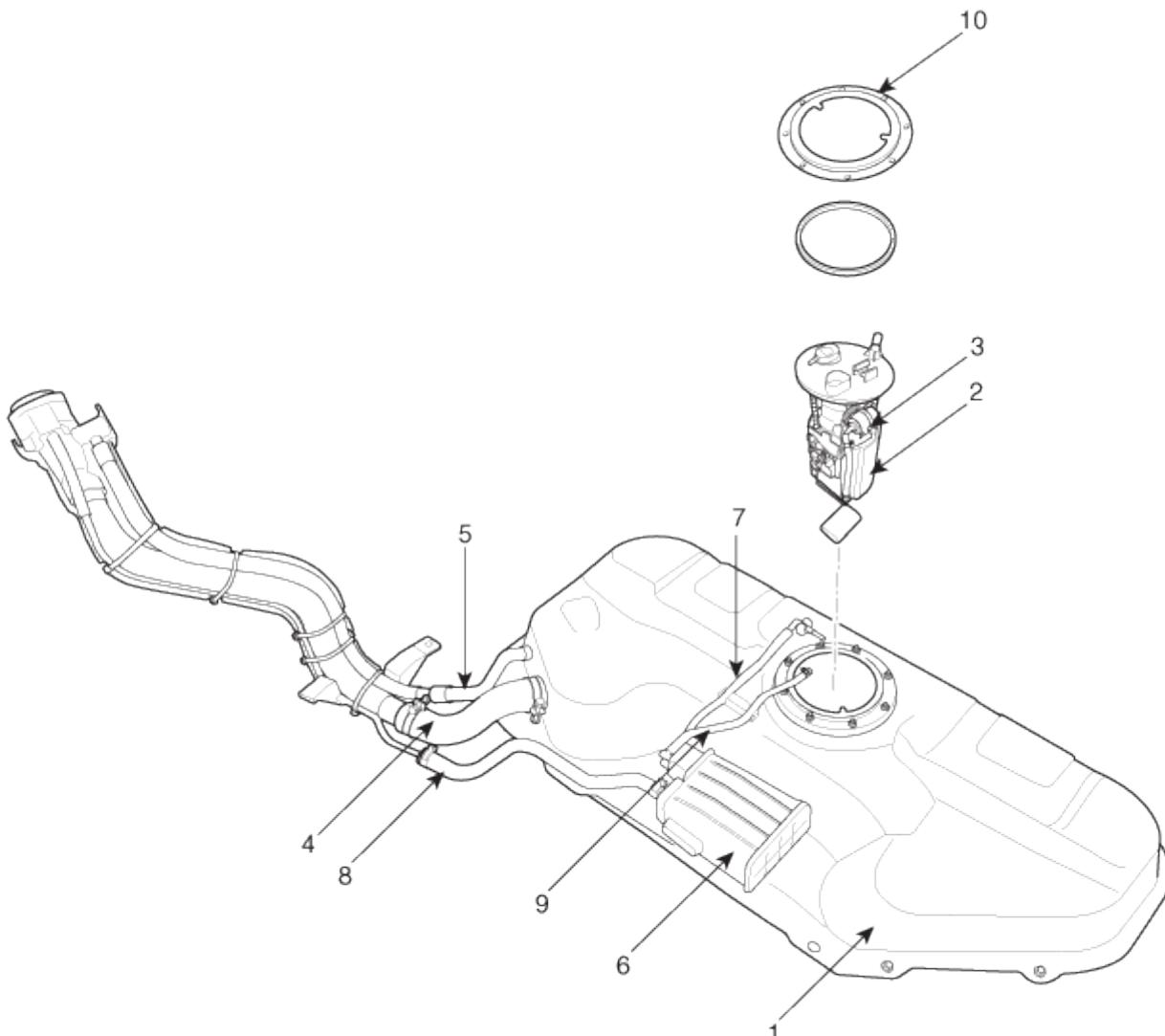
1. Turn ignition switch OFF.
2. Disconnect OCV connector.
3. Measure resistance between OCV terminals 1 and 2.
4. Check that the resistance is within the specification.

Specification: Refer to "Specification"

11.3. Fuel Delivery System

11.3.1. Component and Components Location

Component Location



- | | |
|--------------------------------------|--------------------------------------|
| 1. Fuel Tank | 6. Canister |
| 2. Fuel Pump (Including Fuel Filter) | 7. Tube (Canister ↔ Intake Manifold) |
| 3. Fuel Pressure Regulator | 8. Hose (Canister ↔ Atmosphere) |
| 4. Fuel Filler Hose | 9. Hose (Canister↔ Fuel Tank) |
| 5. Leveling Pipe | 10. Plate cover |

11.3.2. Repair procedures

Fuel Pressure Test

1. PREPARING

1. Fold the rear seat cushion (Refer to "SEAT" in BD group).
2. Open the service cover (A).

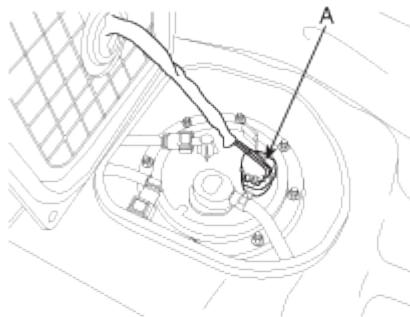


2. RELEASE THE INTERNAL PRESSURE

1. Disconnect the fuel pump connector (A).
2. Start the engine and wait until fuel in fuel line is exhausted.
3. After the engine stalls, turn the ignition switch to OFF position and disconnect the negative (-) terminal from the battery.

NOTE

Be sure to reduce the fuel pressure before disconnecting the fuel feed hose, otherwise fuel will spill out.



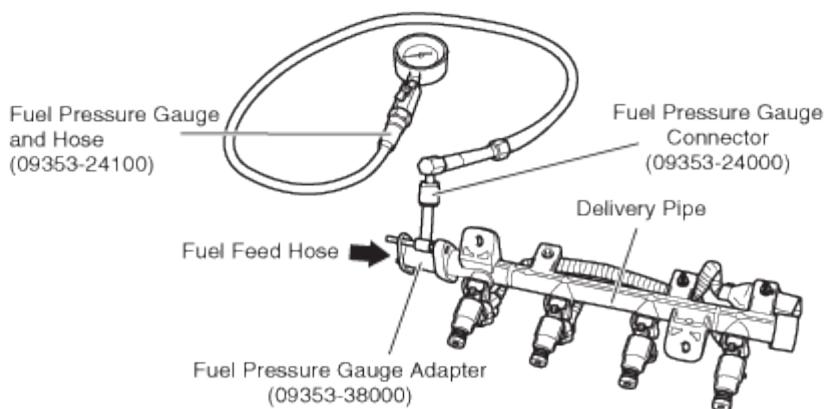
3. INSTALL THE SPECIAL SERVICE TOOL (SST) FOR MEASURING THE FUEL PRESSURE

1. Disconnect the fuel feed hose from the delivery pipe.

CAUTION

Cover the hose connection with a shop towel to prevent splashing of fuel caused by residual pressure in the fuel line.

2. Install the Fuel Pressure Gage Adapter (09353-38000) between the delivery pipe and the fuel feed hose.
3. Connect the Fuel Pressure Gage Connector (09353-24000) to the Fuel Pressure Gage Adapter (09353-38000).
4. Connect the Fuel Pressure Gage and Hose (09353-24100) to Fuel Pressure Gage Connector (09353-24000).
5. Connect the fuel feed hose to the Fuel Pressure Gage Adapter (09353-38000).



4. INSPECT FUEL LEAKAGE ON CONNECTION

1. Connect the battery negative (-) terminal.
2. Apply battery voltage to the fuel pump terminal and activate the fuel pump. With fuel pressure applied, check that there is no fuel leakage from the fuel pressure gauge or connection part.

5. FUEL PRESSURE TEST

1. Disconnect the negative (-) terminal from the battery.
2. Connect the fuel pump connector.
3. Connect the battery negative (-) terminal.
4. Start the engine and measure the fuel pressure at idle.

Standard Value: 345 ~ 355 kpa (3.5 ~ 3.6 kgf/cm², 50.0 ~ 51.5 psi)

- If the measured fuel pressure differs from the standard value, perform the necessary repairs using the table below.

| Condition | Probable Cause | Suspected Area |
|------------------------|---|-------------------------|
| Fuel Pressure too low | Clogged fuel filter | Fuel filter |
| | Fuel leak on the fuel-pressure regulator that is assembled on fuel pump because of poor sealing of the fuel-pressure regulator. | Fuel Pressure Regulator |
| Fuel Pressure too High | Sticking fuel pressure regulator | Fuel Pressure Regulator |

5. Stop the engine and check for a change in the fuel pressure gauge reading.

After engine stops, the gage reading should hold for about 5 minutes

- Observing the declination of the fuel pressure when the gage reading drops and perform the necessary repairs using the table below.

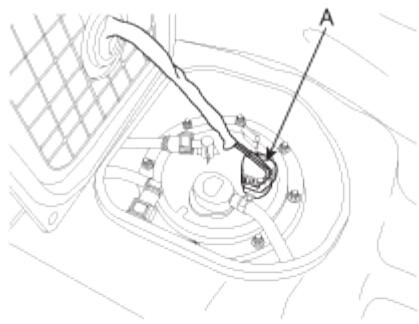
| Condition | Probable Cause | Suspected Area |
|---|--|----------------|
| Fuel pressure drops slowly after engine is stopped | Injector leak | Injector |
| Fuel pressure drops immediately after engine is stopped | The check valve within the fuel pump is open | Fuel Pump |

6. RELEASE THE INTERNAL PRESSURE

1. Disconnect the fuel pump connector (A).
2. Start the engine and wait until fuel in fuel line is exhausted.
3. After the engine stalls, turn the ignition switch to OFF position and disconnect the negative (-) terminal from the battery.

NOTE

Be sure to reduce the fuel pressure before disconnecting the fuel feed hose, otherwise fuel will spill out.



7. REMOVE THE SPECIAL SERVICE TOOL (SST) AND CONNECT THE FUEL LINE

1. Disconnect the Fuel Pressure Gage and Hose (09353-24100) from the Fuel Pressure Gage Connector (09353-24000).
2. Disconnect the Fuel Pressure Gage Connector (09353-24000) from the Fuel Pressure Gage Adapter (09353-38000).
3. Disconnect the fuel feed hose from the Fuel Pressure Gage Adapter (09353-38000).
4. Disconnect the Fuel Pressure Gage Adapter (09353-38000) from the delivery pipe.

CAUTION

Cover the hose connection with a shop towel to prevent splashing of fuel caused by residual pressure in the fuel line.

5. Conenct the fuel feed hose to the delivery pipe.

8. INSPECT FUEL LEAKAGE ON CONNECTION

1. Connect the battery negative (-) terminal.
2. Apply battery voltage to the fuel pump terminal and activate the fuel pump. With fuel pressure applied, check that there is no fuel leakage from the fuel pressure gauge or connection part.
3. If the vehicle is normal, connect the fuel pump connector.

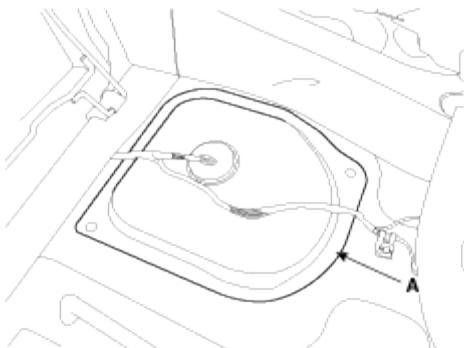
11.3.3. Fuel Tank

11.3.3.1. Repair procedures

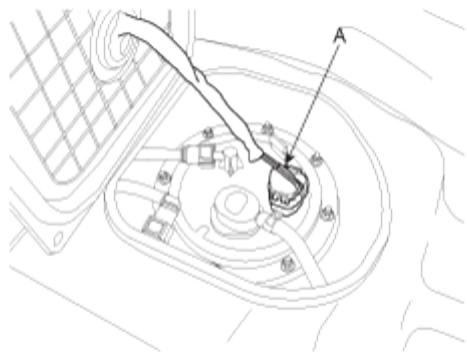
Removal

1. Preparation

- (1) Fold the rear seat cushion (Refer to "SEAT" in BD group).
- (2) Open the service cover (A).



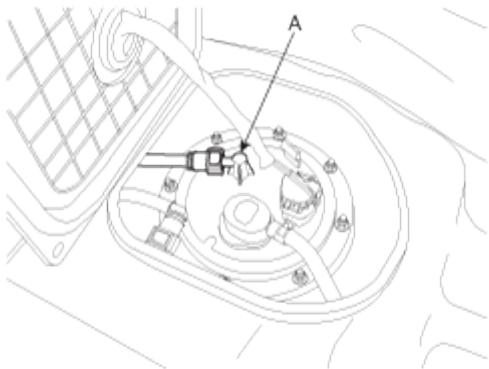
- (3) Disconnect the fuel pump connector (A).



(4) Start the engine and wait until fuel in fuel line is exhausted.

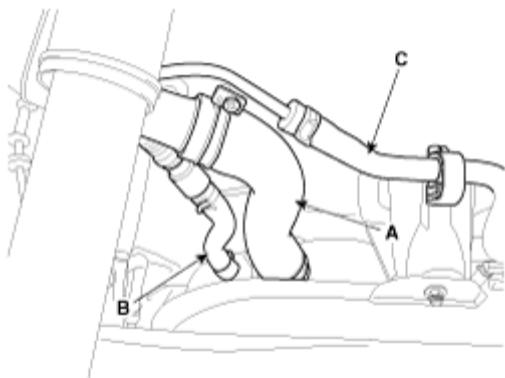
(5) After engine stalls, turn the ignition switch to OFF position.

2. Disconnect the fuel feed quick-connector (A).

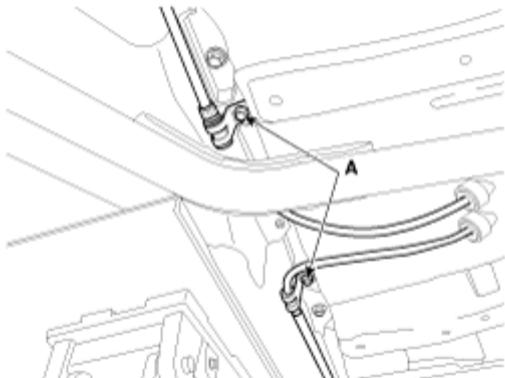


3. Lift the vehicle and remove the mufflers passing under the fuel tank. (Intake and exhaust system in EM group)

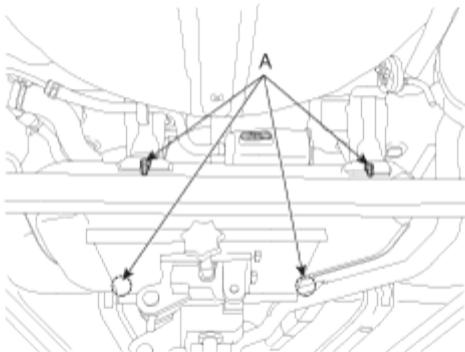
4. Disconnect the fuel filler hose (A), the leveling hose connector (B) and the vapor hose (C).



5. Remove the parking brake line after removing the bolts (A).



6. Unfasten 4 fuel tank mounting nuts/bolts (A) and remove the fuel tank with a jack.



Installation

Installation is reverse of removal.

Fuel Tank installation nuts/bolts:

39.2 ~ 54.0 N.m (4.0 ~ 5.5 kgf.m, 28.9 ~ 39.8 lb-ft)

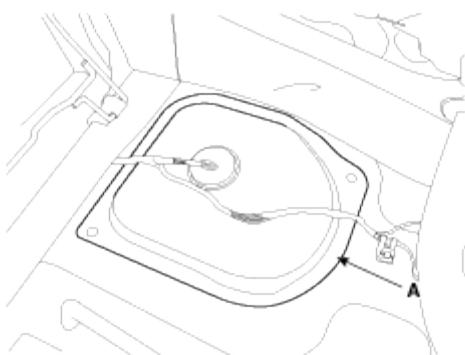
11.3.4. Fuel Pump

11.3.4.1. Repair procedures

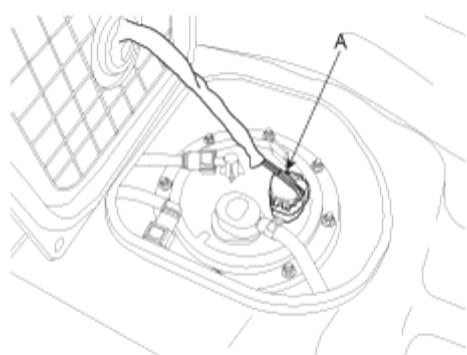
Removal

1. Preparation

- (1) Fold the rear seat cushion (Refer to "SEAT" in BD group).
- (2) Open the service cover (A).

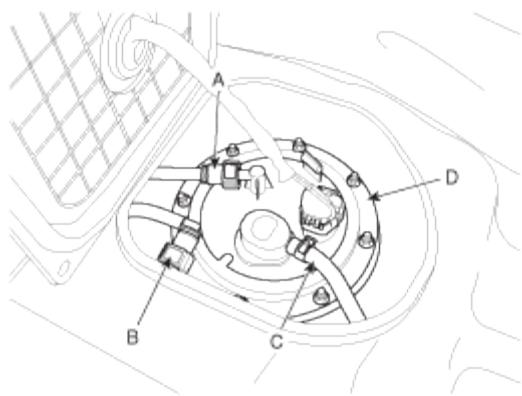


- (3) Disconnect the fuel pump connector (A).

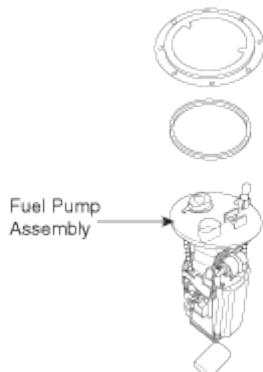


- (4) Start the engine and wait until fuel in fuel line is exhausted.
- (5) After engine stalls, turn the ignition switch to OFF position.

2. Disconnect the fuel feed tube quick-connector (A), the canister vapor tube quick-connector (B) and the canister purge line hose (C).



3. Unfasten the fuel pump plate cover (D) and remove the fuel pump assembly.



Installation

Installation is reverse of removal.

Fuel Pump installation bolts:

2.0 ~ 2.9 N.m (0.2 ~ 0.3 kgf.m, 1.4 ~ 2.2 lb-ft)

CAUTION

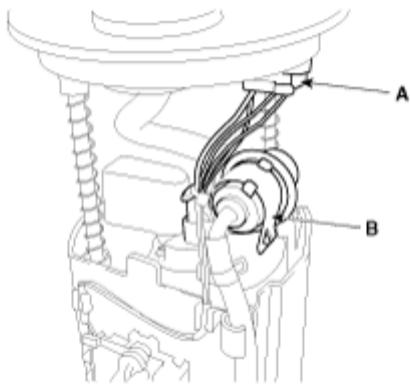
When installing a pump module, be careful not to get the seal-ring entangled

11.3.5. Fuel Filter

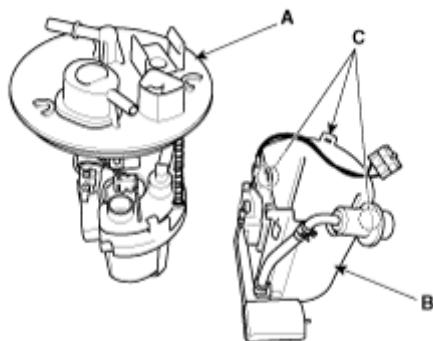
11.3.5.1. Repair procedures

Replacement

1. Remove the fuel pump (Refer to "FUEL PUMP" in this group).
2. Disconnect the fuel pump & sender wiring connector (A) and remove the regulator cap (B).

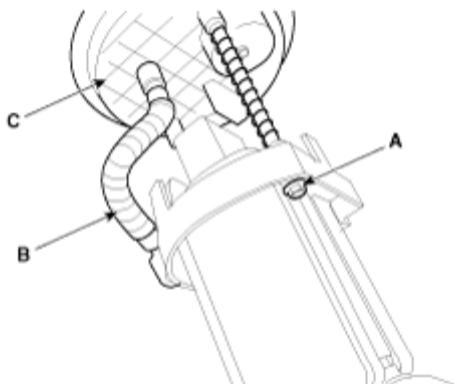


3. Separate the fuel filter & pump (A) from the reservoir cup (B) after disengaging three fixing hooks (C).

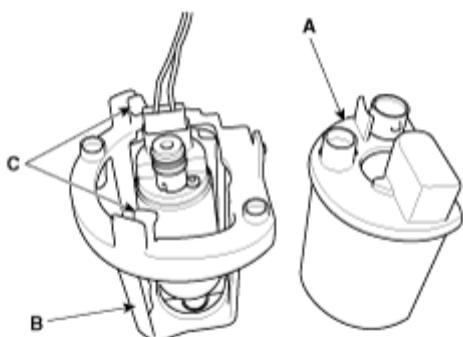


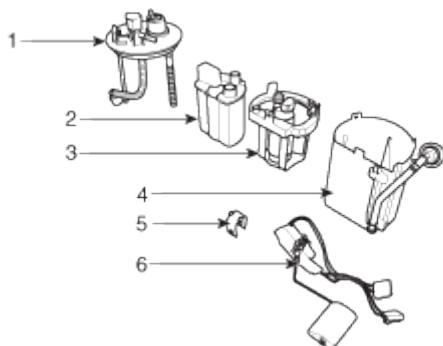
4. Remove the cushion pipe fixing clip (A) after pressing the flange assembly.

5. Separate the flange assembly (C) from the fuel pump & filter assembly after disconnecting the feed hose connector (B).



6. Separate the fuel filter (A) from the electric pump assembly (B) after disengaging two hooks (C).





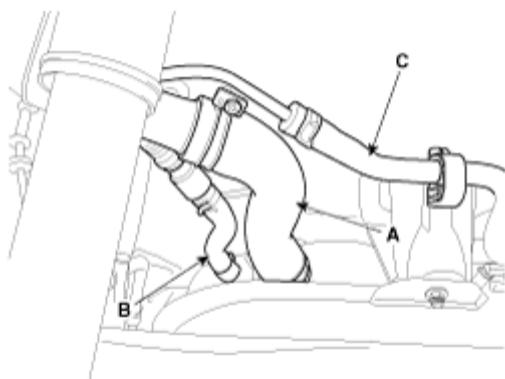
- A. Flange assembly
- B. Fuel filter
- C. Electric pump assembly
- D. Reservoir cup
- E. Regulator cap
- F. Fuel sender

11.3.6. Filter-Neck Assembly

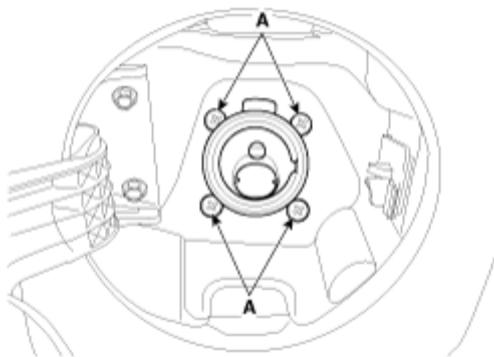
11.3.6.1. Repair procedures

Removal

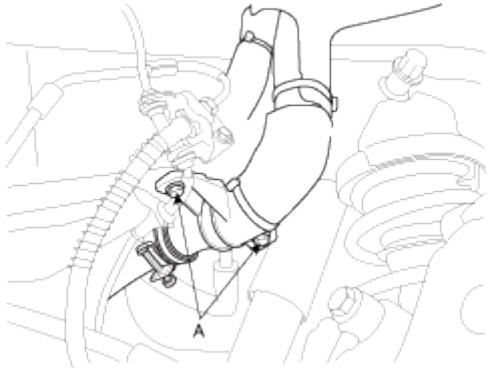
1. Disconnect the fuel filler hose (A), the leveling hose connector (B) and the vapor hose (C).



2. Open the fuel filler door and unfasten the filler-neck assembly mounting screws (A).



3. Remove the rear-LH wheel and tire.
4. Remove the bracket mounting bolt (A) and remove the filler-neck assembly.



Installation

1. Installation is reverse of removal.

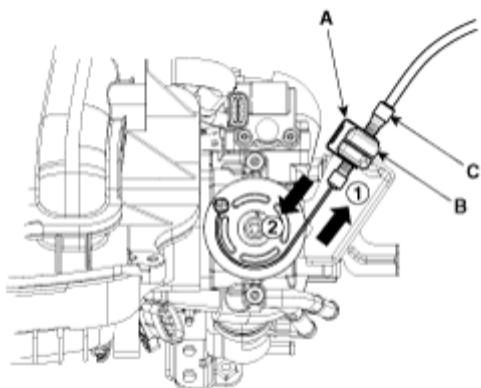
11.3.7. Accelerator Cable 11.3.7.1. Repair procedures

Adjustment

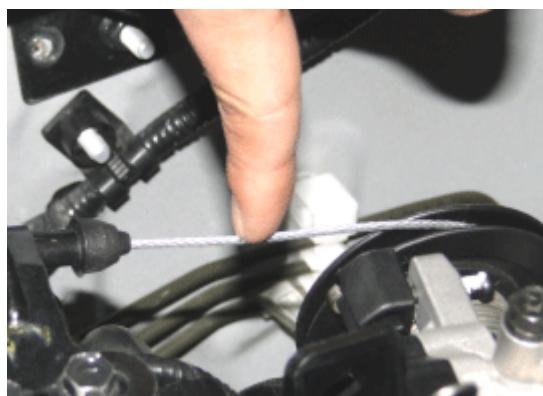
1. Turn on the ignition key, but don't start the engine.
2. Remove the fixing clip (A) after holding for 15 seconds under IG ON condition.
3. Adjust the position of the accelerator cable grommet (B) to secure free stroke.
 - (1) Pull the grommet (B) by taking the cable cap (C) in the direction of an arrow ①until the cable wire tighten.
 - (2) Push the grommet (B) by taking the cable cap (C) in the direction of an arrow ②as below free stroke specification.

Free stroke specification: 1 ~ 3 mm (0.0393 ~ 0.1181 in.)

4. Install the fixing clip (A).



[Abnormal wire tension: No free stroke]



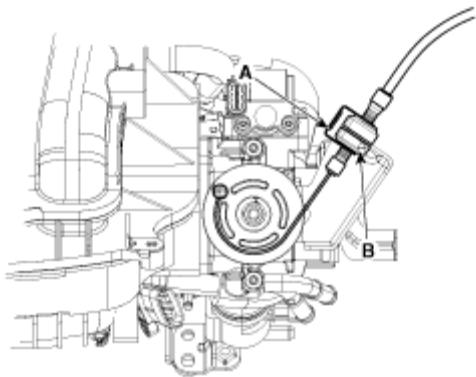
[Normal wire tension: Free stroke]



5. Check the normal operation of the accelerator pedal.

Removal

1. Disconnect the battery negative (-) cable.
2. Remove the air intake hose.
(Refer to Engine Mechanical System - "Engine & Transaxle system")
3. Remove the accelerator cable free-play adjustment clip (A).
4. Remove the accelerator cable retaining grommet (B) from the accelerator cable bracket.

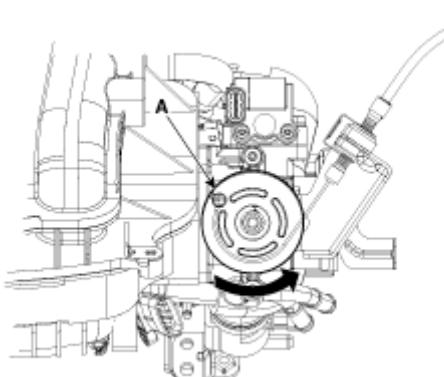


5. Manually open the throttle body to the Wide Open throttle (W.O.T) position and disconnect the throttle cable from the bell crank.

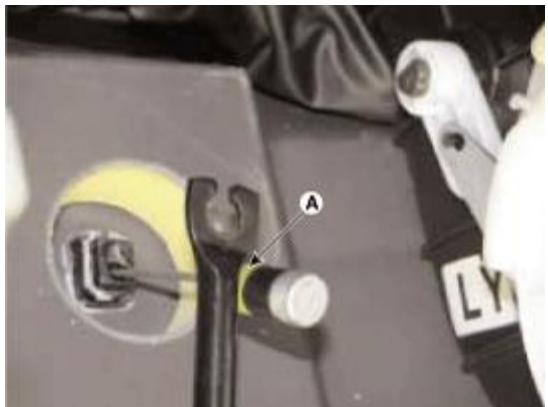
WARNING

Damage to the accelerator cable or the cruise control cable may result if the throttle body cam is rotated by lifting up on the cable.

When disconnecting the accelerator cable from the throttle body, rotate the throttle body cam (A) only by lifting up on the cam itself.



6. Disconnect the retaining clip (A) from the top of the accelerator pedal assembly.



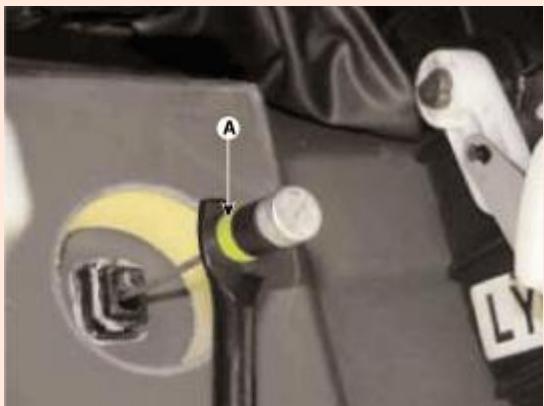
7. Remove the accelerator cable from the vehicle; the accelerator end will have to be guided out through the bulkhead access hole.

Installation

1. Install in the reverse order of removal.

WARNING

Install the accelerator cable end, route the cable through the accelerator pedal and snap the clip (A) into the place.



When installing the accelerator cable to the throttle body, be careful not to twist or bend the cable.

After installing the accelerator pedal, adjust the throttle cable free-play (Refer to Accelerator cable adjustment)

Check the cable and hose routings to ensure that they do not interfere with the throttle or cruise control cables.

Depress the accelerator pedal to Wide Open Throttle (W.O.T) several times to ensure proper operation.

12. Body Electrical System

12.1. General Information

12.1.1. General Information

General Troubleshooting Information

Before Troubleshooting

1. Check applicable fuses in the appropriate fuse/relay box.

2. Using the battery checker (MCR-570 KIT), check the battery for damage, state of charge, and clean and tight connections.

(Refer to the Engine Electrical System - Battery)

NOTE

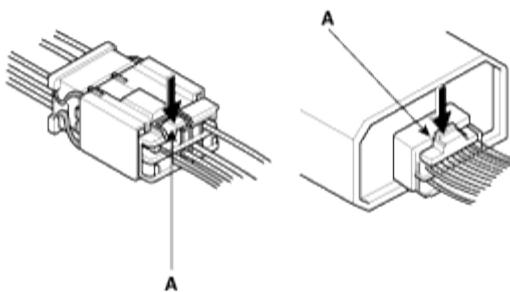
- Do not quick-charge a battery unless the battery ground cable has been disconnected, otherwise you will damage the alternator diodes.
- Do not attempt to crank the engine with the battery ground cable loosely connected or you will severely

damage the wiring.

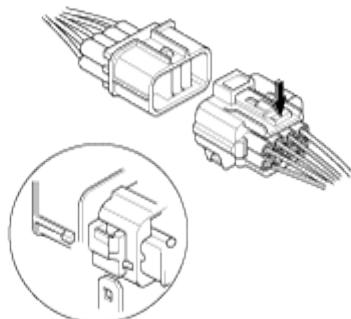
3. Check the alternator belt tension.

Handling Connectors

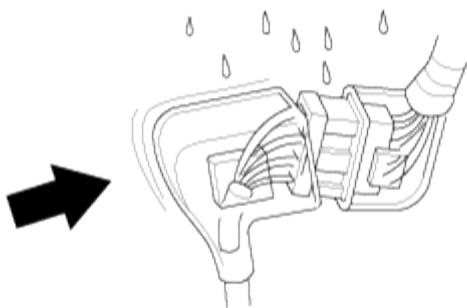
1. Make sure the connectors are clean and have no loose wire terminals.
2. Make sure multiple cavity connectors are packed with grease (except watertight connectors).
3. All connectors have push-down release type locks (A).



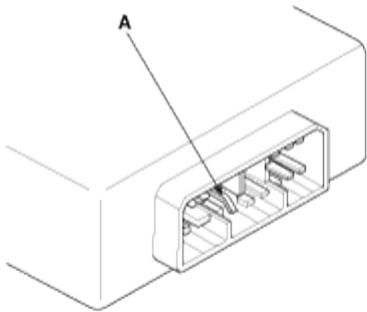
4. Some connectors have a clip on their side used to attach them to a mount bracket on the body or on another component. This clip has a pull type lock.
5. Some mounted connectors cannot be disconnected unless you first release the lock and remove the connector from its mount bracket (A).



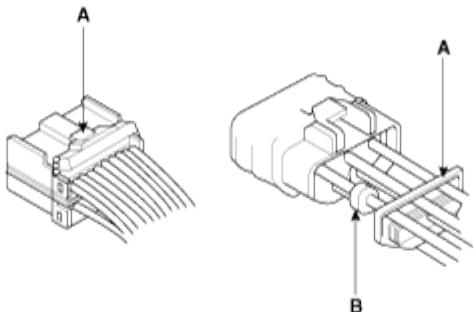
6. Never try to disconnect connectors by pulling on their wires; pull on the connector halves instead.
7. Always reinstall plastic covers.



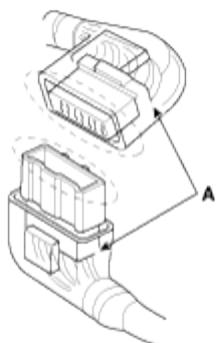
8. Before connecting connectors, make sure the terminals (A) are in place and not bent.



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

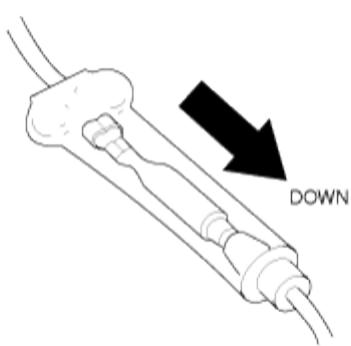


10. The backs of some connectors are packed with grease. Add grease if necessary. If the grease (A) is contaminated, replace it.



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

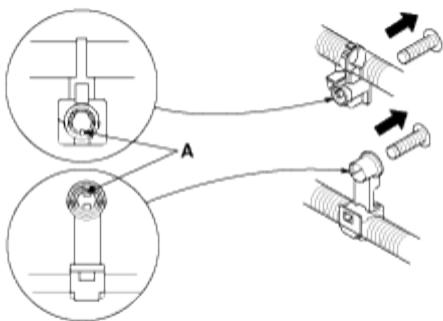
12. Position wires so that the open end of the cover faces down.



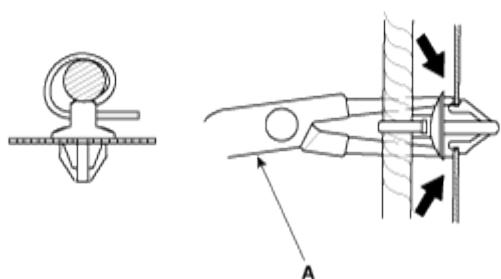
Handling Wires And Harnesses

1. Secure wires and wire harnesses to the frame with their respective wire ties at the designated locations.

2. Remove clips carefully; don't damage their locks (A).



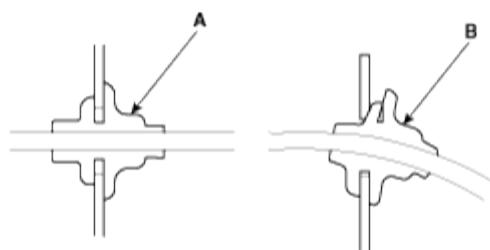
3. Slip pliers (A) under the clip base and through the hole at an angle, and then squeeze the expansion tabs to release the clip.



4. After installing harness clips, make sure the harness doesn't interfere with any moving parts.

5. Keep wire harnesses away from exhaust pipes and other hot parts, from sharp edges of brackets and holes, and from exposed screws and bolts.

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



Testing And Repairs

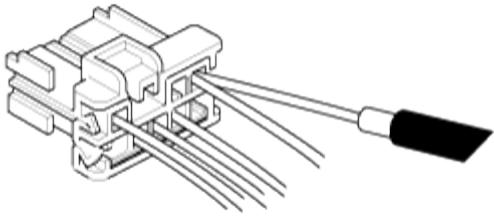
1. Do not use wires or harnesses with broken insulation.

Replace them or repair them by wrapping the break with electrical tape.

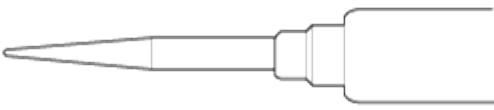
2. After installing parts, make sure that no wires are pinched under them.

3. When using electrical test equipment, follow the manufacturer's instructions and those described in this manual.

4. If possible, insert the remover tool from the wire side (except waterproof connector).



5. Use a probe with a tapered tip.
Refer to the user's guide in the wiring repair kit (Pub No. : TRK 015.)



Five-step Troubleshooting

1. Verify the complaint

Turn on all the components in the problem circuit to verify the customer complaint. Note the symptoms. Do not begin disassembly or testing until you have narrowed down the problem area.

2. Analyze the schematic

Look up the schematic for the problem circuit.

Determine how the circuit is supposed to work by tracing the current paths from the power feed through the circuit components to ground. If several circuits fail at the same time, the fuse or ground is a likely cause.

Based on the symptoms and your understanding of the circuit operation, identify one or more possible causes of the problem.

3. Isolate the problem by testing the circuit.

Make circuit tests to check the diagnosis you made in step 2. Keep in mind that a logical, simple procedure is the key to efficient troubleshooting.

Test for the most likely cause of failure first. Try to make tests at points that are easily accessible.

4. Fix the problem

Once the specific problem is identified, make the repair. Be sure to use proper tools and safe procedures.

5. Make sure the circuit works

Turn on all components in the repaired circuit in all modes to make sure you've fixed the entire problem. If the problem was a blown fuse, be sure to test all of the circuits on the fuse. Make sure no new problems turn up and the original problem does not recur.

Battery Reset

Description

When reconnecting the battery cable after disconnecting, recharging battery after discharged or installing the memory fuse located on the driver's side panel after removing, be sure to reset systems mentioned on the below table.

In addition, when replacing or reinstalling their fuses after removing, they should be reset according to the below table. Please refer to the below table when servicing.

| SYSTEM | RESETTING |
|--------|-----------|
|--------|-----------|

| | |
|---------------------|--|
| Auto up/down window | Whenever the battery is disconnected, discharged or the related fuse is replaced or reinstalled, reset the Auto up/down window system according to the procedure below.
1) Turn the ignition switch to the ON position.
2) Pull up the power window switch in order that the window can close completely, and then keep pulling up the power switch for about 1 second. |
| Sunroof | Whenever the battery is disconnected, discharged or the related fuse is replaced or reinstalled, the sunroof system must be reset according to the procedure below.
1) Turn the ignition switch to the ON position.
2) According to the position of the sunroof, do the following.
- In case the sunroof is closed completely or tilted:
Push the sunroof control lever upward until the sunroof tilts completely upward.
- In case the sunroof is open:
Push the sunroof control lever forward until the sunroof closes completely. Push the sunroof control lever upward until the sunroof tilts completely upward.
3) Release the sunroof control lever.
4) Push the sunroof control lever upward until the sunroof has returned to the original tilt position after it is raised a little higher than the maximum tilt position. Then, release the lever.
5) Push the sunroof control lever upward until the sunroof operates as follows;
TILT DOWN → SLIDE OPEN → SLIDE CLOSE
Then, release the lever. |
| Trip computer | When the battery is disconnected and reconnected, the set functions of the trip computer become initialized. So, you need to explain this information to the customer. |
| Clock | When the battery is disconnected and reconnected, the clock becomes initialized. So, the clock should be reset. |
| Audio | When the battery is disconnected and reconnected, the customer's radio stations become initialized. So, you need to record the customer's radio stations prior to service, and after service, set the customer's radio stations into the audio. |

12.2. Audio

12.2.1. Specifications

Specification

Audio

| Item | Specification | |
|---------------------------------|-------------------------|--|
| Model | RADIO/CD/MP3
(PA710) | RADIO/CD/MP3/RDS
(PA710R) |
| Power supply | DC 14.4V | |
| Rated output | Max 43W x 4 | |
| Antenna | 80PF 75Ω | |
| Tuning type | PLL SYNTHESIZED TUNING | |
| Frequency range / Channel space | FM | 87.5 ~ 108.0 MHz/100 kHz (for General) |
| | AM | 531 ~ 1602 KHz/9 kHz (for General) |
| | FM | 87.5 ~ 108.0 MHz/50 kHz (for Europe) |
| | MW | 522 ~ 1620 KHz/9 kHz (for Europe) |
| | LW | 153 ~ 279 KHz/1 kHz (for Europe) |

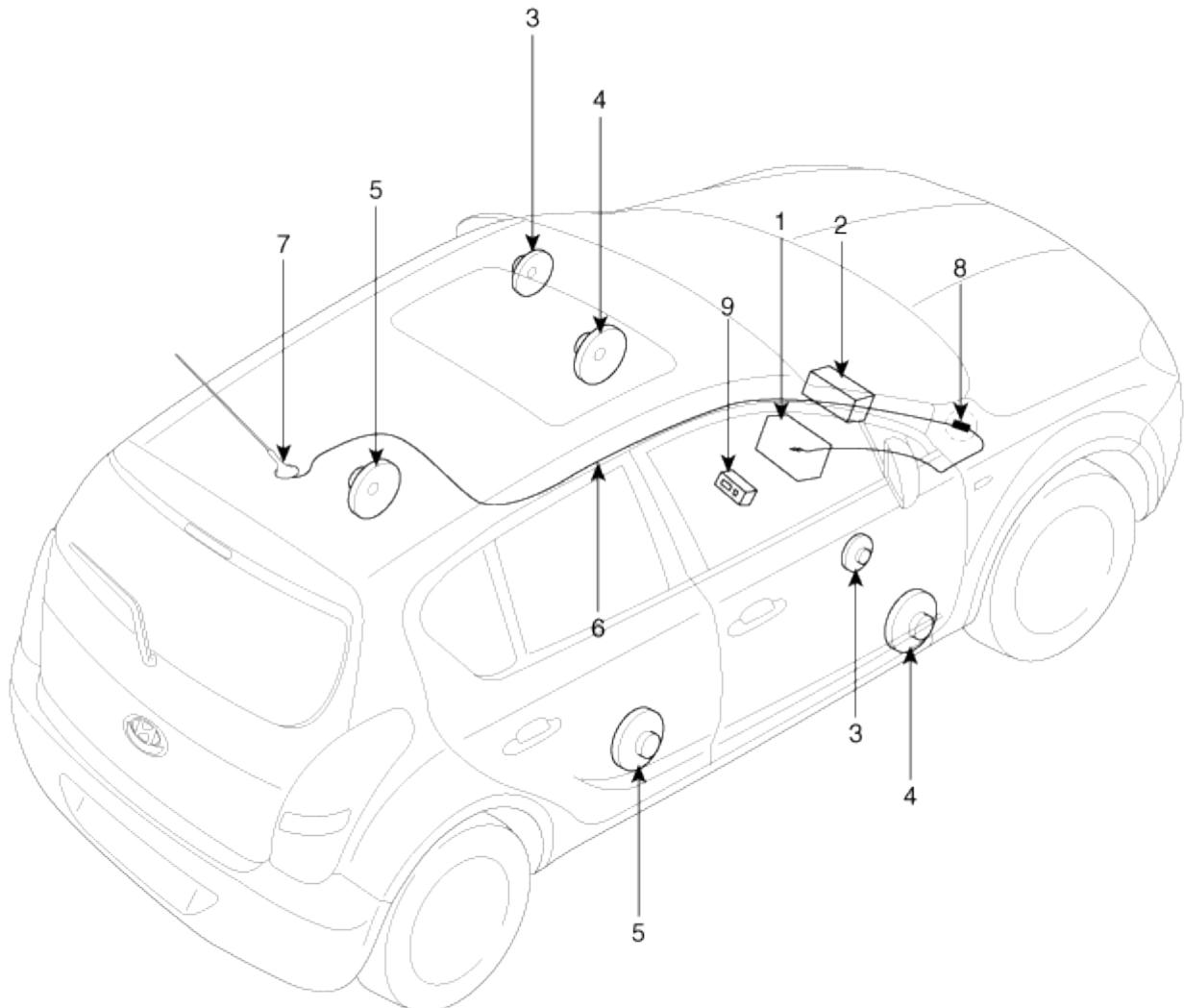
| | |
|-------|--------------|
| Other | AUX/USB/iPod |
|-------|--------------|

Speaker

| Item | Specification | |
|--------------------------|---------------|---------------|
| Input Power
(W) | Tweeter | Max. 40 |
| | Front | Max. 40 |
| | Rear | Max. 40 |
| Speaker Impedance
(Ω) | Tweeter | 4.0 ± 0.6 |
| | Front | 4.0 ± 0.6 |
| | Rear | 4.0 ± 0.6 |
| Speaker Number | | 6 |

12.2.2. Component and Components Location

Component Location



- 1. Audio head unit
- 2. Multi-information display
- 3. Tweeter speaker
- 4. Front door speaker
- 5. Rear door speaker (5DR)
Rear quarter speaker (3DR)

- 6. Antenna feeder cable
- 7. Roof antenna
- 8. Feeder cable joint jack
- 9. Multi-media jack

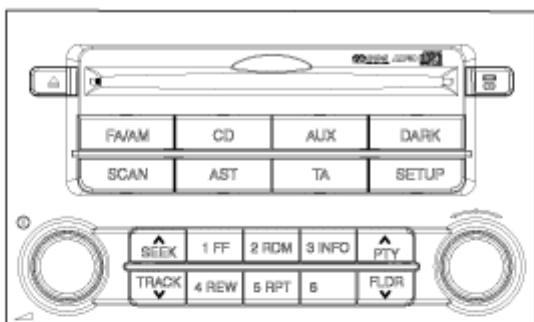
12.2.3. Audio Unit

12.2.3.1. Component and Components Location

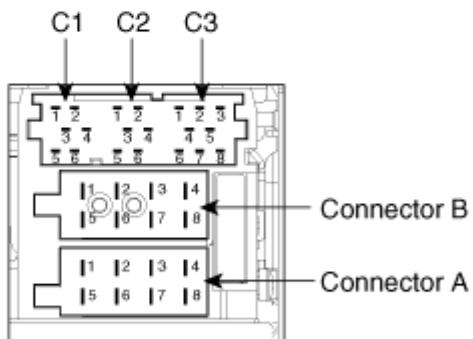
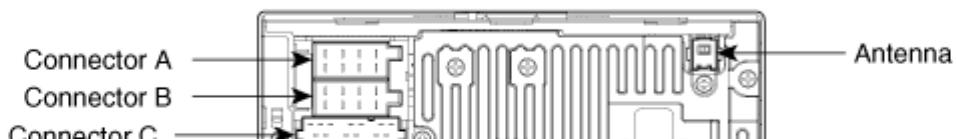
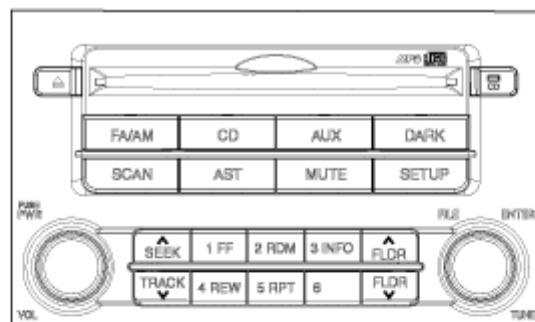
Components

[RADIO/CD/MP3]

(Europe)



(General)

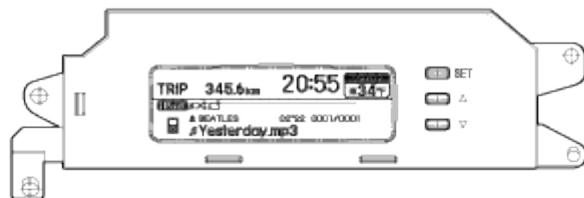


| NO | CONNECTOR A | CONNECTOR B | CONNECTOR C1 | CONNECTOR C2 | CONNECTOR C3 |
|----|-------------|-------------|--------------|--------------|--------------|
| 1 | - | SPEAKER RR+ | - | Aux R in | - |
| 2 | ILL (+) | SPEAKER FR+ | - | Aux L in | USB D - |
| 3 | Remote Ant. | SPEAKER FL+ | - | Aux Ref. | - |
| 4 | BATT + | SPEAKER RL+ | - | Aux Detect | USB D + |
| 5 | Temp. | SPEAKER RR- | - | Wheel Remote | iPod/USB GND |
| 6 | ACC | SPEAKER FR- | Ignition | Remo GND | - |
| 7 | ILL (-) | SPEAKER FL- | | iPod/USB VDD | - |
| 8 | POWER GND | SPEAKER RL- | | | |

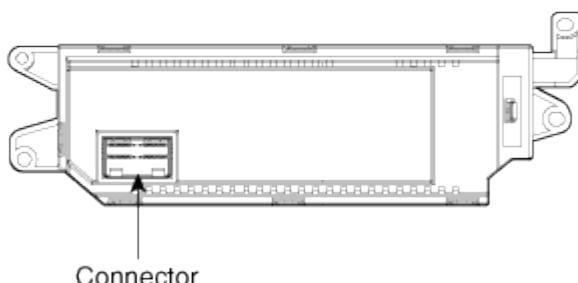
Multi-Information Display



[LHD]



[RHD]



20P Connector

| | | | |
|----|-------------|----|-------------|
| 1 | Speed Input | 11 | CAN HI |
| 2 | Tacho Input | 12 | CAN LO |
| 3 | Injection | 13 | - |
| 4 | Signal GND | 14 | Trip Switch |
| 5 | Temp Input | 15 | AMB GND |
| 6 | Fuel GND | 16 | AMB Input |
| 7 | Fuel Input | 17 | - |
| 8 | ILL(-) | 18 | - |
| 9 | ACC | 19 | ILL(+) |
| 10 | Battery(+) | 20 | IGN1 |

12.2.3.2. Repair procedures

Removal

Audio Head Unit

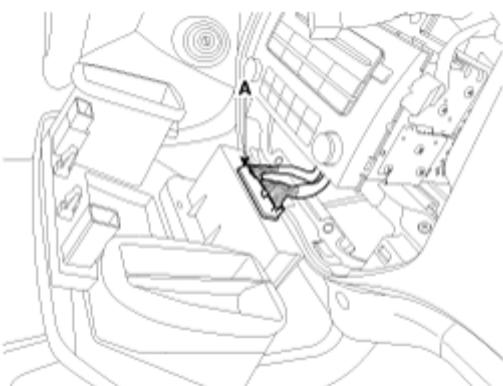
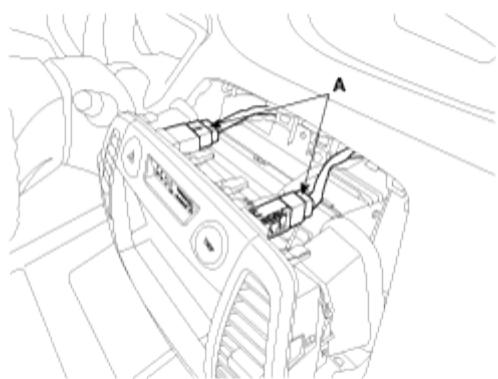
1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad center fascia panel (A).

NOTE

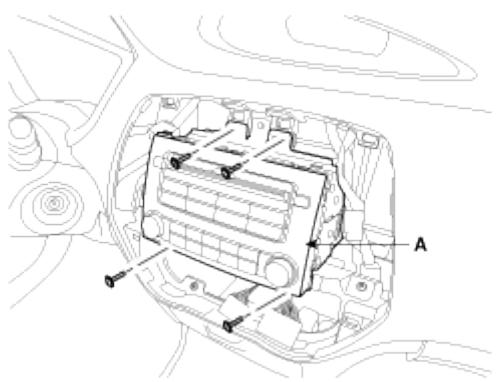
Take care not to scratch the crash pad and related parts.



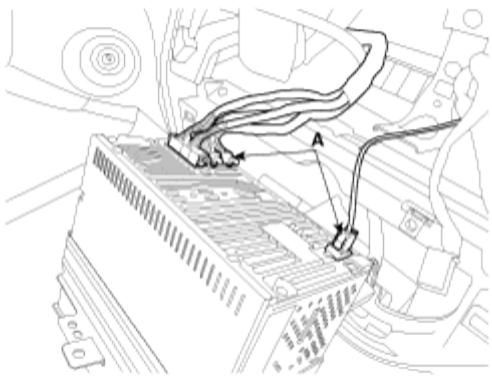
3. Disconnect the connectors (A) from the crash pad center fascia panel.



4. Remove the mounting bolts then remove the audio unit (A).

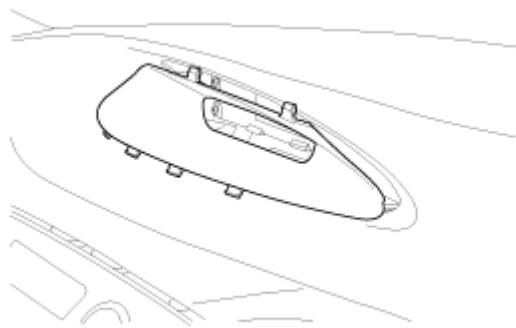


5. Disconnect the audio connectors and cable (A).

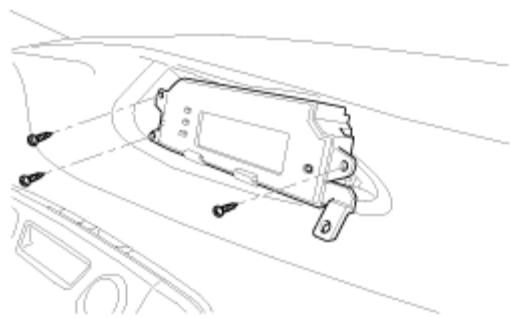


Multi-Information Display

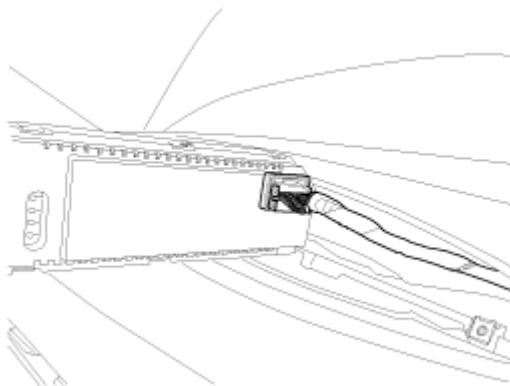
1. Remove the multi-display fascia panel from the crash pad.



2. Remove the multi-display unit after loosening 4 screws.



3. Disconnect the multi-display unit connector.



Installation

Audio Head Unit

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

NOTE

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

Multi-Information Display

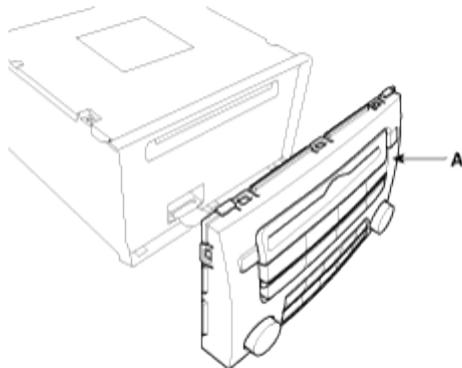
1. Install the multi-display unit.
2. Install the multi-display fascia panel.

NOTE

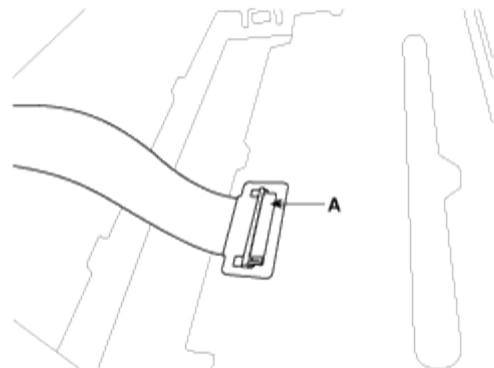
- Make sure the multi-information display connector is plugged in properly.

Disassembly

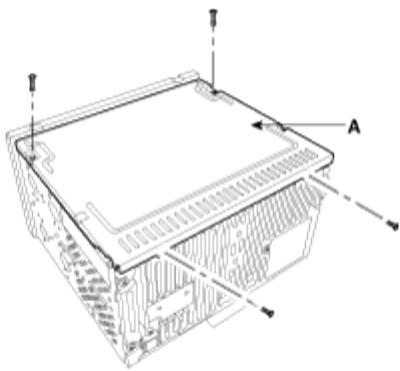
1. Disassemble the front cover (A).



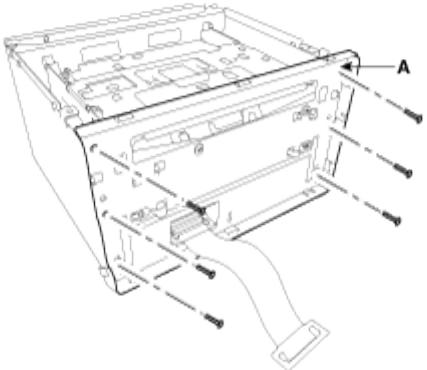
2. Disconnect the film connector (A) carefully from the front cover.



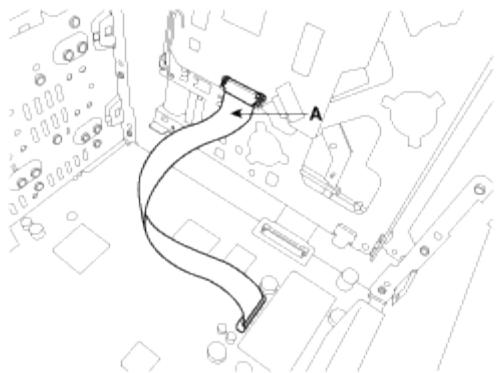
3. Disassemble the top cover (A) after loosening 4 screws.



4. Disassemble the deck cover (A) after loosening 6 screws.



5. Disconnect the connector (A) carefully between the unit and the deck after loosening 4 screws.



6. Disassemble the deck from the unit.

Reassembly

1. Assemble the deck to the unit.
2. Assemble the deck cover.
3. Assemble the front cover.
4. Assemble the top cover.

NOTE

- Make sure the film connectors are plugged in properly.

12.2.4. Speakers

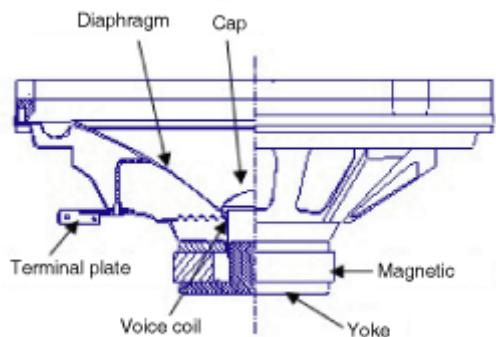
12.2.4.1. Repair procedures

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 | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> 1. Check if the wiring connector is connected normally. If not, reconnect the wiring connector. 2. In case of radio static, check if there is a noise from CD. 3. When a noise is heard on turning radio and CD on, replace the speaker with new one. <p>NOTE</p> <p>In case there is only radio static, this causes from poor radio reception. Thus the speaker needs no repair and replacement.</p> |
| 3 | Poor working | <p>Inspection of the wiring connection between the battery and the speaker</p> <ul style="list-style-type: none"> 1. Before replacing the speaker, inspect the wiring connection between the battery and the speaker is normal. 2. Check the supplying power to the speaker and the resistance, then inspect the sound quality. <ul style="list-style-type: none"> ■ Specified impedance : $2 \sim 4\Omega$ <p>3. If the speaker works poorly, replace it with new one.</p> |

CAUTION

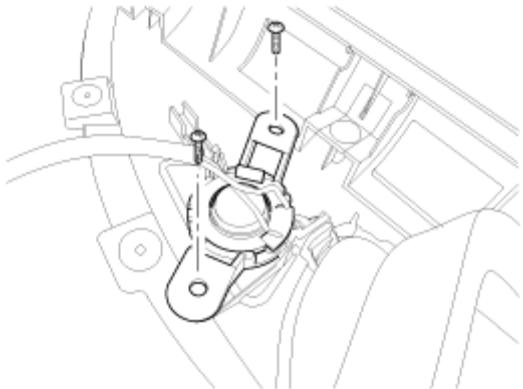
- During dealing of speaker

- Do not damage the speaker with impact as like a drop and a throw.
- Be careful not to cover water and oil over the speaker.
- Caution during dealing of speaker because the material of diaphragm is paper which is easy to be torn by impact and external force.
- When modifying audio system as customer pleases, this does electric damage to speaker.
- And, in this case the speakers are not covered by the manufacturer's warranty.

Removal

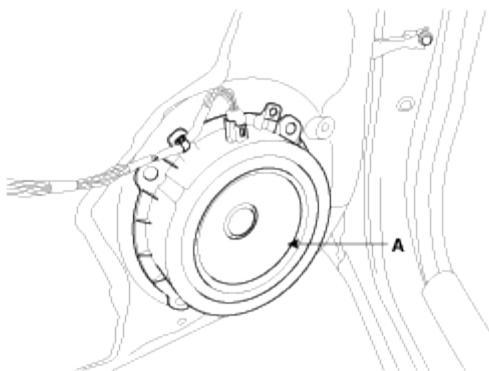
Tweeter Speaker

1. Remove the front door trim.
(Refer to the BD group - "Front door")
2. Remove the tweeter speaker from the door trim after loosing 2 screws.



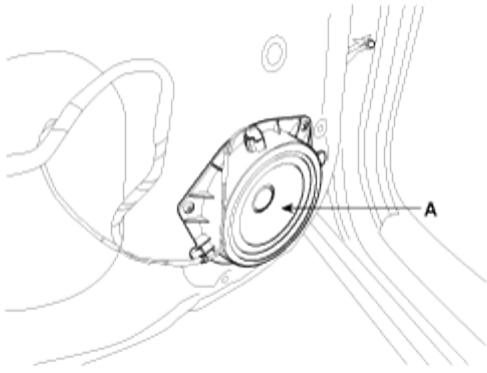
Front Speaker

1. Remove the front door trim.
(Refer to the BD group - "Front door")
2. Remove the front speaker (A) after removing 4 rivets.



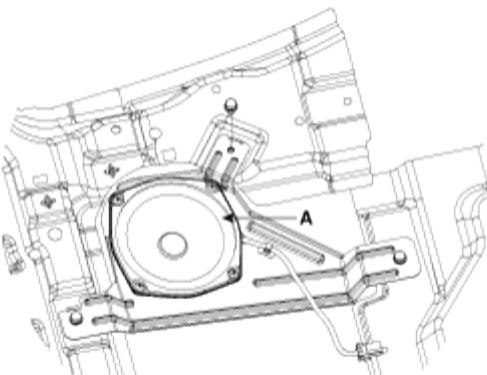
Rear Speaker (5 Door)

1. Remove the rear door trim.
(Refer to the BD group - "Rear door")
2. Remove the rear speaker (A) after removing 3 rivets.



Rear Speaker (3 Door)

1. Remove the rear seat.
(Refer to the BD group - "Rear Seat")
2. Remove the rear quarter panel.
(Refer to the BD group - "Interior")
3. Remove the rear speaker (A) after removing 3 bolts.



Installation

Tweeter Speaker

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

Front Speaker

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

Rear Speaker (5 Door)

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

Rear Speaker (3 Door)

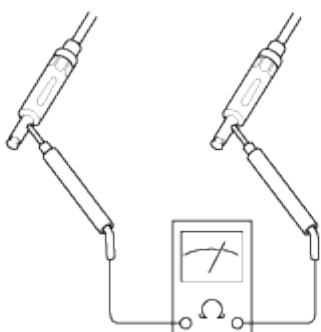
1. Install the rear speaker.
2. Install the rear quarter panel.
3. Install the rear seat.

12.2.5. Antenna
12.2.5.1. Repair procedures

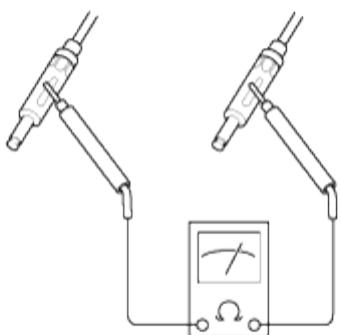
Inspection

Antenna Cable

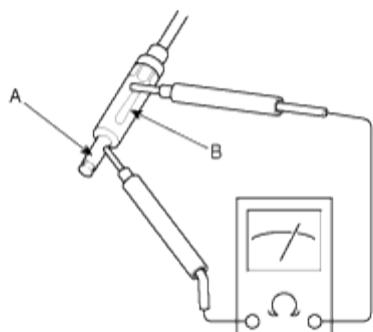
1. Remove the antenna jack from the audio unit and antenna.
2. Check for continuity between the center poles of antenna cable.



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



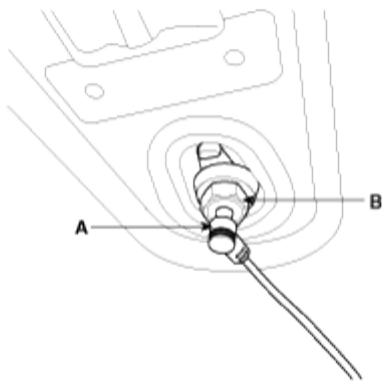
4. If there is no continuity, replace the antenna cable.
5. Check for continuity between the center pole (A) and outer pole (B) of antenna cable. There should be no continuity.



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

Replacement

1. Remove the front roof trim.
(Refer to the BD group - "Roof trim")
2. Disconnect the feeder cable jack (A).



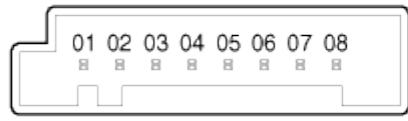
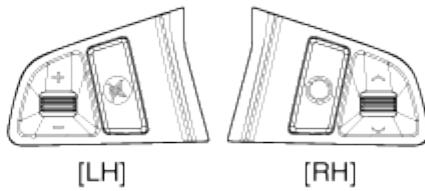
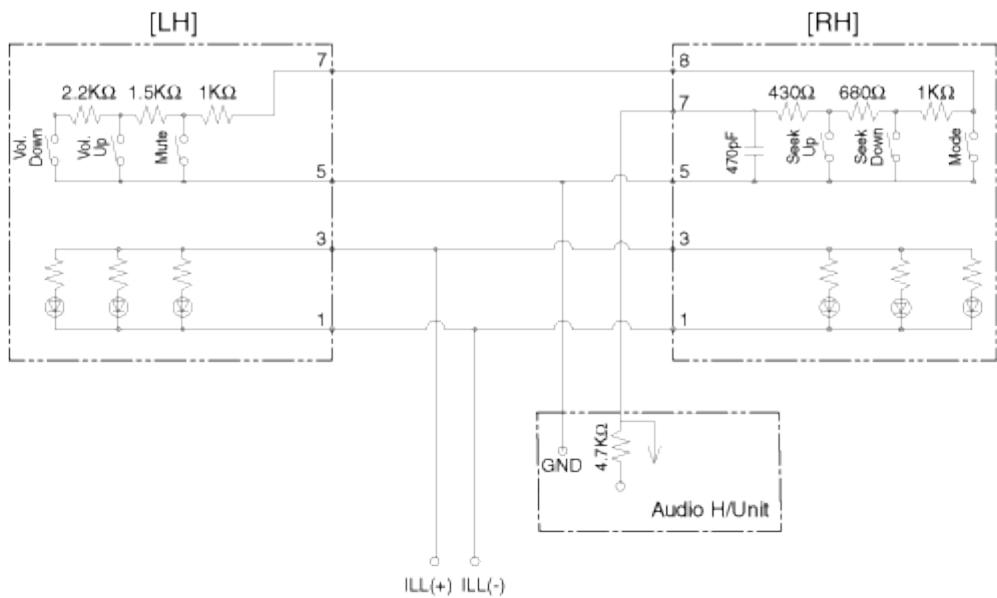
3. Remove the flange nut (B) from the roof antenna.

4. Installation is the reverse of removal.

12.2.6. Audio Remote control

12.2.6.1. Schematic Diagrams

Circuit Diagram



Audio remote control connector

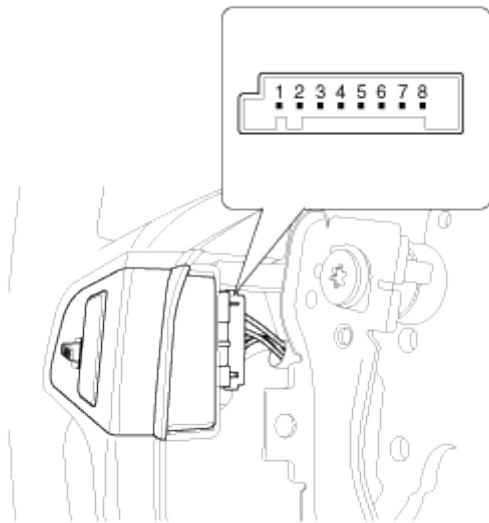
| No. | Connector (LH) | Connector (RH) |
|-----|--------------------------|---------------------------|
| 1 | ILL(-) | ILL(-) |
| 2 | - | - |
| 3 | ILL(+) | ILL(+) |
| 4 | - | - |
| 5 | Audio H/Unit GND | Audio H/Unit GND |
| 6 | - | - |
| 7 | Audio H/Unit (Signal in) | Audio H/Unit (Signal in) |
| 8 | - | Audio H/Unit (Signal out) |

12.2.6.2. Repair procedures

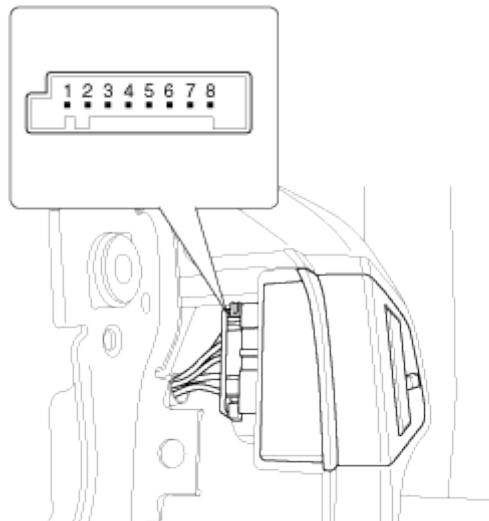
Inspection

1. Check for resistance between No.5 and No.7 terminals in each switch position.

[LH]



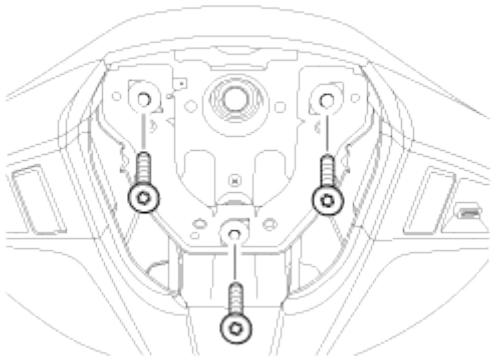
[RH]



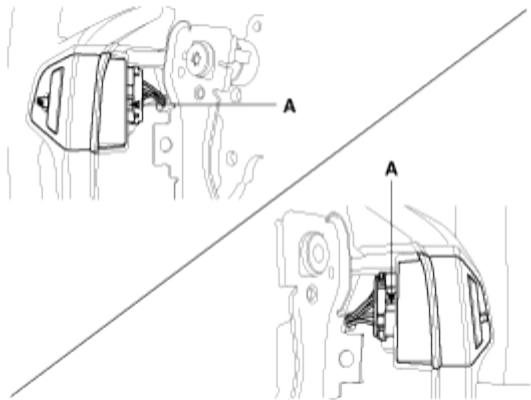
| Switch | Connector terminal | Resistance ($\pm 5\%$) |
|-------------|--------------------|--------------------------|
| Volume Down | 5-7 (LH) | 6.81 k Ω |
| Volume Up | 5-7 (LH) | 4.61 k Ω |
| Mute | 5-7 (LH) | 3.11 k Ω |
| Mode | 5-7 (RH) | 2.11 k Ω |
| Seek Down | 5-7 (RH) | 1.11 k Ω |
| Seek Up | 5-7 (RH) | 430 Ω |

Removal

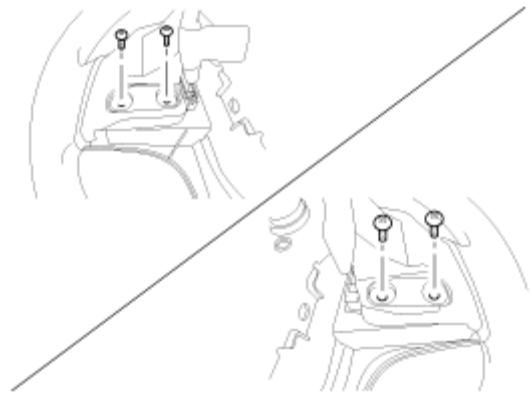
1. Disconnect the negative (-) battery terminal.
2. Remove the driver airbag module.
(Refer to the RT group - "Airbag module and clock spring")
3. Remove the steering wheel after loosening the nut and disconnecting the connector.
(Refer to the ST group - "Steering column and shaft")
4. Remove the steering wheel lower cover after loosening the 3 screws.



5. Disconnect the audio remote control switch connector (A).



6. Loosen the screws (4EA) on the opposite side of the steering wheel.



7. Remove the audio remote control switch.

Installation

1. Install the audio remote control switch on the steering wheel.
2. Connect the audio remote control switch connector.
3. Install the steering wheel.
4. Install the driver airbag module.

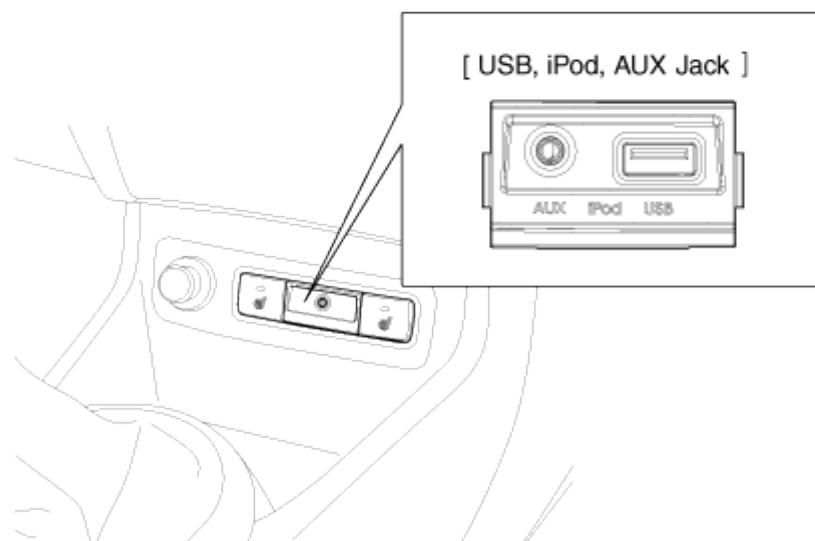
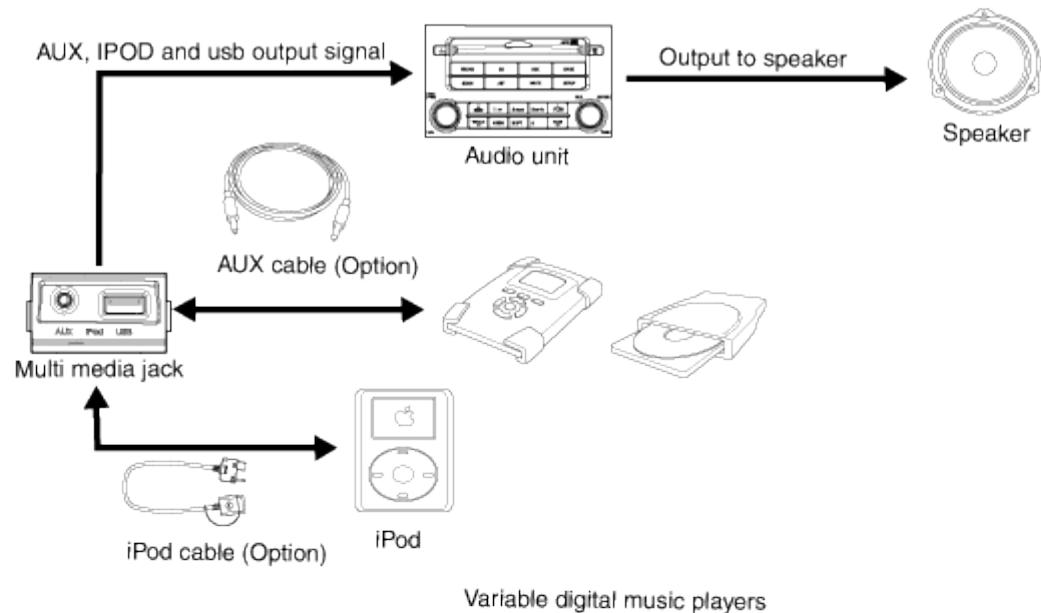
12.2.7. Multimedia jack 12.2.7.1. Description and Operation

Description

The AUX, iPod and USB JACK on the center console is for customers who like to listen to external portable music players like the MP3, iPod, USB memory stick, CD player and etc., through the vehicle's sound system when it is linked to this jack. The customer has this added option.

In case of distortions from media connected to the AUX source, the audio unit may not be defect but the output level of

the used media does not match the specification of the AUX input.



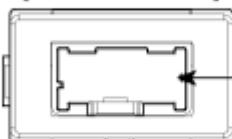
12.2.7.2. Component and Components Location

Components

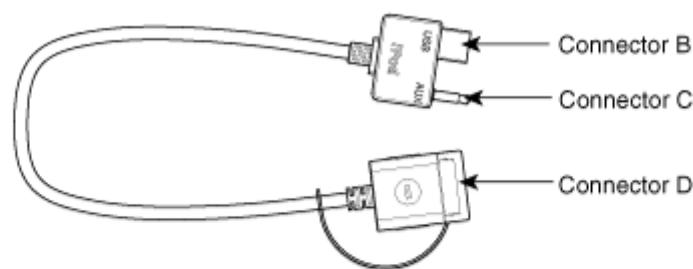
[AUX, USB, iPod]



[Jack Connector]



[iPod Cable]

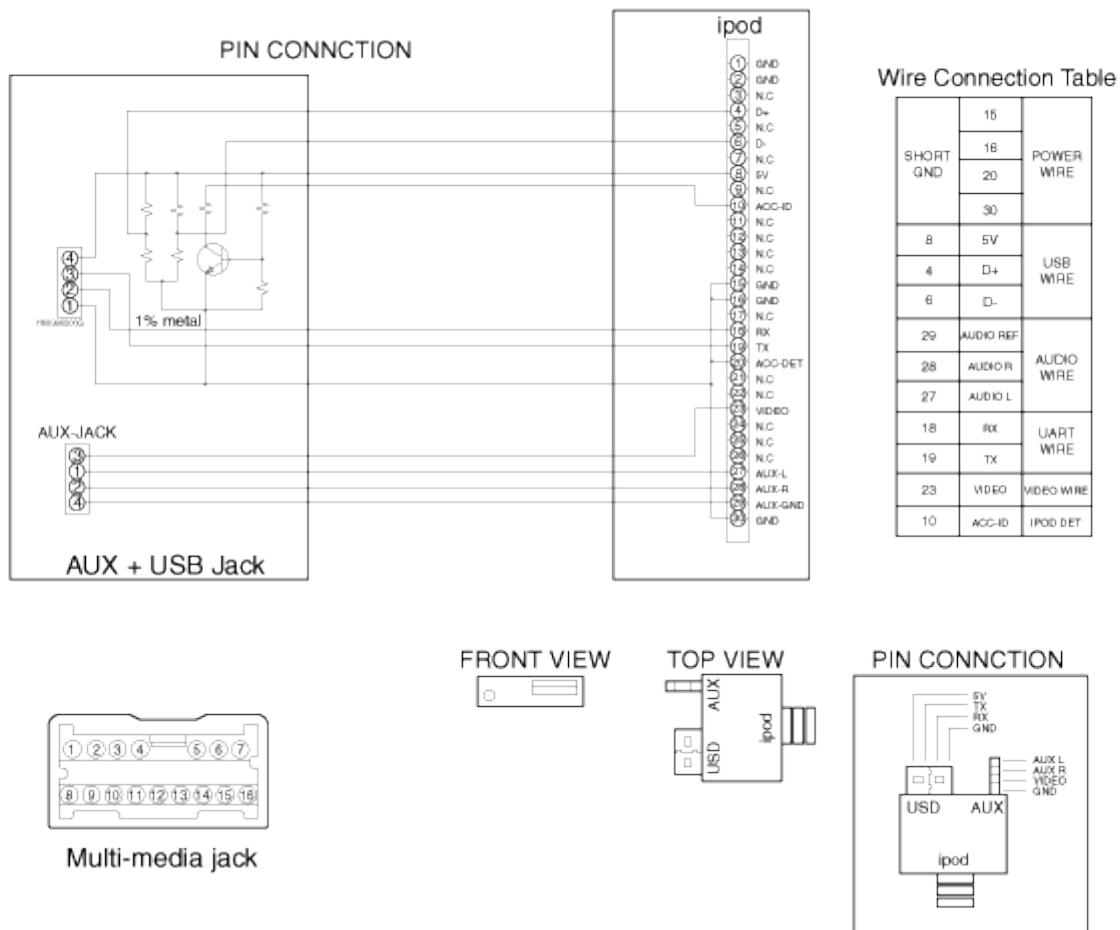


| Name | Multi-media Jack
Connector A
(USB/AUX/iPod) | USB
Connector B | AUX
Connector C | iPod
Connector D |
|-----------|---|--------------------|--------------------|---------------------|
| Connector | | | | |
| 1 | USB/iPod 5V | USB/iPod 5V | AUX1 L IN | - |
| 2 | USB D-/iPod TX | USB D-/iPod TX | AUX1 R IN | - |
| 3 | USB D+/iPod RX | USB D+/iPod RX | Option/ Video | - |
| 4 | USB/ iPod GND | USB/iPod GND | AUX1 GND | D+ |
| 5 | - | | | - |
| 6 | AUX1 REF | | | D- |
| 7 | AUX1 L IN | | | - |
| 8 | ILL+ | | | 5V |
| 9 | USB Shield GND | | | - |
| 10 | - | | | ACC ID |
| 11 | M/Media GND | | | - |
| 12 | - | | | - |
| 13 | - | | | - |
| 14 | AUX DET | | | - |
| 15 | AUX shield GND | | | GND |
| 16 | AUX1 R IN | | | GND |
| 17 | | | | - |
| 18 | | | | RX |
| 19 | | | | TX |
| 20 | | | | ACC GND |
| 21 | | | | - |
| 22 | | | | - |
| 23 | | | | Video |
| 24 | | | | - |
| 25 | | | | - |
| 26 | | | | - |
| 27 | | | | AUX1 L IN |
| 28 | | | | AUX1 R IN |
| 29 | | | | AUX1 REF |
| 30 | | | | Signal wire GND |

12.2.7.3. Schematic Diagrams

Circuit Diagram

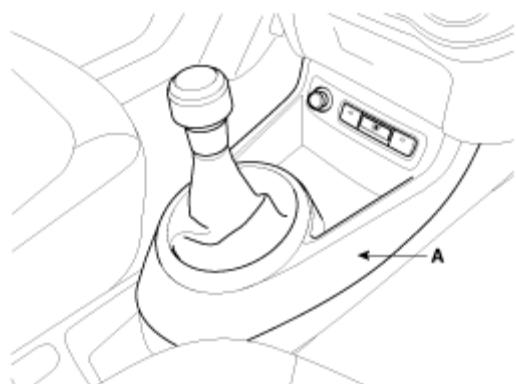
[Aux + USB + iPod] Multimedia jack



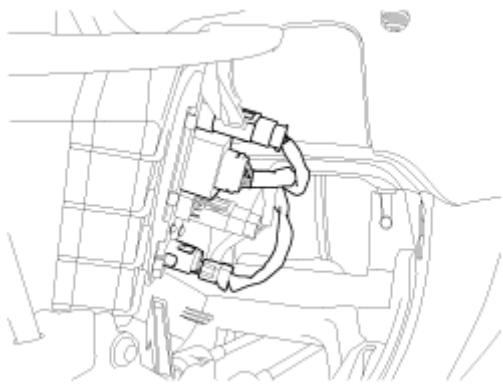
12.2.7.4. Repair procedures

Removal

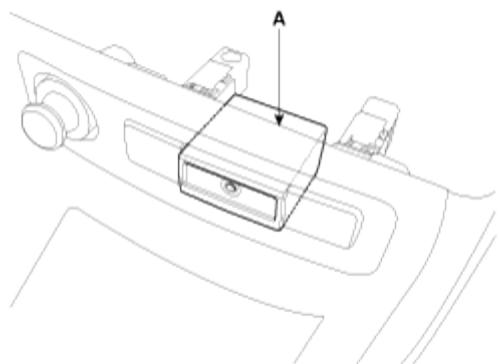
1. Remove the center console cover (A).
(Refer to the BD Group - "Console")



2. Disconnect the jack assembly connectors from the center console cover.



3. Remove the Multi-media jack (A) from the center console cover.



Installation

1. Install the Multi-media jack.
2. Connect the Multi-media jack connector.
3. Install the center console upper cover to the floor console.

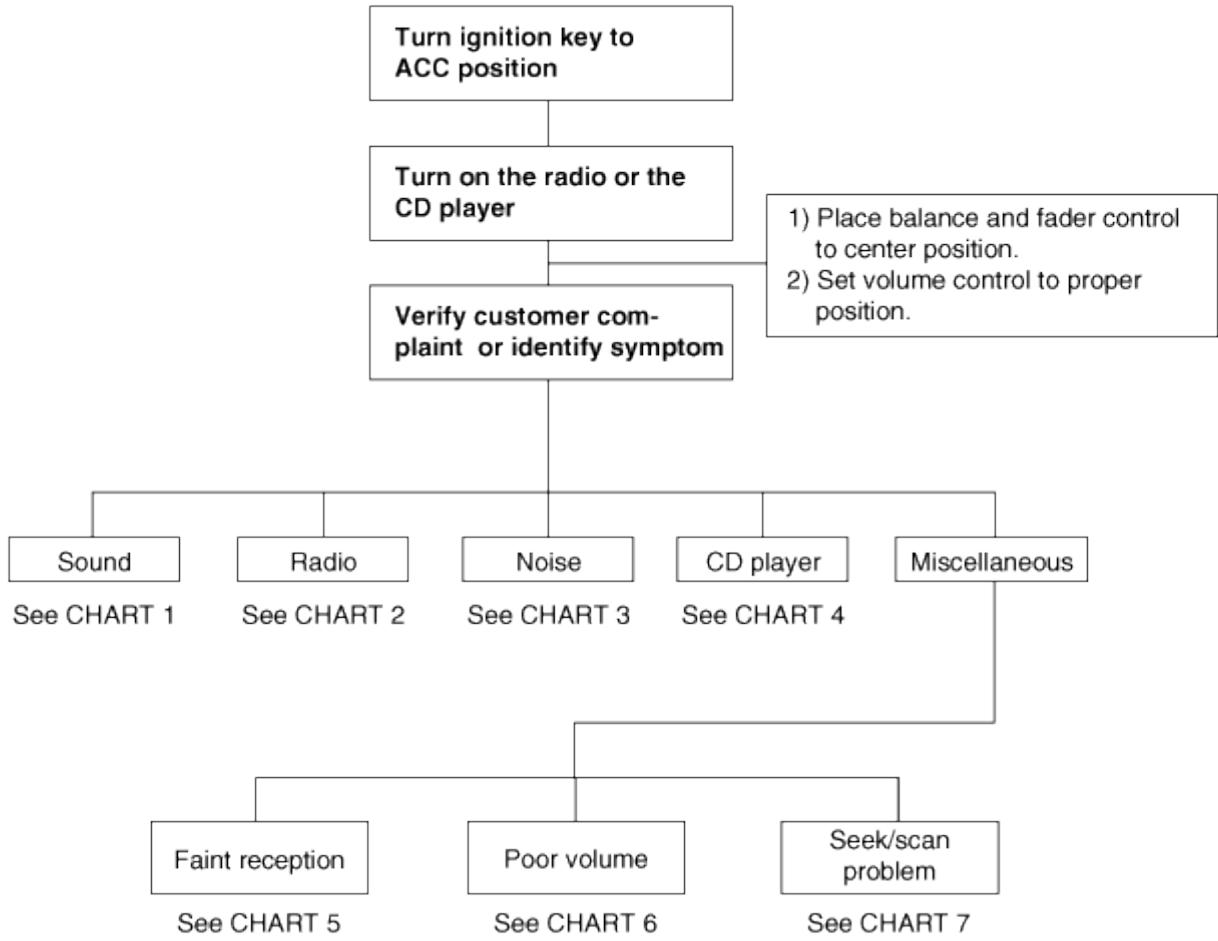
12.2.8. Troubleshooting

Troubleshooting

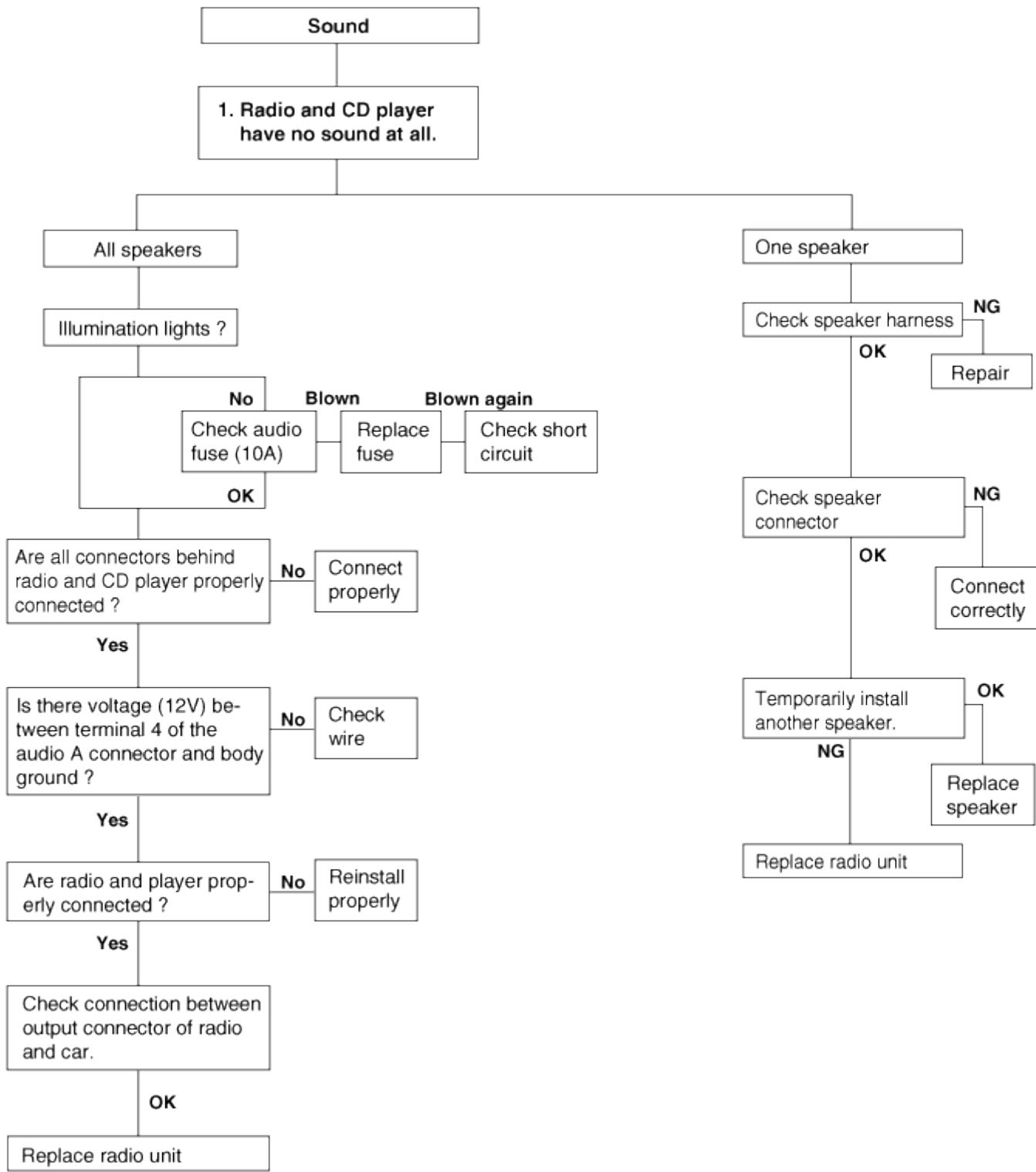
Customer Complaint Analysis Check Sheet

| Item | Status | How to check |
|--------|--|--|
| System | Audio is not functioning and no function of display | <ul style="list-style-type: none"> ▶ Check the fuse between audio unit and vehicle ▶ Check power connections |
| Radio | No radio reception | <ul style="list-style-type: none"> ▶ Check if the antenna is completely and correctly connected. |
| | Poor radio reception | <ul style="list-style-type: none"> ▶ Antenna (disc antenna) obscured, antenna rod bent or antenna defective. ▶ Please arrange for an authorized dealer to check the antenna. |
| | The frequency instead of the station name is displayed. | <ul style="list-style-type: none"> ▶ The unit is tuned to a station that does not transmit RDS signals or the transmitter is too weak. |
| | The required station cannot be tuned to using automatic search | <ul style="list-style-type: none"> ▶ Set desired station manually (manual tuning) ▶ Check whether the antenna is completely and correctly connected |
| | No traffic announcements are switched through (during CD playback) | <ul style="list-style-type: none"> ▶ Activate the traffic announcement by pressing the TA button <p>* TA : Traffic Announcement</p> |
| CD | CD will not be accepted | <ul style="list-style-type: none"> ▶ Clean CD with damp cloth ▶ The CD does not comply with the CD player specification ▶ See notes on Audio and MP3 CDs |
| | Distorted sound/skips during CD play | <ul style="list-style-type: none"> ▶ With the set on, wait for 5 minutes until the condensation evaporates |
| | No sound during CD playback | <ul style="list-style-type: none"> ▶ Some CDs contain multimedia data which is not recognized by the unit ▶ Advance the tracks until music is heard |

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



1. System Check Procedure



2. Radio Check Procedure

Chart 1

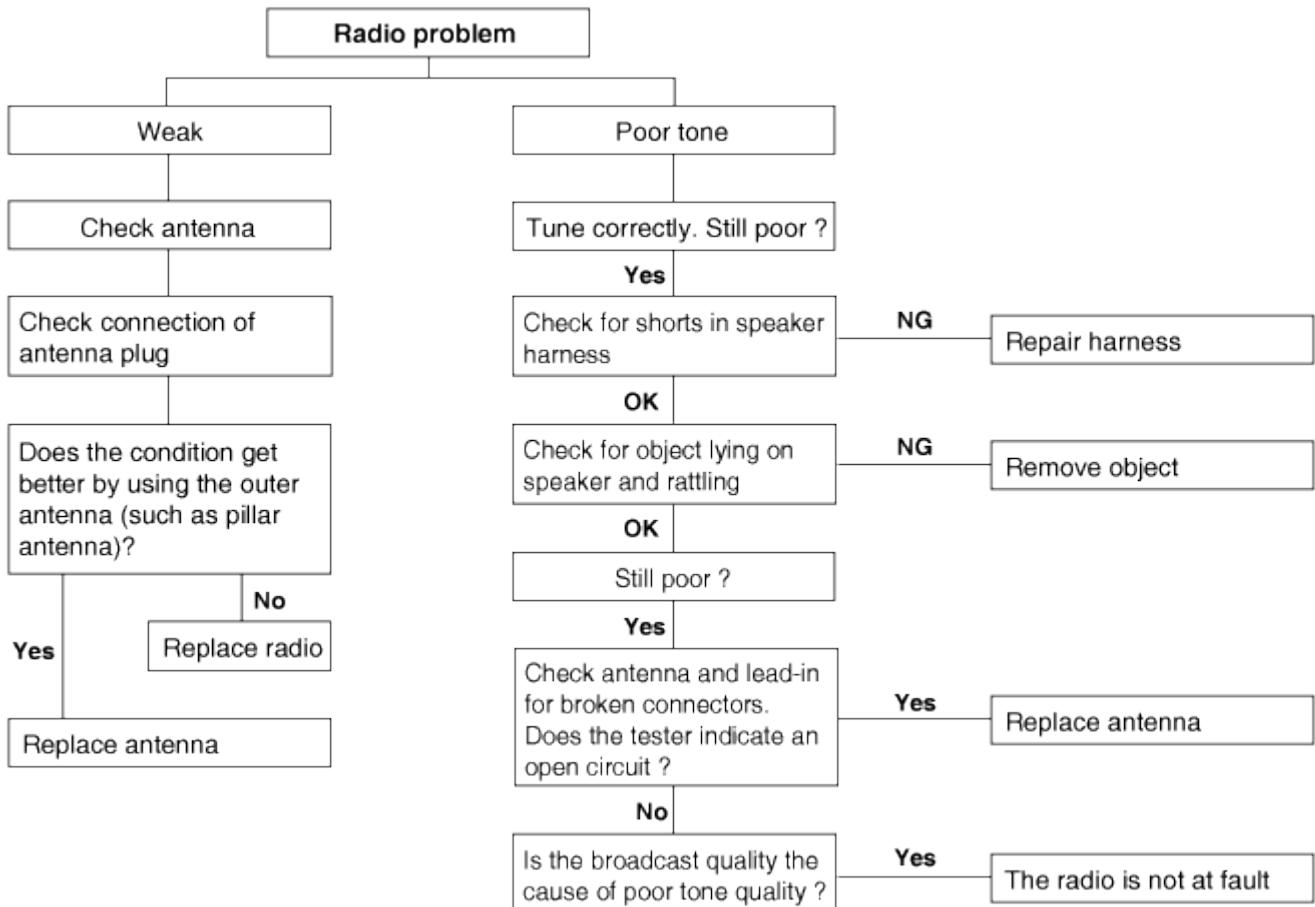


Chart 2

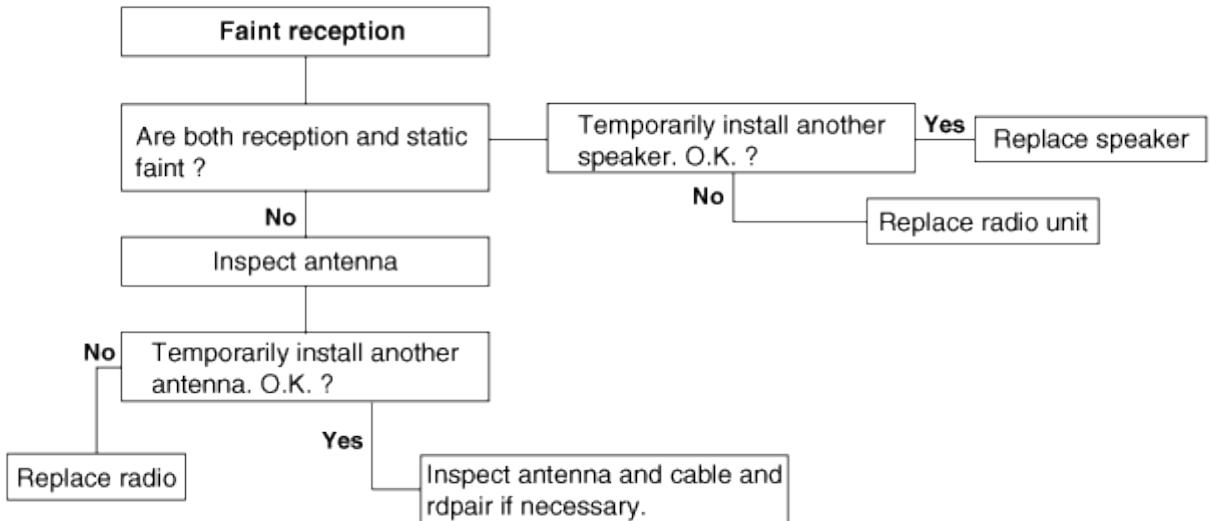


Chart 3

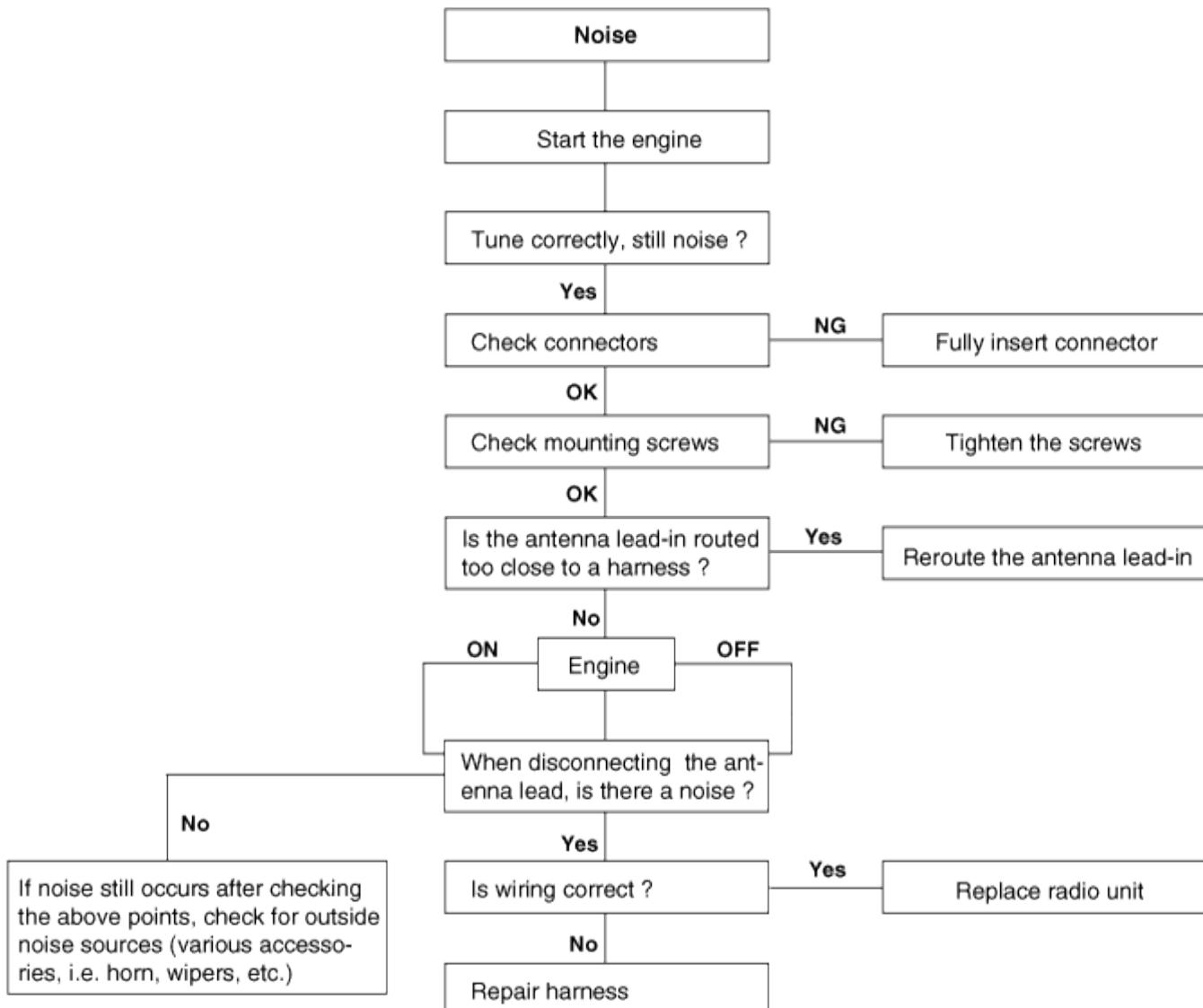


Chart 4

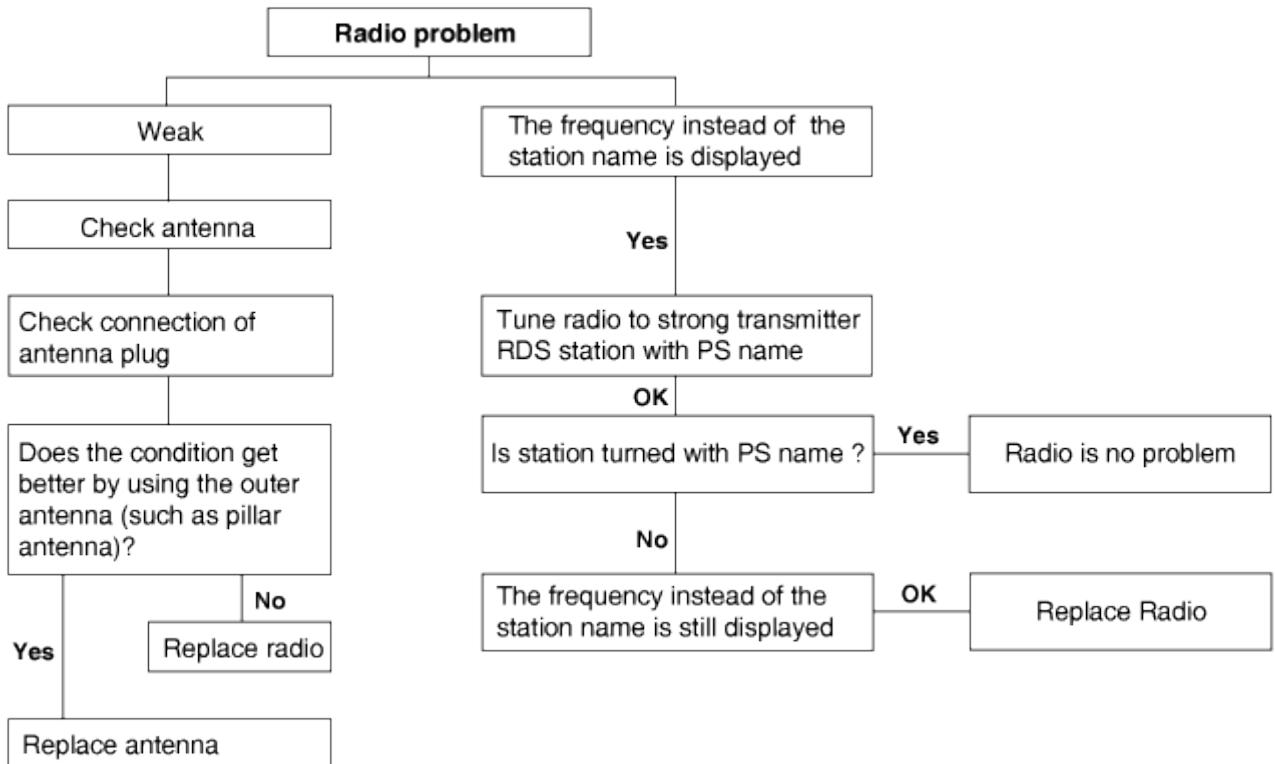


Chart 5

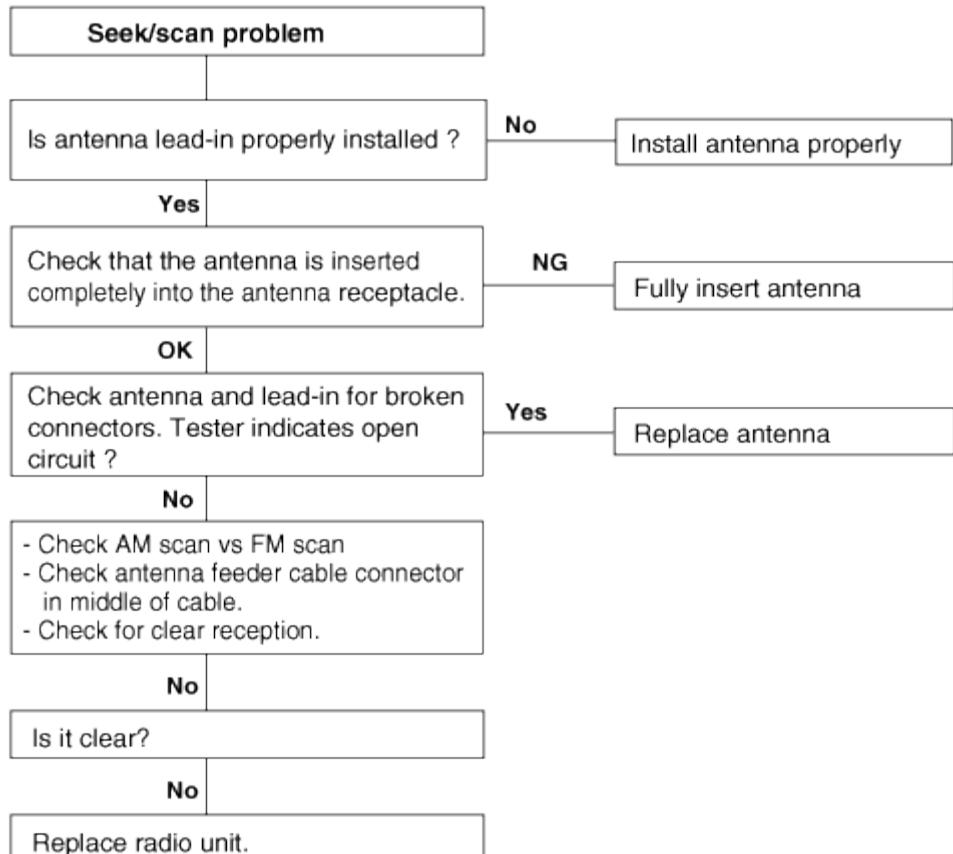
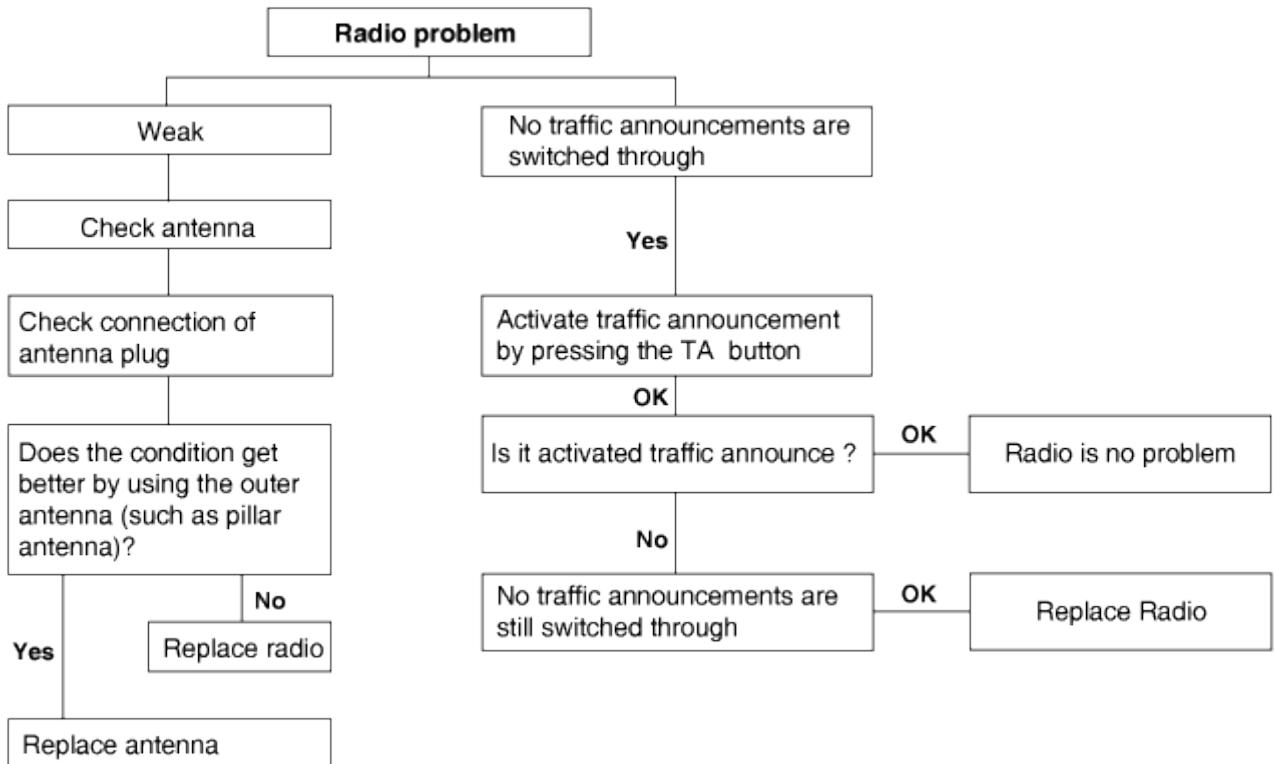


Chart 6



3. CD Check Procedure

Chart 1. CD Will Not Be Accepted

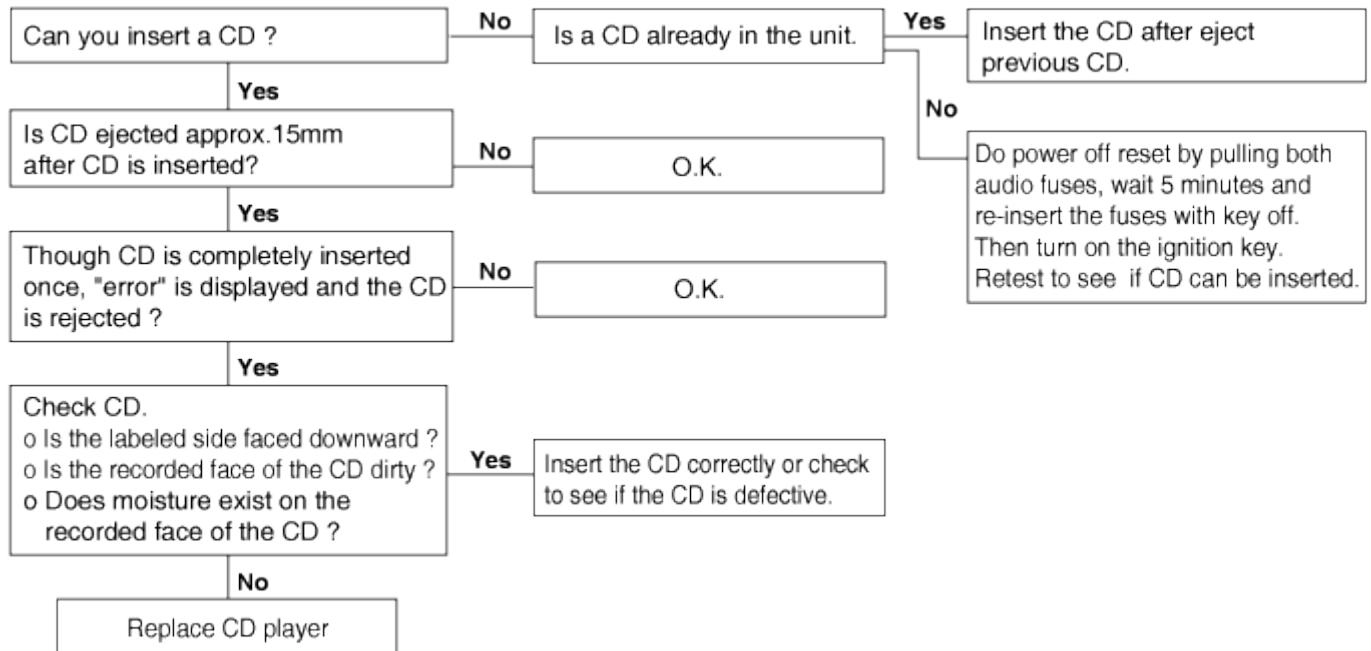
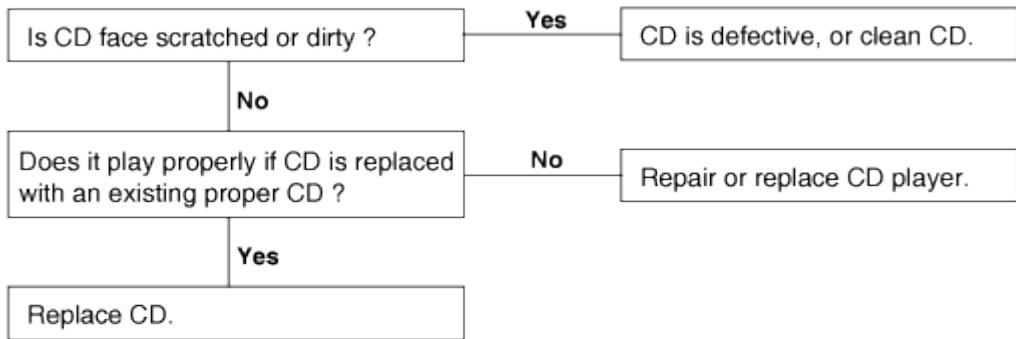


Chart 2. CD Sound Skips

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.)

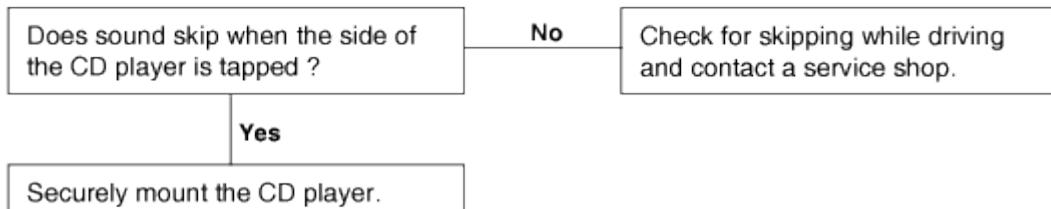
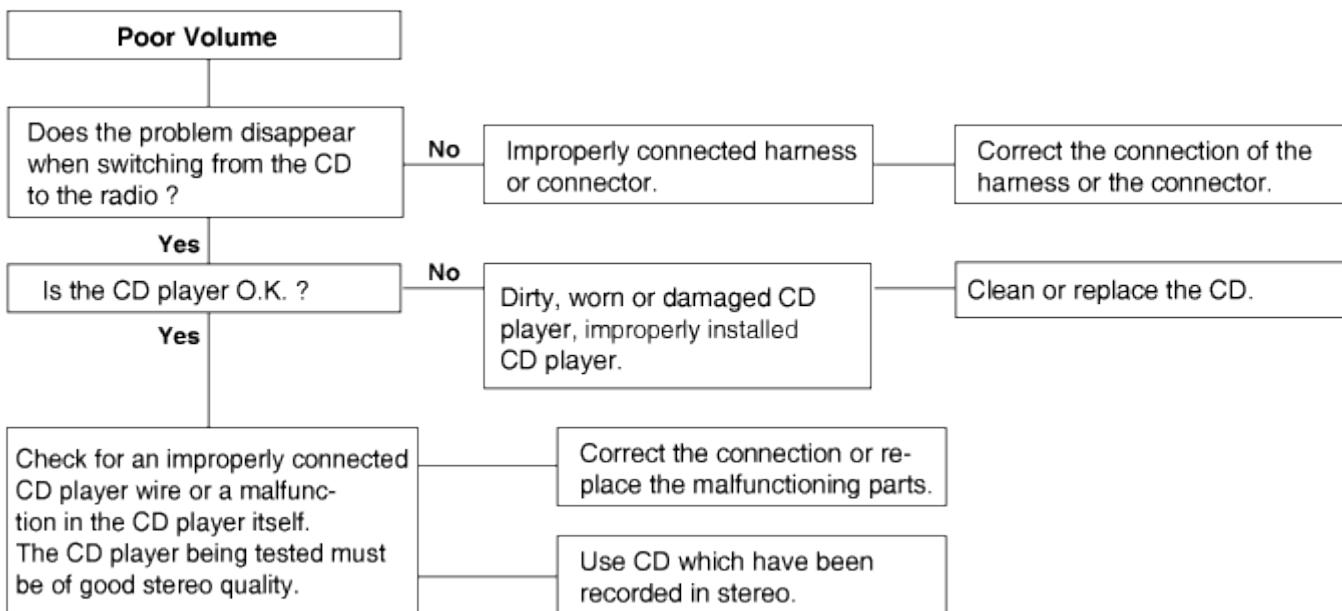


Chart 3



12.3. Multifunction switch

12.3.1. Specifications

Specifications

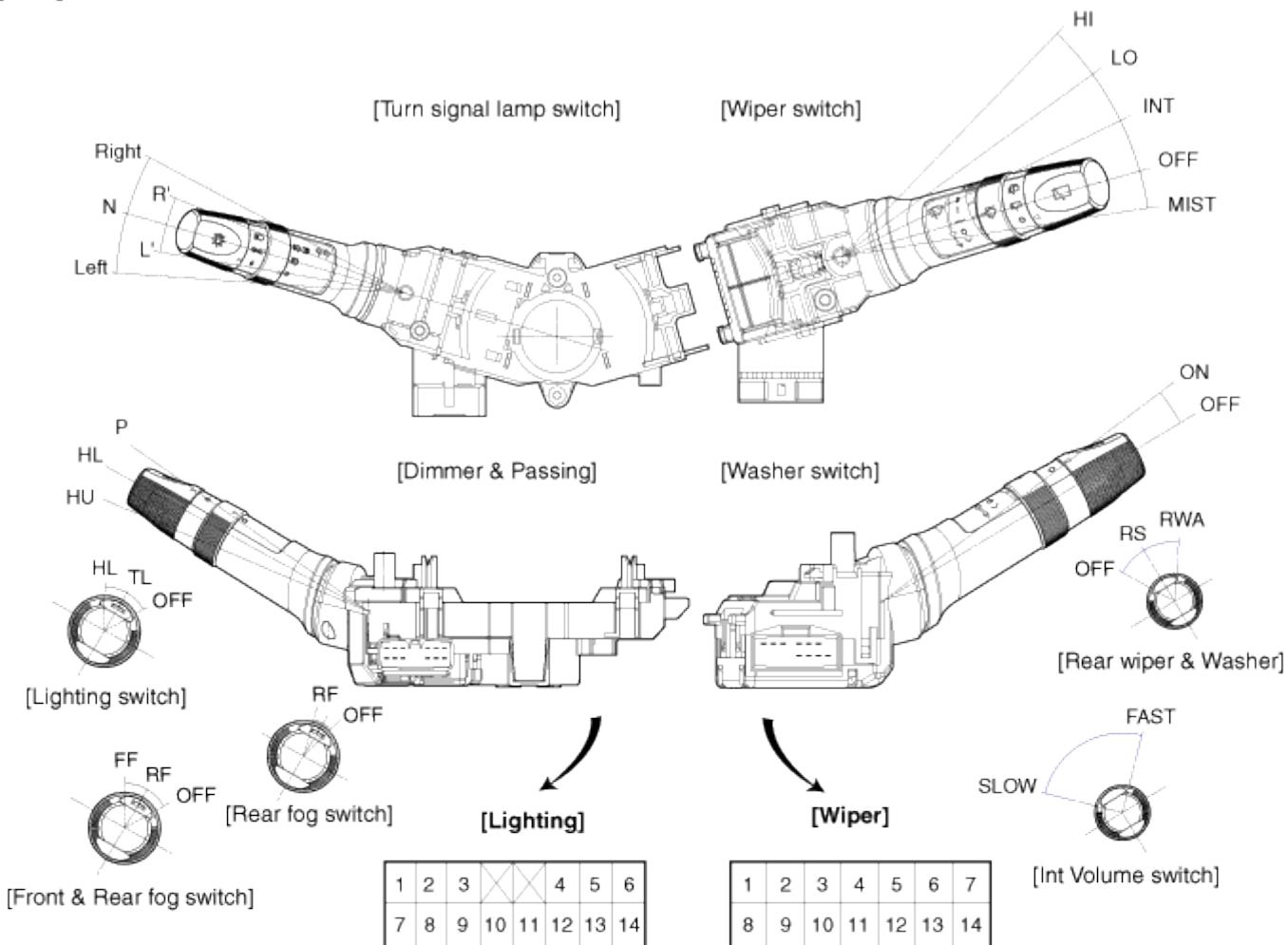
| Items | Specifications |
|-----------------------------|------------------------------|
| Rated voltage | DC 12V |
| Operating temperature range | -30°C ~ +80°C (-22 ~ +176°F) |
| Lever end play | 0.098 in (2.5 mm) |

| | | |
|------------|-------------------------|---|
| Rated load | Dimmer & passing switch | High : 120W (Lamp load)
Low : 110W (Lamp load)
Tail lamp : 66W (Lamp load) |
| | Lighting switch | Rear fog : 21W (Lamp load) |
| | Turn signal switch | 69W (Flasher unit) |
| | Front & Rear Fog | Front fog : 200mA
Rear fog : 200mA
(Relay load) |
| | Wiper & mist switch | High : 5A (Motor load)
Low : 5 A (Motor load)
Lock : Max. 25A (Motor load) |
| | Washer switch | 5A (Motor load) |
| | Variable INT Volume | Max. 25mA |
| | Rear wiper & Washer | Wiper : 3.5A (Relay load)
Washer : 5A (Motor load)
Lock : Rear wiper 14A (Motor load) |

12.3.2. Component and Components Location

Component

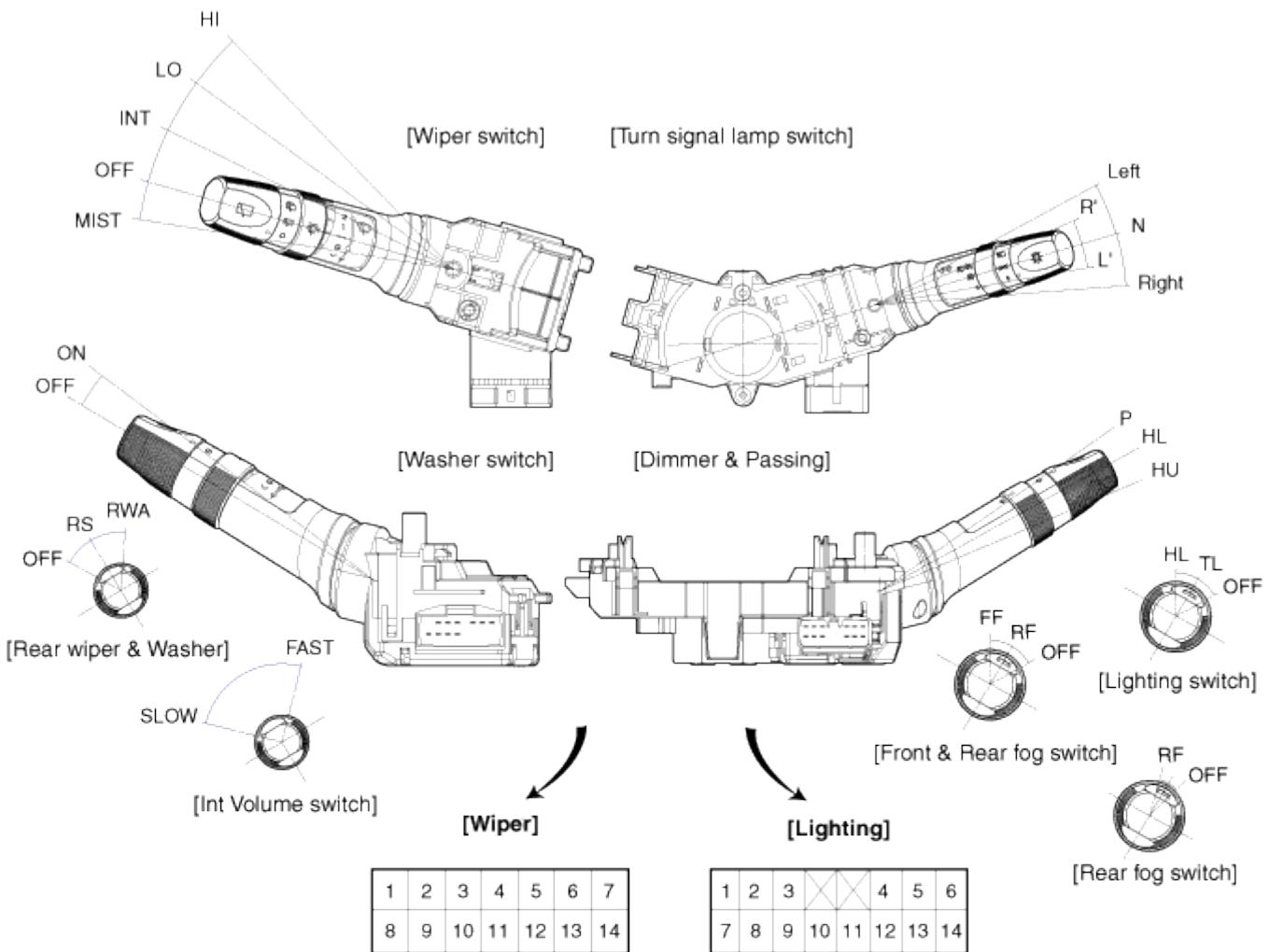
[LHD]



Circuit connection

| Connector Name | Terminal No. | Description | Connector Name | Terminal No. | Description |
|---------------------|--------------|------------------------------|------------------|--------------|-----------------------------|
| Lighting
(14Pin) | 1 | Head lamp switch power | Wiper
(14Pin) | 1 | Wiper ground |
| | 2 | Head lamp switch earth | | 2 | Wiper / Washer / Mist Power |
| | 3 | Head lamp high beam power | | 3 | Wiper High speed |
| | 4 | Head lamp low beam power | | 4 | Wiper Low speed |
| | 5 | Tail lamp switch | | 5 | Wiper parking |
| | 6 | Rear fog lamp switch | | 6 | Front washer switch |
| | 7 | Fog switch earth | | 7 | - |
| | 8 | Front fog lamp switch | | 8 | - |
| | 9 | Rear fog lamp switch | | 9 | - |
| | 10 | - | | 10 | - |
| | 11 | - | | 11 | Rear Parking |
| | 12 | Turn signal lamp (LH) switch | | 12 | Rear washer |
| | 13 | Flasher unit power | | 13 | Rear wiper |
| | 14 | Turn signal lamp (RH) switch | | 14 | Rear wiper & washer power |

[RHD]



Circuit connection

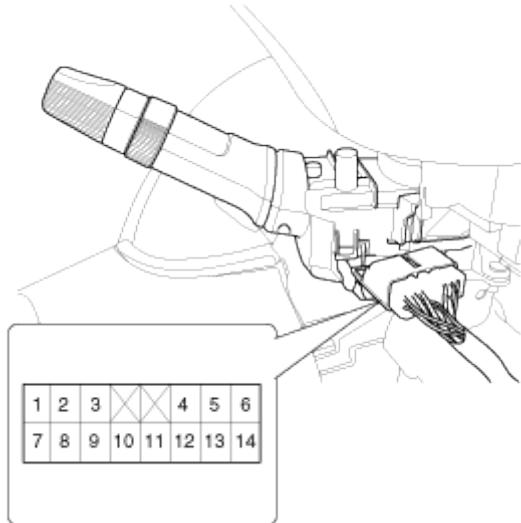
| Connector Name | Terminal No. | Description | Connector Name | Terminal No. | Description |
|------------------|--------------|-----------------------------|------------------|--------------|---------------------------|
| Wiper
(14Pin) | 1 | - | Light
(14Pin) | 1 | Rear fog lamp switch |
| | 2 | Front washer switch | | 2 | Tail lamp switch |
| | 3 | Wiper parking | | 3 | Head lamp low beam power |
| | 4 | Wiper Low speed | | 4 | Head lamp high beam power |
| | 5 | Wiper High speed | | 5 | Head lamp switch ground |
| | 6 | Wiper / Washer / Mist Power | | 6 | Head lamp switch power |
| | 7 | Wiper ground | | 7 | Turn signal lamp (LH) |
| | 8 | Rear wiper & washer power | | 8 | Flasher unit power |
| | 9 | Rear wiper | | 9 | Turn signal lamp (RH) |
| | 10 | Rear washer | | 10 | - |
| | 11 | Rear Parking | | 11 | - |
| | 12 | - | | 12 | Fog switch earth |
| | 13 | - | | 13 | Front fog lamp switch |
| | 14 | - | | 14 | Rear fog lamp switch |

12.3.3. Repair procedures

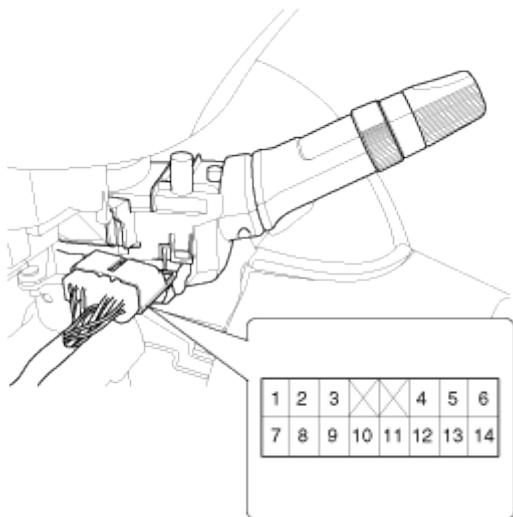
Inspection

Lighting Switch Inspection

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



[RHD]



Lighting Switch

() : RHD

| Terminal
Position | 1(6) | 5(2) | 6(1) | 2(5) | HS |
|----------------------|------|------|------|------|----|
| OFF | | | | | |
| I | ○ | ○ | | | |
| II | ○ | ○ | ○ | ○ | ○ |

HS : Head lamp SW (Short Inside)

Dimmer And Passing Switch

() : RHD

| Terminal
Position | 3(4) | 4(3) | 2(5) | HS |
|----------------------|------|------|------|----|
| HU | ○ | | | ○ |
| HL | | ○ | | ○ |
| P | ○ | | ○ | |

HU : Head lamp high beam

HL : Head lamp low beam

P : Head lamp passing switch

HS : Head lamp switch (Short Inside)

Turn Signal Switch

| | | () : RHD | | |
|---------------|--------------------|-----------|-------|-------|
| Terminal | | 12(7) | 13(8) | 14(9) |
| Hazard switch | Turn signal switch | | | |
| OFF | L | ○ | ○ | |
| | N | | | |
| | R | | ○ | ○ |

Fog Lamp Switch

| | | () : RHD | | |
|--------------|--|-----------|-------|-------|
| Terminal | | 8(13) | 7(12) | 9(14) |
| Position | | | | |
| OFF | | | | |
| Front | | ○ | ○ | |
| Front & Rear | | ○ | ○ | ○ |

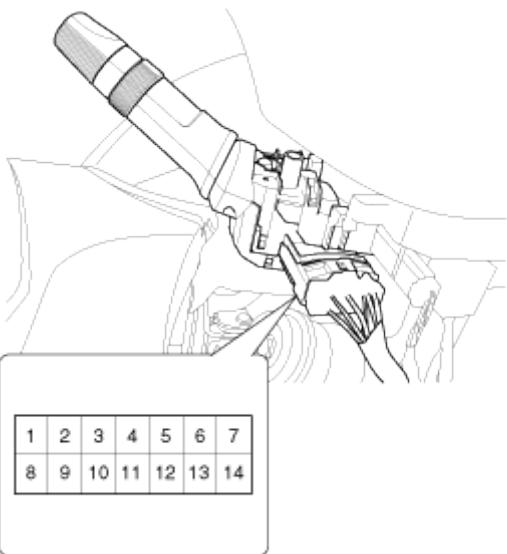
Wiper And Washer Switch Inspection

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

[LHD]



[RHD]



Wiper Switch

| () : RHD | 2(6) | 3(5) | 4(4) | 5(3) |
|----------------------|------|------|------|------|
| Terminal
Position | | | | |
| MIST | ○ | | ○ | |
| OFF | | | ○ | ○ |
| INT | | | ○ | ○ |
| LOW | ○ | | ○ | |
| HI | ○ | ○ | | |

Washer Switch

| () : RHD | 2(6) | 6(2) |
|----------------------|------|------|
| Terminal
Position | | |
| OFF | | |
| ON | ○ | ○ |

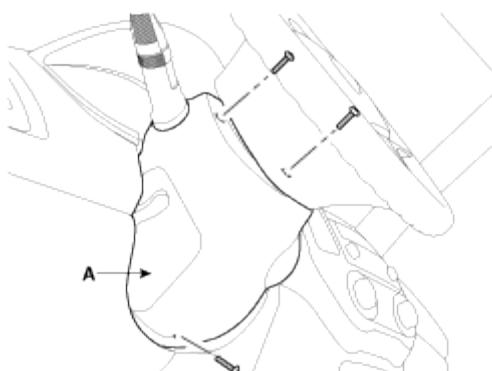
Rear Wiper & Washer Switch

| () : RHD | 13(9) | 11(11) | 14(8) | 12(10) |
|----------------------|-------|--------|-------|--------|
| Terminal
Position | | | | |
| OFF | ○ | ○ | | |
| ON | ○ | | ○ | |
| ON+WASHER | ○ | | ○ | ○ |

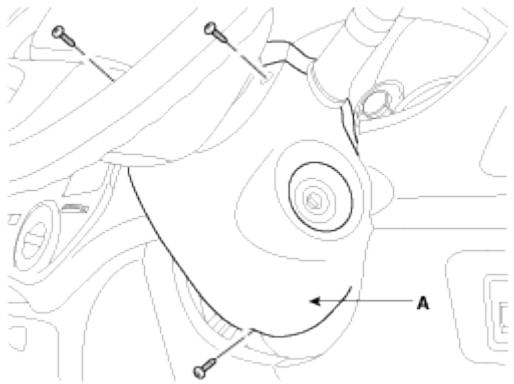
Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the steering wheel.
(Refer to ST group - "Steering column and shaft")
3. Remove the steering column lower shroud (A) after removing 3 screws.
(Refer to ST group - "Steering column and shaft")

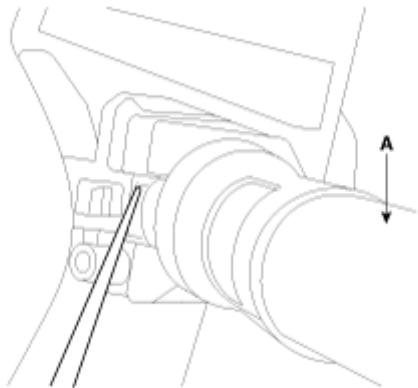
[LHD]



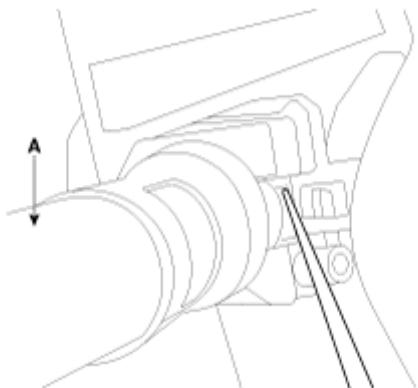
[RHD]



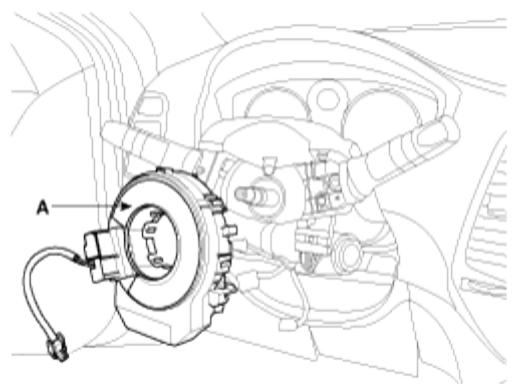
4. Remove the wiper switch (A) by releasing the lock with a suitable tool without removing the steering wheel.
[LHD]



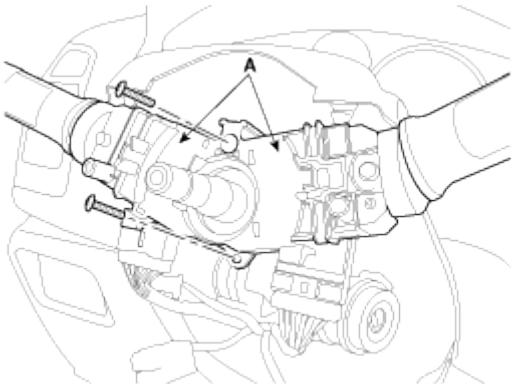
[RHD]



5. Remove the clock spring (A).



6. Remove the multi-function switch assembly (A) after loosening 2 screws.



Installation

1. Install the multi-function switch assembly.
2. Install the clock spring.
3. Install the steering column lower shrouds.
4. Install the steering wheel.

12.4. Horn

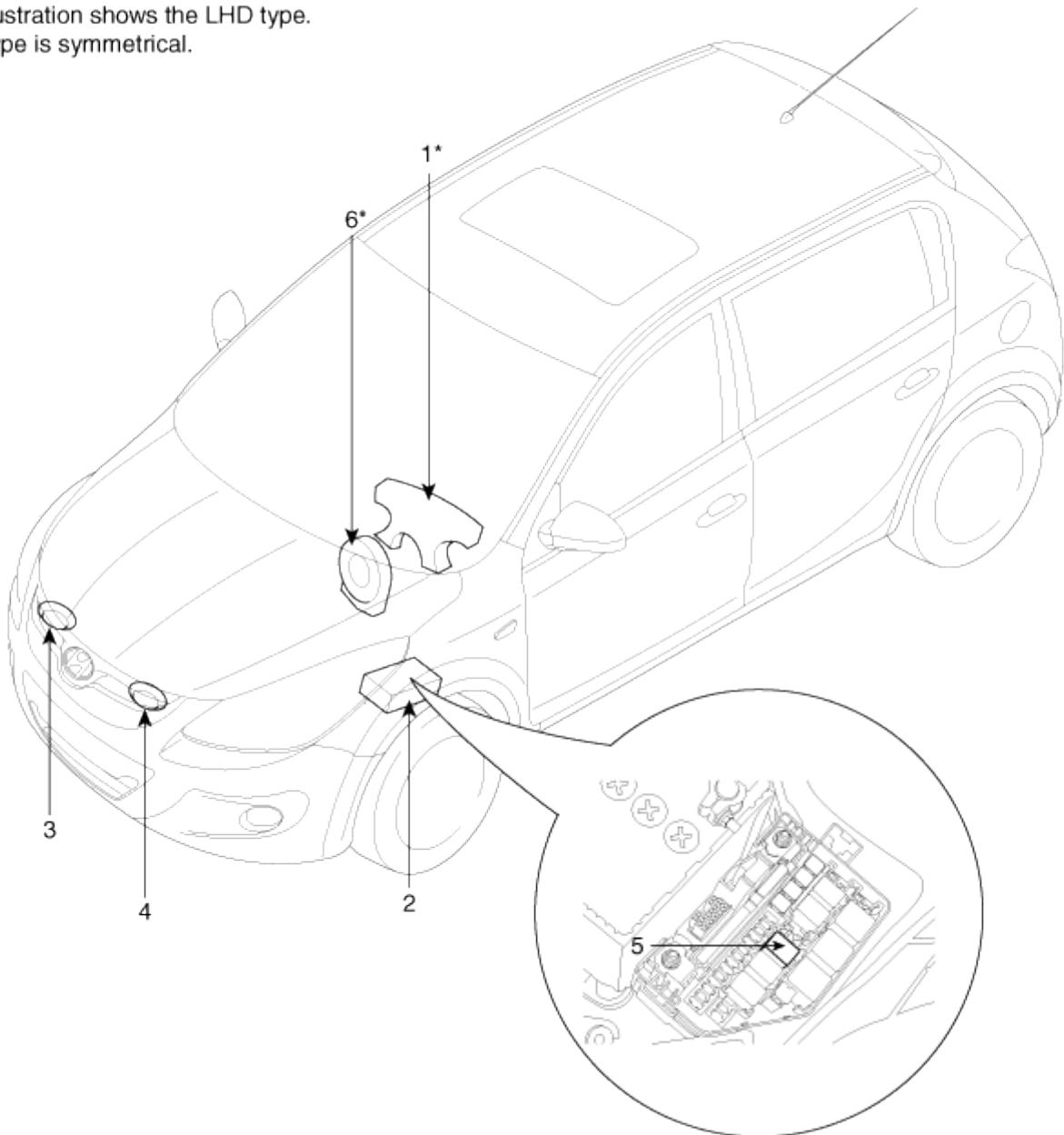
12.4.1. Component and Components Location

Component Location

The parts with asterisk(*) :

This illustration shows the LHD type.

RHD type is symmetrical.



1. Horn switch
2. Relay box (Passenger compartment)
3. Horn (Gasoline only)

4. Horn (Diesel only)
5. Horn relay
6. Clock spring

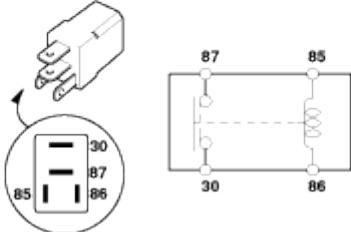
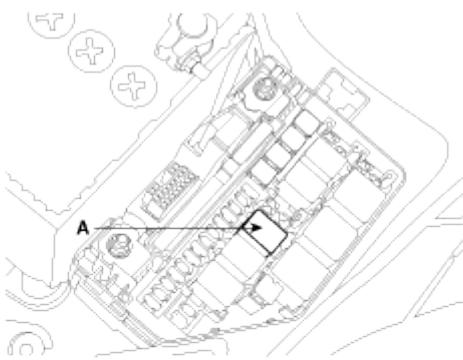
12.4.2. Repair procedures

Inspection

Test the horn by connecting battery voltage to the 1 terminal and ground the 2 terminal. The horn should make a sound. If the horn fails to make a sound, replace it.

Horn Relay Inspection

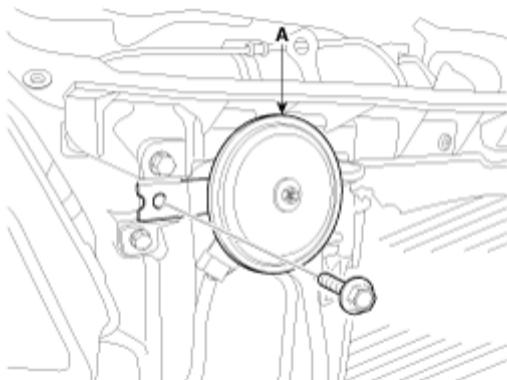
1. Remove the horn relay (A) from the passenger compartment junction box.
2. There should be continuity between the No.30 and No.87 terminals when power and ground are connected to the No.85 and No.86 terminals.
3. There should be no continuity between the No.30 and No.87 terminals when power is disconnected.



| Terminal
Power | 30 | 87 | 85 | 86 |
|-------------------|----|----|----|----|
| Disconnected | | | ○ | ○ |
| Connected | ○ | ○ | ○ | + |

Removal

1. Remove the front bumper.
(Refer to the BD group - "Front bumper")
2. Remove the bolt and disconnect the horn connector, then remove the horn (A).



Installation

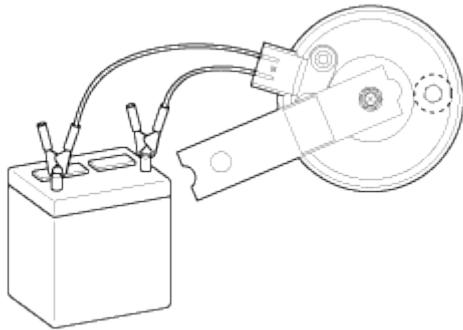
1. Install the horn after connecting the horn connector.
2. Install the front bumper.
(Refer to the BD group - "Front bumper")

Adjustment

1. Operate the horn, and adjust the tone to a suitable level by turning the adjusting hexagon wrench.

NOTE

After adjustment, apply a small amount of UV bond around the hexagon hole to keep it from loosening.



12.5. Keyless Entry And Burglar Alarm

12.5.1. 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 (Frequency Shift Keying) |
| Keyless entry transmitter Power source | Lithium 3V battery (1EA, CR1220) |
| Transmissible distance | 30m or more (For 433.92 MHz)
10m or more (For 313.85 MHz) |
| Life of battery | 2 years or more (at 20 times per day) |
| Button | 3 (Door lock / unlock / Tailgate open) |
| Transmission frequency | 433.92 MHz (Europe, General)
313.85 MHz (Japan) |

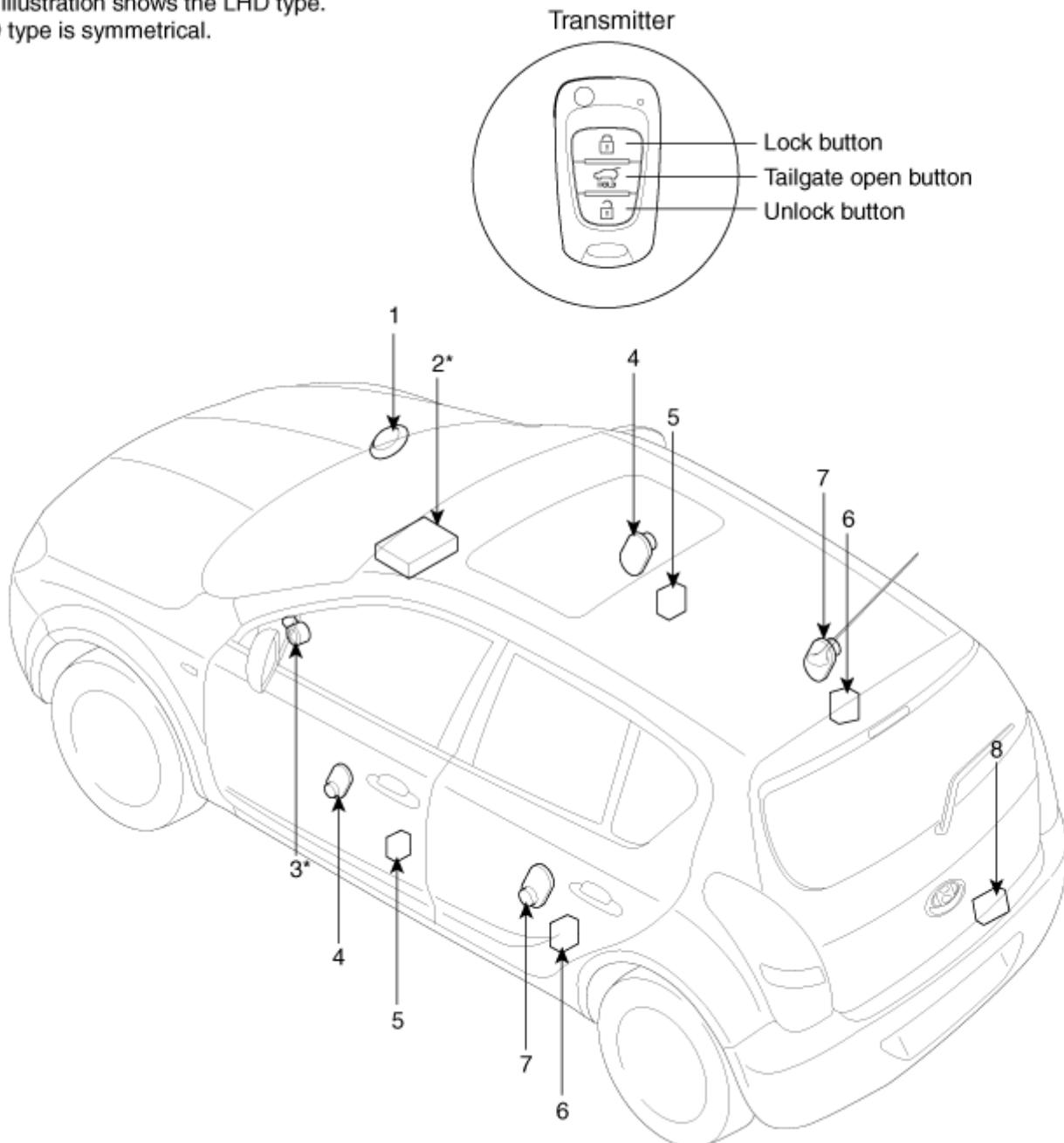
12.5.2. Component and Components Location

Component Location

The parts with asterisk(*) :

This illustration shows the LHD type.

RHD type is symmetrical.



- | | |
|--|---|
| 1. Burglar horn
2. Body control module
3. Key warning switch
4. Front door switch | 5. Front door lock actuator
6. Rear door lock actuator
7. Rear door switch
8. Tailgate actuator & switch |
|--|---|

12.5.3. Description and Operation

Description

Burglar Alarm System

The burglar alarm system is armed automatically after the doors, hood and tailgate are closed and locked.

The system is set off when any of these things occur :

- A door is forced open.
- The tailgate is opened.
- The hood is opened.

When the system is set off, the alarm sounds and the hazard lamp flash for about 27±2sec or until the system is disarmed by unlocking the transmitter or door key.

For the system to arm, the ignition switch must be off and the key removed. Then, the body control module must receive signals that the doors, hood, and tailgate are closed and locked. When everything is closed and locked, none of the control unit inputs are grounded.

The door switches, hood switch and tailgate switch are all close and lock the doors with the remote transmitter and then the system arms after 30s.

If anything is opened after the system is armed, the body control module gets a ground signal from that switch, and the system is set off.

If one of the switches is misadjusted or there is a short in the system, the system will not arm. As long as the body control module continues to get a ground signal, it thinks the vehicle is not closed and locked and will not arm.

Keyless Entry System

The burglar alarm system is integrated with the keyless entry system. The keyless entry system allows you to lock and unlock the vehicle with the remote transmitter. When you push the LOCK button, all doors lock. When you push the UNLOCK button again, all doors unlock.

If you do not open a door, the doors will automatically relock, and the burglar alarm system will rearm.

You cannot lock or unlock the doors with the remote transmitter if the key is in the ignition switch.

The system will signal you when the doors lock and unlock by flashing the hazard lamp once when they lock and closed, and twice when they unlock.

Function

Keyless Entry Function

DOOR LOCK / UNLOCK and Tailgate operations are performed with remocon

1. Keyless entry function is performed in a state that key in SW is eliminated from key cylinder

2. LOCK / UNLOCK and tailgate signals are received from the transmitter and DOOR LOCK / UNLOCK and Tailgate signals are output.

3. In case of tailgate, this operation is performed when pushing the button for 1.0sec or more.

Transmitter(tx) Spec

1. Transmission Distance : 30m or more from outside of the car

Method for registering Transmitter

Registration via Code Save Unit

Case 1) Registration for one transmitter (TX1)

1. Connect the connector of CODE SAVE UNIT to Power Line and Communication Line.

2. Red LED is on and impresses the power to Communication Line at the same time.

3. When pressing the switch of CODE SAVE UNIT (if switching), Output the data memorized on CODE SAVE UNIT.

4. When recognizing the data by BCM, Output SAVE MODE Switching Signal to CODE SAVE UNIT.

5. By receiving CODE SAVE Switching signal, On Green LED and switch to BCM SAVE MODE.

6. If Pressing Button of Lock or Unlock on Transmitter (TX1) to be memorized, one Transmitter is memorized. (When inputting CODE, Output HAZARD once per 1s.) And Green LED is on 2 times.

7. When switch of CODE save unit is off, it is finished.

If disconnecting save unit, it is finished after 5~6 sec.

Case 2) Registration for two transmitters (TX1 and TX2)

1. Connect the connector of CODE SAVE UNIT to Power Line and Communication Line.

2. Red LED is on and impresses the power to Communication Line at the same time.

3. When pressing the switch of CODE SAVE UNIT (if switching), Output the data memorized on CODE SAVE UNIT.

4. When recognizing the data by BCM, Output SAVE MODE Switching Signal to CODE SAVE UNIT.

5. By receiving CODE SAVE Switching signal, On Green LED and switch to BCM SAVE MODE.

6. If Pressing Button of Lock or Unlock on Transmitter (TX1) to be memorized, one Transmitter is memorized. (When inputting CODE, Output HAZARD once per 1s.) And Green LED is on 2 times.

7. If the transmitter is memorized, after registering the first transmitter and 5sec, perform (6) above under save mode.

8. Then code save mode is finished right away.

Procedure for registering Transmitter

1. In the registration mode, it should be possible to register up to max. 4.

However, in case of using Code Save Unit, it is possible to register up to max. 2.

2. When registering again, it is possible to register the new one after removing the previous state TX.

| NO. | CODE memorized | CODE to be registered | CODE changed |
|-----|----------------|-----------------------|-----------------------------|
| 1 | None | A | A |
| 2 | A | B | B (remove A) |
| 3 | B | C,D | C,D (remove B) |
| 4 | C,D | E,F,G | E,F,G (remove C and D) |
| 5 | E,F,G | H,I,J,K | H,I,J,K (remove E, F and G) |
| 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 |

Registration of CODE via HI-SCAN

1. Connect HI-SCAN to OBD CONNECTOR and ON the power.
2. After selecting the diagnosis for each vehicle, press “ENTER” key.
3. After selecting “HYUNDAI MOTOR”, press “ENTER” key.
4. After selecting vehicle type, press “ENTER” key.
5. After selecting “Transmitter Code Registration” Menu, Press “ENTER” key.
6. After selecting “Transmitter Code Registration” Menu and pressing “ENTER” key, then the following screen is indicated.
7. After checking the key removal from key cylinder and pressing “ENTER”, then enter the CODE registration mode.
8. If performing the message as it is, CODE registration is completed.

DISARM

1. From ALARM state

| State | Description |
|--------------|---|
| Event\Action | <ol style="list-style-type: none"> 1. IGN KEY ON during 30s or (IGN1 on & IGN2 on & ALT'L' on during 3s)
 \ALARM Pattern off
 \Start inhibitor Relay off 2. ANY DOOR OPEN & UNLOCK(or TGATE)
 \ Hazard Time 2 times(if UNLOCK) 0.5sec/ON, 0.5sec/OFF
 \Unlock Relay(or Tailgate Unlock Relay on) for 0.5sec
 \ALARM Pattern off\Start inhibitor relay off 3. LOCK confirm failed
 \ALARM Pattern off
 \ Start inhibitor relay off
 \Lock Relay 4. IGN KEY OUT & (DRV SW on or AST DR SW on) & LOCK
 \ ALARM Pattern off
 \ Start inhibitor relay off
 \ Lock Relay→Unlock Relay |

| | |
|--------------|---------------------------|
| After Action | Enter DISARM STATE |
|--------------|---------------------------|

2. From **DISARM state**

| State | Description |
|--------------|--|
| Event\Action | 1. IGN KEY OUT & ANY DOOR OPEN & UNLOCK(or TGATE)
\ Hazard Time 2 times(if UNLOCK) 0.5sec/ON, 0.5sec/OFF
\Unlock Relay(or Tailgate Unlock Relay on) for 0.5sec
2. IGN KEY OUT & (DRV SW on or AST DR SW on) & LOCK
\ Lock Relay→Unlock Relay |
| After Action | Keep DISARM STATE |

3. From **ARMWAIT state**

| State | Description |
|--------------|--|
| Event\Action | 1. Condition1
2. Any door unlocked
3. KEY IN |
| After Action | Enter DISARM STATE |

4. From **AUTOLOCKTIMER1 state**

| State | Description |
|--------------|--|
| Event\Action | 1. Condition1
2. KEY IN
3. LOCK Confirm failed:
\ Lock Relay
4. Autolock(timer expired) Confirm failed
\ Lock Relay |
| After Action | Enter DISARM STATE |

5. From **AUTOLOCKTIMER2 state**

| State | Description |
|--------------|---|
| Event\Action | 1. ANY DOOR OPEN
2. KEY IN
3. LOCK confirm failed
\ Lock Relay
4. Auto lock(timer expired) Confirm failed
\ Lock Relay |
| After Action | Enter DISARM STATE |

6. From **AUTOLOCKTIMER3 state**

| State | Description |
|--------------|--|
| Event\Action | 1. (4DR SW on) or (Hood SW on)
2. KEY IN
3. LOCK confirm failed
\ Lock Relay
4. Autolock(timer expired) confirm failed |

| | |
|--------------|---------------------------|
| | \ Lock Relay |
| After Action | Enter DISARM STATE |

7. From **ARM** state

| State | Description |
|--------------|---------------------------|
| Event\Action | IGN KEY ON |
| After Action | Enter DISARM STATE |

8. From **REARM** state

| State | Description |
|--------------|--|
| Event\Action | 1. IGN KEY ON during 30s or IGN1 on & IGN2 on & ALT'L' on during 3sec
\ Start inhibitor relay off
(But, In region of Immobilizer applied, Start Inhibit Relay not applied) |
| After Action | 2. LOCK confirm failed
\ Start inhibitor relay off
(But, In region of Immobilizer applied, Start Inhibit Relay not applied)
\ Lock Relay |
| After Action | Enter DISARM STATE |

9. From **PREAMP** state

| State | Description |
|--------------|--|
| Event\Action | 1. ANY DOOR OPEN & UNLOCK(or TGATE)
\ Hazard Time 2 times(if UNLOCK) 0.5sec/ON, 0.5sec/OFF
\ Unlock Relay (or Tailgate Unlock Relay on) for 0.5sec |
| After Action | 2. KEY IN
3. All entrances closed & any door unlocked |
| After Action | Enter DISARM STATE |

ARM

1. From **ARM** state

| State | Description |
|--------------|--|
| Event\Action | 1. LOCK
\ Hazard Time 1 time(if LOCK) 1sec ON
\ Lock Relay |
| After Action | Keep ARM STATE |

2. From **ARMWAIT** state

| State | Description |
|--------------|------------------------|
| Event\Action | ARMWAITTIMER expired |
| After Action | Enter ARM STATE |

ALARM

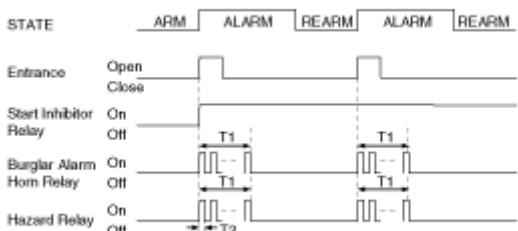
1. From **ARM** state

| State | Description |
|--------------|--|
| Event\Action | 1. Condition1
\ Start ALARM Pattern |

| | |
|--------------|--|
| | \ Start inhibitor relay on
(but, Start Inhibit Relay not applied in region not applied immobilizer) |
| After Action | Enter ALARM STATAE |

ALARM Pattern

- ON Burglar Alarm Horn Relay, Hazard Relay Output for 27 ± 2 sec.



T1: 27 ± 2 sec, T2: 0.5 ± 0.1 sec

- From **REARM** state

| State | Description |
|--------------|---|
| Event\Action | 1. Condition1
\Start ALARM Pattern
\ Start inhibitor relay on
(But, In region of Immobilizer applied, Start Inhibit Relay not applied) |
| After Action | Enter ALARM STATAE |

ARMWAIT

- From **ARMWAIT** state

| State | Description |
|--------------|--|
| Event\Action | 1. LOCK
\ Hazard Time 1 time(if LOCK) 1sec ON
\ Lock Relay |
| After Action | Keep ARMWAIT STATE |

- From **DISARM**

| State | Description |
|--------------|---|
| Event\Action | 1. IGN KEY OUT & All entrances closed &
LOCK & locked confirmed
\ Hazard Time 1 time(if LOCK) 1sec ON
\ Lock Relay
\ Start ARMWAITTIMER |
| After Action | Enter ARMWAIT STATE |

- From **ALARM** state

| State | Description |
|--------------|---|
| Event\Action | 1. IGN KEY OUT & All entrances closed &
LOCK & locked confirmed
\ Hazard Time 1 time(if LOCK) 1sec ON
\ Lock Relay
\ ALARM Pattern off
\ Start inhibitor relay off |

| | |
|--------------|--|
| | (But, In region of Immobilizer applied, Start Inhibit Relay not applied)
\ Start ARMWAITTIMER |
| After Action | Enter ARMWAIT STATE |

4. From **AUTOLOCKTIMER1**

| State | Description |
|--------------|--|
| Event\Action | 1. Autolock(timer expired) & locked confirmed
2. LOCK & locked confirmed
\ Hazard Time 1 time(if LOCK) 1sec ON
\ Lock Relay
\ Start ARMWAITTIMER |
| After Action | Enter ARMWAIT STATE |

5. From **AUTOLOCK TIMER3**

| State | Description |
|--------------|--|
| Event\Action | 1. AUTOLOCK(timer expired) & locked confirmed
2. LOCK & locked confirmed
\ Hazard Time 1 time(if LOCK) 1sec ON
\ Lock Relay
\ Start ARMWAITTIMER |
| After Action | Enter ARMWAIT STATE |

6. From **PREAM** state

| State | Description |
|--------------|--|
| Event\Action | 1. All entrance closed & All doors(include T/G) locked
\ Hazard Time 1 time(if LOCK) 1sec ON
\ start ARMWAITTIMER
2. 4DR SW off & Hood SW off & (Tailgate SW on→off)
\ Hazard Time 1 time(if LOCK) 1sec ON
\ Lock Relay
\ Start ARMWAITTIMER |
| After Action | Enter ARMWAIT STATE |

7. From **REARM** state

| State | Description |
|--------------|---|
| Event\Action | 1. LOCK & locked confirmed
\ Hazard Time 1 time(if LOCK) 1sec ON
\ Lock Relay
\ Start inhibitor relay off
\ Start ARMWAITTIMER |
| After Action | Enter ARMWAIT STATE |

REARM

1. From **ALARM** state

| State | Description |
|--------------|--|
| Event\Action | 1. ALARM Pattern finished & All entrances closed |
| After Action | Enter ARMWAIT STATE |

Auto Lock Timer 1

1. From **ARM** state

| State | Description |
|--------------|---|
| Event\Action | 1. UNLOCK
\ Hazard Time 2 times(if UNLOCK) 0.5sec/ON, 0.5sec/OFF
\ Unlock Relay
\ Start AUTOLOCKTIMER1 |
| After Action | Enter AUTOLOCKTIMER1 STATE |

2. From **AUTOLOCKTIMER1** state

| State | Description |
|--------------|--|
| Event\Action | 1. UNLOCK or TGATE
\ Hazard Time 2 times(if UNLOCK) 0.5sec/ON, 0.5sec/OFF
\ Unlock Relay (or Tailgate Unlock Relay on) for 0.5sec
\ Timer restart |
| After Action | Keep AUTOLOCKTIMER1 STATE |

3. From **AUTOLOCKTIMER3** state

| State | Description |
|--------------|---|
| Event\Action | 1. UNLOCK
\ Hazard Time 2 times(if UNLOCK) 0.5sec/ON, 0.5sec/OFF
\ Unlock Relay
\ Start AUTOLOCKTIMER1 |
| After Action | Enter AUTOLOCKTIMER1 STATE |

4. From **ARMWAIT** state

| State | Description |
|--------------|---|
| Event\Action | 1. UNLOCK
\ Hazard Time 2 times(if UNLOCK) 0.5sec/ON, 0.5sec/OFF
\ Unlock Relay
\ Start AUTOLOCKTIMER1 |
| After Action | Enter AUTOLOCKTIMER1 STATE |

5. From **DISARM** state

| State | Description |
|--------------|---|
| Event\Action | 1. IGN KEY OUT & All entrances closed &
(UNLOCK or TGATE)
\ Hazard Time 2 times(if UNLOCK) 0.5sec/ON, 0.5sec/OFF
\ Unlock Relay (or Tailgate Unlock Relay on) for 0.5sec
\ Start AUTOLOCKTIMER1 |
| After Action | Enter AUTOLOCKTIMER1 STATE |

6. From **ALARM** state

| State | Description |
|--------------|---|
| Event\Action | 1. All entrances closed & (UNLOCK or TGATE)
\ Hazard Time 2 times(if UNLOCK) 0.5sec/ON, 0.5sec/OFF
\ Unlock Relay (or Tailgate Unlock Relay on) for 0.5sec
\ start AUTOLOCKTIMER1
\ ALARM Pattern off |

| | |
|--------------|---|
| | \ Start inhibitor relay off
(but, Start Inhibit Relay not applied in region not applied Immobilizer) |
| After Action | Enter AUTOLOCKTIMER1 STATE |

7. From **REARM** state

| State | Description |
|--------------|--|
| Event\Action | 1. UNLOCK or TGATE
\ Hazard Time 2 times(if UNLOCK) 0.5sec/ON, 0.5sec/OFF
\ Unlock Relay (or Tailgate Unlock Relay on) for 0.5sec
\ Start inhibitor relay off
(but, Start Inhibit Relay not applied in region not applied Immobilizer)
\ Start AUTOLOCKTIMER1 |
| After Action | Enter AUTOLOCKTIMER1 STATE |

Auto Lock Timer 2

1. From **AUTOLOCKTIMER2** state

| State | Description |
|--------------|--|
| Event\Action | 1. UNLOCK or TGATE
\ Hazard Time 2 times(if UNLOCK) 0.5sec/ON, 0.5sec/OFF
\ Unlock Relay (or Tailgate Unlock Relay on) for 0.5sec
\ Timer restart |
| After Action | Keep AUTOLOCKTIMER2 STATE |

2. From **DISARM** state

| State | Description |
|--------------|---|
| Event\Action | 1. IGN KEY OUT & Condition2 &
(UNLOCK or TGATE)
\ Hazard Time 2 times(if UNLOCK) 0.5sec/ON, 0.5sec/OFF
\ Unlock Relay (or Tailgate Unlock Relay on) for 0.5sec
\ start AUTOLOCKTIMER2 |
| After Action | Enter AUTOLOCKTIMER2 STATE |

3. From **ALARM** state

| State | Description |
|---------------|--|
| Event: Action | 1. Condition2 & (UNLOCK or TGATE)
\ Hazard Time 2 times(if UNLOCK) 0.5sec/ON, 0.5sec/OFF
\ Unlock Relay (or Tailgate Unlock Relay on) for 0.5sec
\ ALARM Pattern off
\ Start inhibitor relay off
(but, Start Inhibit Relay not applied in region not applied Immobilizer)
\ Start AUTOLOCKTIMER2 |
| After Action | Enter AUTOLOCKTIMER2 STATE |

4. From **PREAMP** state

| State | Description |
|---------------|--|
| Event: Action | 1. Condition2 & (UNLOCK or TGATE)
\ Hazard Time 2 times(if UNLOCK) 0.5sec/ON, 0.5sec/OFF
\ Unlock Relay (or Tailgate Unlock Relay on) for 0.5sec
\ Start AUTOLOCKTIMER2 |

| | |
|--------------|-----------------------------------|
| After Action | Enter AUTOLOCKTIMER2 STATE |
|--------------|-----------------------------------|

Auto Lock Timer 3 Mode

1. From ARM state

| State | Description |
|--------------|---|
| Event\Action | 1. TGATE
\ Hazard Time 2 times(if UNLOCK) 0.5sec/ON, 0.5sec/OFF
\ Tailgate Unlock Relay on for 0.5sec
\ Start AUTOLOCKTIMER3 |
| After Action | Enter AUTOLOCKTIMER3 STATE |

2. From ARMWAIT state

| State | Description |
|--------------|---|
| Event\Action | 1. TGATE
\ Hazard Time 2 times(if UNLOCK) 0.5sec/ON, 0.5sec/OFF
\ Tailgate Unlock Relay on for 0.5sec
\ Start AUTOLOCKTIMER3 |
| After Action | Enter AUTOLOCKTIMER3 STATE |

3. From AUTOLOCKTIMER3 state

| State | Description |
|--------------|--|
| Event\Action | 1. TGATE
\ Hazard Time 2 times(if UNLOCK) 0.5sec/ON, 0.5sec/OFF
\ Tailgate Unlock Relay on for 0.5sec
\ Timer restart |
| After Action | Keep AUTOLOCKTIMER3 STATE |

PREARM Mode

1. From AUTOLOCKTIMER2 state

| State | Description |
|--------------|--|
| Event\Action | 1. LOCK & locked confirmed
\ Lock Relay
2. Auto lock(timer expired) & locked confirmed
\ Lock Relay |
| After Action | Enter PREARM STATE |

2. From AUTOLOCKTIMER3 state

| State | Description |
|--------------|---------------------------|
| Event\Action | 1. TailGate SW on |
| After Action | Enter PREARM STATE |

3. From DISARM state

| State | Description |
|--------------|--|
| Event\Action | 1. In state of IGN KEY OUT, Condition3 & LOCK & locked confirmed
\ Lock Relay |
| After Action | Enter PREARM STATE |

4. From **ALARM** state

| State | Description |
|--------------|--|
| Event\Action | 1. In state of IGN KEY OUT, Condition3 & LOCK & locked confirmed
\ Lock Relay
\ ALARM Pattern off
\ Start inhibitor relay off |
| After Action | Enter PREAMP STATE |

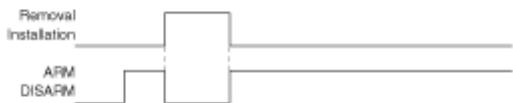
Reset

1. From **ALARM,REARM STATE**

| State | Description |
|--------------|--|
| Event\Action | 1. BATTERY RESET(Cold or Warm RESET), Connect after removal |
| After Action | Enter ALARM STATE
→ Burglar Alarm Horn Relay ON(No remained time of warning signal) one time
→ Hazard Relay is ON as same as Burglar Alarm Horn Relay ON Time |

2. On the state of **ARM**, if remove BATTERY

| State | Description |
|--------------|--|
| Event | BATTERY RESET(Cold or Warm RESET), Connect after removal |
| After Action | Keep ARM STATE |

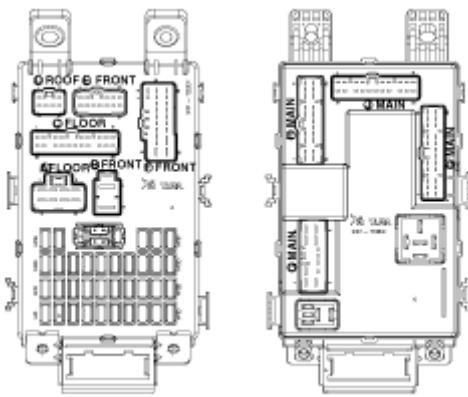


3. The State not **ARM,ALARM,REARM**

| State | Description |
|--------------|--|
| Event | BATTERY RESET(Cold or Warm RESET), Connect after removal |
| After Action | Start from DISARM |

12.5.4. Repair procedures

Inspection



Burglar Alarm Horn Relay

Check for continuity between the terminals.

1. There should be continuity between the B2 and F16 terminals when power and ground are connected to the B2 and J17 in the I/P box.
2. There should be no continuity between the B2 and F16 terminals when power is disconnected.

| Terminal
Power | I/P-B
(2) | I/P-J
(17) | I/P-B
(2) | I/P-F
(16) |
|-------------------|--------------|---------------|--------------|---------------|
| Disconnected | ○ | ○ | | |
| Connected | + | - | ○ | ○ |

Door Lock Relay

Check for continuity between the terminals.

1. There should be continuity between the B2 and C1(or 2) terminals when power and ground are connected to the B2 and K9 terminals in the I/P box.
2. There should be no continuity between the B2 and C1(or 2) terminals when power is disconnected.

| Terminal
Power | I/P-B
(2) | I/P-K
(9) | I/P-B
(2) | I/P-C
(1 or 2) |
|-------------------|--------------|--------------|--------------|-------------------|
| Disconnected | ○ | ○ | | |
| Connected | + | - | ○ | ○ |

Door Unlock Relay

Check for continuity between the terminals.

1. There should be continuity between the B2 and C3(or C12) terminals when power and ground are connected to the B2 and J9 terminals in the I/P box.
2. There should be no continuity between the B2 and C3(or C12) terminals when power is disconnected.

| Terminal
Power | I/P-B
(2) | I/P-J
(9) | I/P-B
(2) | I/P-C
(3 or 12) |
|-------------------|--------------|--------------|--------------|--------------------|
| Disconnected | ○ | ○ | | |
| Connected | + | - | ○ | ○ |

Tailgate Unlock Relay

Check for continuity between the terminals.

1. There should be continuity between the B2 and G9 terminals when power and ground are connected to the B2 and J2 terminals in the I/P box.
2. There should be no continuity between the B2 and G9 terminals when power is disconnected.

| Terminal
Power | I/P-B
(2) | I/P-J
(2) | I/P-B
(2) | I/P-G
(9) |
|-------------------|--------------|--------------|--------------|--------------|
| Disconnected | ○ | ○ | | |
| Connected | + | - | ○ | ○ |

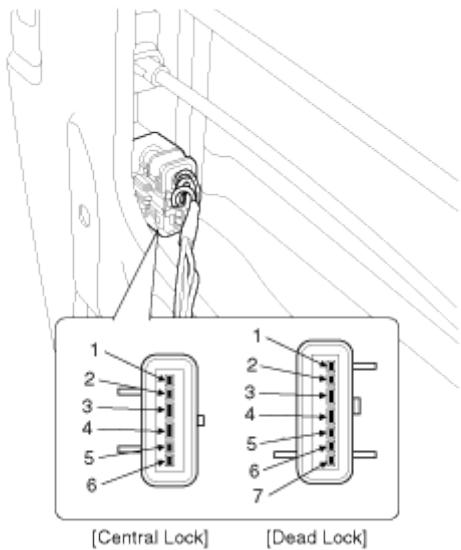
Front Door Lock Actuator

1. Remove the front door trim.

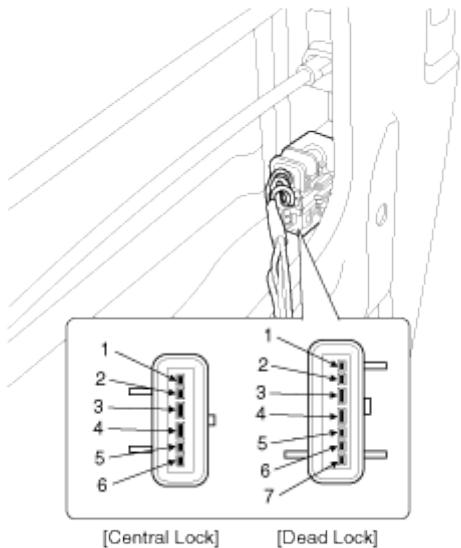
(Refer to the BD group - "Front door")

2. Disconnect the connectors from the actuator.

[LHD]



[RHD]



3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

[Central Lock] () : RHD

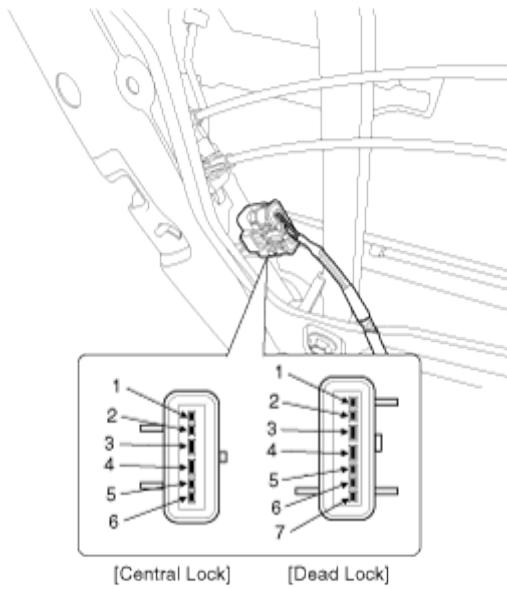
| Position | Terminal | 4(3) | 3(4) |
|-------------|----------------|------|------|
| Front left | Central Lock | ⊕ | ⊖ |
| | Central Unlock | ⊖ | ⊕ |
| Position | Terminal | 3(4) | 4(3) |
| Front right | Central Lock | ⊖ | ⊕ |
| | Central Unlock | ⊕ | ⊖ |

| [Dead Lock] | | | RHD only | | |
|-------------|--------------|----------|----------|---|---|
| Position | | Terminal | 5 | 6 | 7 |
| Front left | Central Lock | Lock | ⊕ | ⊖ | ⊖ |
| | | Unlock | ⊖ | ⊕ | ⊕ |
| | Dead Unock | Lock | ⊖ | ⊖ | ⊕ |
| | | Unlock | ⊕ | ⊕ | ⊖ |
| Position | | Terminal | 3 | 2 | 1 |
| Front Right | Central Lock | Lock | ⊕ | ⊖ | ⊖ |
| | | Unlock | ⊖ | ⊕ | ⊕ |
| | Dead Unock | Lock | ⊖ | ⊖ | ⊕ |
| | | Unlock | ⊕ | ⊕ | ⊖ |

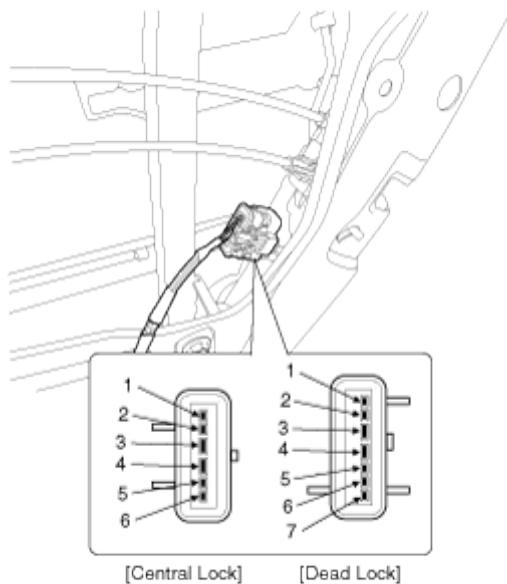
Rear Door Lock Actuator

1. Remove the rear door trim.
(Refer to the BD group - "Rear door")
2. Disconnect the connectors from the actuator.

[LHD]



[RHD]



3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator,

apply battery voltage only momentarily.

| [Central Lock] | | () : RHD | |
|----------------|----------------|-----------|------|
| Position | Terminal | 4(3) | 3(4) |
| Rear left | Central Lock | ⊕ | ⊖ |
| | Central Unlock | ⊖ | ⊕ |
| Rear right | Central Lock | ⊖ | ⊕ |
| | Central Unlock | ⊕ | ⊖ |

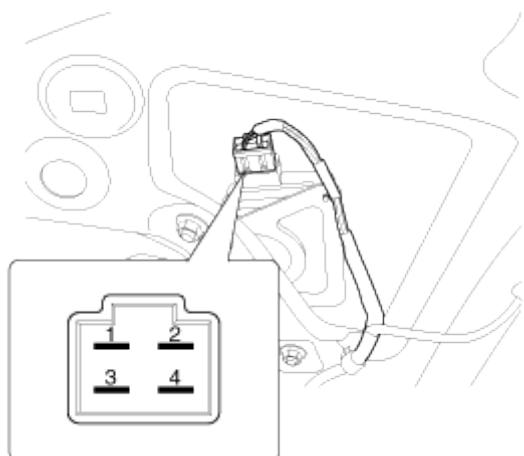
| [Dead Lock] | | RHD only | | |
|-------------|--------------|----------|---|---|
| Position | Terminal | 5 | 6 | 7 |
| Rear left | Central Lock | ⊕ | ⊖ | ⊖ |
| | Unlock | ⊖ | ⊕ | ⊕ |
| | Dead Unock | ⊖ | ⊖ | ⊕ |
| | Unlock | ⊕ | ⊕ | ⊖ |
| Position | Terminal | 3 | 2 | 1 |
| Rear Right | Central Lock | ⊕ | ⊖ | ⊖ |
| | Unlock | ⊖ | ⊕ | ⊕ |
| | Dead Unock | ⊖ | ⊖ | ⊕ |
| | Unlock | ⊕ | ⊕ | ⊖ |

Tailgate Lock Actuator Inspection

1. Remove the tailgate trim (A).
(Refer to the BD group - "Tailgate")



2. Disconnect the 4P connector from the actuator.



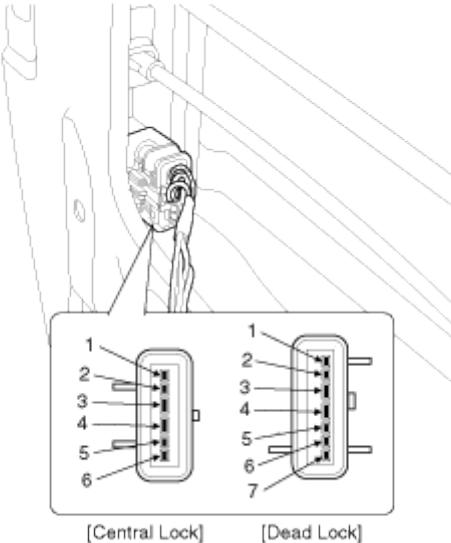
3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

| Terminal Position | 2 | 4 |
|-------------------|---|---|
| Unlock | ⊕ | ⊖ |
| Lock | ⊖ | ⊕ |

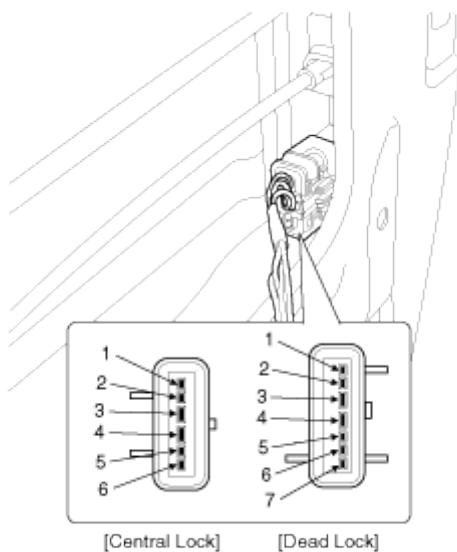
Front Door Lock Switch

1. Remove the front door trim.
(Refer to the BD group - "Front door")
2. Disconnect the connectors from the actuator.

[LHD]



[RHD]



3. Check for continuity between the terminals in each switch position when inserting the key into the door according to the table.

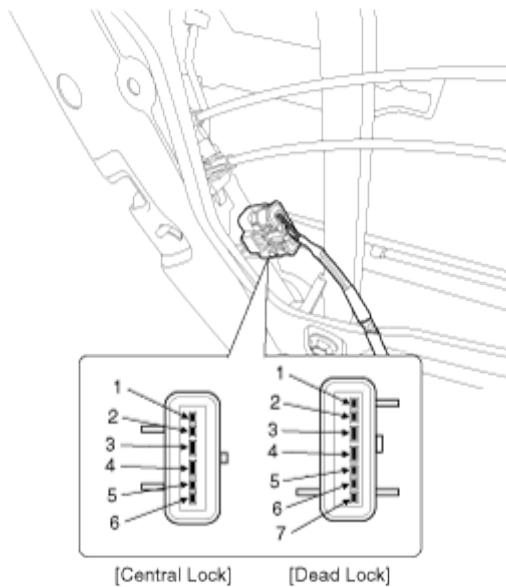
| [CENTRAL LOCK] | | () : RHD | | |
|----------------|-------------------|-----------|------|------|
| Terminal | Position | 2(5) | 5(2) | 1(6) |
| Front left | Clockwise | ○ | — | — |
| | Counter-clockwise | — | ○ | — |
| Terminal | | 5(2) | 2(5) | 6(1) |
| Front right | Clockwise | ○ | — | — |
| | Counter-clockwise | — | ○ | — |

| [DEAD LOCK] | | RHD only | | | |
|-------------|-------------------|----------|---|---|---|
| Position | | Terminal | 2 | 3 | 4 |
| Front left | Clockwise | | ○ | — | ○ |
| | Counter-clockwise | | — | ○ | — |
| Front right | Clockwise | Position | 4 | 5 | 6 |
| | Counter-clockwise | | — | ○ | — |

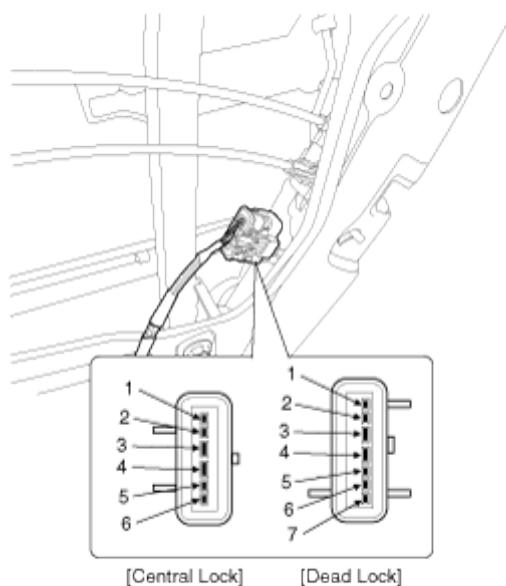
Rear Door Lock Switch

1. Remove the rear door trim.
(Refer to the BD group - "Rear door")
2. Disconnect the connectors from the actuator.

[LHD]



[RHD]



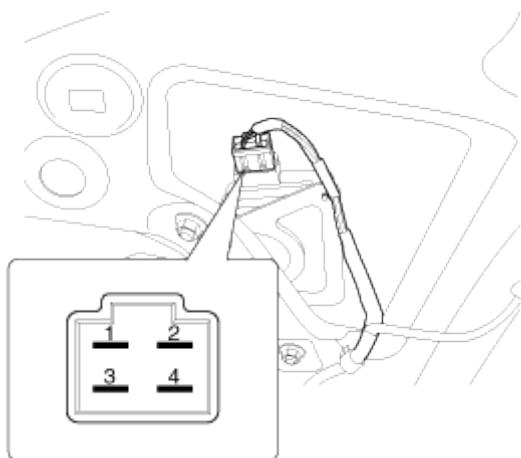
3. Check for continuity between the terminals in each switch position according to the table.

| [CENTRAL LOCK] | | | () : RHD |
|-------------------|------------|----------|-----------|
| Position | | Terminal | |
| Central door lock | Rear left | Lock | |
| | | Unlock | ○ —○ |
| Position | | | Terminal |
| Central door lock | Rear right | Lock | 2(5) |
| | | Unlock | ○ —○ |
| | | | 1(6) |

| [DEAD LOCK] | | | RHD only |
|-------------------|------------|----------|----------|
| Position | | Terminal | |
| Central door lock | Rear left | Lock | |
| | | Unlock | ○ —○ |
| Position | | | Terminal |
| Central door lock | Rear right | Lock | 7 |
| | | Unlock | ○ —○ |
| | | | 5 |

Tailgate Switch

1. Remove the tailgate trim.
(Refer to the BD group - "Tailgate")
2. Disconnect the 4P connector from the actuator.

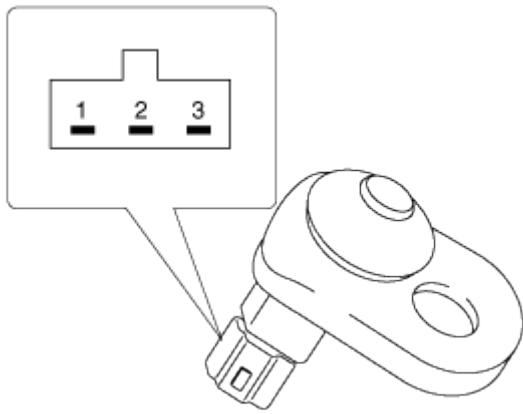


3. Check for continuity between the terminals in each switch position according to the table.

| Position | | Terminal | 1 | 3 |
|----------|--|----------|------|---|
| Lock | | | | |
| Unlock | | | ○ —○ | |

Door Switch

Remove the door switch and check for continuity between the terminals.



| Terminal Position | 1 | 2 | 3
(Ground) |
|-------------------|---|---|---------------|
| Free(Door open) | ○ | ○ | ○ |
| Push(Door close) | | | |

Key In Switch

1. Remove the crash pad lower panel.
(Refer to the BD group - "Crash pad")
2. Disconnect the 6P connector from the key warning switch.



3. Check for continuity between the terminals in each position according to the table.

| Terminal Key position | 5 | 6 |
|-----------------------|---|---|
| Insert | ○ | ○ |
| Removal | | |

Burglar Horn

1. Remove the burglar horn (A) after removing 1 bolt and disconnect the 2P connector from the burglar horn.



2. Test the burglar horn by connecting battery power to the terminal 1 and ground the terminal 2.
3. The burglar horn should make a sound. If the burglar horn fails to make a sound replace it.

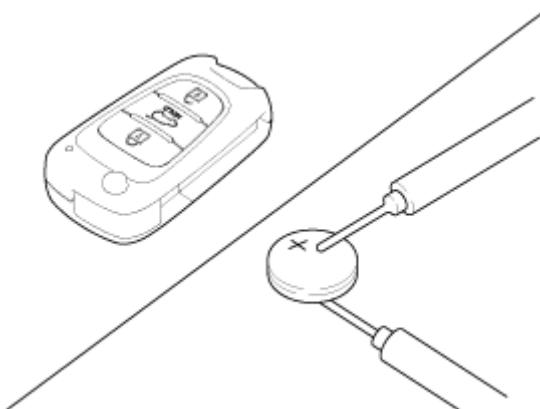
12.5.5. Transmitter

12.5.5.1. Repair procedures

Inspection

1. Check that the red light flickers when the door lock/unlock button is pressed on the transmitter.
2. Remove the battery and check voltage if the red light doesn't flicker.

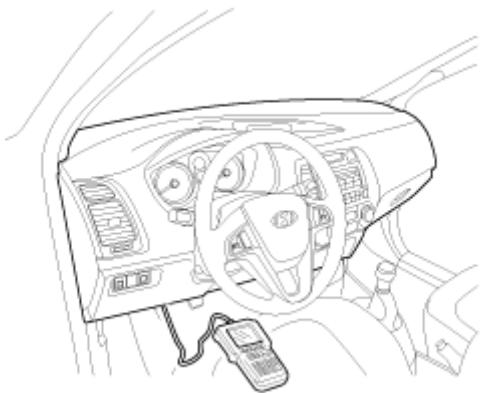
Standard voltage : 3V



3. Replace the transmitter battery with a new one, if voltage is below 3V then try to lock and unlock the doors with the transmitter by pressing the lock/unlock button five or six times.
4. If the doors lock and unlock, the transmitter is O.K, but if the doors don't lock and unlock, register the transmitter code, then try to lock and unlock the doors.
5. If the transmitter fails, replace only the transmitter.

Transmitter Code Registration

1. Connect the DLC cable of scan tool to the data link connector (16 pins) in driver side crash pad lower panel, turn the power on scan tool.



2. Select the vehicle model and then do "CODE SAVING".

| |
|------------------------------|
| 1. HYUNDAI VEHICLE DIAGNOSIS |
| MODEL : PB |
| 01. ENGINE (GASOLINE) |
| 02. ENGINE (DIESEL) |
| 03. AUTOMATIC TRANSAXLE |
| 04. ABS/ESP : |
| |
| |
| |
| 09. CODE SAVING |

3. After selecting "CODE SAVING" menu, push "ENTER" key, then the screen will be shown as below.

| |
|--|
| TRANSMITTER CODE SAVE |
| REMOVE THE IG. KEY FROM THE KEY CYLINDER. CONNECT THE DLC CABLE AND 16 PIN CONNECTOR OF THE VEHICLE. |
| PRESS [ENTER], IF YOU ARE READY! |

4. After removing the ignition key from key cylinder, push "ENTER" key to proceed to the next mode for code saving. Follow steps 1 to 4 and then code saving is completed.

| |
|---|
| TRANSMITTER CODE SAVE |
| 1ST. TRANSMITTER SAVE
PRESS THE TRANSMITTER [LOCK] BUTTON OR [UNLOCK] BUTTON FOR 1 SECOND. |
| * NO. OF CODED KEY : 0 EA |

TRANSMITTER CODE SAVE

1ST. TRANSMITTER SAVE
PRESS THE TRANSMITTER [LOCK] BUTTON
OR [UNLOCK] BUTTON FOR 1 SECOND.

1ST. TRANSMITTER SAVE SUCCESS!

IF YOU WANT TO SAVE THE 2ND KEY
PRESS [YES], OR NOT PRESS [NO]

* NO. OF CODED KEY : 1 EA

TRANSMITTER CODE SAVE

2ND. TRANSMITTER SAVE
PRESS THE TRANSMITTER [LOCK] BUTTON
OR [UNLOCK] BUTTON FOR 1 SECOND.

* NO. OF CODED KEY : 1 EA

TRANSMITTER CODE SAVE

2ND. TRANSMITTER SAVE
PRESS THE TRANSMITTER [LOCK] BUTTON
OR [UNLOCK] BUTTON FOR 1 SECOND.

2ND. TRANSMITTER SAVE SUCCESS!

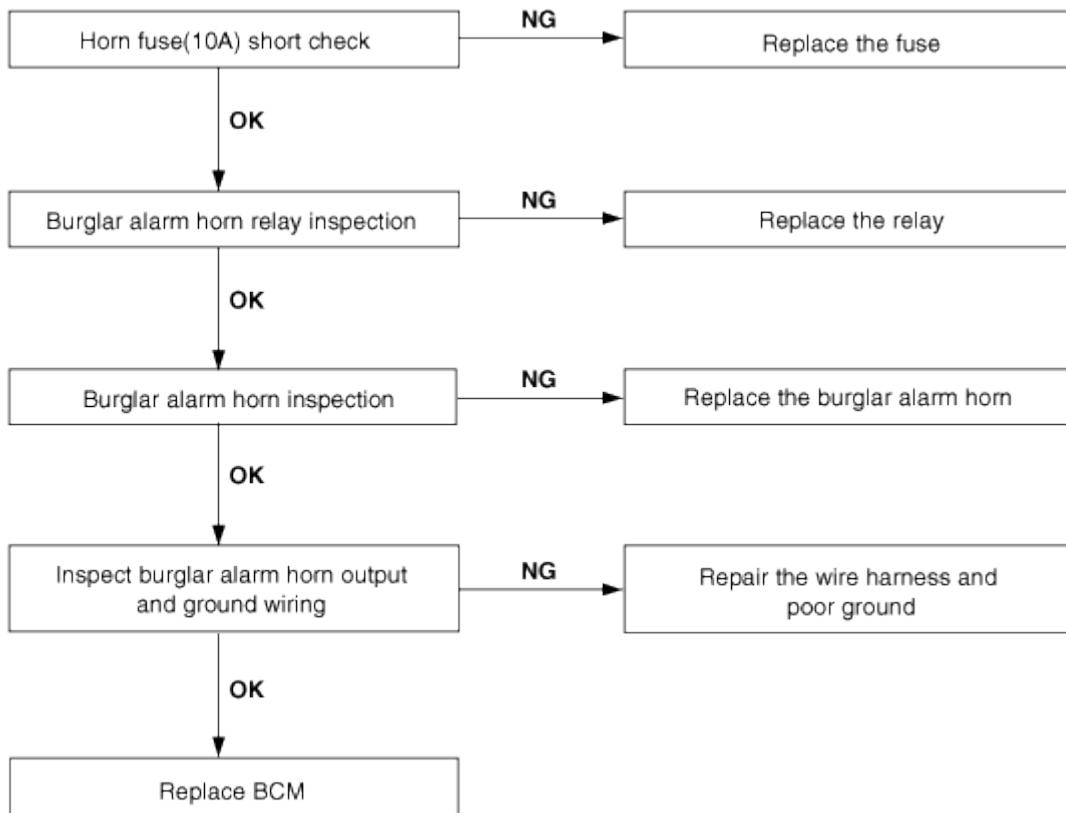
CODE SAVING IS COMPLETED!
IF YOU STOP, PRESS [ESC] KEY!!!

* NO. OF CODED KEY : 2 EA

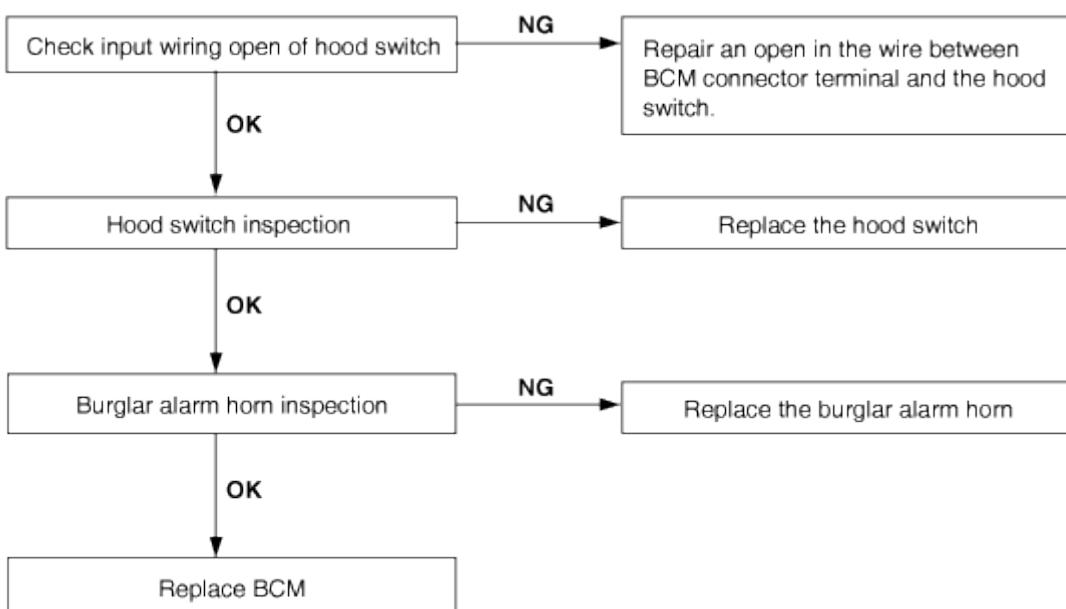
12.5.6. Troubleshooting

Troubleshooting

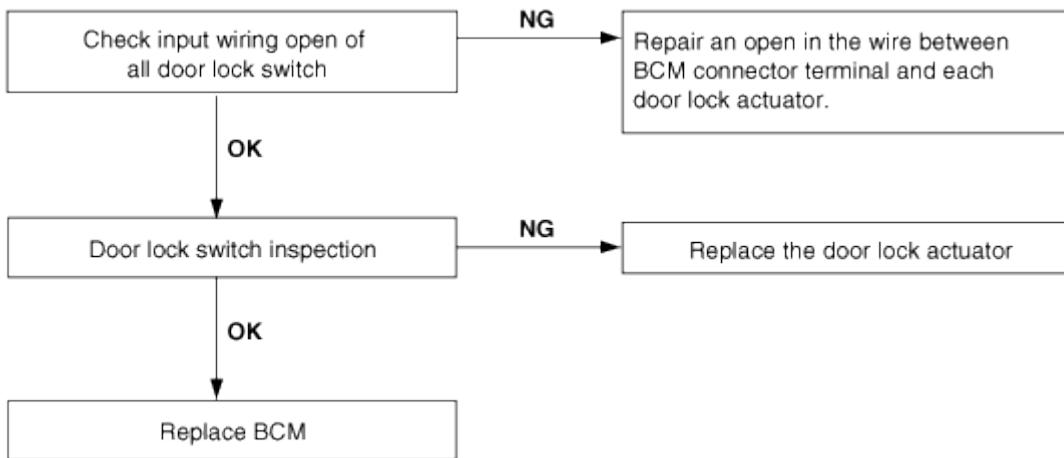
1. Alarm does not work. (Hazard lamps work)



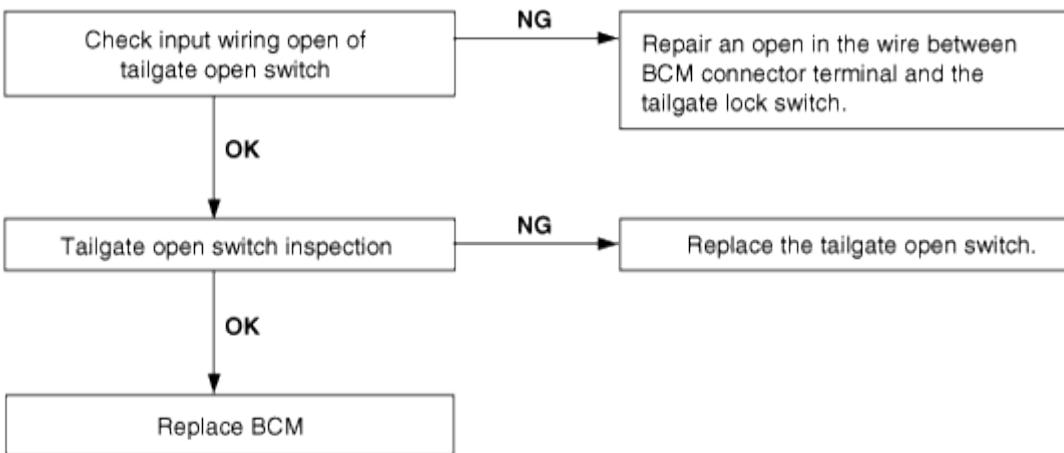
2. When hood is opened in ARM mode, burglar alarm does not work.



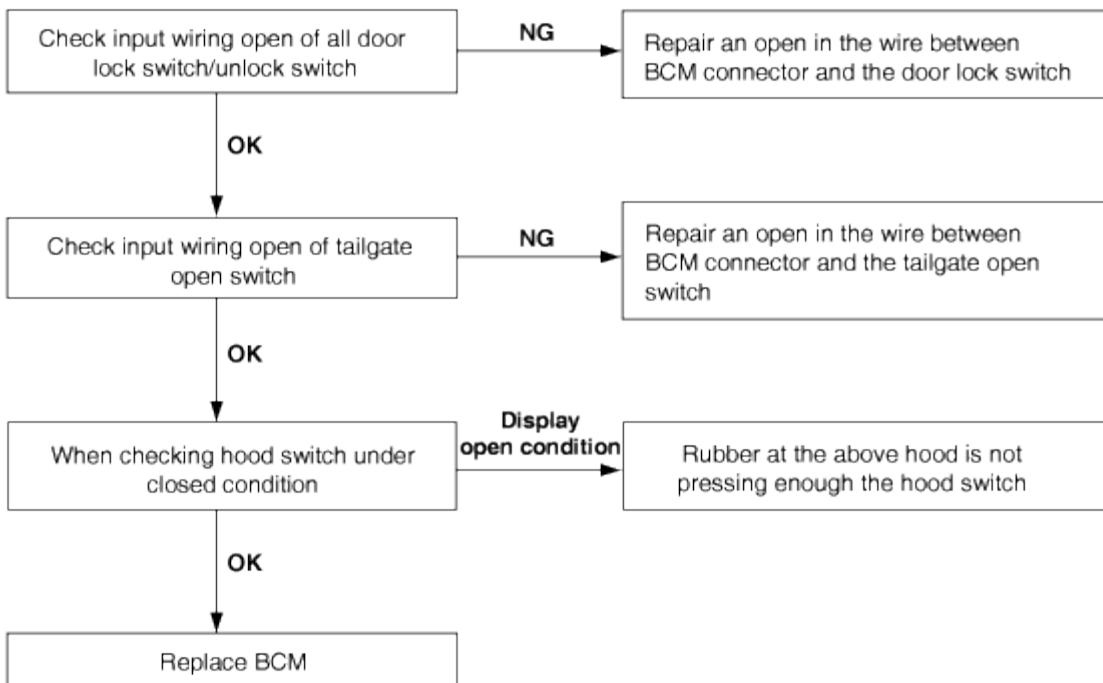
3. When door is opened, burglar alarm does not work. (If tailgate and hood is opened, alarm works)



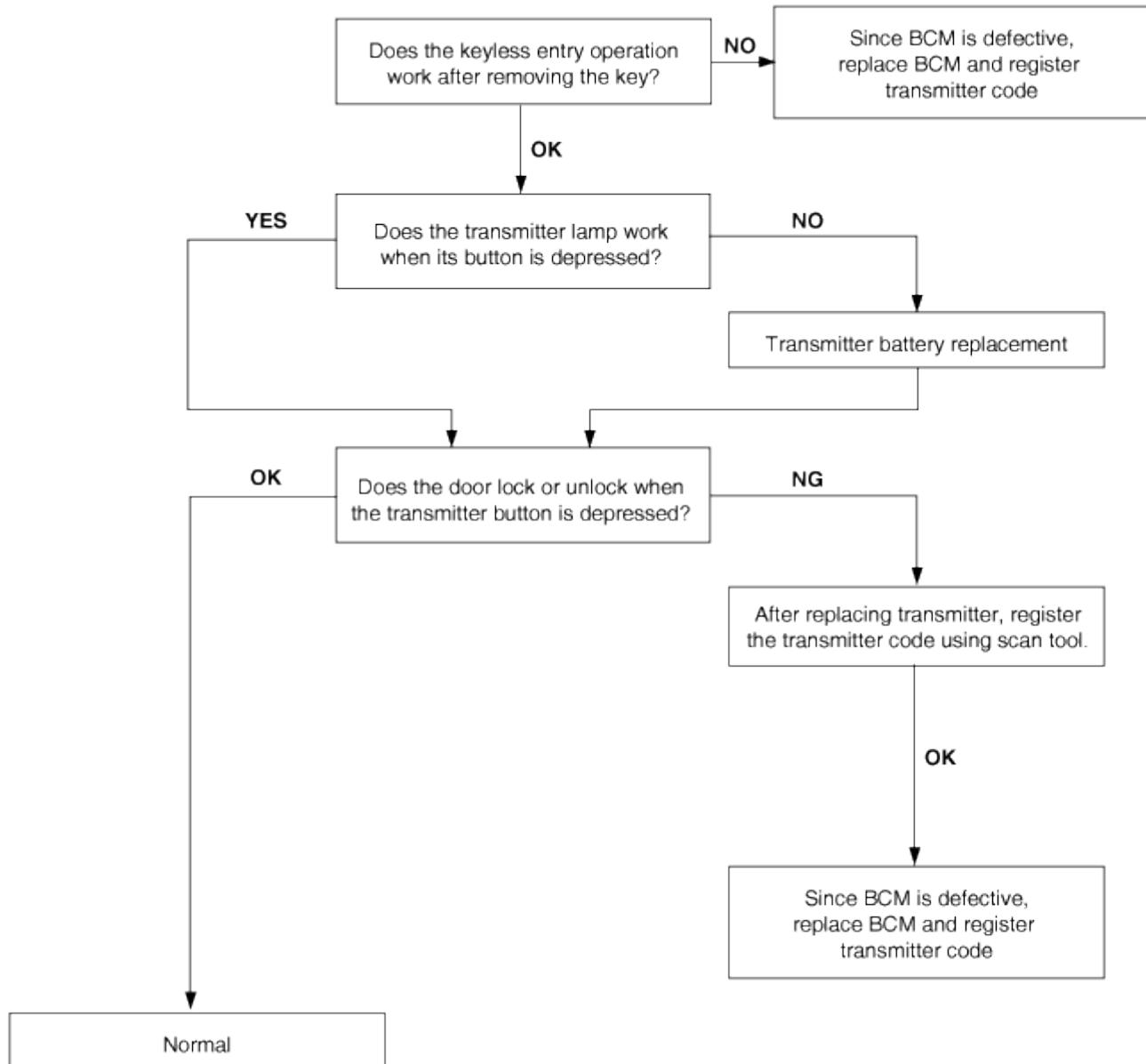
4. When tailgate is opened in ARM mode, burglar alarm does not work.



5. When the vehicle is locked by the transmitter, central door lock function works but hazard lamp doesn't blink.



6. Central door lock function works, but keyless entry system does not work.



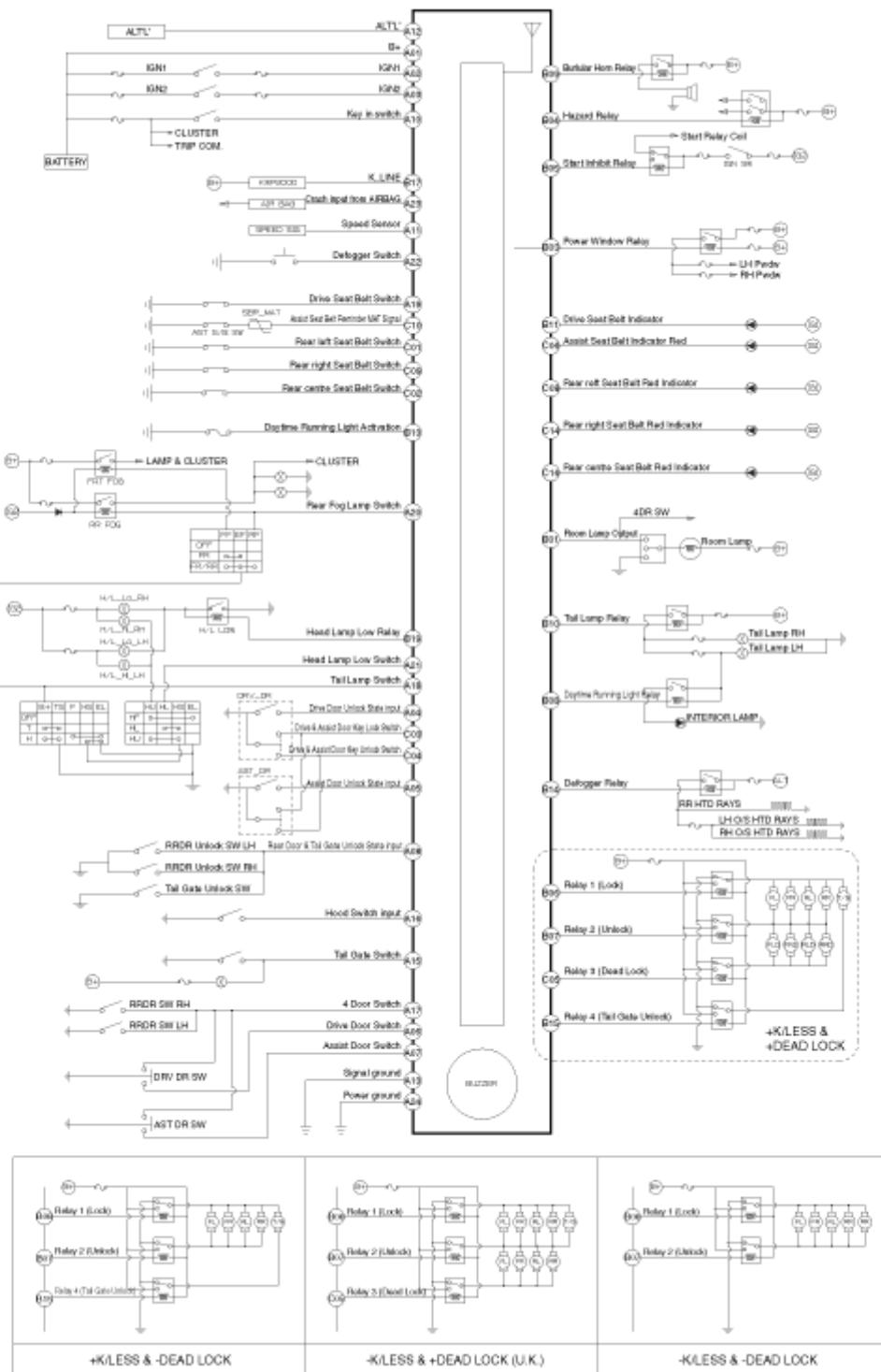
12.6. BCM (Body Control Module)

12.6.1. Body Control Module (BCM)

12.6.1.1. Schematic Diagrams

Circuit Diagram

System Diagram



Body control module (A) receives various input switch signals controlling time and alarm functions for tail lamp auto cut, central door lock, seat belt reminder, seat belt warning timer, key operated warning, power window timer, keyless entry control, burglar alarm control, crash door unlock, key reminder.



Function

Chime Control

Depending upon Input, control built-in Buzzer and Indicator.

- Drive, Assist Seat Belt Reminder
- Rear Seat Belt Reminder
- Seat Belt Warning Timer
- Key Operated Warning
- Rear Fog Lamp Warning
- Any Door Open Drive Warning

1. Data Flow

| Buzzer Control | |
|----------------------------------|---------------------------|
| Input | Output |
| IGN1 | Buzzer (BCM built-in) |
| Driver Door Seat Belt SW | Driver Seat Belt IND |
| Assist Seat belt Reminder Signal | Assist Seat Belt IND |
| Rear Left Seat Belt SW | Rear left Seat Belt IND |
| Rear Centre Seat Belt SW | Rear centre Seat Belt IND |
| Rear Right Seat Belt SW | Rear right Seat Belt IND |
| Speed Sensor | |
| Rear Fog Lamp SW | |
| 4 Door SW | |
| Tailgate SW | |

2. Overview Description

Chime Control should perform the following function.

(1) Seat Belt Reminder / Seat Belt Warning Timer

: When driving on the state not using S/Belt, Output Buzzer and Indicator in order to use S/Belt.

(2) Key Operated Warning

: Depending upon Drive Door and Key Input Condition, Output Buzzer.

(3) Rear Fog Lamp Warning

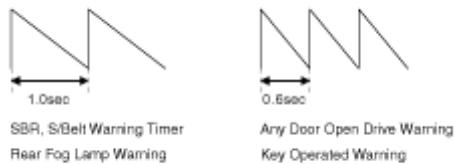
: If Drive Door is open after IGN Off On the state that Rear Fog Lamp SW is ON, Output Buzzer.

(4) Any Door Open Drive Warning

: When driving on the state that All Door(Including Tail Gate) is not closed, Output Buzzer.

3. Buzzer Sound Spec.

| Function | Frequency | Frequency DUTY | Cycle | Sound Pressure |
|------------------------------|-----------|----------------|-------|----------------|
| SBR, Seat Belt Warning Timer | 800Hz | 50% | 1.0s | 70±10 dB |
| Any Door Open Drive Warning | 800Hz | 50% | 0.6s | 70±10 dB |
| Rear Fog Lamp Warning | 800Hz | 50% | 1.0s | 70±10 dB |
| Key Operated Warning | 800Hz | 50% | 0.6s | 70±10 dB |



4. Buzzer Sound Ending

After ending Buzzer Sound outputting, start the other Buzzer Output.

Even if Warning has a high priority among Warning Sound, Output after one cycle of Warning outputting is ended.

5. Sound Priority

- 1st: SBR, Seat Belt Warning Timer
- 2nd: Any Door Open Drive Warning
- 3rd: Rear Fog Lamp Warning
- 4th: Key Operated Warning

6. SBR Indicator Output and Buzzer Synchronization

- (1) Synchronize Driver Seat, Passenger seat, Rear Seat, SBR Alarm Light and Buzzer Output.

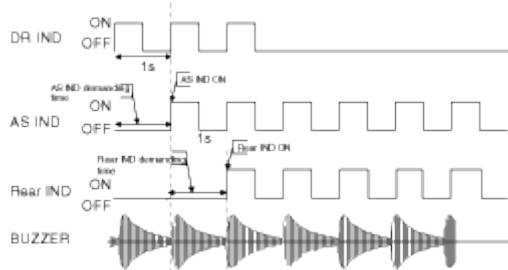
Indicator blinking & Buzzer sound should be synchronized.

- (2) Synchronize depending upon ON/OFF Output of Indicator currently operating.

In other words, there is no output priority among Driver Seat, Passenger seat, Rear Seat Left, Center, Right.

- (3) If request the other SBR output during outputting Indicator operating, Output Synchronization from the next ON point.

- (4) It is possible to generate max. ±1s time error. (100s ± 1 s, 35s ± 1s)



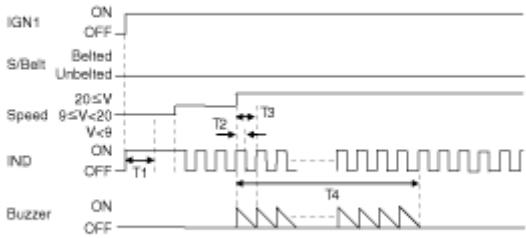
Drive, Assist Seat Belt Reminder

This function's description will be applied to both Drive and Assist SBR.

Pattern = FINAL SIGNAL (in EURO-NCAP PROTOCOL)

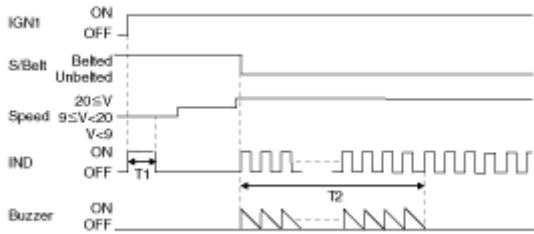
Pattern Start Condition

1. Unbelted & { (V < 20km/h) → (V ≥ 20km/h) } & Pattern = 0



T1: 6 sec, T2: 0.5 sec, T3: 1.0 sec, T4: 100 sec

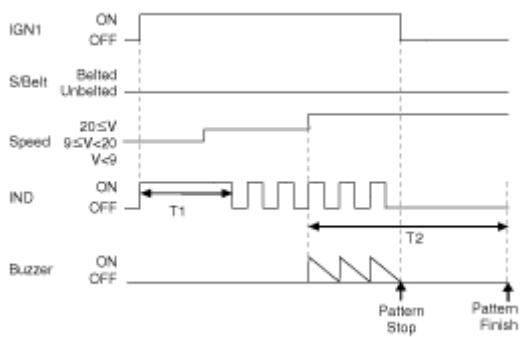
2. (Belted → Unbelted) & V ≥ 20km/h & Pattern = 0



T1: 6 sec, T2: 100 sec

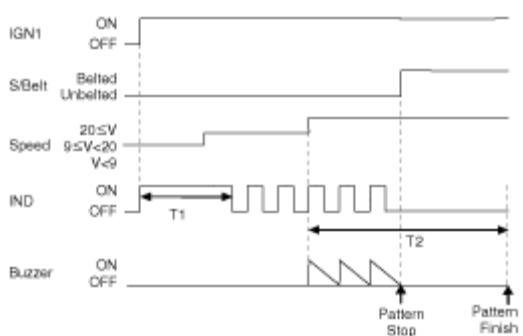
Pattern Stop Condition

1. IGN1 Off



T1: 6 sec, T2: 100 sec

2. Unbelted → Belted

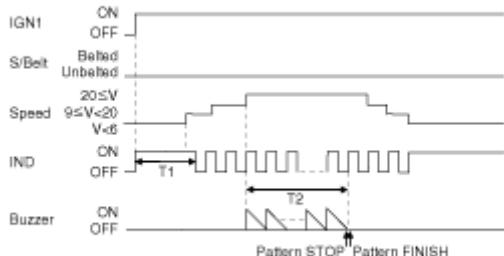


T1: 6 sec, T2: 100 sec

3. Pattern Finished

After pattern is finished, if IGN1 ON and S/Belt State is not changed, there is no re-entering Pattern.

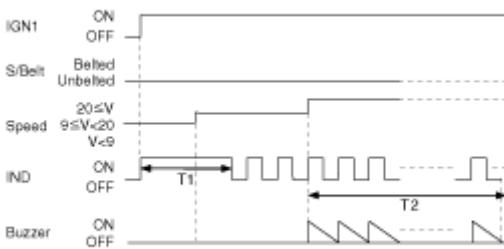
After pattern finished, state cannot be activated for IGN1 ON & Seat belt state not changed



T1: 6 sec, T2: 100 sec

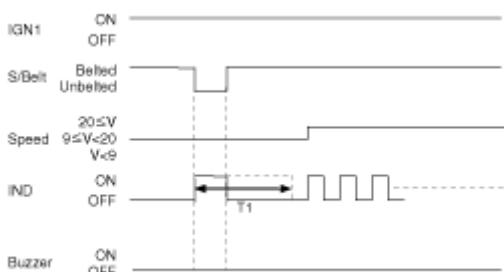
Bulb Check

- Initial IGN1 On, Start 6s Bulb Check



T1: 6 sec, T2: 100 sec

- Belt → Unbelted after IGN ON, No Bulb Check



T1: 6 sec

NOTE

Operation: During 6s Bulb Check Output, PATTERN Entering Condition

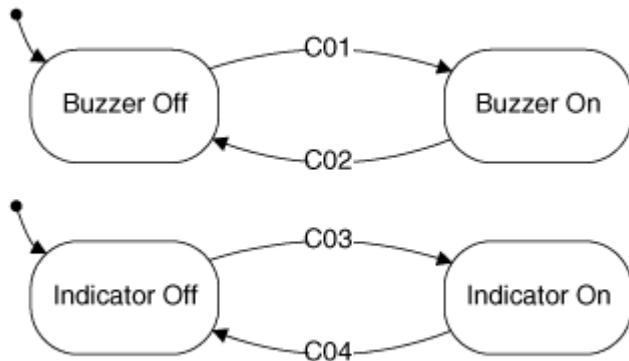
If Unbelted & V≥20Km/h & pattern = 0

Operation: Stop 6sec Bulb Check & Start IND infinite blinking & Start 100sec Buzzer pattern

Rear Seat Belt Reminder

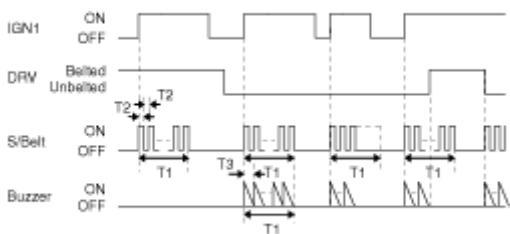
- If all 3 rear belts are buckled, the sign is switched off (=All IND. off)
- When a vehicle stops to allow a passenger to leave and then continues the journey, no change in status indication is required
- Short term deactivation
 - ON: When s/belt is fastened and unfastened twice within 9 seconds.
(Short term deactivation must only affect the seating position for which deactivation had been chosen)
 - OFF: When IGN is off or s/belt is fastened

Seat Belt Warning Timer



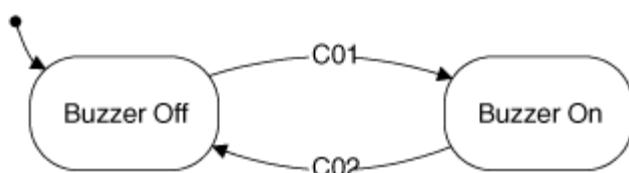
| Transitions | Input | Output |
|-------------|--|------------------------------|
| C01 | [(IGN1 off → on) & Drive Seat Belt SW unbelted] or
(IGN1 on & Drive Seat Belt SW belted → unbelted) | 6sec timer start & Buzzer on |
| C02 | (Drive Seat Belt SW belt) or (timer expired) or
IGN1 on → off | Buzzer off |

| Transitions | Input | Output |
|-------------|---|--|
| C03 | (IGN1 off → on) or
(IGN1 on & Driver Seat Belt SW belted → Unbelted) | 6sec timer start &
Drive Seat Belt IND on |
| C04 | (Timer expired) or (IGN1 on → off) | Driver Seat Belt IND off |



T1: 6 sec, T2: 0.5 sec, T3: 1 sec

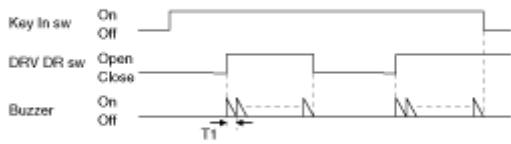
Key Operated Warning



*JAPAN ONLY

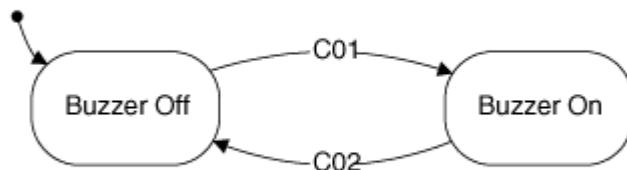
CO1: Key in SW=on & DRV DR SW=on

CO2: Key in SW=off or IGN1=on or DRV DR SW=off



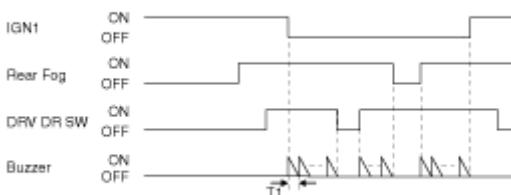
T1: 0.6±0.1sec

Rear Fog Lamp Warning



C01: IGN1=off & Rear Fog Lamp SW on & DRV DR SW on

C02: IGN1=on or Rear Fog Lamp SW off or DRV DR SW off

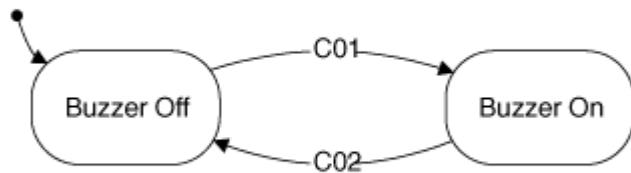


T1: 1.0 sec

Any Door Open Drive Warning

Any Door Open Drive Warning is divided by Enable and Disable, and the default value is enabled.

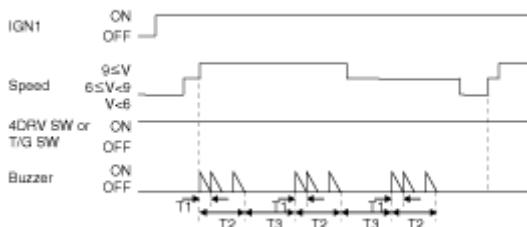
| | |
|-----------|---------------------------------|
| Division | Europe, General, Japan, England |
| Default | Enable |
| Selection | Disable |



Output Buzzer On: 6sec on 20sec Off 3 times

C01: IGN1=on & Speed \geq 9km/h & (4 Door SW on or Tail Gate SW on)

C02: IGN1=off or Speed $<$ 6km/h or (4 Door SW off & Tail Gate SW off) or End of Output 3 times



T1 : 0.6 \pm 0.1sec, T2 : 6sec, T3 : 20sec

NOTE

- During outputting, if occurring SBR PATTERN or Seat Belt Warning output, according Sound Priority, On SBR PATTERN or Seat Belt Warning Output and Reset Any Door Open Drive Warning Operation.
- If SBR PATTERN or Seat Belt Warning Output is finished, and Any Door Open Drive Warning Output condition is satisfied, perform Output 3 times at once.

Door Lock/Unlock Control

Control the following function as Door Lock/Unlock Control by Relay Control.

- Central Door Lock/Unlock by Driver Seat/Passenger seat's safety Knob
- IGN Key reminder
- Crash Door Unlock
- Central Door Lock/Unlock by Transmitter
- Tail Gate Unlock by Transmitter
- Dead Lock/Unlock
- Auto Door Lock/Unlock (Only User Option selected)

1. Data Flow

| Door Lock/Unlock Control | |
|--------------------------------|---------------------------|
| Input | Output |
| IGN1 | Relay1 (Lock) |
| Driver Door Unlock SW | Relay2 (Unlock) |
| Assist Door Unlock SW | Relay3 (Dead Lock) |
| Rear Door & Tailgate Unlock SW | Relay4 (Tail Gate Unlock) |
| Door key Lock SW | |

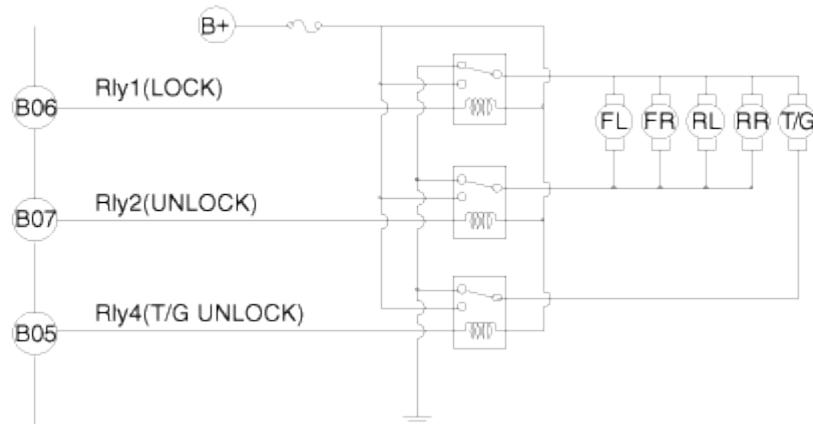
| |
|--------------------|
| Door key Unlock SW |
| TX Lock |
| TX Unlock |
| TX Tailgate Unlock |
| Key In SW |
| Driver Door SW |
| Assist Door SW |
| Crash input |
| IGN2 |
| Speed Sensor |

2. Overview Description

- A. Crash Door Unlock Function takes preference over Lock/Unlock by the other function.
- B. During and After Outputting Crash Door Unlock, Ignore the request of Lock/Unlock by the other function.
However, if IGN1 SW=off & IGN2 SW=off, Control Lock/Unlock by the other function.
- C. During Door Lock/Unlock Output, if there is the same output command, ignore the input.
However, Crash Door Unlock is valid.
- D. During Door Lock/Unlock Output, if there is conflicted output command, off the current output at once and after 100ms delay, perform the inputted Output.
However, During 100ms delay, if there is Output command, perform the last Output command inputted
- E. If Lock Out and Unlock Output is triggered at the same time, perform Lock Output and Ignore Unlock Output.
- F. During all Door Actuator Unlock SW is Lock, if there is Lock request, do not output
However, in case of Lock request by TX, perform Lock Output.
- G. During all Door Actuator Unlock SW is Unlock, if there is Unlock request, do not output
- H. Keeping up central door lock condition is possible in case of 4 door switch off(close) and tailgate switch off(close).

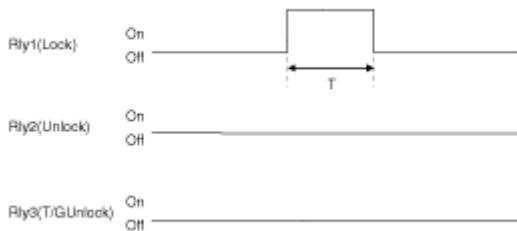
Door Lock/Unlock Relay Control

Non-applied Specification of Dead Lock



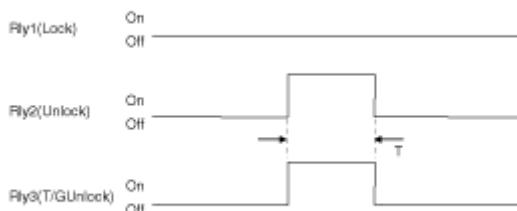
| Mode | Relay1(LOCK) | Relay2(UNLOCK) | Relay4(T/G UNLOCK) |
|----------------|--------------|----------------|--------------------|
| Central Lock | ON | OFF | OFF |
| Central Unlock | OFF | ON | ON |

Central Lock



$T: 0.5 \pm 0.1$ sec

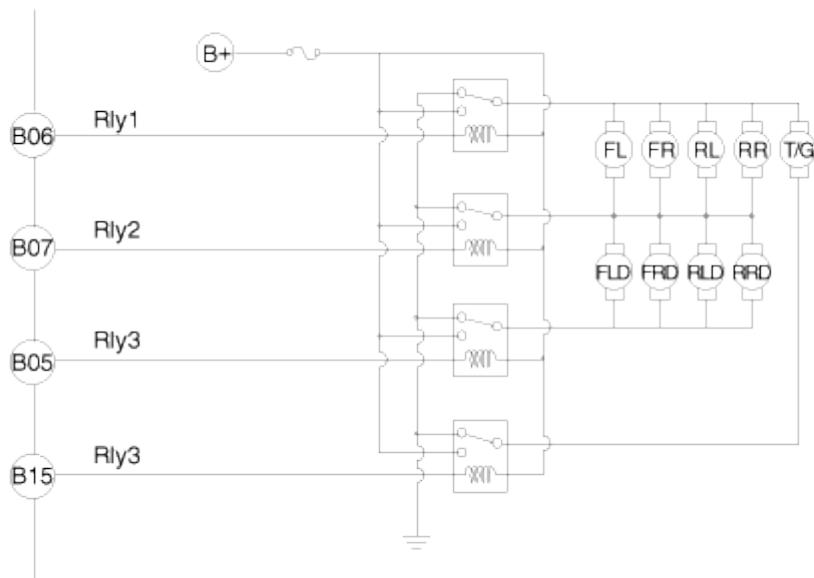
Central Unlock



$T: 0.5 \pm 0.1$ sec

Applied Specification of Dead Lock (only for U.K)

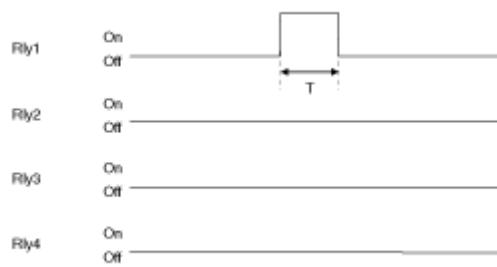
1. In case of Central Door Lock by driver seat (or passenger seat), or TX,
On Central Door Lock for 0.5s and after 200msec, On Dead Lock for 0.5s.
2. In case of Central Door Unlock by driver seat (or passenger seat), or TX,
On Central Door Unlock for 0.5s and after 200msec, On Dead Unlock for 0.5s.



| Mode | Relay1 | Relay2 | Relay3 | Relay4 |
|----------------|--------|--------|--------|--------|
| Central Lock | ON | OFF | OFF | OFF |
| Central Unlock | OFF | ON | ON | ON |
| Dead Lock | OFF | OFF | ON | OFF |

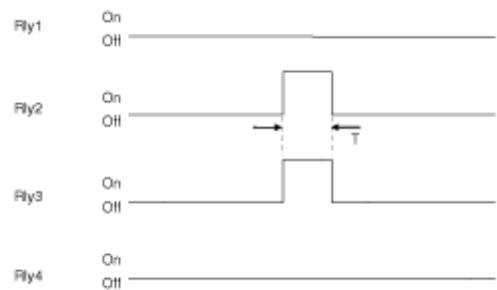
| | | | | |
|-------------|----|----|-----|-----|
| Dead Unlock | ON | ON | OFF | OFF |
|-------------|----|----|-----|-----|

Central Lock



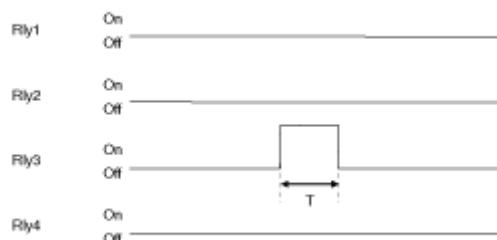
T: 0.5 ± 0.1 sec

Central Unlock



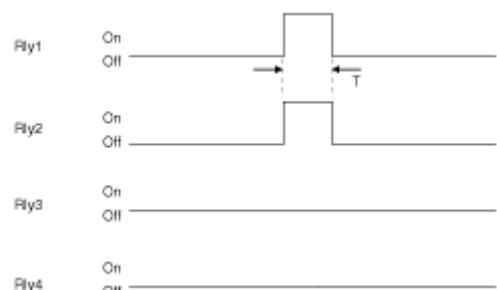
T: 0.5 ± 0.1 sec

Dead Lock



T: 0.5 ± 0.1 sec

Dead Unlock



T: 0.5 ± 0.1 sec

Central Door Lock/Unlock by Safety Knob

If there is Crash Door Unlock Input, regardless the operation state and perform Crash Door Unlock.

| Input | Condition | Output |
|---------------------------------------|--|--------------|
| (Driver seat or passenger seat) LOCK1 | Driver (or Assist) Door Unlock SW on → off | Central Lock |

| | | |
|---|---|----------------|
| (Driver seat or passenger seat) UNLOCK2 | Driver (or Assist) Door Unlock SW off → on | Central Unlock |
|---|---|----------------|

1LOCK: Driver seat or passenger seat Safety Knob Lock

2UNLOCK: Driver seat or passenger seat Safety Knob Unlock

NOTE

- No button for Door Lock in Power Window Switch
- No Output for Lock/Unlock by Rear seat's Safety Knob.
- But, the above logic is executed in condition of 4 Door SW off and Tailgate SW off.
Logic in conditon of 4 Door SW or Tailgate SW ON is referred to Any door open lock inhibition.

Central Door Lock/Unlock by Transmitter

1. Non-application Spec of Dead Lock (Except U.K.)

| Input | Precondition | Output |
|---------------------|---------------|-------------------|
| TX Lock | Key In SW=off | Central Lock1 |
| TX Unlock | Key In SW=off | Central Unlock1 |
| TX Tail Gate Unlock | Key In SW=off | Tail Gate Unlock1 |

2. Dead Lock application (U.K.)

| Input | Precondition | Output |
|---------------------|---------------|--------------------------------|
| TX Lock | Key In SW=off | Central Lock2 → Dead Lock2 |
| TX Unlock | Key In SW=off | Dead Unlock2 → Central Unlock2 |
| TX Tail Gate Unlock | Key In SW=off | Tail Gate Unlock2 |

NOTE

- But, the above logic is executed in condition of 4 Door SW off and Tailgate SW off.
Logic in conditon of 4 Door SW or Tailgate SW ON is referred to Any door open lock inhibition.

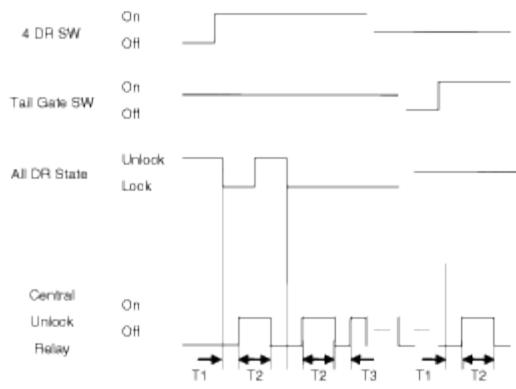
Any Door Open Lock Inhibition

1. This function does not operate if the vehicle speed is more than 3km/h.
2. If the state becomes Any Door Open(4DR SW on or TailGate SW on) and All Door Lock, after 0.5s, perform Central Unlock Output for 1s.(except for Dead Lock Spec.)
3. If the state becomes Any Door Open(4DR SW on or TailGate SW on) and All Door Lock, after 0.5s and Dead Unlock Output for 0.5s, and after 200msec, ON Central Unlock Output for 1s (only for Dead Lock Spec.)
4. Even if outputting Unlock for 1s by (2), and if keeping Any Door Lock State, perform Central Unlock Output max. 3 times (except for 1s output).
(1s cycle:0.5s on/off, except for Dead Lock Spec.)
5. Even if outputting Unlock for 1s by (3), and if keeping Any Door Lock State, after outputting Dead Unlock Output for 0.5s, and after 200msec, Output Central Unlock max. 3 times.
(1s cycle:0.5s on/off, only for Dead Lock Spec.)
6. On the state of Any Door Lock, when 4DRS SW off, perform Central Unlock Output for 1s once.
7. The judgment for Retry Output is performed at the time Retry Output is starting.
(after 1.5s from the first Central Unlock Output)

NOTE

All Door Lock : DRV DR Unlock SW off & AST DR Unlock SW off & RR & TailGate Unlock SW off

Any Door Lock : DRV DR Unlock SW off or AST DR Unlock SW off or RR & TailGate Unlock SW off

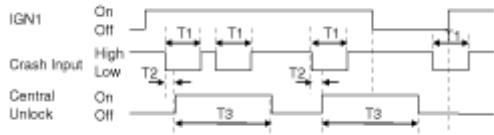


T1,T3 : 0.5 ± 0.1 sec, T2 : 1 ± 0.1 sec

Crash Door Unlock (=Impact Sensing Auto Door Unlock)

1. On the state of IGN1 on, whenever Crash Input is inputted, On Central Unlock1or2 Output for T3.
2. On the state of IGN1 off, Ignore Crash Input input.
3. During Crash Door Unlock Output, Ignore Door Lock Input3
4. During Crash Door Unlock Output, even if IGN1 on → off, keep Crash Door Unlock Output for remain time.
5. After Crash Door Unlock Output, if occurring Door Lock Input3, On Crash Door Unlock Output for T3 again.
6. During or after Crash Door Unlock Output, do not On Central Lock1or2 Output.
7. On the state of Crash Door Unlock, do not perform Auto Door Lock function.
8. After IGN1 off, and if Crash Door Unlock Function is Reset, perform Central Lock1or2 Output normally.

3Door Lock Input: Driver Door Unlock SW on → off or Assist Door Unlock SW on → off or



T1 : 0.2 sec, T2 : Max 40 msec, T3 : 5 ± 0.5 sec

Dead Lock (only for U.K.)

1. By Door Key SW, TX Lock, AUTOLOCKTIMER1, AUTOLOCKTIMER2, AUTOLOCKTIMER3, if it becomes All Door Lock operation condition, after Central Lock2 Output and checking the state (after 200msec), ON Dead Lock2 Output for 0.5s.
2. If inputting Lock signal by Safety Knob of driver seat or passenger seat, after Central Lock2 Output, do not perform Dead Lock2 Output.
3. If it becomes All Door Unlock operation condition by Door Key SW, or if it becomes All Door Unlock operation condition by TX, after Dead Unlock2 Output for 0.5s and checking the state(after 200msec), ON Central Unlock2 Output for 0.5s.
4. If it becomes All Door Unlock operation condition by Safety Knob of driver seat or passenger seat, perform only Central Unlock2Output, and do not perform Dead Unlock2. However, on the state of Dead Lock2, do not perform All Door Unlock by Safety Knob.
5. Perform Dead Lock2/Unlock2 regardless of Door Open/Close.
6. During Central Lock2/Unlock2 Output by Key or TX, if inputting Central Lock2/Unlock2 command, end the current Output at once, after 200msec, Output by new input condition.
7. By Key or TX, after Central Lock2, during Dead Lock2 Output, and if inputting Central Unlock2 command, end the current Output at once, after 200msec, Output by new input condition.
By Key or TX, after Dead Unlock2, during Central Unlock2 Output, and if inputting Central Lock2 command, end the current Output at once, after 200msec, Output by new input condition.
8. If performing Lock/Unlock at the same time, perform Lock function at first.
9. If inputting at the same time by Key/TX/Safety Knob, give the priority with the order as TX > Key > Safety Knob.

10. If it is the same condition as 8 and 9, 9 takes preference over.
11. During Dead Lock2, and if Actuator Unlock SW3=Lock, without 200msec delay, Output Dead Lock2.
12. During Dead Unlock2, and if Actuator Unlock SW3 =Unlock, perform Dead Unlock2, and do not perform Central Unlock2.
13. On the state of Dead Lock2, if Key In and L IGN1 Off → On, Output Dead Unlock2 for 0.5s.
14. If Reset by Battery connect/disconnect, it is considered as a Dead Lock2 State.

NOTE

3Actuator Unlock SW: Driver Door Unlock SW & Assist Door Unlock SW & (Rear & Tailgate Unlock SW)

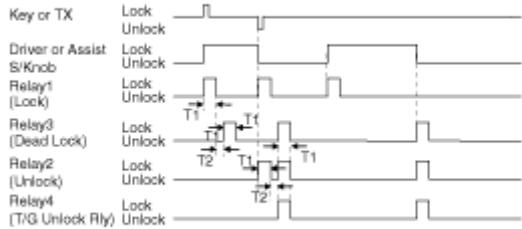
NOTE

All Door Lock Condition by Door Key SW

: Door Key Lock SW=on & (Driver Door Unlock SW=off or Assist Door Unlock SW=off)

All Door Unlock Condition by Door Key SW

: Door Key Unlock SW=on & (Driver Door Unlock SW=on or Assist Door Unlock SW=on)



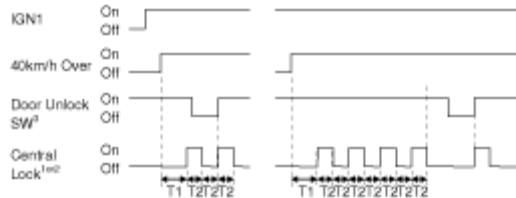
T1: $0.5 \pm 0.1\text{sec}$, T2: $0.2 \pm 0.05\text{sec}$

Auto Door Lock (Speed Sensing Auto Door Lock)

1. Auto Door Lock is divided by Disable and Enable (40km/h), and the default value for each region is disabling.

| | |
|---------------|------------------------------------|
| Item | Europe, General,
Japan, England |
| Default value | Disable |
| Selection | 40km/h |

2. On the state of IGN1 SW on, if keeping the vehicle speed as the setting vehicle speed in (1), On Central Lock 1 or 2 Output within T1. However, if all Doors are Lock State or all Doors are failed, do not perform Central Lock 1 or 2 Output.
3. After Central Lock 1 or 2 Output, if one of Door is unlock State, perform Central Lock 1 or 2 Output max. 3 times.(1s cycle)
However, during outputting 3times, if Door is Unlock → Lock, ignore it.
4. After Central Lock 1 or 2 Output, if the state is Unlock, treat the corresponding Door as Fail.
5. After Door treated as Fail is Unlock → Lock and if it becomes Unlock, Output Central Lock 1 or 2 once.
6. After Central Lock 1 or 2 Output of (2), if Door that the state was Lock becomes Unlock, Output Central Lock 1 or 2 once
However, after Central Lock 1 or 2 Output, even if keeping Unlock state, Output Central Lock 1 or 2 for the corresponding door once.
7. If IGN1 SW = off, Clear Door treated as Fail.
8. On the condition of Crash Unlock, do not perform Auto Door Lock function.



T1: Max 1.5sec, T2: 0.5±0.1sec

NOTE

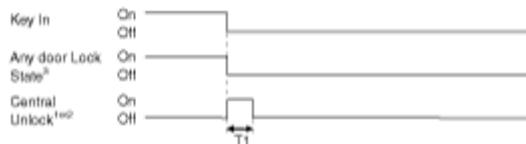
3On (Unlock): Driver Door Unlock SW=on or Assist Door Unlock SW=on or Rear & Tailgate Unlock SW=on
Off (Lock): Driver Door Unlock SW=off & Assist Door Unlock SW=off & Rear & Tailgate Unlock SW=off

Auto Door Unlock

1. Auto Door Unlock is divided by Disable and Enable, and the default value is disable.

| | |
|---------------|------------------------------------|
| Division | Europe, General,
Japan, England |
| default value | Disable |
| Selection | Enable |

2. If setting as Enable, under condition of Any Door Lock, in case of Key In=On→Off, On Central Unlock1or2 Output.(However, if All Safety Knob is Unlock, Not Output.)



T1: 0.5±0.1sec

NOTE

3On (=Any door lock)
: Driver Door Unlock SW=off or Assist Door Unlock SW=off or Rear & Tailgate Unlock SW=off
Off (=All door Unlock)
: Driver Door Unlock SW=on & Assist Door Unlock SW=on & Rear & Tailgate Unlock SW=on

Lamp Control

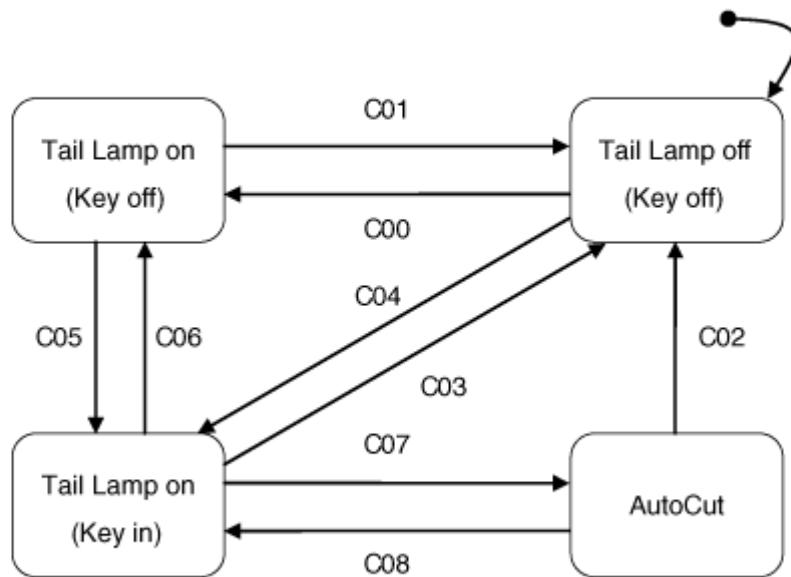
Tail Lamp Auto Cut (Bat. Saver)

Upon Input, Tail lamp is controlled.

1. Data Flow

| Lamp Control | |
|--------------|-----------------|
| Input | Output |
| Tail Lamp SW | Tail Lamp Relay |
| Key In SW | |

2. Behavior For Normal State



C00: Tail Lamp SW on & Key In SW off / Tail Lamp Relay on

C01: Tail Lamp SW off / Tail Lamp Relay off

C02: Tail Lamp SW off

C03: Tail Lamp SW off & Key In SW off / Tail Lamp Relay off

C04: Tail Lamp SW on & Key In SW on / Tail Lamp Relay on

C05: Key In SW on

C06: Key In SW off & Tail Lamp SW on

C07: Key In SW off & Driver Door SW on / Tail Lamp Relay off

C08: Key In SW on/ Tail Lamp Relay on

NOTE

If Battery connect -> disconnect on 4 Type MODE {Tail Lamp on(Key off), Tail Lamp off(Key off), Tail Lamp on(Key in)} above, Keep the previous Mode.

Delay Out Interior Lamp

On the state of IGN1 off, if Door(Except for Tailgate) is opened, Room Lamp is ON, and if Door is closed, Room Lamp is Off after 30sec delay.

Under door is closed, in case of IGN1 off & Key Out, Room Lamp is Off after 30sec delay Room lamp is on only on Room Lamp Switch (Door).

1. Data Flow

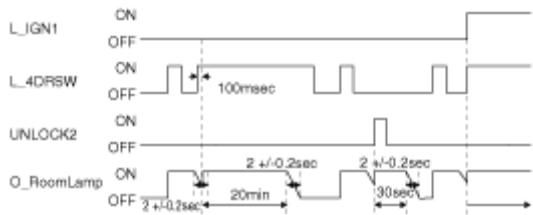
| Delay Out Interior Lamp | |
|-------------------------|-----------|
| INPUT | OUTPUT |
| 4Door SW | Room Lamp |
| IGN1 | |
| TX Unlock | |
| Driver Door Unlock SW | |
| Assist Door Unlock SW | |

| | |
|-----------|--|
| Key In SW | |
|-----------|--|

Description of State

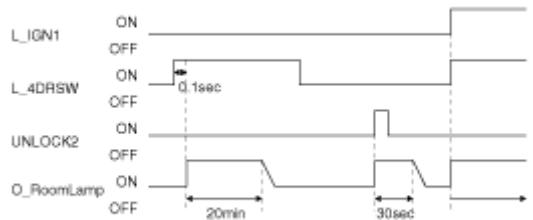
1. Room Lamp off

| State | Description |
|-------------------|---------------------|
| Initial Condition | Room Lamp Decaying |
| Event | Decay finished |
| Action | Enter Room Lamp off |



2. Room Lamp on

| State | Description |
|-------------------|-----------------------|
| Initial Condition | Room Lamp off |
| Event | IGN1=on & 4Door SW=on |
| Action | Enter Room Lamp on |



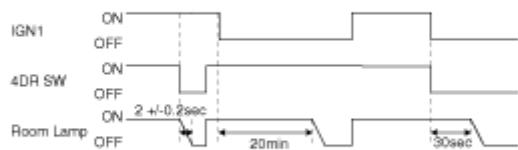
| State | Description |
|-------------------|-----------------------|
| Initial Condition | Room Lamp Decaying |
| Event | IGN1=on & 4Door SW=on |
| Action | Enter Room Lamp on |

| State | Description |
|-------------------|------------------------|
| Initial Condition | Room Lamp on for 20min |
| Event | IGN1=on |
| Action | Enter Room Lamp on |

3. Room Lamp on for 30s

| State | Description |
|-------------------|------------------------------|
| Initial Condition | Room Lamp on for 30s |
| Event | TX Unlock or Key In SW=off |
| Action | Restart Room Lamp on for 30s |

| State | Description |
|-------------------|----------------------------|
| Initial Condition | Room Lamp on |
| Event | IGN1=off & 4Door SW=off |
| Action | Start Room Lamp on for 30s |



NOTE

1. The flickering of lamp is not allowed even though IGN1 ON.
2. The resolution of Decayed Room Lamp must be more than 32 step.

| State | Description |
|-------------------|----------------------------|
| Initial Condition | Room Lamp on for 20min |
| Event | IGN1=off & 4Door SW=off |
| Action | Start Room Lamp on for 30s |

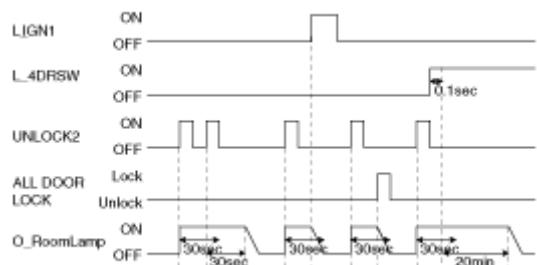
| State | Description |
|-------------------|--|
| Initial Condition | Room Lamp Decaying |
| Event | IGN1=off & 4Door SW=off & (TX Unlock or Key In SW=off) |
| Action | Start Room Lamp on for 30s |

| State | Description |
|-------------------|--|
| Initial Condition | Room Lamp off |
| Event | IGN1=off & 4Door SW=off & (TX Unlock or Key In SW=off) |
| Action | Start Room Lamp on for 30s |

4. Room Lamp Decaying

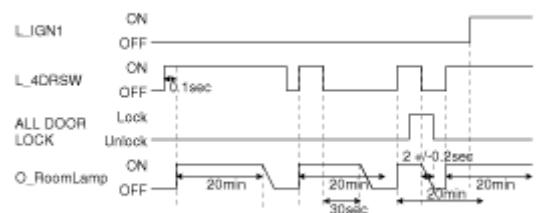
| State | Description |
|-------------------|----------------------|
| Initial Condition | Room Lamp on for 30s |

| | |
|--------|--|
| Event | IGN1=on or 30s elapsed or Any Door Unlock→All Door Lock1 |
| Action | Start Room Lamp Decaying |



| State | Description |
|-------------------|--------------------------|
| Initial Condition | Room Lamp on |
| Event | IGN1=on or 4Door SW=off |
| Action | Start Room Lamp Decaying |

| State | Description |
|-------------------|---|
| Initial Condition | Room Lamp on for 20min |
| Event | 20min elapsed or (IGN1=off & 4Door SW=off & All Door Lock1) |
| Action | Start Room Lamp Decaying |



5. Room Lamp on for 20min

| State | Description |
|-------------------|--|
| Initial Condition | Room Lamp off |
| Event | IGN1=off & (4Door SW=off → on for 100ms) |
| Action | Start Room Lamp on for 20min |

| State | Description |
|-------------------|--|
| Initial Condition | Room Lamp Decaying |
| Event | IGN1=off & (4Door SW=off → on for 100ms) |
| Action | Start Room Lamp on for 20min |

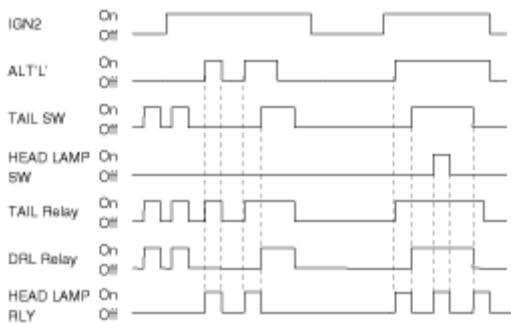
| State | Description |
|-------------------|--|
| Initial Condition | Room Lamp on for 30s |
| Event | IGN1=off & (4Door SW=off → on for 100ms) |
| Action | Start Room Lamp on for 20min |

| State | Description |
|-------------------|------------------------------|
| Initial Condition | Room Lamp on |
| Event | IGN1=off & 4Door SW=on |
| Action | Start Room Lamp on for 20min |

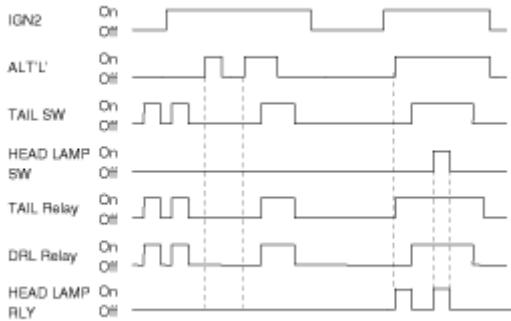
DRL (Daytime Running Light)

1. If IGN2 & ALT'L' = on & Head Lamp SW = off & Tail Lamp SW = off, On Tail Lamp Relay and Head Lamp Low Relay.
2. After 1, if Tail Lamp SW = on, Off Head Lamp Low Relay and On DRL Relay.
3. After 2, if Head Lamp SW = on again, Keep DRL Relay on and On Head Lamp Low Relay.
4. If Tail Lamp SW = on, and IGN2 & ALT'L' off → on, Keep Tail Lamp Relay and DRL Relay on.
5. If DRL Activation Input = off (Open), do not operate DRL.
6. During DRL Function operation, if DRL Activation Input = off (Open), Stop DRL function.
7. Even if DRL Activation Input = off (Open), Tail Lamp Relay perform DRL Relay Control by Tail Lamp SW and Head Lamp Relay Control by Head Lamp SW.

*In case of DRL Activation Input = on (Low, GND)



*In case of DRL Activation Input = off (Open)



Power Window Timer

IF IGN1 on, Power Window Relay Output.

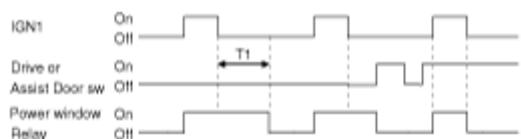
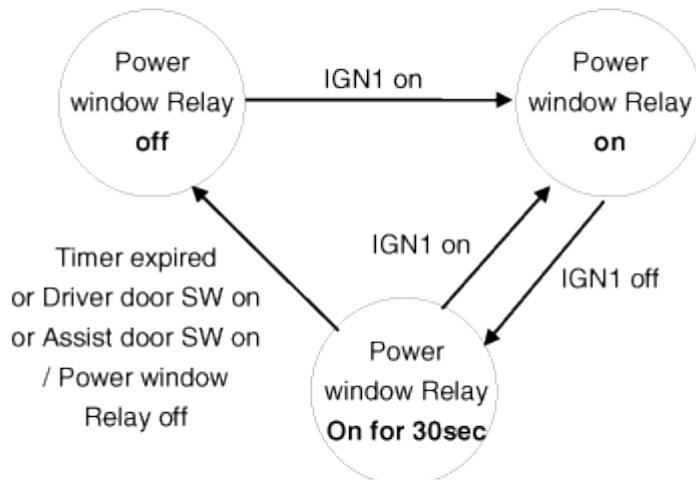
IF IGN1 off, Extend Power Window Relay Output for 30s.

However, During Extension Output, if Driver Door or Passenger door is opened, Stop Output.

1. Data Flow

| Power Window Control | |
|----------------------|--------------------|
| Input | Output |
| IGN1 | Power window Relay |
| Driver Door SW | |
| Assist Door SW | |

2. Behavior for Normal State



Defogger Timer (including Out Side Mirror Heat)

On the state of Alternator High, if Defogger SW is on, Perform Defogger Relay Output.

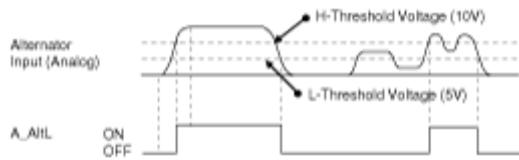
During Output, if Defogger SW is on or Alternator transits to Low State, Stop Output.

Outside mirror heat output is outputted by Wiring back of heating wire relay.

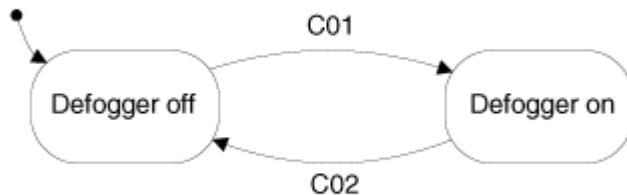
1. Data Flow

| Defogger Timer | |
|----------------|----------------|
| Input | Output |
| IGN1 | Defogger Relay |
| ALT'L' | |
| Defogger SW | |

2. ALT'L' Signal Confirm Method

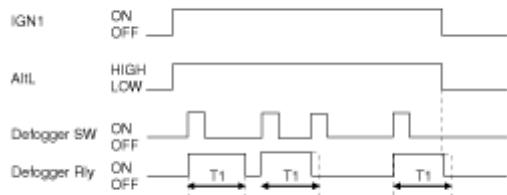


3. Behavior for Normal State



C01: IGN1 on & Alt'L' High & Defogger SW on

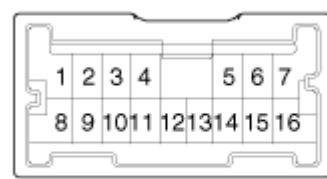
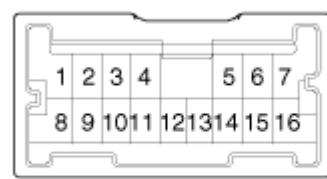
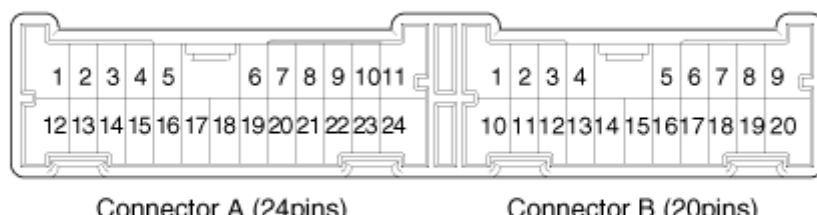
C02: IGN1 off or Alt'L' Low or Defogger SW off



12.6.1.3. Repair procedures

Inspection

BCM Connectors



Connector "A"

| No. | Signal Definition |
|-----|-------------------|
| A01 | Battery Power |

| | |
|-----|---|
| A02 | Local ignition1 input in BCM |
| A03 | Local ignition2 input in BCM |
| A04 | Driver Door Unlock State input |
| A05 | Assist Door Unlock State input |
| A06 | Driver Door Switch |
| A07 | Assist Door Switch |
| A08 | Rear Door & Tail Gate Unlock State input |
| A09 | - |
| A10 | Key in switch |
| A11 | Speed Sensor |
| A12 | Alternator L Terminal: Determine weather Starting, or not |
| A13 | Signal ground |
| A14 | - |
| A15 | Tail Gate Switch |
| A16 | Hood Switch input |
| A17 | 4 Door Switch |
| A18 | Tail Lamp Switch |
| A19 | Drive Seat Belt Switch |
| A20 | Rear Fog Lamp Switch |
| A21 | Head Lamp Low Switch |
| A22 | Defogger Switch |
| A23 | Crash input from AIRBAG |
| A24 | Power ground |

Connector "B"

| No. | Signal Definition |
|-----|-----------------------------|
| B01 | Room Lamp Output |
| B02 | - |
| B03 | Power Window Relay |
| B04 | Hazard Relay |
| B05 | Start Inhibit Relay |
| B06 | Relay 1 (Lock) |
| B07 | Relay 2 (Unlock) |
| B08 | Daytime Running Light Relay |

| | |
|-----|----------------------------------|
| B09 | Burglar Alarm Horn Relay |
| B10 | Tail Lamp Relay |
| B11 | Drive Seat Belt Indicator |
| B12 | - |
| B13 | Daytime Running Light Activation |
| B14 | Defogger Relay |
| B15 | Relay 4 (Tail Gate Unlock) |
| B16 | - |
| B17 | KWP2000 Terminal |
| B18 | - |
| B19 | Head Lamp Low Relay |
| B20 | - |

Connector "C"

| No. | Signal Definition |
|-----|---------------------------------------|
| C01 | Rear left Seat Beat Switch |
| C02 | Rear centre Seat Beat Switch |
| C03 | Drive & Assist Door Key Lock Switch |
| C04 | Drive & Assist Door Key Unlock Switch |
| C05 | Relay 3 (Dead Lock) |
| C06 | Assist Seat Belt Indicator Red |
| C07 | - |
| C08 | Rear left Seat Beat Red Indicator |
| C09 | Rear right Seat Beat Switch |
| C10 | Assist Seat Belt Reminder MAT Signal |
| C11 | - |
| C12 | - |
| C13 | - |
| C14 | Rear right Seat Beat Red Indicator |
| C15 | - |
| C16 | Rear centre Seat Beat Red Indicator |

Rating Load

| NO | Item | Rating Load |
|----|-----------|-----------------------|
| 1 | Room Lamp | DC 12V 30W(LAMP Load) |

| | | |
|----|---------------------------|------------------------------|
| 2 | Driver Seat Belt IND | DC 12V 1.2W (LED Load) |
| 3 | Assist Seat Belt IND | DC 12V 1.2W (LED Load) |
| 4 | Rear left Seat Belt IND | DC 12V 1.2W (LED Load) |
| 5 | Rear centre Seat Belt IND | DC 12V 1.2W (LED Load) |
| 6 | Rear right Seat Belt IND | DC 12V 1.2W (LED Load) |
| 7 | Relay1(Lock) | DC 12V 200mA(Inductive Load) |
| 8 | Relay2(Unlock) | DC 12V 200mA(Inductive Load) |
| 9 | Relay3(Dead Lock) | DC 12V 200mA(Inductive Load) |
| 10 | Relay4(T/G Unlock) | DC 12V 200mA(Inductive Load) |
| 11 | Power window Relay | DC 12V 200mA(Inductive Load) |
| 12 | Defogger Relay | DC 12V 200mA(Inductive Load) |
| 13 | Tail Lamp Relay | DC 12V 200mA(Inductive Load) |
| 14 | Head Lamp Low Relay | DC 12V 200mA(Inductive Load) |
| 15 | DRL Relay | DC 12V 200mA(Inductive Load) |
| 16 | Hazard Relay | DC 12V 200mA(Inductive Load) |
| 17 | Burglar Horn Relay | DC 12V 200mA(Inductive Load) |
| 18 | Start Inhibitor Relay | DC 12V 200mA(Inductive Load) |

Input Signal SPEC

| No | Input Signal Name | Logic State | ON/OFF Voltage Recognition LEVEL(V) |
|----|-----------------------|---|---|
| 1 | B+ | ON = BAT | 9V~16V |
| 2 | IGN1 | ON = BAT
(IGN KEY가 ON or START Position) | More than 7V/less than 4V |
| 3 | IGN2 | ON = BAT (IGN KEY is ON Position) | More than 7V/less than 4V |
| 4 | Alt L | ON = BAT Equality (Started State) | More than 10V/ less than 5V |
| 5 | Key In SW | IN = BAT (KEY Insert STATE) | More than 7V/less than 4V |
| 6 | 4Door SW | GND = OPEN one of 4DR
OPEN = CLOSE all 4DR | less than 2V/OPEN
(Reference value : more than 4V) |
| 7 | Driver Door SW | OPEN = GND | less than 2V/OPEN
(Reference value : more than 4V) |
| 8 | Assist Door SW | OPEN = GND | less than 2V/OPEN
(Reference value : more than 4V) |
| 9 | Tailgate SW | OPEN = GND | less than 2V/OPEN
(Reference value : more than 4V) |
| 10 | Driver Door Unlock SW | LOCK = OPEN, UNLOCK = GND | less than 2V/OPEN
(Reference value : more than 4V) |

| | | | |
|----|---------------------------|---|---|
| 11 | Assist Door Unlock SW | LOCK = OPEN, UNLOCK = GND | less than 2V/OPEN
(Reference value : more than 4V) |
| 12 | Rear & Tailgate Unlock SW | LOCK = OPEN, UNLOCK = GND | less than 2V/OPEN
(Reference value : more than 4V) |
| 13 | Door Key Lock SW | ON = GND | less than 2V/OPEN
(Reference value : more than 4V) |
| 14 | Door Key Unlock SW | ON = GND | less than 2V/OPEN
(Reference value : more than 4V) |
| 16 | Hood SW | OPEN = GND | less than 2V/OPEN
(Reference value : more than 4V) |
| 17 | Defogger SW | ON = GND | less than 2V/OPEN
(Reference value : more than 4V) |
| 18 | Tail Lamp SW | ON = GND | less than 2V/OPEN
(Reference value : more than 4V) |
| 19 | Head Lamp Low SW | ON = GND | less than 2V/OPEN
(Reference value : more than 4V) |
| 20 | Driver Seat Belt SW | Using = OPEN, Not using = GND | less than 2V/OPEN
(Reference value : more than 4V) |
| 21 | Assist SBR Signal | Being Passenger Using = OPEN, Not using = OPEN
Not Being Passenger Using = OPEN, Not using = GND | less than 2V/OPEN
(Reference value : more than 4V) |
| 22 | Rear left Seat Belt SW | Using = OPEN, Not using = GND | less than 2V/OPEN
(Reference value : more than 4V) |
| 23 | Rear centre Seat Belt SW | Using = OPEN, v = GND | less than 2V/OPEN
(Reference value : more than 4V) |
| 24 | Rear right Seat Belt SW | Using = OPEN, Not using = GND | less than 2V/OPEN
(Reference value : more than 4V) |
| 25 | Crash Input | ON = GND(If detecting collision) | less than 2V/OPEN
(Reference value : more than 4V) |
| 26 | Speed Sensor | Speed Input = PULSE(0~5V) | less than 2Vmore than 4V |
| 27 | Rear Fog Lamp SW | ON = GND | less than 2V/OPEN
(Reference value : more than 4V) |
| 28 | K_LINE | | |
| 29 | DRL Activation | ON=GND, OFF=OPEN | less than 2V/OPEN
(Reference value : more than 4V) |

BCM Diagnosis With Scan Tool

1. It will be able to diagnose defects of BCM with scan tool quickly. Scan tool can operates actuator forcefully, input/output value monitoring and self diagnosis.
2. Select model and menu.

1. HYUNDAI VEHICLE DIAGNOSIS ▼

MODEL : PB

- 01. ENGINE (GASOLINE)
- 02. ENGINE (DIESEL)
- 03. AUTOMATIC TRANSAXLE
- 04. ANTI-LOCK BRAKE SYSTEM
- 05. SRS-AIRBAG
- 06. ELEC. POWER STEERING
- 07. BODY CONTROL MODULE**
- 08. FULL AUTO AIR/CON.

3. Select "Current data", if you will check current data of BCM. It provides power supply status, multi function status, lamp status, door status, lock system status, wiper, auto light status and so on.

1. HYUNDAI VEHICLE DIAGNOSIS

MODEL : PB

SYSTEM : BODY CONTROL MODULE

01. CURRENT DATA

- 02. FLIGHT RECORD
- 03. ACTUATION TEST
- 04. SIMU-SCAN
- 05. USER OPTION
- 06. IDENTIFICATION CHECK
- 07. DATA SETUP (UNIT CONV.)

1.1 CURRENT DATA 01/13

| | |
|--------------------|-----|
| WASHER SW | OFF |
| WIPER INT SW | OFF |
| DEFROSTER SW | OFF |
| HEAD LAMP WASH SW | OFF |
| DEFROSTER REPLAY | OFF |
| HEAD LAMP WASH RLY | OFF |
| MIST SW | OFF |

FIX **SCRN** **FULL** **PART** **GRPH** **HELP**

4. If you will check BCM data operation forcefully, select "Actuation test".

1. HYUNDAI VEHICLE DIAGNOSIS

MODEL : PB

SYSTEM : BODY CONTROL MODULE

01. CURRENT DATA

02. FLIGHT RECORD

03. ACTUATION TEST

04. SIMU-SCAN

05. USER OPTION

06. IDENTIFICATION CHECK

07. DATA SETUP (UNIT CONV.)

| | | |
|---|--------------------------------------|-------|
| 1.3 ACTUATION TEST | | 09/21 |
| TAIL LAMP | RELAY/DRL UNIT | |
| DURATION | 1 SECONDS | |
| METHOD | ACTIVATION | |
| CONDITION | ENGINE : IDLE
TRANSAXLE RANGE : P | |
| PRESS [START], IF YOU ARE READY !
SELECT TEST ITEM USING UP/DOWN KEY | | |
| START | | |

User Option Mode

The BCM offers 3 items user option mode for a user convenience (AUTO DOOR LOCK, AUTO DOOR UNLOCK, Any door open driver warning default.)

- It is able to set up the enable or disable of AUTO DOOR LOCK function or AUTO DOOR LOCK operation vehicle speed when using it.
- It is able to set up the enable or disable of AUTO DOOR UNLOCK function or AUTO DOOR UNLOCK operation vehicle speed when using it.
- It is able to set up the enable or disable of any door open drive warning.

1. Select option "PB" and press ENTER.
2. Select option "BODY CONTROL MODULE" and press ENTER.

| | |
|--------------------------------|----|
| 1. HYUNDAI VEHICLE DIAGNOSIS | ▼▲ |
| MODEL : PB | |
| SYSTEM : BODY CONTROL MODULE | |
| 01. ENGINE (GASOLINE) | |
| 02. ENGINE (DIESEL) | |
| 03. AUTOMATIC TRANSAXLE | |
| 04. ANTI-LOCK BRAKE SYSTEM | |
| 05. SRS-AIRBAG | |
| 06. ELEC. POWER STEERING | |
| 07. BODY CONTROL MODULE | |
| 08. FULL AUTO AIR/CON. | |

3. Select option "USER OPTION" and press ENTER.

| |
|------------------------------|
| 1. HYUNDAI VEHICLE DIAGNOSIS |
| MODEL : PB |
| SYSTEM : BODY CONTROL MODULE |
| 01. CURRENT DATA |
| 02. FLIGHT RECORD |
| 03. ACTUATION TEST |
| 04. SIMU-SCAN |
| 05. USER OPTION |
| 06. IDENTIFICATION CHECK |
| 07. DATA SETUP(UNIT CONV.) |

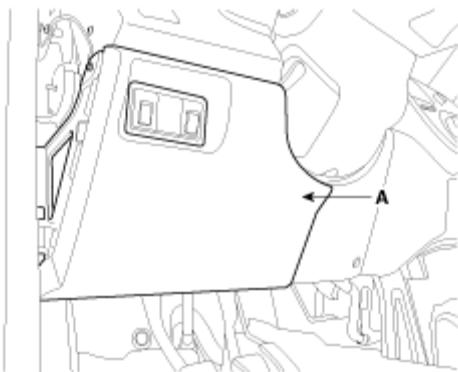
4. Select option "AUTO DOOR LOCK STATUS" by using the direction button(▲ / ▼).
5. Select the parameter by using the direction button(◀ / ▶) and press ENTER to save it.
(Disable /Enable)

| 1.6 USER OPTION | |
|---------------------------------------|---------|
| AUTO DOOR LOCK STATUS | DISABLE |
| AUTO DOOR UNLOCK STATUS | DISABLE |
| ANY DOOR OPEN DRIVER
WARNING | DISABLE |
| DATA WRITE | |
| DISABLE | |
| AFTER SELECT (◀/▶)KEY, PRESS [ENTER]. | |

6. Select option "AUTO DOOR UNLOCK STATUS" by using the direction button(**▲ / ▼**).
7. Select the parameter by using the direction button(**◀ / ▶**) and press ENTER to save it.
(Disable / Enable)
8. Select option "ANY DOOR OPEN DRIVER WARNING" by using the direction button(**▲ / ▼**).
9. Select the parameter by using the direction button (**▲ / ▼**) and press ENTER to save it (Disable/Enable)

Removal

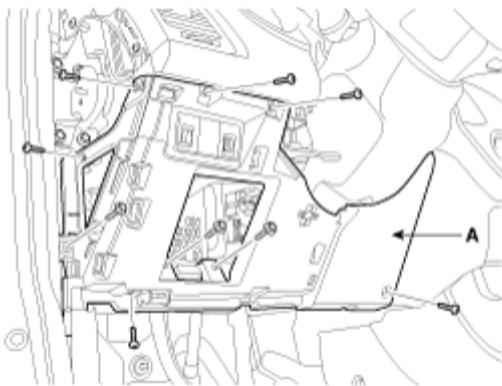
1. Disconnect the negative (-) battery terminal.
2. Remove the fuse box cover (A).



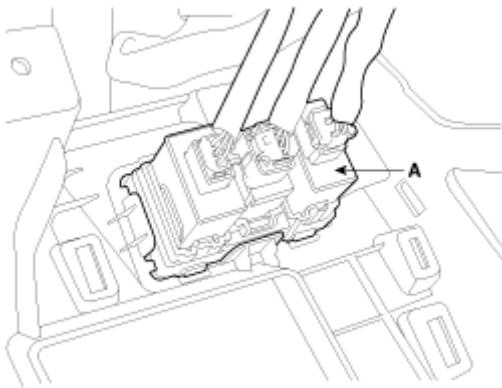
3. Remove the crash pad lower panel (A) after loosening 6 screws and 3 bolts.
(Refer to the BD group - "Crash pad")

NOTE

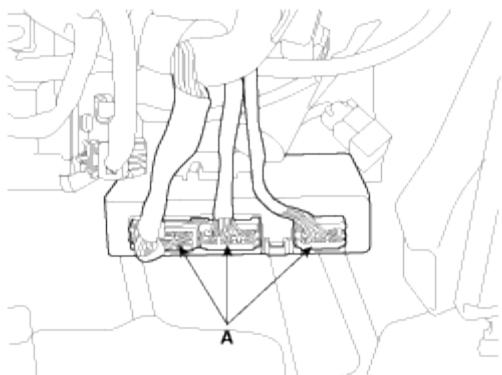
Take care not to scratch the crash pad and related parts.



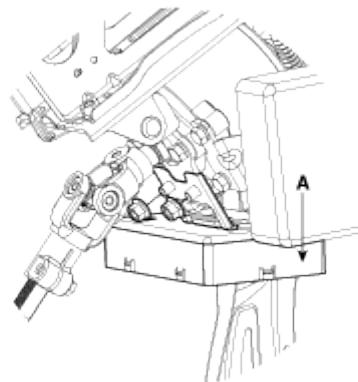
4. Disconnect the connectors (A) from the crash pad lower panel.



5. Disconnect the body control module connectors (A).



6. Remove the body control module (A) after loosening 2 nuts.



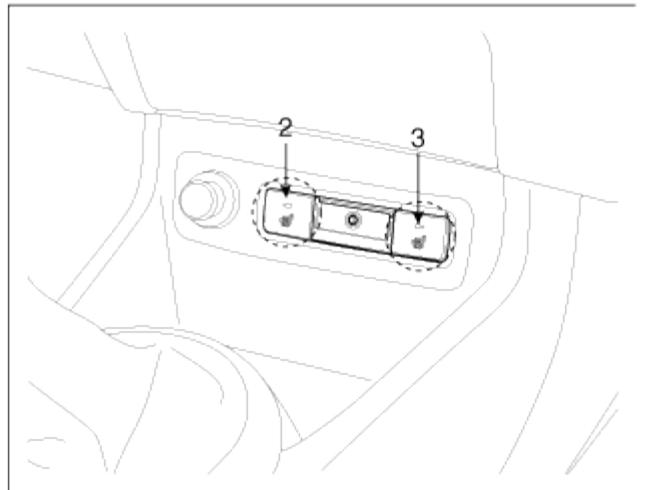
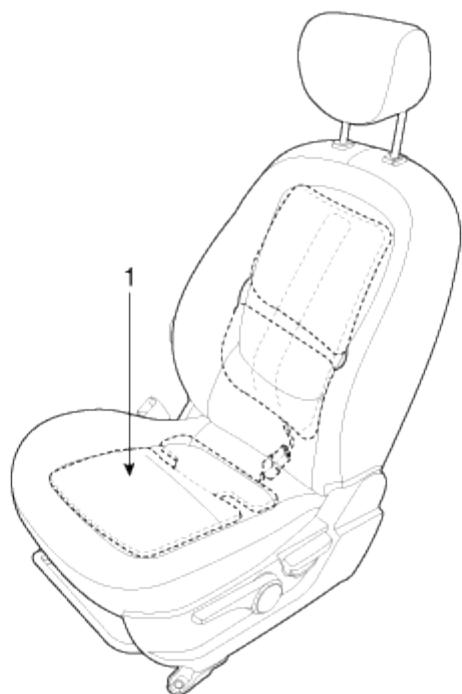
Installation

1. Install the body control module.
2. Install the crash pad lower panel.
3. Install the fuse box cover.

12.7. Seat Electrical

12.7.1. Component and Components Location

Component Location



- | | |
|--|----------------------------|
| 1. Seat warmer
2. Seat warmer switch (LH) | 3. Seat warmer switch (RH) |
|--|----------------------------|

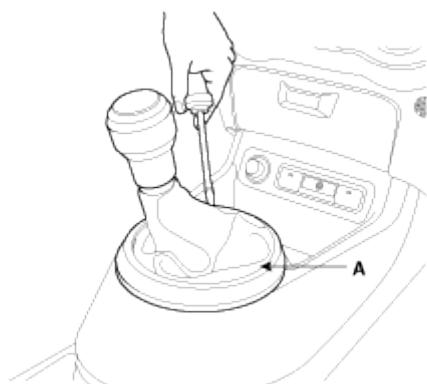
12.7.2. Seat Heater Switch

12.7.2.1. Repair procedures

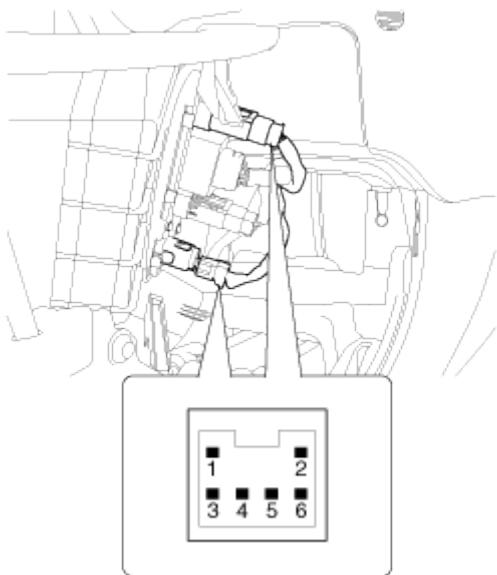
Inspection

Front Seat Warmer Switch

1. Disconnect the negative (-) battery terminal.
2. Remove the console upper cover deco plate (A).
(Refer to the BD group - "console")



3. Remove the upper cover from the console.
4. Using an ohmmeter, inspect the continuity between the terminals after disconnecting the connector.



5. Check that continuity exists between the terminals.

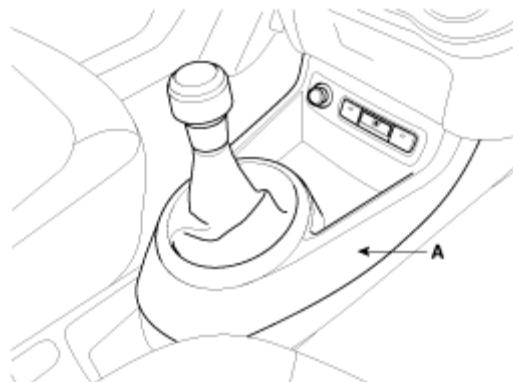
| Position
Terminal | ON(PUSH) | OFF(FREE) | Remark |
|----------------------|-------------|-----------|--------|
| 2 | ○ | | IG |
| 5 | ○—○—○ | | IND+ |
| 6 | ○—○—○—○ | | GND |
| 1 | ○—○—○—○—○ | | ILL- |
| 3 | ○—○—○—○—○—○ | | ILL+ |

Remove

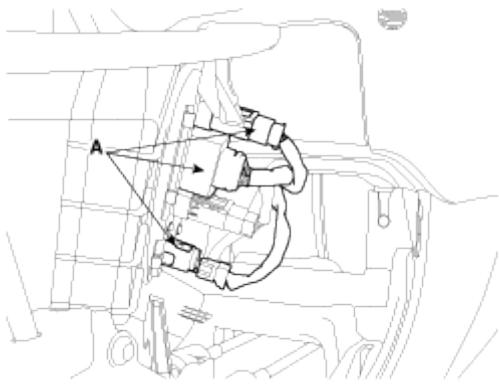
1. Disconnect the negative(-) battery terminal.

2. Remove the console upper cover (A).

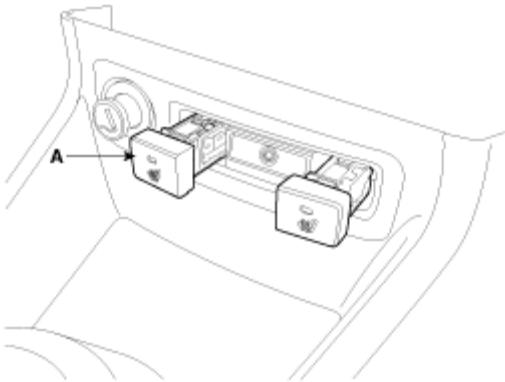
(Refer to the BD group - "console")



3. Disconnect the connectors.



4. Remove the seat heater switches (A) from the console upper cover.



Installation

1. Install the seat heater switch.
2. Install the console upper cover.

12.7.3. Seat Heater 12.7.3.1. Repair procedures

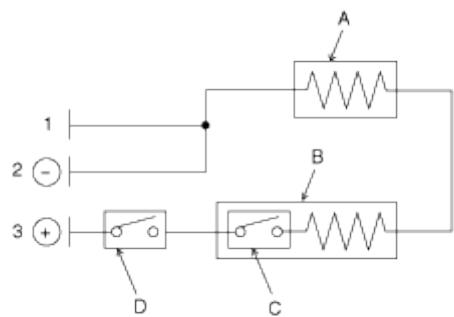
Inspection

1. Check for continuity and measure the resistance between No.1 and NO.3 terminals.
(Terminal NO. 1 : IND(-), 2 : GND, 3 : Heater(+))

$2.51\Omega \pm 10\%/\text{SET}$
(Cushion: $1.16\Omega \pm 10\%$, Back: $1.35\Omega \pm 10\%$)



(A : Back warmer, B : Cushion, C: Thermostat, D: Switch)



2. Operate the seat warmer after connecting the 3P connector, and then check for the thermostat by measuring the temperature of seat surface.
3. Check for continuity between the terminals after disconnecting the 3P connector.

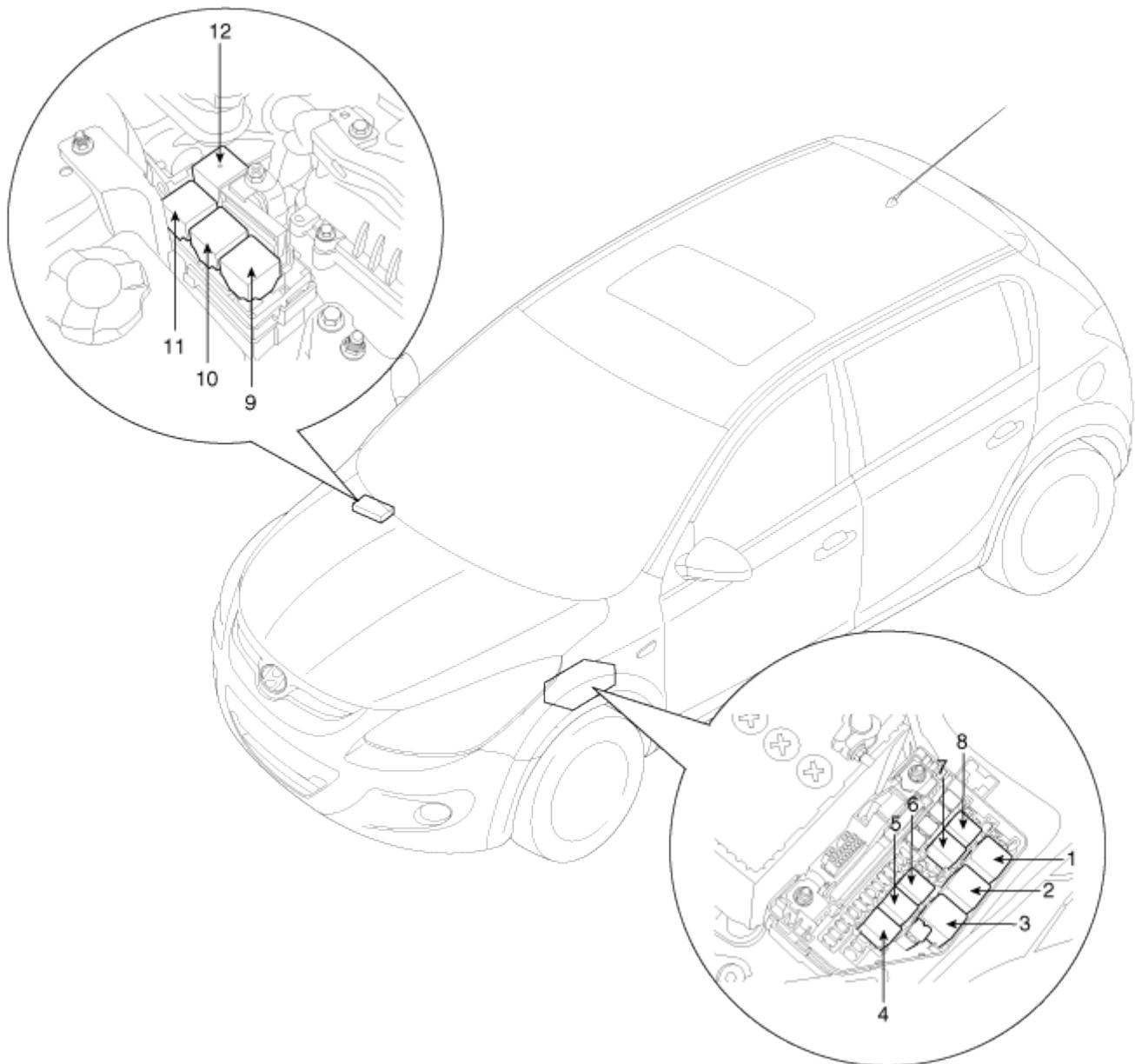
Standard value :

$28 \pm 3.0^{\circ}\text{C}$ (ON), $37 \pm 3.0^{\circ}\text{C}$ (OFF)

12.8. Fuses And Relay
12.8.1. Component and Components Location

Component Location

[Engine room relay box]



- 1. Blower relay
- 2. Fuel pump relay
- 3. Main relay
- 4. Condenser fan HI relay
- 5. Condenser fan low relay
- 6. Horn relay

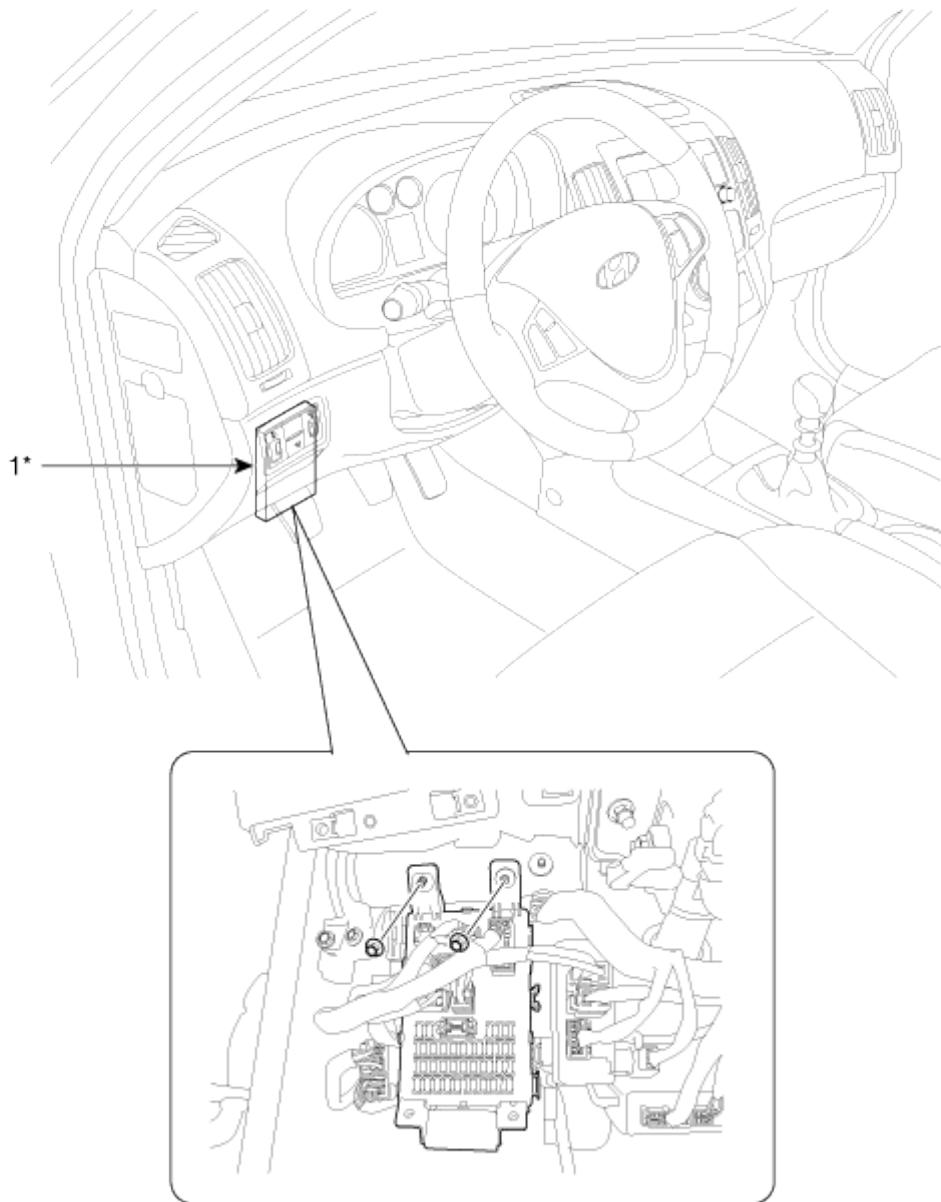
- 7. Start relay
- 8. A/C relay
- 9. PTC heater relay #1
- 10. PTC heater relay #2
- 11. PTC heater relay #3
- 12. Glow relay

[Passenger compartment relay]

The parts with asterisk(*) :

This illustration shows the LHD type.

RHD type is symmetrical.



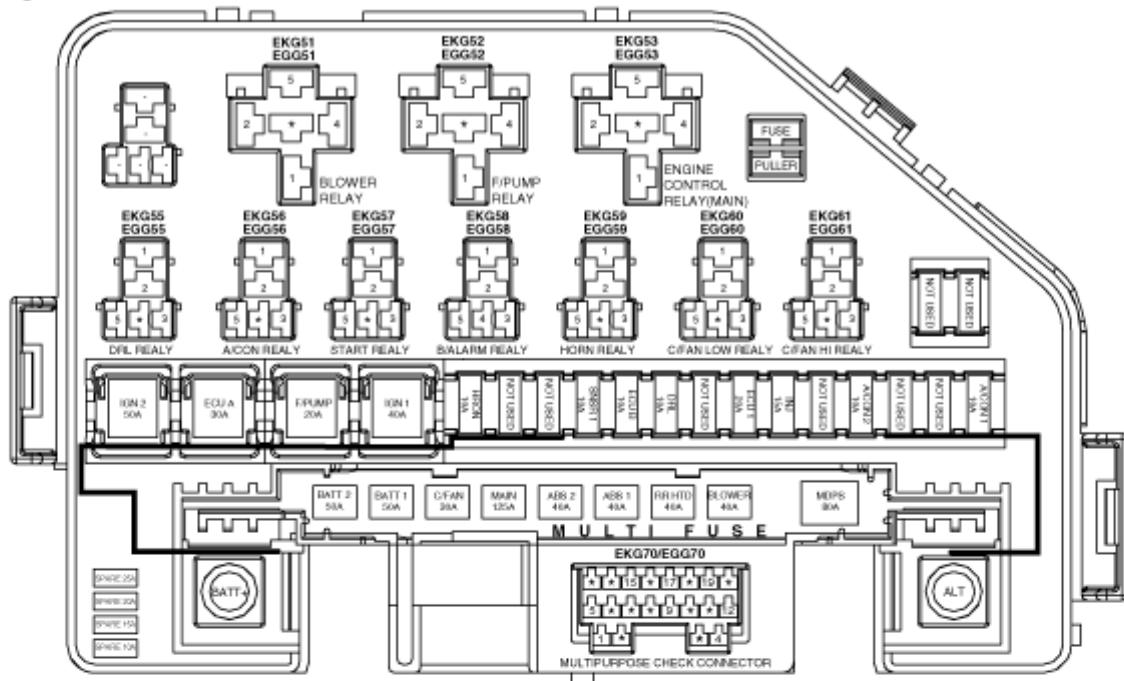
1. Passenger compartment junction box

12.8.2. Relay Box (Engine Compartment)

12.8.2.1. Component and Components Location

Component Location

[Gasoline]

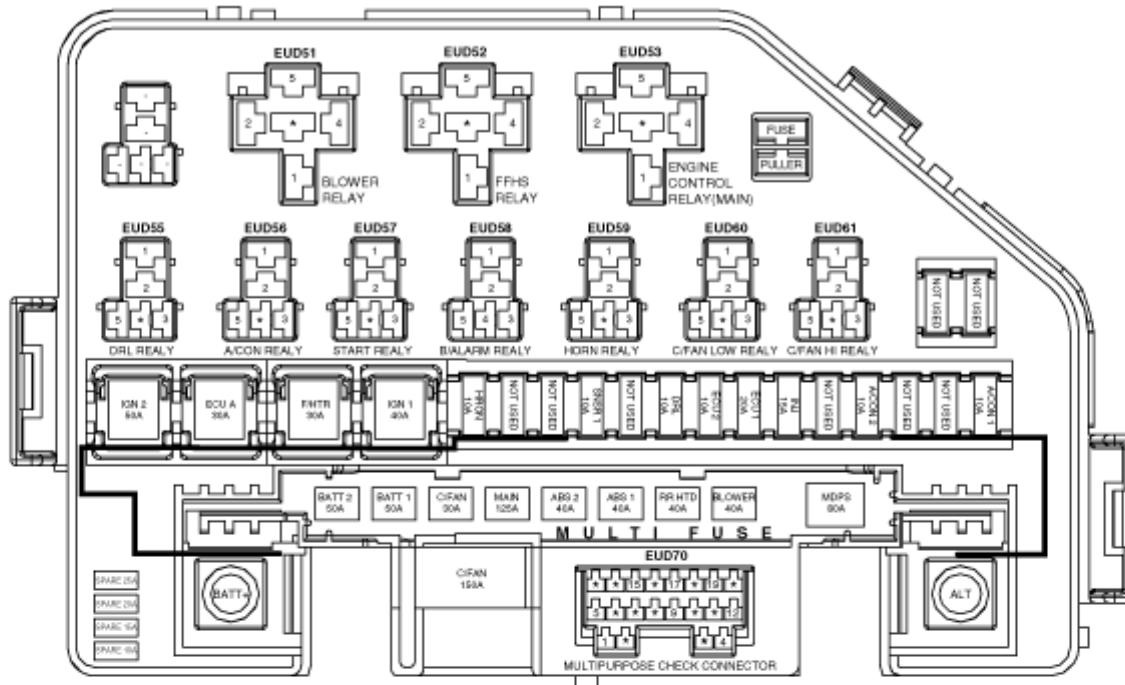


CIRCUIT

| | Description | (A) | Circuit Protected |
|---------------|-------------|-----|--|
| MULTI
FUSE | BATT 2 | 50A | I/P Junction (Tail Relay, S/Roof 20A, Folding 10A, DR Lock 20A, Stop 15A, Room 10A, Audio 20A, B/A Horn 15A, RR Fog 10A, FRT Fog 10A) |
| | BATT 1 | 50A | I/P Junction (P/WWDW Relay, Safety P/Wdw 15A, Hazard 15A) |
| | C/FAN | 30A | C/FAN HI Relay, C/FAN LOW Relay |
| | ABS 2 | 40A | Multipurpose Check Connector, ABS Control Module, ESP Control Module |
| | ABS 1 | 40A | Multipurpose Check Connector, ABS Control Module, ESP Control Module |
| | RR HTD | 40A | RR HTD Relay |
| | BLOWER | 40A | Blower Relay |
| FUSE | MDPS | 80A | ESP Control Module |
| | ING 2 | 50A | Ignition Switch |
| | ECU A | 30A | ECM(M/T), PCM(A/T), Engine Control Relay(Main relay) |
| | F/PUMP | 20A | F/PUMP Relay |
| | ING 1 | 40A | Ignition Switch |
| | HORN | 10A | Horn Relay |
| | SNSR 1 | 10A | Camshaft Position Sensor, Canister Purge Control Solenoid Valve, Oxygen Sensor(Up,Down)
Immobilizer Control Module, C/FAN LOW Relay, C/FAN HI Relay |
| | ECU B | 10A | ECM(M/T), PCM(A/T) |
| | DRL | 10A | BCM |
| | ECU 1 | 20A | ECM(M/T), PCM(A/T) |
| | INJ | 15A | Injector #1~#4, Idle Speed Actuator, A/CON Relay, Oil Control Valve(GAMMA) |
| | A/CON 2 | 10A | A/C Control Module |
| | A/CON 1 | 10A | A/CON Relay |

※ USE THE DESIGNATED FUSE ONLY

[Diesel]

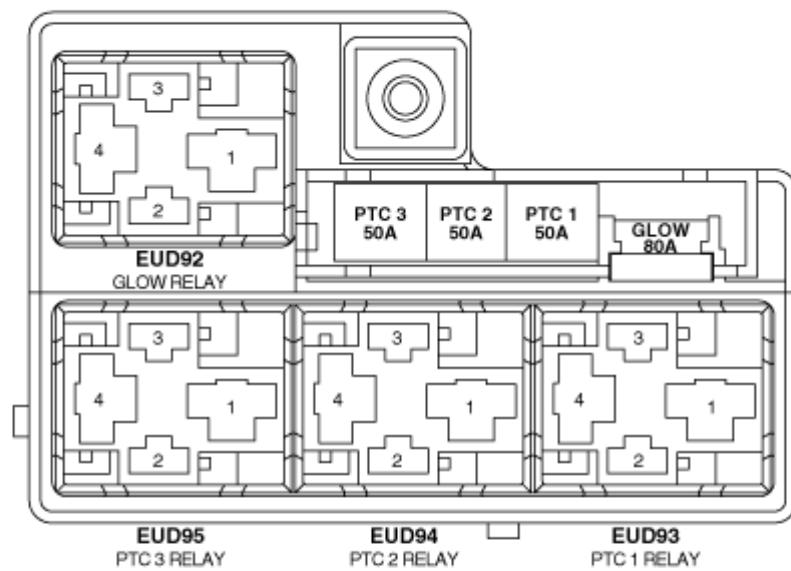


CIRCUIT

| | Description | (A) | Circuit Protected |
|------------|-------------|------|---|
| MULTI FUSE | BATT 2 | 50A | I/P Junction (Tail Relay, S/Roof 20A, Folding 10A, DR Lock 20A, Stop 15A, Room 10A, Audio 20A, B/A Horn 15A, RR Fog 10A, FRT Fog 10A) |
| | BATT 1 | 50A | I/P Junction (P/WWDW Relay, Safety P/WWDW 15A, Hazard 15A) |
| | C/FAN | 30A | C/FAN HI Relay, C/FAN LOW Relay |
| | ABS 2 | 40A | Multipurpose Check Connector, ABS Control Module, ESP Control Module |
| | ABS 1 | 40A | Multipurpose Check Connector, ABS Control Module, ESP Control Module |
| | RR HTD | 40A | RR HTD Relay |
| | BLOWER | 40A | Blower Relay |
| | MDPS | 80A | ESP Control Module |
| FUSE | DSL | 150A | DSL Fuse & Relay Box (Glow Relay, PTC 1 Relay, PTC 2 Relay, PTC 3 Relay) |
| | ING 2 | 50A | Ignition Switch |
| | ECU A | 30A | Engine Control Relay(Main relay) |
| | F/PUMP | 20A | FFHS Relay |
| | ING 1 | 40A | Ignition Switch |
| | HORN | 10A | Horn Relay |
| | SNSR 1 | 10A | C/FAN LOW Relay, C/FAN HI Relay, Lambda Sensor, Stop Lamp Switch, Air Heater Relay |
| | DRL | 10A | BCM |
| | ECU 2 | 10A | Fuel Pressure Regulator Valve |
| | ECU 1 | 20A | ECM |
| | INJ | 15A | A/CON Relay, Camshaft Position Sensor, VGT Actuator, Immobilizer Control Module |
| | | | DSL Fuse & Relay Box (Glow Relay, PTC 1 Relay) |
| | A/CON 2 | 10A | A/C Control Module |
| | A/CON 1 | 10A | A/CON Relay |

※ USE THE DESIGNATED FUSE ONLY

DSL FUSE & RELAY BOX



| Description | (A) | Circuit Protected |
|-------------|-----|------------------------------|
| GLOW | 80A | Glow Relay, Air Heater Relay |
| PTC 1 | 50A | PTC 1 Relay |
| PTC 2 | 50A | PTC 2 Relay |
| PTC 3 | 50A | PTC 3 Relay |

※ USE THE DESIGNATED FUSE ONLY

12.8.2.2. Repair procedures

Inspection

1. Disconnect the negative (-) battery terminal.
2. Pull out the relay from the engine compartment relay box.

Power Relay (Type A)

Check for continuity between the terminals.

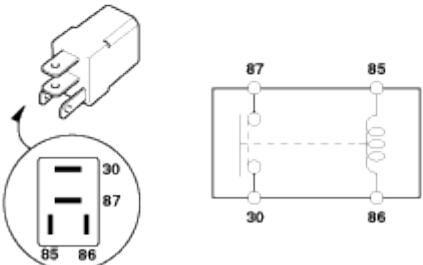
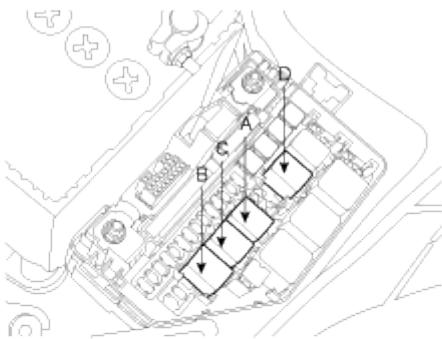
A : Horn relay

B : Condenser fan HI relay

C : Condenser fan low relay

D : Start relay

1. There should be continuity between the No.30 and No.87 terminals when power and ground are connected to the No.85 and No.86 terminals.
2. There should be no continuity between the No.30 and No.87 terminals when power is disconnected.



| Terminal
Power | 30 | 87 | 85 | 86 |
|-------------------|----|----|----|----|
| Disconnected | | | ○ | ○ |
| Connected | ○ | ○ | ○ | ○ |

Power Relay (Type B)

Check for continuity between the terminals.

A : Main relay

B : Fuel pump relay

C : Blower relay

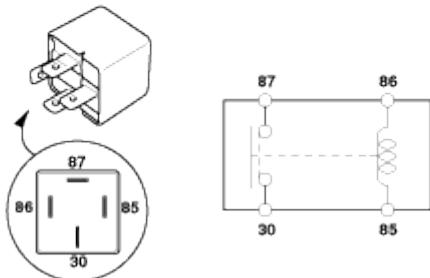
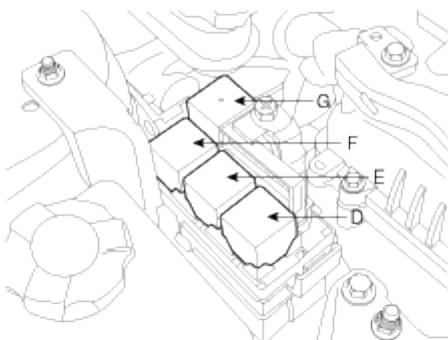
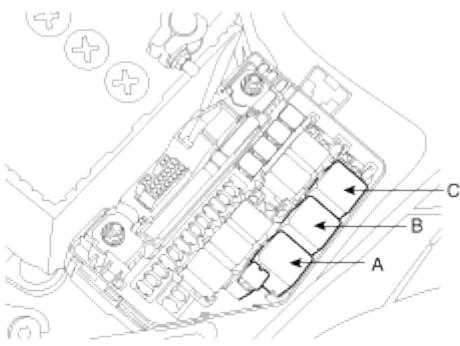
D : PTC heater relay #1

E : PTC heater relay #2

F : PTC heater relay #3

G : Glow relay

1. There should be continuity between the No.30 and No.87 terminals when power and ground are connected to the No.85 and No.86 terminals.
2. There should be no continuity between the No.30 and No.87 terminals when power is disconnected.



| Terminal
Power | 86 | 85 | 87 | 30 |
|-------------------|--------------------------|--------------------------|------------------------|------------------------|
| Disconnected | <input type="circle"/> | <input type="circle"/> | | |
| Connected | <input type="circle"/> - | <input type="circle"/> + | <input type="circle"/> | <input type="circle"/> |

Fuse

1. Be sure there is no play in the fuse holders, and that the fuses are held securely.
2. Are the fuse capacities for each circuit correct?
3. Are there any blown fuses?

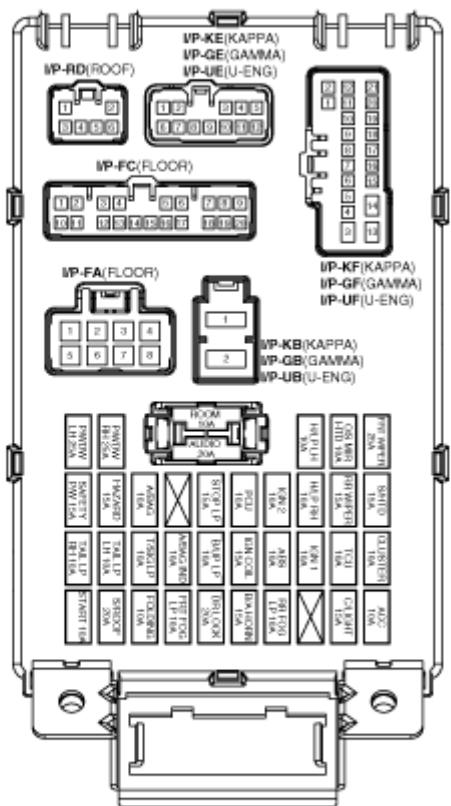
If a fuse is to be replaced, be sure to use a new fuse of the same capacity. Always determine why the fuse blew first and completely eliminate the problem before installing a new fuse.

12.8.3. Relay Box (Passenger Compartment)

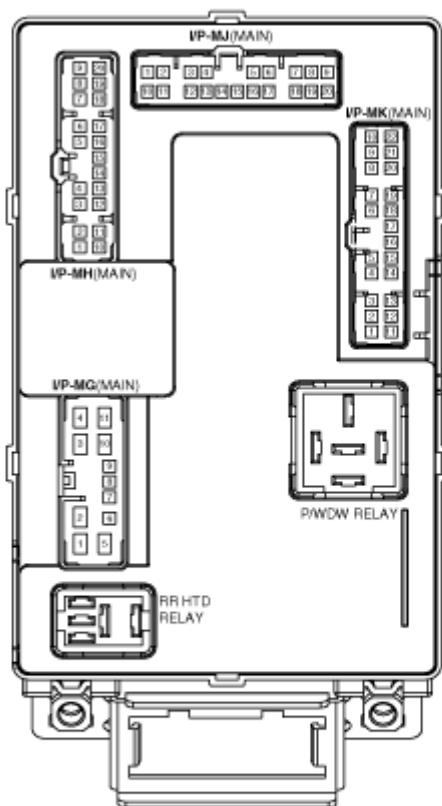
12.8.3.1. Component and Components Location

Component Location

< FRONT >



< REAR >



※ USE THE DESIGNATED FUSE ONLY

CIRCUIT

| FUSE | (A) | Circuit Protected | FUSE | (A) | Circuit Protected |
|-----------------|------|---|------------|-----|---|
| FRT WIPER | 25A | Front Wiper Motor, Multifunction Switch(Wiper Switch) | SAFETY P/W | 15A | Driver Safety Power Window Module |
| O/S MIR HTD | 10A | ECM(M/T), PCM(A/T), A/C Control Module, Driver Power Outside Mirror Motor, Passenger Power Outside Mirror Motor | CLUSTER | 10A | Trip Computer, Instrument Cluster(ILL.), BCM |
| H/LP LH | 10A | Head Lamp LH | TCU | 10A | Over Driver Switch, Pulse Generator "A", Pulse Generator "B" Vehicle Speed Sensor |
| POWER CONNECTOR | ROOM | RR HTD Relay, Door Warning Switch, Instrument Cluster | IGN 1 | 10A | Generator(KAPPA), EPS Control Module |
| | 10A | Trip Computer, Tire Pressure Monitoring Module, BCM
A/C Control Module, Luggage Lamp, Overhead Console
Front Room Lamp, Center Room Lamp | | | Tire Pressure Monitoring Module |
| AUDIO | 20A | Audio | ABS | 10A | ESP Switch, Steering Angle Sensor, ABS Control Module
ESP Control Module, Yaw Rate Sensor,
E/R Fuse & Relay Box(Multipurpose Check Connector) |
| P/WDW RH | 25A | Power Window Main Switch, Safety Power Window Module
Rear Power Window Switch RH, Passenger Power Window Switch(LHD) | IGN COIL | 15A | Ignition Coil(KAPPA), Ignition Coil #1~#4(GAMMA), Condenser(GAMMA) |
| P/WDW LH | 25A | Power Window Main Switch, Safety Power Window Module
Rear Power Window Switch LH, Passenger Power Window Switch(RHD) | B/UP LP | 10A | Transaxle Range Switch(GAMMA), Back-Up Lamp Switch |
| S/HTD | 15A | Passenger Seat Warmer Switch, Driver Seat Warmer Switch | A/BAG IND | 10A | Instrument Cluster(A/BAG ILL.) |
| RR WIPER | 15A | Rear Wiper Motor, Multifunction Switch(Wiper Switch) | T/SIG LP | 10A | Hazard Switch |
| H/LP RH | 10A | Head Lamp RH, Instrument Cluster(Head Lamp ILL.) | TAIL LP LH | 10A | DRL Relay, License Lamp, Rear Combination Lamp LH, Head Lamp LH |
| IGN 2 | 10A | Head Lamp Leveling Switch, Incar Sensor, BCM, A/C Control Module
Sunroof Motor, Head Lamp LH/RH
E/R Fuse & Relay Box(FFHS Relay, DRL Relay, Blower Relay)
DSL Fuse & Relay Box(PTC 2 Relay, PTC 3 Relay) | TAIL LP RH | 10A | Head Lamp RH, Rear Combination Lamp RH, Illuminations |
| | | | ACC | 10A | Power Outside Mirror Switch, Audio, Trip Computer |
| PCU | 10A | Fuel Filter Warning Sensor, Air Flow Sensor, ECM(M/T), PCM(A/T) | C/LIGHT | 15A | Cigarette Lighter |
| STOP LP | 15A | Stop Lamp Switch, Data Link Connector, P/WDW Relay | RR FOG LP | 10A | RR Fog Relay |
| A/BAG | 10A | Seat Belt Reminder Switch Module, SRS Control Module | B/A HORN | 15A | B/A Relay |
| HAZARD | 15A | Hazard Switch, Hazard Relay | DR LOCK | 20A | T/Gate Unlock Relay, DR Lock/Unlock Relay, Dead Lock Relay |
| | | | FRT FOG LP | 10A | FRT Fog Relay |
| | | | FOLDING | 10A | Power Outside Mirror Switch |
| | | | S/ROOF | 20A | Sunroof Motor |
| | | | START | 10A | ECM(DSL), E/R Fuse & Relay Box(Start Relay, B/Alarm Relay) |

※ USE THE DESIGNATED FUSE ONLY

12.8.3.2. Repair procedures

Inspection

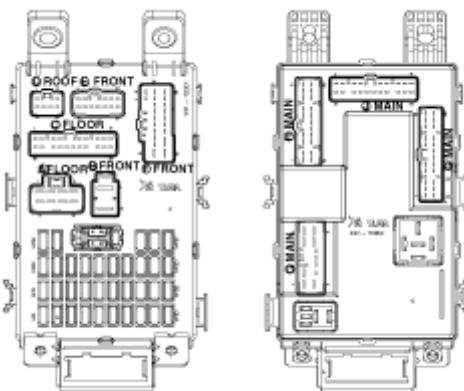
Fuse

1. Be sure there is no play in the fuse holders, and that the fuses are held securely.

2. Are the fuse capacities for each circuit correct?

3. Are there any blown fuses?

If a fuse is to be replaced, be sure to use a new fuse of the same capacity. Always determine why the fuse blew first and completely eliminate the problem before installing a new fuse.



Relay

Burglar alarm horn relay

Check for continuity between the terminals.

1. There should be continuity between the B2 and F16 terminals when power and ground are connected to the B2 and J17 terminals in the I/P Junction box.

2. There should be no continuity between the B2 and F16 terminals when power is disconnected.

| Terminal
Power | I/P-B
(2) | I/P-J
(17) | I/P-B
(2) | I/P-F
(16) |
|-------------------|--------------|---------------|--------------|---------------|
| Disconnected | ○—○ | | | |
| Connected | ⊕—⊖ | | ○—○ | |

Rear HTD relay

Check for continuity between the terminals.

1. There should be continuity between the F13 and A4 terminals when power and ground are connected to the H12 and H10 terminals in the I/P Junction box.
2. There should be no continuity between the F13 and A4 terminals when power is disconnected.

| Terminal
Power | I/P-H
(12) | I/P-H
(10) | I/P-F
(13) | I/P-A
(4) |
|-------------------|---------------|---------------|---------------|--------------|
| Disconnected | ○—○ | | | |
| Connected | ⊕—⊖ | | ○—○ | |

Front fog lamp relay

Check for continuity between the terminals.

1. There should be continuity between the B2 and F15 (or H13) terminals when power and ground are connected to the G7 and G6 terminals in the I/P Junction box.
2. There should be no continuity between the B2 and F15 terminals when power is disconnected.

| Terminal
Power | I/P-G
(7) | I/P-G
(6) | I/P-B
(2) | I/P-F
(15) |
|-------------------|--------------|--------------|--------------|---------------|
| Disconnected | ○—○ | | | |
| Connected | ⊕—⊖ | | ○—○ | |

Rear fog lamp relay

Check for continuity between the terminals.

1. There should be continuity between the B2 and C13 (or K10) terminals when power and ground are connected to the G2 and J11 terminals in the I/P Junction box.
2. There should be no continuity between the B2 and F15 terminals when power is disconnected.

| Terminal
Power | I/P-G
(2) | I/P-J
(11) | I/P-B
(2) | I/P-C
(13) |
|-------------------|--------------|---------------|--------------|---------------|
| Disconnected | ○—○ | | | |
| Connected | ⊕—⊖ | | ○—○ | |

Door lock relay

Check for continuity between the terminals.

1. There should be continuity between the B2 and C1 (or C2) terminals when power and ground are connected to the B2 and K9 terminals in the I/P Junction box.
2. There should be no continuity between the B2 and C1 (or C2) terminals when power is disconnected.

| Terminal
Power | I/P-B
(2) | I/P-K
(9) | I/P-B
(2) | I/P-C
(1 or 2) |
|-------------------|--------------|--------------|--------------|-------------------|
| Disconnected | ○—○ | | | |
| Connected | ⊕—⊖ | | ○—○ | |

Door unlock relay

Check for continuity between the terminals.

1. There should be continuity between the B2 and C3 (or C12) terminals when power and ground are connected to the B2 and J9 terminals in the I/P Junction box.
2. There should be no continuity between the B2 and C3 (or C12) terminals when power is disconnected.

| Terminal
Power | I/P-B
(2) | I/P-J
(9) | I/P-B
(2) | I/P-C
(3 or 12) |
|-------------------|--------------|--------------|--------------|--------------------|
| Disconnected | ○ | ○ | | |
| Connected | + | ○ | ○ | ○ |

Tailgate Unlock relay

Check for continuity between the terminals.

1. There should be continuity between the B2 and G9 terminals when power and ground are connected to the B2 and J2 terminals in the I/P Junction box.
2. There should be no continuity between the B2 and G9 terminals when power is disconnected.

| Terminal
Power | I/P-B
(2) | I/P-J
(2) | I/P-B
(2) | I/P-G
(9) |
|-------------------|--------------|--------------|--------------|--------------|
| Disconnected | ○ | ○ | | |
| Connected | + | - | ○ | ○ |

Tail lamp relay

Check for continuity between the terminals.

1. There should be continuity between the B2 and C7 (or C10) terminals when power and ground are connected to the B2 and K8 terminals in the I/P Junction box.
2. There should be no continuity between the B2 and C7 (or C10) terminals when power is disconnected.

| Terminal
Power | I/P-B
(2) | I/P-K
(8) | I/P-B
(2) | I/P-C
(7 or 10) |
|-------------------|--------------|--------------|--------------|--------------------|
| Disconnected | ○ | ○ | | |
| Connected | + | - | ○ | ○ |

DRL relay

Check for continuity between the terminals.

1. There should be continuity between the B2 and K6 terminals when power and ground are connected to the B2 and K5 terminals in the I/P Junction box.
2. There should be no continuity between the B2 and K6 terminals when power is disconnected.

| Terminal
Power | I/P-B
(2) | I/P-K
(5) | I/P-B
(2) | I/P-K
(6) |
|-------------------|--------------|--------------|--------------|--------------|
| Disconnected | ○ | ○ | | |
| Connected | + | - | ○ | ○ |

Hazard lamp relay

Check for continuity between the terminals.

1. There should be continuity between the B1 and K2 (or K3) terminals when power and ground are connected to the B1 and J16 terminals in the I/P Junction box.
2. There should be no continuity between the B2 and K2 (or K3) terminals when power is disconnected.

| Terminal
Power | I/P-B
(1) | I/P-J
(16) | I/P-B
(1) | I/P-K
(2 or 3) |
|-------------------|--------------|---------------|--------------|-------------------|
| Disconnected | ○ | ○ | | |
| Connected | + | - | ○ | ○ |

Power window relay

Check for continuity between the terminals.

1. There should be continuity between the B1 and A7 terminals when power and ground are connected to the K1 and K7 terminals in the I/P Junction box.
2. There should be no continuity between the B1 and A7 terminals when power is disconnected.

| Terminal
Power | I/P-K
(1) | I/P-K
(7) | I/P-B
(1) | I/P-A
(7) |
|-------------------|--------------|--------------|--------------|--------------|
| Disconnected | ○ | ○ | | |
| Connected | + | ○ | ○ | ○ |

12.9. Indicators And Gauges

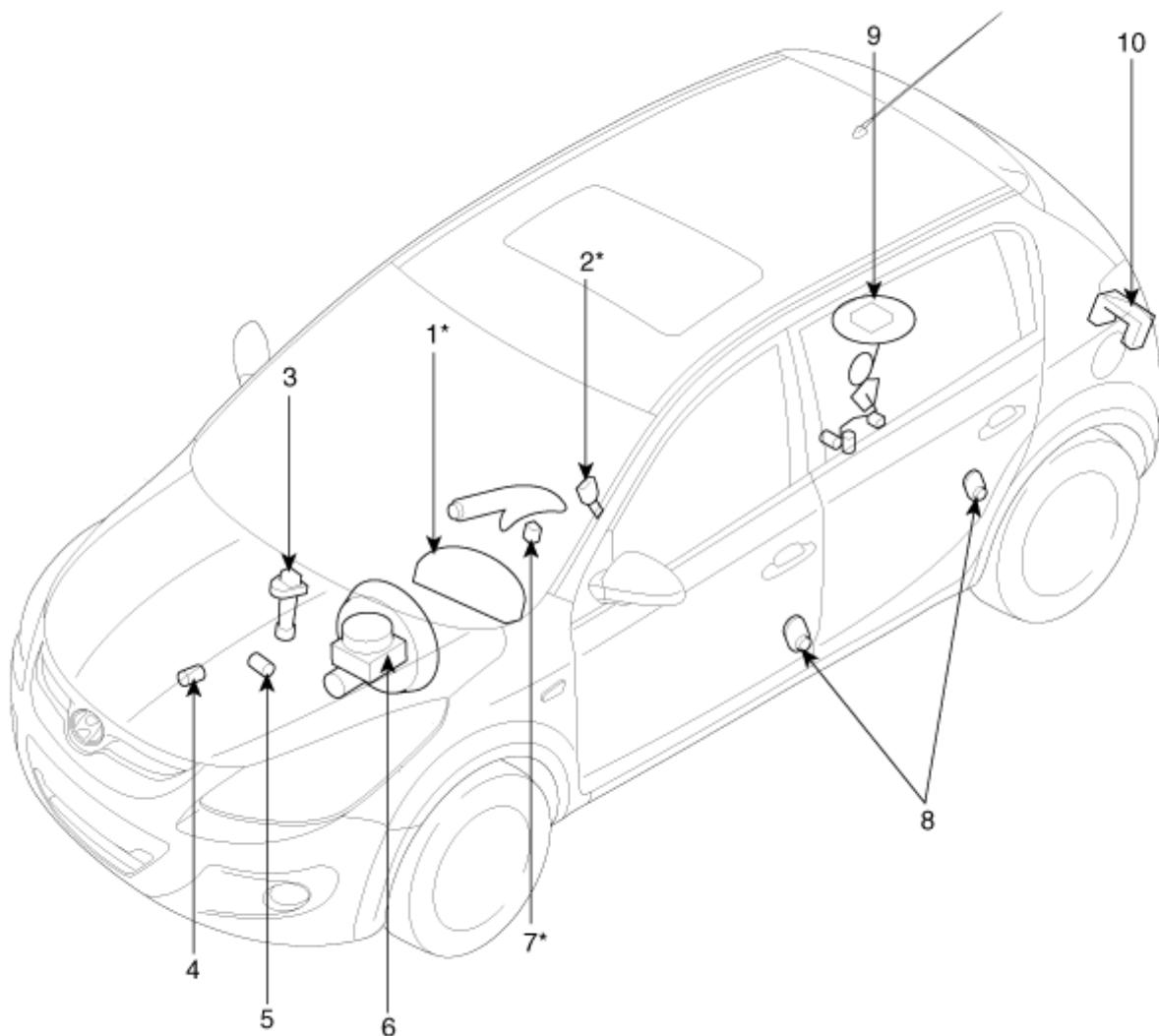
12.9.1. Component and Components Location

Component Location

The parts with asterisk(*) :

This illustration shows the LHD type.

RHD type is symmetrical.



- 1. Cluster assembly
- 2. Seat belt switch
- 3. Vehicle speed sensor
- 4. Engine coolant temperature sender
- 5. Oil pressure switch

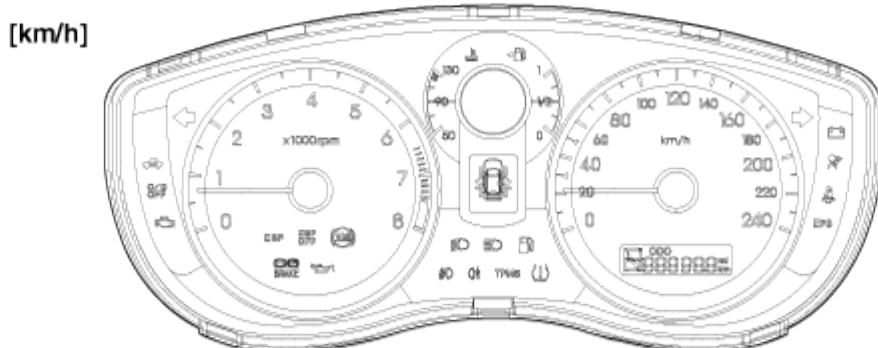
- 6. Brake fluid level warning switch
- 7. Parking brake switch
- 8. Door switch
- 9. Fuel gauge sender
- 10. Tailgate switch

12.9.1. Instrument Cluster

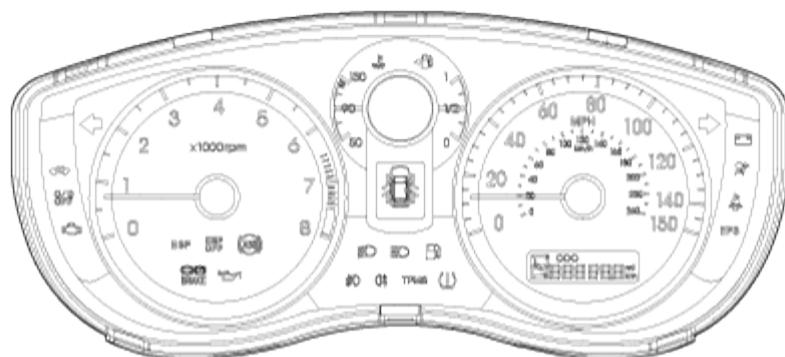
12.9.1.1. Component and Components Location

Components

[GASOLINE]

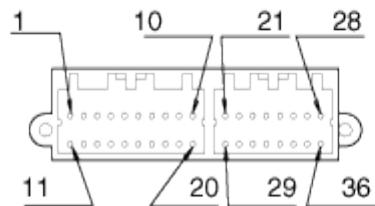
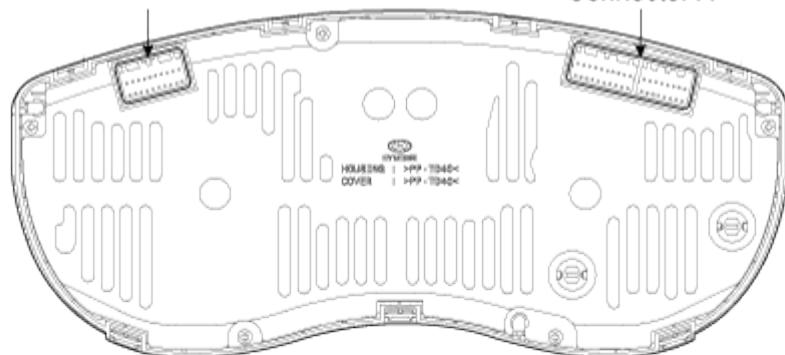


[MPH]

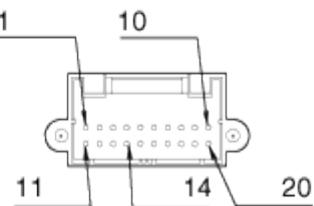


Connector B

Connector A



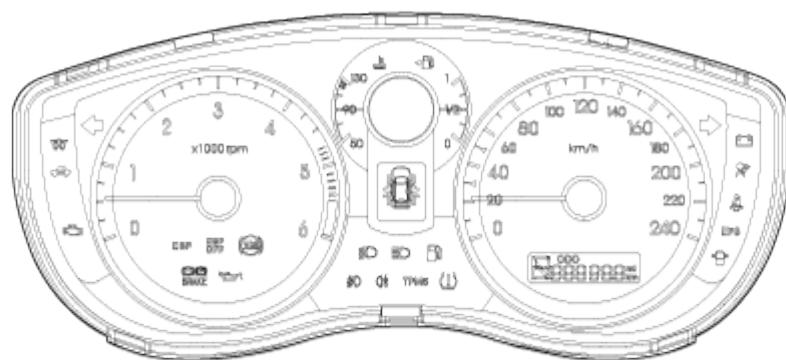
Connector A



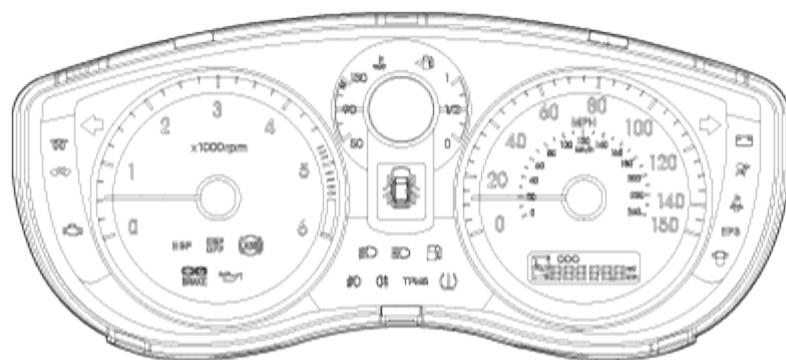
Connector B

[DIESEL]

[km/h]

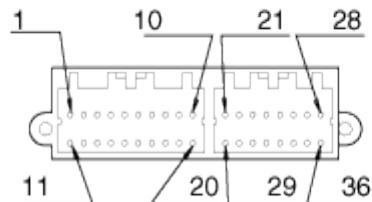
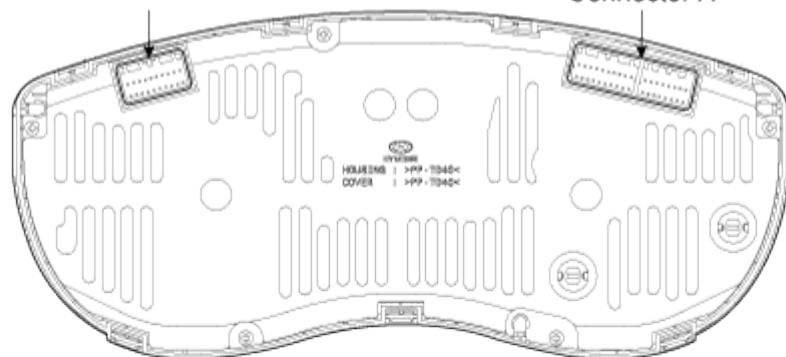


[MPH]

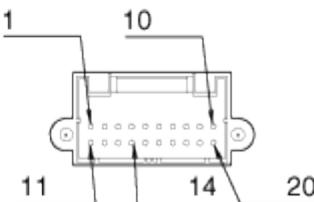


Connector B

Connector A



Connector A



Connector B

Instrument Cluster pin information

| No. | Connector A | Connector B |
|-----|-----------------|---------------|
| 1 | Turn signal - R | Charge |
| 2 | FGND | Air bag(+) |
| 3 | SGND | Air bag input |
| 4 | High Beam(-) | EPS |

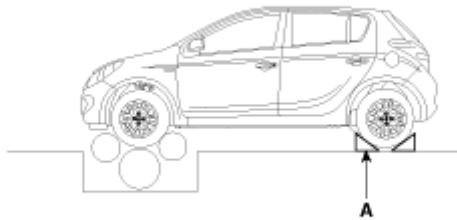
| | | |
|----|-----------------|-----------------|
| 5 | High Beam(+) | Seat belt |
| 6 | IGN | Water separator |
| 7 | ILL(+) | AT- D |
| 8 | - | AT- N |
| 9 | AT PWM | AT- R |
| 10 | Diagnosis | AT- P |
| 11 | Battery | TPMS FR LH |
| 12 | Temp. input | TPMS FR RH |
| 13 | Fuel input | TPMS RR LH |
| 14 | TPMS tread | TPMS RR RH |
| 15 | TPMS Diagnosis | Door FR LH |
| 16 | ILL(-) | Door FR RH |
| 17 | Rear fog | Door RR LH |
| 18 | Speed input | Door RR RH |
| 19 | Tacho input | - |
| 20 | Low beam | - |
| 21 | PGND | |
| 22 | Door open | |
| 23 | Trunk open | |
| 24 | - | |
| 25 | Check engine | |
| 26 | O/D off | |
| 27 | Immobilizer | |
| 28 | Glow | |
| 29 | Front fog | |
| 30 | EBD | |
| 31 | ABS | |
| 32 | ESP off | |
| 33 | ESP off | |
| 34 | P brake | |
| 35 | Oil pressure | |
| 36 | Turn signal - L | |

12.9.1.2. 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) | +4.3
+0.3 | +4.8
+0.8 | +5.8
+0.8 | +6.7
+1.2 | +7.4
+1.4 | +8.5
+1.5 |
| Velocity
(km/h) | 140 | 160 | 180 | 200 | 220 | 240 |
| Tolerance
(km/h) | +9.4
+1.9 | +10.1
+2.1 | +11.0
+2.5 | +12.1
+2.6 | +12.9
+2.9 | +13.6
+3.3 |

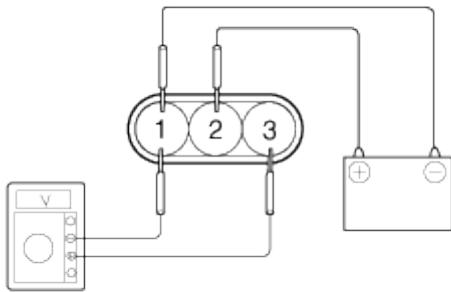
[MPH]

| Velocity
(MPH) | 10 | 20 | 40 | 60 | 80 |
|--------------------|--------------|--------------|--------------|--------------|--------------|
| Tolerance
(MPH) | +2.6
+0.1 | +3.1
+0.1 | +4.1
+0.1 | +4.6
+0.6 | +5.4
+0.9 |
| Velocity
(MPH) | 100 | 120 | 140 | 150 | - |
| Tolerance
(MPH) | +6.5
+1.0 | +7.2
+1.2 | +8.0
+1.5 | +8.3
+1.8 | - |

Vehicle Speed Sensor

1. Connect the positive (+) lead from battery to terminal 2 and negative (-) lead to terminal 1.
2. Connect the positive (+) lead from tester to terminal 3 and the negative (-) lead to terminal 1.
3. Rotate the shaft.

4. Check that there is voltage change from approx. 0V to 11V or more between terminals 3 and 1.
5. The voltage change should be 4 times for every revolution of the speed sensor shaft.
If operation is not as specified, replace the sensor.



Tachometer

1. Connect the scan tool to the diagnostic link connector or install a tachometer.
2. With the engine started, compare the readings of the tester with that of the tachometer. Replace the tachometer if the tolerance is exceeded.

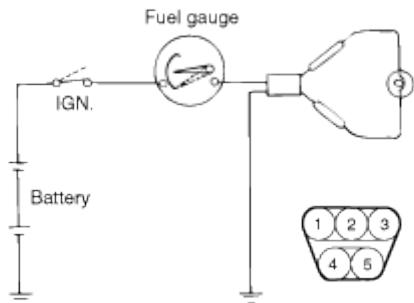
CAUTION

- 1) Reversing the connections of the tachometer will damage the transistor and diodes inside.
- 2) When removing or installing the tachometer, be careful not to drop it or subject it to severe shock.

| Revolution
(rpm) | 1,000 | 2,000 | 3,000 | 4,000 | Remark |
|---------------------|-------|-------|-------|-------|----------|
| Tolerance
(rpm) | ±100 | ±100 | ±100 | ±100 | Gasoline |
| Tolerance
(rpm) | ±100 | ±100 | ±100 | ±100 | Diesel |
| Revolution
(rpm) | 5,000 | 6,000 | 7,000 | - | Remark |
| Tolerance
(rpm) | ±100 | ±100 | ±100 | - | Gasoline |
| Tolerance
(rpm) | ±100 | ±100 | - | - | Diesel |

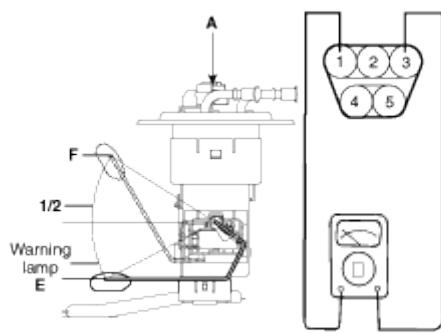
Fuel Gauge

1. Disconnect the fuel sender connector from the fuel sender.
2. Connect a 3.4 wattages, 12V test bulb to terminals 1 and 3 on the wire harness side connector.
3. Turn the ignition switch to the ON, and then check that the bulb lights up and the fuel gauge needle moves to full.



Fuel Gauge Sender

- Using an ohmmeter, measure the resistance between terminals 1 and 3 of sender connector (A) at each float level.



- Also check that the resistance changes smoothly when the float is moved from "E" to "F".

| Position | Resistance(Ω) |
|--------------|--------------------|
| E | $184 \pm 3\Omega$ |
| Warning lamp | $170 \pm 3\Omega$ |
| 1/2 | $66.2 \pm 2\Omega$ |
| Sender (F) | $15 \pm 2\Omega$ |

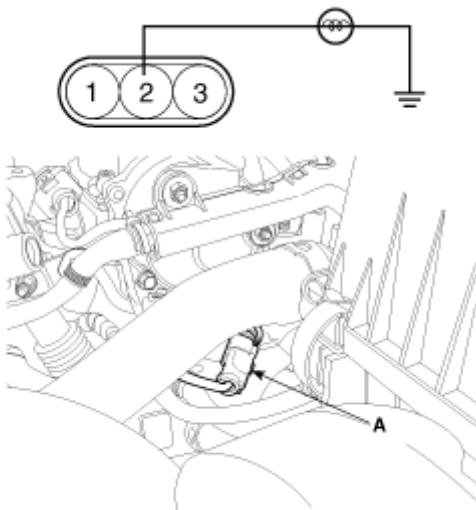
- If the height resistance is unsatisfied, replace the fuel sender as an assembly.

CAUTION

After completing this test, wipe the sender dry and reinstall it in the fuel tank.

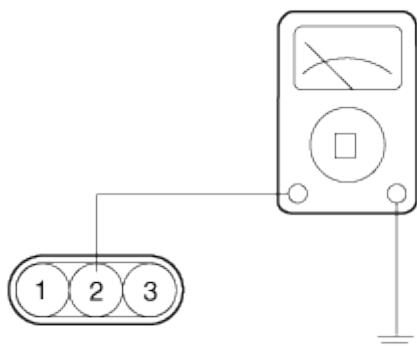
Engine Coolant Temperature Gauge

- Disconnect the wiring connector (A) from the engine coolant temperature sender in the engine compartment.
- Connect a 12V, 3.4 wattages test bulb between the harness side connector 2 terminal and ground.
- Turn the ignition switch ON.
- Verify that the test bulb flashes and that the indicator moves to HOT position.
If operation is not as specified, replace the cluster (Engine coolant temperature gauge). Then recheck the system.



Engine Coolant Temperature Sender

- Using an ohmmeter, measure the resistance between the terminal 2 and ground.

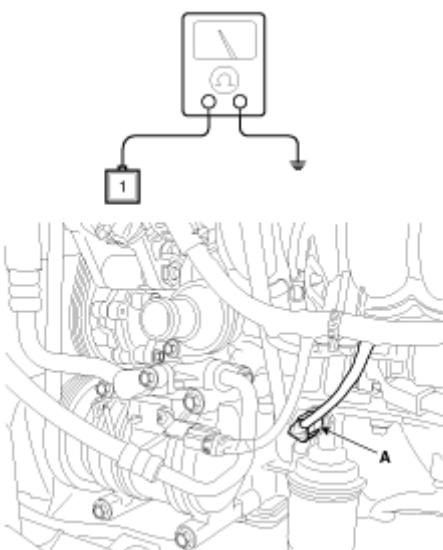


- If the resistance value is not as shown in the table, replace the temperature sender.

| Temp
°F(°C) | 131
(55) | 160
(71) | 230
(110) | 257
(125) | E/G |
|-------------------|-------------|-------------|--------------|--------------|----------|
| Resistance
(Ω) | 125.0 | 80.5 | 23.8 | 18.0 | Gasoline |
| Temp
°F(°C) | 120
(49) | 160
(71) | 230
(110) | 257
(125) | E/G |
| Resistance
(Ω) | 185.0 | 80.5 | 24.3 | 17.1 | Diesel |

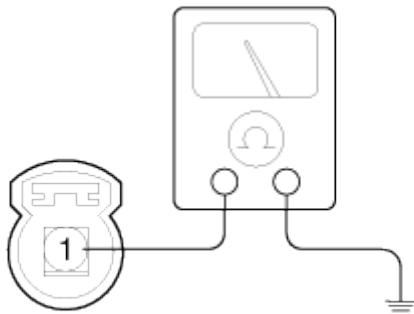
Oil Pressure Switch

- Check that there is continuity between the oil pressure switch (A) terminal and ground with the engine off.
- Check that there is no continuity between the terminal and ground with the engine running.
- If operation is not as specified, replace the switch.



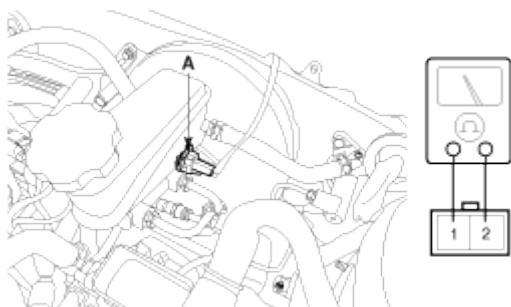
Oil Pressure Warning Lamp

1. Disconnect the connector from the warning switch and ground the terminal on the wire harness side connector.
2. Turn the ignition switch ON. Check that the warning lamp lights up. If the warning lamp doesn't light, test the bulb or inspect the wire harness.



Brake Fluid Level Warning Switch

1. Remove the connector (A) from the switch located at the brake fluid reservoir.
2. Verify that continuity exists between switch terminals 1 and 2 while pressing the switch (float) down with a rod.



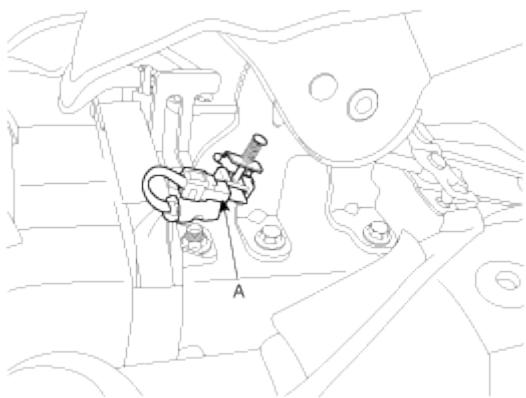
Brake Fluid Level Warning Lamp

1. Ignition "ON".
2. Release the parking brake.
3. Remove the connector from the brake fluid level warning switch.
4. Ground the connector at the harness side.
5. Verify that the warning lamp lights.

Parking Brake Switch

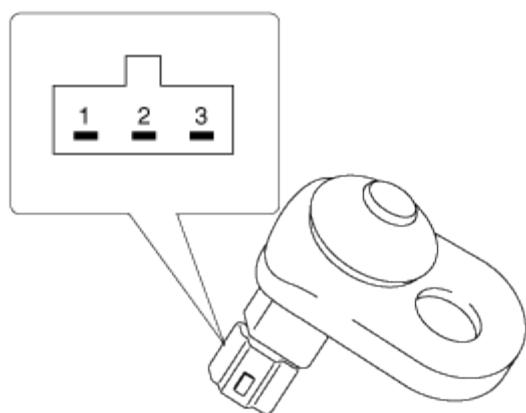
The parking brake switch (A) is a pull type. It is located at the side of the parking brake lever.

1. Check that there is continuity between the terminal and switch body with the switch ON.
2. Check that there is no continuity between the terminal and switch body with the switch OFF.
If continuity is not as specified, replace the switch or inspect its ground connection.



Door Switch

Remove the door switch and check for continuity between the terminals.

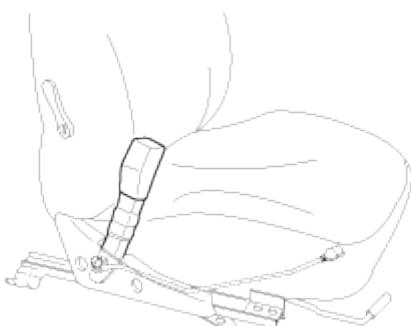


| Terminal Position | 1 | 2 | 3
(Ground) |
|-------------------|---|---|---------------|
| Free(Door open) | ○ | ○ | ○ |
| Push(Door close) | | | |

Seat Belt Switch

1. Remove the connector from the switch.
2. Check for continuity between terminals.

| Seat belt condition | Continuity |
|---------------------|-----------------------------------|
| Fastened | Non-conductive ($\infty\Omega$) |
| 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 |

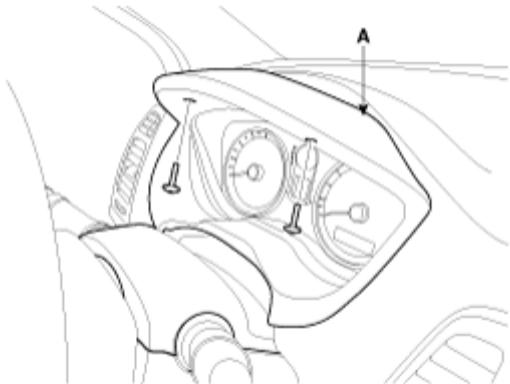
Removal

1. Disconnect the negative (-) battery terminal.

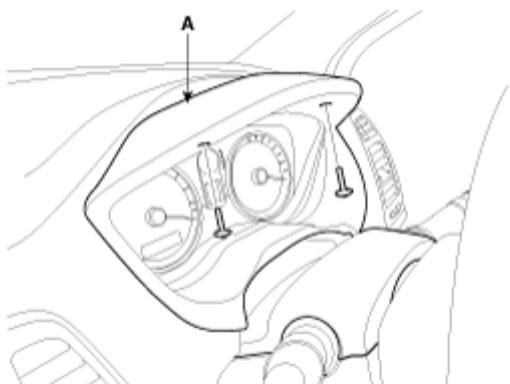
2. Remove the cluster fascia panel (A).

(Refer to the BD group - "Crash pad")

[LHD]

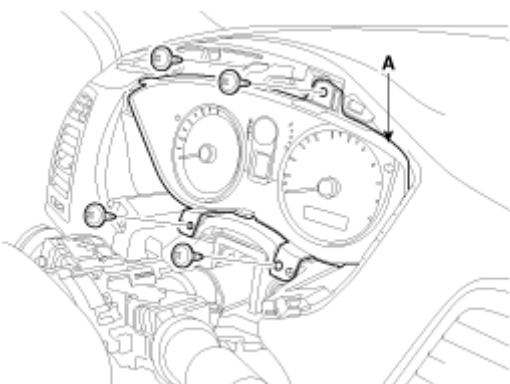


[RHD]

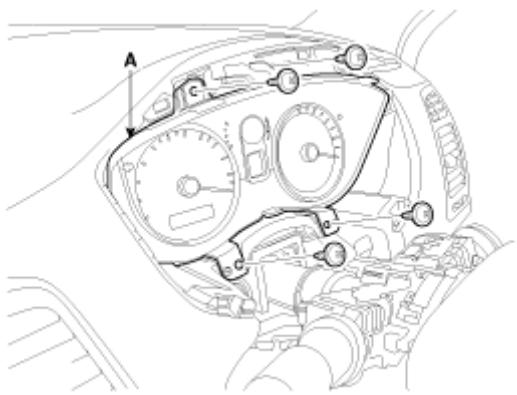


3. Remove the cluster fascia (A) from the housing after removing 4 screws.

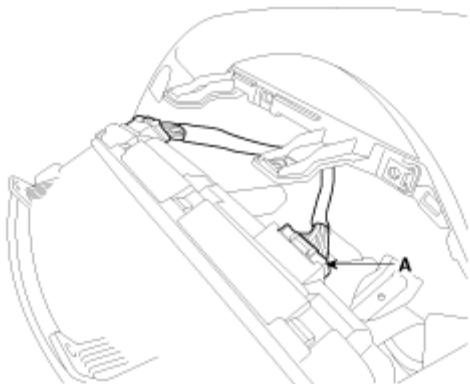
[LHD]



[RHD]



4. Disconnect the cluster fascia connecters (A) and then remove the cluster.



Installation

1. Connect the cluster connector.
2. Install the cluster assembly.
3. Install the center fascia panel.

12.9.2. Troubleshooting

Troubleshooting

| Symptom | Possible cause | Remedy |
|------------------------------|-----------------------------|----------------------------------|
| Speedometer does not operate | Cluster fuse (10A) blown | Check for short and replace fuse |
| | Speedometer faulty | Check speedometer |
| | Vehicle speed sensor faulty | Check vehicle speed sensor |
| | Wiring or ground faulty | Repair if necessary |
| Tachometer does not operate | Cluster fuse (10A) blown | Check for short and replace fuse |
| | Tachometer faulty | Check tachometer |
| | Wiring or ground faulty | Repair if necessary |
| Fuel gauge does not operate | Cluster fuse (10A) blown | Check for short and replace fuse |
| | Fuel gauge faulty | Check gauge |
| | Fuel sender faulty | Check fuel sender |
| | Wiring or ground faulty | Repair if necessary |

| | | |
|---|---|----------------------------------|
| Low fuel warning lamp does not light up
(LED Lamp) | Cluster fuse (10A) blown | Check for short and replace fuse |
| | Fuel sender faulty | Check fuel sender |
| | Wiring or ground faulty | Repair if necessary |
| Water temperature gauge does not operate | Cluster fuse (10A) blown | Check for short and replace fuse |
| | Water temperature gauge faulty | Check gauge |
| | Water temperature sender faulty | Check sender |
| | Wiring or ground faulty | Repair if necessary |
| Oil pressure warning lamp does not light up | Cluster fuse (10A) blown | Check for short and replace fuse |
| | Bulb burned out | Replace bulb |
| | Oil pressure switch faulty | Check switch |
| | Wiring or ground faulty | Repair if necessary |
| Parking brake warning lamp does not light up (LED Lamp) | Cluster fuse (10A) blown | Check for short and replace fuse |
| | Brake fluid level warning switch faulty | Check switch |
| | Parking brake switch faulty | Check switch |
| | Wiring or ground faulty | Repair if necessary |
| Open door warning lamp and tailgate warning lamp do not light up (LED Lamp) | Memory fuse (15A) blown | Check for short and replace fuse |
| | Door switch faulty | Check switch |
| | Wiring or ground faulty | Repair if necessary |
| Seat belt warning lamp does not light up (LED Lamp) | Cluster fuse (10A) blown | Check for short and replace fuse |
| | Seat belt switch faulty | Check switch |
| | Wiring or ground faulty | Repair if necessary |

12.10. Power Door Locks

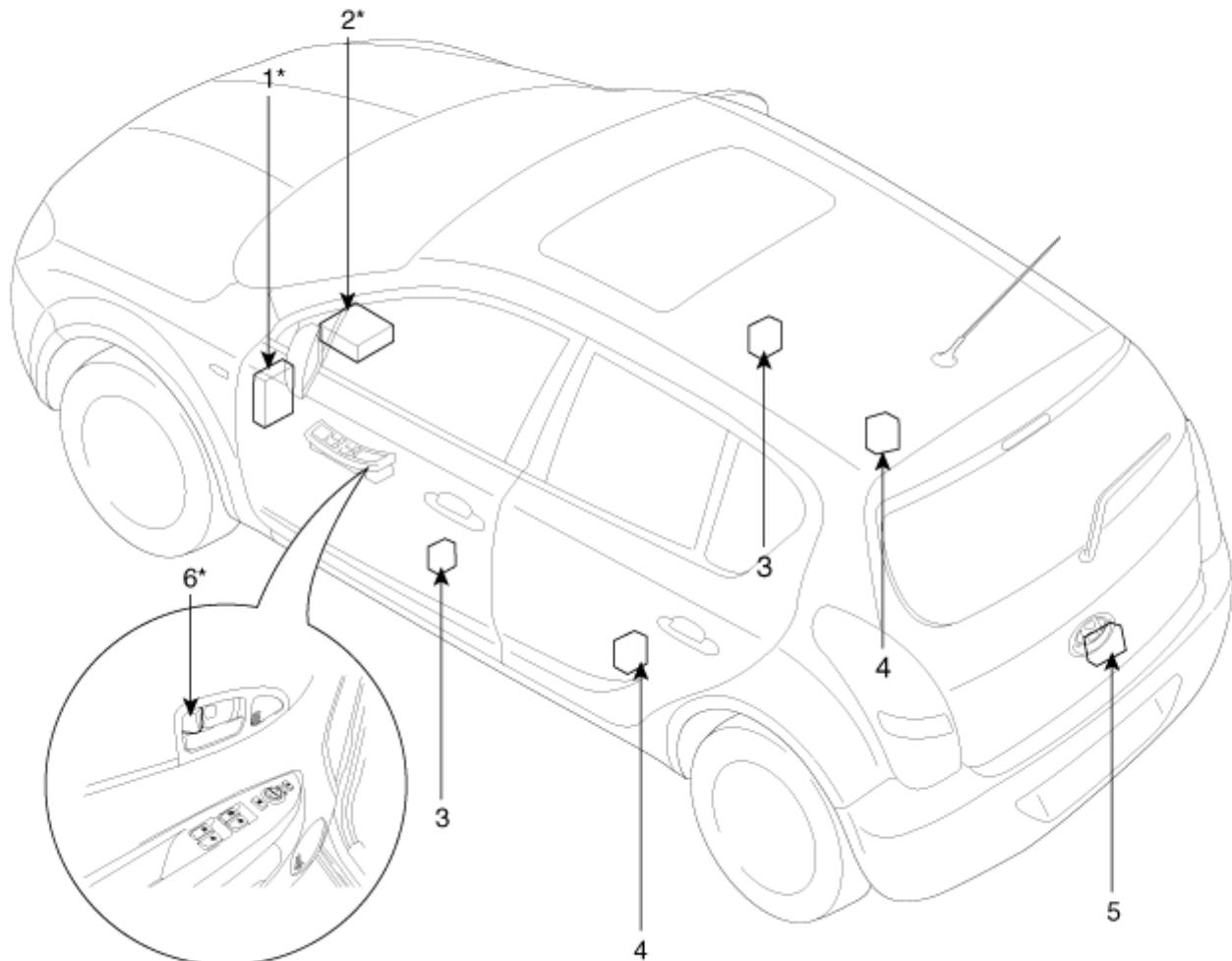
12.10.1. Component and Components Location

Component Location

The parts with asterisk(*) :

This illustration shows the LHD type.

RHD type is symmetrical.



- | | |
|---|---|
| 1. I/P Junction box (Door lock/unlock relay)
2. Body control module (BCM)
3. Front door lock actuator | 4. Rear door lock actuator
5. Tailgate actuator
6. Door lock knob |
|---|---|

12.10.2. Power Door Lock Actuators

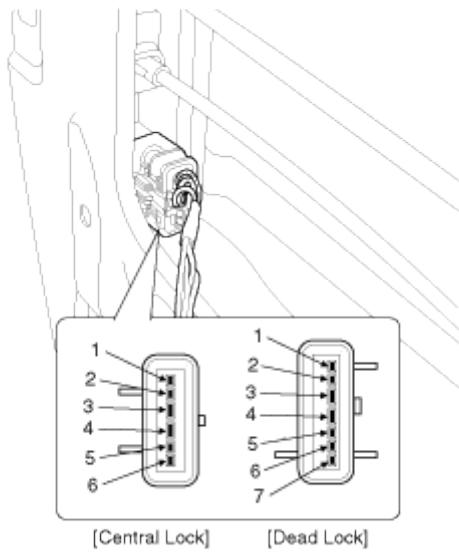
12.10.2.1. Repair procedures

Inspection

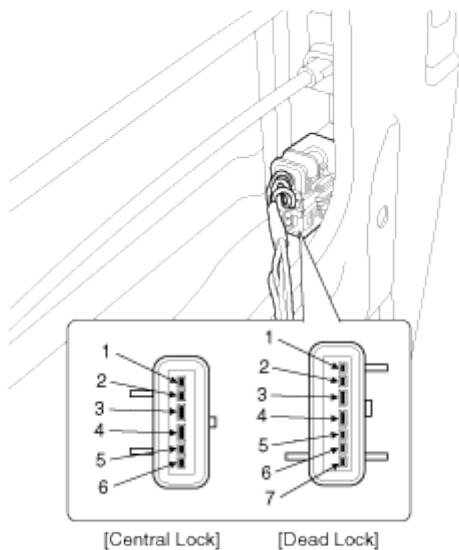
Front Door Lock Actuator

1. Remove the front door trim.
(Refer to the BD group - "Front door")
2. Disconnect the connectors from the actuator.

[LHD]



[RHD]



3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

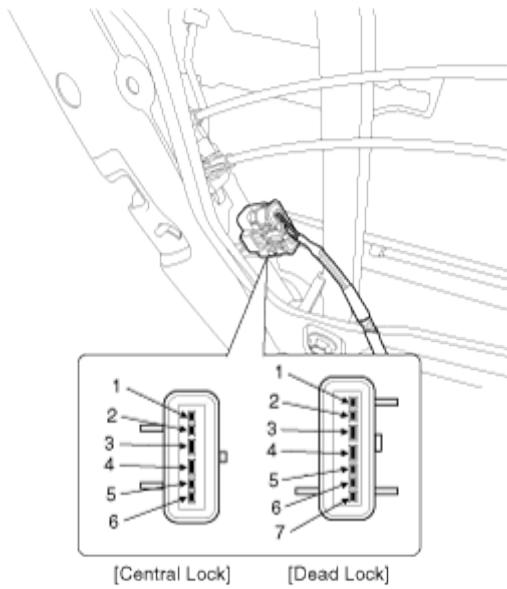
| [Central Lock] | | () : RHD | |
|----------------|----------------|-----------|------|
| Position | Terminal | 4(3) | 3(4) |
| Front left | Central Lock | ⊕ | ⊖ |
| | Central Unlock | ⊖ | ⊕ |
| Position | | 3(4) | 4(3) |
| Front right | Central Lock | ⊖ | ⊕ |
| | Central Unlock | ⊕ | ⊖ |

| [Dead Lock] | | | RHD only | | |
|-------------|--------------|----------|----------|---|---|
| Position | | Terminal | 5 | 6 | 7 |
| Front left | Central Lock | Lock | ⊕ | ⊖ | ⊖ |
| | | Unlock | ⊖ | ⊕ | ⊕ |
| | Dead Unock | Lock | ⊖ | ⊖ | ⊕ |
| | | Unlock | ⊕ | ⊕ | ⊖ |
| Position | | Terminal | 3 | 2 | 1 |
| Front Right | Central Lock | Lock | ⊕ | ⊖ | ⊖ |
| | | Unlock | ⊖ | ⊕ | ⊕ |
| | Dead Unock | Lock | ⊖ | ⊖ | ⊕ |
| | | Unlock | ⊕ | ⊕ | ⊖ |

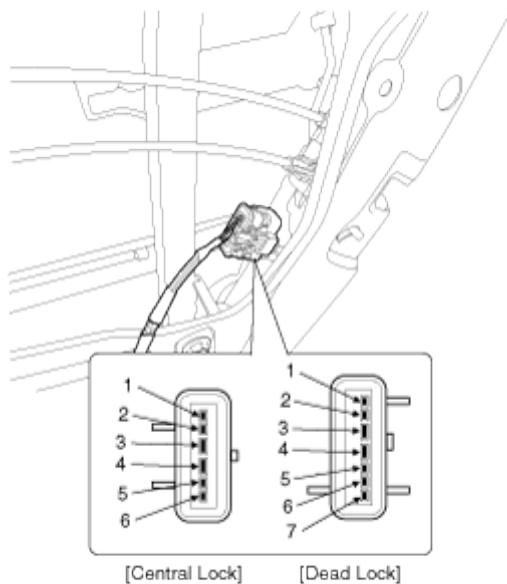
Rear Door Lock Actuator

1. Remove the rear door trim.
(Refer to the BD group - "Rear door")
2. Disconnect the connectors from the actuator.

[LHD]



[RHD]



3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator,

apply battery voltage only momentarily.

| [Central Lock] | | () : RHD | |
|----------------|----------------|-----------|------|
| Position | Terminal | 4(3) | 3(4) |
| Rear left | Central Lock | ⊕ | ⊖ |
| | Central Unlock | ⊖ | ⊕ |
| Position | | 3(4) | 4(3) |
| Rear right | Central Lock | ⊖ | ⊕ |
| | Central Unlock | ⊕ | ⊖ |

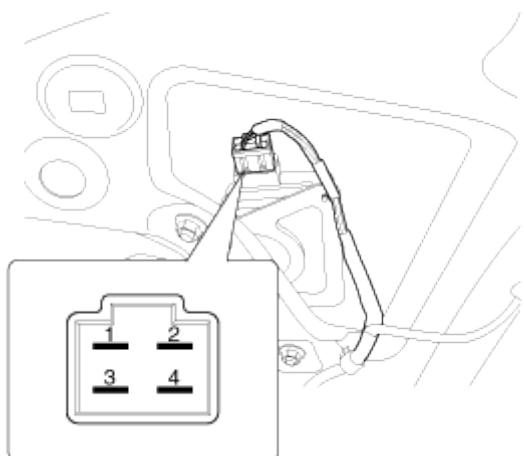
| [Dead Lock] | | RHD only | | |
|-------------|--------------|----------|---|---|
| Position | Terminal | 5 | 6 | 7 |
| Rear left | Central Lock | ⊕ | ⊖ | ⊖ |
| | Unlock | ⊖ | ⊕ | ⊕ |
| | Dead Unock | ⊖ | ⊖ | ⊕ |
| | Unlock | ⊕ | ⊕ | ⊖ |
| Position | | 3 | 2 | 1 |
| Rear Right | Central Lock | ⊕ | ⊖ | ⊖ |
| | Unlock | ⊖ | ⊕ | ⊕ |
| | Dead Unock | ⊖ | ⊖ | ⊕ |
| | Unlock | ⊕ | ⊕ | ⊖ |

Tailgate Lock Actuator Inspection

1. Remove the tailgate trim (A).
(Refer to the BD group - "Tailgate")



2. Disconnect the 4P connector from the actuator.



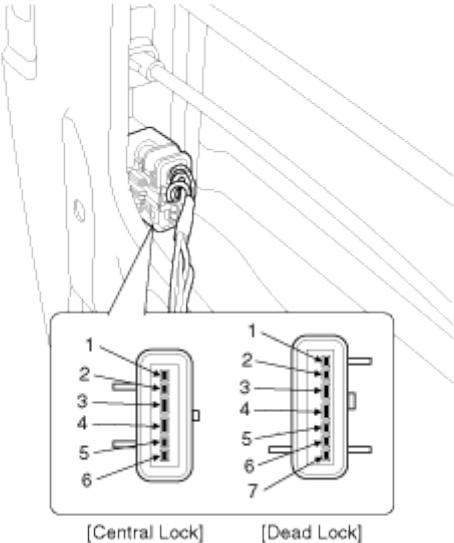
3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

| Terminal Position | 2 | 4 |
|-------------------|---|---|
| Unlock | ⊕ | ⊖ |
| Lock | ⊖ | ⊕ |

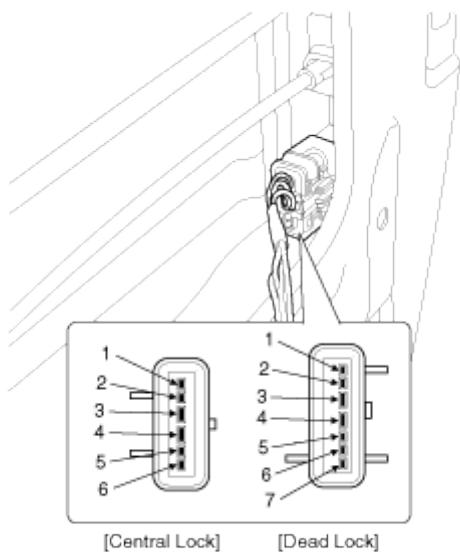
Front Door Lock Switch

1. Remove the front door trim.
(Refer to the BD group - "Front door")
2. Disconnect the connectors from the actuator.

[LHD]



[RHD]



3. Check for continuity between the terminals in each switch position when inserting the key into the door according to the table.

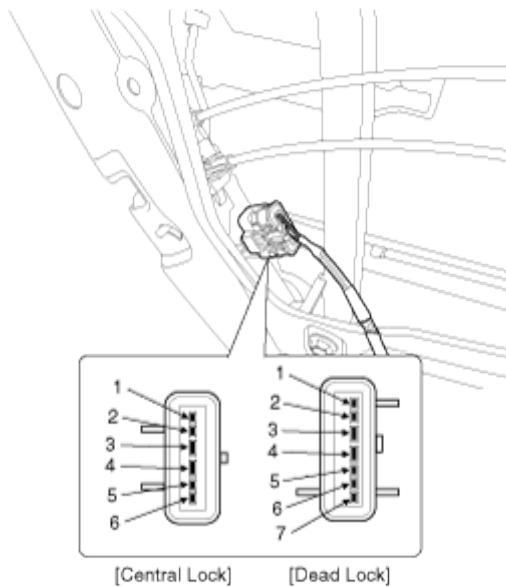
| [CENTRAL LOCK] | | () : RHD | | |
|----------------|-------------------|-----------|------|------|
| Terminal | Position | 2(5) | 5(2) | 1(6) |
| Front left | Clockwise | ○ | — | — |
| | Counter-clockwise | — | ○ | — |
| Terminal | | 5(2) | 2(5) | 6(1) |
| Front right | Clockwise | ○ | — | — |
| | Counter-clockwise | — | ○ | — |

| [DEAD LOCK] | | RHD only | | | |
|-------------|-------------------|----------|---|---|---|
| Position | | Terminal | 2 | 3 | 4 |
| Front left | Clockwise | | ○ | — | ○ |
| | Counter-clockwise | | — | ○ | — |
| Front right | Clockwise | Position | 4 | 5 | 6 |
| | Counter-clockwise | | — | ○ | — |

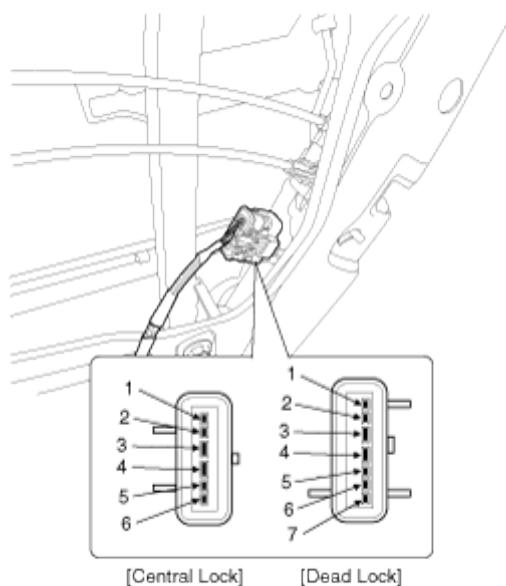
Rear Door Lock Switch

1. Remove the rear door trim.
(Refer to the BD group - "Rear door")
2. Disconnect the connectors from the actuator.

[LHD]



[RHD]



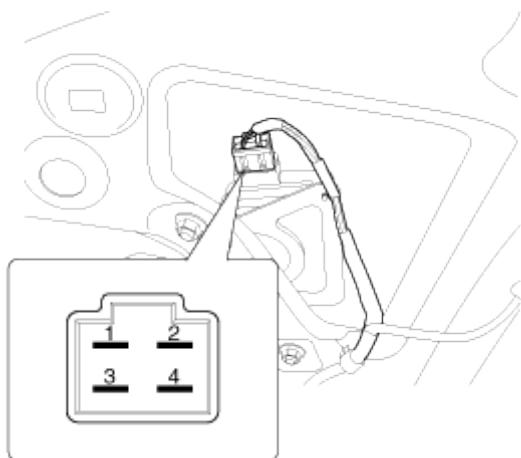
3. Check for continuity between the terminals in each switch position according to the table.

| [CENTRAL LOCK] | | | () : RHD |
|-------------------|------------|----------|-----------|
| Position | | Terminal | |
| Central door lock | Rear left | Lock | |
| | | Unlock | ○ —○ |
| Position | | | Terminal |
| Central door lock | Rear right | Lock | 2(5) |
| | | Unlock | ○ —○ |
| | | | 1(6) |

| [DEAD LOCK] | | | RHD only |
|-------------------|------------|----------|----------|
| Position | | Terminal | |
| Central door lock | Rear left | Lock | |
| | | Unlock | ○ —○ |
| Position | | | 7 |
| Central door lock | Rear right | Lock | 5 |
| | | Unlock | ○ —○ |

Tailgate Switch

1. Remove the tailgate trim.
(Refer to the BD group - "Tailgate")
2. Disconnect the 4P connector from the actuator.



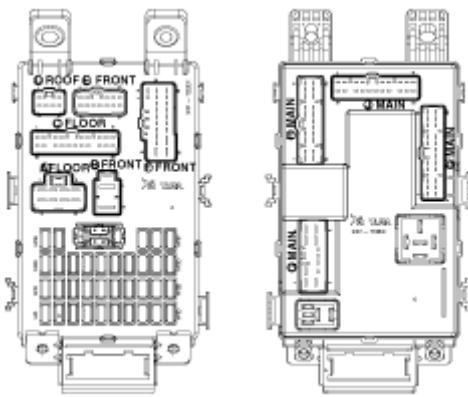
3. Check for continuity between the terminals in each switch position according to the table.

| Position | | Terminal | 1 | 3 |
|----------|--|----------|------|---|
| Lock | | | | |
| Unlock | | | ○ —○ | |

12.10.3. Power Door Lock Relay

12.10.3.1. Repair procedures

Inspection



Door Lock Relay

Check for continuity between the terminals.

1. There should be continuity between the B2 and C1(or 2) terminals when power and ground are connected to the B2 and K9 terminals in the I/P.
2. There should be no continuity between the B2 and C1(or 2) terminals when power is disconnected.

| Terminal
Power | I/P-B
(2) | I/P-K
(9) | I/P-B
(2) | I/P-C
(1 or 2) |
|-------------------|--------------|--------------|--------------|-------------------|
| Disconnected | ○ | ○ | | |
| Connected | + | - | ○ | ○ |

Door Unlock Relay

Check for continuity between the terminals.

1. There should be continuity between the B2 and C3(or C12) terminals when power and ground are connected to the B2 and J9 terminals in the I/P.
2. There should be no continuity between the B2 and C3(or C12) terminals when power is disconnected.

| Terminal
Power | I/P-B
(2) | I/P-J
(9) | I/P-B
(2) | I/P-C
(3 or 12) |
|-------------------|--------------|--------------|--------------|--------------------|
| Disconnected | ○ | ○ | | |
| Connected | + | - | ○ | ○ |

12.11. Power Outside Mirrors

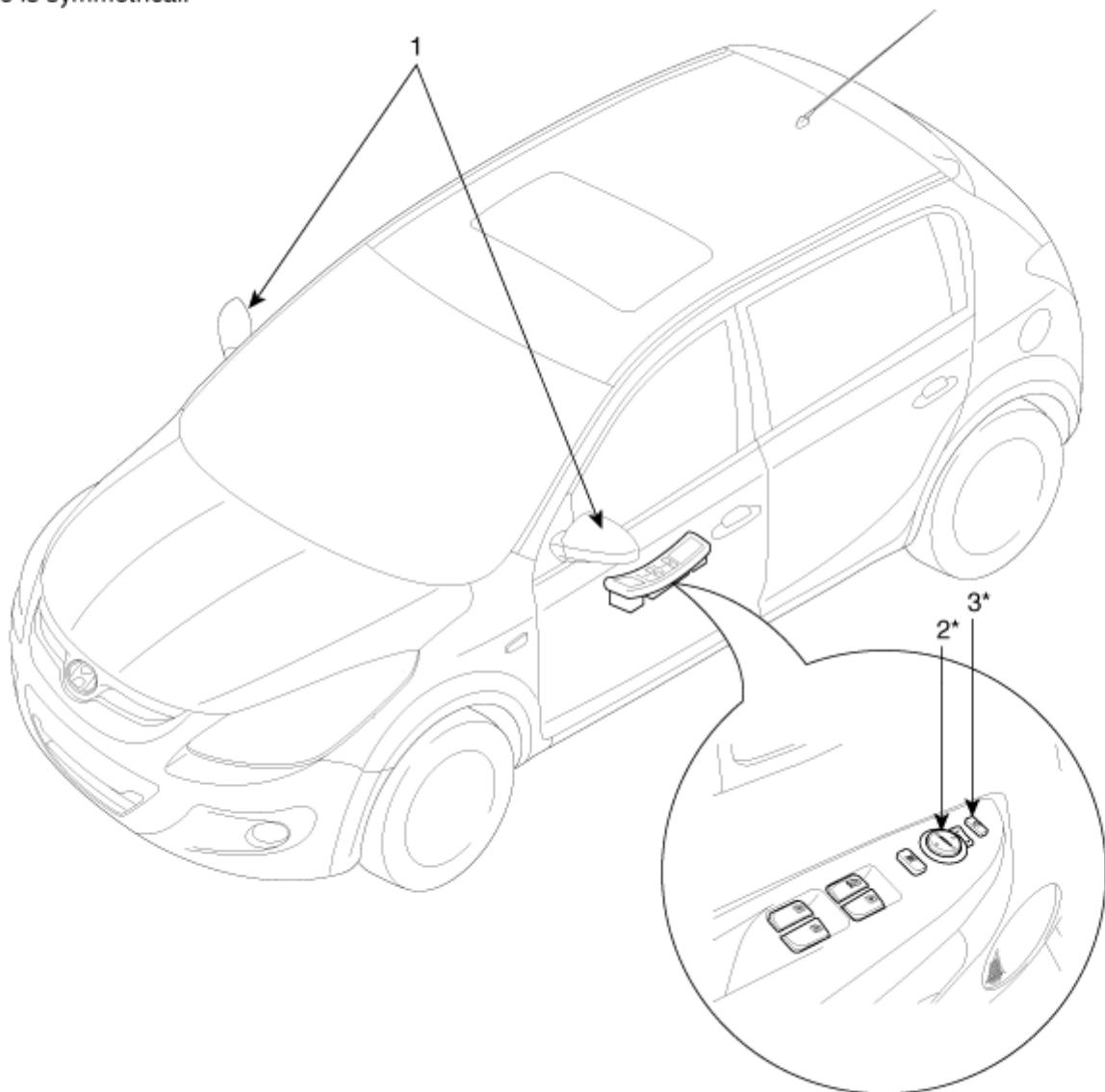
12.11.1. Component and Components Location

Component Location

The parts with asterisk(*) :

This illustration shows the LHD type.

RHD type is symmetrical.

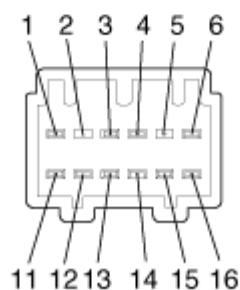
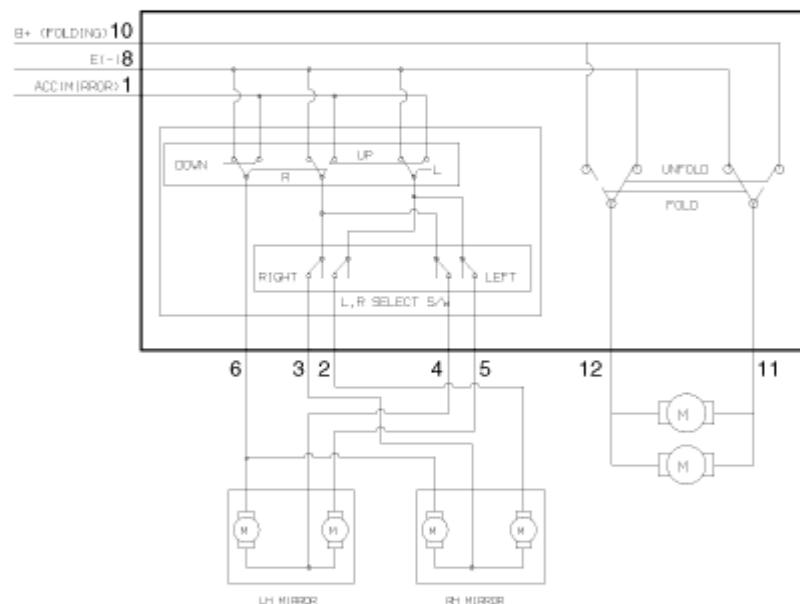
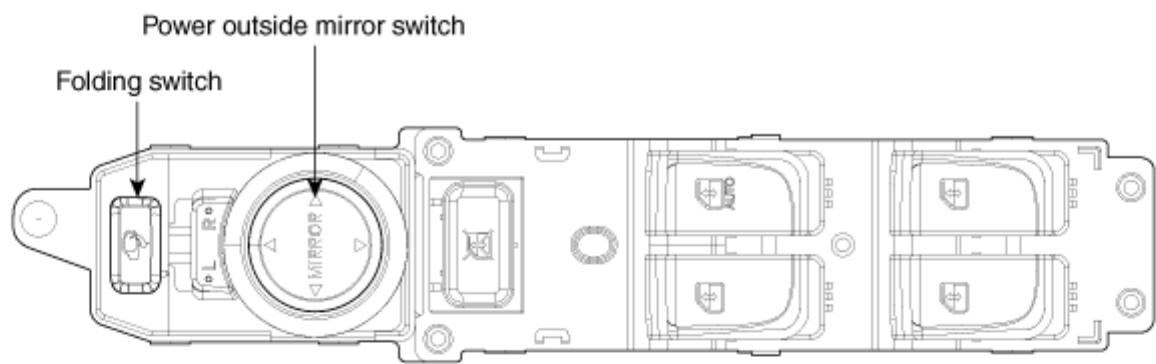


- | | |
|---|-------------------------------|
| 1. Power outside mirror
2. Power outside mirror switch | 3. Door mirror folding switch |
|---|-------------------------------|

12.11.2. Power Outside Mirror Switch

12.11.2.1. Component and Components Location

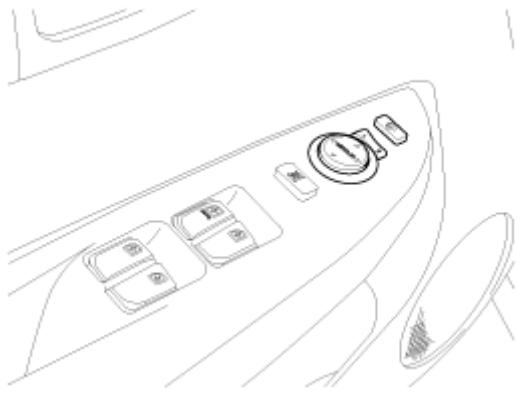
Components



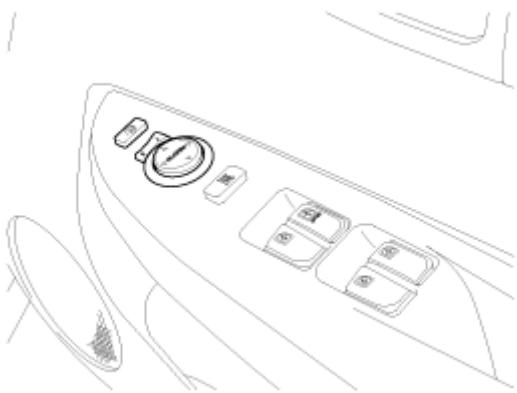
12.11.2.2. Repair procedures

Inspection

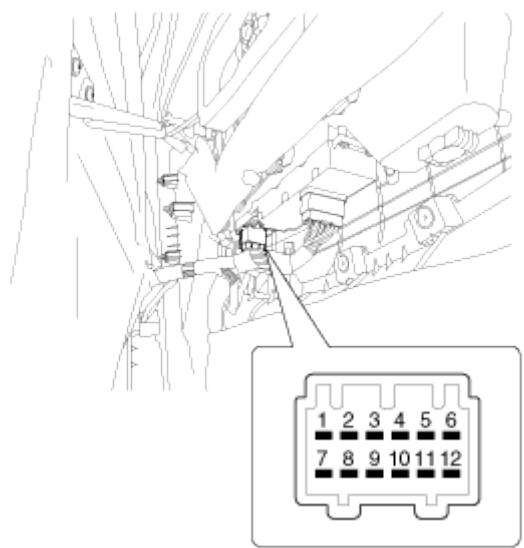
1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim and power window switch module. (Refer to the BD group - "Front door") **[LHD]**



[RHD]



3. Check for the continuity between terminals of power outside mirror switch according to the table.



4. Check for continuity between the terminals in each switch position according to the table.

| Item | Terminal
Direction | 4 | 5 | 3 | 2 | 6 | 1 | 8 |
|-------|-----------------------|---|---|---|---|---|---|---|
| Left | UP | | ○ | | | ○ | ○ | |
| | DOWN | | ○ | | | ○ | ○ | |
| | OFF | | ○ | ○ | | ○ | ○ | |
| | LEFT | ○ | | | | ○ | ○ | |
| | RIGHT | ○ | | | | ○ | ○ | |
| Right | UP | | | ○ | ○ | ○ | ○ | |
| | DOWN | | | ○ | ○ | ○ | ○ | |
| | OFF | | | ○ | ○ | ○ | ○ | |
| | LEFT | | ○ | | ○ | ○ | ○ | |
| | RIGHT | | ○ | | ○ | ○ | ○ | |

[Mirror folding switch]

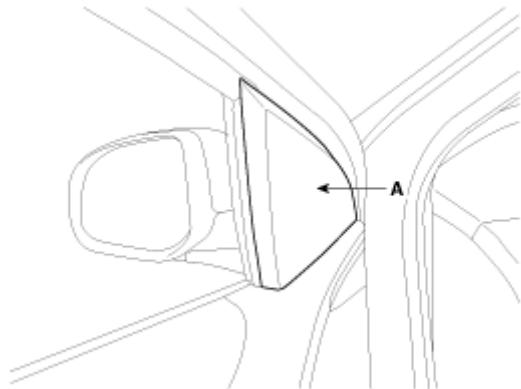
| Terminal
Position | 8 | 10 | 12 | 11 |
|----------------------|---|----|----|----|
| Unfolding | ○ | | ○ | ○ |
| Folding | ○ | | ○ | ○ |

12.11.3. Power Outside Mirror Actuator

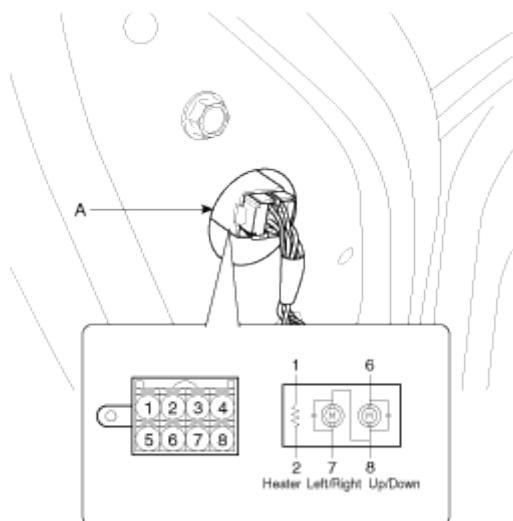
12.11.3.1. Repair procedures

Inspection

1. Remove the front door quadrant inner cover (A). Take care not to damage fixing clips.
(Refer to the BD group - "Front door")



2. Disconnect the power outside mirror connector (A) from the harness.
3. Apply battery voltage to each terminal as shown in the table and verify that the mirror operates properly.

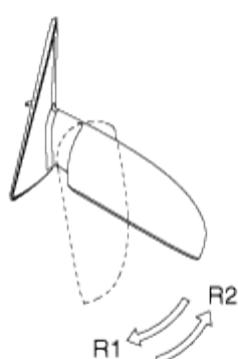


| Terminal Position | 8 | 7 | 6 | B+ | E |
|-------------------|---|---|---|----|---|
| UP | ○ | ○ | ○ | ○ | ○ |
| DOWN | ○ | ○ | ○ | ○ | ○ |
| OFF | ○ | ○ | ○ | ○ | ○ |
| RIGHT | ○ | ○ | ○ | ○ | ○ |
| LEFT | ○ | ○ | ○ | ○ | ○ |

Mirror Heater

| Terminal Position | 1 | 2 |
|-------------------|---|---|
| Heater | ○ | ○ |

Mirror Folding



| Terminal Position | B | E | 4 | 3 |
|-------------------|---|---|---|---|
| Folding R1 | ○ | ○ | ○ | ○ |
| Folding R2 | ○ | ○ | ○ | ○ |

12.12. Power Windows

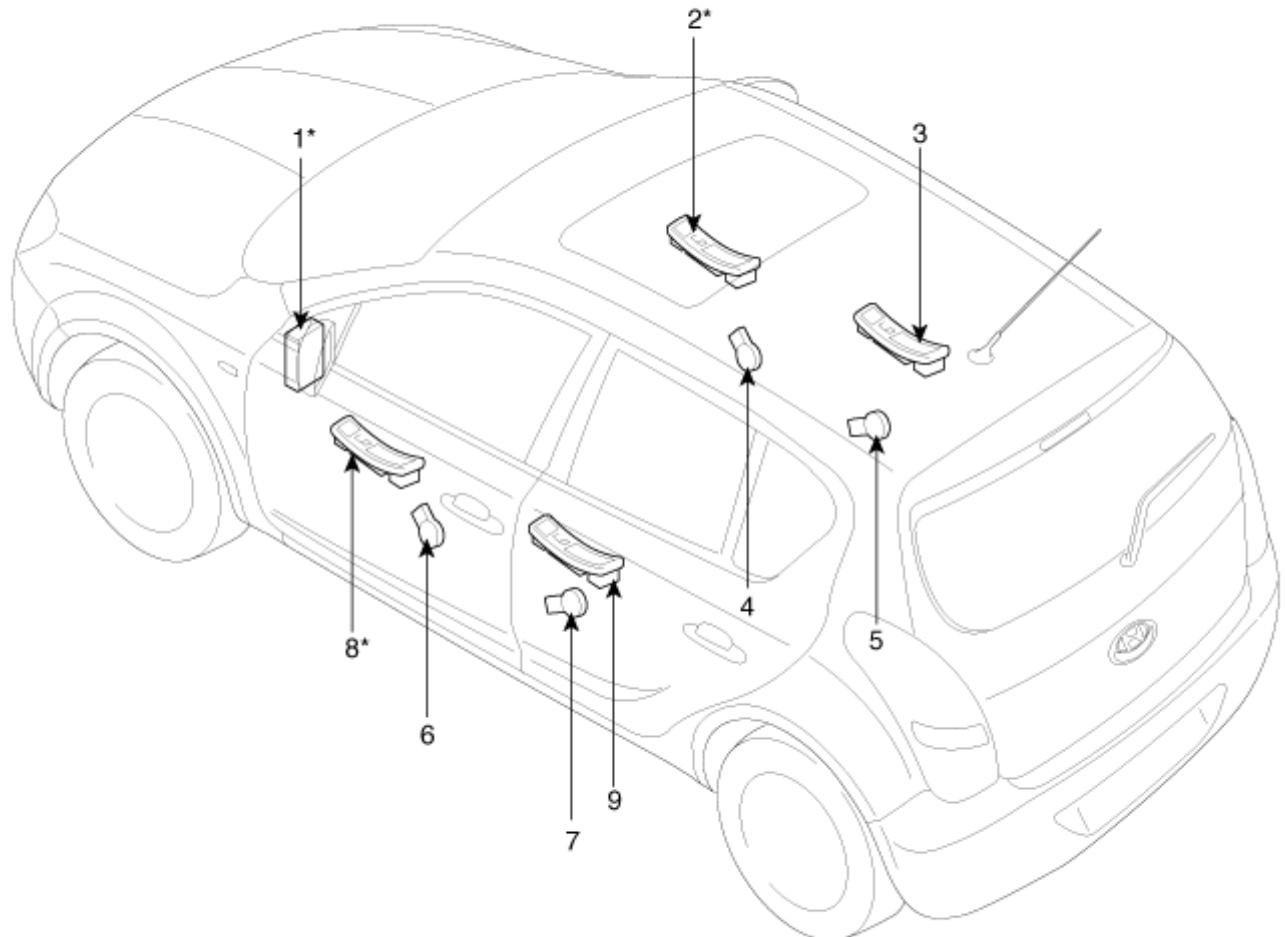
12.12.1. Component and Components Location

Component Location

The parts with asterisk(*) :

This illustration shows the LHD type.

RHD type is symmetrical.



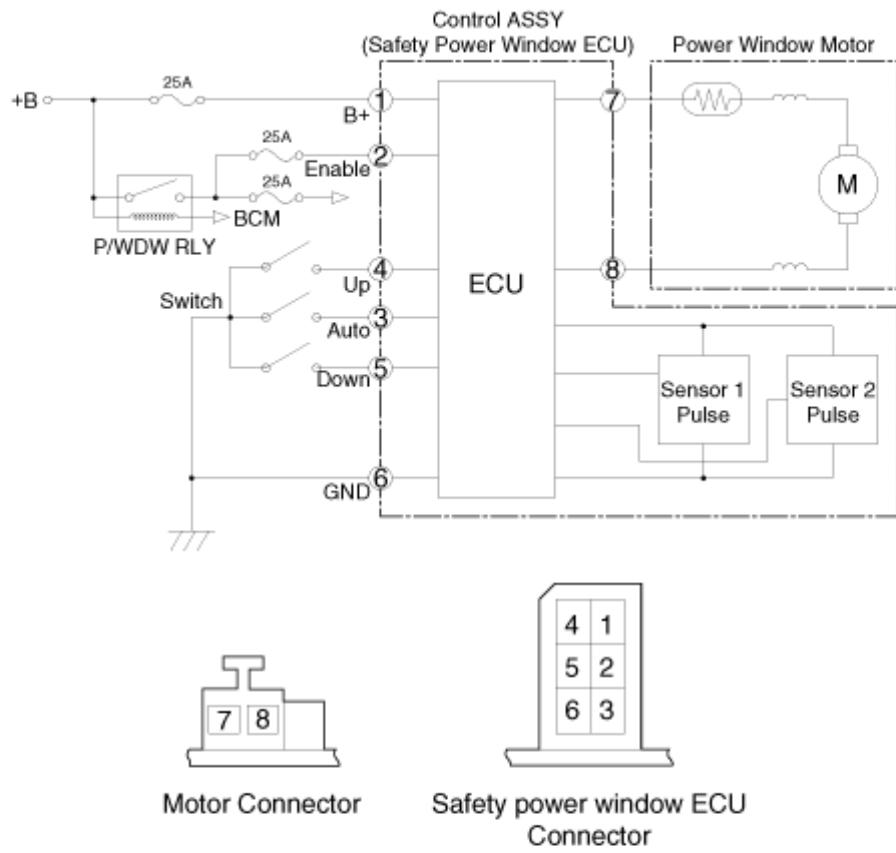
- 1. Instrument panel junction box (Power window relay)
- 2. Passenger window switch
- 3. Rear window switch
- 4. Front window motor
- 5. Rear window motor

- 6. Front window motor
- 7. Rear window motor
- 8. Driver power window main switch
- 9. Rear window switch

12.12.2. Power Window Motor

12.12.2.1. Schematic Diagrams

Circuit Diagram



Connector Pin SPEC(LHD)

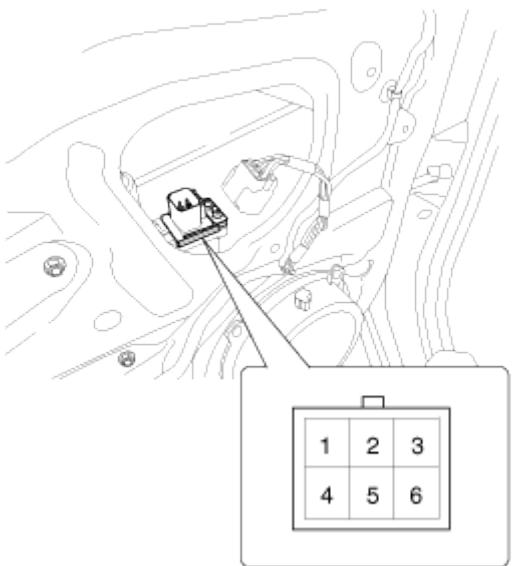
| TML | Contents |
|-----|---------------|
| 1 | BAT. Voltage |
| 2 | P/WDW Enable |
| 3 | Auto SW Input |
| 4 | Up SW Input |
| 5 | Down SW Input |
| 6 | GND |
| 7 | Motor Down |
| 8 | Motor Up |

12.12.2.1. Repair procedures

Inspection

Front Power Window Motor

1. Remove (-) negative battery terminal.
2. Remove the front door trim.
(Refer to the BD group -" Front door")
3. Disconnect the connector from the motor.



4. Connect the terminals No.1 directly to battery voltage (12V) and check that the motor operates smoothly. If the operation is abnormal, replace the motor.

| Terminal Position | | 4 | 5 | 6 |
|-------------------|------|---|---|---|
| Left | UP | ○ | | ○ |
| | DOWN | | ○ | ○ |
| Terminal Position | | 3 | 2 | 1 |
| Right | UP | ○ | | ○ |
| | DOWN | | ○ | ○ |

Rear Power Window Motor

1. Remove (-) negative battery terminal.
2. Remove the rear door trim.
(Refer to the BD group - "Rear door")
3. Disconnect the connector from the motor.



4. Connect the motor terminals directly to battery voltage (12V) and check that the motor operates smoothly. Next, reverse the polarity and check that the motor operates smoothly in the reverse direction. If the operation is abnormal, replace the motor.

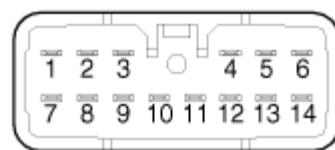
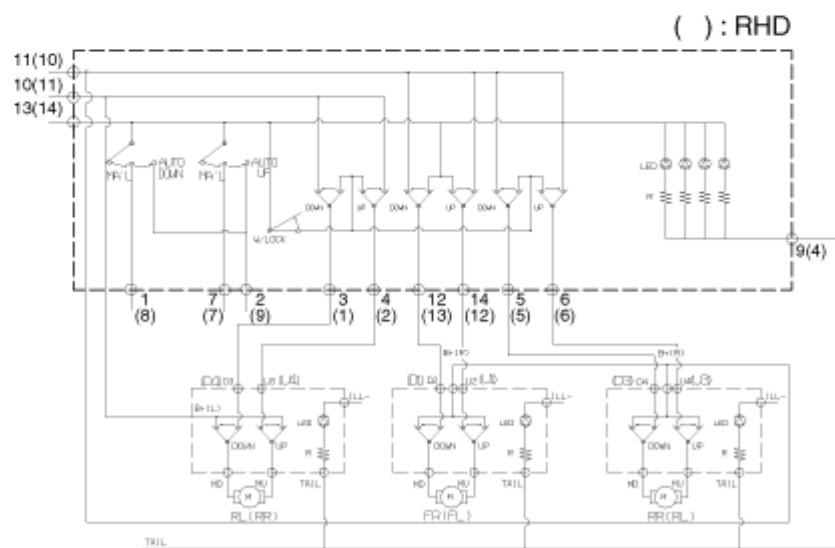
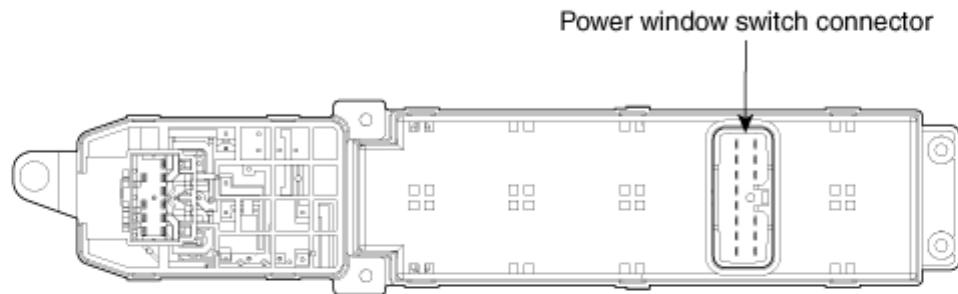
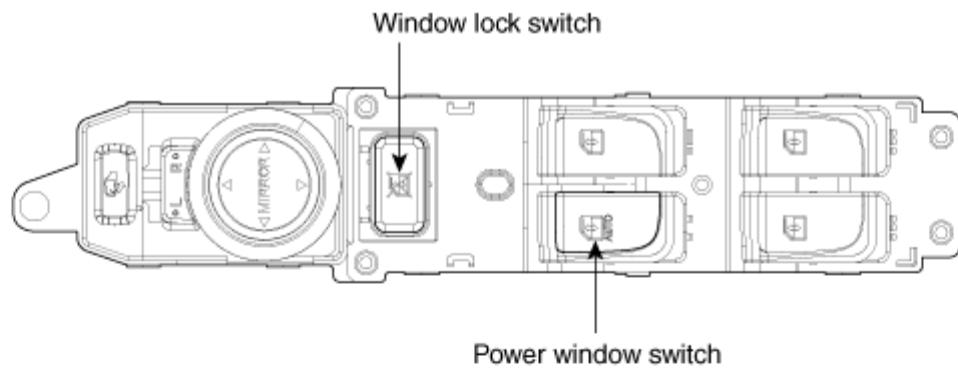
| Position | | Terminal | 1 | 2 |
|----------|------|-------------------|---|---|
| | | | ⊕ | ⊖ |
| Left | UP | Clockwise | ⊕ | ⊖ |
| | DOWN | Counter-clockwise | ⊖ | ⊕ |
| Right | DOWN | Clockwise | ⊖ | ⊕ |
| | UP | Counter-clockwise | ⊕ | ⊖ |

12.12.3. Power Window Switch

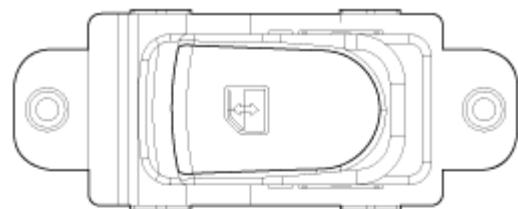
12.12.3.1. Component and Components Location

Components

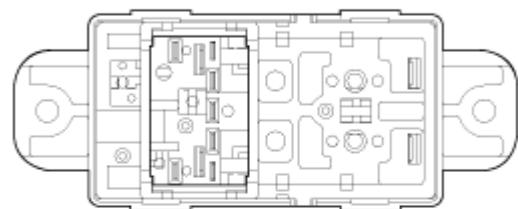
Power Window Main Switch



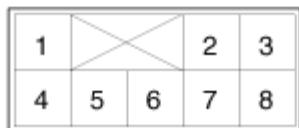
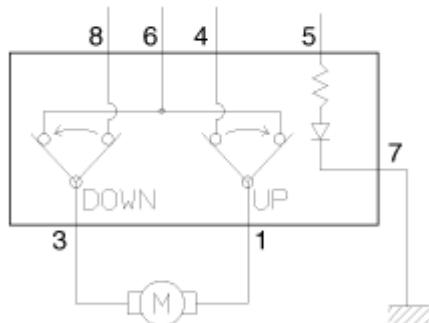
Passenger/rear Power Window Switch



Power window switch



Passenger power window switch connector



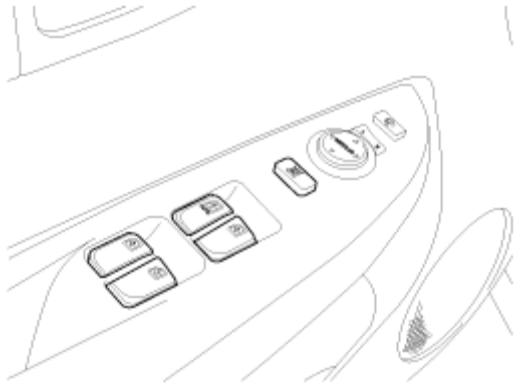
12.12.3.2. Repair procedures

Inspection

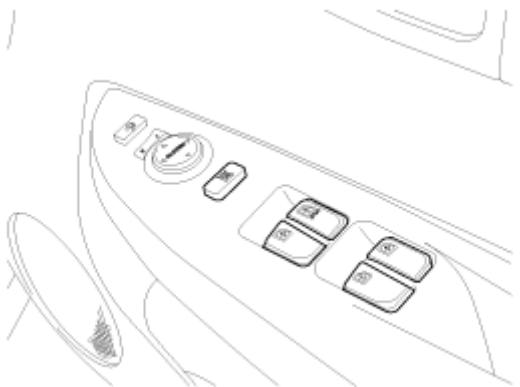
Power Window Main Switch Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim.
(Refer to the BD group - "Front door")
3. Disconnect the connector from the switch.

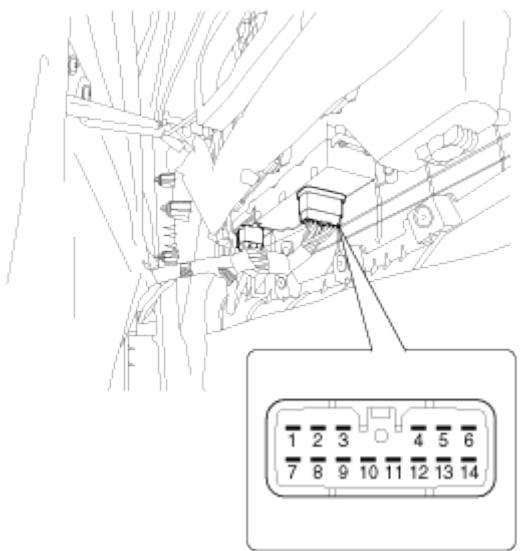
[LHD]



[RHD]



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.



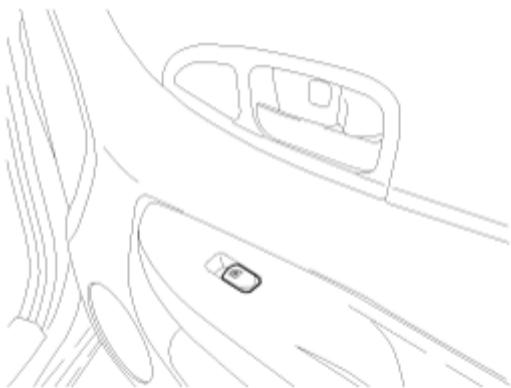
(): RHD

| Terminal Position | 13(14) | 3(1) |
|-------------------|--------|------|
| LOCK | | |
| NORMAL | ○ | ○ |

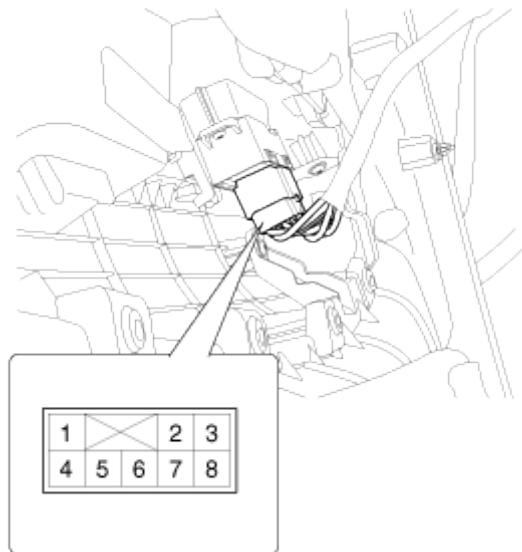
| Terminal | | Front left | | | | Front right | | | |
|----------|------|------------|----------|----------|------------|-------------|------------|------------|------------|
| Position | | 13
(14) | 7
(7) | 1
(8) | 2
(9) | 11
(10) | 14
(12) | 12
(13) | 13
(14) |
| | UP | Manual | ○—○ | | | ○—○ | ○—○ | | |
| | Auto | | ○—○ | | ○ | | | | |
| | | OFF | | | | | ○—○ | ○—○ | |
| Position | | Manual | ○—○ | ○ | | ○—○ | ○—○ | ○—○ | |
| | | Auto | ○—○ | ○ | ○ | | | | |
| Terminal | | Rear left | | | | Rear right | | | |
| Position | | 10
(11) | 4
(2) | 3
(1) | 13
(14) | 11
(10) | 6
(6) | 5
(5) | 13
(14) |
| | UP | Manual | ○—○ | ○—○ | | ○—○ | ○—○ | | |
| | Auto | | | | | | | | |
| | | OFF | | ○—○ | ○—○ | | ○—○ | ○—○ | |
| Position | | Manual | ○—○ | ○—○ | ○ | ○—○ | ○—○ | ○—○ | |
| | | Auto | | | | | | | |

Passenger Power Window Switch Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim.
(Refer to the BD group - "Front door")



3. Disconnect the 8P connector from the switch.



4. Check for continuity between the terminals in each switch position according to the table. If the continuity condition is not normal, replace the switch.

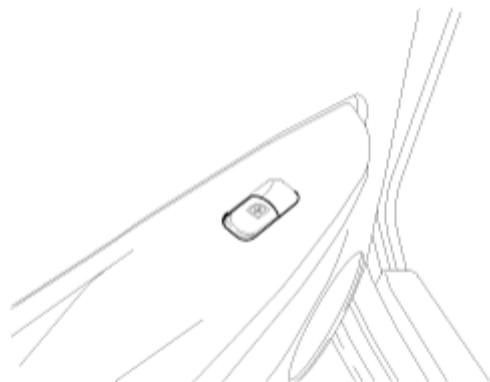
| Terminal
Position \ | 6 | 1 | 4 | 8 | 3 |
|------------------------|-----|-----|-----|-----|-----|
| UP | ○—○ | | | ○—○ | |
| OFF | | ○—○ | ○—○ | | |
| DOWN | ○—○ | | | | ○—○ |

Rear Power Window Switch Inspection

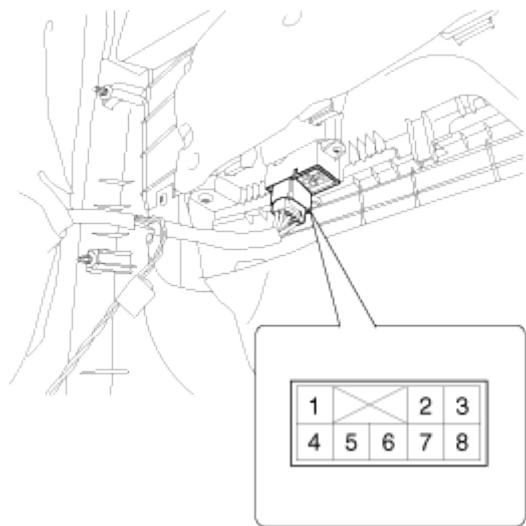
1. Disconnect the negative (-) battery terminal.

2. Remove the rear door trim.

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



3. Disconnect the 8P connector from the switch.



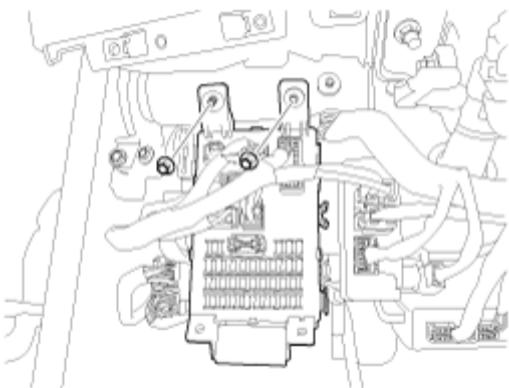
4. Check for continuity between the terminals in each switch position according to the table. If the continuity condition is not normal, replace the switch.

| Terminal
Position \ | 6 | 1 | 4 | 8 | 3 |
|------------------------|-----|-----|-----|-----|-----|
| UP | ○—○ | | | ○—○ | |
| OFF | | ○—○ | ○—○ | | |
| DOWN | ○—○ | | | | ○—○ |

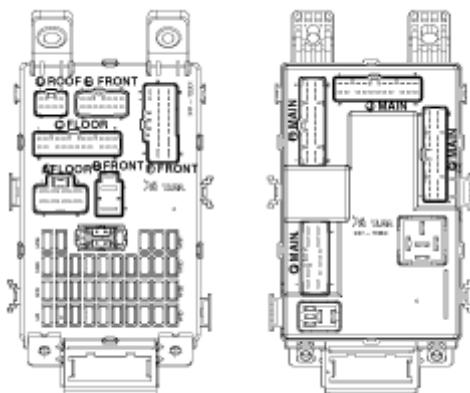
12.12.4. Power Window Relay 12.12.4.1. Repair procedures

Inspection

1. Disconnect the negative (-) battery terminal.
 2. Remove the crash pad lower panel.
(Refer to Body group - "Crash pad")
 3. Remove the Instrument panel junction box.



4. Check for continuity between the terminals. There should be continuity between the B1 and A7 terminals when power and ground are connected to the K1 and K7 terminals in the I/P Junction box.
 5. There should be no continuity between the B1 and A7 terminals when power is disconnected.

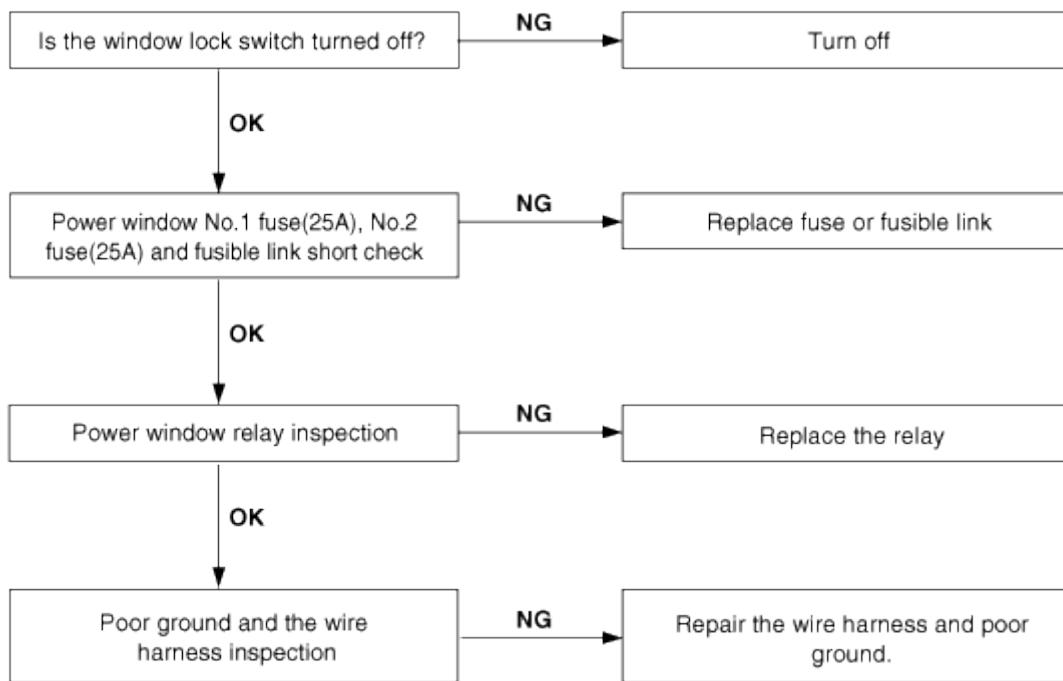


| Terminal
Power | I/P-K
(1) | I/P-K
(7) | I/P-B
(1) | I/P-A
(7) |
|-------------------|--------------|--------------|--------------|--------------|
| Disconnected | | | | |
| Connected | | | | |

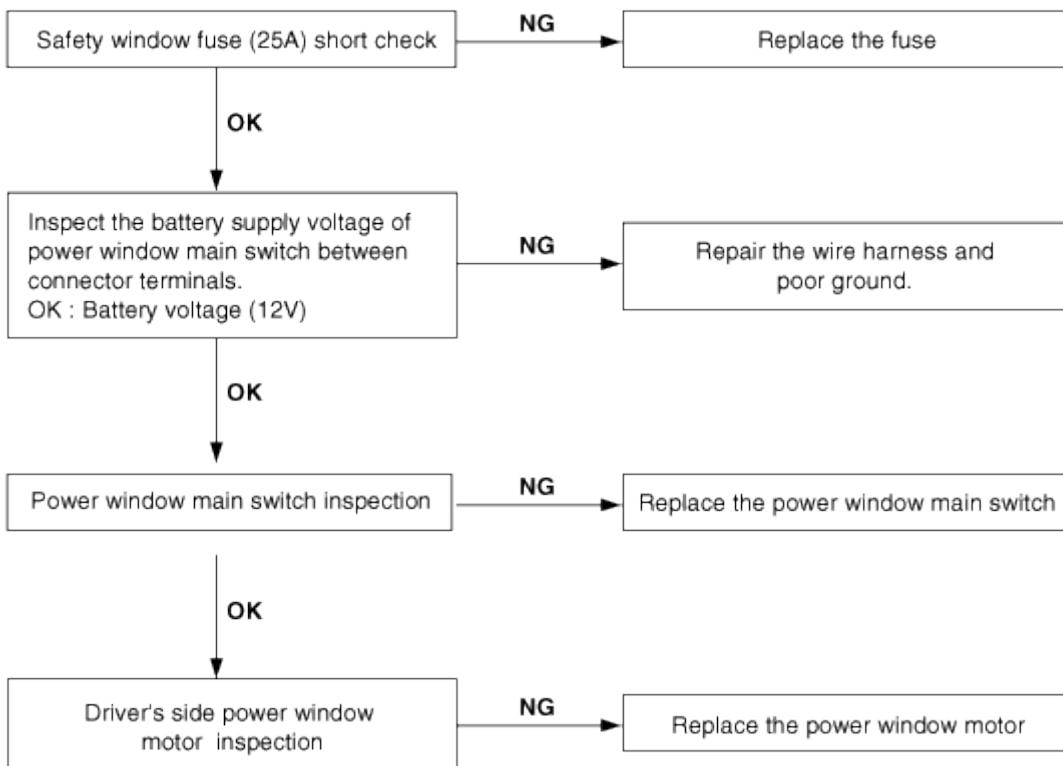
12.12.5. Troubleshooting

Troubleshooting

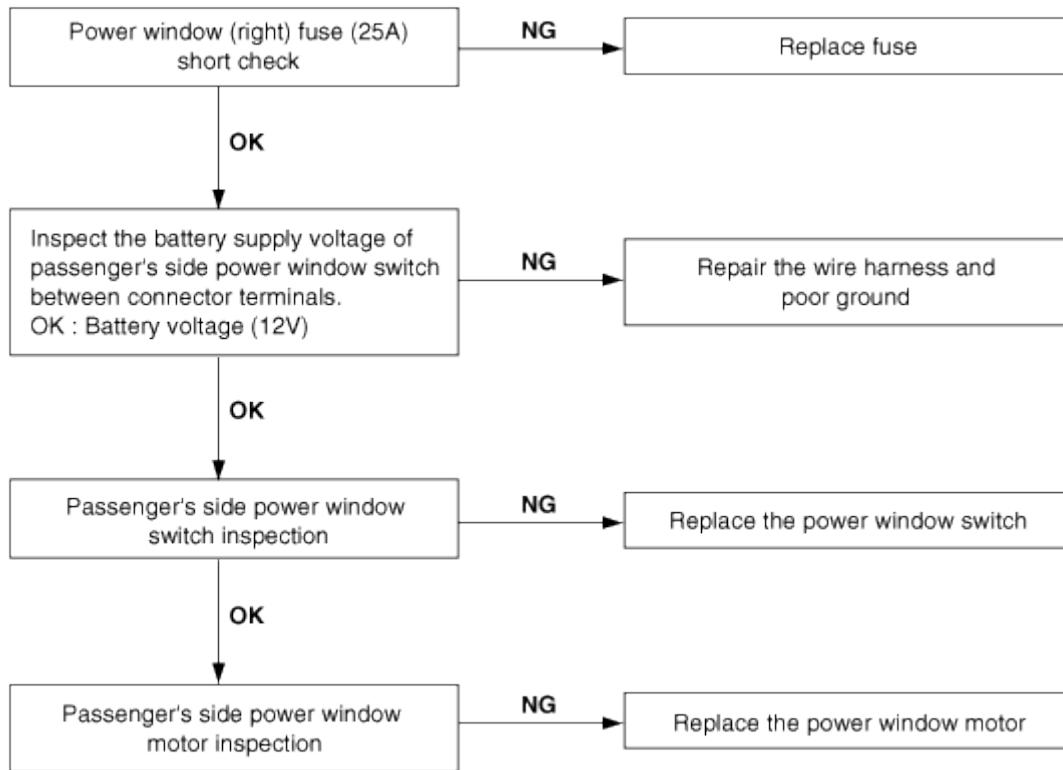
1. No windows operate from the main switch on the driver's door.



2. Driver's side window does not operate.



3. Passenger's side window does not operate.



12.13. Rear Glass Defogger

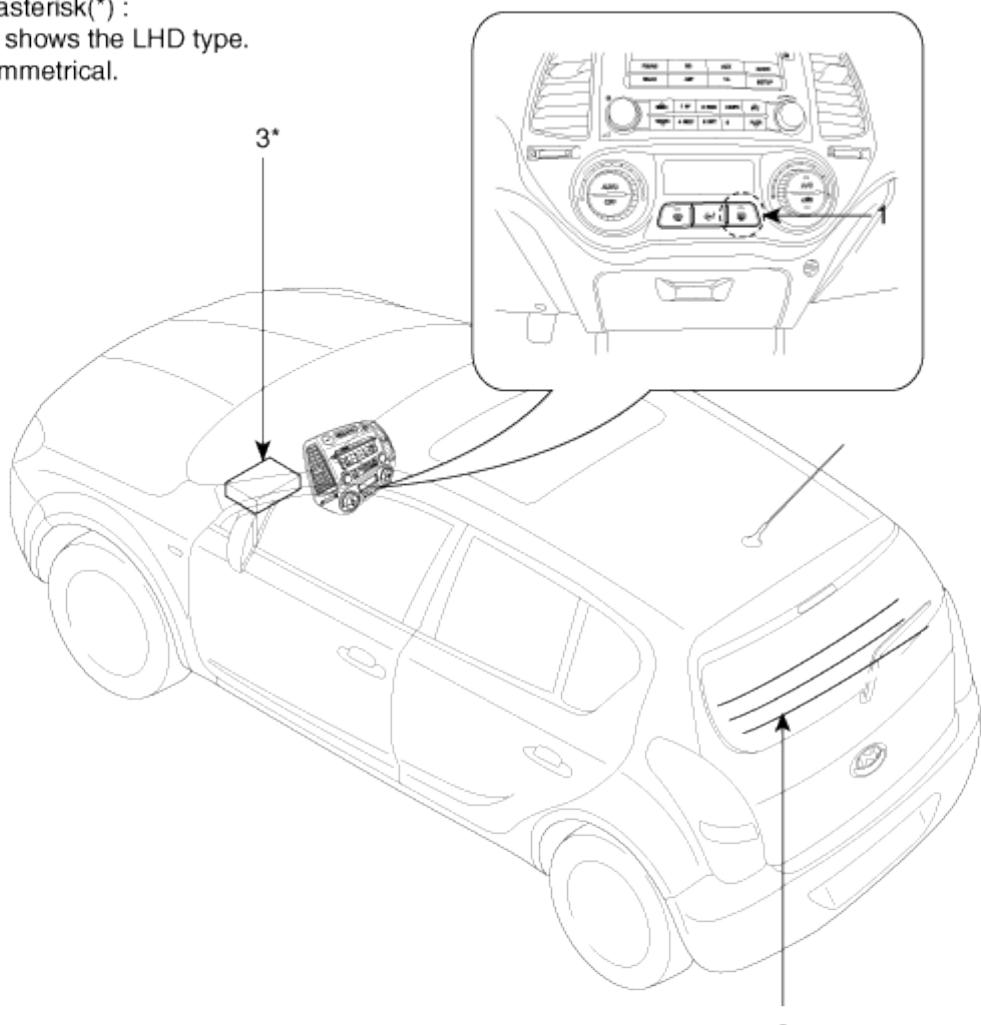
12.13.1. Component and Components Location

Component Location

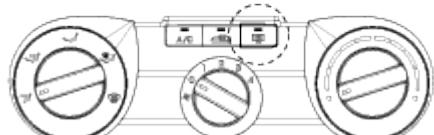
The parts with asterisk(*) :

This illustration shows the LHD type.

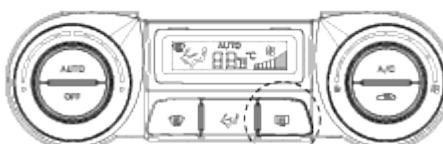
RHD type is symmetrical.



[Manual]



[FATC]



1. Rear window defogger switch
2. Rear window defogger

3. Body control module

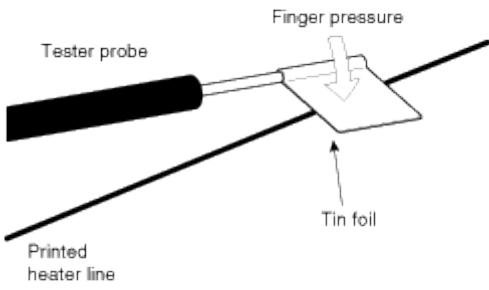
12.13.2. Rear Glass Defogger Printed Heater

12.13.2.1. Repair procedures

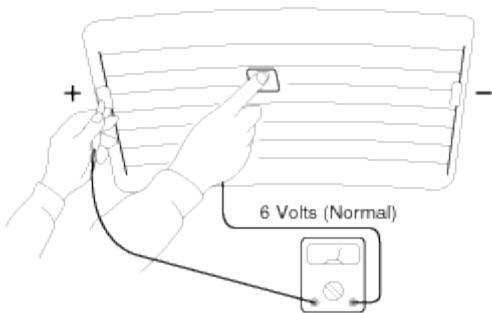
Inspection

CAUTION

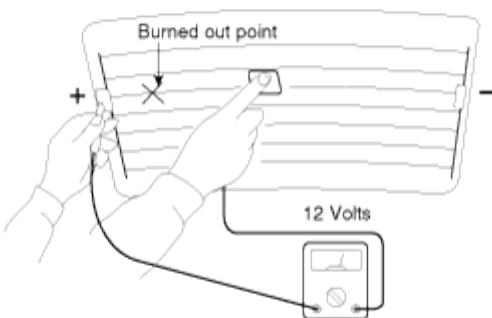
Wrap tin foil around the end of the voltmeter test lead to prevent damaging the heater line. Apply finger pressure on the tin foil, moving the tin foil along the grid line to check for open circuits.



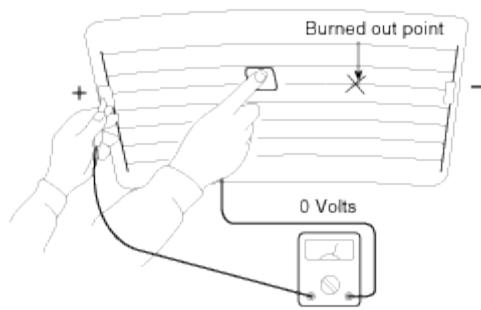
1. Turn on the defogger switch and use a voltmeter to measure the voltage of each heater line at the glass center point. If a voltage of approximately 6V is indicated by the voltmeter, the heater line of the rear window is considered satisfactory.



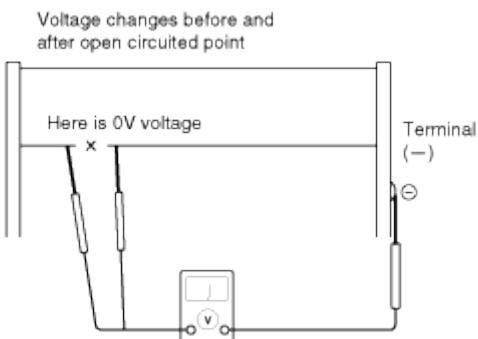
2. If a heater line is burned out between the center point and (+) terminal, the voltmeter will indicate 12V.



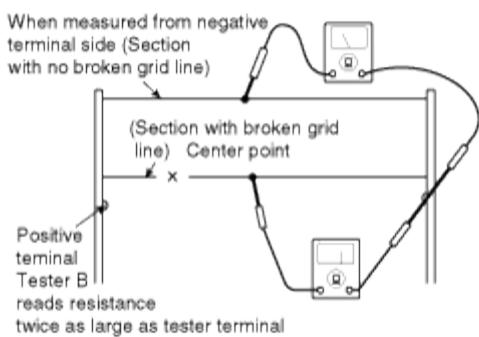
3. If a heater line is burned out between the center point and (-) terminal, the voltmeter will indicate 0V.



4. To check for open circuits, slowly move the test lead in the direction that the open circuit seems to exist. Try to find a point where a voltage is generated or changes to 0V. The point where the voltage has changed is the open-circuit point.



5. Use an ohmmeter to measure the resistance of each heater line between a terminal and the center of a grid line, and between the same terminal and the center of one adjacent heater line. The section with a broken heater line will have a resistance twice as that in other sections. In the affected section, move the test lead to a position where the resistance sharply changes.



Repair Of Broken Heater Line

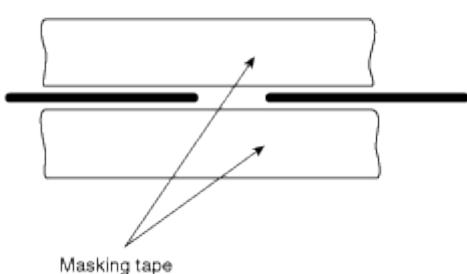
Prepare the following items :

1. Conductive paint.
2. Paint thinner.
3. Masking tape.
4. Silicone remover.
5. Using a thin brush :

Wipe the glass adjacent to the broken heater line, clean with silicone remover and attach the masking tape as shown.

Shake the conductive paint container well, and apply three coats with a brush at intervals of about 15 minutes apart.

Remove the tape and allow sufficient time for drying before applying power. For a better finish, scrape away excess deposits with a knife after the paint has completely dried. (Allow 24 hours).



12.13.3. Rear Glass Defogger Switch 12.13.3.1. Repair procedures

Inspection

Rear Window Defogger Switch

- When checking the rear window defogger switch operation, select a vehicle type and menu.

| | |
|----------------------------|---|
| HYUNDAI VEHICLE DIAGNOSIS | ▼ |
| MODEL : PB | |
| 01. ENGINE (GASOLINE) | |
| 02. ENGINE (DIESEL) | |
| 03. AUTOMATIC TRANSAXLE | |
| 04. ANTI-LOCK BRAKE SYSTEM | |
| 05. SRS-AIRBAG | |
| 06. ELEC. POWER STEERING | |
| 07. BODY CONTROL MODULE | |
| 08. FULL AUTO AIR/CON. | |

- Select option "Current Data".

| |
|------------------------------|
| 1. HYUNDAI VEHICLE DIAGNOSIS |
| MODEL : PB |
| SYSTEM : BODY CONTROL MODULE |
| 01. CURRENT DATA |
| 02. FLIGHT RECORD |
| 03. ACTUATION TEST |
| 04. SIMU-SCAN |
| 05. USER OPTION |

| 1.2 CURRENT DATA | | 35/48 |
|-----------------------|-----|-------|
| WINDSHIELD DEFOG | OFF | ▲ |
| REAR DEFOG | ON | ■ |
| PARKING BREAK | ON | ■ |
| HAZARD SW | ON | ■ |
| SEAT BELT | ON | ■ |
| FR WIPER MIST SW | ON | ■ |
| FLASH TO PASS | OFF | ■ |
| IGNITION KEY REMINDER | OFF | ■ |

- To check the input value of rear window defogger switch in force mode, select option "Actuation Test".

| |
|------------------------------|
| 1. HYUNDAI VEHICLE DIAGNOSIS |
| MODEL : PB |
| SYSTEM : BODY CONTROL MODULE |
| 01. CURRENT DATA |
| 02. FLIGHT RECORD |
| 03. ACTUATION TEST |
| 04. SIMU-SCAN |
| 05. USER OPTION |

| DEFROGGER RELAY | |
|-----------------|-------------|
| DURATION | 10S 1 TIMES |
| METHOD | ACTIVATION |
| CONDITION | IG. KEY ON |

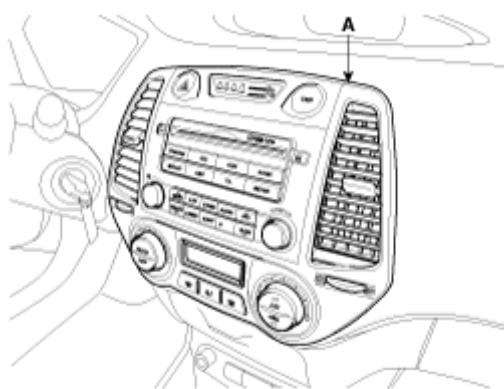
PRESS [STRT], IF YOU ARE READY !

STRT **STOP**

※ Above voltage and numerical value may be different from the real value.

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the heater control assembly (A) including the rear window defogger switch.



3. Disconnect the heater control unit connector (A).



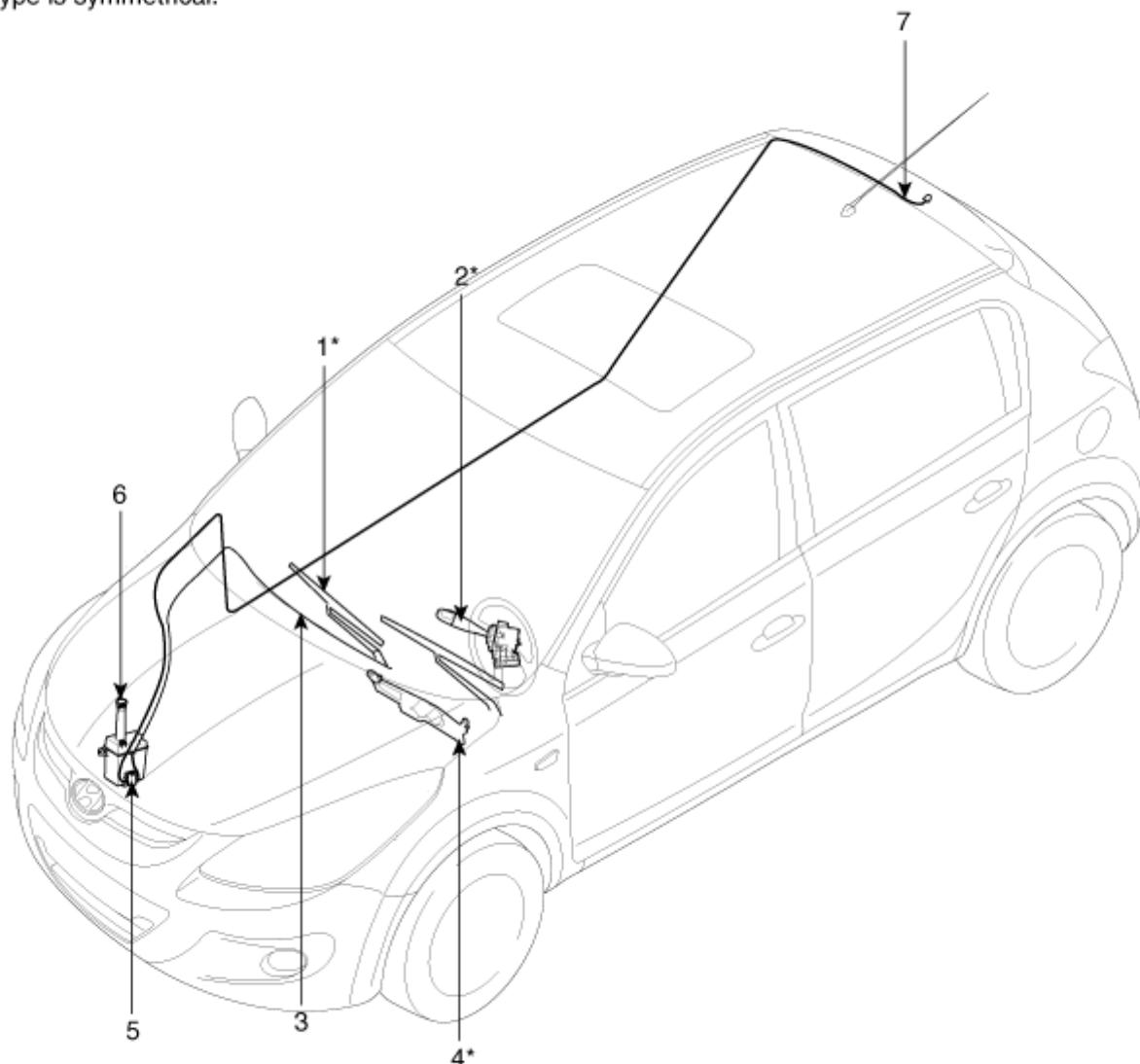
Installation

1. Install the heater control assembly.

12.14. Windshield Wiper / Washer 12.14.1. Component and Components Location

Component Location

The parts with asterisk(*) :
This illustration shows the LHD type.
RHD type is symmetrical.

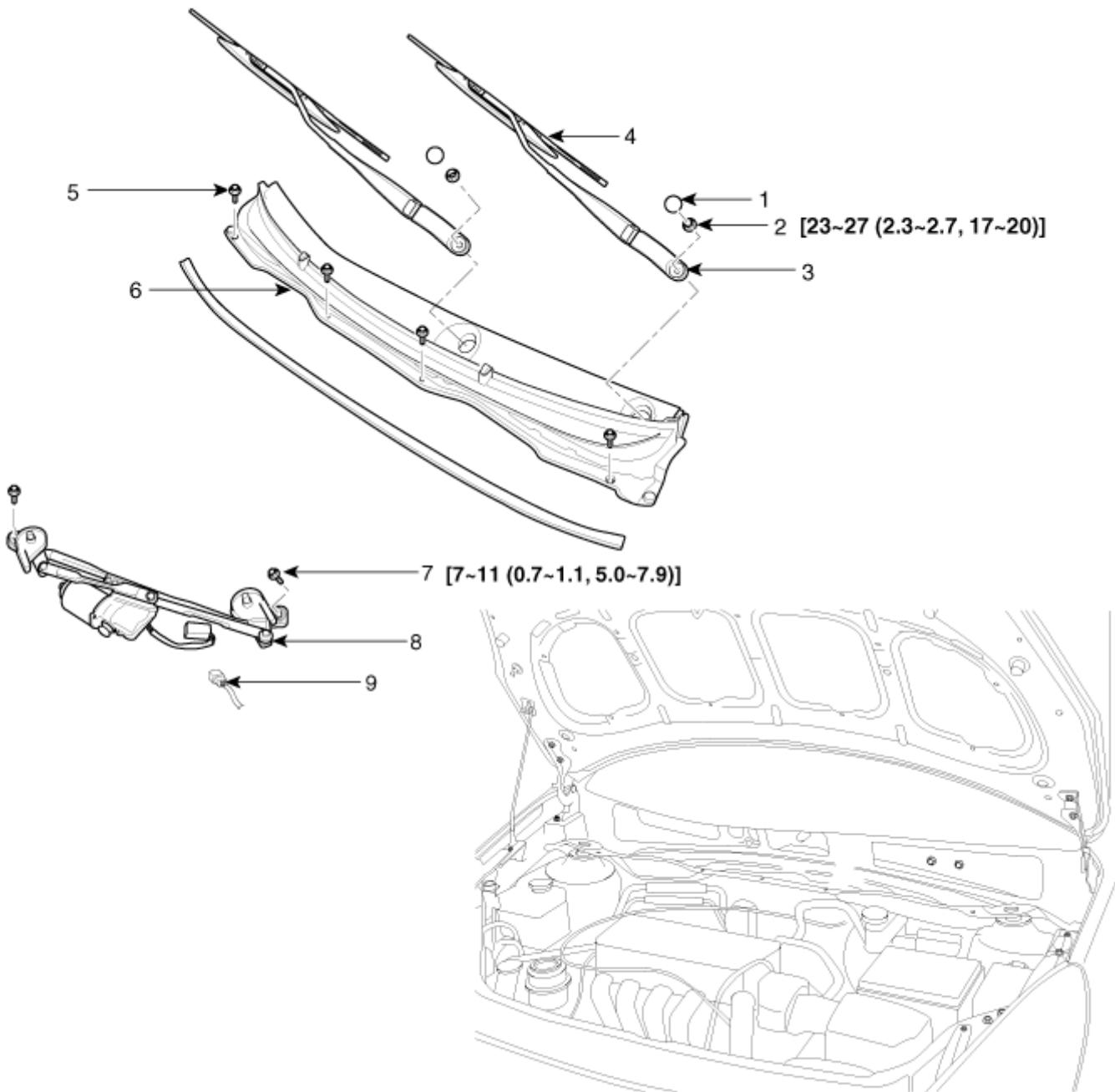


- | | |
|---|---|
| 1. Windshield wiper arm & blade
2. Wiper & washer switch
3. Windshield washer hose
4. Windshield wiper motor & linkage | 5. Washer motor
6. Washer reservoir
7. Rear washer hose |
|---|---|

12.14.2. Windshield Wiper – Washer Switch

12.14.2.1. Component and Components Location

Component Location



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

| | |
|--------------|-----------------------------------|
| 1. Cap | 6. Cowl top cover |
| 2. Nut | 7. Bolt |
| 3. Wiper arm | 8. Wiper motor & linkage assembly |
| 4. Blade | 9. Wiper motor connector |
| 5. Retainer | |

12.14.2.2. Repair procedures

Inspection

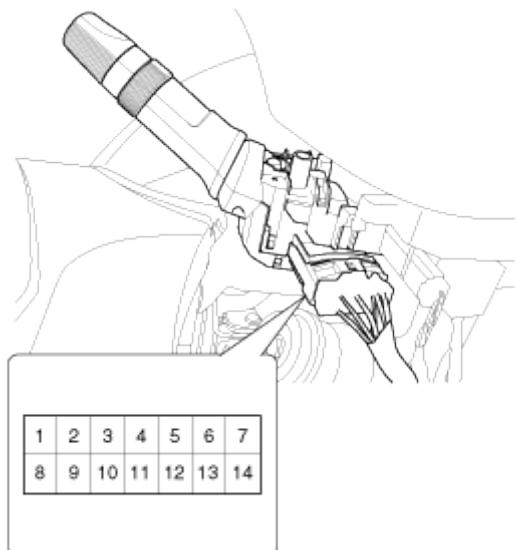
Wiper And Washer Switch Inspection

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

[LHD]



[RHD]



Wiper Switch

() : RHD

| Terminal
Position | 2(6) | 3(5) | 4(4) | 5(3) |
|----------------------|------|------|------|------|
| MIST | ○ | | ○ | |
| OFF | | | ○ | ○ |
| INT | | | ○ | ○ |
| LOW | ○ | | ○ | |
| HI | ○ | ○ | | |

Washer Switch

() : RHD

| Terminal
Position | 2(6) | 6(2) |
|----------------------|------|------|
| OFF | | |
| ON | ○ | ○ |

Removal

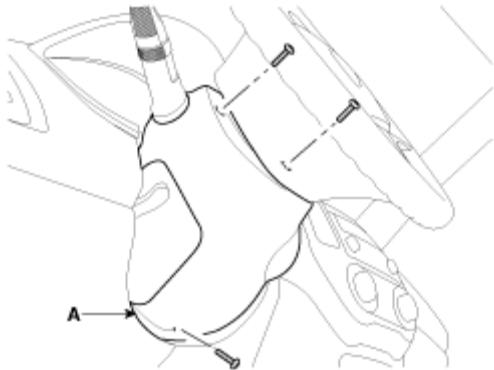
1. Disconnect the negative (-) battery terminal.
2. Remove the steering wheel.

(Refer to the ST group - "Steering column and shaft")

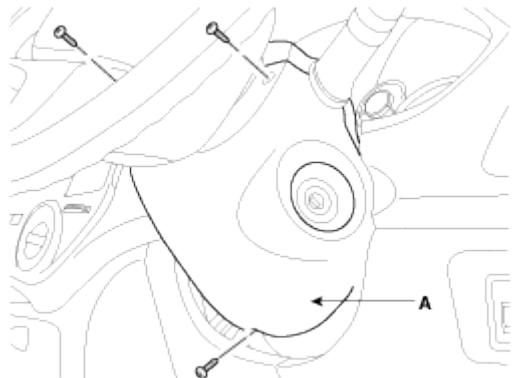
3. Remove the steering column lower shroud (A) after removing 3 screws.

(Refer to the ST group - "Steering column and shaft")

[LHD]

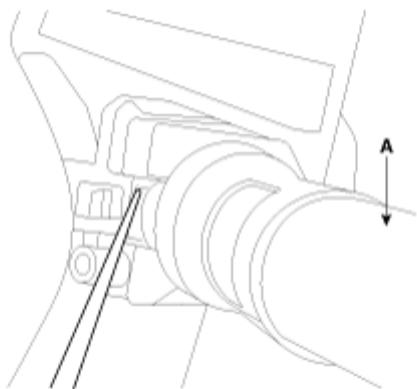


[RHD]

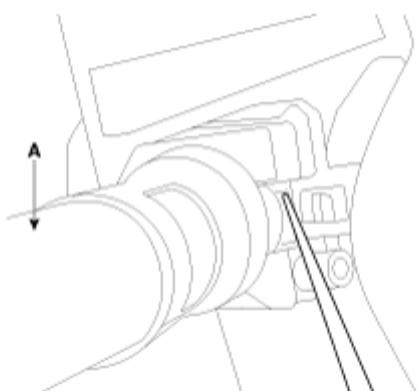


4. Remove the wiper switch (A) by releasing the lock with a suitable tool without removing the steering wheel.

[LHD]



[RHD]



Installation

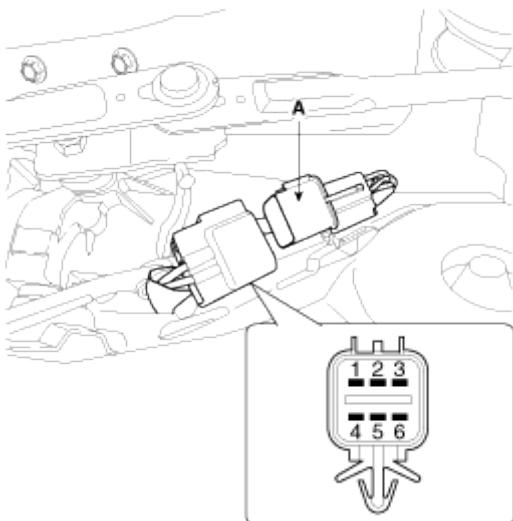
1. Connect the wiper switch connector.
2. Install the steering column lower shrouds.

12.14.3. Front Wiper Motor 12.14.3.1. Repair procedures

Inspection

Speed Operation Check

1. Remove the connector (A) from the wiper motor.



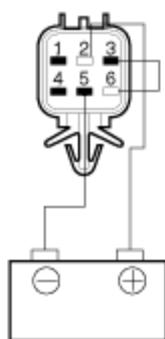
(Terminal Information

No.1. Blank, 2. B, 3. Parking, 4. High, 5. E, 6. Low)

2. Attach the positive (+) lead from the battery to terminal 2 and the negative (-) lead to terminal 6.
3. Check that the motor operates at low speed.
4. Connect the positive (+) lead from the battery to terminal 2 and the negative (-) lead to terminal 4.
5. Check that the motor operates at high speed.

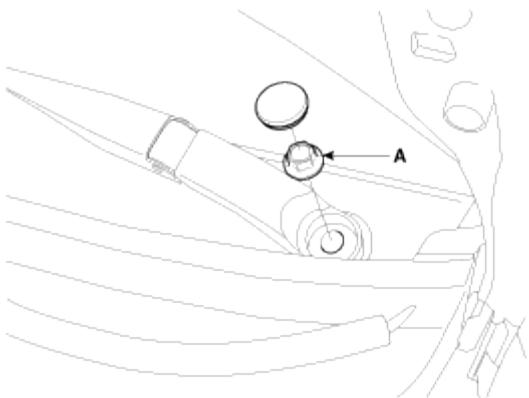
Automatic Stop Operation Check

1. Operate the motor at low speed using the stalk control.
2. Stop the motor operation anywhere except at the off position by disconnecting terminal 3.
3. Connect terminals 3 and 6.
4. Connect the positive (+) lead from the battery to terminal 2 and the negative (-) lead to terminal 5.
5. Check that the motor stops running at the off position.

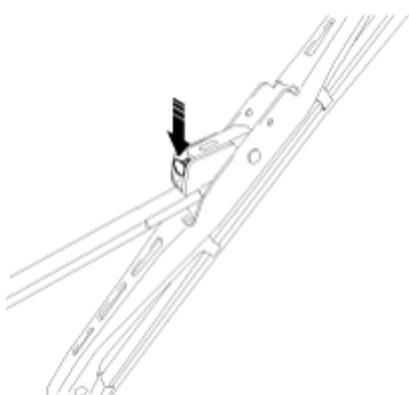


Removal

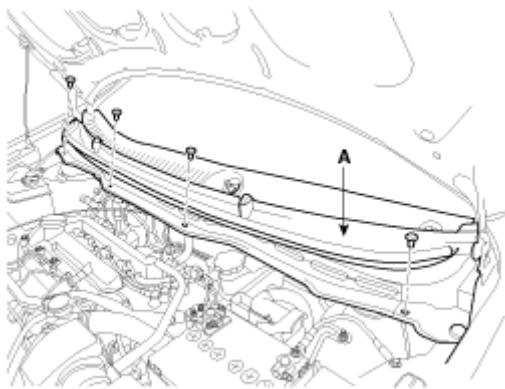
1. Remove the windshield wiper arm and blade after removing a nut (A).



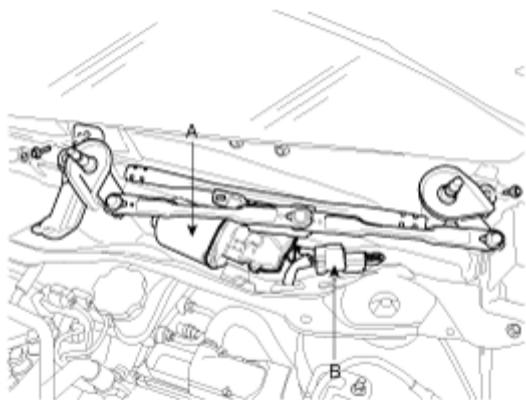
2. If necessary, push in the button of the wiper blade clip and remove the wiper blade from the inside radius of the wiper arm.



3. Remove the weather strip and the cowl top cover (A) after removing 4 retainers.



4. Remove the windshield wiper motor and linkage assembly (A) after removing 2 bolts. Disconnect the wiper motor connector (B) from the wiper motor & linkage assembly.



Installation

1. Install the wiper motor and linkage assembly and then connect the wiper motor connector.

7-11N.m (0.7-1.1, kgf.m, 5.0-7.9 lbf-ft)

2. Install the cowl top cover.

3. Install the wiper blade to the wiper arm.

NOTE

- Position the wiper blade pivot in the inside radius of the wiper arm hook.
- And pull the wiper blade pivot into the wiper arm hook until the pivot locks into the hook.

4. Install the windshield wiper arm and blade.

23~27N.m (2.3~2.7 kgf.m, 17~20 lbf-ft)

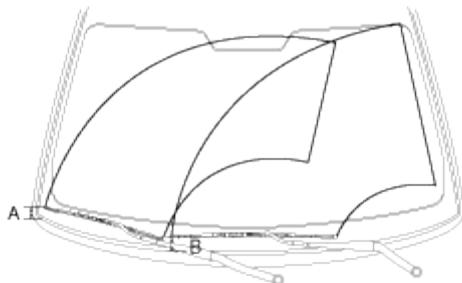
NOTE

- The windshield wiper motor must be cycled to make sure that it is in the park position.
If necessary, adjust the wiper arm and blade.

5. Install the wiper arm and blade to the specified position.

| Specified position | A | B |
|-----------------------|----------------------------------|----------------------------------|
| Distance
[in (mm)] | 1.06 ± 0.2
(27 ± 5) | 1.42 ± 0.2
(36 ± 5) |

(Distance : From the cowl top cover to auto stop position)



12.14.4. Front Washer Motor

12.14.4.1. Repair procedures

Inspection

1. With the washer motor connected to the reservoir tank, fill the reservoir tank with water.

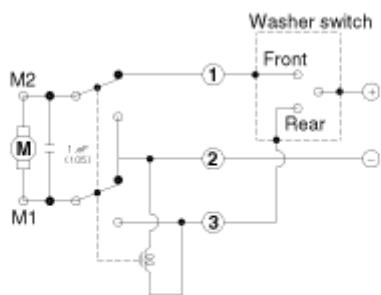
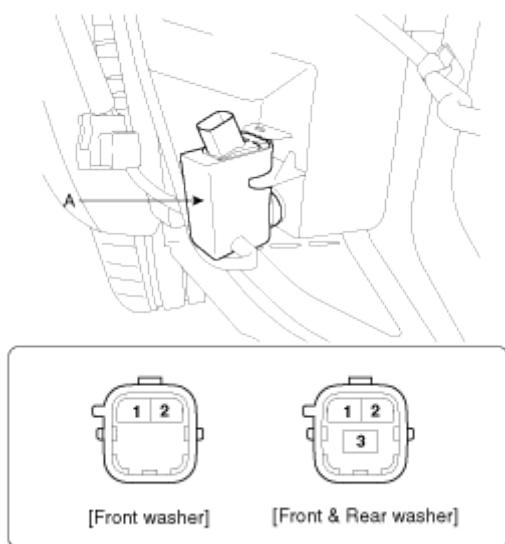
NOTE

Before filling the reservoir tank with water, check the filter for foreign material or contamination. If necessary, clean the filter.

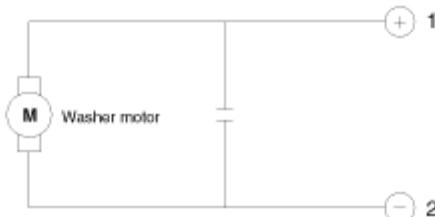
2. Connect positive (+) battery cables to terminal 1 and negative (-) battery cables to terminal 2 respectively.

3. Check that the motor operates normally and the washer motor runs and water sprays from the front nozzles.

4. If they are abnormal, replace the washer motor (A).
(No. 1. Windshield washer(+), 2. Ground, 3. Rear washer(+))



<Windshield & Rear washer motor>



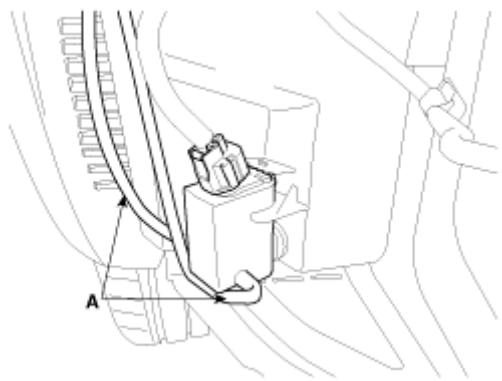
[Windshield washer motor]

Removal

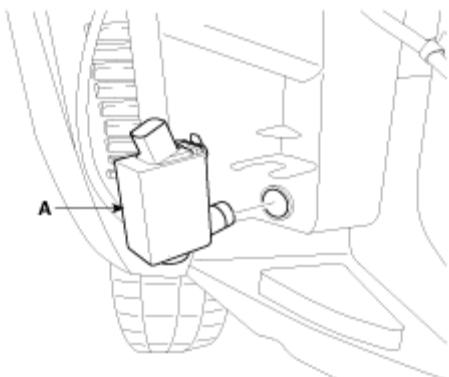
CAUTION

- When servicing the washer pump, be careful not to damage the washer pump seal.
- Do not operate the washer pump before filling the washer reservoir.
Failure to do so could result in premature pump failure.

1. Disconnect the negative (-) battery terminal.
2. Remove the front bumper cover.
(Refer to the BD group - "Front bumper")
3. Remove the washer hose (A) and the washer motor connector.



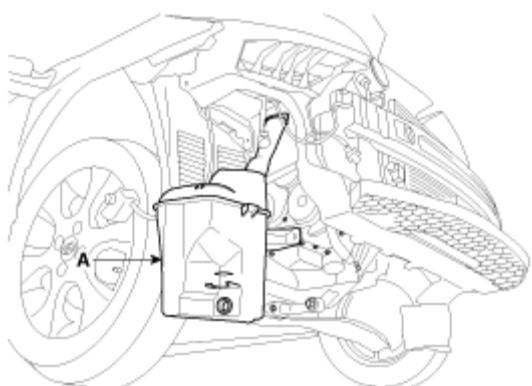
4. Remove the washer motor (A) from the reservoir.



5. Remove the washer reservoir mounting bolts.



6. Remove the washer reservoir (A).



Installation

1. Install the washer reservoir.

NOTE

Before installing the pump motor, check the filter for foreign material or contamination. If necessary, clean the filter into the pump motor.

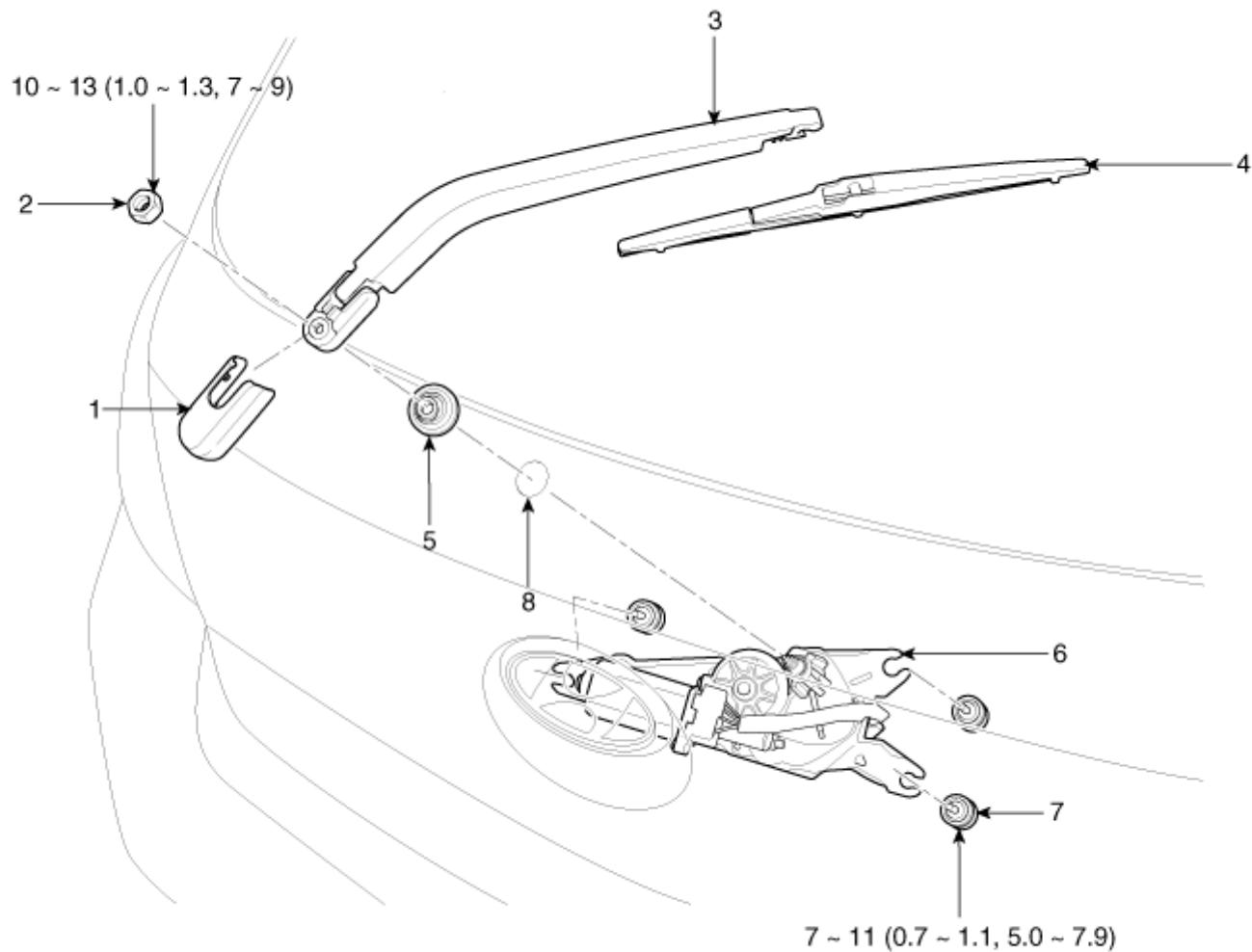
2. Install the washer motor and connect the washer hose and the motor connector.

3. Install the front bumper cover.

12.15. Rear Wiper / Washer

12.15.1. Component and Components Location

Component Location



Torque : N.m (kg.cm, lb-ft)

| | |
|---------------------|------------------------------|
| 1. Head cap | 5. Rear wiper grommet |
| 2. Nut | 6. Rear wiper motor assembly |
| 3. Rear wiper arm | 7. Bolt |
| 4. Rear wiper blade | 8. Panel hole |

12.15.2. Rear Wiper Motor

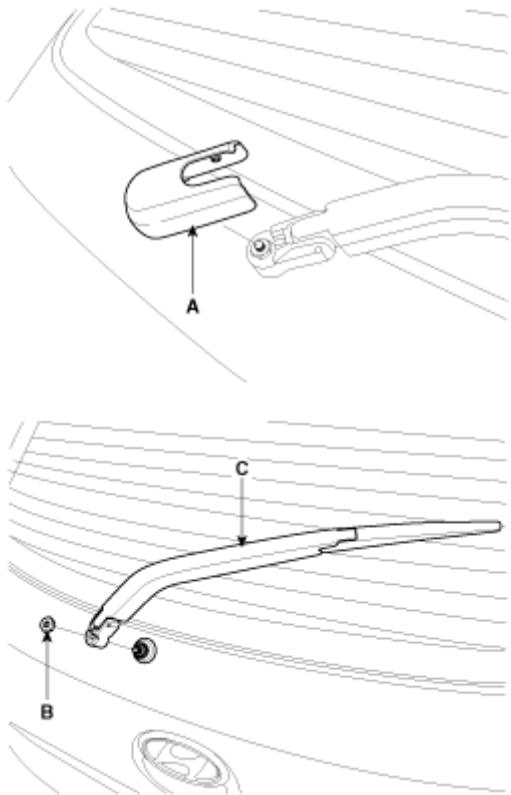
12.15.2.1. Repair procedures

Replacement

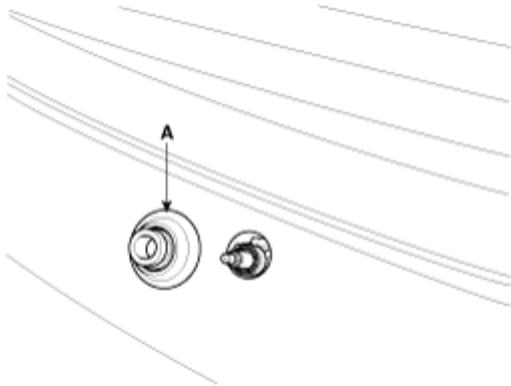
1. Detach the wiper cap (A), then remove the rear wiper arm (C) after removing a nut (B).

Tightening torque :

10~13 Nm (1.0~1.3 kgf.m, 7~9 lbf·ft)



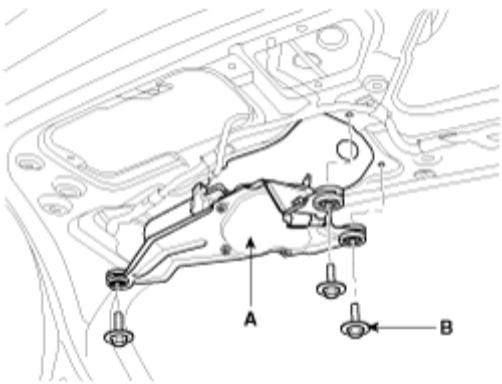
2. Remove the rear wiper grommet (A).



3. Open the tailgate then remove the tailgate trim. (Refer to BD Group - "Tailgate")
4. Disconnect the rear wiper motor connector then remove the rear wiper motor (A) after removing 3 bolts (B).

Tightening torque :

7~11 Nm (0.7~1.1 kgf.m, 5.0~7.9 lbf·ft)



5. Installation is the reverse of removal.

NOTE

Before installation, be sure that the rear wiper motor is in the park position.

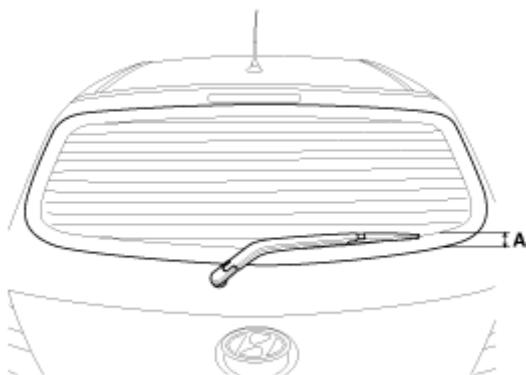
Turn the wiper switch ON and OFF to allow the rear wiper motor to cycle and stop in the park position.

Inspection

1. Install the rear wiper arm and blade to the specified position.

| | |
|---------------------|----------------------------|
| Specified position | (A) |
| Distance
in (mm) | 1.65 ± 0.2
(42 ± 5) |

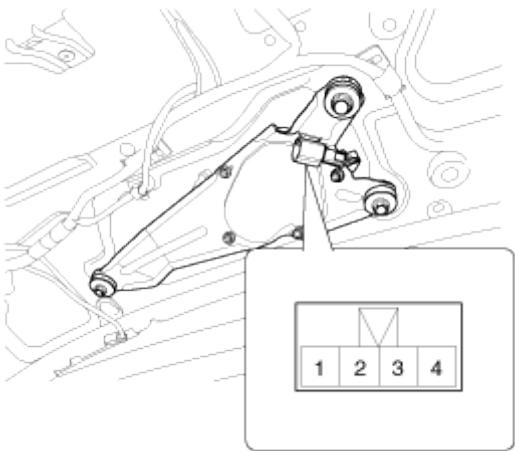
(Distance : From tailgate glass boundary line to rear wiper blade setting)



2. Set the rear wiper blade to the lowest defogger heat line and tailgate glass.

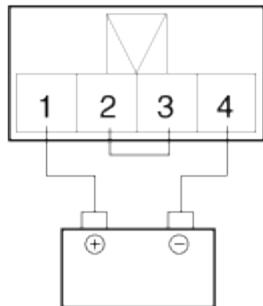
Rear Wiper Motor

1. Remove the 4P connector from the rear wiper motor.
2. Connect battery positive (+) and negative (-) cables to terminals 1 and 4 respectively.
3. Check that the motor operates normally. Replace the motor if it operates abnormally.
(1. B+, 2. Parking, 3. Switch, 4. GND)



Automatic Stop Operation Check

1. Operate the motor at low speed using the stalk control.
2. Stop the motor operation anywhere except at the off position by disconnecting terminal 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.



12.15.3. Rear Washer Switch

12.15.3.1. Repair procedures

Inspection

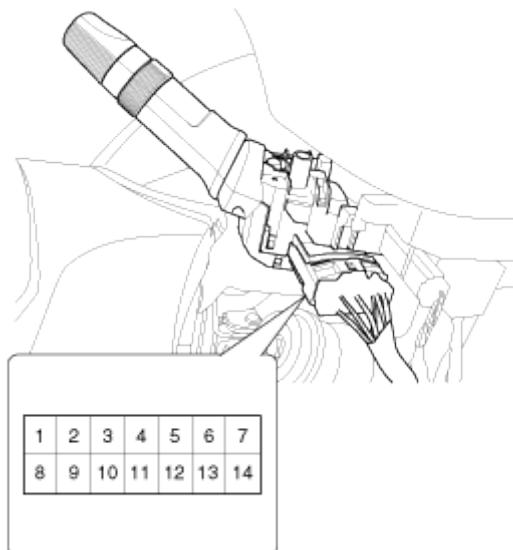
Wiper And Washer Switch Inspection

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

[LHD]



[RHD]



Rear Wiper & Washer Switch

| | | () : RHD | | | |
|-----------|--|-----------|--------|-------|--------|
| Terminal | | 13(9) | 11(11) | 14(8) | 12(10) |
| Position | | | | | |
| OFF | | ○ | —○— | | |
| ON | | ○ | —○— | ○ | |
| ON+WASHER | | ○ | —○— | ○ | ○ |

12.15.4. Rear Washer Motor

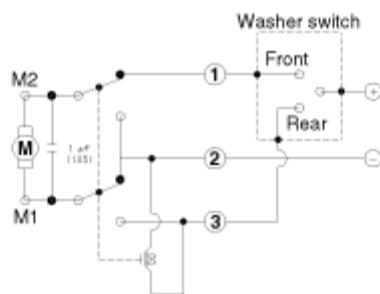
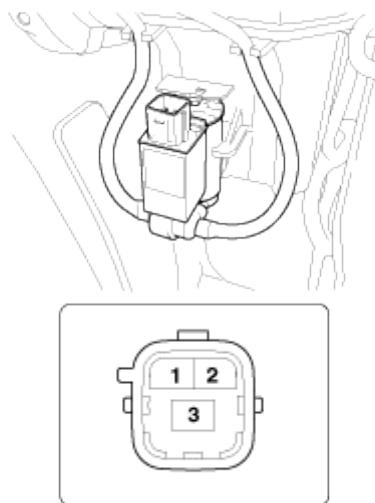
12.15.4.1. Repair procedures

Inspection

1. With the washer motor connected to the reservoir tank, fill the reservoir tank with water.
2. Remove the front bumper cover.
(Refer to the BD group - "Front bumper")
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. Windshield washer (+)
2. Ground
3. Rear washer (+)

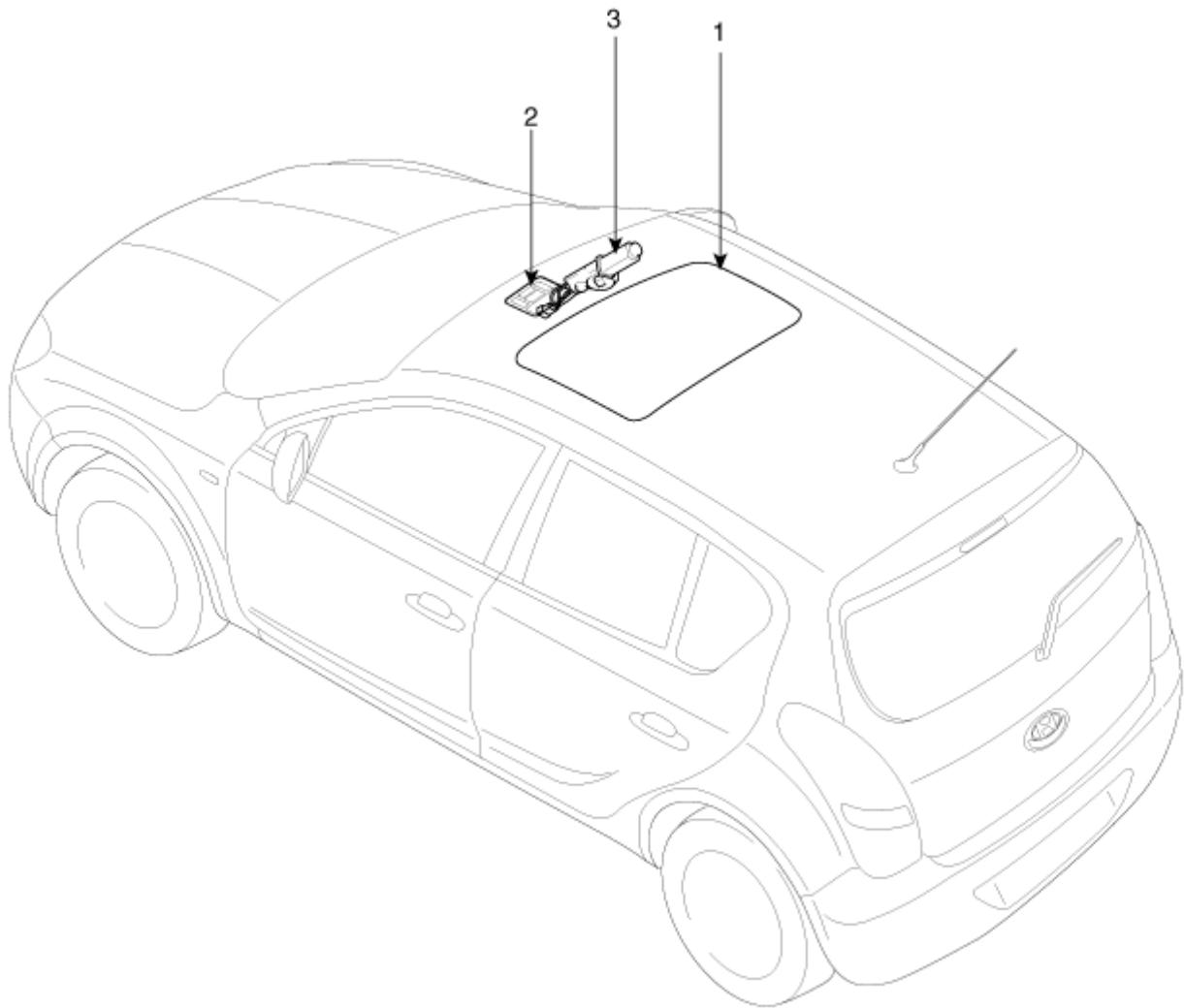


<Windshield & Rear washer motor>

12.16. Sun Roof

12.16.1. Component and Components Location

Component Location

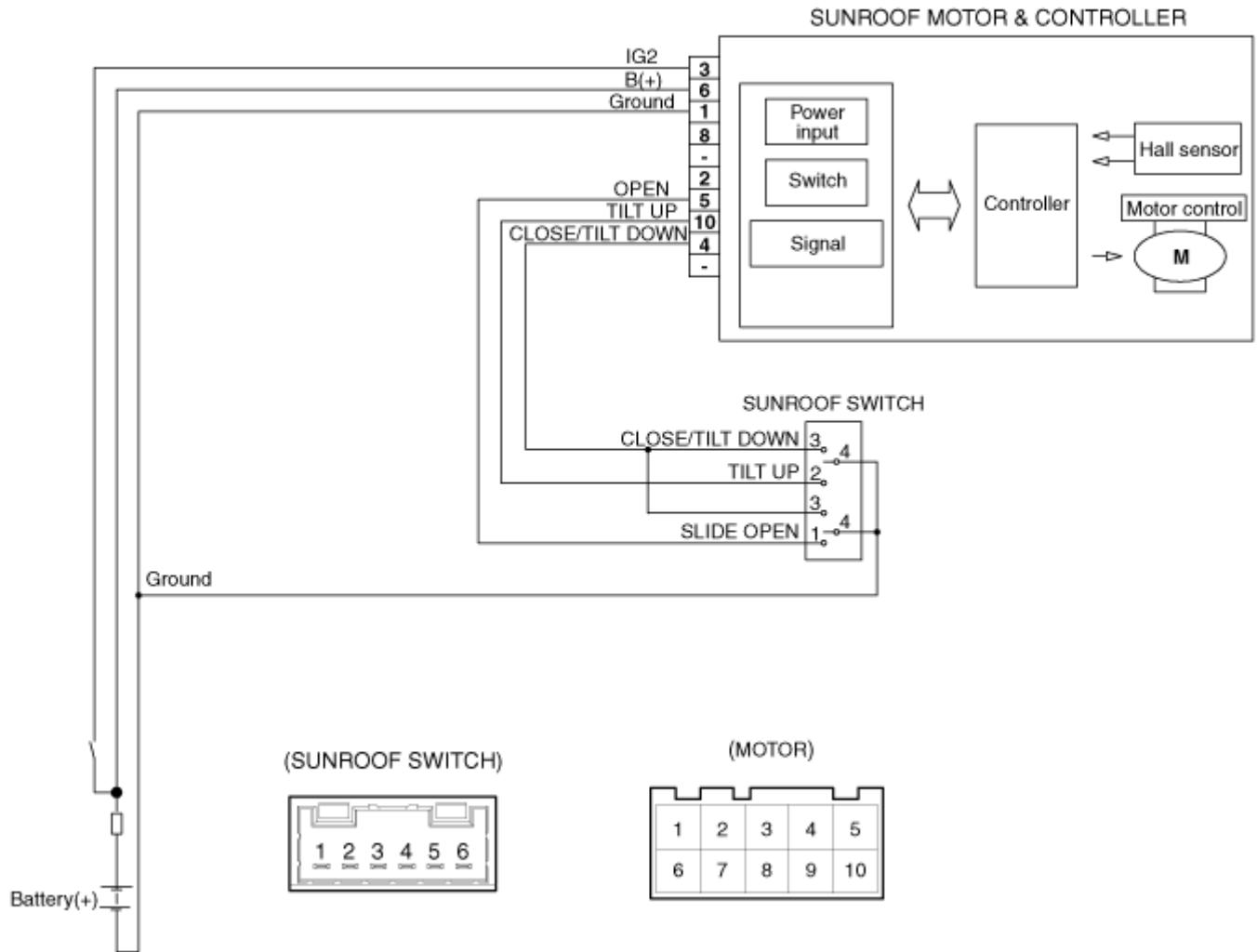


1. Sunroof
2. Sunroof switch

3. Sunroof motor & controller

12.16.2. Schematic Diagrams

Circuit Diagram

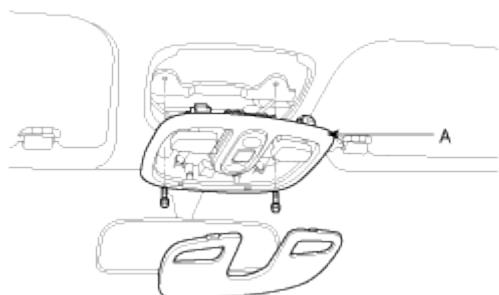


12.16.3. Sunroof Switch

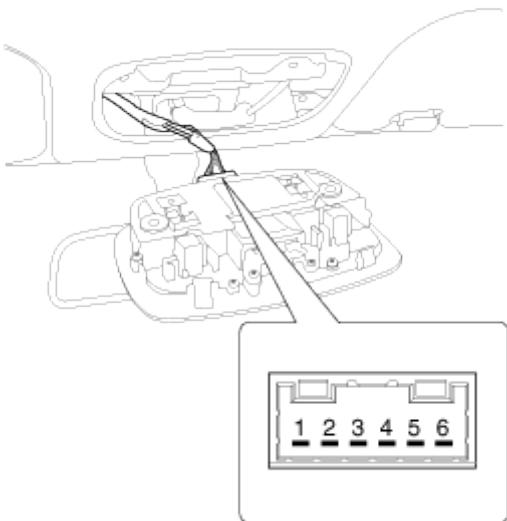
12.16.3.1. Repair procedures

Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the overhead console lamp assembly (A) after removing 2 screws.



3. Check for continuity between the terminals. If the continuity is not as specified, replace the sunroof switch.

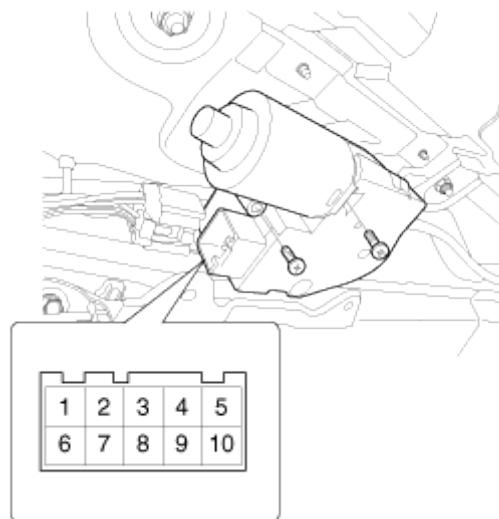


| Terminal Position \n | 1 | 2 | 3 | 4 |
|----------------------|---|---|---|---|
| TILT UP | | ○ | — | ○ |
| CLOSE/
TILT DOWN | | | ○ | — |
| SLIDE OPEN | ○ | — | | ○ |

12.16.4. Sunroof Motor 12.16.4.1. Repair procedures

Replacement

1. Disconnect the negative (-) battery terminal.
2. Remove the overhead console then remove the sun roof motor mounting screws (3EA). And then remove the sunroof motor after disconnecting the connector (10 Pin).



3. Ground the terminals as below table, and check that the sunroof unit operates as below table.

| Terminal Position \n | 3 | 4 | 5 | 10 |
|----------------------|---|---|---|----|
| TILT UP | ⊕ | | | ⊖ |
| SLIDE CLOSE/DOWN | ⊕ | ⊖ | | |
| SLIDE OPEN | ⊕ | | ⊖ | |

4. Make these input tests at the connector
if any test indicates a problem, find and correct the cause, then recheck the system.

If all the input tests prove OK, the sunroof motor must be faulty; replace it.

| Terminal | Test condition | Test : Desired result |
|----------|----------------------|---|
| 3 | IG2 ON | Check for voltage to ground :
There should be battery voltage |
| 1 | Under all conditions | Check for continuity to ground :
There should be continuity. |
| 6 | Under all conditions | Check for voltage to ground :
There should be battery voltage. |

Resetting The Sunroof

Whenever the vehicle battery is disconnected or discharged, or you use the emergency handle to operate the sunroof, you have to reset your sunroof system as follows :

1. Turn the ignition key to the ON position.
2. According to the position of the sunroof, do as follows.
 - (1) In case that the sunroof has closed completely or been tilted :

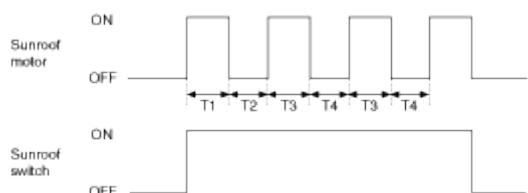
Press the TILT button until the sunroof has tilted upward completely.
 - (2) In case that the sunroof has slide-opened :

Press and hold the CLOSE button for more than 5 seconds until the sunroof has closed completely.
Press and hold the CLOSE button for more than 5 seconds after the sunroof has closed completely. Press the TILT button until the sunroof has tilted upward completely.
3. Release the TILT button.
4. Press and hold the TILT button once again until the sunroof has returned to the original position of TILT after it is raised a little higher than the maximum TILT position.
When this is complete, the sunroof system is reset.

Protecting Motor From Overheating

In order to protect the sunroof motor from overheating from continuous motor operation, the sunroof ECU controls the Run-time and Cool-time of the motor as follows:

1. The Sunroof ECU detects the Run- time of motor
2. Motor can be operated continuously for the 1st run-time(120 ± 10 sec.).
3. The continuous operation of motor stops after the 1st Run-time(120 ± 10 sec.).
4. Then Motor is not operated for the 1st Cool-time(18 ± 2 sec.).
5. Motor is operated for the 2nd Run-time(10 ± 2 sec.) at the continued motor operation after 1st Cool-time(18 ± 2 sec.)
6. The continuous operation of motor stops operating after the 2nd Run-time(10 ± 2 sec.).
7. Motor is not operated for the 2nd Cool-time(18 ± 2 sec.).
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.

12.17. Lighting System

12.17.1. Specifications

Specification

| Items | Bulb Wattage (W) |
|------------------------|------------------|
| Head lamp (HIGH/LOW)) | 60/55 |
| Front turn signal lamp | 21 |
| Front fog lamp | 27 |
| Rear stop/tail lamp | 21/5 |
| Back up lamp | 16 |
| Rear turn signal lamp | 21 |
| Rear fog lamp - Europe | 21 |
| License plate lamp | 5 |
| Side repeater | 5 |
| Room lamp | 10 |
| Overhead console lamp | 10 |
| High mounted stop lamp | 5 |
| Luggage lamp | 5 |
| Glove box lamp | 5 |

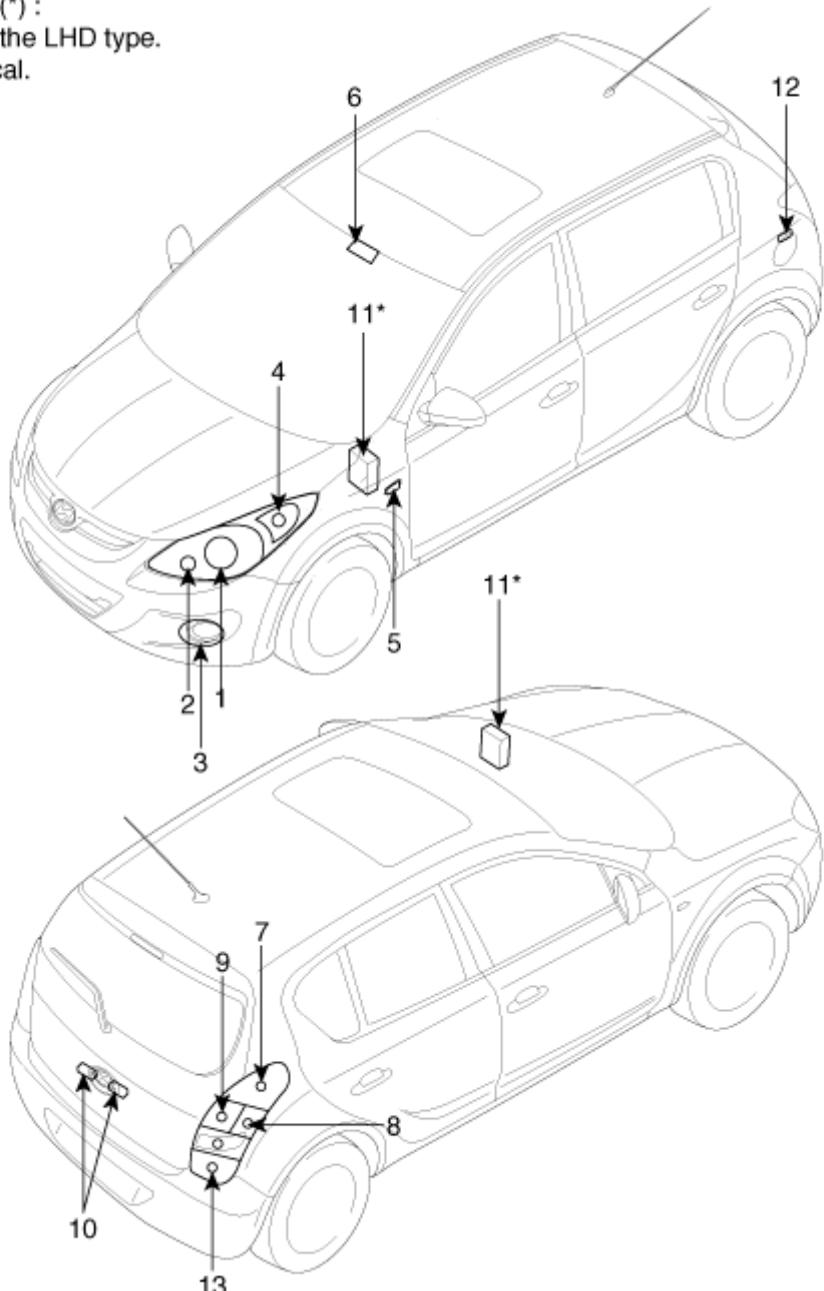
12.17.2. Component and Components Location

Component Location

The parts with asterisk(*) :

This illustration shows the LHD type.

RHD type is symmetrical.



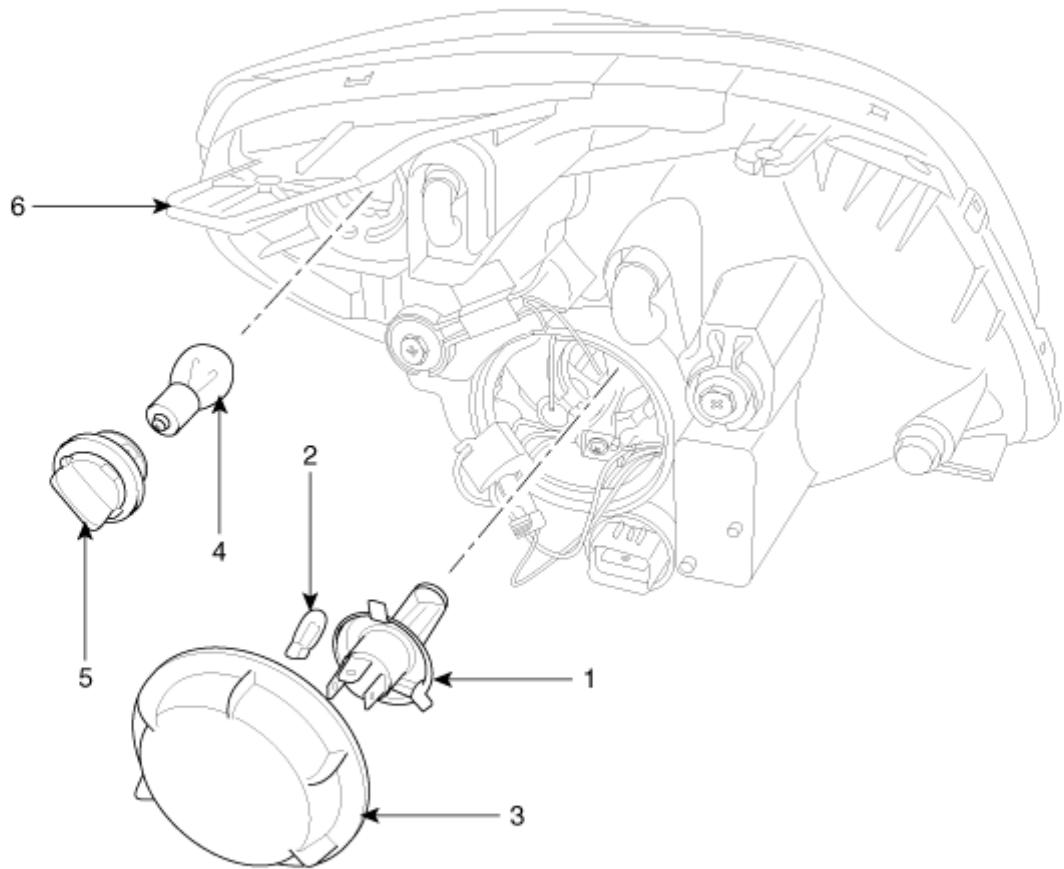
- 1. Head lamp (Low/High)
- 2. Position lamp
- 3. Front fog lamp
- 4. Front turn signal lamp
- 5. Side repeater
- 6. Overhead console lamp
- 7. Tail/Stop lamp
- 8. Rear turn signal lamp

- 9. Back up lamp
- 10. License plate lamp
- 11*. Passenger compartment junction box (Tail lamp relay, Front fog lamp relay, Hazard relay, Rear fog lamp relay)
- 12. Luggage room lamp
- 13. Rear fog lamp (EUR/GEN)

12.17.3. Head Lamps

12.17.3.1. Component and Components Location

Component Location



1. Head lamp High/Low
 2. Position lamp
 3. Head lamp dust cover

4. Turn signal lamp
 5. Turn signal lamp cap
 6. Head lamp lens and housing assembly

12.17.3.2. Repair procedures

Adjustment

Head Lamp Aiming Instructions

CAUTION

Head lamps become very hot during use; do not touch them or any attaching hardware immediately after they have been turned off.

The head lamps should be aimed with the proper beam-setting equipment, and in accordance with the equipment manufacturer's instructions.

NOTE

If there are any regulations pertinent to the aiming of head lamps in the area where the vehicle is to be used, adjust so

as to meet those requirements.

Alternately turn the adjusting gear to adjust the head lamp aiming. If beam-setting equipment is not available, proceed as follows :

1. Inflate the tires to the specified pressure and remove any loads from the vehicle except the driver, spare tire, and tools.
2. The vehicle should be placed on a flat floor.
3. Draw vertical lines (Vertical lines passing through respective head lamp centers) and a horizontal line (Horizontal line passing through center of head lamps) on the screen.
4. With the head lamp and battery in normal condition, aim the head lamps so the brightest portion falls on the horizontal and vertical lines.

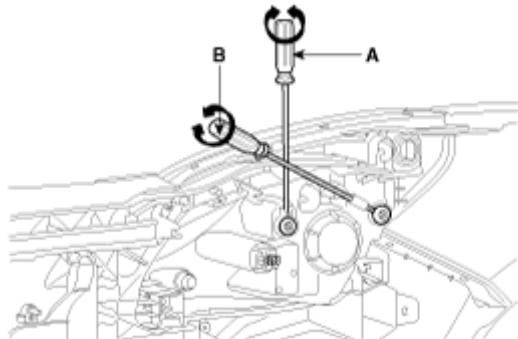
Make vertical (A) and horizontal (B) adjustments to the lower beam using the adjusting wheel.

NOTE

Priority of head lamp aiming :

The horizontal lines should be adjusted after aiming the vertical lines.

| Condition | Aiming Direction | |
|---------------------------|------------------|-------|
| | A | B |
| Turning Clockwise | Down | Left |
| Turning Counter clockwise | Up | Right |

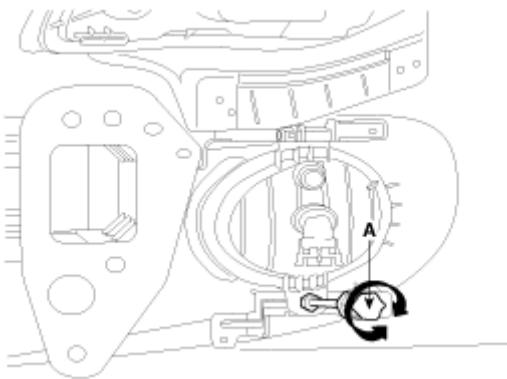


Front Fog Lamp Aiming

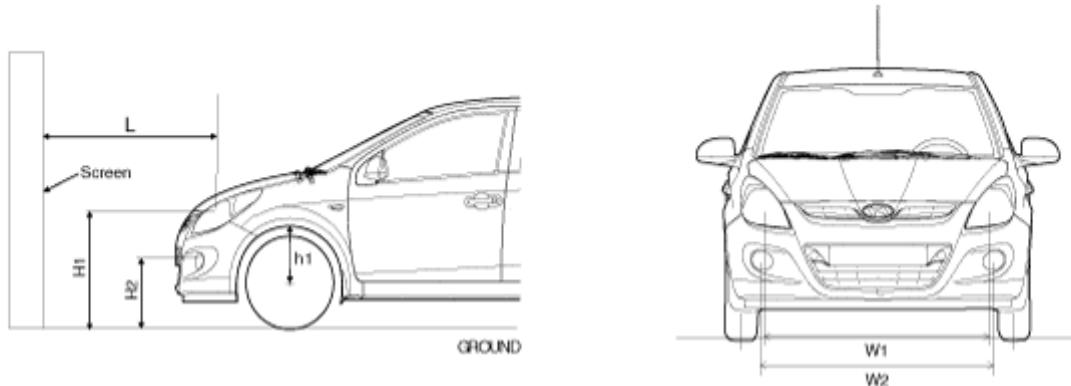
The front fog lamps should be aimed as the same manner of the head lamps aiming.

With the front fog lamps and battery normal condition, aim the front fog lamps by turning the adjusting gear (A).

| Condition | Aiming Direction |
|---------------------------|------------------|
| Turning Clockwise | Down |
| Turning Counter clockwise | Up |



Head Lamp And Fog Lamp Aiming Point



H1 : Height between the head lamp bulb center and ground (Low & High Beam)

H2 : Height between the fog lamp bulb center and ground

W1 : Distance between the two head lamp bulbs centers (Low & High Beam)

W2 : Distance between the two fog lamp bulbs centers

L : Distance between the head lamp bulb center and screen

h1 : Front Ride height

Unit : in (mm)

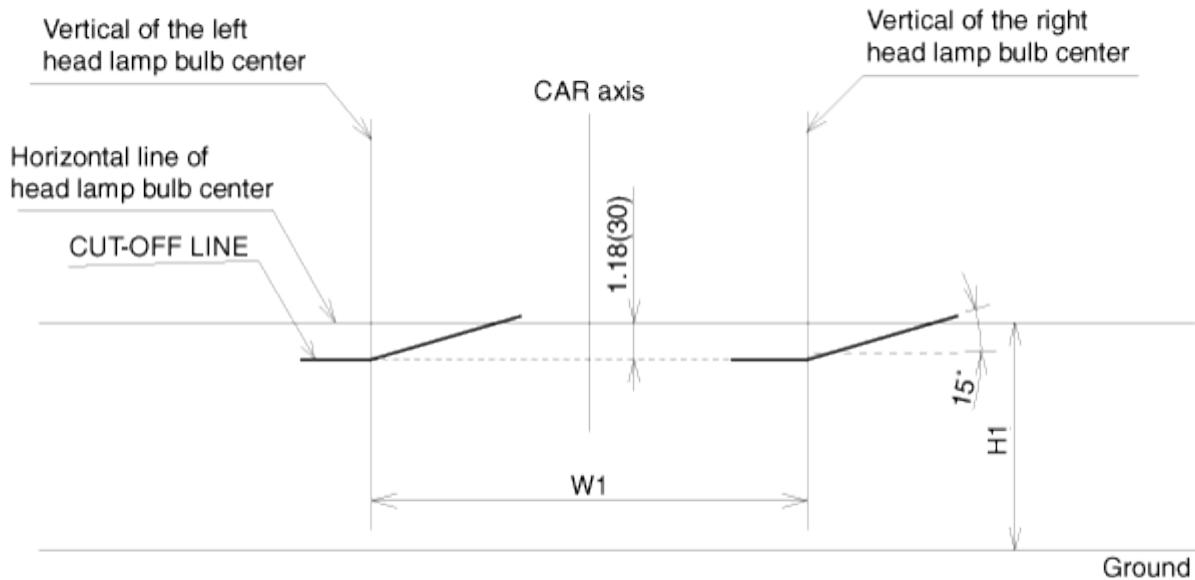
| Vehicle condition | | H1 | H2 | h1 | W1 | W2 | L |
|---------------------------|----------------|-----------|-----------|-----------|-------------|-------------|------------|
| India | Without driver | 27.6(702) | 17.0(433) | 14.5(368) | 49.3(1,252) | 50.4(1,280) | 118(3,000) |
| | With driver | 27.3(694) | 16.7(425) | | | | |
| EC,
General,
M/East | Without driver | 27.0(687) | 16.5(418) | | | | |
| | With driver | 26.7(679) | 16.1(410) | | | | |

1. Turn the low beam on with driver.

The cut-off line should be projected in the allowable range shown in the picture.

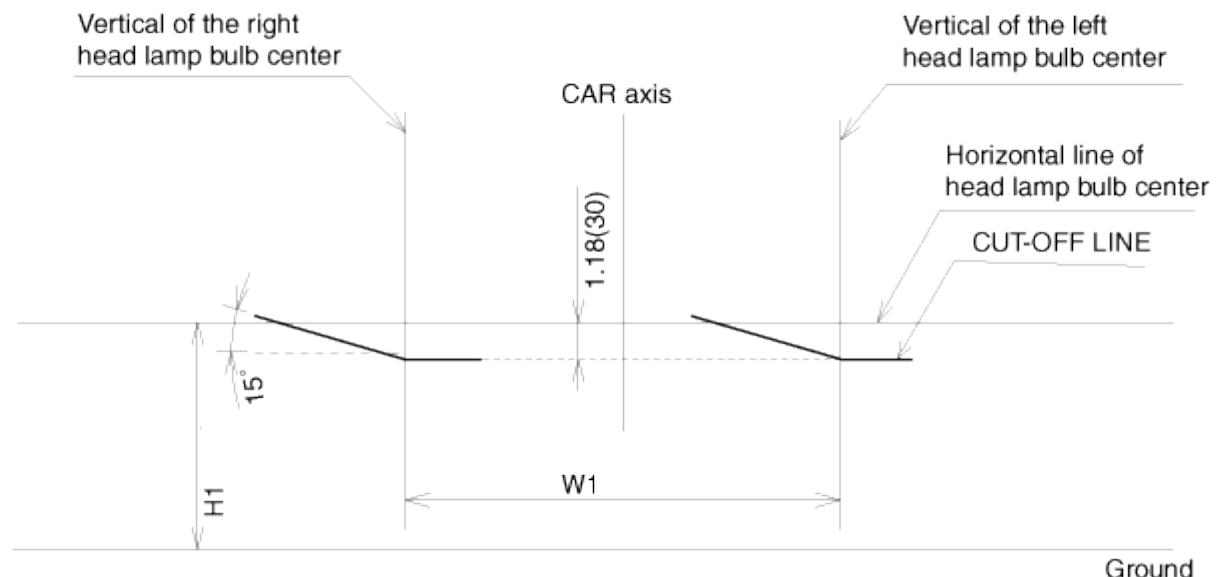
In case of equipping with the leveling device, set the leveling device switch on the "O" position.

[LHD] - EC, General, M/East



Unit : in.(mm)

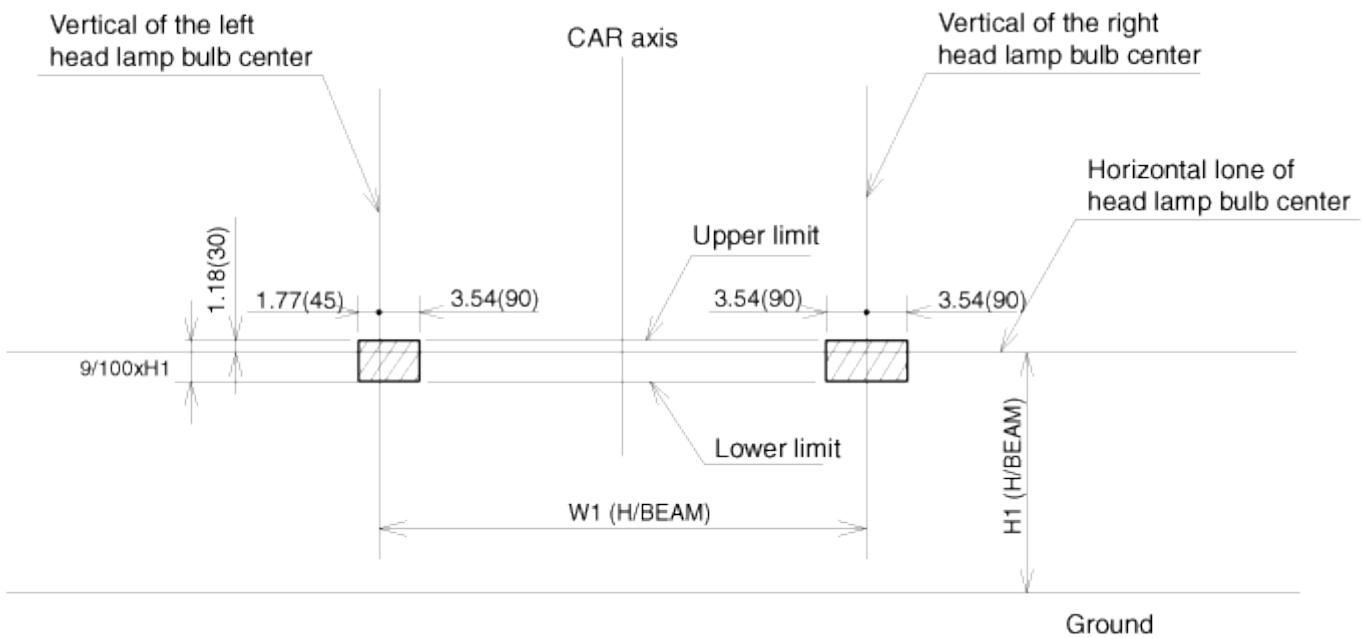
[RHD] - India, EC, General



Unit : in.(mm)

2. Turn the high beam on with driver.

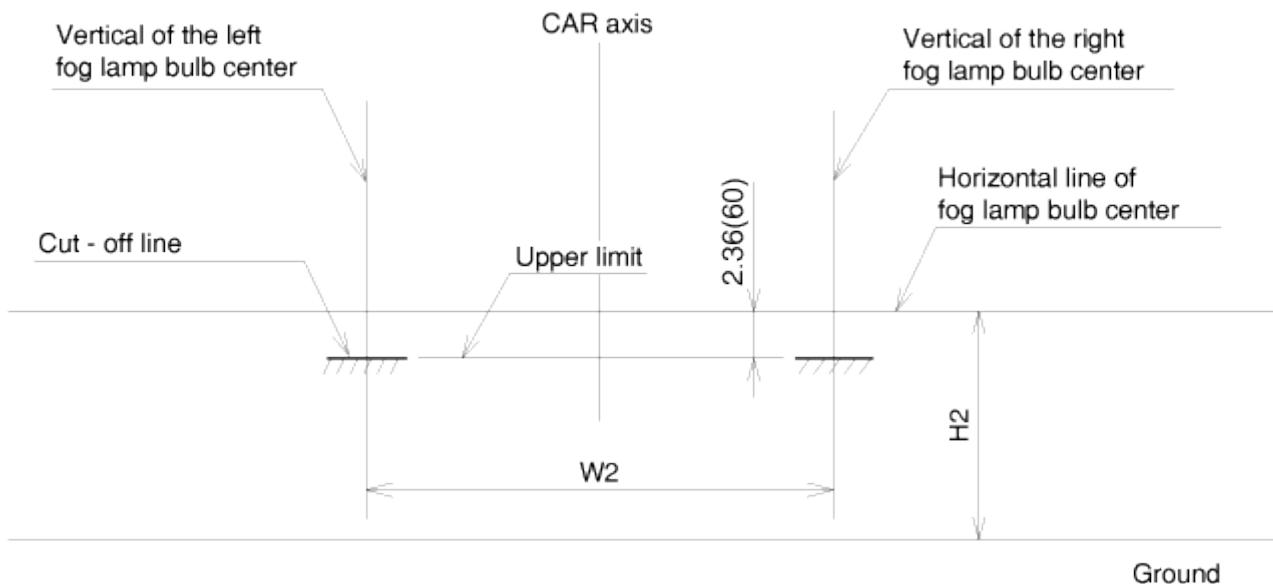
The HOT-Zone should be projected in the allowable range (shaded region).



Unit : in.(mm)

3. Turn the front fog lamp on with driver.

The cut-off line should be projected in the allowable range shown in the picture.



Unit : in.(mm)

Removal

CAUTION

Head lamps become very hot during use; do not touch them or any attaching hardware immediately after they have been turned off.

NOTE

The headlamp bulb should not be removed from the headlamp assembly until just before a new bulb is installed.

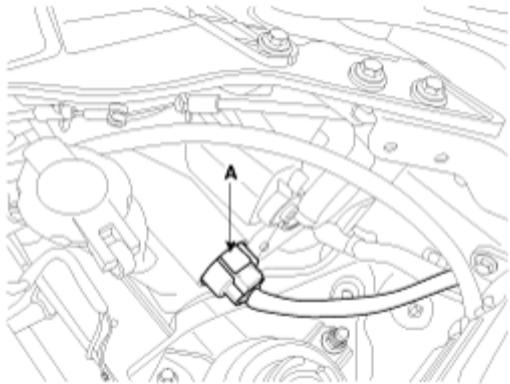
Removing bulb for an extended period of time may affect headlamp bulb performance.

Contaminants may enter the headlamp assembly where they can settle on the lens and reflector.

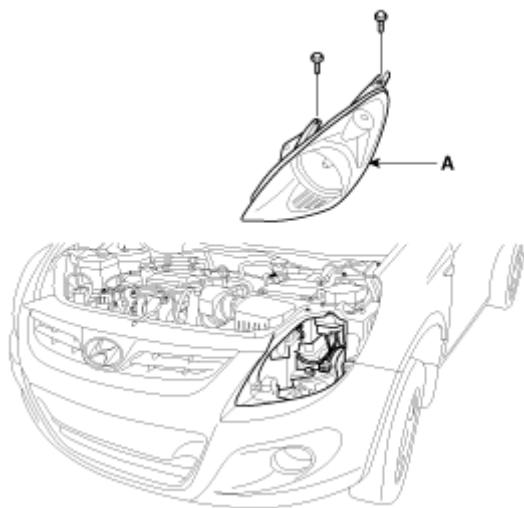
Never turn on the head lamps with the bulb removed from the headlamp assembly.

1. Disconnect the negative (-) battery terminal.

2. Disconnect the head lamp connector (A).

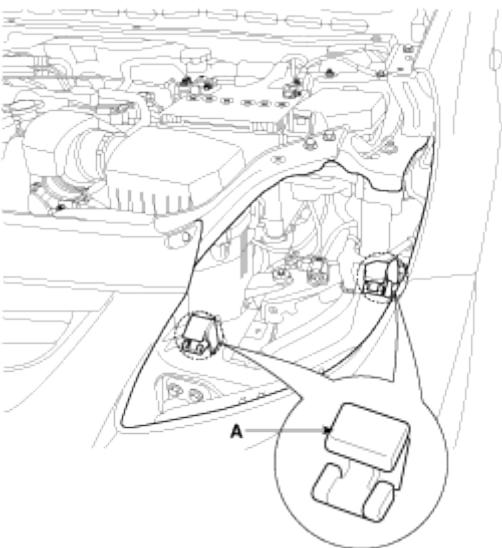


3. Loosen the mounting bolts (2EA) of head lamp. Remove the head lamp assembly (A).



NOTE

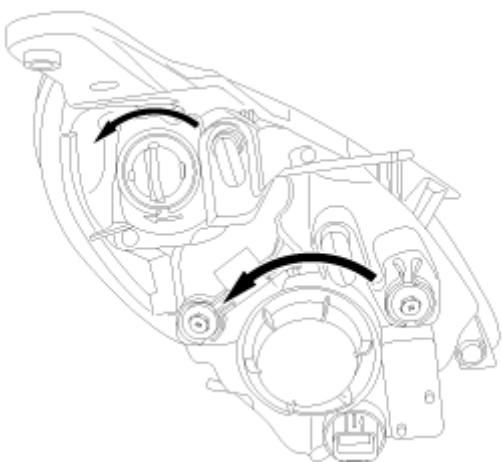
Take care that retaining clips (A) is not to be damaged.



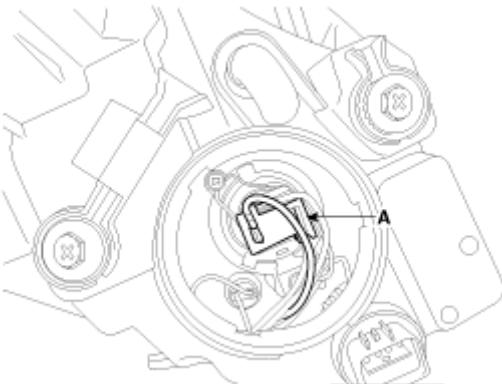
4. Remove the bulb caps from the head lamp assembly after turning in the counter clock-wise direction.

A : Head lamp high/low bulb & position bulb cap

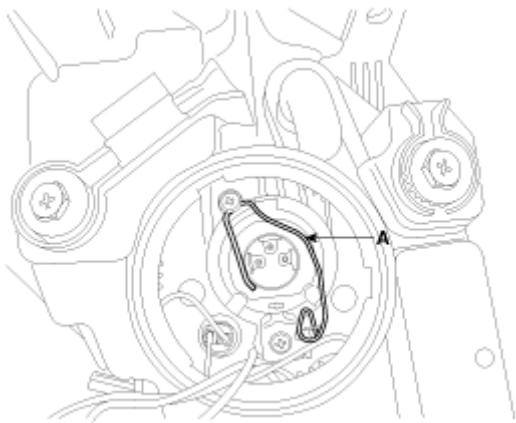
B : Turn signal bulb cap



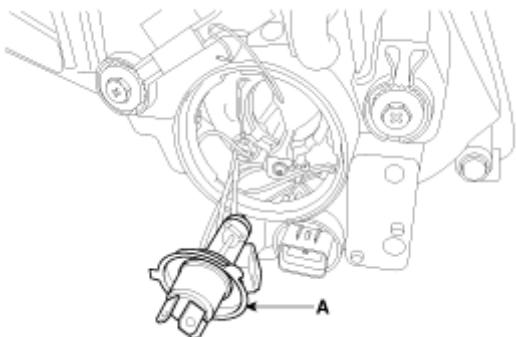
5. Disconnect the head lamp bulb connector (A).



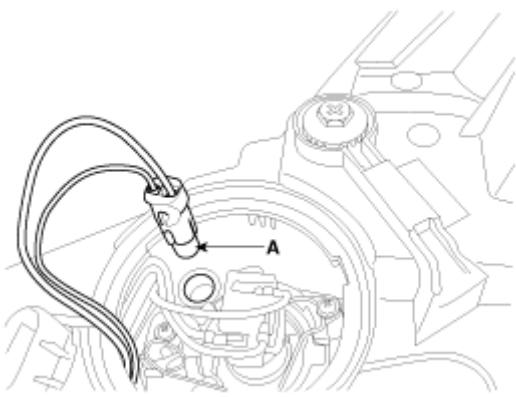
6. Release the lock of the set spring (A).



7. Remove the head lamp bulb (A).



8. If necessary to remove the position lamp, remove the position bulb (A) without removing the head lamp bulb.



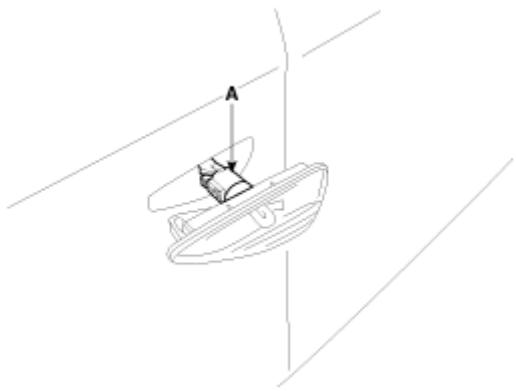
Installation

1. Install the head lamp bulbs.
2. Install the head lamp bulb caps.
3. Install the head lamp assembly after connecting the lamp connector.

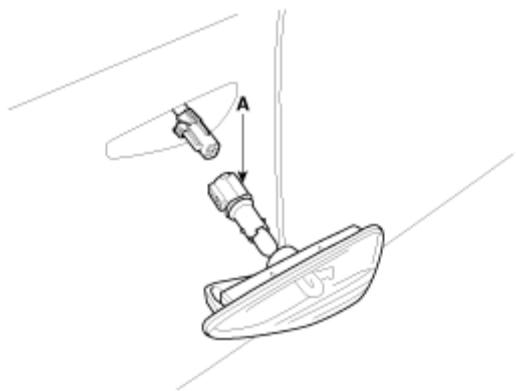
12.17.4. Turn Signal Lamp (Side repeater) 12.17.4.1. Repair procedures

Removal

1. Disconnect the negative(-)battery terminal.
2. Remove the fender side repeater lamp (A).



3. Disconnect the connector then remove the bulb (A).



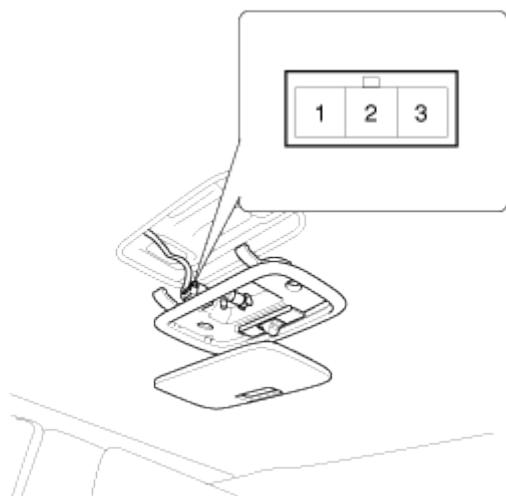
Installation

1. Install the bulb.
2. Reconnect the lamp connector.
3. Install the side repeater lamp.

12.17.5. Room Lamp 12.17.5.1. Repair procedures

Inspection

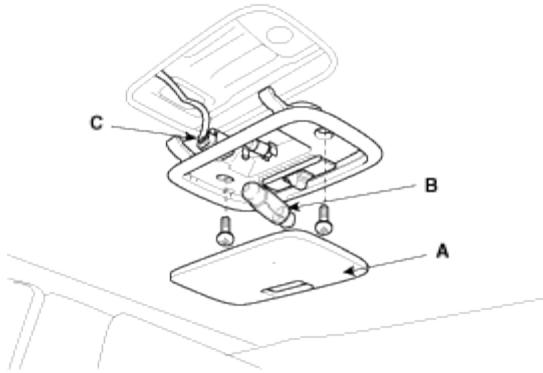
1. Remove the front room lamp assembly then check for continuity between terminals.



| Terminal
Position | 1 | 3 | 2 |
|----------------------|---|---|---|
| DOOR | | ○ | — |
| ON | ○ | — | ○ |
| OFF | | | |

Removal

1. Disconnect the negative (-) battery terminal.
2. Detach the lamp lens (A) from the front room lamp with a flat-tip screwdriver then remove the bulb (B).



3. Loosen the fixing screw (2EA) and disconnect the 3P connector (C). And then remove the front room lamp assembly.

Installation

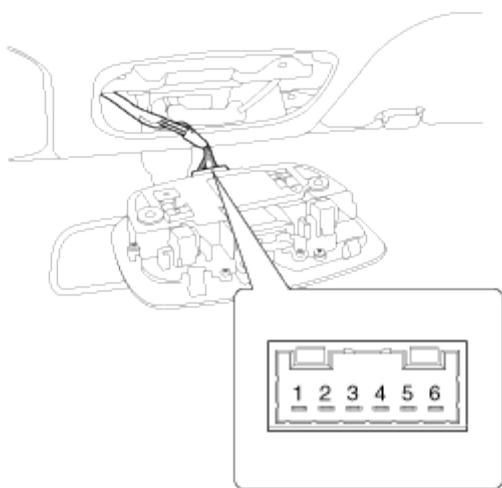
1. Install the front room lamp assembly after connecting the lamp connector.
2. Install the lamp lens after assembling the bulb.

12.17.6. Overhead Console Lamp

12.17.6.1. Repair procedures

Inspection

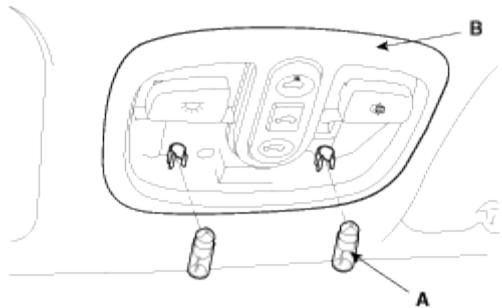
Remove the overhead console lamp assembly then check for continuity between terminals. If the continuity is not as specified, replace the overhead console lamp assembly.



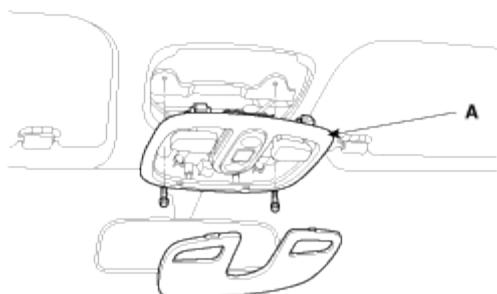
| Position
Terminal \ | 4 | 5 | 6 |
|------------------------|-----------|-----------|---|
| DOOR | | ○ — T — ○ | |
| ROOM | ○ — T — ○ | | |
| OFF | | | |

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the lamp lens and then remove the lamp bulb (A) from the overhead console lamp (B).



3. Remove the overhead console lamp (A) after loosening the overhead console lamp bolts(2EA).



Installation

1. Install the overhead console lamp after connecting the sunroof switch and lamp connector.
2. Install the lens after tightening 2 bolts.

12.17.7. Hazard Lamp Switch

12.17.7.1. Repair procedures

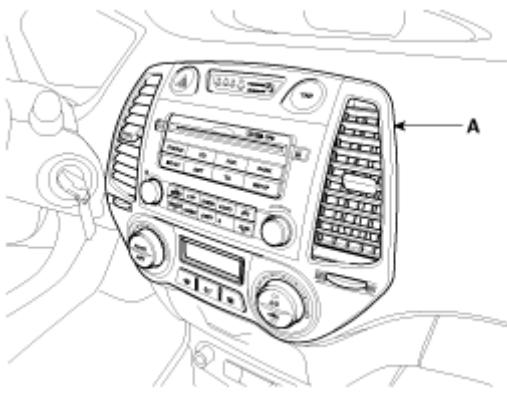
Inspection

Hazard Lamp Switch

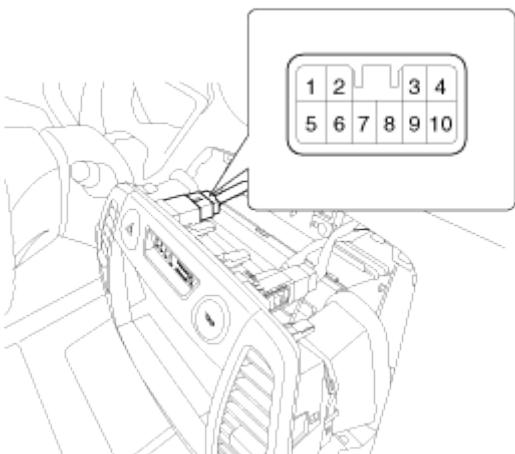
1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad center fascia panel (A).

NOTE

Take care not to scratch the crash pad and related parts.



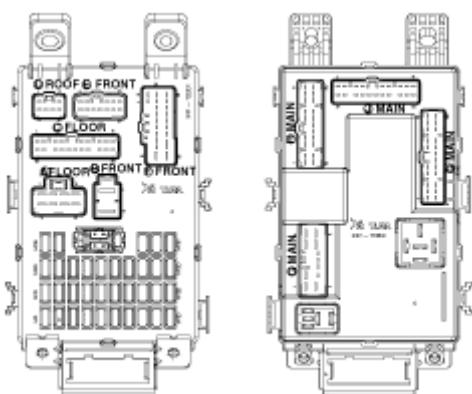
3. Disconnect the hazard lamp switch connector.



4. Operate the switch and check for continuity between terminals with an ohmmeter.

| Terminal Position | OFF | ON | Remark |
|-------------------|-----|-----------------|----------------|
| 5 | ○ | | IGN |
| 7 | | ○ | Battery |
| 8 | ○ | ○ | Common |
| 6 | | ○ | F BATT |
| 10 | | ○ | Right |
| 9 | | ○ | Left |
| 2 | ○ | ○ — (wavy line) | Illumination + |
| 3 | | ○ | Illumination - |

Hazard lamp relay



Check for continuity between the terminals.

1. There should be continuity between the B1 and K2 (or K3) terminals when power and ground are connected to the B1

and J16 terminals in the I/P Junction box.

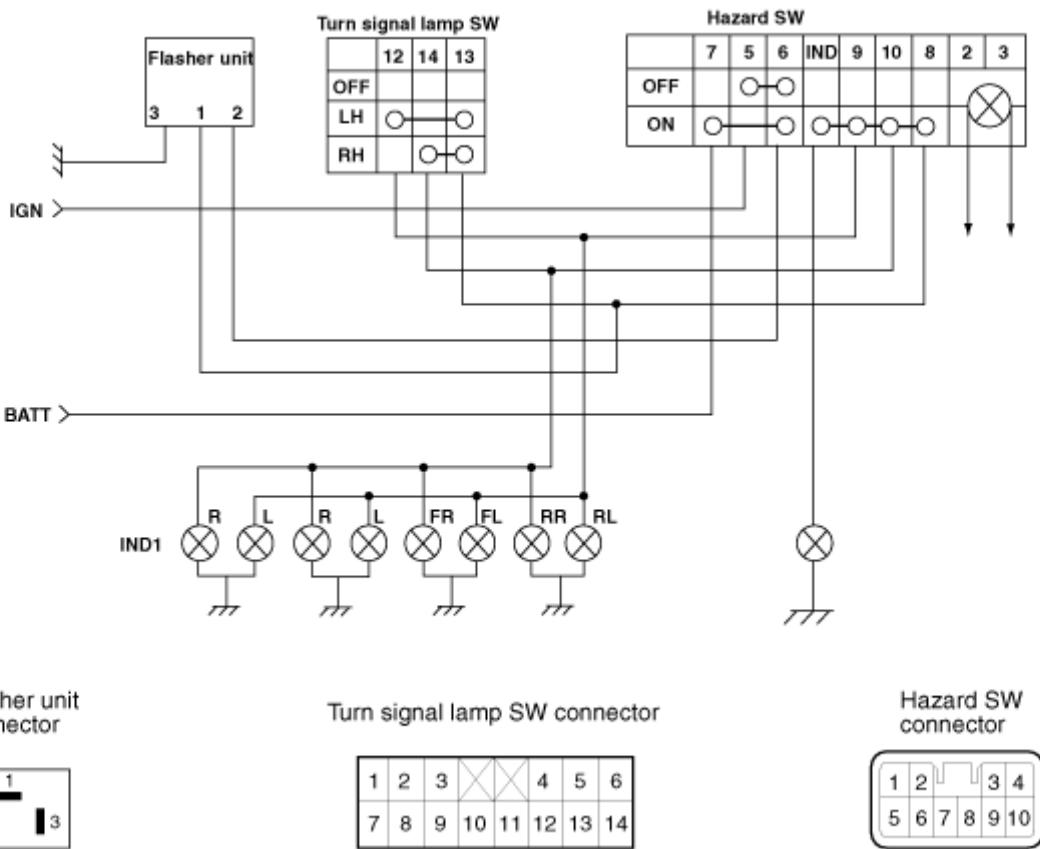
2. There should be no continuity between the B2 and K2 (or K3) terminals when power is disconnected.

| Terminal Power | I/P-B (1) | I/P-J (16) | I/P-B (1) | I/P-K (2 or 3) |
|----------------|-----------|------------|-----------|----------------|
| Disconnected | ○ | ○ | | |
| Connected | + | - | ○ | ○ |

12.17.8. Flasher Unit

12.17.8.1. Schematic Diagrams

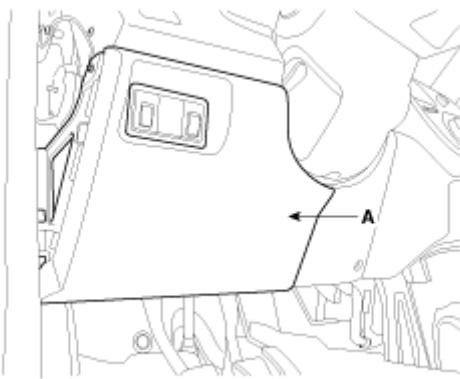
Circuit Diagram



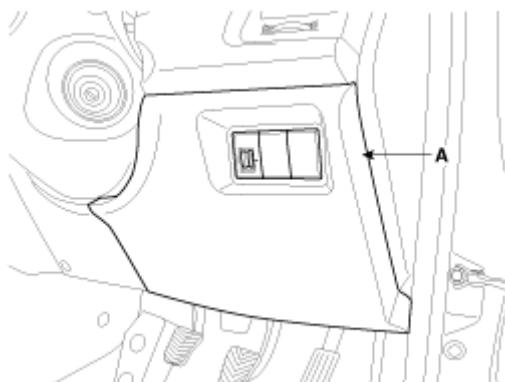
12.17.8.2. Repair procedures

Inspection

1. Disconnect the negative (-) battery terminal.
 2. Remove the fuse box cover.
 3. Remove the fuse box cover (A).
- [LHD]**



{RHD}

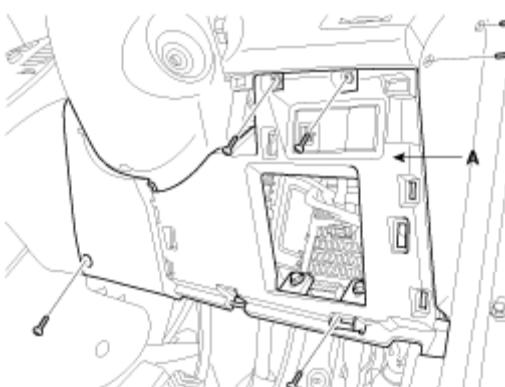


4. Remove the driver crash pad lower panel (A).

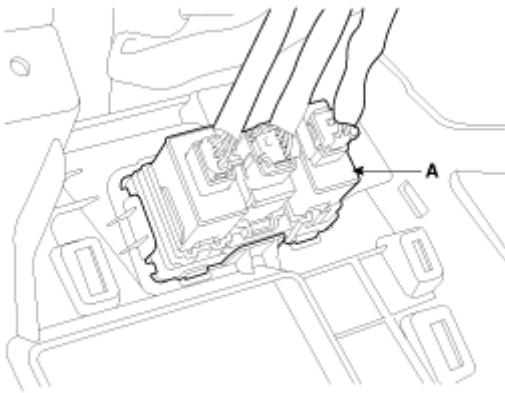
[LHD]



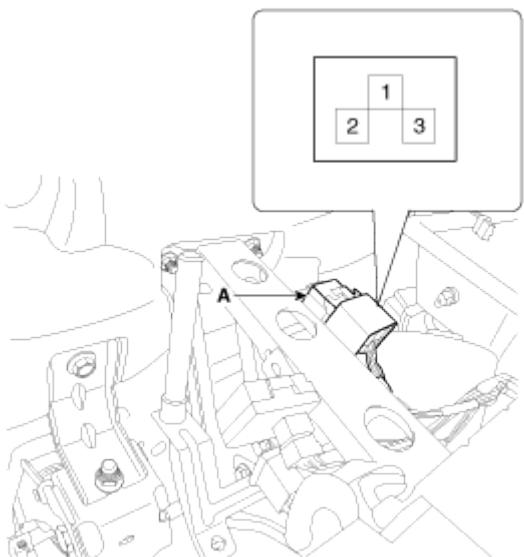
[RHD]



5. Disconnect the connectors (A) from the crash pad lower panel.



6. Pull out the flasher unit (A) from relay box (Passenger compartment).



7. Connect the positive (+) lead from the battery to terminal 2 and the negative (-) lead to terminal 3.

8. Connect the two turn signal lamps in parallel to terminals 1 and 3. Check that the bulbs turn on and off.

NOTE

The turn signal lamps should flash 60 to 120 times per minute. If one of the front or rear turn signal lamps has an open circuit, the number of flashes will be more than 120 per minute. If operation is not as specified, replace the flash unit.

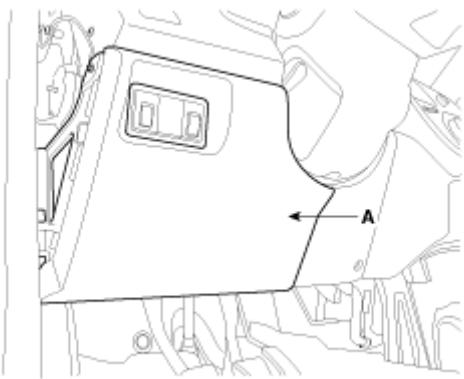
12.17.9. Rheostat

12.17.9.1. Repair procedures

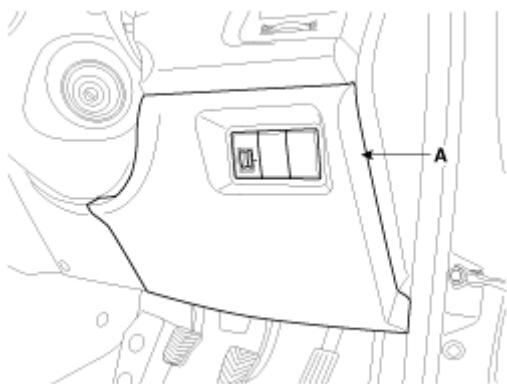
Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the fuse box cover (A).

[LHD]

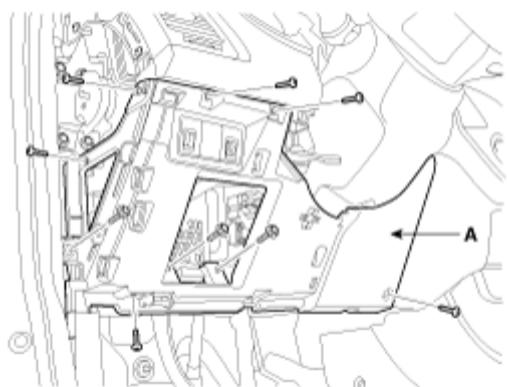


[RHD]

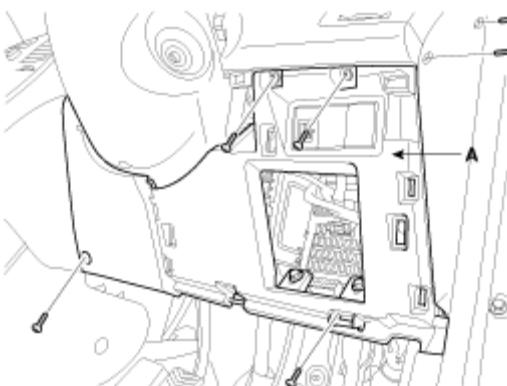


3. Remove the lower side crash pad switch assembly (A) by using the trim remover tool.

[LHD]

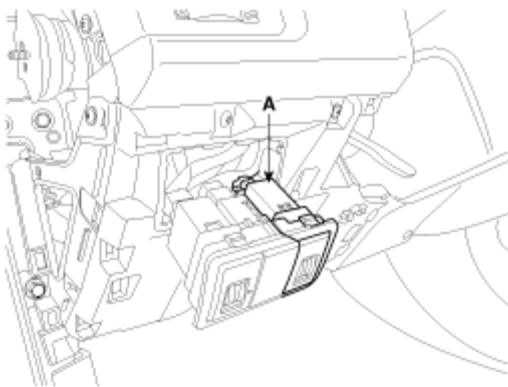


[RHD]

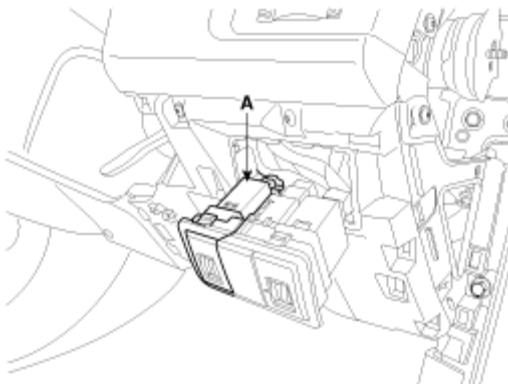


4. Disconnect the rheostat switch connector (A).

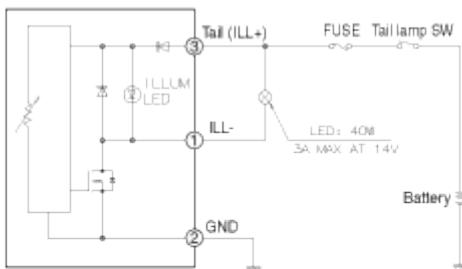
[LHD]



[RHD]



- Check for intensity of new rheostat switch. If the light intensity of the lamps changes smoothly without any flickering when the rheostat is turned, it can be assumed that the rheostat is normal.

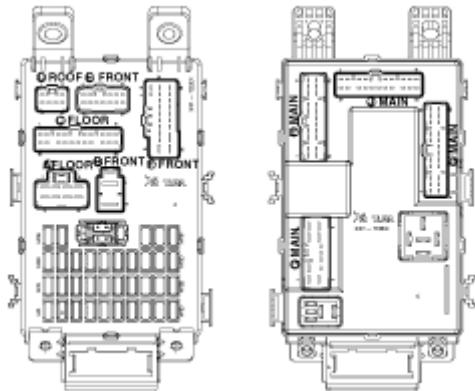


12.17.10. Front Fog Lamp 12.17.10.1. Repair procedures

Inspection

Front Fog Lamp Relay

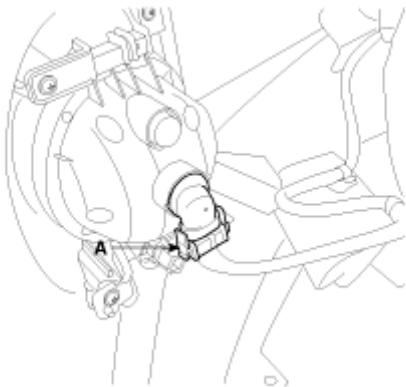
- Disconnect the negative(-) battery terminal.
- Pull out the front fog lamp relay from the passenger compartment relay box.
- Check for continuity between terminals. There should be continuity between the B2 and F15 (or H13) terminals when power and ground are connected to the G7 and G6 terminals in the I/P Junction box.
- There should be no continuity between the B2 and F15 terminals when power is disconnected.



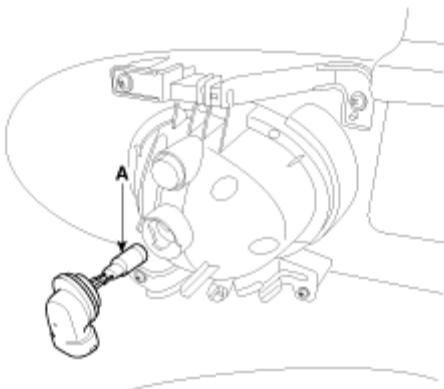
| Terminal
Power \ | I/P-G
(7) | I/P-G
(6) | I/P-B
(2) | I/P-F
(15) |
|---------------------|--------------|--------------|--------------|---------------|
| Disconnected | | ○ — ○ | | |
| Connected | ○ — ○ | | ○ — ○ | |

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the front side cover screw.
3. Remove the front fog lamp assembly connector (A).



4. Remove the front fog lamp bulb (A) turning in the counter clock-wise direction.



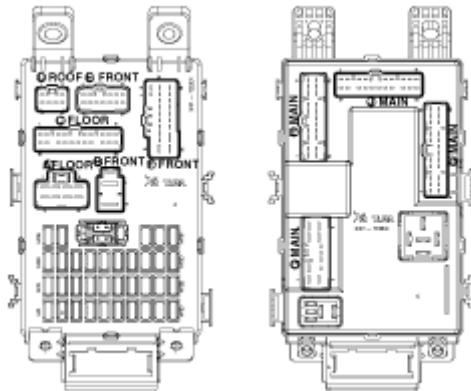
Installation

1. Install the front fog lamp bulb.
2. Connect the front fog lamp connector.
3. Install the front side cover.

12.17.11. Rear Fog Lamp

Inspection

Rear fog lamp relay



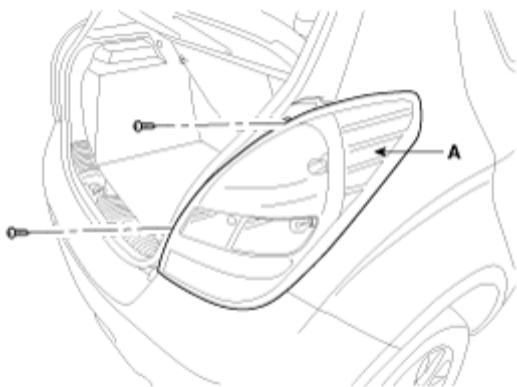
Check for continuity between the terminals.

1. There should be continuity between the B2 and F15 (or H13) terminals when power and ground are connected to the G7 and G6 terminals in the I/P Junction box.
2. There should be no continuity between the B2 and F15 terminals when power is disconnected.

| Terminal
Power \ | I/P-G
(2) | I/P-J
(11) | I/P-B
(2) | I/P-C
(13) |
|---------------------|--------------|---------------|--------------|---------------|
| Disconnected | ○ — ○ | | | |
| Connected | ○ — ○ | ○ — ○ | | |

Removal

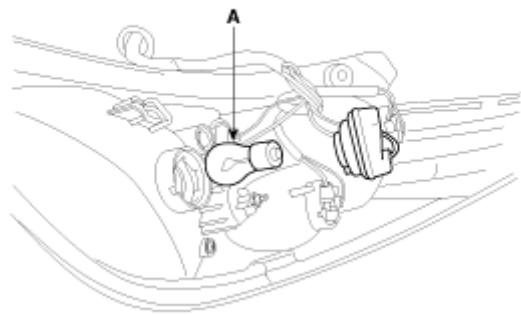
1. Disconnect the negative (-) battery terminal.
2. Loose the screws (2EA) holding the rear combination lamp then remove the rear combination lamp (A).



3. Disconnect the connector.



4. Remove the rear fog lamp bulb (A) turning in the counter clockwise direction.



Installation

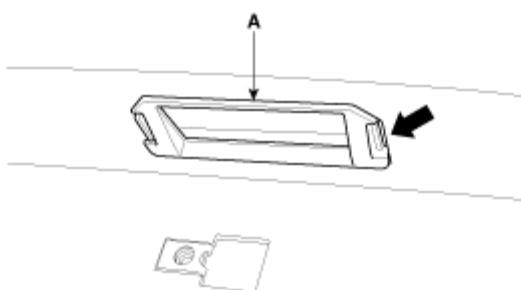
1. Connect the lamp connector after assembling the rear fog lamp bulb.
2. Install the rear combination lamp assembly.

12.17.12. License Lamps 12.17.12.1. Repair procedures

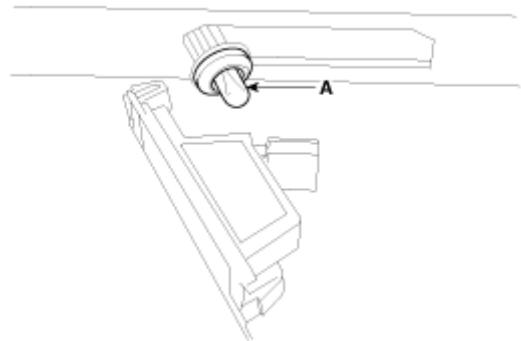
Removal

License Lamp

1. Disconnect the negative (-) battery terminal.
2. Remove the license lamp lens (A) by using the remover tool

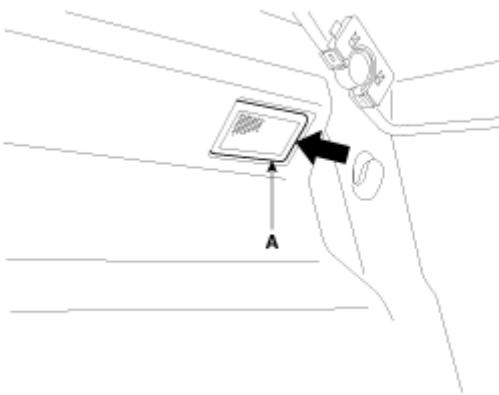


3. Remove the bulb (A).

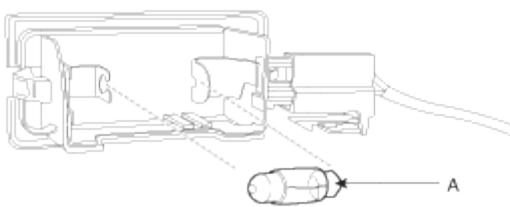


Tailgate Room Lamp

1. Disconnect the negative(-) battery terminal.
2. Remove the tailgate room lamp lens (A) from the luggage side trim.



3. Remove the bulb (A).



Installation

License Lamp

1. Install the bulb.
2. Install the license lamp lens.

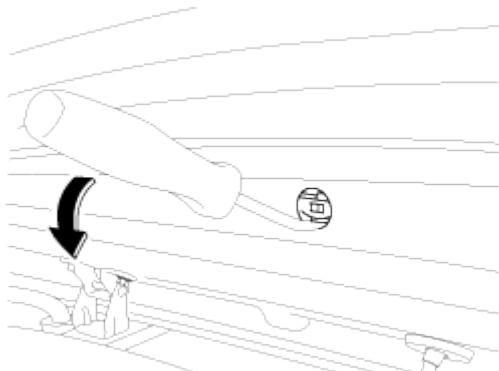
Tailgate Room Lamp

1. Install the bulb.
2. Install the tailgate room lamp lens.

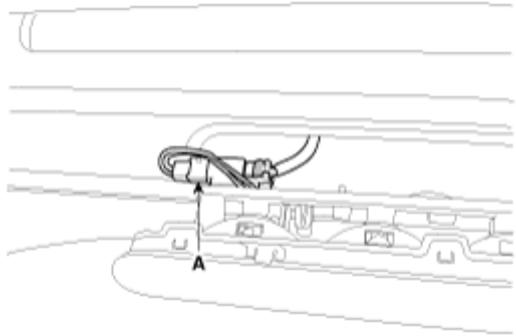
[12.17.13. High Mounted stop lamp](#)
[12.17.13.1. Repair procedures](#)

Removal

1. Disconnect the negative(-) battery terminal.
2. Remove the high mounted stop lamp by using a screw driver or remover tool.



3. Disconnect the lamp connector (A) and rear washer hose then remove the high mounted stop lamp.



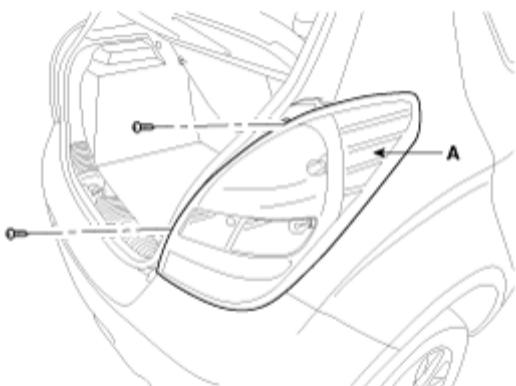
Installation

1. Connect the high mounted stop lamp connector and rear washer hose.
2. Install the high mounted stop lamp.

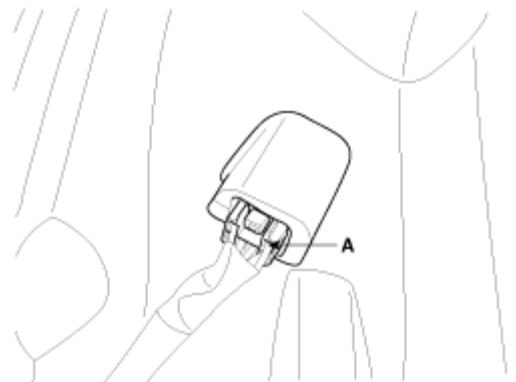
12.17.14. Rear combination Lamp 12.17.14.1. Repair procedures

Removal

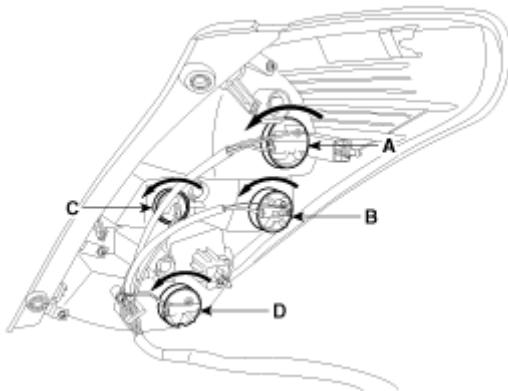
1. Disconnect the negative (-) battery terminal.
2. Loose the screws (2EA) holding the rear combination lamp then remove the rear combination lamp (A).



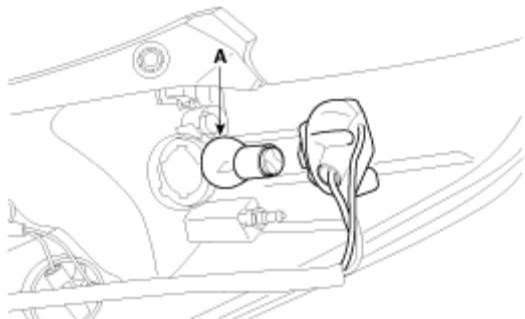
3. Disconnect the connector (A).



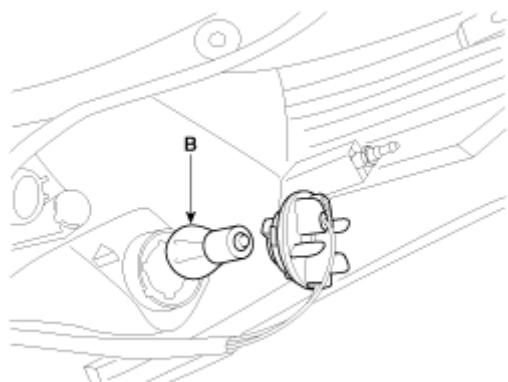
4. Remove the bulbs (4EA) turning in the counter clockwise direction.



A : Tail / Stop lamp

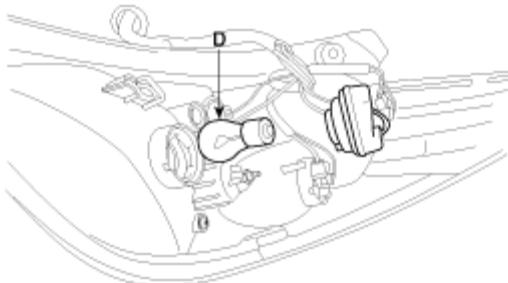


B : Rear turn signal lamp



C : Back up lamp

D : Rear fog lamp (Europe) / Tail lamp (General)



Installation

1. Connect the lamp connector after assembling the bulb.
2. Install the rear combination lamp assembly.

12.17.15. Troubleshooting

Troubleshooting

| Symptom | Possible cause | Remedy |
|---|--------------------------------------|----------------------------------|
| One lamp does not light
(all exterior) | Bulb burned out | Replace bulb |
| | Socket, wiring or ground faulty | Repair if necessary |
| Head lamps do not light | Bulb burned out | Replace bulb |
| | Head lamp fuse (10A) blown | Check for short and replace fuse |
| | Head lamp fuse (10A) blown | Check for short and replace fuse |
| | Head lamp relay faulty | Check relay |
| | Lighting switch faulty | Check switch |
| | Wiring or ground faulty | Repair if necessary |
| Tail lamps and license plate lamps do not light | Bulb burned out | Replace bulb |
| | Tail lamp fuse (10A) blown | Check for short and replace fuse |
| | Tail lamp relay faulty | Check relay |
| | Lighting switch faulty | Check switch |
| | Wiring or ground faulty | Repair if necessary |
| Stop lamps do not light | Bulb burned out | Replace bulb |
| | Stop lamp fuse (10A) blown | Check for short and replace fuse |
| | Stop lamp switch faulty | Adjust or replace switch |
| | Wiring or ground faulty | Repair if necessary |
| Stop lamps do not turn off | Stop lamp switch faulty | Repair or replace switch |
| Instrument lamps do not light
(Tail lamps light) | Rheostat faulty | Check rheostat |
| | Wiring or ground faulty | Repair if necessary |
| Turn signal lamp does not flash on one side | Bulb burned out | Replace bulb |
| | Turn signal switch faulty | Check switch |
| | Wiring or ground faulty | Repair if necessary |
| Turn signal lamps do not light | Bulb burned out | Replace bulb |
| | Turn signal lamp fuse (10A) blown | Check for short and replace fuse |
| | Flasher unit faulty | Check flasher unit |
| | Turn signal switch faulty | Check switch |
| | Wiring or ground faulty | Repair if necessary |
| Hazard warning lamps do not light | Bulb burned out | Replace bulb |
| | Hazard warning lamp fuse (10A) blown | Check for short and replace fuse |

| | | |
|-----------------------------------|--|----------------------------------|
| | Flasher unit faulty | Check flasher unit |
| | Hazard switch faulty | Check switch |
| | Wiring or ground faulty | Repair if necessary |
| Flasher rate too slow or too fast | Lamps' wattages are smaller or larger than specified | Replace lamps |
| | Flasher unit faulty | Check flasher unit |
| Back up lamps do not light | Bulb burned out | Replace bulb |
| | Back up lamp fuse (10A) blown | Check for short and replace fuse |
| | Back up lamp switch (M/T) faulty | Check switch |
| | Transaxle range switch (A/T) faulty | Check switch |
| | Wiring or ground faulty | Repair if necessary |
| Room lamp does not light | Bulb burned out | Replace bulb |
| | Room lamp fuse (10A) blown | Check for short and replace fuse |
| | Room lamp switch faulty | Check switch |
| | Wiring or ground faulty | Repair if necessary |
| Front fog lamps do not light | Bulb burned out | Replace bulb |
| | Front fog lamp fuse (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 |
| Rear fog lamps do not light | Bulb burned out | Replace bulb |
| | Rear fog lamp fuse (10A) blown | Check for short and replace fuse |
| | Rear fog lamp fuse (10A) blown | Check for short and replace fuse |
| | Rear fog lamp switch faulty | Check switch |
| | Rear fog lamp relay faulty | Check relay |
| | Wiring or ground faulty | Repair if necessary |
| Room lamp does not light | Bulb burned out | Replace bulb |
| | Room lamp fuse (10A) blown | Check for short and replace fuse |
| | Map lamp switch faulty | Check switch |
| | Wiring or ground faulty | Repair if necessary |
| Tailgate room lamp does not light | Bulb burned out | Replace bulb |
| | Room lamp fuse (10A) blown | Check for short and replace fuse |
| | Tailgate room lamp switch faulty | Check switch |
| | Wiring or ground faulty | Repair if necessary |

12.18. Head Lamp Leveling Device

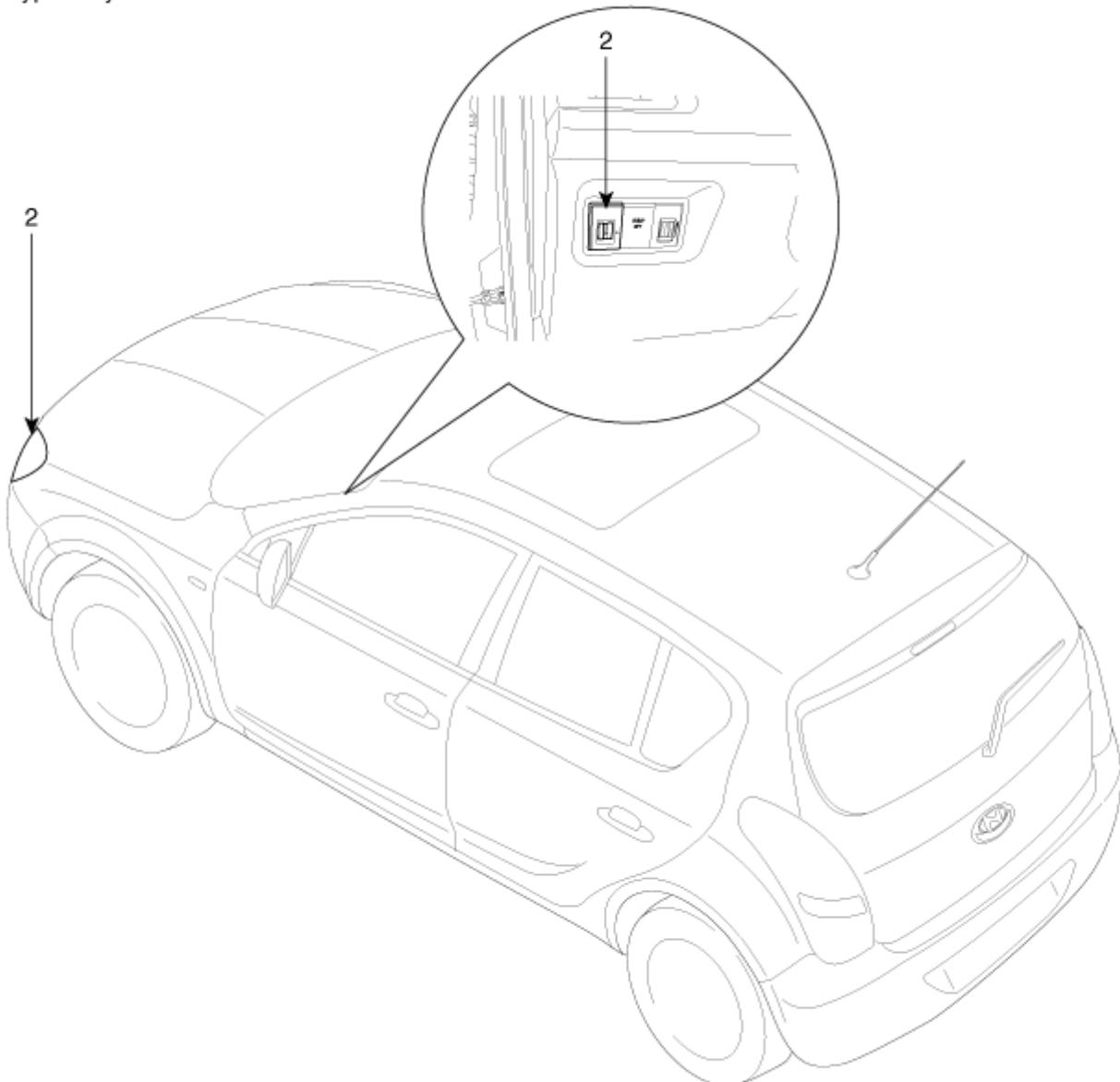
12.18.1. Component and Components Location

Component Location

The parts with asterisk (*) :

This illustration shows the LHD type.

RHD type is symmetrical.

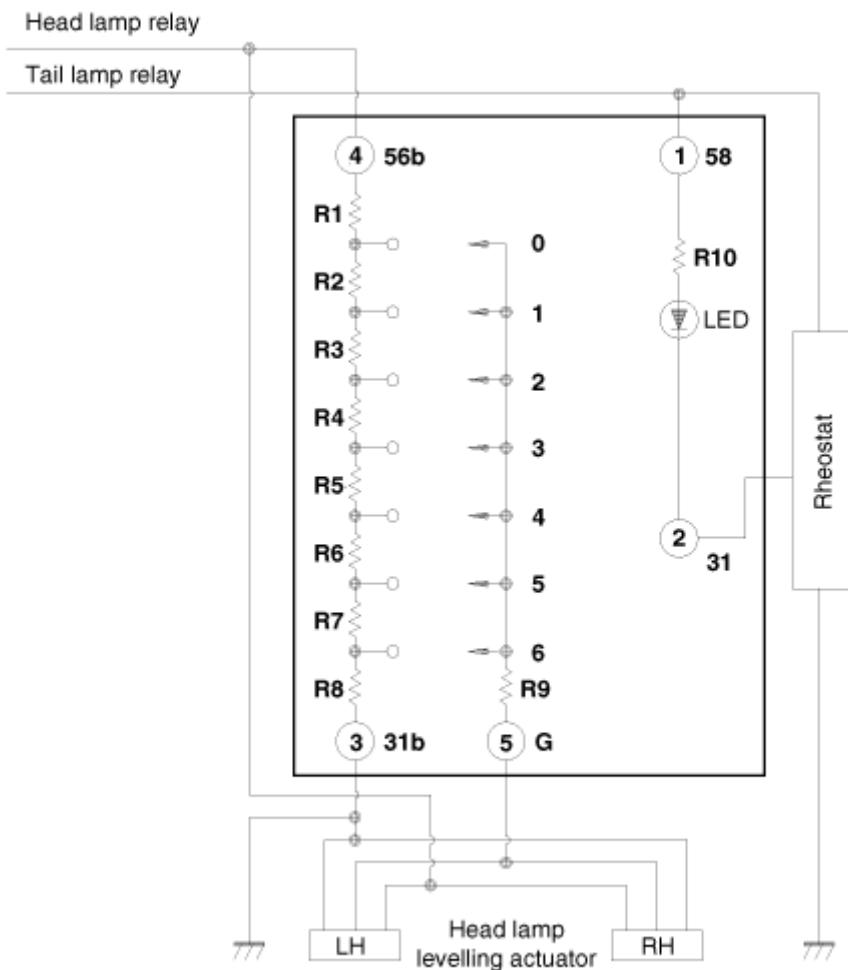


1. Headlamp leveling switch

2. Headlamp

12.18.2. Schematic Diagrams

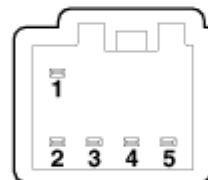
Circuit Diagram



PIN CONNECTION

| PIN NO | Description |
|--------|--------------|
| 1 | Tail(+) |
| 2 | ILL(+) |
| 3 | Ground |
| 4 | IGN |
| 5 | Actuator (+) |

Head lamp leveling SW connector



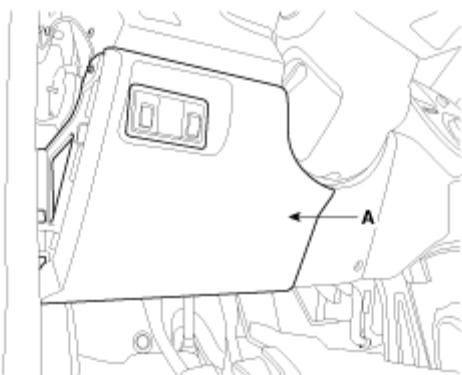
12.18.3. Head Lamp Leveling Switch

12.18.3.1. Repair procedures

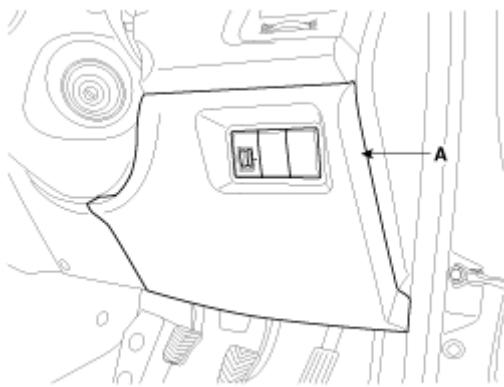
Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the fuse box cover (A).

[LHD]



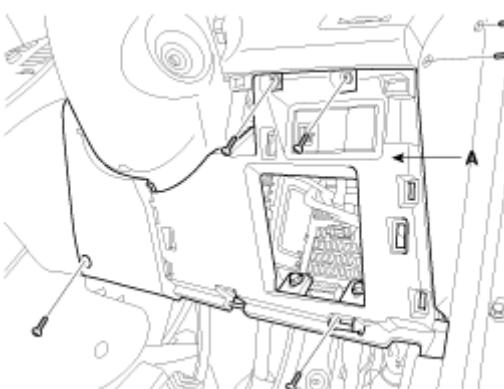
[RHD]



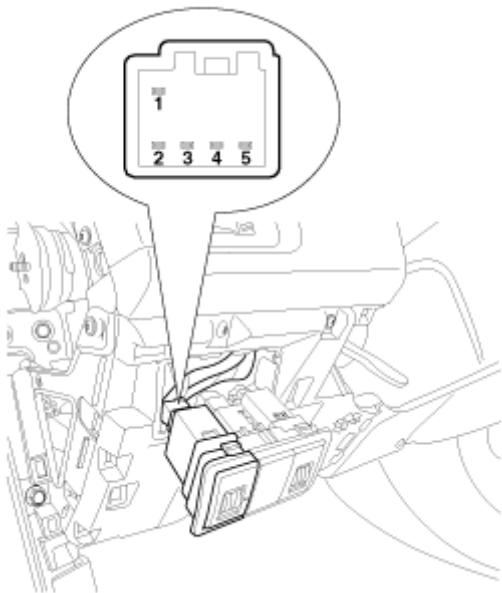
3. Remove the lower side crash pad switch (A) from the lower side crash pad cover by using the trim removal tool.
[LHD]



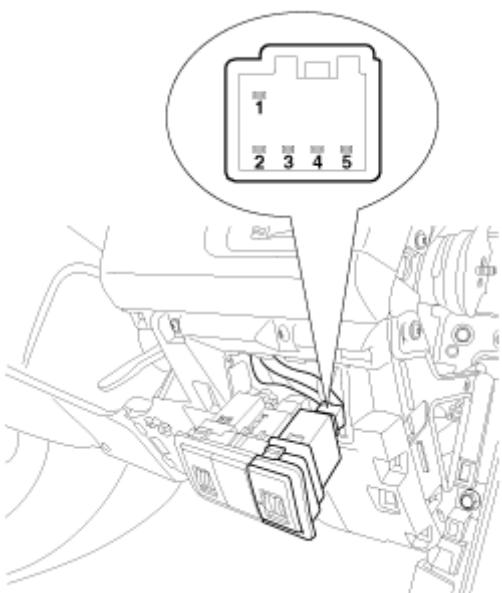
[RHD]



4. Remove the head lamp leveling switch connector from the lower crash pad switch.
[LHD]



[RHD]



5. Connect the battery voltage between terminals 3 and 4.
6. Measure the voltage between terminals 4 and 5 at each position.

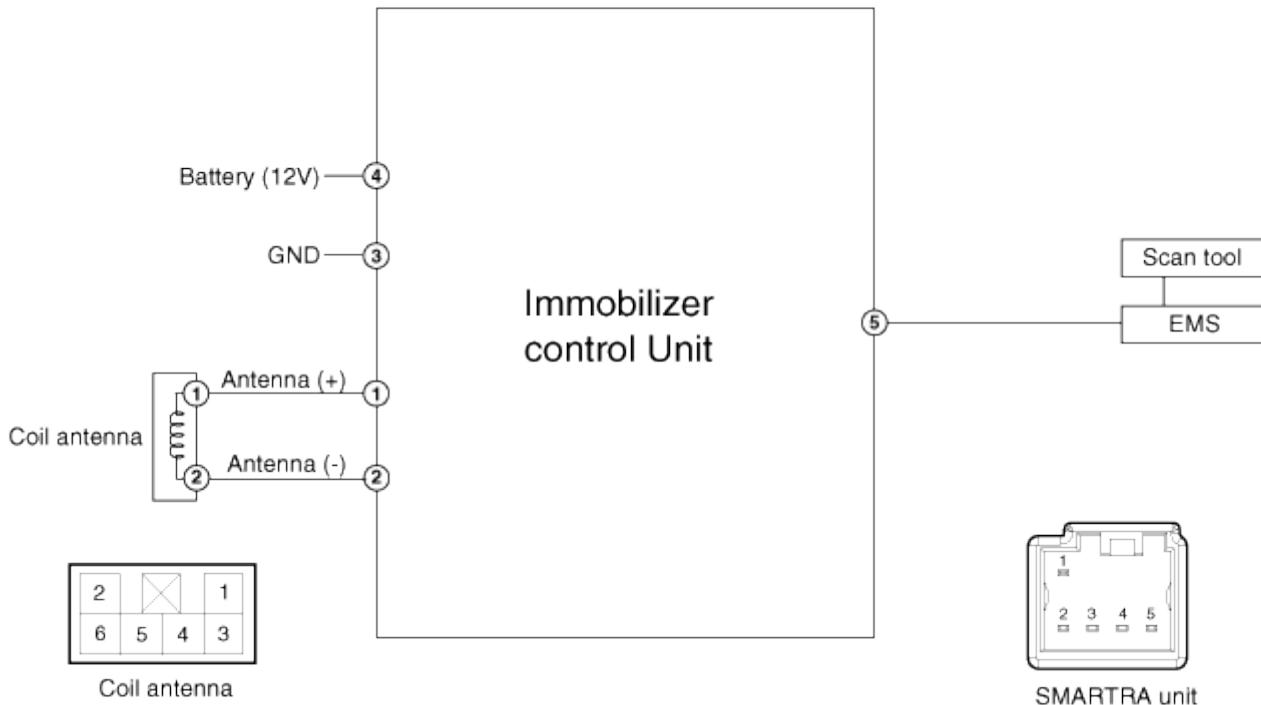
| Position No. | Rotation | Voltage (V) ($\pm 5\%$) |
|--------------|----------|---------------------------|
| 0 | 0° | 11.69 |
| 1 | 20° | 9.29 |
| 2 | 40° | 8.19 |
| 3 | 60° | 6.75 |

7. If the voltage is not as specified, replace the head lamp leveling switch.

12.19. Immobilizer System

12.19.1. Schematic Diagrams

Circuit Diagram

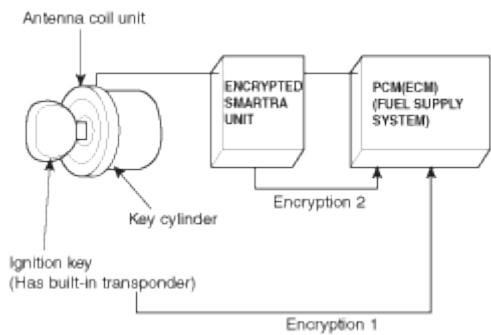


12.19.2. Description and Operation

Description

The immobilizer system will disable the vehicle unless the proper ignition key is used, in addition to the currently available anti-theft systems such as car alarms, the immobilizer system aims to drastically reduce the rate of auto theft.

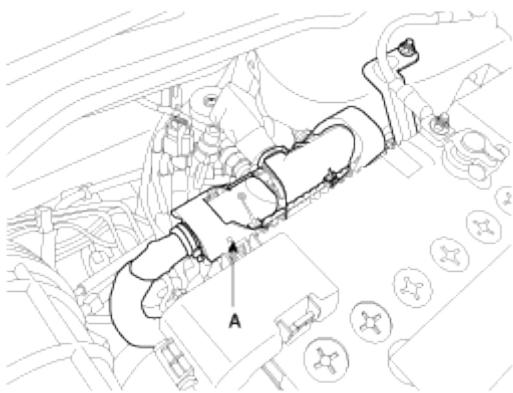
1. Encrypted SMARTRA type immobilizer
 - A. The SMARTRA system consists of a passive challenge - response (mutual authentication)transponder located in the ignition key, an antenna coil, a encoded SMARTRA unit, an indicator light and the PCM(ECM).
 - B. The SMARTRA communicates to the PCM(ECM) (Engine Control Module) via a dedicated communications line. Since the vehicle engine management system is able to control engine mobilization, it is the most suitable unit to control the SMARTRA.
 - C. When the key is inserted in the ignition and turned to the ON position, the antenna coil sends power to the transponder in the ignition key. The transponder then sends a coded signal back through the SMARTRA unit to the PCM(ECM).
 - D. If the proper key has been used, the PCM(ECM) will energize the fuel supply system. The immobilizer indicator light in the cluster will simultaneously come on for more than five seconds, indicating that the SMARTRA unit has recognized the code sent by the transponder.
 - E. If the wrong key has been used and the code was not received or recognized by the PCM(ECM) the indicator light will continue blinking for about five seconds until the ignition switch is turned OFF.
 - F. If it is necessary to rewrite the PCM(ECM) to learn a new key, the dealer needs the customer's vehicle, all its keys and the Hi-scan (pro) equipped with an immobilizer program card. Any key that is not learned during rewriting will no longer start the engine.
 - G. The immobilizer system can store up to eight key codes.
 - H. If the customer has lost his key, and cannot start the engine, contact Hyundai motor service station.



Components Operations

PCM (Power Train Control Module)

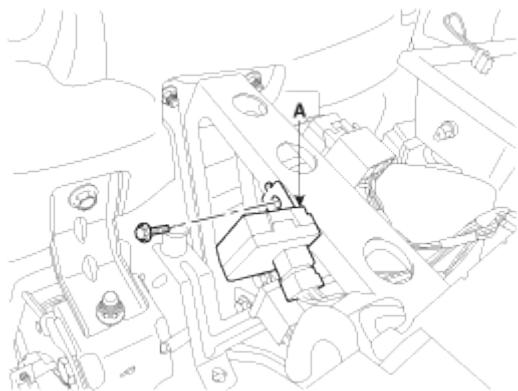
1. The PCM(ECM) (A) carries out a check of the ignition key using a special encryption algorithm, which is programmed into the transponder as well as the PCM(ECM) simultaneously. Only if the results are equal, the engine can be started. The data of all transponders, which are valid for the vehicle, are stored in the PCM(ECM). ERN (Encrypted Random Number) value between EMS and encrypted smartra unit is checked and the validity of coded key is decided by EMS.



ENCRYPTED SMARTRA unit (A)

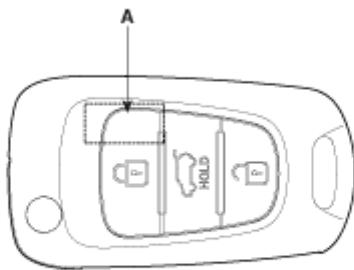
The SMARTRA carries out communication with the built-in transponder in the ignition key. This wireless communication runs on RF (Radio frequency of 125 kHz). The SMARTRA is mounted behind of the crash pad close to center cross bar. The RF signal from the transponder, received by the antenna coil, is converted into messages for serial communication by the SMARTRA device. And, the received messages from the PCM(ECM) are converted into an RF signal, which is transmitted to the transponder by the antenna.

The SMARTRA does not carry out the validity check of the transponder or the calculation of encryption algorithm. This device is only an advanced interface, which converts the RF data flow of the transponder into serial communication to the PCM(ECM) and vice versa.



TRANSPONDER (Built-in keys)

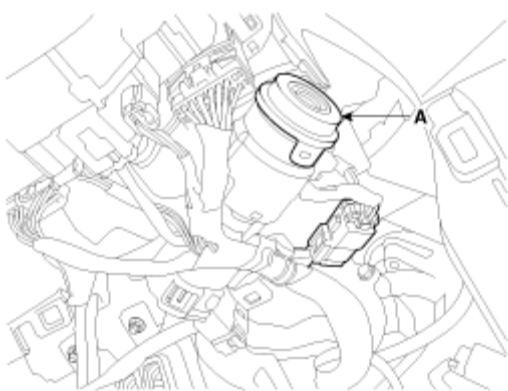
The transponder (A) has an advanced encryption algorithm. During the key teaching procedure, the transponder will be programmed with vehicle specific data. The vehicle specific data are written into the transponder memory. The write procedure is once only; therefore, the contents of the transponder can never be modified or changed.



Antenna coil

The antenna coil (A) has the following functions.

- The antenna coil supplies energy to the transponder.
 - The antenna coil receives signal from the transponder.
 - The antenna coil sends transponder signal to the SMARTRA.
- It is located directly in front of the steering handle lock.



12.19.3. Repair procedures

Teaching Procedures

1. Key Teaching Procedure

Key teaching must be done after replacing a defective PCM(ECM) or when providing additional keys to the vehicle owner.

The procedure starts with an PCM(ECM) request for vehicle specific data (PIN code: 6digits) from the tester. The "virgin" PCM(ECM) stores the vehicle specific data and the key teaching can be started. The "learnt" PCM(ECM) compares the vehicle specific data from the tester with the stored data. If the data are correct, the teaching can proceed.

If incorrect vehicle specific data have been sent to the PCM(ECM) three times, the PCM(ECM) will reject the request of key teaching for one hour. This time cannot be reduced by disconnecting the battery or any other manipulation. After reconnecting the battery, the timer starts again for one hour.

The key teaching is done by ignition on with the key and additional tester commands. The PCM(ECM) stores the relevant data in the EEPROM and in the transponder. Then the PCM(ECM) runs the authentication required for confirmation of the teaching process. The successful programming is then confirmed by a message to the tester.

If the key is already known to the PCM(ECM) from a previous teaching, the authentication will be accepted and the EEPROM data are updated. There is no changed transponder content (this is impossible for a learnt transponder).

The attempt to repeatedly teach a key, which has been taught already during the same teaching cycle, is recognized by the PCM(ECM). This rejects the key and a message is sent to the tester.

The PCM(ECM) rejects invalid keys, which are presented for teaching. A message is sent to the tester. The key can be invalid due to faults in the transponder or other reasons, which result from unsuccessful programming of data. If the PCM(ECM) detects different authenticators of a transponder and an PCM(ECM), the key is considered to be invalid.

The maximum number of taught keys is 8

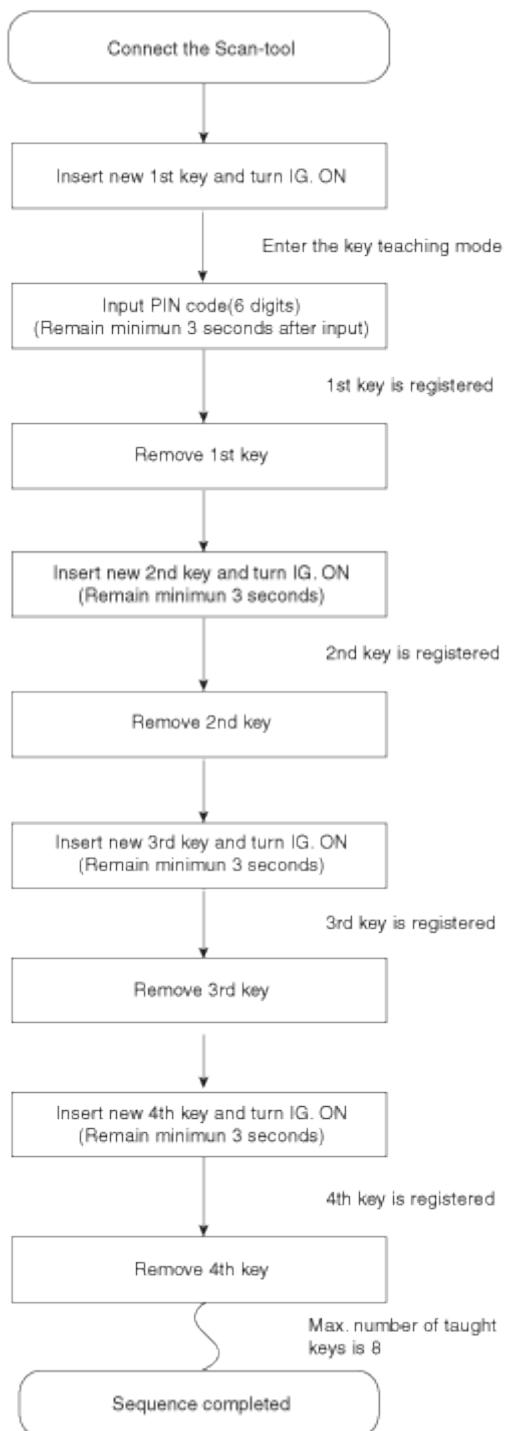
If an error occurs during the Immobilizer Service Menu, the PCM(ECM) status remains unchanged and a specific fault

code is stored.

If the PCM(ECM) status and the key status do not match for teaching of keys, the tester procedure will be stopped and a specific fault code will be stored at PCM(ECM).

NOTE

When teaching the 1st key, Smartra regists at the same time.



(1) PCM(ECM) learnt status.

1. HYUNDAI VEHICLE DIAGNOSIS ▼

MODEL : PB

- 03. AUTOMATIC TRANSAXLE
- 04. ABS/ESP
- 05. SRS-AIRBAG
- 06. ELEC. POWER STEERING
- 07. BODY CONTROL MODULE
- 08. FULL AUTO AIR/CON
- 09. IMMOBILIZER**

1. HYUNDAI VEHICLE DIAGNOSIS

MODEL : PB

SYSTEM : IMMOBILIZER

- 01. CURRENT DATA
- 02. PASSWORD TEACHING/CHANGING
- 03. TEACHING**
- 04. NEUTRAL MODE
- 05. LIMP HOME MODE
- 06. SMARTRA NEUTRAL

1.3 TEACHING

MODEL : PB

SYSTEM : IMMOBILIZER

STATUS : LEARNED

INPUT PIN OF SIX
FIGURE AND PRESS [ENTER] KEY

CODE : 234567

1.3 TEACHING

MODEL : PB

SYSTEM : IMMOBILIZER

STATUS : LEARNED

1st KEY TEACHING
ARE YOU SURE ? [Y/N]

CODE : 234567

| |
|-------------------------------|
| 1.3 TEACHING |
| MODEL : PB |
| SYSTEM : IMMOBILIZER |
| STATUS : LEARNT |
| 1st KEY TEACHING
COMPLETED |
| CODE : 234567 |

| |
|--|
| 1.3 TEACHING |
| MODEL : PB |
| SYSTEM : IMMOBILIZER |
| STATUS : LEARNT |
| 2st KEY TEACHING
ARE YOU SURE ? [Y/N] |
| CODE : 234567 |

| |
|-------------------------------|
| 1.3 TEACHING |
| MODEL : PB |
| SYSTEM : IMMOBILIZER |
| STATUS : LEARNT |
| 2st KEY TEACHING
COMPLETED |
| CODE : 234567 |

(2) PCM(ECM) virgin status.

After replacing new "PCM(ECM)" scan tool displays that PCM(ECM) is virgin status in Key Teaching mode. "VIRGIN" status means that PCM(ECM) has not matched any PIN code before.

| |
|--|
| 1.3 TEACHING |
| MODEL : PB |
| SYSTEM : IMMOBILIZER |
| STATUS : VIRGIN |
| INPUT PIN OF SIX
FIGURE AND PRESS [ENTER] KEY |
| CODE : 234567 |

| |
|--|
| 1.3 TEACHING |
| MODEL : PB
SYSTEM: IMMOBILIZER
STATUS : VIRGIN |
| 1st KEY TEACHING
ARE YOU SURE ? [Y/N] |
| CODE : 234567 |

| |
|--|
| 1.3 TEACHING |
| MODEL : PB
SYSTEM: IMMOBILIZER
STATUS : VIRGIN |
| 1st KEY TEACHING
COMPLETED |
| CODE : 234567 |

| |
|--|
| 1.3 TEACHING |
| MODEL : PB
SYSTEM: IMMOBILIZER
STATUS : VIRGIN |
| 2st KEY TEACHING
ARE YOU SURE ? [Y/N] |
| CODE : 234567 |

| |
|--|
| 1.3 TEACHING |
| MODEL : PB
SYSTEM: IMMOBILIZER
STATUS : VIRGIN |
| 2st KEY TEACHING
COMPLETED |
| CODE : 234567 |

2. User Password Teaching Procedure

The user password for limp home is taught at the service station. The owner of the vehicle can select a number with four digits.

The user password teaching is only accepted by a "learnt" PCM(ECM). Before first teaching of user password to an PCM(ECM), the status of the password is "virgin" No limp home function is possible.

The teaching is started by ignition on, with a valid key(learnt key) and sending the user password by tester. After successful teaching, the status of the user password changes from "virgin" to "learnt"

The learnt user password can also be changed. This can be done if the user password status is "learnt" and the tester sends authorization of access, either the old user password or the vehicle specific data. After correct authorization, the

PCM(ECM) requests the new user password. The status remains "learnt" and the new user password will be valid for the next limp home mode.

If wrong user passwords or wrong vehicle specific data have been sent to the PCM(ECM) three times continuously or intermittently, the PCM(ECM) will reject the request to change the password for one hour. This time cannot be reduced by disconnecting the battery or any other actions. After reconnecting the battery, the timer starts again for one hour.

(1) User password teaching

| |
|---------------------------------------|
| 1. HYUNDAI VEHICLE DIAGNOSIS |
| MODEL : PB |
| SYSTEM : IMMOBILIZER |
| 01. CURRENT DATA |
| 02. PASSWORD TEACHING/CHANGING |
| 03. TEACHING |
| 04. NEUTRAL MODE |
| 05. LIMP HOME MODE |
| 06. SMARTRA NEUTRAL |

| |
|--|
| 1.2 PASSWORD TEACHING/CHANGING |
| MODEL : PB |
| SYSTEM : IMMOBILIZER |
| STATUS : VIRGIN |
| INPUT NEW PASSWORD OF FOUR FIGURES AND PRESS [ENTER] KEY |
| NEW PASSWORD : |

| |
|--|
| 1.2 PASSWORD TEACHING/CHANGING |
| MODEL : PB |
| SYSTEM : IMMOBILIZER |
| STATUS : VIRGIN |
| INPUT NEW PASSWORD OF FOUR FIGURES AND PRESS [ENTER] KEY |
| NEW PASSWORD : 2345 |

| |
|--------------------------------|
| 1.2 PASSWORD TEACHING/CHANGING |
| MODEL : PB |
| SYSTEM : IMMOBILIZER |
| STATUS : VIRGIN |
| ARE YOU SURE ? [Y/N] |
| NEW PASSWORD : 2345 |

1.2 PASSWORD TEACHING/CHANGING

MODEL : PB
SYSTEM : IMMOBILIZER
STATUS : VIRGIN

COMPLETED
PRESS [ESC] TO EXIT

NEW PASSWORD : 2345

※ In case of putting wrong password, retry from first step after 10 seconds.

(2) User password changing

1. HYUNDAI VEHICLE DIAGNOSIS

MODEL : PB
SYSTEM : IMMOBILIZER

01. CURRENT DATA

02. PASSWORD TEACHING/CHANGING

03. TEACHING

04. NEUTRAL MODE

05. LIMP HOME MODE

06. SMARTRA NEUTRAL

1.2 PASSWORD TEACHING/CHANGING

MODEL : PB
SYSTEM : IMMOBILIZER
STATUS : LEARNED

INPUT OLD PASSWORD OF FOUR
FIGURES AND PRESS [ENTER] KEY

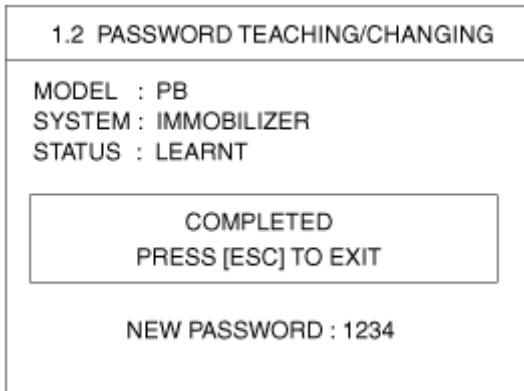
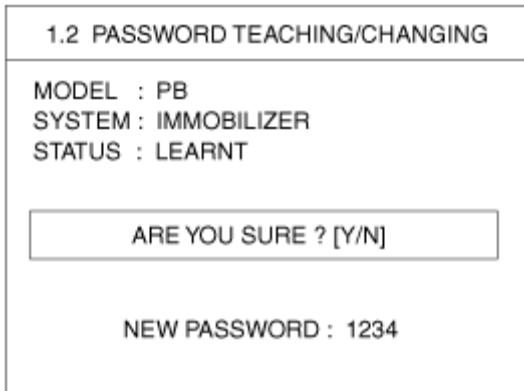
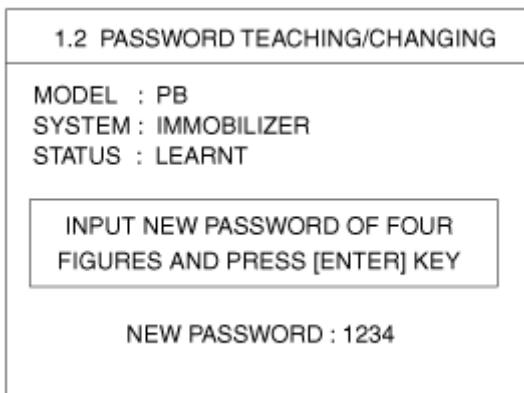
OLD PASSWORD :

1.2 PASSWORD TEACHING/CHANGING

MODEL : PB
SYSTEM : IMMOBILIZER
STATUS : LEARNED

INPUT OLD PASSWORD OF FOUR
FIGURES AND PRESS [ENTER] KEY

OLD PASSWORD : 2345



Limp Home Function

1. LIMP HOME BY TESTER

If the PCM(ECM) detects the fault of the SMARTRA or transponder, the PCM(ECM) will allow limp home function of the immobilizer. Limp home is only possible if the user password (4 digits) has been given to the PCM(ECM) before. This password can be selected by the vehicle owner and is programmed at the service station.

The user password can be sent to the PCM(ECM) via the special tester menu.

Only if the PCM(ECM) is in status "learnt" and the user password status is "learnt" and the user password is correct, the PCM(ECM) will be unlocked for a period of time (30 sec.). The engine can only be started during this time. After the time has elapsed, engine start is not possible.

If the wrong user password is sent, the PCM(ECM) will reject the request of limp home for one hour. Disconnecting the battery or any other action cannot reduce this time. After connecting the battery to the PCM(ECM), the timer starts again for one hour.

1. HYUNDAI VEHICLE DIAGNOSIS

MODEL : PB

SYSTEM : IMMOBILIZER

- 01. CURRENT DATA
- 02. PASSWORD TEACHING/CHANGING
- 03. TEACHING
- 04. NEUTRAL MODE
- 05. LIMP HOME MODE**
- 06. SMATRA NEUTRAL

1.5 LIMP HOME MODE

MODEL : PB

SYSTEM : IMMOBILIZER

INPUT PASSWORD OF FOUR
FIGURES AND PRESS [ENTER] KEY

PASSWORD :

1.5 LIMP HOME MODE

MODEL : PB

SYSTEM : IMMOBILIZER

INPUT PASSWORD OF FOUR
FIGURES AND PRESS [ENTER] KEY

NEW PASSWORD : 2345

1.5 LIMP HOME MODE

MODEL : PB

SYSTEM : IMMOBILIZER

COMPLETED
PRESS [ESC] TO EXIT

2. LIMP HOME BY IGNITION KEY

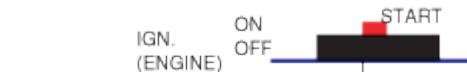
The limp home can be activated also by the ignition key. The user password can be input to the PCM(ECM) by a special sequence of ignition on/off.

Only if the PCM(ECM) is in status "learnt" and the user password status is "learnt" and the user password is correct, the PCM(ECM) will be unlocked for a period of time (30 sec.).

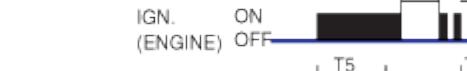
The engine can be started during this time. After the time has elapsed, engine start is not possible. After a new password has been input, the timer (30 sec.) will start again.

After ignition off, the PCM(ECM) is locked if the timer has elapsed 8 seconds. For the next start, the input of the user password is requested again.

1. NORMAL CONDITION(NO FAILURE)



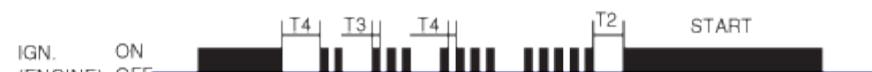
3. LIMP HOME OPERATING



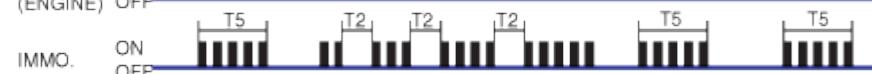
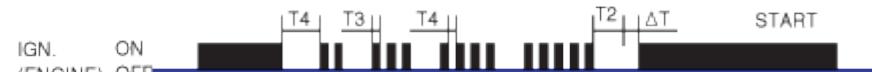
USER PASSWORD : 2345H



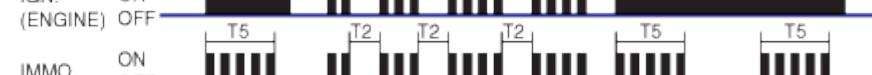
USER PASSWORD : 2345H



USER PASSWORD : 2345H



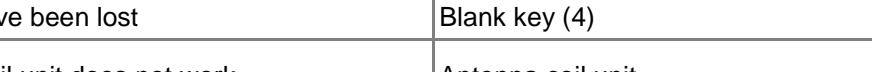
USER PASSWORD : 2345H



USER PASSWORD : 2345H



USER PASSWORD : 2345H



Replacement

Problems And Replacement Parts:

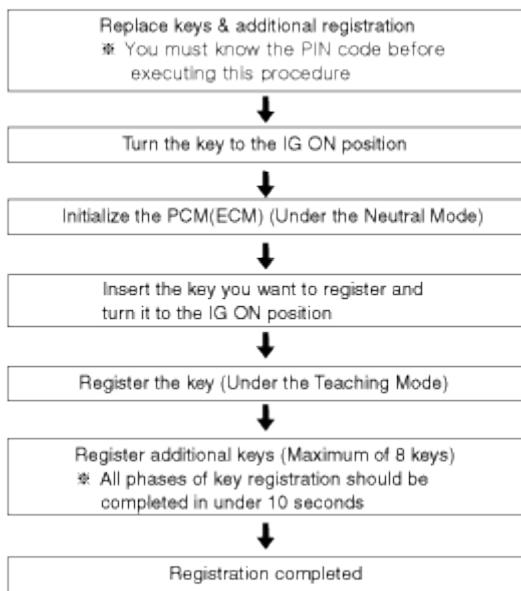
| Problem | Part set | Scan tool required? |
|---|--|---------------------|
| All keys have been lost | Blank key (4) | YES |
| Antenna coil unit does not work | Antenna coil unit | NO |
| ECM does not work | PCM(ECM) | YES |
| Ignition switch does not work | Ignition switch with Antenna coil unit | YES |
| Unidentified vehicle specific data occurs | Key, PCM(ECM) | YES |
| SMARTRA unit does not work | SMARTRA unit | YES |

Replacement Of Ecm And SMARTRA

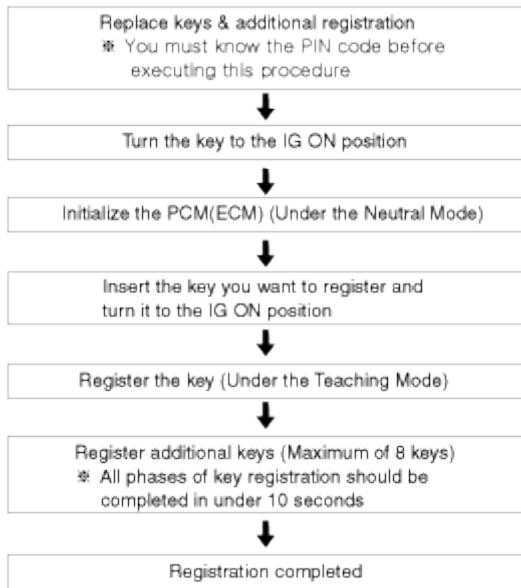
In case of a defective ECM, the unit has to be replaced with a "virgin" or "neutral" ECM. All keys have to be taught to the new ECM. Keys, which are not taught to the ECM, are invalid for the new ECM (Refer to key teaching procedure). The vehicle specific data have to be left unchanged due to the unique programming of transponder.

In case of a defective SMARTRA, it needs teaching the smartra. A new SMARTRA device replaces the old one and smartra need teaching.

1. Things to remember before a replacement (PCM(ECM))



2. Things to remember before a replacement (Keys & Additional registration)



NOTE

1. When there is only one key registered and you wish to register another key, you need to re-register the key which was already registered.
2. When the key #1 is registered and master key #2 is not registered, Put the key #1 in the IG/ON or the start position and remove it. The engine can be started with the unregistered key #2.
(Note that key #2 must be used within 10 seconds of removing key #1)
3. When the key #1 is registered and key #2 is not registered, put the unregistered master key #2 in the IG/ON or the start position.
The engine cannot be started even with the registered key #1.
4. When you inspect the immobilizer system, refer to the above paragraphs 1, 2 and 3.
Always remember the 10 seconds zone.
5. If the pin code & password are entered incorrectly on three consecutive inputs, the system will be locked for one hour.
6. Be cautious not to overlap the transponder areas.
7. Problems can occur at key registration or vehicle starting if the transponders should overlap.

Neutralizing Of ECM

The PCM(ECM) can be set to the "neutral" status by a tester.

A valid ignition key is inserted and after ignition on is recorded, the PCM(ECM) requests the vehicle specific data from the tester. The communication messages are described at "Neutral Mode" After successfully receiving the data, the PCM(ECM) is neutralized.

The ECM remains locked. Neither the limp home mode nor the "twice ignition on" function, is accepted by the PCM(ECM).

The teaching of keys follows the procedure described for the virgin PCM(ECM). The vehicle specific data have to be unchanged due to the unique programming of the transponder. If data should be changed, new keys with a virgin transponder are requested.

This function is for neutralizing the PCM(ECM) and Key. Ex) when lost key, Neutralize the PCM(ECM) then teach keys. (Refer to the Things to do when Key & PIN Code the PCM(ECM) can be set to the "neutral" status by a scanner. If wrong vehicle specific data have been sent to SMATRA three times continuously or intermittently, the SMATRA will reject the request to enter neutral mode for one hour. Disconnecting the battery or other manipulation cannot reduce this time. After connecting the battery the timer starts again for one hour.

NOTE

- Neutralizing setting condition

- In case of PCM(ECM) status "Learned" regardless of user password "Virgin or Learned"
- Input correct PIN code by scanner.
- Neutralizing meaning .
 - : PIN code (6) & user password (4) deletion.
 - : Locking of ECM (except key teaching permission)

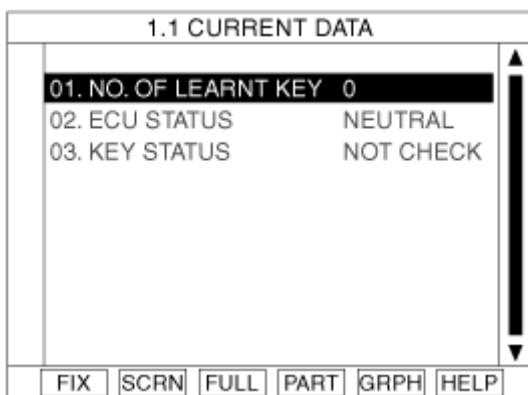
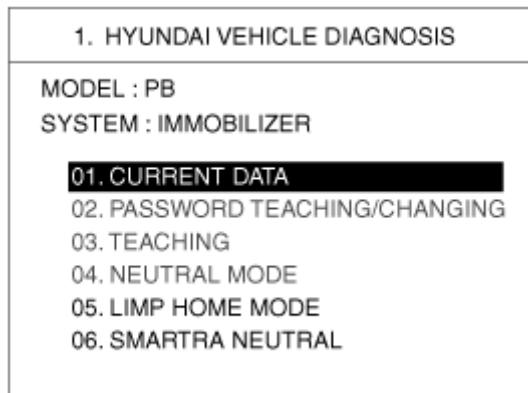
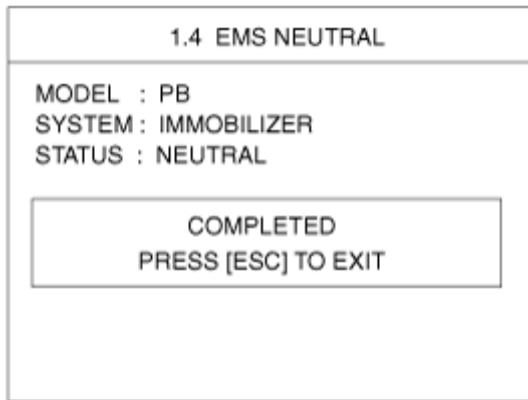
- Neutralizing meaning:

- 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 |

| |
|--------------------------------|
| 1. HYUNDAI VEHICLE DIAGNOSIS |
| MODEL : PB |
| SYSTEM : IMMOBILIZER |
| 01. CURRENT DATA |
| 02. PASSWORD TEACHING/CHANGING |
| 03. TEACHING |
| 04. NEUTRAL MODE |
| 05. LIMP HOME MODE |
| 06. SMARTRA NEUTRAL |

| |
|--|
| 1.4 EMS NEUTRAL |
| MODEL : PB |
| SYSTEM : IMMOBILIZER |
| STATUS : LEARNED |
| INPUT PIN OF SIX
FIGURE AND PRESS [ENTER] KEY |
| CODE : 234567 |



Neutralizing Of SMARTRA

The EMS can be set to the status "neutral" by tester

Ignition key (regardless of key status) is inserted and after IGN ON. If receiving the correct vehicle password from GST, SMARTRA can be neutralized. The neutralization of SMARTRA is possible if DPN is same as the value inputted by GST. In case that the SMARTRA status is neutral, the EMS keeps the lock state. And the start is not possible by "twice ignition".

In case of changing the vehicle password, new virgin transponder must be only used. And in case of virgin key, after Learning the key of vehicle password, it can be used.

If wrong vehicle specific data have been sent to SMATRA three times continuously or intermittently, the SMATRA will reject the request to enter neutral mode for one hour. Disconnecting the battery or other manipulation cannot reduce this time. After connecting the battery the timer starts again for one hour.

NOTE

- Neutralizing Setting condition :
 - In case of "SMARTRA status", "Learnt"
 - Input correct Pin code by tester
- Neutralizing meaning :
 - Vehicle password(DPN Code) & SEK Code deletion.
 - Permission of New DPN Learning.

| Function | Engine Running | | | Learning | |
|----------|----------------|---------------------|----------------|----------|---------------|
| | Learnt Key | Limp home | Twice Ignition | Key | User Password |
| SMARTRA | No | Yes
(EMS learnt) | No | Yes | No |
| Neutral | | | | | |

1. HYUNDAI VEHICLE DIAGNOSIS

MODEL : PB
SYSTEM : IMMOBILIZER

- 01. CURRENT DATA
- 02. PASSWORD TEACHING/CHANGING
- 03. TEACHING
- 04. NEUTRAL MODE
- 05. LIMP HOME MODE
- 06. SMARTRA NEUTRAL

1.6 SMARTRA3 NEUTRAL

MODEL : PB
SYSTEM : IMMOBILIZER
STATUS : LEARNED

INPUT PIN OF SIX
FIGURE AND PRESS [ENTER] KEY

CODE : 234567

1.6 SMARTRA3 NEUTRAL

MODEL : PB
SYSTEM : IMMOBILIZER
STATUS : NEUTRAL

COMPLETED
PRESS [ESC] TO EXIT

1.1 CURRENT DATA

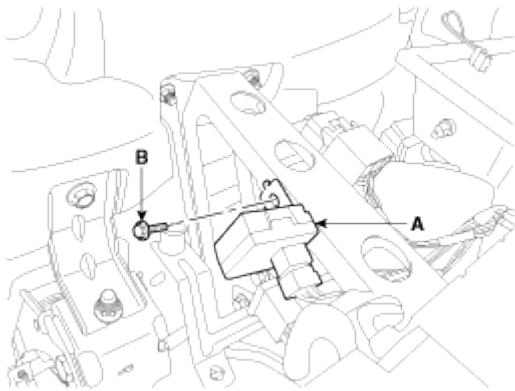
| | |
|--------------------------|--------|
| 01. NO. OF LEARNED KEY 0 | ▲ |
| 02. EMS STATUS | |
| 03. KEY STATUS | VIRGIN |
| 04. SMARTRA3 STATUS | |
| | ▼ |
| FIX | SCRN |
| FULL | PART |
| GRPH | HELP |

12.19.4. Immobilizer Control Unit

12.19.4.1. Repair procedures

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the lower side crash pad panel.
(Refer to the BD group - "Crash pad")
3. Disconnect the 5P connector of the SMARTRA unit and then remove the SMARTRA unit (A) after loosening a bolt (B).



Installation

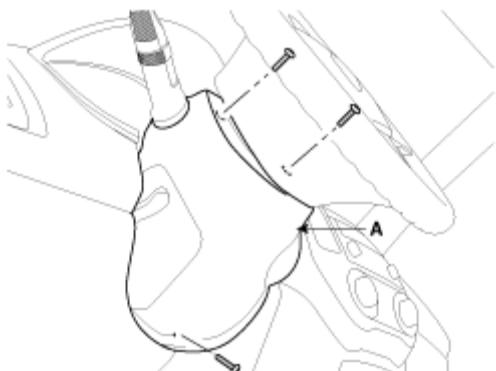
1. Install the immobilizer control unit and bracket after connecting the unit connector.
2. Install the lower side crash pad panel.

12.19.5. Antenna Coil 12.19.5.1. Repair procedures

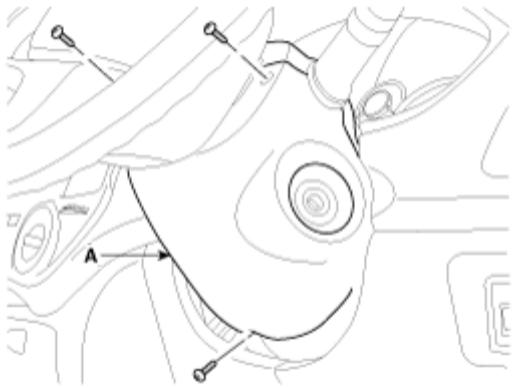
Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the steering column lower shrouds (A).
(Refer to the ST group - "Steering column and shaft")

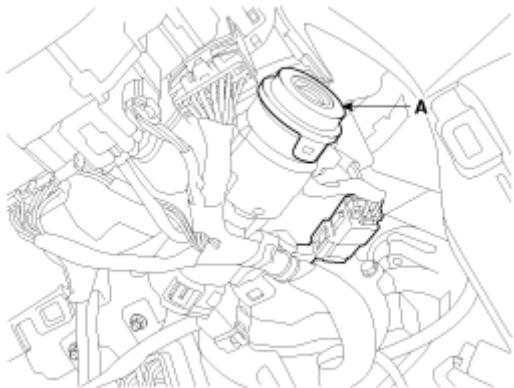
[LHD]



[RHD]



3. Disconnect the 6P connector of the coil antenna and then remove the coil antenna (A).



Installation

1. Install the coil antenna and connect the 6P connector.
2. Install the steering column lower shrouds.

12.19.6. Troubleshooting

Diagnosis Of Immobilizer Faults

- Communication between the ECM and the SMARTRA.
- Function of the SMARTRA and the transponder.
- Data (stored in the ECM related to the immobilizer function).

The following table shows the assignment of immobilizer related faults to each type:

| Immobilizer Related Faults | Fault types | Diagnostic codes |
|----------------------------|--|--|
| PCM(ECM) fault | 1. Non-Immobilizer-EMS connected to an Immobilizer | P1610 |
| Transponder key fault | 1. Transponder not in password mode
2. Transponder transport data has been changed. | P1674
(Transponder status error) |
| Transponder key fault | 1. Transponder programming error | P1675
(Transponder programming error) |
| SMARTRA fault | 1. Invalid message from SMARTRA to PCM(ECM) | P1676
(SMARTRA message error) |
| SMARTRA fault | 1. Virgin SMARTRA at learnt EMS
2. Neutral SMARTRA at learnt EMS
3. Incorrect the Authentication of EMS and SMARTRA
4. Locking of SMARTRA | P169A
(SMARTRA Authentication fail) |

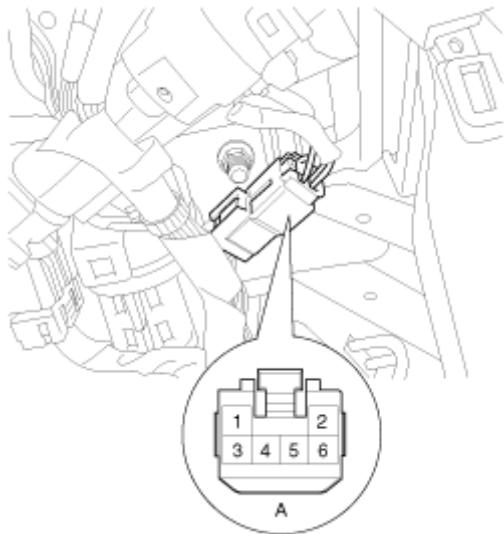
| | | |
|---|---|---|
| SMARTRA fault | 1. No response from SMARTRA
2. Antenna coil error
3. Communication line error (Open/Short etc.)
4. Invalid message from SMARTRA to PCM(ECM) | P1690
(SMARTRA no response) |
| Antenna coil fault | 1. Antenna coil open/short circuit | P1691
(Antenna coil error) |
| Immobilizer indicator lamp fault | 1. Immobilizer indicator lamp error (Cluster) | P1692
(Immobilizer lamp error) |
| Transponder key fault | 1. Corrupted data from transponder
2. More than one transponder in the magnetic field (Antenna coil)
3. No transponder (Key without transponder) in the magnetic field (Antenna coil) | P1693
(Transponder no response error/invalid response) |
| PCM(ECM) fault | 1. Request from PCM(ECM) is invalid (Protocol layer violation- Invalid request, check sum error etc.) | P1694
(PCM(ECM) message error) |
| PCM(ECM) internal permanent memory (EEPROM) fault | 1. PCM(ECM) internal permanent memory (EEPROM) fault
2. Invalid write operation to permanent memory (EEPROM) | P1695
(PCM(ECM) memory error) |
| Invalid key fault | 1. Virgin transponder at PCM(ECM) status "Learnt" Learnt (Invalid) Transponder at PCM(ECM) status "Learnt" (Authentication fail) | P1696
(Authentication fail) |
| Locked by timer | 1. Exceeding the maximum limit of Twice IGN ON (≥ 32 times) | P1699
(Twice IG ON over trial) |

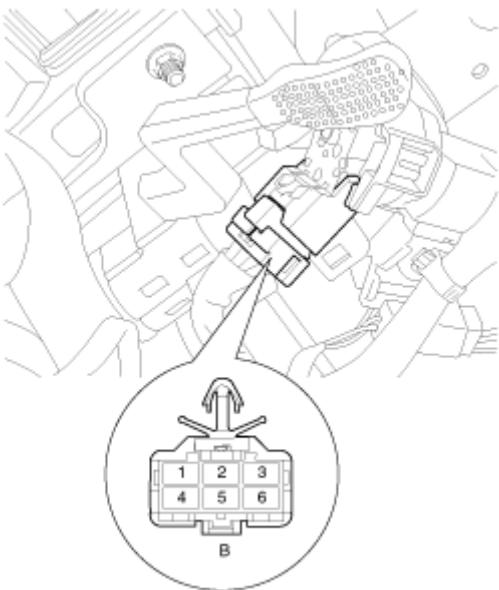
12.20. Ignition Switch Assembly

12.20.1. Repair procedures

Inspection

1. Disconnect the ignition switch connector (B) and key warning switch connector (A) from under the steering column.



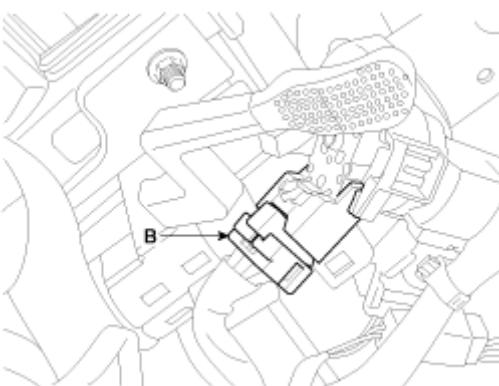


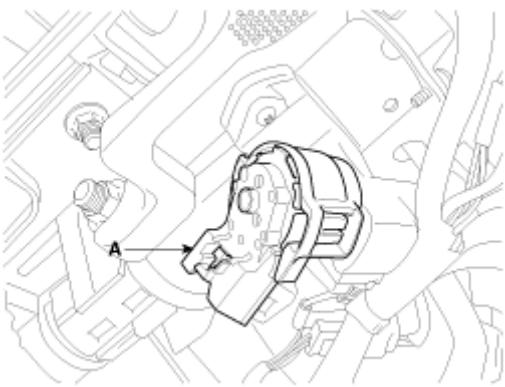
2. Check for continuity between the terminals.
3. If continuity is not specified, replace the switch.

| POSITION | KEY | IGNITION SWITCH (B) | | | | | | STEERING | | KEY
WARNING
SWITCH (A) | | | | |
|----------|---------|---------------------|---|---|---|---|---|----------|--------|------------------------------|---|--|--|--|
| | | 1 | 3 | 4 | 6 | 2 | 5 | TRAVEL | TRAVEL | 5 | 6 | | | |
| LOCK | REMOVAL | | | | | | | LOCK | | | | | | |
| | | | | | | | | LOCK | UNLOCK | | | | | |
| ACC | INSERT | | | | | | | UNLOCK | | | | | | |
| | | | | | | | | | | | | | | |
| ON | | | | | | | | UNLOCK | | | | | | |
| START | | | | | | | | | | | | | | |

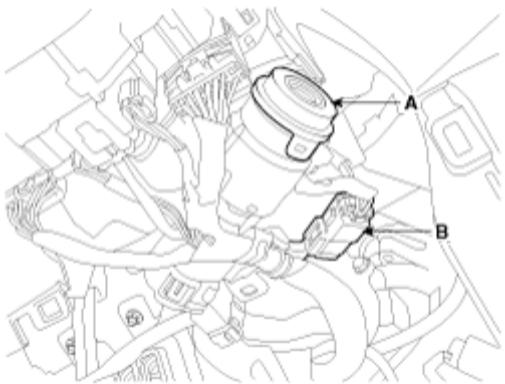
Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the steering column lower shrouds.
(Refer to ST group - "Steering column and shaft")
3. Remove the ignition switch (A) after disconnecting the 6P connector (B).

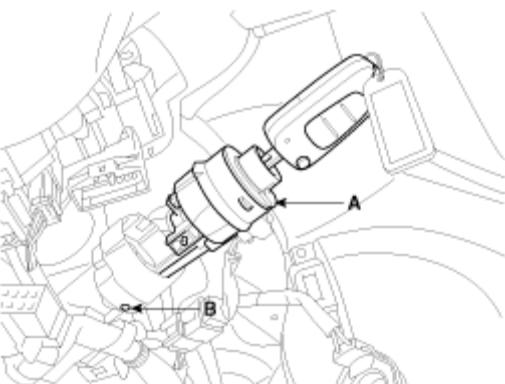




4. Remove the door warning switch (A) and disconnecting the 6P connector (B).



5. If it is necessary to remove the key lock cylinder (A), remove the key lock cylinder after pushing lock pin (B) with key ACC.



Installation

1. Install the key lock cylinder.
2. Install the door warning switch.
3. Install the ignition switch.
4. Install the steering column cover.

13. Steering System

13.1. General Information

13.1.1. Specifications

Specifications

| Item | Specification |
|------|---------------|
|------|---------------|

| | | |
|---------------|--------------------------------|----------------|
| Type | Manual Steering System | |
| | Electric Power Steering System | |
| Steering gear | Type | Rack & Pinion |
| | Rack stroke | Manual
MDPS |

Tightening Torques

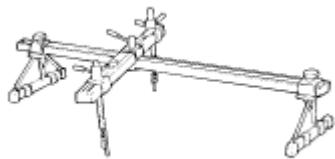
| Item | Tightening torque (kgf.m) | | |
|--|---------------------------|-------------|------------|
| | N.m | kgf.m | lb-ft |
| Hub nuts | 90 ~ 110 | 9.0 ~ 11.0 | 65 ~ 80 |
| Steering wheel lock nut | 40 ~ 50 | 4.0 ~ 5.0 | 29 ~ 36 |
| Steering column mounting bolts and nuts | 13 ~ 18 | 1.3 ~ 1.8 | 9.4 ~ 13.0 |
| Bolt connecting universal joint to pinion | 30 ~ 35 | 3.0 ~ 3.5 | 22 ~ 25 |
| Bolt connecting steering column to universal joint | 30 ~ 35 | 3.0 ~ 3.5 | 22 ~ 25 |
| Tie rod end castle nut | 24 ~ 34 | 2.4 ~ 3.4 | 17 ~ 25 |
| Lower arm ball joint bolts | 100 ~ 120 | 10.0 ~ 12.0 | 72 ~ 87 |
| Steering gear box mounting bolts | 60 ~ 80 | 6.0 ~ 8.0 | 43 ~ 58 |
| Stabilizer link nut | 100 ~ 120 | 10.0 ~ 12.0 | 72 ~ 87 |
| Front and Rear roll stopper bolt & nut | 50 ~ 65 | 5.0 ~ 6.5 | 36 ~ 47 |
| Rear roll stopper mounting bolts | 50 ~ 65 | 5.0 ~ 6.5 | 36 ~ 47 |
| Sub frame stay mounting bolts & nuts | 45 ~ 55 | 4.5 ~ 5.5 | 33 ~ 40 |
| Sub frame mounting bolts & nuts | 160~ 180 | 16.0 ~ 18.0 | 116 ~ 130 |

13.1.2. Special Service Tools

| Special Service Tools | | |
|--------------------------------------|---|---------------------------------------|
| Tool (Number and Name) | Illustration | Use |
| 09561-11001
Steering wheel puller |  | Removal of the steering wheel |
| 09568-2J100
Ball joint puller |  | Removal of the tie rod end ball joint |

09200-38001

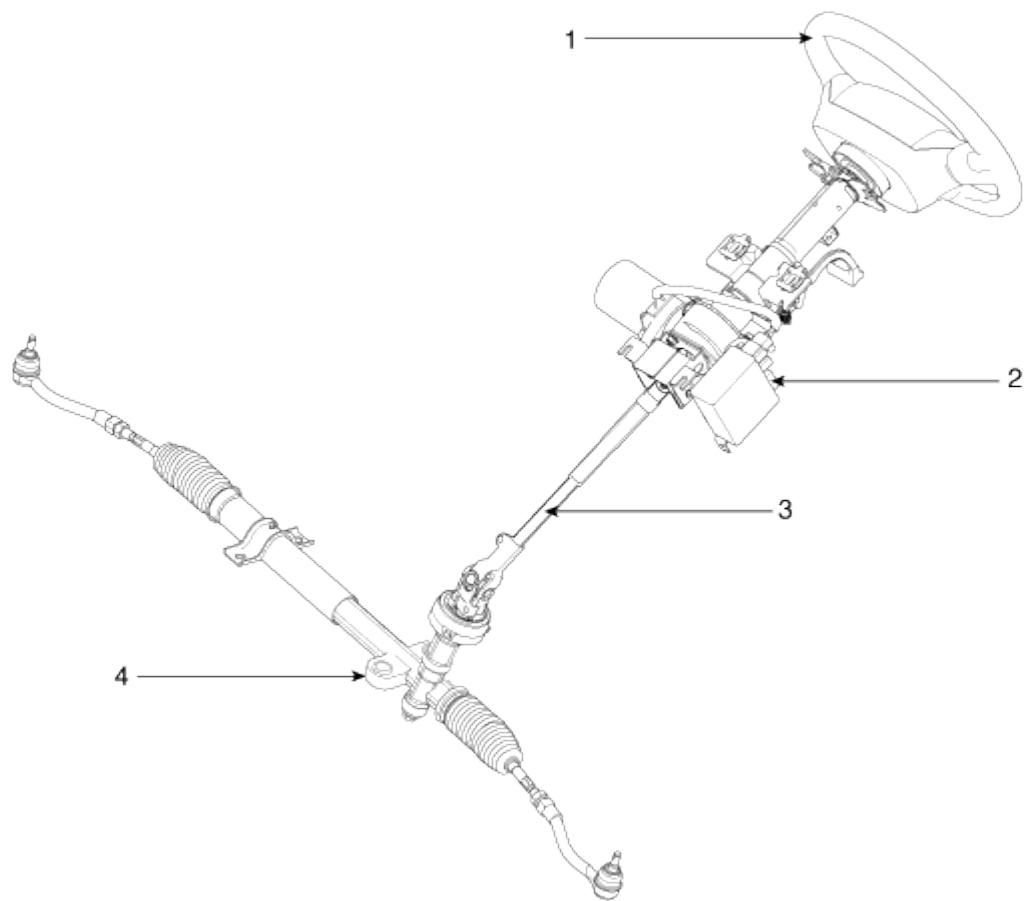
Engine support fixture



Removal and installation of the transaxle

Components

13.2. Electronic Power Steering System 13.2.1. Component and Components Location



1. Steering wheel

2. Steering column & EPS unit assembly

3. Universal joint assembly
4. Steering gear box

13.2.2. 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 resulting in a more precise and timely control of steering assist than conventional engine-driven hydraulic systems.

Components (Torque Sensor, Fail-safe relay, etc.) of the EPS system are located inside the steering column & EPS unit assembly and the steering column & EPS unit assembly must not be disassemble to inspect or replace them.

Notes with Regard to Diagnosis

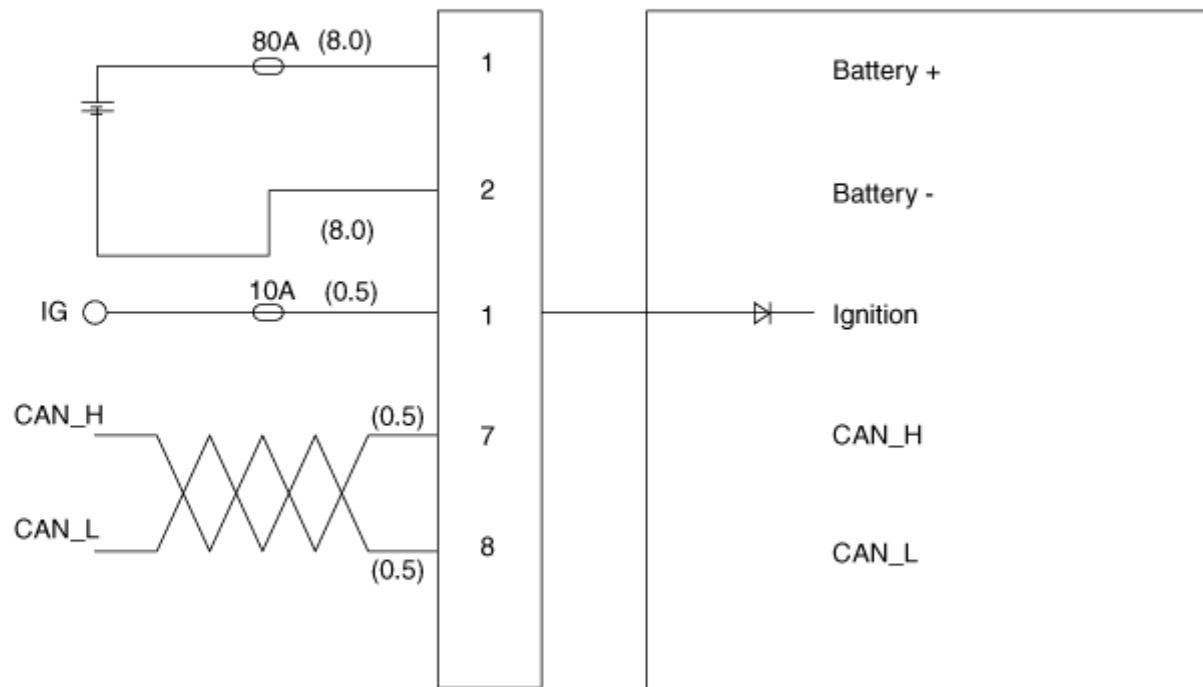
| Trouble factor | Check item | Trouble symptom | Explanation | Note |
|------------------------------|---------------|--|--|---|
| Drop, impact, and overload | Motor | Abnormal noise | - Visable or unvisable damage can occur.
The steering wheel could pull to one side by using the dropped parts. | - Do not use the impacted EPS.
- Do not overload each parts. |
| | ECU | Circuit damage
- Wrong welding point
- Broken PCB
- Damaged precise parts | - Precise parts of motor/ECU are sensitive to vibration and impact.
- Overload can cause unexpected damage | |
| | Torque sensor | Insufficient steering effort | Overload to INPUT shaft can cause malfunction of the torque sensor | - Do not impact the connecting parts (When inserting and torquing)
- Use the specified tool to remove the steering wheel. (Do not hammer on it)
- Do not use the impacted EPS |
| | Shaft | Insufficient steering effort (Uneven between LH and RH) | | Do not use the impacted EPS |
| Pull/Dent | Harness | - Malfunction-impossible power operation
- Malfunction of EPS | Disconnection between harness connecting portion and harness | Do not overload the harness |
| Abnormal storage temperature | Motor/ECU | Abnormal steering effort by improper operation of the motor/ECU | - Waterproof at the normal condition
- Even a little moisture can cause malfunction of the precise parts of the motor/ECU | - Keep the normal temperature and proper moisture, while storing
- Avoid drowning |

1. Do not impact the electronic parts, if they are dropped or impacted, replace them with new ones.
2. Avoid heat and moisture to the electronic parts.
3. Do not contact the connect terminal to avoid deformation and static electricity.
4. Do not impact the motor and torque sensor parts, if they are dropped or impacted, replace them with new ones.
5. The connector should be disconnected or connected with IG OFF.

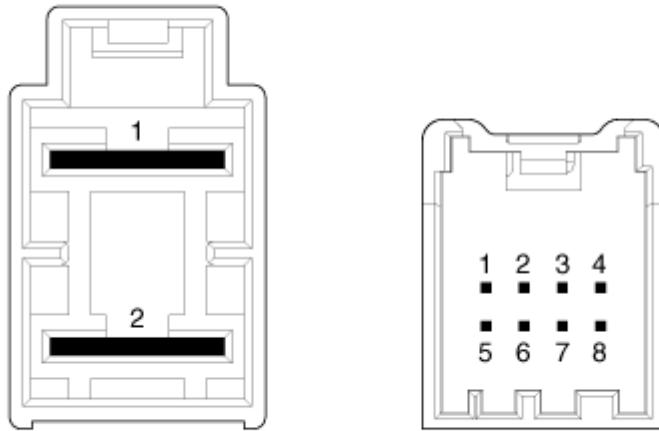
13.2.3. Schematic Diagrams

Schematic Diagrams

MDPS Circuit Diagram



Harness Connector



| Connector | Pin no | Pin name |
|----------------|--------|-----------|
| Battery | 1 | Battery + |
| | 2 | Battery - |
| Vehicle signal | 1 | Ignition |
| | 2 | - |
| | 3 | - |
| | 4 | - |
| | 5 | - |
| | 6 | - |
| | 7 | CAN_High |
| | 8 | CAN_Low |

13.2.4. 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.

Vehicle S/W Management

ID Register

System Identification

Data Treatment

ASP CALIBRATION(CAN)

EPS Type Recognition

ASP CALIBRATION(CAN)



[ASP Calibration]

This function is used for initiating ASP Calibration. Perform this function when you replace EPS ECU or do work related to EPS.

1. Ignition On
2. Engine On

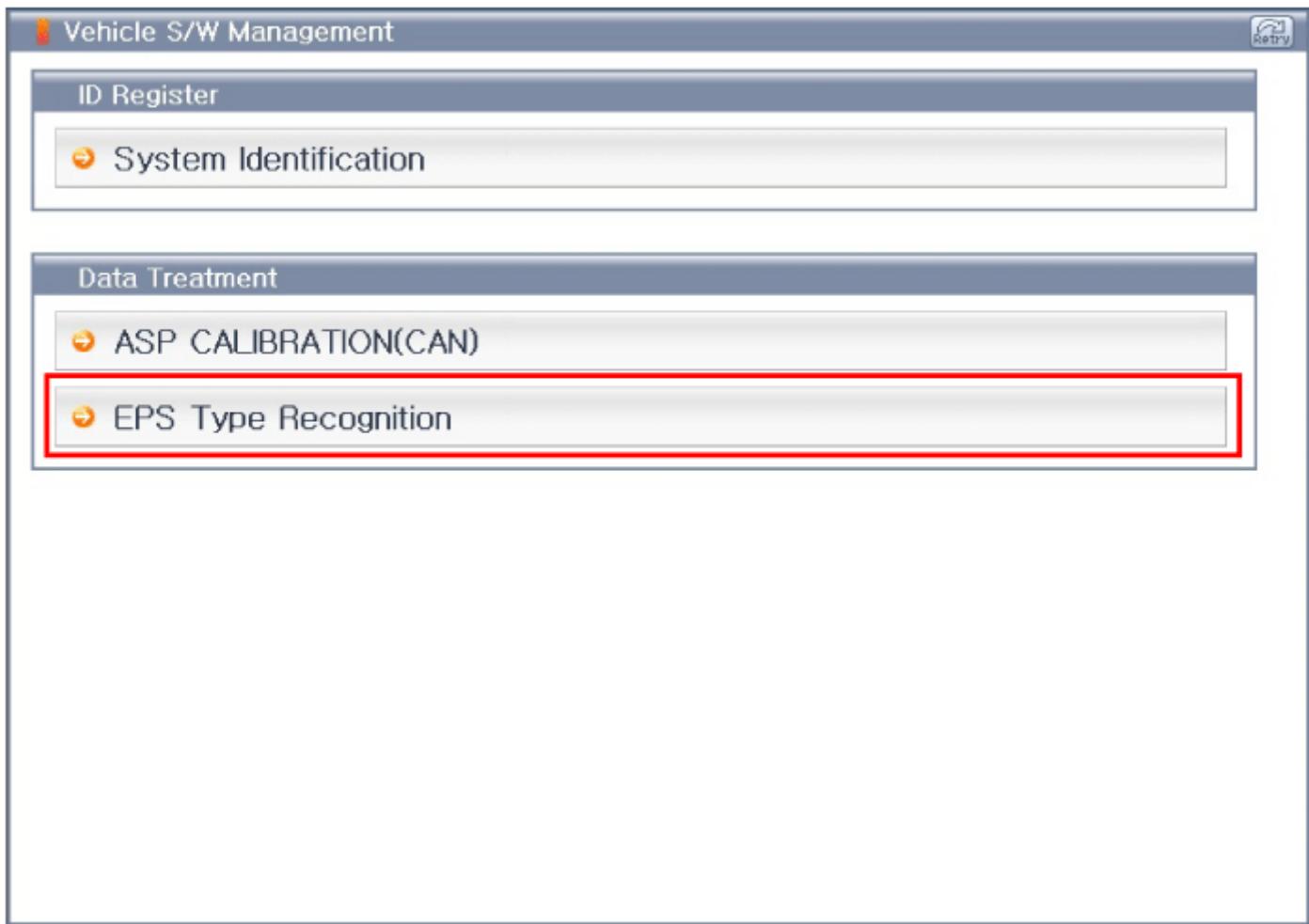
Turn the steering wheel to straight ahead position and press [OK] button.

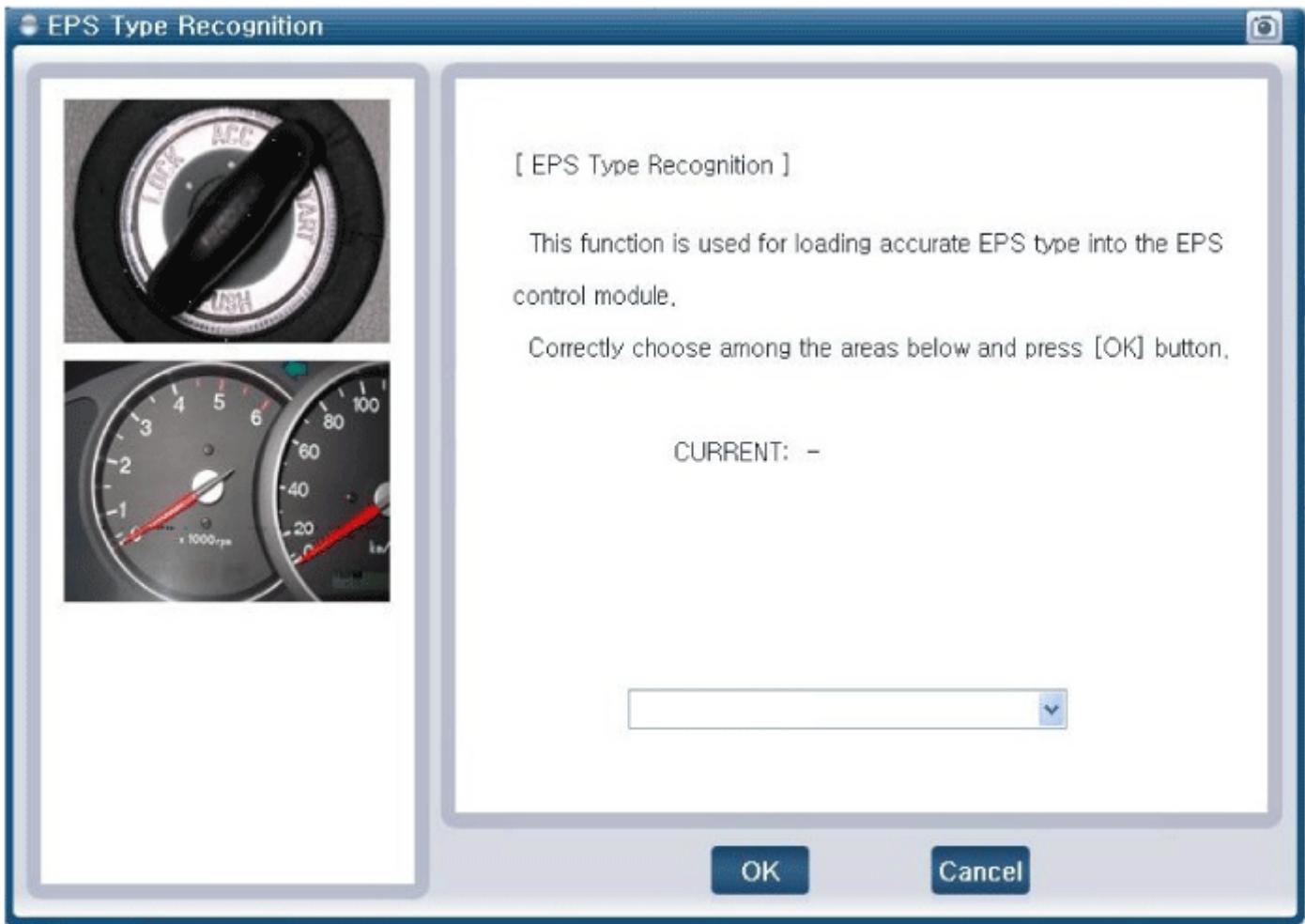
Press [CANCEL] button to exit.

OK Cancel

EPS Type Recognition Procedure

1. Select "EPS Variant Coding".
2. Proceed with the test according to the screen introductions.



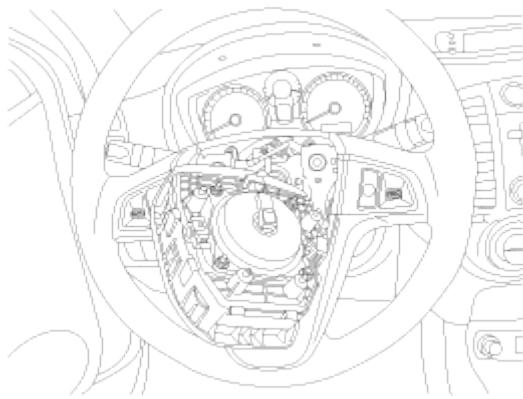


13.2.5. Steering Column and Shaft

13.2.5.1. Repair procedures

Replacement

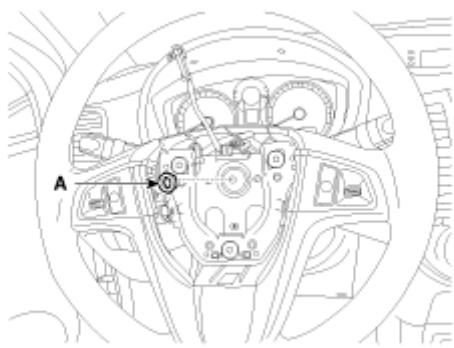
1. Disconnect the battery negative cable from the battery and then wait for at least 30 seconds.
2. Turn the steering wheel so that the front wheels can face straight ahead.
3. Remove the airbag module.



4. Loosen the lock nut (A) and then remove the steering wheel from the steering column shaft by using a SST (09561-11001).

Tightening torque :

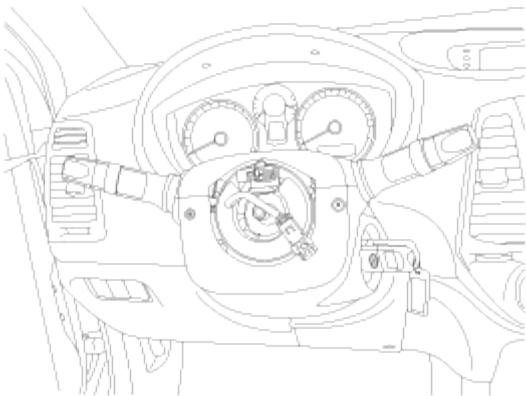
39.2 ~ 49.0N.m (4.0 ~ 5.0kgf.m, 28.9 ~ 36.2lb-ft)



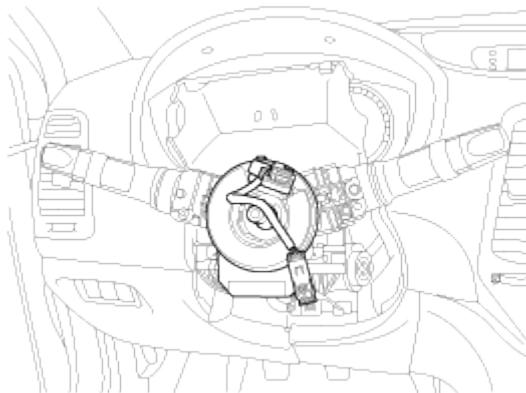
CAUTION

Do not hammer on the steering wheel to remove it; it may damage the steering column.

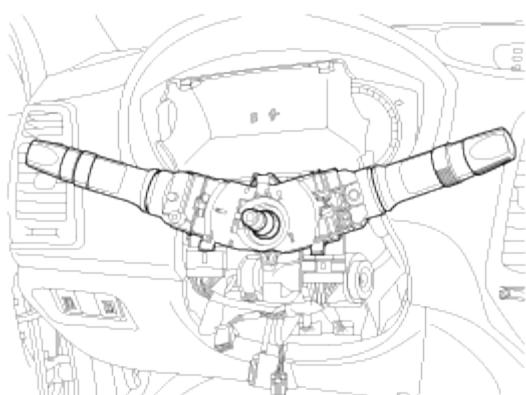
5. Remove the steering column upper and lower shroud.



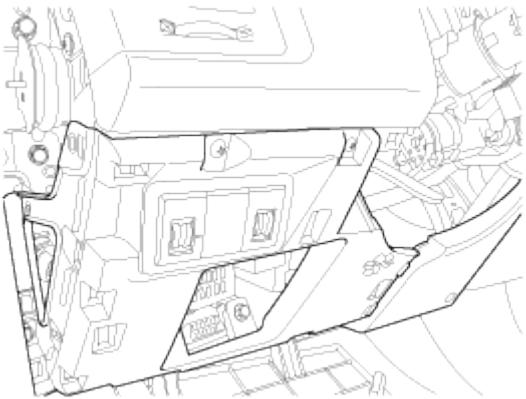
6. Remove the clock spring.



7. Remove the multifunction switches.



8. Remove the lower crash pad.



9. Loosen the bolt and then disconnect the universal joint assembly from the pinion of the steering gear box.

CAUTION

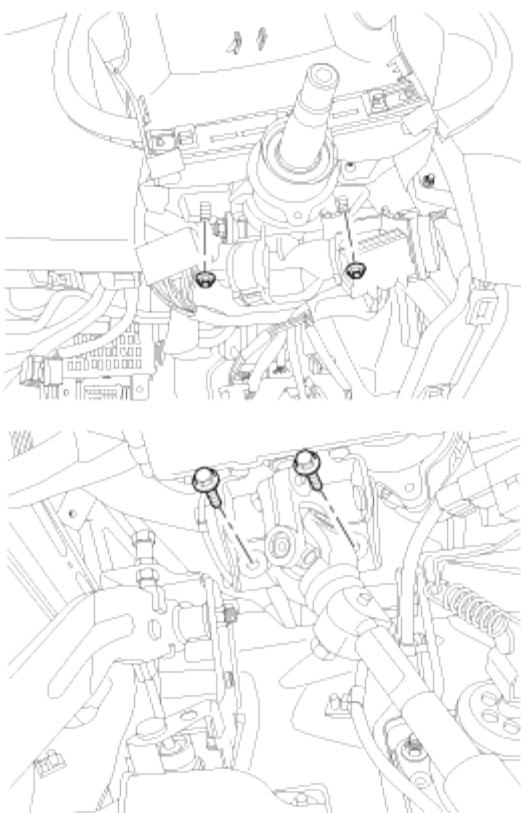
Keep the neutral-range to prevent the damage of the clock spring inner cable when you handle the steering wheel.

10. Disconnect all connectors connected to the steering column & EPS unit assembly.

11. Remove the steering column & EPS unit assembly by loosening the mounting bolts and nuts.

Tightening torque :

13 ~ 18N.m (1.3 ~ 1.8kgf.m, 9.4 ~ 13.0lb-ft)



12. Installation is the reverse of the removal.

CAUTION

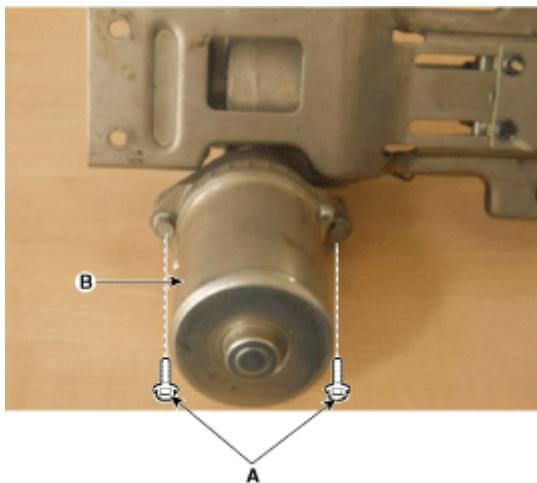
When installing the clock spring, refer the RT group to prevent the damage of clock spring inner cable.

Replacement of motor assembly

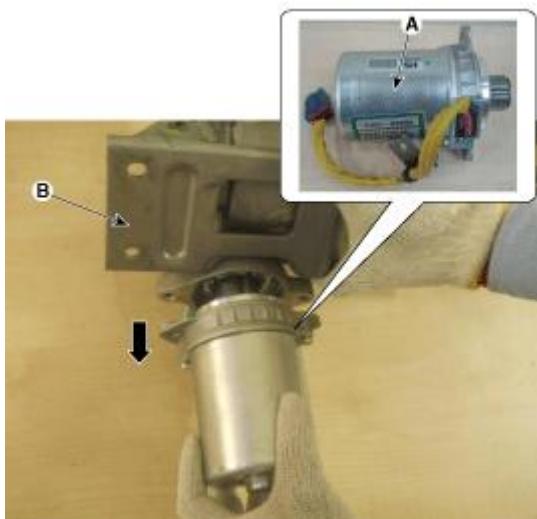
1. Remove the motor assembly (B) loosening the bolt (A-2ea).

Tightening torque :

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



2. Pull the motor assembly (A) and remove it from the steering column assembly (B).



3. Installation is the reverse of removal.

Replacement of MDPS ECU & Bracket assembly

1. Disconnect all the connectors (B) from the MDPS ECU (A).



2. Remove the ECU assembly (B) loosening the ECU bracket mounting bolt (A-2ea).

Tightening torque :

8.8 ~ 11.8 N.m (0.9 ~ 1.2 kgf.m, 6.5 ~ 8.7 lb-ft)



3. Installation is the reverse of removal.
4. After replacing the relevant parts, conduct "EPS recognition and initialization of steering angle sensor".
(Refer to Electronic Power Steering System - "Repair procedures")

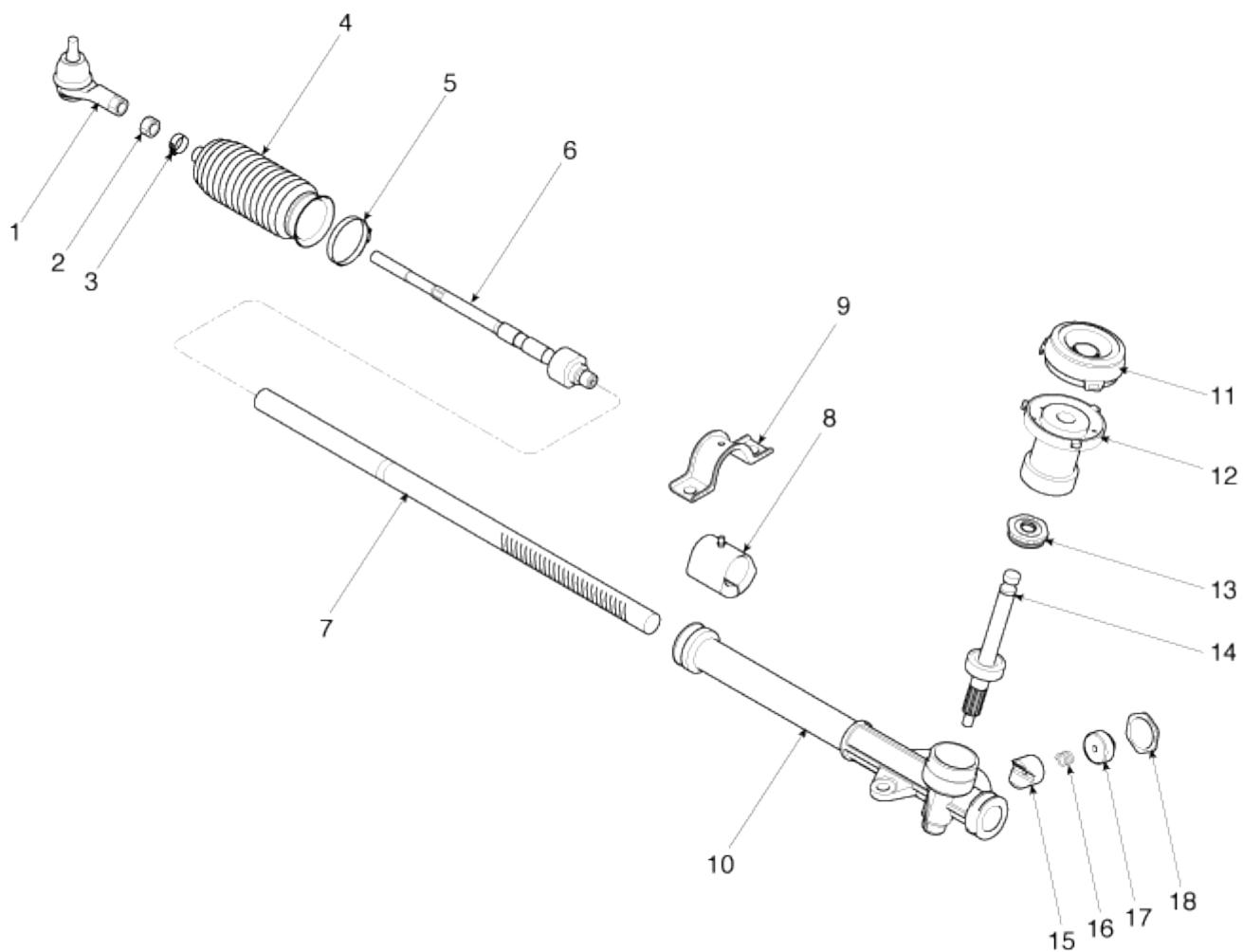
Inspection

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.

13.2.5. Steering Gear box

13.2.5.1. Component and Components Location

Components



- 1. Tie-rod end
- 2. Lock nut
- 3. Bellows clip
- 4. Bellows
- 5. Bellows band
- 6. Tie-rod
- 7. Rack bar
- 8. Mounting rubber
- 9. Mounting clamp

- 10. Rack housing
- 11. Dust packing
- 12. Dust cap
- 13. Pinion plug
- 14. Pinion
- 15. Support yoke
- 16. Yoke spring
- 17. Yoke plug
- 18. Lock nut

13.2.5.2. Repair procedures

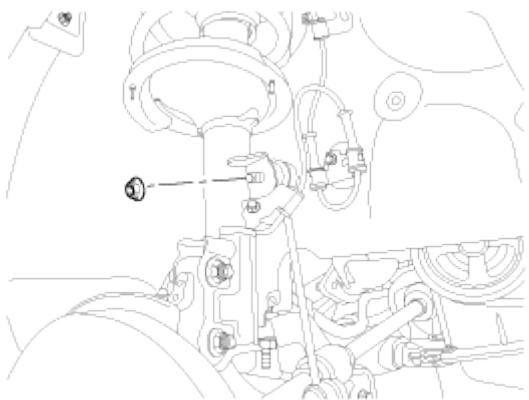
Replacement

1. Remove the front wheel & tire.

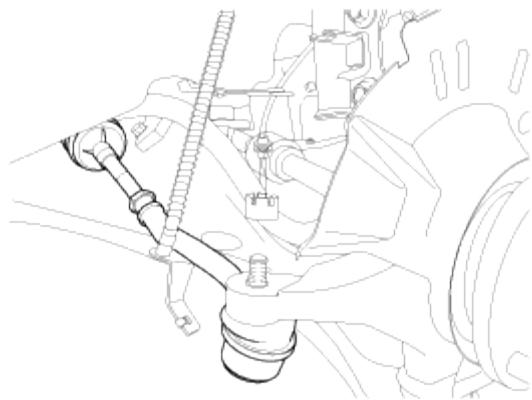
Tightening torque :

90 ~ 110N.m (9.0 ~ 11.0kgf.m, 65 ~ 80lb-ft)

2. Disconnect the stabilizer link with the front strut assembly after loosening the nut.



3. Remove the split pin and castle nut and then disconnect the tie-rod end from the front knuckle.



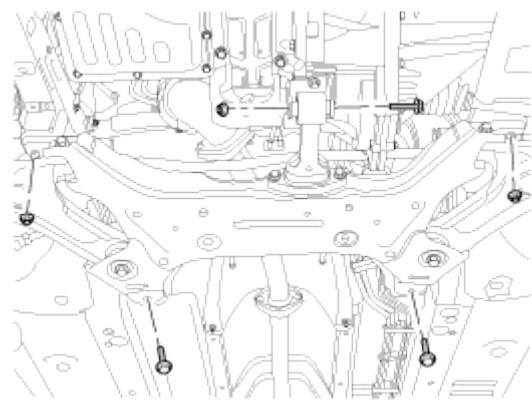
4. Loosen the bolt and then disconnect the universal joint assembly from the pinion of the steering gear box.

CAUTION

Keep the neutral-range to prevent the damage of the clock spring inner cable when you handle the steering wheel.

5. Using the special tool (09200-38001), support the engine assembly safely.

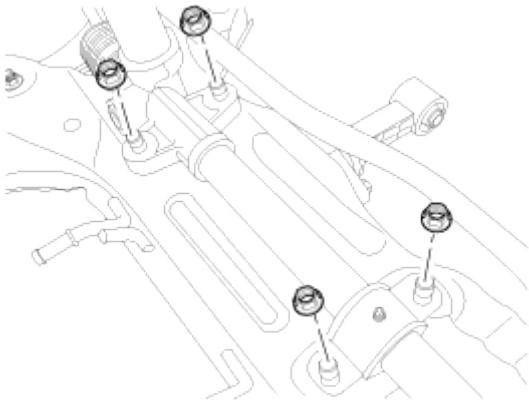
6. Remove the cross member from the body by loosening the mounting bolts and nuts.



7. Remove steering gearbox from the cross member by loosening the bracket mounting bolts.

Tightening torque :

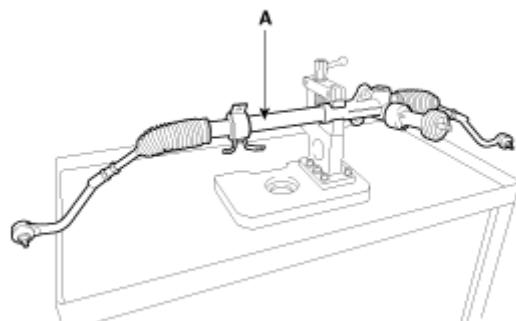
60 ~ 80N.m (6.0 ~ 8.0kgf.m, 43.0 ~ 58.00lb-ft)



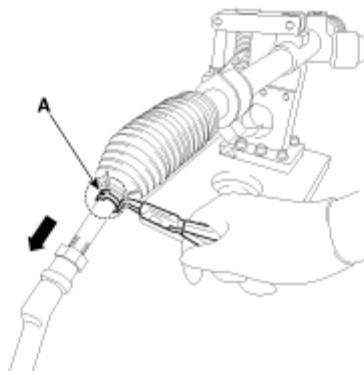
8. Installation is the reverse of the removal.

Disassembly

1. Fix the steering gear box assembly (A) on the vice.

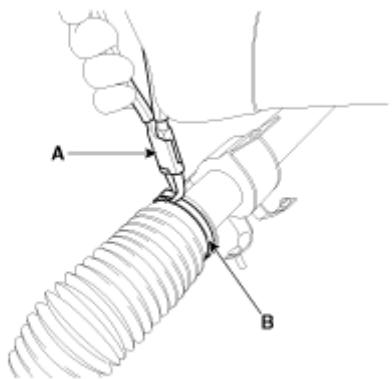


2. Remove the bellows clip (A) in the direction of the arrow. (The left and right same work.)

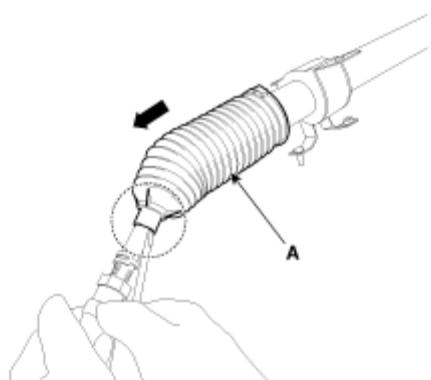


3. Give space to bellows bend (B) by using the ring pliers (A). (The left and right same work)

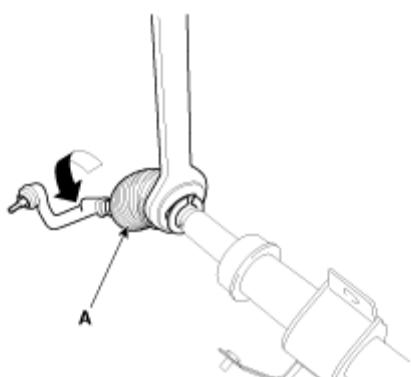
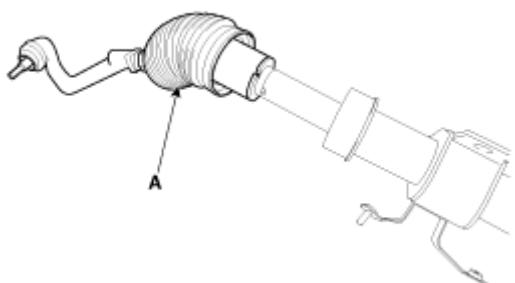
| Ring pliers work | |
|--------------------------------|-------------------------------|
| Bellows bend
(Before shape) | Bellows bend
(After shape) |
| | |



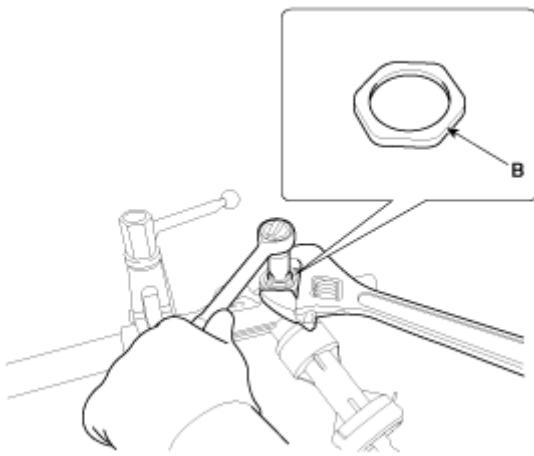
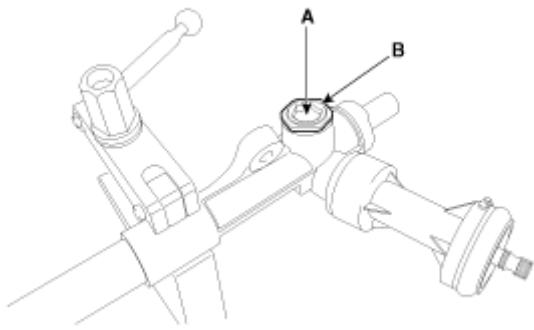
4. After making the space to the bellows and tie-rod end contact part by using the (-) driver, remove the bellows (A) in the direction of the arrow.(The left and right same work)



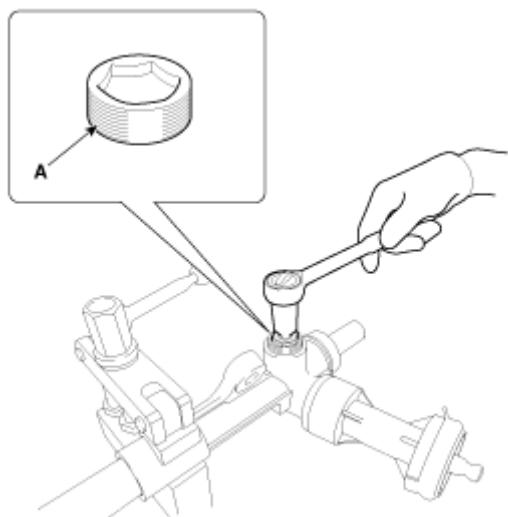
5. Remove the tie-rod & tie-rod end assembly (A).(The left and right same work)



6. After fixing the yoke plug (A), remove the rock nut (B).



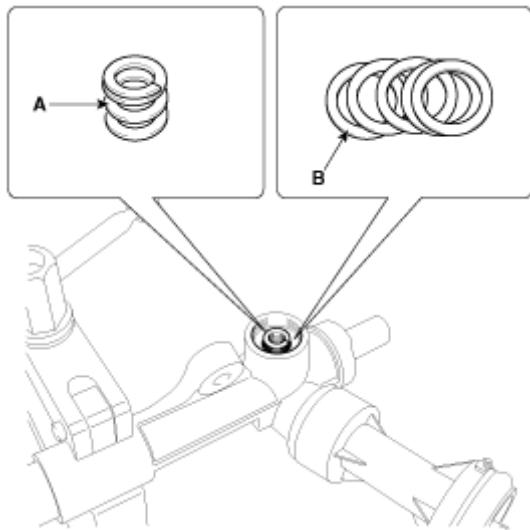
7. Remove the yoke plug (A).



8. Remove the yoke spring (A) and leaf spring (B).

NOTE

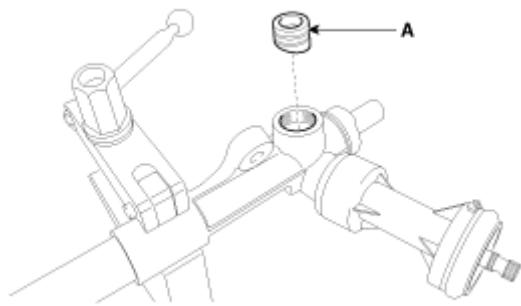
- Note that there may be urethane pads or back side of O-ring in place of leaf spring.
- The number of leaf spring can be differs from depending on vehicle.



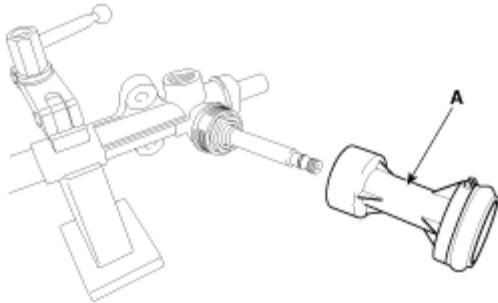
9. Remove the support yoke assembly (A) from the inner track hosing.

NOTE

- In case of support yoke assembly (A), the number and availability of O-ring can differ from depending on vehicle.



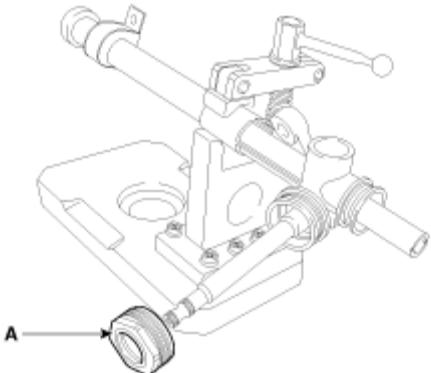
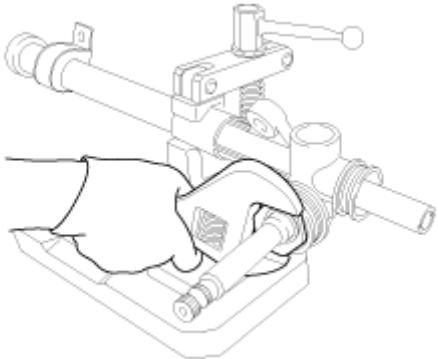
10. Remove the dust packing & cap (A).



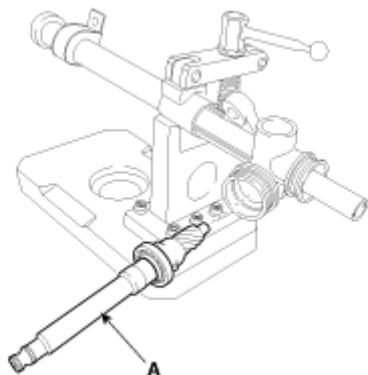
11. Remove the top plug (A) by using the spanner.

CAUTION

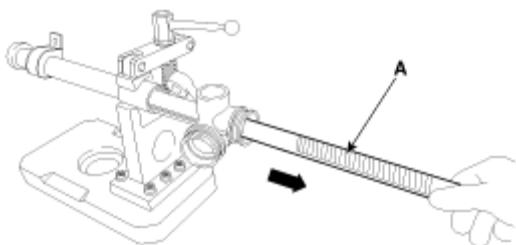
- When removing the top plug, top plug is made of aluminum, so be careful to avoid distortion.



12. Remove the pinion assembly (A).



13. Remove the rack bar (A) in the direction of the arrow.

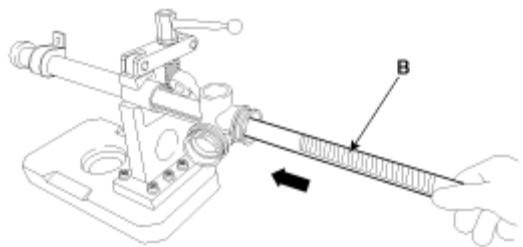
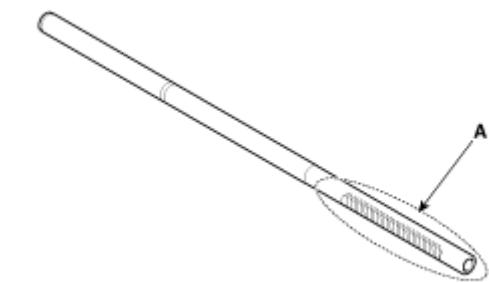


Reassembly

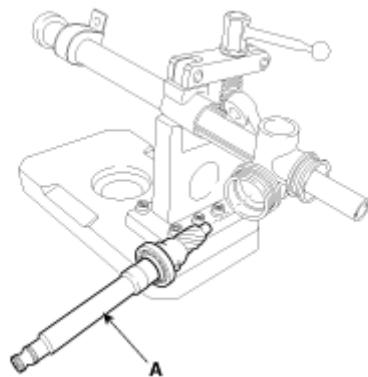
1. After spreading grease on the rack bar gear part (A), install rack bar (B) in the direction of the arrow.

CAUTION

- When inserting the rack bar, be careful not to damage to inner rack housing.



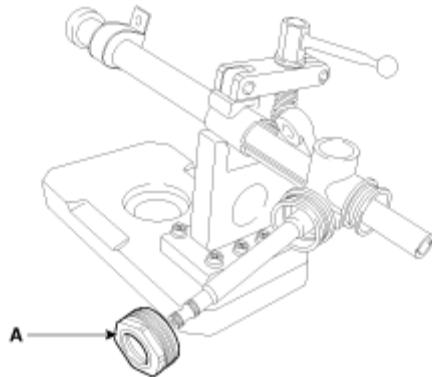
2. After spreading grease on the pinion gear part, install the pinion assembly (A).



3. After spreading three bond (Loctite) on the top plug (A) thread, install the top plug by using the spanner.

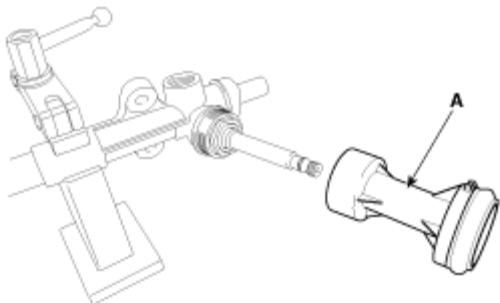
CAUTION

- When installing the top plug, top plug is made of aluminum, so be careful to avoid distortion.





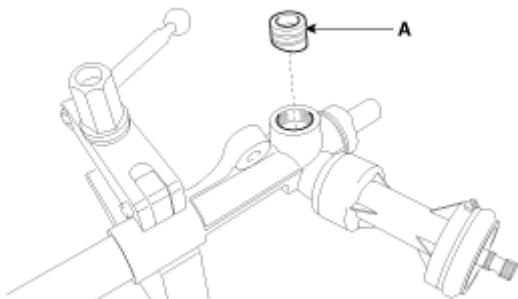
4. Install the dust packing & cap (A).



5. Install the support yoke (A).

CAUTION

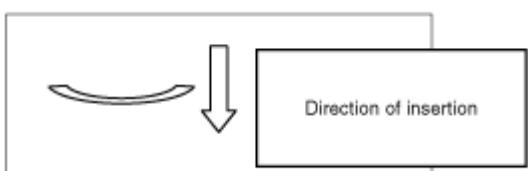
- Before installing the support yoke assembly, make sure to whether the O-ring damage.

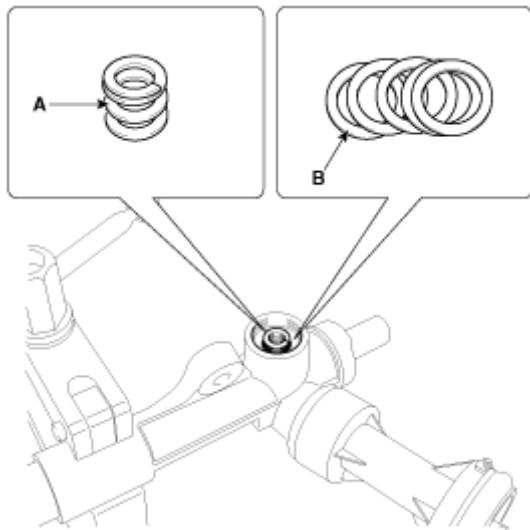


6. Install the Yoke plug (A) and leaf spring (B).

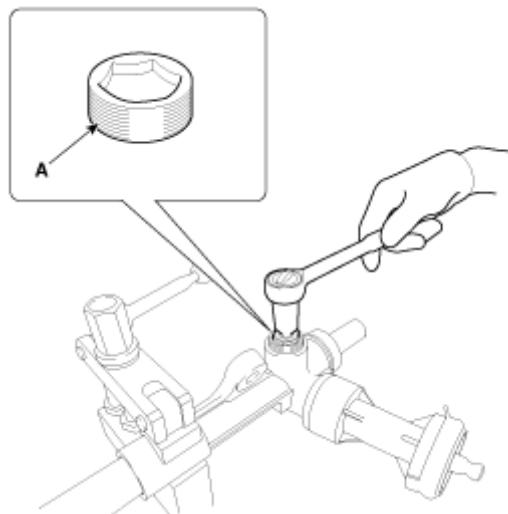
CAUTION

- The number of leaf spring can differ from depending on vehicle, pay attention to direction.
- Direction of leaf spring



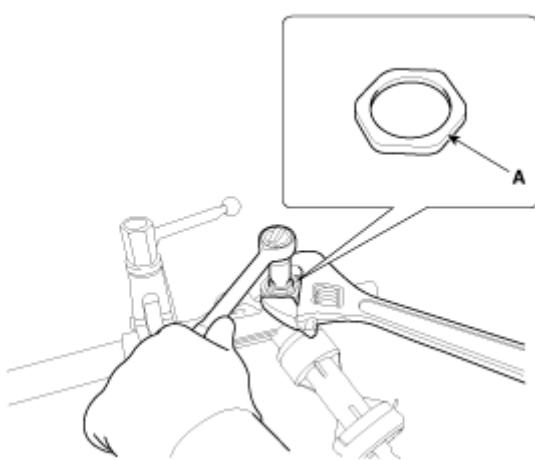


7. After spreading three bond (Loctite) on the Yoke plug (A) thread, install the Yoke plug.

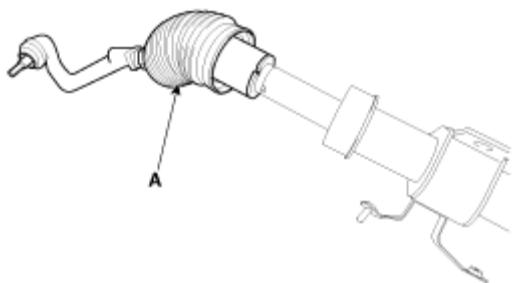
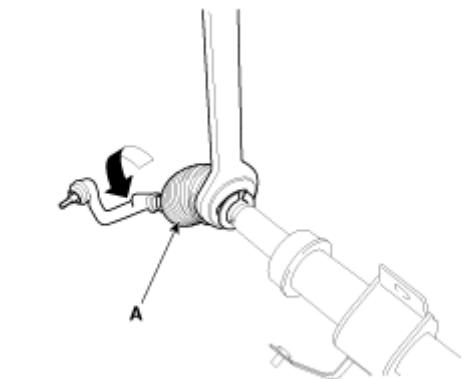


8. Adjust Yoke with reference to the "How to adjust Yoke".(Refer to "Steering gear box(Adjustment)" in ST group)

9. After fixing the yoke plug, install the rock nut (A).



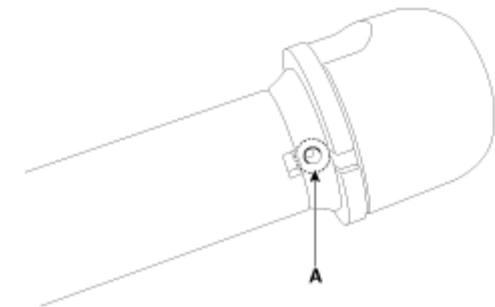
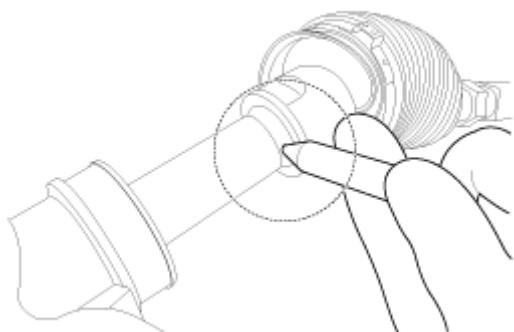
10. Install the tie-rod & tie-rod end assembly (A). (The left and right same work)



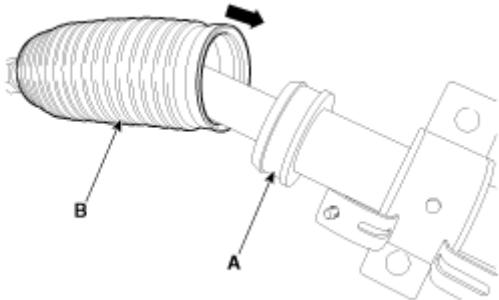
11. Caulk (A) the rack bar and tie-rod assembly joints. (The left and right same work)

CAUTION

- When you doing caulking, use the air tool or chisel.



12. After spreading sealant on the rack hosing and the bellow joints (A), install the bellows (B) in the direction of the arrow.



Inspection

1. Rack bar
 - A. Check the rack gear for damage.
 - B. Check the rack bar for bend and deformation.
2. Pinion assembly
 - A. Check the pinion gear for damage.
 - B. Check the surface contacting the oil seal for damage.
 - C. Check the oil seal for damage.
3. Check the inside of rack housing for damage.
4. Check the bellows for being torn.

14. Suspension System

14.1. General Information

14.1.1. Specifications – Revised

Specifications

Front Suspension

| Item | | Specification |
|-----------------|--------------------------|----------------------|
| Suspension type | | MacPherson Strut |
| Shock absorber | Type | Gas |
| Coil spring | Free Height [I.D. color] | 341.0mm (Blue - Red) |

Rear Suspension

| Item | | Specification |
|-----------------|--------------------------|-------------------------|
| Suspension type | | Torsion Axle |
| Shock absorber | Type | Gas |
| Coil spring | Free Height [I.D. color] | 317.7mm (White - White) |

Wheel & Tire

| Item | | Specification |
|-------|--|---------------|
| Wheel | | 5.0J x 14 |
| | | 5.5J x 15 |

| | |
|---------------|-------------------------------|
| | 5.5J x 16 |
| Tire | 175/70 R14 |
| | 185/60 R15 |
| | 195/50 R16 |
| Tire pressure | 2.3kg/cm ² (33psi) |

Wheel Alignment

Front

| Item | | Specification | |
|----------------|------------|---------------|-------------|
| | | MDPS | Manual |
| Toe-in | Total | 0.2°±0.2° | 0.2°±0.2° |
| | Individual | 0.1°±0.1° | 0.1°±0.1° |
| Camber angle | | -0.5°±0.5° | -0.5°±0.5° |
| Caster angle | | 3.5°±0.5° | 3°±0.5° |
| King-pin angle | | 13.83°±0.5° | 13.58°±0.5° |

Rear

| Item | | Specification | |
|--------------|------------|---------------|------------|
| | | MDPS | Manual |
| Toe-in | Total | 0.4°±0.2° | 0.4°±0.2° |
| | Individual | 0.2°± 0.1° | 0.2°± 0.1° |
| Camber angle | | -1.5°±0.5° | -1.5°±0.5° |

※ in. = Individual

Tightening Torques

Front Suspension

| Item | Tightening torque (kgf.m) | | |
|---------------------------------------|---------------------------|------------|----------|
| | Nm | kgf.m | lb-ft |
| Hub nuts | 90 ~ 110 | 9.0 ~ 11.0 | 65 ~ 80 |
| Strut assembly to wheel housing penal | 50 ~ 70 | 5 ~7 | 36 ~ 50 |
| Strut assembly to knuckle | 100 ~ 120 | 10.0 ~12.0 | 72 ~ 87 |
| Strut assembly lock nut | 50 ~ 70 | 5 ~7 | 36 ~ 50 |
| Stabilizer link to strut assembly | 35 ~ 45 | 3.5 ~4.5 | 25 ~ 33 |
| Lower arm to sub frame (Front) | 100 ~ 120 | 10 ~ 12.0 | 72 ~ 87 |
| Lower arm to sub frame (Rear) | 120 ~ 140 | 12 ~ 14 | 87 ~ 101 |
| Lower arm to knuckle | 60 ~ 72 | 6.0 ~ 7.2 | 43 ~ 52 |
| Stabilizer bar to stabilizer link | 35 ~ 45 | 3.5 ~4.5 | 25 ~ 33 |

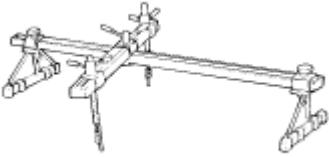
| | | | |
|---|-----------|-----------|-----------|
| Stabilizer bracket mounting bolts | 44 ~ 54 | 4.4 ~ 5.4 | 32 ~ 40 |
| Cross member to body | 160 ~ 180 | 16 ~ 18 | 116 ~ 130 |
| Rear roll stopper through bolt & nut | 50 ~ 65 | 5.0 ~ 6.5 | 36 ~ 47 |
| Tie rod end castle nut | 16 ~ 34 | 1.6 ~ 3.4 | 12 ~ 25 |
| Universal join to pinion of steering gear (MNL) | 30 ~ 35 | 3.0 ~ 3.5 | 22 ~ 26 |
| Universal join to pinion of steering gear (EPS) | 30 ~ 35 | 3.0 ~ 3.5 | 22 ~ 26 |

Rear Suspension

| Item | Tightening torque (kgf.m) | | |
|---------------------------|---------------------------|-------------|---------|
| | Nm | kgf.m | lb-ft |
| Hub nuts | 90 ~ 110 | 9.0 ~ 11.0 | 65 ~ 80 |
| Shock absorber to body | 100 ~ 120 | 10.0 ~ 12.0 | 72 ~ 87 |
| Shock absorber to carrier | 100 ~ 120 | 10.0 ~ 12.0 | 72 ~ 87 |
| Carrier to torsion beam | 50 ~ 60 | 5 ~ 6 | 36 ~ 43 |
| Torsion beam to body | 100 ~ 120 | 10.0 ~ 12.0 | 72 ~ 87 |

14.1.2. Special Service Tools

Special Service Tools

| Tool (Number and Name) | Illustration | Use |
|--|---|---|
| 09546-26000
Strut spring compressor |  | Compression of coil spring |
| 09568-2J100
Ball joint puller |  | Remover of ball joint |
| 09200-38001
Engine support fixture |  | Removal and installation of the transaxle |

14.1.3. 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

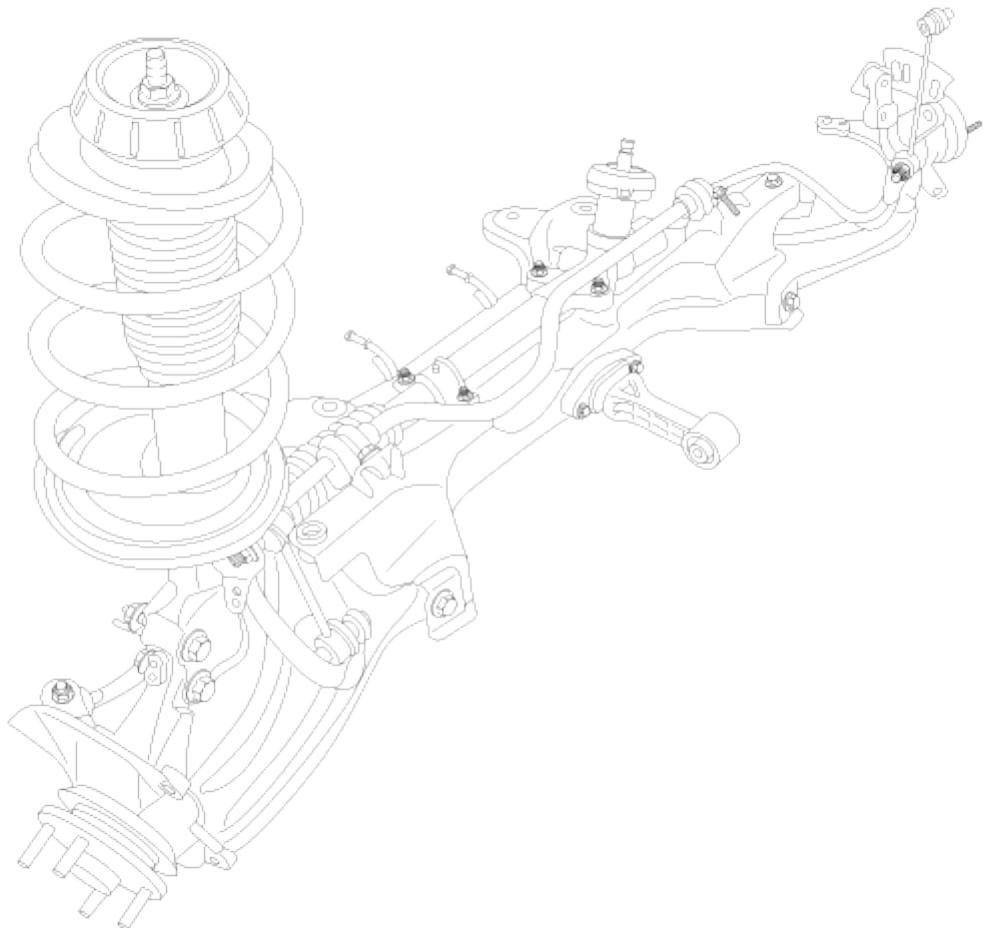
| Wheel and tire diagnosis | | |
|--------------------------|------------------------------|----------------------|
| Rapid wear at the center | Rapid wear at both shoulders | Wear at one shoulder |

| | | |
|--|--|--|
|  |  |  |
| <ul style="list-style-type: none"> Center-tread down to fabric due to excessive over inflated tires Lack of rotation Excessive toe on drive wheels Heavy acceleration on drive | <ul style="list-style-type: none"> Under-inflated tires Worn suspension components Excessive cornering speeds Lack of rotation | <ul style="list-style-type: none"> Toe adjustment out of specification Camber out of specification Damaged strut Damaged lower arm |
| Partial wear | Feathered edge | Wear pattern |
|  |  |  |
| <ul style="list-style-type: none"> Caused by irregular burrs on brake drums | <ul style="list-style-type: none"> Toe adjustment out of specification Damaged or worn tie rods Damaged knuckle | <ul style="list-style-type: none"> Excessive toe on non-drive wheels Lack of rotation |

14.2. Front Suspension System

14.2.1. Component and Components Location

Components

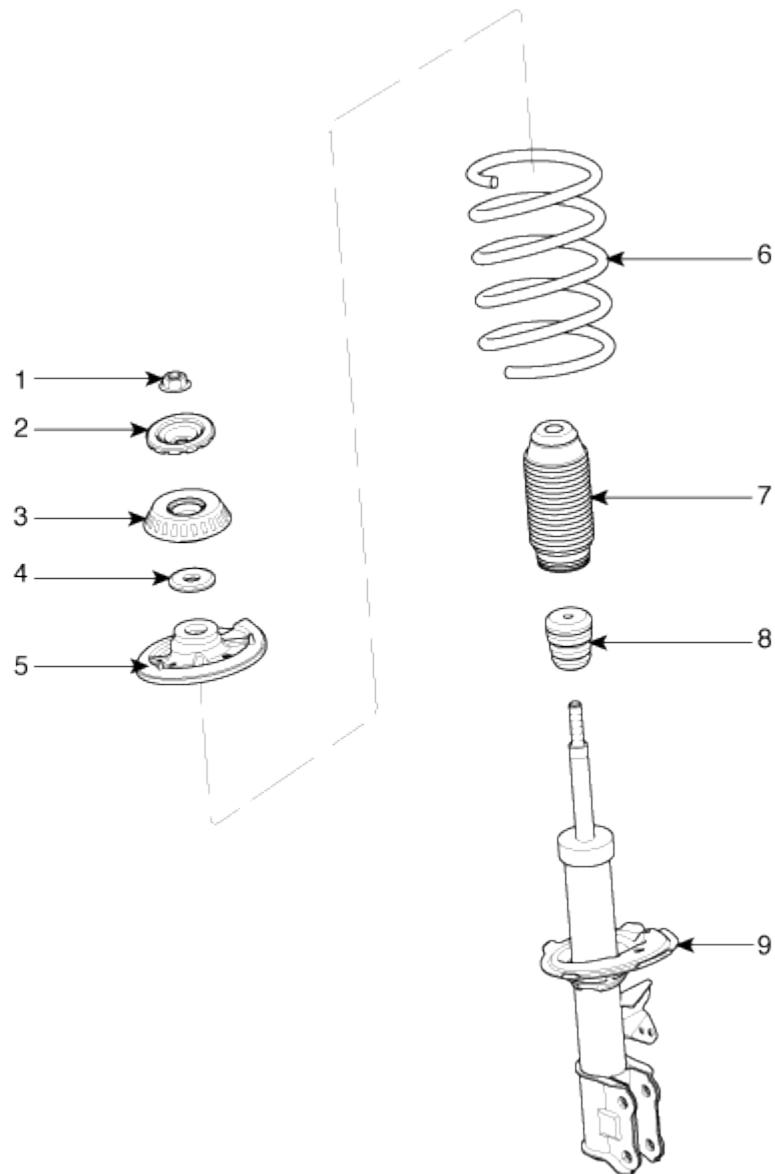


1. Sub frame
2. Strut assembly
3. Lower arm
4. Steering gearbox
5. Stabilizer

14.2.2. Front Strut Assembly

14.2.2.1. Component and Components Location

Components



| | |
|--|--|
| 1. Lock nut
2. Insulator Dust cap
3. Strut insulator
4. Strut bearing
5. Spring upper seat | 6. Coil spring
7. Dust cover
8. Bumper rubber
9. Shock absorber |
|--|--|

14.2.2.2. Repair procedures

Replacement

1. Remove the front wheel & tire.

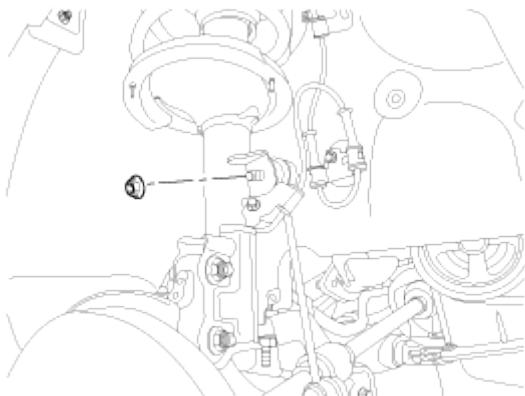
Tightening torque :

90 ~ 110N.m (9.0 ~ 11.0kgf.m, 65 ~ 80lb-ft)

2. Remove the wheel speed sensor bracket from the front strut assembly by loosening mounting bolts.
3. Disconnect the stabilizer link with the front strut assembly after loosening the nut.

Tightening torque :

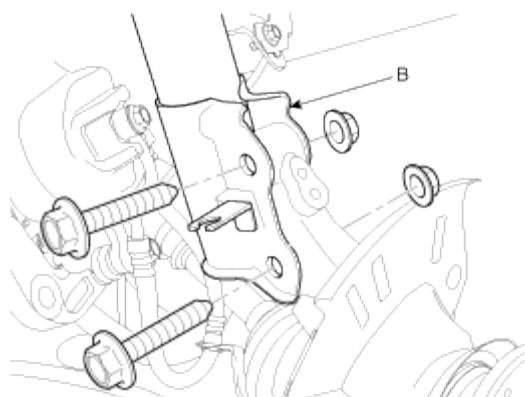
35 ~ 45N.m (3.5 ~ 4.5kgf.m, 25 ~ 33lb-ft)



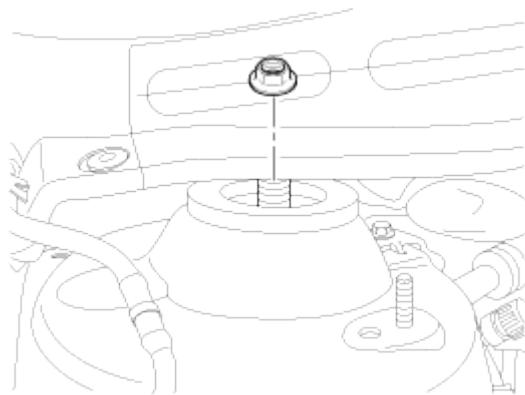
4. Disconnect the front strut assembly (B) with the knuckle by loosening the bolt & nut.

Tightening torque :

100 ~ 120N.m (10.0 ~ 12.0kgf.m, 72 ~ 87lb-ft)



5. Remove the cap and then loosen the strut mounting nuts.



6. Installation is the reverse of removal.

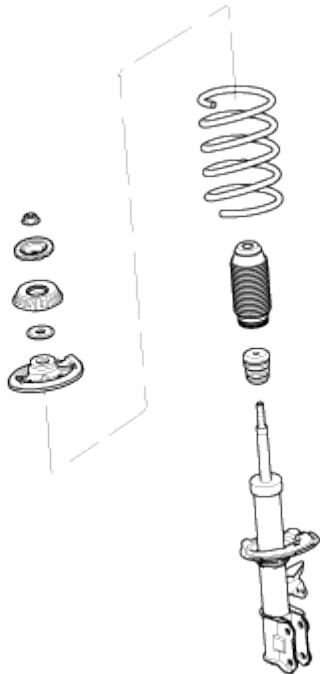
Disassembly and Reassembly

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 :

49 ~ 69N.m (5.0 ~ 7.0kgf.m, 36 ~ 50lb-ft)

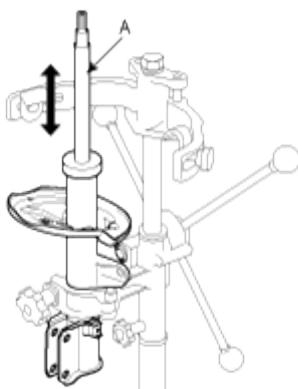
3. Disassemble the components of front strut assembly in sequence. (Refer to Front strut assembly components)



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.



14.2.3. Front Lower Arm 14.2.3.1. Repair procedures

Replacement

1. Remove the front wheel & tire.

Tightening torque :

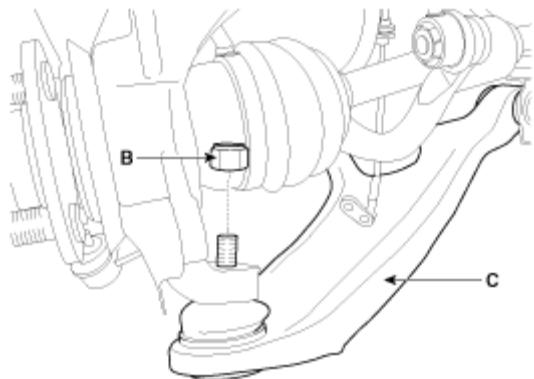
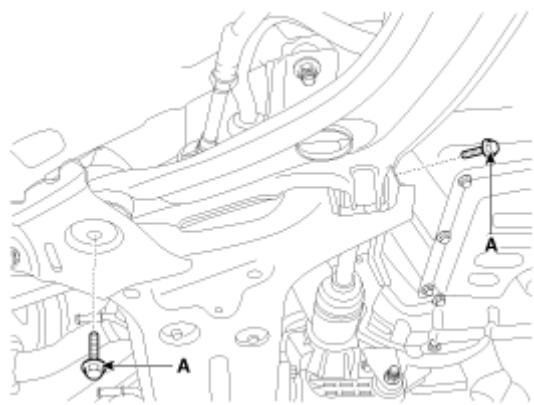
90 ~ 110N.m (9.0 ~ 11.0kgf.m, 65 ~ 80lb-ft)

2. Loosen the bolts (A) and nut (B) and then remove the lower arm (C) from the sub frame.

Tightening torque :

60 ~ 72N.m (6.0 ~ 7.2kgf.m, 43 ~ 52lb-ft)

100 ~ 120N.m (10.0 ~ 12.0kgf.m, 72 ~ 87lb-ft)
120 ~ 140N.m (12.0 ~ 14.0kgf.m, 87 ~ 101lb-ft)

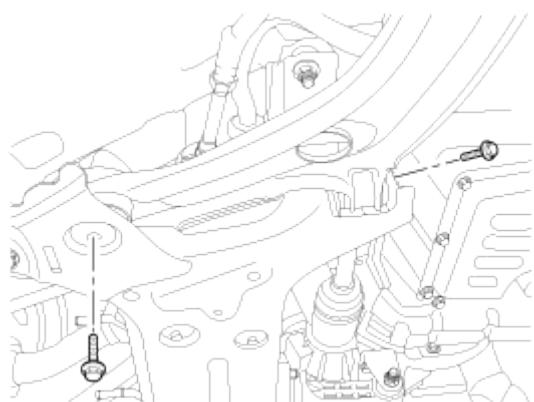


Tightening torque :

100 ~ 120N.m (10.0 ~ 12.0kgf.m, 72 ~ 87lb-ft)
120 ~ 140N.m (12.0 ~ 14.0kgf.m, 87 ~ 101lb-ft)

Tightening torque :

60 ~ 72N.m (6.0 ~ 7.2kgf.m, 43 ~ 52lb-ft)
100 ~ 120N.m (10.0 ~ 12.0kgf.m, 72 ~ 87lb-ft)
120 ~ 140N.m (12.0 ~ 14.0kgf.m, 87 ~ 101lb-ft)



3. Installation is the reverse of removal.

14.2.4. Front Stabilizer Bar

14.2.4.1. Repair procedures

Replacement

1. Remove the front wheel & tire.

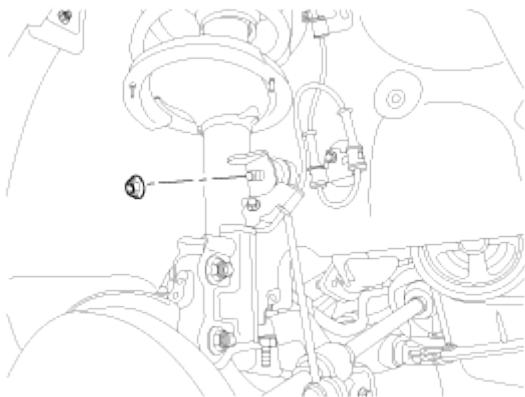
Tightening torque :

90 ~ 110N.m (9.0 ~ 11.0kgf.m, 65 ~ 80lb-ft)

-
2. Disconnect the stabilizer link with the front strut assembly after loosening the nut.
-

Tightening torque :

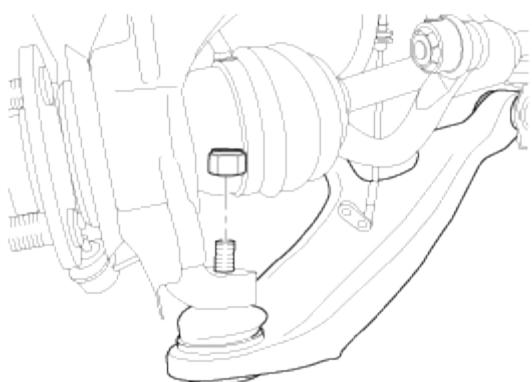
35 ~ 45N.m (3.5 ~ 4.5kgf.m, 25 ~ 33lb-ft)



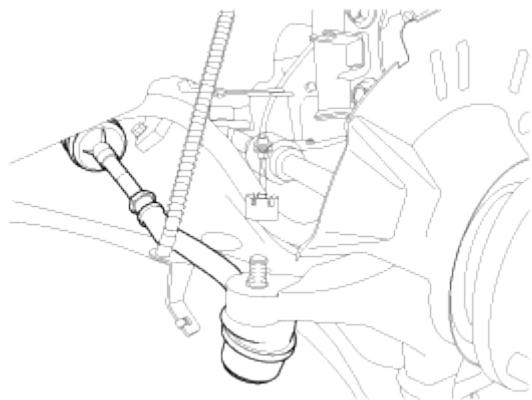
3. Loosen the nuts.

Tightening torque :

60 ~ 72N.m (6.0 ~ 7.2kgf.m, 43 ~ 52lb-ft)



4. Remove the split pin and castle nut and then disconnect the tie-rod end from the front knuckle.

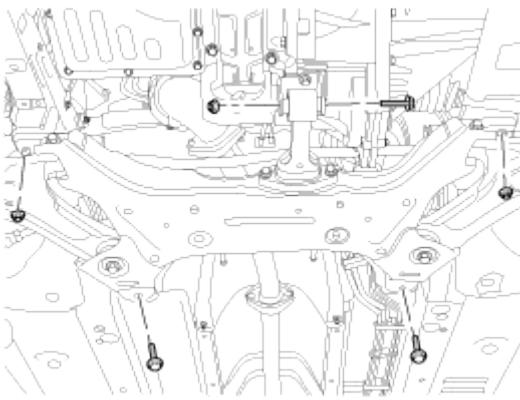


5. Loosen the bolt and then disconnect the universal joint assembly from the pinion of the steering gear box.

CAUTION

Keep the neutral-range to prevent the damage of the clock spring inner cable when you handle the steering wheel.

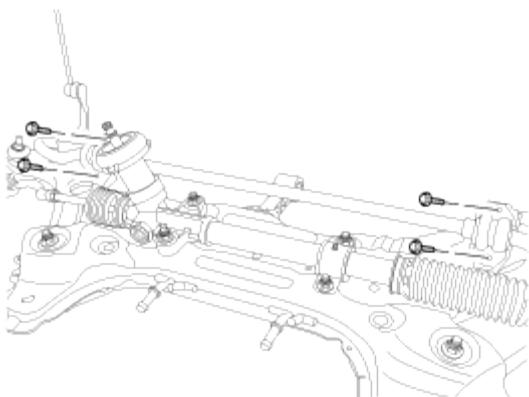
6. Remove the cross member from the body by loosening the mounting bolts and nuts.



7. Remove stabilizer from the cross member by loosening the bracket (A) mounting bolts.

Tightening torque :

45 ~ 55N.m (4.5 ~ 5.5kgf.m, 32 ~ 40lb-ft)



8. 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.

14.2.5. Front Cross Member 14.2.5.1. Repair procedures

Replacement

1. Remove the front wheel & tire.

Tightening torque :

90 ~ 110N.m (9.0 ~ 11.0kgf.m, 65 ~ 80lb-ft)

2. Loosen the bolt and then disconnect the universal joint assembly from the pinion of the steering gear box.

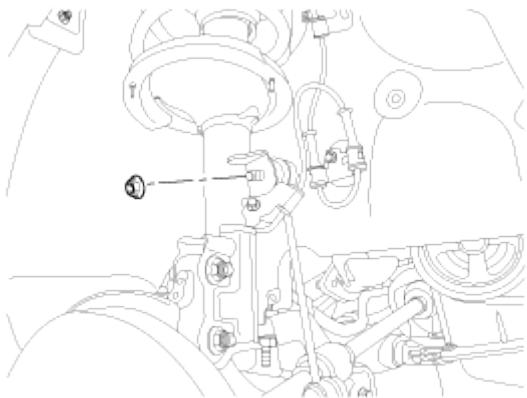
CAUTION

Keep the neutral-range to prevent the damage of the clock spring inner cable when you handle the steering wheel.

3. Disconnect the stabilizer link with the front strut assembly after loosening the nut.

Tightening torque :

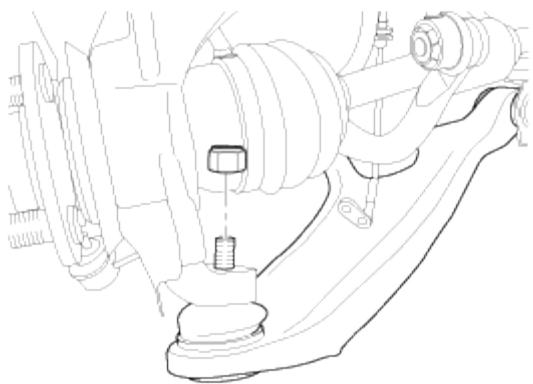
35 ~ 45N.m (3.5 ~ 4.5kgf.m, 25 ~ 33lb-ft)



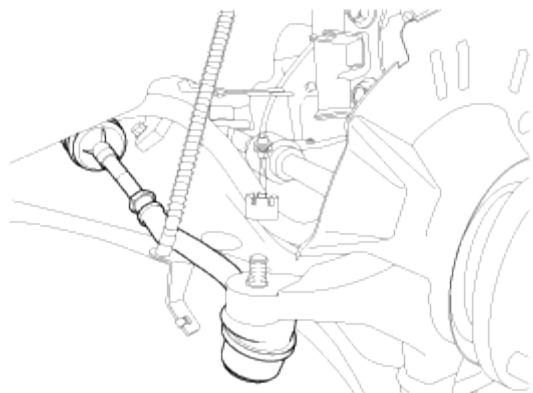
4. Loosen the nuts.
-

Tightening torque :

60 ~ 72N.m (6.0 ~ 7.2kgf.m, 43 ~ 52lb-ft)

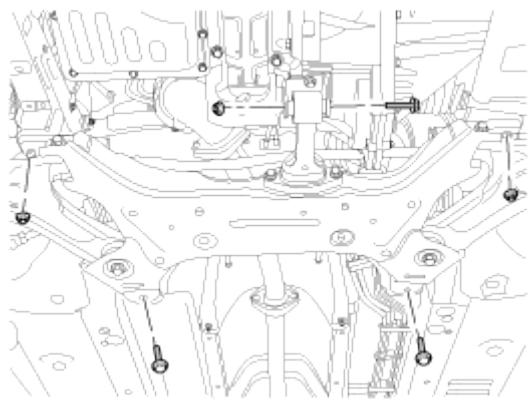


5. Remove the sprit pin and castle nut and then disconnect the tie-rod end from the front knuckle.



6. Using the special tool (09200-38001), support the engine assembly safely.

7. Remove the cross member from the body by loosening the mounting bolts and nuts.



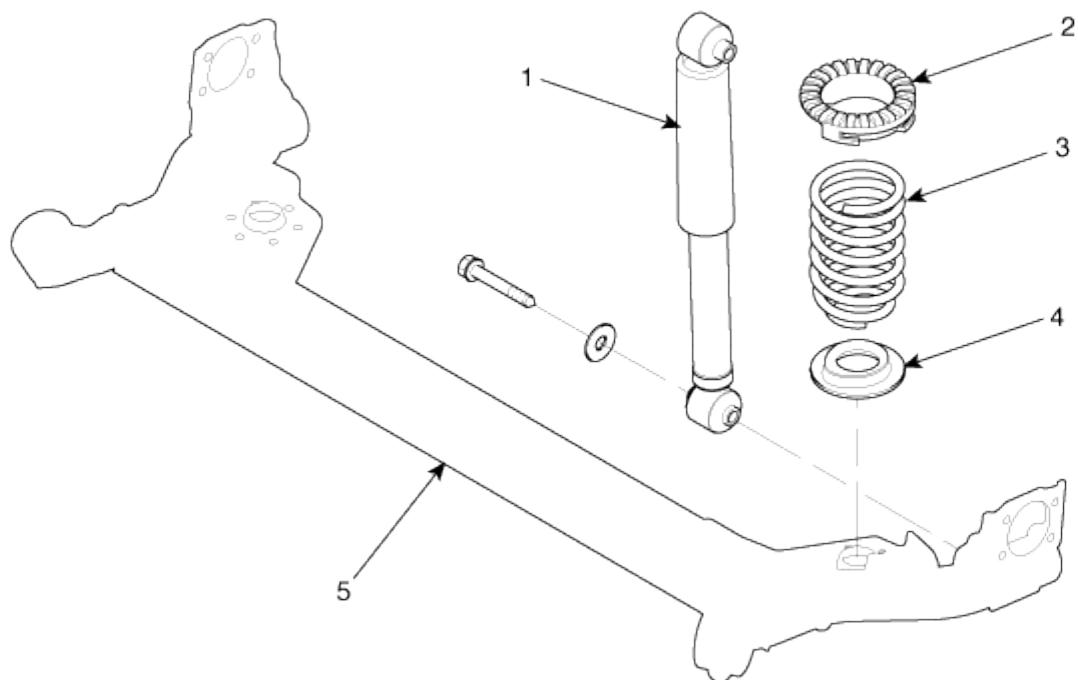
8. Remove the stabilizer & steering gearbox.

9. Installation is the reverse of removal.

14.3. Rear Suspension System

14.3.1. Component and Components Location

Components



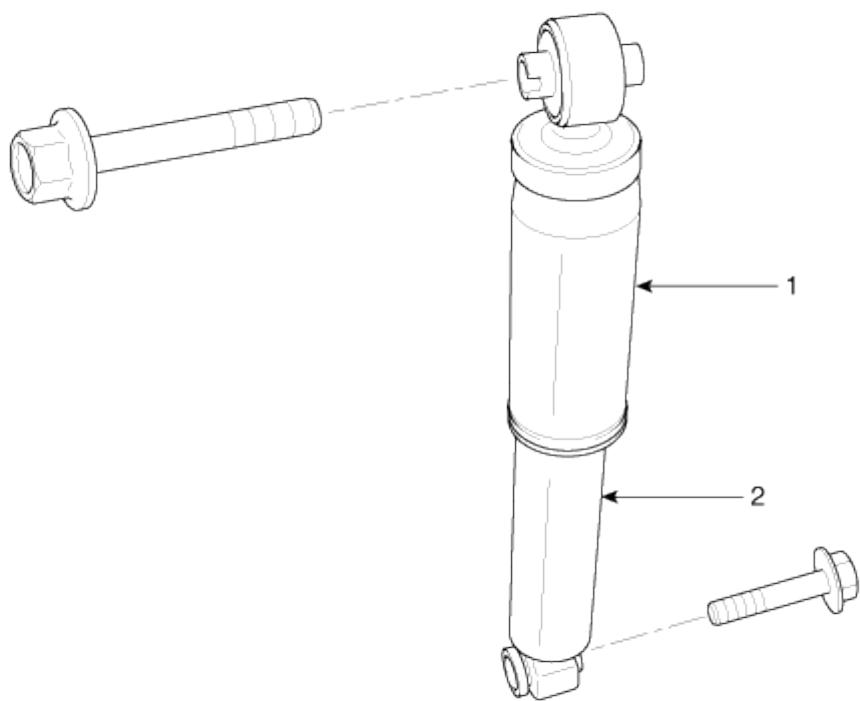
1. Rear shock absorber
2. Spring upper pad
3. Coil spring

4. Spring lower pad
5. Torsion Axle

14.3.2. Rear Shock Absorber

14.3.2.1. Component and Components Location

Components



- 1. Dust cover
- 2. Shock absorber

14.3.2.2. Repair procedures

Replacement

1. Remove the rear wheel & tire.

Tightening torque :

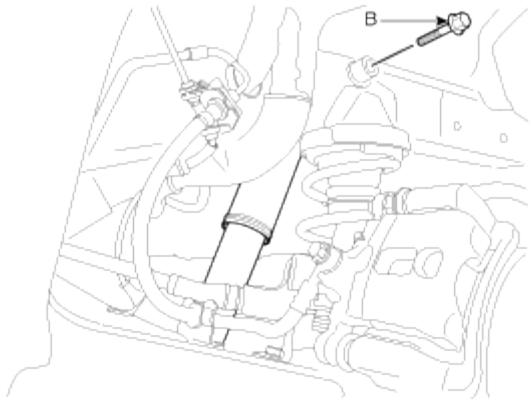
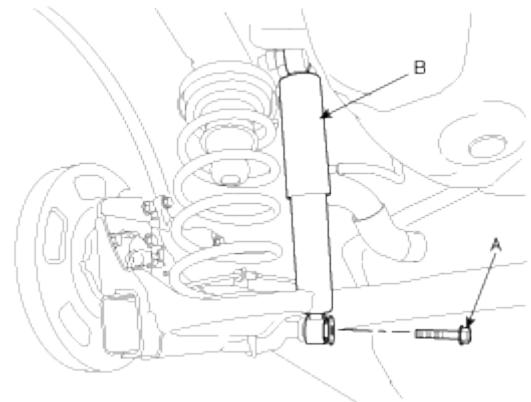
90 ~ 110N.m (9.0 ~ 11.0kgf.m, 65 ~ 80lb-ft)

2. Support the lower portion of the torsion axle with a jack.

3. Loosen the bolts (A, B) and then remove the rear shock absorber.

Tightening torque :

100 ~ 120N.m (10.0 ~ 12.0kgf.m, 72 ~ 87lb-ft)



4. Installation is the reverse of removal.

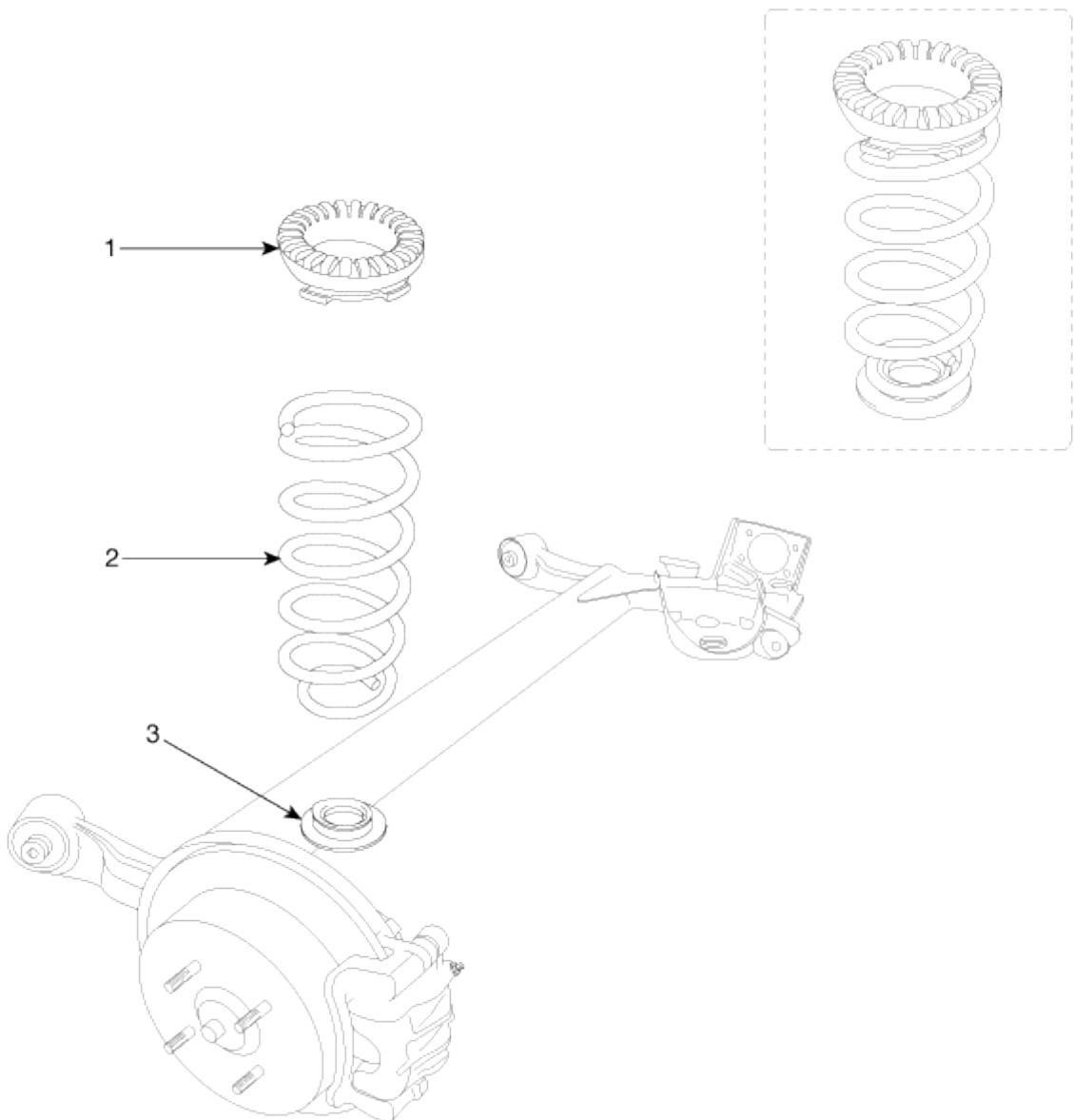
Inspection

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.

14.3.3. Rear Coil Spring

14.3.3.1. Component and Components Location

Components



1. Spring upper pad
2. Spring
3. Spring lower pad

14.3.3.2. Repair procedures

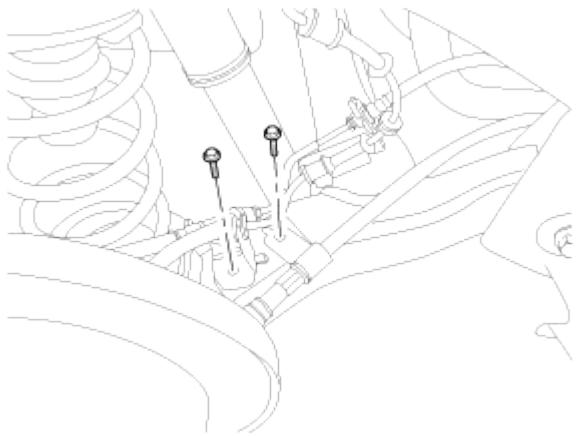
Replacement

1. Remove the rear wheel & tire.

Tightening torque :

90 ~ 110N.m (9.0 ~ 11.0kgf.m, 65 ~ 80lb-ft)

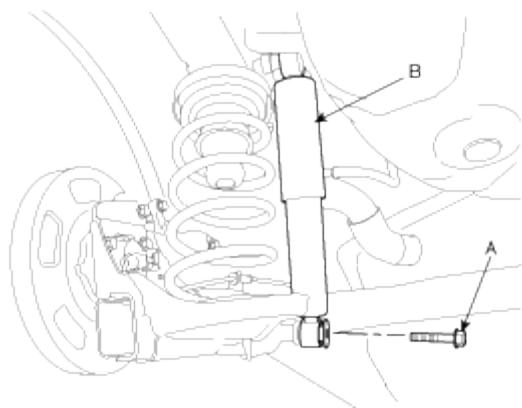
2. Remove the brake hose bracket (B) and the wheel speed sensor wire bracket (A).



3. Remove the rear shock absorber lower mounting bolt (A).

Tightening torque :

100 ~ 120N.m (10.0 ~ 12.0kgf.m, 72 ~ 87lb·ft)



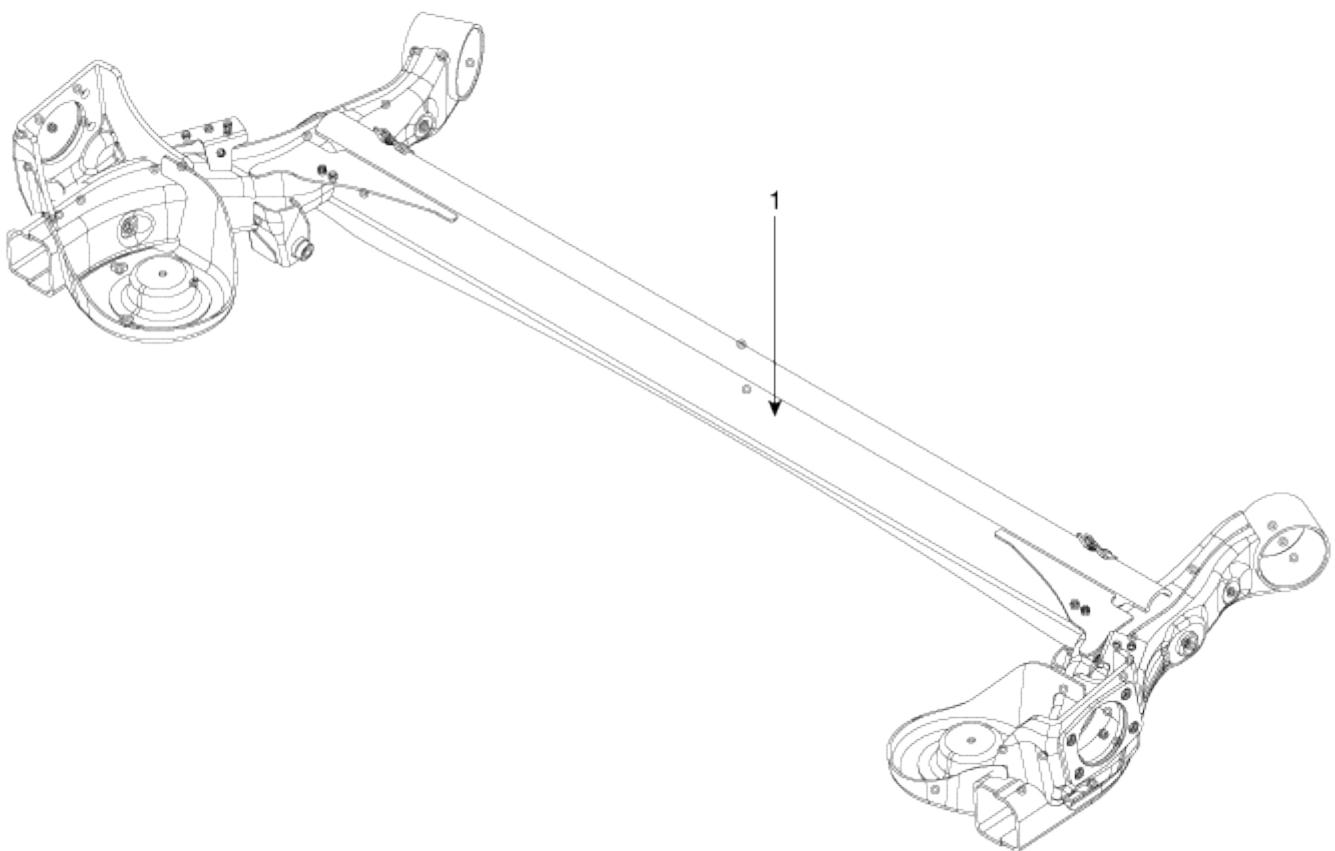
4. Installation is the reverse of removal.

Inspection

1. Check the coil spring for crack and deformation.
2. Check the coil spring pad for damage and deformation.

14.3.4. Rear Torsion Beam Axle 14.3.4.1. Component and Components Location

Components



1. Rear torsion beam axle

14.3.4.2. Repair procedures

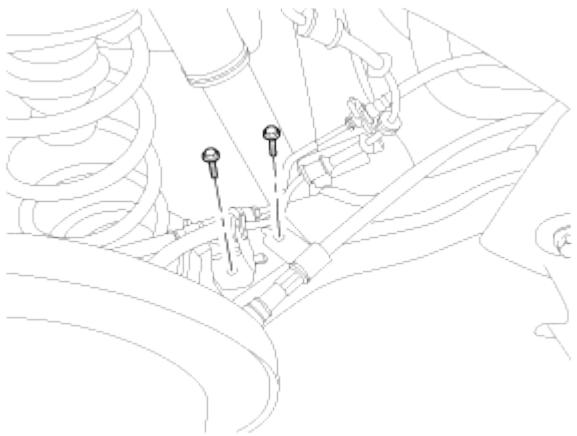
Replacement

1. Remove the rear wheel & tire.

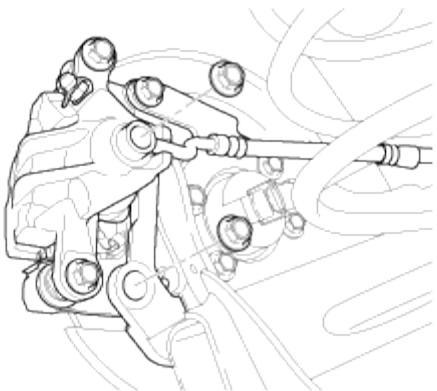
Tightening torque :

90 ~ 110N.m (9.0 ~ 11.0kgf.m, 65 ~ 80lb-ft)

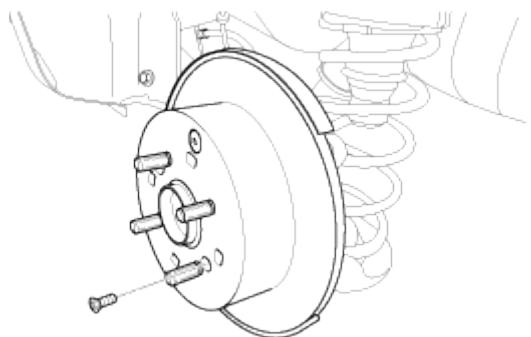
2. Remove the brake hose bracket (B) and the wheel speed sensor wire bracket (A).



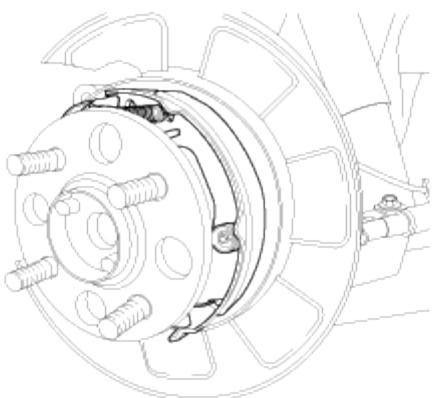
3. Remove the rear caliper assembly (A) and then suspend it with wire.



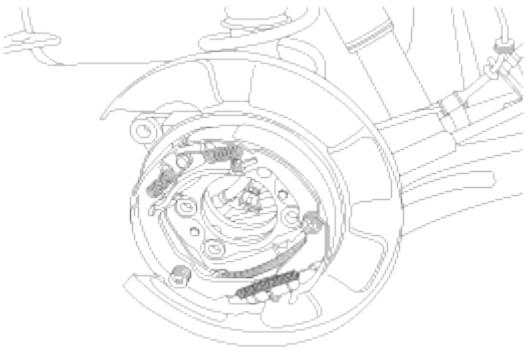
4. Remove the brake disk.



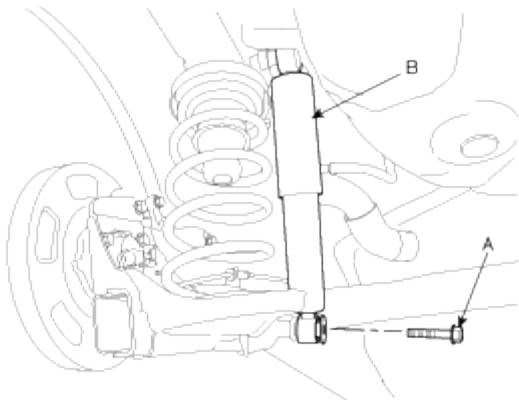
5. Remove the rear hub unit bearing.



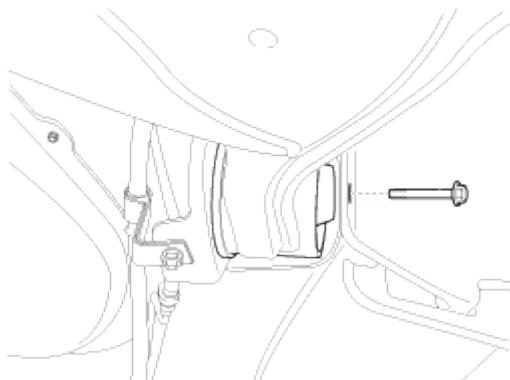
6. Remove the parking brake wire.



7. Remove the rear shock absorber lower mounting bolt (A).



8. Remove the torsion axle from the body loosening the bolts.



9. Installation is the reverse of removal.

14.4. Tires / Wheels

14.4.1. Tire

14.4.1.1. Repair procedures

Tire Wear

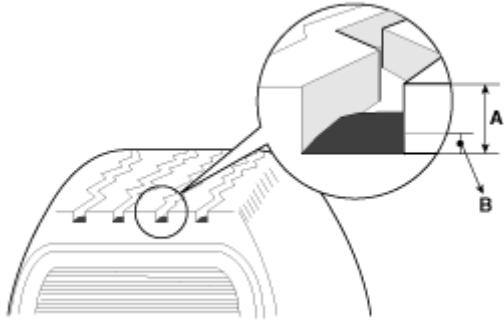
1. Measure the tread depth of the tires.

Tread depth [limit] : 1.6 mm (0.063 in)

2. If the remaining tread depth (A) is less than the limit, replace the tire.

NOTE

When the tread depth of the tires is less than 1.6 mm(0.063 in), the wear indicators (B) will appear.



14.4.2. Wheel

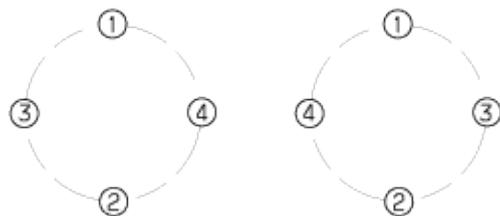
14.4.2.1. Repair procedures

Hub Nut Tightening Sequence

Tighten the hub nuts as follows.

Tightening torque :

90 ~ 110N.m (9.0 ~ 11.0kgf.m, 65 ~ 80lb-ft)



CAUTION

When using an impact gun, final tightening torque should be checked using a torque wrench.

14.4.3. Alignment

14.4.3.1. Repair procedures – Revised

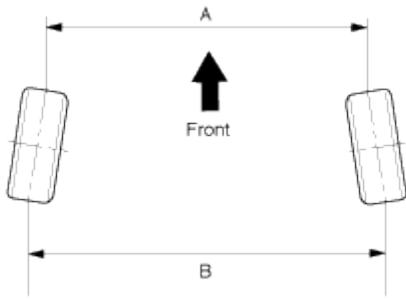
Front Wheel Alignment

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 (-)

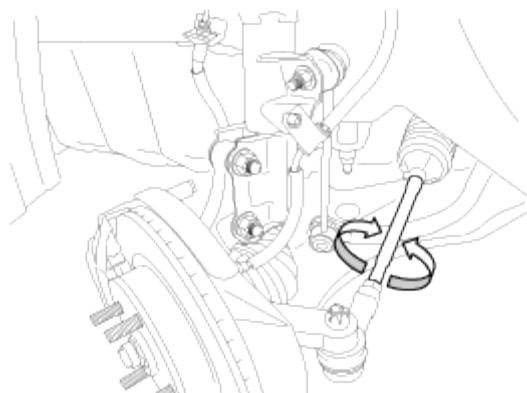
Toe Adjustment

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-in

Total : $0.2^\circ \pm 0.2^\circ$

Individual : $0.1^\circ \pm 0.1^\circ$



4. When completing the toe adjustment, install the bellows clip and tighten the tie rod end lock nut to specified torque.

Tightening torque :

50 ~ 55N.m (5.0 ~ 5.5kgf.m, 36 ~ 40lb-ft)

Camber and Caster

Camber and Caster are pre-set at the factory, so they do not need to be adjusted. If the camber and caster are not within the standard value, replace or repair the damaged parts and then inspect again.

Camber angle: $-0.5^\circ \pm 0.5^\circ$

Caster angle :

MDPS : $3.5^\circ \pm 0.5^\circ$

Manual : $3^\circ \pm 0.5^\circ$

Camber angle: $-0.5^\circ \pm 0.5^\circ$

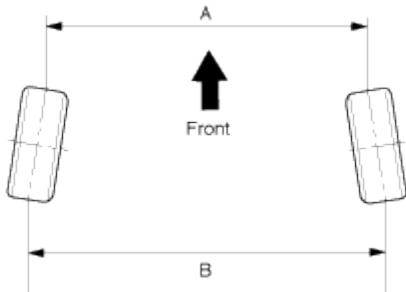
Rear Wheel Alignment

CAUTION

When using a commercially available computerized wheel alignment equipment to inspect the rear wheel alignment, always position the vehicle on a level surface.

Prior to inspection, make sure that the rear suspension system is in normal operating condition and that the tires are inflated to the specified pressure.

Toe



B - A > 0: Toe in (+)

B - A < 0: Toe out (-)

Toe 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-in

Total : $0.4^\circ \pm 0.2^\circ$

Individual : $0.2^\circ \pm 0.1^\circ$

B - A > 0: Toe in (+)

B - A < 0: Toe out (-)

Camber

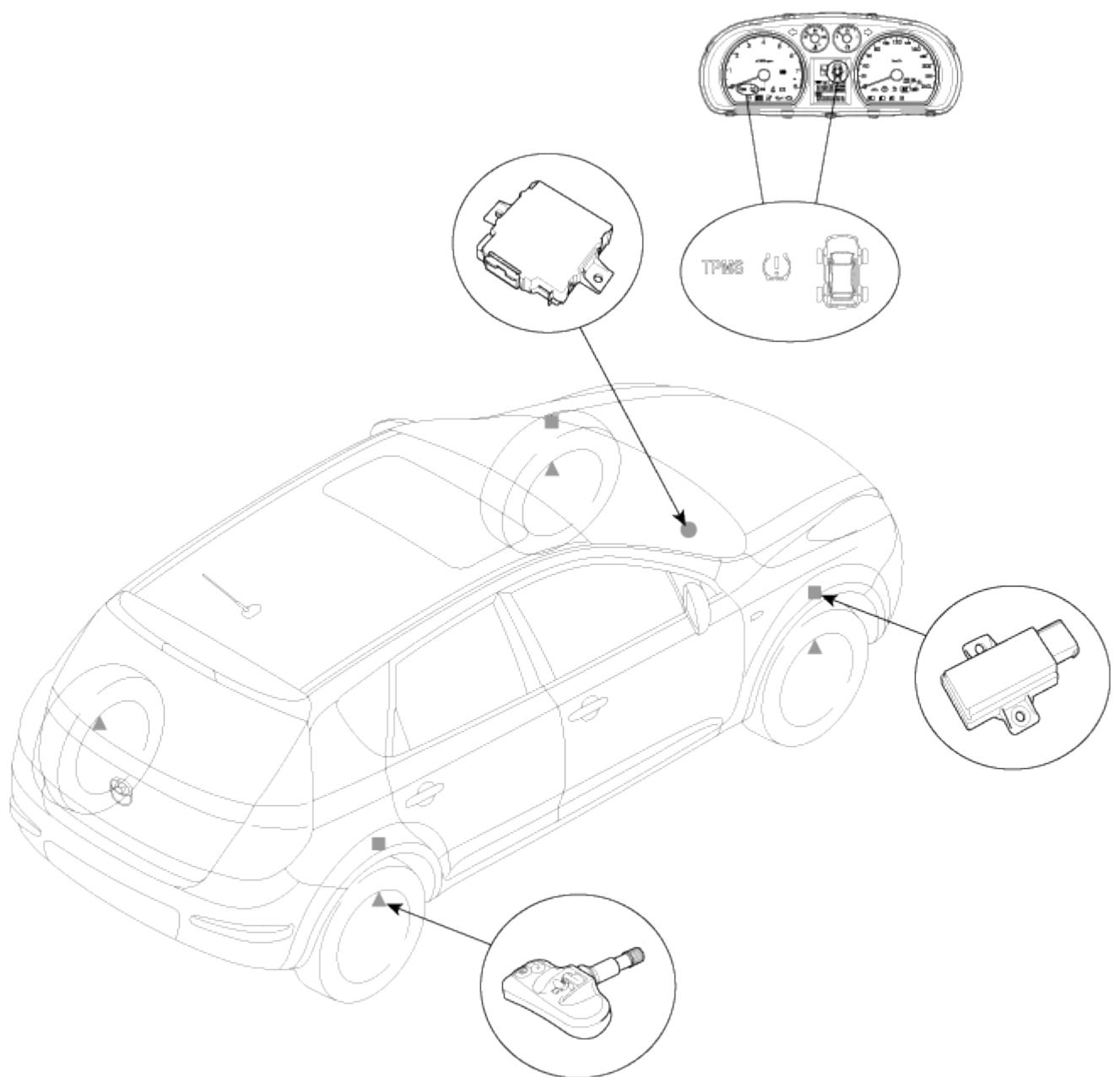
Camber is pre-set at the factory, so it does not need to be adjusted. If the camber is not within the standard value, replace or repair the damaged parts and then inspect again.

Camber: $-1.5^\circ \pm 0.5^\circ$

14.5. Tire Pressure Monitoring System

14.5.1. Component and Components Location

Components



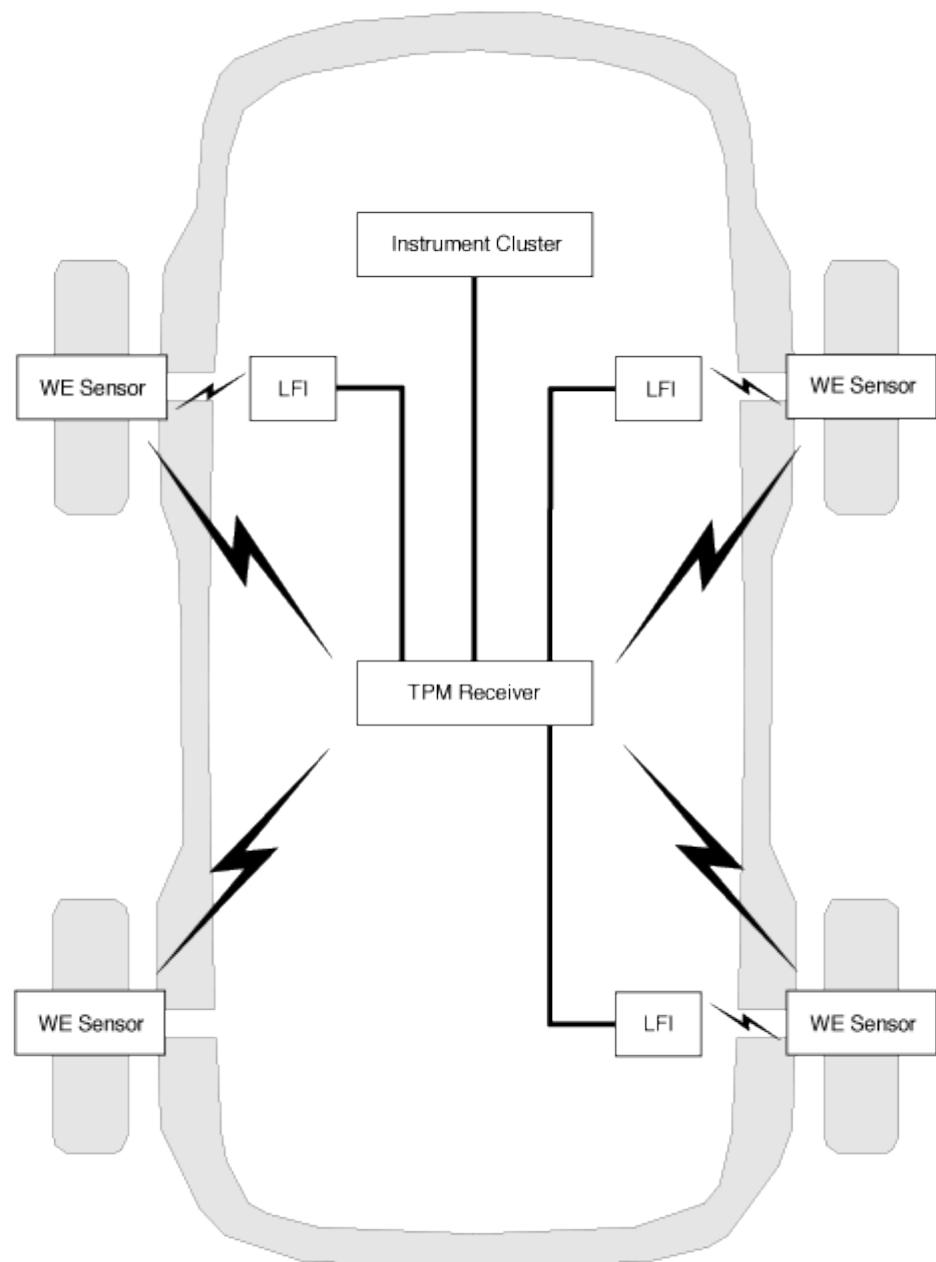
▲ : TPM Sensor (4EA)

■ : LFI Low Frequency Initiator (3EA)

● : TPM Receiver

14.5.2. Schematic Diagrams

Schematic Diagram



14.5.3. Description and Operation

Description

1. System Description

NOTE

AL: Auto Learning

CAN: Controller Area Network

ECU: Electronic Control Unit

IC: Instrument Cluster

LF: Low Frequency

LFI: Low Frequency Initiator

MIL: Malfunction Indicator LED

RF: Radio Frequency

WE: Wheel Electronic

WU: Wheel Unit

The TPMS monitors the pressure and temperature of a vehicle's tire to alert on pressure variations that may impact the driving conditions. Messages deduced from processed data are displayed at the Instrument Cluster (IC) via 2 warning lamps and 4 tire-related LEDs. In parallel, the ECU executes error evaluation on input and output signals. Pressure monitoring during parking is provided.

The ECU processes data from the WE sensor, determines the state of the tires and communicates the required warning message via the CAN line to the driver.

2. Functional Description

Warning Thresholds

Hard Warning

One non temperature compensated hard warning threshold applies to front and rear axle of vehicle. If the pressure reported by the WE sensor is below the tire-specific minimum pressure then the low pressure warning telltale and the telltale indicating position of the under-inflated tire is illuminated immediately. A warning is reset when tire pressure is reported to be at 211kPa (30.6psi).

NOTE

TPMS warning can be light on because the tire pressure declined by low temperature in the cold weather.

Fast Pressure Loss

Fast pressure loss function is deactivated during parking and only active while driving. So it is avoided that a warning is set when the driver manually deflates the tire to a level above hard warning threshold.

Upon a rapid pressure decrease the WE emits a delta-p telegram which triggers the fast pressure loss function to start. Including the first dp-telegram the function waits for a 2nd telegram of the same wheel electronic and calculates the pressure loss rate. If the pressure drops by more than 20kPa/min, a "fast pressure loss" warning is generated and displayed with a maximum of 60s delay while driving.

Initialization

The initialization function determines which WE sensor identifier belongs to the vehicle.

The corresponding set of identifiers is stored in the ECU memory and used to determine if a received RF telegram comes from a wheel unit, which belongs to the vehicle.

Only telegrams containing known (initialized) identifiers are being supervised in the warning algorithm.

The initialization function is implemented in two independent parts: as an auto learning function and as an auto location function.

Initialization-auto Learning

AL starts every time the vehicle was parked long enough to change or permute wheels (19min), and is traveling again at a speed that ensures that the WE sensors are transmitting.

AL is automatically considering all WE identifiers received and extracts, based on statistical evaluation, IDs belonging to the WEs mounted on the vehicle. If new (unknown) IDs are detected, their recurrence will be tracked by AL.

AI compares the acceleration reported by the wheel unit to the vehicle speed to rule out transmissions received from neighboring vehicles traveling with different speeds.

A WE sensor identifier is assigned to the vehicle when 8 RF telegrams have been received while driving above 25km/h.

Initialization-auto Location

This function gives very reliable full localization information.

It relies on the physical properties of long wave emissions in the frequency range of 125 kHz. These emissions are inductively sensed in the wheel unit.

The localization consists in a classification of the WU identifiers in the following order:

0. Left Front Wheel
1. Right Front Wheel
2. Right Rear Wheel

After activation of the initiators the system listens for wheel units reporting that their transmission was caused by an LF trigger signal. If such a transmission is received, the respective identifier is assigned to the triggered wheel well.

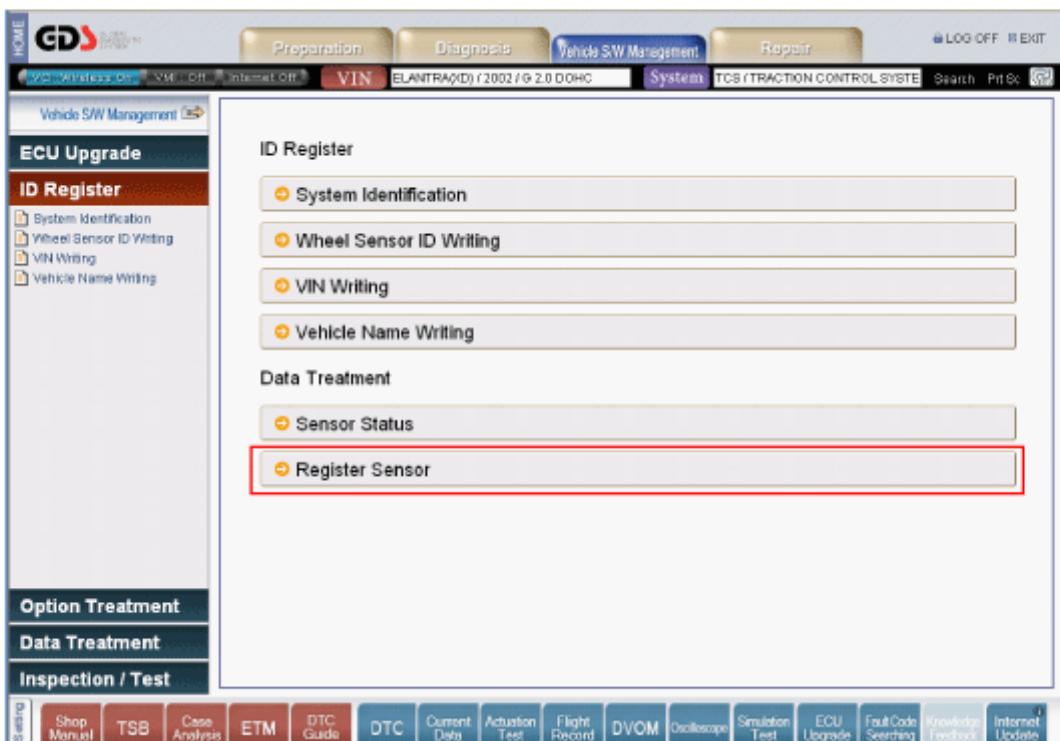
The position of the WE, which belongs to the wheel well without LF initiator, is deduced by identifying the WE sensor, that never detected LF, but assigned to the vehicle by auto learning.

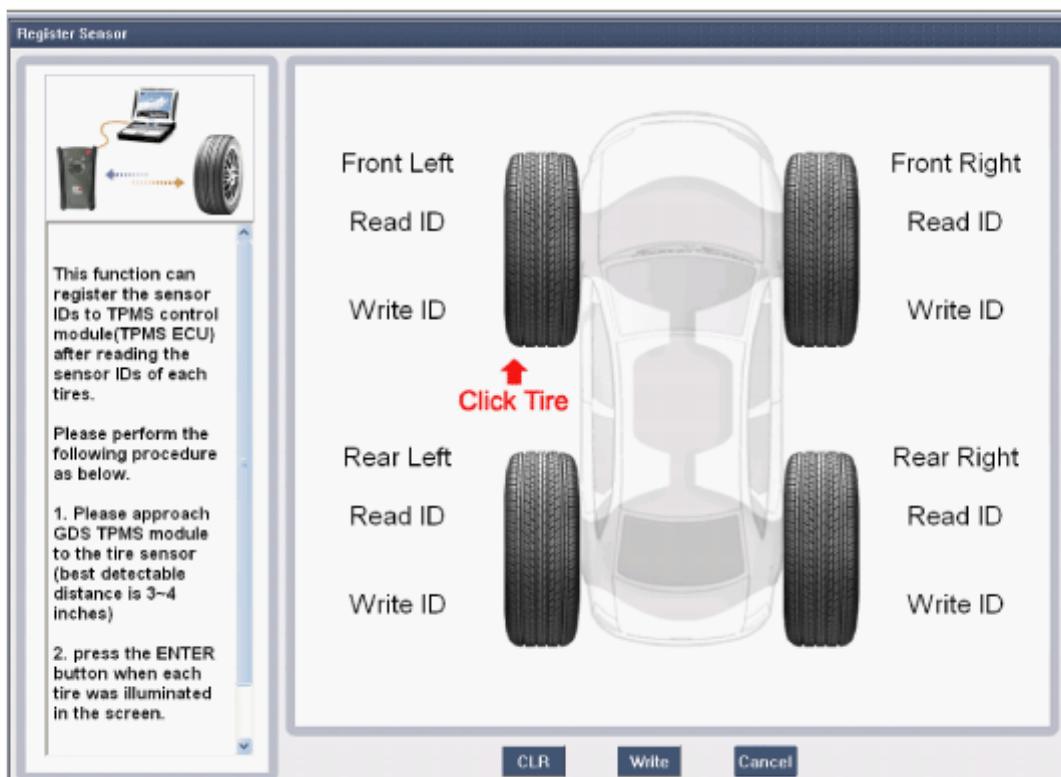
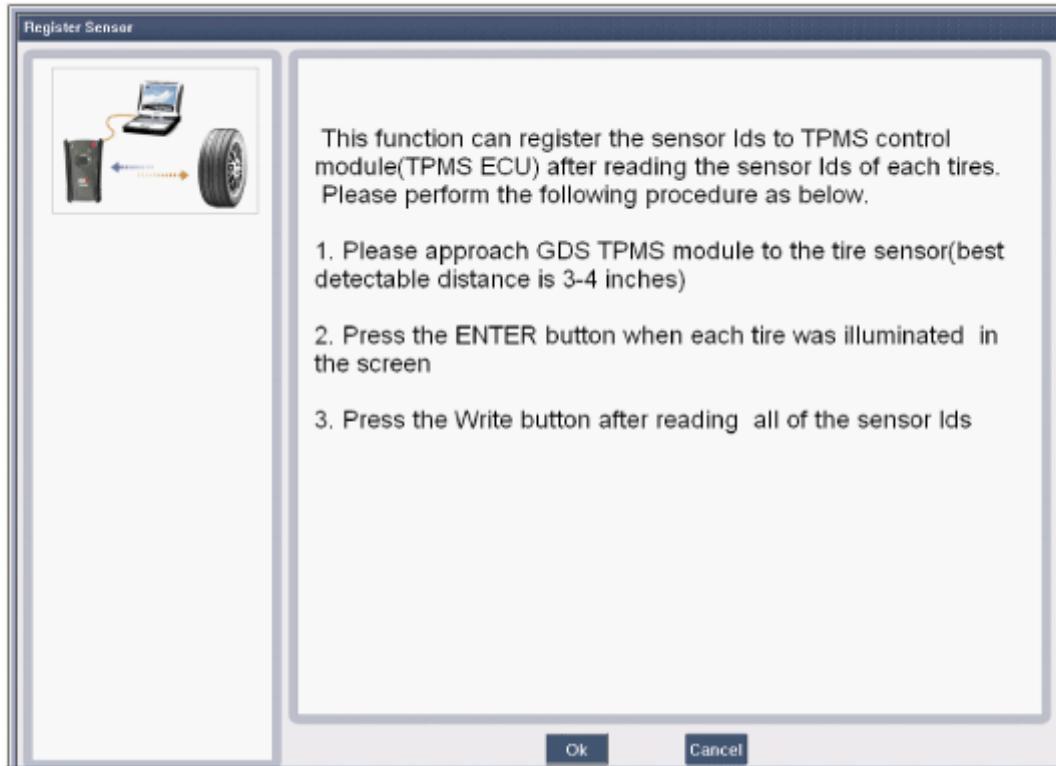
Sensor Registration

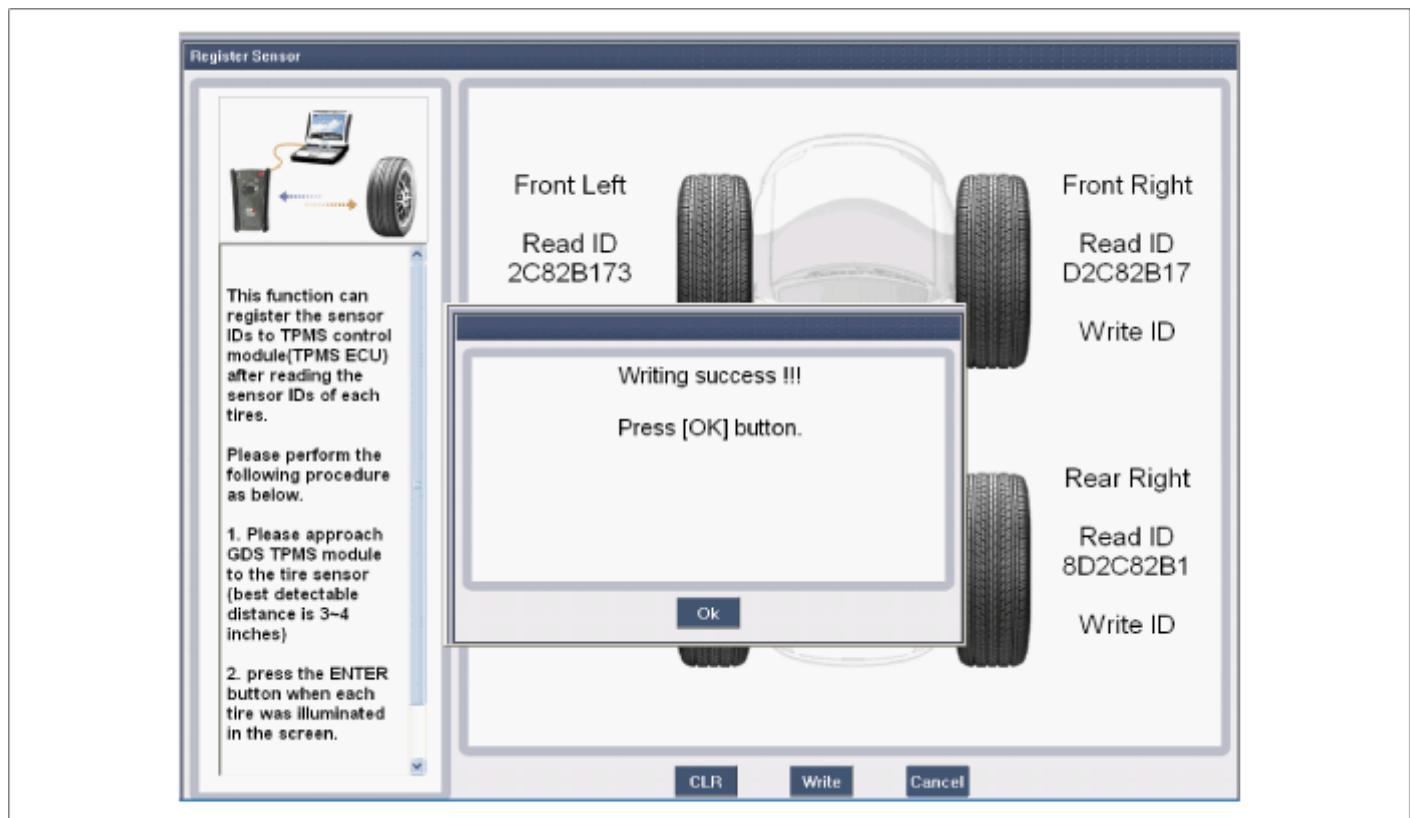
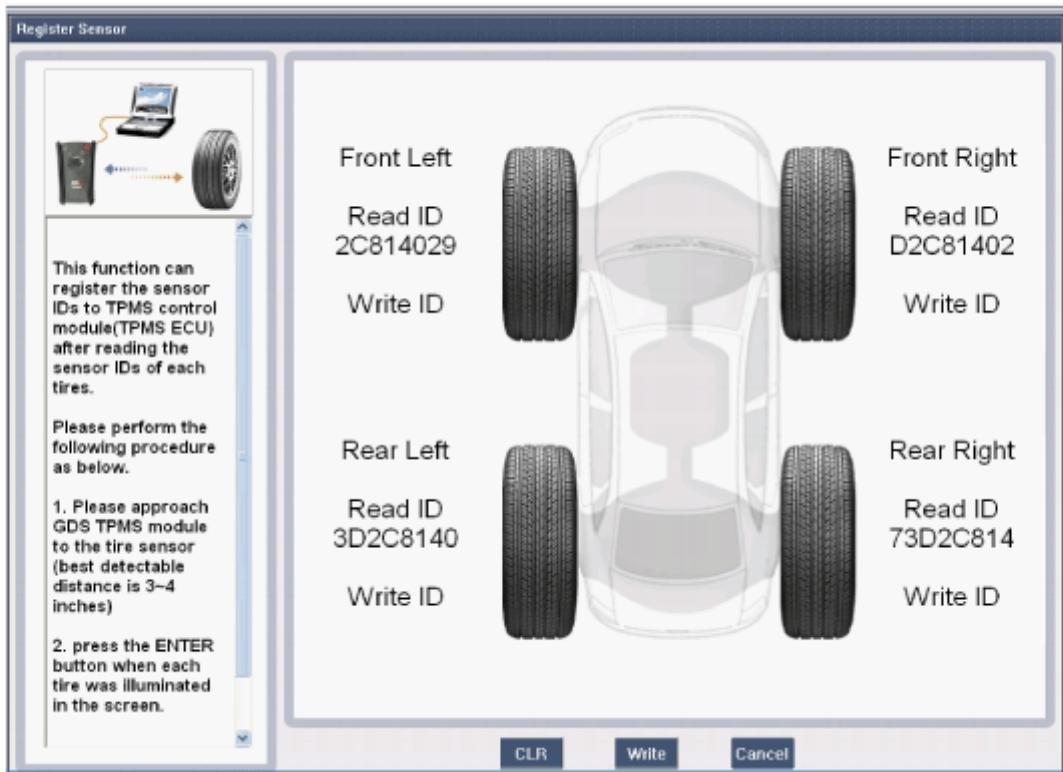
CAUTION

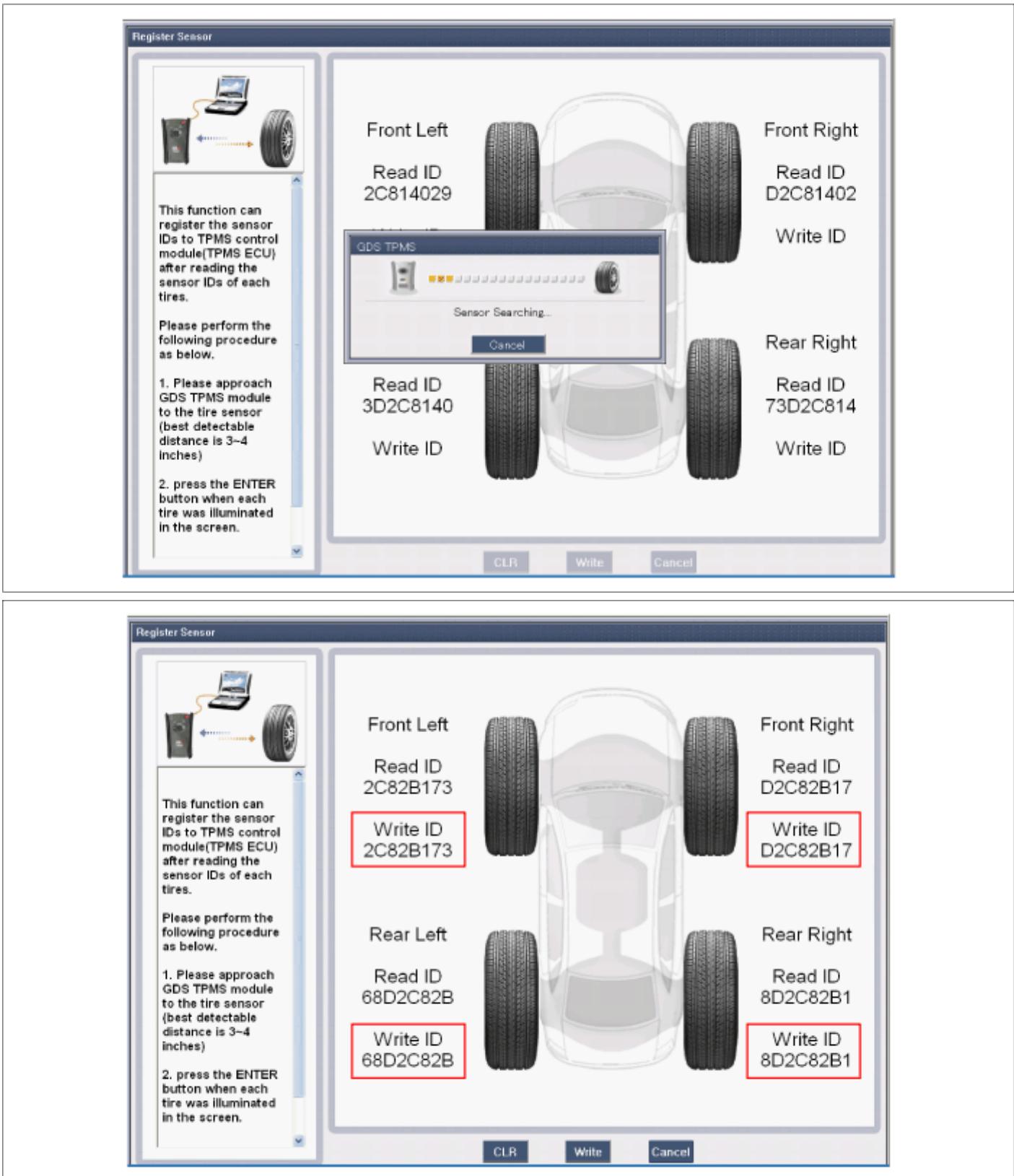
If the sensor registration procedure is not performed by GDS after replacing the TPM sensor or Receiver, TPMS is not operated.

1. Install GDS (Global Diagnostic System) and GDS TPMS module to vehicle.
2. Select the model and perform the sensor registration procedure according to instruction of the GDS as follows.









Vin And Vehicle Name Writing

1. Install GDS (Global Diagnostic System) and GDS TPMS module to vehicle.
2. Select the model and perform the VIN and vehicle name writing procedure according to instruction of the GDS as follows.

[VIN Writing]

Vehicle S/W Management

ECU Upgrade

ID Register

- System Identification
- Wheel Sensor ID Writing
- VIN Writing
- Vehicle Name Writing

Option Treatment

Data Treatment

Inspection / Test

Preparation **Diagnosis** **Vehicle S/W Management** **Repair**

LOG OFF EXIT

WIRELESS ON VIN: DH ELANTRA(XD) (2002 / G 2.0 DOHC System TCS (TRACTION CONTROL SYSTEM) Search Print

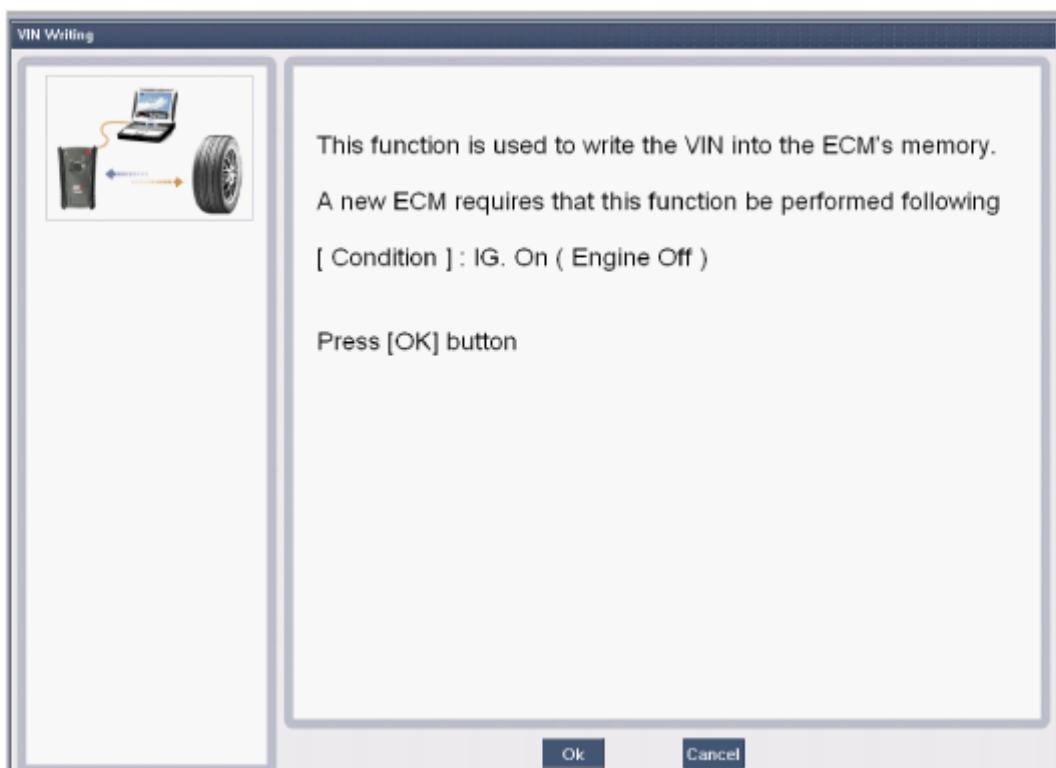
ID Register

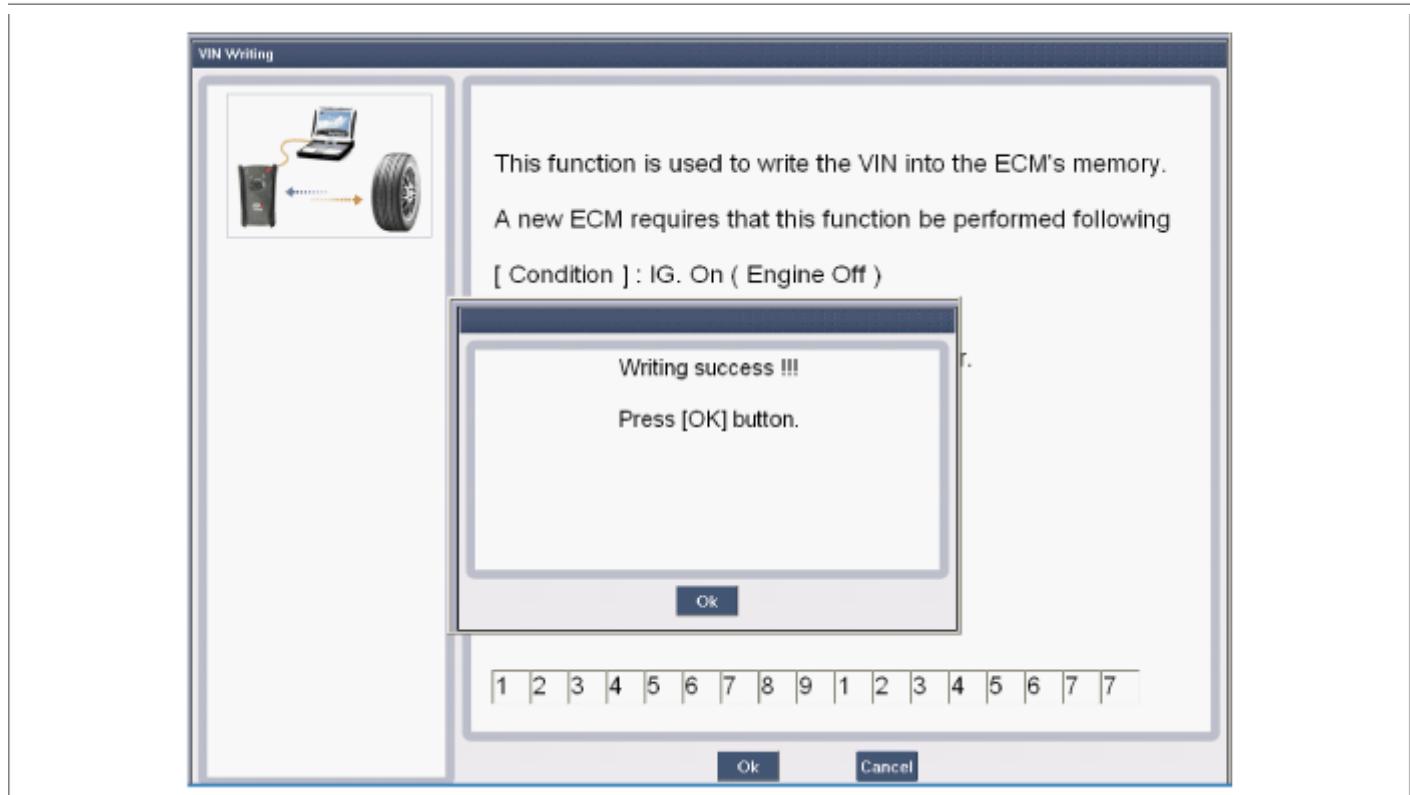
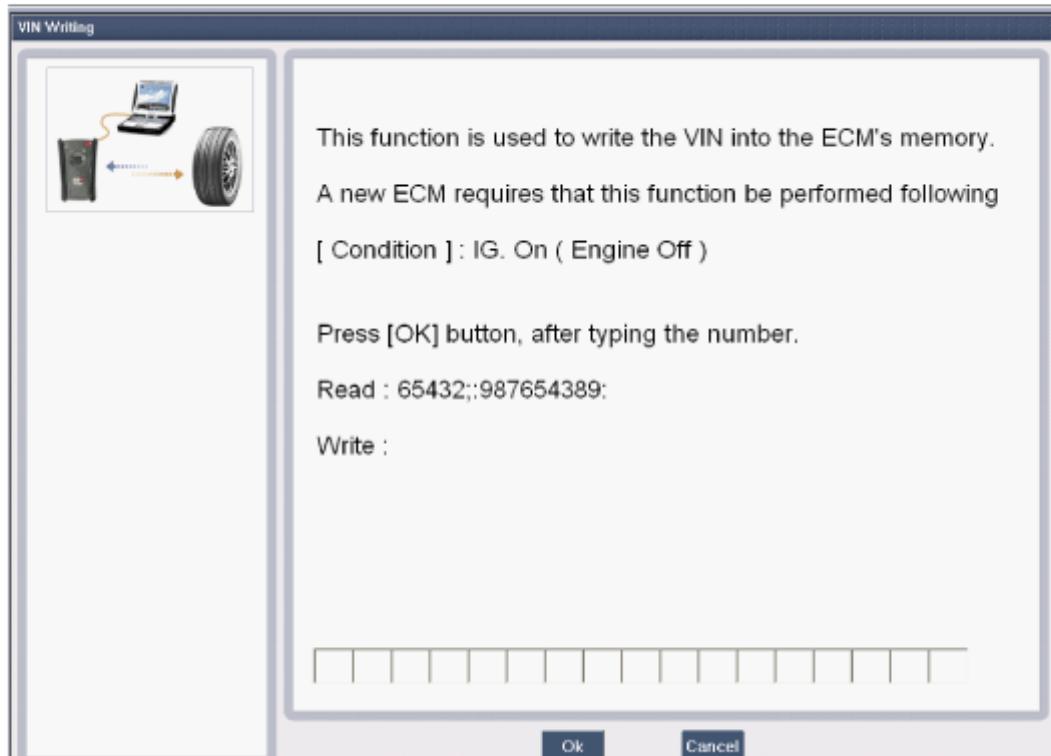
- System Identification
- Wheel Sensor ID Writing
- VIN Writing**
- Vehicle Name Writing

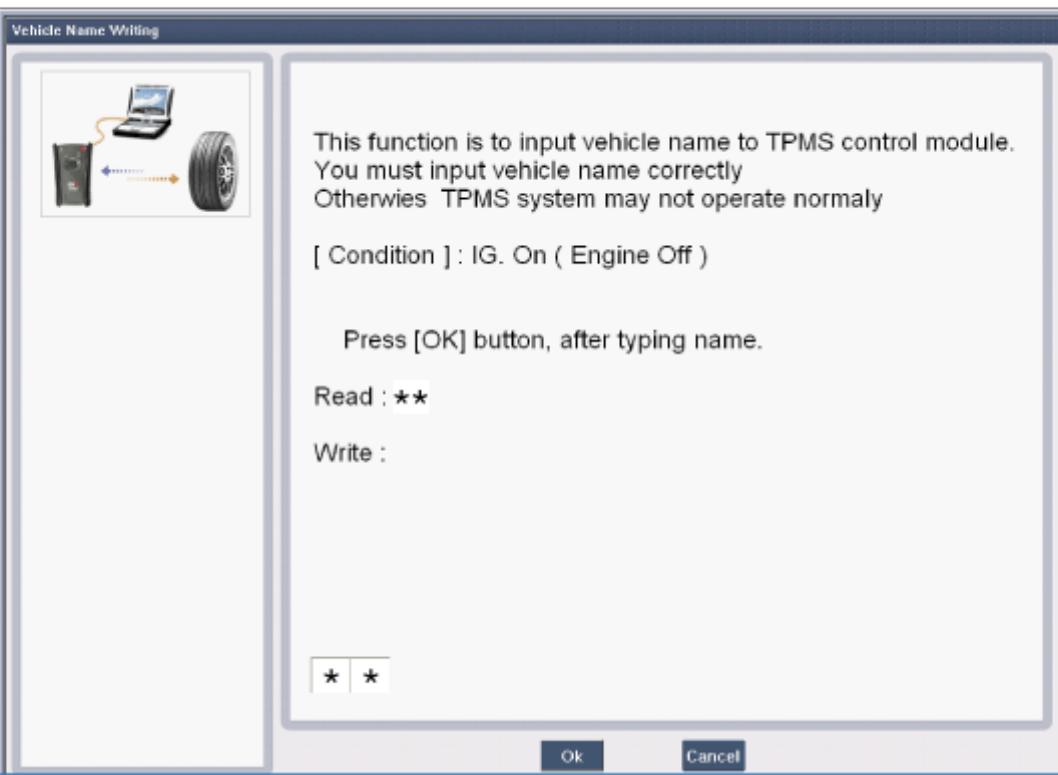
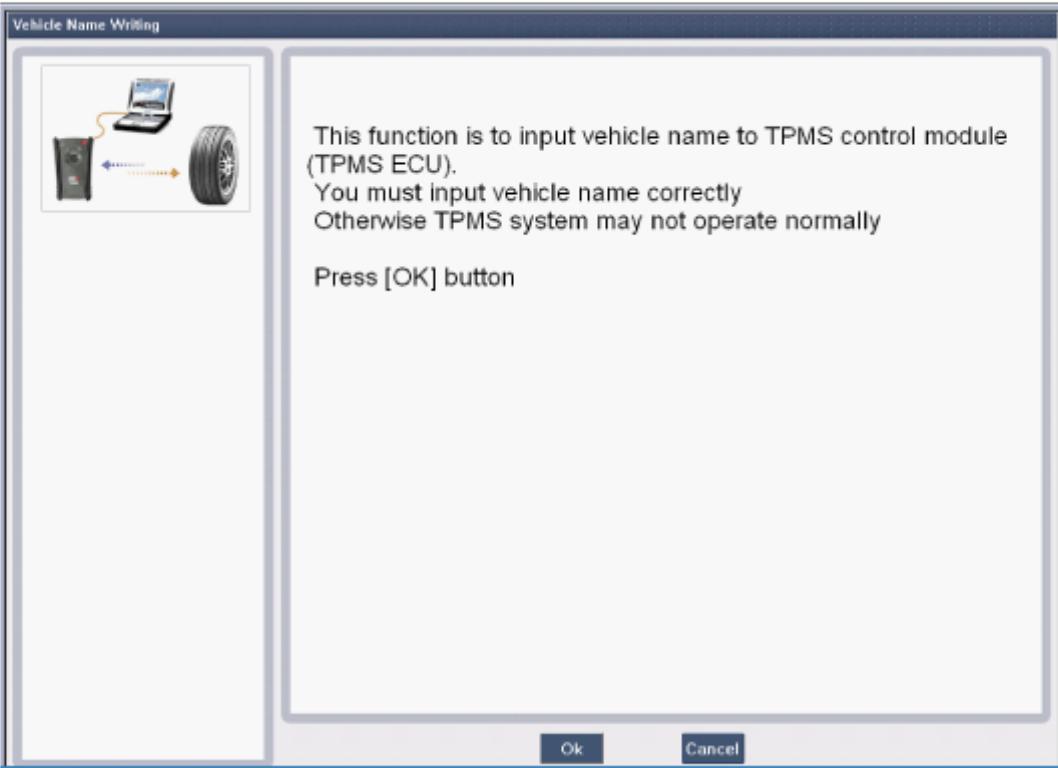
Data Treatment

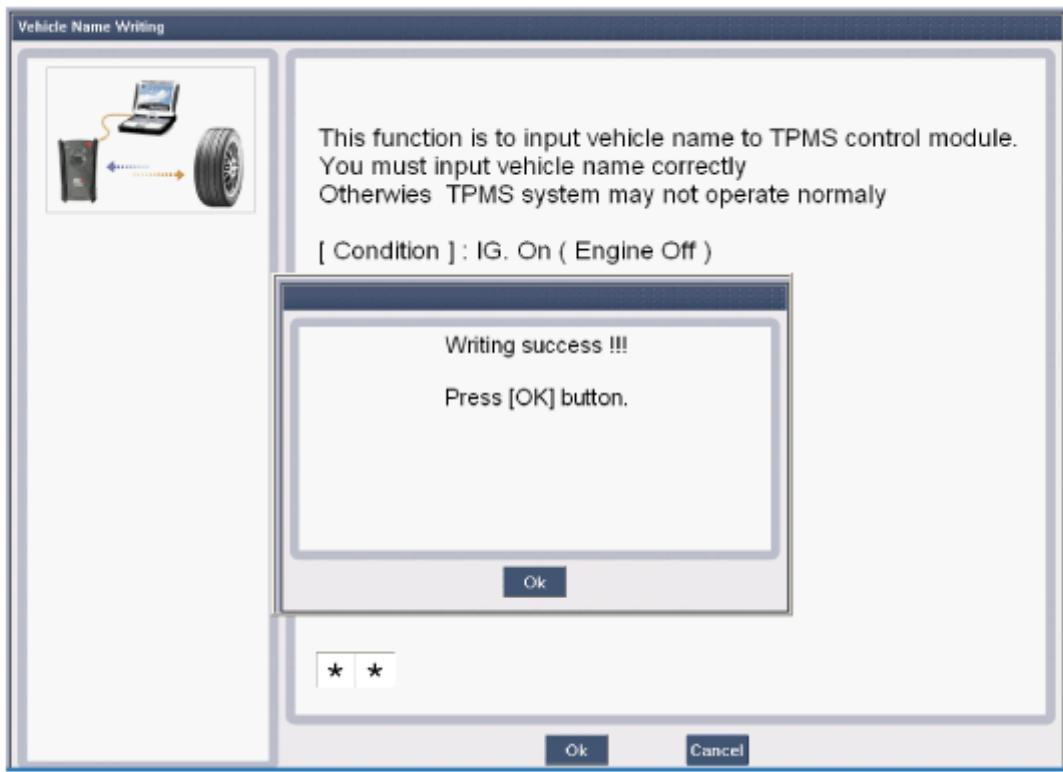
- Sensor Status
- Register Sensor

Shop Manual TSB Case Analysis ETM DTC Guide DTC Current Data Actuation Test Flight Record DVOM Oscilloscope Simulator Test ECU Upgrade FaultCode Searching Knowledge Feedback Internet Update









14.5.4. TPMS Sensor

14.5.4.1. Repair procedures

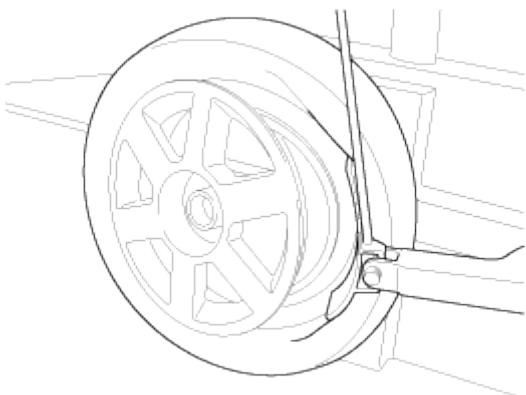
Removal

Removing The Tire From The Rim

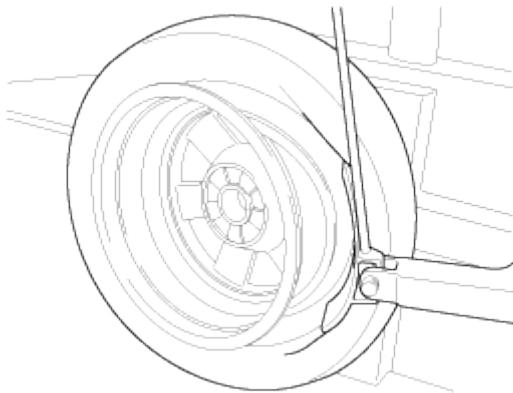
CAUTION

During all the operations on the tire, the sensor must be correctly maintained and thus it is FORBIDDEN to unscrew the nut and to force the sensor into the wheel. This could damage the sensor.

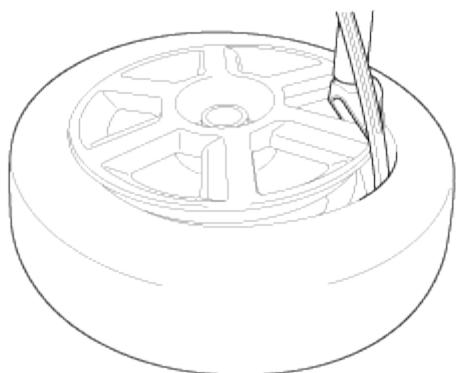
1. Take off the first side of the tire. The tool should not be used near the valve (no less than 30 cm).



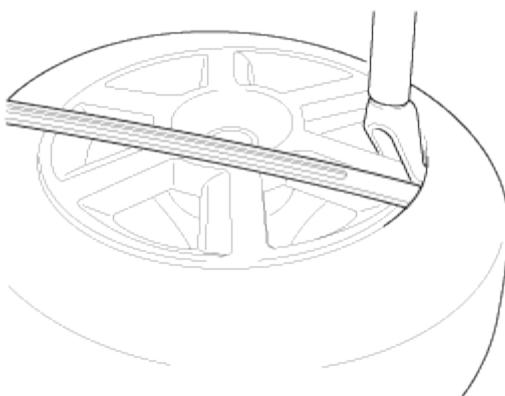
2. Take off the second side of the tire. The tool should not be used near the valve (No less than 30 cm).



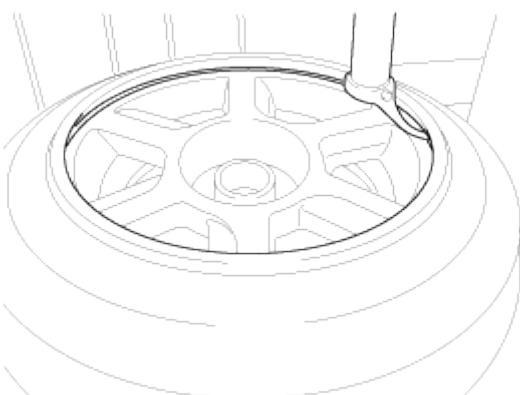
3. Dismount the first side of the tire: Place the shoe of the tool between 5 and 15 cm away from the sensor and use the tire lever as shown in the picture.



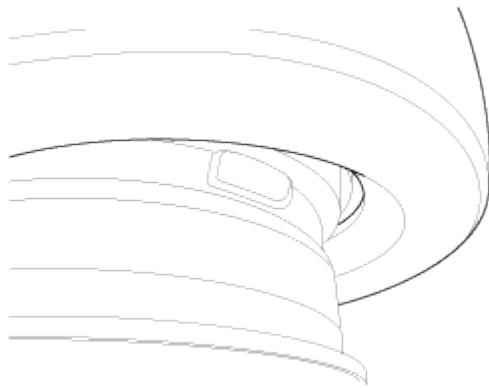
4. By using the tire lever, extract the external side wall of the tire and engage on the shoe of the machine. The lever and the tire must not come into contact with the sensor. Then remove the lever.



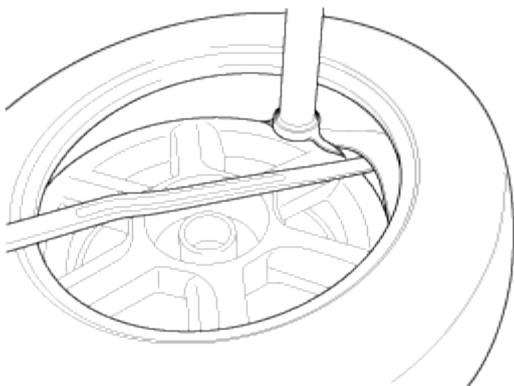
5. The wheel rotation allows the complete extraction of the first side of tire.



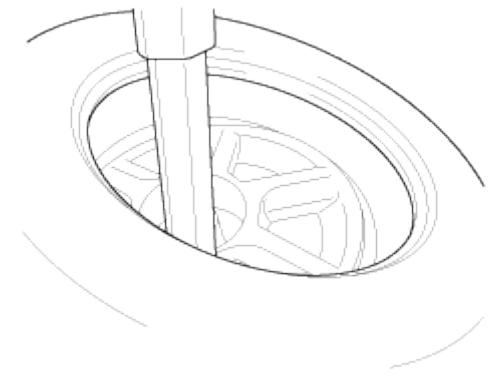
6. Raise the tire to prepare the introduction of the tire lever to aid extraction of the second side wall, the same recommendations as for the first side wall will apply.



7. By using the tire lever, extract the external side wall of the tire and engage the shoe of the machine. The lever and the tire must not come into contact with the sensor. Then remove the lever.

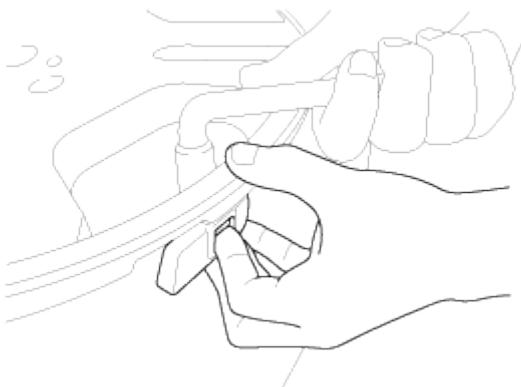


8. Extract entirely the second side wall of the tire.

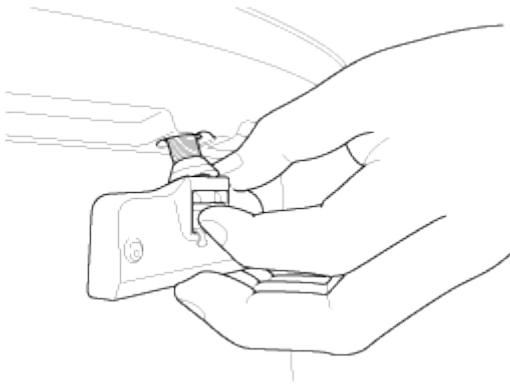


Pressure Sensor Removing

1. While supporting the sensor unit, unscrew the nut.



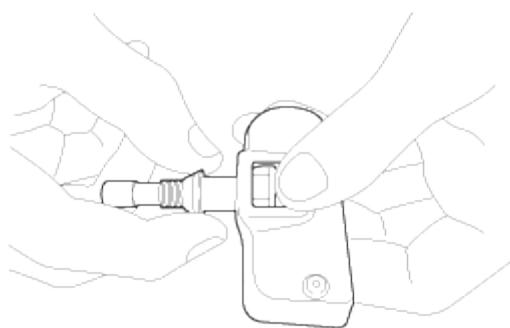
2. Remove the sensor.



Installation

Sensor Reinstallation

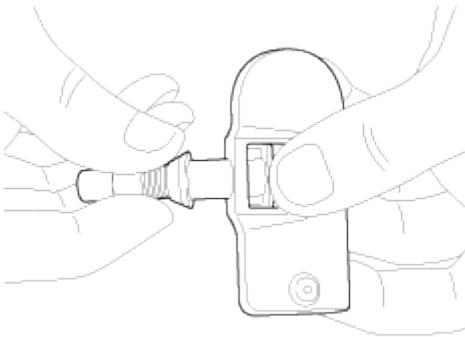
1. Hold the sensor and the seal washer, then extract it, this also extracts the seal. Take care to not damage the valve thread.



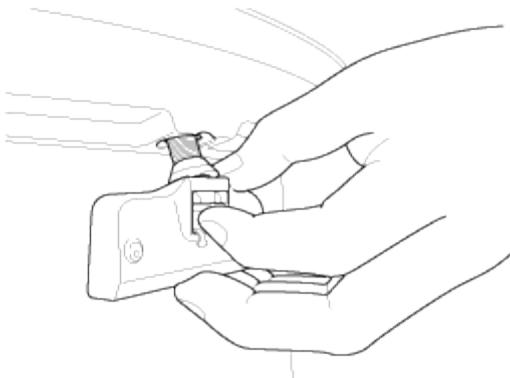
2. Clean the sensor and the valve stem holding the valve using a dry cloth as shown on the picture. Take care to support the rear of the valve with a thumb so that there is no movement of the stem.



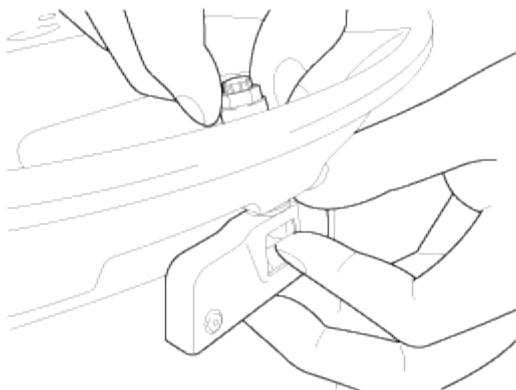
3. When removing the sensor, a new washer and seal must be used. Insert these up to the base of the sensor, making sure to secure the valve base with a thumb, as shown. Wipe the seal and threading.



4. Insert the valve, in the valve hole, without modifying the angle of the stem (retain position of delivery). The laser marking should be visible to the operator.



5. When the valve is completely inserted, maintain the sensor in contact with the rim (as shown on the picture), then screw manually the nut until it is in contact with the wheel (without force).

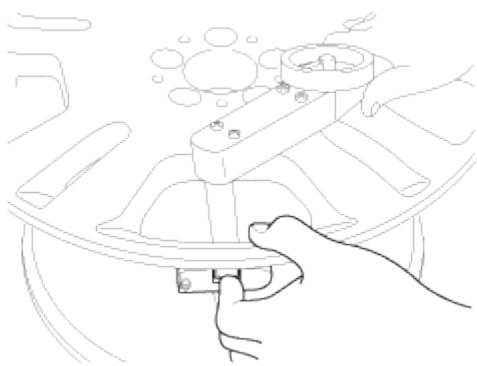


6. While maintaining the sensor contact with the rim by applying pressure to the back of the valve, slightly press on the cap towards the center of the wheel in order to adapt the angle of the valve/sensor to the profile of the rim. It is mandatory to guarantee the contact of the housing unit on the rim drop center.



7. While maintaining the sensor unit and valve in position, screw the nut with a torque wrench.

Apply a torque of 7.5 ~ 8.5Nm (0.76 ~ 0.86kgf.m, 5.5 ~ 6.2lb-ft).
Take care that the wrench socket is correctly inserted on the nut.



8. Check the followings.

- (1) It is normal that the seal washer becomes bent during the nut tightening.
- (2) Check that the visible part of the antenna is not damaged or broken.
- (3) The plastic bridge should neither be cracked nor broken. It is designed so that it will fracture due to an error in the assembly process (too high torque, bad positioning.....). Any defect must mean the rejection of the sensor.

Mounting of Tire

CAUTION

- Before any tire mounting operation, make sure that the sensor has been correctly mounted and tightened to the rim.
- No lubricant product or any other material may partially or completely cover the air pressure inlet hole of the sensor.
- The assembly tools have to never have a collision with the sensor.
- The tire cannot be in contact with the sensor only after it is engaged in the rim and after the exceeded peak of traction. Therefore, generally at the end of the assembly.

1. Prepare the tire and fix the rim as usual.



2. Put the tire on the rim, so that the cross point of the belt with the rim is between 15 and 20 cm away from the valve (see the picture).



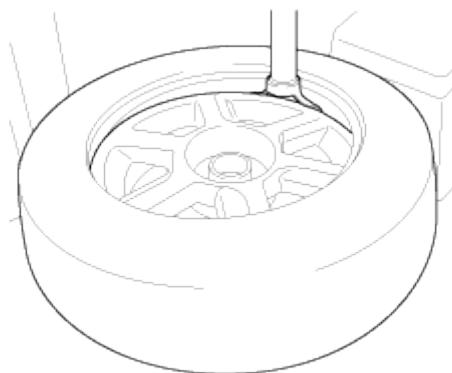
3. Engage the shoe and make sure that 20cm is maintained between the cross point and the valve. The arrow shows the direction of rotation of the wheel.



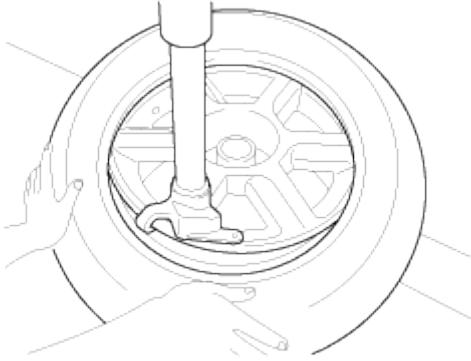
4. Turn the wheel in order to engage all the first side of the tire.

NOTE

The standard shoes can pass over the sensor without damaging it.



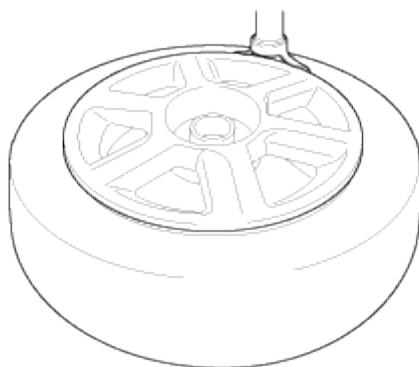
5. Put the second side of the tire in position, so that the cross point of the belt with the rim is approximately 20 cm away from the valve (see the picture). The curved arrow shows the direction of rotation of the wheel.



6. Turn the wheel in order to engage all of the second side of the tire.

NOTE

The standard shoes can pass over the sensor without damaging it.

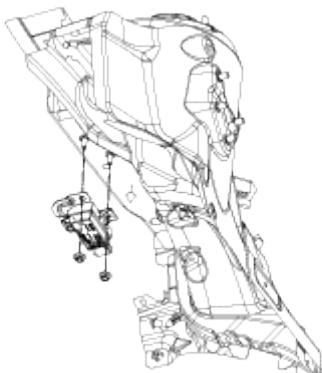


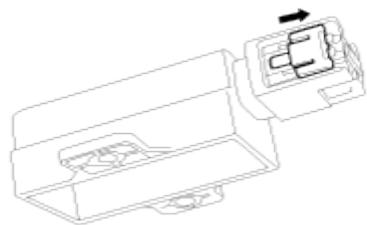
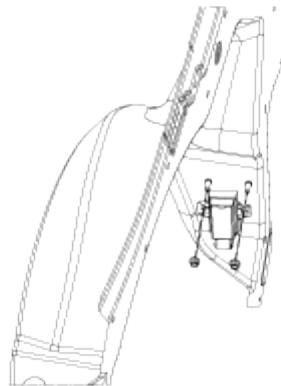
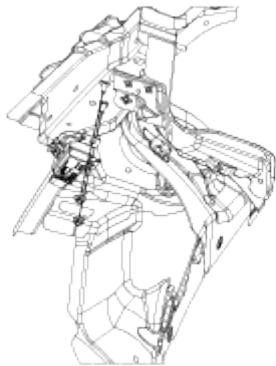
7. Perform the Register Sensor procedure. (Refer to Register Sensor.)

14.5.5. TPMS Initiator
14.5.5.1. Repair procedures

Replacement

1. Disconnect the battery negative cable from the battery.
2. Remove the wheel and the wheel cover.
3. Remove the malfunctioning part and fit new part.





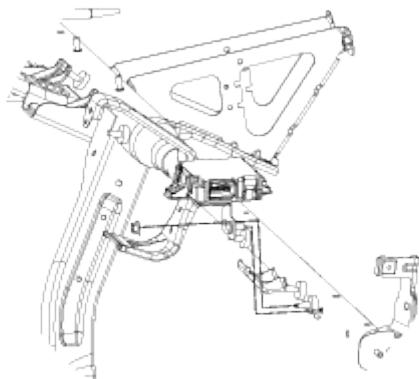
4. Reinstall the wheel and wheel cover.
5. Connect the battery negative cable to the battery.

14.5.6. TPMS Receiver

14.5.6.1. Repair procedures

Replacement

1. Disconnect the battery negative cable from the battery.
2. Remove the malfunctioning part and fit new part.



3. Reinstall the floor console rear cover.

4. Connect the battery negative cable to the battery.
5. Perform the VIN and Vehicle name writing procedure. (Refer to VIN and Vehicle name writing.)
6. Perform the sensor registration procedure. (Refer to Sensor registration.)

15. Automatic Transaxle System (Automatic Transaxle)

15.1. General Information

15.1.1. Specifications

Specifications

| Transaxle model | A4CF1 | |
|-------------------------------|-----------------------------|-------|
| Engine model | Gasoline 1.4/ 1.6 | |
| T/con | 3 elements 2 phases 1 stage | |
| T/con size (Φ) | 210 | |
| O/PUMP type | Parachoid | |
| T/M CASE type | Separated | |
| Friction elements | Clutch: 3EA | |
| | Brake: 2EA | |
| | OWC : 1EA | |
| Planetary gear | 2EA | |
| Gear ratio | 1st | 2.919 |
| | 2nd | 1.551 |
| | 3rd | 1.000 |
| | 4th | 0.713 |
| | Reverse | 2.480 |
| Final gear ratio | 4.121 | |
| Fluid pressure balance piston | 2EA | |
| Accumulator | 4EA | |
| Solenoid valve | 6EA (PWM:5EA, VFS:1EA) | |
| Gear shift position | 6 range (P,R,N,D,2,L) | |
| Oil filter | 1EA | |

- PWM : Pulse Width Modulation
- VFS : Variable Force Solenoid

Tightening Torques

| Item | Nm | kgf.m | lb·ft |
|----------------------------------|-------|---------|-----------|
| Transaxle lower mounting bolts | 43~55 | 4.3~5.5 | 31.1~39.8 |
| Rear roll stopper mounting bolts | 50~65 | 5.0~6.5 | 36.2~47.0 |

| | | | |
|--------------------------------------|-------|---------|-----------|
| Torque converter mounting bolts | 46~53 | 4.6~5.3 | 33.3~38.3 |
| Transaxle insulator mounting bracket | 50~65 | 5.0~6.5 | 36.2~47.0 |
| Transaxle upper mounting bolts | 43~55 | 4.3~5.5 | 31.1~39.8 |
| Starter motor mounting bolts | 27~34 | 2.7~3.4 | 19.5~24.6 |
| Control cable assembly | 10~14 | 1.0~1.4 | 7.2~10.1 |
| Retainer and bolts | 10~14 | 1.0~1.4 | 7.2~10.1 |
| Shift lever assembly | 10~14 | 1.0~1.4 | 7.2~10.1 |

Lubricants

| Item | Specified lubricant | Quantity |
|---------------------------------------|--|-----------------|
| Transaxle fluid liter (US qt, Imp.qt) | GENUINE DIAMOND ATF SP-III or SK ATF SP -III | 6.8 (7.2, 5.98) |

Sealant

| Item | Specified sealant |
|---|-------------------|
| Rear cover
Torque converter housing
Oil pan | LOCTITE FMD-546 |

15.1.2. Special Service Tools

Special Service Tools

| Tool
(Number and name) | Illustration | Use |
|---------------------------------------|--------------|--|
| 09200-38001
Engine support fixture | | Removal and installation of the transaxle. |

15.2. Automatic Transaxle System

15.2.1. Description and Operation

Description

The new small sized automatic transaxle (A4CF1) is for gasoline 1.6 engine. The transaxle (A4CF1) is improved on the durability, fuel consumption and efficiency by the new main features as followed.

The new main features

1. The hydraulic centrifugal oil pressure balance piston.
2. The full line pressure variable control system.
3. The long travel damper clutch.
4. The disc type return spring.

5. The ultra flat torque converter.

Functions

| Item | Contents |
|---------------------------|--|
| Components | <p>The full line pressure variable control operates in the valve body to improve the fuel consumption.</p> <p>The long travel damper clutch is applied to the torque converter to improve the engine revolution change reduction capability and the fuel consumption. (17~20°)</p> <p>The oil pump of the trochocentric type is changed to parachoid type to improve the processing and the capacity efficiency at the low RPM range.</p> <p>The disc type return spring is applied to the low&reverse brake to improve the durability and reduce the length.</p> <p>The hydraulic centrifugal oil pressure balance piston is applied to the inside of clutch to improve the durability and the shift control capability.</p> <p>The low noise gear and the gear teeth face grinding are applied to the transfer driven gear to improve the noise and the durability.</p> |
| Electronic control system | <p>The oil pressure value set by TCM is coupled with the engine torque so that the stable shift feeling can be improved.</p> <p>The engine torque reduction control operates effectively to improve the shift feeling and the durability.</p> <p>It can be the skip shift of 1↔3 and 2↔4 when shifting.</p> <p>The reverse clutch, not L/R brake is controlled when controlling the N→R shift so that the N→R shift feeling can be improved.</p> <p>The range of the damper clutch direct control expands to improve the fuel consumption.</p> <p>The current control chip is installed into the TCM to regulate the solenoid control current and control the oil pressure securely according to the change of the temperature and voltage.</p> <p>The FPC(Flexible Printed Circuit) harness is composed of the thin and flat copper in the insulating film like electric wire.</p> <p>The tachometer is operated by the change of the frequency forwarded from the TCM to the instrument cluster, not vehicle speed sensor.</p> |

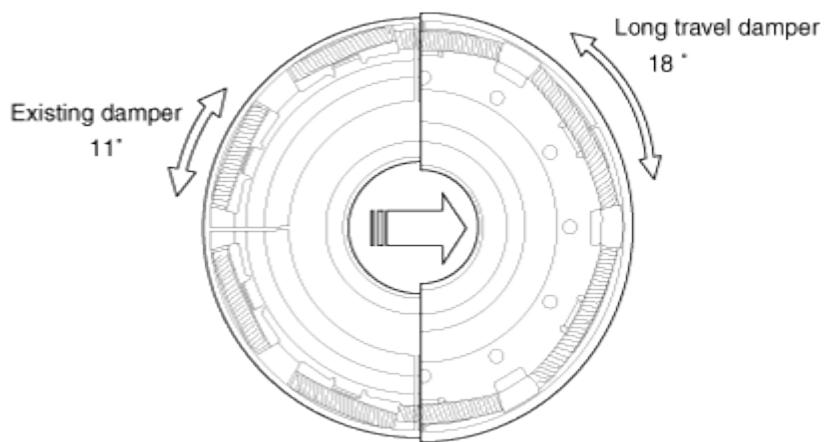
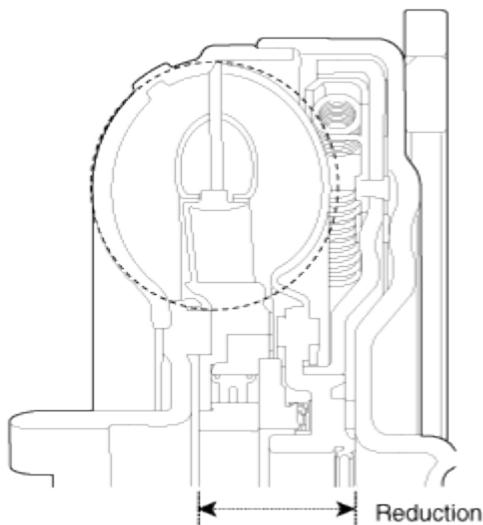
Mechanical system

Function

Torque Converter

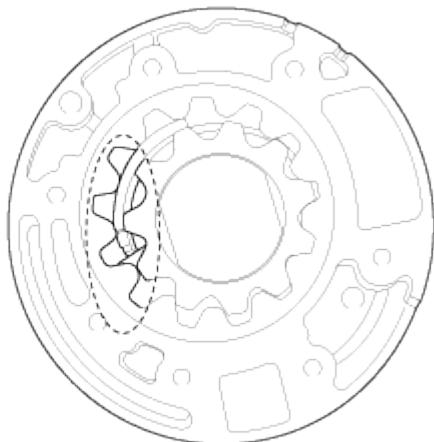
The torque converter, as the power plant which delivers the power of engine to the automatic transaxle, consists of 3 elements, 2 phases and 1 stage type.

- The flowing section form of the torque converter changes the round type to the flat type to reduce the length of the torque converter.
- The maximum operating degree of the damper clutch installed inside the transaxle increases from 11° to 18° to improve the engine revolution change reduction capability and the fuel consumption.

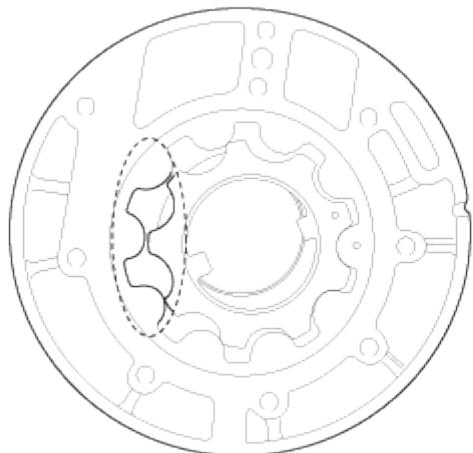


Oil Pump

The oil pump is made of the aluminum (the reaction shaft support) to loose the weight and selects the parachoid type to improve the processing and the capacity efficiency at the low RPM range.



<Trochoid>



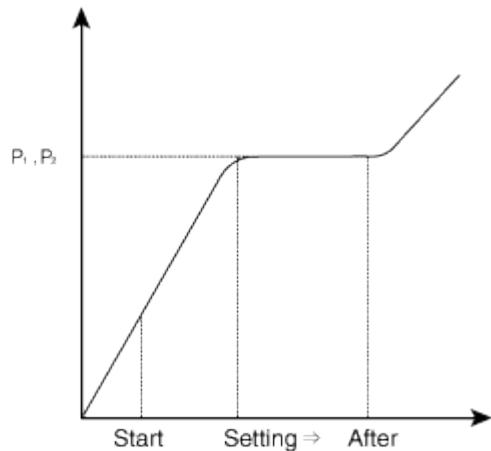
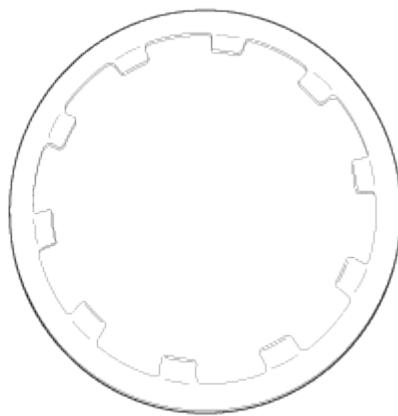
<Pharakoid>

Brakes

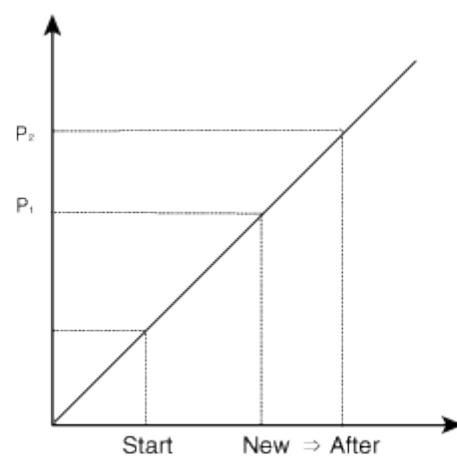
The automatic transaxle (A4CF1) uses the low and reverse brake and the second brake. The low and reverse brake is fixed by the low and reverse annulus gear and overdrive planetary carrier.

- The disc type return spring is applied to the low and reverse brake and it minimizes the slip of the friction material from the uniform spring operation power to improve the durability and reduce the length.

The overdrive sun gear is held on the transaxle case by the second brake.



<Disc type return spring>



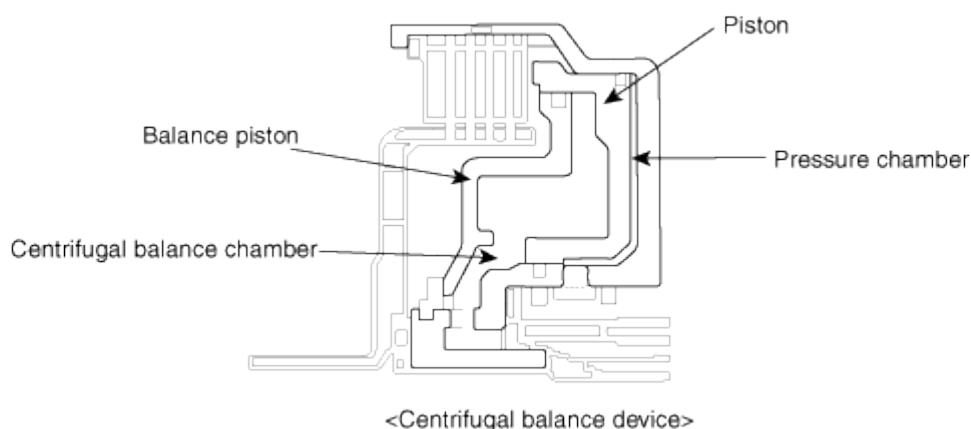
<Coil type return spring>

Clutch

The multiple clutches and the one way clutch are used as the transaxle device.

The retainer of each clutch is composed of the precision sheet metal parts to realize the productivity and the light weight. The hydraulic centrifugal oil pressure balance device places inside the clutch assembly.

Generally the oil remained in the piston oil pressure chamber pushes the piston by the centrifugal force. But to prevent the piston from being pushed, the oil filled in between the piston and the return spring retainer occurs the centrifugal force and both of the power is offset so that the piston don't move. In result, it improves the durability and the shift control ability.

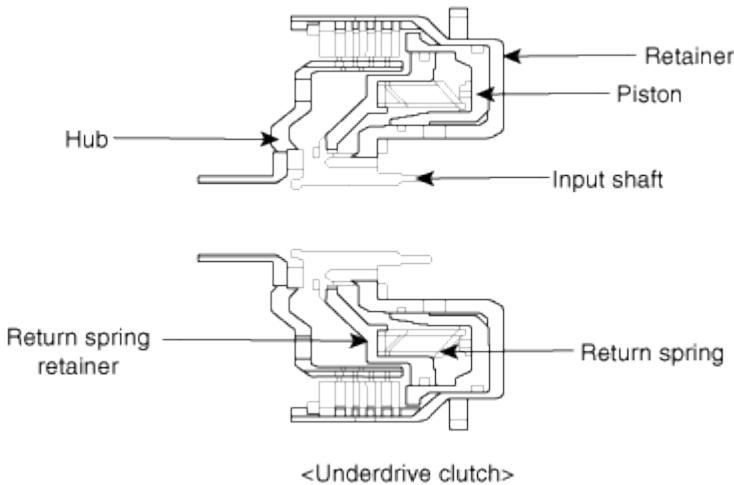


<Centrifugal balance device>

1. Underdrive Clutch

The driving force of input shaft is delivered to the underdrive sun gear.

The operating oil pressure in the underdrive clutch components operates between the piston and the retainer and pushes the piston to the clutch discs to deliver the driving force from the retainer to the hub.



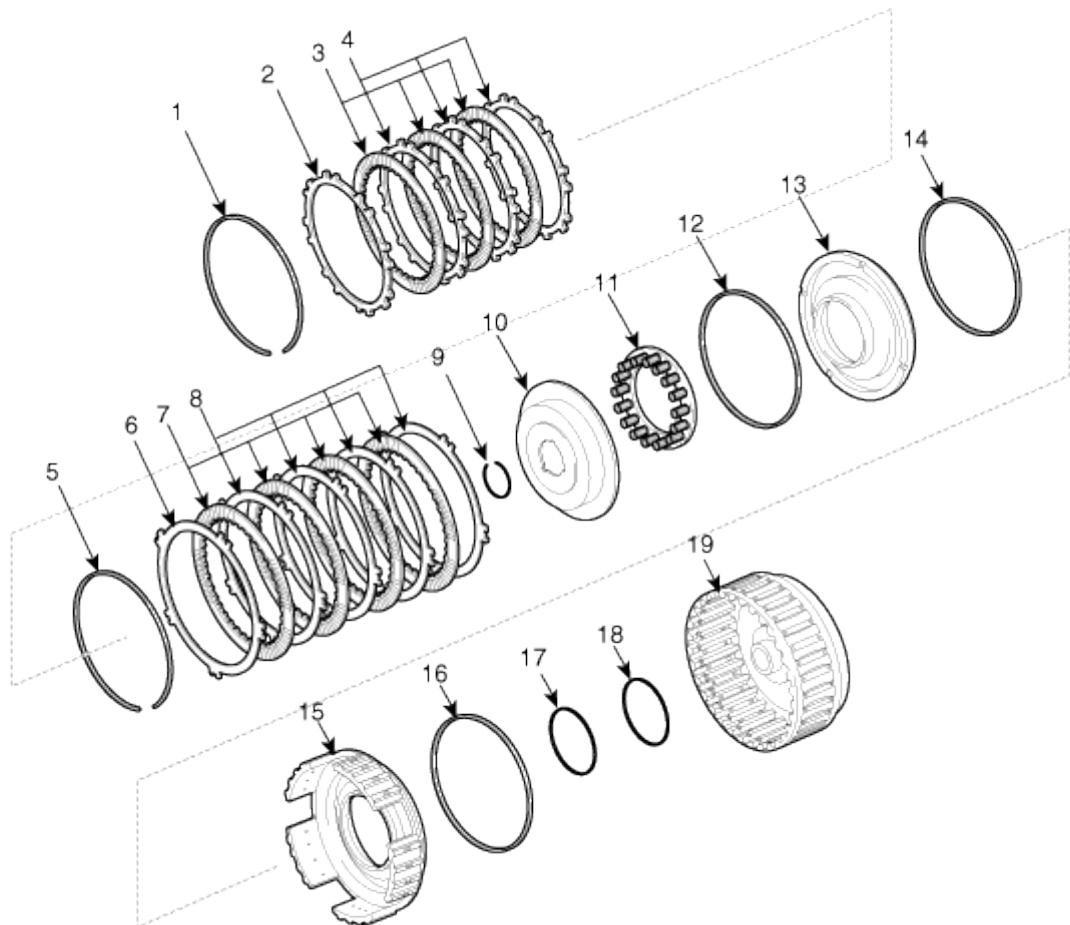
2. Reverse clutch and overdrive clutch

The reverse clutch delivers the driving force of input shaft to the reverse sun gear.

The overdrive clutch delivers the driving force of input shaft to the overdrive planetary carrier and the low and reverse annulus gear.

The operating oil pressure of the reverse clutch operates between the reverse clutch retainer and reverse clutch piston and it has the whole overdrive clutch moved to deliver through the hub splines.

Structure Of The Reverse And The Overdrive Clutch

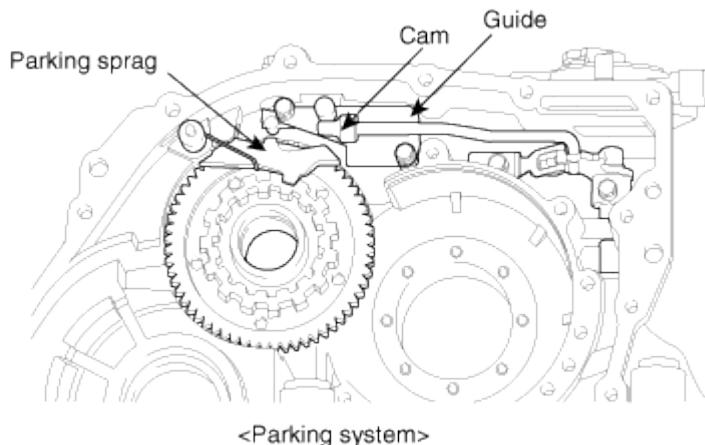


| | | |
|--------------------------|-----------------------------|-----------------------------|
| 1. Snap ring | 8. Clutch plate | 15. Reverse clutch piston |
| 2. Clutch reaction plate | 9. Snap ring | 16. D-ring |
| 3. Clutch disc | 10. Spring retainer | 17. D-ring |
| 4. Clutch plate | 11. Return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

Parking System

The parking system for A4CF1 model is the cam type.

The roller type installed to the existing new generation AT needs the support to move the roller when operating the parking system and is so complicated. But the cam type for A4CF1 model doesn't need the support and the structure is simply. It only needs the guide to prevent from moving the cam idly.



Operation

Hydraulic Control System

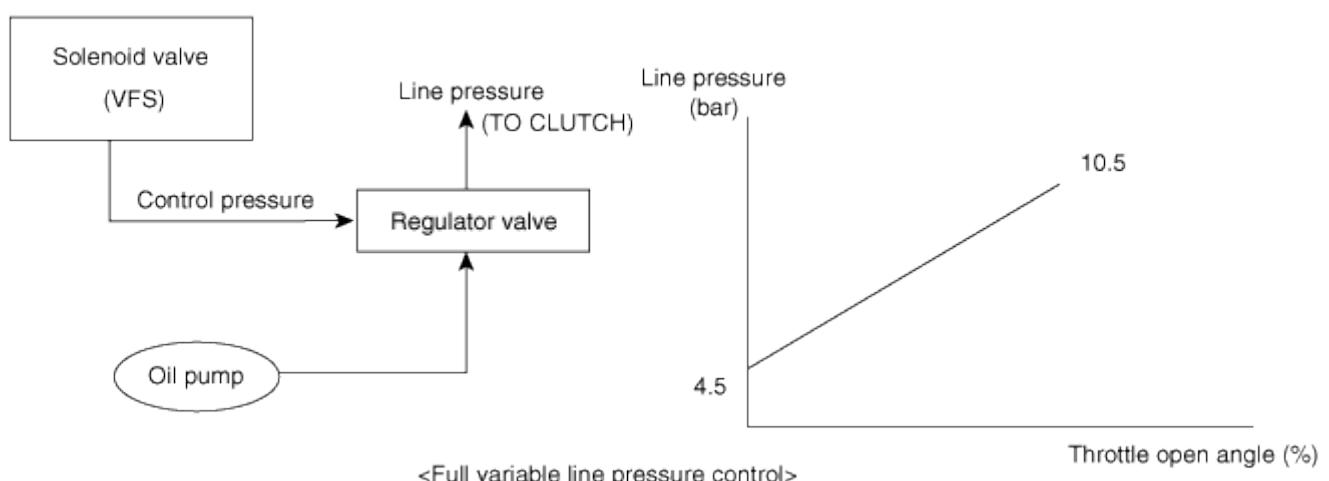
Main Features

The VFS (Variable Force Solenoid) installed in the valve body is applied to transaxle. VFS varies the line pressure from 4.5bar to 10.5bar according to throttle open angle and shift range to improve the fuel consumption and shift ability.

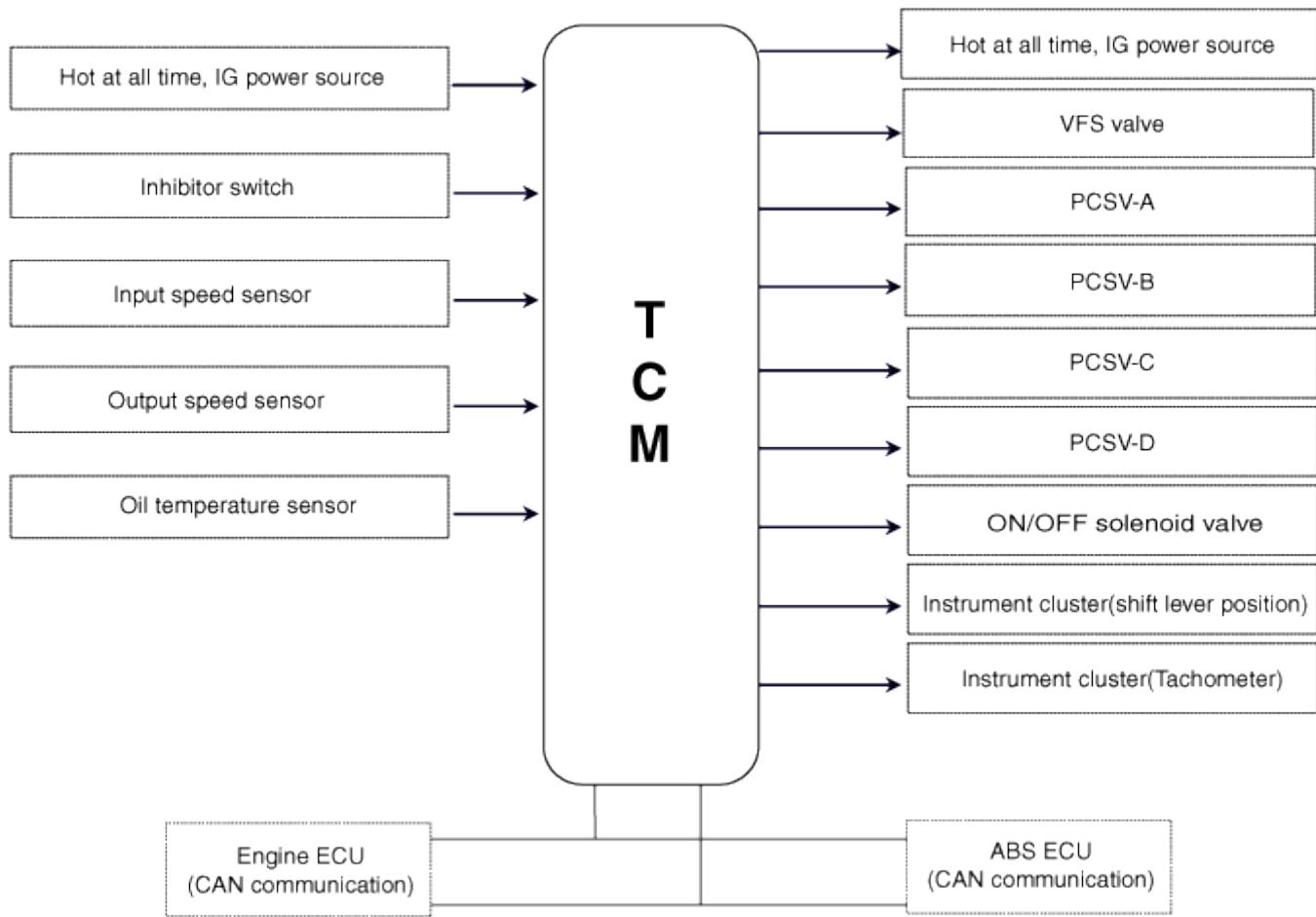
And the reducing valve which is installed in the valve body makes the solenoid control pressure using the reducing pressure instead of the line pressure like the HIVEC transaxle.

The material of spool valve in the valve body is changed from the steel to aluminum to reduce the oil leakage by the thermal expansion between the valve body and spool valve at the high temperature.

The switch valve, the solenoid valve and the fail safe valve are operated to drive the vehicle at the 3rd speed and reverse even through the malfunction of the electronic control parts occur.



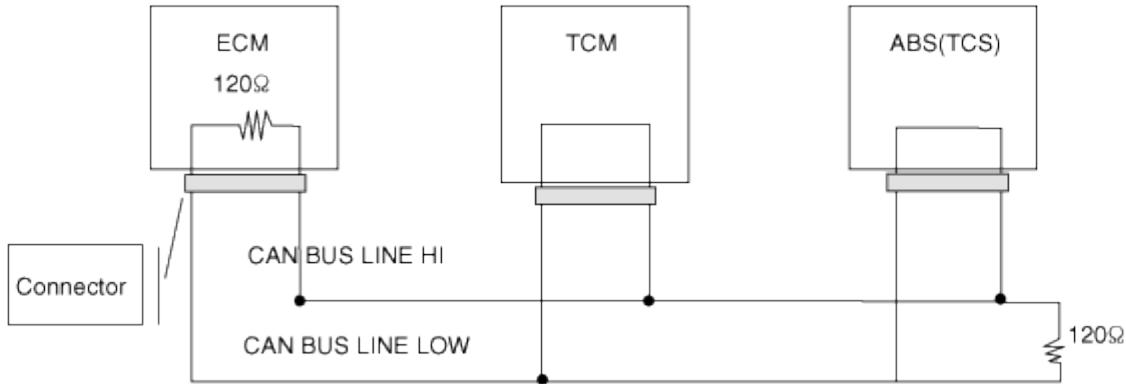
Electronic Control System



Sensor And Actuator Function

| Item | Function |
|-----------------------------------|---|
| Input speed sensor | Detect the input shaft rpm(TURBINE RPM) at the OD/RVS retainer |
| Output speed sensor | Detect the output shaft rpm(T/F DRIVEN GEAR RPM) at the T/F driven gear |
| Engine rpm signal | Receive the engine rpm via CAN communication with ECM |
| Fluid temperature sensor | Detect the temperature of ATF through the thermistor |
| Brake switch | Detect the brake operation at the contact switch of the brake pedal |
| ON/OFF solenoid valve
(SCSV-A) | Control the hydraulic passage for the shift control |
| VFS solenoid valve | Change the line pressure from 4.5 bar to 10.5 bar according to throttle open angle and shift ranges |
| PCSV-A(SCSV-B) | Control the OD or L/R hydraulic pressure to the pressure control valve for shift control |
| PCSV-B(SCSV-C) | Control the 2/4 or REV hydraulic pressure to the pressure control valve for shift control |
| PCSV-C(SCSV-D) | Control the UD hydraulic pressure to the pressure control valve for shift control |
| PCSV-D(DCCV) | Control the hydraulic pressure for the damper clutch control |
| Cluster | Send the signal of the current position of shift lever and vehicle speed |

CAN Communication Layout



ECM- TCM CAN Communication error management

| No. | Item | Error management |
|-----|----------------------------|------------------|
| 1 | Engine rpm | 3,000 RPM |
| 2 | Engine torque | 80% |
| 3 | Vehicle speed | 0 km/h |
| 4 | A/C Switch | OFF |
| 5 | Engine coolant temperature | 70°C |
| 6 | TPS | 50% |
| 7 | Shift range hold signal | OFF |

15.2.2. Repair procedures

Basic Inspection Adjustment

Transaxle Fluid Level

Inspection

1. Drive the vehicle until the fluid reaches normal operating temperature [70~80°C(158~176°F)].
2. Place the vehicle on a level surface.
3. Move the gear selector lever through all gear positions. This will fill the torque converter with trans fluid. Set the selector lever to the "N" (Neutral) position.
4. Before removing the oil level gauge, wipe all contaminants from around the oil level gauge. Then take out the oil level gauge and check the condition of the fluid.

NOTE

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

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

Automatic transaxle fluid :

DIAMOND ATF SP-III, SK ATF SP-III

Automatic transaxle fluid capacity:

6.8liter(7.2 US qt, 5.98Imp.qt)

NOTE

Low fluid level can cause a variety of abnormal conditions because it allows the pump to take in air along with fluid. Air trapped in the hydraulic system forms bubbles, which are compressible. Therefore, pressures will be erratic, causing delayed shifting, slipping clutches and brakes, etc. Improper filling can also raise fluid level too high. When the transaxle has too much fluid, gears churn up foam and cause the same conditions which occur with low fluid level, resulting in accelerated deterioration of automatic transaxle fluid. In either case, air bubbles can cause overheating, and fluid oxidation, which can interfere with normal valve, clutch, and brake operation. Foaming can also result in fluid escaping from the transaxle vent where it may be mistaken for a leak.

6. Insert the oil level gauge securely.

NOTE

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

Replacement

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

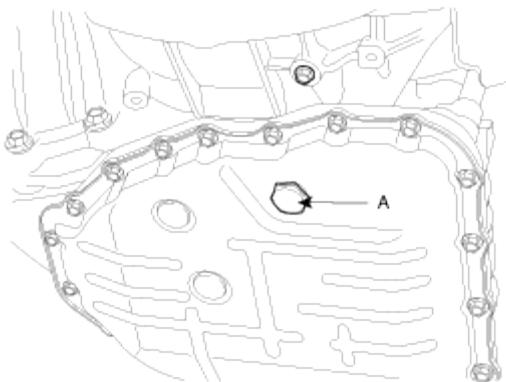
1. Disconnect the hose, which connects the transmission and the oil cooler (inside the radiator).
2. Start the engine and let the fluid drain out.

Running conditions : "N" range with engine idling

CAUTION

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

3. Remove the drain plug(A) from the bottom of the transmission case to drain the fluid.



4. Install the drain plug via the gasket, and tighten it the specified torque.

Tightening torque :

40~50 Nm (4.0~5.0kgf.m, 28.9~36.2lb·ft)

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

CAUTION

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

6. Repeat the procedure in step (2).

NOTE

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

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

8. Reconnect the hose, which was disconnected in step (1) above, and firmly replace the oil level gauge.

(In case of this "replace", this means after wiping off any dirt around the oil level gauge, insert it into the filler tube.)

9. Start the engine and run it at idle for 1~2 minutes.

10. Move the select lever through all positions, and then move it to the "N" or "P" position.

11. Drive the vehicle until the fluid temperature rises to the normal temperature (70~80°C(158~176°F)), and then check the fluid level again. The fluid level must be at the HOT mark.

12. Firmly insert the oil level gauge into the oil filler tube.

Torque Converter Stall Test

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

CAUTION

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

1. Check the automatic transmission fluid level and temperature and the engine coolant temperature.

A. Fluid level : At the HOT mark on the oil level gauge

B. Fluid temperature : 80~100°C (176~212°F)

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

2. Check both rear wheels (left and right).

3. Pull the parking brake lever on, with the brake pedal fully depressed.

4. Start the engine.

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

CAUTION

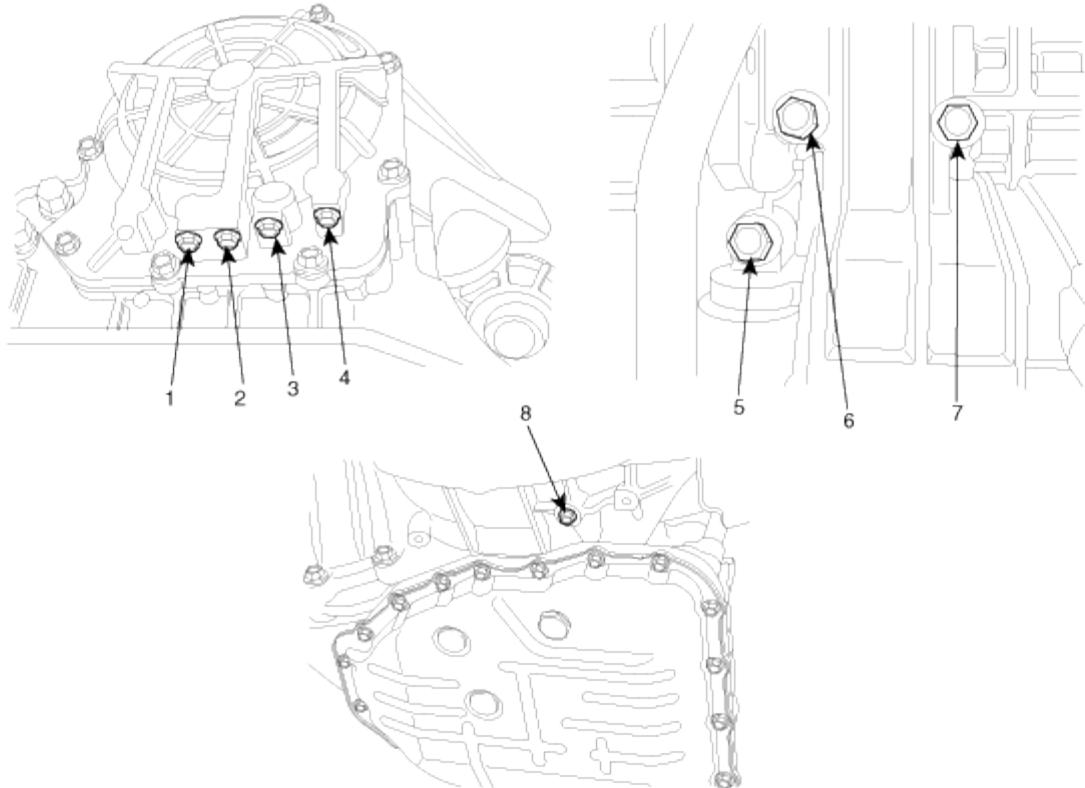
- The throttle should not be left fully open for any more than 5 seconds.
- If carrying out the stall test two or more times, move the select lever to the "N" position and run the engine at 1,000 r/min to let the automatic transaxle fluid cool down before carrying out subsequent tests.
- Move the select lever to the "R" position and carry out the same test again.

Stall rpm : 2,000~2,700 RPM

| Range | Condition | Passable cause |
|--------------------------|------------------------------|--|
| R range slip | Reverse | REV in D range normal
L/R in D range abnormal |
| D1 rang slip | D range 1st/ Sports mode 1st | L/R in reverse range abnormal
UD in reverse range normal |
| D3 range slip | 3rd gear hold | OD in 3rd gear slip
(1st and 2nd gear normal) |
| Forwarding, reverse slip | D range, R range | Torque converter
Oil pump, Manual valve in the valve
Driving device abnormal |

Hydraulic Pressure Test

1. Warm up the engine until the automatic transaxle fluid temperature is 80~100°C(176~212°F).
2. Jack up the vehicle so that the wheels are free to turn.
3. Connect the special tools(09452-21500, 09452-21000) oil pressure gauge to each pressure discharge port.
4. Measure the hydraulic pressure at each port under the conditions given in the standard hydraulic pressure table, and check that the measured values are within the standard value ranges.
5. If a value is outside the standard range, correct the problem while referring to the hydraulic pressure test diagnosis table.
 - A. Bottom side



Torques : 8~10Nm(80~100kgf.cm, 6~7lb-ft)

| | |
|----------------------|---------------------|
| 1. RED pressure port | 5. DA pressure port |
| 2. OD pressure port | 6. UD pressure port |
| 3. 2/4 pressure port | 7. LR pressure port |
| 4. REV pressure port | 8. DR pressure port |

Standard Hydraulic Pressure Table

| No. | Shift range position | Operation | | | | | Measuring | Oil pressure (kgf/cm ²) | | | | |
|-----|----------------------|-----------|--------|--------|--------|--------|-----------|-------------------------------------|----------|----------|----------|----------|
| | | PCSV-A | PCSV-B | PCSV-C | PCSV-D | ON/OFF | | LR | 2-4(2ND) | UD | OD | REV |
| 1 | D | 0 | 100 | 0 | 0 | ON | LR | 10.5±0.2 | 0 | 10.5±0.2 | 0 | 0 |
| 2 | ↑ | 50 | ↑ | ↑ | ↑ | ↑ | ↑ | 5.6±0.4 | ↑ | ↑ | ↑ | ↑ |
| 3 | ↑ | 75 | ↑ | ↑ | ↑ | ↑ | ↑ | 1.0±0.3 | ↑ | ↑ | ↑ | ↑ |
| 4 | ↑ | 100 | ↑ | ↑ | ↑ | ↑ | ↑ | 0 | ↑ | ↑ | ↑ | ↑ |
| 5 | ↑ | ↑ | 0 | ↑ | 100 | OFF | 2-4(2ND) | 0 | 10.5±0.2 | ↑ | ↑ | ↑ |
| 6 | ↑ | ↑ | 50 | ↑ | ↑ | ↑ | ↑ | 5.3±0.4 | ↑ | ↑ | ↑ | ↑ |
| 7 | ↑ | ↑ | 75 | ↑ | ↑ | ↑ | ↑ | 0.9±0.3 | ↑ | ↑ | ↑ | ↑ |
| 8 | ↑ | ↑ | 100 | ↑ | ↑ | ↑ | ↑ | 0 | ↑ | ↑ | ↑ | ↑ |
| 9 | ↑ | 0 | ↑ | ↑ | ↑ | ↑ | OD | ↑ | ↑ | ↑ | 10.5±0.2 | ↑ |
| 10 | ↑ | 50 | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | 5.6±0.4 | ↑ |
| 11 | ↑ | 75 | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | 1.0±0.3 | ↑ |
| 12 | ↑ | 100 | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | 0 | ↑ |
| 13 | ↑ | ↑ | ↑ | 0 | 0 | ↑ | UD | ↑ | ↑ | 10.5±0.2 | ↑ | ↑ |
| 14 | ↑ | ↑ | ↑ | 50 | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | 5.8±0.4 | ↑ |
| 15 | ↑ | ↑ | ↑ | 75 | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | 1.0±0.3 | ↑ |
| 16 | ↑ | 0 | ↑ | 100 | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | 0 | ↑ |
| 17 | R | ↑ | 0 | ↑ | ↑ | ON | REV | 17.7±0.8 | ↑ | ↑ | ↑ | 17.7±0.8 |
| 18 | ↑ | ↑ | 50 | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | 8.7±0.8 |
| 19 | ↑ | ↑ | 75 | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | 0.9±0.5 |
| 20 | ↑ | ↑ | 100 | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | ↑ | 0 |

[Measure condition]

- Oil pump revolution : 2500rpm
- LPCSV Duty ratio : 0%

Note) The oil pressure values of "0" marked on the above table must measure less than 0.1kgf/cm² when testing.

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

15.2.3. Troubleshooting

Troubleshooting

Diagnostic Trouble Codes (Inspection Procedure)

Check the Diagnostic Trouble Codes

1. Turn the ignition switch to OFF.
2. Connect the Hi-scan tool to the DLC connector for diagnosis.
3. Turn the ignition switch to ON.
4. Check the diagnostic trouble codes using the Hi-scan tool.
5. Read the output diagnostic trouble codes. Then follow the remedy procedures according to the "DIAGNOSTIC TROUBLE CODE DESCRIPTION" on the following pages.

NOTE

- A maximum of 5 diagnostic trouble codes (in the sequence of occurrence) can be stored in the Random Access Memory (RAM) incorporated within the control module.
- The same diagnostic trouble code can be stored one time only.
- If the number of stored diagnostic trouble codes or diagnostic trouble patterns exceeds 5, already stored diagnostic trouble codes will be erased in sequence, beginning with the oldest.
- Do not disconnect the battery until all diagnostic trouble codes or diagnostic trouble patterns have been read out, because all stored diagnostic trouble codes or diagnostic trouble patterns will be cancelled when the

battery is disconnected.

- All diagnostic trouble codes are deleted from memory the 200th time the ATF temperature reaches 50°C(122°F) after memorization of the most recent diagnostic code.

6. Delete the diagnostic trouble code.

7. Disconnect the Hi-scan tool.

NOTE

DTC cleaning should only be done with the scan tool.

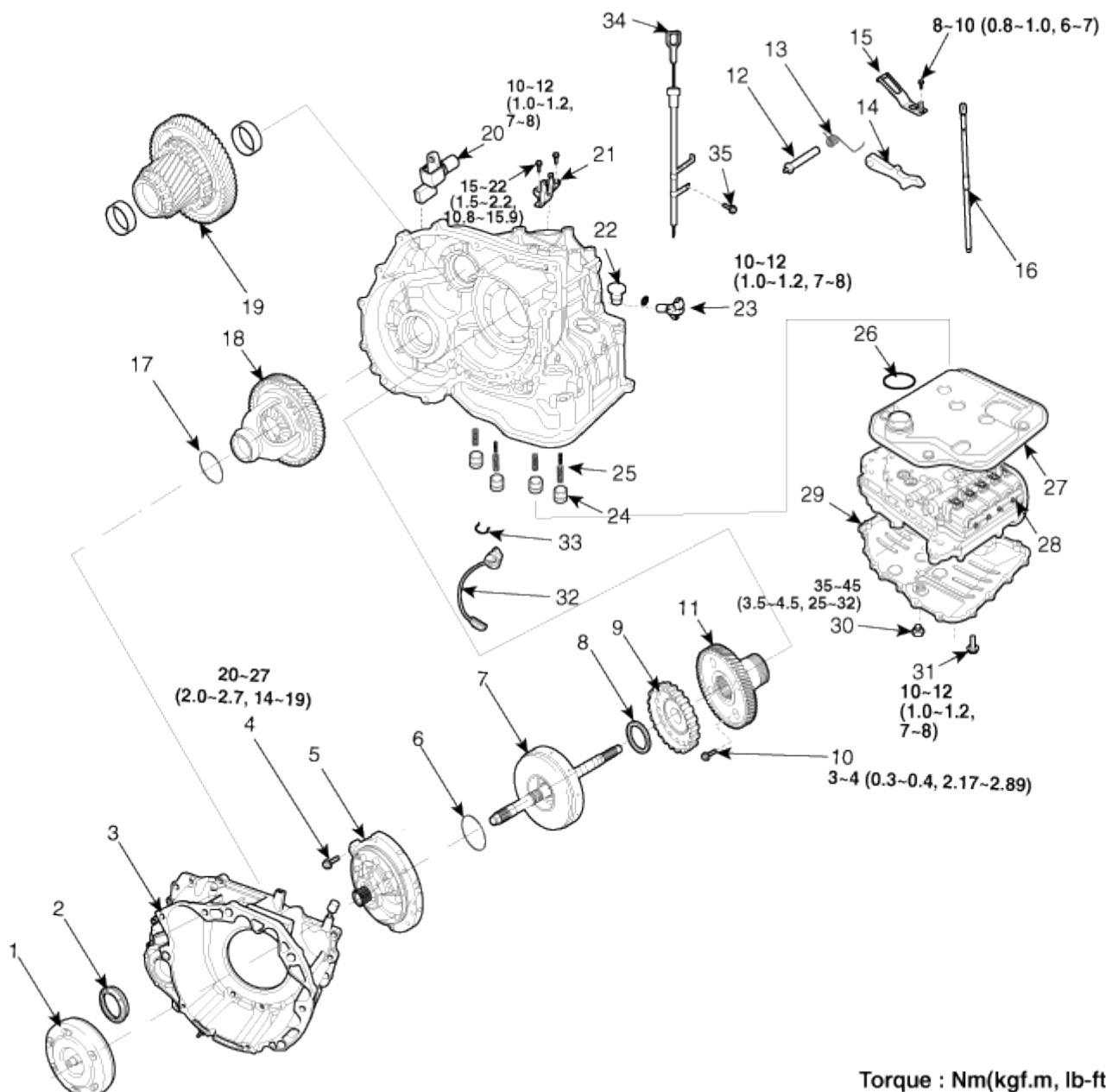
Diagnostic Trouble Code Table

| No. | Code | Description | MIL | Remark |
|-----|-------|--|-----|--------|
| 1 | P0707 | Transmission Range Sensor Circuit Low Input | • | |
| 2 | P0708 | Transmission Range Sensor Circuit High Input | • | |
| 3 | P0712 | Transmission Fluid Temperature Sensor 'A' Circuit Low Input | • | |
| 4 | P0713 | Transmission Fluid Temperature Sensor 'A' Circuit High Input | • | |
| 5 | P0717 | Input/Turbine Speed Sensor 'A' Circuit No Signal | • | |
| 6 | P0722 | Output Speed Sensor Circuit No Signal | • | |
| 7 | P0731 | Gear 1 Incorrect Ratio | • | |
| 8 | P0732 | Gear 2 Incorrect Ratio | • | |
| 9 | P0733 | Gear 3 Incorrect Ratio | • | |
| 10 | P0734 | Gear 4 Incorrect Ratio | • | |
| 11 | P0741 | Torque Converter Clutch Circuit Performance or Stuck Off | • | |
| 12 | P0742 | Torque Converter Clutch Circuit Stuck On | • | |
| 13 | P0743 | Torque Converter Clutch Circuit Electrical | • | |
| 14 | P0748 | Pressure Control Solenoid Valve(VFS) 'A' Electrical | | |
| 15 | P0750 | Shift Control Solenoid Valve 'A' | • | |
| 16 | P0755 | Shift Control Solenoid Valve 'B' | • | |
| 17 | P0760 | Shift Control Solenoid Valve 'C'(2nd Brake Solenoid) | • | |
| 18 | P0765 | Shift Control Solenoid Valve 'D' | • | |
| 19 | U0001 | High Speed CAN Communication Bus off | • | |
| 20 | U0100 | Lost Communication With ECM/PCM 'A' | • | |

15.2.4. Automatic Transaxle

15.2.4.1. Component and Components Location

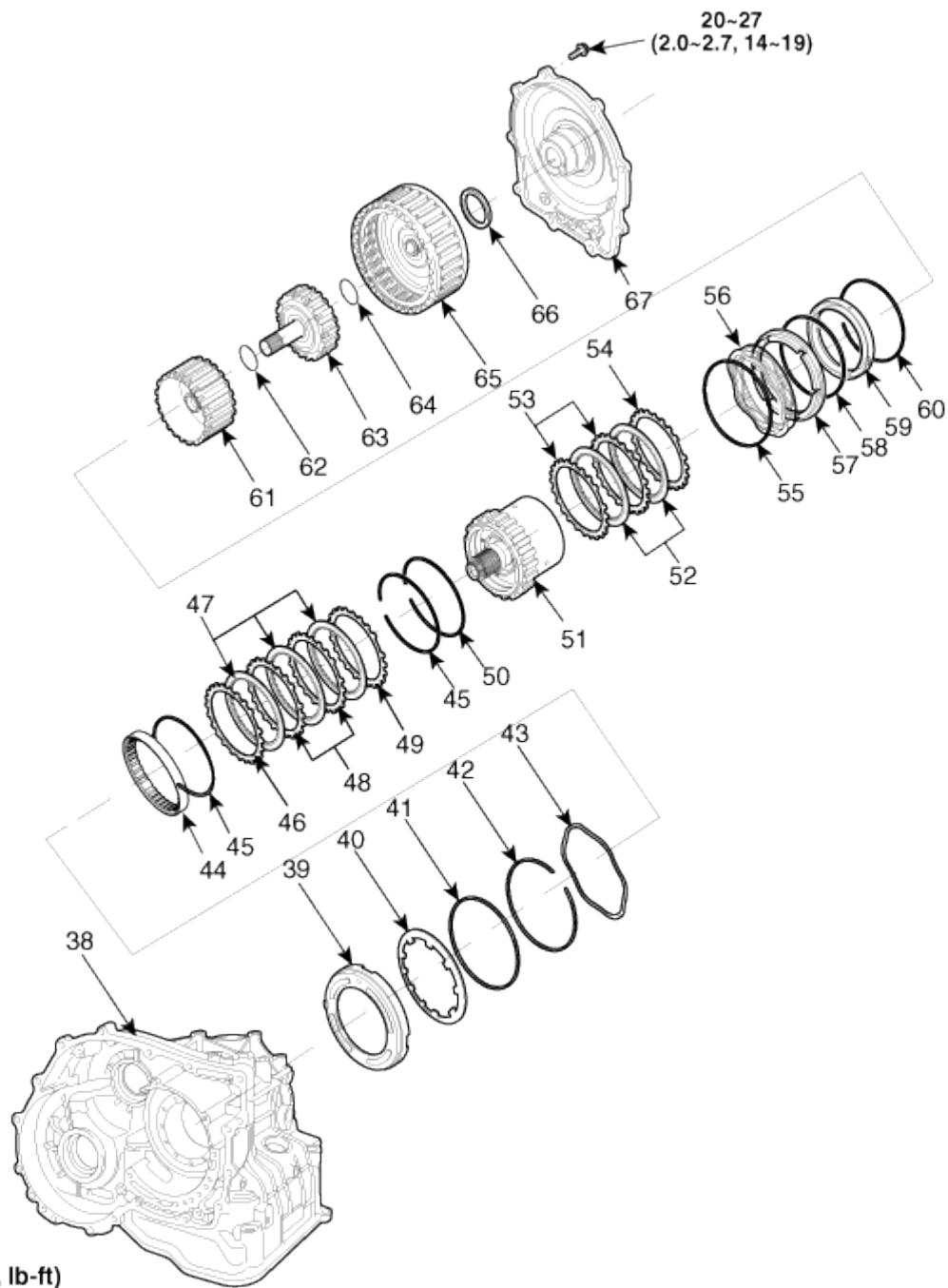
Components (1)



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

| | | |
|---------------------------------------|--------------------------|--|
| 1. Torque converter | 13. Sprag spring | 25. Coil spring |
| 2. Differential oil seal | 14. Parking sprag | 26. O-ring |
| 3. Converter housing | 15. Detent spring | 27. Oil filter |
| 4. Oil pump mounting bolt | 16. Manual control shaft | 28. Valve body assembly |
| 5. Oil pump assembly | 17. Spacer | 29. Oil pan |
| 6. Thrust washer | 18. Differential | 30. Drain plug |
| 7. Underdrive(U/D) clutch | 19. Transfer driven gear | 31. Valve body cover bolt |
| 8. Thrust bearing | 20. Output speed sensor | 32. Valve body connector |
| 9. Underdrive(U/D) clutch hub | 21. Shift cable bracket | 33. Valve body connector mounting clip |
| 10. Transfer drive gear mounting bolt | 22. Plug | 34. Oil level gauge |
| 11. Transfer drive gear | 23. Input speed sensor | 35. Oil level gauge bracket bolt |
| 12. Parking sprag shaft | 24. Accumulator piston | |

Components (2)



Torque : Nm(kgf.m, lb·ft)

| | | |
|---------------------------------------|--------------------------------------|-------------------------------------|
| 38. Transmission case | 48. Low&reverse brake plate | 58 . D-ring |
| 39. Low&reverse brake piston | 49. Low&reverse brake reaction plate | 59. 2ND brake retainer |
| 40. Return spring | 50. Snap ring | 60. Snap ring |
| 41. Low&reverse brake spring retainer | 51. Low&reverse planetary gear set | 61. Reverse sun gear |
| 42. Snap ring | 52. 2ND brake disc | 62. Thrust bearing |
| 43. Wave spring | 53. 2ND brake plate | 63. Overdrive(O/D) hub |
| 44. One way clutch inner race | 54. 2ND brake pressure plate | 64. Thrust bearing |
| 45. Snap ring | 55. D-ring | 65. Reverse & Overdrive(O/D) clutch |
| 46. Low&reverse pressure plate | 56. 2ND brake return spring | 66. Thrust bearing |
| 47. Low&reverse brake disc | 57. 2ND brake piston | 67. Rear cover |

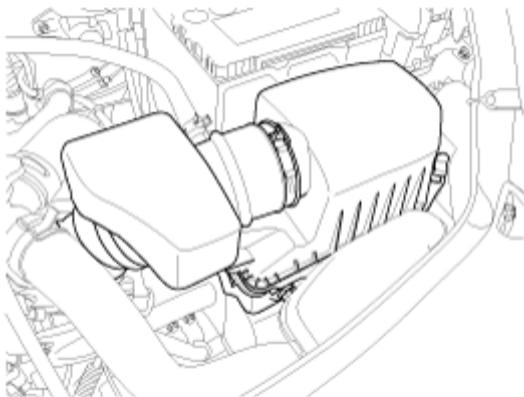
15.2.4.2. Repair procedures

Removal

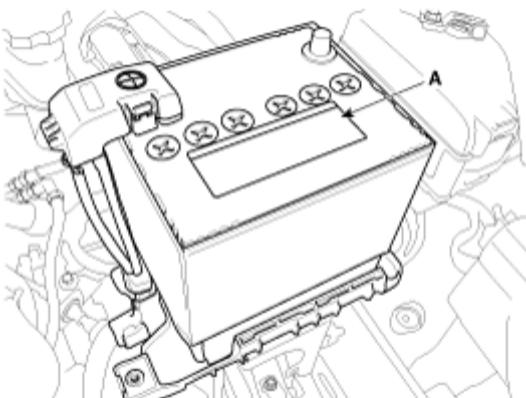
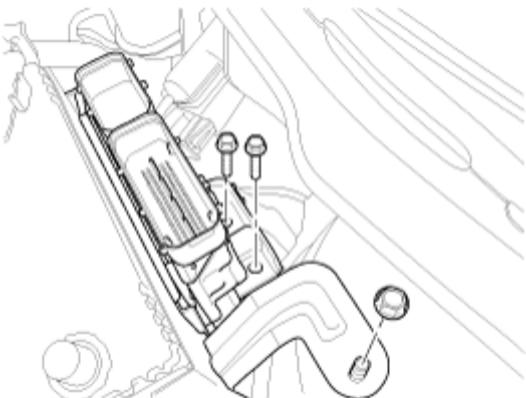
- Use fender covers to avoid damaging painted surfaces.

- To avoid damage, unplug the wiring connectors carefully while holding the connector portion.
- Mark all wiring and hoses to avoid misconnection.

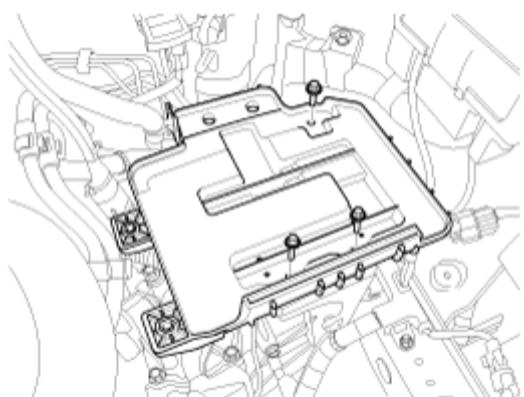
1. Remove the air cleaner assembly and the intake hose by removing the bolts and the clamps.



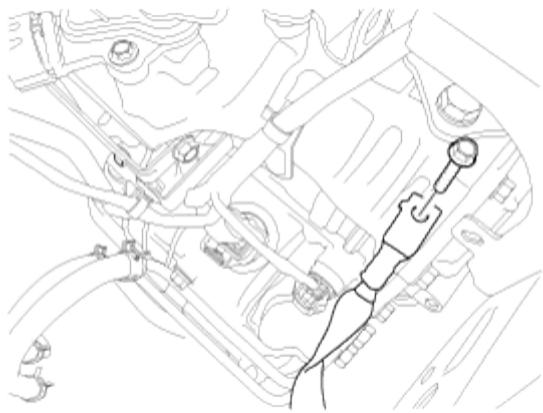
2. Remove the ECU by removing the bolts(2ea) and the battery (A).



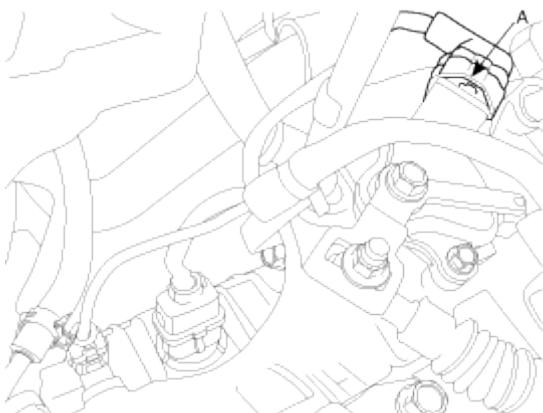
3. Remove the battery tray by removing the bolts(3ea).



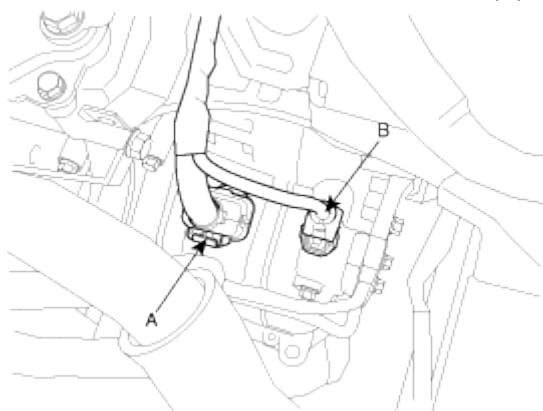
4. Remove the ground cable by removing a bolt.



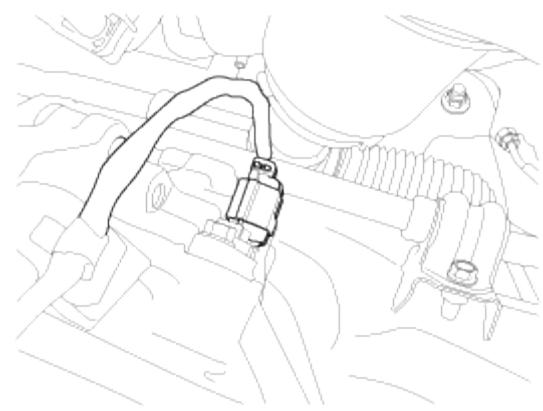
5. Disconnect the inhibitor switch connector (A).



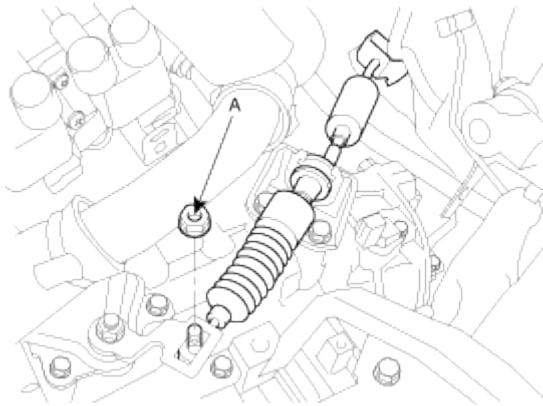
6. Disconnect the solenoid valve connector (A) and the input speed sensor connector (B).



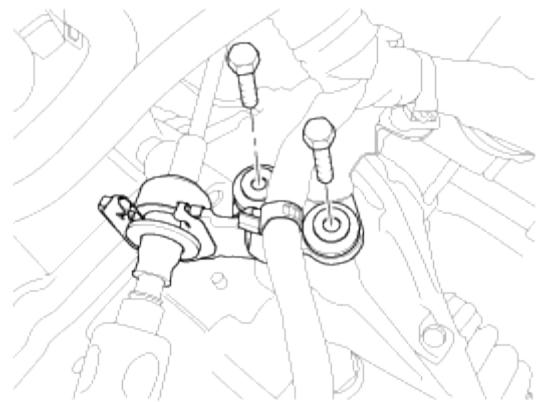
7. Disconnect the output speed sensor connector.



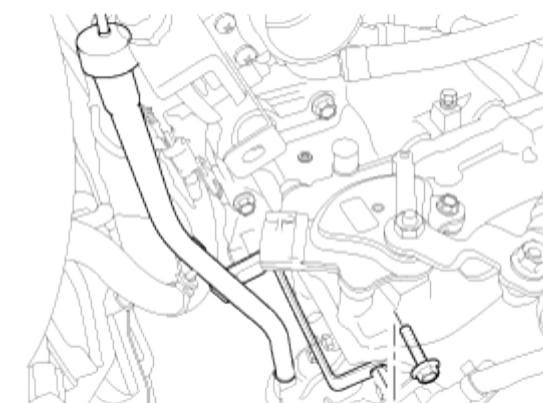
8. Remove the shift cable nut (A).



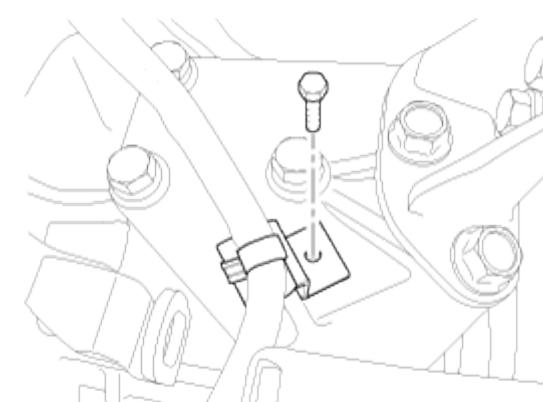
9. Remove the shift cable bracket bolts(2ea).



10. Remove the oil level gauge by removing a bracket bolt.

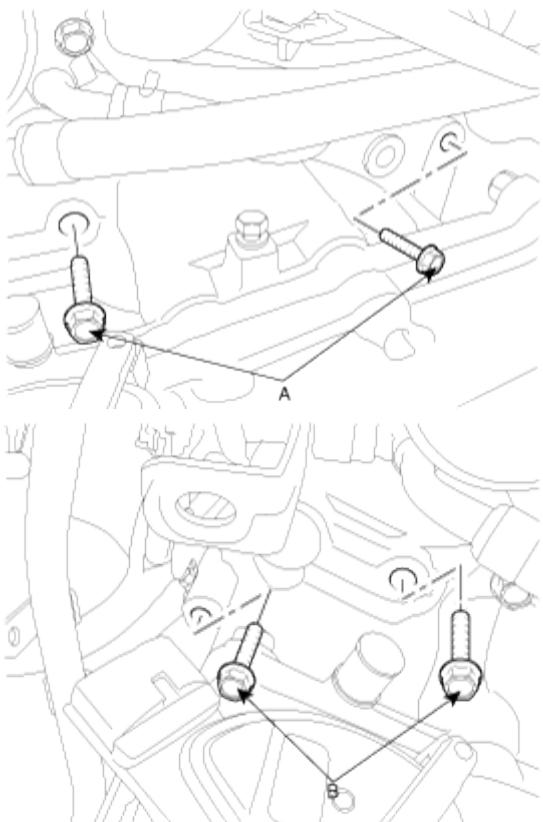


11. Remove the wire bracket bolt.

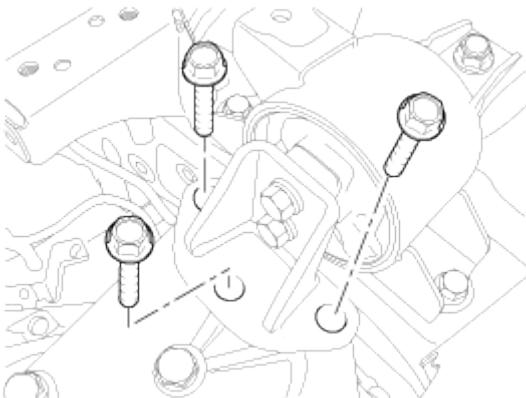


12. Using the special tool (09200-38001), support the engine assembly safely.

13. Remove the transaxle upper mounting bolts (A-2ea) and the starter motor mounting bolts (B-2ea).



14. Remove the transaxle support bracket bolts(3ea).

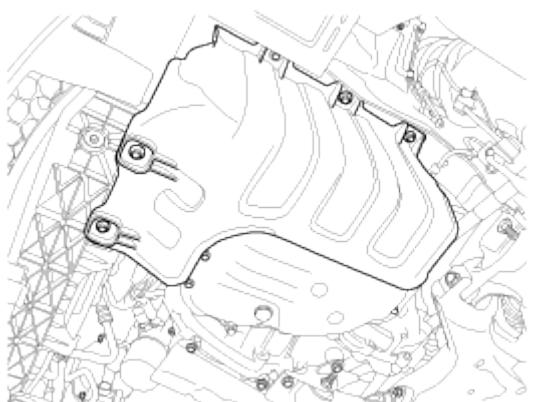


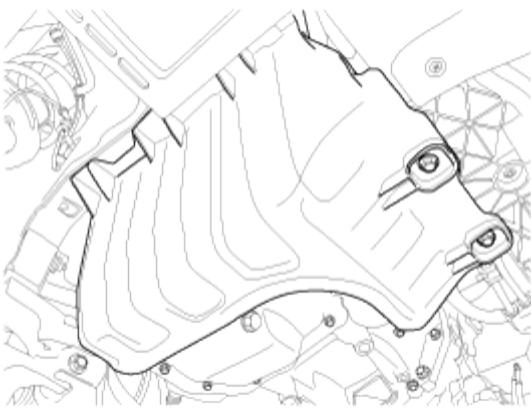
15. Lifting up the vehicle.

16. Remove the front wheels and tires.

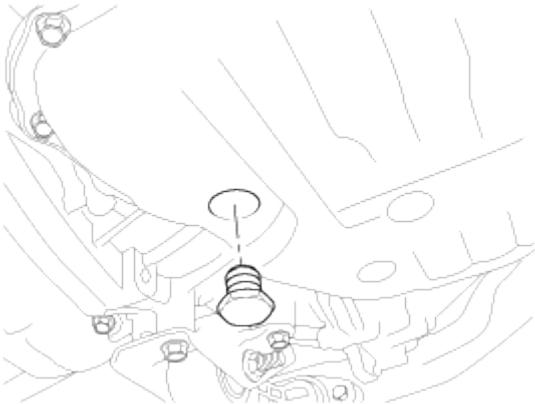
17. Remove the lower arm ball joint mounting nut and the stabilizer link mounting nut from the front knuckles.
(refer to Front suspension system in SS group)

18. Remove the under shield covers.

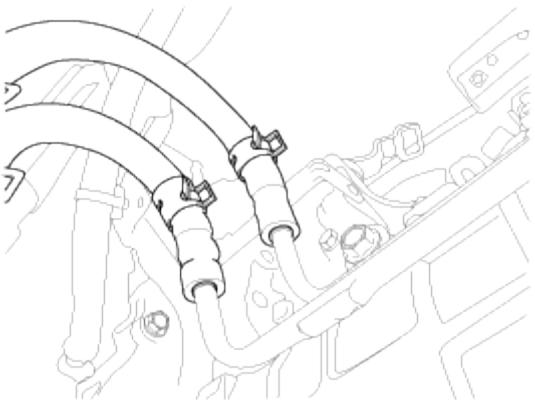




19. Drain the transalxe fluid by removing the drain plug.

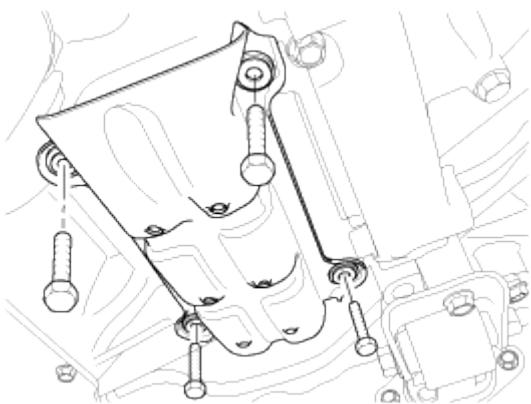


20. Remove the oil cooler hoses by moving clamps.

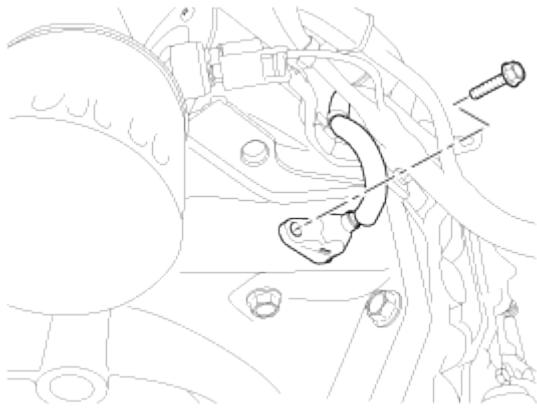


21. Disconnect the drive shafts from the transaxle. (refer to Front Driveshaft in DS group)

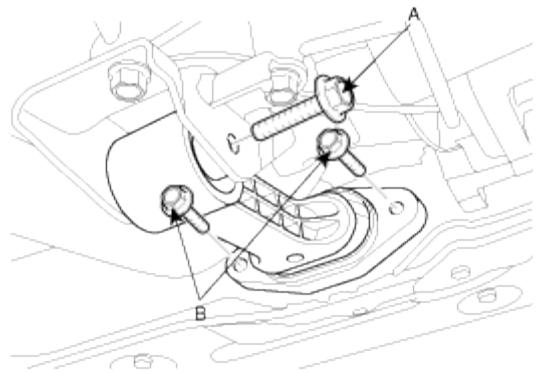
22. Remove the bracket (A).



23. Remove the CKP sensor by removing a bolt.



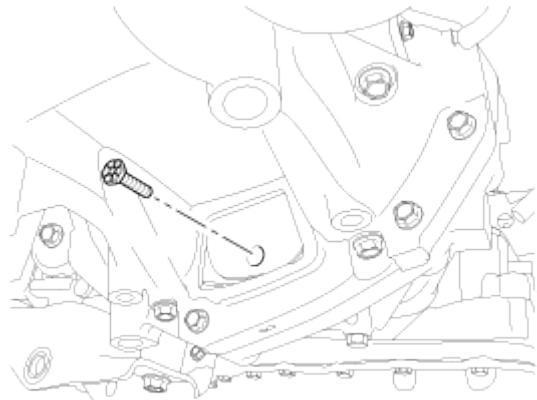
24. Install the transaxle jack.
25. Remove the roll stopper bracket by removing bolts(A-1ea,B-2ea).



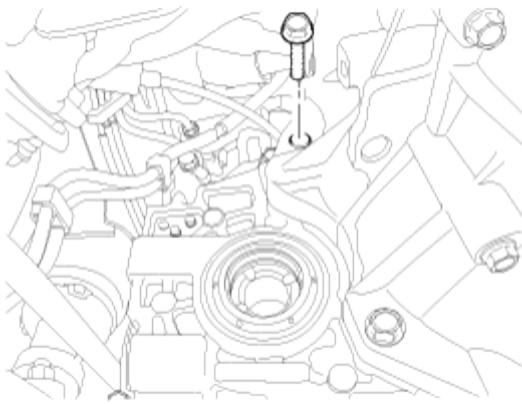
26. Remove the plastic dust cover.



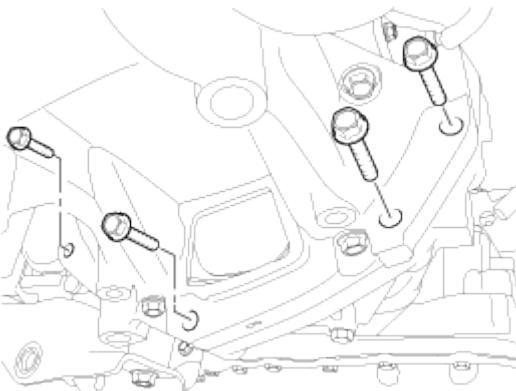
27. Remove the torque converter mounting bolts(3ea) by rotating the crankshaft.



28. Remove a bolt left in the engine side.



29. Supporting the transaxle with a jack, remove the transaxle lower mounting bolts(4ea).



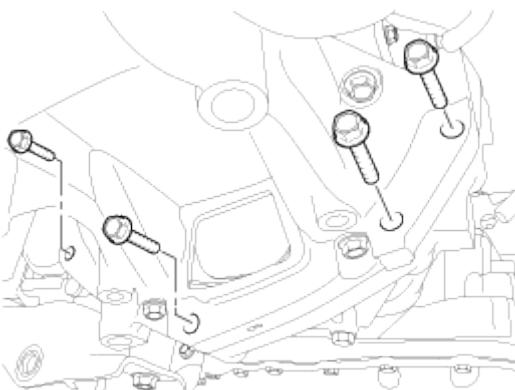
30. Lowering the jack slowly, remove the transaxle.

Installation

1. Install the transaxle lower mounting bolts(4ea) after fitting the transaxle assembly into the engine assembly.

Tightening torque :

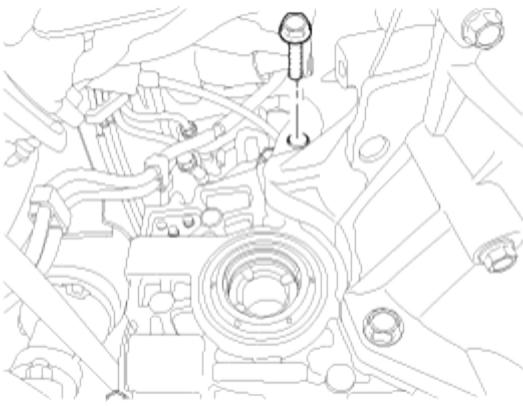
45~55 Nm (4.5~5.5 kgf.m, 32.5~39.8 lb-ft)



2. Install a bolt left in the engine side.

Tightening torque :

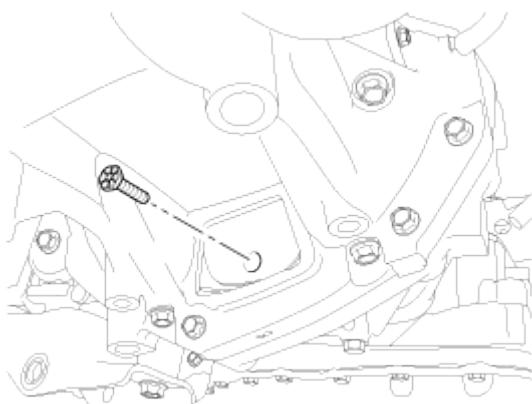
43~55 Nm (4.3~5.5 kgf.m, 31.1~39.8 lb-ft)



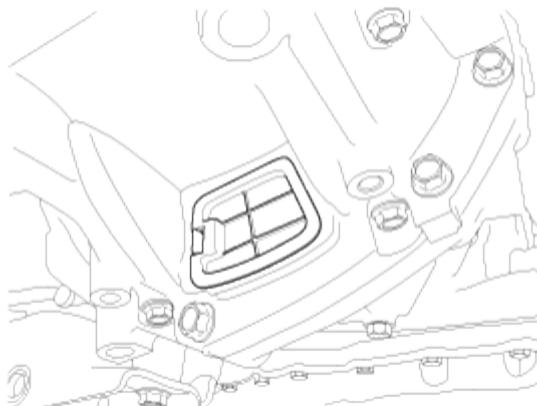
3. Install the torque converter mounting bolts(3ea) by rotating the crankshaft.

Tightening torque :

46~53 Nm (4.6~5.3 kgf.m, 33.3~38.3 lb-ft)



4. Install the plastic dust cover.

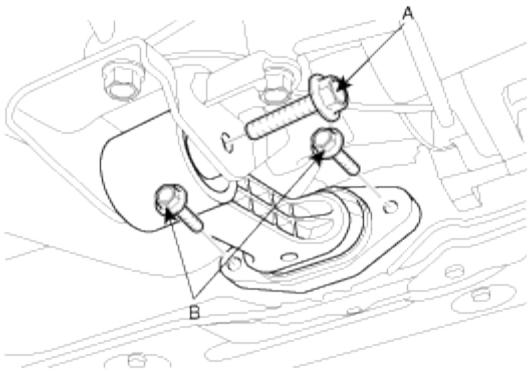


5. Install the roll stopper bracket by installing bolts(A-1ea,B-2ea).

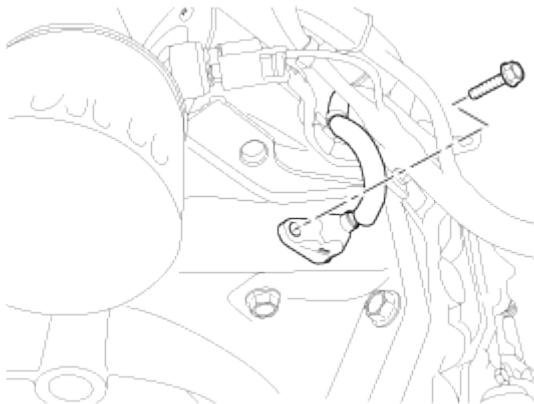
Tightening torque :

[A] 90~110 Nm (9~11 kgf.m, 65~79 lb-ft)

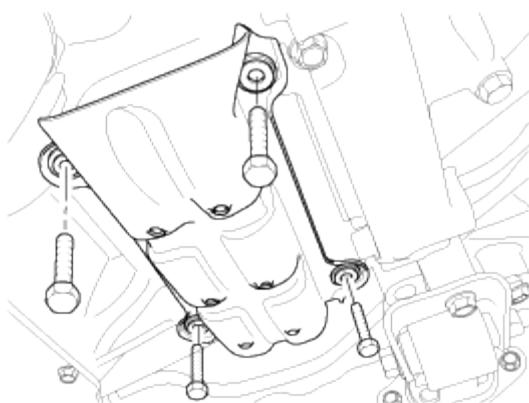
[B] 50~65 Nm (5.0~6.5 kgf.m, 36.2~47.0 lb-ft)



6. Install the CKP sensor by installing a bolt.

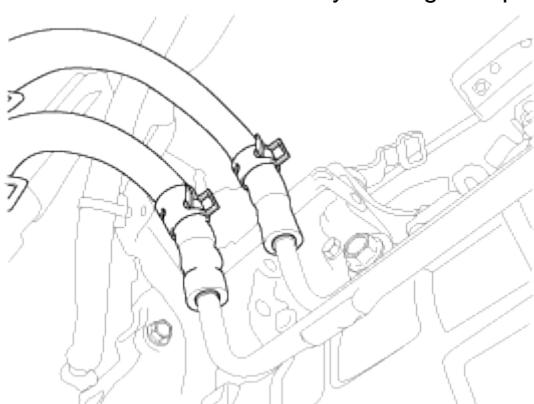


7. Install the bracket (A).

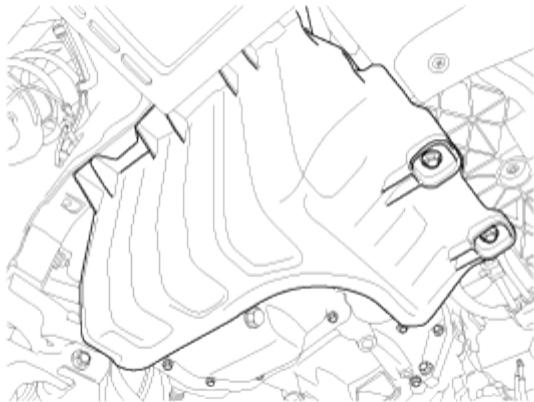
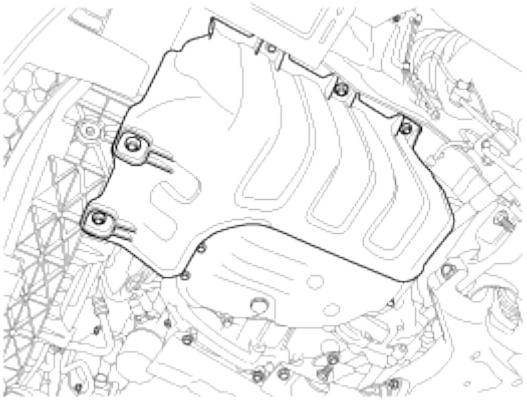


8. Connect the drive shafts to the transaxle. (refer to Front Driveshaft in DS group)

9. Install the oil cooler hoses by moving clamps.



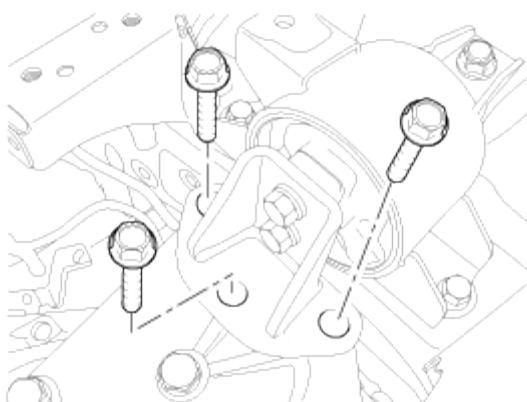
10. Install the under shield cover (A).



11. Install the lower arm ball joint mounting nut and the stabilizer link mounting nut to the front knuckles.
(refer to Front suspension system in SS group)
12. Install the front wheels and tires. (refer to installation in SS group)
13. Install the transaxle support bracket bolts(3ea).

Tightening torque :

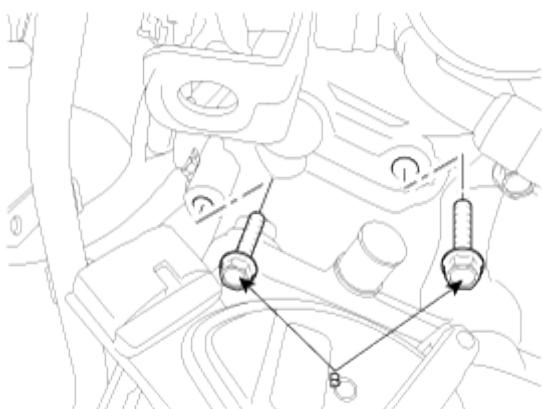
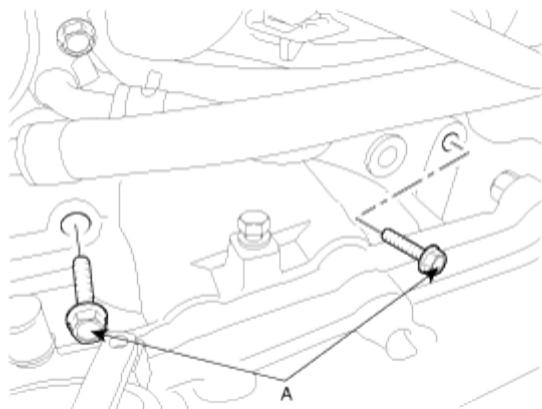
70~95 Nm (7.0~9.5 kgf.m, 50.6~68.7 lb-ft)



14. Install the transaxle upper mounting bolts (A-2ea) the starter motor mounting bolts (B-2ea).

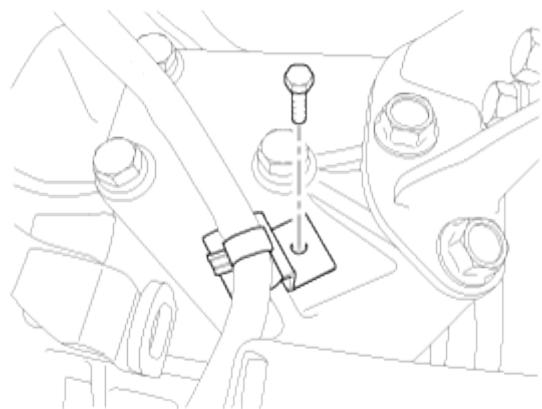
Tightening torque :

[A] 60~80 Nm (6.0~8.0 kgf.m, 43.4~57.9 lb-ft)
[B] 43~55 Nm (4.3~5.5 kgf.m, 31.1~39.8 lb-ft)

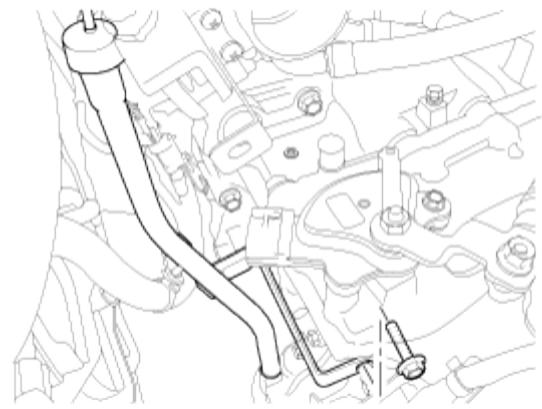


15. Put aside the engine support fixture (09200-38001).

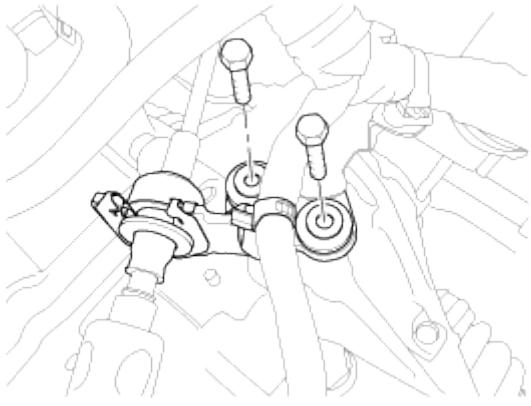
16. Install the wire bracket bolt.



17. Install the oil level gauge by installing a bracket bolt.



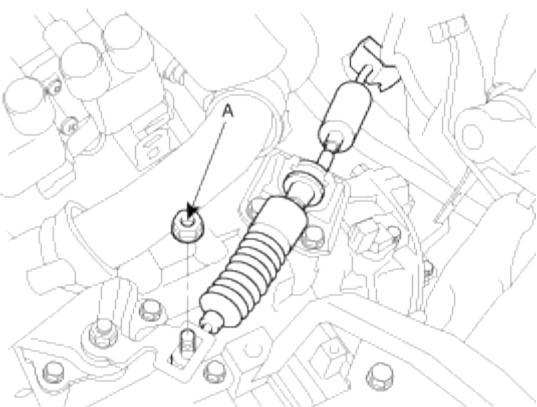
18. Install the shift cable bracket bolts(2ea).



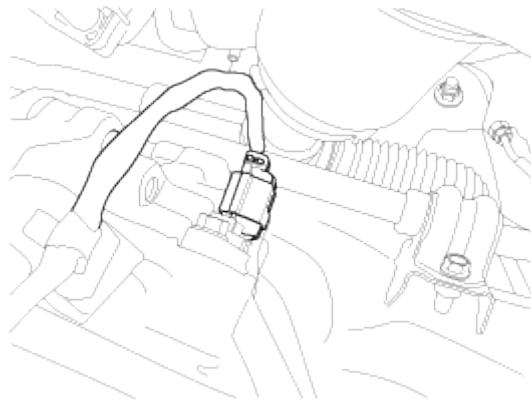
19. Install the control cable bracket by installing a nut.

Tightening torque :

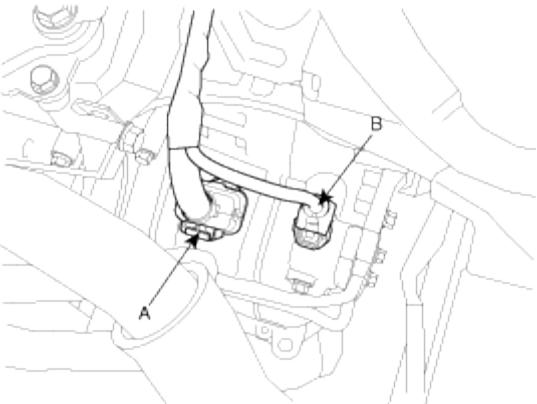
10~14 Nm (1.0~1.4 kgf.m, 7.2~10.1 lb-ft)



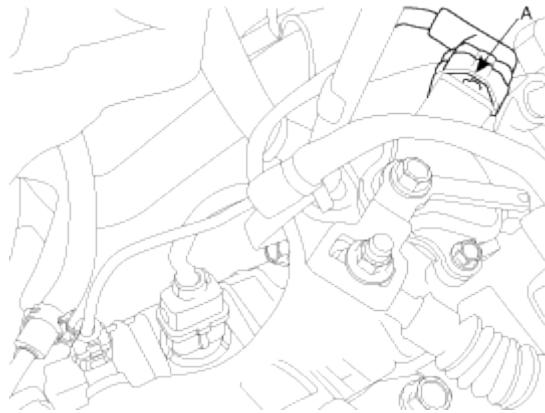
20. Connect the output speed sensor connector (A).



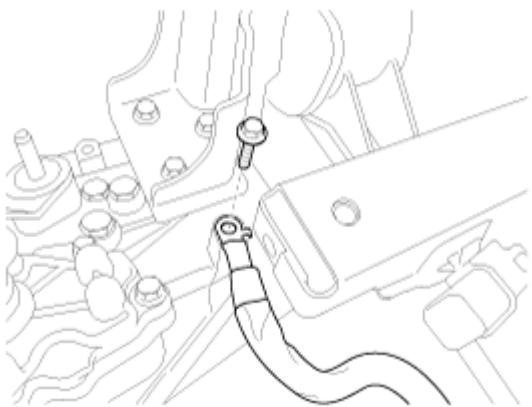
21. Connect the solenoid valve connector (A) and the input speed sensor connector (B).



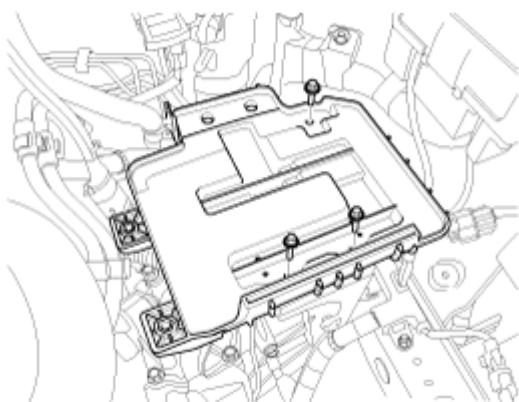
22. Connect the inhibitor switch connector (A).



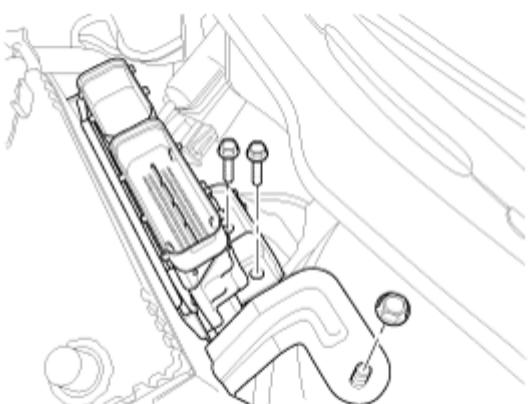
23. Install the ground wire by installing a bolt.

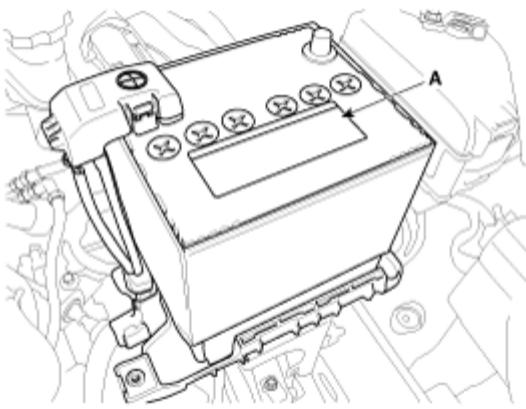


24. Install the battery tray by installing the bolts(3ea).

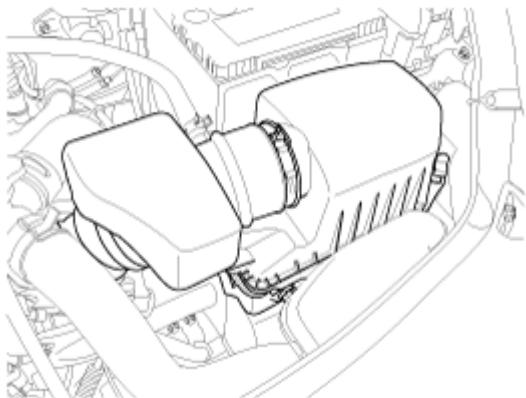


25. After installing the battery (A), install the ECU by installing the bolts(2ea) and a nut.





26. Install the air cleaner assembly and the intake hose by installing the bolts and the clamps.



27. After completing the installation perform the following procedure;

- A. Adjust the shift cable.
- B. Refill the transaxle fluid.
- C. Clean the battery posts and cable terminals with sandpaper and grease them to prevent corrosion before installing.

NOTE

When replacing the automatic transaxle, reset the automatic transaxle's values by using the High- Scan Pro.

1. Connect the Hi-Scan Pro connector to the data link connector under the crash pad and power cable to the cigar jack under the center facia.
2. Turn the ignition switch on and power on the Hi-Scan Pro.
3. Select the vehicle's name.
4. Select 'AUTOMATIC TRANSAXLE'.
5. Select 'RESETTING AUTO T/A VALUES' and perform the procedure

1.7. RESETTING AUTO T/A VALUES

**THIS FUNCTION IS FOR RESETTING
THE ADAPTIVE VALUES FROM THE
USED AUTO T/A WHEN REPLACING IT.**

**IF YOU ARE READY,
PRESS [ENTER] KEY!**

6. Perform the procedure by pressing F1 (REST).

| 1.7. RESETTING AUTO T/A VALUES | |
|----------------------------------|---|
| RESETTING AUTO T/A VALUES | |
| CONDITION | IG KEY ON
TRANSAKLE RANGE : P
VEHICLE SPEED : 0
ENGINE OFF |
| PRESS [REST], IF YOU ARE READY ? | |
| REST | |

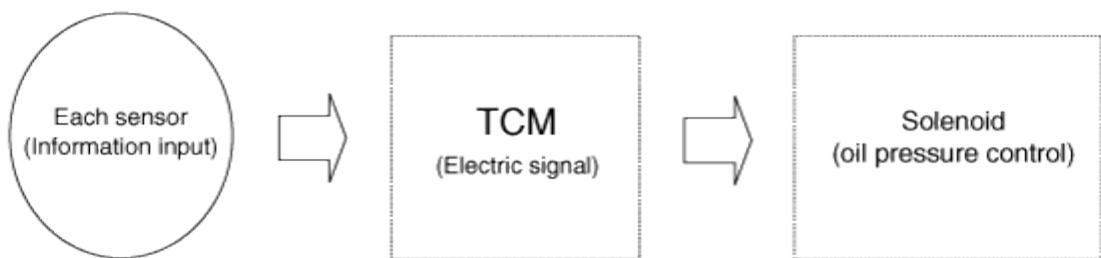
15.3. Valve Body System

15.3.1. Solenoid valve

15.3.1.1. Description and Operation (A4CF2)

Description

TCM calculates the best condition using the information from all kinds of sensors. If the solenoid valve receives the information on the oil pressure, the solenoid valve actuates according to the driving signal. All kinds of regulators in the valve body are controlled to change the oil passage and also the line pressure is controlled by TCM.



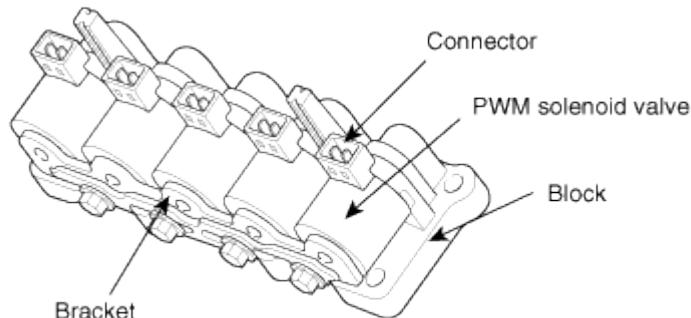
• PWM (Pulse Width Modulation) Solenoid Valve

Structure and functions

PWM solenoid valve is composed of five solenoid valves and the oil capacity in the solenoid valve is changed by the electric duty value of TCM. The oil pressure of the valve body and the torque converter engages or disengages the damper clutch. The solenoid valves send the operating oil pressure to the clutches and brakes at the each range and also control the strength and weakness of oil pressure to reduce the shock when shifting the range.



1. PCSV-A (OD & LR)
2. PCSV-B (2-4 brake)
3. ON-OFF solenoid
4. PCSV-D (DCC solenoid)
5. Ground
6. PCSV-C (UD)
7. VFS
8. VFS ground



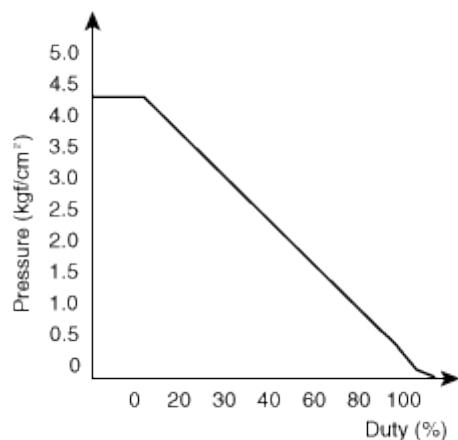
<PWM block assembly>

PWM (Pulse Width Modulation) solenoid

| Range | PWM solenoid valve | | | | |
|---------|--------------------|--------------------|--------------------|------------------|---------------------|
| | PCSV-A
(SCSV-B) | PCSV-B
(SCSV-C) | PCSV-C
(SCSV-D) | PCSV-D
(DCCV) | ON, OFF
(SCSV-A) |
| N, P | OFF | ON | ON | OFF | ON |
| 1st | ON | ON | OFF | OFF | ON |
| 2nd | ON | OFF | OFF | ON | OFF |
| 3rd | OFF | ON | OFF | ON | OFF |
| 4th | OFF | OFF | ON | ON | OFF |
| Reverse | OFF | OFF | ON | OFF | ON |
| LOW | OFF | ON | OFF | OFF | ON |

PWM (Pulse Width Modulation) Solenoid Valve Control Feature

Performance Curve



<PWM Solenoid valve performance curve>

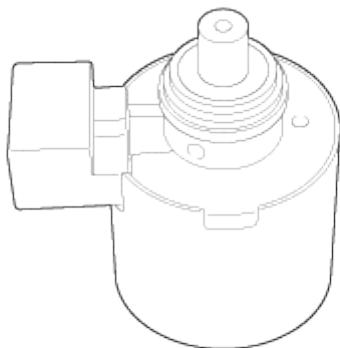
PWM solenoid valve is controlled linearly according to the duty ratio.

Oil pressure range:

0~4.3 kgf/cm² (0~422kpa, 0~61.2psi)

| | |
|---------------|--------------------|
| Type | 3way & Normal High |
| Input voltage | 12V |

| | |
|-----------------|-------------------------------------|
| Coil resistance | $3.2 \pm 0.2\Omega$ (at 25°C, 77°F) |
| Cycle | 50Hz |

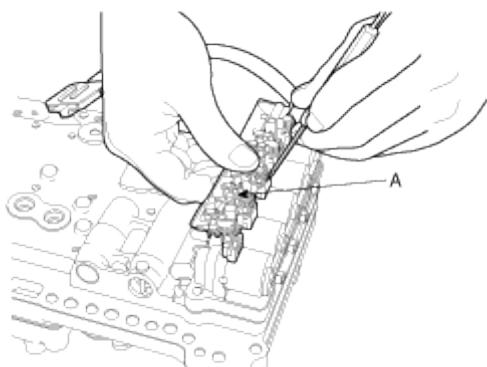


<PWM Solenoid valve form>

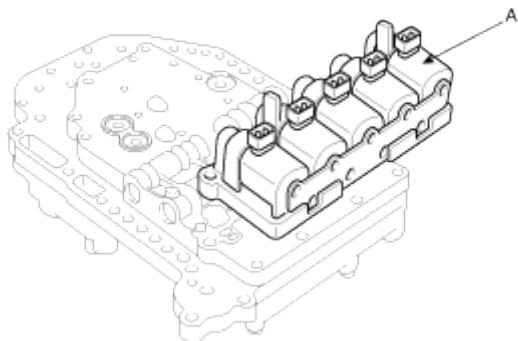
15.3.1.2. Repair procedures (A4CF2)

Removal

1. Remove the battery terminal.
2. Lift the vehicle.
3. Remove the under cover.
4. Loosen the drain plug and drain the transaxle oil.
5. Remove the oil pan. (Refer to Automatic transaxle's disassembly in 'A4CF1' overhaul manual)
6. Remove the oil filter.
7. Remove the valve body. (Refer to Valve body's disassembly in 'A4CF1' overhaul manual)
8. Disconnect the main harness(A) from valve body.



9. Remove the solenoid valve assembly(A).



Installation

1. Install the solenoid valve.

CAUTION

Apply the ATF oil or White Vaseline to the O-ring not to be damaged.

2. Connect the solenoid valve connector to the valve body.

CAUTION

When connecting the solenoid valve connector, check the connector for rust, dirt, or oil, then reconnect it.

3. Install the valve body. (Refer to Valve body's reassembly in 'A4CF1' overhaul manual)

Tightening torque :

10~12Nm(1.0~1.2kgf.m, 7~8lb-ft)

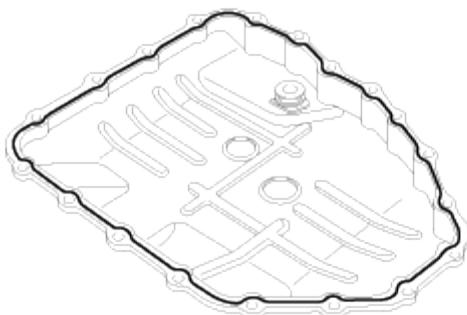
4. Install the oil filter.

Tightening torque :

10~12Nm(1.0~1.2kgf.m, 7~8lb-ft)

5. Continue to apply liquid gasket at application points at the oil pan with Ø2.5mm (0.098in) thickness.

Liquid gasket Part name : Threebond 1281B



6. Tighten the mounting bolt with the specified torque after installing the oil pan.

Tightening torque :

10~12Nm(1.0~1.2kgf.m, 7~8lb-ft)

7. Install the drain plug.

Tightening torque :

40~50Nm(4.0~5.0kgf.m, 28.9~36.2lb·ft)

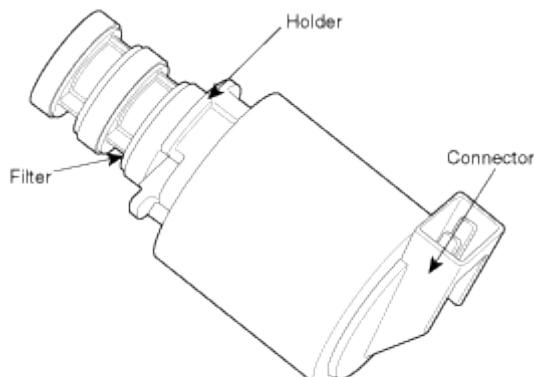
8. Installation is the reverse of the removal.

15.3.2. VFS (Variable Force Solenoid) Valve

15.3.2.1. Description and Operation (A4CF2)

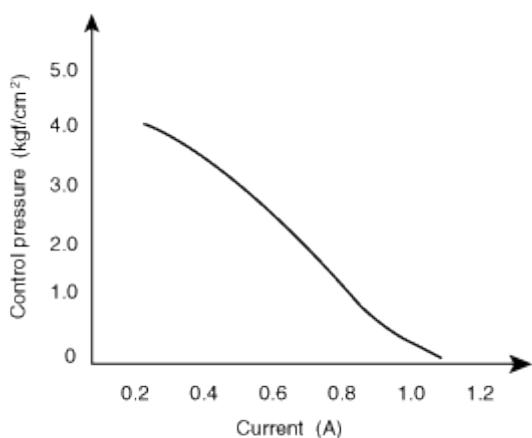
Description

VFS valve controls the regulator valve and varies the line pressure from 4.5bar to 10.5bar according to the throttle open angle and the shift range. The holder is installed on the upper side of the case and the filter is installed to the two places on the holder outside to prevent in the strange material from flowing in the VFS.



<VFS assembly >

VFS (Variable Force Solenoid) Valve Control Feature



<VFS Solenoid valve performance curve>

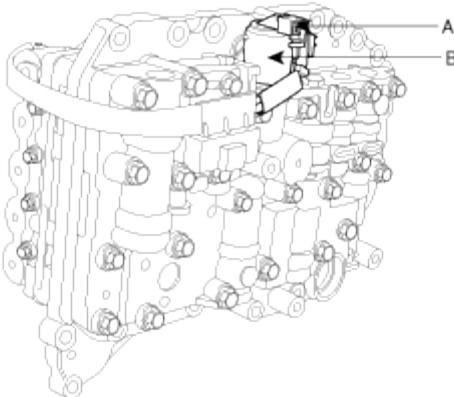
PWM solenoid valve is controlled linearly according to the current value.

| | |
|-------------------|-------------------------------------|
| type | 3way & Normal High |
| Input voltage | 12V |
| Coil resistance | $3.5 \pm 0.2\Omega$ (at 25°C, 77°F) |
| Operating current | 0 ~ 1200 mA |

15.3.2.2. Repair procedures (A4CF2)

Removal

1. Remove the battery terminal.
2. Lift the vehicle.
3. Remove the under cover.
4. Loosen the drain plug and drain the transaxle oil.
5. Remove the oil pan. (Refer to Automatic transaxle's disassembly in 'A4CF1' overhaul manual)
6. Remove the oil filter.
7. Remove the valve body. (Refer to Valve body's disassembly in 'A4CF1' overhaul manual)
8. Disconnect the VFS solenoid valve connector (A).



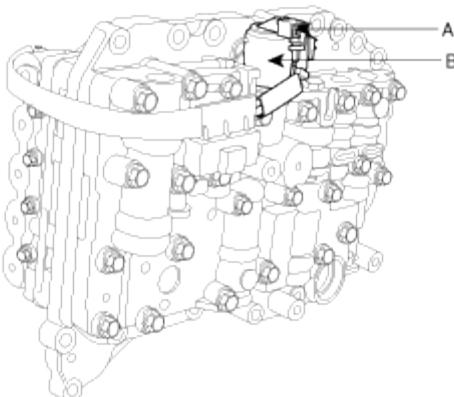
9. Remove the solenoid valve assembly (B).

Installation

1. Install the solenoid valve (B).

CAUTION

Apply the ATF oil or White Vaseline to the O-ring not to be damaged.



2. Connect the solenoid valve connector (A).

CAUTION

When connecting the solenoid valve connector, check the connector for rust, dirt, or oil, then reconnect it.

3. Install the valve body. (Refer to Valve body's reassembly in 'A4CF1' overhaul manual)

Tightening torque :

10~12Nm(1.0~1.2kgf.m, 7~8lb·ft)

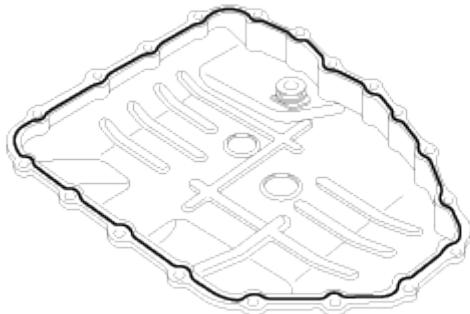
4. Install the oil filter.

Tightening torque :

5~7Nm(0.5~0.7kgf.m, 4~5lb-ft)

5. Continue to apply liquid gasket at application points at the oil pan with Ø2.5mm (0.098in) thickness.

Liquid gasket Part name : Threebond 1281B



6. Tighten the mounting bolt with the specified torque after installing the oil pan.

Tightening torque :

10~12Nm(1.0~1.2kgf.m, 7~8lb-ft)

7. Install the drain plug.

Tightening torque :

40~50Nm(4.0~5.0kgf.m, 28.9~36.2lb-ft)

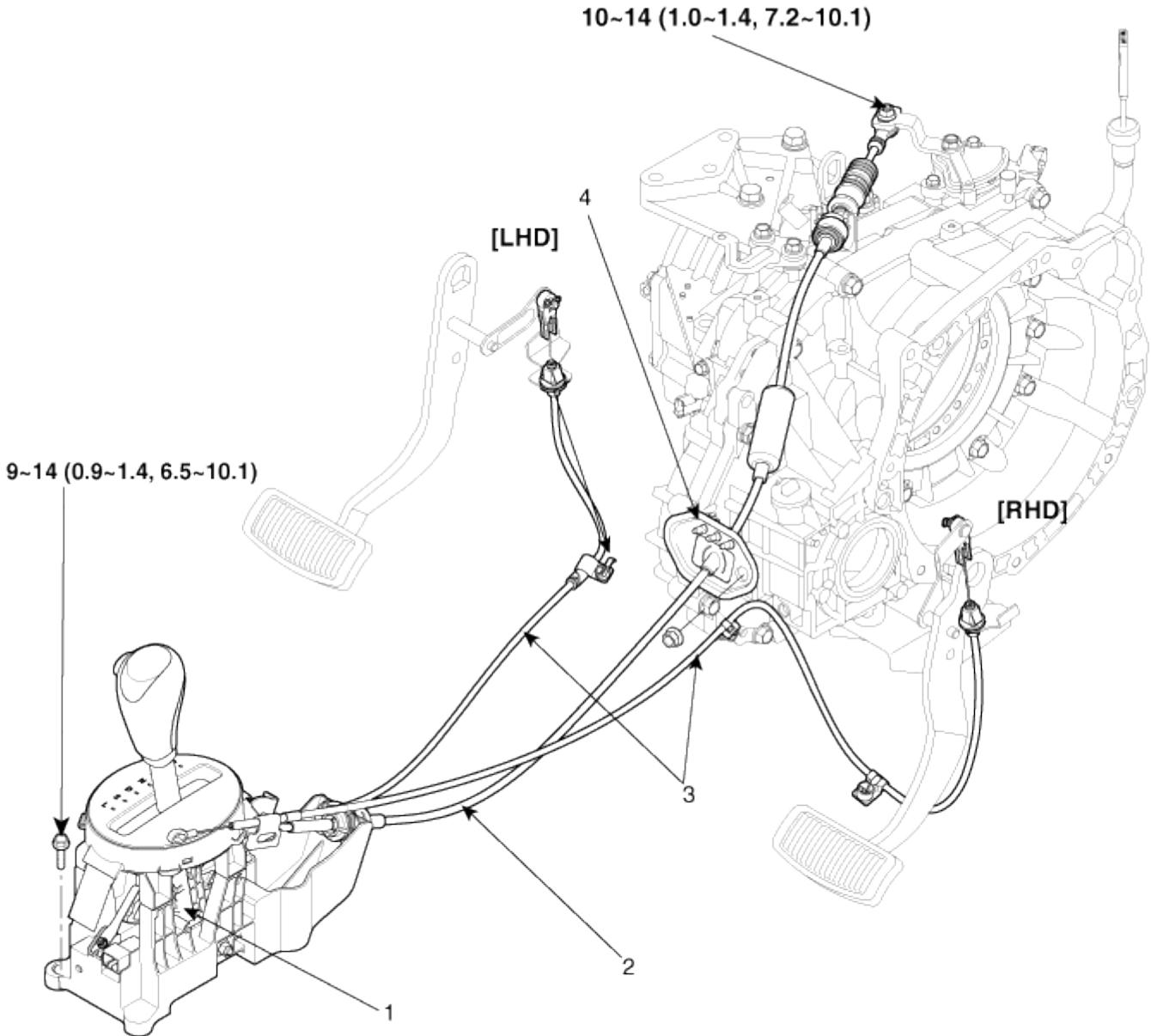
8. Installation is the reverse of the removal.

15.4. Automatic Transaxle Control System

15.4.1. Shift Lever

15.4.1.1. Component and Components Location

Components



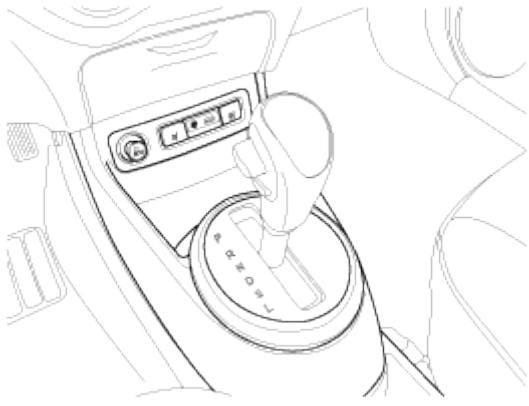
Torque : Nm (kgf.m, lb-ft)

| | |
|-------------------------|---|
| 1. Shift lever assembly | 3. Shift lock cably assembly
(Japan & Taiwan only) |
| 2. Shift cable assembly | 4. Retainer |

15.4.1.2. Repair procedures

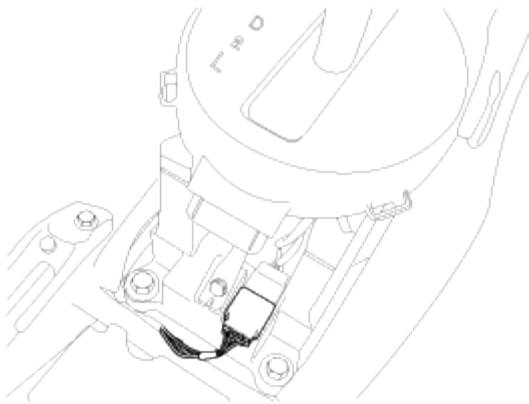
Removal

1. Remove the plastic cover.

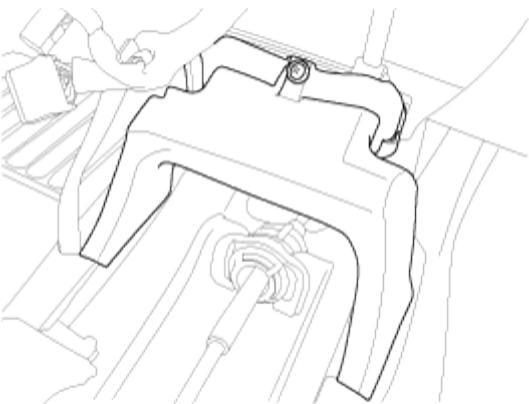


2. Remove the center console.(refer to Console in BD group)

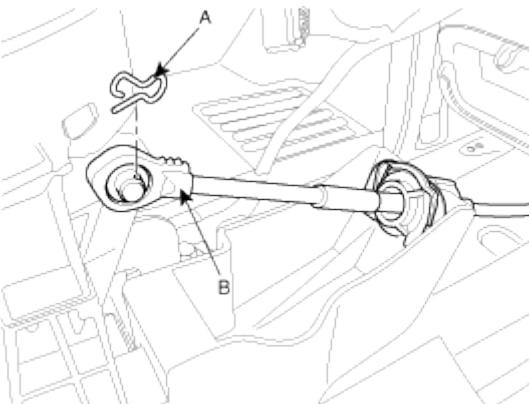
3. Disconnect the sports mode connector.



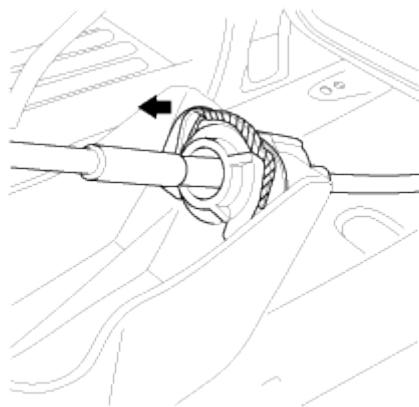
4. Remove the air duct.



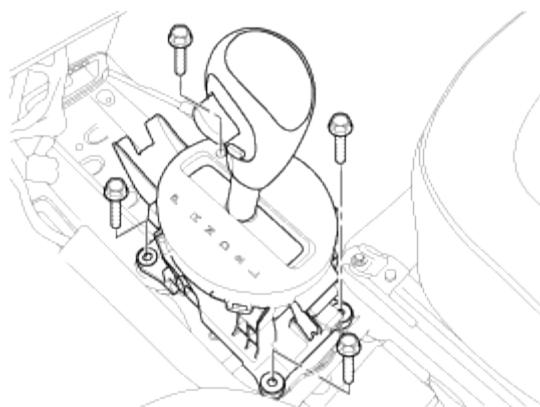
5. Remove the snap pin (A) and remove the shift cable assembly (B) from the shift lever assembly.



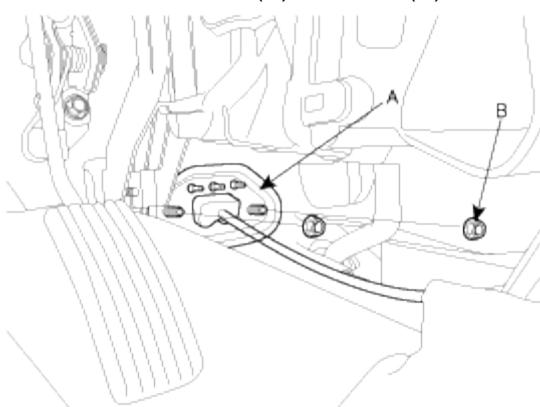
6. Remove the shift cable assembly by pulling out the clamp as shown in the illustration.



7. Remove the shift lever assembly by removing the bolts(4ea).



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



9. Remove the shift cable assembly from the transaxle. (refer to Removal of Automatic Transaxle).

Inspection

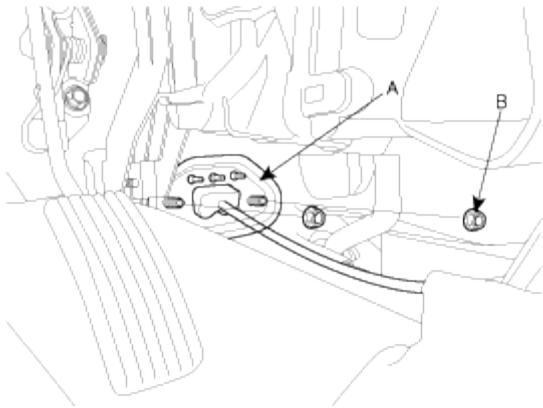
1. Check the shift cable for proper operation and for damage.
2. Check the boot for wear abrasion sticking, restricted movement or damage.

Installation

1. Install the cable assembly placing the shift lever in neutral position. (Refer to Transaxle installation).
2. Install the retainer (A) and nuts (B).

Tightening torque :

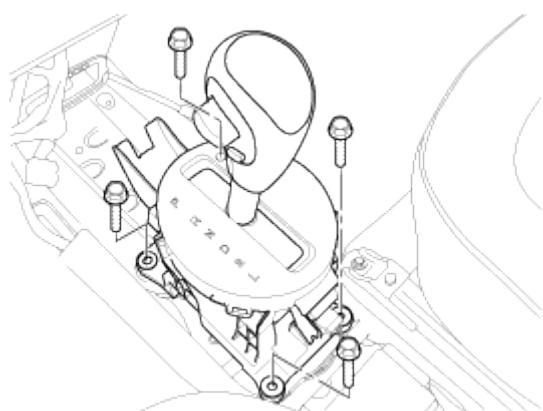
9~14 Nm (0.9~1.4 kgf.m, 6.0~9.5 lb-ft)



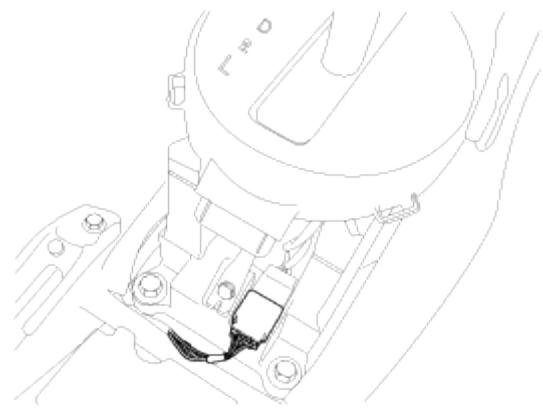
3. Install the shift lever assembly.

Tightening torque :

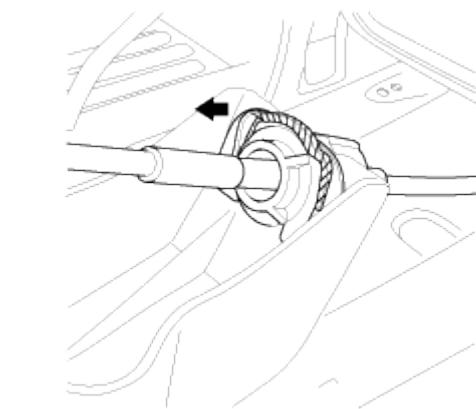
9~14 Nm (0.9~1.4 kgf.m, 6.0~9.5 lb-ft)



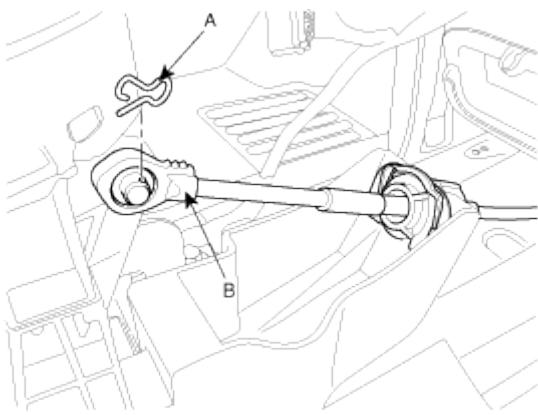
4. Connect the sports mode connector.



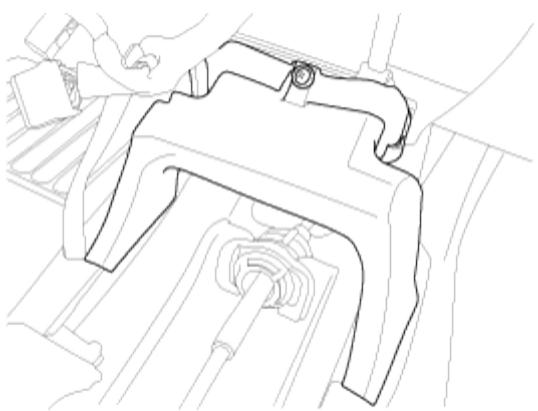
5. Install the shift cable assembly by inserting the clamp.



6. Install the snap pin (A) to hold the select cable assembly (B).



7. Install the air duct.



8. Install the center console. (Refer to Console in BD group)

9. Install the plastic cover.



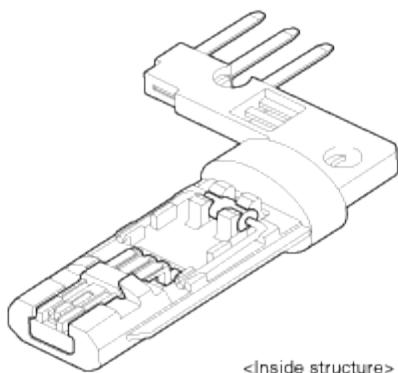
15.4.2. Input Speed Sensor

15.4.2.1. Description and Operation (A4CF2)

Description

| | |
|-------------|---|
| Sensor type | 1. Type : HALL SENSOR
2. Operating voltage : DC 12V
3. Current consumption : 22mA (Max) |
| Function | 1. Input speed sensor: Detect the input shaft rotation at the OD & REV retainer side to control oil pressure when shifting.
2. Feedback control, clutch-clutch control, damper clutch control, shift range control, incorrect ratio control and sensor trouble detection signal. |

| | | |
|-----------|---|---|
| Connector |  | 1. Ground
2. Signal
3. Power source |
|-----------|---|---|

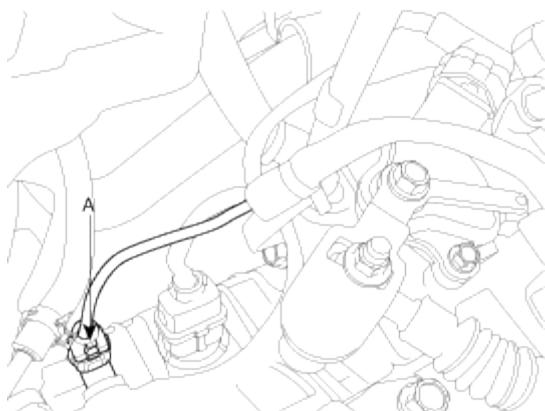


| Item | Inspection item | Standard value |
|-------------------|--------------------|----------------|
| Air gap | Input speed sensor | 0.035in(0.9mm) |
| Sensor resistance | Input speed sensor | Over 1 MΩ |
| Output voltage | HIGH | Over 4.8V |
| | LOW | Below 0.8V |

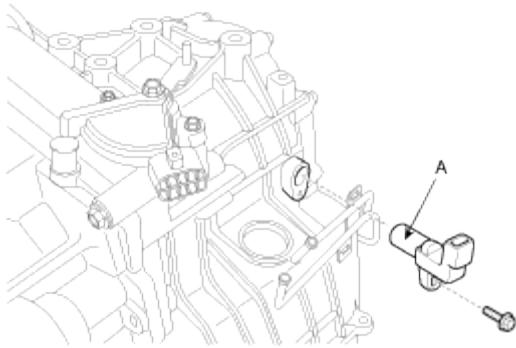
15.4.2.2. Repair procedures (A4CF2)

Removal

1. Remove the battery terminal.
2. Remove the battery and battery tray.
3. Remove the air duct.
4. Remove the air cleaner assembly. (Refer to Automatic transaxle's Removal)
5. Remove the input speed sensor connector (A).



6. Remove the input speed sensor(A).



Installation

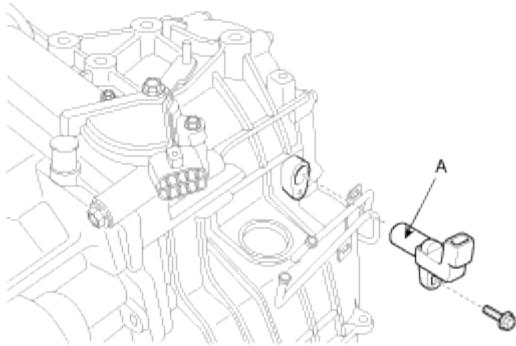
1. Install the new O-ring to the input speed sensor.
2. Install the input speed sensor (A).

Tightening torque :

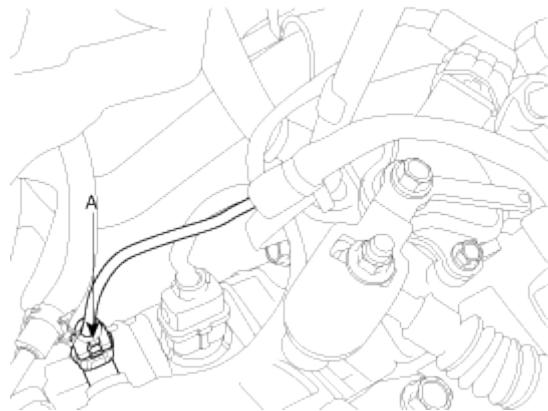
10~12Nm(1.0~1.2kgf.m, 7~8lb·ft)

CAUTION

While installing the input shaft speed sensor, do not allow dust or other foreign particles to enter the transaxle.



3. Check the connector for dust, dirt, or oil, and then connect the input speed sensor connector (A) securely.



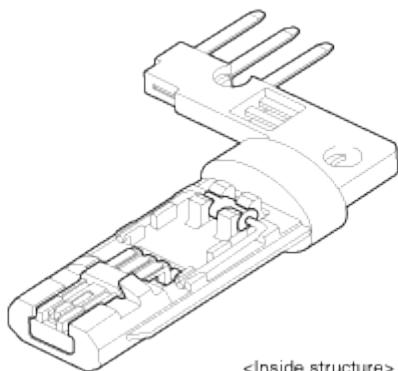
4. Installation is the reverse of removal.

15.4.3. Output Speed Sensor

15.4.3.1. Description and Operation (A4CF2)

Description

| | |
|-------------|--|
| Sensor type | 1. Type : HALL SENSOR
2. Output voltage : DC 12V
3. Current consumption : 22mA (Max) |
| Function | 1. Output speed sensor : Detect the output shaft rpm(T/F DRIVEN GEAR RPM) at the T/F driven gear
2. Feedback control, clutch-clutch control, damper clutch control, shift range control, incorrect ratio control and sensor trouble detection signal. |
| Connector | 
1. Ground
2. Signal
3. Power source |

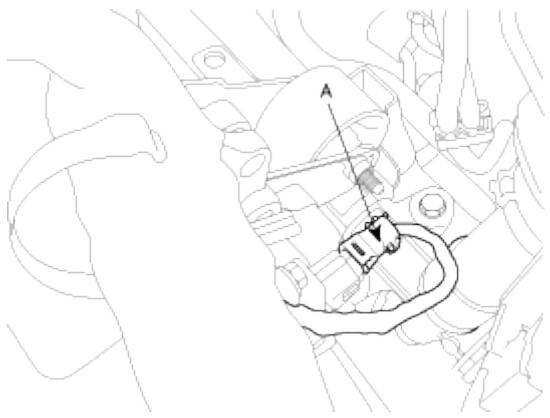


| Item | Inspection item | Standard value |
|-------------------|---------------------|-----------------|
| Air gap | Output speed sensor | 0.025in(0.65mm) |
| Sensor resistance | Output speed sensor | Over 1 MΩ |
| Output voltage | HIGH | Over 4.8V |
| | LOW | Below 0.8V |

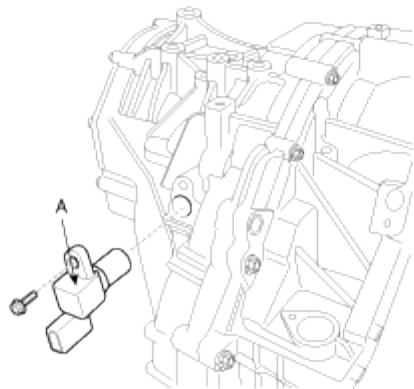
15.4.3.2. Repair procedures (A4CF2)

Removal

1. Remove the battery terminal.
2. Remove the battery and battery tray.
3. Remove the air duct.
4. Remove the air cleaner assembly. (Refer to Automatic transaxle's Removal)
5. Remove the output speed sensor connector(A).



6. Remove the output speed sensor(A).



Installation

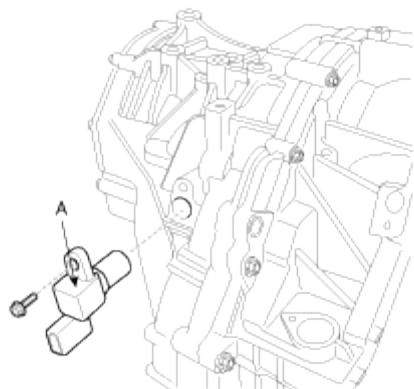
1. Install the new O-ring to the output shaft speed sensor.
2. Remove the output speed sensor (A).

Tightening torque :

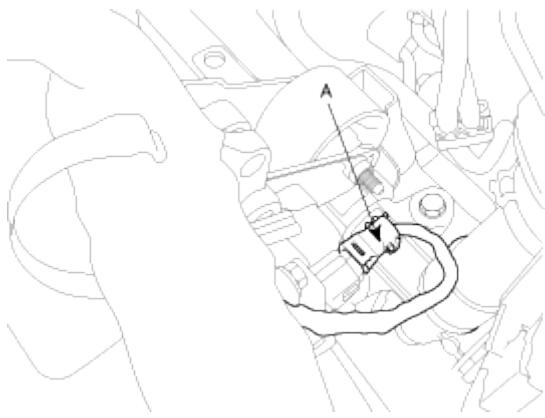
10~12Nm(1.0~1.2kgf.m, 7~8lb-ft)

CAUTION

While installing the output speed sensor, do not allow dust or other foreign particles to enter the transaxle.



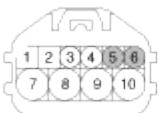
3. Check the connector for dust, dirt, or oil, then connect the output speed sensor connector (A) securely.



4. Installation is the reverse of removal.

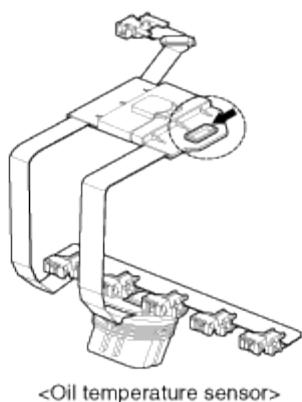
15.4.4. Transaxle Oil Temperature Sensor

15.4.4.1. Description and Operation (A4CF2)

| Description | |
|----------------------|--|
| Sensor type | 1. Type : Thermister
2. Use available temperature :-40~160°C(-40~320°F) |
| Function and feature | 1. Detect the temperature of ATF through the thermistor which is exposed outside.
2. When shifting the range, it is used as the oil pressure control information. |
| Connector |  5. Sensor input
6. Ground |

| Temp.[°C(°F)] | Resistance (KΩ) | Temp.[°C(°F)] | Resistance (KΩ) |
|---------------|-----------------|---------------|-----------------|
| -40(-40) | 139.5 | 80(176) | 1.08 |
| -20(-4) | 47.4 | 100(212) | 0.63 |
| 0(32) | 18.6 | 120(248) | 0.38 |
| 20(68) | 8.1 | 140(284) | 0.25 |
| 40(104) | 3.8 | 160(320) | 0.16 |
| 60(140) | 1.98 | | |

| Installation Location |
|-----------------------|
|-----------------------|

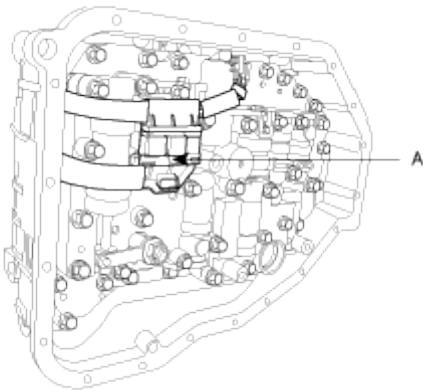


<Oil temperature sensor>

15.4.4.2. Repair procedures (A4CF2)

Removal

1. Remove the battery terminal.
2. Lift the vehicle.
3. Remove the under cover.
4. Loosen the drain plug and drain the transaxle oil.
5. Remove the oil pan. (Refer to Automatic transaxle's disassembly in 'A4CF1' overhaul manual)
6. Remove the oil filter.
7. Remove the valve body. (Refer to Valve body's disassembly in 'A4CF1' overhaul manual)
8. Disconnect the main harness connector (A) from the valve body.

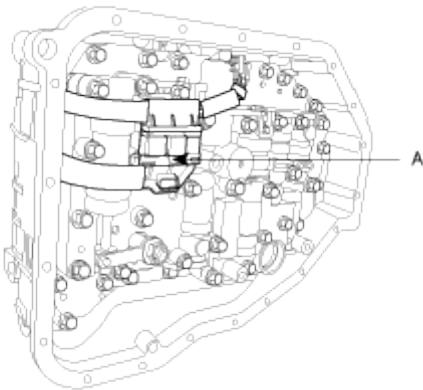


Installation

1. Connect the main harness connector (A) to the valve body.

CAUTION

When connecting the oil temperature connector, check the connector for rust, dirt, or oil, then reconnect it.



2. Install the valve body. (Refer to Valve body's reassembly in 'A4CF1' overhaul manual)

Tightening torque :

10~12Nm(1.0~1.2kgf.m, 7~8lb-ft)

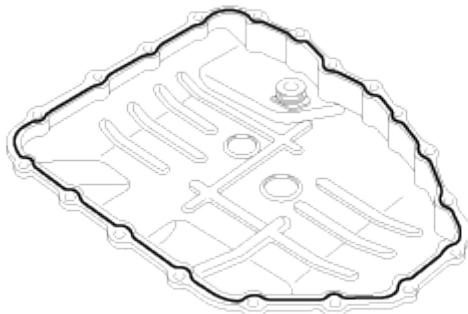
3. Install the oil filter.

Tightening torque :

5~7Nm(0.5~0.7kgf.m, 4~5lb-ft)

4. Continue to apply liquid gasket at application points at the oil pan with Ø0.098in(2.5mm) thickness.

Liquid gasket Part name : Threebond 1281B



5. Tighten the mounting bolt with the specified torque after installing the oil pan.

Tightening torque :

10~12Nm(1.0~1.2kgf.m, 7~8lb-ft)

6. Install the drain plug.

Tightening torque :

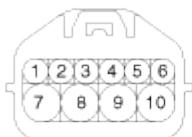
40~50Nm(4.0~5.0kgf.m, 28.9~36.2lb-ft)

7. Installation is the reverse of the removal.

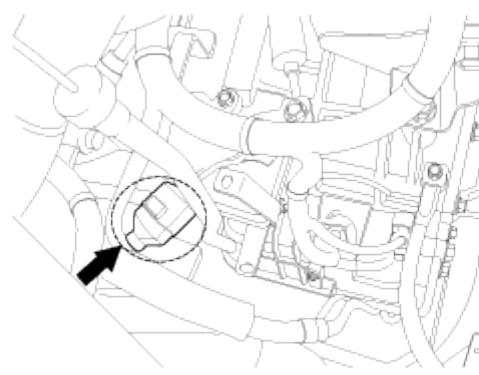
15.4.5. Inhibiter Switch

15.4.5.1. Description and Operation (A4CF2)

| Description | |
|-------------|--|
| Sensor type | 1. Type : ROTARY
2. Available temperature range : -40~150°C(-40~320°F)
3. Tightening torque : 10~12Nm(1.0~1.2kgf.m, 7~8lb-ft) |
| Function | Detect the position of select lever through the contact switch. It makes starting possible in "P" and "N". |



- 1. P range
- 2. D range
- 3. L range
- 5. 2 range
- 6. N range
- 7. R range
- 8. Power supply IG1
- 9. Start circuit
- 10. Start circuit

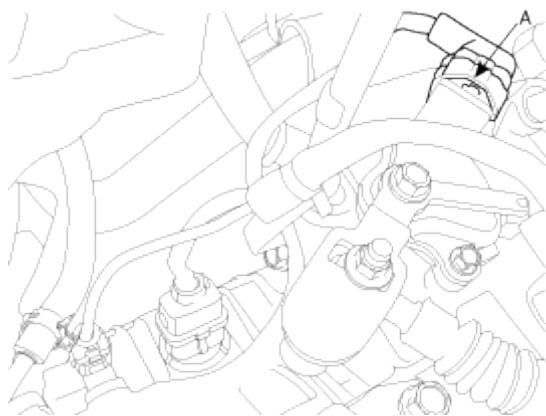


| Shift lever
Terminal No. | P | R | N | D | 2 | L |
|-----------------------------|---|---|---|---|---|---|
| 1 | ● | | | | | |
| 2 | | | | ● | | |
| 3 | | | | | | ● |
| 4 | | | | | | |
| 5 | | | | | ● | |
| 6 | | | ● | | | |
| 7 | ● | ● | | | | |
| 8 | ● | ● | ● | ● | ● | ● |
| 9 | ● | | ● | | | |
| 10 | ● | | ● | | | |

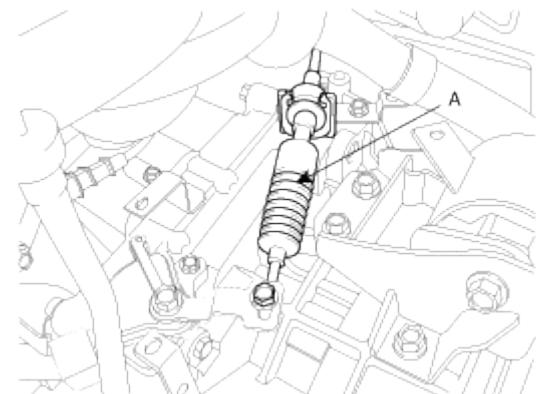
15.4.5.2. Repair procedures (A4CF2)

Removal

1. Remove the battery terminal.
2. Remove the battery and battery tray.
3. Remove the air duct.
4. Remove the air cleaner assembly. (Refer to Automatic transaxle's Removal)
5. Disconnect the inhibitor switch connector (A).



6. Remove the control cable(A) from the manual control lever.



7. Remove the inhibitor switch and manual control lever.

Installation

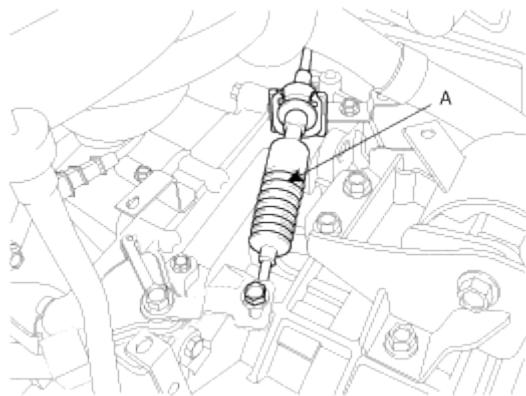
1. Set the inhibitor switch to the "N" position.
2. Set the inhibitor switch control shaft to the "N" position.
3. Install the inhibitor switch and manual control lever.

Tightening torque :

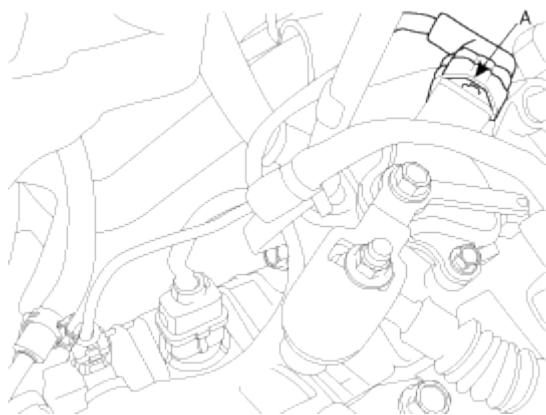
Shaft nut: 17~21Nm(1.7~2.1kgf.m, 12~15lb-ft)

Bolt(2EA): 10~12Nm(1.0~1.2kgf.m, 7~8lb-ft)

4. Install the control cable (A) to the manual control lever.



5. Connect the inhibitor switch connector (A).



6. Installation is the reverse of the removal.

7. Turn the ignition switch ON after installation.

Move the shift lever from "P" range to "L" range, and verify that the A/T gear position indicator follows the transaxle range switch.

16. Manual Transaxle System (M5CF1)

16.1. General Information

16.1.1. Specifications – Revised

Specifications

| Transaxle type | | M5CF1-1 |
|----------------|---------|-------------------|
| Engine type | | Gasoline 1.4/ 1.6 |
| Gear ratio | 1st | 3.615 |
| | 2nd | 1.962 |
| | 3rd | 1.286 |
| | 4th | 1.036 |
| | 5th | 0.839 |
| | Reverse | 3.545 |

| | |
|------------------|-------|
| Final gear ratio | 3.833 |
|------------------|-------|

Tightening Torques

| Items | Nm | kgf.m | lb·ft |
|---------------------------------|--------|---------|-----------|
| Oil drain plug | 60~80 | 6.0~8.0 | 43.4~57.8 |
| Oil filler plug | 60~80 | 6.0~8.0 | 43.4~57.8 |
| Shift control cable bracket | 15~22 | 1.5~2.2 | 10.8~15.9 |
| Roll rod support bracket bolt | 90~110 | 9~11 | 65~79 |
| Transaxle support bracket bolts | 70~95 | 7.0~9.5 | 50.6~68.7 |

WARNING

Always follow torque tightening levels. Failure to follow such levels can result in parts breaking if over-tightened or loosening if under-tightened. In either case, serious personal injury or death could result to vehicle occupants.

Specifications

| | | |
|------------------|-------------------|-------|
| Transaxle type | M5CF1-1 | |
| Engine type | Gasoline 1.4/ 1.6 | |
| Gear ratio | 1st | 3.769 |
| | 2nd | 2.045 |
| | 3rd | 1.286 |
| | 4th | 1.036 |
| | 5th | 0.839 |
| | Reverse | 3.545 |
| Final gear ratio | 3.833 | |

Tightening Torques

| Items | Nm | kgf.m | lb·ft |
|---------------------------------|--------|---------|-----------|
| Oil drain plug | 60~80 | 6.0~8.0 | 43.4~57.8 |
| Oil filler plug | 60~80 | 6.0~8.0 | 43.4~57.8 |
| Shift control cable bracket | 15~22 | 1.5~2.2 | 10.8~15.9 |
| Roll rod support bracket bolt | 90~110 | 9~11 | 65~79 |
| Transaxle support bracket bolts | 70~95 | 7.0~9.5 | 50.6~68.7 |

WARNING

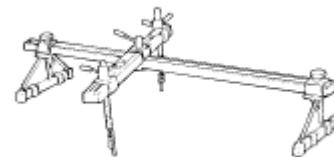
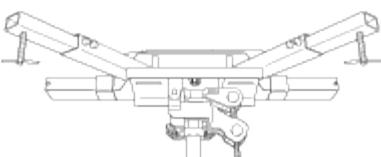
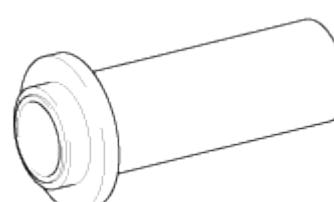
Always follow torque tightening levels. Failure to follow such levels can result in parts breaking if over-tightened or loosening if under-tightened. In either case, serious personal injury or death could result to vehicle occupants.

Lubricants

| Items | Recommend Lubricant | Quantity |
|-------------------------------------|---|----------------------------|
| Transaxle gear oil | SAE 75W/85
API GL-4
TGO-7(MS517-14) | 1.9l(2.0US qt, 1.67Imp qt) |
| Air breather | MS721-38 | As required |
| Transaxle housing | MS721-40 or MS721-38 | As required |
| Surface of release fork and bearing | Grease (CASMOLY L9508) | As required |

16.1.2. Special Service Tools

Special Service Tools

| Tool
(Number and Name) | Illustration | Use |
|---------------------------------------|---|---|
| 09200-38001
Engine support fixture |  | Removal and installation of the transaxle |
| 09624-38000
Crossmember supporter |  | Supporting of crossmember |
| 09452-21200
Oil seal installer |  | Installation of differential oil seal |

16.1.3. Troubleshooting

Troubleshooting

| Symptom | Probable cause | Remedy |
|------------------|--|----------------------------|
| Vibration, noise | Loose or damaged transaxle and engine mounts | Tighten or replace mounts |
| | Inadequate shaft end play | Correct end play |
| | Worn or damaged gears | Replace gears |
| | Inadequate grade of oil | Replace with specified oil |
| | Low oil level | Replenish |

| | | |
|-------------------|---|--|
| | Inadequate engine idle speed | Adjust idle speed |
| Oil leakage | Broken or damaged, oil seal or O-ring | Replace control cable oil seal or O-ring |
| Hard shift | Faulty control cable | Replace control cable |
| | Poor contact or wear of synchronizer ring and gear cone | Correct or replace |
| | Inadequate grade of oil | Replace with specified oil |
| Jumps out of gear | Worn gear shift fork or broken poppet spring | Replace shift fork or poppet spring |
| | Synchronizer hub-to-sleeve spline clearance too large | Replace synchronizer hub and sleeve |

16.2. Manual Transaxle System

16.2.1. Repair procedures

Service Adjustment Procedure

Transaxle gear oil level

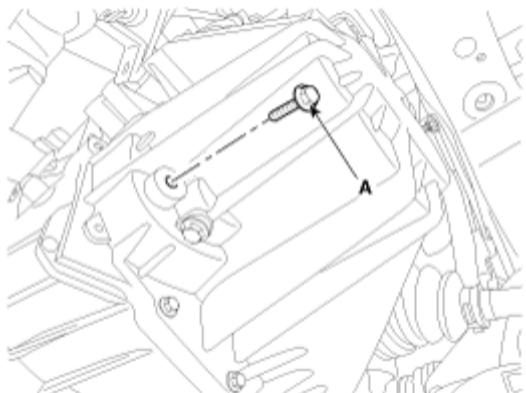
Inspection

Inspect each component for evidence of leakage.

Check the gear oil level by removing the filler plug.

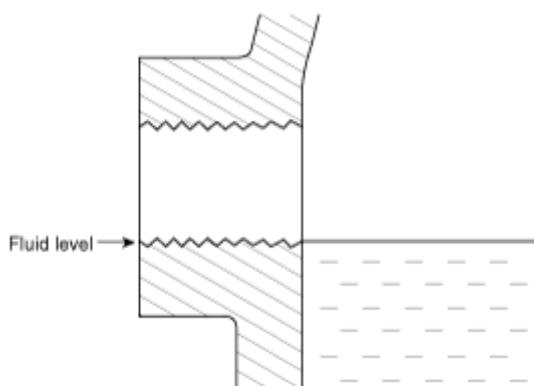
If the oil is contaminated, it is necessary to replace it with new oil.

1. Remove oil filler plug(A).



2. Check level with finger.

Oil level must be up to fill the hole, if not, add oil until it runs over.



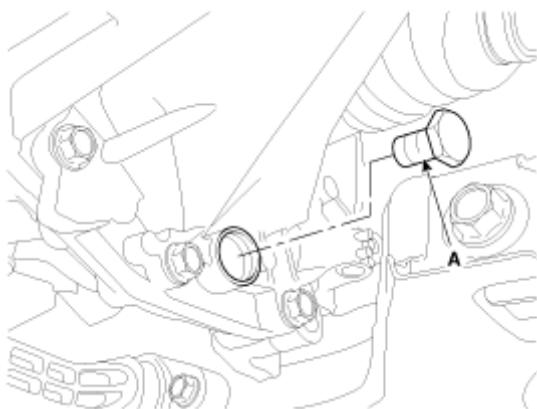
3. Install filler plug.

Tightening torque :

60~80 Nm (6.0~8.0 kgf.m, 43.4~57.8 lb-ft)

Replacement

1. With the vehicle parked on a level surface, remove the drain plug.
2. Drain the transaxle oil after loosening the drain plug (A).



3. Install the drain plug with new washer.

Tightening torque :

60~80 Nm (6.0~8.0 kgf.m, 43.4~57.8 lb·ft)

4. Add new oil through the file plug hole and, fill it just below the plug opening.

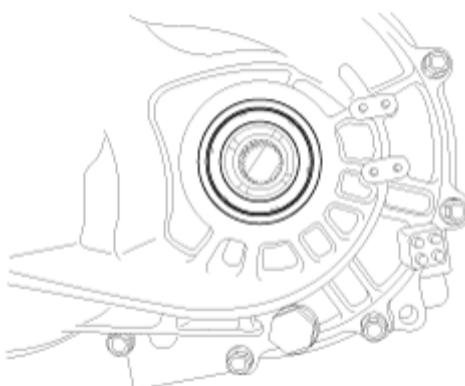
Standard oil : SAE 75W/85, API GL-4

Oil capacity : 1.9l(2.0US qt, 1.67Imp qt)

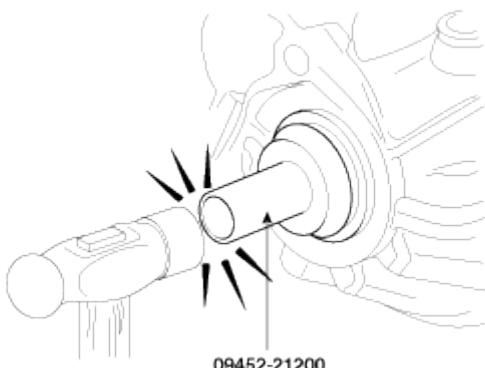
Driveshaft Oilseal

Replacement

1. Disconnect the drive shaft from the transaxle. (refer to Drive shaft in DS group)
2. Using a flat-tip screwdriver, remove the oil seal.



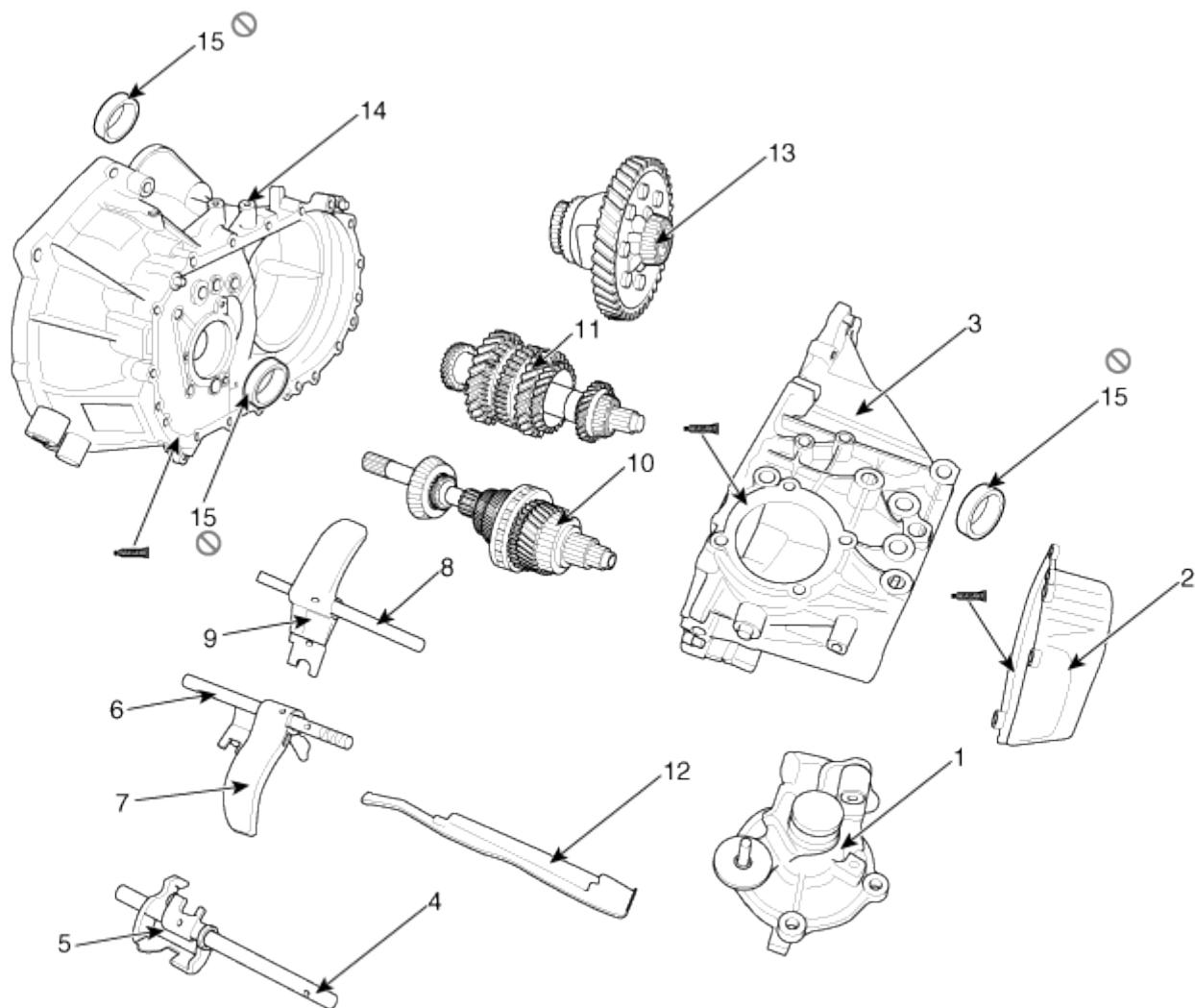
3. Using the special tool(09452-21200), tap the drive shaft oil seal into the transaxle.



16.2.2. Manual Transaxle

16.2.2.1. Component and Components Location

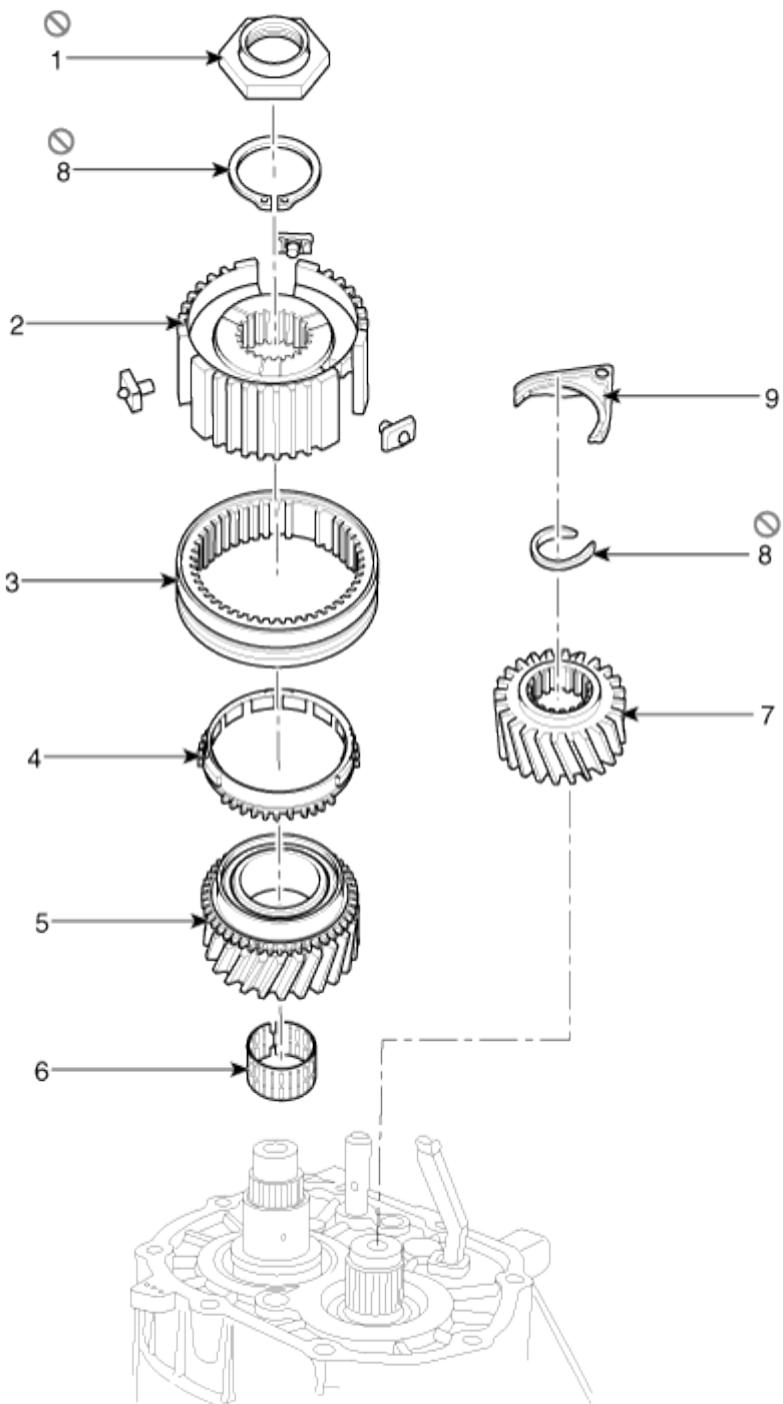
Components (1)



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

| | | |
|---------------------------|--------------------------|---------------------------|
| 1. Control shaft complete | 6. 3&4th shift rail | 11. Output shaft assembly |
| 2. Rear cover | 7. 3&4th shift fork | 12. Oil guide |
| 3. Transaxle case | 8. 1&2nd shift rail | 13. Differential assembly |
| 4. 5th shift rail | 9. 1&2nd shift fork | 14. Clutch housing |
| 5. Reverse shift rug | 10. Input shaft assembly | 15. Oil seal |

Components (2)



1. Lock nut
 2. 5th synchronizer hub
 3. 5th synchronizer sleeve
 4. 5th synchronizer ring
 5. 5th gear (input)

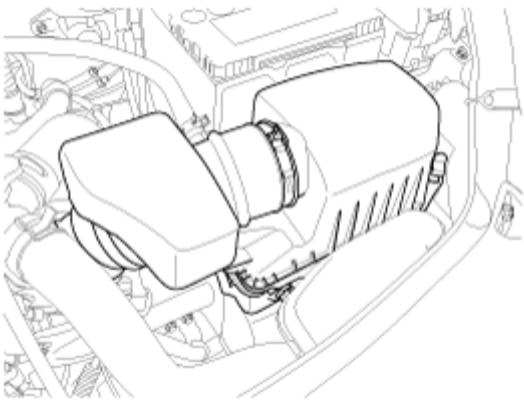
6. Needle roller bearing
 7. 5th gear (output)
 8. Snap ring
 9. 5th shift fork

16.2.2.2. Repair procedures

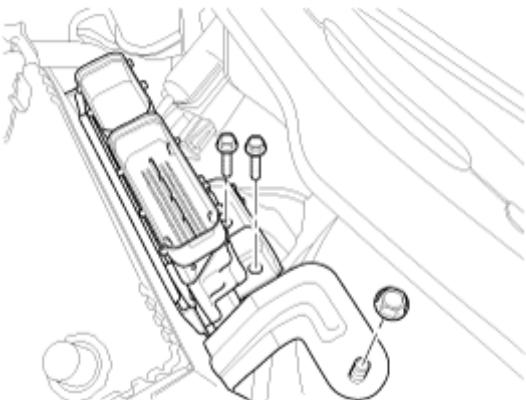
Removal

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

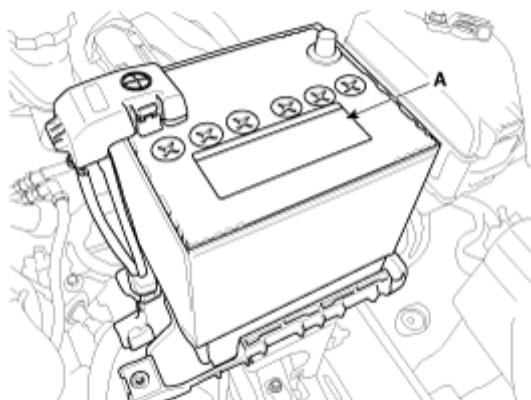
1. Remove the air cleaner assembly and the intake hose by removing the bolts and the clamps.



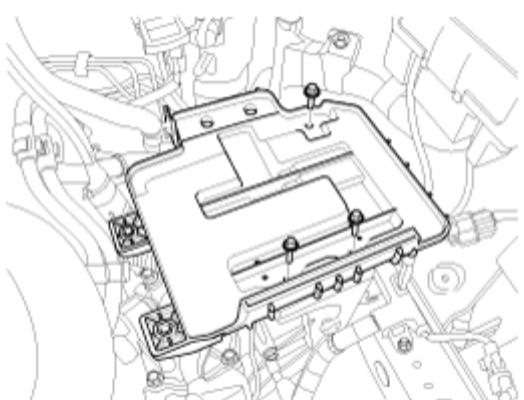
2. Remove the ECU by removing the bolts(2ea) and a nut.



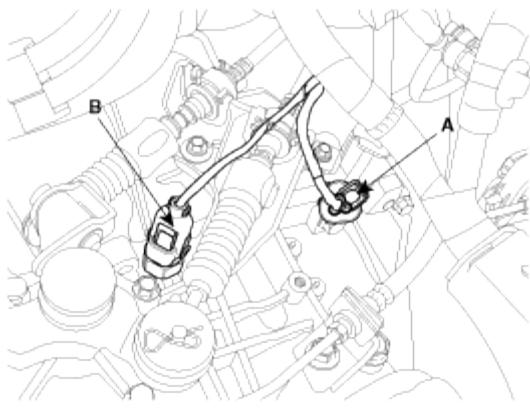
3. Remove the battery (A).



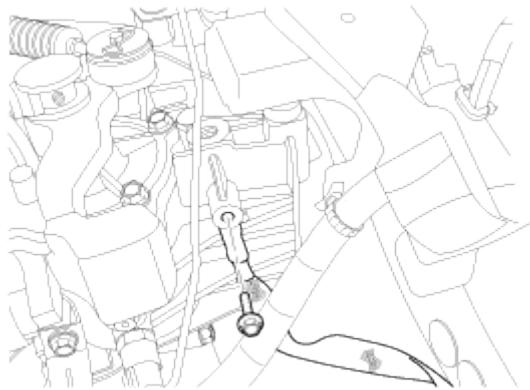
4. Remove the battery tray by removing the bolts(3ea).



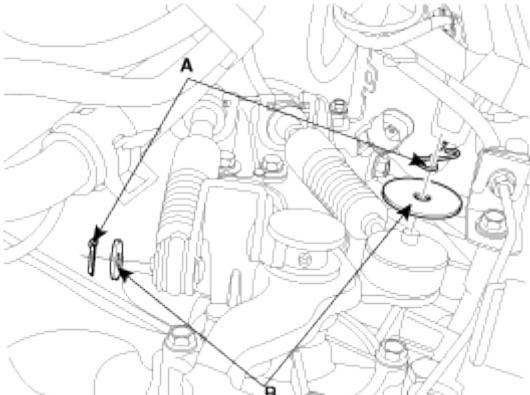
5. Disconnect the vehicle speed sensor connector (A) and the back lamp switch connector (B).



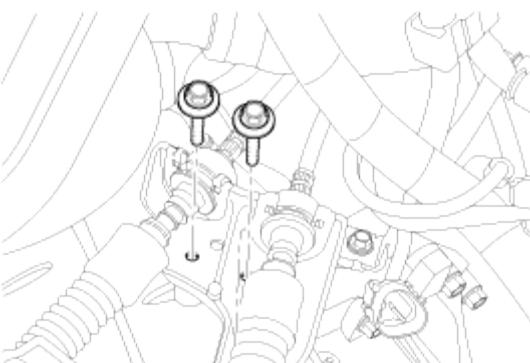
6. Remove the ground wire by removing a bolt.



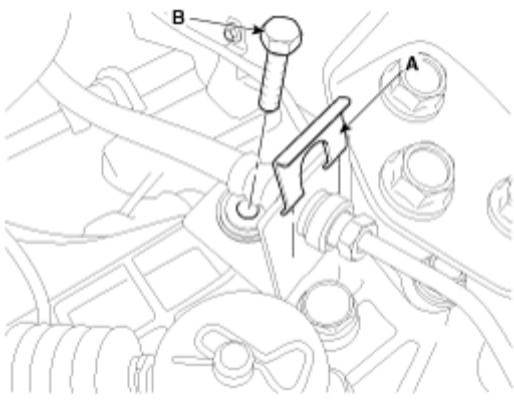
7. Remove the snap pins (A) and clips (B).



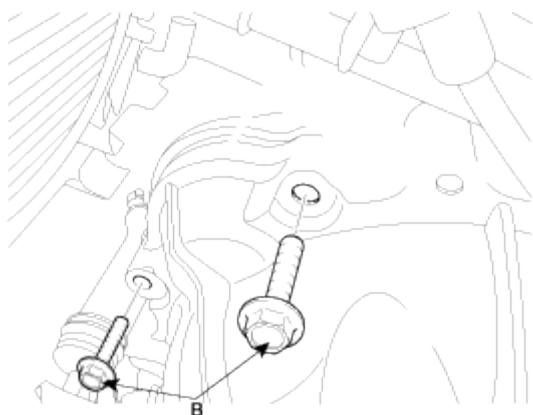
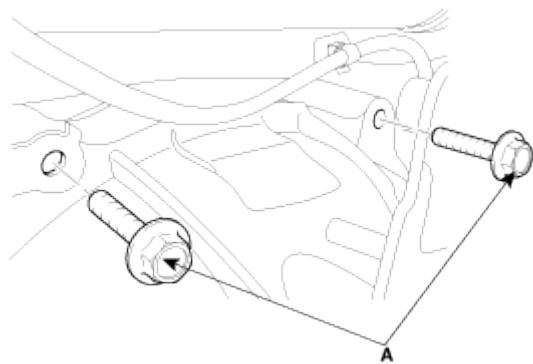
8. Remove the control cable bracket by removing bolts(3ea).



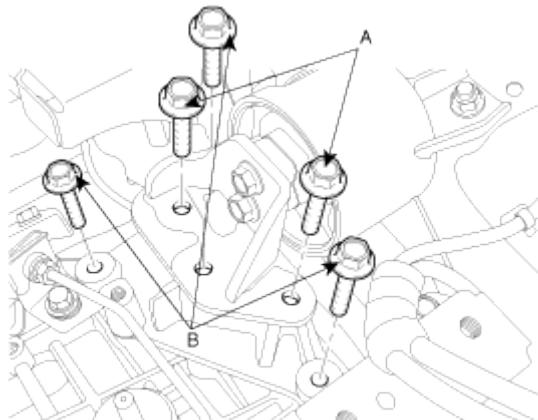
9. After removing the clip (A) and take off the clutch tube, remove the bracket mounting bolt (B).



10. Using the special tool (09200-38001), support the engine assembly safely.
11. Remove the transaxle upper mounting bolts (A-2ea) and the starter motor mounting bolts (B-2ea).



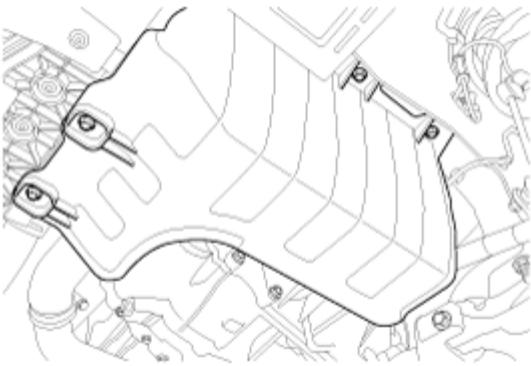
12. Remove the transaxle support bracket bolts (A-3ea,B-3ea).



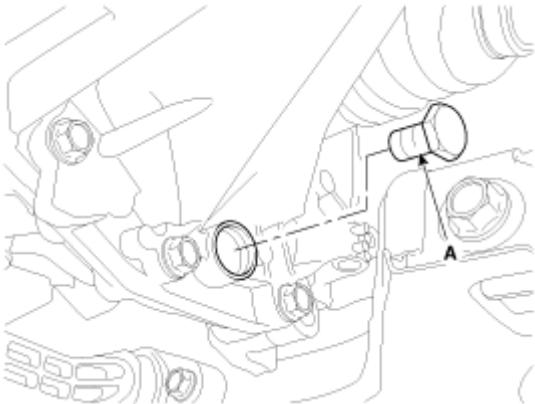
13. Lifting up the vehicle.
14. Remove the front wheels and tires.
15. Remove the lower arm ball joint mounting nut and the stabilizer link mounting nut from the front knuckles.

(refer to Front suspension system in SS group)

16. Remove the under shield cover.

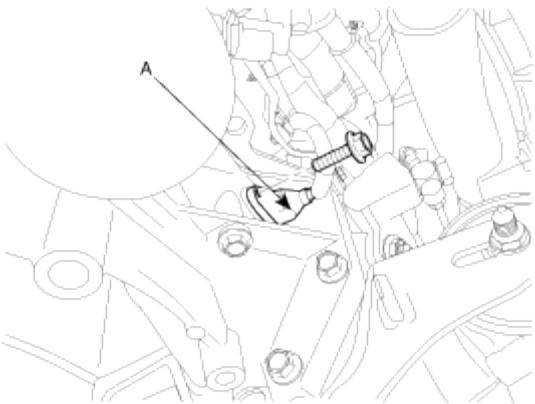


17. Drain the transalxe fluid by removing the drain plug.

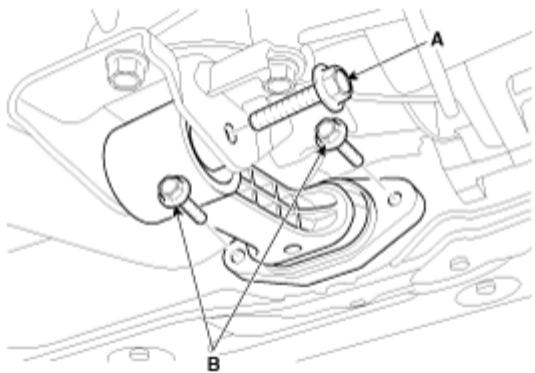


18. Disconnect the drive shafts from the transaxle. (refer to Front Driveshaft in DS group)

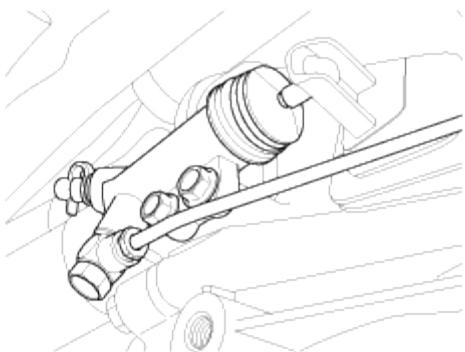
19. Remove the CKP sensor (A) by removing a bolt.



20. Remove the roll stopper bracket by removing bolts(A-1ea,B-2ea).



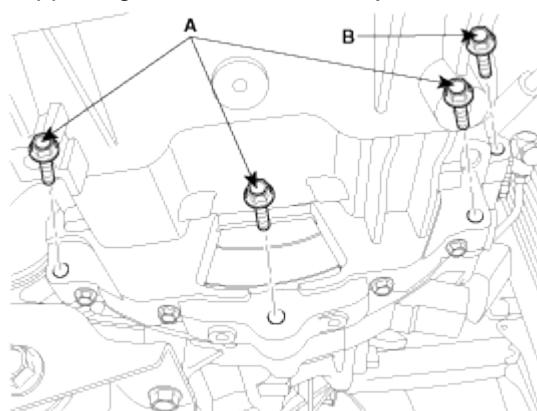
21. Remove the clutch release cylinder assembly.



22. Remove the bolt left in the engine side.



23. Supporting the transaxle with a jack, remove the transaxle lower mounting bolts(A-3ea, B-1ea).



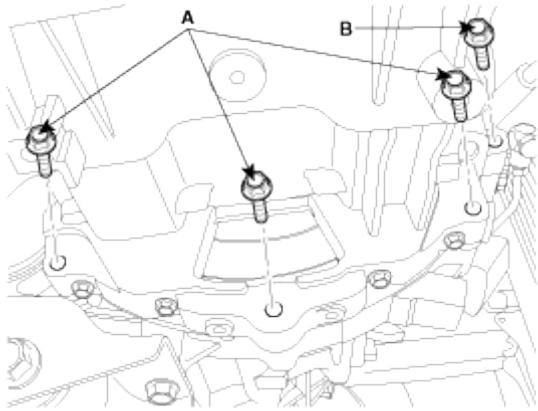
24. Lowering the jack slowly, remove the transaxle.

Installation

1. Install the transaxle lower mounting bolts (A-3ea,B-1ea) after fitting the transaxle assembly into the engine assembly.

Tightening torque :

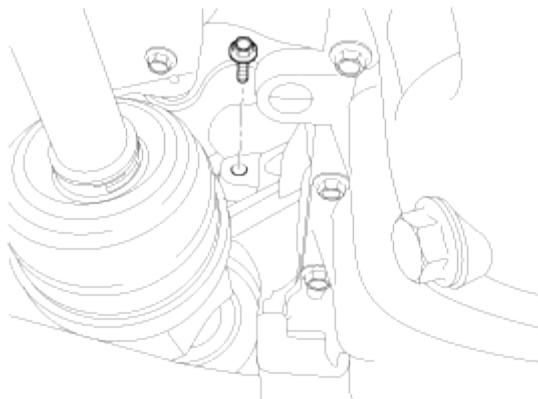
- [A] 43~55 Nm (4.3~5.5 kgf.m, 31.1~39.8 lb-ft)
- [B] 43~55 Nm (4.3~5.5 kgf.m, 31.1~39.8 lb-ft)



2. Install the bolt left in the engine side.

Tightening torque :

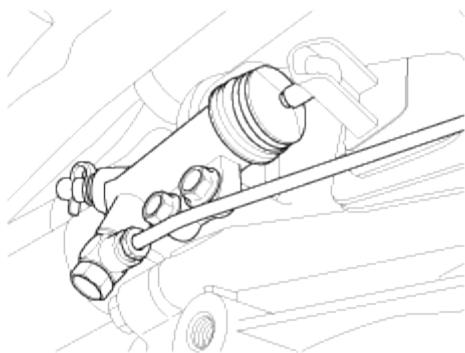
43~55 Nm (4.3~5.5 kgf.m, 31.1~39.8 lb-ft)



3. Install the clutch release cylinder assembly.

Tightening torque :

15~22 Nm (1.5~2.2 kgf.m, 10.8~15.9 lb-ft)

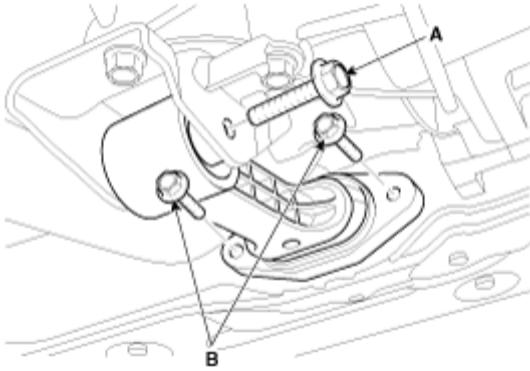


4. Install the roll stopper bracket by installing bolts(A-1ea,B-2ea).

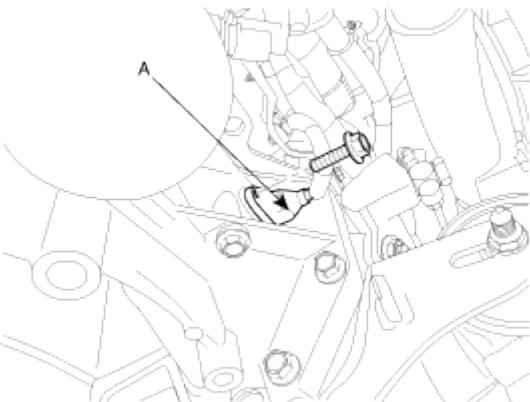
Tightening torque :

[A] 90~110 Nm (9~11 kgf.m, 65~79 lb-ft)

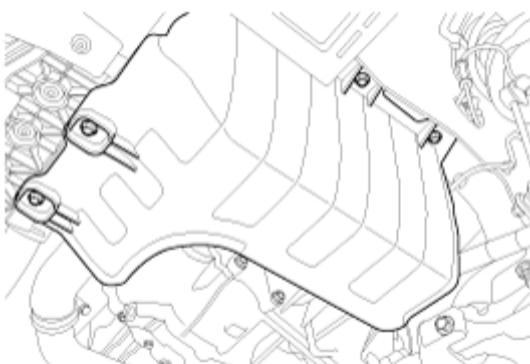
[B] 50~65 Nm (5.0~6.5 kgf.m, 36.2~47.0 lb-ft)



5. Install the CKP sensor (A) by installing a bolt.



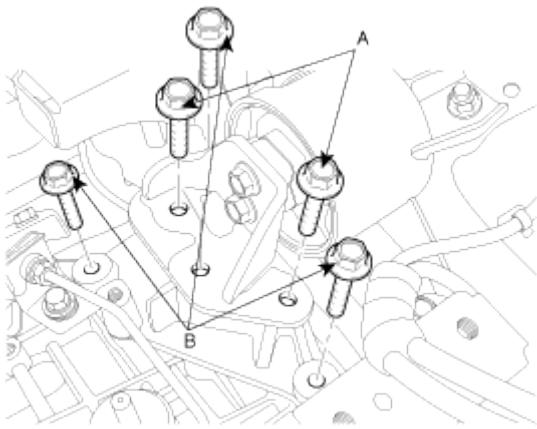
6. Connect the drive shafts to the transaxle. (refer to Front Driveshaft in DS group)
7. Refill the transaxle fluid through the filler hole. (refer to Service Adjustment Procedure)
8. Install the under shield cover.



9. Install the lower arm ball joint mounting nut and the stabilizer link mounting nut to the front knuckles.
(refer to Front suspension system in SS group)
10. Install the front wheels and tires. (refer to installation in SS group)
11. Install the transaxle support bracket bolts (A-3ea,B-3ea).

Tightening torque :

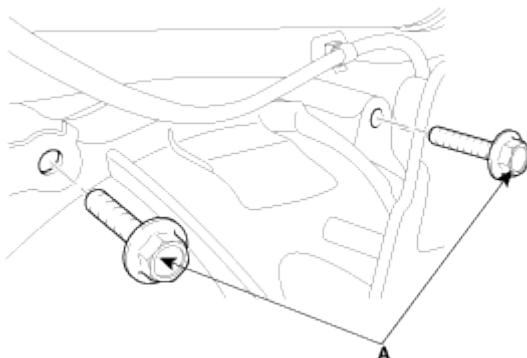
- [A] 70~95 Nm (7.0~9.5 kgf.m, 50.6~68.7 lb-ft)
[B] 60~80 Nm (6.0~8.0 kgf.m, 43.4~57.9 lb-ft)
-



12. Install the transaxle upper mounting bolts (A-2ea) the starter motor mounting bolts (B-2ea).

Tightening torque :

- [A] 43~55 Nm (4.3~5.5 kgf.m, 31.1~39.8 lb-ft)
[B] 43~55 Nm (4.3~5.5 kgf.m, 31.1~39.8 lb-ft)

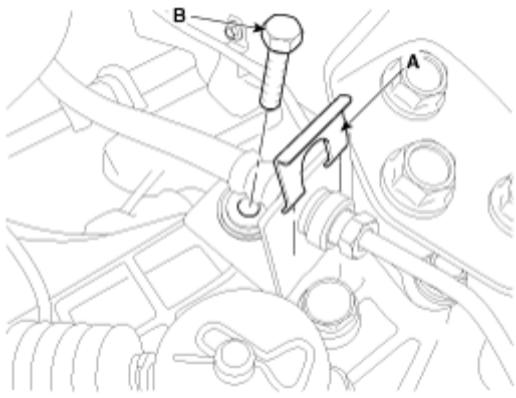


13. Put aside the engine support fixture (09200-38001).

14. After installing the bracket mounting bolt (B), install the clutch tube with the clip (A).

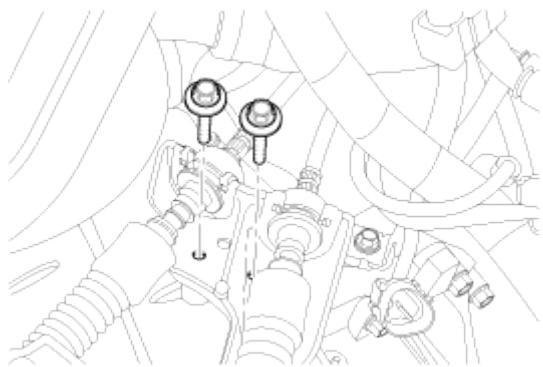
Tightening torque :

- 15~22 Nm (1.5~2.2 kgf.m, 10.8~15.9 lb-ft)

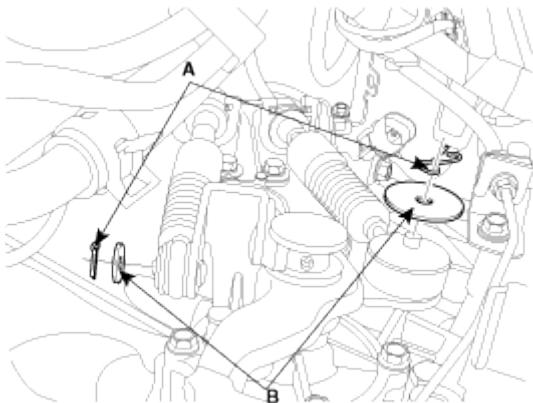


15. Install the control cable bracket by installing bolts(3ea).

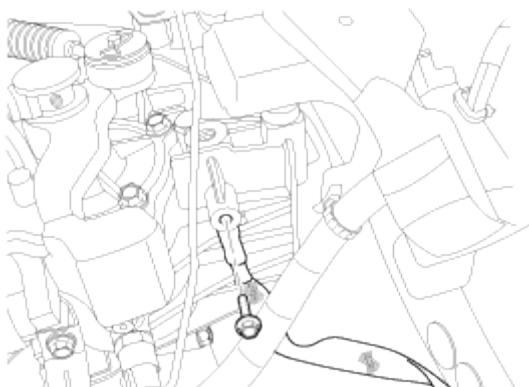
Tightening torque :
15~22 Nm (1.5~2.2 kgf.m, 10.8~15.9 lb-ft)



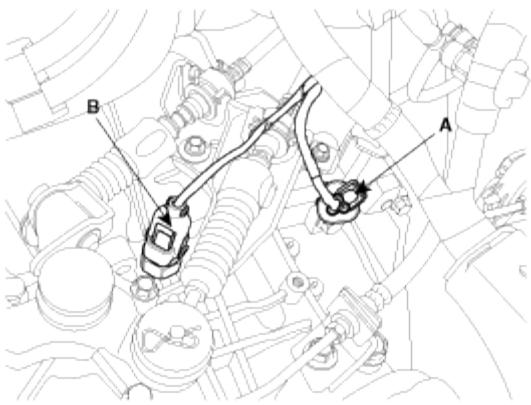
16. Install the clips (B) and pins (A).



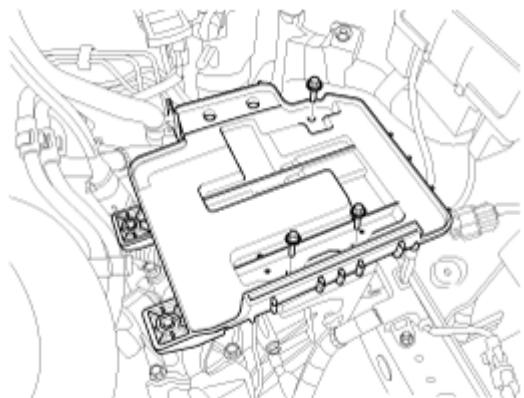
17. Install the ground wire by installing a bolt.



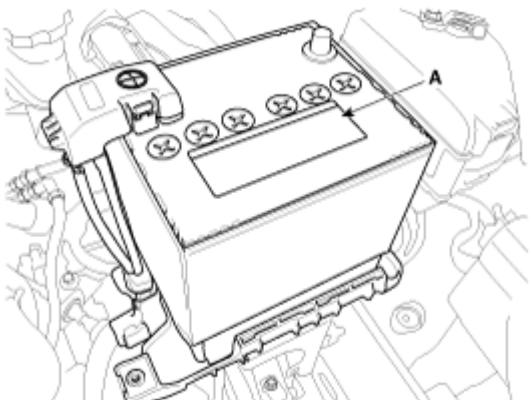
18. Connect the vehicle speed sensor connector (A) and the back lamp switch connector (B).



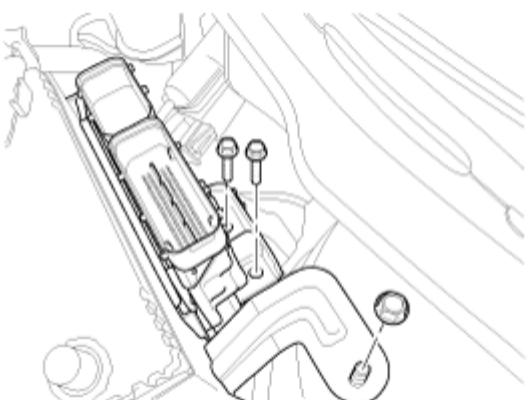
19. Install the battery tray by installing the bolts(3ea).



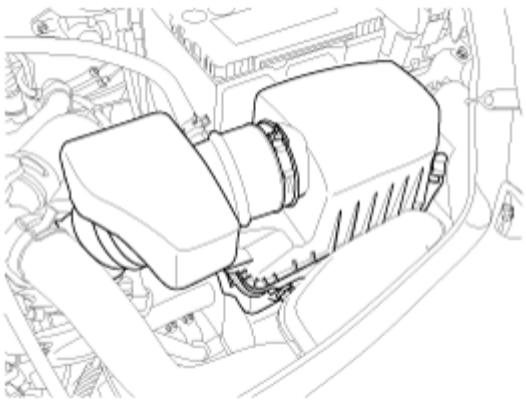
20. Install the battery (A).



21. Install the ECU by installing the bolts(2ea) and a nut.



22. Install the air cleaner assembly and the intake hose by installing the bolts and the clamps.

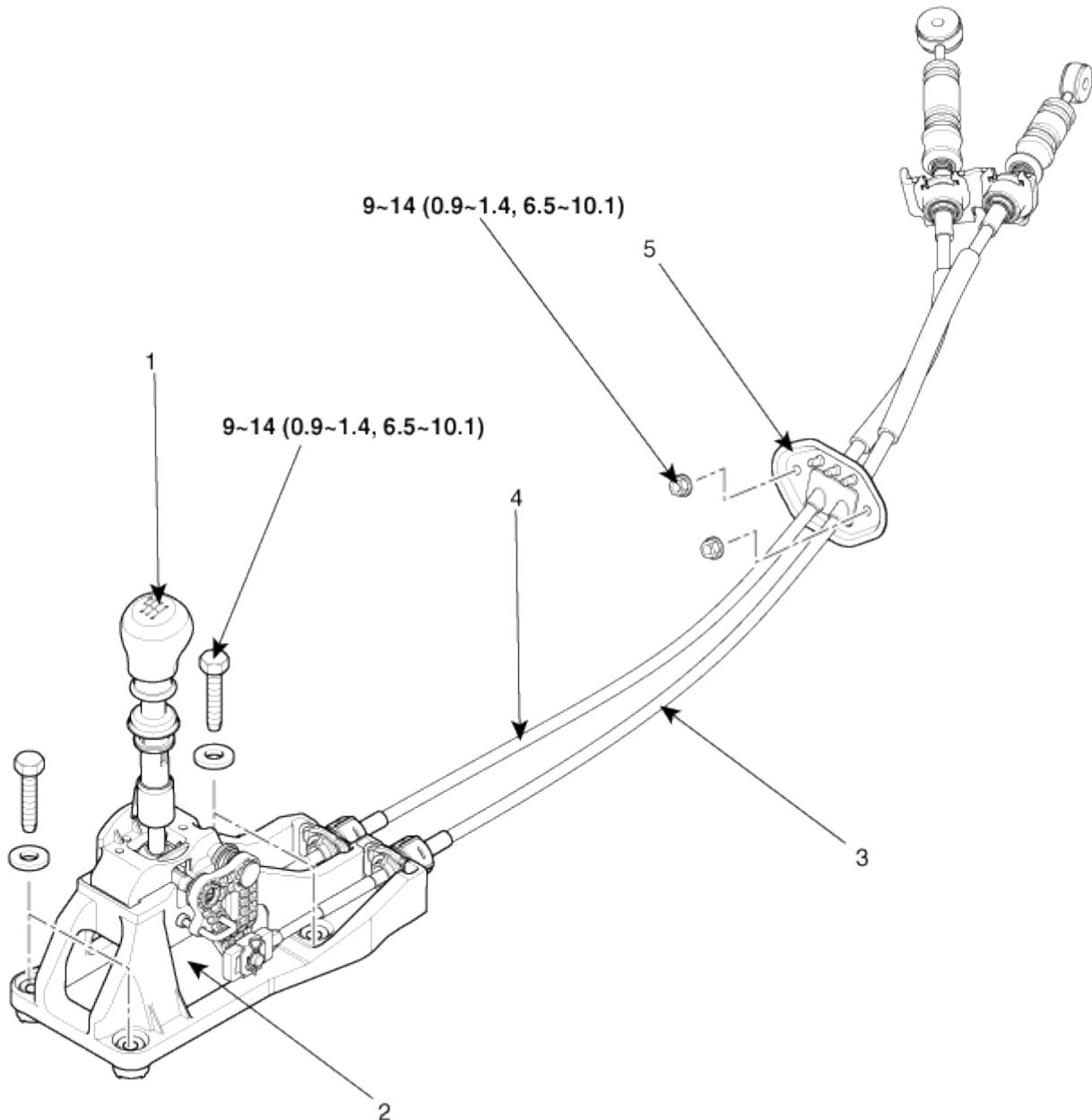


16.3. Manual Transaxle Control System

16.3.1. Shift Lever

16.3.1.1. Component and Components Location

Components



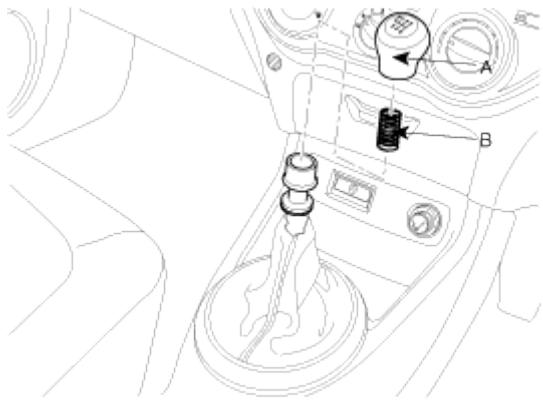
Torques : Nm (kgf.m, lb-ft)

| | |
|--|--|
| 1. Shift lever knob
2. Shift lever assembly
3. Select cable assembly | 4. Shift cable assembly
5. Retainer |
|--|--|

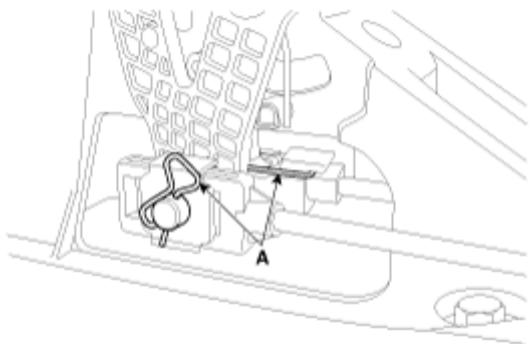
16.3.1.2. Repair procedures

Removal

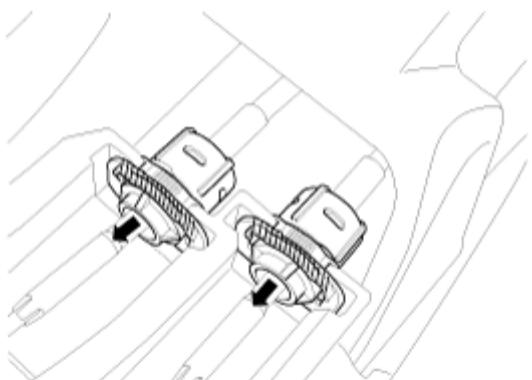
1. Remove the shift lever knob (A) by turning the knob, the spring (B).



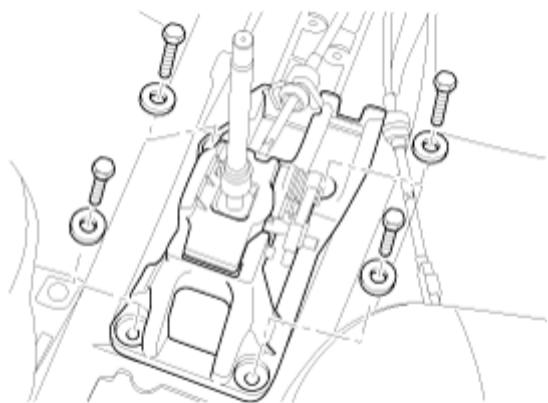
2. Remove the shift boot.
3. Remove the center console.(refer to Console in BD group)
4. Remove the snap pin (A) and remove the select cable assembly.



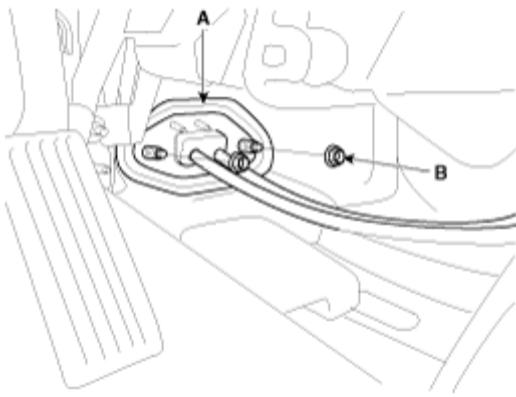
5. Remove the cable assembly by pulling the marking parts.



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



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



8. Remove the select and shift cable assembly from the transaxle. (refer to Manual Transaxle removal).

Inspection

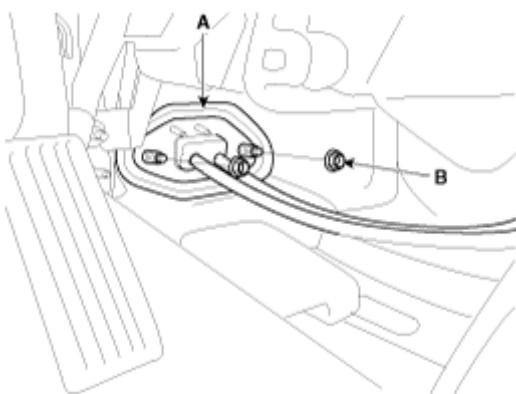
1. Check the select cable for proper operation and for damage.
2. Check the shift cable for proper operation and for damage.
3. Check the boots for damage.
4. Check the boots for wear abrasion sticking, restricted movement or damage.
5. Check for the weak or damaged spring.

Installation

1. Install the cable assembly placing the select and shift lever in neutral position. (Refer to Transaxle installation).
2. Install the retainer (A) and nuts (B).

Tightening torque :

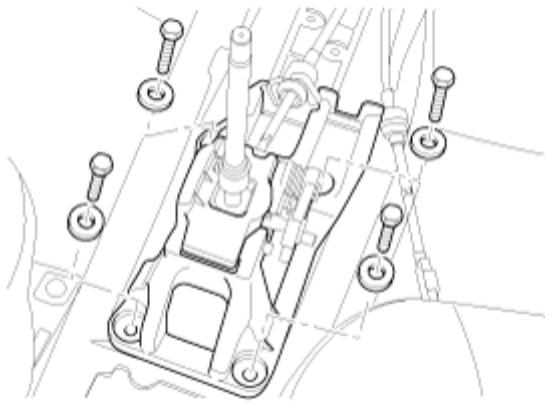
9~14 Nm (0.9~1.4 kgf.m, 6.0~9.5 lb-ft)



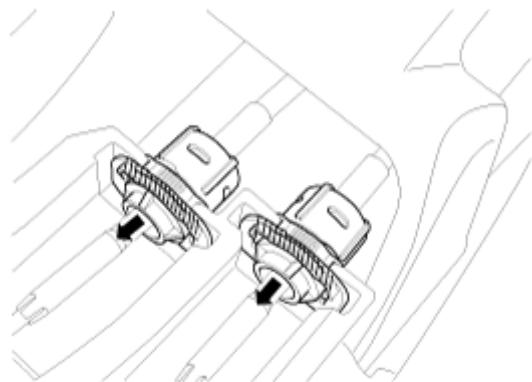
3. Install the shift lever assembly by installing the bolts (4ea).

Tightening torque :

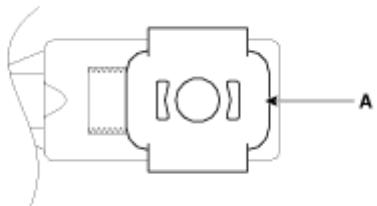
9~14 Nm (0.9~1.4 kgf.m, 6.0~9.5 lb-ft)



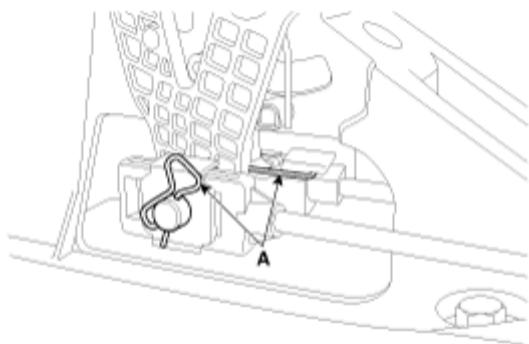
4. Install the cable with the clip to the shift lever.



5. Move the slide clip (A) in the direction as shown in the illustration in order to adjust the slide clip fit into the select lever.



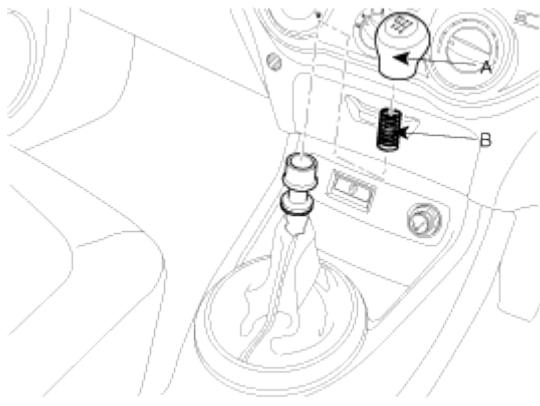
6. Install the snap pin (A) to hold the select cable assembly.



7. Install the center console. (Refer to Console in BD group)

8. Install the shift boot.

9. Install the spring(B) and the shift lever knob (A) by turning the knob.



16.3.2. Back-up Lamp Switch

16.3.2.1. Description and Operation

Description

Back up lamp switch is pushed by the reverse lug sliding when shifting reverse, and switches the back up lamp.

16.3.2.2. Specifications

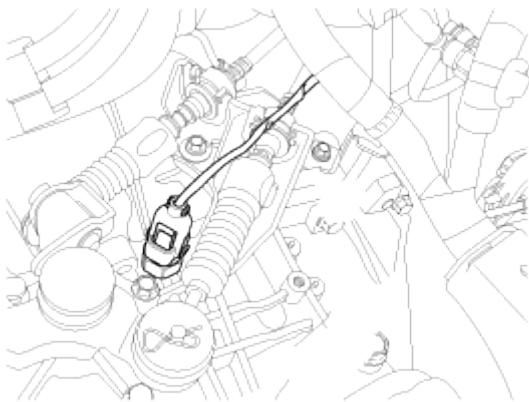
Specificaitons

1. Current voltage : 12V
2. Working voltage : 10~15V
3. Operating force : 1.0 kg +0.2kg Max. (at 2mm stroke position)
4. Voltage drop : Max 0.15V with rated load before test, Max 0.24V with rated load after test
5. Working temperature : -30°C ~ 80°C

16.3.2.3. Repair procedures

Inspection

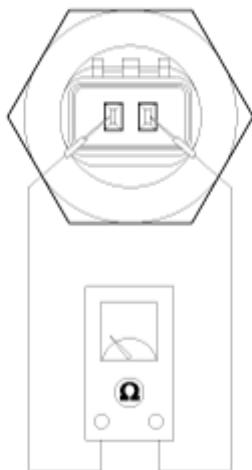
1. Disconnect the back up lamp switch connector.



2. Check the continuity between no. 1 and 2 terminals of backup lamp switch.
When the shift lever is in reverse, there should be contunuity.
3. If necessary, repair or replace the backup lamp switch.

| Condition | 1 | 2 |
|---------------|---|---|
| Reverse Range | ● | |
| Other Range | | ● |

*The back up Lamp "ON" shall keep over 0.5mm(0.02in)
From ON-OFF point.



Replacement

1. Disconnect the back up lamp switch connector.



2. Remove the back up lamp switch.
3. Replace a new one and install the back up lamp switch, then connect the connector.

Tightening torque :

30~35 Nm (3.0~3.5 kgf.m, 21.7~25.3 lb-ft)
