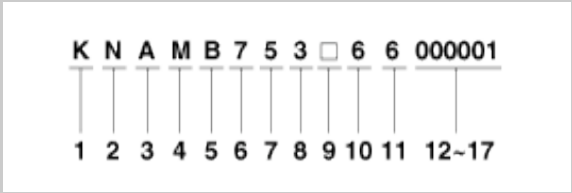
CHAPTER 1:

General Information

IDENTIFICATION NUMBER DESCRIPTION

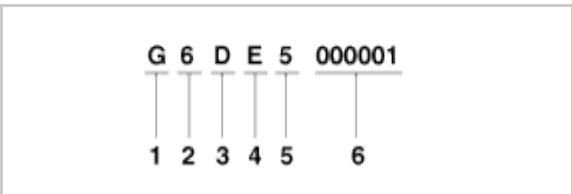
VEHICLE IDENTIFICATION NUMBER



1 : Geographic zone
- K = Korea
2 : Manufacturer
- N = Kia motor company
3 : Vehicle type
- A = Passenger car
4 - 5 : Vehicle Line/Series
- MB = VQ
- MC = EP
6 - 7: Body type
- 75 = Coach & GVW 2271 ~ 2720 kg
- 76 = Long coach & GVW 2271 ~ 2720 kg
8 : Engine type
- 1 = J2.9 Diesel
- 2 = μ 2.7
- 3 = λ3.8 Gasoline
9 : Transmission type
- 2 : Manual
- 5 : Automatic
10 : Model year
- 5 = 2005, 6 = 2006, 7 = 2007
11 : Plant location
- 6 = Soha plant
12 - 17 : Production sequential number
- 000001 ~ 999999

ENGINE IDENTIFICATION NUMBER

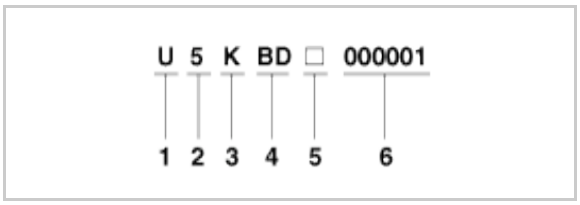
GASOLINE



1. Engine fuel
- G : Gasoline
2. Engine range
- 4 : 4 cycle 4 cylinder
- 6 : 4 cycle 6 cylinder
3. Engine development order
- D : Lambda engine
4. Engine capacity
- E : 2656 cc (μ-engine)
5. Production year
- 5 : 2005, 6 : 2006
6. Engine production sequence number
- 000001 ~ 999999

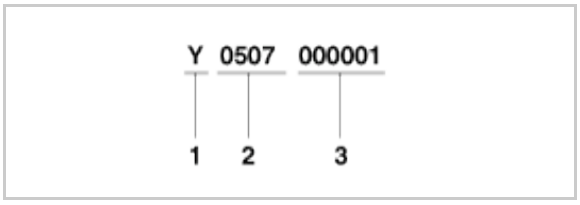
TRANSMISSION IDENTIFICATION NUMBER

AUTOMATIC



1. Modle
   - U : A5HF1
2. Production year
   - 5 : 2005, 6 : 2006, 7 : 2007
3. Gear ratio
   - K : 3.333
4. Detailed chassification
   - FD : 3.8D
5. Spare
6. Transaxle production sequence number
   - 000001 ~ 999999

MANUAL



1. Model
- Y : M5HF2
2. Production year
- 5 : 2005, 6 : 2006, 7 : 2007
3. Transaxle production sequence number
- 000001 ~ 999999

LUBRICANTS

RECOMMENDED LUBRICANTS

Parts		OIL & GREASE STANDARD	
Engine Oil	Gasoline	API SJ or SL	SAE 5W -20
		If 5W-20 engine oil is not available, 5W-30 or secondary recommended engine oil for corresponding temperature range can be used.	
Transaxle	Auto	DIAMOND ATF SP-III, SK ATF SP-III	
	Manual	API Classification GL-4 (SAE 75W/85)	
Power Steering		PSF - 3	
Breake Steering		DOT 3 or equivalent	
Coolant		Ethlyene glycol base for aluminium radiator	
Transaxle linkage, parking breake cable mechanism, hood, door latch, seat adjuster,tailgate latch, door hinges, tailgate hinge		Multipurpose grease NIGL grade #2	

WARNING

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

LUBRICANTS CAPACITIES

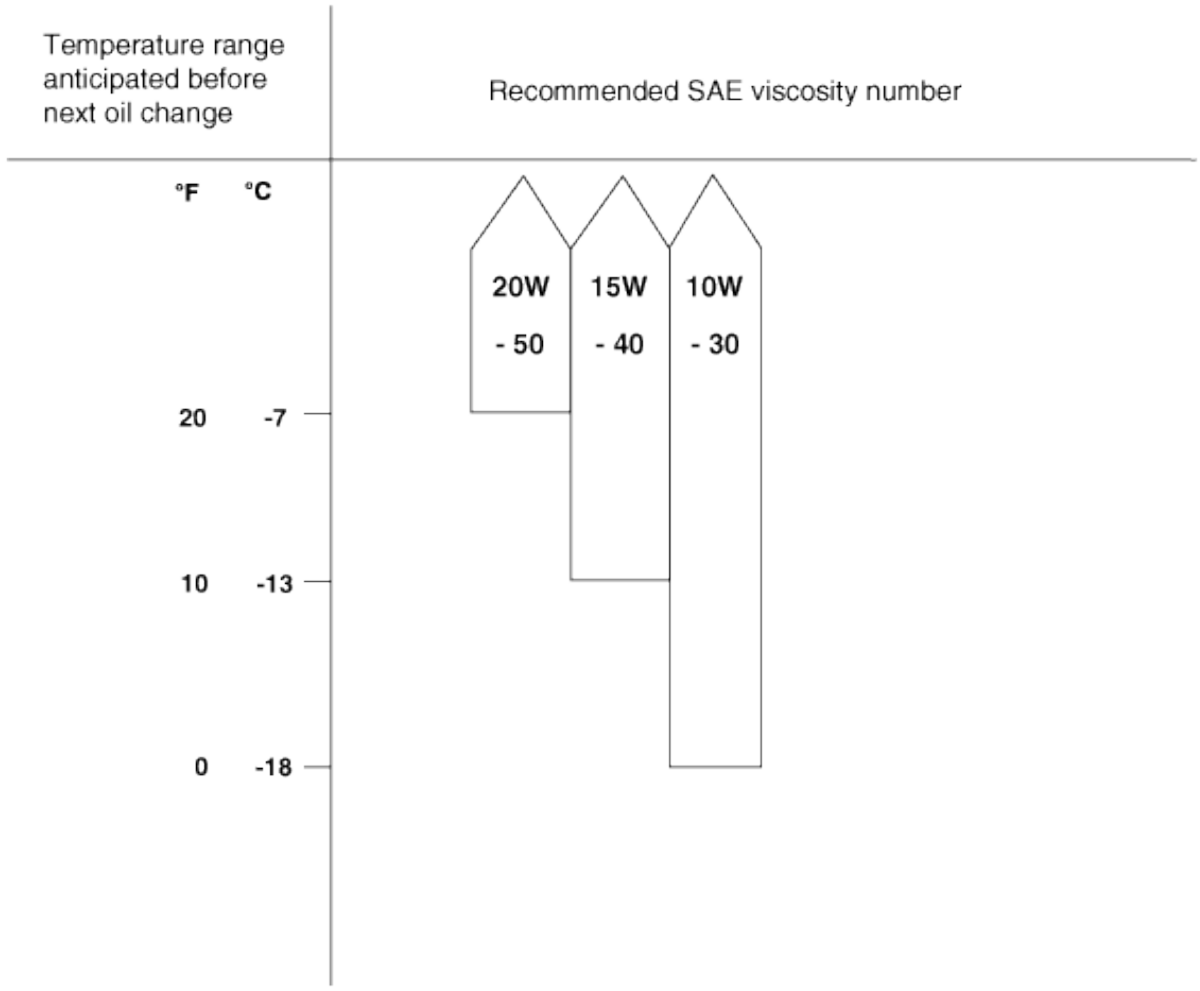
Description		2.7
Engine oil	Oil pan	4.2 (4.44, 3.70)
	Oil filter	0.3 (0.32, 0.26)
	Total	4.5 (4.76, 0.26)
Cooling system		8.2~8.3 (8.66~8.77, 7.22~7.3)
Manual transaxle		1.85 (1.95, 1.62)
Automatic transaxle		10.7 (11.3, 9.41)
Power steering		1.0 (1.06, 0.88)

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

SELECTION OF ENGINE OIL (Gasoline-2.7)

RECOMMENDED ILSAC classification : GF-3 OR ABOVE
RECOMMENDED API classification : SL(SJ) OR ABOVE

RECOMMENDED SAE viscosity grades :



NOTICE

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

a. Satisfy the requirements of the API classification.

b. Have the proper SAE grade number for expected ambient temperature range.

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

WORKSHOP MANUAL PUBLICATION INFORMAION

Each workshop manual contains the following contents.

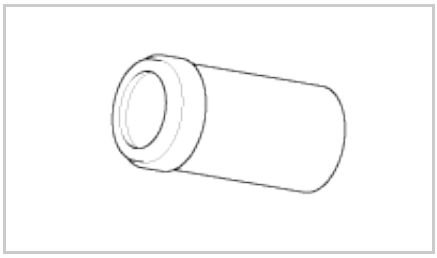
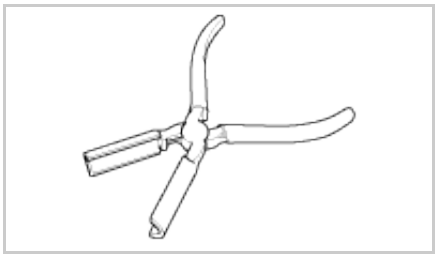
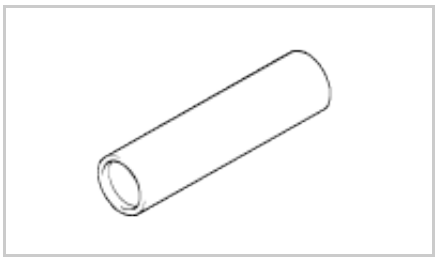
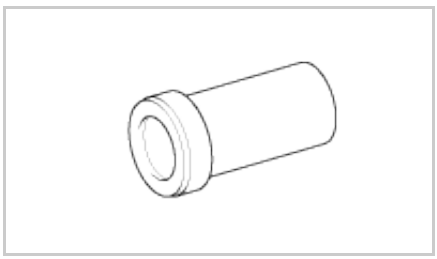
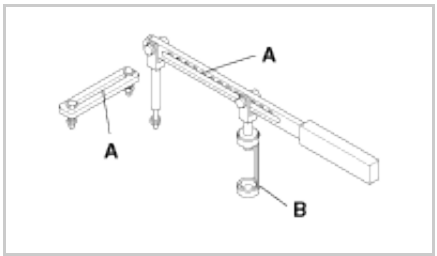
TITLE	Group	Workshop Manual				
		2006MY (GEN)		2006MY (GEN)	2006MY (EUROPE)	
		Volume 1	Volume 2	Supplement	Volume 1	Volume 2
Publication code	BOOK	A4DS-EG56A1	A4DS-EG56A2	A4DS-EG63C	A4DS-EG62B1	A4DS-EG62B2
	CD	A4DC-EG50A		A4DC-EG63B		
General Information	GI	●	-	●	●	-
Engine	EM	J3 TCI (DSL 2.9)	-	G6EA (GSL 2.7)	J3 (DSL 2.9 VGT)	-
		G6DA (GSL 3.8)	-	-	G6EA (GSL 2.7)	-
Engine Electrical System	EE	J3 TCI (DSL 2.9)	-	G6EA (GSL 2.7)	J3 (DSL 2.9 VGT)	-
		G6DA (GSL 3.8)	-	-	G6EA (GSL 2.7)	-
Emissions Control System	EC	G6DA (GSL 3.8)	-	G6EA (GSL 2.7)	G6EA (GSL 2.7)	-
Fuel System	FL	J3 TCI (DSL 2.9)	-	G6EA (GSL 2.7)	J3 (DSL 2.9 VGT)	-
		G6DA (GSL 3.8)	-	-	G6EA (GSL 2.7)	-
Clutch System	CH	-	●	-	-	●
Manual Transaxle	MT	-	M5HF2	M5GF2	-	M5HF2
		-	-	-	-	M5GF2
Automatic Transaxle	AT	-	A5HF1	F4A51-2	-	A5HF1
		-	-	-	-	F4A51-2
Driveshaft and Axle	DS	-	●	-	-	●
Suspension System	SS	-	●	-	-	●
Steering System	ST	-	●	-	-	●
Restraints	RT	-	●	-	-	●
Brake System	BR	-	●	-	-	●
Body (Interior & Exterior)	BD	-	●	-	-	●
Body Electrical System	BE	-	●	-	-	●
Heating, Ventilation & Air Conditioning	HA	-	●	-	-	●
Electrical Troubleshooting Manual (ETM)	BOOK	A4DE-EG56A		A4DE-EG62B	A4DE-EG62B	
	CD	A4DC-EG50A		A4DC-EG63B		
Overhaul Manual	M5HF2	Refer to Overhaul Manual (BOOK : MTMS-EG55C, CD : A4DC-EG50A)				
	M5GF2	Refer to Overhaul Manual (BOOK : MTMS-EG50I, CD : A4DC-EG63B)				
	A5HF1	Refer to Overhaul Manual (BOOK : ATMS-EG55B, CD : A4DC-EG50A)				
	F4A51-2	Refer to Overhaul Manual (BOOK : ATMS-EG25B)				

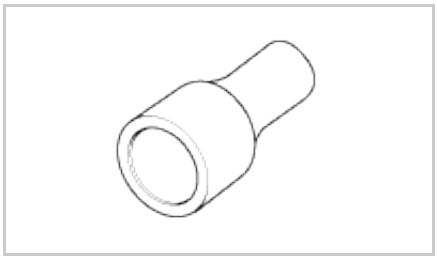
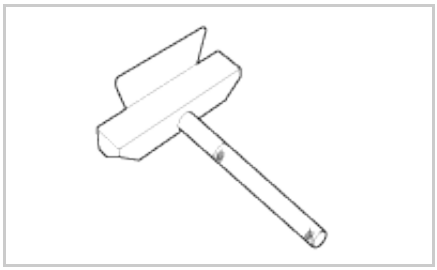
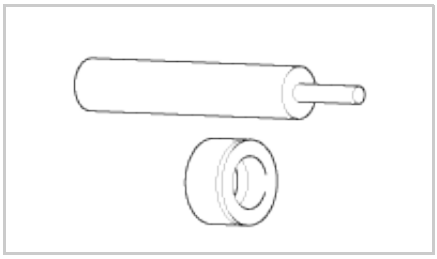
'●' Symbol means that the marked group is included in the relevant manual and CD.

CHAPTER 2:

Engine Mechanical System

SPECIAL TOOLS

Tool (Number and name)	Illustration	Use
Crankshaft front oil seal installer (09214-33000)		Installation of the front oil seal
Torque angle adapter (09221-4A000)		Installation of bolts & nuts needing an angular method
Valve stem seal remover (09222-29000)		Removal of the valve stem seal
Valve stem seal installer (09222-22001)		Installation of the valve stem seal
Camshaft oil seal installer (09214-21000)		Installation of the camshaft oil seal
Valve spring compressor & holder (09222-3K000) (09222-3C300)		Removal and installation of the intake or exhaust valves. A : 09222-3K000 B : 09222-3C300 (holder)

Crankshaft rear oil seal installer (09231-33000)		Installation of the crankshaft rear oil seal
Oil pan remover (09215-3C000)		Removal of oil pan
Valve guide installer (09221-3F100 A/B)		Removal and installation of the valve guide

TROUBLESHOOTING

Symptom	Suspect area	Remedy
Engine misfire with abnormal internal lower engine noises.	Worn crankshaft bearings. Loose or impropes engine drive plate.	Replace the crankshaft and bearings as required. Repair or replace the drive plate 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)	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 valve lifters.
Engine misfire with coolant consumption.	a. Faulty cylinder head gasket and/or cranking or other damage to the cylinder head and engine block cooling system. b. Coolant consumption may or may not cause the engine to overheat.	a. Inspect the cylinder head and engine block for damage to the coolant passages and/or a faulty head gasket. b. Repair or replace as required.
Engine misfire with excessive oil consumption.	Worn valves, guides and/or valve stem oil seals.	Repair or replace as required.
	Worn piston rings. (Oil consumption may or may not cause the engine to misfire)	a. Inspect the cylinder for a loss of compression. b. Repair or replace as required.
Engine noise on start-up, but only lasting a few seconds.	Incorrect oil viscosity.	a. Drain the oil. b. Install the correct viscosity oil.
	Worn crankshaft thrust bearing.	a. Inspect the thrust bearing and crankshaft. b. 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.	a. Inspect the camshaft lobes. b. Replace the timing camshaft and valve lifters as required.
	Worn valve guides or valve stems.	Inspect the valves and valve guides,then repair as required.
	Stuck valves. Carbon on the valve stem or valve seat may cause the valve to stay open.	Inspect the valves and valve guides, then repair as required.
	Worn drive belt, idler, tensioner and bearing.	Replace as required.
Lower engine	Low oil pressure.	Repair as required.

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

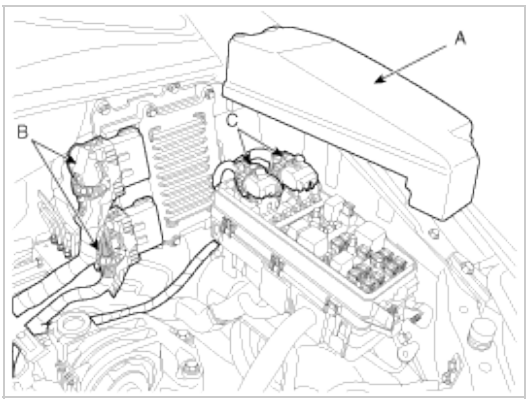
	Seized crankshaft or connecting rod bearings.	a. Inspect crankshaft and connecting rod bearing. b. Repair as required.
	Bent or broken connecting rod.	a. Inspect connecting rods. b. Repair as required.
	Broken crankshaft.	a. Inspect crankshaft. b. Repair as required.

Compression pressure inspection

NOTICE

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

1. Warm up the engine until the normal operating temperature becoming 80~95°C(176~203°F).
2. Remove the surge tank.
3. Remove the ignition coil connectors(B) and ignition coils.



4. Using a 16mm plug wrench, remove the 6 spark plugs.
5. Check cylinder compression pressure.
   (1) Insert a compression gauge into the spark plug hole.
   (2) Open the throttle fully.
   (3) With the fully-open throttle in cranking, measure the compression pressure.

   NOTICE

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

   Repeat steps 1) through 3) for each cylinder.

   NOTICE

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

   Compression pressure: 1,176.79kPa (12.0kgf/cm², 170.68psi) - 200 ~ 250rpm
   Minimum pressure: 1,029.69kPa (10.5kgf/cm², 149.34psi)
   Difference between cylinders: 98.07kPa (1.0kgf/cm², 14.22psi)

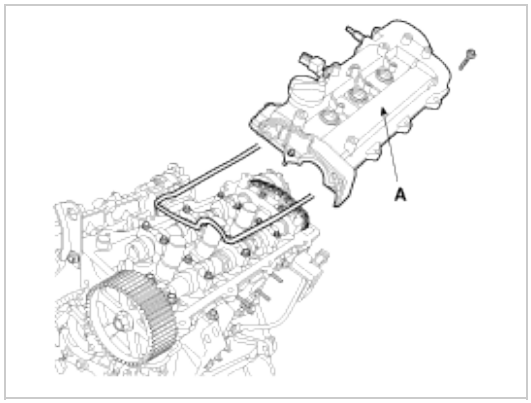
   (4) If the compression pressure in 1 or more cylinders is lower than the specification above, pour a small amount of engine oil into the cylinder through the spark plug hole, repeat the steps (1) through (3) for the cylinder and measure the pressure again.
      a. If adding oil increases the pressure up, the piston rings or cylinder bores might be worn or damaged.
      b. If the pressure doesn't increase, a valve may be sticking or seating may be improper, or there may be leakage from the gasket.
6. Reinstall the spark plugs.
7. Install the ignition coils and connect ignition coil connectors.
8. Install the surge tank.

VALVE CLEARANCE INSPECTION AND ADJUSTMENT

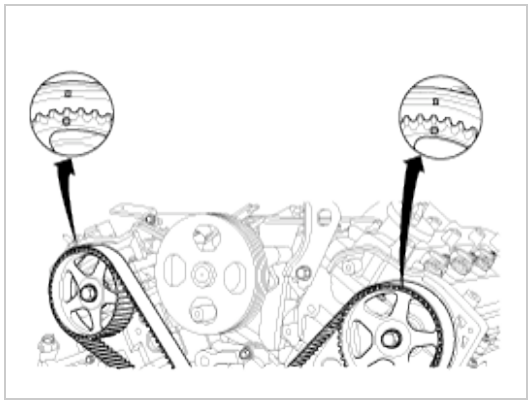
NOTICE

Inspect and adjust the valve clearance when the engine is cold (Engine coolant temperature : 20°C ±5°C(59~77°F)) and cylinder head is installed on the cylinder block.

1. Remove the engine cover.
2. Remove air cleaner assembly.
3. Remove the surge tank.
4. Remove the cylinder head cover.
   (1) Disconnect the ignition coil connector and remove the ignition coil.
   (2) Remove the cylinder head cover.



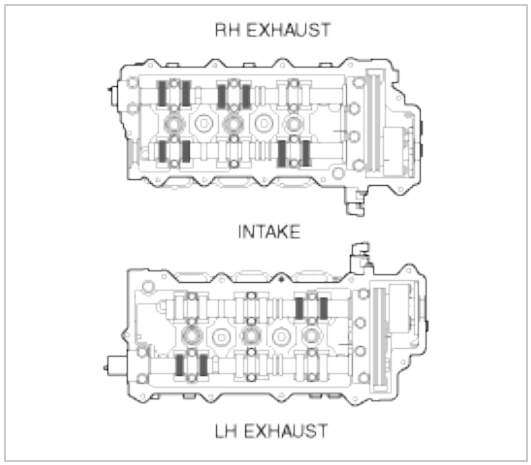
5. Set the piston of the No.1 cylinder to TDC(Top Dead Center) position.
   (1) Turn the crankshaft pulley clockwise and align its groove with the timing mark "T" of the timing chain cover.
   (2) Check that the timing marks of the camshaft sprocket are in straight line on that of the cylinder head cover surface as shwn in the illustration. It makes the piston of the No.1 cylinder position at TDC.



NOTICE

If not, turn the crankshaft one revolution clockwise.

6. Inspect the intake and the exhaust valve clearance.
   (1) With the piston of the No.1 cylinder positioning at TDC, the valves which can be measured its clearance are as shown below.

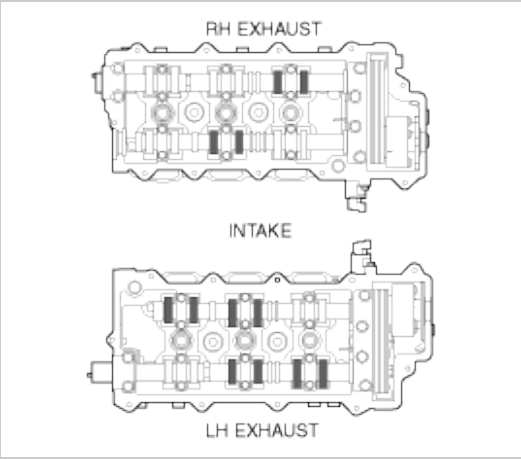


Measurement method.
   a. Using a thickness gauge, measure the clearance between the tappet and the base circle of camshaft.
   b. Record the out-of-specification valve clearance measurements. They will be used later to determine the required adjusting tappet for replacement.

Specification
Limit (Engine coolant temperature : 20°C [68°F])
Intake : 0.10 ~ 0.30mm (0.0039 ~ 0.0118in.)
Exhaust : 0.20 ~ 0.40mm (0.0079 ~ 0.0157in.)

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

(3) With the piston of the No.4 cylinder positioning at TDC, the valves which can be measured its clearance are as shown below.

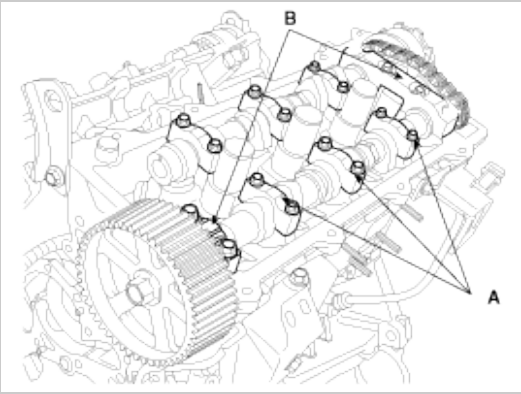


7. Adjust the intake and the exhaust valve clearances.

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

(2) Remove the timing belt.

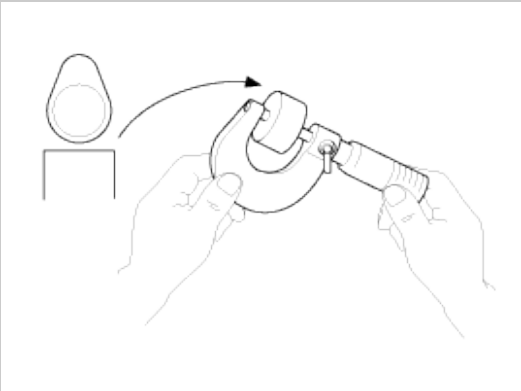
(3) Remove the camshaft bearing caps(A, B).



(4) Remove the camshaft assembly.

(5) Remove MLA(Mechanical Lash Adjuster)s.

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



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

T : Thickness of removed tappet
A : Measured valve clearance

N : Thickness of new tappet
Intake : N = T + [A - 0.20mm(0.0079in.)]
Exhaust : N = T + [A - 0.30mm (0.0118in.)]

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

NOTICE

Tappets are available with 41different size increments of 0.015mm (0.0006in.) from 3.00mm (0.118in.) to 3.600mm (0.1417in.)

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

NOTICE

Apply engine oil on the periphery surface of the selected tappet.

(10) Install the intake and exhaust camshafts.

(11) Install the bearing caps.

(12) Install the timing belt.

(13) Turn the crankshaft two revolutions in the operating direction(clockwise) and realign crankshaft sprocket and camshaft sprocket timing marks(A).

(14) Recheck the valve clearance.

Specification (Engine coolant temperature: 20°C[68°F])
Intake : 0.17 ~ 0.23mm (0.0067 ~ 0.0090in.)
Exhaust : 0.27 ~ 0.33mm (0.0106 ~ 0.0129in.)

SPECIFICATIONS

Description			Specifications	Limit
General				
Type			V-type, DOHC	
Number of cylinder			6	
Bore			86.7mm(3.4134in.)	
Stroke			75mm(2.9528in.)	
Total displacement			2,656cc	
Compression ratio			10.4	
Firing order			2-3-4-5-6-1	
Valve timing				
Intake valve	Opens (ATDC)		4° ~ -56°	
	Closes (ABDC)		60° ~ 0°	
Exhaust valve	Opens (BBDC)		46°	
	Closes (ATDC)		10°	
Cylinder head				
Flatness of gasket surface			0.03mm(0.0012in.) or less	0.05mm(0.0020in.)
Flatness of manifold mounting	Intake		0.15mm(0.0059in.) or less	
	Exhaust		0.15mm(0.0059in.) or less	
Camshaft				
Cam height	LH Camshaft	Intake	44.5mm(1.7520in.)	
		Exhaust	44.5mm(1.7520in.)	
	RH Camshaft	Intake	44.5mm(1.7520in.)	
		Exhaust	44.5mm(1.7520in.)	
Journal outer diameter	LH Camshaft	Intake	27.964 ~ 27.980mm(1.1009 ~ 1.1016in.)	
		Exhaust	27.964 ~ 27.980mm(1.1009 ~ 1.1016in.)	
	RH Camshaft	Intake	27.964 ~ 27.980mm(1.1009 ~ 1.1016in.)	
		Exhaust	27.964 ~ 27.980mm(1.1009 ~ 1.1016in.)	
Bearing oil clearance	Intake		0.020 ~ 0.057mm(0.0008 ~ 0.0022in.)	
	Exhaust		0.020 ~ 0.057mm(0.0008 ~ 0.0022in.)	
End play			0.05 ~ 0.15mm(0.0020 ~ 0.0059in.)	
Valve				
Valve length	Intake		110.1mm(4.3346in.)	
	Exhaust		111.1mm(4.3740in.)	
Stem outer diameter	Intake		5.965 ~ 5.980mm(0.2348 ~ 0.2354in.)	
	Exhaust		5.950 ~ 5.965mm(0.2343 ~ 0.2348in.)	
Face angle			45° ~ 45.5°	
Thickness of valvehead(margin)	Intake		1.0mm(0.0394in.)	
	Exhaust		1.3mm(0.0512in.)	

Valve stem to valve guide clearance	Intake	0.020 ~ 0.050mm(0.0008 ~ 0.0020in.)	0.10mm(0.0039in.) or less
	Exhaust	0.035 ~ 0.065mm(0.0014 ~ 0.0026in.)	0.13mm(0.0051in.) or less
Valve guide			
Inner diameter	Intake	6.000 ~ 6.015mm(2.2362 ~ 2.2368in.)	
	Exhaust	6.000 ~ 6.015mm(2.2362 ~ 2.2368in.)	
Length	Intake	45.8 ~ 46.2mm(1.8031 ~ 1.8189in.)	
	Exhaust	46.8 ~ 47.2mm(1.8425 ~ 1.8583in.)	
Valve spring			
Free length		46.8mm(1.8425in.)	
Load	Height: 35mm	180.5 ~ 199.5N(18.4 ~ 20.3Kgf, 40.6 ~ 44.8lb)	
	Height: 26.5mm	342 ~ 378N(34.9 ~ 38.6Kgf, 76.9 ~ 85.1lb)	
Out of squareness		1.5° or less	
MLA(Mechanical Lash Adjuster)			
MLA outer diameter	Intake	29.964 ~ 29.980mm(1.1797 ~ 1.1803in.)	
	Exhaust	29.964 ~ 29.980mm(1.1797 ~ 1.1803in.)	
Cylinder head tappet bore inner diameter	Intake	30.000 ~ 30.025mm(1.1811 ~ 1.1821in.)	
	Exhaust	30.000 ~ 30.025mm(1.1811 ~ 1.1821in.)	
MLA to tappet bore clearance	Intake	0.020 ~ 0.061mm(0.0008 ~ 0.0024in.)	0.07mm(0.0027in.) or less
	Exhaust	0.020 ~ 0.061mm(0.0008 ~ 0.0024in.)	0.07mm(0.0027in.) or less
Valve clearance			
Intake		0.17 ~ 0.23mm (0.0067 ~ 0.0090in.)	0.10 ~ 0.30mm (0.0039 ~ 0.0118in.)
Exhaust		0.27 ~ 0.33mm (0.0106 ~ 0.0129in.)	0.20 ~ 0.40mm (0.0078 ~ 0.0157in.)
Cylinder block			
Cylinder bore		96.00 ~ 96.03mm (3.7795 ~ 3.7807in.)	
Flatness of gasket surface		Less than 0.05mm (0.0019in.) [Less than 0.02mm (0.0008in.) / 150x150]	
Piston			
Piston outer diameter		95.96 ~ 95.99mm(3.7779 ~ 3.7791in.)	
Piston to cylinder clearance		0.03 ~ 0.05mm(0.0012 ~ 0.0020in.)	
Ring groove width	No. 1 ring groove	1.22 ~ 1.24mm (0.0480 ~ 0.0488in.)	
	No. 2 ring groove	1.22 ~ 1.24mm (0.0480 ~ 0.0488in.)	
	Oil ring groove	2.01 ~ 2.03mm (0.0791 ~ 0.0799in.)	
Piston O.S.		0.25mm(0.0098in.)	
Piston ring			
Side clearance	No. 1 ring	0.04 ~ 0.08mm(0.0016 ~ 0.0031in.)	0.1mm(0.0039in.)

	No. 2 ring	0.03 ~ 0.07mm(0.0012 ~ 0.0027in.)	0.1mm(0.0039in.)
	Oil ring	0.06 ~ 0.15mm(0.0024 ~ 0.0059in.)	0.2mm(0.0079in.)
End gap	No. 1 ring	0.15 ~ 0.30mm(0.0059 ~ 0.0118in.)	0.6mm(0.0236in.)
	No. 2 ring	0.30 ~ 0.45mm(0.0118 ~ 0.0177in.)	0.7mm(0.0275in.)
	Oil ring	0.20 ~ 0.70mm(0.0078 ~ 0.0275in.)	0.8mm(0.0315in.)
Piston ring O.S.		0.25mm(0.0098in.)	
Piston pin			
Piston pin outer diameter		21.001 ~ 21.007mm(0.8268 ~ 0.8270in.)	
Piston pin hole inner diameter		21.014 ~ 21.023mm(0.8273 ~ 0.8277in.)	
Piston pin hole clearance		0.007 ~ 0.022mm(0.0003 ~ 0.0009in.)	
Connecting rod small end inner diameter		20.974 ~ 20.985mm(0.8257 ~ 0.8262in.)	
Connecting rod small end hole clearance		0.016 ~ 0.033mm(0.0006 ~ 0.0013in.)	
Connecting rod			
Connecting rod big end inner diameter		51.000 ~ 51.018mm(2.0079 ~ 2.0086in.)	
Connecting rod bearing oil clearance		0.018 ~ 0.036mm(0.0007 ~ 0.0014in.)	
Side clearance		0.1 ~ 0.25mm (0.0039 ~ 0.0098in.)	0.4mm(0.0157in.)
Crankshaft			
Main journal outer diameter		61.982 ~ 62.000mm(2.4402 ~ 2.4409in.)	
Pin journal outer diameter		47.982 ~ 48.000mm(1.8891 ~ 1.8898in.)	
Main bearing oil clearance		0.004 ~ 0.022mm(0.0002 ~ 0.0009in.)	
End play		0.07 ~ 0.25mm(0.0028 ~ 0.0098in.)	0.30mm(0.0118in.)
Oil pump			
Relief valve opening pressure		490.33 ~ 588.40kPa(5.0 ~ 6.0kgf/cm², 71.12 ~ 85.34 psi)	
Engine oil			
Oil quantity (Total)		4.8 L (5.07 US qt, 4.22 lmp qt)	
Oil quantity (Oil pan)		4.2 L (4.43 US qt, 3.69 lmp qt)	
Oil quantity (Drain and refill including oil filter)		4.5 L (4.75 US qt, 3.95 lmp qt)	
Oil quality		ABOVE API SJ / SL or SAE 5W-20	
Oil pressure		130kPa(1.32kgf/cm²,18.77psi) [at 1000rpm,110°C(230°F)]	
Cooling system			
Cooling method		Forced circulation with electrical fan	
Coolant quantity		8.2~8.3L(8.66~8.77U.S.qts,7.22~7.30lmp.qts)	
Thermostat	Type	Wax pellet type	
	Opening temperature	82±2°C (179.6±35.6°F)	
	Fully opened temperature	95°C (203°F)	
	Full lift	10mm (0.3937in.) or more	
Radiator cap	Main valve opening pressure	93.16 ~ 122.58kpa(0.95 ~ 1.25 kg/cm², 13.51 ~ 17.78psi)	

	Vacuum valve opening pressure	0.98 ~ 4.90 kpa(0.01 ~ 0.05 kg/cm², 0.14 ~ 0.71 psi)	
Engine coolant temperature sensor			
Type		Thermister type	
Resistance	20°C (68°F)	2.31 ~ 2.59 kΩ	
	80°C(176°F)	0.3222 kΩ	

TIGHTENING TORQUE

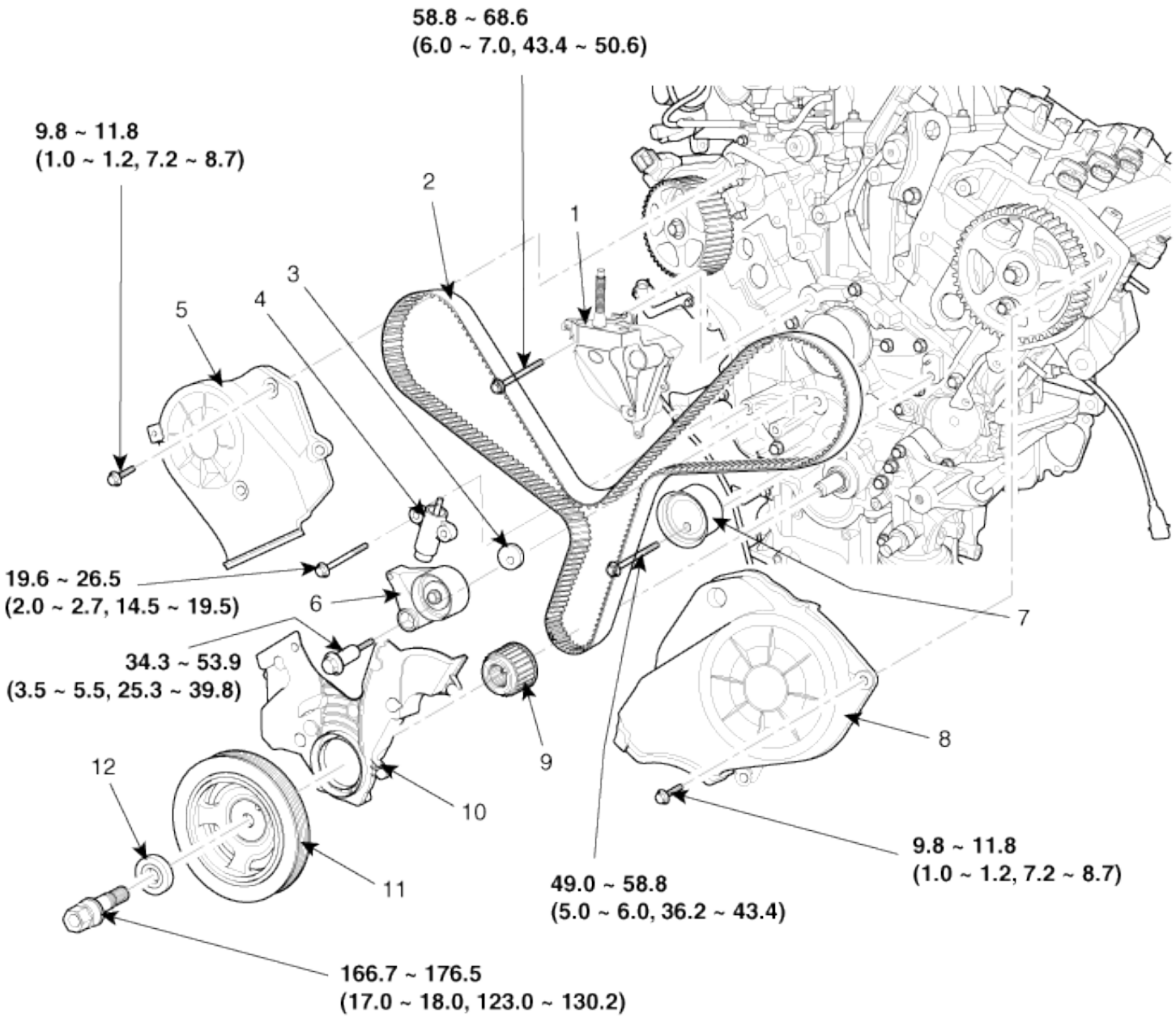
Item	Quantity	Nm	kgf.m	lb-ft
Oil seal case bolt	3	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Main bearing cap bolt(M10)	8	29.4 + 90°	3.0 + 90°	21.7 + 90°
Main bearing cap bolt(M8)	8	15.7 + 90°	1.6 + 90°	11.6 ~ + 90°
Rear plate bolt	1	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Oil pump case bolt(8×25)	1	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Oil pump case bolt(8×35)	1	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
TimingOil pump case bolt(8×65)	1	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
TimiOil relief plug	1	39.2 ~ 49.0	4.0 ~ 5.0	28.9 ~ 36.2
Oil filter bracket bolt(8×35)	4	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Oil filter bracket bolt(8×65)	2	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Oil filter insert	1	44.1 ~ 53.9	4.5 ~ 5.5	32.5 ~ 39.8
Timing chain cover bolt	21	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Upper oil pan bolt(8×22)	15	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Upper oil pan bolt(163.5mm)	1	4.9 ~ 6.9	0.5 ~ 0.7	3.6 ~ 5.1
Upper oil pan bolt(154.5mm)	1	4.9 ~ 6.9	0.5 ~ 0.7	3.6 ~ 5.1
Lower oil pan bolt	11	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Oil drain plug	1	34.3 ~ 44.1	3.5 ~ 4.5	25.3 ~ 32.5
Engine support bracket bolt(10×94)	2	58.8 ~ 68.6	6.0 ~ 7.0	43.4 ~ 50.6
Engine support bracket bolt(10×102.5)	1	58.8 ~ 68.6	6.0 ~ 7.0	43.4 ~ 50.6
Camshaft bearing cap bolt(6×38)	24	10.8 ~ 12.7	1.1 ~ 1.3	8.0 ~ 9.4
Camshaft bearing cap bolt(8×38)	12	20.6 ~ 25.5	2.1 ~ 2.6	15.2 ~ 18.8
Cylinder head bolt	16	22.6~26.5 + (60° +2°) + (45°+2°)	2.3~2.7 + (60° ±2°) + (45°±2°)	16.6~19.5 + (60° +2°) + (45°+2°)
Cylinder head cover bolt	22	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Crankshaft pulley bolt	1	166.7 ~ 176.5	17.0 ~ 18.0	123.0 ~ 130.2
Drive plate bolt	8	71.6 ~ 75.5	7.3 ~ 7.7	52.8 ~ 55.7
Connecting rod bearing cap bolt	12	19.6 ~ 90°	2.0 ~ 90°	14.5 ~ 90°
OCV(Oil Control Valve) bolt	2	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
CVVT & exhaust cam sprocket bolt	4	66.7 ~ 78.5	6.8 ~ 8.0	49.2 ~ 57.9
Timing chain auto tensioner bolt	4	10.8 ~ 12.7	1.1 ~ 1.3	8.0 ~ 9.4
Camshaft sprocket bolt	2	88.3 ~ 107.9	9.0 ~ 11.0	65.1 ~ 79.6
Timing belt idler bolt	1	49.0 ~ 58.8	5.0 ~ 6.0	36.2 ~ 43.4

Timing belt tensioner bolt	2	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Timing belt tensioner arm bolt	1	34.3 ~ 53.9	3.5 ~ 5.5	25.3 ~ 39.8
Water pump bolt(8×20)	3	14.7 ~ 21.6	1.5 ~ 2.2	10.8 ~ 15.9
Water pump bolt(8×25)	4	14.7 ~ 21.6	1.5 ~ 2.2	10.8 ~ 15.9
Drive belt idler bolt	1	34.3 ~ 53.9	3.5 ~ 5.5	25.3 ~ 39.8
Drive belt tensioner bolt	1	34.3 ~ 53.9	3.5 ~ 5.5	25.3 ~ 39.8
Water pipe bolt	1	16.7 ~ 19.6	1.7 ~ 2.0	12.3 ~ 14.5
Water temp. control assembly nut	4	29.4 ~ 41.2	3.0 ~ 4.2	21.7 ~ 30.4
Oil level gauge bolt	1	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Oil screen bolt	2	14.7 ~ 21.6	1.5 ~ 2.2	10.8 ~ 15.9
Water outlet pipe bolt	3	16.7 ~ 19.6	1.7 ~ 2.0	12.3 ~ 14.5
Water inlet pipe bolt	2	16.7 ~ 19.6	1.7 ~ 2.0	12.3 ~ 14.5
Water inlet pipe nut	1	16.7 ~ 19.6	1.7 ~ 2.0	12.3 ~ 14.5
Surge tank bolt(8×28)	3	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Surge tank bolt(8×80)	2	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Surge tank nut	2	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Intake manifold bolt	4	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Intake manifold nut	4	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Surge tank bracket bolt	2	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Exhaust manifold bolt	14	29.4 ~ 34.3	3.0 ~ 3.5	21.7 ~ 25.3
Heat protect bolt	6	16.7 ~ 21.6	1.7 ~ 2.2	12.3 ~ 15.9
Front muffler bolt	2	39.2 ~ 58.8	4.0 ~ 6.0	28.9 ~ 43.4

Timing system

Timing belt

COMPONENTS

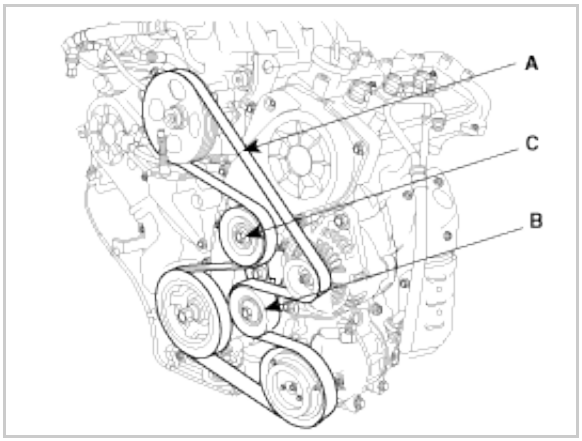


TORQUE : N.m (kgf.m, lb-ft)

1. Engine support bracket
2. Timing belt
3. Tensioner arm assembly washer
4. Timing belt auto tensioner
5. Bank 1 timing belt upper cover
6. Timing belt tensioner arm assembly
7. Idler pulley
8. Bank 2 timing belt upper cover
9. Crankshaft sprocket
10. Timing belt lower cover
11. Damper pulley
12. Special washer

REMOVAL

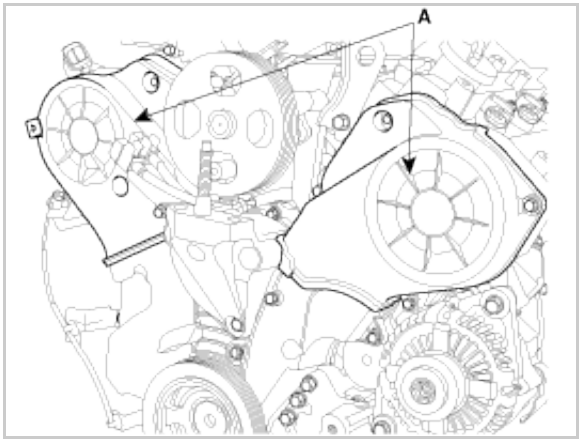
1. Remove the engine cover.
2. Remove the front right wheel and tire.
3. Remove the right side cover.
4. Remove the drive belt(A), the idler(B) and the tensioner(C).



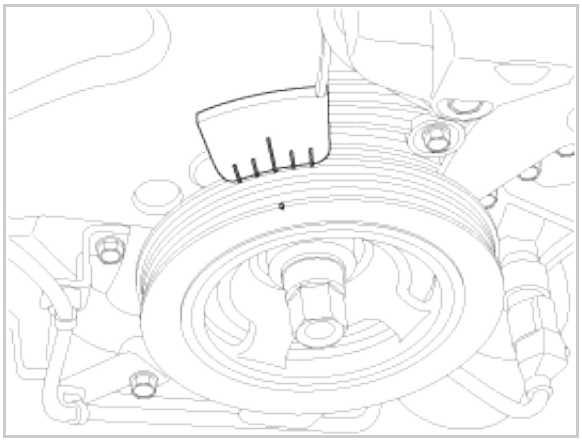
NOTICE

In removing the drive belt, fix a tool in the auto tensioner pulley bolt and turn the bolt counter clockwise.

5. Remove the timing belt upper cover(A).



6. Align the groove of the pulley with the timing mark of the timing belt cover by turning the crankshaft pulley clockwise. Check if the timing mark of the camshaft sprocket is aligned with that of the cylinder head cover at the moment.
(No.1 cylinder piston at TDC)



7. Remove the engine mounting bracket(A).

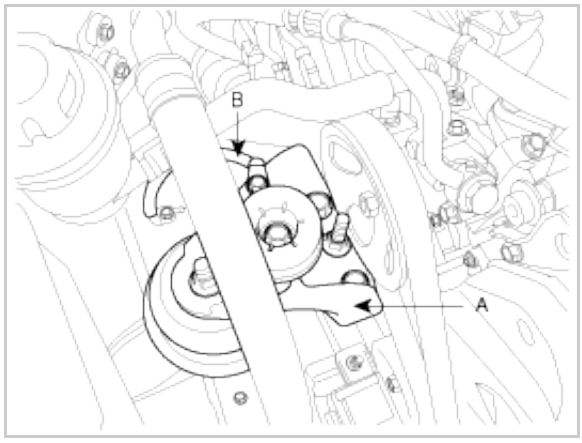
NOTICE

Sustain the engine oil pan with a jack.

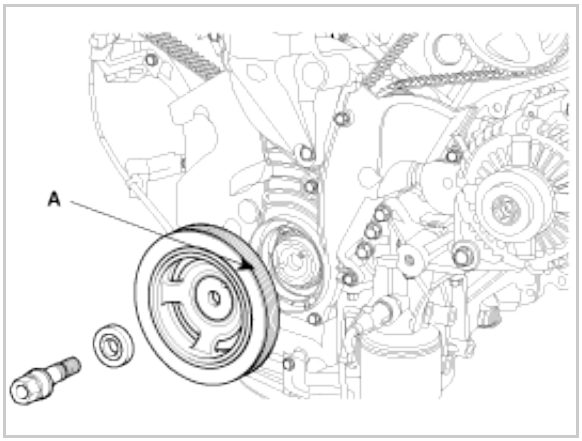
(1)

CAUTION

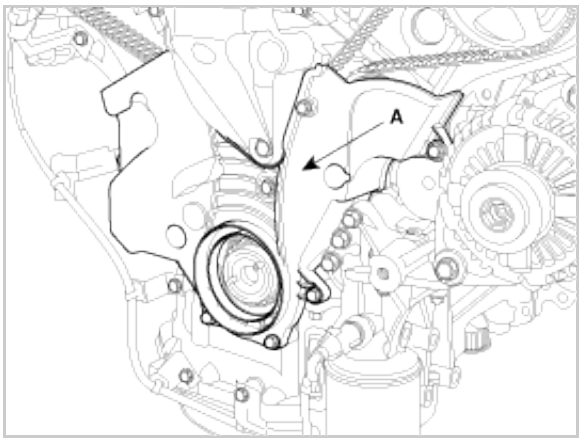
Put a wooden or rubber block between the jack and the engine oil pan.



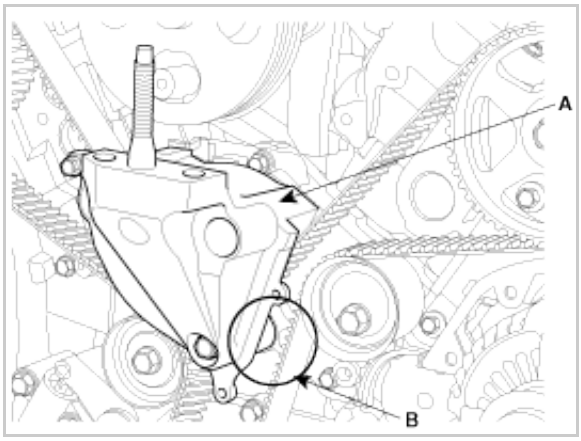
8. Remove the crankshaft damper pulley(A).



9. Remove the timing belt lower cover(A).



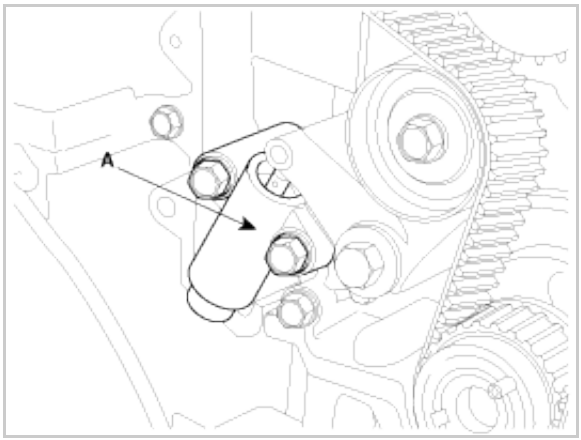
10. Remove the engine support bracket(A).



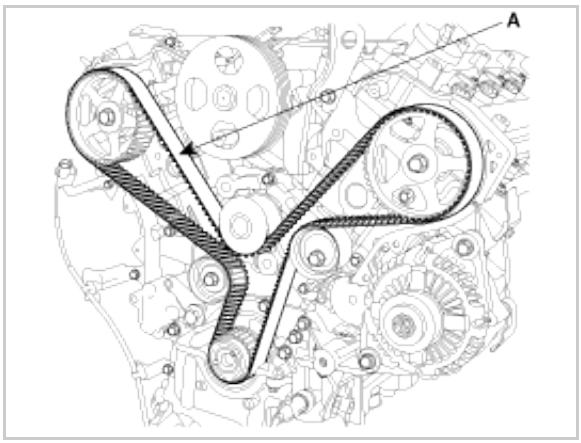
NOTICE

After the removal, engine coolant can be drained a little from that point(B) which is a matter of no importance.

11. Remove the timing belt auto tensioner(A).



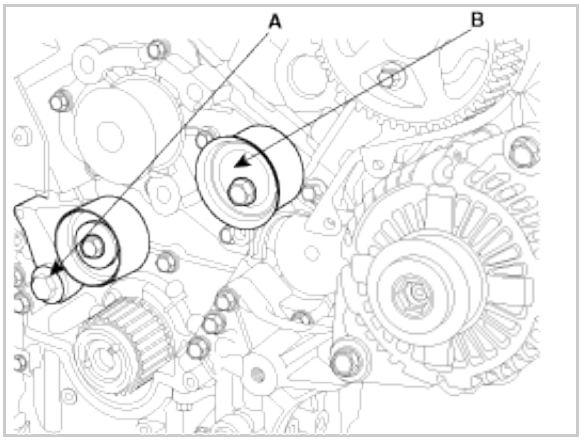
12. Remove the timing belt(A).



NOTICE

Make a direction mark of revolution on the timing belt for reusal.

13. Remove the tensioner arm assembly(A) and the idler(B).

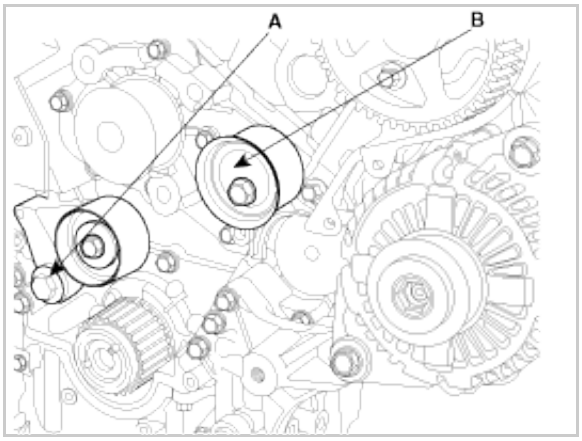


14. Remove the crankshaft sprocket.

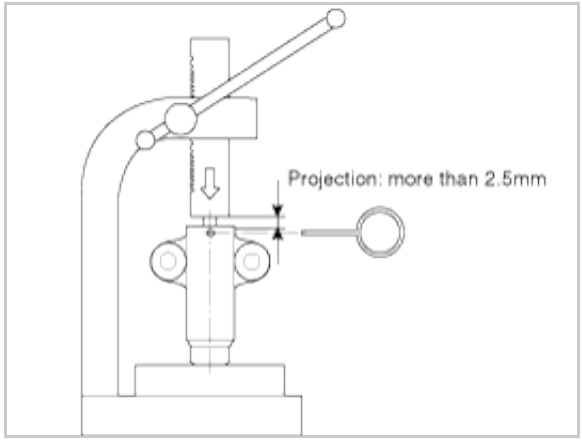
INSTALLATION

1. Install the crankshaft sprocket.
2. Install the tensioner arm assembly(A) and the idler(B).

Tightening torque
Tensioner arm bolt : 34.3 ~ 53.9Nm(3.5 ~ 5.5kgf.m, 25.3~ 39.8lb-ft)
Idler pulley bolt : 49.0 ~ 58.8Nm(5.0 ~ 6.0kgf.m, 36.2~ 43.4lb-ft)



3. Install the timing belt auto tensioner.
   (1) Fixing the tensioner with a vice and compressing the rod, insert a set-pin.



NOTICE

a. Handle the auto tensioner in the vertical position.
b. If it is treated by laying, tilting or turning over, stand it vertically for about five minutes in order for air to move upward.
c. Do not pull the pin out before its installation to the engine assembly because pulling the pin can cause noise of timing system by making aiir go in the high pressure chamber.

CAUTION

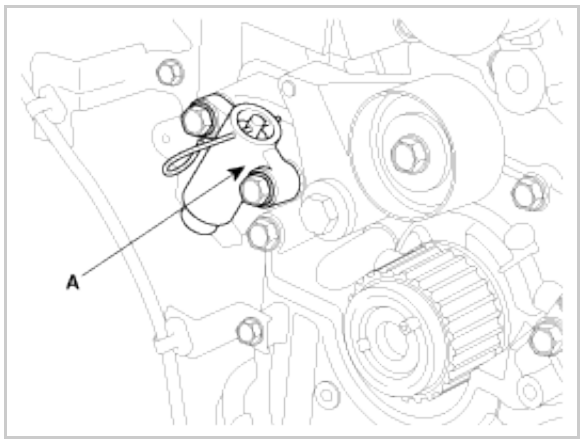
a. When pressing the rod, use a vertical vice certainly.
b. There is a high possibility for air to get in the high pressure chamber, when using a horizotal vice.
c. Do not apply more load than 400N on the rod.
d. Do not press the rod until its position is below 2.5mm from the body surface.
e. The projection of the rod is secured more than 2.5mm.

NOTICE

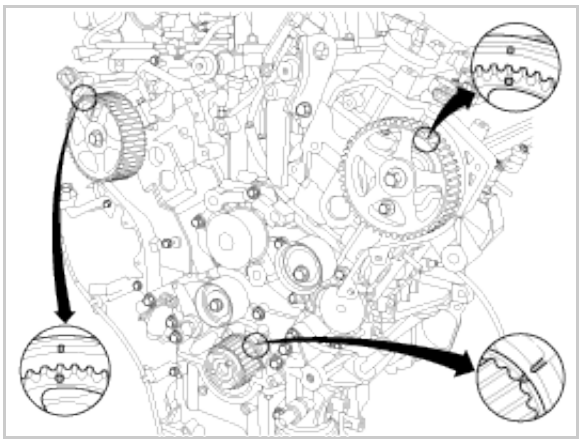
a. Repairing orders when disassembling the auto tensioner and reassembling it to the engine, or pulling the pin out before its installation ;
a. Stand it vertically for about five minutes.
b. Press the rod with the force, 150~200N.
c. If the rod has a stiffness, press it slowly and insert the pin into the set hole.
d. If not(the tensioner is in 'sponge' state), press the rod slowly from its maximum projection to 2.9mm position(the meeting point with the rod and the hole of the body) two or three times.
Afterwards, if stiffness is sensed, insert the pin into the hole. However, if not, scrap the tensioner.

(2) Install the auto tensioner(A) to the front case with the set-pin inserted.

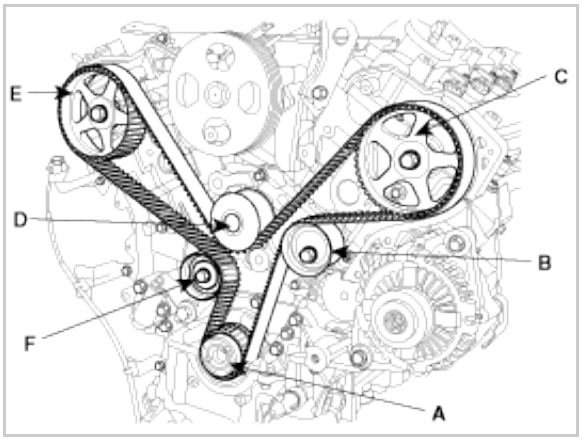
Tightening torque
19.6 ~ 26.5Nm(2.0 ~ 2.7kgf.m, 14.5 ~ 19.5lb-ft)



4. Ensure the timing marks on the camshaft and the crankshaft sprockets.

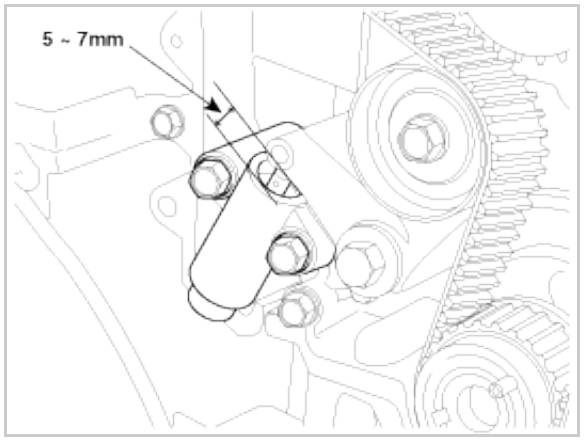


5. Install the timing belt.
Crankshaft sprocket(A) → Idler(B) → Bank 2 exhaust camsprocket(C) → Water pump pulley(D) → Bank 1 exhaust camsprocket(E) → Tensioner pulley(F).



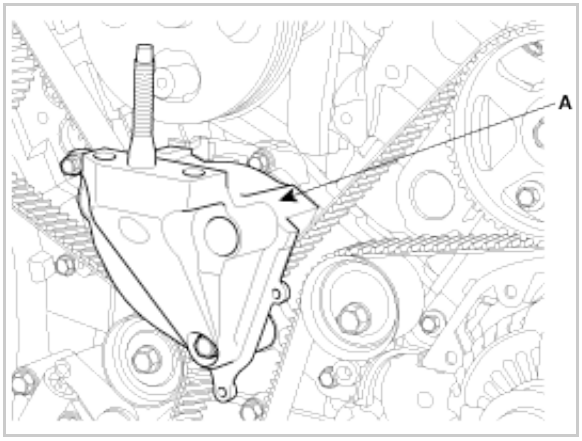
6. Remove the auto tensioner set-pin.
7. Check the tension of the timing belt.
   (1) Turn the crankshaft 2 rev. clockwise which makes the No.1 cylinder piston position at TDC. After 5minutes, measure the length of the projected rod.

   Specification
   5 ~ 7mm(0.1969 ~ 0.2756in.)



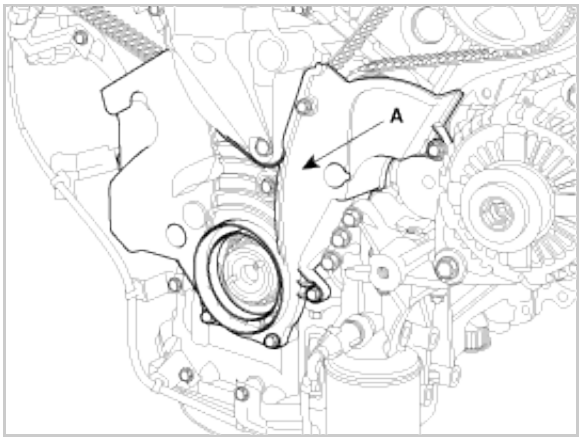
   (2) Ensure the locations of the timing marks for each sprocket.
8. Install the engine support bracket(A).

   Tightening torque
   58.8 ~ 68.6Nm(6.0 ~ 7.0kgf.m, 43.4 ~ 50.6lb-ft)



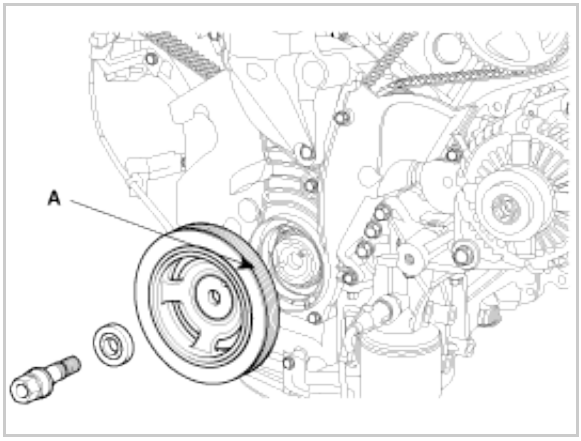
9. Install the timing belt lower cover(A).

   Tightening torque
   9.8 ~ 11.8Nm(1.0 ~ 1.2kgf.m, 7.8 ~ 8.7lb-ft)



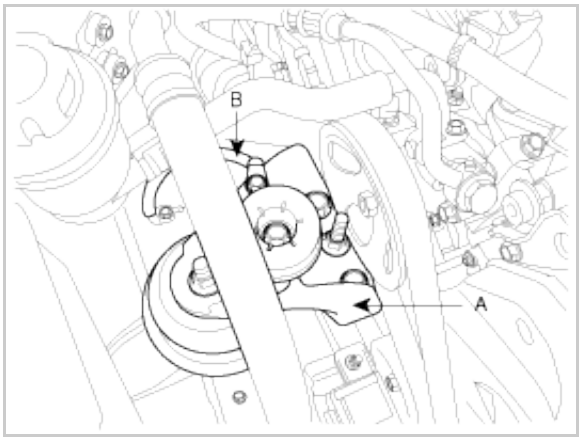
10. Install the crankshaft damper pulley(A).

Tightening torque
166.7 ~ 176.5Nm(17.0 ~ 18.0kgf.m, 123.0 ~ 130.2lb-ft)



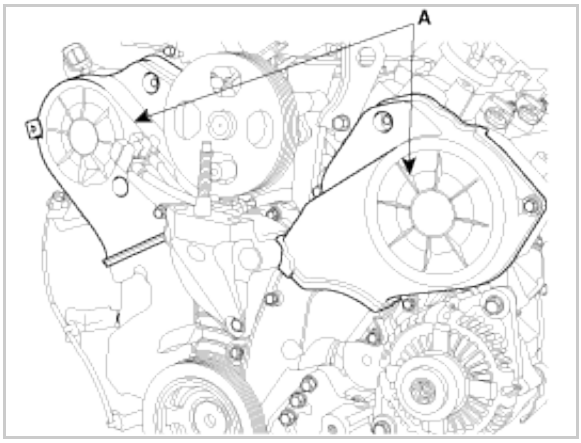
11. Install the engine mounting bracket(A).

Tightening torque
63.7 ~ 83.4Nm(6.5 ~ 8.5kgf.m, 47.0 ~ 61.5lb-ft)



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

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

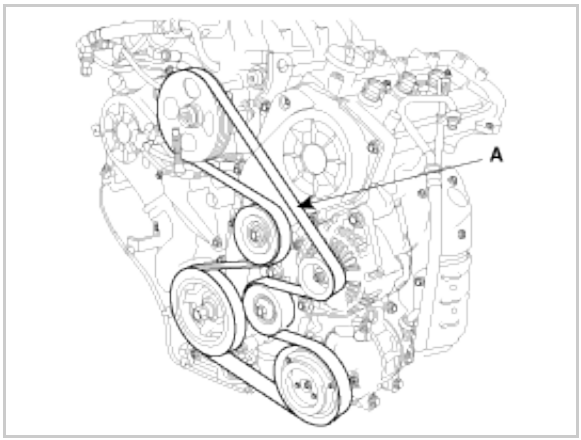


13. Install the drive belt tensioner(C).

Tightening torque
34.3 ~ 53.9Nm(3.5 ~ 5.5kgf.m, 25.3 ~ 39.8lb-ft)

14. Install the drive belt idler and the drive belt(A).

Tightening torque
34.3 ~ 53.9Nm(3.5 ~ 5.5kgf.m, 25.3 ~ 39.8lb-ft)

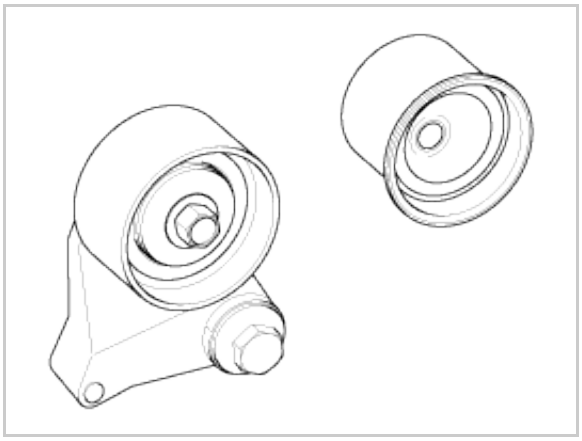


15. Install the right side cover.
16. Install the front right wheel and tire.
17. Install the engine cover.

INSPECTION

SPROCKETS, TENSIONER, IDLER

1. Check the camshaft sprocket and crankshaft sprocket, tensioner pulley and idler pulley for abnormal wear, cracks, or damage. Replace as necessary.
2. Inspect the tensioner and the idler for easy and smooth rotation and check for play or noise. Replace as necessary.



3. Replace the tensioner and the idler if grease is leaked from bearings.

TIMING BELT

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

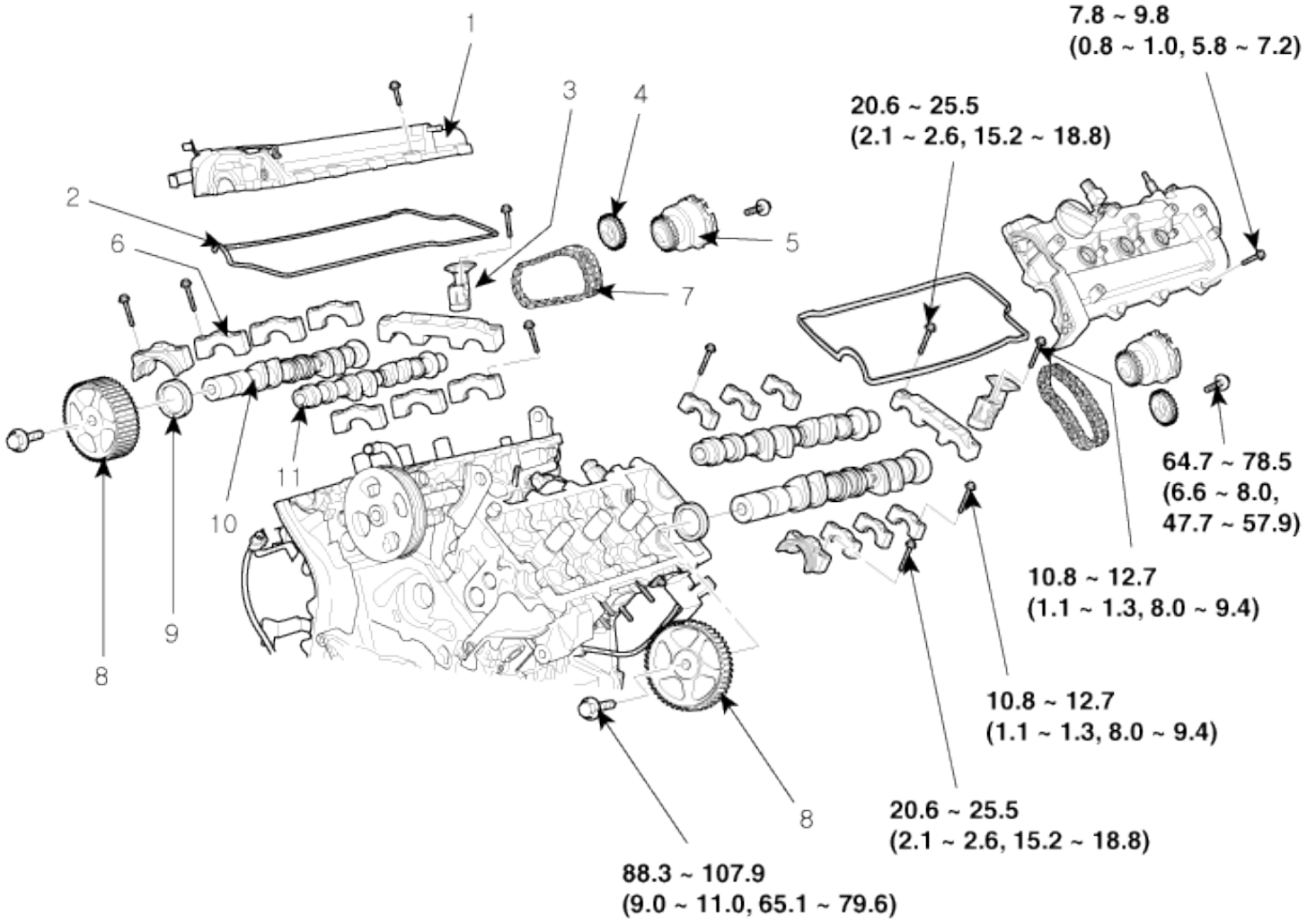
   NOTICE

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

3. Inspect the idler for easy and smooth rotation and check for play or noise.

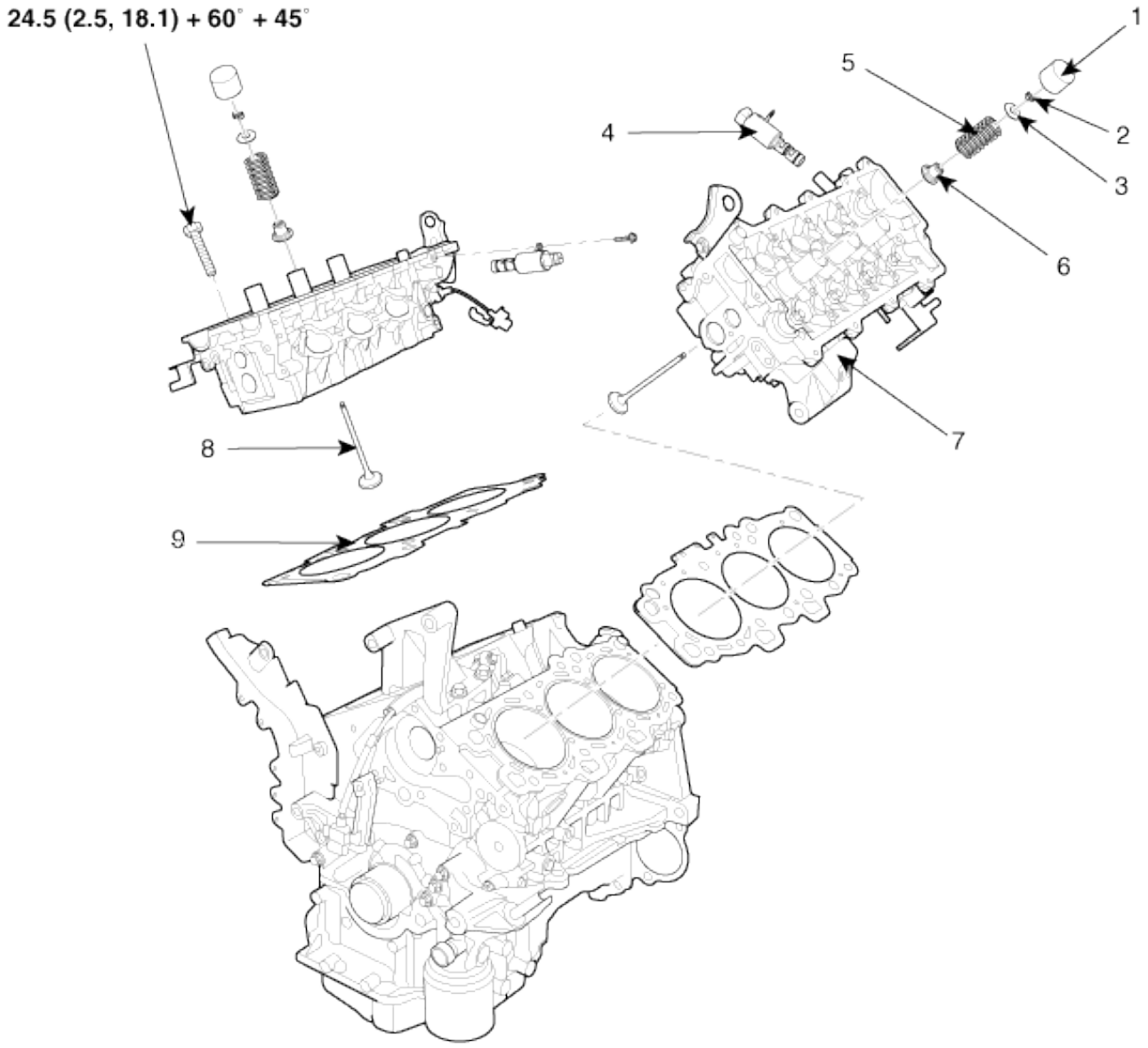
Cylinder Head Assembly

COMPONENTS



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

1. Cylinder head cover
2. Cylinder head cover gasket
3. Timing chain auto tensioner
4. Exhaust camshaft chain sprocket
5. CVVT assembly
6. Camshaft bearing cap
7. Timing chain
8. Exhaust camshaft sprocket
9. Camshaft oil seal
10. Exhaust camshaft
11. Intake camshaft



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

1. MLA(Mechanical Lash Adjuster)
2. Retainer lock
3. Retainer
4. OCV(Oil Control Valve)
5. Valve spring
6. Valve stem seal
7. Cylinder head
8. Valve
9. Cylinder head gasket

REMOVAL

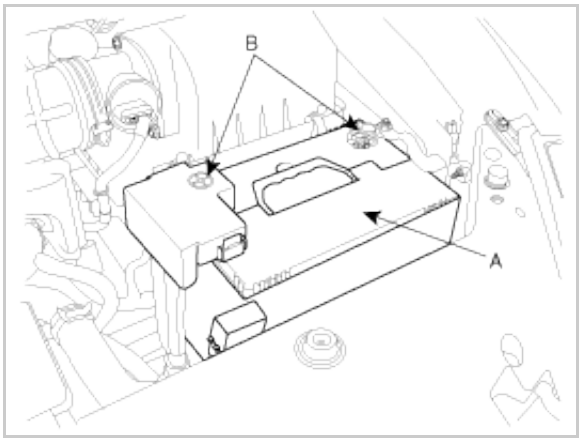
CAUTION

a. Use fender covers to avoid damaging painted surfaces.
b. To avoid damaging the cylinder head, wait until the engine coolant temperature drops below normal temperature before removing it.
c. When handling a metal gasket, take care not to fold the gasket or damage the contact surface of the gasket.
d. To avoid damage, unplug the wiring connectors carefully while holding the connector portion.

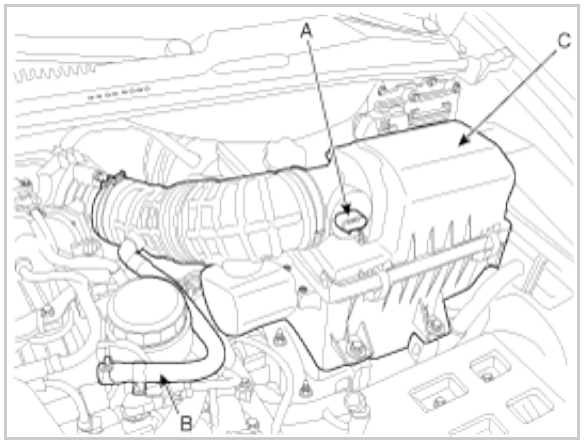
NOTICE

a. Mark all wiring and hoses to avoid misconnection.
b. Turn the crankshaft pulley so that the No. 1 piston is at top dead center.

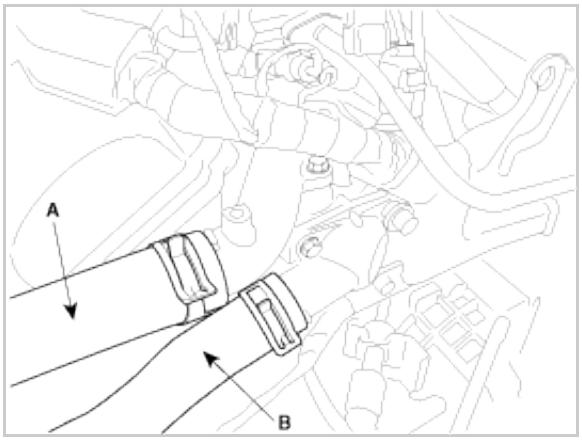
1. Remove the air duct and the battery(A) after disconnecting the terminals(B) from the battery.



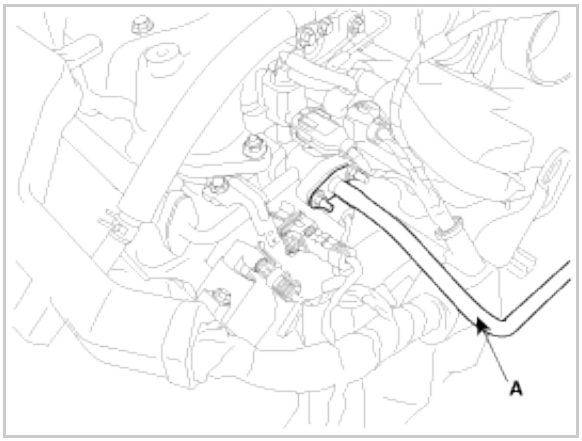
2. Remove the engine cover.
3. Remove the intake air hose and air cleaner assembly.
   (1) Disconnect the MAF connector(A).
   (2) Disconnect the breather hose(B) from air cleaner hose.
   (3) Remove the intake air hose and air cleaner assembly(C).



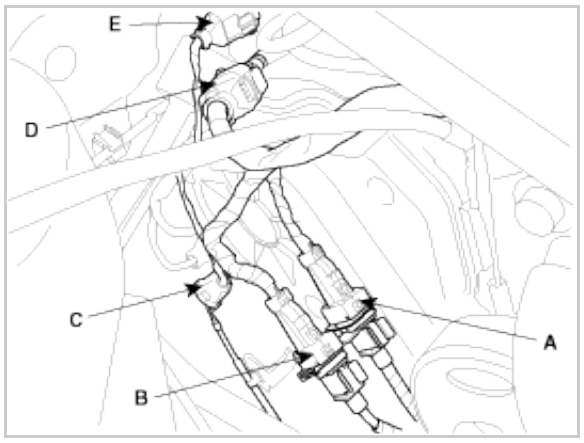
4. Remove the upper radiator hose(A) and lower radiator hose(B).



5. Remove the fuel inlet hose(A) from the delivery pipe.



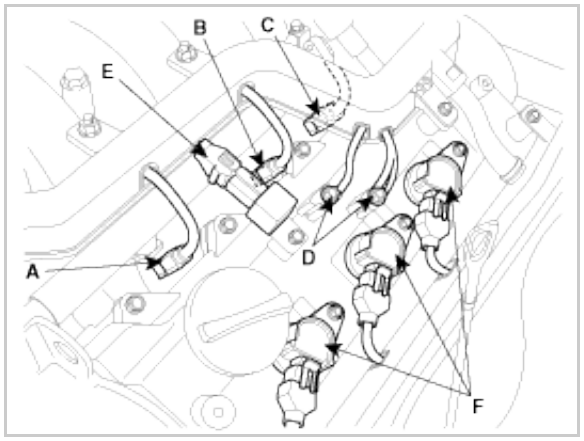
6. Disconnect the engine wiring harness connectors.
   (1) Disconnect the No.1/No.2 knock sensor connectors(A,B), the oil pressure switch connector(C), the ignition coil harness(D) and the No.1 VIS(Variable Induction System) connector(E).



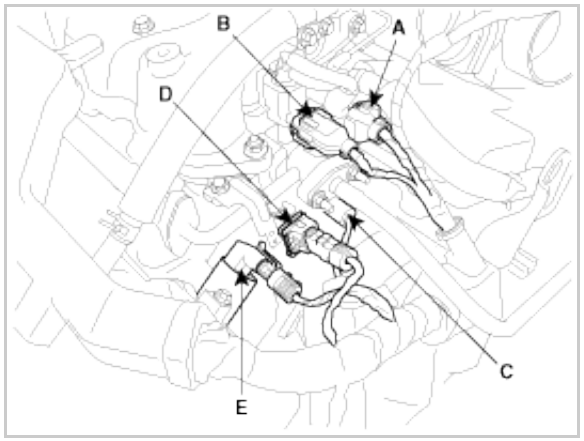
   (2) Disconnect the bank 1 front/rear O2 sensor connectors(A).



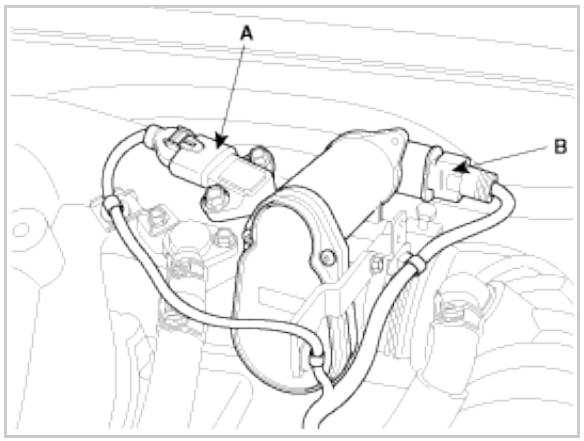
   (3) Disconnect the injection connectors(A,B,C), the ground lines(D), the condensor connector(E) and the Ignition coil connectors(F).

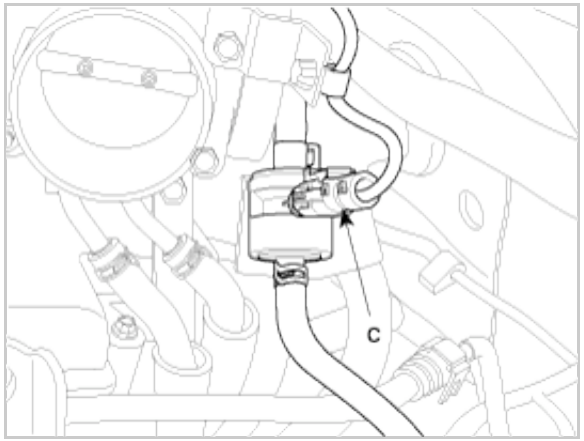


(4) Disconnect the injection harness connector(A), the No.2 VIS(Variable Induction System) connector(B), the No.1/No.2 OCV(Oil Control Valve) connectors(C,D) and the OTS(Oil Temperature Sensor) connector(E).

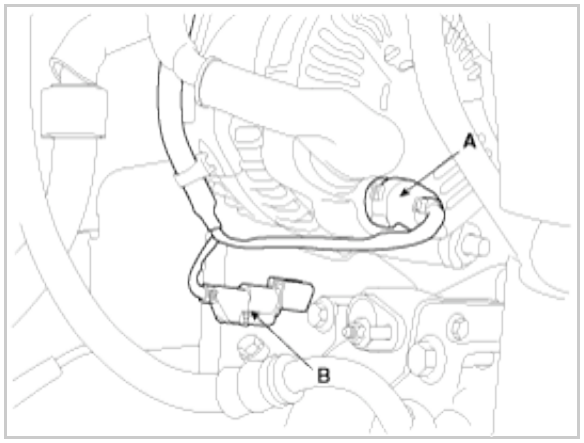


(5) Disconnect the MAPS(Manifold Absolute Pressure Sensor) connector(A), the ETC(Electronic Throttle Control) connector(B) and the PCSV(Purge Control Solenoid Valve) connector(C).

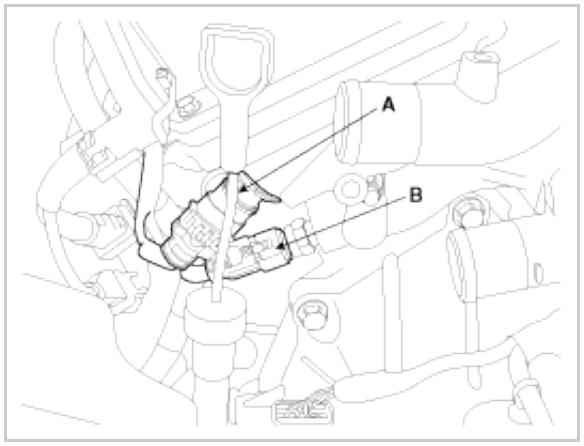




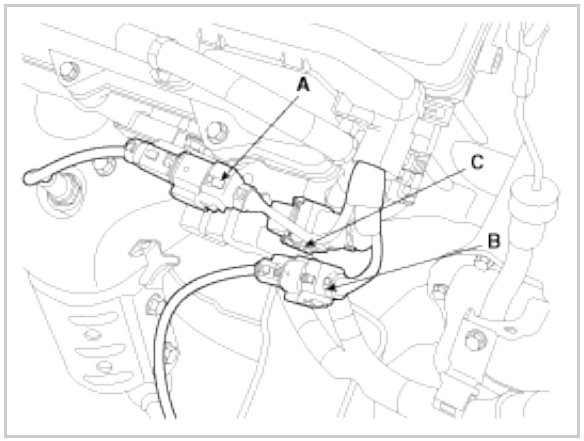
(6) Disconnect the generator connector(A) and the air conditioning compressor connector(B).



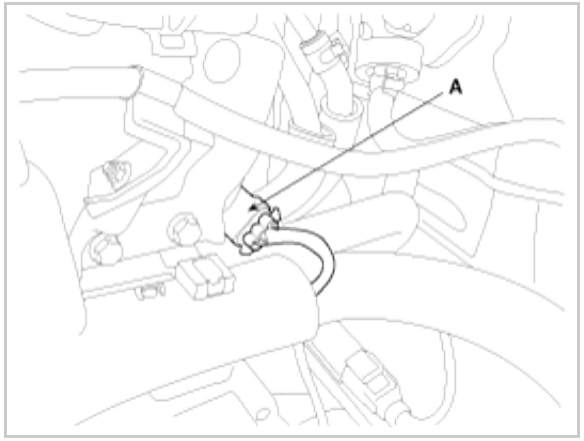
(7) Disconnect the bank 2 CMP sensor connector(A) and the ECT(Engine Coolant Temperature) sensor connector(B).



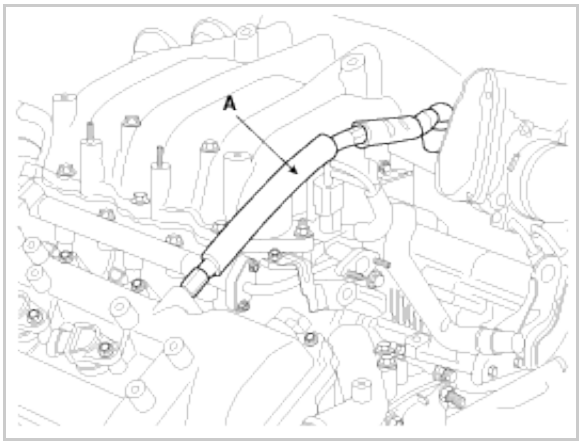
(8) Disconnect the bank 2 front/rear O2 sensor connectors(A,B) and the CKP sensor connector(C).



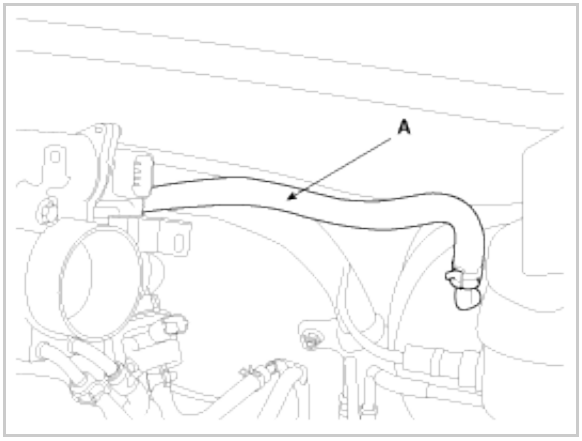
(9) Disconnect the bank 1 CMP sensor connector(A).



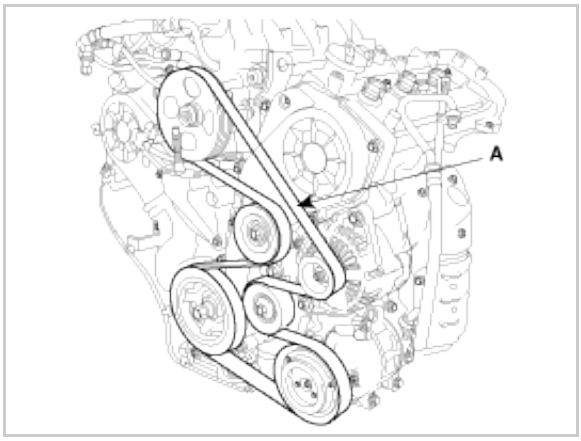
7. Remove the PCV(Pulge Control Valve) hose(A).



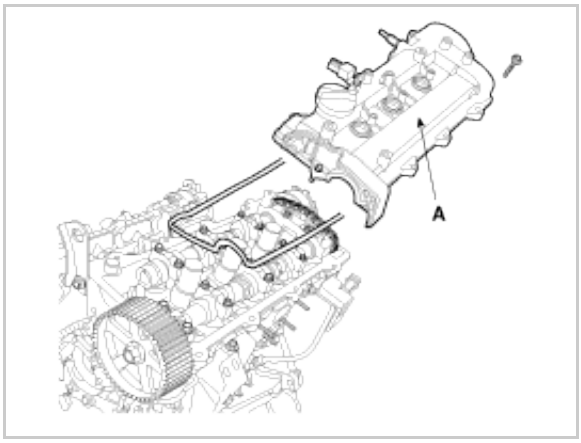
8. Disconnect the brake vaccume hose(A).



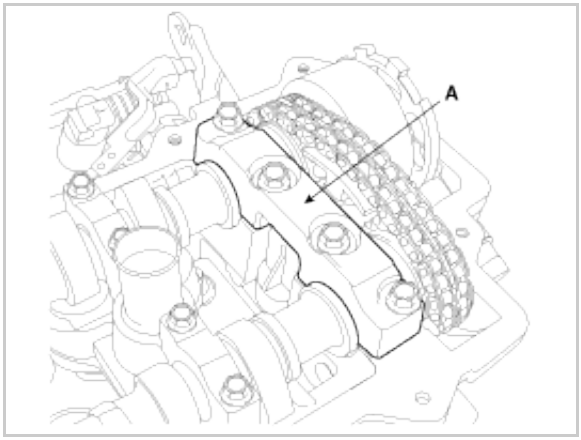
9. Remove the heater hoses.
10. Remove the drive belt(A).



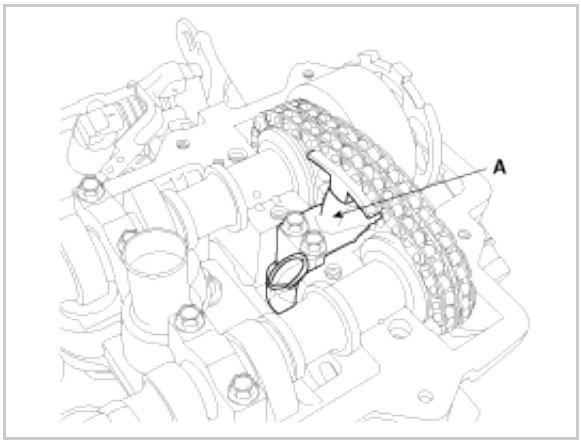
11. Remove the power steering pump.(Refer to 'ST' group).
12. Remove the exhaust manifold assembly.(Refer to 'Intake and exhause system').
13. Remove the intake manifold assembly.(Refer to 'Intake and exhause system').
14. Remove the timing belt.(Refer to 'Timing system').
15. Remove the ignition coils.
16. Remove the water temp. control assembly.
17. Remove the cylinder head cover(A).



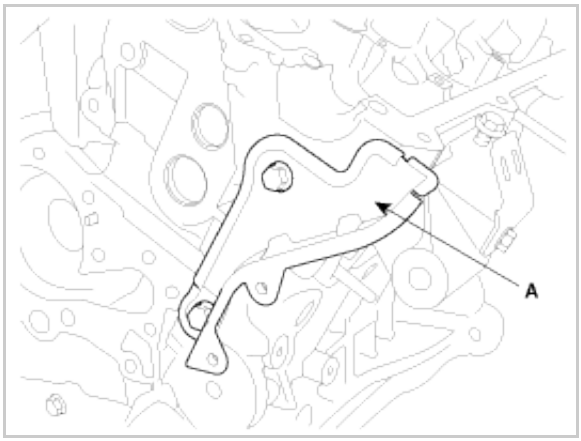
18. Remove the camshaft bearing cap(A).



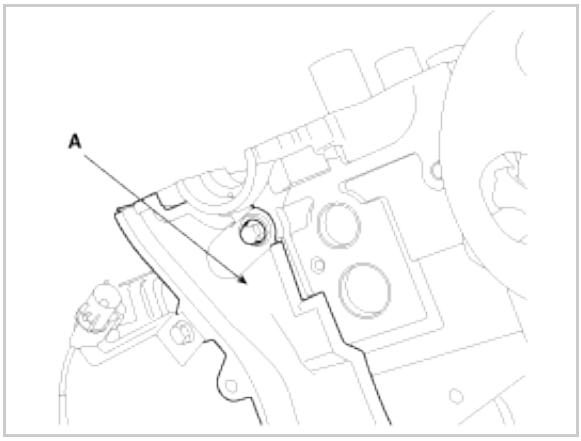
19. Remove the timing chain tensioner(A).



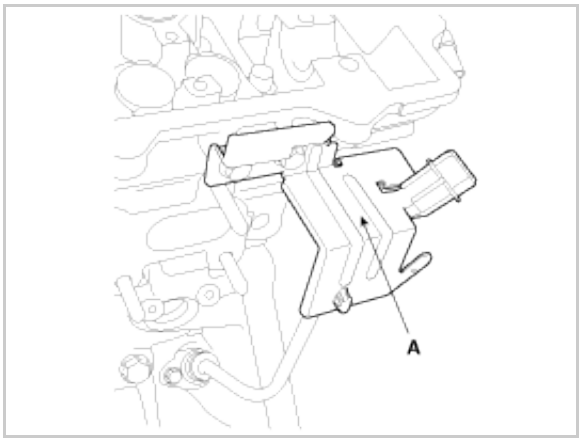
20. Remove the camshaft.
21. Remove the bank 2 timing belt rear cover(A).



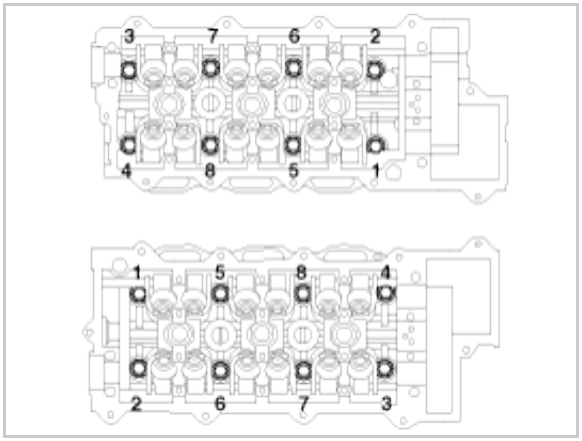
22. Remove the bank 1 timing belt rear cover(A).



23. Remove the CKP sensor connector bracket(A).



24. Remove the cylinder head assembly.
    (1) Remove the bolts in 2~3 steps as following orders.



> **CAUTION**
>
> If the bolts are not removed as the order, the deformation of the head assembly can be occurred.

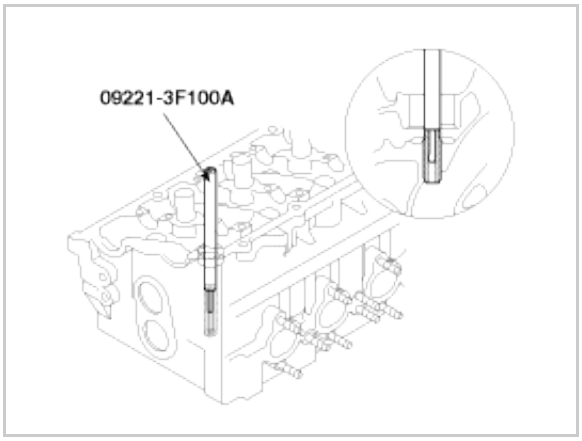
    (2) Put the cylinder head assembly on a wooden block after removal from the cylinder block.

> **CAUTION**
>
> Ensure that the surface between the cylinder head and the block is not damaged.

REPLACEMENT

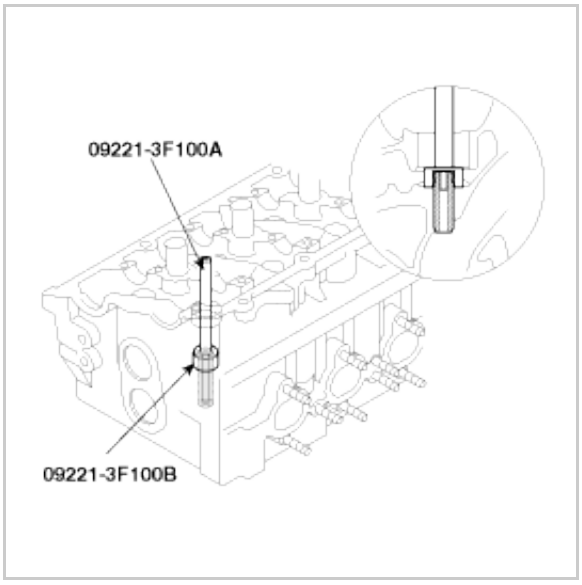
Valve guide

1. Using the SST(09221-3F100A), remove the valve guide from the downside of the cylinder head assembly.



2. Reprocess the valve guide hole for the oversized valve guide newly installed.
3. Using the SST(09221-3F100A/B), insert the valve guide in the upside of the cylinder head assembly. Be aware of the difference in length between the intake and the exhaust valve guides.

Specification
Intake valve guide: 45.8 ~ 46.2mm(1.8031 ~ 1.8189in.)
Exhaust valve guide: 46.8 ~ 47.2mm(1.8425 ~ 1.8583in.)



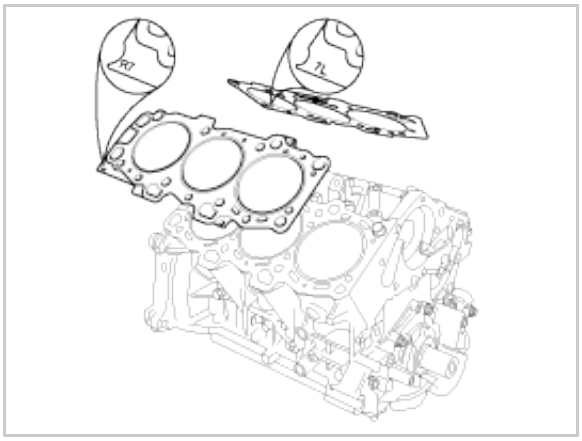
4. After installing the valve guides, insert new valves and check the clearance between the valve stems and the valve guides.
5. After replacing the valve guides, check if they are properly installed with the valve seats. Reprocess valve seats if necessary.

INSTALLATION

NOTICE

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

1. After putting the cylinder head gasket on the cylinder block, install the cylinder head.



CAUTION

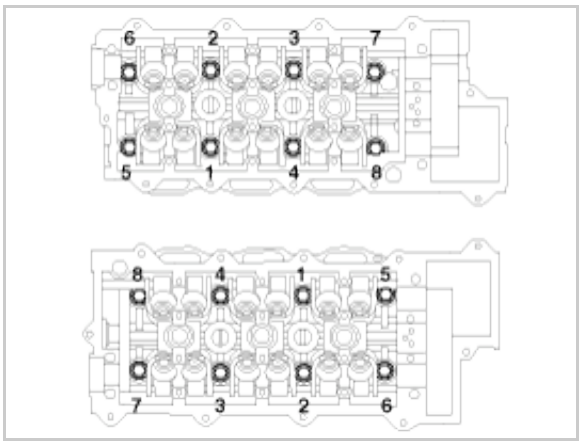
Ensure the LH/RH classification of the cylinder head gasket when installing.

2. Tighten the cylinder head bolts with the plain washers in several steps as following order.

NOTICE

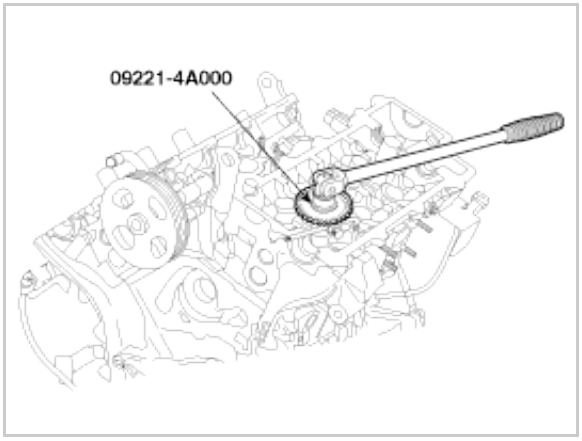
a. In assembling washers, the marked surface should face upward.
b. In installing the cylinder head bolts, apply engine oil on the thread of the bolts and the surface of the washers.

Tightening torque
22.6~26.5Nm(2.3~2.7kgf.m, 16.6~19.5lb-ft) + (60° + 2°) + (45° + 2°)



NOTICE

Using the SST(09221-4A000), tighten the bolts which need to be tightened with the angular tightening method.



3. Install the CVVT assembly and camshaft chain sprocket with the dowel pin in the CVVT installed to the intake

camshaft. Ensure that the pin will not be installed in the hole for oil feeding.

Tightening torque
66.7~78.5Nm(6.8~8.0kgf.m, 49.2~57.9lb-ft)

NOTICE

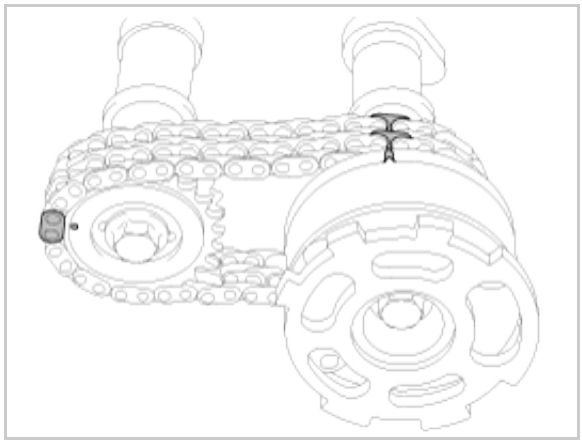
After tightening the CVVT bolts, rotate the CVVT assembly housing counterclockwise by hand to seat the lock pin in the CVVT assembly in good position.

CAUTION

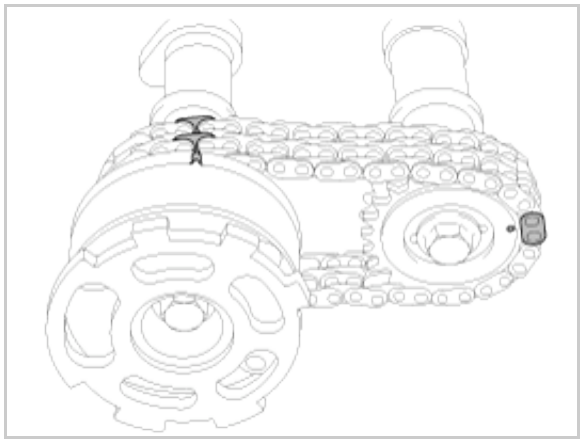
Fix the hexagonal part of the camshaft in a vice when tightening the CVVT bolts. Do not fix the CVVT housing or sprocket in a vice.

4. Install the camshaft in the cylinder head assembly.
   (1) Align the timing mark of the camshaft timinig chain.

LH camshaft chain timing mark



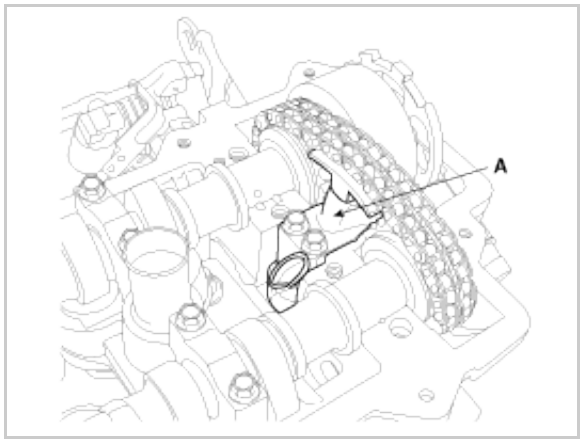
RH camshaft chain timing mark



CAUTION

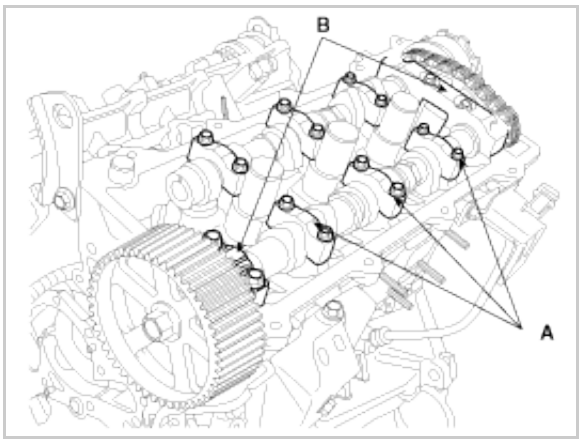
Both timing marks should face upward in reassemby.

5. Install the timing chain tensioner.
   (1) Insert the set pin by pressing the timing chain tensioner.
   (2) Install the chain tensioner(A) in the cylinder head assembly.



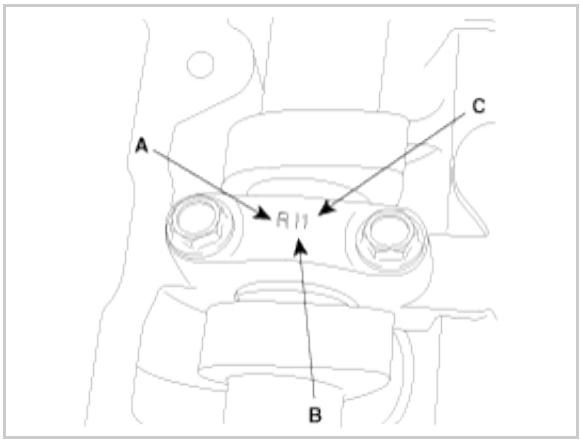
6. Install the camshaft bearing caps.

Tightening torque
Bearing cap bolt(A: 6×38) - 10.8~12.7Nm(1.1~1.3kgf.m, 8.0~9.4lb-ft)
Bearing cap bolt(B: 8×38) - 20.6~22.5Nm(2.1~2.6kgf.m, 15.2~18.8lb-ft)



NOTICE

When installing the bearing caps, check the marks on them as shown below and install them in its proper position.

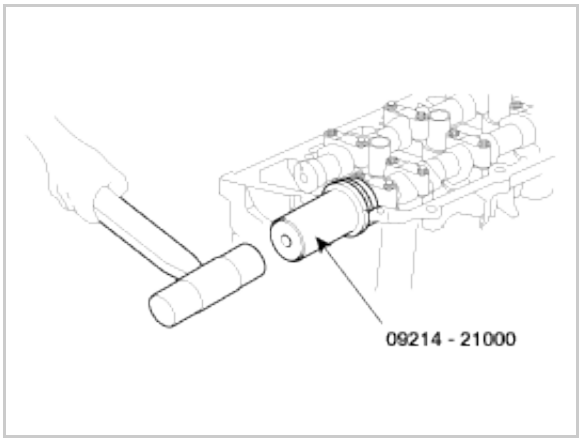


A(LH/RH HEAD): L(LH), R(RH)
B(Intake/Exhaust): I(Intake), E(Exhaust)
C(Cap no.): 1,2,3

CAUTION

When installing the bearing caps, turn the crankshaft to place a piston in the middle of the block because linterference between valves and pistons can occur.

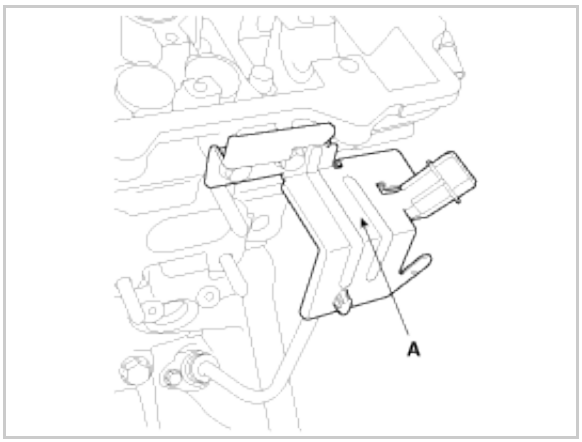
7. Using the SST(09214-21000), install the camshaft oil seal.



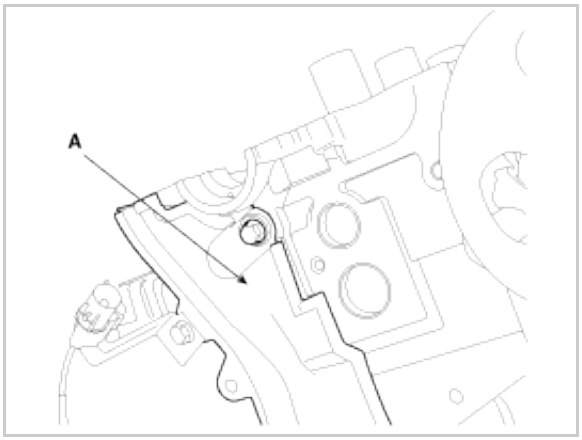
NOTICE

a. Befor installing, apply engine oil.
b. The camshaft cap surface should adhere to the cylinder head assembly.
c. Do not press an eccentric load.

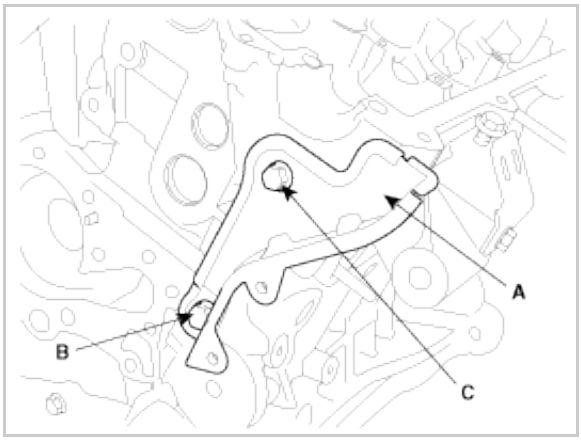
8. Install the CKP sensor connector bracket(A).



9. Install the bank 1 timing belt rear cover(A).



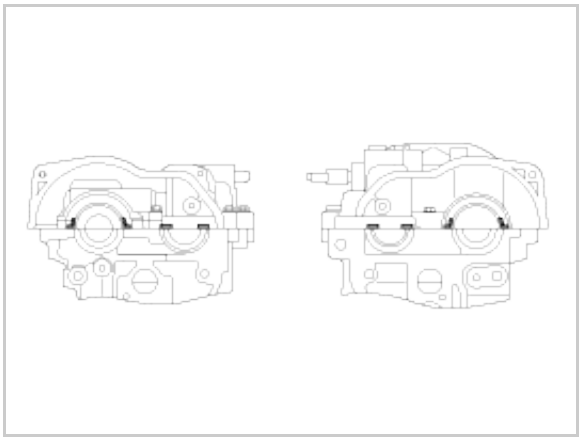
10. Install the bank 2 timing belt rear cover(A).



NOTICE

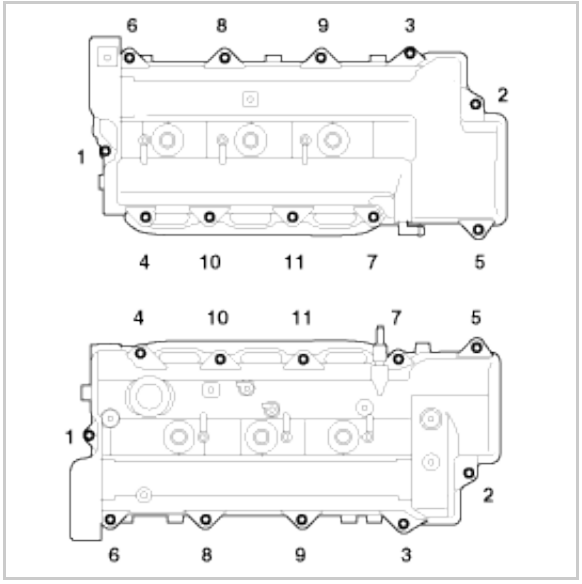
The length of the bolt(B) is longer than that of the bolt(C).

11. Install the timing belt.(Refer to 'Timing system').
12. Check and adjust the valve clearance.
13. Install the cylinder head cover.
    (1) Remove oil, dust or sealant on the upper surface of the cylinder before assembling cylinder head cover.
    (2) Assemble the cylinder head cover in five minites after applying liquid gasket(LOCTITE 5900) on the camshaft cap and packing part.



    (3) Tighten the cylinder head cover bolts as following order(A).

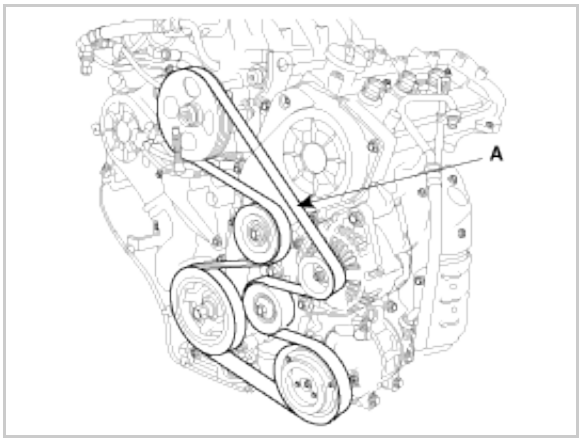
Tightening torque
7.8~9.8Nm(0.8~1.0kgf.m, 5.8~7.2lb-ft)



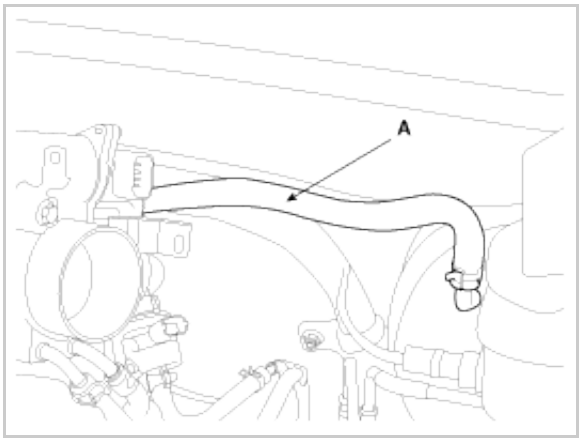
NOTICE

a. Do not start engine for thirty minites after assembling the cylinder head cover.
b. Do not reuse the cylinder head cover gasket.

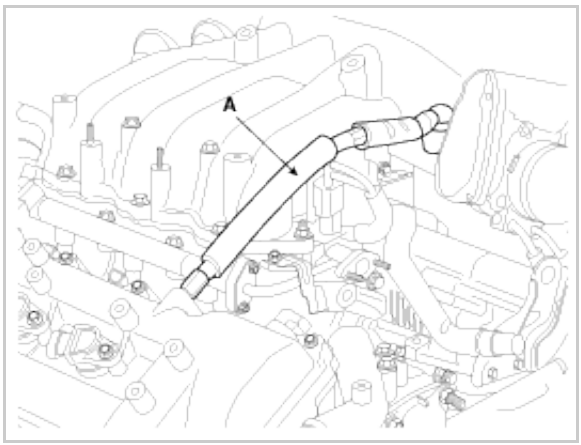
14. Install the water temp. control assembly.
15. Install the intake manifold assembly.
16. Install the exhaust mainfold assembly.
17. Install the power steering pump.(Refer to 'ST' group).
18. Install the drive belt(A).



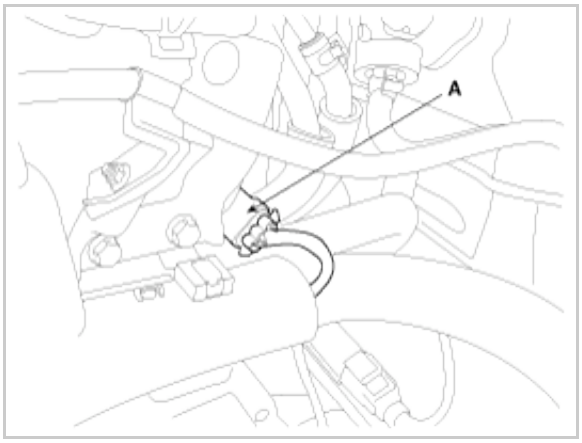
19. Install the heater hose.
20. Connect the brake vaccume hose(A).



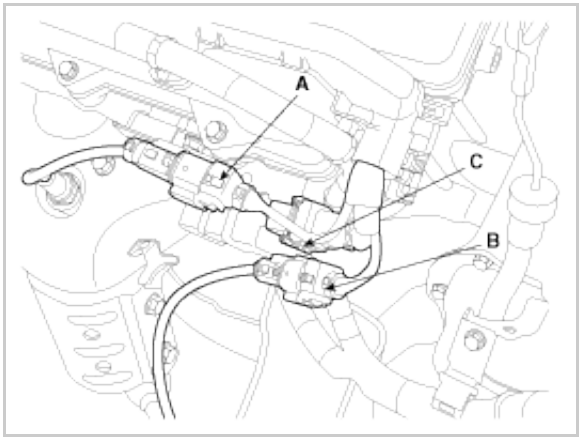
21. Install the PCV(Pulge Control Valve) hose(A).



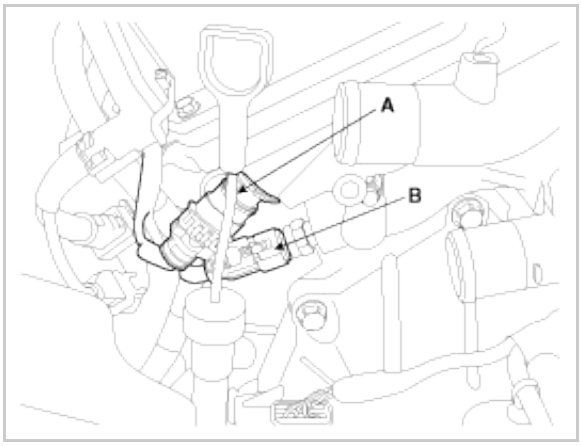
22. Connect the engine wiring harness connectors.
    (1) Connect the bank 1 CMP sensor connector(A).



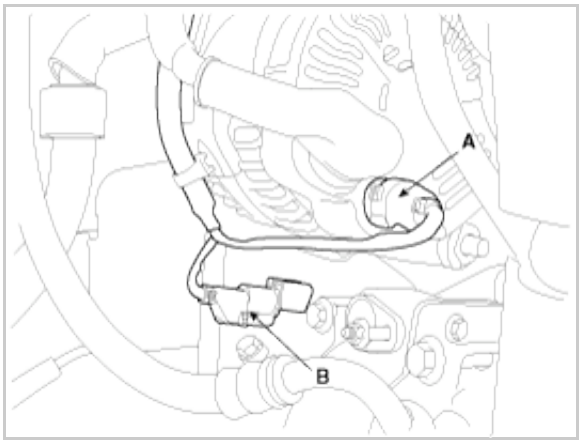
(2) Connect the bank 2 front/rear O2 sensor connectors(A,B) and the CKP sensor connector(C).



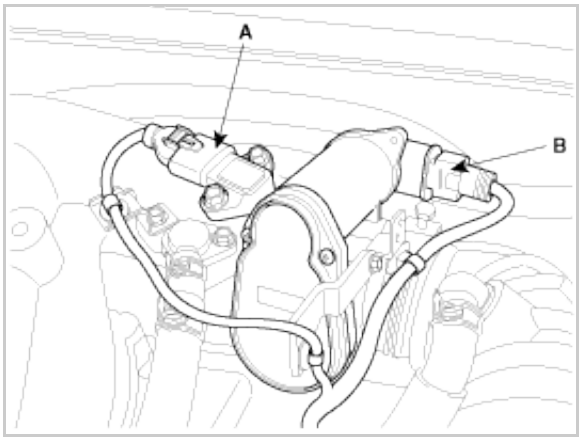
(3) Connect the bank 2 CMP sensor connector(A) and the WTS(Water Temperature Sensor) connector(B).

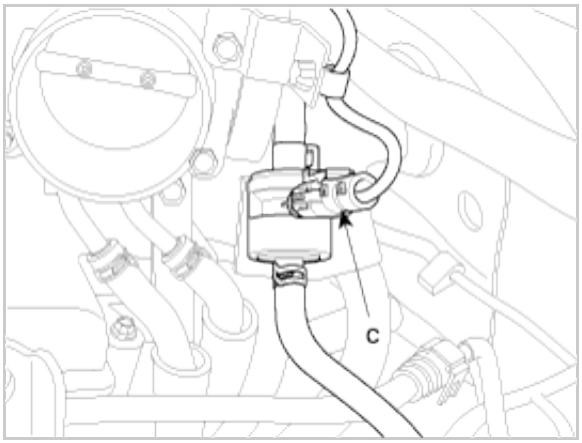


(4) Connect the generator connector(A) and the air conditioning compressor connector(B).

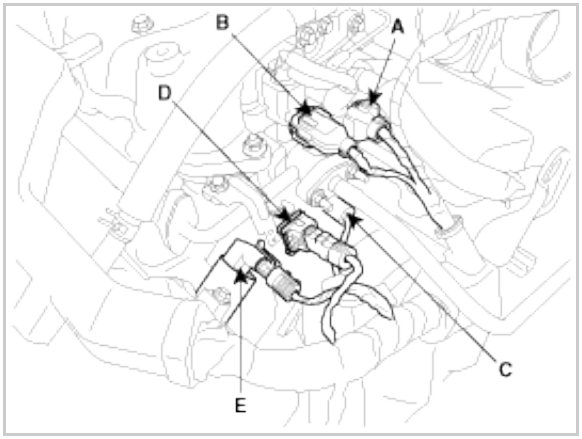


(5) Connect the MAPS(Manifold Absolute Pressure Sensor) connector(A), the ETC(Electronic Throttle Control) connector(B) and the PCSV(Purge Control Solenoid Valve) connector(C).

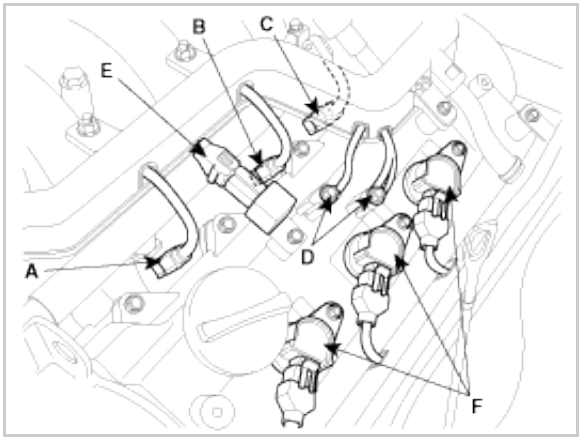




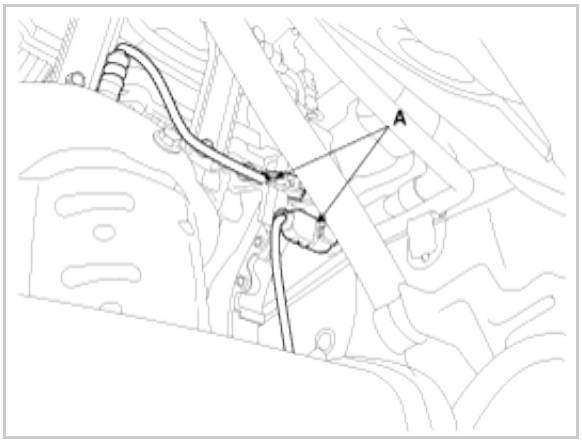
(6) Connect the injection harness connector(A), the No.2 VIS(Variable Induction System) connector(B), the No.1/No.2 OCV(Oil Control Valve) connectors(C,D) and the OTS(Oil Temperature Sensor) connector(E).



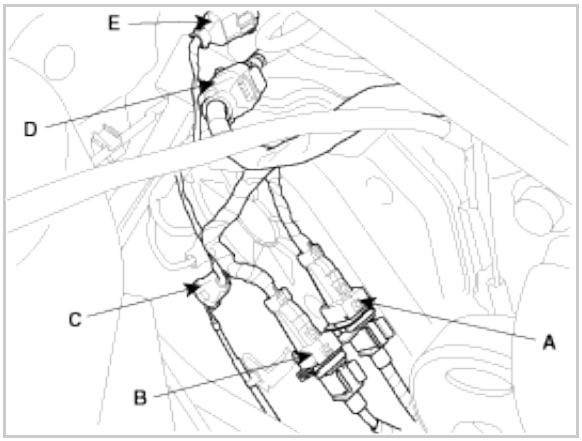
(7) Connect the injection connectors(A,B,C), the ground lines(D), the condensor connector(E) and the Ignition coil connectors(F).



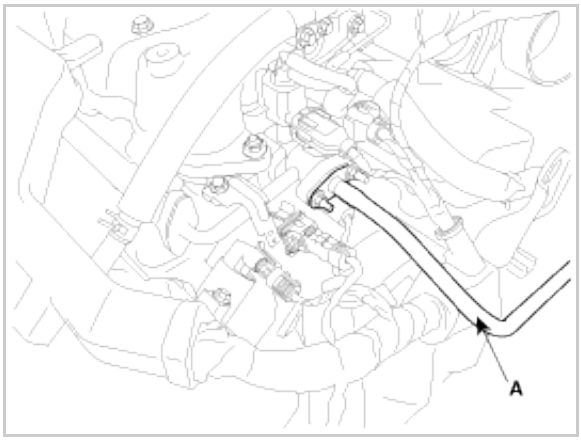
(8) Connect the bank 1 front/rear O2 sensor connectors(A).



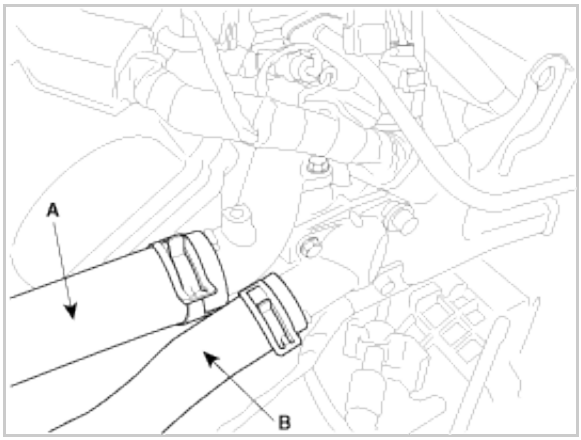
(9) Connect the No.1/No.2 knock sensor connectors(A,B), the oil pressure switch connector(C), the ignition coil harness(D) and the No.1 VIS(Variable Induction System) connector(E).



23. Install the fuel inlet hose(A) from the delivery pipe.



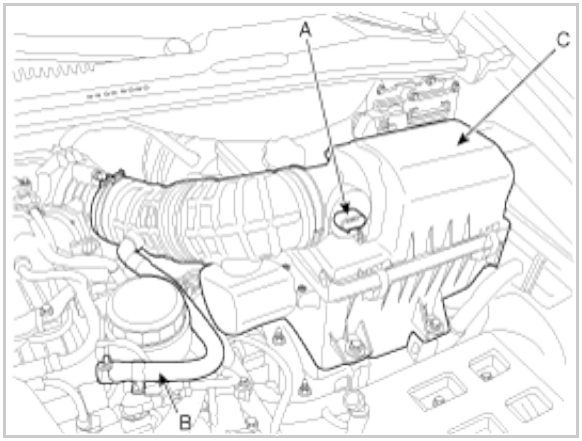
24. Install the upper radiator hose(A) and lower radiator hose(B).



25. Install the intake air hose and air cleaner assembly.
    (1) Install the intake air hose and air cleaner assembly(C).

(2) Connect the breather hose(B) from air cleaner hose.

(3) Connect the MAF connector(A).



26. Install the engine cover.

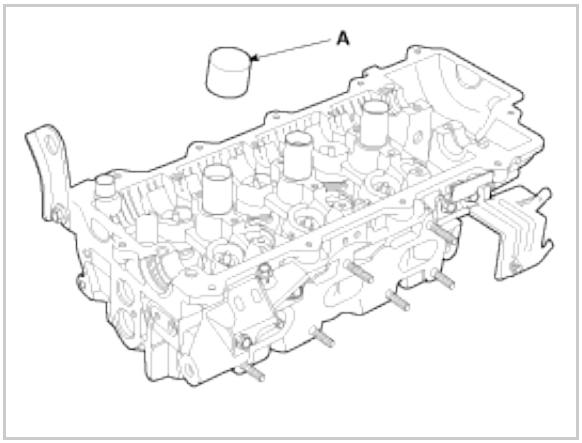
27. Refill engine coolant.

DISASSEMBLY

NOTICE

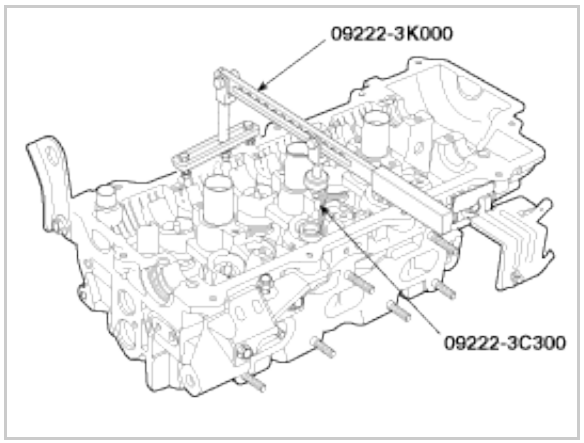
Identify MLA(Mechanical Lash Adjuster), valves and valve springs as they are removed so that each item can be reinstalled in its original position.

1. Remove MLA(Mechanical Lash Adjuster)s(A).



2. Remove valves.

(1) Using SST(09222-3K000, 09222-3C300), compress the valve spring and remove retainer lock.

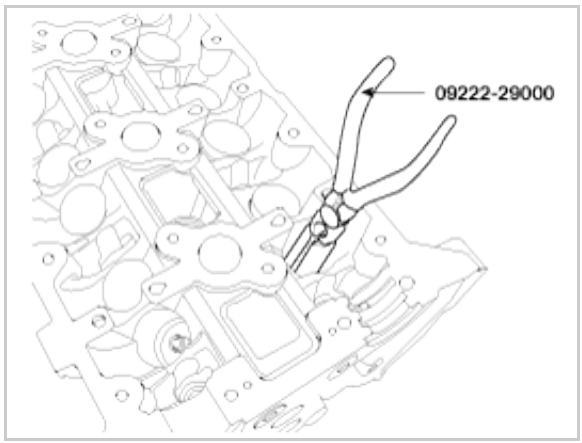


(2) Remove the spring retainer.

(3) Remove the valve spring.

(4) Remove the valve.

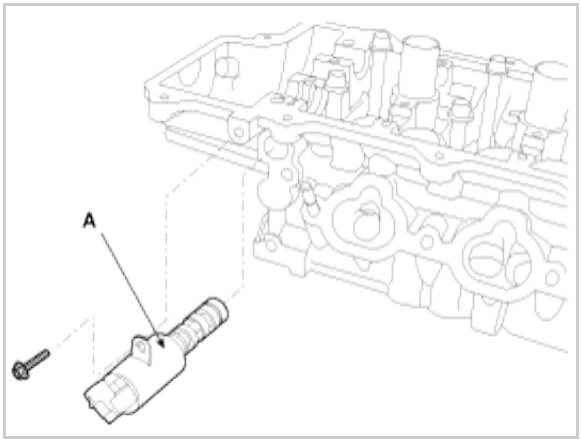
(5) Using SST(09222-29000), remove the valve stem seal.



NOTICE

Do not reuse the removed valve stem seals.

3. Remove OCV(Oil Control Valve)(A).

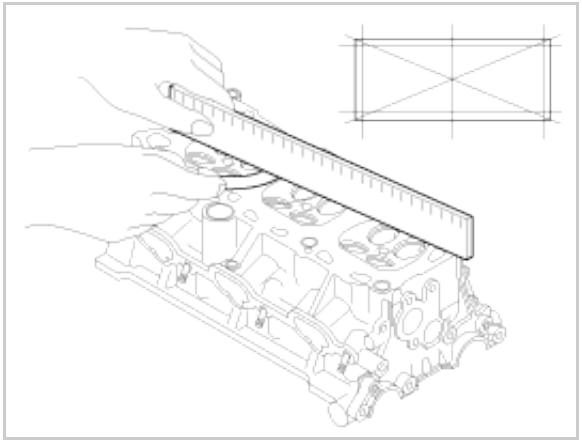


INSPECTION

CYLINDER HEAD

1. Inspect for flatness.
   Using a precision straight edge and feeler gauge, measure the surface contacting cylinder block and the manifolds for warpage.

   Flatness of cylinder head gasket surface
   Standard : 0.03mm(0.0012in.) or less
   Flatness of manifold gasket surface
   Standard : 0.15mm(0.0059in.) or less



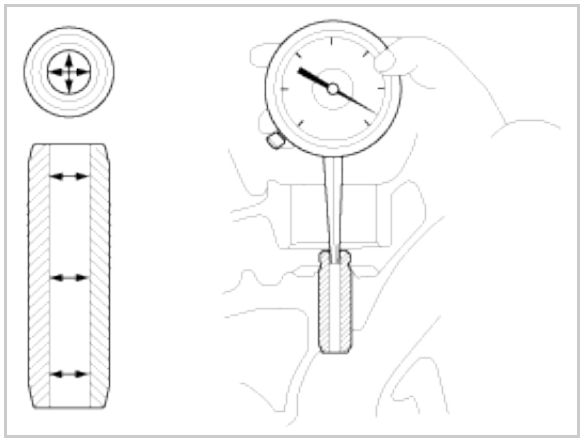
2. Inspect for cracks.

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

VALVE AND VALVE SPRING

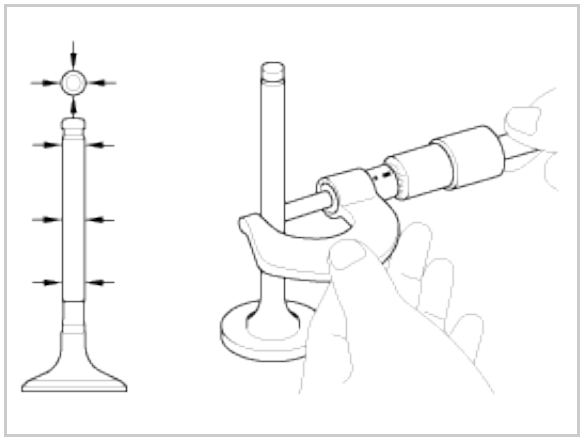
1. Inspect valve stems and valve guides.
   (1) Using a caliper gauge, measure the inside diameter of the valve guide.

Valve guide inside diameter
Intake / Exhaust : 6.000 ~ 6.015mm (2.2362 ~ 2.2368in.)



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

Valve stem outer diameter
Intake : 5.585 ~ 5.980mm (0.2348 ~ 0.2354in.)
Exhaust : 5.950 ~ 5.595mm (0.2343 ~ 0.2348in.)



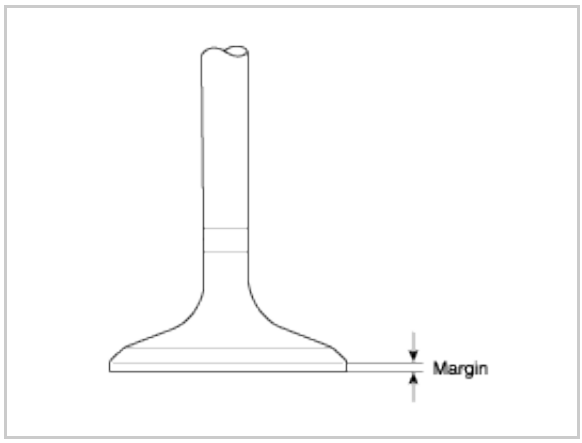
   (3) Calculate the clearance between the valve guides and the stems by difference between the valve stem measured diameter and the valve guide measured inside diameter.

Valve stem-to-guide clearance
[Standard]
Intake : 0.020 ~ 0.050mm (0.0008 ~ 0.0020in.)
Exhaust : 0.035 ~ 0.065mm (0.0014 ~ 0.0026in.)
[Limit]
Intake : 0.10mm (0.0039in.) or less
Exhaust : 0.13mm (0.0051in.) or less

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

If the margin thickness is less than the specification, replace the valve.

Specification
Intake : 1.0mm(0.0394in.)
Exhaust : 1.3mm(0.0512.)



(4) Check the valve length.

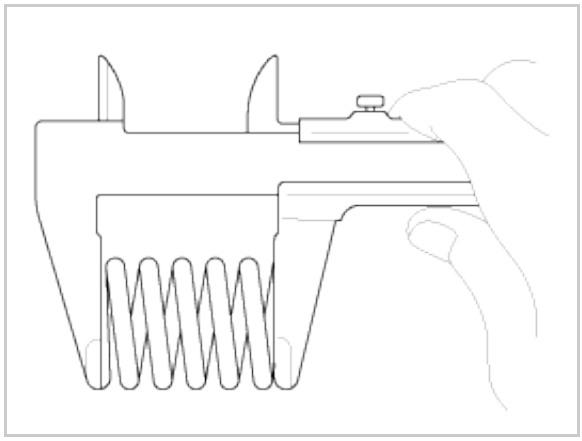
Length
Intake : 110.1mm(4.3346in)
Exhaust : 111.1mm(4.3740in)

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

3. Inspect valve seats
(1) Check the valve seat for evidence of overheating or improper contact with the valve face.
If the valve seat is worn, replace cylinder head.
(2) Before reconditioning the seat, check the valve guide for wear. If the valve guide is worn, replace the valve guide first.
(3) Recondition the valve seat with a valve seat grinder or cutter. The valve seat contact width should be within specifications and centered on the valve face.

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

Valve spring
[Standard]
Free height : 46.8mm (1.8425in.)
Out-of-square : 1.5° or less



MLA(Mechanical Lash Adjuster)

1. Inspect MLA.
   Using a micrometer, measure the MLA outside diameter.

   MLA O.D.
   Intake/Exhaust : 29.964 ~ 29.980mm(1.1797 ~ 1.1803in.)

2. Using a caliper gauge, measure MLA tappet bore inner diameter of cylinder head.

   Tappet bore I.D.
   Intake/Exhaust : 30.000 ~ 30.025mm(1.1811 ~ 1.1821in.)

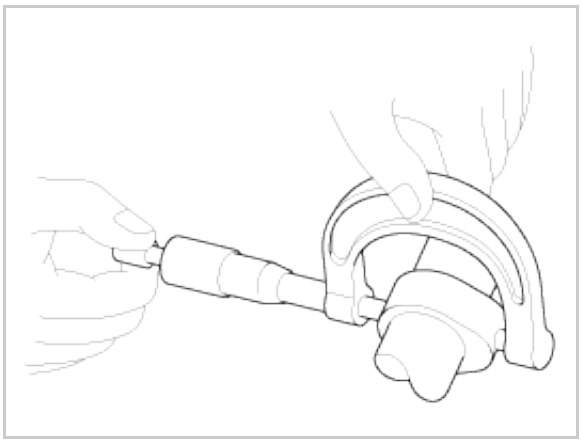
3. Calculate the clearance by subtracting MLA outside diameter measurement from tappet bore inside diameter measurement.

   MLA to tappet bore clearance
   [Standard]
   Intake/Exhaust : 0.020 ~ 0.061mm(0.0008 ~ 0.0024in.)
   [Limit]
   Intake/Exhaust : 0.07mm(0.0027in.) or less

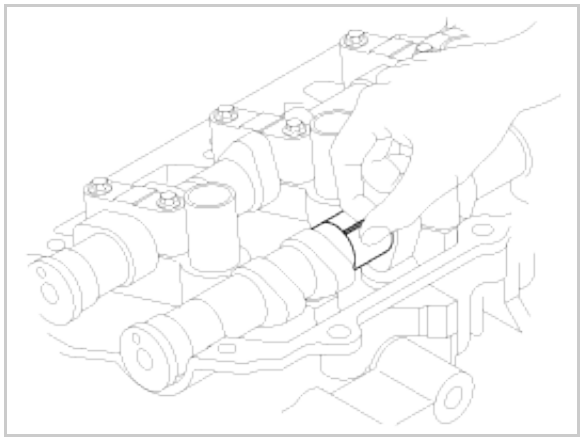
CAMSHAFT

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

   Cam height
   [Standard value]
   Intake : 44.5mm (1.7520in.)
   Exhaust : 44.5mm (1.7520in.)

   If the cam lobe height is less than standard, replace the camshaft.
2. Check the cam lobe surface for wear or damage. If necessary, replace it.
3. Inspect camshaft journal clearance.
   (1) Clean the bearing caps and camshaft journals.
   (2) Place the camshafts on the cylinder head.
   (3) Lay a strip of plastigage across each of the camshaft journals.



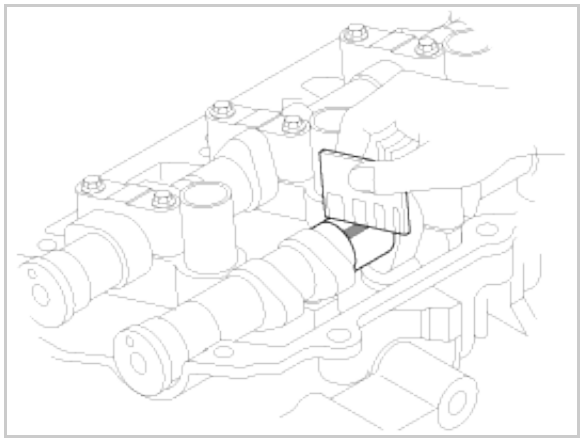
(4) Install the bearing caps with the tightening torque.

> **CAUTION**
>
> Do not turn the camshaft.

(5) Remove the bearing caps.

(6) Measure the plastigage at its widest point.

Bearing oil clearance
[Standard value]
Intake : 0.020 ~ 0.057mm (0.0008 ~ 0.0022in.)
Exhaust : 0.020 ~ 0.057mm (0.0008 ~ 0.0022in.)



If the oil clearance is greater than the maximum, replace the camshaft. If necessary, replace the cylinder head.

(7) Completely remove the plastigage.

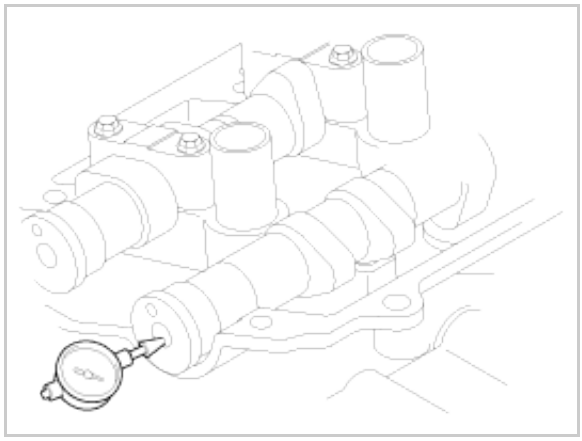
(8) Remove the camshafts.

4. Inspect camshaft end play.

(1) Install the camshafts.

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

Camshaft end play
[Standard value] : 0.05 ~ 0.15mm(0.0020 ~ 0.0059in.)



If the end play is greater than the maximum, replace the camshaft. If necessary, replace the cylinder head.

(3) Remove the camshafts.

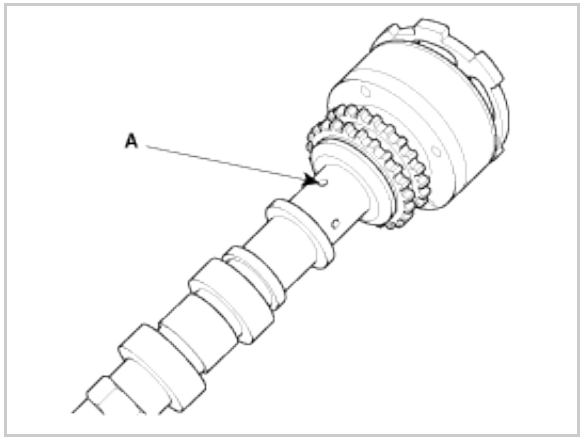
CVVT ASSEMBLY

1. Inspect CVVT assembly.

(1) Fix the CVVT assembly with a vice. Ensure that the cam lobe and journal is not damaged.

(2) Check that the CVVT assembly will not turn.
It should not be turned.

(3) Apply vinyl tape to the retard hole except the one(A) indicated by the arrow in the illustration.



(4) Wind tape around the tip of the air gun and apply air of approx. 150kpa(1.5kgf/cm², 21psi) to the port of the camshaft.
(Perform this in order to release the lock pin for the maximum delay angle locking.)

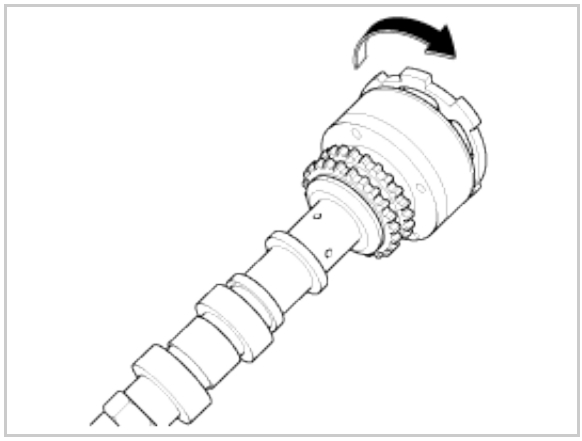
> NOTICE
>
> When the oil splashes, wipe it off with a shop rag.

(5) After the lock pin released, the CVVT assembly can turned in advanced direction.
If the air applied is leaked much, the lock pin can not be 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 resistance to movement.

Standard: Movable smoothly in the range about 60°

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

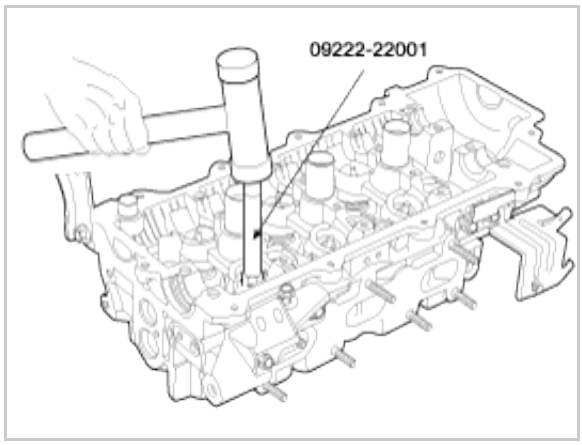


REASSEMBLY

NOTICE

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

1. Install valves.
(1) Using SST(09222-22001), push in a new valve stem seal with applying engine oil.



NOTICE

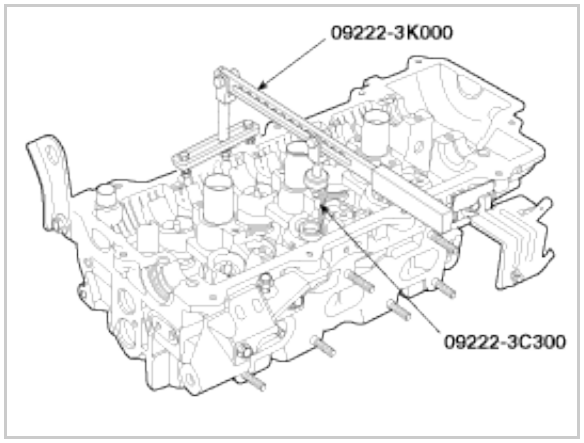
a. Do not reuse old valve stem seals.
Incorrect installation of the seal could result in oil leakage past the valve guides.
b. Reassemble the valve stem seals

(2) After applying engine oil on the outer surface of each valve stem, insert the valve in the valve guide. Install the valve, valve spring and spring retainer.

NOTICE

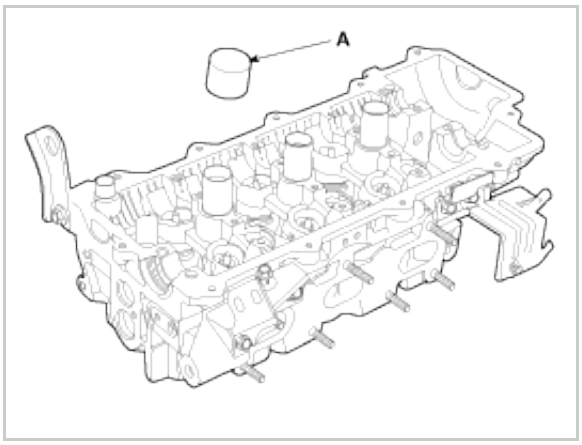
When installing valve springs, the side coated with enamel should face toward the valve spring retainer

(3) Using the SST(09222 - 3K000, 09222-3C300), compress the springs and install the retainer locks. After installing the valves, ensure that the retainer locks are correctly in place before releasing the valve spring compressor.



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

2. Install MLAs with engine oil applied on its surface.
Check that the MLA rotates smoothly by hand.

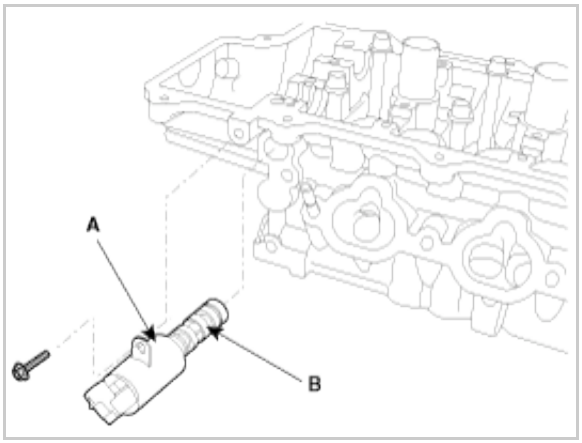


NOTICE

MLA should be reinstalled in its original position.

3. Install OCV(Oil Control Valve)(A).

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



NOTICE

a. To install OCV with gray colored connector into RH bank.
b. To install OCV with black colored connector into LH bank.

CAUTION

a. Do not reuse the OCV when dropped.
b. Keep clean the OCV.
c. Do not hold the OCV sleeve during servicing.
d. When the OCV is installed on the engine, do not move the engine while holding the OCV yoke.
e. If there is dust on the filter(B) of the OCV, clean it all.

Engine
And
Transaxle Assembly

REMOVAL

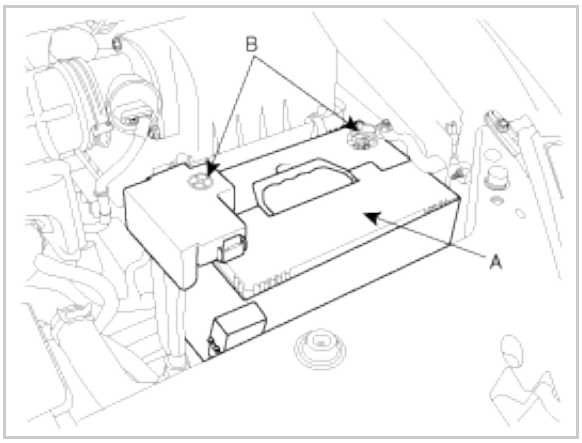
CAUTION

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

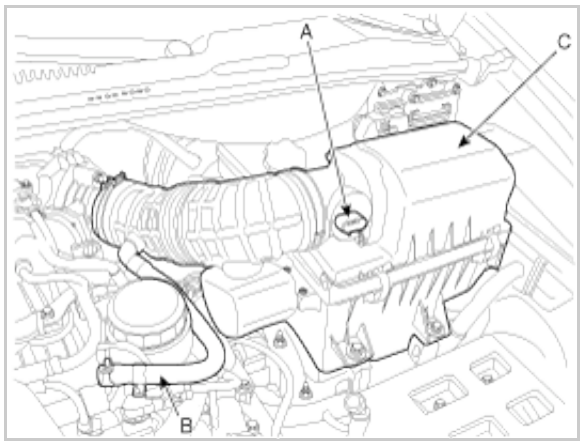
NOTICE

a. Mark all wiring and hoses to avoid misconnection.

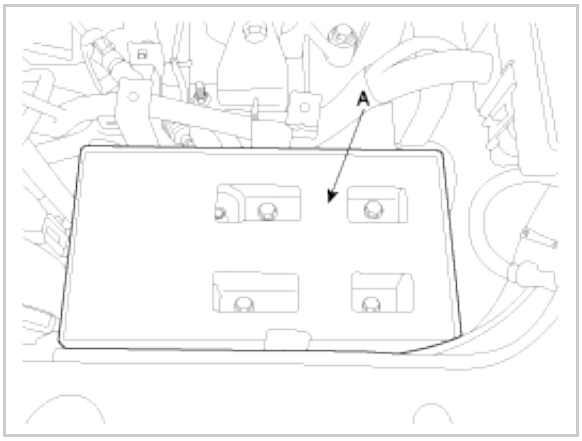
1. Remove the engine cover.
2. Disconnect the neagative terminal from the battery and remove the battery(A).



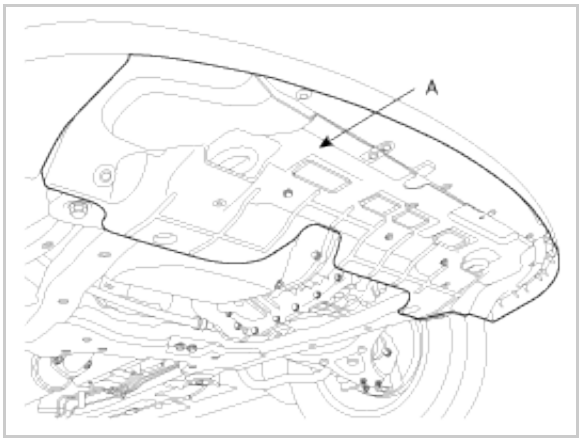
3. Remove the intake air hose and air cleaner assembly.
   (1) Disconnect the MAF connector(A).
   (2) Disconnect the breather hose(B) from air cleaner hose.
   (3) Remove the intake air hose and air cleaner assembly(C).



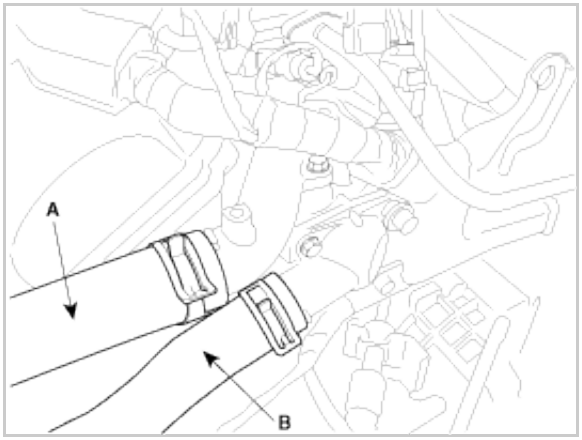
4. Remove the battery tray(A).



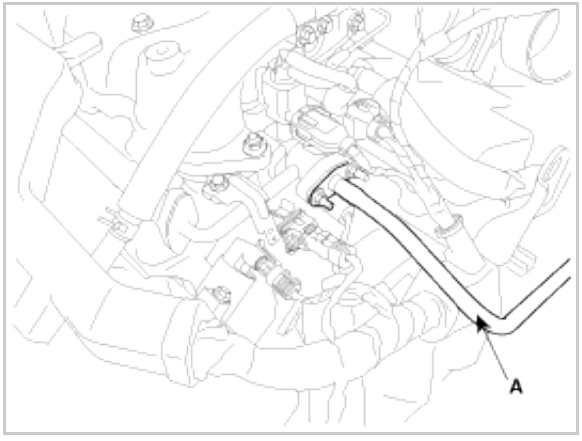
5. Remove the under cover.



6. Drain the engine coolant.
7. Remove the upper radiator hose(A) and lower radiator hose(B).

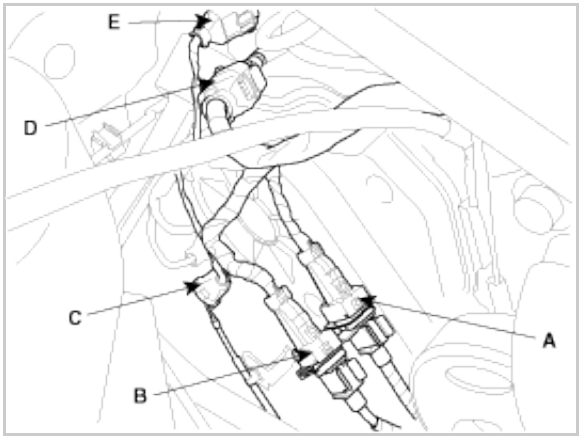


8. Remove the transaxle oil cooler hoses(A/T vehicles only).
9. Remove the fuel inlet hose(A) from the delivery pipe.

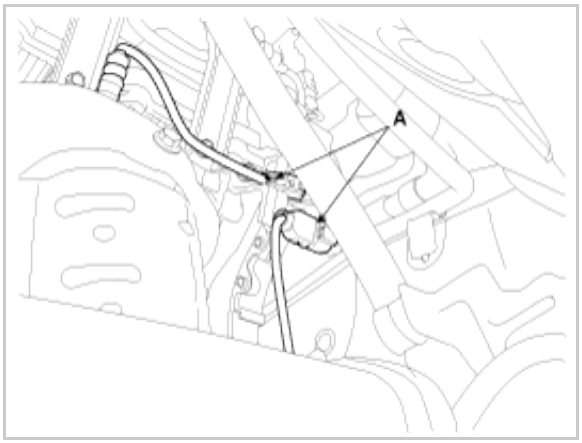


10. Disconnect the engine wiring harness connectors.

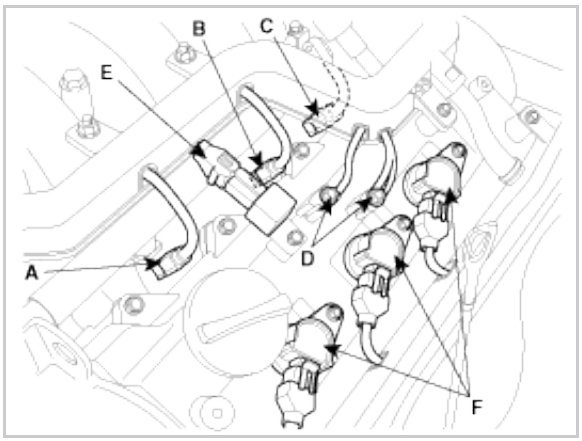
(1) Disconnect the No.1/No.2 knock sensor connectors(A,B), the oil pressure switch connector(C), the ignition coil harness(D) and the No.1 VIS(Variable Induction System) connector(E).



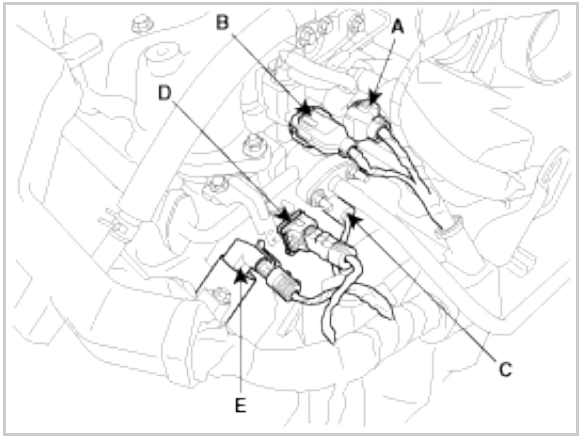
(2) Disconnect the bank 1 front/rear O2 sensor connectors(A).



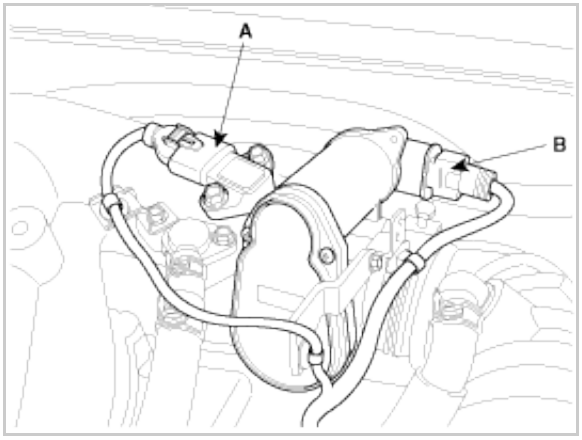
(3) Disconnect the injection connectors(A,B,C), the ground lines(D), the condenser connector(E) and the Ignition coil connectors(F).



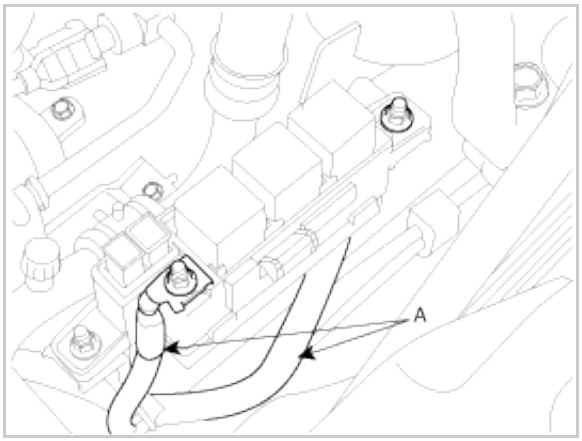
(4) Disconnect the injection harness connector(A), the No.2 VIS(Variable Induction System) connector(B), the No.1/No.2 OCV(Oil Control Valve) connectors(C,D) and the OTS(Oil Temperature Sensor) connector(E).



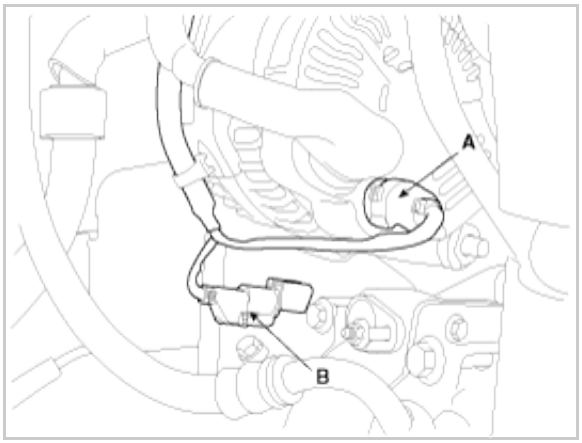
(5) Disconnect the MAPS(Manifold Absolute Pressure Sensor) connector(A), the ETC(Electronic Throttle Control) connector(B) and the PCSV(Purge Control Solenoid Valve) connector(C).



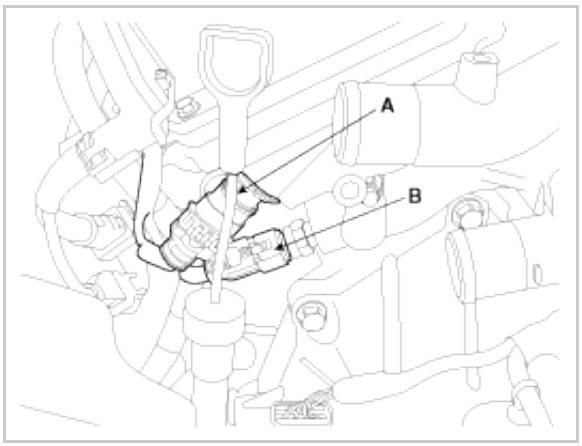
(6) Remove the cooling fan relay cable(A).



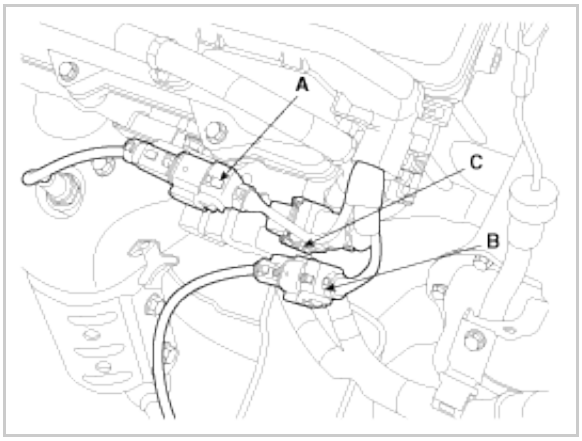
(7) Disconnect the generator connector(A) and the air conditioning compressor connector(B).



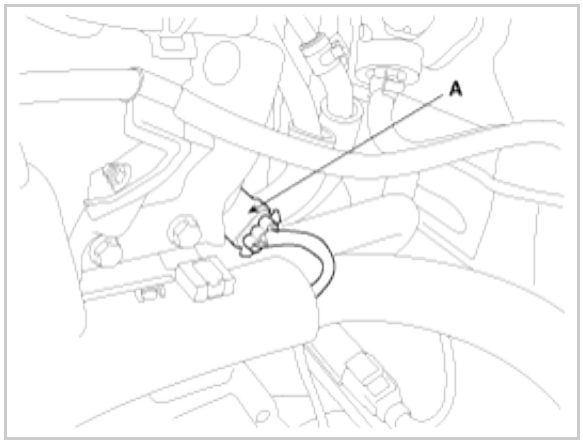
(8) Disconnect the bank 2 CMP sensor connector(A) and the WTS(Water Temperature Sensor) connector(B).



(9) Disconnect the bank 2 front/rear O2 sensor connectors(A,B) and the CKP sensor connector(C).



(10) Disconnect the bank 1 CMP sensor connector(A).

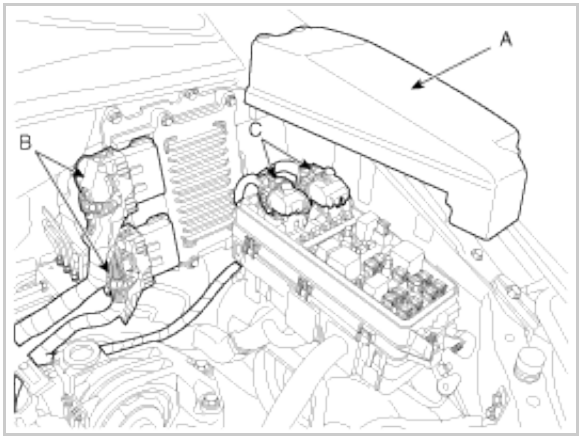


11. Disconnect engine wiring.

(1) Remove the engine room fuse and relay box cover(A).

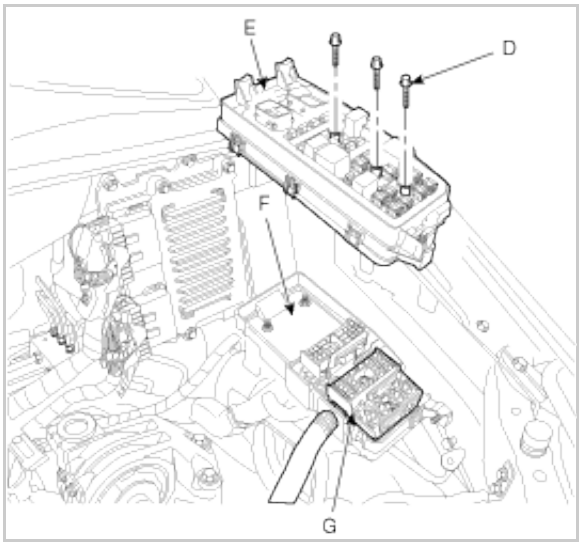
(2) Disconnect the PCM connectors(B).

(3) Disconnect the FAM connectors(C)(Refer to HA group).

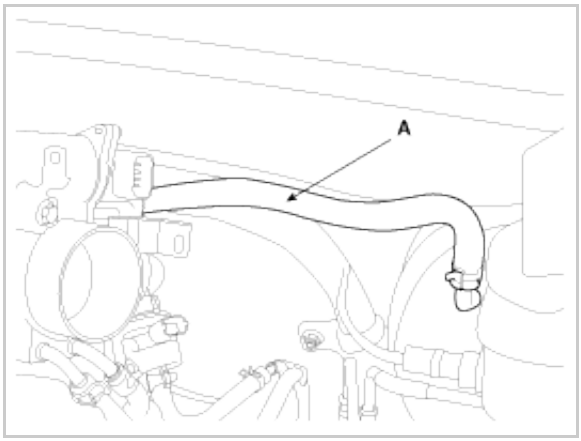


(4) Unscrew the FAM mounting bolts(D-3EA) and take the FAM(E) out of the splash shield(F).

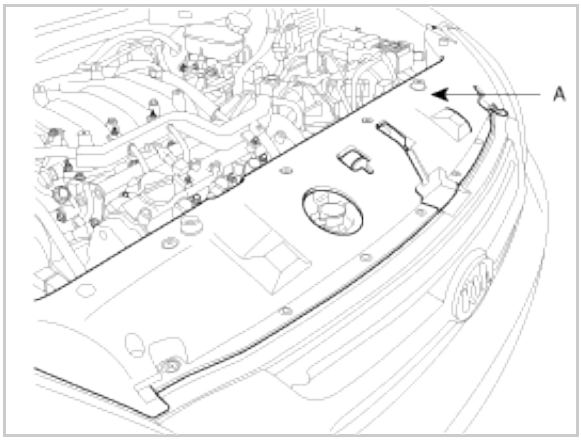
(5) Disconnect the connector(G) from the splash shield(B).



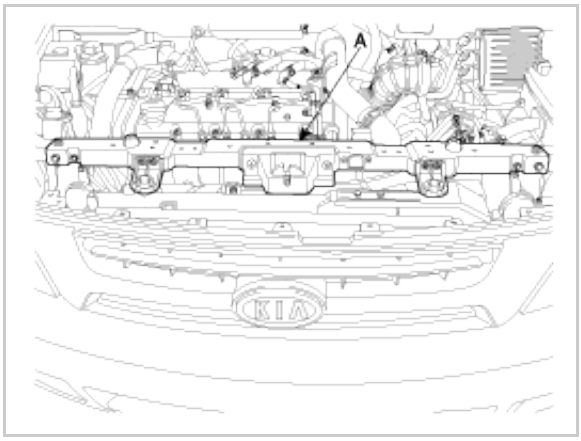
12. Remove the heater hoses.
13. Disconnect the brake vaccume hose(A).



14. After draining or gathering power steering fluid, disconnect the power steering hose(A).
15. Remove the radiator grille upper cover(A) for convenience sake.

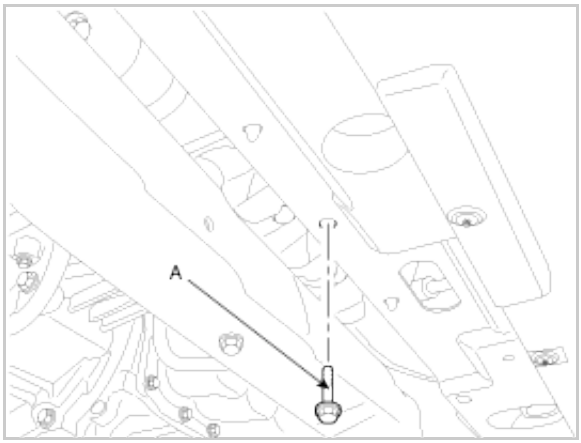


16. Disconnect the power steering return hose.
17. Remove the radiator support upper member assembly(A) for convenience sake.

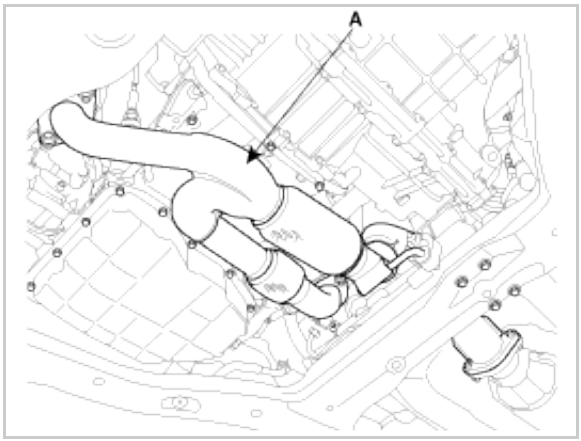


NOTICE

The bottom side bolt(A) which can be seen after removing the under cover should be loosened for removal of the radiator support upper member assembly.



18. Drain engine oil.
19. Remove the brake caliper.(Refer to DS group).
20. Disconnect the air conditioning compressor hoses.(Refer to HA group).
21. Remove the front wheels and tires.(Refer to DS group).
22. Remove the brake caliper hub nut.(Refer to DS group).
23. Remove the tie rod end ball joint from the knuckle.(Refer to DS group)
24. Remove the driver shaft and the stabilizer bar link(Refer to SS group).
25. Remove the front muffler(A).



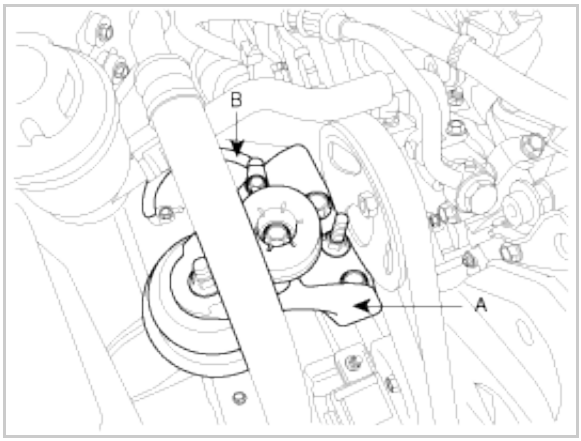
26. Using a floor jack, support the engine and transaxle assembly.

NOTICE

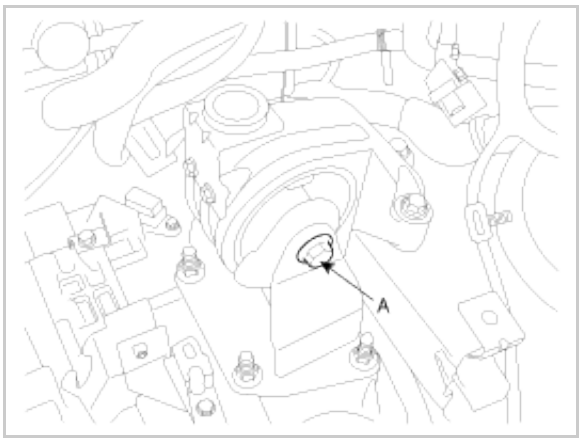
After removing the sub frame mounting bolt , the engine and transaxle assembly may fall downward, and so

support them securely with floor jack.
Verify that the hoses and connectors are disconnected before removing the engine and transaxle assembly.

27. Remove the engine mounting bracket(A) and the ground(B).



28. Remove the transaxle insulator mounting bolt(A).



NOTICE

Remove the ECM(Electronic Controlled Mounting) nuts and the solenoid valve connector for A/T vehicles.

29. Supporting the engine and transaxle assembly with a jack, remove the assembly from the vehicle by loosening the sub frame mounting bolts and lifting up the vehicle slowly.

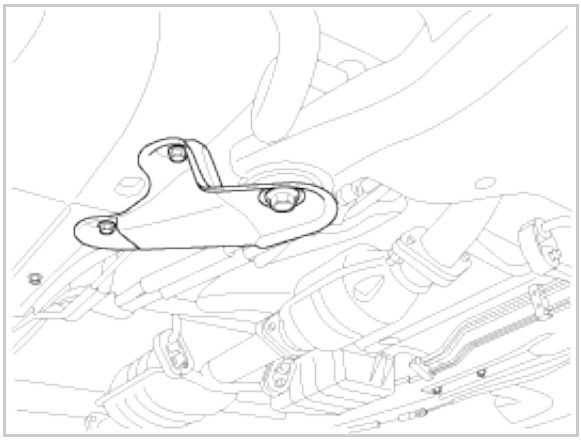
NOTICE

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

Front



Real



INSTALLATION

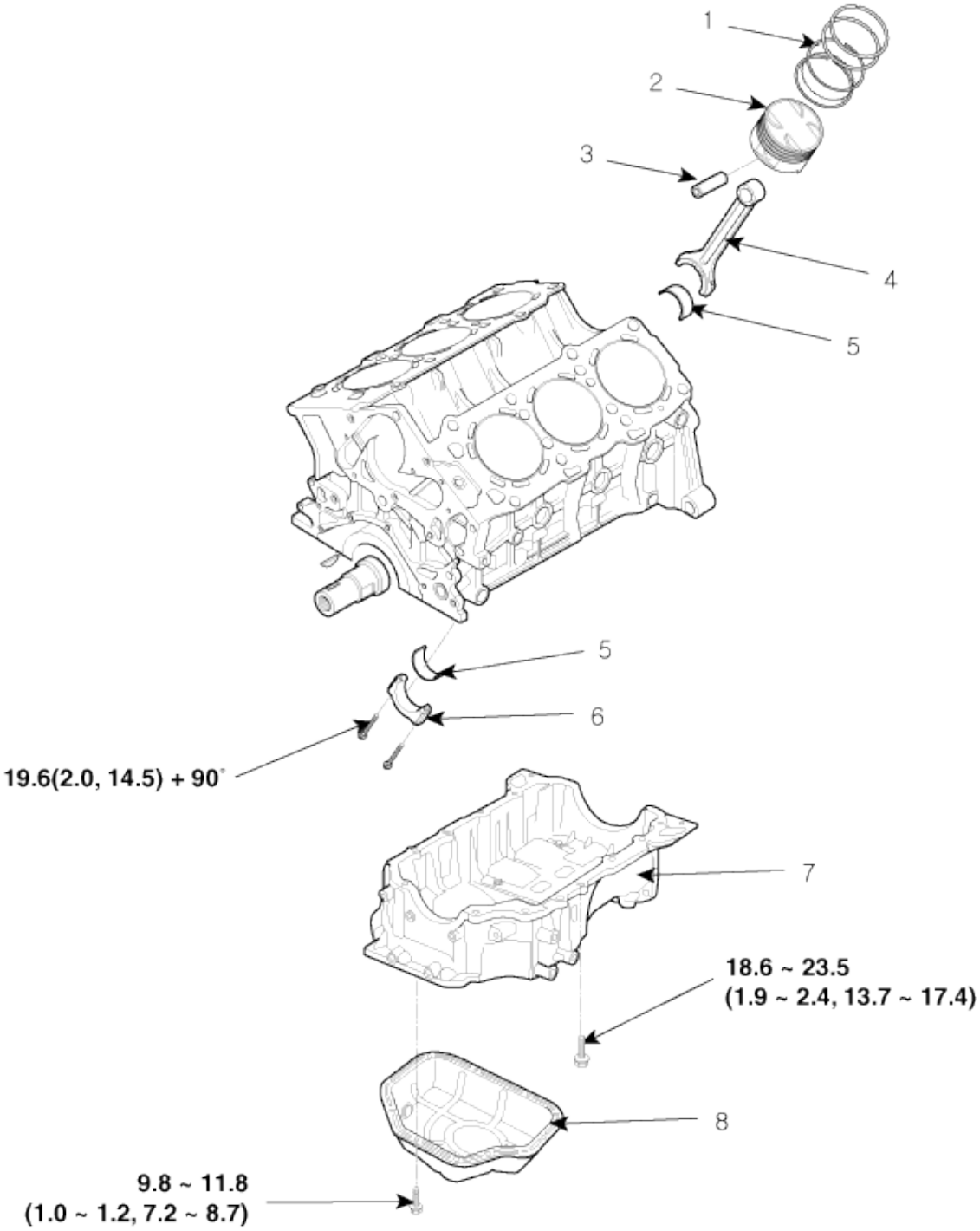
Installation is in the reverse order of removal.
Perform the following :

a. Adjust the shift cable.
b. Refill the engine with engine oil.
c. Refill the transaxle with fluid.
d. Refill the radiator with engine coolant.
e. Bleed air from the cooling system with the heater valve open.
f. Clean the battery posts and cable terminals with sandpaper assemble them, then apply grease to prevent corrosion.
g. Inspect for fuel leakage.
   After assembling the fuel line, turn on the ignition switch (do not operate the starter) so that the fuel pump runs for approximately two seconds and fuel line pressurizes.
   Repeat this operation two or three times, then check for fuel leakage at any point in the fuel line.

Cylinder Block

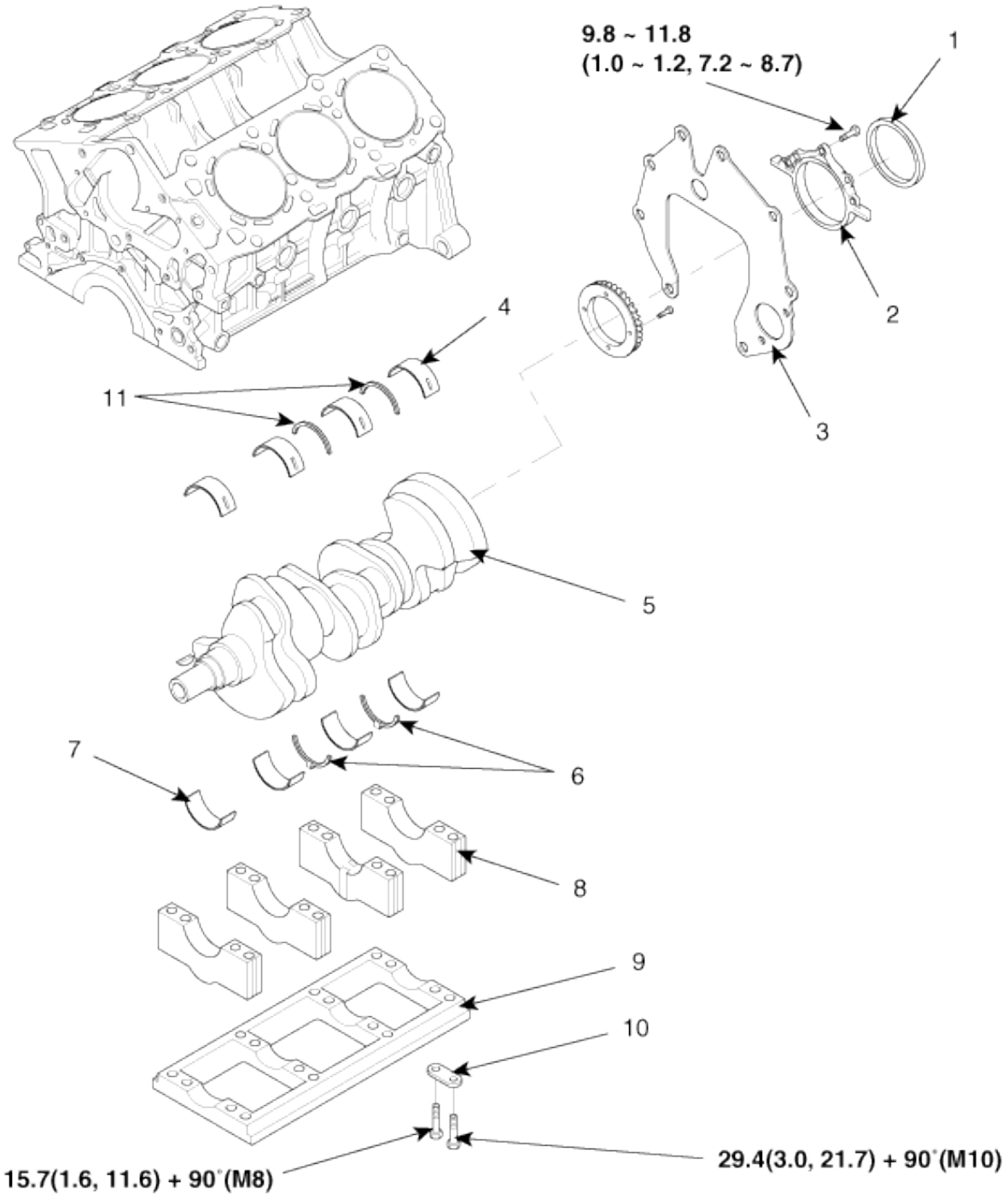
Piston and Connecting Rod

COMPONENTS



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

1. Piston ring
2. Piston
3. Piston pin
4. Connecting rod
5. Connecting rod bearing
6. Connecting rod cap
7. Upper oil pan
8. Lower oil pan

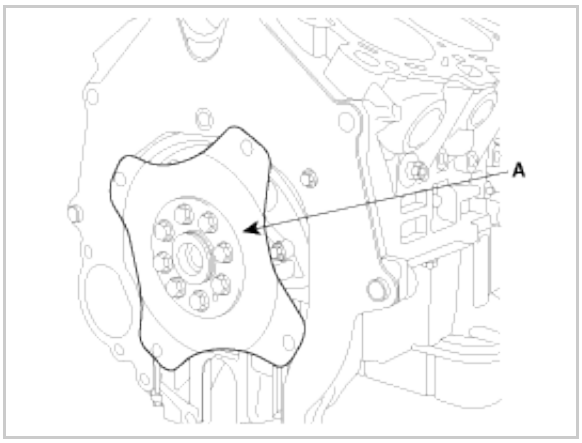


TORQUE : N.m (kgf.m, lb-ft)

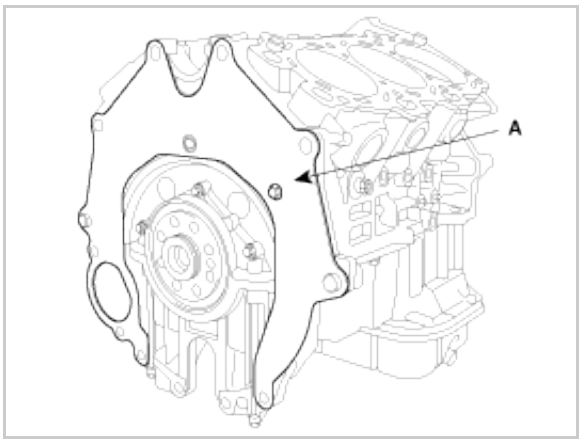
1. Rear oil seal
2. Rear oil seal case
3. Rear plate
4. Crankshaft upper bearing
5. Crankshaft
6. Lower thrust bearing
7. Crankshaft lower bearing
8. Main bearing cap
9. Bearing cap bridge
10. Bearing cap bolt washer
11. Upper thrust bearing

REMOVAL

1. Remove the drive plate(A).



2. Remove the rear plate(A).



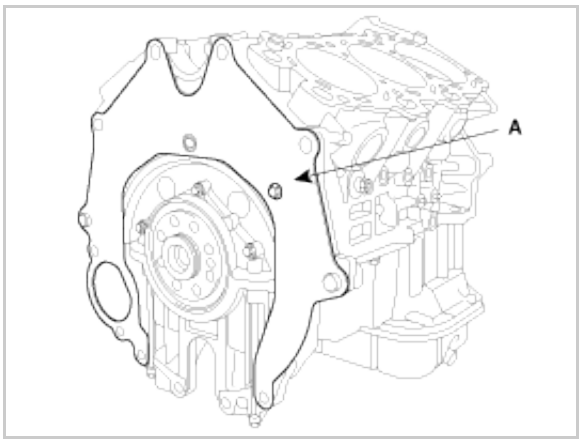
3. Remove timing belt.
4. Remove intake manifold.
5. Remove exhaust manifold.
6. Remove generator from engine.(Refer to 'ST' group).
7. Remove power steering pump from engine.(Refer to 'HA' group).
8. Remove cylinder head.
9. Remove A/C compressor from engine.(Refer to 'EE' group).
10. Remove water pump assembly.

INSTALLATION

1. Install the water pump.
2. Install the air conditioning compressor.(Refer to 'HA' group).
3. Install the cylinder head.
4. Install the power steering pump.(Refer to 'ST' group).
5. Install the generator.
6. Install the intake manifold.
7. Install the exhaust manifold.
8. Install the timing belt.
9. Install the rear plate(A).

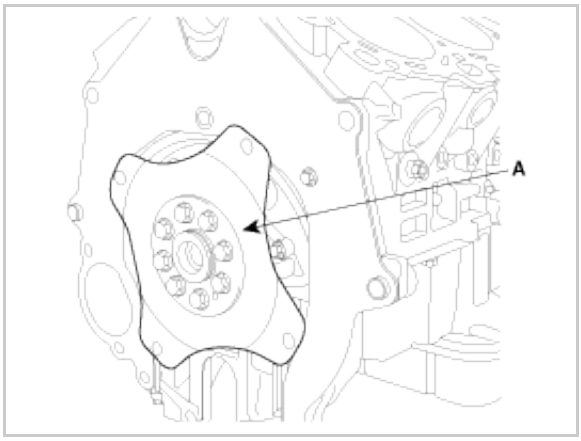
Tightening torque

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



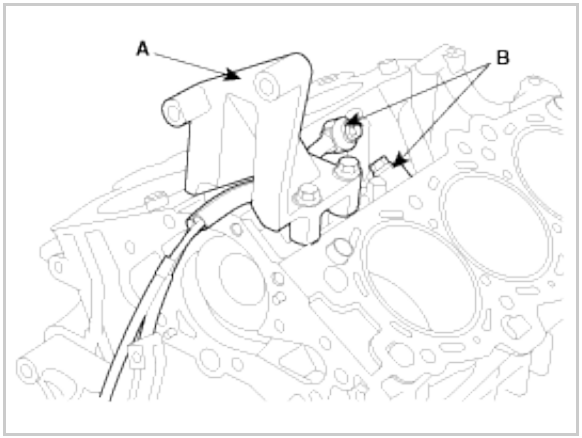
10. Install the drive plate(A).

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

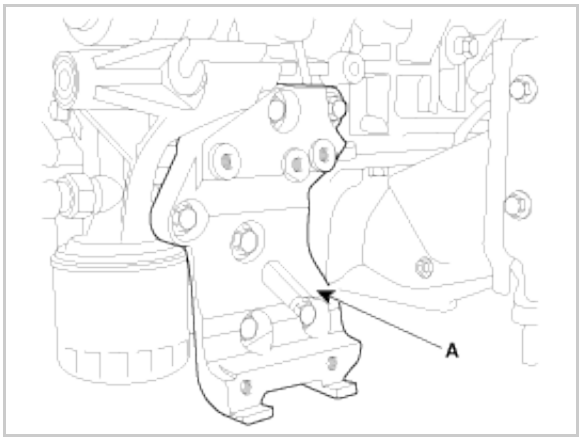


DISASSEMBLY

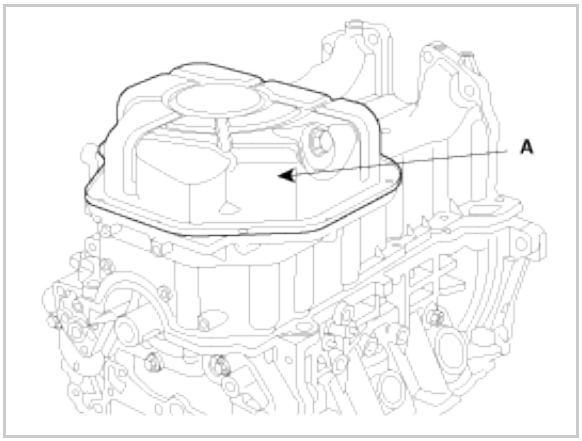
1. Remove the power steering pump bracket(A) and the knock sensor(B).



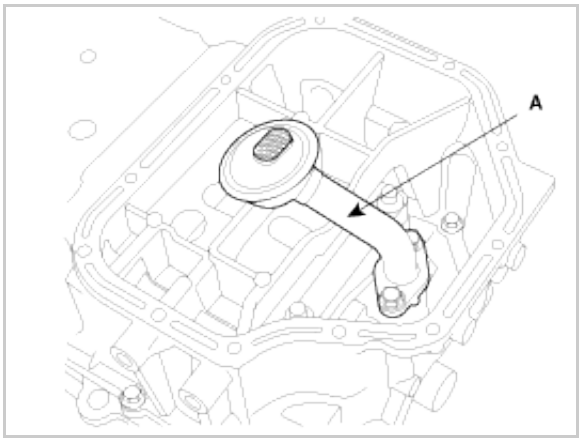
2. Remove the air conditioning compressor bracket(A).



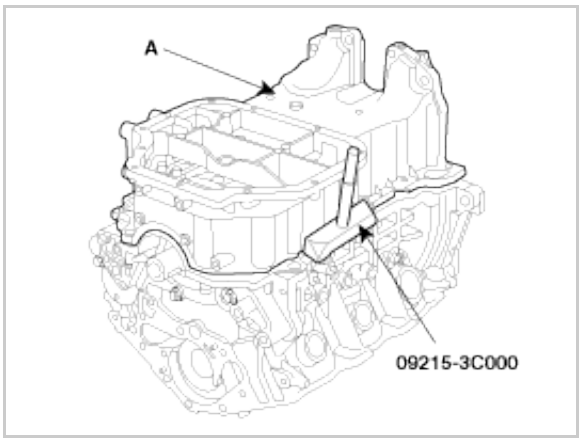
3. Remove the lower oil pan(A).



4. Remove the oil screen(A).



5. Remove the upper oil pan(A).



CAUTION

When removing the oil pan, use the SST(09215-3C000) not to damage the contacting surface of the oil pan.

6. Check the connecting rod side clearance.

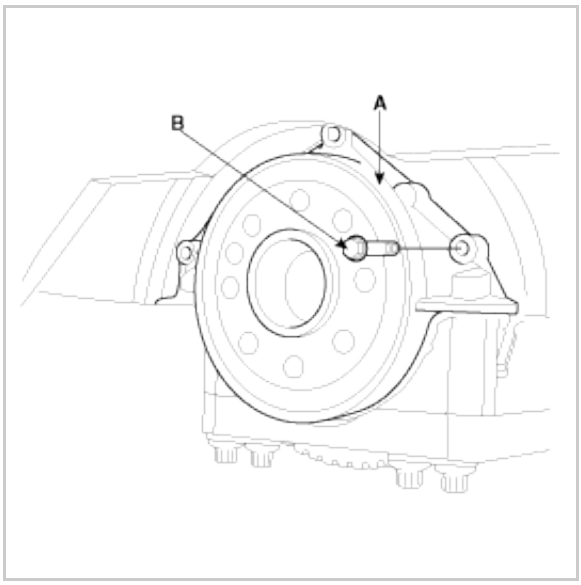
7. Check the connecting rod bearing oil clearance.

8. Remove the piston and connecting rod assemblies.

> **NOTICE**
>
> a. Keep the bearings the connecting rods and the caps together.
> b. Arrange the piston and connecting rod assemblies in the correct order.

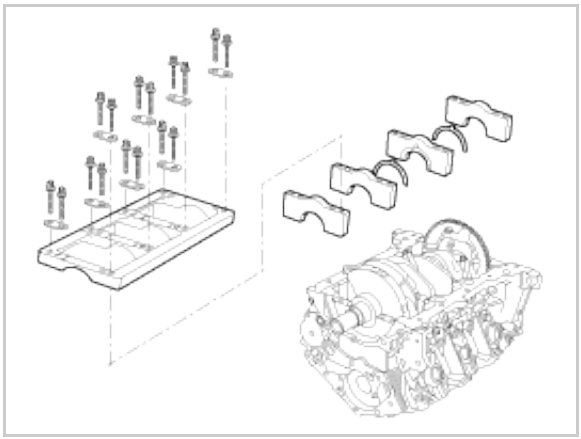
9. Remove the oil pump case.

10. Remove the oil seal case(A).



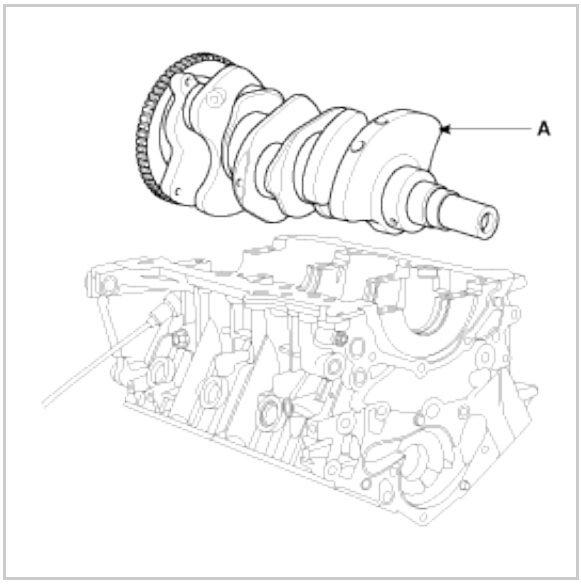
11. Check the crankshaft end play.

12. Remove the crankshaft bearing cap and check oil clearance.

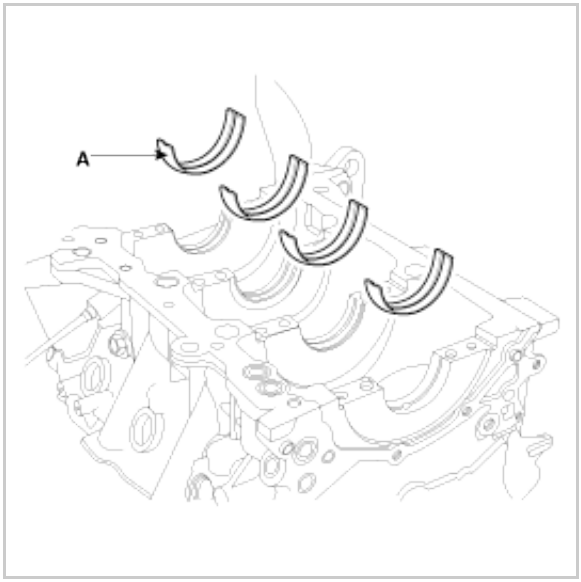


> **NOTICE**
>
> Arrange the bearings and the bearing caps in order.

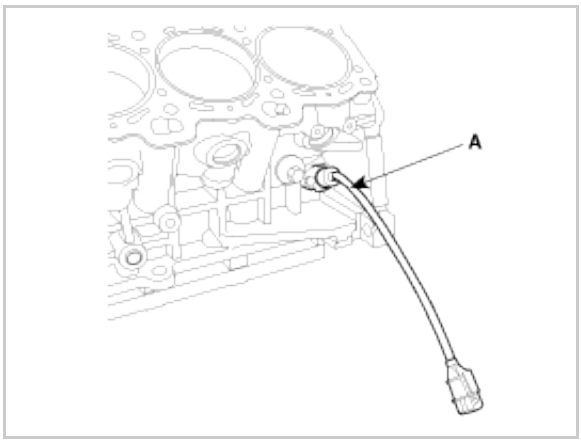
13. Lift the crankshaft(A) out of the block, being careful not to damage journals.



14. Remove and arrange the main bearings and thrust bearings in the correct order.



15. Remove the CKP sensor(A).



16. Check the free play between a piston and a piston pin.
    Try to move the piston back and forth on the piston pin. If any movement is felt, replace the piston and the piston pin as a set.
17. Remove the piston rings.
    (1) Using a piston ring expander, remove the 2 compression rings.
    (2) Remove the 2 side rails and the oil ring by hand.

NOTICE

Arrange the piston rings in the correct order only.

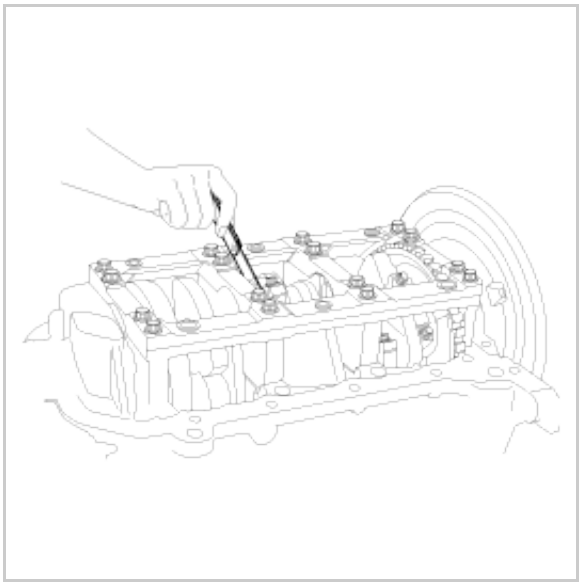
18. Disconnect the connecting rod from the piston.
    Using a press, remove the piston pin from the piston.
    (Press-in load : 2451.7 ~ 12258.3N(250 ~ 1250kg, 551.2 ~ 2755.81lb)

INSPECTION

CONNECTING ROD AND CRANKSHAFT

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

Specification
Standard : 0.1~ 0.25mm(0.0039 ~ 0.0098in.)
Limit : 0.4mm(0.0157in.)



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 matchmarks 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 the lower bearing.
   (4) Clean the crankshaft pin journal and the bearing.
   (5) Place a plastigage across the crankshaft pin.
   (6) Reinstall the lower bearing and the connecting rod cap and torque the bolts.

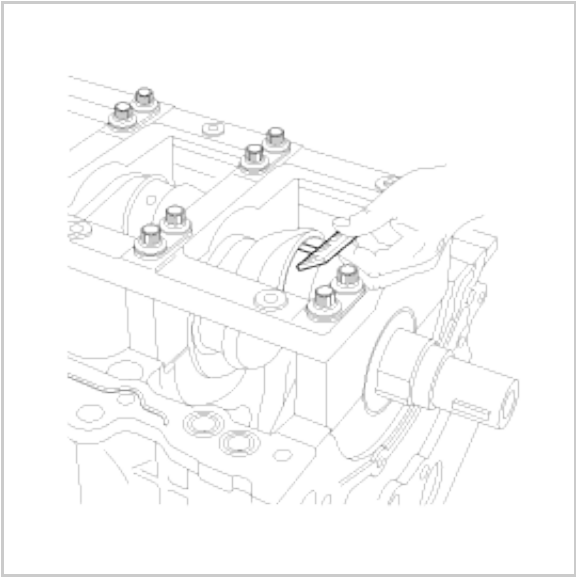
Tightening torque
19.6Nm (2.0kgf.m, 14.46lb-ft) + 90°

NOTICE

Do not turn the crankshaft.

   (7) Remove the connecting rod cap again.
   (8) Measure the plastigage at its widest point.

Standard oil clearance
0.018 ~ 0.036mm(0.0007 ~ 0.0014in.)



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

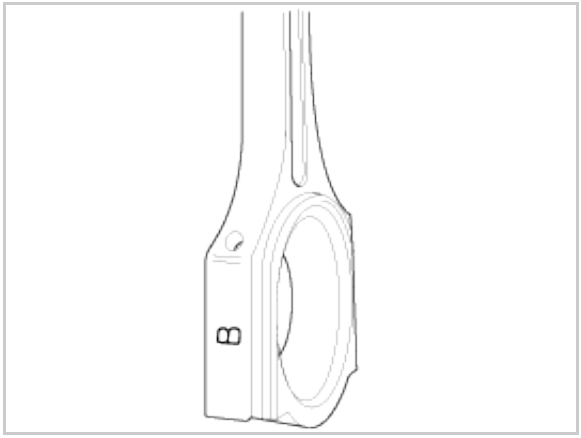
> **CAUTION**
>
> Do not file, shim, or scrape the bearings or the caps to adjust clearance.

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

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

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

CONNECTING ROD MARK LOCATION



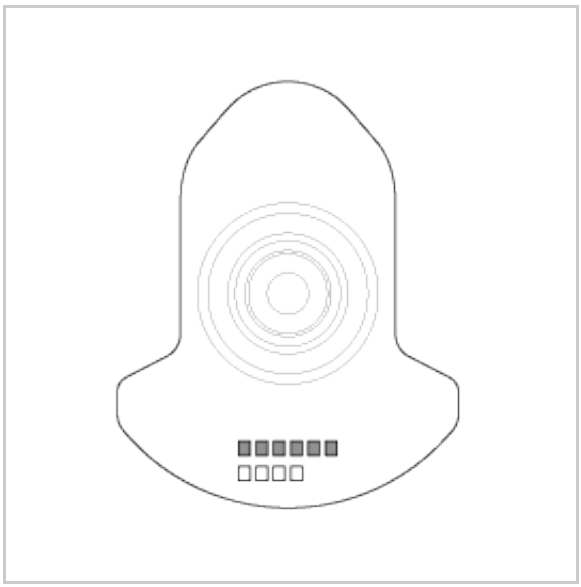
DISCRIMINATION OF CONNECTING ROD

CLASS	MARK	INSIDE DIAMETER
0	a	51.000 ~ 51.006mm (2.0079 ~ 2.0081in.)
1	b	51.006 ~ 51.012mm (2.0081 ~ 2.0083in.)

2	c	51.012 ~ 51.018mm (2.0083 ~ 2.0086in.)

CRANKSHAFT PIN MARK LOCATION

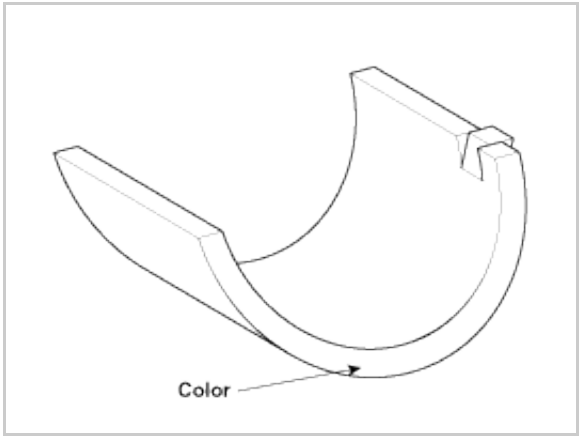
DISCRIMINATION OF CRANKSHAFT



DISCRIMINATION OF CRANKSHAFT

CLASS	MARK	OUTSIDE DIAMETER OF PIN
I	1 or A	47.994 ~ 48.000mm (1.8895 ~ 1.8898in.)
II	2 or B	47.988 ~ 47.994mm (1.8893 ~ 1.8895in.)
III	3 or C	47.982 ~ 47.988mm (1.8891 ~ 1.8893in.)

PLACE OF IDENTIFICATION MARK (CONNECTING ROD BEARING)



DISCRIMINATION OF CONNECTING ROD BEARING

CLASS	MARK	THICKNESS OF BEARING
A	BLUE	1.5000 ~ 1.503mm (0.0591 ~ 0.0592in.)
B	BLACK	1.497 ~ 1.500mm (0.0589 ~ 0.0591in.)
C		1.494 ~ 1.497mm

C	-	(0.0588 ~ 0.0589in.)
D	GREEN	1.491 ~ 1.494mm (0.0587 ~ 0.0588in.)
E	YELLOW	1.488 ~ 1.491mm (0.0586 ~ 0.0587in)

(11) Select the proper connecting rod bearing from the table below.

		CONNECTING ROD IDENTIFICATION MARK		
		0(A)	1(B)	2(C)
CRANKSHAFT INDENTIFICATION MARK	I(A)	E (YELLOW)	D (GREEN)	C (-)
	II(B)	D (GREEN)	C (-)	B (BLACK)
	III(C)	C (-)	B (BLACK)	A (BLUE)

3. Check the connecting rod.

(1) When reinstalling, check the cylinder numbers on the connecting rods and the caps. When installing a new connecting rod, the notches for bearing fixing on the connecting rods and caps should face the same direction.

(2) If one or both edge of the connecting rod thrust surface is damaged, replace the rod. If the inner surface of the rod is damaged or rough, also replace it.

(3) Using a connecting rod aligner, measure the bent or torsion of the rod. If the measurement is near the specification, adjust the rod with a press. If the rod is bent or twisted excessily, replace it.

Bending : 0.05mm/100mm(0.0020in./3.9370in.)
Torsion : 0.1mm/100mm(0.0039in./3.9370in.)

NOTICE

When assembling the rod without a bearing, there should be no difference.

4. Check the crankshaft bearing oil clearance.

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

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

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

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

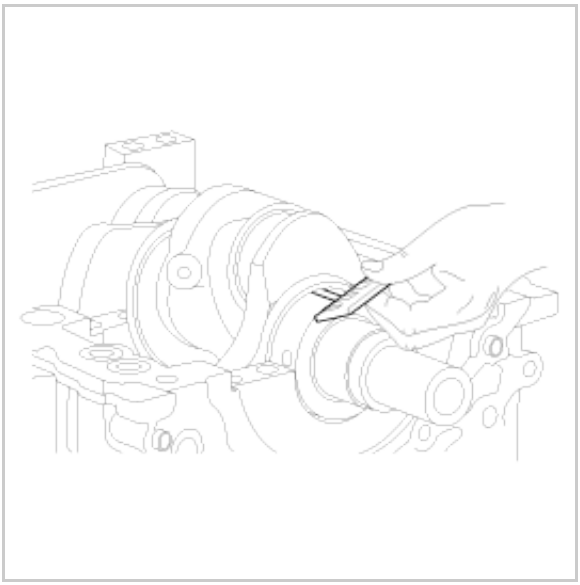
Tightening torque
M8 : 15.7Nm(1.6 kgf.m, 11.6lb-ft) + 90°
M10 : 29.4 Nm(3.0 kgf.m, 21.7lb-ft)+ 90°

NOTICE

Tighten the bolts in order.

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

Standard oil clearance
0.004~ 0.022mm (0.0002 ~ 0.0009in.)



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

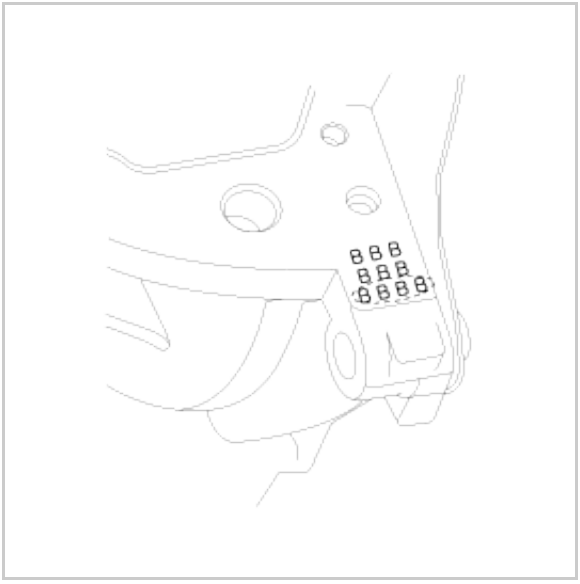
> **CAUTION**
>
> Do not file, shim, or scrape the bearings or the caps to adjust clearance.

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

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

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

Crankshaft bore mark location
Letters have been stamped on the block as a mark for the each size of the 4 main journal bores.
No.1 journal stamping mark starts from the front of the engine.
Use the size marks which are stamped on the block and the crankshaft for the journal bore inner diameter and the journal outer diameter to choose the correct bearings.

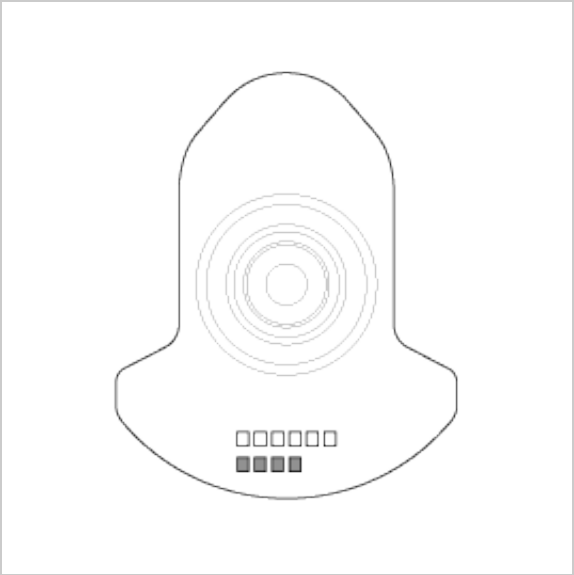


DISCRIMINATION OF CYLINDER BLOCK

CLASS	MARK	INSIDE DIAMETER
a	A	66.000 ~ 66.006mm (2.5984 ~ 2.5987in.)
b	B	66.006 ~ 66.012mm (2.5987 ~ 2.5989in.)
c	C	66.012 ~ 66.018mm (2.5989 ~ 2.5991in.)

CRANKSHAFT JOURNAL MARK LOCATION

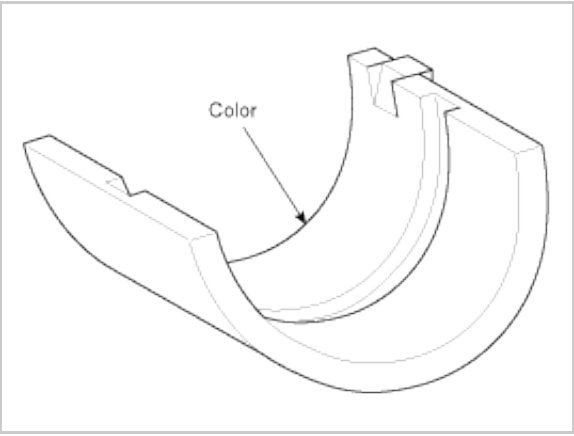
DISCRIMINATION OF CRANKSHAFT



DISCRIMINATION OF CRANKSHAFT

CLASS	MARK	OUTSIDE DIAMETER OF JOURNAL
I	A	61.994 ~ 62.000mm (2.4407 ~ 2.4409in.)
II	B	61.988 ~ 61.994mm (2.4405 ~ 2.4407in.)
III	C	61.982 ~ 61.988mm (2.4402 ~ 2.4405in.)

PLACE OF IDENTIFICATION MARK (CRANKSHAFT BEARING)



DISCRIMINATION OF CRANKSHAFT BEARING

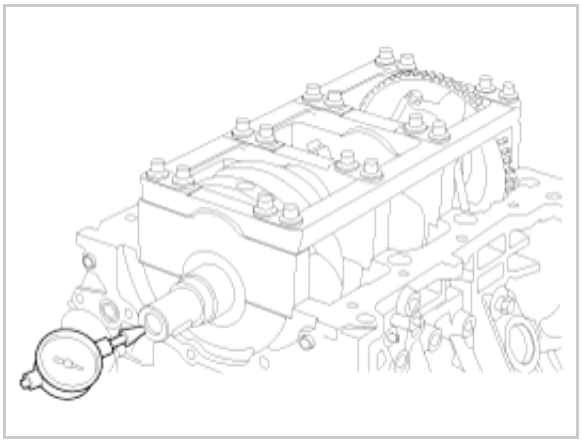
CLASS	MARK	THICKNESS OF BEARING
A	BLUE	2.007 ~ 2.010mm (0.0790 ~ 0.0791in.)
B	BLACK	2.004 ~ 2.007mm (0.0789 ~ 0.0790in.)
C	-	2.001 ~ 2.004mm (0.0788 ~ 0.0789in.)
D	GREEN	1.998 ~ 2.001mm (0.0787 ~ 0.0788in.)
E	YELLOW	1.995 ~ 1.998mm (0.0785 ~ 0.0787in.)

SELECTION TABLE

		CRANKSHAFT BORE IDENTIFICATION MARK		
		a(A)	b(B)	c(C)
CRANKSHAFT IDENTIFICATION MARK	I(A)	E (YELLOW)	D (GREEN)	C (-)
	II(B)	D (GREEN)	C (-)	B (BLACK)
	III(C)	C (-)	B (BLACK)	A (BLUE)

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

   Standard end play
   0.07 ~ 0.25mm (0.0028 ~ 0.0098in.)
   [Limit]
   0.3mm(0.0118in.)

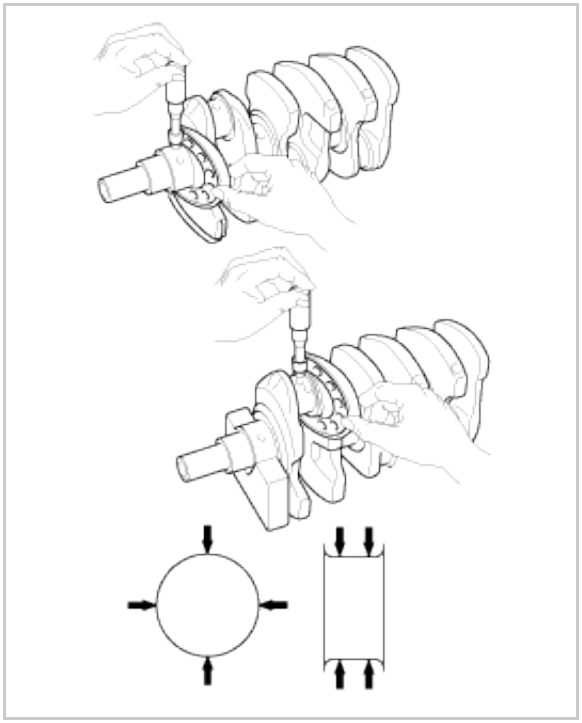


   If the end play is greater than the maximum, replace the center bearing.

   Thrust bearing thickness
   1.925 ~ 1.965mm(0.0758 ~ 0.0774in.)

6. Inspect the main journals and the pin journals of the crankshaft.
7. Using a micrometer, measure the outer diameter of each main journal and pin journal.

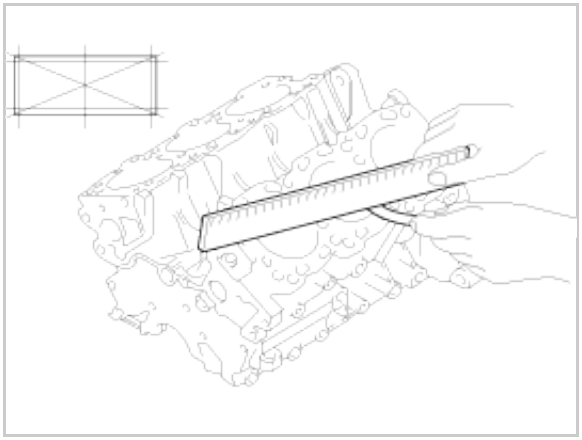
   Main journal diameter : 61.982~ 62.000mm (2.4402 ~ 2.4409in.)
   Crank pin diameter : 47.982 ~ 48.000mm (1.8891 ~ 1.8898in.)



CYLINDER BLOCK

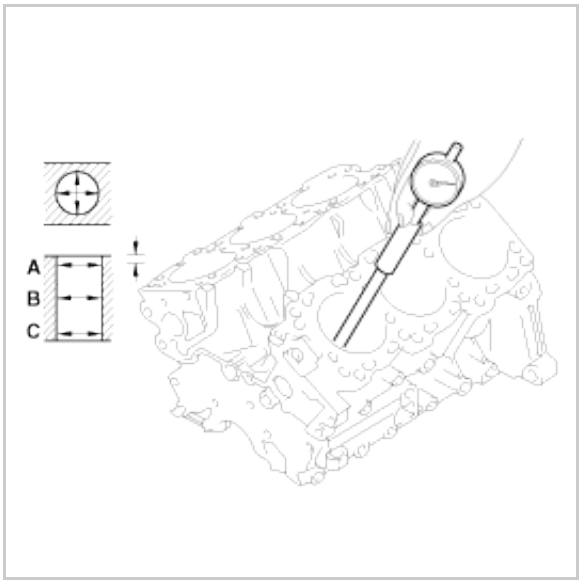
1. Remove gasket materials.
   Using a gasket scraper, remove all the gasket material from the top surface of the cylinder block.
2. Clean cylinder block
   Using a soft brush and solvent, thoroughly clean the cylinder block.
3. Inspect the top surface of cylinder block for flatness.
   Using a precision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

Flatness of cylinder block gasket surface
Standard : 0.03mm(0.0012in.) or less

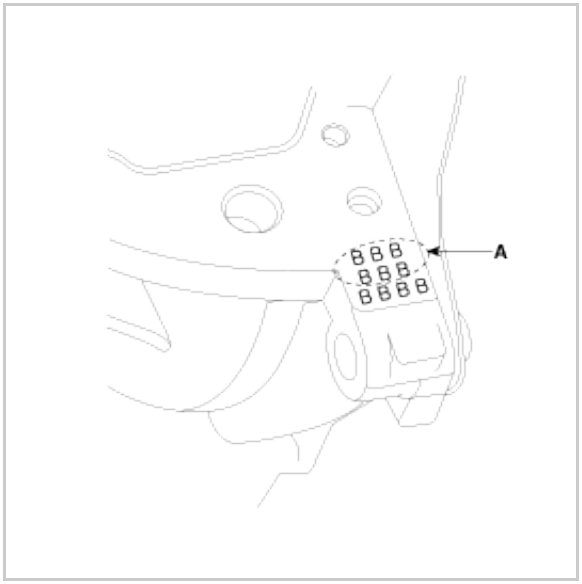


4. Inspect cylinder bore diameter
   Visually check the cylinder for vertical scratchs.
   If deep scratches are present, replace the cylinder block or process the piston to be oversized.
5. Inspect the cylinder bore diameter
   Using a cylinder bore gauge, measure the cylinder bore diameter at position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

Standard diameter
86.70 ~ 86.73mm (3.4134 ~ 3.4146in.)

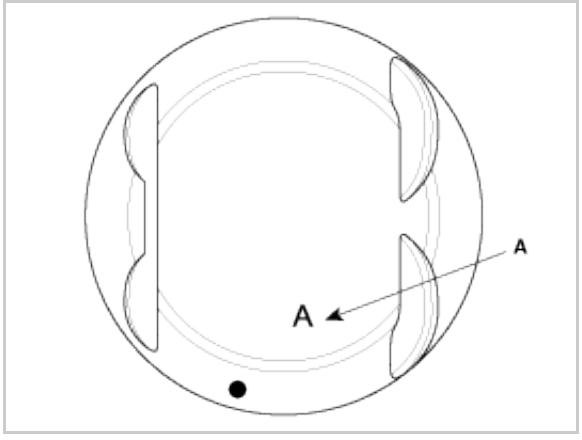


6. Check the cylinder bore size code(A) on the cylinder block.



Class	Size code	Cylinder bore inner diameter
A	A	86.70 ~ 86.71mm (3.4134 ~ 3.4138in.)
B	B	86.71 ~ 86.72mm (3.4138 ~ 3.4142in.)
C	C	86.72 ~ 86.73mm (3.4142 ~ 3.4146in.)

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



Class	Size code	Piston outer diameter
A	A	86.67 ~ 86.68mm (3.4122 ~ 3.4126in.)
B	-	86.68 ~ 86.69mm (3.4126 ~ 3.4130in.)
C	C	86.69 ~ 86.70mm (3.4130 ~ 3.4134in.)

8. Select the proper piston related to the cylinder bore class.

Clearance : 0.02 ~ 0.04mm(0.0008 ~ 0.0016in.)

CYLINDER BORING

1. The over size piston is chosen on the maximum inner diameter of the cylinder.

> NOTICE
>
> The piston size mark is on the top surface of the piston.

2. Measure the outer diameter of the piston which is installed before.
3. Calculate the new bore size with the measurement in the step 2.

New bore size = measured outer diameter of piston + 0.02 ~ 0.04mm(0.0008~0.0016in.)[clearance] - 0.01mm(0.0004in.)[for horning]

4. Bore the cylinder to the calculated size.

> CAUTION
>
> Bore the cylinders in firing order to prevent the cylinders from be twisted by high temperature.

5. Stop boring and start horning for the proper clearance.
6. Measure the clearance between a piston and a cylinder.

Specification
0.02 ~ 0.04mm(0.0008 ~ 0.0016in.)

> NOTICE
>
> Bore all the cylinders with the same over size.

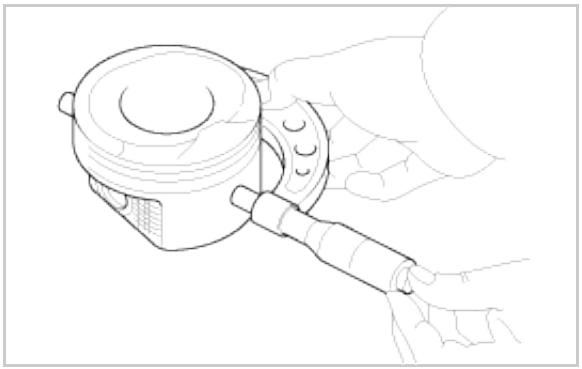
PISTON AND RINGS

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

> NOTICE
>
> Do not use a wire brush.

2. The standard measurement of the piston outside diameter is taken 14 mm (0.5512 in.) from the bottom of the piston.

Standard diameter
86.67 ~ 87.00(3.4122 ~ 3.4252in.)

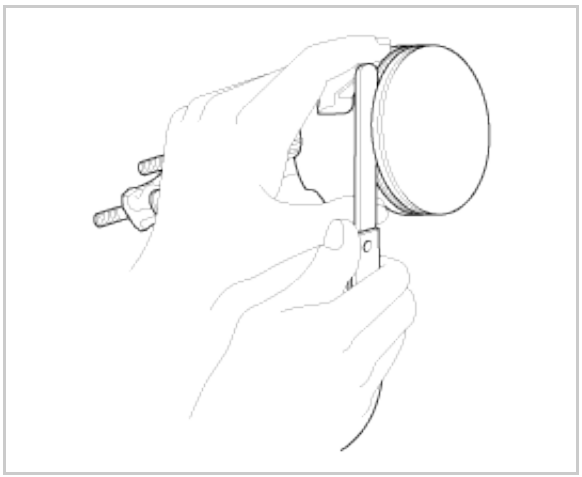


3. Calculate the difference between the cylinder bore inner diameter and the piston outer diameter.

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 a new piston ring and the ring groove.

Piston ring side clearance
Standard
No.1 : 0.04 ~ 0.08mm (0.0016 ~ 0.0031in.)
No.2 : 0.03 ~ 0.07mm (0.0012 ~ 0.0027in.)
Oil ring : 0.06 ~ 0.15mm (0.0024 ~ 0.0059in.)
Limit
No.1 : 0.1mm (0.004in.)
No.2 : 0.1mm (0.004in.)
Oil ring : 0.2mm (0.008in.)

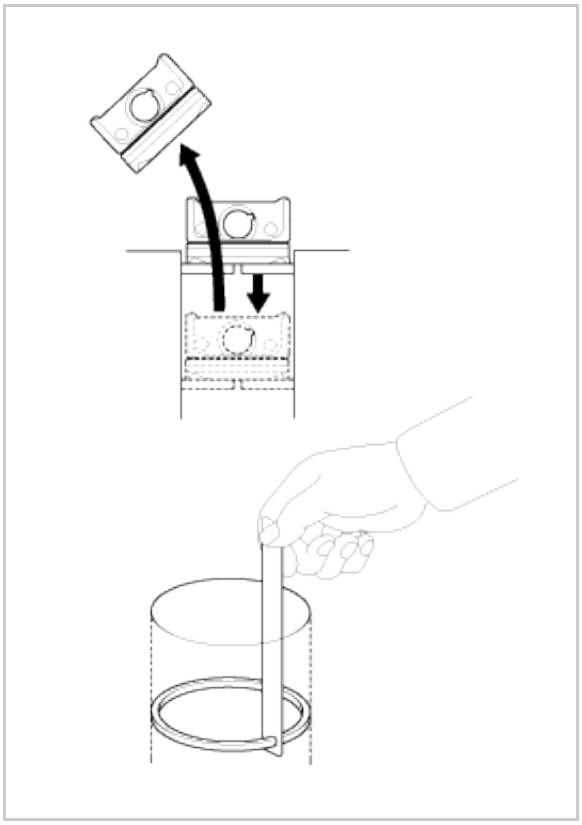


If the clearance is greater than the maximum, replace the piston.

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

Piston ring end gap
Standard
No.1 : 0.15 ~ 0.30mm (0.0059 ~ 0.0118in.)
No.2 : 0.30 ~ 0.45m (0.0118 ~ 0.0177in.)
Oil ring : 0.20 ~ 0.70mm (0.0079 ~ 0.0275in.)
Limit

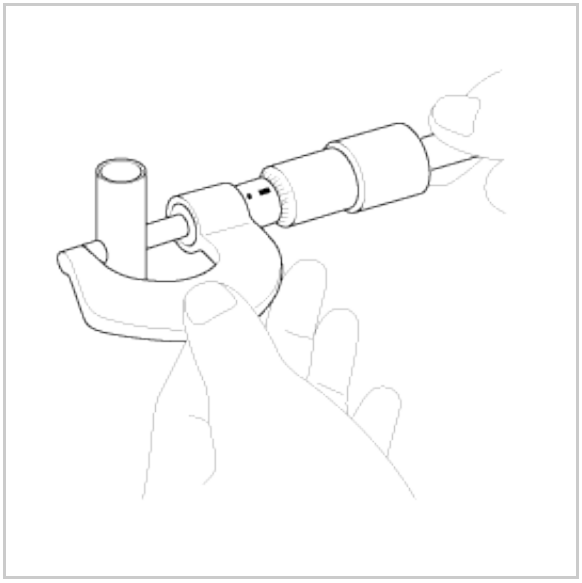
No.1 : 0.6mm (0.0236in.)
No.2 : 0.7mm (0.0275in.)
Oil ring : 0.8mm (0.0315in.)



PISTON PINS

1. Measure the outer diameter of the piston pin.

Piston pin outerdiameter
21.001 ~ 21.007mm (0.8268 ~ 0.8270in.)



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

Piston pin-to-piston clearance
0.007 ~ 0.022mm (0.0003 ~ 0.0009in.)

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

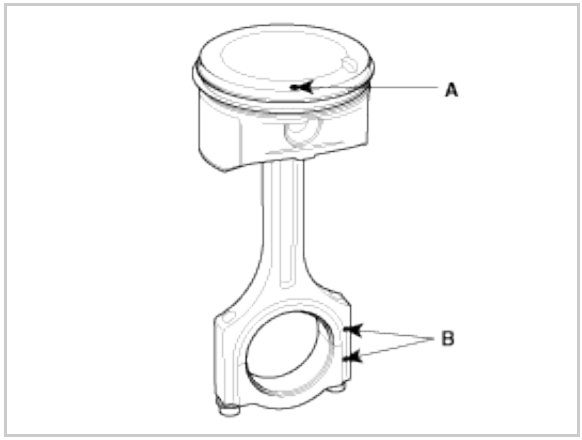
Piston pin-to-connecting rod interference
-0.033 ~ -0.016mm (-0.0013 ~ -0.0006in.)

REASSEMBLY

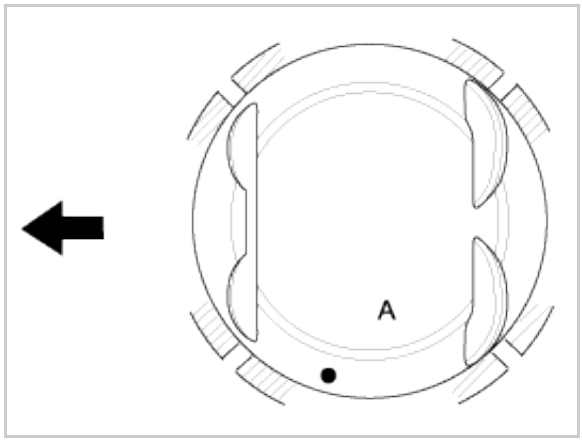
NOTICE

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

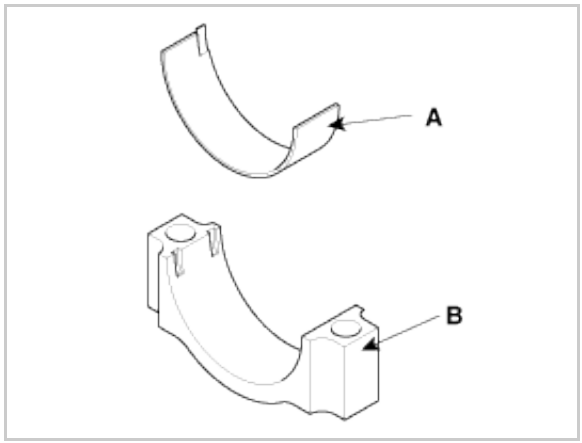
1. Assemble the piston and the connecting rod.
   (1) Use a hydraulic press for installation.
   (2) The piston front mark(A) and the connecting rod front mark must face the timing belt side of the engine.



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



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

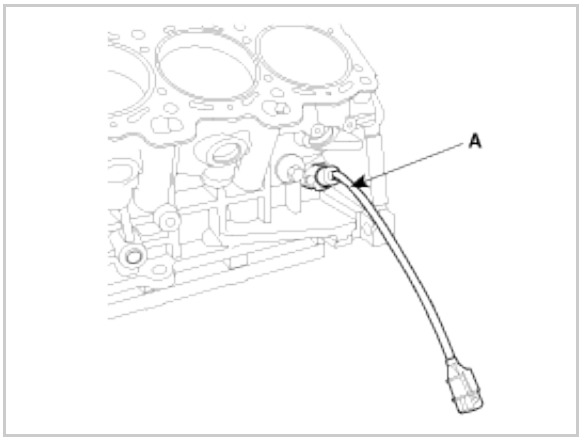


CAUTION

When reassembling the connecting rods and the caps, ensure the front marks on them.

4. Install the CKP sensor(A).

Tightening torque
6.9 ~ 9.8Nm(0.7 ~ 1.0kgf.m, 5.1 ~ 7.2lb-ft)

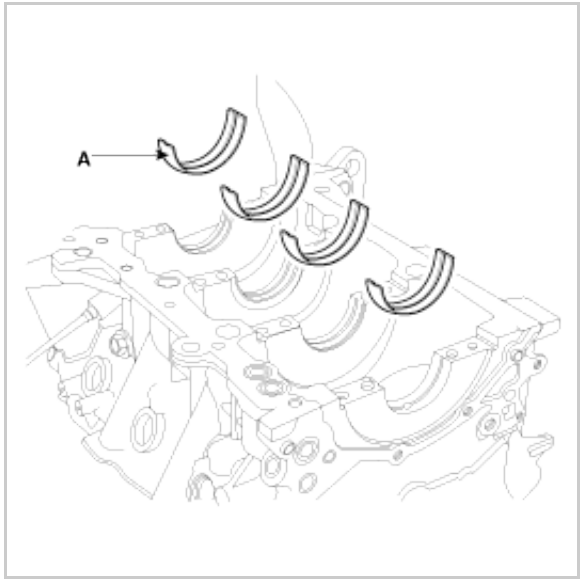


5. Install main bearings.

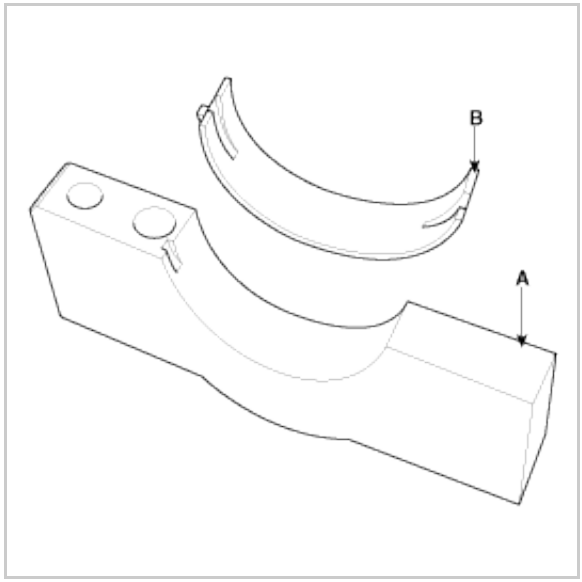
NOTICE

Upper bearings have the oil grooves of the oil holes; Lower bearings do not.

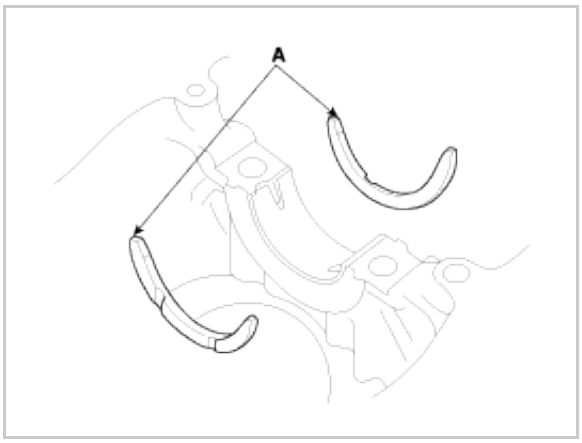
(1) Aligning the bearing claw with the claw groove of the cylinder block, push in the 4 upper bearings(A).



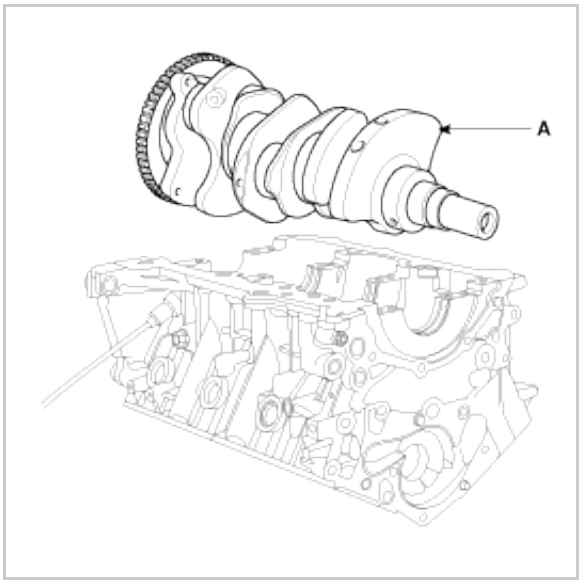
(2) Aligning the bearing claw with the claw groove of the main bearing cap, push in the 4 lower bearings(B) on the bearing caps(A).



6. Install thrust bearings.
   Install the 2 thrust bearings(A) under the No.3 journal position of the cylinder block with the oil grooves facing outward.



7. Place crankshaft(A) on the cylinder block.



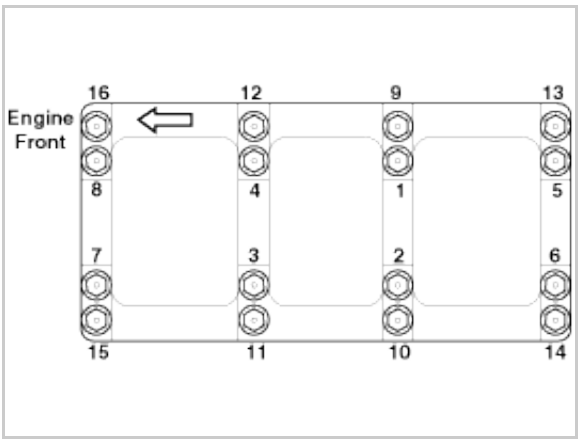
8. Place main bearing caps on cylinder block.
9. Install main bearing cap bolts.
   (1) Install and uniformly tighten the bearing cap bolts, in two steps, in the sequence shown.

Tightening torque

M8 : 15.7Nm(1.6 kgf.m, 11.6lb-ft) + 90°
M10 : 29.4Nm(3.0 kgf.m, 21.7lb-ft)+ 90°

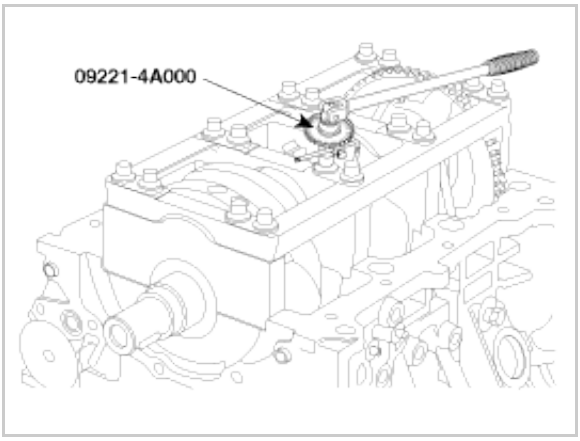
NOTICE

a. Use new main bearing cap bolt with engine oil applied.
b. If any of the bearing cap bolts are broken or deformed, replace it.
c. Washers have their direction(Up/Down)
d. Assemble the bearing cap bridge on which its arrow mark faces the engine front.
e. Before tightening, make the bearing caps be seated on the block firmly.



NOTICE

Use SST(09221-4A000), install main bearing cap bolts.



(2) Check that the crankshaft turns smoothly.

10. Check crankshaft end play.

11. Install the piston and connecting rod assemblies.

NOTICE

a. Before installing the pistons, apply a coat of engine oil to the ring grooves and cylinder bores.
b. When installing the piston, ensure that the coat on the cylinder wall is not damaged or scratched.

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

(2) Stop inserting the piston when the ring inserted in the cylinder and check the alignment of the journal and the connecting rod.

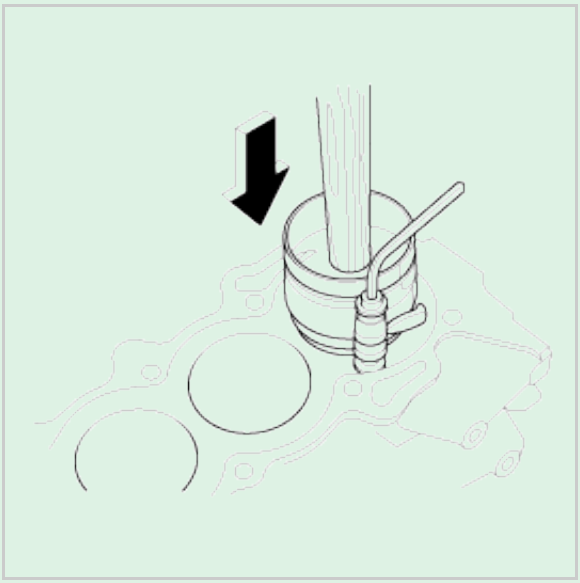
(3) Apply engine oil to the bolt threads. Install the rod caps with bearings, and torque the bolts.

Tightening torque

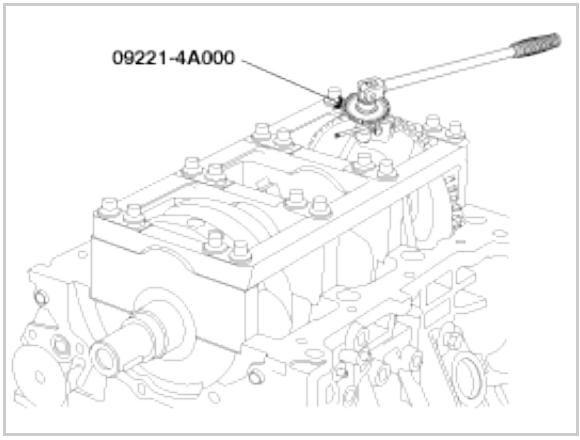
19.6Nm (2.0kgf.m, 14.46lb-ft) + 90°

NOTICE

a. Always use new connecting rod bolts.
b. Maintain downward force on the ring compressor to prevent the rings from expanding before entering the cylinder bore.

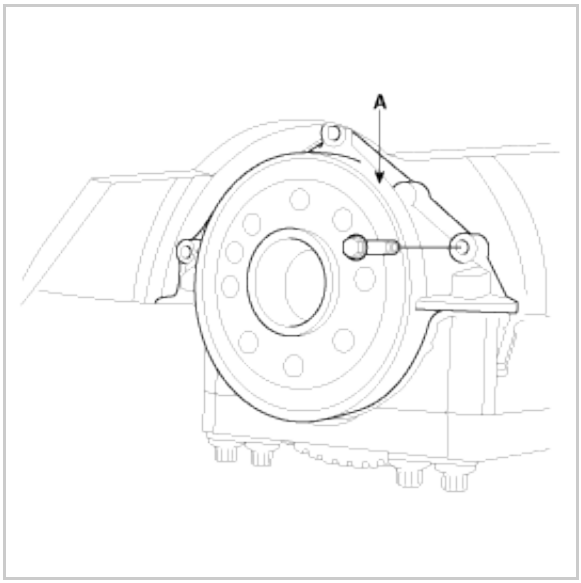


c. Use SST(09221-4A000), install connecting rod bearing cap bolts.



12. Install the rear oil seal case.

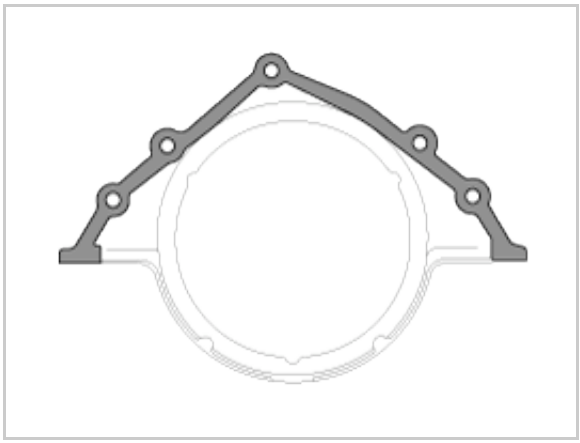
Tightening torque
9.80 ~ 11.76Nm (1.0 ~ 1.2kgf.m, 7.23 ~ 8.67lb-ft)



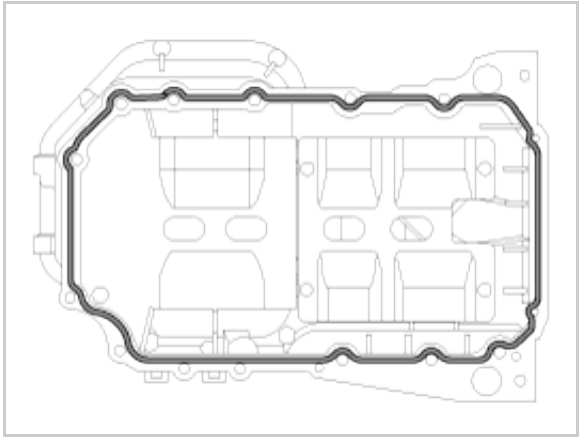
(1) Make clean the sealing face before assembling two parts.

> **NOTICE**
>
> a. Remove harmful foreign materials on the sealing face before applying sealant
> b. Apply sealant to the inner threads of the bolt holes.

(2) Assembling rear oil seal case, the liquid sealant TB1217H should be applied to the rear oil seal case. The part must be assembled within 5 minutes after sealant was applied.



13. Using SST(09231-33000), install rear oil seal after applying engine oil on the rip of the oil seal.
14. Install the oil pump case.
15. Install upper oil pan.
    (1) Using a gasket scraper, remove all the old packing material from the gasket surfaces.
    (2) Before assembling the oil pan, the liquid sealant TB1217H should be applied on upper oil pan. The part must be assembled within 5 minutes after the sealant was applied.

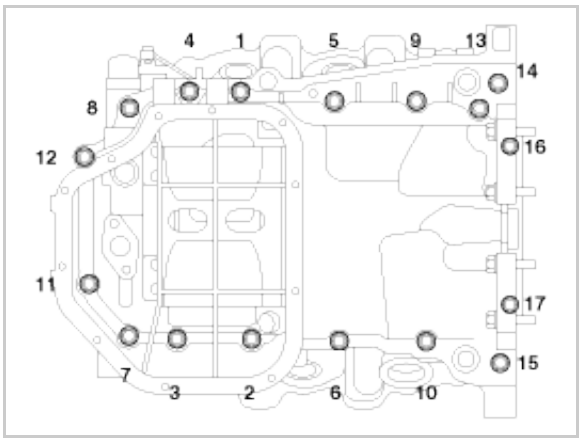


NOTICE

a. Clean the sealing face before assembling two parts.
b. Remove harmful foreign materials on the sealing face before applying sealant.
c. When applying sealant gasket, sealant must not protrude into the inside of oil pan.
d. To prevent leakage of oil, apply sealant gasket to the inner threads of the bolt holes.

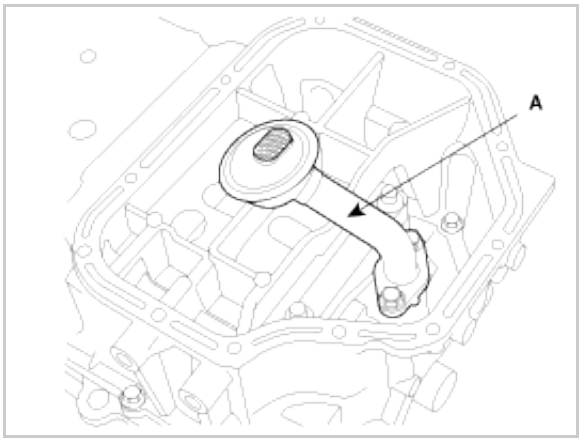
(3) Install upper oil pan.
Uniformly tighten the bolts in several passes.

Tightening torque
Bolts 1~15 : 18.6 ~ 23.5Nm(1.9 ~ 2.4kgf.m, 13.7 ~ 17.4lb-ft)
Bolts 16,17 : 4.9 ~ 6.9Nm(0.5 ~ 0.7kgf.m, 3.6 ~ 5.1lb-ft)



16. Install the oil screen(A).

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



17. Install the lower oil pan.
(1) Using a gasket scraper, remove all the old packing material from the gasket surfaces.
(2) Before assembling the oil pan, the liquid sealant TB1217H should be applied on lower oil pan.
The part must be assembled within 5 minutes after the sealant was applied.

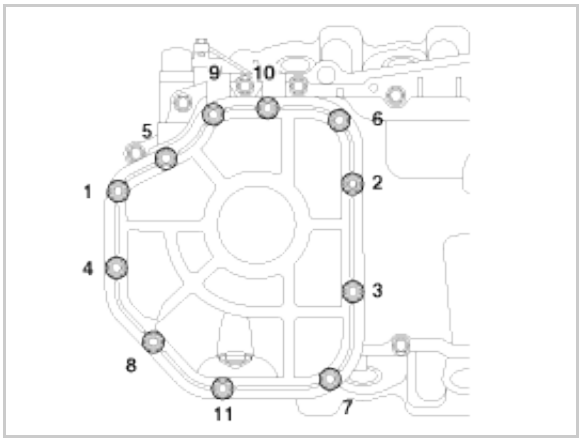
NOTICE

a. Clean the sealing face before assembling two parts.
b. Remove harmful foreign materials on the sealing face before applying sealant.
c. When applying sealant gasket, sealant must not protrude into the inside of oil pan.
d. To prevent leakage of oil, apply sealant gasket to the inner threads of the bolt holes.

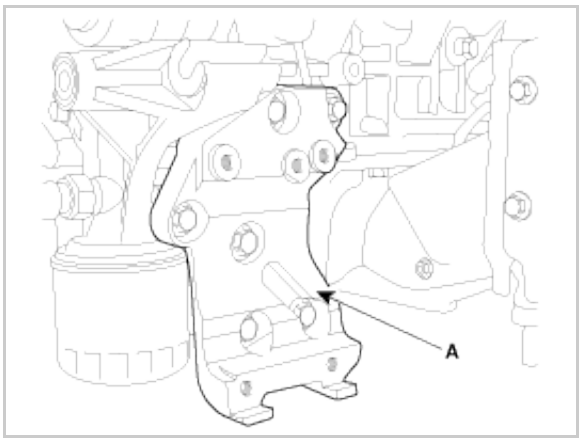
(3) Install lower oil pan.

Uniformly tighten the bolts in several passes.

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

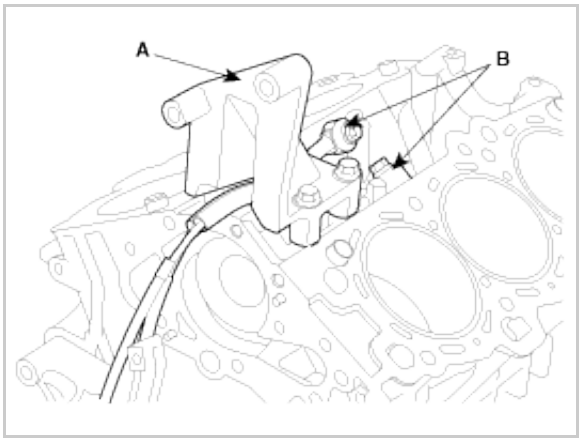


18. Install the air conditioning compressor bracket(A). (Refer to 'HA' group)



19. Install the power steering pump bracket(A) and the knock sensor(B).

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

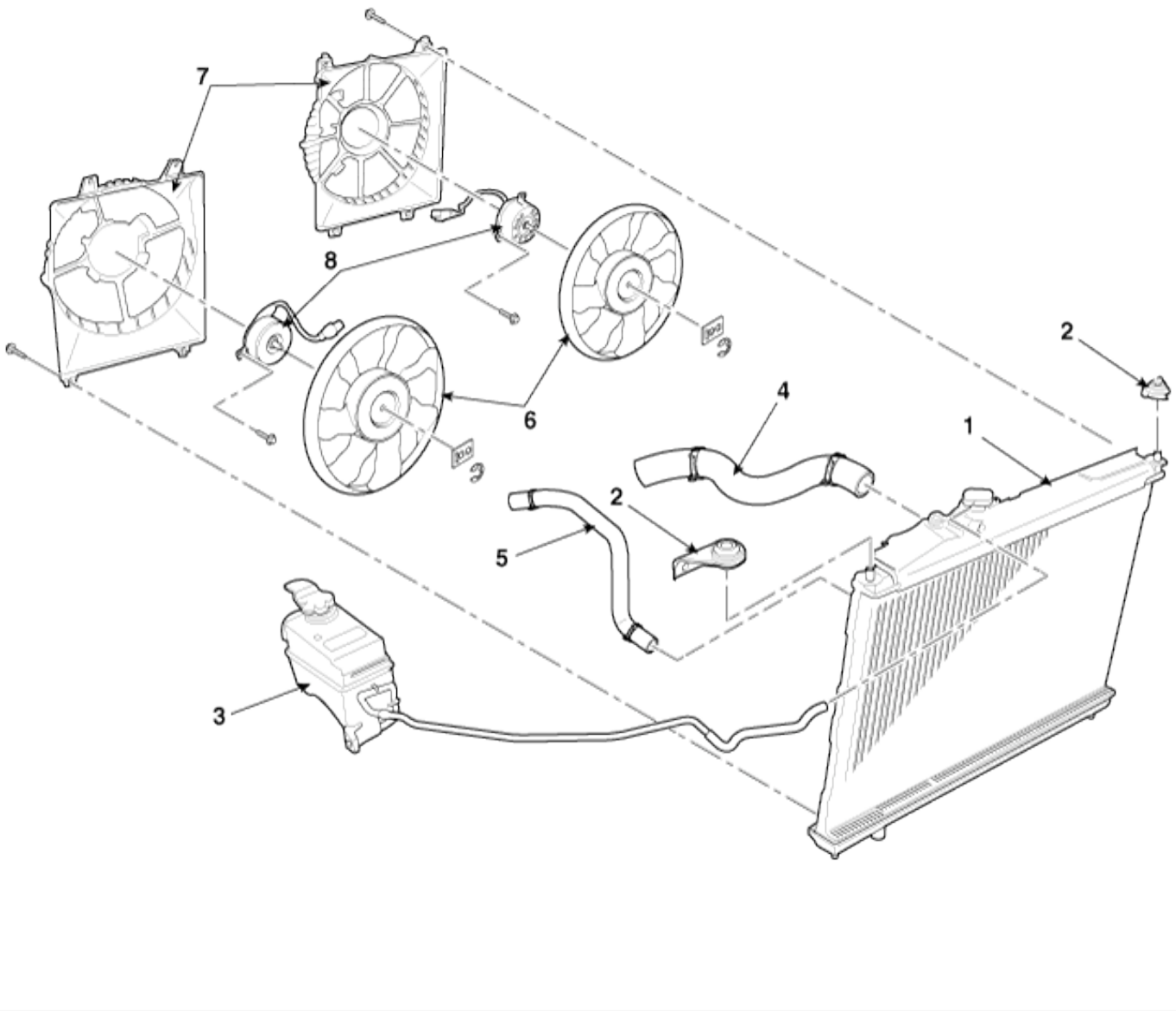


CAUTION

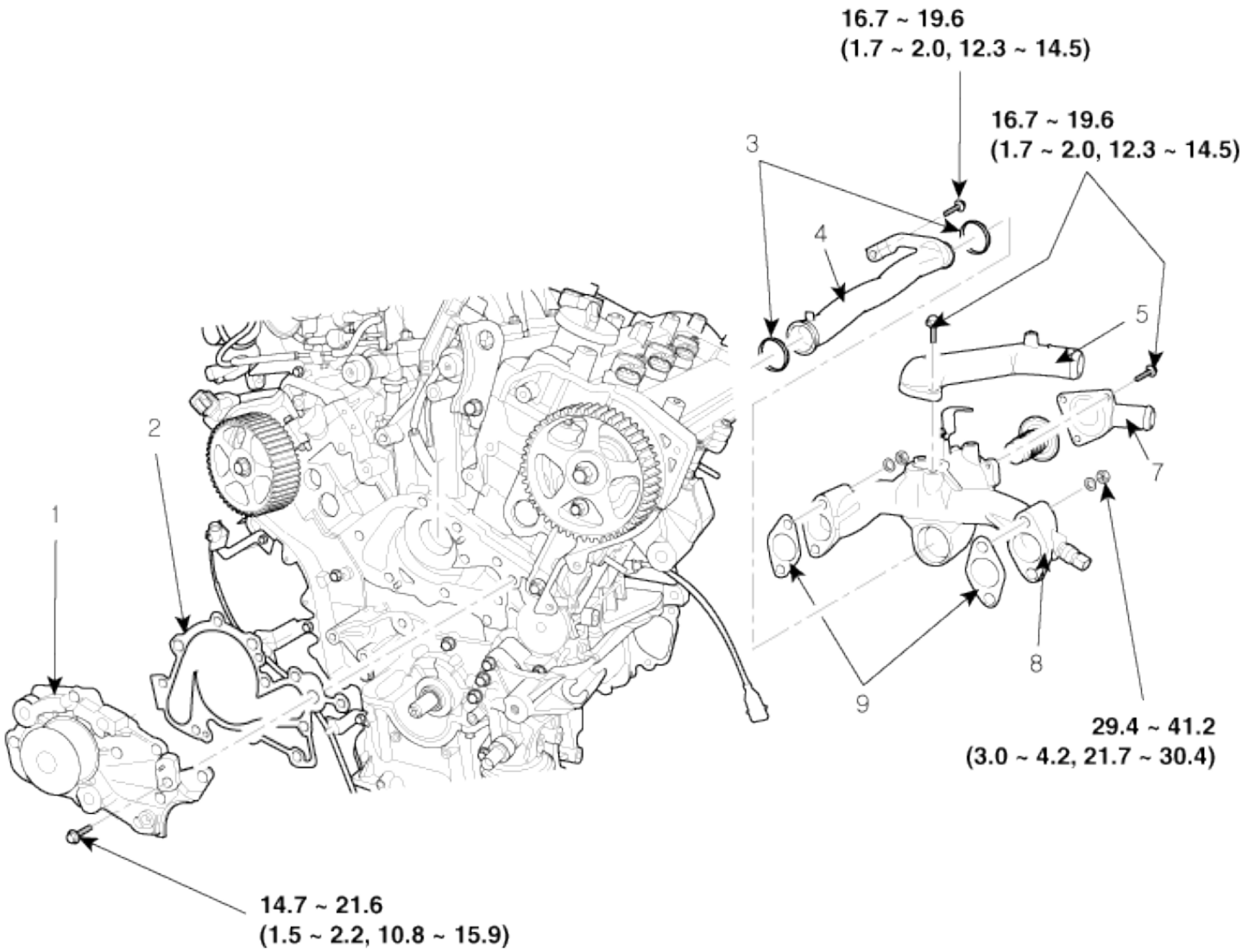
a. On Bank 1, the black knock sensor connector should be installed and on Bank 2, the gray one should.

Cooling system

COMPONENTS



1. Radiator
2. Radiator bracket
3. Coolant reservoir tank
4. Radiator upper hose
5. Radiator lower hose
6. Radiator fan
7. Shroud
8. Motor assembly



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

1. Water pump
2. Water pump gasket
3. Water pipe O-ring
4. Water inlet pipe
5. Water outlet pitting
6. Thermostat
7. Water inlet pitting
8. Water temp. control assembly
9. Water temp. control assembly gasket

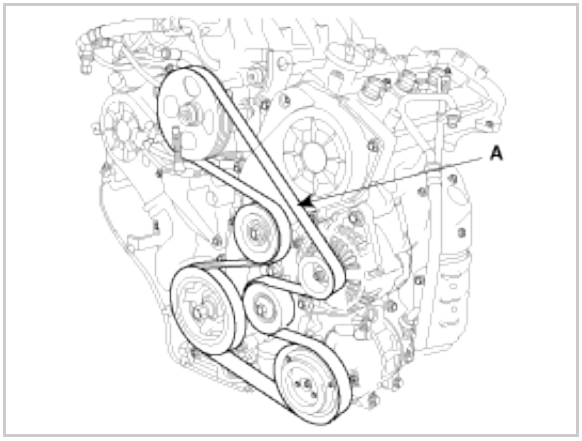
REMOVAL

WATER PUMP

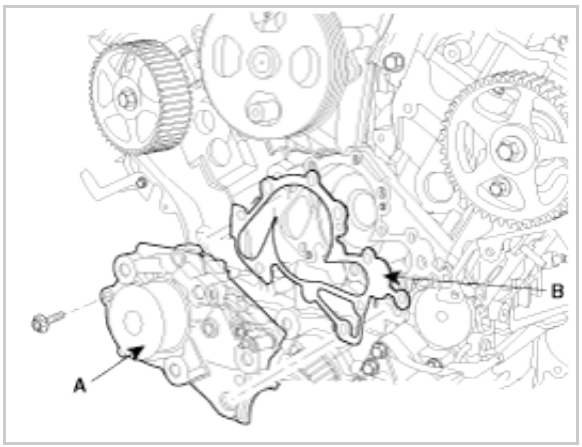
1. Drain the engine coolant.

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

2. Remove drive belt(A).

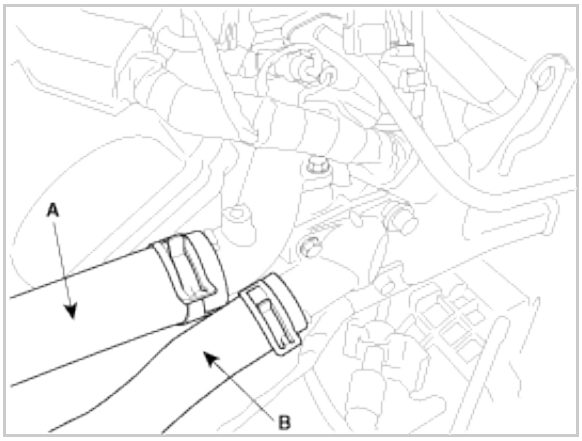


3. Remove the timing belt.
4. Remove the water pump(A) and gasket(B).

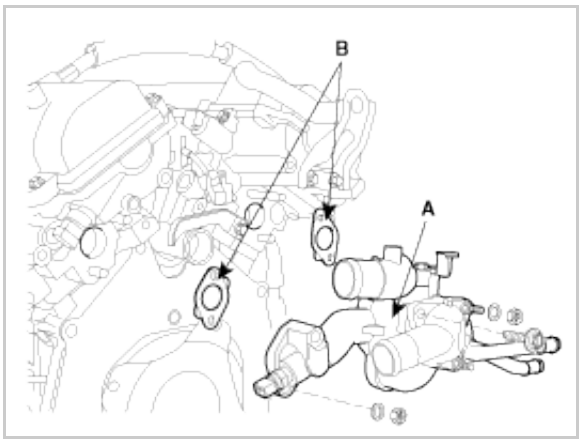


WATER TEMPERATURE CONTROL ASSEMBLY

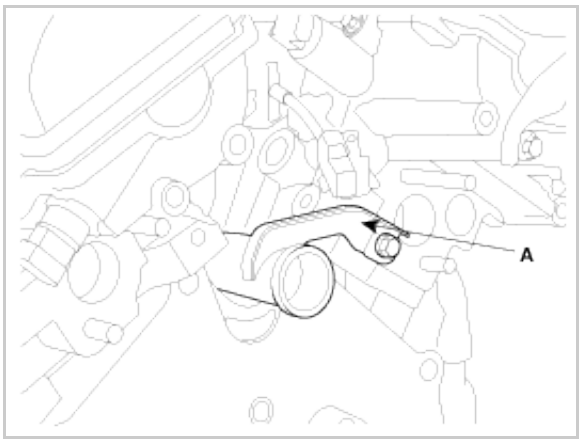
1. Drain the engine coolant.
2. Remove the air cleaner assembly.
3. Disconnect the radiator upper and lower hose(A, B).



4. Disconnect the ECT(Engine Coolant Temperature) sensor connector.
5. Remove the coolant hose related to the heater hoses and the ECT(Engine Coolant Temperature) system.
6. Remove wiring protector.
7. Remove water temperature control assembly(A) and the gaskets(B).



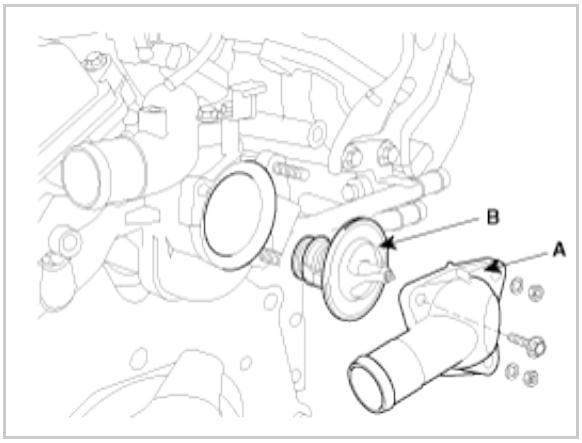
8. Remove the water pipe(A).



THERMOSTAT

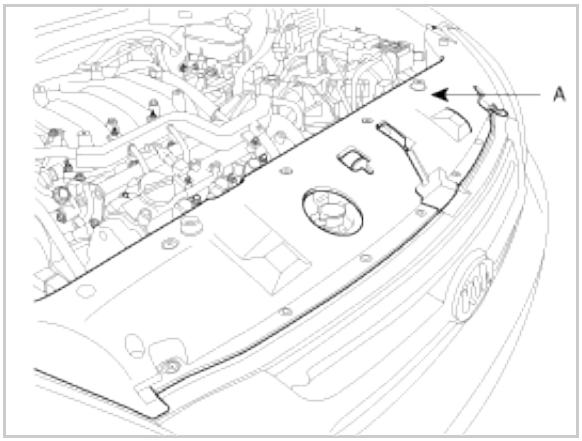
> **NOTICE**
>
> Removal of the thermostat would have an adverse effect, causing a lowering of cooling efficiency. Do not remove the thermostat, even if the engine tends to overheat.

1. Drain engine coolant so its level is below thermostat.
2. Remove the coolant inlet pitting(A) and the thermostat(B).

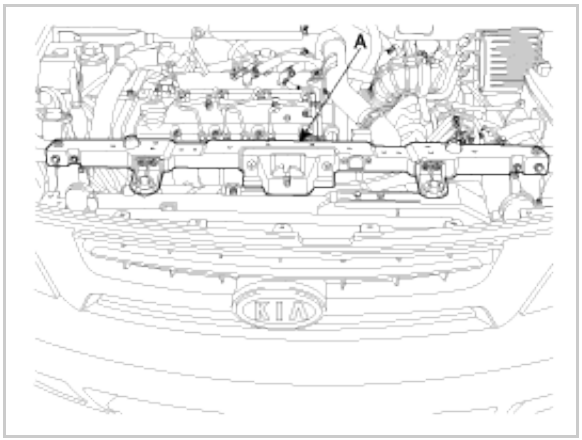


RADIATOR

1. Drain the engine coolant.
2. Remove the radiator grille upper cover(A).

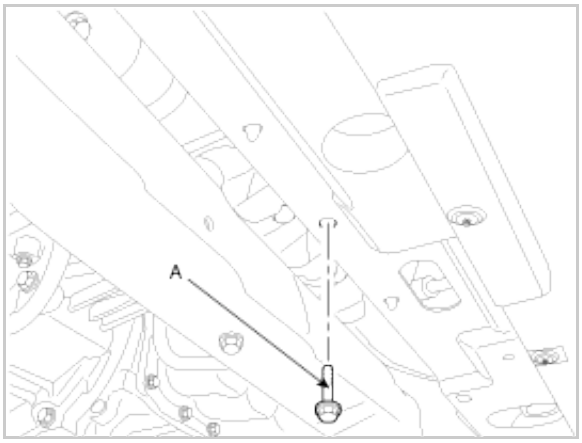


3. Remove the radiator support upper member assembly(A) for convenience sake.

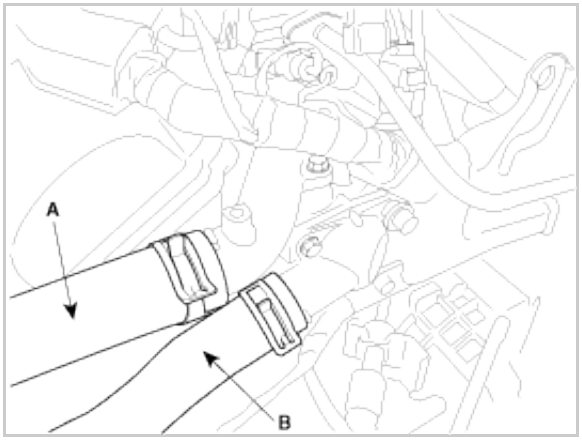


NOTICE

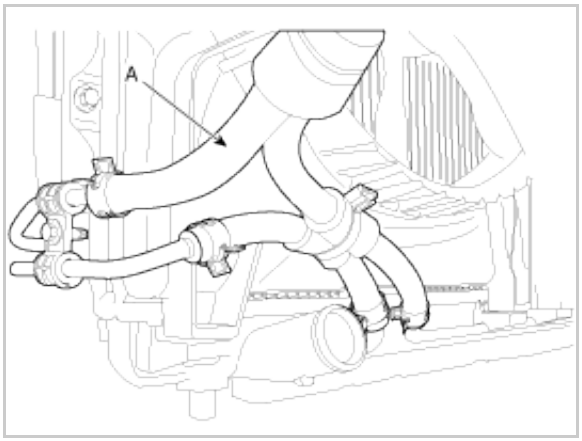
The bottom side bolt(A) which can be seen after removing the under cover should be loosened for removal of the radiator support upper member assembly.



4. Remove the radiator upper and the lower hoses(A).

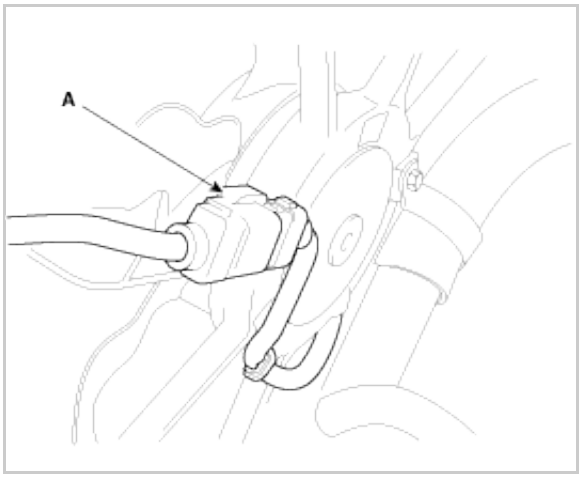


5. Disconnect transaxle oil cooler hoses(A).(Refer to TR group)

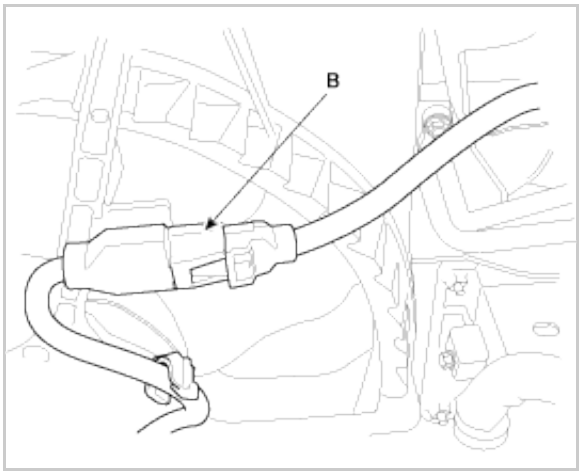


6. Disconnect the radiator fan connectors(A,B).

LH

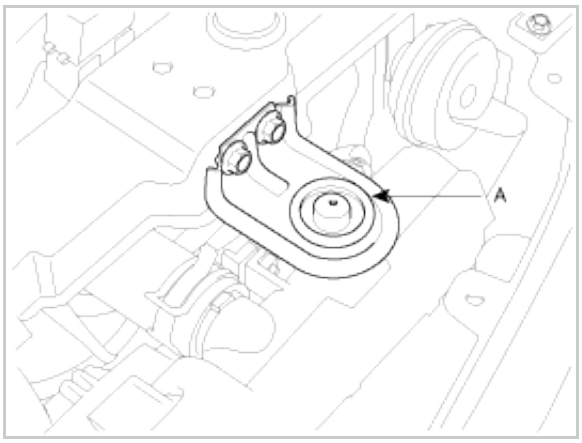


RH

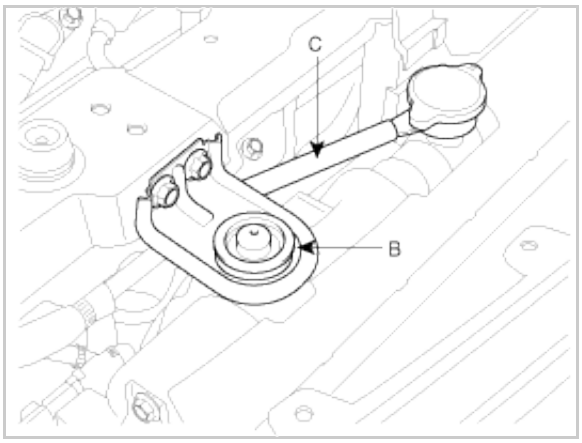


7. Remove the radiator bracket(A, B) and the bleeder hose(C).

LH



RH



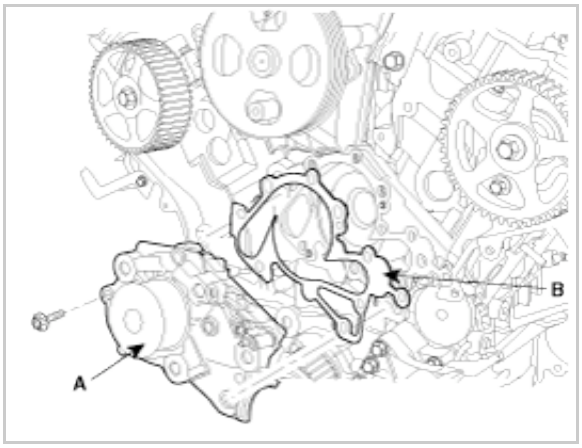
8. Separate the condenser from the radiator assembly by removing the bolts.
9. Remove the radiator assembly.
10. Remove the radiator cooling fan.

INSTALLATION

WATER PUMP

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

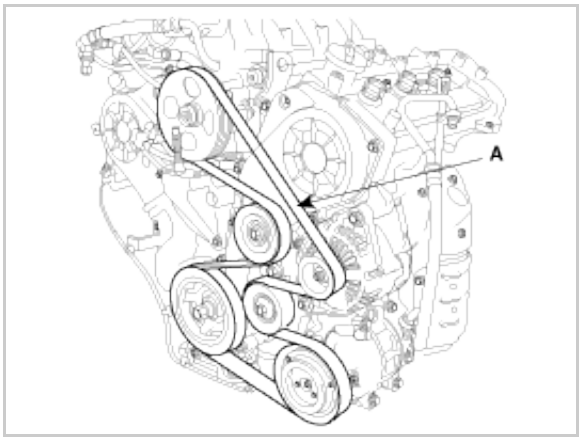
Tightening torque
14.7 ~ 21.6Nm (1.5 ~ 2.2kgf.m, 10.8 ~ 15.9lb-ft)



NOTICE

Clean the contacting face before assembling.

2. Install the timing belt.
3. Install drive belt(A).

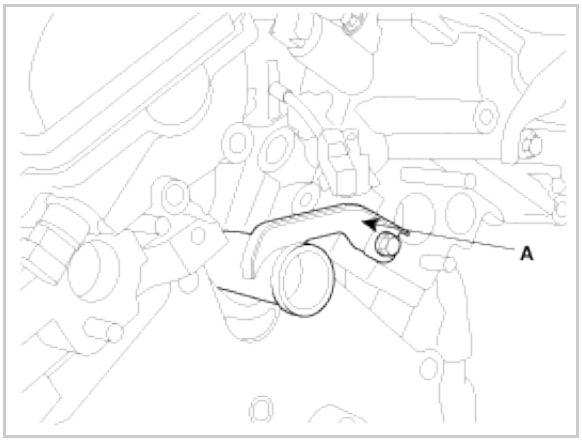


4. Fill with engine coolant.
5. Start engine and check for leaks.
6. Recheck engine coolant level.

WATER TEMPERATURE CONTROL ASSEMBLY

1. Install the water pipe(A).

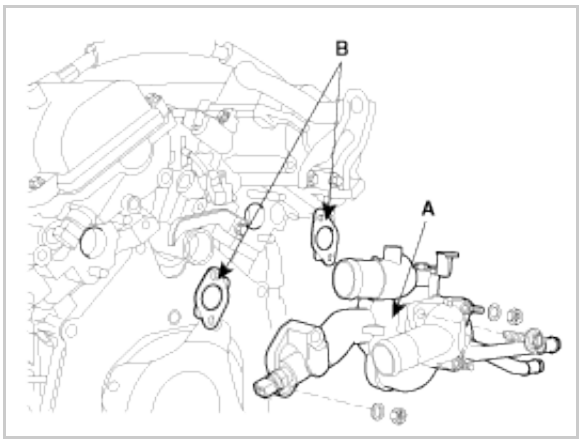
Tightening torque
16.7 ~ 19.6Nm (1.7 ~ 2.0kgf.m, 12.3 ~ 14.5lb-ft)



2. Install the water temperature control assembly(A) with a new gasket(B).

Tightening torque

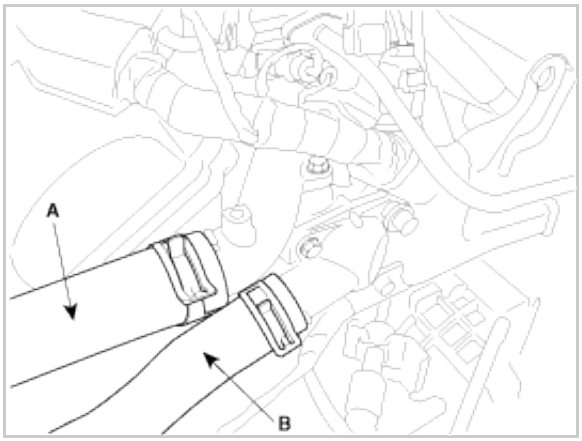
29.4 ~ 41.2Nm(3.0 ~ 4.2kgf.m, 21.7 ~ 30.4lb-ft



NOTICE

Use new O-rings and wet them with water or coolant when reassembling.

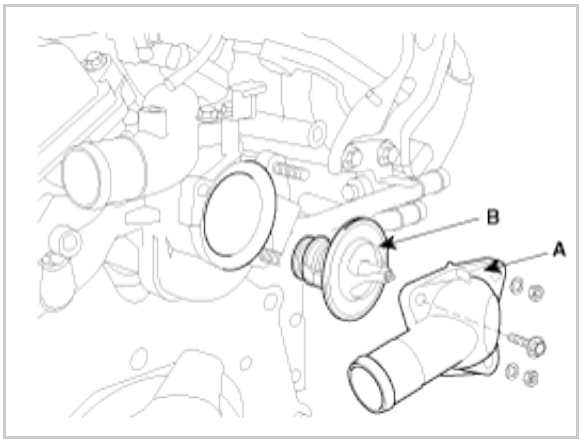
3. Install the wiring protector.
4. Connect the heater hose and ECT hose.
5. Connect the ECT sensor connector.
6. Connect the radiator upper and the lower hose(A).



7. Install the air cleaner assembly.
8. Fill with engine coolant.
9. Start engine and check for leaks.
10. Recheck engine coolant level.

THERMOSTAT

1. Place thermostat(B) in coolant inlet pitting(A).
   Install the thermostat with the jiggle valve upward.



2. Install the coolant inlet pitting(A).

Tightening torque
16.66 ~ 19.60Nm (1.7 ~ 2.0kgf.m, 12.30 ~ 14.47lb-ft)

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

RADIATOR

1. Install the radiator fan(A) to the radiator.

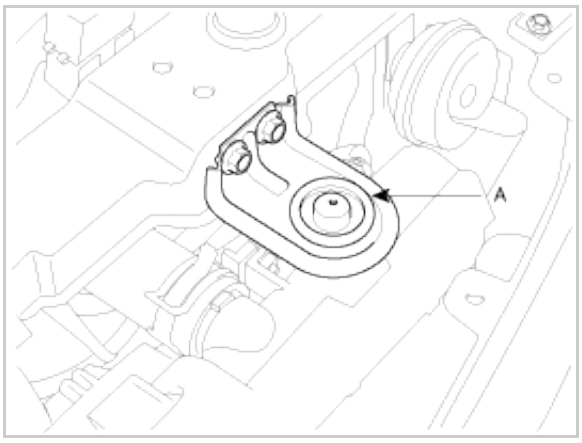
Tightening torque
4.9 ~ 7.8Nm (0.5 ~ 0.8kgf.m, 3.6 ~ 5.8lb-ft)

2. Install the radiator assembly to the vehicle.
3. Fix the condenser with the radiator assembly.

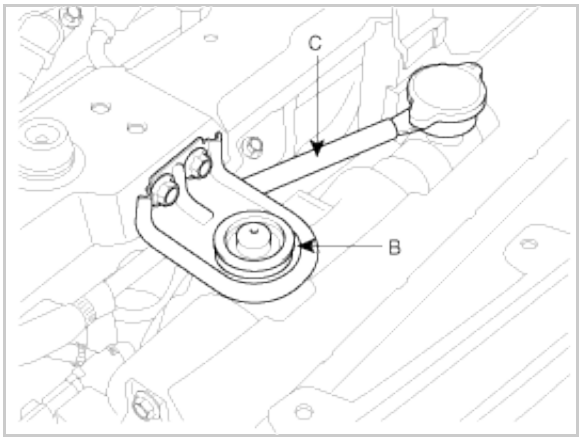
Tightening torque
4.9 ~ 7.8Nm (0.5 ~ 0.8kgf.m, 3.6 ~ 5.8lb-ft) - D
6.9 ~ 9.8Nm (0.7 ~ 1.0kgf.m, 5.1 ~ 7.2lb-ft) - C

4. Install the radiator bracket(A, B) and the bleeder hose(C).

LH

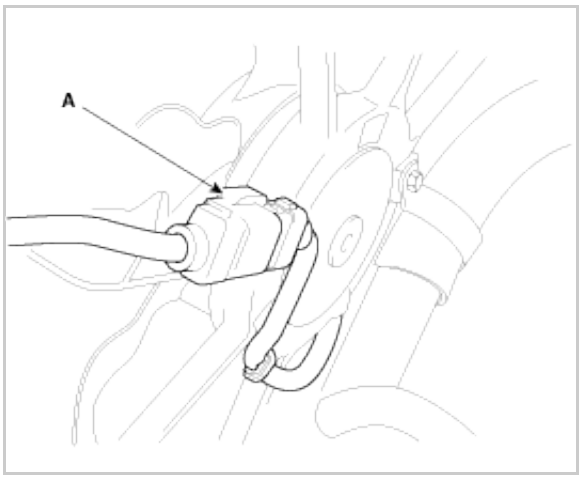


RH

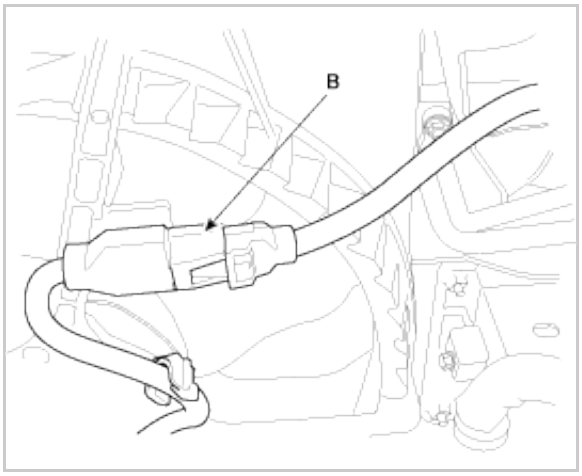


5. Connect the radiator fan connectors(A,B)

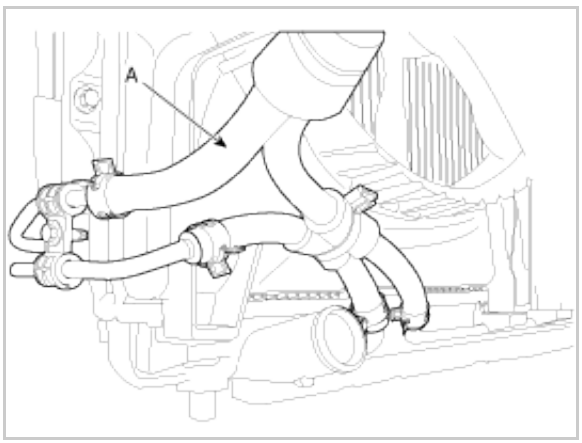
LH



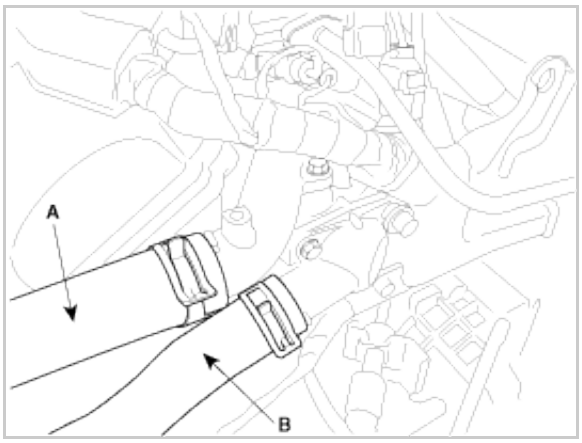
RH



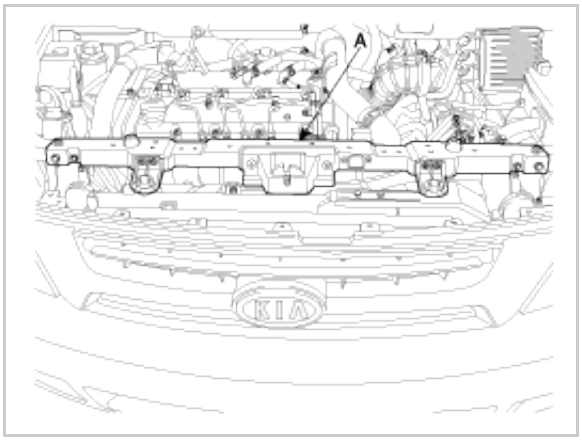
6. Install the transaxle oil cooler hoses(A).(Refer to TR group)



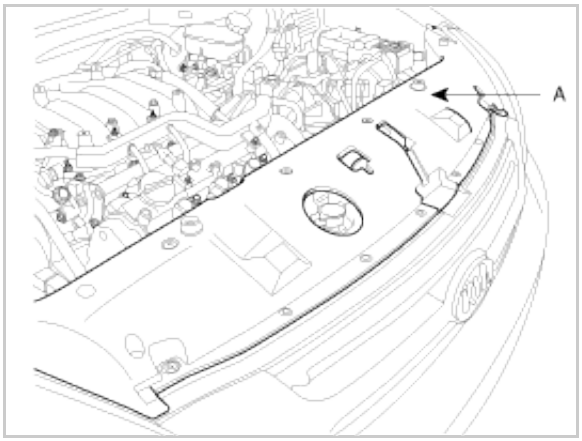
7. Install the radiator upper(A) and lower hoses(B).



8. Install the radiator support upper member assembly(A).



9. Install the radiator grille upper cover(A).



10. Fill with engine coolant.
11. Start engine and check for leaks.
12. Recheck engine coolant level.

INSPECTION

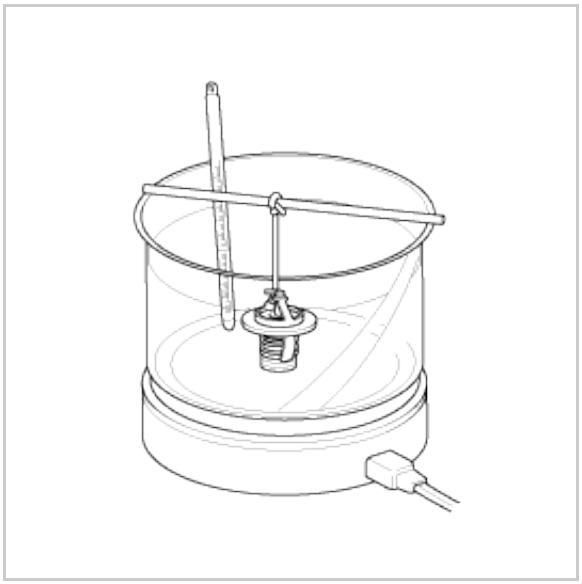
WATER PUMP

1. Check each part for cracks, damage or wear, and replace the coolant pump assembly if necessary.
2. Check the bearing for damage, abnormal noise and sluggish rotation, and replace the coolant pump assembly if necessary.
3. Check for coolant leakage. If coolant leaks from hole, the seal is defective. Replace the coolant pump assembly.

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

THERMOSTAT

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



2. Check the valve opening temperature.
   Valve opening temperature : 82°C (177°F)
   Full opening temperature : 95°C (205°F)
   If the valve opening temperature is not as specified, replace the thermostat.
3. Check the valve lift.
   Valve lift : Min. 10mm (0.4in.) at 95°C (205°F)
   If the valve lift is not as specified, replace the thermostat.

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 or the paint. If any coolant spills, rinse it off immediately.

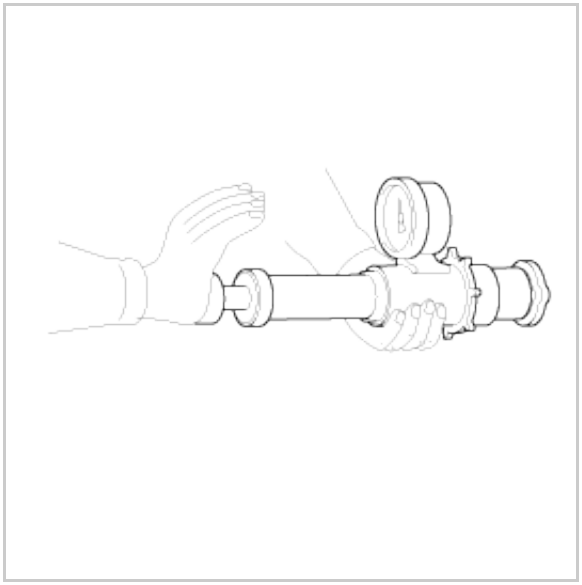
1. Make sure the engine and radiator are cool to the touch.
2. Open the radiator cap.
3. Loosen the drain plug, and drain the coolant.
4. Tighten the radiator drain plug securely.
5. Remove, drain and clean the reservoir tank.
6. Fill water slowly through the radiator cap. Push the upper/lower hoses of the radiator so as to bleed air easily.
7. Warm the engine until the cooling fan operates 2~3 times.
   Accelerate the engine 2~3 times without load.
8. Wait until the engine is cold.
9. Repeat the steps 1~8 until the water drained is clean.
10. Fill fluid mixture with coolant and water(4 : 6) slowly through the radiator cap. Push the upper/lower hoses of the radiator so as to bleed air easily.
11. Start the engine and run so coolant circulates.
    When the cooling fan operates and coolant circulates, refill coolant through the radiator cap.
12. Repeat 11 until the cooling fan cycles 3 ~ 5 times and bleed air sufficiently out of the cooling system.

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

> **NOTICE**
>
> Check the coolant level again in the reservoir tank for 2 ~ 3 days after replacing coolant.

CAP TESTING

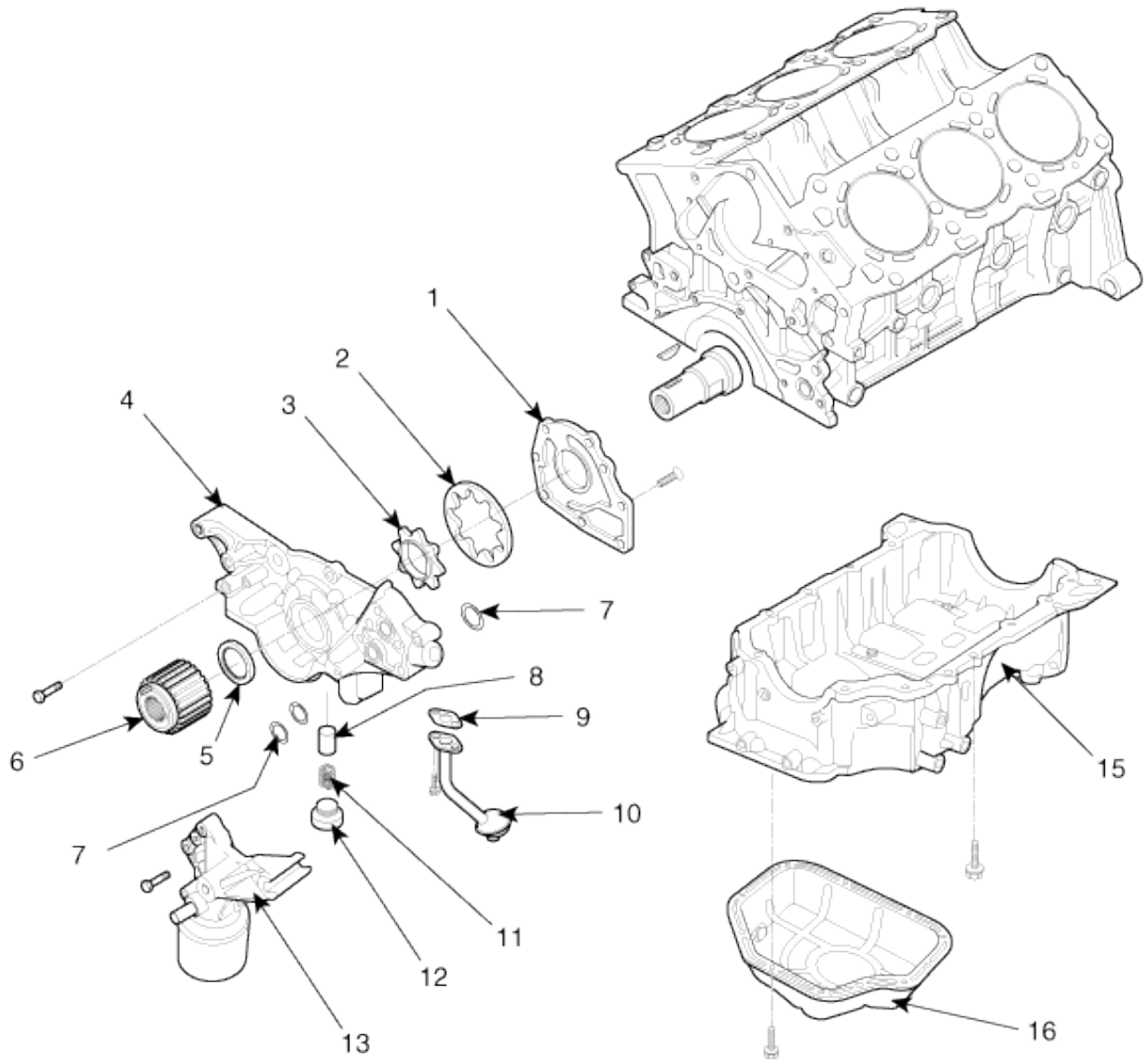
1. Remove the radiator cap, wet its seal with engine coolant, and install it to a pressure tester.



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

Lubrication system

COMPONENTS

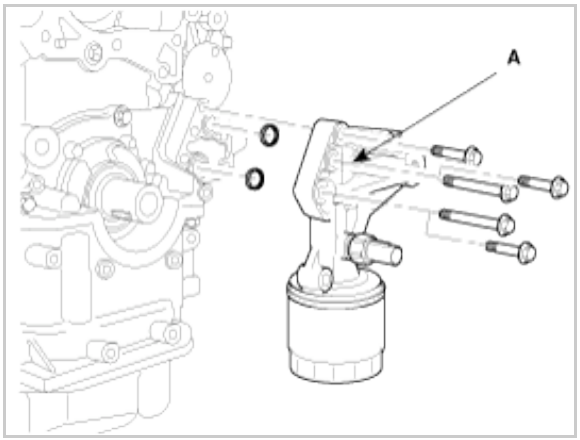


1. Oil pump cover
2. Oil pump outer rotor
3. Oil pump inner rotor
4. Oil pump case rotor
5. Oil seal
6. Crankshaft sprocket
7. O-ring
8. Relief plunger
9. Oil screen gasket
10. Oil screen
11. Relief spring
12. Plug
13. Oil filter bracket
15. Upper oil pan
16. Lower oil pan

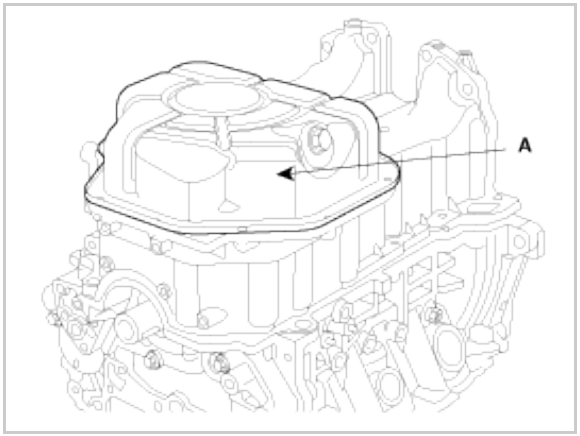
REMOVAL

Oil pump case

1. Drain engine oil.
2. Remove the front right wheel and tire.
3. Remove the front right side cover.
4. Remove the front muffler.
5. Remove the generator.
6. Remove the timing belt.
7. Remove the oil filter bracket(A).



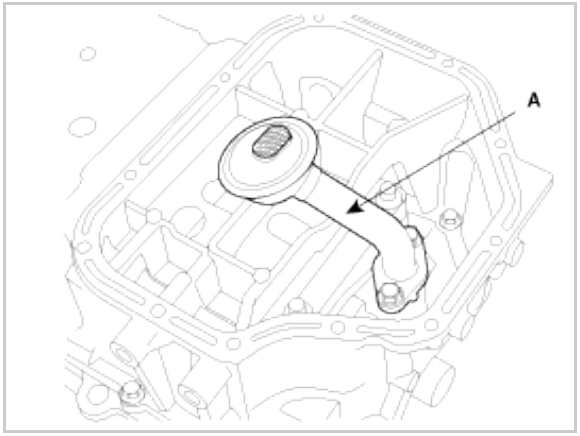
8. Using SST(09215-3C000), remove the lower oil pan(A).



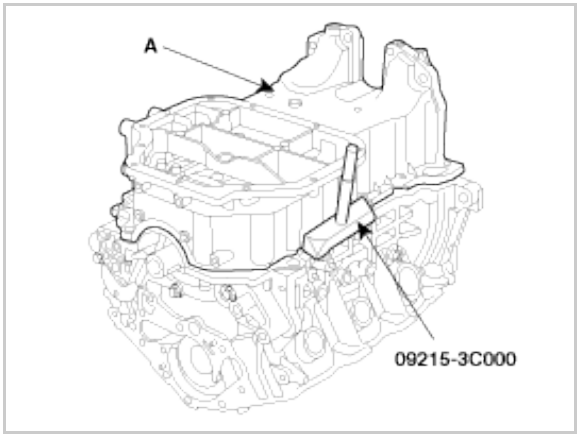
CAUTION

Be careful not to damage the contact surfaces of upper oil pan and lower oil pan.

9. Remove the oil screen(A).



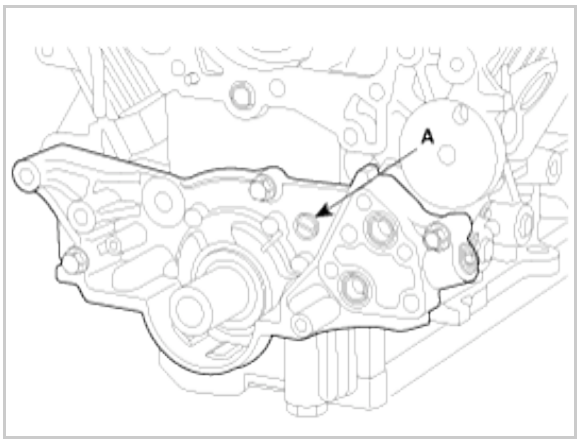
10. Remove the upper oil pan, using the SST(09215-3C000)(A).



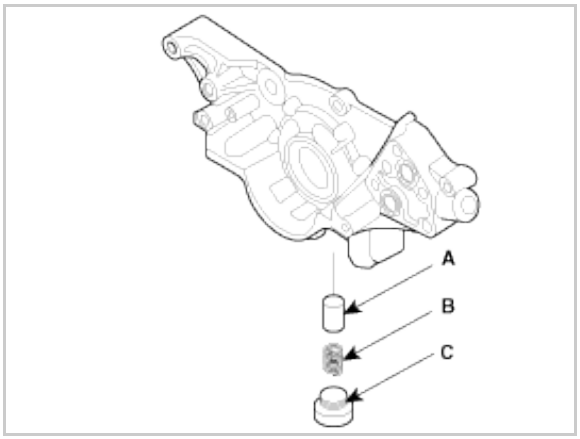
CAUTION

Be careful not to damage the contact surfaces of upper oil pan and lower oil pan.

11. Remove the oil pump case(A).



12. After removing the plug(A), remove the relief spring(B) and the velief plunger(C).



REPLACEMENT

OIL AND FILTER

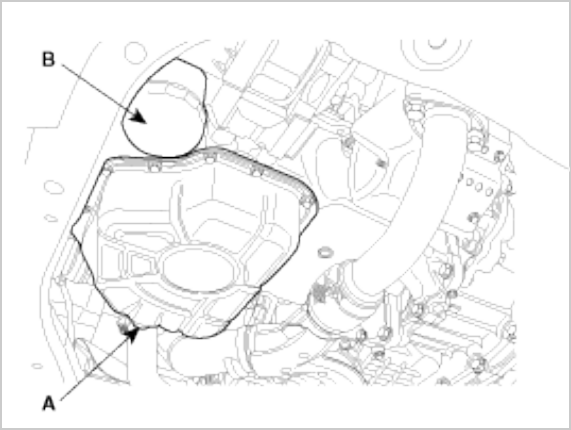
CAUTION

a. 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.

b. Wear protective clothing and gloves in order to minimize the length and frequency of contact of your skin to used oil. 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.

c. In order to preserve environment, used oil or used oil filter must be disposed only at designated disposal sites.

1. Park the car on a level ground.
   Start the engine and let it warm up.
2. Turn the engine off.
3. Drain engine oil.
   (1) Remove the oil filler cap.
   (2) After lifting the car, remove the oil drain plug(A) and drain oil into a container.
4. Replace the oil filter.
   (1) Remove the oil filter(B).



   (2) Check the part number of a new oil filter is as the same as that of the old one.
   (3) Replace the oil filter.
   (4) Tighten it slightly until the o-ring of the filter cap contacting on its position.
   (5) Tighten it with the specified torque.

Tightening torque
16.7 ~ 24.5Nm(1.7 ~ 2.5kgf.m, 12.3 ~ 18.1lb-ft)

5. Refill with engine oil.
   (1) Install the oil drain plug with a new gasket.

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

   (2) Fill with fresh engine oil, after removing the engine oil level gauge.

Capacity
Total : 4.8 L (5.07 US qt, 4.22 Imp qt)
Oil pan : 4.2 L (4.43 US qt, 3.69 Imp qt)
Drain and refill including oil filter : 4.5 L (4.75 US qt, 3.95 Imp qt)
Oil quality : ABOVE API SJ / SL or SAE 5W-20

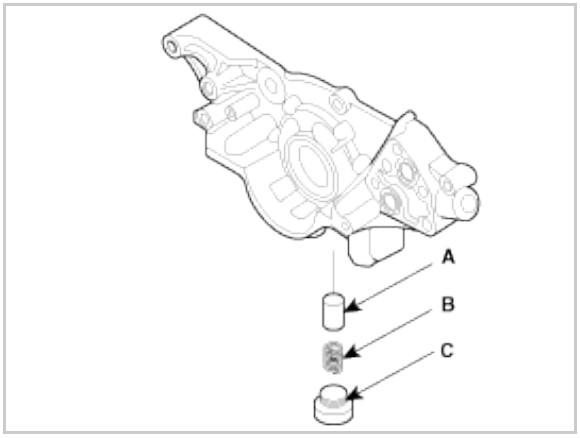
   (3) Install the oil filler cap and the oil level gauge.
6. Start the engine and ensure that no oil is leaking from the drain plug or the oil filter.
7. Recheck engine oil level.

INSTALLATION

Oil pump case

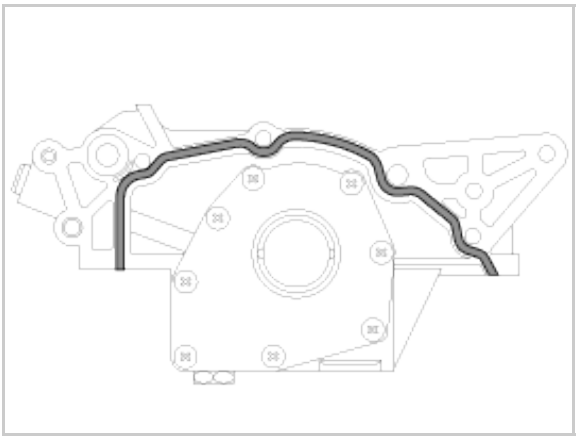
1. Assembly the relief spring(B) and the relief plunger(C) and tighten the plug(A).

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



2. Install oil pump case.
   (1) Using a gasket scraper, remove all the old packing material from the gasket surfaces.
   (2) Before assembling the oil pan, the liquid sealant TB1217H should be applied on the oil pan. The part must be assembled within 5 minutes after the sealant was applied.

Bead width : 2.5mm(0.0984in.)

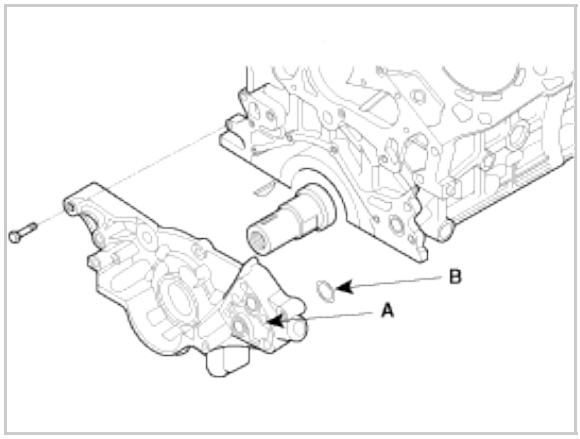


CAUTION

a. Make clean the sealing face before assembling two parts.
b. Remove harmful foreign materials on the sealing face before applying sealant.
c. When applying sealant gasket, sealant must not be protrude into the inside of oil pan.
d. To prevent leakage of oil, apply sealant gasket to the inner threads of the bolt holes.
e. After assembly, wait at least 30 minutes before filling the engine with oil.

   (3) Install the oil pump case(A).

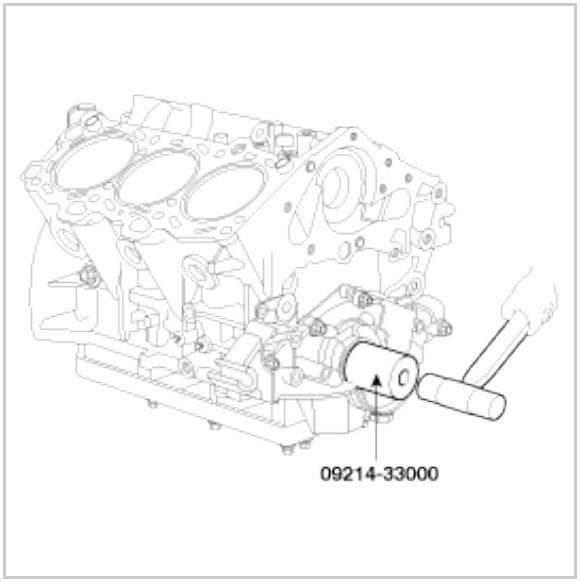
Tightening torque
18.6 ~ 23.5(1.9 ~ 2.4kgf.m, 13.7 ~ 17.4lb-ft)



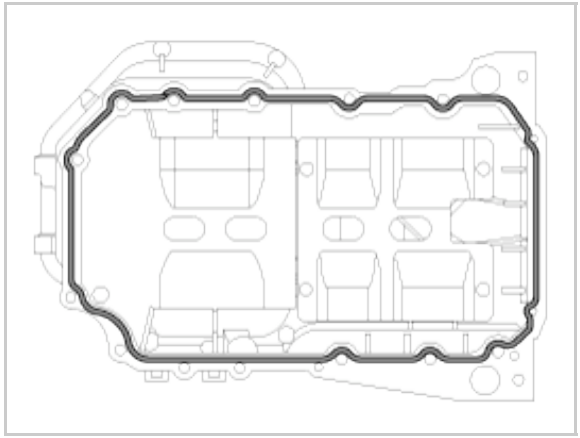
CAUTION

In the installation of the oil pump, always use a new o-ring(B).

3. Using the SST(09214~33000), install the oil pump case oil seal.



4. Install the upper oil pan.
   (1) Using a gasket scraper, remove all the old packing material from the gasket surfaces.
   (2) Before assembling the oil pan, the liquid sealant TB1217H should be applied on the oil pan. The part must be assembled within 5 minutes after the sealant was applied.



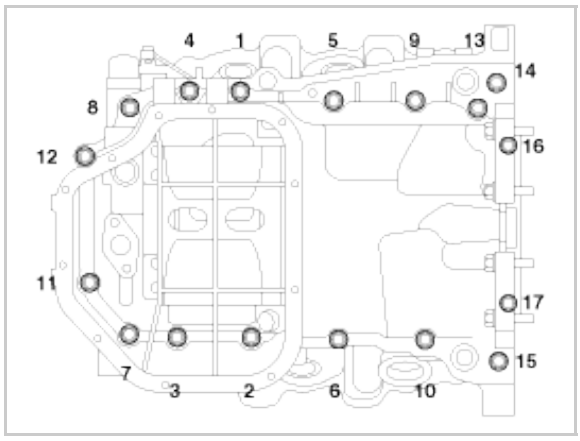
CAUTION

a. Make clean the sealing face before assembling two parts.
b. Remove harmful foreign materials on the sealing face before applying sealant.
c. When applying sealant gasket, sealant must not be protrude into the inside of oil pan.

d. To prevent leakage of oil, apply sealant gasket to the inner threads of the bolt holes.
e. After assembly, wait at least 30 minutes before filling the engine with oil.

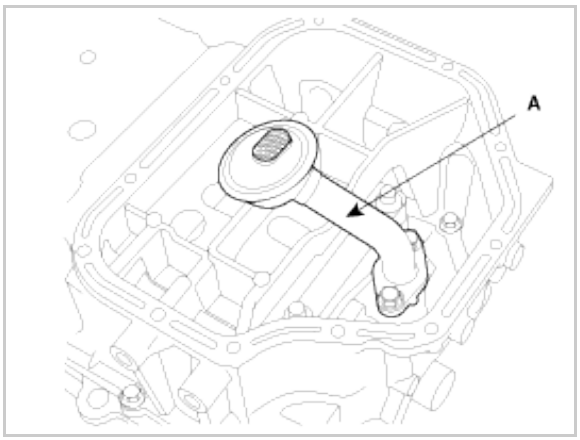
(3) Fix the oil pan and tighten the bolts in several steps uniformly.

Tightening torque
Bolts 1~15 : 18.6 ~ 23.5Nm(1.9 ~ 2.4kgf.m, 13.7 ~ 17.4lb-ft)
Bolts 16,17 : 4.9 ~ 6.9Nm(0.5 ~ 0.7kgf.m, 3.6 ~ 5.1lb-ft)



5. Install the oil screen.

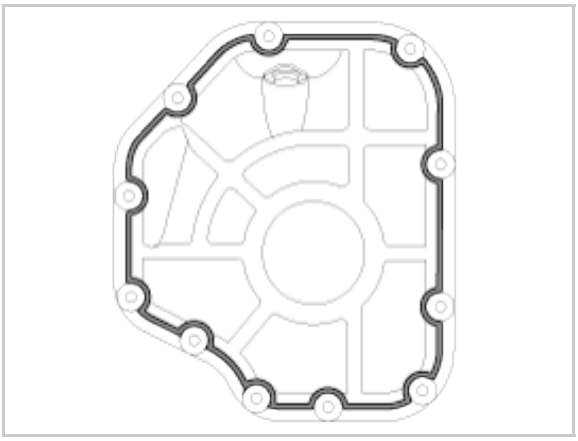
Tightening torque
14.7 ~ 21.6Nm(1.5 ~ 2.2kgf.m, 10.8 ~ 15.9lb-ft)



NOTICE

Always use a new gasket.

6. Install the lower oil pan.
(1) Using a gasket scraper, remove all the old packing material from the gasket surfaces.
(2) Before assembling the oil pan, the liquid sealant TB1217H should be applied on the oil pan.
The part must be assembled within 5 minutes after the sealant was applied.

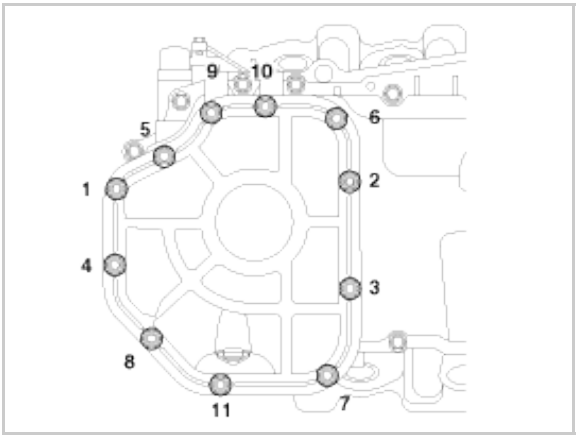


CAUTION

a. Make clean the sealing face before assembling two parts.
b. Remove harmful foreign materials on the sealing face before applying sealant.
c. When applying sealant gasket, sealant must not be protrude into the inside of oil pan.
d. To prevent leakage of oil, apply sealant gasket to the inner threads of the bolt holes.
e. After assembly, wait at least 30 minutes before filling the engine with oil.

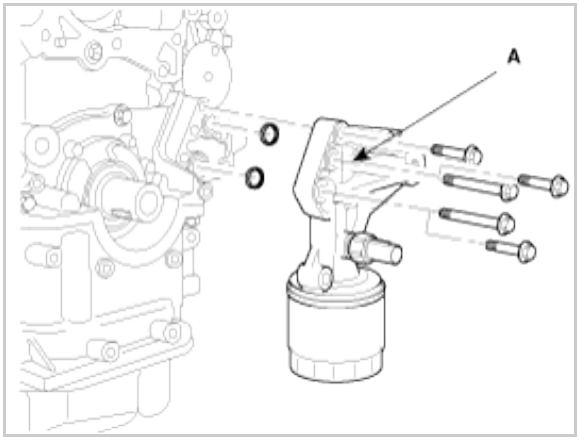
(3) Fix the oil pan and tighten the bolts in several steps uniformly.

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



7. Install the oil filter bracket(A).

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



CAUTION

Always use a new O-ring.

8. Install the timing belt, the generator and the front muffler.
9. Install the front right side cover and the wheel and tire.
10. Fill with engine coolant.
11. Start engine and check for leaks.
12. Recheck engine coolant level.

INSPECTION

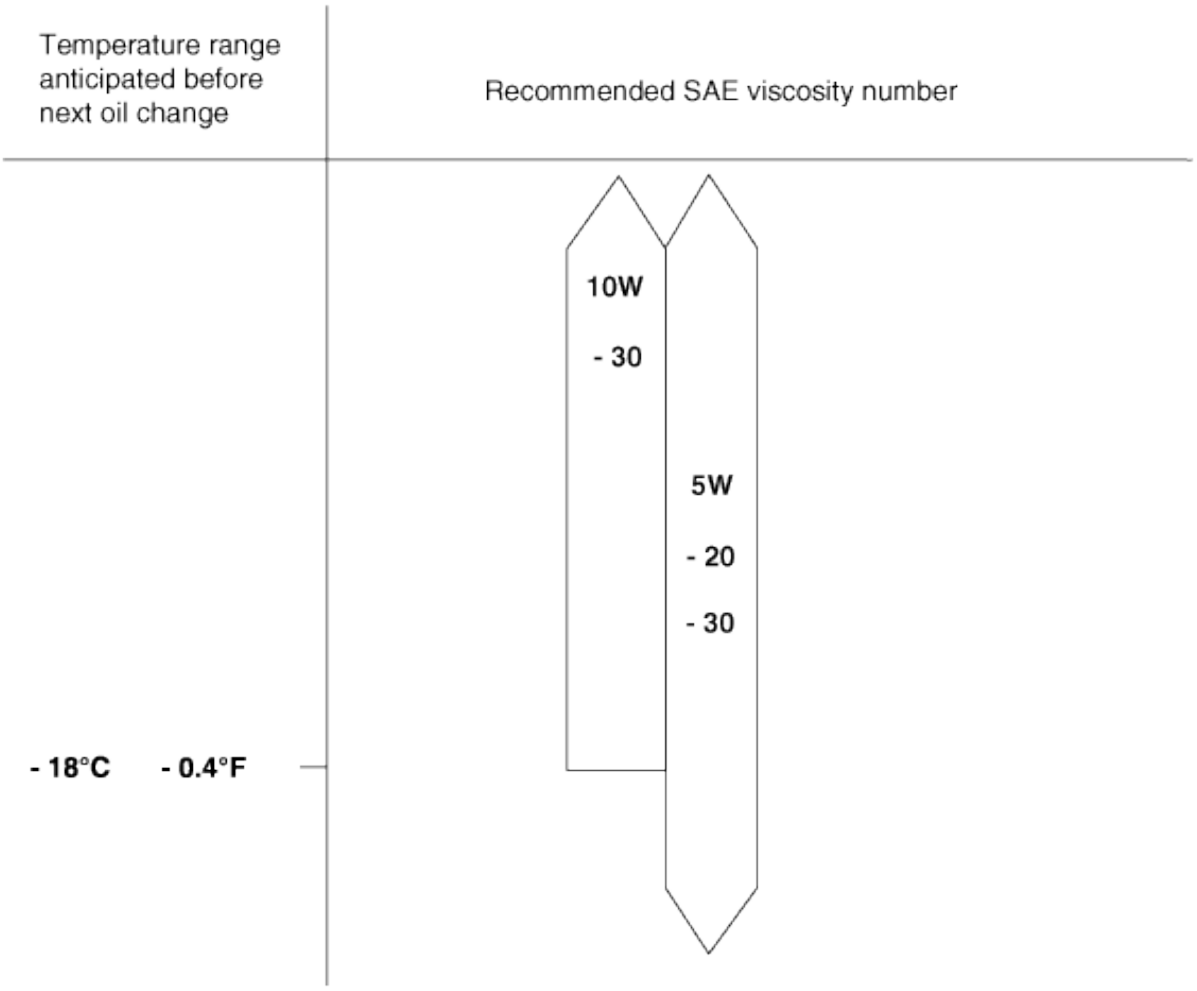
1. Check engine oil quality.
   Check the oil for deterioration, entry of water, discoloring or thinning.
   If the quality is visibly poor, replace oil.
2. Check the engine oil level.
   After warning up the engine, make the engine stand still for five minutes or more. The oil level should be between the 'L' and 'F' marks on the dipstick, then.
   If low, check for leakage and add oil up to the "F" mark.

NOTICE

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

SELECTION OF ENGINE OIL

Recommended API classification : Above SJ or SL
Recommended SAE viscosity grades : 5W-20



NOTICE

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

a. Satisfy the requirement of the API classification.

b. Have proper SAE grade number for expected ambient temperature range.
Lubricants that do not have both an SAE grade number and API service classification on the container should not be used.

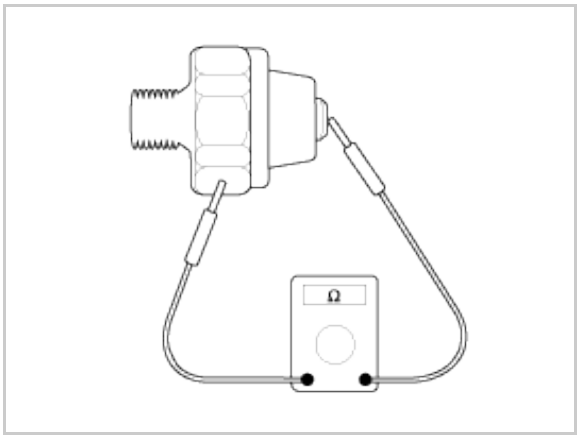
RELIEF SPRING

1. Check the relief plunger.
   Apply engine oil on the plunger and check that it moves smoothly in the hole. If it does not, replace the plunger or the front case only in necessary cases.
2. Check the relief valve spring.
   Check deformation or damage of the relief valve spring.

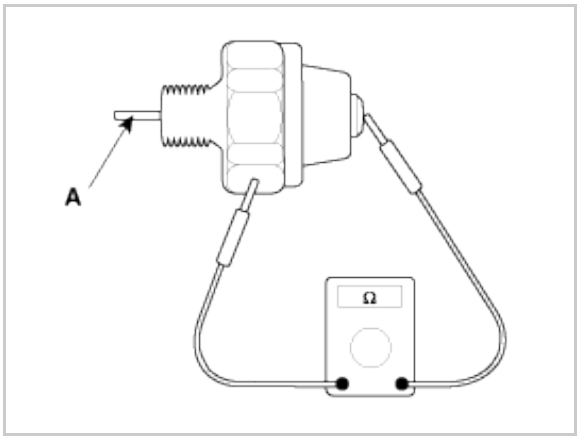
Specification
Free length : 43.8mm(1.7244in.)
Load : 36.3N(3.7kg, 8.21b)±3.9N(0.4kg, 0.9lb) / 40.1mm(1.5787in.)

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.



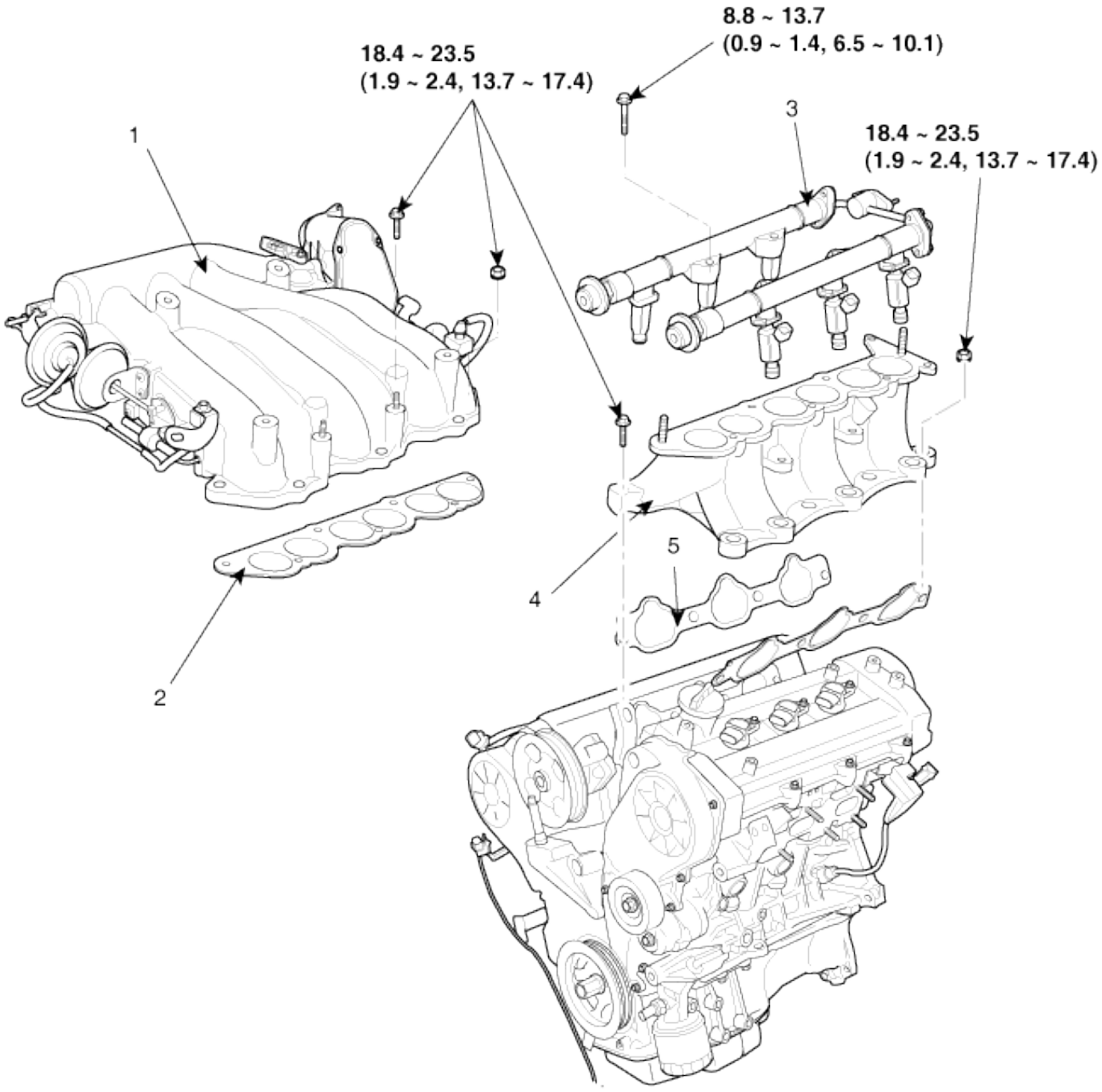
2. Check the continuity between the terminal and the body when its hole is pushed by a fine rod(A). If there is continuity with pressed, replace the switch.



3. If there is no continuity when the pressure 49.3kpa (0.5kg/cm², 7.11psi) is applied through the oil hole, the switch is operating properly.
   Check for air leakage. If air leaks, the diaphragm is broken. Replace the switch.

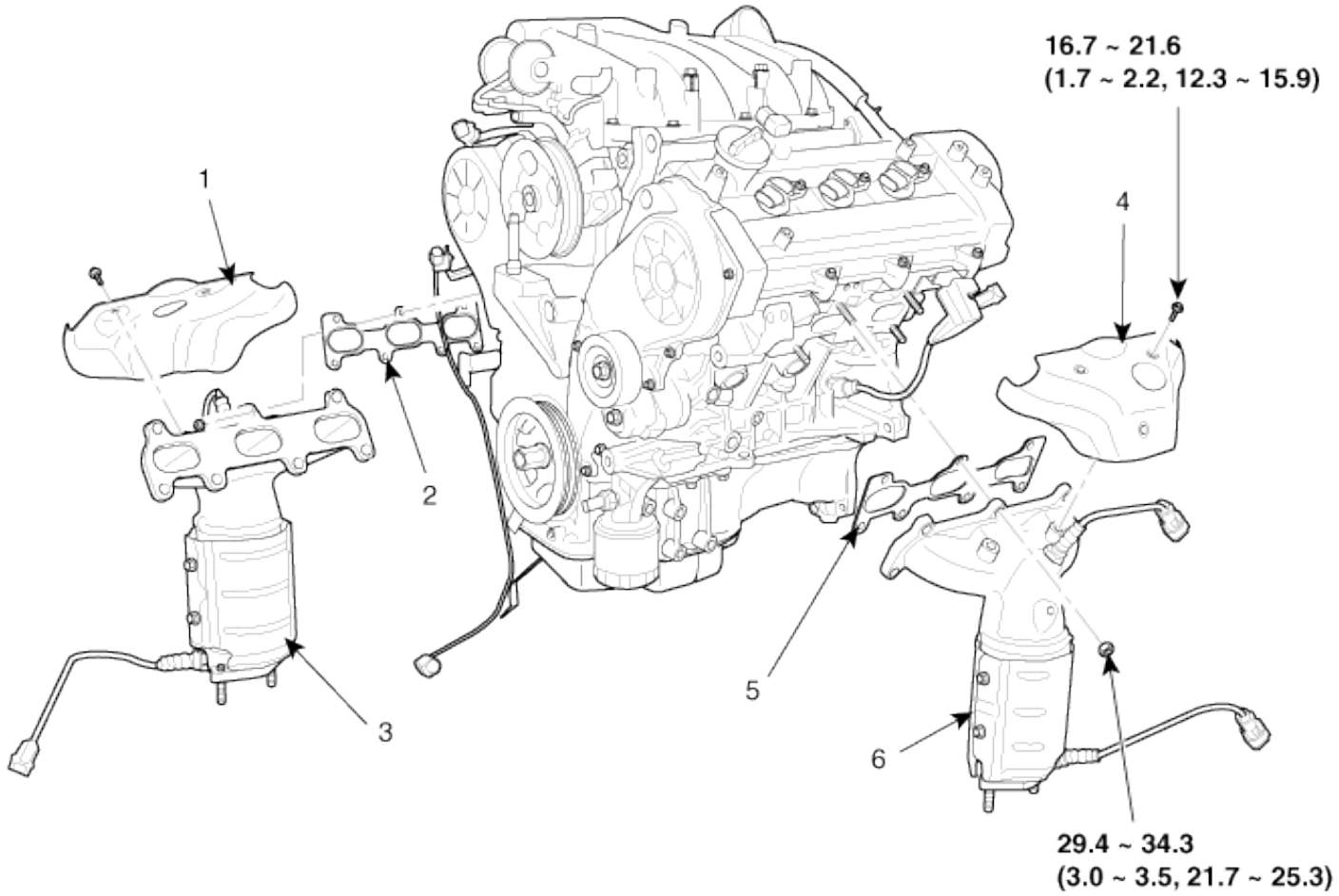
Intake
and
Exhaust system

COMPONENTS



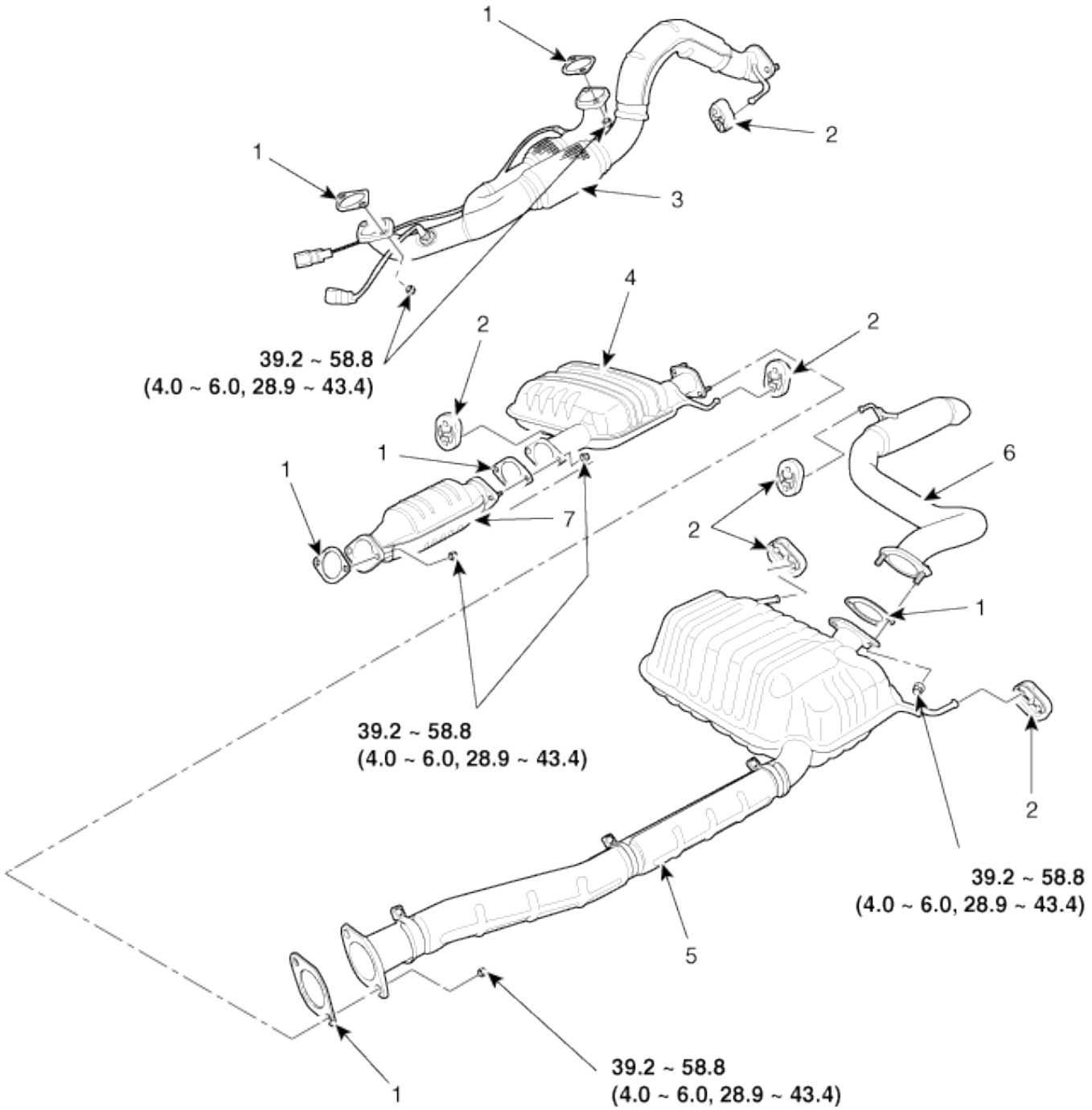
TORQUE : N.m (kgf.m, lb-ft)

1. Surge tank
2. Surge tank gasket
3. Delivery pipe
4. Intake manifold
5. Intake manifold gasket



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

1. Bank 1 heat protector
2. Bank 1 exhaust manifold
3. Bank 1 exhaust gasket
4. Bank 2 protector
5. Bank 2 exhaust manifold gasket
6. Bank 2 exhaust manifold



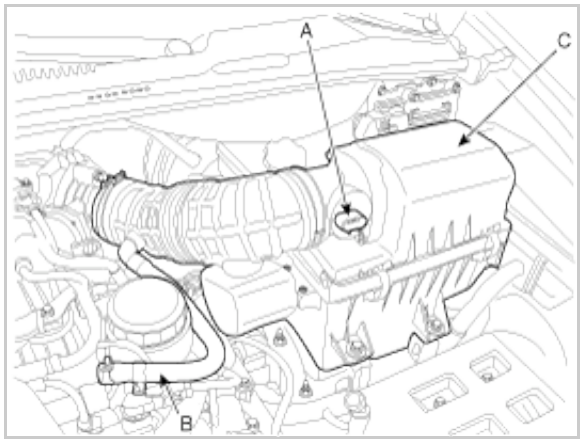
TORQUE : N.m (kgf.m, lb-ft)

1. Gasket
2. Hanger
3. Front muffler assembly
4. Center muffler assembly
5. Main muffler assembly
6. Tail pipe muffler assembly
7. Catalytic converter assembly

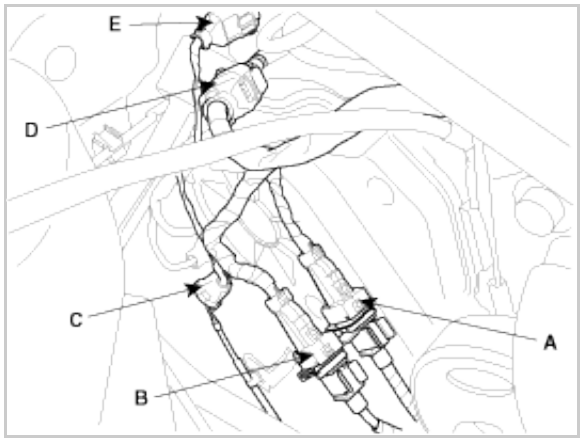
REMOVAL

INTAKE MANIFOLD ASSEMBLY

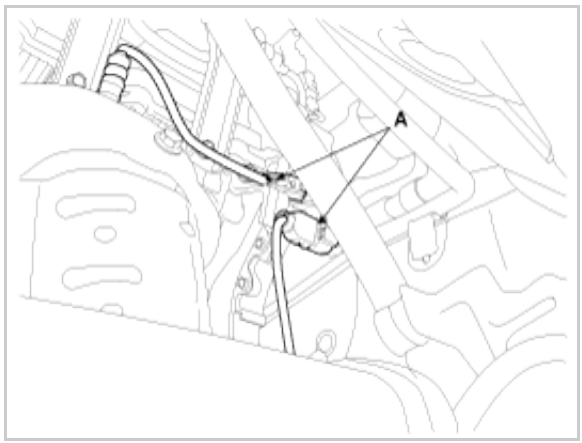
1. Remove the engine cover.
2. Remove the intake air hose and air cleaner assembly.
   (1) Disconnect the MAF connector(A).
   (2) Disconnect the breather hose(B) from air cleaner hose.
   (3) Remove the intake air hose and air cleaner assembly(C).



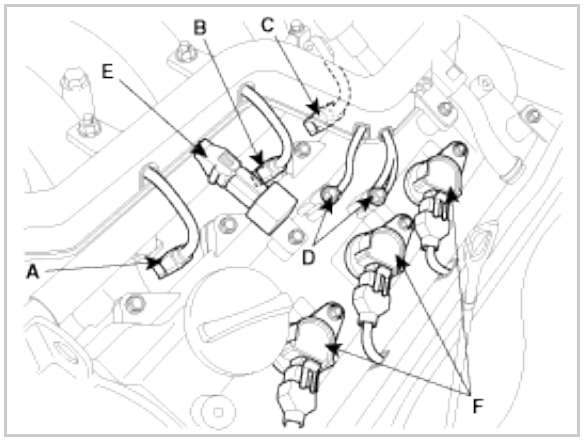
3. Disconnect the engine wiring harness connectors.
   (1) Disconnect the No.1/No.2 knock sensor connectors(A,B), the oil pressure switch connector(C), the ignition coil harness(D) and the No.1 VIS(Variable Induction System) connector(E).



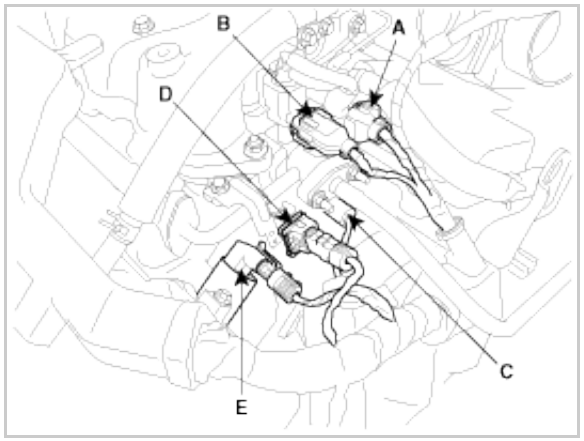
   (2) Disconnect the bank 1 front/rear O2 sensor connectors(A).



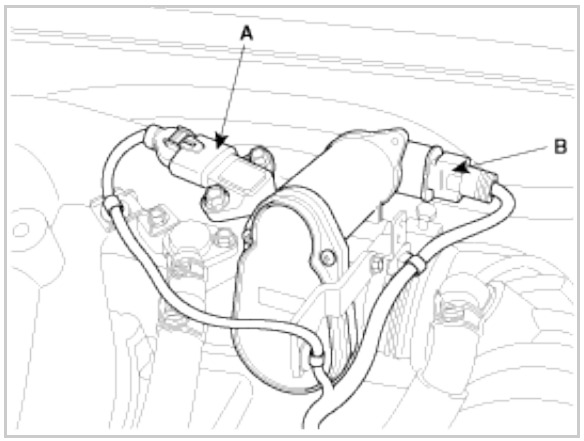
   (3) Disconnect the injection connectors(A,B,C), the ground lines(D), the condensor connector(E) and the Ignition coil connectors(F).

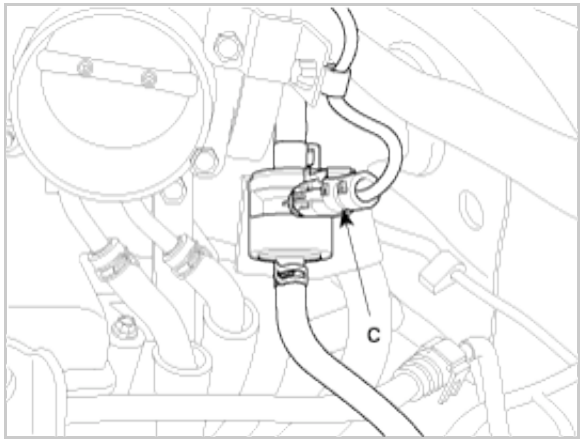


(4) Disconnect the injection harness connector(A), the No.2 VIS(Variable Induction System) connector(B), the No.1/No.2 OCV(Oil Control Valve) connectors(C,D) and the OTS(Oil Temperature Sensor) connector(E).

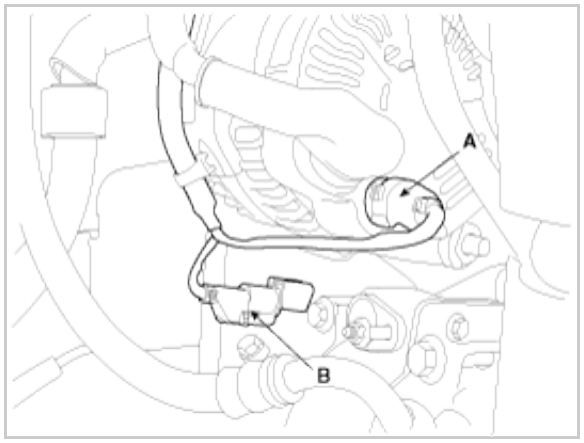


(5) Disconnect the MAPS(Manifold Absolute Pressure Sensor) connector(A), the ETC(Electronic Throttle Control) connector(B) and the PCSV(Purge Control Solenoid Valve) connector(C).

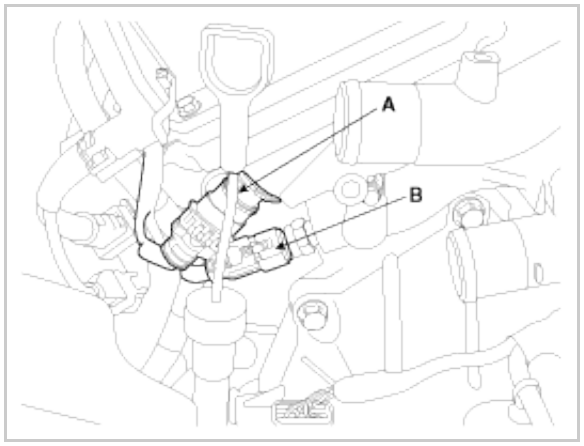




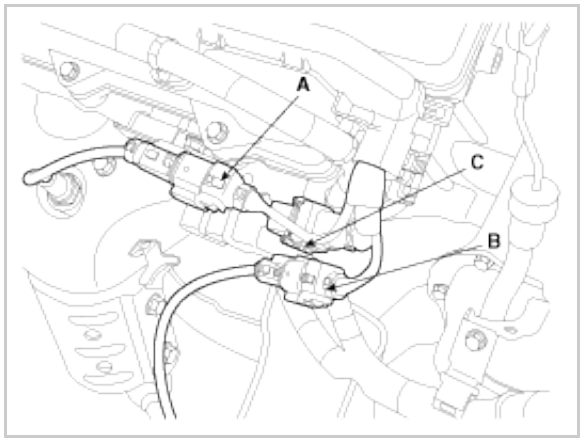
(6) Disconnect the generator connector(A) and the air conditioning compressor connector(B).



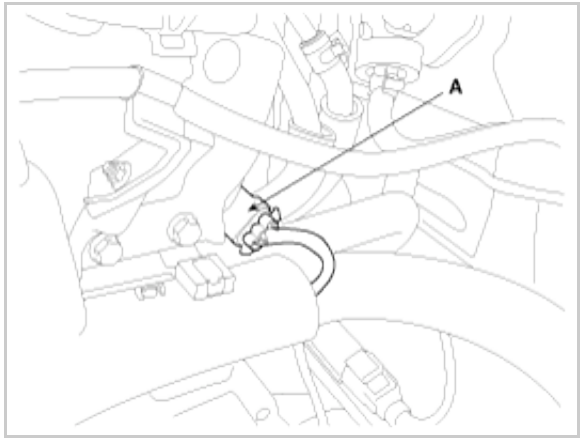
(7) Disconnect the bank 2 CMP sensor connector(A) and the ECT(Engine Coolant Temperature) sensor connector(B).



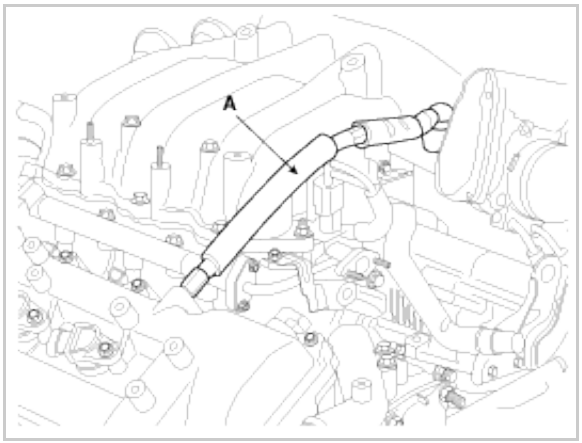
(8) Disconnect the bank 2 front/rear O2 sensor connectors(A,B) and the CKP sensor connector(C).



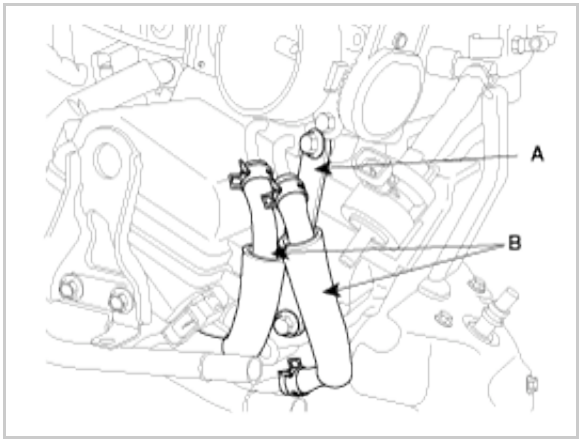
(9) Disconnect the bank 1 CMP sensor connector(A).



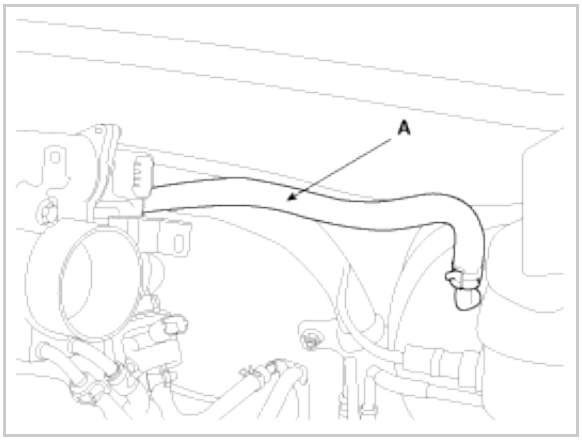
4. Remove the PCV(Pulge Control Valve) hose(A).



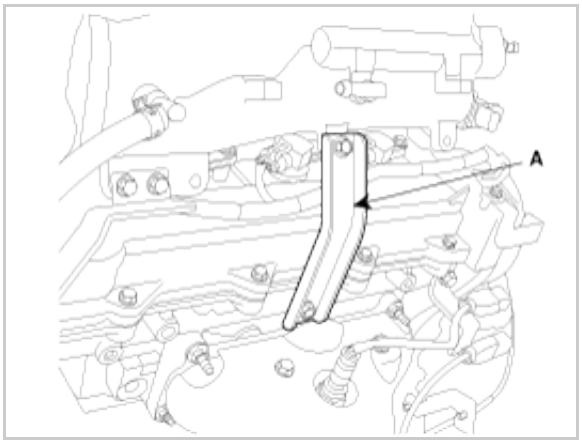
5. Remove the ETC(Electric Throttle Control) bracket(A) and the cooling hoses(B).



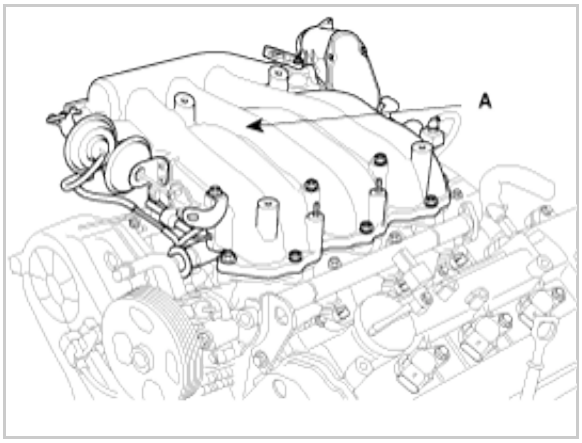
6. Disconnect the brake vaccume hose(A).



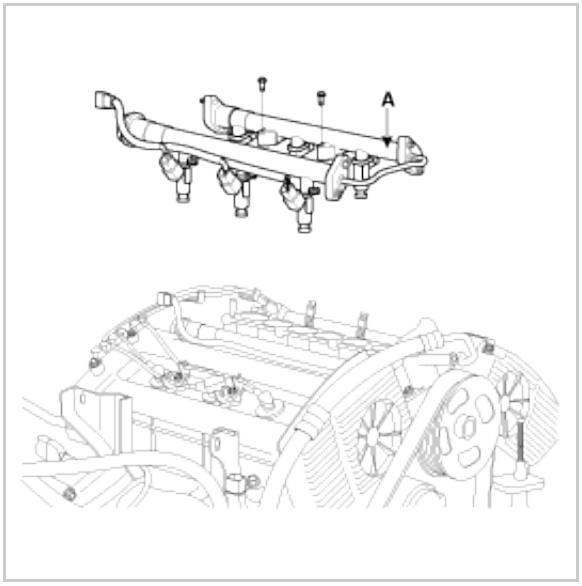
7. Remove the surge tank mounting bracket(A).



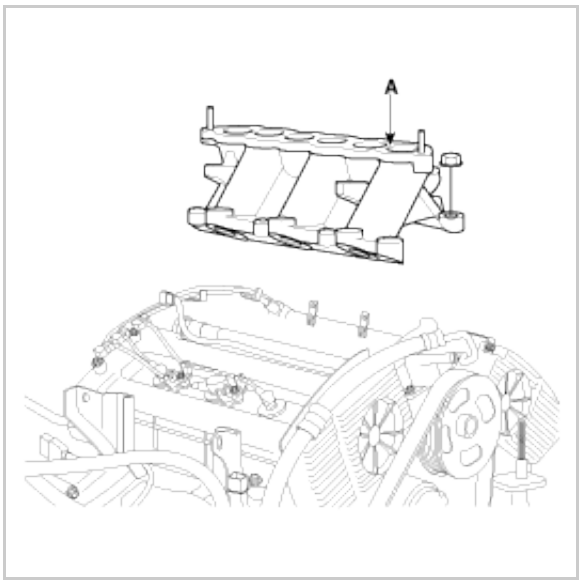
8. Remove the surge tank(A).



9. Remove the delivery pipe assembly(A).

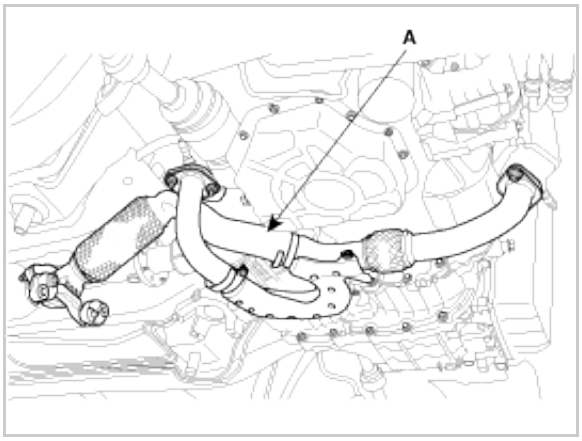


10. Remove the intake manifold assembly(A).

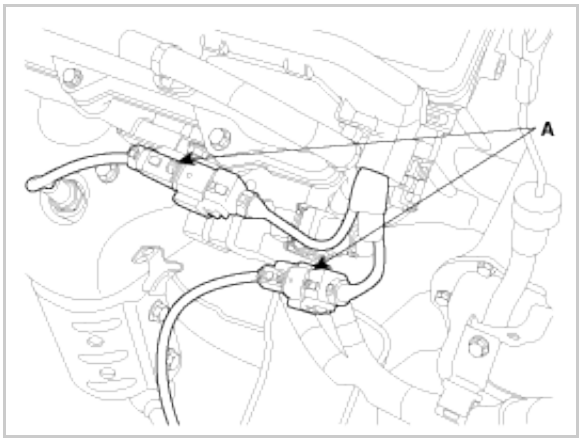


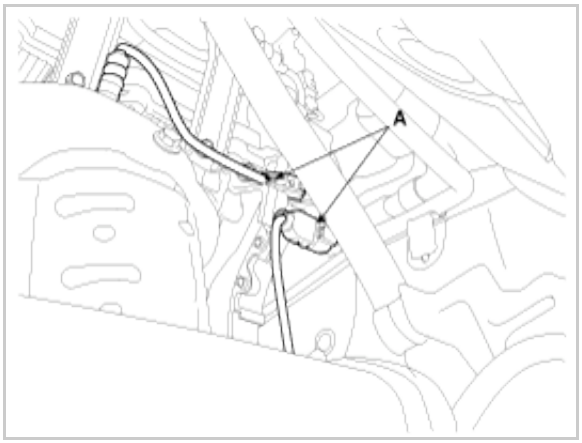
EXHAUST MANIFOLD ASSEMBLY

1. Remove the under cover.
2. Remove the front muffler(A).

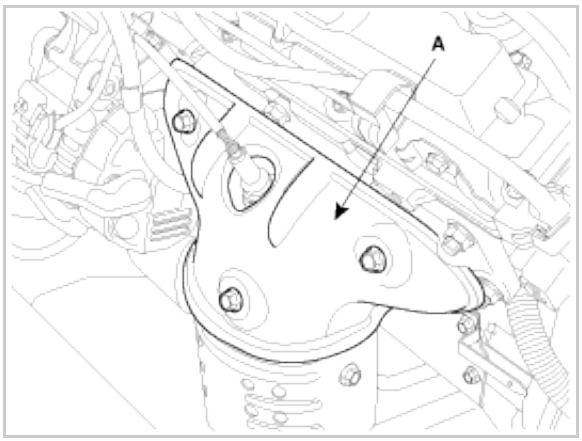


3. Disconnect the oxygen sensor connectors(A).





4. Remove the oil level gauge.
5. Remove the heat protector(A).



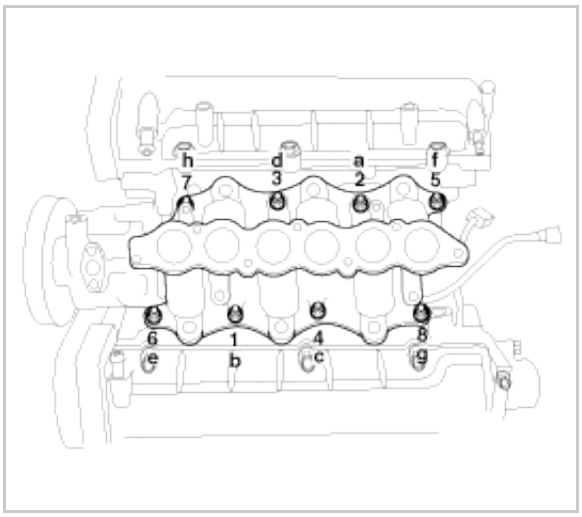
6. Remove the exhaust manifold assembly.

INSTALLATION

INTAKE MANIFOLD ASSEMBLY

1. Install the intake manifold assembly with a new gasket to a cylinder head assembly. Tighten the bolts in two steps.

Tightening torque
Step 1(a~h): 3.9~5.9Nm(0.4~0.6kgf.m, 2.9~4.3lb-ft)
Step 2(1~8): 18.6~23.5Nm(1.9~2.4kgf.m, 13.7~17.4lb-ft)



CAUTION

When installing the gasket on the cylinder head, check the indentification marks(LH/RH) not to be installed wrong.

2. Install the delivery pipe.
3. Connect the LH injector connector.
4. Install the surge tank.

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

5. Install the surge tank mounting bracket.

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

6. Install the ETC(Electronic Throttle Control) system fixing bracket.
7. Connect the hoses and connectors.
8. Install the air cleaner assembly.
9. Install the engine cover.

EXHAUST MANIFOLD ASSEMBLY

1. Install the exhaust manifold assembly with a new gasket.

Tightening torque
29.4~34.3Nm(3.0~3.5kgf.m, 21.7~25.3lb-ft)

2. Install the heat protector.

Tightening torque
16.7~21.6Nm(1.7~2.2kgf.m, 12.3~15.9lb-ft)

3. Install the front muffler assembly.

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

4. Connect the oxygen sensor connector.
5. Install the under cover.

CHAPTER 3:

Engine Electrical System

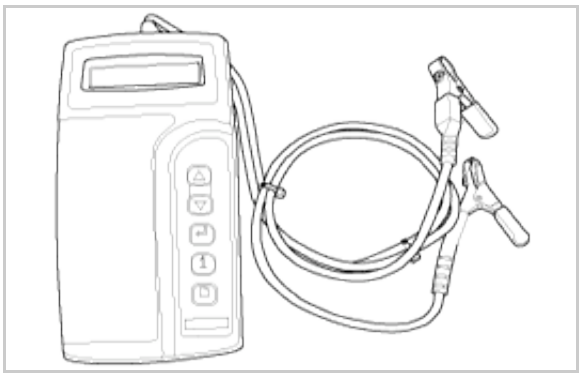
General information

THE MICRO 570 ANALYZER

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

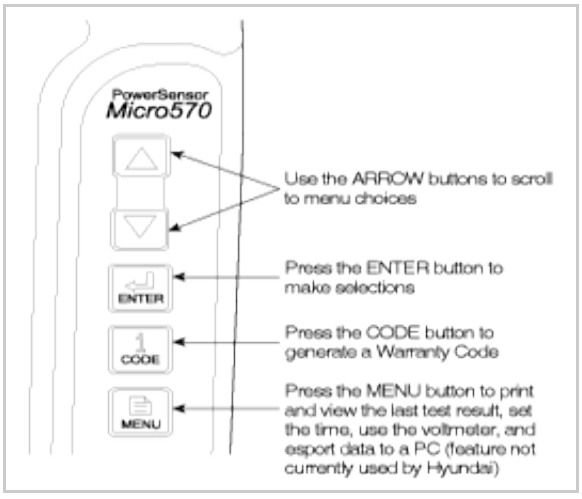
CAUTION

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



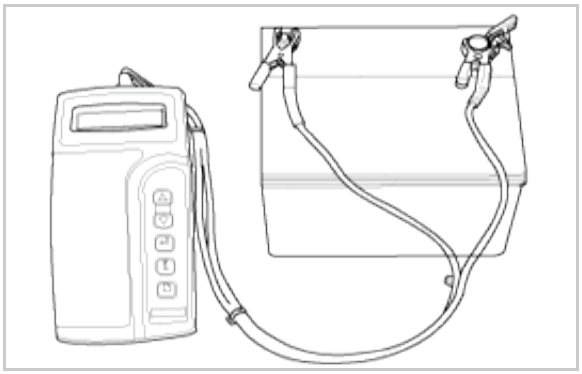
KEYPAD

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



BATTERY TEST PROCEDURE

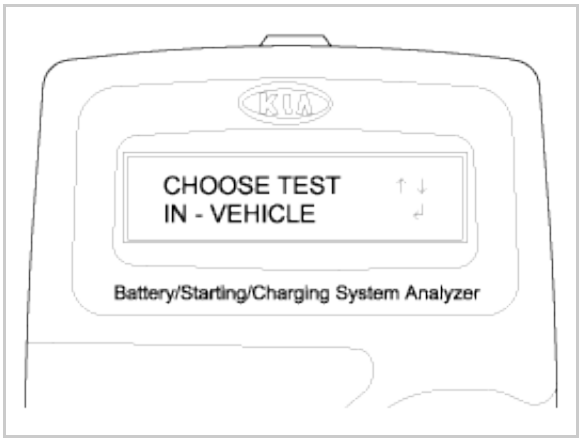
1. Connect the tester to the battery.
   a. Red clamp to battery positive (+) terminal.
   b. Black clamp to battery negative (-) terminal.



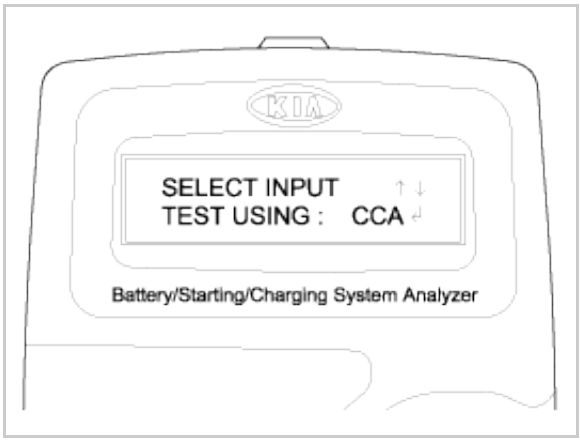
CAUTION

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

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



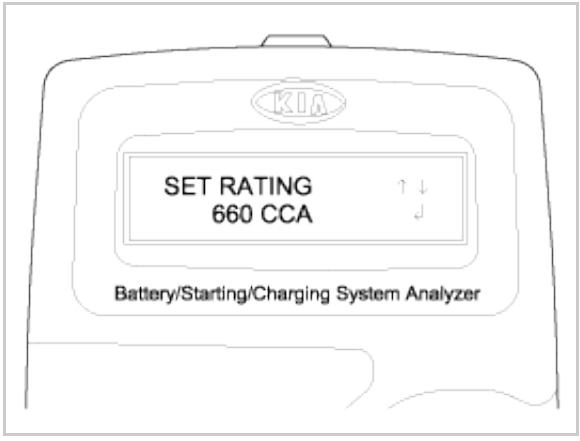
3. Choose either CCA or CCP and press the ENTER button.



NOTICE

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

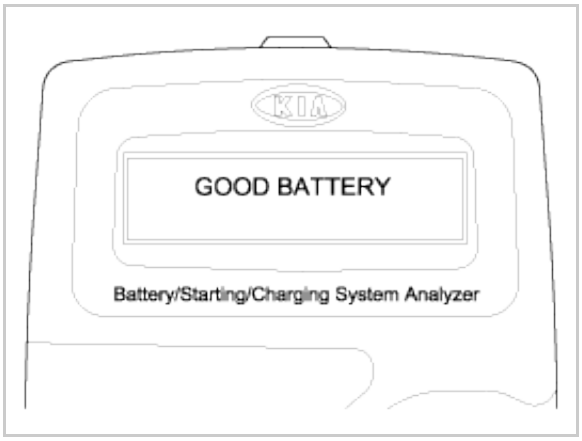
4. Set the CCA value displayed on the screen to the CCA value marked on the battery label by pressing up and down buttons and press ENTER.



NOTICE

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

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



NOTICE

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

6. To conduct starter test, press ENTER.

BATTERY TEST RESULTS

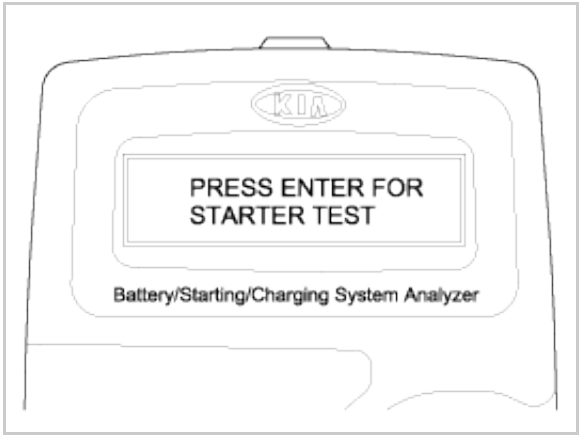
RESULT ON PRINTER	REMEDY
Good battery	No action is required
Good recharge	Battery is in a good state Recharge the battery and use
Charge & Retest	Battery is not charged properly => Charge and test the battery again (Failure to charge the battery fully may read incorrect measurement value)
Replace battery	=> Replace battery and recheck the charging system. (Improper connection between battery and vehicle cables may cause "REPLACE BATTERY", retest the battery after removing cables and connecting the tester to the battery terminal directly prior to replacing the battery)
Bad cell-replace	=> Charge and retest the battery. And then, test results may cause "REPLACE BATTERY", replace battery and recheck the charging system

WARNING

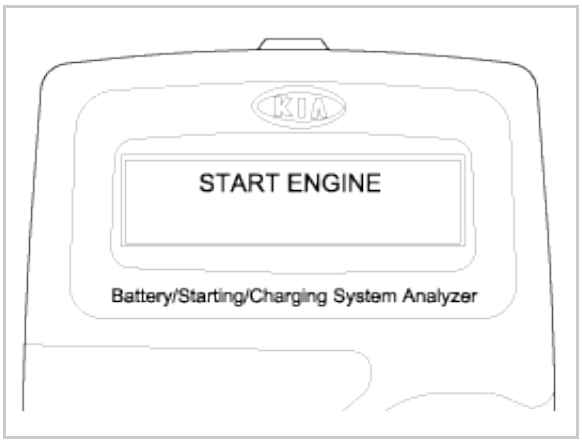
Whenever filing a claim for battery, the print out of the battery test results must be attached.

STARTER TEST PROCEDURE

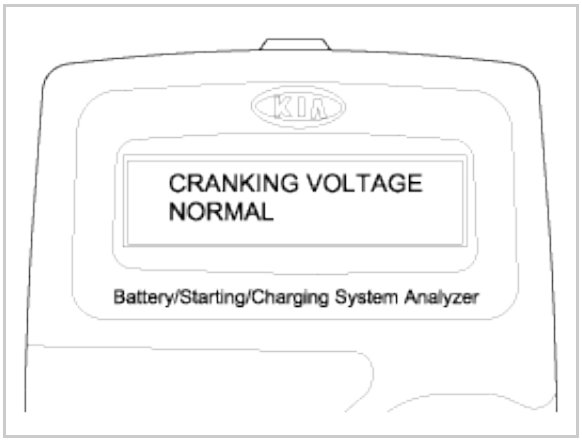
1. After the battery test, press ENTER immediately for the starter test.



2. After pressing ENTER key, start the engine.



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



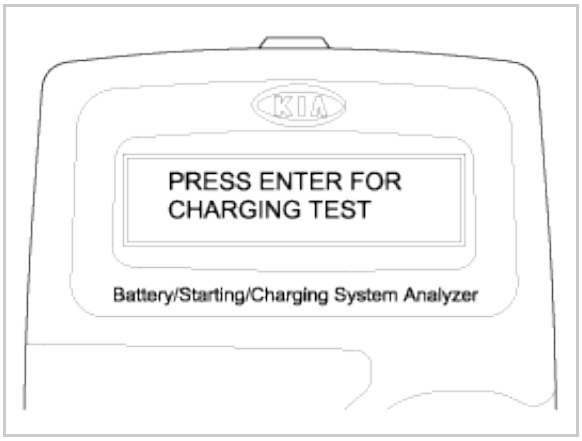
4. To continue charging system test, press ENTER.

STARTER TEST RESULTS

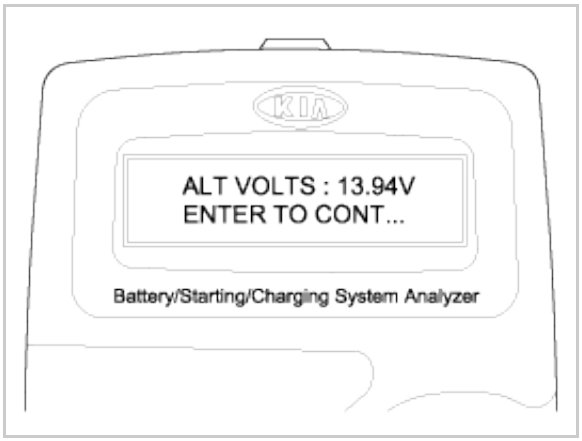
RESULT ON PRINTER	REMEDY
Cranking voltage normal	System shows a normal starter draw
Cranking voltage low	Cranking voltage is lower than normal level => Check starter
Charge battery	The state of battery charge is too low to test =>Charge the battery and retest
Replace battery	=> Replace battery => If the vehicle is not started though the battery condition of "Good and fully charged" is displayed. => Check wiring for open circuit, battery cable connection, starter and repair or replace as necessary.

CHARGING SYSTEM TEST PROCEDURE

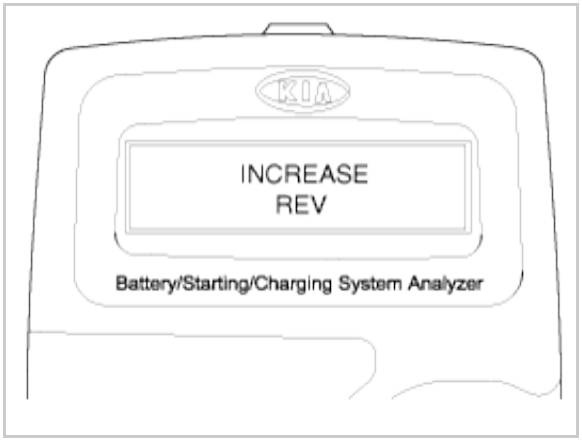
1. Press ENTER to begin charging system test.



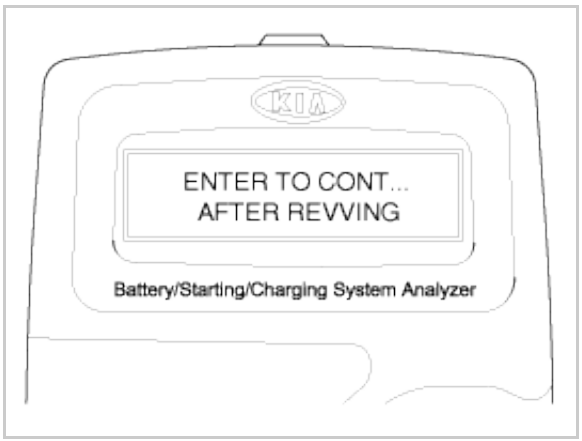
2. ENTER button is pressed, the tester displays the actual voltage of generator.
   Press ENTER to test the charging system.



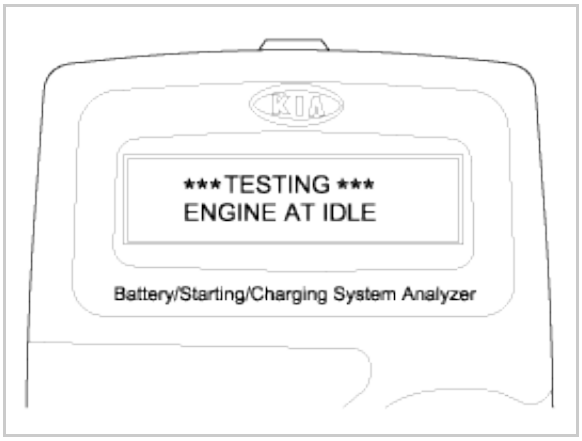
3. The MICRO 570 will prompt you to rev the engine until the rev detected. It will then collect the data.



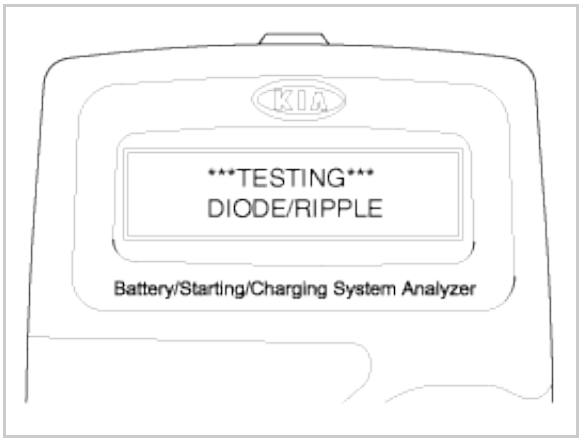
4. Press ENTER.



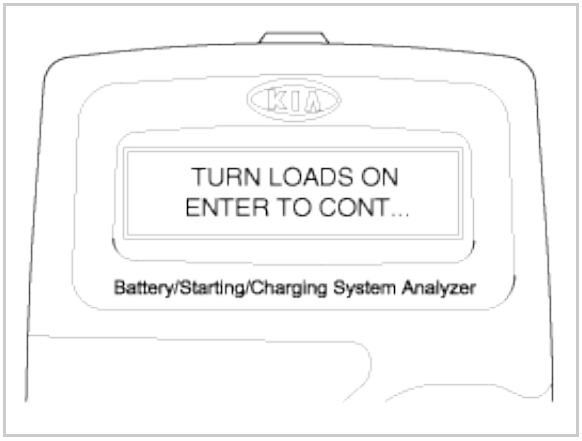
5. The MICRO 570 will analyze the charging system output at idle for comparison to other readings.



6. The MICRO 570 will detect the amount of ripple from the charging system to the battery. Excessive ripple usually means the stator is damaged or that one or more generator diodes have failed.



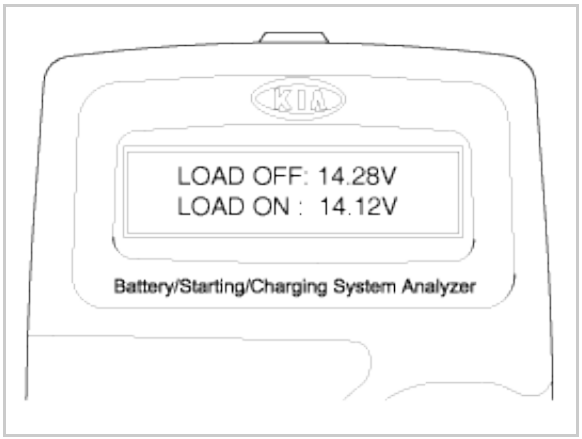
7. The MICRO 570 will prompt you to turn on accessary loads. It will then test at idle and prompt you to rev the engine. The analyzer will determine if the charging system can provide enough current for the demands of the vehicle's electrical system.

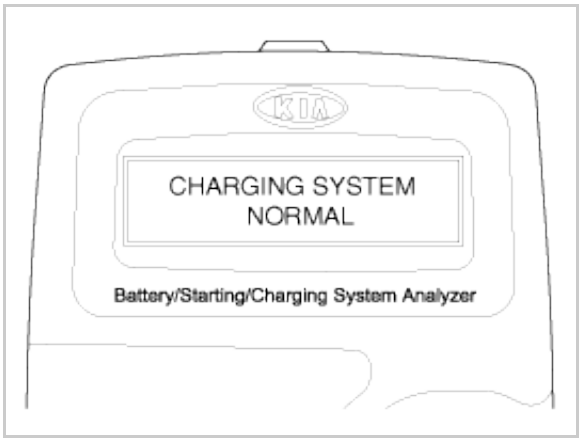


NOTICE

When asked to turn of the accessory loads, turn of the blower to high(heater), the high beam beadlights, and rear defogger. DO NOT use cyclical loads such as air conditioning or wind-shield wipers.

8. After the test, the MICRO 570 will display the idle voltage, load voltage and the state results.

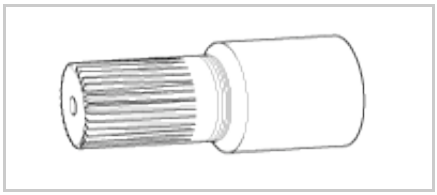




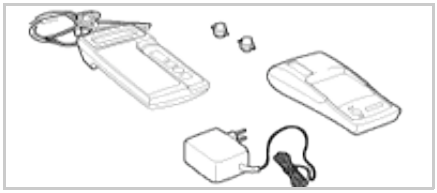
CHARGING SYSTEM TEST RESULTS

RESULT ON PRINTER	REMEDY
Charging system normal/Diode ripple normal	Charging system is normal
No charging voltage	Generator does not supply charging current to battery => Check belts, connection between generator and battery Replace belts or cable or generator as necessary
Low charging voltage	Generator does not supply charging current to battery and electrical load to system fully => Check belts and generator and replace as necessary
High charging voltage	The voltage from generator 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 generator is not functioning properly => Check generator mounting and belts and replace as necessary

SPECIAL SERVICE TOOL

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

REFERENCE SERVICE TOOLS

Tool (Number and name)	Illustration	Use
Micro-570 Battery checker		a. Check the battery condition b. Check the charging and starting system

TROUBLE SHOOTING

IGNITION SYSTEM

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

CHARGING SYSTEM

Symptom	Suspect area	Remedy
Charging warning indicator does not light with ignition switch "ON" and engine off.	Fuse blown	Check fuses
	Light burned out	Replace light
	Wiring connection loose	Tighten loose connection
	Electronic voltage regulator	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

SPECIFICATION

IGNITION SYSTEM

Items		Specification
Ignition coil	Primary resistance	0.715 ± 0.015 Ω
	Secondary resistance	-
Spark plugs	NGK	ILFR5B11
	Plugs Gap	1.0 ~ 1.1 mm (0.0394 ~ 0.0433 in)

STARTING SYSTEM

Items			Specification
Starter	Rated voltage		12 V, 1.2 kW
	No. of pinion teeth		8
	No-load characteristics	Voltage	11.5 V
		Ampere	90A, MAX
		Speed	2,600 rpm, MIN

CHARGING SYSTEM

Items		Specification
Alternator	Type	Battery voltage sensing
	Rate voltage	13.5 V, 110A
	Speed in use	1,000 ~ 18,000 rpm
	Voltage regulator	Electronic built-in type
	Regulator setting voltage	14.2 ~ 14.8V
Battery	Type	MF 68AH
	Cold cranking amperage [at -18°C(-0.4°F)]	600 A
	Reserve capacity	110 min
	Specific gravity [at 20°C(68°F)]	1.280 ± 0.01

NOTICE

a. 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.

b. 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).

Ignition System

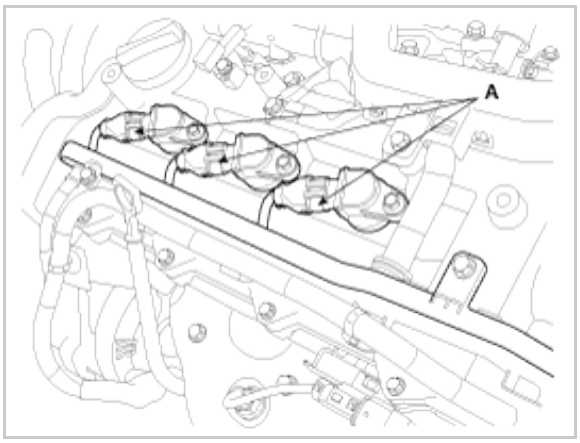
DESCRITION

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

REMOVAL

IGNITION COIL

1. Remove the engine cover.
2. Remove the ignition coil (A).

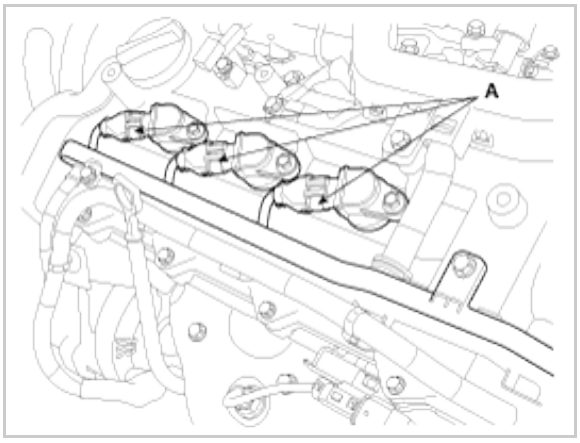


3. Remove the ignition coil.
4. Installation is the reverse of removal.

REPLACEMENT

SPARK PLUG

1. Remove the ignition coil connector(A).



2. Remove the ignition coil.
3. Using a spark plug socket, remove the spark plug.

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

4. When replacing the spark plug, always use the long reach type spark plug.
   (1) Color Marking (Tip)
      a. [2.7L]
         Unleaded : Yellow Marking
         Leaded : Green Marking

   (2) Length(Tip-Tip / PT Length)
      a. [2.7L]
      b. 83.2mm/ 26.5mm
      c. Others: The length is different from the specification above.

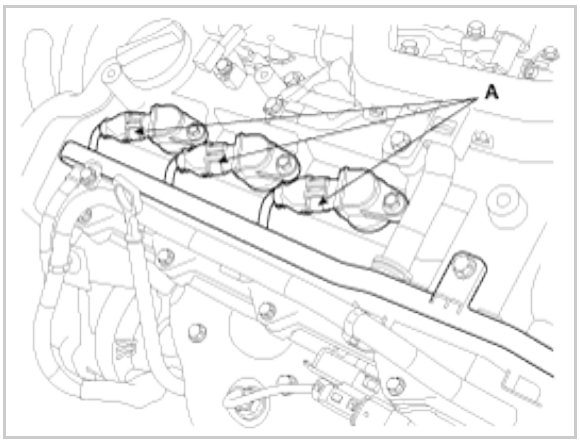
   (3) Part ID

a. [U2.7]
L nleaded : ILFR5B11
Leaded : LFR5A

ON-VEHICLE INSPECTION

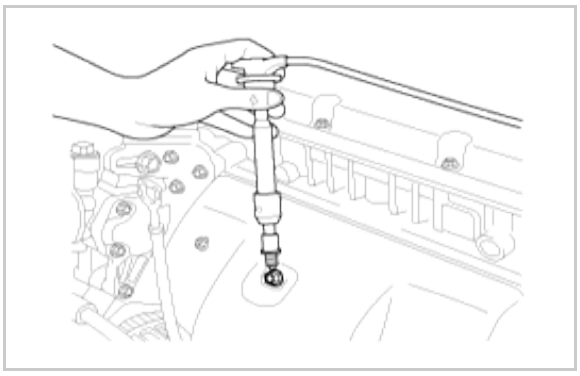
SPARK TEST

1. Remove the ignition coil connector(A).



> NOTICE
>
> Disconnect the iguition coil connector while pulling up tre connector lock.

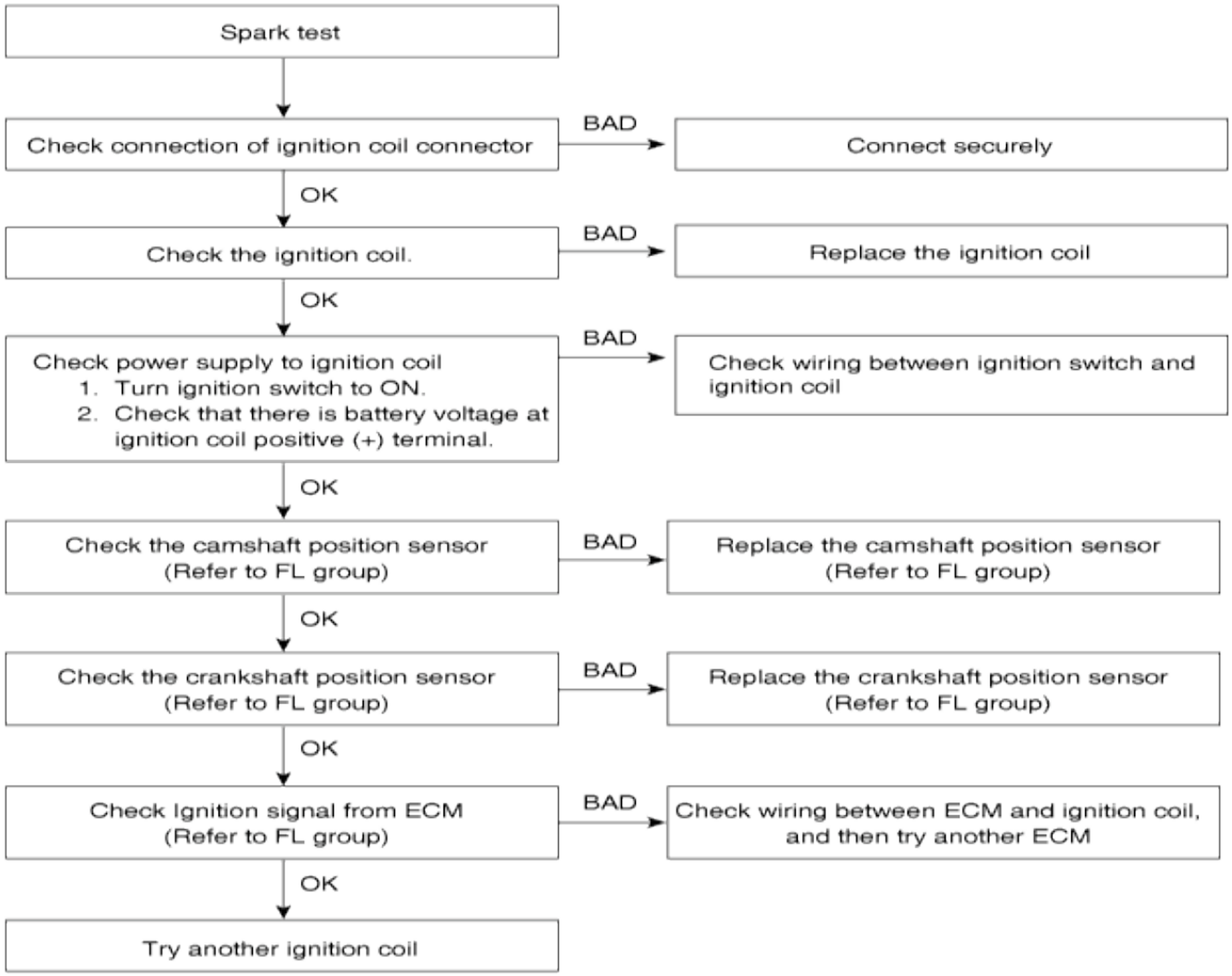
2. Remove the ignition coil.
3. Using a spark plug socket, remove the spark plug.
4. Install the spark plug to the ignition coil.
5. Ground the spark plug to the engine.



6. Check is spark occurs while engine is being cranked.

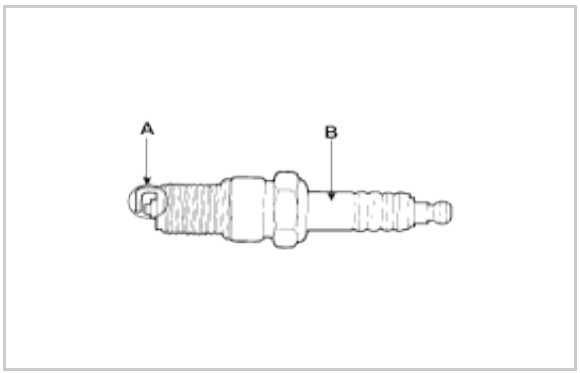
> NOTICE
>
> To prevent fuel being injected from injectors while the engine is being cranked, remove the fuel pump(A) relay from the fuse box.
> Crank the engine for no more than 5 ~ 10 seconds.

7. Inspect all the spark plugs.
8. Using a spark plug socket, install the spark plug.
9. Install the ignition coil.
10. Reconnect the ignition coil connector.



INSPECT SPARK PLUG

1. Inspect the electrodes(A) an ceramic insulator(B).

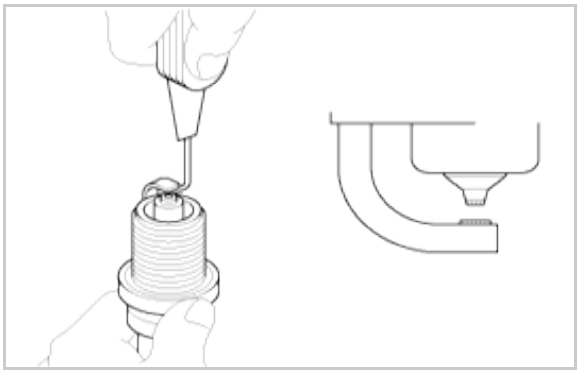


INSPECTION OF ELECTRODES

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

2. Check the electrode gap (A).

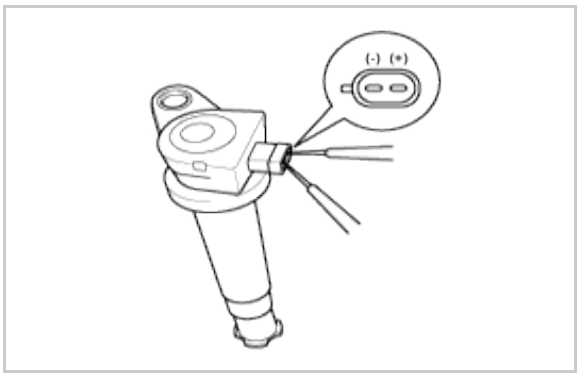
Standard : 1.0 ~ 1.1 mm (0.0394 ~ 0.0433 in.)



INSPECT IGNITION COIL

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

Standard : 0.0715 ± 0.015Ω



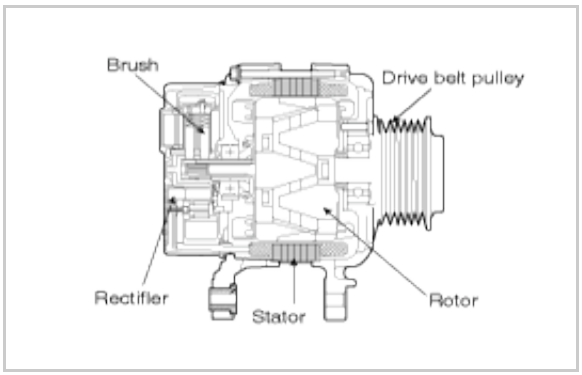
NOTICE

Mesure the resistance between the terminals No.1 and No.3.

Charging System

DESCRIPTION

The charging system included a battery, an alternator with a built-in regulator, and the charging indicator light and wire.
The Alternator has built-in diodes, each rectifying AC current to DC current.
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 INPECTION

CAUTION

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

CHECK BATTERY VOLTAGE

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

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

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

CHECK THE BATTERY TERMINALS AND FUSES

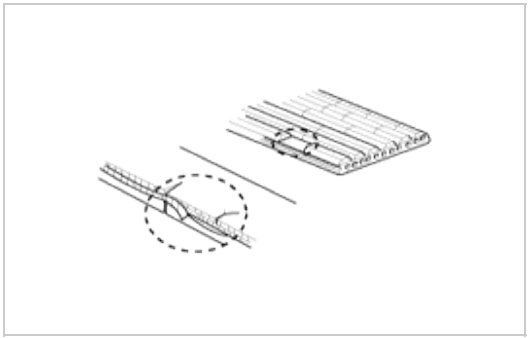
1. Check that the battery terminals are not loose or corroded.
2. Check the fuses for continuity.

INSPECT DRIVE BELT

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

NOTICE

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



VISUALLY CHECK ALTERNATOR WIRING AND LISTEN FOR ABNORMAL NOISES

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

CHECK DISCHARGE WARNING LIGHT CIRCUIT

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

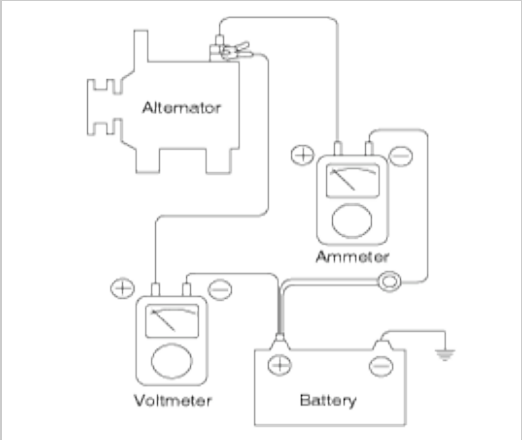
INSPECT CHARGING SYSTEM

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.

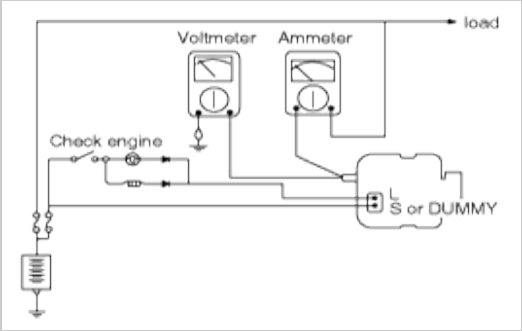
PREPARATION

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.

   NOTICE

   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.

> **NOTICE**
>
> 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 : 70% of the rated current

> **NOTICE**
>
> a. The nominal output current value is shown on the nameplate affixed to the alternator body.
> b. The output current value changes with the electrical load and the temperature of the alternator itself.
> Therefore, the nominal output current may not be obtained. If such is the case, keep the headlamps on the cause discharge of the battery, or use the lights of another vehicle to increase the electrical load.
> The nominal output current may not be obtained if the temperature of the alternator itself or ambient temperature is too high.
> In such a case, reduce the temperature before testing again.

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

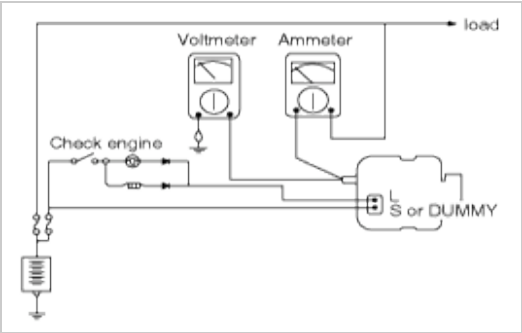
REGULATED VOLTAGE TEST

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

PREPARATION

1. Prior to the test, check the following items and correct if necessary.
   Check that the battery installed on the vehicle is fully charged. The battery checking method is described in the section "Battery".
   Check the alternator drive belt tension. The belt tension check method is described in the section "Inspect drive belt".
2. Turn ignition switch to "OFF".
3. Disconnect the battery ground cable.
4. Connect a digital voltmeter between the "B" terminal of the alternator and ground. Connect the (+) lead of the voltmeter to the "B" terminal of the alternator. Connect the (-) lead to good ground or the battery (-) terminal.
5. Disconnect the alternator output wire from the alternator "B" terminal.

6. Connect a DC ammeter (0 to 150A) in series between the "B" terminal and the disconnected output wire. Connect the (-) lead wire of the ammeter to the disconnected output wire.
7. Attach the engine tachometer and connect the battery ground cable.



TEST

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

   Voltage: Battery voltage

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

RESULT

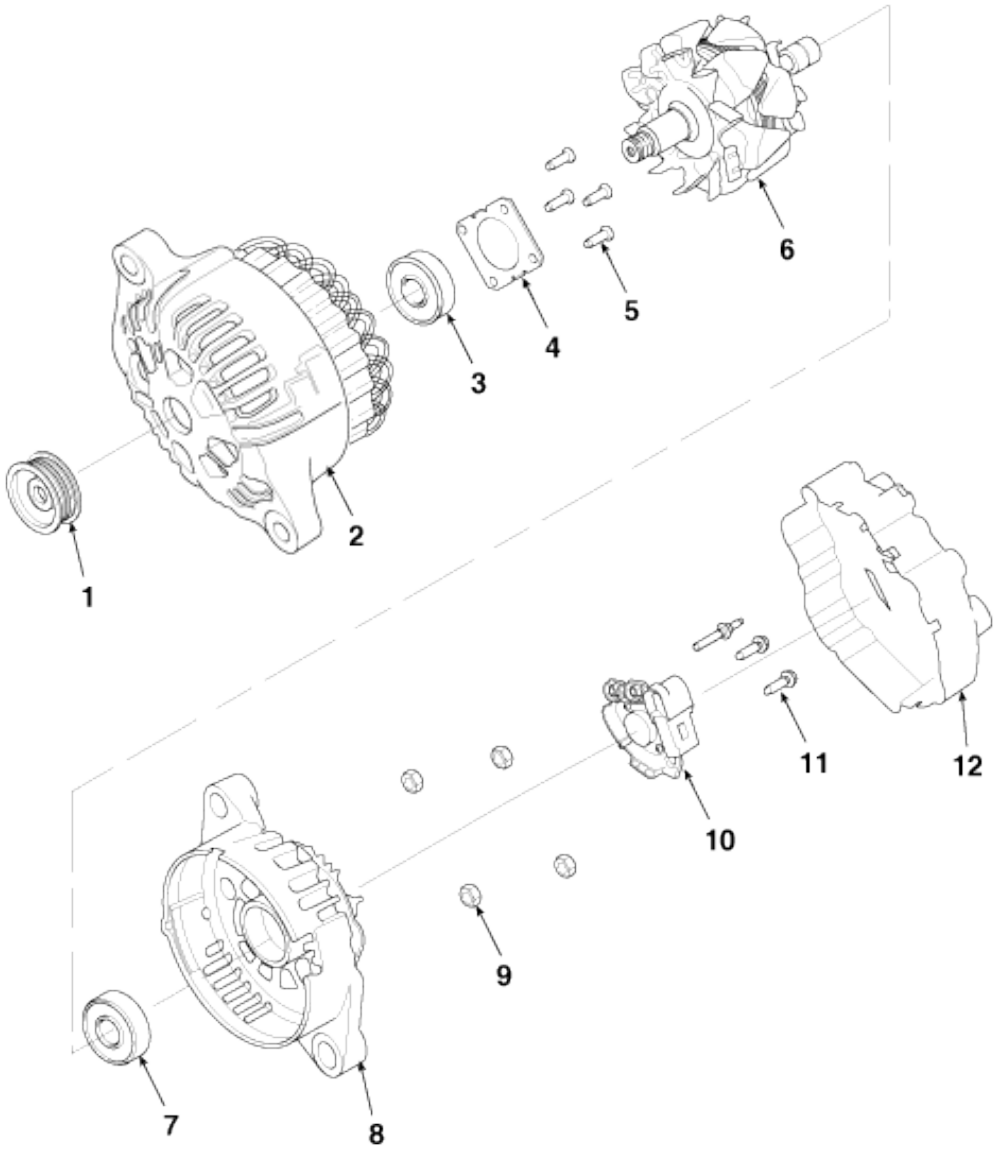
1. If the voltmeter reading agrees with the value listed in the regulating voltage table below, the voltage regulator is functioning correctly. If the reading is other than the standard value, the voltage regulator or the alternator is faulty.
   REGULATING VOLTAGE TABLE

Voltage regulator ambient temperature °C (°F)	Regulating voltage (V)
-20 (-4) 20 (68) 60 (140) 80 (176)	14.2 ~ 15.4 14.0 ~ 15.0 13.7 ~ 14.9 13.5 ~ 14.7

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

Alternator

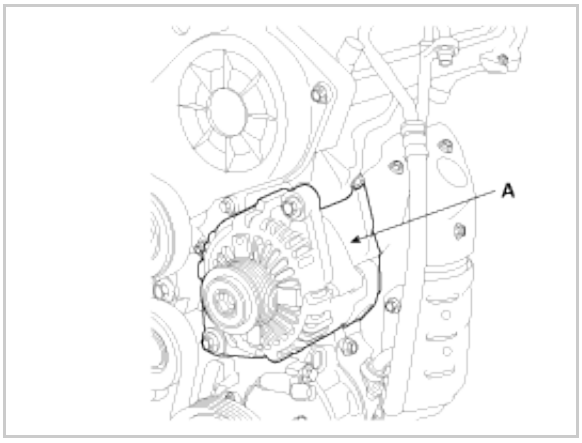
COMPONENT



1. Pulley
2. Front bracket
3. Front bearing
4. Bearing cover
5. Bearing cover bolt
6. Rotor coil
7. Rear bearing
8. Rear bracket
9. Nut
10. Brush holder assembly
11. Brush holder bolt
12. Rear cover

REMOVAL

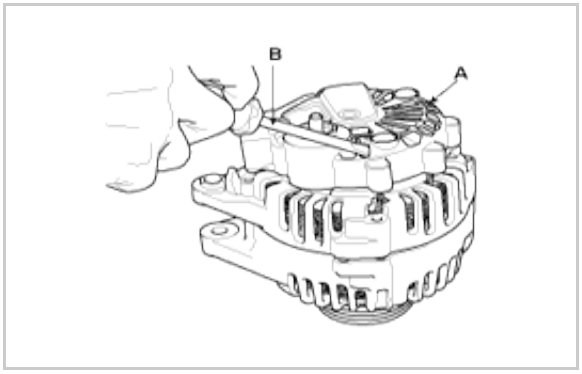
1. Disconnect the battery negative terminal first, then the positive terminal.
2. Disconnect the alternator connector, and remove the cable from alternator "B" terminal.
3. Remove the drive belt.
4. Pull out the through bolt and then remove the alternator(A).



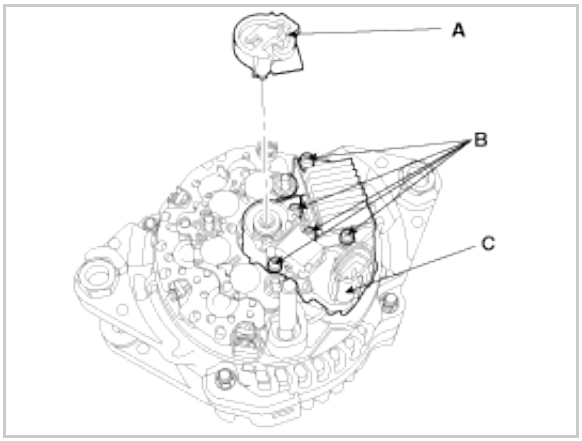
5. Installation is the reverse of removal.

DISASSEMBLY

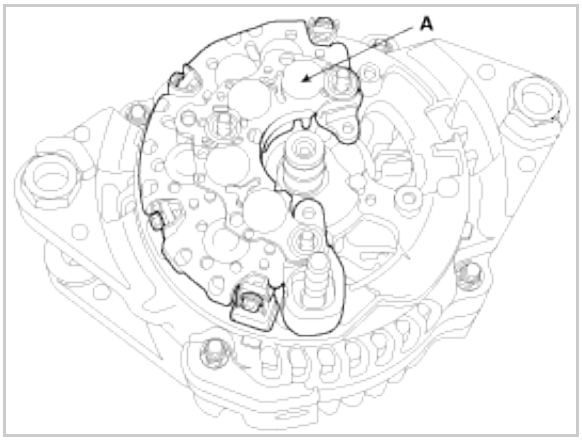
1. Remove the alternator cover(A) using a screw driver(B).



2. Remove the slip ring guide(A).
3. Loosen the mounting bolts(B) and disconnect the brush holder assembly(C).



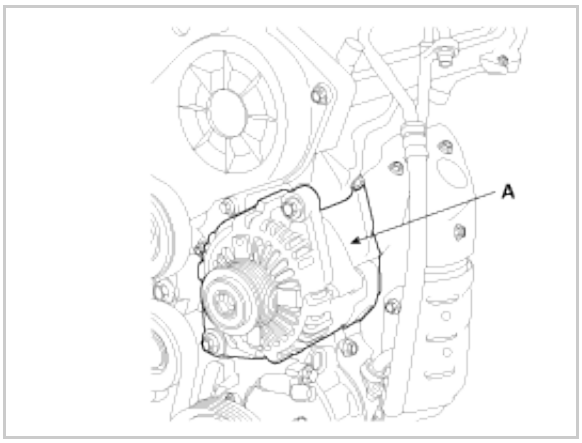
4. Remove the rectifler(A) with 4 screws.



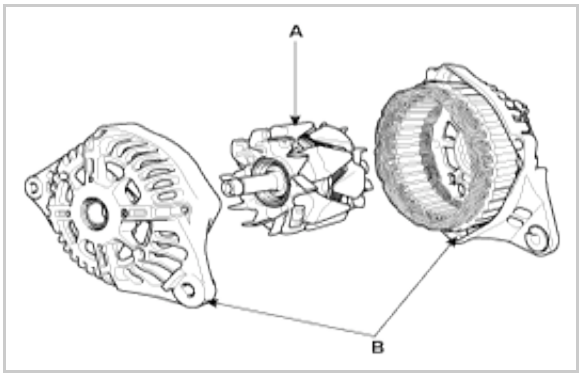
5. Remove the nut, pulley(A) and spacer.



6. Loosen the 4 through bolts(A).



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

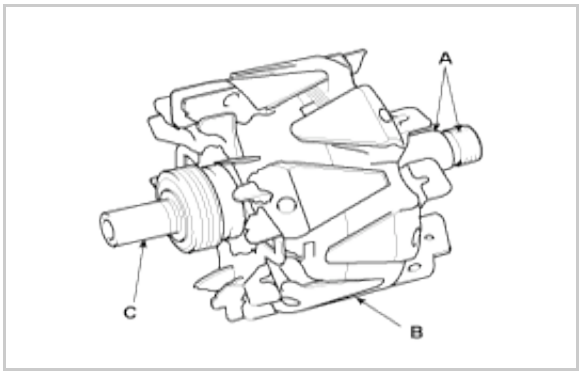


8. Reassembly is the reverse order of disassembly.

INSPECTION

INSPECT ROTOR

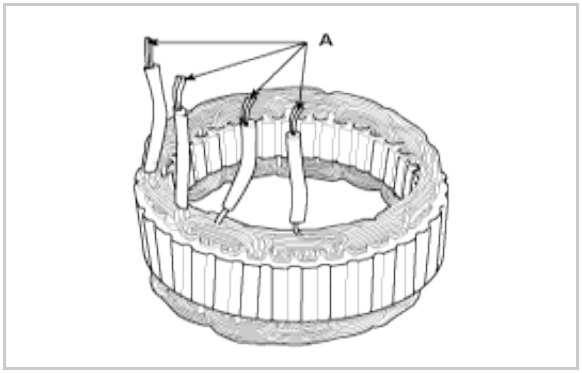
1. Check that there is continuity between the slip rings (A).



2. Check that there is no continuity between the slip rings and the rotor (B) or rotor shaft (C).
3. If the rotor fails either continuity check, replace the alternator.

INSPECT STATOR

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

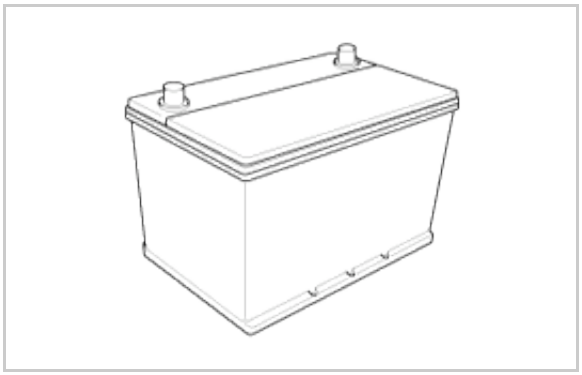


2. Check that there is no continuity between each lead and the coil core.
3. If the coil fails either continuity check, replace the alternator.

Battery

DESCRIPTION

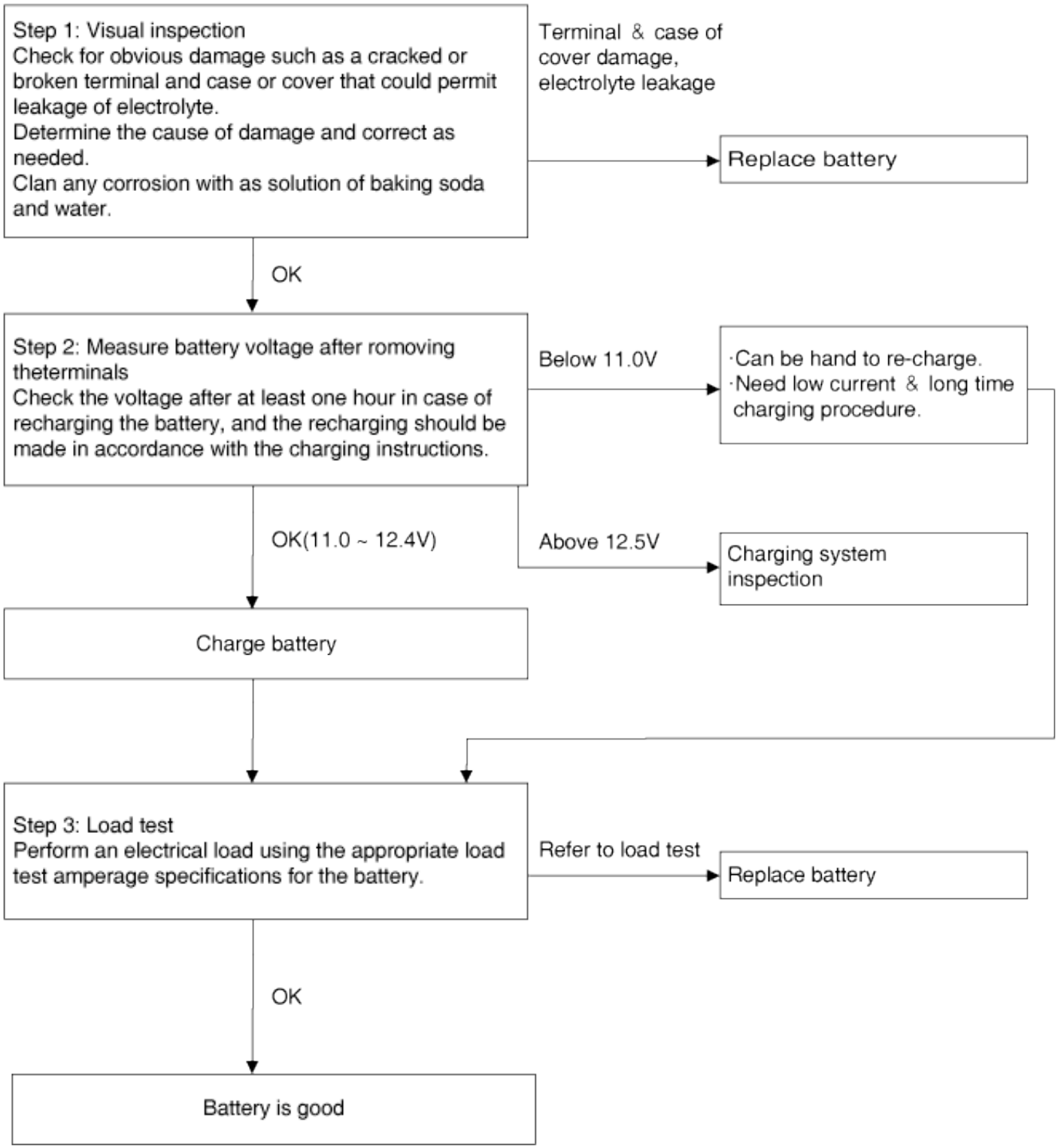
1. The maintenance-free battery is, as the name implies, totally maintenance free and has no removable battery cell caps.
2. Water never needs to be added to the maintenance-free battery.
3. The battery is completely sealed, except for small vent holes in the cover.



INSPECTION

BATTERY DIAGNOSTIC TEST (1)

CHECKING FLOW



LOAD TEST

1. Perform the following steps to complete the load test procedure for maintenance free batteries.
2. Connect the load tester clamps to the terminals and proceed with the test as follow:

(1) If the battery has been on charge, remove the surface charge by connect a 300ampere load for 15 seconds.

(2) Connect the voltmeter and apply the specified load.

(3) Read the voltage after the load has been applied for 15 seconds.

(4) Disconnect the load.

(5) Compare the voltage reading with the minimum and replace the battery if battery test voltage is below that shown in the voltage table.

Voltage	Temperature
9.6V	20°C (68.0°F) and above
9.5V	16°C (60.8°F)
9.4V	10°C (50.0°F)
9.3V	4°C (39.2°F)
9.1V	-1°C (30.2°F)
8.9V	-7°C (19.4°F)
8.7V	-12°C (10.4°F)
8.5V	-18°C (-0.4°F)

NOTICE

a. If the voltage is greater shown in the table, the battery is good.

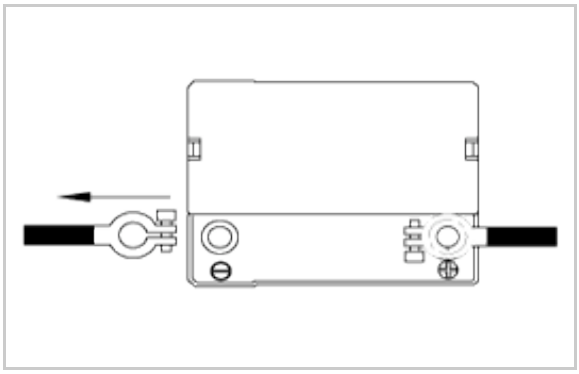
b. If the voltage is less than shown in the table, replace the battery.

BATTERY DIAGNOSTIC TEST (2)

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

CAUTION

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

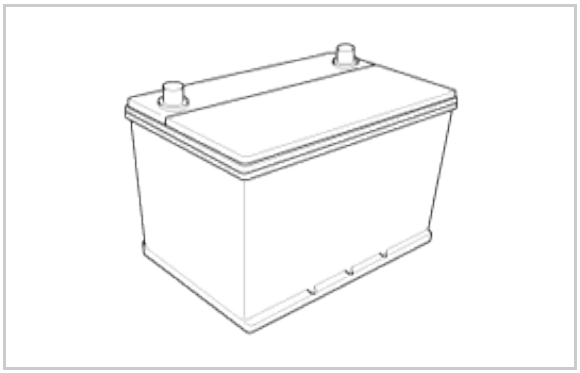


4. Inspect the battery tray for damage caused by the loss of electrolyte. If acid damage is present, it will be necessary to clean the area with a solution of clean warm water and baking soda. Scrub the area with a stiff brush and wipe off with a cloth moistened with baking soda and water.
5. Clean the top of the battery with the same solution as described above.
6. Inspect the battery case and cover for cracks. If cracks are present, the battery must be replaced.
7. Clean the battery posts with a suitable battery post tool.

8. Clean the inside surface of the terminal clamps with a suitable battery cleaning tool. Replace damaged or frayed cables and broken terminal clamps.
9. Install the battery in the vehicle.
10. Connect the cable terminals to the battery post, making sure tops of the terminals are flush with the tops of the posts.
11. Tighten the terminal nuts securely.
12. Coat all connections with light mineral grease after tightening.

CAUTION

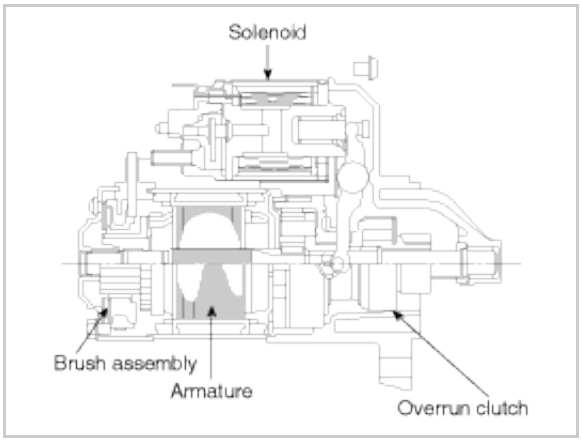
When batteries are being charged, an explosive gas forms beneath the cover of each cell. Do not smoke near batteries being charged or which have recently been charged. Do not break live circuit at the terminals of batteries being charged.
A spark will occur when the circuit is broken. Keep open flames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



Starting System

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.



STARTER CIRCUIT TROUBLESHOOTING

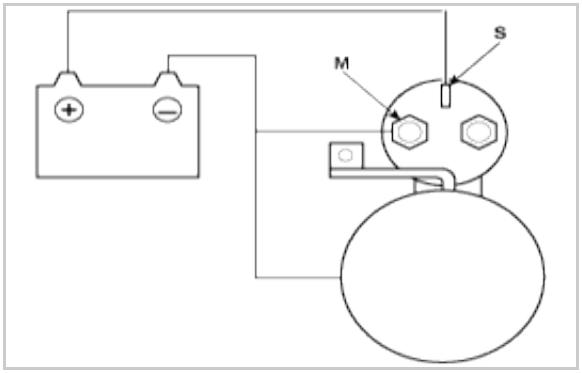
NOTICE

The battery must be in good condition and fully charged.

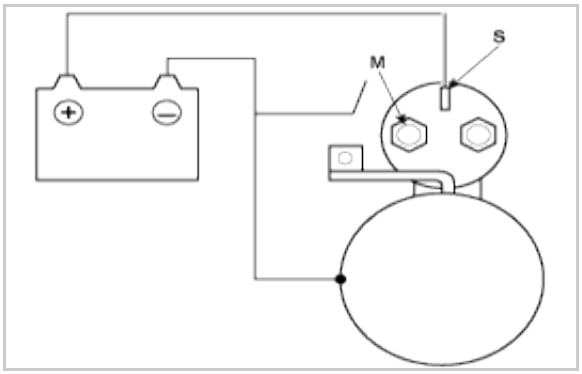
1. Remove the fuel pump relay(A) from the fuse box.
2. With the shift lever in N or P (A/T) or clutch pedal pressed (M/T), turn the ignition switch to "START"
   If the starter normally cranks the engine, starting system is OK. If the starter will not crank the engine at all, go to next step.
   If it 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.

STATER SOLENOID TEST

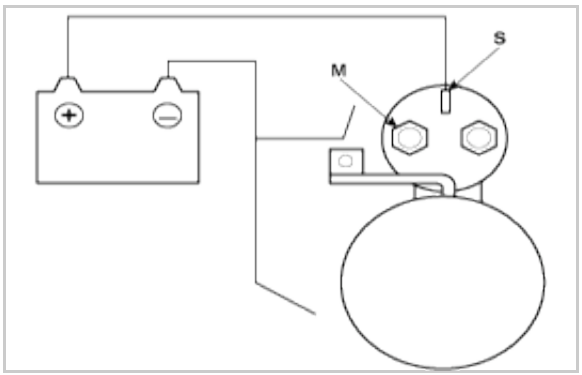
1. Disconnect the field coil wire from the M-terminal of solenoid switch.
2. Connect the battery as shown. If the starter pinion pops out, it is working properly. To avoid damaging the starter, do not leave the battery connected for more than 10 seconds.



3. Disconnect the battery from the M terminal.
   If the pinion does not retract, the hold-in coil is working properly. To avoid damaging the starter, do not leave the battery connected for more than 10 seconds.

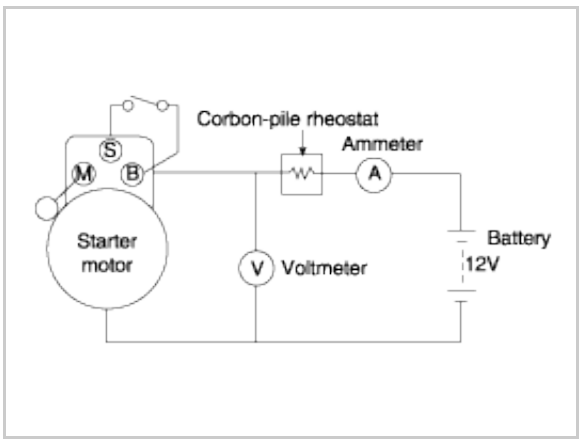


4. Disconnect the battery also from the body. If the pinion retracts immediately, it is working properly. To avoid damaging the starter, do not leave the battery connected for more than 10 seconds.



FREE RUNNING TEST

1. Place the starter motor in a vise equipped with soft jaws and connect a fully-charged 12-volt battery to starter motor as follows.
2. Connect a test ammeter (100-ampere scale) and carbon pile rheostats shown is the illustration.
3. Connect a voltmeter (15-volt scale) across starter motor.

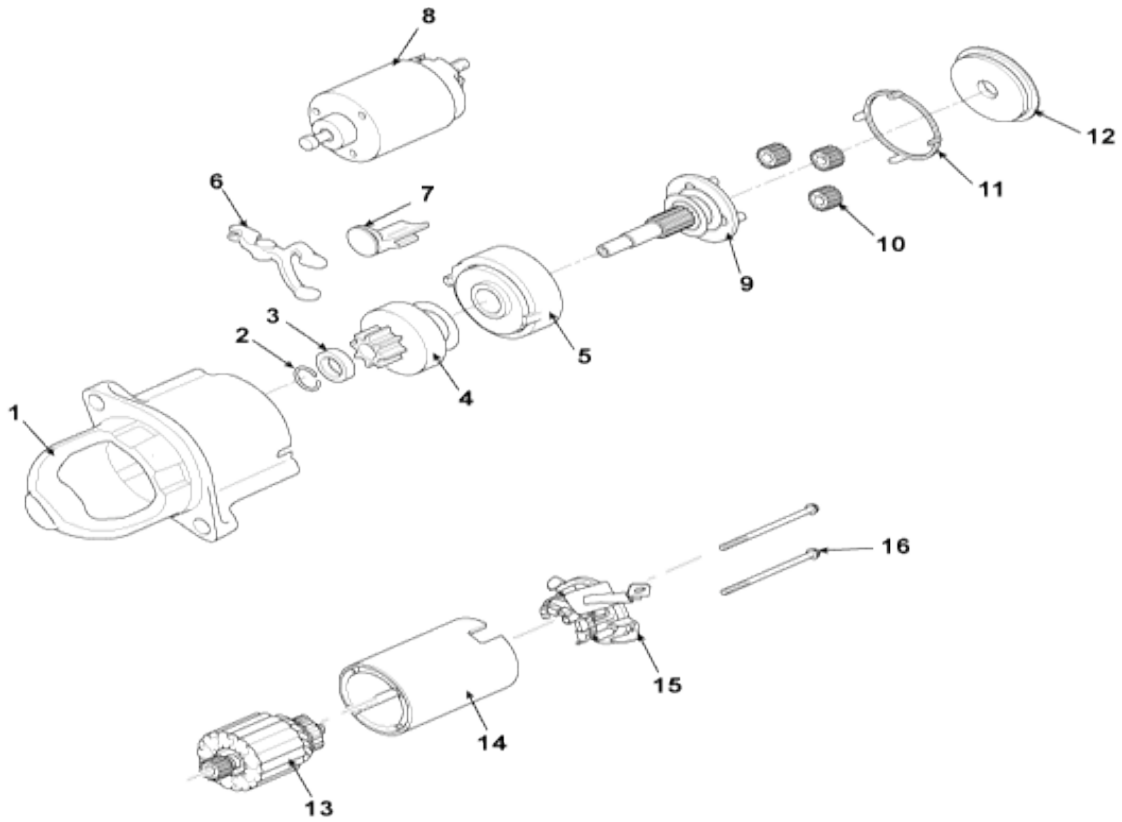


4. Rotate carbon pile to the off position.
5. Connect the battery cable from battery's negative post to the starter motor body.
6. Adjust until battery voltage shown on the voltmeter reads 11volts.
7. Confirm that the maximum amperage is within the specifications and that the starter motor turns smoothly and freely.

Current : 900A
Speed : 2,800 rpm

Starter

COMPONENT

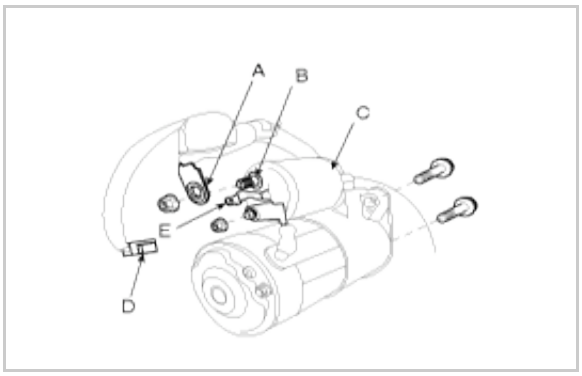


1. Front bracket
2. Stop ring
3. Stopper
4. Overrun clutch assembly
5. Internal gear assembly
6. Lever
7. Lever packing
8. Magnet switch assembly
9. Planet shaft assembly
10. Planetary gear assembly
11. Packing
12. Shield
13. Armature assembly
14. Yoke assembly
15. Brush holder assembly
16. Through bolt

REMOVAL

STATATER

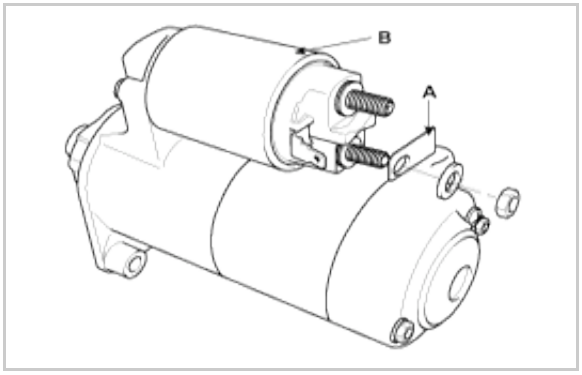
1. Disconnect the battery negative cable.
2. Disconnect the starter cable (A) from the B terminal (B) on the solenoid (C), then disconnect the connector (D) from the S terminal (E).



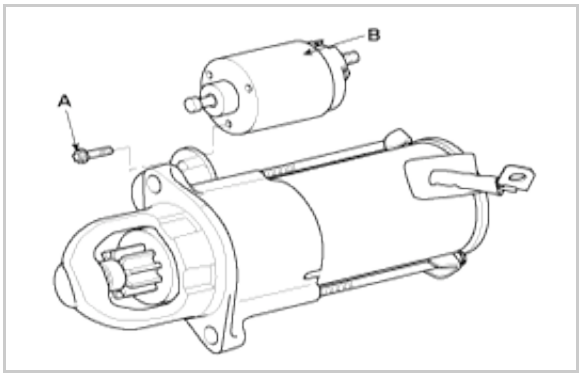
3. Remove the 2 bolts holding the starter, then remove the starter.
4. Installation is the reverse of removal.
5. Connect the battery negative cable to the battery.

DISASSEMBLY

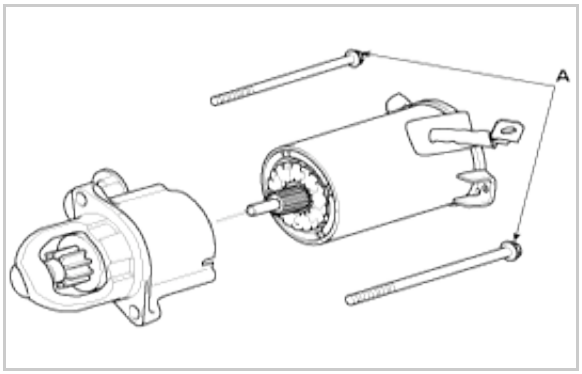
1. Disconnect the M-terminal (A) on the magnet switch assembly (B).



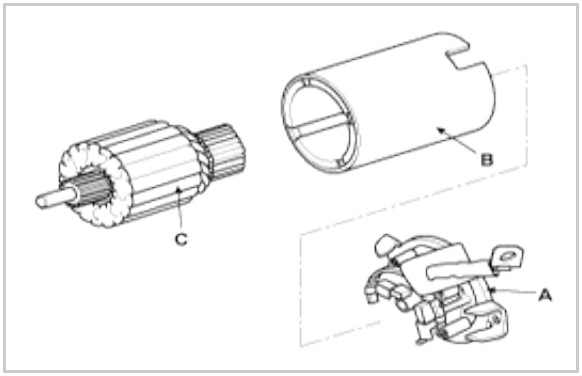
2. After loosening the 3 screws (A), detach the magnet switch assembly (B).



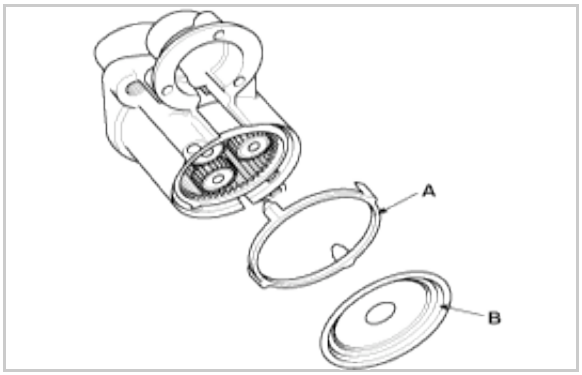
3. Loosen the through bolts (A).



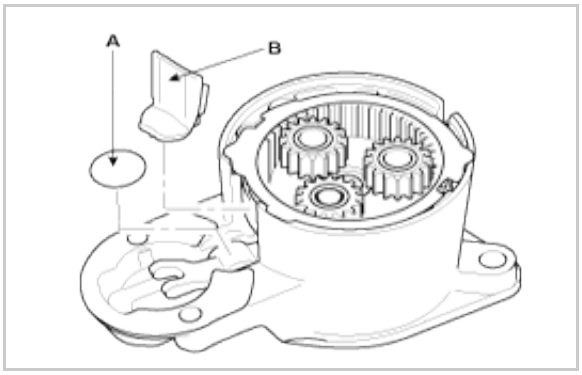
4. Remove the brush holder assembly (A), yoke (b) and armature (C).



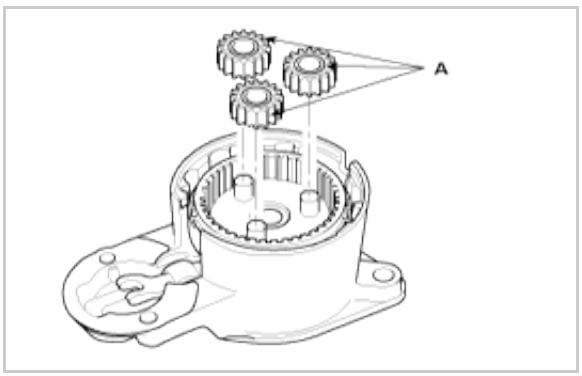
5. Remove the shield (A) and packing (B).



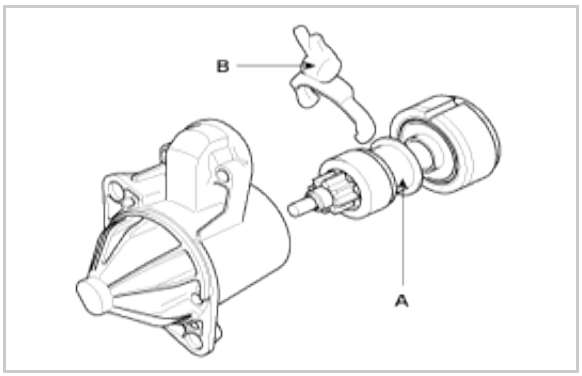
6. Remove the lever plate (A) and lever packing (B).



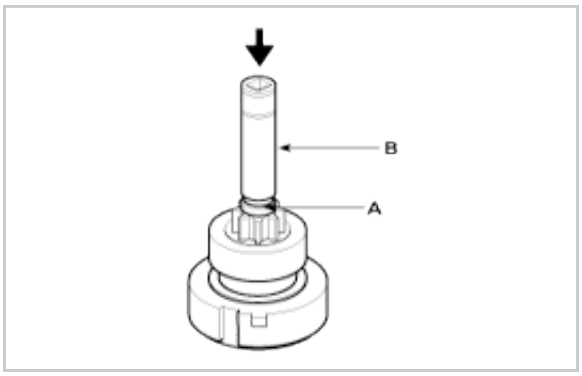
7. Disconnect the planet gear (A).



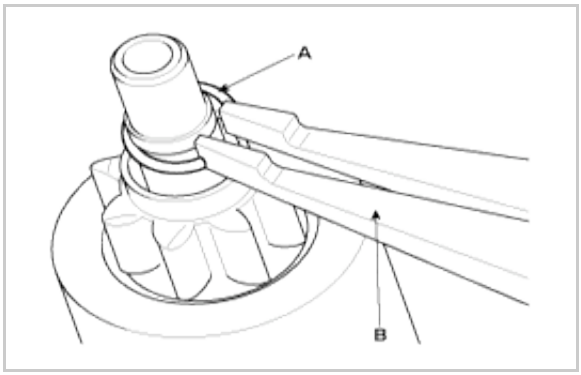
8. Disconnect the planet shaft assembly (A) and lever (B).



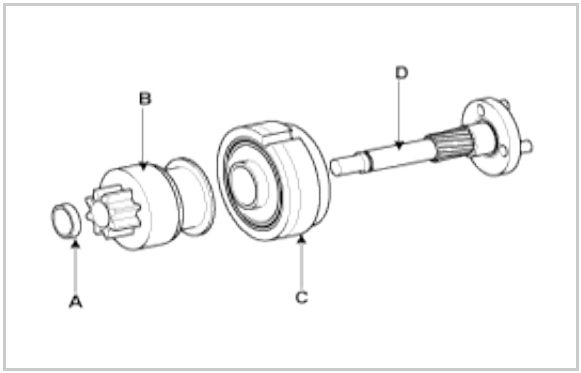
9. Press the stop ring (A) using a socket (B).



10. After removing the stopper (A) using stopper pliers (B).



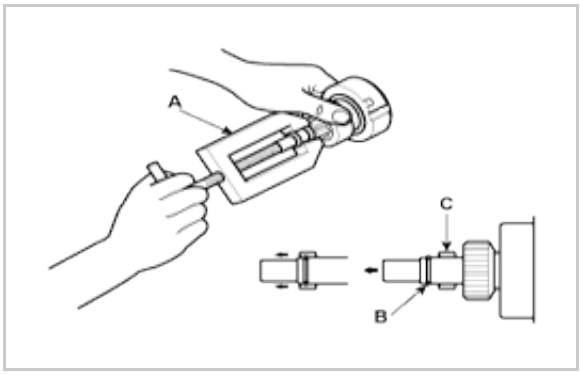
11. Disconnect the stop ring (A), overrunning clutch (B), internal gear (C) and planet shaft (D).



12. Reassembly is the reverse of disassembly.

NOTICE

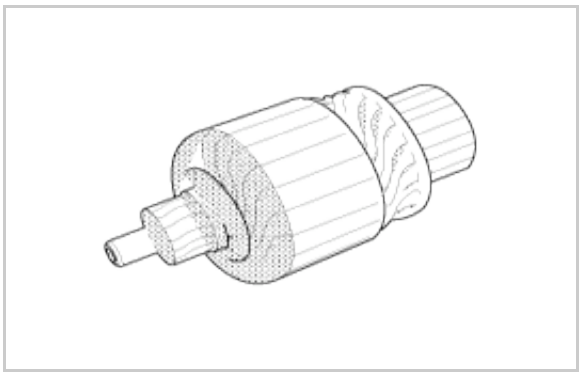
Using a suitable pulling tool (A), pull the overrunning clutch stop ring (B) over the stopper (C).



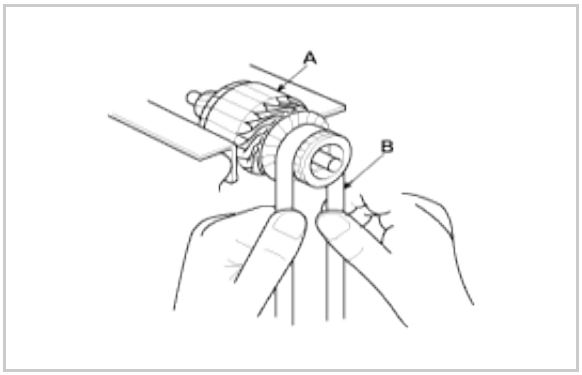
INSPECTION

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.

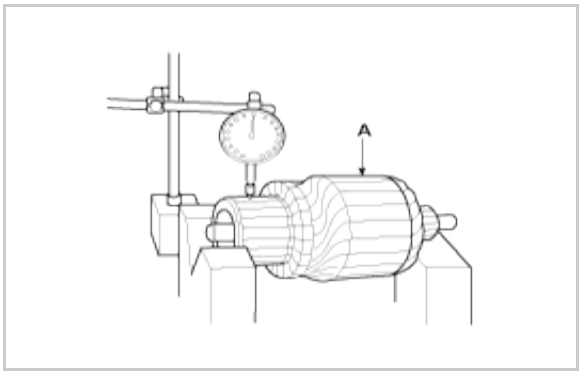


4. Check the commutator (A) surface. If the surface is dirty or burnt, resurface with emery cloth or a lathe within the following specifications, or recondition with #500 or #600 sandpaper (B).



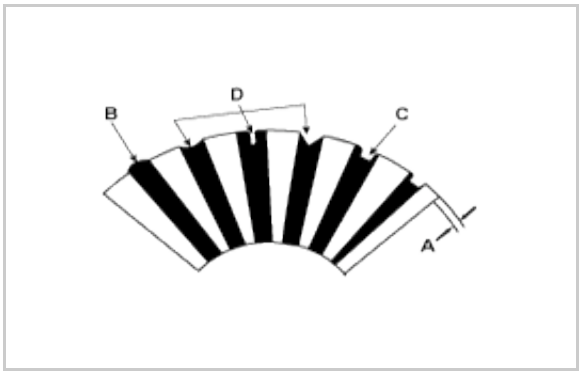
5. Measure the commutator (A) runout.
   a. If the commutator runout is within the service limit, check the commutator for carbon dust or brass chips between the segments.
   b. If the commutator run out is not within the service limit, replace the armature.

Commutator runout
Standard (New): 0.02mm (0.0008in.) max
Service limit: 0.05mm (0.0020in.)

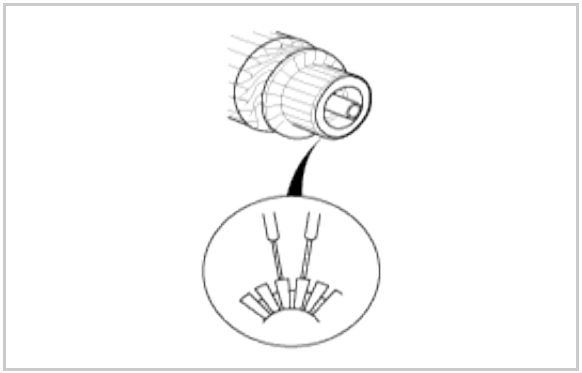


6. Check the mica depth (A). If the mica is too high (B), undercut the mica with a hacksaw blade to the proper depth. Cut away all the mica (C) between the commutator segments. The undercut should not be too shallow, too narrow, or v-shaped (D).

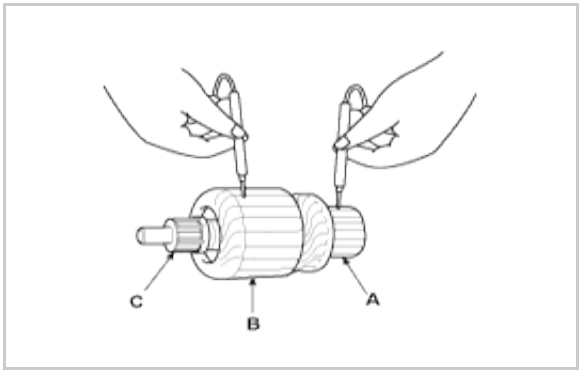
Commutator mica depth
Standard (New) : 0.5 mm (0.0197 in.)
Limit : 0.2mm (0.0079 in.)



7. Check for continuity between the segments of the commutator. If an open circuit exists between any segments, replace the armature.

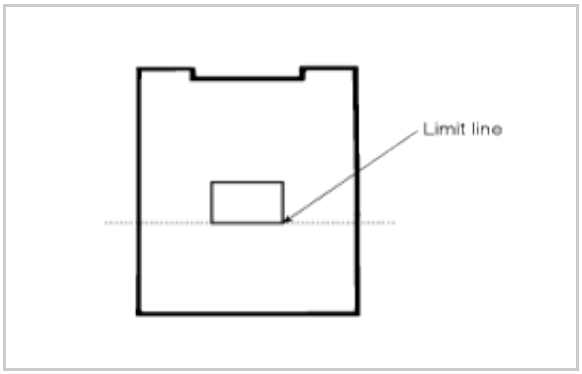


8. Check with an ohmmeter that no continuity exists between the commutator (A) and armature coil core (B), and between the commutator and armature shaft (C). If continuity exists, replace the armature.



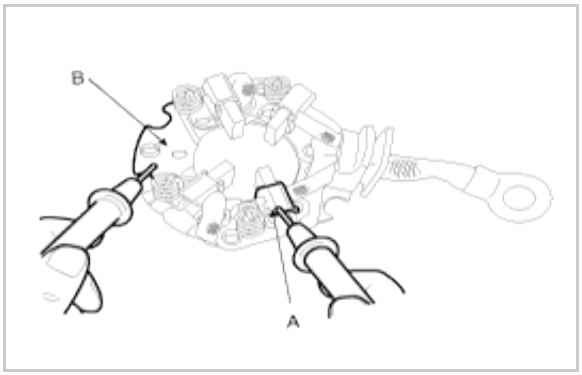
INSPECT STARTER BRUSH

Brushes that are worm out, or oil-soaked, should be replaced.

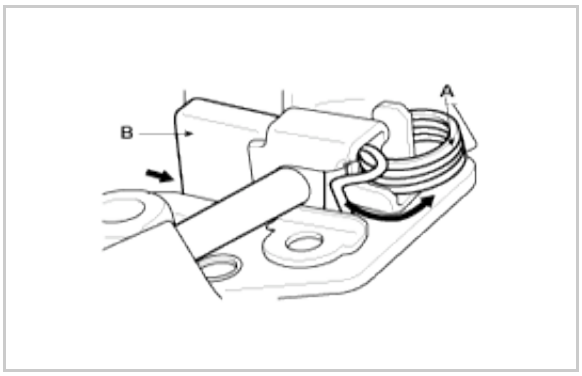


STARTER BRUSH HOLDER TEST

1. Check that there is no continuity between the (+) brush holder (A) and (-) brush holder (B). If there is no continuity, replace the brush holder assembly.

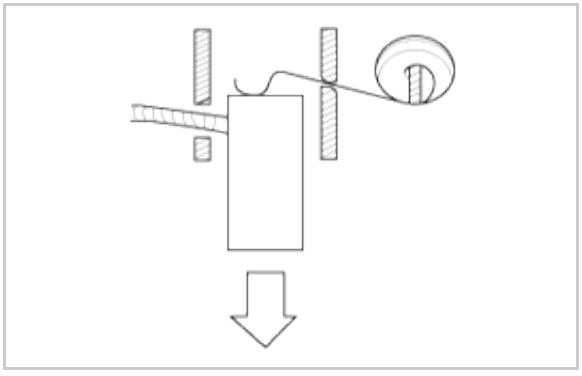


2. Pry back each brush spring (A) with a screwdriver, then position the brush (B) about halfway out of its holder, and release the spring to hold it there.



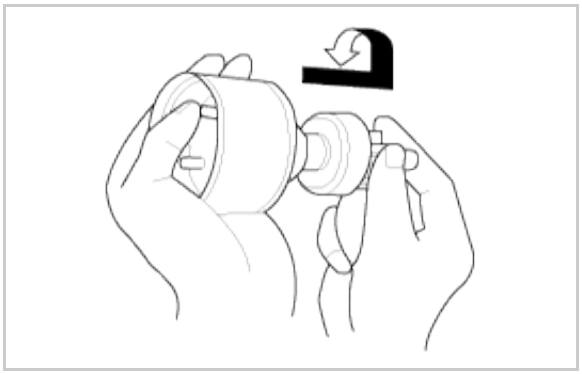
3. Install the armature in the housing, and install the brush holder. Next, pry back each brush spring again, and push the brush down until it seats against the commutator, then release the spring against the end of the brush.

> **NOTICE**
>
> 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 of it locks in both directions, replace it.



3. If the starter drive gear is worn or damaged, replace the overrunning clutch assembly. (the gear is not available separately).
   Check the condition of the flywheel or torque converter ring gear if the starter drive gear teeth are damaged.

CLEANING

1. Do not immerse parts in cleaning solvent. Immersing the yoke assembly and/or armature will damage the insulation. Wipe these parts with a cloth only.
2. Do not immerse the drive unit in cleaning solvent. The overrun clutch is pre-lubricated at the factory and solvent will wash lubrication from the clutch.
3. The drive unit may be cleaned with a brush moistened with cleaning solvent and wiped dry with a cloth.

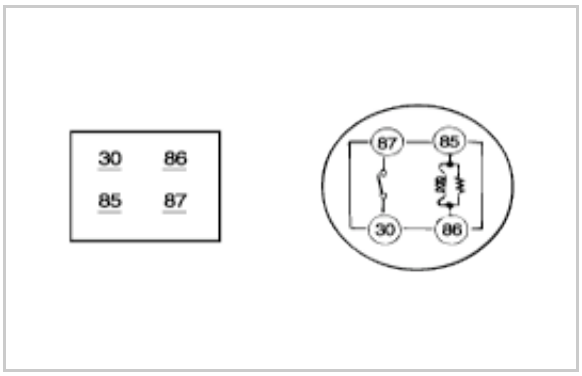
Starter Relay

INSPECTION

1. Remove the fuse box cover.
2. Remove the starter relay.
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.

CHAPTER 4:

Emission Control System

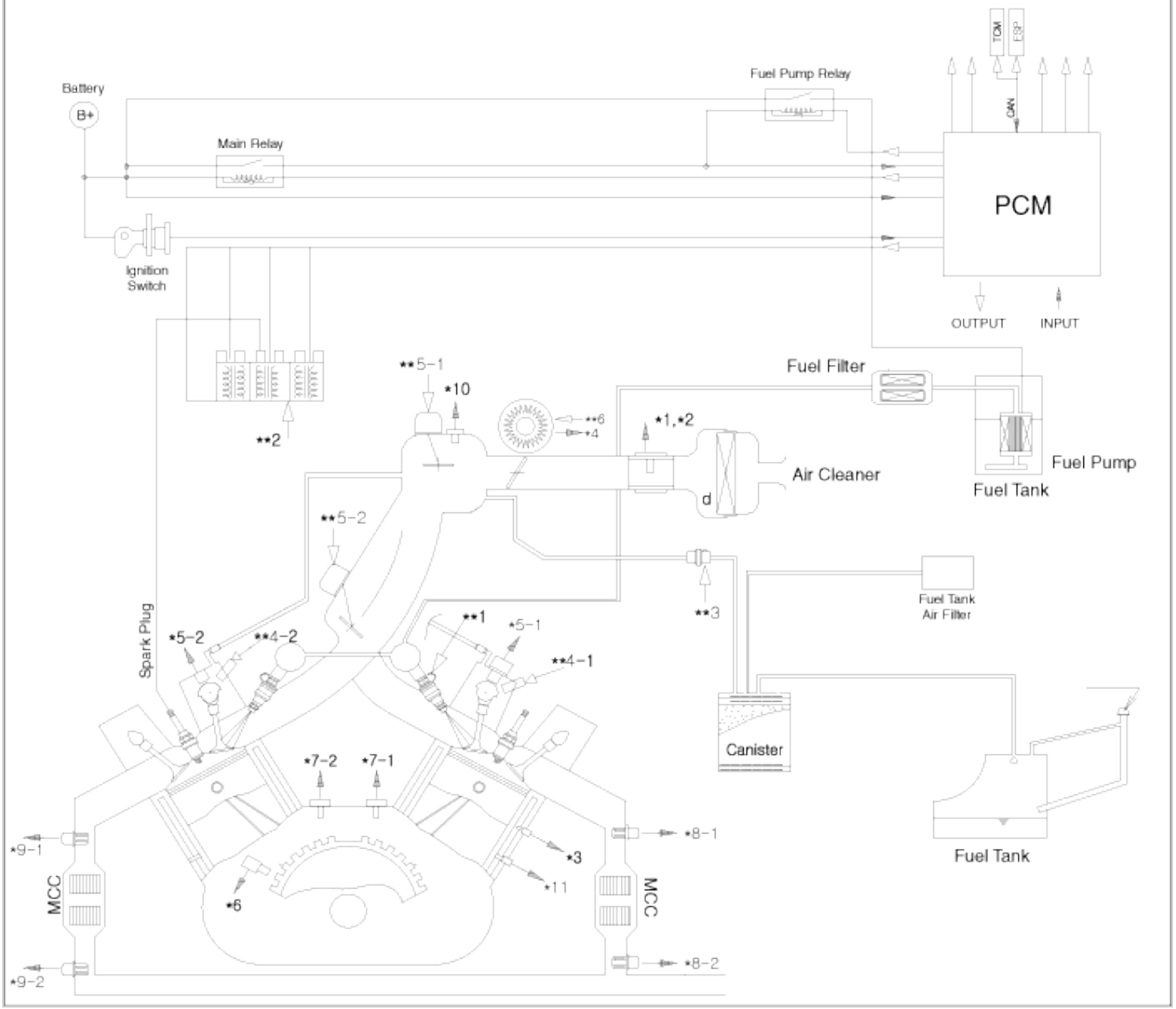
SCHEMATIC DIAGRAM

*1. Mass Air Flow Sensor (MAFS)
*2. Intake Air Temperature Sensor (IATS)
*3. Engine Coolant Tmeperature Sensor (ECTS)
*4. Throttle Position Sensor (TPS)
*5-1. Camshaft Position Sensor (CMPS) [BANK1]
*5-2. Camshaft Position Sensor (CMPS) [BANK2]
*6. Crankshaft Position Sensor (CKPS)
*7-1. Knock Sensor (KS) #1
*7-2. Knock Sensor (KS) #2
*8-1. Heated Oxygen Sensor (HO2S) [B1/S1]
*8-2. Heated Oxygen Sensor (HO2S) [B1/S2]
*9-1. Heated Oxygen Sensor (HO2S) [B2/S1]
*9-2. Heated Oxygen Sensor (HO2S) [B2/S2]
*10. Manifold Absolute Pressure Sensor (MAPS)
*11. CVVT Oil Temperature Sensor (OTS)

- Ignition Switch
- Battery Voltage
- Vehicle Speed Signal
- Coolant Load Signal
- "PNP" Switch (A/T only)
- Fuel Pump Relay Signal

PCM

**1. Fuel Injector
**2. Ignition Coil
**3. Purge Control Solenoid Valve (PCSV)
**4-1. CVVT Oil control valve (OCV) [BANK1]
**4-2. CVVT Oil control valve (OCV) [BANK2]
**5-1. Variable Intake Manifold Solenoid (VIS) Valve [Surge Tank]
**5-2. Variable Intake Manifold Solenoid (VIS) Valve [Intake Manifold]
**6. ETC Motor
. Fuel Pump Control
. Main Relay
. Cooler Relay
. Ignition Timing Control
. Diagnosis

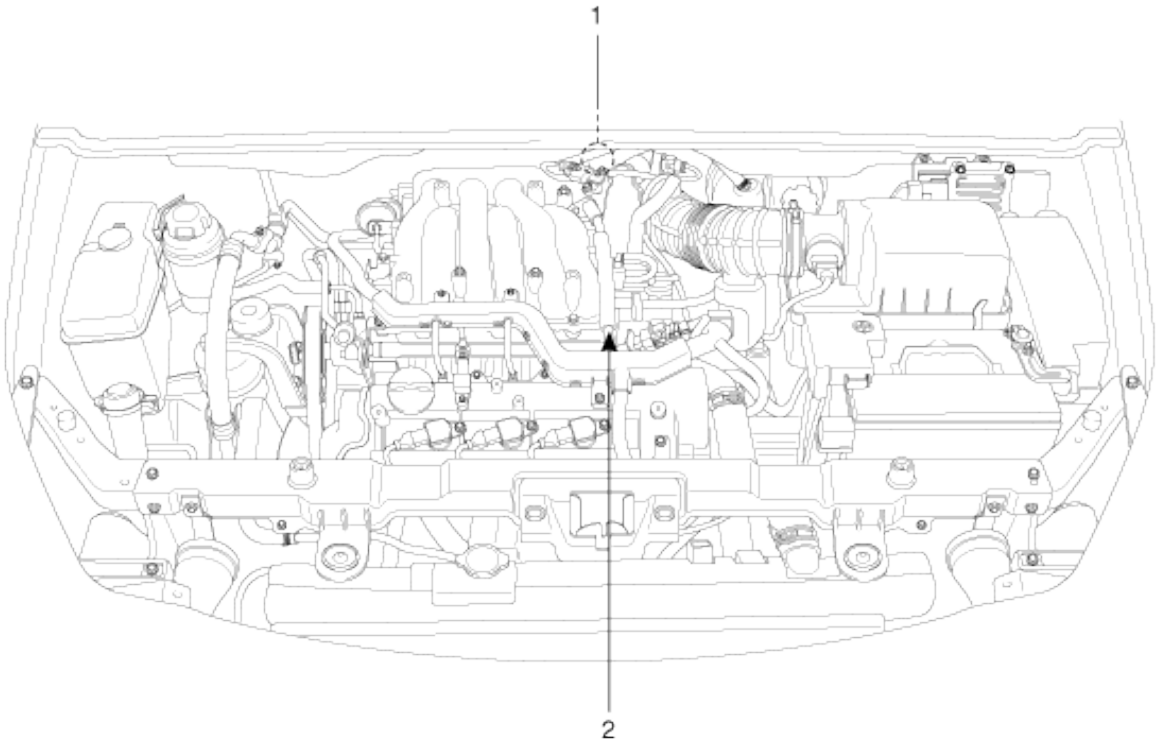


General Information

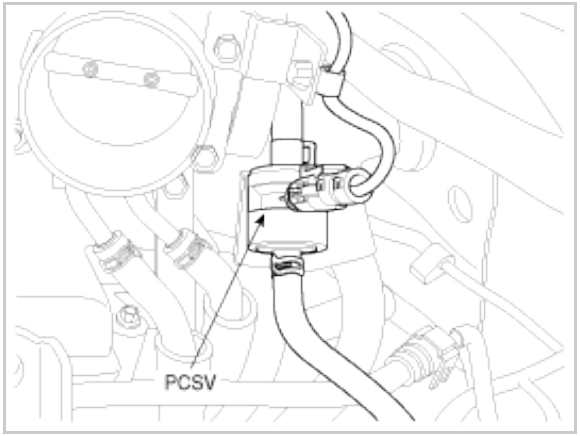
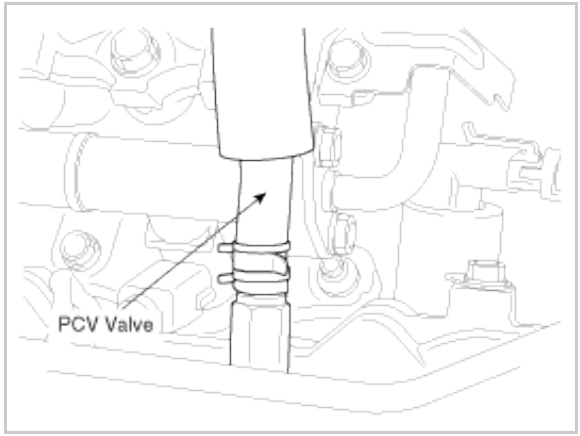
DESCRIPTION

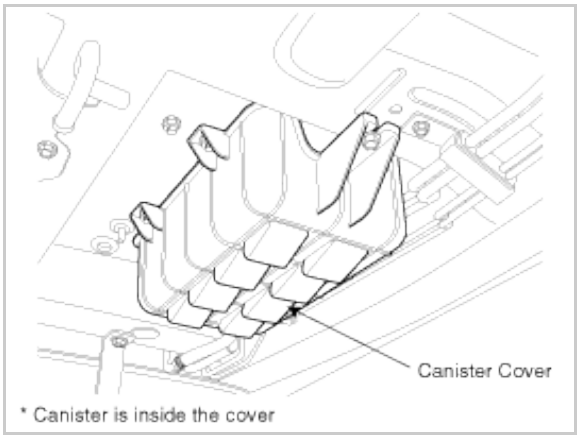
Components	Function	Remarks
Crankcase Emission System a. Positive Crankcase Ventilation (PCV) valve	HC reduction	Variable flow rate type
Evaporative Emission System a. Evaporative emission canister b. Purge Control Solenoid Valve (PCSV)	 HC reduction HC reduction	 Duty control solenoid valve
Exhaust Emission System a. MFI system (air-fuel mixture control device) b. Three-way catalytic converter	 CO, HC, NOx reduction CO, HC, NOx reduction	 Heated oxygen sensor feedback type Monolithic type

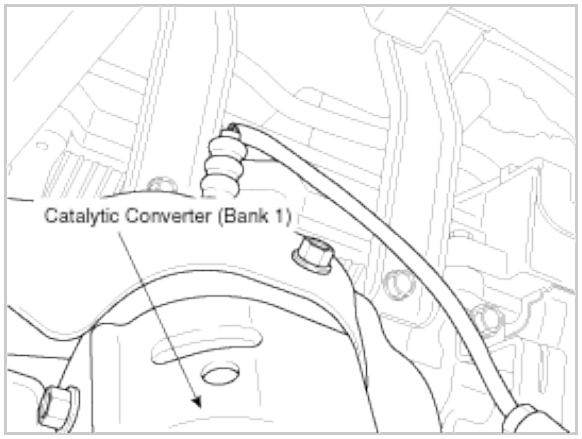
COMPONENT LOCATION



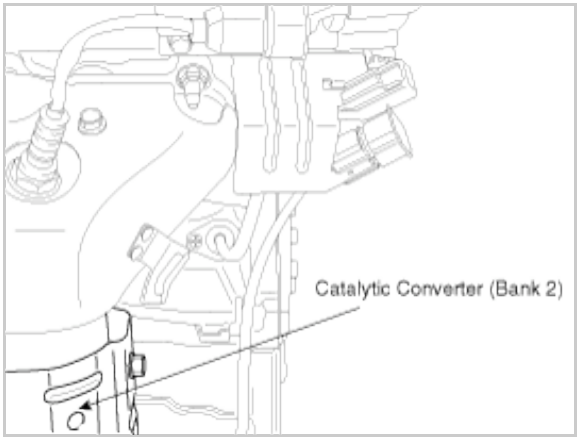
1. Purge Control Solenoid Vavle (PCSV)
2. PCV Valve
3. Canister
4. Catalytic Converter (Bank1)
5. Catalytic Converter (Bank2)

1	Purge Control Solenoid Valve (PCSV)	2	Positive Crankcase Ventilation (PCV) Valve
			
3	Canister	4	Catalytic Converter (Bank 1)





5	Catalytic Converter (Bank 2)		



TROUBLESHOOTING

Symptom	Suspect area	Remedy
Engine will not start or hard to start	Vacuum hose disconnected or damaged	Repair or replace
	Malfunction of the Purge Control Solenoid Valve	Repair or replace
Rough idle or engine stalls	Vacuum hose disconnected or damaged	Repair or replace
	Malfunction of the PCV valve	Replace
	Malfunction of the evaporative emission canister purge system	Check the system; if there is a problem, check related components parts
Excessive oil consumption	Positive crankcase ventilation line clogged	Check positive crankcase ventilation system

SPECIFICATIONS

▷ Specification

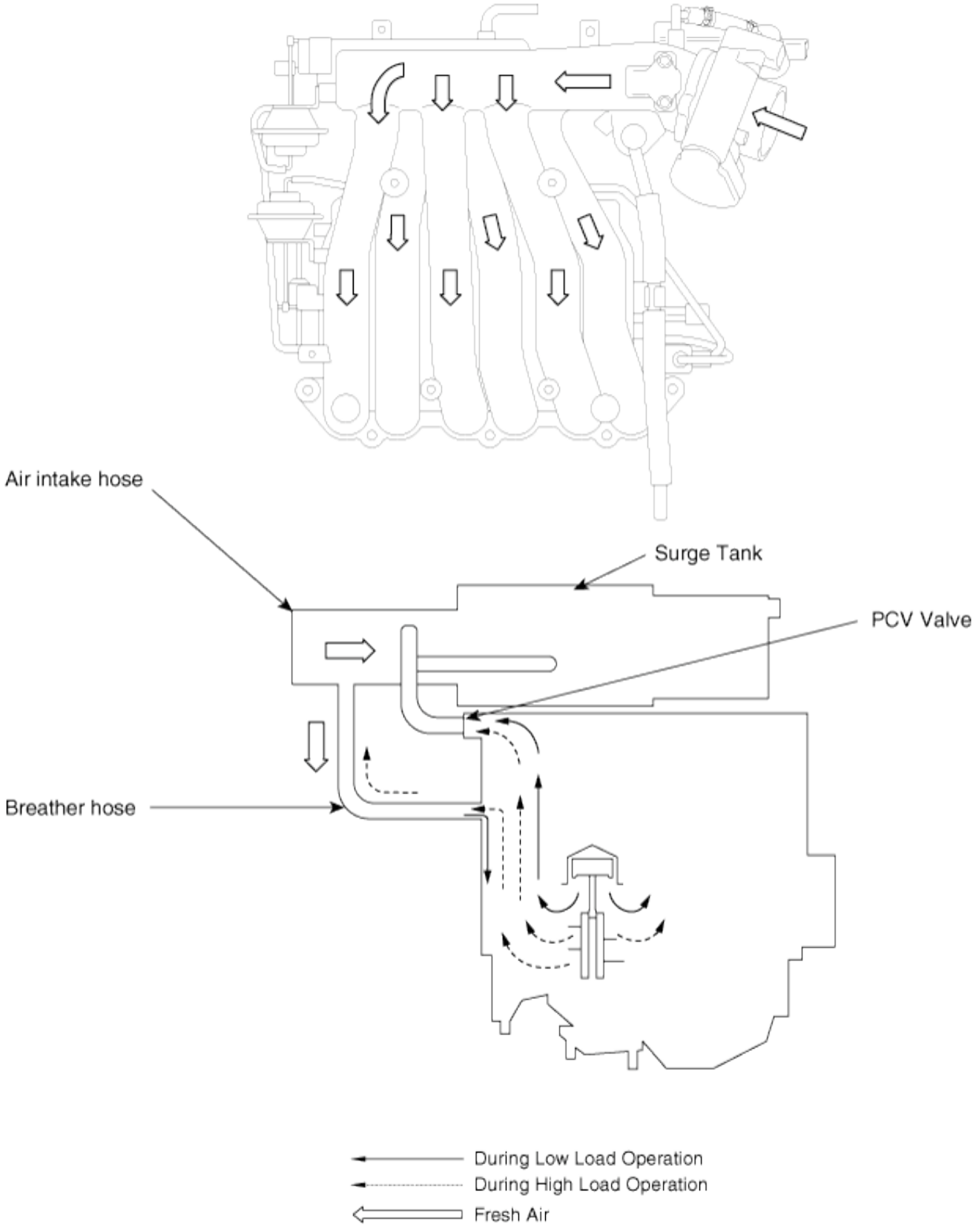
Item	Specification
Coil Resistance (Ω)	14.0 ~ 18.0 Ω [20°C (68°F)]

TIGHTENING TORQUES

Item	N·m	kgf·m	lbf·m
Positive Crankcase Ventilation Valve	8.0 ~ 12.0	0.8 ~ 1.2	6.0 ~ 8.0

Crankcase Emission Control System

COMPONENTS

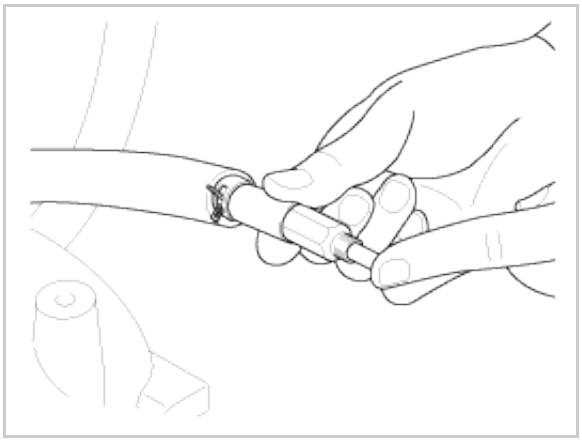

Air intake hose
Surge Tank
PCV Valve
Breather hose
During Low Load Operation
During High Load Operation
Fresh Air

INSPECTION

1. Disconnect the ventilation hose from the positive crankcase ventilation (PCV) valve. Remove the PCV valve from the rocker cover and reconnect it to the ventilation hose.
2. 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.

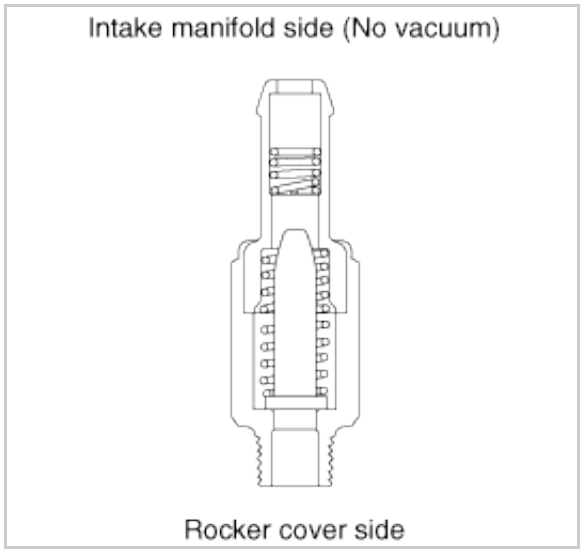
NOTICE

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

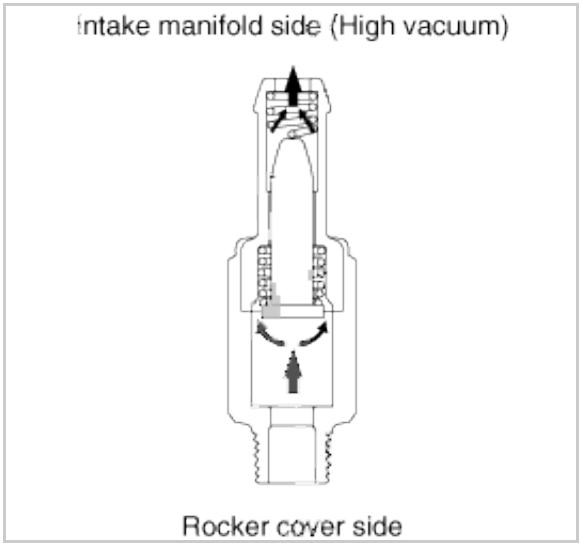


Positive Crankcase Ventilation (PVC) Valve

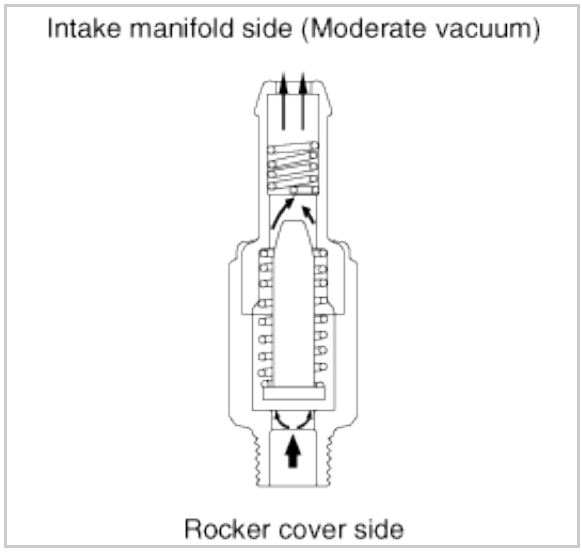
OPERATION



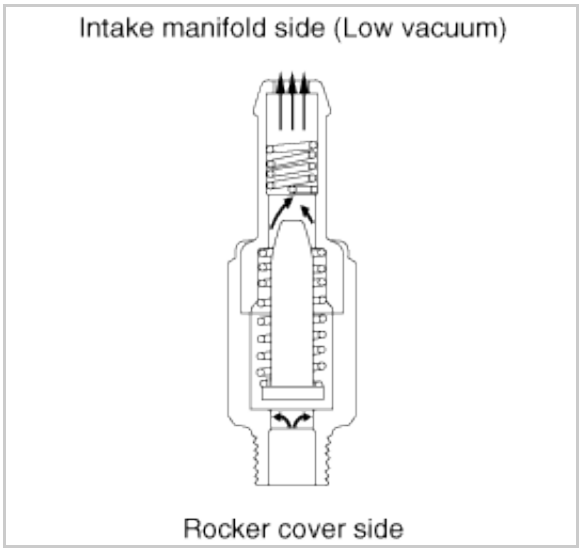
Engine condition	Not running
PCV valve	Not operating
Vacuum passage	Restricted



Engine condition	Idling or decelerating
PCV valve	Fully operating
Vacuum passage	Small



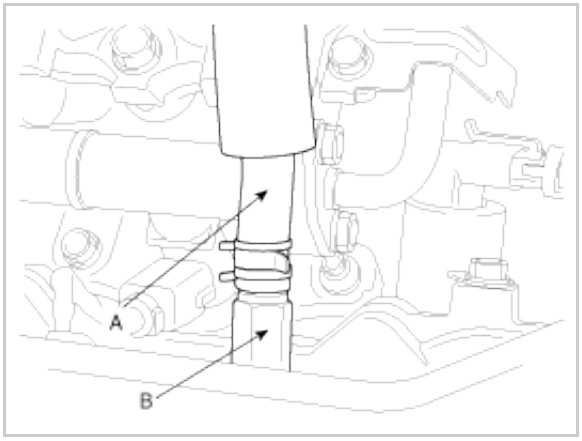
Engine condition	Normal operation
PCV valve	Properly operating
Vacuum passage	Large



Engine condition	Accelerating and high load
PCV valve	Slightly operating
Vacuum passage	Very large

REMOVAL

1. Disconnect the vacuum hose (A).



2. Remove the PCV Valve (B).

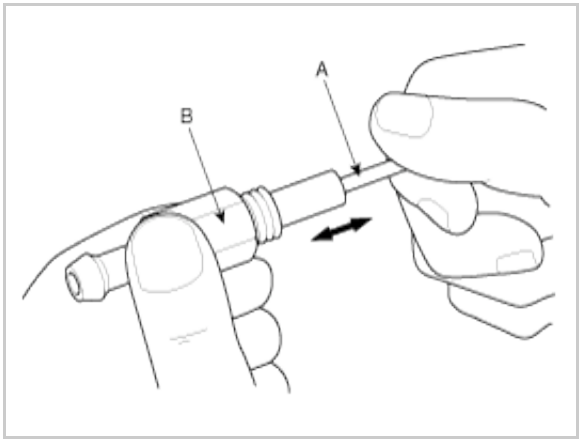
INSTALLATION

Install the PCV valve and tighten to the specified torque.

PCV Valve installation : 7.8 ~ 11.8 N·m (0.8 ~ 1.2 kgf·m, 5.8 ~ 8.7lbf·ft)

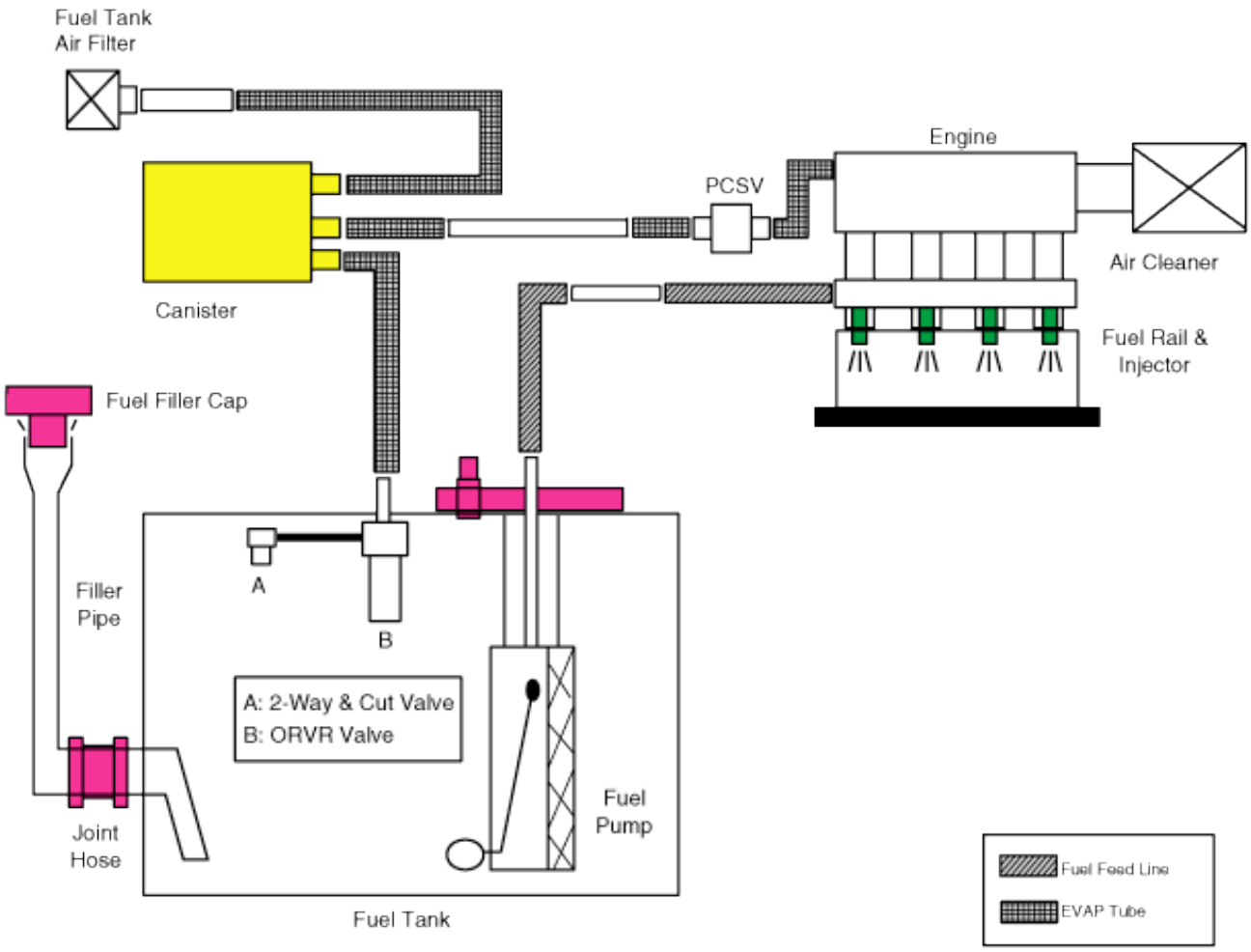
INSPECTION

1. Remove the PCV valve.
2. Insert a thin stick(A) into the PCV valve(B) from the threaded side to check that the plunger moves.
3. If the plunger does not move, the PCV valve is clogged. Clean it or replace.



Evaporative Emission Control System

DESCRIPTION



INSPECTION

1. Disconnect the vacuum hose from the throttle body, and connect a vacuum pump to the vacuum hose.
2. Check the following points when the engine is cold [engine coolant temperature 60°C(140°F) or below] and when it is warm [engine coolant temperature 80°C(176°F) or higher].

WHEN ENGINE IS COLD

Engine operating condition	Applied vacuum	Result
Idling	50 kPa (7.3 psi)	Vacuum is held
3,000 rpm		

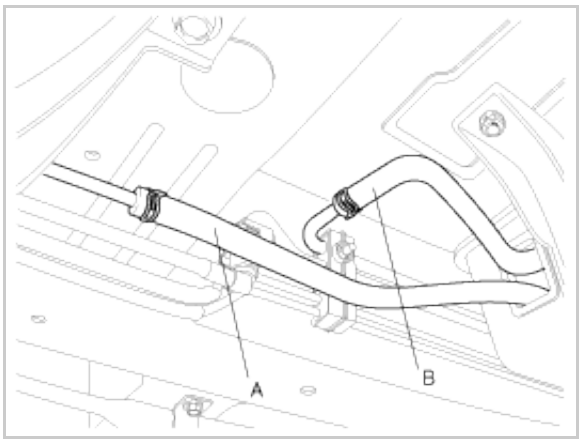
WHEN ENGINE IS WARM

Engine operating condition	Applied vacuum	Result
Idling	50 kPa (7.3 psi)	Vacuum is held
Within 3 minutes after engine start at 3,000 rpm	Try to apply vacuum	Vacuum is released
After 3 minutes have passed after engine start at 3,000 rpm	50 kPa (7.3 psi)	Vacuum will be held momentarily, after which, it will be released

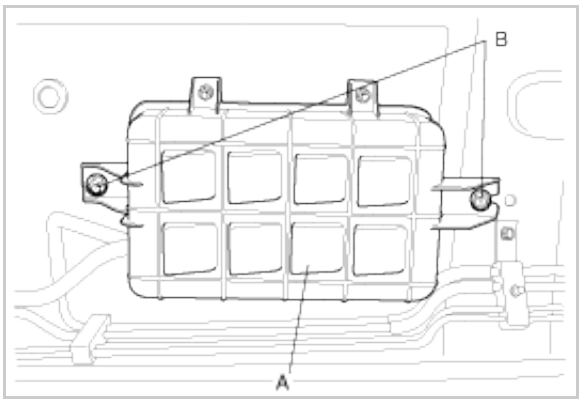
Canister

REMOVAL

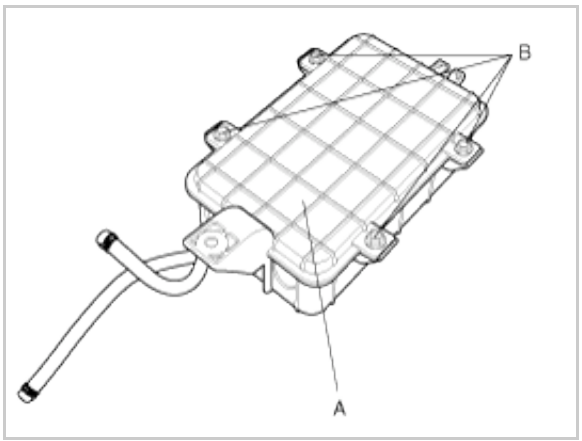
1. Disconnect the vacuum hoses (A,B).

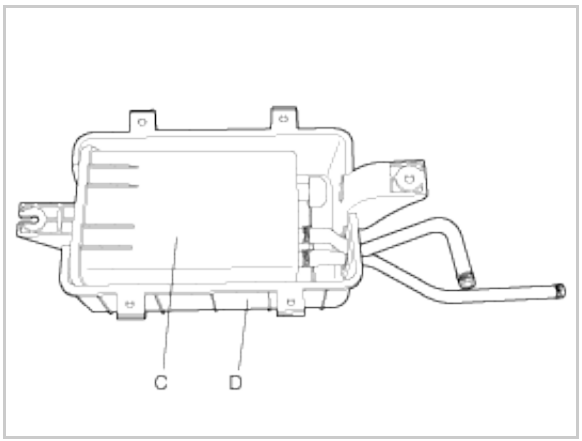


2. Remove the canister assembly (A) with unscrewing the two mounting bolts (B).



3. Open the canister upper cover (A) with unfastening the four bolts (B) and remove the canister (C) from the canister lower cover (D).



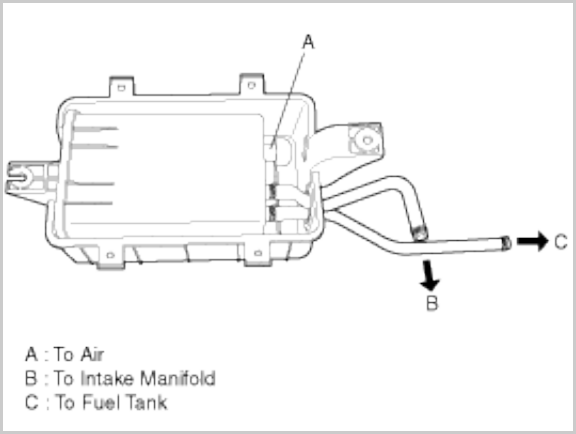


INSTALLATION

Install the canister according to the reverse order of "REMOVAL" procedure.

INSPECTION

1. Look for loose connections, sharp bends or damage to the fuel vapor lines.
2. Look for distortion, cracks or fuel damage.
3. After removing the canister, inspect for cracks, damage or saturated canister.



Purge Control Solenoid Valve (PCSV)

INSPECTION

NOTICE

When disconnecting the vacuum hose, make an identification mark on it so that it can be reconnected to its original position.

1. Disconnect the vacuum hose from the solenoid valve.
2. Detach the harness connector.
3. Connect a vacuum pump to the nipple which is connected to intake manifold.
4. Apply vacuum and check when voltage is applied to the PCSV and when the voltage is discontinued.

Battery voltage	Normal condition
When applied	Vacuum is released
When discontinued	Vacuum is maintained

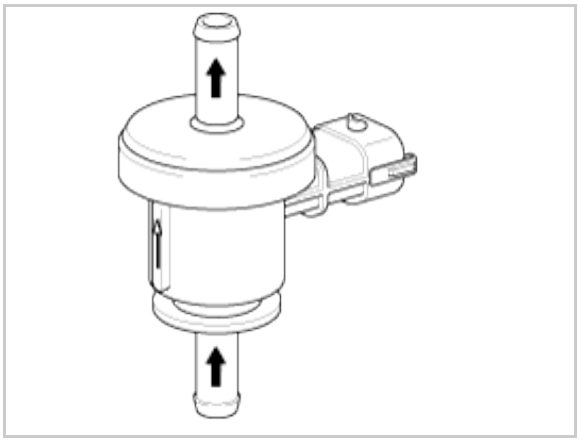
5. Measure the resistance between the terminals of the solenoid valve.

PCSV coil resistance(Ω) :
14.0 ~ 18.0Ω at 20°C (68°F)

INSPECTION

FUNCTION AND OPERATION PRICIPLE

Purge Control Solenoid Valve (PCSV) is installed on the surge tank and controls the passage between the canister and the intake manifold. It is a solenoid valve and is open when the PCM grounds the valve control line. When the passage is open (PCSV ON), fuel vapors stored in the canister is transferred to the intake manifold.

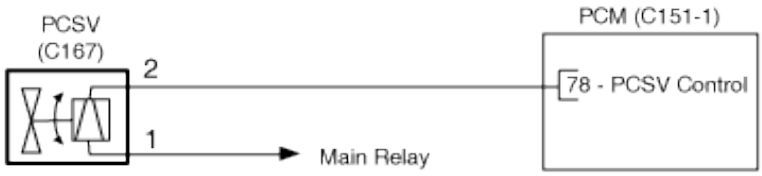


SPECIFICATION

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

CIRCUIT DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

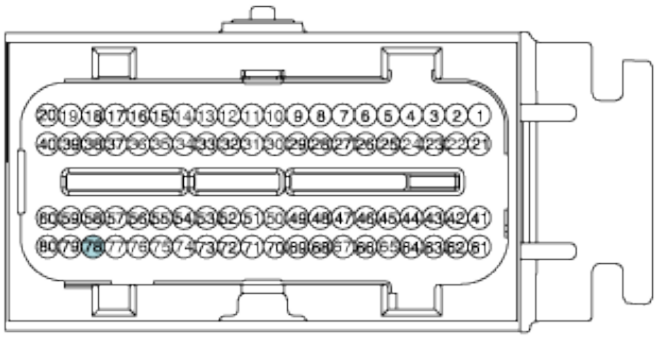
Terminal	Connected to	Function
1	Main Relay	Battery Voltage (B+)
2	PCM C151-1 (78)	PCSV Control

[HARNESS CONNECTORS]



C167

PCSV

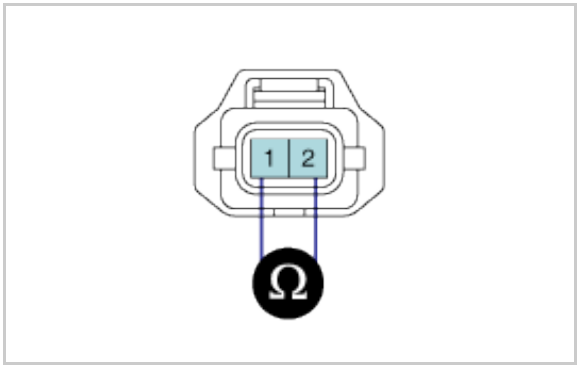


C151-1

PCM

COMPONENT INSPECTION

1. Turn ignition switch OFF.
2. Disconnect PCSV connector.
3. Measure resistance between PCSV terminals 1 and 2.

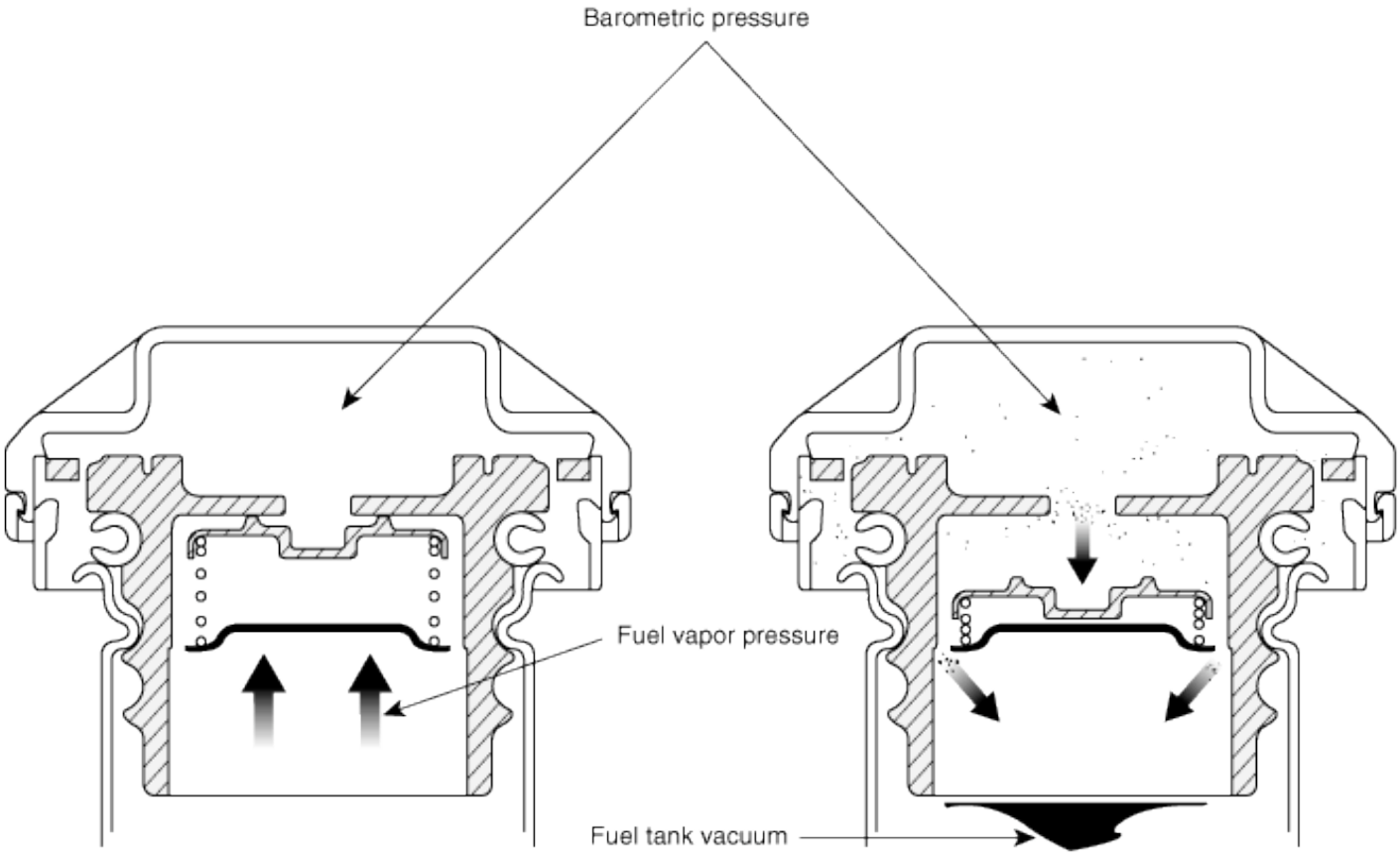


4. Check that the resistance is within the specification.

Specification: Refer to SPECIFICATION.

Fuel Filler cap

DESCRIPTION



When fuel tank is under pressure.

When fuel tank is under vacuum.

Exhaust Emission Control System

DESCRIPTION

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 driveability and fuel economy.

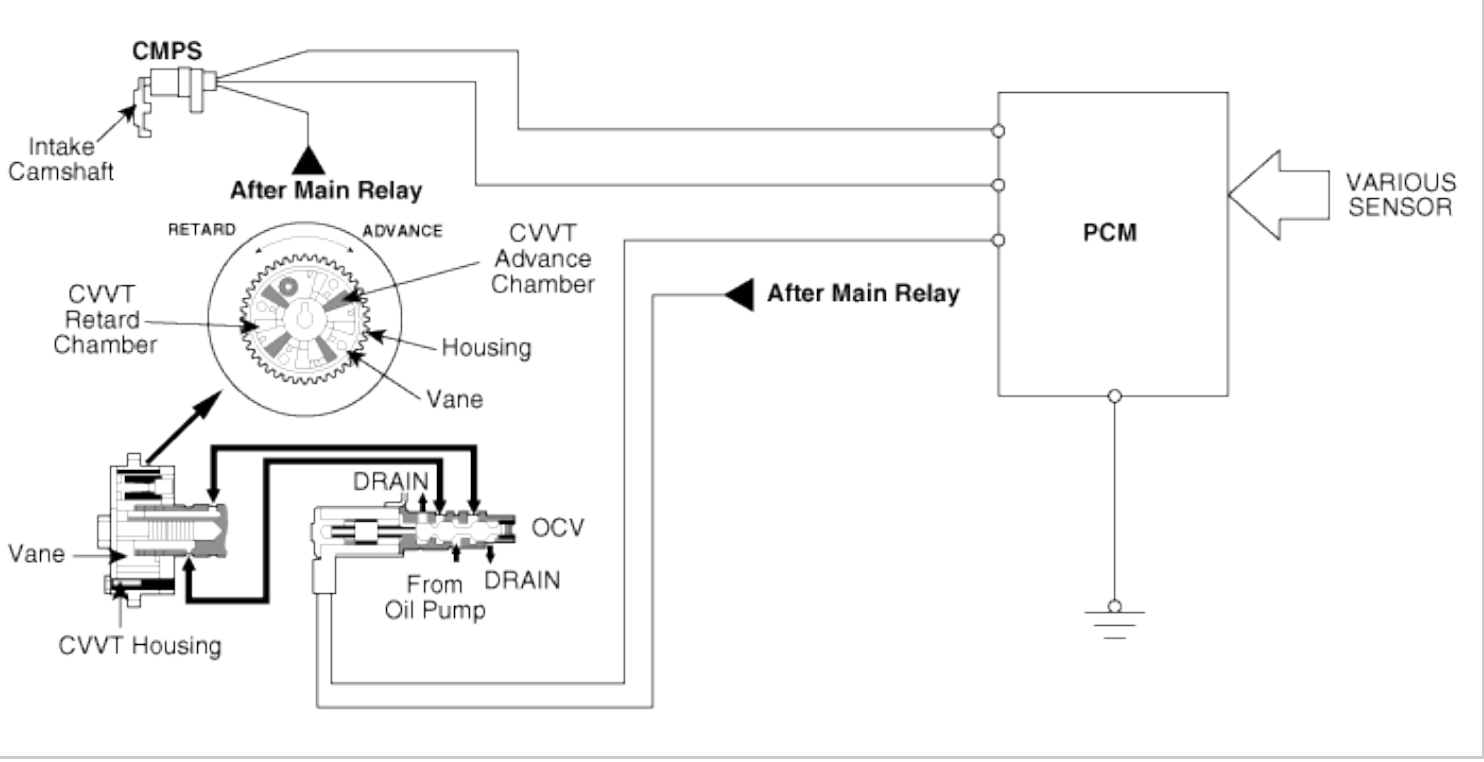
AIR/FUEL MIXTURE CONTROL SYSTEM [MULTIPORT FUEL INJECTION (MFI) SYSTEM]

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.

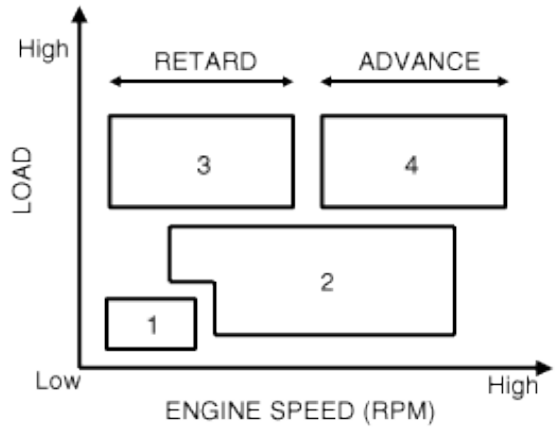
1. Open Loop air/fuel ratio is controlled by information programmed into the ECM.
2. Closed Loop air/fuel ratio is adjusted by the ECM based on information supplied by the oxygen sensor.

CVVT (Continuously Variable Valve Timing) System

DESCRIPTION



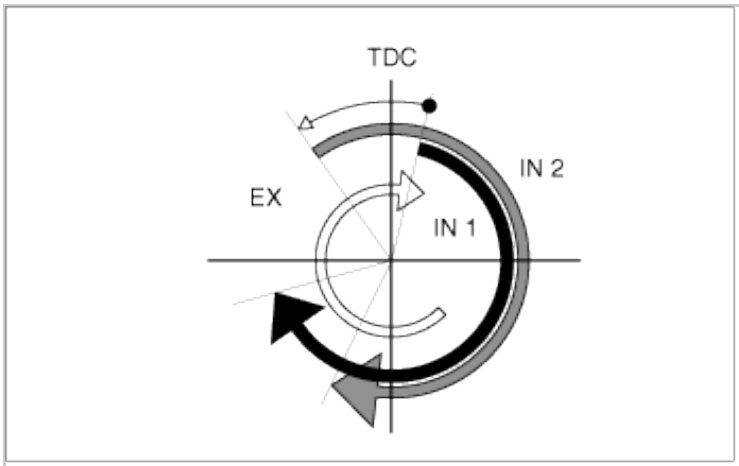
The CVVT (Continuously Variable Valve Timing) which is installed on the exhaust camshaft controls intake valve open and close timing in order to improve engine performance.
The intake valve timing is optimized by CVVT system depending on engine rpm.
This CVVT system improves fuel efficiency and reduces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

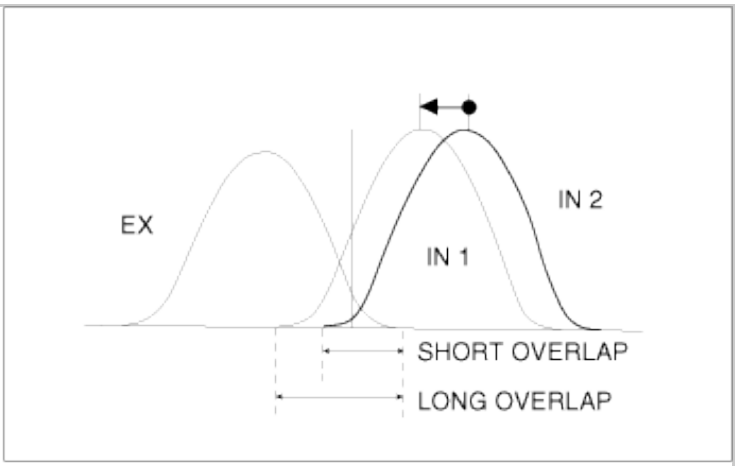


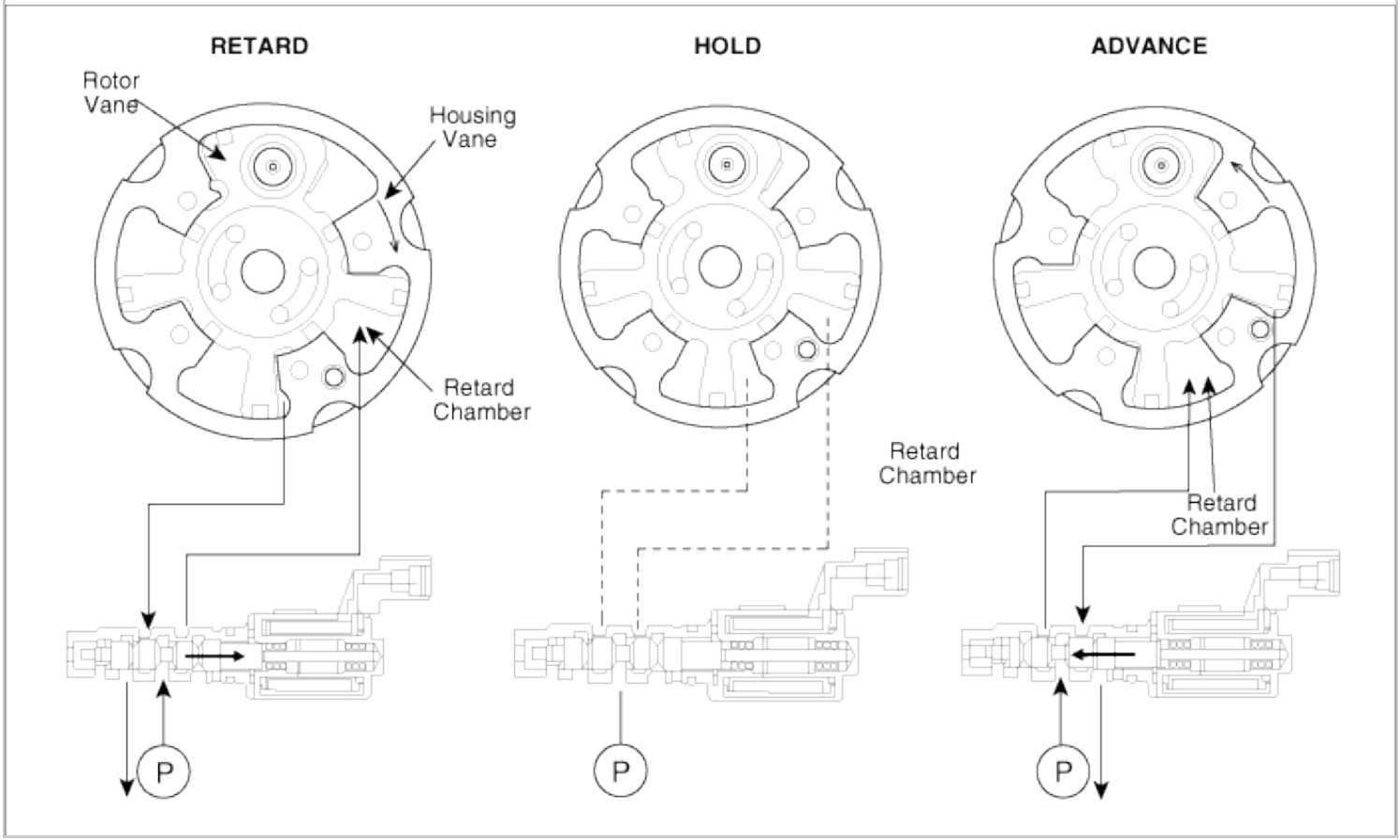
Driving Condition	Intake Valve Timing	Effect
Light load (1)	Retard	Stable combustion
Part load (2)	Advance	Enhanced fuel economy and exhaust emissions
High load& Low rpm (3)	Advance	Enhanced torque
High load& High rpm (4)	Retard	Enhanced Power

OPERATION

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.

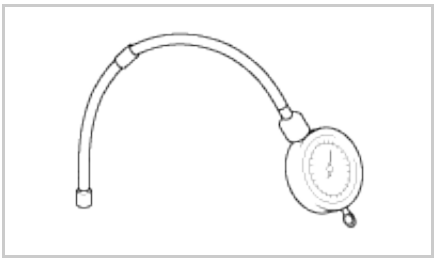
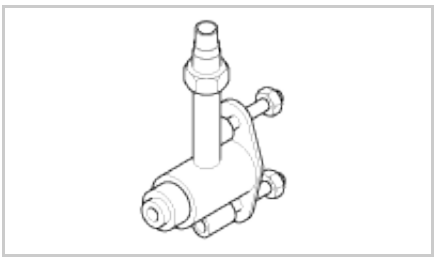
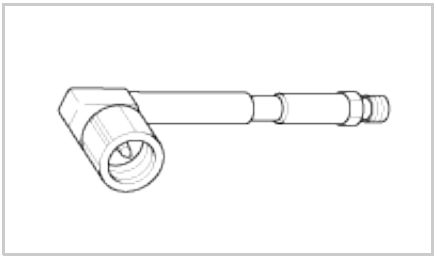
The OCV (Oil-flow Control Valve) spool location at this time is as follows.
Oil pump → Advance oil chamber (Little by little open the inflow side to the advance oil chamber) → Almost close the drain side
Be sure there might be a difference in the position according to the engine running state (rpm, oil temperature, and oil pressure).

CHAPTER 5:

Fuel System

General Information

SPECIAL SERVICE TOOLS

Tool (Number and name)	Illustration	Application
09353-24100 Fuel Pressure Gauge		Measuring the fuel line pressure
09353-38000 Fuel Pressure Gauge Adapter		Connection between the delivery pipe and fuel feed line
09353-24000 Fuel Pressure Gauge Connector		Connection between Fuel Pressure Gauge (09353-24100) and Fuel Pressure Gauge Adapter (09353-38000)

BASIC TROUBLESHOOTING

BASIC TROUBLESHOOTING GUIDE

1	**Bring Vehicle to Workshop**
2	**Analyze Customer's Problem**

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

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

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

NOTE

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

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

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

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

WARNING

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

6	**Inspect Vehicle Visually**

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

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

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

8	**Confirm Symptoms of Problem**

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

9	**Recreate (Simulate) Symptom**

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

10	**Check the DTC**

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

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

CUSTOMER PROBLEM ANALYSIS SHEET

1. VEHICLEINFORMAITON

VIN No.		Transmission	☐ M/T ☐ A/T ☐CVT ☐ etc.
Production date		Driving type	☐ 2WD (FF) ☐ 2WD (FR) ☐ 4WD
Odometer Reading	_____km/mile		

2. SYMPTOMS

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

3. ENVIRONMENT

Problem frequency	☐ Constant ☐ Sometimes (_____) ☐ Once only ☐ Other_____
Weather	☐ Fine ☐ Cloudy ☐ Rainy ☐ Snowy ☐ Other_____
Outdoor temperature	Approx. _____ °C/°F
Place	☐ Highway ☐ Suburbs ☐ Inner City ☐ Uphill ☐ Downhill ☐ Rough road ☐ Other_____
Engine temperature	☐ Cold ☐ Warming up ☐ After warming up ☐ Any temperature
Engine operation	☐ Starting ☐ Just after starting (_____min) ☐ Idling ☐ Racing ☐ Driving ☐ Constant speed ☐ Acceleration ☐ Deceleration ☐ A/C switch ON/OFF ☐ Other_____

4. MIL/DTC

MIL (Malfunction Indicator Lamp)		☐ Remains ON ☐ Sometimes lights up ☐ Does not light
DTC	Normal check (Pre-check)	☐ Normal ☐ DTC (_____) ☐ Freeze Frame Data
	Check mode	☐ Normal ☐ DTC (_____) ☐ Freeze Frame Data

5. ECM/PCM INFORMATION

ECM/PCM Part No.	
ROM ID	

BASIC INSPECTION PROCEDURE

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.

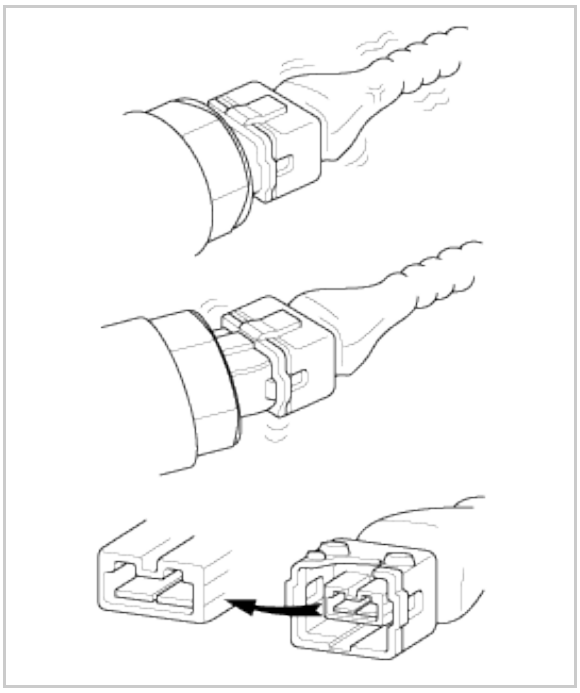
NOTICE

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

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

a. Sensors and Actuators
: Slightly vibrate sensors, actuators or relays with finger.

> WARNING
>
> Strong vibration may break sensors, actuators or relays

b. Connectors and Harness
: Lightly shake the connector and wiring harness vertically and then horizontally.

● SIMULATING HEAT

a. Heat components suspected of causing the malfunction with a hair dryer or other heat source.

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

● SIMULATING WATER SPRINKLING

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

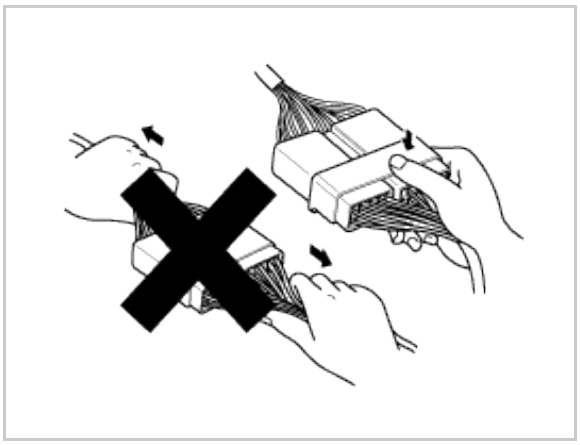
> WARNING
>
> DO NOT sprinkle water directly into the engine compartment or electronic components.

● SIMULATING ELECTRICAL LOAD

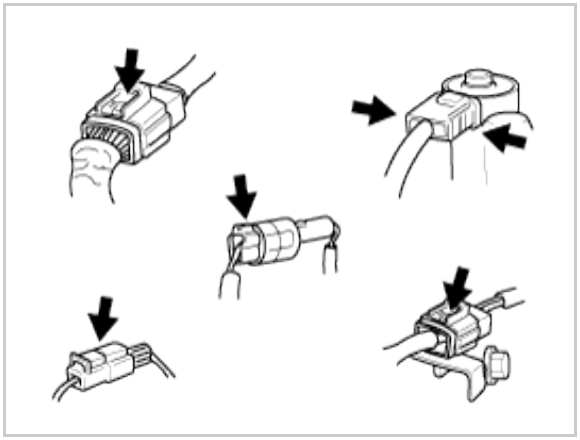
a. Turn on all electrical systems to simulate excessive electrical loads (Radios, fans, lights, rear window defogger, etc.).

CONNECTOR INSPECTION PROCEDURE

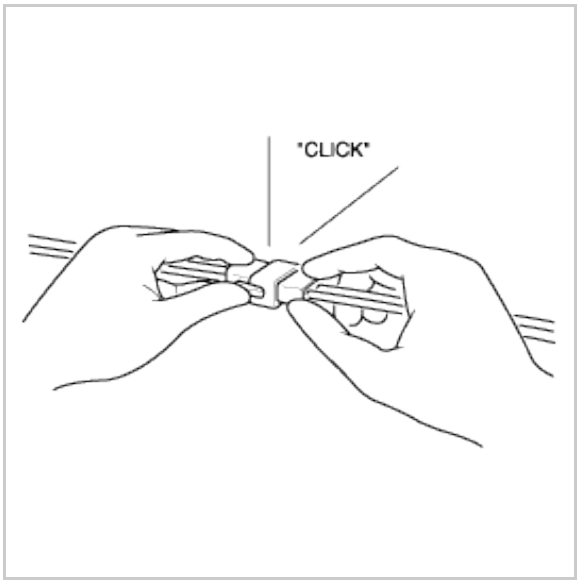
1. Handling of Connector
   a. Never pull on the wiring harness when disconnecting connectors.



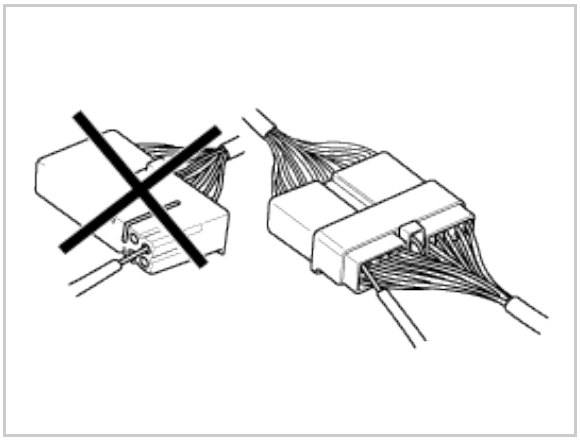
   b. When removing the connector with a lock, press or pull locking lever.



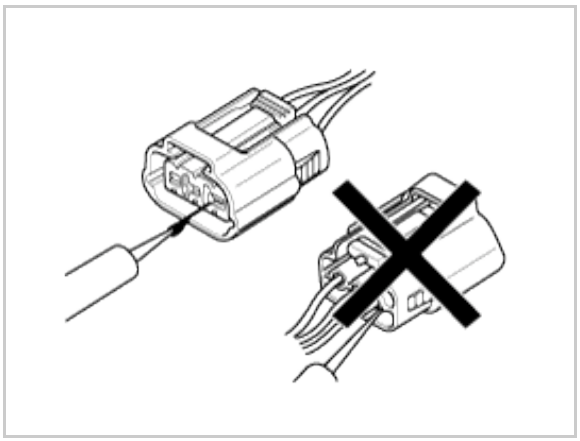
   c. Listen for a click when locking connectors. This sound indicates that they are securely locked.



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



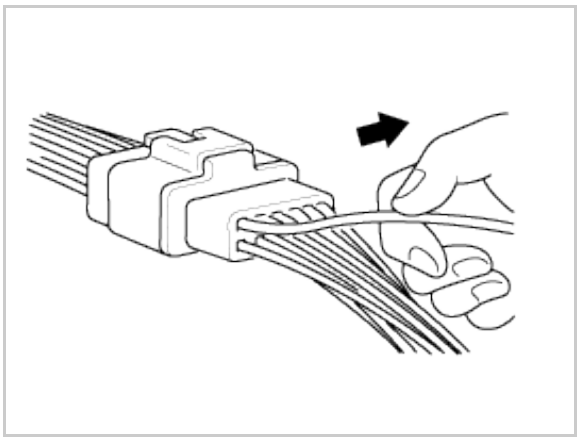
e. Check waterproof connector terminals from the connector side. Waterproof connectors cannot be accessed from harness side.



NOTICE

a. Use a fine wire to prevent damage to the terminal.
b. 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.

NOTICE

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.

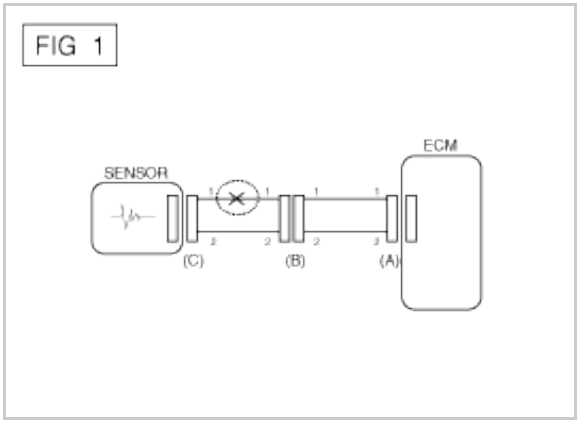
ELECTRICAL CIRCUIT INSPECTION PROCEDURE

● 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

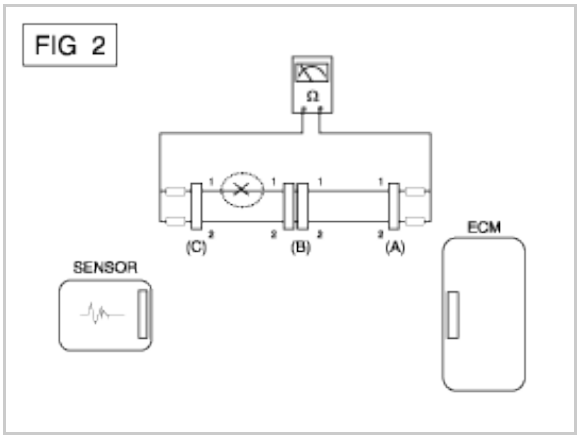
NOTICE

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

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

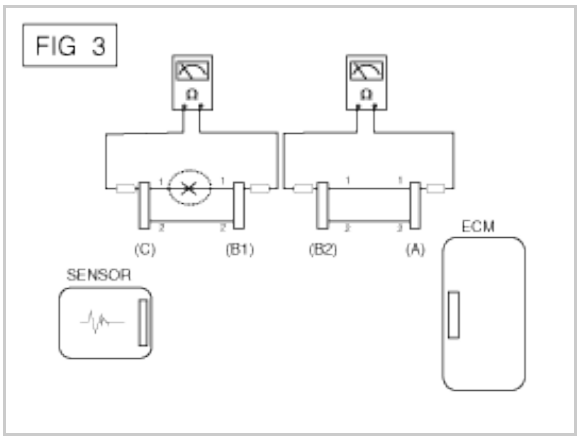
a. Disconnect connectors (A), (C) and measure resistance between connector (A) and (C) as shown in [FIG. 2]. In [FIG.2.] the measured resistance of line 1 and 2 is higher than 1MΩ and below 1 Ω respectively. Specifically the open circuit is line 1 (Line 2 is normal). To find exact break point, check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

FIG 2



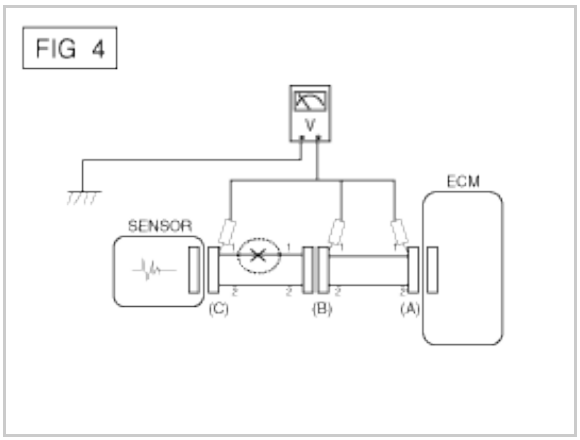
b. Disconnect connector (B), and measure for resistance between connector (C) and (B1) and between (B2) and (A) as shown in [FIG. 3].
In this case the measured resistance between connector (C) and (B1) is higher than 1MΩ and the open circuit is between terminal 1 of connector (C) and terminal 1 of connector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

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

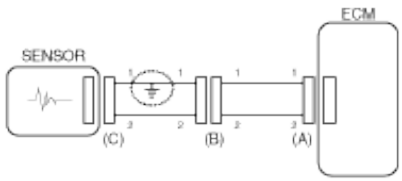


● CHECK SHORT CIRCUIT

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)

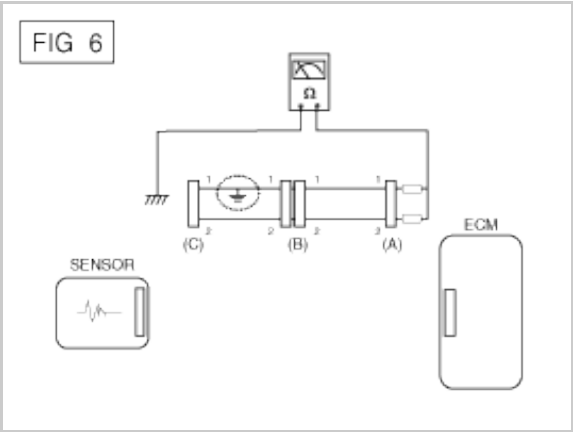
NOTICE

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

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

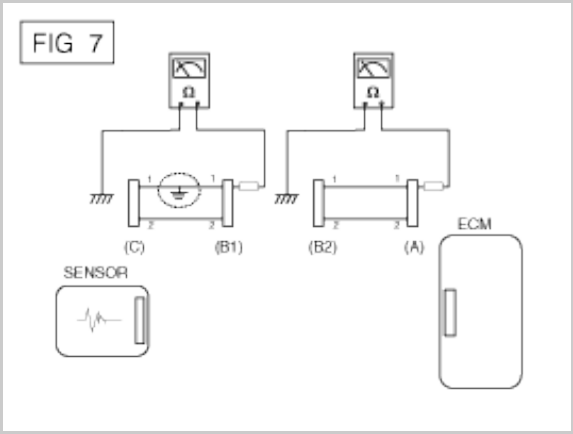
a. Disconnect connectors (A), (C) and measure for resistance between connector (A) and Chassis Ground as shown in [FIG. 6].
The measured resistance of line 1 and 2 in this example is below 1 Ω and higher than 1MΩ respectively. Specifically the short to ground circuit is line 1 (Line 2 is normal). To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

FIG 6



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

FIG 7



SYMPTOM TROUBLESHOOTING GUIDE CHART

MAIN SYMPTOM	DIAGNOSTIC PROCEDURE	ALSO CHECK FOR
Unable to start (Engine does not turn over)	a. Test the battery b. Test the starter c. Inhibitor switch (A/T) or clutch start switch (M/T)	
Unable to start (Incomplete combustion)	a. Test the battery b. Check the fuel pressure c. Check the ignition circuit d. Troubleshooting the immobilizer system (In case of immobilizer lamp flashing)	a. DTC b. Low compression c. Intake air leaks d. Slipped or broken timing belt e. Contaminated fuel
Difficult to start	a. Test the battery b. Check the fuel pressure c. Check the ECTS and circuit (Check DTC) d. Check the ignition circuit	a. DTC b. Low compression c. Intake air leaks d. Contaminated fuel e. Weak ignition spark
Poor idling (Rough, unstable or incorrect Idle)	a. Check the fuel pressure b. Check the Injector c. Check the long term fuel trim and short term fuel trim (Refer to CUSTOMER DATASTREAM) d. Check the idle speed control circuit (Check DTC) e. Inspect and test the Throttle Body f. Check the ECTS and circuit (Check DTC)	a. DTC b. Low compression c. Intake air leaks d. Contaminated fuel e. Weak ignition spark
Engine stall	a. Test the Battery b. Check the fuel pressure c. Check the idle speed control circuit (Check DTC) d. Check the ignition circuit e. Check the CKPS Circuit (Check DTC)	a. DTC b. Intake air leaks c. Contaminated fuel d. Weak ignition spark
Poor driving (Surge)	a. Check the fuel pressure b. Inspect and test Throttle Body c. Check the ignition circuit d. Check the ECTS and Circuit (Check DTC) e. Test the exhaust system for a possible restriction f. Check the long term fuel trim and short term fuel trim (Refer to CUSTOMER DATASTREAM)	a. DTC b. Low compression c. Intake air leaks d. Contaminated fuel e. Weak ignition spark
Knocking	a. Check the fuel pressure b. Inspect the engine coolant c. Inspect the radiator and the electric cooling fan d. Check the spark plugs	a. DTC b. Contaminated fuel
Poor fuel economy	a. Check customer's driving habits a. Is A/C on full time or the defroster mode on? b. Are tires at correct pressure? c. Is excessively heavy load being carried? d. Is acceleration too much, too often?	a. DTC b. Low compression c. Intake air leaks

	b. Check the fuel pressure c. Check the injector d. Test the exhaust system for a possible restriction e. Check the ECTS and circuit	d. Contaminated fuel e. Weak ignition spark
Hard to refuel (Overflow during refueling)	a. Test the canister close valve b. Inspect the fuel filler hose/pipe a. Pinched, kinked or blocked? b. Filler hose is torn c. Inspect the fuel tank vapor vent hose between the EVAP. canister and air filter d. Check the EVAP. canister	a. Malfunctioning gas station filling nozzle (If this problem occurs at a specific gas station during refueling)

SPECIFICATIONS

FUEL DELIVERY SYSTEM

Items	Specification	
Fuel Tank	Capacity	80 lit. (21.1 U.S.gal., 17.6 Imp.gal.)
Fuel Filter (built in Fuel Pump assembly)	Type	High pressure type
Fuel Pressure Regulator (built in Fuel Pump assembly)	Regulated Fuel Pressure	375 ~ 385 kPa(3.82 ~ 3.92 kgf/cm², 54.3 ~ 55.8 psi)
Fuel Pump	Type	Electrical, in-tank type
	Driven by	Electric motor

SENSORS

MASS AIR FLOW SENSOR (MAFS)

▷ Type: Hot-film type

▷ Specification

Air Flow (kg/h)	Frequency (Hz)
12.6 kg/h	2,617Hz
18.0 kg/h	2,958Hz
23.4 kg/h	3,241Hz
32.4 kg/h	3,653Hz
43.2 kg/h	4,024Hz
57.6 kg/h	4,399Hz
72.0 kg/h	4,704Hz
108.0 kg/h	5,329Hz
144.0 kg/h	5,897Hz
198.0 kg/h	6,553Hz
270.0 kg/h	7,240Hz
360.0 kg/h	7,957Hz
486.0 kg/h	8,738Hz
666.0 kg/h	9,644Hz
900.0 kg/h	10,590Hz

INTAKE AIR TEMPERATURE SENSOR (IATS)

▷ Type: Thermistor type

▷ Specification

Temperature		Resistance (kΩ)
°C	°F	
-40	-40	100.87
-20	-4	28.58
0	32	9.40
10	50	5.66

20	68	3.51
40	104	1.47
60	140	0.67
80	176	0.33

MANIFOLD ABSOLUTE PRESSURE SENSOR (MAPS)

▷ Type: Piezo-resistive pressure type

▷ Specification

Pressure (kPa)	Output Voltage (V)
20.0kPa	0.79
46.66kPa	1.84
101.32kPa	4.0

ENGINE COOLANT TEMPERATURE SENSOR (ECTS)

▷ Type: Thermistor type

▷ Specification

Temperature		Resistance (kΩ)
°C	°F	
-40	-40	48.14
-20	-4	14.13 ~ 16.83
0	32	5.79
20	68	2.31 ~ 2.59
40	104	1.15
60	140	0.59
80	176	0.32

THROTTLE POSITION SENSOR (TPS)

▷ Type: Variable resistor type

▷ Specification (When reference voltage = 5.0V)

Throttle Angle (°)	Output Voltage(V)	
	TPS1	TPS2
0	0	5.0
10	0.5	4.5
20	0.9	4.1
30	1.4	3.6
40	1.8	3.2
50	2.3	2.7
60	2.7	2.3
70	3.2	1.8
80	3.6	1.4
90	4.1	0.9
100	4.5	0.5
110	5.0	0.0

Item	Sensor Resistance (kΩ)
TPS1	4.0 ~ 6.0 [20°C (68°F)]
TPS2	2.7 ~ 4.1 [20°C (68°F)]

ACCELERATOR POSITION SENSOR (APS)
▷ Type: Variable resistor type
▷ Specification (When reference voltage = 5.0V)

Accelerator Position	Output Voltage (V)	
	APS1	APS2
C.T	0.70 ~ 0.80	0.29 ~ 0.46
W.O.T	3.85 ~ 4.35	1.93 ~ 2.18

Item	Sensor Resistance (kΩ)
APS1	0.7 ~ 1.3 [20°C (68°F)]
APS2	1.4 ~ 2.6 [20°C (68°F)]

HEATED OXYGEN SENSOR (HO2S)
▷ Type: Zirconia (ZrO2) type
▷ Specification

A/F Ratio	Output Voltage (V)
RICH	0.80 ~ 0.92
LEAN	0.1

Item	Resistance (Ω)
Sensor Heater	3.0 ~ 4.0 [21°C (69.8°F)]

CAMSHAFT POSITION SENSOR (CMPS)
▷ Type: Hall effect type
▷ Specification

Item	Specification
Output Voltage (V)	High: 4.75 ~ 5.25
	Low: 0 ~ 0.7
Air Gap (mm)	0.5 ~ 1.5

CRANKSHAFT POSITION SENSOR (CKPS)
▷ Type: Magnetic field sensitive type
▷ Specification

Item	Specification
Coil Resistance (Ω)	630 ~ 770 [20°C (68°F)]
Air Gap (mm)	0.5 ~ 1.5

KNOCK SENSOR (KS)
▷ Type: Piezo-electricity type

▷ Specification

Item	Specification
Capacitance (pF)	950 ~ 1,350pF

CVVT OIL TEMPERATURE SENSOR (OTS)
▷ Type: Thermistor type
▷ Specification

Temperature		Resistance (kΩ)
°C	°F	
-40	-40	52.0
-20	-4	16.5
0	32	6.0
20	68	2.45
40	104	1.10
60	140	0.544
80	176	0.290
100	212	0.164
120	248	0.099

ACTUATORS

INJECTOR
▷ Number: 6
▷ Specification

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

PURGE CONTROL SOLENOID VALVE (PCSV)
▷ Specification

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

VARIABLE INTAKE SOLENOID (VIS) VALVE #1 (SURGE TANK SIDE)
▷ Specification

Item	Specification
Coil Resistance (Ω)	29.0 ~ 35.0 [22°C (71.6°F)]

VARIABLE INTAKE SOLENOID (VIS) VALVE #2 (INTAKE MANIFOLD SIDE)
▷ Specification

Item	Specification
Coil Resistance (Ω)	29.0 ~ 35.0 [20°C (68°F)]

CVVT OIL CONTROL VALVE (OCV) [BANK 1]
▷ Specification

Item	Specification

Coil Resistance (Ω)	6.7 ~ 7.7 [20°C (68°F)]

CVVT OIL CONTROL VALVE (OCV) [BANK 2]

▷ Specification

Item	Specification
Coil Resistance (Ω)	6.7 ~ 7.7 [20°C (68°F)]

ETC MOTOR

▷ Specification

Item	Specification
Coil Resistance (Ω)	1.275 ~ 1.725 [20°C (68°F)]

IGNITION COIL

▷ Type: Stick type

▷ Specification

Item	Specification
1st Coil Resistance (Ω)	0.62Ω±10% [20°C (68°F)]
2nd Coil Resistance (kΩ)	7.0kΩ±15% [20°C (68°F)]

SERVICE STANDARD

Ignition Timing	BTDC 7°± 10°		
Idle Speed	A/CON OFF	Neutral,N,P-range	650 ± 100 rpm
		D-range	650 ± 100 rpm
	A/CON ON	Neutral,N,P-range	650 ± 100 rpm
		D-range	650 ± 100 rpm

TIGHTENING TORQUES

ENGINE CONTROL SYSTEM

Item	kgf·m	N·m	lbf·ft
PCM installation bolts (on bracket)	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
PCM bracket installation bolts/nuts (on air cleaner assembly)	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
Camshaft position sensor [Bank 1] installation bolt	0.7 ~ 1.0	6.9 ~ 9.8	5.1 ~ 7.2
Camshaft position sensor [Bank 2] installation bolt	0.7 ~ 1.0	6.9 ~ 9.8	5.1 ~ 7.2
Crankshaft position sensor installation bolt	0.7 ~ 1.0	6.9 ~ 9.8	5.1 ~ 7.2
CVVT Oil control valve [Bank 1] installation bolt	0.8 ~ 1.0	7.8 ~ 9.8	5.8 ~ 7.2
CVVT Oil control valve [Bank 2] installation bolt	0.8 ~ 1.0	7.8 ~ 9.8	5.8 ~ 7.2
CVVT Oil temperature sensor installation	2.0 ~ 4.0	19.6 ~ 39.2	14.5 ~ 28.9
Engine coolant temperature sensor installation	2.0 ~ 4.0	19.6 ~ 39.2	14.5 ~ 28.9
ETC module installation bolt	0.9 ~ 1.1	8.8 ~ 10.8	6.5 ~ 8.0
Heated oxygen sensor (Bank 1 / Sensor 1) installation	3.5 ~ 4.5	34.3 ~ 44.1	25.3 ~ 32.6
Heated oxygen sensor (Bank 1 / Sensor 2) installation	3.5 ~ 4.5	34.3 ~ 44.1	25.3 ~ 32.6
Heated oxygen sensor (Bank 2 / Sensor 1) installation	3.5 ~ 4.5	34.3 ~ 44.1	25.3 ~ 32.6

Heated oxygen sensor (Bank 2 / Sensor 2) installation	3.5 ~ 4.5	34.3 ~ 44.1	25.3 ~ 32.6
Ignition coil installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
Knock sensor [Bank 1] installation	1.9 ~ 2.4	18.6 ~ 23.5	13.7 ~ 17.4
Knock sensor [Bank 2] installation	1.9 ~ 2.4	18.6 ~ 23.5	13.7 ~ 17.4
Manifold absolute pressure sensor installation bolt	0.8 ~ 1.2	7.8 ~ 11.8	5.8 ~ 8.7

FUEL DELIVERY SYSTEM

Item	kgf·m	N·m	lbf·ft
Fuel tank band mounting nuts	4.0 ~ 5.5	39.2 ~ 53.9	28.9 ~ 39.8
Fuel pump assembly mounting bolts	0.2 ~ 0.3	2.0 ~ 2.9	1.4 ~ 2.2
Delivery pipe installation bolts	0.9 ~ 1.4	8.8 ~ 13.7	6.5 ~ 10.1
Accelerator pedal module installation bolts	1.3 ~ 1.6	12.8 ~ 15.7	9.4 ~ 11.6

Engine Control System

DESCRIPTION

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).

NOTICE

a. Before removing or installing any part, read the diagnostic trouble codes and then disconnect the battery negative (-) terminal.
b. 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.
c. 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.
d. When checking the generator for the charging state, do not disconnect the battery '+' terminal to prevent the ECM from damage due to the voltage.
e. When charging the battery with the external charger, disconnect the vehicle side battery terminals to prevent damage to the ECM.

Malfunction Indicator Lamp (MIL)

Faults with the following items will illuminate the MIL.

a. Catalyst
b. Fuel system
c. Mass Air Flow Sensor (MAFS)
d. Intake Air Temperature Sensor (IATS)
e. Engine Coolant Temperature Sensor (ECTS)
f. Throttle Position Sensor (TPS)
g. Upstream Oxygen Sensor
h. Upstream Oxygen Sensor Heater
i. Downstream Oxygen Sensor
j. Downstream Oxygen Sensor Heater
k. Injector
l. Misfire
m. Crankshaft Position Sensor (CKPS)
n. Camshaft Position Sensor (CMPS)
o. Evaporative Emission Control System
p. Vehicle Speed Sensor (VSS)
q. Idle Speed Control Actuator (ISCA)
r. Power Supply
s. ECM/ PCM
t. MT/AT Encoding
u. Acceleration Sensor
v. MIL-on Request Signal
w. Power Stage

NOTICE

Refer to "INSPECTION CHART FOR DIAGNOSTIC TROUBLE CODES (DTC)" for more information.

Faults with the following items will illuminate the MIL

a. Heated oxygen sensor (HO2S)
b. Mass Air Flow sensor (MAFS)
c. Throttle position sensor (TPS)
d. Engine coolant temperature sensor (ECTS)
e. Idle speed control actuator (ISCA)
f. Injectors
g. ECM

NOTICE

Refer to "INSPECTION CHART FOR DIAGNOSTIC TROUBLE CODES (DTC)" for more information.

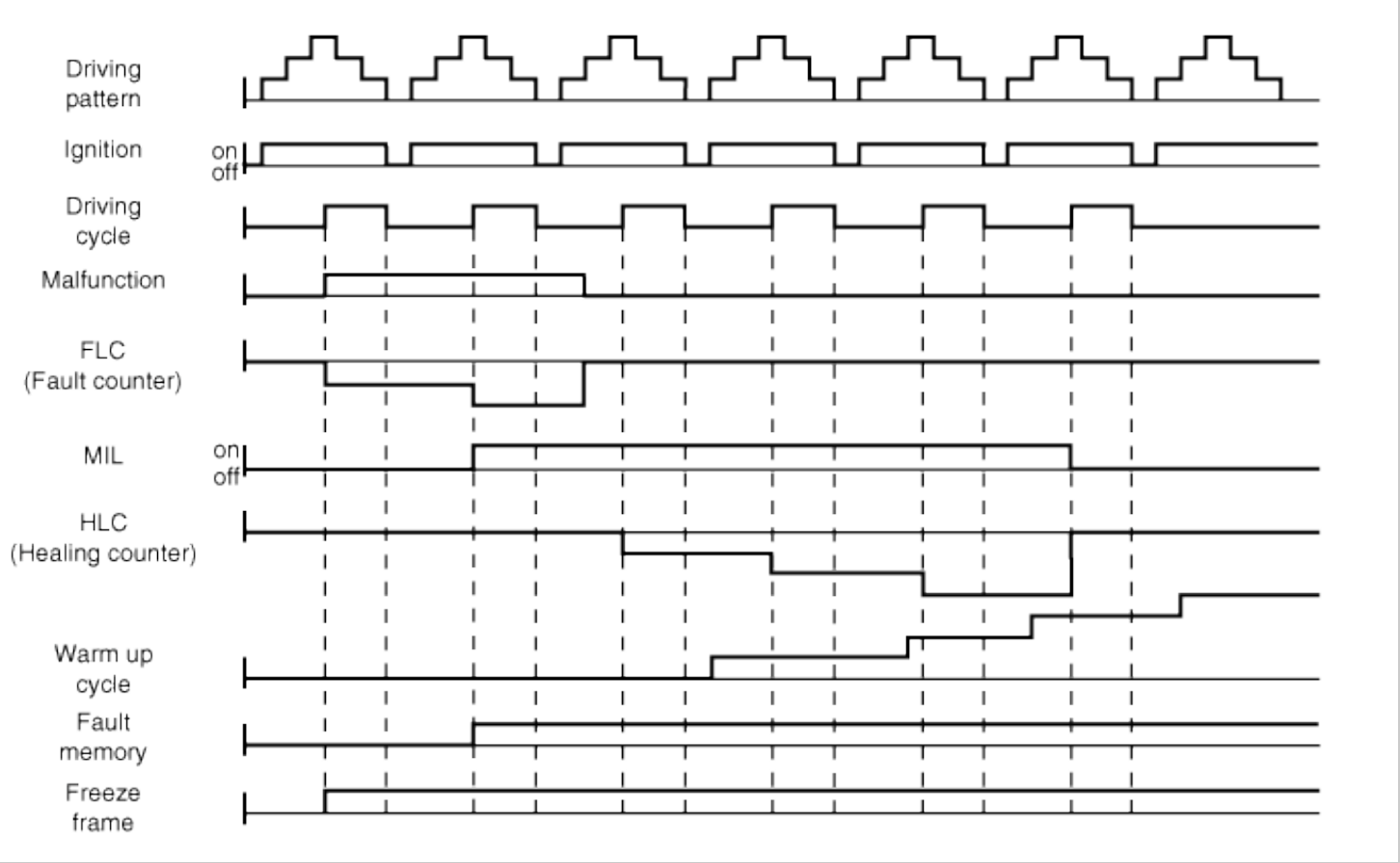
1. After turning ON the ignition key, ensure that the light illuminates for about 5 seconds and then goes out.
2. If the light does not illuminate, check for an open circuit in the harness, a blown fuse or a blown bulb.

Self-Diagnosis

NOTICE

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.

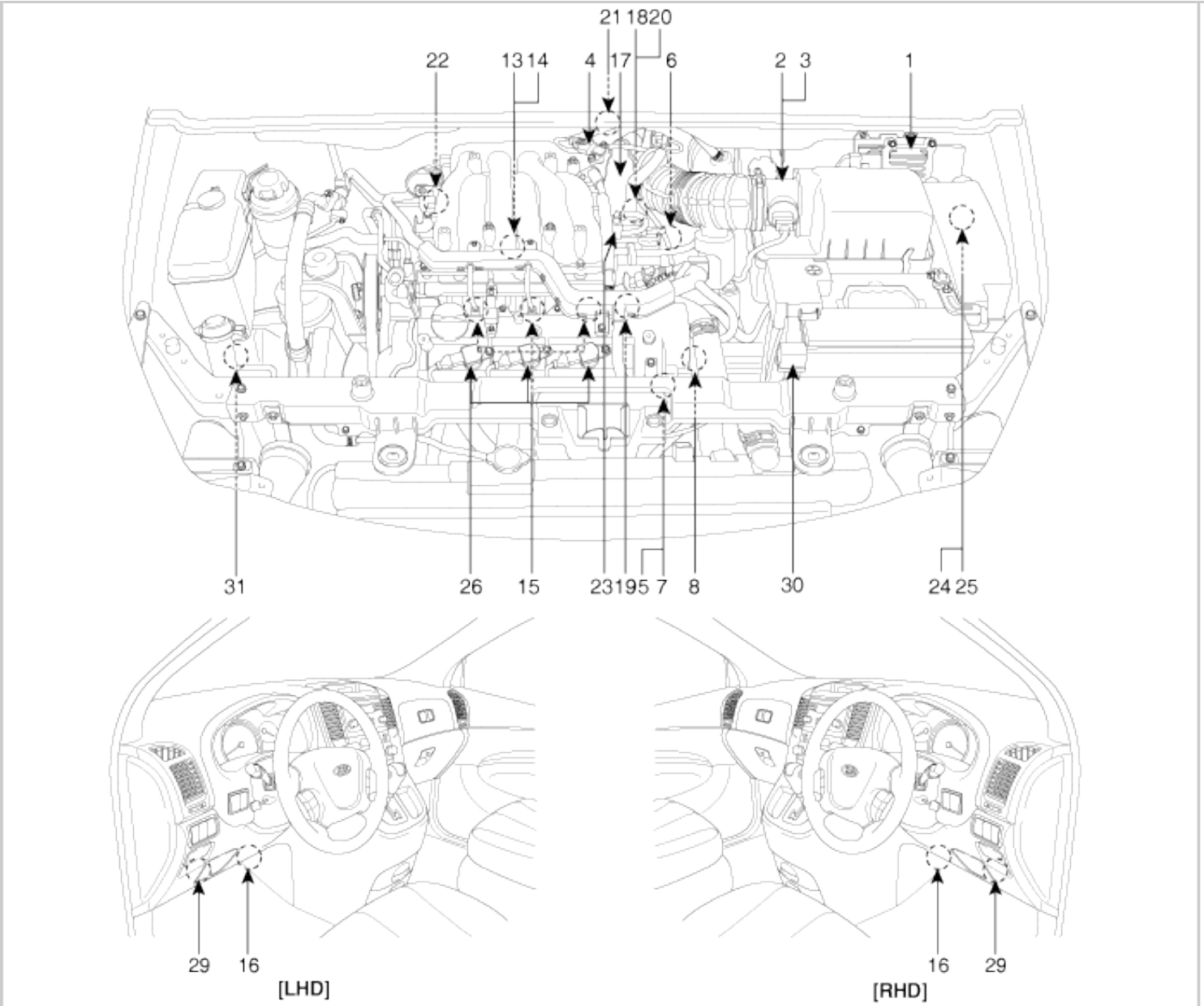
4. A Diagnostic Trouble Code(DTC) will automatically erase from ECM memory if the same malfunction is not detected for 40 driving cycles.

NOTICE

a. 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 degress Fahrenheit.

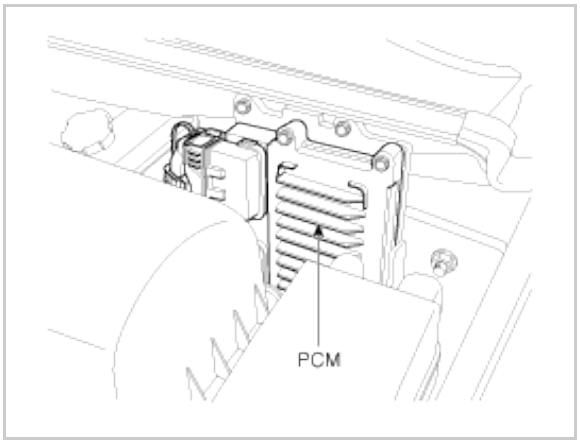
b. A "driving cycle" consists of engine startup, vehicle operation beyond the beginning of closed loop operation.

COMPONENT LOCATION

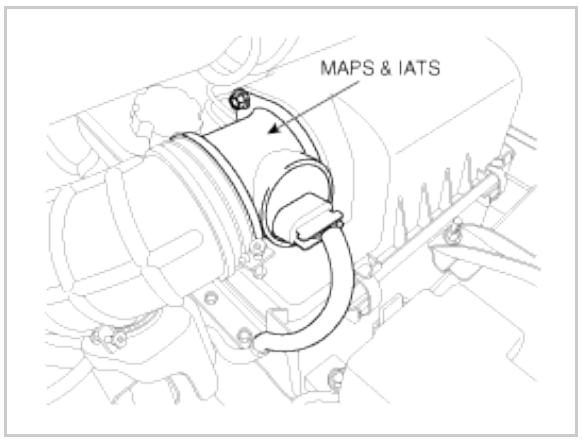


1. PCM (Powertrain Control Module)
2. Mass Air Flow Sensor (MAFS)
3. Intake Air Temperature Sensor (IATS)
4. Manifold Absolute Pressure Sensor (MAPS)
5. Engine Coolant Temperature Sensor (ECTS)
6. Camshaft Position Sensor (CMPS) [Bank 1]
7. Camshaft Position Sensor (CMPS) [Bank 2]
8. Crankshaft Position Sensor (CKPS)
9. Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 1]
10. Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2]
11. Heated Oxygen Sensor (HO2S) [Bank 2 / Sensor 1]
12. Heated Oxygen Sensor (HO2S) [Bank 2 / Sensor 2]
13. Knock Sensor (KS) [Bank 1]
14. Knock Sensor (KS) [Bank 2]
15. Injector
16. Accelerator Position Sensor (APS)
17. ETC Module [Throttle Position Sensor (TPS) + ETC Motor]
18. CVVT Oil Control Valve (OCV) [Bank 1]
19. CVVT Oil Control Valve (OCV) [Bank 2]
20. CVVT Oil Temperature Sensor (OTS)
21. Purge Control Solenoid Valve (PCSV)
22. Variable Intake Solenoid (VIS) Valve #1 (Surge Tank Side)
23. Variable Intake Solenoid (VIS) Valve #2 (Intake Manifold Side)
24. Fuel Pump Relay
25. Main Relay
26. Ignition Coil
27. Wheel Speed Sensor (WSS) [Without ABS/ESP (Euro-III/IV)]
28. Vehicle Speed Sensor (VSS) [Except for Euro-III/IV]
29. Data Link Connector (DLC)
30. Multi-Purpose Connector
31. A/C Pressure Transducer (APT)

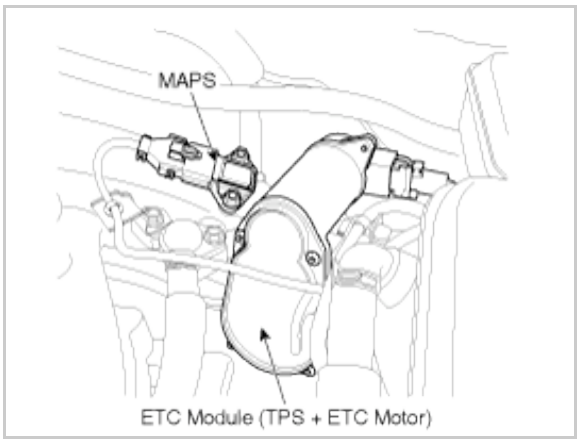
1. PCM (Powertrain Control Module)	2. Mass Air Flow Sensor (MAFS) 3. Intake Air Temperature Sensor (IATS)



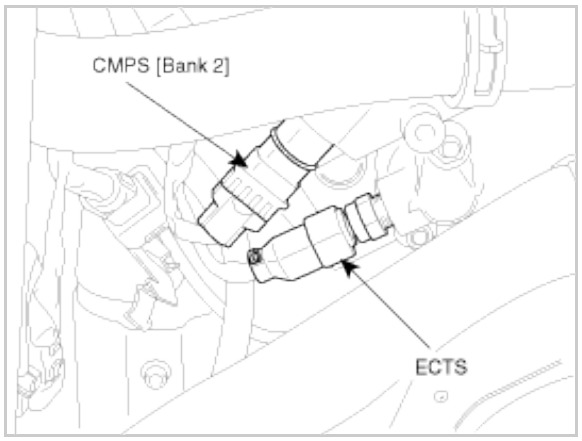
4. Manifold Absolute Pressure Sensor (MAPS)
17. ETC Module [Throttle Position Sensor (TPS) + ETC Motor]



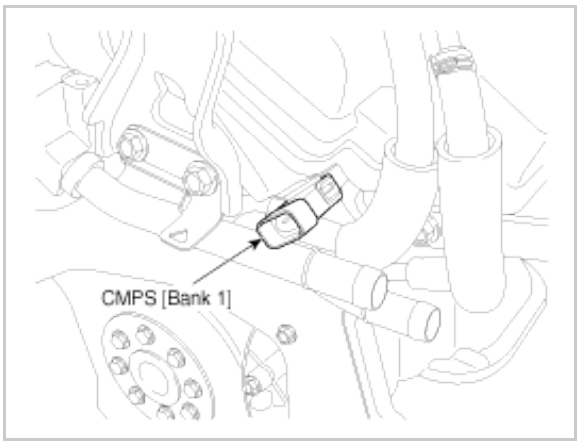
5. Engine Coolant Temperature Sensor (ECTS)
7. Camshaft Position Sensor (CMPS) [Bank2]



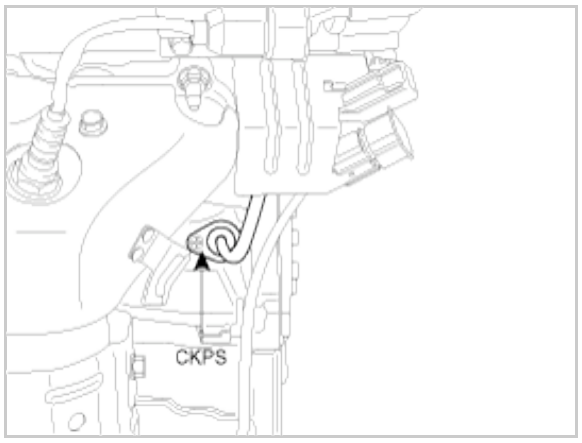
6. Camshaft Position Sensor (CMPS) [Bank 1]



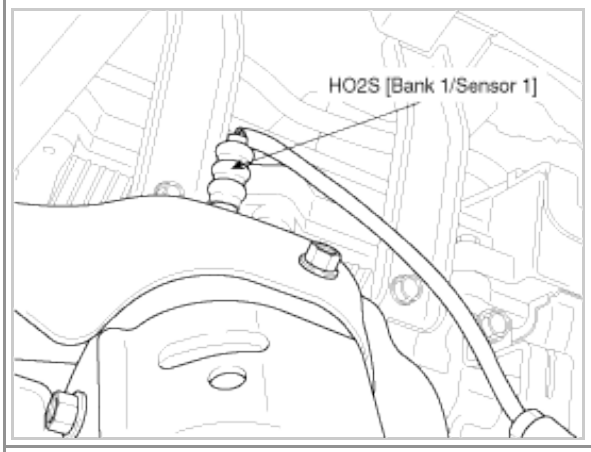
8. Crankshaft Position Sensor (CKPS)



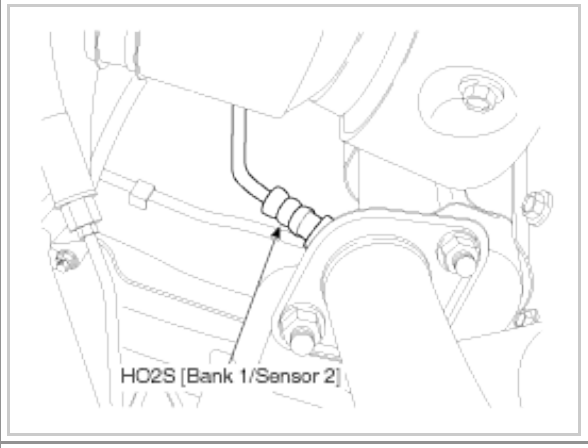
9. Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 1]



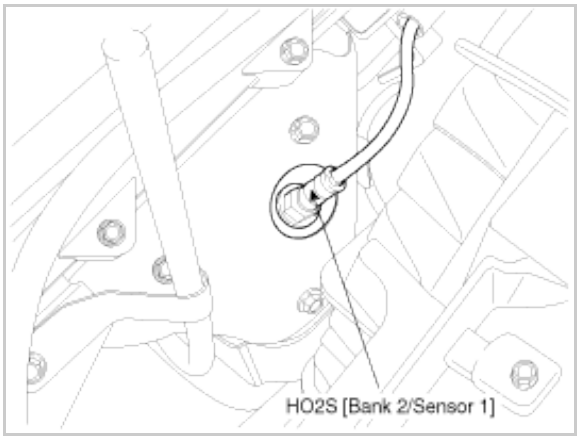
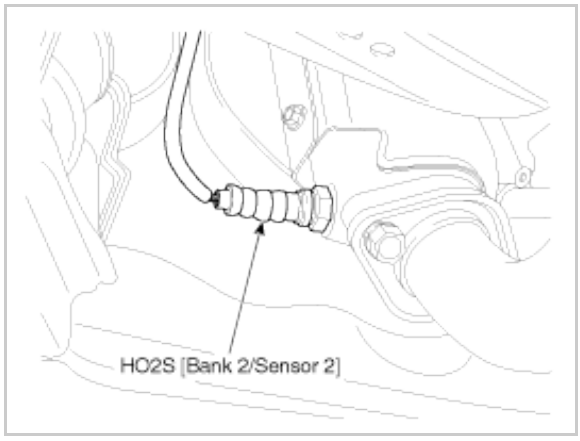
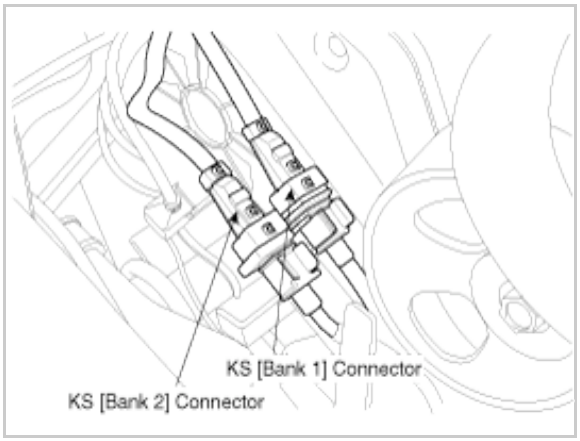
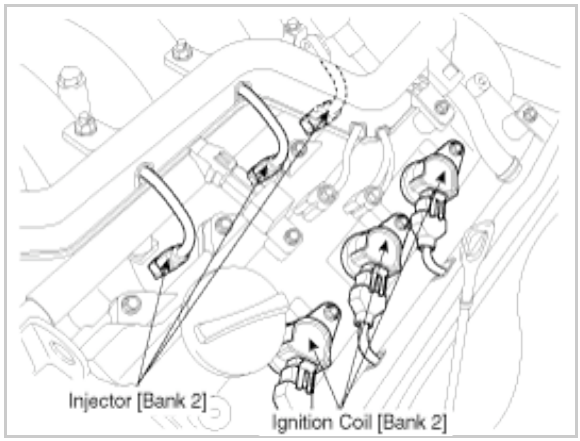
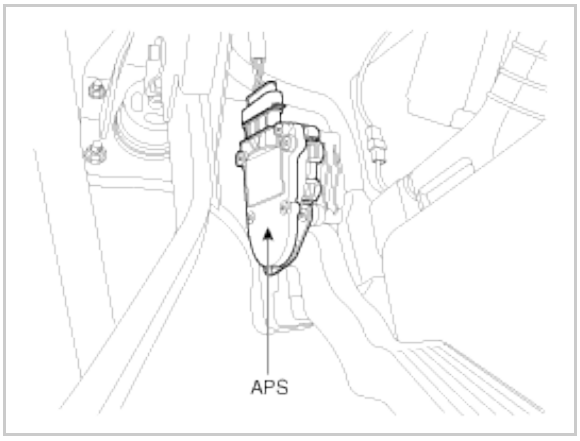
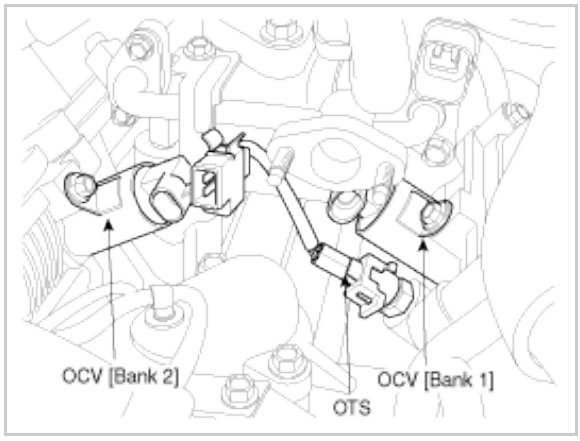
10. Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2]

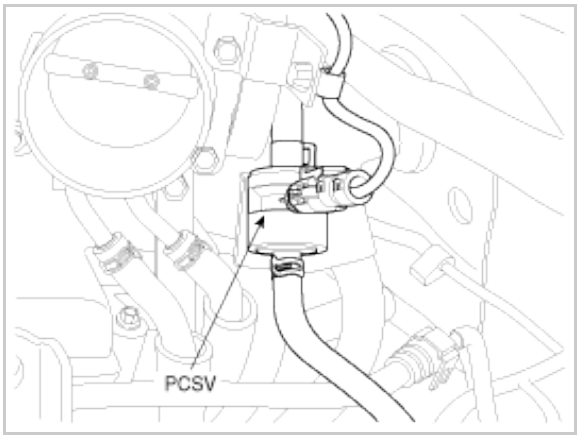


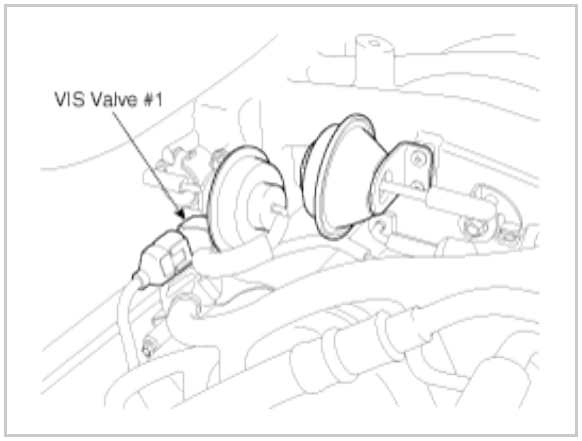
11. Heated Oxygen Sensor (HO2S) [Bank 2 / Sensor 1]



12. Heated Oxygen Sensor (HO2S) [Bank 2 / Sensor 2]

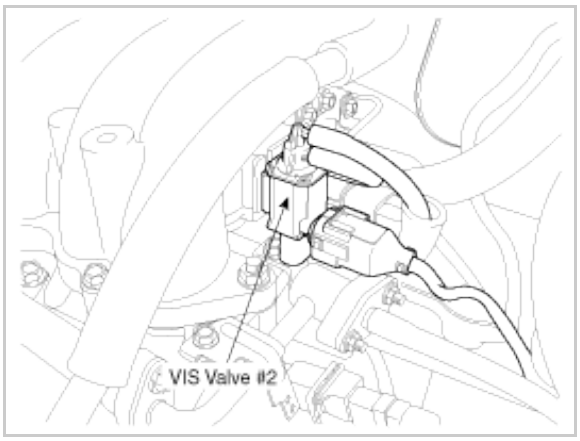
	
13. Knock Sensor (KS) [Bank 1] 14. Knock Sensor (KS) [Bank 2]	15. Injector 26. Ignition Coil
	
16. Accelerator Position Sensor (APS)	18. CVVT Oil Control Valve (OCV) [Bank 1] 19. CVVT Oil Control Valve (OCV) [Bank 2] 20. CVVT Oil Temperature Sensor (OTS)
	
21. Purge Control Solenoid Valve (PCSV)	22. Variable Intake Solenoid (VIS) #1 Valve (Surge Tank Side)

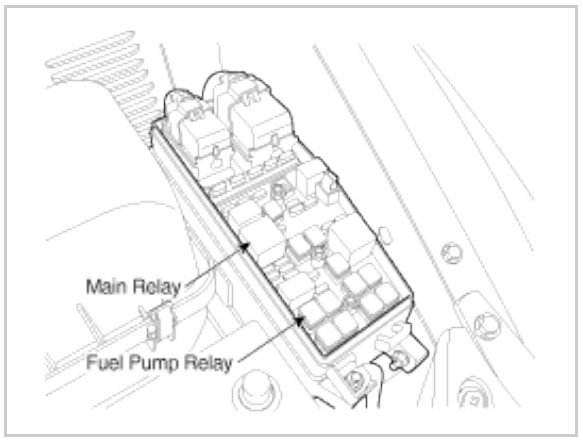




23. Variable Intake Solenoid (VIS) #2 Valve (Intake Manifold Side)

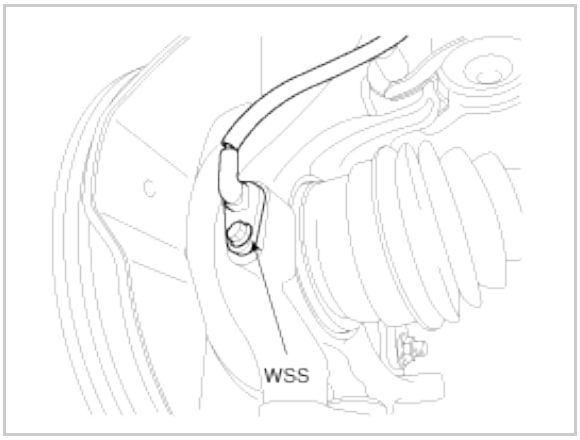
24. Fuel Pump Relay
25. Main Relay

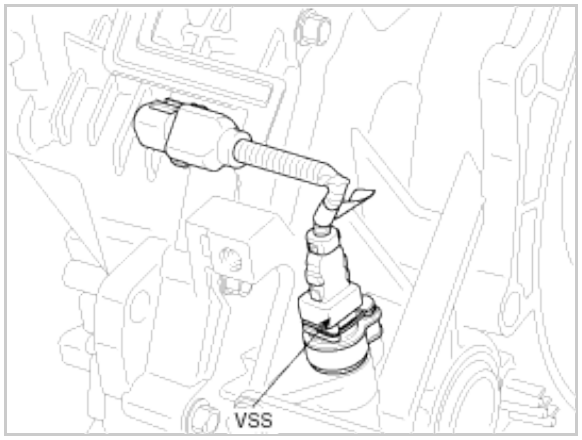




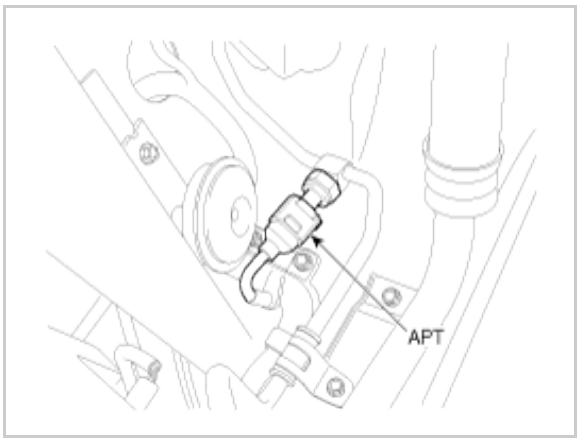
27. Wheel Speed Sensor (WSS)

28. Vehicle Speed Sensor (VSS)



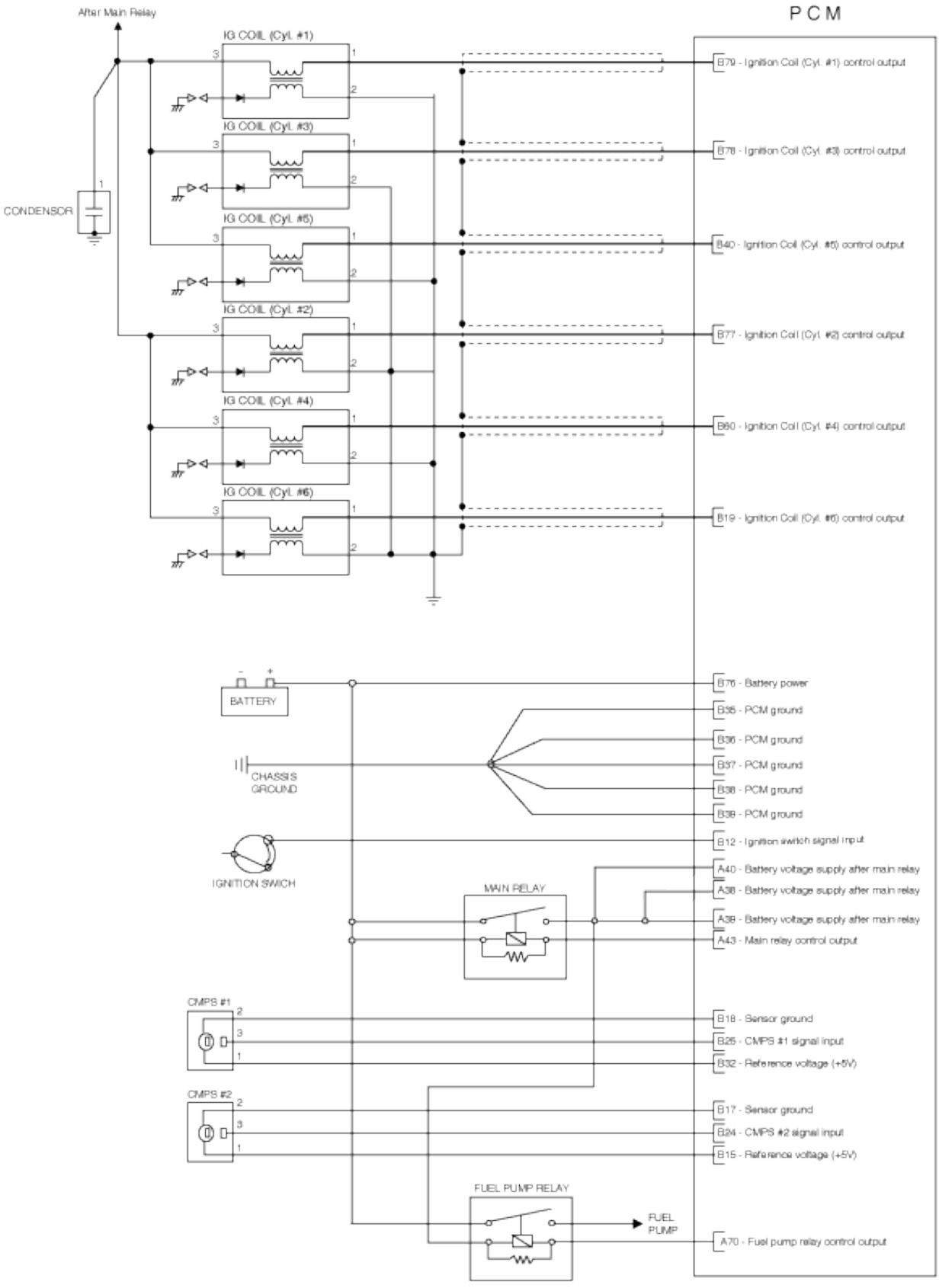


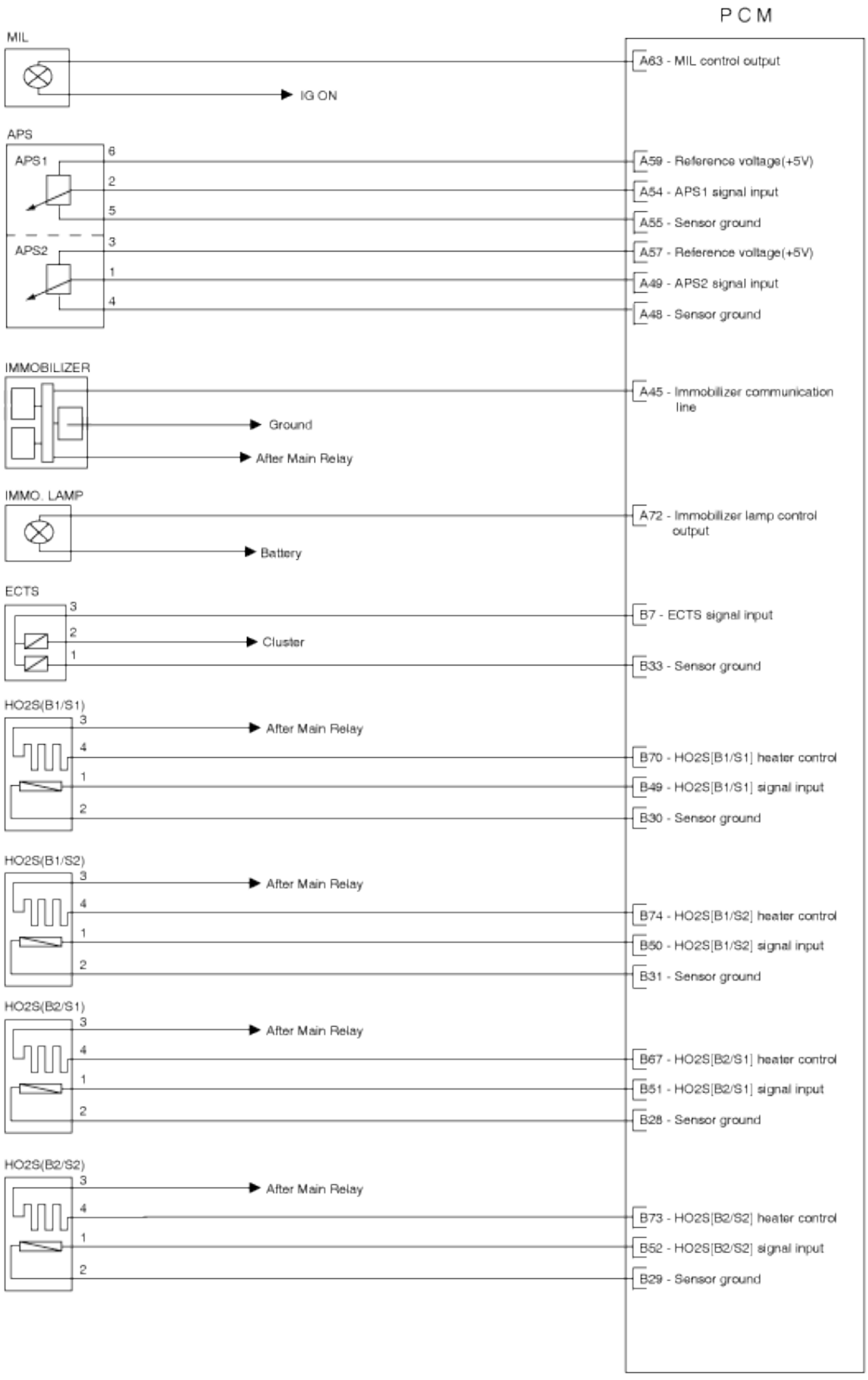
31. A/C Pressure Transducer (APT)

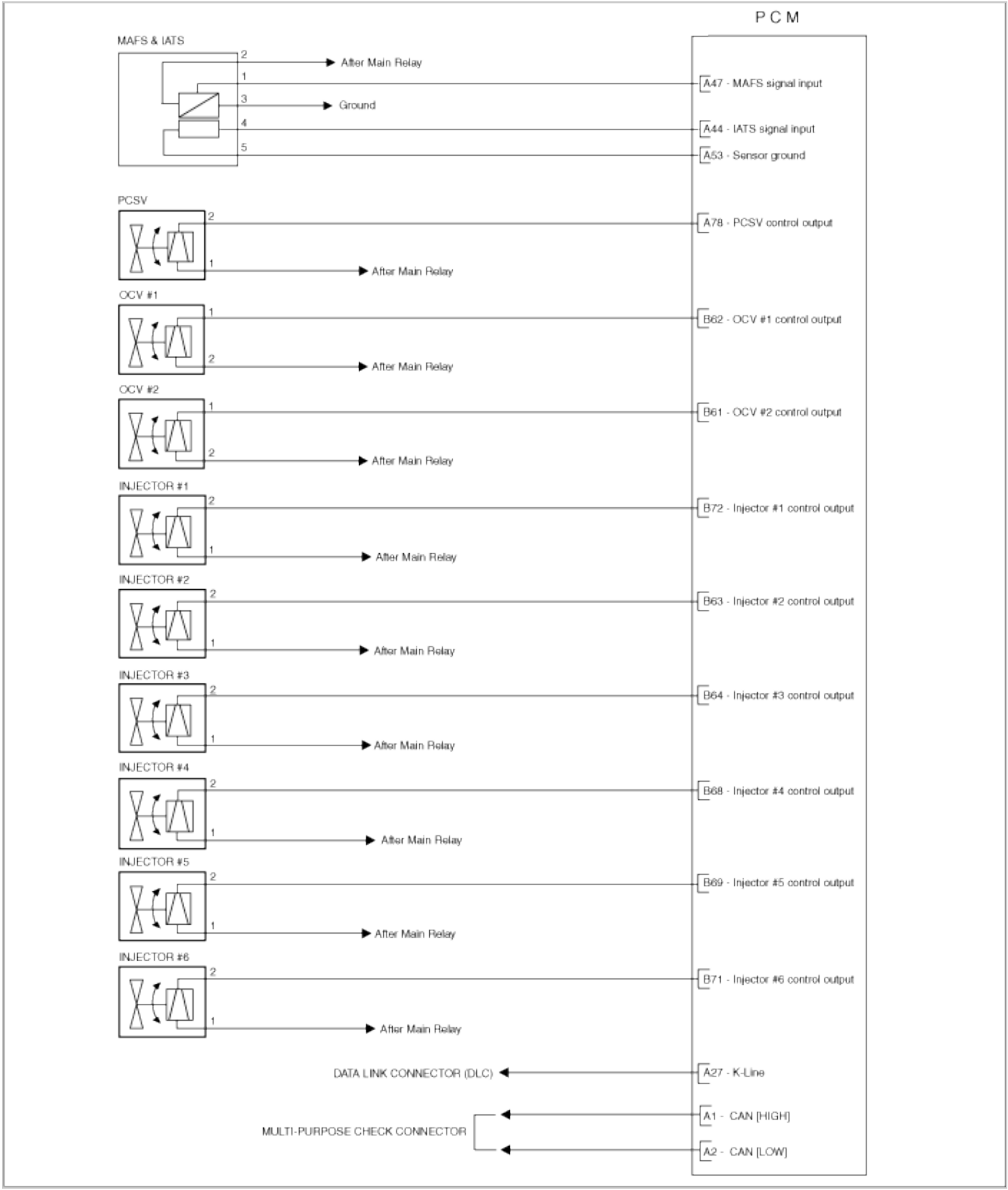


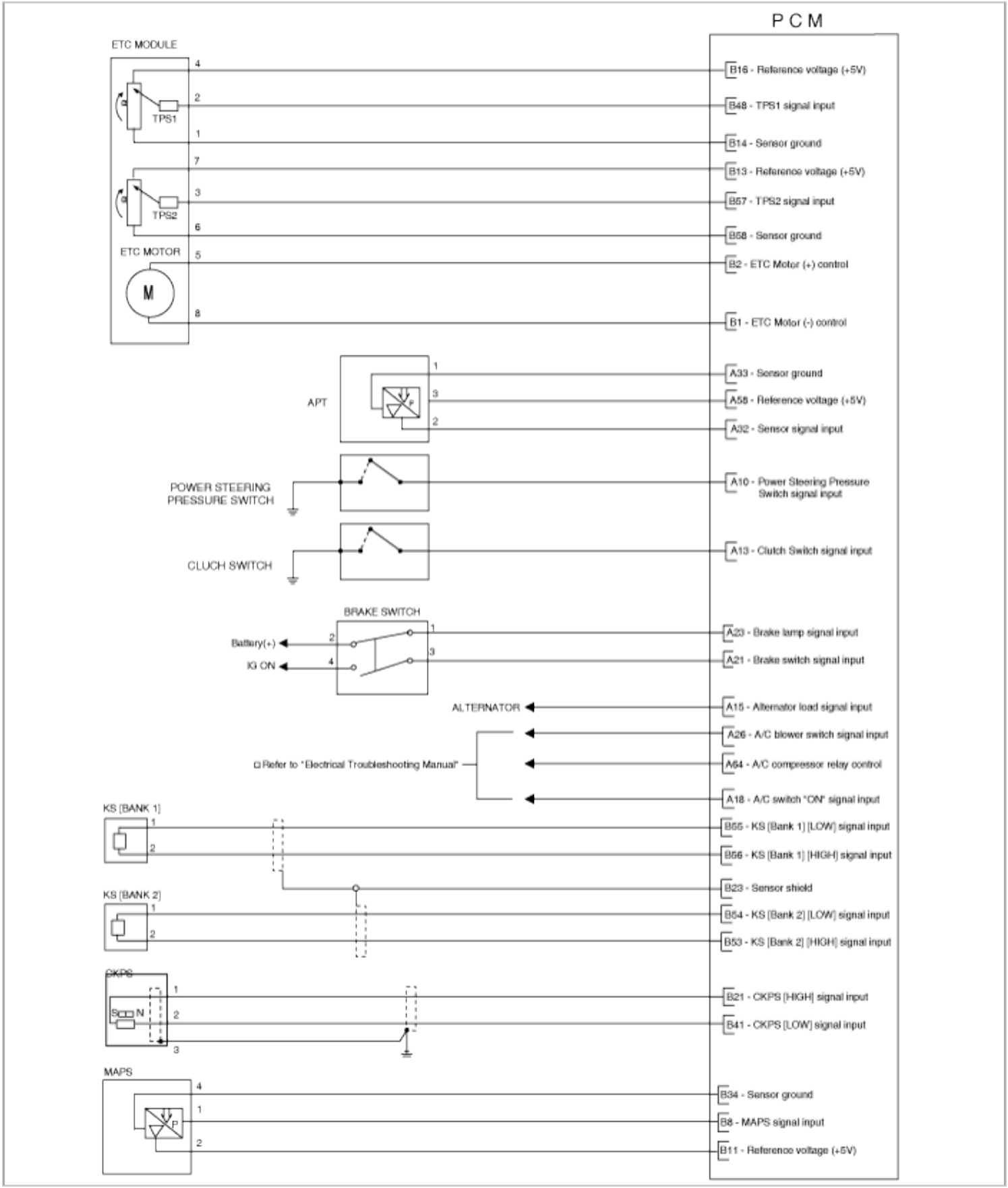
Engine Control Module (ECM)

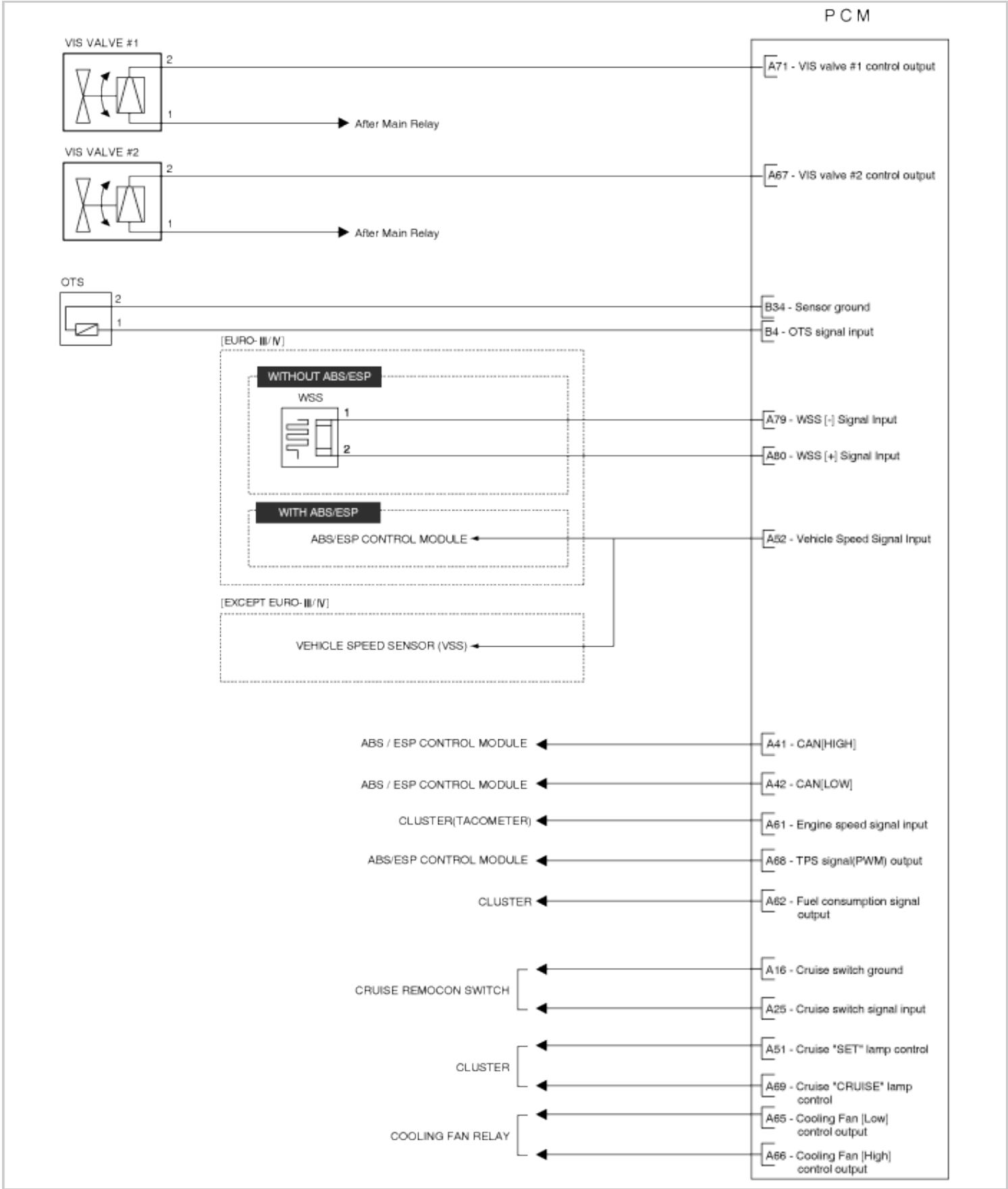
CIRCUIT DIAGRAM




PCM
MIL
IG ON
A63 - MIL control output
APS
APS1
APS2
6
2
5
3
1
4
A59 - Reference voltage(+5V)
A54 - APS1 signal input
A55 - Sensor ground
A57 - Reference voltage(+5V)
A49 - APS2 signal input
A48 - Sensor ground
IMMOBILIZER
Ground
After Main Relay
A45 - Immobilizer communication line
IMMO. LAMP
Battery
A72 - Immobilizer lamp control output
ECTS
3
2
1
Cluster
B7 - ECTS signal input
B33 - Sensor ground
HO2S(B1/S1)
After Main Relay
B70 - HO2S[B1/S1] heater control
B49 - HO2S[B1/S1] signal input
B30 - Sensor ground
HO2S(B1/S2)
After Main Relay
B74 - HO2S[B1/S2] heater control
B50 - HO2S[B1/S2] signal input
B31 - Sensor ground
HO2S(B2/S1)
After Main Relay
B67 - HO2S[B2/S1] heater control
B51 - HO2S[B2/S1] signal input
B28 - Sensor ground
HO2S(B2/S2)
After Main Relay
B73 - HO2S[B2/S2] heater control
B52 - HO2S[B2/S2] signal input
B29 - Sensor ground


PCM
MAFS & IATS
2
1
3
4
5
After Main Relay
Ground
A47 - MAFS signal input
A44 - IATS signal input
A53 - Sensor ground
PCSV
2
1
A78 - PCSV control output
After Main Relay
OCV #1
1
2
B62 - OCV #1 control output
After Main Relay
OCV #2
1
2
B61 - OCV #2 control output
After Main Relay
INJECTOR #1
2
1
B72 - Injector #1 control output
After Main Relay
INJECTOR #2
2
1
B63 - Injector #2 control output
After Main Relay
INJECTOR #3
2
1
B64 - Injector #3 control output
After Main Relay
INJECTOR #4
2
1
B68 - Injector #4 control output
After Main Relay
INJECTOR #5
2
1
B69 - Injector #5 control output
After Main Relay
INJECTOR #6
2
1
B71 - Injector #6 control output
After Main Relay
DATA LINK CONNECTOR (DLC)
A27 - K-Line
MULTI-PURPOSE CHECK CONNECTOR
A1 - CAN [HIGH]
A2 - CAN [LOW]


PCM
ETC MODULE
TPS1
TPS2
ETC MOTOR
M
B16 - Reference voltage (+5V)
B48 - TPS1 signal input
B14 - Sensor ground
B13 - Reference voltage (+5V)
B57 - TPS2 signal input
B58 - Sensor ground
B2 - ETC Motor (+) control
B1 - ETC Motor (-) control
APT
A33 - Sensor ground
A58 - Reference voltage (+5V)
A32 - Sensor signal input
POWER STEERING PRESSURE SWITCH
A10 - Power Steering Pressure Switch signal input
CLUCH SWITCH
A13 - Clutch Switch signal input
BRAKE SWITCH
Battery(+)
IG ON
A23 - Brake lamp signal input
A21 - Brake switch signal input
ALTERNATOR
A15 - Alternator load signal input
A26 - A/C blower switch signal input
A64 - A/C compressor relay control
A18 - A/C switch "ON" signal input
Refer to "Electrical Troubleshooting Manual"
KS [BANK 1]
B55 - KS [Bank 1] [LOW] signal input
B56 - KS [Bank 1] [HIGH] signal input
B23 - Sensor shield
KS [BANK 2]
B54 - KS [Bank 2] [LOW] signal input
B53 - KS [Bank 2] [HIGH] signal input
CKPS
B21 - CKPS [HIGH] signal input
B41 - CKPS [LOW] signal input
MAPS
B34 - Sensor ground
B8 - MAPS signal input
B11 - Reference voltage (+5V)


PCM
VIS VALVE #1
2
1
After Main Relay
A71 - VIS valve #1 control output
VIS VALVE #2
2
1
After Main Relay
A67 - VIS valve #2 control output
OTS
2
1
B34 - Sensor ground
B4 - OTS signal input
[EURO-Ⅲ/Ⅳ]
WITHOUT ABS/ESP
WSS
1
2
A79 - WSS [-] Signal Input
A80 - WSS [+] Signal Input
WITH ABS/ESP
ABS/ESP CONTROL MODULE
A52 - Vehicle Speed Signal Input
[EXCEPT EURO-Ⅲ/Ⅳ]
VEHICLE SPEED SENSOR (VSS)
ABS / ESP CONTROL MODULE
A41 - CAN[HIGH]
ABS / ESP CONTROL MODULE
A42 - CAN[LOW]
CLUSTER(TACOMETER)
A61 - Engine speed signal input
ABS/ESP CONTROL MODULE
A68 - TPS signal(PWM) output
CLUSTER
A62 - Fuel consumption signal output
CRUISE REMOCON SWITCH
A16 - Cruise switch ground
A25 - Cruise switch signal input
CLUSTER
A51 - Cruise "SET" lamp control
A69 - Cruise "CRUISE" lamp control
COOLING FAN RELAY
A65 - Cooling Fan [Low] control output
A66 - Cooling Fan [High] control output

PCM PROBLEM INSPECTION PROCEDURE

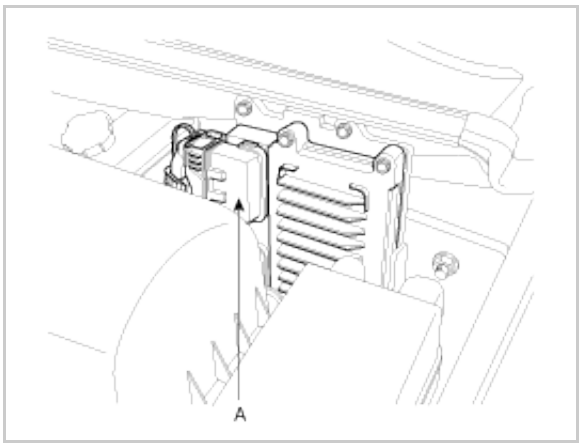
1. TEST PCM GROUND CIRCUIT: Measure resistance between PCM and chassis ground using the backside of PCM harness connector as PCM side check point. If the problem is found, repair it.

   Specification (Resistance): 1Ω or less

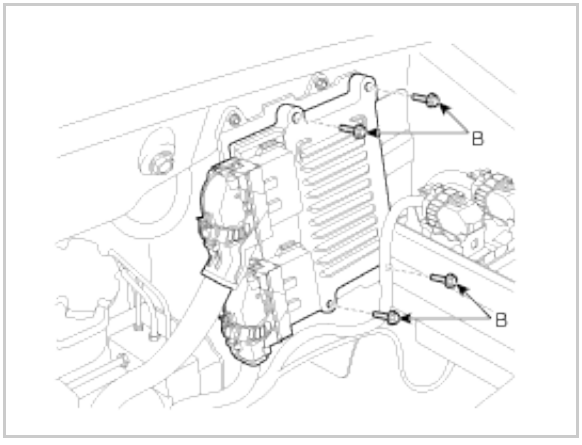
2. TEST PCM CONNECTOR: Disconnect the PCM connector and visually check the ground terminals on PCM side and harness side for bent pins or poor contact pressure. If the problem is found, repair it.
3. If problem is not found in Step 1 and 2, the PCM could be faulty. If so, replace the PCM with a new one, and then check the vehicle again. If the vehicle operates normally then the problem was likely with the PCM.
4. RE-TEST THE ORIGINAL PCM : Install the original PCM (may be broken) into a known-good vehicle and check the vehicle. If the problem occurs again, replace the original PCM with a new one. If problem does not occur, this is intermittent problem (Refer to INTERMITTENT PROBLEM PROCEDURE in BASIC INSPECTION PROCEDURE).

REPLACEMENT

1. Turn ignition switch off.
2. Disconnect the battery (-) cable from the battery.
3. Disconnect the PCM connectors (A).



4. Unscrew the PCM mounting bolts (B) and remove the PCM from the air cleaner assembly.

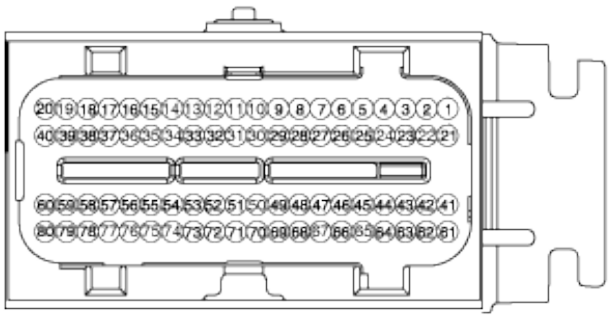


5. Install a new PCM.

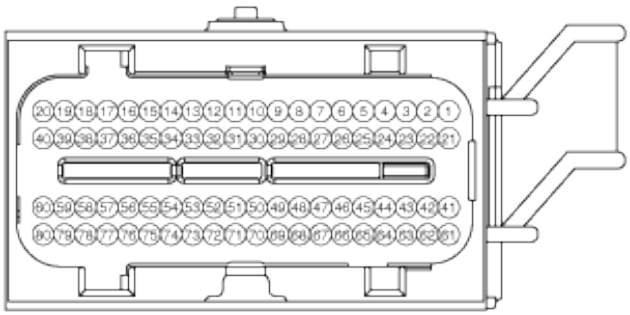
   PCM installation bolts: 9.8 ~ 11.8 N·m (1.0 ~ 1.2 kgf·m, 7.2 ~ 8.7 lbf·ft)

POWERTRAIN CONTROL MODULE (PCM)

1. HARNESS CONNECTOR



C151-1



C151-2

2. TERMINAL FUNCTION

CONNECTOR [C151-1]

Pin No.	Description	Connected to
1	2nd CAN [High]	Multi-Purpose Check Connector
2	2nd CAN [Low]	Multi-Purpose Check Connector
3	-	
4	-	
5	-	
6	-	
7	-	
8	-	
9	-	
10	Power Steering Switch signal input	Power Steering Switch
11	-	
12	-	
13	Clutch Switch signal input	Clutch Switch
14	-	
15	Alternator load signal input	Alternator
16	Cruise Switch ground	Cruise Switch
17	-	
18	A/C switch "ON" signal input	A/C Switch
19	-	
20	-	
21	Brake switch signal input	Brake Switch
22	-	
23	Brake lamp signal input	Brake Switch
24	-	
25	Cruise Switch signal input	Cruise Switch
26	A/C thermal switch signal input	A/C Thermal Switch
27	Diagnostic Data Line (K-Line)	Data Link Connector (DLC)

28	-	
29	-	
30	-	
31	-	
32	A/C Pressure Transducer signal input	A/C Pressure Transducer (APT)
33	Sensor ground	A/C Pressure Transducer (APT)
34	-	
35	-	
36	-	
37	-	
38	Battery voltage supply after main relay	Main Relay
39	Battery voltage supply after main relay	Main Relay
40	Battery voltage supply after main relay	Main Relay
41	CAN [High]	ABS/ESP Control Module
42	CAN [Low]	ABS/ESP Control Module
43	Main Relay control output	Main Relay
44	Intake Air Temperature Sensor signal input	Intake Air Temperature Sensor (IATS)
45	Immobilizer communication line	Immobilizer control module
46	-	
47	Mass Air Flow Sensor signal input	Mass Air Flow Sensor (MAFS)
48	Sensor ground	Accelerator Position Sensor (APS) #2
49	Accelerator Position Sensor #2 signal input	Accelerator Position Sensor (APS) #2
50	-	
51	Cruise "SET" lamp control output	Cruise "SET" Lamp
52	Vehicle speed signal input	ABS/ESP Control Module (With ABS/ESP [Euro-III/IV])
		Vehicle Speed Sensor (VSS) (Except Euro-III/IV)
53	Sensor ground	Intake Air Temperature Sensor (IATS)
54	Accelerator Position Sensor #1 signal input	Accelerator Position Sensor (APS) #1
55	Sensor ground	Accelerator Position Sensor (APS) #1
56	-	
57	Sensor (+5V)	Accelerator Position Sensor (APS) #2
58	Sensor (+5V)	A/C Pressure Transducer (APT)
59	Sensor (+5V)	Accelerator Position Sensor (APS) #1
60	-	
61	Engine speed signal output	Cluster (Tachometer)
62	Fuel consumption signal output	Trip Computer
63	Malfunction Indicator Lamp (MIL) control output	Cluster (Malfunction Indicator Lamp)
64	A/C Compressor Relay control output	A/C Compressor Relay
65	Cooling Fan [Low] control output	Cooling Fan Relay [Low]
66	Cooling Fan [High] control output	Cooling Fan Relay [High]
67	Variable Intake Solenoid Valve #2 control output	Variable Intake Solenoid (VIS) Valve #2 [Intake

67	Variable Intake Solenoid Valve #2 control output	Manifold Side]
68	Throttle Position Sensor signal (PWM) output	ABS/ESP Control Module
69	Cruise "MAIN" lamp control output	Cruise "MAIN" Lamp
70	Fuel Pump Relay control output	Fuel Pump Relay
71	Variable Intake Solenoid Valve #1 control output	Variable Intake Solenoid (VIS) Valve #1 Surge Tank Side]
72	Immobilizer lamp control output	Immobilizer Lamp
73	-	
74	-	
75	-	
76	-	
77	-	
78	Purge Control Solenoid Valve control output	Purge Control Solenoid Valve (PCSV)
79	Wheel Speed Sensor [Low] signal input	Wheel Speed Sensor (WSS)(Without ABS/ESP [Euro-III/IV])
80	Wheel Speed Sensor [High] signal input	Wheel Speed Sensor (WSS)(Without ABS/ESP [Euro-III/IV])

CONNECTOR [C151-2]

Pin No.	Description	Connected to
1	ETC Motor [-] control output	ETC Motor (in ETC Module)
2	ETC Motor [+] control output	ETC Motor (in ETC Module)
3	-	
4	CVVT Oil Temperature Sensor signal input	CVVT Oil Temperature Sensor (OTS)
5	-	
6	-	
7	Engine Coolant Temperature Sensor signal input	Engine Coolant Temperature Sensor (ECTS)
8	Manifold Absolute Pressure Sensor signal input	Manifold Absolute Pressure Sensor (MAPS)
9	-	
10	-	
11	Reference voltage (+5V)	Manifold Absolute Pressure Sensor (MAPS)
12	Battery voltage supply after ignition switch	Ignition Switch
13	Reference voltage (+5V)	Throttle Position Sensor (TPS) #2
14	Sensor ground	Throttle Position Sensor (TPS) #1
15	Reference voltage (+5V)	Camshaft Position Sensor (CMPS) [Bank 2]
16	Reference voltage (+5V)	Throttle Position Sensor (TPS) #1
17	Sensor ground	Camshaft Position Sensor (CMPS) [Bank 2]
18	Sensor ground	Camshaft Position Sensor (CMPS) [Bank 1]
19	Ignition Coil (Cylinder #6) control output	Ignition Coil (Cylinder #6)
20	-	
21	Crankshaft Position Sensor [High] signal input	Crankshaft Position Sensor (CKPS)
22	-	
23		Knock Sensor (KS) [Bank 1], Knock Sensor (KS)

23	Sensor Shield	Knock Sensor (KS) [Bank 1], Knock Sensor (KS) [Bank 2]
24	Camshaft Position Sensor [Bank 2] signal input	Camshaft Position Sensor (CMPS) [Bank 2]
25	Camshaft Position Sensor [Bank 1] signal input	Camshaft Position Sensor (CMPS) [Bank 1]
26	-	
27	-	
28	Sensor ground	HO2S [B2 / S1] [Except for LEADED]
29	Sensor ground	HO2S [B2 / S2] [Euro-III/IV]
30	Sensor ground	HO2S [B1 / S1] [Except for LEADED]
31	Sensor ground	HO2S [B1 / S2] [Euro-III/IV]
32	Reference voltage (+5V)	Camshaft Position Sensor (CMPS) [Bank 1]
33	Sensor ground	Engine Coolant Temperature Sensor (ECTS)
34	Sensor ground	Manifold Absolute Pressure Sensor (MAPS), CVVT Oil Temperature Sensor (OTS)
35	Power ground	Chassis Ground
36	Power ground	Chassis Ground
37	Power ground	Chassis Ground
38	Power ground	Chassis Ground
39	Power ground	Chassis Ground
40	Ignition Coil (Cylinder #4) control output	Ignition Coil (Cylinder #4)
41	Crankshaft Position Sensor [Low] signal input	Crankshaft Position Sensor (CKPS)
42	-	
43	-	
44	-	
45	-	
46	-	
47	-	
48	Throttle Position Sensor #1 signal input	Throttle Position Sensor (TPS) #1
49	Heated Oxygen Sensor [Bank 1 / Sensor 1] signal input	HO2S (B1/S1) [Except for LEADED]
50	Heated Oxygen Sensor [Bank 1 / Sensor 2] signal input	HO2S (B1/S2) [Euro-III/IV]
51	Heated Oxygen Sensor [Bank 2 / Sensor 1] signal input	HO2S (B2/S1) [Except for LEADED]
52	Heated Oxygen Sensor [Bank 2 / Sensor 2] signal input	HO2S (B2/S2) [Euro-III/IV]
53	Knock Sensor (KS) [Bank 2] [High] signal input	Knock Sensor (KS) [Bank 2]
54	Knock Sensor (KS) [Bank 2] [Low] signal input	Knock Sensor (KS) [Bank 2]
55	Knock Sensor (KS) [Bank 1] [Low] signal input	Knock Sensor (KS) [Bank 1]
56	Knock Sensor (KS) [Bank 1] [High] signal input	Knock Sensor (KS) [Bank 1]
57	Throttle Position Sensor #2 signal input	Throttle Position Sensor (TPS) #2
58	Sensor ground	Throttle Position Sensor (TPS) #2
59	-	
60	Ignition Coil (Cylinder #2) control output	Ignition Coil (Cylinder #2)

61	CVVT Oil Control Valve [Bank 2] control output	CVVT Oil Control Valve (OCV) [Bank 2]
62	CVVT Oil Control Valve [Bank 1] control output	CVVT Oil Control Valve (OCV) [Bank 1]
63	Injector (Cylinder #2) control output	Injector (Cylinder #2)
64	Injector (Cylinder #3) control output	Injector (Cylinder #3)
65	-	
66	-	
67	Heated Oxygen Sensor [Bank 2 / Sensor 1] Heater control output	HO2S [B2 / S1] [Except for LEADED]
68	Injector (Cylinder #4) control output	Injector (Cylinder #4)
69	Injector (Cylinder #5) control output	Injector (Cylinder #5)
70	Heated Oxygen Sensor [Bank 1 / Sensor 1] Heater control output	HO2S [B1 / S1] [Except for LEADED]
71	Injector (Cylinder #6) control output	Injector (Cylinder #6)
72	Injector (Cylinder #1) control output	Injector (Cylinder #1)
73	Heated Oxygen Sensor [Bank 2 / Sensor 2] Heater control output	HO2S [B2 / S2] [Euro-III/IV]
74	Heated Oxygen Sensor [Bank 1 / Sensor 2] Heater control output	HO2S [B1 / S2] [Euro-III/IV]
75	-	
76	Battery Power	Battery
77	Ignition Coil (Cylinder #3) control output	Ignition Coil (Cylinder #3)
78	Ignition Coil (Cylinder #5) control output	Ignition Coil (Cylinder #5)
79	Ignition Coil (Cylinder #1) control output	Ignition Coil (Cylinder #1)
80	-	

3. TERMINAL INPUT/OUTPUT SIGNAL

CONNECTOR [C151-1]

Pin No.	Description	Condition	Type	Level	Test Result
1	2nd CAN [High]	Idle	DC	2.0 ~ 3.0V	2.5V
2	2nd CAN [Low]	Idle	DC	2.0 ~ 3.0V	2.5V
3	-				
4	-				
5	-				
6	-				
7	-				
8	-				
9	-				
10	Power Steering Switch signal input	S/W ON	DC	Max. 0.5V	-0.125V
		S/W OFF		Battery Voltage	13.47V
11	-				
12	-				
13	Clutch Switch signal input				
14	-				

15	Alternator load signal input	Idle	Pulse	Hi: Battery Voltage	13.67V
				Lo: Max 1.5 V	-0.125mV
16	Cruise Switch ground	Idle	DC	Max. 50 mV	22.44mV
17	-				
18	A/C switch "ON" signal input	A/C Relay OFF	DC	Battery Voltage	12.37V
		A/C Relay ON		Max. 1.0V	-25mV
19	-				
20	-				
21	Brake switch signal input	Pedal Release	DC	Battery Voltage	13.97V
		Pedal Push		Max. 0.5V	-25mV
22	-				
23	Brake lamp signal input	Pedal Release	DC	Max. 0.5V	-225mV
		Pedal Push		Battery Voltage	12.97V
24	-				
25	Cruise Switch signal input	All Release	DC	4.3 ~ 4.7V	4.39V
		Main SW		Battery Voltage	13.37V
		Set SW		1.3 ~ 1.7V	1.38V
		Resume SW		2.8 ~ 3.2V	2.82V
		Cancel SW		-0.2 ~ 0.2V	-37.54mV
26	A/C thermal switch signal input	A/C OFF	DC	Max. 1.0V	-25mV
		A/C ON		Battery Voltage	12.57V
27	Diagnostic Data Line (K-Line)	When transmitting	Pulse	Hi: Min. Vbatt × 80%	11.57V
				Lo: Max. Vbatt × 20%	175mV
		When receiving		Hi: Min. Vbatt × 70%	
				Lo: Max. Vbatt × 30%	
28	-				
29	-				
30	-				
31	-				
32	A/C Pressure Transducer signal input	A/C OFF	DC	0 ~ 5V	1.36V
		A/C ON			1.83V
33	Sensor ground	Idle	DC	Max. 50 mV	22.66mV
34	-				
35	-				
36	-				
37	-				
38	Battery voltage supply after main relay	IG OFF	DC	Max. 1.0 V	-25mV
		IG ON		Battery Voltage	12.77V
39	Battery voltage supply after main relay	IG OFF	DC	Max. 1.0 V	-25mV
		IG ON		Battery Voltage	12.77V

40	Battery voltage supply after main relay	IG OFF	DC	Max. 1.0 V	-25mV
		IG ON		Battery Voltage	12.37V
41	CAN [High]	Recessive	Pulse	2.0 ~ 3.0 V	2.4V
		Dominant		2.75~4.5 V	3.56V
42	CAN [Low]	Recessive	Pulse	2.0 ~ 3.0 V	2.42V
		Dominant		0.5~2.25 V	1.62V
43	Main Relay control output	Relay ON	DC	Battery Voltage	0.875V
		Relay OFF		Max. 1.0V	12.47V
44	Intake Air Temperature Sensor signal input	Idle	Analog	0 ~ 5V	2.05V
45	Immobilizer communication line	When communicating after IG ON	Pulse	Hi: Min. 8.5V	11.87V
				Lo: Max. 3.5V	875mV
46	-				
47	Mass Air Flow Sensor signal input	Idle	Pulse	Hi: Vcc	4.97V
				Lo: Max. 0.5V	70mV
48	Sensor ground	Idle	DC	Max. 50 mV	22.52mV
49	Accelerator Position Sensor #2 signal input	C.T	Analog	0.3 ~ 0.9V	0.38V
		W.O.T		1.5 ~ 3.0V	2V
50	-				
51	Cruise "SET" lamp control output	Cruise OFF	DC	Battery Voltage	12.57V
		Cruise ON		Max. 1.0V	-25mV
52	Vehicle speed signal input	Vehicle Run	Pulse	Hi: Min. 5.0V	11.07V
				Lo: Max. 1.0V	-125mV
53	Sensor ground	Idle	DC	Max. 50 mV	22.37mV
54	Accelerator Position Sensor #1 signal input	C.T	Analog	0.3 ~ 0.9V	819mV
		W.O.T		4.0 ~ 4.8V	4.01V
55	Sensor ground	Idle	DC	Max. 50mV	22.6mV
56	-				
57	Reference voltage (+5V)	IG OFF	DC	Max. 0.5V	4.95V
		IG ON		4.9 ~ 5.1V	-10mV
58	Reference voltage (+5V)	IG OFF	DC	Max. 0.5V	4.95V
		IG ON		4.9 ~ 5.1V	-10mV
59	Reference voltage (+5V)	IG OFF	DC	Max. 0.5V	4.95V
		IG ON		4.9 ~ 5.1V	-10mV
60	-				
61	Engine speed signal output	Idle	Pulse	Hi: Battery Voltage	13.57V
				Lo: Max. 0.5V	-25mV
				20 ~ 26Hz	
62	Fuel consumption signal output	Idle	Pulse	Hi: Battery Voltage	13.57V
				Lo: Max. 0.5V	-25mV
63	Malfunction Indicator Lamp (MIL) control output	Lamp OFF	DC	Hi: Battery Voltage	13.37V
		Lamp ON		Lo: Max. 2.0V	-25mV

64	A/C Compressor Relay control output	A/C OFF	DC	Battery Voltage	13.97V
		A/C ON		Max. 1.0V	175mV
65	Cooling Fan [Low] control output	Fan OFF	DC	Battery Voltage	13.77V
		Fan ON		Max. 1.0V	175mV
66	Cooling Fan [High] control output	Fan OFF	DC	Battery Voltage	13.57V
		Fan ON		Max. 1.0V	-25mV
67	Variable Intake Solenoid Valve #2 control output	Active	DC	Max. 1.0 V	13.77
		Inactive		Battery Voltage	-25mV
68	Throttle Position Sensor signal (PWM) output	Idle	Pulse	Hi: Battery Voltage	13.37V
				Lo: 0 ~ 0.5 V	-25mV
69	Cruise "MAIN" lamp control output	Cruise OFF	DC	Battery Voltage	12.37V
		Cruise ON		Max. 1.0V	-25mV
70	Fuel Pump Relay control output	Relay OFF	DC	Battery Voltage	12.57V
		Relay ON		Max. 1.0V	-25mV
71	Variable Intake Solenoid Valve #1 control output	Active	DC	Max. 1.0 V	175mV
		Inactive		Battery Voltage	13.77V
72	Immobilizer lamp control output	Lamp OFF	DC	Battery Voltage	12.77V
		Lamp ON		Max. 1.0V	-25mV
73	-				
74	-				
75	-				
76	-				
77	-				
78	Purge Control Solenoid Valve control output	Inactive	Pulse	Hi: Battery Voltage	13.83V
		Active		Lo: Max. 1.0V	31.54mV
79	Wheel Speed Sensor [Low] signal input				
80	Wheel Speed Sensor [High] signal input				

CONNECTOR [C151-2]

Pin No.	Description	Condition	Type	Level	Test Result
1	ETC Motor [-] control output	Idle	Pulse	Hi: Battery Voltage	14.07V
				Lo: Max . 1.0V	-125mV
2	ETC Motor [+] control output	Idle	Pulse	Hi: Battery Voltage	14.07V
				Lo: Max . 1.0V	-325mV
3	-				
4	CVVT Oil Temperature Sensor signal input	Idle	Analog	0 ~ 5.0V	282mV at 96°C
5	-				
6	-				
7	Engine Coolant Temperature Sensor signal input	Idle	Analog	0 ~ 5.0V	1.88V

8	Manifold Absolute Pressure Sensor signal input	IG ON	Analog	3.9 ~ 4.1V	3.96V
		Idle		0.8 ~ 1.6V	1.31V
9	-				
10	-				
11	Reference voltage (+5V)	IG OFF	DC	Max. 0.5V	4.91V
		IG ON		4.9 ~ 5.1V	-50mV
12	Battery voltage supply after ignition switch	IG OFF	DC	Max. 0.5 V	13.87V
		IG ON		Battery Voltage	-125mV
13	Reference voltage (+5V)	IG OFF	DC	Max. 0.5V	4.89V
		IG ON		4.9 ~ 5.1V	-70mV
14	Sensor ground	Idle	DC	Max. 50 mV	19.77mV
15	Reference voltage (+5V)	IG OFF	DC	Max. 0.5V	4.91V
		IG ON		4.9 ~ 5.1V	-50mV
16	Reference voltage (+5V)	IG OFF	DC	Max. 0.5V	4.91V
		IG ON		4.9 ~ 5.1V	-50mV
17	Sensor ground	Idle	DC	Max. 50 mV	21.1mV
18	Sensor ground	Idle	DC	Max. 50 mV	20.87mV
19	Ignition Coil (Cylinder #6) control output	Idle	Pulse	1st Voltage: 200~400V	278V
				ON Voltage: Max. 2V	1.97V
20	-				
21	Crankshaft Position Sensor [High] signal input	Idle	SINE WAVE	Vp_p : Min.1.0V	41.6V
22	-				
23	Sensor Shield	Idle	DC	Max. 50 mV	21.41mV
24	Camshaft Position Sensor [Bank 2] signal input	Idle	Pulse	Hi: Vcc	4.95V
				Lo: Max . 0.5V	-10mV
25	Camshaft Position Sensor [Bank 1] signal input	Idle	Pulse	Hi: Vcc	4.95V
				Lo: Max . 0.5V	-10mV
26	-				
27	-				
28	Sensor ground	Idle	DC	Max. 50 mV	20.73mV
29	Sensor ground	Idle	DC	Max. 50 mV	21.9mV
30	Sensor ground	Idle	DC	Max. 50 mV	20.16mV
31	Sensor ground	Idle	DC	Max. 50 mV	20.63mV
32	Reference voltage (+5V)	IG OFF	DC	Max. 0.5V	4.91V
		IG ON		4.9 ~ 5.1V	-50mV
33	Sensor ground	Idle	DC	Max. 50 mV	22.52mV
34	Sensor ground	Idle	DC	Max. 50 mV	20.99mV
35	Power ground	Idle	DC	Max. 50 mV	
36	Power ground	Idle	DC	Max. 50 mV	
37	Power ground	Idle	DC	Max. 50 mV	

38	Power ground	Idle	DC	Max. 50 mV	
39	Power ground	Idle	DC	Max. 50 mV	
40	Ignition Coil (Cylinder #4) control output	Idle	Pulse	1st Voltage: 2300~400V	294V
				ON Voltage: Max. 2V	1.93V
41	Crankshaft Position Sensor [Low] signal input	Idle	SINE WAVE	Vp_p: Min.1.0V	8.24V
42	-				
43	-				
44	-				
45	-				
46	-				
47	-				
48	Throttle Position Sensor #1 signal input	C.T	Analog	0.25 ~ 0.9V	0.68V
		W.O.T		Min. 4.0V	4.27V
49	Heated Oxygen Sensor [Bank 1 / Sensor 1] signal input	Racing	DC	Rich: 0.6 ~ 1.0V	774mV
				Lean: 0 ~ 0.4V	137mV
50	Heated Oxygen Sensor [Bank 1 / Sensor 2] signal input	Racing	DC	Rich: 0.6 ~ 1.0V	
				Lean: 0 ~ 0.4V	
51	Heated Oxygen Sensor [Bank 2 / Sensor 1] signal input	Racing	DC	Rich: 0.6 ~ 1.0V	705.2mV
				Lean: 0 ~ 0.4V	82mV
52	Heated Oxygen Sensor [Bank 2 / Sensor 2] signal input	Racing	DC	Rich: 0.6 ~ 1.0V	
				Lean: 0 ~ 0.4V	
53	Knock Sensor (KS) [Bank 2] [High] signal input	Knocking	Variable Frequency	-0.3 ~ 0.3 V	
		Normal		0 V	
54	Knock Sensor (KS) [Bank 2] [Low] signal input	Knocking	Variable Frequency	-0.3 ~ 0.3 V	
		Normal		0 V	
55	Knock Sensor (KS) [Bank 1] [Low] signal input	Knocking	Variable Frequency	-0.3 ~ 0.3 V	
		Normal		0 V	
56	Knock Sensor (KS) [Bank 1] [High] signal input	Knocking	Variable Frequency	-0.3 ~ 0.3 V	
		Normal		0 V	
57	Throttle Position Sensor #2 signal input	C.T	Analog	Min. 4.0V	4.23V
		W.O.T		0.25 ~ 0.9V	703mV
58	Sensor ground	Idle	DC	Max. 50 mV	21.64mV
59	-				
60	Ignition Coil (Cylinder #2) control output	Idle	Pulse	1st Voltage: 200~400V	305V
				ON Voltage: Max. 2V	1.85V
61	CVVT Oil Control Valve [Bank 2] control output	Idle	Pulse	Battery Voltage	14.45V
				Max. 1.0V	50mV
62	CVVT Oil Control Valve [Bank 1] control output	Idle	Pulse	Battery Voltage	14.47V
				Max. 1.0V	75mV
	Injector (Cylinder #2) control			Battery Voltage	14.06V

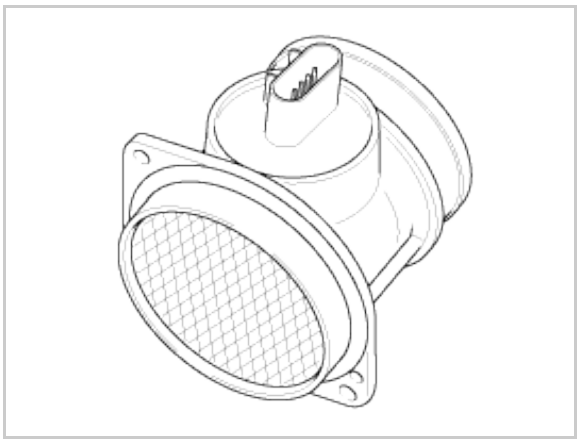
63	Injector (Cylinder #2) control output	Idle	Pulse	Battery Voltage	14.00V
				Max. 1.0V	44.2mV
64	Injector (Cylinder #3) control output	Idle	Pulse	Battery Voltage	14V
				Max. 1.0V	38.31mV
65	-				
66	-				
67	Heated Oxygen Sensor [Bank 2 / Sensor 1] Heater control output	Engine Run	Pulse	Hi: Battery Voltage	14.07V
				Lo: Max. 1.0V	275mV
68	Injector (Cylinder #4) control output	Idle	Pulse	Hi: Battery Voltage	13.96V
				Lo: Max. 1.0V	55.71mV
69	Injector (Cylinder #5) control output	Idle	Pulse	Hi: Battery Voltage	14V
				Lo: Max. 1.0V	40.82mV
70	Heated Oxygen Sensor [Bank 1 / Sensor 1] Heater control output	Engine Run	Pulse	Hi: Battery Voltage	14.07V
				Lo: Max. 1.0V	275mV
71	Injector (Cylinder #6) control output	Idle	Pulse	Hi: Battery Voltage	13.95mV
				Lo: Max. 1.0V	55.77mV
72	Injector (Cylinder #1) control output	Idle	Pulse	Hi: Battery Voltage	14.07V
				Lo: Max. 1.0V	56.7mV
73	Heated Oxygen Sensor [Bank 2 / Sensor 2] Heater control output	Engine Run	Pulse	Hi: Battery Voltage	13.87V
				Lo: Max. 1.0V	275mV
74	Heated Oxygen Sensor [Bank 1 / Sensor 2] Heater control output	Engine Run	Pulse	Hi: Battery Voltage	14.07V
				Lo: Max. 1.0V	275mV
75	-				
76	Battery Power	Always	DC	Battery Voltage	12.39V
				1.0 mA or below 1.5 mA	0.34mA
77	Ignition Coil (Cylinder #3) control output	Idle	Pulse	1st Voltage: 200~400V	289V
				ON Voltage: Max. 2V	1.87V
78	Ignition Coil (Cylinder #5) control output	Idle	Pulse	1st Voltage: 200~400V	279V
				ON Voltage: Max. 2V	1.93V
79	Ignition Coil (Cylinder #1) control output	Idle	Pulse	1st Voltage: 200~400V	269V
				ON Voltage: Max. 2V	1.91V
80	-				

Mass Air Flow Sensor (MAFS)

INSPECTION

FUNCTION AND OPERATION PRINCIPLE

Mass Air Flow Sensor (MAFS) is a hot-film type sensor and is located in between the air cleaner and the throttle body. It consists of a tube, a sensor assembly and honeycomb cell and detects intake air quantity flowing into the intake manifold. Air flows from the air cleaner assembly through the honeycomb cell and over the hot film element. At this time, heat transfer is generated by convection and this sensor loses its energy. This sensor detects the mass air flow by using the energy loss and transfers the information to the PCM by frequency. The PCM calculates fuel quantity and ignition timing.

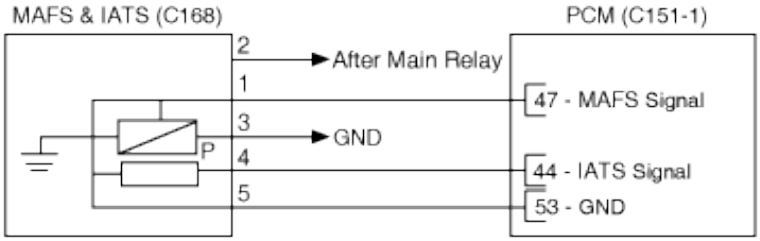


SPECIFICATION

Air Flow (kg/h)	Output Frequency (Hz)
12.6 kg/h	2,617Hz
18.0 kg/h	2,958Hz
23.4 kg/h	3,241Hz
32.4 kg/h	3,653Hz
43.2 kg/h	4,024Hz
57.6 kg/h	4,399Hz
72.0 kg/h	4,704Hz
108.0 kg/h	5,329Hz
144.0 kg/h	5,897Hz
198.0 kg/h	6,553Hz
270.0 kg/h	7,240Hz
360.0 kg/h	7,957Hz
486.0 kg/h	8,738Hz
666.0 kg/h	9,644Hz
900.0 kg/h	10,590Hz

CIRCUIT DIAGRAM

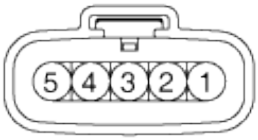
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

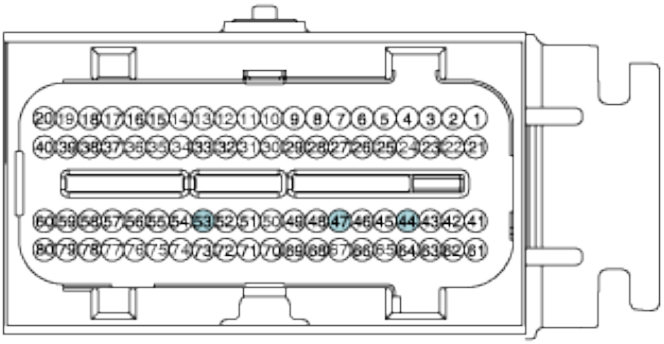
Terminal	Connected to	Function
1	PCM C151-1 (47)	MAFS Signal
2	Main Relay	Battery Voltage (B+)
3	Chassis Ground	Ground
4	PCM C151-1 (44)	IATS Signal
5	PCM C151-1(53)	Sensor Ground

[HARNESS CONNECTORS]



C168

MAFS & IATS



C151-1

PCM

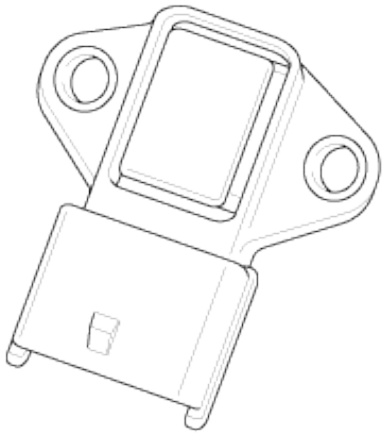
COMPONENT INSPECTION

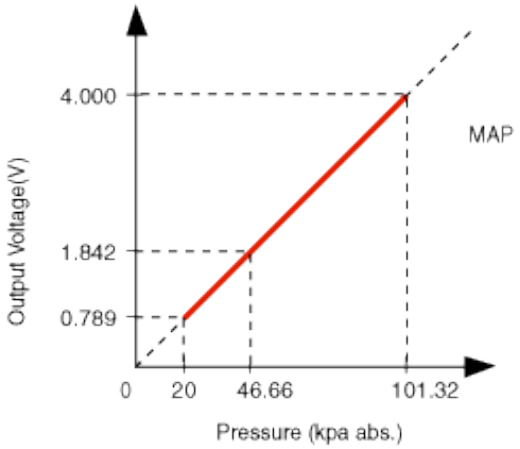
1. Check the MAFS visually.
   a. Mounting direction correct.
   b. Any contamination, corrosion or damage on connector.
   c. Air cleaner's clogging or wet.
   d. MAFS cylinder's deforming or blocking by any foreign material.
2. Check any leakage on intake system and intercooler system.

Manifold Absolute Pressure Sensor (MAPS)

INSPECTION

FUNCTION AND OPERATION PRICIPLE





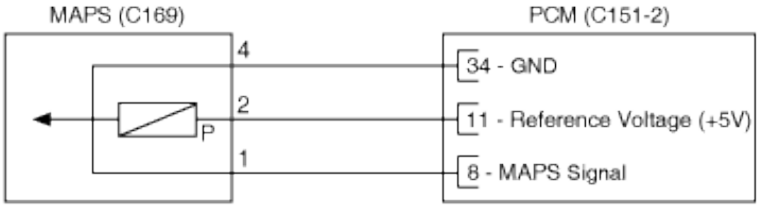
Manifold Absolute Pressure Sensor (MAPS) is speed-density type sensor and is installed on the surge tank. This MAPS senses absolute pressure in surge tank and transfers this analog signal proportional to the pressure to the PCM. The PCM calculates the intake air quantity and engine speed based on this signal. This MAPS consists of piezo-electric element and hybrid IC that amplifies the element output signal. The element is silicon diaphragm type and adapts pressure sensitive variable resistor effect of semi-conductor. 100% vacuum and the manifold pressure applies to both sides of it respectively. That is, this sensor outputs the silicon variation proportional to pressure change by voltage.

SPECIFICATION

Pressure(kPa)	Output Voltage (V)
20.0	0.79
46.66	1.84
101.32	4.0

CIRCUIT DIAGRAM

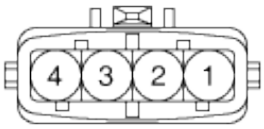
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

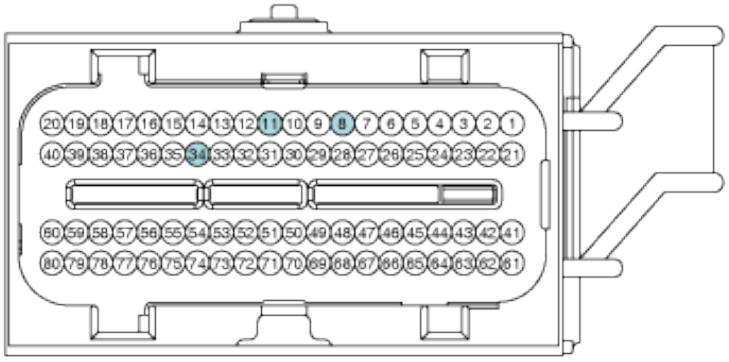
Terminal	Connected to	Function
1	PCM C151-2 (8)	MAPS Signal
2	PCM C151-2 (11)	Reference Voltage (+5V)
3	-	-
4	PCM C151-2 (34)	Sensor ground

[HARNESS CONNECTORS]



C169

MAPS



C151-2

PCM

COMPONENT INSPECTION

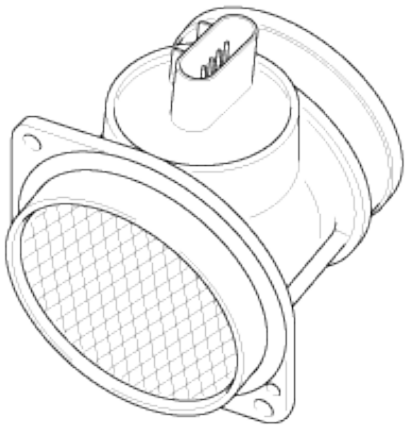
1. Connect a scantool on Diagnisis Link Connector (DLC).
2. Check MAPS output voltage at idle and IG ON.

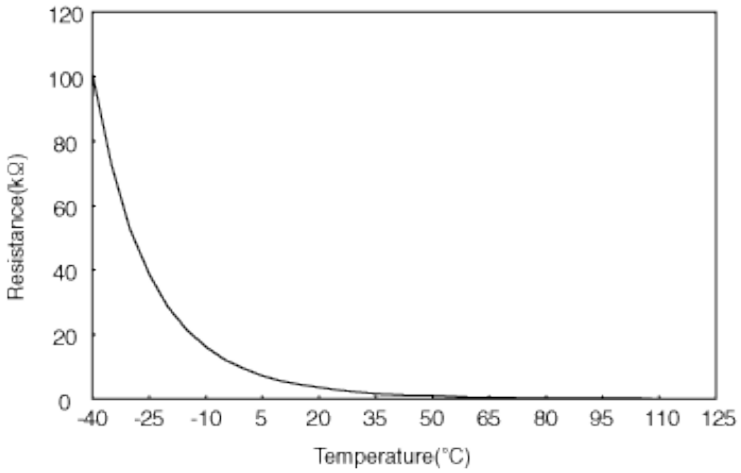
Condition	Output Voltage (V)
Idle	0.8V ~ 1.6V
IG ON	3.9V ~ 4.1V

Intake Air Temperature Sensor (IATS)

INSPECTION

FUNCTION AND OPERATION PRICIPLE





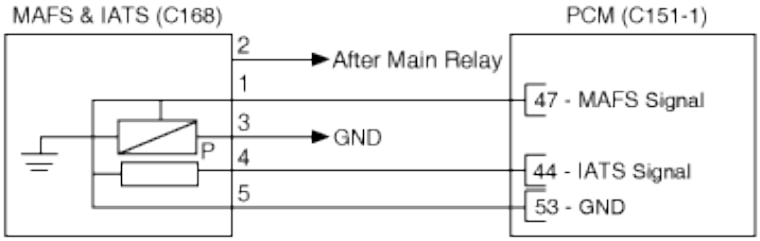
Intake Air Temperature Sensor (IATS) is installed inside the Mass Air Flow Sensor (MAFS) and detects the intake air temperature. To calculate precise air quantity, correction of the air temperature is needed because air density varies according to the temperature. So the PCM uses not only MAFS signal but also IATS signal. This sensor has a Negative Temperature Coefficient (NTC) and its resistance is in inverse proportion to the temperature.

SPECIFICATION

Temperature		Resistance (kΩ)
°C	°F	
-40	-40	100.87
-20	-4	28.58
0	32	9.40
10	50	5.66
20	68	3.51
40	104	1.47
60	140	0.67
80	176	0.33

CIRCUIT DIAGRAM

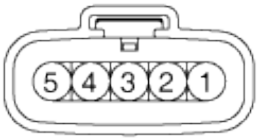
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

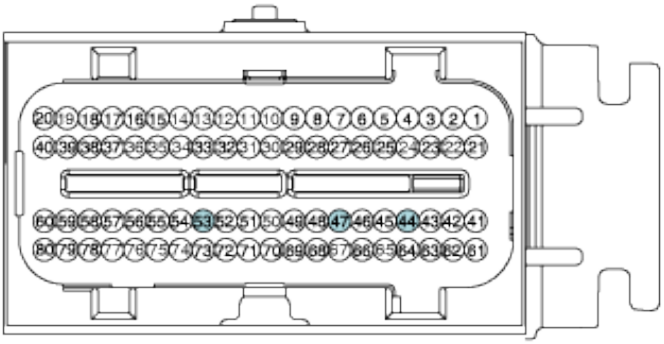
Terminal	Connected to	Function
1	PCM C151-1 (47)	MAFS Signal
2	Main Relay	Battery Voltage (B+)
3	Chassis Ground	Ground
4	PCM C151-1 (44)	IATS Signal
5	PCM C151-1(53)	Sensor Ground

[HARNESS CONNECTORS]



C168

MAFS & IATS

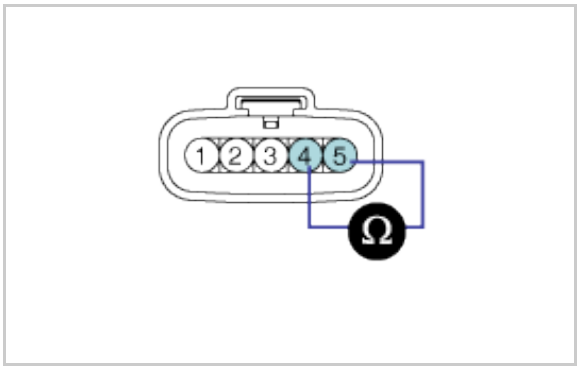


C151-1

PCM

COMPONENT INSPECTION

1. Turn ignition switch OFF.
2. Disconnect IATS connector.
3. Measure resistance between IATS terminals 4 and 5.



4. Check that the resistance is within the specification.

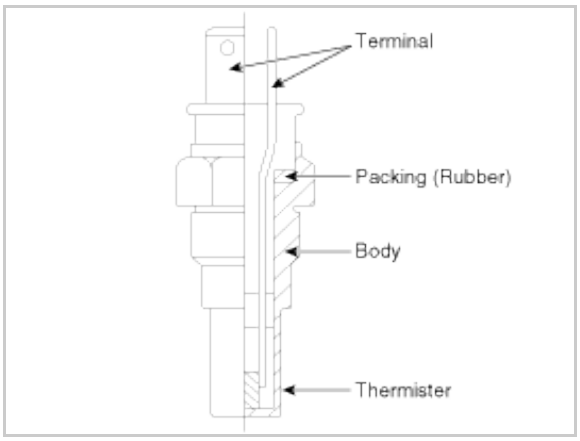
Specification: Refer to SPECIFICATION.

Engine Coolant Temperature Sensor (ECTS)

INSPECTION

FUNCTION AND OPERATION PRICIPLE

Engine Coolant Temperature Sensor (ECTS) is located in the engine coolant passage of the cylinder head for detecting the engine coolant temperature. The ECTS uses a thermistor whose resistance changes with the temperature. The electrical resistance of the ECTS decreases as the temperature increases, and increases as the temperature decreases. The reference 5 V in the PCM is supplied to the ECTS via a resistor in the PCM.That is, the resistor in the PCM and the thermistor in the ECTS are connected in series. When the resistance value of the thermistor in the ECTS changes according to the engine coolant temperature, the output voltage also changes. During cold engine operation the PCM increases the fuel injection duration and controls the ignition timing using the information of engine coolant temperature to avoid engine stalling and improve drivability.

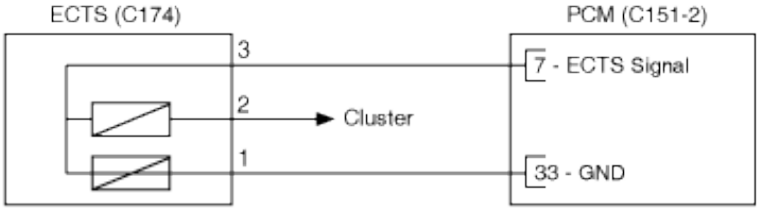


SPECIFICATION

Temperature		Resistance(kΩ)
°C	°F	
-40	-40	48.14
-20	-4	14.13 ~ 16.83
0	32	5.79
20	68	2.31 ~ 2.59
40	104	1.15
60	140	0.59
80	176	0.32

CIRCUIT DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

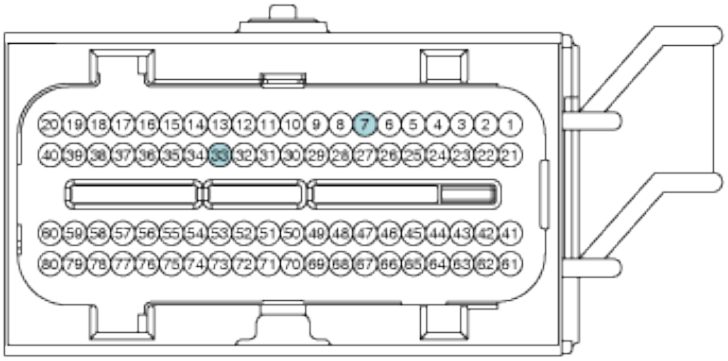
Terminal	Connected to	Function
1	PCM C151-2 (33)	Sensor ground
2	Cluster	-
3	PCM C151-2 (7)	ECTS Signal

[HARNESS CONNECTORS]



C174

ECTS

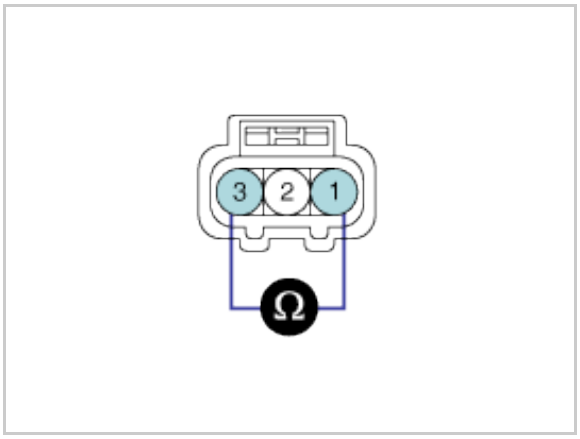


C151-2

PCM

COMPONENT INSPECTION

1. Turn ignition switch OFF.
2. Disconnect ECTS connector.
3. Remove the ECTS.
4. After immersing the thermistor of the sensor into engine coolant, measure resistance between ECTS terminals 1 and 3.



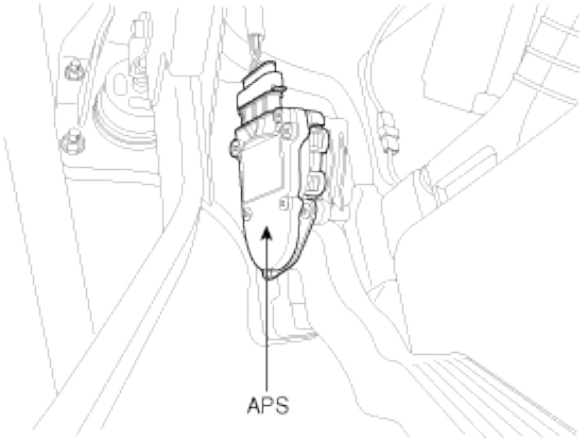
5. Check that the resistance is within the specification.

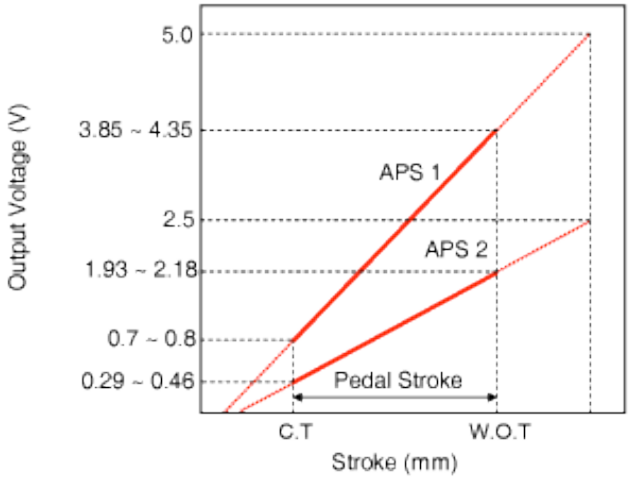
Specification: Refer to SPECIFICATION.

Accelerator Position Sensor (APS)

INSPECTION

FUNCTION AND OPERATION PRICIPLE





Accelerator Position Sensor (APS) is installed on the accelerator pedal module and detects the rotation angle of the accelerator pedal. The APS is one of the most important sensors in engine control system, so it consists of the two sensors which adapt individual sensor power and ground line. The second sensor monitors the first sensor and its output voltage is half of the first one. If the ratio of the sensor 1 and 2 is out of the range (approximately 1/2), the diagnostic system judges that a malfunction has occurred.

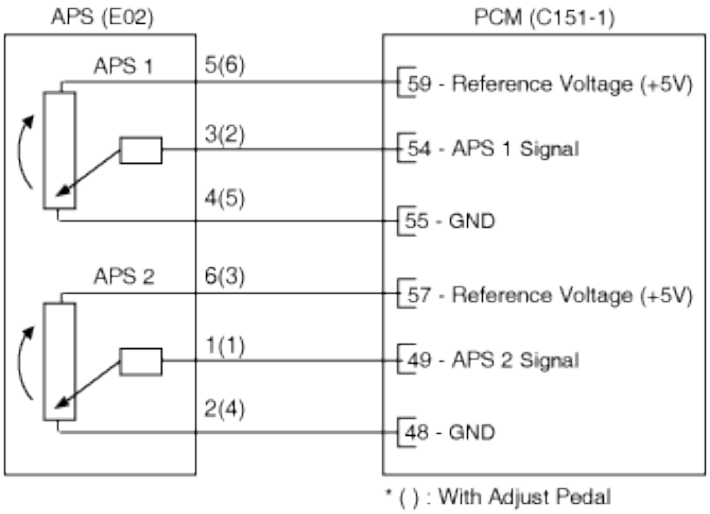
SPECIFICATION

Pedal Position	Output Voltage (V) [Vref = 5.0V]	
	APS1	APS2
C.T	0.7 ~ 0.8V	0.29 ~ 0.46V
W.O.T	3.85 ~ 4.35V	1.93 ~ 2.18V

Item	Sensor Resistance
APS1	0.7 ~ 1.3kΩ at 20°C (68°F)
APS2	1.4 ~ 2.6kΩ at 20°C (68°F)

CIRCUIT DIAGRAM

[CIRCUIT DIAGRAM]



* ( ) : With Adjust Pedal

[CONNECTION INFORMATION]

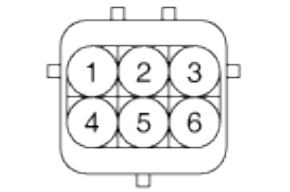
[WITH ADJUSTABLE PEDAL]

Terminal	Connected to	Function
1	PCM C151-1 (49)	APS 2 Signal
2	PCM C151-1 (54)	APS 1 Signal
3	PCM C151-1 (57)	APS 2 Reference Voltage (+5V)
4	PCM C151-1 (48)	APS 2 Ground
5	PCM C151-1 (55)	APS 1 Ground
6	PCM C151-1 (59)	APS 1 Reference Voltage (+5V)

[WITHOUT ADJUSTABLE PEDAL]

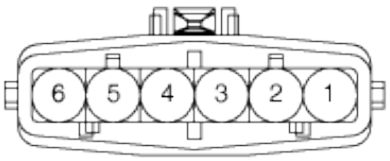
Terminal	Connected to	Function
1	PCM C151-1 (49)	APS 2 Signal
2	PCM C151-1 (48)	APS 2 Ground
3	PCM C151-1 (54)	APS 1 Signal
4	PCM C151-1 (55)	APS 1 Ground
5	PCM C151-1 (59)	APS 1 Reference Voltage (+5V)
6	PCM C151-1 (57)	APS 2 Reference Voltage (+5V)

[HARNESS CONNECTORS]



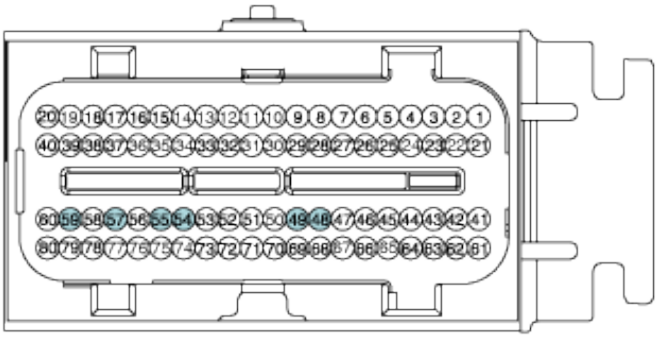
WITH ADJUSTABLE PEDAL

E02
APS



WITHOUT ADJUSTABLE PEDAL

E02
APS



C151-1
PCM

COMPONENT INSPECTION

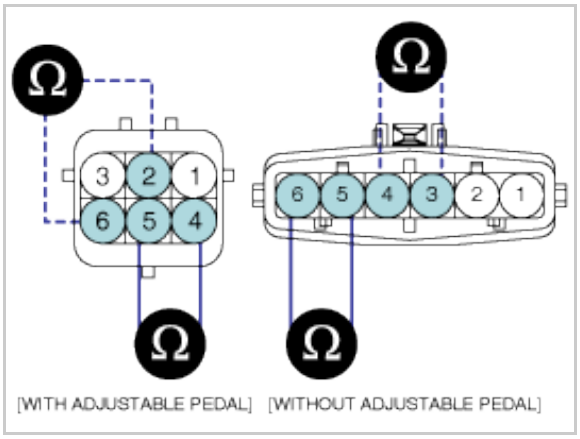
1. Connect a scantool on Diagnoisis Link Connector (DLC).
2. Start engine and check output voltages of APS 1 and 2 at C.T and W.O.T.
   Specification

Condition	Output Voltage (V)	
	APS1	APS2
C.T	0.70 ~ 0.80	0.29 ~ 0.46
W.O.T	3.85 ~ 4.35	1.93 ~ 2.18

3. Turn ignition switch OFF and disconnect the scantool from the DLC.
4. Disconnect APS connector and measure resistance between APS terminals 5(6) and 4(5) (APS 1).

   Specification: Refer to SPECIFICATION.

5. Disconnect APS connector and measure resistance between APS terminals 6(3) and 2(4) (APS 2).



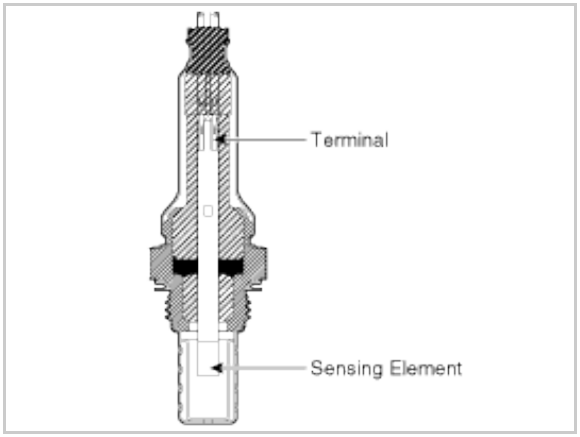
Specification: Refer to SPECIFICATION.

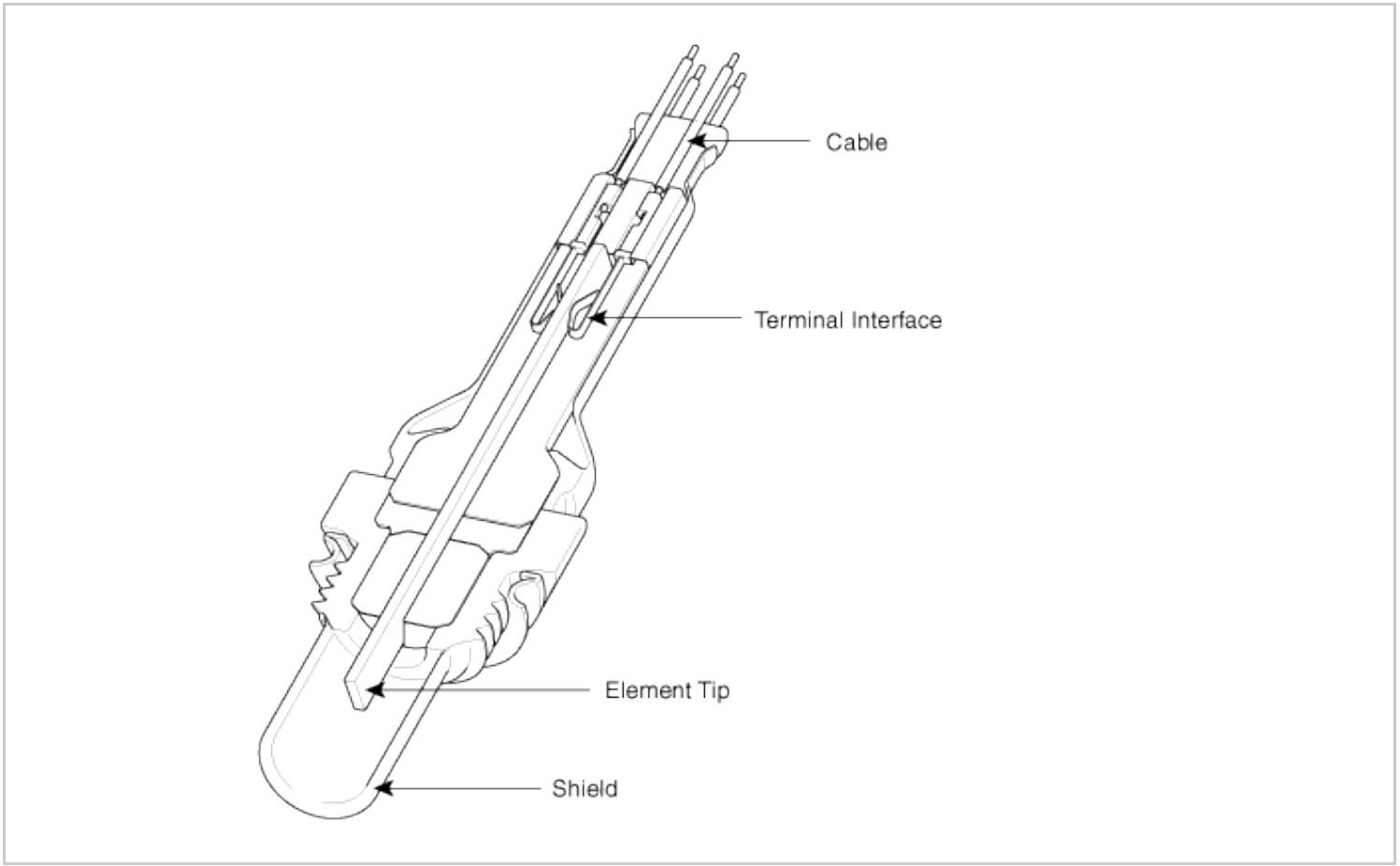
Heated Oxygen Sensor (HO2S)

INSPECTION

FUNCTION AND OPERATION PRICIPLE

Heated Oxygen Sensor (HO2S) consists of zirconium and alumina and is installed on upstream and downstream of the Manifold Catalyst Converter (MCC). After it compares oxygen consistency of the atmosphere with the exhaust gas, it transfers the oxygen consistency of the exhaust gas to the PCM. 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 is higher than 370°C (698°F). So it has a heater which is controlled by the PCM duty signal. When the exhaust gas temperature is lower than the specified value, the heater warms the sensor tip.





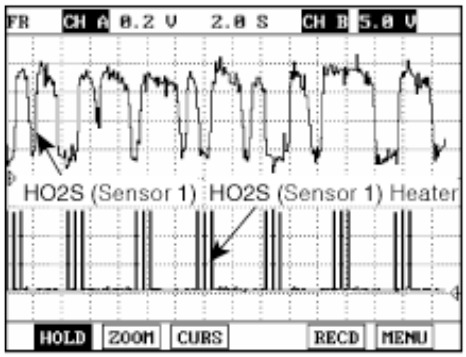
SPECIFICATION

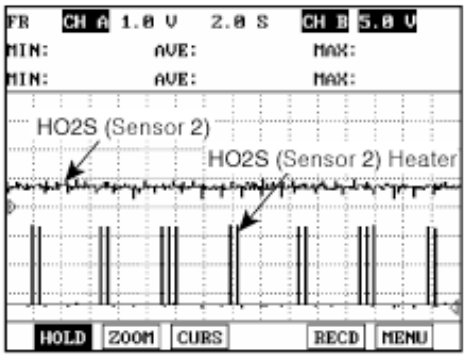
A/F Ratio	Output Voltage (V)
RICH	0.80 ~ 0.92
LEAN	0.1

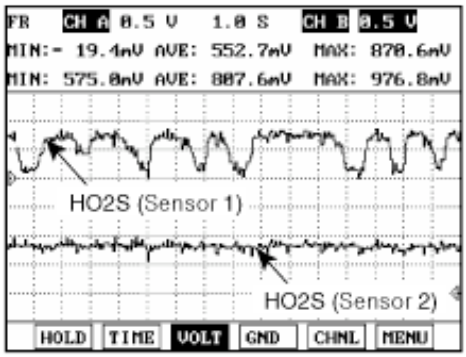
Item	Specification

Heater Resistance (Ω)	3.0 ~ 4.0Ω at 21°C (69.8°F)

WAVEFORM

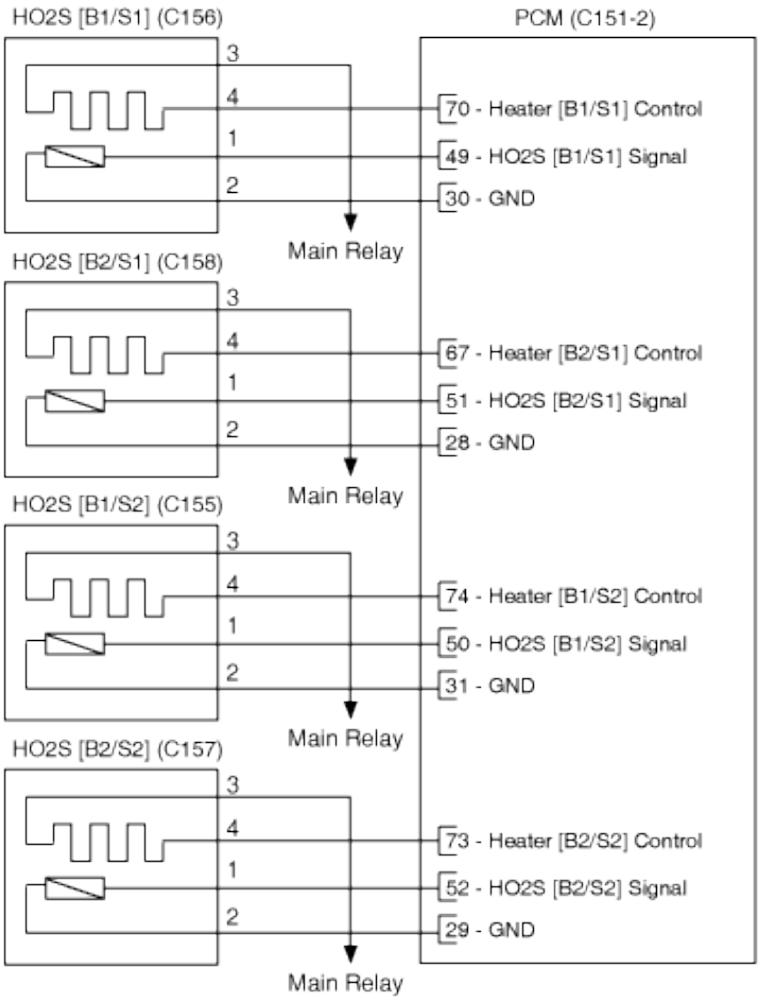






CIRCUIT DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

HO2S [B1/S1]

Terminal	Connected to	Function
1	PCM C151-2 (49)	HO2S [B1/S1] Signal
2	PCM C151-2 (30)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C151-2 (70)	Heater [B1/S1] Control

HO2S [B2/S1]

Terminal	Connected to	Function
1	PCM C151-2 (51)	HO2S [B2/S1] Signal
2	PCM C151-2 (28)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C151-2 (67)	Heater [B2/S1] Control

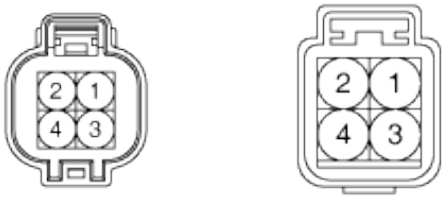
HO2S [B1/S2]

Terminal	Connected to	Function
1	PCM C151-2(50)	HO2S [B1/S2] Signal
2	PCM C151-2 (31)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C151-2 (74)	Heater [B1/S2] Control

HO2S [B2/S2]

Terminal	Connected to	Function
1	PCM C151-2 (52)	HO2S [B2/S2] Signal
2	PCM C151-2 (29)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C151-2 (73)	Heater [B2/S2] Control

[HARNESS CONNECTORS]

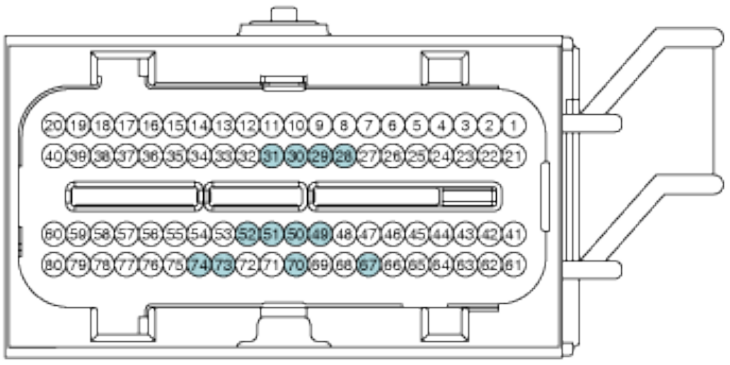


C156, C158

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]

C155, C157

HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C151-2

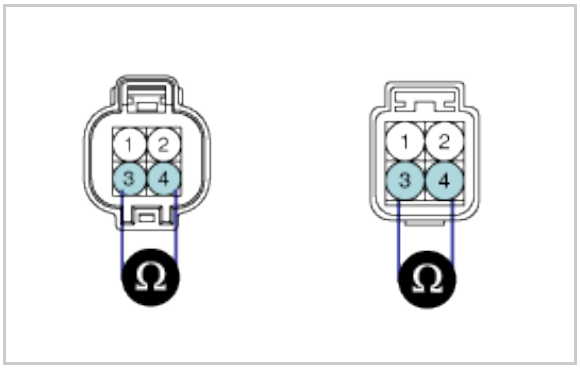
PCM

COMPONENT INSPECTION

1. Check signal waveform of HO2S using a scantool.

   Specification: Refer to "waveform".

2. Disconnet the HO2S connector.
3. Measure resistance between HO2S heater terminals 3 and 4.



4. Check that the resistance is within the specification.

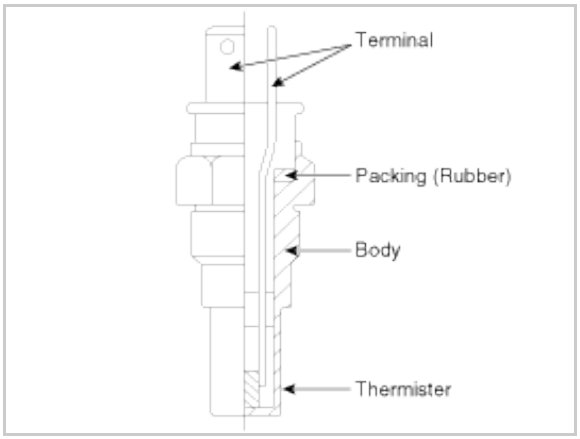
Specification: Refer to SPECIFICATION.

CVVT Oil Temperature Sensor (OTS)

INSPECTION

FUNCTION AND OPERATION PRICIPLE

The CVVT Oil Temperature Sensor (OTS) is a negative coefficient thermistor used by the PCM tl measure engine oil temperature for the purpose of adjusting CVVT calculations.

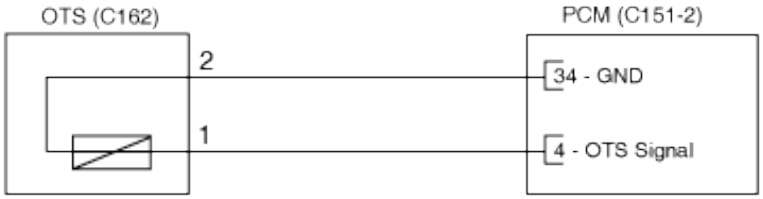


SPECIFICATION

Temperature		Resistance (kΩ)
°C	°F	
-40	-40	52.0
-20	-4	16.5
0	32	6.0
20	68	2.45
40	104	1.10
60	140	0.544
80	176	0.290
100	212	0.164
120	248	0.099

CIRCUIT DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

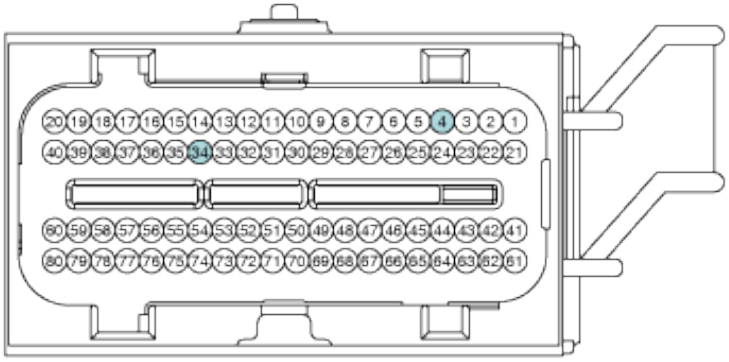
Terminal	Connected to	Function
1	PCM C151-2 (4)	OTS Signal
2	PCM C151-2 (34)	Sensor ground

[HARNESS CONNECTORS]



C162

OTS

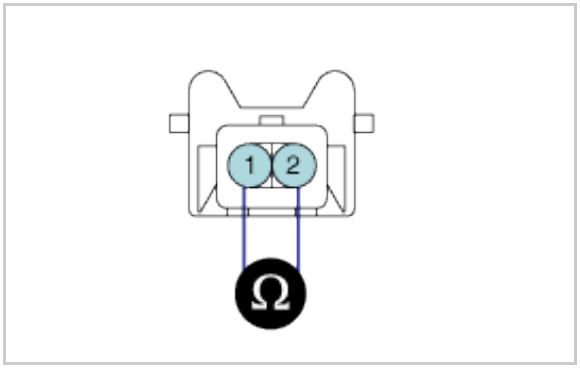


C151-2

PCM

COMPONENT INSPECTION

1. Turn ignition switch OFF.
2. Disconnect OTS connector.
3. Remove the OTS.
4. After immersing the thermistor of the sensor into water (or engine coolant), measure resistance between OTS terminals 1 and 2.



5. Check that the resistance is within the specification.

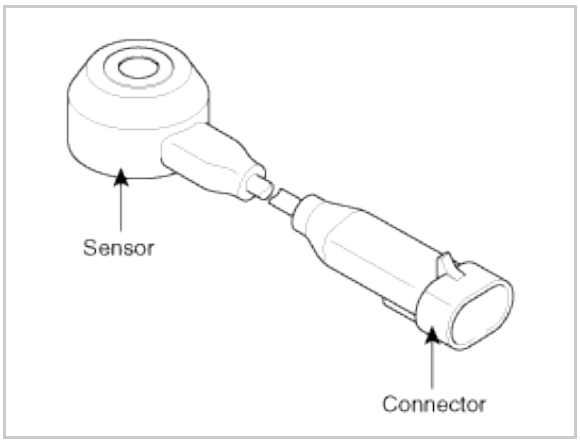
Specification: Refer to SPECIFICATION.

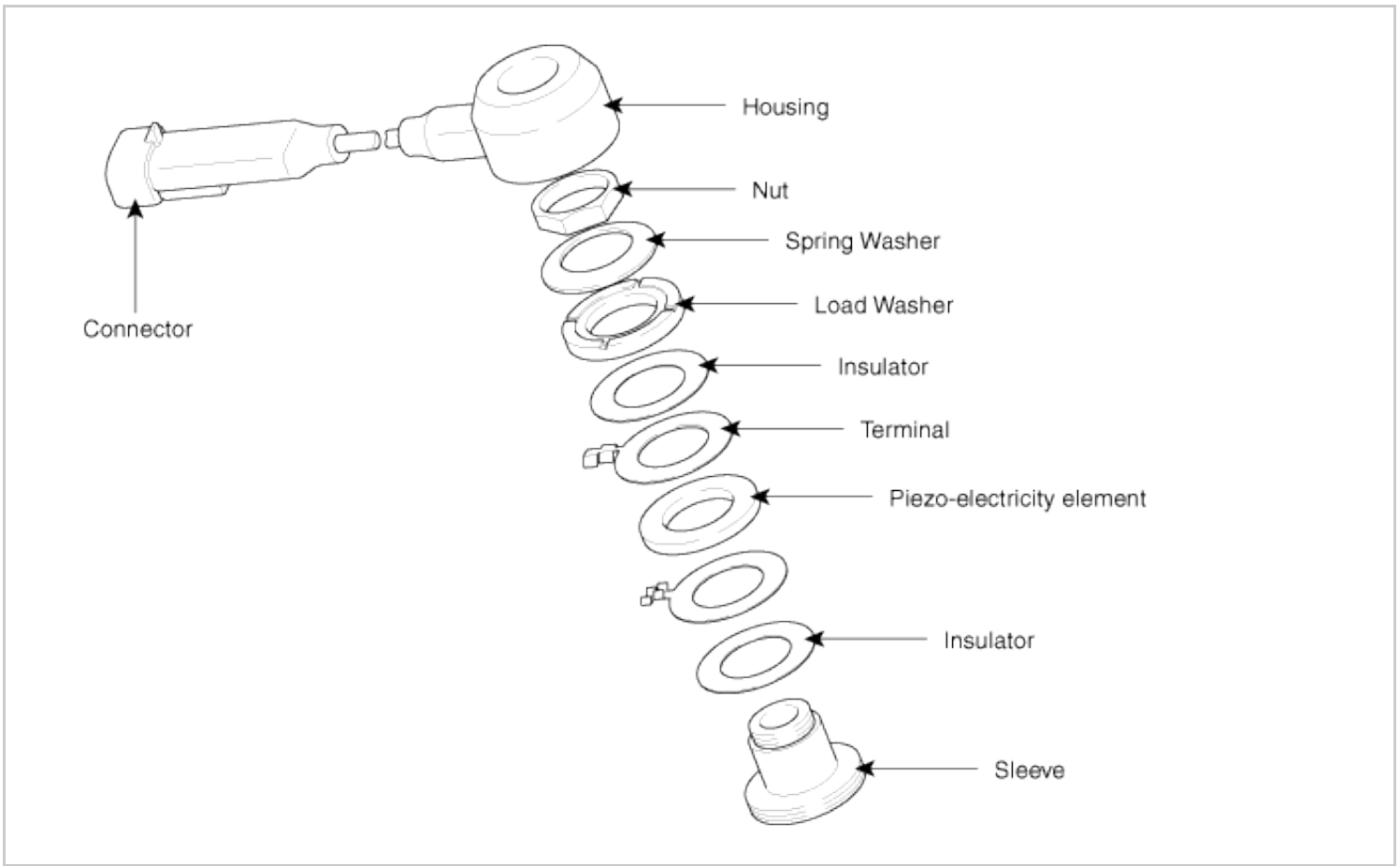
Knock Sensor (KS)

INSPECTION

FUNCTION AND OPERATION PRICIPLE

Knocking is a phenomenon characterized by undesirable vibration and noise and can cause engine damage. Knock Sensor (KS) senses engine knocking and the two sensors are installed inside the V-valley of the cylinder block. 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 PCM and the PCM retards the ignition timing. If the knocking disappears after retarding the ignition timing, the PCM will advance the ignition timing. This sequential control can improve engine power, torque and fuel economy.

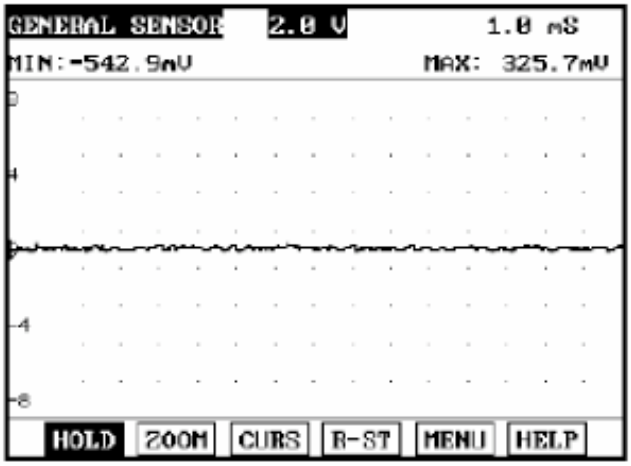




SPECIFICATION

Item	Specification
Capacitance (pF)	950 ~ 1,350pF

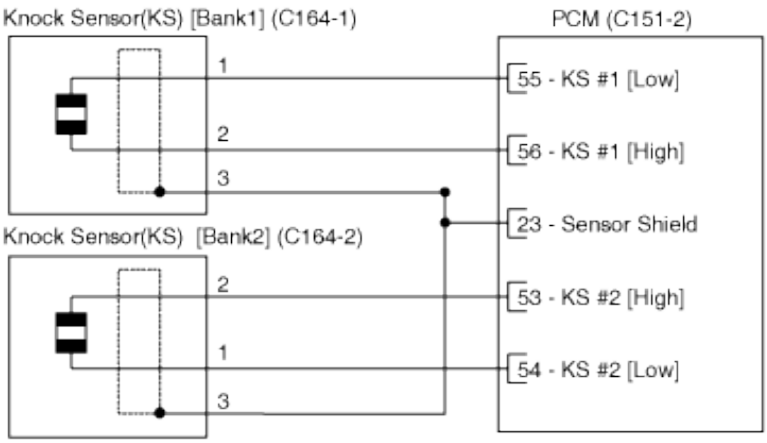
WAVEFORM



The knock sensor is installed at cycliner block to detect the vibration effectively during engine running.
The above waveform shows the signal waveform of knock sensor when knock dosen't happen. Generally, knock signal has more noise than other sensor.

CIRCUIT DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

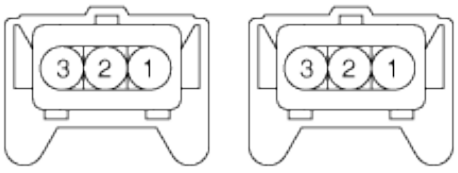
KS [Bank1]

Terminal	Connected to	Function
1	PCM C151-2 (55)	KS #1 [Low] signal
2	PCM C151-2 (56)	KS #1 [High] signal
3	PCM C151-2 (23)	Shield ground

KS [Bank2]

Terminal	Connected to	Function
1	PCM C151-2 (54)	KS #2 [Low] signal
2	PCM C151-2 (53)	KS #2 [High] signal
3	PCM C151-2 (23)	Shield ground

[HARNESS CONNECTORS]

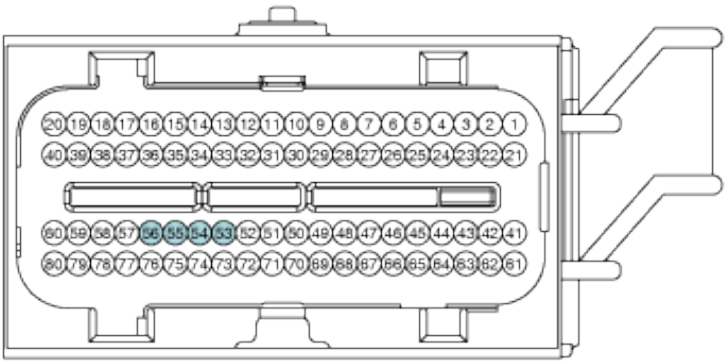


C164-1

KS [Bank1]

C164-2

KS [Bank2]



C151-2

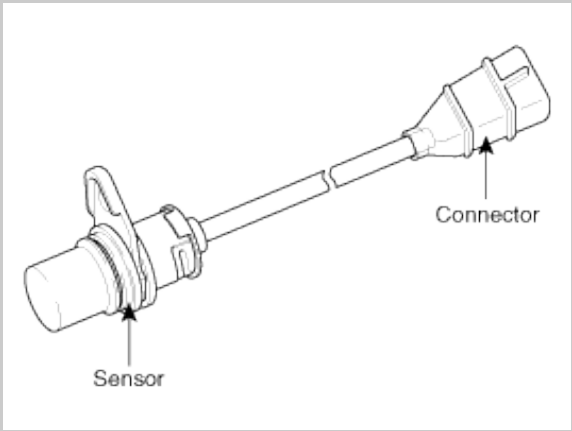
PCM

Crankshaft Position Sensor (CKPS)

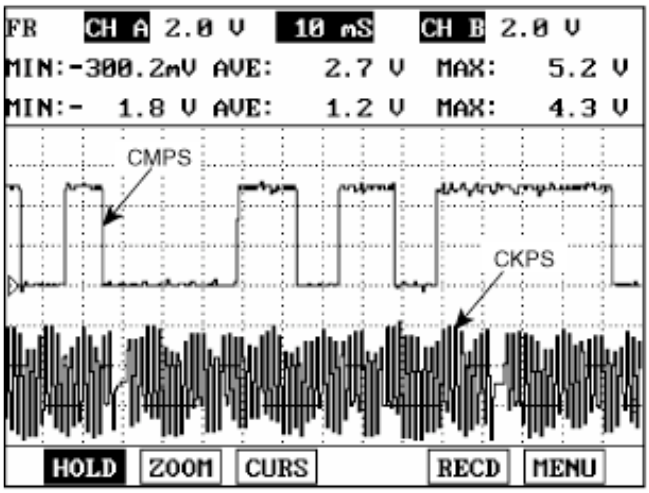
INSPECTION

FUNCTION AND OPERATION PRICIPLE

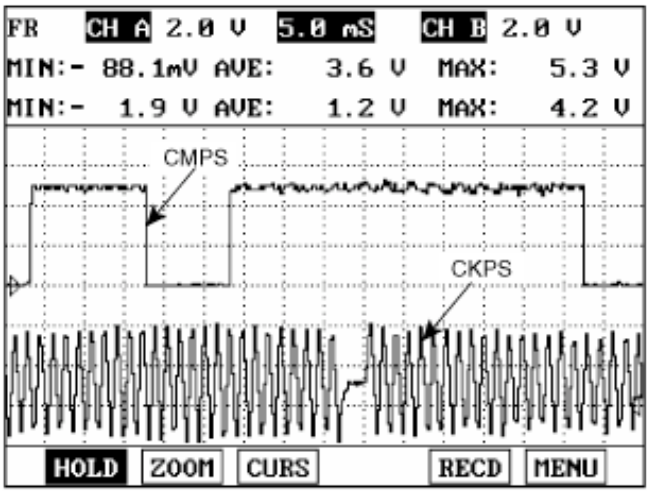
Crankshaft Position Sensor (CKPS) detects the crankshaft position and is one of the most important sensors of the engine control system. If there is no CKPS signal input, fuel is not supplied and the main relay does not operate. That is, vehicle can't run without CKPS signal. This sensor is installed on 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 CA (Crank Angle).



WAVEFORM



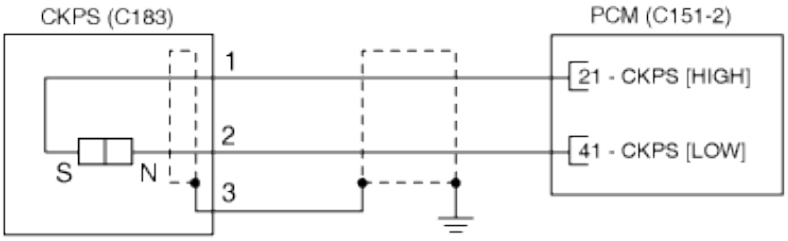
At Idle



At Idle

CIRCUIT DIAGRAM

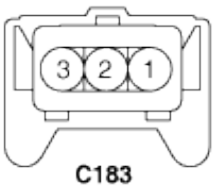
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

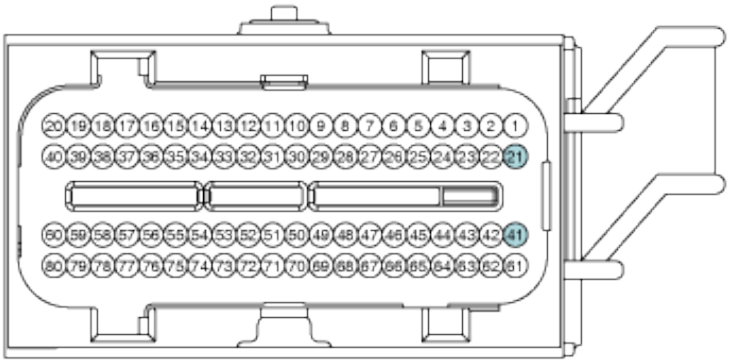
Terminal	Connected to	Function
1	PCM C151-2 (21)	CKPS [HIGH] Signal
2	PCM C151-2 (41)	CKPS [LOW] Signal
3	Chassis Ground	Sensor Shield

[HARNESS CONNECTORS]



C183

CKPS



C151-2

PCM

COMPONENT INSPECTION

1. Check signal waveform of CKPS and CMPS using a scantool.

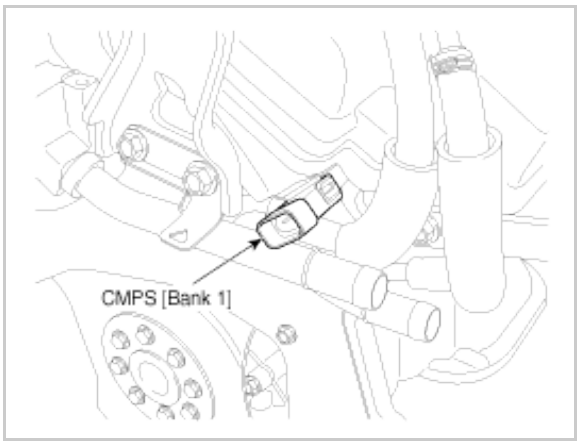
Specification : Refer to "WAVE FORM"

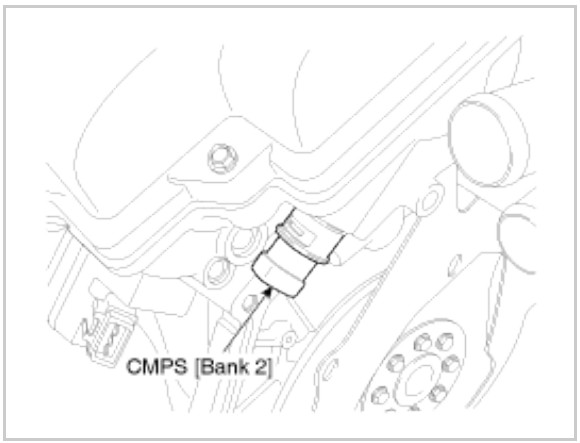
Camshaft Position Sensor (CMPS)

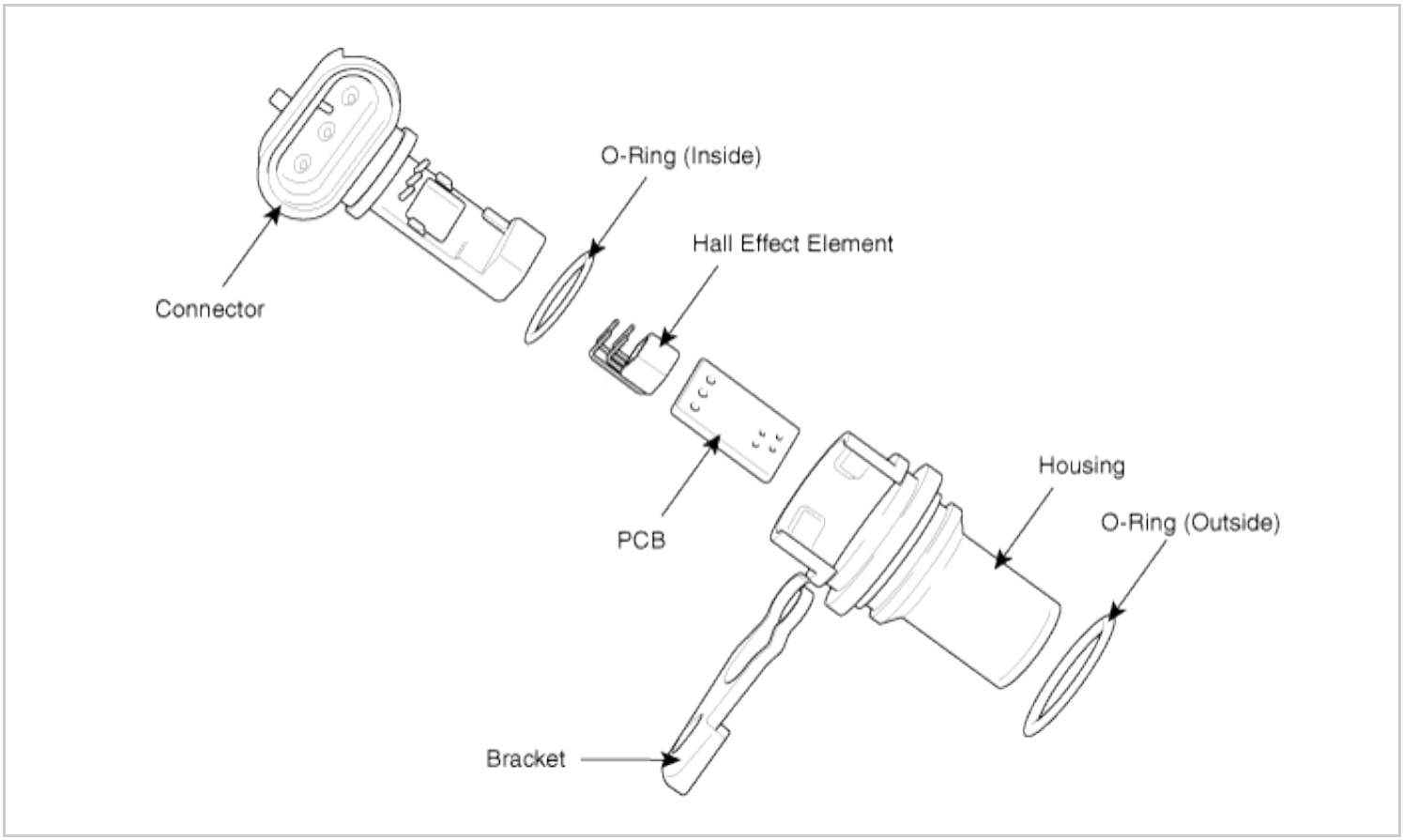
INSPECTION

FUNCTION AND OPERATION PRICIPLE

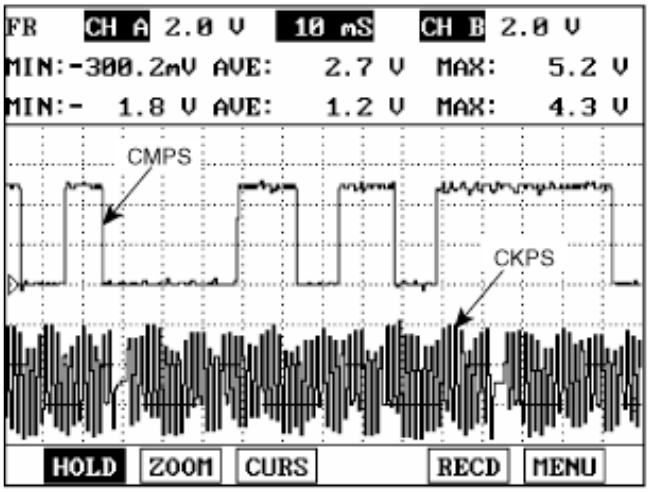
Camshaft Position Sensor (CMPS) is a hall sensor and detects the camshaft position by using a hall element. It is related with Crankshaft Position Sensor (CKPS) and detects the piston position of each cylinder which the CKPS can't detect. The two CMPS are installed on engine head cover of bank 1 and 2 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.



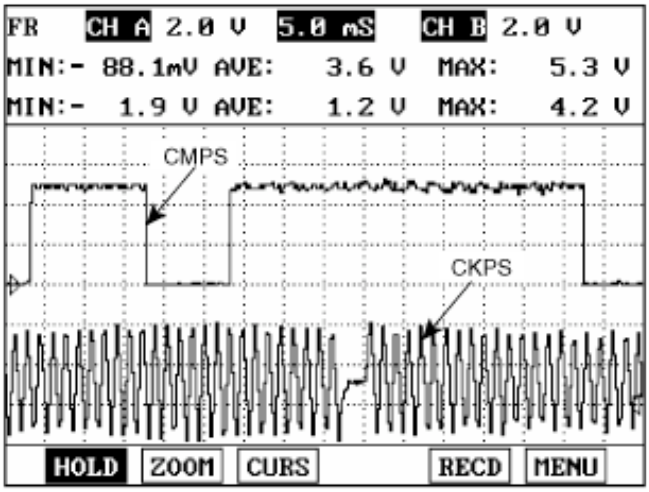




WAVEFORM



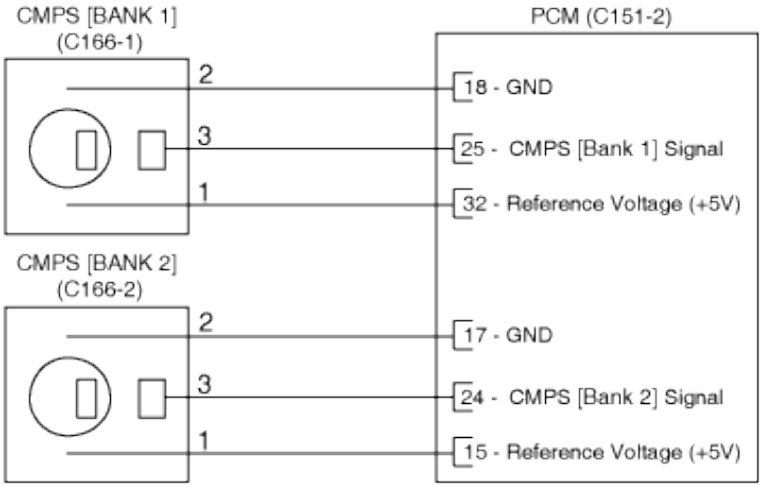
At Idle



At Idle

CIRCUIT DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

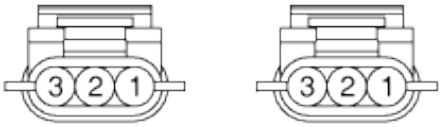
CMPS [BANK 1]

Terminal	Connected to	Function
1	PCM C151-2 (32)	Reference Voltage (+5V)
2	PCM C151-2 (18)	Sensor ground
3	PCM C151-2 (25)	CMPS [Bank 1] signal

CMPS [BANK 2]

Terminal	Connected to	Function
1	PCM C151-2 (15)	Reference Voltage (+5V)
2	PCM C151-2 (17)	Sensor ground
3	PCM C151-2 (24)	CMPS [Bank 2] signal

[HARNESS CONNECTORS]

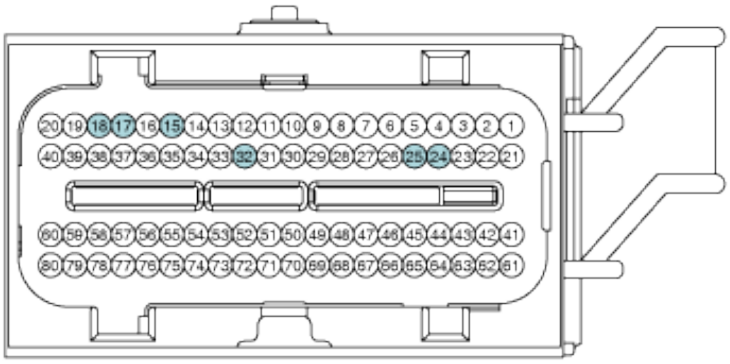


C166-1

CMPS [BANK 1]

C166-2

CMPS [BANK 2]



C151-2

PCM

COMPONENT INSPECTION

1. Check signal waveform of CMPS and CKPS using a scantool.

Specification : Refer to "WAVE FORM"

Injector

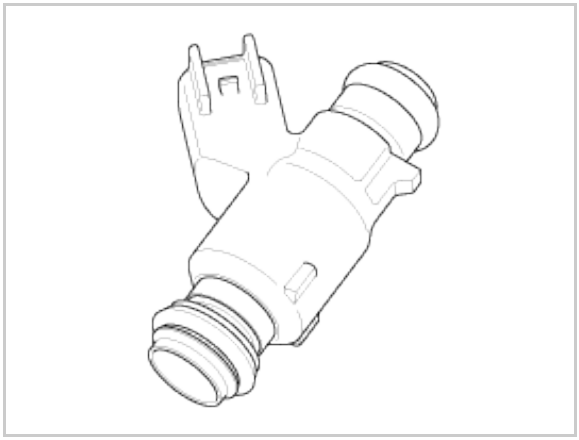
INSPECTION

FUNCTION AND OPERATION PRICIPLE

Based on information from various sensors, the PCM measures the fuel injection amount. The fuel injector is a solenoid-operated valve and the fuel injection amount is controlled by length of time that the fuel injector is held open. The PCM controls each injector by grounding the control circuit. When the PCM energizes the injector by grounding the control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should momentarily peak.

WARNING

If an injector connector is disconnected for more than 46 seconds while the engine runs, the PCM will determine that the cylinder is misfiring and cut fuel supply. So be careful not to exceed 46 seconds. But the engine runs normally in 10 seconds after turning the ignition key off.

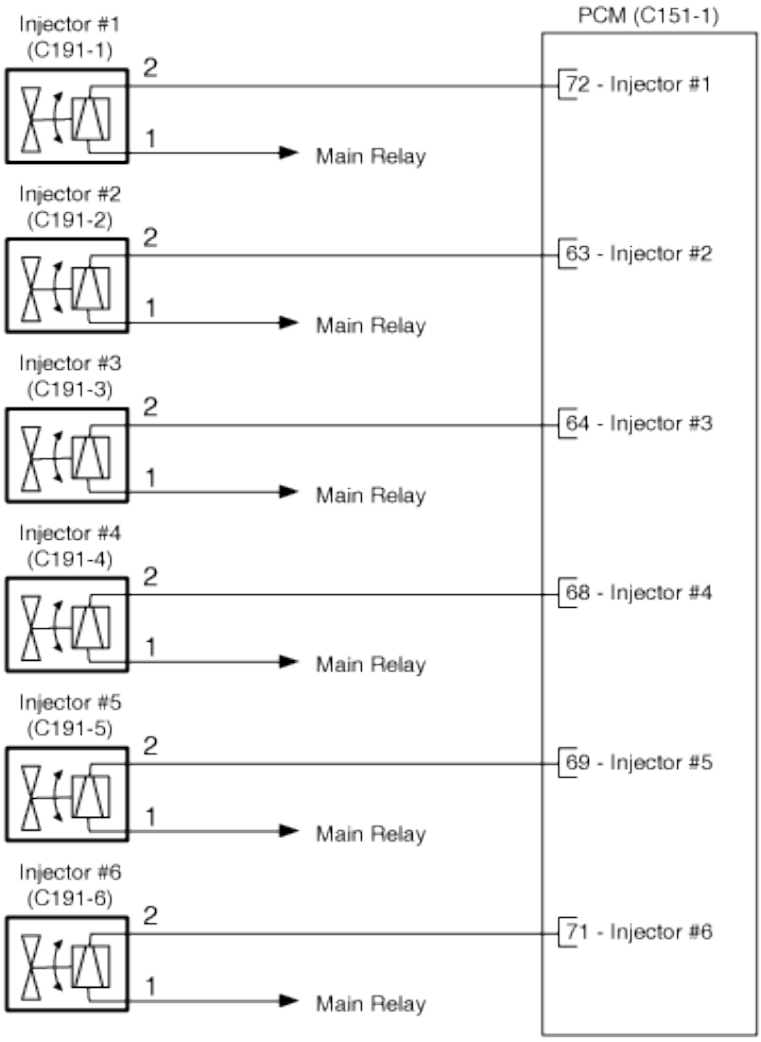


SPECIFICATION

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

CIRCUIT DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Injector #1

Terminal	Connected to	Function
1	PCM C151-1 (72)	Injector #1 control
2	Main Relay	Battery Voltage (B+)

Injector #2

Terminal	Connected to	Function
1	PCM C151-1 (63)	Injector #2 control
2	Main Relay	Battery Voltage (B+)

Injector #3

Terminal	Connected to	Function
1	PCM C151-1 (64)	Injector #3 control
2	Main Relay	Battery Voltage (B+)

Injector #4

Terminal	Connected to	Function
1	PCM C151-1 (68)	Injector #4 control
2	Main Relay	Battery Voltage (B+)

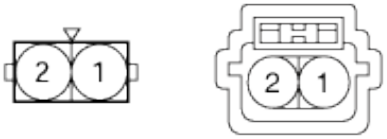
Injector #5

Terminal	Connected to	Function
1	PCM C151-1 (69)	Injector #5 control
2	Main Relay	Battery Voltage (B+)

Injector #6

Terminal	Connected to	Function
1	PCM C151-1 (71)	Injector #6 control
2	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTORS]

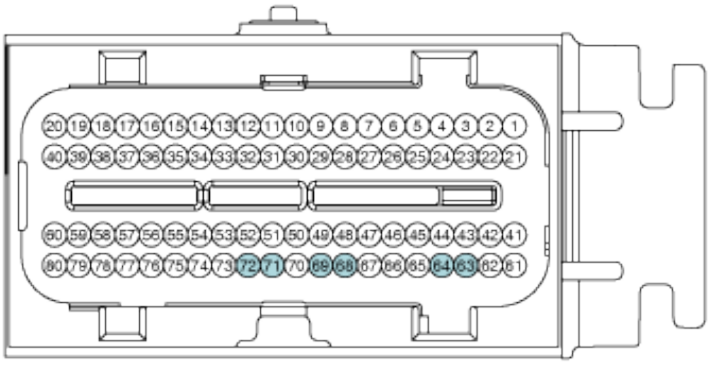


C191-1,3,5

Injector #1,3,5

C191-2,4,6

Injector #2,4,6

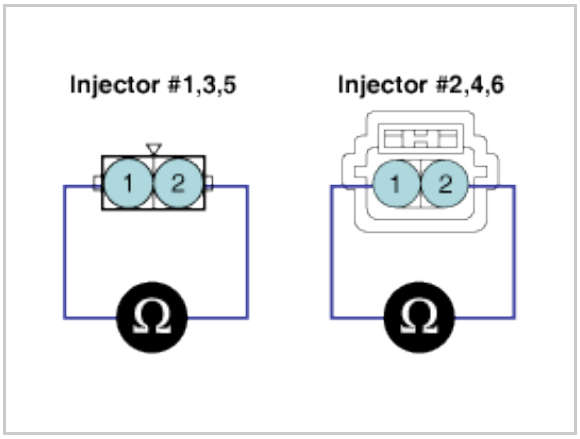


C151-1

PCM

COMPONENT INSPECTION

1. Turn ignition switch OFF.
2. Disconnect injector connector.
3. Measure resistance between injector terminals 1 and 2.



4. Check that the resistance is within the specification.

Specification: Refer to SPECIFICATION.

CVVT Oil Control Valve (OCV)

INSTALLATION

CAUTION

If the OCVs are installed incorrectly, the vehicle may be damaged.
So when installing them, ensure the OCV and harness connector colors match(Components and harness side).

[Bank and its color]

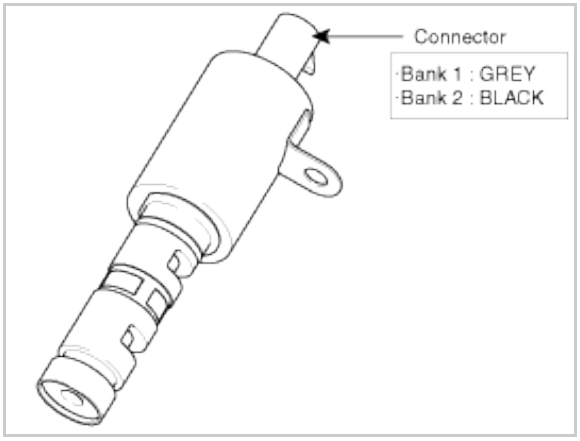
Bank	Component side	Harness side
Bank 1 (RH)	Grey	Grey
Bank 2 (LH)	Black	Black

INSPECTION

FUNCTION AND OPERATION PRICIPLE

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 each intake camshaft through PCM control of an oil control valve. This system uses two oil control valves, one on each bank. An Oil Temperature Sensor (OTS) is used to allow PCM monitoring of engine oil temperature. As oil is directed into the chambers of the CVVT assembly, the cam phase is changed to suit various performance and emissions requirements..

1. When camshaft rotates engine rotation-wise: Intake-Advance / Exhaust-Retard
2. When camshaft rotates counter engine rotation-wise: Intake- Retard / Exhaust- Advance

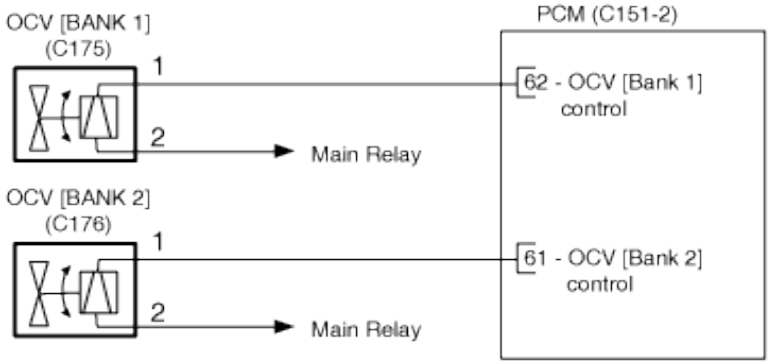


SPECIFICATION

Item	Specification
Coil Resistance (Ω)	6.7 ~ 7.7Ω at 20°C (68°F)

CIRCUIT DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

OCV [BANK 1]

Terminal	Connected to	Function
1	PCM C151-2 (62)	OCV [Bank 1] control
2	Main Relay	Battery Voltage (B+)

OCV [BANK 2]

Terminal	Connected to	Function
1	PCM C151-2 (61)	OCV [Bank 2] control
2	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTORS]

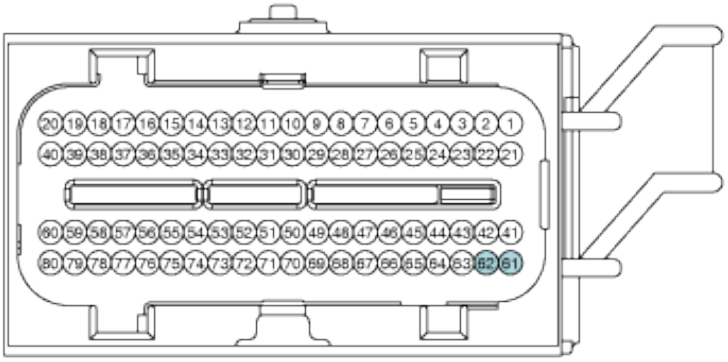


C175

OCV [Bank 1]

C176

OCV [Bank 2]

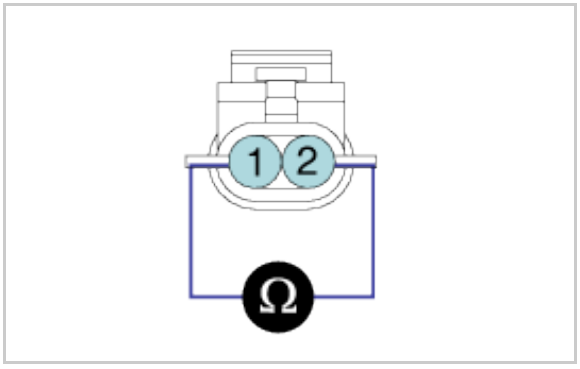


C151-2

PCM

COMPONENT 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.

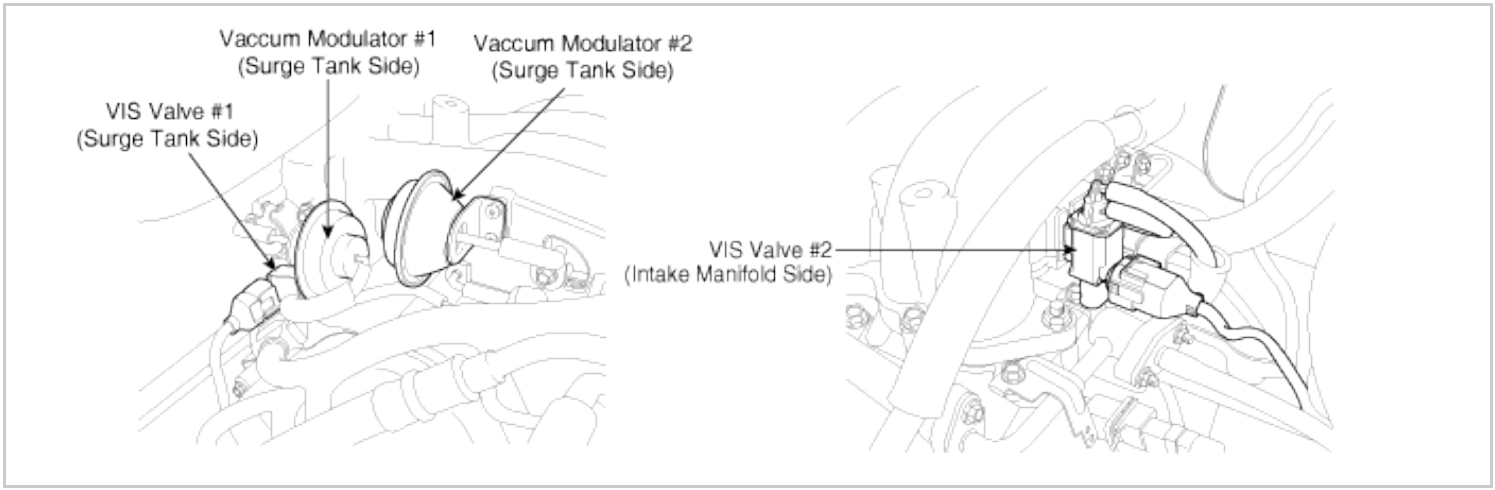
Variable Intake Solenoid Valve (VIS)

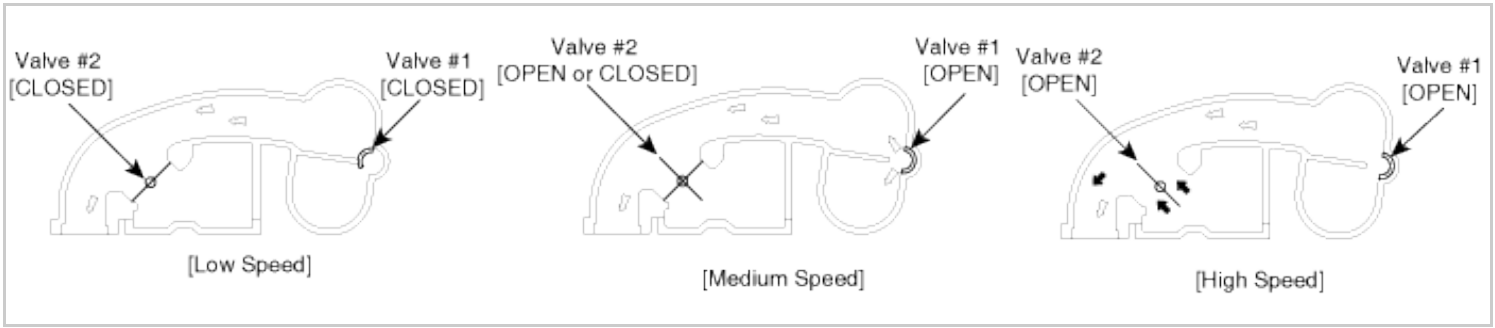
INSPECTION

FUNCTION AND OPERATION PRICIPLE

Variable Intake manifold Solenoid (VIS) valves are installed on surge tank (VIS Valve #1) and intake manifold (VIS Valve #2). These VIS valve #1 and #2 control vacuum modulators which activate valves in surge tank and intake manifold. These valves are opened or closed by PCM according to engine condition (Refer to below table).

Engine Condition	VIS Valve #1 (Surge Tank)	VIS Valve #2 (In-manifold)	Operation
Low Speed	Closed	Closed	Increasing engine performance in low engine speed by reducing intake interference among cylinders
Medium Speed	Open	Open or closed	Increasing intake efficiency
High Speed	Open	Open	Minimizing intake resistance by shortening intake manifold length and increasing area of air entrance



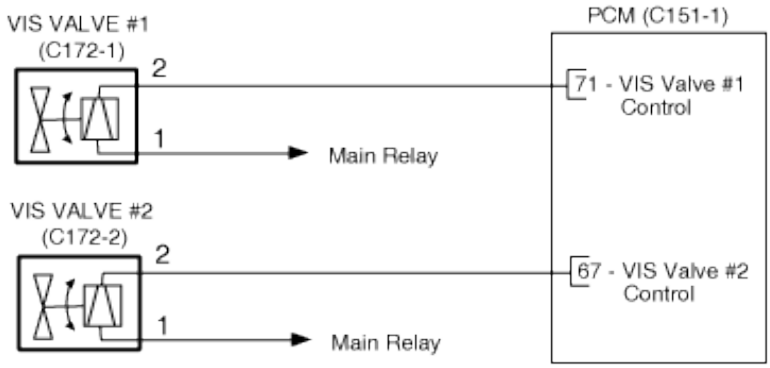


SPECIFICATION

Item	Specification
Coil Resistance (Ω)	29.0 ~ 35.0 Ω at 20°C (68°F)

CIRCUIT DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

VIS VALVE #1

Terminal	Connected to	Function
1	Main Relay	Battery voltage (B+)
2	PCM C151-1 (71)	VIS Valve #1 control

VIS VALVE #2

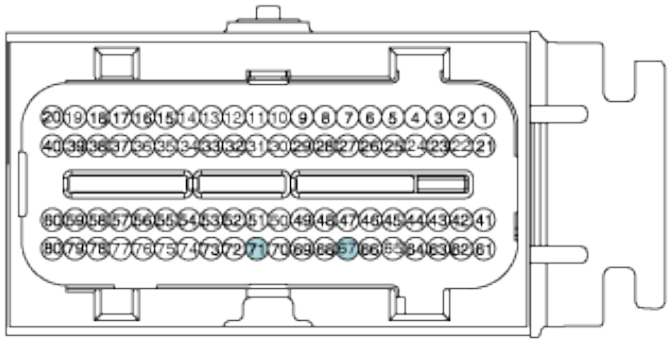
Terminal	Connected to	Function
1	Main Relay	Battery voltage (B+)
2	PCM C151-1 (67)	VIS Valve #2 control

[HARNESS CONNECTORS]



C172-1,2

VIS VALVE #1,2

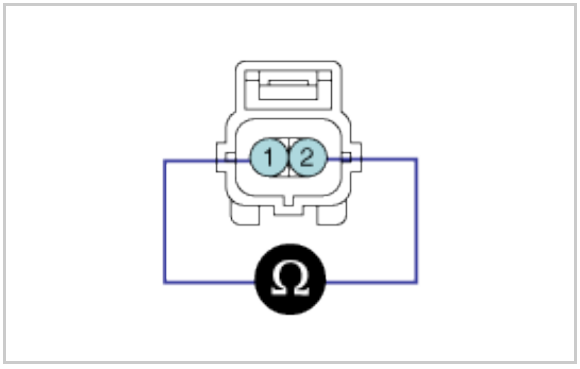


C151-1

PCM

COMPONENT INSPECTION

1. Turn ignition switch OFF.
2. Disconnect VIS Valve connector.
3. Measure resistance between VIS Valve #1,2 terminals 1 and 2.



4. Check that the resistance is within the specification.

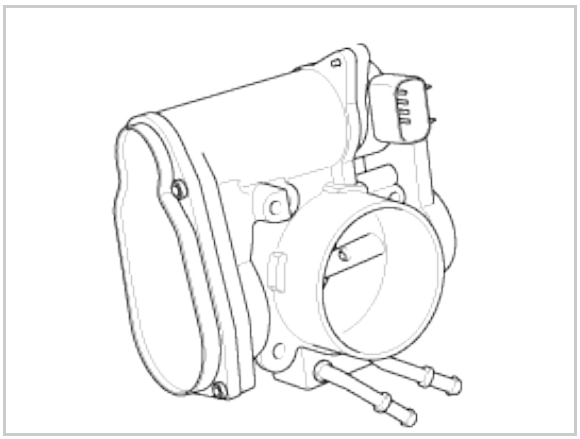
Specification: Refer to SPECIFICATION.

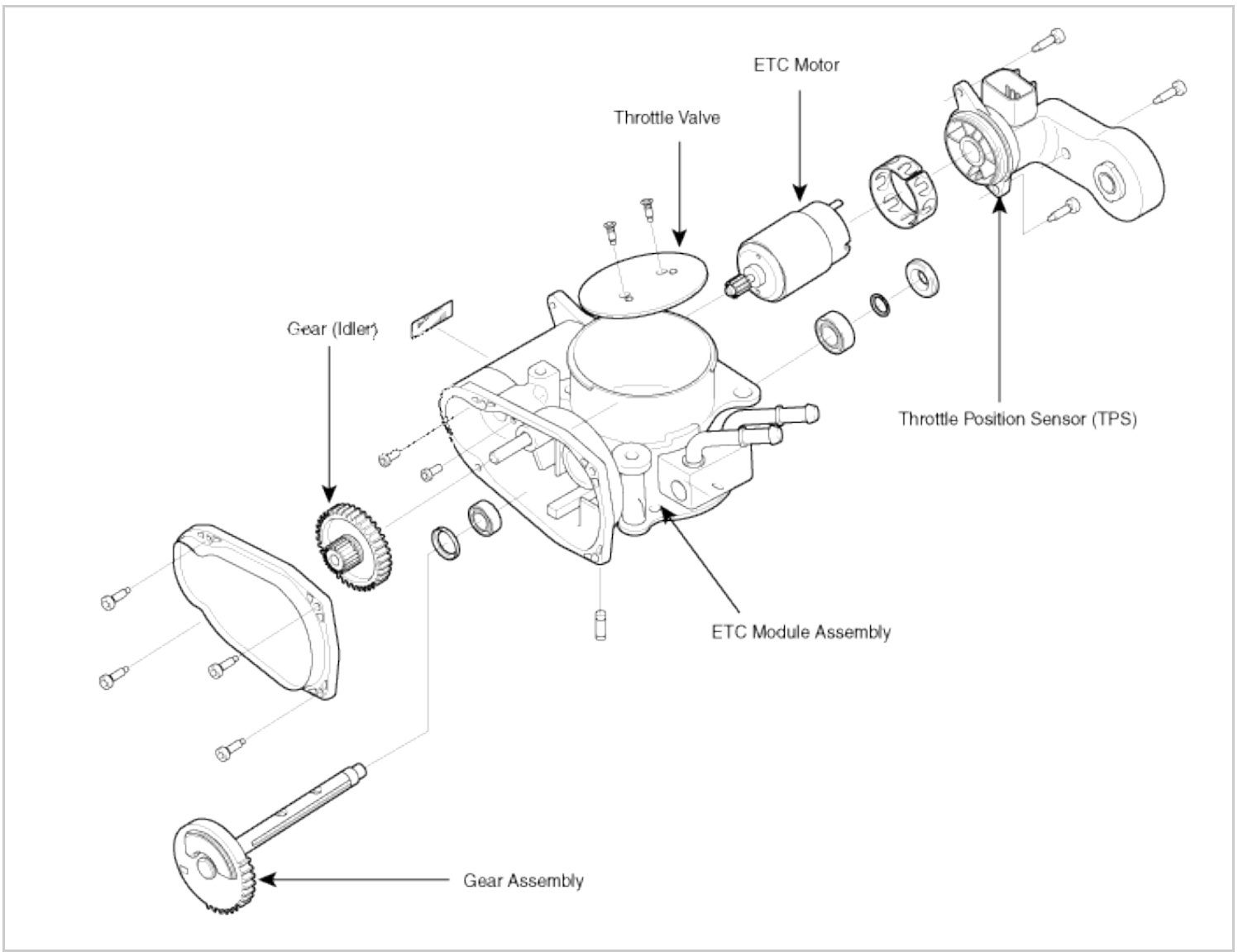
Electronic Throttle System (ETS)

INSPECTION

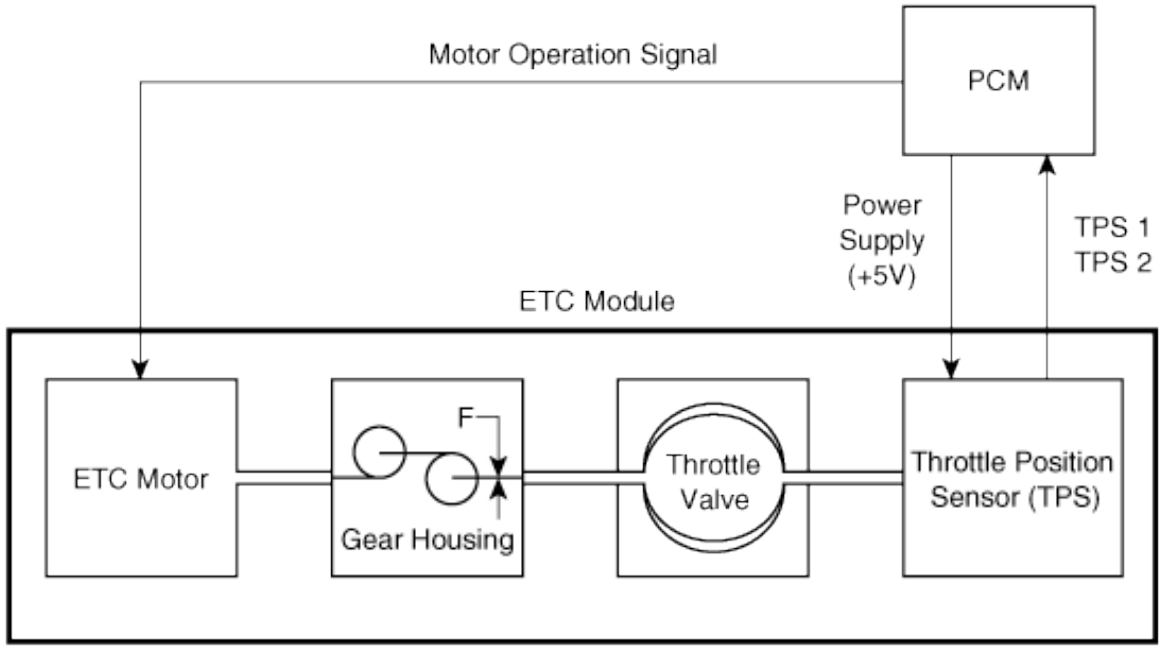
FUNCTION AND OPERATION PRICIPLE

ETC (Electronic Throttle Control) system is electronically controlled throttle device which controls the throttle valve. It consists of ETC motor, throttle body and throttle position sensor (TPS). A mechanical throttle control system receives a driver's intention via a wire cable between the accelerator and the throttle valve, while this ETC system uses the signal from the Accelerator Position Sensor (APS) installed on the accelerator pedal. After the PCM receives the APS signal and calculates the throttle opening angle, it activates the throttle valve by using the ETC motor. Additionally, it can handle cruise control function without any special devices.





SHEMATIC DIAGRAM

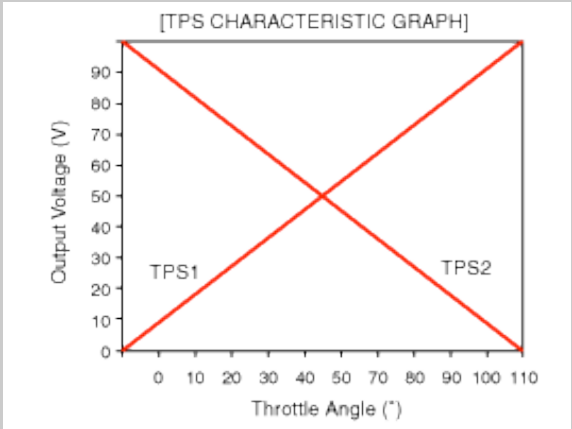


SPECIFICATION

[THROTTLE POSITION SENSOR]

Throttle Angle(°)	Output Voltage(V) [Vref = 5.0V]	
	TPS1	TPS2
0°	0V	5.0V
10°	0.5V	4.5V
20°	0.9V	4.1V
30°	1.4V	3.6V
40°	1.8V	3.2V
50°	2.3V	2.7V
60°	2.7V	2.3V
70°	3.2V	1.8V
80°	3.6V	1.4V
90°	4.1V	0.9V
100°	4.5V	0.5V
110°	5.0V	0V

Item	Sensor Resistance
TPS1	4.0 ~ 6.0kΩ at 20°C (68°F)
TPS2	2.7 ~ 4.1kΩ at 20°C (68°F)

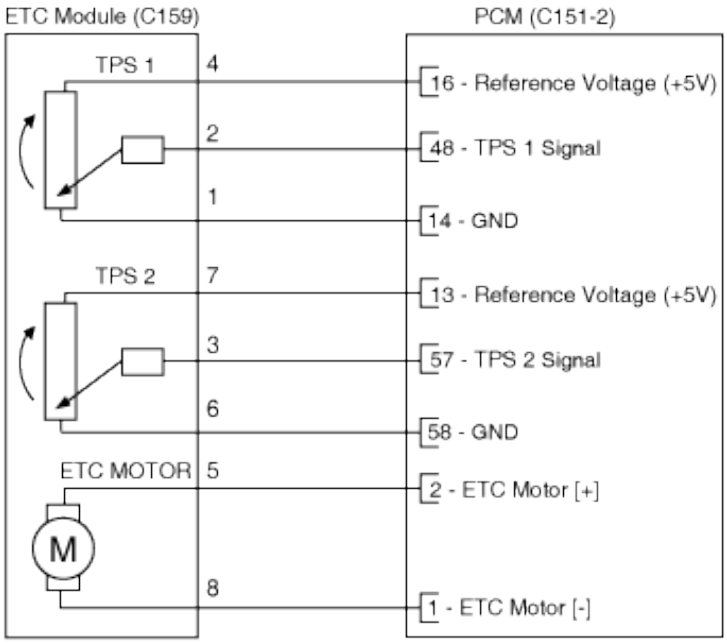


[ETC MOTOR]

Item	Sensor Resistance
Coil Resistance (Ω)	1.275 ~ 1.725Ω at 20°C (68°F)

CIRCUIT DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

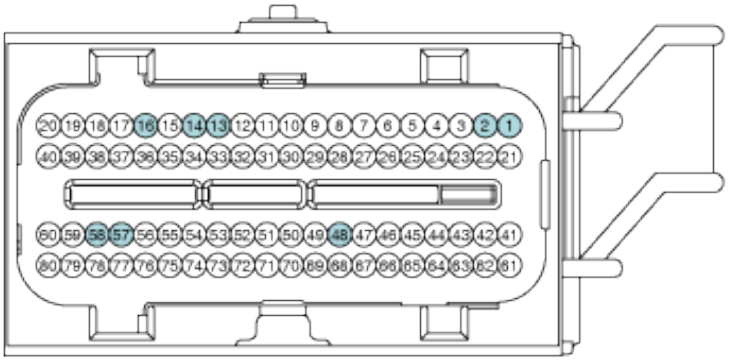
Terminal	Connected to	Function
1	PCM C151-2 (14)	TPS 1 Ground
2	PCM C151-2 (48)	TPS 1 Signal
3	PCM C151-2 (57)	TPS 2 Signal
4	PCM C151-2 (16)	TPS 1 Reference Voltage (+5V)
5	PCM C151-2 (2)	ETC Motor [+] Control
6	PCM C151-2 (58)	TPS 2 Ground
7	PCM C151-2 (13)	TPS 2 Reference Voltage (+5V)
8	PCM C151-2 (1)	ETC Motor [-] Control

[HARNESS CONNECTORS]



C159

ETC MODULE



C151-2

PCM

FAIL-SAFE MODE

Mode	Description	Symptom	Possible Cause
			a. ETC system can't proceed reliable

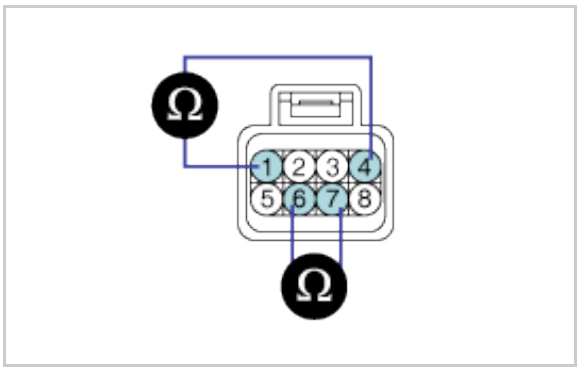
MODE 1	FORCED ENGINE SHUTDOWN	Engine stop	algorithm procedure a. Fatal PCM internal programming error b. Faulty intake system or throttle body
MODE 2	FORCED IDLE & POWER MANAGEMENT	Forced idle state controlled by fuel quantity regulation and ignition timing adjustment	a. ETC system can't control engine power via throttle device b. Disabled throttle control or broken throttle position information
MODE 3	FORCED IDLE	Forced idle state and no response for accelerator activation	a. No information about the accelerator position a. Malfuctioning APS 1 and 2, faulty A/D converter or internal controller
MODE 4	LIMIT PERFORMANCE & POWER MANAGEMENT	Engine power is determined by accelerator position and idle power requirement (Limited vehicle running)	a. ETC system can't securely control engine power
MODE 5	LIMIT PERFORMANCE	a. Engine power varies with accelerator position, but driver perceives lack of engine power. b. MIL ON (Normal vehicle running)	a. Not reliable accelerator position signal or bad maximum power generation a. Faulty APS, ignition voltage or internal controller
MODE 6	NORMAL	Normal	

COMPONENT INSPECTION

1. Connect a scantool on Diagnoisis Link Connector (DLC).
2. Start engine and check output voltages of TPS 1 and 2 at C.T and W.O.T.

Condition	Output Voltage (V)	
	TPS 1	TPS 2
C.T	0.25 ~ 0.9V	Min. 4.0V
W.O.T	Min. 4.0V	0.25 ~ 0.9V

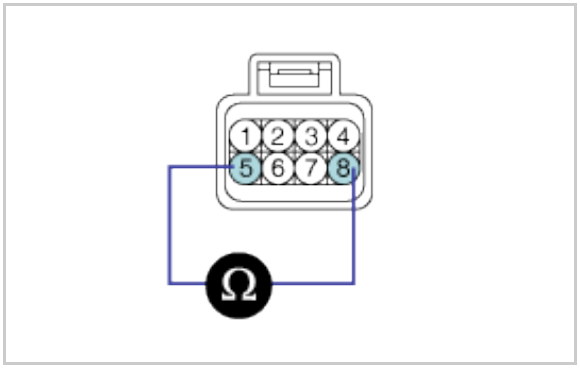
3. Turn ignition switch OFF and disconnect the scantool from the DLC.
4. Disconnect ETC module connector and measure resistance between ETC module terminals 4 and 1 (TPS 1).
5. Measure resistance between ETC module terminals 7 and 6 (TPS 2).



Specification: Refer to SPECIFICATION.

ETC MOTOR

1. Disconnect ETC module connector and measure resistance between ETC module terminals 5 and 8.



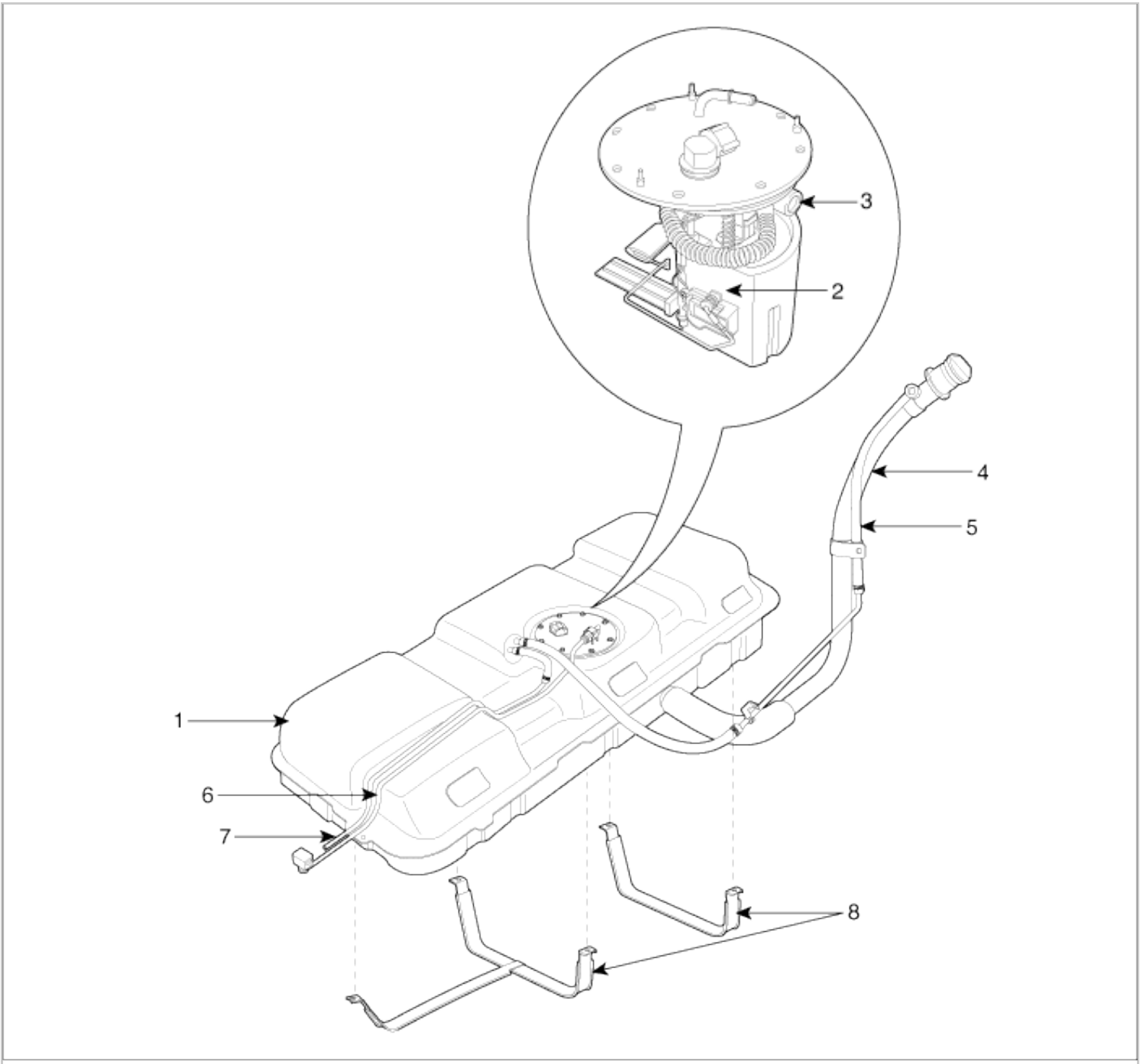
Specification: Refer to SPECIFICATION.

ETC SYSTEM INITIALIZATION

1. Erase DTC(s) memorized in PCM with a scan tool.
2. Turn ignition switch off and wait for about 10 seconds.
3. Turn ignition switch on for more then 1 second. (At this time, the PCM records initial position of ETC motor on its EEPROM).

Fuel Delivery System

COMPONENT LOCATION

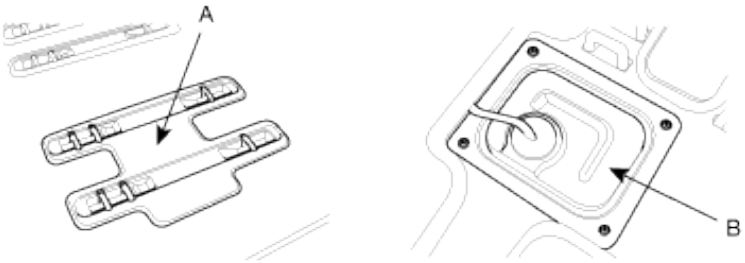


1. Fuel Tank
2. Fuel Pump (including Fuel Filter)
3. Fuel Pressure Regulator
4. Fuel Filler Pipe
5. Leveling Pipe
6. Tube - Fuel Feed
7. Tube (Canister ↔ Fuel Tank)
8. Fuel Tank Band

FUEL PRESSURE TEST

1. PREPARING

1. Remove the 2nd seat(s) (Refer to "BD" group in this WORKSHOP MANUAL).
2. Remove the Striker Cover (A).
3. Remove the Service Cover (B).

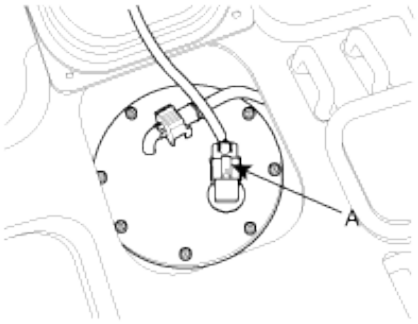


2. RELEASE THE INTERNAL PRESSURE

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.



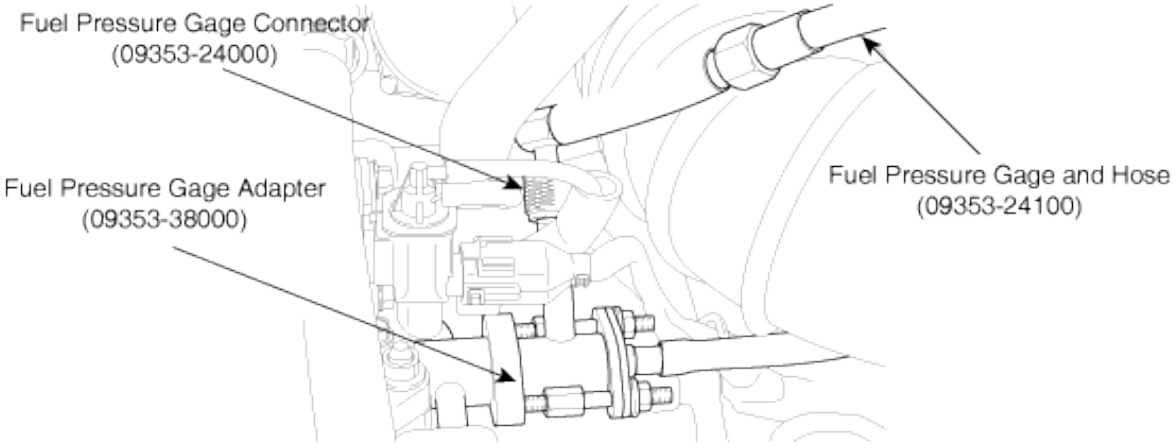
3. INSTALL THE SPECIAL SERVICE TOOL (SST) FOR MEASURING THE FUEL PRESSURE

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 Gauge Adapter (09353-38000) between the delivery pipe and the fuel feed hose.
3. Connect the Fuel Pressure Gauge Connector (09353-24000) to the Fuel Pressure Gauge Adapter (09353-38000).
4. Connect the Fuel Pressure Gauge and Hose (09353-24100) to Fuel Pressure Gauge Connector (09353-24000).
5. Connect the fuel feed hose to the Fuel Pressure Gauge 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 PRESURE 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: 374 ~ 384 kpa (3.82 ~ 3.92 kgf/㎠, 54.3 ~ 55.8 psi)

- If the measured fuel pressure differs from the standard value, perform the necessary repairs using the table below.

Condition	Probable Cause	Suspected Area
Fuel Pressure too low	Clogged fuel filter	Fuel filter
	Fuel leak on the fuel-pressure regulator that is assembled on fuel pump because of poor seating of the fuel-pressure regulator.	Fuel Pressure Regulator
Fuel Pressure too High	Sticking fuel pressure regulator	Fuel Pressure Regulator

5. Stop the engine and check for a change in the fuel pressure gauge reading.

After engine stops, the gauge reading should hold for about 5 minutes

- Observing the declination of the fuel pressure when the gauge reading drops and perform the necessary repairs using the table below.

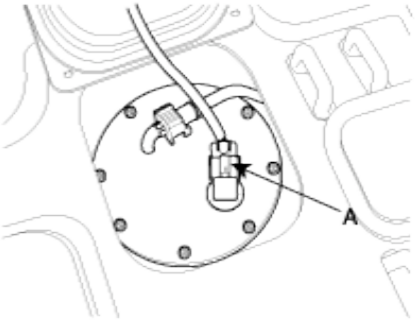
Condition	Probable Cause	Supected Area
Fuel pressure drops slowly after engine is stopped	Injector leak	Injector
Fuel pressure drops immediately after engine is stopped	The check valve within the fuel pump is open	Fuel Pump

6. RELEASE THE INTERNAL PRESSURE

1. Disconnect the fuel pump connector(A).
2. Start the engine and wait until fuel in fuel line is exhausted.
3. After the engine stalls, turn the ignition switch to OFF position and 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 Gauge and Hose (09353-24100) from the Fuel Pressure Gauge Connector (09353-24000).
2. Disconnect the Fuel Pressure Gauge Connector (09353-24000) from the Fuel Pressure Gauge Adapter (09353-38000).
3. Disconnect the fuel feed hose from the Fuel Pressure Gauge Adapter (09353-38000).
4. Disconnect the Fuel Pressure Gauge Adapter (09353-38000) from the delivery pipe.

CAUTION

Cover the hose connection with a shop towel to prevent splashing of fuel caused by residual pressure in the fuel line.

5. Conenct the fuel feed hose to the delivery pipe.

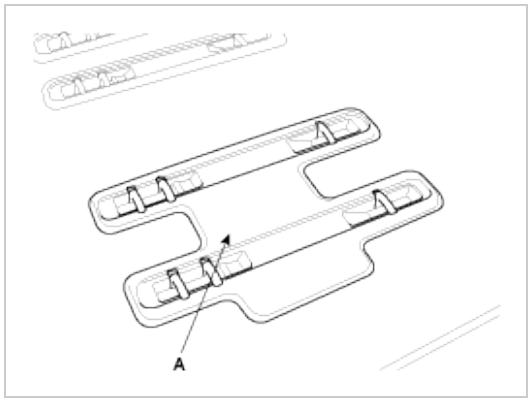
8. INSPECT FUEL LEAKAGE ON CONNECTION

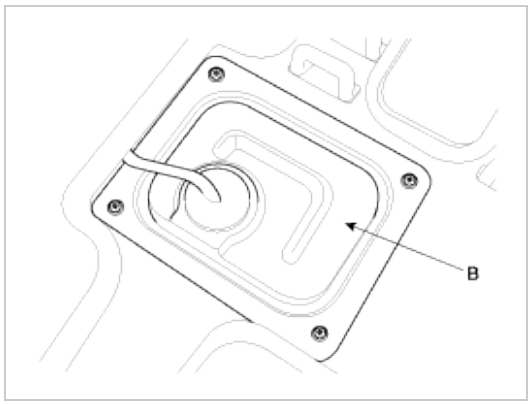
1. Connect the battery negative (-) terminal.
2. Apply battery voltage to the fuel pump terminal and activate the fuel pump. With fuel pressure applied, check that there is no fuel leakage from the fuel pressure gauge or connection part.
3. If the vehicle is normal, connect the fuel pump connector.

Fuel Tank

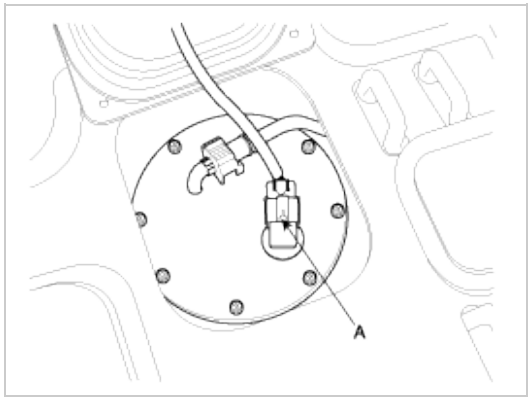
REMOVAL

1. Preparation
   (1) Remove the 2nd seat(s) (Refer to "BD" group in this WORKSHOP MANUAL).
   (2) Remove the striker cover (A).
   (3) Remove the Service Cover (B).



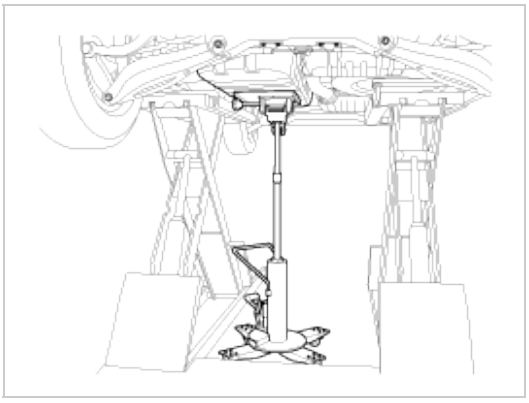


   (4) Disconnect the Fuel Pump Connector (A).

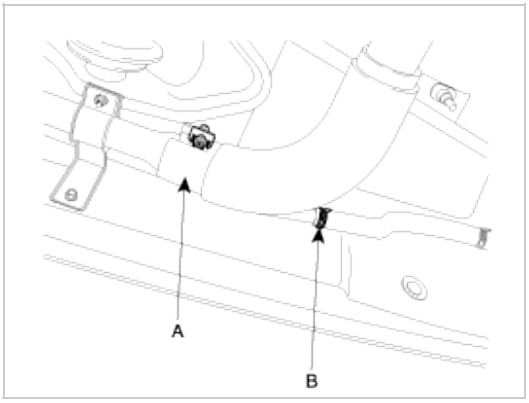


   (5) Start the engine and wait until fuel in fuel line is exhausted.
   (6) After the engine stalls, turn the ignition switch OFF.

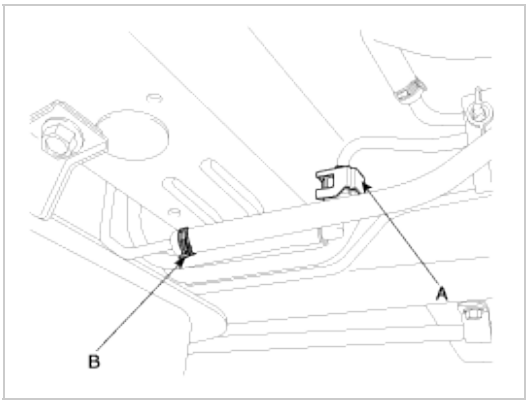
2. Lift the vehicle and support it with a jack.



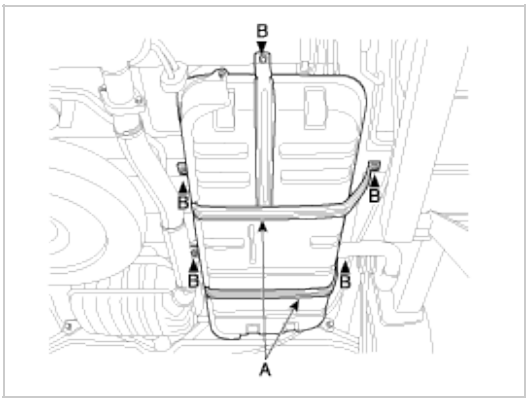
3. Disconnect the fuel filler hose (A) and the leveling hose (B).



4. Disconnect the fuel feed quick connector (A) and vaccum hose (B).



5. Remove the fuel tank band (A) with unscrewing the mounting bolts (B) and remove the fuel tank from the vehicle.



INSTALLATION

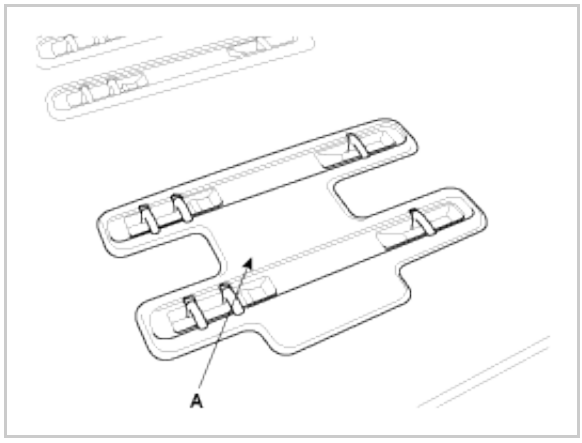
1. Install the Fuel Tank according to the reverse order of "REMOVAL" procedure.

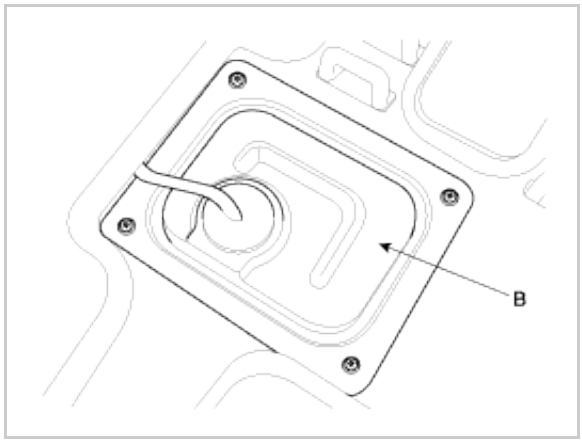
Fuel tank band mounting bolts :
39.2 ~ 53.9 N·m (4.0 ~ 5.5 kgf·m, 28.9 ~ 39.8 lbf·ft)

Fuel Pump

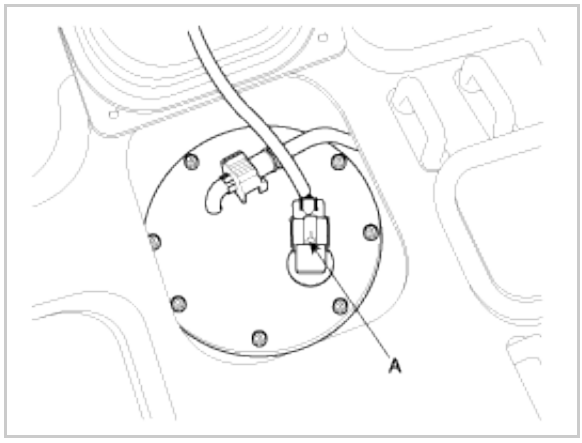
REMOVAL(INCLUDING FUEL FILTER AND FUEL PRESSURE REGULATOR)

1. Preparation
   (1) Remove the 2nd seat(s) (Refer to "BD" group in this WORKSHOP MANUAL).
   (2) Remove the striker cover (A).
   (3) Remove the Service Cover (B).



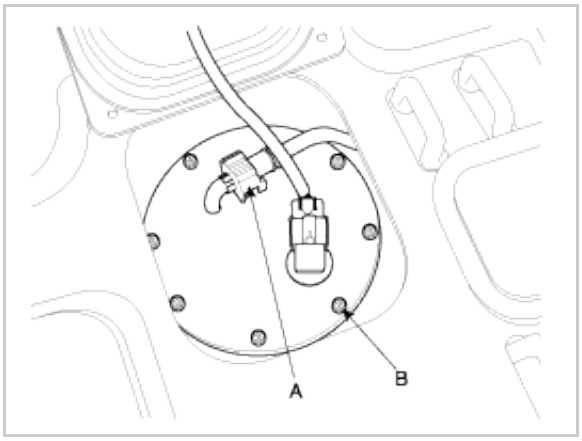


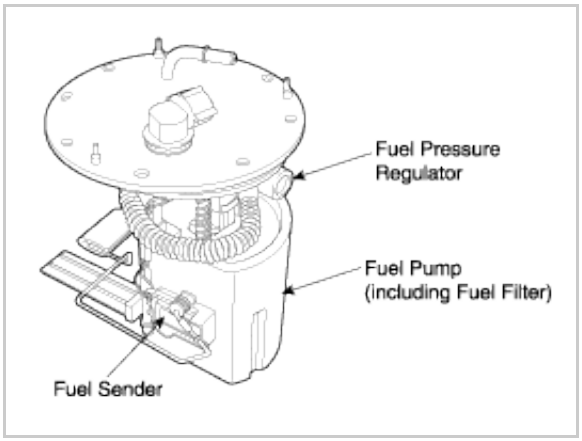
   (4) Disconnect the Fuel Pump Connector (A).



   (5) Start the engine and wait until fuel in fuel line is exhausted.
   (6) After the engine stalls, turn the ignition switch OFF.

2. After disconnecting the fuel feed quick connector (A) and unscrewing the the eight screws (B), remove the fuel pump assembly.





INSTALLATION

1. Install the Fuel Pump assembly according to the reverse order of "REMOVAL" procedure.

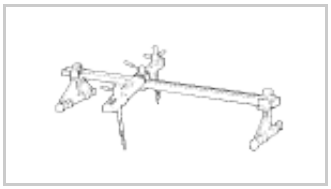
Fuel Pump assembly mounting bolts :
2.0 ~ 2.9 N·m (0.2 ~ 0.3 kgf·m, 1.4 ~ 2.2 lbf·ft)

CHAPTER 6:

Automatic Transaxle System

General Information

SPECIAL TOOLS

TOOL (Number and name)	Illustration	Use
09200 - 38001 Engine support fixture		Removal and installation of transaxle.

SPECIFICATION

Item		F4A51
Torque converter type		3-element, 1-stage, 2-phase type
Transaxle type		4-speed forward, 1-speed reverse
Engine displacement		2.7L GSL
Gear ratio	1st	2.842
	2nd	1.495
	3rd	1.000
	4th	0.731
	Reverse	2.720
Final gear ratio		4.520
Shift pattern	Variable	
Shift range	4range (P-R-N-D) + Sports mode	
Shift range valve	PWM ; 5EA(Duty control) , VFS	
Planetary gear	2EA(Output planetary/Overdrive planetary)	
Clutch	3EA	
Brake	2EA	
OWC	1EA	

TIGHTENING TORQUE

ITEM	Nm	kgf·m	lb-ft
Control cable nut	8 ~ 12	0.8 ~ 1.2	5.8 ~ 8.6
Input shaft speed sensor	10 ~ 12	1.0 ~1.2	7 ~ 8
Output shaft speed sensor	10 ~ 12	1.0 ~1.2	7 ~ 8
Manual control lever	18 ~ 25	1.8 ~ 2.5	13 ~ 18
Transaxle range switch	10 ~ 12	1.0 ~1.2	7 ~ 8
Valve body cover	10 ~ 12	1.0 ~1.2	7 ~ 8
Valve body mounting bolt	10 ~ 12	1.0 ~1.2	7 ~ 8
Oil temperature sensor	10 ~ 12	1.0 ~1.2	7 ~ 8
Oil filler plug	29 ~ 34	2.9 ~ 3.4	21.4 ~ 25.1
Oil drain plug	40 ~ 50	4.0 ~ 5.0	29 ~ 36
Solenoid valve support	5 ~ 7	0.5 ~ 0.7	4 ~ 5
Pressure check plug	8 ~ 10	0.8 ~ 1.0	6 ~ 7
Transaxle mounting sub bracket nut	60 ~ 80	6.0 ~ 8.0	43 ~ 58
Transaxle mounting bracket bolts	40 ~ 55	4.0 ~ 5.5	29 ~ 40
Transaxle mounting insulator bolt	90 ~ 110	9.0 ~ 11	65 ~ 80
Transaxle and engine mounting bolt	65 ~ 85	6.5 ~ 8.5	47 ~ 61.5
Drive plate bolt	46 ~ 53	4.6 ~ 5.3	33.3 ~ 38.3

LUBRICANT

Item	Specified lubricant	Quantity
Transmission oil	Diamond ATF SP-III	8.5ℓ(9.0 Us qt, 7.5Imp.qt)

SEALANT

Item	Specified Sealant
Rear cover Torque converter housing Valve body cover	Three Bond - TB 1281B or LOCTITE - FMD - 546
Transmission case side cover	Three Bond - TB 1389 or LOCTITE - 518
Side cover	Three Bond - TB 1389 or LOCTITE - 518/587

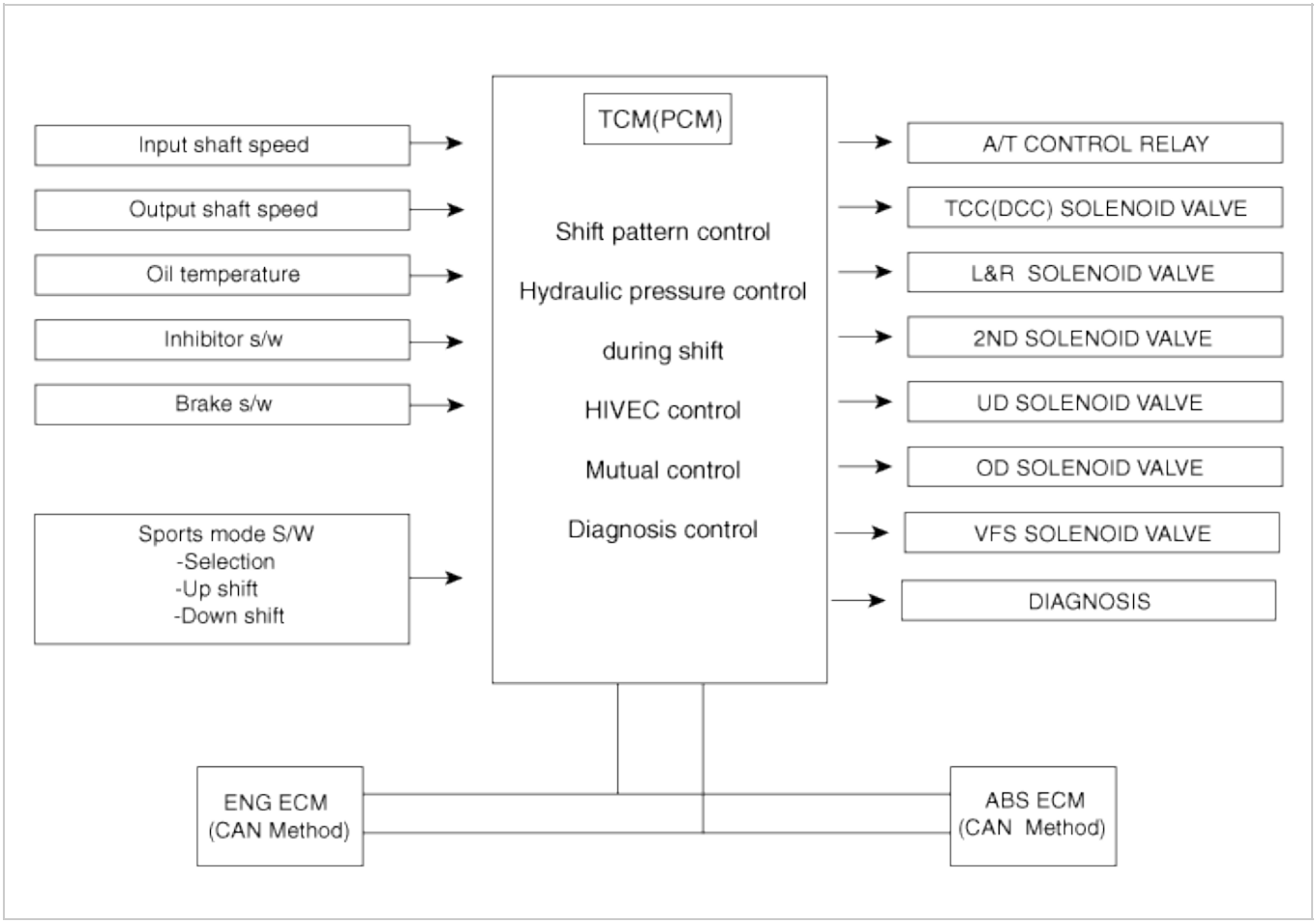
Automatic Transaxle System

Electronic Control System

DESCRIPTION

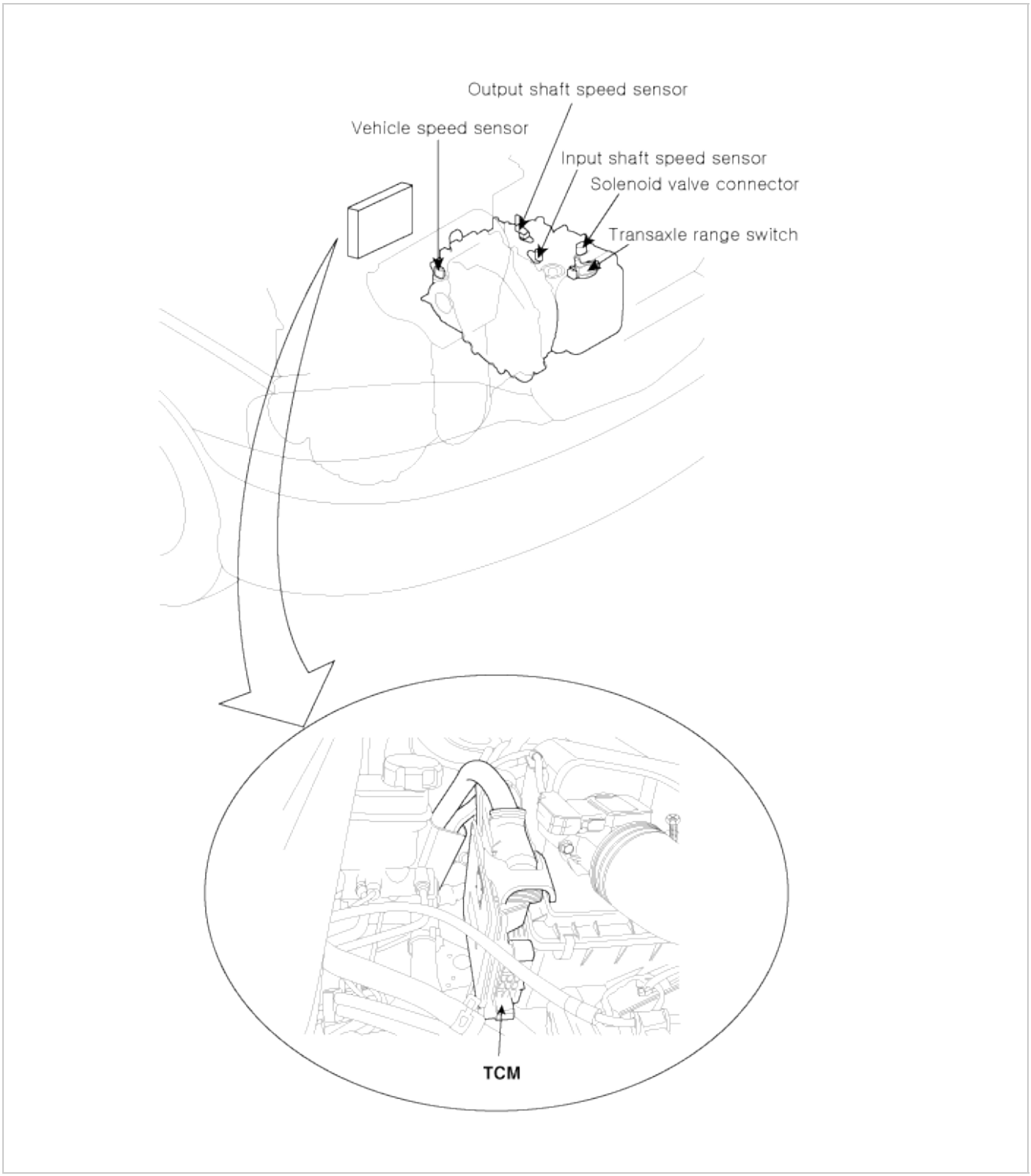
The electronic control system used in the new generation auto transaxle is far superior to the previous systems. This system is able to adopt a variable shift pattern for smooth and problem free shifting.
A solenoid valve is applied to each of the clutches and brakes and is independently controlled. Feedback control and correction control is performed in all gears as well as utilization of mutual control system to increase shift feeling.
The torque converter damper clutch uses a partial lock up and full lock-up system. An additional control method called the HIVEC system (neural network) is adopted to increase shift feeling.

Block Diagram (CAN)



ELECTRIC CONTROL LOCATION

The TCM(PCM) is located on the intake manifold in the engine room.



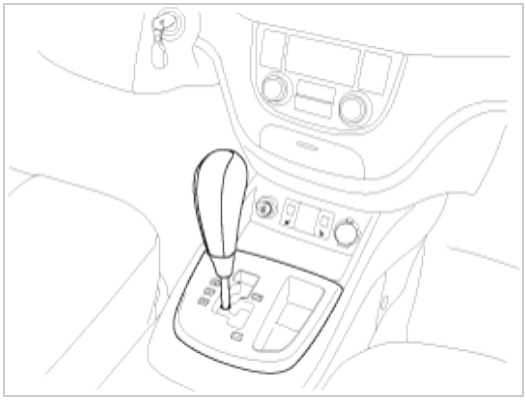
OPERATING COMPONENTS AND FUNCTIONS

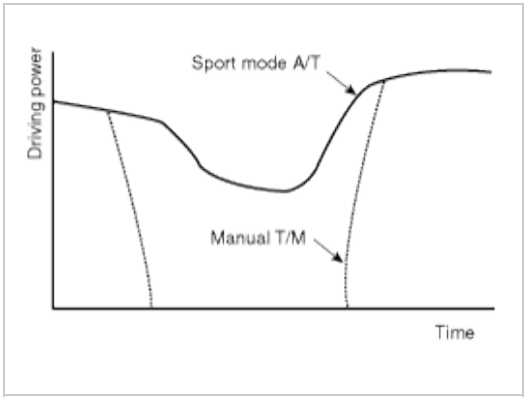
Sensor	Function
Input shaft speed sensor	Detect turbine speed at UD retainer
Output shaft speed sensor	Detect T/F drive gear speed at T/F driven gear (4A/T)
Crank angle sensor	Detect engine speed
TPS(Gasoline)	Throttle opening ratio by potentiometer
Air conditioner switch	A/C load by thermister
Inhibitor switch	Select lever position by contact switch
Brake switch	Brake pedal position
Vehicle speed sensor	Detect vehicle speed by speedometer driven gear
Sport mode switch	Sport mode On/Off signal

Sport mode up-shift switch	Sport mode up-shift signal
Sport mode downshift switch	Sport mode downshift signal
Request of torque reduction	Send the request of torque reduction to ECM
ABS-ECM, Engine ECM	In case of CAN communication

Sports Mode

Sports Mode Switch





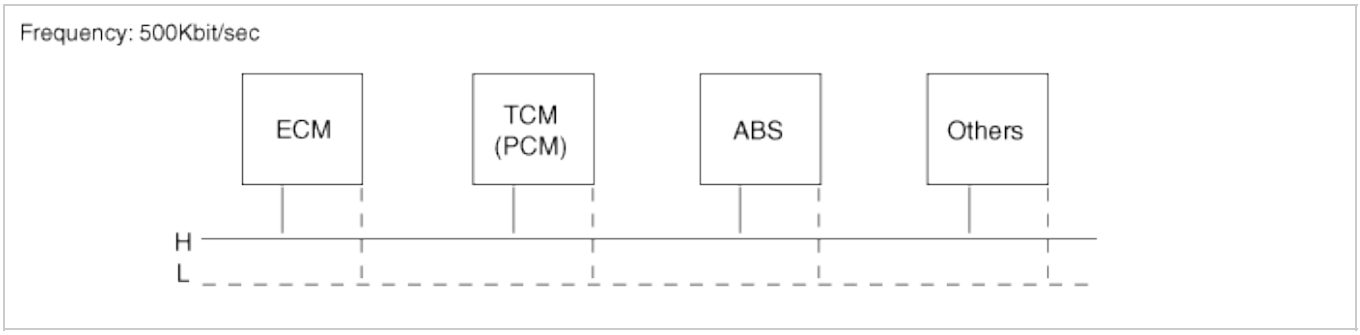
Sports mode allows the manual up-shift and downshift with the accelerator pedal is depressed. The prompt response and shift would be obtained due to the continuous shifting without cutting of driving power. The shifting time is also decreased about 0.1sec during up-shift, 0.2sec during downshift. As the selector lever is pushed upward or downward one time, the gear is up shifted or downshifted by one gear.

Signals of sports mode switch

Items	Mode S/W	UP S/W	DOWN S/W
D range selection	OFF	OFF	OFF
Sports mode selection	ON	OFF	OFF
Sports mode up-shift selection	ON	ON	OFF
Sports mode downshift selection	ON	OFF	ON

Controller Area Network (CAN)

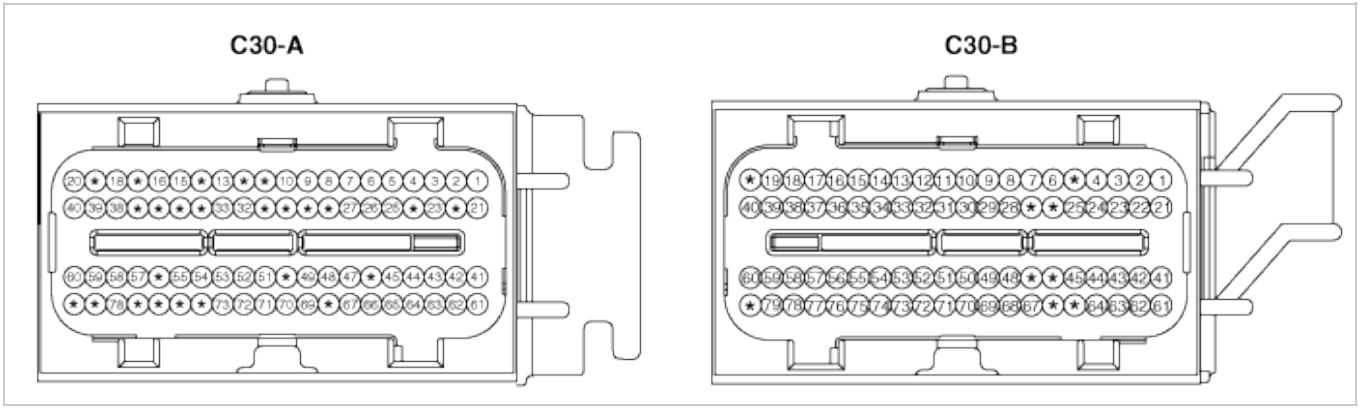
Previously, for different computers in the vehicle to share the same information, each signal required a different pin and wiring. However, with the introduction of a CAN system, only two lines are required to achieve the same function. The information is in digital format. This method does not use an integrated ECM.



Input signals to TCM(PCM) through ‘CAN communication’
- Engine rpm, TPS signal
- A/CON signal, Engine coolant temperature
- Quantity of intake airflow, Vehicle speed
- Shift holding signal (FTCS ON)

Output signals from TCM(PCM) through ‘CAN communication’
- Request signal for torque reduction
- ATF temperature, TCM(PCM) type, TCM(PCM) error or not
- Damper clutch ON, OFF / Gear position

TCM PIN DESCRIPITION



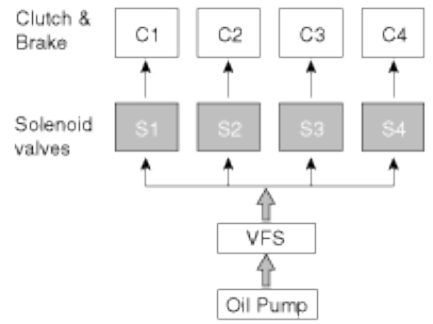
PIN No.	Check item	Condition	Input/Output value		Measurement Value	Remarks
			Type	Level		
A01	2nd CAN_HI	-	-	-	-	-
A02	2nd CAN_LO	-	-	-	-	-
A03	P Range Selection	P Position Otherwise	DC Voltage	V_BAT Max. 1.0V	12.9V 0V	
A04	R Range Selection	R Position Otherwise	DC Voltage	V_BAT Max. 1.0V	12.3V 0V	
A05	N Range Selection	N Position Otherwise	DC Voltage	V_BAT Max. 1.0V	13.2V 0V	
A06	D Range Selection	D Position Otherwise	DC Voltage	V_BAT Max. 1.0V	13.2V 0V	
A07	Select Position	-	DC Voltage	V_BAT Max. 1.0V	13.2V 0V	
A08	Up Position	-	DC Voltage	V_BAT Max. 1.0V	13.2V 0V	
A09	Down Position	-	DC Voltage	V_BAT Max. 1.0V	13.2V 0V	
A12	N.A	-	-	-	-	
A14	N.A	-	-	-	-	
A19	N.A	-	-	-	-	
A20	A/T Control Relay	Relay On Relay Off	DC Voltage	V_BAT Max. 1.0V Vpeak : Max. 70V Resistance : 680Ω	13.8V 0V -0.7V Resistance : 680Ω	
		W/H Open		DTC Spec : P0890	DTC : P0890	
A27	Diagnosis "K"	Communicated with GST	Pulse	At transmitting HI : V_BAT* 80%↑ LO : V_BAT∗20%↓ AT receiving HI : V_BAT* 70%↑ LO : V_BAT*30%↓	11.3V 0.14/ 0.32V	V_BAT : 13.2V

A31	N.A	-	-	-	-	
A32	A/C Pressure Analog	-	-	-	-	-
A34	N.A	-	-	-	-	
A36	N.A	-	-	-	-	
A37	N.A	-	-	-	-	
A41	CAN_HI	Recessive Dominant	Pulse	2.0 ~ 3.0 V 2.75 ~ 4.5 V	3.85V 2.5V	
A42	CAN_LO	Recessive Dominant	Pulse	2.0 ~ 3.0 V 0.5 ~ 2.25 V	2.55V 1.34V	
A60	A/T PWR Source	IG Off IG On IG. Key On IG. Key Off Idle Key Off from Idle Fuse 1/2/3 Removal Condition	DC Voltage	Max. 0.5 V V_BAT MAX. +/- 75V (ECU GND) MAX. +/- 75V (ECU GND) MAX. +/- 75V (ECU GND) MAX. +/- 75V (ECU GND) MAX. +/- 75V (ECU GND)	0V 11.9V +30V / -10V or less ↑	
		W/H Open		DTC Spec : P0888	DTC : P0888	
A73	Shift Position Signal(To Cluster)	Running 1 gear 2 gear 3 gear 4 gear 5 gear	Pulse Duty ↑ ↑ ↑ ↑	HI : V_BAT LO : Max. 1.0V Freq.: 50±2Hz (Reference) 12.5±2% 27.5±2% 42.5±2% 57.5±2% 72.5±2%	N.A	Sports mode
B03	UD Solenoid	Shifting	Pulse	HI : V_BAT LO : Max. 1.0V Vpeak : Max. 70V	14.4V 0.35V 56.3V	
		W/H Open		DTC Spec : P0755	DTC : P0755	
B05	N.A	-	-	-	-	
B06	Oil temperature sensor_ATM	Idle	Analog	0.5V ~ 4.5V	4.4V 3.1V	16Hz
B09	Output speed sensor	30kph	Pulse	HI : Min. 4.0V LO : Max. 1.0V	5.08V 0.34V	
		W/H Open		DTC Spec : P0722	DTC : P0722	
B10	Input speed sensor	Idle	Pulse	HI : Min. 4.0V LO : Max. 1.0V	5.06V 0.35V	630Hz
		W/H Open		DTC Spec : P0717	DTC : P0717	
B20	N.A	-	-	-	-	
B22	LR Solenoid	Shifting	Pulse	HI : V_BAT LO : Max. 1.0V Vpeak : Max. 70V	13.9V 0.38V 56.1V	
		W/H Open		DTC Spec : P0750	DTC : P0750	
B26	N.A	-	-	-	-	
B27	N.A	-	-	-	-	
B33	GND_Sensor	Idle	DC Voltage	Max. 50 mV	13mV	WTS & OTS_ATM
		W/H Open		DTC Spec : P0118/ 1115	DTC : P0118/ P1115	
		Shifting		HI : V_BAT LO : Max. 1.0V	15.4V 0.45V	

B42	OD Solenoid		Pulse	Vpeak : Max. 70V	56.3V	
		W/H Open		DTC Spec : P0765	DTC : P0765	
B43	DCC solenoid	Lock_Up on	Pulse	HI : V_BAT LO : Max. 1.0V Vpeak : Max. 70V	15.4V 0.45V 56.3V	
		W/H Open		DTC Spec : P0743	DTC : P0743	
B44	RED Solenoid	Shifting	Pulse	HI : V_BAT LO : Max. 1.0V Vpeak : Max. 70V	15.4V 0.45V 56.3V	
		W/H Open		DTC Spec : P0770	DTC : P0770	
B45	2ND Solenoid	Shifting	Pulse	HI : V_BAT LO : Max. 1.0V Vpeak : Max. 70V	15.4V 0.45V 56.3V	
		W/H Open		DTC Spec : P0760	DTC : P0760	
B46	N.A	-	-	-	-	
B47	N.A	-	-	-	-	
B59	Variable Solenoid (-)	Idle	Pulse	HI : V_BAT LO : Max. 1.0V Vpeak : Max. 70V	1.8/1.2V - N range 0.03V(DC) - D range	600Hz
		W/H Open		DTC Spec : P0748	DTC : P0748	
B65	N.A	-	-	-	-	
B66	N.A	-	-	-	-	
B75	Variable Solenoid (+)	Idle	Pulse	HI : V_BAT LO : Max. 1.0V Vpeak : Max. 70V	13.1V -0.07V	
		W/H Open		DTC Spec : P0748	DTC : P0748	
B80	N.A	-	-	-	-	

Hydraulic Control System

DESCRIPTION



Each clutch and brake have a Solenoid valve for independent control of hydraulic pressure

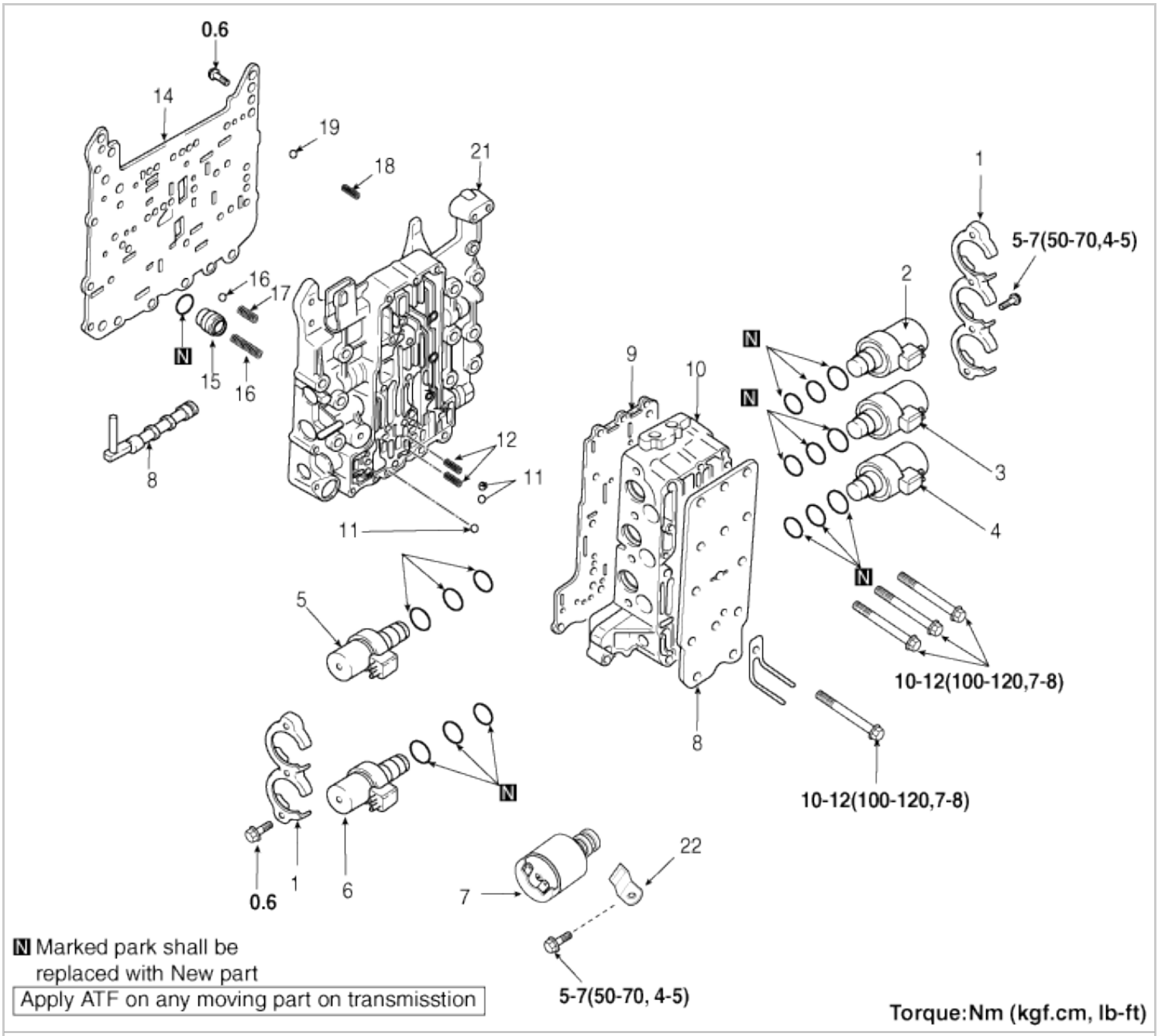
a. Better and smoother shift quality.

b. In order to prevent ATF leakage from the valve body or each elements, the exhaust ports have been grouped into only one with an addition of a check ball.

c. If a failure occurs in its electric control, the switch valve and fail safe valve is able to move to enable 3rd speed drive or reverse.

d. The hydraulic system consists of oil pump, regulator valve, solenoid valves, pressure control valve and valve body.

e. In order to control the optimal line pressure and inprove the efficiency of power transmission according to maximize the efficiency of the oil pump, VFS(Variable Force Solenoid) valve has been added in the valve body hydralic circuit.



Disassembly steps
1. Solenoid valve support
2. UD clutch solenoid valve
3. 2nd brake solenoid valve
4. Damper clutch control solenoid\oid valve
5. OD clutch solenoid valve
6. Low and reverse brake solenoid valve
7. VFS solenoid valve
8. Manual valve
9. Cover
10. Plate
11. Outside valve body assembly
12. Steel ball (Orifice check ball)
13. Spring
14. Plate
15. Damping valve
16. Damping valve spring
17. Steel ball (line relief)
18. Spring
19. Steel ball (Orifice check ball)
20. Spring
21. Inside valve body assembly
22. VFS plate

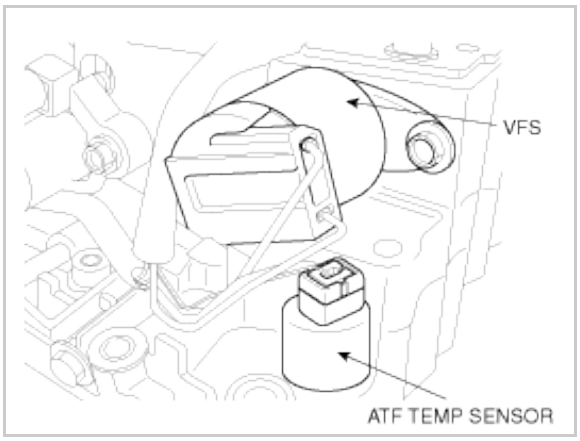
VFS (Variable Force Solenoid)

VRS Function

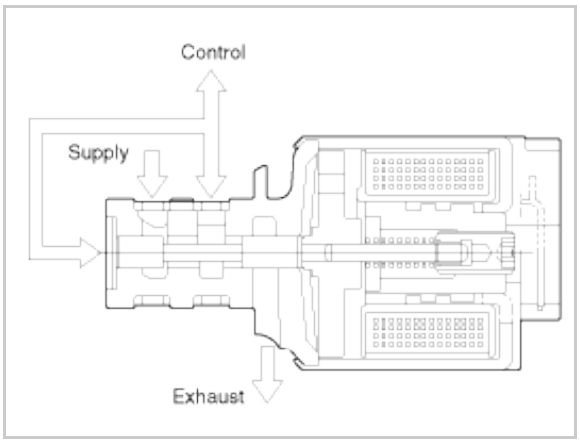
The spool rod in VFS is not duty cycled like one of PWM, it minutely vibrates at the range between the control port and exhaust port to control the hydraulic pressure. That is, it uses the equilibrium effect between the spring force and the magnetic force, the spring force is mechanical characteristics decided at the stage of design and the magnetic force is controlled by TCM. This electrical magnetic force is proportional to the current. So TCM will control the current.

In case of VFS valve, the electrical ‘time constant’ is considered to decide the frequency for the current not to be

fluctuated even though turns on or off the input signal. The electrical ‘time constant’ is much more fast than one of mechanical so the frequency of VFS is extremely higher than the conventional PWM type.



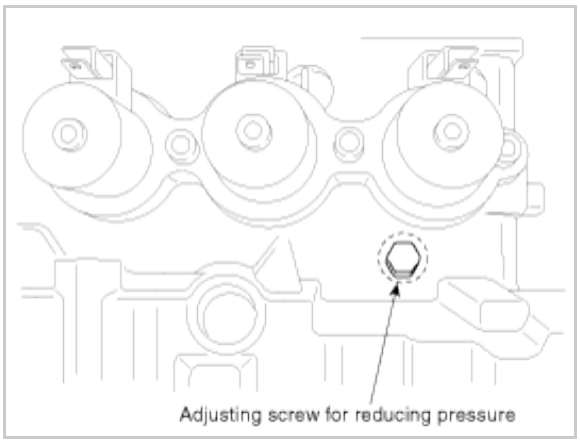
Characteristics of Bosch VFS:
Supply pressure : 700~1600kPa
Control pressure: typically 600~0 kPa
Current range: typically 0~1,000 mA
Dither frequency: Up to 600 Hz
Dimension: 32 mm protrusion reach 42 mm



The reducing pressure will be supplied to the ‘Supply’ port of the VFS valve on the above illustration to control the line pressure.

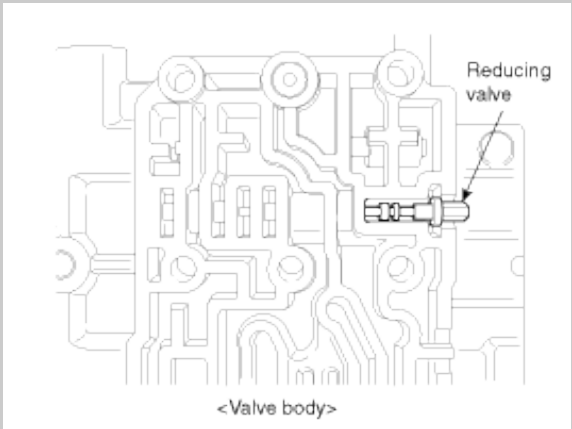
Reducing pressure

Function

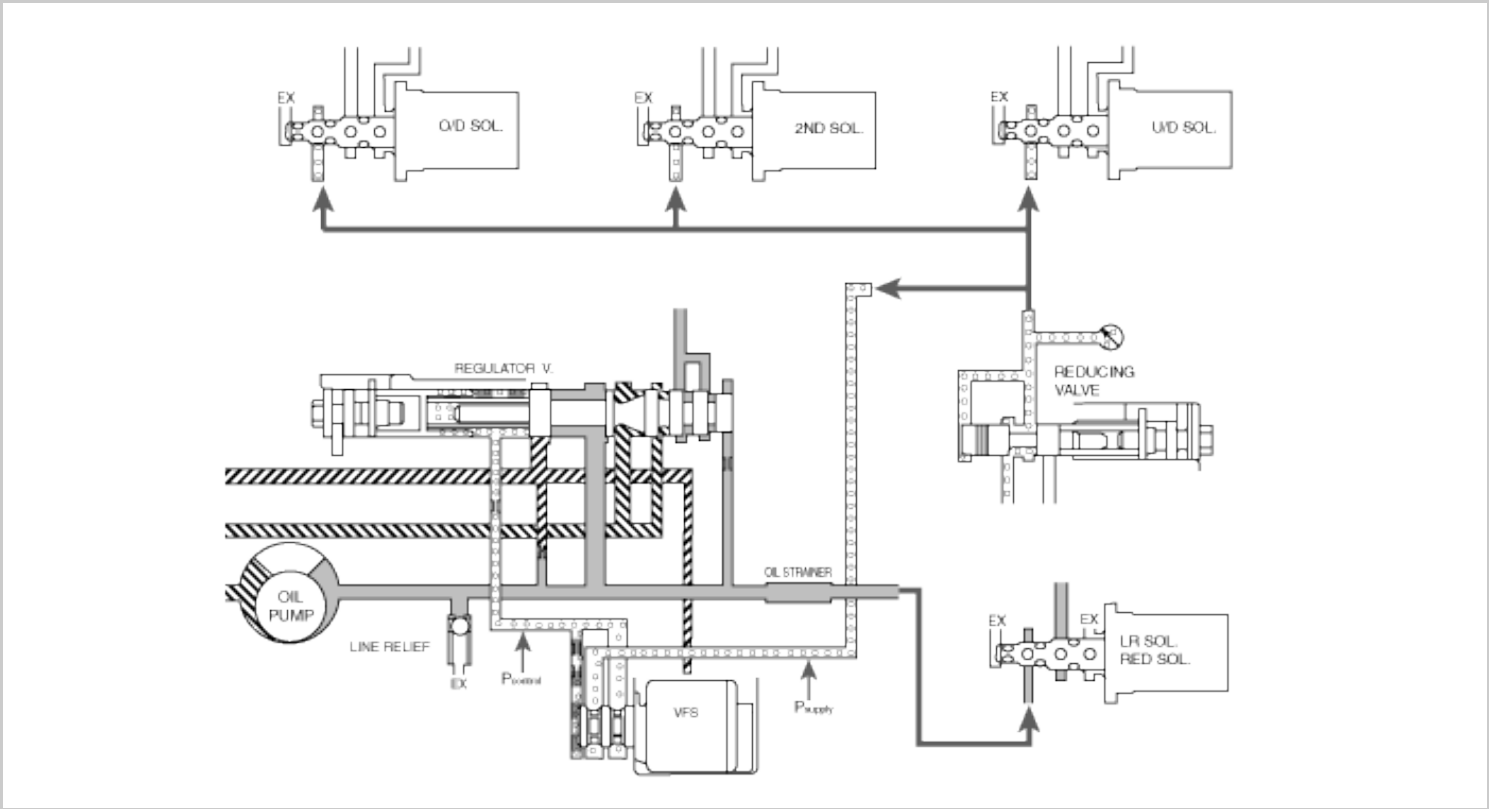


As same as one of Alpha or Beta automatic transaxle system, this reducing valve length can be adjusted by rotating the screw on the picture. As you rotate the screw toward clockwise by 90°, the reducing pressure will increase about 1.0bar. However, the reducing pressure is used just as a ‘supply pressure’ for the solenoid valves (except Low&Reverse, Reduction and Damper Clutch control solen), so this may not be handled to rotate in the field service shop. VFS is operated based on the ‘supply pressure’ and it outputs the ‘control pressure’ to control the regulator valve indirectly. While developing the VFS system, the line pressure was used as a ‘supply pressure’ for VFS and other solenoid valves but it has been changed into additional ‘reducing pressure’ because the line pressure is variably

changed by VFS so the control pressure becomes unstable and some hydraulic pressure oscillation occurred. That is why the reducing pressure has been added in the hydraulic circuit of VFS system for both 4th and 5th speed A/T.



<Valve body>



The reducing pressure is about 6.5bar and this value does not be changed regardless of the driving or engine load condition. Be sure that the conventional line pressure is used for the 'supply pressure' of Low&Reverse, Reduction solenoid because the variable line pressure is not available at reverse range.

HYDRULIC PRESSURE TABLE

Under the constant current amount of VFS (200mA), the line pressure will become as below table. Be sure that the following data can be achieved by specific special facility or device to check the performance of A/T assembly (not on the vehicle), however we can refer the maximum pressure value according to each element.

Solenoid valve Duty(%)					Measured Element	Pressure kPa(Psi)
LR	2ND	UD	OD	RED*		
0	100	0	100	0	LR	1030±20(149±3)
60	↑	↑	↑	↑		520±40(75±6)
75	↑	↑	↑	↑		230±40(33±6)
100	↑	↑	↑	↑		0
100	0	0	100	0	2ND	1030±20(149±3)
↑	60	↑	↑	↑		550±40(80±6)
↑	75	↑	↑	↑		220±40(32±6)

↑	100	↑	↑	↑		0
100	100	0	0	0	OD	1030±20(149±3)
↑	↑	↑	60	↑		520±40(75±6)
↑	↑	↑	75	↑		210±40(30±6)
↑	↑	↑	100	↑		0
100	100	0	0	0	UD	1030±20(149±3)
↑	↑	60	↑	↑		470±40(68±6)
↑	↑	75	↑	↑		170±40(25±6)
↑	↑	100	↑	↑		0
100	0	100	0	100	DIR*	0
75	↑	↑	↑	↑		270±40(39±6)
60	↑	↑	↑	↑		540±40(78±6)
0	↑	↑	↑	↑		1030±20(149±3)

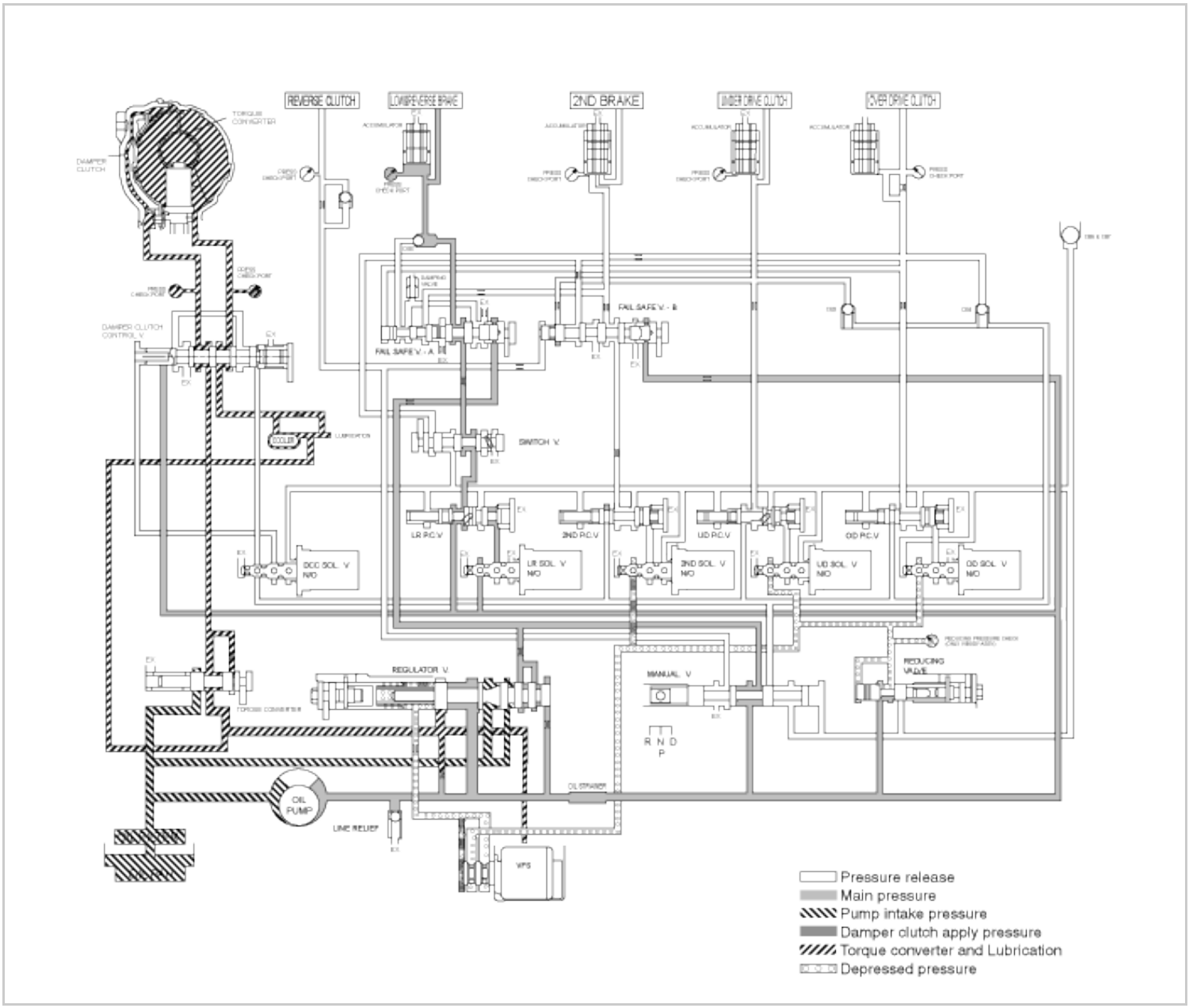
Measuring condition:

a. PG-A (Input speed): 2,500rpm

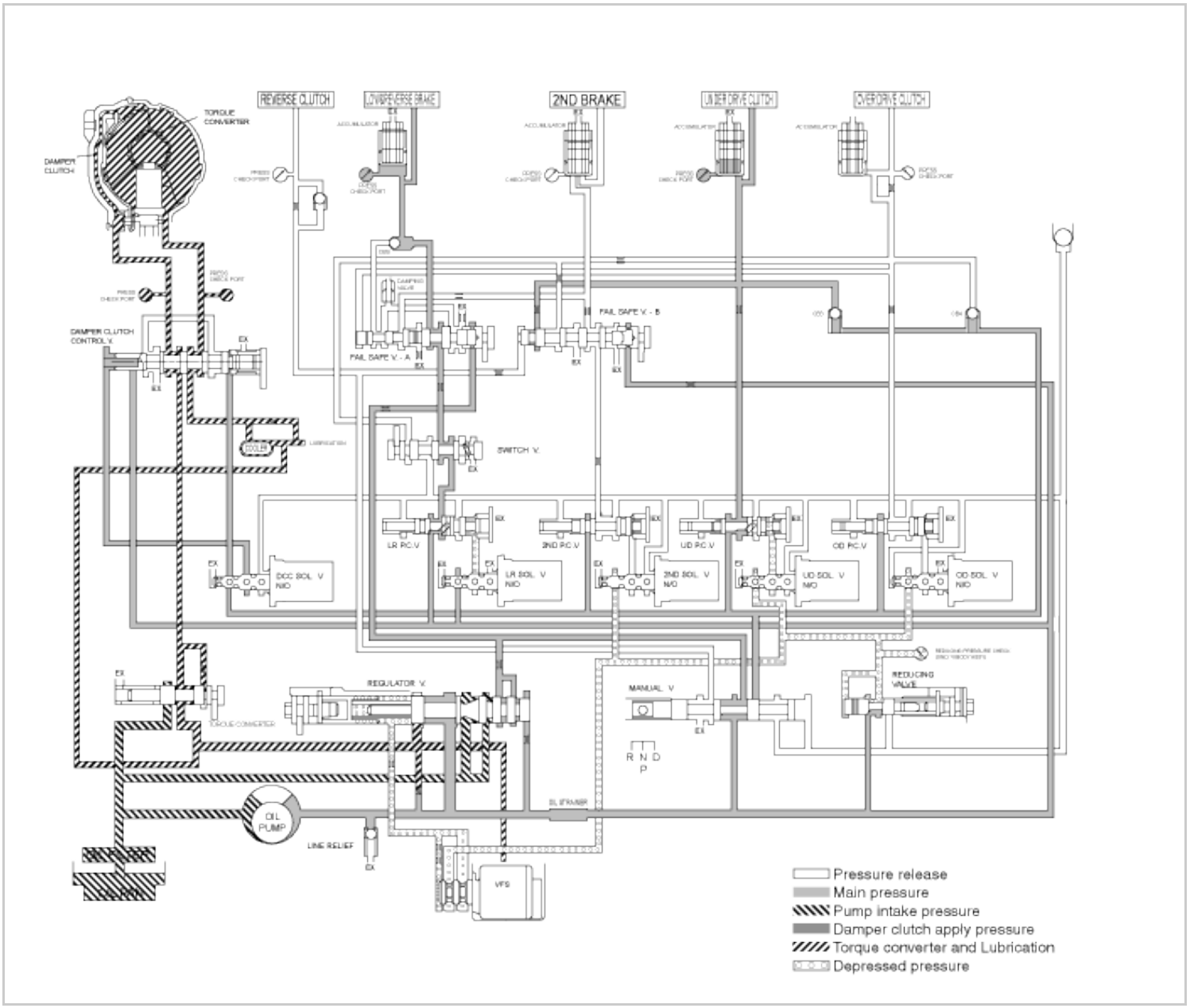
b. Manual valve position: D

c. DCC Solenoid duty: 0%

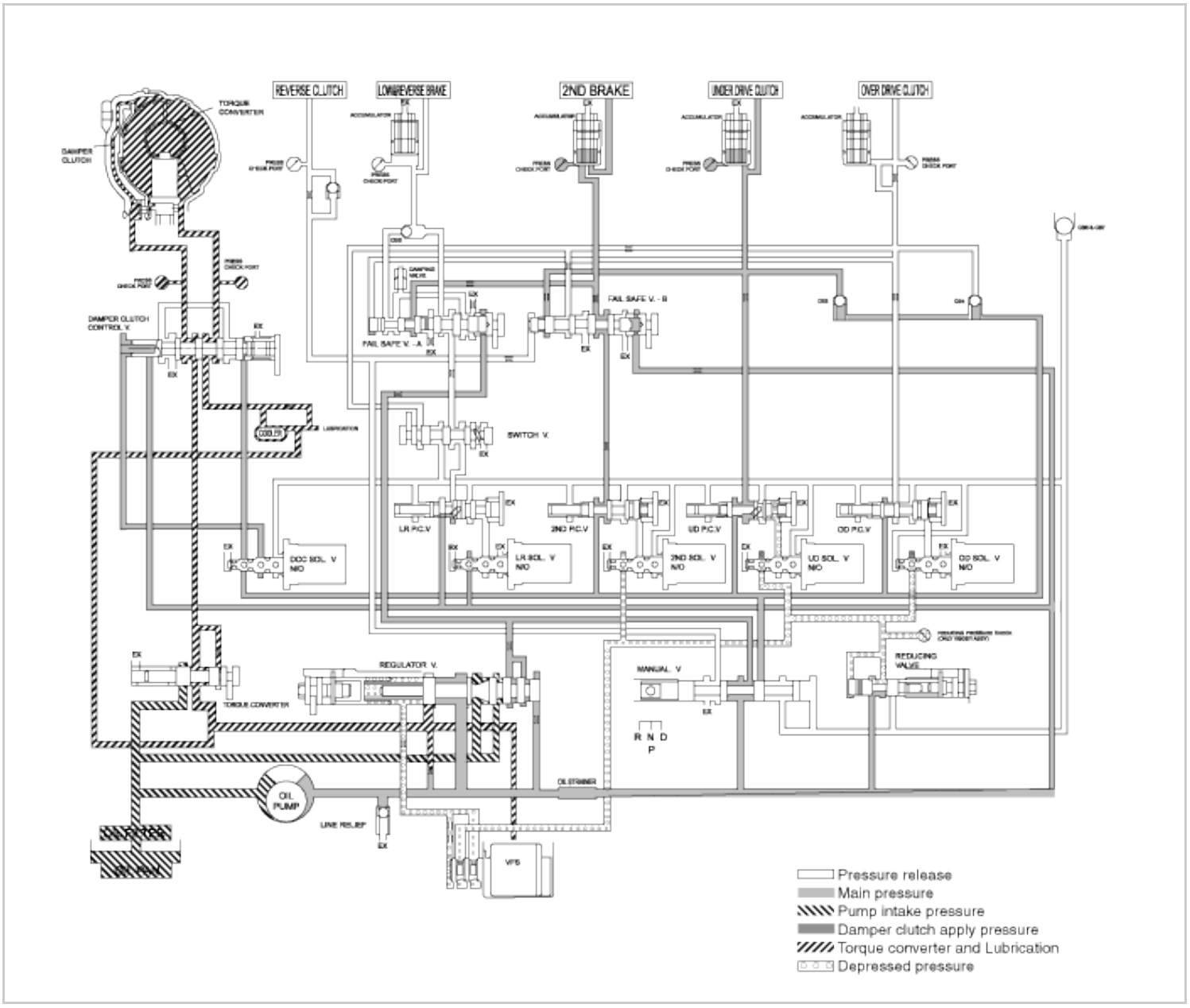
N-P


REVERSE CLUTCH
LOW&REVERSE BRAKE
2ND BRAKE
UNDER DRIVE CLUTCH
OVER DRIVE CLUTCH
TORQUE CONVERTER
DAMPER CLUTCH
DAMPER CLUTCH CONTROL V.
FAIL SAFE V. - A
FAIL SAFE V. - B
SWITCH V.
LR P.C.V
2ND P.C.V
UD P.C.V
OD P.C.V
DCC SOL. V N/O
LR SOL. V N/C
2ND SOL. V N/C
UD SOL. V N/C
OD SOL. V N/C
REGULATOR V.
MANUAL V.
REDUCING VALVE
R N D P
OIL PUMP
LINE RELIEF
VFS
Pressure release
Main pressure
Pump intake pressure
Damper clutch apply pressure
Torque converter and Lubrication
Depressed pressure

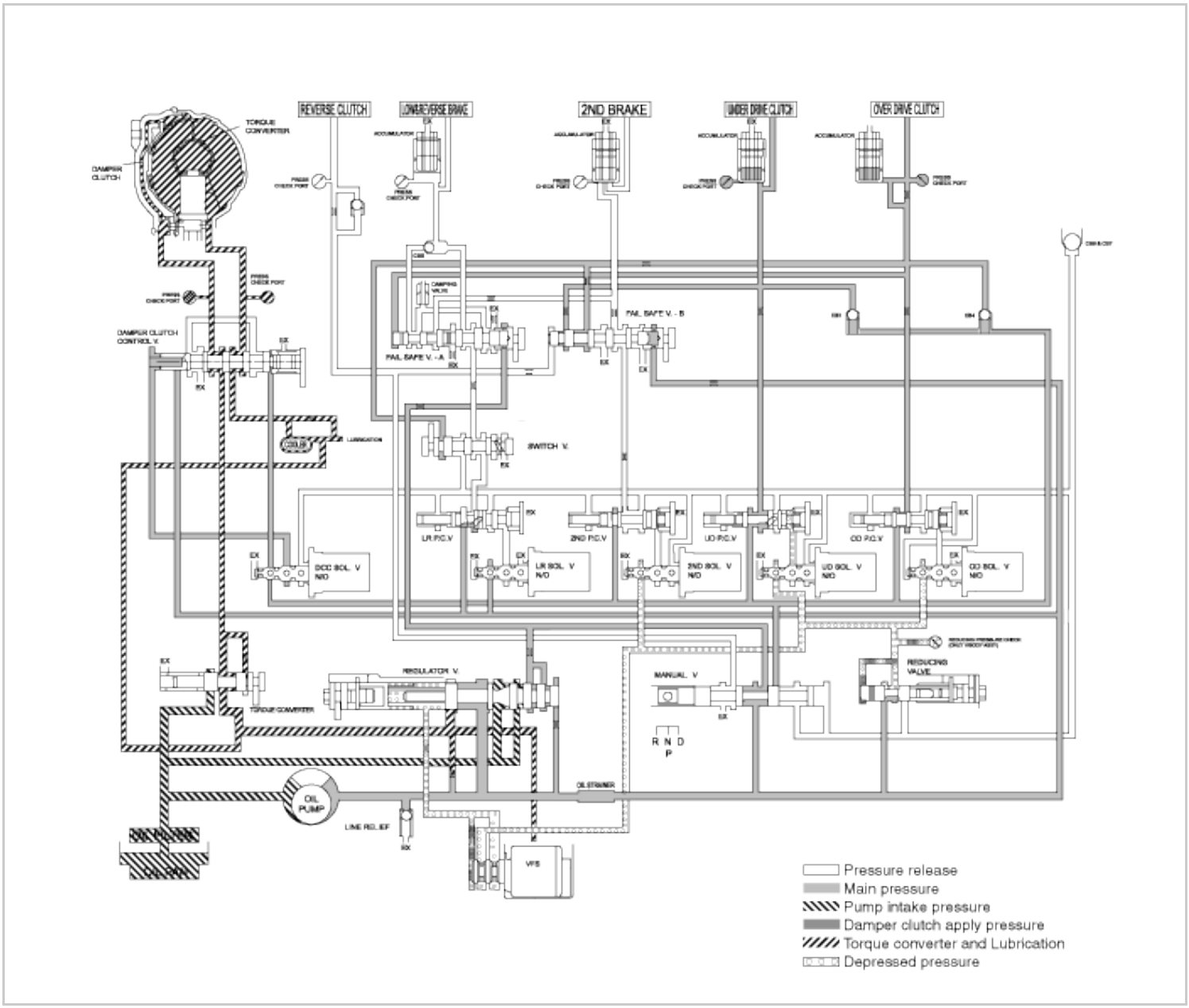
D 1ST gear


REVERSE CLUTCH
LOW&REVERSE BRAKE
2ND BRAKE
UNDER DRIVE CLUTCH
OVERDRIVE CLUTCH
TORQUE CONVERTER
DAMPER CLUTCH
DAMPER CLUTCH CONTROL V.
FAIL SAFE V. - A
FAIL SAFE V. - B
SWITCH V.
LR P.C.V
2ND P.C.V
UD P.C.V
OD P.C.V
DCC SOL. V N/O
LR SOL. V N/O
2ND SOL. V N/O
UD SOL. V N/O
OD SOL. V N/O
REGULATOR V.
MANUAL V.
REDUCING VALVE
R N D P
OIL PUMP
LINE RELIEF
VFS
Pressure release
Main pressure
Pump intake pressure
Damper clutch apply pressure
Torque converter and Lubrication
Depressed pressure

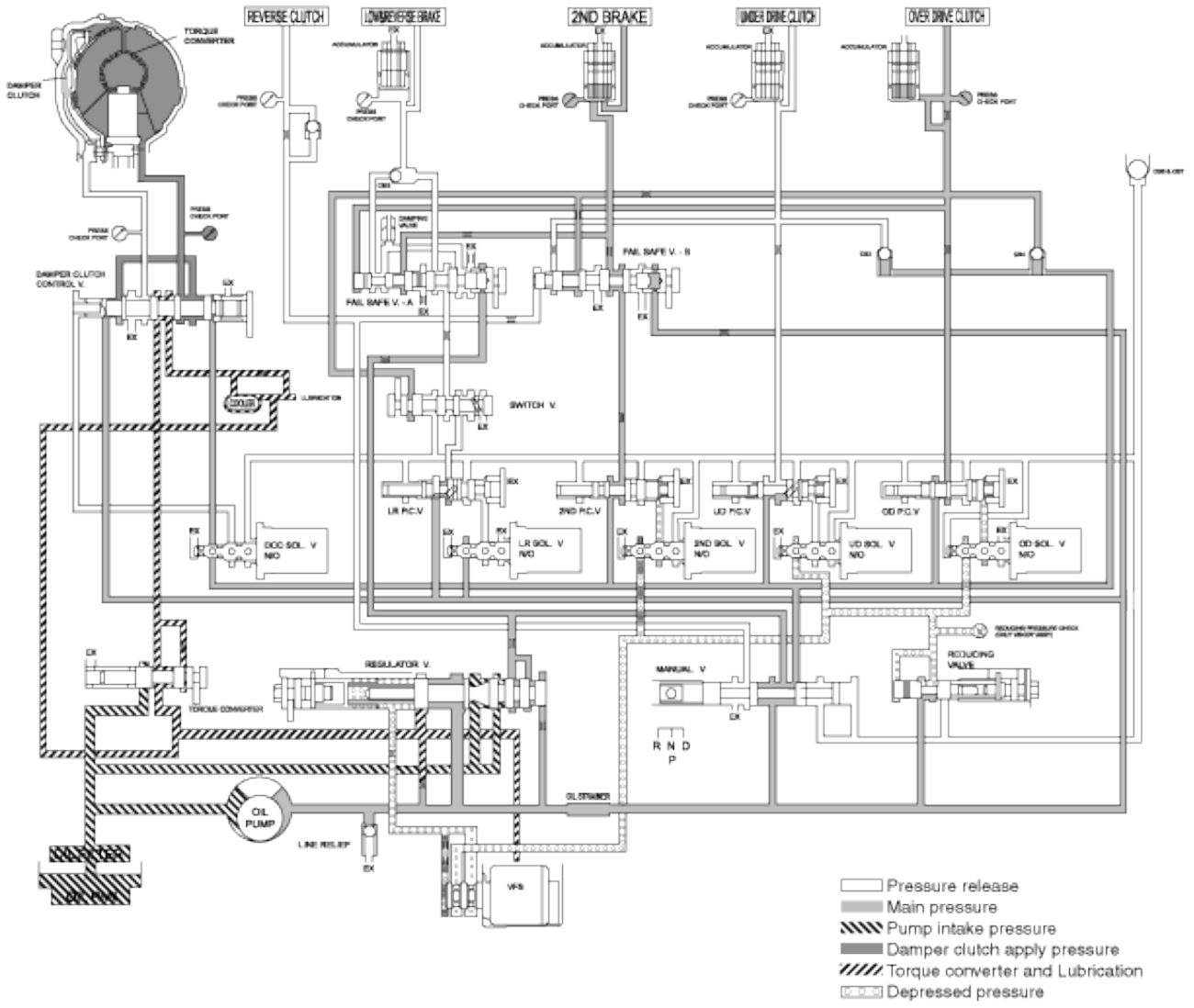
D 2ND gear


REVERSE CLUTCH
LOW&REVERSE BRAKE
2ND BRAKE
UNDER DRIVE CLUTCH
OVER DRIVE CLUTCH
TORQUE CONVERTER
DAMPER CLUTCH
DAMPER CLUTCH CONTROL V.
FAIL SAFE V. - A
FAIL SAFE V. - B
SWITCH V.
LR P.C.V
2ND P.C.V
UD P.C.V
OD P.C.V
DCC SOL. V N/O
LR SOL. V N/O
2ND SOL. V N/O
UD SOL. V N/O
OD SOL. V N/O
REGULATOR V.
MANUAL V.
REDUCING VALVE
R N D P
OIL STRAINER
OIL PUMP
LINE RELIEF
VFS
Pressure release
Main pressure
Pump intake pressure
Damper clutch apply pressure
Torque converter and Lubrication
Depressed pressure

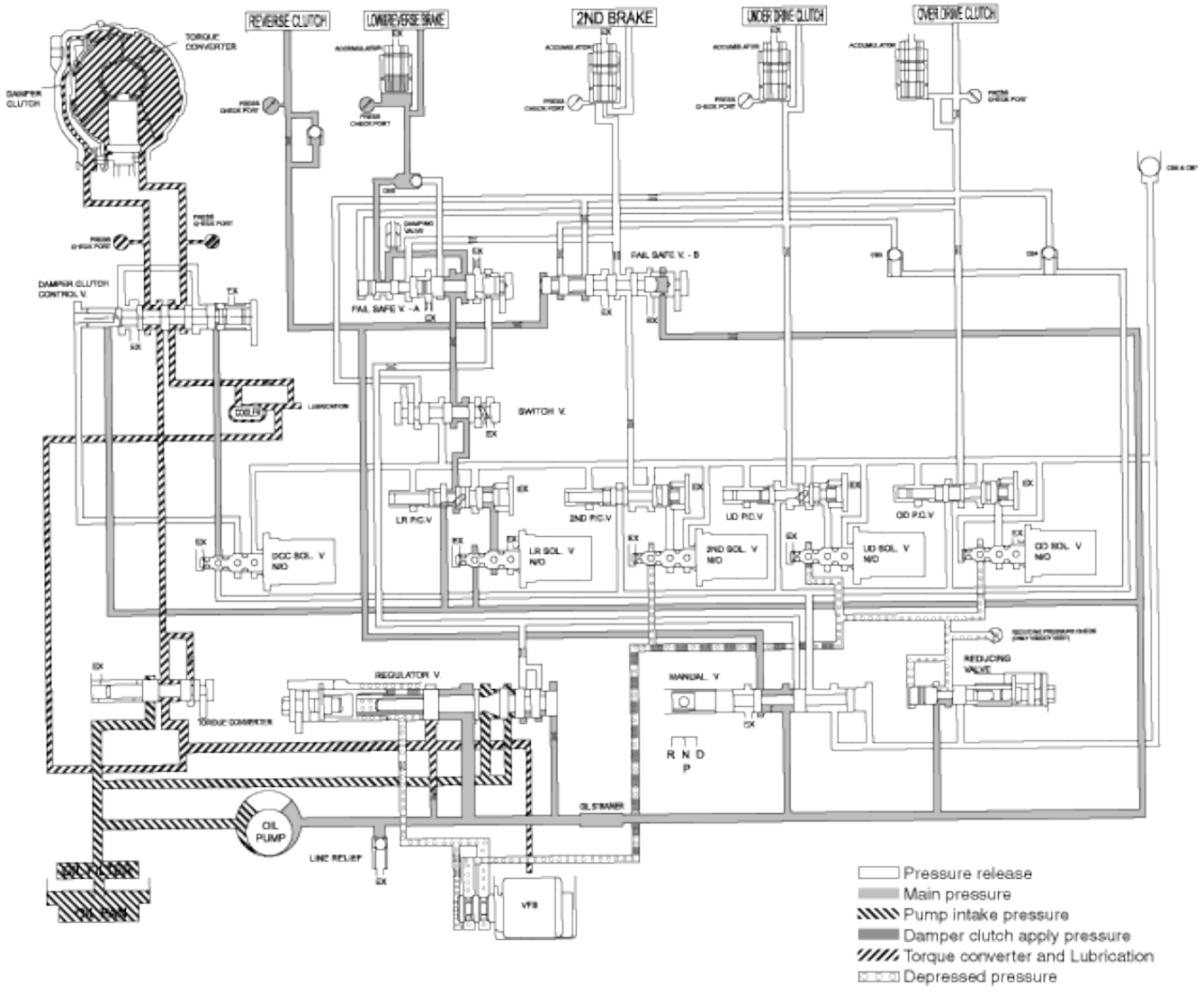
D 3nd gear


REVERSE CLUTCH
LOW&REVERSE BRAKE
2ND BRAKE
UNDER DRIVE CLUTCH
OVER DRIVE CLUTCH
TORQUE CONVERTER
DAMPER CLUTCH
DAMPER CLUTCH CONTROL V.
FAIL SAFE V. - A
FAIL SAFE V. - B
SWITCH V.
LR P.C.V
2ND P.C.V
UD P.C.V
OD P.C.V
DCC SOL. V N/O
LR SOL. V N/O
2ND SOL. V N/O
UD SOL. V N/O
OD SOL. V N/O
REGULATOR V.
MANUAL V
REDUCING VALVE
R N D P
OIL PUMP
OIL STRAINER
LINE RELIEF
VFS
Pressure release
Main pressure
Pump intake pressure
Damper clutch apply pressure
Torque converter and Lubrication
Depressed pressure

D 4th gear


REVERSE CLUTCH
LOW&REVERSE BRAKE
2ND BRAKE
UNDER DRIVE CLUTCH
OVER DRIVE CLUTCH
TORQUE CONVERTER
DAMPER CLUTCH
DAMPER CLUTCH CONTROL V.
FAIL SAFE V. - A
FAIL SAFE V. - B
SWITCH V.
LR P.C.V
2ND P.C.V
UD P.C.V
OD P.C.V
DCC SOL. V N/O
LR SOL. V N/O
2ND SOL. V N/O
UD SOL. V N/O
OD SOL. V N/O
REGULATOR V.
MANUAL V
REDUCING VALVE
R N D P
OIL PUMP
LINE RELIEF
STRAINER
VFS
Pressure release
Main pressure
Pump intake pressure
Damper clutch apply pressure
Torque converter and Lubrication
Depressed pressure

Reverse


REVERSE CLUTCH
LOW&REVERSE BRAKE
2ND BRAKE
UNDER DRIVE CLUTCH
OVER DRIVE CLUTCH
TORQUE CONVERTER
DAMPER CLUTCH
DAMPER CLUTCH CONTROL V.
FAIL SAFE V. - A
FAIL SAFE V. - B
SWITCH V.
LR P.C.V
2ND P.C.V
UD P.C.V
OD P.C.V
DCC SOL. V N/O
LR SOL. V N/O
2ND SOL. V N/O
UD SOL. V N/O
OD SOL. V N/O
REGULATOR V.
MANUAL V.
REDUCING VALVE
R N D P
OIL PUMP
LINE RELIEF
OIL STRAINER
OIL PAN
VFS
Pressure release
Main pressure
Pump intake pressure
Damper clutch apply pressure
Torque converter and Lubrication
Depressed pressure

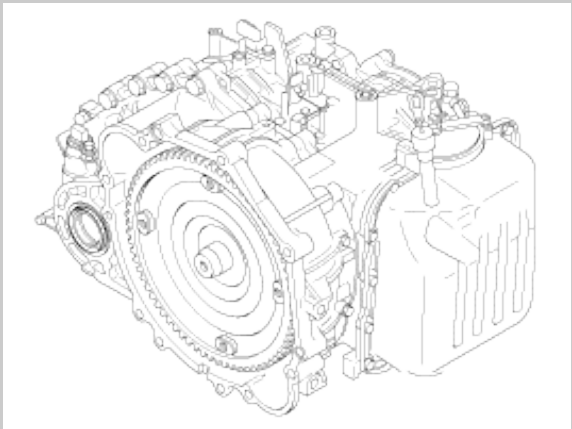
Description

The automatic transmission is a combination of 3-element 2-phase 1-stage torque converter and double shaft electrocally-controlled unit which provides 4 speeds forward and 1 reverse. To improve the efficiency of power transmission, the line pressure control was changed applying “Variable Force Solenoid (VFS) valve” on this model. However, adopting VFS on this model, the line pressure is variably changed according to TPS and the vehicle speed, this will enable more improved efficiency of power transmission and fuel consumption.

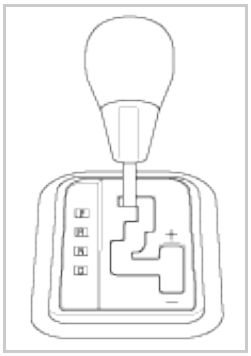
Characteristics

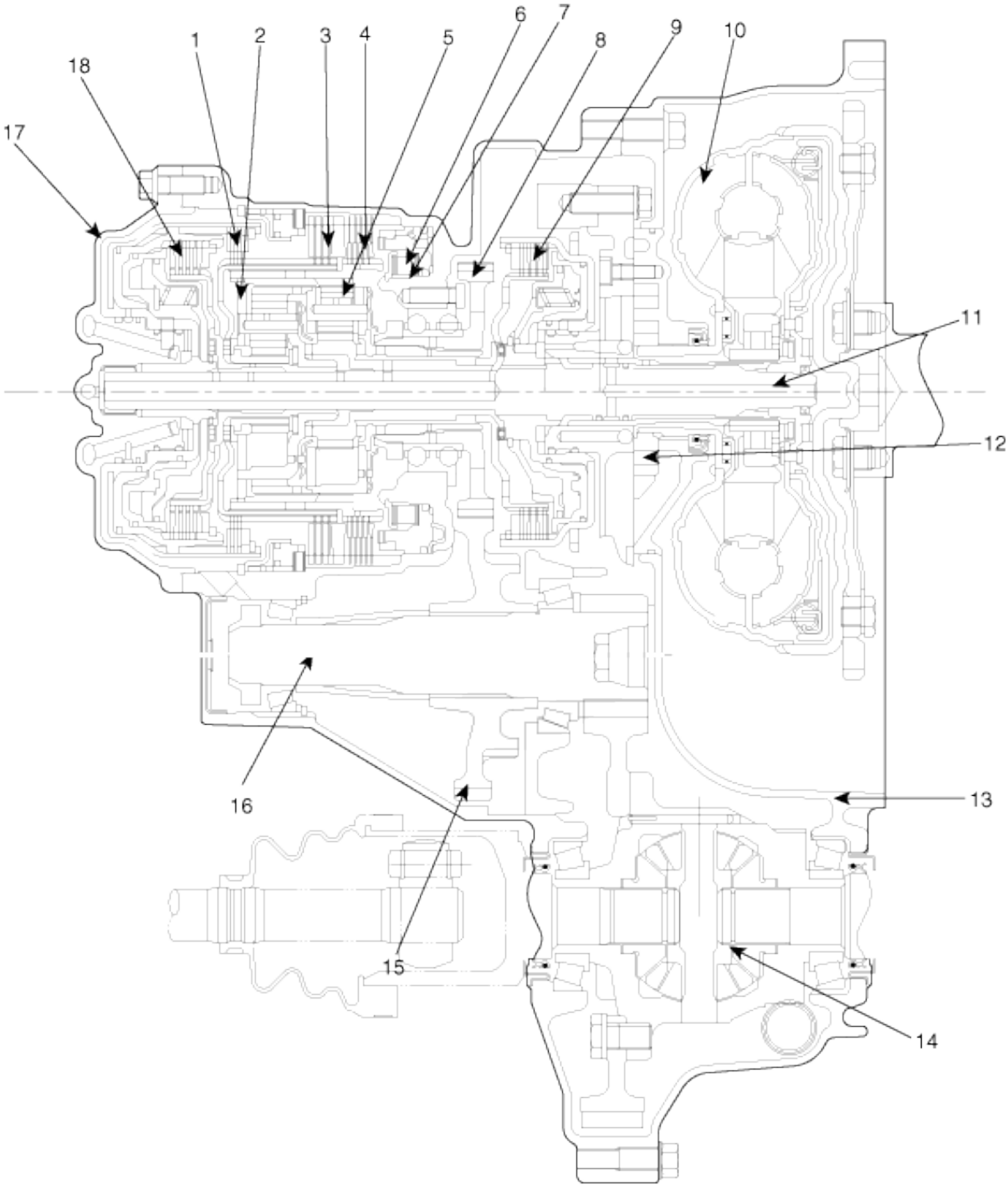
Some of the characteristics include:

▶Different power transfer
▶Different component layout
▶New shift logic(HIVEC) to improve shift feeling
▶Position of Valve Body
▶Variable shift pattern
▶Communication protocol and method
▶Step gate type shift lever.



Item	Details
Weight Reduction	1. Aluminum oil pump a. 2.3kg Approx 2. Pressed parts a. Retainer and hub of brakes and clutches b. Carrier of planetary gear set
Better shift quality	1. Independent control of clutches and brakes enabled better control of hydraulic pressure and skiped shifts (4 to 2, 3 to 1) 2. During N to D or N to R shift, feedback control adopted. 3. When starting from Creep condition, reduction of shock.(Creep condition is controlled with 1st gear) 4. Solenoid valve frequency is increased for more accurate control. 35Hz to 61.3Hz except DCCSV that is 35Hz and VFS that is 600Hz. 5. HIVEC adoption for better shift feeling. 6. Variable shift pattern.
Increase in Power train efficiency	1. Fully Variable Line Pressure 2. VFS(Variable Force Solenoid)
	- Manual shifting possible - Step gate type shift lever

Dynamic drive by sports mode	



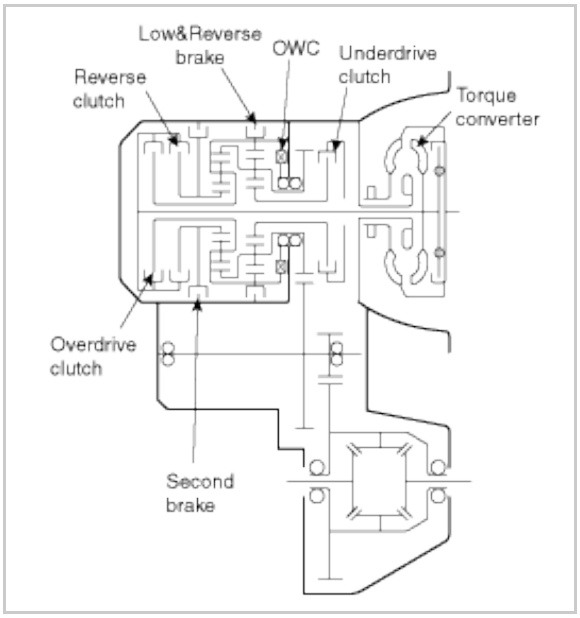
1. Reverse clutch
2. Overdrive planetary gear set
3. Second brake
4. Low-reverse brake
5. Output plantary gear set
6. Oneway clutch
7. Oneway clutch inner race
8. Transfer drive gear
9. Underdrive clutch
10. Torque converter
11. Input shaft
12. Oil pump
13. Converter housing
14. Differential
15. Transfer driven gear
16. Output shaft
17. Rear cover
18. Overdrive clutch

MECHANICAL SYSTEM

OPERATION COMPONENTS AND FUNCTION

Operating Element	Symbol	Function
Under drive clutch	UD	Connect input shaft and under drive sun gear
Reverse clutch	REV	Connect input shaft and reverse sun gear
Overdrive clutch	OD	Connect input shaft and over drive carrier

Low&Reverse brake	LR	Hold LR annulus gear and OD carrier
Second brake	2ND	Hold reverse sun gear
One way clutch	OWC	Restrict the rotating direction of low & reverse annulus gear



Operating elements

	UD/C	OD/C	REV/C	2ND/B	LR/B	OWC
P					●	
R			●		●	
N					●	
D1	●				●	○
D2	●			●		
D3	●	●				
D4		●		●		

1) ○ : OWC is operated when shifts from 1st gear to 2nd gear.
2) L&R brake is released in 1st gear when the vehicle speed is more than 5KPH approximately.

Torque converter and shaft

The torque converter consists of an impeller(pump), turbine and stator assembly in a single unit. The pump is connected to the engine crankshaft and turns as the engine turns. This drawing force is transmitted to the turbine through the oil which is recycled by the stator.
The transmission has two parallel shafts ; the input shaft and the output shaft. Both shafts are in line with the engine crankshaft. The input shaft includes the overdrive clutch, reverse clutch, underdrive clutch, one way clutch, 2ND brake, low&reverse brake, overdrive planetary carrier, output planetary carrier and transfer drive gear. The output shaft includes the transfer driven gear.

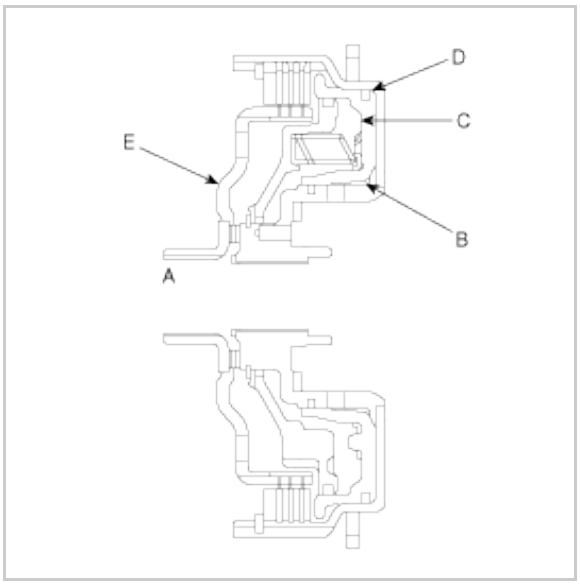
CLUTCHES

The gear changing mechanism utilizes three multi-disc clutches. The retainers of these clutches are fabricated from high-precision sheet metal for lightness and ease of production. Also, more responsive gearshifts at high engine speeds are achieved by a pressure-balanced piston mechanism that cancels out centrifugal hydraulic pressure. This mechanism replaces the conventional ball check valve.

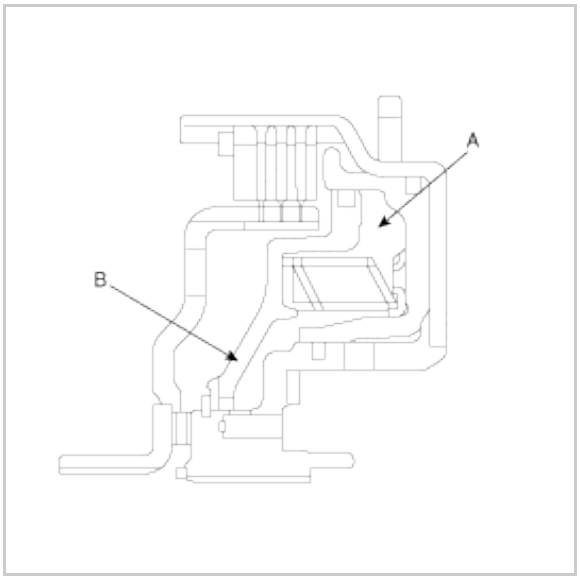
UNDERDRIVE CLUTCH

The underdrive clutch operates in 1st, 2nd, and 3rd gears and transmits driving force from the input shaft to the underdrive sun gear(A).
The components comprising the under clutch are as illustrated below.

Hydraulic pressure acts in the piston pressure chamber(B) (between the piston(c) and retainer) and thus pushes the piston(C). In turn, the piston depresses the clutch discs and thereby transmits driving force from the retainer(D) to the hub(E) side.

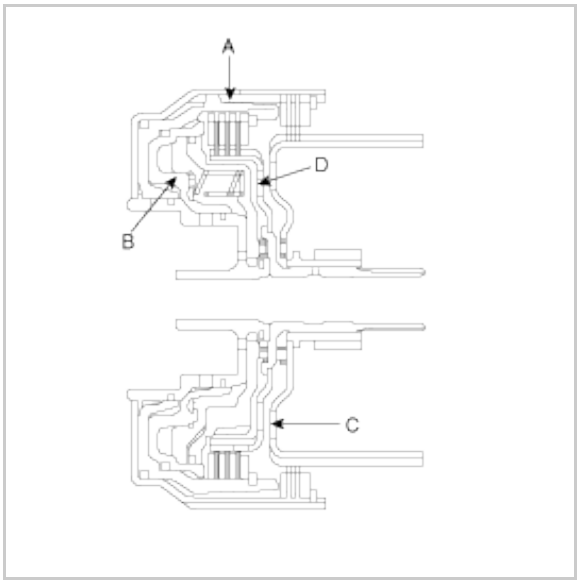


At high speed, fluid remaining in the piston pressure chamber is subjected to centrifugal force and attempts to push the piston.
However, fluid in the balance fluid chamber(A) (the space between the piston and return spring retainer(B)) is also subjected to centrifugal force.
Thus, the hydraulic pressure on one side of the piston cancels out the hydraulic pressure on the other side, and the piston does not move.



REVERSE CLUTCH AND OVERDRIVE CLUTCH

The reverse clutch(C) operates when the reverse gear is selected and transmits driving force from the input shaft to the reverse sun gear.
The overdrive clutch(D) operates in 3rd and 4th gears and transmits driving force from the input shaft to the overdrive planetary carrier and low-reverse annulus gear.

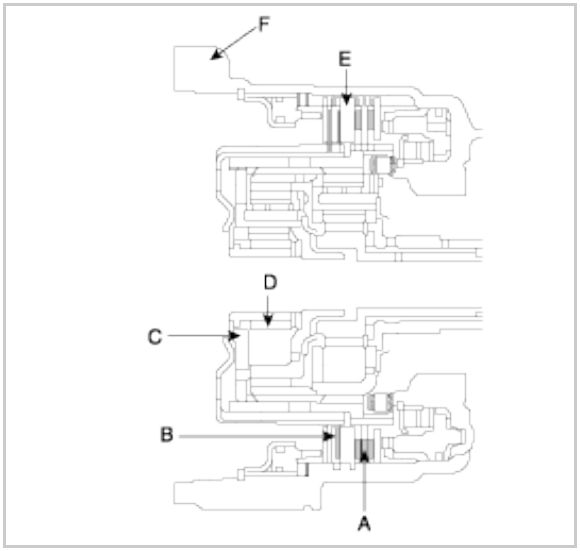


BRAKES

The gear changing mechanism utilizes two multi-disc brakes.

LOW&REVERSE BRAKE AND SECOND BRAKE

The low&reverse brake(A) operates in 1st and reverse gears, when the vehicle is parked, and during manual operation. It locks the low&reverse annulus gear and overdrive planetary carrier to the case.
The second(C) brake(B) operates in 2nd and 4th gears and locks the reverse sun gear(D) to the case.
The components comprising the low&reverse brake and second brake are as illustrated below.
As shown, the discs and plates of the two brakes are arranged on either side of the rear cushion plate(E), which is itself secured to the case(F) by a snap ring.

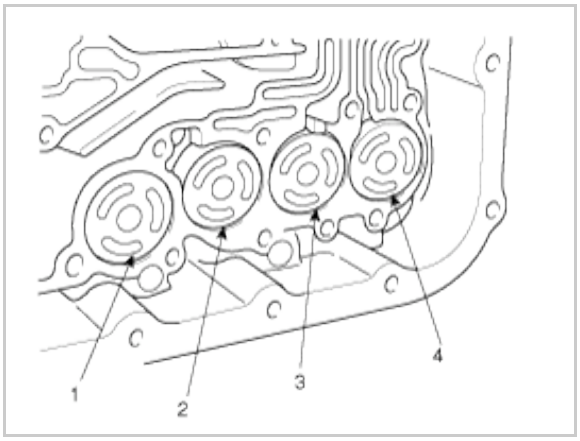


OWC

To improve the shift feeling from 1st to 2nd gear, OWC was adopted on the low&reverse brake annulus gear. Instead of hydraulic fixing by Low&reverse brake at the 1st gear, this mechanical fixing device was used. This structure is not a new concept, because this OWC already has been installed on the previous models.

ACCUMULATORS

Number	Function Name	Color
1	Low&Reverse Brake	None
2	Underdrive Clutch	Yellow
3	Second Brake	Blue
4	Overdrive Clutch	None

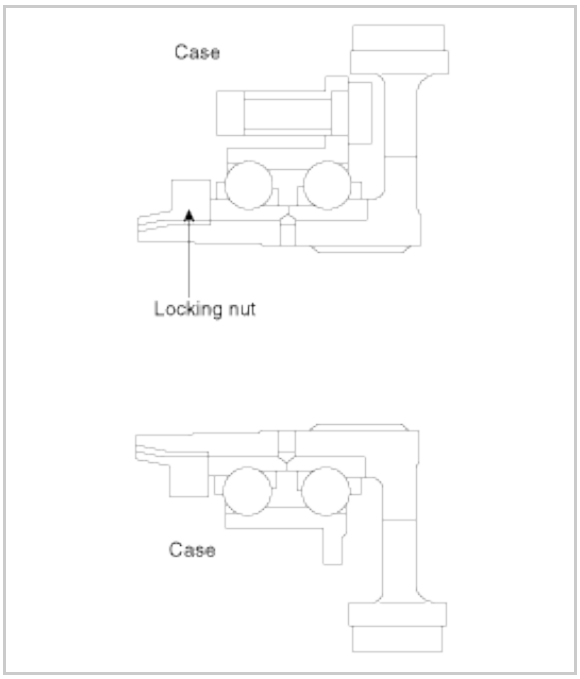


Objective

* Energy (hydraulic pressure) storage
* Impact and pulsation damping when solenoid valves operating
* Operation as spring element
* Smooth shifting by preventing sudden operation of clutches and brakes

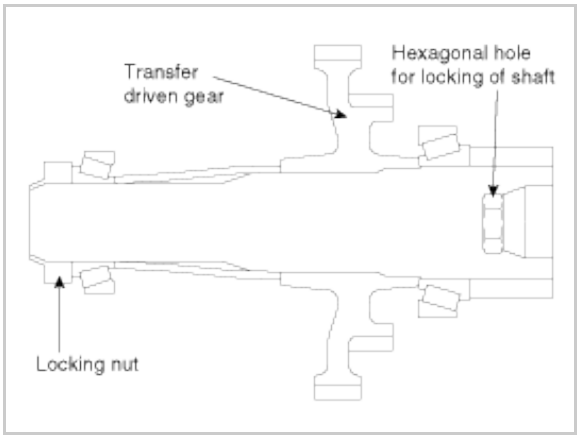
TRANSFER DRIVE GEAR

With the transfer drive gear, increased tooth height and a higher contact ratio have reduced gear noise.
Also, the bearing that supports the drive gear is a preloaded type that eliminates rattle, and the rigidity of the gear mounting has been increased by bolting the bearing directly onto the case.



OUTPUT SHAFT/TRANSFER DRIVEN GEAR

As shown in the illustration below, the transfer driven gear is press-fitted onto the output shaft, and the output shaft is secured by a locking nut and supported by bearings.
The locking nut has a left-handed thread, and a hexagonal hole in the other end of the shaft enables the shaft to be held in position for locking nut removal.



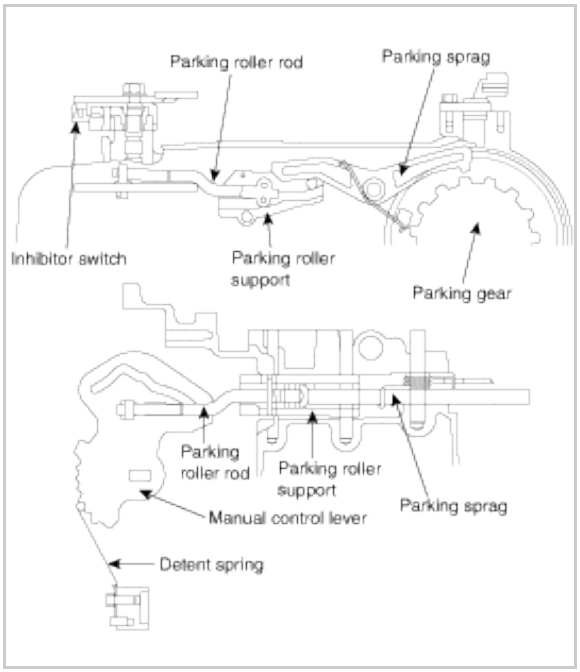
MANUAL CONTROL SYSTEM

MANUAL CONTROL LEVER

The manual control lever is fitted to the top of the valve body and is linked to the parking roller rod and manual control valve pin.
A detent mechanism is provided to improve the gear shift feeling during manual selection.

PARKING MECHANISM

When the manual control lever is moved to the parking position, the parking roller rod moves along the parking roller support and pushes up the parking sprag.
As a result, the parking sprag meshes with the transfer driven gear (parking gear), thereby locking the output shaft. To minimize the operating force required, a roller is fitted to the end of the rod.



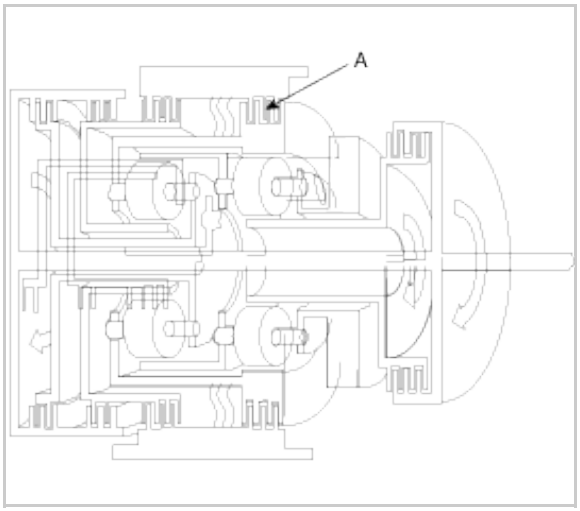
POWER TRAIN

P POSITION

Hydraulic pressure is applied to the LR brake and the RED brake, so power is not transmitted from the input shaft to the UD clutch or OD clutch, and the output shaft is locked by the park brake pawl interlocking the park gear.

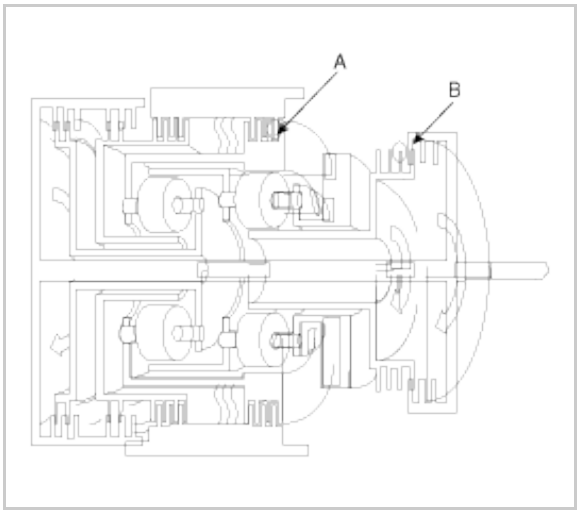
N POSITION

Hydraulic pressure is applied to the LR brake(A) and the RED brake, so power is not transmitted from the input shaft to the UD clutch or OD clutch.



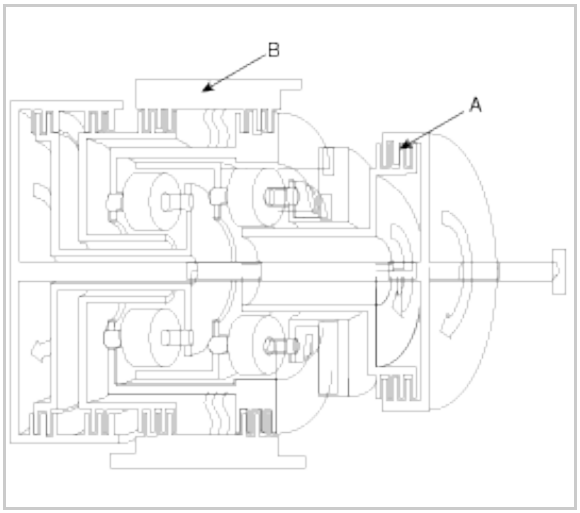
1st GEAR POWER FLOW

Hydraulic pressure is applied to the UD clutch(B) the LR brake(A) and the one way clutch(OWC), then the UD clutch transmits driving force from the input shaft to the UD sun gear, and the LR brake locks the LR annulus gear to the case.The UD sun gear of the planetary gear drives the output pinion gear, and the LR brake locks the annulus gear, and the output pinion drives the output carriers, and the output carrier drives the transfer drive gear, and the transfer drive gear drives the transfer driven gear of the output shaft, and power is transmitted to the differential gear through the differential drive gear.



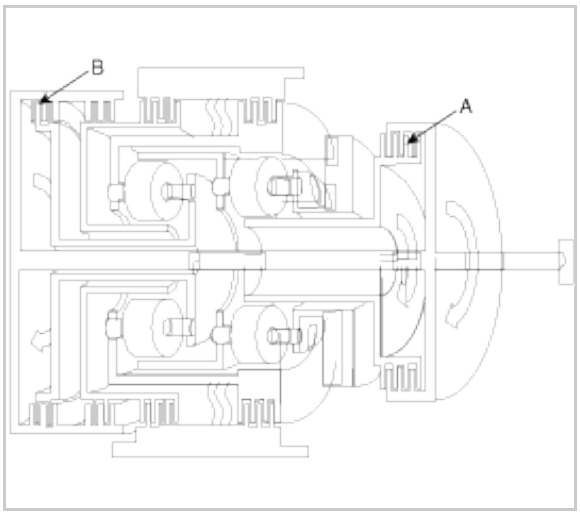
2nd GEAR POWER FLOW

Hydraulic pressure is applied to the UD clutch(A) the 2nd brake(B) and the one way clutch(OWC), then the UD clutch transmits driving force from the input shaft to the UD sun gear, and the 2nd brake locks the reverse sun gear to the case.The UD sun gear of the planetary gear drives the output pinion gear and the LR annulus gear, and the LR annulus gear drives the OD planetary carriers, and OD planetary carriers drives OD pinion gear, and the OD pinion gear drives the output carriers, and the output carrier drives the transfer drive gear, and the transfer drive gear drives the transfer driven gear of the output shaft, and power is transmitted to the differential gear through the differential drive gear.



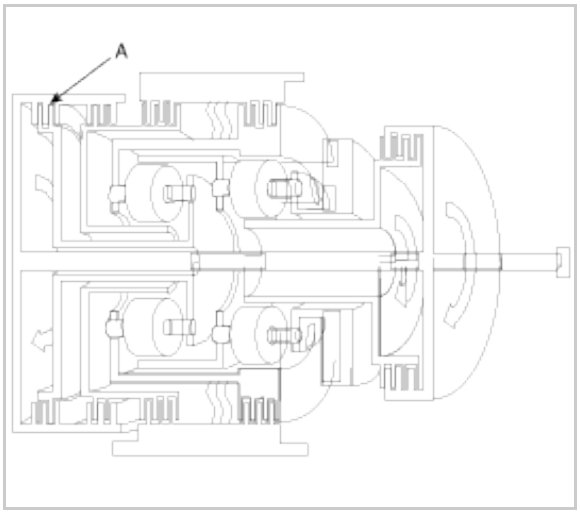
3rd GEAR POWER FLOW

Hydraulic pressure is applied to the UD clutch(A) and the OD clutch(B), then the UD clutch transmits driving force from the input shaft to the UD sun gear, and the OD clutch transmits driving force from the input shaft to the overdrive planetary carrier and low&reverse annulus gear.The UD sun gear of the planetary gear drives the output pinion gear and the LR annulus gear, and the LR annulus gear drives the OD pinion gear through the OD planetary carrier, and the OD pinion gear drives the reverse sun gear and the output carrier.The OD clutch drives the OD carrier, and the OD carrier drives the OD pinion gear, and the OD pinion gear drives the reverse sun gear and the output carrier, and the output carrier drives the transfer drive gear, and the transfer drive gear drives the transfer driven gear of the output shaft, and power is transmitted to the differential gear through the differential drive gear.



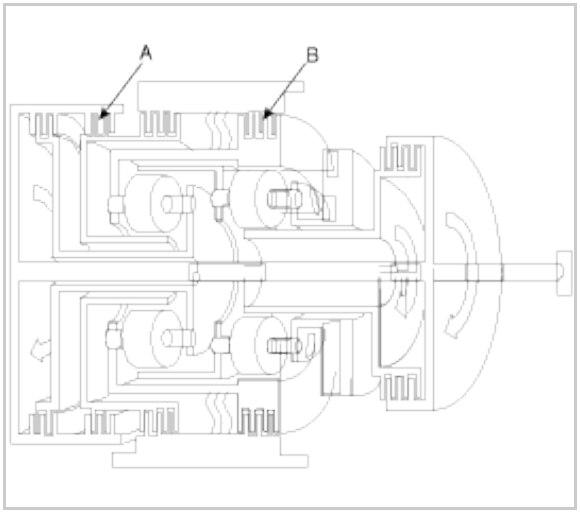
4th GEAR POWER FLOW

Hydraulic pressure is applied to the OD clutch(A) and the 2nd brake(B), then the OD clutch transmits driving force from the input shaft to the OD planetary carrier and LR annulus gear, and the 2nd brake locks the reverse sun gear to the case.The OD clutch drives the OD carrier, and the OD carrier drives the OD pinion gear and the LR annulus gear, and the OD pinion gear drives the output carrier, and the output carrier drives the transfer drive gear, and the transfer drive gear drives the transfer driven gear of the output shaft, and power is transmitted to the differential gear through the differential drive gear.



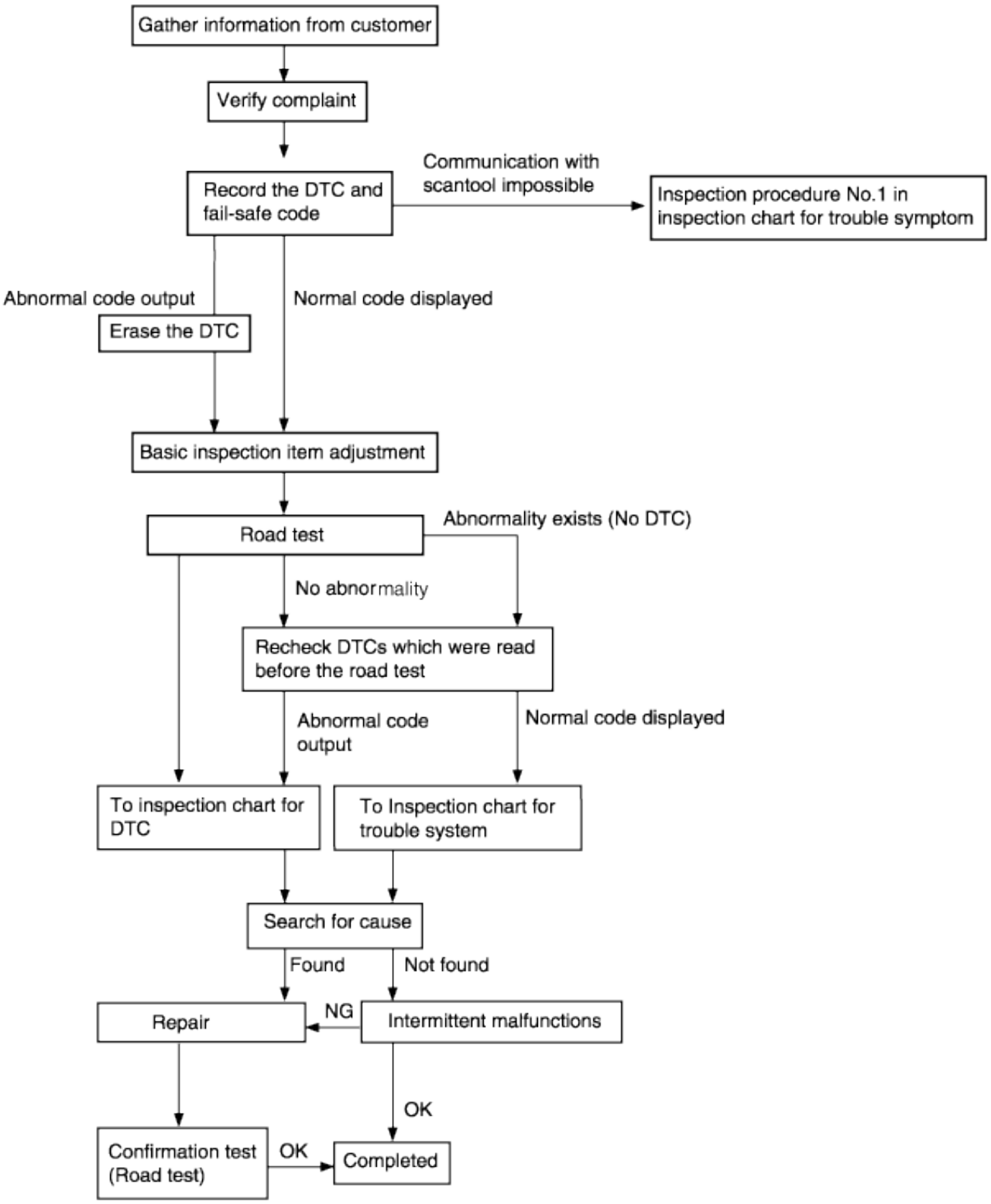
Reverse GEAR POWER FLOW

Hydraulic pressure is applied to the reverse clutch(A) and the LR brake(B), then the reverse clutch transmits driving force from the input shaft to the reverse sun gear, and the LR brake locks the LR annulus gear and OD planetary carrier to the case.The reverse clutch drives the reverse sun gear, and the reverse sun gear drives the output carrier through the OD pinion gear, and the output carrier drives the transfer drive gear, and the transfer drive gear drives the transfer driven gear of the output shaft, and power is transmitted to the differential gear through the differential drive gear.



TROUBLESHOOTING

DIAGNOSIS FLOW



INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom	Probable cause
Communication with HI-SCAN is not possible If communication with the HI-SCAN is not possible, the cause is probably a defective diagnosis line or the TCM(PCM) is not	a. Malfunction diagnosis line b. Malfunction of connector c. Malfunction of the TCM(PCM)

functioning.		c. Malfunction of the TCM(P-CM)
Driving impossible	Starting impossible Starting is not possible when the selector lever is in P or N range. In such cases, the cause is probably a defective engine system, torque converter or oil pump.	a. Malfunction of the engine system b. Malfunction of the torque converter c. Malfunction of the oil pump
	Does not move forward If the vehicle does not move forward when the selector lever is shifted from N to D, 3, 2 or L range while the engine is idling, the cause is probably abnormal line pressure or a malfunction of the underdrive clutch or valve body.	a. Abnormal line pressure b. Malfunction of the underdrive solenoid valve c. Malfunction of the underdrive clutch d. Malfunction of the valve body
	Does not reverse If the vehicle does not reverse when the selector lever is shifted from N to R range while the engine is idling, the cause is probably abnormal pressure in the reverse clutch or low and reverse brake or a malfunction of the reverse clutch, low and reverse brake or valve body.	a. Abnormal reverse clutch pressure b. Abnormal low and reverse brake pressure c. Malfunction of the low and reverse brake solenoid valve d. Malfunction of the reverse clutch e. Malfunction of the low and reverse brake f. Malfunction of the valve body
	Does not move (forward or reverse) If the vehicle does not move forward or reverse when the selector lever is shifted to any position while the engine is idling, the cause is probably abnormal line pressure or a malfunction of the power train, oil pump or valve body.	a. Abnormal line pressure b. Malfunction of power train c. Malfunction of the oil pump d. Malfunction of the valve body
Malfunction when starting	Engine stalling when shifting If the engine stalls when the selector lever is shifted from N to D or R range while the engine is idling, the cause is probably a malfunction of the engine system, damper clutch solenoid valve, valve body or torque converter (damper clutch malfunction).	a. Malfunction of the engine system b. Malfunction of the damper clutch control solenoid valve c. Malfunction of the valve body d. Malfunction of the torque converter (Malfunction of the damper clutch)
	Shocks when changing from N to D and large time lag If abnormal shocks or a time lag of 2 seconds or more occur when the selector lever is shifted from N to D range while the engine is idling, the cause is probably abnormal underdrive clutch pressure or a malfunction of the underdrive clutch, valve body or idle position switch.	a. Abnormal underdrive clutch pressure b. Abnormal low and reverse brake pressure c. Malfunction of the underdrive solenoid valve d. Malfunction of the valve body e. Malfunction of the idle position switch
Malfunction when starting	Shocks when changing from N to R and large time lag If abnormal shocks or a time lag of 2 seconds or more occur when the selector lever is shifted from N to R range while the engine is idling, the cause is probably abnormal reverse clutch pressure or low and reverse brake pressure, or a malfunction of the reverse clutch, low and reverse brake, valve body or idle position switch.	a. Abnormal reverse clutch pressure b. Abnormal low and reverse brake pressure c. Malfunction of the low and reverse solenoid valve d. Malfunction of the reverse clutch e. Malfunction of the low and reverse brake f. Malfunction of the valve body g. Malfunction of the idle position switch

	Shocks when changing from N to D, N to R and large time lag If abnormal shocks or a time lag of 2 seconds or more occur when the selector lever is shifted from N to D range and from N to R range while the engine is idling, the cause is probably abnormal line pressure or a malfunction of the oil pump or valve body.	a. Abnormal line pressure b. Malfunction of the oil pump c. Malfunction of the valve body
Malfunction when shifting	Shocks and running up If shocks occur when driving due to up shifting or down shifting and the transmission speed becomes higher than the engine speed, the cause is probably abnormal line pressure or a malfunction of a solenoid valve, oil pump, valve body or of a brake or clutch.	a. Abnormal line pressure b. Malfunction of each solenoid valve c. Malfunction of the oil pump d. Malfunction of the valve body e. Malfunction of each brake or each clutch
Displaced shifting points	All points If all shift points are displaced while driving, the cause is probably a malfunction of the output shaft speed sensor, TPS or of a solenoid valve.	a. Malfunction of the output shaft speed sensor b. Malfunction of the throttle position sensor c. Malfunction of each solenoid valve d. Abnormal line pressure e. Malfunction of the valve body f. Malfunction of the TCM(PCM)
	Some points If some of the shift points are displaced while driving, the cause is probably a malfunction of the valve body, or it is related to control and is not an abnormality.	a. Malfunction of the valve body
Does not shift	No diagnosis codes If shifting does not occur while driving and no diagnosis codes are output, the cause is probably a malfunction of the transaxle range switch, or TCM(PCM)	a. Malfunction of the transaxle range b. Malfunction of the TCM(PCM)
Malfunction while driving	Poor acceleration If acceleration is poor even if down shifting occurs while driving, the cause is probably a malfunction of the engine system or of a brake or clutch.	a. Malfunction of the engine system b. Malfunction of the brake or clutch
Malfunction while driving	Vibration If vibration occurs when driving at constant speed or when accelerating and deceleration in top range, the cause is probably abnormal damper clutch pressure or a malfunction of the engine system, damper clutch control solenoid valve, torque converter or valve body.	a. Abnormal damper clutch pressure b. Malfunction of the engine system c. Malfunction of the damper clutch control solenoid valve d. Malfunction of the torque converter e. Malfunction of the valve body
Transaxle range switch system The cause is probably a malfunction of the inhibitor switch circuit, ignition switch circuit or a defective TCM(PCM).		a. Malfunction of the transaxle range switch b. Malfunction of the ignition switch c. Malfunction of connector d. Malfunction of the TCM(PCM)
Idle position switch system The cause is probably a defective idle position switch circuit, or a defective TCM(PCM).		a. Malfunction of the triple pressure switch b. Malfunction of connector c. Malfunction of the TCM(PCM)

Triple pressure switch system The cause is probably a defective dual pressure switch circuit or a defective TCM(PCM).	a. Malfunction of the triple pressure switch b. Malfunction of connector c. Malfunction of A/C system d. Malfunction of the TCM(PCM)
Vehicle speed sensor system The cause is probably a defective vehicle speed sensor circuit or a defective TCM(PCM).	a. Malfunction of the vehicle speed sensor b. Malfunction of connector c. Malfunction of the TCM(PCM)

DTC TROUBLESHOOTING INDEX

No.	Code	Item	MIL	Remark
1	P0707	TRANSAXLE RANGE SWITCH CIRCUIT LOW INPUT	ON	
2	P0708	TRANSAXLE RANGE SWITCH CIRCUIT HIGH INPUT	ON	
3	P0711	TRANSAXLE FLUID TEMPERATURE SENSOR RATIONALITY	ON	
4	P0712	TRANSAXLE FLUID TEMPERATURE SENSOR CIRCUIT LOW INPUT	ON	
5	P0713	TRANSAXLE FLUID TEMPERATURE SENSOR CIRCUIT HIGH INPUT	ON	
6	P0717	A/T INPUT SPEED SENSOR CIRCUIT - OPEN or SHORT(GND)	ON	
7	P0722	AT OUTPUT SPEED SENSOR CIRCUIT - OPEN or SHORT(GND)	ON	
8	P0731	GEAR 1 INCORRECT RATIO	ON	
9	P0732	GEAR 2 INCORRECT RATIO	ON	
10	P0733	GEAR 3 INCORRECT RATIO	ON	
11	P0734	GEAR 4 INCORRECT RATIO	ON	
12	P0741	TORQUE CONVERTER CLUTCH STUCK OFF	ON	
13	P0742	TORQUE CONVERTER CLUTCH STUCK ON	ON	
14	P0743	TORQUE CONVERTER CLUTCH CONTROL SOLENOID VALVE - OPEN or SHORT(GND)	ON	
15	P0748	VFS SOLENOID	OFF	
16	P0750	LOW and REVERSE SOLENOID VALVE CIRCUIT - OPEN or SHORT(GND)	ON	
17	P0755	UNDER DRIVE SOLENOID VALVE CIRCUIT - OPEN or SHORT(GND)	ON	
18	P0760	SECOND SOLENOID VALVE CIRCUIT - OPEN or SHORT(GND)	ON	
19	P0765	OVERDRIVE SOLENOID VALVE CIRCUIT - OPEN or SHORT(GND)	ON	
20	P0885	A/T CONTROL RELAY - OPEN or SHORT(GND)	ON	
21	P0890	TCM power Relay sense circuit low	ON	
22	P0891	TCM power Relay sense circuit High	ON	

Failsafe

Activation and deactivation of error failsafe is coordinated Error failsafe Management.
Once Error failsafe is activated, it will be kept until ignition key OFF.
In every new TCM start, TCM start with No Error failsafe and No Error present.
0. Mechanical Limp Home Mode
 a. Switch off A/T relay
1. Electrical Limp Home Mode
 a. Keep 2nd / 3rd gear
2. Prohibit Intelligent Shift
 a. Fuzzy SAT(Siements Adaptive Transmission) shift pattern (Medium Driver, Sporty Driver) will not be used

3. Prohibit Adaptive Control
 a. No learning is done
6. Prohibit Torque Reduction Request
 a. No torque reduction is sent to ECU
7. Prohibit Lockup Control
 a. Stay in non-lockup control state
8. Substitute Input Value Oil Temperature
 a. Set oil temperature(tf) to 80° C (192°F)
9. Substitute Value Speed Ratio
 a. Set speed ratio to 0.7
10. Substitute CAN Input Value
 a. Set engine torque to 42%
 b. Set throttle position to 50%
 c. Set accelerator pedal signal to 50%
 d. Set engine speed (Ne) to 3000 rpm
 e. Set vehicle speed to 0 km/h
 f. Set status of air condition relay to OFF
11. Prohibit VFS control
 a. Stop the Line Pressure Control till IG Off

Failsafe according to the DTC

NOTICE

a. Refer the detail description in the previous page for the indicated number on the 'Failsafe' column.

Items	Type of error	Failsafe	OBD-II relevant DTC	DTC
Oil temperature sensor	Short to ground	2, 3, 7, 8, 11	P0712	P0712
	Open or short to B+		P0713	P0713
	Stuck signal		P0711	P0711
	Sensor fail		P0711	P0711
PG-A	Short to ground	1,11	P0717	P0717
	Open or short to B+			
PG-B	Short to ground		P0722	P0722
	Open or short to B+			
	Sensor fail		P0721	P0721
Brake switch	Open	2	—	P0713
	Short to B+			
LR Solenoid valve	Short to B+	0,11	P0750	P0750
	Open or short to ground			
2nd Solenoid valve	Short to B+		P0760	P0760
	Open or short to ground			
UD Solenoid valve	Short to B+		P0755	P0755
	Open or short to ground			
OD Solenoid valve	Short to B+		P0765	P0765
	Open or short to ground			
	Open or short to B+		P0765	P0765

DCC Solenoid valve	Short to B+		P0743	P0743
	Open or short to ground			
1st speed asynchronous	Synchronous error	0,11	P0731	P0731
2nd speed asynchronous	Synchronous error		P0732	P0732
3rd speed asynchronous	Synchronous error		P0733	P0733
4th speed asynchronous	Synchronous error		P0734	P0734
Reverse speed asynchronous	Synchronous error		—	—
CAN	No ID from ECM	2,3,6,7,9,10,11	—	P1604
	CAN BUS off		—	P1603
Damper clutch	Abnormal system	7	P0741	P0741
A/T relay	Short to ground or open	0,11	P0885	P0885
Inhibitor switch	Short to ground or open	—	P0707	P0707
	Short to B+ or short between switches		P0708	P0708
VFS	Short to B+	11	—	P0748
	Short to ground	0,11		
	Open	11		
CKP sensor	Sensor error	Ne=3,000rpm 7,9	—	—
TPS sensor	Sensor error	TPS=50%	—	—

SERVICE DATA LIST(WITH SCAN TOOL)

No.	ITEM NAME	UNIT	DATA	Data Description	Failure
1	ENGINE RPM	rpm	700 rpm	Current Engine rpm	0 rpm
2	VEHICLE SPEED	km/h	0km/h	Current Vehicle speed	0km/h
3	THROTTLE P.SENSOR	%	12.5%	Current TPS open angle	0%
4	INPUT SPEED(PG-A)	rpm	700 rpm	Input speed rpm. Always output rpm when turning start ON	0 rpm
5	OUTPUT SPEED(PG-B)	rpm	0 rpm	Output speed rpm. Always output rpm when driving	0 rpm
6	DCC(TCC) SOLENOID DUTY	%	0%	Control 0% → 100% when operating Damper Clutch	
7	DAMPER CLUTCH SLIP	rpm	260 rpm	Current Damper clutch slip ratio	0 rpm
8	LR SOLENOID DUTY	%	100%	Control 100% → 0% when operating brake	0%
9	UD SOLENOID DUTY	%	100%	Control 100% → 0% when operating clutch	0%
10	2ND SOLENOID DUTY	%	100%	Control 100% → 0% when operating clutch	0%
11	OD SOLENOID DUTY	%	100%	Control 100% → 0% when operating clutch	0%
12	VFS SOLENOID DUTY	%	0~400%	—	

13	OIL TEMPERATURE	°C	40°C	Current Oil temperature	80°C
14	SHIFT POSITION	N,P,REV/1st G/…/5th G	D	Current shift position	P, N
15	SELECT LEVEL	P,N/R/D/SPORTS	D	Current shift lever position	P, N
16	A/CON SWITCH	OFF/ON/-/NOT SUPP	OFF	-	
17	IDLE STATUS	OFF/ON/-/NOT SUPP	ON	When idling, ON	
18	BRAKE SWITCH	OFF/ON/-/NOT SUPP	ON	When braking, ON	
19	AUTO CRUISE SWITCH	OFF/ON/-/NOT SUPP			
20	AUTO CRUISE RELEASE	—	—		
21	SPORT MODE SELECT SW	OFF/ON/-/NOT SUPP	ON	When selecting sport mode, ON	
22	SPORT MODE UP SW	OFF/ON/-/NOT SUPP	ON	When Selecting Sport mode up, ON	
23	SPORT MODE DOWN SW	OFF/ON/-/NOT SUPP	ON	When selecting sport mode down, ON	
24	A/T CONTROL RELAY VOLT	V	12.9V		0V
25	ENGINE TORQUE	%	20%		
26	HIVEC MODE	A/B/C/D/E/F/G/H/I/J/K	F	A/B/C/D is control mode, F is release mode	F

HIVEC -SAT(SIEMENS ADAPTIVE TRANSMISSION CONTROL) Mode (Shift Patten)

Shift patten	Description(Help)	SCAN DISPLAY
ECONOMY	Economy Driver shift patten for flat road	A
MEDIUM	Shift patten for medium road	B
SPORTS	Shift patten for sport road	C
LOAD 1	Shift patten for low land, slow grade and slope	D
LOAD 2	Shift patten for low land, steep grade and slope	E
LOAD 3	Shift patten for downhill road	F
LOAD 1 HI ALT	Shift patten for high land, steep grade and slope	G
LOAD 2 HI ALT	Shift patten for low land, steep grade and slope	H
HI TEMP	Shift patten for high temperture ATF	I
WARM UP	Shift patten for exhaust gas decrease	J
HOLD	Shift patten for when hold, switch on	K

Actuator inspection

NO	ITEM NAME	Actuator Driving	Condition
1	LR SOLENOID(SCSV A)		1. IG Key ON 2. Inhibitor SW normal 3. P range
2	UD SOLENOID(SCSV B)		

3	2ND SOLENOID(SCSV C)	Solenoid valve driver for 5sec.	4. Vehicle speed 0km/h 5. Engine stop 6. No failure 7. TPS < 1V
4	OD SOLENOID(SCSV D)		
5	TORQUE CONVERTER SOLENOID VALVE		
6	A/T CONTROL RELAY	OFF for 3 sec.	-
7	INTELLIGENT SHIFT PROHIBIT	Prohibit until IG off	-
8	CLEAR LEARNING VALUE	-	-

ROAD TEST

No.	Condition	Operation	Judgment value	Check item
1	Ignition switch : OFF	Ignition switch (1) ON	Battery voltage (mV)	Control relay
2	a. Ignition switch : ON b. Engine : Stopped c. Selector lever position : P	Selector lever position (1) P, (2) R, (3) N, (4) D	(1) P, (2) R, (3) N, (4) D	Transaxle range switch
		Accelerator pedal (1) Released (2) Half depressed (3) Depressed	(1) 400~1,000 mV (2)Gradually rises from (1) (3) 4,500~5,000 mV	Throttle position sensor
		Brake pedal (1) Depressed (2) Released	(1) ON (2) OFF	Brake switch
3	a. Ignition switch : ST b. Engine : Stopped	Starting test with lever P or N range	Starting should be possible	Starting possible or impossible
4	Warming up	Drive for 15 minutes or more so that the automatic fluid temperature becomes 70~90°C	Gradually rises to 70~90°C	Oil temperature sensor
5	a. Engine : Idling b. Selector lever position : N	A/C switch (1) ON (2) OFF	(1) ON (2) OFF	Triple pressure switch
		Accelerator pedal (1) Released (2) Half depressed	(1) ON (2) OFF	Idle position switch
			(1) 600~900 rpm (2) Gradually rises from (1)	
			(1) Data changes	Communication with engine-ECU
		Selector lever position (1) N→D (2) N→R	Should be no abnormal shifting shocks Time lag should be within 2 seconds	Malfunction when starting
	Selector lever position : N (Carry out on a flat and straight road)	Selector lever position and vehicle speed a. Idling in 1st gear (Vehicle stopped)	(2) 1st, (4) 3rd, (3) 2nd, (5) 4th	Shift condition
			(2) 0%, (4) 100%, (3) 100%, (5) 100%	Low and reverse solenoid valve
		b. Driving at constant speed of 20 km/h in 1st gear	(2) 0%, (4) 0%, (3) 0%	Underdrive solenoid valve

6		c. Driving at constant speed of 30 km/h in 2nd gear d. Driving at 50 km/h in 3rd gear with accelerator fully closed e. Driving at constant speed of 50 km/h in 4th gear	(1) 100%, (2) 0%, (3) 100%	Second solenoid valve
			(2) 100%, (3) 100%, (4) 0%	Overdrive solenoid valve
			(1) 0km/h (4) 50km/h	Vehicle speed sensor
			(4) 1,800 ~ 2,100rpm	Input shaft speed sensor
			(4) 1,800 ~ 2,100rpm	Output shaft speed sensor
7	Selector lever position : D (Carry out on a flat and straight road)	a. Accelerate to 4th gear at a throttle position sensor output of 1.5V (accelerator opening angle of 30 %). b. Gently decelerate to a standstill. c. Accelerate to 4th gear at a throttle position sensor output of 2.5 V (accelerator opening angle of 50%). d. While driving at 60 km/h in 4th gear, shift down to 3rd gear. e. While driving at 40 km/h in 3rd gear, shift down to 2nd gear. f. While driving at 20 km/h in 2nd gear, shift down to 1st gear.	For (1), (2) and (3), the reading should be the same as the specified output shaft torque, and no abnormal shocks should occur. For (4), (5) and (6), downshifting should occur immediately after the shifting operation is made.	Malfunction when shifting
				Displaced shift points
				Does not shift
				Does not shift from 1 to 2 or 2 to 1
				Does not shift from 2 to 3 or 3 to 2
				Does not shift from 3 to 4 or 4 to 3
8	Selector lever position : N (Carry out on a flat and straight road)	Move selector lever to R range drive at constant speed of 10km/h	The ratio between input and output shaft speed sensor data should be the same as the gear ratio when reversing.	Does not shift

TORQUE CONVERTER STALL TEST

This test measures the maximum engine speed when the selector lever is in the D or R position. The torque converter stalls to test the operation of the torque converter, starter motor, one-way clutch operation, the holding performance of the clutches, and brakes in the transaxle.

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. Prevent all the wheels from moving during the test.
3. Pull the parking brake lever up, with the brake pedal fully depressed.
4. Start the engine.

5. Move the selector lever to the "D" position, fully depress the accelerator pedal and take a reading of the maximum engine speed at this time.

Stall speed : 2,100~2,900rpm

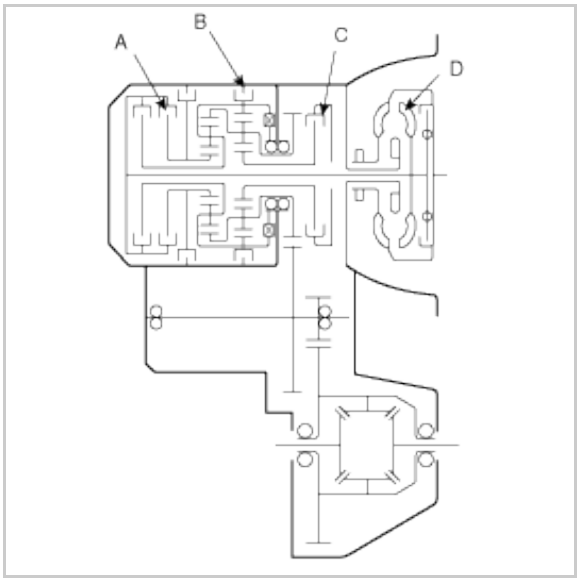
CAUTION

a. The throttle should not be left fully open for any more than five seconds.
b. If carrying out the stall test two or more times, move the selector 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.

6. Move the selector lever to the "R" position and carry out the same test again.

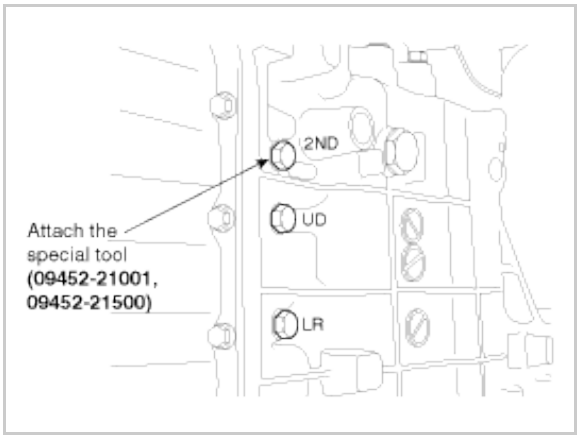
TORQUE CONVERTER STALL TEST CONCLUSION

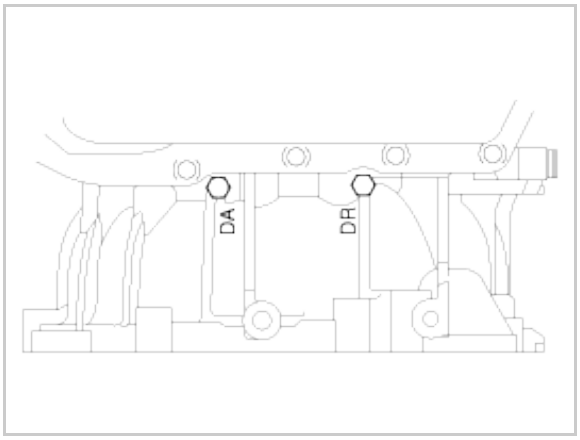
1. Stall speed is too high in both "D" and "R" ranges
   a. Low line pressure
   b. Low & reverse brake(B) slippage
2. Stall speed is to high in "D" range only
   a. Underdrive clutch(C) slippage
3. Stall speed is too high in "R" range only
   a. Reverse clutch(A) slippage
4. Stall speed too low in both "D" and "R" ranges
   a. Malfunction of torque converter(D)
   b. Insufficient engine output

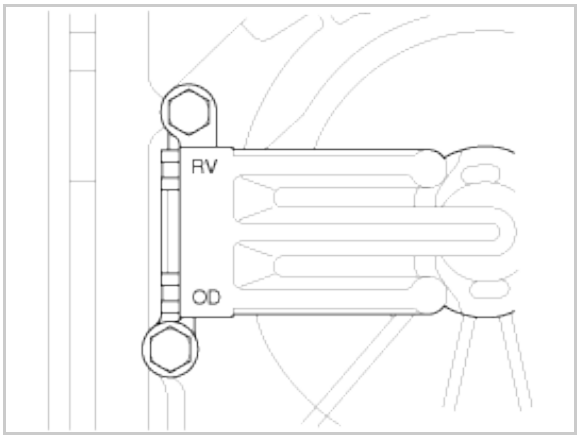


HYDRAULIC PRESSURE TEST

1. Warm up the engine until the automatic transaxle fluid temperature is 80-100°C.
2. Lift up the vehicle so that the wheels are free to turn.
3. Connect the special tool (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.







STANDARD HYDRAULIC PRESSURE TEST

Measurement condition			Standard hydraulic pressure kPa (psi)						
Selector lever position	Shift position	Engine speed (rpm)	Under drive clutch pressure	Reverse clutch pressure	Overdrive clutch pressure	Low&reverse brake pressure	Second brake pressure	Damper clutch Apply pressure (DA)	Damper clutch Release pressure (DR)
P	-	2,500	-	-	-	260-340 (38-50)	-	-	-
R	Reverse	2,500	-	1,270-1,770 (185-256)	-	1,270-1,770 (185-256)	-	-	-
N	-	2,500	-	-	-	260-340 (38-50)	-	-	-
	1st gear	2,500	430-510 (62-74)	-	-	1,010-1,050 (146-152)	-	-	-
	2nd gear	2,500	430-510 (62-74)	-	-	-	430-510 (62-74)	-	-

D									
	3rd gear	2,500	430-510 (62-74)	-	430-510 (62-74)	-	-	More than 730 (100)	0-10 (0-1)
	4th gear	2,500	-	-	430-510 (62-74)	-	780-880 (110-130)	More than 730 (100)	0-10 (0-1)

※ The values are subject to change according to vehicle model or condition
※ Depress the acceleration pedal "GENTLY" under no load when measuring the hydraulic pressure.

SERVICE ADJUSTMENT PROCEDURE

Automatic transaxle fluid

INSPECTION

1. Drive the vehicle until the fluid reaches normal operating temperature [70~80°C].
2. Place the vehicle on a level surface.
3. Move the selector lever through all gear positions. This will fill the torque converter and the hudraulic system with fluid and move the selector lever to the "N" (Neutral) or "P"(Park) 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.

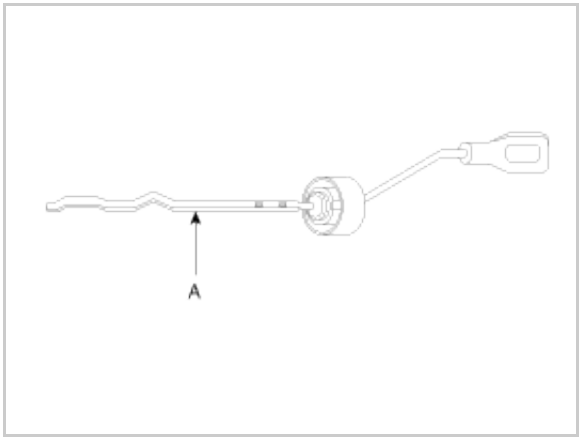
> NOTICE
>
> If the fluid smells as if it is burning, it means that the fluid has been contaminated by fine particles from the bushes and friction materials, a transaxle overhaul may be necessary.

5. Check that the fluid level is at the HOT mark on the oil level gauge. If the fluid level is low, add automatic transaxle fluid until the level reaches the "HOT" mark.

Auto transaxle fluid:
DIAMOND ATF SP-III, SK ATF SP-III
Quantity : 8.5ℓ (9.0 US qt, 7.5 Imp.qt)

> NOTICE
>
> Low fluid level can cause a variety of a abnormal conditions because it allows the pump to take in air along with fluid. Air trapped in the hydraulic system forms bubbles, which are compressable. 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 acuise 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(A) securely.



> NOTICE
>
> 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, replace it using the following procedure.

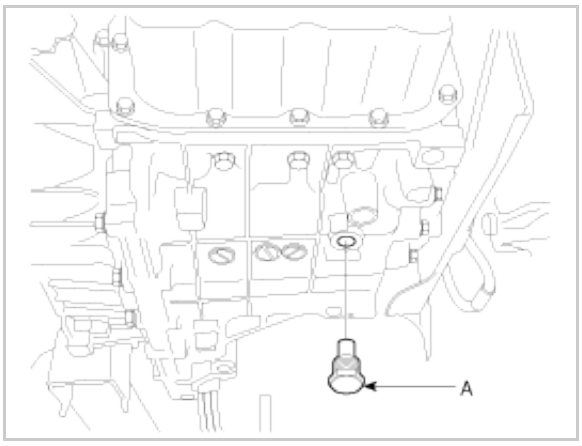
1. Disconnect the hose which connects the transmission and the oil cooler which is within the radiator only in 2.4L engine(3.3L-the oil cooler is separated).
2. Start the engine and let the fluid drain out.

   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. Romove 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 to the specified torque.

   TORQUE :
   40~50Nm (4.0~5.0 kgf.m, 29~36 lb-ft)

5. Pour the new fluid in through the oil filler tube.

   CAUTION

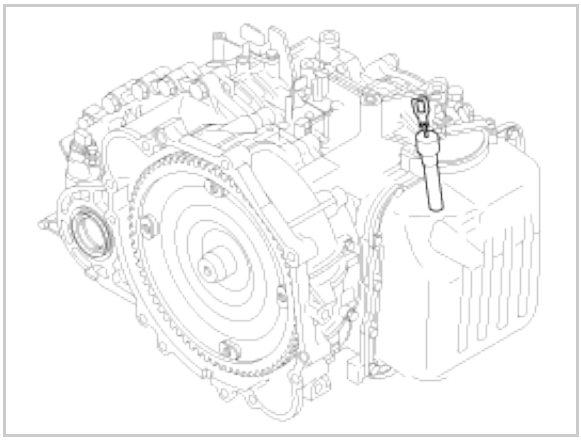
   Stop pouring if the full volume of fluid cannot be poured in.

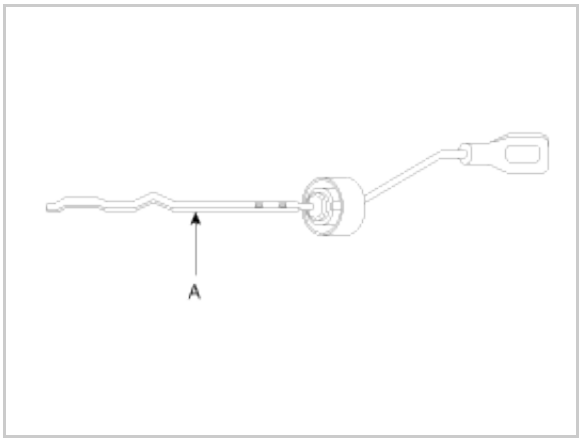
6. Repeat the procedure in step (2).

   NOTICE

   Check the old fluid for contamination. If it has been contaminated, repeat the steps (5) and (6).

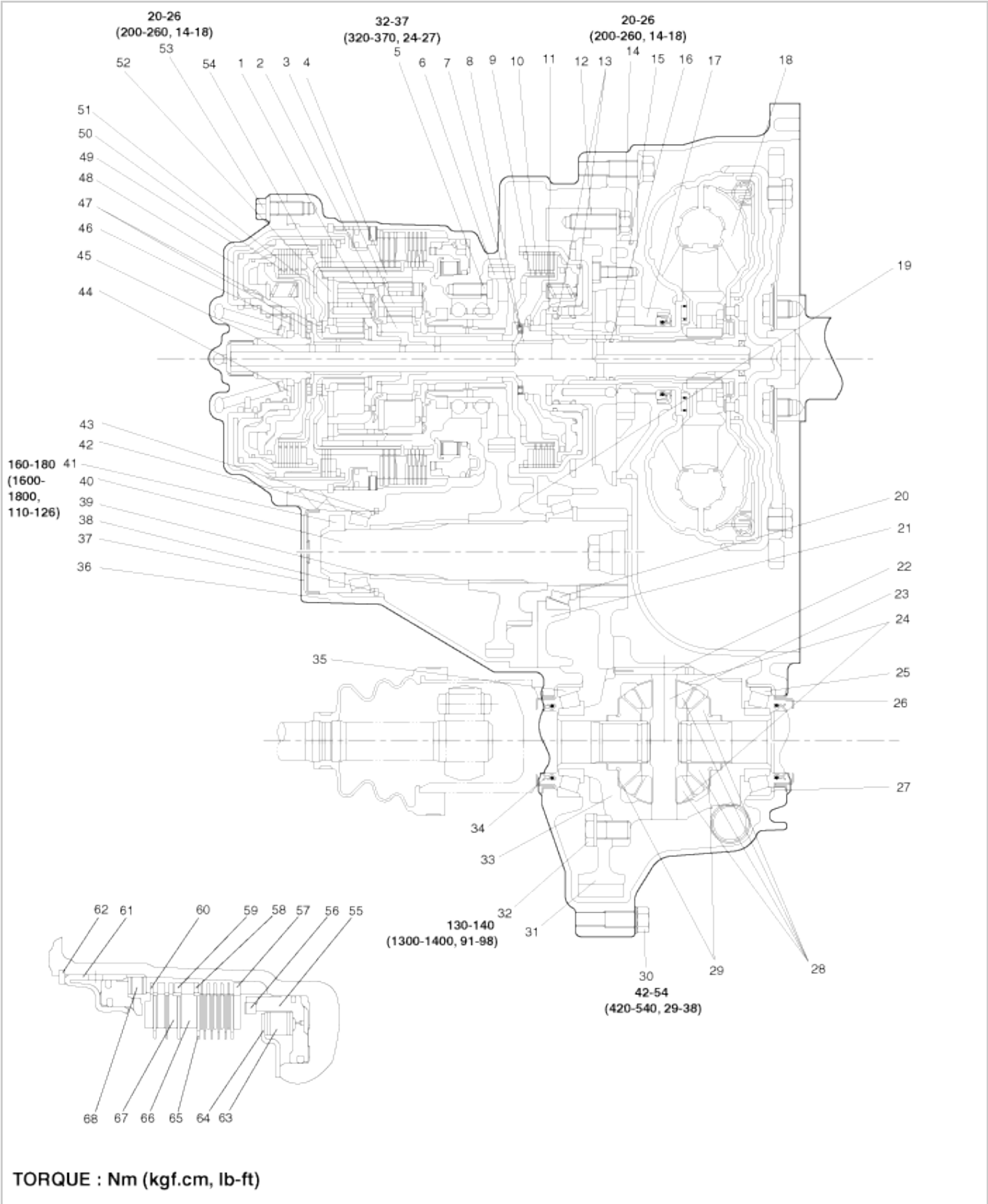
7. Pour the new fluid in through the oil filler tube.
8. Reconnect the hose which was disconnected in step (1) above and firmly replace the oil level gauge.(In case of this "replace", this means after wiping off any dirt around the oil level gauge, insert it into the filler tube.)
9. Start the engine and run it at idle for 1~2 minutes.
10. Move the select lever through all positions, and then move it to the "N" position.
11. Drive the vehicle until the fluid temperature rises to the normal temperature (70~80°C), and then check the fluid level again. The fluid level must be at the HOT mark.
12. Firmly insert the oil level gauge(A) into the oil filler tube.




A

Automatic Transaxle

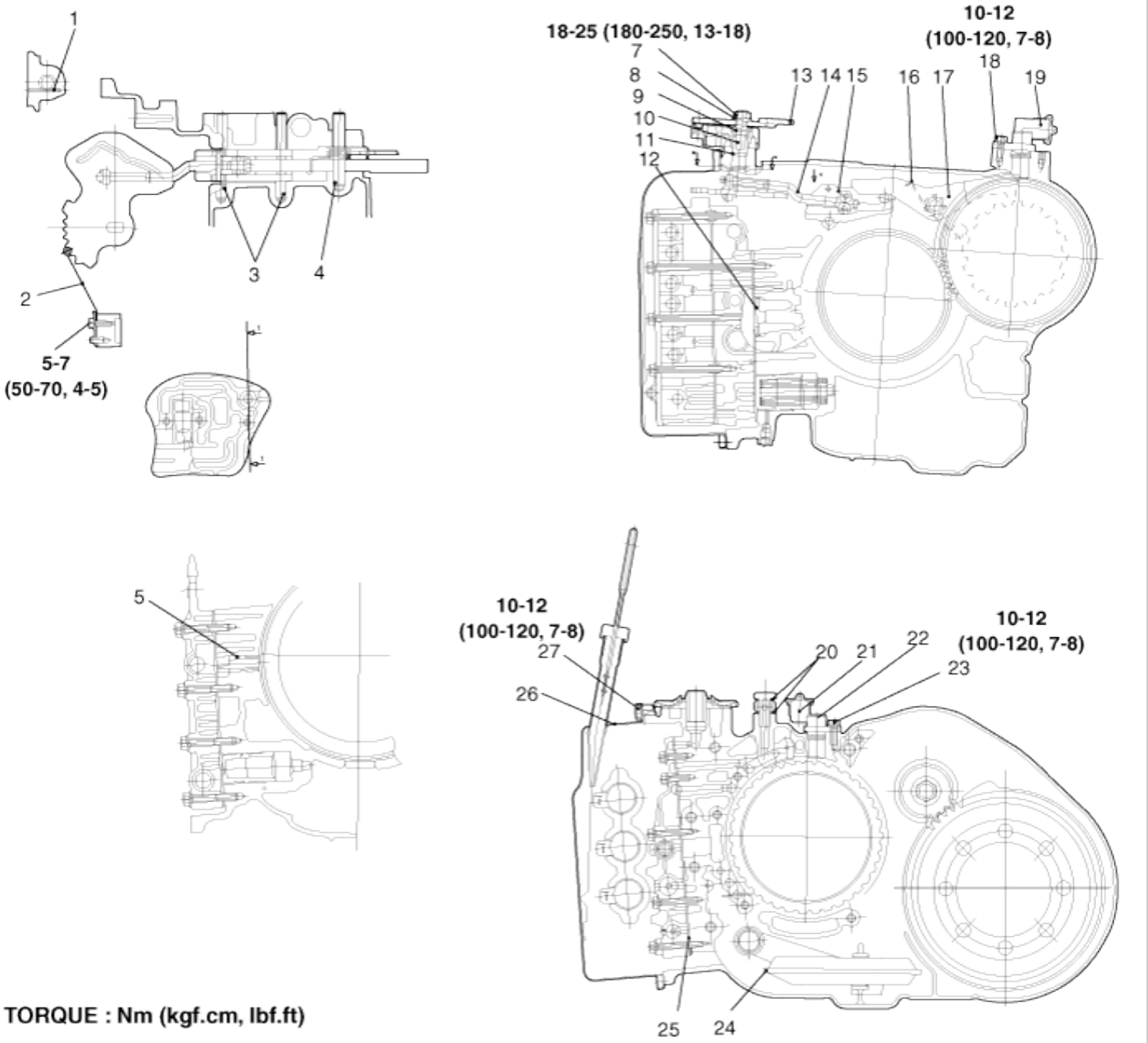
COMPONENTS (1)



TORQUE : Nm (kgf.cm, lb-ft)

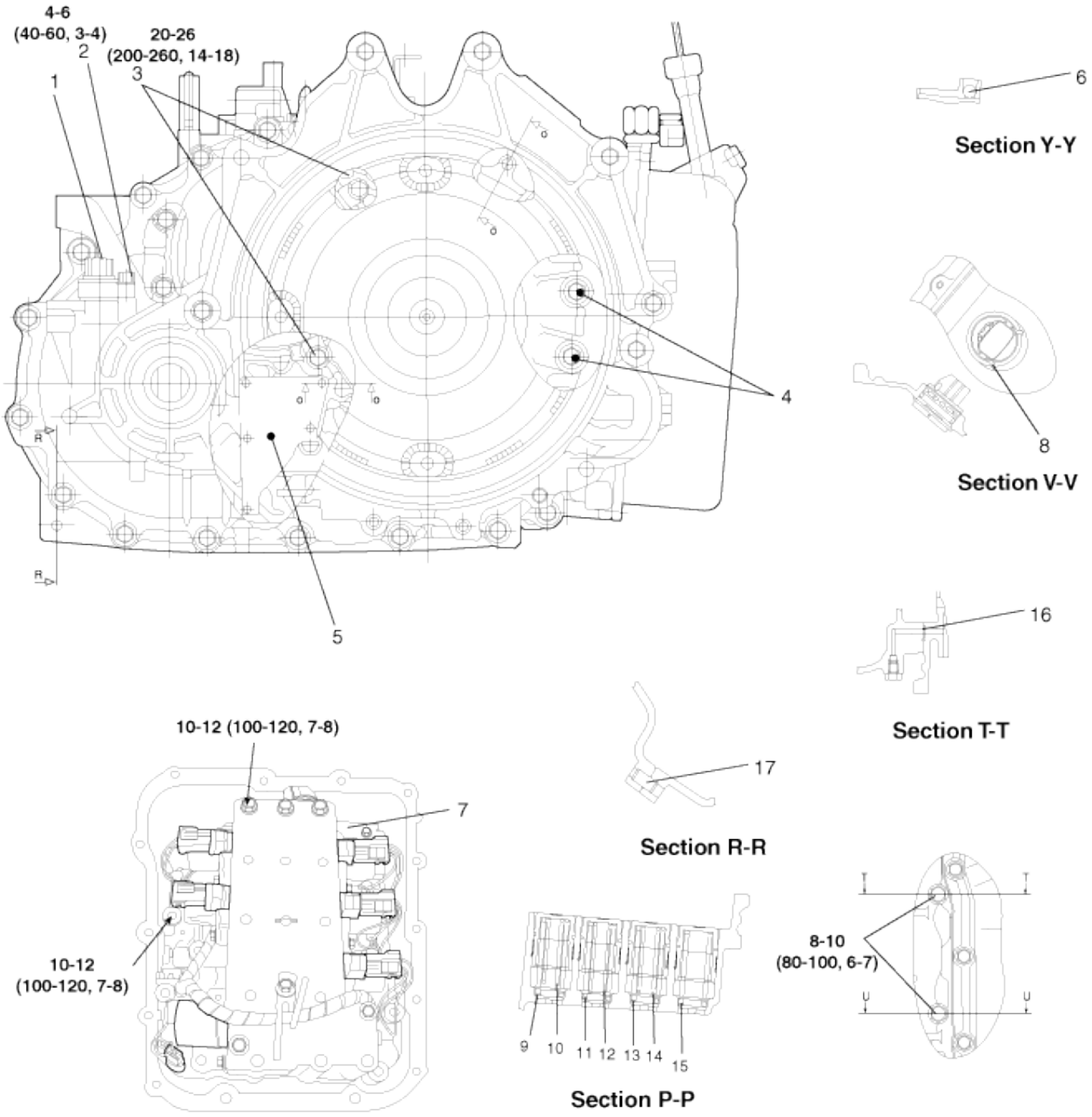
1. Thrust bearing
2. Underdrive sun gear
3. Output carrier
4. Low and reverse annulus gear
5. Bolt
6. Transfer drive gear
7. Snap ring
8. Thrust bearing
9. Underdrive clutch hub
10 . Underdrive clutch
11. Thrust washer
12. Oil pump gasket
13. Seal ring
14. Flange bolt
15. O-ring
16. Seal ring
17. Oil pump
18. Torque converter
19. Transfer driven gear
20. Taper roller bearing
21. Bearing retainer
22. Lock pin
23. Pinion shaft
24. Washer
25. Taper roller bearing
26. Oil seal
27. Differential spacer
28. Differential gear
29. Differential spacer set
30. Flange bolt
31. Differential drive gear
32. Fly wheel bolt
33. Differential case
34. Oil seal
35. Transmission case
36. One-way Clutch Inner Race
37. Sealing cap
38. Output spacer set
39. Collar
40. Output shaft
41. Locking pin
42. Roller bearing
43. Snap ring
44. Thrust race
45. Input shaft
46. Thrust bearing
47. Thrust bearing
48. Return & O/D clutch
49. Rear cover
50. O/D clutch hub
51. Return sun gear
52. Output carrier
53. Flange bolt
54. Snap ring
55. Low and reverse brake piston
56. Wave spring
57. Brake pressure plate
58. Snap ring
59. Snap ring set
60. Brake pressure plate
61. 2nd brake retainer
62. Snap ring
63. 2nd brake return spring
64. Brake disc
65. Brake reaction plate
66. Brake plate
67. Brake spring retainer
68. Low and reverse return spring

COMPONENTS (2)



1. Roller
2. Detent spring
3. Parking roller shaft
4. Parking spring shaft
5. Oil seal
6. 2nd brake retainer
7. Flange nut
8. Spring washer
9. Oil ring
10. Manual control shaft
11. Oil ring
12. Oil strainer
13. Manual control lever
14. Parking roller rod
15. Parking roller shaft
16. Parking sprag
17. Parking sprag shaft
18. Flange bolt
19. Output speed sensor
20. Eye bolt
21. Gasket
22. Input speed sensor
23. Flange bolt
24. Oil filter
25. Valve body gasket
26. Valve body
27. Flange bolt

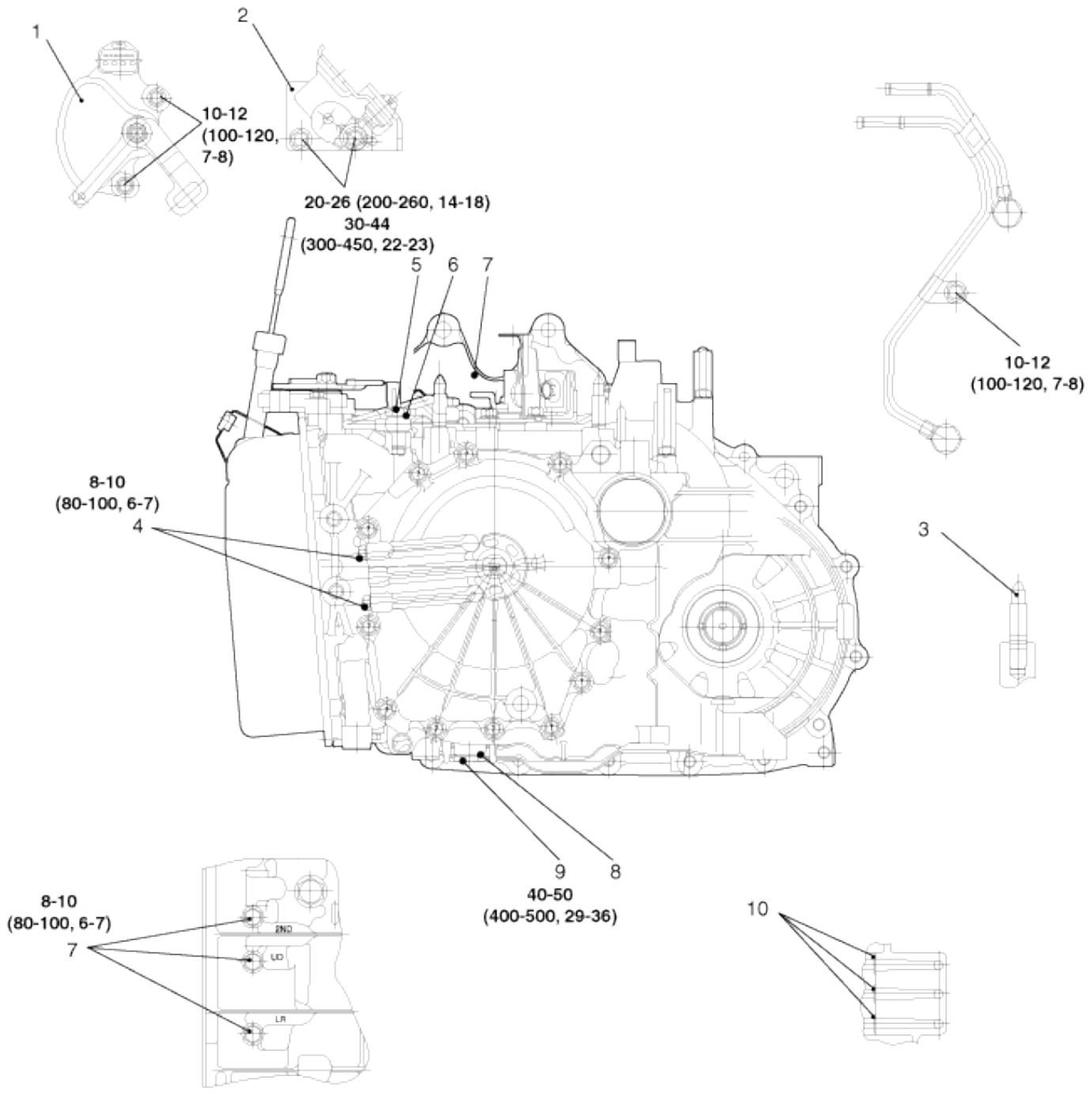
COMPONENTS (3)



TORQUE : Nm (kgf.cm, lbf.ft)

1. Vehicle speed sensor
2. Washer
3. Seal bolt
4. Flange bolt
5. Oil guide
6. Steel ball
7. Harness
8. Snap ring
9. Coil spring
10. Coil spring
11. Coil spring
12. Coil spring
13. Coil spring
14. Coil spring
15. Coil spring
16. O-ring
17. Dowel pin

COMPONENTS (4)



TORQUE : Nm (kgf.cm, lbf.ft)

1. Inhibitor switch
2. Control cable bracket
3. Stud
4. Pressure check plug
5. Eye bolt
6. Gasket
7. Converter housing
8. Gasket
9. Magnet plug
10. Accumulator piston

REMOVAL

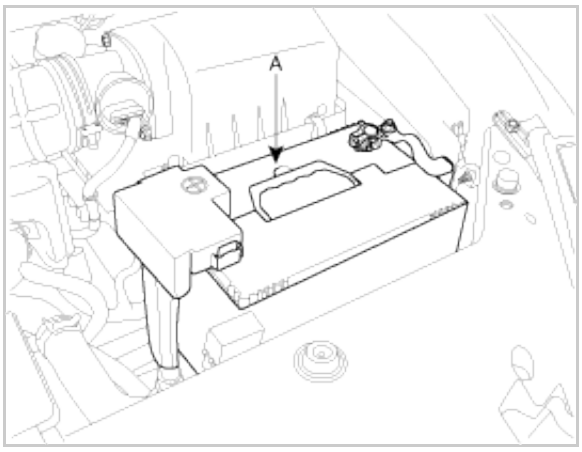
CAUTION

a. Use a cover not to damage the vehicle surface.
b. Disconnect connectors carefully not to be damaged.

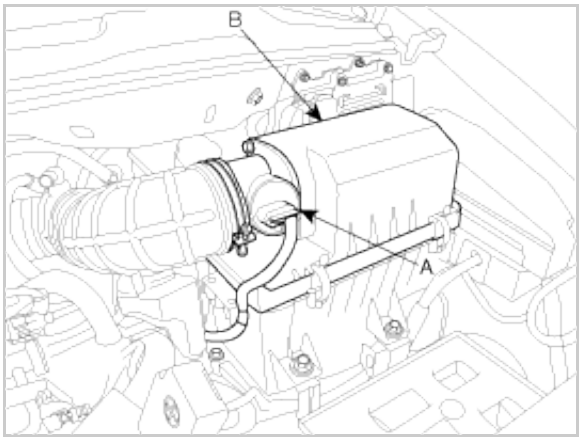
NOTICE

a. Mark wires or hoses for identification not to be confused.

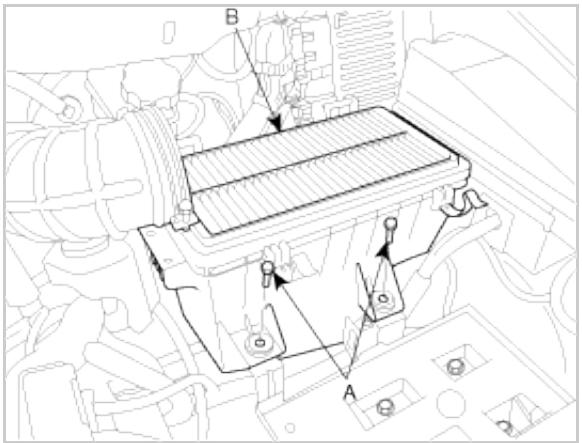
1. Remove the battery (A).



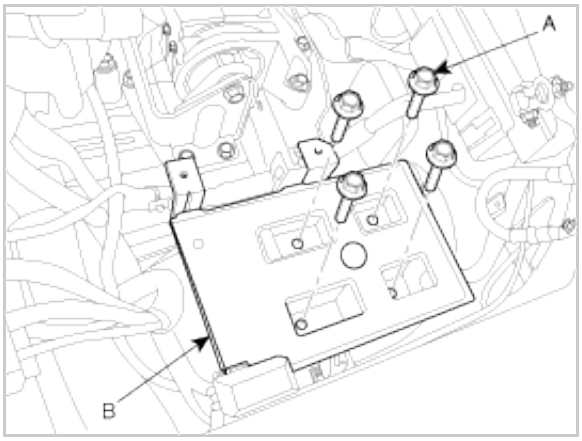
2. After disconnecting the AFS connector(A) and removing the alr cleaner upper body(B) taka the air cleaner filter out of the air cleaner under body.



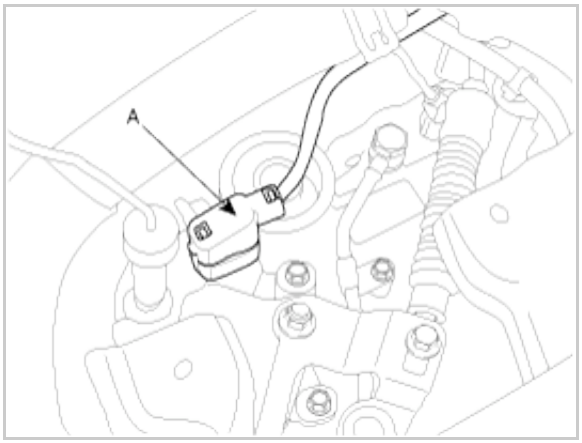
3. Remove the air cleaner assembly (B) by removing the two mounting bolts(A).



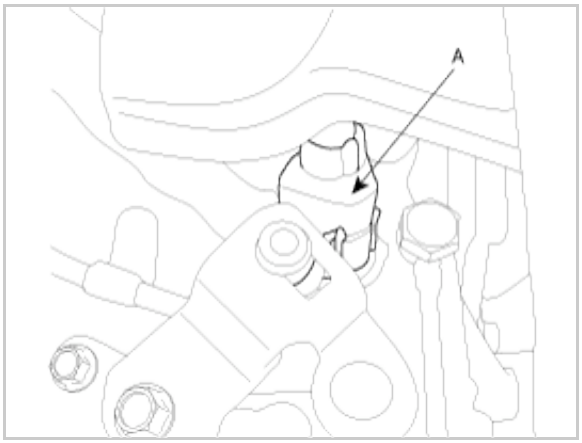
4. Remove the battery tray (B) by removing the four mounting bolts (A).



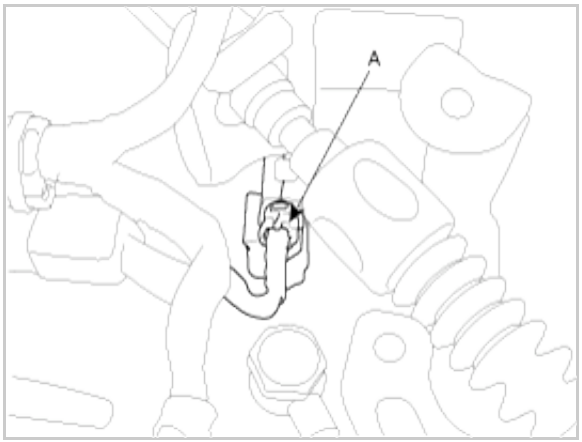
5. Remove the inhibiter switch connector (A).



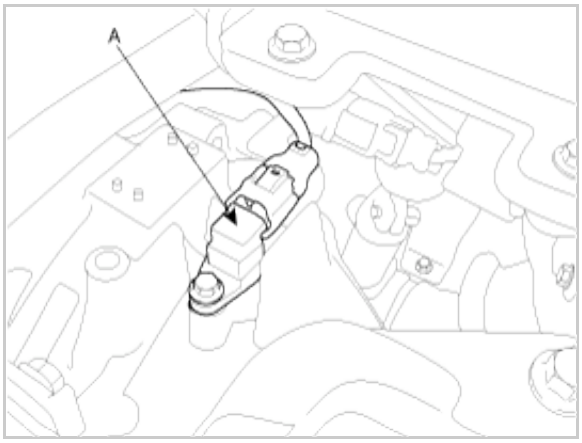
6. Remove the solenoid valve connector (A).



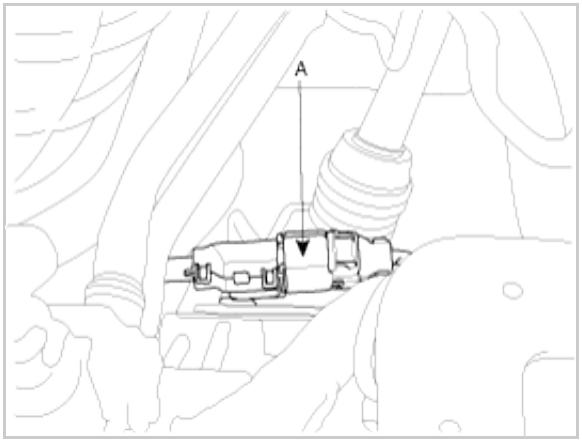
7. Remove the input speed sensor connector (A).



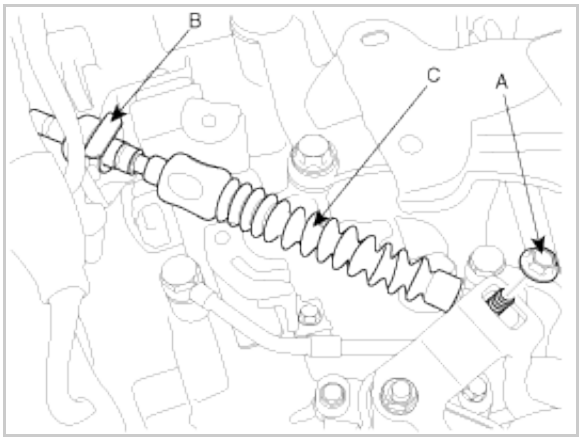
8. Remove the output speed sensor connector (A).



9. Remove the vehicle speed sensor connector (A).



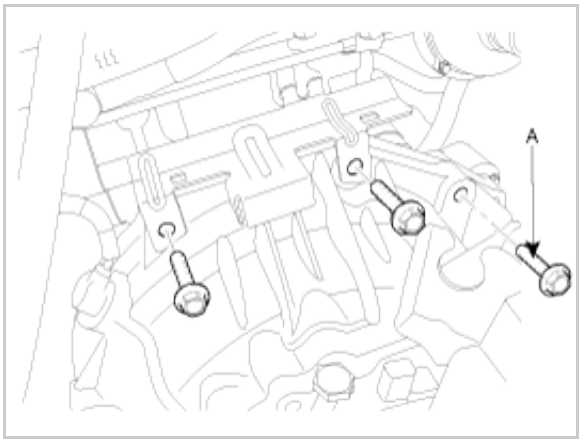
10. Remove the control cable assembly(C) by removing the nut (A) and clip (B).



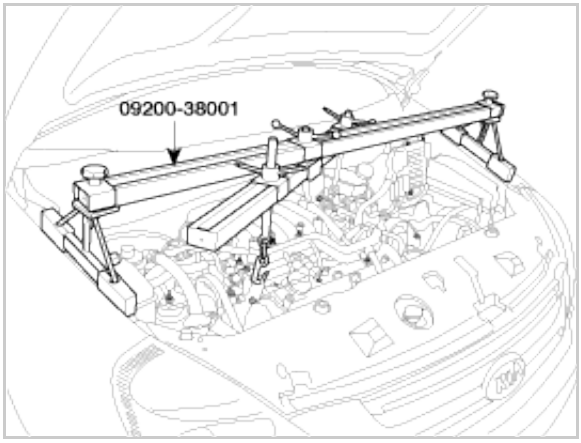
11. Disconnect the transaxle oil cooler hoses (B) from the tubes by loosening the clamps (A).



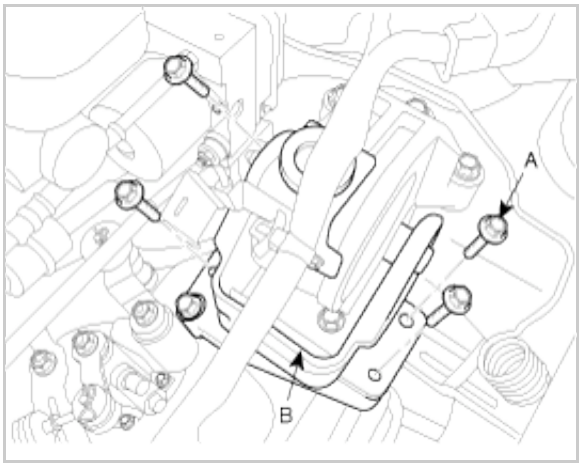
12. Remove the transaxle mounting bolts (A).



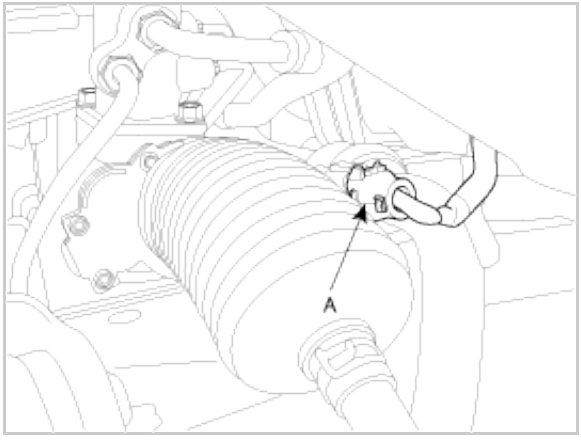
13. Remove the starter motor by disconnecting the connector. (see EE group)
14. Using the SST(09200-38001), hold the engine and transaxle assembly safely.



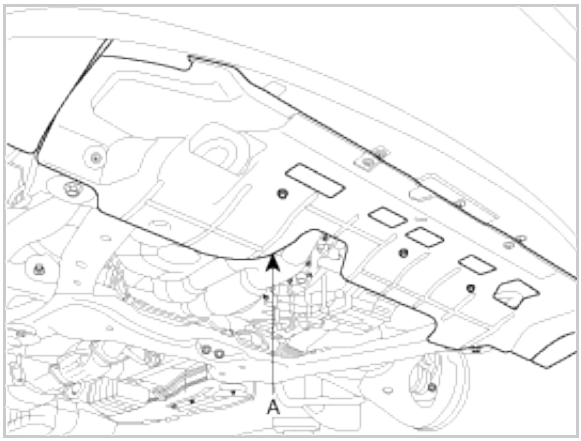
15. Remove the transaxle insulator mounting (B) bolts (A).



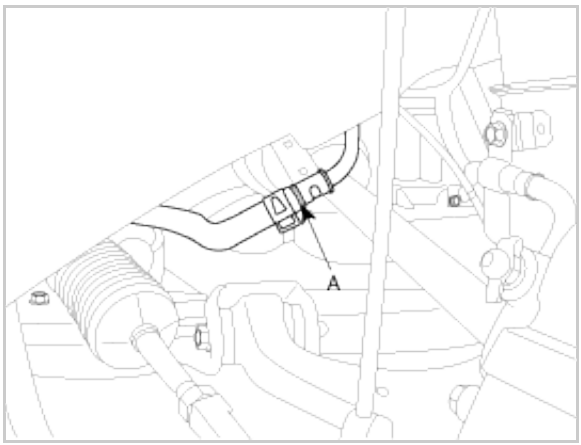
16. Remove the front wheels. (see SS group)
17. Lift up the vehicle.
18. Remove the power steering column joint bolt and the VRS connector (A). (see ST group)



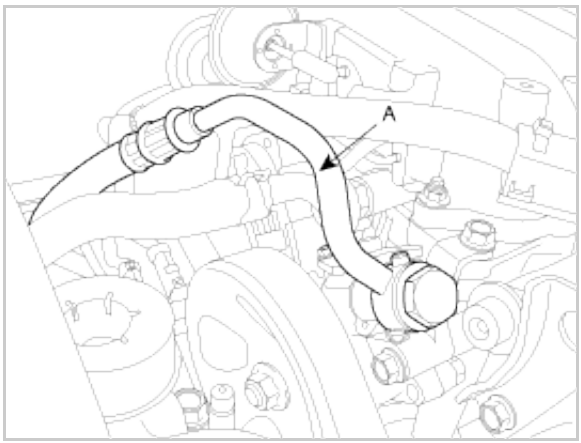
19. Remove the under cover (A).



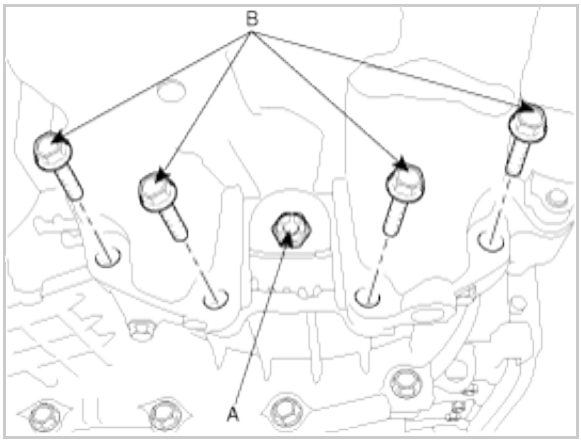
20. Drain the transaxle fluid.
21. Drain power steering fluid through the return tube(A). (see ST group)



22. Disconnect the power steering pressure tube (A) from the power steering oil pump.



23. Disconnect the lower arm, the tie rod end ball joint, the stabilizer bar link from the front knuckle. (see SS group)
24. Remove the roll stopper mounting bolts.
25. Remove the mounting bolts from the sub frame by supporting the sub frame with a jack. (see SS group)
26. Remove drive shaft from transaxle. (see DS group).
27. Install a jack for supporting the transaxle assembly.
28. Remove the drive plate bolts (A) and the transaxle lower mounting bolts (B-4EA).



29. Lifting the vehicle up and lowering the jack slowly, remove the transaxle assembly.

INSTALLATION

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

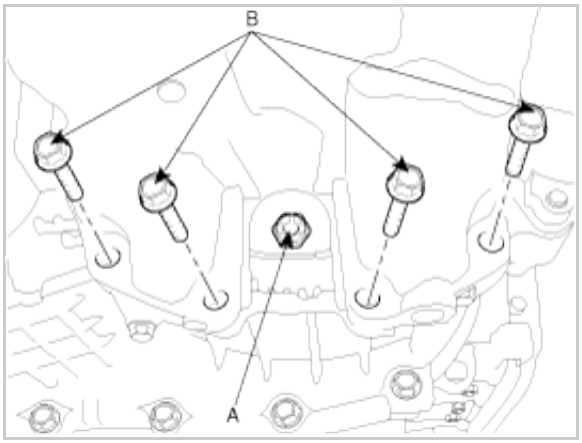
a. Adjust the shift cable.
b. Refill the transaxle with fluid.
c. Refill the radiator with engine coolant.
d. Bleed air from the cooling system with the heater valve open.
e. Clean the battery posts and cable terminals with sandpaper, assemble them, and apply grease to prevent corrosion.

1. Lowering the vehicle or lifting up a jack, install the transaxle assembly.
2. Tighten the transaxle lower mounting bolts (B-4EA).

TORQUE:
65~85 Nm(6.5~8.5 kgf.m, 47.0~61.5 lb-ft)

3. Install the drive plate bolts (A) by turning the timing gear.

TORQUE:
46~53 Nm(4.6~5.3 kgf.m, 33.3~38.3 lb-ft)

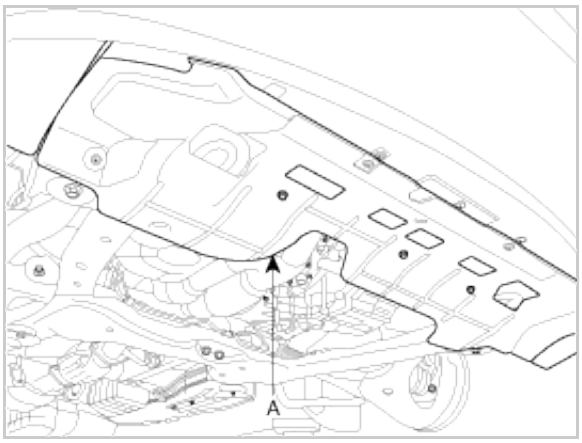


4. After removing a jack, insert the drive shafts. (see DS group)
5. Install the sub frame. (see SS group).
6. Tighten the roll stopper mounting bolts.

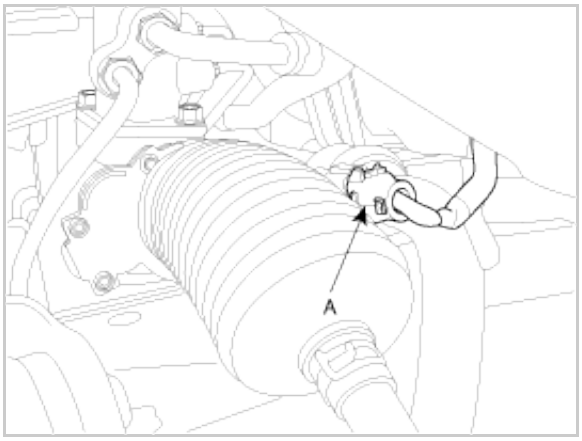
TORQUE:
90~110 Nm(9~11 kgf.m, 65.1~79.5 lb-ft)

7. Connect the lower arm, the tie rod end ball joint, the stabilizer bar link to the front knuckle. (see SS group)

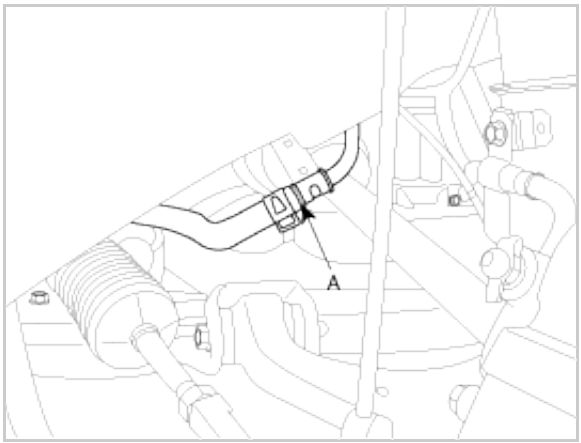
8. Install the under cover (A).



9. Install the steering column joint bolt and the VRS connector (A). (see ST group)

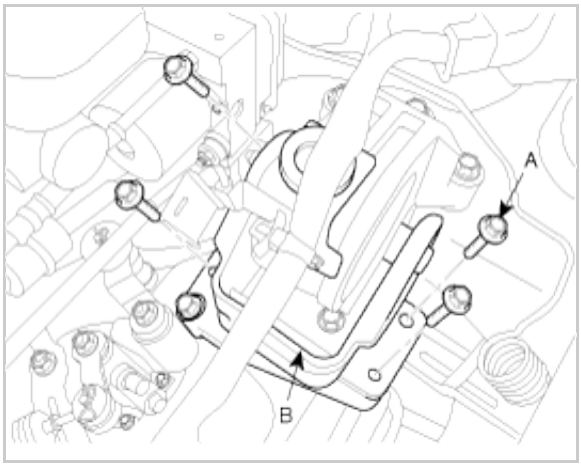


10. Connect the return tube(A) with a clamp. (see ST group)



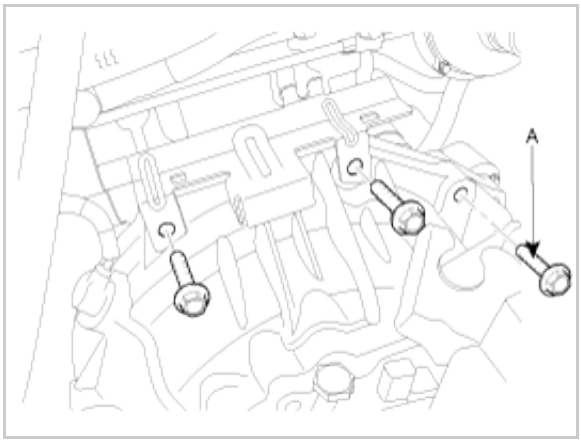
11. Install the front wheels and tires.
12. Tighten the transaxle insulator mounting (B) bolt (A).

TORQUE:
90~110 Nm(9~11 kgf.m, 65.1~79.5 lb-ft)

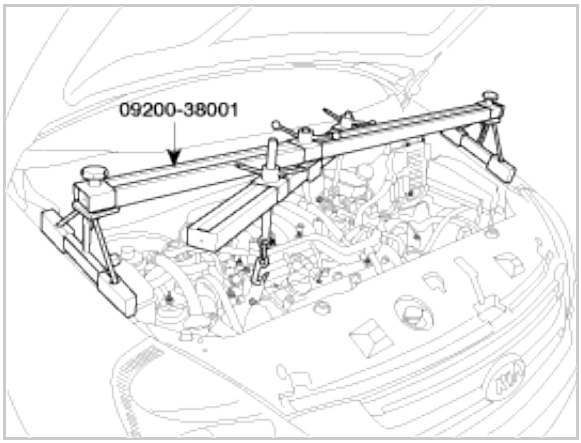


13. Tighten the transaxle mounting bolts (A).

TORQUE:
65~85 Nm(6.5~8.5 kgf.m, 47.0~61.5 lb-ft)



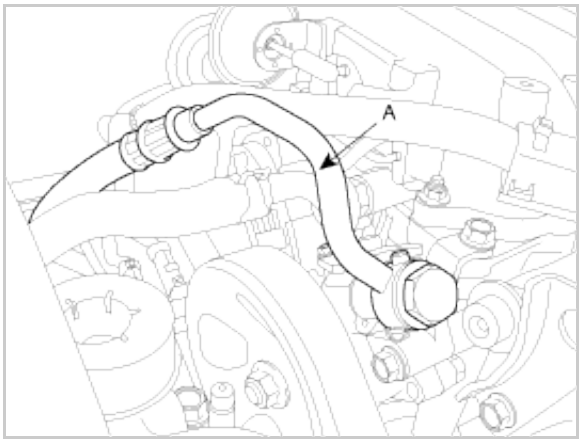
14. Remove the SST (09200-38001) holding the engine and transaxle assembly.



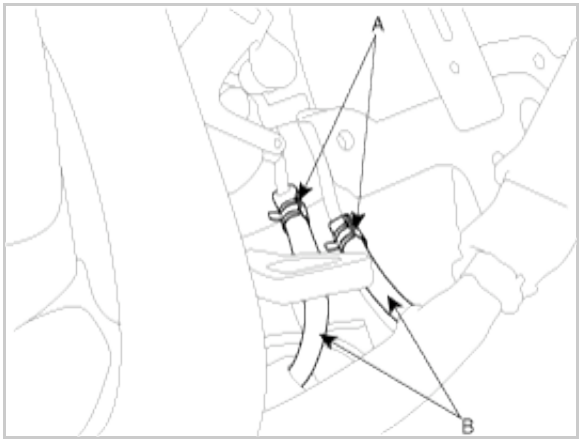
15. Install the starter motor. (see EE group).

TORQUE:
65~85 Nm(6.5~8.5 kgf.m, 47.0~61.5 lb-ft)

16. Connect the power steering pressure tube (A) to the power steering oil pump.

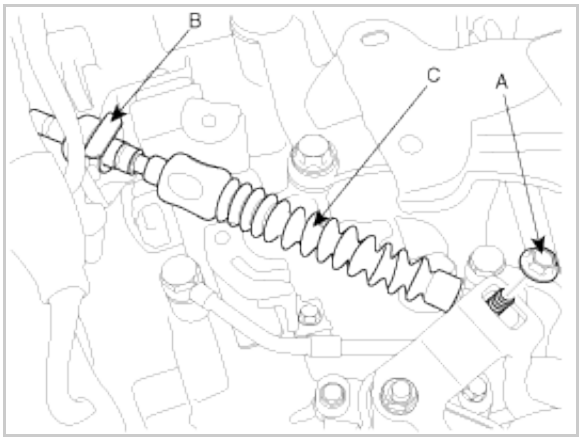


17. Connect the transaxle oil cooler hoses (A) to the tubes by fastening the clamps (B).

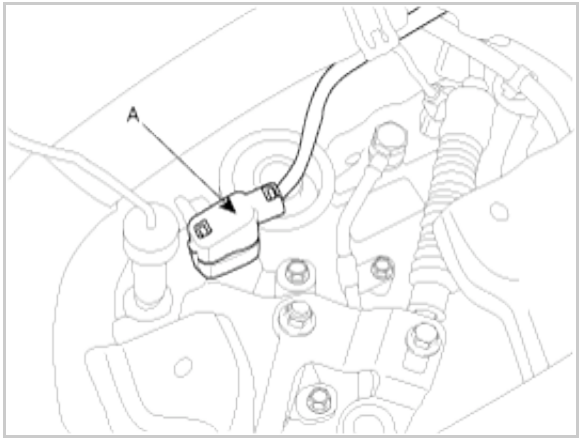


18. Install the control cable assembly(C) by tightening the nut (A) and clip (B).

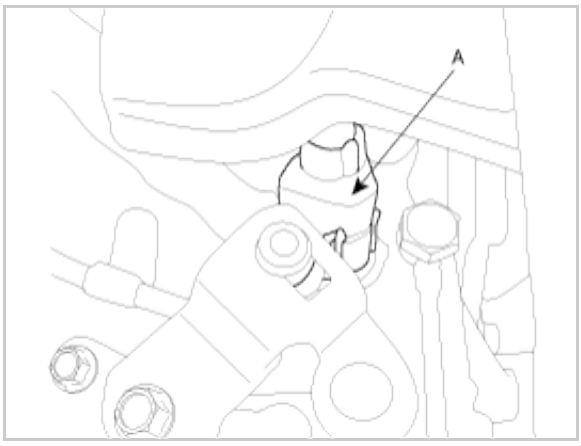
TORQUE:
8~12 Nm(0.8~1.2 kgf.m, 5.8~8.6 lb-ft)



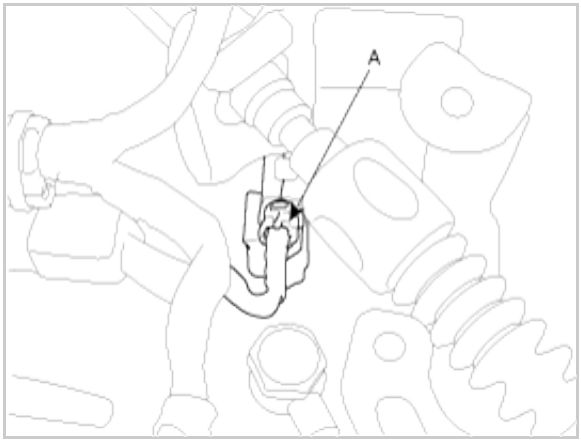
19. Install the inhibiter switch connector (A).



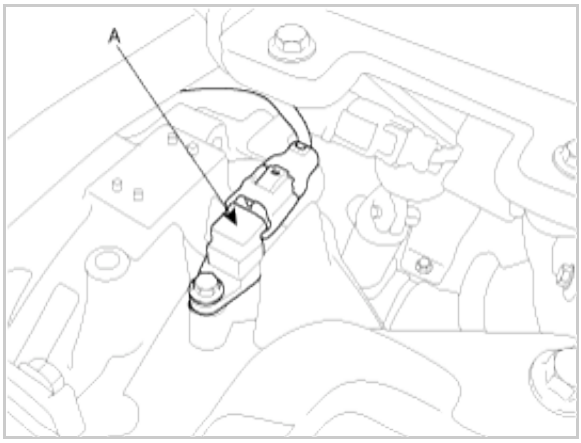
20. Install the solenoid valve connector (A).



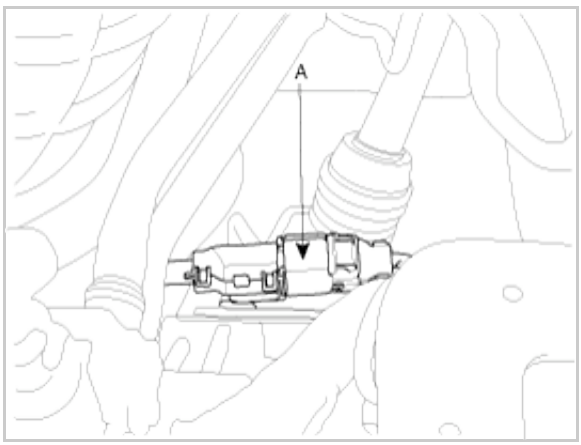
21. Install the input speed sensor connector (A).



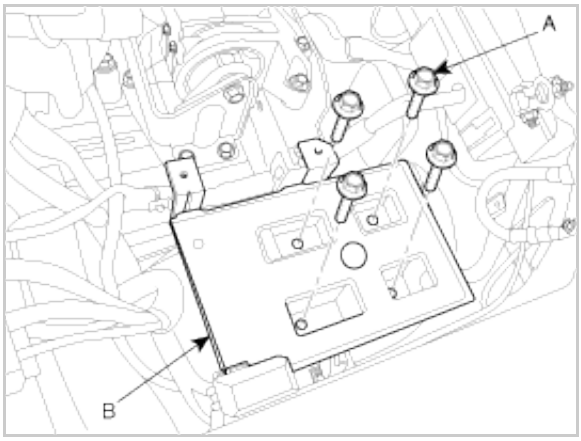
22. Install the output speed sensor connector (A).



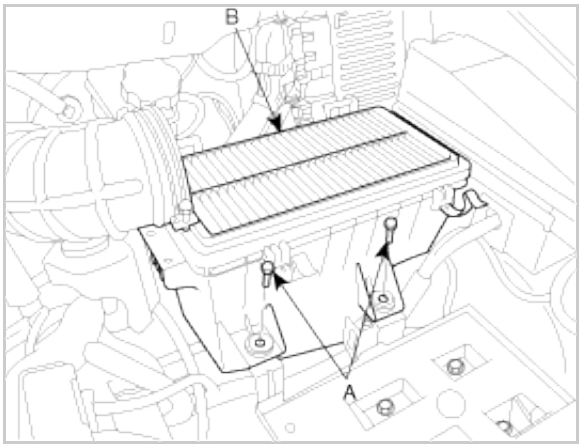
23. Install the vehicle speed sensor connector (A).



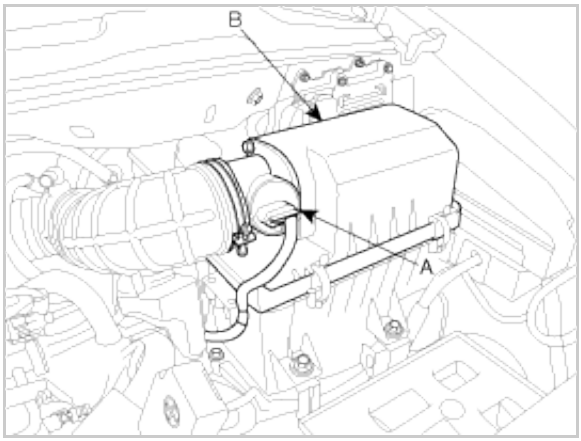
24. Install the battery tray (B) by removing the four mounting bolts (A).



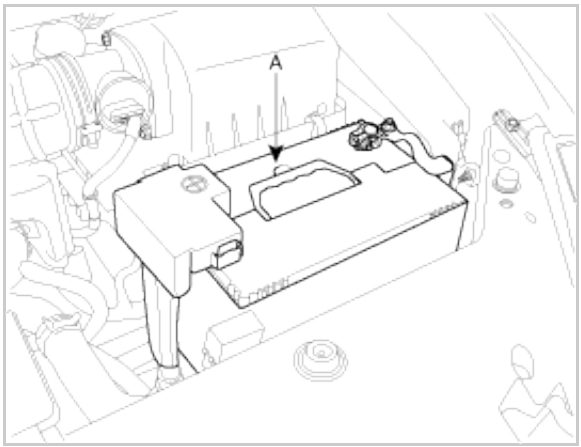
25. Install the air cleaner assembly (B) by tightening the two mounting bolts (A).



26. Reassemble the air cleaner filter, install the air cleaner upper body (B) and connect the air flow sensor connector (A).



27. Install the battery (A).



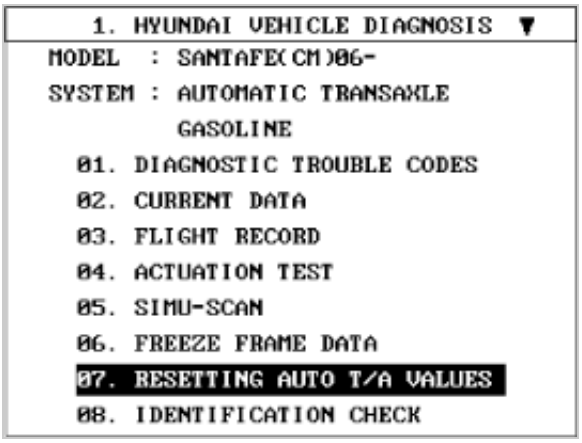
28. Refill the transaxle fluid. (see 'Service adjustment procedure')
29. Refill the power steering fluid. (see 'ST' group)

30. Install the engine cover. (see 'EM' group)

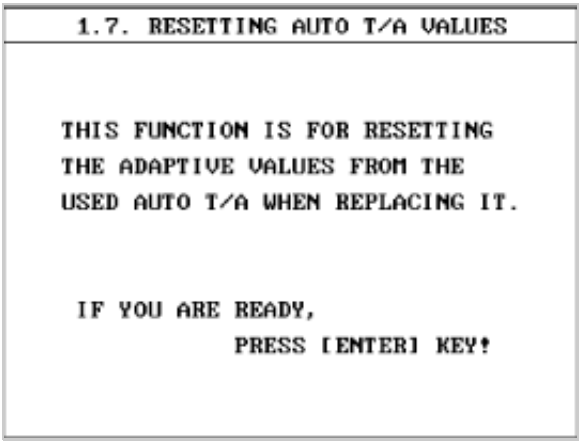
NOTICE

When replacing the automatic transaxle, reset the automatic transaxle's values by using the High- Scan Pro.

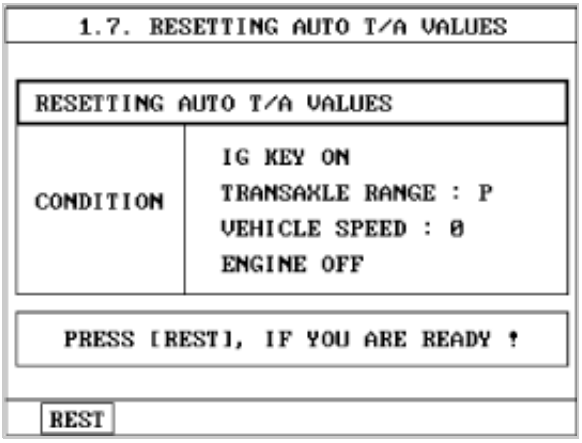
a. Connect the Hi-Scan Pro connector to the data link connector under the crash pad and power cable to the cigar jack under the center facia.
b. Turn the ignition switch on and power on the Hi-Scan Pro.
c. Select the vehicle's name.
d. Select 'AUTOMATIC TRANSAXLE'.



e. Select 'RESETTING AUTO T/A VALUES' and perform the procedure.



f. Perform the procedure by pressing F1 (REST).



Valve Body System

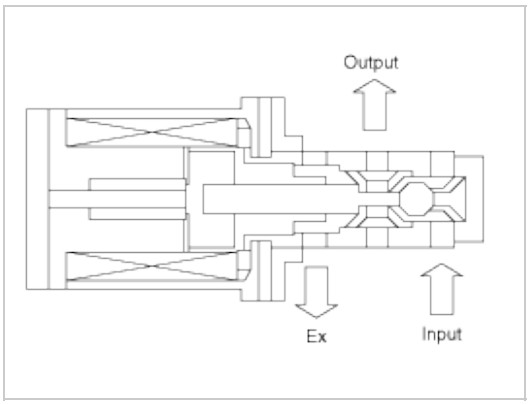
Solenoid Valve

DESCRIPTION

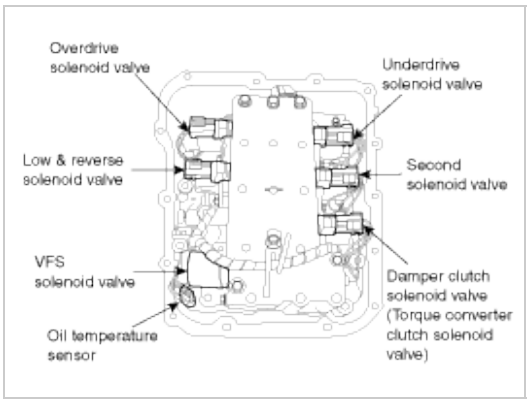
Actuators

Solenoid Valve for Pressure Control
- Sensor type: Normal open 3-way
- Operating temperature : -30°C~130°C(-22°F~266°F)
- Frequency:
LR, 2ND, UD, OD: 61.27Hz (at the ATF temp. above -20°C(-4°F))
DCC: 30.64Hz
- Internal resistance:
3.0 ± 0.5 Ω (LR, 2ND, UD, OD, TCC)
4.35 ± 0.5 Ω (VFS)
- Surge voltage: 56 V (Except VFS)

(LR, 2ND, UD, OD, DCC)



Location



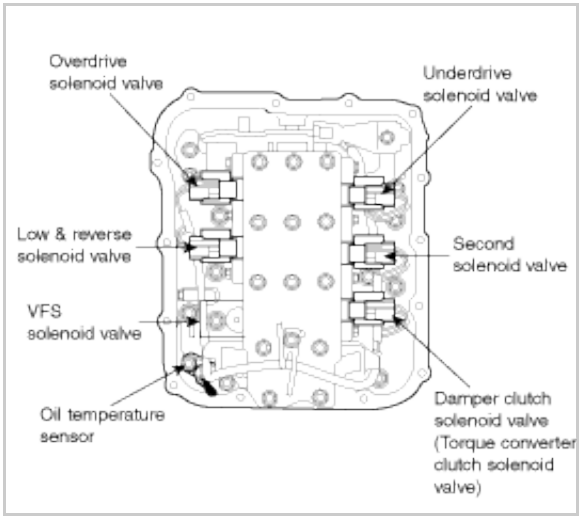
Solenoid Valves Schedule

Position	Solenoid valves				
Operation	LR	2ND	UD	OD	* DCC
1st gear	OFF	ON	OFF	ON	OFF
2nd gear	ON	OFF	OFF	ON	OFF
3rd gear	ON	ON	OFF	OFF	ON
4th gear	ON	OFF	ON	OFF	ON
Reverse	OFF	ON	ON	ON	OFF
N, P (STD. mode)	OFF	ON	ON	ON	OFF
N, P (Hold mode)	ON	OFF	ON	ON	OFF

*: Reference value.
(DCC solenoid valve will be ON when the operating condition is satisfied)

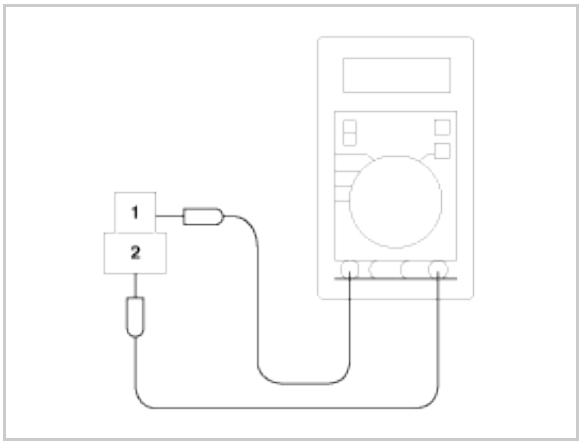
INSPECTION

1. If the value is out of specification according to the chart below, remove the valve body cover.



2. Measure the resistance again after disconnecting solenoid valve connector.

Specification (20°C):
2.5 ~ 3.5 Ω (LR, 2ND, UD, OD, TCC)



3. If the value is out of specification replace the solenoid valve.

Pin No.	Name	Resistance
6&9	DCC (TCC)	2.5~3.5Ω (20°C)
6&11	LR	
4&5	2ND	
3&5	UD	
5&12	OD	


1
2
3
4
5
6
7
8
9
10
11
12

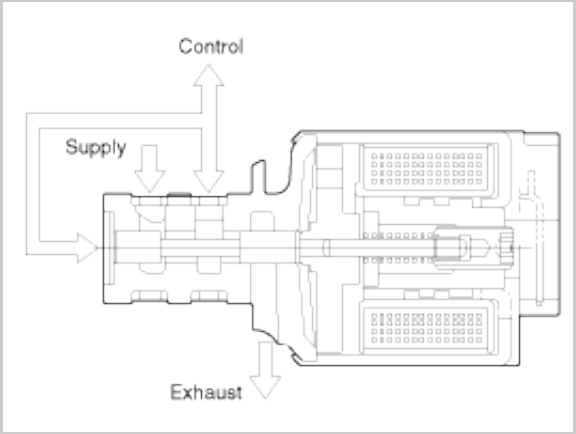
VFS
(Variable Force Solenoid) Valve

DESCRIPTION

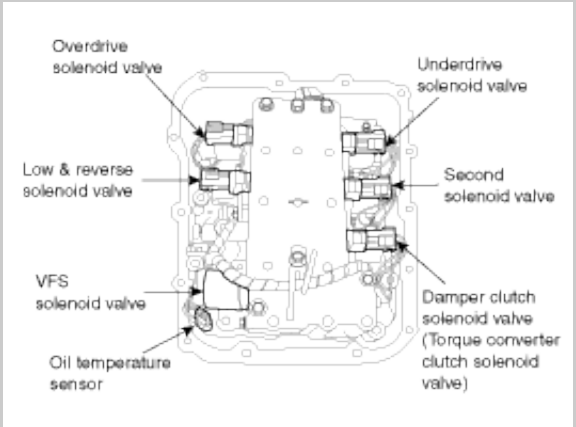
Actuators

Solenoid Valve for Pressure Control
- Sensor type: Normal open 3-way
- Operating temperature : -30°C~130°C(-22°F~266°F)
- Frequency:
LR, 2ND, UD, OD: 61.27Hz (at the ATF temp. above -20°C(-4°F))
DCC: 30.64Hz
- Internal resistance:
3.0 ± 0.5 Ω (LR, 2ND, UD, OD, TCC)
4.35 ± 0.5 Ω (VFS)
- Surge voltage: 56 V (Except VFS)

(VFS)



Location



VFS Control pressure

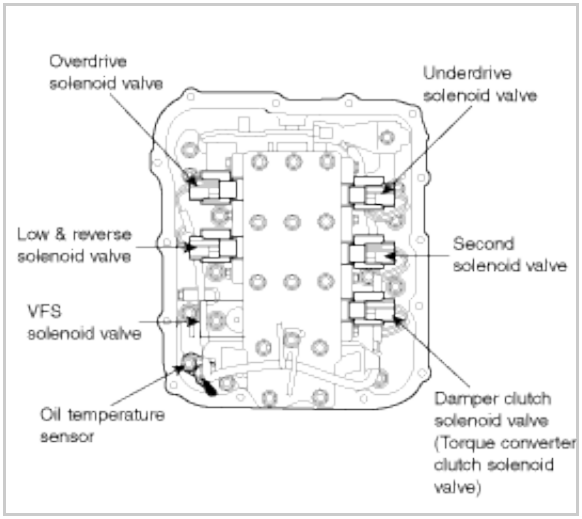
Input Current(mA)	Control Pressure (No line pressure)			
	Increasing Current			Decreasing Current
	MAX. (Kgf/cm²) [Kpa]	MIN. (Kgf/cm²) [Kpa]	Δ (Kgf/cm²) [Kpa]	MIN. (Kgf/cm²) [Kpa]
100	6.52 [639]	5.87 [575]	[64]	
200	6.23 [611]	5.70 [559]	[52]	5.43 [532]
300	5.76 [564]	5.24 [514]	[50]	4.49 [484]
400	5.08 [498]	4.59 [450]	[48]	4.30 [421]
500	4.24 [416]	3.78 [370]	[46]	3.52 [345]

700	2.29［224］	1.82［178］	［46］	1.51［148］
800	1.41［138］	0.09［88］	［50］	0.58［57］
900	0.65［64］	0.14［14］	［50］	0［0］
1,000	0.24［24］	0［0］	［24］	
1,100	0.24［24］	0［0］	［24］	

*Test condition:
Ps : Supply Pressure (Ps＝7.1 ± 0.3 KGf/cm²)
Pc : Control Pressure
Pex : Exhaust Pressure (Atmosphere pressure)
ATF : DIAMOND ATF SP-III
ATF temperature : 30 ± 3°C (86°F)
- Coil resistance : 4.35 ± 35Ω
- Dither Frequency : 600 ± 20Hz
In case of VFS solenoid valve, the relation between Duty and oil pressure can't be expressed.

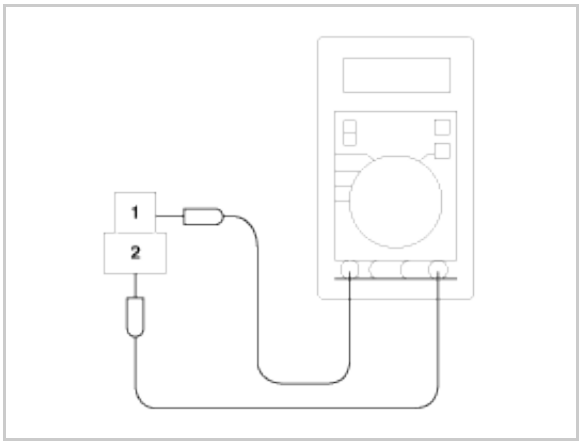
INSPECTION

1. If the value is out of specification according to the chart below, remove the valve body cover.



2. Measure the resistance again after disconnecting solenoid valve connector.

Specification (20°C):
4.3 ~ 4.4Ω (VFS)



3. If the value is out of specification replace the solenoid valve.

Pin No.	Name	Resistance
7&8	VFS	4.3~4.4Ω (20°C)



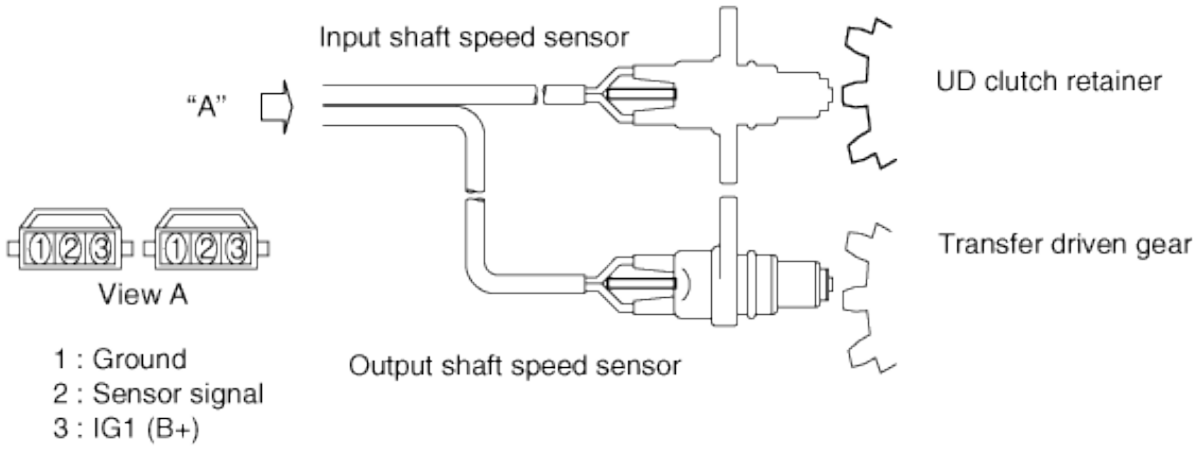
Automatic Transaxle Control System

Input Speed Sensor

DESCRIPTION

Input shaft speed sensor

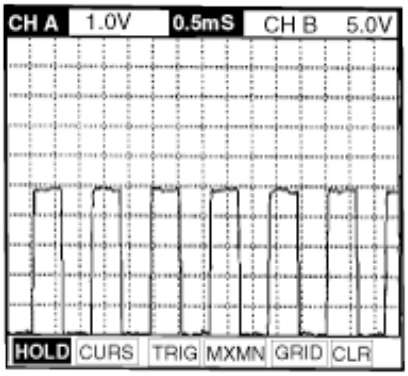
- Type: Hall sensor
- Current consumption: 22mA (MAX.)
- Sensor body and sensor connector have been unified as one.



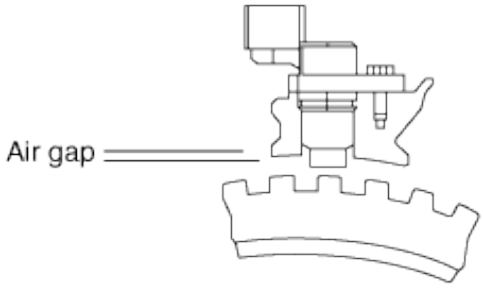
Hall type sensor: specification

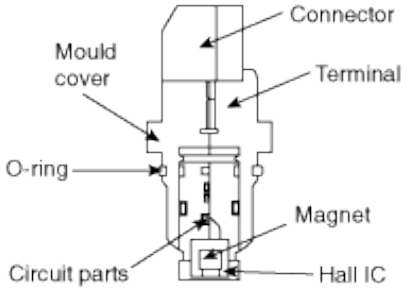
Air gap (mm)	Input shaft speed sensor	1.3
Coil Resistance	Input shaft speed sensor	over 1MΩ
Peak-Peak Voltage	High	4.8~5.2V
	Low	0.8V

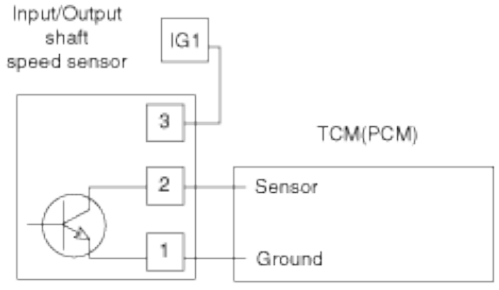
Wave Form With High-scan

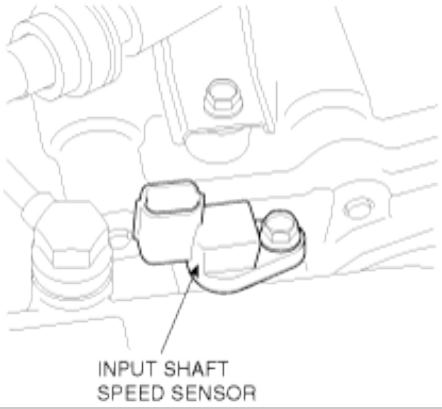


Hall Type Sensor: Structure & Interface


Air gap

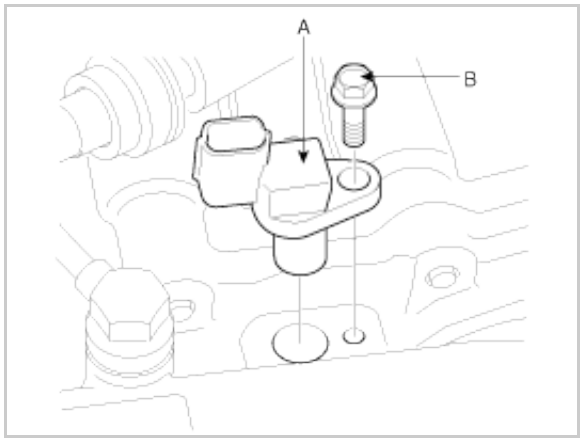

Connector
Mould cover
Terminal
O-ring
Magnet
Circuit parts
Hall IC


Input/Output shaft speed sensor
IG1
3
TCM(PCM)
2
Sensor
1
Ground


INPUT SHAFT SPEED SENSOR

REPLACEMENT

1. Remove the battery and air cleaner (see "Transaxle range switch replacement").
2. Remove the transaxle range switch connector.
3. Remove the control cable to transaxle range switch mounting nut.
4. Remove the input shaft speed sensor(A).
   (1) Disconnect the input shaft speed sensor connector.
   (2) Remove the bolt(B).



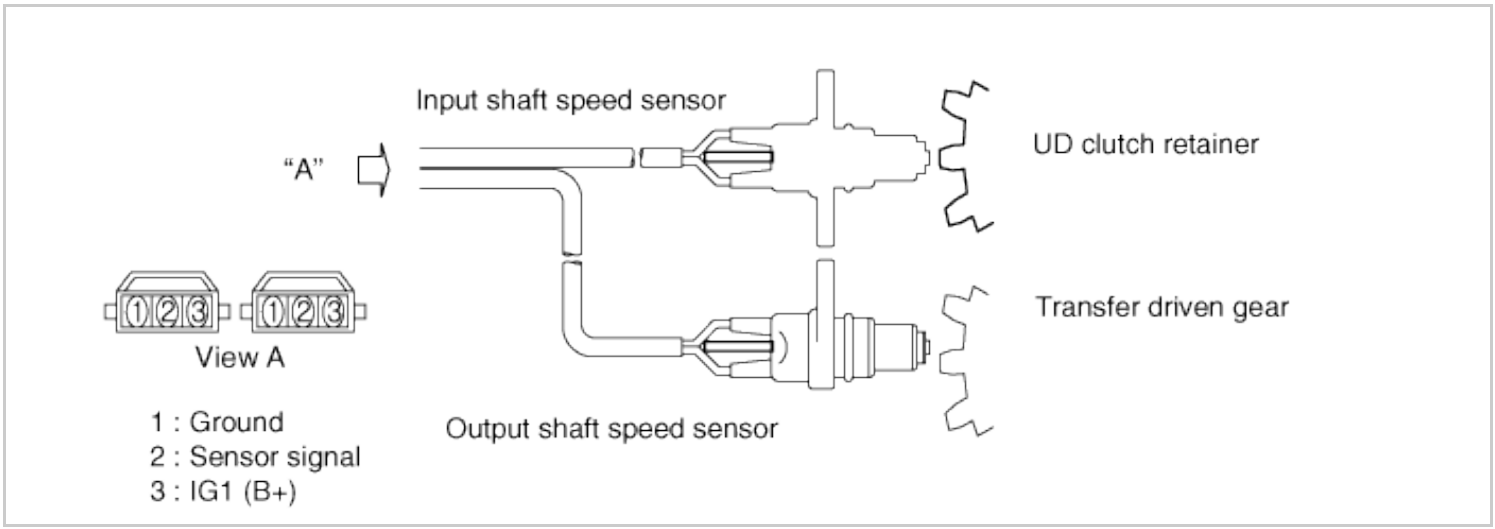
   (3) Inspect the input shaft speed sensor bore.
5. Apply a light coat of automatic transaxle fluid to the O-ring seal before installation.
6. Install the input shaft speed sensor.
7. Install the control cable mounting bracket.
8. Connect the input shaft speed sensor connector.
9. Install the holder of the control cable.
10. Adjust the control cable to transaxle range switch and tighten the transaxle manual lever to the control cable mounting nut. (see "Automatic transaxle shift control installation")
11. Installation is the reverse of removal.

Output Speed Sensor

DESCRIPTION

Output shaft speed sensor

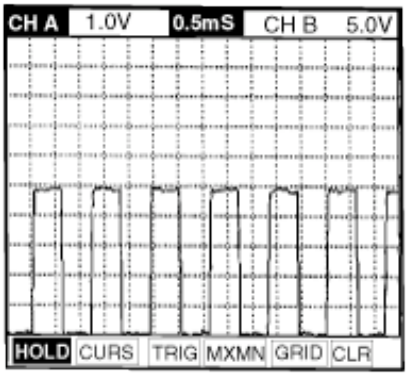
- Type: Hall sensor
- Current consumption: 22mA (MAX.)
- Sensor body and sensor connector have been unified as one.



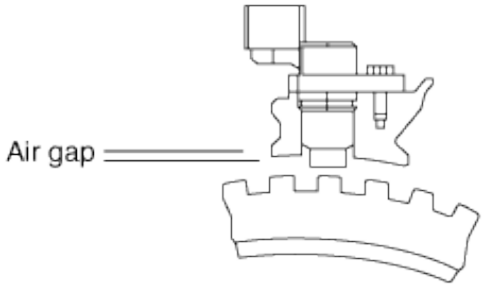
Hall type sensor: specification

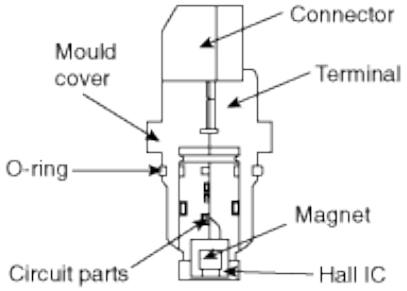
Air gap (mm)	Output shaft speed sensor	0.85
Coil Resistance	Output shaft speed sensor	over 1MΩ
Peak-Peak Voltage	High	4.8~5.2V
	Low	0.8V

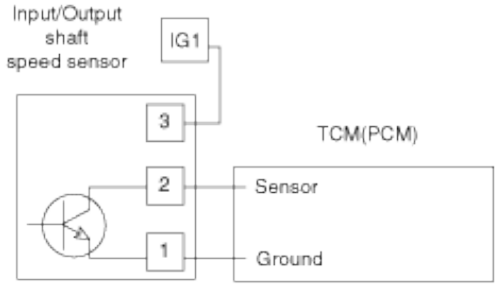
Wave Form With High-scan

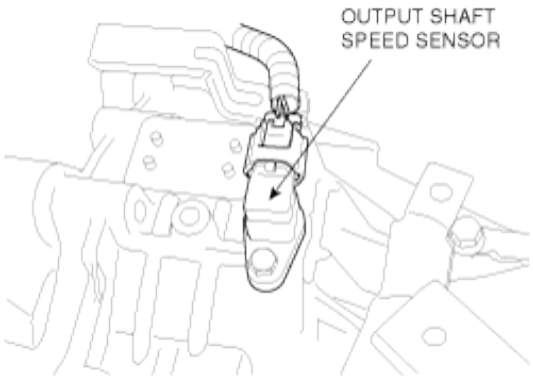


Hall Type Sensor: Structure & Interface


Air gap

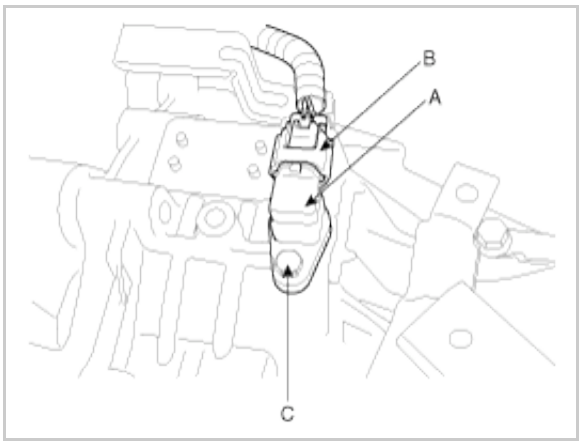

Connector
Mould cover
Terminal
O-ring
Magnet
Circuit parts
Hall IC


Input/Output shaft speed sensor
IG1
3
TCM(PCM)
2
Sensor
1
Ground


OUTPUT SHAFT SPEED SENSOR

REPLACEMENT

1. Remove the battery and air cleaner. (see "Transaxle range switch replacement")
2. Remove the output shaft speed sensor(A).



(1) Disconnect the output shaft speed sensor connector(B).

(2) Remove the bolt(C).

(3) Inspect the output shaft speed sensor bore.

3. Apply a light coat of automatic transaxle fluid to the O-ring seal before installation.
4. Installation is the reverse of removal.

Transaxle Oil Temperature Sensor

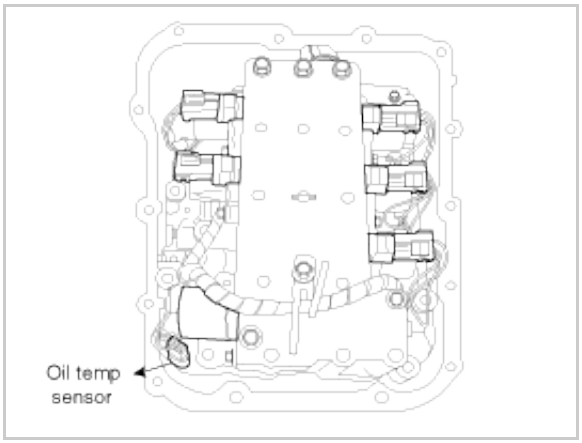
DESCRIPTION

Oil Temperature Sensor

The oil temperature sensor is of the thermistor type, and senses the automatic transaxle fluid temperature. Using the signal from this sensor, TCM(PCM) controls the shift pattern optimally during shift. In order to operate the damper clutch, this signal is also referred.

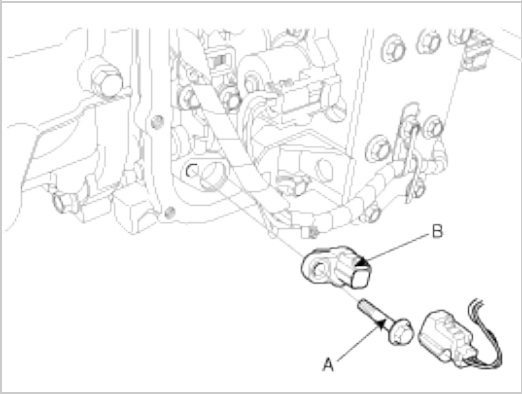
- Range of temperature : -40°C~145°C
- Type: Separated type (High / Low temperature)
- Standard value of internal resistance

Temp.[°C(°F)]	Resistance(kΩ)	Temp.[°C(°F)]	Resistance(kΩ)
-40(-40)	139.5	80(176)	1.08
-20(-4)	47.7	100(212)	0.63
0(32)	18.6	120(248)	0.38
20(68)	8.1	140(284)	0.25
40(104)	3.8	160(320)	0.16
60(140)	1.98		



REPLACEMENT

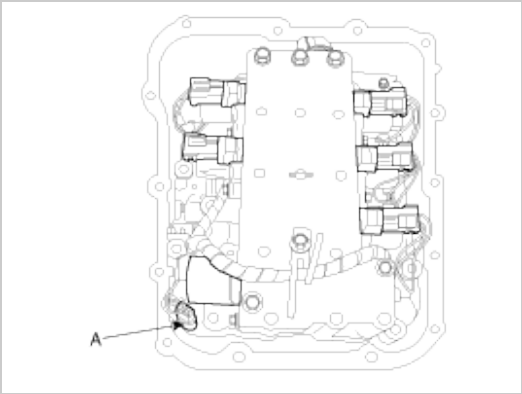
1. Remove the automatic transaxle assembly.
2. Remove the valve body cover(refer to the overhaul manual).
3. Disconnect the oil temperature sensor connector.
4. Remove the oil temperature sensor(B), loosening the mounting bolt(A).



5. Replace the sensor with the new one and reassemble the rest of the parts.

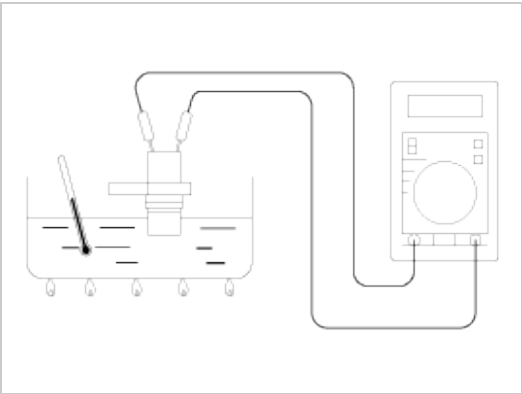
INSPECTION

1. Remove the oil temperature sensor(A).



2. Measure the resistance between the terminal 1 and 2 of the sensor connector.

Temp.[°C(°F)]	Resistance(KΩ)
0(32) 100(212)	18.6 0.63



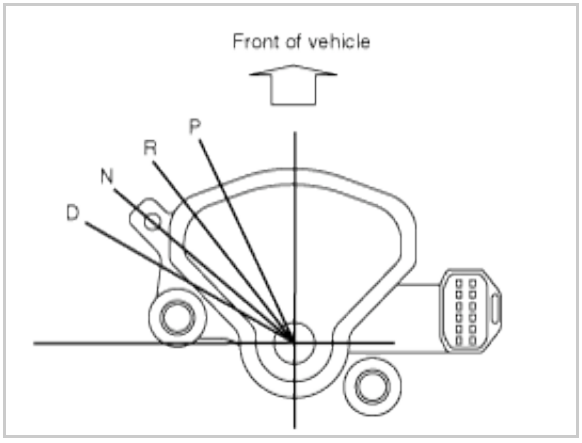
3. If the value is out of the specfication, replace the oil temperature sensor.

Inhibiter Switch

DESCRIPTION

Inhibitor Switch

- Type: Rotary contact type
- Range of temperature : -40°C~145°C(-40°F~293°F)

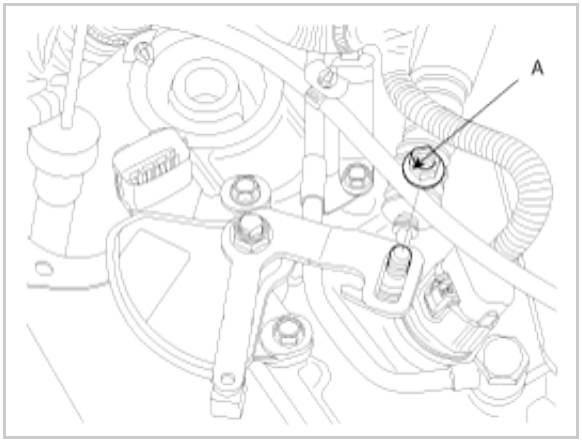


Inhibitor Switch - Continuity check(Sports mode)

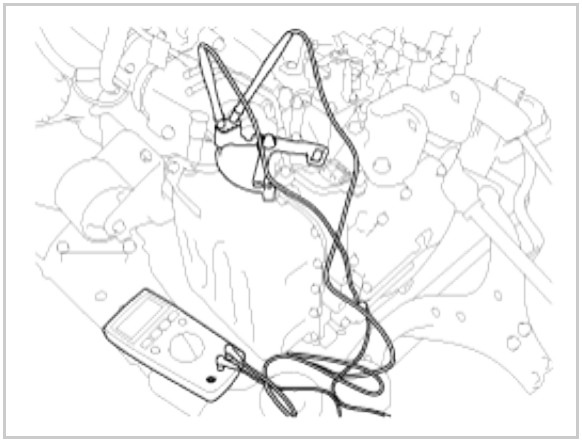
Range	Terminal Number									
	1	2	3	4	5	6	7	8	9	10
P			○					○	○	○
R							○	○		
N				○				○	○	○
D	○							○		

REPLACEMENT

1. Pull up the parking brake.
2. Position the shift lever in 'N' range.
3. Remove the air cleaner assembly.
4. Remove the battery.
5. Remove the battery tray.
6. Remove the inhibiter switch connector.
7. Remove the shift cable mounting nut(A).



8. Remove the inhibiter switch loosening the mounting bolts.
9. Refering to 'INSPECTION', check for continuity. If there is an error, replace the inhibiter switch.

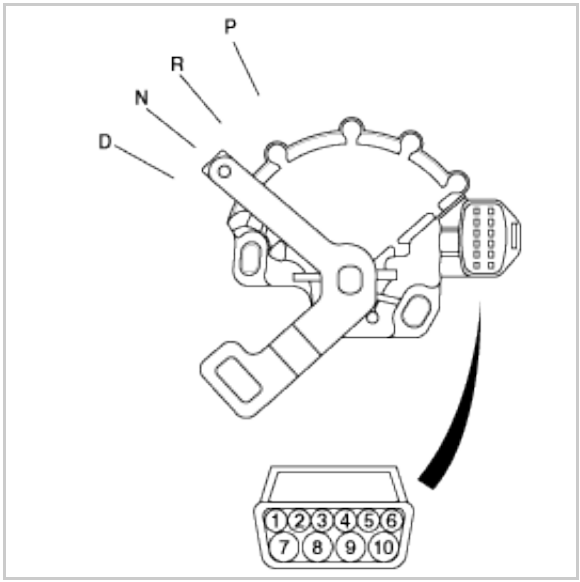


10. After tightening the shift cable mounting nut, connect the inhibiter switch.
11. Install the battery, battery tray and the air cleaner assembly.

INSPECTION

1. Check for the starter motor when the ignition switch is at 'START' position and the shift lever at 'P' or 'N' range.
2. Check for the rear lamp when the ignition switch if it does not work properly.
3. Check for the inhibiter switch if it does not work properly.
4. If the inhibiter switch is not fixed in a proper position, reassemble it in the right position.
5. Re-check 1 and 2 procedures.
6. Using a scan tool, confirm the DTCs.
7. Disconnect the battery (-) terminal and the inhibiter switch.
8. Check for continuity between terminals at the switch connector.

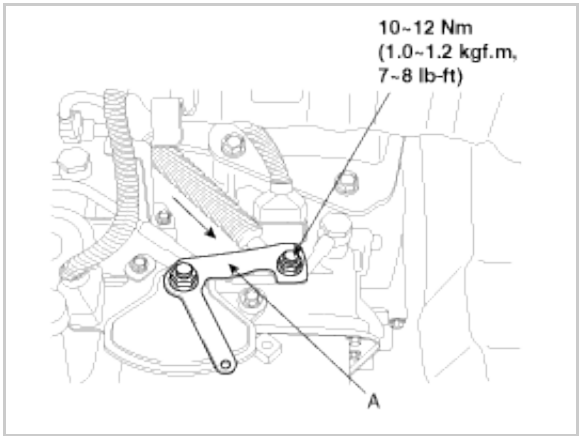
Range	Terminal Number									
	1	2	3	4	5	6	7	8	9	10
P			○					○	○	○
R							○	○		
N				○				○	○	○
D	○							○		



9. If there is not continuity between the terminals in the table above for each switch position, replace the inhibiter switch.

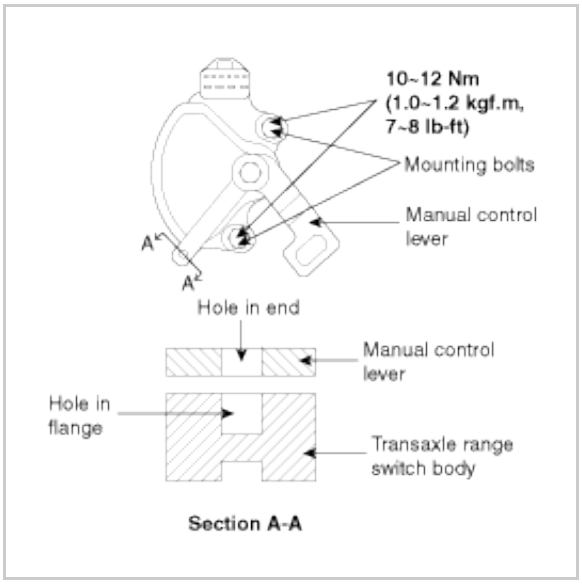
ADJUSTMENT

1. Set the select lever to the "N" position.
2. Loosen the control cable to manual control lever coupling nut to free the cable and lever.
3. Set the manual control lever to the neutral position.

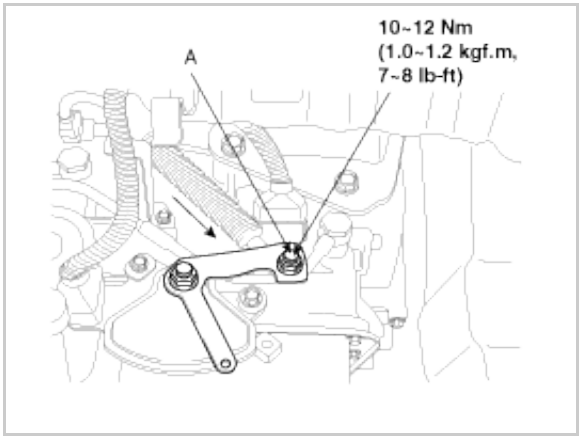


4. Loosen the transaxle range switch body mounting bolts and then turn the transaxle range switch body so the hole in the end of the manual control lever and the hole (cross section A-A in the figure) in the flange of the transaxle range switch body flange are aligned.
5. Tighten the transaxle range switch body mounting bolts to the specified torque. Make sure at this time that the position of the switch body did not move.

TORQUE :
10~12Nm (1.0~1.2kgf.m, 7~8lb-ft)



6. Gently pull the transmission control cable in the direction of the arrow, and then tighten the adjusting nut.



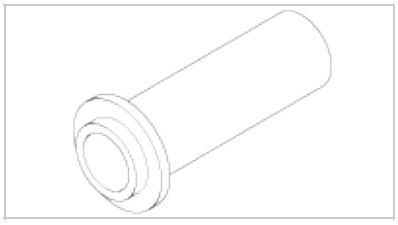
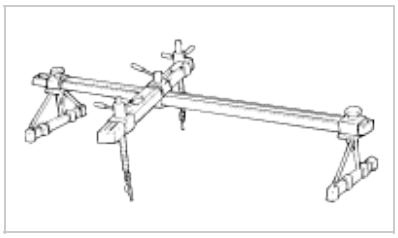
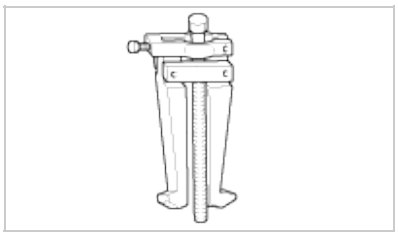
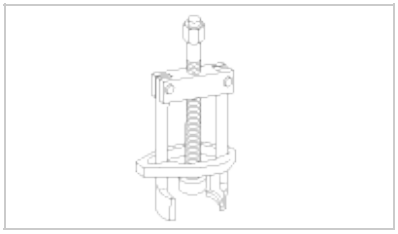
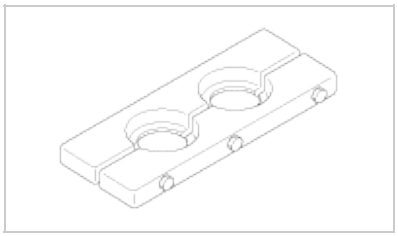
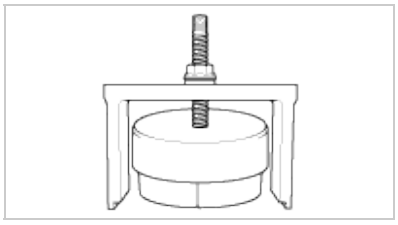
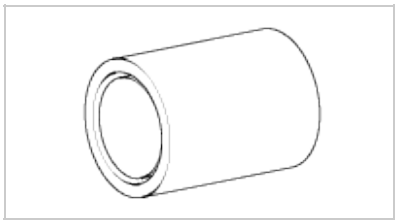
7. Check that the select lever is in the "N" position.

CHAPTER 7:

Manual Transaxle

General Information

SPECIAL TOOLS

Item(Namber&Name)	Illustration	Use
09452-21200 Oil seal installer		Oil seal installation
09200-38001 Engine supporting fixture		Removal and installation of transaxle
09455-32200 Oil seal puller		Removal of oil seal
09455-21000 Bearing&gear puller		Removal of taper roller vearing
09432-33200 plate		Removal of oil seal
09478-26100 Backing plate remover		Removal of 4WD coupling backing plate
09478-26000 Flange oil seal installer		Installation of 4WD coupling flange oil seal

SPECIFICATION

Engine type		μ 2.7
Manual transaxle type		M5GF2
Gear ratio	1st	3.615
	2nd	1.931
	3rd	1.969
	4th	1.273
	5th	0.974
	Reverse	3.416
Final gear ratio		5.071
		3.737
T/M oil capacity(ℓ)※		1.9 liter (2.0077US qt, 1.6718mp qt)

※ The quantity in the chart above is for the reference. The actual filling quantity of the automatic transaxle fluid must be set according to 'INSPECTION' or 'REPLACEMENT' procedure of the automatic transaxle fluid.

Recommended transaxle oil			SAE75W/85 or API GL-4
Check&Replenishment			Every one year or every 100,000km
Replacement	Private use	Normal use	No service required
		Severe use(※)	Every 100,000 Km
	Business use		

※ Severe use(marked '※') is defined as:

1. Driving on rough road(bumpy road, gravel road, snowy road, unpaved road etc.).
2. Driving on mountain road, ascent/descent.
3. Repetition of short distance driving.
4. More than 50% operation in heavy city traffic during hot weather above 32°C(89.6°F).
5. Police car, Taxi, Commercial type operation or trailer towing, etc.

TIGHTENING TORQUE

Item	Nm	kgf.m	lb-ft
Oil drain plug	30~35	3.0~3.5	21.7~25.3
Oil filler plug	30~35	3.0~3.5	21.7~25.3
Back up lamp switch	30~35	3.0~3.5	21.7~25.3
Control shaft assembly	10~12	1.0~1.2	7.2~8.7
Select lever	43~55	4.3~5.5	31.1~39.8
Shift link assembly	43~55	4.3~5.5	31.1~39.8
Transaxle mounting bracket assembly	65~85	6.5~8.5	47.0~61.5
Transaxle and enging mounting bolt	65~85	6.5~8.5	47.0~61.5

SERVICE STANDARD

Item	Specification [mm(inch)]

Differential end play	0.15T-0.20T (0.0059T~0.0079T)
Input shaft end play	0.05T-0 (0.0020T~0)
1st output shaft end play	0.05T-0.10T (0.0020T~0.0039T)
2nd output shaft end play	0.05T-0.10T (0.0020T~0.0039T)
1st gear end play	0.135T-0.435T (0.0053T~0.0171T)
2nd gear end play	0.230T-0.430T (0.0091T~0.0169T)
3rd gear end play	0.142T-0.472T (0.0056T~0.0186T)
4th gear end play	0.230T-0.430T (0.0091T~0.0169T)
5th gear end play	0.125T-0.305T (0.0049T~0.0120T)
Reverse gear end play	0.135T-0.345T (0.0053T~0.0136T)

LUBRICANTS

Item	Lubricant	Quantity
Transaxle input shaft splin	CASMOLY L9508	0.2 gr.
Transaxle case gasket	LOCTITE 587	As required
Concentric slave cylinder assembly	KLUBER 9R100	As reguired

Manual Transaxle System

SERVICE ADJUSTMENT PROCEDURE

Transmission oil inspection and replacement

1. After parking the vehicle on a plain, stop the engine.
2. After removing the oil filler plug and washer, inspect the manual transaxle fluid condition and quantity.
3. If the manual transaxle fluid is contaminated, drain it out by removing the oil drain plug.
4. Tighten the new oil drain plug and feed manual transaxle fluid to a proper level.

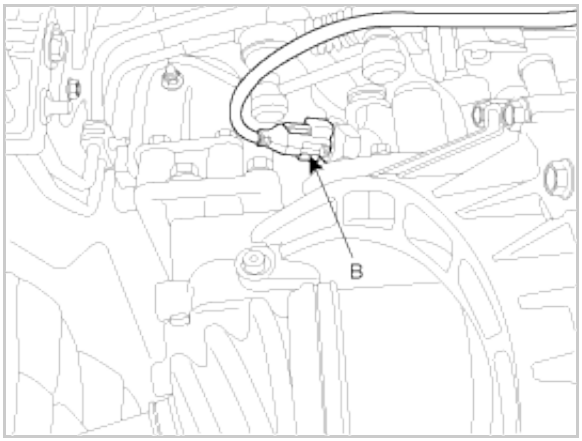
TORQUE:
29.4~34.4 Nm(3.0~3.5kgf.m, 21.7~25.3lb-ft)
Oil type: SAE75W/85
Oil quantity:
1.9 liter(2.0077 US qt, 1.6718 lmp qt)

5. Retighten the oil filler plug with a new washer.

TORQUE:
29.4~34.4 Nm(3.0~3.5kgf.m, 21.7~25.3lb-ft)

Back up lamp switch inspection

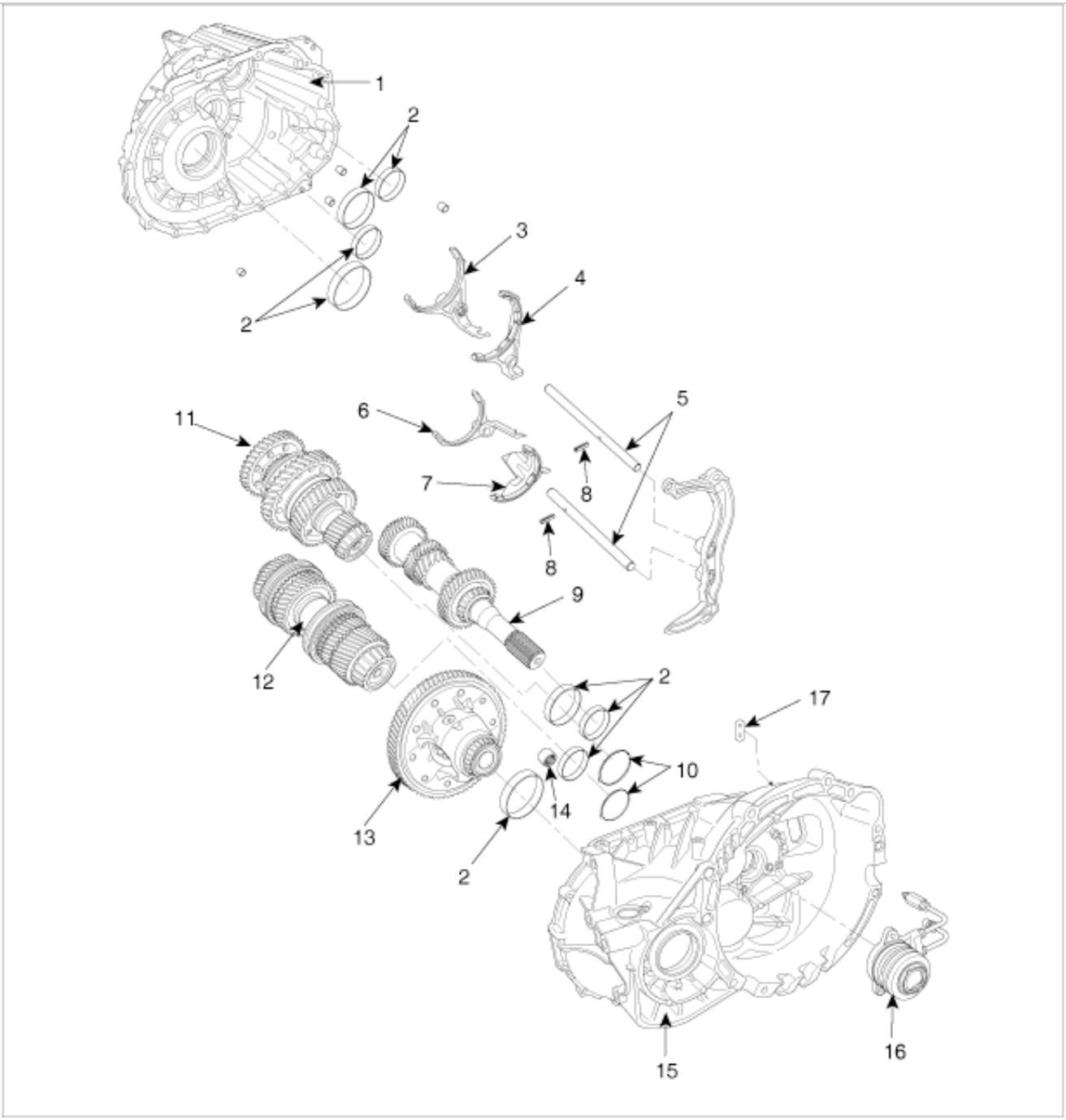
1. Disconnect the back up lamp switch connector(B).



2. Inspect the continuity of the switch. When the shift lever is located in reverse range, it should be applied an electric current.
3. Replace the back up lamp switch, if necessary.

TORQUE:
29.4~34.4 Nm(3.0~3.5kgf.m, 21.7~25.3lb-ft)

COMPONENTS



1. Transaxle case
2. Taper roller bearing outer race
3. 1st/2nd shift fork
4. Reverse shift fork
5. Shift rail
6. 3rd/4th shift fork
7. 5th/6th shift fork
8. Spring pin
9. Input shaft
10. Oil guide
11. 1st output shaft
12. 2nd output shaft
13. Differential assembly
14. Needle bearing
15. Clutch housing
16. Concentric slave cylinder assembly
17. Boot

REMOVAL

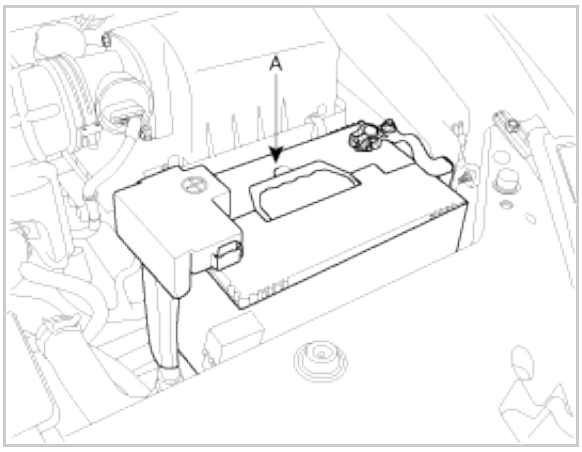
CAUTION

a. Use a cover not to damage the vehicle surface.
b. Disconnect connectors carefully not to be damaged.

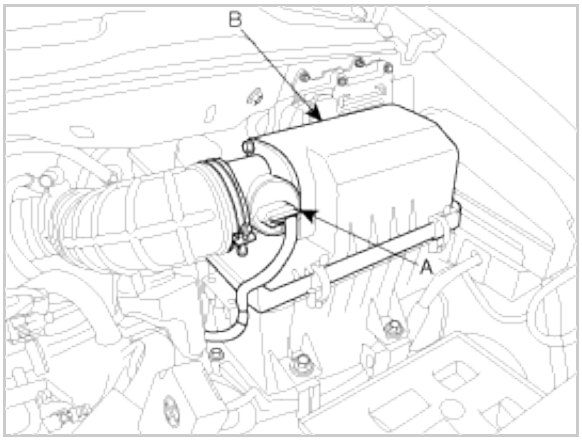
NOTICE

a. Mark wires or hoses for identification not to be confused.

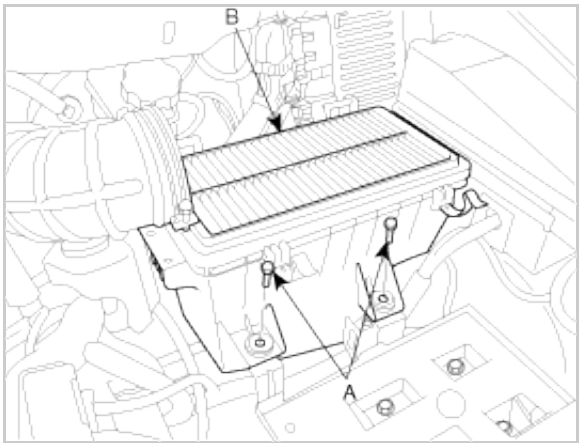
1. Remove the battery(A).



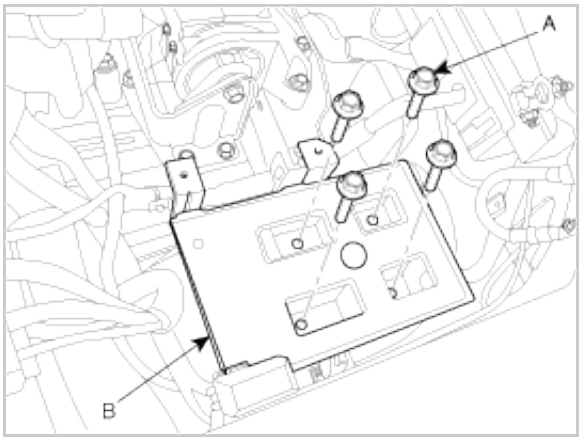
2. After disconnecting the AFS connector(A) and removing the alr cleaner upper body(B) taka the air cleaner filter out of the air cleaner under body.



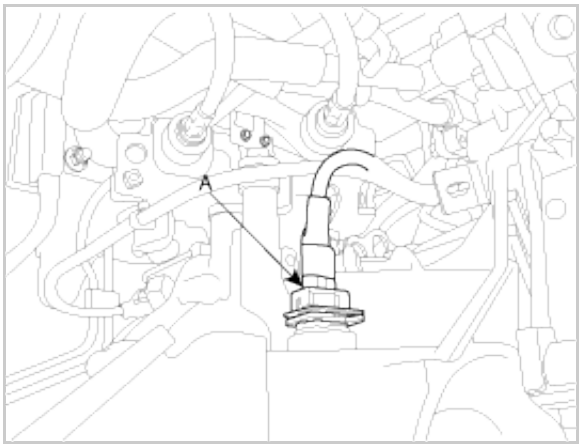
3. Remove the air cleaner assembly (B) by removing the two mounting bolts(A).

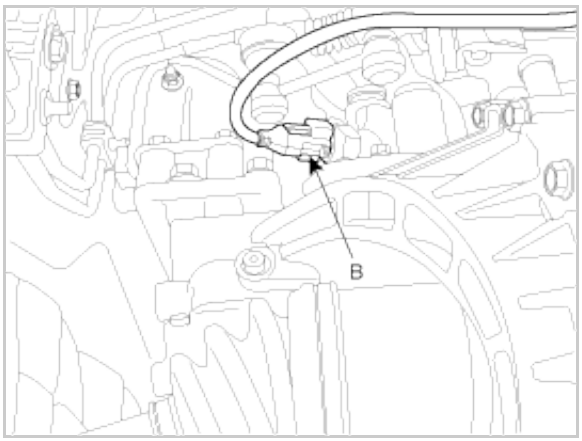


4. Remove the battery tray(B) by removing the four mounting bolts(A).

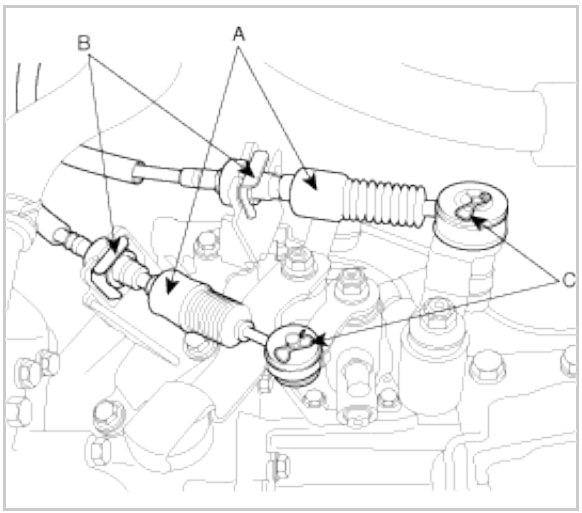


5. Disconnect the vehicle speed sensor connector (A) and the back up lamp switch(B).

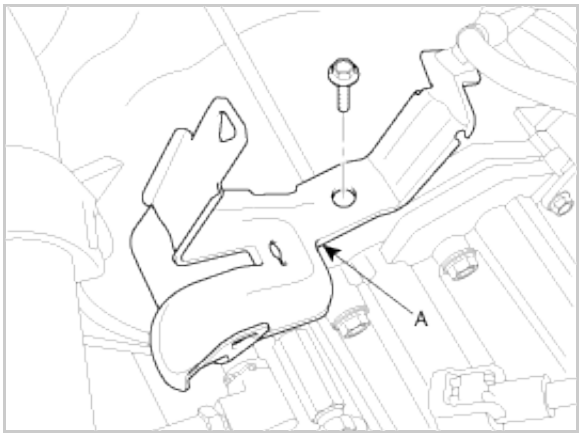




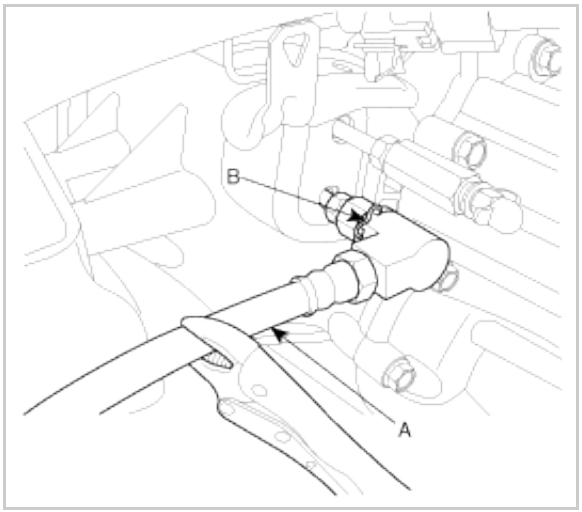
6. Disconnect the shift cable assembly(A) after remaing the clips(B) and pins(C).



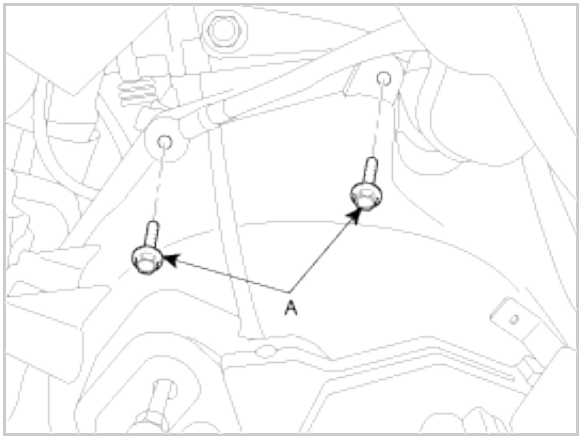
7. Remove the wire harness bracket(A).

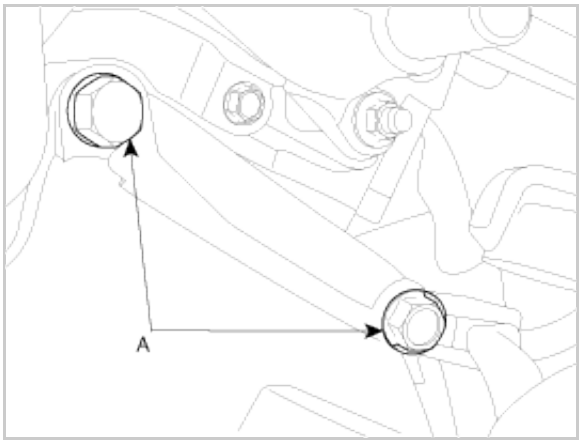


8. Remove C.S.C (Concentric Slave Cylinder) tube(A) which is being clamped by loosening the nut(B).

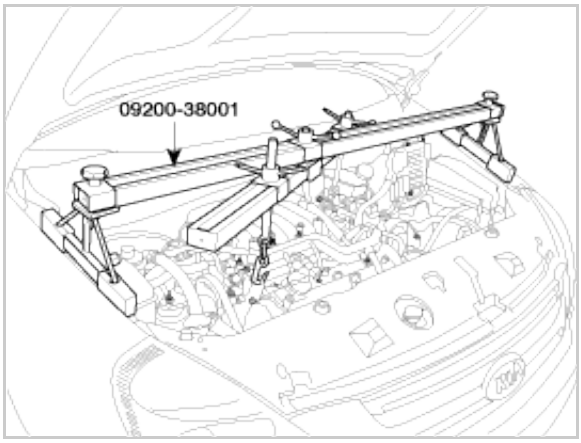


9. Remove the transaxle upper mounting bolts(A).

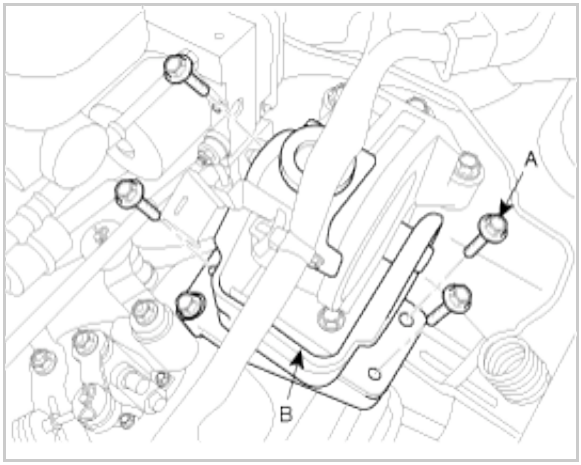




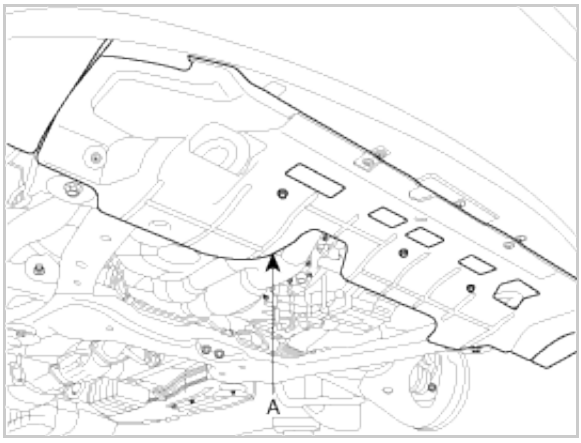
10. Support the engine and transaxle by using the special tool (09200-38001).



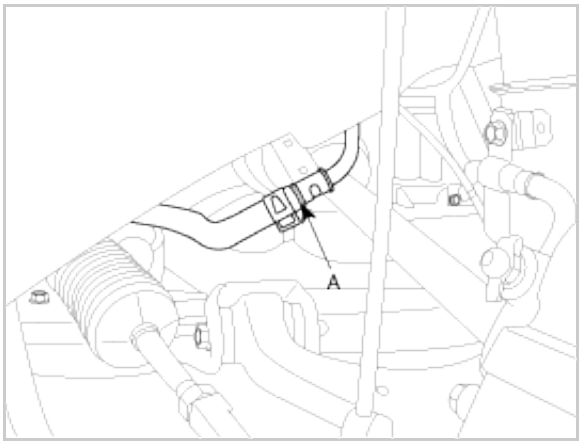
11. Remove the transaxle insulator bracket (B) by removing the bolts (A).



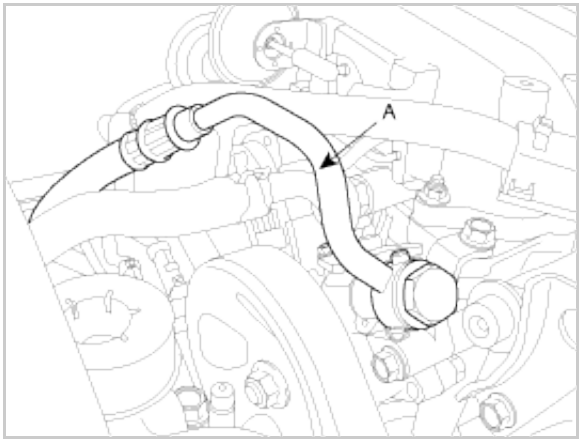
12. Remove the front wheels and tires. (see SS group)
13. Lift up the vehicle.
14. Remove the steering column joint bolt. (see ST group).
15. Remove the under cover(A).



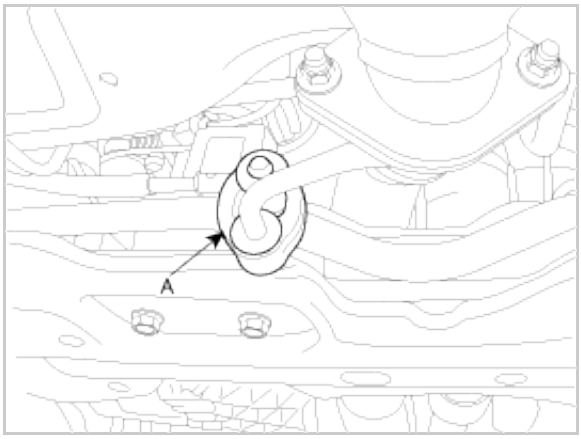
16. Drain power steering oil through the return tube(A). (see ST group)



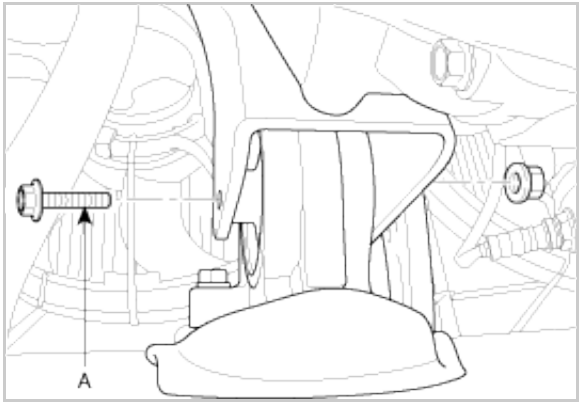
17. Disconnect the power steering pressure hose (A) from the power steering oil pump. (see ST group)



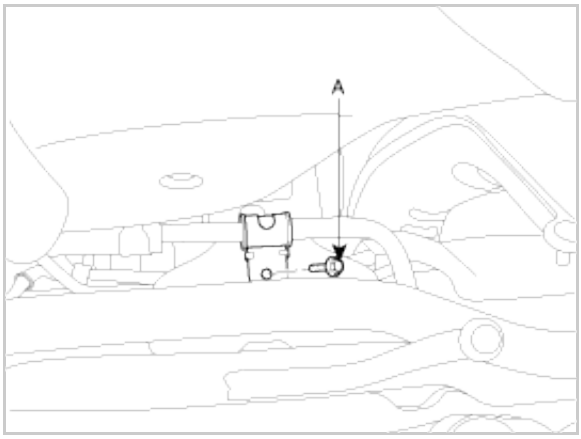
18. Drain the tranaxle fluid through the drain plug.
19. Remove the hanger(A).



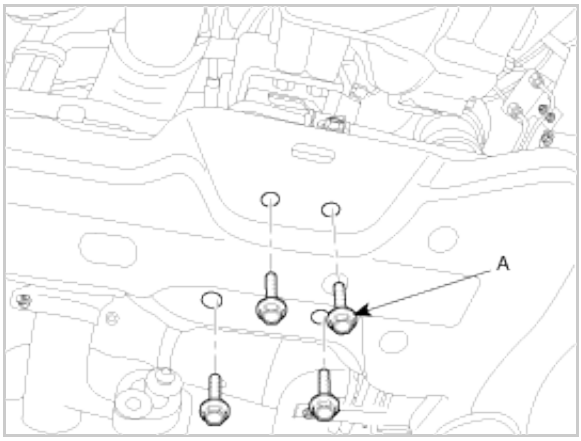
20. Disconnect the lower arm, the tie rod end ball joint, the stabilizer bar link from the front knuckle. (see SS group)
21. Remove the roll stopper mounting bolt(A).



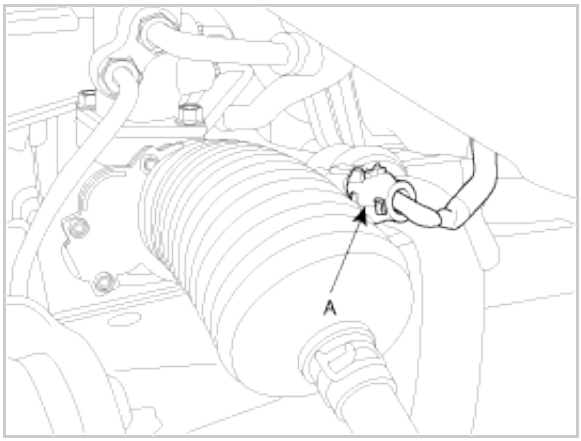
22. Remove the power steering return tube mounting bolt(A)



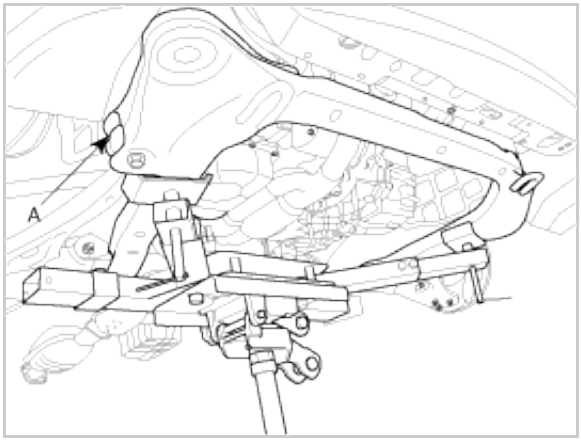
23. Remove the rear roll stopper mounting bolts(A).



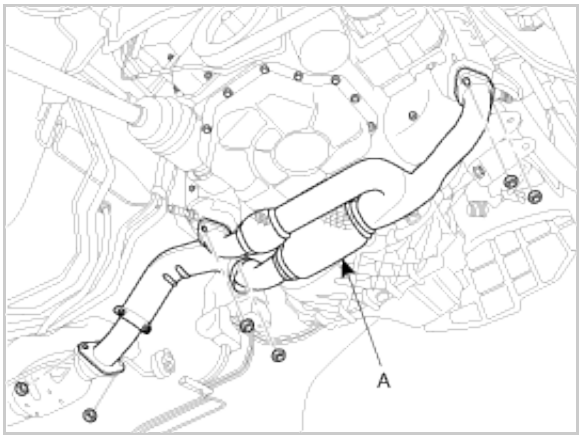
24. Disconnect the VRS connector(A). (see ST group)



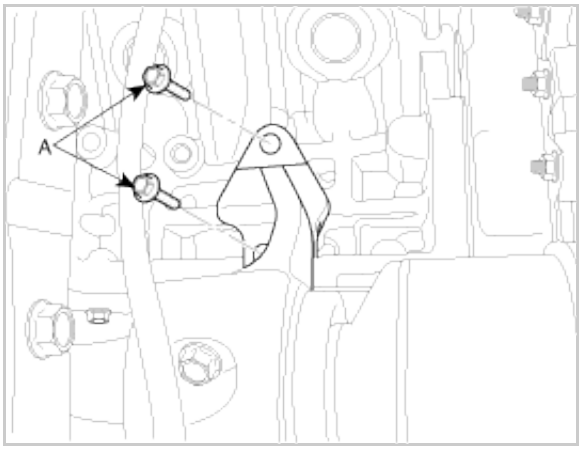
25. Remove the mounting bolts from the sub frame by supporting the sub frame(A) with a jack. (see SS group)



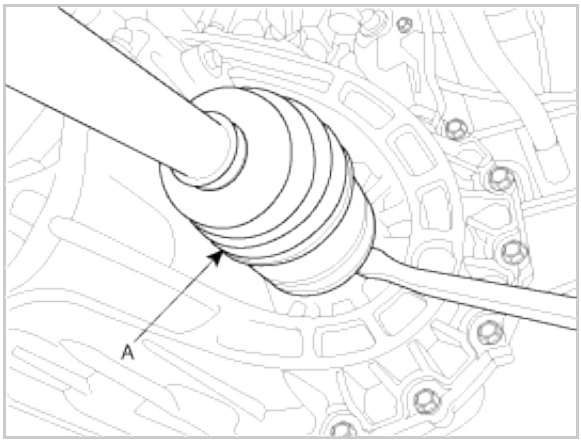
26. Remove the exhaust pipe(A).

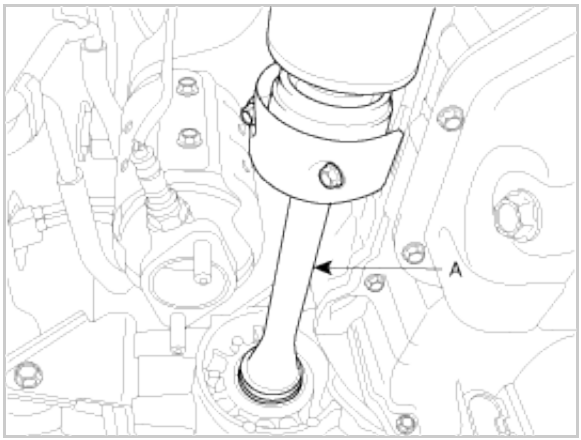


27. Remove the inner shaft bracket mounting bolt(A). RH

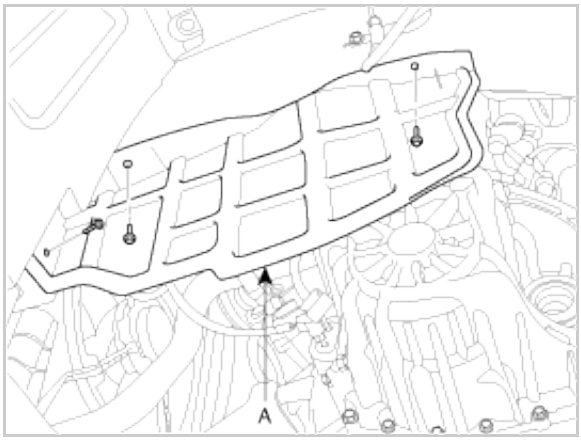


28. Remove the drive shafts(A) from the transaxle. (see DS group)

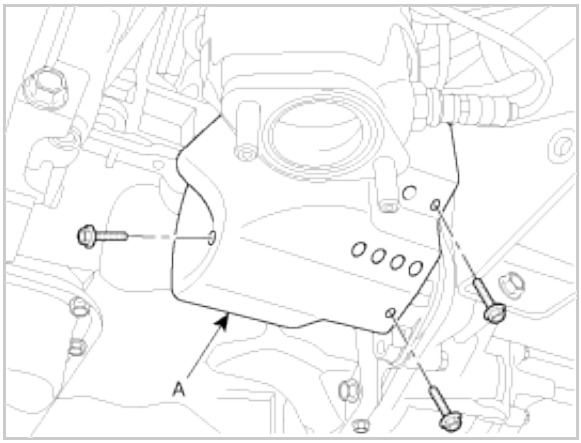




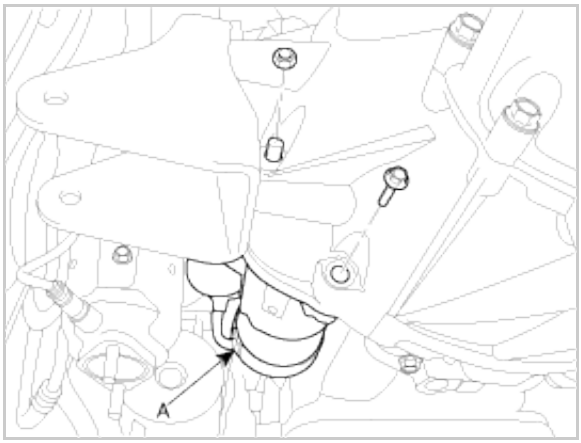
29. Remove the side cover(A).



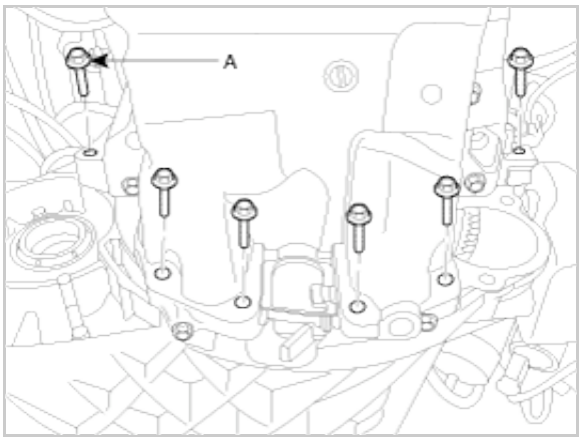
30. Remove the starter motor cover(A).



31. Disconnect the starter motor connector and remove the starter motor(A). (see EE group)



32. Remove the mounting bolts(A) of lower part of the transaxle, and remove the transaxle assembly by supporting it with a jack.

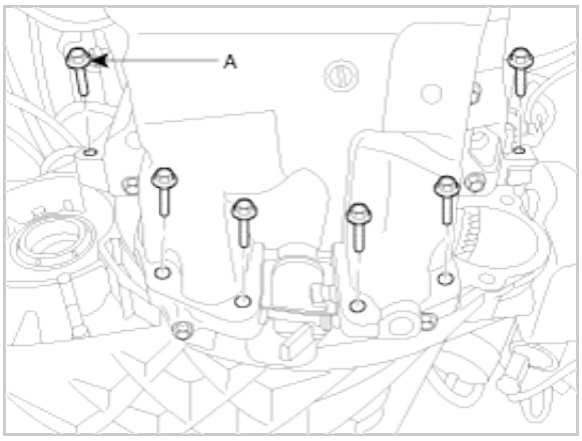


INSTALLATION

1. Lowering the vehicle or lifting up a jack, install the transaxle assembly.

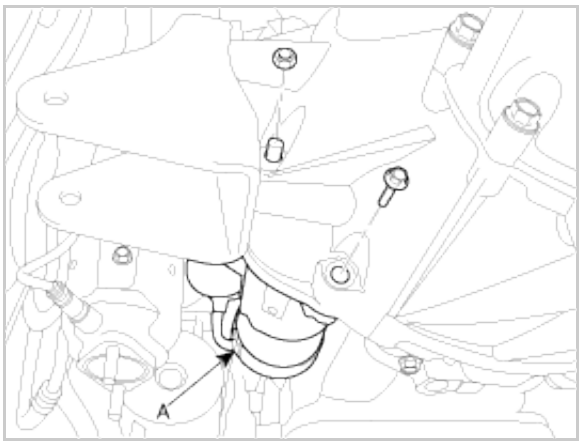
2. Tighten the transaxle under mounting bolts.

TORQUE:
65~85 Nm(6.5~8.5 kgf.m, 47.0~61.5 lb-ft)

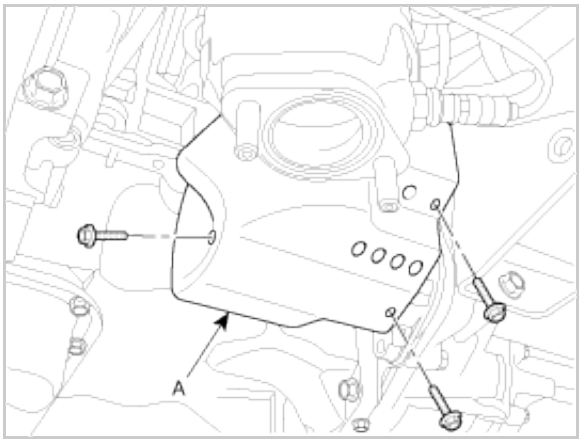


3. Install the starter motor(A) and connect the starter motor connector. (see EE group)

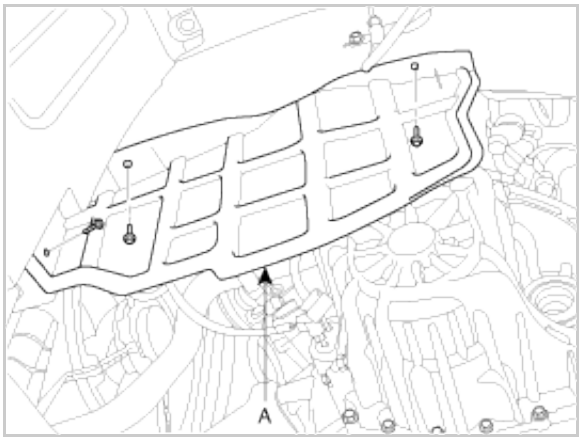
TORQUE:
65~85 Nm(6.5~8.5 kgf.m, 47.0~61.5 lb-ft)



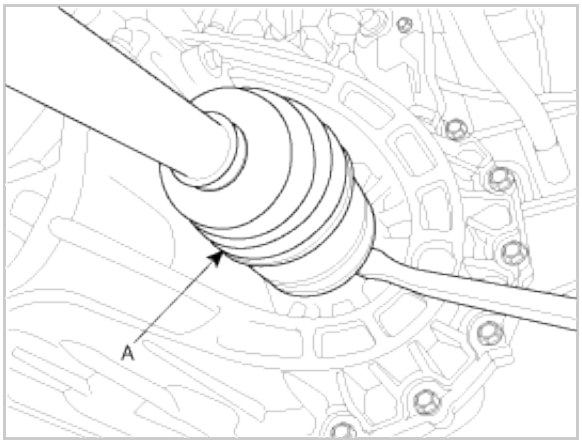
4. install the starter motor cover(A).

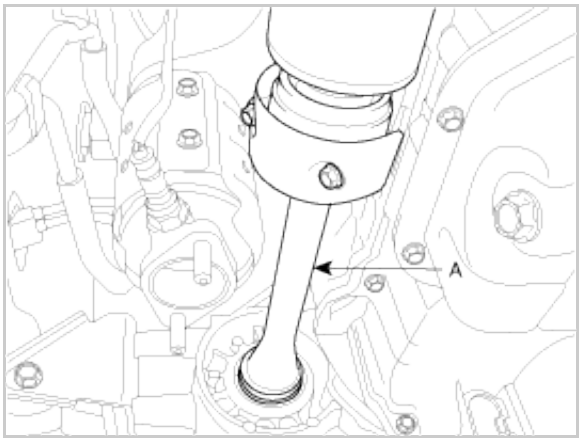


5. install the side cover(A).

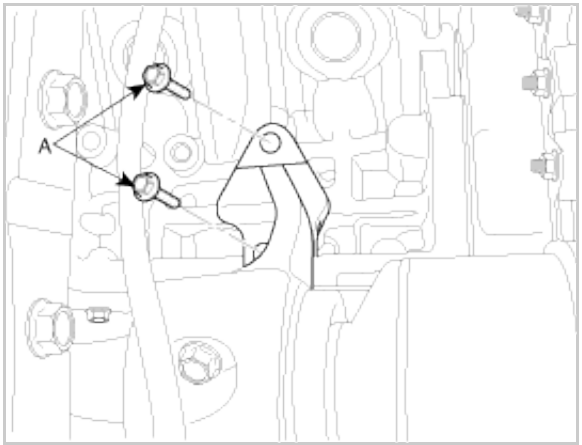


6. Install the drive shafts(A) to the transaxle. (see DS group)



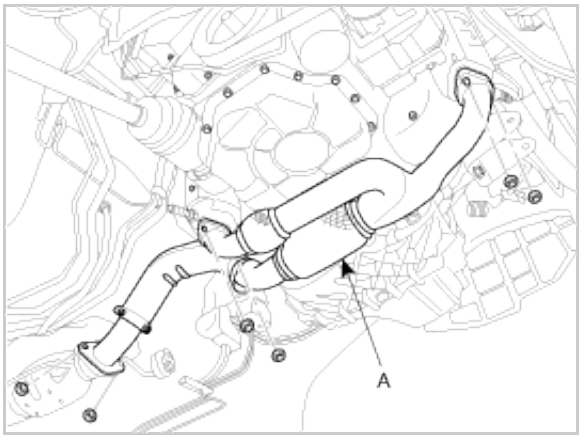


7. Install the inner shaft bracket mounting bolt(A). (see DS group)



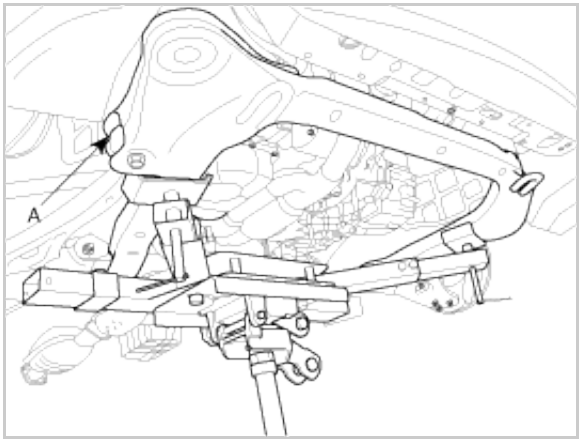
8. Install the exhaust pipe(A).

TORQUE:
39.2~58.8Nm(4.0~6.0kgf.m, 28.9~43.4lb-ft)

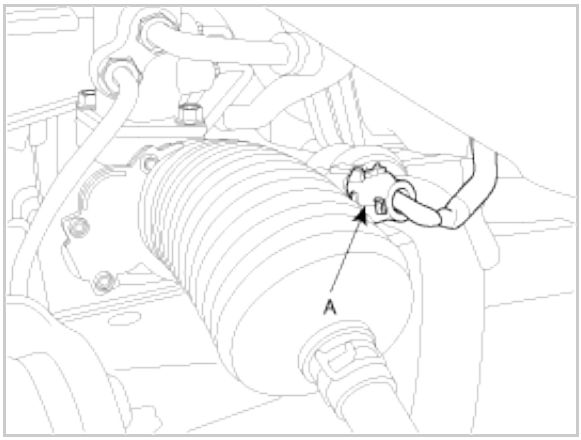


9. Install the sub frame(A). (see SS group)

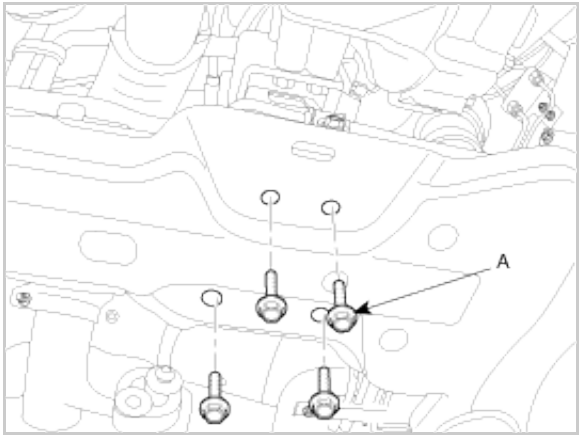
TORQUE:
60~80Nm(6.0~8.0kgf.m, 65.1~79.5lb-ft)



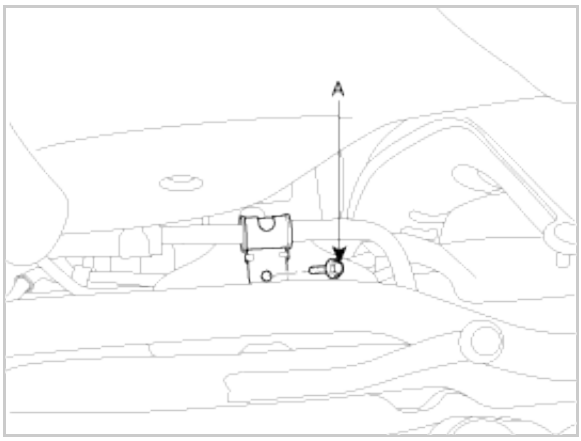
10. Connect the vrs connector(A). (see ST group)



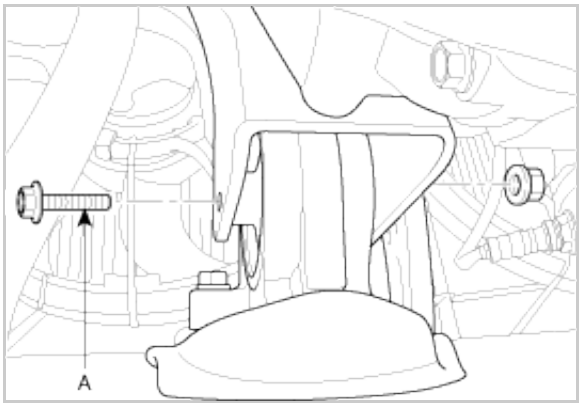
11. Install the rear roll stopper mounting bolts(A).



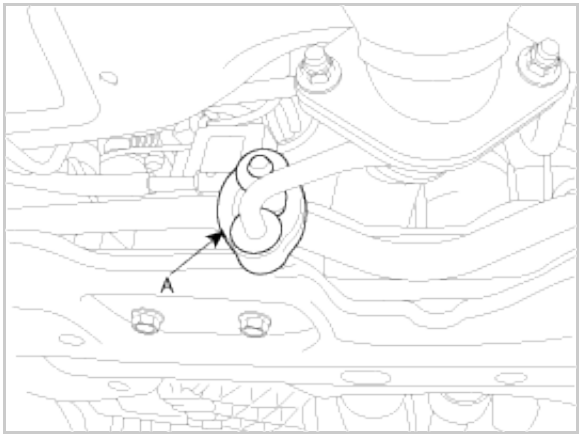
12. Install the power steering return tube mounting bolt(A).



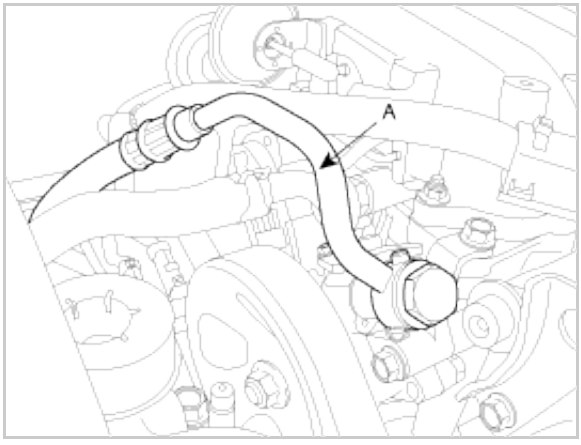
13. Install the front roll stopper mounting bolt(A).



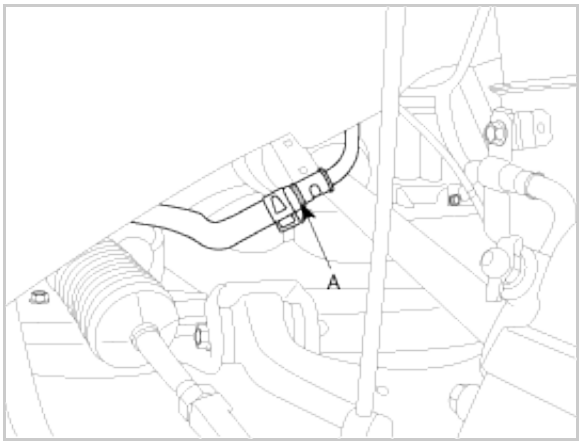
14. Connect the lower arm, the rod end ball joint, the stabilizer bar link to the front knuckle.(see SS group)
15. Install the hanger(A).



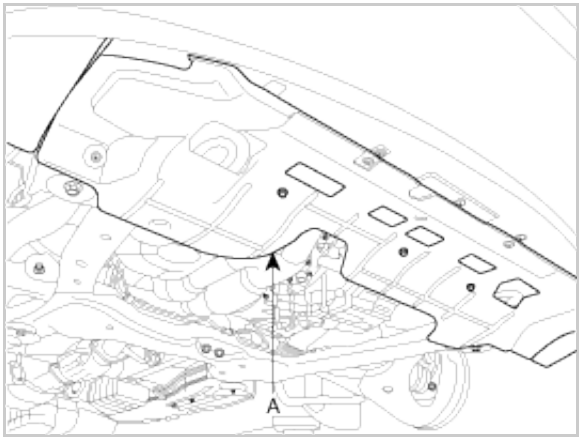
16. Refill the transaxle with fluid.
17. Connect the power steering pressure hose (A) to the power steering oil pump.



18. Connect the power steering return hose(A). (see ST group)

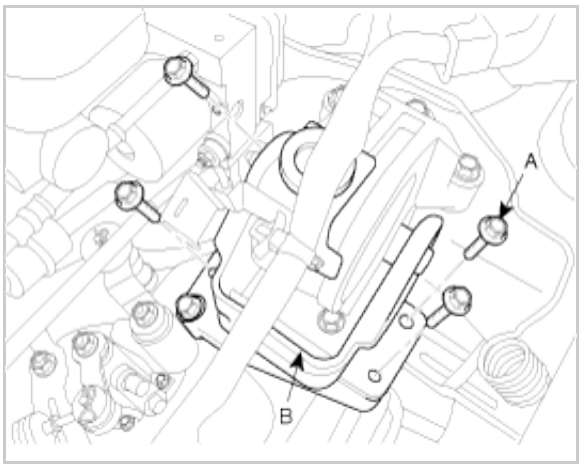


19. Install the under cover(A).



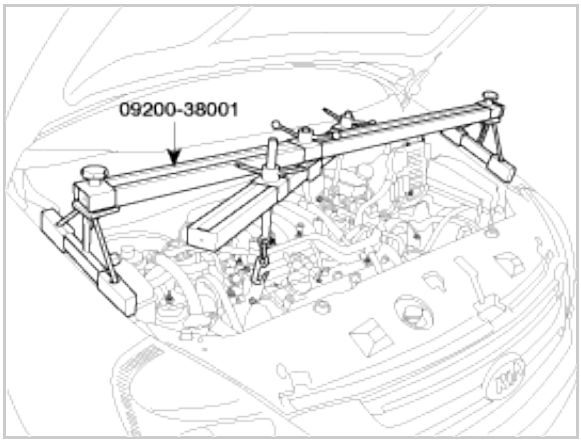
20. Install the steering column joint bolt.(See ST group).
21. Install the front wheels and tires. (see SS group)
22. Install the transaxle insulator and mounting bracket (B) by tightening the bolts (A).

TORQUE:
60~80 Nm (6~8 kgf.m, 43.6~58.2 lb-ft)



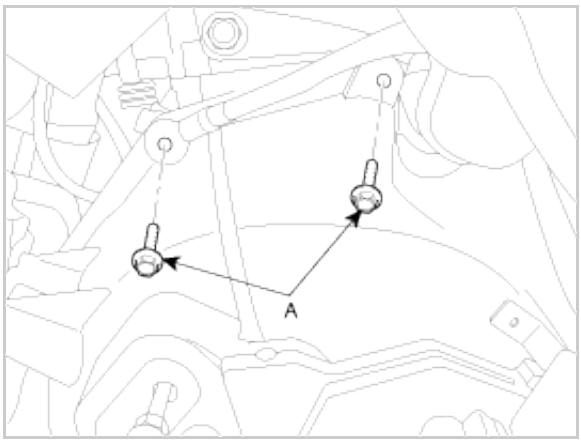
23. remove the SST (09200-38001) holding the engine and transaxle assembly.

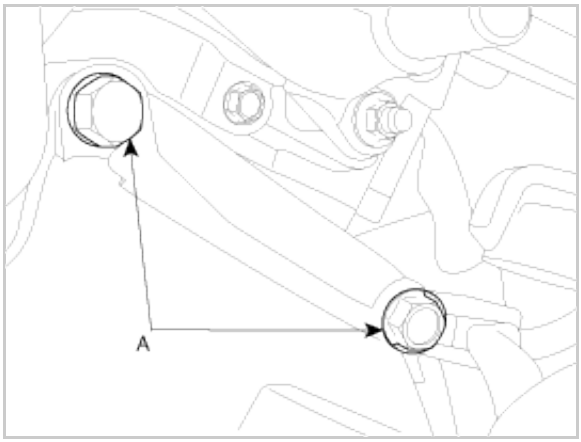
TORQUE:
65~85 Nm (6.5~8.5kgf.m, 47.0~61.5 lb-ft)



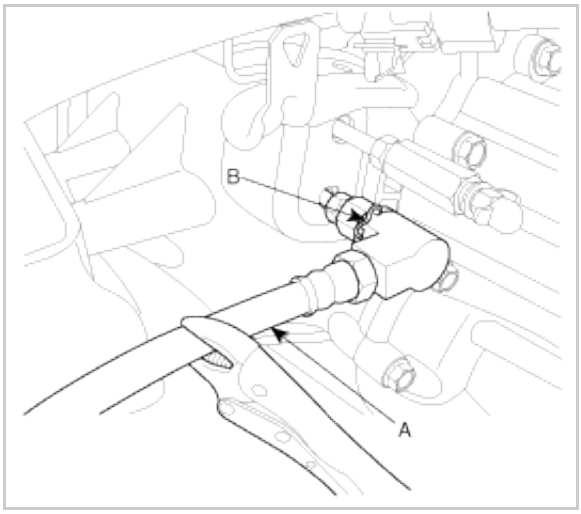
24. Install the transaxle upper mounting bolts(A).

TORQUE:
65~85Nm(6.5~8.5kgf.m, 47.0~61.5lb-ft)

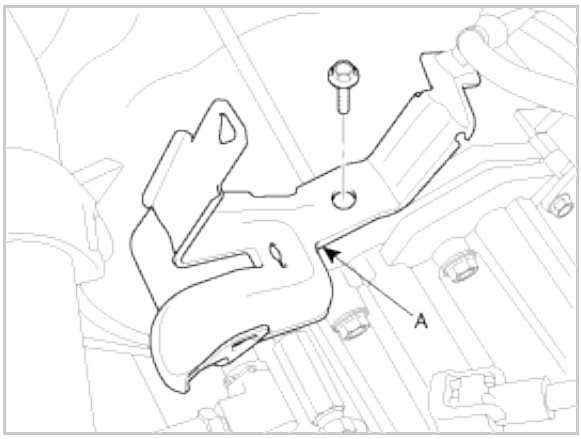




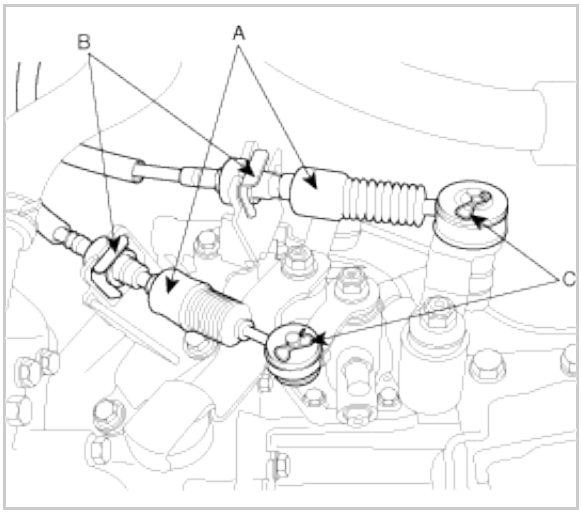
25. Install the C.S.C (Cincentric Slave Cylinder) tube(A) by tightening the nut(B).



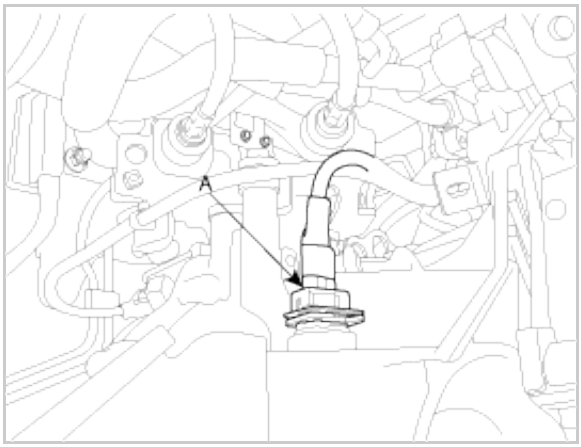
26. Install the wire harness bracket(b).

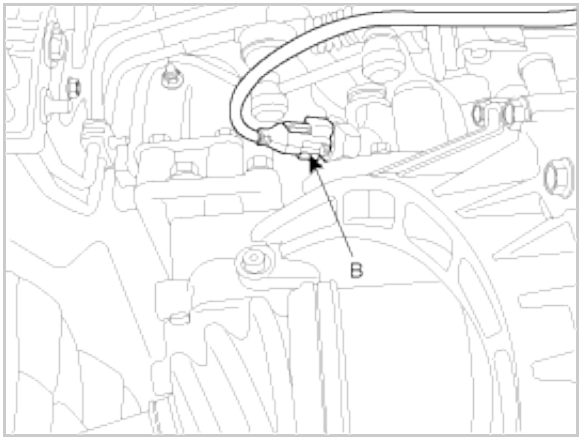


27. Install the shift cable assembly (A) with the clips(B) and pins(C).

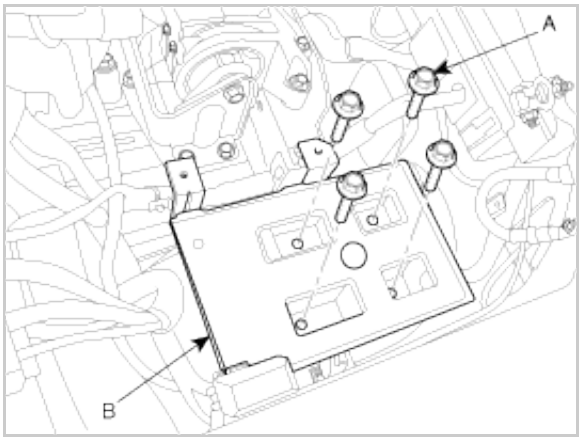


28. Install the vehicle speed sensor connector (A) and the back up lamp switch(B).

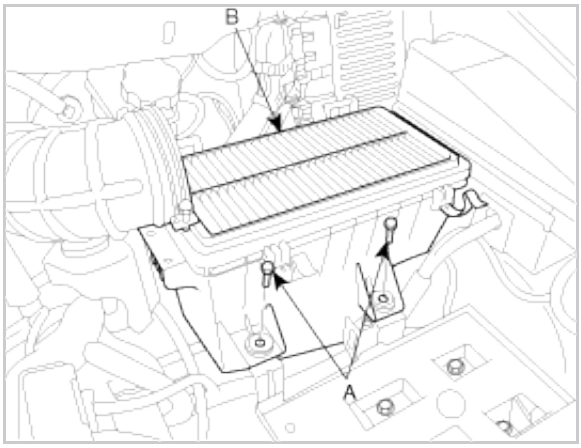




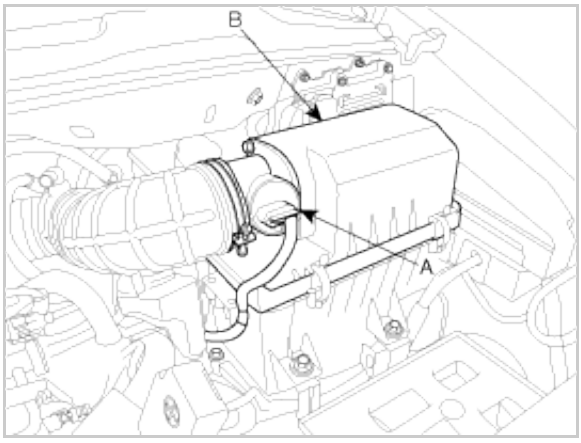
29. Install the battery tray(B) by removing the four mounting bolts(A).



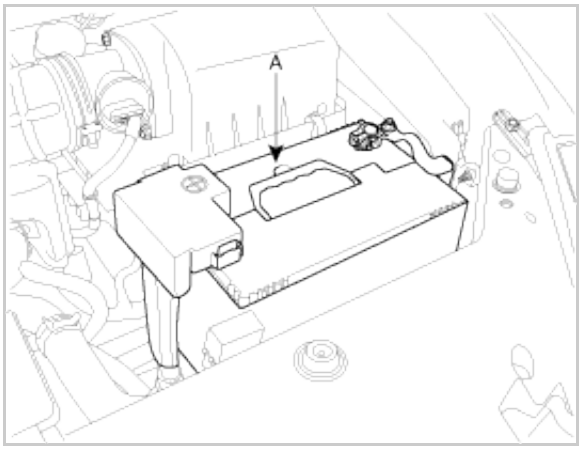
30. Install the air cleaner assembly(B) by tightening the two mounting bolts(A).



31. Reassemble the air cleaner filter, install the air cleaner upper body(B) and connect the air flow sensor connector(A).



32. Install the battery(A).

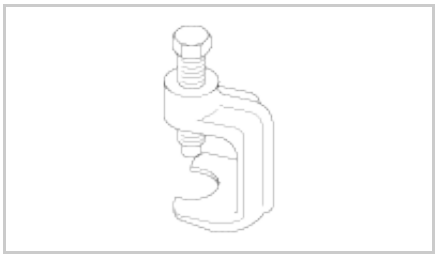
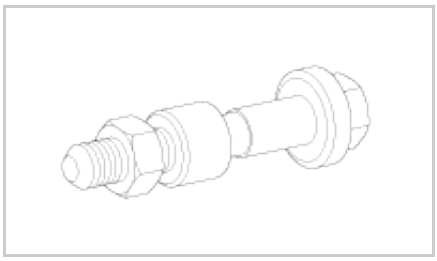
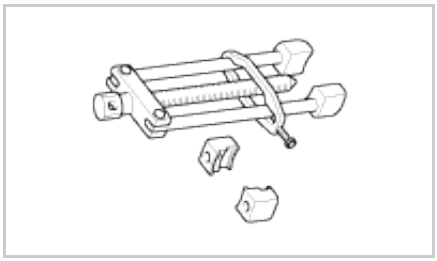
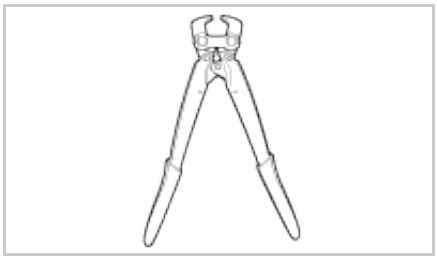
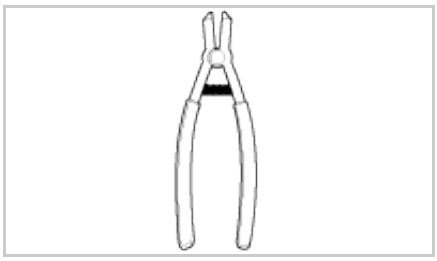


CHAPTER 8:

Driveshaft and Axle

General Information

SPECIAL TOOLS

Tool(Number and name)	Illustration	Use
Tie rod end puller 09568-4A000		Separation of a lower arm and a tie rod end ball joint
Front hub remover and installer 09517-21500		Removal of a front hub from a knuckle. (use with 09517-21600)
Main shaft bearing puller 09432-11000		Removla of a tone wheel from a driveshaft
09495-3K000 Band installer		Installation of ear type boot band
09495-39100 Band installer		Installation of hook type boot band

TROUBLESHOOTING

Symptom	Possible cause	Remedy
Vehicle pulls to one side	Scoring of driveshaft ball joint Wear, rattle or scoring of wheel bearing Defective front suspension and steering	Replace Replace Adjust or replace
Vibration	Wear, damage or bending of driveshaft Driveshaft rattle and worn hub splines Wear, rattle or scratching of wheel bearing	Replace Replace Replace
Shimmy	Improper wheel balance Bent wheel Defective front suspension and steering	Adjust or replace Replace Adjust or replace
Excessive noise	Wear, damage or bending of driveshaft Driveshaft rattle and worn hub splines Driveshaft rattle and worn side gear splines Wear, rattle or galling of wheel bearing Loose hub nut Defective front suspension and steering	Replace Replace Replace Replace Adjust or replace Adjust or replace
Bent cage	Cage damaged by improper handling or tool usage	Replace bearing
Galling	Metal smears on roller end due to overheating, incorrect lubricant or overloading	Replace bearing Check seals, check for proper lubrication
Cracked inner race	Race cracked due to improper fit, cocking or poor bearing seats	Replace bearing
Etching	Bearing surfaces appear gray or grayish black in color accompanied by material etched away usually at roller spacing	Replace bearing Check seals, check for proper lubrication
Brinelling	Surface indentations on race surface caused by rollers being under impact loading or vibration while the bearing is not rotating	Replace bearing
Heat discoloration	Heat discoloration is dark blue resulting from overload or no lubricant (Yellow or brown color is normal)	Replace bearing Check seals and other parts
Fatigue spalling	Flaking of surface metal resulting from fatigue	Replace bearing Clean all related parts

SPECIFICATIONS

Driveshaft					
Engine	Transaxle	Joint type		Max. permissible angle	
		Inner	Outer	Inner	Outer
2.9 CRDi	M/T	TSJ#26	BJ#28	46.5°	23°
	A/T	UTJ-II#25	BJ#26	46.5°	23°
3.8 MPI	A/T	UTJ-II#25	BJ#26	46.5°	23°
Front hub & bearing assembly					
Starting torque		1.97 Nm (20 kgf.cm, 1.45 lb-ft)			
Rear hub & bearing assembly					
Starting torque		1.97 Nm (20 kgf.cm, 1.45 lb-ft)			

NOTICE

Inner: On transaxle side
Outer : On tire side

TGHTENING TORQUE

Items	Nm	Kgf.m	lb-ft
Hub nut	90 ~ 110	9.0 ~ 11.0	65 ~ 80
Driveshaft lock nut	245 ~ 275	24.5 ~ 27.5	177 ~ 199
Tie rod end castle nut	60 ~ 80	6.0 ~ 8.0	43 ~ 58
Front lower arm to knuckle bolt & nut	90 ~ 120	9.0 ~ 12.0	65 ~ 87
Inner shaft bearing & bracket assembly bolts (DSL)	43 ~ 63	4.3 ~ 6.3	31 ~ 46
Inner shaft bearing & bracket assembly bolts (GSL)	50 ~ 65	5.0 ~ 6.5	36 ~ 47
Front caliper assembly to knuckle bolts	85 ~ 100	8.5 ~ 10.0	61 ~ 72
Front strut assembly to knuckle bolts	100 ~ 120	10.0 ~ 12.0	72 ~ 87
Front hub & bearing assembly to knuckle bolts	160 ~ 180	16.0 ~ 18.0	116 ~ 130
Rear lower arm to carrier bolt & nut	160 ~ 180	16.0 ~ 18.0	116 ~ 130
Rear caliper assembly to carrier assembly bolts	50 ~ 60	5.0 ~ 6.0	36.2 ~ 43.4
Rear hub lock nut	200 ~ 260	20.0 ~ 26.0	145 ~ 188
Rear brake assembly to carrier assembly bolts	50 ~ 60	5.0 ~ 6.0	36 ~ 43
Carrier assembly to assist arm bolt	90 ~ 100	9.0 ~ 10.0	65 ~72
Carrier assembly to upper arm bolt	90 ~ 100	9.0 ~ 10.0	65 ~72

LUBRICANTS

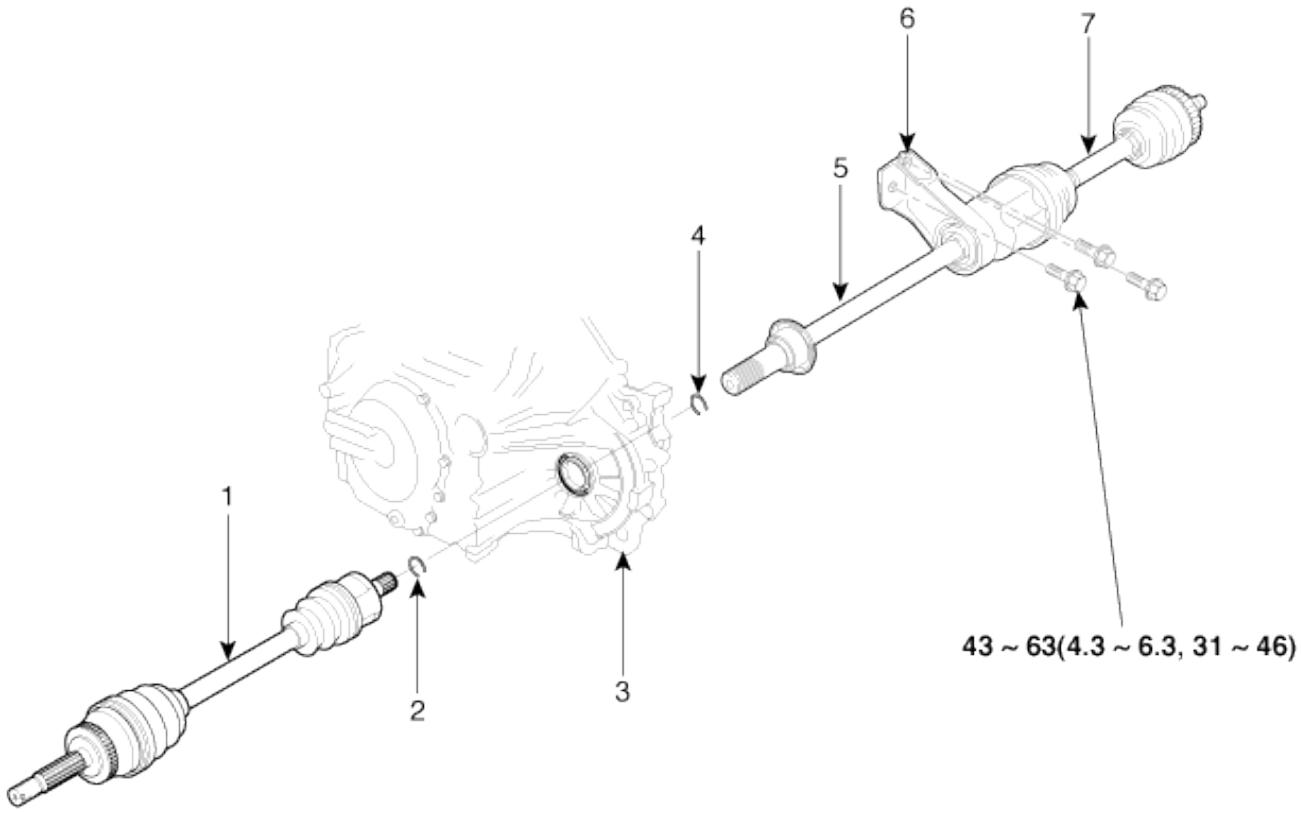
Joint type	Recommended grease	Quantity

BJ#28	RBA	250 g
BJ#26	RBA	210 g
TSJ#26	RBA	150 g
UTJ-II#25	CK-2	220 g

Driveshaft Assembly

Front Driveshaft

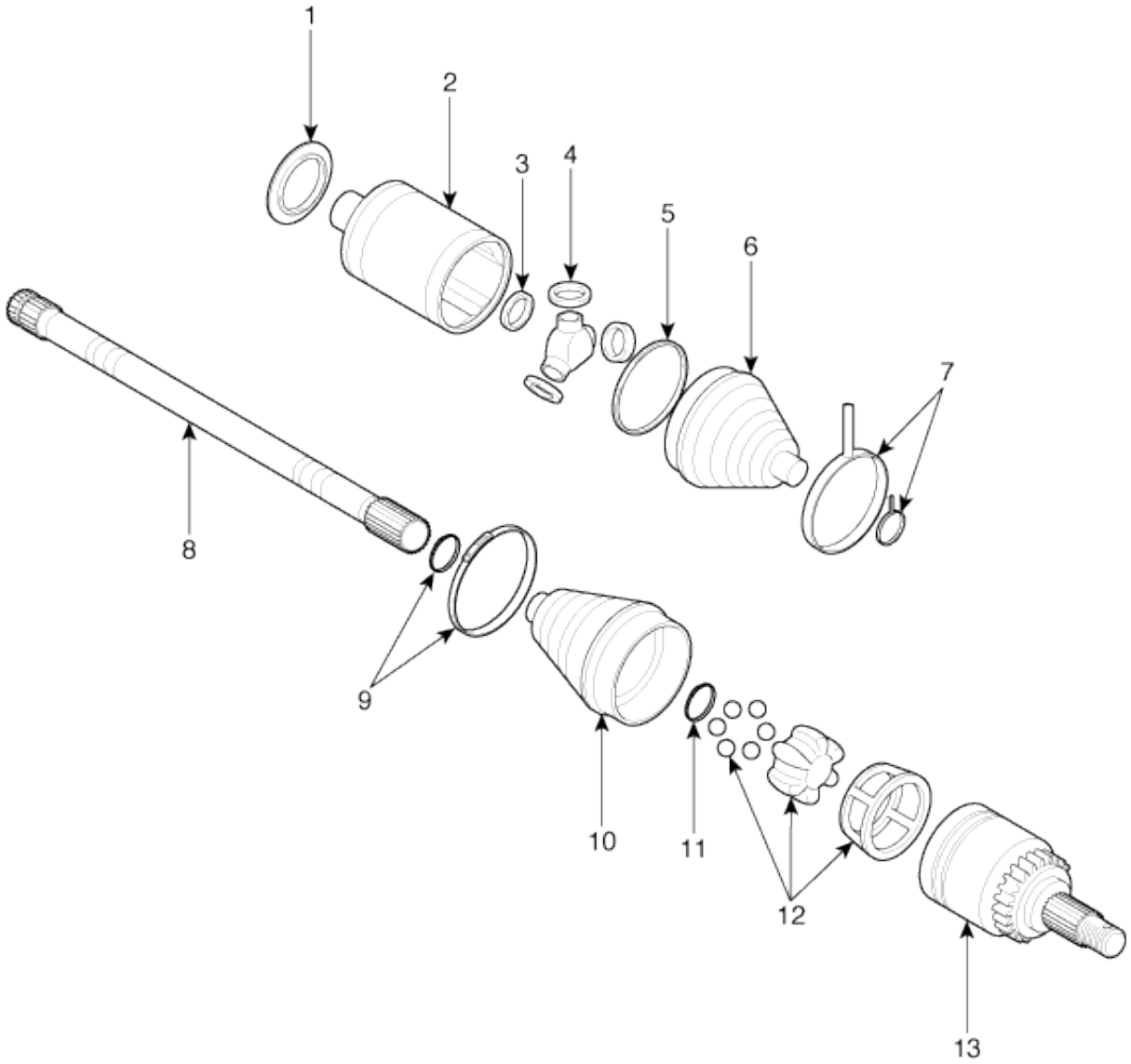
COMPONENTS



TORQUE : Nm (kgf·m, lb-ft)

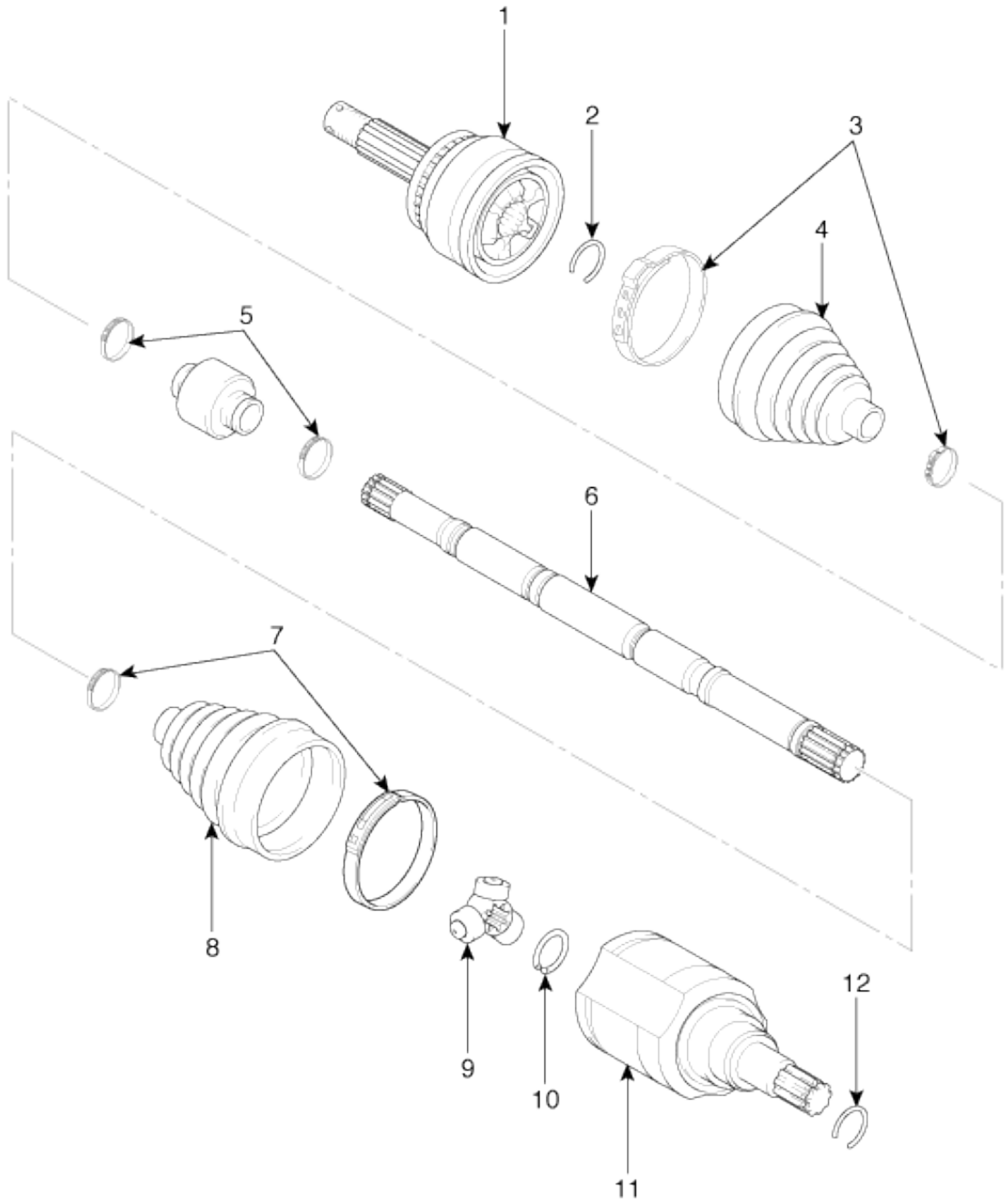
1. Driveshaft [LH]
2. Circlip
3. Transaxle
4. Circlip
5. Inner shaft
6. Bearing & bracket assembly
7. Driveshaft [RH]

COMPONENTS



1. Dust cover
2. TSJ assembly
3. Snap ring
4. Spider assembly
5. Circle ring
6. TSJ boot
7. TSJ boot band
8. Shaft
9. BJ boot band
10. BJ boot
11. Snap ring
12. BJ inner race and ball
13. BJ assembly

COMPONENTS

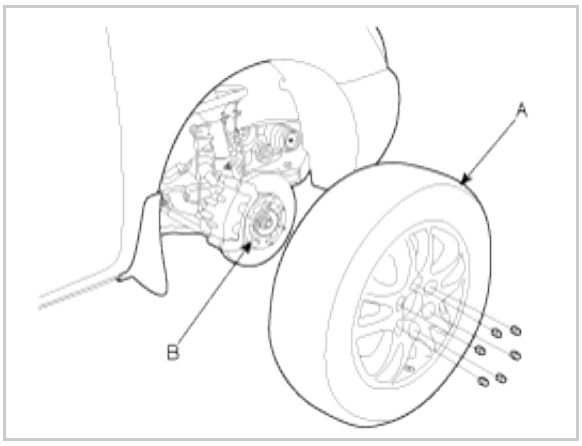


1. BJ assembly
2. Circlip
3. BJ boot bands
4. BJ boot
5. Dynamic damper bands
6. Shaft
7. UTJ boot bands
8. UTJ boot
9. Spider assembly
10. Circlip
11. UTJ case
12. Clip

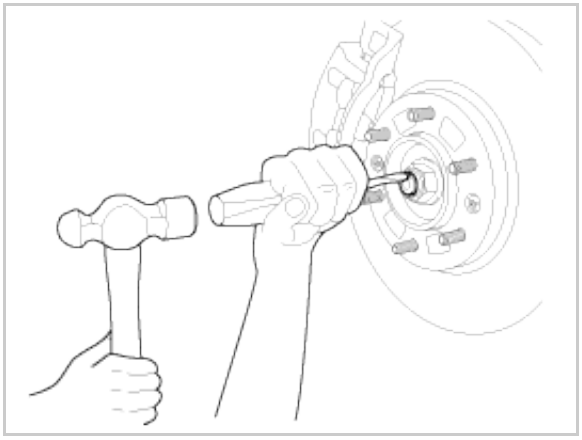
REMOVAL

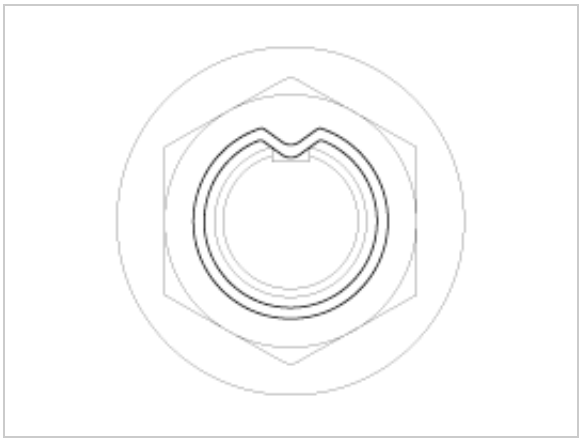
1. Raise the vehicle and remove the wheel & tire assembly (A) from the front hub assembly (B).

Tightening torque Nm (Kgf.m, lb-ft):
90 ~ 110 (9.0 ~ 11.0, 65 ~ 80)



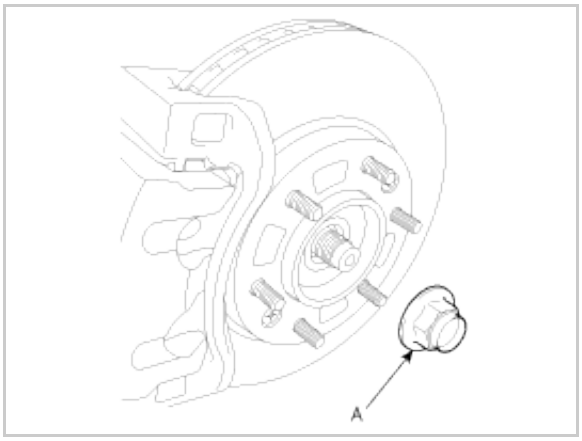
2. Unstake the driveshaft lock nut using a chisel and hammer.





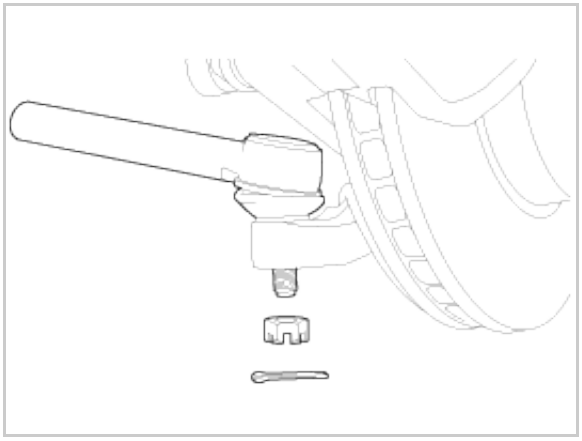
3. Remove the driveshaft lock nut (A).

Tightening torque Nm (Kgf.m, lb-ft):
245 ~ 275 (24.5 ~ 27.5, 177 ~ 199)

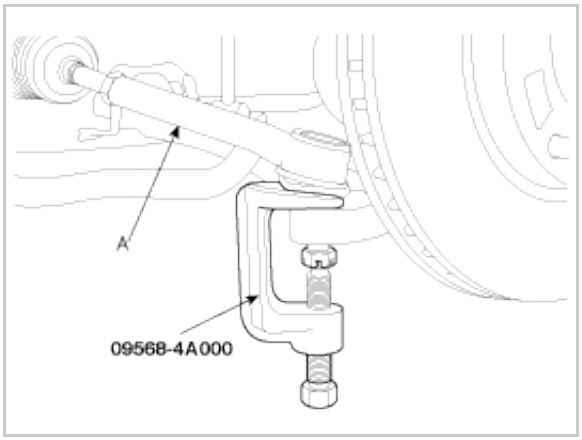


4. Remove the split pin and castle nut form the tie rod end ball joint.

Tightening torque Nm (Kgf.m, lb-ft):
60 ~ 80 (6.0 ~ 8.0, 43 ~ 58)

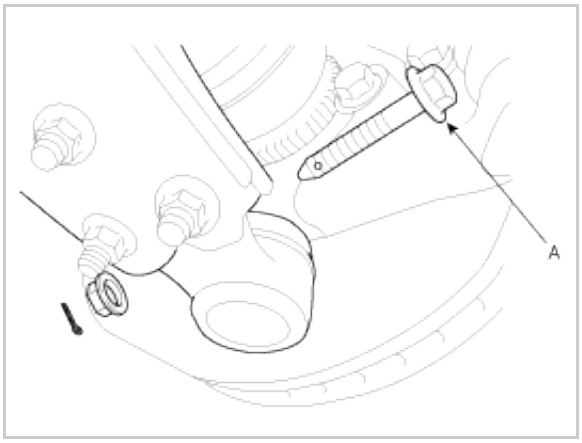


5. Disconnect the tie rod end (A) from the knuckle using a SST (09568-4A000).

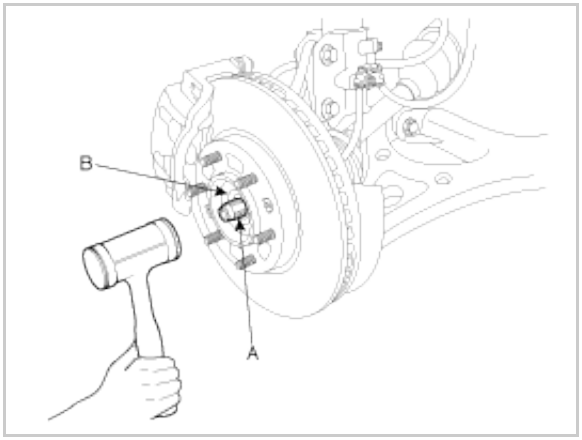


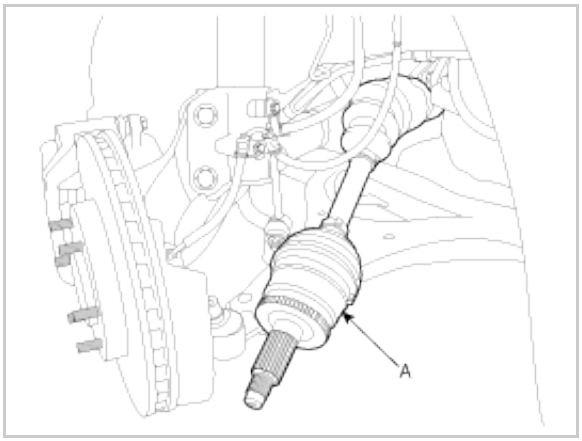
6. Remove the split pin and lower arm bolt and nut (A).

Tightening torque Nm (Kgf.m, lb-ft):
90 ~ 120 (9.0 ~ 12.0, 65 ~ 87)

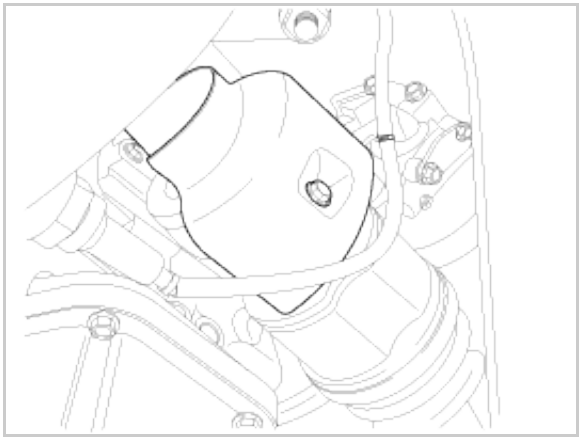


7. Using a plastic hammer, disconnect the driveshaft (A) from the front hub assembly (B).





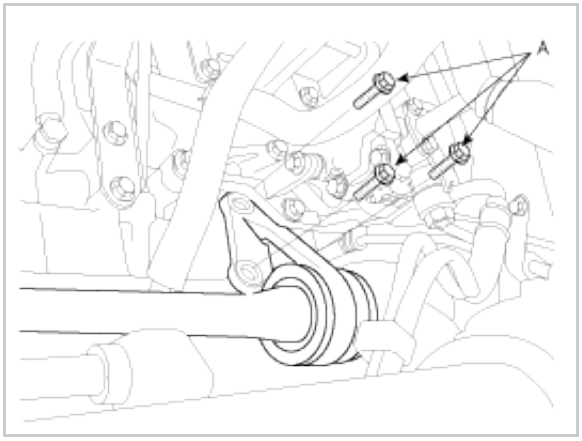
8. Removal of the driveshaft [RH].
   a. [Gasoline 3.8 only]
      Remove the heat protector (A).



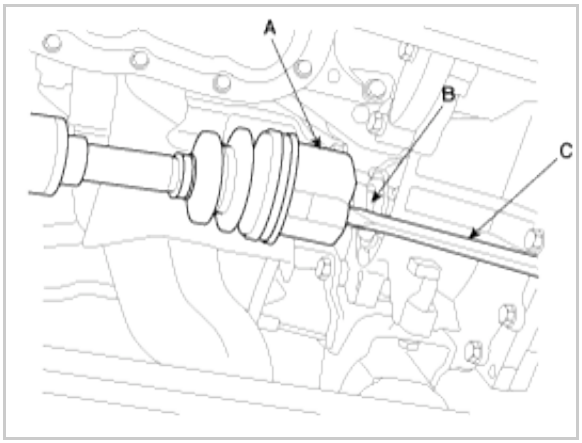
   b. Remove the inner shaft bearing bracket assembly mounting bolts (A).

Tightening torque Nm (Kgf.m, lb-ft):
Diesel: 43 ~ 63 (4.3 ~ 6.3, 31 ~ 46)

Gasoline: 50 ~ 65 (5.0 ~ 6.5, 36 ~ 47)



9. Insert pry bar (C) between the transaxle case (B) and driveshaft joint (A), separate driveshaft from the transaxle.



CAUTION

a. Use a pry bar being careful not to damage the transaxle and joint.
b. Do not insert a pry bar too deep, as this may cause damage to the oil seal.
c. Do not pry on the driveshaft by excessive force it may cause components inside the joint kit to dislodge resulting in a torn boot or a damaged bearing.

10. Pull out the driveshaft from the transaxle case.

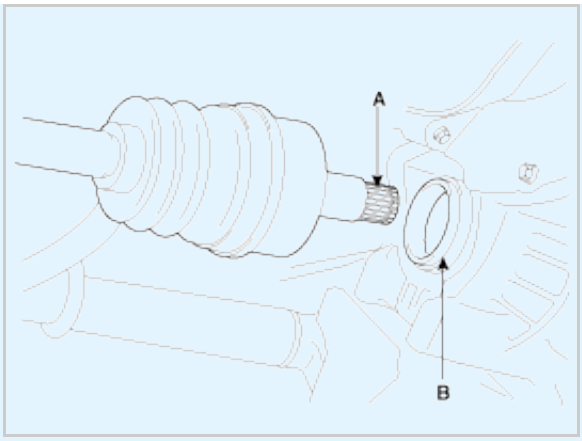
CAUTION

a. Plug the hole of the transaxle case with the oil seal cap to prevent contamination.
b. Replace the retainer ring whenever the driveshaft is removed from the transaxle case.

INSTALLATION

CAUTION

a. Replace the circlip with new ones before the installation.
b. Before the installation, apply the gear oil on the driveshaft splines (A) and contacting surface of differential case oil seal (B).

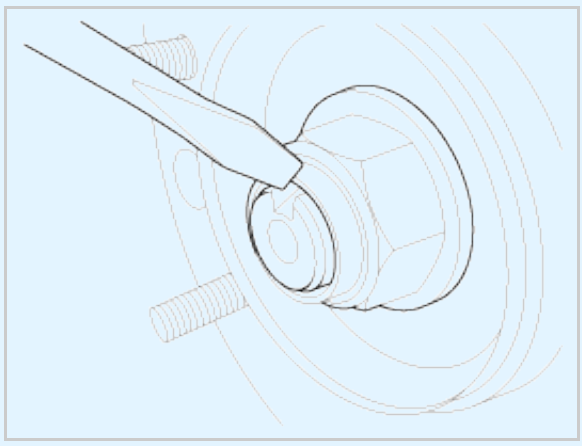


1. Installation is reverse of the removal.

CAUTION

a. The driveshaft lock nut should be replaced with new ones.
b. After installation driveshaft lock nut, stake the lock nut using a chisel and hammer as shown in the illustration below.

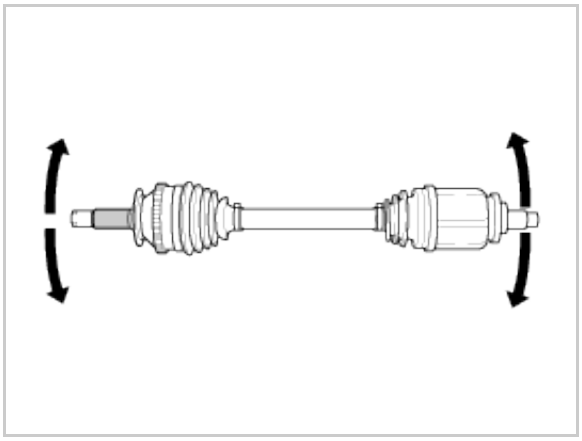
CAUTION





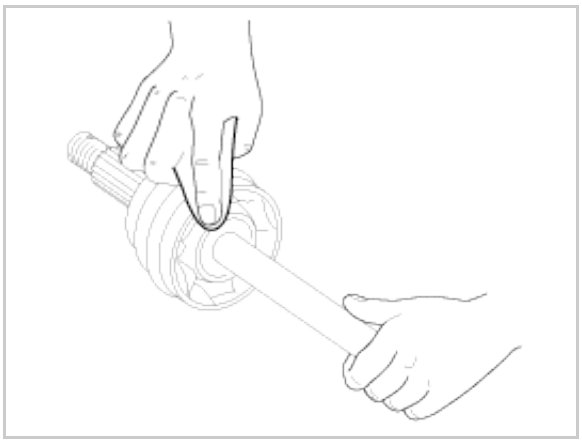
INSPECTION

1. Check the driveshaft boots for damage and deterioration.
2. Check the ball joints for wear and damage.
3. Check the splines for wear and damage.
4. Check the dynamic damper for cracks and wear.



INSPECTION

1. Check the drive shaft spline for wear or damage.
2. Check that there is no water or foreign material in the BJ.
3. Check the spider assembly for roller rotation, wear or corrosion.
4. Check the groove inside the UTJ case for wear or corrosion.
5. Check the dynamic damper for damage or cracks.



DISASSEMBLY

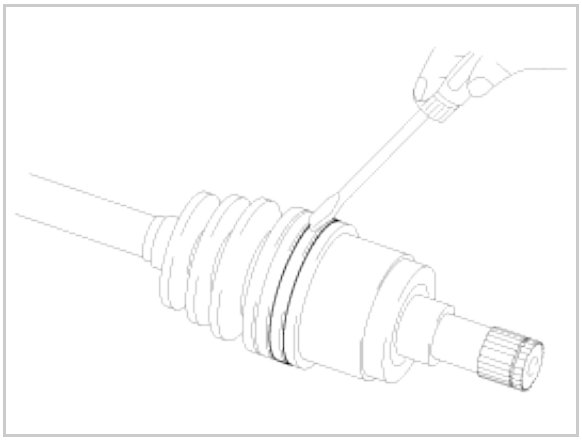
NOTICE

a. Do not disassemble the BJ assembly.
b. The Driveshaft joint uses special grease. Do not subtitute with another type of grease.
c. The Boot band should be replaced with a new one.

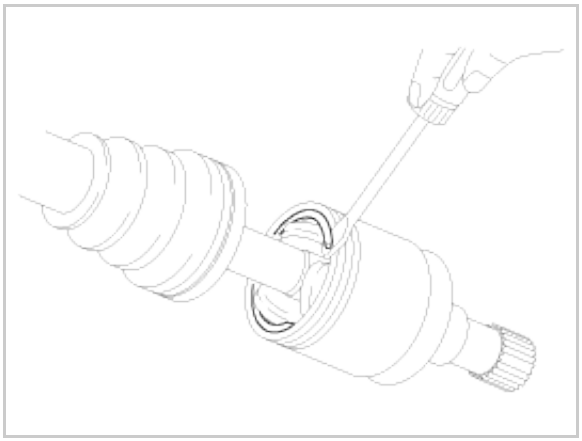
1. Remove the TSJ boot band and pull the boot from TSJ outer race.

NOTICE

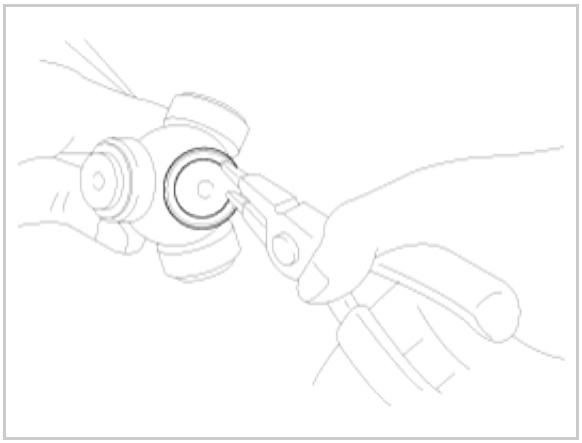
Be careful not to damage it.



2. Remove the circlip using a screwdriver.

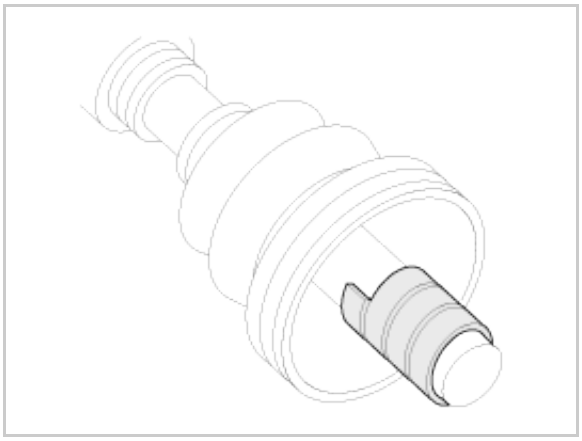


3. Remove the driveshaft from TSJ outer race.

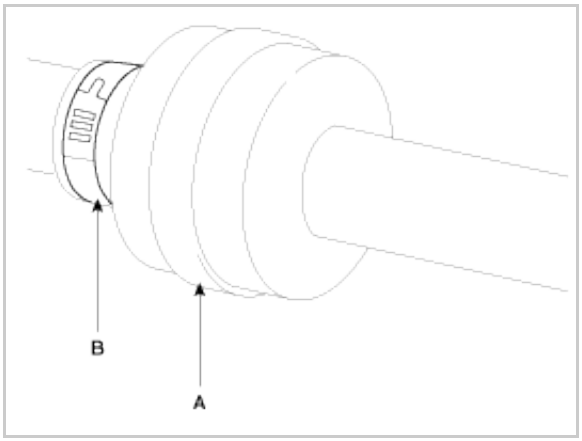


4. Remove the snap ring and disassemble the spider assembly from the shaft.
5. Clean the spider assembly.
6. Remove the BJ boot band and removal of the TSJ boot and the BJ boot.

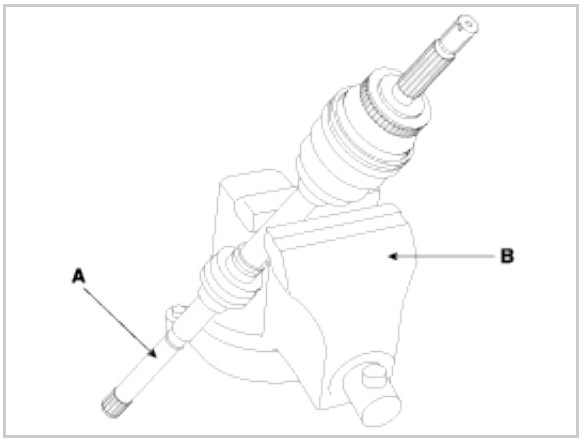
> **CAUTION**
>
> If the boot is reused, wrap a tape around the driveshaft splines to protect the boot.



7. Remove both side of bands(B) of the dunamic damper(A).

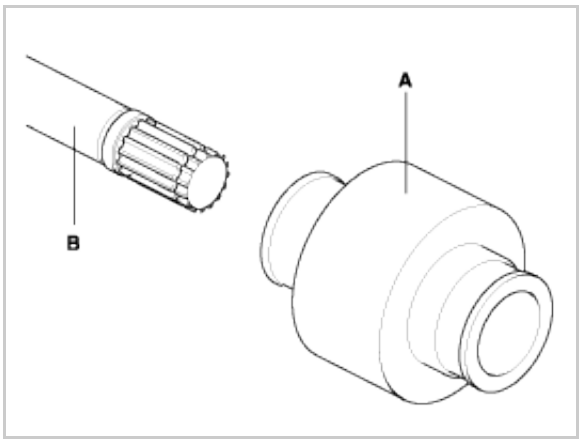


8. Fix the drive shaft(A) with a vice(B) as illustrated.



9. Apply soapy water to the shaft to prevent being damaged between the shaftspline and the dynamic damper when the dynamic damper is removed.

10. Separate dynamic damper(A) from the shaft(B) carefully.

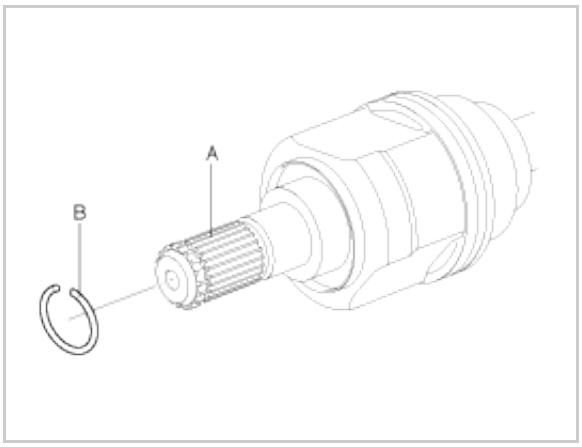


DISASSEMBLY

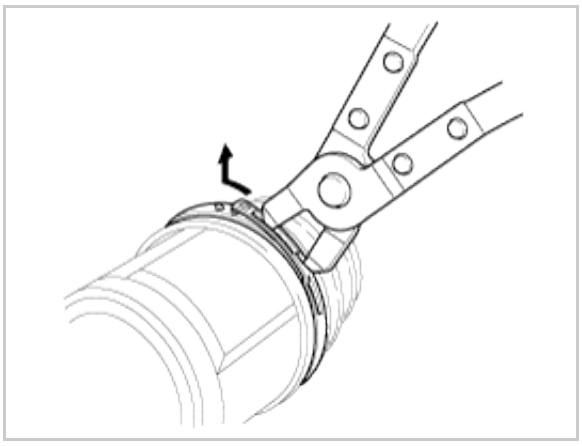
NOTICE

a. Do not disassemble the BJ assembly.
b. Special grease must be applied to the drive shaft joint. Do not substitute with another type of grease.
c. The boot band should be replaced with a new one.

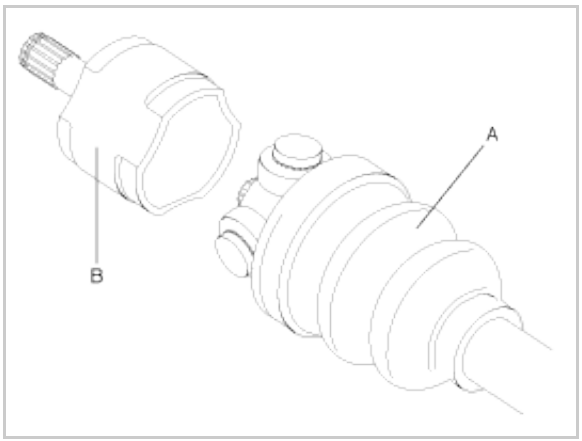
1. Remove the clip (B) from drive shaft splines (A) of the transaxle side.



2. Remove both boot bands from the transaxle side UTJ case.

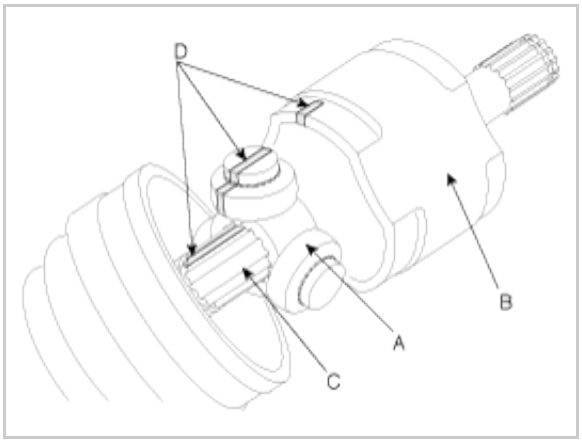


3. Pull out the boot from the transaxle side joint(UTJ).
4. When separating the joint and boot (A), remove the grease from the UTJ case (B).

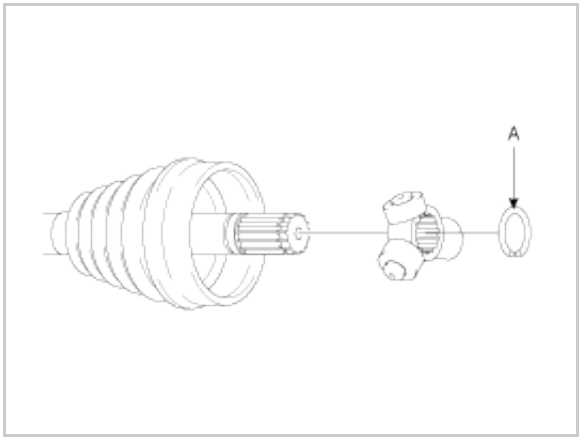


CAUTION

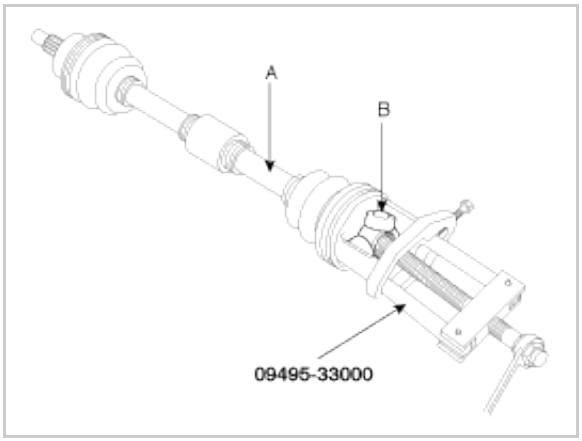
a. Be careful not to damage the boot.
b. According to ullustration below, put alignment marks across spider roller assembly (A), UTJ case (B), and shaft splines (C) to aid in reassembly.



5. Using a plier or flat-tipped (-) screwdriver, remove the snap ring (A).



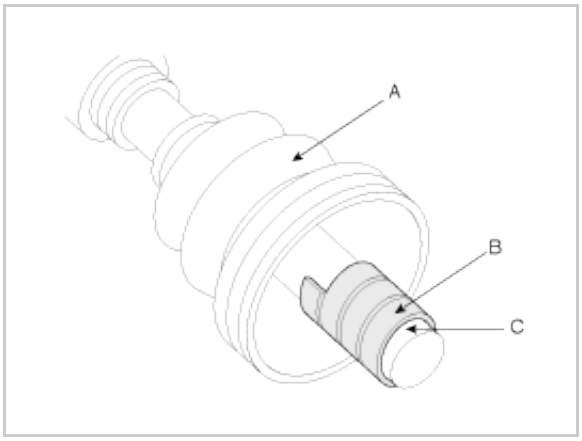
6. Remove the spider assembly (B) from drive shaft (A) by using the Special Tool(09495-33000).



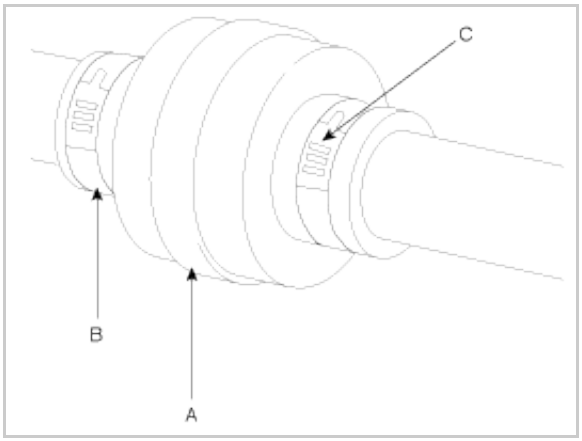
7. Clean the spider assembly.
8. Remove the boot (A), of the transaxle side joint(UTJ).

CAUTION

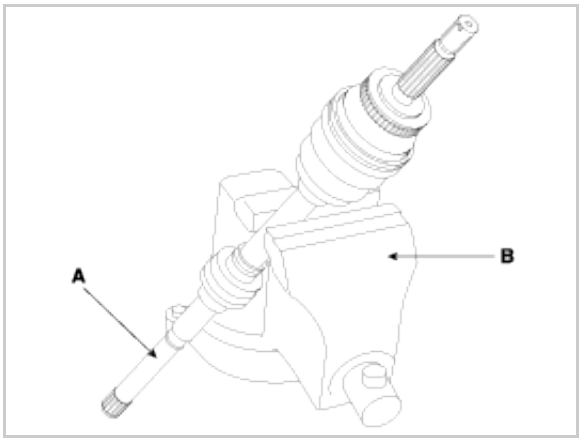
Wrap tape (B) around the driveshaft splines (C) to protect the boot (A).



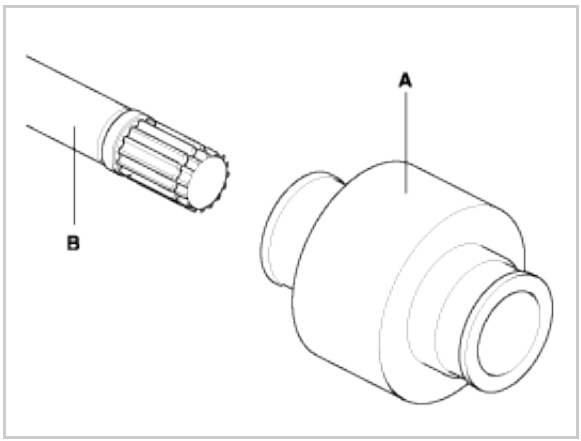
9. Remove both side of bands (B, C) of the dynamic damper (A).



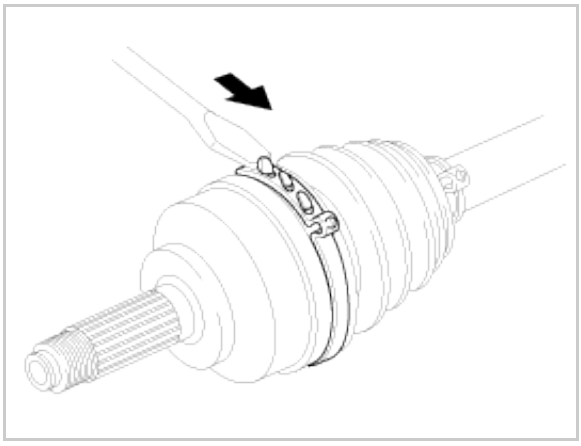
10. Fix the driveshaft (A) with a vice (B) as illustrated.



11. Apply soap powder on the shaft to prevent being damage between the shaft spline and the dynamic damper when the dynamic damper is removal.
12. Separated dynamic damper (A) from the shaft (B) carefully.



13. Remove both bands on the side of wheel.

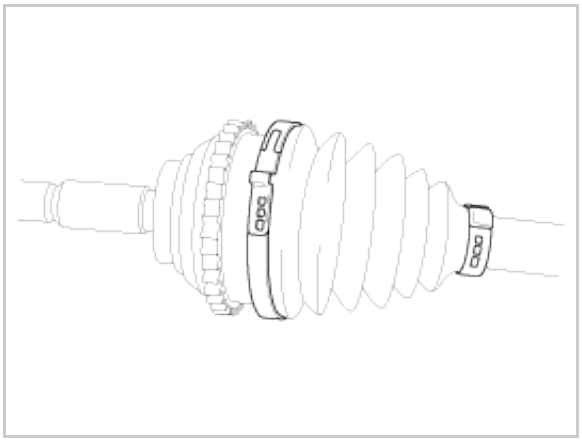


14. Pull out the joint(BJ) boot on the side of wheel into the transaxle direction.

> **CAUTION**
>
> Be careful not to damage the boot.

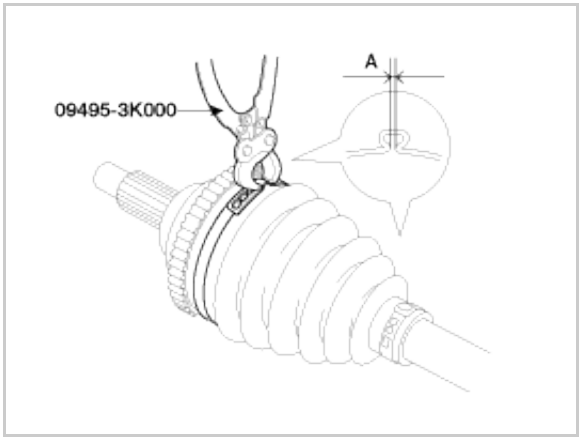
REASSEMBLY

1. Wrap tape around the drive shaft splines (UTJ side) to prevent damage to the boots.
2. Apply grease to the joint(BJ) boot on the side of wheel and install the boots.
3. Install the bands to both boots.



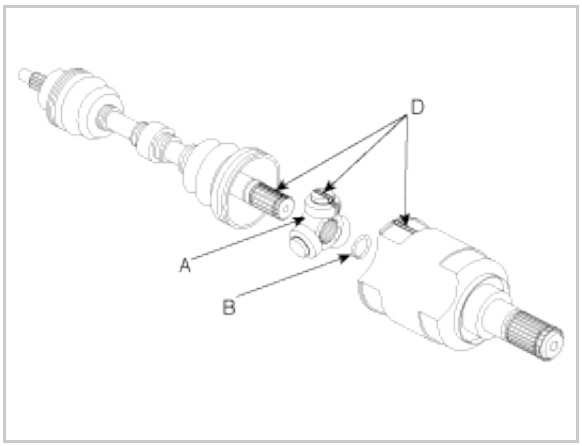
4. Using clamp, secure the boot bands.

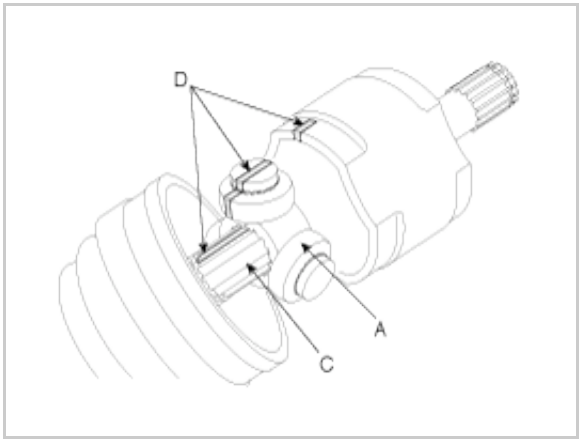
Clearance (A) : 2.0 mm (0.079 in.) or less



5. To install the dynamic damper, keep the BJ shaft in a straight line and secure the dynamic damper with the dynamic damper bands.
6. Install the UTJ boot bands and UTJ boot.
7. 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).

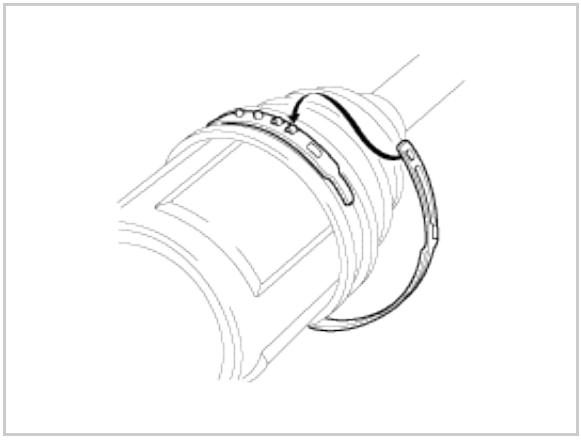


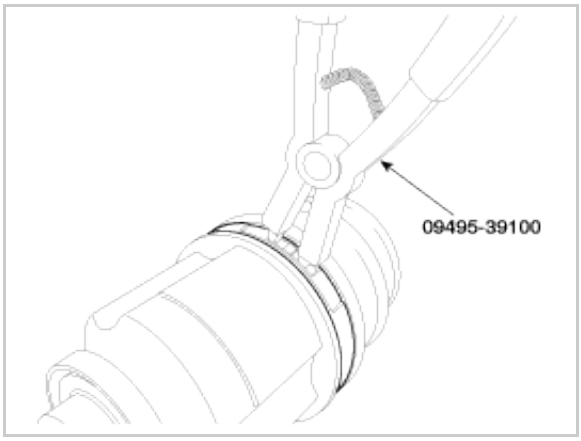


8. Add the specified grease to the joint(UTJ) boot as mush as wiped away at inspection.
9. Install the boots.
10. To control the air in the UTJ boot, keep the specified distance between the boot bands when they are tightened.
Standard value [A]

Items	Standard (A) mm(in)	
	LH	RH
2.9 Diesel M/T	505.4 (19.90)	466.8 (18.38)
2.9 Diesel A/T	507.5 (19.98)	466.9 (18.38)
3.8 Gasoline A/T	557.1 (21.93)	570.7 (22.47)

11. Install both sides of the boot bands by using SST (09495-39100).

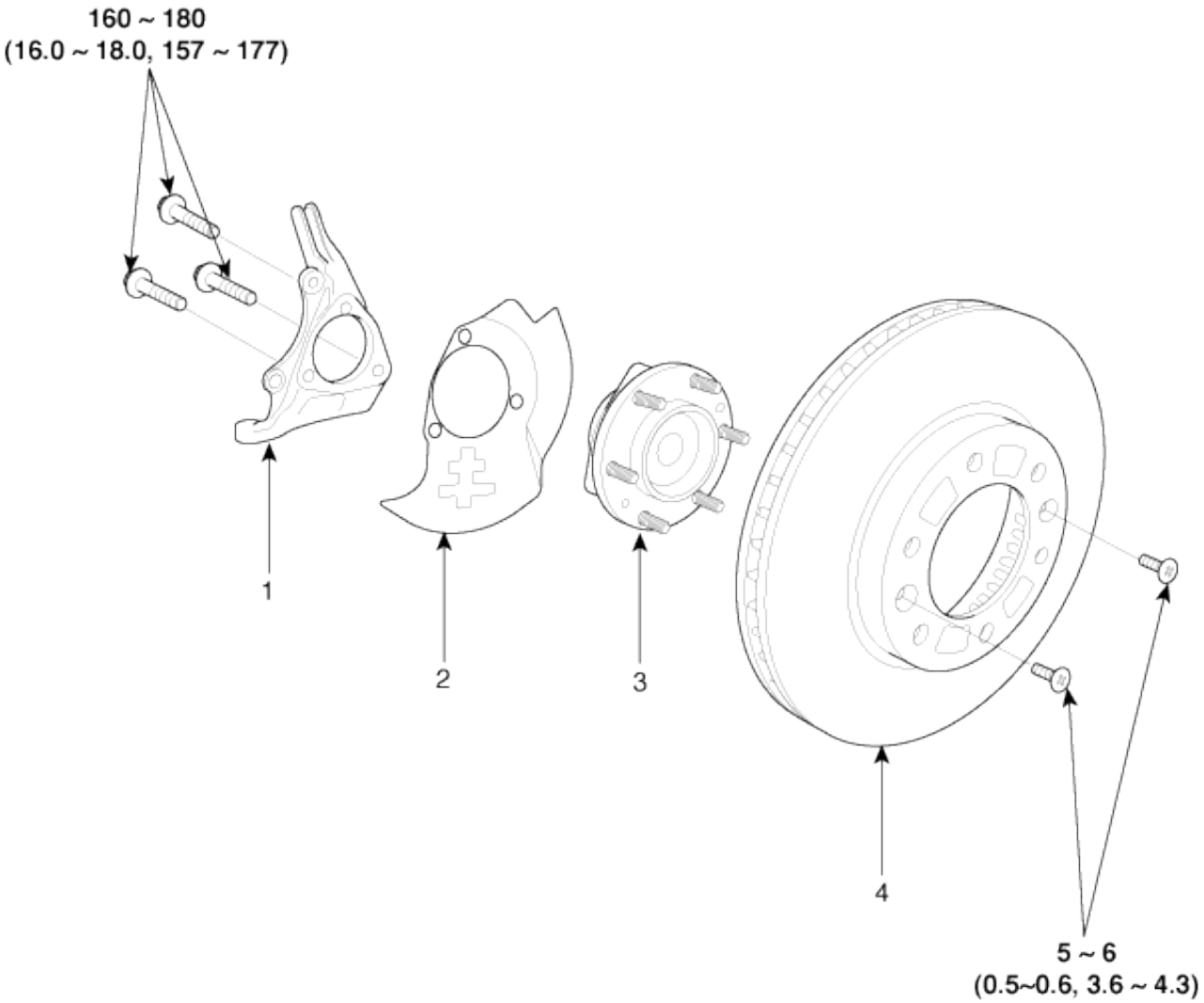



09495-39100

Front Axle Assembly

Front Hub - Axle

COMPONENTS



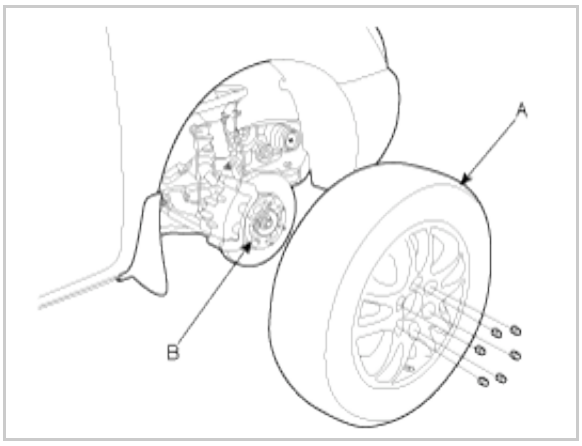
TORQUE : Nm (kgf·m, lb-ft)

1. Knuckle
2. Dust cover
3. Front hub & bearing assembly
4. Brake disc

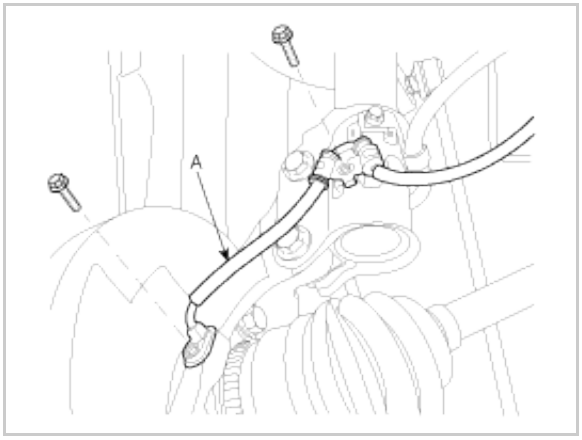
REMOVAL

1. Raise the vehicle and remove the wheel & tire assembly (A) from the front hub assembly (B).

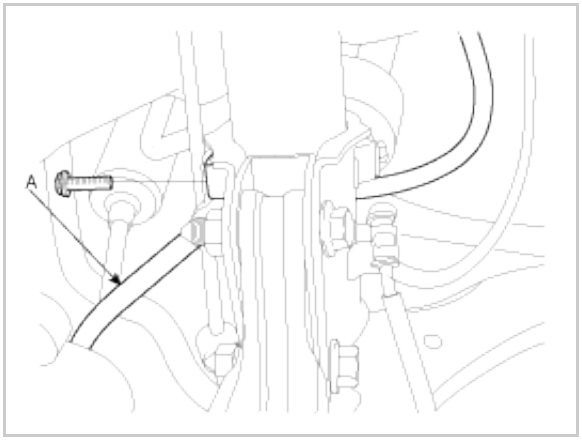
Tightening torque Nm (Kgf.m, lb-ft):
90 ~ 110 (9.0 ~ 11.0, 65 ~ 80)



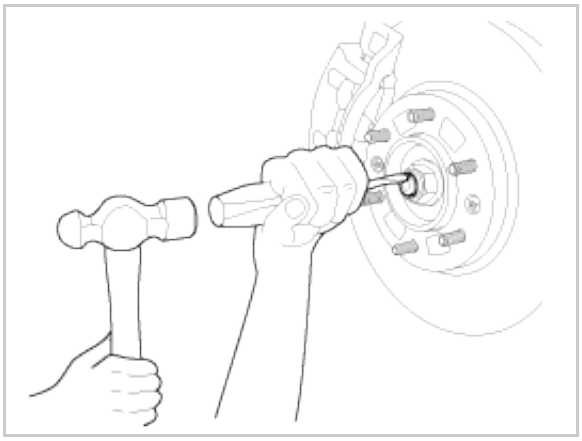
2. Remove the wheel speed sensor & wire (A) by loosening the bolts.

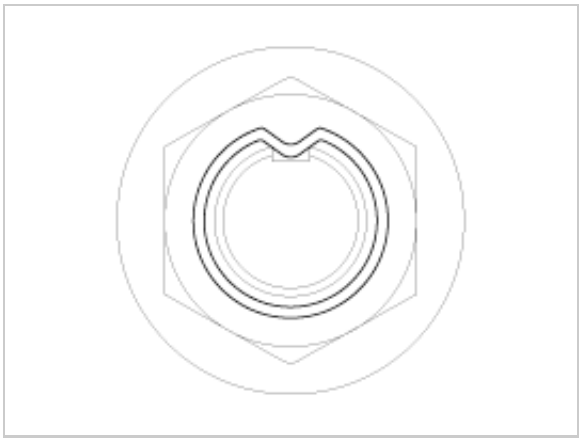


3. Disconnect the brake hose (A) from the strut assembly.



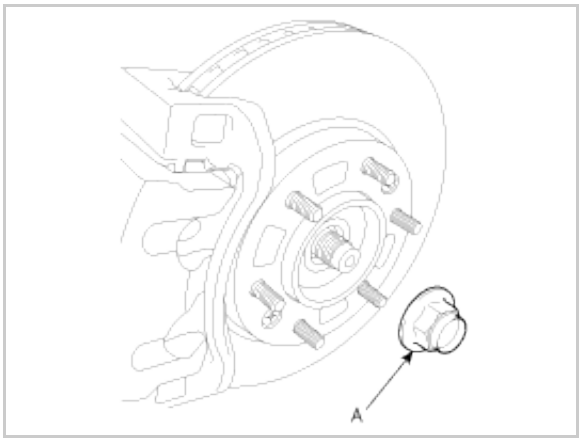
4. Unstake the driveshaft lock nut using a chisel and hammer.





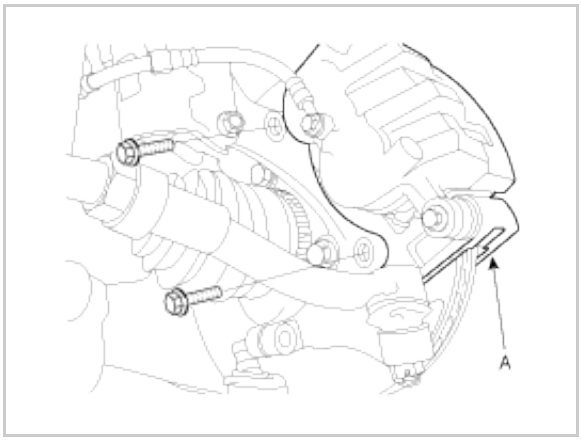
5. Remove the driveshaft lock nut (A).

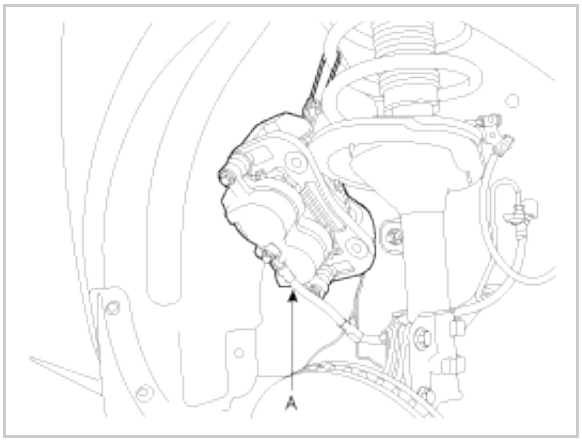
Tightening torque Nm (kgf,m, lb-ft):
245 ~ 275 (24.5 ~ 27.5, 177 ~ 199)



6. Remove the caliper assembly (A) from the knuckle and suspend it with wire.

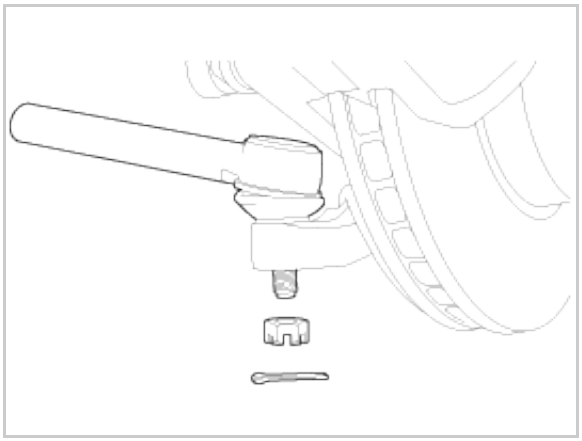
Tightening torque Nm (kgf,m, lb-ft):
85 ~ 100 (8.5 ~ 10.0, 61 ~ 72)



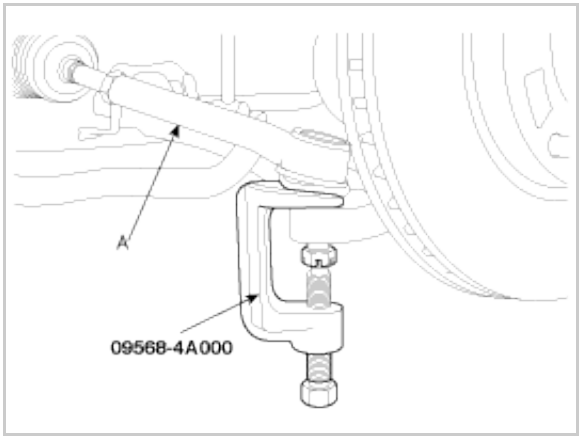


7. Remove the split pin and castle nut from the tie rod end ball joint.

Tightening torque Nm (Kgf.m, lb-ft):
60 ~ 80 (6.0 ~ 8.0, 43 ~ 58)

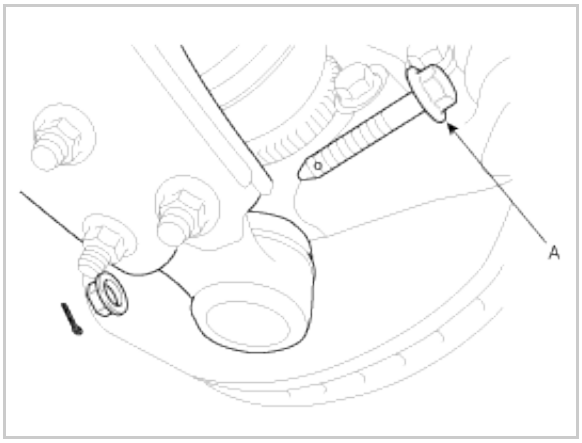


8. Disconnect the tie rod end (A) from the knuckle using a SST (09568-4A000).

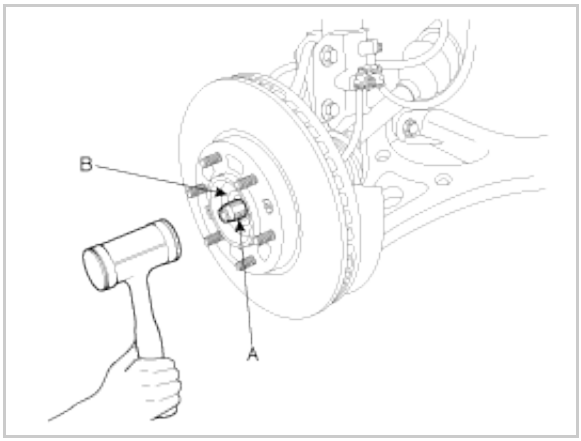


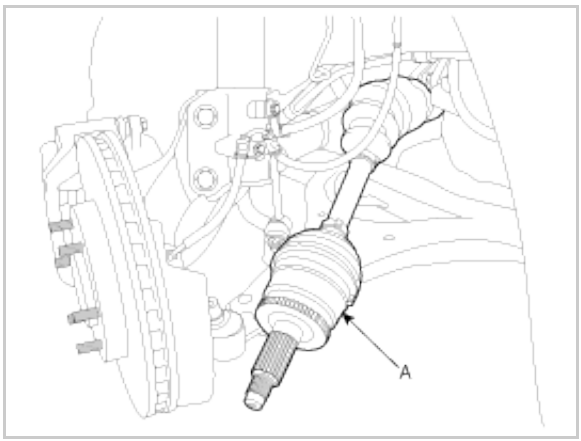
9. Remove the split pin and lower arm bolt and nut (A).

Tightening torque Nm (Kgf.m, lb-ft):
90 ~ 120 (9.0 ~ 12.0, 65 ~ 87)

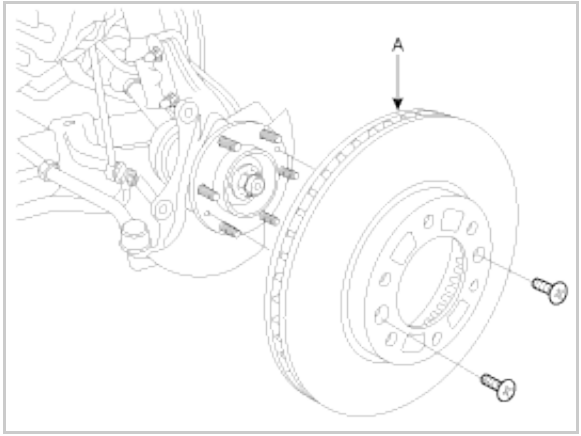


10. Using a plastic hammer, disconnect the driveshaft (A) from the front hub assembly (B).



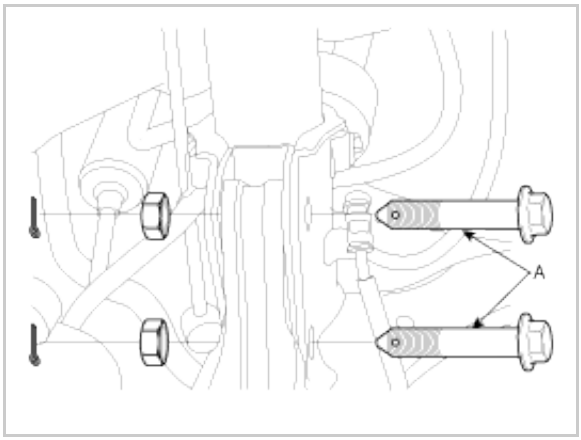


11. Remove the brake disc (A) from the front hub assembly.



12. Remove the knuckle from the strut assembly by loosening the bolts (A).

Tightening torque Nm (kgf.m, lb-ft):
100 ~ 120 (10.0 ~12.0, 72 ~ 87)

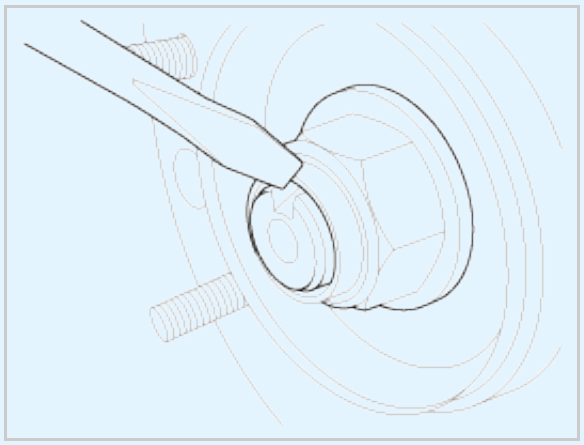


INSTALLATION

1. Installation is reverse of the removal.

CAUTION

a. The driveshaft lock nut should be replaced with new ones.
b. After installation driveshaft lock nut, stake the lock nut using a chisel and hammer as shown in the illustration below.

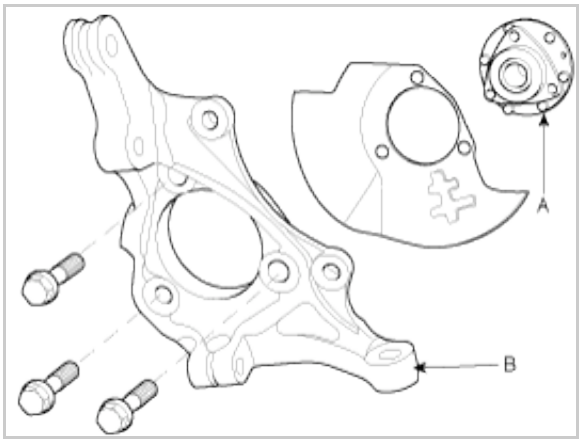




DISASSEMBLY

1. Separate the hub & bearing assembly (A) from the knuckle (B) by loosening the bolts.

Tightening torque Nm (kgf.m, lb-ft):
160 ~ 180 (16.0 ~ 18.0, 116 ~ 130)



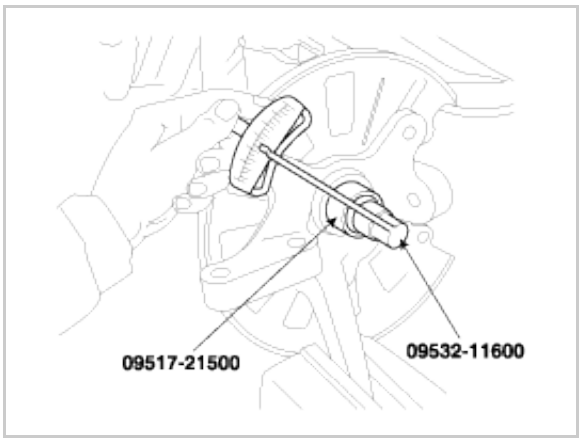
INSPECTION

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.

REASSEMBLY

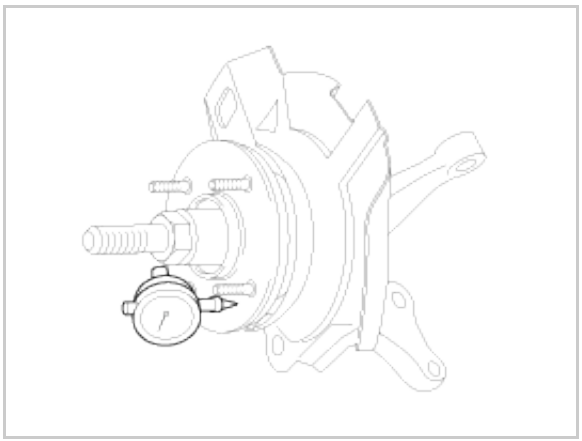
1. Reassembly is reverse of the disassembly.
2. Measure the wheel bearing starting toque.

20 kgf.cm or less



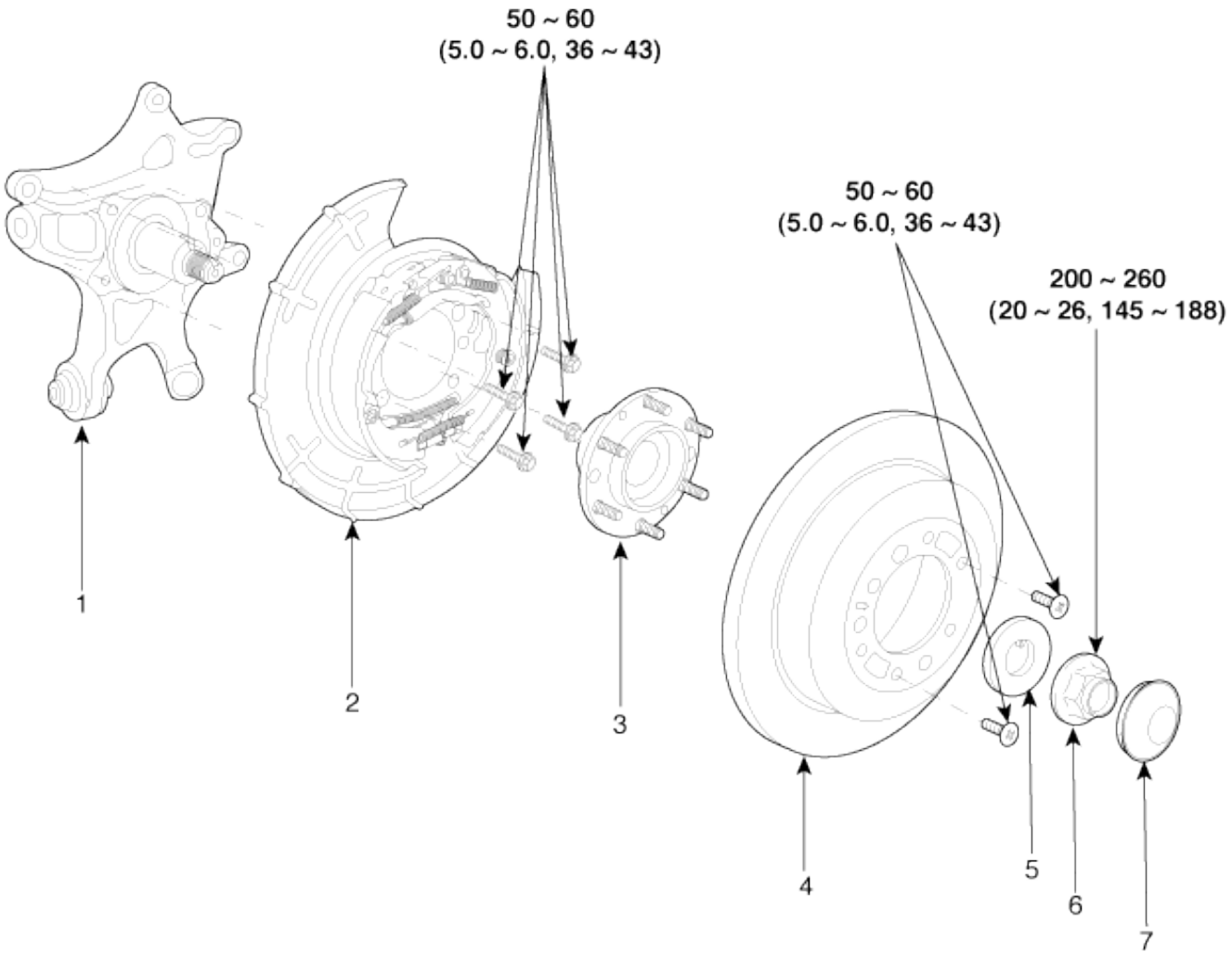
3. Measure the hub assembly axial play using a dial gauge.

0.008 mm or less



Rear Axle Assembly

COMPONENTS



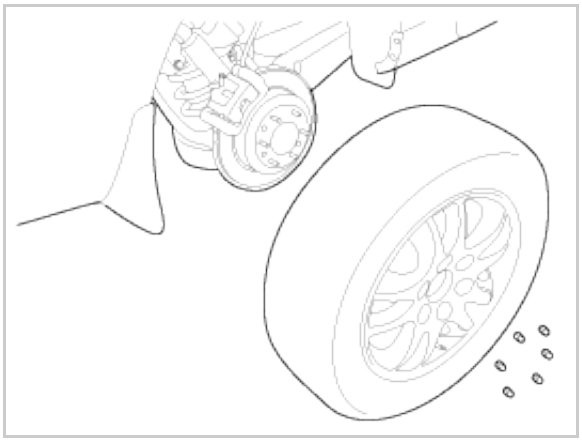
TORQUE : Nm (kgf·m, lb-ft)

1. Carrier assembly
2. Brake assembly
3. Hub & bearing assembly
4. Brake disc
5. Washer
6. Nut
7. Cap

REMOVAL

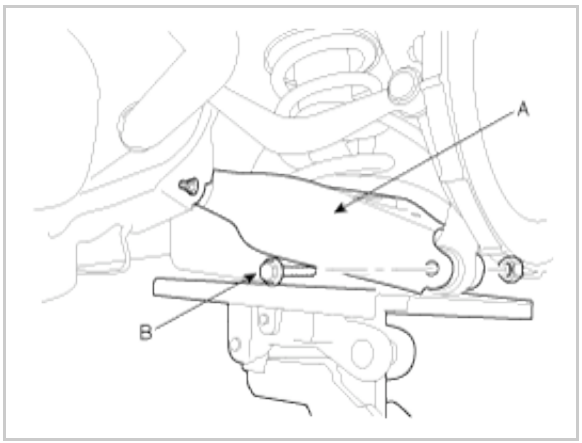
1. Release the parking brake.
2. Remove the wheel & tire assembly.

Tightening torque Nm (kgf.m, lb-ft):
90 ~ 110 (9.0 ~ 11.0, 65 ~ 80)

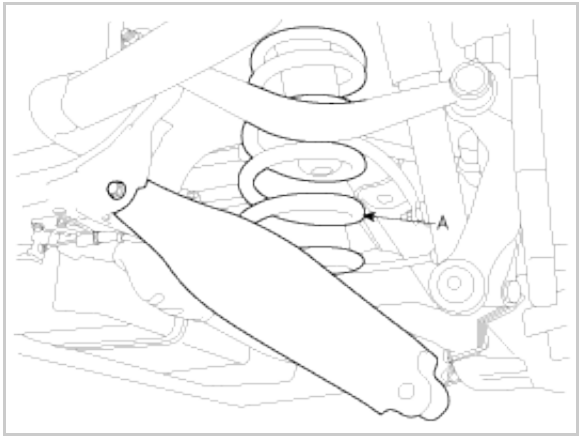


3. Support lower part of the lower arm (A) using a jack and remove the bolt & nut (B).

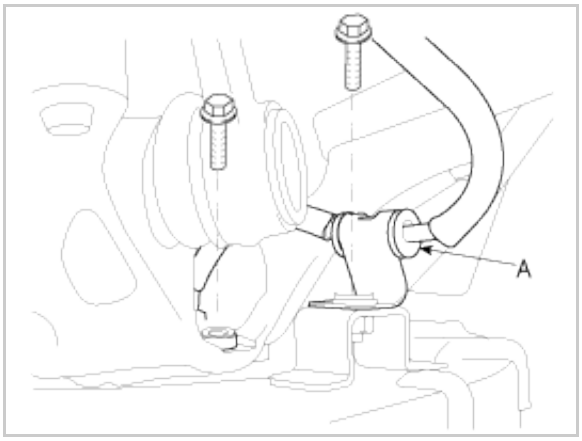
Tightening torque Nm (kgf.m, lb-ft):
160 ~ 180 (16.0 ~ 18.0, 116 ~ 130)



4. Remove the coil spring (A) and upper pad.

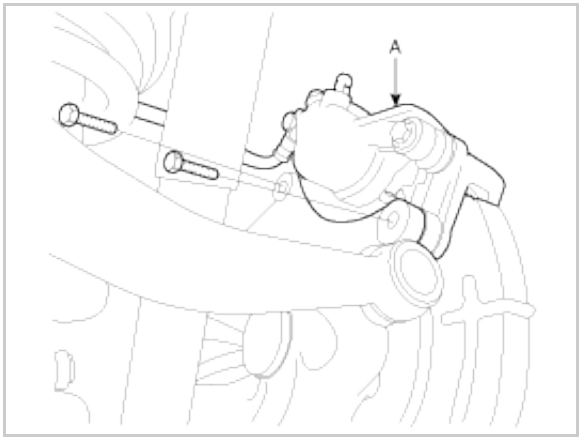


5. Remove the wheel speed sensor (A).

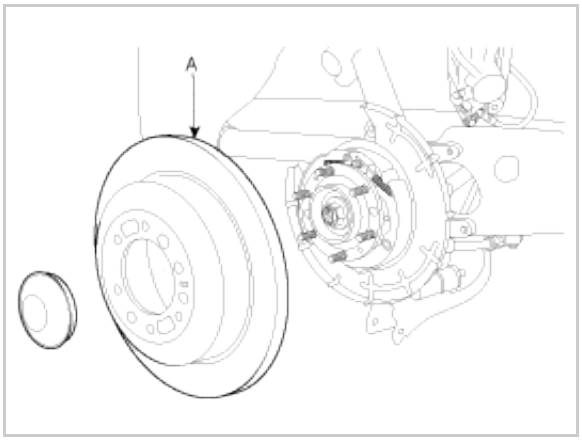


6. Remove the rear brake caliper assembly (A) from the carrier assembly and suspend it with wire.

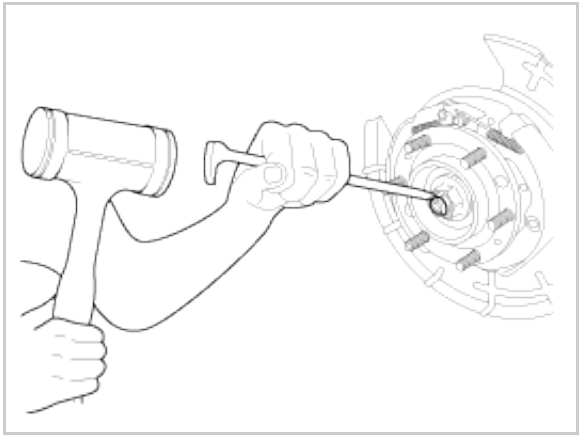
Tightening torque Nm (kgf.m, lb-ft):
50 ~ 60 (5.0 ~ 6.0, 36 ~ 43)

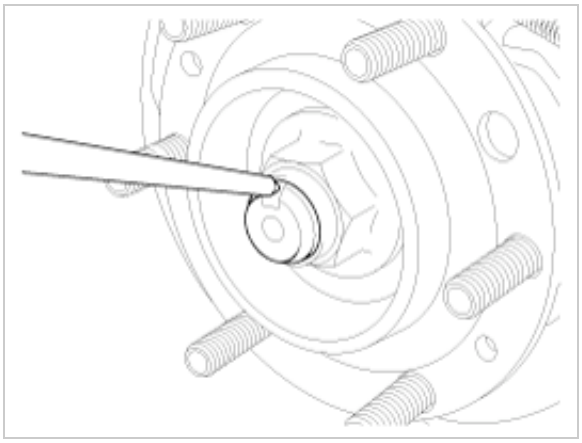


7. Remove the rear brake disc (A) by loosening the screws.



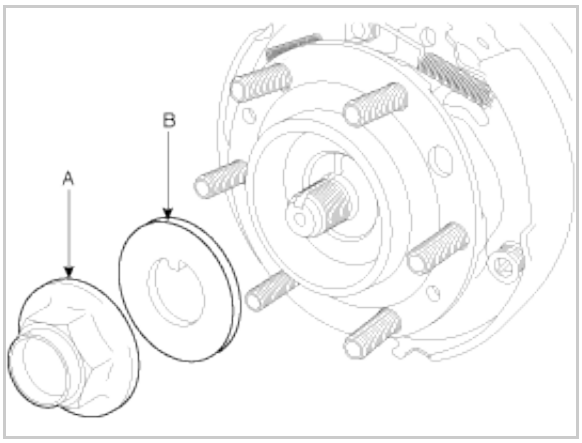
8. Unstake the lock nut using a chisel and hammer.



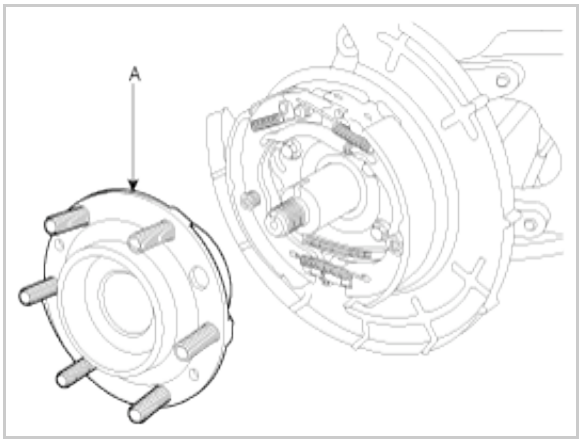


9. Remove the lock nut (A) and washer (B).

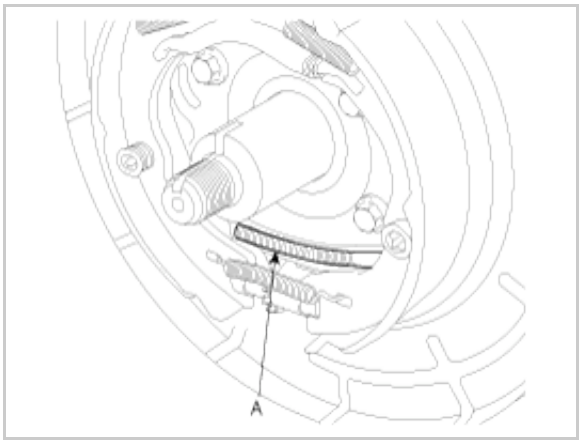
Tightening torque Nm (kgf.m, lb-ft):
200 ~ 260 (20.0 ~ 26.0, 145 ~ 188)



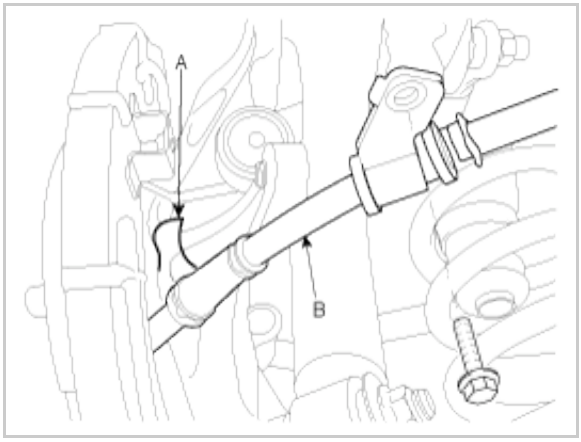
10. Remove the hub & bearing assembly (A).



11. Disconnect the parking brake cable (A) from the brake assembly.

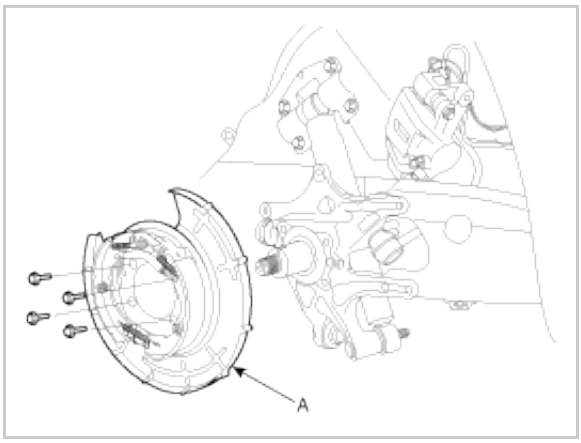


12. Remove the clip (A) and bracket mounting bolt and disconnect the parking brake cable (B) from the carrier assembly.

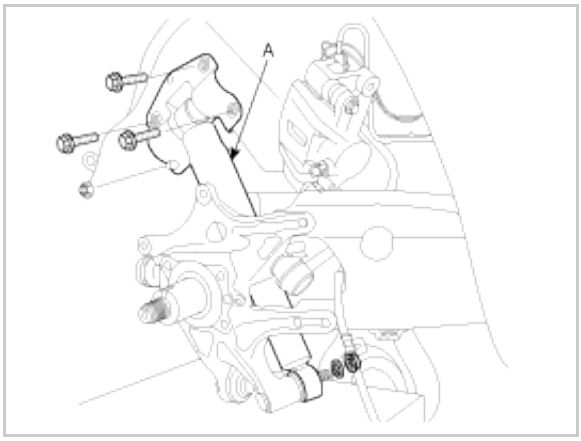


13. Remove the rear brake assembly (A).

Tightening torque Nm (kgf.m, lb-ft):
50 ~ 60 (5.0 ~ 6.0, 36 ~ 43)

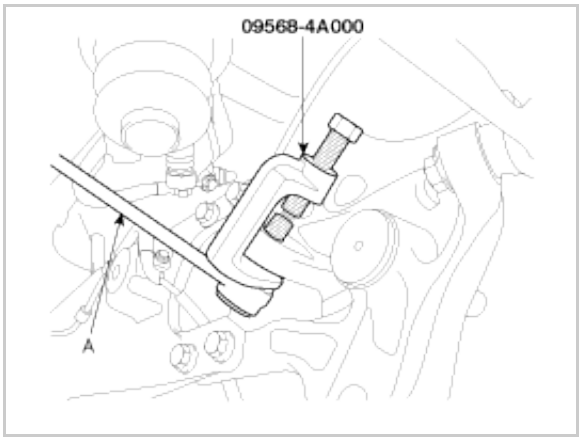


14. Remove the rear shock absorber (A).



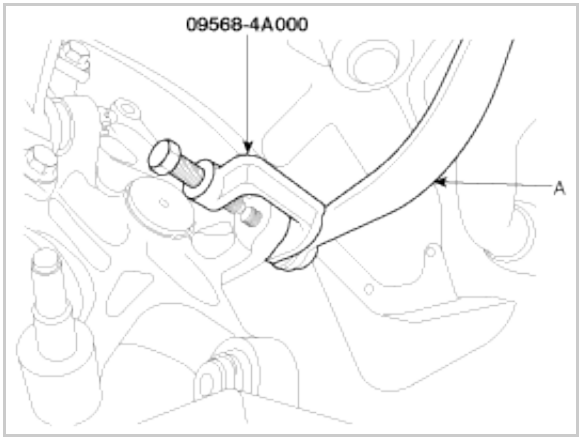
15. After loosening the castle nut and split pin, disconnect the assist arm (A) from the carrier assembly using a SST (09568-4A000).

Tightening torque Nm (kgf.m, lb-ft):
90 ~ 100 (9.0 ~ 10.0, 65 ~72)



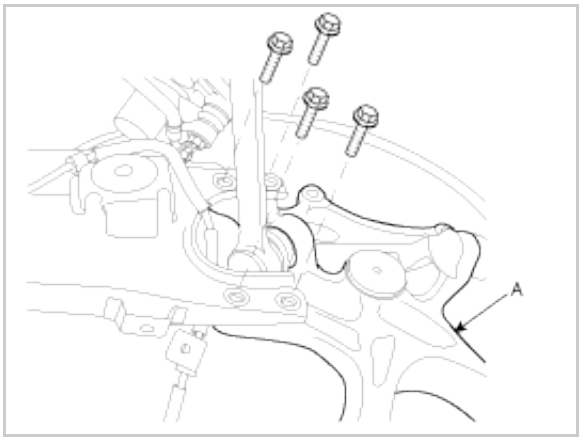
16. After loosening the castle nut and split pin, disconnect the upper arm (A) from the carrier assembly using a SST (09562-4A000).

Tightening torque Nm (kgf.m, lb-ft):
90 ~ 100 (9.0 ~ 10.0, 65 ~ 72)



17. Remove the carrier assembly (A) from the trailing arm by loosening the bolts.

Tightening torque Nm (kgf.m, lb-ft):
80 ~ 110 (8.0 ~ 11.0, 58 ~ 80)

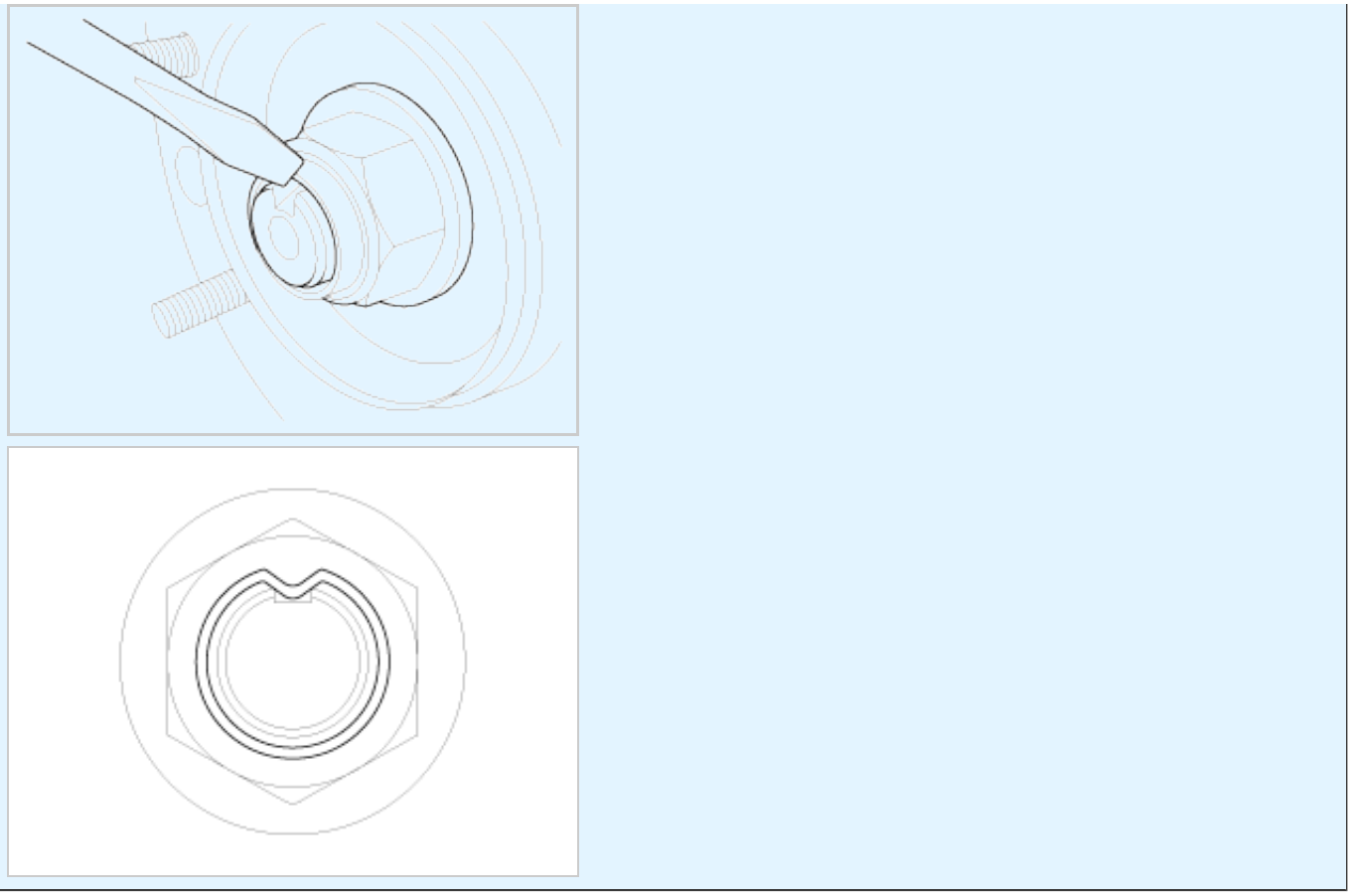


INSTALLATION

1. Installation is the reverse of removal.

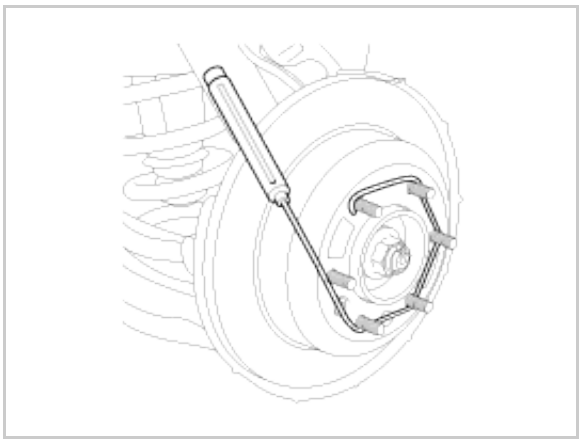
CAUTION

a. The rear hub lock nut should be replaced with new ones.
b. After installation lock nut, stake the lock nut using a chisel and hammer as shown in the illustration below.



2. Check the rear hub & bearing assembly starting torque using a spring balance.

20 kgf.cm



INSPECTION

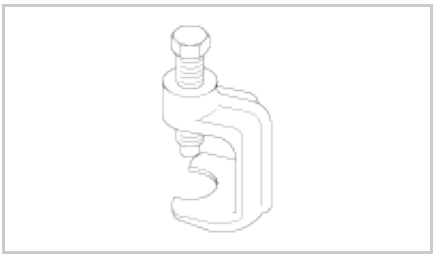
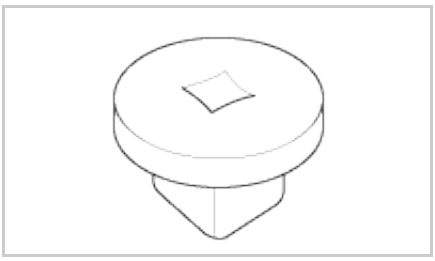
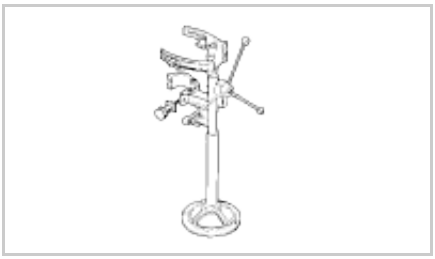
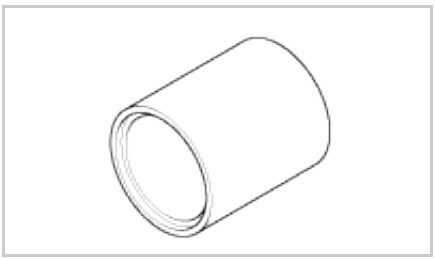
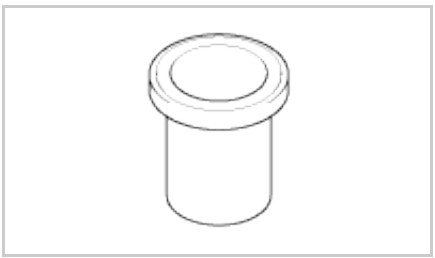
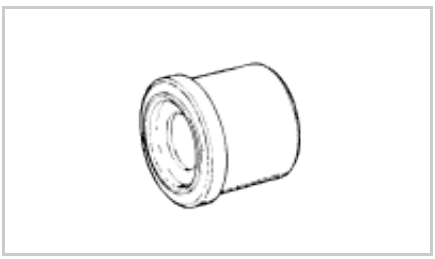
1. Check the hub for cracks and wear.
2. Check the brake disc for scoring and damage.
3. Check the carrier for cracks.

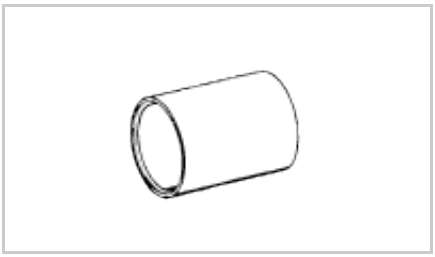
CHAPTER 9:

Suspension System

General Information

SPECIAL SERVICE TOOLS

Tool (Number and Name)	Illustration	Use
09568-4A000 Ball joint remover		Removal of Ball joint (Front upper arm/lower arm, & Rear upper arm)
09532-11600 Preload socket		Measurement of the front lower arm ball joint starting torque. (Use with torque wrench)
09546-26000 Strut spring compressor		Compression of the coil spring
09214-32000 Mount bushing remover and installer		Removal & installation of lower arm bushing(G) (Use with 09216-21100)
09216-21100 Mount bushing remover and installer		Removal & installation of lower arm bushing(G) (Use with 09216-32000)
09216-21600 Mount bushing remover and installer arbor		Removal and installation of trailing arm bushing (Use with 09552-38100)

09552-38100 Rear trailing arm bushing remover and installer		Removal and installation of the rear trailing arm bushing (Use with 09216-21600)

TROUBLESHOOTING

Vehicle inspection

WHEEL/TIRE CHECK :

Tire Pressure Check **Yes/No**

Balance Check **Yes / No**

Maximum Runout Allowed :

Wheel : Radial _____ Lateral _____

Tire : Radial _____ Lateral _____

Measured Runout :

Tire/Wheel	Radial :	LF _____	LR _____	RF _____	RR _____
	Lateral :	LF _____	LR _____	RF _____	RR _____
Wheel Only	Radial :	LF _____	LR _____	RF _____	RR _____
	Lateral :	LF _____	LR _____	RF _____	RR _____

SUSPENSION INSPECTION :

Concerns Shimmy ☐ Clunk ☐ Squeak ☐ Harshness ☐

Suspension Bushing : Loose ☐ Worn ☐ Missing ☐ OK ☐

Front stabilizer ☐ Rear stabilizer (sway bar) ☐ Rear trailing arm ☐

Front lower arm ☐ Rear suspension front ☐ Rear suspension rear arm ☐

Other _____

Suspension/Components : Loose Worn Missing OK

Ball Joint ☐ Shock absorbers F/R ☐ Springs F/R ☐ The rod ends/sleeve ☐

SYMPTOM CHART

Symptom	Suspect Area	Remedy (See page)
Squeak or grunt-noise from the front suspension, occurs more in cold ambient temperatures-more noticeable over rough roads or when turning	Front stabilizer bar	Under these conditions, the noise is acceptable.
Clunk-noise from the front suspension, occurs in and out of turns	Loose front struts or shocks	Inspect for loose nuts or bolts. Tighten to specifications.
Clunk-noise from the rear suspension, occurs when shifting from reverse to drive	Loose rear suspension components	Inspect for loose or damaged rear suspension components. Repair or install new components as necessary.
Click or pop - noise from the front suspension - more noticeable over rough roads or over bumps	Worn or damaged ball joints	Install new lower arm as necessary.
Click or pop - noise occurs when vehicle is turning	Worn or damaged ball joints	Install new lower arm as necessary.
Click or snap - occurs when accelerating around a corner	Damaged or worn Birfield joint	Repair or install a new Birfied joint as necessary.

accelerating around a corner		See DS group - driveshaft.
Front suspension noise - A squeak, creak, or rattle noise - occurs mostly over bumps or rough roads	Steering components Loose or bent front struts or shock absorbers Damaged spring or spring mounts Damaged or worn arm bushings Worn or damaged stabilizer bar bushing or links	Go to detailed test A.
Groaning or grinding - noise from the front strut, occurs when driving on bumpy roads or turning the vehicle	Uneven seating surface between the insulator and panel by the burrs around the strut insulator mounting bolts and the insulator boltes mounting holes	Repair or install a new parts as necessary.
Rear suspension noise - a squeak, creak or rattle noise - occurs mostly over bumps or rough roads	Loose or bent rear shock absorbers Damaged spring or spring mounts Damaged or worn control arm bushings	Go to detailed test B.
Shudder - occurs during acceleration from a slow speed or stop	Rear axle assembly mis-positioned Damaged or worn front suspension components	Check the axle mounts and rear suspension for damage or wear. Repair as necessary. Check for a loose stabilizer bar, damaged or loose strut/strut bushings or loose or worn ball joints. Inspect the steering linkage for wear or damage. Repair or Install new components as necessary.
Shimmy - most noticeable on coast/deceleration - also hard steering condition	Excessive positive caster	Check the caster alignment angle. Correct as necessary.
Tire noise - hum/moan at constant speeds	Abnormal wear patterns	Spin the tire and Check for tire wear. Install a new tire as necessary. Inspect for damaged/worn suspension components. Perform wheel alignment.
Tire noise - noise tone lowers as the vehicle speed is lowered	Out-of-balance tire	Balance the tire and road test. Install a new tire as necessary.
Tire noise - ticking noise, change with speed	Nail puncture or stone in tire tread	Inspect the tire. Repair or replace as necessary.
Wheel and tire - vibration and noise concern is directly related to vehicle speed and is not affected by acceleration, coasting or decelerating	Damaged or worn tire	Go to detailed test C.
Tire wobble or shudder - occurs at lower speeds	Damaged wheel bearings	Spin the tire and check for abnormal wheel bearing play or roughness. Adjust or Install new wheel bearings as necessary. See DS group - front/rear axle.
	Damaged wheel	Inspect the wheel for damage. Install a new wheel as necessary.
	Damaged or worn suspension components	Inspect the suspension components for wear or damage. Repair as necessary.

	Loosen wheel nuts	Check the wheel nuts. Tighten to specification.
	Damaged or uneven tire wear	Spin the tire and Check for abnormal tire wear or damage. Install a new tire as necessary.
Tire shimmy or shake - occurs at lower speeds	Wheel/tire out of balance	
	Uneven tire wear	Check for abnormal tire wear. Install a new tire as necessary.
	Excessive radial runout of wheel or tire	Perform a radial runout test of the wheel and tire. Install a new tire as necessary.
	Worn or damaged wheel studs or elongate stud holes	Inspect the wheel studs and wheels. Install new components as necessary.
	Excessive lateral runout of the wheel or tire	Perform a lateral runout test of the wheel and tire. Check the wheel, tire and hub. Repair or Install new components as necessary.
	Foreign materal between the brake disc and hub.	Clean the mounting surfaces of the brake disc and hub. See DS group - front/rear axle.
High speed shake or shimmy - occurs at high speeds	Excessive wheel hub runout Damaged or worn tires Damaged or worn wheel bearings Worn or damaged suspension or steering linkage Brake disc or drum imbalance	Go to detailed test D.
Drift left or right	Tires Steering linkage Alignment Base brake system	Go to detailed test E.
Steering wheel	Alignment Steering linkage Front lower arm ball joint	Go to detailed test F.
Tracks incorrectly	Rear suspension Caster	Go to detailed test G.
Rough ride	Front strut and spring assembly Rear shock absorber and spring assembly	Go to detailed test H.
Excessive noise	Front or rear stabilizer bar components Springs Suspension components Shock absorbers	Go to detailed test I.
Incorrect tire wear	Tire or unbalanced wheels Tire inflation Strut Alignment	Go to detailed test J.
Vibration	Wheel/tire Front wheel driveshaft(s) Steering system	Go to detailed test K.

	Strut and spring assembly Spring and strut mounting Front lower arm ball joint Front lower arm mounting bolt bushing Stabilizer bar bushings Wheel hubs and bearing Rear suspension arms and bushings	
Vehicle leans	Tire/wheel Vehicle load Suspension components Incorrect ride height	Inflate tires to specification. Redistribute the load as necessary. Visually inspect the suspention system. Correct the ride height as necessary.
Poor steering returnability	High knuckle rotating torque Alignment	Go to detailed test E.

DETAILED TEST A : FRONT SUSPENSION NOISE

CONDITIONS	DETAILS/RESULTS/ACTIONS
ROAD TEST THE VEHICLE	
	a. Test drive the vehicle. b. During the road test, drive the vehicle over a rough road. Determine from which area/component the noise is originating. ● Is there a squeak, creak or rattle noise ? → YES Go to → NO The suspension system is OK. Conduct a diagnosis on other suspect systems.
INSPECT THE STEERING SYSTEM	
	a. Check the steering system for wear or damage. Perform a steering linkage test. Inspect the tire wear pattern. ● Are the steering components worn or damaged ? → YES Repair the steering system. Install new components as necessary. Test the system for normal operation. → NO Go to
FRONT SHOCK ABSORBER/STRUT CHECK	
	a. Check the front shock absorbers/strut mounts for loose bolts or nuts. b. Check the front shock absorbers/struts for damage. Perform a shock absorber check. ● Are the front shock absorbers/struts loose or damaged ? → YES Tighten to specifications if loose. Install new front shock absorbers/struts if damaged. Test the system for normal operation. → NO Go to
CHECK THE FRONT SPRINGS	
	Check the front spring and front spring mounts/brackets for wear or damage

	● Are the front springs or spring mounts/brackets worn or damaged ? → YES Repair or Install new components as necessary. Test the system for normal operation. → NO Go toA5.
CHECK THE STABILIZER BAR	
	a. Check the stabilizer bar bushings and links for damage or wear. b. Check the stabilizer bar for damage. c. Check for loose or damaged stabilizer brackets. ● Are the stabilizer bar/track bar components loose, worn or damaged ? → YES Repair or Install new components as necessary. Test the system for normal operation. → NO Suspension system is OK. Conduct diagnosis on other suspect systems.

DETAILED TEST B : REAR SUSPENSION NOISE

CONDITIONS	DETAILS/RESULTS/ACTIONS
ROAD TEST THE VEHICLE	
	a. Test drive the vehicle. b. During the road test, drive the vehicle over a rough road. Determine from which area/component the noise is originating. ● Is there a squeak, creak or rattle noise ? → YES Go to → NO The suspension system is OK. Conduct a diagnosis on other suspect systems.
REAR SHOCK ABSORBER/STRUT CHECK	
	a. Raise and support the vehicle. See GI group - lift support point. b. Check the rear shock absorber/strut mounts for loose bolts or nuts. c. Check the rear shock absorbers/strut for damage. Perform a shock absorber check. ● Are the rear shock absorbers/struts loose or damaged ? → YES Tighten to specifications if loose. Install new rear shock absorbers/struts if damaged. Test the system for normal operation. → NO Go to
CHECK THE REAR SPRINGS	
	Check the rear springs and rear spring mounts/brackets for wear or damage. ● Are the rear springs or spring mounts/brackets worn or damaged ? → YES Repair or Install new components as necessary. Test the system for normal

	operation. → NO Go toB4.
CHECK THE TRAILING ARMS	
	a. Inspect the trailing arm bushings for wear or damage. Check for loose trailing arm bolts. b. Inspect for twisted or bent trailing arms. ● Are the trailing arms loose, damaged or worn ? → YES Repair or Install new components as necessary. Test the system for normal operation. → NO Suspension system is OK. Conduct diagnosis on other suspect systems.

DETAILED TEST C : WHEEL AND TIRE

CONDITIONS	DETAILS/RESULTS/ACTIONS
ROAD TEST THE VEHICLE	
	NOTICE Wheel or tire vibrations felt in the steering wheel are most likely related to the front wheel or tire. Vibration felt through the seat are most likely related to the rear wheel or tire. This may not always be true, but it can help to isolate the problem to the front or rear of the vehicle. Test drive the vehicle at different speed ranges. During the road test, if the vibration can be eliminated by placing the vehicle in neutral or is affected by the speed of the engine, the cause is not the wheels or tires. ● Is there a vibration and noise ? → YES Go toC2. → NO The wheel and tires are OK. Conduct a diagnosis on other suspect systems.
CHECK THE FRONT WHEEL BEARINGS	
	Check the front wheel bearings. Refer to Wheel Bearing Check (See DS group - front axle). ● Are the wheel bearings OK ? → YES Go toC3. → NO Inspect the wheel bearings. Adjust or Repair as necessary. Test the system for normal operation.
INSPECT THE TIRES	
	a. Check the tires for missing weights. b. Check the wheels for damage.

	c. Inspect the tire wear pattern. ● Do the tires have an abnormal wear pattern ? → YES Correct the condition that caused the abnormal wear. Install new tire(s). Test the system for normal operation. → NO Go to
TIRE ROTATION DIAGNOSIS	
	a. Spin the tires slowly and watch for signs of lateral runout. b. Spin the tires slowly and watch for signs of radial runout. ● Are there signs of visual runout ? → YES Go to → NO Check the wheel and tire balance. Correct as necessary. Test the system for normal operation.
RADIAL RUNOUT CHECK ON THE TIRE	
	Measure the radial runout of the wheel and tire assembly. A typical specification for total radial runout is 1.15mm (0.059 inch). ● Is the radial runout within specifications ? → YES Go toC8. → NO Go toC6.
RADIAL RUNOUT CHECK ON THE WHEEL	
	Measure the radial runout of the wheel. A typical specification for total radial runout is 1.14mm (0.045 inch.). ● Is the radial runout within specifications ? → YES Install a new tire. Test the system for normal operation. → NO Go toC7.
CHECK THE HUB/BRAKE DISC OR DRUM PILOT RUNOUT OR BOLT CIRCLE RUNOUT	
	Measure the pilot or bolt circle runout. A typical specification for radial runout is : ● pilot runout - less than 0.15mm (0.006 inch.) ● bolt circle runout - less than 0.38 mm (0.015 inch.) ● Is the radial runout within specification ? → YES Install a new wheel. Test the system for normal operation. → NO Repair or Install new components as necessary.
LATERAL RUNOUT CHECK ON THE TIRE	
	Measure the lateral runout of the wheel and tire assembly. A typical

	specification for total lateral runout is 2.5mm (0.098 inch). ● Is the lateral runout within specifications ? → YES Wheel and tires are OK. Conduct diagnosis on other suspect systems. → NO Go toC9.
LATERAL RUNOUT CHECK ON THE WHEEL	
	Measure the lateral runout of the wheel. A typical specification for total radial runout is 1.2mm (0.047 inch.) ● Is the lateral runout within specifications ? → YES Install a new tire. Test the system for normal operation. → NO Go toC10.
CHECK THE FLANGE FACE LATERAL RUNOUT	
	Measure the flange face lateral runout. A typical specification for lateral runout is : ● hub/brake disc - less than 0.13mm (0.005 inch) ● Is the lateral runout within specifications ? → YES Install a new wheel. Test the system for normal operation. → NO Repair or Install new components as necessary.

DETAILED TEST D :

CONDITIONS	DETAILS/RESULTS/ACTIONS
CHECK FOR FRONT WHEEL BEARING ROUGHNESS	
	a. Raise and support the front end of the vehicle so that the front wheel and tire assemblies can spin. See GI group - lift support point. b. Spin the front tires by hand. ● Do the wheel bearings feel rough ? → YES Inspect the wheel bearings. Repair as necessary. Test the system for normal operation. → NO Go to
CHECK THE END PLAY OF THE FRONT WHEEL BEARINGS	
	Check the end play of the front wheel bearings. ● Is the end play OK ? → YES

	Go toD3. → NO Adjust or Repair as necessary. Test the system for normal operation.
MEASURE THE LATERAL RUNOUT AND THE RADIAL RUNOUT OF THE FRONT WHEELS ON THE VEHICLE	
	Measure the lateral runout and the radial runout of the front wheels on the vehicle. Go to detailed test C. ● Are the measurements within specifications ? → YES Go toD4. → NO Install new wheels as necessary and Balance the assembly. Test the system for normal operation.
MEASURE THE LATERAL RUNOUT OF THE FRONT TIRES ON THE VEHICLE	
	Measure the lateral runout of the front tires on the vehicle. Go to detailed test C. ● Is the runout within specifications ? → YES Go toD5. → NO Install new tires as necessary and Balance the assembly. Test the system for normal operation.
MEASURE THE RADIAL RUNOUT OF THE FRONT TIRES ON THE VEHICLE	
	Measure the radial runout of the front tires on the vehicle. Go to detailed test C. ● Is the runout within specifications ? → YES Balance the front wheel and tire assemblies. If any tire cannot be balanced, Install a new tire. Test the system for normal operation. → NO Go toD6.
MATCH MOUNT THE TIRE AND WHEEL ASSEMBLY	
	Mark the high runout location on the tire and also on the wheel. Break the assembly down and rotate the tire 180 degrees (halfway around) on the wheel. Inflate the tire and measure the radial runout. ● Is the runout within specifications ? → YES Balance the assembly. Test the system for normal operation. → NO If the high spot is not within 101.6mm (4 inches) of the first high spot on the tire, Go toD7.
MEASURE THE WHEEL FLANGE RUNOUT	

	Dismount the tire and mount the wheel on a wheel balancer. Measure the runout on both wheel flanges. Go to detailed test C ● Is the runout within specifications ? → YES Locate and Mark the low spot on the wheel. Install the tire, matching the high spot on the tire with the low spot on the wheel. Balance the assembly. Test the system for normal operation. If the condition persists, Go toD8. → NO Install a new wheel. Check the runout on the new wheel. If the new wheel is within limits, locate and Mark the low spot. Install the tire, matching the high spot on the tire with the low spot on the wheel. Balance the assembly. Test the system for normal operation. If the condition persists, Go toD8.
CHECK FOR VIBRATION FROM THE FRONT OF THE VEHICLE	
	Spin the front wheel and tire assemblies with a wheel balancer while the vehicle is raised on a hoist. Feel for vibration in the front fender or while seated in the vehicle. ● Is the vibration present ? → YES Substitute known good wheel and tire assemblies as necessary. Test the system for normal operation. → NO Check the driveline components. Test the system for normal operation.

DETAILED TEST E : DRIFT LEFT OR RIGHT

CONDITIONS	DETAILS/RESULTS/ACTIONS
CHECK THE TIRES	
	Inspect the tires for excessive wear or damage. ● Are the tires excessively worn or damaged ? → YES Install new tires. → NO Go toE2.
CHECK THE STEERING LINKAGE	
	a. Raise and support the vehicle. b. Check the steering components for indications of excessive wear or damage. See ST group - specification. ● Is there an indication of excessive wear or damage ? → YES Repair or Install new components as necessary. → NO Go to
CHECK THE VEHICLE ALIGNMENT	
	a. Place the vehicle on an alignment rack.

	Check the vehicle alignmnt. ● Is the alignment within specification ? → YES Go to → NO Adjust the alignment as necessary. See page SS-69 (wheel alignment).
BRAKE DRAG DIAGNOSIS	
	Apply the brakes while driving. ● Does drift or pull occur when the brakes are applied ? → YES See BR group - specification. → NO If the steering wheel is in the center, the vehicle is OK. If the steering wheel is off-center, Go to Detailed TestF.

DETAILED TEST F : STEERING WHEEL OFF-CENTER

CONDITIONS	DETAILS/RESULTS/ACTIONS
CHECK THE CLEAR VISION	
	Place the vehicle on an alignment rack. ● Is the clear vision within specification ? → YES Go toF2. → NO Adjust the clear vision to specification.
INSPECT THE STEERING COMPONENTS	
	a. Raise and support the vehicle. b. Inspect the steering components for excessive wear or damage. See ST group - specification. ● Are the steering components excessively worn or damaged ? → YES Repair or Install new components as necessary. → NO If it tracks correctly, vehicle is OK. If it tracks incorrectly, Go to Detailed Test

DETAILED TEST G : TRACKS INCORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
CHECK THE CASTER	
	Place the vehicle on an alignment rack. ● Is the caster within specification ? → YES Go toG2.

	→NO Replace bent or damaged parts.
CHECK THE REAR SUSPENSION	
	a. Measure the vehicle wheel base for LH and RH. b. Compare the measurements. ● Are the measurements the same ? → YES If the ride is smooth, vehicle is OK. If the ride is rough, Go to Detailed Test → NO Inspect the rear suspension components for wear or damage. Repair or Install new components as necessary.

DETAILED TEST H : ROUGH RIDE

CONDITIONS	DETAILS/RESULTS/ACTIONS
CHECK THE FRONT SHOCK ABSORBER	
	a. Raise support the vehicle. b. Inspect the front shock absorber for oil leaks or damage. ● Are the tires excessively worn or damaged ? → YES Install new front shock absorbers. → NO Go to
CHECK THE REAR SHOCK ABSORBERS	
	Inspect the rear shock absorbers for oil leaks or damage. ● Are the rear shock absorbers leaking ? → YES Install new rear shock absorbers. → NO The vehicle is OK. Go toTROUBLESHOOTING.

DETAILED TEST I : EXCESSIVE NOISE

CONDITIONS	DETAILS/RESULTS/ACTIONS
INSPECT THE SUSPENSION	
	a. Raise and support the vehicle. b. Inspect the shock absorber mounting bolts. ● Are the mounting bolts loose or broken ? → YES Tighten or Install new shock absorber mounting bolts. → NO Go to
INSPECT THE SPRING AND TORSION BARS	
	Inspect the springs and stabilizer bars for damage. ● Are the spring or stabilizer bars damaged ? → YES

	Install new spring and/or stabilizer bars. → NO Go toI3.
INSPECT THE FRONT SUSPENSION	
	Inspect the front suspension components for excessive wear or damage. ● Are the front suspension components worn or damaged ? → YES Install new front suspension components. → NO The vehicle is OK. Go toTROUBLESHOOTING.

DETAILED TEST J : INCORRECT TIRE WEAR

CONDITIONS	DETAILS/RESULTS/ACTIONS
INSPECT THE TIRES	
	a. Raise and support the vehicle. b. Inspect the tires for uneven wear on the inner or outer shoulder. ● Is there uneven tire wear ? → YES Align the vehicle. Install new tires if badly worn. → NO Go to
UNEVEN TIRE WEAR	
	Inspect the tires for a feathering pattern. ● Do the tires have a feathering pattern ? → YES Align the vehicle. Install new tires if badly worn. → NO Go toJ3.
CHECK FOR CUPPED TIRE	
	Inspect the tires for cupping or dishing. ● Are the tires cupped or dished ? → YES Balance and Rotate the tires. → NO The vehicle is OK. Go toTROUBLESHOOTING.

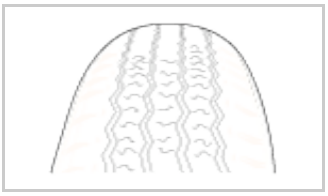
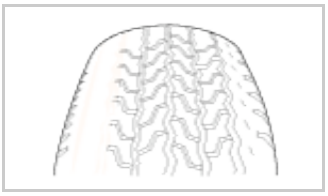
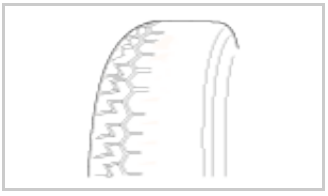
DETAILED TEST K : VIBRATION

CONDITIONS	DETAILS/RESULTS/ACTIONS
ROAD TEST	
	Accelerate the vehicle to the speed at which the customer indicated the vibration occured.

	● Is the vibration present ? → YES Go toK2. → NO The vehicle is OK. Go toTROUBLESHOOTING.
INSPECT THE TIRES	
	a. Raise and support the vehicle with a frame contact hoist. b. Inspect the tires for extreme wear or damage, cupping, or flat spots. ● Are the tires OK ? → YES Go to → NO Check the suspension components for misalignment, abnormal wear, or damage that may have contributed to the tire wear. Correct the suspension concerns and Install new tires.
INSPECT THE WHEEL BEARINGS	
	Spin the tires by hand to check for wheel bearing rougness. ● Is the front wheel bearing OK ? → YES Go toK4. → NO Install new front wheel bearings as necessary. See Ds group - front axle.
TIRE/WHEEL BALANCE	
	Check the tire/wheel balance. ● Are the tires balanced ? → YES Go toK5. → NO Balance the tires and wheels as necessary.
MEASURE THE RUNOUTS	
	For each wheel position measure, locate and mark the following items. - High point of the tire/wheel assembly total radial runout - High point of the wheel radial runout - High point of the wheel lateral runout ● Are the runouts as specified ? → YES Go toK7. → NO Go toK6.
SUBSTITUTE THE WHEELS AND TIRE	

	a. Substitute a known good set of wheels and tires. b. Perform a road test. c. If the vehicle still exhibits a shake or vibration, note the vehicle speed and/or engine rpm which it occurs. ● Is the vibration felt ? → YES Engine/transmission imbalance. See the specification of TR group, EM group, FL group and EC group. → NO Install the original tire/wheel assemblies one by one, Road testing at each step until the damaged tire(s)/wheel(s) as necessary. Test the system for normal operation.

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
		
a. Center-tread down to fabric due to excessive over inflated tires b. Lack of rotation c. Excessive toe on drive wheels d. Heavy acceleration on drive	a. Under-inflated tires b. Worn suspension components c. Excessive cornering speeds d. Lack of rotation	a. Toe adjustment out of specification b. Camber out of specification c. Damaged strut d. Damaged lower arm
Partial wear	Feathered edge	Wear pattern
		
a. Caused by irregular burrs on brake drums	a. Toe adjustment out of specification b. Damaged or worn tie rods c. Damaged knuckle	a. Excessive toe on non-drive wheels b. Lack of rotation

SPECIFICATIONS

FRONT SUSPENSION SYSTEM

Items					Specification	
Type					Macpherson strut	
Shock Absorber	Type				Gas	
	Stroke mm (in)				195.5 (7.70)	
	Expansion mm (in)				595.5 ± 3 (23.44 ± 0.12)	
	Compression mm (in)				400 + 3, -Free (15.75 + 3, Free)	
	I.D. Color		DIESEL		WHITE	
			GASOLINE		RED	
	Damping force (0.3 m/s)	DIESEL	Expansion N(kgf)		1265 ± 186 (129 ± 19)	
			Compression N (kgf)		618 ± 108 (63 ± 11)	
		GASOLINE	Expansion N(kgf)		980 ± 220 (100 ± 15)	
			Compression N (kgf)		588 ± 118 (60 ± 12)	
Spring	DIESEL		Free height mm (in)		418.9 (16.49)	
			Load(kg)	I.D. Color	594.8~606.7	Yellow 2 point
					582.9~594.7	Yellow 1 point
	GASOLINE		Free height mm (in)		415.9 (16.37)	
			Load(kg)	I.D. Color	550.0~561.2	Green 2 point
					538.8~549.9	Green 1 point

REAR SUSPENSION SYSTEM

Items					Specification	
Type					Multi Link	
Shock Absorber	Type				Gas	
	Stroke mm (in)				170 (6.68)	
	Expansion mm (in)				478.0 ± 3 (18.82 ± 0.12)	
	Compression mm (in)				308 + 3, -Free (12.13 + 0.12, -Free)	
	I.D. Color		DIESEL		WHITE	
			GASOLINE		RED	
	Damping force (0.3 m/s)	DIESEL	Expansion N(kgf)		1540 ± 216 (157 ± 22)	
			Compression N (kgf)		647 ± 127 (66 ± 13)	
		GASOLINE	Expansion N(kgf)		1422 ± 206 (145 ± 21)	
			Compression N (kgf)		549 ± 108 (56 ± 11)	
	DIESEL		Free height mm (in)		286.7 (11.29)	
			Load(kg)	I.D. Color	642.2~674.7	Yellow 2 point

Spring				610.0~642.2	Yellow 1 point
	GASOLINE	Free height mm (in)		291.1(11.46)	
		Load(kg)	I.D. Color	623.6~653.0	White 2 point
				594.2~623.6	White 1 point

WHEELS AND TIRES

Items		Specification	
Tire Size		225/70 R16	
		235/60 R17	
Wheel Size	Steel	6.5J×16	
	Aluminium	6.5J×16	
		6.5J×17	
Tire Pressure KPa (kg/cm², psi)		Front	Rear
	225/70 R16	2.4(35)	2.4(35)
	235/60 R17	2.4(35)	2.4(35)

WHEEL ALIGNMENT

Items		Front	Rear
Camber		0° ± 30´	-6´ ± 30´
Caster	to Ground	3°46´ ± 30´	-
	to Body	4°40´	-
Toe-in mm(in)		0 ± 2(0 ± 0.0787)	2.6 ± 2(0.1024 ± 0.0787)
King pin angle		12°27´±30´	-
Tread mm(in)		1685(66.34)	1685(66.34)

TIGHTENING TORQUE

FRONT SUSPENSION

Items	Nm	kgf.m	lb-ft
Front strut assembly mounting nut(to body)	45 ~ 60	4.5 ~ 6.0	32.5 ~ 43.4
Front strut assembly self-locking nut	60 ~ 70	6 ~ 7	43.4 ~ 50.6
Front strut assembly mounting bolt(to knuckle)	100 ~ 120	10 ~ 12	72.3 ~ 86.8
Front lower arm ball joint mounting bolt(to knuckle)	90 ~ 120	9 ~ 12	65.1 ~ 86.8
Front lower arm bushing(A) mounting bolt(to subframe)	160 ~ 180	16 ~ 18	115.7 ~ 130.2
Front lower arm bushing(G) mounting bolt(to subframe)	160 ~ 180	16 ~ 18	115.7 ~ 130.2
Front stabilizer link self-locking nut	100 ~ 120	10 ~ 12	72.3 ~ 86.8
Front stabilizer bar bracket mounting bolt(to Subframe)	39 ~ 60	3.9 ~ 6.0	28.2 ~ 43.4
Wheel nut	90 ~ 110	9 ~ 11	65.1 ~ 79.5

REAR SUSPENSION

Items	Nm	kgf.m	lb-ft

Rear shock absorber bracket mounting bolt(to body)	80 ~ 110	8 ~ 11	57.9 ~ 79.5
Rear shock absorber bracket mounting nut(to body)	90 ~ 120	9~ 12	65.1 ~ 86.8
Rear shock absorber nut (to rear knuckle)	140 ~ 160	14 ~ 16	101.2 ~ 115.7
Rear upper arm ball joint nut (to rear knuckle)	90 ~ 110	9 ~ 11	65.1 ~ 79.5
Rear upper arm self-locking nut (to cross member)	160 ~ 180	16 ~ 18	115.7 ~ 130.2
Rear lower arm mounting bolt (to rear knuckle)	160 ~ 180	16 ~ 18	115.7 ~ 130.2
Rear lower arm mounting nut (to cross member)	200 ~ 270	20 ~ 27	144.7 ~ 195.3
Rear assist arm mounting bolt (to rear knuckle)	90 ~ 110	9 ~ 11	65.1 ~ 79.5
Rear assist arm mounting nut (to cross member)	90 ~ 120	9 ~ 12	65.1 ~ 86.8
Trailing arm bracket mounting nut (to body)	80 ~ 110	8 ~ 11	57.9 ~ 79.5
Trailing arm self-locking nut (to rear knuckle)	80 ~ 100	8 ~ 10	57.9 ~ 72.3
Trailing arm mounting bolt(to bracket)	160~ 180	16 ~ 18	115.7 ~ 130.2
Rear stabilizer bar bracket mounting bolt(to cross member)	39 ~ 60	3.9 ~ 6.0	28.2 ~ 43.4
Rear stabilizer link self-locking nut(to trailing arm)	50 ~ 65	5.0 ~ 6.5	36.2 ~ 47.0
Wheel nut	90 ~ 110	9 ~ 11	65.1 ~ 79.5
Rear cross member to body	160 ~ 180	16 ~ 18	115.7~130.2

CAUTION

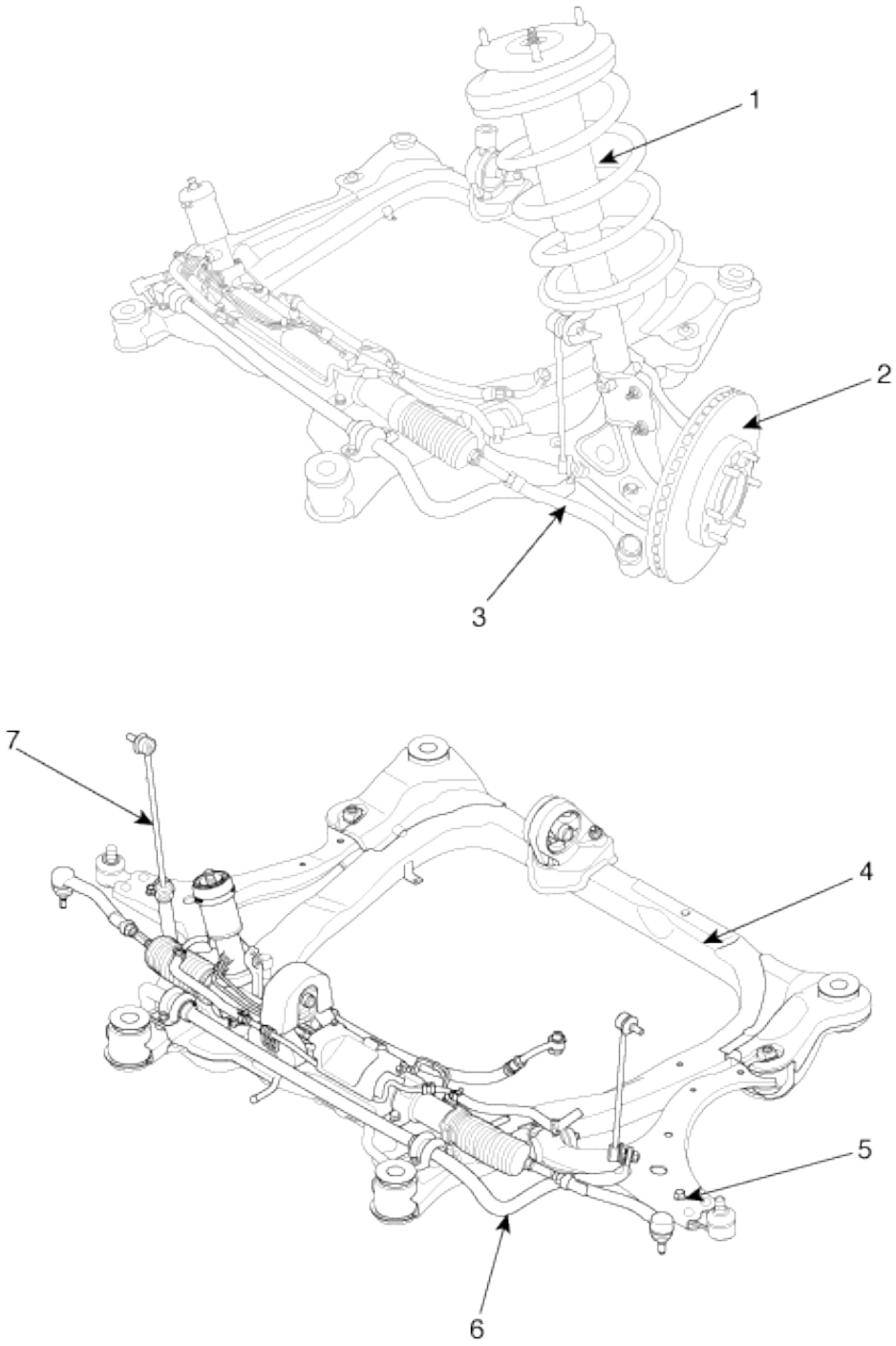
Replace the self-locking nuts with new ones after removal.

LUBRICANTS

Items	The Recommended	Quantity
Front lower arm ball joint	Boot : CGMS03 (CMS-H006) Ball seat : CGMS02 (CMS-H006)	As required
Rear upper arm ball joint	Boot : CGMS03 (CMS-H006) Ball seat : CGMS01 (CMS-H006)	
Rear assist arm ball joint		
Stabilizer link ball joint(Front Rear)		

Front Suspension System

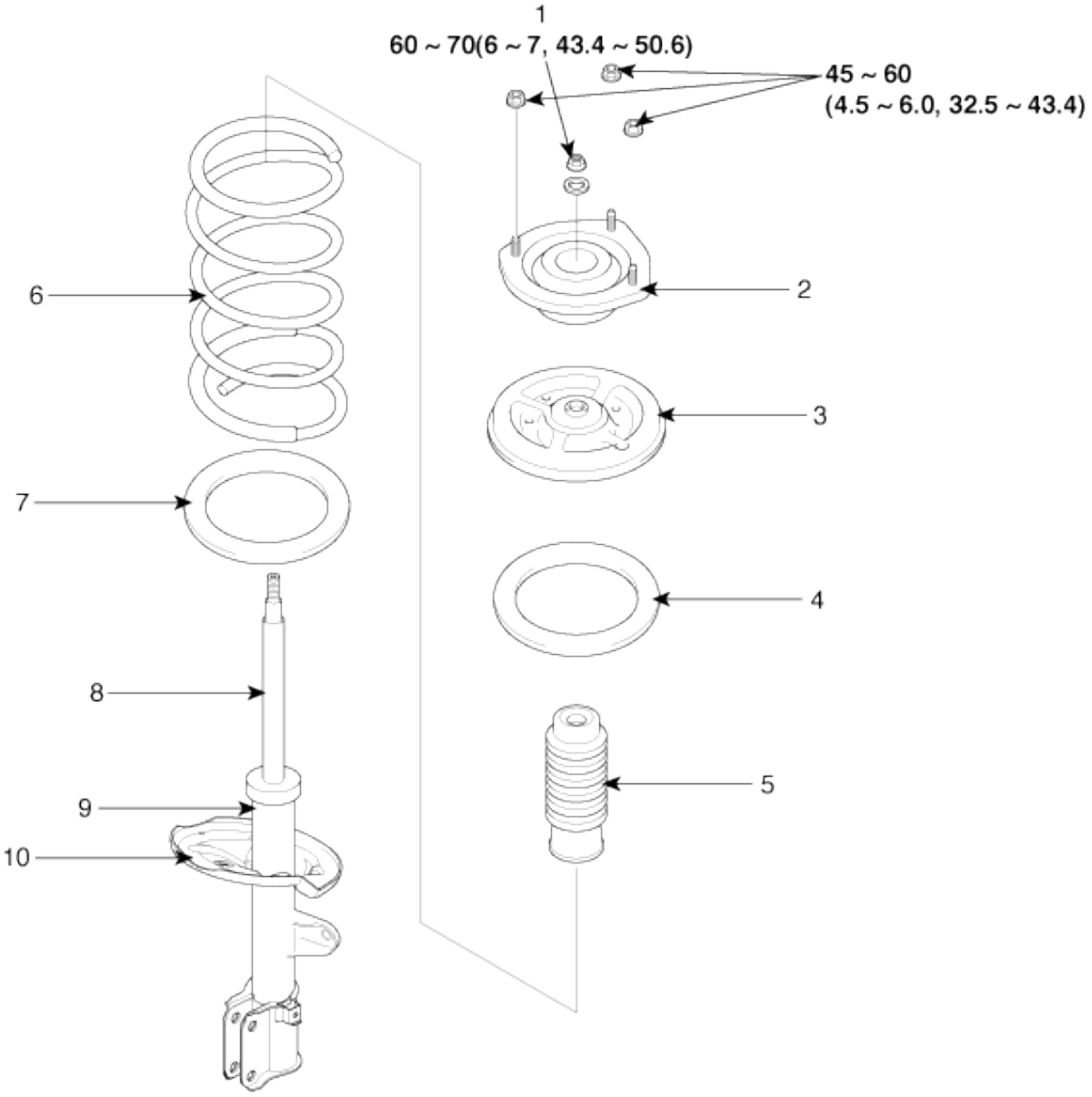
COMPONENTS



1. Front strut assembly
2. Front disk
3. Tie rod end assembly
4. Front subframe
5. Front lower arm
6. Front stabilizer bar assembly
7. Front stabilizer link assembly

Front Strut Assembly

COMPONENTS

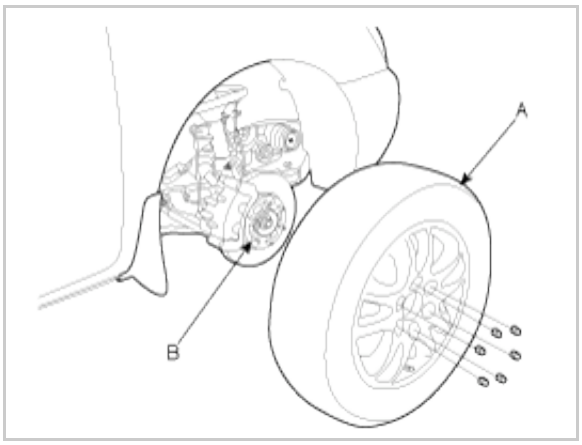


TORQUE : Nm (kgf.m, lb-ft)

1. Self-locking nut
2. Insulator
3. Spring upper seat
4. Spring upper pad
5. Strut dust cover and Urethane bumper
6. Coil spring
7. Spring lower pad
8. Piston rod
9. Strut assembly
10. Spring lower seat

REMOVAL

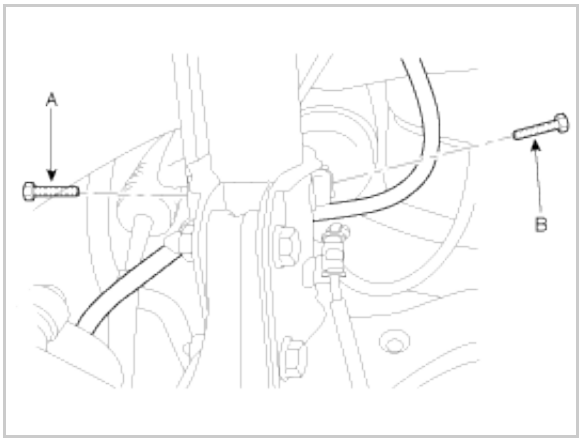
1. Loosen the wheel nuts slightly.
   Raise the front of the vehicle, and make sure it is securely supported.
2. Remove the front wheel and tire (A) from front hub (B).



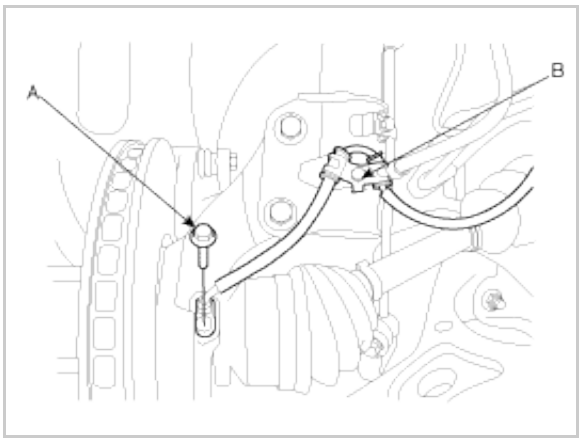
CAUTION

Be careful not to damage to the hub bolts (C) when removing the front wheel and tire (A).

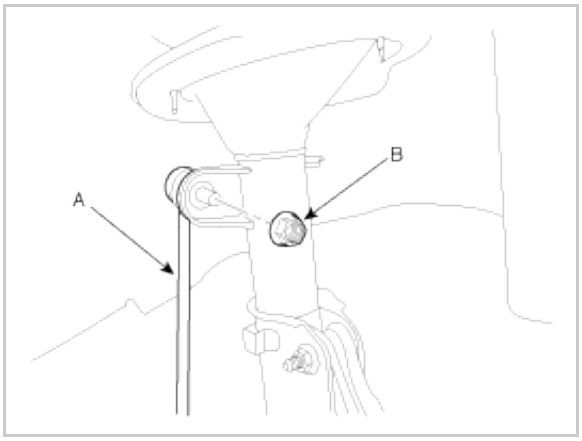
3. Remove the brake hose bracket bolt (A, B) from the front strtu assembly.



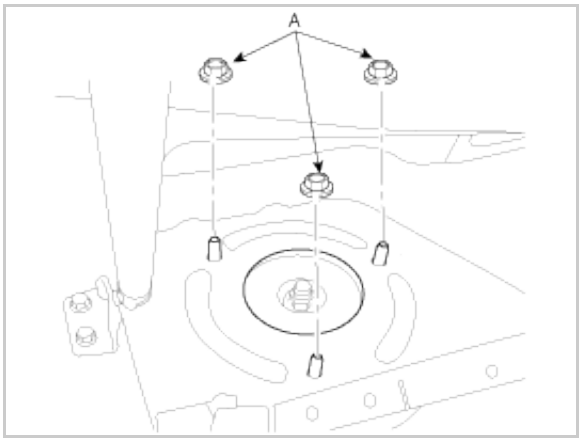
4. Remove the speed sensor (A) and wire (B) bolts from the front knuckle.



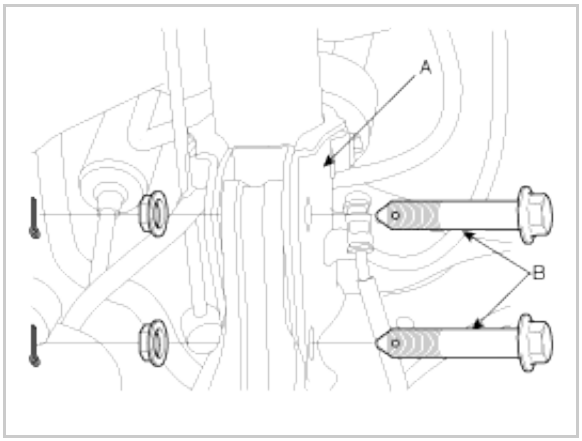
5. Remove the front stabilizer link (A) nut (B) from the strut assembly.



6. Remove the strut upper mounting nuts(A).



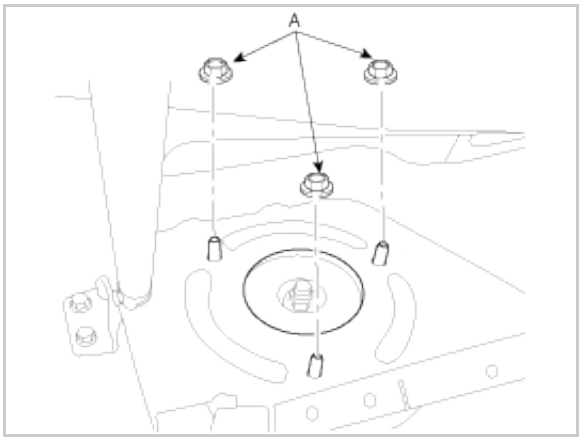
7. Remove the front strut assembly (A) bolts (B) from the front knuckle.



INSTALLATION

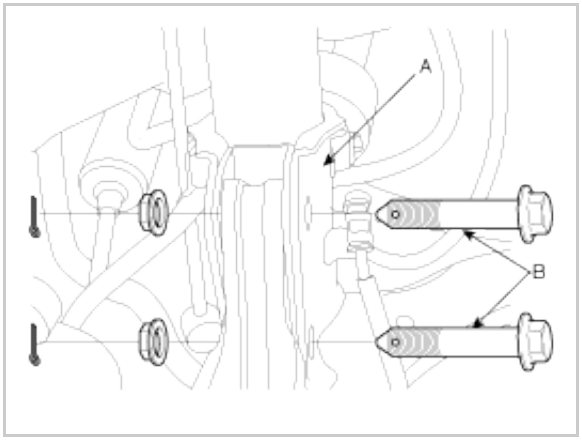
1. Install the strut upper mounting nuts (A).

Tightening torque Nm (kgf.m, lb-ft) :
45 ~ 60 (4.5 ~ 6.0, 32.5 ~ 43.4)



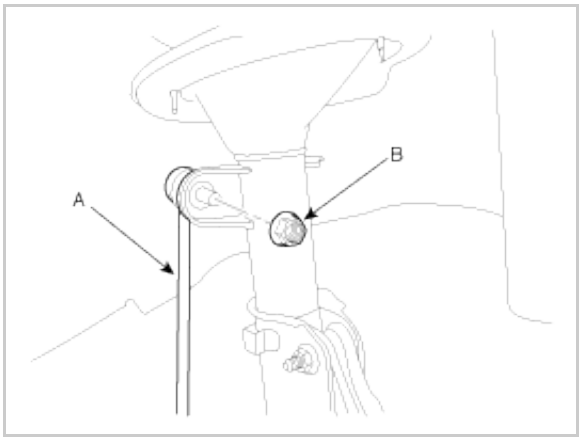
2. Install the front strut assembly (A) bolts (B) to the front knuckle.

Tightening torque Nm (kgf.m, lb-ft) :
100 ~ 120 (10 ~ 12, 72.3 ~ 86.8)



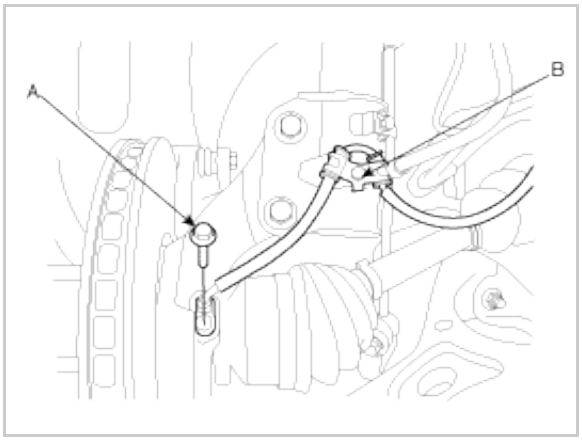
3. Install the front stabilizer link (A) nut (B) to the strut assembly.

Tightening torque Nm (kgf.m, lb-ft) :
100 ~ 120 (10 ~ 12, 72.3 ~ 86.8)



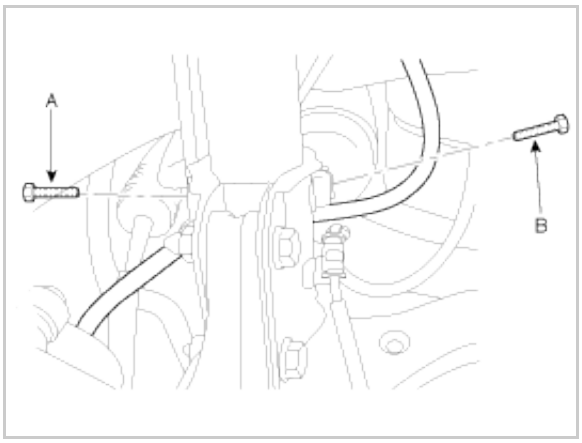
4. Install the speed sensor (A) and wire (B) bolts.

Tightening torque Nm (kgf.m, lb-ft) :
7 ~ 11 (0.7 ~ 1.1, 5.1 ~ 8.0)



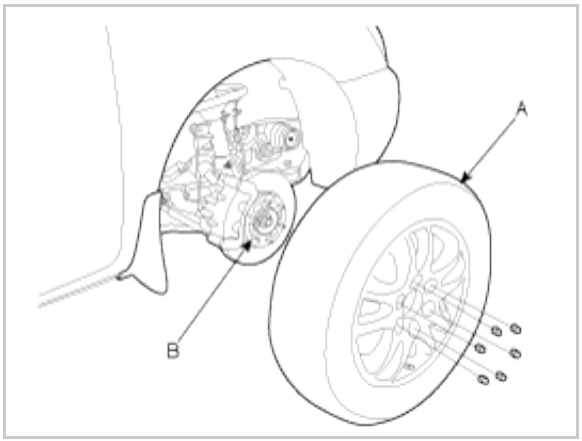
5. Install the brake hose bracket bolt (A, B) to the axle assembly.

Tightening torque Nm (kgf.m, lb-ft) :
6.9 ~ 11 (0.7 ~ 1.1, 5.1 ~ 8.0)



6. Install the wheel and the tire (A) to the front hub (B).

Tightening torque Nm (kgf.m, lb-ft) :
90 ~ 110 (9 ~ 11, 65.1 ~ 79.5)

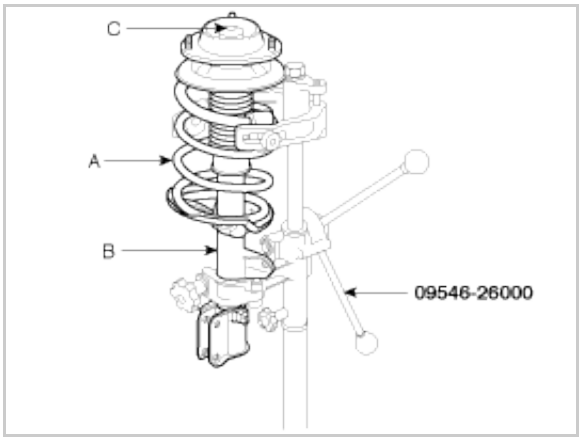


CAUTION

Be careful not to damage the hub bolts(C) when installing the front wheel and tire(A).

DISASSEMBLY

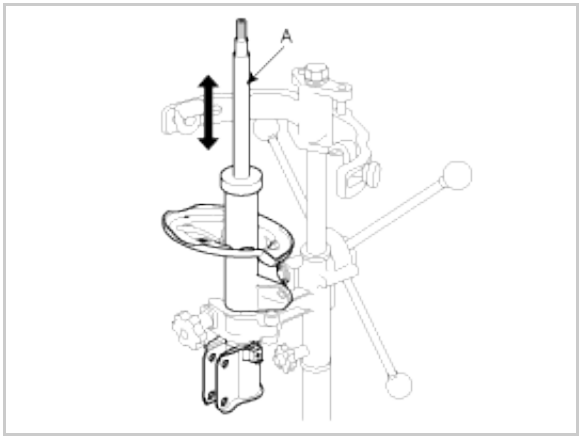
1. Using the special tool (09546-26000), compress the coil spring (A).



2. Remove the self-locking nut (C) from the strut assembly (B).
3. Remove the insulator, spring seat, coil spring and dust cover from the strut assembly.

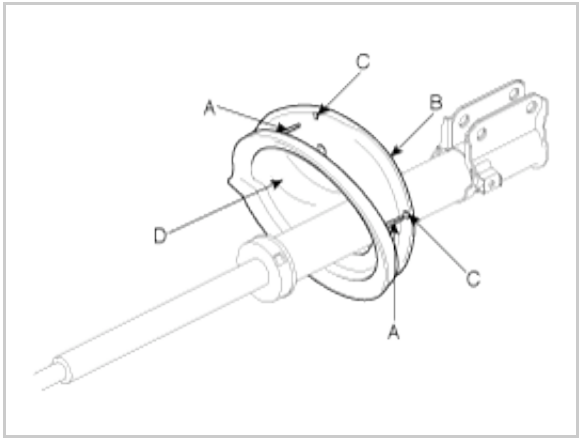
INSPECTION

1. Check the strut insulator for wear or damage.
2. Check rubber parts for damage or deterioration.
3. Compress and extend the piston rod (A) and check that there is no abnormal resistance or unusual sound during operation.



REASSEMBLY

1. Install the spring lower pad (D) so that the protrusions (A) fit in the holes (C) in the spring lower seat (B).



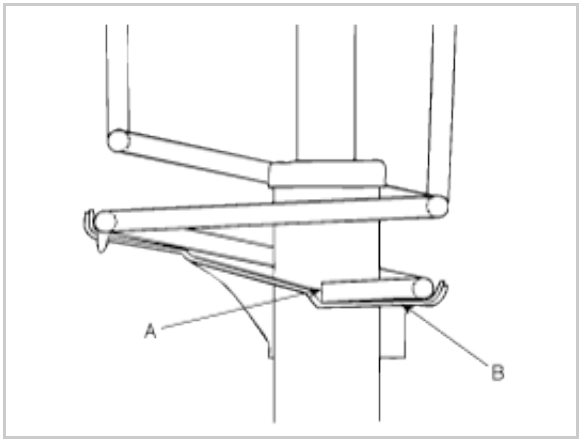
2. Compress coil spring using special tool (09546-26000).
   Install compressed coil spring into shock absorber.

NOTICE

a. Indicated two identification color marks on the coil spring one follows model option the other follows load classification according to the below.
   Pay attention to distiuguish between the two marks and then install them.

b. Install the coil spring wth the identification mark directed toward the knuckle.

3. After fully extending the piston rod, install the spring upper seat and insulator assembly.
4. After seating the upper and lower ends of the coil spring (A) in the upper and lower spring seat grooves (B) correctly, tighten new self-locking nut temporarily.

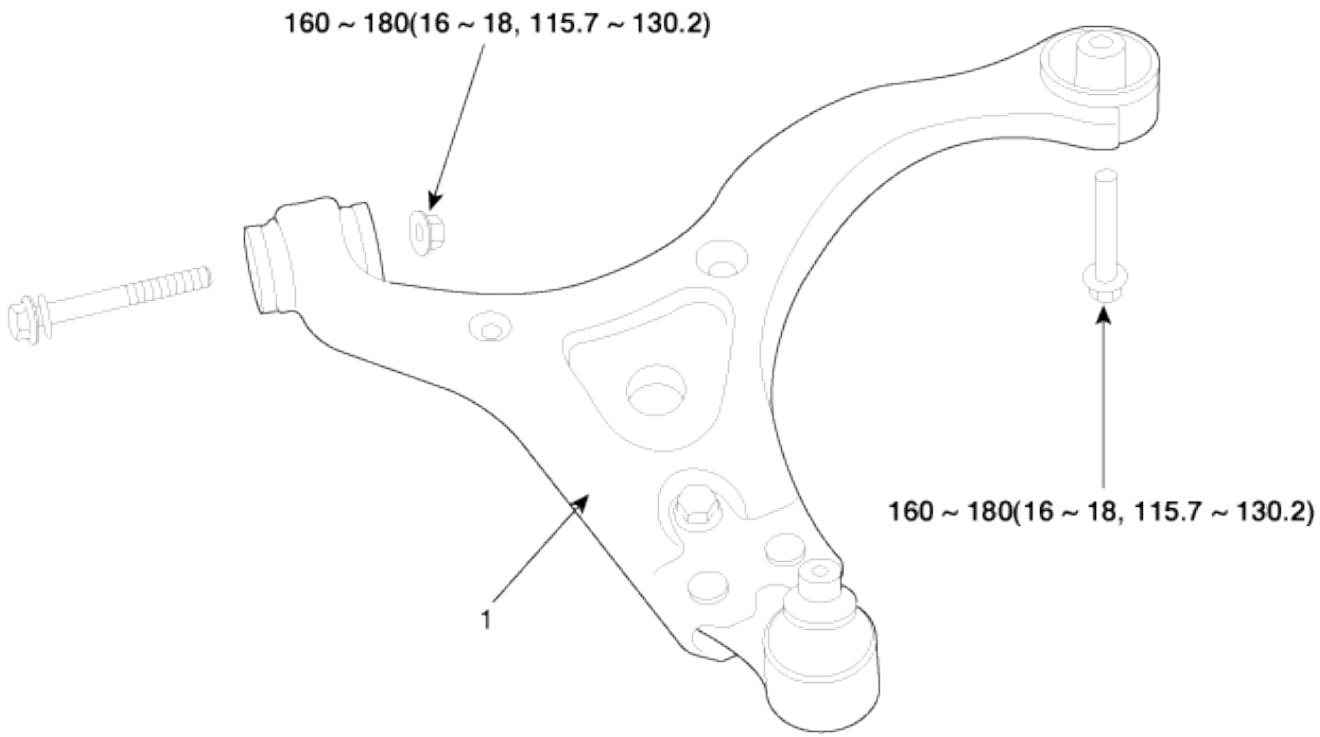


5. Remove the special tool (09546-26000).
6. Tighten the self-locking nut to the specified torque.

Tightening torque :
60 ~ 70 Nm (6 ~7 kgf.m, 43.4 ~ 50.6 lb-ft)

Front Lower Arm

COMPONENTS

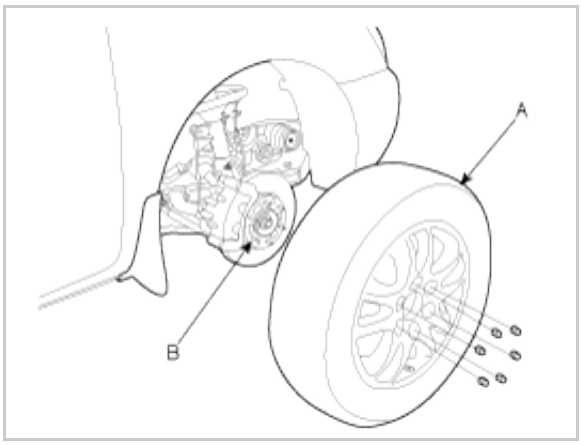


TORQUE : Nm (kgf.m, lb-ft)

1. Front lower arm

REMOVAL

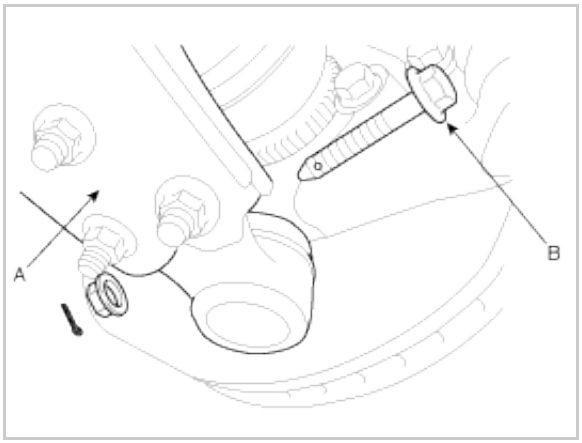
1. Loosen the wheel nuts slightly.
   Raise the front of the vehicle, and make sure it is securely supported.
2. Remove the front wheel and tire (A) from front hub (B).



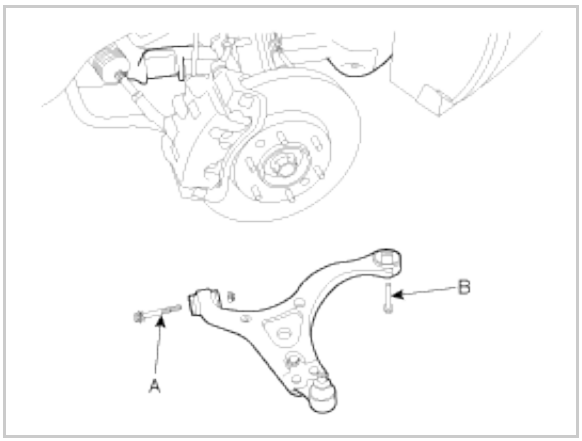
CAUTION

Be careful not to damage the hub bolts(C) when removing the front wheel and tire(A).

3. Remove the front lower arm (A) mounting bolt (B) from the knuckle.

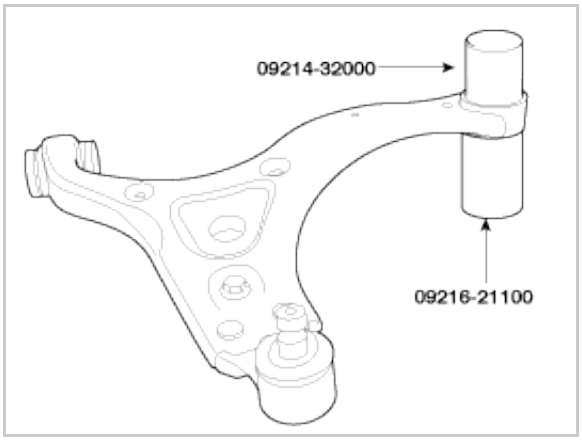


4. Remove the lower arm mounting bolts (A, B).

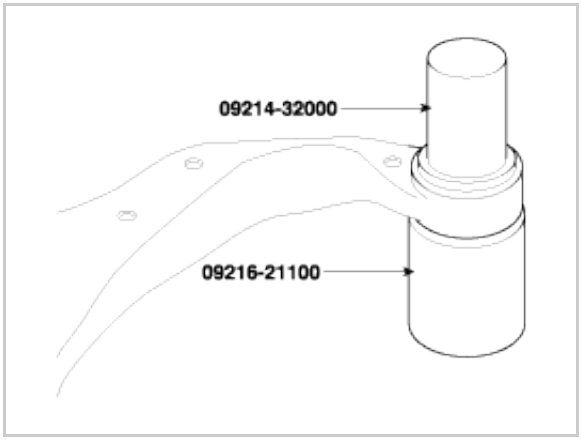


REPLACEMENT

1. Using the special tools(09214-32000 & 09216- 211000), remove the bushing from the lower arm.



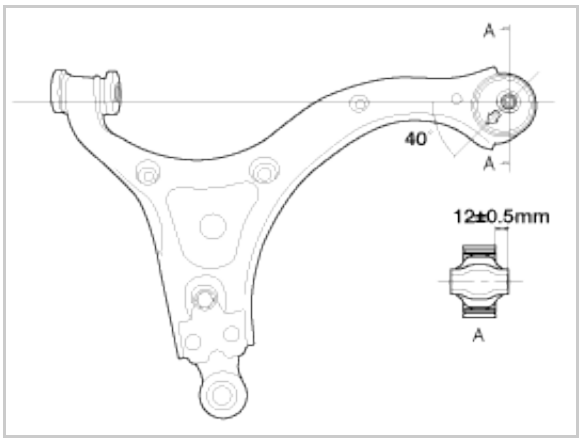
2. Apply soap solution to the following parts.
   a. Outer surface of the bushing.
   b. Inner surface of the lower bushing mounting part.
3. Using the special tools(09214-32000 & 09216-21100), install the busing on the lower arm.



CAUTION

Insert bushing in the direction shown in the illustration.

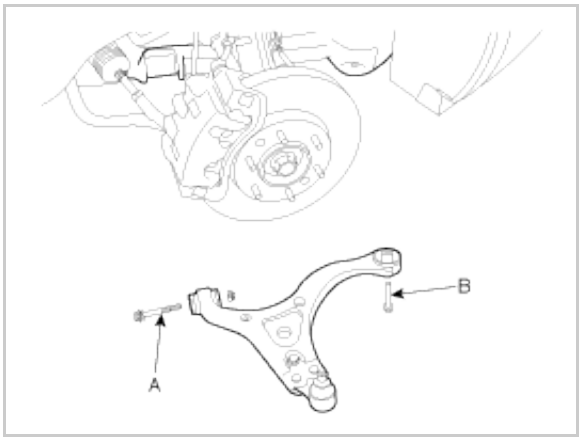
Separation force is over 100 Nm (1000Kgf, 2204 lbf)



INSTALLATION

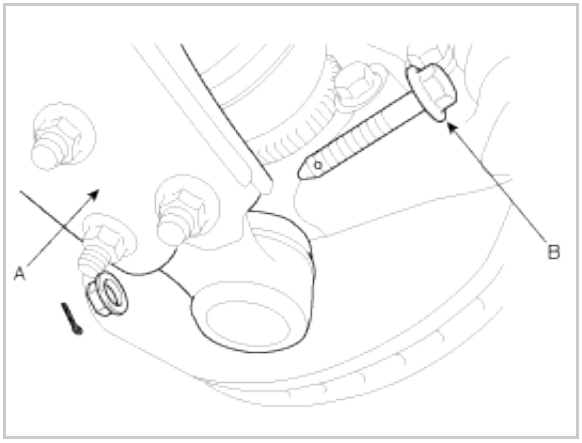
1. Install the lower arm mounting bolts (A, B).

Tightening torque Nm (kgf.m, lb-ft) :
160 ~ 180 (16 ~ 18, 115.7 ~ 130.2)



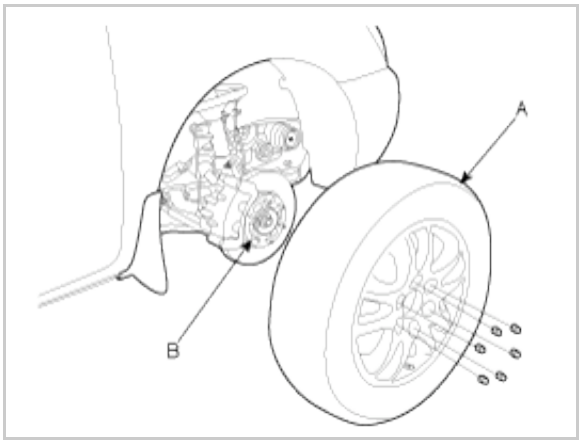
2. Install the front lower arm (A) ball joint mounting bolt (B) to the knuckle.

Tightening torque Nm (kgf.m, lb-ft) :
90 ~ 120 (9 ~ 12, 65.1 ~ 86.8)



3. Install the wheel and the tire(A) to the front hub(B).

Tightening torque Nm (kgf.m, lb-ft) :
90 ~ 110 (9 ~ 11, 65.1 ~ 79.5)



CAUTION

Be careful not to damage the hub bolts(C) when installing the front wheel and tire(A).

INSPECTION

1. Check the bushing for wear and deterioration.
2. Check the lower arm for bending or breakage.
3. Check the ball joint dust cover for cracks.

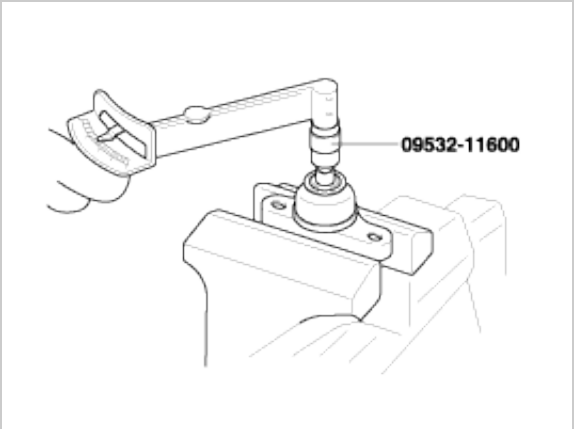
4. Check all bolts.

5. Check the lower arm ball joint for rotating torque.
   (1) If a crack is noted in the dust cover, replace the ball joint assembly.
   (2) Move the ball joint stud several times in a circular motion.
   (3) Measure the ball joint rotating torque.

Standard value :
1 ~ 3.5 Nm (10 ~ 35 kgf.cm, 0.72 ~ 2.53 lb-ft)

NOTICE

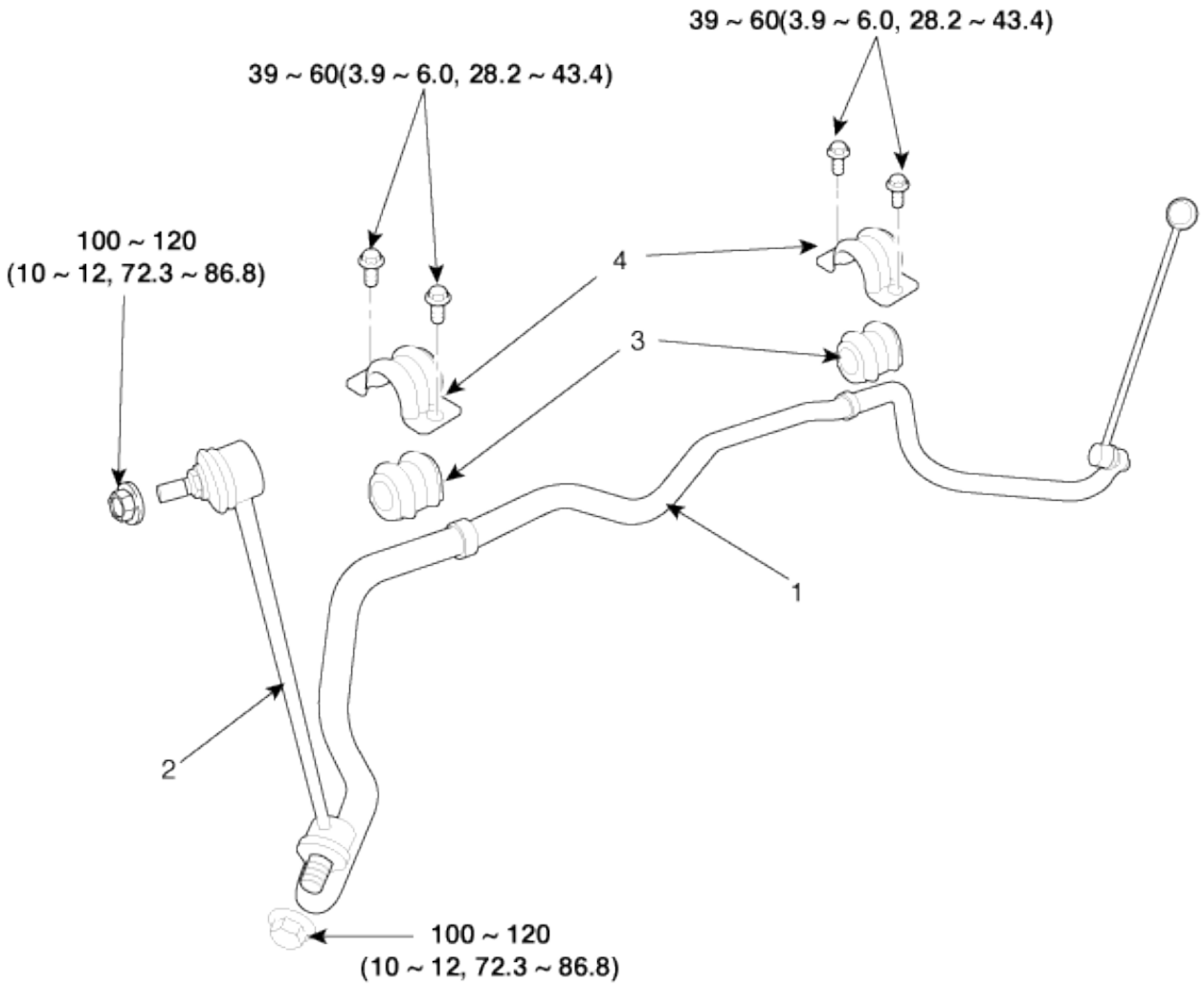
Measure torque using the special tool(09532-11600) and torque wrench at the range of 0.5 - 2 rpm after moving the ball joint stud 10 times at room temperature.



   (4) If the rotating torque is below the lower limit of standard value, replace the ball joint assembly.
   (5) Even if the rotating torque is below the lower limit of the standard value, the ball joint may be reused unless it has drag and excessive play.

Front Stabilizer Bar

COMPONENTS

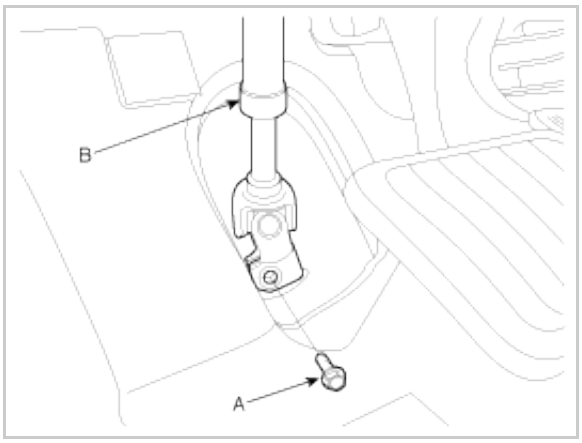


TORQUE : Nm (kgf.m, lb-ft)

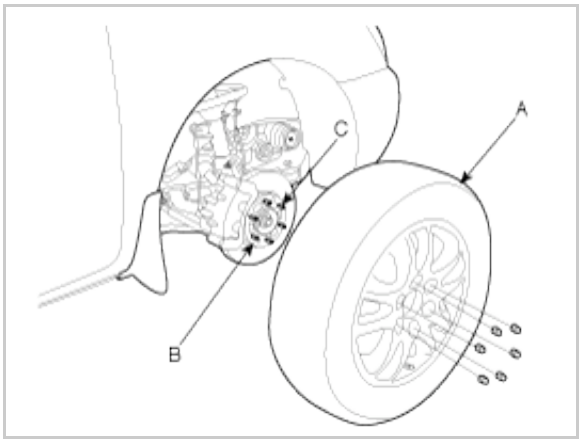
1. Front stabilizer bar
2. Front stabilizer link
3. Bushing
4. Bracket

REMOVAL

1. Remove the connecting bolt (A) between the steering universal joint assembly (B) and the pinion assembly.



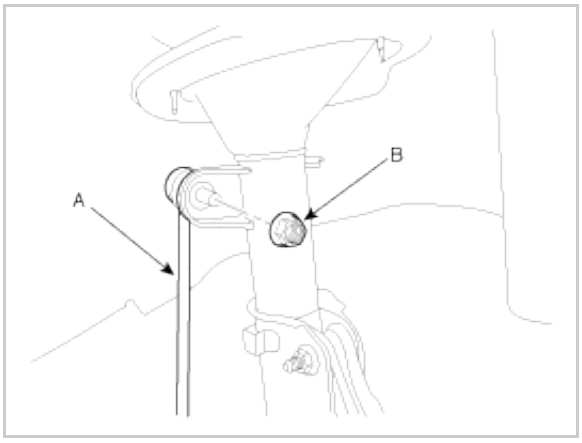
2. Loosen the wheel nuts slightly. Raise the front of the vehicle, and make sure it is securely supported.
3. Remove the front wheel and tire (A) from front hub (B).



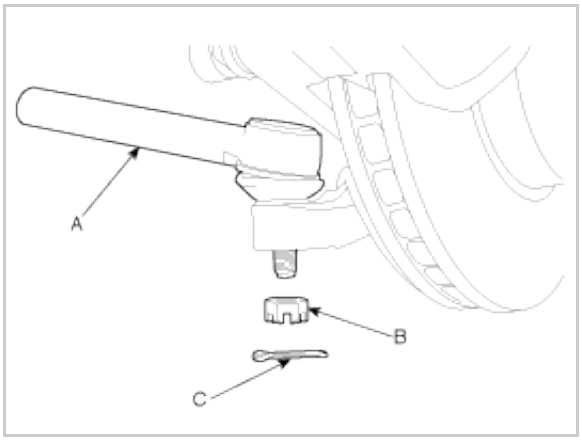
CAUTION

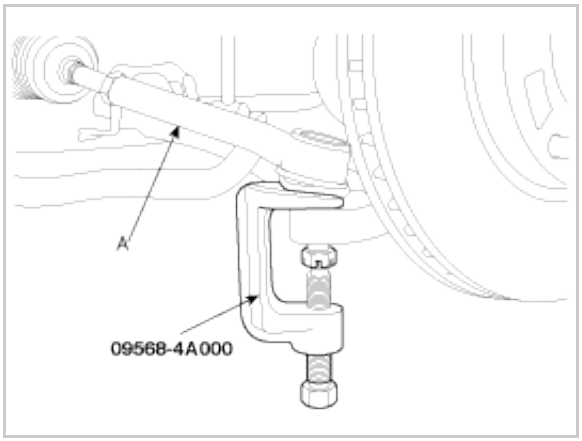
Be careful not to damage the hub bolts (C) when removing the front wheel and tire (A).

4. Remove the front stabilizer link (A) nut (B) from the strut assembly.

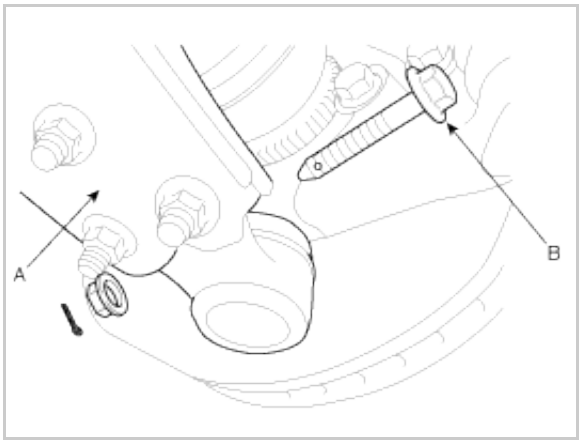


5. After removing both sides of the tie rod end (A) self-locking nuts (B) and cotterpin (C), remove the ball joint by using the special tool(09568-4A000).

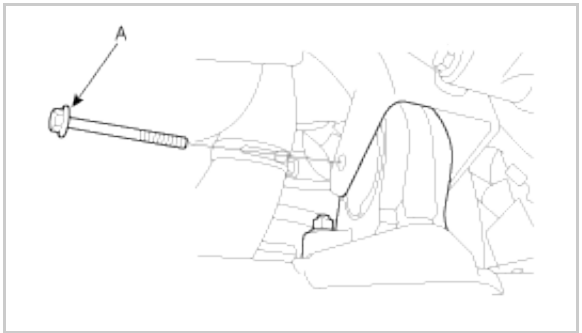


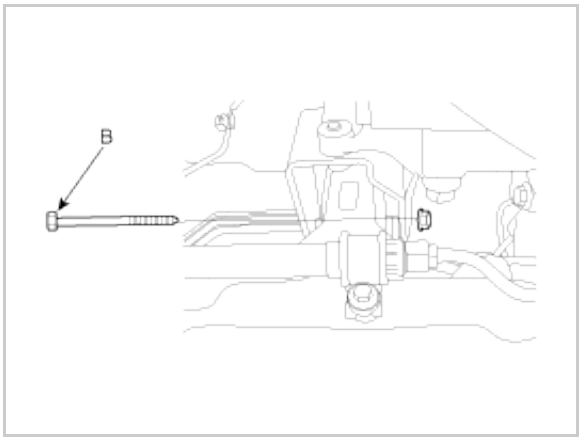


6. Remove both sides of the lower arm (A) mounting bolts (B).

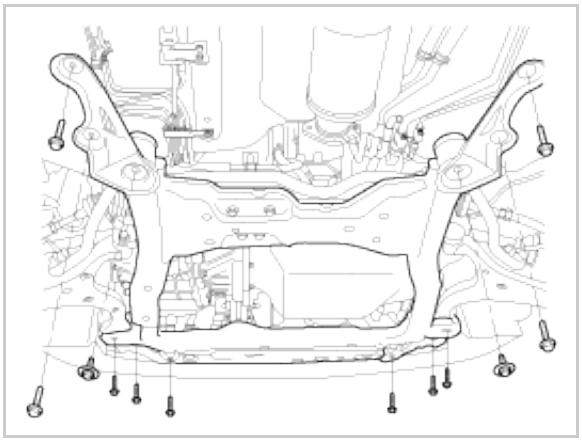


7. Remove the engine mounting bolts (A, B)

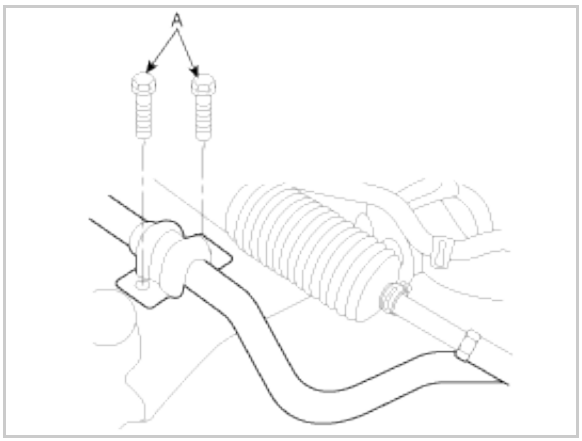




8. Remove the twelve bolts and nuts of the sub frame by supporting it with a jack.



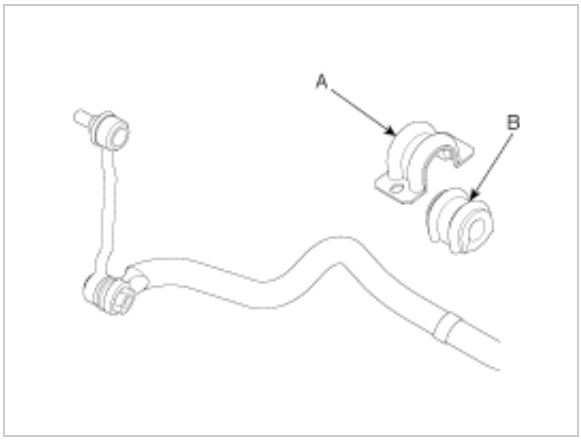
9. After lowering the jack which supports the sub frame in a proper level, remove both sides of the stabilizer bar assembly mounting bolts (A).



10. Remove the stabilizer bar assembly through the gap between the body and the rear side of the sub frame.

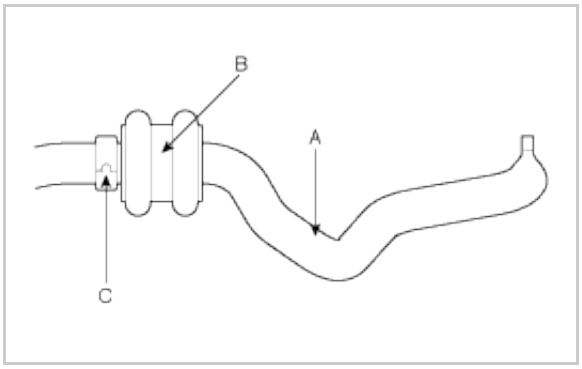
> **CAUTION**
>
> Be careful not to damage to the power steering related tubes.

11. Remove the brackets (A) and the bushings (B).



INSTALLATION

1. Install the bushing (B) on the stabilizer bar (A).

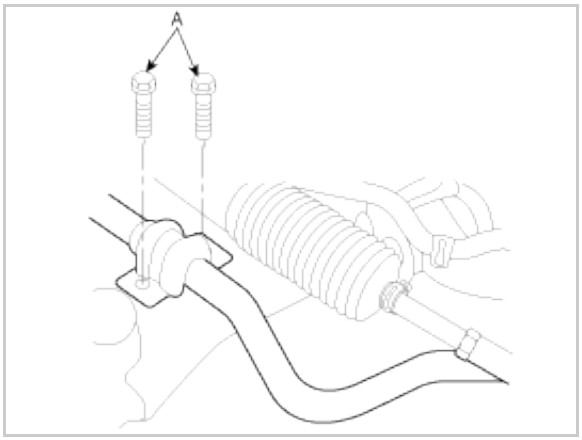


NOTICE

Bring clamp (C) of stabilizer bar (A) into contact with bushing (B).

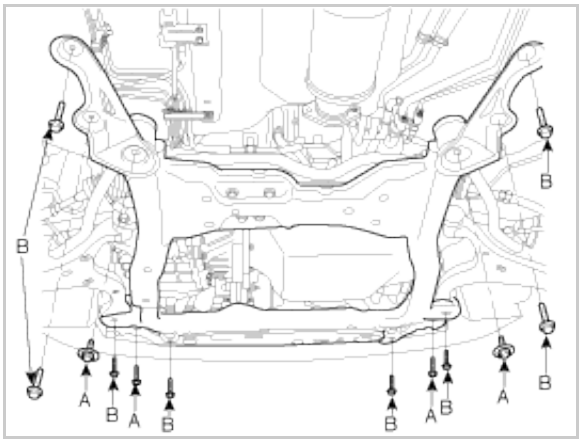
2. Install the bracket on the bushing (B).
3. After tightening the bolts of the bushing bracket temporarily, install the bushing bracket on the opposite side.
4. Install the stabilizer bar bracket mounting bolts (A) to the sub frame.

Tightening torque Nm (kgf.m, lb-ft) :
39 ~ 60 (3.9 ~ 6.0, 28.2 ~ 43.4)



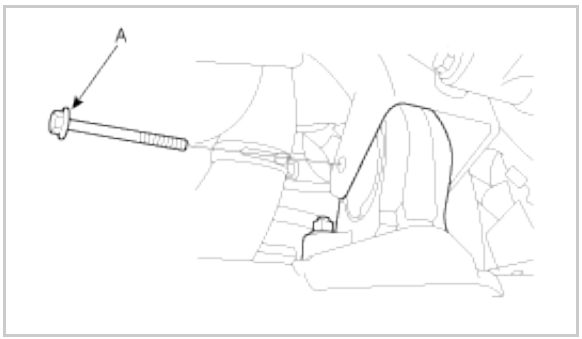
5. After lifting the jack which supports the sub frame, install the four bolts (A) of the sub frame and the eight bolts (B) of the guide bracket.

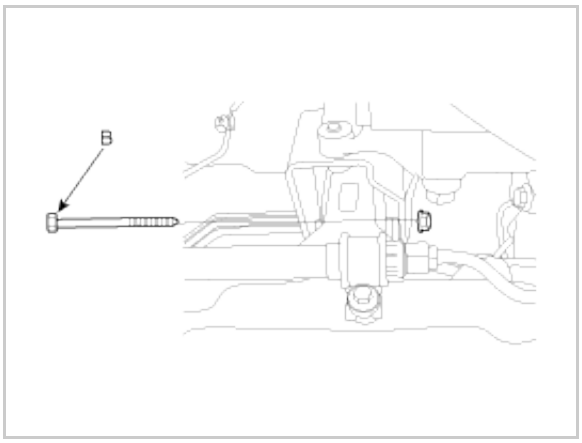
Tightening torque Nm (kgf.m, lb-ft) :
Bolt (A) : 160 ~ 180 (16 ~ 18, 115.7 ~ 130.2)
Bolt (B) : 45 ~ 60 (4.5 ~ 6.0, 32.5 ~ 43.4)



6. Install the engine mounting bolts (A, B)

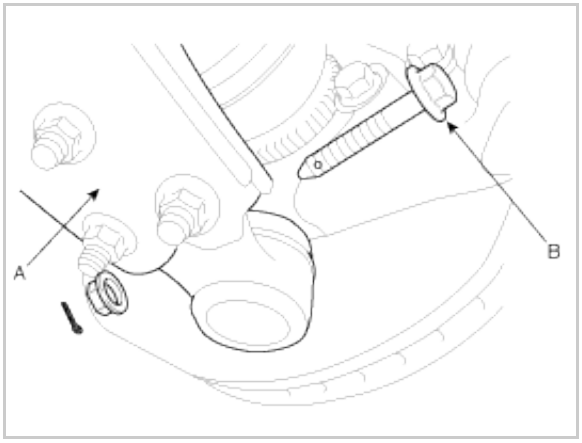
Tightening torque Nm (kgf.m, lb-ft) :
65 ~ 85 (6.5 ~ 8.5, 47.0 ~ 61.5)





7. Install both sides of the lower arm (A) mounting bolts(B).

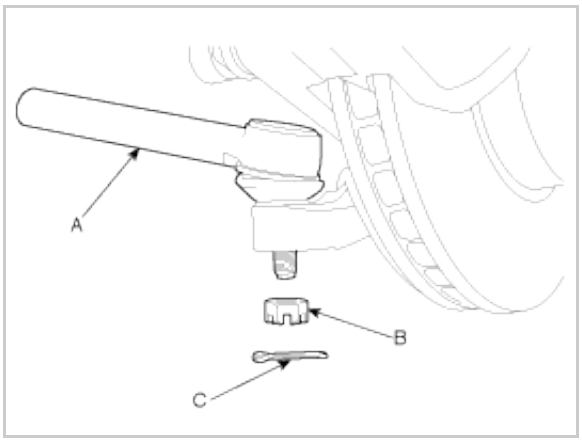
Tightening torque Nm (kgf.m, lb-ft) :
90 ~ 120 (9 ~ 12, 65.1 ~ 86.8)



8. Install both sides of the tie rod end (A) self-locking nuts (B). Insert cooter pin (C) after nut is torqued to

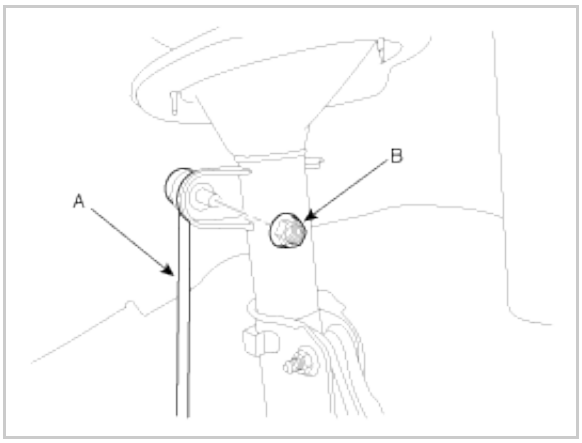
specification.

Tightening torque Nm (kgf.m, lb-ft) :
65 ~ 80 (6 ~ 8, 43.4 ~ 57.8)



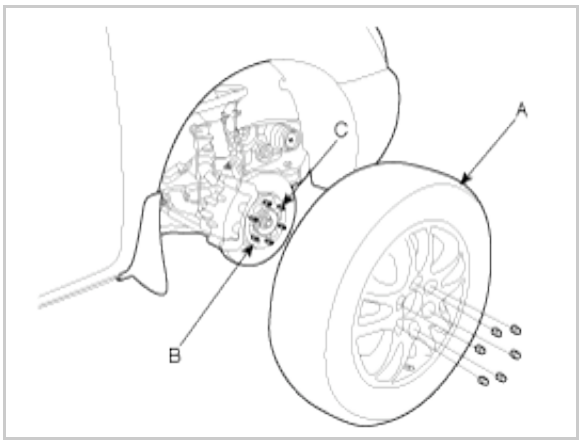
9. Install the front stabilizer link (A) nut (B) to the strut assembly.

Tightening torque Nm (kgf.m, lb-ft) :
100 ~ 120 (10 ~ 12, 72.3 ~ 86.8)



10. Install the wheel and the tire (A) to the front hub (B).

Tightening torque Nm (kgf.m, lb-ft) :
90 ~ 110 (9 ~ 11, 65.1 ~ 79.5)

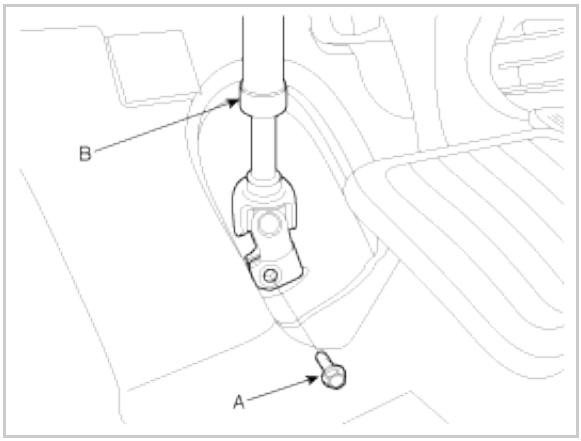


CAUTION

Be careful not to damage the hub bolts(C) when installing the front wheel and tire(A).

11. Install the connecting bolt (A) between the steering universal joint assembly (B) and the pinion assembly.

Tightening torque Nm (kgf.m, lb-ft) :
13 ~ 18 (1.3 ~ 1.8, 9.4 ~ 13.0)



CAUTION

After installation, if neccessary, adjust the alignment of the steering wheel and front tires

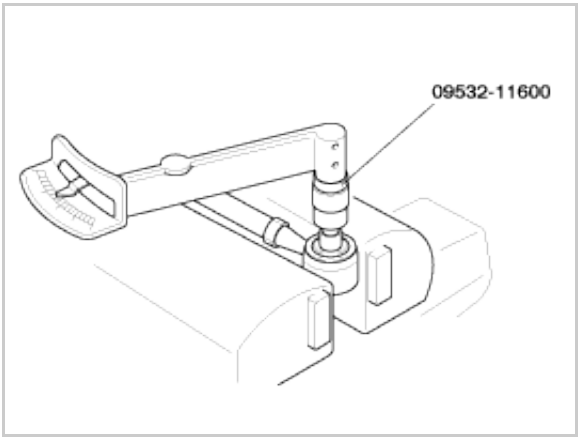
INSPECTION

1. Check the bushing for wear and deterioration.
2. Check the stabilizer bar for bending or breakage.
3. Check the ball joint for rotating torque.
   (1) If there is a crack in the dust cover, replace it and add grease.
   (2) Move the stabilizer link ball joint stud several times in a circular motion.
   (3) Mount the self-locking nut on the ball joint, and then measure the ball joint rotating torque.

   Standard value :
   0.5 ~ 2.5 Nm (5 ~ 25 kgf., 0.36 ~ 1.81 lb-ft)

   NOTICE

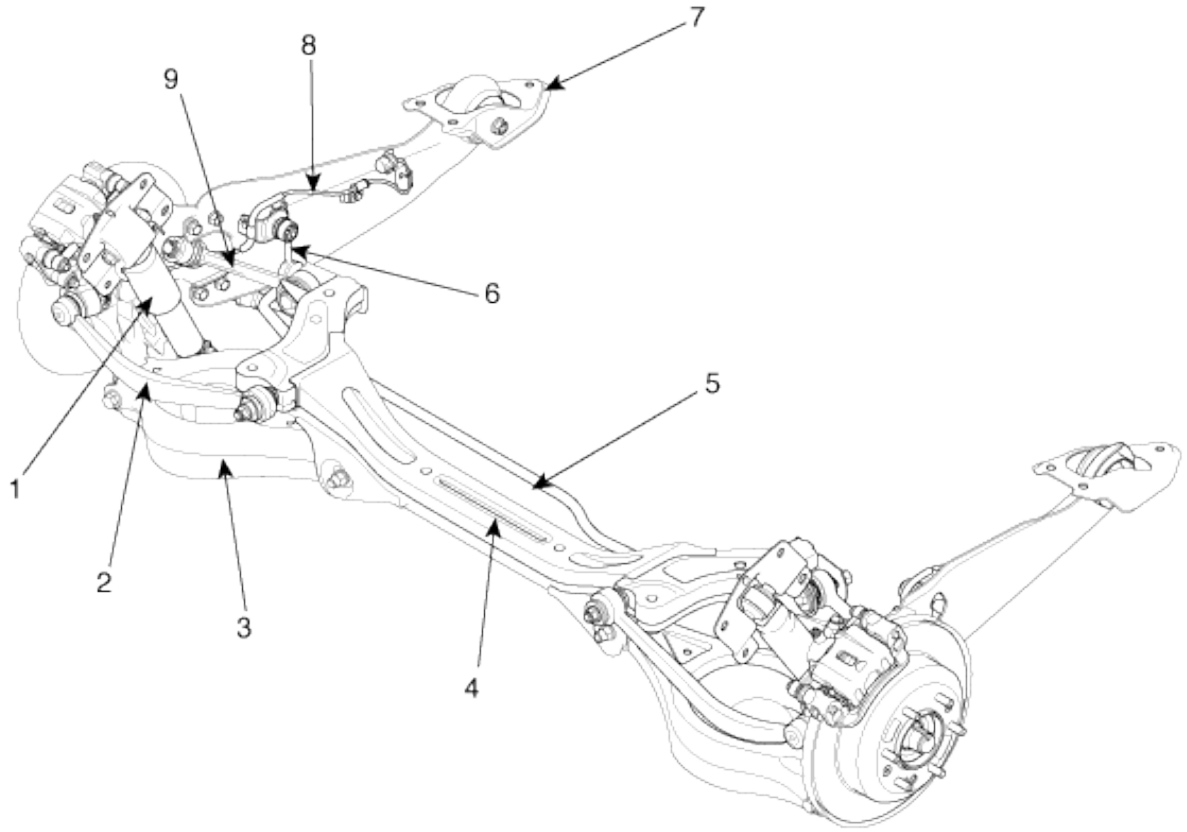
   Measure torque using the special tool(09532-11600) and torque wrench at the range of 0.5 - 2 rpm after moving the ball joint stud 10 times at room temperature.



   (4) If the rotating torque exceeds the upper limit of standard value, replace the upper arm assembly.
   (5) Even if the rotating torque is below the lower limit of the standard value, the ball joint may be reused unless it has drag and excessive play.

Rear Suspension System

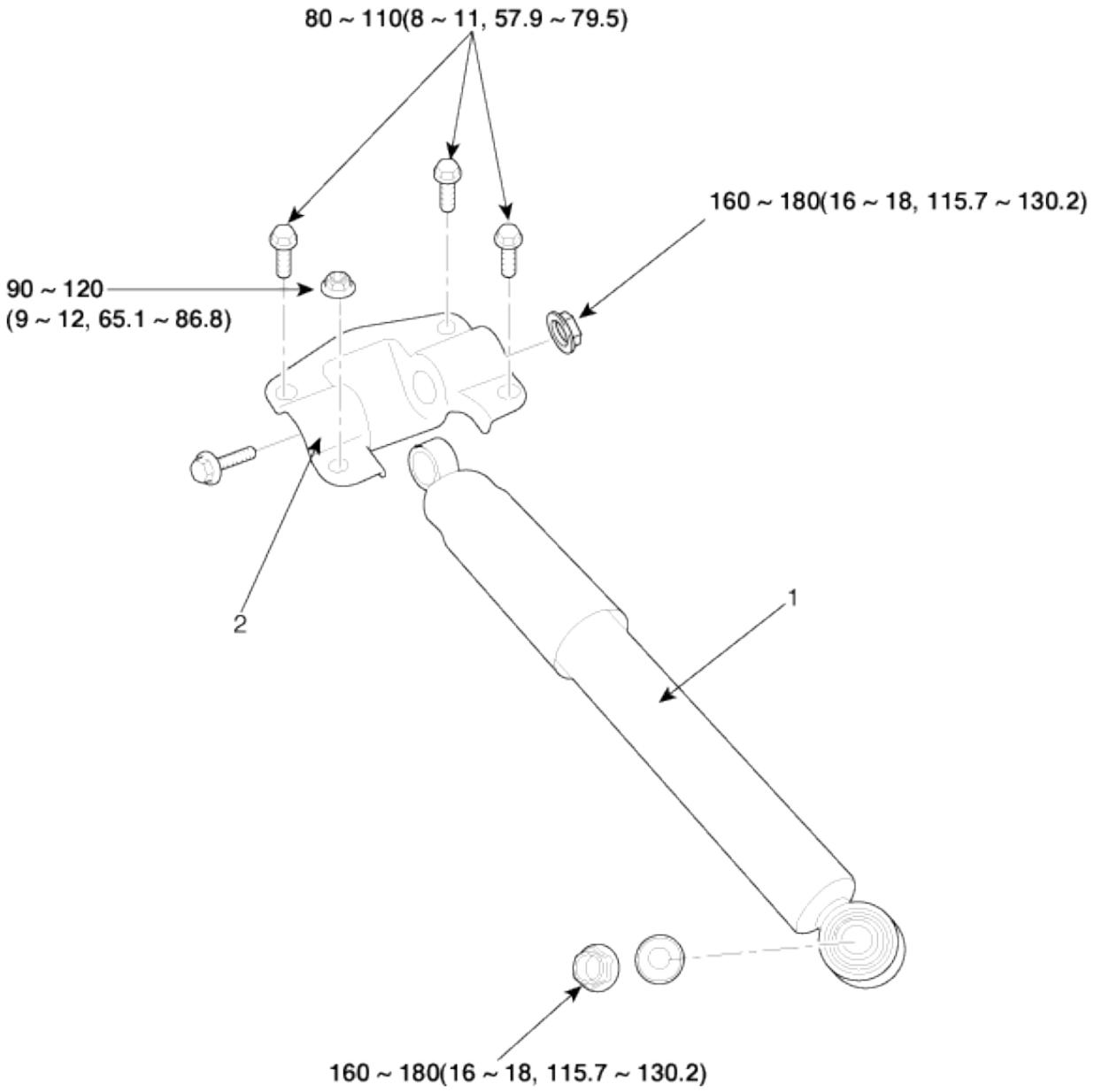
COMPONENTS



1. Rear shock absorber assembly
2. Rear upper arm
3. Rear lower arm
4. Rear cross member
5. Rear stabilizer bar assembly
6. Rear stabilizer link assembly
7. Trailing arm bracket
8. Trailing arm
9. Rear assist arm

Rear Shock Absorber

COMPONENTS

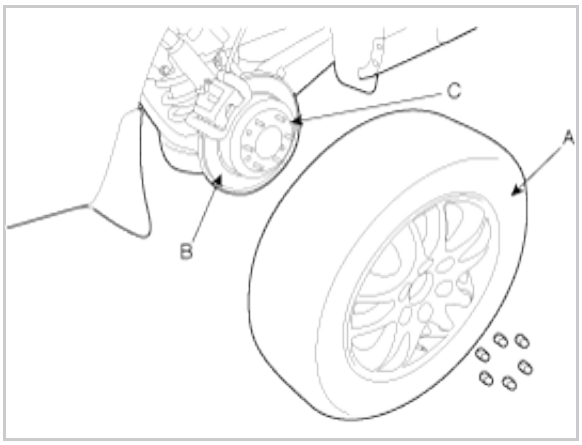


TORQUE : Nm (kgf.m, lb-ft)

1. Rear shock absorber
2. Rear shock absorber bracket

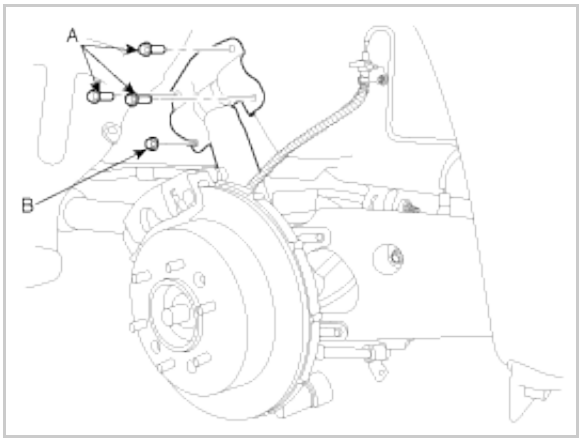
REMOVAL

1. Loosen the wheel nuts slightly.
   Raise the rear of the vehicle, and make sure it is securely supported.
2. Remove the rear wheel and tire (A) from rear hub (B).

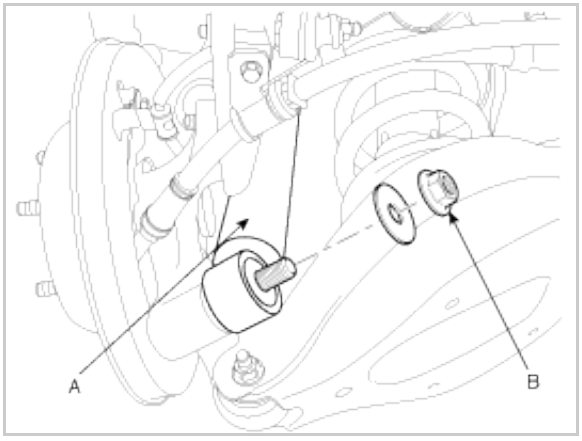


> **CAUTION**
>
> Be careful not to damage the hub bolts (C) when removing the rear wheel and tire (A).

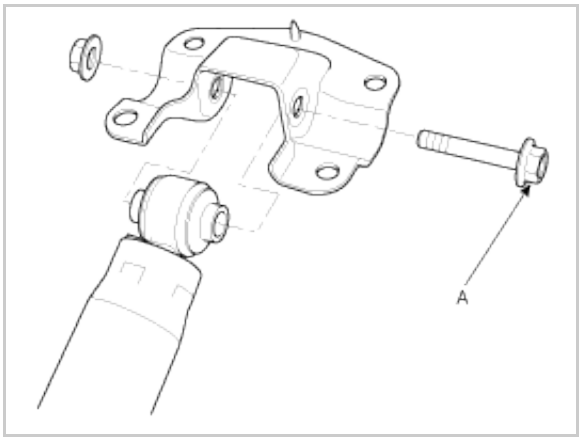
3. Remove the rear shock absorber assembly mounting bolts (A) and nut (B) from the baby.



4. Remove the rear shock absorber assembly nut (B) from the rear knuckle, then remove the shock absorber assembly (A).



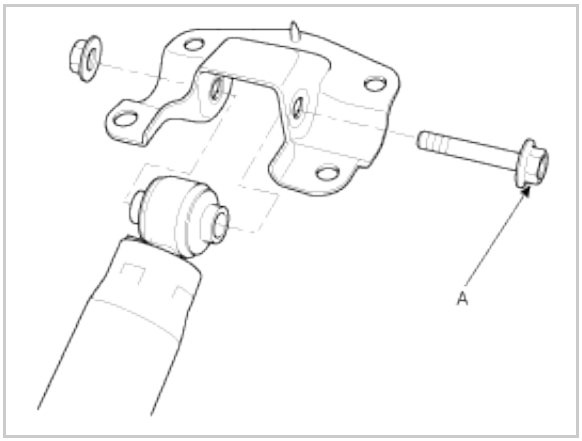
5. Remove the rear shock absorber bracket bolt (A).



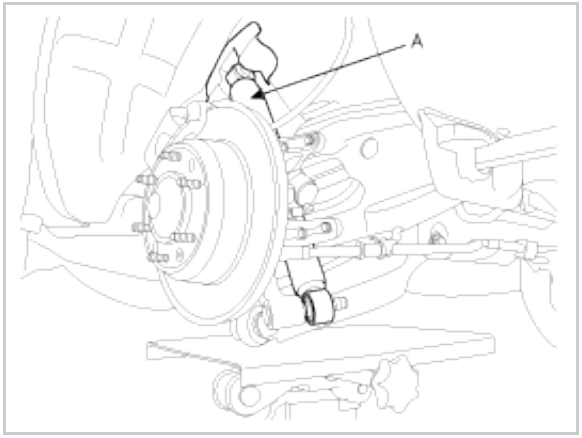
INSTALLATION

1. Install the connecting bolt (A) between the rear shock absorber and the bracket.

Tightening torque Nm(kgf.m, lb-ft) :
160 ~ 180 (16 ~ 18, 115.7 ~ 130.2)

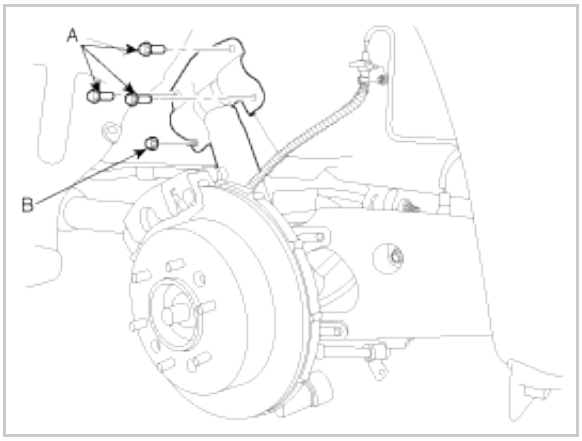


2. Install the rear shock absorber (A) to the knuckle temporarily.



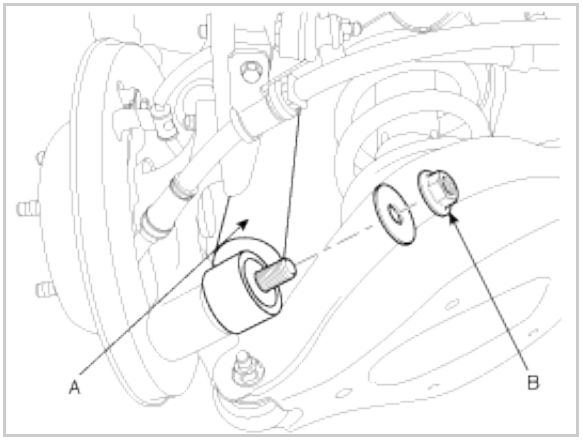
3. Install the rear shock absorber bracket mounting bolts (A) and nut (B).

Tightening torque Nm(kgf.m, lb-ft) :
Bolt : 80 ~ 110 (8 ~ 11, 59.7 ~ 79.5)
Nut : 90 ~ 120 (9 ~ 12, 65.1 ~ 86.8)



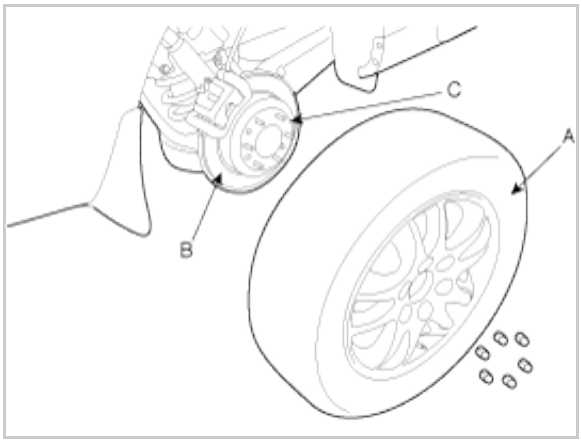
4. Install the rear shock absorber (A) nut (B) to the knuckle.

Tightening torque Nm(kgf.m, lb-ft) :
160 ~ 180 (16 ~ 18, 115.7 ~ 130.2)



5. Install the wheel and the tire (A) to the rear hub (B).

Tightening torque Nm (kgf.m, lb-ft) :
90 ~ 110 (9 ~ 11, 65.1 ~ 79.5)



CAUTION

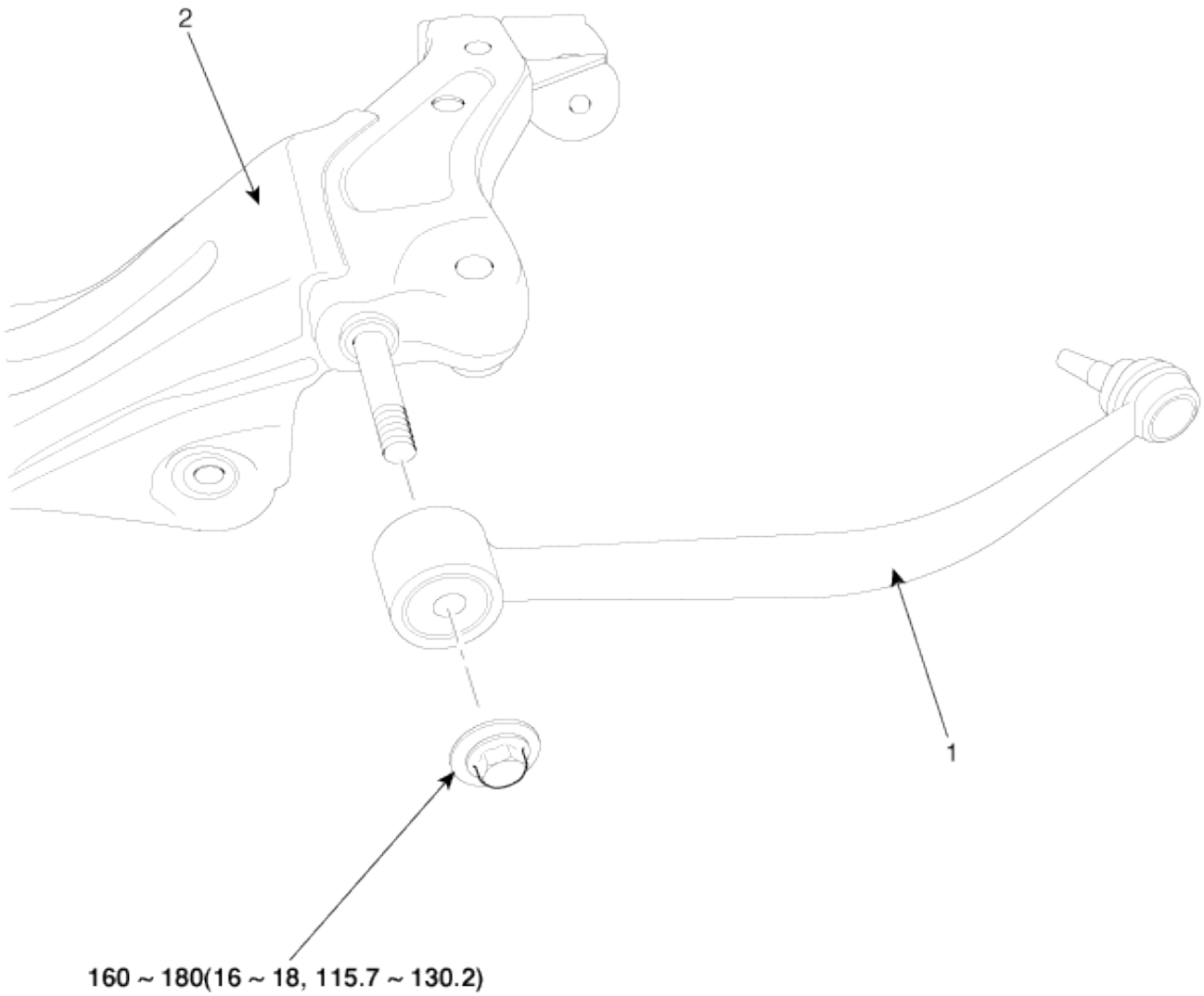
Be careful not to damage the hub bolts (C) when installing the rear wheel and tire (A).

INSPECTION

1. Check the rubber parts for damage or deterioration.
2. Check the shock absorber for abnormal resistance or unusual sounds.

Rear Upper Arm

COMPONENTS

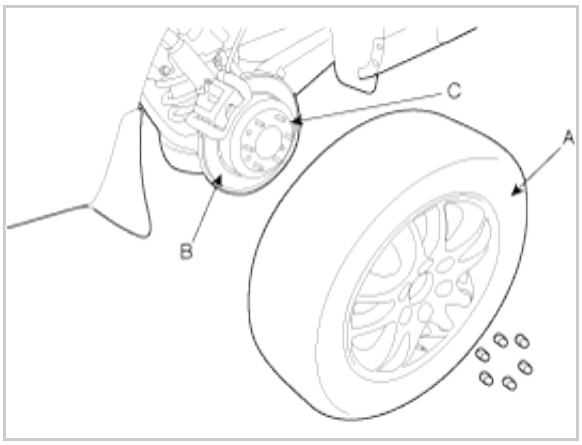


TORQUE : Nm (kgf.m, lb-ft)

1. Rear upper arm
2. Rear cross member

REMOVAL

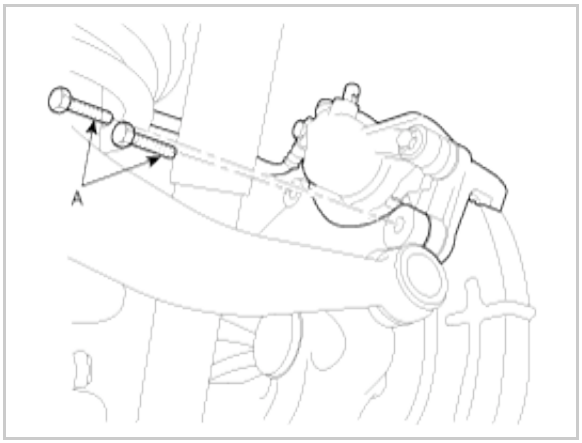
1. Loosen the wheel nuts slightly. Raise the rear of the vehicle, and make sure it is securely supported.
2. Remove the rear wheel and tire (A) from rear hub (B).

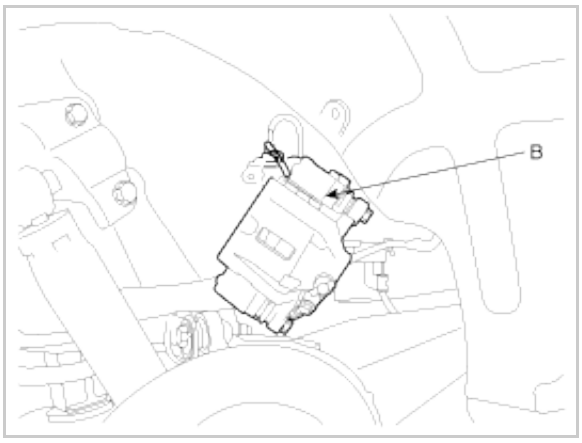


CAUTION

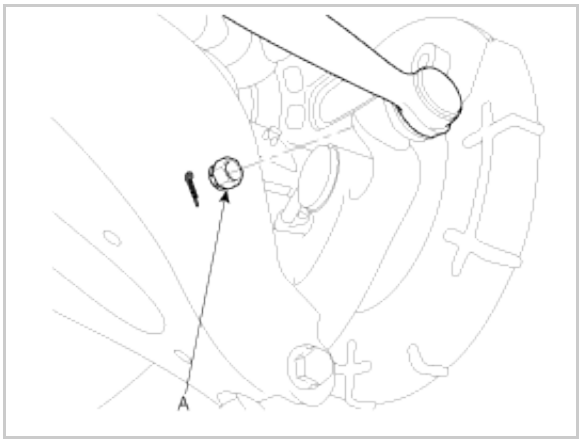
Be careful not to damage the hub bolts (C) when removing the rear wheel and tire (A).

3. Remove the brake caliper mounting bolts (A), and then place the brake caliper assembly (B) with wire as shown in the illustration.

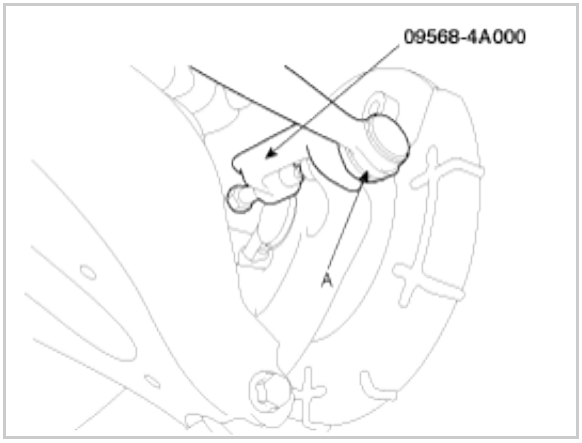




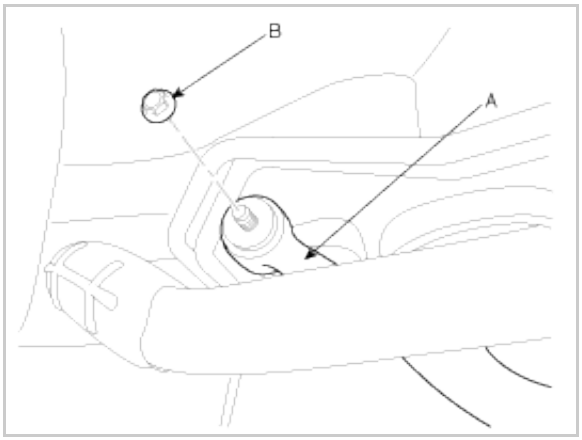
4. Remove the rear upper arm ball joint self-locking nut (A) and the cotter pin.



5. Remove the rear upper arm ball joint (A) by using the special tool(09568-4A000).



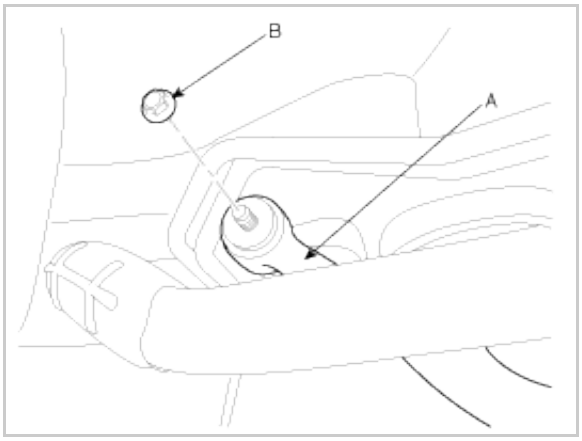
6. Remove the rear upper arm (A) mounting nut (B) from the cross member.



INSTALLATION

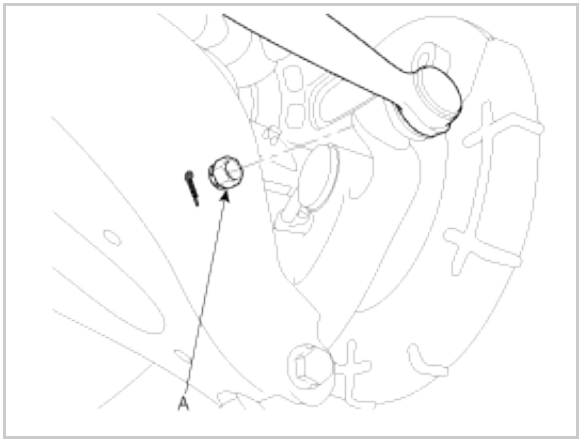
1. Install the rear upper arm (A) mounting nut (B) to the cross member.

Tightening torque Nm (kgf.m, lb-ft) :
160 ~ 180 (16 ~ 18, 115.7 ~ 130.2)



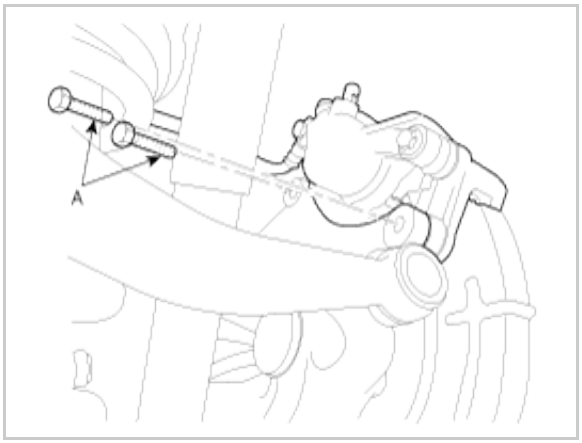
2. Install the rear upper arm ball joint self-locking nut (A) and the cotter pin.

Tightening torque Nm (kgf.m, lb-ft) :
90 ~ 110 (9 ~ 11, 65.1 ~ 79.5)



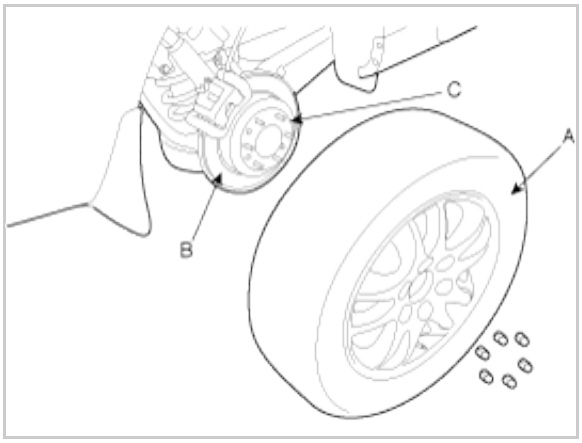
3. Install the brake caliper mounting bolts (A).

Tightening torque Nm (kgf.m, lb-ft) :
50 ~ 60 (5.0 ~ 6.0, 36.2 ~ 43.4)



4. Install the wheel and the tire (A) to the rear hub (B).

Tightening torque Nm (kgf.m, lb-ft) :
90 ~ 110 (9 ~ 11, 65.1 ~ 79.5)



CAUTION

Be careful not to damage the hub bolts (C) when installing the rear wheel and tire (A).

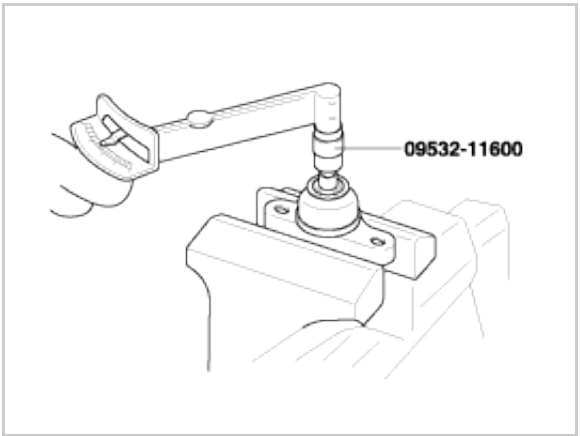
INSPECTION

1. Check the bushing for wear and deterioration.
2. Check the upper arm for bending or breakage.
3. Check the ball joint for rotating torque.
   (1) If there is a crack in the dust cover, replace it and add grease.
   (2) Move the stabilizer link ball joint stud several times in a circular motion.
   (3) Mount the self-locking nut on the ball joint, and then measure the ball joint rotating torque.

Specified torque :
1 ~ 3 Nm (10 ~ 30 kgf.cm, 0.72 ~ 2.17 lb-ft)

NOTICE

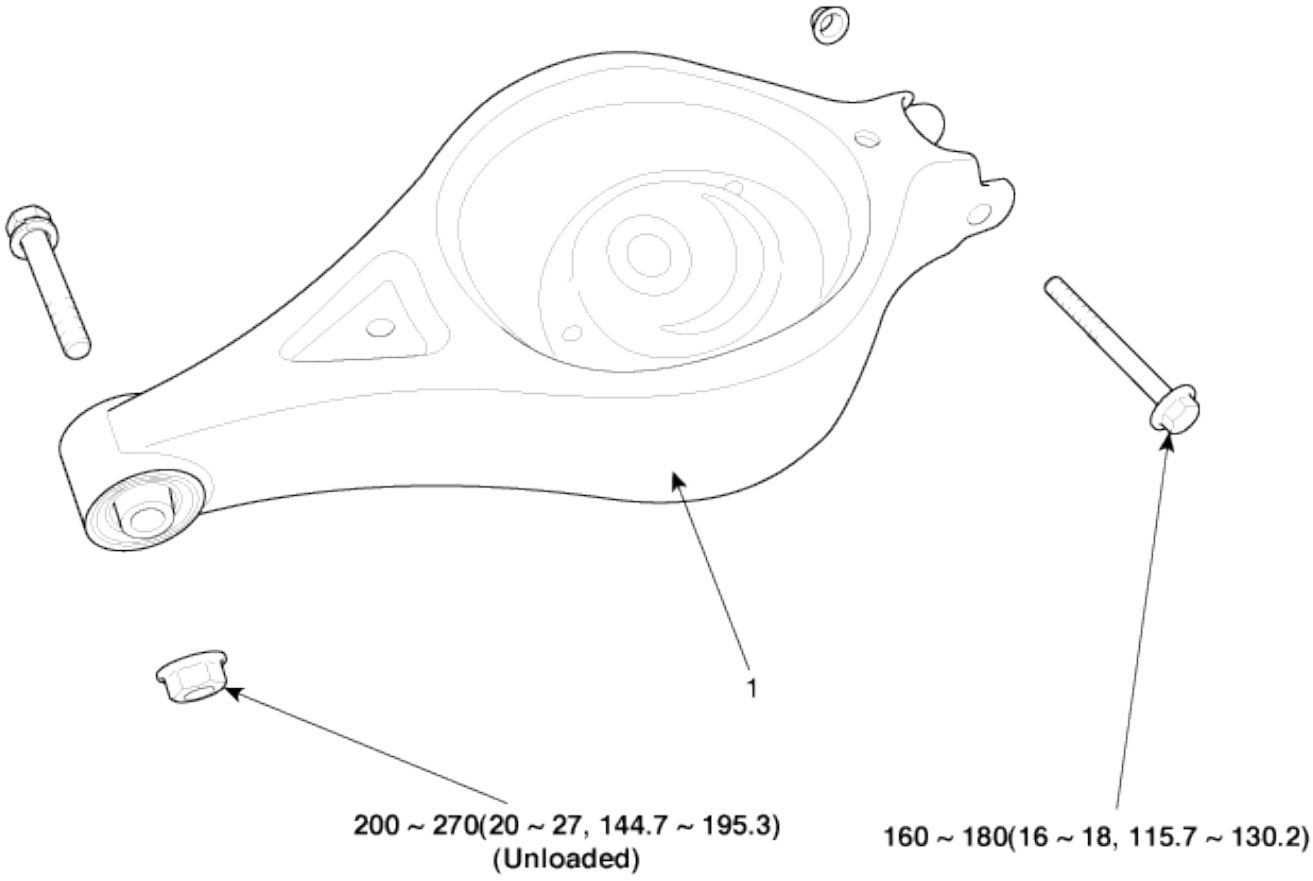
Measure a torque by using the special tool(09532-11600) and torque wrench, at the range of 0.5 ~ 2 rpm after moving the ball joint stud 10 times at room temperature.



   (4) If the rotating torque exceeds the upper limit of standard value, replace the upper arm assembly.
   (5) Even if the rotating torque is below the lower limit of the standard value, the ball joint may be reused unless it has drag and excessive play.

Rear Lower Arm

COMPONENTS

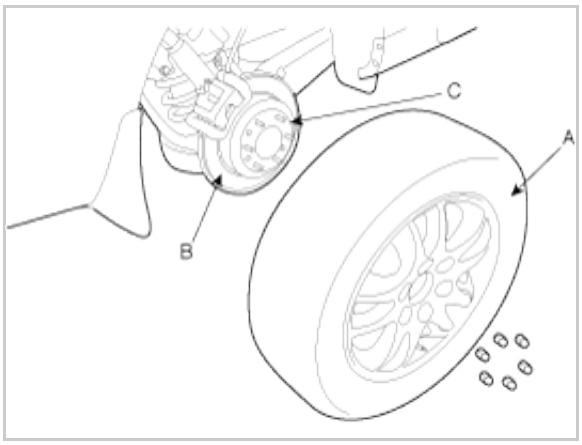


TORQUE : Nm (kgf.m, lb-ft)

1. Rear lower arm

REMOVAL

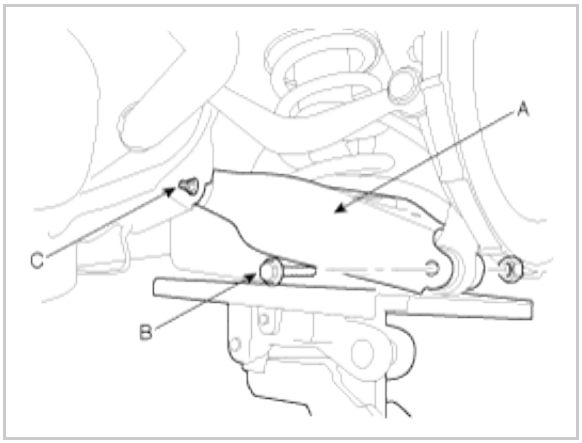
1. Loosen the wheel nuts slightly.
   Raise the rear of the vehicle, and make sure it is securely supported.
2. Remove the rear wheel and tire (A) from rear hub (B).



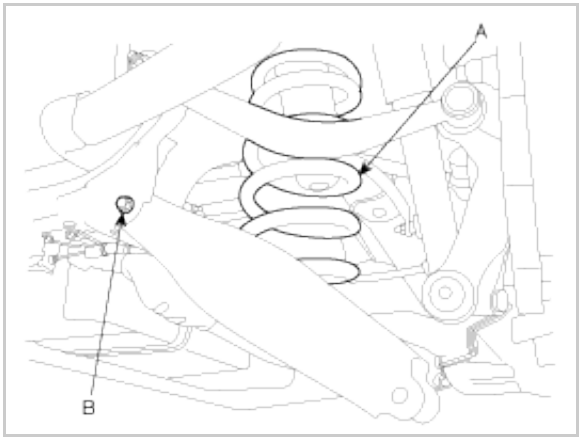
CAUTION

Be careful not to damage the hub bolts (C) when removing the rear wheel and tire (A).

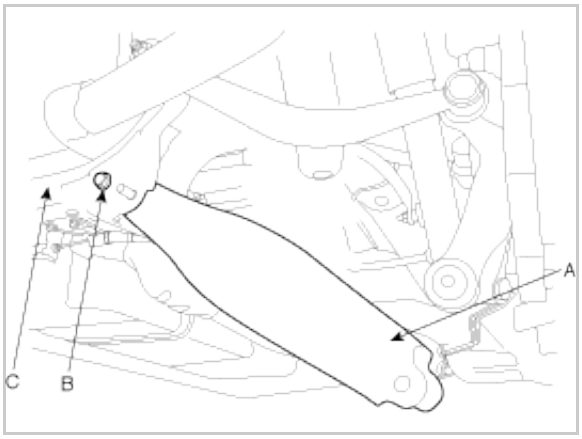
3. Remove the lower arm bolt (B) from the rear knuckle, while supporting the lower arm (A) with a jack as shown in the illustration. Loosen the lower arm bolt (C) from the cross member.



4. Remove the spring (A), the lower seat, and the upper pad.

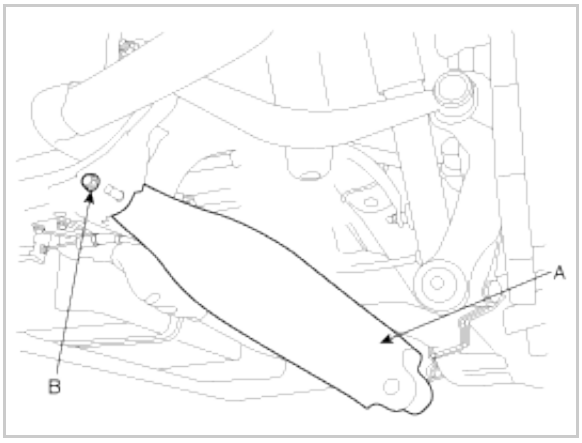


5. Remove the lower arm (A) mounting bolts (B) from the cross member (C).

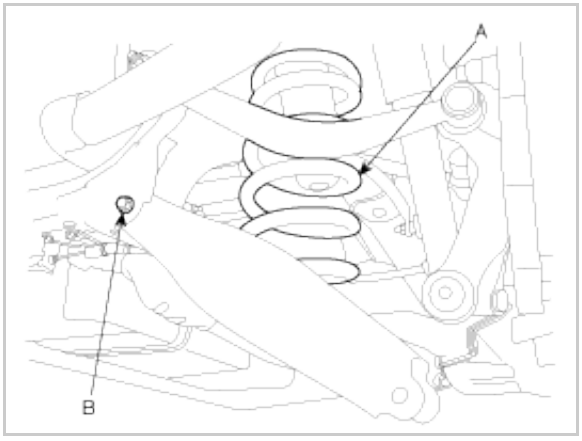


INSTALLATION

1. Pretighten the lower arm (A) mounting bolts (B) to the cross member.

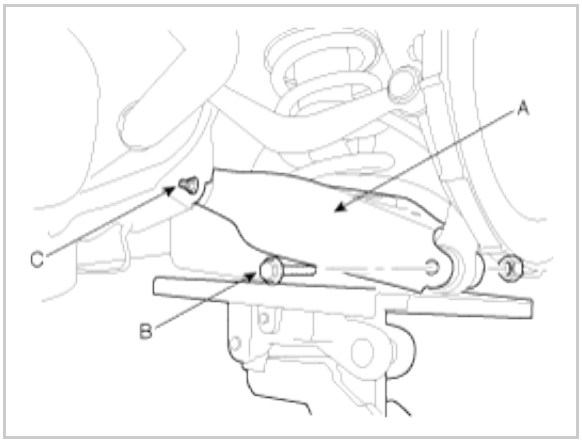


2. Install the spring (A), the lower seat, and the upper pad.



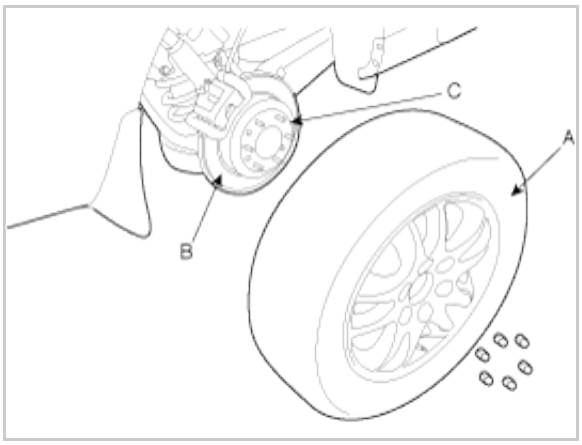
3. Install the lower arm bolt (B) to the rear knuckle and the lower arm bolt (C) to the cross member with a specified torque, while supporting the lower arm (A) with a jack as shown in the illustration.

Tightening torque Nm (kgf.m, lb-ft) :
Bokt (B) : 120 ~ 160 (12 ~ 16, 86.8 ~ 115.7)
Bolt (C) : 200 ~ 270 (20 ~ 27, 144.7 ~ 195.3)



4. Install the wheel and the tire (A) to the rear hub (B).

Tightening torque Nm (kgf.m, lb-ft) :
90 ~ 110 (9 ~ 11, 65.1 ~ 79.5)



CAUTION

Be careful not to damage the hub bolts (C) when installing the rear wheel and tire (A).

INSPECTION

Rear lower arm

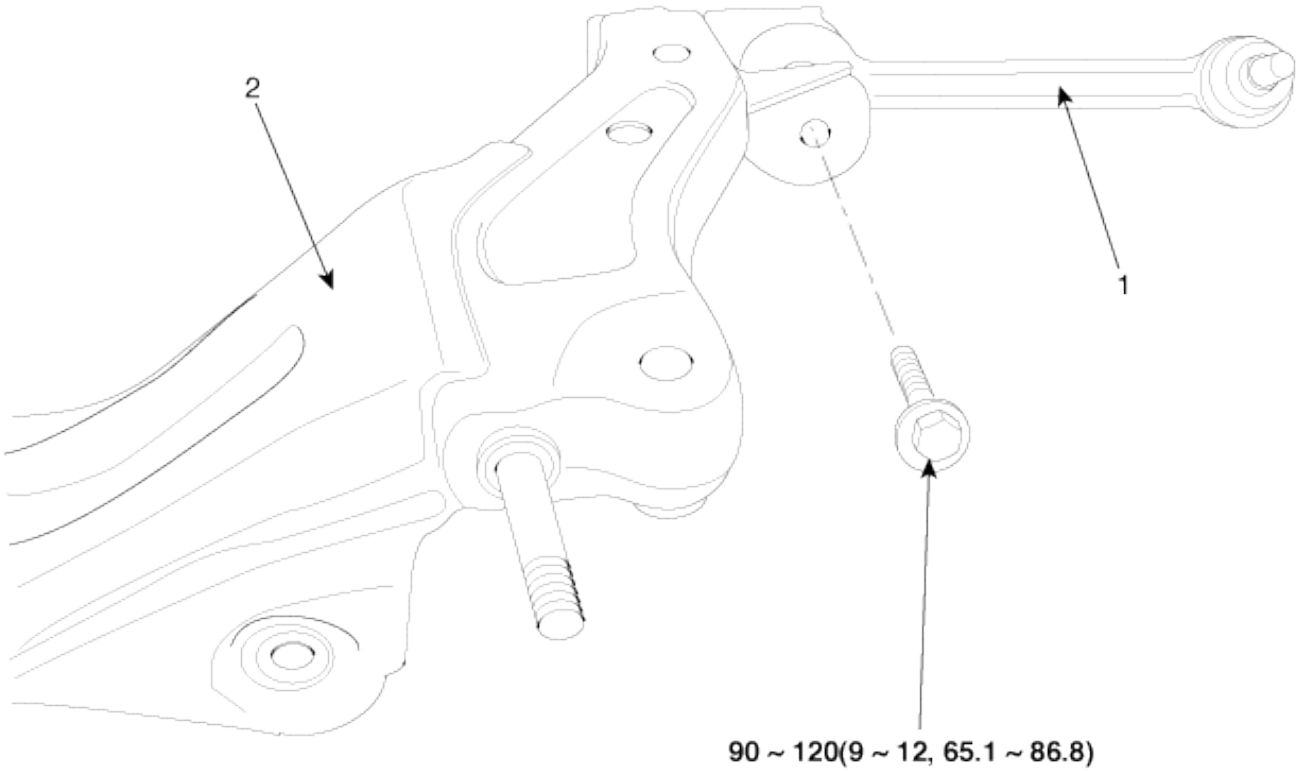
1. Check the bushing for wear and deterioration.
2. Check the center arm for bending or breakage.
3. Check the bolts for damage.

Spring

1. Check the spring for distortion, aging or damage.
2. Check the spring upper pad for aging or damage.

Rear Assist Arm

COMPONENTS

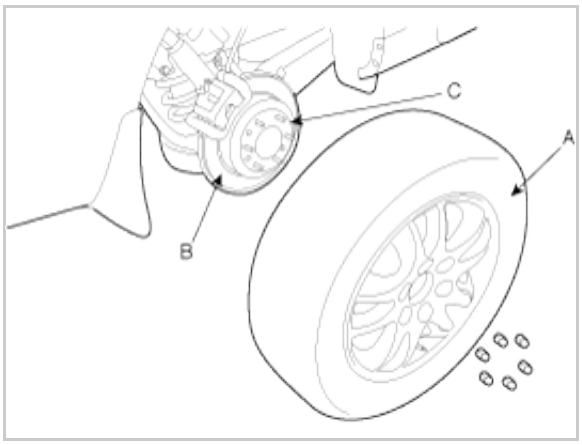


TORQUE : Nm (kgf.m, lb-ft)

1. Rear assist arm
2. Rear cross member

REMOVAL

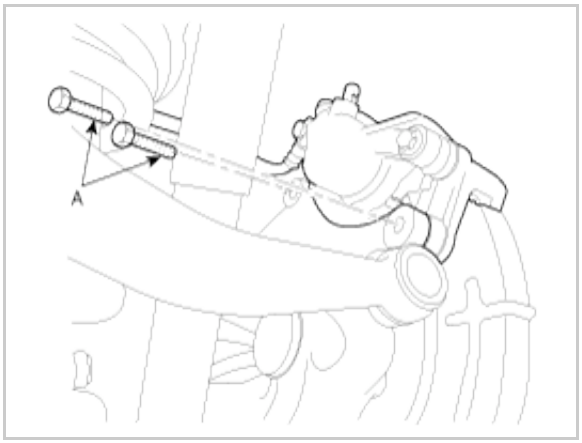
1. Loosen the wheel nuts slightly. Raise the rear of the vehicle, and make sure it is securely supported.
2. Remove the rear wheel and tire (A) from rear hub (B).

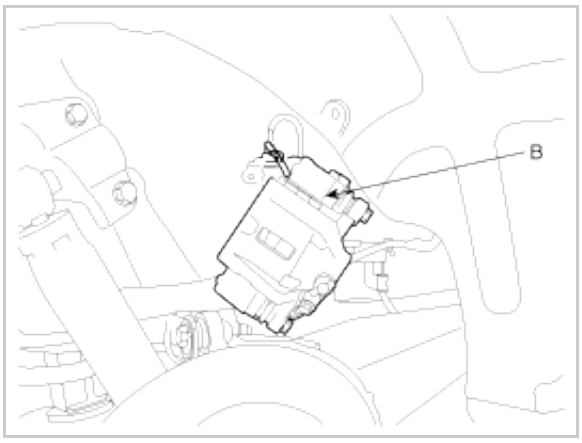


CAUTION

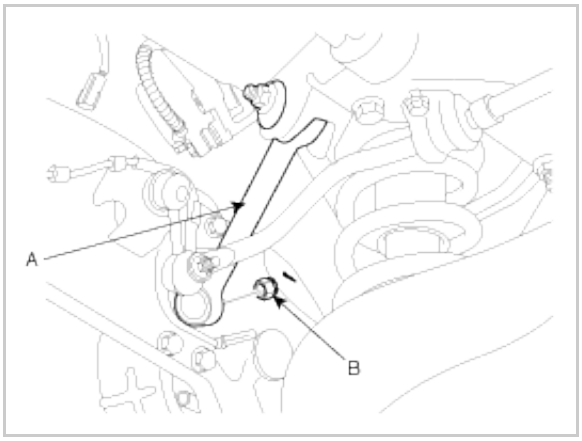
Be careful not to damage the hub bolts (C) when removing the rear wheel and tire (A).

3. Remove the brake caliper mounting bolts (A), and then place the brake caliper assembly (B) with wire as shown in the illustration.

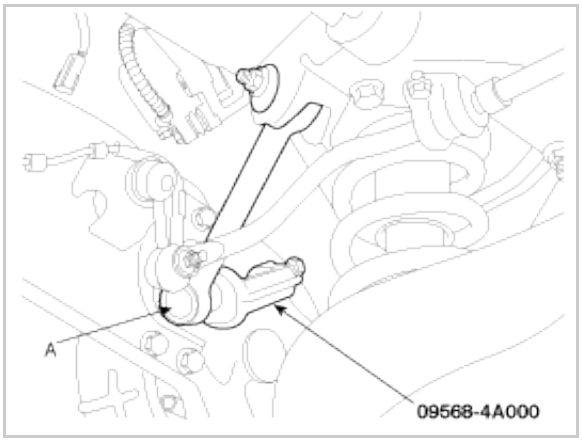




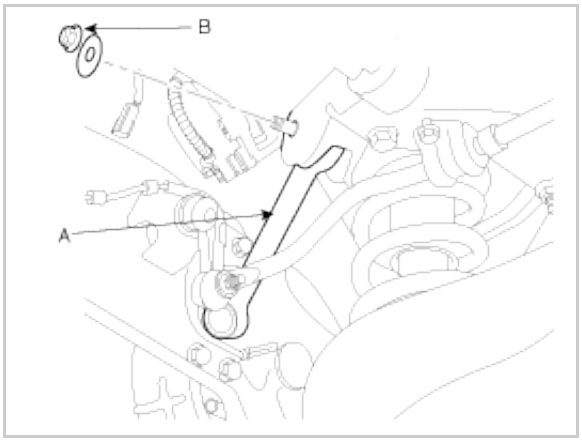
4. Remove the rear assist arm (A) ball joint self-locking nut (B) and the cotter pin.



5. Remove the rear assist arm ball joint (A) by using the special tool(09568-4A000).



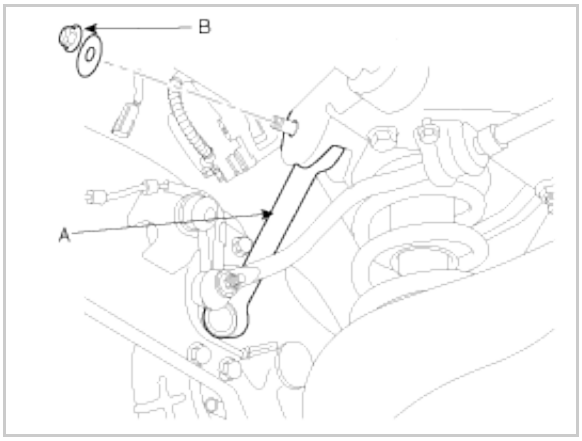
6. Remove the rear assist arm (A) mounting nut (B) from the cross member.



INSTALLATION

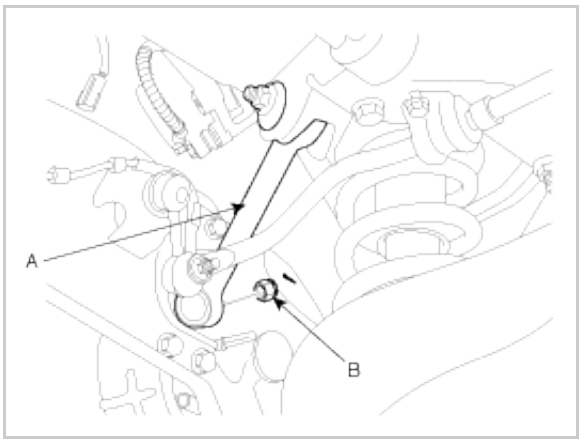
1. Install the rear assist arm (A) mounting nut (B) to the cross member.

Tightening torque Nm (kgf.m, lb-ft) :
90 ~ 120 (9 ~ 12, 65.1 ~ 86.8)



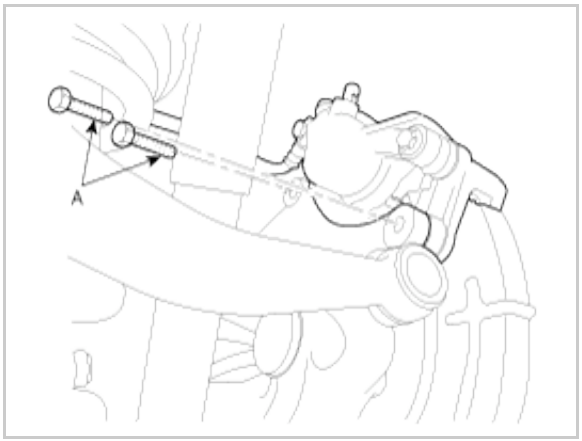
2. Install the rear assist arm (A) ball joint self-locking nut (B) and the cotter pin.

Tightening torque Nm (kgf.m, lb-ft) :
160 ~ 180 (16 ~ 18, 115.7 ~ 130.2)



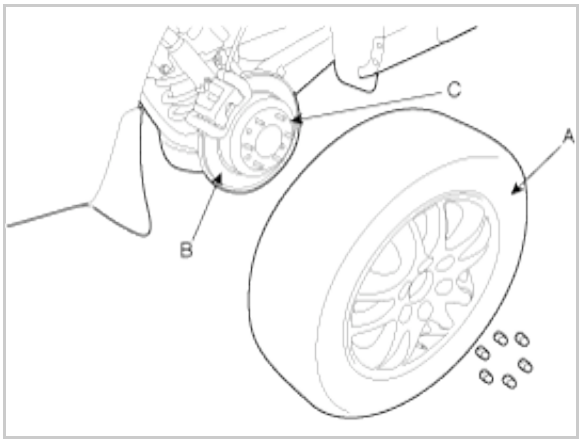
3. Install the brake caliper mounting bolts (A).

Tightening torque Nm (kgf.m, lb-ft) :
50 ~ 60 (5.0 ~ 6.0, 36.2 ~ 43.4)



4. Install the wheel and the tire (A) to the rear hub (B).

Tightening torque Nm (kgf.m, lb-ft) :
90 ~ 110 (9 ~ 11, 65.1 ~ 79.5)



CAUTION

Be careful not to damage the hub bolts (C) when installing the rear wheel and tire (A).

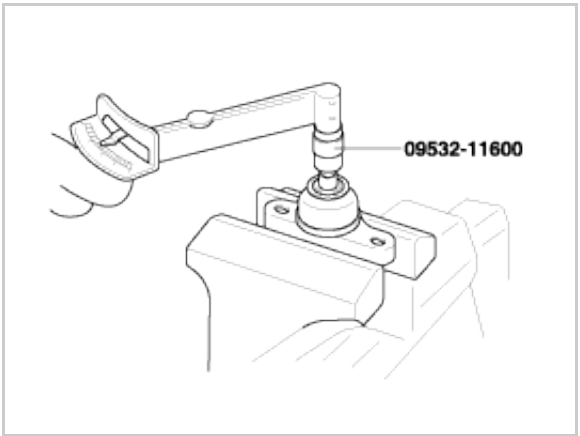
INSPECTION

1. Check the bushing for wear and deterioration.
2. Check the upper arm for bending or breakage.
3. Check the ball joint for rotating torque.
   (1) If there is a crack in the dust cover, replace it and add grease.
   (2) Move the stabilizer link ball joint stud several times in a circular motion.
   (3) Mount the self-locking nut on the ball joint, and then measure the ball joint rotating torque.

Specified torque :
1 ~ 3 Nm (10 ~ 30 kgf.cm, 0.72 ~ 2.17 lb-ft)

NOTICE

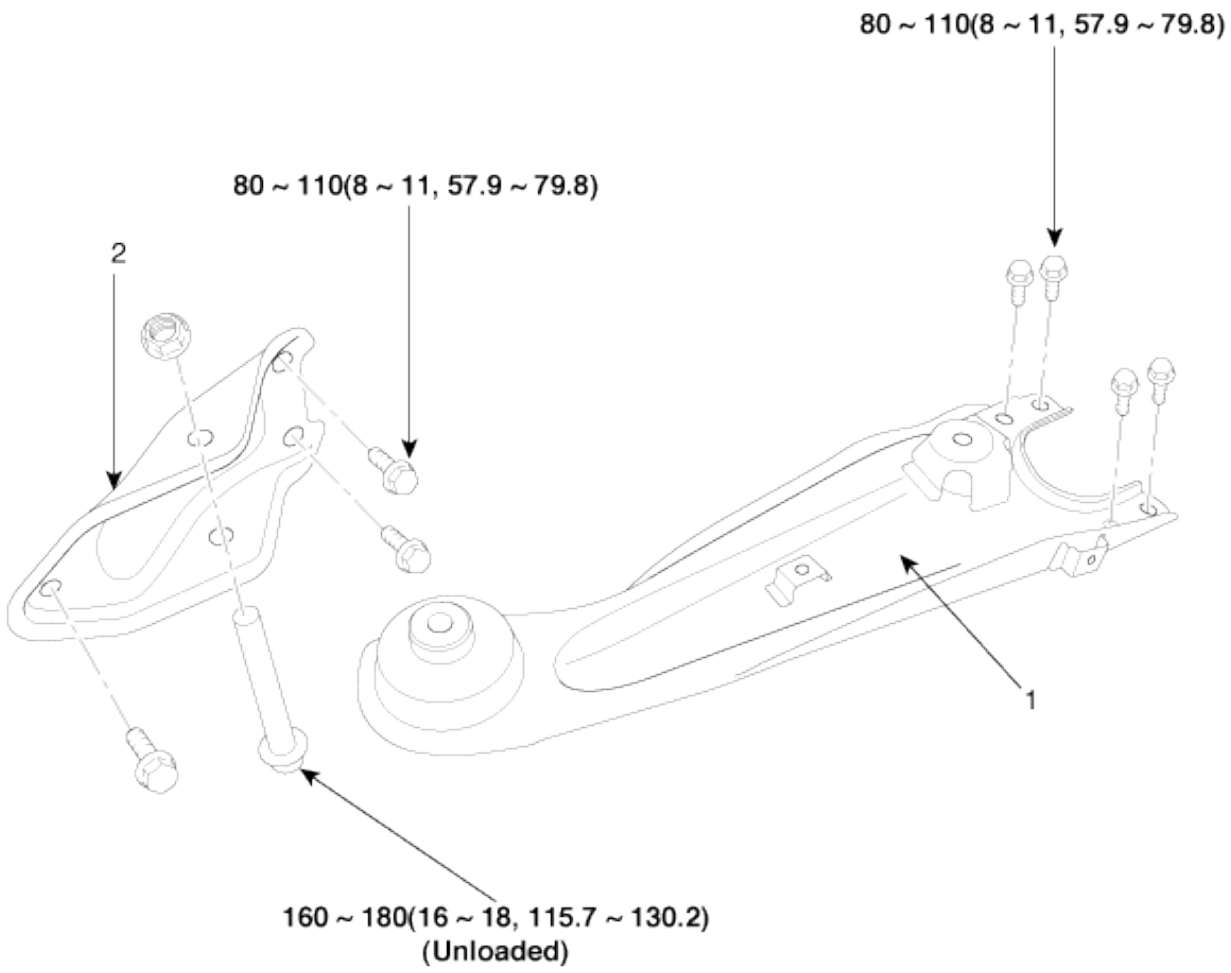
Measure a torque by using the special tool(09532-11600) and torque wrench, at the range of 0.5-2 rpm after moving the ball joint stud 10 times at room temperature.



   (4) If the rotating torque exceeds the upper limit of standard value, replace the upper arm assembly.
   (5) Even if the rotating torque is below the lower limit of the standard value, the ball joint may be reused unless it has drag and excessive play.

Trailing Arm

COMPONENTS

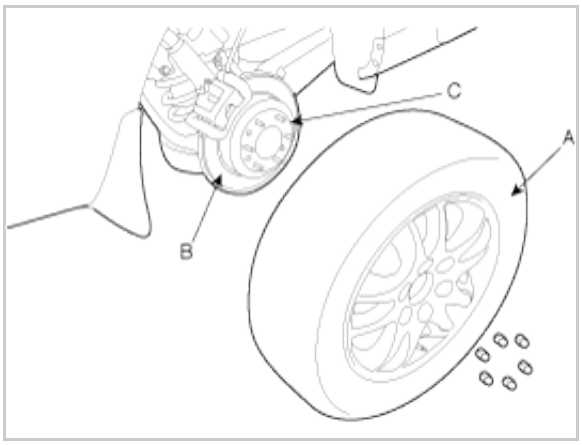


TORQUE : Nm (kgf.m, lb-ft)

1. Trailing arm
2. Bracket

REMOVAL

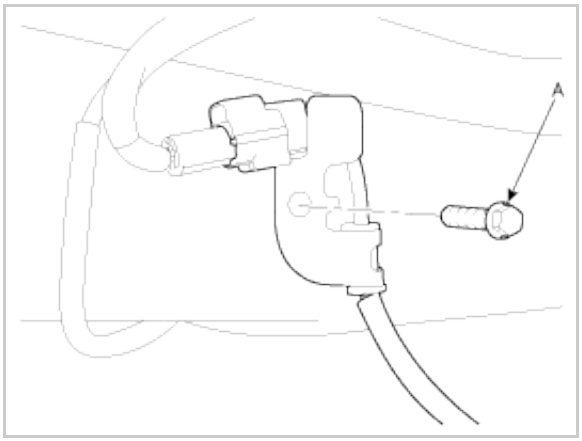
1. Loosen the wheel nuts slightly. Raise the rear of the vehicle, and make sure it is securely supported.
2. Remove the rear wheel and tire (A) from rear hub (B).



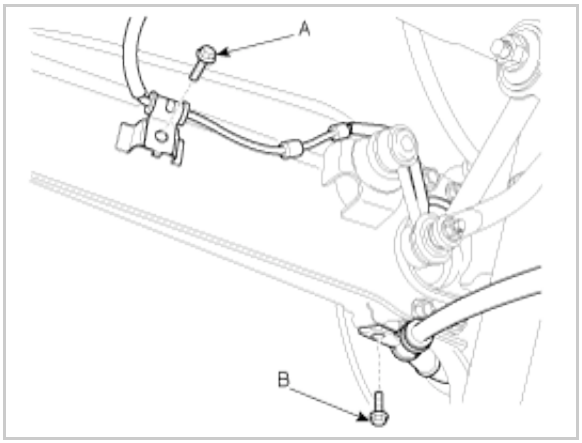
CAUTION

Be careful not to damage the hub bolts (C) when removing the rear wheel and tire (A).

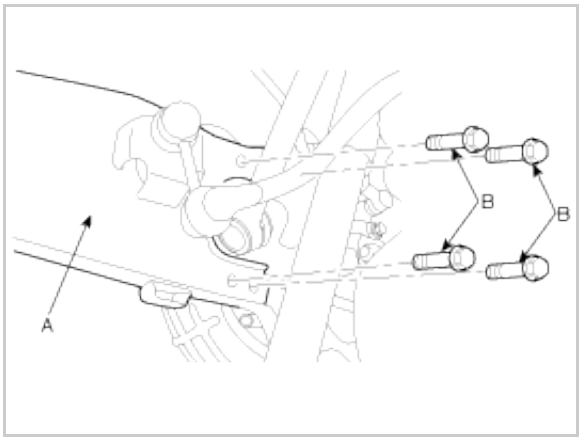
3. Remove the wheel speed sensor wire's bracket bolt (A) from the body and the connector.



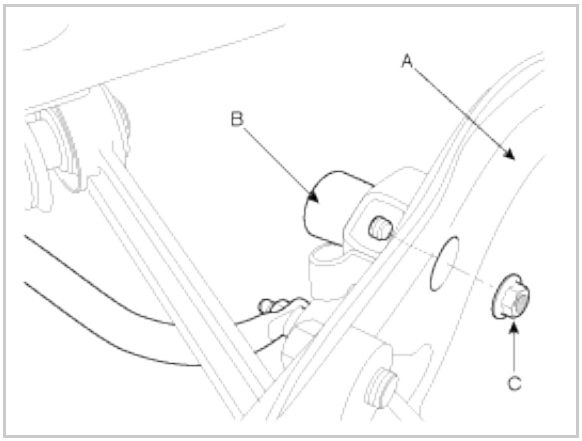
4. Remove the wheel speed sensor wire's bracket bolt (A) and the parking brake wire's bracket bolt (B).



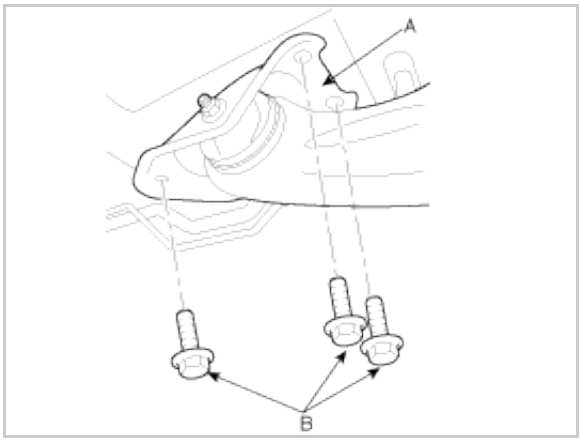
5. Remove the trailing arm (A) mounting nuts (B) from the knuckle.



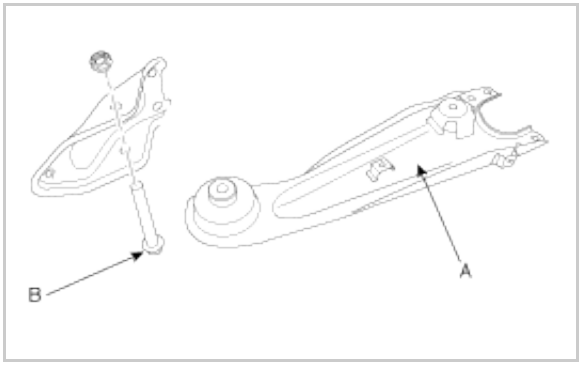
6. Remove the stabilizer link (B) nut (C) from the trailing arm (A).



7. Remove the trailing arm bracket (A) mounting bolts (B) from the body.



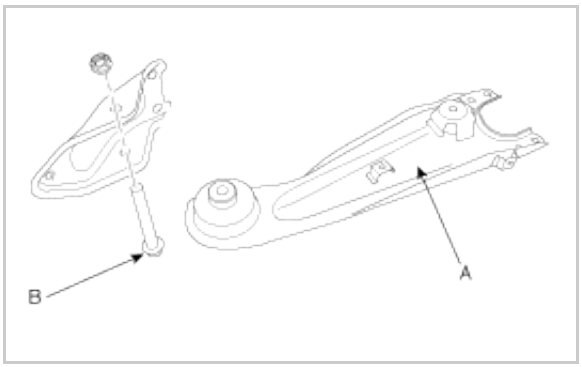
8. Remove the connecting bolt (B) between the trailing arm (A) and the bracket.



INSTALLATION

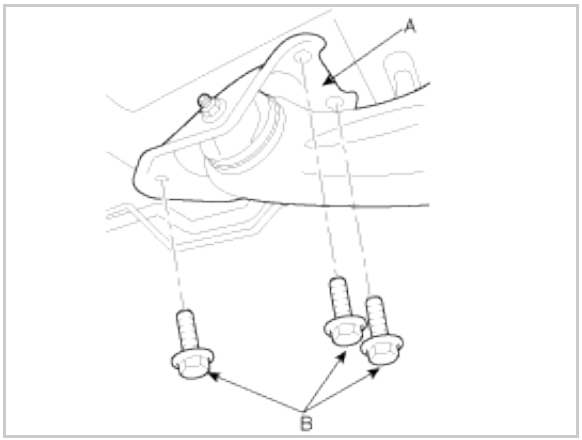
1. Install the connecting bolt (B) between the trailing arm (A) and the bracket.

Tightening torque Nm (kgf.m, lb-ft) :
160 ~ 180 (16 ~ 18, 115.7 ~ 130.2)



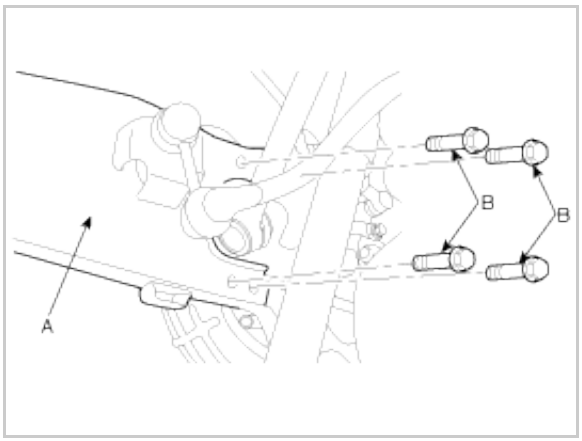
2. Install the trailing arm bracket (A) mounting bolts (B) from the body.

Tightening torque Nm (kgf.m, lb-ft) :
80 ~ 110 (8 ~ 11, 57.9 ~ 79.5)



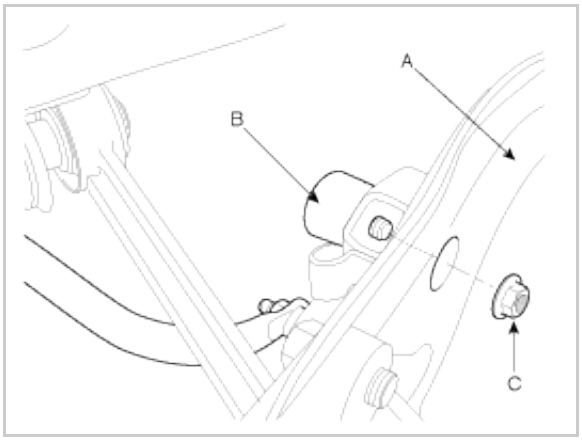
3. Install the trailing arm (A) mounting nuts (B) from the knuckle.

Tightening torque Nm (kgf.m, lb-ft) :
80 ~ 100 (8 ~ 10, 57.9 ~ 72.3)



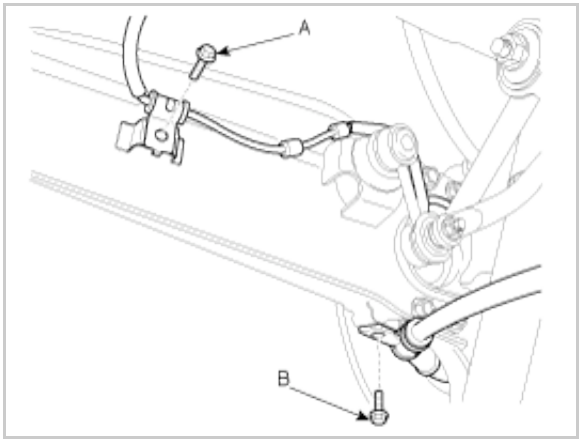
4. Install the stabilizer link (B) nut (C) to the trailing arm (A).

Tightening torque Nm (kgf.m, lb-ft) :
50 ~ 65 (5.0 ~ 6.5, 36.2 ~ 47.0)



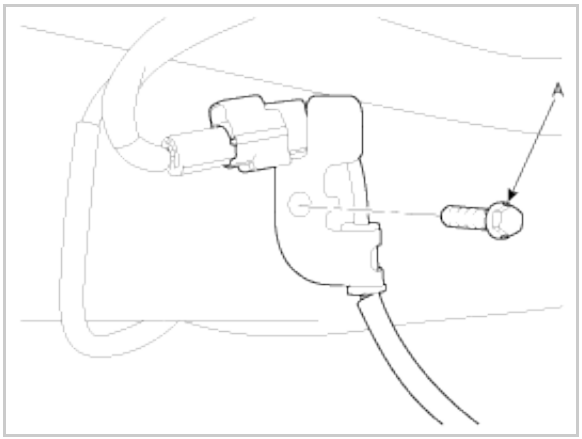
5. Remove the wheel speed sensor wire's bracket bolt (A) and the parking brake wire's bracket bolt (B).

Tightening torque Nm (kgf.m, lb-ft) :
7 ~ 11 (0.7 ~ 1.1, 5.1 ~ 8.0)



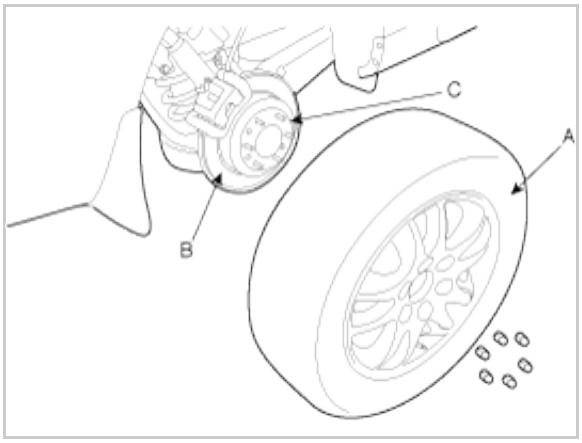
6. Install the wheel speed sensor wire's bracket bolt (A) from the body and the connector.

Tightening torque Nm (kgf.m, lb-ft) :
7 ~ 11 (0.7 ~ 1.1, 5.1 ~ 8.0)



7. Install the wheel and the tire (A) to the rear hub (B).

Tightening torque Nm (kgf.m, lb-ft) :
90 ~ 110 (9 ~ 11, 65.1 ~ 79.5)



CAUTION

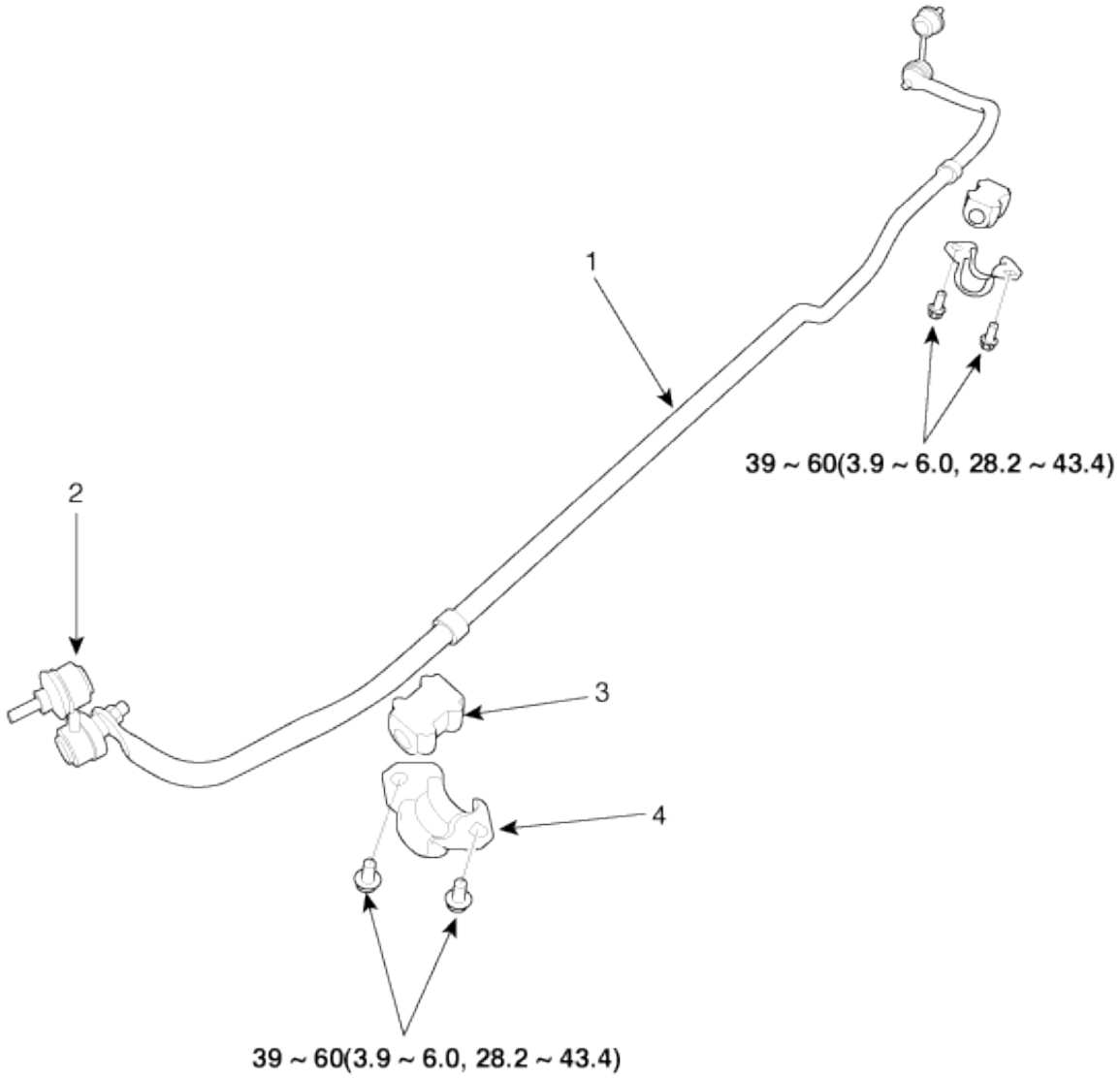
Be careful not to damage the hub bolts (C) when installing the rear wheel and tire (A).

INSPECTION

1. Check the bushing for wear and deterioration.
2. Check the trailing arm for bending or breakage.
3. Check all the bolts for damage.

Rear Stabilizer Bar

COMPONENTS

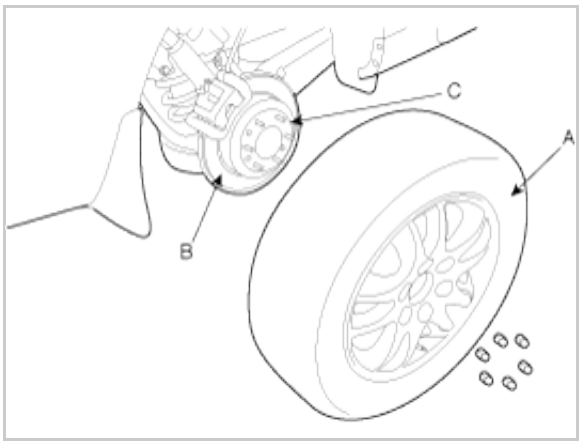


TORQUE : Nm (kgf.m, lb-ft)

1. Rear stabilizer bar
2. Rear stabilizer link
3. Bushing
4. Bracket

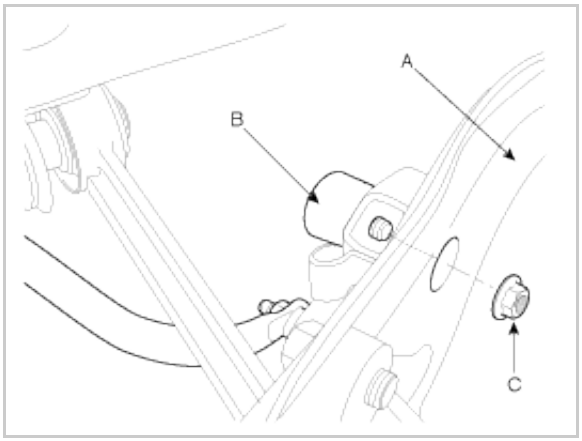
REMOVAL

1. Loosen the wheel nuts slightly.
   Raise the rear of the vehicle, and make sure it is securely supported.
2. Remove the rear wheel and tire (A) from rear hub (B).

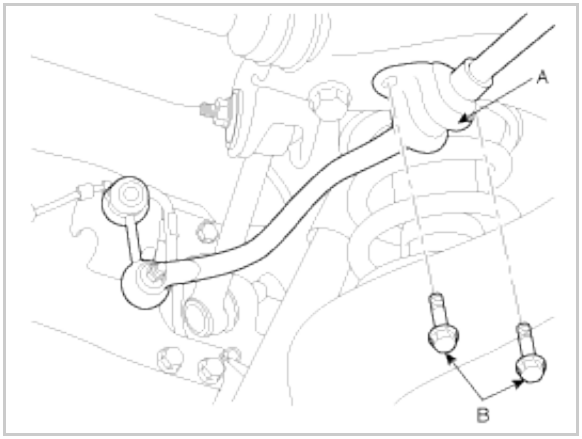


> **CAUTION**
>
> Be careful not to damage the hub bolts (C) when removing the rear wheel and tire (A).

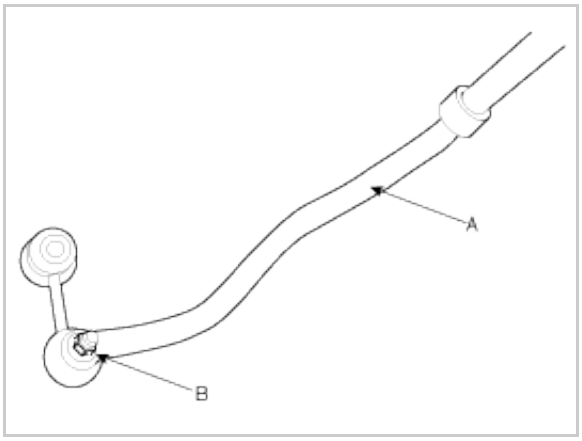
3. Remove the left/right nuts (C) of the rear stabilizer links (B) from the trailing arm (A).



4. Remove the left/right mounting nuts (B) of the rear stabilizer bar brackets (A).



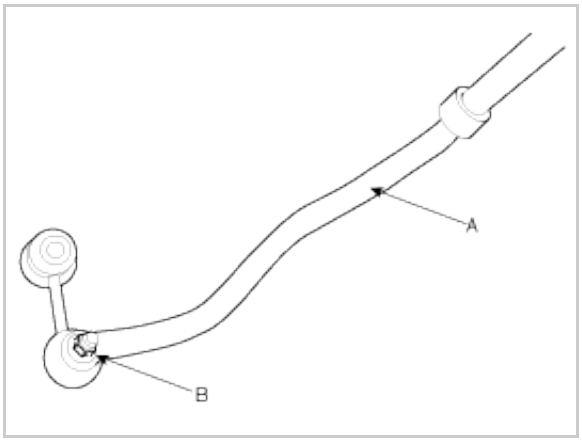
5. Remove the rear stabilizer link (A) nut (B) from the stabilizer bar assembly.



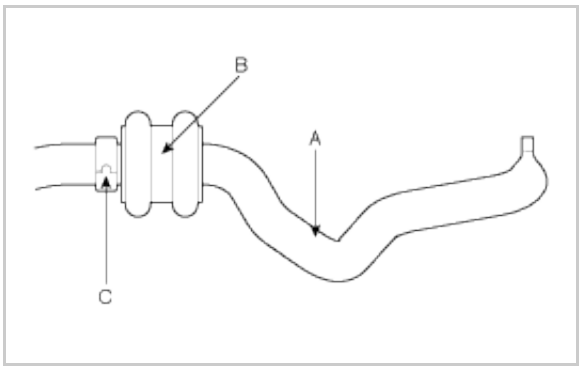
INSTALLATION

1. Install the rear stabilizer link (A) nut (B) to the stabilizer bar assembly.

Tightening torque Nm (kgf.m, lb-ft) :
50 ~ 65 (5.0 ~ 6.5, 36.2 ~ 47.0)



2. Install the bushing (B) on the stabilizer bar (A).

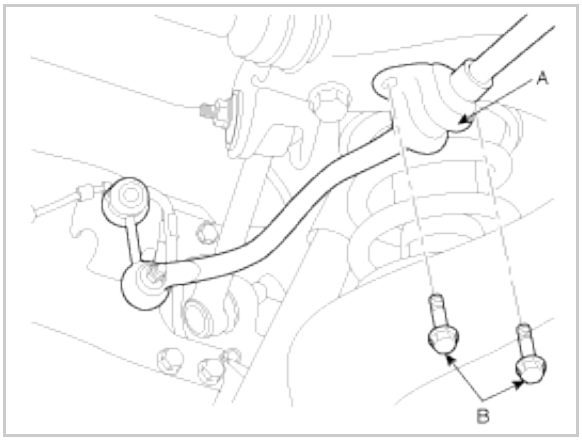


NOTICE

Bring clamp (C) of stabilizer bar (A) into contact with bushing (B).

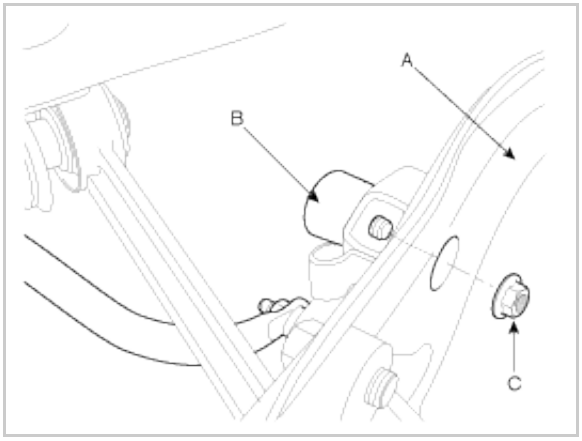
3. One side bracket should be temporarily tightened, and then install the bushing on the opposite side.
4. Install the stabilizer bracket (A) bolt (B) to the cross member.

Tightening torque Nm (kgf.m, lb-ft) :
39 ~ 60 (3.9 ~ 6.0, 28.2 ~ 43.4)



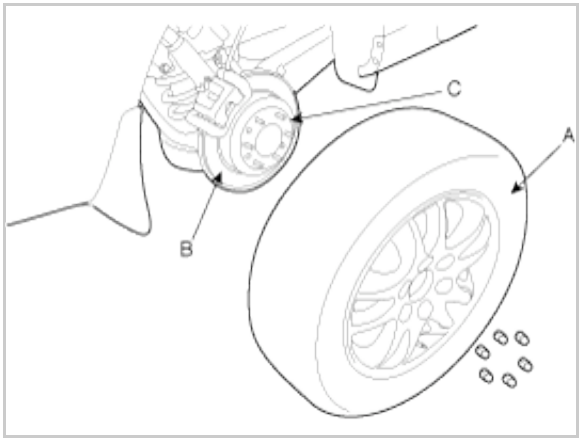
5. Install the stabilizer link (B) nut (C) to the trailing arm (A).

Tightening torque Nm (kgf.m, lb-ft) :
50 ~ 65 (5.0 ~ 6.5, 36.2 ~ 47.0)



6. Repeat step 4 and 5 for the other side.
7. Install the wheel and the tire (A) to the rear hub (B).

Tightening torque Nm (kgf.m, lb-ft) :
90 ~ 110 (9 ~ 11, 65.1 ~ 79.5)



CAUTION

Be careful not to damage the hub bolts (C) when installing the rear wheel and tire (A).

INSPECTION

1. Check the bushing for wear and deterioration.
2. Check the stabilizer bar for bending or breakage.

3. Check the ball joint for rotating torque.

(1) If there is a crack in the dust cover, replace it and add grease.

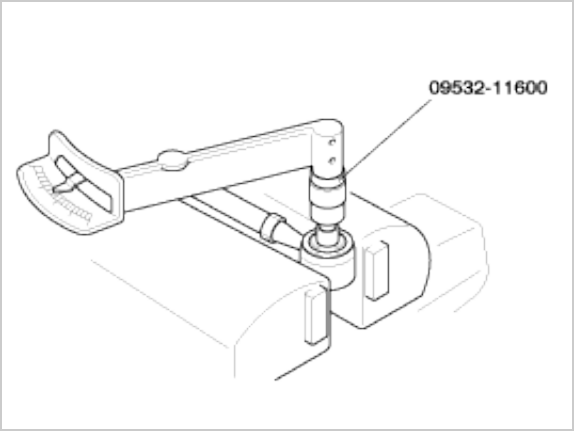
(2) Shake the stabilizer link ball joint stud several times.

(3) Mount the self-locking nut on the ball joint, and then measure the ball joint rotating torque.

Specified torque :
0.5 ~ 2.5 Nm (5 ~ 25 kgf.m, 3.62 ~ 1.81 lb-ft)

NOTICE

Measure torque using the special tool(09532-11600) and torque wrench at the range of 0.5 - 2 rpm after moving the ball joint stud 10 times at room temperature.



(4) If the rotating torque exceeds the upper limit of standard value, replace the upper arm assembly.

(5) Even if the rotating torque is below the lower limit of the standard value, the ball joint may be reused unless it has drag and excessive play.

Tires / Wheels

Tires

TIRE WEAR

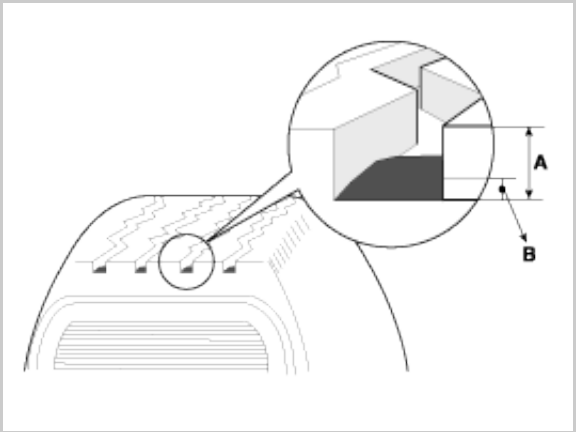
1. Measure the tread depth of the tires.

Tread depth [limit] : 1.6 mm (0.063 in)

2. If the remaining tread(A) depth is less than the limit, replace the tire.

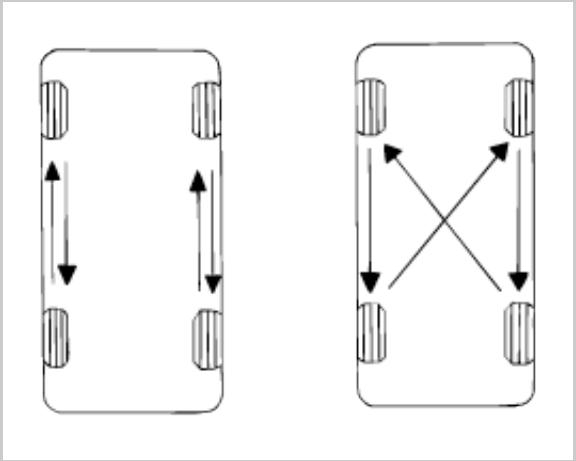
NOTICE

When the tread depth of the tires is less than 1.6 mm (0.063 in), the wear indicators(B) will appear.



TIRE ROTATION

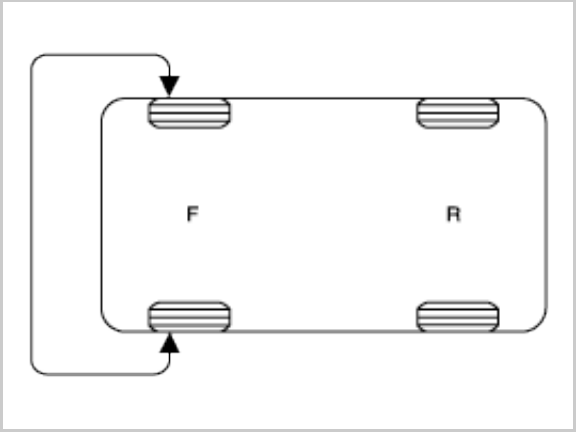
Rotate the tires in the pattern illustrated.



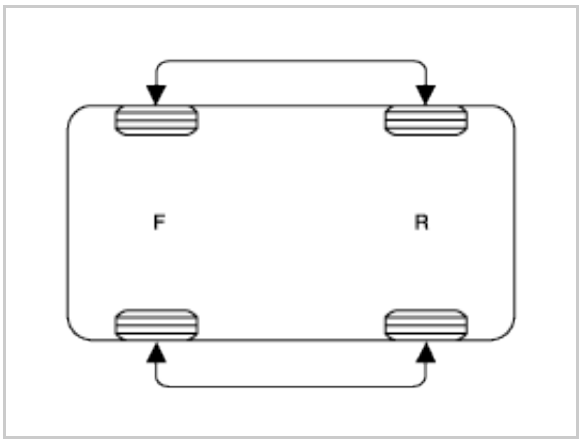
CHECKING FOR PULL AND WANDER

If the steering pulls to one side, rotate the tires according to the following wheel rotation procedure.

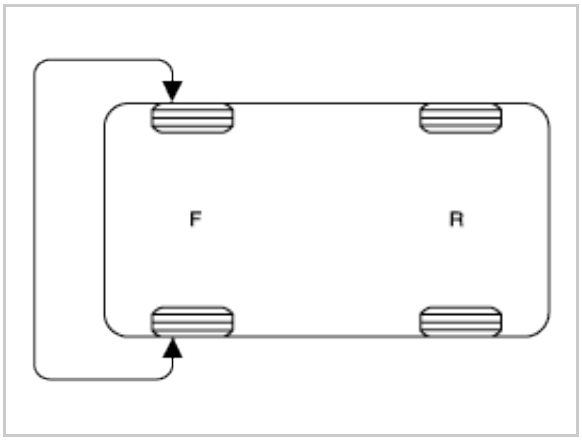
1. Rotate the front right and front left tires, and perform a road test in order to confirm vehicle stability.



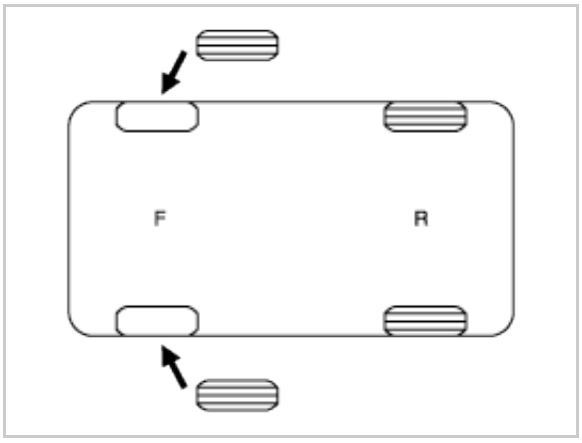
2. If the steering pulls to the opposite side, rotate the front and rear tires, and perform a road test again.



3. If the steering continues to pull to one side, rotate the front right and left tires again, and perform a road test.



4. If the steering continues to pull to the opposite side, replace the front wheels with new ones.



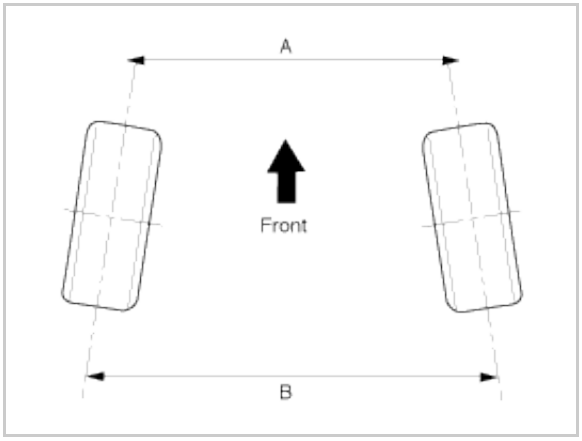
Wheel

WHEEL ALIGNMENT

When using commercially available computerized four wheel alignment equipment (caster, camber, toe) to inspect the front wheel alignment, always position the car 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 wheels and tires face straight ahead and the tires are inflated to the specified pressure.

TOE

Toe is a measurement of how much the front of the wheels are turned in or out from the straight-ahead position.



Item	Description
A - B < 0	Positive (+) toe (toe in)
A - B > 0	Negative (-) toe (toe out)

When the wheels are turned in toward the front of the vehicle, toe is positive (+) (toe in). When the wheels are turned out toward the front of the vehicle, toe is negative(-) (toe out). Toe is measured in degrees, from side to side, and totaled.

[FRONT]

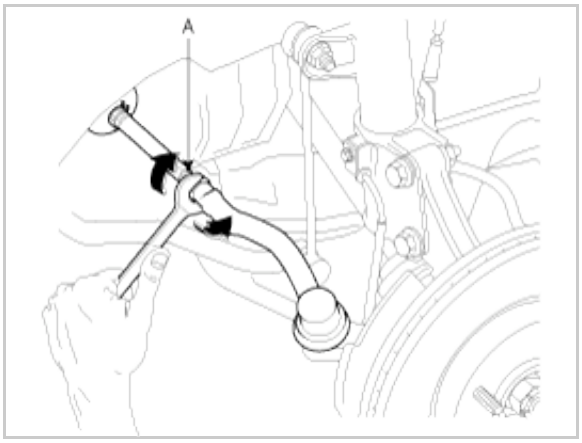
Toe-in(B-A or angle a+b) is adjusted by turning the tie rod turnbuckles. Toe-in on the left front wheel can be reduced by turning the tie rod toward the rear of the car. Toe- in change is adjusted by turning the tie rods for the right and left heels simultaneously at the same amount as follows.

Standard value :
Toe-in (B-A) mm (in) : 0 ± 2 (0 ± 0.0787)

NOTICE

a. Toe-in adjustment should be made by turning the right and left tie rods at the same amount.
b. When adjusting toe-in, loosen the outer bellows clip to prevent twisting the bellows.
c. After the adjustment, tighten the tie rod end lock nuts firmly and reinstall the bellows clip.
d. Adjust each toe-in to be the range of ±1mm.

Tie rod(A) Specified torque Nm (kgf.m, lb-ft) :
70 ~ 80 (7 ~ 8, 50.6 ~ 57.8)



[REAR]

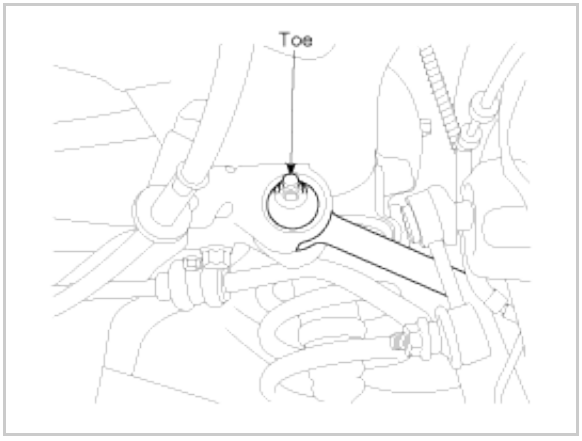
Standard value :
Toe-in (B-A) mm (in) : 2.6 ± 2 (0.1024 ± 0.0787)

Adjust the toe-in by turning the cambolt of the assist arm.

Left cambolt : Clockwise → toe-in
Right cambolt : Clockwise → toe-out
The variation of toe by a rotation of the cambolt :
About 3.2 mm (0.126 in)

CAUTION

a. Each toe should be within ±1 mm (± 0.039 in).
If the difference between right and left is not within +2mm (0.079 in), repeat adjustment.
b. After adjusting the cambolt, tighten the nut to the specified torque.

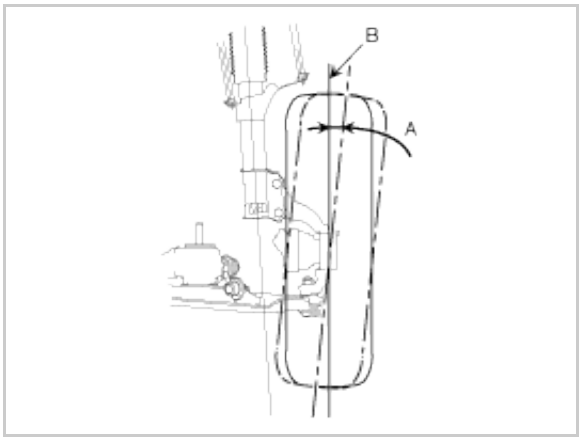


Specified torque
90 ~ 120 Nm (9 ~ 12 kgf.m, 65.1 ~ 86.8 lb-ft)

CAMBER

[FRONT]

Camber is the inward or outward tilting of the wheels at the top.



Item	Description
A	Positive camber angle
B	True vertical

When the wheel tilts out at the top, then the camber is positive (+).
When the wheel tilts in at the top, then the camber is negative(-).

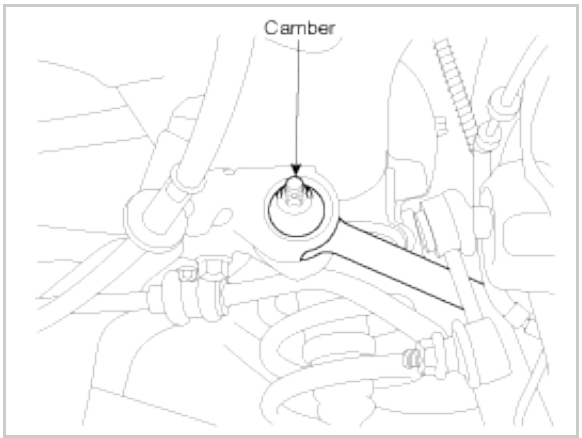
Standard value : 0° ± 30´
Difference between right and left angle is within 0° 30´

NOTICE

Camber is pre-set at the factory and doesn't need to be adjusted. If the camber is not within the standard value, replace the bent or damaged parts.

[REAR]

Standard value : -6´ ± 30´
Difference between right and left angle is within 0° 30´



Adjust the camber by turning the cambolt of the rear upper arm.

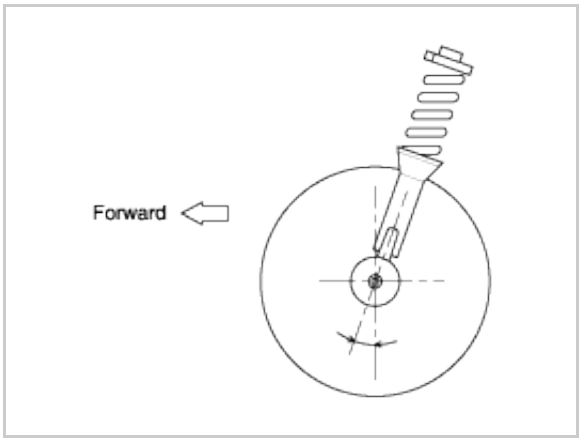
Left cambolt : Clockwise → camber(-)
Right cambolt : Clockwise →camber(+)
The variation of camber by a rotation of the cambolt :
About 0°8´35´´

CASTER

Caster is the tilting of the strut axis either forward or backward from vertical. A backward tilt is positive (+) and a forward tilt is negative (-).
Caster is pre-set at the factory and doesn't need to be adjusted. If the caster is not within the standard value, replace

the bent or damaged parts.

Caster : 3°46´ ± 30´ (to ground), 4°40´ (to body)



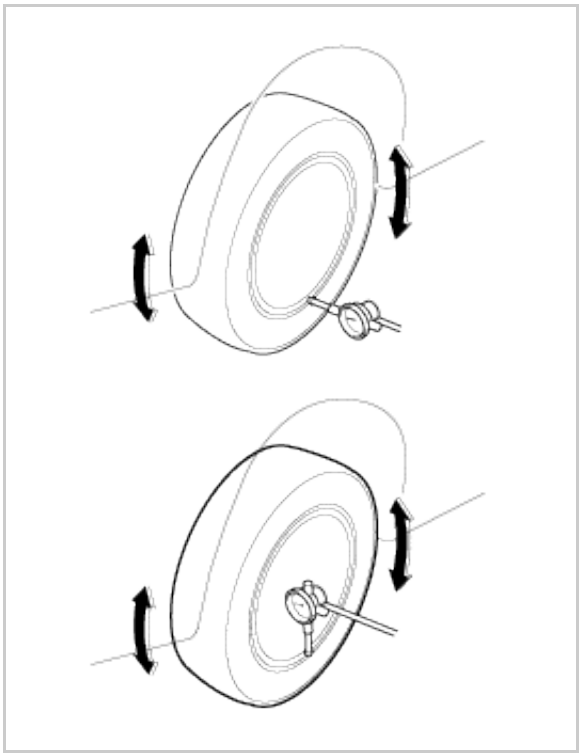
NOTICE

a. The worn loose or damaged parts of the front suspension assembly must be replaced prior to measuring front wheel alignment.
b. Caster are pre-set to the specified value at the factory and don't need to be adjusted.
c. If the caster are not within specifications, replace bent or damaged parts.
d. The difference of left and right wheels about the the caster must be within the range of 0° ± 30´.

WHEEL RUNOUT

1. Jack up the vehicle and support it with jack stands.
2. Measure the wheel runout with a dial indicator as illustrated.
3. Replace the wheel if the wheel runout exceeds the limit.

Limit		Radial	Axial
Runout mm(in)	Steel	0.7(0.028)	1.1(0.043)
	Aluminium	0.3(0.012)	0.3(0.012)



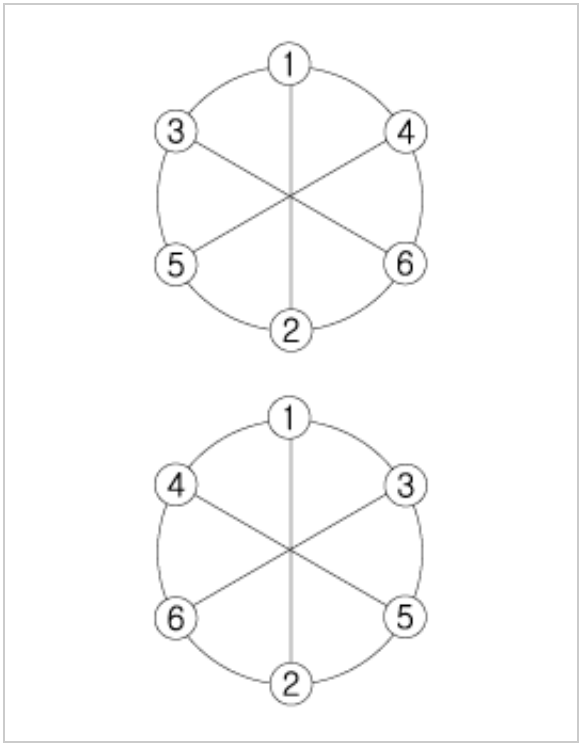
WHEEL NUT TIGHTENING

1. Tightening torque.

Tightening torque Nm (kgf.m, lb-ft) :
90 ~ 110 (9 ~11, 65.1 ~ 79.5)

> **CAUTION**
>
> When using an impact gun, final tightening torque should be checked using a torque wrench.

2. Tightening order.
   Check the torque again after tightening the wheel nuts diagonally.

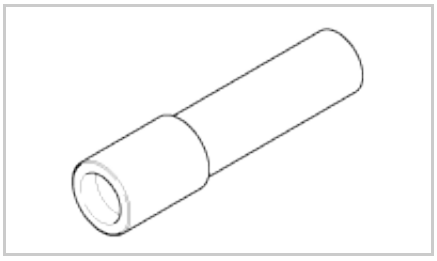
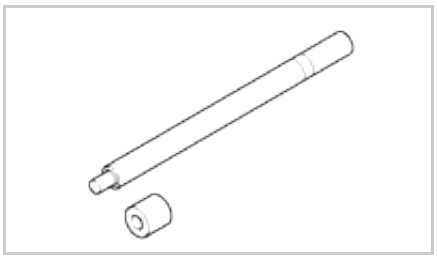
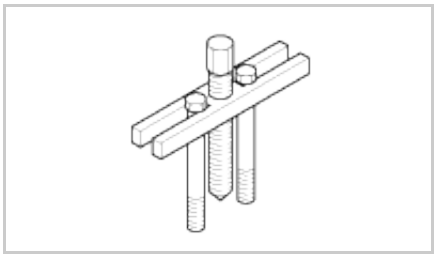
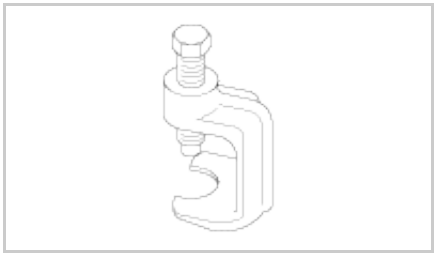
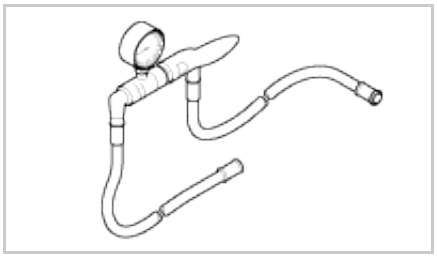
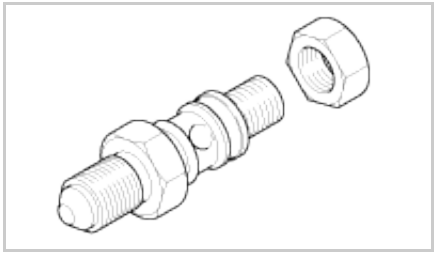


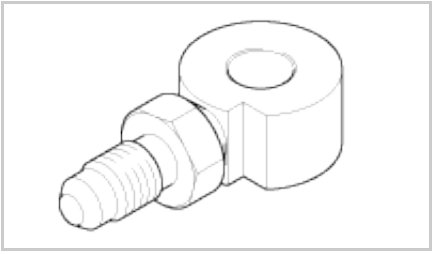
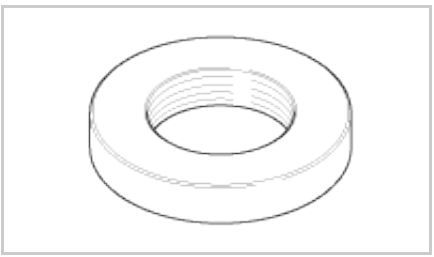
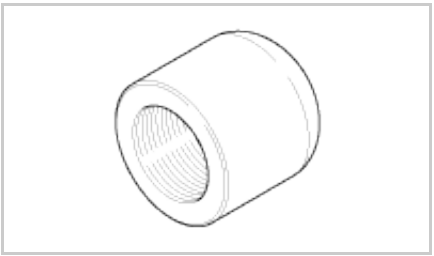
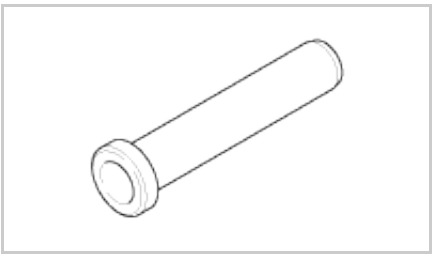
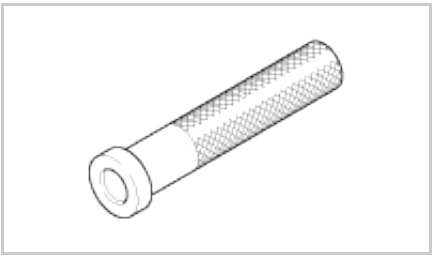
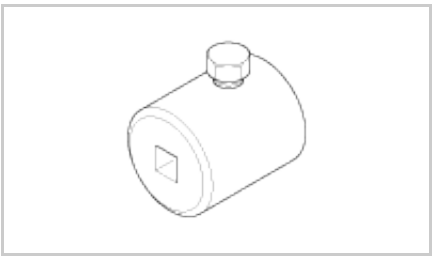
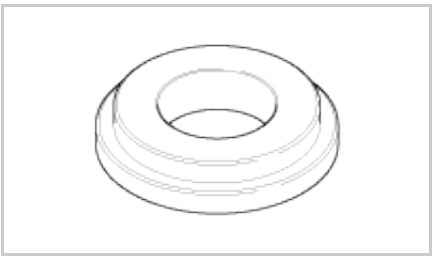
CHAPTER 10:

Steering System

General Information

SPECIAL TOOLS

Tool (Number and Name)	Illustration	Use
09222-32100 Valve stem oil seal installer		Installation of the oil pump oil seal
09555-21000 Bar		Removal and installation of the oil seal (Use with 09573-33100, 09573-33000,09573-21000)
09561-11001 Steering wheel puller		Removal of steering wheel
09568-4A000 Tie rod end puller		Separation of the tie rod end bail joint
09572-21000 Oil pressure gauge		Measurement of the oil pressure (Use with 09572-22100, 09572-21200)
09572-21200 Oil pressure gauge adapter		Measurement of the oil pressure (Use with 09572-21000, 09572-22100)

09572-22100 Oil pressure gauge adapter		Measurement of the oil pressure (Use with 09572-21000, 09572-21200)
09573-21100 Oil seal installer		Installation of the back up washer and oil seal (Use with 09753-21000,09573-33100, 09555-21000)
09573-33100 Oil seal guide		Removal and installation of the oil seal (Use with 09573-21000, 09573-33000,09555-21000)
09432-21600 Bearing installer		Installing the pinion gear bearing
09434-14200 Counter shaft bearing installer		Installing the gear box oil seal
09565-11100 Preload socket		Measuring the pinion shaft preload
09573-21000 Oil seal installer guide		Installation of oil seal

TROUBLESHOOTING

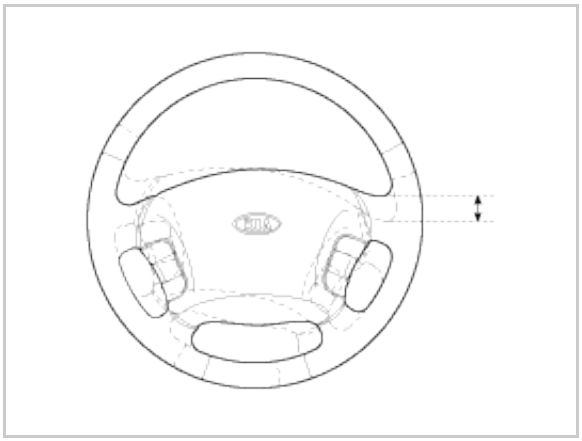
Symptom	Probable cause	Remedy
Excessive play in steering	Loose yoke plug	Retighten
	Loose steering gear mounting bolts	Retighten
	Loose or worn tie rod end	Retighten or replace as necessary
Steering wheel operation is not smooth (Insufficient power assist)	V-belt slippage	Readjust
	Damaged V-belt	Replace
	Low fluid level	Replenish
	Air in the fluid	Bleed air
	Twisted or damaged hoses	Correct the routing or replace
	Insufficient oil pump pressure	Repair or replace the oil pump
	Sticky flow control valve	Replace
	Excessive internal oil pump leakage	Replace the damaged parts
	Excessive oil leaks from rack and pinion in gear box	Replace the damaged parts
	Distorted or damaged gear box or valve body seals	Replace
Steering wheel does not return properly	Excessive turning resistance of tierod end	Replace
	Yoke plug excessively tight	Adjust
	Tie rod and/or ball joint cannot turn smoothly	Replace
	Loose mounting of gear box mounting bracket Worn steering shaft joint and/or	Retighten
	Worn steering shaft joint and/or body grommet	Correct or replace
	Distorted rack	Replace
	Damaged pinion bearing	Replace
	Twisted or damaged hoses	Reposition or replace
	Damaged oil pressure control valve	Replace
	Damaged oil pump input shaft bearing	Replace
Noise	Hissing Noise in Steering Gear There is some noise with all power steering systems. One of the most common is a hissing sound when the steering wheel is turned and the car is not moving. This noise will be most evident when turning the wheel while the brakes are being applied. There is no relationship between this noise and steering performance. Do not replace the valve unless the "hissing" noise becomes extreme. A replaced valve will also make a slight noise, and is not always a solution for the condition.	
Rattling or chucking noise in the rack and pinion	Interference with hoses from vehicle body	Reposition
	Loose gear box bracket	Retighten
	Loose tie rod end and/or ball joint	Retighten
	Worn tie rod and/or ball joint	Replace
Noise in the oil pump	Low fluid level	Replenish
	Air in the fluid	Bleed air
	Loose pump mounting bolts	Retighten

SERVICE ADJUSTMENT PROCEDURE

CHECKING STEERING WHEEL FREE PLAY

1. Start the engine and with the steering wheel in the straight ahead position.
2. Measure the play while turning the steering wheel to the left and right.

Standard value :
Steering wheel free play : 30 mm (1.1 in)



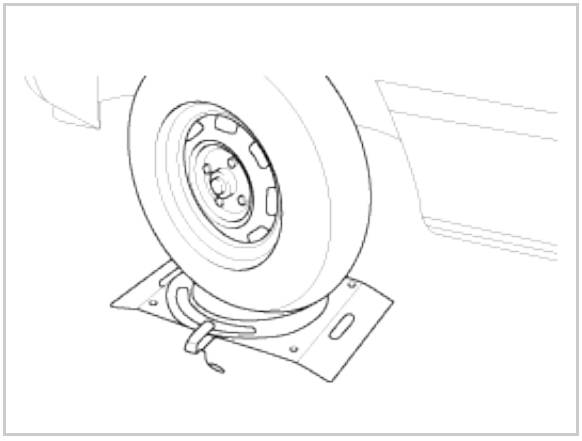
3. If the play exceeds the standard value, inspect the connection between the steering shaft and tie rod ends.

CHECKING STEERING ANGLE

1. Place the front wheel on a turning radius gauge and measure the steering angle.
   Standard value

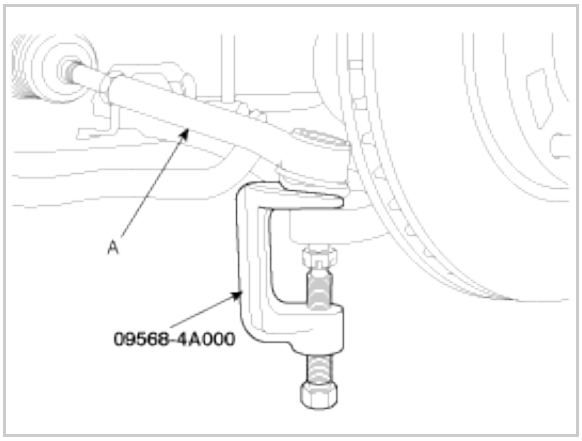
VRS on	Inner	38.64 °
	Outer	31.78 °
VRS off	Inner	41.91 °
	Outer	33.54 °

2. If the measured value is not within the standard value, adjust the toe and inspect again.



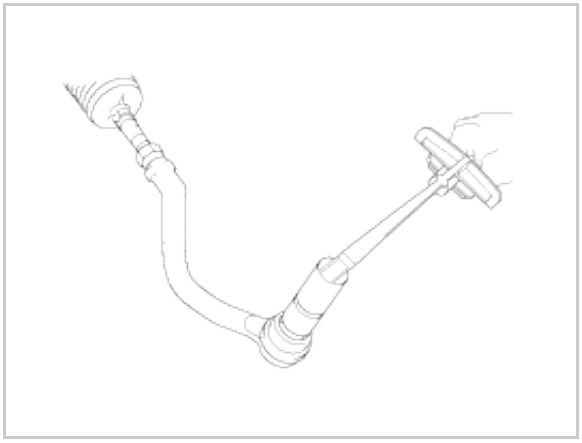
CHECKING THE TIE ROD END BALL JOINT STARTING TORQUE

1. Disconnect tie rod and knuckle with the special tool (09568-4A000).



2. Shake the ball joint stud several times to check for looseness.

Tie rod end ball joint starting torque :
30 kg·cm or less



3. If the starting torque exceeds the upper limit of the standard value, replace the tie rod end.
4. Even if the starting torque is below the lower limit of the standard value, check the play of the ball joint and replace if necessary.

CHECKING STEERING WHEEL RETURN

1. The force required to turn the steering wheel and the wheel return should be the same for both moderate and sharp turns.
2. When the steering wheel is turned 90° and held for a couple of seconds while the vehicle is being driven at 20-30 kph (12-19 mph), the steering wheel should return at least 20° from its central position when it is released.

NOTICE

If the steering wheel is turned very quickly, steering may be momentarily difficult. This is not a malfunction because the oil pump output will be somewhat decreased.



CHECKING POWER STEERING BELT TENSION

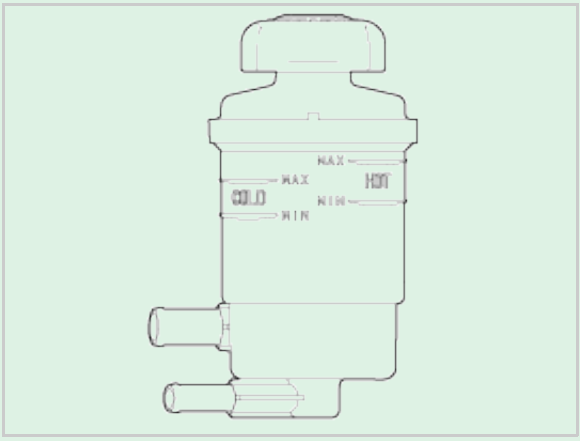
Refer to EM group(Timing system).

CHECKING POWER STEERING FLUID LEVEL

1. Position the vehicle on a level surface.
2. Start the engine. With the vehicle kept stationary, turn the steering wheel several times continuously to raise the fluid temperature to 50-60°C (122-140°F).
3. With the engine at idle, turn the steering wheel fully clockwise and counter-clockwise several times.
4. Make sure that there is no foaming or cloudiness in the reservoir fluid.
5. Stop the engine and check for any difference in fluid level between a stationary and a running engine.

NOTICE

a. If the fluid level varies 5 mm (0.2 in) or more, bleed the system again.
b. If the fluid level suddenly rises after stopping the engine, further bleeding is required.
c. Incomplete bleeding will produce a chattering sound in the pump and noise in the flow control valve, and lead to decreased durability of the pump.



REPLACING POWER STEERING FLUID

1. Jack up the front wheels and support them with jackstands.
2. Disconnect the return hose from the oil reservoir and plug the oil reservoir.
3. Connect a vinyl hose to the disconnected return hose, and drain the oil into a container.
4. Remove the fuel pump fuse, then start the engine and wait for the engine to stall. Next, while operating the starting motor intermittently, turn the steering wheel all the way to the left and then to the right several times to drain the fluid.
5. Connect the return hoses, then fill the oil reservoir with the specified fluid.
6. Reinstall the fuel pump fuse.
7. Start the engine. Check for oil leakage.
8. Stop the engine.
9. Bleed the system.

Power steering fluid type : PSF-3
Total quantity : Approx 1.1 liter

AIR BLEEDING

1. Remove the fuel pump fuse, then start the engine and wait for the engine to stall. Next, while operating the starting motor intermittently (for 15 ~ 20 seconds), turn the steering wheel all the way to the left and then to the right five or six times.

NOTICE

a. During air bleeding, replenish the fluid supply so that the level never falls below the lower position of the filter.
b. If air bleeding is done while the vehicle is idling, the air will be broken up and absorbed into the fluid. Be sure to do the bleeding only while cranking.
c. Reinstall the fuel pump fuse, and start the engine(idling).
d. Turn the steering wheel to the left and the right until there are no air bubbles in the oil reservoir.

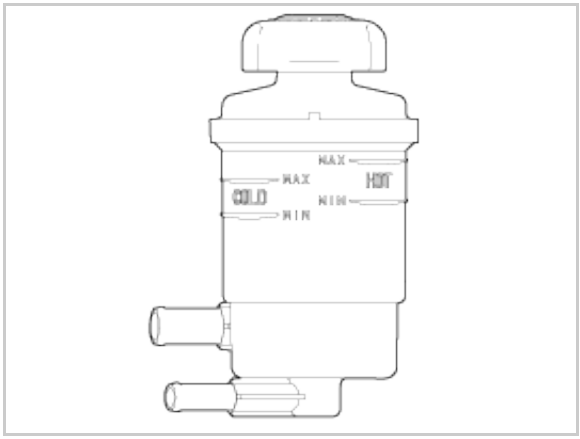
CAUTION

Do not hold the steering wheel turned all the way to either side for more than ten seconds.

e. Confirm that the fluid is not milky, and that the level is up to the position specified on the level gauge.
f. Confirm that there is little change in the surface o the fluid when the steering wheel is turned left and right.

CAUTION

a. If the surface of the fluid changes considerably, air bleeding should be done again.
b. If the fluid level rises suddenly when the engine is stopped, it indicates that there is still air in the system.
c. If there is air in the system, a jingling noise may be heard from the pump and the control valve may also produce unusual noises. Air in the system will shorten the life of the pump and other parts.



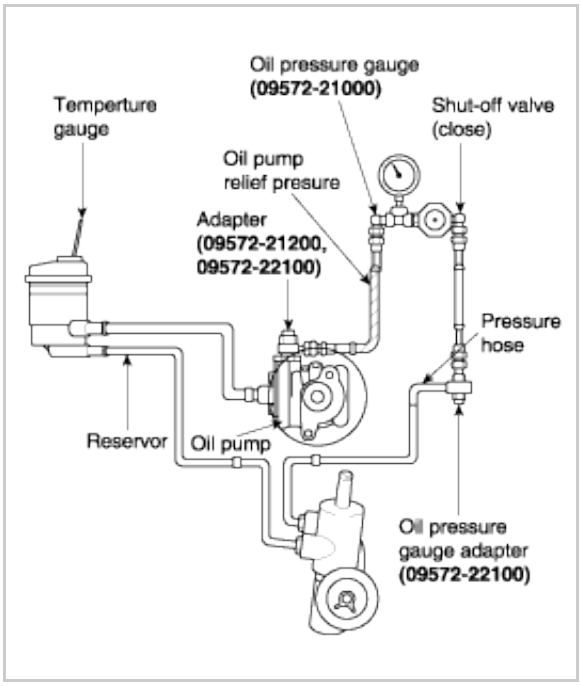
OIL PUMP PRESSURE TEST (OIL PUMP RELIEF PRESSURE)

1. Disconnect the pressure hose from the oil pump. Connect the special tool between the oil pump and pressure hose as illustrated.
2. Bleed the air, and then start the engine and turn the steering wheel several times so that the fluid temperature rises to approximately 50°C (122°F).
3. Set the engine speed to 1,000 rpm.
4. Close the shut-off valve of the special tool and measure the fluid pressure to confirm that it is within the range.

standard vaule :
Relief pressure: 90 +3/-2 kgf/cm²

CAUTION

Don’t keep the shut-off valve on the pressure gauge closed for longer than seconds.



5. Remove the special tools, and tighten the pressure hose to the specified torque.

Tightening Torque Nm(kgf·m, lb-ft) :
65 ~ 75(6.5 ~ 7.5, 47 ~ 54)

---

6. Bleed the system.

SPECIFICATIONS

Items			Specifications
Steering column/ shaft	Type		Tilt
	Tilt stroke		+7°/ -11.7°
Steering gear	Type		Rack & pinion
	Rack stroke	VRS On	148 mm (5.827 in)
		VRS Off	156 mm (6.142 in)
Power steering pump	Type		Vane
	Diesel	Relief pressure	90 kgf/cm²
		Discharge	9.6 cc/rev
	Gasoline	Relief pressure	90 kgf/cm²
		Discharge	10.5 cc/rev

SERVICE STANDARD

Items			Specifications
Steering wheel free play			30 mm (1.12 in)
Steering angle	VRS on	Inner	38.64°
		Outer	31.78°
	VRS off	Inner	41.91°
		Outer	33.54°

TIGHTENING TORQUE

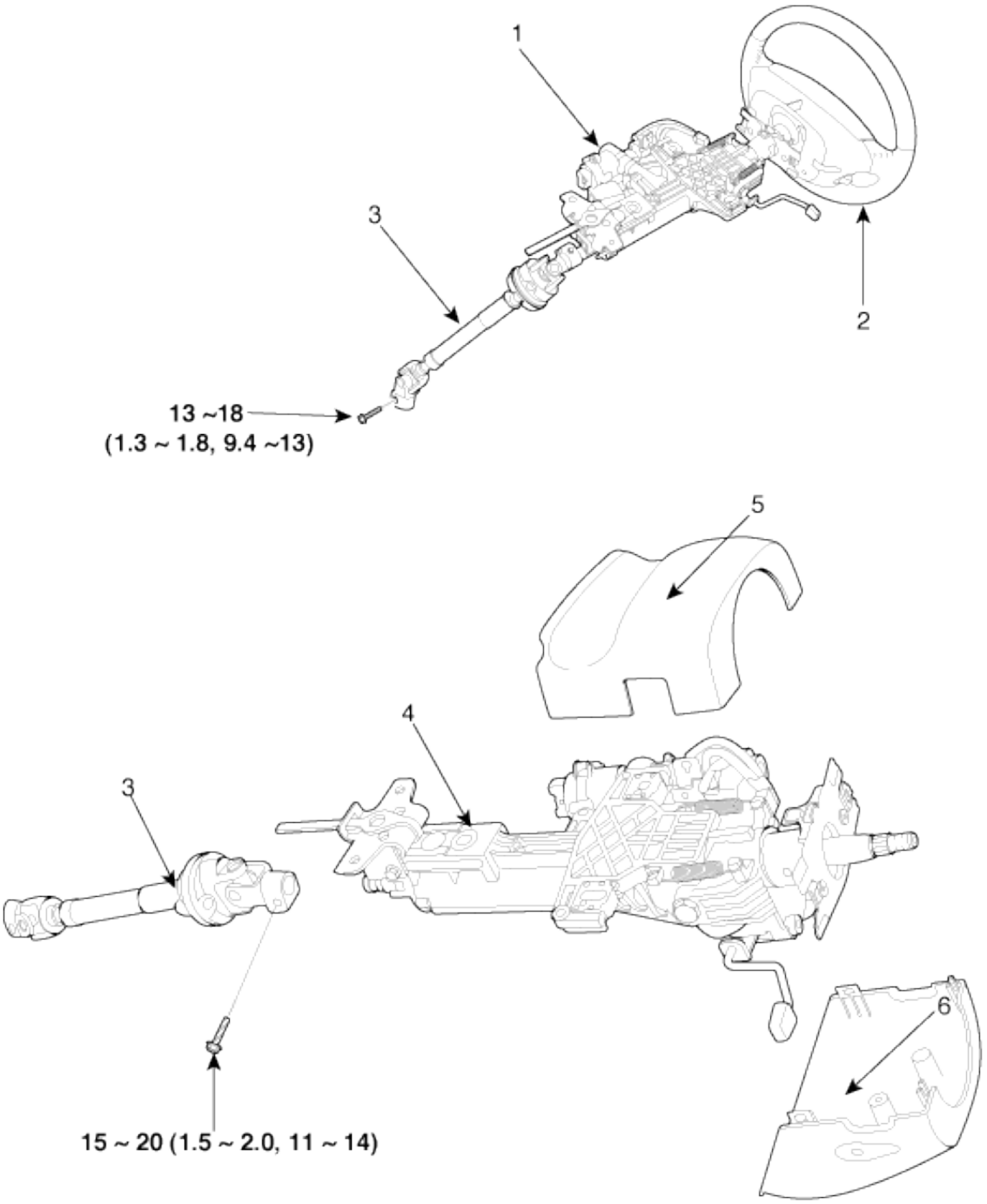
Items	Nm	Kgf.m	Lb-ft
Steering wheel lock nut	40 ~ 50	4.0 ~ 5.0	29 ~ 36
Steering column mounting bolts and nut	13 ~ 18	1.3 ~ 1.8	9.4 ~ 13.0
Bolt connecting steering column to universal joint	15 ~ 20	1.5 ~ 2.0	10.8 ~ 14.5
Bolt connecting universal joint to steering gear	13 ~ 18	1.3 ~ 1.8	9.4 ~ 13.0
Steering column mounting bolts and nut	13 ~ 18	1.3 ~ 1.8	9.4 ~ 13.0
Tie rod end castle nut	35 ~ 45	3.5 ~ 4.5	25 ~ 33
Front lower arm ball joint assembly bolts	90 ~ 120	9.0 ~ 12.0	65 ~ 87
Stabilizer link to strut assembly nut	100 ~ 120	10.0 ~ 12.0	72 ~ 87
Rear roll stopper to sub-frame bolts	50 ~ 60	5.0 ~ 6.0	36 ~ 43
Pressure tube to valve body housing nut	12 ~ 18	1.2 ~ 1.8	9 ~ 13
Pressure tube to oil pump eye bolt	65 ~ 75	6.5 ~ 7.5	47 ~ 54
Return tube to valve body housing nut	12 ~ 18	1.2 ~ 1.8	9 ~ 13
Power steering gear box to sub-frame bots	90 ~ 110	9.0 ~ 11.0	65 ~ 80

LUBRICANT

Item	Lubricant	Quantity
Power steering fluid	PSF-3	1.1 L

Steering Column & Shaft

COMPONENTS

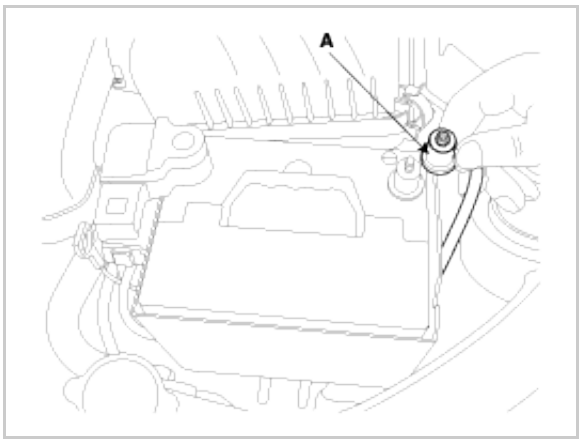


TORQUE : Nm (kgf.m, lb-ft)

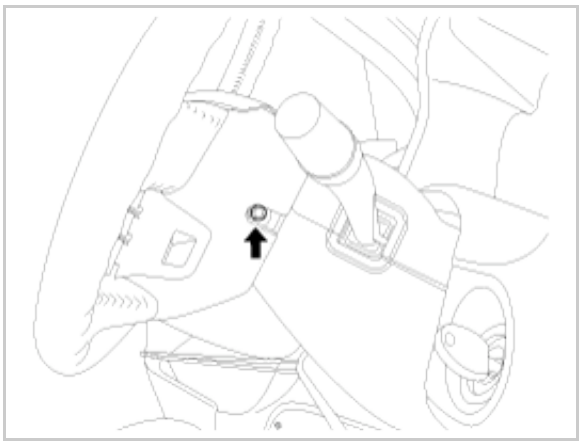
1. Key lock assembly
2. Steering wheel
3. Universal joint assembly
4. Steering column assembly
5. Steering column upper shroud
6. Steering column lower shroud

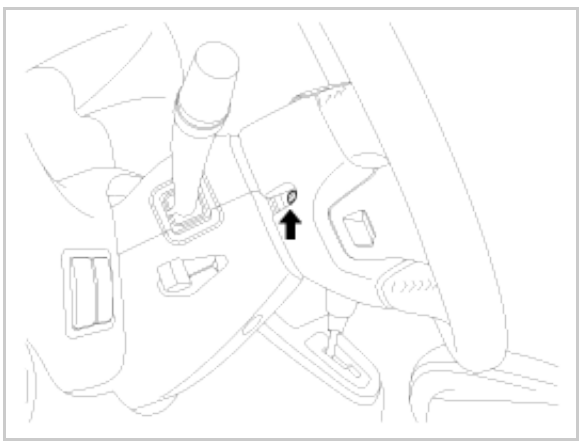
REMOVAL

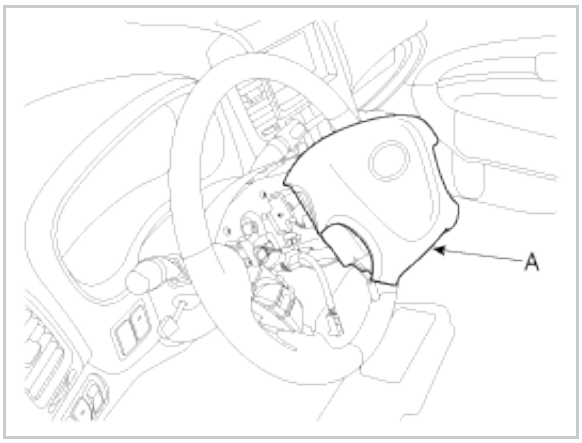
1. Disconnect the negative terminal (A) from the battery and then wait for 30 seconds.



2. Loosen the bolts in the illustration and then remove the horn pad (A).





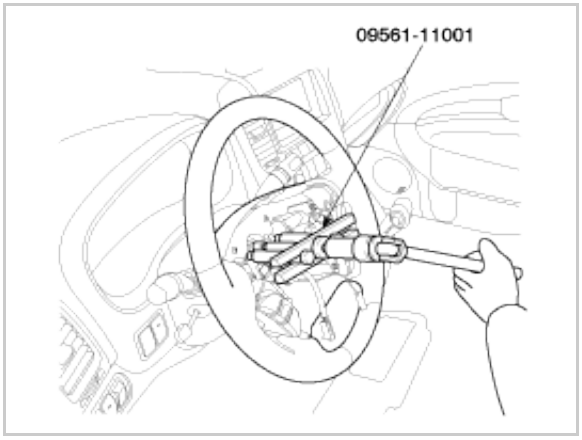


3. Disconnect the connectors and remove the steering wheel lock nut.

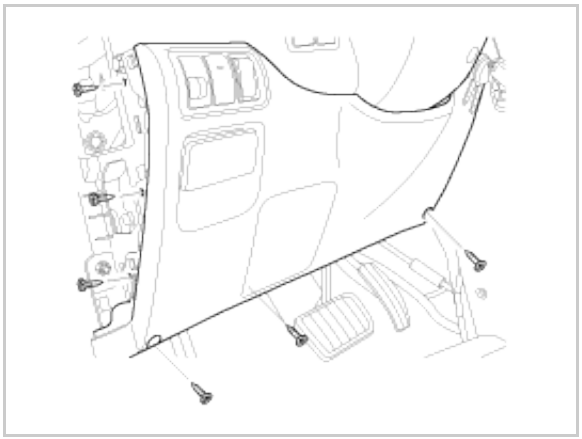
Tightening torque Nm (kgf.m, lb-ft):
40 ~ 50 (4.0 ~ 5.0, 29 ~ 36)

4. After making the marks on the steering wheel and shaft for reinstallation, remove the steering wheel using a SST (09561-11002).

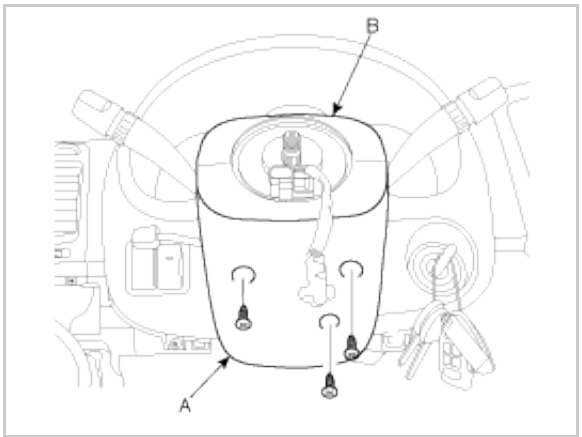
> **CAUTION**
>
> Do not hammer on the steering wheel to remove it ; it may damage the steering column.



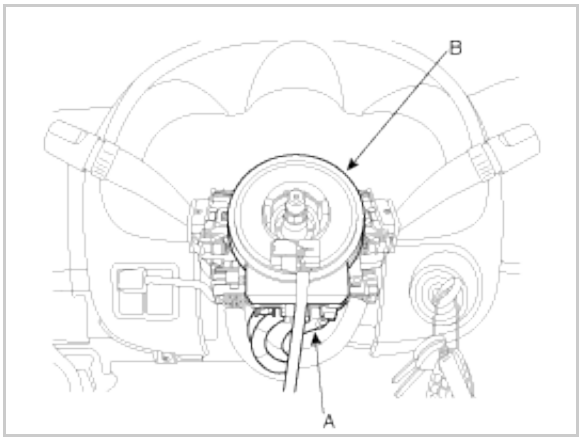
5. Loosen the screws, and then remove the lower crash pad (A).



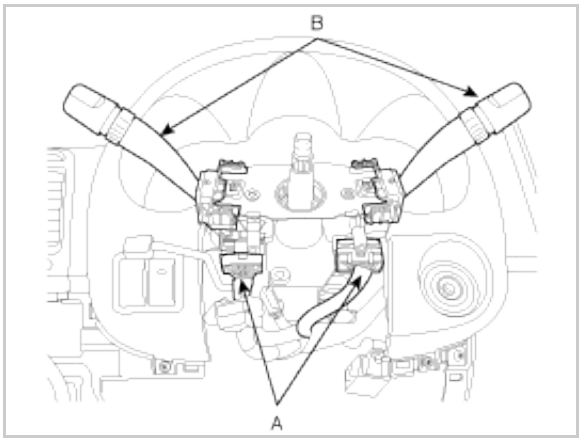
6. Loosen the screws, and then remove the steering column upper (B) and lower shrouds (A).



7. Disconnect the connectors (A) and then remove the clock sprig (B).

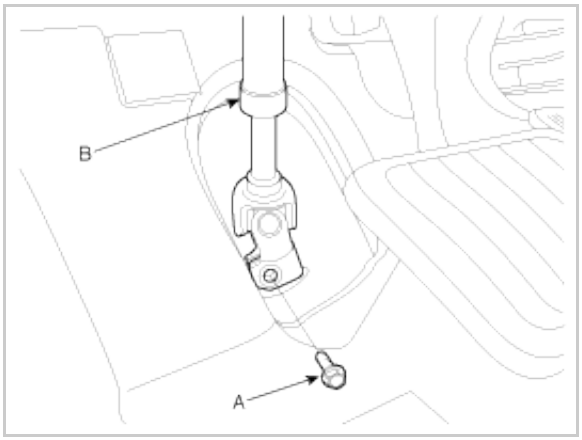


8. Disconnect the connectors (A) and remove the mutifunction switch (B).



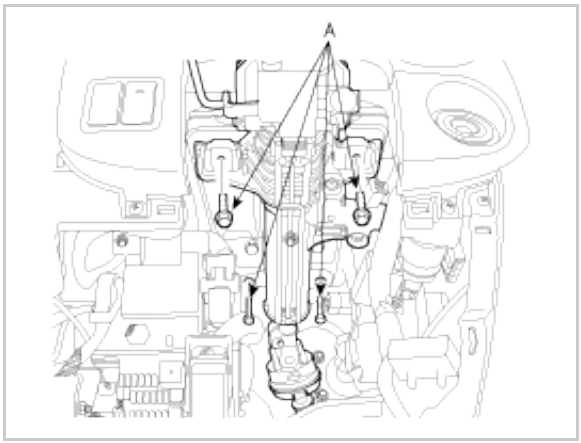
9. Loosen the bolt (A) and then disconnect the universal joint assembly (B) from the steering gear assembly.

Tightening torque Nm (kgf.m, lb-ft):
13 ~ 18 (1.3 ~ 1.8, 9.4 ~ 13.0)



10. Remove the steering column assembly by loosening the steering column mounting bolts and nut (A).

Tightening torque Nm (kgf.m, lb-ft):
13 ~ 18 (1.3 ~ 1.8, 9.4 ~ 13.0)



INSTALLATION

NOTICE

Before installing, apply multi purpose grease to each moving parts.

1. Installation is the reverse of removal.

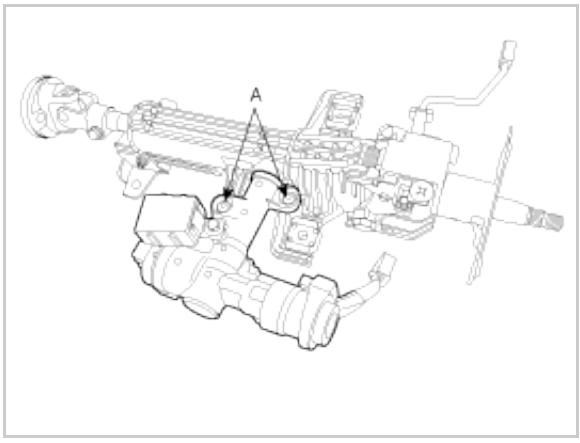
CAUTION

Align the marks on the steering wheel and shaft for reinstallation when installing the steering wheel.

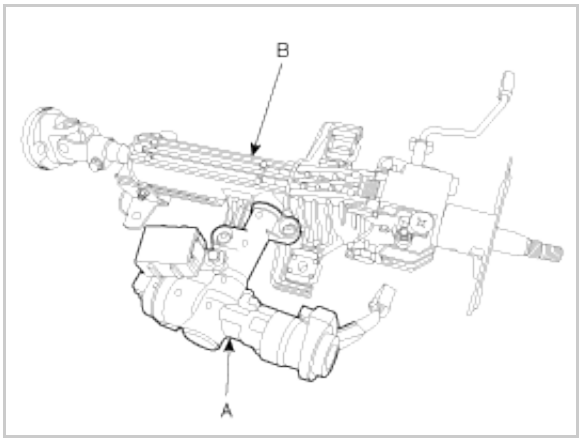
DISASSEMBLY

KEY LOCK ASSEMBLY

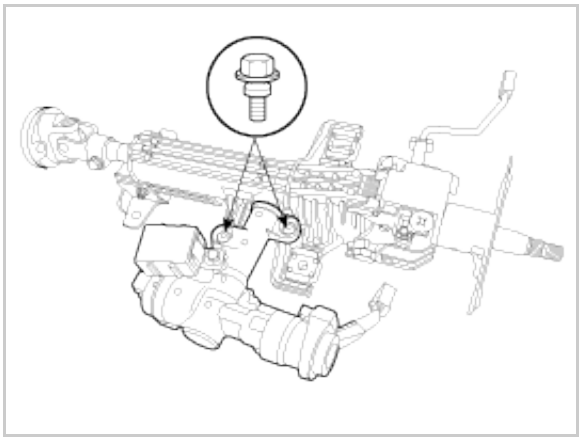
1. Make a groove on head of the special bolt (A) by using a punch.



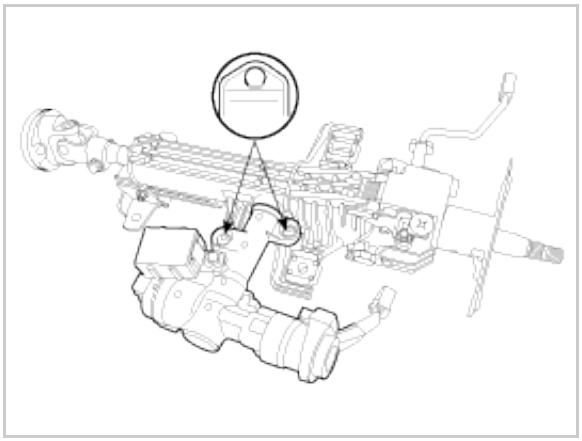
2. Remove the key lock assembly (A) from the steering column (B) by loosing special bolts.



3. When reassembling the key lock assembly, loosely install new special bolts to the steering column shaft.

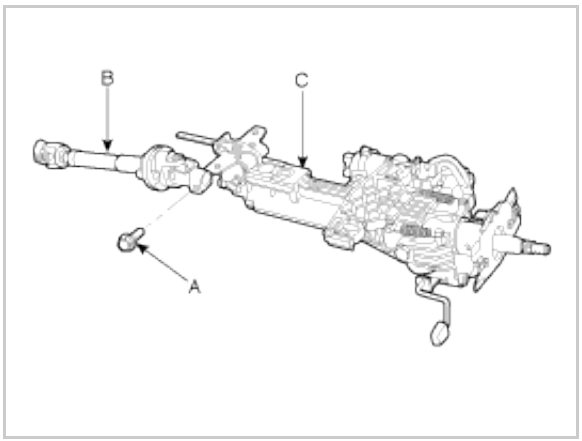


4. Tighten the special bolt until its head is cut off.



UNIVERSAL JOINT ASSEMBLY

1. Remove the universal joint (B) assembly from the steering column assembly (C) by loosening the bolt (A).



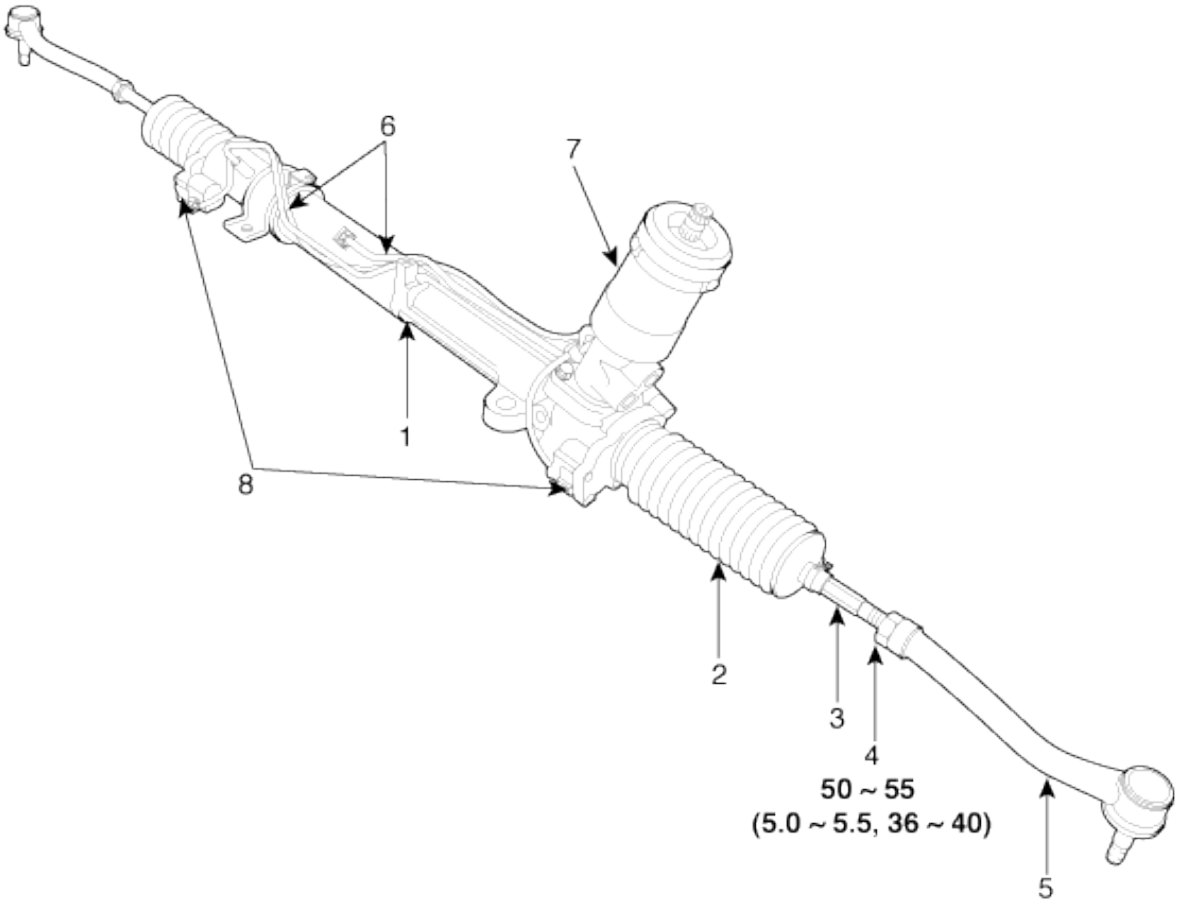
2. Reassembly is the reverse of disassembly.

INSPECTION

1. Check the steering column shaft for damage and deformation.
2. Check connection for play, damage and smooth operation.
3. Check the joint bearing for wear and damage.

Hydraulic Power Steering System

COMPONENTS

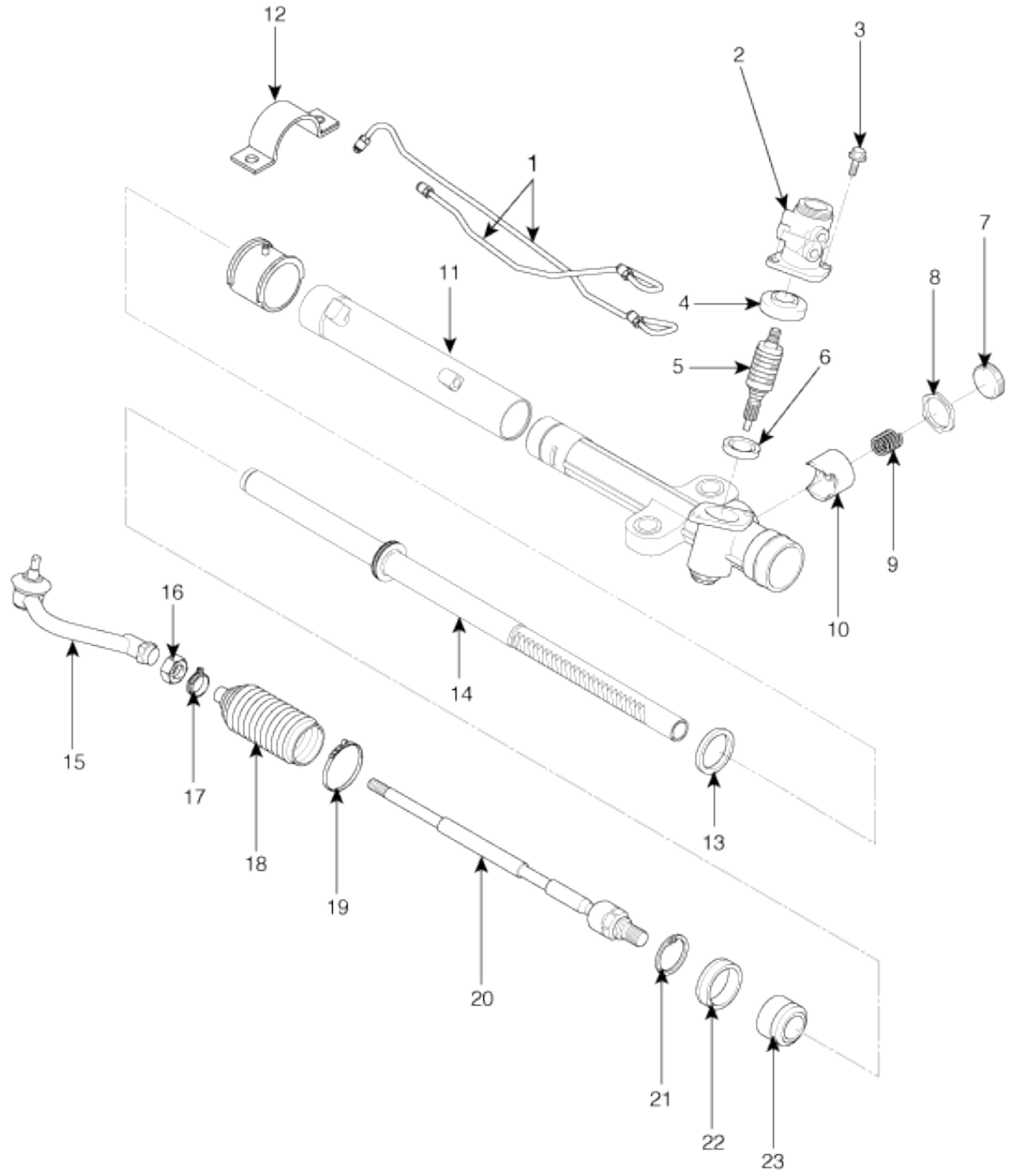


TORQUE : Nm (kgf.m, lb-ft)

1. Rack housing
2. Bellows
3. Tie rod
4. Tie rod lock nut
5. Tie rod end
6. Feed tube
7. Valve body assembly
8. VRS operating unit

Power Steering Gear

COMPONENT

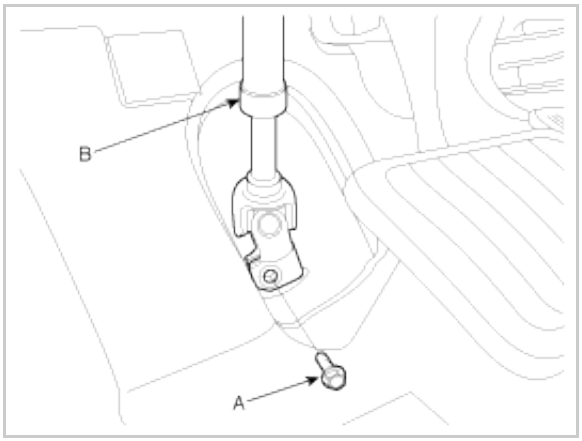


1. Feed tube
2. Valve body housing
3. Bolt
4. Oil seal
5. Pinion valve assembly
6. Oil seal
7. Yoke plug
8. Lock nut
9. Rack support spring
10. Rack support yoke
11. Rack housing
12. Power steering gear box mounting clamp
13. Oil seal
14. Rack
15. Tie rod end
16. Lock nut
17. Bellows clip
18. Bellows
19. Bellows band
20. Tie rod
21. Circlip
22. Oil seal
23. Rack stopper

REMOVAL

1. Remove the both front wheel & tire assemblies.
2. Drain the power steering fluid.
3. Remove the bolt (A) connecting steering column to universal joint.

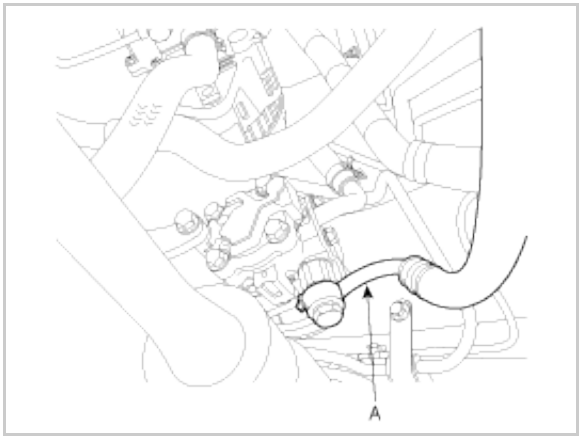
Tightening torque Nm (kgf.m, lb-ft):
13 ~ 18 (1.3 ~ 1.8, 9.4 ~ 13.0)



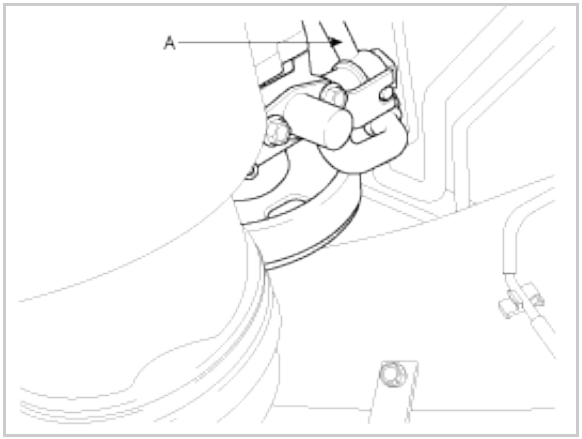
4. Disconnect the pressure tube (A) from the power steering oil pump by loosening eye bolt.

Tightening torque Nm (kgf.m, lb-ft):
65 ~ 75 (6.5 ~ 7.5, 47 ~ 54)

[Diesel]

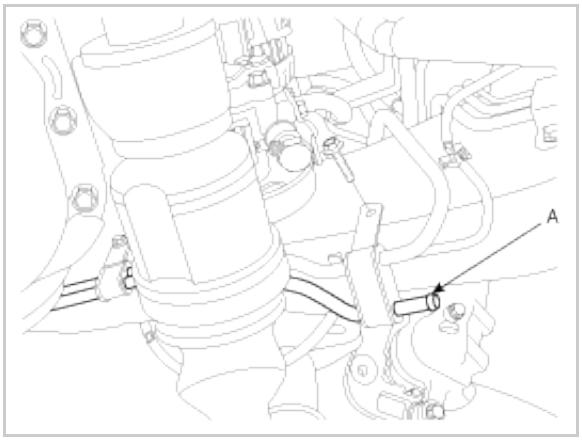


[Gasoline]

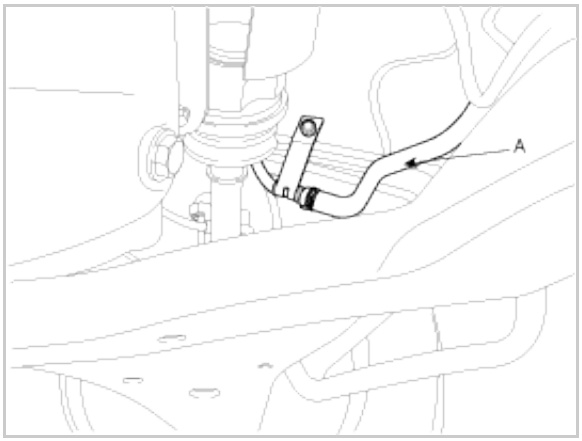


5. Disconnect the return hose (A)

[Diesel]

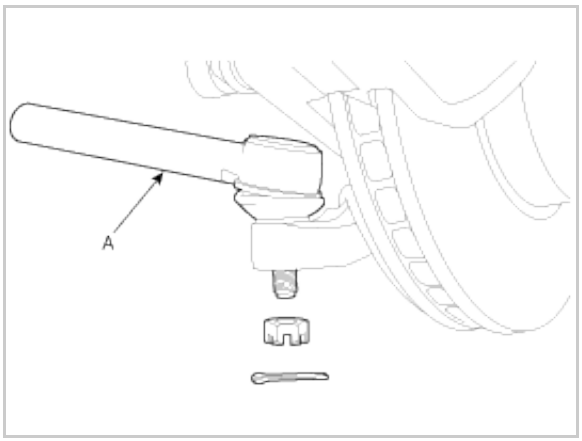


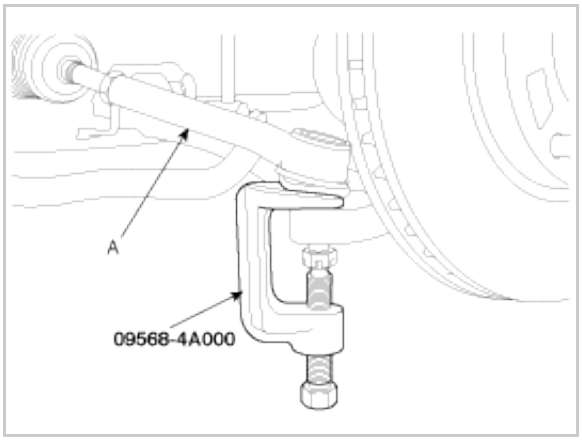
[Gasoline]



6. Loosen the split pin and castle nut, and then remove the tie rod end (A) from the knuckle by using a SST (09568-4A000).

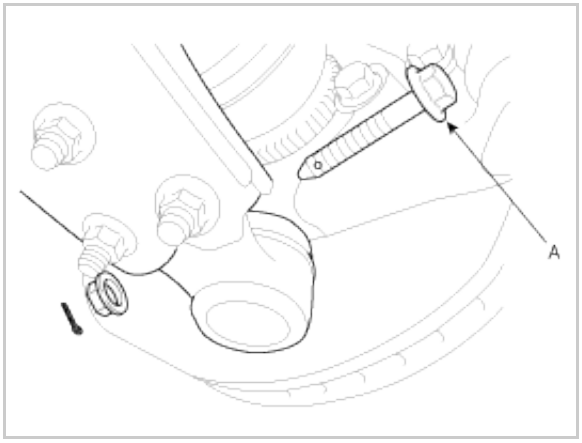
Tightening torque Nm (kgf.m, lb-ft):
50 ~ 55 (5.0 ~ 5.5, 36 ~ 40)





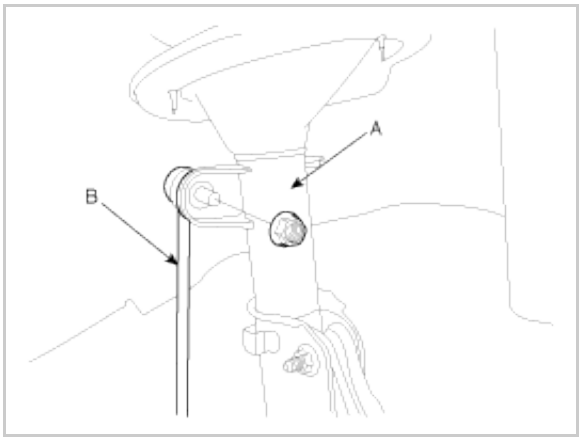
7. Remove the split pin and lower arm bolts and nut (A).

Tightening torque Nm (kgf-m, lb-ft):
90 ~ 120 (9.0 ~ 12.0, 65 ~ 87)



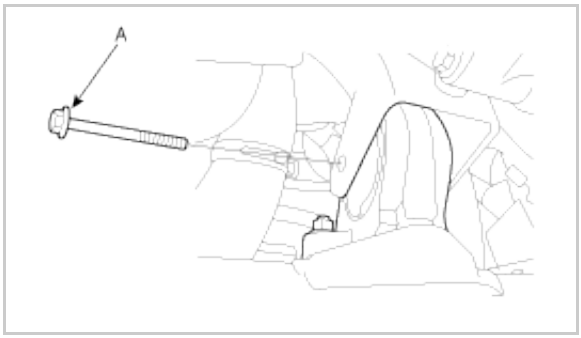
8. Disconnect the stabilizer link (B) from the strut assembly (A) by loosening nut.

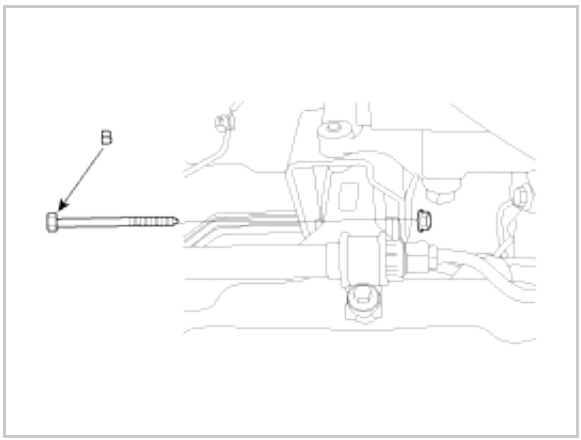
Tightening torque Nm (kgf.m, lb-ft):
100 ~ 120 (10.0 ~ 12.0, 72 ~ 87)



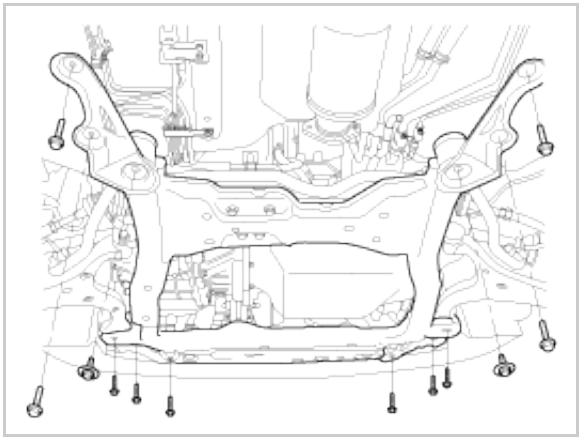
9. Repeat on the other side.

10. Remove the front and rear roll stopper bolts and nuts (A, B).

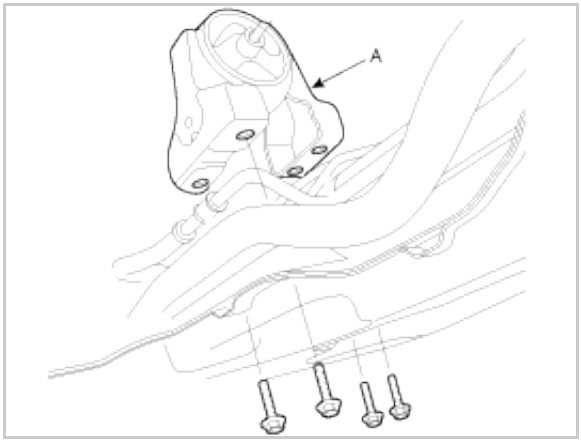




11. Remove the sub-frame by loosening the bolts and nuts.

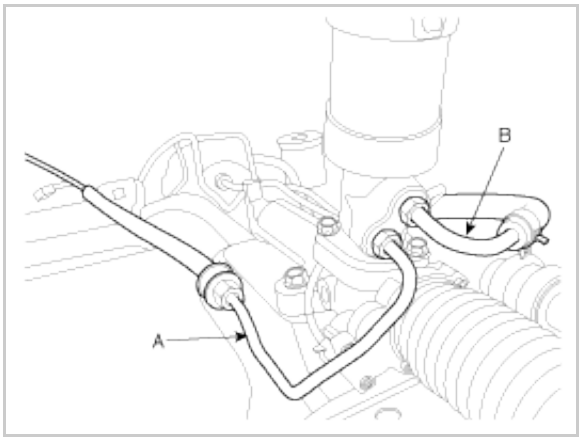


12. Remove the rear roll stopper (A) from the sub-frame.



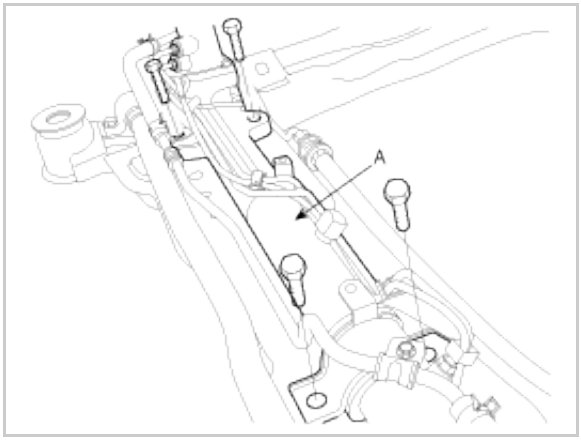
13. Disconnect the pressure tube (A) and return (B) from the valve body housing.

Tightening torque Nm (kgf.m, lb-ft):
12 ~ 18 (1.2 ~ 1.8, 9 ~ 13)



14. Remove the power steering gear box (A) from the sub-frame by loosening the mounting bolts.

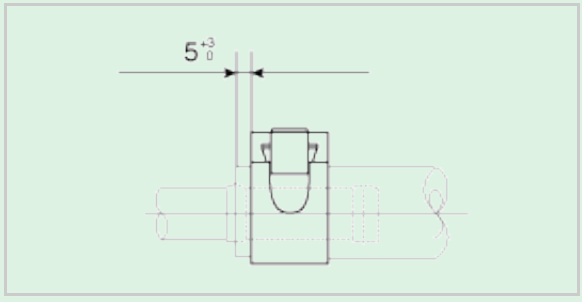
Tightening torque Nm (kgf.m, lb-ft):
60 ~ 80 (6.0 ~ 8.0, 43~58)



INSTALLATION

NOTICE

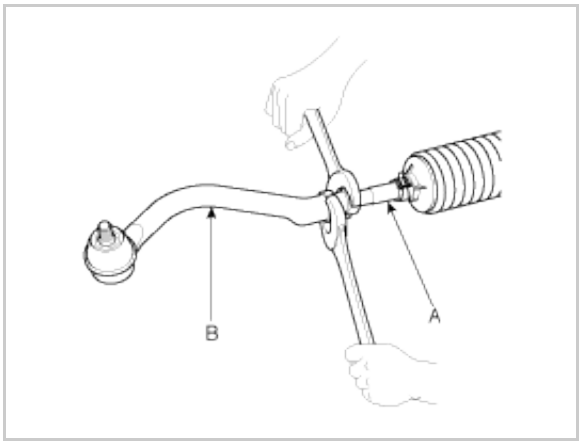
Be sure to connect between a tube and a hose as shown in the illustration.



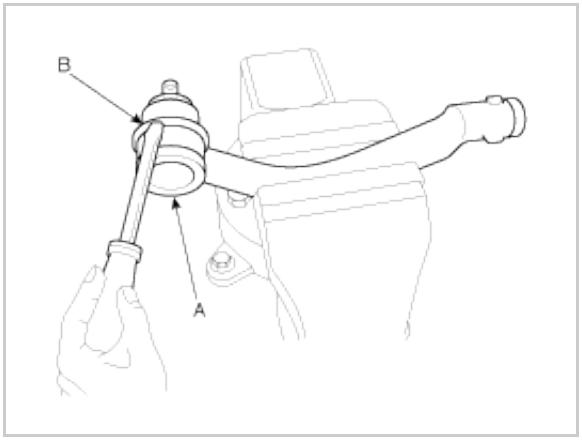
1. Installation is the reverse of removal.
2. After installation, bleed the power steering system. (Refer to the air bleeding in ST group)
3. Adjust the wheel alignment. (Refer to SS group)

DISASSEMBLY

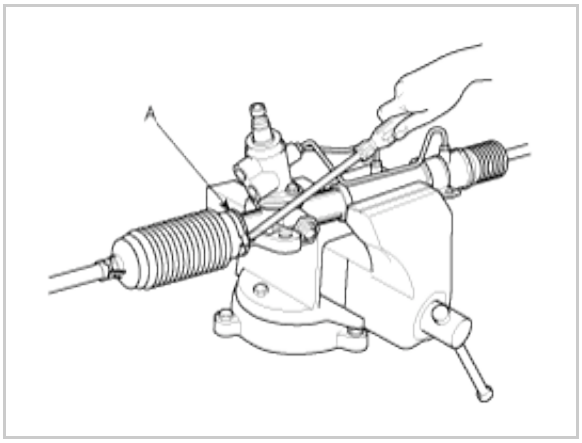
1. Remove the tie rod end (B) from the tie rod (A).



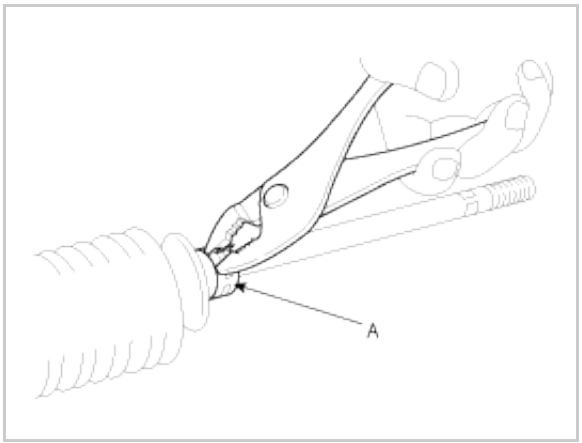
2. Remove the dust cover (B) from the ball joint (A).



3. Remove the bellows band (A).



4. Remove the bellows clip (A).

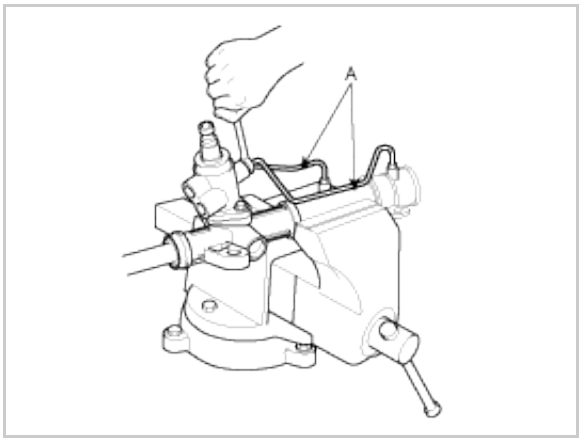


5. Pull the bellows out toward the tie rod.

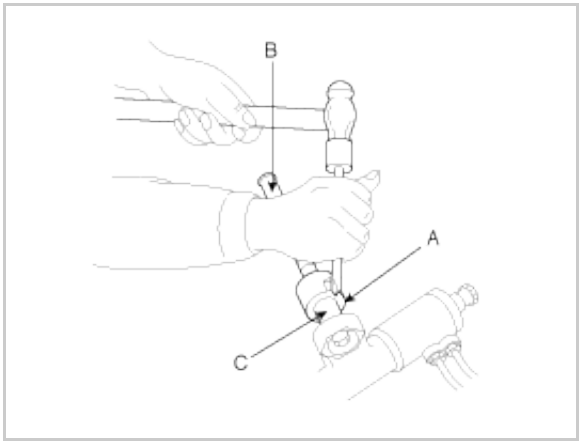
NOTICE

Check for rust on the rack when the bellows are replaced.

6. Remove the feed tube(A) from the rack housing.



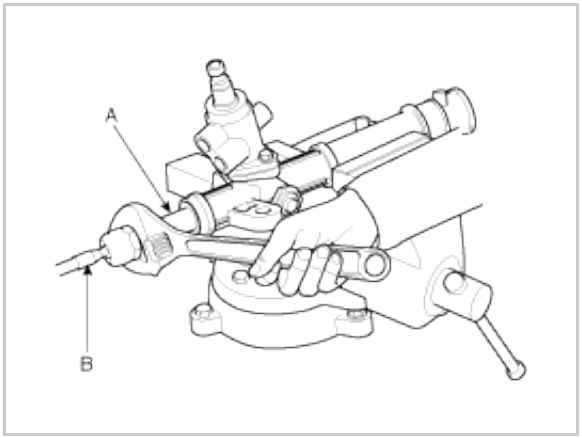
7. While moving the rack slowly, drain the fluid from the rack housing.
8. Unstake the tab washer (A) which fixes the tie rod (B) and rack (C) with a chisel.



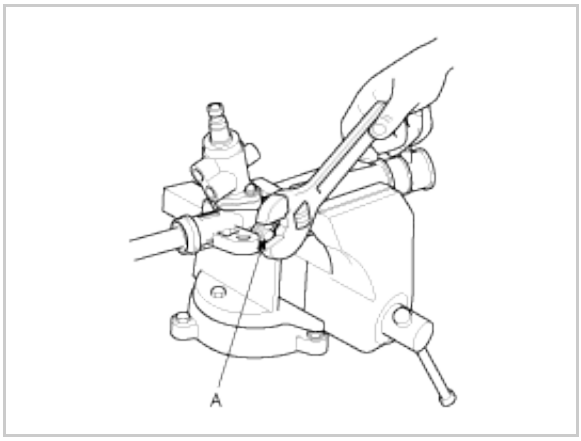
9. Remove the tie rod (B) from the rack (A).

CAUTION

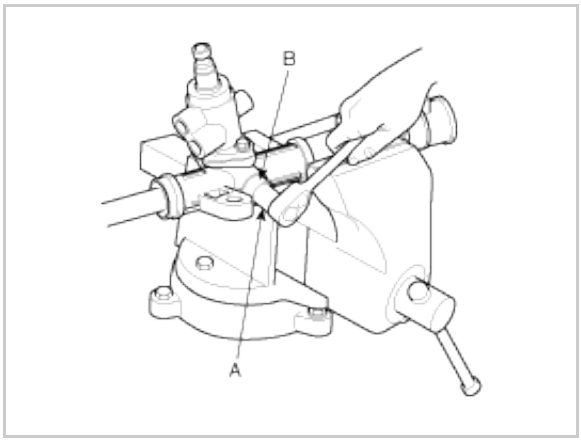
Remove the tie rod (B) from the rack (A), taking care not to twist the rack.



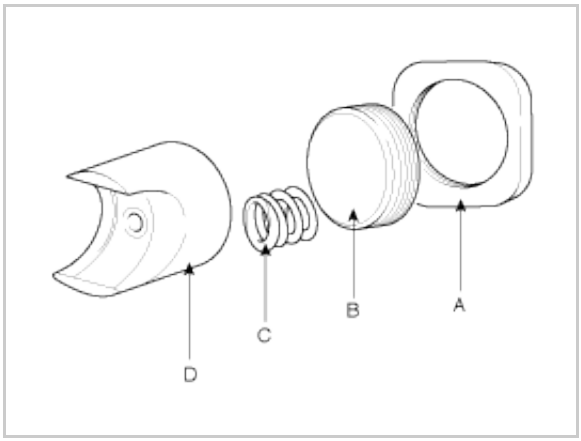
10. Remove the yoke plug locking nut (A).



11. Remove the yoke plug (B) with a 14mm socket (A).

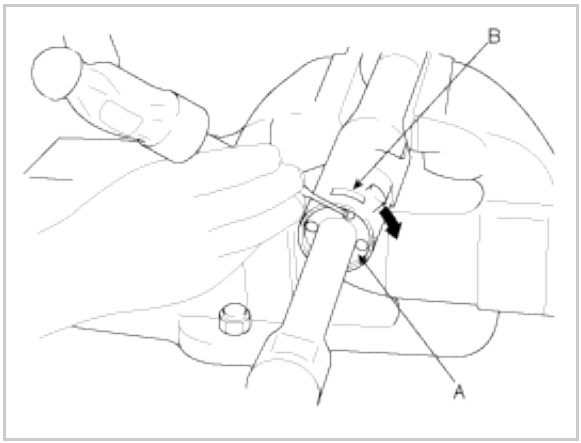


12. Remove the lock nut (D), yoke plug (C), rack support spring (B) and rack support yoke (A) from the gear box.



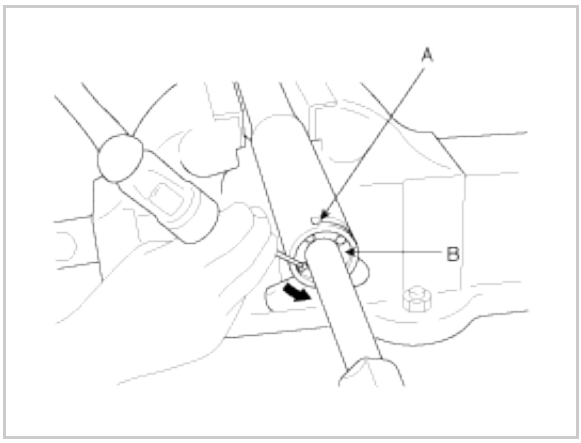
13. When the end of the circlip comes out of the notchedhole of the housing rack cylinder, turn the rack stopper (A) clockwise and remove the circlip.

> **CAUTION**
>
> Be careful not to damage the rack.

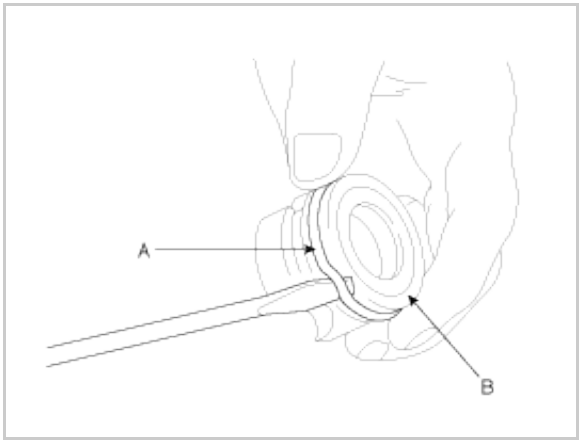


14. When the end of the circlip comes out of the notched hole (A) of the housing rack cylinder, turn the rack stopper (B) counterclockwise and remove the circlip.

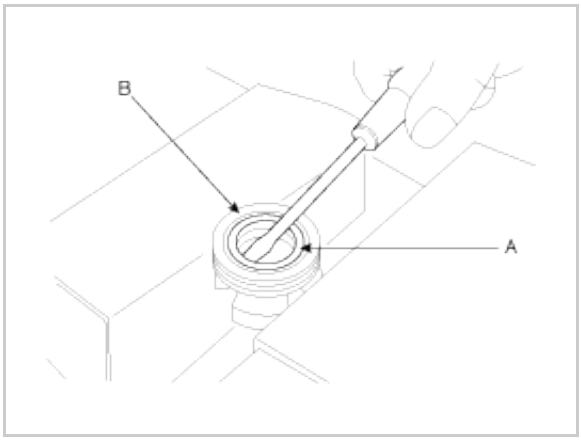
> **CAUTION**
>
> Be careful not to damage the rack.



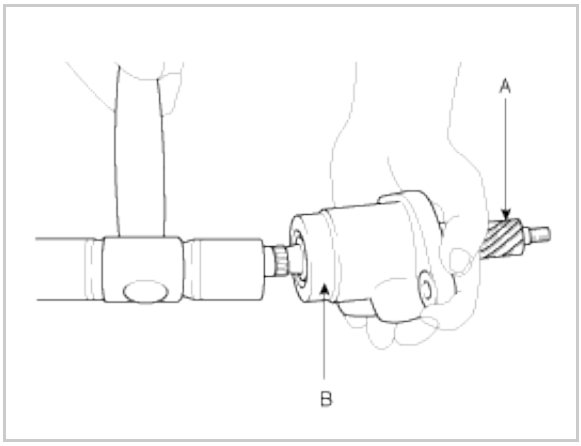
15. Remove the rack bushing and rack from the rack housing.
16. Remove the O-ring(A) from the rack bushing (B).



17. Remove the oil seal (B) from the rack bushing (A).



18. Remove the valve body (A) from the valve body housing (B) with a soft hammer.

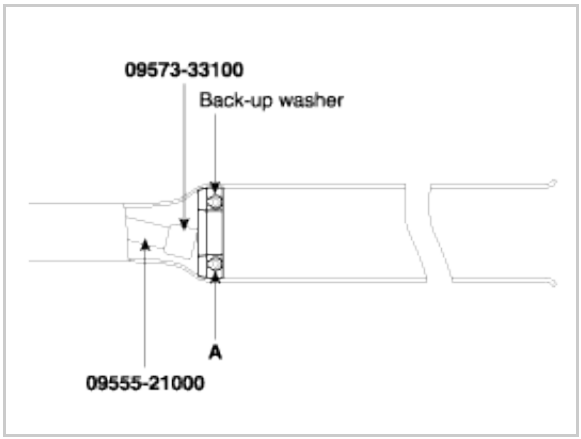


19. Using the special tool, remove the oil seal and ballbearing from the valve body housing.
20. Remove the oil seal and O-ring from the rack housing.

> **CAUTION**
>
> Be careful not to damage the pinion valve cylinderinside of the rack housing.

21. Using the special tool (09573-33100, 09555-21000),remove the oil seal (A) from the rack housing.

> **CAUTION**
>
> Be careful not to damage the rack cylinder insideof the rack housing.

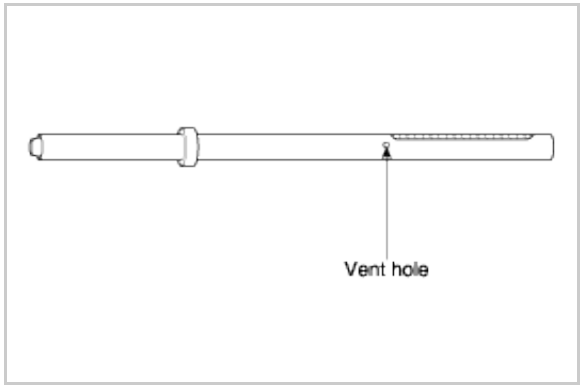


INSPECTION

1. Rack
   (1) Check for rack tooth face damage or wear.
   (2) Check for oil seal contact surface damage.
   (3) Check for rack bending or twisting.

(4) Check for oil seal ring damage or wear.

(5) Check for oil seal damage or wear.



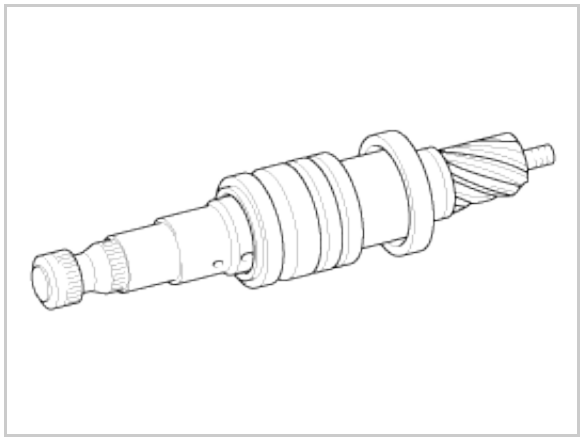
2. Pinion valve

(1) Check for pinion gear tooth face damage or wear.

(2) Check for oil seal contact surface damage.

(3) Check for seal ring damage or wear.

(4) Check for oil seal damage or wear.



3. Bearing

(1) Check for seizure or abnormal noise during abearing rotation.

(2) Check for excessive play.

(3) Check for missing needle bearing rollers.

4. Others

(1) Check for damage of the rack housing cylinder bore.

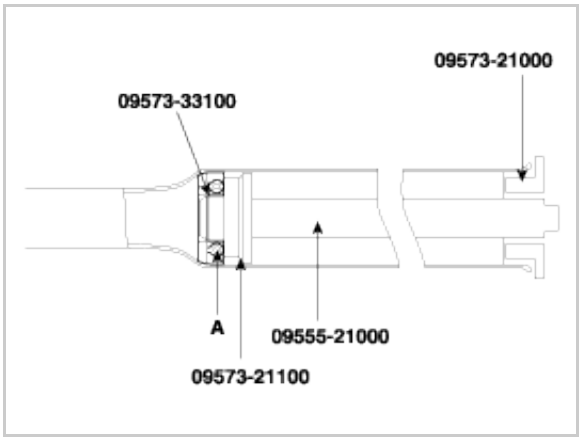
(2) Check for boot damage, cracking or aging.

REASSEMBLY

1. Apply the specified fluid to the entire surface of the rack oil seal.

Recommended fluid : PSF-3

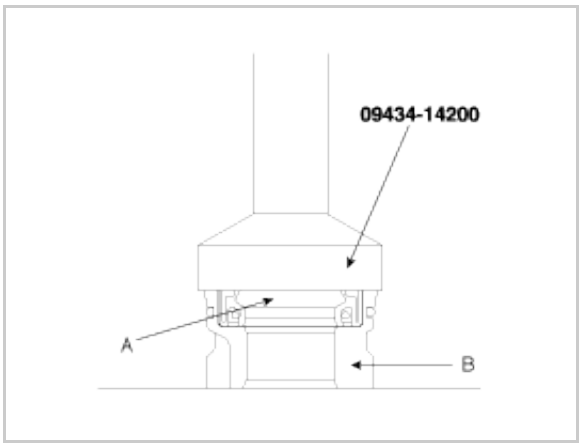
2. Install the backup washer and oil seal (A) to the specified position in the rack housing.



3. Apply the specified fluid to the entire surface of the rack bushing oil seal.

Recommended fluid : PSF-3

4. Install the oil seal (A) in the rack bushing (B).

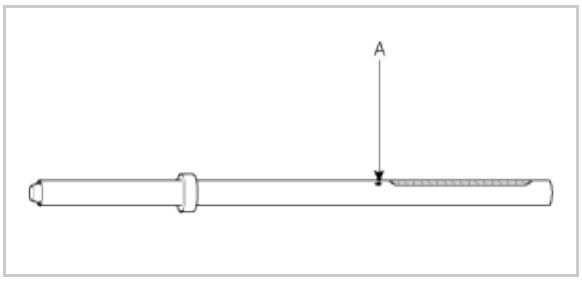


5. Apply the specified fluid to the entire surface of the O-ring and install it in the rack bushing.
6. Apply the specified grease to the rack teeth.

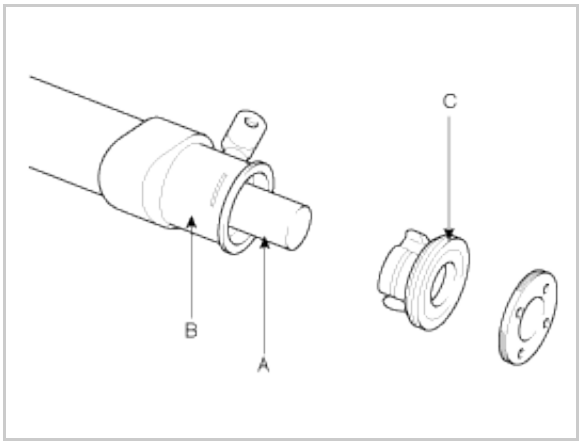
Recommended grease
Multipurpose grease SAE J310a NLGI No.2

NOTICE

Do not plug the vent hole(A) in the rack with grease.

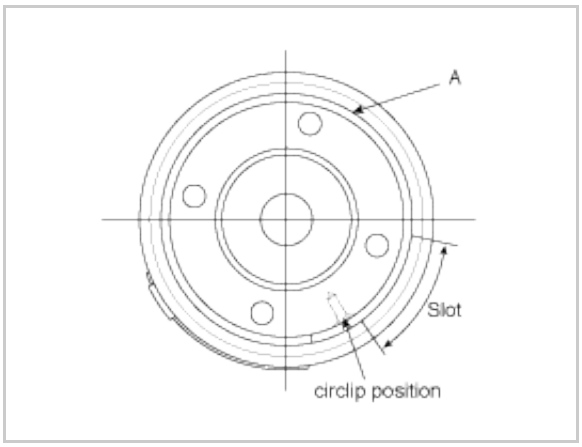


7. Insert the rack(A) into the rack housing(B) and install the rack bushing(C).

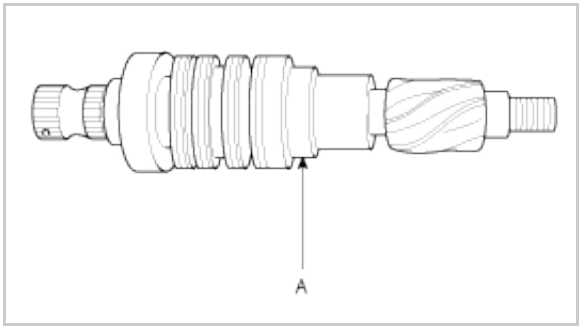


8. Push in the rack stopper (A) until the circlip groove of the rack stopper is aligned with the notched hole of the rack housing. Then, install the circlip while turning the rack stopper.

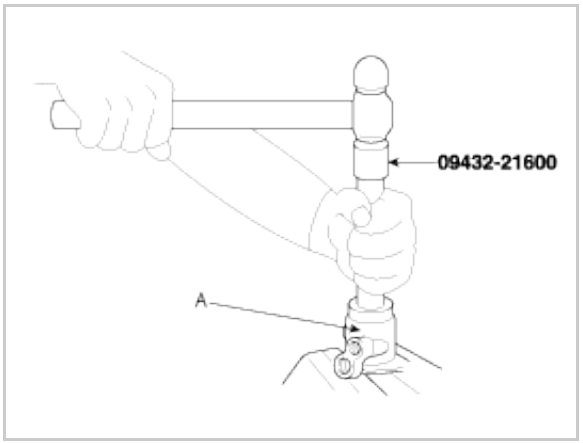
> **CAUTION**
>
> The circlip should not be visible through the notched hole of the rack housing.



9. Using special Tool (09432-21600), install the oil seal and the ball bearing in the valve body (A).

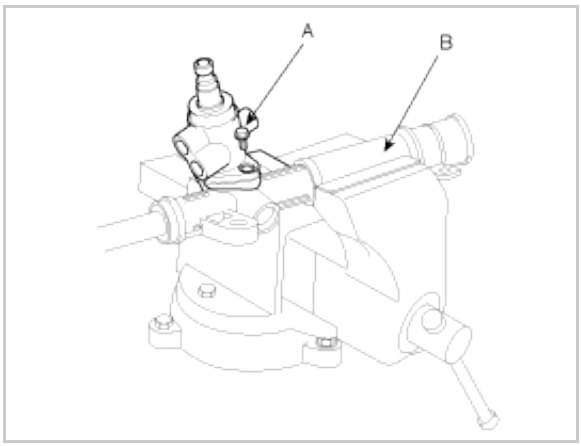


10. After applying the specified fluid and grease to the pinion valve assembly (A), install it in the rack housing assembly.

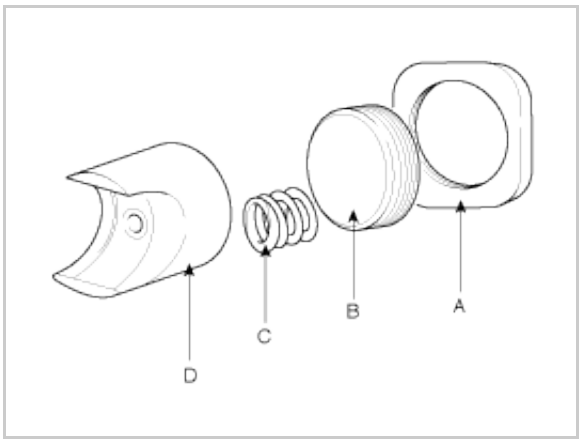


11. After applying the specified fluid to the oil seal, install it in the rack housing and fix the valve body assembly(A)

and O-ring in the gear box(B).

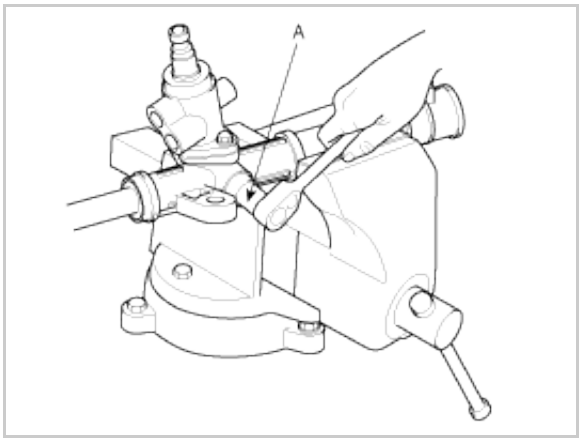


12. Install the rack support yoke (A), rack supportspring (B), yoke plug (C) and lock nut (D) in the ordershown in the illustration. Apply semi-drying sealantto the threaded section of the yoke plug before installation.

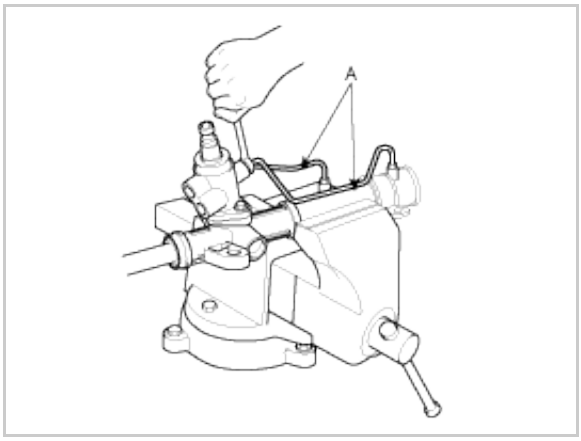


13. With the rack placed in the center position, attach the yoke plug to the rack housing. Tighten the yoke plug to 12 Nm (120 kg·cm, 8.9 lb·ft), with a 14mm socket (A). Loosen the yoke plug approximately from 30° to 60° and tighten the yoke nut to the specified torque.

Tightening Torque Nm(kgf·m, lb-ft) :
50 ~ 70(5 ~ 7, 37 ~ 52)

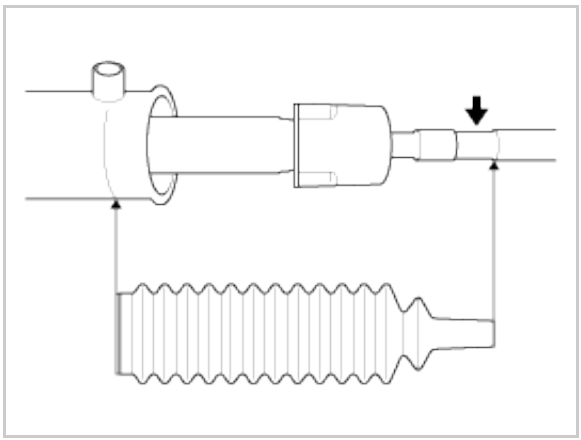


14. Tighten the feed tube (A) to the specified torque and install the mounting rubber using adhesive.



15. Apply the specified grease to the bellows mounting position (fitting groove) of the tie rod.

Recommended grease : Silicone grease

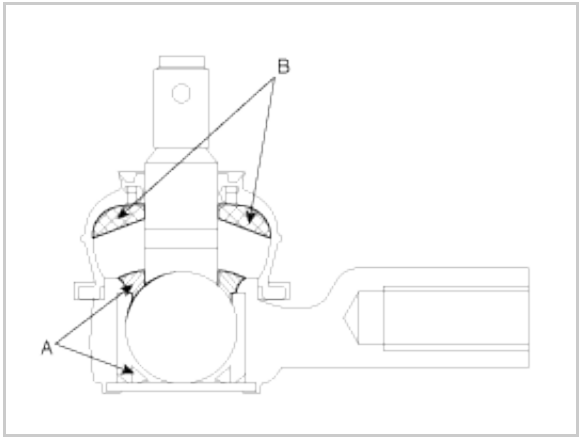


16. Install the new attaching band to the bellows.

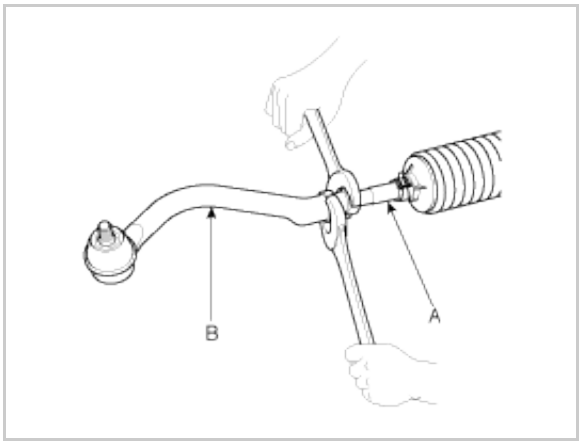
> **NOTICE**
>
> When the bellows are installed, a new band must be used.

17. Install the bellows in position, taking care not to twist it.
18. Fill the dust cover inner side and lip with the specified grease, and fix the dust cover in position with the clipring attached in the groove of the tie rod end.

Recommended grease
A : POLY LUB GLY 801K or equivalent
B : SHOWA SUNLIGHT MB2 or equivalent
Dust cover inner side and lip : THREE BOND



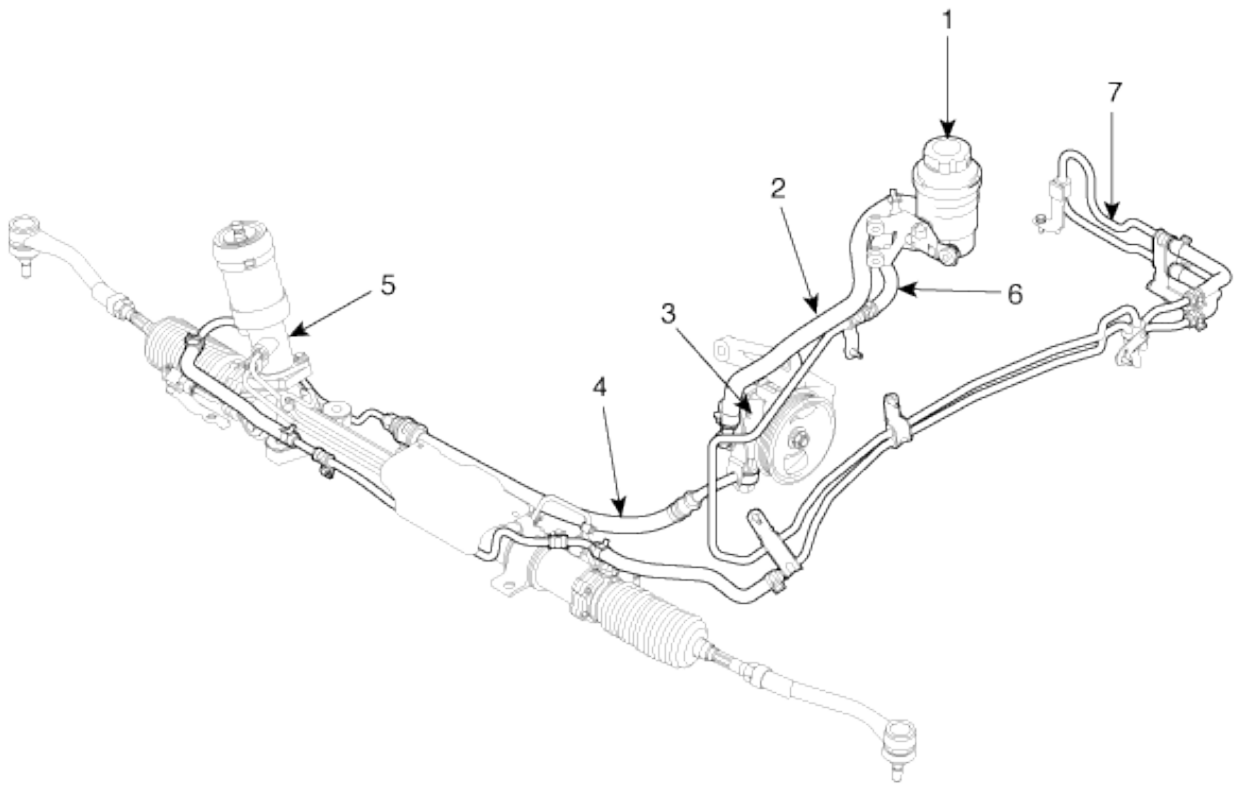
19. Install the tie rod end (B) to the tie rod (A).


B
A

Power Steering Hoses

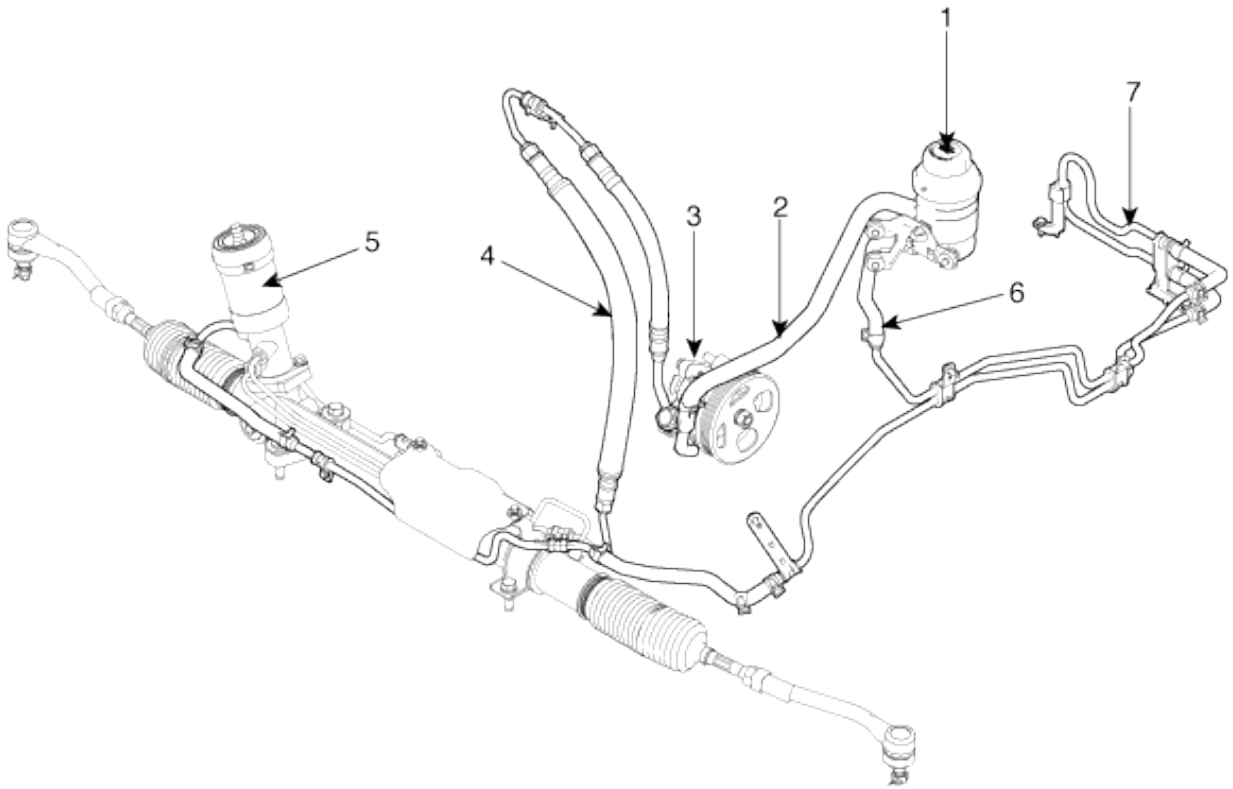
COMPONENTS

[Diesel]



1. Reservoir
2. Suction hose
3. Oil pump
4. Pressure hose
5. Power steering gear box
6. Return tube
7. Cooler tube

[Gasoline]



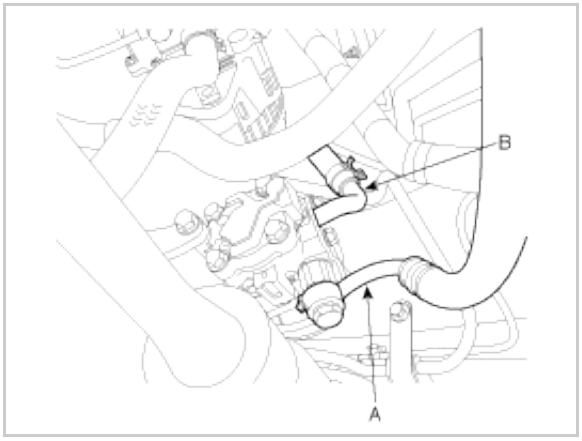
1. Reservoir
2. Suction hose
3. Oil pump
4. Pressure hose
5. Power steering gear box
6. Return tube
7. Cooler tube

REPLACEMENT

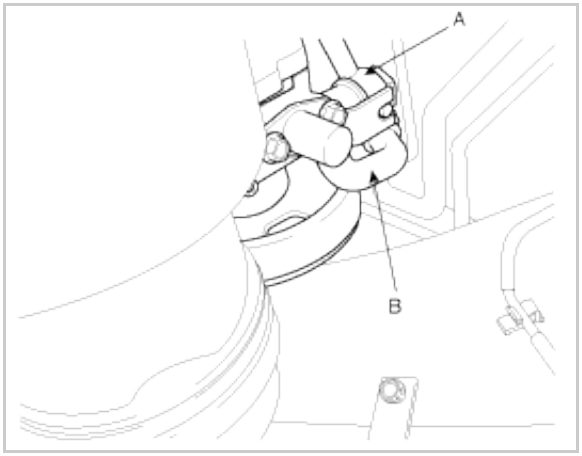
1. Drain the power steering fluid.
2. Disconnect the pressure tube (A) and suction tube (B) from the power steering oil pump.

Tightening torque Nm (kgf.m, lb-ft):
55 ~ 65 (4.5 ~ 5.5, 40 ~ 47)

[Diesel]

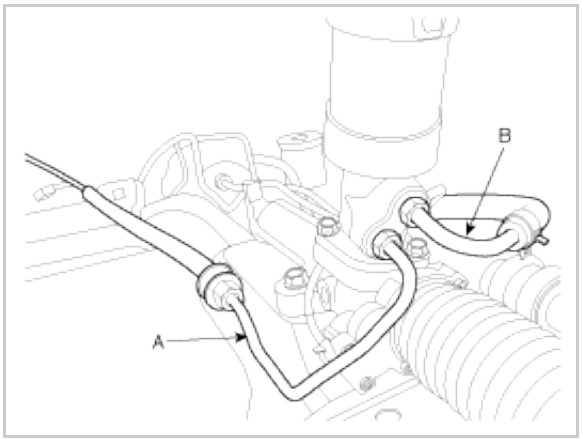


[Gasoline]



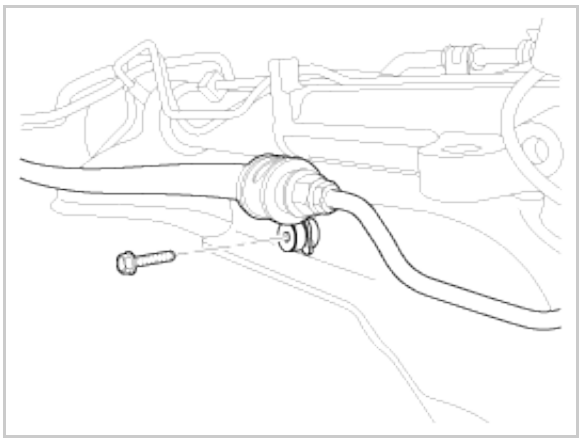
3. Disconnect the pressure tube (A) and return tube from the valve body housing.

Tightening torque Nm (kgf.m, lb-ft):
12 ~ 18 (1.2 ~ 1.8, 9 ~ 13)

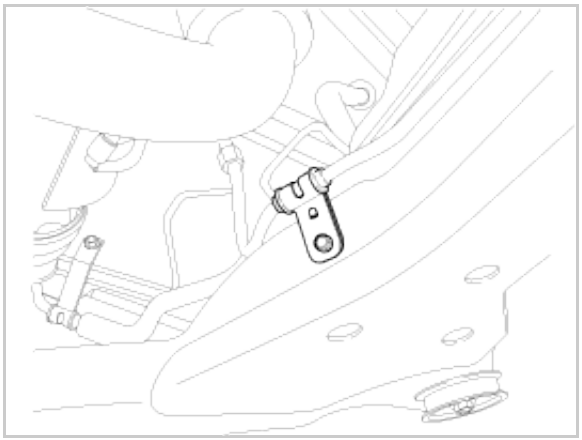


4. Remove the brackets of the pressure tube and hose from the sub-frame.

[Diesel]

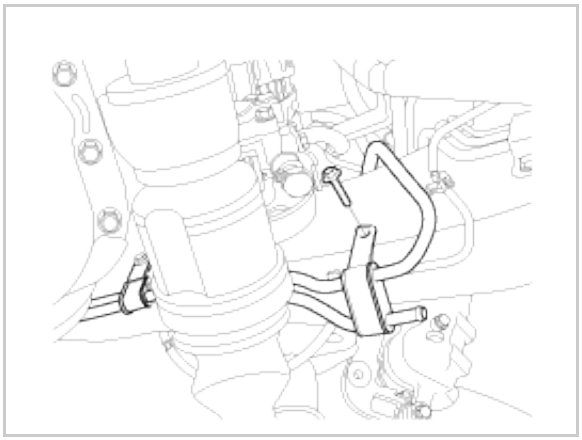


[Gasoline]

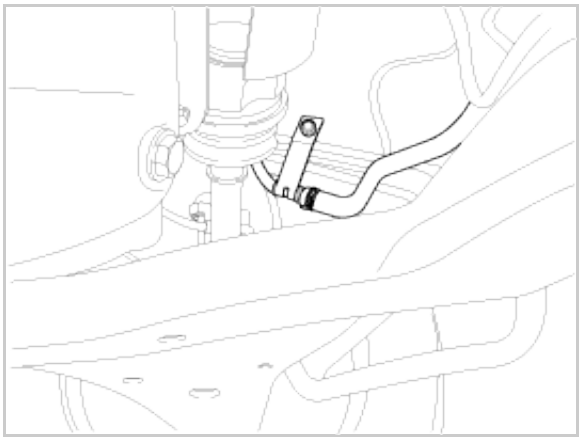


5. Remove the bracket of the return tube and hose.

[Diesel]



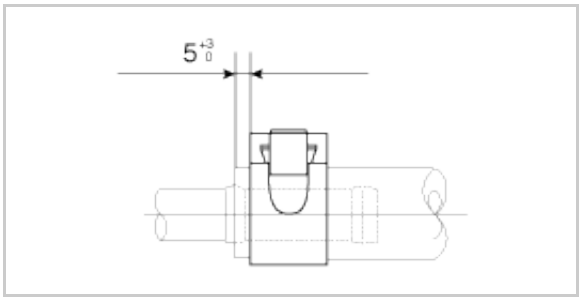
[Gasoline]



6. Remove the under cover and then loosen the oil cooler tube bracket bolts. (Refer to BD-group)

NOTICE

Be sure to connect between a tube and a hose as shown in the illustration.

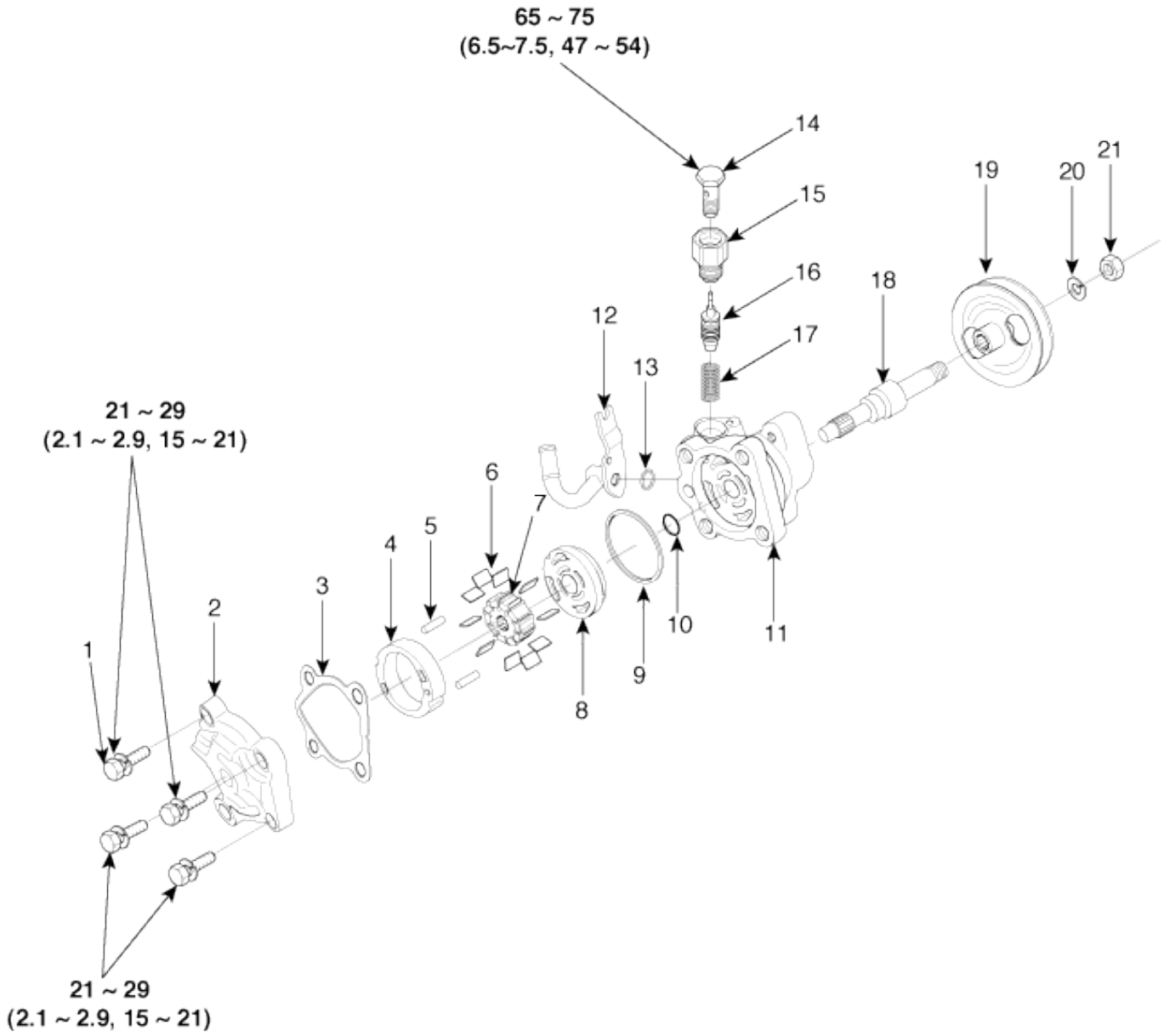


7. Installation is reverse of the removal.

8. After installation, bleed the power steering system. (Refer to the air bleeding in ST group)

Power Steering Oil Pump

COMPONENTS



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

1. Bolt
2. Oil pump cover assembly
3. Gasket
4. Cam ring
5. Lock pin
6. Vane
7. Rotor
8. Side plate
9. O-ring(Inner)
10. O-ring(Outer)
11. Front housing
12. Suction pipe
13. O-ring
14. Bolt
15. Connector
16. Flow control valve
17. Flow control spring
18. Shaft
19. Pulley
20. Washer
21. Nut

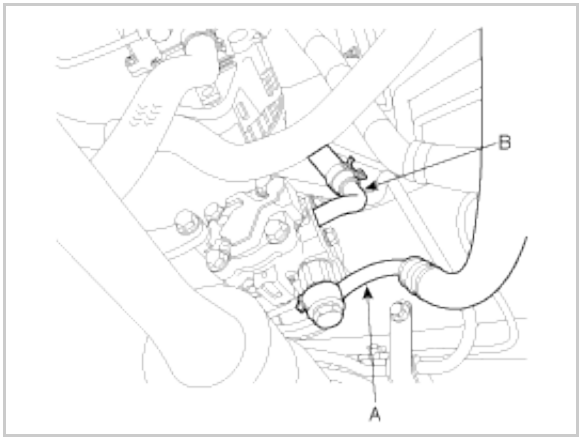
REMOVAL

1. Disconnect the pressure tube (A) from the oil pump by loosening the eye bolt.

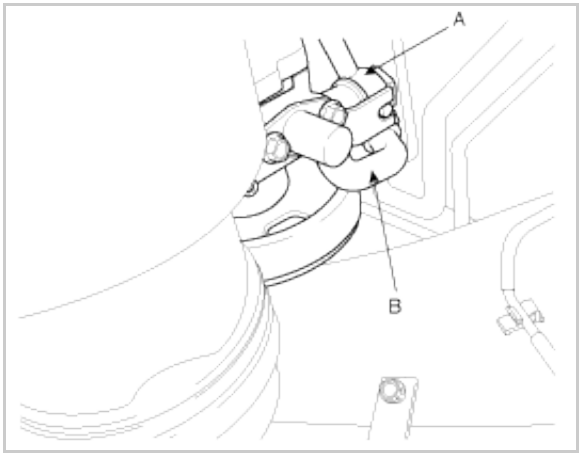
Tightening torque Nm (kgf-m, lb-ft):
65 ~ 75 (6.5 ~ 7.5, 47 ~ 54)

2. Disconnect the suction hose (B) from the suction pipe.

[Diesel]



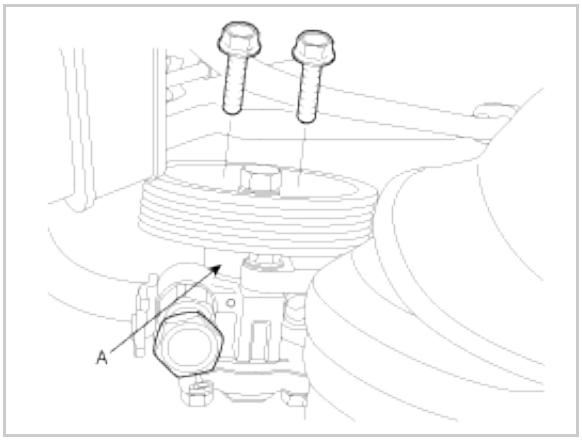
[Gasoline]



3. Remove the drive belt.
4. Loosen the power steering pump mounting bolts, and then remove the power steering pump assembly (A) from the pump bracket.

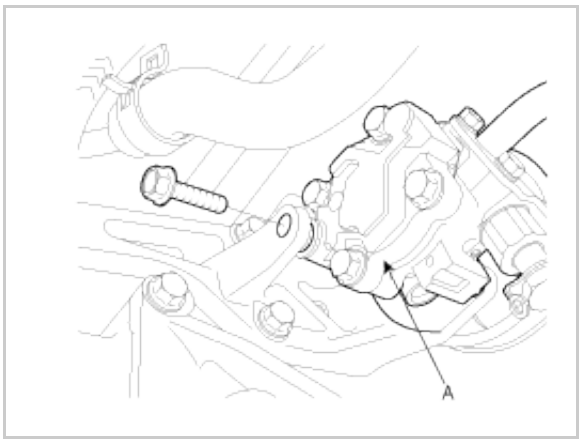
Tightening torque Nm (kgf.m lb-ft):
17 ~ 26 (1.7 ~ 2.6, 12 ~ 19)

[Diesel]



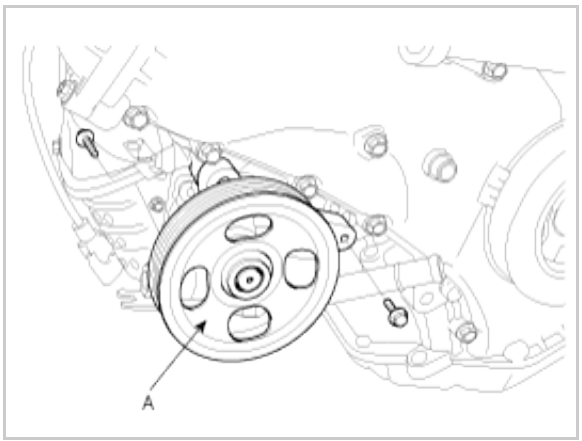
Tightening torque Nm (kgf.m lb-ft):
38 ~ 47 (3.8 ~ 4.7, 27 ~ 34)

[Diesel]



Tightening torque Nm (kgf.m lb-ft):
35 ~ 50 (3.5 ~ 5.0, 25 ~ 36)

[Gasoline]



NOTICE

Be careful not to spill fluid from the power steering oil pump.

INSTALLATION

1. Installation is the reverse of removal.

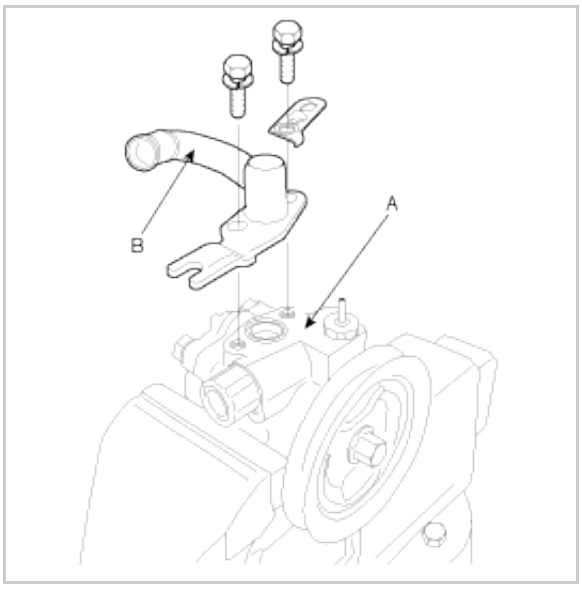
CAUTION

The pressure tube does not twist and come in contact with other components.

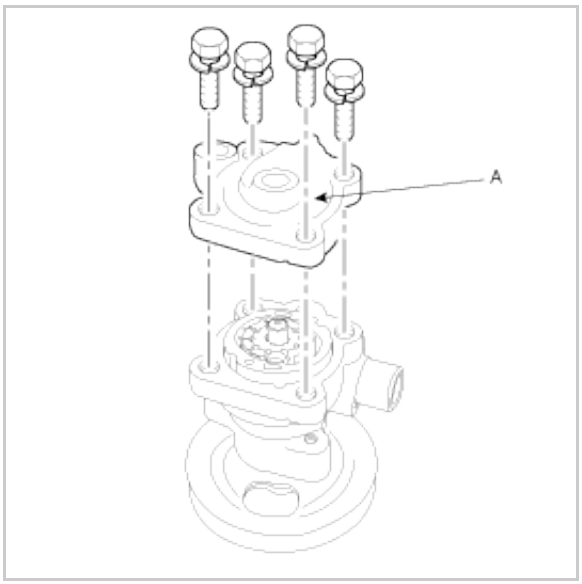
2. Add power steering fluid
3. Bleed the power steering system. (Refer to the air bleeding in ST group)
4. Check the oil pump pressure.

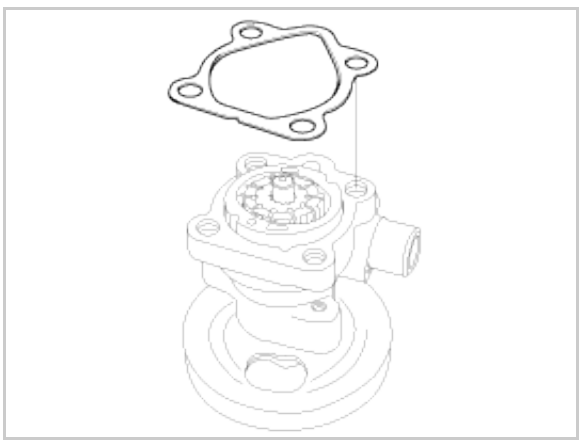
DISASSEMBLY

1. Remove two bolts from the oil pump body (A), and then remove the suction pipe (B) and O-ring.

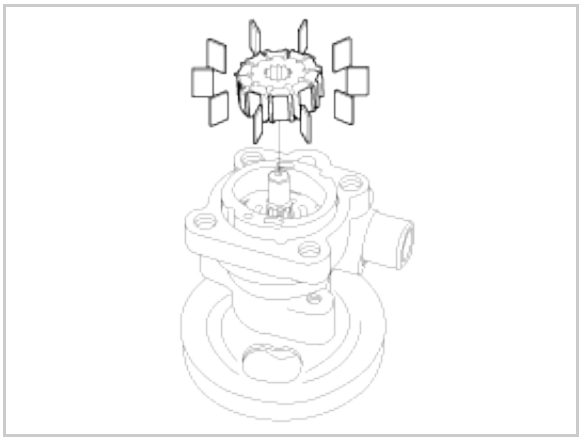


2. Loosen the four bolts and remove the oil pump cover assembly (A) and the gasket.

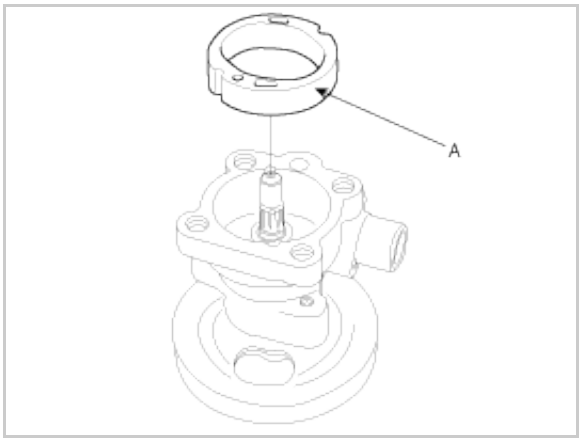




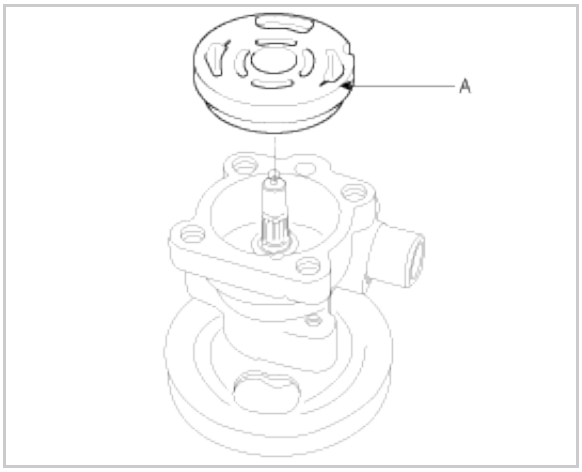
3. Remove the rotor and vanes.



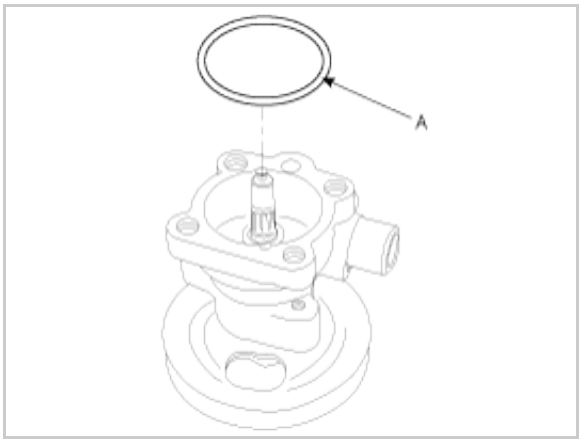
4. Remove the cam ring.



5. Remove the oil pump side plate (A).



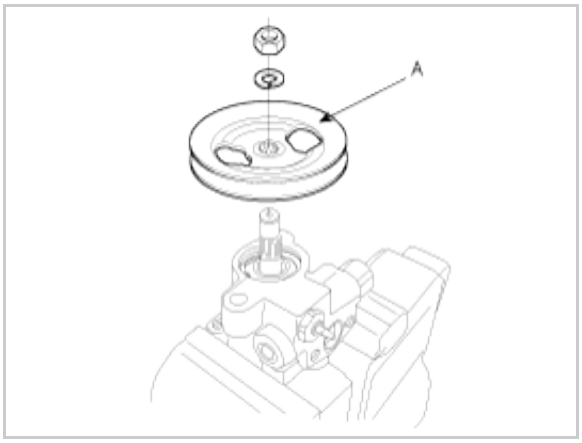
6. Remove the inner and outer O-ring (A).



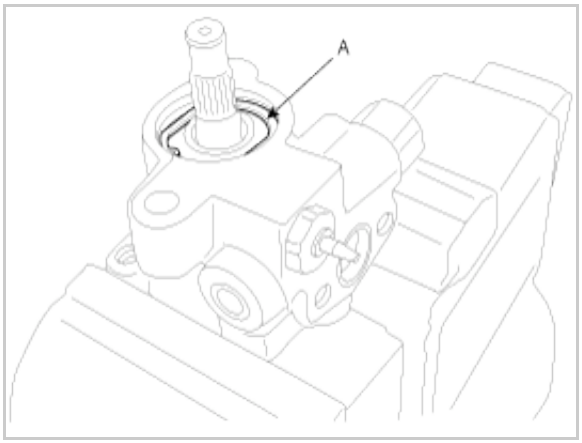
NOTICE

When assembling, use a new gasket and O-ring.

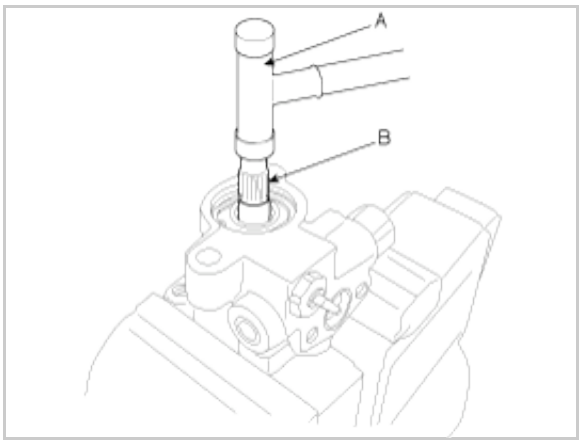
7. Mount the pump in a vise and remove the pulley (A) nut and the spring washer.



8. After removing the snap ring (A) of the shaft with snap ring pliers, remove the dust spacer.



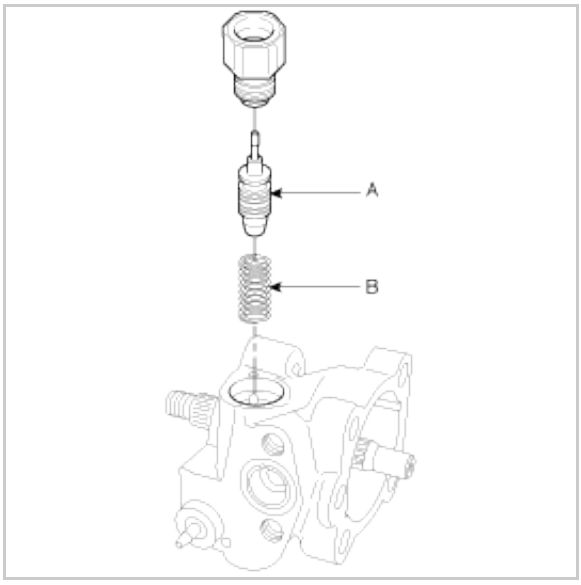
9. Tap the rotor side of the shaft slightly with a plastic hammer (A) to remove the shaft (B).



10. Remove the oil seal from the oil pump body.

> **NOTICE**
>
> When assembling, use a new oil seal.

11. Remove the connector from the oil pump body, and take out the flow control valve (A) and the flow control spring (B).



12. Remove the O-ring from the connector.

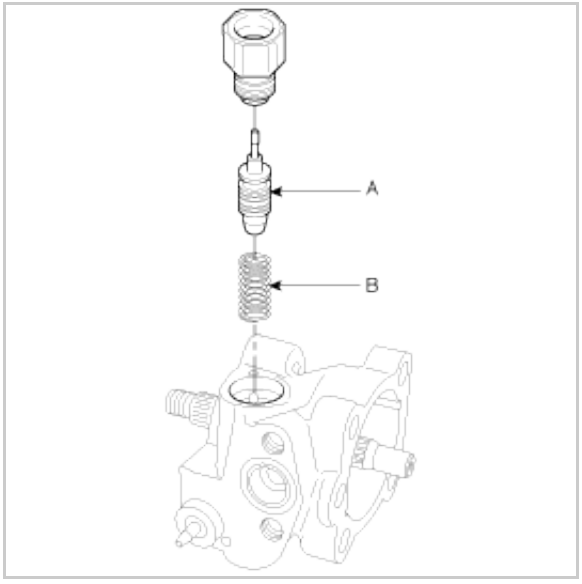
> **CAUTION**
>
> Do not disassemble the flow control valve.

INSPECTION

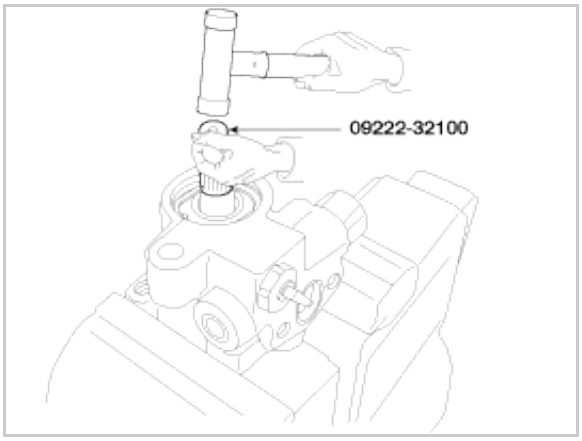
1. Check that the flow control valve is not bent.
2. Check the shaft for wear and damage.
3. Check the V belt for wear and deterioration.
4. Check the grooves of the rotor and vanes for stratified abrasion.
5. Check the contact surface of the cam ring and vanes for stratified abrasion.
6. Check vanes for damage.
7. Check that there is no striped wear in the side plate or contacting part between the shaft and the pump cover surface.

REASSEMBLY

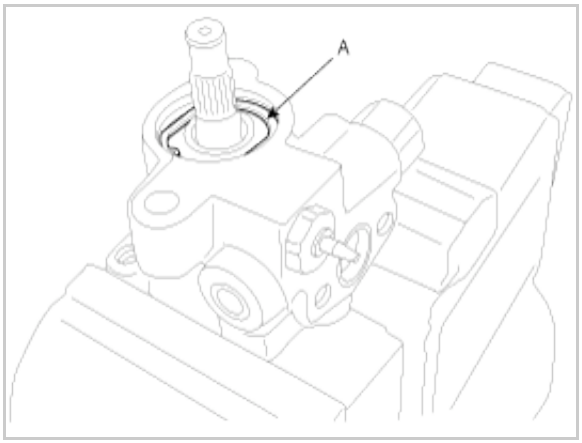
1. Install the flow control spring (B), the flow control valve (A) and the connector into the pump body.



2. Install the oil seal in the pump body by using the special tool (09222-32100).

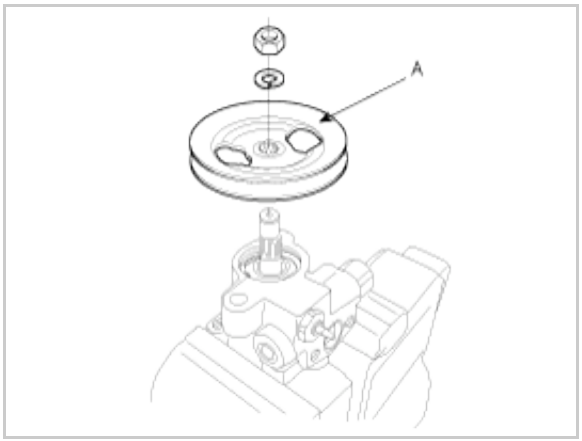


3. After inserting the shaft assembly into the pump body, install the dust spacer and snap ring (A).

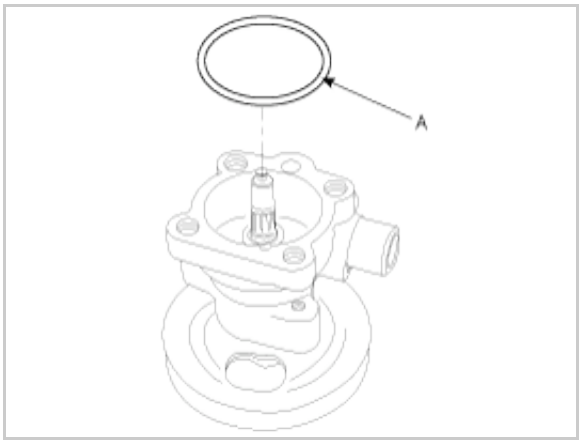


4. Install the pump pulley(A).

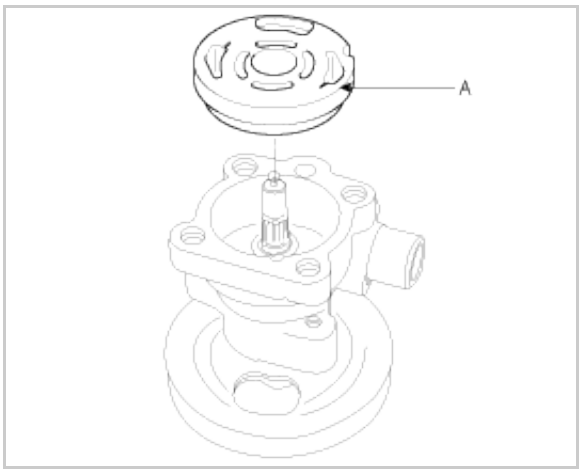
Tightening torque :
55 ~ 69 Nm (5.5 ~ 6.9 kgf·m, 39.8 ~ 49.9 lb-ft)



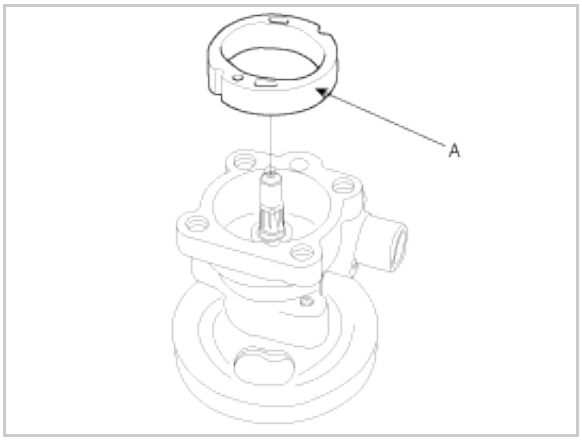
5. Install the inner O-ring and outer O-ring (A).



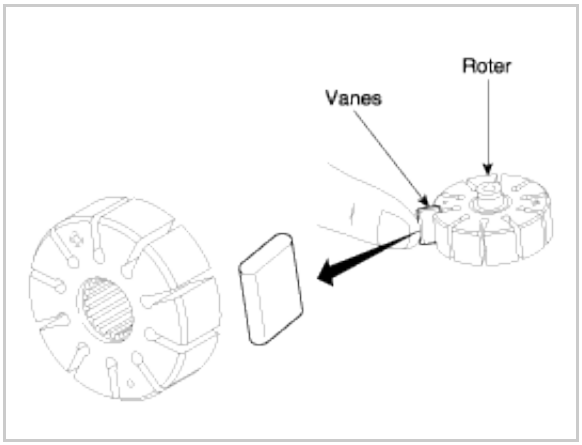
6. Install the oil pump side plate (A).

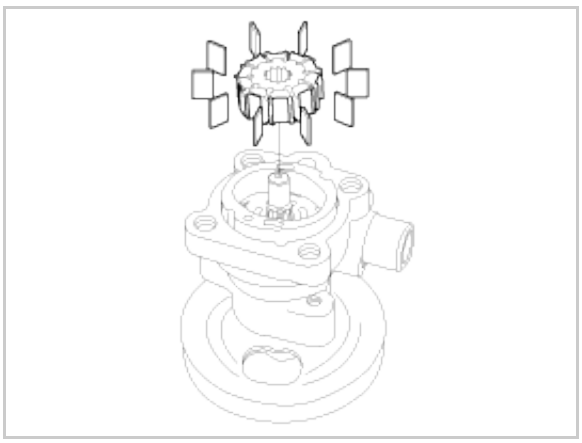


7. After inserting the lock pin into the groove of the front housing, install the camring (A) attending to the direction.

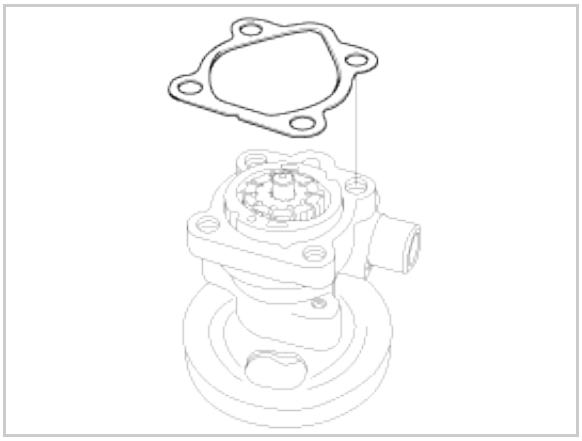


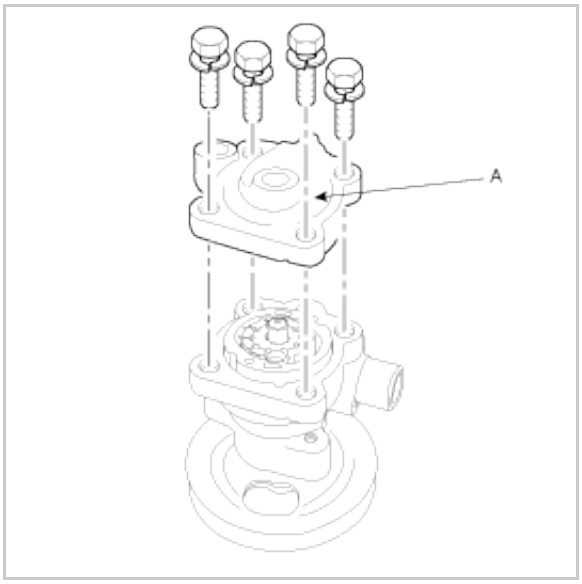
8. Install the rotor and the vanes.





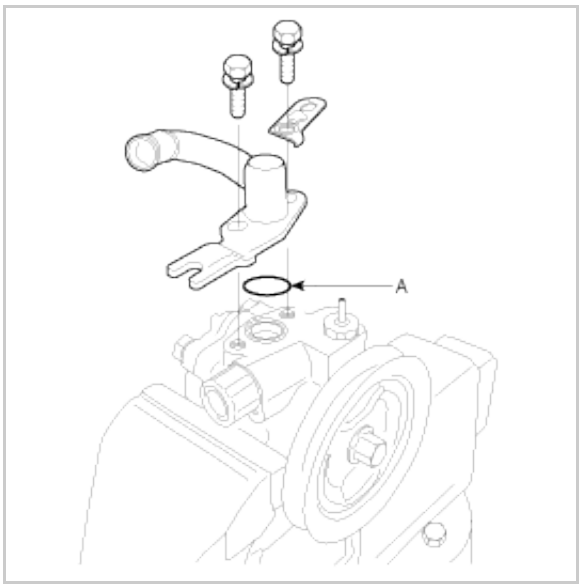
9. Install the gasket and oil pump cover assembly (A).





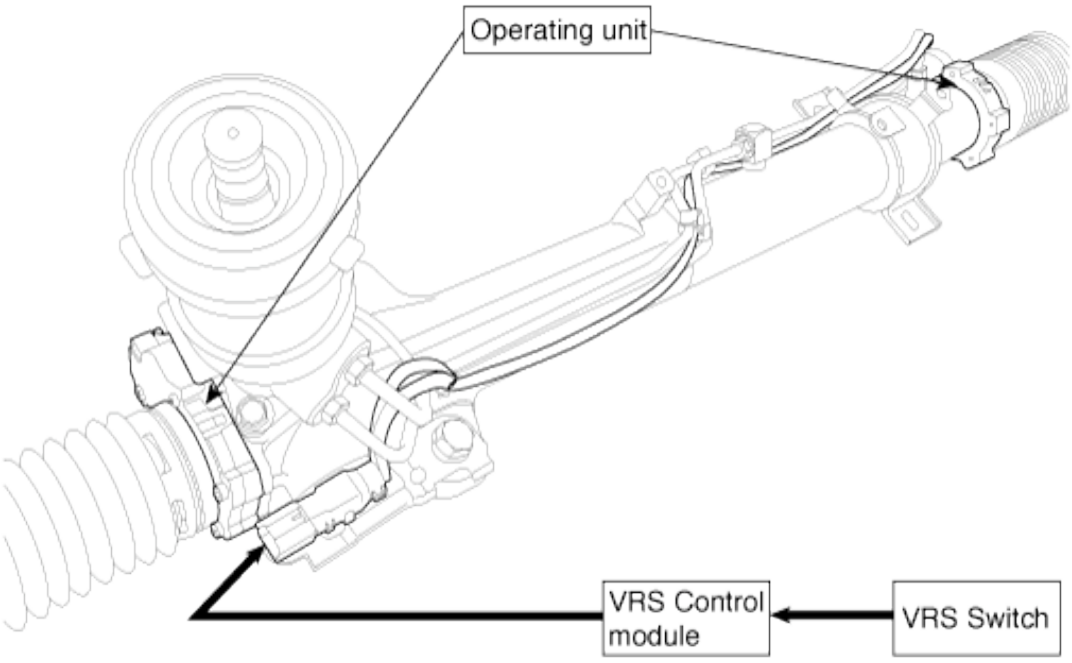
10. Install the O-ring (A) and the suction pipe mounting bolt.

Tightening torque :
13.6 ~ 18.4 Nm (1.36 ~ 1.84 kgf·m, 9.84 ~ 13.3 lb-ft)



Variouble Rack Stroke

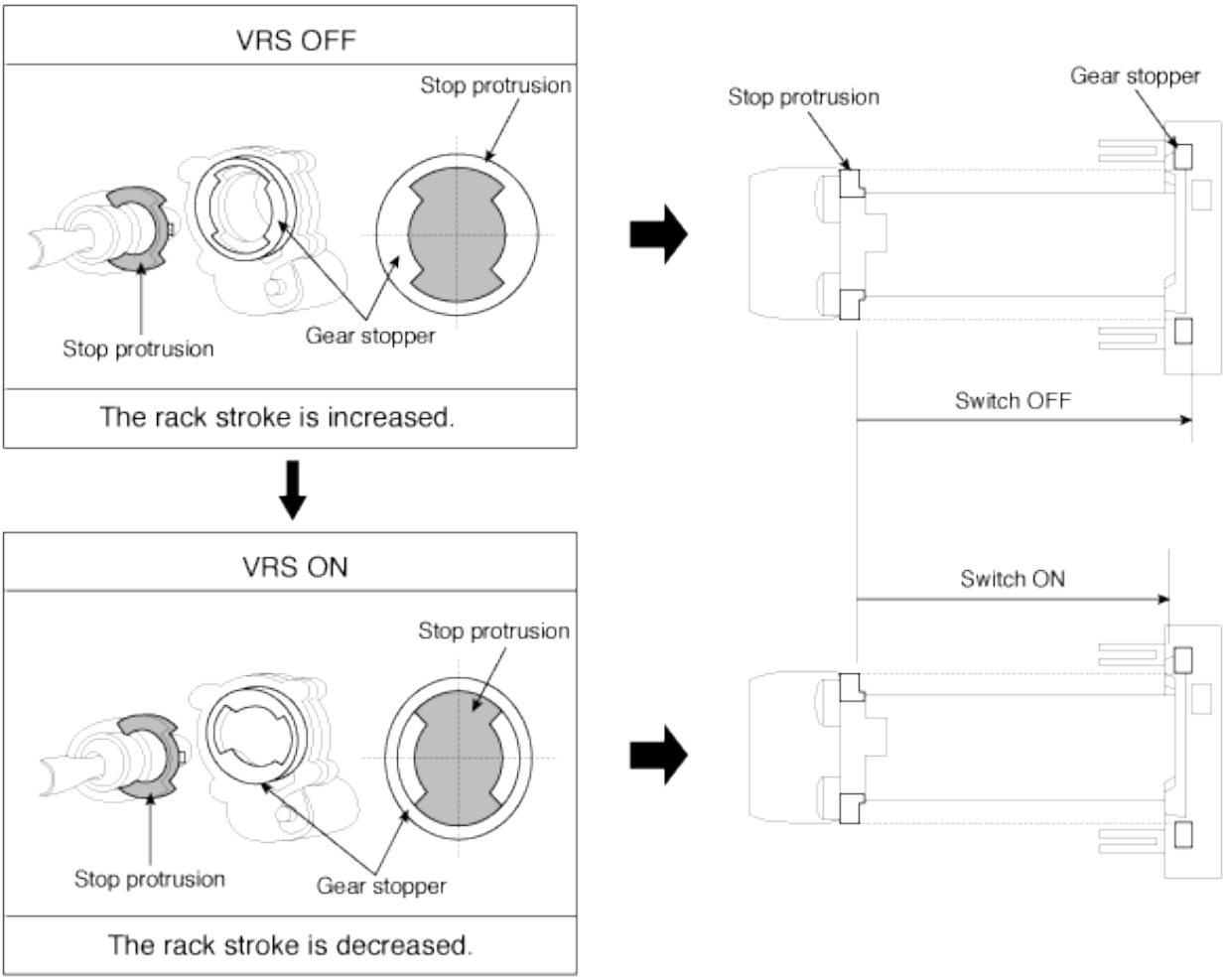
Description



The VRS (Variable Rack Stroke) is the system that controls the rack stroke using the operating unit installed on both ends of the gear box. Normally the VRS system keeps switching OFF and the rack stroke stays increased, so the vehicle's turning radius becomes reduced. On the other hand, when fitting the snow chains in winter season, the VRS switch must be turned ON and the VRS system will prevent interference between the snow chains and the vehicle by decreasing the rack stoke.

Operating principle

When switching the VRS system ON, the DC motor in the VRS operating unit rotates the gear stopper by 90 degrees and the gear stopper stops the stop protrusion from entering as shown in the illustration below. This operation reduces the maximum steering angle by decreasing the rack stroke. When switching the VRS system OFF, the gear stopper returns to original location and the rack stroke also returns to normal.


VRS OFF
Stop protrusion
Stop protrusion
Gear stopper
The rack stroke is increased.
Stop protrusion
Gear stopper
Switch OFF
VRS ON
Stop protrusion
Stop protrusion
Gear stopper
The rack stroke is decreased.
Switch ON

TROUBLE SHOOTING

Symptom	Probable cause	Remedy
There is no change made in rack stroke even though turning the VRS switch ON or OFF.	a. VRS operating unit b. VRS control module c. VRS switch	a. Inspect the VRS operating unit. b. Check Input/ output signal of the VRS control module. c. Inspect connection of the VRS switch.
LED is not illuminated even though turning the VRS switch ON.	VRS switch	a. Inspect connection of the VRS switch. b. Check the LED for damage.

There is no change made in rack stroke (the minimum turning radius) even though turning the VRS switch ON or OFF.

Inspection of the rack stroke

1. Is the rack stoke (the maximum steering angle) changed when pressing the VRS switch?

YES

▶ The VRS system is in normal condition.

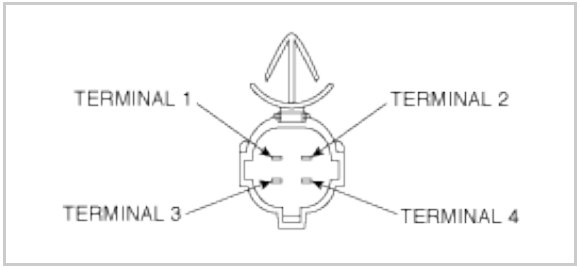
NO

▶ Go to step 2.

2. Measure the resistance of the VRS operating unit.
   (1) Disconnect the VRS operating unit connector.
   (2) Measure the resistance between the terminal No.1 and No.2.

   Repeat the terminal No.3 and No.4.
   Is the measured resistance within standard value?

4 ~ 20 Ω → Normal condition (standard value)
1 Ω or below → Short
100 Ω or above → Open circuit



YES

▶ Go to step 3.

NO

▶ Repair or replace the power steering gear box.

3. Measure the output voltage of the VRS control module.
   (1) Disconnect the VRS control module connector.
   (2) Connect 9 ~ 15 V power between the terminal No.3 and No.4.
   (3) Measure the output voltage (to DC motor) between the terminal No.5 ~ 8.

   Is the voltage measured within standard value?

Supplied power	Measured output voltage

Supplied power	Standard value	VRS CM failure
9 V	8 V or above	Below 8 V
12 V	11 V or above	Below 11 V
15 V	14 V or above	Below 14 V

YES

▶ Inspect connection of connectors and harness for the VRS system.

NO

▶ Replace the VRS control module.

LED is not illuminated even though turning the VRS switch ON.

1. Is the LED on the VRS switch illuminated when turning the VRS switch ON?

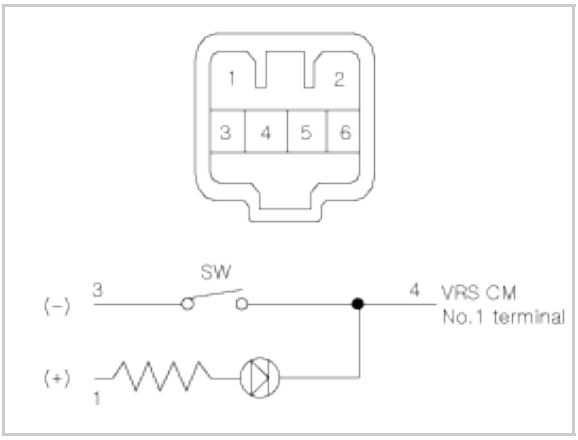
YES

▶ The VRS switch has normal condition.

NO

▶ Go to step 2.

2. Inspect the VRS switch connector.
   (1) Disconnect the VRS switch connector.
   (2) Connect 12 V power between terminal No. 1 (+) and No.3 (-).
   Check if the LED is turned ON or OFF by pressing the VRS switch.



Is the LED turned ON or OFF when pressing the VRS switch?

YES

▶ The VRS switch is in normal condition.

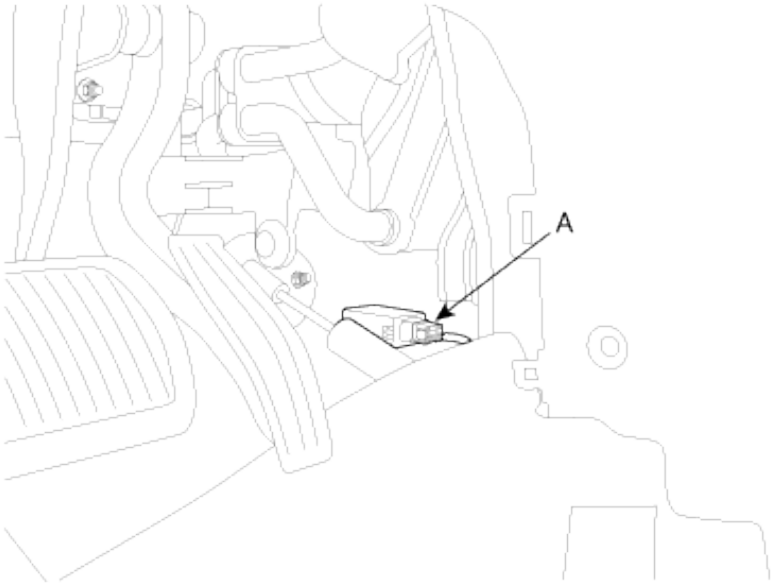
NO

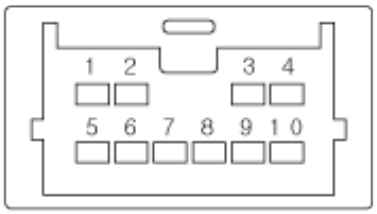
▶ Repair or replace the VRS switch.

VRS Control Unit

Description

The VRS control module (A) controls the DC motor in the VRS operating unit according to signal of the VRS switch (ON or OFF) and is mounted behind the center fascia.



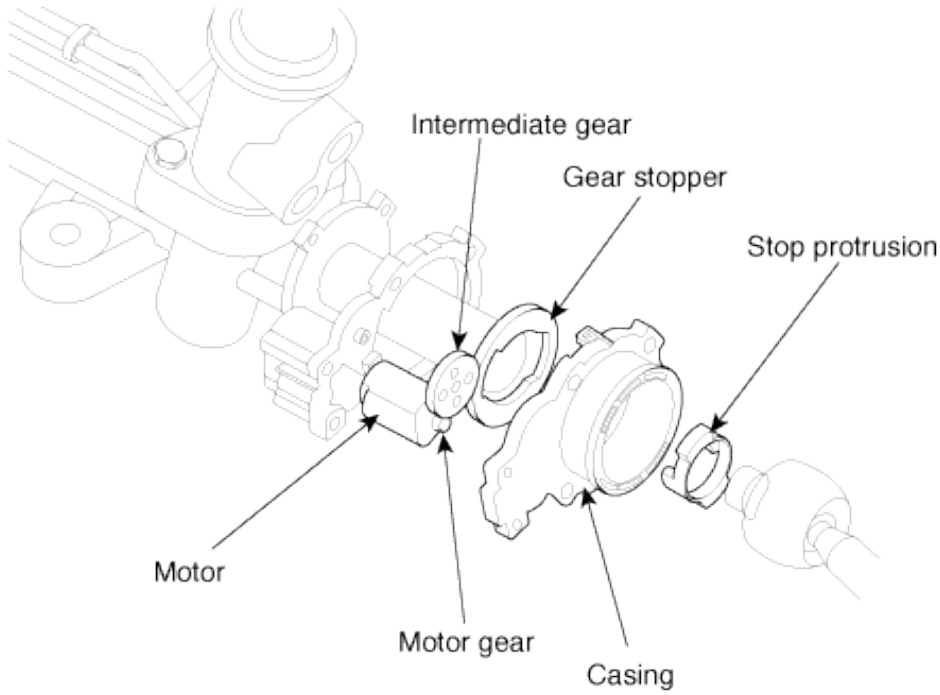


Pin No.	Function
1	Switch signal
2	-
3	IG2 (+)
4	IG2 (-)
5	Motor LH (-)
6	Motor LH (+)
7	Motor RH (+)
8	Motor RH (-)
9	-
10	-

VRS Operating Unit

Description

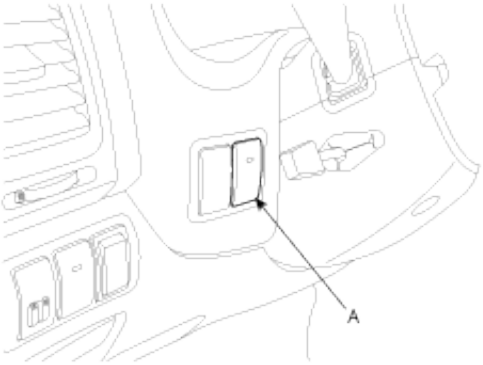
The VRS operating unit installed on both ends of the steering gear box can change the rack stoke by changing angle of the gear stopper.



VRS Switch

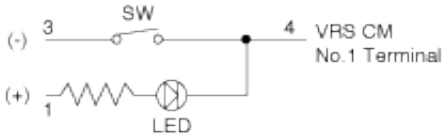
Description

The VRS switch (A) is located on the cluster fascia panel as shown in the illustration and "VRS" is printed on the VRS switch.



SWITCH DIAGRAM

P / T	ON (Push)	OFF (Free)	REMARK
3			GND
4			Control module
1			IGN2
2			ILL (+)
5			ILL (-)



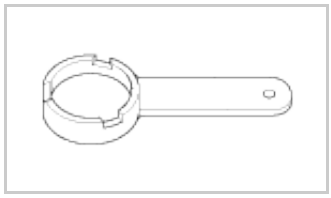
	Signal (Switch No.4 terminal)	LED
Switch OFF → ON	High → Low	ON
Switch ON → OFF	Low → High	OFF

CHAPTER 11:

Heating, Ventilation, Air Conditioning

Air Conditioning System

SPECIAL TOOLS

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

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	See page
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. Dual pressure switch 6. A/C switch 7. Evaporator temperature sensor 8. Wire harness	
No cool comes out	1. Refrigerant capacity 2. Refrigerant pressure 3. Drive belt 4. Magnetic clutch 5. Compressor 6. Dual pressure switch 7. Evaporator temperature sensor 8. A/C switch 9. Heater control assembly 10. Wire harness	
Insufficient cooling	1. Refrigerant capacity 2. Drive belt 3. Magnetic clutch 4. Compressor 5. Condenser 6. Expansion valve 7. Evaporator 8. Refrigerant lines 9. Dual pressure switch 10. Heater control assembly	
No engine idle-up when A/C switch ON	1. Engine ECM 2. Wire harness	
No air inlet control	1. Heater control assembly	
No mode control	1. Heater control assembly 2. Mode actuator	
No cooling fan operation	1. Cooling fan fuse 2. Fan motor 3. Engine ECM 4. Wire harness	

SPECIFICATION

Air conditioner

Item		Specification
Compressor	Type	VS (Variable capacity)
	Oil type & Capacity	ND-OIL8 (PAG), 120 ± 10cc
	Pulley type	L5OS-TYPE
	Displacement	180cc/rev
Condenser	Heat rejection	14,000 ± 5% kcal/hr
Dual pressure switch	High [psi(kg/cm²)]	ON: 370 ± 2.8 (26.0 ± 0.2) OFF: 455 ± 2.8 (32.0 ± 0.2)
	Low ([psi(kg/cm²)]	ON : 28.6 ~ 36.3 (2.00 ~ 2.55) OFF : 28.4 ± 2.8 (2.0 ± 0.2)
Expansion valve	Type	Block
Refrigerant	Type	R-134a
	Capacity [oz.(g)]	28.21 ± 0.88 (800 ± 25)

Blower unit

Item		Specification
Fresh and recirculation	Operating method	Actuator
Blower	Type	Sirocco
	Speed step	Auto + 8 speed (Automatic) 1~8speed (Manual)
	Speed control	Power mosfet
Air filter	Type	Particle filter

Heater and evaporator unit

Item		Specification
Heater	Type	Pin & Tube type
	Heating capacity	4,700 ± 5% kcal/hr
	Mode operating method	Actuator
	Temperature operating method	Actuator
Evaporator	Temperature control type	Evaporator temperature sensor
	A/C ON/OFF [°C(°F)]	ON : 2.3 ± 0.5 (36.14 ± 32.9) OFF: 1.3 ± 0.5 (34.34 ± 32.9)

Air Conditioning System

INSTRUCTIONS

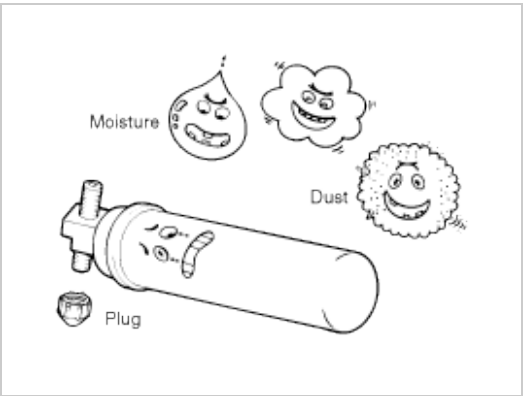
WHEN HANDLING REFRIGERANT

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 that the 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 the 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 immediately the components to prevent from the 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 resuming service.



WHEN REPLACING PARTS ON A/C SYSTEM

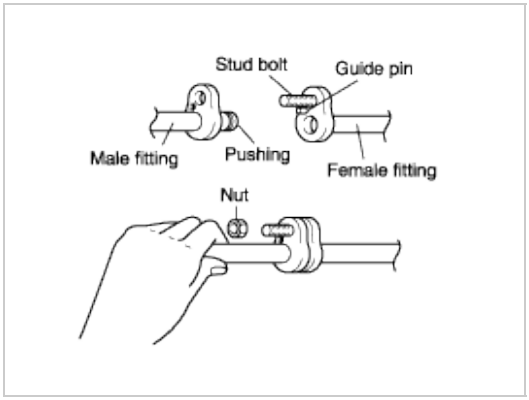
1. Never open or loosen a connection before discharging the system.
2. Seal the open fittings of components with a cap or plug immediately to prevent intrusion of moisture or dust.
3. Do not remove the sealing caps from a replacement component until it is ready to be installed.
4. Before connecting an 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 it 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)a
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)

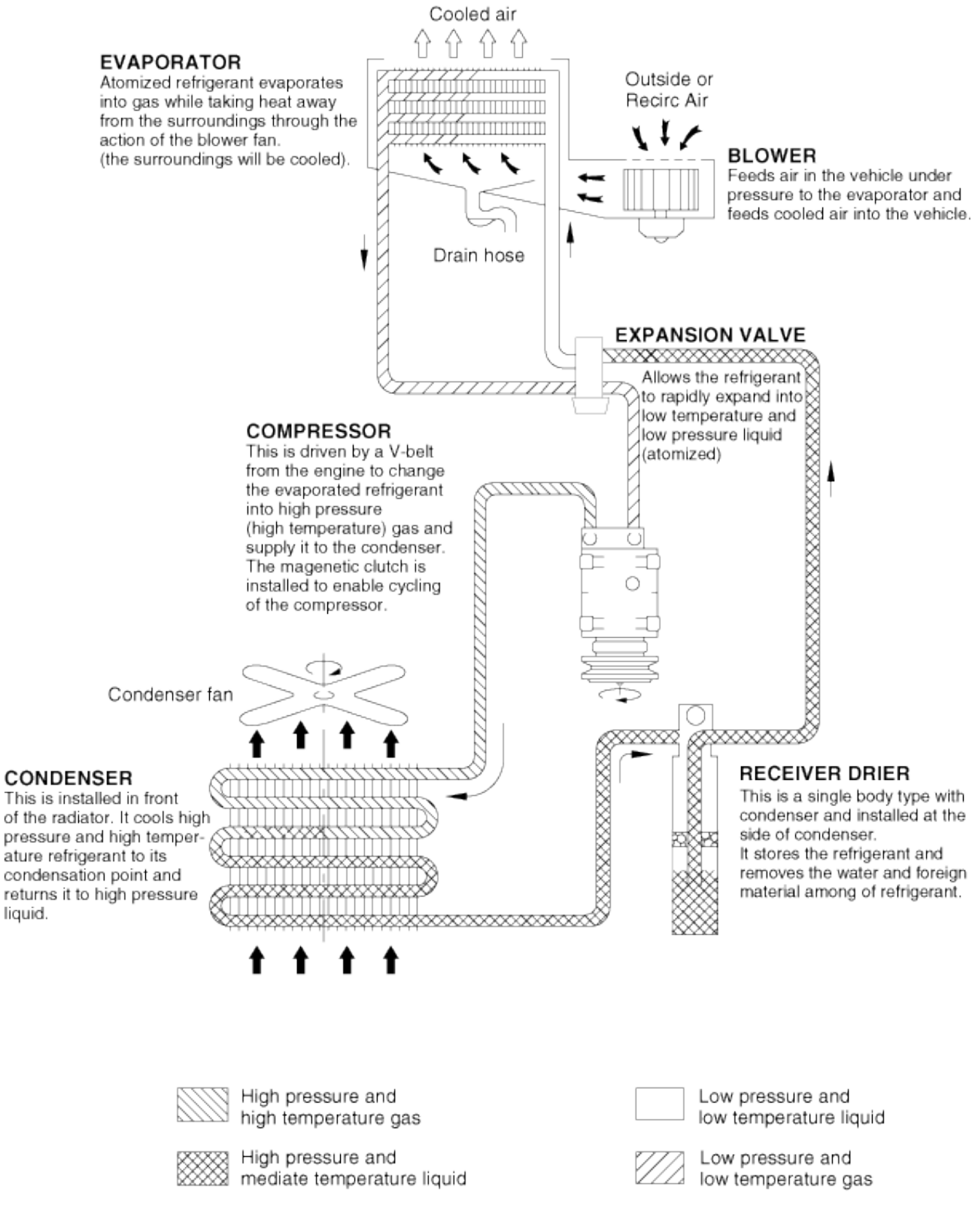
HANDLING TUBING AND FITTINGS

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

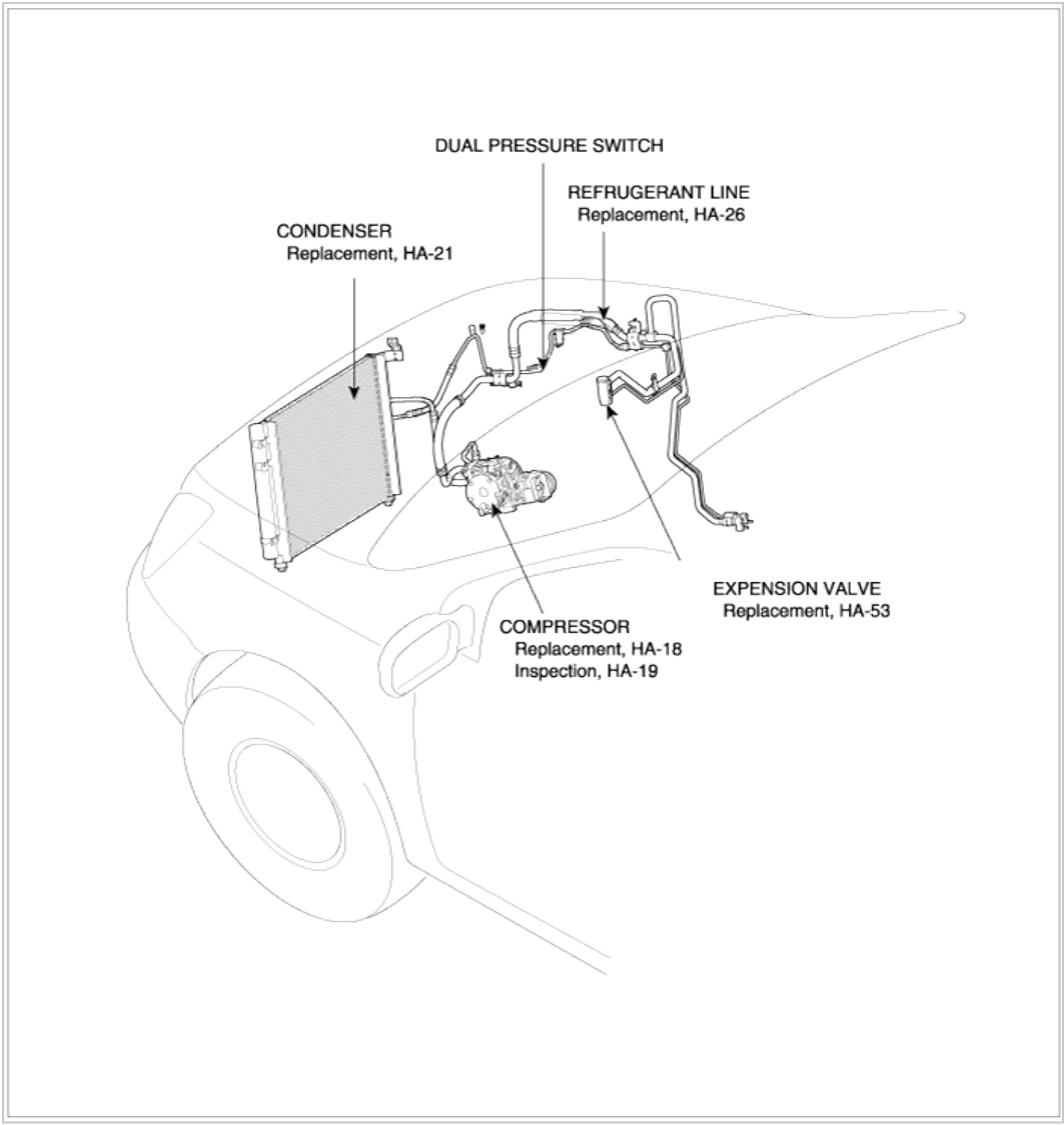
1. When it is necessary to open the refrigeration system, have everything you will need to service the system ready so the system will not be left open any longer than necessary.
2. Cap or plug all lines and fittings as soon as they are opened to prevent the entrance of dirt and moisture.
3. All lines 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.

REFRIGERATION CYCLE

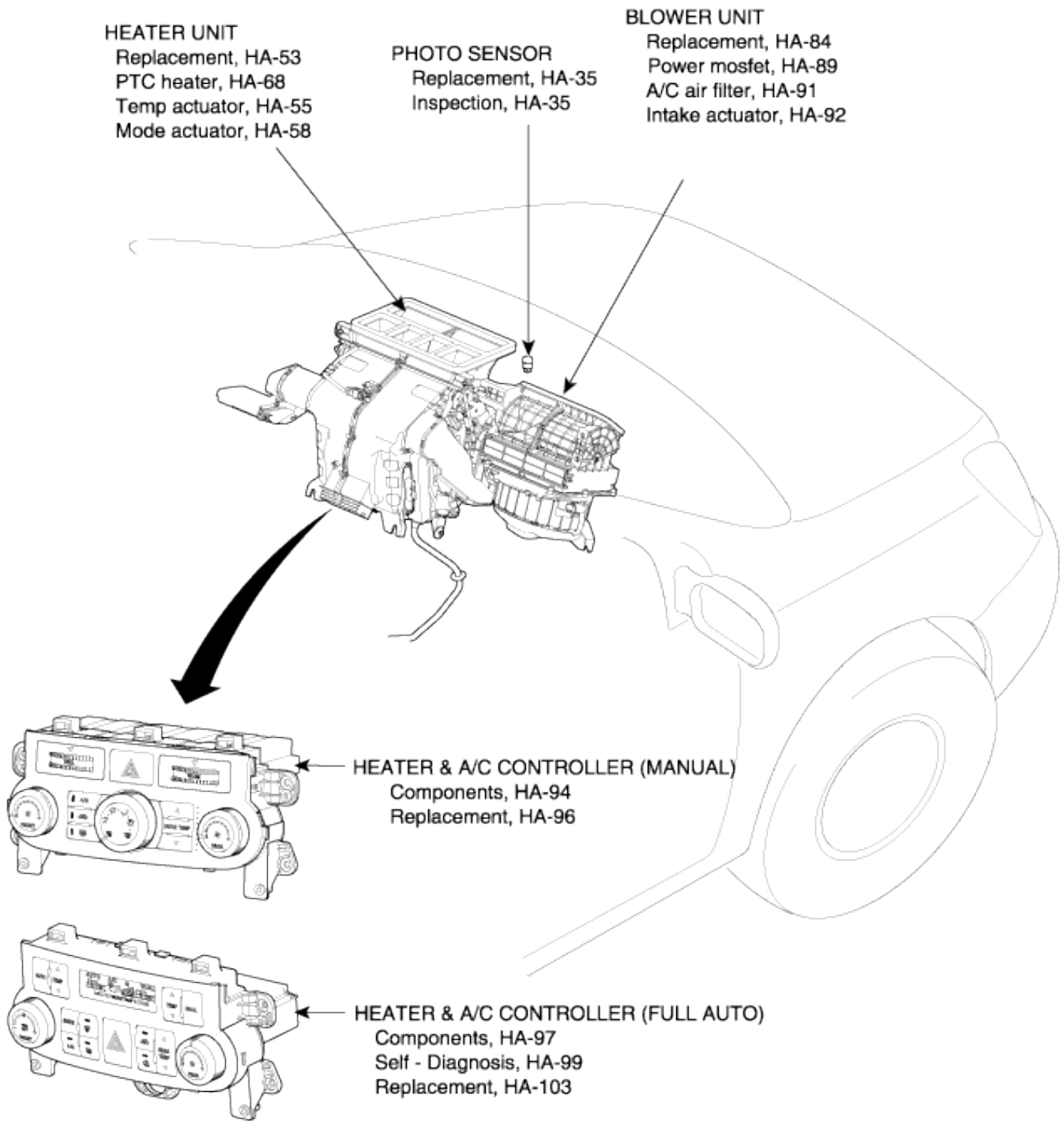


COMPONENT LOCATION INDEX

ENGINE ROOM



INTERIOR


HEATER UNIT
Replacement, HA-53
PTC heater, HA-68
Temp actuator, HA-55
Mode actuator, HA-58
PHOTO SENSOR
Replacement, HA-35
Inspection, HA-35
BLOWER UNIT
Replacement, HA-84
Power mosfet, HA-89
A/C air filter, HA-91
Intake actuator, HA-92
HEATER & A/C CONTROLLER (MANUAL)
Components, HA-94
Replacement, HA-96
HEATER & A/C CONTROLLER (FULL AUTO)
Components, HA-97
Self - Diagnosis, HA-99
Replacement, HA-103

REFRIGERANT SYSTEM SERVICE BASICS

REFRIGERANT RECOVERY

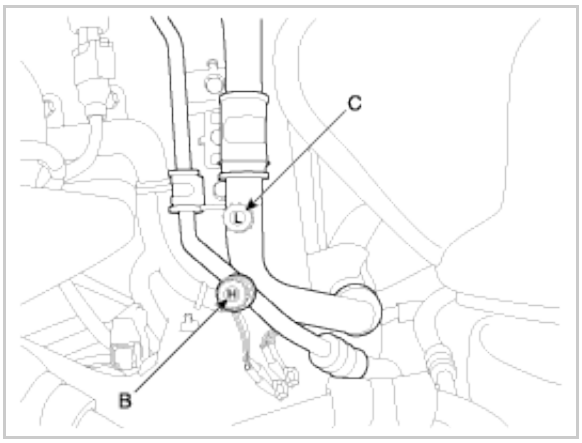
Use only service equipment that is U.L-listed and is certified to meet the requirements of SAE J2210 to remove HFC-134a(R-134a) from the air conditioning system.

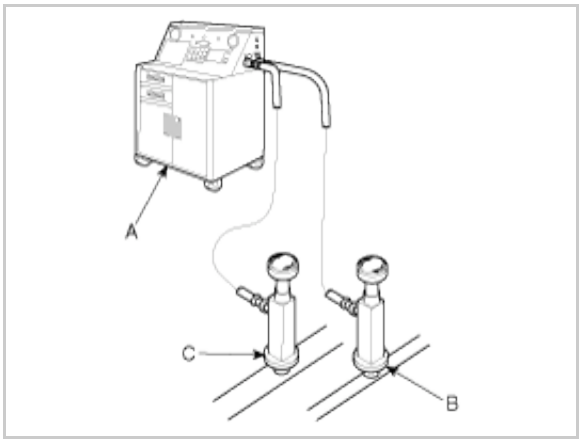
CAUTION

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

If accidental system discharge occurs, ventilate work area before resuming 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.

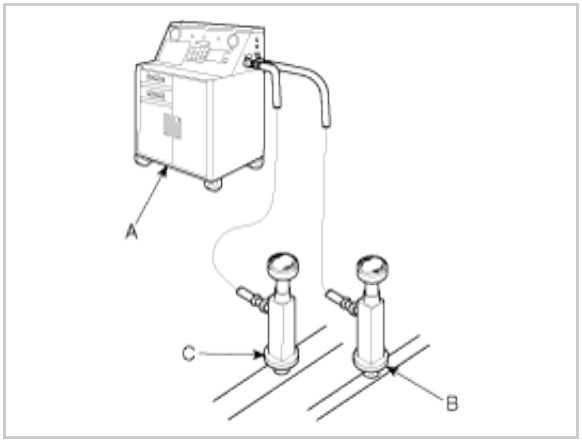
CAUTION

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

If accidental system discharge occurs, ventilate work area before resuming 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

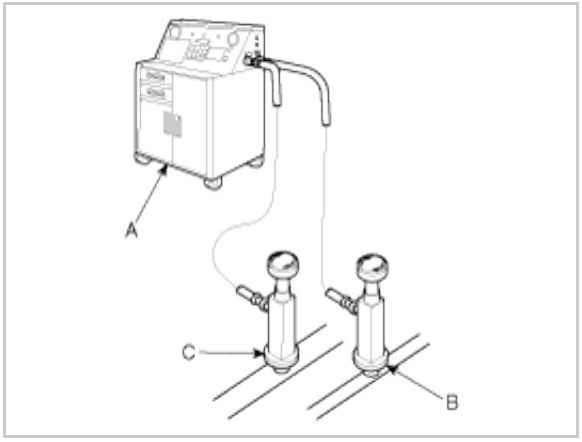
Use only service equipment that is U.L-listed and is certified to meet the requirements of SAE J2210 to remove HFC-134a(R-134a) from the air conditioning system.

CAUTION

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

If accidental system discharge occurs, ventilate work area before resuming 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 28.21 ± 0.88 oz. (800 ± 25g) of R-134a refrigerant. Do not overcharge the system the compressor will be damaged.

REFRIGERANT LEAK TEST

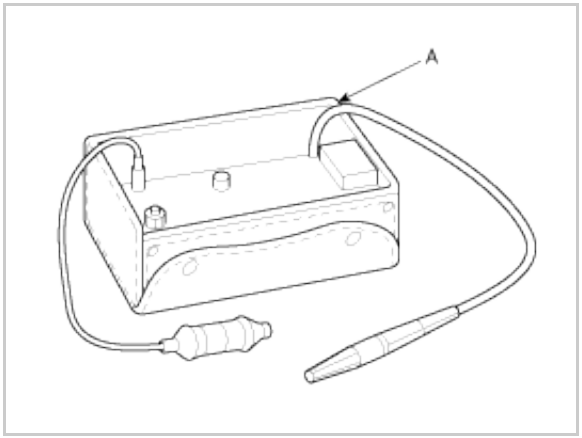
Always conduct a leak test with an electronic leak detector whenever leakage or refrigerant is suspected and when conducting service operations which are accompanied by disassembly or loosening or connection fittings.

NOTICE

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

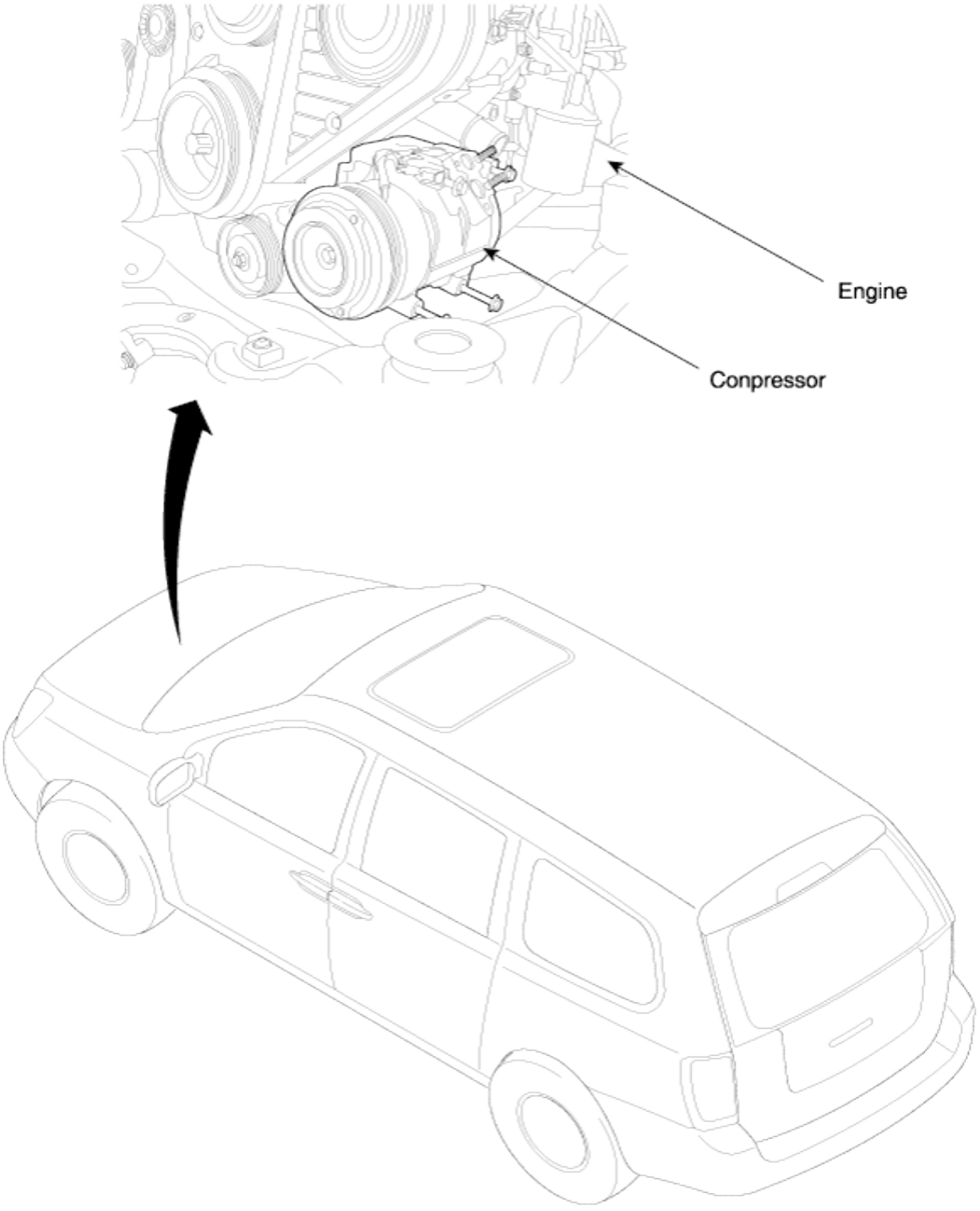
If a gas leak is detected, proceed as follows:

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.

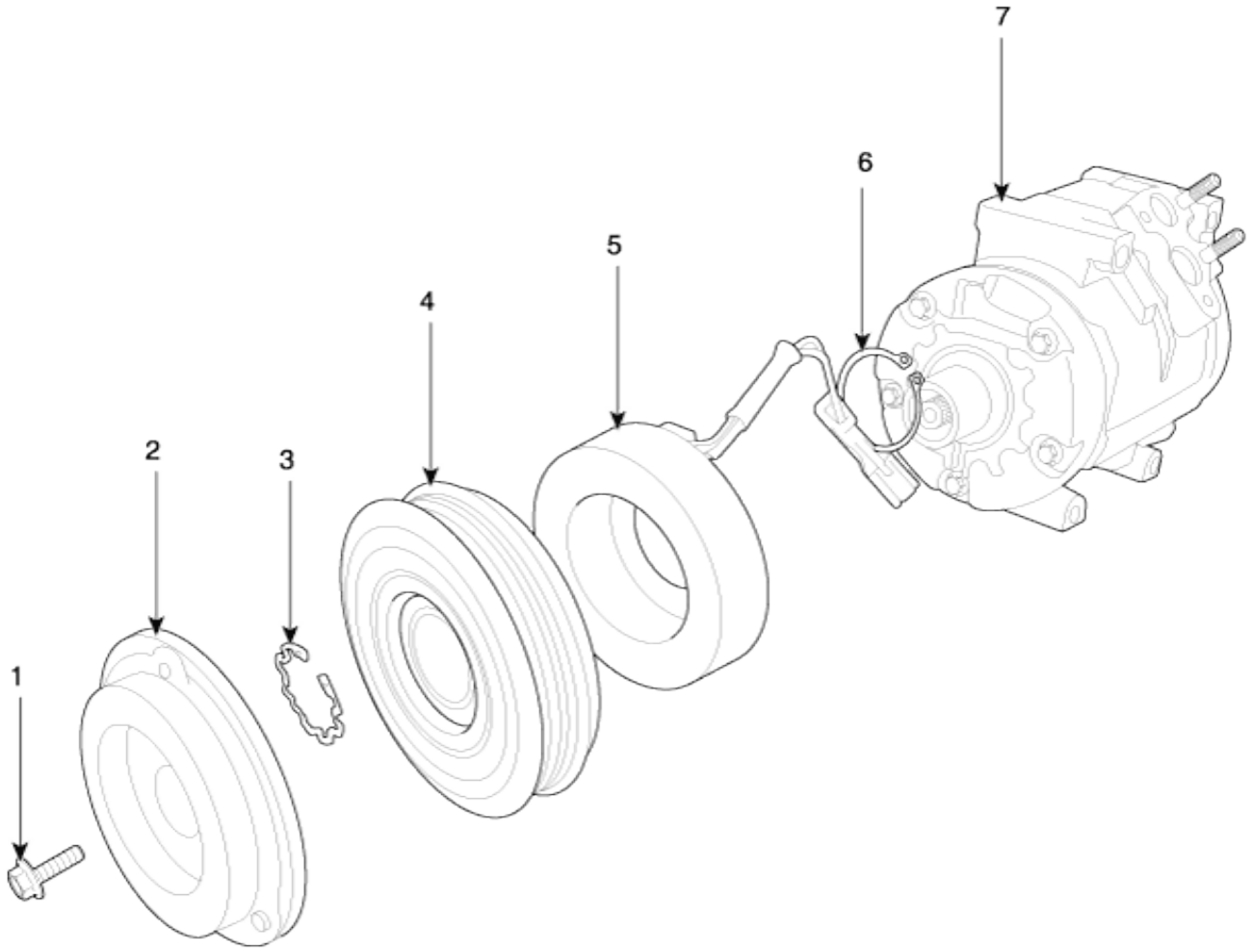


Compressor

COMPONENT LOCATION



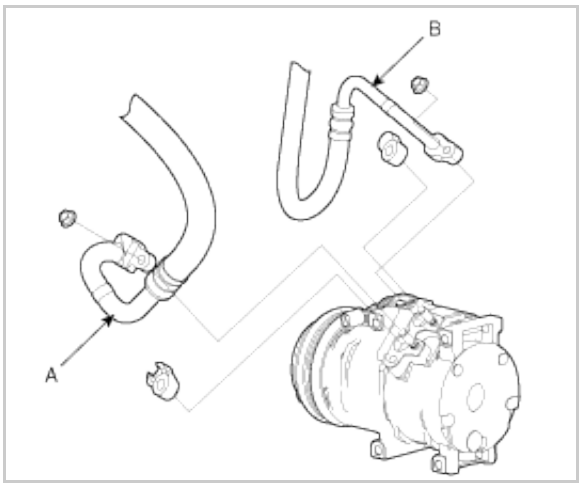
COMPONENTS



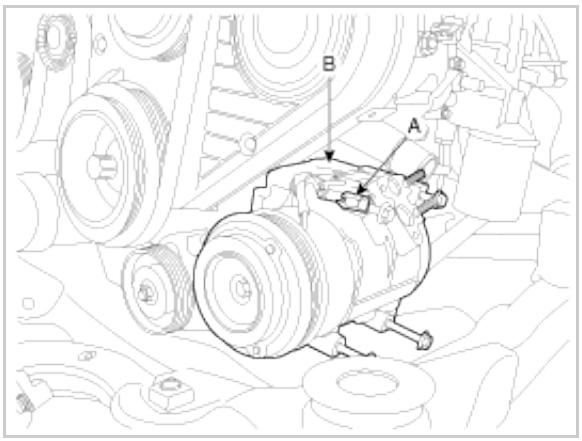
1. Bolt
2. Disc & hub assembly
3. Retainer ring (Pully)
4. Pully
5. Field coil
6. Retainer reing(Field coil)
7. Compressor assembly

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 (Refer to HA-8).
4. Loosen the drive belt (Refer to HA-14).
5. Remove the bolts, then disconnect the suction line (A) and discharge line (B) from the compressor. Plug (C) or cap the lines immediately after disconnecting them to avoid moisture and dust contamination.

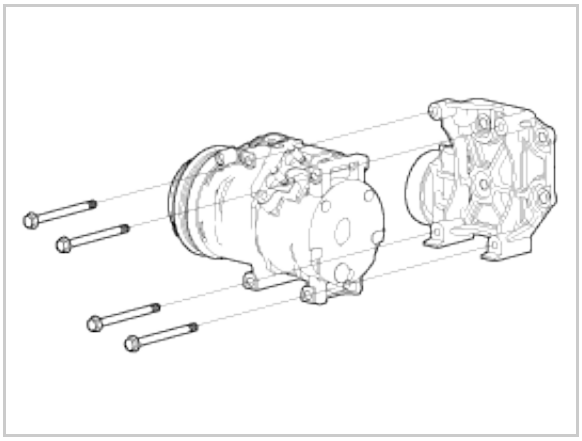


6. Disconnect the compressor clutch connector (A), and then remove 4 mounting bolts and the compressor.



INSTALLATION

1. Make sure of the length of compressor mounting bolts.



2. Install in the reverse order of removal, and note these items.
   a. If you're installing a new compressor, drain all the refrigerant oil from the removed compressor, and measure its

volume, Subtract the volume of drained oil from 120cc(4.20 oz.) the result is the amount of oil you should drain from the new compressor (through the suction fitting).

b. Replace the O-rings with new ones at each fitting, and apply a thin coat of refrigerant oil before installing them. Be sure to use the right O-rings for R-134a to avoid leakage.

c. To avoid contamination, do not return the oil to the container once dispensed, and never mix it with other refrigerant oils.

d. Immediately after using the oil, replace the cap on the container and seal it to avoid moisture absorption.

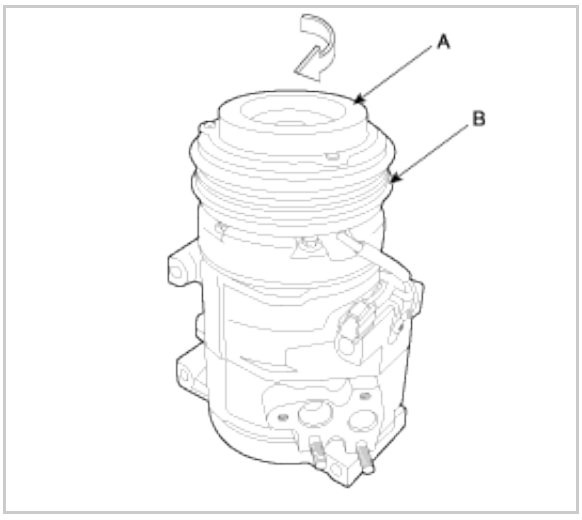
e. Do not spill the refrigerant oil on the vehicle; it may damage the paint; if the refrigerant oil contacts the paint, wash it off immediately.

f. Adjust the drive belt (Refer to HA-14)

g. Charge the system and test its performance. (Refer to HA-9)

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.

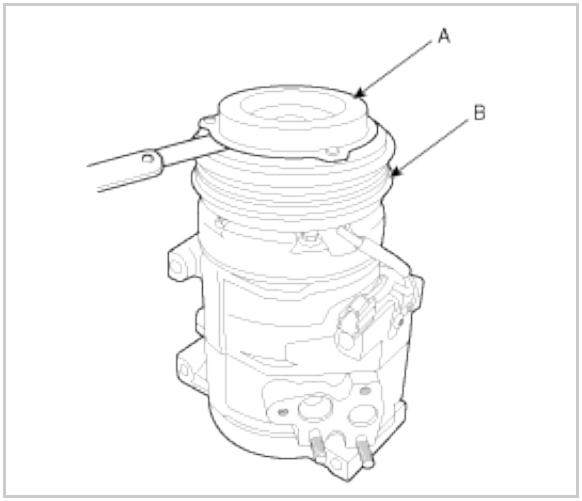


3. Measure the clearance between the pulley (B) and the disc & hub assembly (A) all the way around. If the clearance is not within specified limits, remove the disc & hub assembly and add or remove shim (gap washer) as needed to increase or decrease clearance.

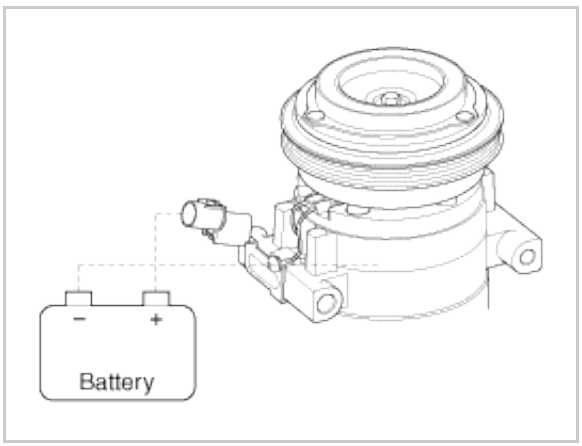
Clearance: 0.45 ± 0.1mm (0.018 ± 0.004 in.)

NOTICE

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



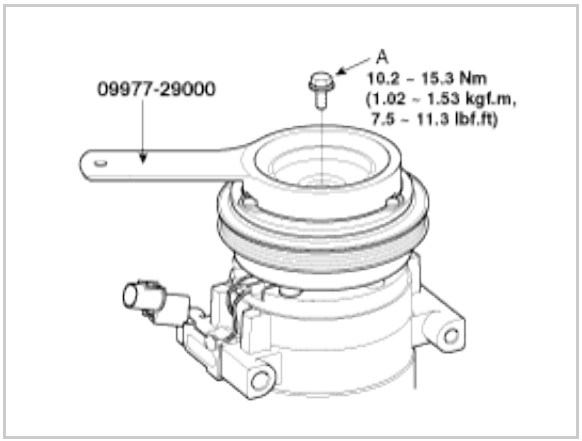
4. Check operation of the magnetic clutch.Connect the compressor side terminals to the battery (+) terminal and the ground battery (-) terminal to the compressor body.
   Check the magnetic clutch operating noise to determine the condition.



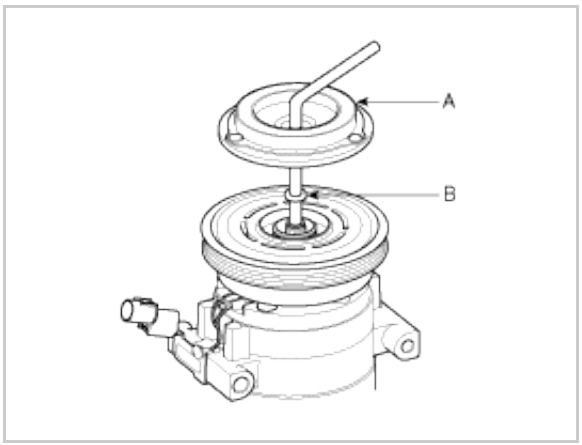
DISASSEMBLY

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)

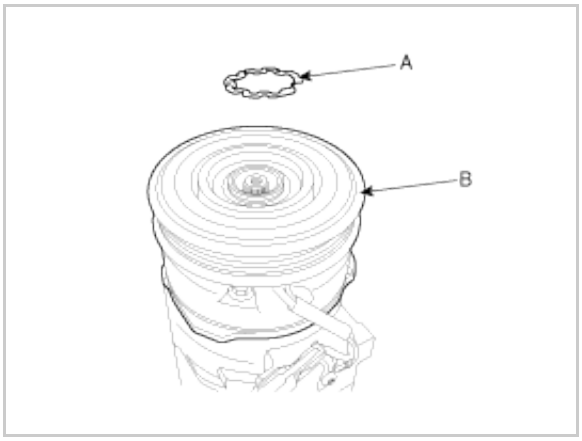


2. Remove the disc & hub assembly (A) and shim (gap washer) (B), taking care not to lose the shims. If the clutch needs adjustment, increase or decrease the number and thickness of shims as necessary, then reinstall the disc & hub assembly, and recheck its clearance (Refer to HA-19).

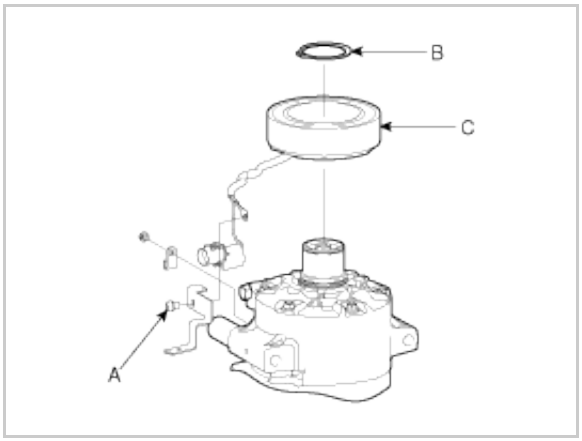


3. If you removal the field coil, remove retainer ring (A) with retainer ring pliers.

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



4. Remove the screw (A) from the field coil ground terminal. Remove the retainer ring (B) and then remove the field coil (C) from the shaft with a puller. Be careful not to damage the coil and compressor.



5. Reassemble the compressor clutch in the reverse order of disassembly, and note these items :
   a. Clean the pulley and compressor sliding surfaces with non-petroleum solvent.
   b. Install new retainer rings, and make sure they are fully seated in the groove.
   c. Make sure that the pulley turns smoothly after its reassembled.

Compressor oil

INSPECTION

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)

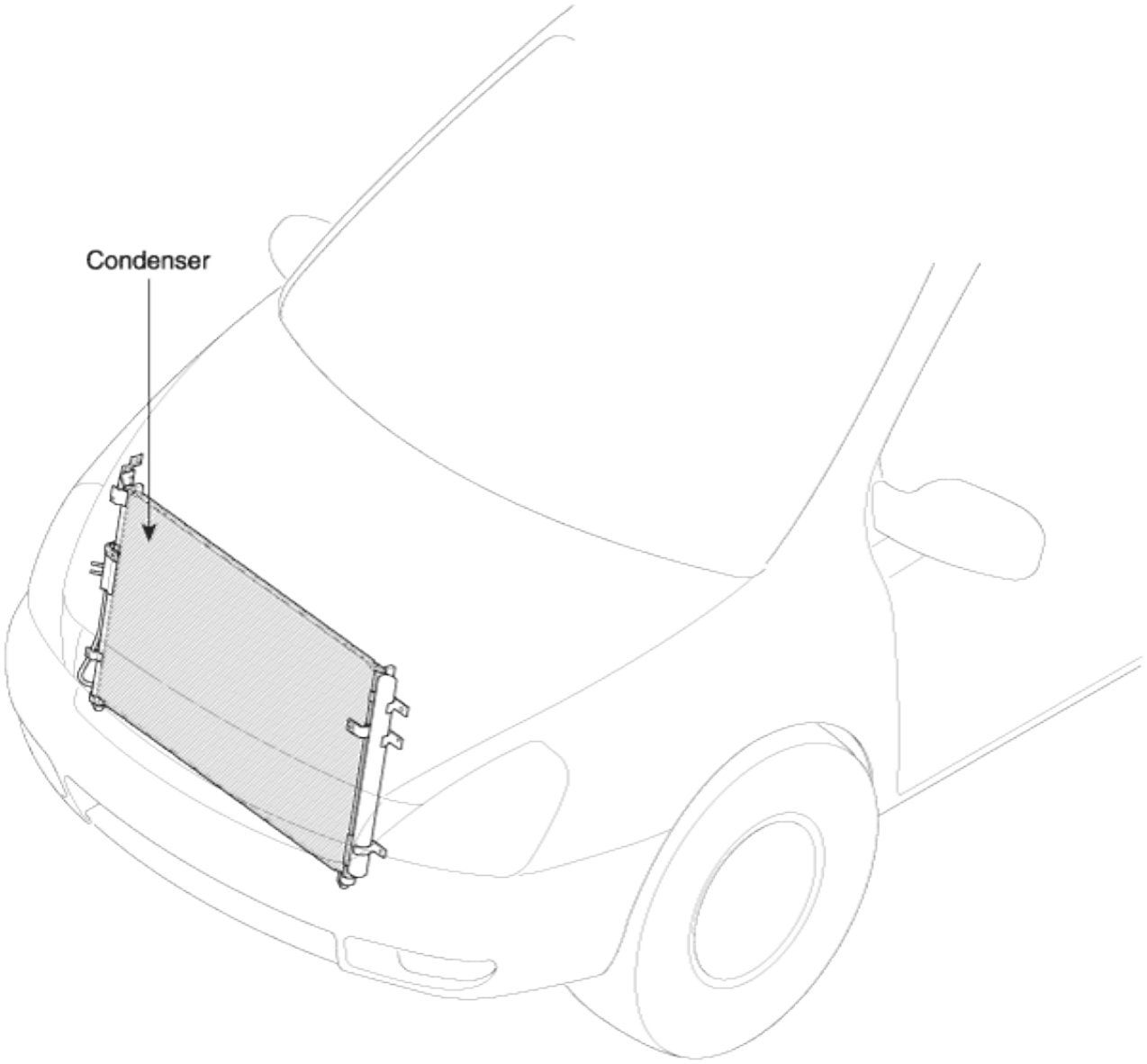
For compressor replacement, subtract the volume of oil drained from the removed compressor from the specified volume, and drain the calculated volume of oil from the new compressor:
The specified volume - volume of removed compressor = volume to drain from the new compressor.

NOTICE

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

Condenser

COMPONENT LOCATION



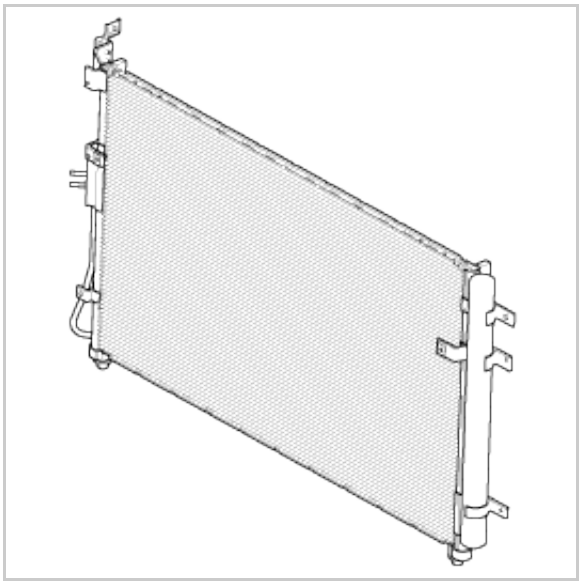
INSPECTION

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 (Refer to HA-8).
2. Disconnect the negative (-) battery terminal.
3. Remove the radiator. (Refer to EM group)
4. Remove 2 bolts, and then remove the condenser (A) by lifting it up. Be careful not to damage the radiator and condenser fins when removing the condenser.

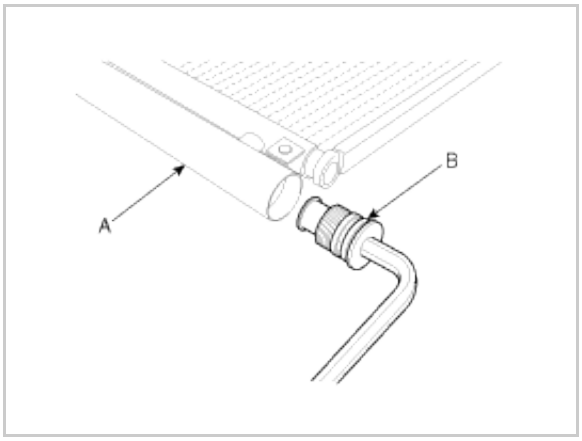


5. Install in the reverse order of removal, and note these items :
   a. If you're installing a new condenser, add refrigerant oil ND-OIL8.
   b. Replace the O-rings with new ones at each fitting, and apply a thin coat of refrigerant oil before installing them. Be sure to use the right O-rings for R-134a 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. (Refer to HA-9)

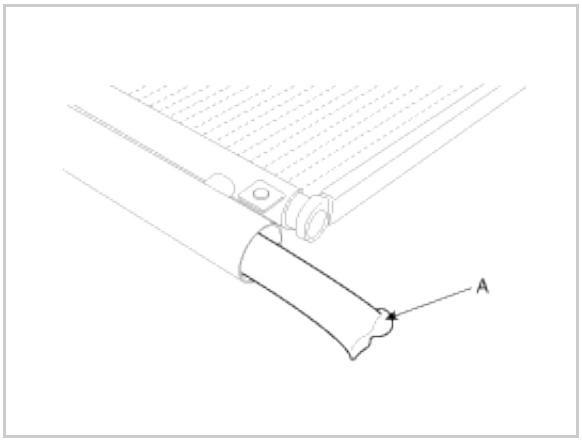
DESICCANT

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.



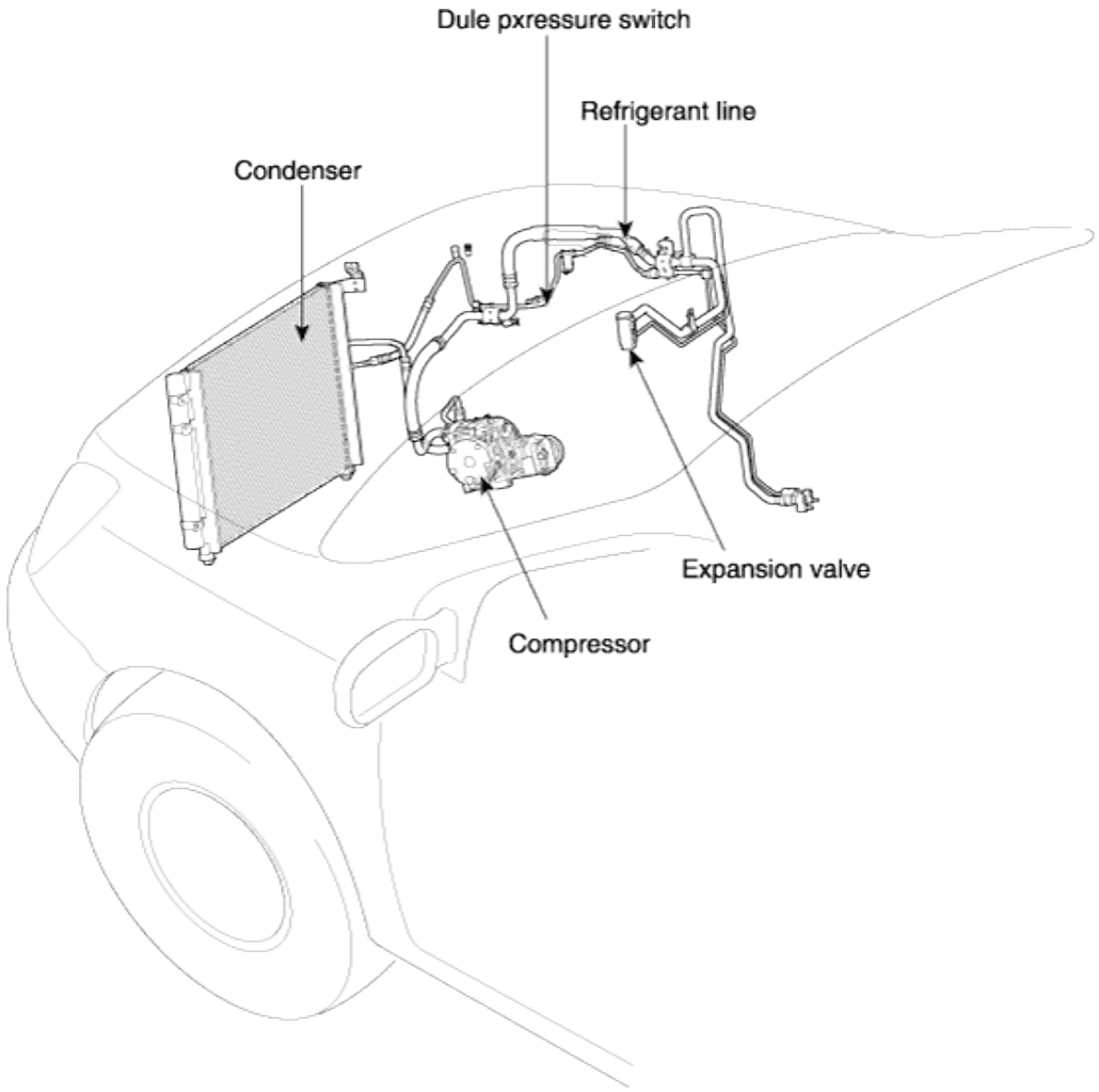
3. Apply air conditioning compressor oil along the O-rings and threads of the new bottom cap.
4. Insert the new desiccant into the receiver drier tank. The desiccant must be sealed in vacuum before it is exposed to air for use.
5. Install the new bottom cap to the condenser.

NOTICE

a. Always replace the desiccant and bottom cap at the same time.
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. (Refer to HA-10)

Refrigerant Line

COMPONENT LOCATION



REPLACEMENT

1. Discharge refrigerant from refrigeration system (Refer to HA-8).
2. Replace faulty tube or hose.

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

3. Tighten joint of bolt or nut to specified torque.

> CAUTION
>
> Connections should not be torque tighter than the specified torque.

Part tightened	N.m	Kgf.m	lbf.ft
Condenser x Discharge hose	8 ~ 12	0.8~1.2	5.8 ~ 8.7
Condenser x Liquid tube			
Compressor x Discharge hose			
Compressor x Suction hose			
Expansion valve x Evaporator			

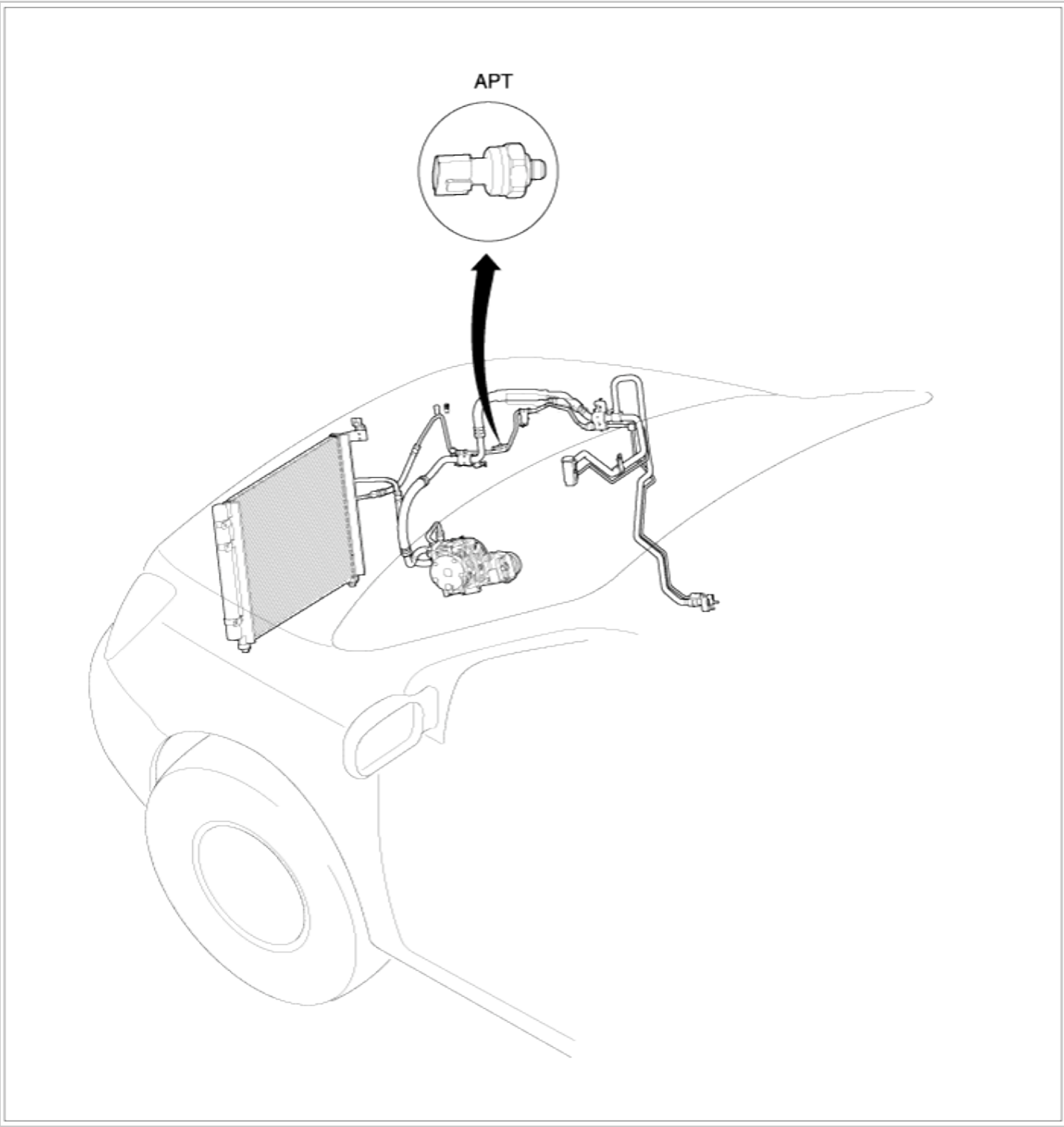
4. Evacuate air in refrigeration system and charge system with refrigerant (Refer to HA-9).

   Specified amount: 800 ± 25g

5. Inspect for leakage of refrigerant.
   Using a gas leak detector, check for leakage of refrigerant (Refer to HA-9).
6. Inspect A/C operation.

A/C Pressure Transducer

COMPONENT LOCATION

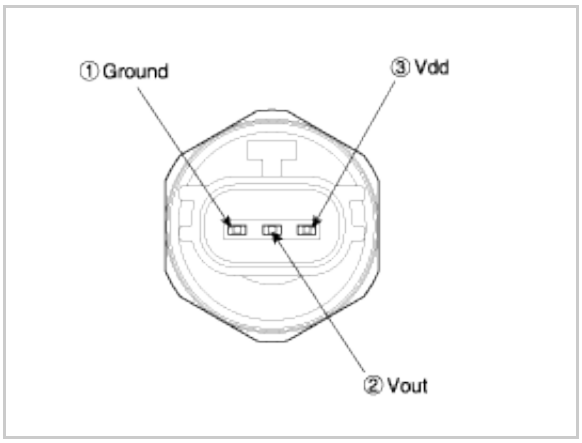


DESCRIPTION

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

INSPECTION

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



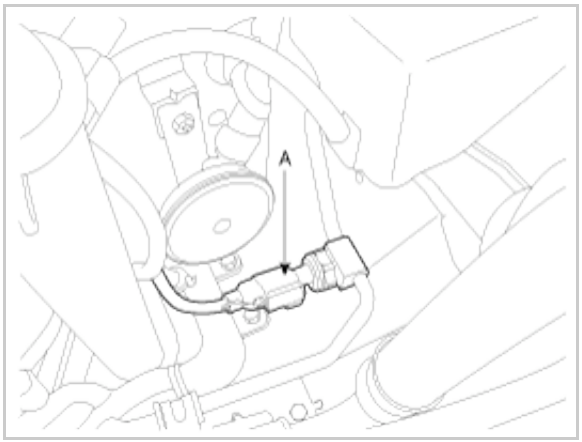
2. Inspect the voltage value whether it is sufficient to be regular value or not.

Vout = Vdd(0.025 * P + 0.1) [kgf/cm²G]
Vout = Vdd(0.001758 * P + 0.074162) [PSIA]

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

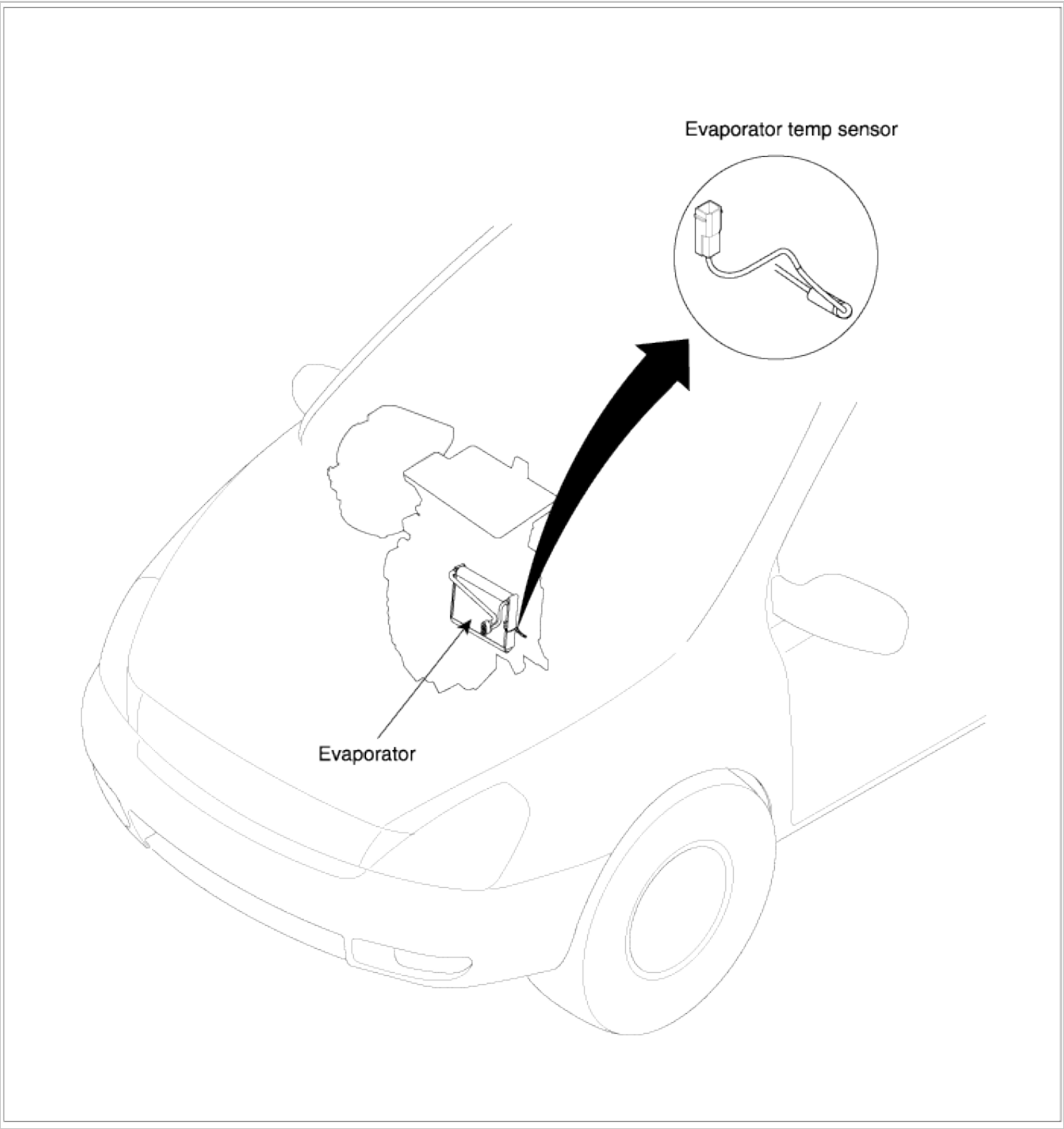
REPLACEMENT

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



Evaporator Temperature Sensor

COMPONENT LOCATION

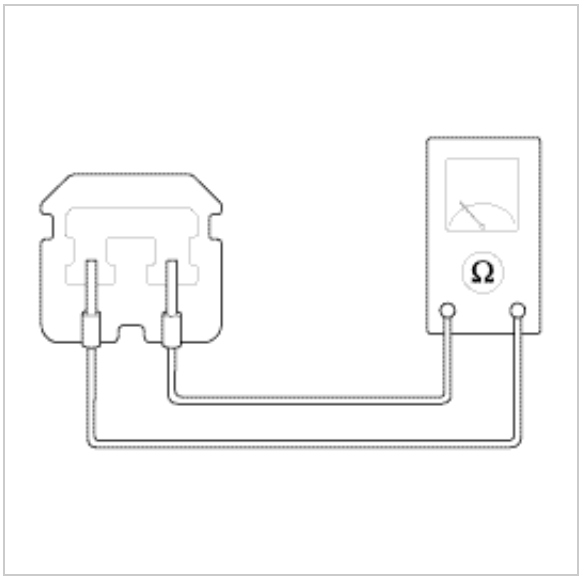


DESCRIPTION

The evaporator temperature sensor will detect the evaporator core temperature and interrupt compressor relay power in order to prevent evaporator freezing by excessive cooling.

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.



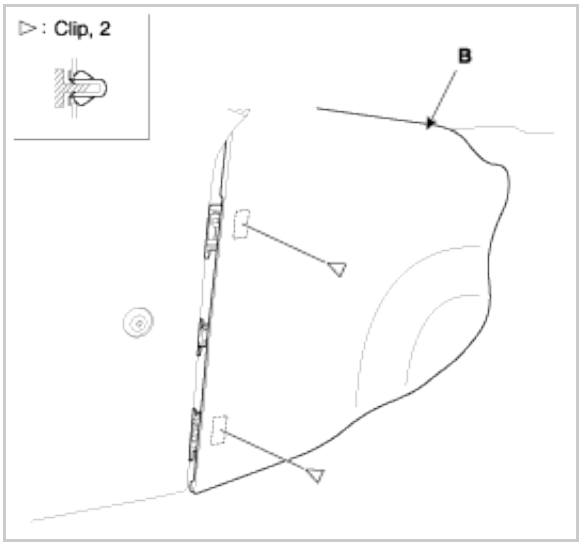
Specification

Evaporator core temperature [°C(°F)]	Resistance [kΩ]
-10(14)	13.6
0(32)	8
10(50)	4.9
15(59)	3.9
30(86)	2
40(104)	1.3
50(122)	0.9

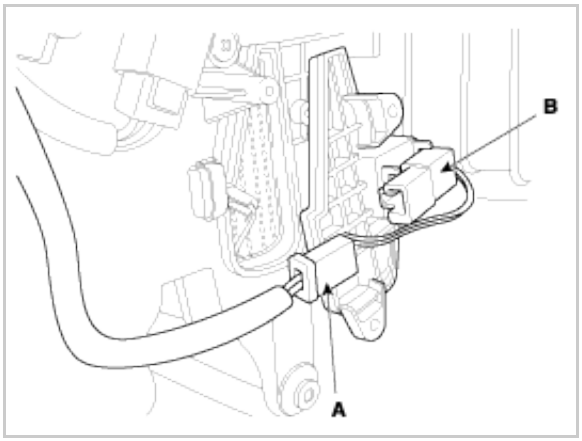
4. If the measured resistance is not specification, substitute with a known-good evaporator temperature sensor and check for proper operation.
5. If the problem is corrected, replace the evaporator temperature sensor.

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the center lower side cover(B).



3. Disconnect the evaporator sensor connector (A).
4. Loosen 2 screws and then remove the evaporator sensor cover(B).
5. Remove the evaporator sensor.



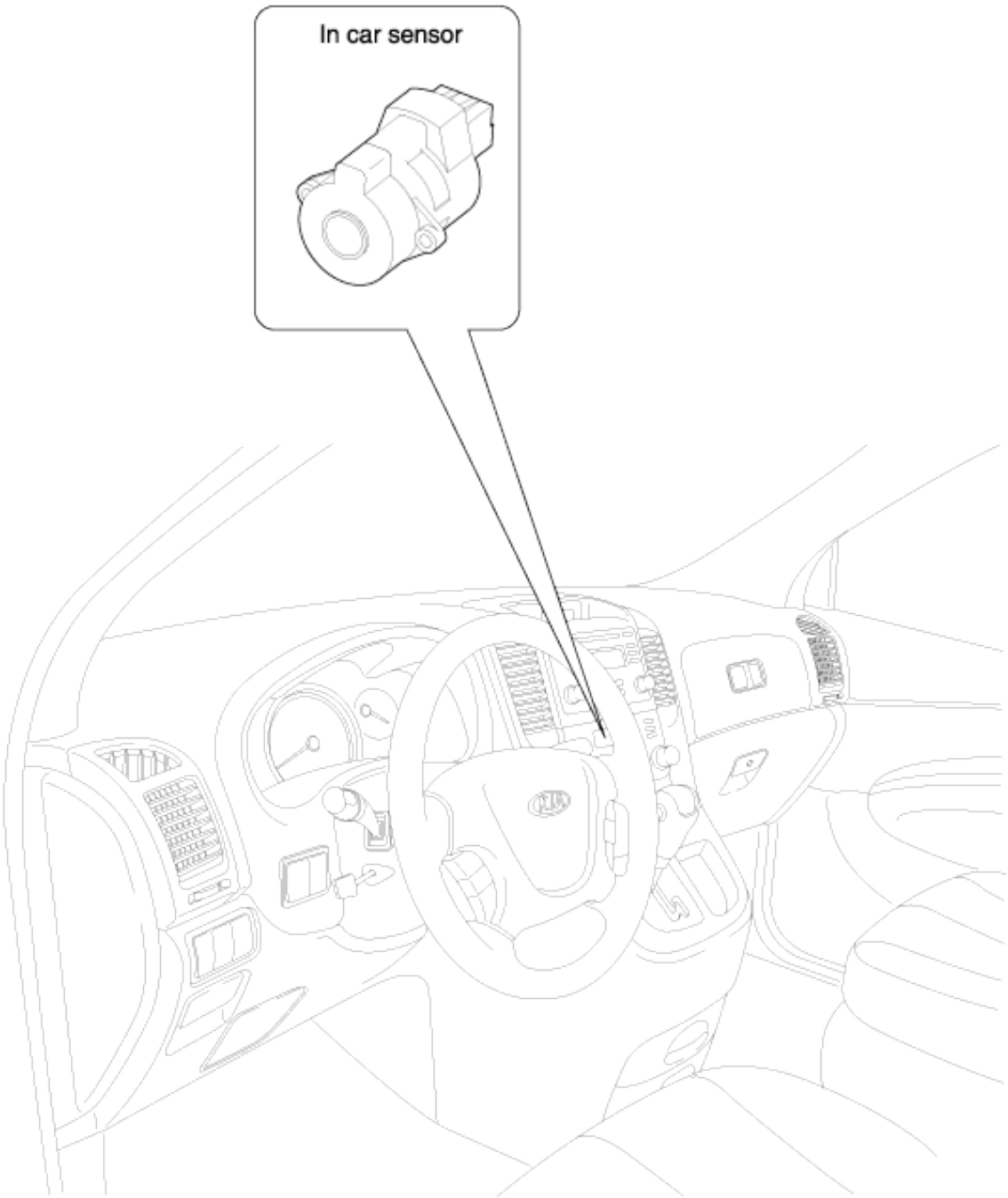
CAUTION

Take care that evaporator core pins are not bent.

6. Installation is the reverse order of removal.

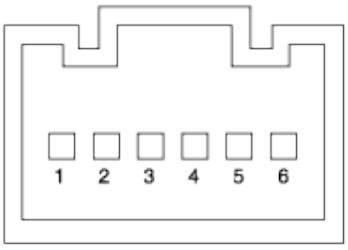
In-car Sensor

COMPONENT LOCATION



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.
3. It perceives the inside temperature, changes the resistance value, and enters the corresponding voltage into the automatic temperature control module.
4. It will used for discharge temperature control, sensor failsafe, temperature door control, blower motor level control, and A/C auto control.



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

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

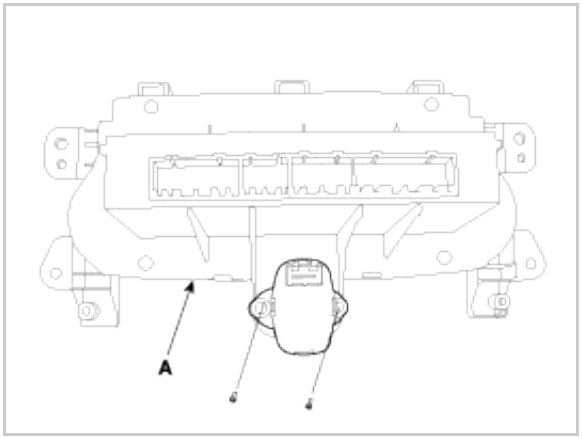
Temperature [°C(°F)]	Resistance between terminals 2and 4 (kΩ)
0 (32)	97.83 ± 2.61%
15 (59)	47.12 ± 1.45%
25 (77)	30.00 ± 1.20%
35 (95)	19.60 ± 1.44%
50 (122)	10.82 ± 2.26%

NOTICE

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

REPLACEMENT

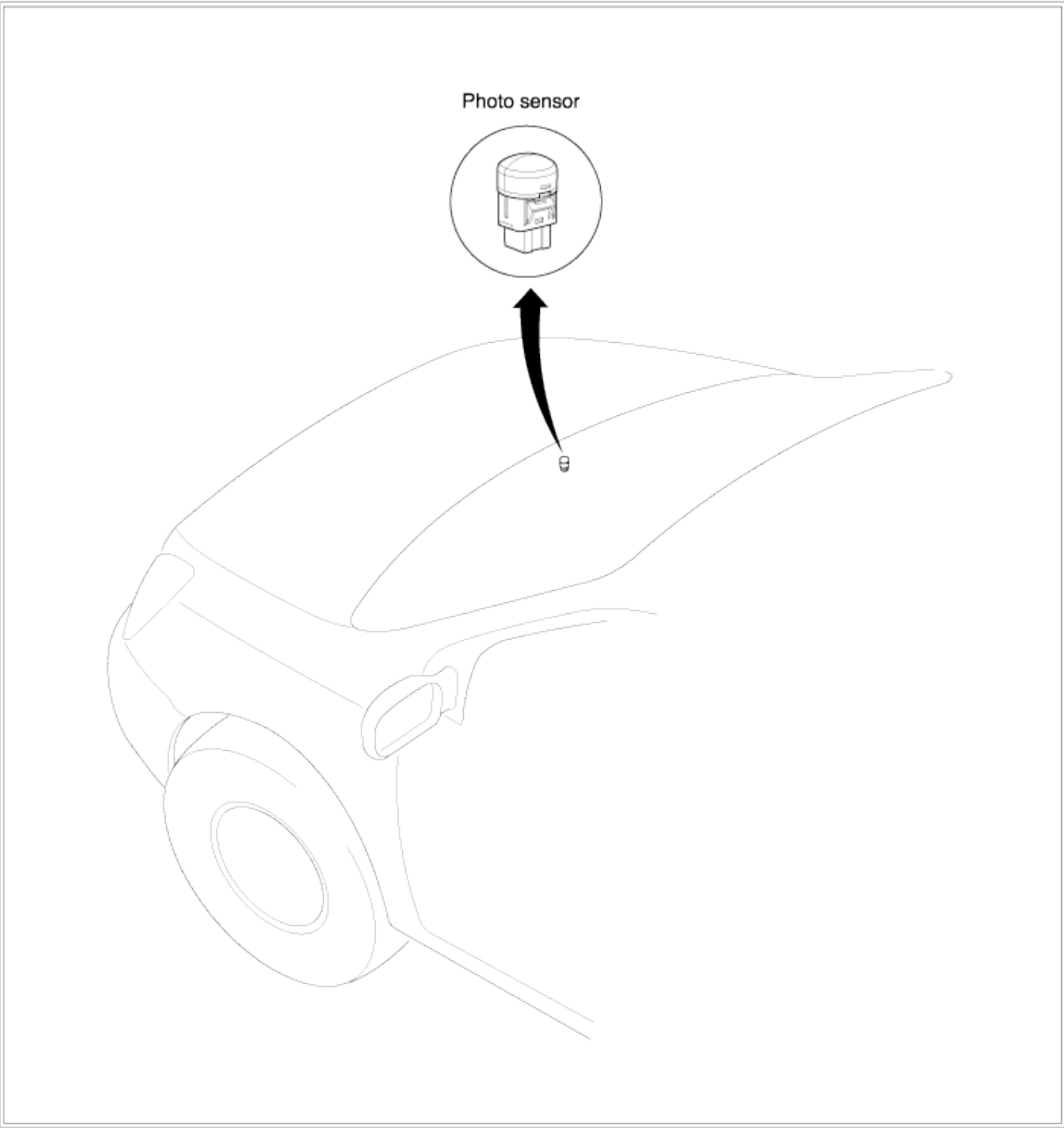
1. Disconnect the negative (-) battery terminal.
2. Remove the A/C control pannel. (Refer to BD group).
3. Disconnect the connector of in-car sensor (A).Loosen the mounting 2 screws and then remove the in-car sensor (B).



4. Installation is the reverse order of removal.

Photo Sensor

COMPONENT LOCATION

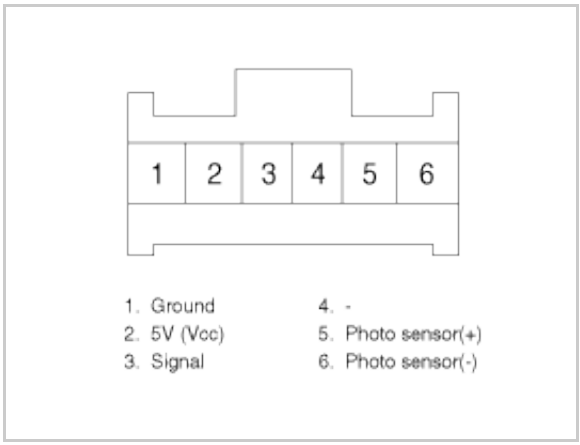


DESCRIPTION

1. The photo sensor (A) 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.

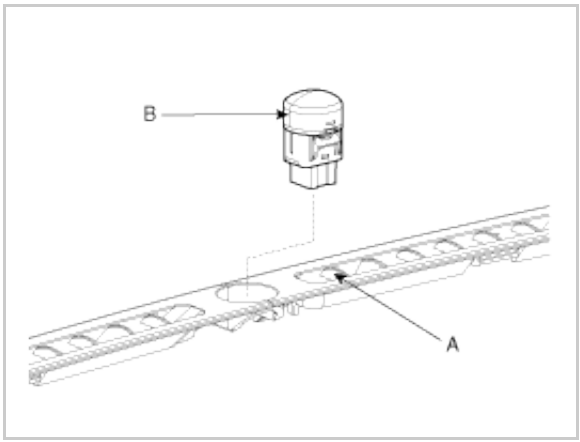
INSPECTION

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



REPLACEMENT

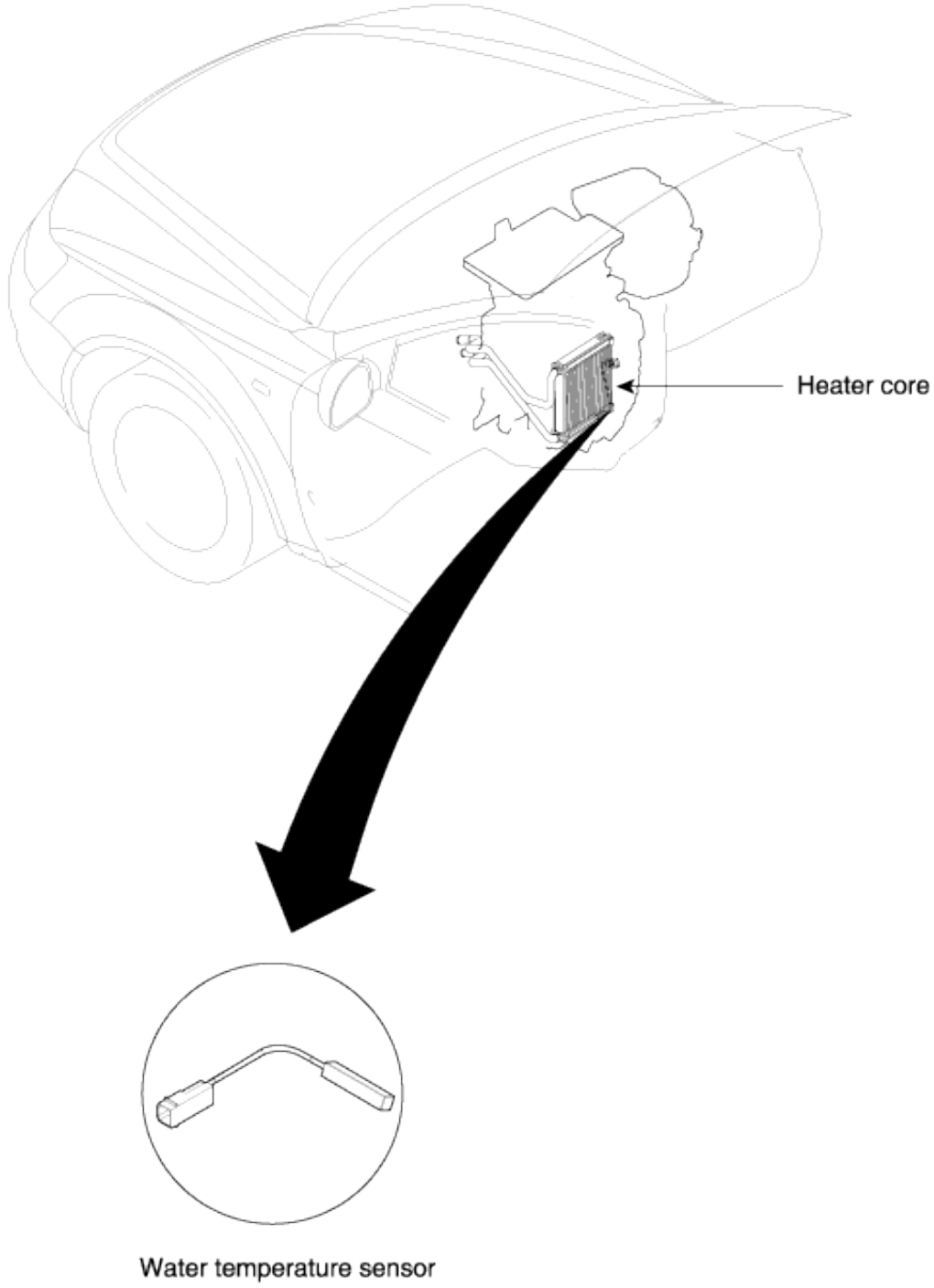
1. Disconnect the negative (-) battery terminal.
2. With the (-) driver, remove the photo sensor (B) from the center of defrost nozzle (A).



3. Install in the reverse order of removal.

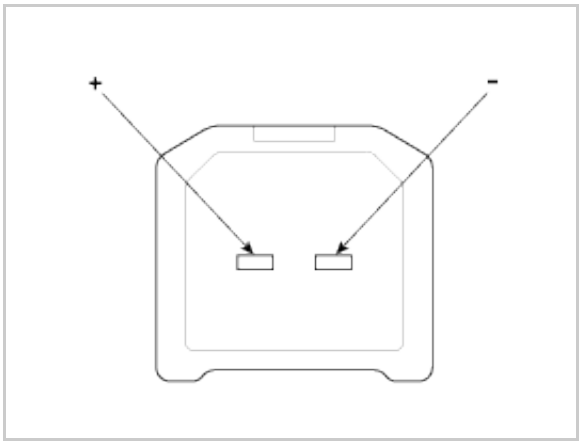
Water Temperature Sensor

COMPONENT LOCATION



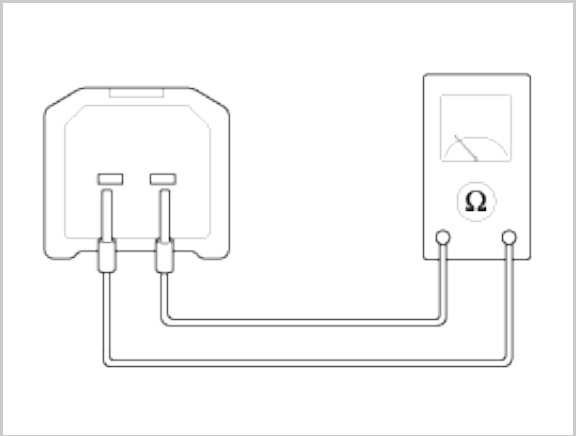
DESCRIPTION

1. Water temperature sensor is located at the heater unit.
2. It detects coolant temperature. Its signal is used for cold engine lockout control. When the driver operates the heater before the engine is warmed up, the signal from sensor causes the heater control unit to reduce blower motor speed until coolant temperature reaches the threshold value.



INSPECTION

1. Ignition "ON"
2. Using the multi-tester, Measure resistance between terminal "1" and "2" of water temperature sensor.



Specification

Coolant temperature [°C(°F)]	Resistance (kΩ)	Voltage (V)
-10(14)	55.85 ± 3%	4.24 ± 3%
0(32)	32.91 ± 3%	3.83 ± 3%
10(50)	19.99 ± 3%	3.33 ± 3%
20(68)	12.51 ± 3%	2.78 ± 3%
30(86)	8.047 ± 3%	2.23 ± 3%
40(104)	5.311 ± 3%	1.73 ± 3%
50(122)	3.588 ± 3%	1.32 ± 3%
60(140)	2.476 ± 3%	0.99 ± 3%
70(158)	1.742 ±3%	0.74 ± 3%
80(176)	1.246 ± 3%	0.55 ± 3%

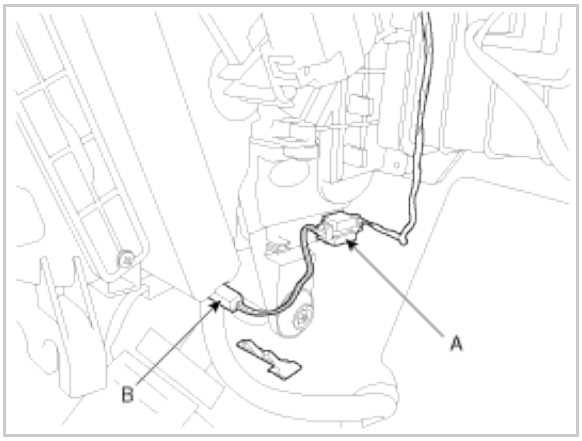
3. If the measured resistance is not specification, substitute with a known-good water temperature sensor and check for proper operation.
4. If the problem is corrected, replace the water temperature sensor.

NOTICE

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 grove box. (Refer to BD group)
3. Disconnect the connector (B) of water temperature sensor and then remove the water temperature sensor(A) by pulling out.



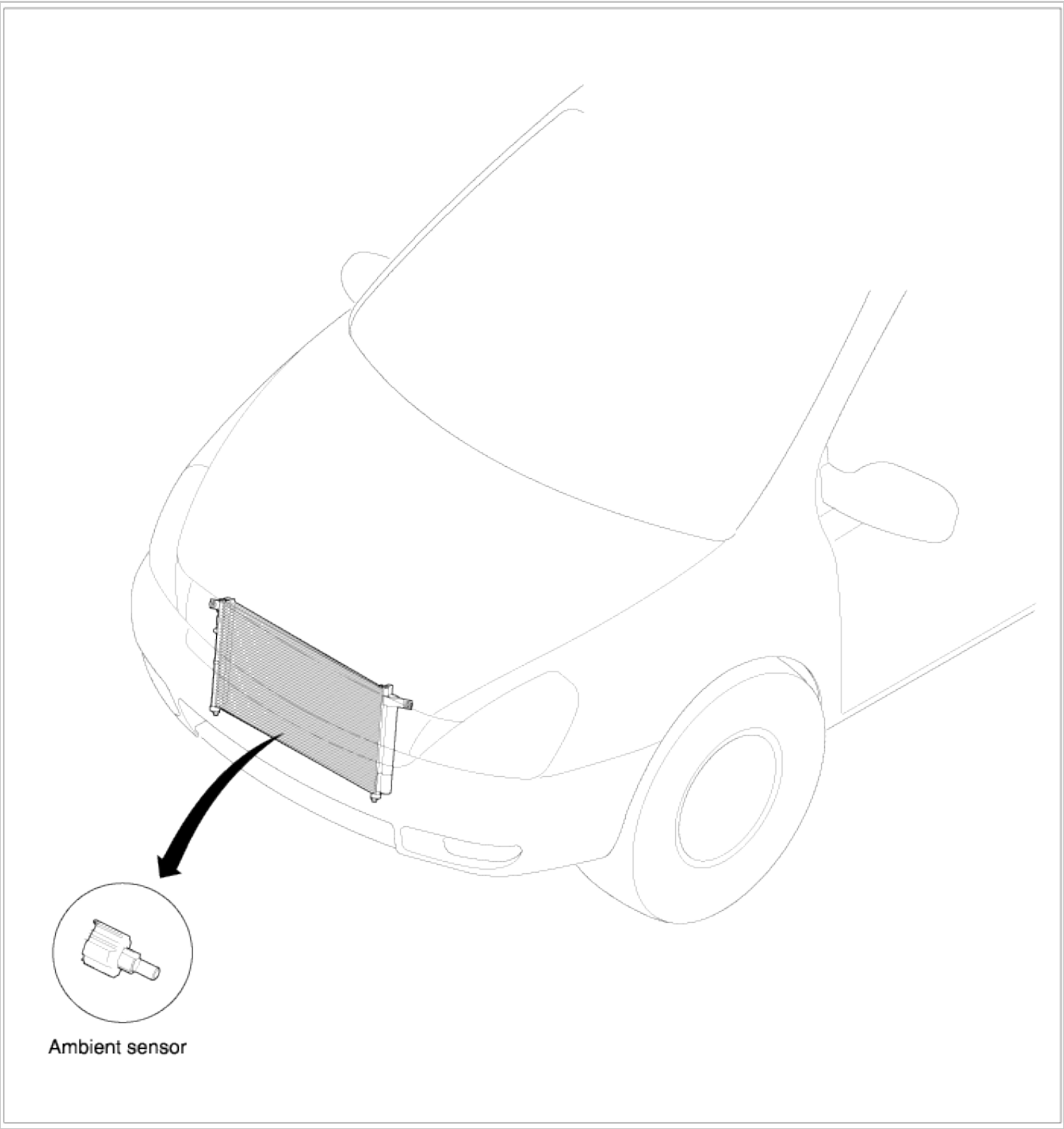
4. Installation is the reverse order of removal.

NOTICE

Take care that wire of water temperature sensor is not to be damaged

Ambient Sensor

COMPONENT LOCATION



DESCRIPTION

1. The ambient temperature sensor is located at the front of the condenser and detects ambient air temperature. It is a negative type thermistor; resistance will increase with lower temperature, and decrease with higher temperatures.
2. The sensor output will be used for discharge temperature control, temperature regulation door control, blower motor level control, mix mode control and in-car humidity control.

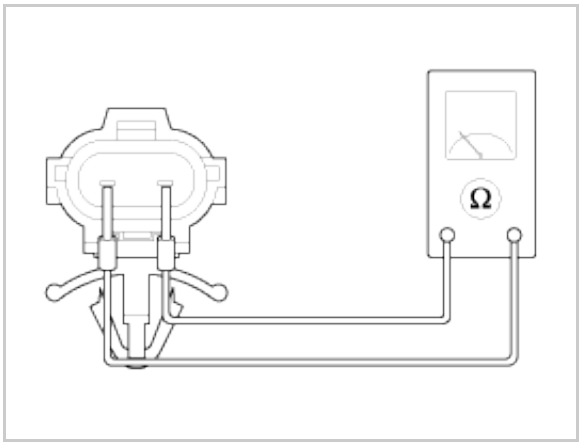
NOTICE

If the ambient temperature is below -3°C (26.2°F), the A/C compressor will be stopped.
The compressor will be operated by manual operating.

INSPECTION

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

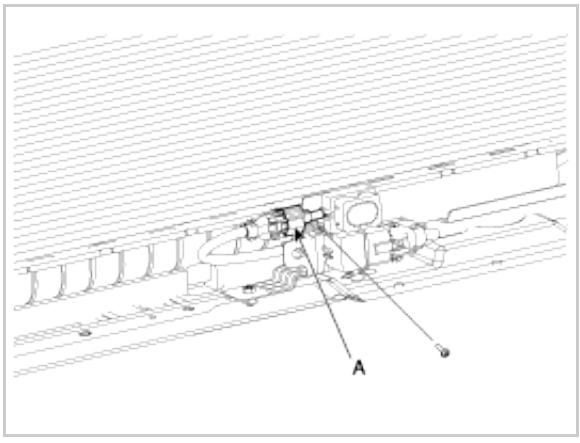
Ambient temperature [°C(°F)]	Resistance between terminals 1and 2 (kΩ)
-10(14)	164 ± 3%
0 (32)	97.5 ± 3%
10 (50)	59.6 ± 3%
20 (68)	37.5 ± 3%



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

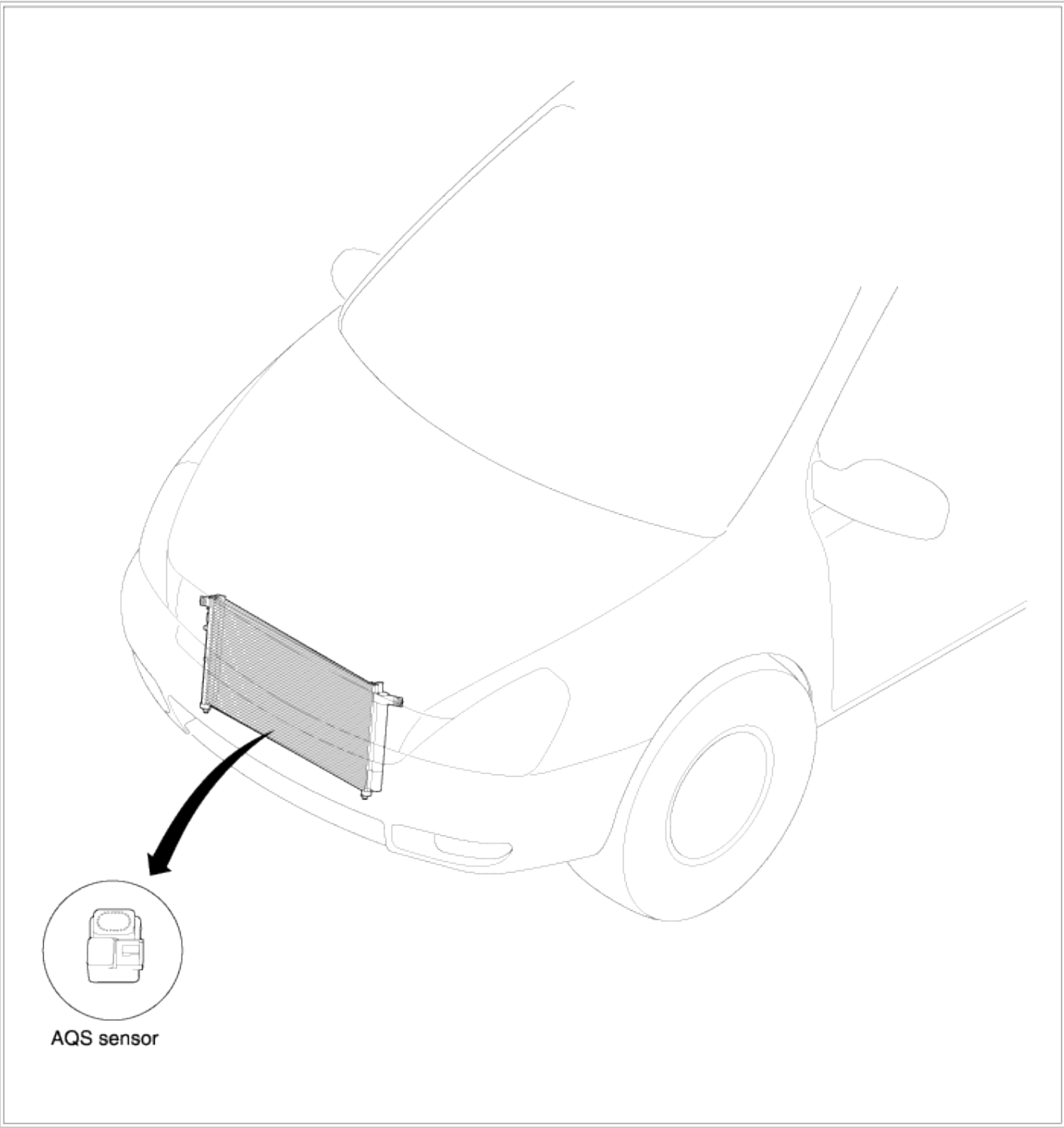
1. Disconnect the negative (-) battery terminal.
2. Remove the front bumper. (Refer to BD group)
3. Remove the ambient temperature sensor (A).



4. Installation is the reverse order of removal.

Air Quality Sensor

COMPONENT LOCATION



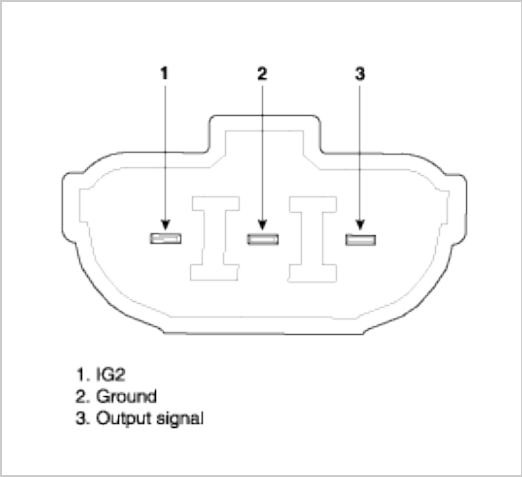
DESCRIPTION

1. A.Q.S is located at center support in front of the engine radiator, and detects hazardous elements in ambient air providing output signal to control.
2. It will detect sulfurous acid gas, carbon dioxide, carbon monoxide, hydrocarbon and allergen.

INSPECTION

1. Ignition "ON"
2. Using the scan tool.
3. Check the output voltage of AQS between terminals 2 and 3.
   Specification

Condition	Output signal	Fresh/recirculation
Normal condition	4 ~ 5V	Fresh
Hazardous gas detection	0 ~ 1V	Recirculation

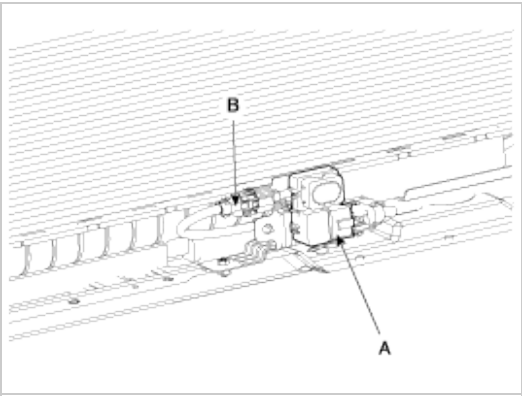


4. AQS diagnosis and fail safe
   Detect the open of signal for 7 seconds without choosing the AQS switch when IG on.
   If 2.5V or more is detected for 3.5 seconds or more among 7 seconds, be judged the open of AQS signal.
   Operate as below fail safe function, while choosing AQS.
   Fail safe: Release the AQS (AQS cannot be selected), Fresh/recirculation maintains previous situation of AQS selection.

> NOTICE
>
> When IG is turned ON, AQS heats for 34±5 seconds, it will output below 1.0 voltage during this time.

REPLACEMENT

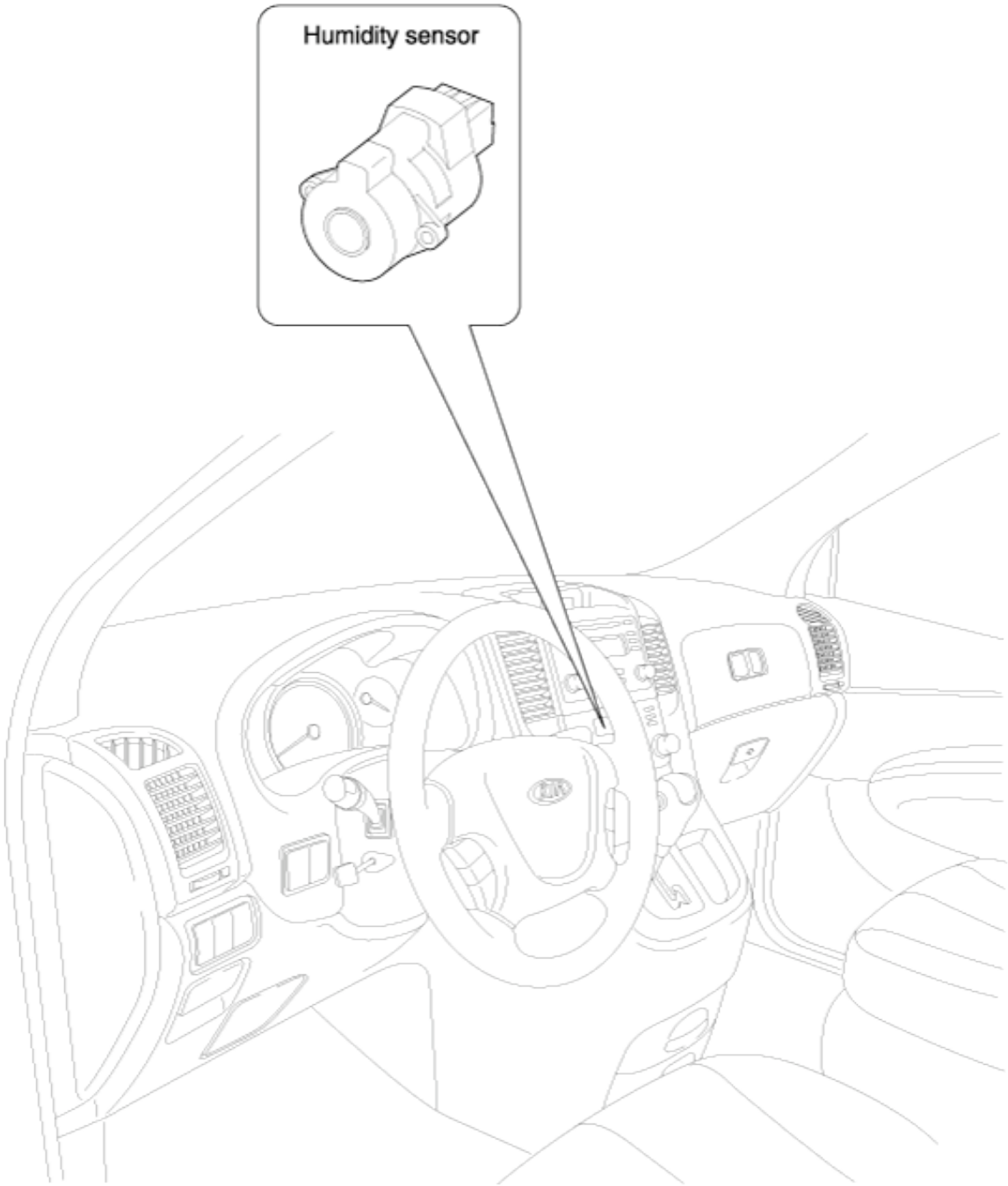
1. Disconnect the negative (-) battery terminal.
2. Remove the front bumper (Refer to BD group).
3. Remove the AQS (A) after loosening the mounting screws (B).



4. Installation is the reverse order of removal.

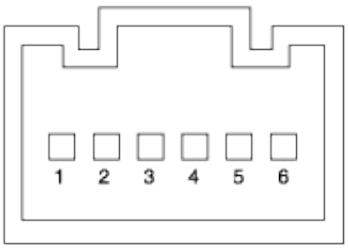
Humidity Sensor

COMPONENT LOCATION



DESCRIPTION

1. Humidity sensor is located at the lower crush pad and detected in-car humidity for in-car humidity control.
2. If ambient air temperature or in-car humidity is outside certain range, it will turn on A/C to control in-car humidity preventing in car fogging.
   Air conditioner operation depends on ambient temperature and humidity.



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

INSPECTION

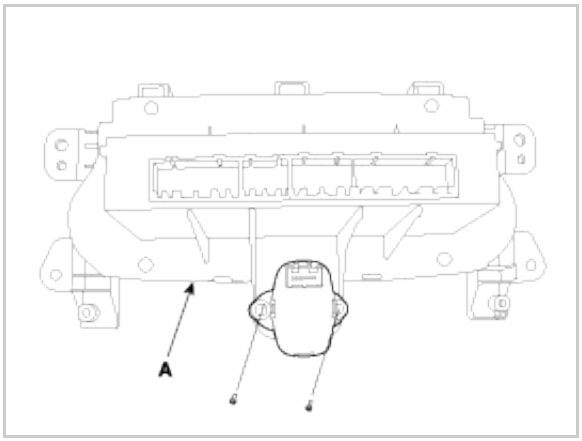
1. Ignition "ON"
2. Using the scan tool.
3. Check the frequency of humidity sensor between terminals 2 and 3.

Humidity (%)	Frequency between terminals 2and 3 (Hz)
30	6976 ± 5%
50	6728 ± 5%
60	6600 ± 5%
70	6468 ± 5%
80	6330 ± 5%
90	6186 ± 5%

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

REPLACEMENT

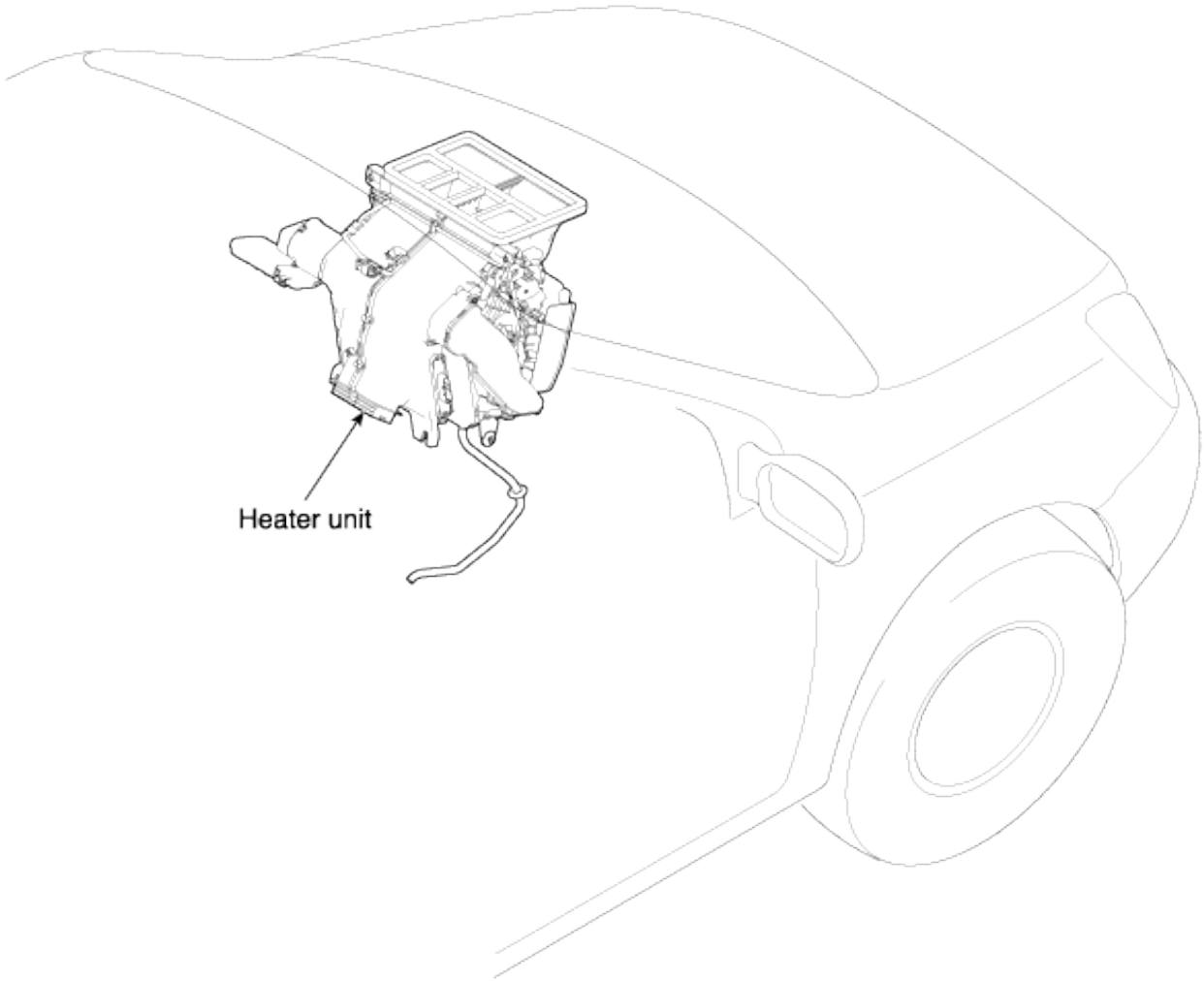
1. Disconnect the negative (-) battery terminal.
2. Remove the center facia lower panel (A). (Refer to BD group)
3. Disconnect the humidity sensor connector (A).
4. Loosen 2 screws and then remove the humidity sensor (B).



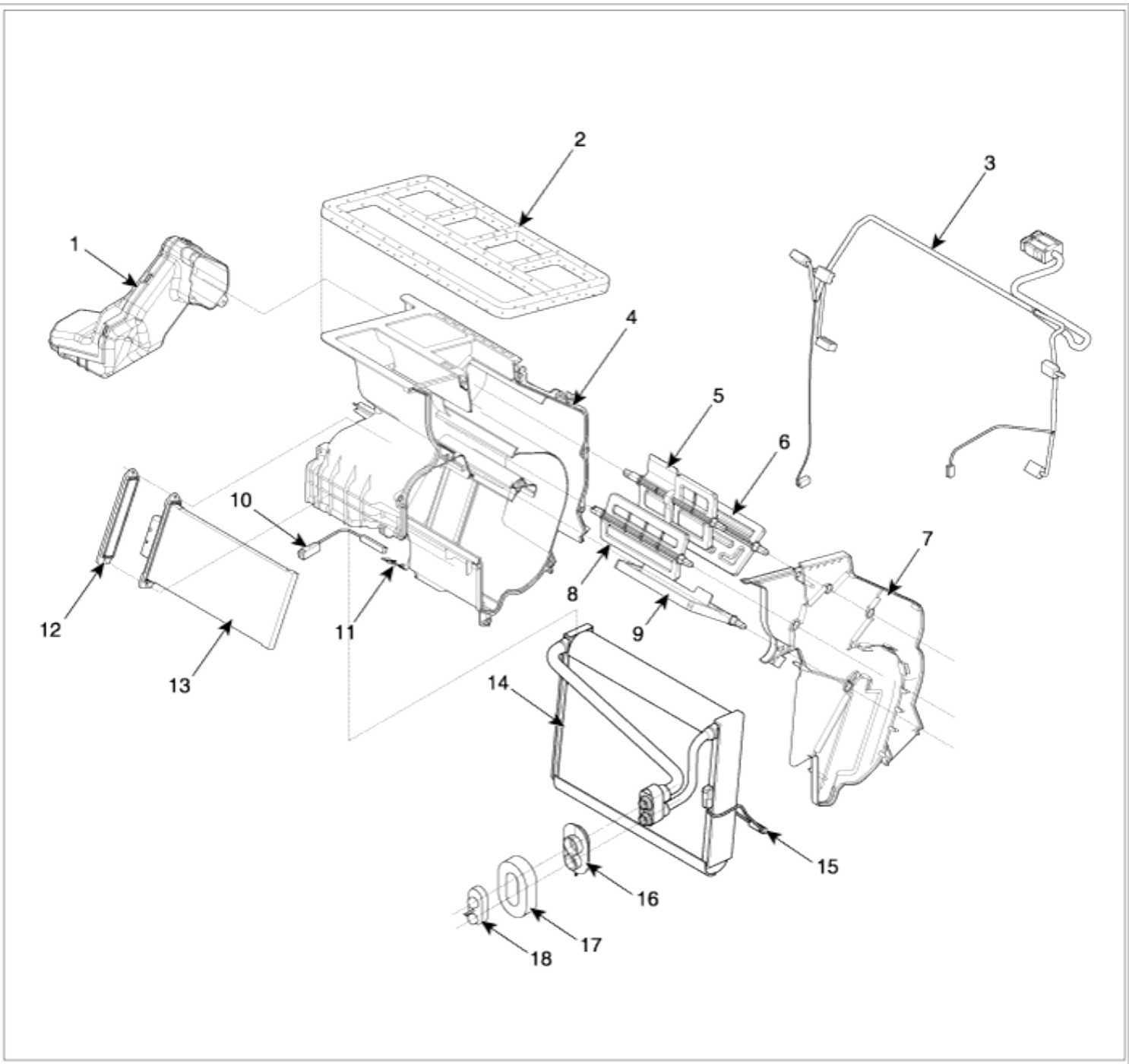
5. Installation is the reverse order of removal.

Heater

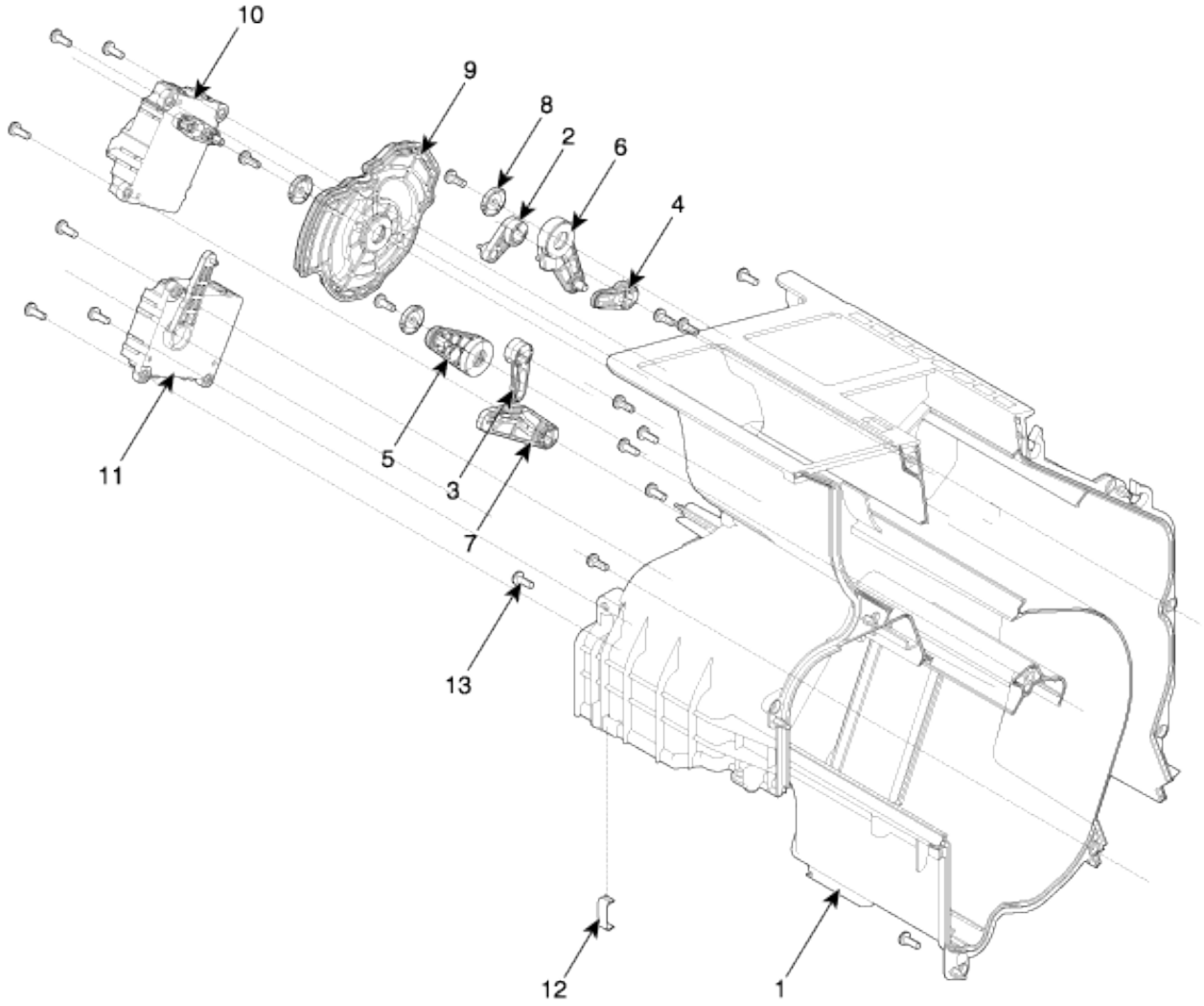
COMPONENT LOCATION



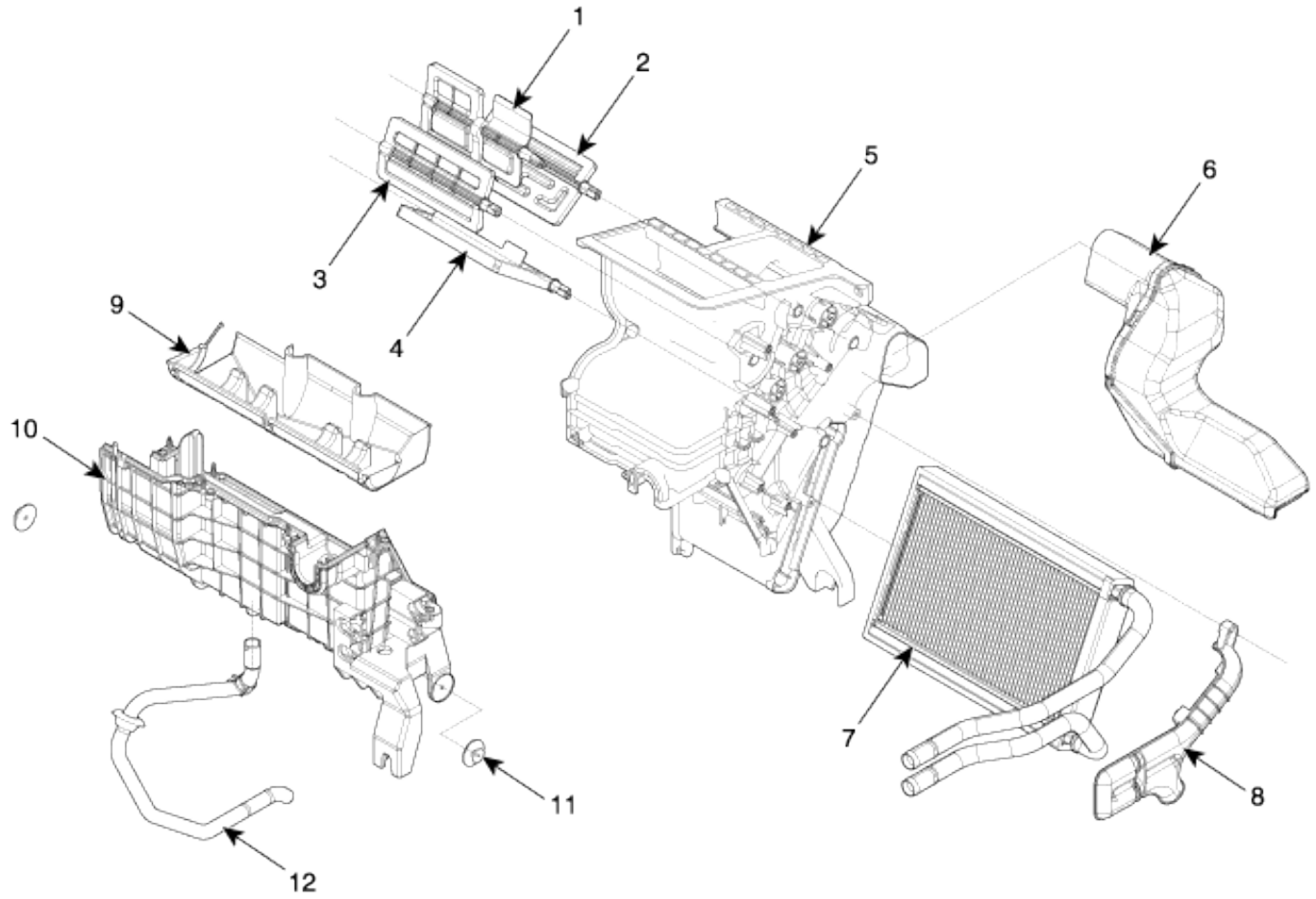
COMPONENTS



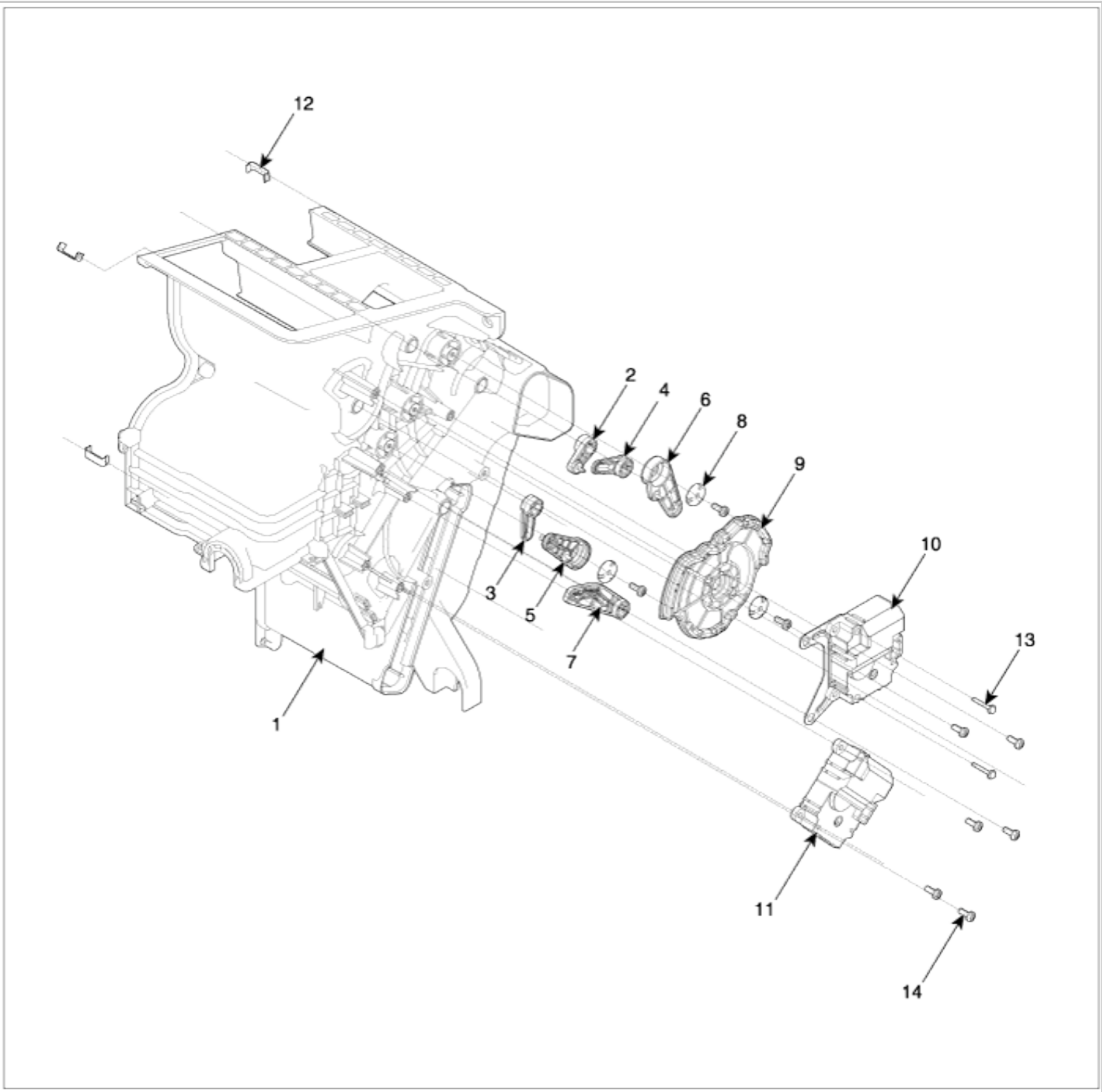
1. Shower duck(R)
2. Frame duct seal
3. Wire harness assembly
4. Heater case(R)
5. Vent door assembly(R)
6. Foot door assembly(R)
7. Blind case
8. DEF door assembly(R)
9. Mix door assembly(R)
10. Water temp sensor
11. Water temp sensor clip
12. PTC cover
13. PTC heater
14. Eva core assembly
15. Eva(duct) sensor
16. Eva flange cover
17. Flange seal
18. Flange cover



1. Heater case(R)
2. Vet mode lever
3. Pef mode lever
4. Foot mode lever
5. Def mode sub lever(R)
6. Foot mode sub lever(R)
7. Mix lever(R)
8. Tension washer
9. Mode main lever
10. Mode actuator assembly(R)
11. Mix actuator assembly(R)
12. Case clip
13. Case screw



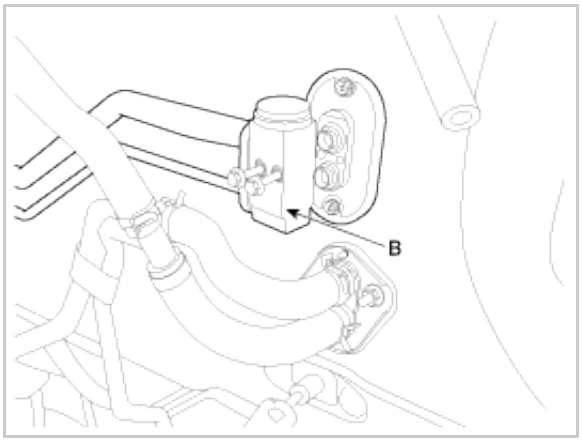
1. Vet door assembly(L)
2. Foot door assembly(L)
3. Fef door assembly(L)
4. Mix door assembly(L)
5. Heater case(L)
6. Shower duct(L)
7. Heater core assembly
8. Heater pipe cover
9. Lower case seal
10. Lower case
11. Bush
12. Drain hose assembly



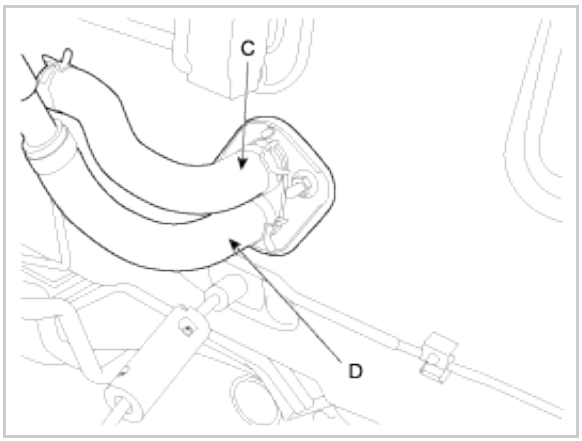
1. Heater case(L)
2. Vent mode lever
3. Def mode lever
4. Foot mode lever
5. Def mode sub lever(L)
6. Foot mode sub lever(L)
7. Mix lever(L)
8. Tension washer
9. Mode main lever
10. mode actuator assembly(L)
11. Mix actuator assembly(L)
12. Case clip
13. Screw with washer
14. Case serew

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Recover the refrigerant with a recovery/ recycling/ charging station. (Refer to HA-8)
3. When the engine is cool, drain the engine coolant from the radiator.
4. 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.



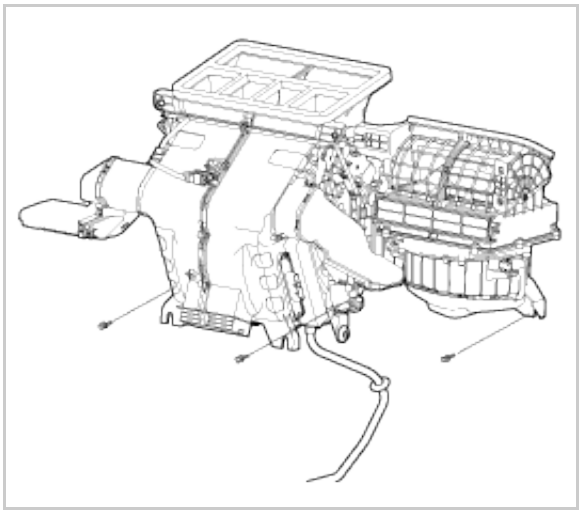
5. Disconnect the inlet (A) and outlet (B) heater hoses from the heater unit.



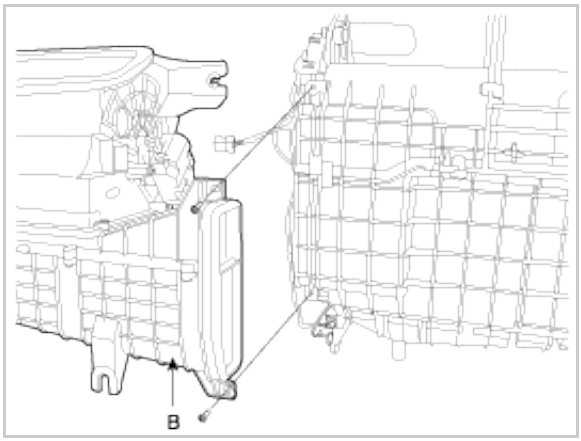
CAUTION

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

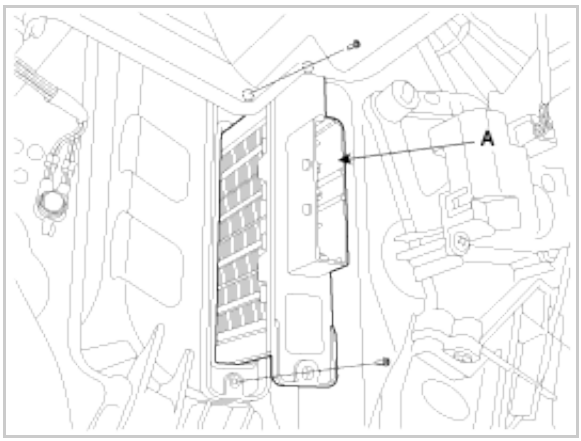
6. Remove the crash pad (Refer to BD group).
7. Remove the cowl cross bar assembly. (Refer to BD group)
8. Disconnect the connectors from the temperature control actuator, the mode control actuator and the evaporator temperature sensor.
9. Remove the heater & blower unit after loosening 3 mounting bolts.



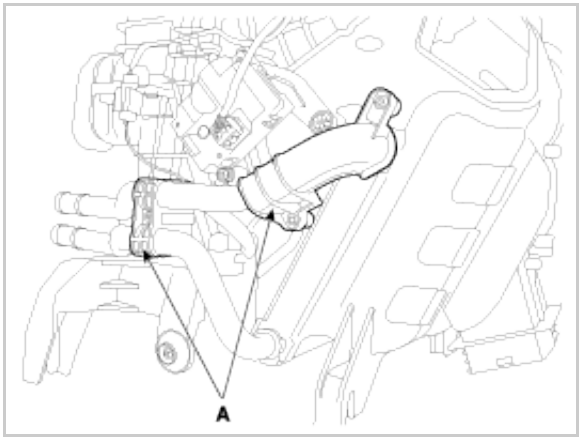
10. Remove the blower unit (B) from heater unit after loosening 2 screws.



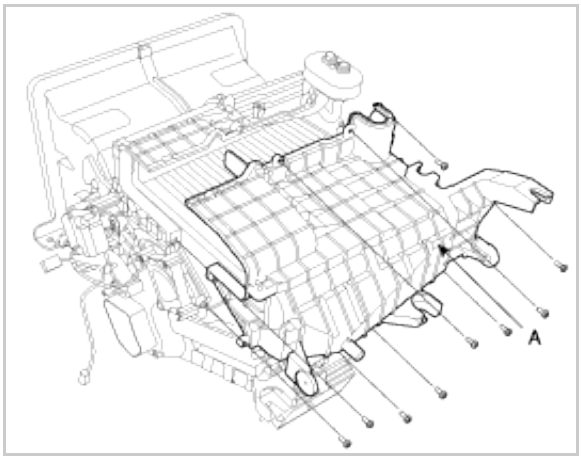
11. Remove the self-tapping screws (A) and remove the PTC heater unit (B) or cover. (In case of PTC heater)



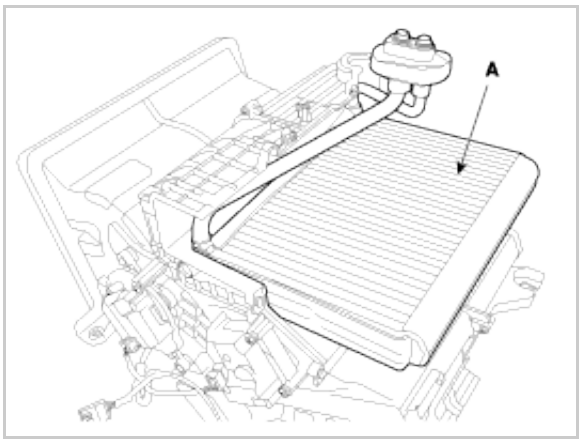
12. Remove the heater core (B) after remove the cover (A).



13. Loosen a screw and then remove the heater unit cover(A).



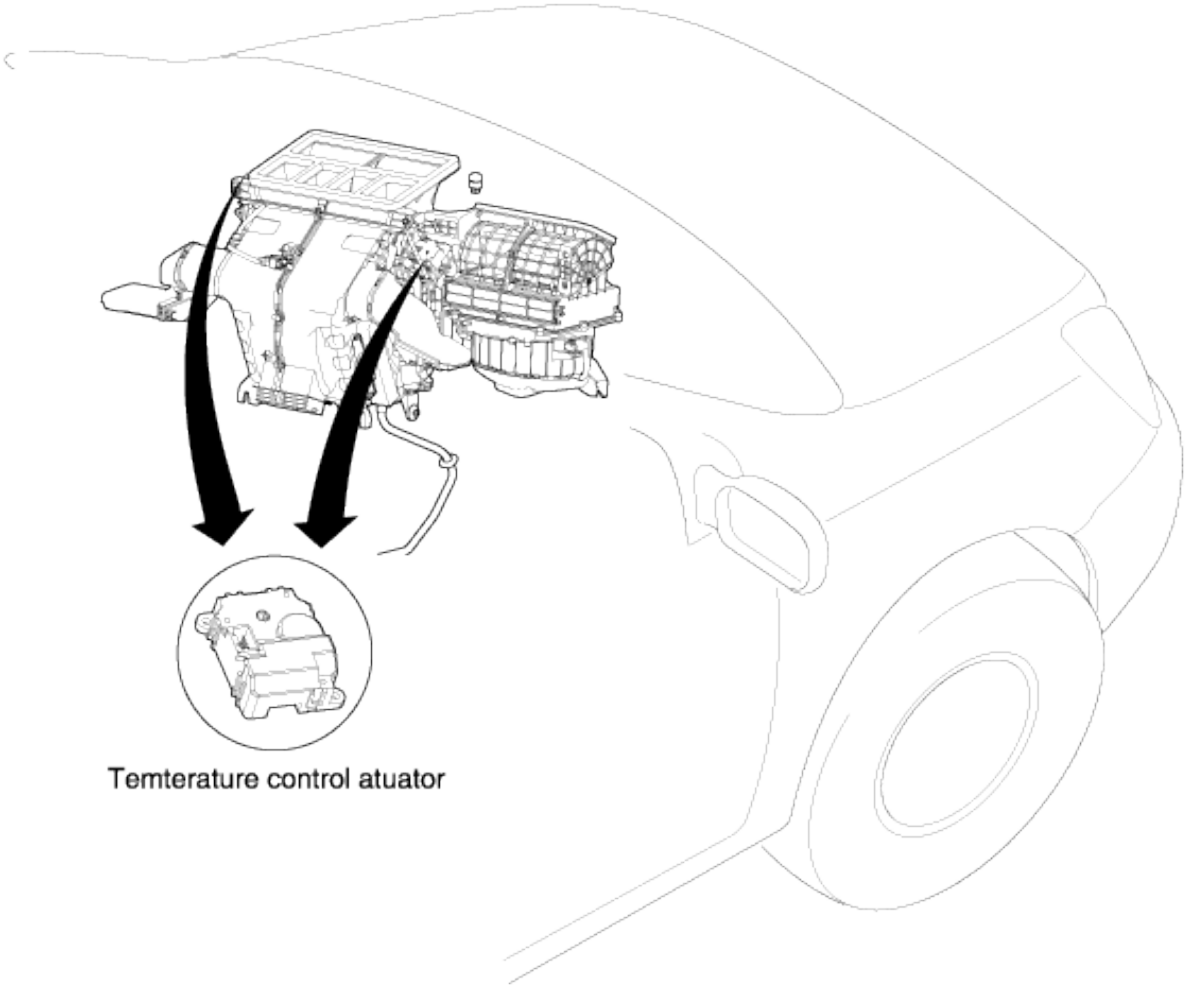
14. Remove the evaporator core(A).



15. Be careful that the inlet and outlet pipe are not bent during heater core removal, and pull out the heater core.
16. Install the heater core in the reverse order of removal.
17. Installation is the reverse order of removal, and note these items :
    a. If you're installing a new evaporator, add refrigerant oil (ND-OIL8).
    b. Replace the O-rings with new ones at each fitting, and apply a thin coat of refrigerant oil before installing them. Be sure to use the right O-rings for R-134a to avoid leakage.
    c. Immediately after using the oil, replace the cap on the container, and seal it to avoid moisture absorption.
    d. Do not spill the refrigerant oil on the vehicle ; it may damage the paint ; if the refrigerant oil contacts the paint, wash it off immediately
    e. Apply sealant to the grommets.
    f. Make sure that there is no air leakage.
    g. Charge the system and test its performance.
    h. Do not interchange the inlet and outlet heater hoses and install the hose clamps securely.
    i. Refill the cooling system with engine coolant.

Temperature Control Actuator

COMPONENT LOCATION



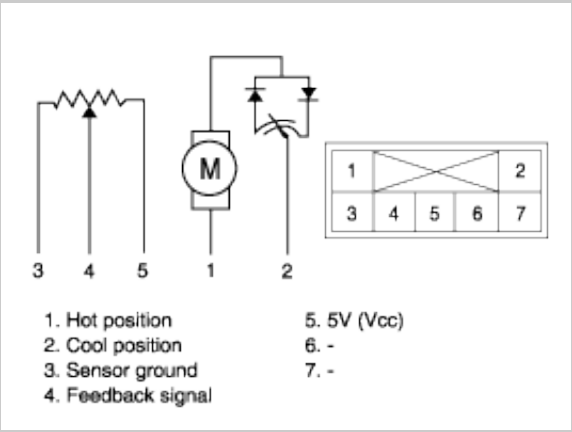
DESCRIPTION

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

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 1 and grounding terminal 2.
   Verify that the temperature control actuator operates to the cool position when connecting in the reverse.

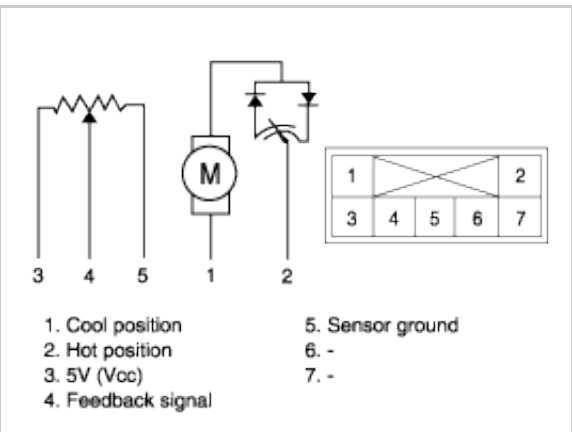
[PASSENGER]



Specification

Door position	Voltage (3-4)	Error detecting
Max. cooling	0.4 ± 0.15V	Low voltage : 0.1V or less
Max. heating	4.6 ± 0.15V	High voltage :4.9V or more

[DRIVER]



Specification

Door position	Voltage (4-5)	Error detecting
Max. cooling	0.4 ± 0.15V	Low voltage : 0.1V or less
Max. heating	4.6 ± 0.15V	High voltage :4.9V or more

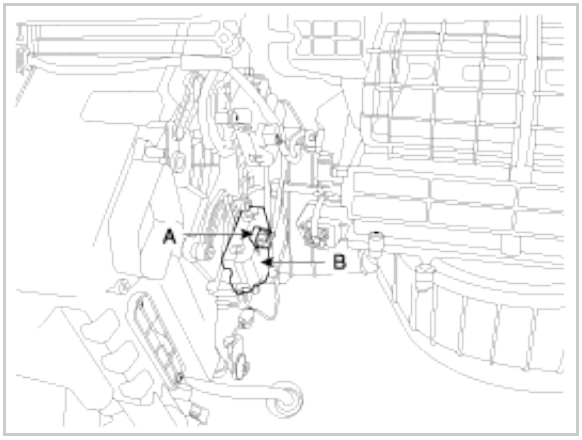
It will feedback current position of actuator to controls.

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

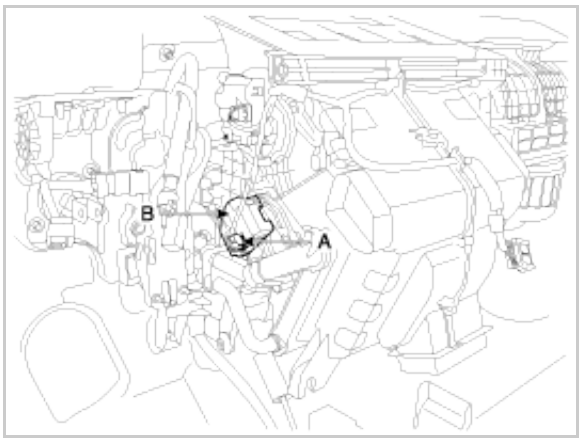
REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the driver’s crush pad lower panel (Refer to BD group).
3. Disconnect the temperature control actuator connector (A) after removing the air duct.
4. Loosen the mounting screw and then remove the temperature control actuator (B).

[Passenger's]



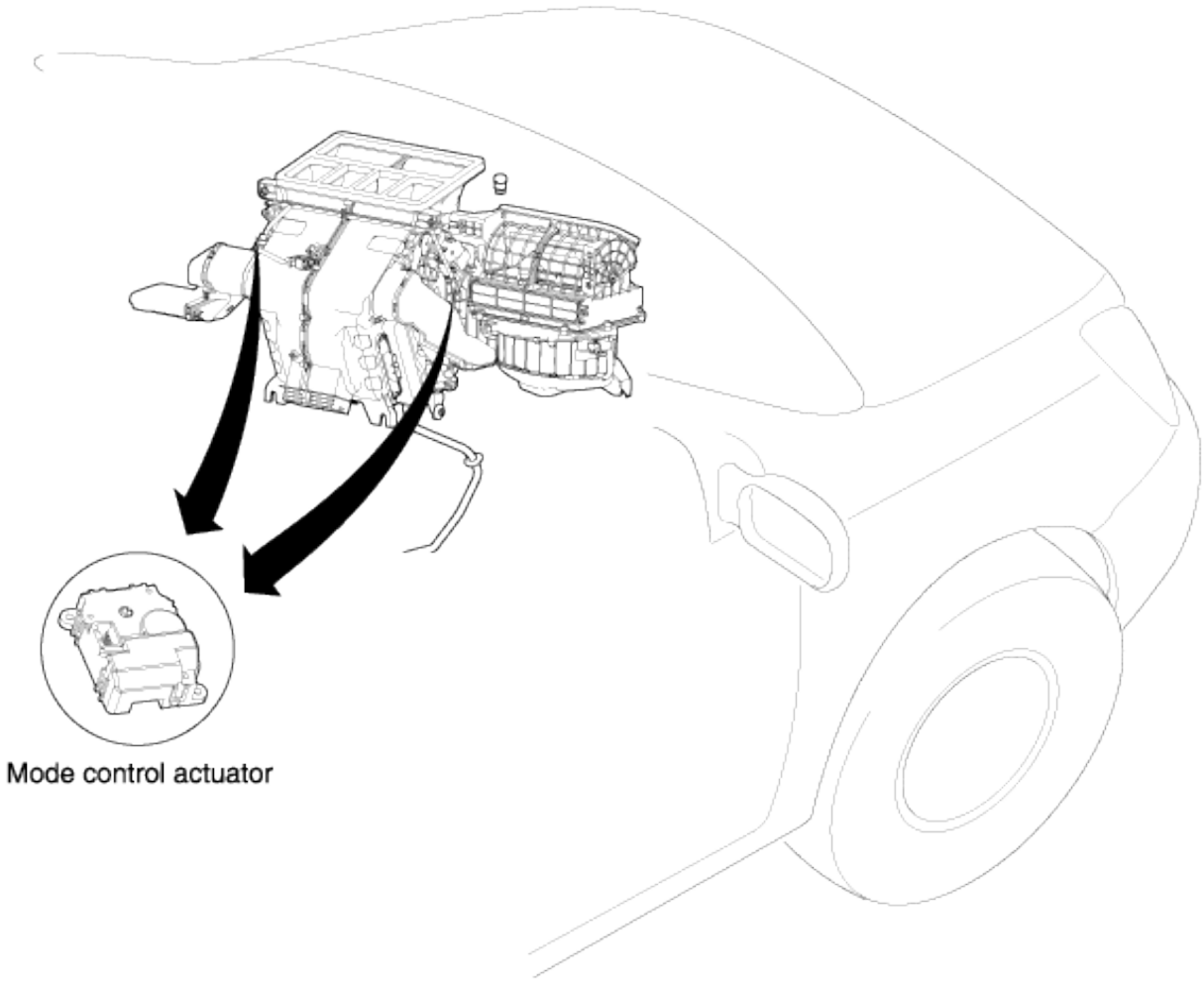
[Driver's]



5. Installation is the reverse order of removal.

Model Control Actuator

COMPONENT LOCATION



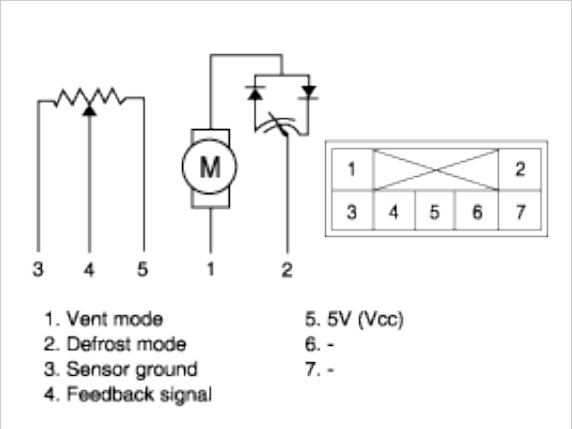
DESCRIPTION

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.

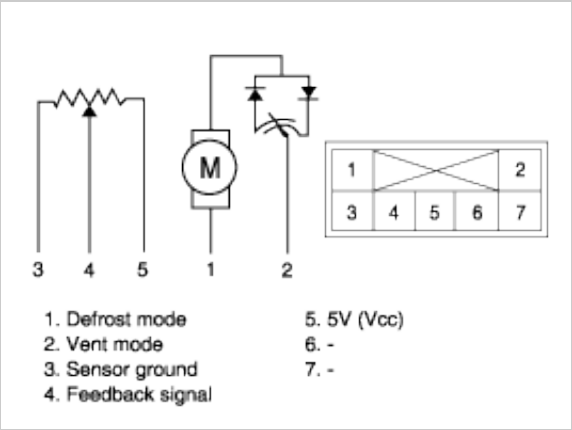
INSPECTION

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 1 and grounding terminal 2.
4. Verify that the mode control actuator operates to the vent mode when connecting in the reverse.

[DRIVER]



[PASSENGER]



5. Check the voltage between terminals 3 and 4.

Door position	Voltage (3-4)	Error detecting
Vent	0.4 ± 0.15V	Low voltage :0.1V or less
Defrost	4.6 ± 0.15V	High voltage :4.9V or more

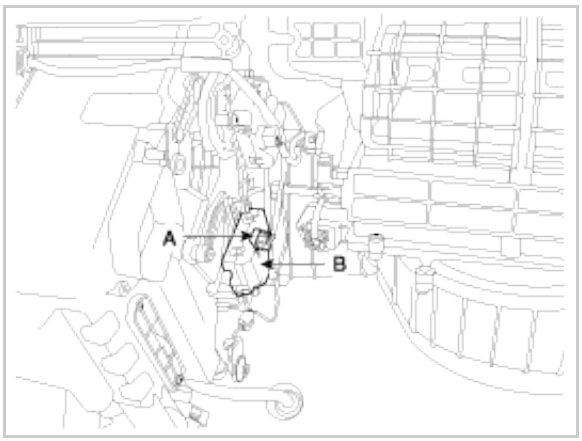
It will feedback current position of actuator to controls.

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

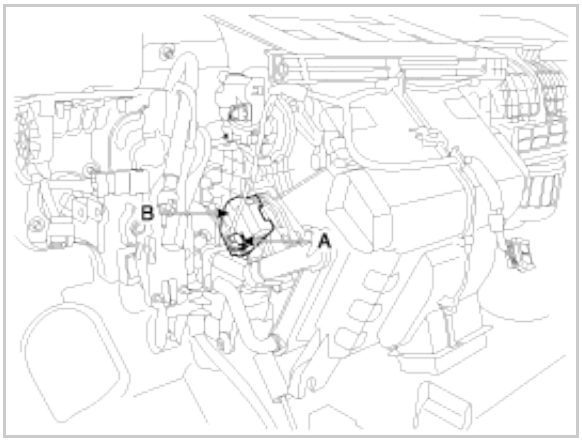
REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the driver's crush pad lower panel (Refer to BD group).
3. Disconnect the temperature control actuator connector (A) after removing the air duct.
4. Loosen the mounting screw and then remove the temperature control actuator (B).

[Passenger's]



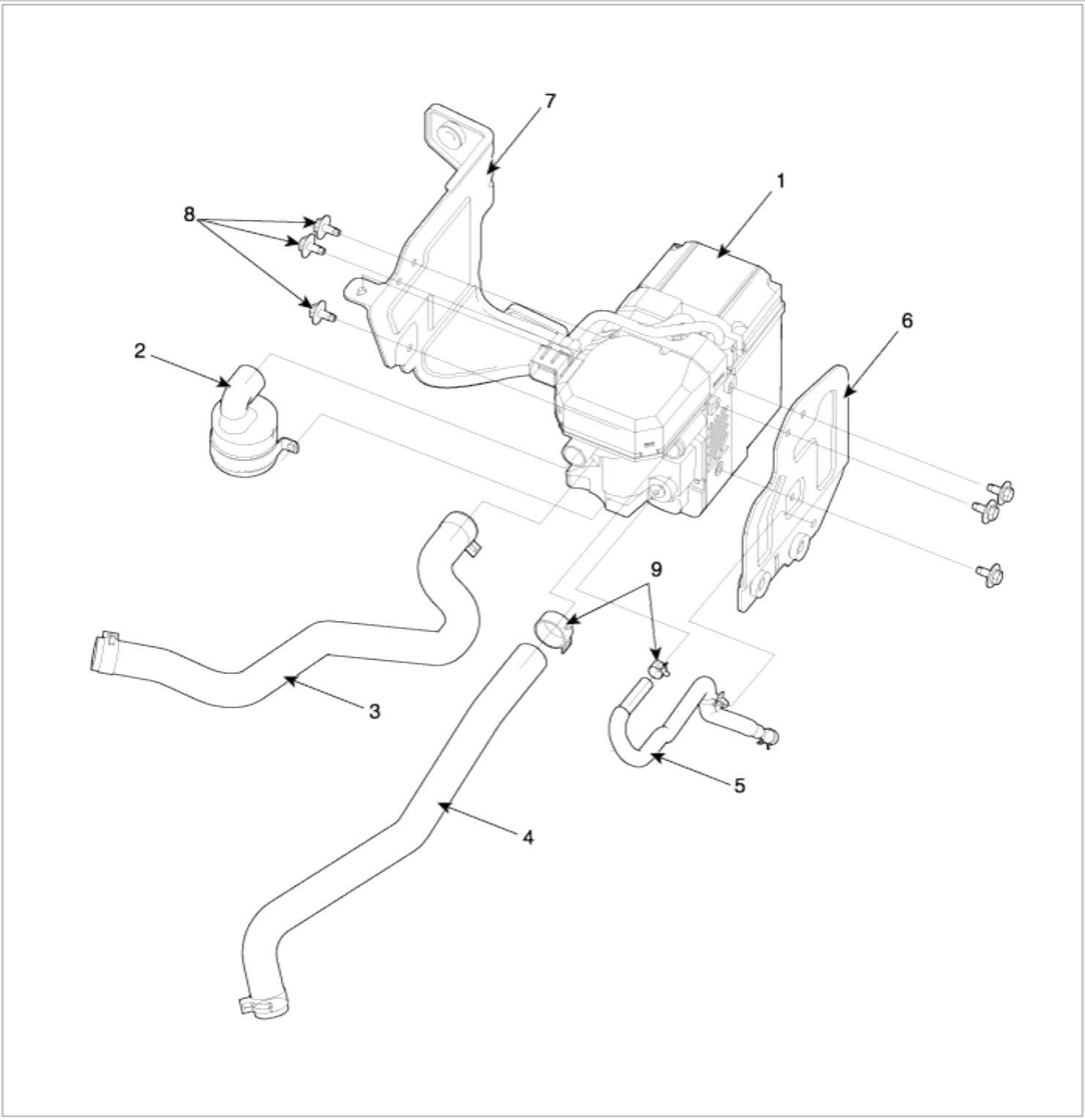
[Driver's]



5. Installation is the reverse order of removal.

Fuel Fired Heater

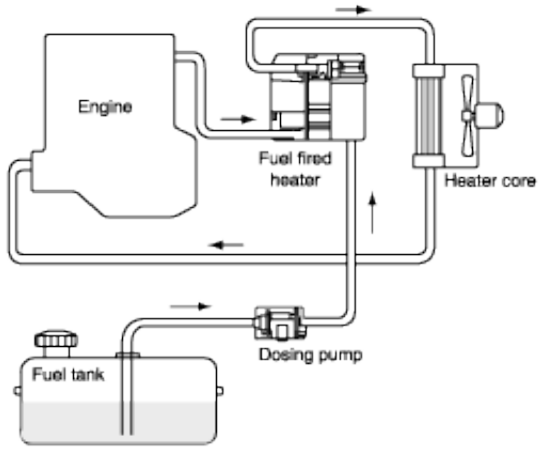
COMPONENT LOCATION



1. Fuel fired heater assembly
2. Intake air silencer
3. Water hose(Inlet)
4. Water hose(Outlet)
5. Fuel hose
6. Braket(No.1)
7. Braket(No.2)
8. Bolt
9. Clamp

DESCRIPTION

The fuel fired heater has been applied to the diesel engine (CRDi) to increase heating capability by using diesel only in cold weather



▷ Coolant route : Engine → Heating burner → Heating core → Engine
▷ Fuel route : Fuel tank → Dosing pump → Heating burner → Combustion

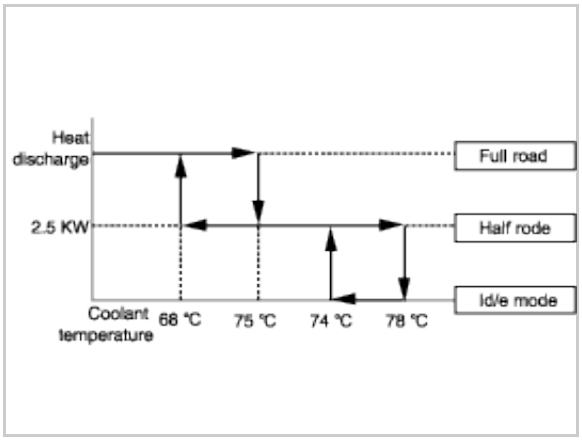
CAUTION

a. Follow the procedures specified in this bulletin during service or it may cause personal injury.
b. Be sure to turn the fuel fired heater off when refueling at station.
c. The fuel fired heater must be mounted at designated position, never in the passenger compartment.
d. The fuel fired heater must be kept below 120°C or a permanent failure on the components may occur.
e. Operational principle : The following 3 conditions should be met at the same time for automatic operation of the fuel fired heater.
a. Engine runs.
b. Ambient temperature is lower than 2°C (Winter)
c. Coolant temperature is lower than 68°C
f. Cleaning process
a. A cleaning process of the fuel fired heater will be performed automatically when the heater is not operated due to increase of coolant temperature and ignition off.
b. During cleaning process, supplied fuel in the heater will be burnt completely and any smoke will be expelled. It is a necessary process for next operation and durability of the heater and takes about 3 minutes.
g. Others
The following symptoms should be explained to customers or technicians as a normal occurrence.
a. A white smoke may come out from the fuel fired heater exhaust pipe installed at the front side of the right front tire during operation of the heater.
This is not an exhaust fumes.
When moisture in the fuel and air is discharged from the heater and is met cold ambient air, it is condensed and looks like a white smoke however, when an excessive black smoke is discharged, the fuel fired heater should be inspected.
b. A "buk-buk" noise from the heater is a noise to form flame for combustion. This is a normal operation.
c. When the heater is operated at full load, a "Wooing" noise is occurred.
d. When shutting off the engine during heater operation, a "Wing" noise is occurred to perform the cleaning process.

OVERVIEW

1. This fuel fired heater supplies additional heat to the interior compartment with a low fuel consumption to compensate the heat provided by engine alone.
2. The fuel fired heater has been adopted to warm up the interior compartment in a short time.

3. The two coolant temperature sensors are installed to the heater inner. The sensor valves determine heater operation.
4. One of the temperature sensors functions to prevent the heater from overheating.
   If the sensor temperature valve exceeds 125°C, the fuel will be cut and the heater will be deactivated by the determination of the overheating of the heater.
   The other temperature sensor determines the operation mode of the fuel fired heater.The temperature of this sensor enables to activate the heater at full load(5kw) or half load(2.5kw).
   • The coolant temperature shown on the above Figure is the value of the inner sensor and the actual coolant temperature is higher about 5°C ~7°C than the above value.



OPERATION

Switch on/ Operation start

The fuel fired heater is operated when the coolant temperature is below 68°C and the ambient temperature is below 2°C after starting the engine.
At this time, the glow plug and combustion air fan are operated first and after 30 seconds, the dosing pump is operated with stopping the combustion fan for 3 seconds.
After that, the operation of the fan increases continuously until it approaches to full load within 56 seconds. If fuel supply reaches to full load the glow plug does not operate and the operation of the fan reaches to full load.
After that the glow plug monitors ignition condition as a flame sensor for 45 seconds.
The above operation procedure is done automatically and in case the ignition fails, the above operation will be done again automatically.
If the condition of ignition failure sustains continuously, fuel supply and fan operation will be stopped and error codes will be stored to find cause of failure.
Generally, the cause of ignition failure during combustion is caused by the automatic re-operation of the above procedure.

Operation for heating

The fuel fired heater operates at full load when the coolant temperature is below 68°C and the ambient temperature is below 2°C after starting the engine.
It operates at half load when the coolant temperature is 74°C and it operates at idle mode when the coolant temperature is 78°C.
The fuel fired heater during the transformation process does a cleaning function from the half mode to the idle mode. At idle mode, all components do not work.
The fuel fired heater operating at idle mode turns into the half load when the coolant temperature is 74°C. At this time, if the coolant temperature drops again below 68°C, the heater operates with full load and turns into the idle mode if the temperature is 78°C.
This serial operating process is performed automatically.

Key switch off / Operation stop

The fuel fired heater ECU stops the operation of the fuel pump and cuts fuel supply when shutting off the engine during the heater operation.
The heater conducts cleaning operation at this time.
This is a process of burning the fuel completely supplied in the heater inner.
In this process, the glow plug and combustion air fan are operated.

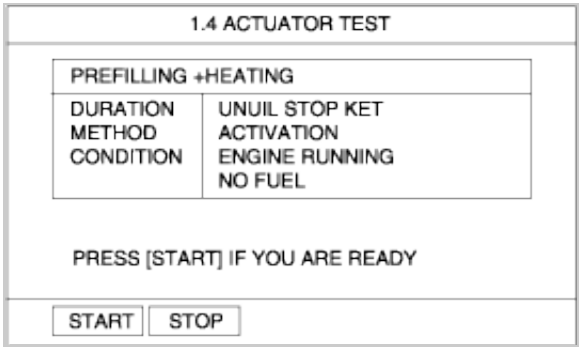
When the cleaning process is over, the operation of the heater is stopped.
The time for cleaning when the engine is turned off during the operation of the heater at full load is about 175 seconds.
About 100 seconds are required to conduct the cleaning of the heater at half load condition.
The operating sound of cleaning the heater is heard from the outside of the heater after turning the engine off and this is a normal process of operation

INSPECTION

OPERATION TEST

Fuel-fired heater operation test by force using Hi-Scan

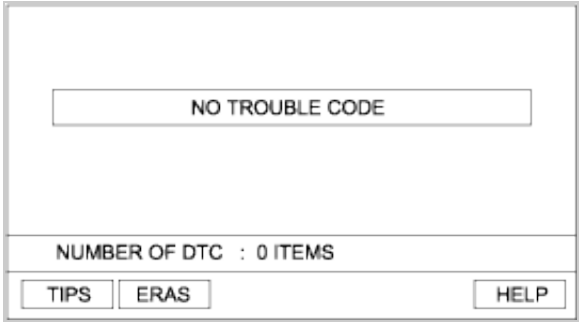
1. Start the engine.
2. Connect the Hi-Scan to the vehicle.
3. Select "SORENTO" and then select "FUEL FIRED HEATER".
4. Select "04. ACTUATION TEST" mode.
5. Select "PREFILLING + HEATING" to conduct the performance test after replacing the fuel fired heater system.
   Fuel supply and heating will be initiated if the "F1 key STRT" is pressed.
   However, a repair or replacement of the components related to the fuel line system in the fuel-fired heater were not done, operate the component by force after selecting the appropriate item from the menu screen.



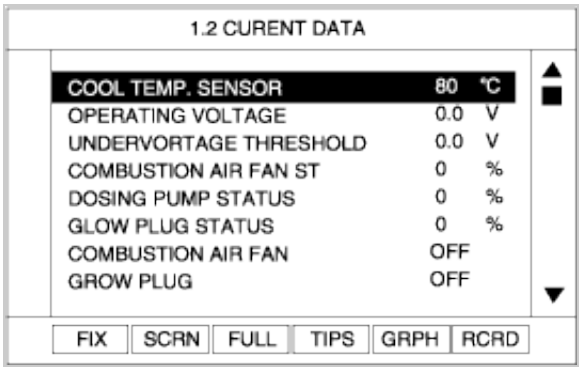
NOTICE

Do not operate the system by force with selecting the " PREFILLING + HEATING " option if no repair for the fuel line relating components has been done.
This means the fuel is in the fuel line.If an excessive fuel is supplied, it may cause smoke and abnormal "Banging" noise when the fuel is burned.
If the "F2 KEY STOP" is pressed, operation test is stopped.
For self-diagnosis test and sensors outputs during compulsory operation test, press "ESC KEY".
When a self-diagnosis test is completed, disconnect the self-diagnosis connector or press "F2 KEY STOP" from the "PREFILLING + HEATING" menu to stop the compulsory operation.
In case of selecting the individual part (ex. Combustion air fan, water pump,), press "ESC KEY" to stop the test.
In case of selecting the "PREFILLING + HEATING" option, about 2 minutes are required to conduct cleaning process after pressing the "F2 KEY STOP".
It is a normal process to burn the fuel left in the fuel line.

6. To conduct self diagnosis test, press "ESC" and then "01. DIAGNOSTIC TROUBLE CODES" option.



7. Select "02. CURRENT DATA" to view the current status of the components.



Component test

1. Using the Hi-Scan, conduct component test after selecting "FUEL FIRED HEATER" and "ACTUATION TEST" mode.
2. After conducting component test, perform self-diagnosis test.
3. It is recommended to conduct the fuel fired heater system test after completing the component test.
4. Test values for glow plug.

Resistance : 0.324 W ~ 0.360 W
Current : < 5mA

TROUBLESHOOTING

SYMPTOM	REMEDY
Fuel smell	Check fuel system on vehicle.
	Check the fuel supply line in the fuel fired heater for fuel leaking and fuel hose for twisting or clogging.
	If none of above is affected, there is likelihood of fuel leaking from the heater inner. Repair the heater after removing it.
Heater does not work at full load	Repair the heater after removing it.
White smoke occurs continuously during operation	Repair the heater after removing it.
Shortage of coolant Smoke occurs during operation Excessive exhaust gas smell	Check coolant hose for leaking, twisting and hose clamp for looseness.
	If above items are normal, leaks from the heater inner may cause these symptoms. Repair the heater after removing it.
Loss of fuel	Check fuel system on vehicle.
	Check the fuel supply line in the fuel fired heater for fuel leaking and fuel hose for twisting or clogging.
	If above items are normal, there is likelihood of fuel leaking from the heater inner. Repair the heater after removing it.

SPECIFICATIONS

ITEM		OPERATION STATE	SPECIFICATION
Fuel fired heater body	Heater discharge	Full load	5.0kw
		Half load	2.5kw
	Full load		Diesel
	Fuel consumption	Full load	0.63 l/h
		Half load	0.32 l/h
	Rated voltage		12.0V
	Operation voltage range		9.5V~15.0V
	Power consumption	Full load	37w(Normal)
		Half load	13w(Normal)
	Permissible ambient temperature	At operation	-40°C~80°C
		At storage	-40°C~120°C
	Permissible operation pressure		0.4bar ~ 2.5bar
	Minimum coolant flow volume		250 l/h
	Permissible CO_2 value		8~13 vol %

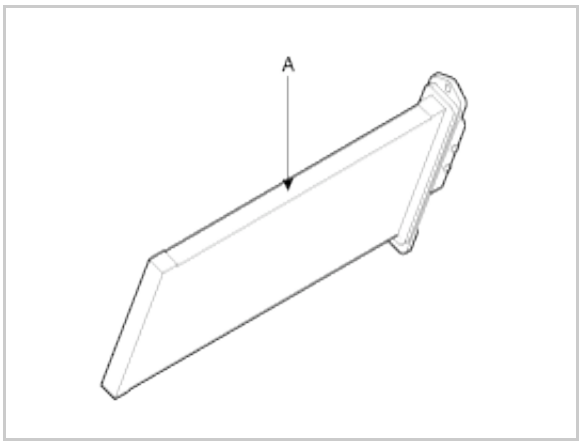
ITEM		SPECIFICATION
Dosing pump	Rated voltage	12.0V
	Operation voltage range	9.0V ~ 15.0V
	Maximum power consumption	4w(Normal)

ITEM		SPECIFICATION
Ambient switch	Rated voltage	12.0V
	Temperature of ON/OFF	ON : 2°C(Tolerance : + 3°C, -2°C)
		OFF : 8°C(Tolerance : + 2°C, -3°C)

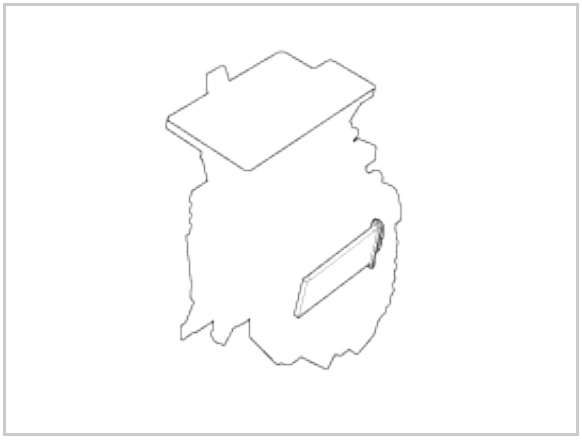
Positive Temperature Coefficient Heater

DESCRIPTION

PTC (Positive Temperature Coefficient) heater (A) is an electric heater using a PTC element as an auxiliary heating device that supplements deficiency of interior heat source in highly effective diesel engine (U engine).

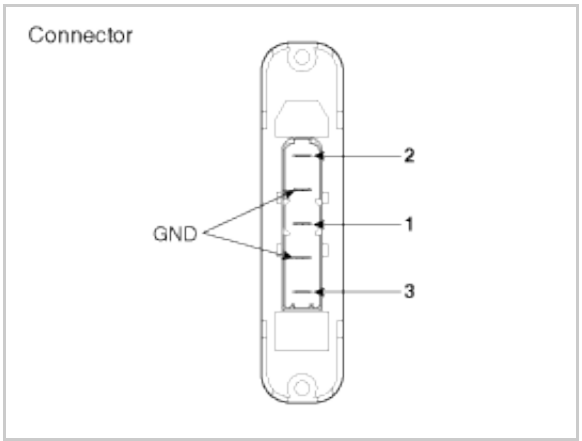


An electric heater heats up the interior by directly heating the air that passes through the heater.
PTC = positive Temperature Coefficient
The name itself implies that the element has a proportional resistance change sensitive to temperature. PTC heater is installed at the exit or the backside of heater core.



OPERATION PRINCIPLE

ECM outputs a PTC on signal. Operate PTC from 1st setting to 3rd setting with an interval of 15 seconds.
Heat up the air, which passes through a heater core.



OPERATION CONDITION

Judge the condition by ambient temperature is below 5°C, coolant temperature is below 70°C, and battery voltage is above 11V and engine RPM is above 700RPM.

INSPECTION

Inspect the PTC operation by confirmation logic as below.

1. Entering method
   (1) Set the floor mode, maximum heating
   (2) Turn off the blower switch
   (3) Press the intake button more than 5 times.
   (4) Indicator of entire button is flashed with an interval of 0.5 seconds continuously (Manual).
   Graphics of the entire LCD display switch on and off with an interval of 0.5 seconds continuously (Automatic)
   (5) Confirm the PTC operation by operating the blower switch
   Manual : 1~4 step, Automatic: 1~8step.
   (6) Each PTC relay is operated with an interval of 3 seconds.
   (7) Execute the PTC operation by confirmation logic for 30 seconds.

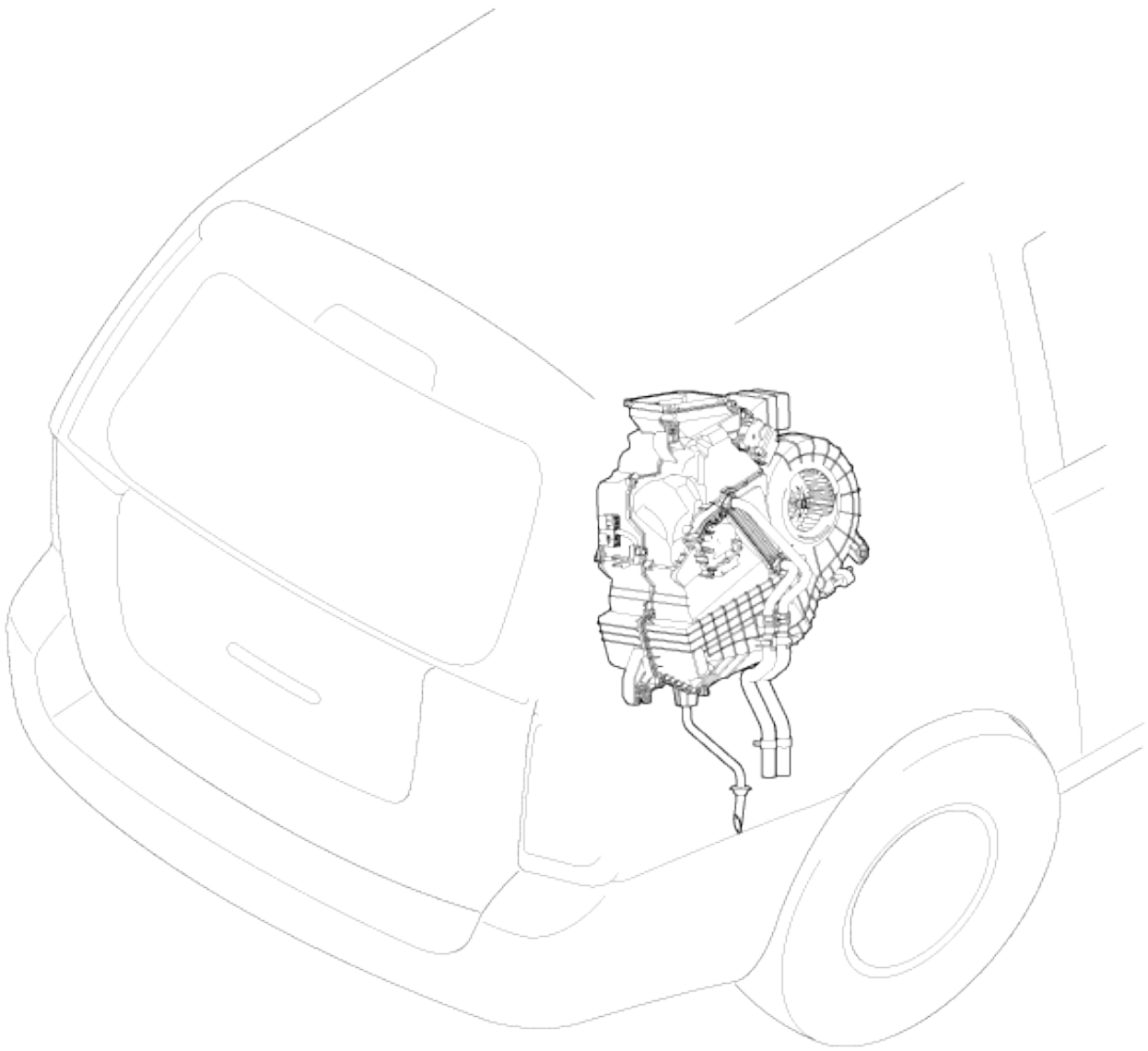
2. Cancellation method
   (1) Select the A/C button or intake button.
   (2) IG "OFF".
   (3) Cancel the logic after 30 seconds automatically.

3. If the PTC operation is not operated, substitute with a known-good PTC and check for proper operation.
   If the problem is corrected, replace the PTC.

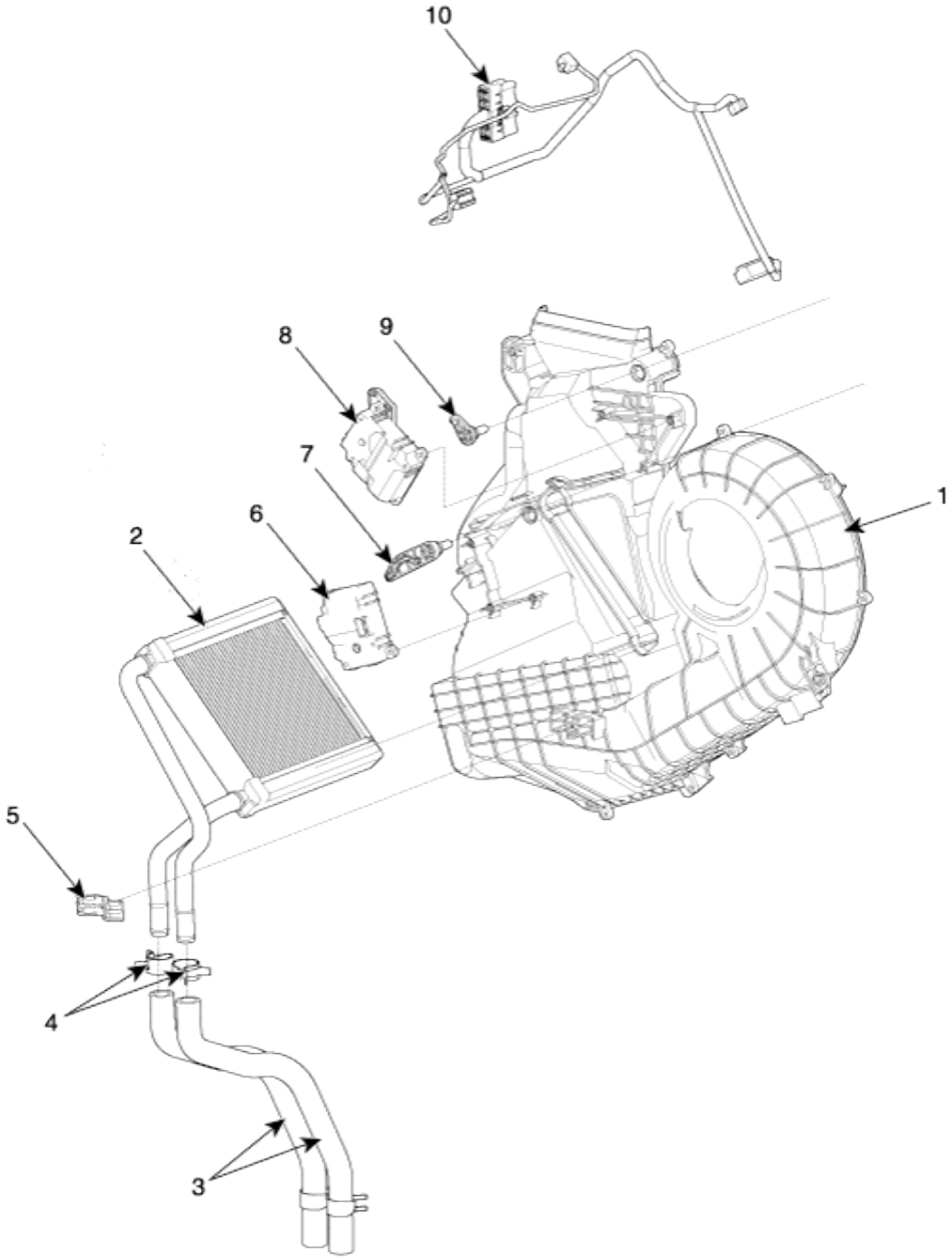
Rear Heater

Rear Heater Unit

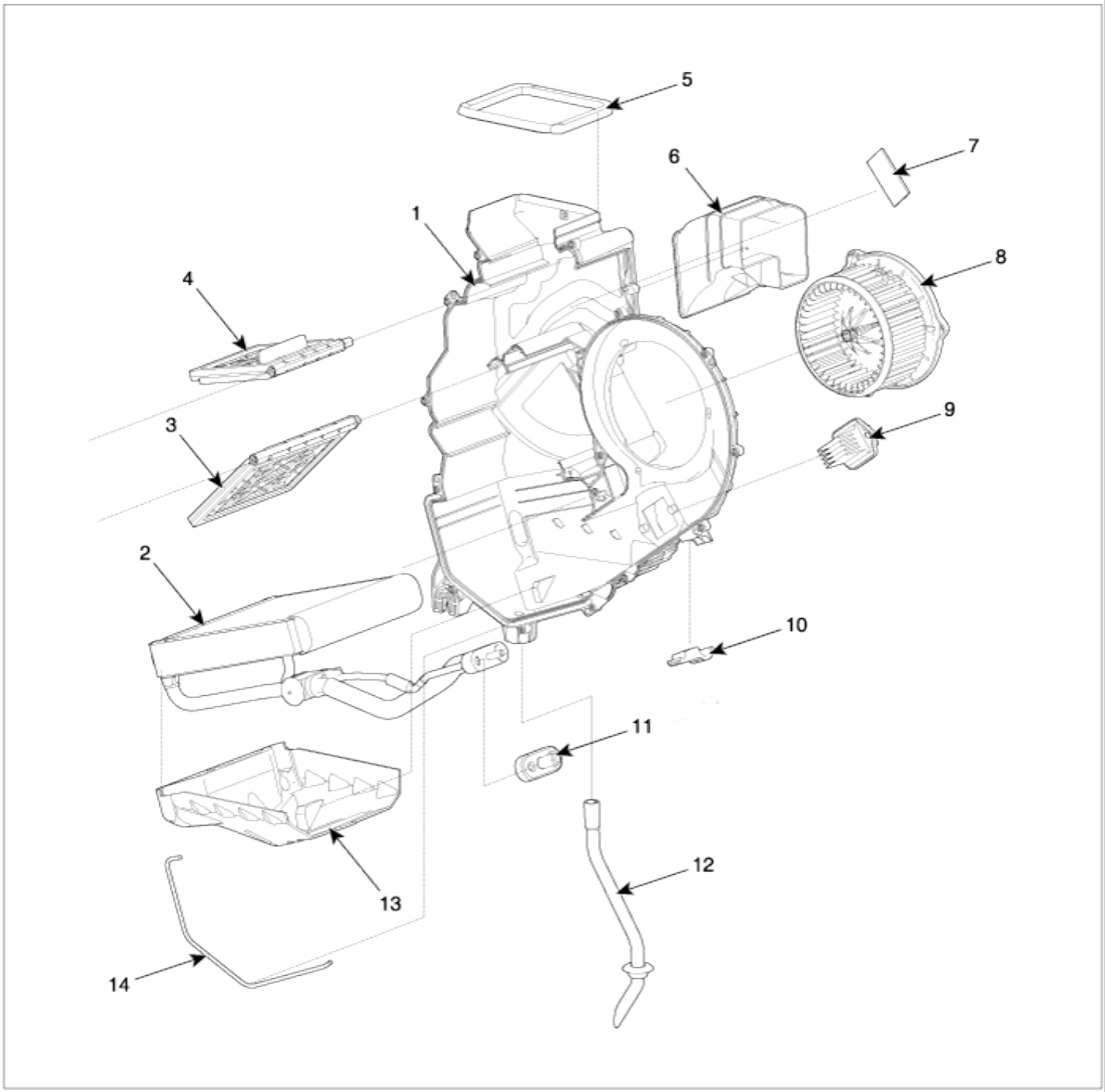
COMPONENT LOCATION



COMPONENTS



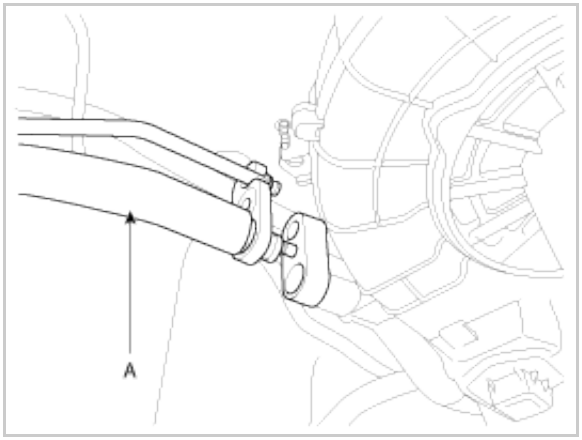
1. Heater case(R)
2. Heater core assembly
3. Heater hose assembly
4. Heater hose clip
5. Heater pipe clip
6. Temp control actuator
7. Mix door lever
8. Mode control actuator
9. Mode door lever
10. Wire harness



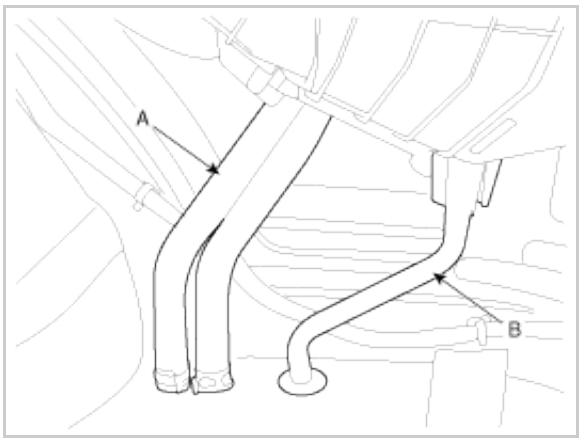
1. Heater case(L)
2. Eva core assembly
3. Mix door assembly
4. Mode door assembly
5. Vent seal
6. Foot duck
7. Wire
8. Blower motor assembly
9. Power mosfet
10. Eva pipe clip
11. Eva flange cover
12. Drain hose assembly
13. Lower case seal
14. Case insert seal

REPLACEMENT

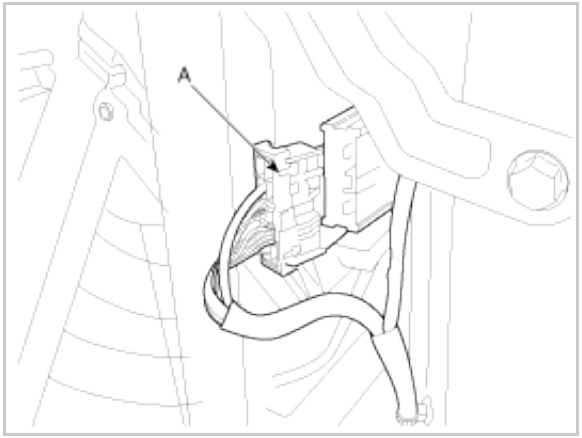
1. Disconnect the negative(-) battery terminal.
2. Recover the refrigerant with a recover/ recycling/ charging station.
3. When the engine is cool, drain the engine coolant from the radiator.
4. Remove luggage side trim(Refer to BD-).
5. Loosen the refrigerant line mounting bolts, and then remove the rear refrigerant line(A).



6. Remove the heater hose(A), drain hose(B).



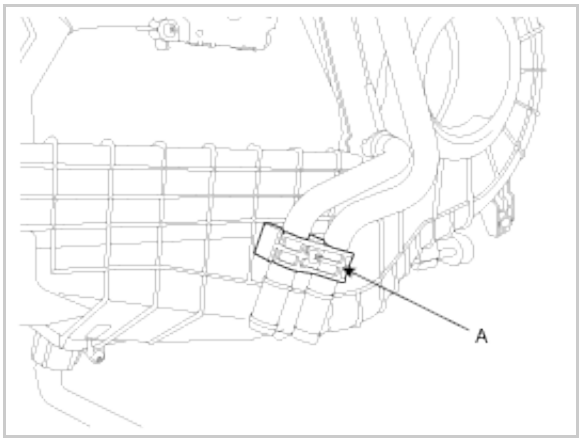
7. Remove the rear heater main connector(A).



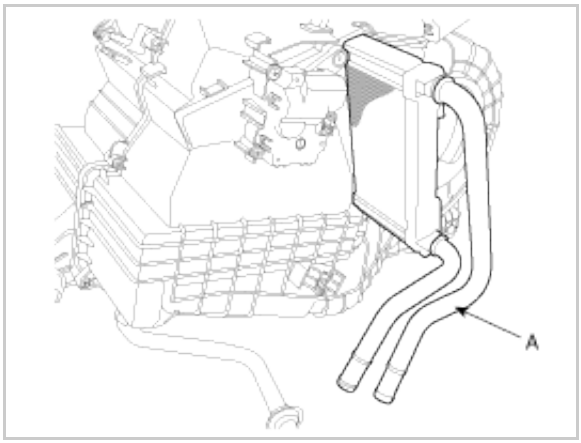
8. Loosen the rear heater mounting nuts, and then remove the rear heater unit(A).



9. Remove the heater core mouting cover(A), after loosening the screw.



10. Remove the heater core(A).

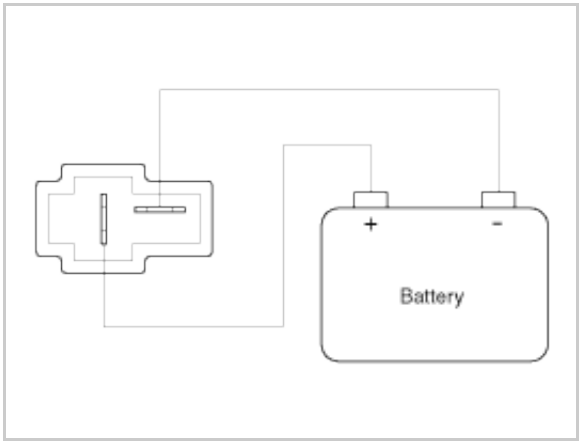


11. Installation is the reverse order of removal.

Rear Blower Unit

INSPECTION

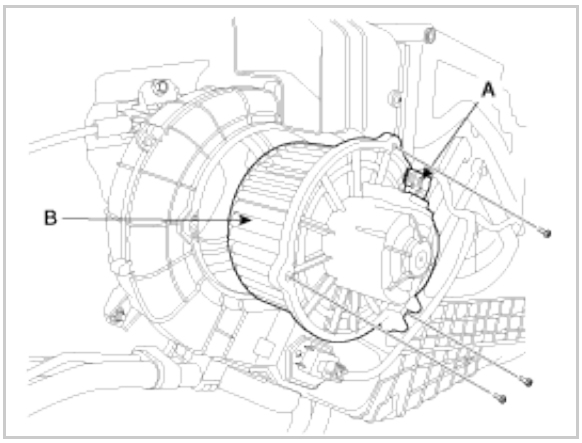
1. Connect the battery voltage and check the blower motor rotation.



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. Disconnect the connector (A) of the blower motor.
3. Remove the blower motor (A) after loosening the mounting screws.



4. Installation is the reverse order of removal.

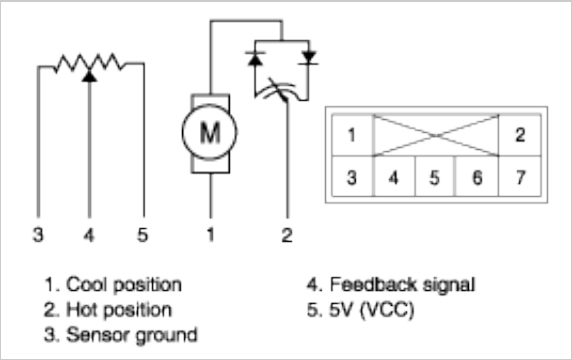
Rear Temperature Control Actuator

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.

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 1 and grounding terminal 2.
   Verify that the temperature control actuator operates to the cool position when connecting in the reverse.



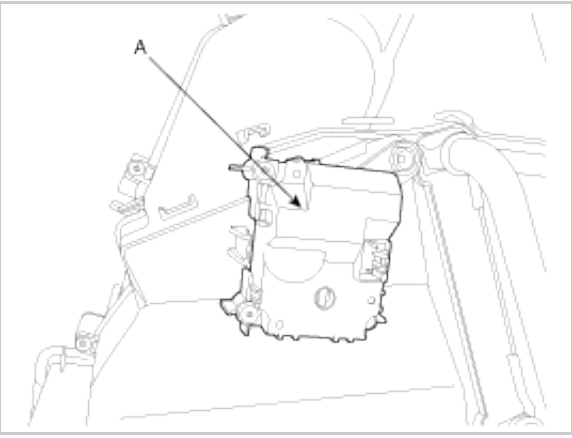
4. Check the voltage between terminals 3 and 4.
   Specification

Door position	Voltage (3-4)	Error detecting
Max. cooling	0.4 ± 0.15V	Low voltage : 0.1V or less
Max. heating	4.6 ± 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 luggage side trim (Refer to BD-).
3. Remove the rear heater unit (Refer to HA-).
4. Disconnect the temperature control actuator connector after removing the air duct.
5. Loosen the mounting screw and then remove the temperature control actuator (A).

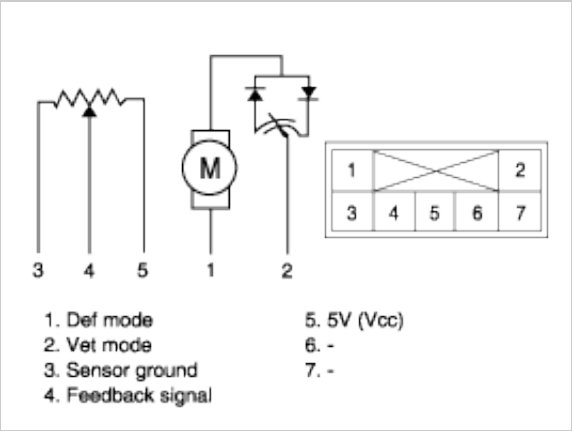


6. Installation is the reverse order of removal.

Rear Mode Control Actuator

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 1 and grounding terminal 2.
4. Verify that the mode control actuator operates to the vent mode when connecting in the reverse.

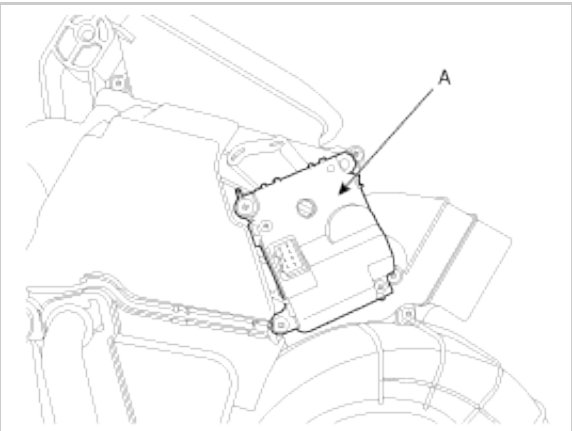


5. Check the voltage between terminals 3 and 4.

Door position	Voltage (3-4)	Error detecting
Vent	0.4 ± 0.15V	Low voltage :0.1V or less
Defrost	4.6 ± 0.15V	High voltage :4.9V or more

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the rear heater unit.
3. Disconnect the mode control actuator connector (A).
4. Loosen the mounting screws and then remove the mode control actuator (B).

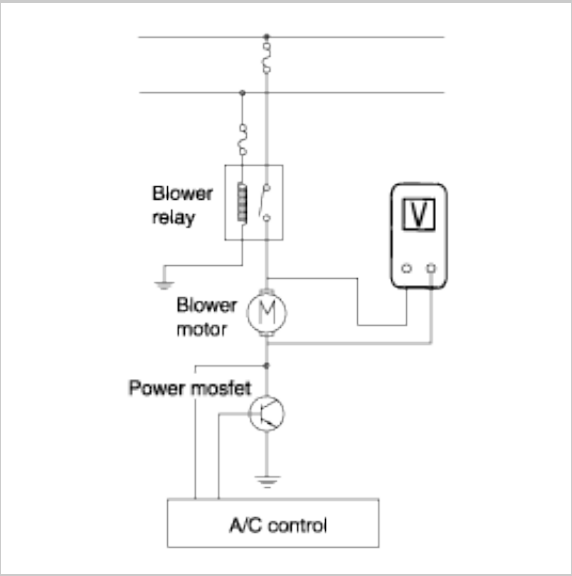


5. Installation is the reverse order of removal.

Rear Power Mosfet

INSPECTION

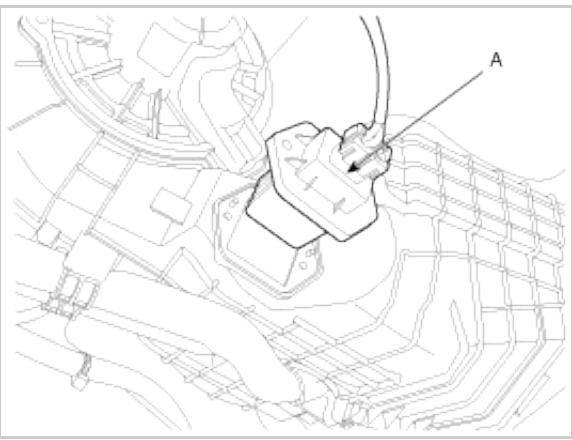
1. Ignition "ON".
2. Manually operate the control switch and measure the voltage of blower motor between pin 1 and 2.
3. Select the control switch to raise voltage until high speed.



Fan	Voltage
	Manual
1 STEP	4.5 ± 0.5V
2 STEP	5.7 ± 0.5V
3 STEP	6.9 ± 0.5V
4 STEP	8.1 ± 0.5V
5 STEP	9.3 ± 0.5V
6 STEP	10.3 ± 0.5V
7 STEP	Battary(+)

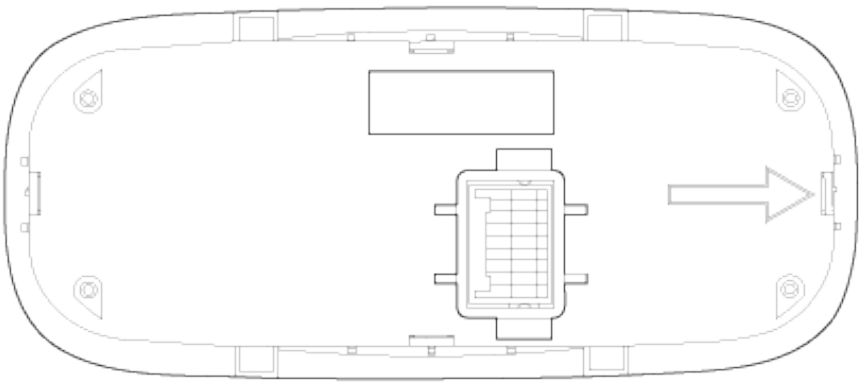
REPLACEMENT

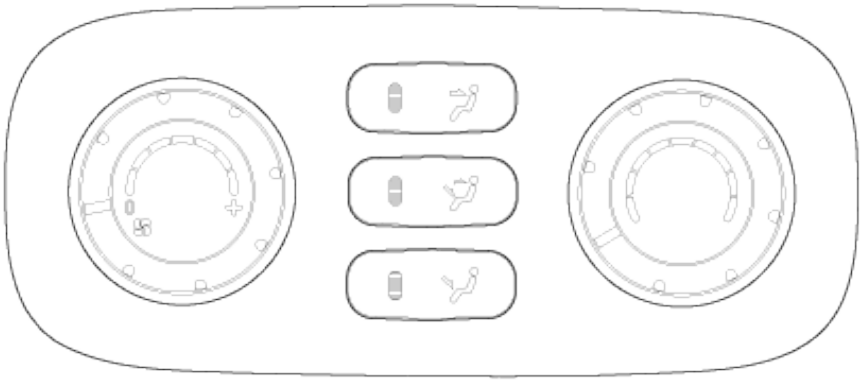
1. Disconnect the negative (-) battery terminal.
2. Remove the luggage side trim (Refer to BD-).
3. Disconnect the power mosfet connector (A).
4. Remove the power mosfet (B) after loosening the mounting screws.

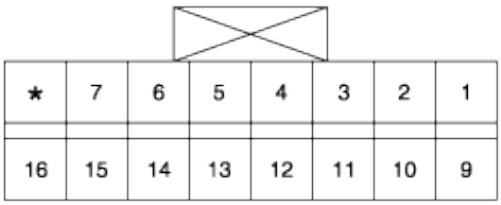


Rear Control Panel

COMPONENT





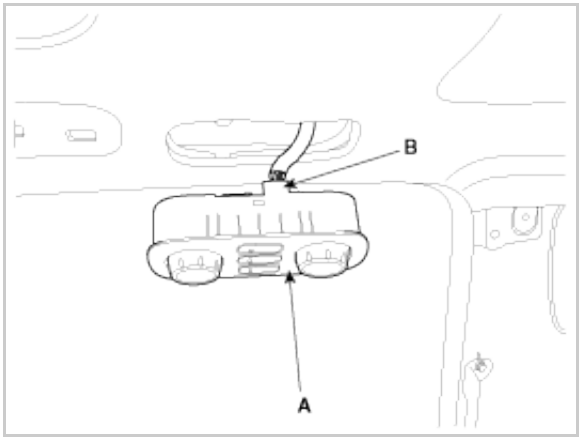


1	Tail lamp (ILL+)
2	IGN 2
3	Rear temp S/W
4	Rear temp S/W (VENT)
5	Rear temp S/W (B/L)

6	Rear temp S/W (FLOOR)
7	Rhostat (ILL-)
8	Sensor Ref (+5V)
9	Sensor ground
10	Rear mode IND (VENT)
11	Rear mode IND (B/L)
12	Rear mode IND (FLOOR)
13	GND
14	-
15	-
16	Rear blower S/W

REPLACEMENT

1. Remove the rear control panel(A) and then dissconnect the rear control panel connector(B).

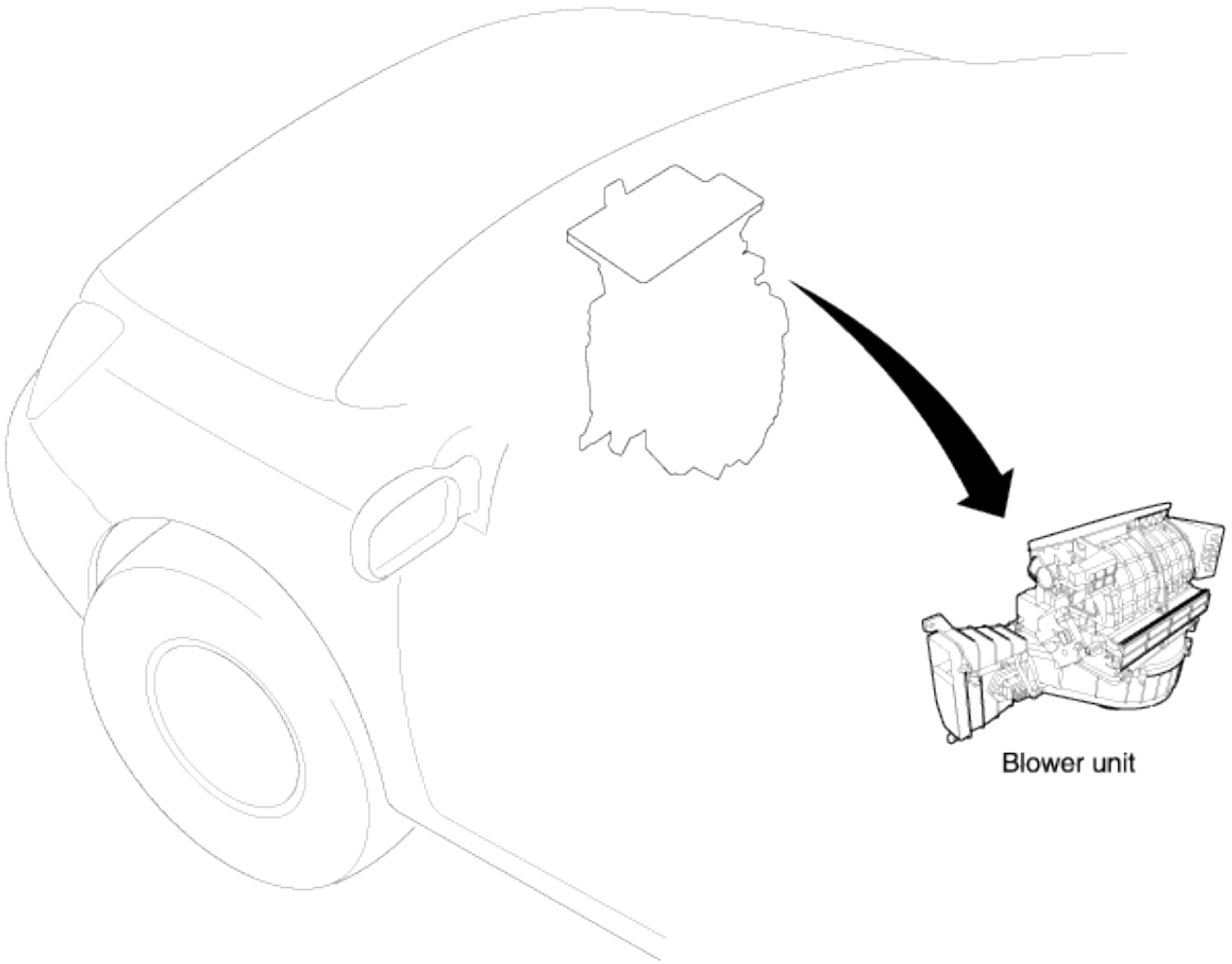


2. Installation is the reverse order of removal.

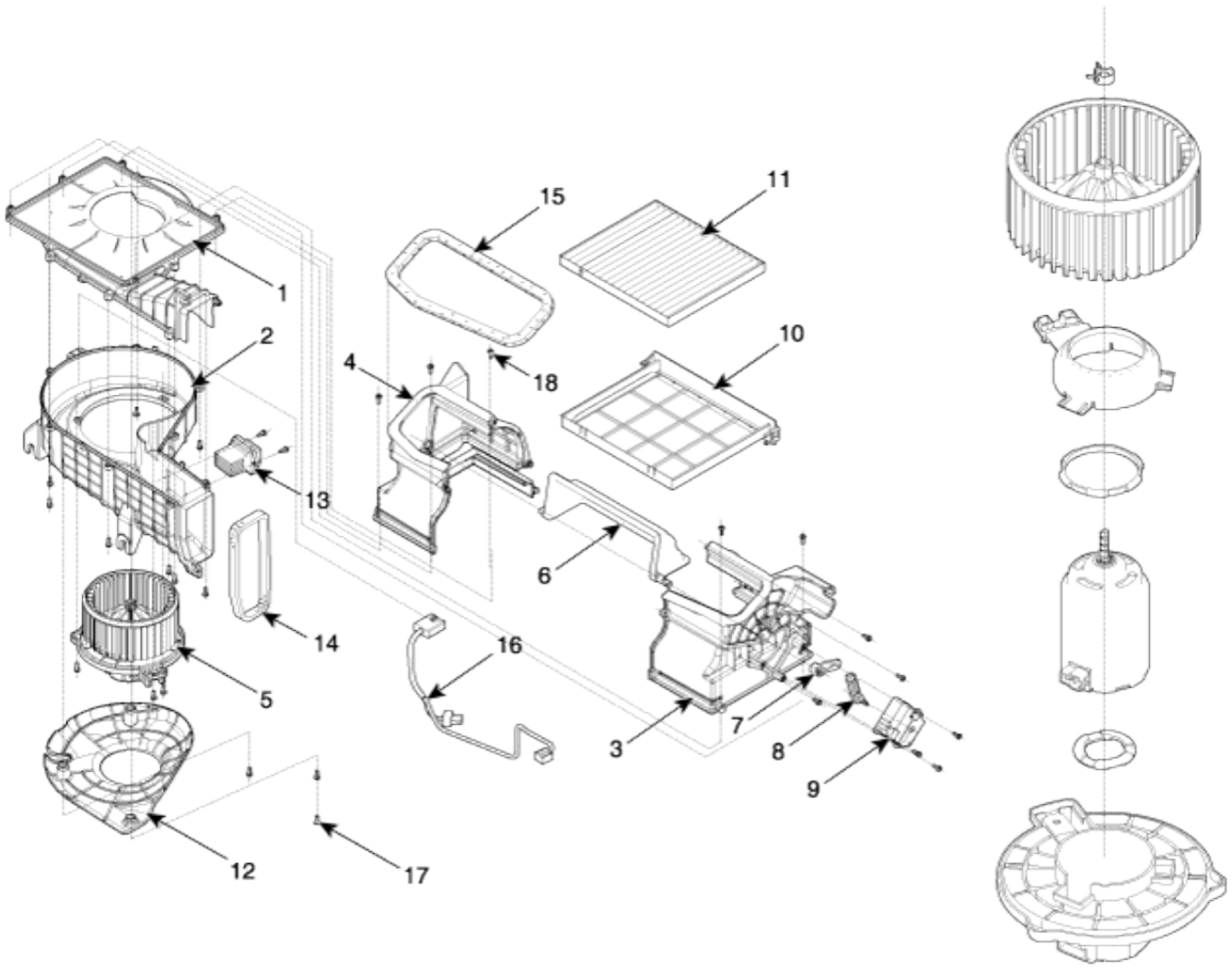
Blower

Blower Unit

COMPONENT LOCATION



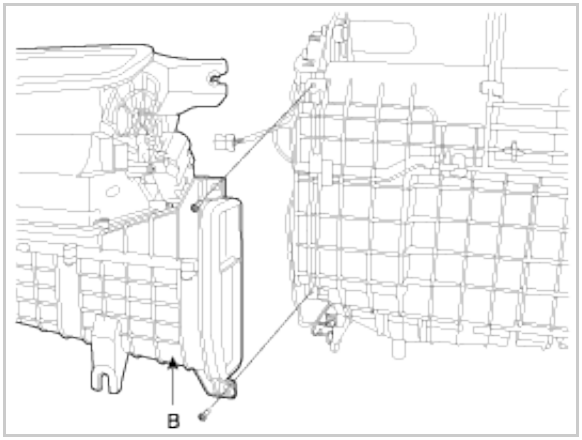
COMPONENTS



1. Upper case
2. Lower case
3. Intake case(L)
4. Intake case(R)
5. Blower motor assembly
6. Intake door
7. Intake door lever
8. Intake actuator lever
9. Intake actuator
10. Filter care
11. Filter
12. Blower motor cover
13. Power mosfet
14. Blower joint seal
15. Cowl seal
16. Wire harness
17. Blower motor screw
18. Case screw

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the crush pad.(Refer to BD group)
3. Disconnect the connectors from the intake actuator, the blower motor and power mosfet.
4. Remove the cowl cross bar assembly.(Refer to BD group)
5. Remove the blower unit (A) from the heater unit after loosening a mounting bolt and 2 screws.



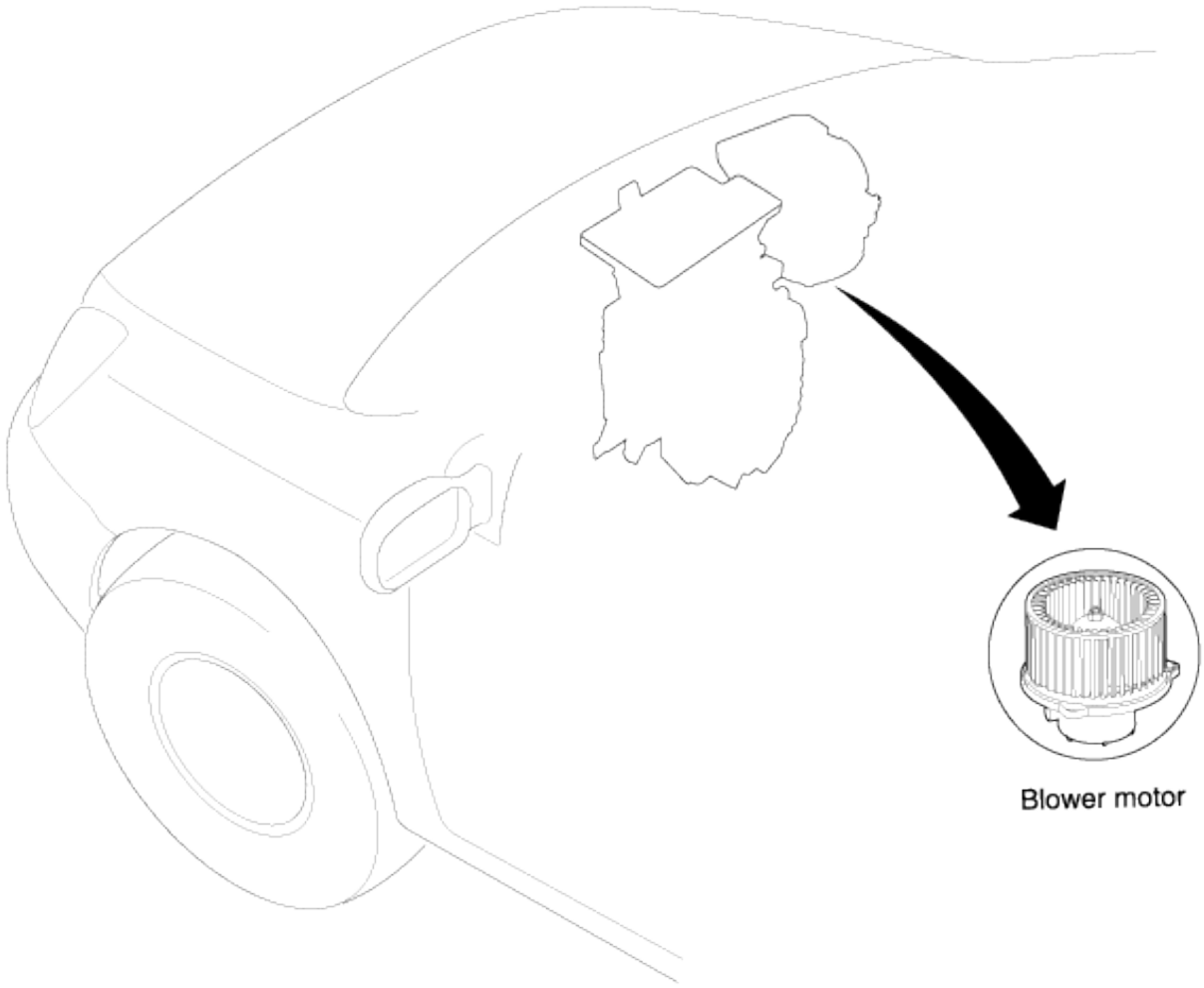
NOTICE

Make sure that there is no air leaking out of the blower and duct joints.

6. Installation is the reverse order of removal.

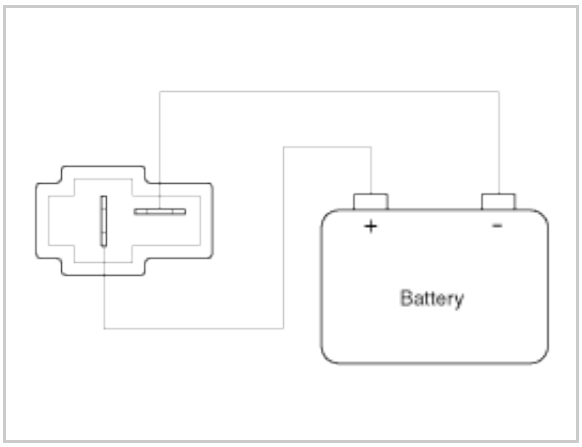
Blower Motor

COMPONENT LOCATION



INSPECTION

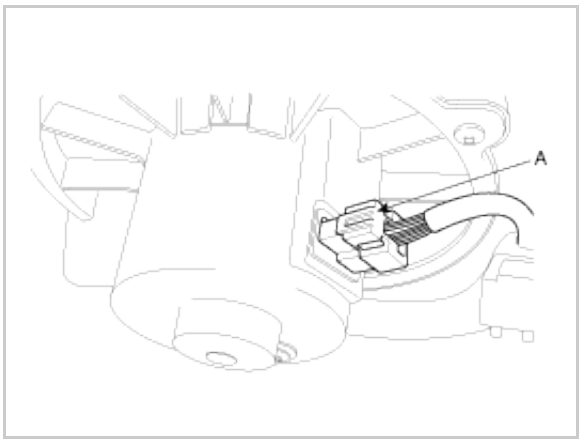
1. Connect the battery voltage and check the blower motor rotation.



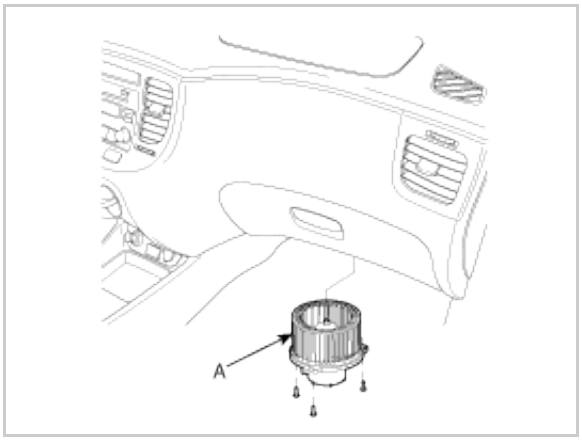
2. If the blower motor voltage is not operated well, substitute with a known-good blower motor and check for proper operation.
3. If the problem is corrected, replace the blower motor.

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Disconnect the connector (A) of the blower motor.



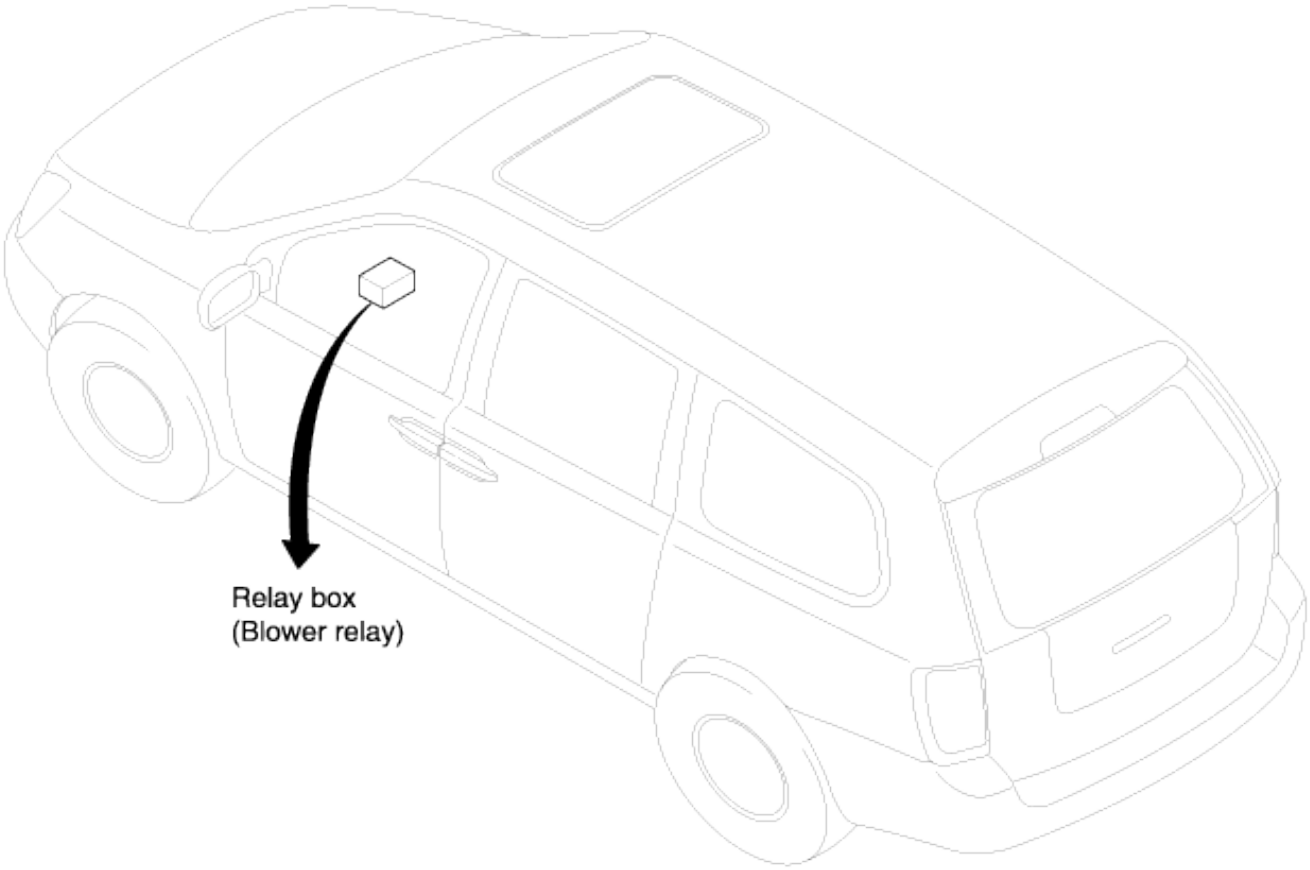
3. Remove the blower motor (A) after loosening the mounting screws.



4. Installation is the reverse order of removal.

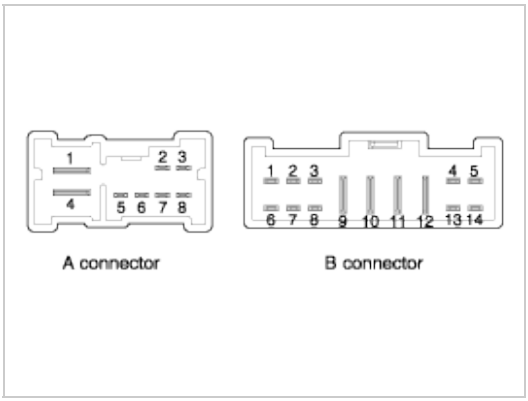
Blower Relay

COMPONENT LOCATION



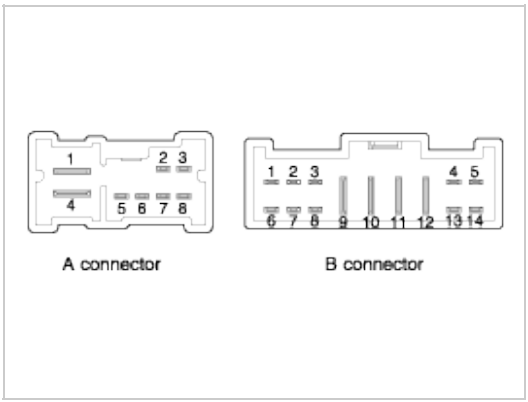
INSPECTION

1. There should be continuity between the NO.1 in the A and NO.10 in the B terminals when power and ground are connected to the NO.7 and NO.13 in the A terminals. (Passenger compartment relay box)
2. There should be to no continuity btween the NO.1 in the A and NO.10 in the B terminals when power is disconnected.



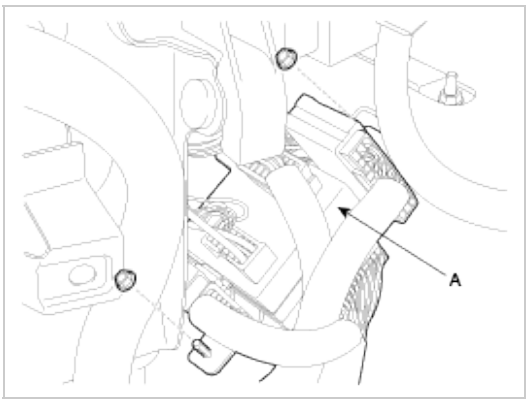
REAR BLOWER

1. There should be continuity between the NO.4in the A and NO.12n the B terminals when power and ground are connected to the NO.2and NO.14in the A terminals. (Passenger compartment relay box)
2. There should be to no continuity btween the NO.4in the A and NO.12in the B terminals when power is disconnected.



REPLACEMENT

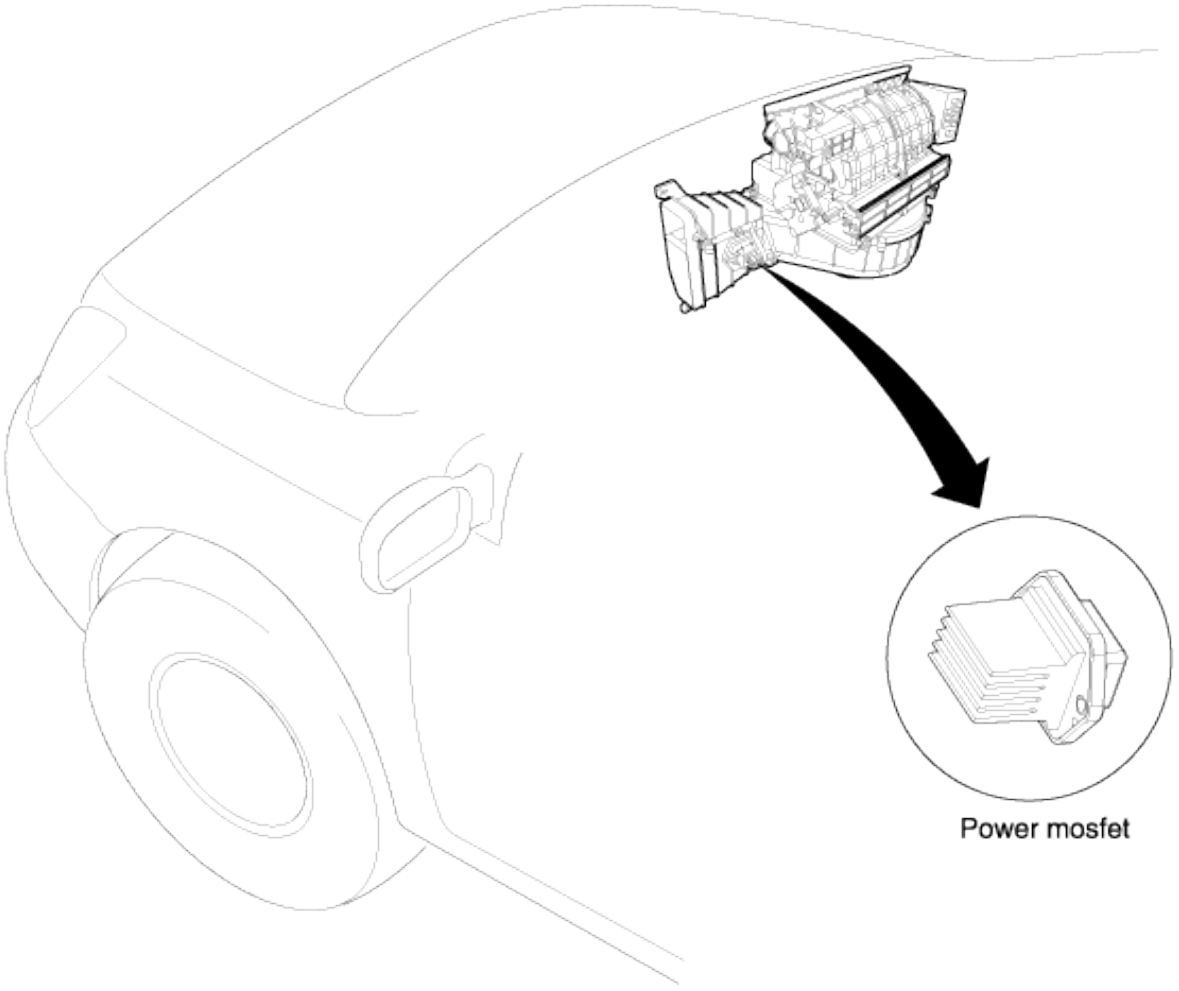
1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad center lower side cover. (Refer to BD group)
3. Loosen the relat box mounting nut, and then remove the relay box(A).



4. Install in the reverse order of removal.

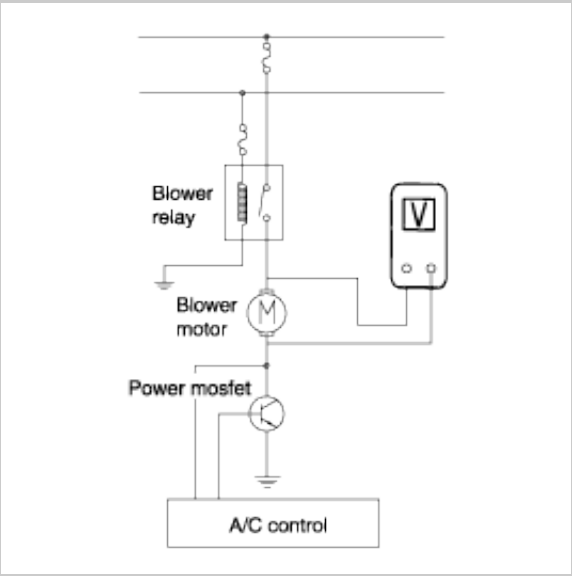
Power Mosfet

COMPONENT LOCATION



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

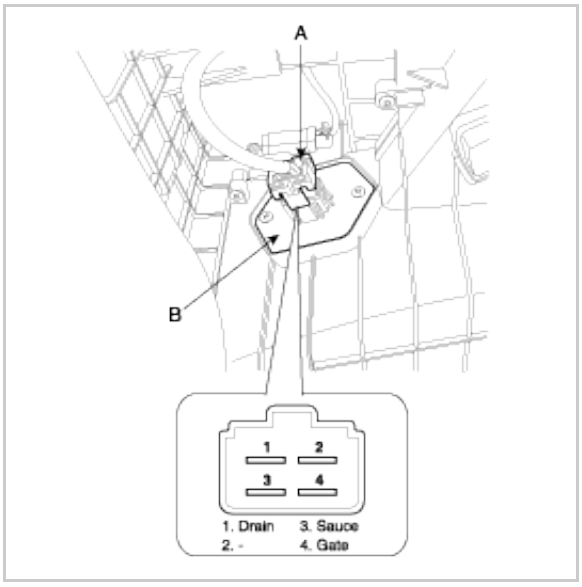
Fan	Motor Voltage
	Manual
First speed	4.0 ±0.5V
Second speed	5.1 ±0.5V
Third speed	6.2 ±0.5V
Fourth speed	7.3 ±0.5V
Fifth speed	8.4 ±0.5V
Sixth speed	9.5 ±0.5V
Seventh speed	10.5 ±0.5V
eighth speed	Battary(+)

*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. Disconnect the power mosfet connector (A) at the connecting part between heater and blower unit.
3. Remove the power mosfet (B) after loosening the mounting screws.



4. Installation is the reverse order of removal.

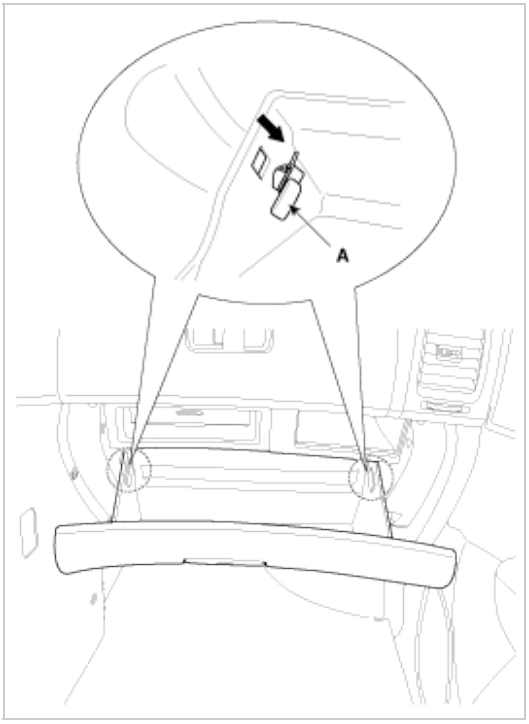
Climate Control Air Filtar

DESCRIPTION

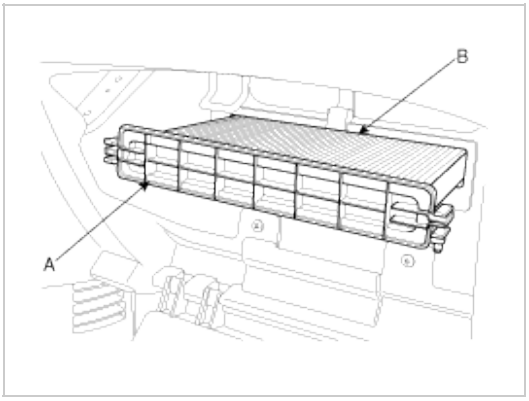
This has particle filter which eliminates foreign materials and odor. The particle filter includes odor filter as well as conventional dust filter to ensure comfortable interior environment.

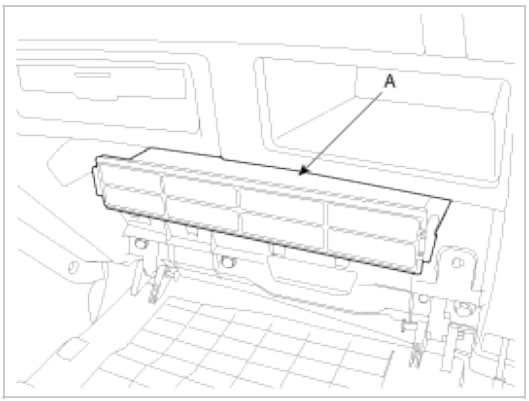
REPLACEMENT

1. Open the glove box (B).
   Lower the glove box down completely by removing the glove box stopper (A) to the glove box.



2. Remove the filter cover (A) with pushing the knob.
3. Replace the air filter (B), install it after making sure of the direction of air filter.





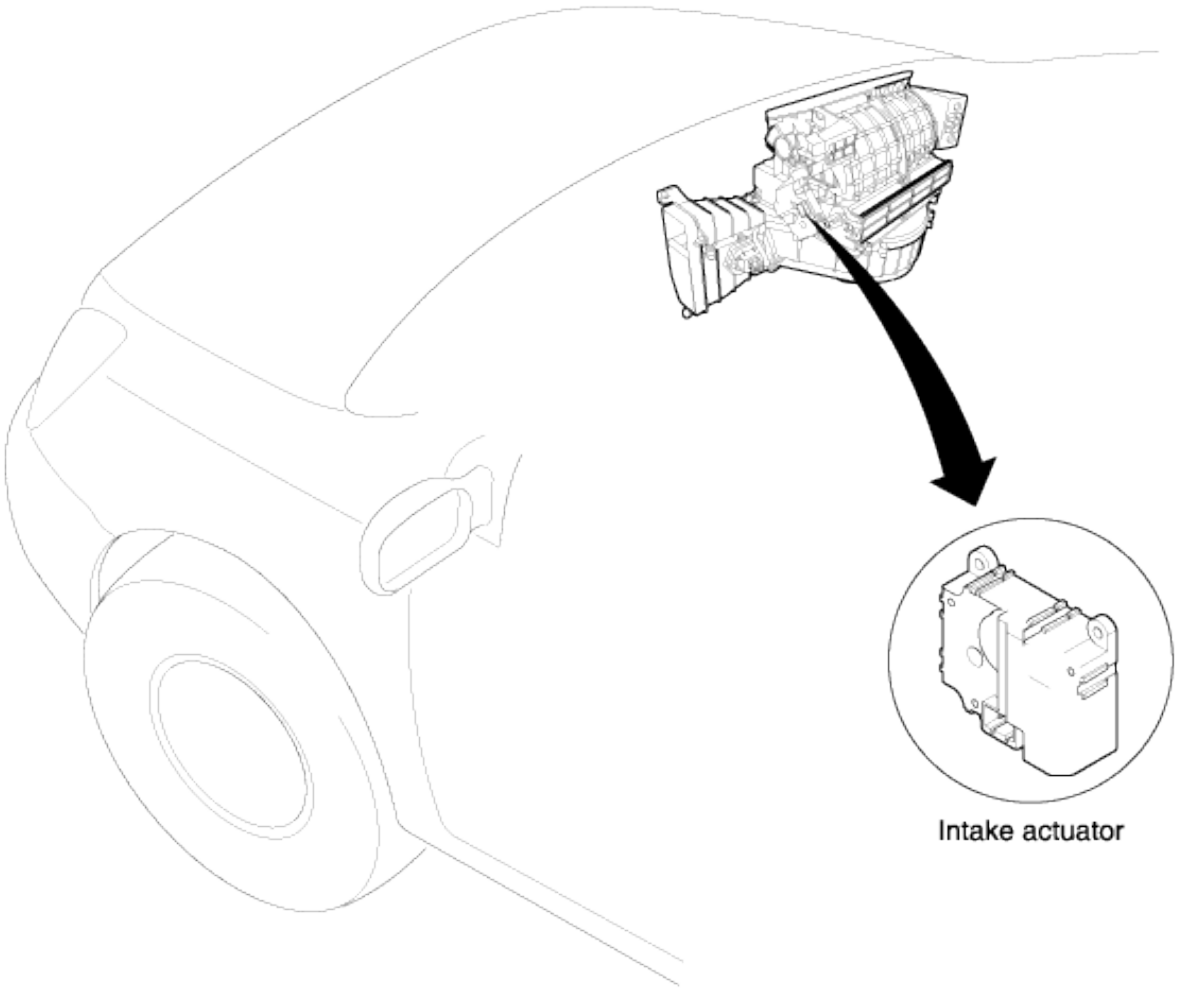
NOTICE

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

Replacement period: 15,000 km (9320 mile)

Intake Actuator

COMPONENT LOCATION

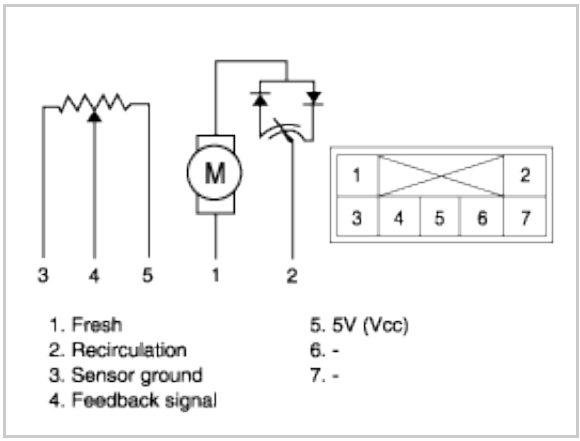


DESCRIPTION

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.

INSPECTION

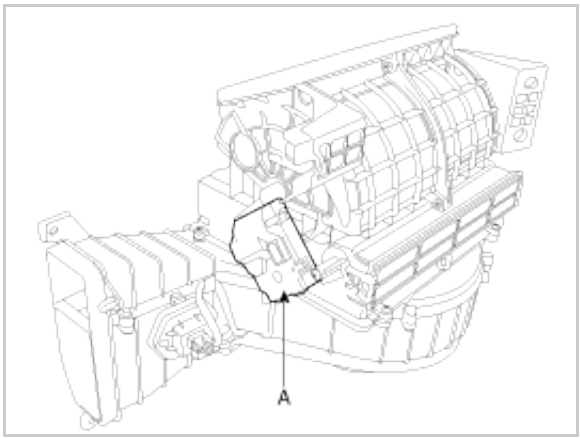
1. Ignition "OFF"
2. Disconnect the intake actuator connector.
3. Verify that the actuator operates to the recirculation position when connecting 12V to the terminal 3 and grounding terminal 4.
4. Verify that the intake actuator operates to the fresh position when connecting in the reverse.



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

REPLACEMENT

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

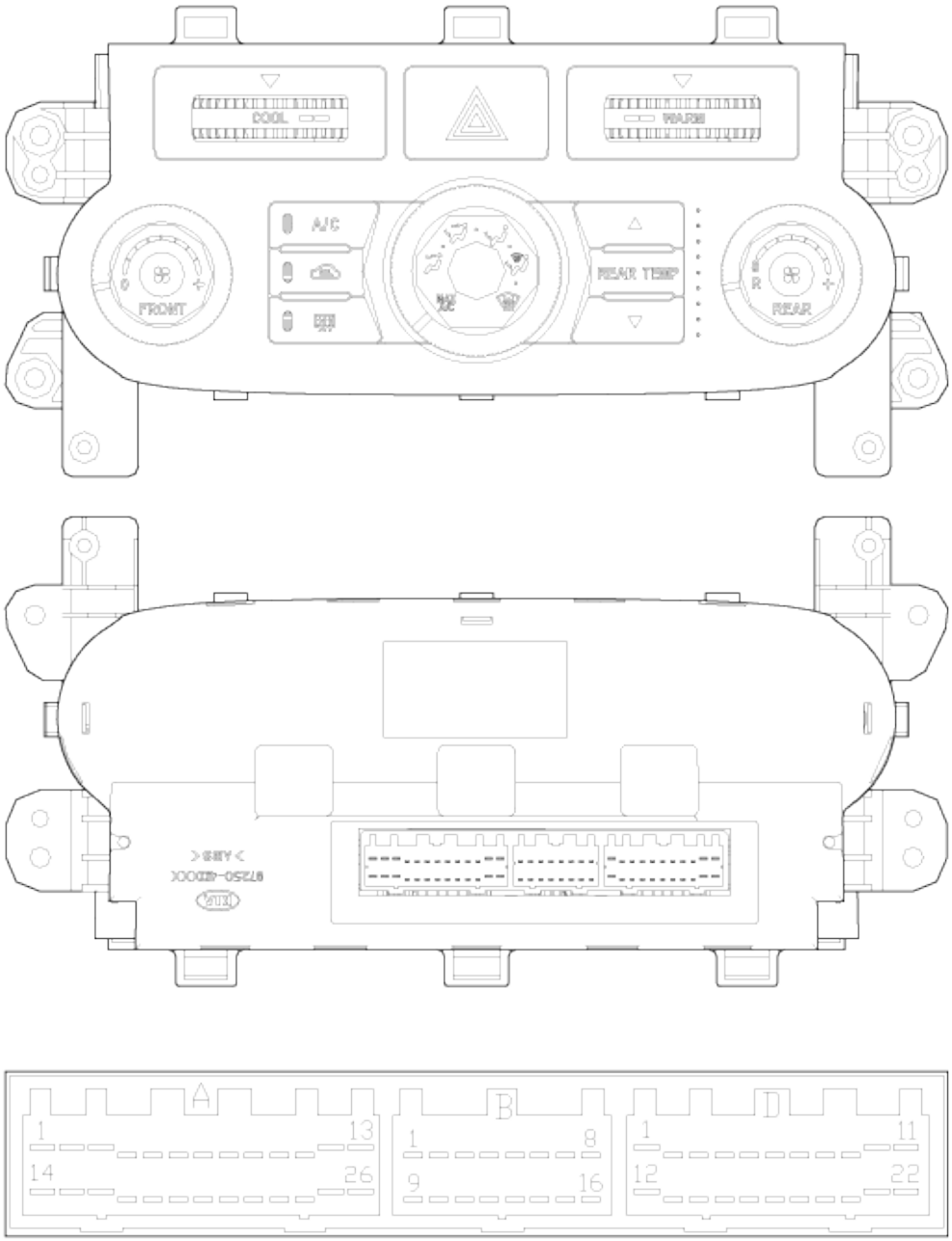


5. Installation is the reverse order of removal.

Controller

MANUAL

COMPONENT



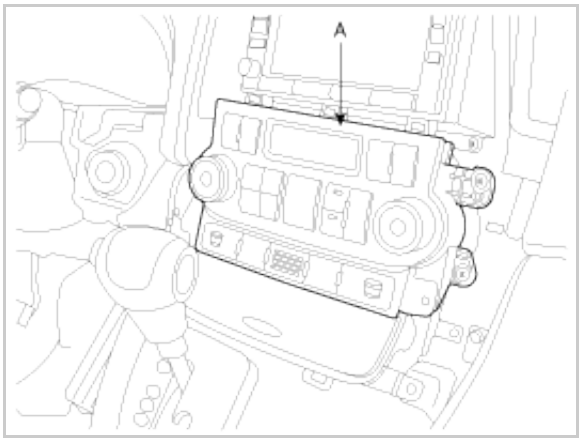
CONNECTOR PIN FUNCTION

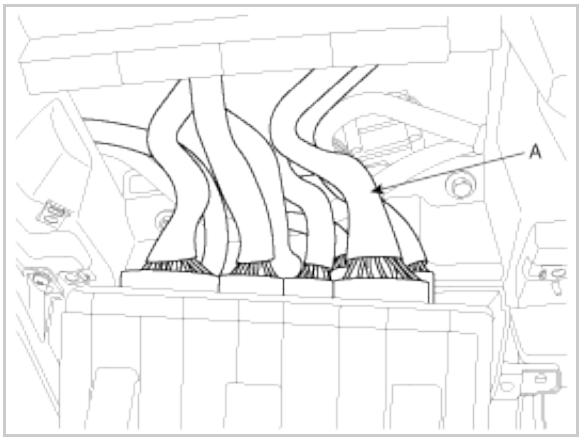
PIN NO.		Function	PIN NO.		Function
	1	BATTERY		7	-
	2	IGN 2		8	POWER MOSFET (GATE) - REAR
	3	TAIL LAMP (ILL+)		9	POWER MOSFET (DRAIN) - REAR
	4	REAR TEMP ACTUATOR (COOL)		10	-
	5	REAR TEMP ACTUATOR (WARM)		11	SENSOR GND

	6	REAR TEMP ACTUATOR (F/B)	Connector B	12	SENSOR POWER (+5V)
	7	REAR TEMP SWITCH		13	-
	8	REAR MODE ACTUATOR (VENT)		14	HAZARD SEIECT
	9	REAR MODE ACTUATOR (FLOOR)		15	-
	10	REAR MODE ACTUATOR (F/B)		16	-
	11	BLOWER MOTOR (+)		1	DRIVE'S TEMP ACTUATOR (COOL)
	12	GROUND		2	DRIVE'S TEMP ACTUATOR (WARM)
	13	RHEOSTAT (ILL-)		3	DRIVE'S TEMP ACTUATOR (F/B)
Connector A	14	A/C SELECT SIGNAL		4	DRIVE'S MODE ACTUATOR (COOL)
	15	A/C OUTPUT		5	DRIVE'S MODE ACTUATOR (WARM)
	16	REAR DEFOGGER		6	DRIVE'S MODE ACTUATOR (F/B)
	17	REAR DEFOGGER SWITCH		7	INTAKE ACTUATOR (FRESH)
	18	-		8	INTAKE ACTUATOR (RECIRCULATION)
	19	REAR BLOWER SWITCH		9	INTAKE ACTUATOR (F/B)
	20	REAR MODE SWITCH (VENT)		10	PASSENGER'S TEMP ACTUATOR (COOL)
	21	REAR MODE SWITCH (B/L)	Connector C	11	EVAPORATOR SENSOR (+)
	22	REAR MODE SWITCH (FLOOR)		12	SENSOR POWER (+5V)
	23	REAR MODE GND (VENT)		13	PASSENGER'S TEMP ACTUATOR (WARM)
	24	REAR MODE GND (B/L)		14	PASSENGER'S TEMP ACTUATOR (F/B)
	25	REAR MODE GND (FLOOR)		15	-
	26	-		16	DATA PORT
	1	-		17	RESET PIN
	2	A/C OUTPUT		18	-
	3	PTC RELAY2		19	POWER MOSFET (GATE) - FRONT
Connector B	4	PTC RELAY3		20	POWER MOSFET (DRAIN) - FRONT
	5	BLOWER SELECT SIGNAL		21	SENSOR GND
	6	PTC ON SIGNAL		22	-

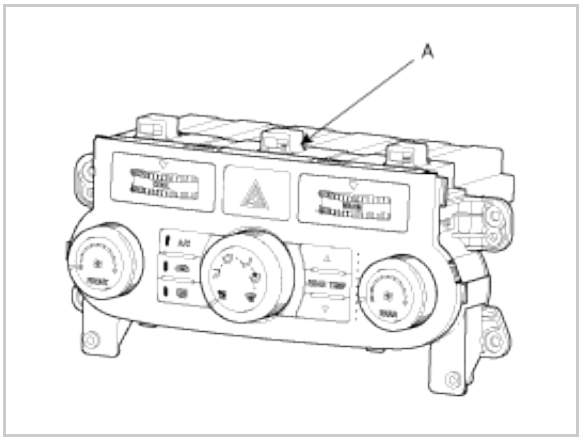
REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the center air vent. (Refer to BD group)
3. Remove the heater & A/C controller (A) after loosening 4 screws.





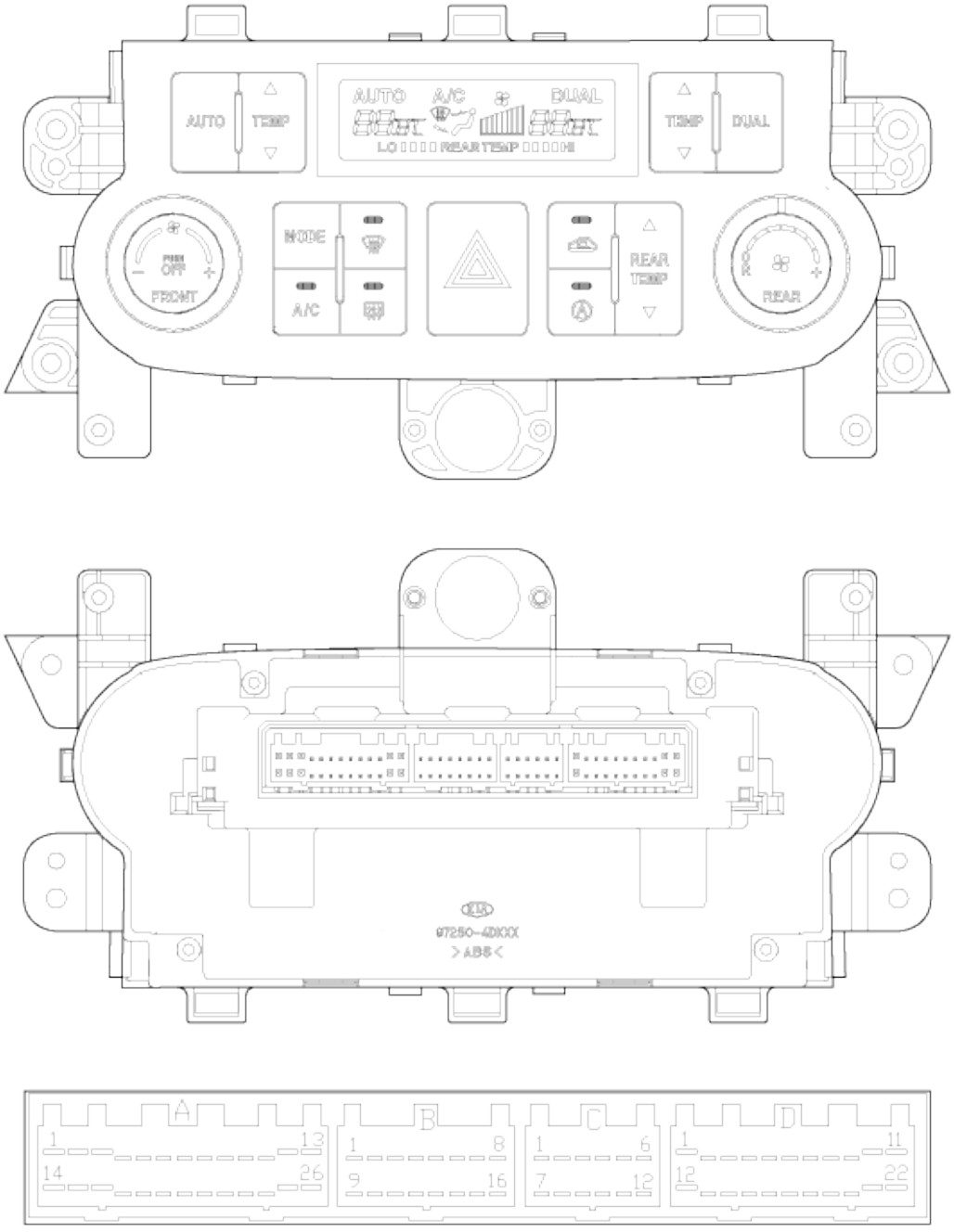
4. Remove the heater & A/C controller (A).



5. Installation is the reverse order of removal.

FULL AUTOMATIC

COMPONENT



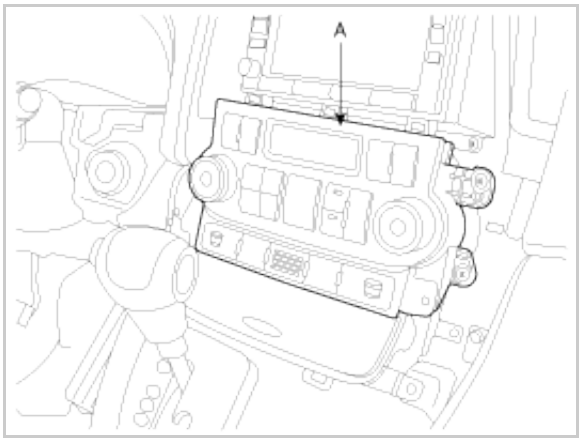
CONNECTOR PIN FUNCTION

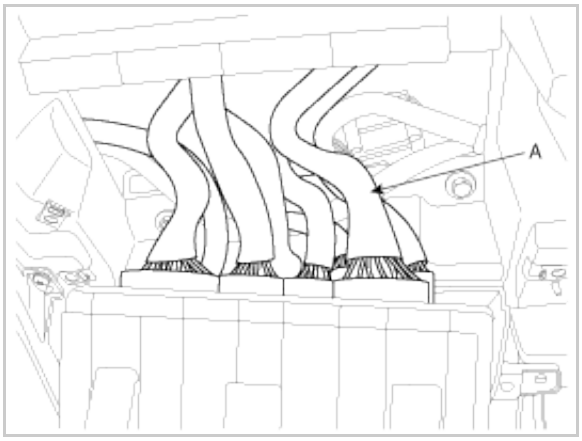
PIN NO.	Function	PIN NO.	Function
1	BATTERY	7	-
2	IGN 2	8	POWER MOSFET (GATE) - REAR
3	TAIL LAMP (ILL+)	9	POWER MOSFET (DRAIN) - REAR
4	REAR TEMP ACTUATOR (COOL)	10	-
5	REAR TEMP ACTUATOR (WARM)	11	SENSOR GND

	6	REAR TEMP ACTUATOR (F/B)	Connector B	12	SENSOR POWER (+5V)
	7	REAR TEMP SWITCH		13	-
	8	REAR MODE ACTUATOR (VENT)		14	HAZARD SEIECT
	9	REAR MODE ACTUATOR (FLOOR)		15	-
	10	REAR MODE ACTUATOR (F/B)		16	-
	11	BLOWER MOTOR (+)		1	DRIVE'S TEMP ACTUATOR (COOL)
	12	GROUND		2	DRIVE'S TEMP ACTUATOR (WARM)
	13	RHEOSTAT (ILL-)		3	DRIVE'S TEMP ACTUATOR (F/B)
Connector A	14	A/C SELECT SIGNAL		4	DRIVE'S MODE ACTUATOR (COOL)
	15	A/C OUTPUT		5	DRIVE'S MODE ACTUATOR (WARM)
	16	REAR DEFOGGER		6	DRIVE'S MODE ACTUATOR (F/B)
	17	REAR DEFOGGER SWITCH		7	INTAKE ACTUATOR (FRESH)
	18	-		8	INTAKE ACTUATOR (RECIRCULATION)
	19	REAR BLOWER SWITCH		9	INTAKE ACTUATOR (F/B)
	20	REAR MODE SWITCH (VENT)		10	PASSENGER'S TEMP ACTUATOR (COOL)
	21	REAR MODE SWITCH (B/L)	Connector C	11	EVAPORATOR SENSOR (+)
	22	REAR MODE SWITCH (FLOOR)		12	SENSOR POWER (+5V)
	23	REAR MODE GND (VENT)		13	PASSENGER'S TEMP ACTUATOR (WARM)
	24	REAR MODE GND (B/L)		14	PASSENGER'S TEMP ACTUATOR (F/B)
	25	REAR MODE GND (FLOOR)		15	-
	26	-		16	DATA PORT
	1	-		17	RESET PIN
	2	A/C OUTPUT		18	-
	3	PTC RELAY2		19	POWER MOSFET (GATE) - FRONT
Connector B	4	PTC RELAY3		20	POWER MOSFET (DRAIN) - FRONT
	5	BLOWER SELECT SIGNAL		21	SENSOR GND
	6	PTC ON SIGNAL		22	-

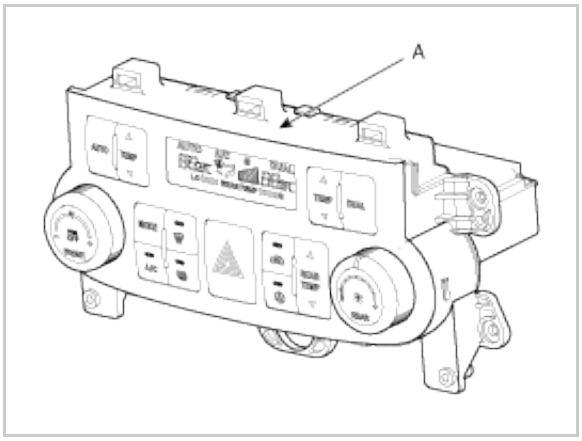
REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the center air vent. (Refer to BD group)
3. Remove the heater & A/C controller (A) after loosening 4 screws.





4. Remove the heater & A/C controller (A).



5. Installation is the reverse order of removal.

CHAPTER 12:

Restraint

General information

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.

a. 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.

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

b. 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.

c. 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.



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

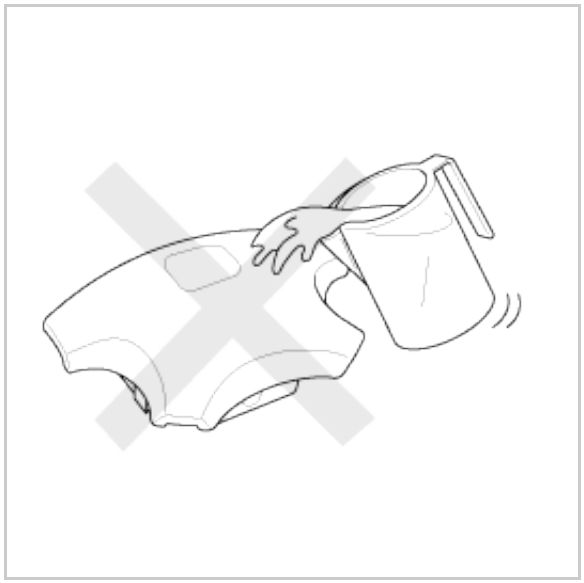
Airbag Handling and Storage

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.

a. Store the removed airbag with the pad surface up.

b. Keep free from any oil, grease, detergent, or water to prevent damage to the airbag assembly.

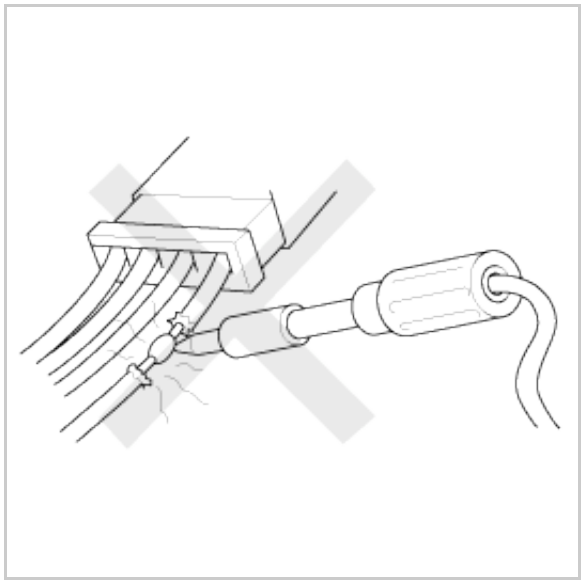


c. Store the removed airbag on secure, flat surface away from any high heat source (exceeding 85°C/185°F).
d. Never perform electrical inspections to the airbags, such as measuring resistance.
e. Do not position yourself in front of the airbag assembly during removal, inspection, or replacement.
f. Refer to the scrapping procedures for disposal of the damaged airbag.
g. 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.
h. 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.
i. 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.
j. Do not disassemble the SRS unit, the front impact sensor or the side impact sensors
k. 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.
l. Be sure the SRS unit, the front impact sensor and side impact sensors are installed securely with the mounting bolts.
m. 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.
n. Store the SRS unit, the front impact sensor and the side impact sensors in a cool (less than 40°C/104°F) and dry (less than 80% relative humidity, no moisture) area.

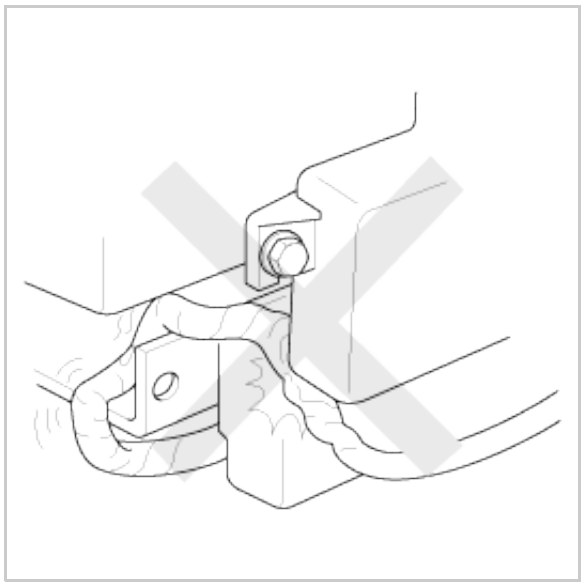
Wiring Precautions

SRS wiring can be identified by special yellow outer covering (except the SRS circuits under the front seats).
Observe the instructions described in this section.

a. Never attempt to modify, splice, or repair SRS wiring.
   If there is an open or damage in SRS wiring, replace the harness.



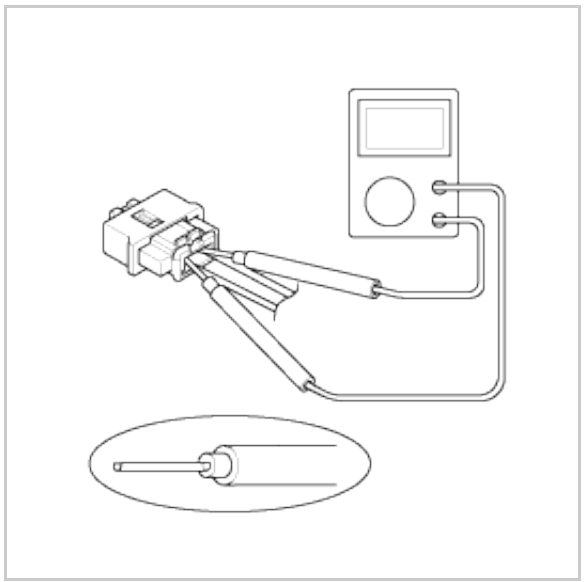
b. Be sure to install the harness wires so that they are not pinched, or interfere with other parts.



c. 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

a. 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.

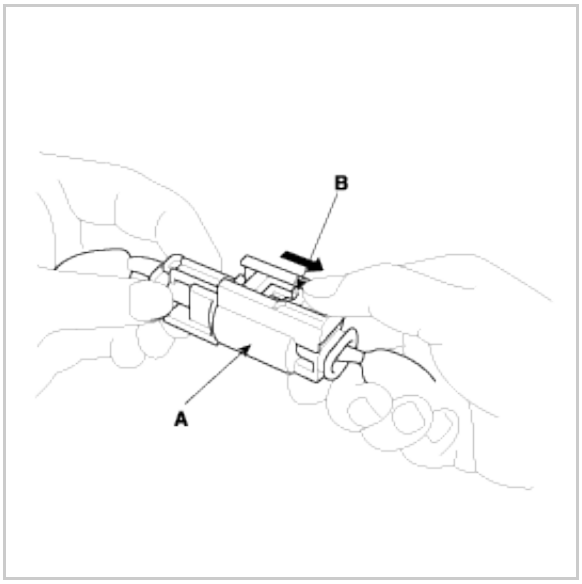


b. Use a u-shaped probe. Do not insert the probe forcibly.

c. Use specificed service connectors for troubleshooting.

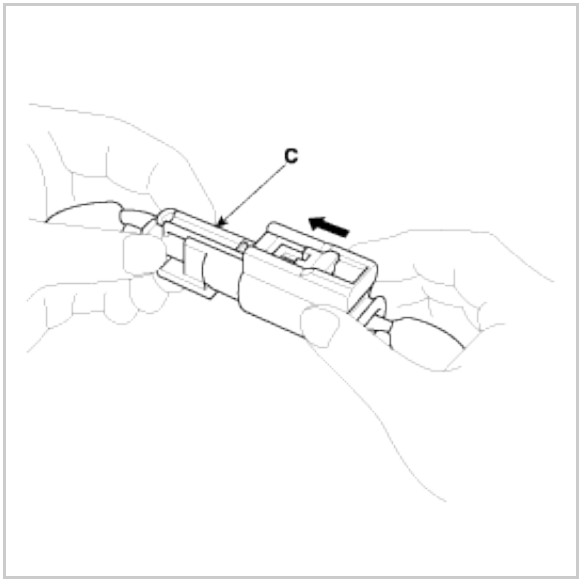
Using improper tools could cause an error in inspection due to poor metal contact.

Airbag Connector



Connecting

Hold both connector halves and press firmly until the projection (C) of the sleeve-side connector clicks to lock.



General

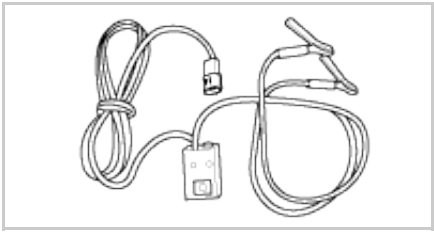
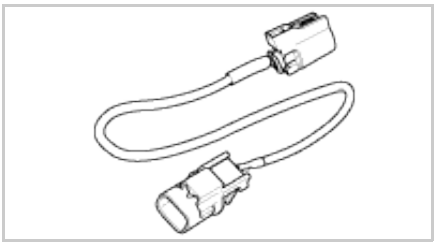
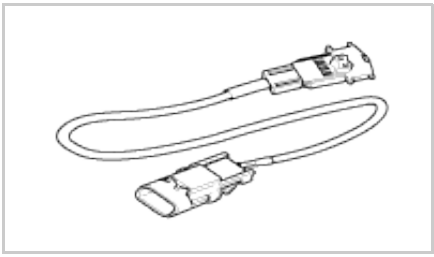
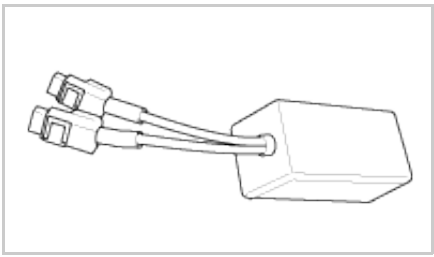
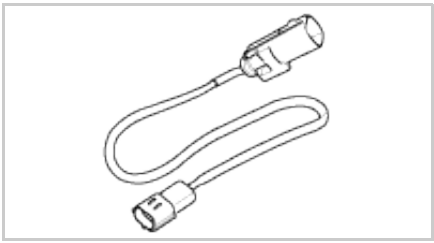
The supplemental restraint system (SRS) is designed to supplement the seat belt to help reduce the risk or severity of injury to the driver and passenger by activating and deploying the driver, passenger, side airbag and belt pretensioner in certain frontal or side collisions.
The SRS (Airbag) consists 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. Safety sensor: Safety sensor is located in airbag ignition circuit. Safety sensor will operate airbag circuit at any deployment condition and release airbag circuit safely at normal driving condition. Safety sensor is a double contact electro-mechanical switch that will close detecting deceleration above certain criteria.
3. Back up power supply: SRSCM has separate back up power supply, that will supply deployment energy instantly in low voltage condition or upon power failure by front crash.
4. Self diagnosis: SRSCM will constantly monitor current SRS operation status and detect system failure while vehicle power supply is on, system failure may be checked with trouble codes using scan tool. (Hi-Scan)
5. Airbag warning lamp on: Upon detecting error, the module will transmit signal to SRSCM indicator lamp located at cluster. MIL lamp will indicate driver SRS error. Upon ignition key on, SRS lamp will turn on for about six seconds.
6. Trouble code registration: Upon error occurrence in system, SRSCM will store DTC corresponding to the error. DTC can be cleared only by Hi-Scan. However, if an internal fault code is logged or if a crash is recorded the fault clearing should not happen.
7. Self diagnostic connector: Data stored in SRSCM memory will be output to Hi-Scan or other external output devices through connector located below driver side crash pad.
8. Once airbag is deployed, SRSCM should not be used again but replaced.
9. SRSCM will determine whether passenger put on seat belt by the signal from built-in switch in seat belt buckle, and deploy front seat airbag at each set crash speed.
10. Side airbag deployment will be determined by SRSCM that will detect satellite sensor impact signal upon side crash, irrespective to seat belt condition.

SPECIAL SERVICE TOOLS

Tool(Number and Name)	Illustration	Use
Deployment tool 0957A-34100A		Airbag deployment tool
Deployment adapter 0957A-3F100		Use with deployment tool. (PAB, 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 (PAB, SAB)
Dummy adapter 0957A-1C000		Use with dummy (DAB, CAB, BPT)

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

WARNING LAMP ACTIVATION

WARNING LAMP BEHAVIOR AFTER IGNITION ON

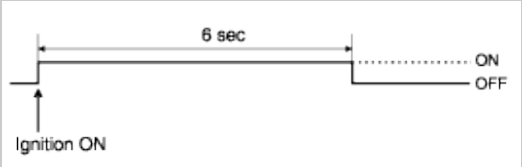
As soon as the operating voltage is applied to the SRSCM ignition input, the SRSCM activates the warning lamp for a bulb check.

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



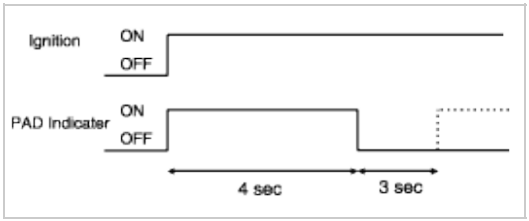
SRSCM INDEPENDENT WARNING LAMP ACTIVATION

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.



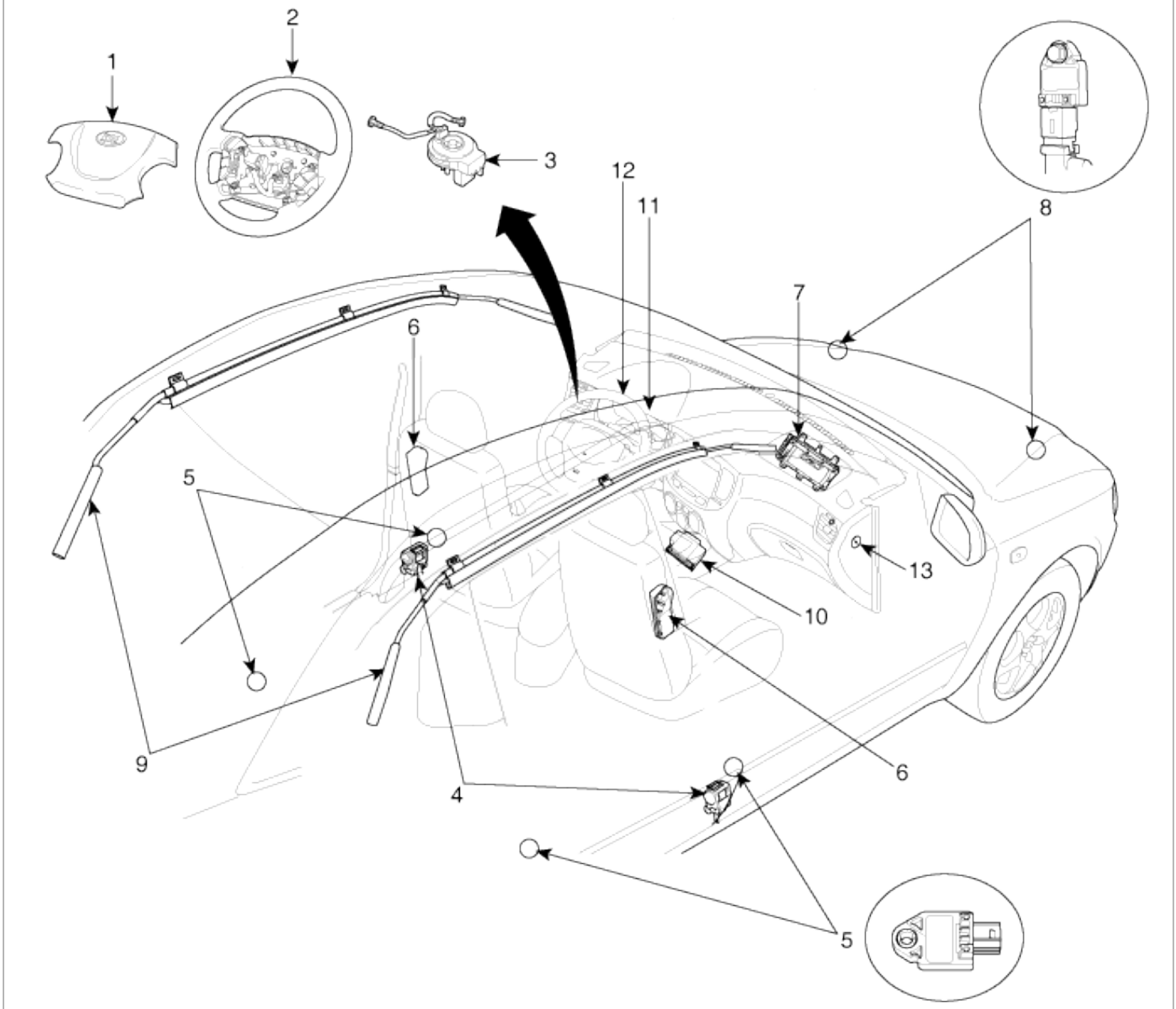
PASSENGER RESTRAINTS ACTIVATION WITH PAD SWITCH

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

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

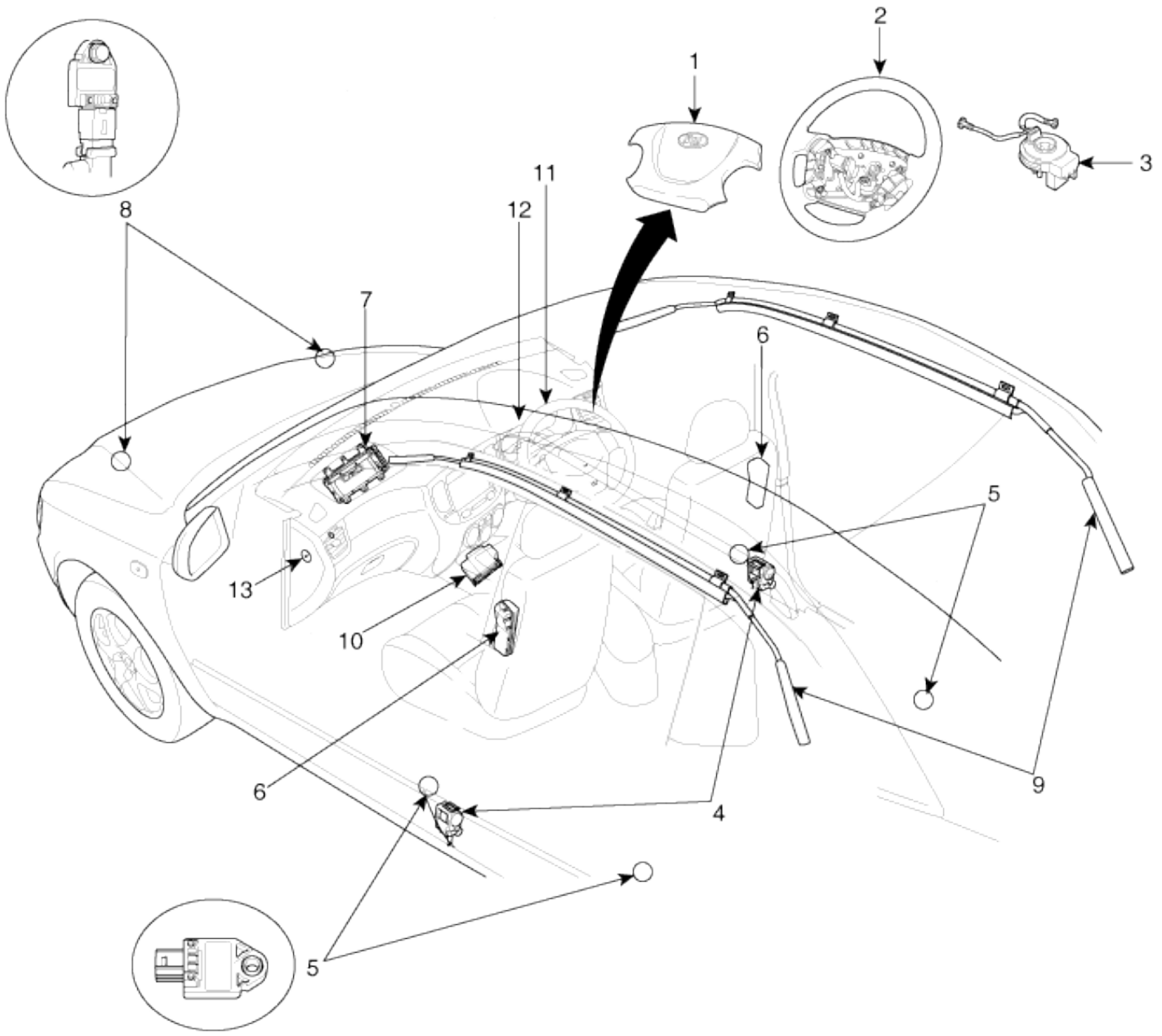
COMPONENTS

[LHD]



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

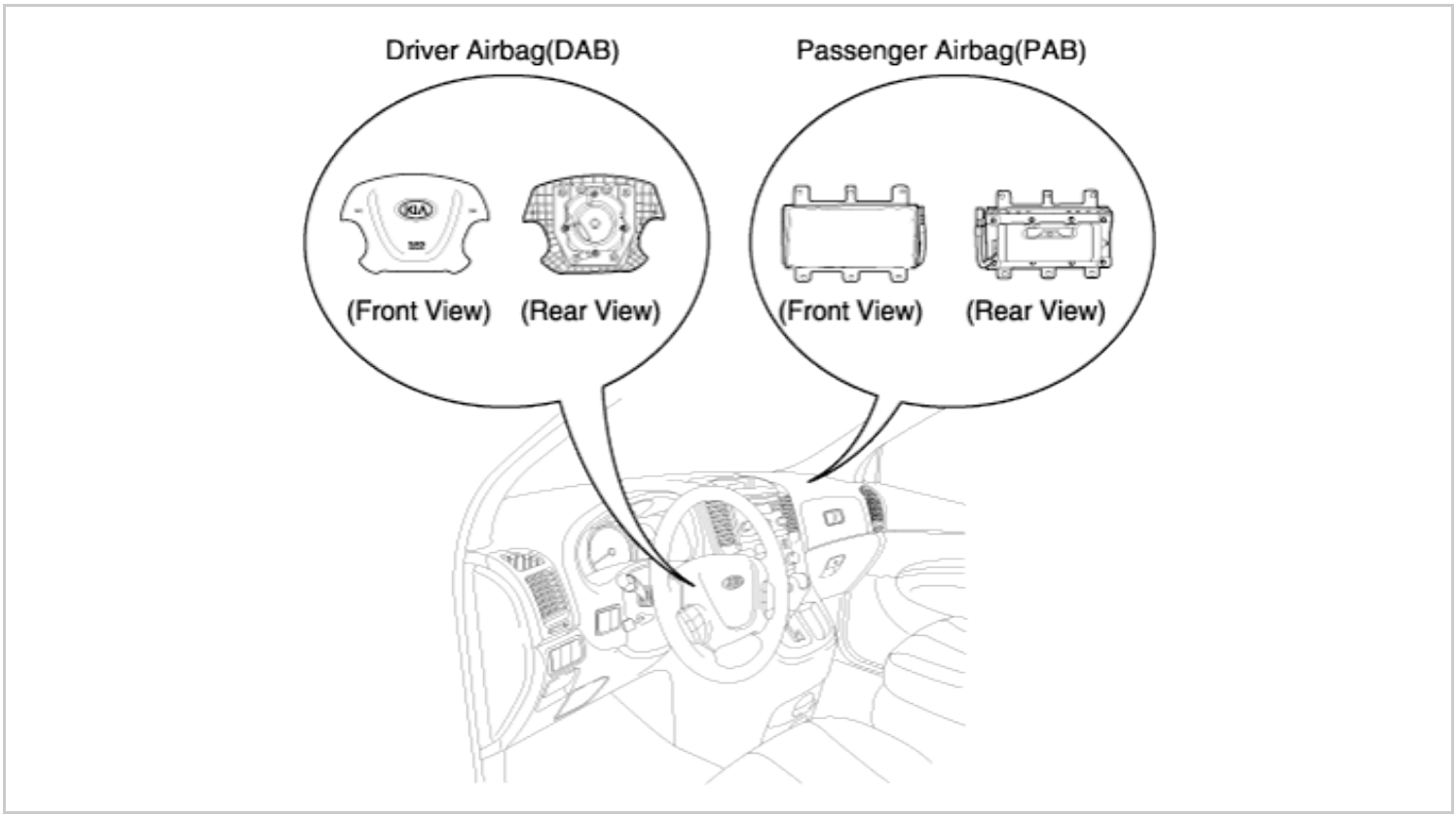
[RHD]



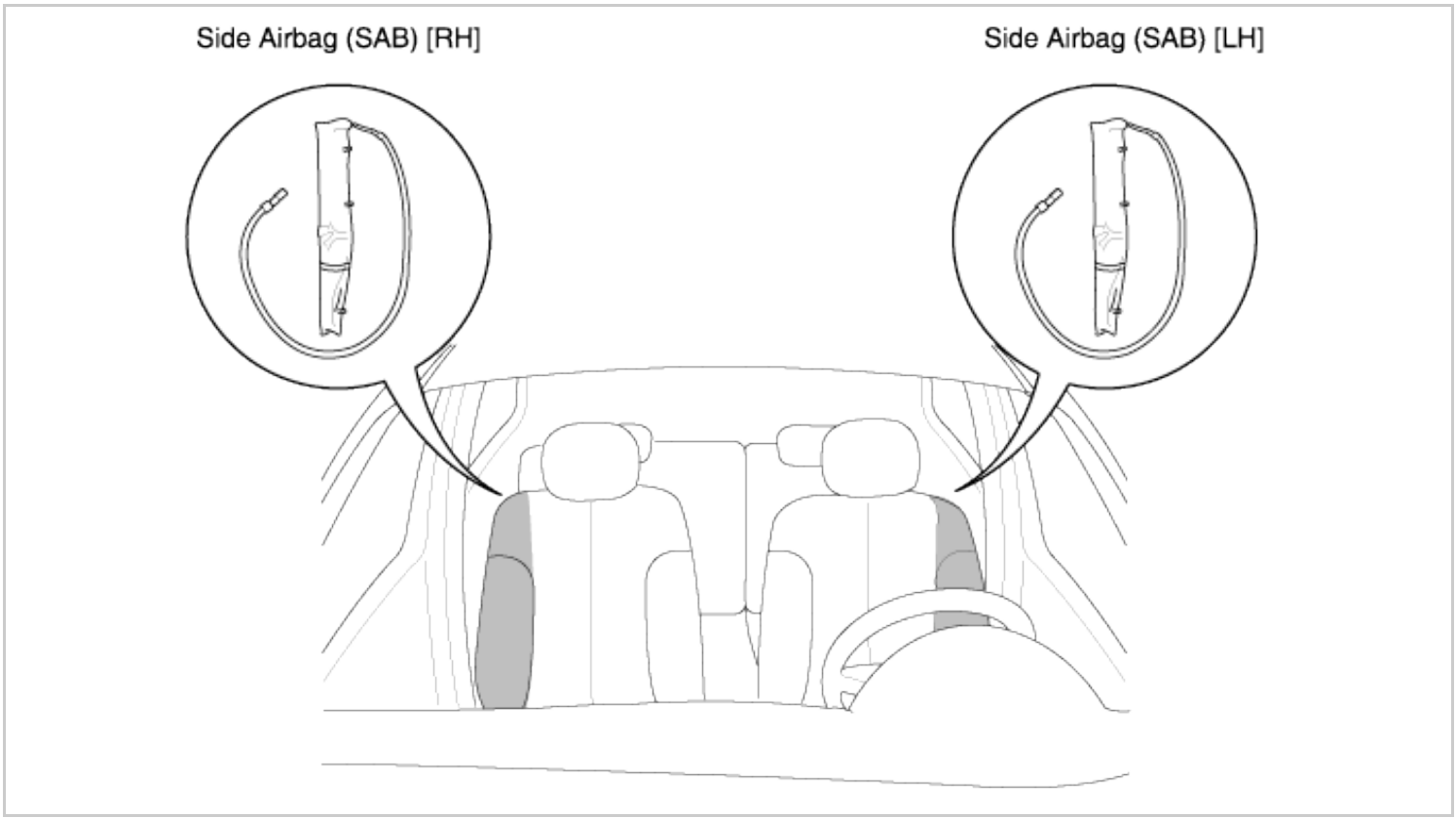
1. Driver Airbag (DAB)
2. Steering Wheel
3. Clock Spring
4. Seat Belt Pretensioner (BPT)
5. Side Impact Sensor (SIS)
6. Side Airbag (SAB)
7. Passenger Airbag (PAB)
8. Front Impact Sensor (FIS)
9. Curtain Airbag (CAB)
10. Supplemental Restraint System Control Module(SRSCM)
11. Airbag Warning Lamp
12.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

COMPONENTS LOCATION

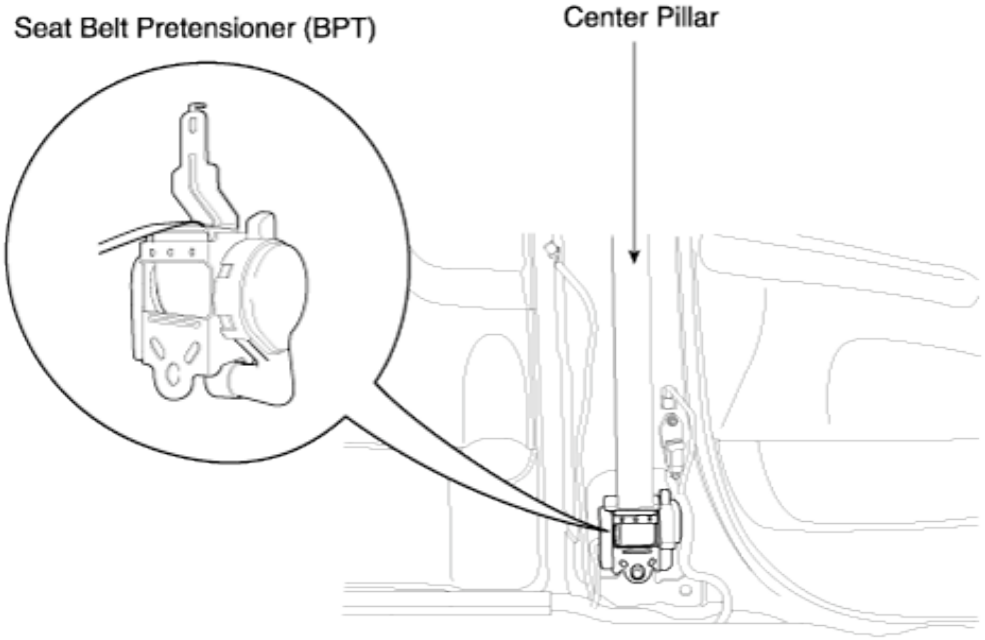
DRIVER AIRBAG (DAB) / PASSENGER AIRBAG (PAB)



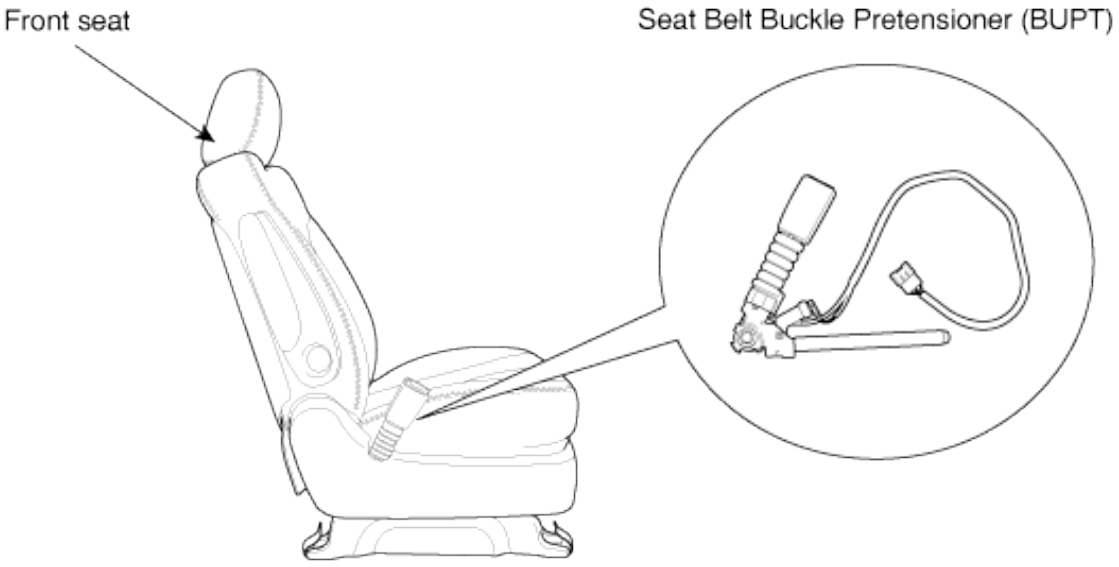
SIDE AIRBAG (SAB)



SEAT BELT PRETENSIONER (BPT)

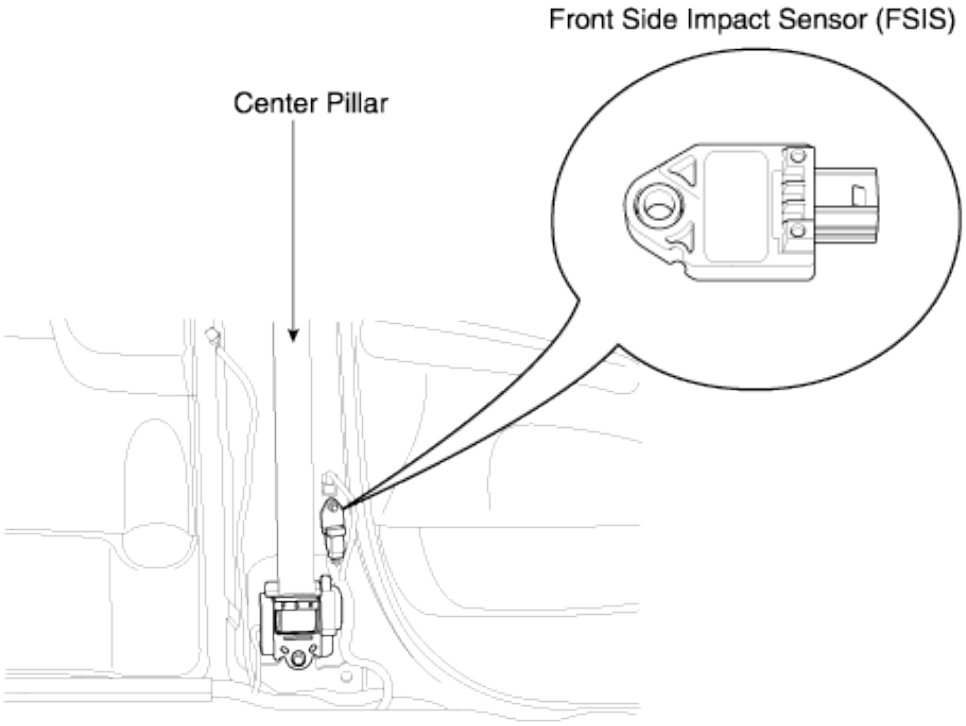


SEAT BELT BUCKLE PRETENSIONER (BUPT)

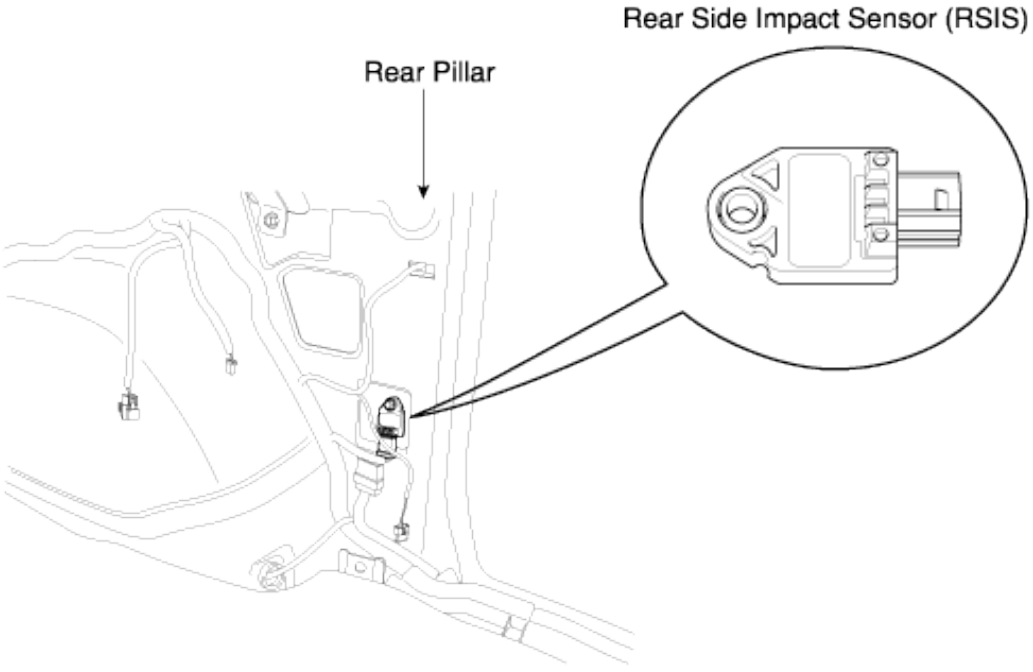


SIDE IMPACT SENSOR (SIS)

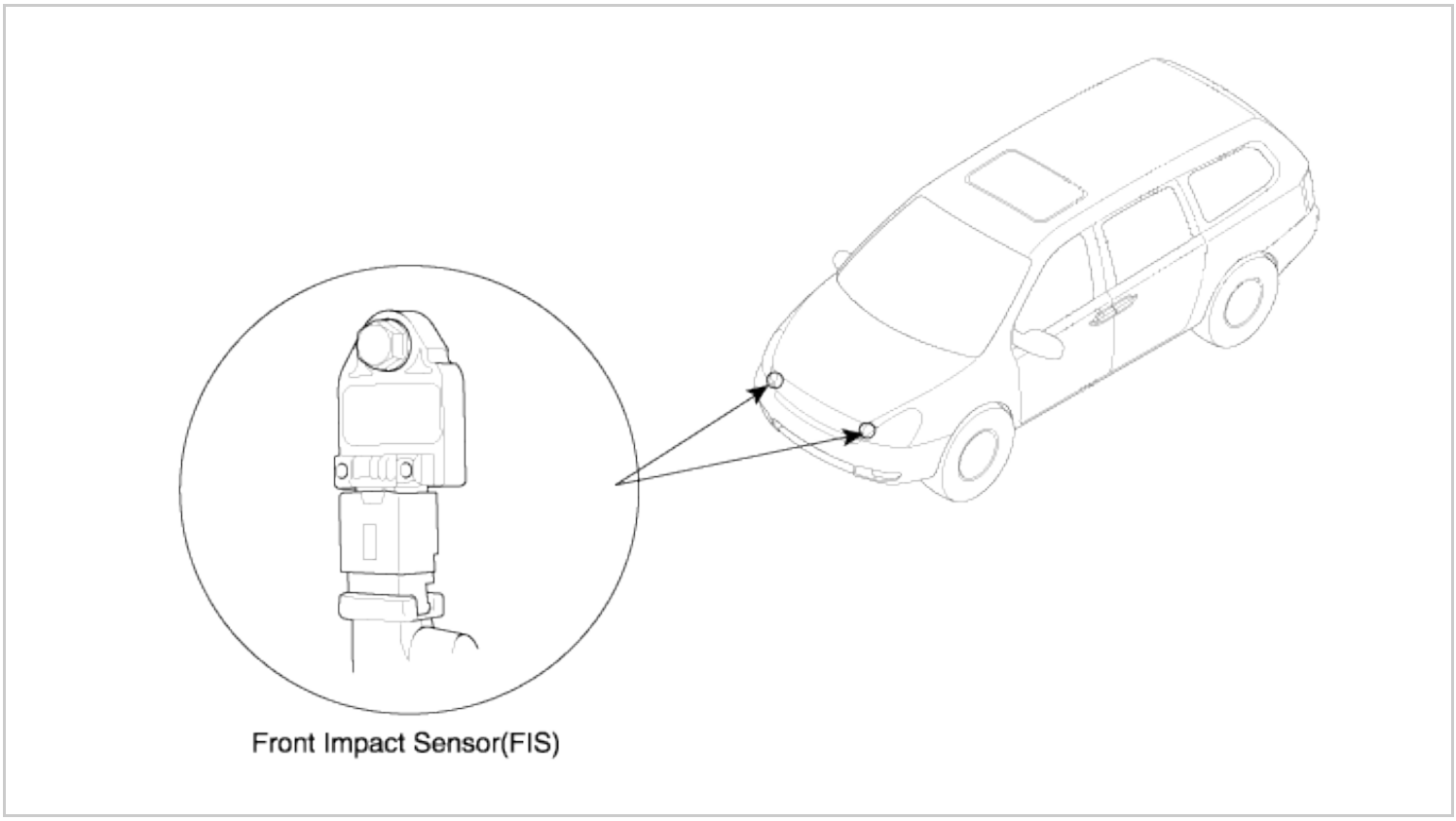
[Front]



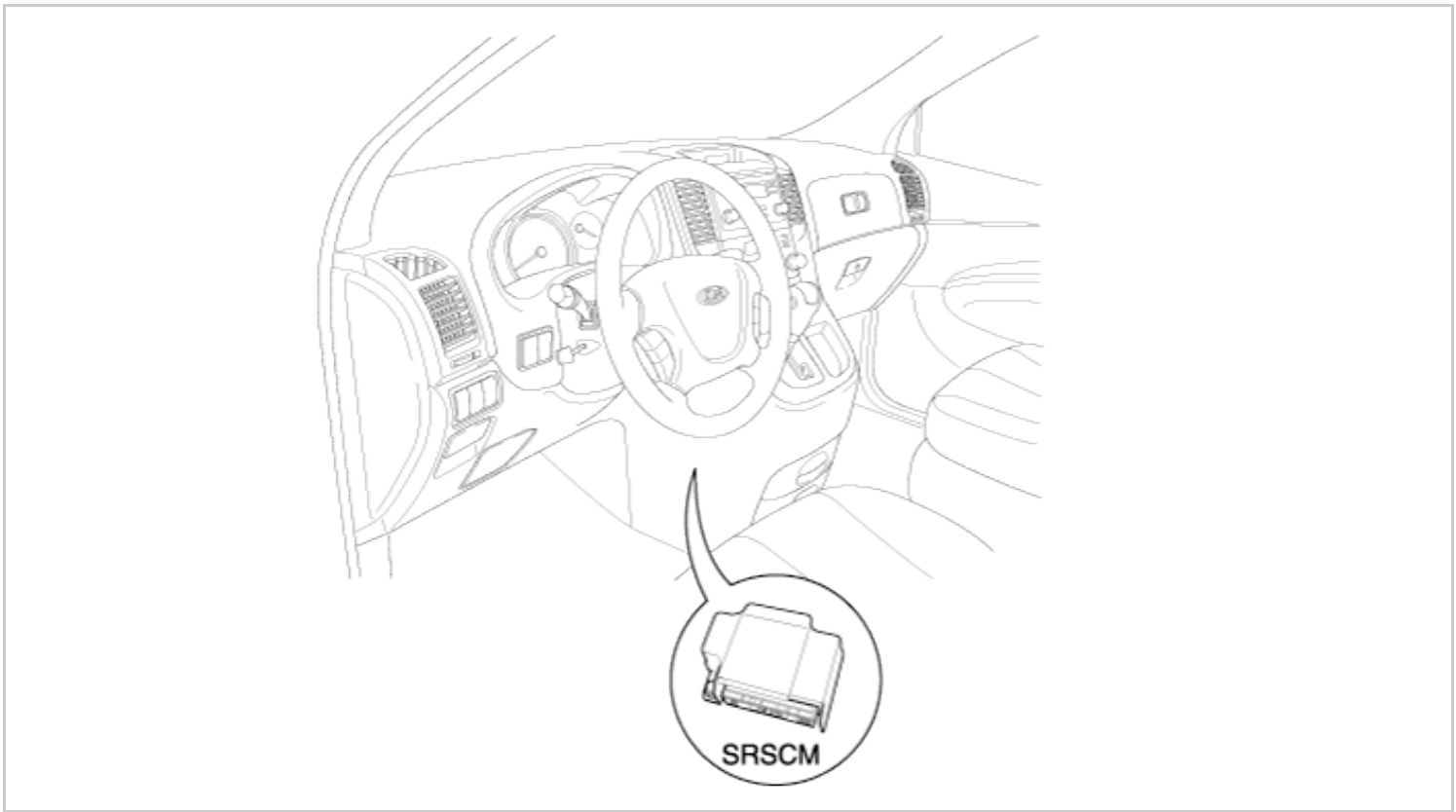
[Rear]



FRONT IMPACT SENSOR (FIS)



SUPPLEMENTAL RESTRAINT SYSTEM CONTROL MODULE (SRSCM)



COMPONENT REPLACEMENT AFTER DEPLOYMENT

NOTICE

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.

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

When the seat belt pretensioner(s) deployed after a collision, replace the following items.

a. Seat belt pretensioner(s)
b. SRSCM (if B1658 detected)
c. Front impact sensors
d. SRS wiring harnesses

When the side/curtain airbag(s) deployed after a collision, replace the following items.

a. SRSCM
b. Deployed airbag(s)
c. Side impact sensor(s) for the deployed side(s)
d. SRS wiring harnesses

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

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

SPECIFICATION

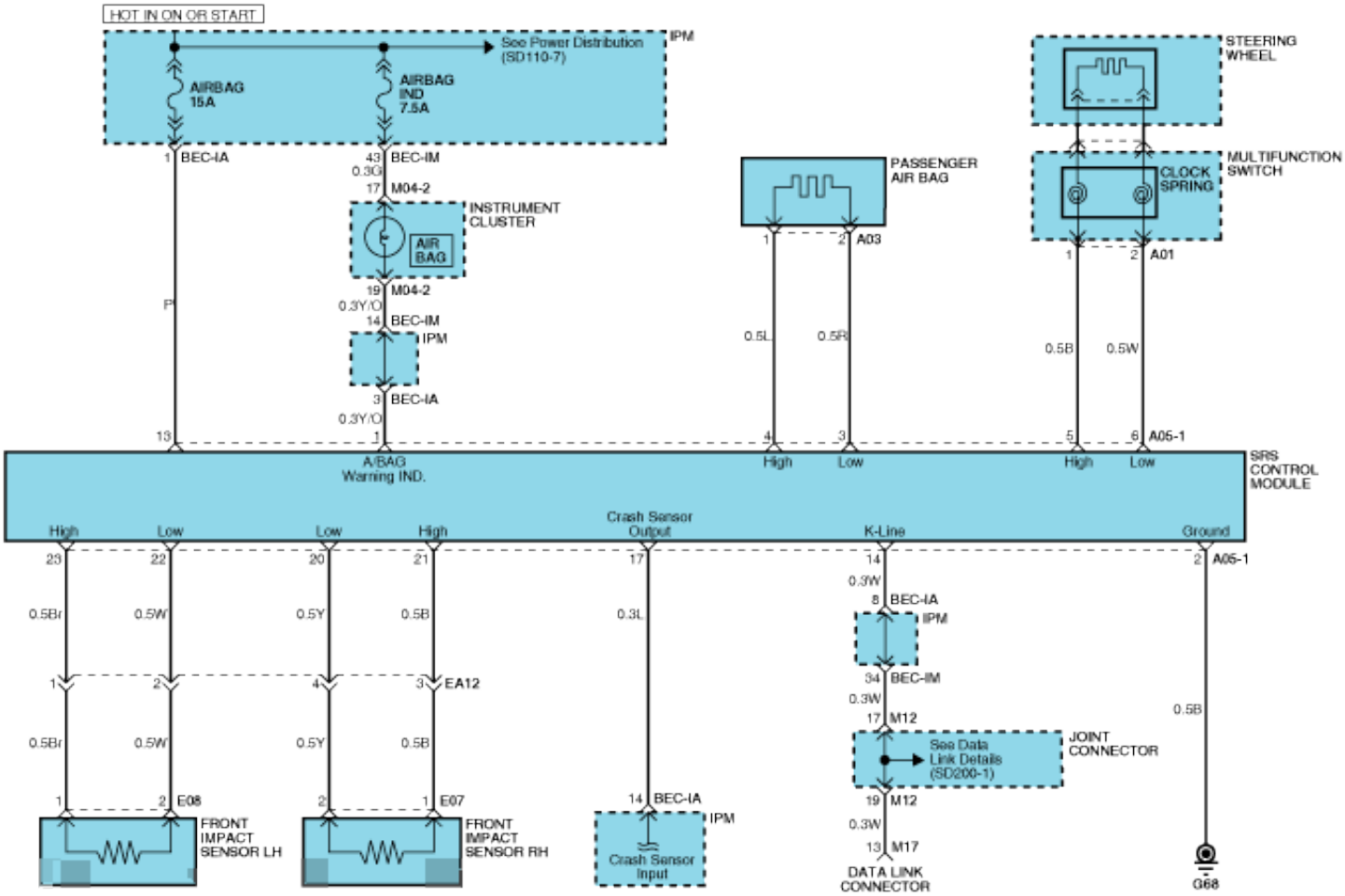
Item	Resistance (Ω)
Driver Airbag (DAB)	1.6 ~ 4.7
Passenger Airbag (PAB)	1.6 ~ 4.7
Side Airbag (SAB)	1.6 ~ 4.7
Curtain Airbag (CAB)	1.6 ~ 4.7
Seat Belt Pretensioner (BPT)	1.6 ~ 4.7
Seat Belt Buckle Pretensioner (BUPT)	1.6 ~ 4.7

TIGHTENING TORQUES

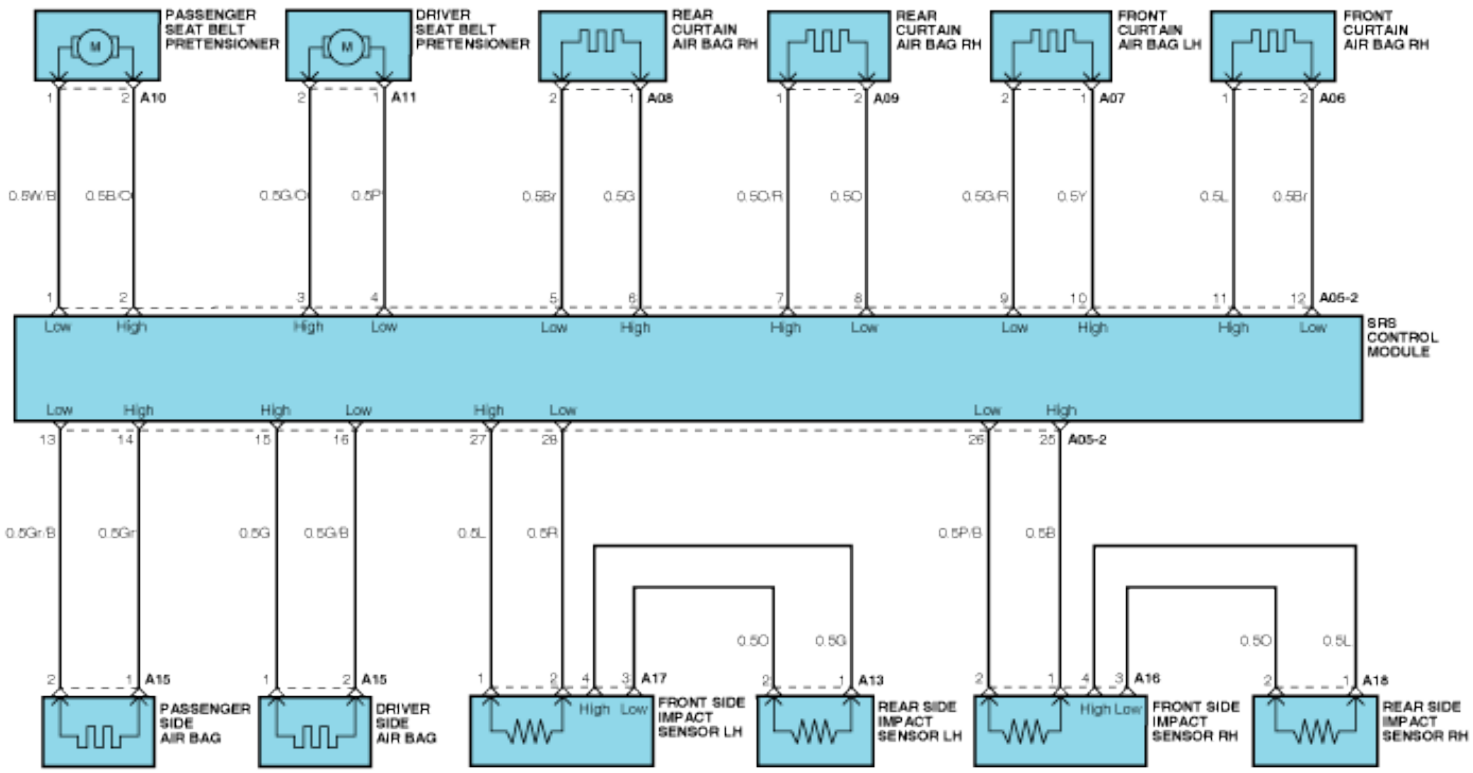
Item	kgf·m	Nm	lb-ft
Driver Airbag (DAB)	0.8 ~ 1.1	7.9 ~ 10.8	5.8 ~ 8.0
Passenger Airbag (PAB)	Bolt : 1.2 ~ 1.3 Nut : 0.7 ~ 0.8	12.0 ~ 13.0 7.0 ~ 8.0	8.9 ~ 9.6 5.2 ~ 5.9
Curtain Airbag (CAB)	1.9 ~ 2.7	18.6 ~ 26.5	13.7 ~ 19.5
Side Airbag (SAB)	1.9 ~ 2.7	18.6 ~ 26.5	13.7 ~ 19.5
Seat Belt Anchor Bolt (BPT)	4.0 ~ 5.5	39.2 ~ 53.9	28.9 ~ 39.8
Buckle Pretensioner (BUPT)	4.0 ~ 5.5	39.2 ~ 53.9	28.9 ~ 39.8
SRSCM Mounting Bolt	1.0 ~ 1.4	9.5 ~ 13.6	7.0 ~ 10.0
Front Impact Sensor (FIS) Mounting Bolt	1.0 ~ 1.4	9.5 ~ 13.6	7.0 ~ 10.0
Side Impact Sensor (SIS) Mounting Bolt	1.0 ~ 1.4	9.5 ~ 13.6	7.0 ~ 10.0

Supplemental Restraint System Control Module (SRSCM)

CIRCUIT DIAGRAM(1)

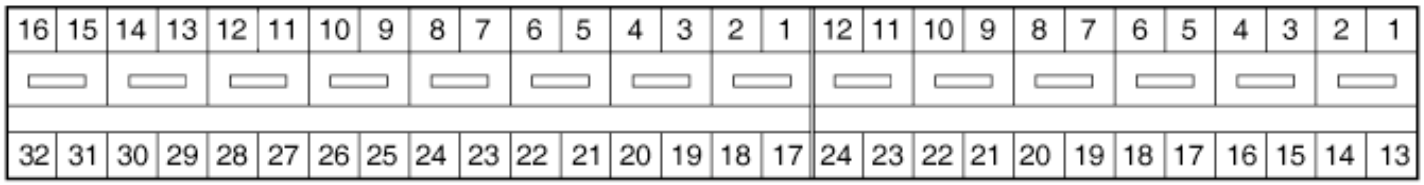


CIRCUIT DIAGRAM(2)



SRSCM CONNECTOR TERMINAL

SRSCM HARNESS CONNECTOR



CONNECTOR B (A05-2) CONNECTOR A (A05-1)

Shorting bar (▭) : located between the upper side and lower side pins of SRSCM connector.
Note : For short circuit check, shorting bar must be opened. Use a plastic clip as a shorting bar opener for disconnecting shorting bar.

Pin	Function (Connector A)	Pin	Function (Connector B)
1	Airbag Warning Lamp	1	Seat Belt Pretensioner [Front-Passenger] Low
2	Ground	2	Seat Belt Pretensioner [Front-Passenger] High
3	Passenger Airbag Low	3	Seat Belt Pretensioner [Front-Driver] High
4	Passenger Airbag High	4	Seat Belt Pretensioner [Front-Driver] Low
5	Driver Airbag High	5	Curtain Airbag [Rear-Passenger] Low
6	Driver Airbag Low	6	Curtain Airbag [Rear-Passenger] High
7	-	7	Curtain Airbag [Rear-Driver] High
8	-	8	Curtain Airbag [Rear-Driver] Low
9	-	9	Curtain Airbag [Front-Driver] Low
10	-	10	Curtain Airbag [Front-Driver] High
11	-	11	Curtain Airbag [Front-Passenger] High
12	-	12	Curtain Airbag [Front-Passenger] Low
13	Ignition	13	Side Airbag [Front-Passenger] Low
14	K-Line Diagnostic	14	Side Airbag [Front-Passenger] High
15	-	15	Side Airbag [Front-Driver] High
16	-	16	Side Airbag [Front-Driver] Low
17	Crash Output	17	Buckle Pretensioner [Passenger] Low
18	PAD Lamp	18	Buckle Pretensioner [Passenger] High
19	-	19	Buckle Pretensioner [Driver] High
20	Front Impact Sensor [Passenger] Low	20	Buckle Pretensioner [Driver] Low
21	Front Impact Sensor [Passenger] High	21	-
22	Front Impact Sensor [Driver] Low	22	-
23	Front Impact Sensor [Driver] High	23	-
24	PAD Switch	24	-
		25	Side Impact Sensor [Passenger] High
		26	Side Impact Sensor [Passenger] Low
		27	Side Impact Sensor [Driver] High
		28	Side Impact Sensor [Driver] Low
		29	-
		30	-
		31	-
		32	-

DIAGNOSTIC TROUBLE CODES (DTC)

DTC	FAULT DESCRIPTION	PAGE
B1101	Battery Voltage too High	
B1102	Battery Voltage too Low	
B1328	Front Impact Sensor [Driver] Defect	
B1329	Front Impact Sensor [Driver] Communication Error	
B1333	Front Impact Sensor [Passenger] Defect	
B1334	Front Impact Sensor [Passenger] Communication Error	
B1346	Driver Airbag Resistance too High	
B1347	Driver Airbag Resistance too Low	

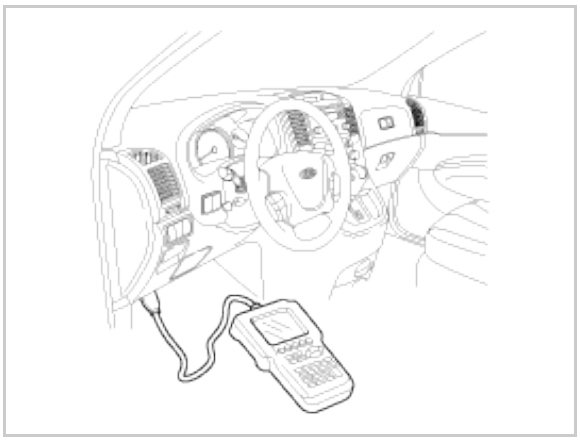
B1348	Driver Airbag Circuit Short to Ground	
B1349	Driver Airbag Circuit Short to Battery	
B1352	Passenger Airbag Resistance too High	
B1353	Passenger Airbag Resistance too Low	
B1354	Passenger Airbag Circuit Short to Ground	
B1355	Passenger Airbag Circuit Short to Battery	
B1361	Seat Belt Pretensioner [Front-Driver] Resistance too High	
B1362	Seat Belt Pretensioner [Front-Driver] Resistance too Low	
B1363	Seat Belt Pretensioner [Front-Driver] Circuit Short to Ground	
B1364	Seat Belt Pretensioner [Front-Driver] Circuit Short to Battery	
B1367	Seat Belt Pretensioner [Front-Passenger] Resistance too High	
B1368	Seat Belt Pretensioner [Front-Passenger] Resistance too Low	
B1369	Seat Belt Pretensioner [Front-Passenger] Circuit Short to Ground	
B1370	Seat Belt Pretensioner [Front-Passenger] Circuit Short to Battery	
B1378	Side Airbag [Front-Driver] Resistance too High	
B1379	Side Airbag [Front-Driver] Resistance too Low	
B1380	Side Airbag [Front-Driver] Circuit Short to Ground	
B1381	Side Airbag [Front-Driver] Circuit Short to Battery	
B1382	Side Airbag [Front-Passenger] Resistance too High	
B1383	Side Airbag [Front-Passenger] Resistance too Low	
B1384	Side Airbag [Front-Passenger] Circuit Short to Ground	
B1385	Side Airbag [Front-Passenger] Circuit Short to Battery	
B1395	Squib Interconnection Fault	
B1400	Side Impact Sensor [Front-Driver] Defect	
B1403	Side Impact Sensor [Front-Passenger] Defect	
B1409	Side Impact Sensor [Front-Driver] Communication Error	
B1410	Side Impact Sensor [Front-Passenger] Communication Error	
B1412	Side Impact Sensor [Rear-Driver] Communication Error	
B1413	Side Impact Sensor [Rear-Passenger] Communication Error	
B1418	Side Impact Sensor [Rear-Driver] Defect	
B1419	Side Impact Sensor [Rear-Passenger] Defect	
B1473	Curtain Airbag [Driver] Resistance too High	
B1474	Curtain Airbag [Driver] Resistance too Low	
B1475	Curtain Airbag [Driver] Circuit Short to Ground	
B1476	Curtain Airbag [Driver] Circuit Short to Battery	
B1477	Curtain Airbag [Passenger] Resistance too High	
B1478	Curtain Airbag [Passenger] Resistance too Low	
B1479	Curtain Airbag [Passenger] Circuit Short to Ground	
B1480	Curtain Airbag [Passenger] Circuit Short to Battery	
B1527	Passenger Airbag Deactivation Switch Open or Short to Battery	
B1528	Passenger Airbag Deactivation Switch Short or Short to Ground	

B1529	Passenger Airbag Deactivation Switch Defect	
B1530	Passenger Airbag Deactivation Switch Instability	
B1620	Supplemental Restraint System Control Module Internal Fault (Replace SRSCM)	
B1650	Crash Recorded - Frontal (Replace SRSCM)	
B1651	Crash Recorded - Driver Side (Replace SRSCM)	
B1652	Crash Recorded - Passenger Side (Replace SRSCM)	
B1655	Crash Recorded - Passenger Side with PAB inhibited (Replace SRSCM)	
B1657	Crash Recorded - Belt Pretensioner Only	
B1658	Belt Pretensioner 6 times Deployment (Replace SRSCM)	
B1701	Buckle Pretensioner [Front-Driver] Resistance Too High	
B1702	Buckle Pretensioner [Front-Driver] Resistance Too Low	
B1703	Buckle Pretensioner [Front-Driver] Resistance Circuit Short to Ground	
B1704	Buckle Pretensioner [Front-Driver] Resistance Circuit Short to Battery	
B1706	Buckle Pretensioner [Front-Passenger] Resistance Too High	
B1707	Buckle Pretensioner [Front-Passenger] Resistance Too Low	
B1708	Buckle Pretensioner [Front-Passenger] Resistance Circuit Short to Ground	
B1709	Buckle Pretensioner [Front-Passenger] Resistance Circuit Short to Battery	
B1722	Curtain Airbag [Rear-Driver] Resistance too High	
B1723	Curtain Airbag [Rear-Driver] Resistance too Low	
B1724	Curtain Airbag [Rear-Driver] Circuit short to Ground	
B1725	Curtain Airbag [Rear-Driver] Circuit short to Battery	
B1726	Curtain Airbag [Rear-Passenger] Resistance too High	
B1727	Curtain Airbag [Rear-Passenger] Resistance too Low	
B1728	Curtain Airbag [Rear-Passenger] Circuit short to Ground	
B1729	Curtain Airbag [Rear-Passenger] Circuit short to Battery	
B2500	SRS Warning Lamp Fault	
B2505	Passenger Airbag Deactivation Lamp Fault	

DESCRIPTION

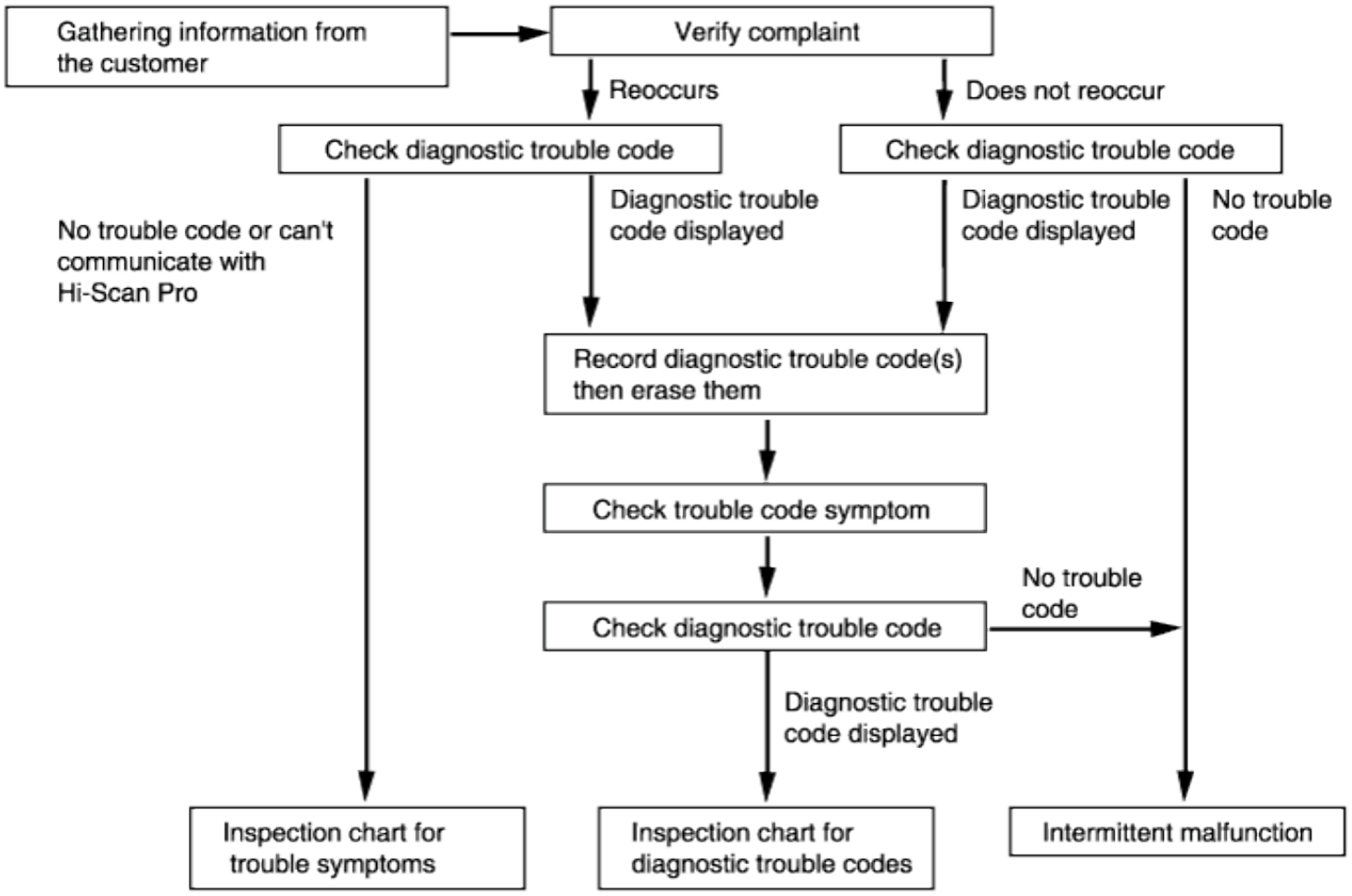
HI-SCAN CHECK

1. Turn the ignition switch off.
2. Connect the Hi-Scan Pro connector to the data link connector located under the crash pad.



3. Turn the ignition switch on and power on the Hi-Scan Pro.
4. Read DTCs.
5. Find and repair the trouble, and clear the DTCs using Hi-Scan Pro.
6. Disconnect the Hi-Scan Pro.

DIAGNOSTIC TROUBLESHOOTING FLOW



TERMINAL & CONNECTOR INSPECTION

Be sure to perform "TERMINAL & CONNECTOR INSPECTION" before doing "INSPECTION PROCEDURE" for troubleshooting of each DTC.

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

> **CAUTION**
>
> Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▶ Go to next step (INSPECTION PROCEDURE).

YES

▶ After repairing the trouble part, check whether DTC occurs or not.

PREPARATION OF INSPECTION

Refer to the following steps while doing "INSPECTION PROCEDURE" which is described in the DTC troubleshooting section

1. Turn the ignition switch to LOCK.
2. Disconnect the battery negative cable from the battery and wait for at least 3 minutes.
3. Remove the DAB module and disconnect the DAB connector.
4. Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

5. Disconnect the SRSCM connector.

CHECKING OF SHORT OR OPEN CIRCUIT

Refer to the following tips for checking of short or open circuit.

1. Shorting bar is located between the upper and lower side pins of SRSCM connector.
2. When checking the short circuit shorting bar must be opened. Use a plastic clip to put into as a shorting bar opener for disconnecting shorting bar.
3. Use SST Dummy adapter (0957A-1C000) to measure resistance or voltage for checking of short or open circuit. Plug it into DAB (CAB, BPT) connector to avoid enlarging or damaging the connector pins.

CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

1. Install the DAB module and connect the DAB connector.
2. Connect the connector of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
3. Connect the SRSCM connector.
4. Connect the battery negative cable to the battery.
5. Connect a Hi-Scan(Pro) to the data link connector.
6. Turn the ignition switch to ON.
7. Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro)
8. Turn the ignition switch to LOCK and wait for at least 30 seconds.
9. Turn the ignition switch to ON and wait for at least 30 seconds.
10. Check the vehicle again with the Hi-Scan(Pro).
    Does the above DTC(s) go off?

YES

▶ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

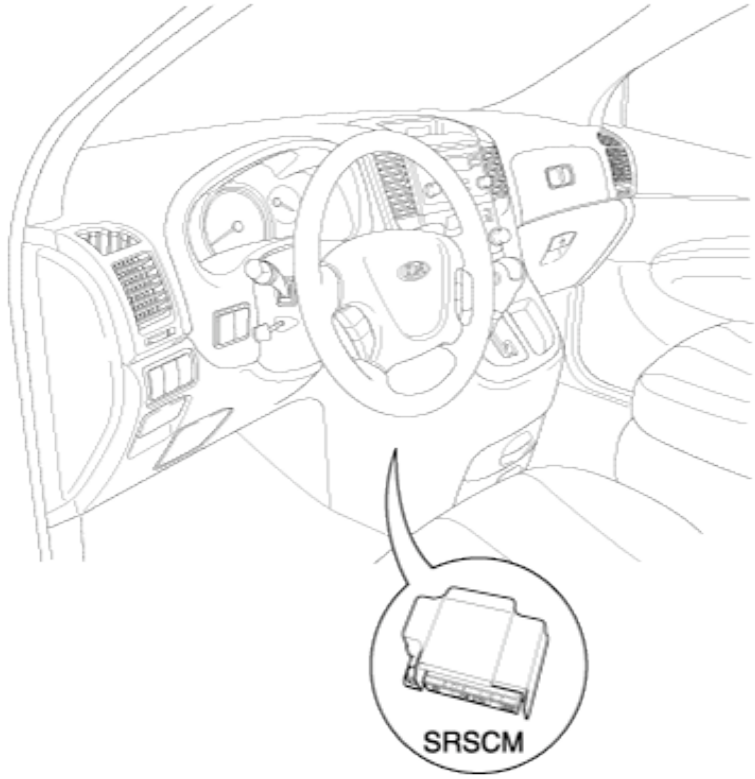
▶ Replace the SRSCM with a new one and then check the vehicle again. At this time, if the vehicle normally operates with a new one, the fault may be the SRSCM. Replace the SRSCM.

SRS Control Module (SRSCM)

DESCRIPTION

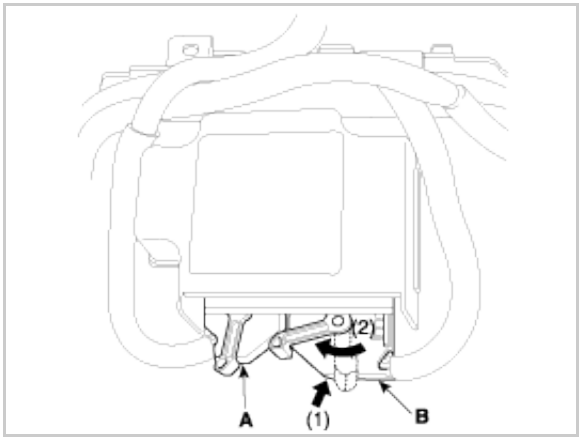
The primary purpose of the SRSCM (Supplemental Restraints System Control Module) is to discriminate between an event that warrants restraint system deployment and an event that does not. The SRSCM must decide whether to deploy the restraint system or not. After determining that pretensioners and/or airbag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

COMPONENTS

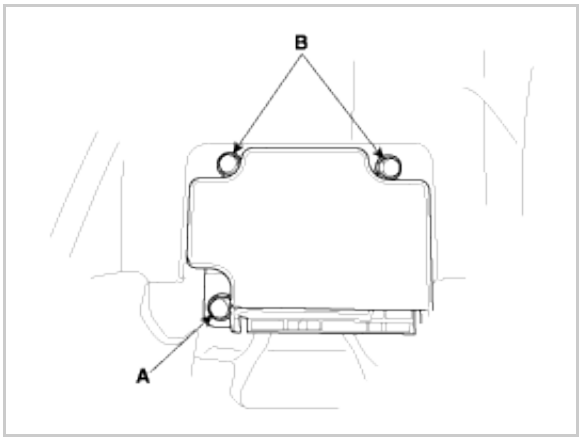


REMOVAL

1. Disconnect the negative (-) cable from battery and wait for at least three minutes.
2. Remove ignition key from the vehicle.
3. Disconnect the DAB, PAB, SAB, CAB and BPT connectors.
4. Remove the floor console and heater ducts. (Refer to BD group)
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 bolt (A) and nuts (B) from the SRSCM, then remove the SRSCM.



INSTALLATION

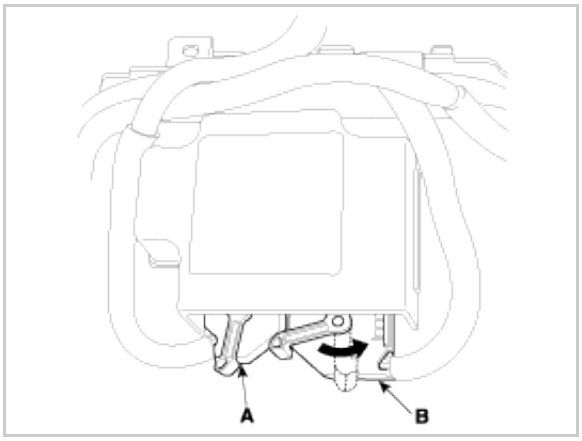
1. Disconnect the negative (-) cable from battery and wait for at least three minutes.
2. Remove ignition key from the vehicle.
3. Install the SRSCM with the SRSCM mounting bolt and nuts.

Tightening Torque
: 1.0 ~ 1.4 kgf.m (9.5 ~ 13.6 Nm, 7.0 ~ 10.0 lb.ft)

NOTICE

Use new mounting bolts when replacing the SRSCM after a collision.

4. Connect the SRSCM harness connector.



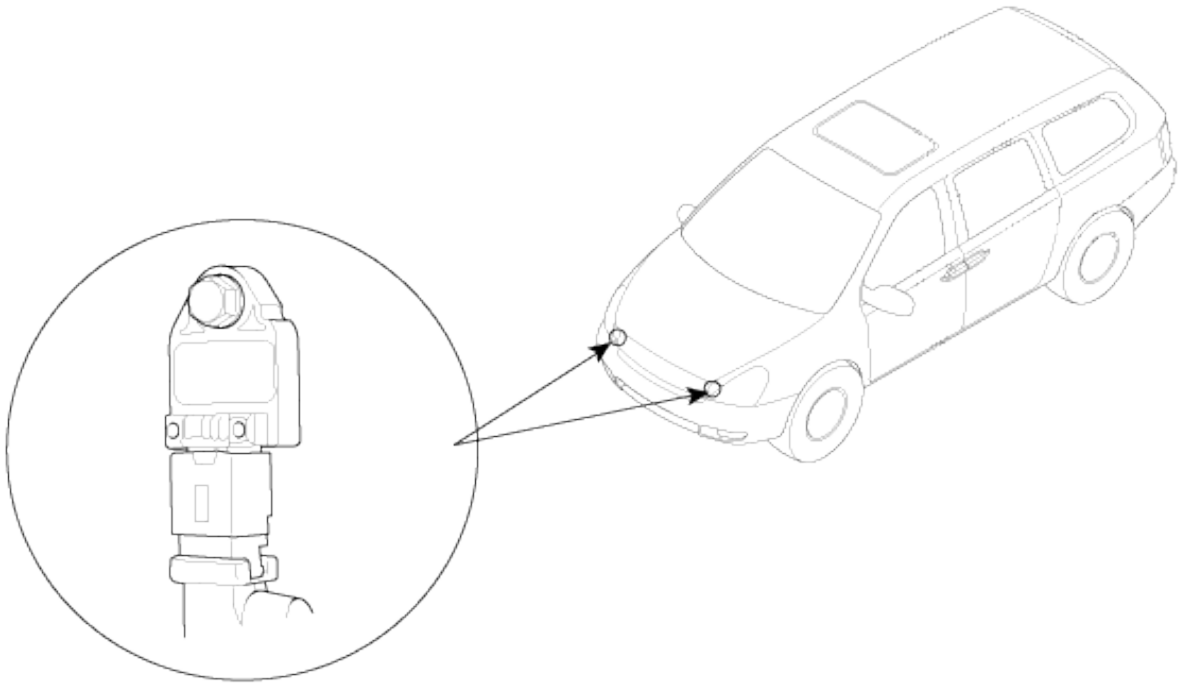
5. Install the heater ducts and floor console. (Refer to BD group)
6. Connect the DAB, PAB, SAB, CAB and BPT connectors.
7. Reconnect the battery negative cable.
8. After installing the SRSCM, confirm proper system operation:
   a. Turn the ignition switch ON; the SRS indicator light should be turned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

Front Impact Sensor (FIS)

DESCRIPTION

The front impact sensors (FIS) are installed in the side member. 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.

COMPONENTS



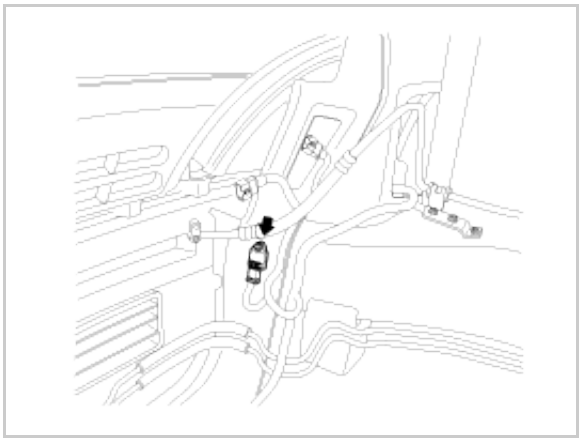
Front Impact Sensor(FIS)

removal

CAUTION

a. Removal of the airbag must be performed according to the precautions/ procedures described previously.
b. Before disconnecting the front impact sensor connector, disconnect the front airbag connector(s).
c. Do not turn the ignition switch ON and do not connect the battery cable while replacing the front impact sensor.

1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
2. Disconnect Front Impact Sensor conncetor.
3. Remove the FIS mounting bolt then remove the Front Impact Sensor.



INSTALLATION

CAUTION

a. Ensure that the harness is installed and routed properly to prevent damage to the wiring.
b. Do not turn the ignition switch ON and do not connect 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
: 1.0 ~ 1.4 kgf.m (9.5 ~ 13.6 Nm, 7.0 ~ 10.0 lb.ft)

2. Reconnect the negative battery cable.
3. 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.

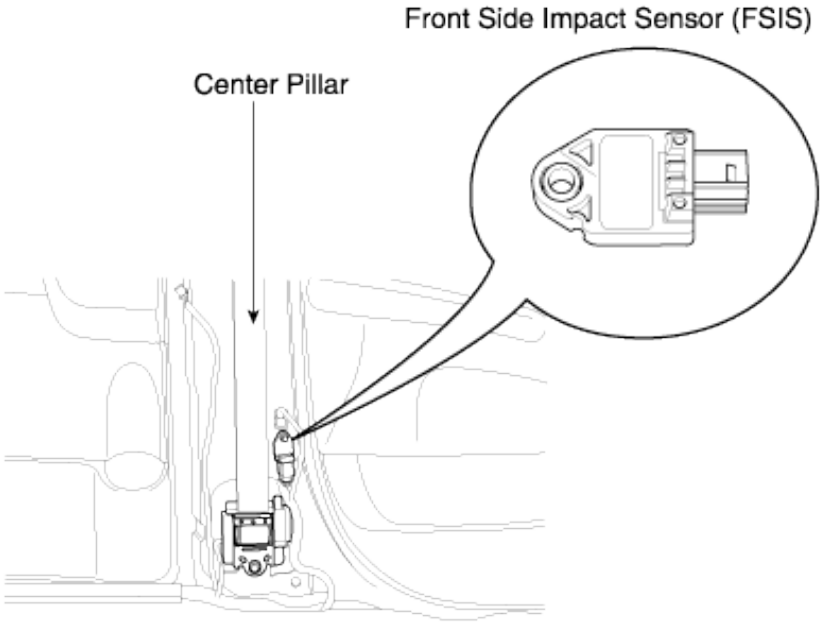
Side Impact Sensor (SIS)

DESCRIPTION

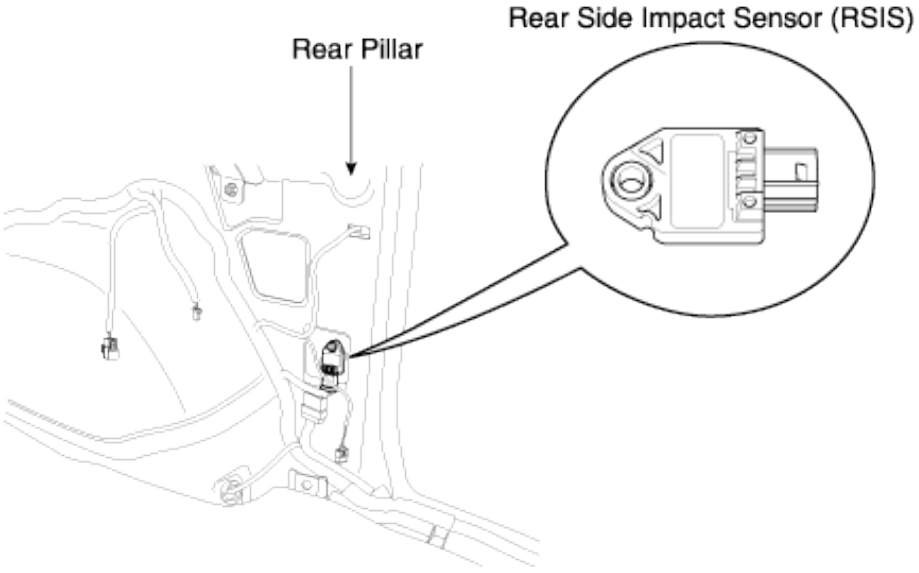
The Side Impact Sensor (SIS) system consists of two front SIS which are installed inside the Center Pillar (LH and RH) and two rear SIS which are installed in the rear pillar (LH and RH). They are remote sensors that detect acceleration due to collision at their mounting locations. The primary purpose 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.

COMPONENTS

[Front]



[Rear]



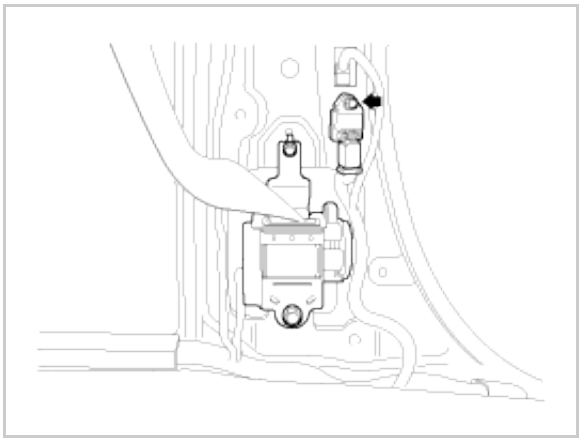
REMOVAL

FRONT SIDE IMPACT SENSOR

CAUTION

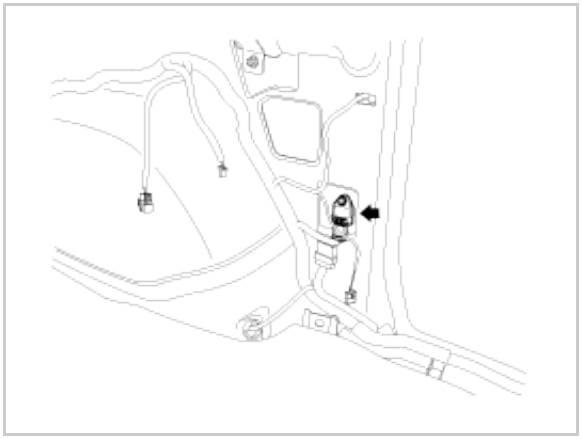
a. Removal of the airbag must be performed according to the precautions/procedures described previously.
b. Before disconnecting the side impact sensor connector(s), disconnect the side airbag connector(s).
c. Do not turn the ignition switch ON and do not connect the battery cable while replacing the side impact sensor.

1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
2. Remove the door scuff trim. (Refer to BD group)
3. Remove the center pillar trim. (Refer to BD group)
4. Disconnect the Side Impact Sensor connector.
5. Remove the SIS mounting bolt then remove the Side Impact Sensor.



REAR SIDE IMPACT SENSOR

1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
2. Remove the rear pillar trim. (Refer to BD group)
3. Disconnect the Side Impact Sensor connector.
4. Remove the SIS mounting bolt then remove the Side Impact Sensor.



INSTALLATION

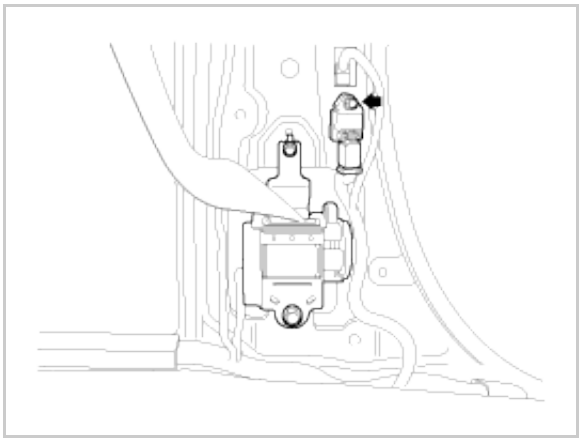
FRONT SIDE IMPACT SENSOR

CAUTION

a. Ensure that the harness is installed and routed properly to prevent damage to the wiring.
b. 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
: 1.0 ~ 1.4 kgf.m (9.5 ~ 13.6 Nm, 7.0 ~ 10.0 lb.ft)

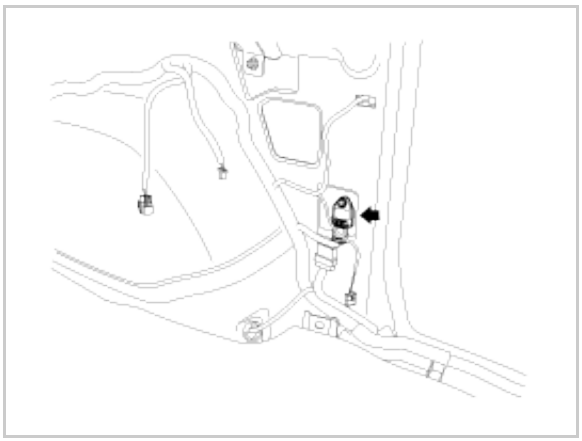


2. Install the center pillar trim. (Refer to BD group)
3. Install the door scuff trim. (Refer to BD group)
4. Reconnect the battery negative cable.
5. After installing the Side Impact Sensor, confirm proper system operation: Turn the ignition switch ON, the SRS indicator light should be turned on for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

REAR SIDE IMPACT SENSOR

1. Be sure that the battery negative cable is disconnected.
2. Install the new Side Impact Sensor with the bolt then connect the SRS harness connector to the Side Impact Sensor.

Tightening torque
: 1.0 ~ 1.4 kgf.m (9.5 ~ 13.6 Nm, 7.0 ~ 10.0 lb.ft)



3. Install the rear pillar trim. (Refer to BD group)
4. Reconnect the battery negative cable.
5. 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.

Airbag Module

AIRBAG DISPOSAL

SPECIAL TOOL REQUIRED

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.

DRIVER'S AIRBAG :

1. Remove the driver's airbag and install the SST(0957A-38500).
2. Install the driver's airbag on the steering wheel.

FRONT PASSENGER'S AIRBAG :

1. Remove the glove box, then disconnect the 2P connector between the front passenger's airbag and SRS main harness.
2. Install the SST(0957A-3F100).

SIDE AIRBAG :

1. Disconnect the 2P connector between the side airbag and side wire harness.
2. Install the SST (0957A-3F100).

CURTAIN AIRBAG :

1. Disconnect the 2P connector between the curtain airbag and wire harness.
2. Install the SST(0957A-38500).

SEAT BELT PRETENSIONER :

1. Disconnect the 2P connector from the seat belt pretensioner.
2. Install the SST(0957A-38500).
3. Place the deployment tool at least thirty feet (10 meters) away from the airbag.
4. Connect a 12 volt battery to the tool.
5. 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)
6. 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. 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.

Drive Airbag (DAB) Module
and
Clock Spring

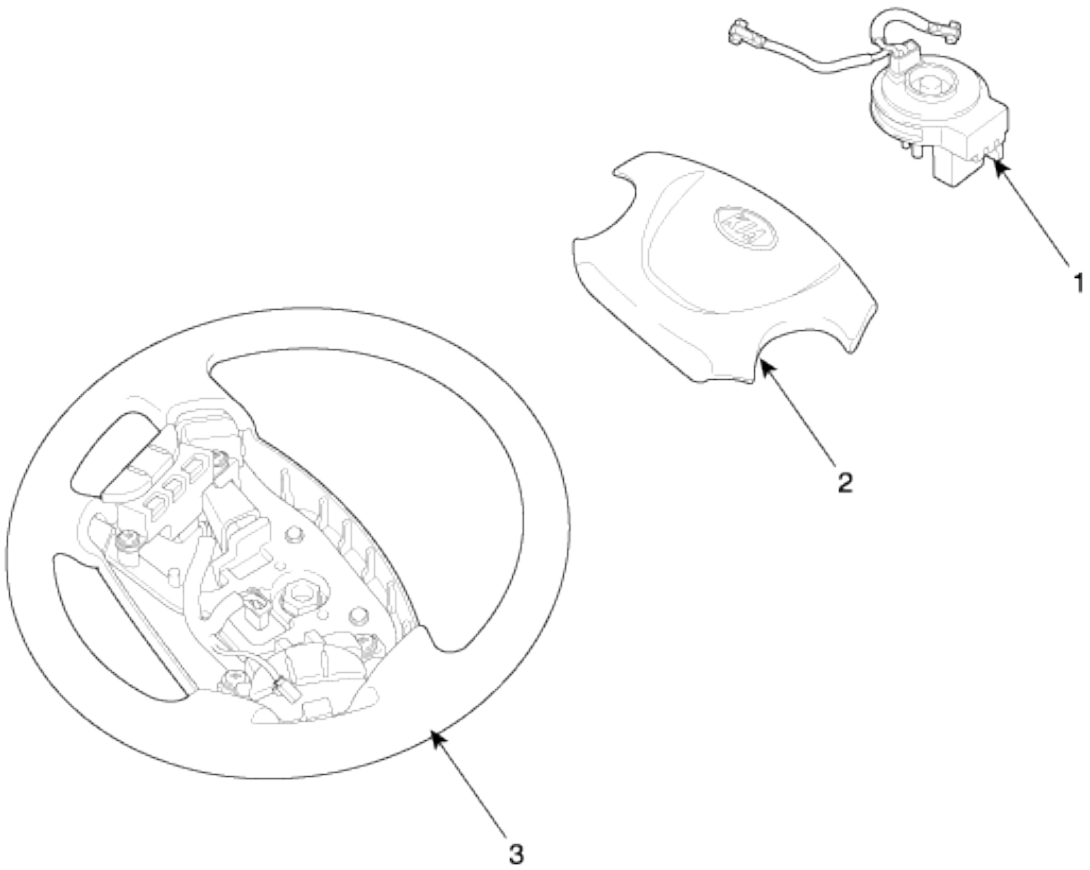
DESCRIPTION

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.

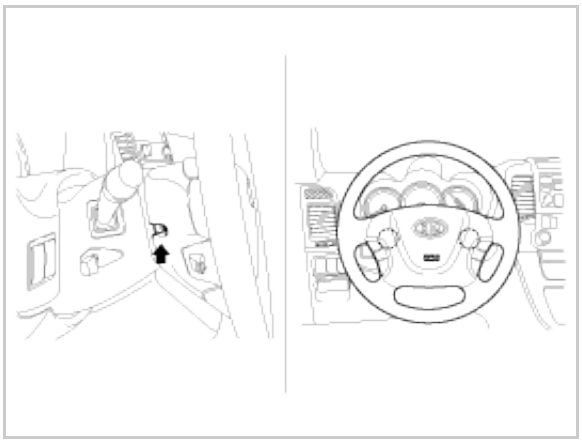
COMPONENTS



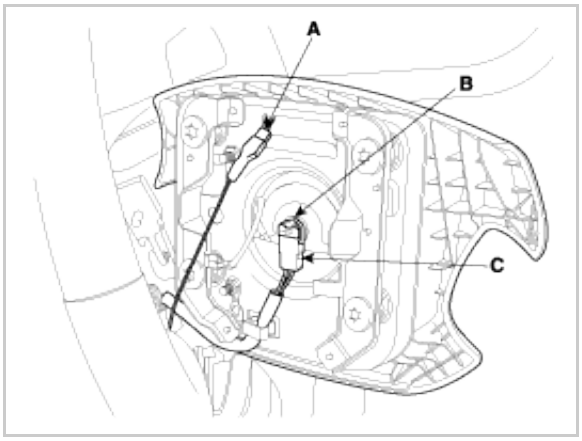
1. Clock Spring
2. Driver Airbag (DAB)
3. Steering Wheel

REMOVAL

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



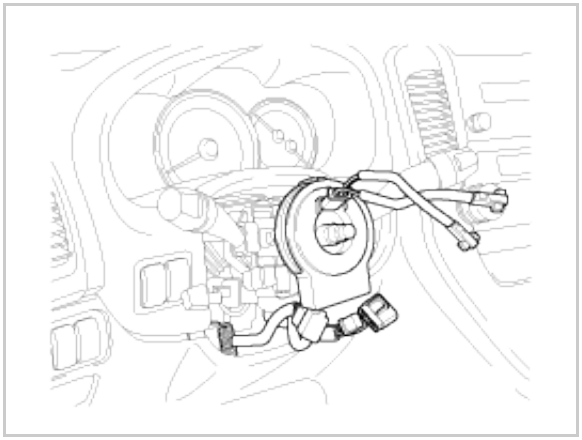
3. Disconnect the horn connector(A).



4. Release the connector locking pin(B), then disconnect the driver airbag module connector(C).

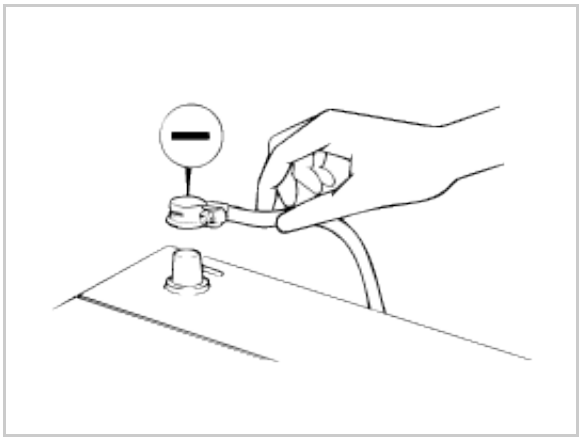
> CAUTION
>
> The removed airbag module should be stored in a clean, dry place with the pad cover face up.

5. Remove the steering wheel and steering wheel column cover(Refer to ST group in the Workshop Manual).
6. Disconnect the clock spring and horn connector, then remove the clock spring.



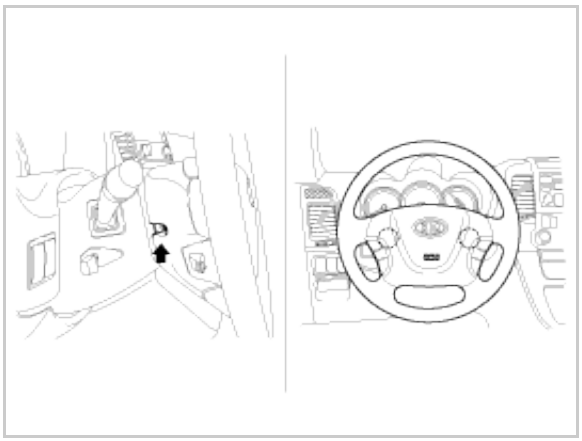
INSTALLATION

1. Disconnect the negative (-) cable from battery and wait for at least three minutes.



2. Remove ignition key from the vehicle.
3. Connect the clock spring harness connetor and horn harness connector to the clock spring.
4. Set the clock spring on neutral position and after turning the front wheels to the straight-ahead position, install the clock spring.
5. Install the steering wheel column cover and the steering wheel. (Refer to ST group)
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 (DAB Mounting Bolt)
: 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.

INSPECTION

Driver Airbag (DAB)

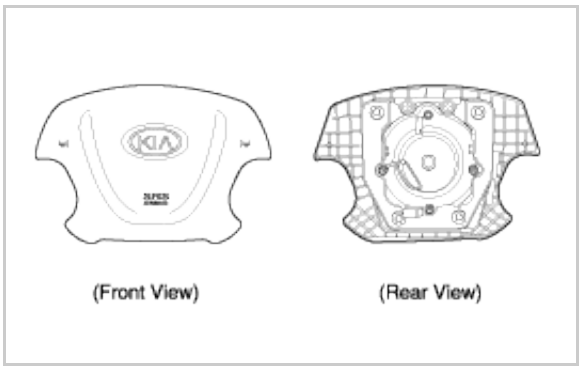
If any improper parts are found during the following inspection, replace the airbag module with a new one.

CAUTION

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

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

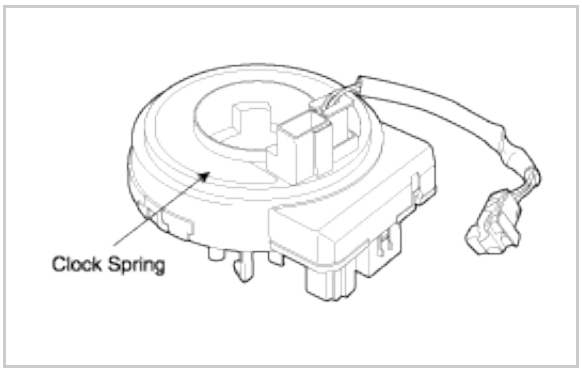
4. Check airbag inflator case for dents, cracks or deformities.



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

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.



Passenger Airbag (PAB) Module

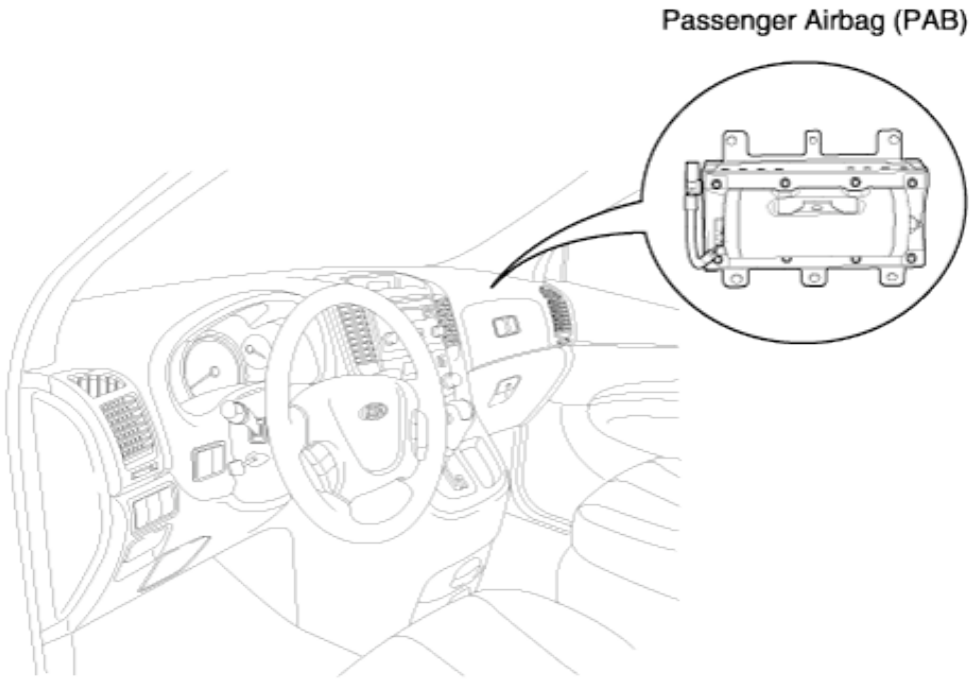
DESCRIPTION

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

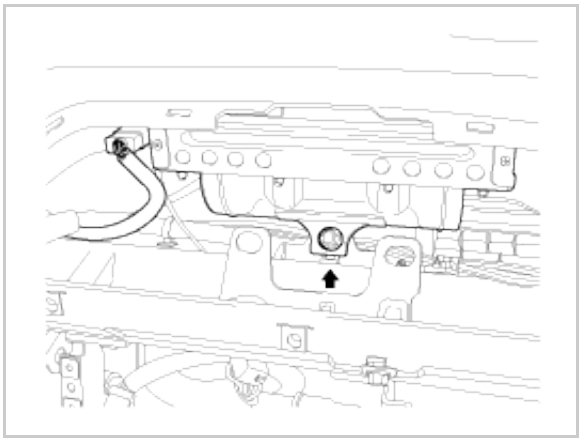
Never attempt to measure the circuit resistance of the airbag module (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment will result in serious personal injury.

components



REMOVAL

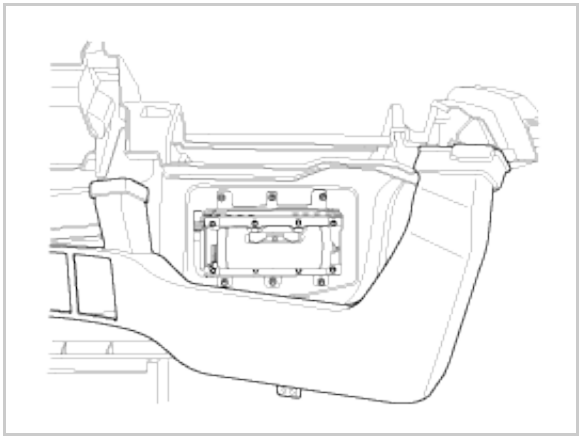
1. Disconnect the battery negative cable and wait for at least three minutes before beginning work.
2. Remove the glove box. (Refer to BD group)
3. Disconnect the PAB connector and remove the PAB mounting bolts. (Refer to BD group)



4. Remove the crash pad. (Refer to BD group)

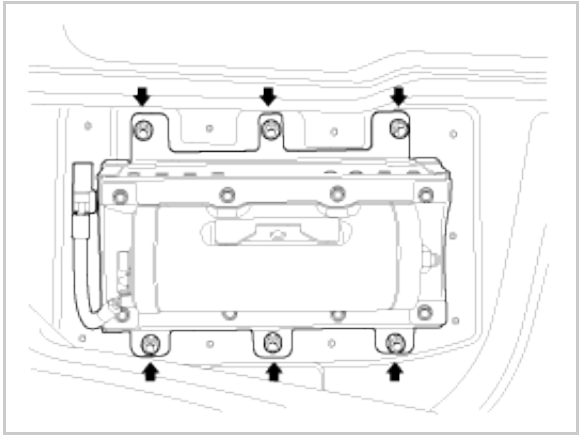
> **NOTICE**
>
> Replace the crash pad which is damaged while PAB is deployed.

5. Remove the heater duct from the crash pad.



6. Remove the mounting nuts from the crash pad. Then remove the passenger airbag.

> **CAUTION**
>
> The removed airbag module should be stored in a clean, dry place with the airbag coushion up.



INSTALLATION

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

   Tightening Torque
   : 0.7 ~ 0.8 kgf.m (7.0 ~ 8.0 N.m, 5.2 ~ 5.9 lb.ft)

4. Install the heater duct to the crash pad.
5. Install the crash pad. (Refer to BD group)
6. Tighten the PAB mounting bolts.

   Tightening Torque
   : 1.2 ~ 1.3 kgf.m (12.0 ~ 13.0 N.m, 8.9 ~ 9.6 lb.ft)

7. Connect the Passenger Airbag (PAB) harness connector to the SRS main harness connector.
8. Reinstall the bolve box. (Refer to BD group)
9. Reconnect the battery negative cable.
10. After installing the Passenger Airbag (PAB), confirm proper system operation:
    a. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

Curtain Airbag (CAB) Module

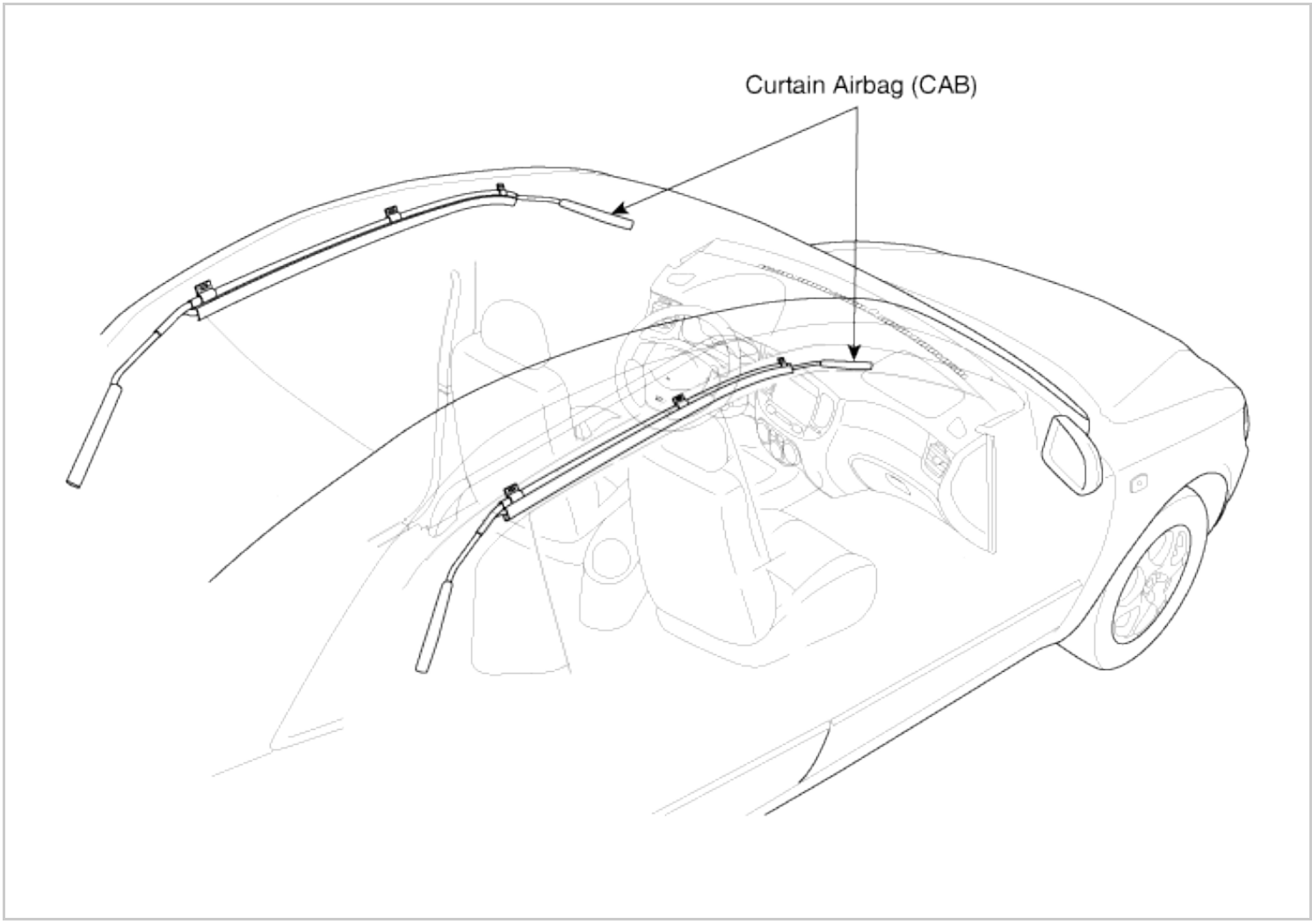
DESCRIPTION

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

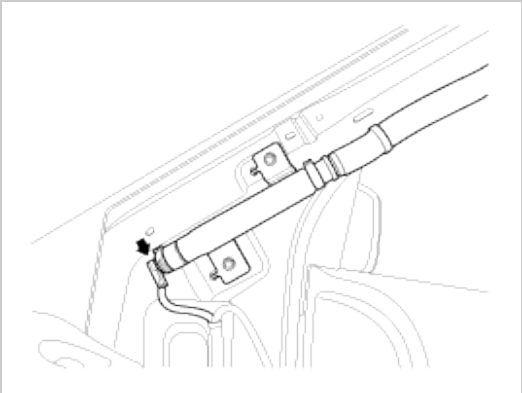
Never attempt to measure the circuit resistance of the airbag module even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment will result in serious personal injury.

components

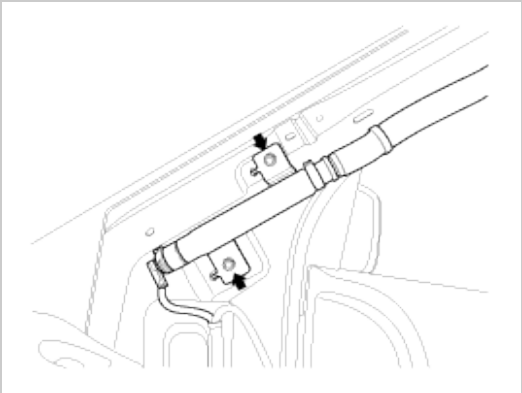


removal

1. Disconnect the battery negative cable and wait for at least 3 minutes before beginning work.
2. Remove the following parts. (Refer to BD group)
   a. Interior trim
   b. Headlining
3. Disconnect the Curtain Airbag harness connector (front & rear).



4. After loosening the mounting bolts (13EA), remove the curtain airbag.



INSTALLATION

CAUTION

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

1. Disconnect the negative (-) cable from battery and wait for at least three minutes.
2. Remove ignition key from the vehicle.
3. Install a Curtain Airbag (CAB) on the mounting bracket.
4. Tighten the CAB mounting bolts (13EA).

Tightening Torque (CAB Mounting Bolt)
: 1.9 ~ 2.7 kgf.m(18.6 ~ 26.5 Nm, 13.7 ~ 19.5 lb.ft)

CAUTION

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

5. Connect the CAB connector (front & rear).
6. Reconnect the battery negative cable.
7. After installing the Curtain Airbag (CAB), confirm proper system operation:
   a. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

Side Airbag (SAB) Module

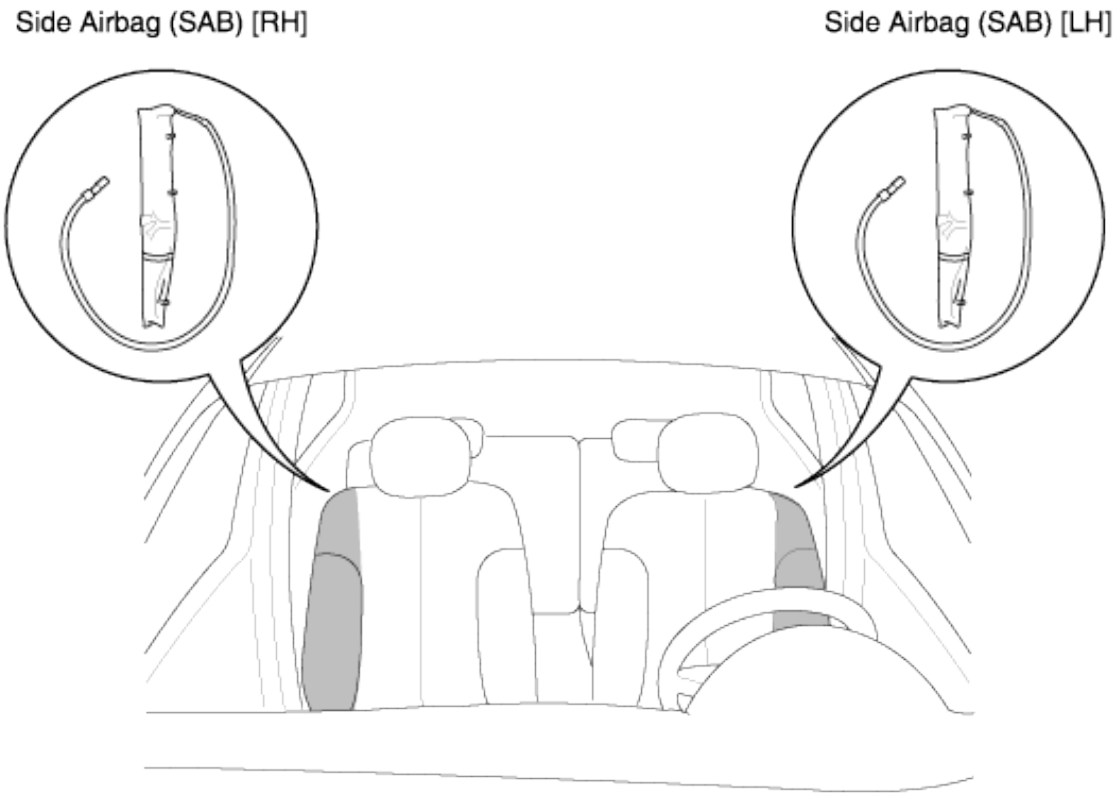
DESCRIPTION

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.

components

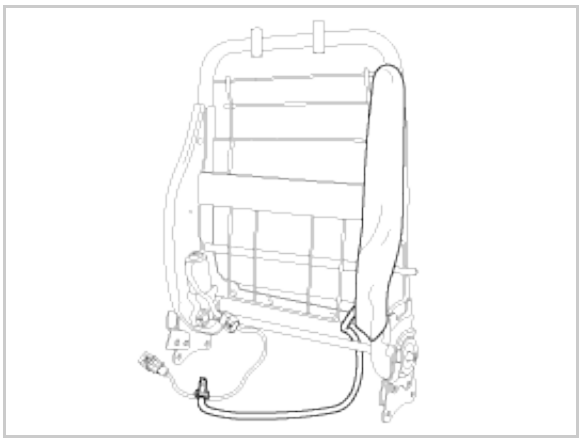


REMOVAL

1. Disconnect the battery negative cable and wait at least 3 minutes before beginning work.
2. Remove the front seat assambly.(Refer to BD group)
3. Remove the seatback cover.(Refer to BD group)

> NOTICE
>
> When the side airbag depoyed after a collision, replace the seatback as an assembly.

4. Loosen the SAB mounting nuts and remove the SAB module.



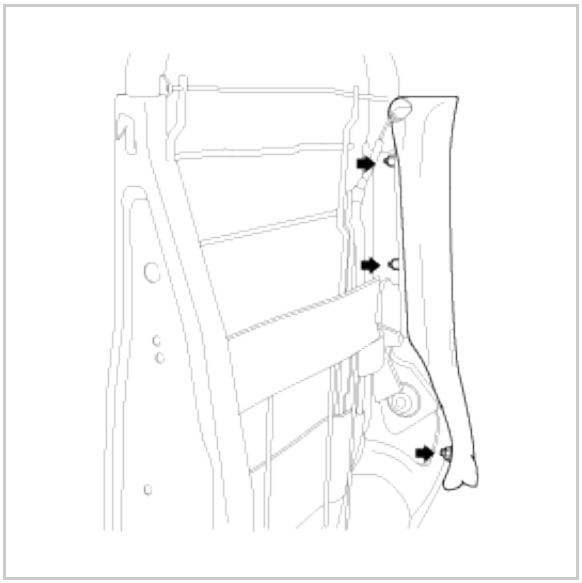
INSTALLATION

> CAUTION
>
> Ensure that the harness is installed and routed properly to prevent damage to the wiring.

> NOTICE
>
> a. Do not open the lid of the side airbag cover.
> b. Use a new mounting nuts when you replace a side airbag.
> c. Make sure that the seatback cover is installed properly. Improper installation may prevent the proper deployment.

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

Tightening torque
: 1.9 ~ 2.7 kgf.m (18.6 ~ 26.5 Nm, 13.7 ~ 19.5 lb.ft)



4. Install the new seatback cover.(Refer to BD group)
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.

Seat Belt Pretensioner (BPT)

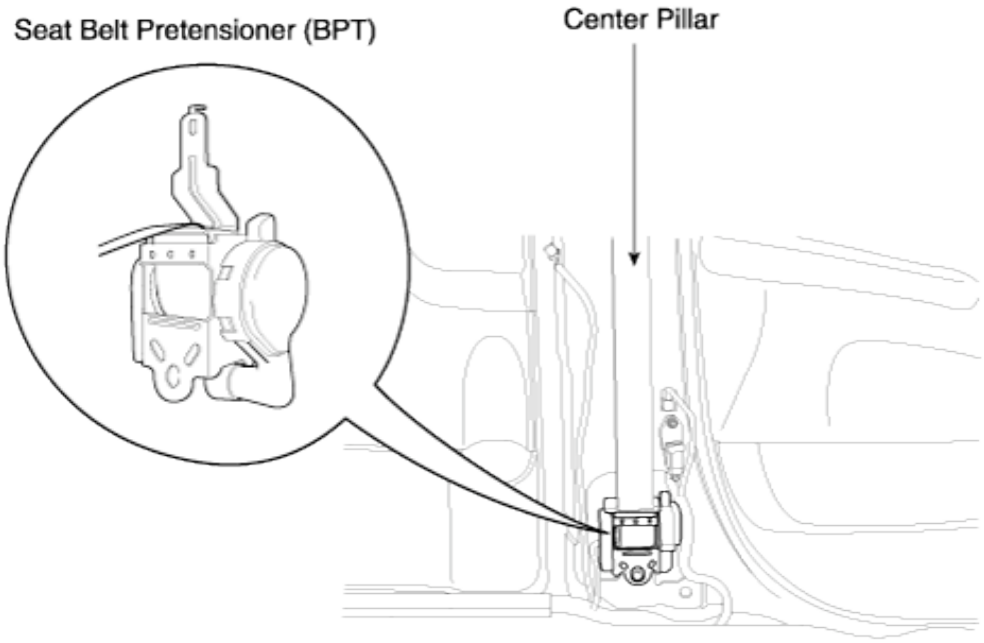
DESCRIPTION

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

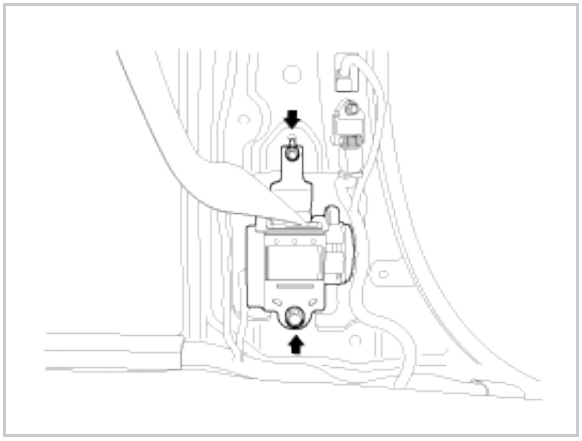
Never attempt to measure the circuit resistance of the Seat Belt Pretensioner (BPT) even if you are using the specified tester. If the circuit resistance is measured with a tester, the pretensioner will be ignited accidentally. This will result in serious personal injury.

components



REMOVAL

1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
2. Remove the door scuff trim. (Refer to BD group)
3. Remove the center pillar trim. (Refer to BD group)
4. Remove the lower anchor bolt.
5. Remove the upper anchor bolt.
6. Loosen the Seat Belt Pretensioner mounting bolts and remove the Seat Belt Pretensioner.



7. Disconnect the Seat Belt Pretensioner connector.

INSTALLATION

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

Tightening Torque (Seat Belt Anchor Bolt)
: 4.0 ~ 5.5 kgf.m (39.2 ~ 53.9 Nm, 28.9 ~ 39.8 lb.ft)

5. Install the upper and lower anchor bolts.

Tightening Torque (Seat Belt Anchor Bolt)
: 4.0 ~ 5.5 kgf.m (39.2 ~ 53.9 Nm, 28.9 ~ 39.8 lb.ft)

6. Install the center pillar trim and door scuff trim.
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.

Seat Belt Buckle Pretensioner

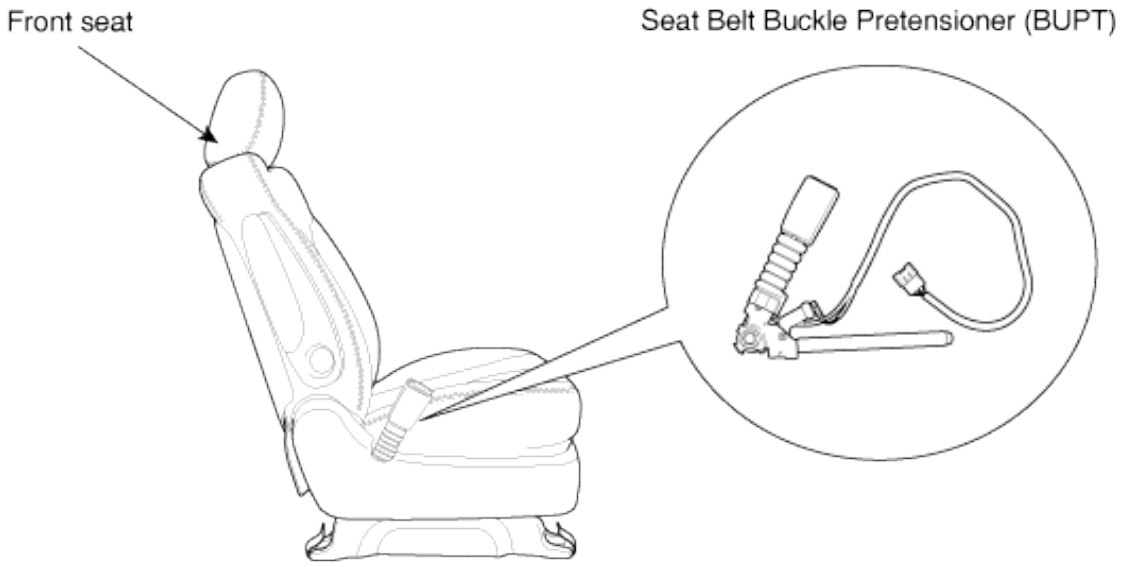
DESCRIPTION

The Seat Belt Buckle Pretensioners (BUPT) are installed in the right side of the driver seat and the left side of the passenger seat. When a vehicle crashes with a certain degree of frontal impact, the seat belt buckle pretensioner helps to reduce the severity of injury to the front seat occupants by retracting the seat belt buckle. This prevents the front occupants from thrusting forward and hitting the steering wheel or the instrument panel when the vehicle crashes.

CAUTION

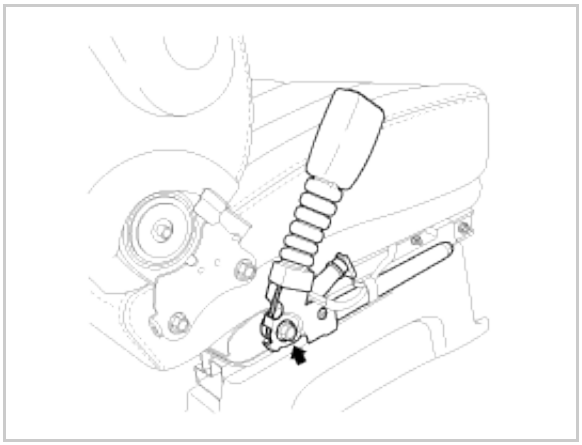
Never attempt to measure the circuit resistance of the Seat Belt Buckle Pretensioner (BUPT) even if you are using the specified tester. If the circuit resistance is measured with a tester, the pretensioner will be ignited accidentally. This will result in serious personal injury.

components



REMOVAL

1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
2. Remove the front seat assembly. (Refer to BD group)
3. Loosen the Seat Belt Buckle Pretensioner mounting bolt and remove the Seat Belt Buckle Pretensioner.



INSTALLATION

1. Disconnect the battery negative cable and wait for at least three minutes.
2. Remove the ignition key from the vehicle.
3. Install the Seat Belt Buckle Pretensioner (BUPT) with the bolt.

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

4. Install the front seat assembly.

CAUTION

a. Ensure that the harness is installed and routed properly to prevent damage to the wiring.

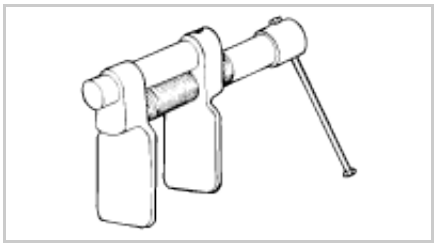
5. Reconnect the battery negative cable.
6. After installing the Seat Belt Buckle Pretensioner (BUPT), confirm proper system operation:
   a. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

CHAPTER 13:

Brake System

General information

SPECIAL TOOL

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

TROUBLESHOOTING

PROBLEM SYMPTOMS TABLE

Symptom	Suspect Area	Reference
Lower pedal or spongy pedal	a. Brake system (Fluid leaks) b. Brake system (Air in) c. Piston seals (Worn or damaged) d. Rear brake shoe clearance(Out of adjustment) e. Master cylinder (Inoperative)	repair air·bleed replace adjust replace
Brake drag	a. Brake pedal freeplay (Minimum) b. Parking brake lever travel (Out of adjustment) c. Parking brake wire (Sticking) d. Rear brake shoe clearance(Out of adjustment) e. Pad or lining (Cracked or distorted) f. Piston (Stuck) g. Piston (Frozen) h. Anchor or Return spring (Inoperative) i. Booster system (Vacuum leaks) j. Master cylinder (Inoperative)	adjust adjust repair adjust replace replace replace replace repair replace
Brake pull	a. Piston (Sticking) b. Pad or lining (Oily) c. Piston (Frozen) d. Disc (Scored) e. Pad or lining (Cracked or distorted)	replace replace replace replace replace
Hard pedal but brake inefficient	a. Brake system (Fluid leaks) b. Brake system (Air in) c. Pad or lining (Worn) d. Pad or lining (Cracked or distorted) e. Rear brake shoe clearance(Out of adjustment) f. Pad or lining (Oily) g. Pad or lining (Glazed) h. Disc (Scored) i. Booster system (Vacuum leaks)	repair air·bleed replace replace adjust adjust replace replace repair
Noise from brake	a. Pad or lining (Cracked or distorted) b. Installation bolt (Loosen) c. Disc (Scored) d. Sliding pin (Worn) e. Pad or lining (Dirty) f. Pad or lining (Glazed) g. Anchor or Return spring (Faulty) h. Brake pad shim (Damage) i. Shoe hold-down spring (Damage)	replace adjust replace replace clean replace replace replace replace
Brake fades	a. master cylinder	replace
Brake vibration, pulsation	a. brake booster b. pedal free play c. master cylinder d. caliper	replace adjust replace replace

	e. master cylinder cap seal f. damaged brake lines	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.	

SPECIFICATIONS

Item	Specification
Master cylinder · Type · I.D. mm(in) · Piston stroke mm(in) · Fluid level warning sensor	 Tandem type 26.99/(1.063) 30(1.18) Provided
Brake booster · Type · Boosting ratio	 8 + 9 in Tandem 9.0 : 1
Front brake(Disc) · Type · Disc O.D. · Disc thickness · Pad thickness · Cylinder type · Cylinder I.D.	 Floating type with ventilated disc 298 mm (11.73 in) 28 mm (1.10 in) 10.5 mm (0.41 in) Double piston Ø48 mm (Ø1.89 in)
Rear brake(Disc) · Type · Disc O.D. · Disc thickness · Pad thickness · Cylinder type · Cylinder I.D	 Floating type with solid disc 302 mm (11.89 in) 12 mm (0.47 in) 10 mm (0.39 in) Single piston Ø42.9 mm (Ø1.69 in)
Parking brake · Type · Actuation · Drum	 DIH(Drum in hat) Foot brake Ø190 mm (Ø7.48 in)

O.D=Outer Diameter
I.D=Inner Diameter

NOTICE

ABS : Anti-lock Brake System
ESP : Electronic Stability Program

SERVICE STANDARD

Items	Standard value
Brake pedal height	192.4 mm(7.57 in)
Brake pedal full stroke	122 mm (4.8 in)
Adjust Brake pedal full stroke	60 mm (2.36 in)
Brake pedal free play	3 ~ 8 mm(0.11 ~ 0.31 in)
Stop lamp switch outer case to pedal stopper clearance	1.0 ~ 1.5 mm (0.04 ~ 0.06 in)
Booster push rod to master cylinder piston clearance	0.6 ~ 1.7(0.02 ~ 0.07 in)(at 500 mmHg)
Parking brake pedal stroke when pedal assembly is depressed with 294N (30kgf, 66lb force)	145 mm (5.71 in) above
Front disc brake pad thickness	10.5 mm (0.41 in)
Front disc thickness	28 mm (1.10 in)
Rear disc brake pad thickness	10 mm (0.39 in)
Rear disc brake disc thickness	12 mm (0.47 in)
Rear parking brake liner thickness	4 mm (0.16 in)

TIGHTENING TORQUE

Items	Nm	kgf.m	lb-ft
Master cylinder to booster mounting nut	8 ~ 12	0.8 ~ 1.2	5.8 ~ 8.7
Brake booster mounting nut	13 ~ 16	1.3 ~ 1.6	9.4 ~ 11.6
Bleeder screw	7 ~ 13	0.7 ~ 1.3	5.06 ~ 9.4
Brake tube nut, brake hose	13 ~ 17	1.3 ~ 1.7	9.4 ~ 12.3
Caliper guide rod bolt (Front)	22 ~ 32	2.2 ~ 3.2	15.9 ~ 23.1
Caliper guide rod bolt (Rear)	22 ~ 32	2.2 ~ 3.2	15.9 ~ 23.1
Caliper assembly to knuckle (Front)	85 ~ 100	8.5 ~ 10	61.5 ~ 72.3
Caliper assembly to knuckle (Rear)	50 ~ 60	5.0 ~ 6.0	36.2 ~ 43.4
Brake hose to front caliper	25 ~ 30	2.5 ~ 3.0	18.1 ~ 21.7
Brake pedal assembly bracket mounting nut	10 ~ 15	1.0 ~ 1.5	7.2 ~ 10.8
Brake pedal mounting nut	13 ~ 16	1.3 ~ 1.6	9.4 ~ 11.6
Stop lamp switch mounting nut	8 ~ 10	0.8 ~ 1.0	5.8 ~ 7.23
Active wheel speed sensor mounting bolt on the brake plate	7 ~ 10	0.7 ~ 1.0	5.1 ~ 7.2
HECU mounting bracket bolt	17 ~ 26	1.7 ~ 2.6	12.3 ~ 18.8
HECU mounting nut	6 ~ 10	0.6 ~ 1.0	4.3 ~ 7.2
Yaw rate & lateral acceleration sensor bolt	5 ~ 8	0.5 ~ 0.8	3.62 ~ 5.8

SPECIFICATION (ABS)

Part	Item		Standard value	Remark
HECU(Hydraulic and Electronic Control Unit)	System		4 channel 4 sensor (Solenoid)	·ABS system:ABS & EBD control
	Type		Motor, valve relay intergrated type	
	Operating voltage		8 V ~ 16 V(DC)	
	Operating temperature		-40 ~ 120 °C (-40 ~ 248 °F)	
Warning lamp	Operating voltage		12 V	·ABS W/L:ABS failure ·Brake W/L:Parking, brake oil, EBD failure
	Current consumption		80 mA	
Acitve wheel speed sensor	Supply voltage		DC 4.5 ~ 2.0 V	
	Operating temperature		-40 ~ 150 °C	
	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	0.15 ~ 1.5 mm	Typ.0.7 mm
		Rear	0.2 ~ 1.2 mm	Typ.0.7 mm
	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		8 V ~ 16 V(DC)	
	Operating temperature		-40 ~ 120 °C(-40 ~ 248 °F)	
Warning lamp	Operating voltage		12 V	·ESP Operating Lamp ·ESP Warning Lamp
	Current consumption		80 mA	
Active wheel speed sensor	Supply voltage		DC 4.5 ~ 20V	
	Operating temperature		-40 ~ 150 °C	
	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	0.15 ~ 1.5 mm	Typ. 0.7 mm
		Rear	0.2 ~ 1.2 mm	Typ. 0.7 mm
Steering Wheel Angle Sensor	Operating Voltage		8V ~ 16 V	
	Current Consumption		Max 150 mA	
	Operating Angular velocity		Max ± 780 °/sec	
Yaw-rate & Lateral G sensor	Operating Voltage		8 V ~ 16 V	
	Current Consumption		Max. 120 mA	
	Output Voltage high		4.35 V~ 4.65 V	Typ. 4.5 V
	Output Voltage low		0.35 ~ 0.65 V	Typ. 0.5 V
	Yaw Sensor Operating Range		±100 ° /s	
	G Sensor Operating Range		±1.8 G	
	Reference voltage output		2.464 ~ 2.536 V	Typ. 2.5 V

LUBRICANT

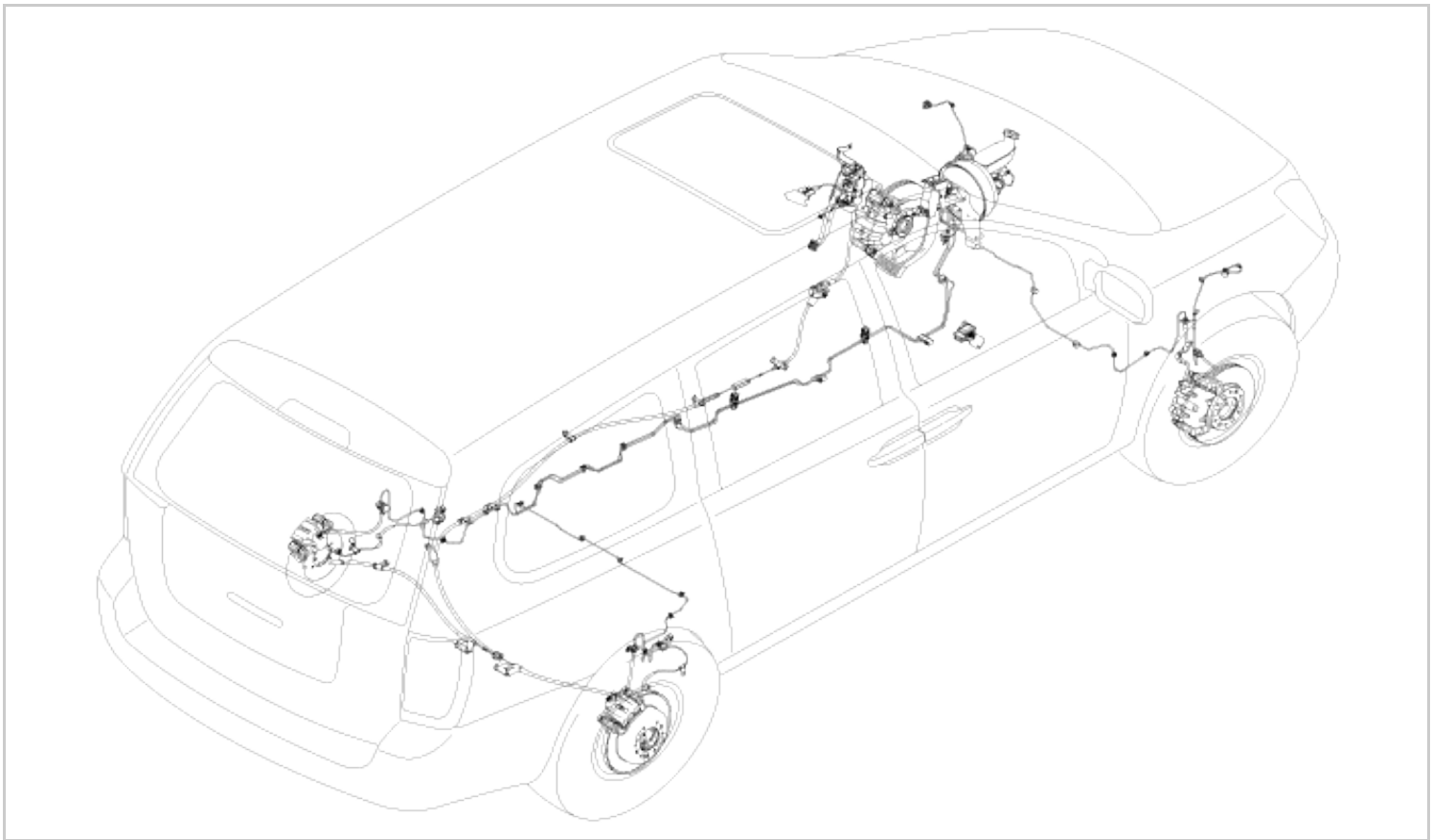
Item	Recommended lubricant	Quantity
Brake fluid	DOT 3 or DOT 4	As required
Brake pedal bushing and brake pedal bolt	Chassis grease	As required
Parking brake shoe and backing plate contact surfaces	Bearing grease	As required
Caliper guide rod and boot	RX-2 grease	0.8 ~ 1.3 g
Rear caliper guide rod and boot	Rubber grease	0.8 ~ 1.3g

Brake System

Operation and Leakage Check

Check all of the following items:

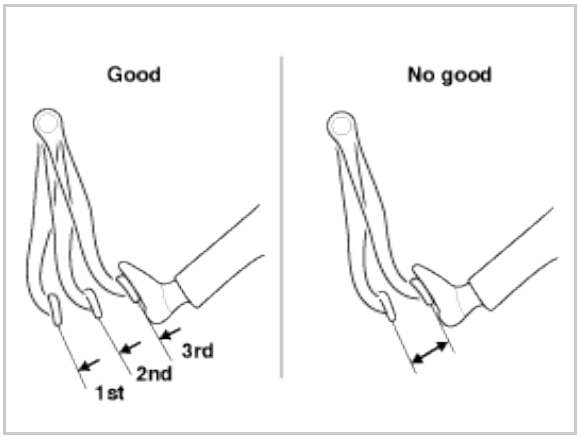
Component	Procedure
Brake Booster (A)	Check brake operation by applying the brakes during a test drive. If the brakes do not work properly, check the brake booster. Replace the brake booster as an assembly if it does not work properly or if there are signs of leakage.
Piston cup and pressure cup inspection (B)	a. 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. b. Check for a difference in brake pedal stroke between quick and slow brake applications. Replace the master cylinder if there is a difference in pedal stroke.
Brake hoses (C)	Look for damage or signs of fluid leakage. Replace the brake hose with a new one if it is damaged or leaking.
Caliper piston seal and piston boots (D)	Check brake operation by applying the brakes. Look for damage or signs of fluid leakage. If the pedal does not work properly, the brakes drag, or there is damage or signs of fluid leakage, disassemble and inspect the brake caliper. Replace the boots and seals with new ones whenever the brake caliper is disassembled.



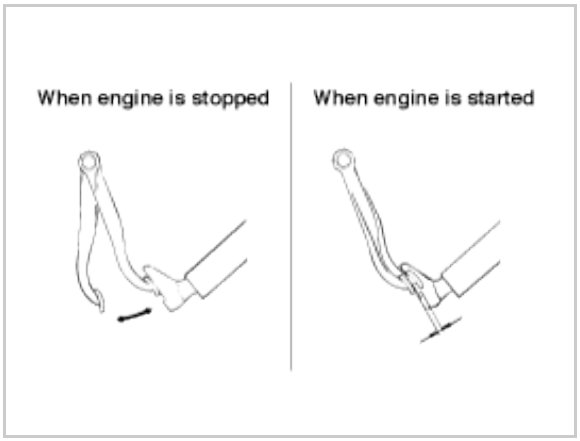
BRAKE BOOSTER OPERATING TEST

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

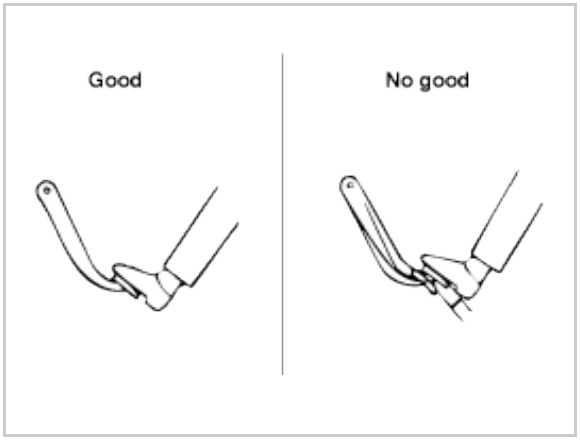
1. Run the engine for one or two minutes, and then stop it. If the pedal depresses fully the first time but gradually becomes higher when depressed succeeding times, the booster is operating properly, if the pedal height remains unchanged, thebooster is inoperative.



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.

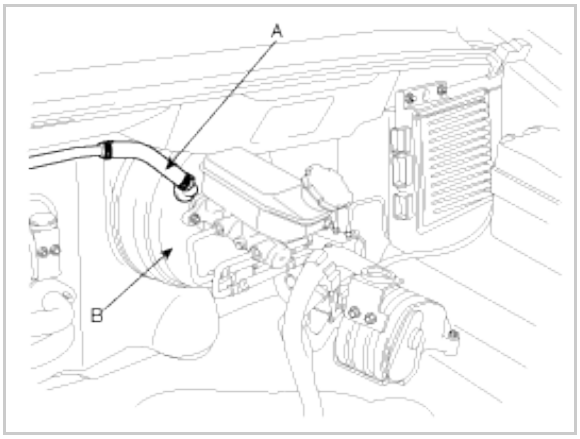


VACUUM HOSE (CHECK VALVE)

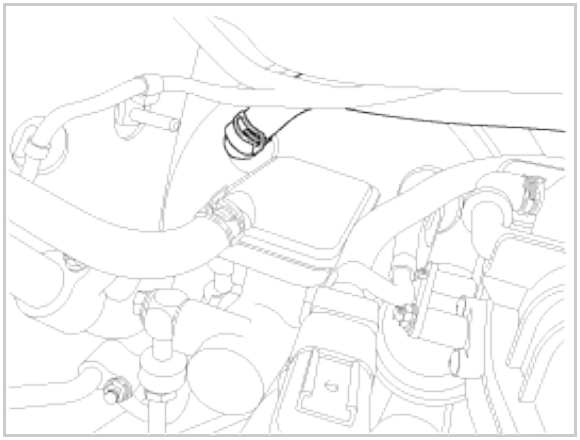
INSPECTION

1. Disconnect the brake booster vacuum hose (check valve built in) (A) at the booster (B).
2. Start the engine and let it idle. There should be vacuum available. If no vacuum is available, the check valve is not working properly. Replace the back booster vacuum hose and check valve and retest.

[LHD]



[RHD]

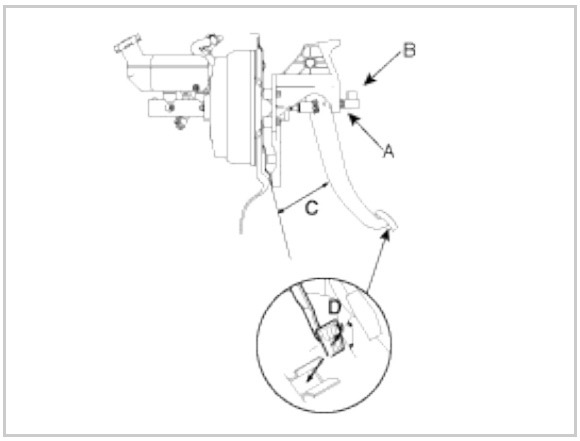


BRAKE PEDAL BRAKE SWITCH ADJUSTMENT

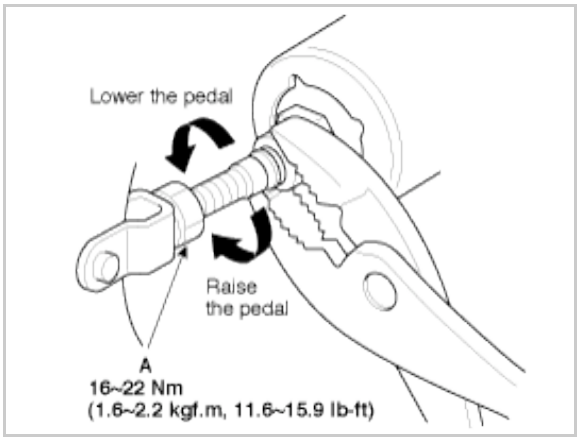
PEDAL HEIGHT

1. Disconnect the brake switch connector, loosen the brake switch locknut (A), and brake off the brake switch (B) until it is no longer touching the brake pedal.
2. Lift up the carpet. At the insulator cutout, measure the pedal height (C) from the middle of the left-side center of the pedal pad (D).

Standard pedal height(with carpet removed): 192.4 mm(7.57 in.)

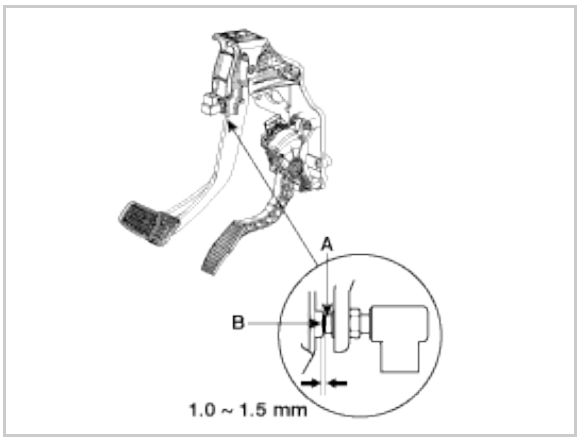


3. Loosen the pushrod locknut (A), and screw the pushrod in or out with pliers until the standard pedal height from the floor is reached. After adjustment, tighten the locknut firmly. Do not adjust the pedal height with the pushrod depressed.



BRAKE SWITCH CLEARANCE

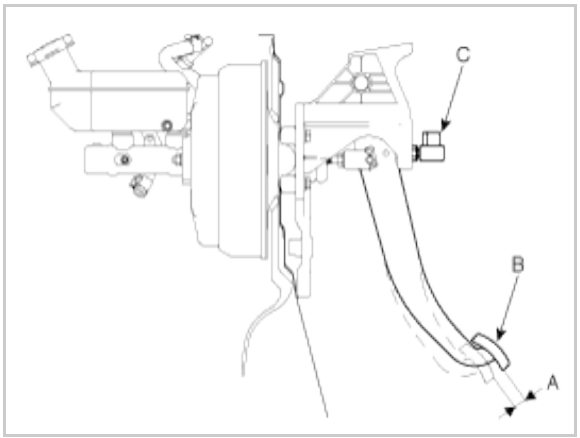
Screw in the brake switch until its plunger is fully depressed (threded end (A) touching the pad (B) on the pedal arm) then brake off the switch 3/4 turn to make 0.5 ~ 1.0 mm(0.0197 ~ 0.0394 in.) of clearance between the brake switch connector. Make sure that the brake lights go off when the pedal is released.



PEDAL FREE PLAY

1. With the engine off, inspect the pedal free play (A) on the pedal pad (B) by pushing the pedal by hand.

Free play: 3 ~ 8 mm (0.12 ~ 0.31 in.)

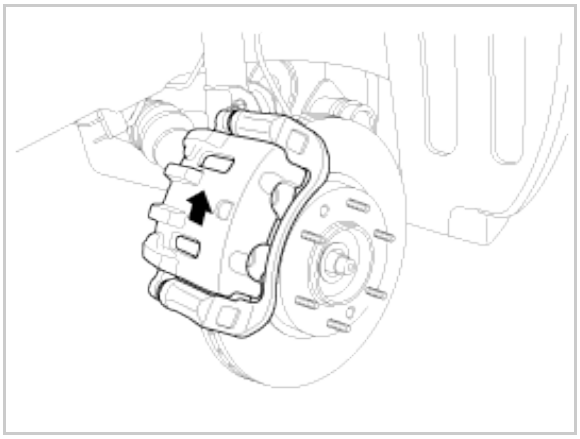


2. If the pedal free play is out of specification, adjust the brake switch (C). If the pedal free play is insufficient, it may result in brake drag.

INSPECTION OF FRONT DISC BRAKE PAD

1. Check the brake pad thickness through the caliper body inspection hole.

Pad thickness
Standard value : 10.5 mm (0.41 in)
Service limit : 2 mm (0.0787 in)



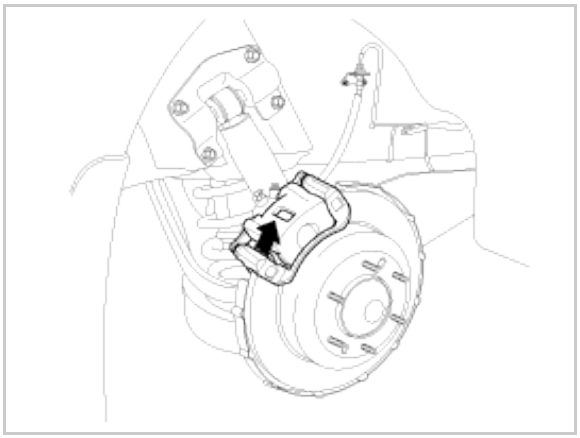
CAUTION

a. If the pad thickness is out of specilfication, left and right pads must be replaced as a complete set.
b. When the thickness difference between the left pad and right pad is large, check the sliding condition of the piston and the guide rod.

INSPECTION OF REAR DISC BRAKE PAD

1. Check the rear disc brake pad thickness through the caliper body inspection hole.

Pad thickness
Standard value : 10.0 mm (0.39 in)
Service limit : 2.0 mm (0.0787 in)



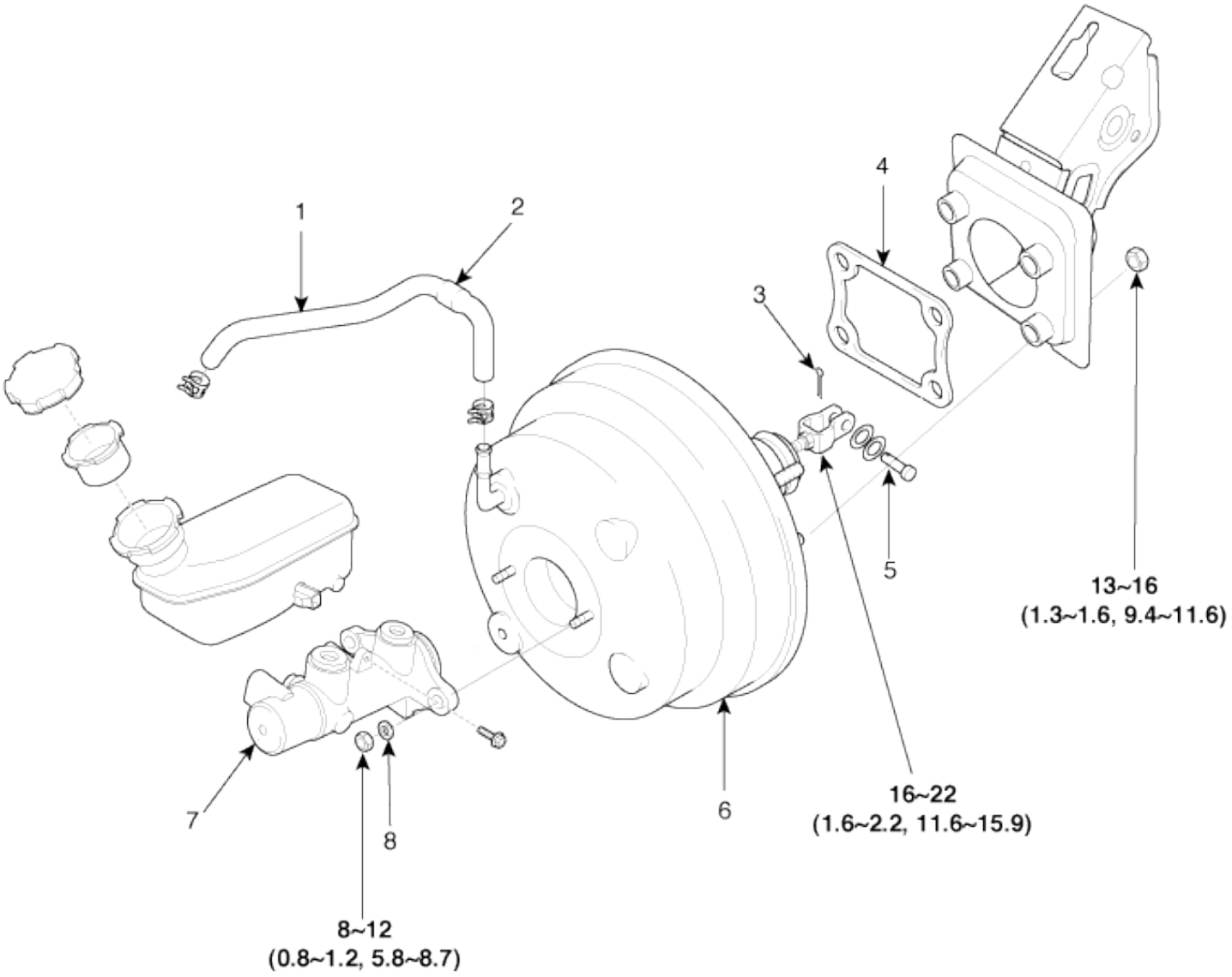
CAUTION

a. If the pad thickness is out of specification, left and right pads must be replaced as a complete set.
b. When the thickness difference between the left pad and right pad is large, check the sliding condition of the piston and the guide rod.

Brake Booster

COMPONENTS

[LHD]



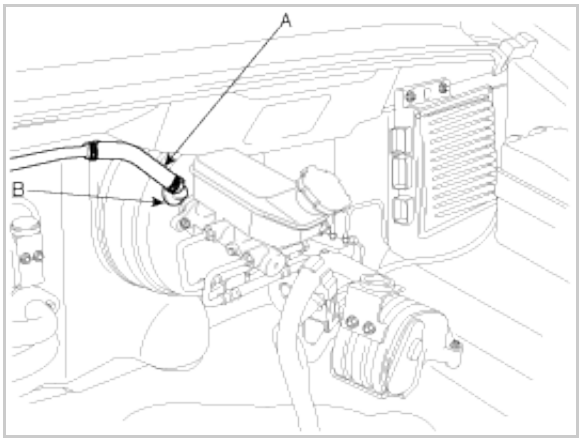
TORQUE : Nm (kgf.m, lb-ft)

1. Vacuum hose
2. Check valve
3. Snap pin
4. Seal
5. Clevis pin
6. Brake booster
7. Master cylinder
8. Washer

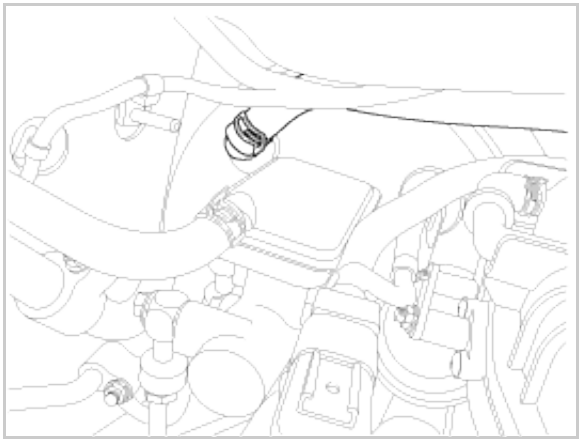
Removal

1. Disconnect the vacuum hose (A) from the brake booster (B).

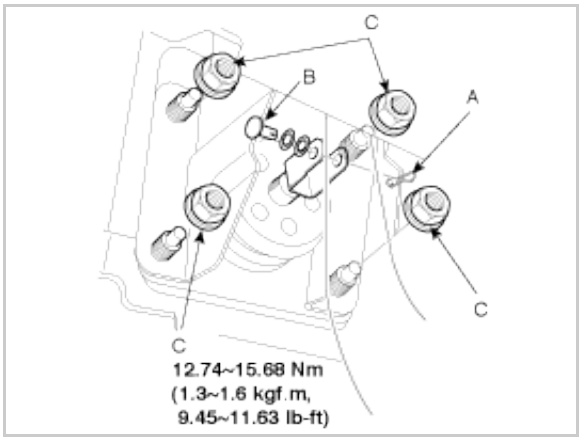
[LHD]



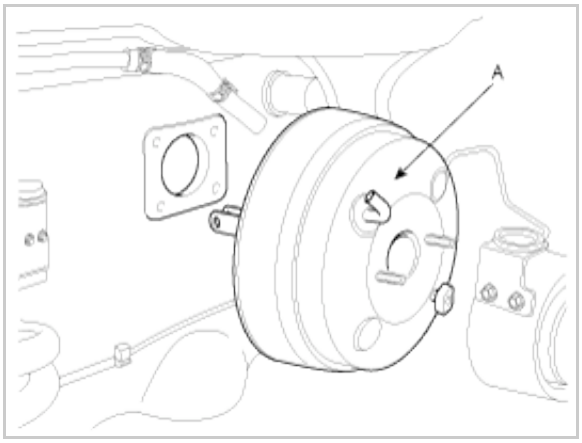
[RHD]



2. Remove the master cylinder (Refer to 'Master cylinder removal').
3. Remove the snap pin (A) and clevis pin (B).



4. Remove the four booster mounting nuts (C).
5. Remove the brake booster (A).

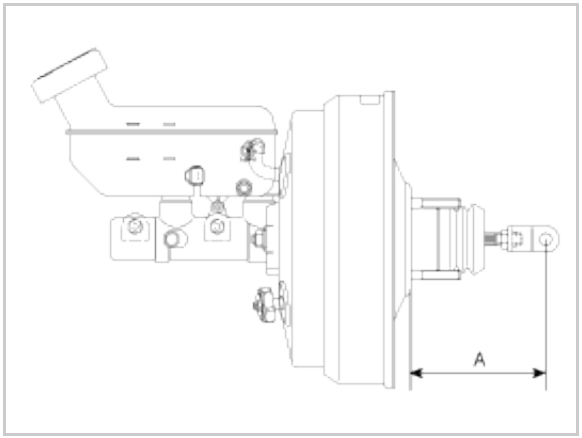


INSTALLATION

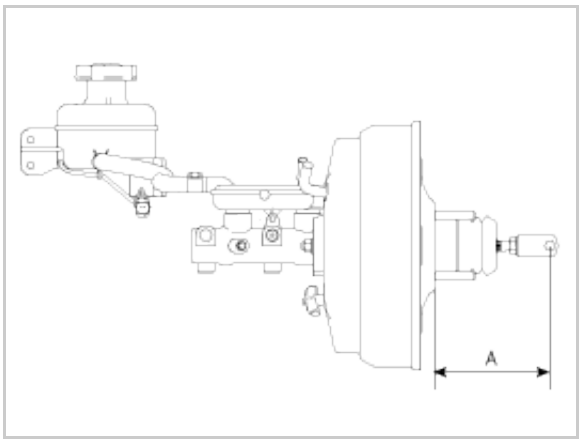
1. Adjust push rod length of the booster, and then install the seal on the booster assembly.

Standard length (A):
LHD : 112 ± 0.5 mm (4.43 ± 0.019 in.)
RHD : 115 ± 0.5 mm (4.53 ± 0.019 in.)

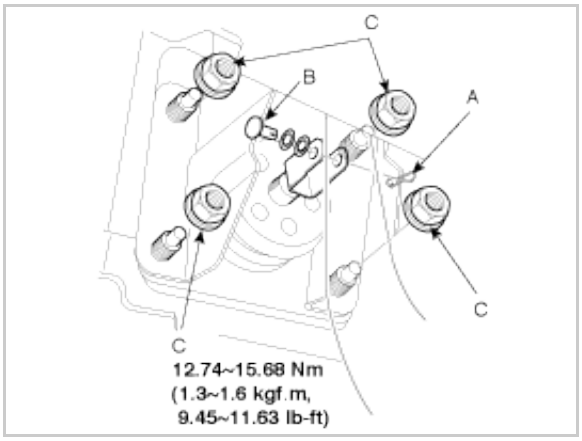
[LHD]



[RHD]



2. Insert the booster and tighten the nuts (C).



3. Connect the booster push rod and brake pedal with a pin (B) and install a snap clevis pin (A) to the clevis pin (B).

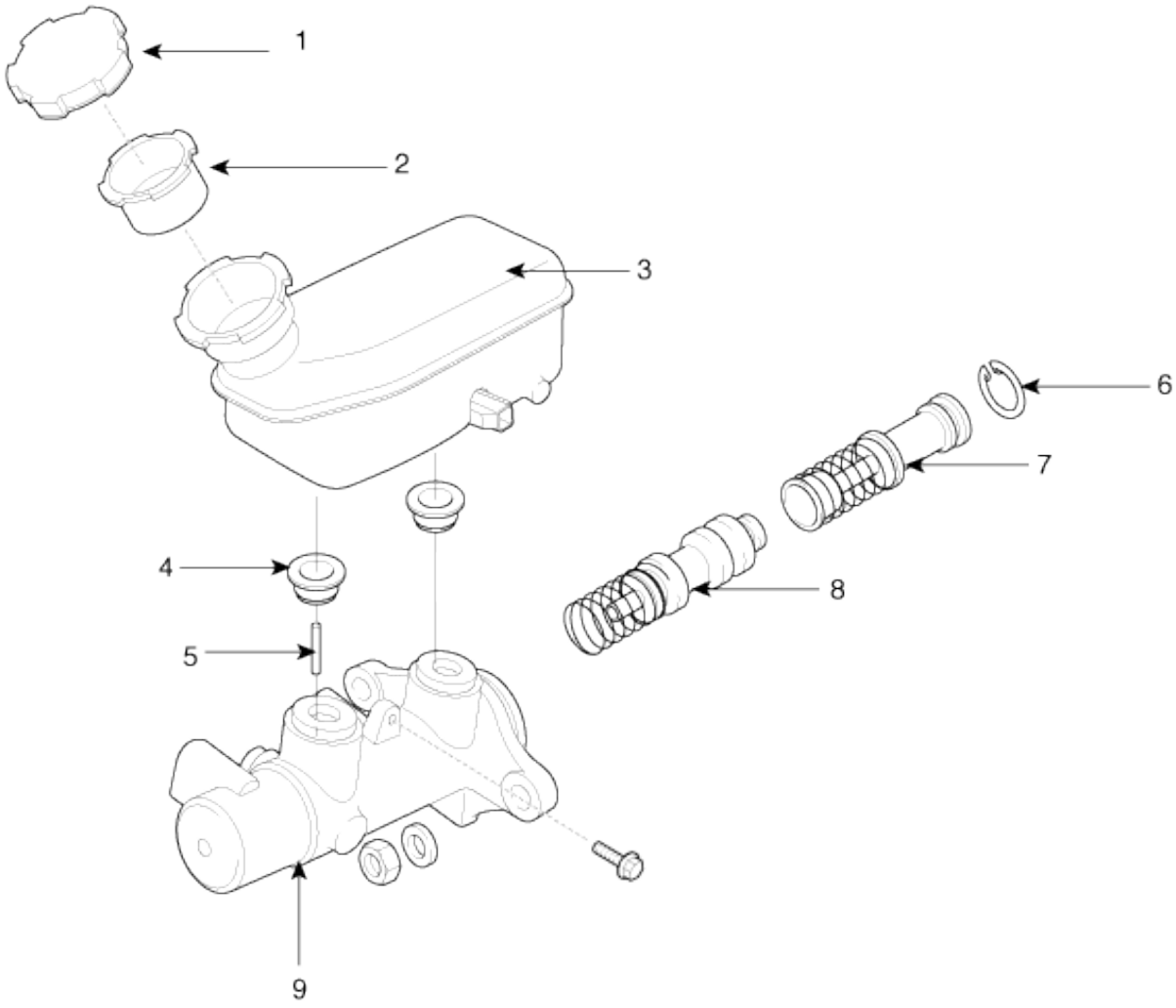
> **CAUTION**
>
> Grease the pin before installing the snap pin.
> Always use a new snap pin.

4. Install the master cylinder.
5. Connect the vacuum hose to the brake booster.
6. After filling the brake reservoir with brake fluid, bleed the system (Refer to 'Bleeding of brake system',).
7. Check for fluid leakage.
8. Check and adjust the brake pedal for proper operation.

Master Cylinder

COMPONENTS

[LHD]



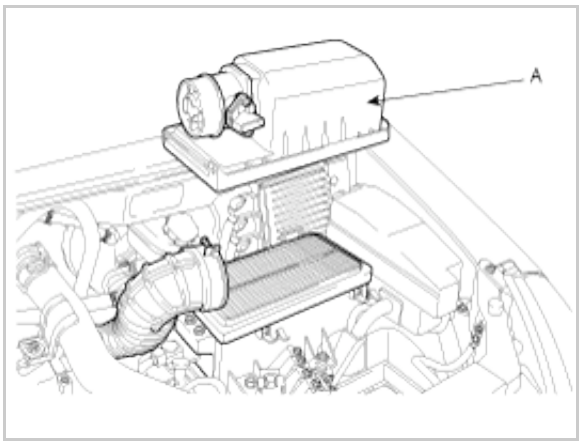
1. Reservoir cap
2. Brake fluid filter
3. Reservoir
4. Grommet
5. Cylinder pin
6. Retainer
7. Primary piston assembly
8. Secondary piston assembly
9. Master cylinder body

REMOVAL

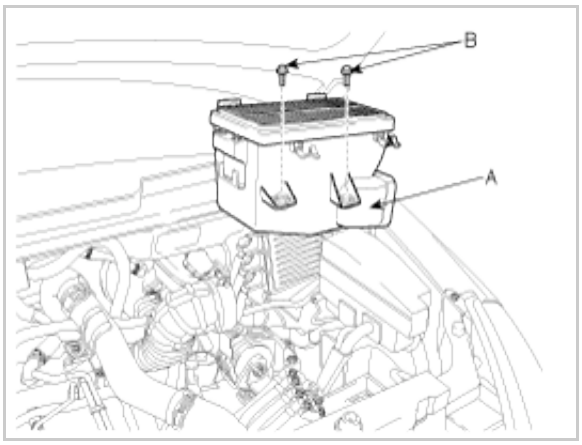
NOTICE

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

1. Remove air cleaner mounting bolts (B) from the air cleaner mounting bracket and air cleaner body (A).(LHD)

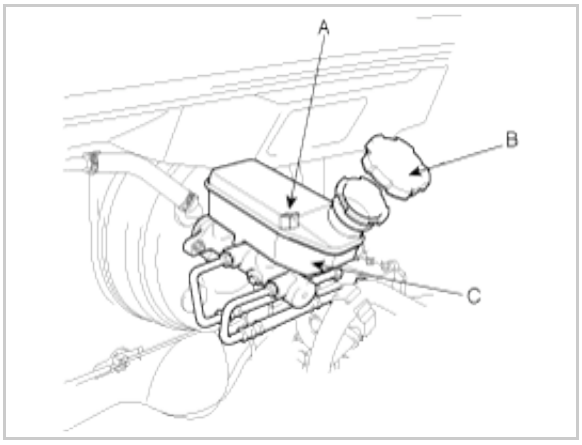


2. Remove the air cleaner assembly (A) by removing the air cleaner mounting bolt (B) from the bracket.(LHD)

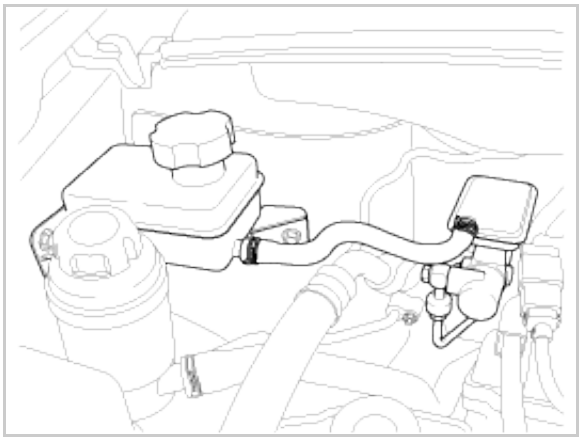


3. Remove the surge tank.(Refer to EM Gr.)
   (RHD-GSL 3.8)
4. Disconnect the brake fluid level switch connector (A), and remove the reservoir cap (B).

[LHD]

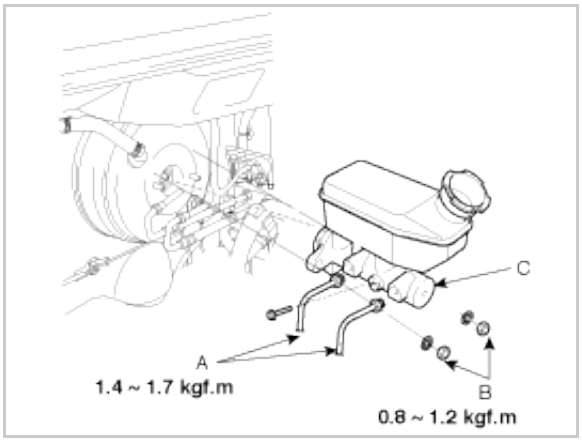


[RHD]

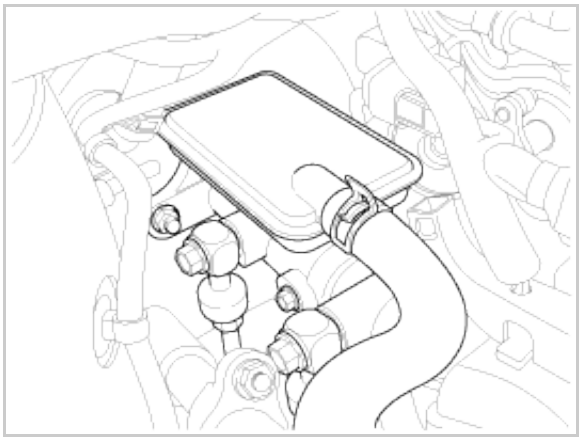


5. Remove the brake fluid from the master cylinder reservoir (C) with a syringe.
6. Disconnect the brake lines (A) from the master cylinder. To prevent spills, cover the hose joints with rags or shop towels.
7. Remove the master cylinder mounting nuts (B) and washers.

[LHD]



[RHD]

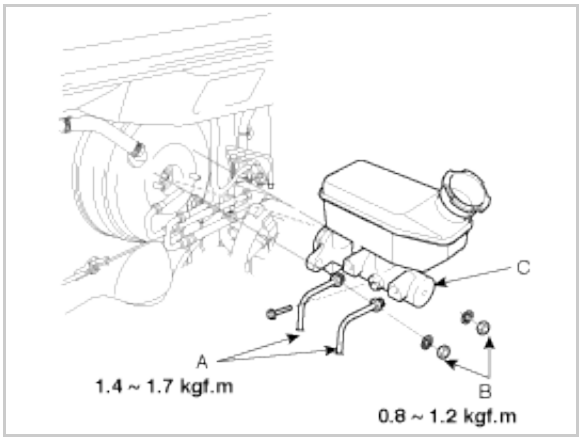


8. Remove the master cylinder(C) from the brake booster. Be careful not to bend or damage the brake lines when removing the master cylinder.

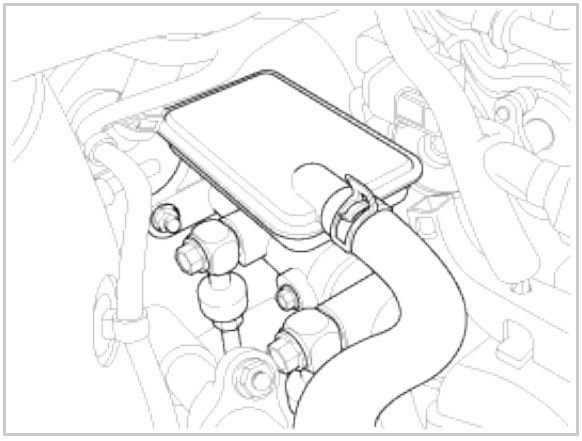
INSTALLATION

1. Install the master cylinder on the brake booster with 2 nuts.
2. Connect the two brake tubes and the brake fluid level sensor connector.

[LHD]



[RHD]

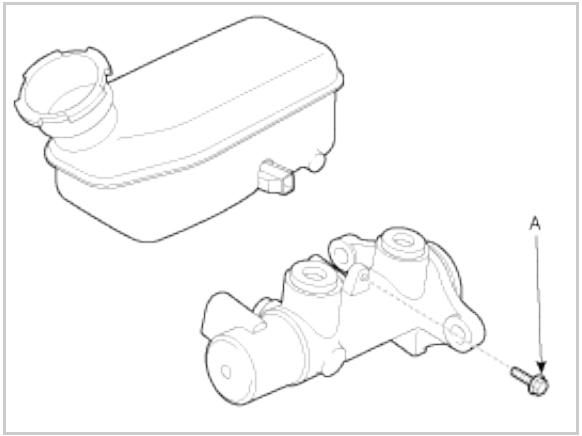


3. Fill the brake reservoir with the brake fluid and bleed the brake system (Refer to 'Bleeding of brake system').

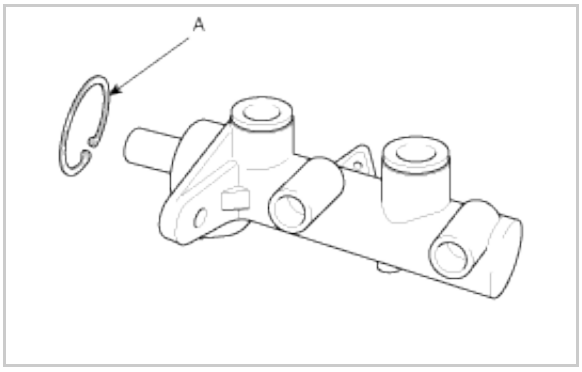
DISASSEMBLY

1. Remove the reservoir cap and drain the brake fluid into a suitable container.
2. Remove the fluid level sensor.
3. Remove the reservoir from the master cylinder, after remove mounting screw (A).

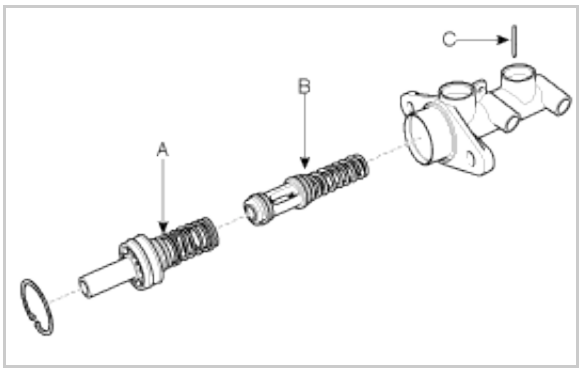
[LHD]



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



5. Remove the primary piston assembly (A).
6. Remove the pin (C) with the secondary piston (B) pushed completely using a screwdriver. Remove the secondary piston assembly (B).



NOTICE

Do not disassemble the primary and secondary piston assembly.

INSPECTION

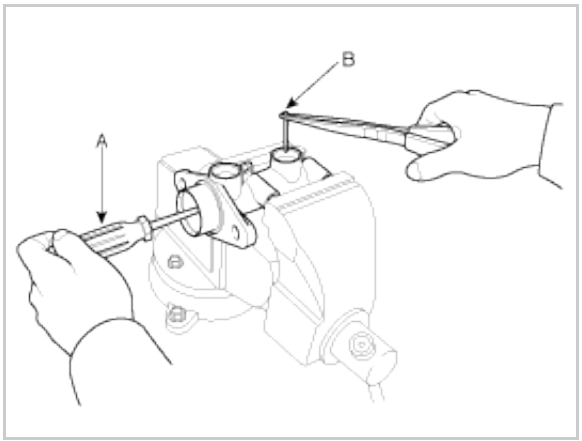
1. Check the master cylinder bore for rust or scratching.
2. Check the master cylinder for wear or damage. If necessary, clean or replace the cylinder.

CAUTION

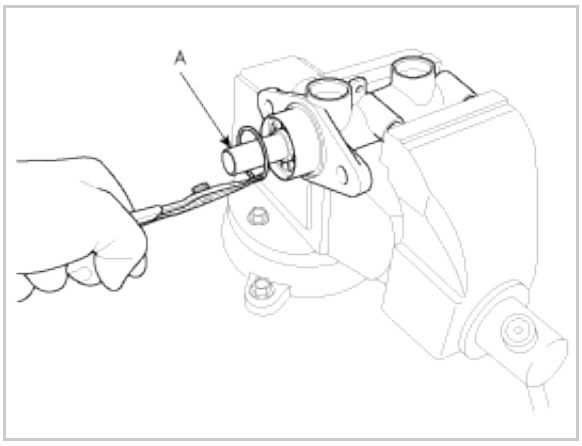
a. If the cylinder bore is damaged, replace the master cylinder assembly.
b. Wash the contaminated parts in alcohol.

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 piston with a screwdriver (A) and install the cylinder pin (B).



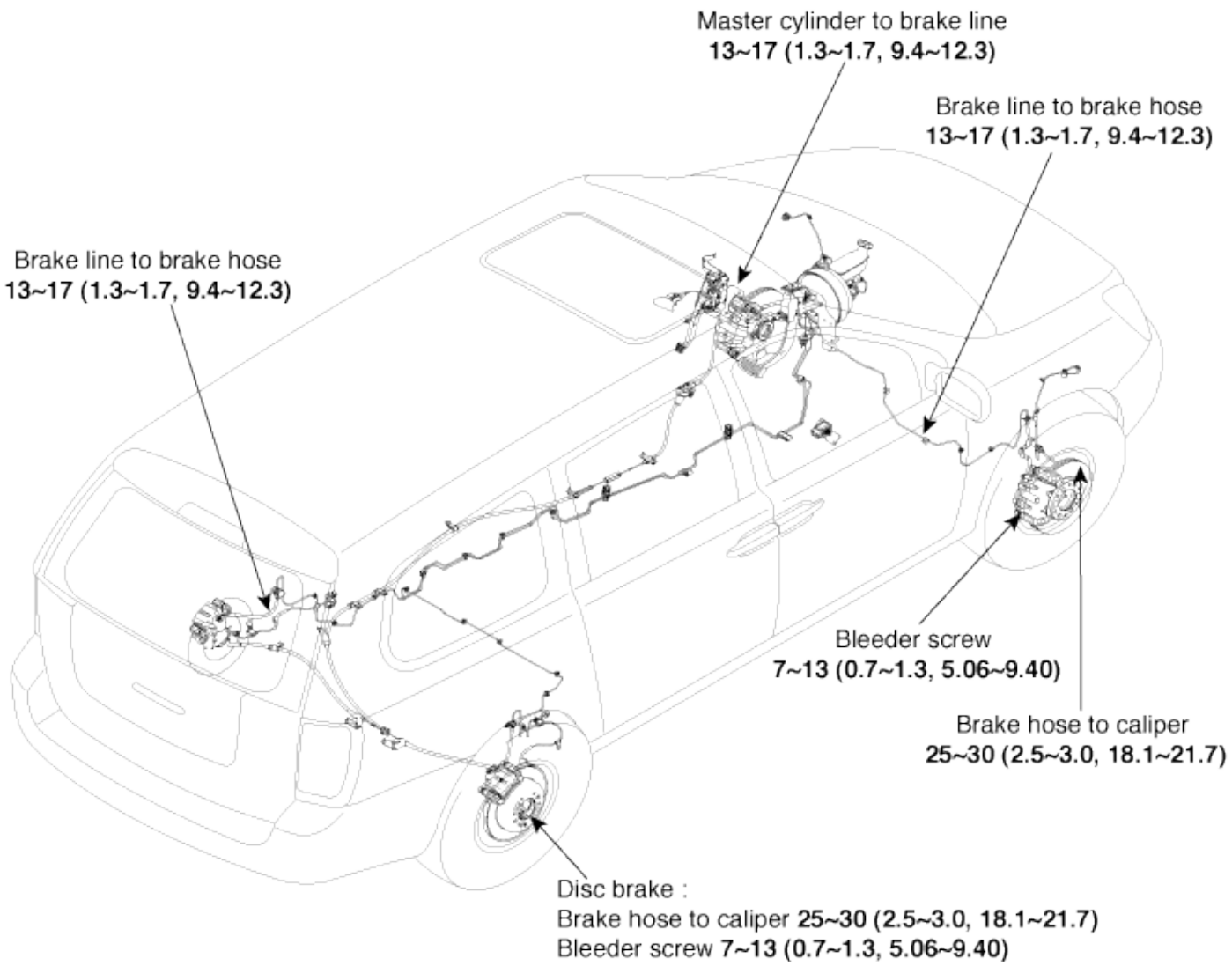
4. Install the retainer ring (A) after installing primary piston assembly.



5. Mount two grommets.
6. Install the reservoir on the cylinder.

Brake Line

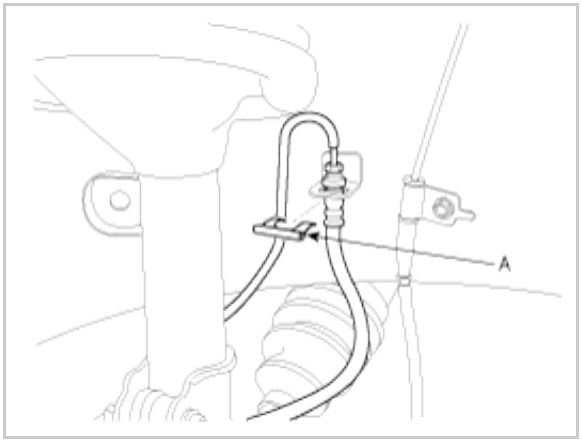
COMPONENT



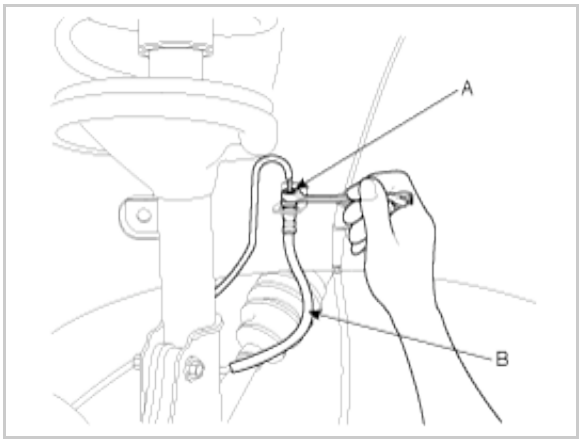
TORQUE : Nm (kgf.m, lb-ft)

REMOVAL

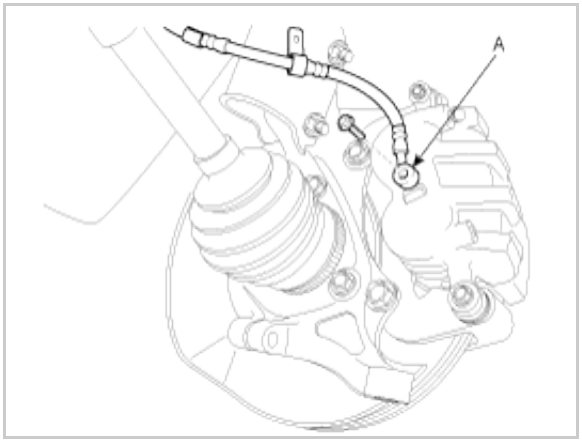
1. Remove the brake hose clip (A).



2. Loosen the brake tube (A) nut holding the brake hose (B) nut with a wrench.

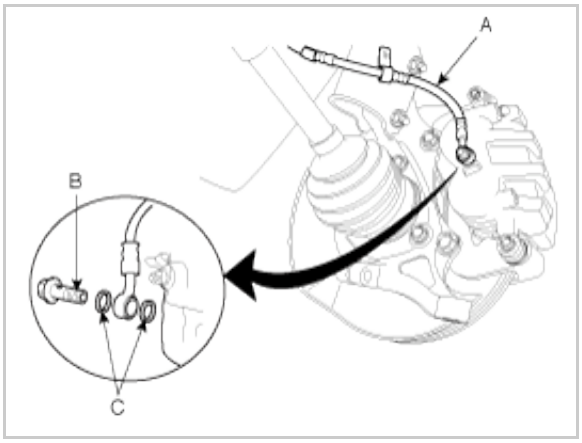


3. Remove the brake hose (B).
4. Remove the brake hose connecting bolt (A) from the caliper assembly.

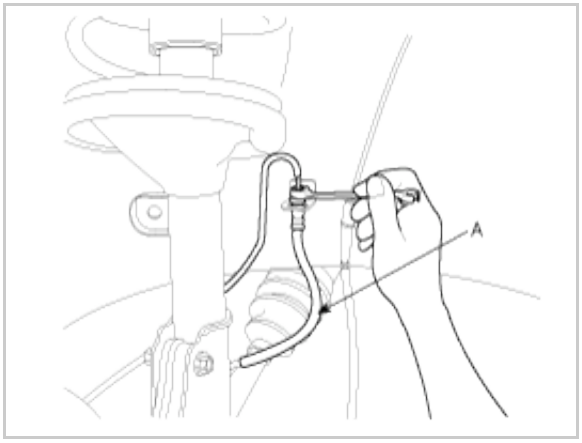


INSTALLATION

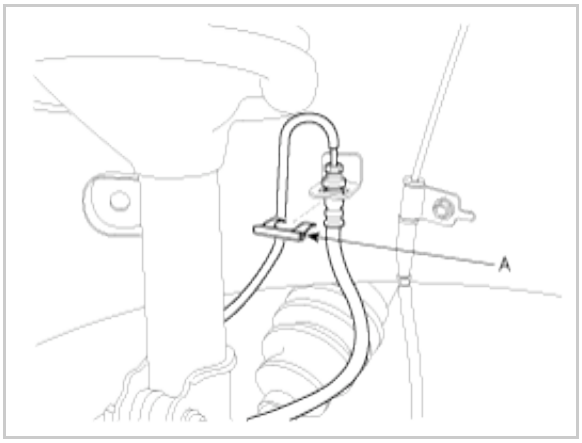
1. Install the brake hose (A) connecting bolt (B) and washer (C).



2. Tighten the brake tube (A) nut holding the brake hose (B) nut with a wrench.



3. Install the brake hose clip (A).



4. After installation, breed the air in the brake system.

CAUTION

Be careful not to damage the brake hose by sharp edges or tools.

INSPECTION

a. Check the brake tubes for cracks, crimps and corrosion.
b. Check the brake hoses for cracks, damaged and oil leakage.
c. Check the brake tube flare nuts for damage and oil leakage.

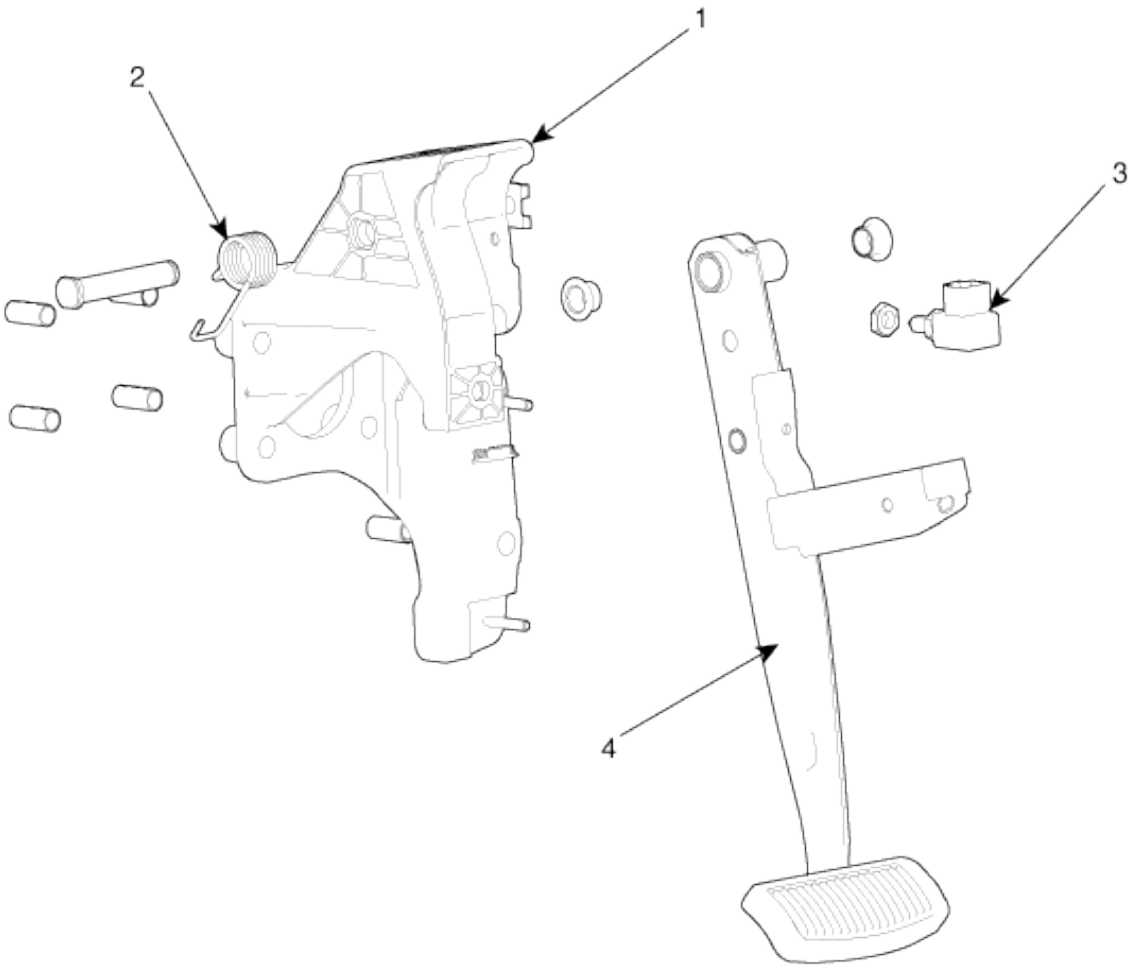
INSPECTION

a. Check the brake tubes for cracks, crimps and corrosion.
b. Check the brake hoses for cracks, damaged and oil leakage.
c. Check the brake tube flare nuts for damage and oil leakage.

Brake Pedal

COMPONENTS

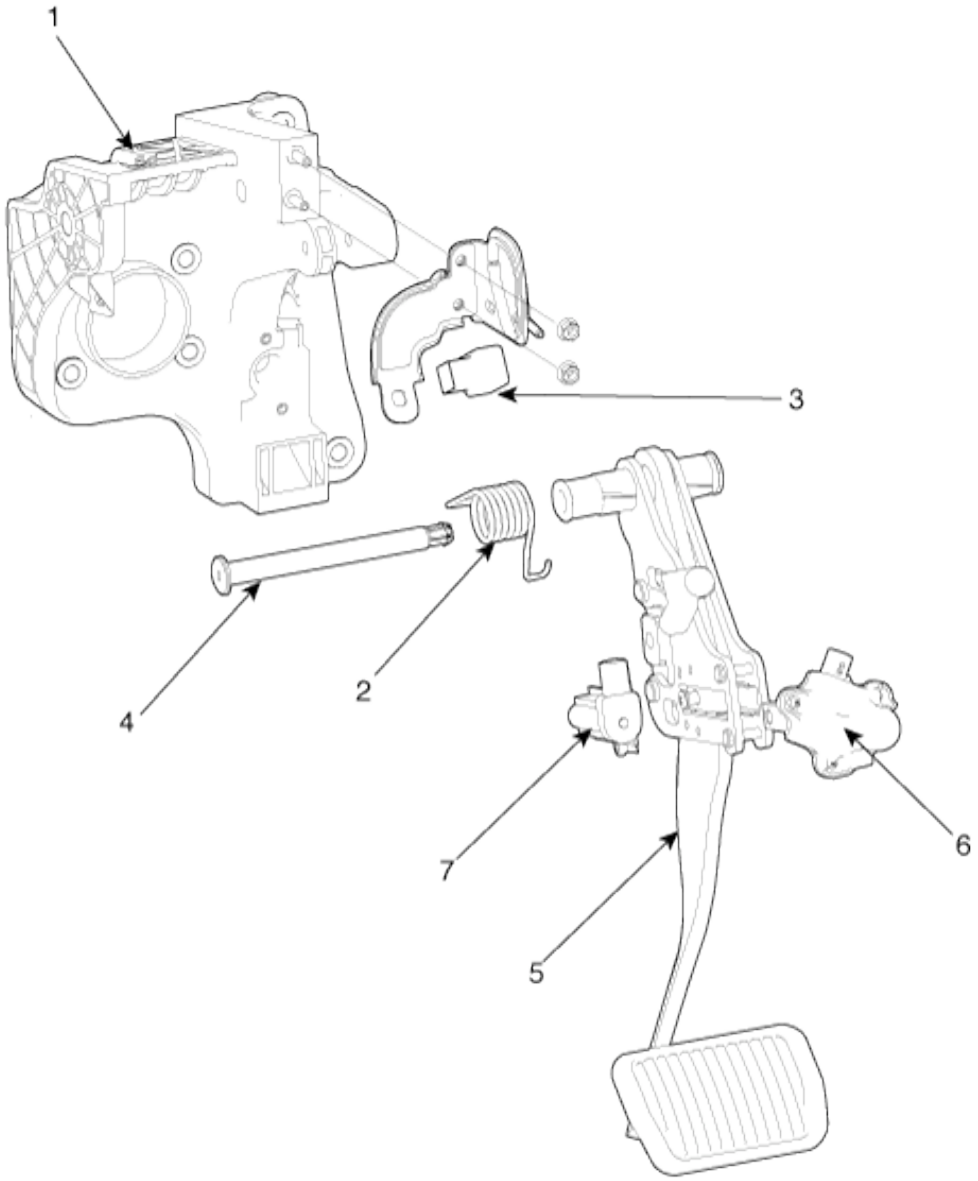
[LHD]



1. Member assembly bracket
2. Return spring
3. Stop lamp switch
4. Brake pedal

COMPONENTS (ADJUSTABLE PEDAL)

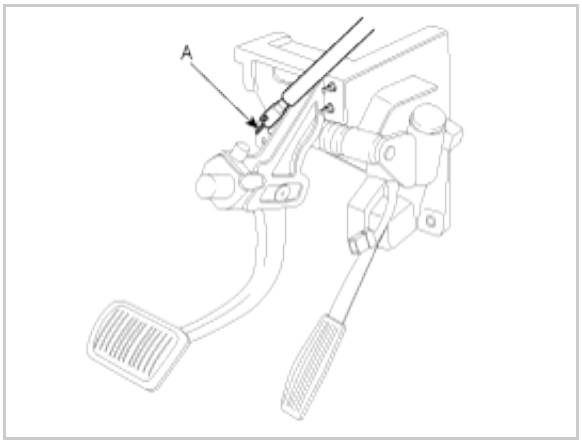
[LHD]



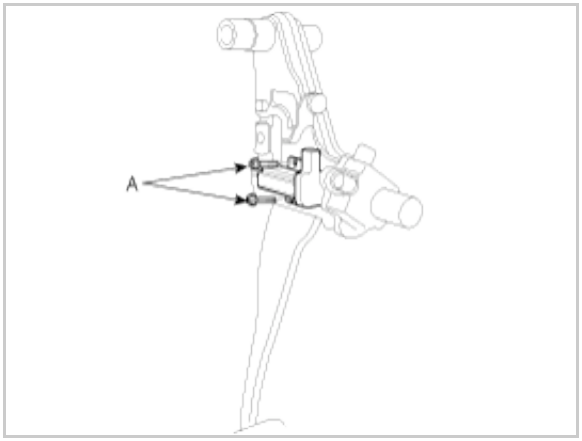
1. Member assembly bracket
2. Return spring
3. Stop lamp switch
4. Shaft bolt
5. Brake pedal
6. Arm yoke assembly
7. Arm yoke assembly (memory) (for IMS only)

REMOVAL

1. Remove the lower crash pad. (Refer to BD group 'Crash pad')
2. Remove the brake switch connector.
3. Remove the trans cable (A) in case of the adjustable brake pedal.



4. Remove the mounting bolt(A) of the peal position sensor connector in case of the adjustable brake pedal.



5. Remove the snap pin connecting the booster.
6. Remove the hinge shaft connecting the pedal tray.
7. Remove the brake pedal.

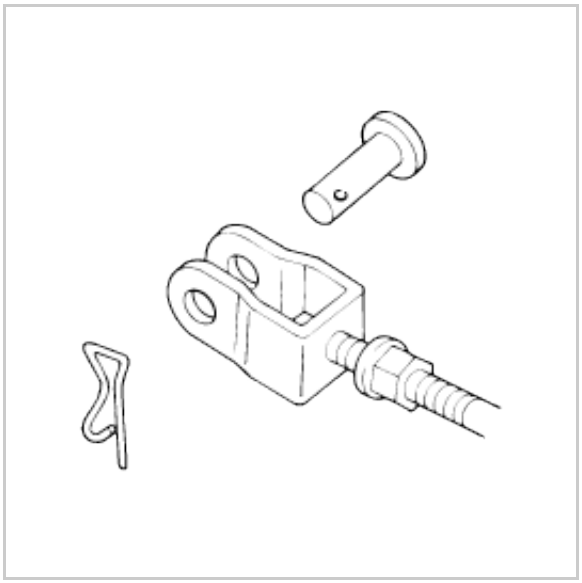
INSTALLATION

1. Installation is the reverse of removal.

> CAUTION
>
> Coat the inner surface of the bushings with the specified grease.

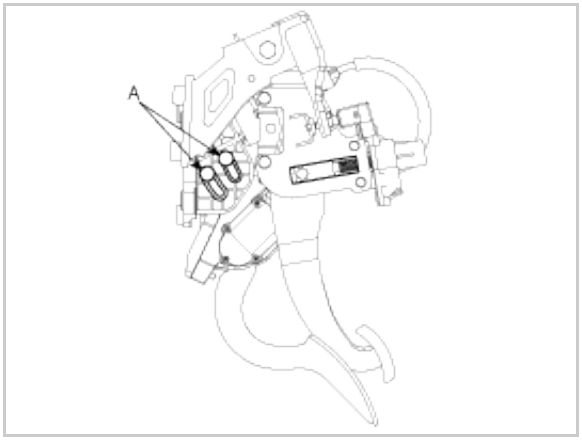
Specified grease : Lig-2

2. Before inserting the pin, apply the specified grease to the clevis pin.



3. Install the snap pin.
4. Adjust the brake pedal height and free play.

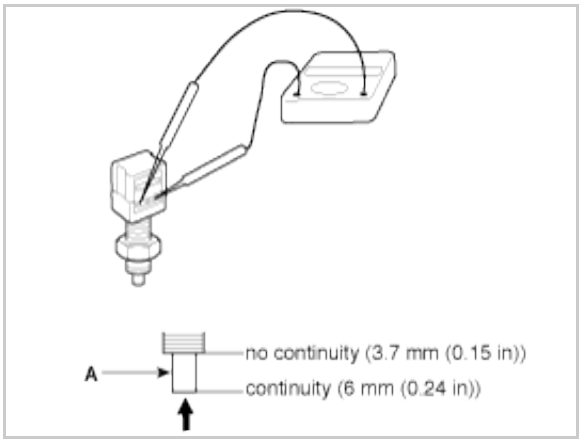
> **CAUTION**
>
> Before connecting trans cable, be sure that position of pivot pin (A) is initializen.



5. Install the stop lamp switch.

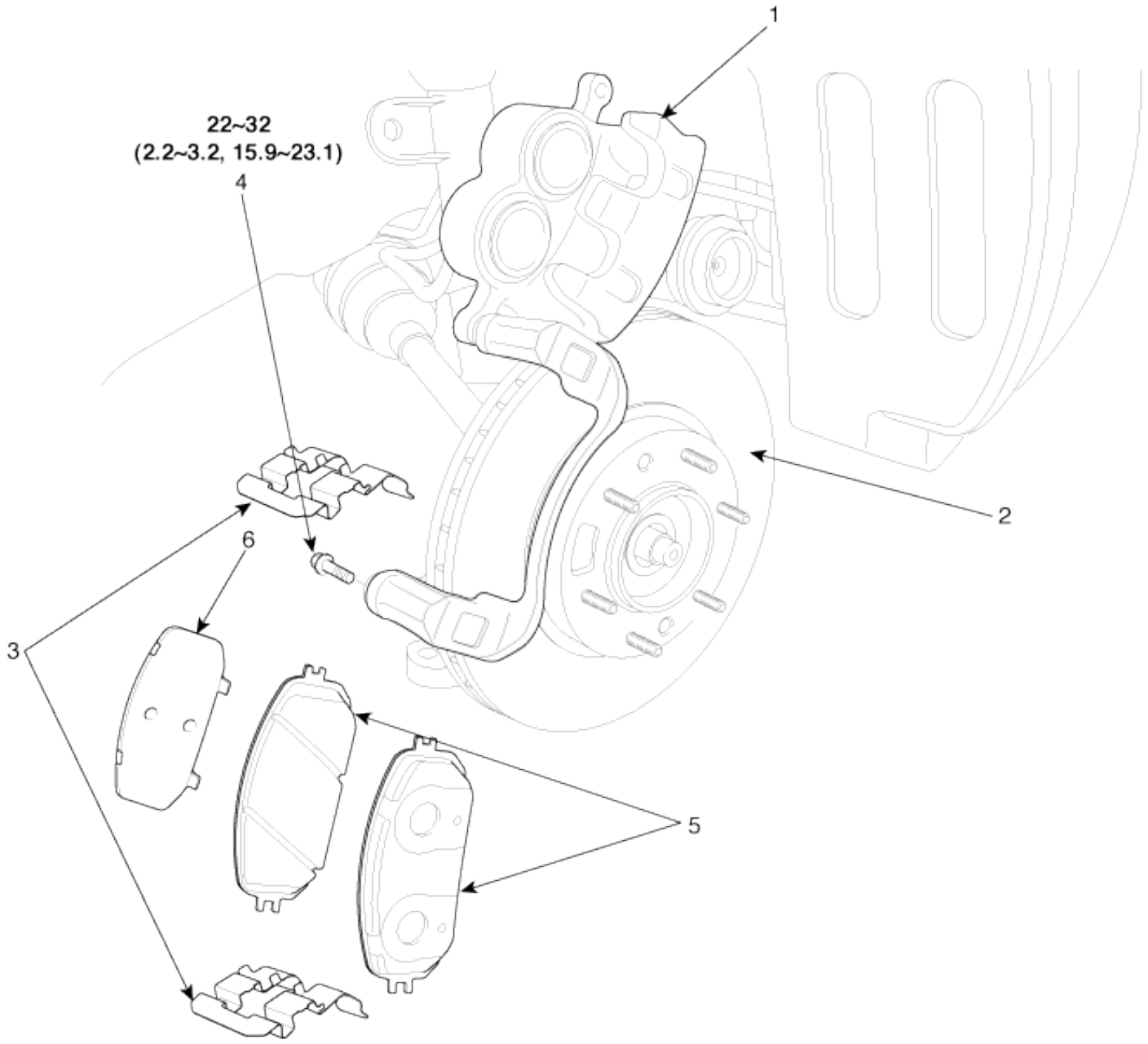
INSPECTION

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.


A
no continuity (3.7 mm (0.15 in))
continuity (6 mm (0.24 in))

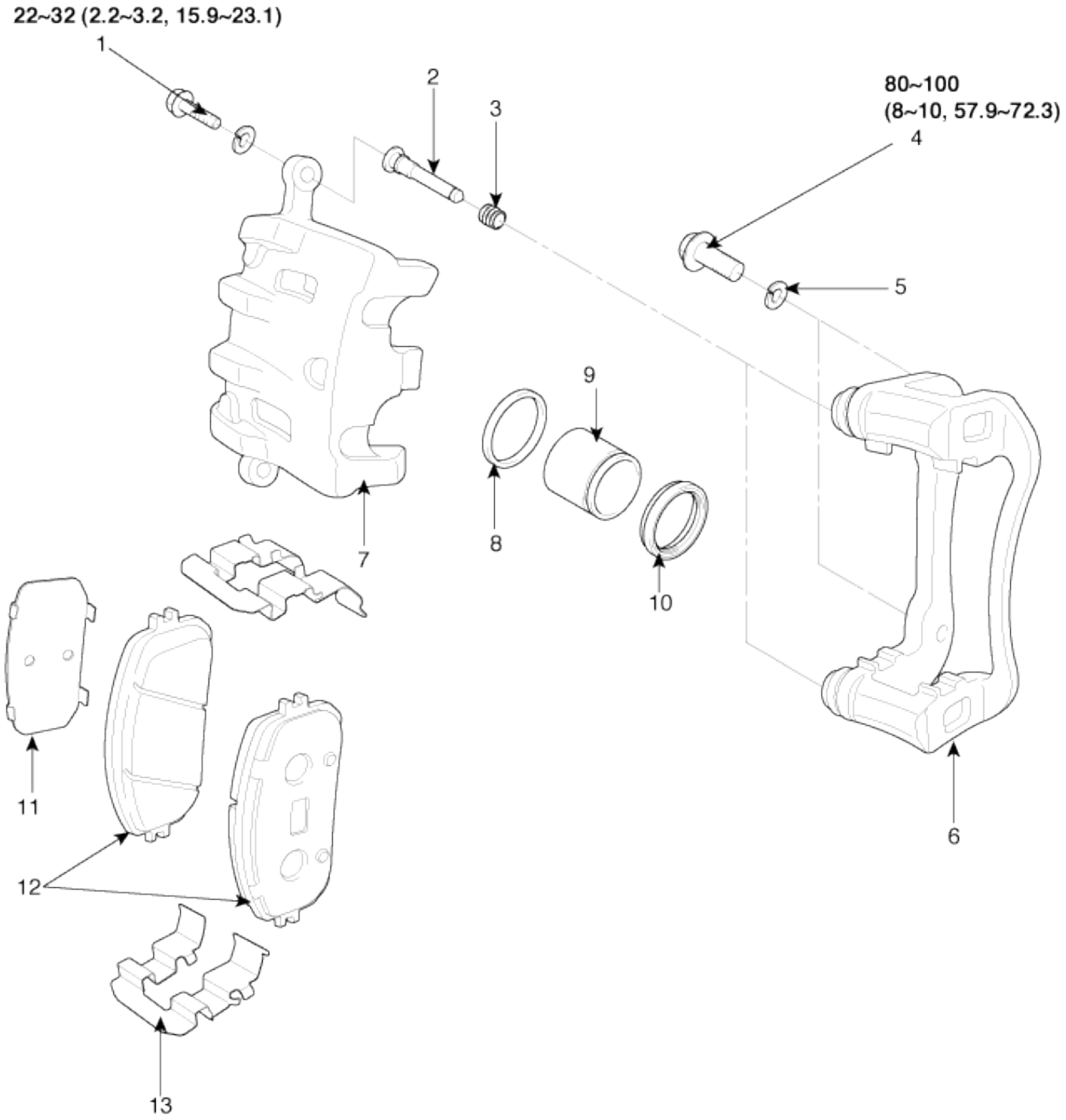
Front Disc Brake

COMPONENTS



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

1. Brake caliper
2. Brake disc
3. Pad retainers
4. Guide rod bolt
5. Brake pads
6. Brake pad shims



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

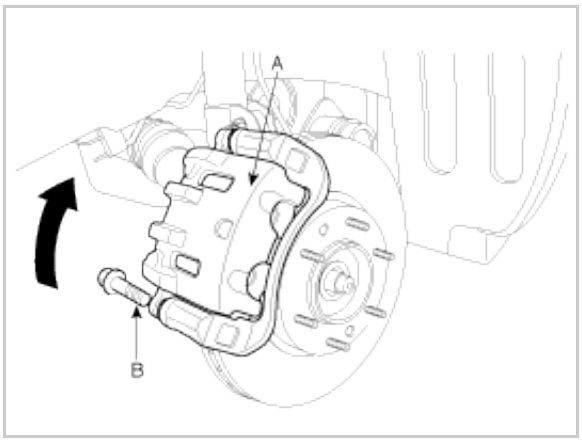
1. Guide rod bolt
3. Guide rod
4. Boot
5. Caliper mounting bolt
6. Washer
7. Caliper bracket
8. Caliper body
9. Piston seal
10. Piston
11. Piston boot
12. Inner shim
13. Brake pad
14. Pad retainer

REMOVAL

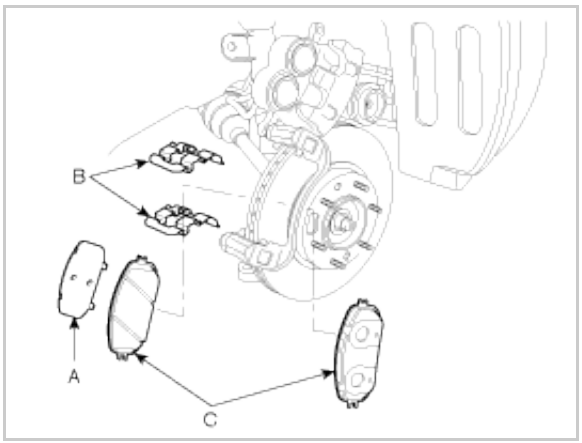
CAUTION

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

1. Loosen the front wheel nuts slightly. Raise the front of the vehicle, and make sure it is securely supported. Remove the front wheels.
2. Remove the guide rod bolt (B), After raise the caliper assembly (A), support it with a wire.

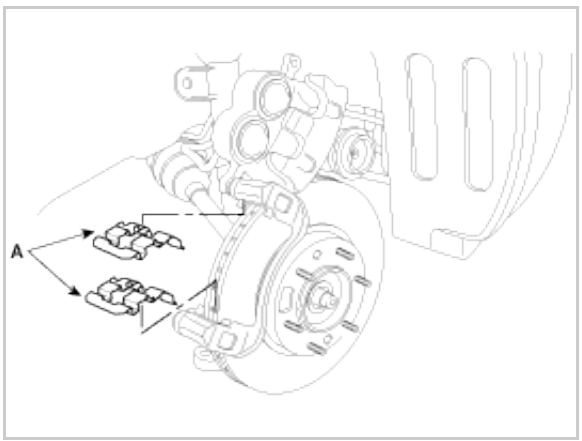


3. Remove pad shim (A), pad retainer (B) and pad assembly (C) in the caliper bracket.



INSTALLATION

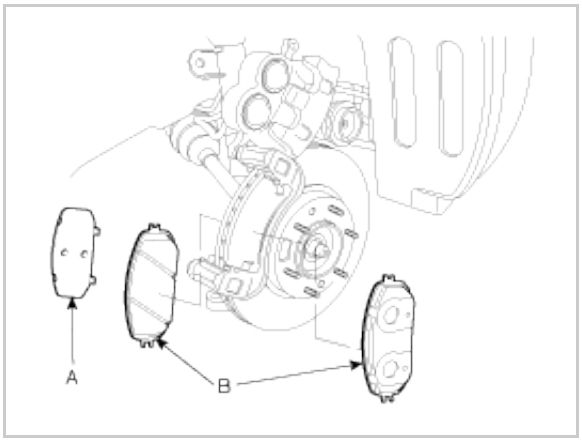
1. Install the pad retainers (A) on the caliper bracket.



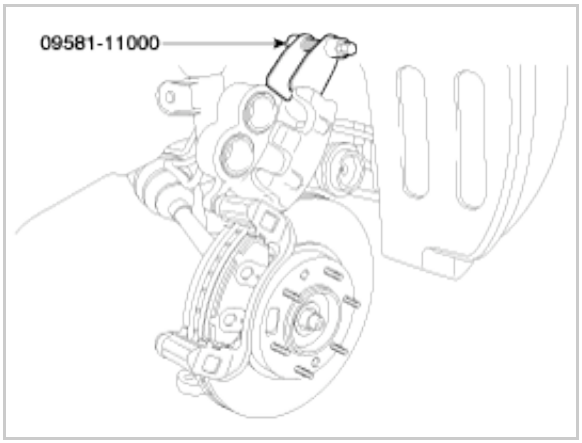
2. Install pad shims (A) and the brake pads (B) with the wear indicator on the inside.

CAUTION

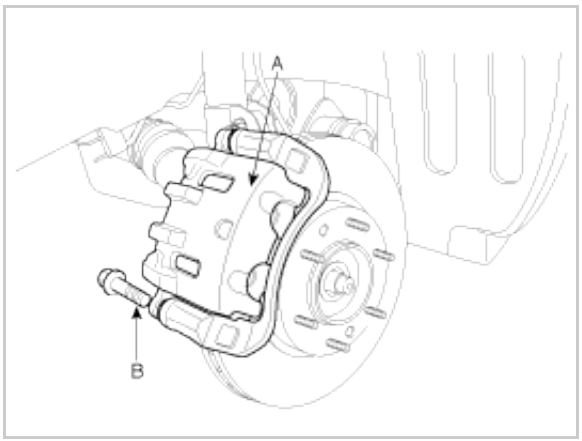
If you are reusing the pads, always reinstall the brake pads in their original positions to prevent a momentary loss of braking efficiency.



3. Insert the piston in the cylinder using the special tool (09581-11000).



4. Push in the piston (A) so that the caliper will fit over the pads. Make sure that the piston boot is in position to prevent damaging it when pivoting the caliper down.
5. Being careful not to damage the pin boot, install the guide rod bolt (B) with the specified torque.



6. If caliper assembly was removed, install the brake hose to the caliper.
7. Refill the master cylinder reservoir to the MAX line.
8. Bleed the brake system.(Refer to 'Bleeding of ABS system')
9. Depress the brake pedal several times to make sure the brakes work, then test-drive.

NOTICE

Engagement of the brake may require a greater pedal stroke immediately after the brake pads have been replaced as a set. Several applications of the brake will restore the normal pedal stroke.

10. After installation, check for leaks at hose and line joints or connections, and retighten if necessary.

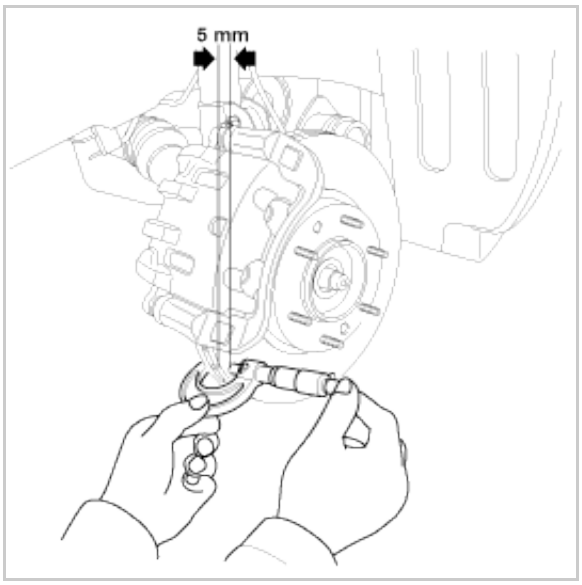
INSPECTION

FRONT BRAKE DISC THICKNESS CHECK

1. Remove all rust and contramination from the surface, and measure the disc thickness at 8 points, at least, of same distance (5mm) front the brake disc outer circle.

Front brake disc thickness
Standard value : 28 mm(1.10 in)
Limit : 26 mm(1.02 in)

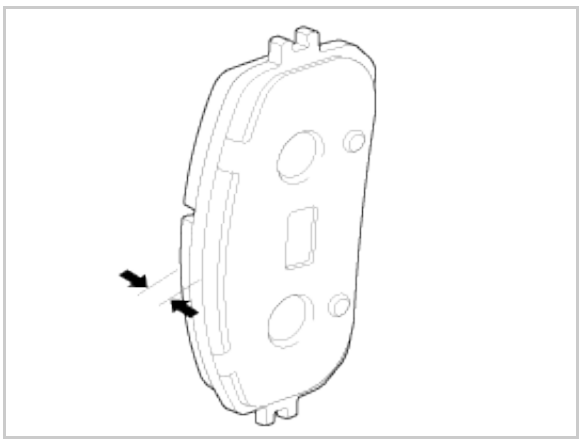
2. Thickness variation should not exceed 0.005mm (0.0002 in) (circumference) and 0.01 mm (0.0004 in)(radius) at any directions.
3. If wear exceeds the limit, replace the discs and pad assemblies on the left and right sides of the vehicle.



FRONT BRAKE PAD CHECK

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

Pad thickness
Standard value : 11 mm (0.43 in)
Service limit : 2 mm (0.0787 in)



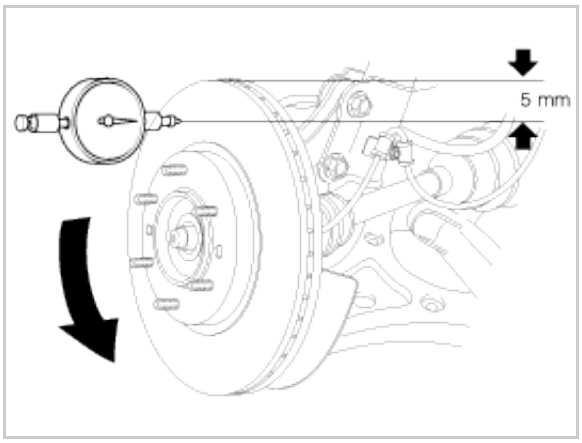
2. Check that grease is applied, to sliding contact points and the pad and backing metal for damage.

FRONT BRAKE DISC RUN OUT CHECK

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

Brake disc run out
Limit : 0.03 mm (0.0012 in.) 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 180° 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.

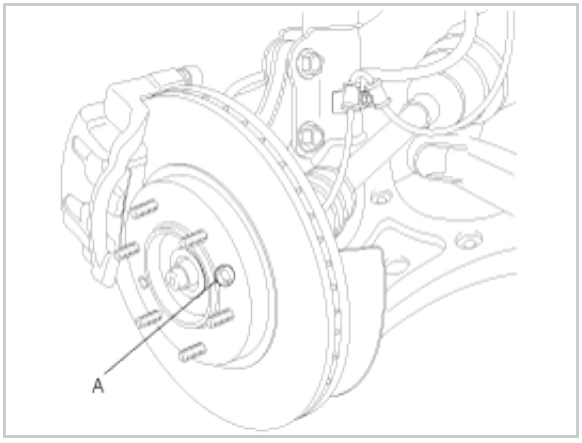


Seizing of Front brake disc

1. Remove the brake disc from hub using an M8 screw(A) if the brake disc has been seized with the hub due to corrosion or overheating.

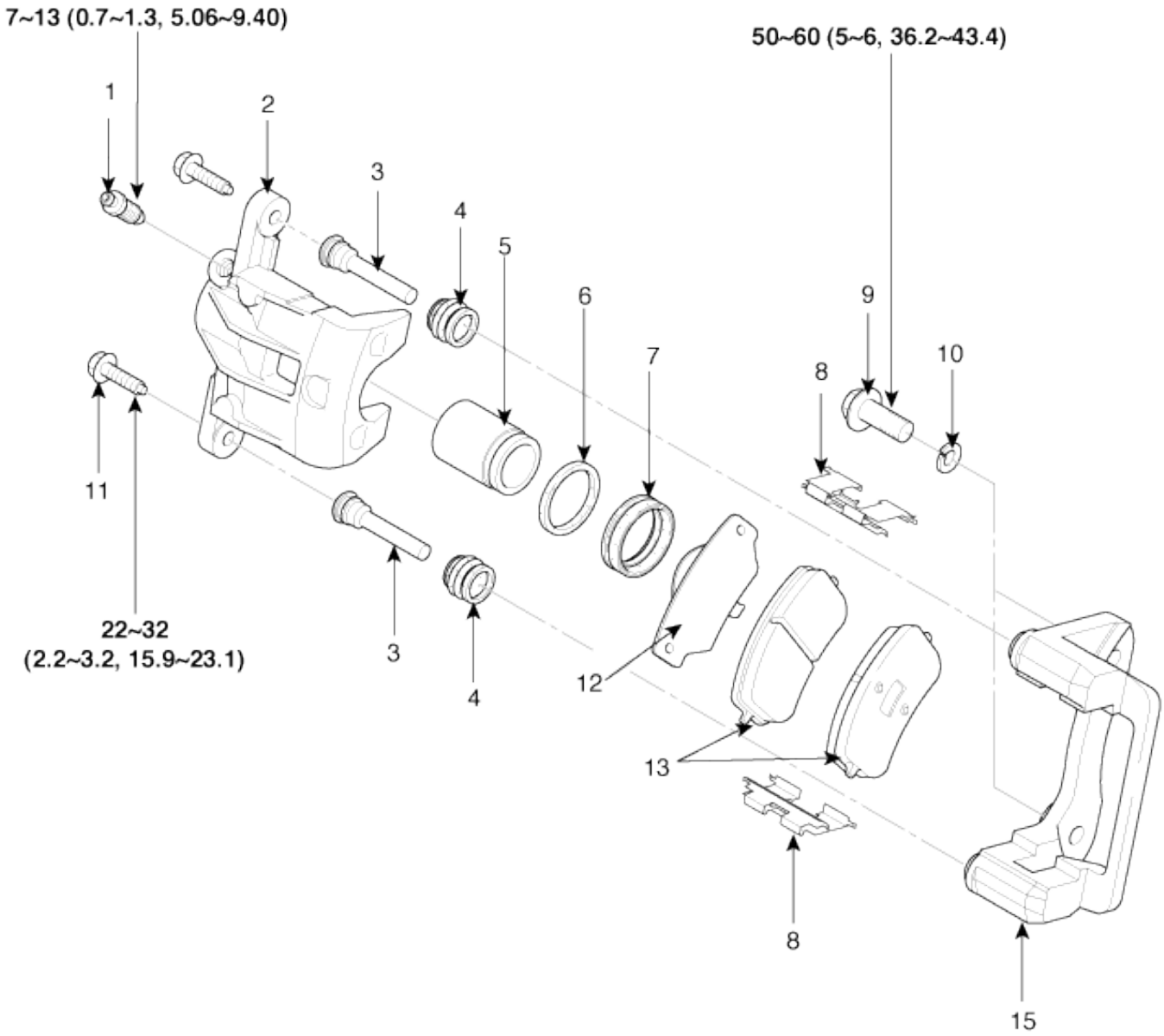
NOTICE

Be careful not to use a hammer. The disc can be damaged if you remove the disc from the hub by hammering.



Rear Disc Brake

COMPONENTS

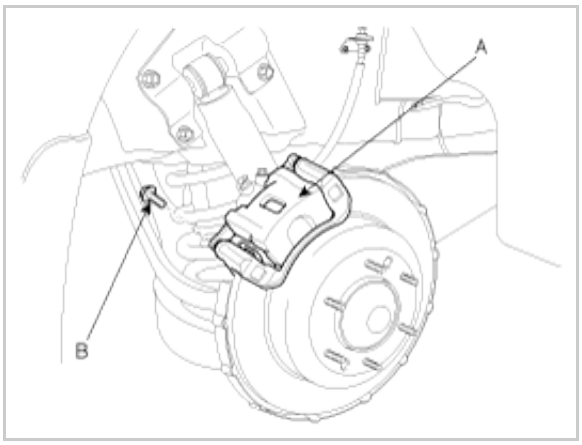


TORQUE : Nm (kgf.m, lb-ft)

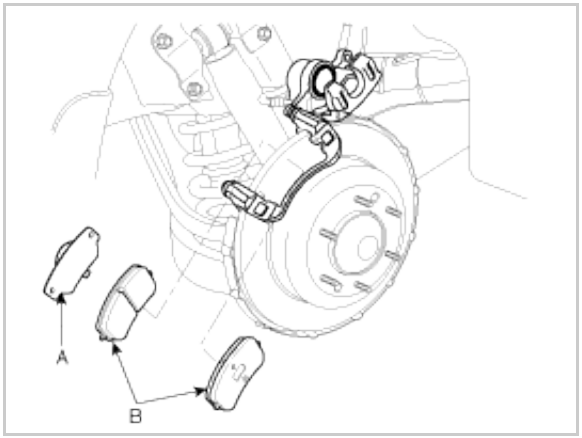
1. Bleeder screw
2. Caliper body
3. Guide rod
4. Boot
5. Piston
6. Piston seal
7. Piston boot
8. Pad retainer
9. Caliper mounting bolt
10. Washer
11. Guide rod bolt
12. Inner shim
13. Brake Pad
14. Outer shim
15. Caliper bracket

REMOVAL

1. Raise the rear of the vehicle and make sure it is securely supported. Remove the rear wheel.
2. Remove the guide rod bolt(B), After raising the caliper assembly (A), support it with a wire.

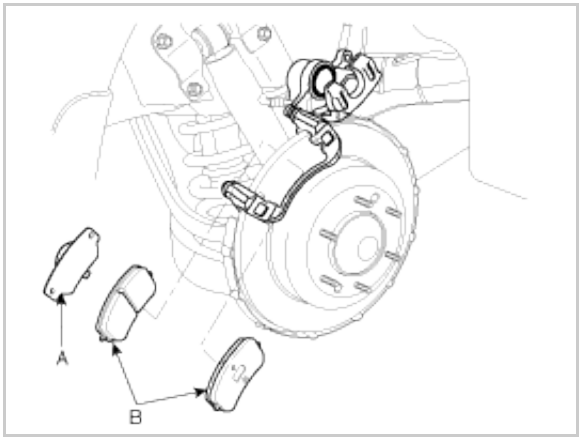


3. Remove pad shim (A), pad retainer (B) and pad assembly (C) in the caliper bracket.



INSTALLATION

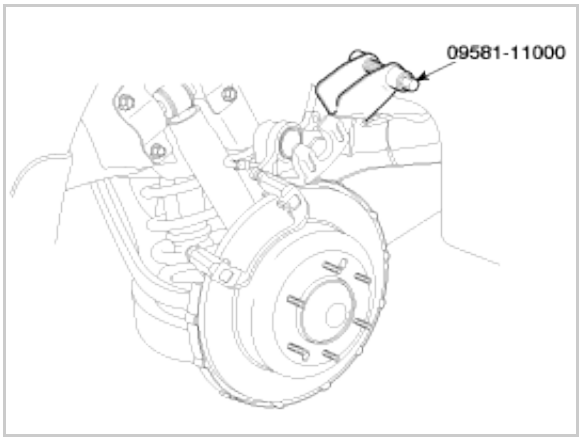
1. Install the pad retainer (A) to the caliper bracket.
2. Install the brake pads (B) and pad shims (A) and Install the pad with the wear indicator (C) on the inside.



CAUTION

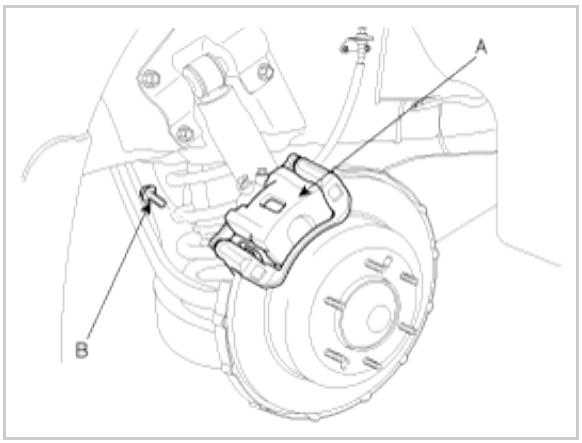
If you reuse the pads, check for foreign material between the pad shim (A) and the back of the pads (B) and reinstall the brake pads in their original position to prevent a momentary loss of braking efficiency.

3. Press in the piston with the special tool (09581-11000).



4. Grease the piston boot to prevent from twisting.
5. Install the guide rod.
6. Install the cylinder assembly (A) to the disc plate.

> **CAUTION**
>
> Be careful not to damage the piston boot.



7. Install the guide rod bolt (B).

Tightening torque Nm(kgf.m,lb-ft) :
22 ~ 32 (2.2 ~ 3.2, 15.9 ~ 23.1)

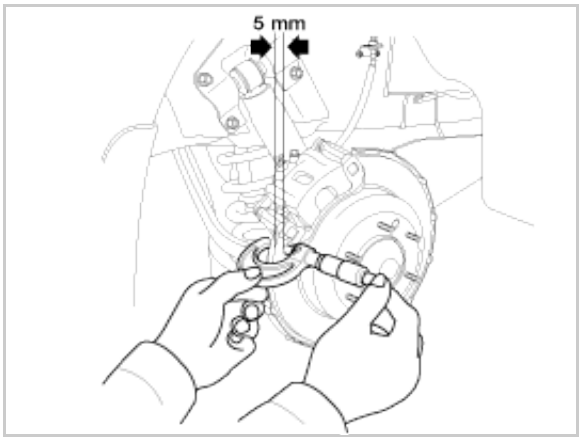
INSPECTION

REAR BRAKE DISC THICKNESS CHECK

1. Remove all rust and contamination from the disc surface, and then measure the disc thickness at 8 points, al least, of the same distance (5 mm(0.12 in)) from the brake disc outer circle.

Rear brake disc thickness
Standard value : 12.0 mm (0.47 in)
Limit : 10.4 mm (0.41 in)

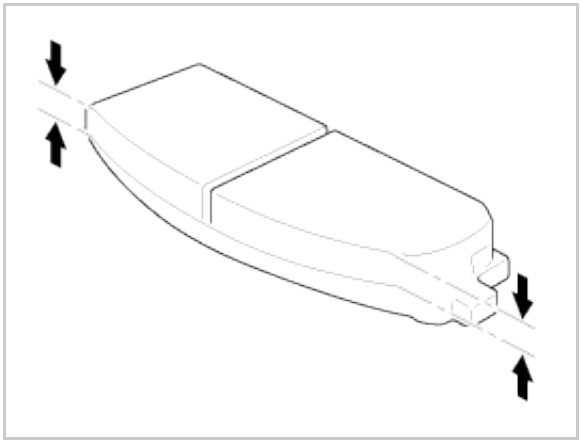
2. Thickness variation should not exceed 0.01 mm(0.0004 in) (circumference) and 0.01 mm(0.0004 in) (radius) at any directions.
3. If wear exceeds the limit, replace the discs and pad assembly for left and right of the vehicle.



REAR BRAKE PAD CHECK

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

Pad thickness
Standard value :
10.0 mm (0.39 in)
Service limit : 2.0 mm (0.08 in)

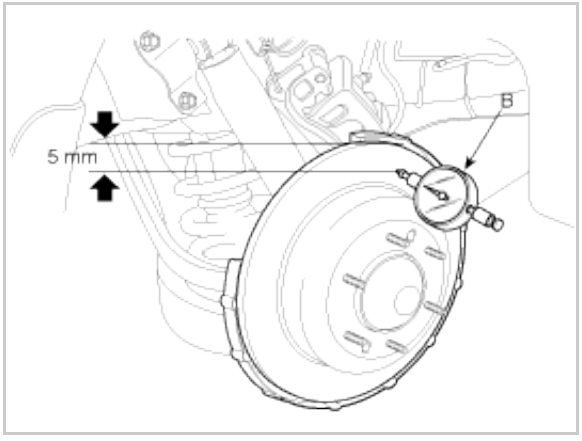


2. Check that grease is applied, and the pad and backing metal for damage.

REAR BRAKE DISC RUN OUT CHECK

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

Brake disc run out
Limit : 0.05 mm (0.002 in) or less (new one)



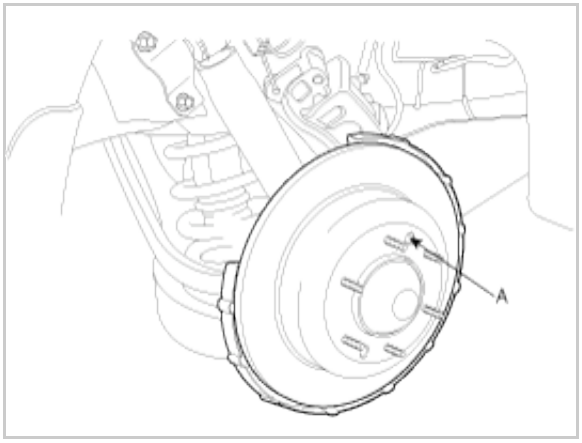
2. If the run out of the brake disc exceeds the limit specification, replace the disc, and then measure the run out again.

3. If the run out does not exceed the limit specification, install the brake disc after turning it 180° 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.

Seizing of Rear brake disc

1. Remove the brake disc from hub using an M8 screw (A) if the brake disc has been seized with the hub due to corrosion or overheating.

> **NOTICE**
>
> Be careful not to use a hammer. The disc can be damaged if you remove the disc from the hub by hammering.

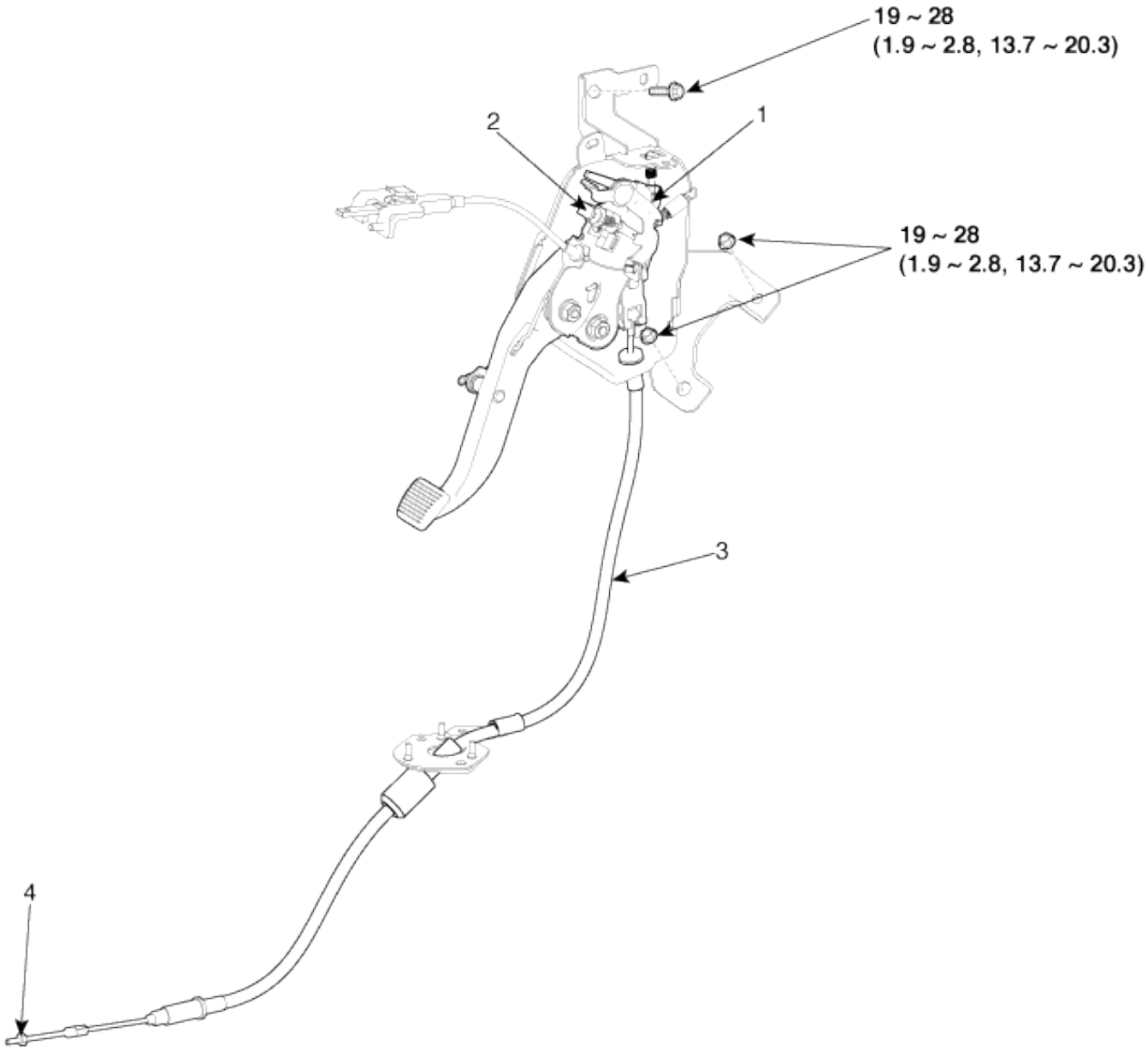


Parking Brake System

Parking Brake Assembly

COMPONENTS(1)

[LHD]

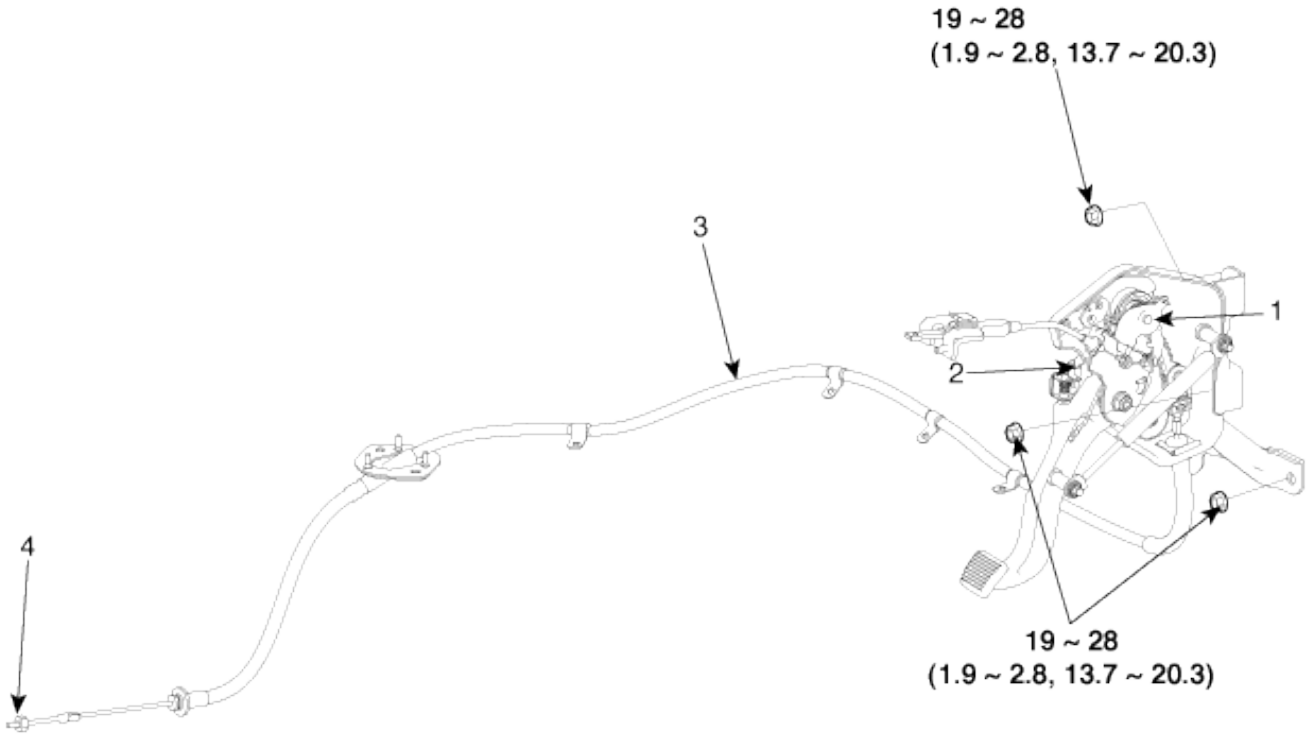


TORQUE : Nm (kgf.m, lb-ft)

1. Parking brake pedal assembly
2. Parking brake switch assembly
3. Parking brake cable
4. Adjusting nut

COMPONENTS(2)

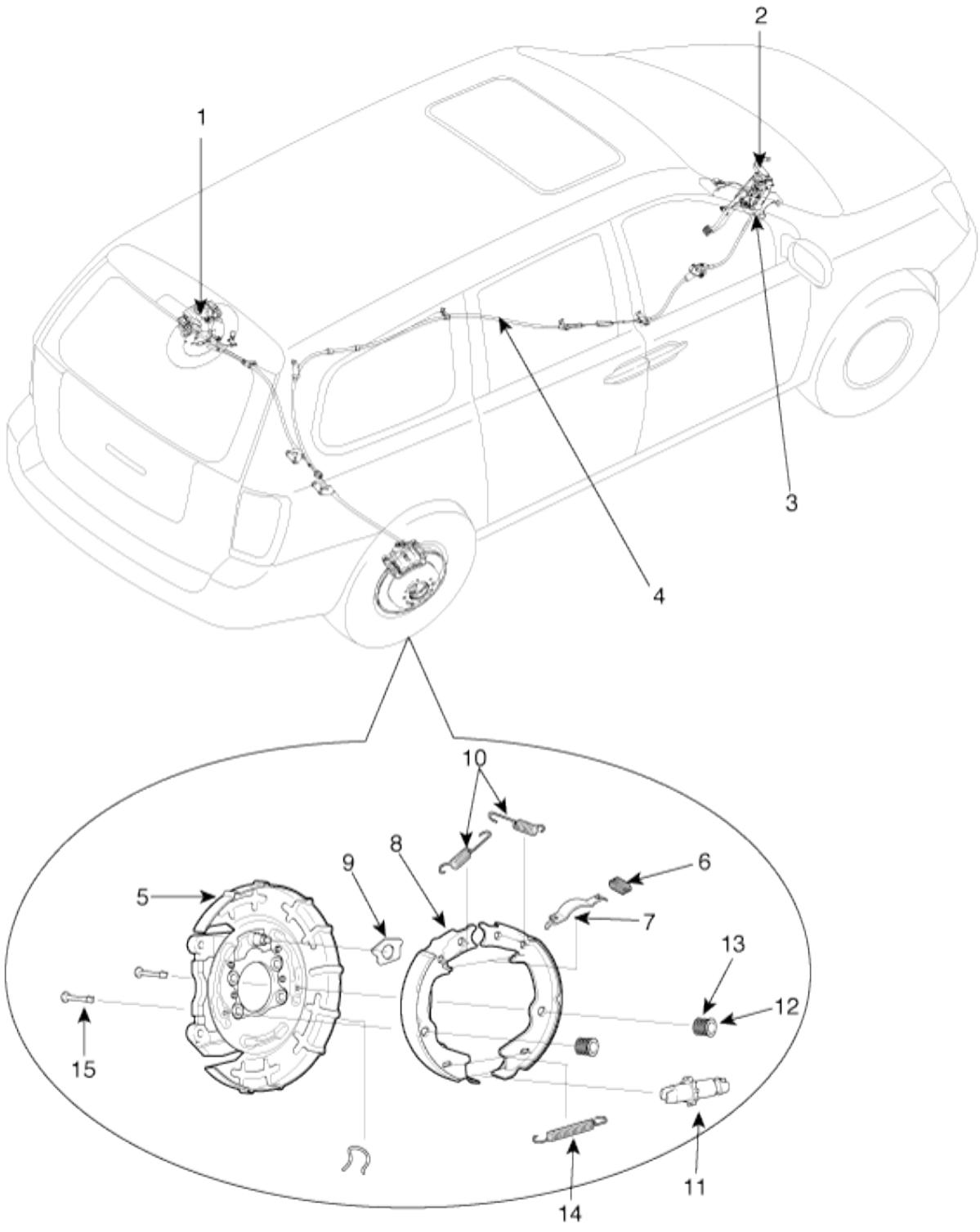
[RHD]



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

1. Parking brake pedal assembly
2. Parking brake switch assembly
3. Parking brake cable
4. Adjusting nut

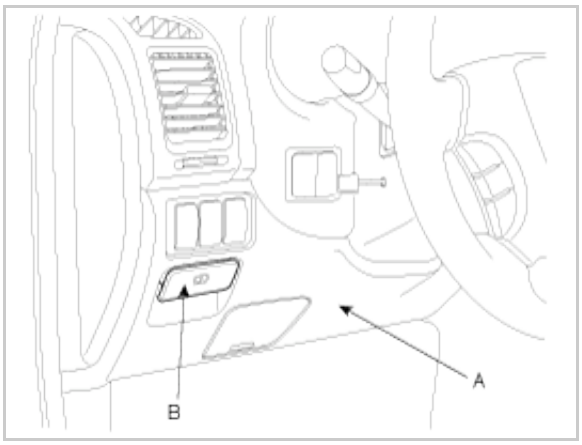
COMPONENTS(3)



1. Rear brake caliper
2. Parking brake lever
3. Parking brake switch
4. Parking brake cable
5. Backing plate
6. Strut spring
7. Strut
8. Shoe & lining
9. Shoe guide
10. Return spring
11. Adjuster
12 .Cup washer
13. Shoe hold down spring
14. Return spring
15. Shoe hold down pin

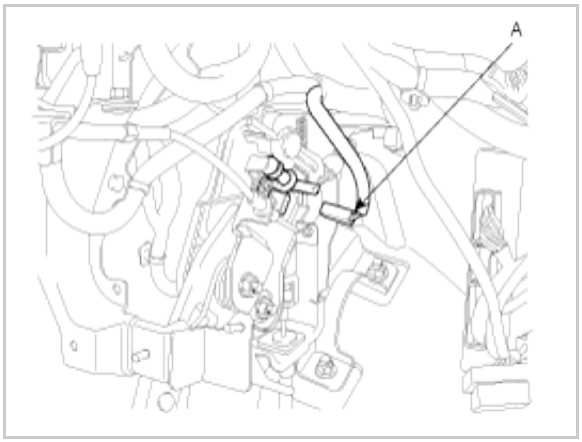
REMOVAL

1. Remove the lower panel (A), after loosening the parking lever. (Refer to BD group 'Crash pad')

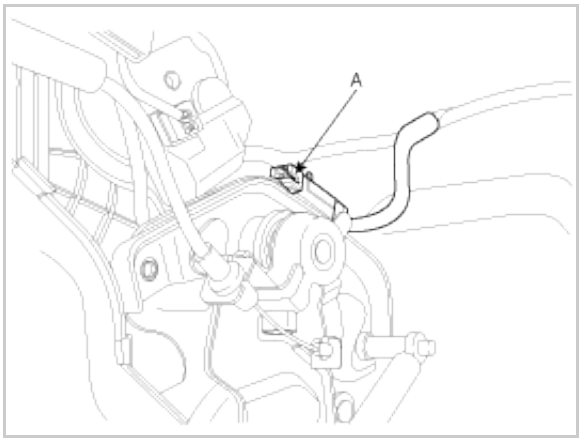


2. Remove the parking release nose (B).
3. Remove the parking brake switch (A).

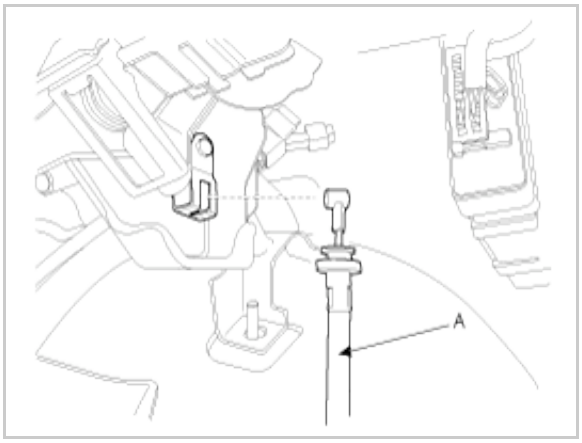
[LHD]



[RHD]

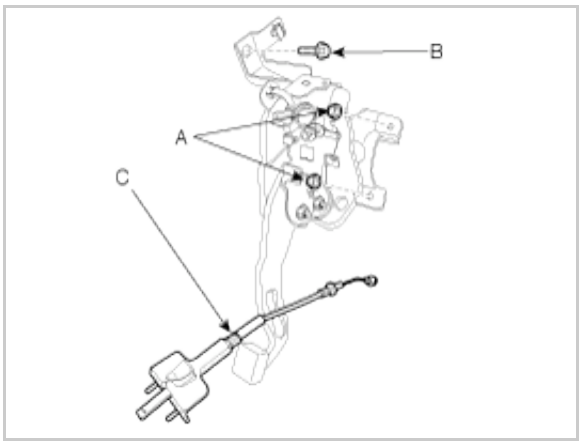


4. Remove the parking brake cable (A).

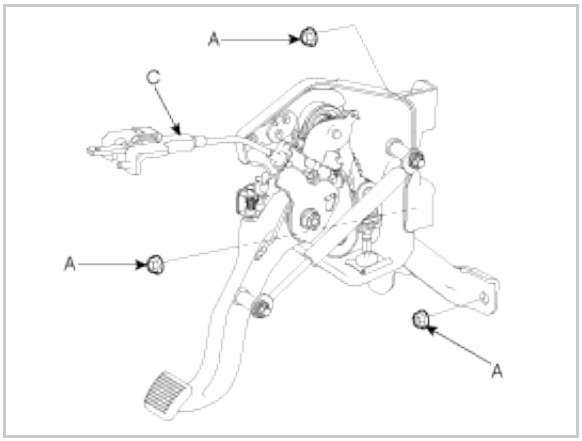


5. Remove the mounting nuts (A) and bolt (B) of the parking brake bracket.

[LHD]

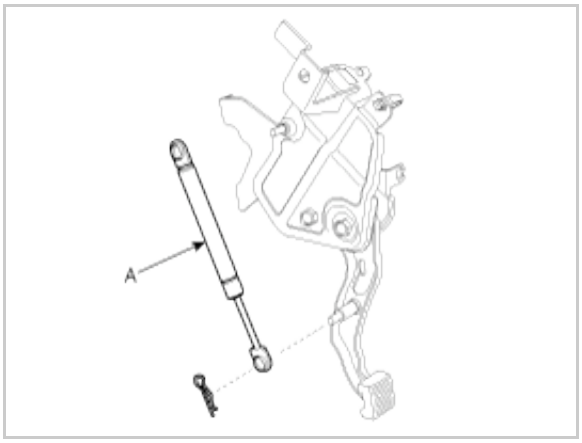


[RHD]

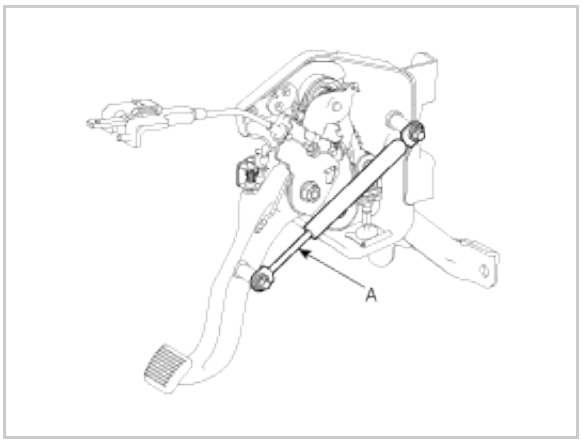


6. Remove the release cable assembly (C).
7. Remove the damper assembly (A).

[LHD]

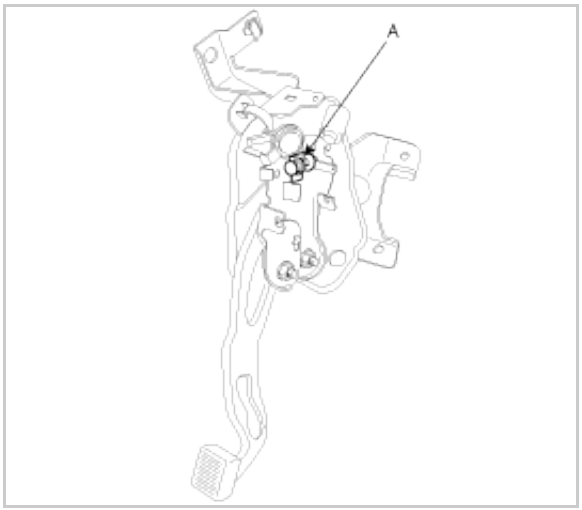


[RHD]

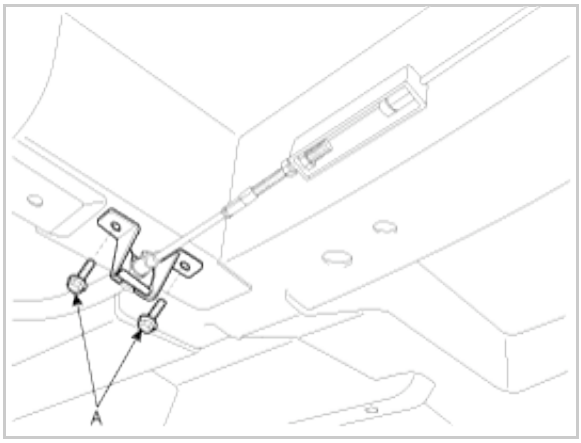


8. Remove the parking brake lamp switch (A).

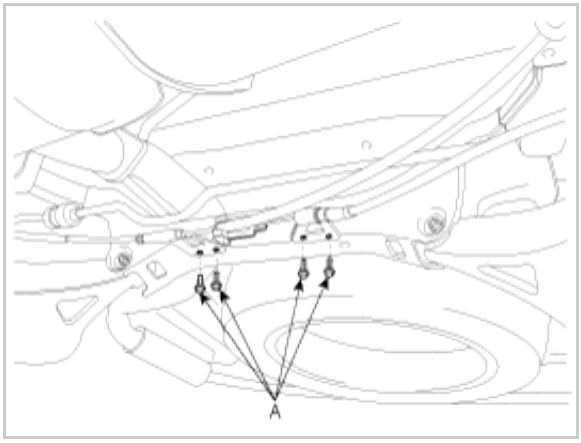
[LHD]



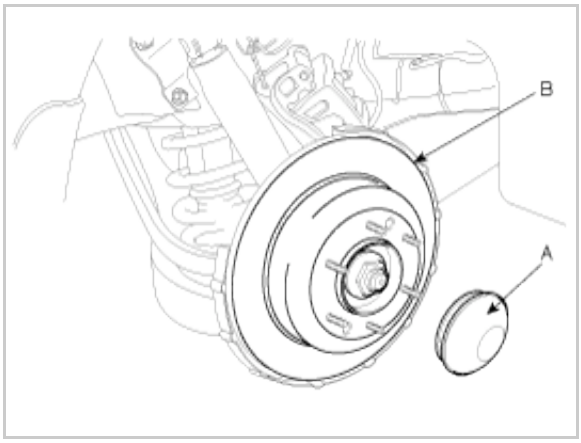
9. Raise the rear of the vehicle and make sure it is securely supported.
10. Remove the mounting bolt (A) of the parking brake wire bracket from the body.



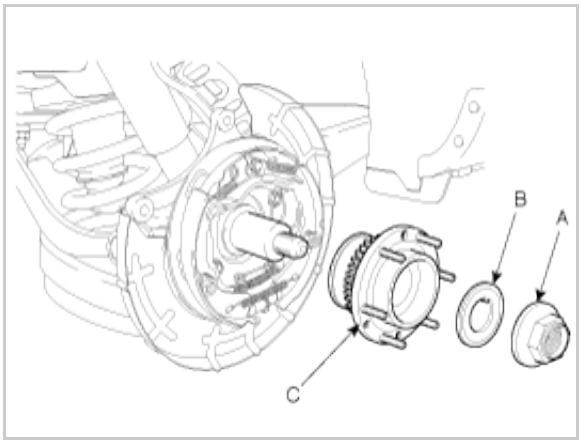
11. Remove the four mounting bolts (A) of the parking brake wire bracket from the rear cross member.



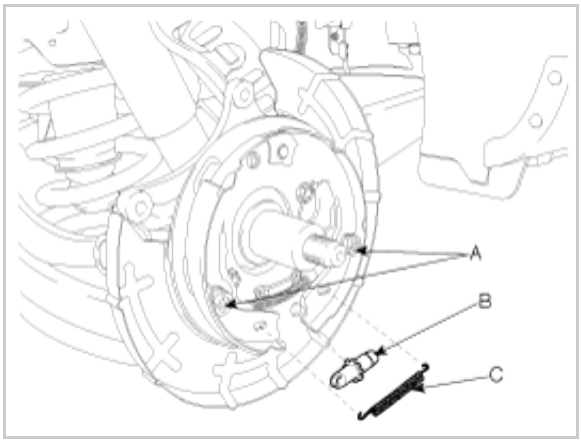
12. Remove the rear wheels and tires from the rear hubs.
13. Remove the hub cap (A) and the disc (B).



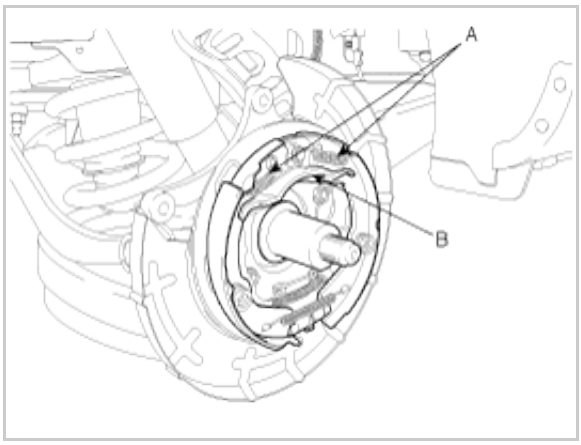
14. Remove the hub nut (A) and washer (B) and remove the rear hub (C).



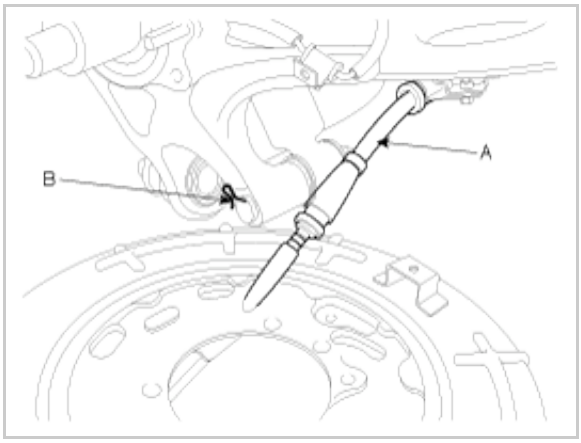
15. Remove the shoe hold down pin and spring (A) by pressing and rotating the spring.



16. Remove the adjuster assembly (B) and the lower return spring (C).
17. Remove the strut (B) and the upper return spring (A).



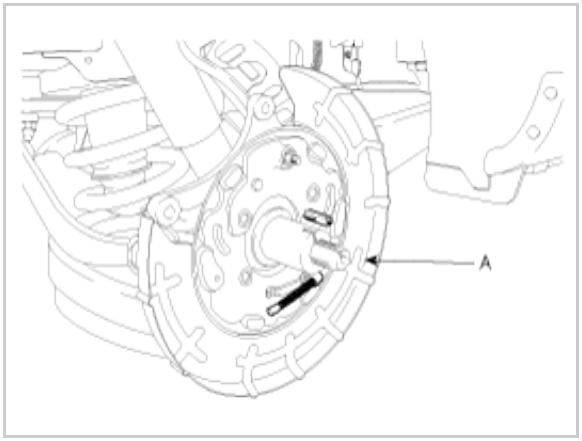
18. Remove the retaining ring (B) of the parking brake wire (A) from back of the backing plate.



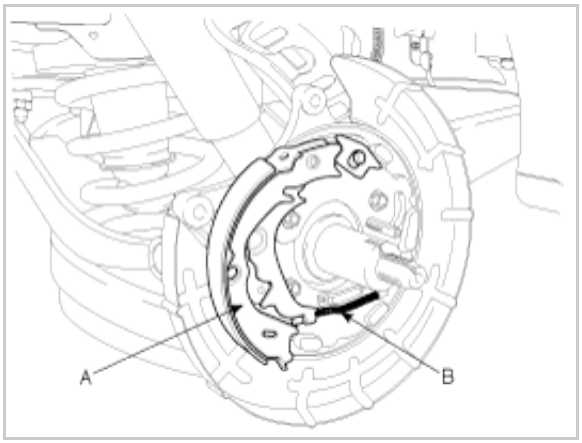
19. Disconnect the parking brake wire from the brake shoe.

INSTALLATION

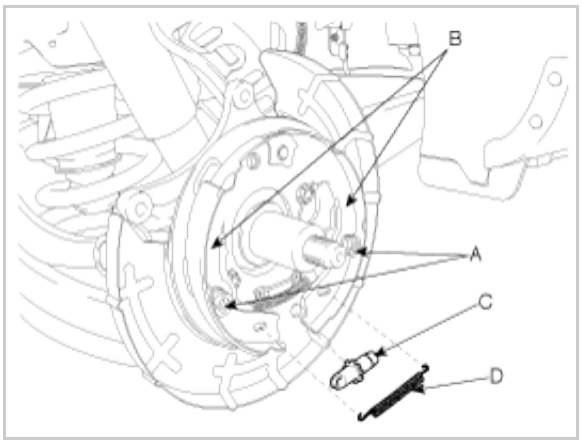
1. Install the backing plate (A).



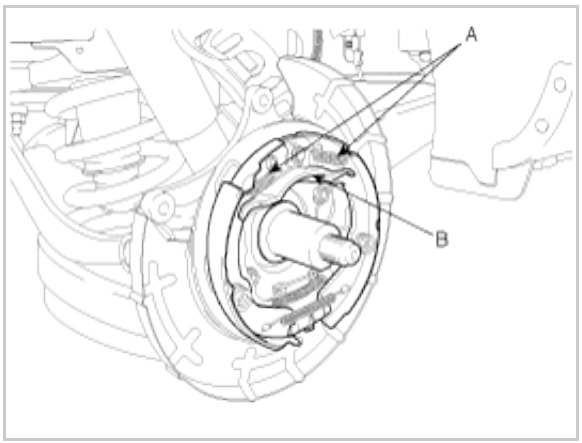
2. Connect the parking brake wire (B) to the brake shoe (A).



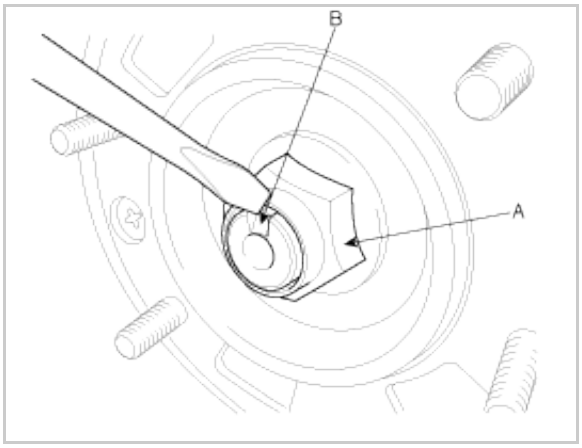
3. Install the shoe hold down pin and spring (A) to hold the brake shoe (B).



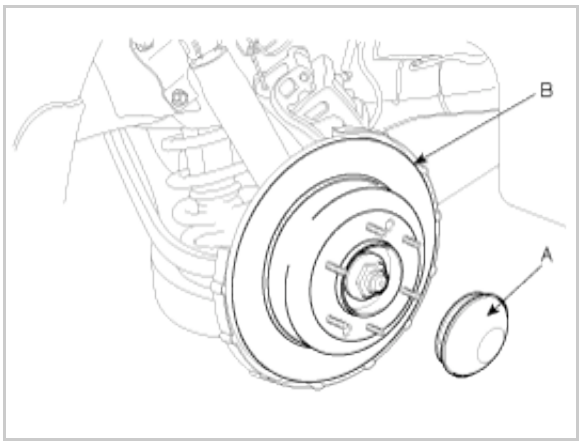
4. Install the adjuster assembly (B) and the lower return spring (C).
5. Install the upper return spring (A) and strut (B).



6. Grease where is necessary.
7. Install the rear hubs.
8. Install the hub nut (A). After installation, lock the nut to the spindle as shown in the illustration.



9. Install the hub cap (A) and the disc (B).

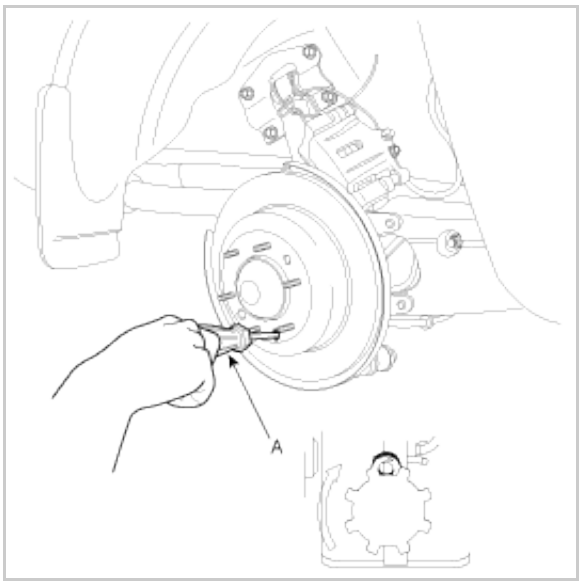


10. Install the rear wheels and tires from the rear hubs.
11. Tighten the parking brake adjusting nut.
12. Install the parking brake wire and the pedal assembly.

ADJUSTMENT

ADJUSTMENT OF REAR BRAKE SHOE CLEARANCE

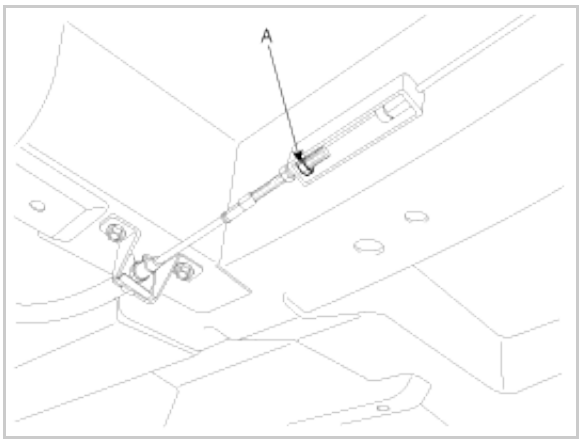
1. Raise the vehicle, and make sure it is securely supported.
2. Remove the rear wheel and tire from the rear hub.
3. After removing the plug from the disc, rotate the toothed wheel by a screw driver until the disc is not moving, and then return it by 5 notches.



ADJUSTMENT PRECEDURE OF DIH FOOT PARKING BRAKE

1. Adjust the adjusting nut (A) so that parking pedal stoke is to be 88 ~ 98 mm(3.46 ~ 3.86 in) when operating effort

is 200 N(20 kgf, 44 lb) after full stroke operation of parking pedal over 3 times for setting parking wire.



CAUTION

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

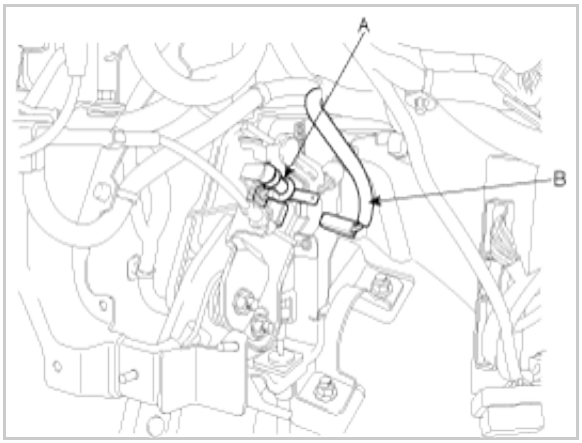
BED-IN PROCEDURE FOR DIH FOOT PARKING BRAKE

Parking Brake Switch

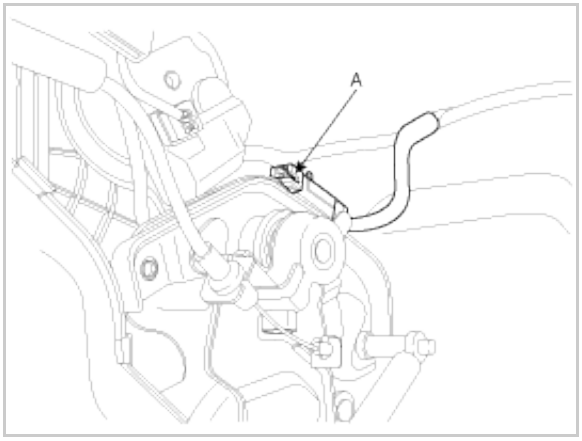
INSPECTION

1. Remove the floor console and the connector (B) from the switch (A).

[LHD]



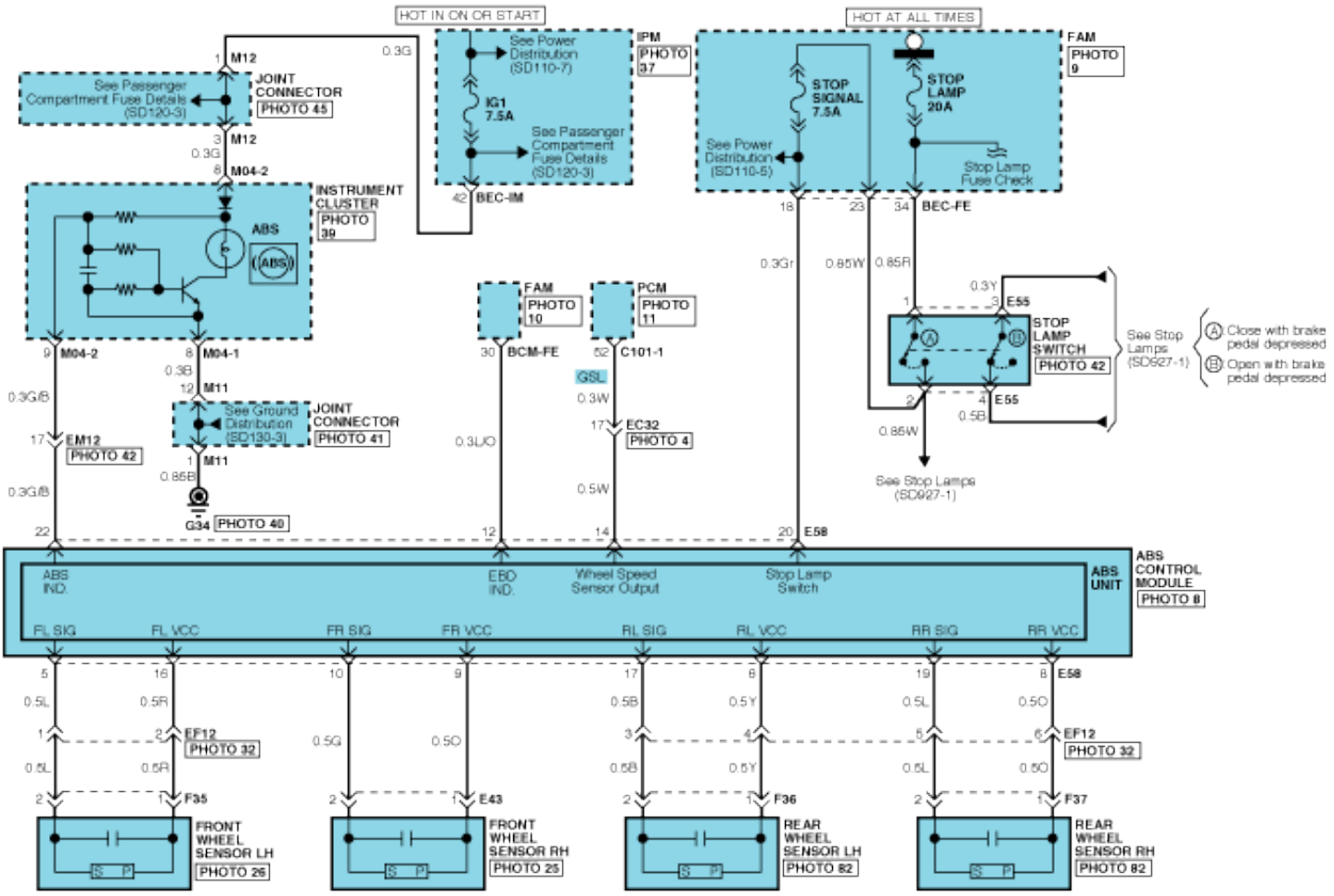
[RHD]



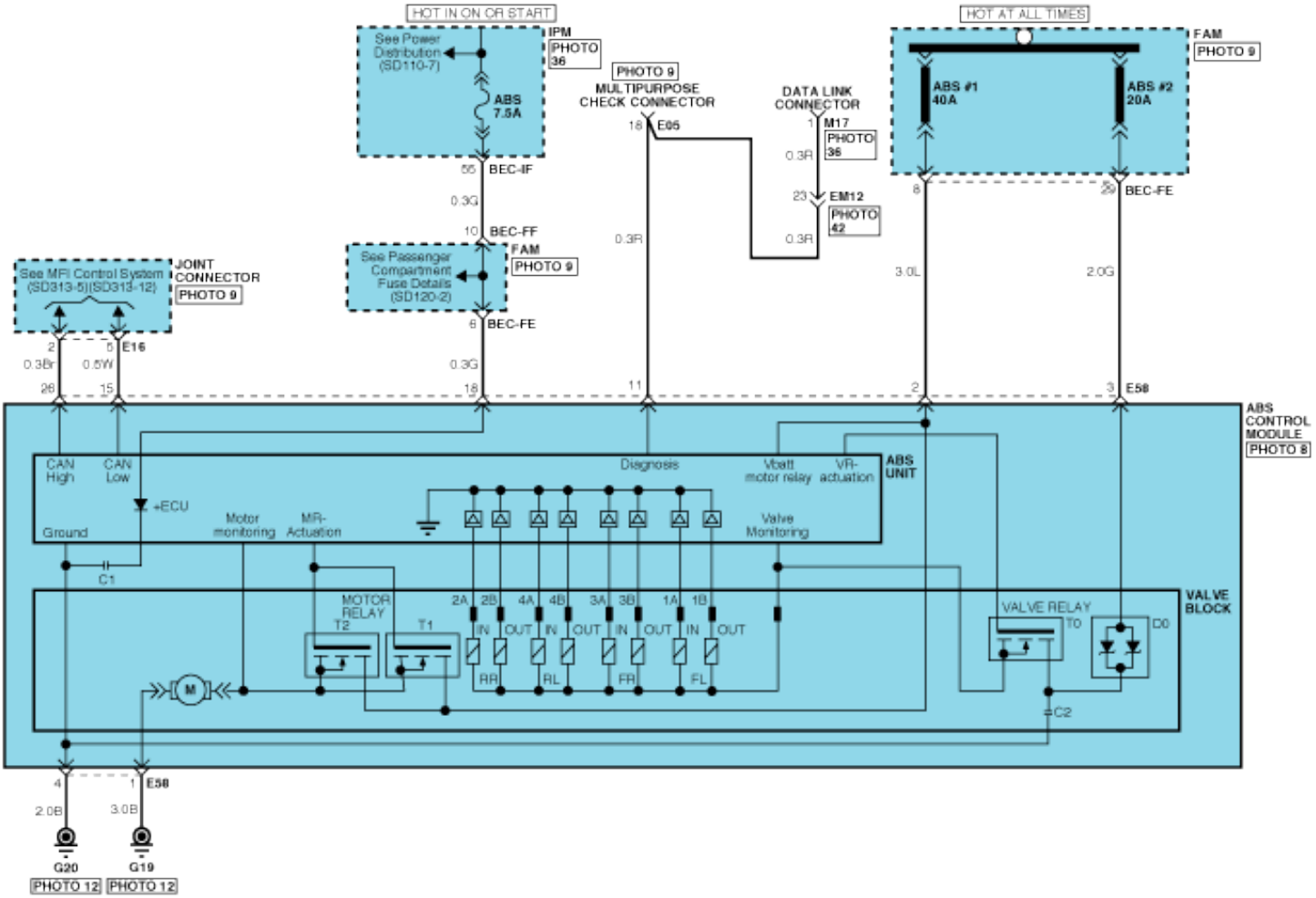
2. Inspect the continuity between (-) terminal and the ground.
   a. When the brake lever is pulled, there should be the continuity between them.
   b. When the brake lever is released, there should be no continuity between them.

ABS
(Anti-lock Brake System)

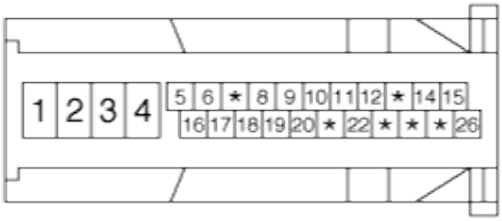
ABS CIRCUIT DIAGRAM(1)



ABS CIRCUIT DIAGRAM(2)



ECU CONNECTOR INPUT/OUTPUT(ABS)



Wire No.	Designation	Current		max.permissible wire resistance R_L (mΩ)	min.leakage resistance R_P (kΩ)
		max	min		
1	Ground for recirculation pump	20~39 A	10 A	10	
4	Ground for solenoid valves and ECU	5~15 A	2.5 A	10	
2	Voltage supply for pump motor	20~39 A	10 A	10	200
3	Voltage supply for solenoid valves	5~15 A	2 A	10	200

18	Voltage for hybrid ECU	1 A	500 mA	60	200
5,10,17,19	signal wheel speed sensor FL, FR, RL,RR	6 mA	16 mA	250	200 to ground 1.5M to bat
16,9,6,8	Voltage supply for the active wheel speed sensor FL,FR, RL, RR	6 mA	16 mA	250	200 to ground 1.5M to bat
14,24	wheel speed sensor output (FR, RL)	20 mA	10 mA	250	200
11	Diagnostic wire K	6 mA	3 mA	250	200
22	ABS-warning lamp actuation	30 mA	5 mA	250	200
12	EBD-warning lamp actuation	30 mA	5 mA	250	200
20	brake light switch	10 mA	5 mA	250	200
15	CAN Low	30 mA	20 mA	250	200
26	CAN High	30 mA	20 mA	250	200

ABS HECU CONNECTOR

Connector terminal		Specification	Condition
Number	**Description**		
1	Ground for recirculation pump	Current range: Min.10A Max.20~39A	Always
4	Ground for solenoid valves and ECU	Current range: Min.2.5A Max.5~15A	Always
2	Voltage supply for pump motor	Battery voltage	Always
3	Voltage supply for solenoid valves		
16	Voltage supply for the active wheel speed sensor FL,FR, RL, RR	Battery voltage	IG ON
9			
6			
8			
5	signal wheel speed sensor FL, FR, RL,RR	Voltage(High) : 0.89~1.26 V Voltage (Low) : 0.44~0.63 V	On driving
10			
17			
19			
11	Diagnostic wire K	Voltage (High) ≥ 0.8 * IG ON Voltage (Low) ≤ 0.2 * IG ON	On SCAN TOOL communication
18	Voltage for hybrid ECU	Battery voltage	KEY ON/OFF
20	Brake light switch	Voltage (High) ≥ 0.8 * IG ON Voltage (Low) ≤ 0.3 * IG ON	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	-	

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.

a. Input of signal from Pressure sensor, Steering angle sensor, Yaw & Lateral G sensor, the wheel speed sensors attached to each wheel.
b. Control of braking force / traction force/ yaw moment.
c. Failsafe function.
d. Self diagnosis function.
e. Interface with the external diagnosis tester.

Installation position : engine compartment

a. Brake tube length from Master cylinder port to HECU inlet port should be max. 1m
b. 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

a. 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.
b. 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.

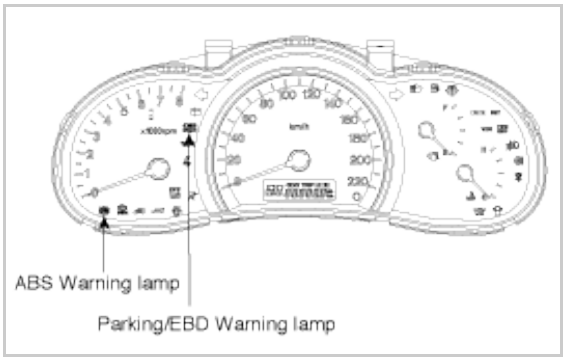
Pump Motor Checking

The ECU performs a pump motor test at a speed of 15km/h once after IGN is switched on.

Diagnostic Interface

Failures detected by the ECU are encoded on the ECU, stored in a EEPROM and read out by diagnostic equipment when the ignition switch is turned on.
The diagnosis interface can also be used for testing the ECU during production of the ECU and for actuating the HCU (Air-bleeding line or Roll and Brake Test line).

Warning Lamp module



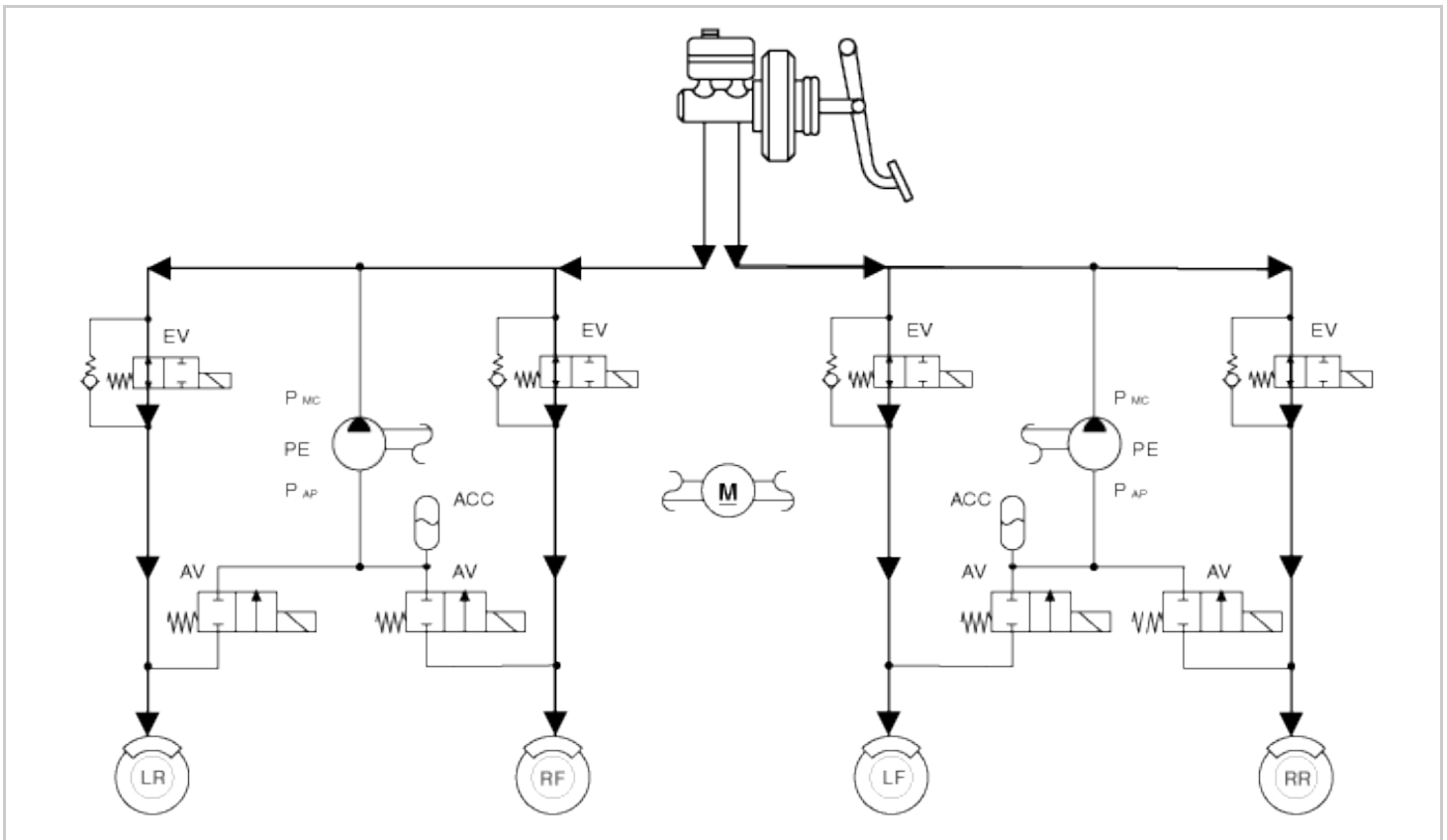
1. ABS WARNING LAMP MODULE
   The active ABS warning lamp module indicates the selftest and failure status of the ABS.The ABS warning lamp shall be on:
   a. During the initialization phase after IGN ON. (continuously 3 seconds).
   b. In the event of inhibition of ABS functions by failure.
   c. During diagnostic mode.
   d. When the ECU Connector is seperated from ECU.

2. PARKING/EBD WARNING LAMP MODULE
   The active EBD warning lamp module indicates the selftest and failure status of the EBD.However, in case the Parking Brake Switch is turned on, the EBD warning lamp is always turned on regardless of EBD functions.The EBD warning lamp shall be on:
   a. During the initialization phase after IGN ON. (continuously 3 seconds).
   b. When the Parking Brake Switch is ON or brake fluid level is low.
   c. When the EBD function is out of order.
   d. During diagnostic mode.
   e. When the ECU Connector is seperated from ECU.

ABS CONTROL

1. NORMAL BRAKING without ABS

	Inlet valve(EV)	Outlet valve(AV)	Pump motor
Operation	Open	Close	OFF

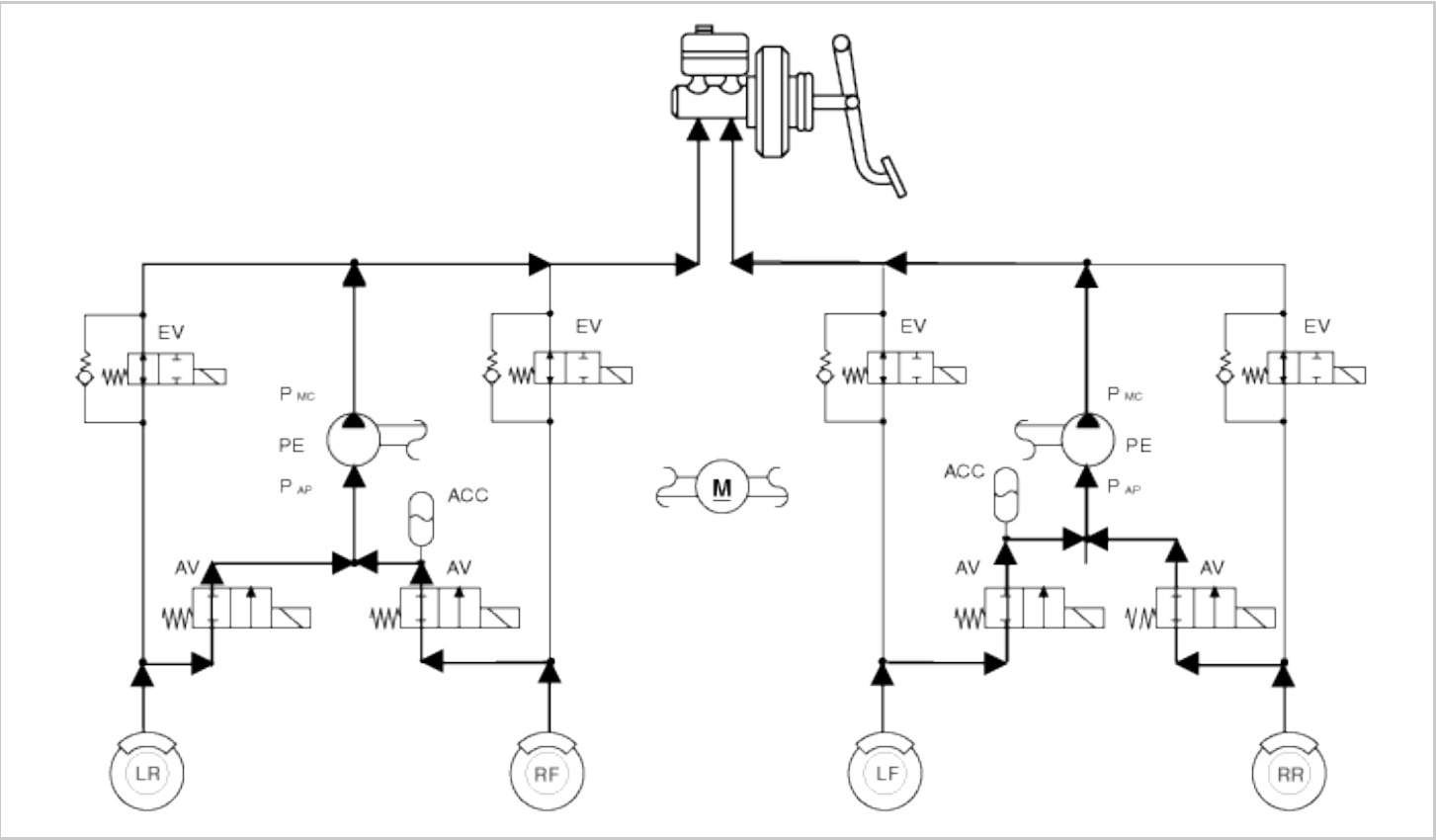


NOTICE

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)

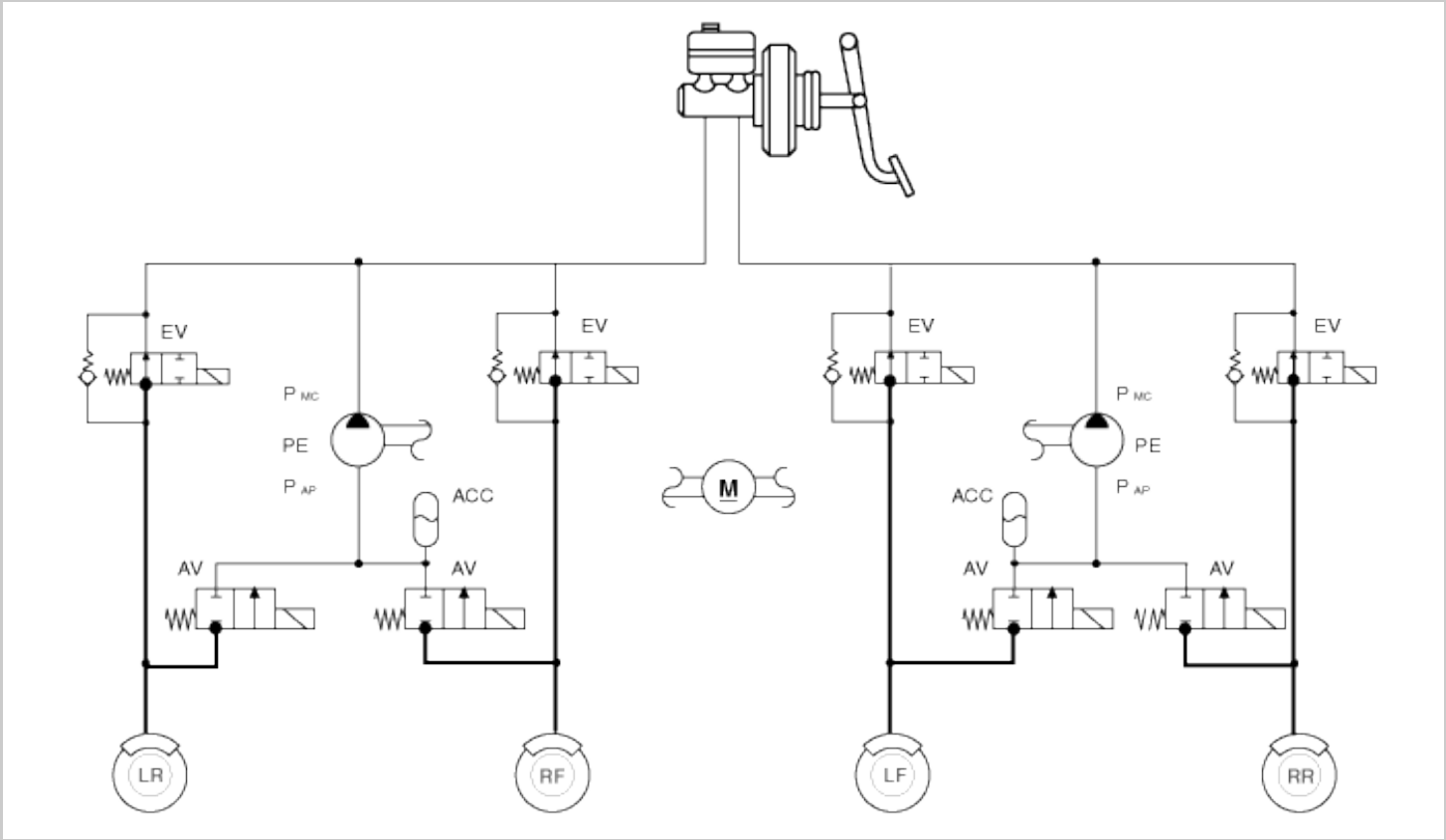


NOTICE

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

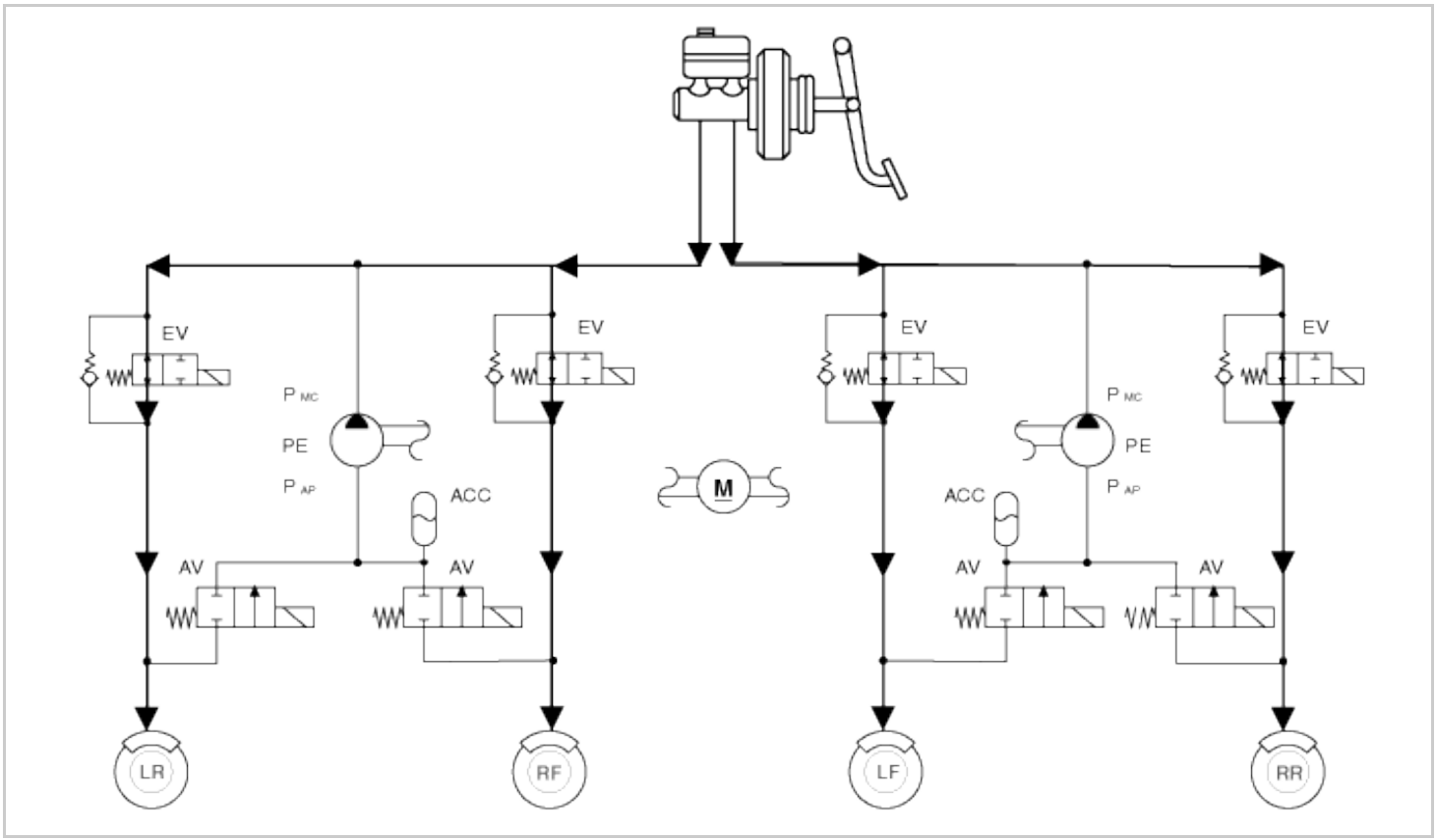


NOTICE

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

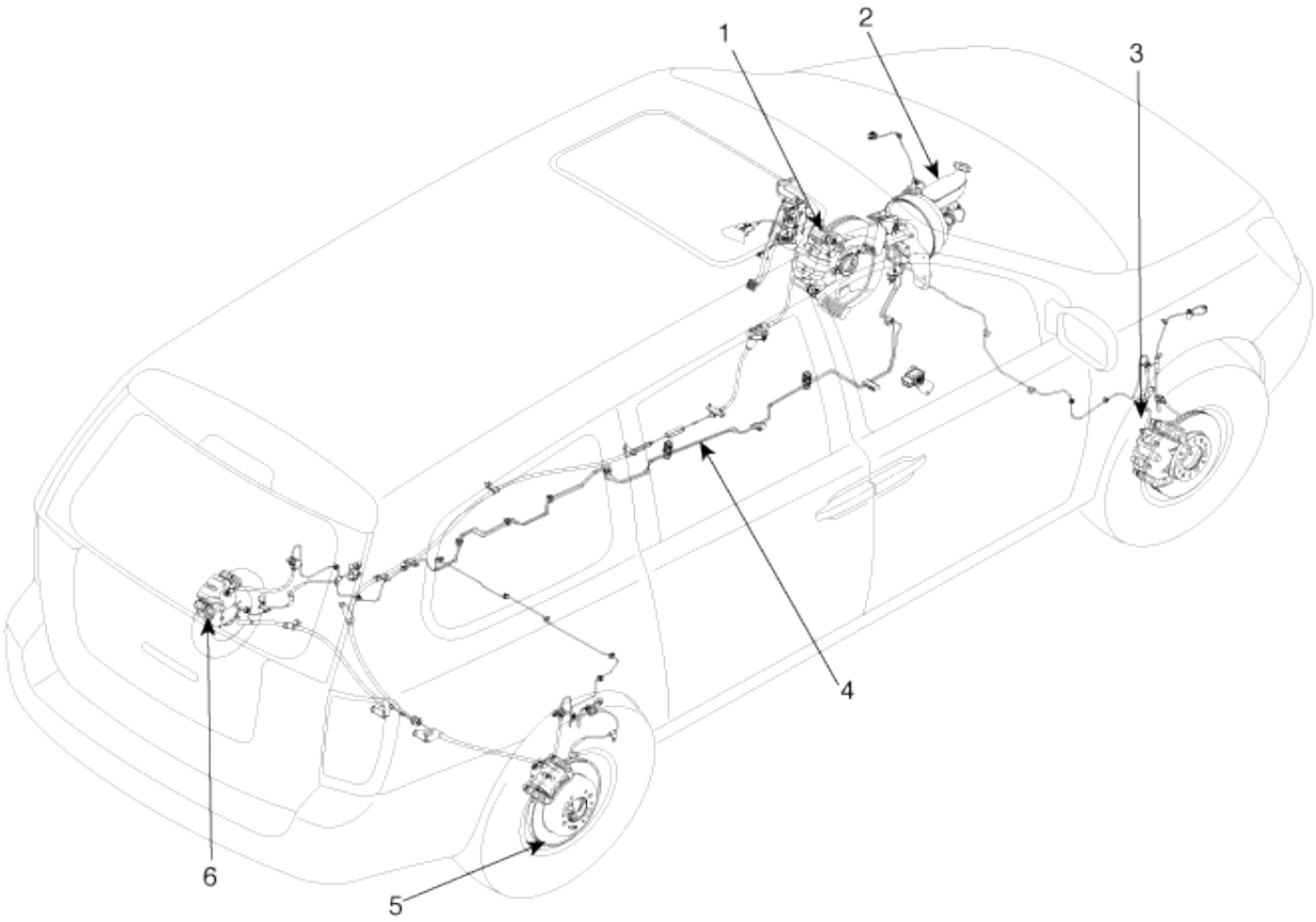
	Inlet valve(EV)	Outlet valve(AV)	Pump motor
Operation	Open	Close	OFF



NOTICE

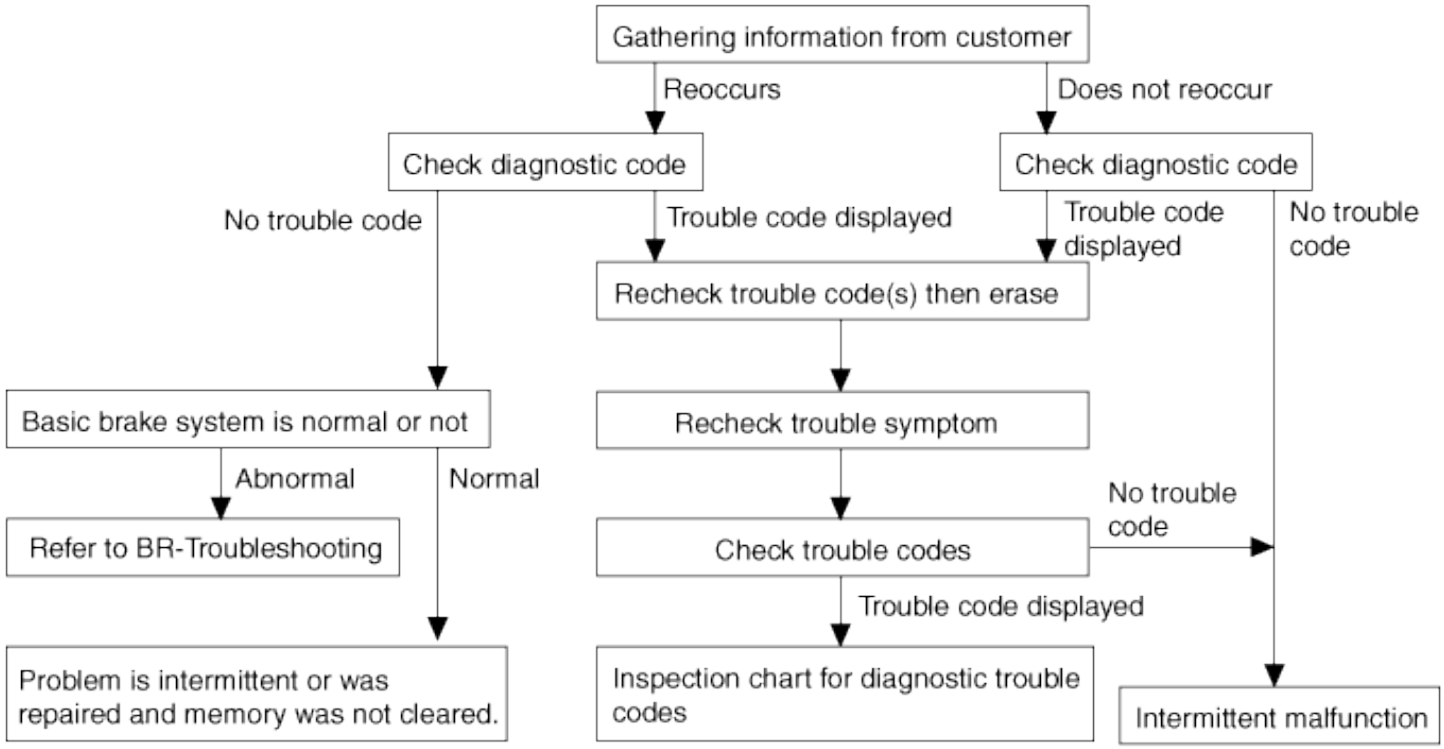
EV : Inlet Valve
AV : Outlet Valve
LR : Rear left wheel
RF : Front right wheel
LF : Front left wheel
RR : Rear right wheel
PE : Pump motor

COMPONENTS



1. Front left wheel speed sensor
2. ABS control module(HECU)
3. Front right wheel speed sensor
4. Hydrauric line
5. Rear right wheel speed sensor
6. Rear left wheel speed sensor

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.**

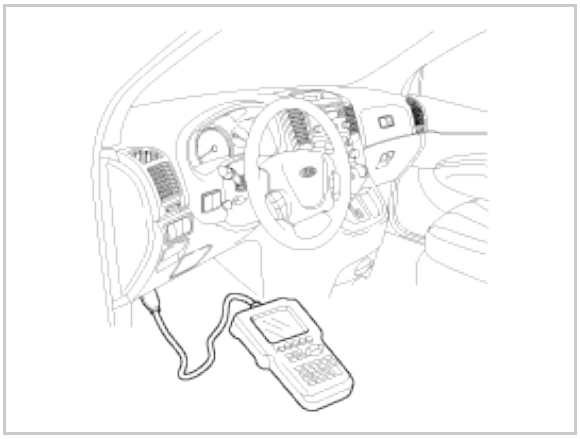
NOTES WITH REGARD TO DIAGNOSIS

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	a. Sound of the motor inside the ABS hydraulic unit operation (whine). b. Sound is generated along with vibration of the brake pedal (scraping). c. When ABS operates, sound is generated from the vehicle chassis due to repeated brake application and release (Thump : suspension; squeak: tires)
ABS operation (Long braking distance)	For road surfaces such as snow-covered and gravel roads, the braking distance for vehicles with ABS can sometimes be longer than that for other vehicles. Accordingly, advise the customer to drive safely on such roads by lowering the vehicle speed.
Diagnosis detection conditions can vary depending on the diagnosis code. When checking the trouble symptom after the diagnosis code has been erased, ensure that the requirements listed in "Comment" are met.	

SCAN TOOL (PRO) CHECK

1. Turn the ignition switch OFF.
2. Connector the Scan tool to the 16P data link connector located the driver's side kick panel.



3. Turn the ignition switch ON.
4. Check for DTC using the Scan tool
5. After completion trouble of the repair or correction of the problem, erase the stored fault codes using the scan tool.
6. Disconnect the Scan tool from the 16P data link connector.

ABS CHECK SHEET

ABS Check Sheet

Inspector's Name _____

Customer's Name		Registration No.	
		Registration Year	/ /
		VIN.	
Date Vehicle Brought In	/ /	Odometer	Km Miles

Date the Problem First Occurred	/ /
Frequency of Occurence of Problem	☐ Continuous ☐ Intermittent (times a day)

Symptoms	☐ ABS does not operate.	
	☐ ABS does not operate efficiently.	☐ Intermittent (times a day)
	ABS Warning Light Abnormal	☐ Remains ON ☐ Does not light up

Diagnostic Trouble Code Check	1st Time	☐ Normal Code	☐ Malfunction Code (Code)
	2nd Time	☐ Normal Code	☐ Malfunction Code (Code)

PROBLEM SYMPTOMS TABLE

Symptom	Suspect Area
ABS does not operate.	Only when 1. -4. are all normal and the problem is still occurring, replace the HECU. a. Check the DTC reconfirming that the normal code is output. b. Power source circuit. c. Speed sensor circuit. d. 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. a. Check the DTC reconfirming that the system is operating to specifications. b. Wheel speed sensor circuit.

	c. Stop lamp switch circuit. d. Check the hydraulic circuit for leakage.
Communication with Scan tool is not possible. (Communication with any system is not possible)	a. Power source circuit b. Diagnosis line
Communication with Scan tool is not possible. (Communication with ABS only is not possible)	a. Power source circuit b. Diagnosis line c. HECU
When ignition key is turned ON (engine OFF), the ABS warning lamp does not light up.	a. ABS warning lamp circuit b. HECU
Even after the engine is started, the ABS warning lamp remains ON.	a. ABS warning lamp circuit b. 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.	a. Inoperative power source circuit b. Inoperative wheel speed sensor circuit c. Inoperative hydraulic circuit for leakage d. 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.
   Is the system operating to specifications?

NO

▶ Check the power source circuit.

YES

▶ Erase the DTC and recheck using Scan Tool.

CHECK THE POWER SOURCE CIRCUIT.

1. Disconnect the connector from the ABS control module.
2. Turn the ignition switch ON, measure the voltage between terminal 18 of the ABS control module harness side connector and body ground.

   Specification: approximately B+

   Is the voltage within specification?

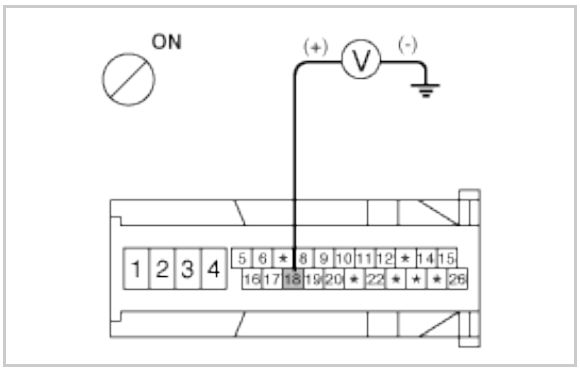
YES

▶ Check the ground circuit.

NO

▶ Check the harness or connector between the fuse (10A) in the engine compartment junction block and the ABS

control module. Repair if necessary.



CHECK THE GROUND CIRCUIT.

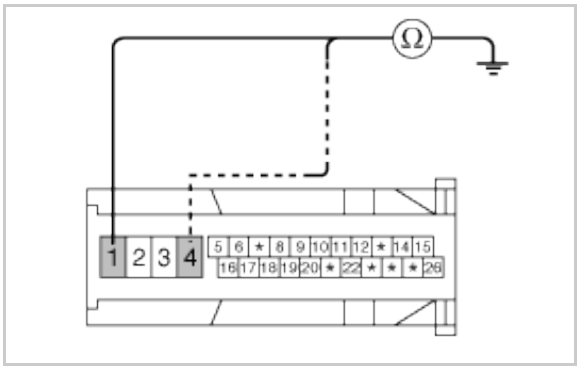
1. Disconnect the connector from the ABS control module.
2. Check for continuity between terminals 1,4 of the ABS control module harness side connector and ground point. Is there continuity?

YES

▶ Check the wheel speed sensor circuit.

NO

▶ Repair an open in the wire and ground point.



CHECK THE WHEEL SPEED SENSOR CIRCUIT.

Refer to the DTC troubleshooting procedures.
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.

Refer to the hydraulic lines.
Inspect leakage of the hydraulic lines.
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	a. Inoperative power source circuit b. Inoperative wheel speed sensor circuit

DTC is displayed, check the following probable cause. When the problem is still occurring, replace the ABS control module.	c. Inoperative hydraulic circuit for leakage d. 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.
   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.

Refer to the DTC troubleshooting procedures.
Is the system operating to specifications?

YES

▶ Check the stop lamp switch circuit.

NO

▶ Repair or replace the wheel speed sensor.

CHECK THE STOP LAMP SWITCH CIRCUIT.

1. Check that stop lamp lights up when brake pedal is depressed and turns off when brake pedal is released.
2. Measure the voltage between terminal 20 of the ABS control module harness side connector and body ground when brake pedal is depressed.

   Specification: approximately B+

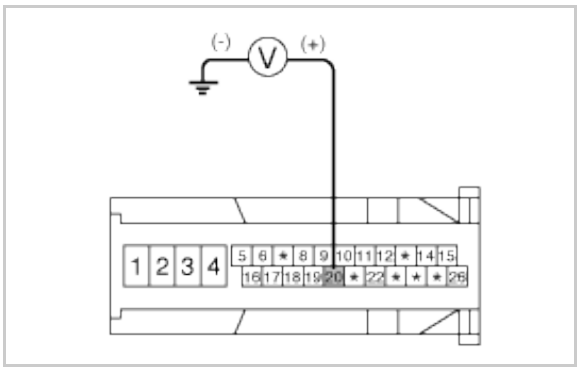
   Is the voltage within specification?

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.

Refer to the hydraulic lines.
Inspect leakage of the hydraulic lines.
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.	a. An open in the wire b. Poor ground c. Inoperative power source circuit

INSPECTION PROCEDURES

CHECK THE POWER SUPPLY CIRCUIT FOR THE DIAGNOSIS
Measure the voltage between terminal 9 of the data link connector and body ground.

Specification: approximately B+

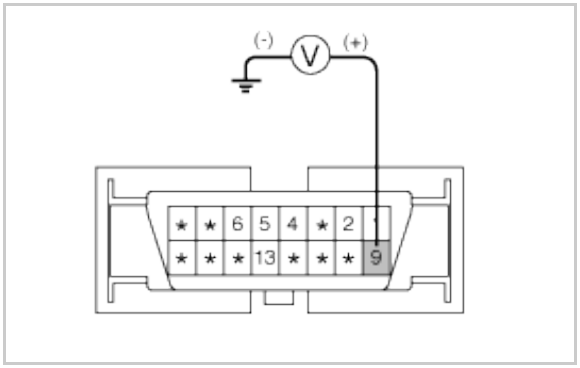
Is voltage within specification?

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.

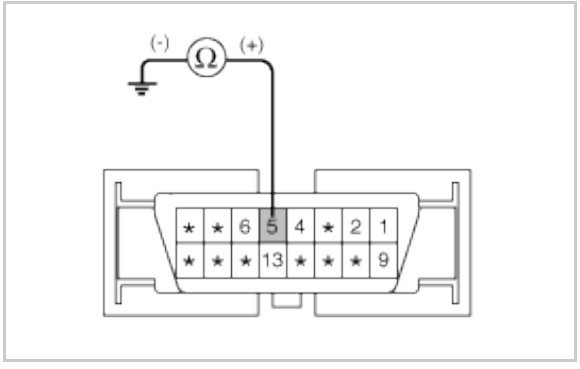


CHECK THE GROUND CIRCUIT FOR THE DIAGNOSIS

Check for continuity between terminal 5 of the data link connector and body ground.
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	a. An open in the wire

be probably an open in the HECU power circuit or an open in the diagnosis output circuit.	b. Inoperative HECU c. Inoperative power source circuit

INSPECTION PROCEDURES

CHECK FOR CONTINUITY IN THE DIAGNOSIS LINE

1. Disconnect the connector from the ABS control module.
2. Check for continuity between terminals 11 of the ABS control module connector and 1 of the data link connector. Is there continuity?

YES

▶ Check the power source of ABS control module.

NO

▶ Repair an open in the wire.

CHECK THE POWER SOURCE OF ABS CONTROL MODULE

1. Disconnect the connector from the ABS control module.
2. Turn the ignition switch ON, measure the voltage between terminal 18 of the ABS control module harness side connector and body ground.

Specification: approximately B+

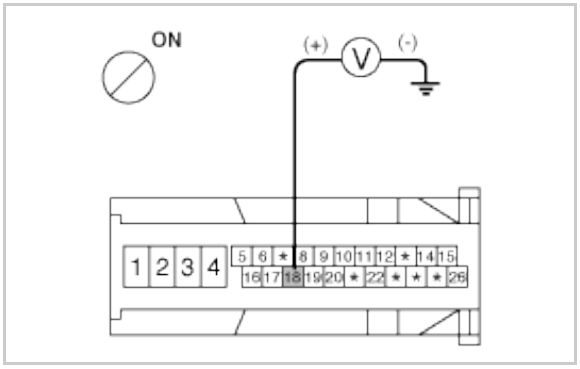
Is voltage within specification?

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

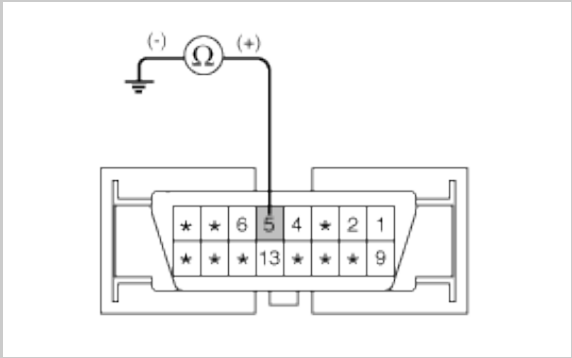
Check for continuity between terminal 5 of the data link connector and ground point.

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.	a. Inoperative ABS warning lamp bulb b. Blown No.2 fuse (10A) in the engine compartment junction block c. Inoperative ABS warning lamp module d. Inoperative HECU

INSPECTION PROCEDURES

PROBLEM VERIFICATION

Disconnect the connector from the ABS control module and turn the ignition switch ON.

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 and turn the ignition switch ON.
2. Measure the voltage between terminal 8 of the cluster harness side connector and body ground.

Specification: approximately B+

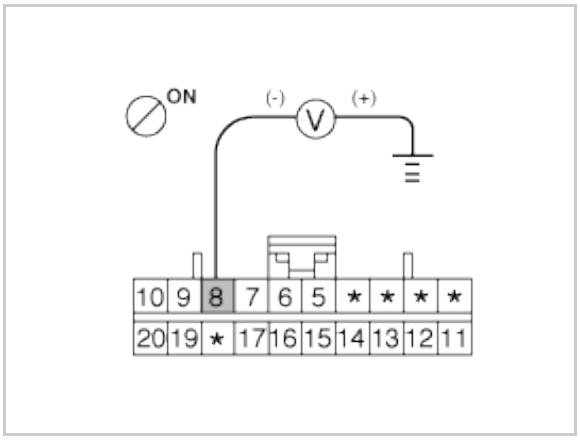
Is voltage within specification?

YES

▶ Repair bulb or instrument cluster assembly.

NO

▶ Check for blown fuse.



CHECK FOR BLOWN FUSE

Check continuity of fuse (10A) from the engine compartment junction block.
Is there continuity?

YES

▶ Repair an open in the wire between ABS fuse and 1 of cluster connector.

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.	a. An open in the wire b. Inoperative instrument cluster assembly c. Inoperative ABS warning lamp module d. 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.
   Is DTC output?

YES

▶ Repair circuit indicated by code output.

NO

▶ Check instrument cluster.

CHECK INSTRUMENT CLUSTER

Disconnect the cluster connector and turn the ignition switch ON.
Does the ABS warning lamp remains ON?

YES

▶ Replace the instrument cluster.

NO

▶ Check for open the wire.

CHECK FOR OPEN IN THE WIRE

Check for continuity in the wire between cluster and ABS control module.
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

1. Remove the reservoir cap and fill the brake reservoir with brake fluid.

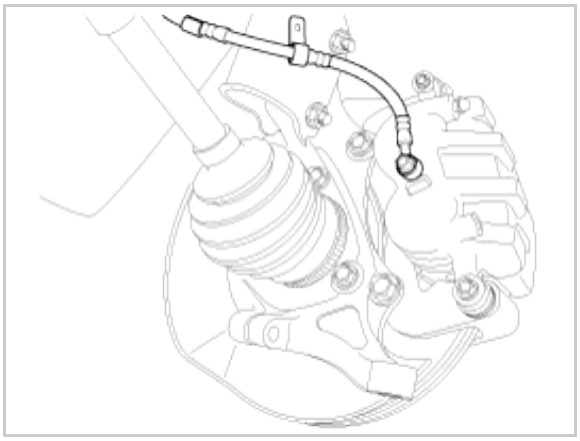
CAUTION

If there is any brake fluid on any painted surface, wash it off immediately.

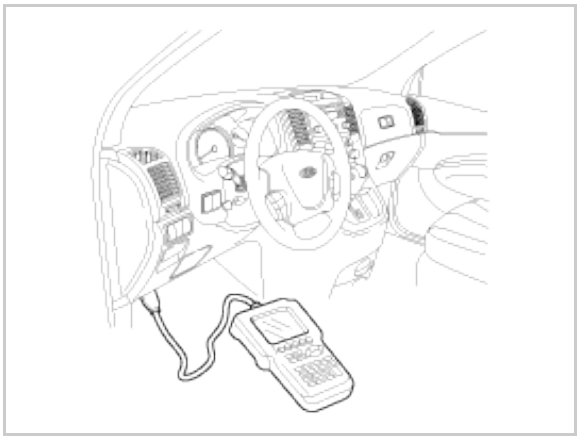
NOTICE

When pressure bleeding, do not depress the brake pedal.
Recommended fluid..... DOT3 or DOT4

2. Connect a clear plastic tube to the brake caliper bleeder plug and insert the other end of the tube into a half filled clear plastic bottle.



3. Connect the scan tool to the data link connector located underneath the dash panel.



4. Select and operate according to the instructions on the scan tool screen.

CAUTION

You must obey the maximum operating time of the ABS motor with the scan tool to prevent the motor pump from burning.

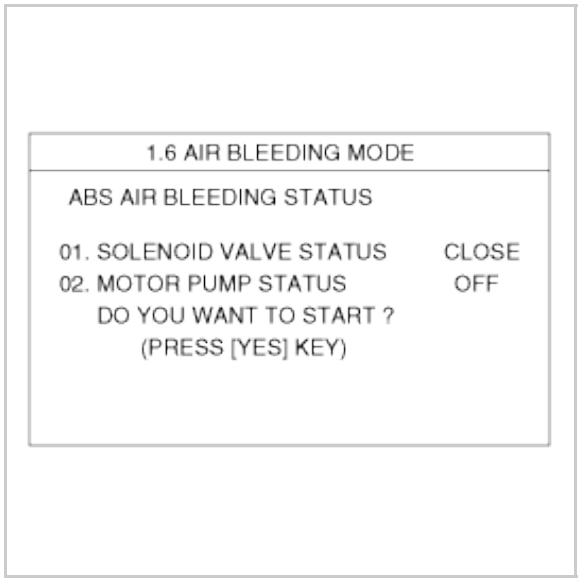
(1) Select kia vehicle diagnosis.

(2) Select vehicle name.

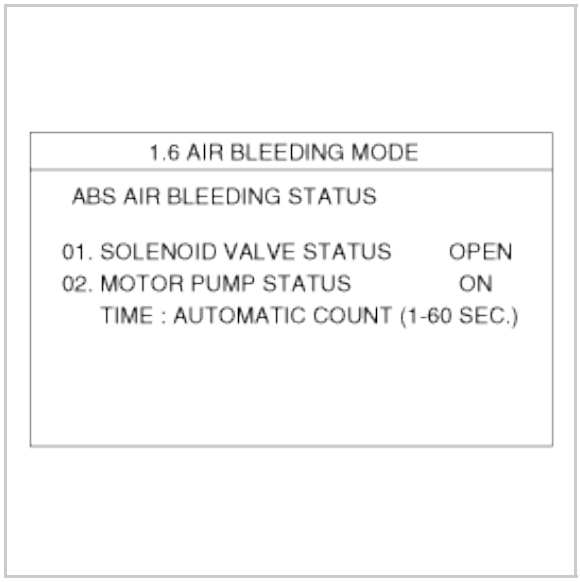
(3) Select Anti-Lock Brake system.

(4) Select air bleeding mode.

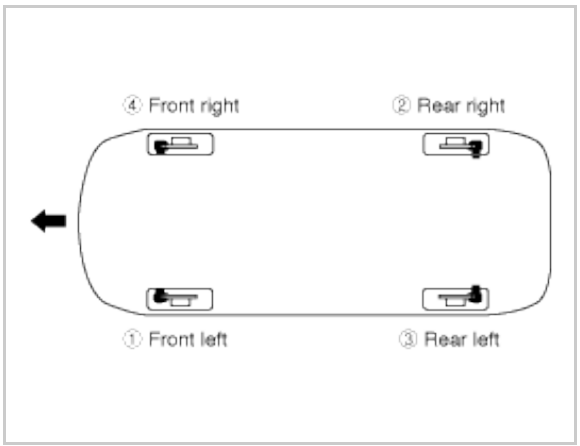
(5) Press "YES" to operate motor pump and solenoid valve.



(6) Wait 60 sec. before operating the air bleeding again. (If not, you may damage the motor.)



5. Pump the brake pedal several times, and then loosen the bleeder screw until fluid starts to run out without bubbles. Then close the bleeder screw.
6. Repeat step 5 until there are no more bubbles in the fluid for each wheel.



7. Tighten the bleeder screw.

Bleed screw tightening torque:
7~1 3 Nm (0.7 ~1.3 kgf·m, 5.06 ~ 9.4 lb-ft)

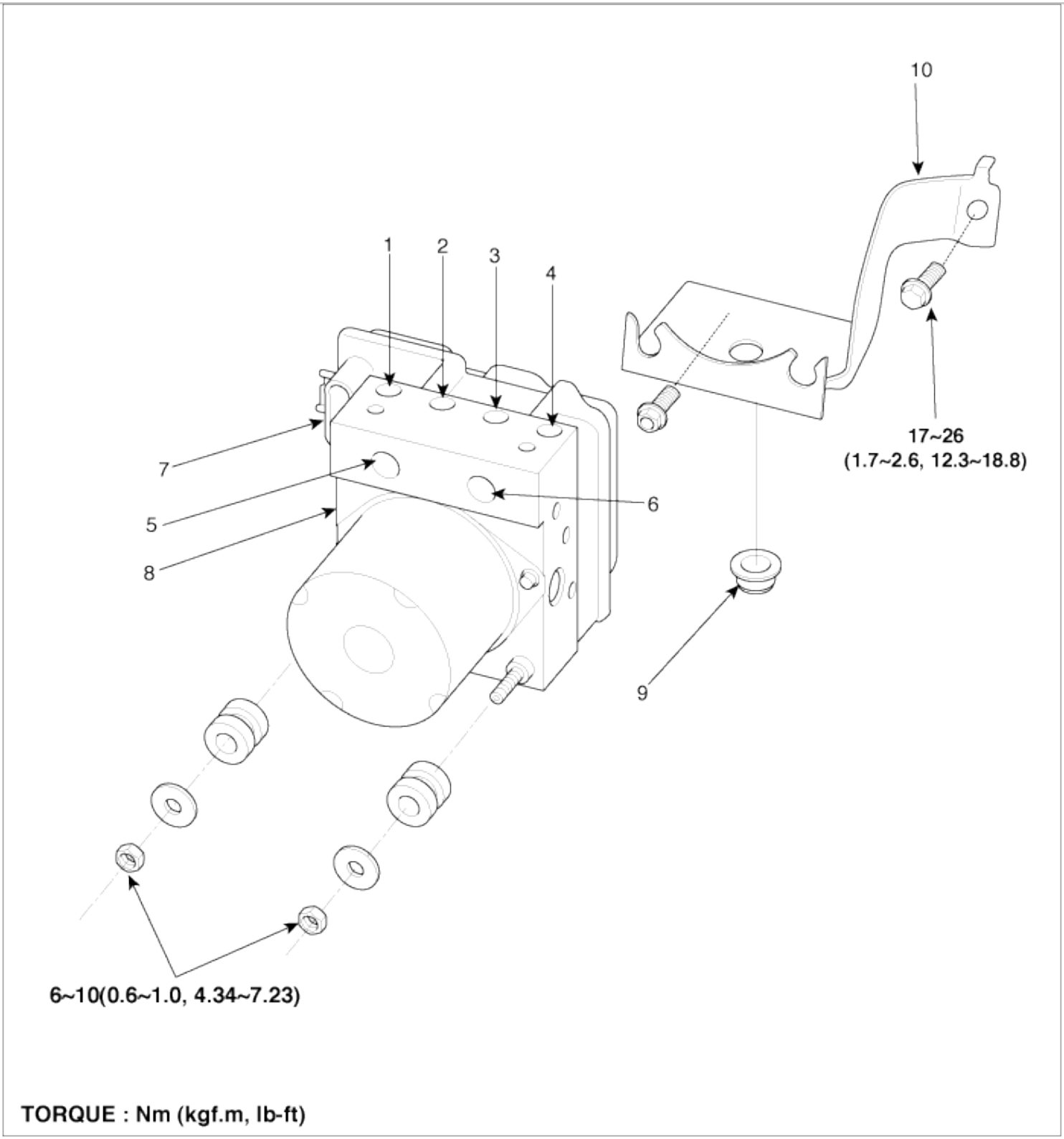
DIAGNOSTIC TROUBLE CODE CHART(DTC)

DTC	DESCRIPTION	WARNING LAMP			REMARK
		ABS	EBD	ESC	
C1101	BATTERY VOLTAGE HIGH	O	O	O	
C1102	BATTERY VOLTAGE LOW	O		O	
C1200	FL WHEEL SPEED SENSOR- OPEN/SHORT	O		O	
C1201	FL WHEEL SENSOR- RANGE/ PERFORMANCE	O		O	
C1202	FL WHEEL WHEEL SPEED SENSOR-NO SIGNAL	O		O	
C1203	FR WHEEL SPEED SENSOR- OPEN/SHORT	O		O	
C1204	FR WHEEL SENSOR- RANGE/ PERFORMANCE	O		O	
C1205	FR WHEEL SPEED SENSOR-NO SIGNAL	O		O	
C1206	RL WHEEL SPEED SENSOR- OPEN/SHORT	O		O	
C1207	RL WHEEL SENSOR- RANGE/ PERFORMANCE	O		O	
C1208	RL WHEEL SPEED SENSOR-NO SIGNAL	O		O	
C1209	RR WHEEL SPEED SENSOR- OPEN/SHORT	O		O	
C1210	RR WHEEL SENSOR- RANGE/ PERFORMANCE	O		O	
C1211	RR WHEEL SPEED SENSOR-NO SIGNAL	O		O	
C1213	WHEEL SPEED FREQUENCY ERROR	O		O	
C1235	PRESSURE SENSOR-ELECTRICAL			O	ESP
C1237	PRESSURE SENSOR-SIGNAL FAULT			O	ESP
C1260	STEERING ANGLE SENSOR-SIGNAL			O	ESP
C1261	STEERING ANGLE SENSOR NOT CALIBRATED			O	ESP
C1282	YAW RATE & LATERAL G SENSOR-ELECTRICAL			O	ESP
C1283	YAW RATE & LATERAL G SENSOR-SIGNAL			O	ESP
C1503	ESP SWITCH ERROR			O	ESP
C1513	BRAKE LIGHT SWITCH MALFUNCTION			O	
C1604	ECU HARDWARE ERROR	O	O	O	
C1605	CAN CONTROL HARDWARE ERROR			O	ESP
C1611	CAN TIME OUT-PCM(ECM)			O	ESP
C1612	CAN TIME OUT-PCM(TCM)			O	ESP
C1616	CAN BUS OFF			O	ESP
C1623	CAN TIMEOUT STEERING ANGLE SENSOR			O	ESP
C1625	CAN TIME OUT-ESP			O	ESP
C1626	IMPLAUSIBLE CONTROL	O		O	ESP
C1702	VARIANT CODING	O	O	O	ESP
C2112	VALVE RELAY MALFUNCTION	O	O	O	
C2308	FL INLET VALVE MALFUNCTION	O	O	O	
C2312	FL OUTLET VALVE MALFUNCTION	O	O	O	
C2316	FR INLET VALVE MALFUNCTION	O	O	O	
C2320	FR OUTLET VALVE MALFUNCTION	O	O	O	
C2324	RL INLET VALVE MALFUNCTION	O	O	O	
C2328	RL OUTLET VALVE MALFUNCTION	O	O	O	

C2332	RR INLET VALVE MALFUNCTION	O	O	O	
C2336	RR OUTLET VALVE MALFUNCTION	O	O	O	
C2366	TC VALVE PRIMARY(USV1) ERROR	O	O	O	ESP
C2370	TC VALVE SECONDARY (USV2) ERROR	O	O	O	ESP
C2372	ESP VALVE 1(HSV1) ERROR	O	O	O	ESP
C2374	ESP VALVE 2 (HSV2) ERROR	O	O	O	ESP
C2402	MOTOR-ELECTRICAL	O	O	O	

ABS Control Unit

COMPONENTS

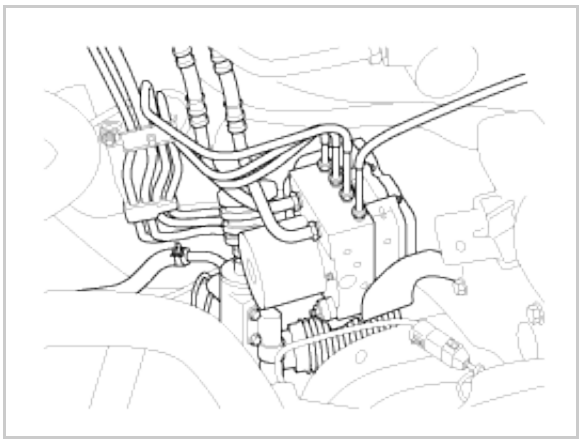


TORQUE : Nm (kgf.m, lb-ft)

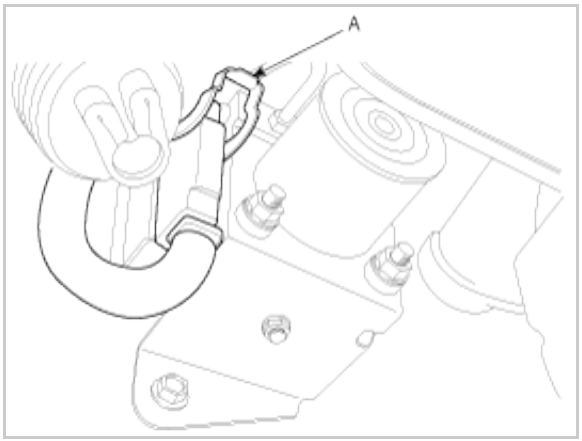
1. Front-right tube
2. Rear-left tube
3. Rear-right tube
4. Front-left tube
5. Master cylinder tube 2
6. Master cylinder tube 1
7. ABS control module connector(26P)
8. ABS control module(HECU)
9. Damper
10. Bracket

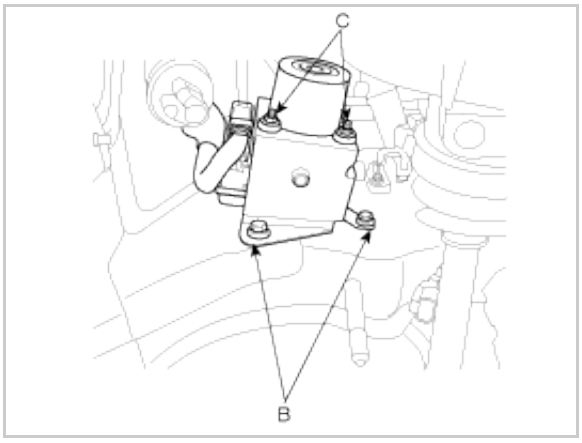
REMOVAL

1. Remove the air cleaner. (Refer to 'Master cylinder Removal')
2. Disconnect the brake tube from the HECU by unlocking the nuts counterclockwise with a spanner.



3. Disconnect the connector(A) from the HECU.





4. Remove the two HECU brake mounting bolts(B) , and then disassemble the HECU with the bracket.

> **CAUTION**
>
> a. Never attempt to disassemble the HECU.
> b. The HECU must be protected during storage and transport, and must not be subjected to excessive shock.

5. Remove the two HECU mounting nuts (C) and washer, and then remove the bracket.

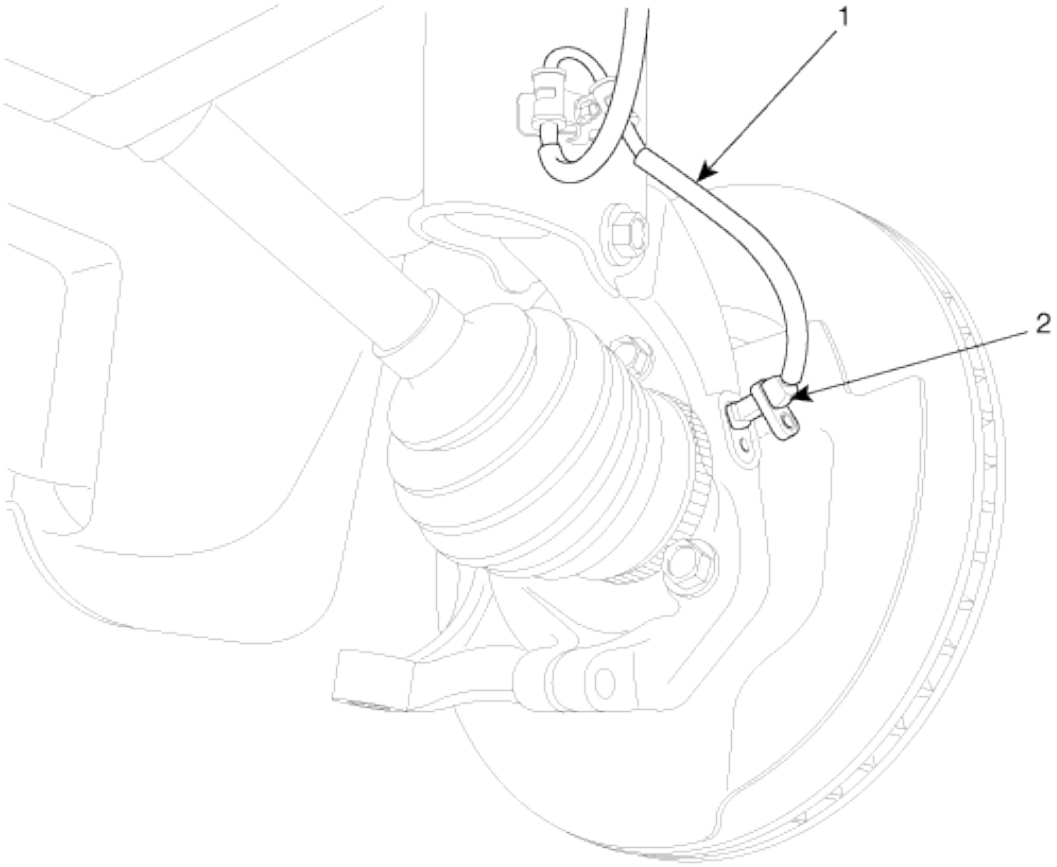
INSTALLATION

1. Installation is the reverse of removal.
2. Tighten the HECU mounting bolts and brake tube nuts to the specified torque.

Tighterning torque
HECU mounting nut :
6~10 Nm (0.6~1.0 kgf·m, 4.34~7.23 lb-ft)
HECU bracket mounting bolt:
17~26 Nm (1.7~2.6 kgf·m, 12.3~18.8 lb-ft)

Front Wheel Speed Sensor

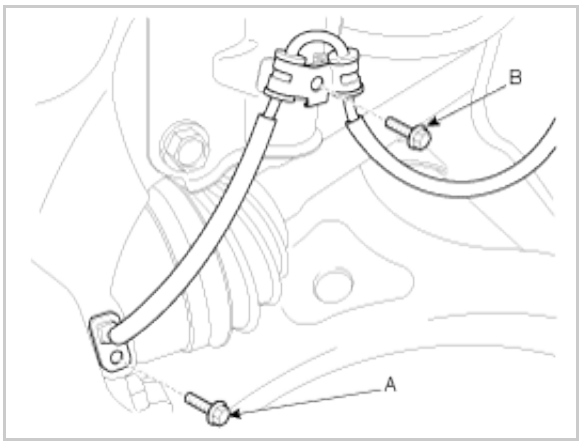
COMPONENTS



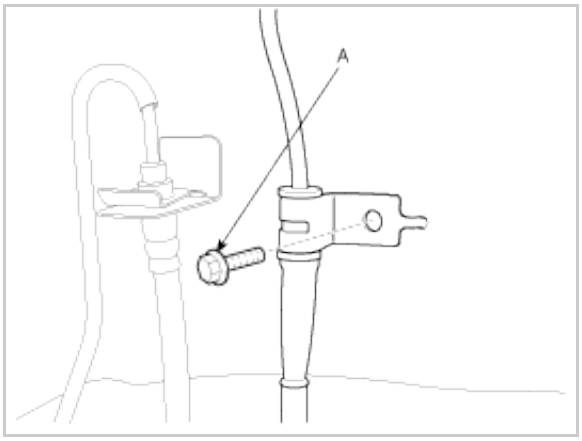
1. Front wheel speed sensor cable
2. Front wheel speed sensor

REMOVAL

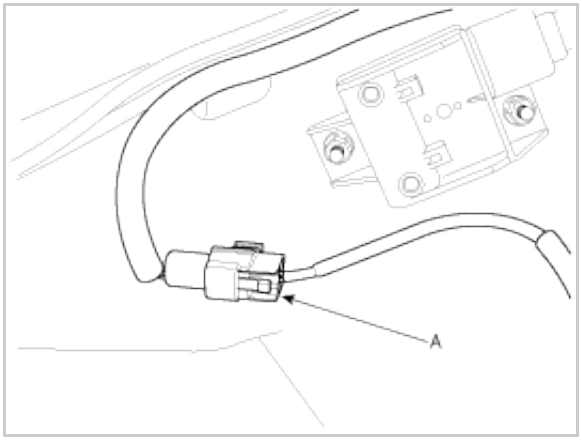
1. Remove the front wheel speed sensor mounting bolt (A) and the wire bracket mounting bolt (B)..



2. Remove the wire bracket bolt (A).



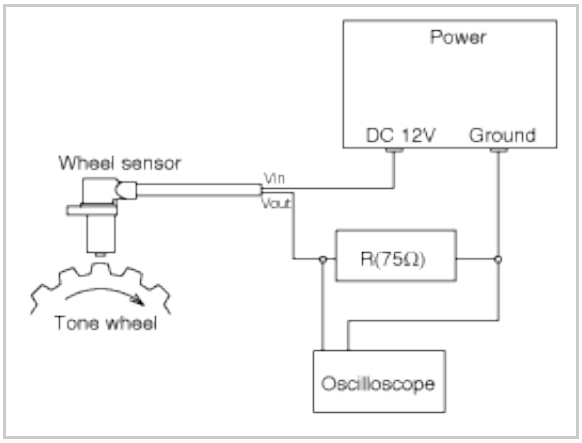
3. Remove the front wheel guard.
4. Remove the front wheel speed sensor after disconnecting the wheel speed sensor connector (A).



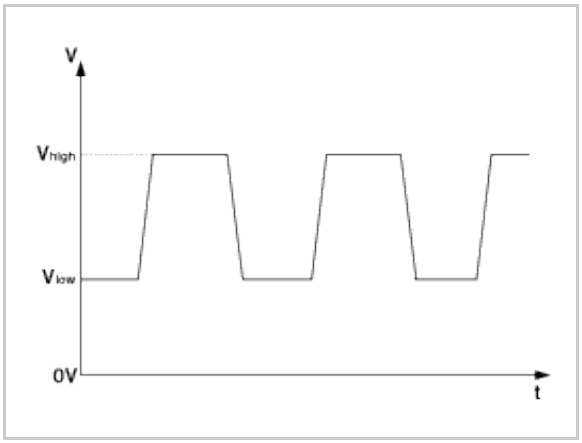
INSPECTION

1. Measure the output voltage between the terminal of the wheel speed sensor and the body ground.

> **CAUTION**
>
> In order to protect the wheel speed sensor, when measuring output voltage, a 75Ω resistor must be used as shown.



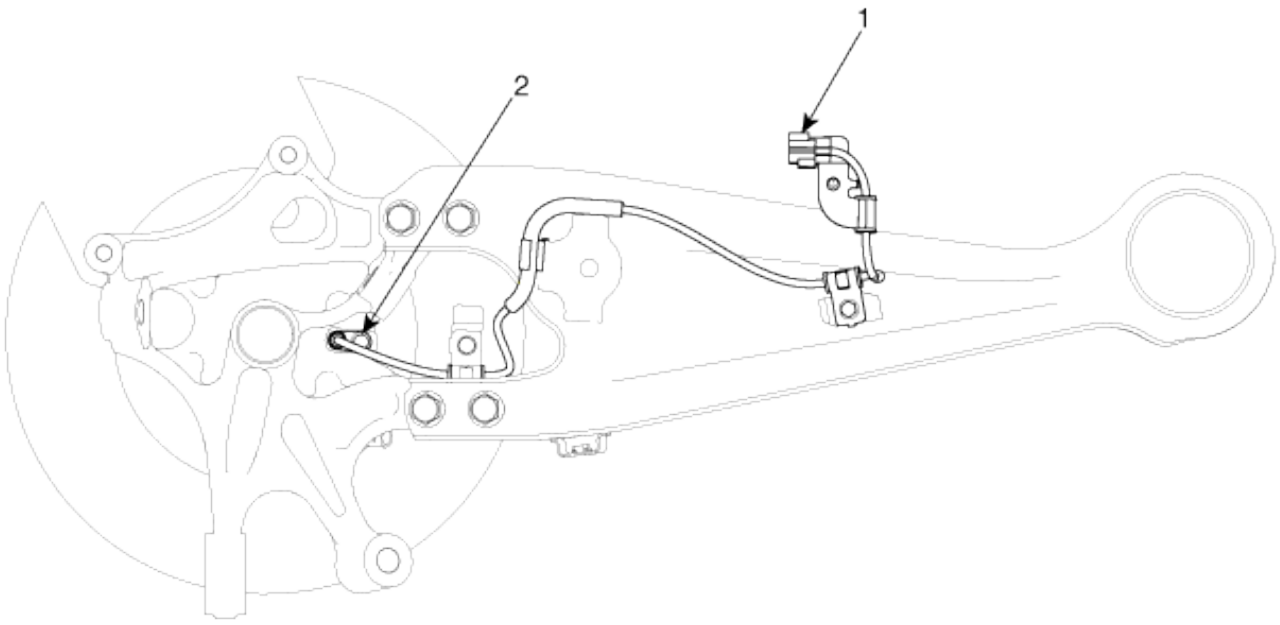
2. Compare the change of the output voltage of the wheel speed sensor to the normal change of the output voltage as shown below.



a. V_low : 0.44 V ~ 0.63 V
b. V_high : 0.885 V ~ 1.26 V
c. Frequency range : 1~2,500 Hz

Rear Wheel Speed Sensor

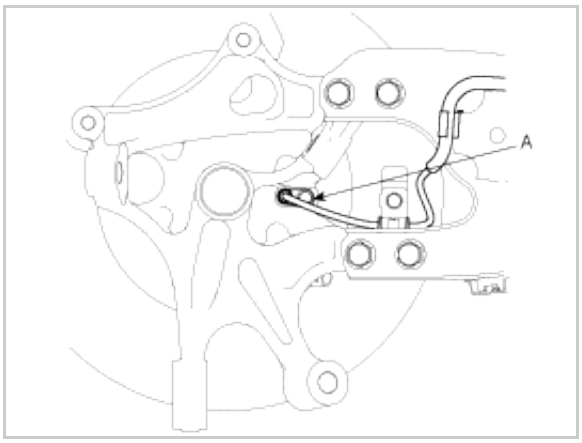
COMPONENTS



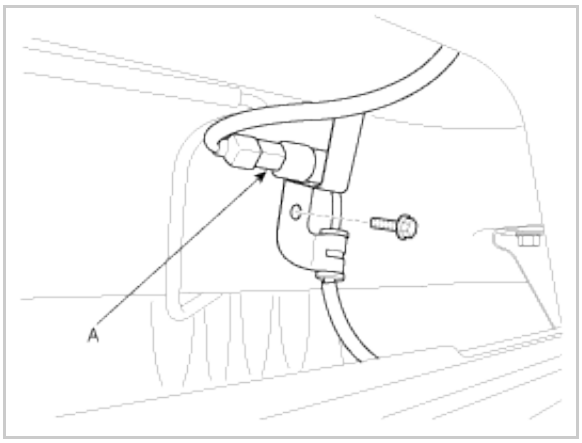
1. Rear wheel speed sensor connector
2. Rear wheel speed sensor

REMOVAL

1. Remove the rear wheel speed sensor mounting bolt (A).



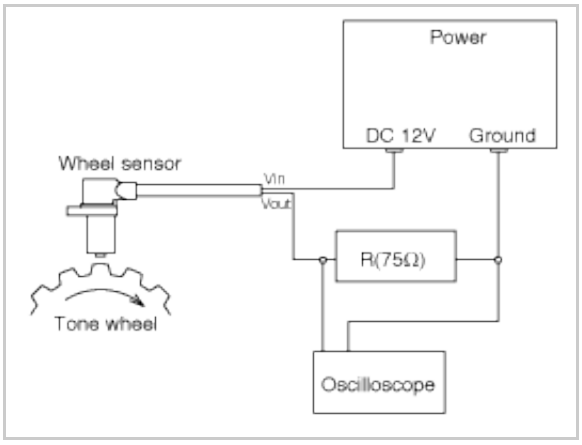
2. Remove the rear seat side pad then disconnect the rear wheel speed sensor connector (A).



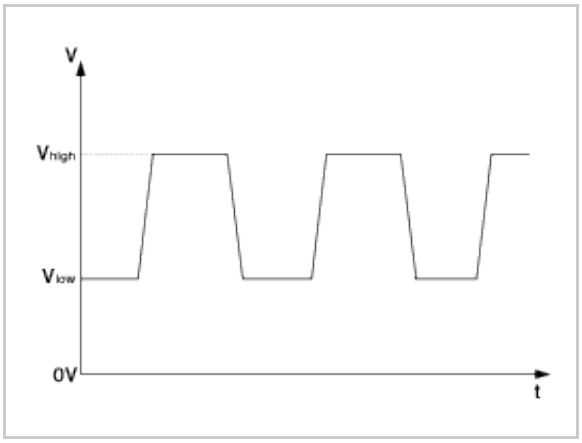
INSPECTION

1. Measure the output voltage between the terminal of the wheel speed sensor and the body ground.

> **CAUTION**
>
> In order to protect the wheel speed sensor, when measuring output voltage, a 75Ω resistor must be used as shown.



2. Compare the change of the output voltage of the wheel speed sensor to the normal change of the output voltage as shown below.



a. V_low : 0.44 V ~ 0.63 V
b. V_high : 0.885 V ~ 1.26 V
c. Frequency range : 1~2,500 Hz

EBFD
(Electronic Brake Force Distribution)

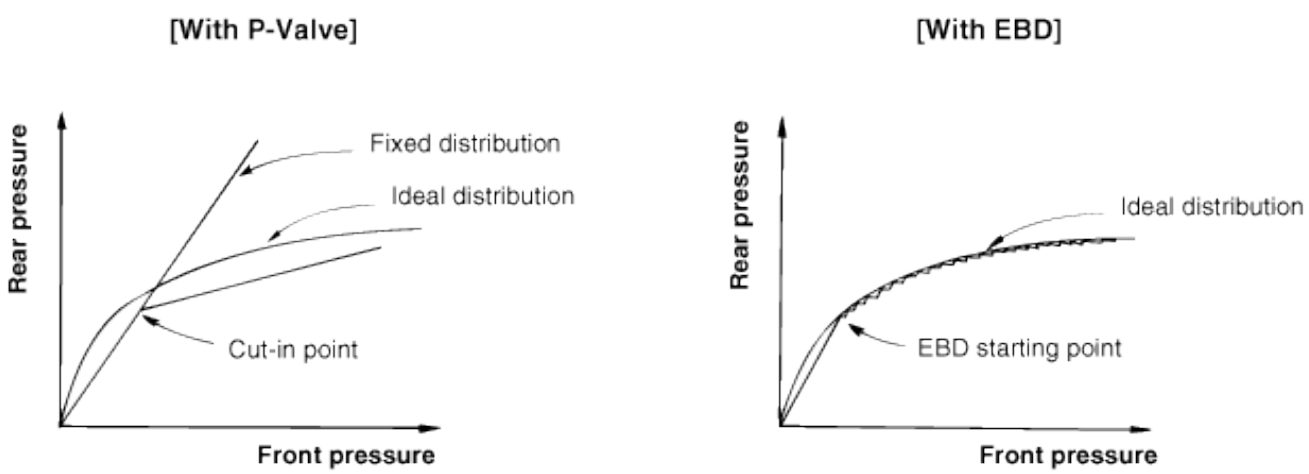
DESCRIPTION

The EBD system (Electronic Brake force Distribution) as a sub-system of the ABS system is to control the effective adhesion utilization by the rear wheels.
It further utilizes the efficiency of highly developed ABS equipment by controlling the slip of the rear wheels in the partial braking range.
The brake force is moved even closer to the optimum and controlled electronically, thus dispensing with the need for the proportioning valve.
The proportioning valve, because of a mechanical device, has limitations to achieve an ideal brake force distribution tothe rear wheels as well as to carry out the flexible brake force distribution proportioning to the vehicle load or weight increasing. And in the event of malfunctioning, driver cannot notice whether it fails or not.
EBD controlled by the ABS Control Module, calculates the slip ratio of each wheel at all times and controls the brake pressure of the rear wheels not to exceed that of the front wheels.
If the EBD fails, the EBD warning lamp (Parking brake lamp) lights up.

ADVANTAGES

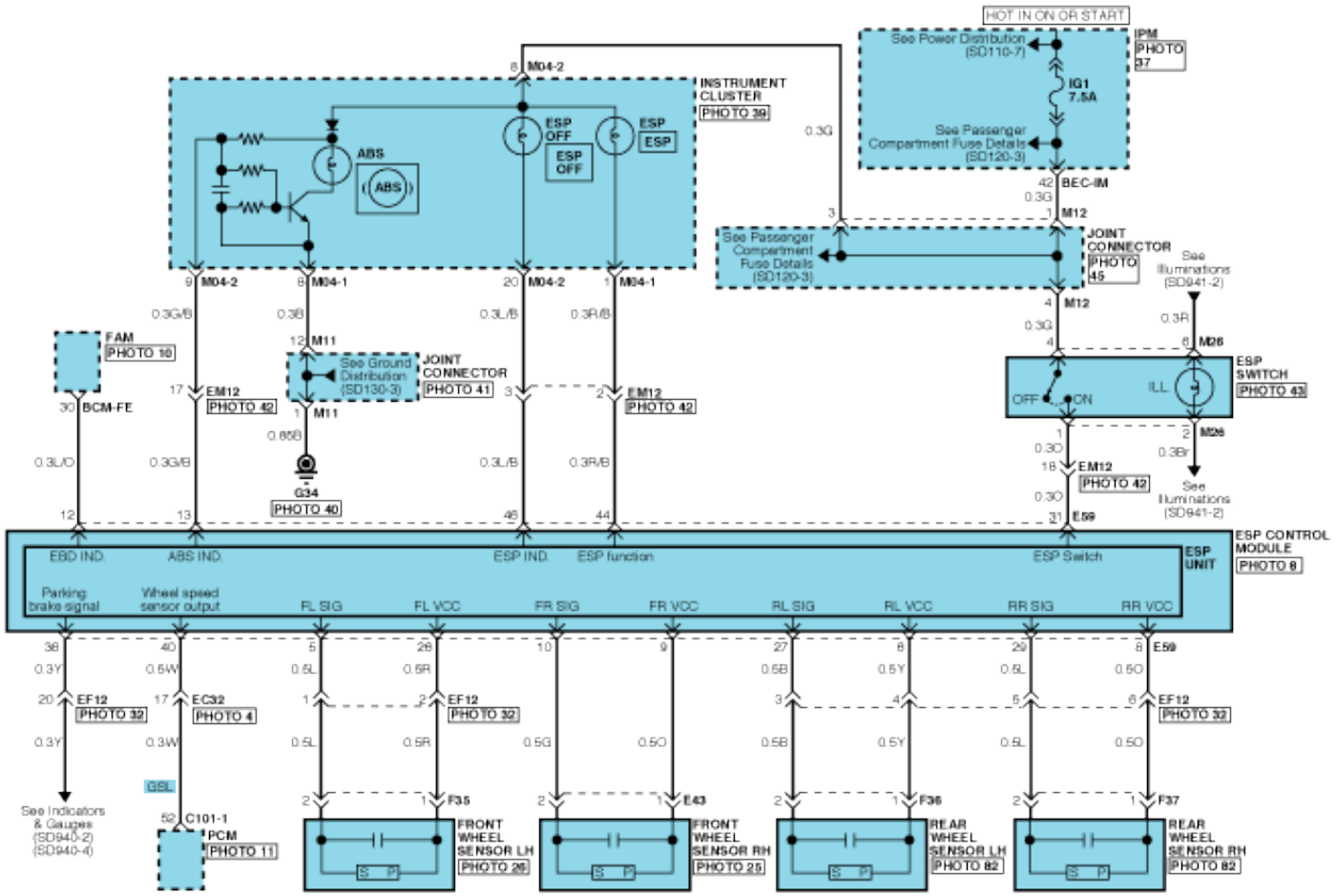
a. Function improvement of the base-brake system.
b. Compensation for the different friction coefficients.
c. Elimination of the proportioning valve.
d. Failure recognition by the warning lamp.

Comparison between Proportioning valve and EBD

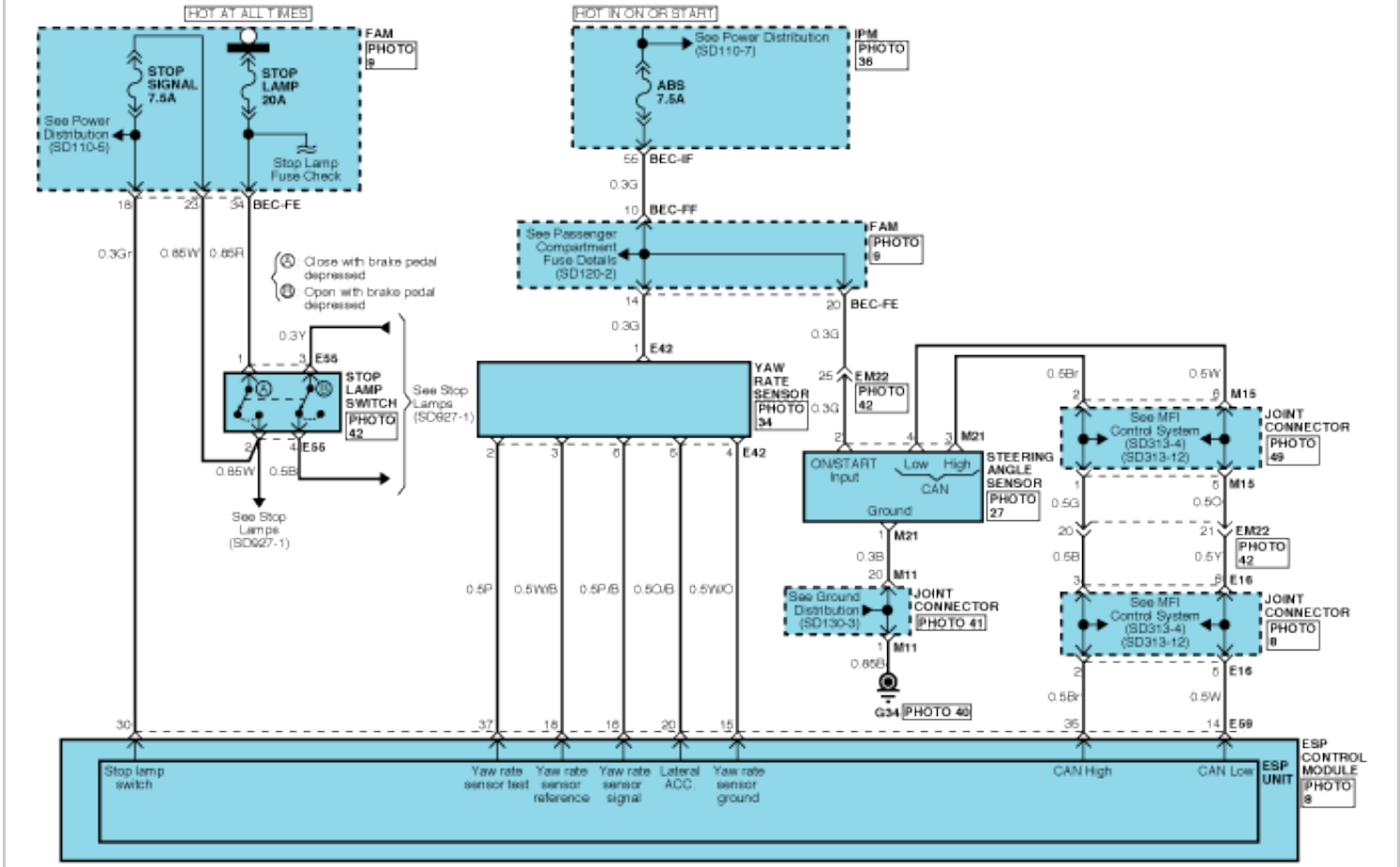


ESP (Electronic Stability Program) System

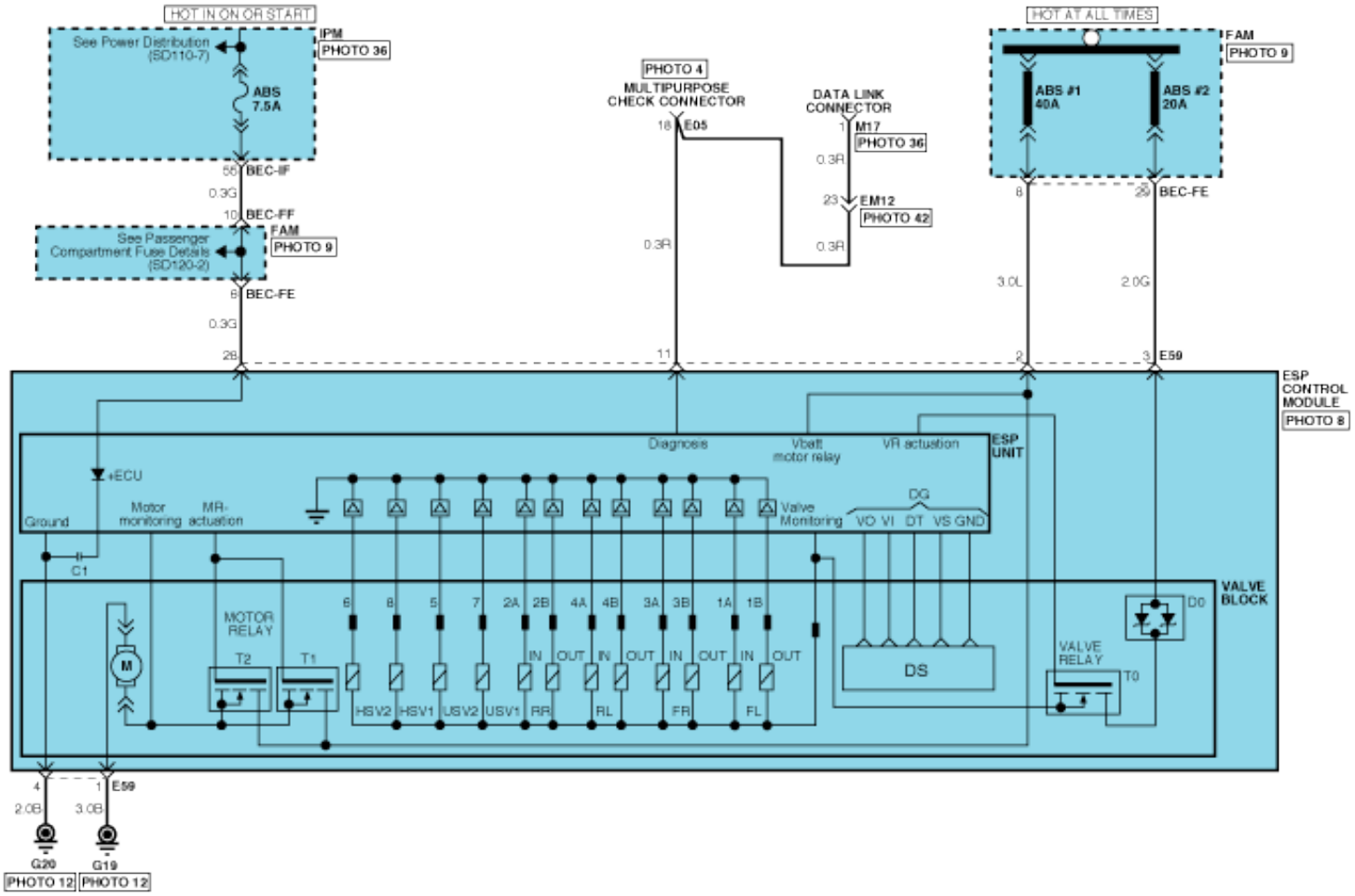
ESP circuit DIAGRAM(1)



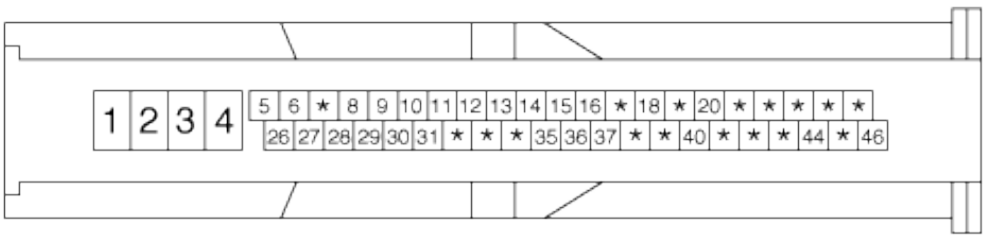
ESP circuit DIAGRAM(2)



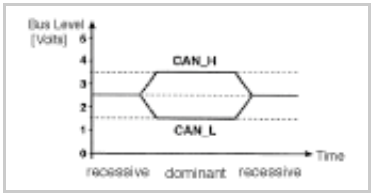
ESP circuit DIAGRAM(3)



ESP HECU CONNECTOR INPUT / OUTPUT

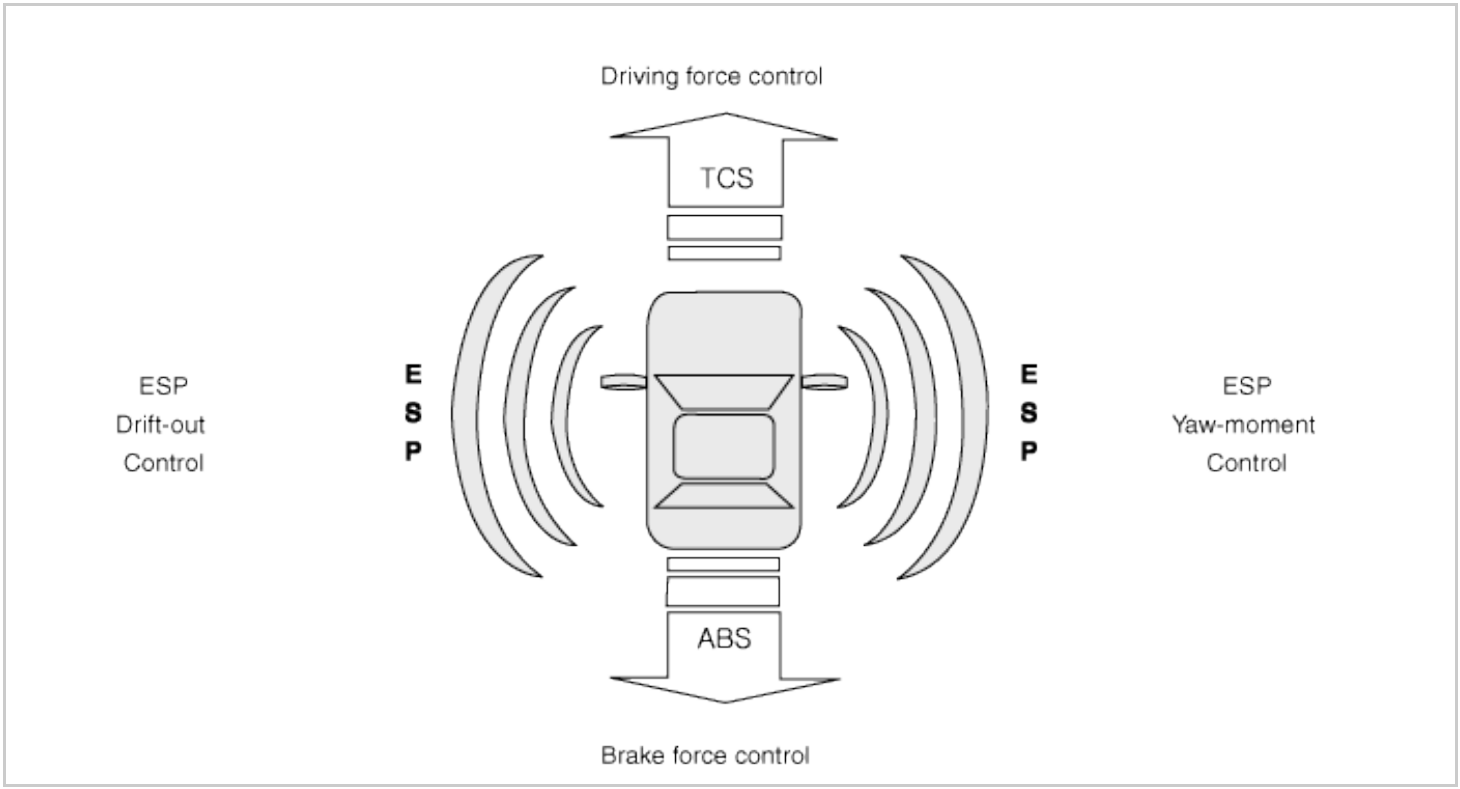


Connector Terminal		Specifications	Conditions
No	Description		
1	Ground(Pump)	Current range : Min-10 A Max-20 ~ 39 A	Always
4	Ground(Valve,ECU)	Current range : Min-2.5 A Max-5 ~ 15 A	Always
2	Supply voltage(Pump)	Battery voltage	Always
3	Supply voltage(Valve)		

26	Wheel sensor voltage(FL)	Battery voltage	IG ON
9	Wheel sensor voltage(FR)		
6	Wheel sensor voltage(RL)		
8	Wheel sensor voltage(RR)		
5	Wheel sensor signal(FL)	Voltage(High) : 0.89~1.26 V Voltage(Low) : 0.44~0.63 V	RUNNING
10	Wheel sensor signal(FR)		
27	Wheel sensor signal(RL)		
29	Wheel sensor signal(RR)		
11	Diagnosis Input/oupput	Voltage(High) : 0.8 * IG ON more Voltage(Low) : 0.2 * IG ON lower	SCAN TOOL Communication
28	Ignition	Battery voltage	KEY ON/OFF
31	ESP Passive switch	Voltage(High) : 0.6 * IG ON more Voltage(Low) : 0.4 * IG ON lower	Switch ON/OFF
36	Hand brake switch	Voltage(High) : 0.7 * IG ON more Voltage(Low) : 0.3 * IG ON lower	Switch ON/OFF
37	Yaw Rate Sensor Test	Voltage(High) : 4.1 V more Voltage(Low) : 1 V lower	IG ON
18	Yaw Rate Sensor Reference	2.464 V ~ 2.536 V	IG ON
16	Yaw Rate Sensor Signal	Offset voltage :2.5 V range : 0.35 V ~ 4.65 V(-100 ~ 100 °/s)	IG ON
20	Acceleration Sensor Signal	Offset voltage :2.5 V range : 0.35 V ~ 4.65 V(-1.8 g ~ 1.8 g)	IG ON
15	Yaw Rate Sensor Ground	GND LEVEL	Always
35	CAN High	not communicating:2.5 ± 0.5 V communication : 	IG ON
14	CAN Low		
30	BRAKE LIGHT SWITCH	voltage(High) : 0.8 * IG ON more voltage(Low) : 0.3 * IG ON lower	BRAKE ON/OFF

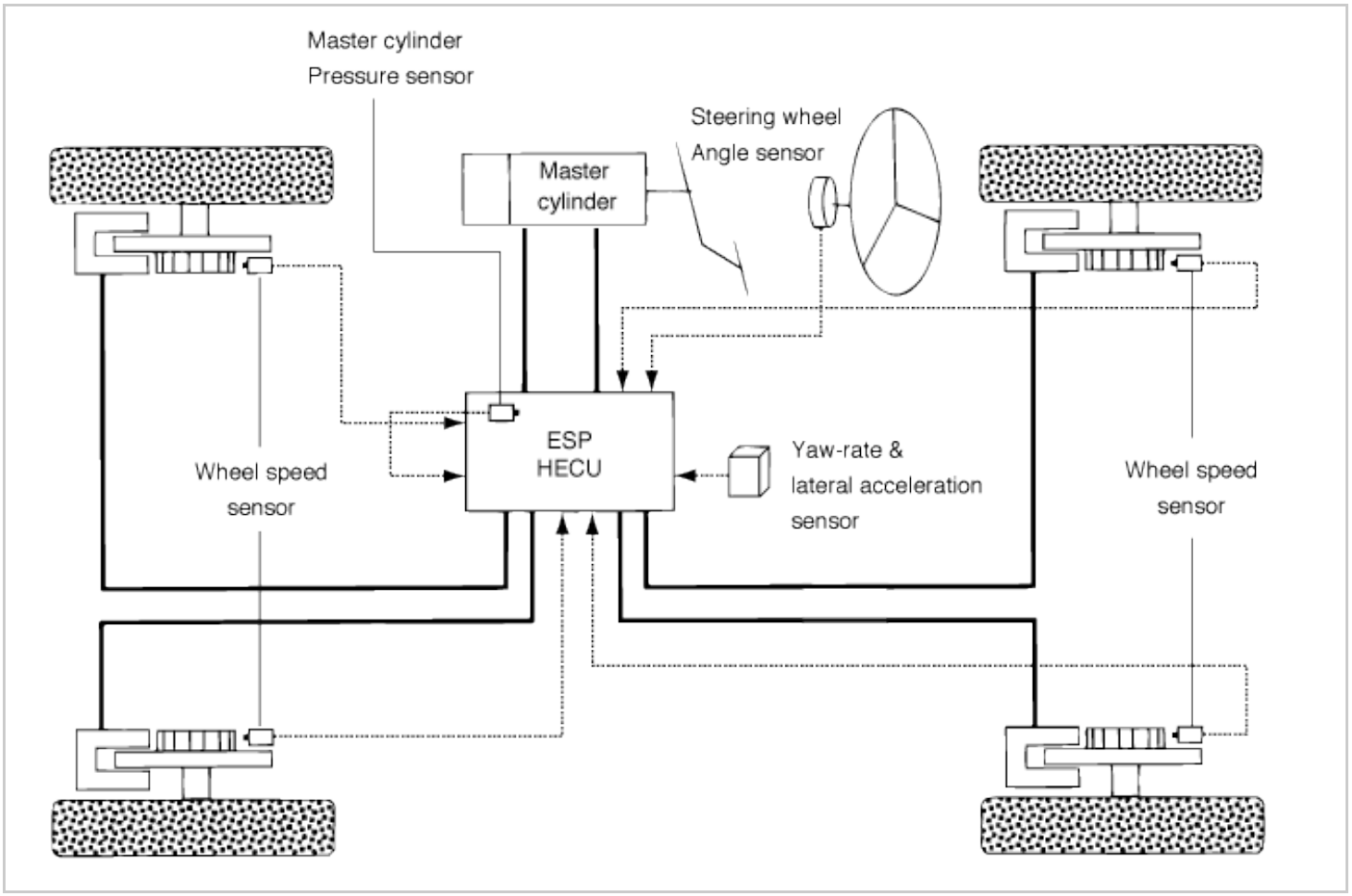
description of ESP

Optimum driving safety now has a name : ESP, the Electronic Stability Control.
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 needfor 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.
ESC essentially consists of three assemblies : the sensors, the electronic control unit and the actuators.
Of course, the stability control feature works under all driving and operating conditions. Under certain driving conditions, the ABS/TCS function can be activated simultaneously with the 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.



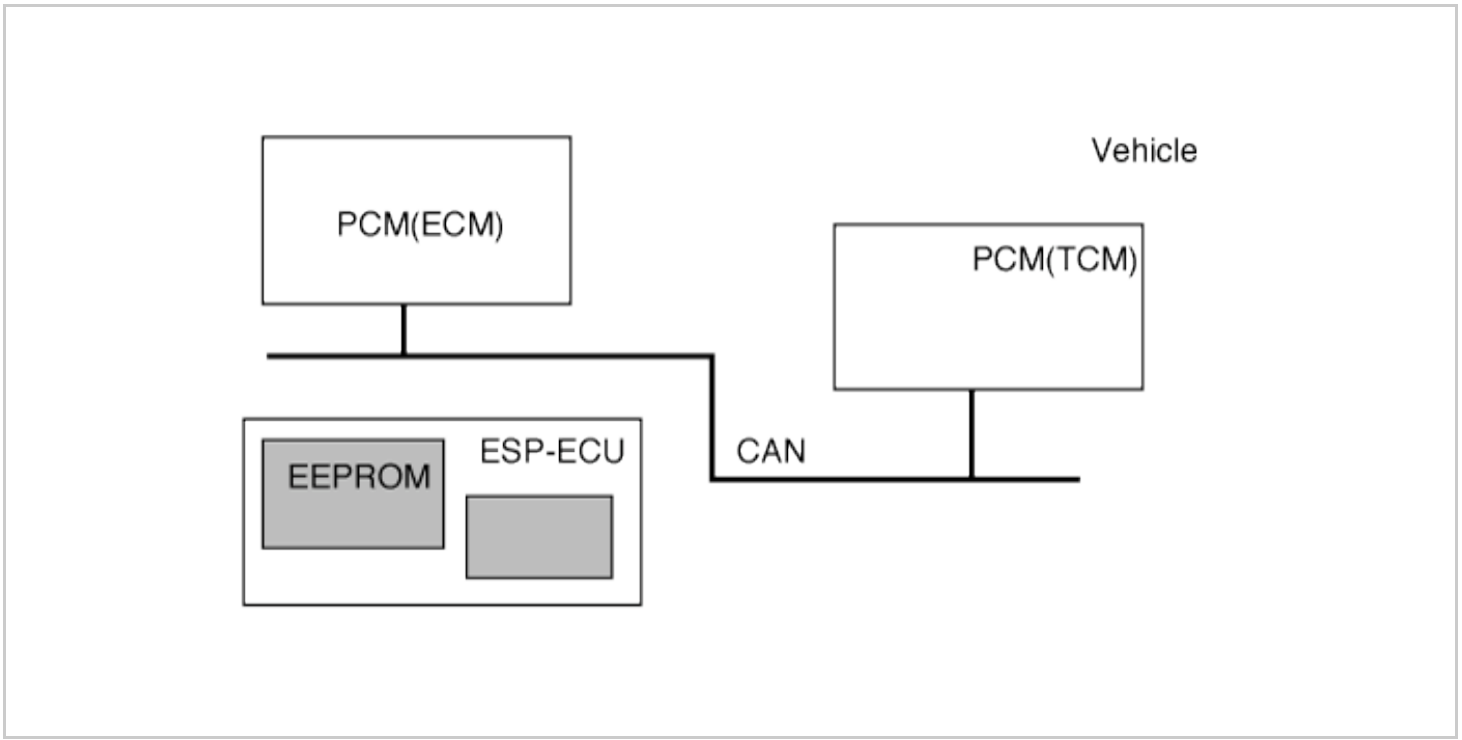
DESCRIPTION OF ESP CONTROL

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

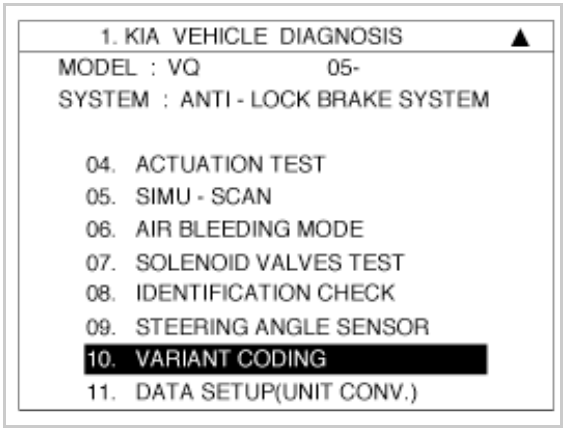
The HECU is programmed with a variant code based on the vehicle powertrain configuration. This variant code is used to determine the appropriate ESP calculations. Variant code programming should be performed whenever an HECU is replaced.



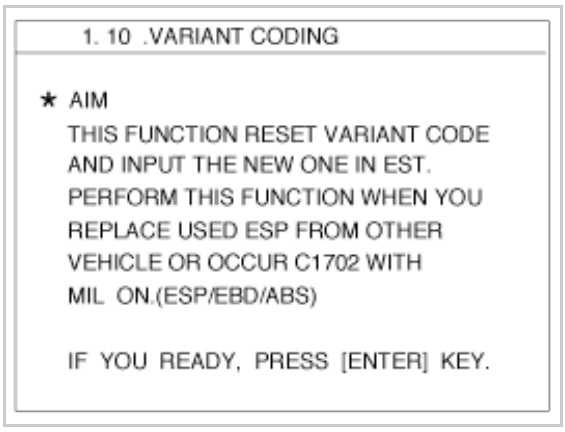
PROCEDURE OF VARIANT CODING

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.

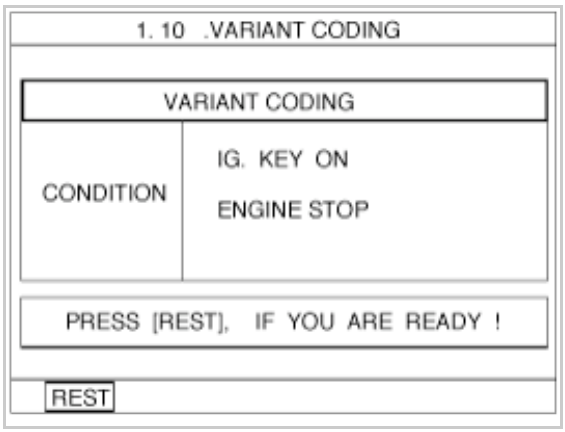
5. Select the variant coding.



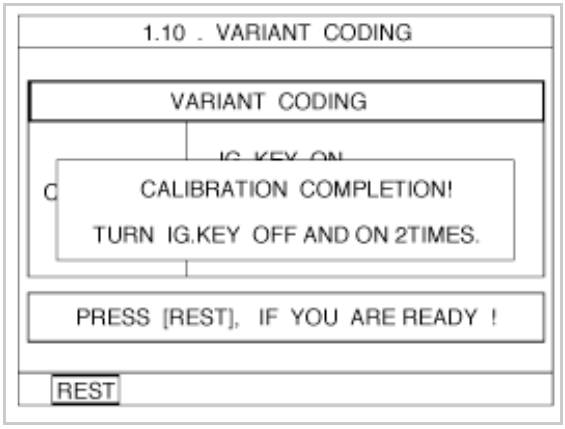
6. Follow the next procedure according to the comment .



7. Confirm the condition , and then push the "REST".



8. If the procedure is finished, the screen is displayed as shown below.



9. IGN off.

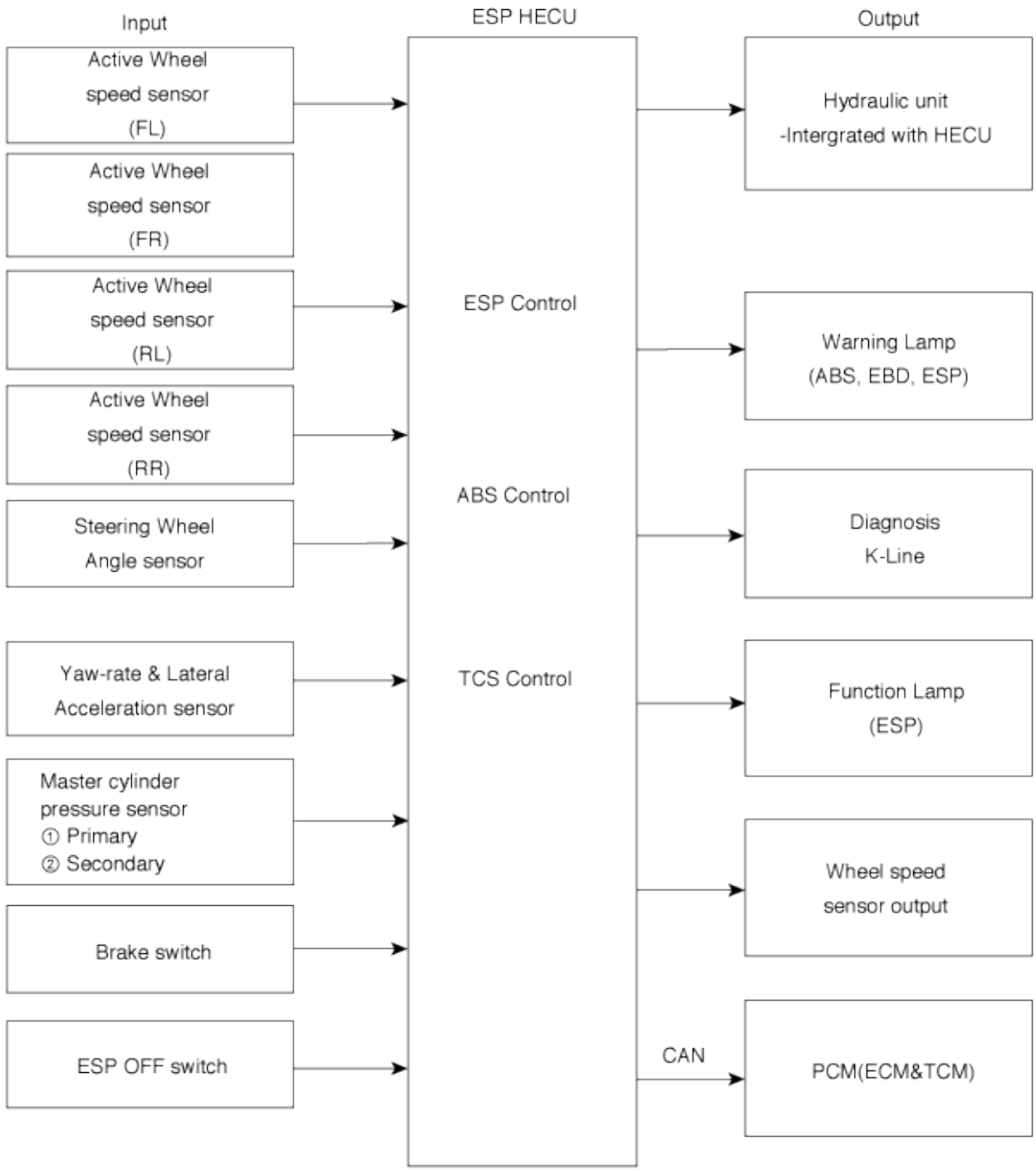
10. IGN on.

11. The variant coding is completed.

CAUTION

If the warning lamp(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.

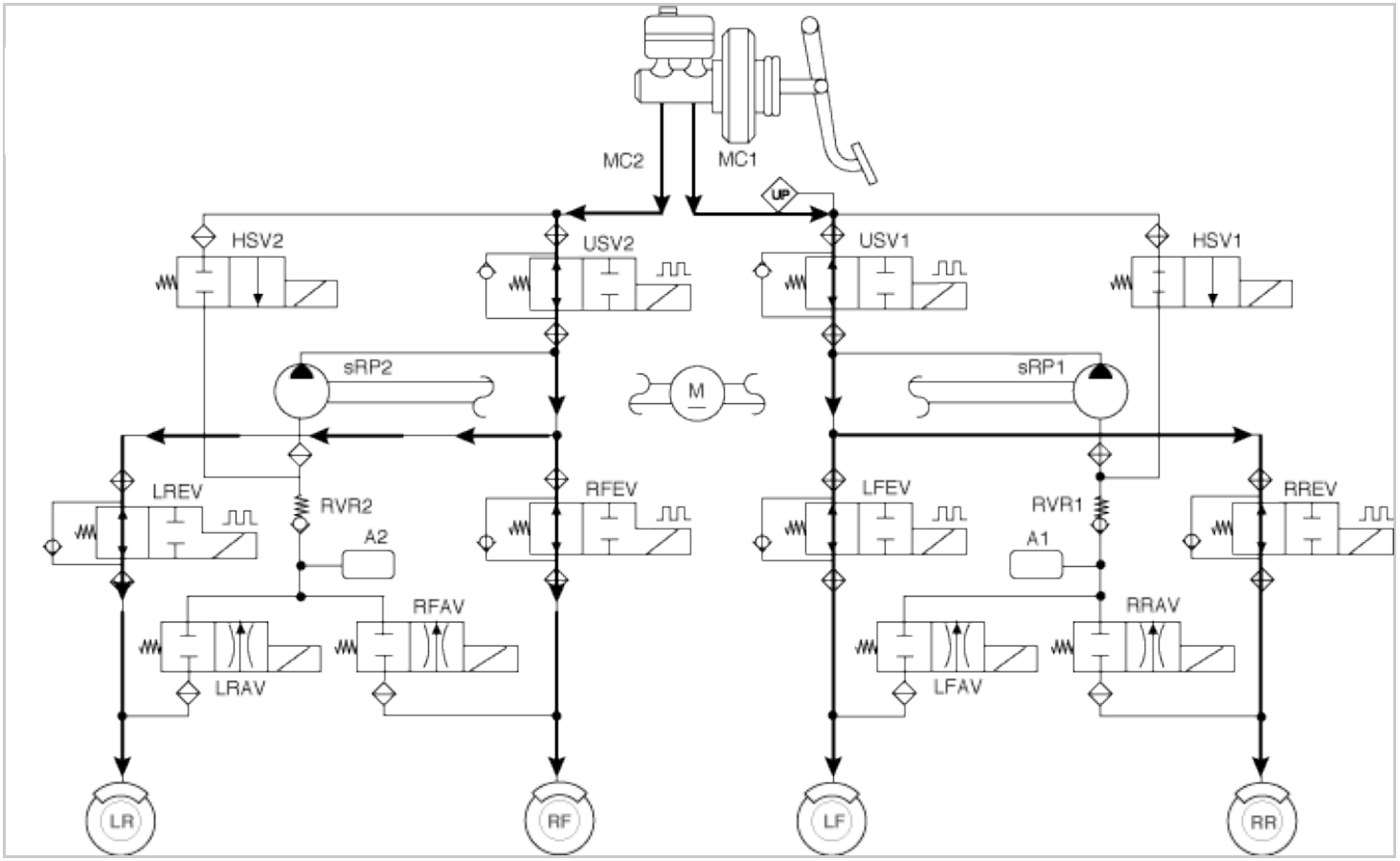
Vehicle rotation speed
+ Operated power to the side
→ ECU decides movement of the ESP vehicle.

3. STEP 3
he HECU calculates the required strategy, then actuates the appropriate valves and sents 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



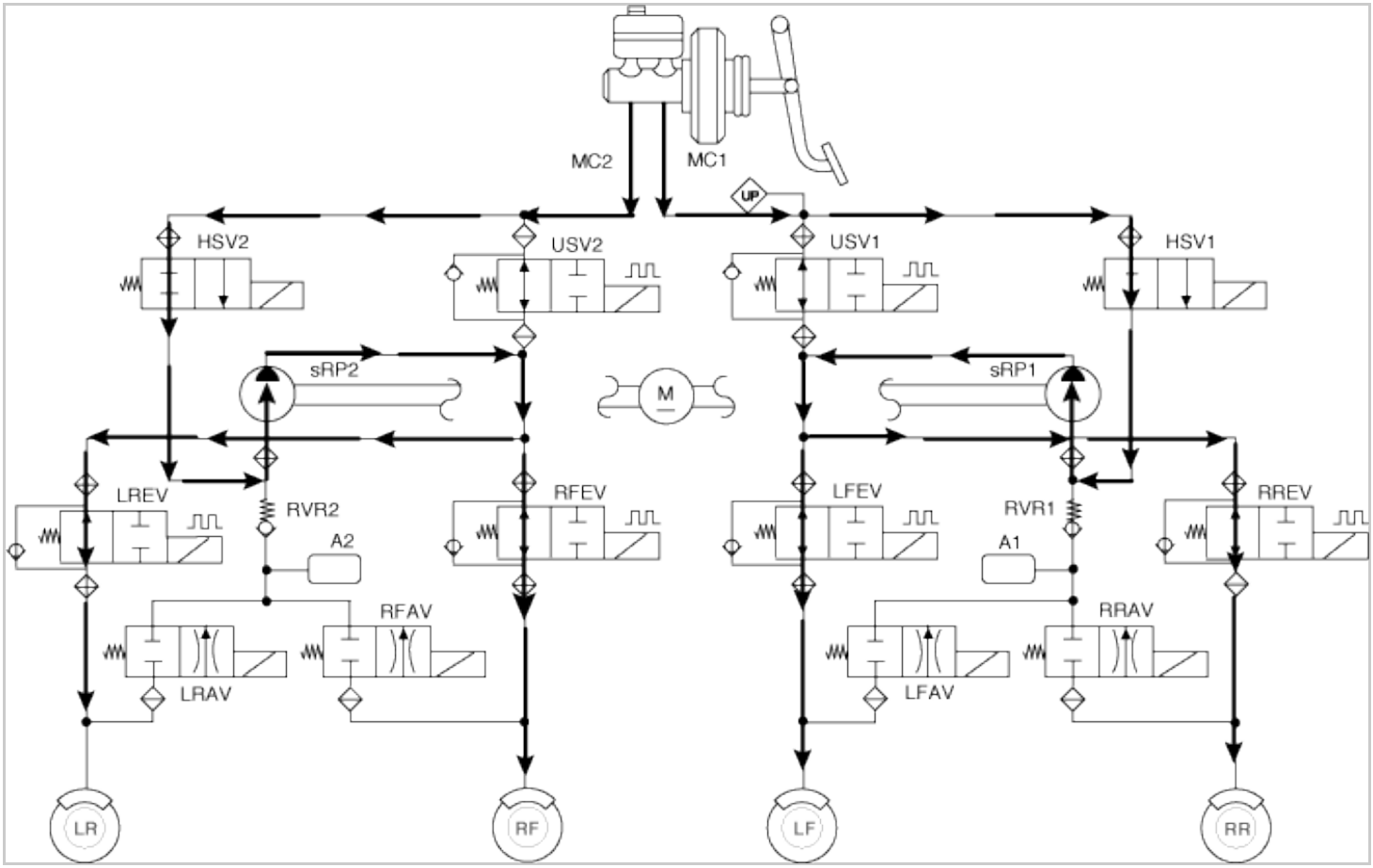
NOTICE

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 valve(HSV)	Pump motor
Normal braking	Open	Close	Close(Partial)	Open	ON(Motor speed control)

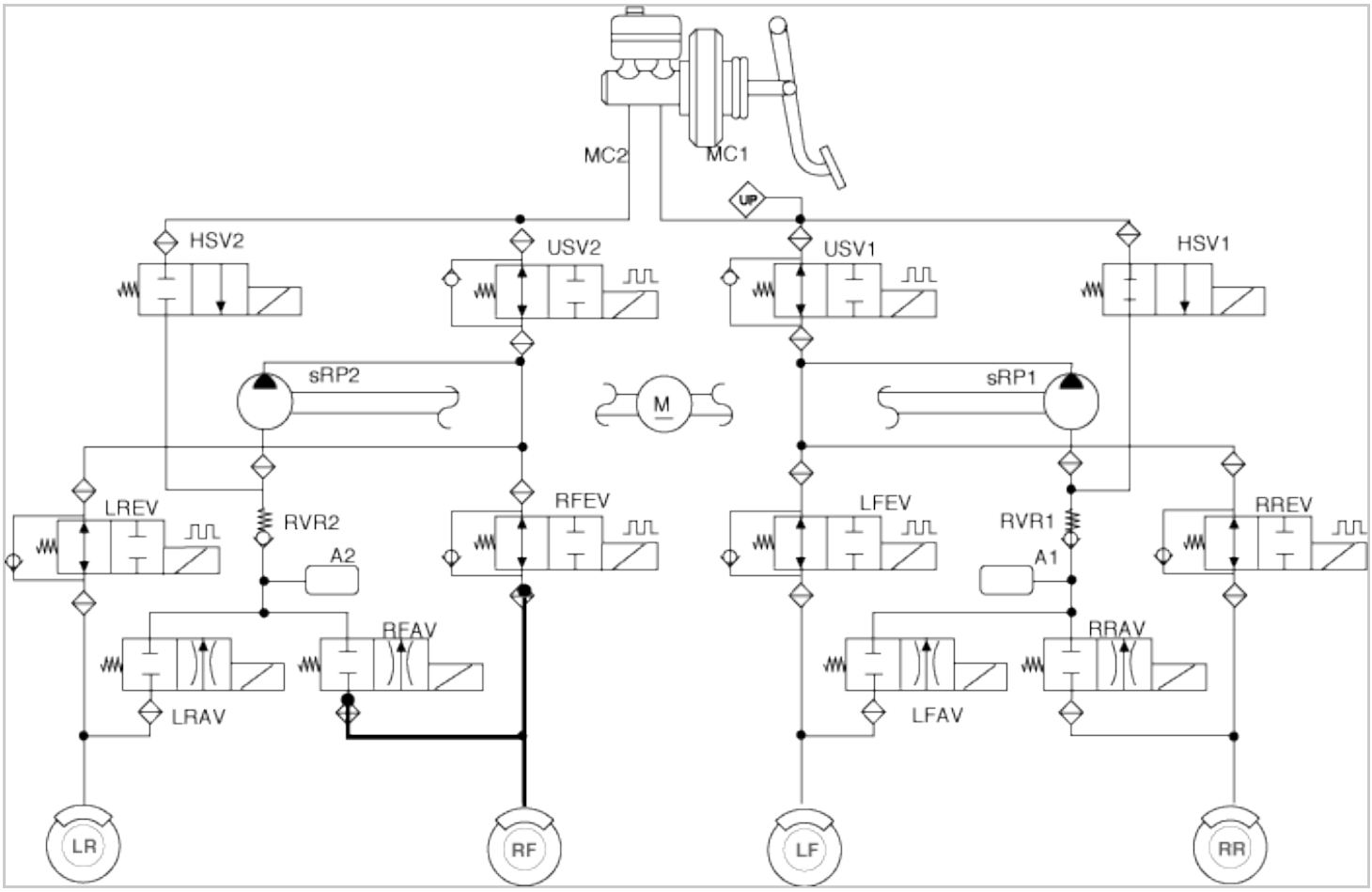


NOTICE

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	ON(Motor speed low control)

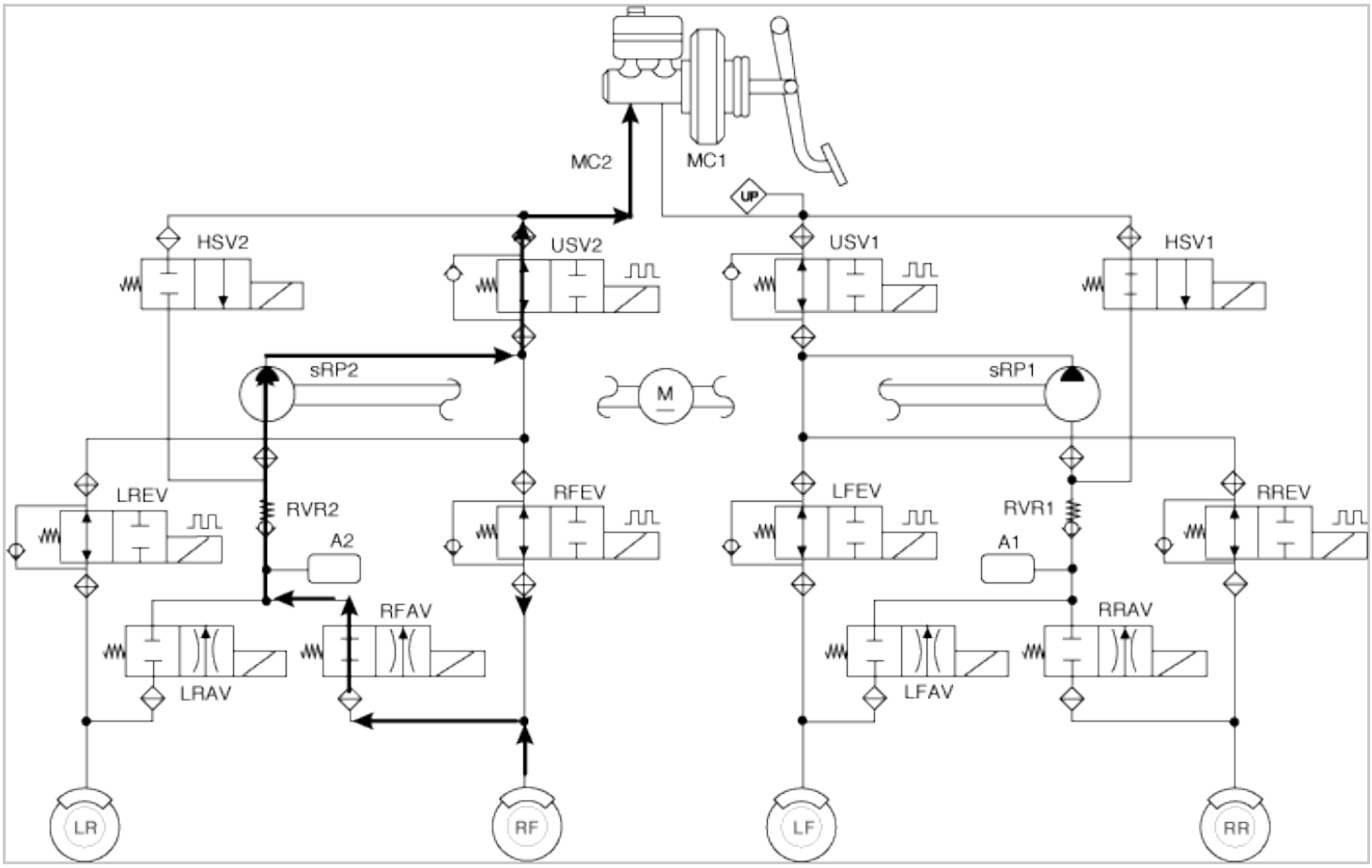


NOTICE

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

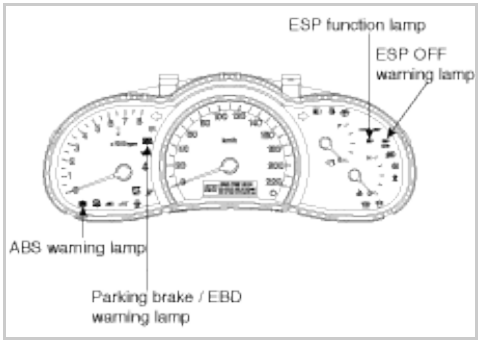
4. ESP DECREASE MODE (FR is only controlled)

	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)



NOTICE

EV : Inlet Valve
AV : Outlet Valve
LR : Rear left wheel
RF : Front right wheel
LF : Front left wheel
RR : Rear right wheel
PE : Pump motor
USV : Pilot Valve
HSV : High pressure Switch Valve



ABS Warning Lamp module

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

a. During the initialization phase after IGN ON. (continuously 3 seconds).
b. In the event of inhibition of ABS functions by failure.
c. During diagnostic mode.
d. When the ECU Connector is seperated from ECU.

EBD/PARKING BRAKE WARNING LAMP MODULE

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

a. During the initialization phase after IGN ON. (continuously 3 seconds).
b. When the Parking Brake Switch is ON or brake fluid level is low.
c. When the EBD function is out of order .
d. During diagnostic mode.
e. When the ECU Connector is seperated from ECU.

ESP Warning Lamp (ESP system)

The ESP warning lamp indicates the self-test and failure status of the ESP.
The ESP warning lamp is turned on under the following conditions :

a. During the initialization phase after IGN ON. (continuously 3 seconds).
b. In the event of inhibition of ESP functions by failure.
c. When driver turn off the ESP function by on/off switch.
d. During diagnostic mode.

ESC Function Lamp (ESC system)

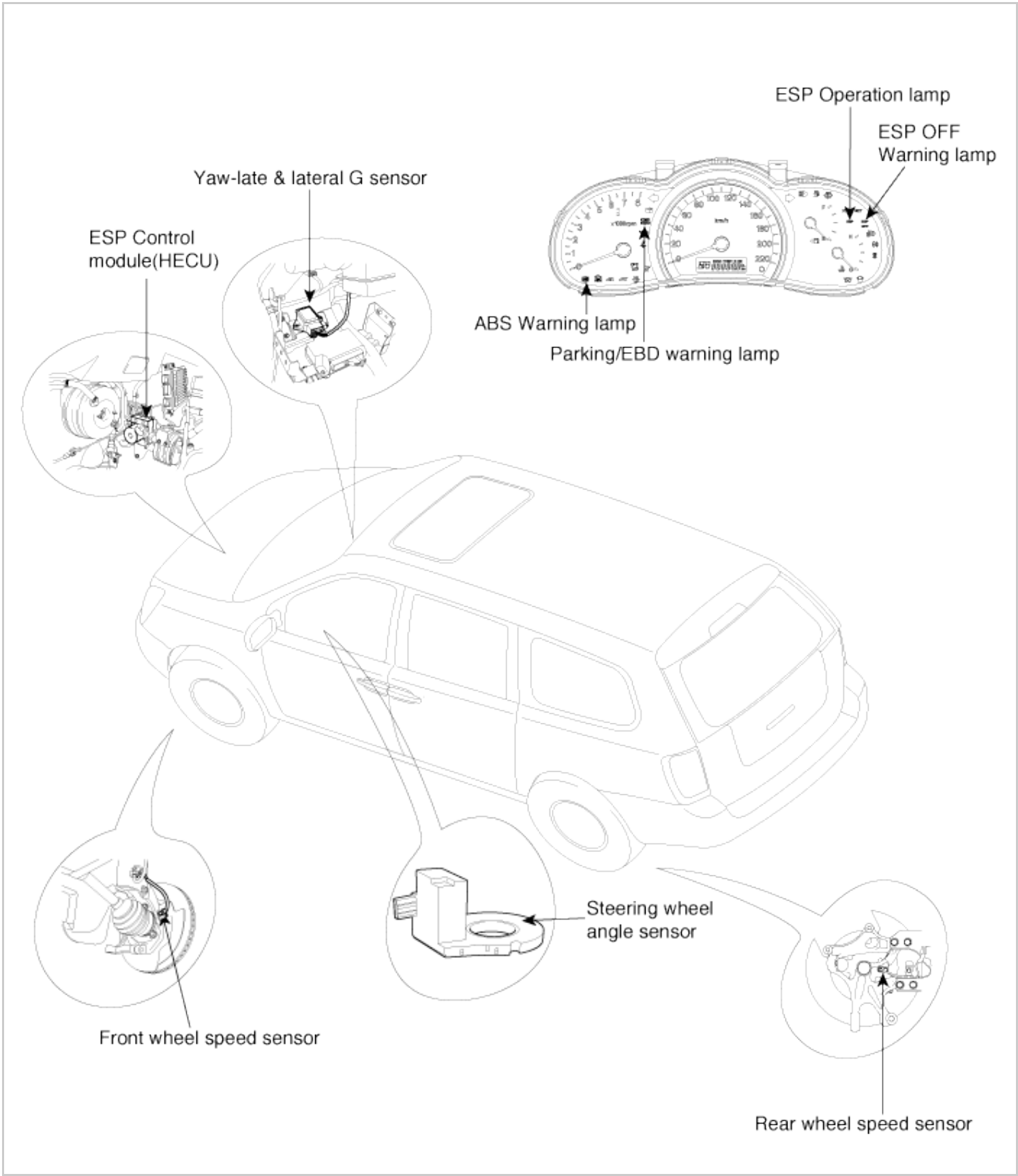
The ESP function lamp indicates the self-test and operating status of the ESP.
The ESP Function lamp operates under the following conditions :

a. During the initialization phase after IGN ON. (continuously 3 seconds).
b. When the ESP control is operating. (Blinking - 2Hz)

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.

COMPONENTS


ESP Operation lamp
ESP OFF
Warning lamp
Yaw-late & lateral G sensor
ESP Control
module(HECU)
ABS Warning lamp
Parking/EBD warning lamp
Steering wheel
angle sensor
Front wheel speed sensor
Rear wheel speed sensor

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.
4. Initial checkup is made in the following cases.
   (1) When no failure is detected
   (2) When ABS and ESP are not in control.
   (3) Initial checkup is not made after ECU power on.
   (4) If the vehicle speed is over 5 mph(8 km/h) when the brake lamp switch is off.
   (5) When the vehicle speed is over 24.8 mph(40 km/h).
5. Though, it keeps on checkup even if the brake lamp switch is on.
6. When performing ABS or ESP control before the initial checkup, stop the initial checkup and wait for the HECU power input again.
7. Judge failure in the following cases.
   (1) When the power is normal.
   (2) From the point in which the vehicle speed reaches 4.9 mph(8 km/h) after HECU power on.

COUNTERMEASURES IN FAIL

1. 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

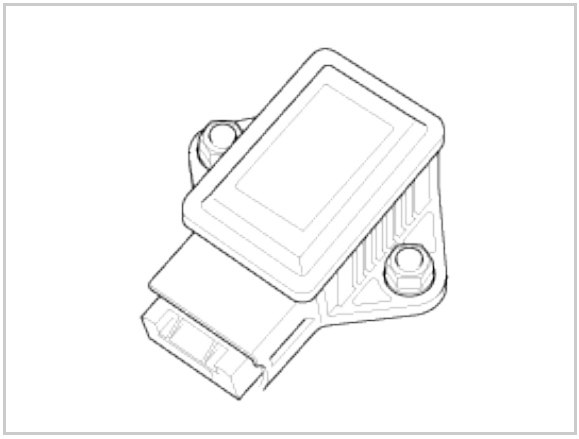
1. ABS warning lamp turns on when ABS is malfunctioning.
2. ESP operation lamp turns on when ESP is malfunctioning.

When power voltage and valve relay voltage are abnormal, input/output related failure judgment is not made.

Steering Angle Sensor

DESCRIPTION

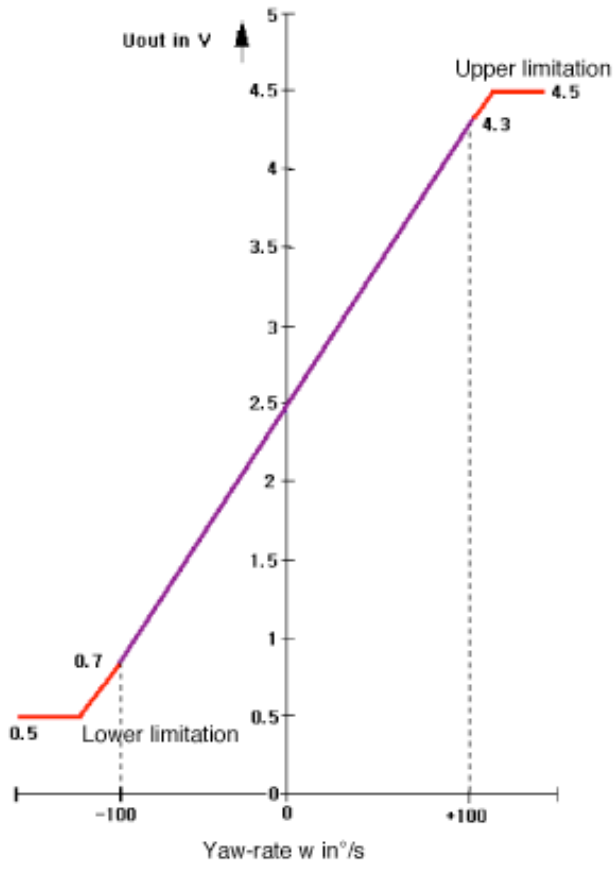
1. The yaw-rate & lateral G sensor is applied for the ESP system.
2. The yaw-rate is the angular velocity, when a vehicle turns a corner, and the lateral G is the acceleration to move a vehicle out of the way when cornering.
3. The sensor is located in the crash pad lower floor on vehicle.

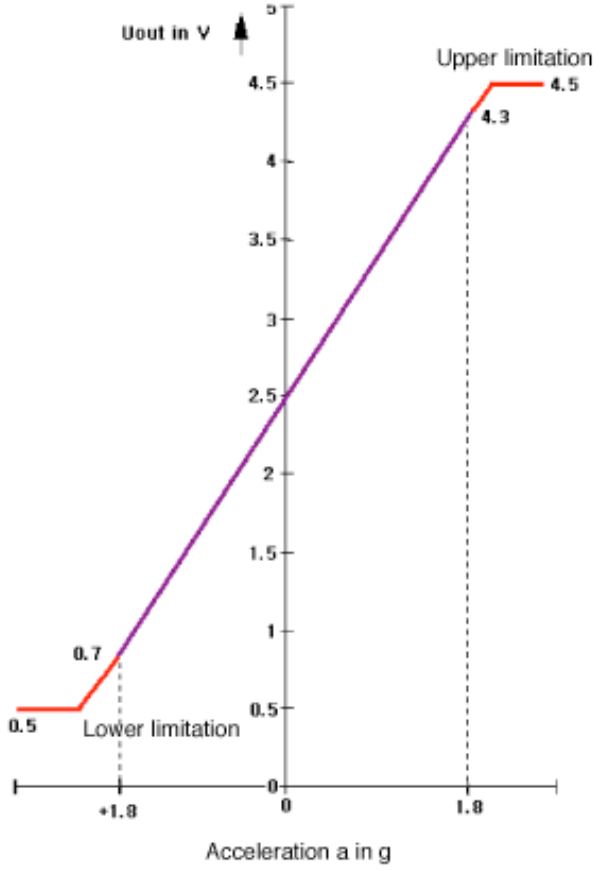


SPECIFICATION

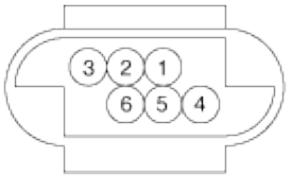
Description			Specification	Remark
Nominal supply voltage			11.5 ~ 12.5 V	
Supply voltage range			8 ~ 16 V	
Supply current			Max. 120 mA	Typ. 75 mA
Reference Voltage Output			2.464 ~ 2.536 V	Typ. 2.5 V
Operating temperature range			-40 ~ 85°C	
Yaw-late sensor	Measurement range	+w direction, left turn	Min.100 °/s	Typ. 111 °/S
		-w direction, right turn	Min.100 °/s	Typ. 111 °/S
	Non-linearity		-1 ~ 1 %	
	Offset (within life,within operating temperature)		3.75 °/S	
	Upper cut-off frequency		Min. 45 Hz	Typ. 60 Hz
Lateral G sensor	Measurement range	+y direction, left turn	Min.1.8 g	Typ. 2 g
		-y direction, right turn	Min. -1.8 g	Typ. 2 g
	Non-linearity		-4 ~ 4 %	
	Offset (within life,within operating temperature)		-0.09 ~ 0.09 g	
	Upper cut-off frequency		Min. 20 Hz	Typ. 40 Hz

OUTPUT CHARACTERISTIC

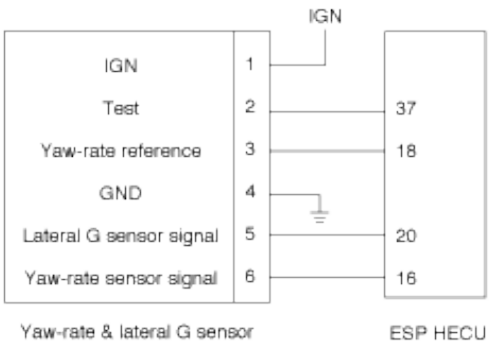




CIRCUIT DIAGRAM (YAW-RATE & LATERAL G SENSOR)



[Yaw-rate & lateral G sensor connector]



ESP OFF Switch

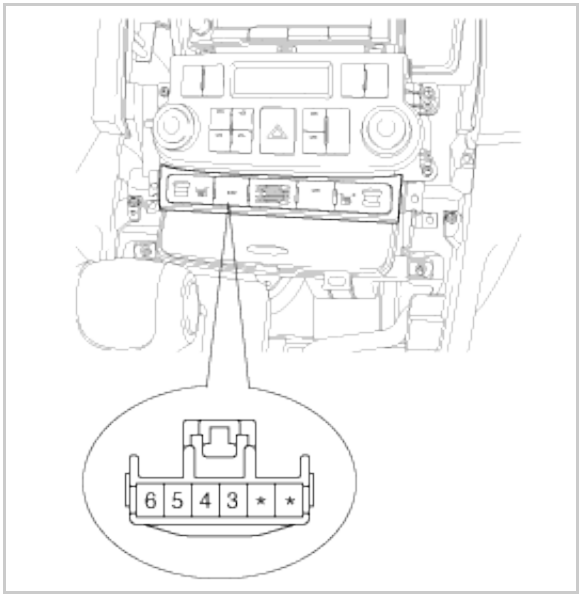
DESCRIPTION

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.

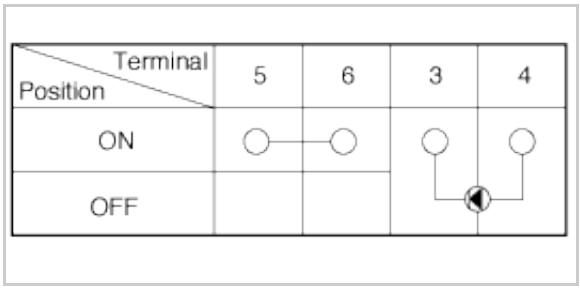
Yaw - rate
and
Lateral G Sensor

INSPECTION

1. Remove the ESP OFF switch from the switch panel on the crach pad of the driver's side.



2. Check the continuity between the switch terminals as the ESP OFF switch is engaged.



Steering Angle Sensor

DESCRIPTION

GENERAL DATA

The steering angle speed sensor detects the angle of the steering wheel in order to which direction a user chooses.

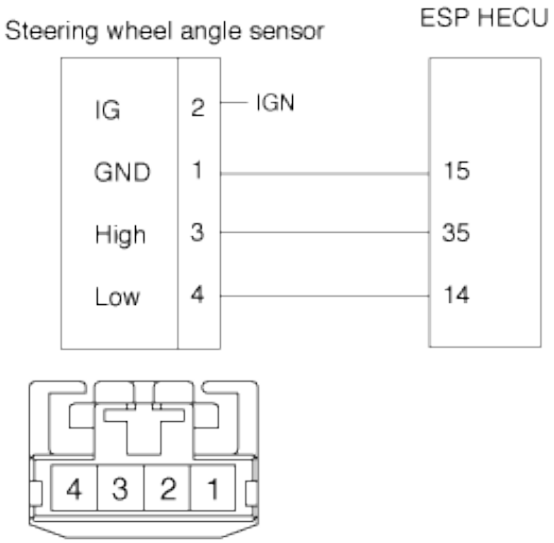
MEASUREING PRINCIPLE

A non contact, analog angle sensor carrying out absolute measuring by the use of the Anisotropic-Magneto-Resistive effect (AMR).Measuring of the absolute angle by means of a toothed measuring gear with magnetic properties in combination with different ratios. Corresponding AMR elements that change their electrical resistance according to the magnetic field direction detect the angle position of the measuring gears.A micro-controller decodes the measured voltage signals after A/D converting with the help of a mathematical function. Output of the digital angle value and velocity via CAN-interface.

SPECIFICATION

Description		Specification
Operating voltage		8~16 V
Operating temperature		-40 ~ 85 °C
Current consumption		Max.150 mA
Steering angle velocity		Max. ±2000 °/sec
Connection delay time		t < 200 ms
Reverse voltage		-13.5 V
Measuring range	Angle	-780 ° ~ 779 °
	Angular velocity	0~ 1016 °/s
Nonlinearity angle		-2.5 ° ~ +2.5 °
Hysteresis angle		0 ° ~ 5 °
Rotational friction torque measuring		10 °/s

CIRCUIT DIAGRAM(STEERING WHEEL SPEED ANGLE SENSOR)

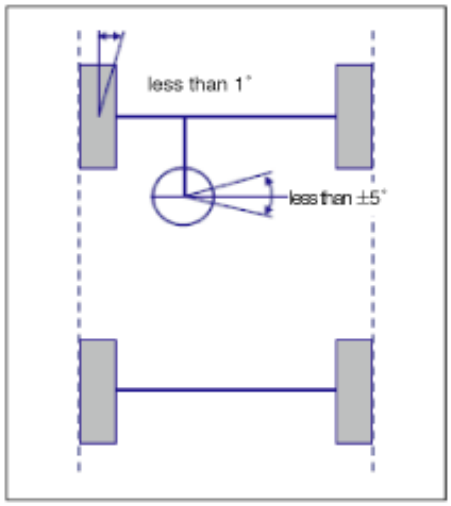


STEERING ANGLE SENSOR (SAS) calibration

1. PURPOSE OF calibration
   a. On vehicle control, an ESP analyzes the intention of the driver.
   b. An ESP recognizes a steering angle which a driver rotates through the steering angle sensor.

c. A steering angle sensor used in ESP adjusts 0° setting of steering wheel through K-line or CAN communication.

2. STEERING ANGLE SENSOR (SAS) CALIBRATION METHOD



(1) Align the wheel to the straight line. (steering wheel < ± 5°)
ex) Perform the wheel alignment first.
Align the wheel to the straight line.
A driver moves the vehicle to the front and back about 5 meters twice or three times.

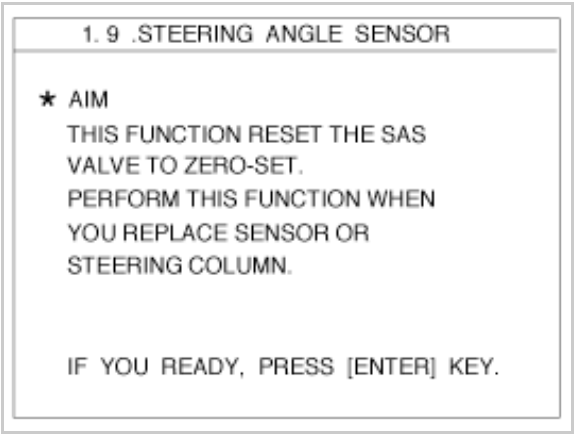
(2) Connect Scan tool to the vehicle.

(3) Select Brake system.

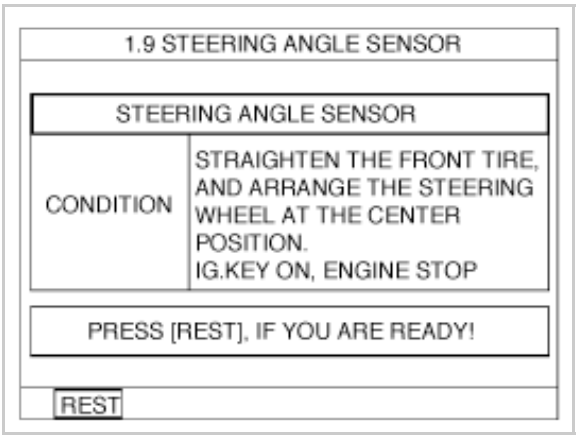
(4) Select Steering angle sensor(SAS) calibration.



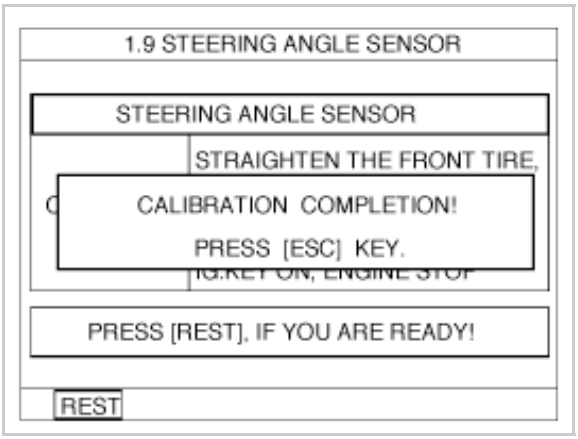
(5) Perform the Steering angle sensor(SAS) calibration.



(6) Perform the procedure continuously.



(7) The procedure is finished. Push the "ESC" key.



(8) Scanner OFF.

(9) Remove the scanner from the vehicle.

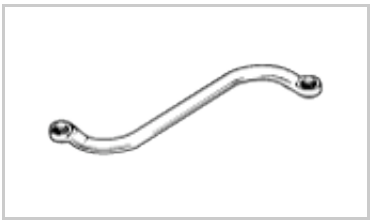
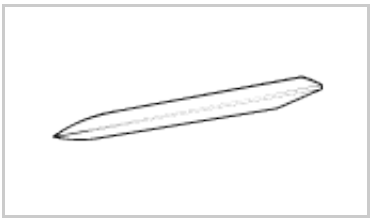
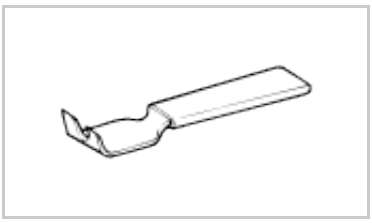
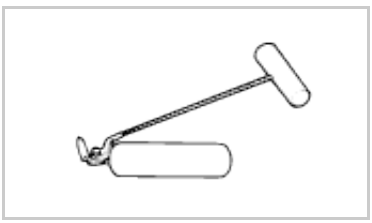
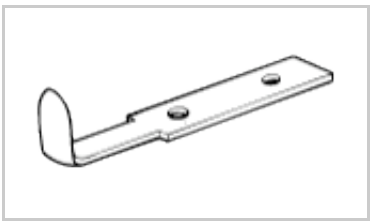
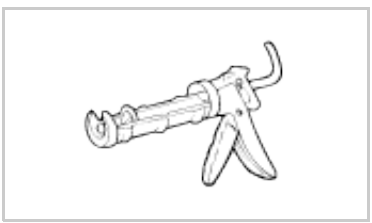
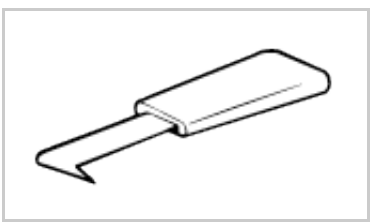
(10) Confirm the Steering angle sensor(SAS) calibration as driving the vehicle.(turn left once, turn right once)

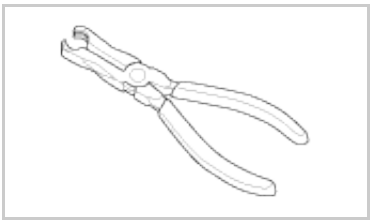
CHAPTER 14:

Body
(Interior and Exterior)

General information

SPECIAL TOOLS

Tool (Number and name)	Illustration	Use
09793-21000 Door hinge adjusting wrench		Adjustment, removal and installation Of the door hinge
09800-21000 Ornament remover		Trim removal
09853-31000 Headliner clip remover		Removal of the headliner clips
09861-31100 Sealant cut-out tool		Cutting the sealant of the windshield (Use with 09861-31200)
09861-31200 Sealant cutting blade		Cutting the sealant of the windshield (Use with 09861-31100)
09861-31300 Sealant gun		Application of the sealant to the windshield
09861-31400 Glass holder		Removal and installation of the windshield
09861-31000 Windshield moulding remover		Removal of the windshield moulding

09880-4F000 Hogring clip installer		Installation of the hogring clip

TROUBLESHOOTING

Symptom	Suspect Area	Remedy (See page)
Water leaks from sunroof	Dirt accumulated in drain tube	Clear dirt inside of drain
	Clogged drain tube	Blow air into drain to remove dirt
	Broken or dislocated drain tube, defective Or cracked clip	Check tube installation and Flange contact
	Deteriorated roof lid weatherstrip	Replace
	Excessive roof lid-to-body clearance and Improperly fitted weatherstrip	Adjust
Wind noise around sunroof	Loose or deformed deflector, gaps In body work	Retighten adjust or replace
Sunroof lid makes a noise when moveing	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	Check drive cable and guide Rails for foreign particles
	Incorrect engagement of motor pinion With drive cable	Check for loose motor installation And damaged pinion
	Decrease in motor`s clutch slipping force	Adjust
	Increased sunroof sliding resistance Or interference of sunroof with drive cables, weatherstrip, etc. due to maladjustment of sunroof	Adjust or replace
Noise in motor (clutch slipping Noise from motor when sunroof Is fully opened or closed is not An unusual noise	Incorrect engagement of motor pinion With drive cable	Check pinion installation and Retighten motor
	Worn out or damaged motor pinion bearing	Replace motor assembly
	Worn out or deformed drive cable	Replace
Door glass fails to operate Up and down	Incorrect window glass installation	Adjust position
	Damaged or faulty regulator arm or regulator	Correct or replace
Door does not open or close completely	Incorrect door installation	Adjust position
	Defective door check assembly	Correct or replace
	Door hinge requires grease	Apply grease
Hood does not open or close completely	Striker and latch not properly aligned	Adjust
	Incorrectly installed hood	Adjust
	Incorrect hood bumper height	Adjust
Water leak through windshield end rear window	Defective seal	Fill with sealant
	Defective flange	Correct

SPECIFICATIONS

HOOD	Type	Rear hinged, gas lifter type
REAR DOOR	Construction Regulator system Locking system	Front hinged, full door construction X-ARM type Pin-fork system
FRONT DOOR	Construction Regulator system Locking system	Sliding door construction Wire drum type Pin-fork system
TAILGATE	Type	Inner hinged, gas lifter type
GLASS THICKNESS	Windshield glass Front door glass Rear door glass Rear window glass	5mm 4mm 4mm 3.5mm
SEAT BELTS	Front Rear	3 point type with Emergency Locking Retractor (E.L.R) 3 point type with Emergency Locking Retractor (E.L.R)

TIGHTENING TORQUE

Items		N.m	Kgf.m	Lbf.ft
Front and rear doors	Door hinge to body	33.3~41.2	3.4~4.2	24.6~30.4
	Door hinge to door	21.6~26.5	2.2~2.7	15.9~19.5
	Striker	6.9~10.8	0.7~1.1	5.1~8.0
	Glass mounting bolt	7.8~11.8	0.8~1.2	5.8~8.7
	Outside handle mounting bolt	6.9~10.8	0.7~1.1	5.1~8.0
	Rear channel mounting nut	7.8~11.8	0.8~1.2	5.8~8.7
Tailgate	Tailgate hinge to body	6.9~8.8	0.7~0.9	5.1~6.5
	Tailgate hinge to tailgate	6.9~8.8	0.7~0.9	5.1~6.5
	Tailgate lift mounting bolt	6.9~8.8	0.7~0.9	5.1~6.5
	Key cylinder mounting nut	6.9~10.8	0.7~1.1	5.1~8.0
Hood	Hood hinge to body	21.6~26.5	2.2~2.7	15.9~19.5
	Hood hinge to hood	21.6~26.5	2.2~2.7	15.9~19.5
	Hood latch to body	6.9~10.8	0.7~1.1	5.1~8.0
Seat	Front seat mounting bolts	43.1~64.7	4.4~6.6	31.8~47.7
	Rear seat mounting bolts	43.1~64.7	4.4~6.6	31.8~47.7
Seat belt	Front seat belt height adjuster			
	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 39.2~53.9	4.0~5.5 4.0~5.5	28.9~39.8 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	39.2~53.9	4.0~5.5	28.9~39.8
	attaching bolt	39.2~53.9	4.0~5.5	28.9~39.8
	Rear seat belt retractor mounting bolt			

Exterior

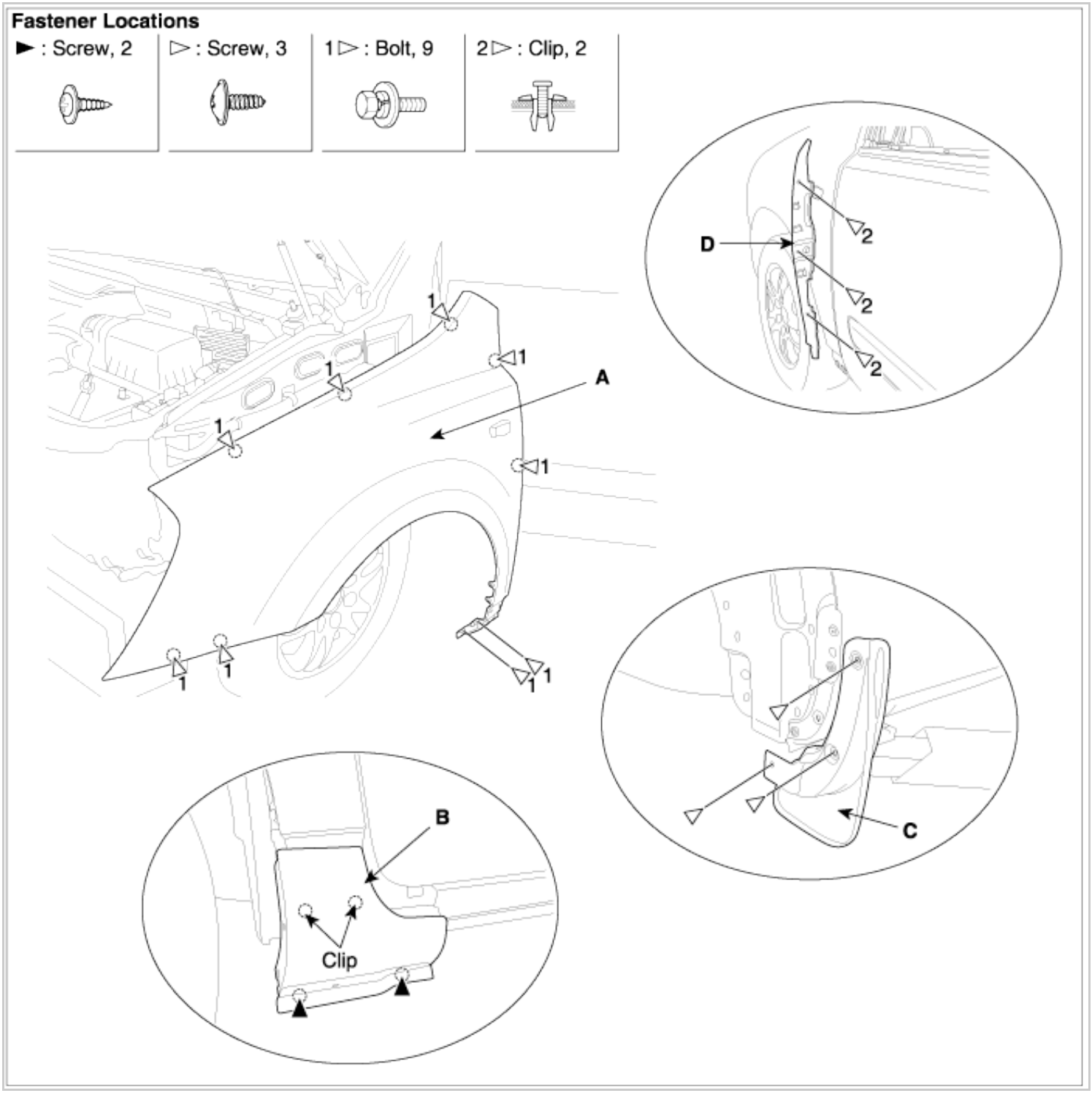
Fender

REPLACEMENT

NOTICE

a. Take care not to damage the hood and body.
b. When removing the clips, use a clip remover.

1. Remove the following items.
   a. Headlamp assembly.
   b. Front bumper.
   c. Side garnish (B), mud guide (C), cover (D)
2. After loosening the fender mounting bolts, remove the fender (A).
3. Installation is the reverse of removal.



Hood

REPLACEMENT

HOOD ASSEMBLY REPLACEMENT

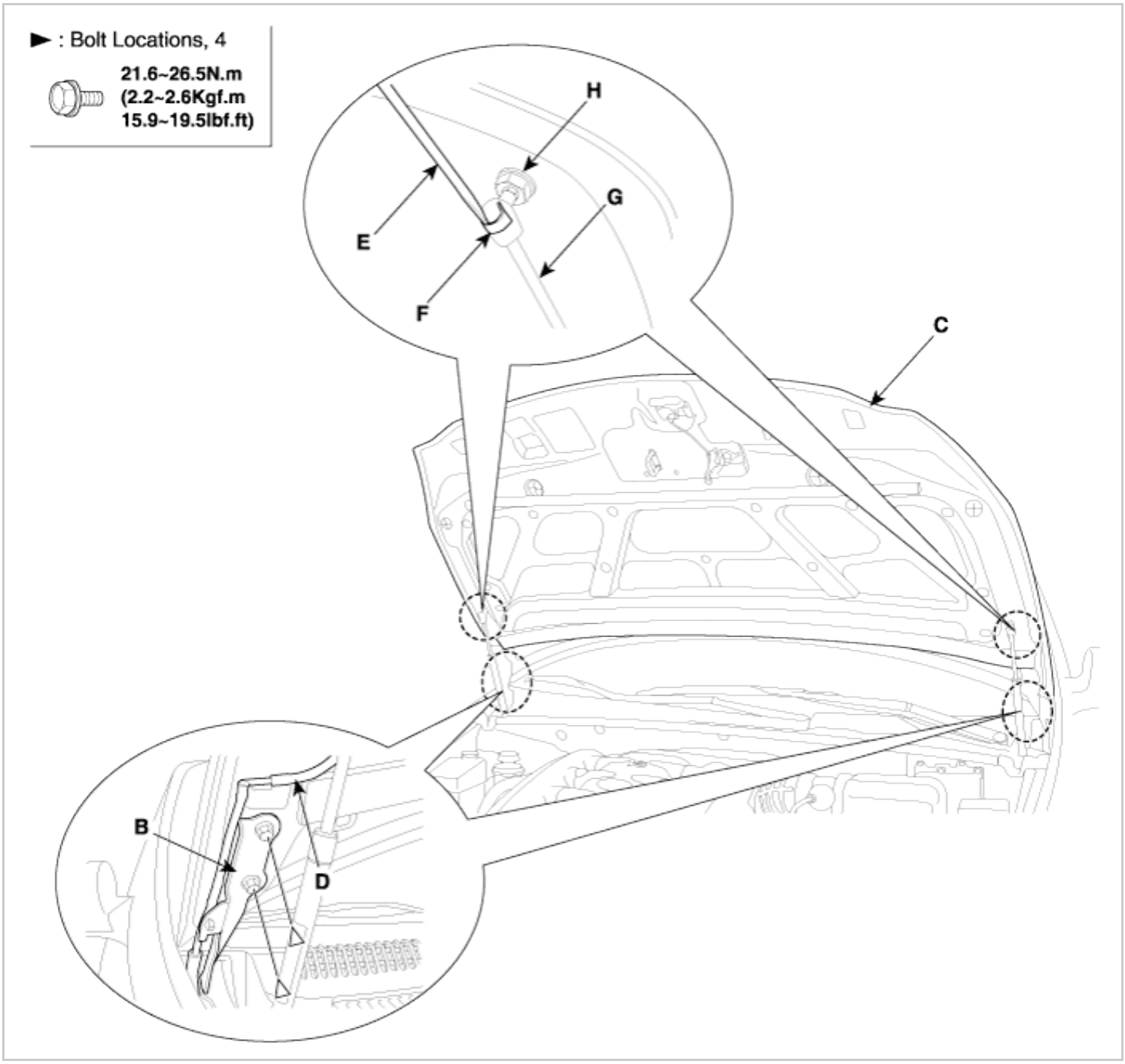
NOTICE

a. When removing and installing the hood, an assistant is necessary.
b. Take care not to damage the hood and body.
c. When removing the clips, use a clip remover.

1. Disconnect the windshield washer nozzle connecting tube (D).
2. Using a screwdriver (E), lift up slightly the socket clips (F) of both ends on the lifter (G), and then remove the lifter from the bracket (H).
3. After loosen the hood hinge (B) mounting bolts, remove the hood (C).
4. Installation is the reverse of removal.

NOTICE

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

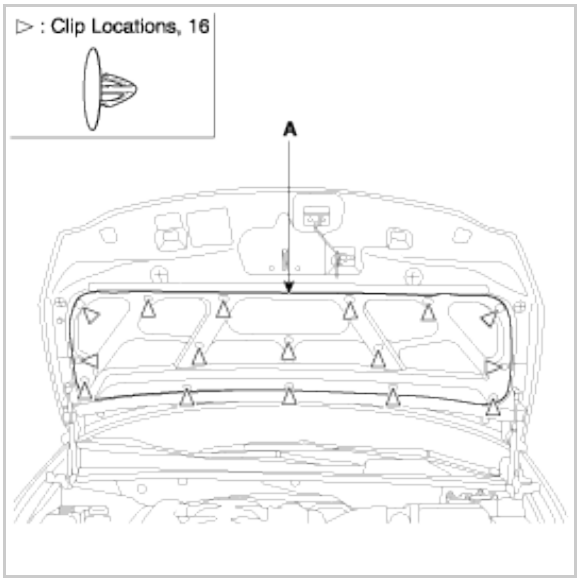


HOOD INSULATOR REPLACEMENT

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

NOTICE

a. Take care not to scratch the hood panel.



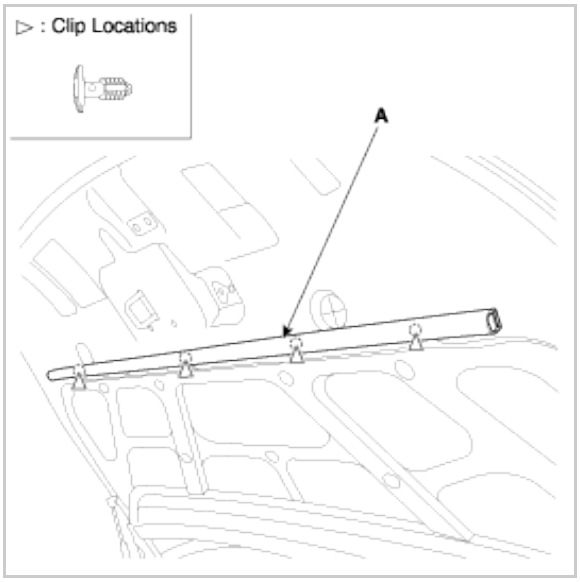
2. Installation is the reverse of removal.

NOTICE

a. Replace any damaged clips.

HOOD WEATHERSTRIP REPLACEMENT

1. Detach the clips, then remove the hood weatherstrip(A). Take care not to scratch the hood.



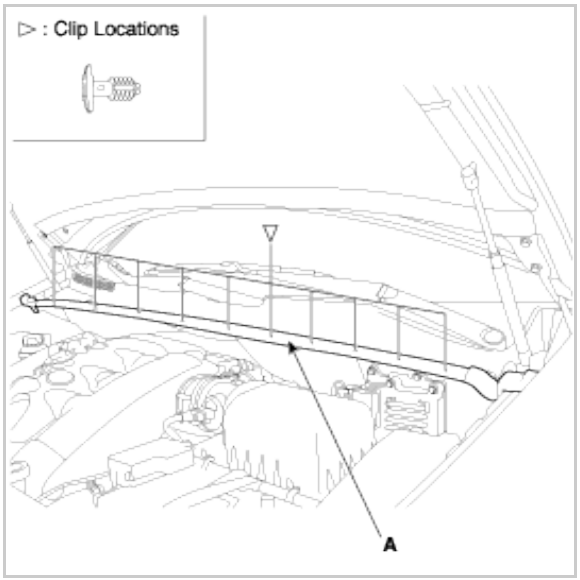
2. Installation is the reverse of removal.

NOTICE

a. Replace any damaged clips.

HOOD SEAL WEATHERSTRIP REPLACEMENT

1. Detach the clips, then remove the hood weather strip(A). Take care not to scratch the hood.



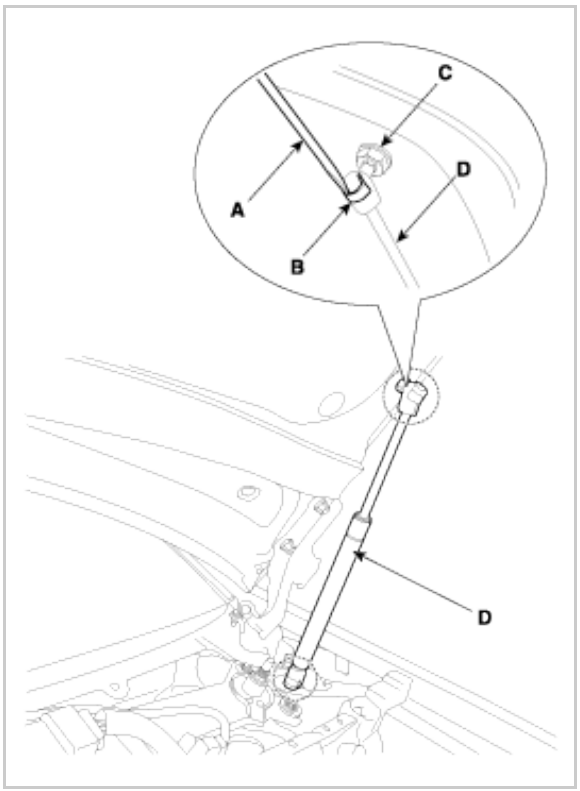
2. Installation is the reverse of removal.

NOTICE

a. Replace any damaged clips.

HOOD LIFT REPLACEMENT

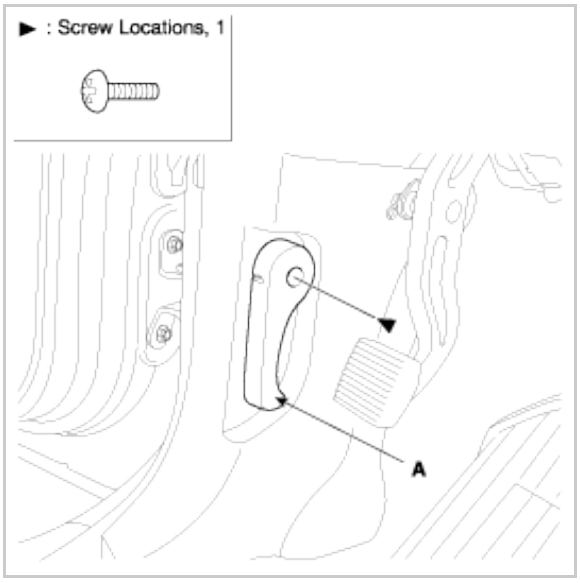
1. Using a screwdriver (A), lift up slightly the socket clips (B) of both ends on the lifter (D), and then remove the lifter from the bracket (C).



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

HOOD RELEASE HANDLE REPLACEMENT

1. Remove the mounting bolt, then remove the hood release handle (A).

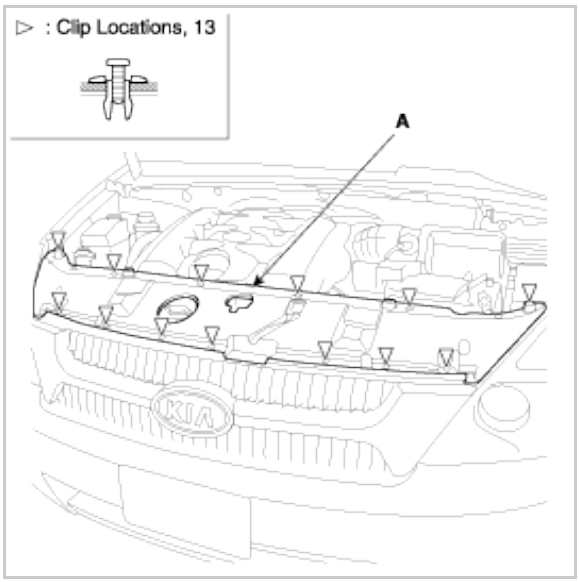


2. Installation is the reverse of removal.

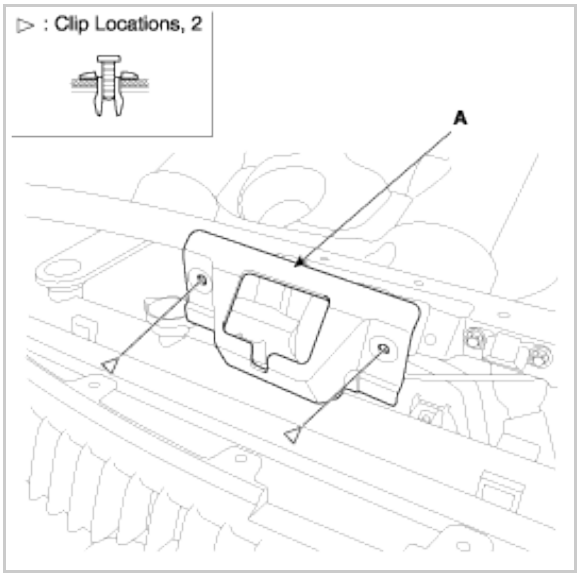
> **NOTICE**
>
> a. Make sure the hood latch cable is connected properly.
> b. Make sure the hood locks securely.

HOOD LATCH REPLACEMENT

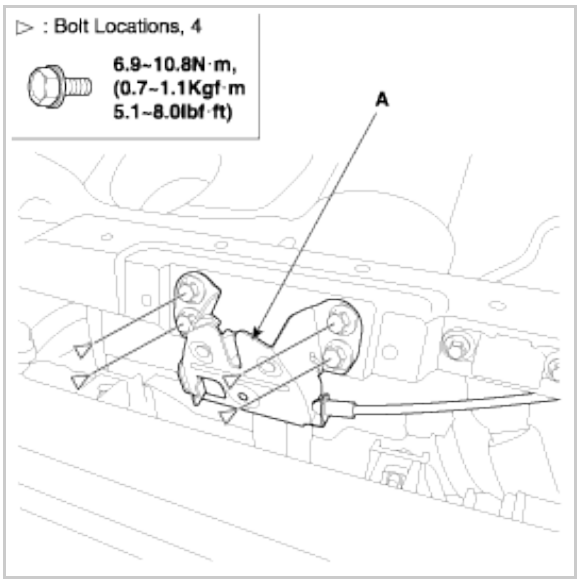
1. Detach the clips, then remove the under cover(A).



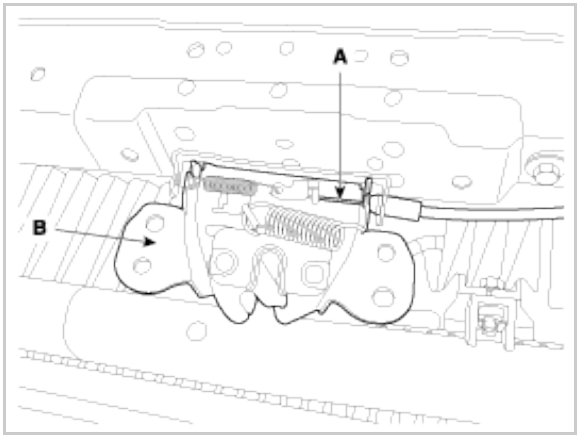
2. Detach the clips, then remove the hood latch cover(A).



3. Remove the hood latch (A) mounting bolts.
4. Remove the latch (A).



5. Disconnect the hood latch cable (A) and Remove the latch (B).



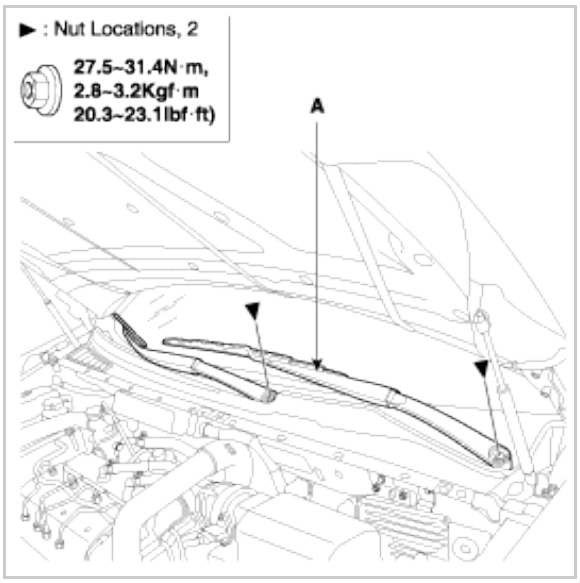
6. Installation is the reverse of removal.

NOTICE

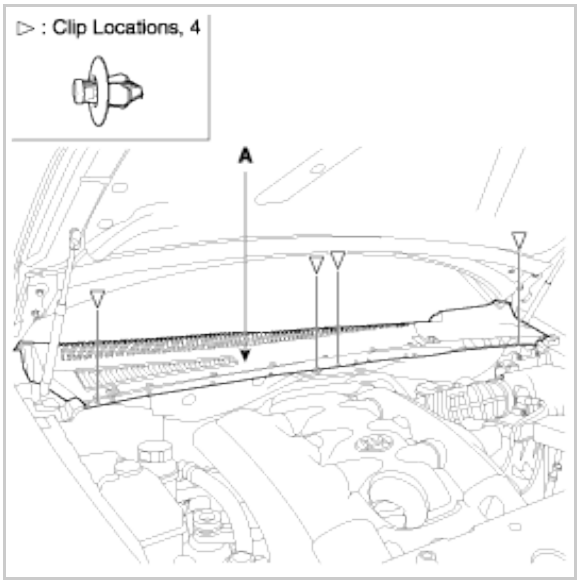
a. Make sure the hood latch cable is connected properly.
b. Make sure the hood locks securely.

COWL TOP COVER REPLACEMENT

1. Remove the wiper (A).



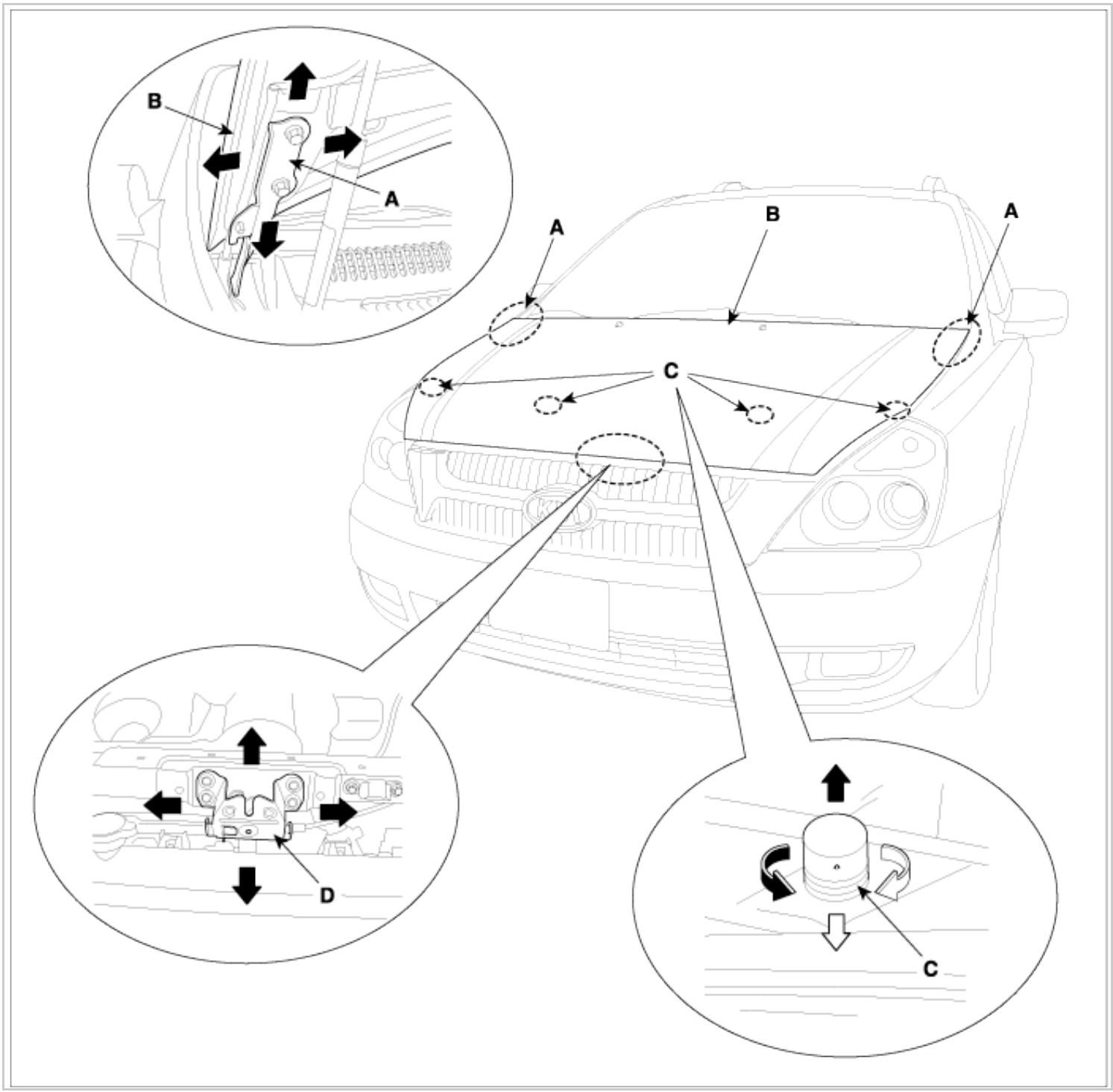
2. Remove the hood seal weather strip.
3. Detach the clips, then remove the cowl top cover (A).



4. Installation is the reverse of removal.

HOOD ADJUSTMENT PROCEDURES

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

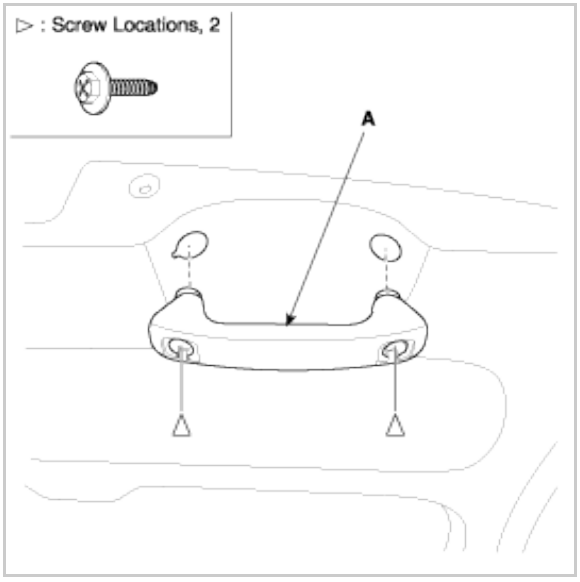

B
A
A
B
A
C
D
C

Taligate

REPLACEMENT

INSIDE HANDLE REPLACEMENT

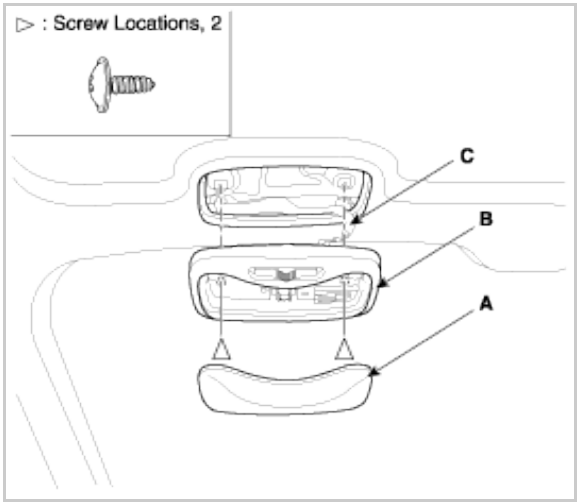
1. After loosening the mounting screws, remove the inside handle (A).



2. Installation is the reverse of removal.

ROOM LAMP REPLACEMENT

1. Remove the room ramp.
   a. Remove the lens (A).
   b. Remove the screw.
   c. Pull out the room lamp (B).
   d. Disconnect the connector (C).



2. Installation is the reverse of removal.

TAILGATE TRIM REPLACEMENT

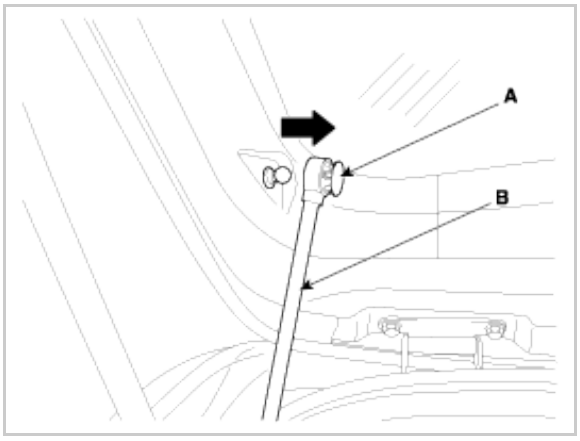
NOTICE

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

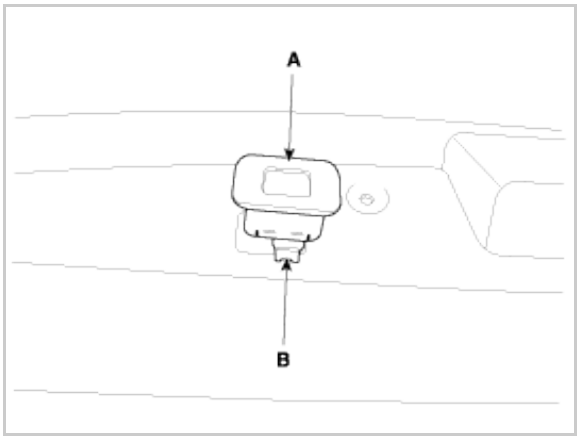
1. Remove the following items.
   a. Room lamp

b. Inside handle

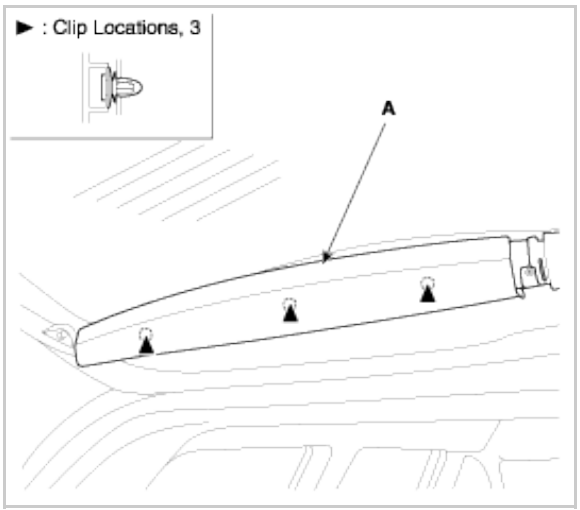
2. Disconnect the clip (A), remove the tailgate lifter (B).



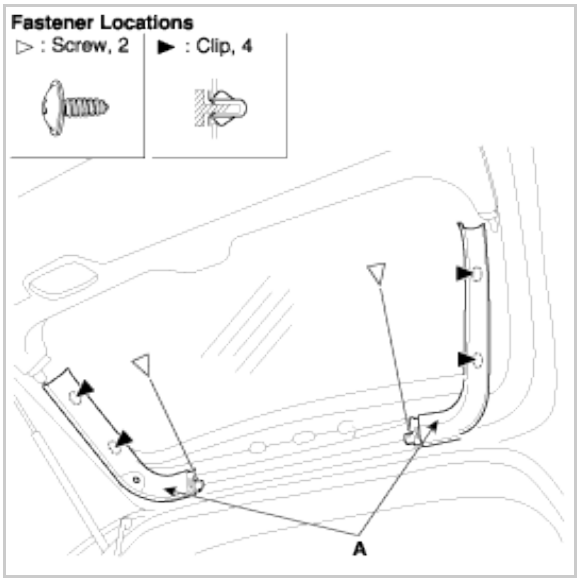
3. Using a screwdriver, remove the tailgate switch (A).
4. Disconnect the connector (B).



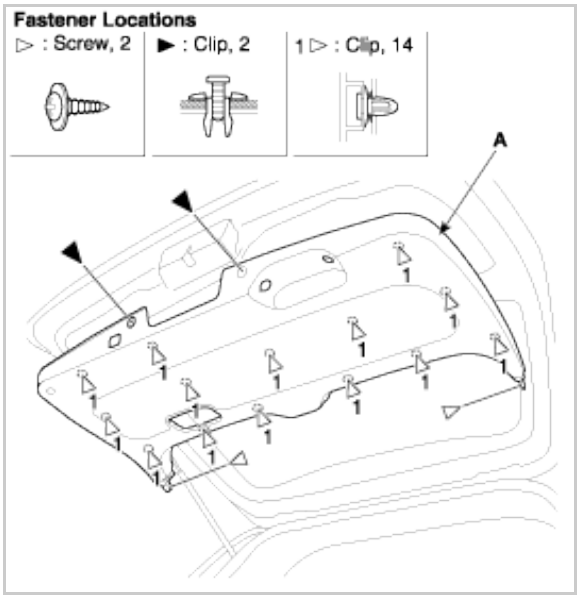
5. Using a screwdriver, remove the tailgate upper trim (A).



6. Loosen the screw, then remove tailgate side trim (A).



7. Loosen the screws and clips to the lower tailgate trim (A).



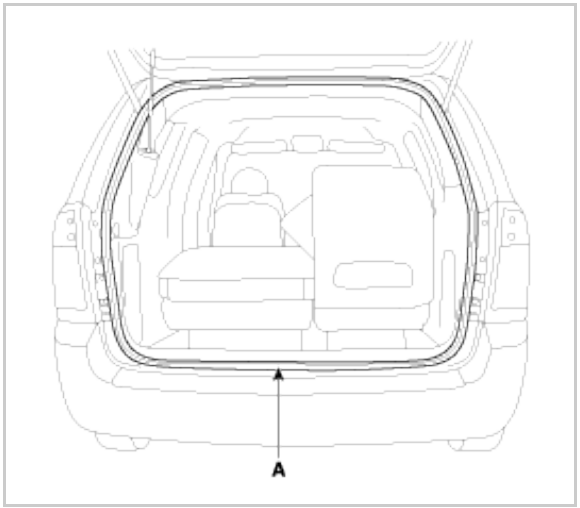
8. Installation is the reverse of removal.

NOTICE

a. Replace and damaged clips.

TAILGATE WEATHERSTRIP REPLACEMENT

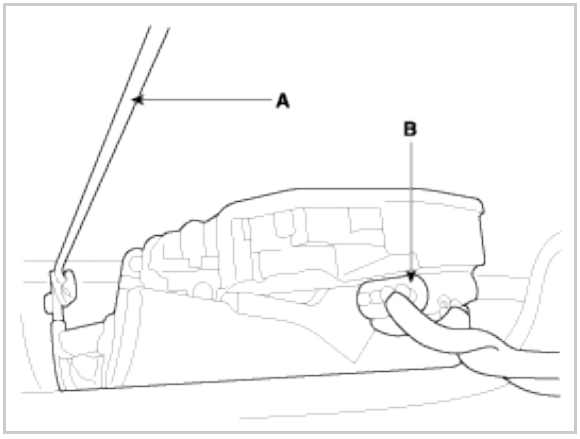
1. Remove the tailgate weather strip (A).



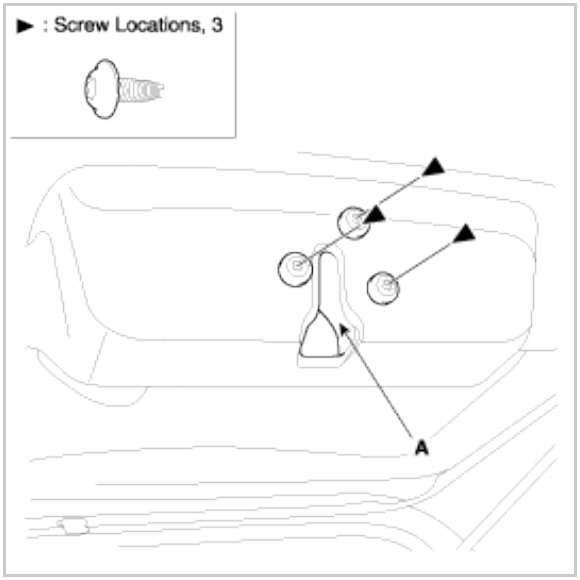
2. Installation is the reverse of removal.

LATCH ASSEMBLY REPLACEMENT

1. Remove the tailgate trim.
2. Disconnect the outside handle rod (A), connector (B).



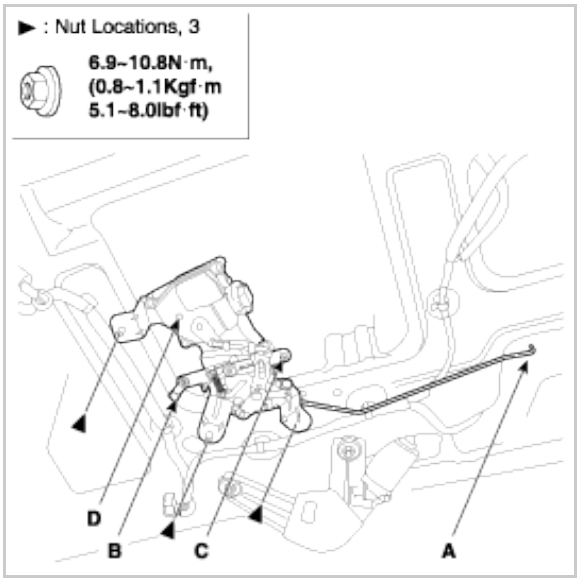
3. After loosening the mounting screws, then remove the latch assembly (A).



4. Installation is the reverse of removal.
   a. Make sure the connector is connected properly and the connecting rod is connected properly.
   b. Make sure the tailgate opens properly and locks securely.

ACTUATOR ASSEMBLY REPLACEMENT

1. Remove the tailgate trim.
2. Disconnect the outside handle rod (A), actuator rod (B), key cylinder rod (C) and connector.
3. After loosening the mounting bolt and nuts, then remove the actuator assembly (D).



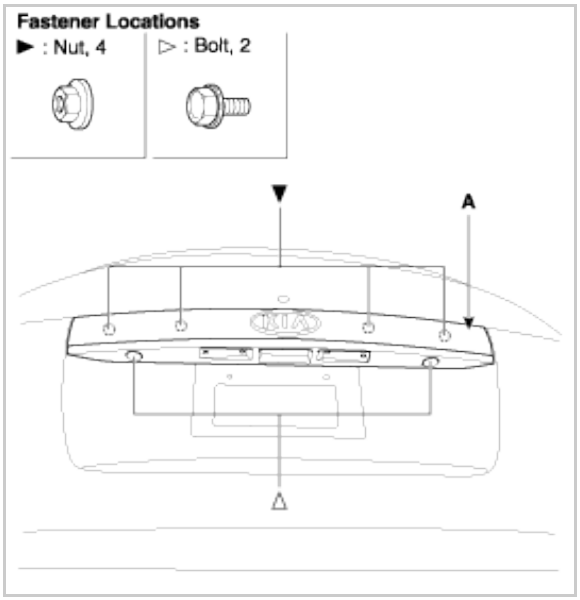
4. Installation is the reverse of removal.

NOTICE

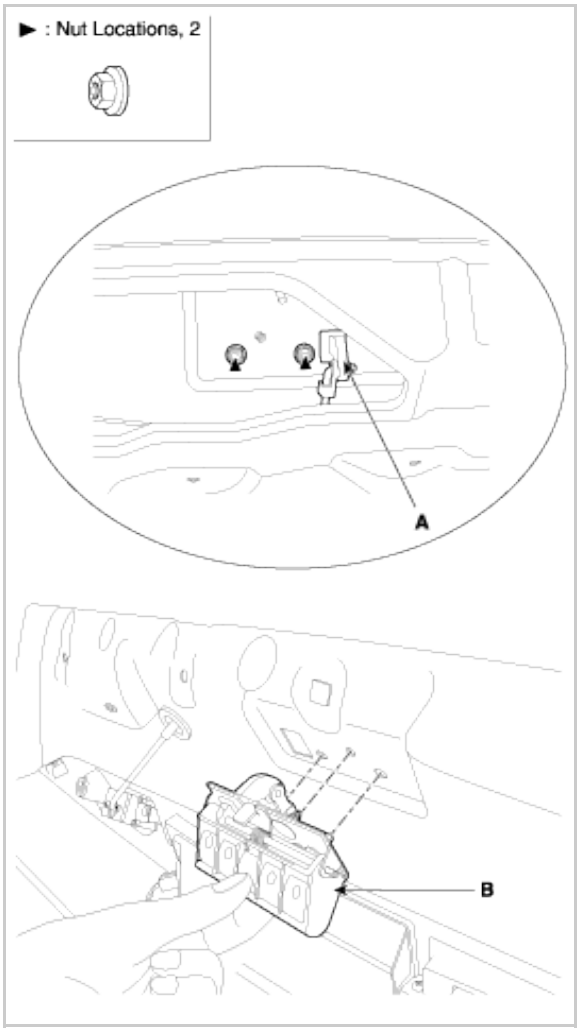
a. Make sure the connector is connected properly and the connecting rod is connected properly.
b. Make sure the tailgate opens properly and locks securely.

OUTSIDE HANDLE REPLACEMENT

1. Remove the tailgate trim.
2. After loosening the mounting bolt and nuts, then remove the tailgate garnish (A).



3. Disconnect the outside handle rod (A).
4. Loosen the outside handle (B) mounting bolts.



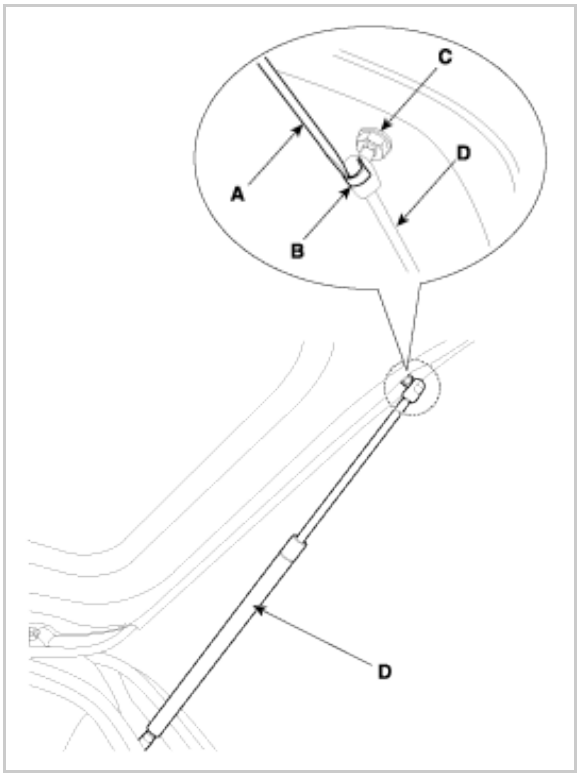
5. Installation is the reverse of removal.

NOTICE

a. Make sure the tailgate opens properly and locks securely.

LIFTER REPLACEMENT

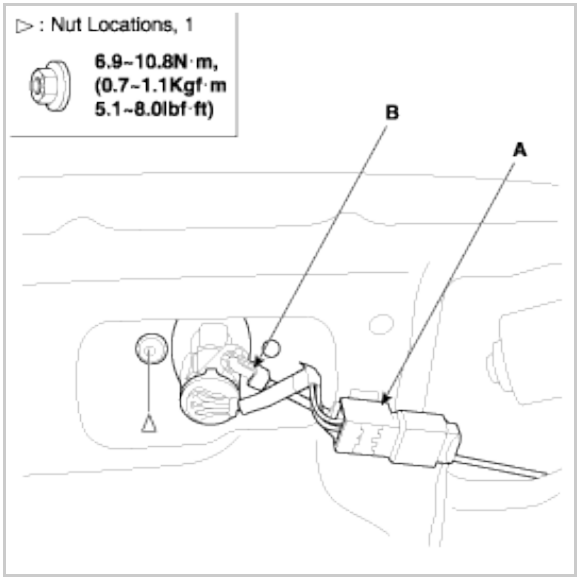
1. Using a screwdriver (A), lift up slightly the socket clips (B) of both ends on the lifter (D), and then remove the lifter from the bracket (C).



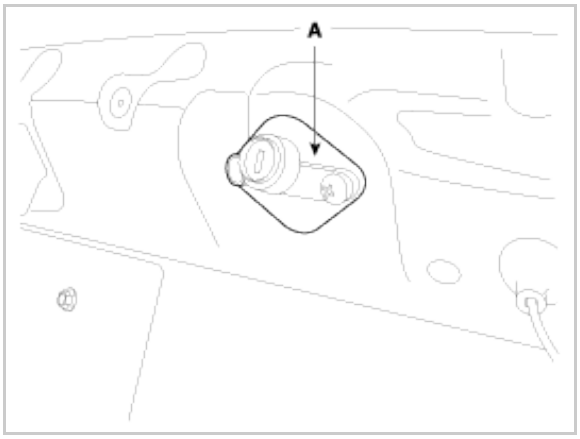
2. Push the socket of the lifter into the bracket for installation.

KEY HOLDER REPLACEMENT

1. Remove the tailgate trim.
2. Remove the tailgate garnish.
3. Disconnect the key rod (B) and connector (A).



4. Remove the key holder (A).



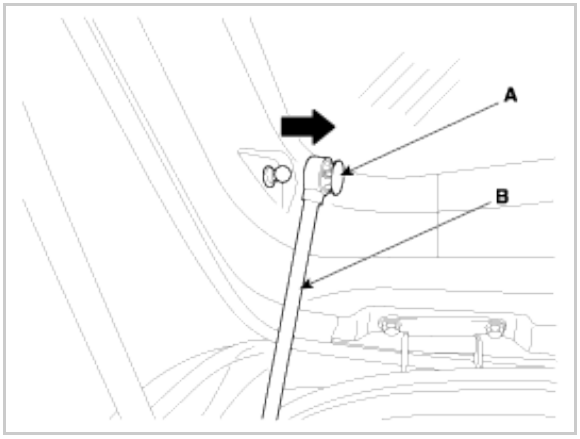
5. Installation is the reverse of removal.

NOTICE

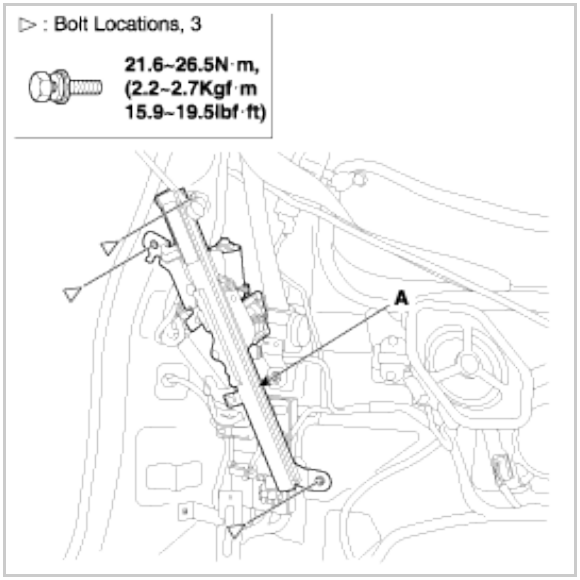
a. Make sure the tailgate opens properly and locks securely.

POWER TAILGATE MOTER ASSEMBLY REPLACEMENT

1. Remove the rear seat assembly.
2. Remove the luggage trim.
3. Disconnect the clip (A), remove the tailgate lifter (B).



4. Disconnect the connector.
5. After loosening the mounting bolts, then remove the tailgate motor assembly (A).



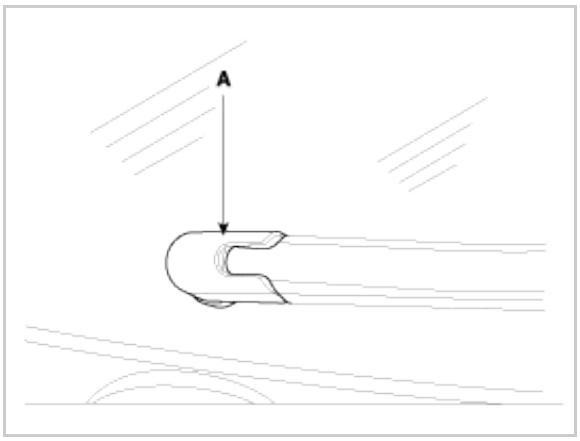
6. Installation is the reverse of removal.

NOTICE

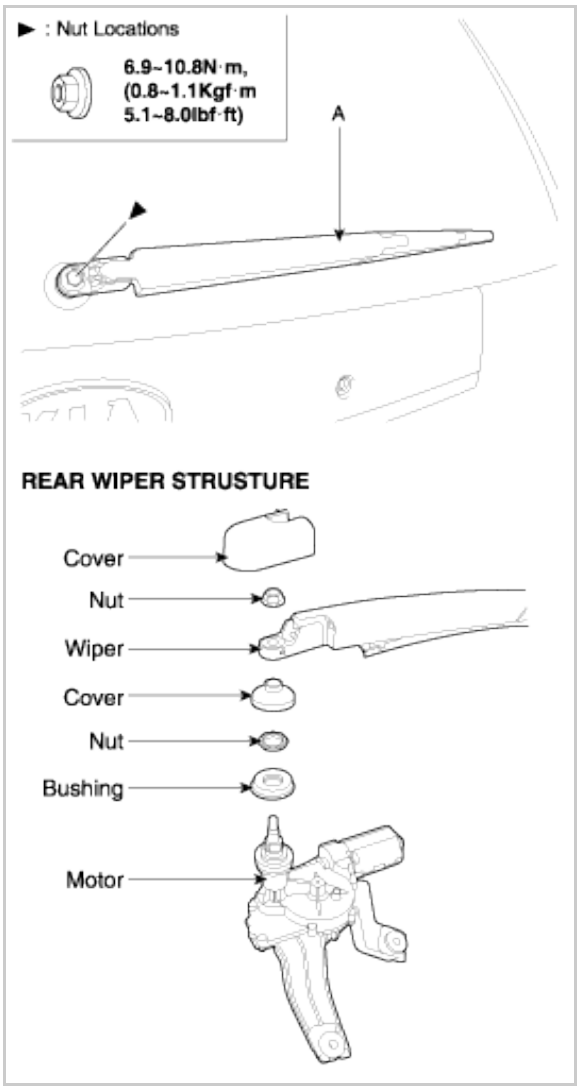
a. Make sure the connector is plugged in properly.
b. Make sure the tailgate opens properly and locks securely.

REAR WIPER REPLACEMENT

1. Using a screwdriver, detach cover (A).



2. Remover the rear wiper (A).

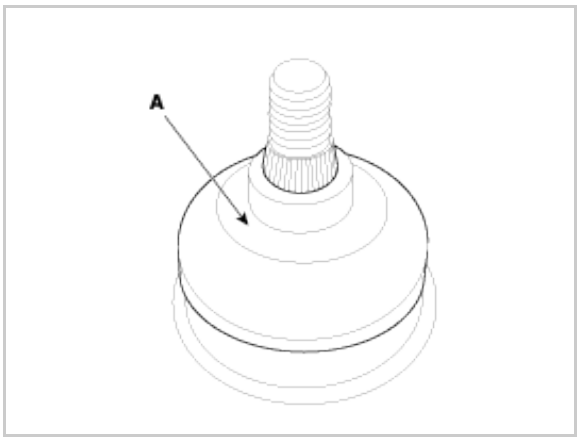


3. Installation is the reverse of removal.

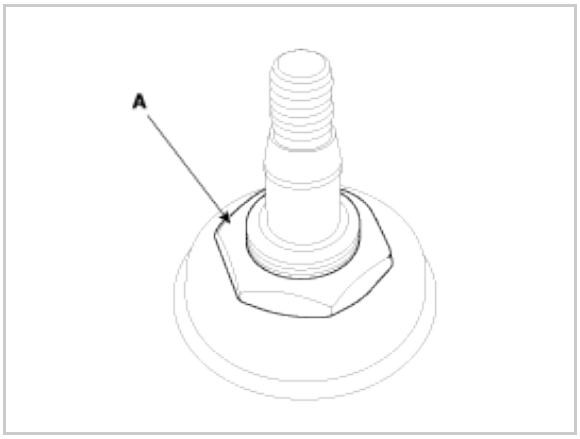
REAR WIPER MOTER ASSEMBLY REPLACEMENT

1. Remove the tailgate trim.
2. Remove the rear wiper.

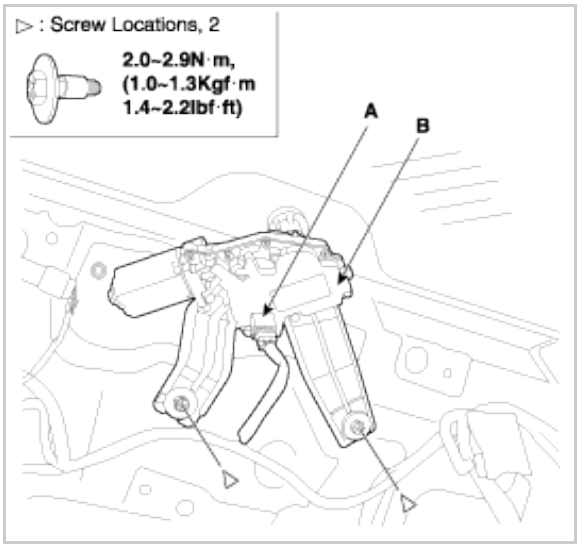
3. Remove cover (A).



4. Loosen the mounting nut (A).



5. After disconnecting the connector (A), remove the motor (B).

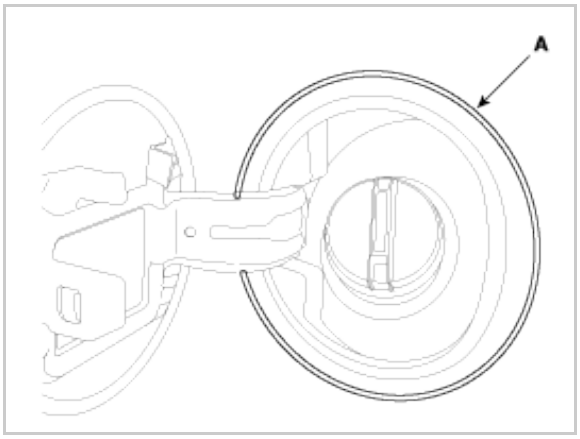


6. Installation is the reverse of removal.

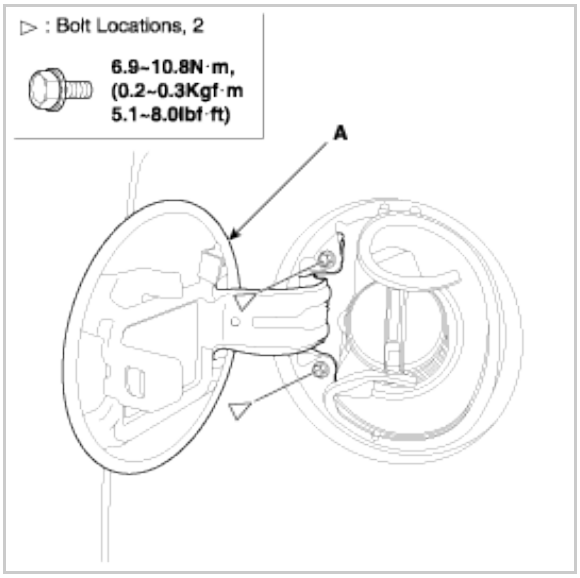
> **NOTICE**
>
> a. Make sure the connector is plugged in properly.
> b. Make sure the rear wiper.

FUEL FILL DOOR REPLACEMENT

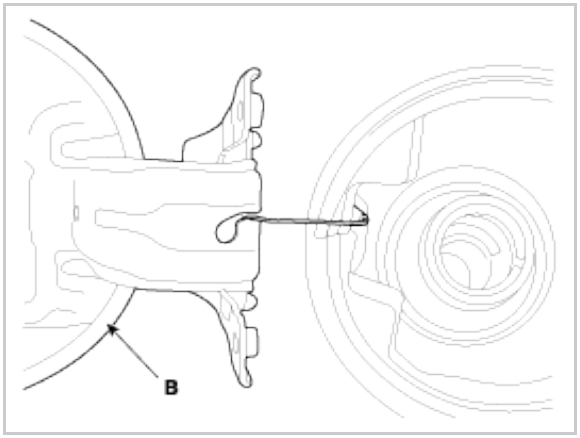
1. Remove the clip (A).



2. Loosen the bolts, then remove the fuel fill door (A).



3. Remove the fuel fill door (B).

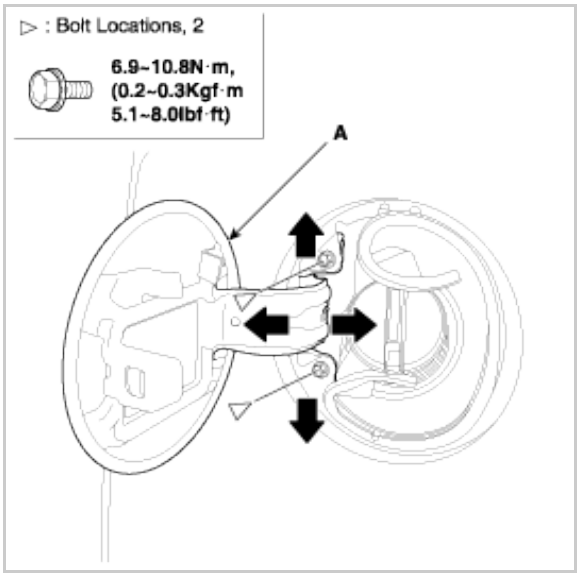


4. Installation is the reverse of removal.

NOTICE

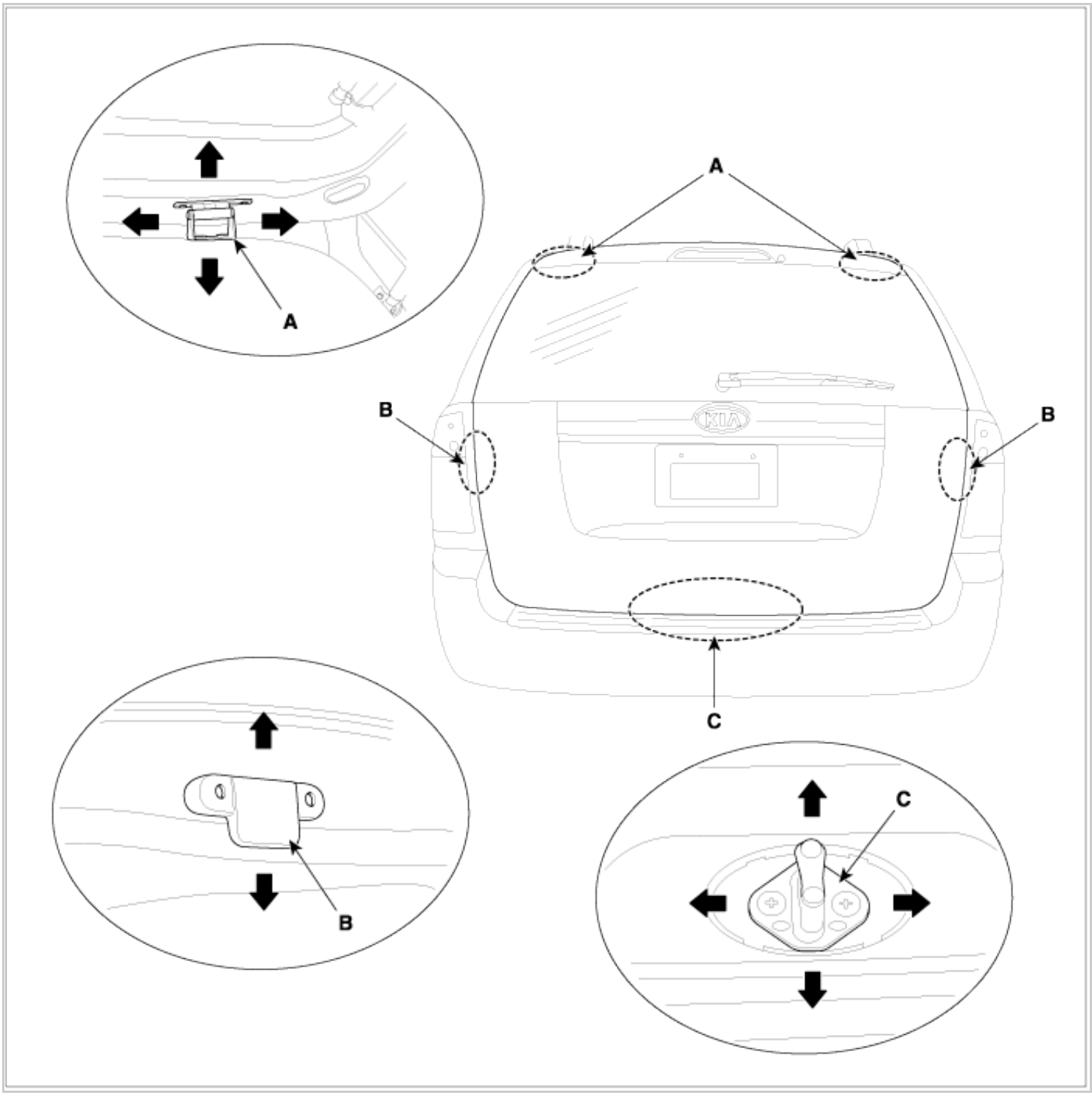
a. Make sure the fuel fill door opens properly and locks securely.

5. Check that the fuel fill door (A) fits flush against the body. If necessary, adjust it.



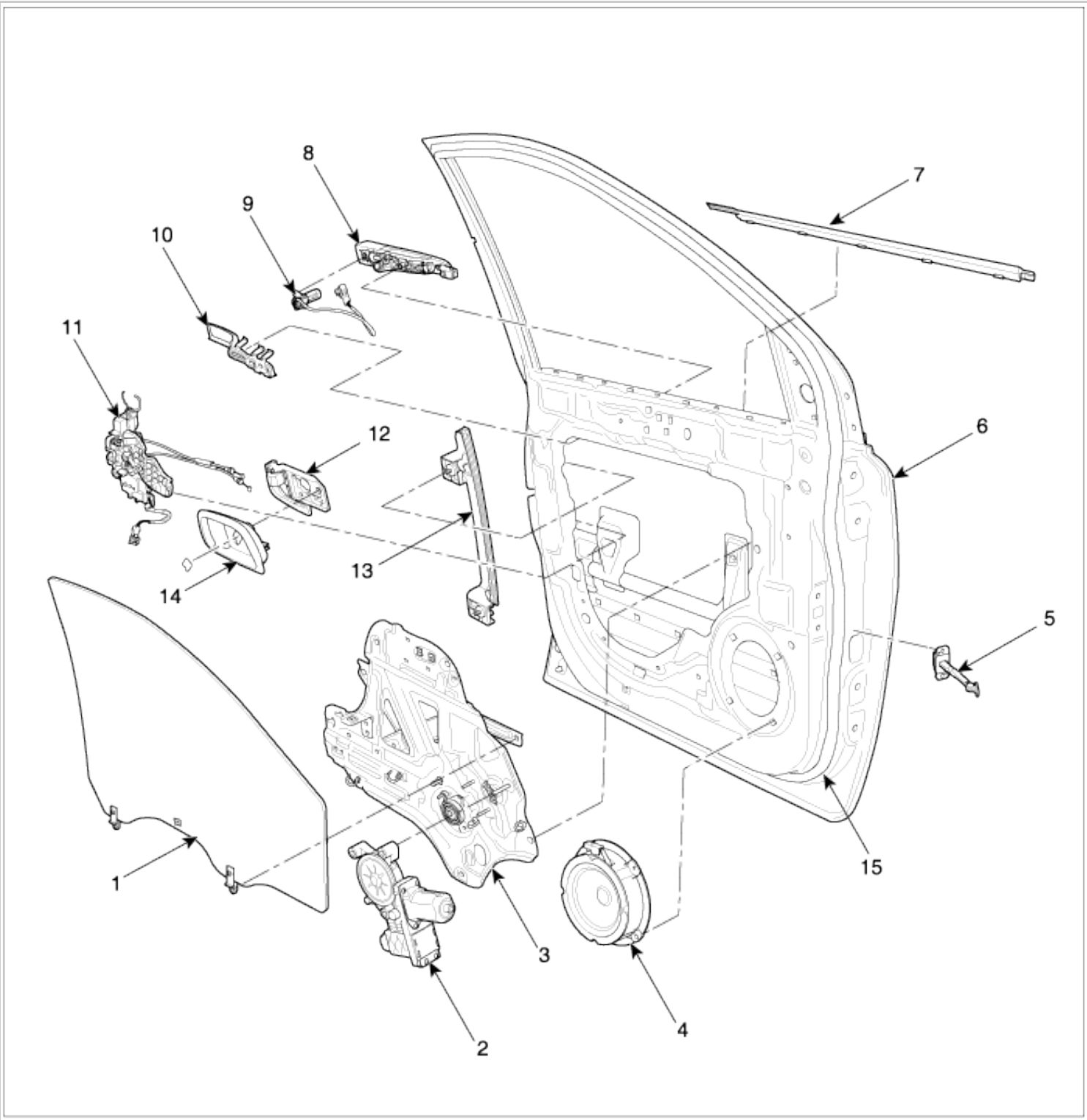
TAILGATE ADJUSTMENT PROCEDURES

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 closing the tailgate over slam bumper and side bumper (B).
3. Adjust the striker (C) by moving it up or down, or right or left.


A
A
B
B
C
B
C

Front Door

COMPONENTS



1. Glass
2. Power window motor
3. Door module
4. Speaker
5. Door checker
6. Door panel
7. Door belt weatherstrip
8. Out side handle
9. Key holder
10. Bracket
11. Latch assembly
12. Inside handle
13. Channel
14. Inside handle cover
15. Door weatherstrip

REPLACEMENT

FRONT DOOR TRIM REPLACEMENT

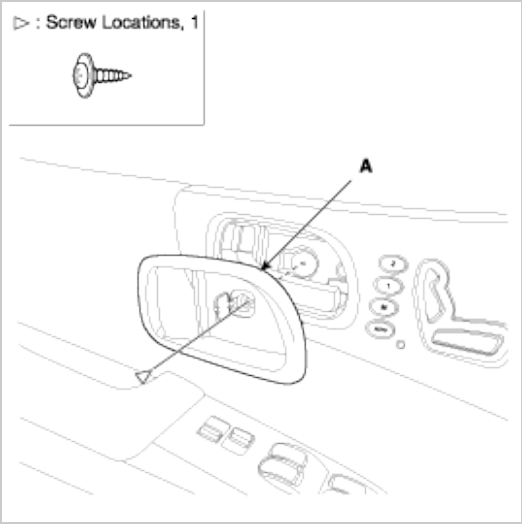
NOTICE

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

1. Remove the quadrant inner cover (A).

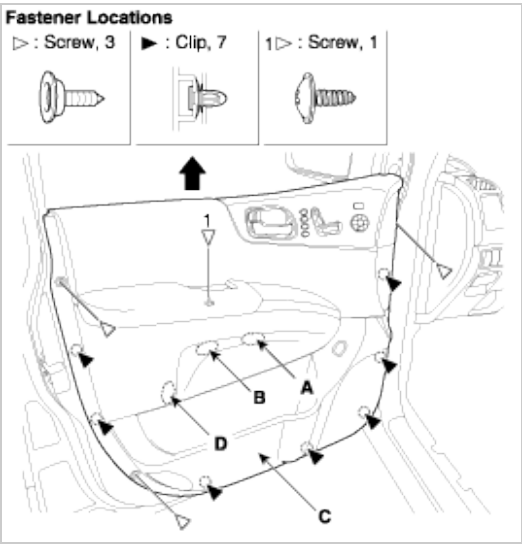


2. Loosen the mounting screw, remove the inside handle cover (A).

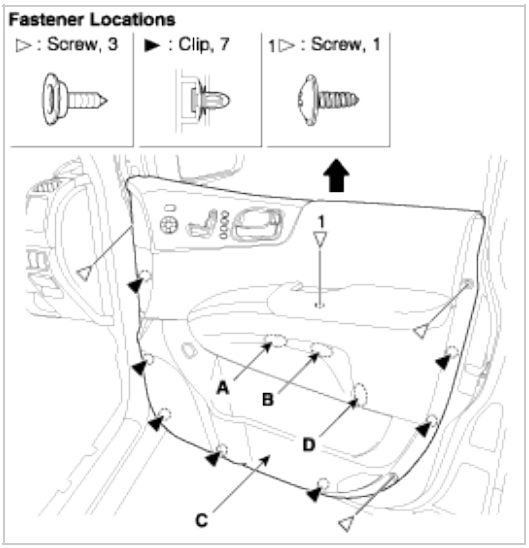


3. Loosen the door trim (C) mounting screws. Release the clips that hold the door trim, then remove the door trim by pulling it upward. Disconnect the power window switch connector (A), power mirror connector (B), and door courtesy lamp connector (D).

[LHD]



[RHD]

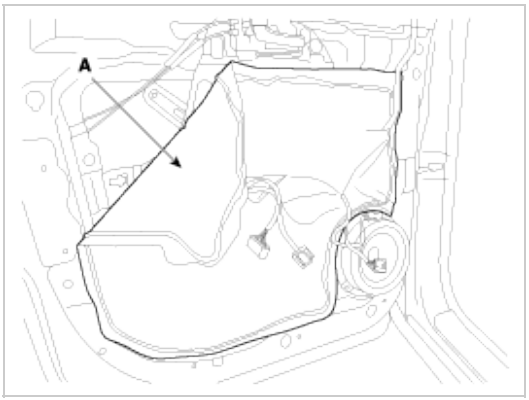


4. Installation is the reverse of removal.

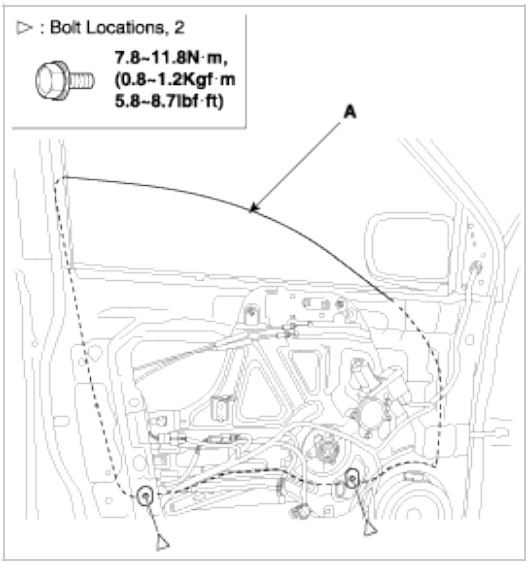
> **NOTICE**
>
> a. Make sure of connectors is plugged in properly and each rod is connected securely.
> b. Make sure the door locks and opens properly.

GLASS REPLACEMENT

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



3. Carefully move the glass (A) until you can see the bolts, then loosen them. Carefully pull the glass out through the window slot (B).



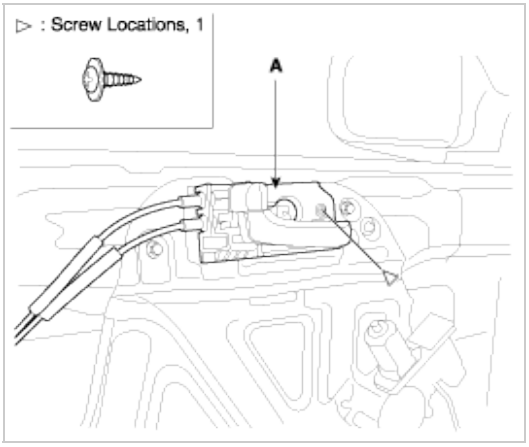
4. Installation is the reverse of removal.

NOTICE

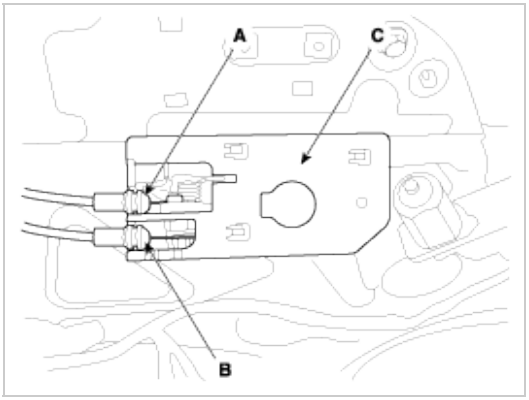
a. Roll the glass up down to see if it moves freely without binding.
b. Make sure that there is no clearance between the glass and glass run channel when the glass is closed.
c. Adjust the position of the glass as necessary.

INSIDE HANDLE REPLACEMENT

1. Remove the front door trim.
2. Loosen the inside handle (A) mounting screw.



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



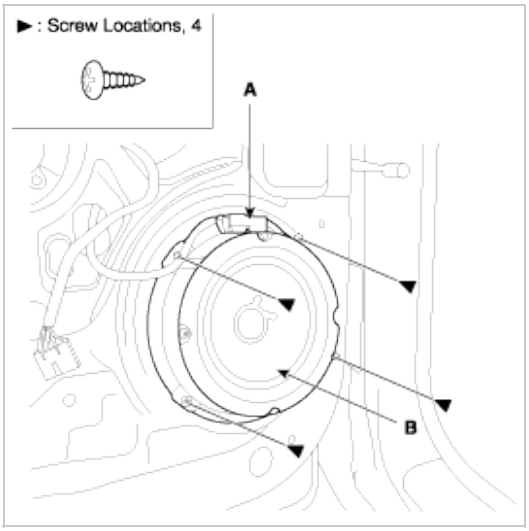
4. Installation is the reverse of removal.

NOTICE

a. Make sure the door locks and opens properly.

SPEAKER REPLACEMENT

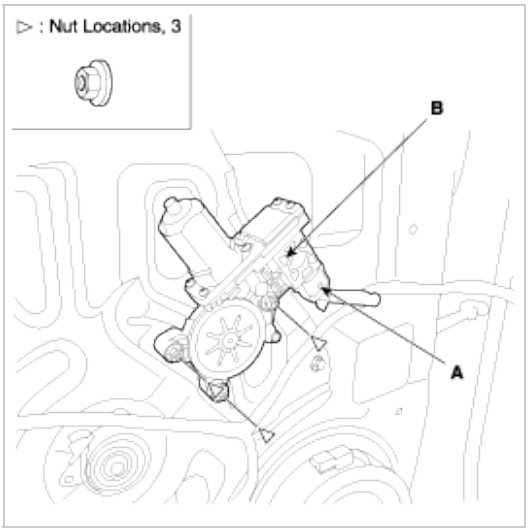
1. Remove the door trim.
2. After disconnecting the speaker connector (A), remove the speaker (B).



3. Installation is the reverse of removal.

POWER WINDOW MOTOR REPLACEMENT

1. Remove the door trim .
2. Disconnect the power window motor connector (A).
3. After loosening the mounting nuts, remove the power window motor (B).

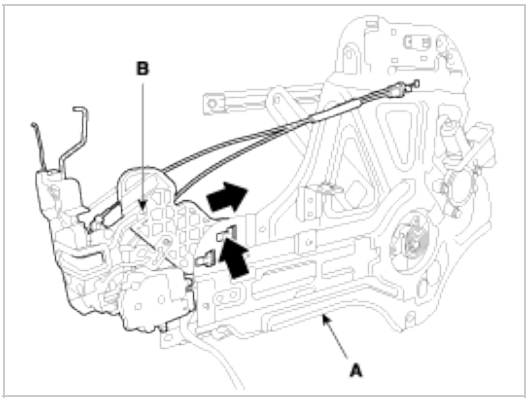


4. Installation is the reverse of removal.

> **NOTICE**
>
> a. Make sure that there is no clearance between the glass and glass run channel when the glass is closed.
> b. Adjust the position of the glass as necessary.

FRONT DOOR LATCH ASSEMBLY REPLACEMENT

1. Remove the following parts.
   a. Front door trim.
   b. Glass.
   c. Inside handle.
   d. Door module.
2. Remove the latch assembly (A).

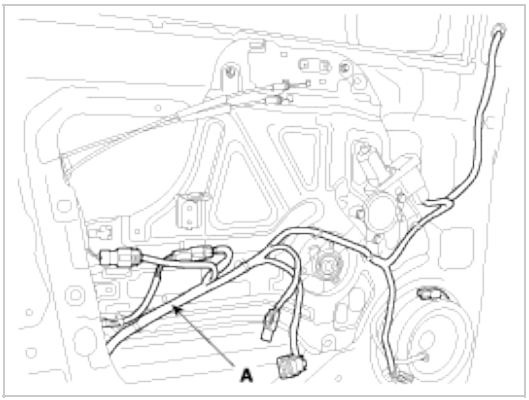


3. Installation is the reverse the removal.

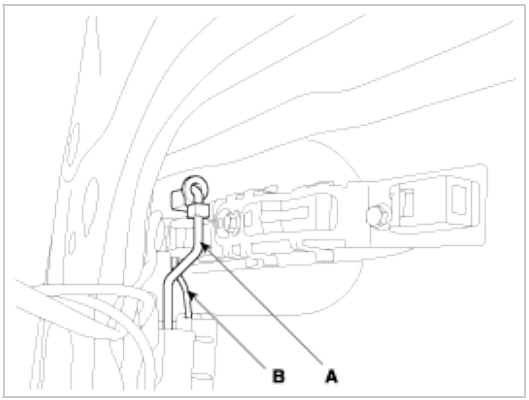
> **NOTICE**
>
> a. Make sure the door locks and opens properly.

DOOR MODULE ASSEMBLY REPLACEMENT

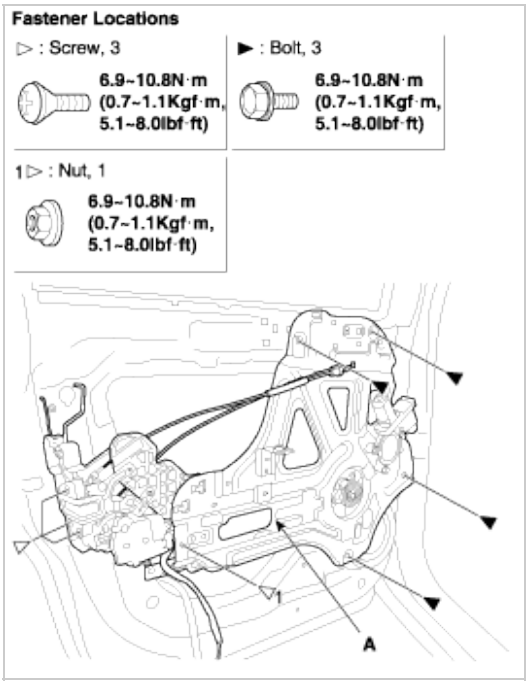
1. Remove the following parts.
   a. Front door trim.
   b. Glass.
   c. Channel.
2. Disconnect the wiring harness (A).



3. Disconnect the lock rod (A) and outside handle rod (B).



4. Loosen the door module mounting bolts, then remove the door module (A).

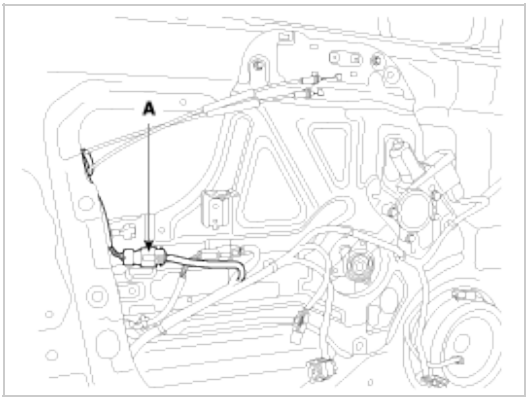


5. Installation is the reverse of removal.

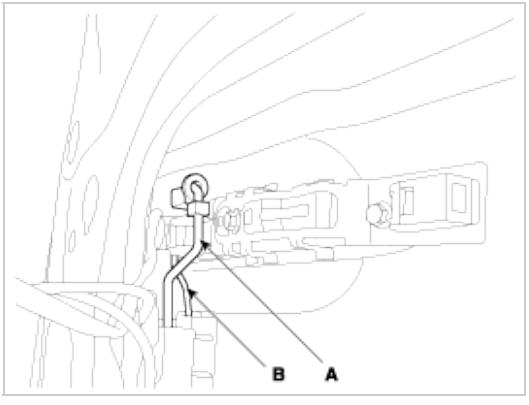
> **NOTICE**
>
> a. Make sure the connector is plugged in properly and each rod is connected securely.
> b. Make sure the door locks and opens properly.

OUTSIDE HANDLE REPLACEMENT

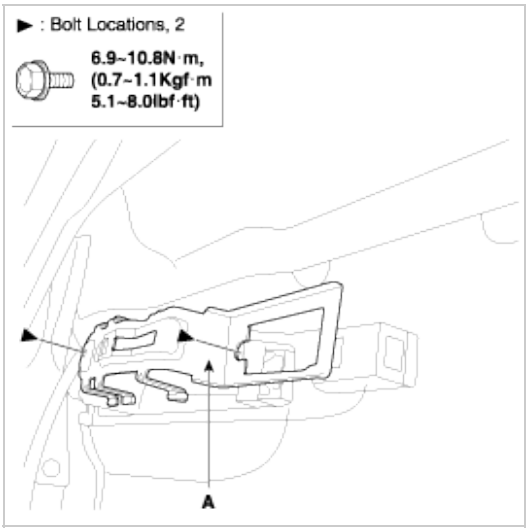
1. Remove the door trim.
2. Remove the door trim seal.
3. Disconnect the connector (A).



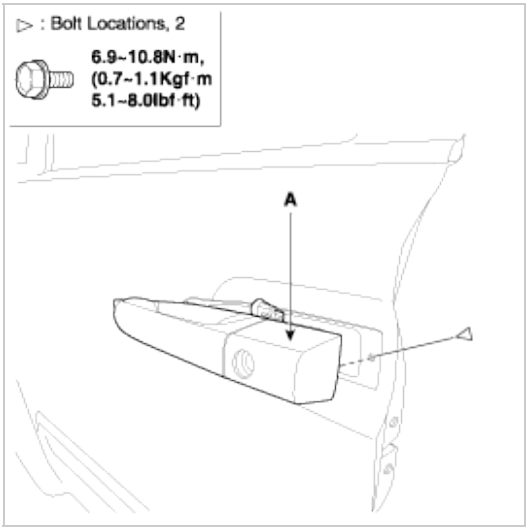
4. Disconnect the lock rod (A) and outside handle rod (B).



5. Loosen the outside handle mounting bolts, remove the outside handle bracket (A).



6. After removing the outside handle mounting bolts, remove the outside handle (A).

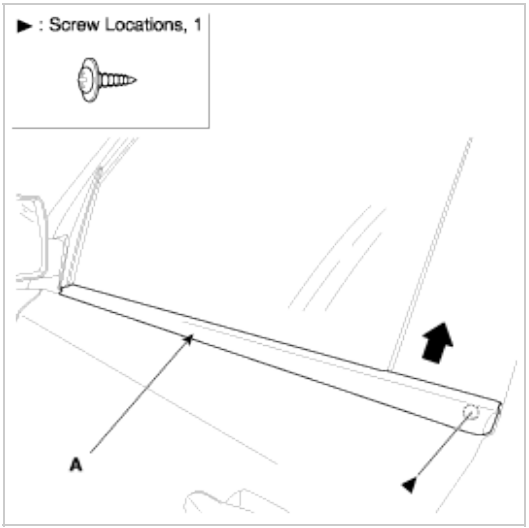


7. Installation is the reverse the removal.

> **NOTICE**
>
> a. Make sure the door locks and opens properly.

DOOR BELT WEATHERSTRIP REPLACEMENT

1. Loosen the mounting screw, then remove the door belt weather strip (A).

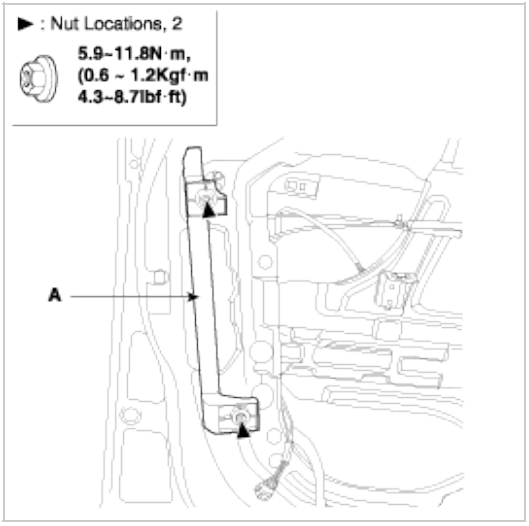


2. Installation is the reverse of removal.

REAR CHANNEL REPLACEMENT

1. Remove the door trim.

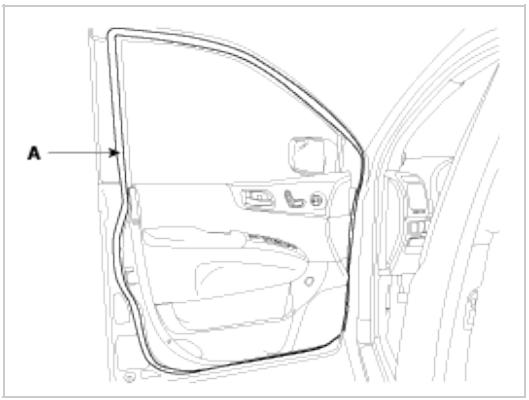
2. Remove the glass.
3. Loosen the rear channel mounting nuts.
4. After disconnecting the glass molding, remove the rear channel (A).



5. Installation is the reverse of removal.

DOOR WEATHERSTRIP REPLACEMENT

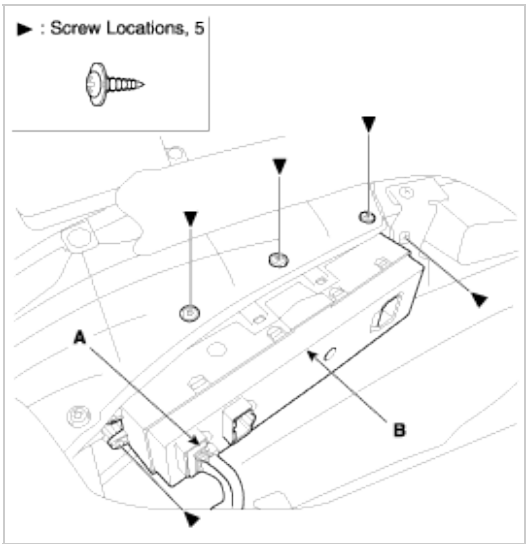
1. Loosen the checker mounting bolts.
2. Release the clips then remove the door weatherstrip(A).



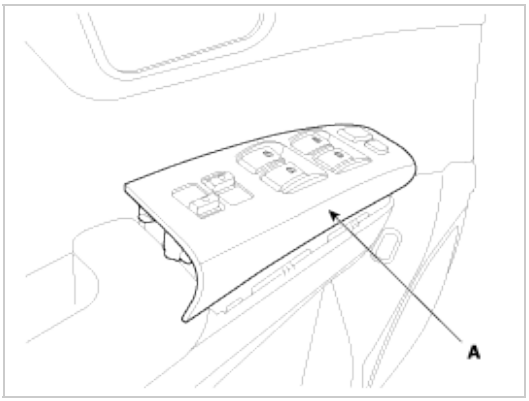
3. Installation is the reverse of removal.

POWER WINDOW SWITCH REPLACEMENT

1. Remove the front door trim.
2. Loosen the mounting screws (B).
3. Disconnect the connector (A).



4. Remove the power window switch (A).



5. Installation is the reverse the removal.

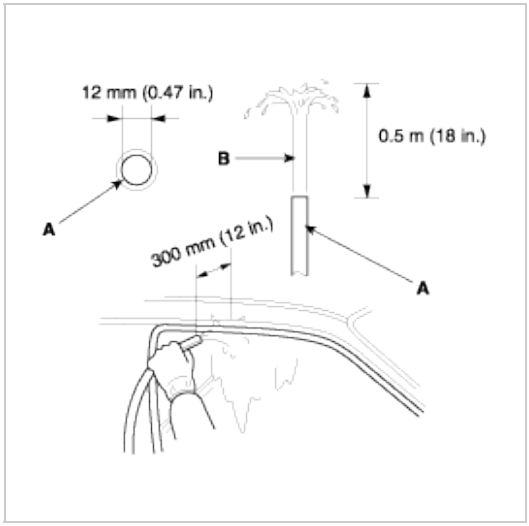
ADJUSTMENT

GLASS ADJUSTMENT

NOTICE

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

1. Remove the following parts.
   a. Quadrant cover.
   b. Door trim.
2. Carefully move the glass 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 (A).
   b. Adjust the rate of water flow as shown (B).
   c. Do not use a nozzle.
   d. Hold the hose about 300mm(12in.) away from The door (C).



DOOR POSITION ADJUSTMENT

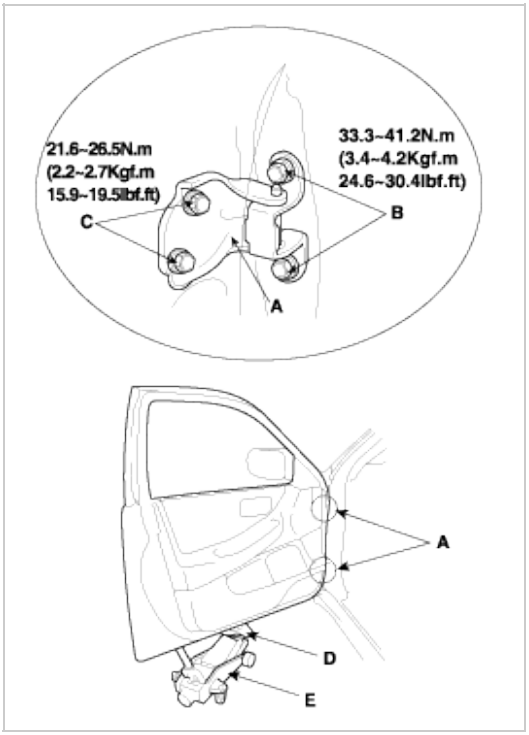
NOTICE

a. 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.

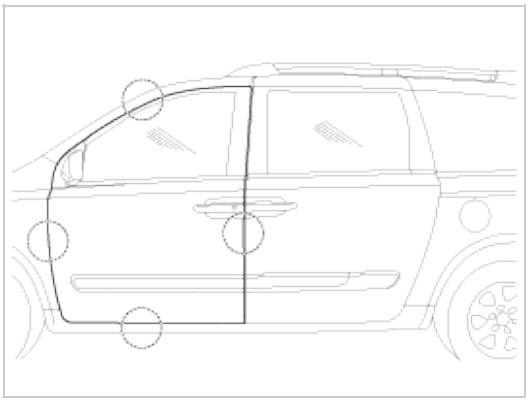
1. Place the vehicle on a firm, level surface when adjusting the doors.
2. Adjust at the hinges (A):
   a. Loosen the door mounting bolts (B) slightly, and move the door IN or OUT until it aligns flush with the body.

b. Loosen the hinge mounting bolts (C) slightly, and move the door BACKWARD or FORWARD, UP or DOWN as necessary to equalize the gaps.

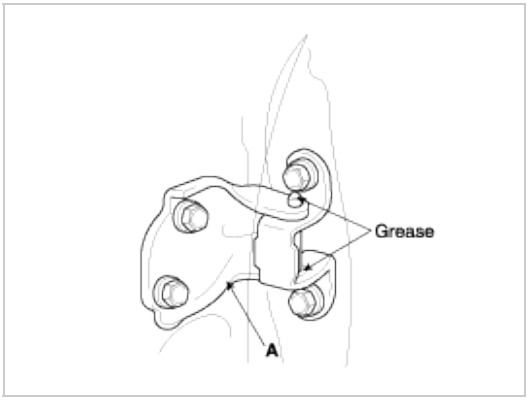
c. Place a shop towel (D) on the jack (E) to prevent damage to the door when adjusting the door.



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



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



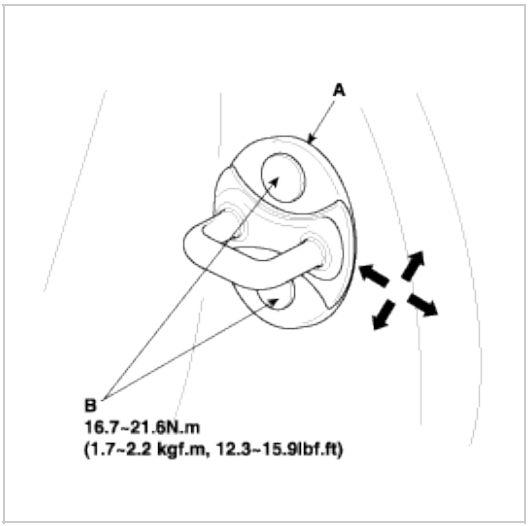
5. Check for water leaks.

DOOR STRIKER ADJUSTMENT

Make sure the door latches securely without slamming It.

If necessary, adjust the striker (A): The striker nuts Are fixed. The strike can be fine adjusted up or down, and in or out. striker ceater to be adjusted max ± 1.5mm

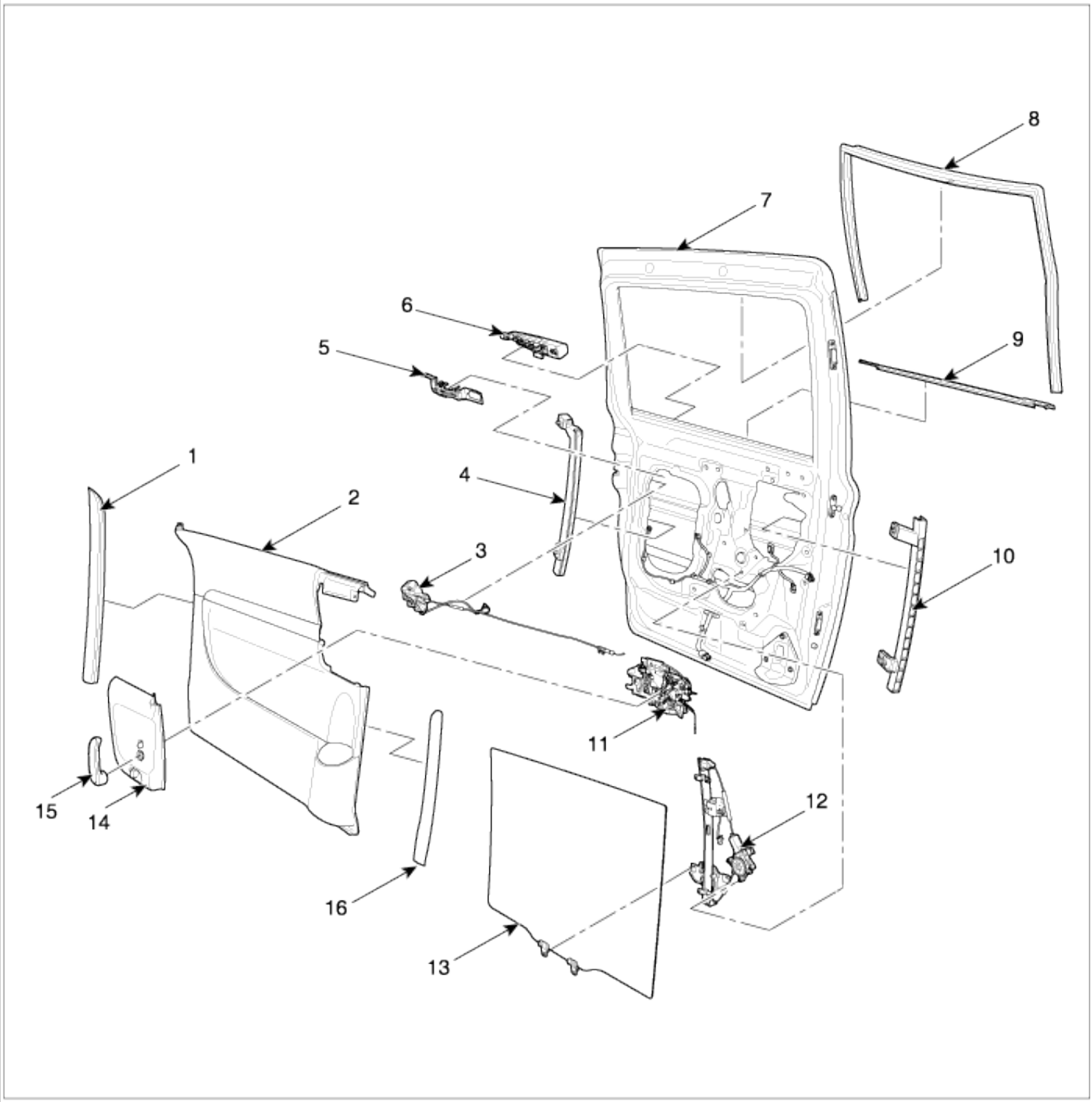
1. Loosen the screws (B), then insert a shop towel between the body and striker(A).



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.

Rear Door

COMPONENTS



1. Rear side trim
2. Door trim
3. Latch assembly
4. Rear channel
5. Out side handle bracket
6. Out side handle
7. Door panel
8. Glass run
9. Door belt weather strip
10. Front channel
11. Remote controller assembly
12. Window regulator
13. Glass
14. Inside handle cover
15. Inside handle
16. Front side trime

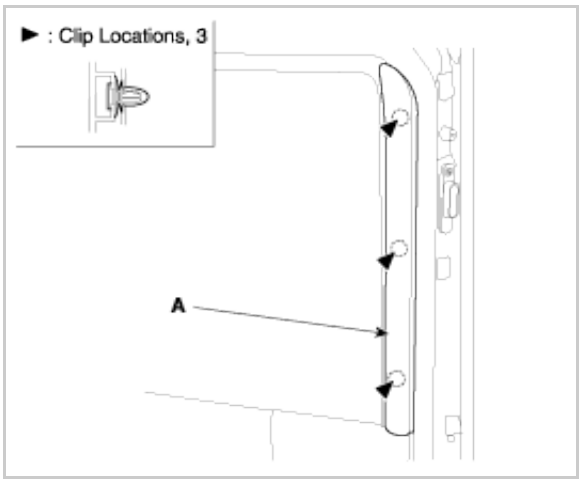
REPLACEMENT

REAR DOOR TRIM REPLACEMENT

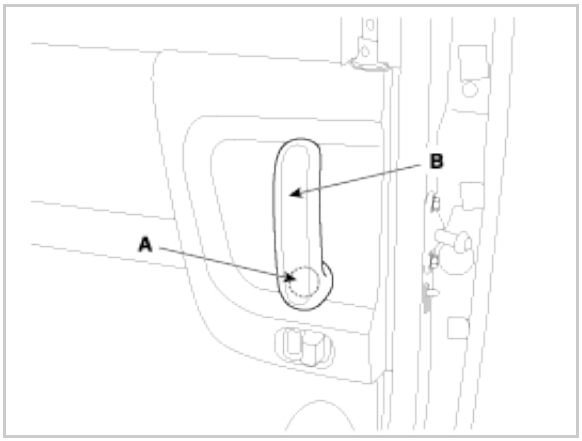
NOTICE

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

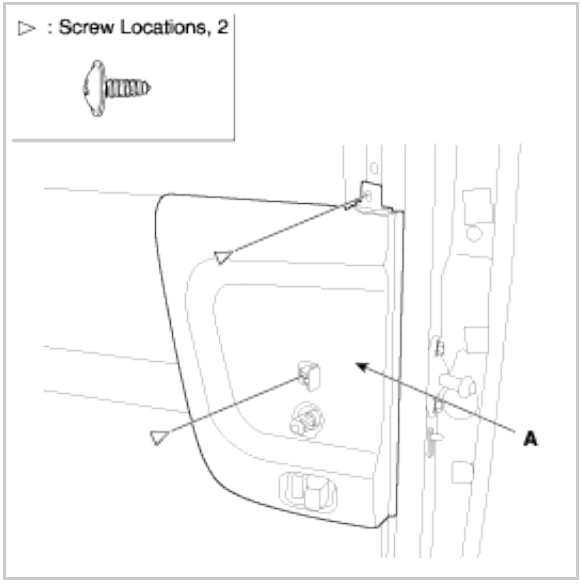
1. Remove the front side trim(A) and rear side trim.



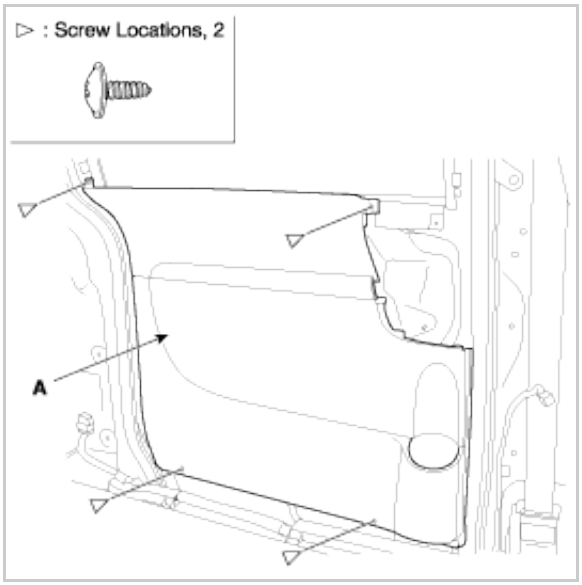
2. Disconnect the clip (A), remove the inside handle (B).



3. Loosen the inside handle cover (A) mounting screws, remove the inside handle cover.



4. Loosen the trim (A) mounting screws, remove the trim.



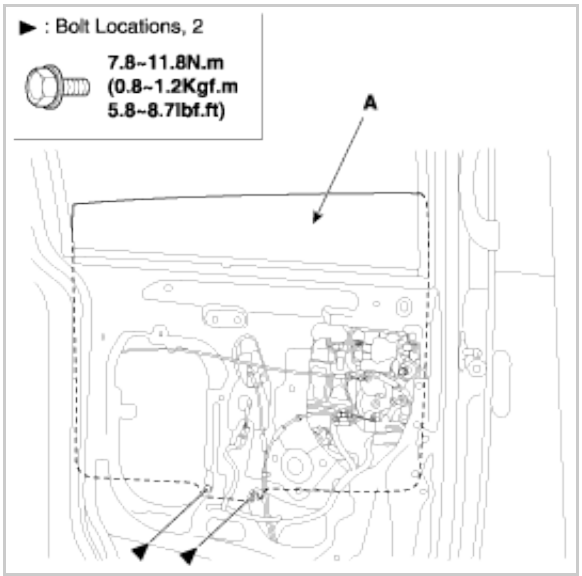
5. Installation is the reverse of removal.

GLASS REPLACEMENT

1. Remove the following items.
   a. Door trim.
   b. Door belt weather strip.
   c. Rear channel.

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

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



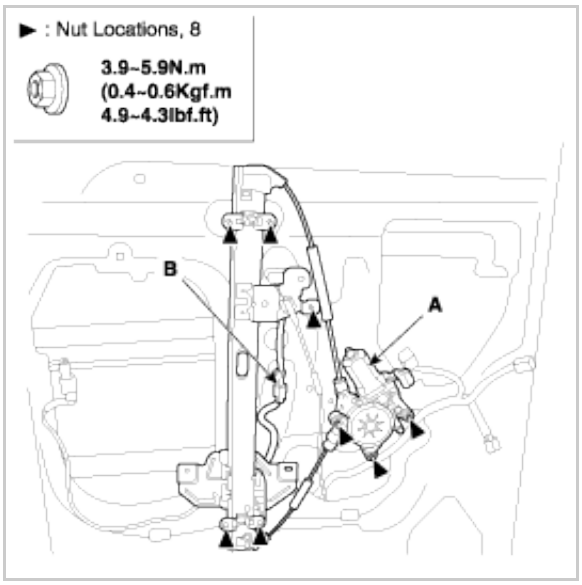
3. Installation is the reverse of removal.

> **NOTICE**
>
> a. Roll the glass up and down to see if it will move freely without binding.
> b. Make sure that there is no gap between the glass and glass run channel when the glass is closed.
> c. Adjust the position of the glass as necessary.

POWER WINDOW MOTOR REPLACEMENT

1. Remove the rear door trim.

2. After disconnecting the connector (B), remove the power window motor (A).

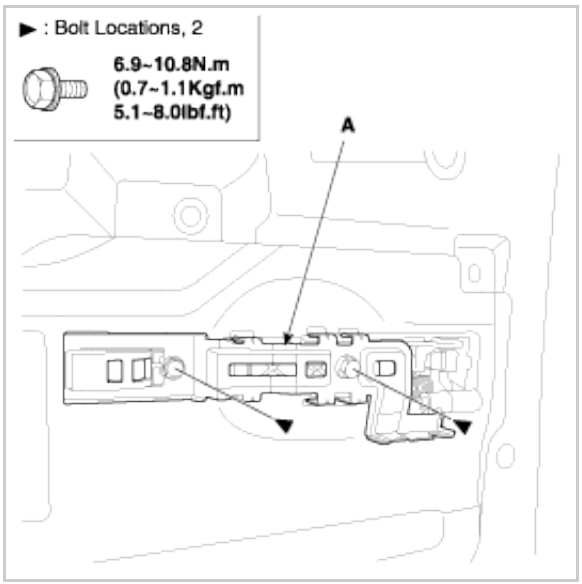


3. Installation is the reverse of removal.

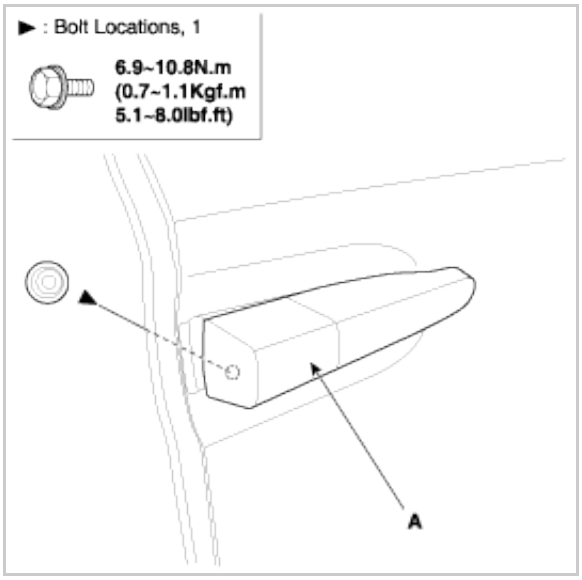
> **NOTICE**
>
> a. Roll the glass up and down to see if it move will freely without binding.

OUT SIDE HANDLE REPLACEMENT

1. Remove the following items.
   a. Door trim.
   b. Door trim seal.
   c. Actuator.
2. Loosen the mounting bolt, then remove the outside handle bracket (A).



3. Remove the outside handle (A).



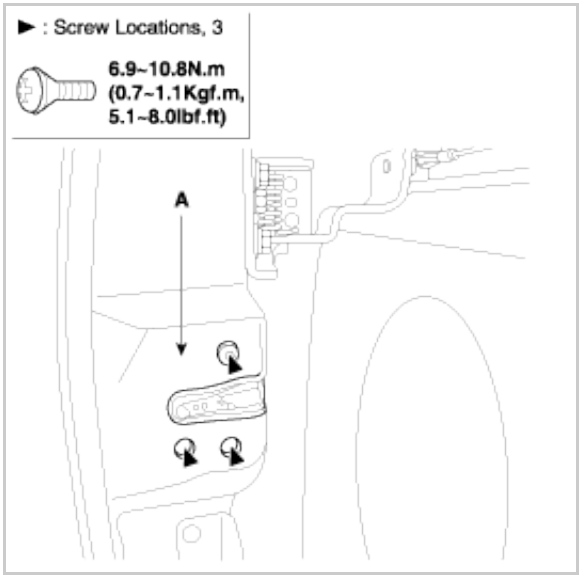
4. Installation is the reverse of removal.

NOTICE

a. Make sure the door locks and opens properly.

LATCH ASSEMBLY REPLACEMENT

1. Remove the following parts.
   a. Door trim.
   b. Door trim seal.
2. Disconnect the connector.
3. Loosen the latch mounting screws, remove the latch (A).



4. Installation is the reverse the removal.

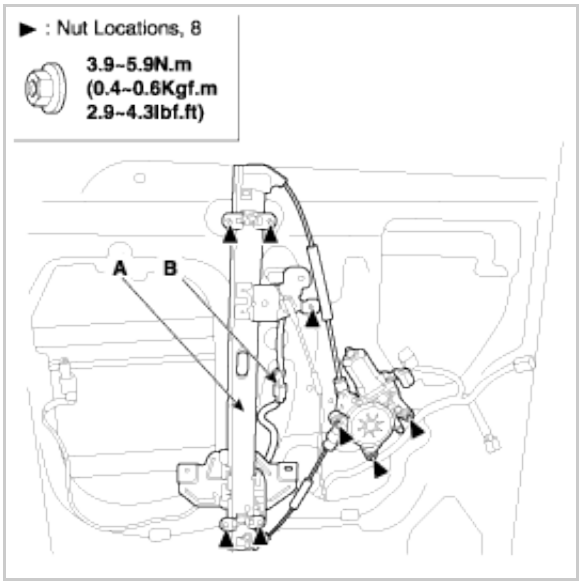
NOTICE

a. Make sure the door lock and opens properly.

REGULATOR ASSEMBLY REPLACEMENT

1. Remove the following parts.
   a. Door trim.
   b. Door trim seal.
   c. Glass.

2. Disconnect the connector (B).
3. After loose the dooring module mounting nuts, remove the window regulator (A).

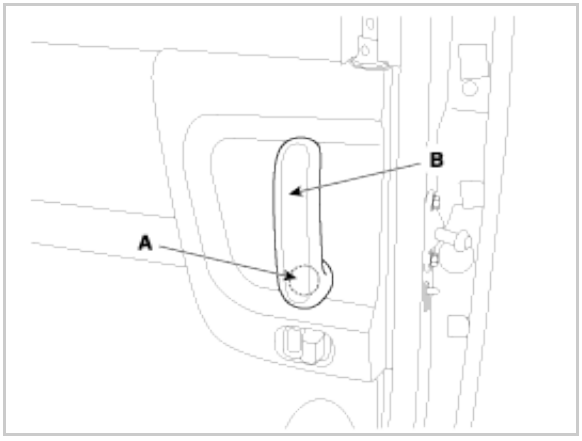


4. Installation is the reverse of removal.

> NOTICE
>
> a. Make sure the connector is plugged in properly and each rod is connected securely.
> b. Make sure the door lock and open properly.

INSIDE HANDLE REPLACEMENT

1. Disconnect the clip (A), remove the inside handle (B).

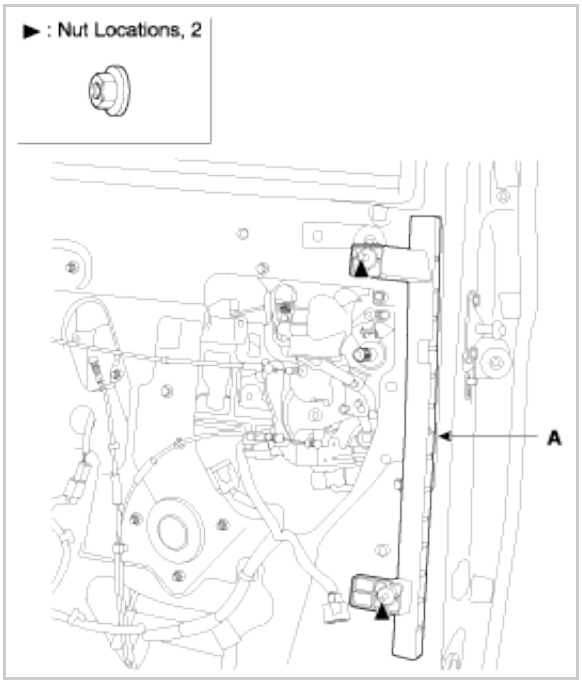


2. Installation is the reverse of removal.

> NOTICE
>
> a. Make sure the door lock and open properly.

CHANNEL REPLACEMENT

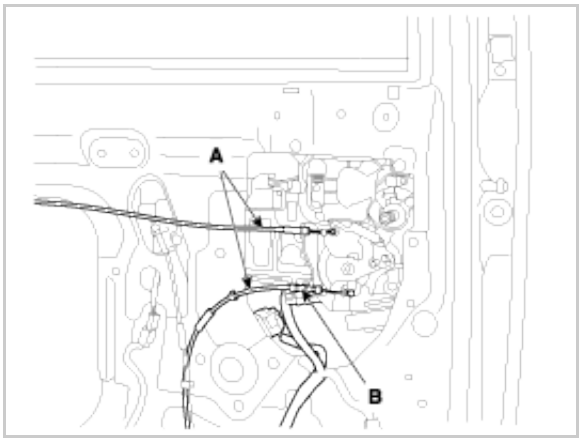
1. Remove the door trim.
2. Remove the glass.
3. Loosen the channel mounting nuts, remove the channel (A).



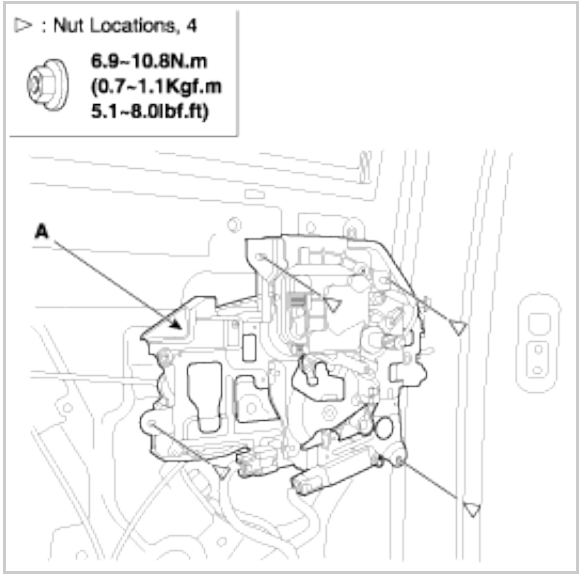
4. Installation is the reverse of removal.

DOOR ACTUATOR REPLACEMENT

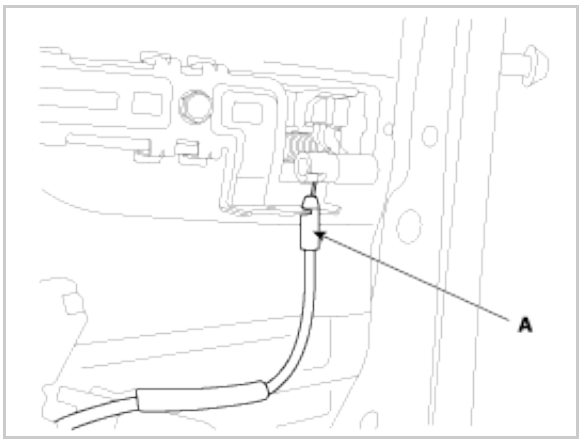
1. Remove the inside handle.
2. Remove the door trim.
3. Remove the door trim seal.
4. Disconnect the connector (A) and cable (B).



5. After loosening the mounting bolts and nuts, then remove the actuator assembly (A).



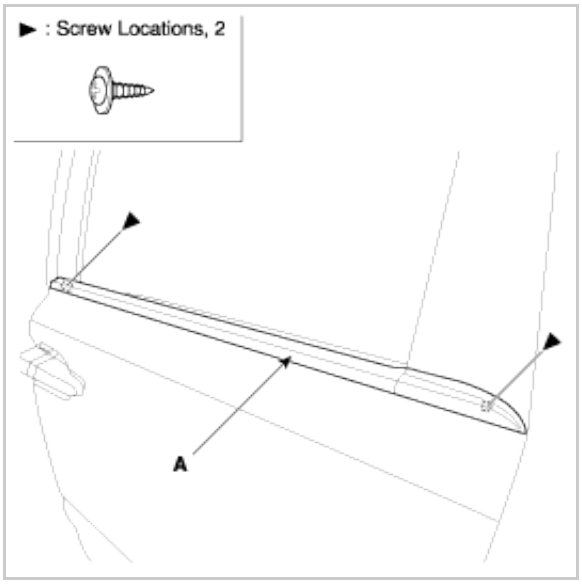
6. Disconnect the outside handle cable (A).



7. Installation is the reverse of removal.

DOOR BELT WEATHERSTRIP REPLACEMENT

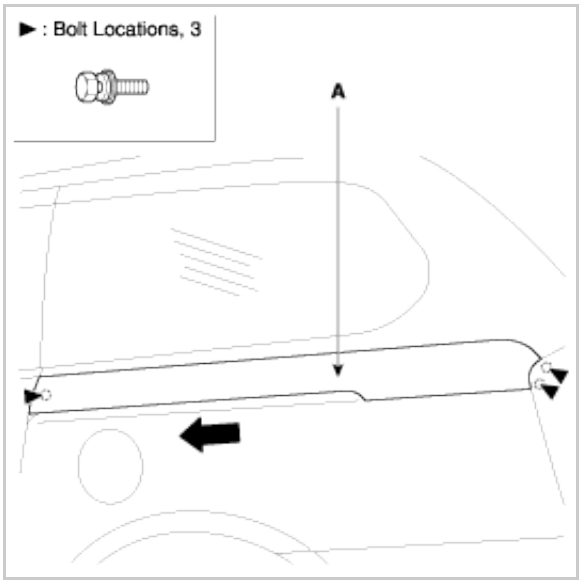
1. Loosen the mounting screw, then remove the door belt weather strip (A).



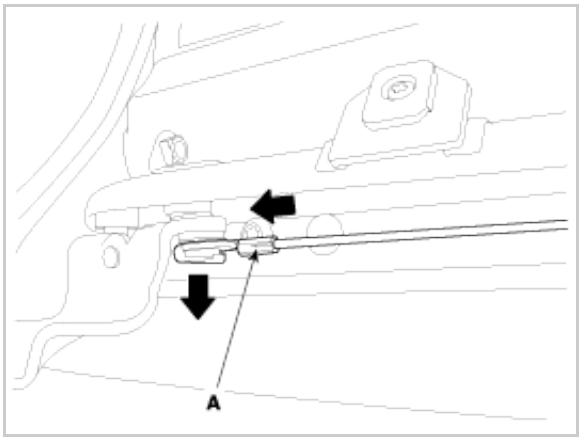
2. Installation is the reverse of removal.

DOOR MOTOR REPLACEMENT

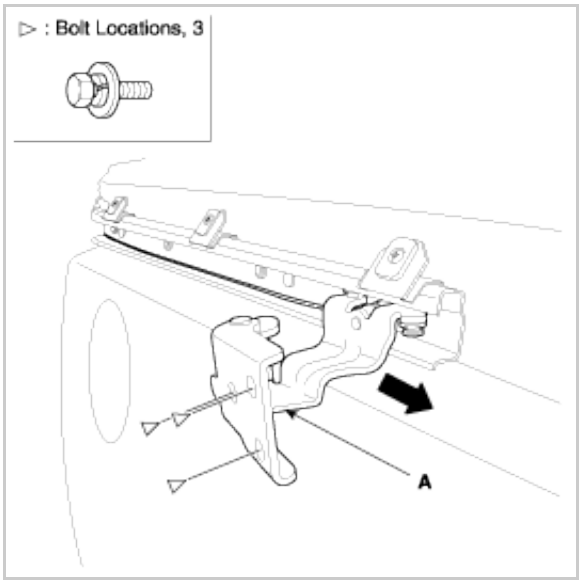
1. Remove the rear combination ramp.
2. After loosening the rail cover mounting bolts, then remove the rail cover (A).



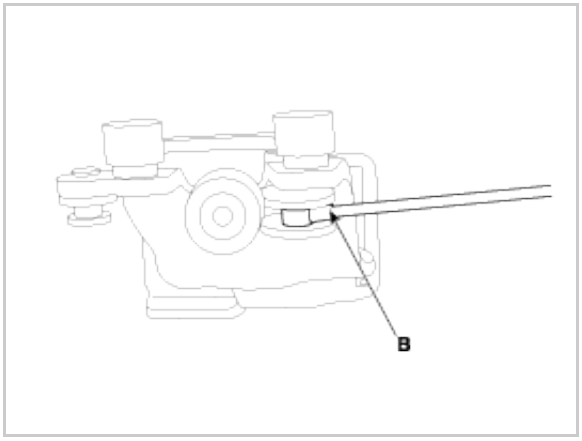
3. Remove the rear cable (A).



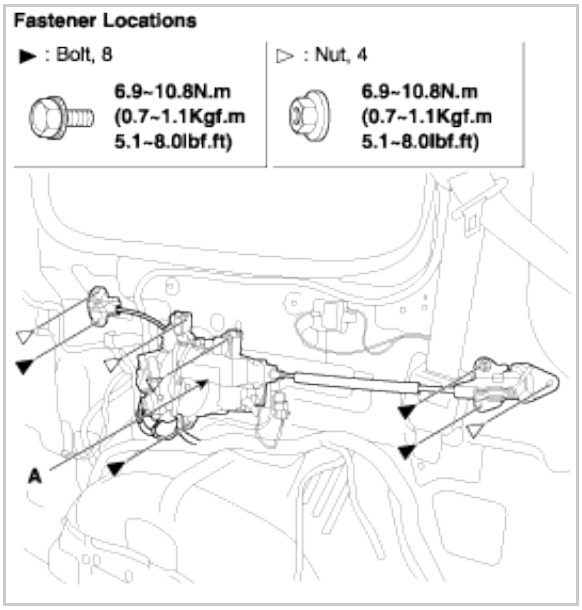
4. Loosen the mounting bolts, remove the bracket (A).



5. Remove the front cable (B).



6. Disconnect the connector.
7. After removing the motor mounting and nut, remove the motor (A).



8. Installation is the reverse of removal.

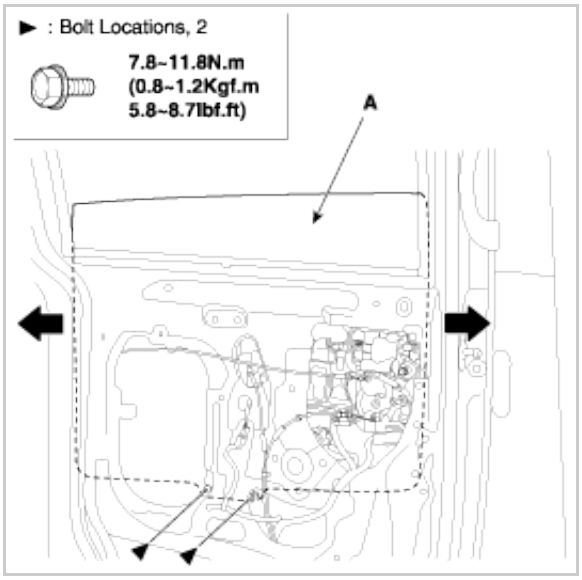
ADJUSTMENT

GLASS ADJUSTMENT

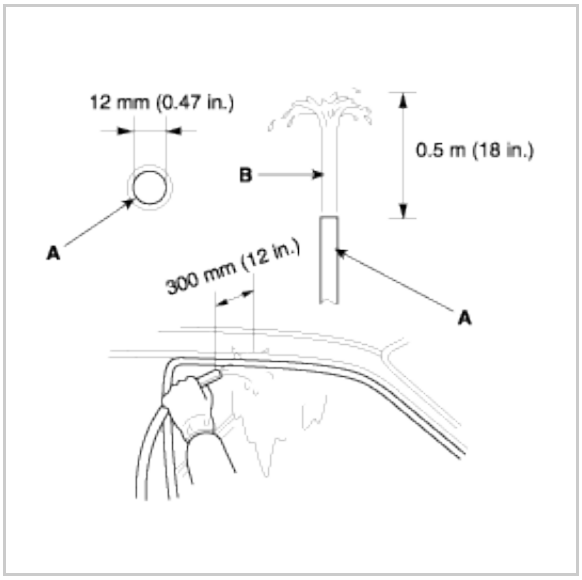
NOTICE

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

1. Remove the following parts.
   a. Door trim.
2. Carefully move the glass (A) until you can see the glass mounting bolts then loosen them.



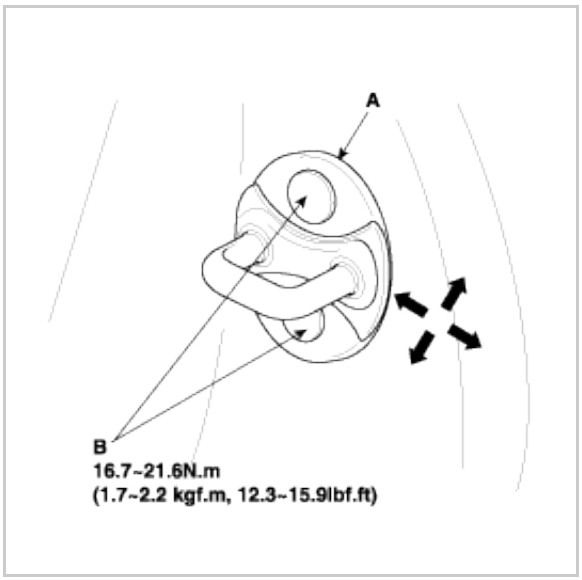
3. Push the glass against the channel then tighten the glass mounting bolts.
4. Check that the glass moves smoothly.
5. Raise the glass fully, and check for gaps. check that the glass contacts the glass run channel evenly.
6. Check for water leaks. Run water over the roof and on the sealing area as shown, and note these items:
   a. Use a 12mm (1/2in.) diameter hose (A).
   b. Adjust the rate of water flow as shown (B).
   c. Do not use a nozzle.
   d. Hold the hose about 300mm(12in.) away from The door.



DOOR STRIKER ADJUSTMENT

Make sure the door latches securely without slamming It.
If necessary, adjust the striker (A): The strike nuts Are fixed. The strike can be fine adjusted up or down, and in or out. striker ceater to be adjusted max ± 1.5mm

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



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.

Body Side Moldings

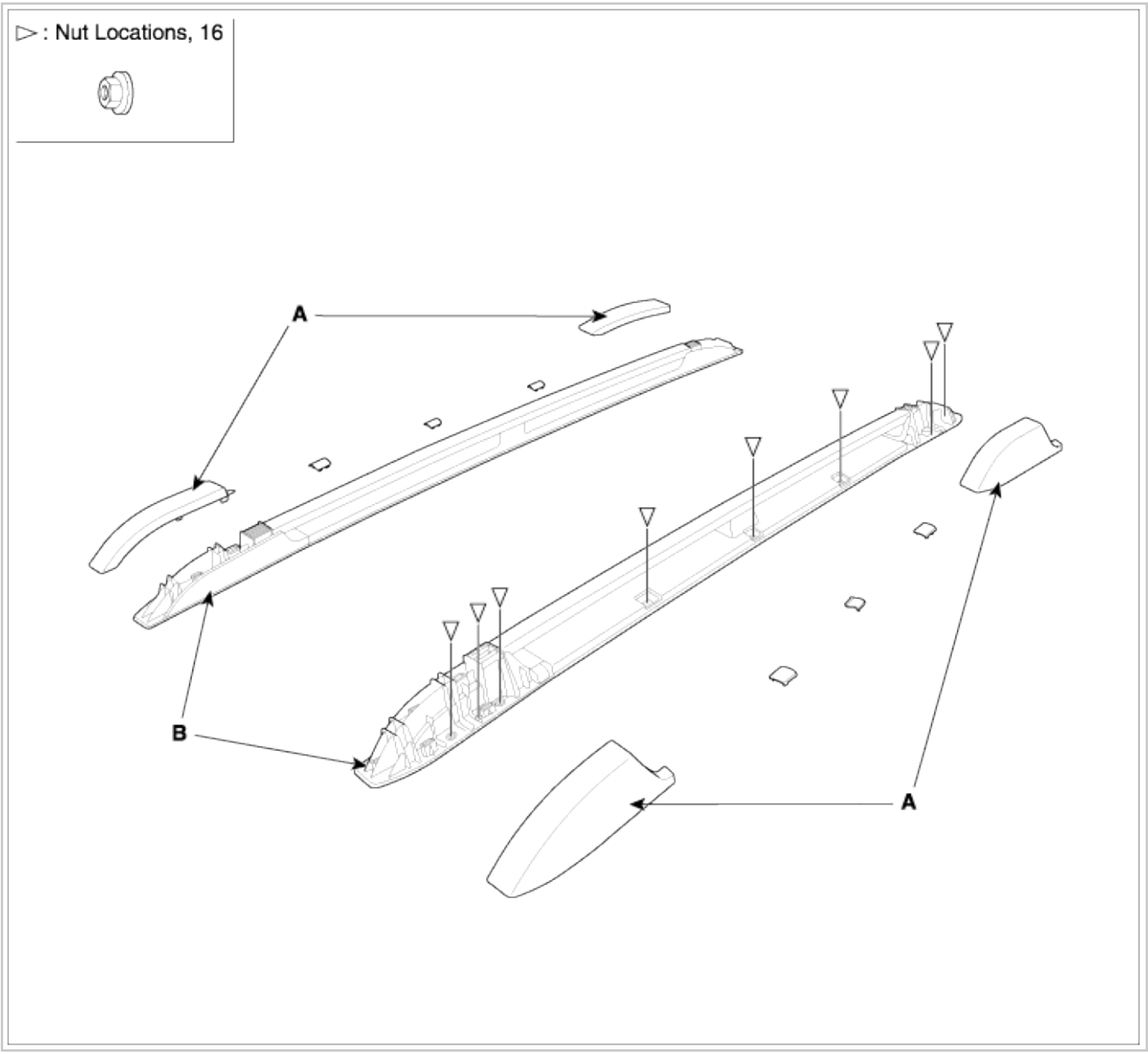
REPLACEMENT

ROOF RACK REPLACEMENT

NOTICE

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

1. Remove the roof rack cover (A).
2. Remove the roof rack (B), by removing nut protector covers, and removing the nuts.
3. Installation is the reverse of removal.

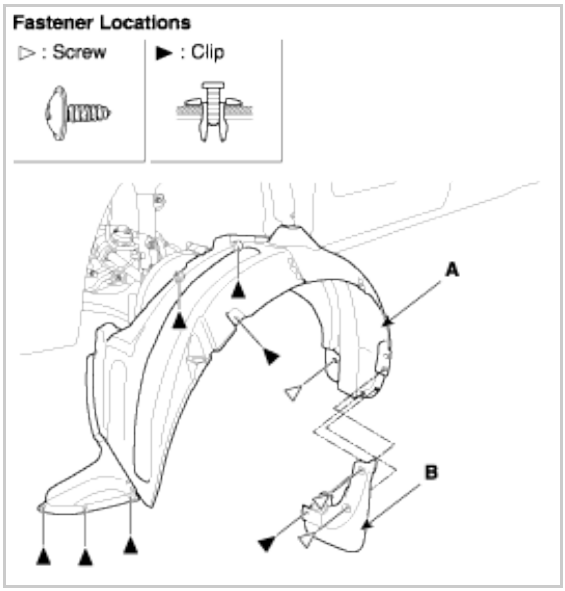


FRONT MUD GUARD AND WHEEL GUARD REPLACEMENT

NOTICE

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

1. Remove the wheel guard (B) first by removing the clip and screw, then remove the wheel guard(A), by removing the screws and clip.



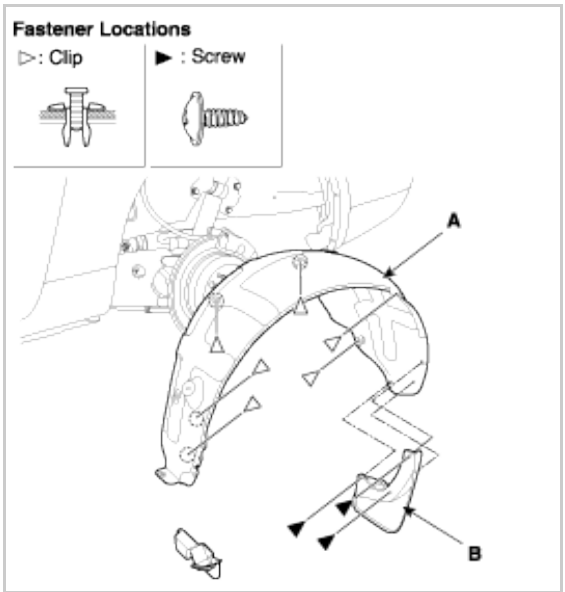
2. Installation is the reverse of removal.

REAR MUD GUARD AND WHEEL GUARD REPLACEMENT

NOTICE

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

1. Remove the wheel guard (B) first by removing the clip and screw, then remove the wheel guard(A), by removing the screws and clip.



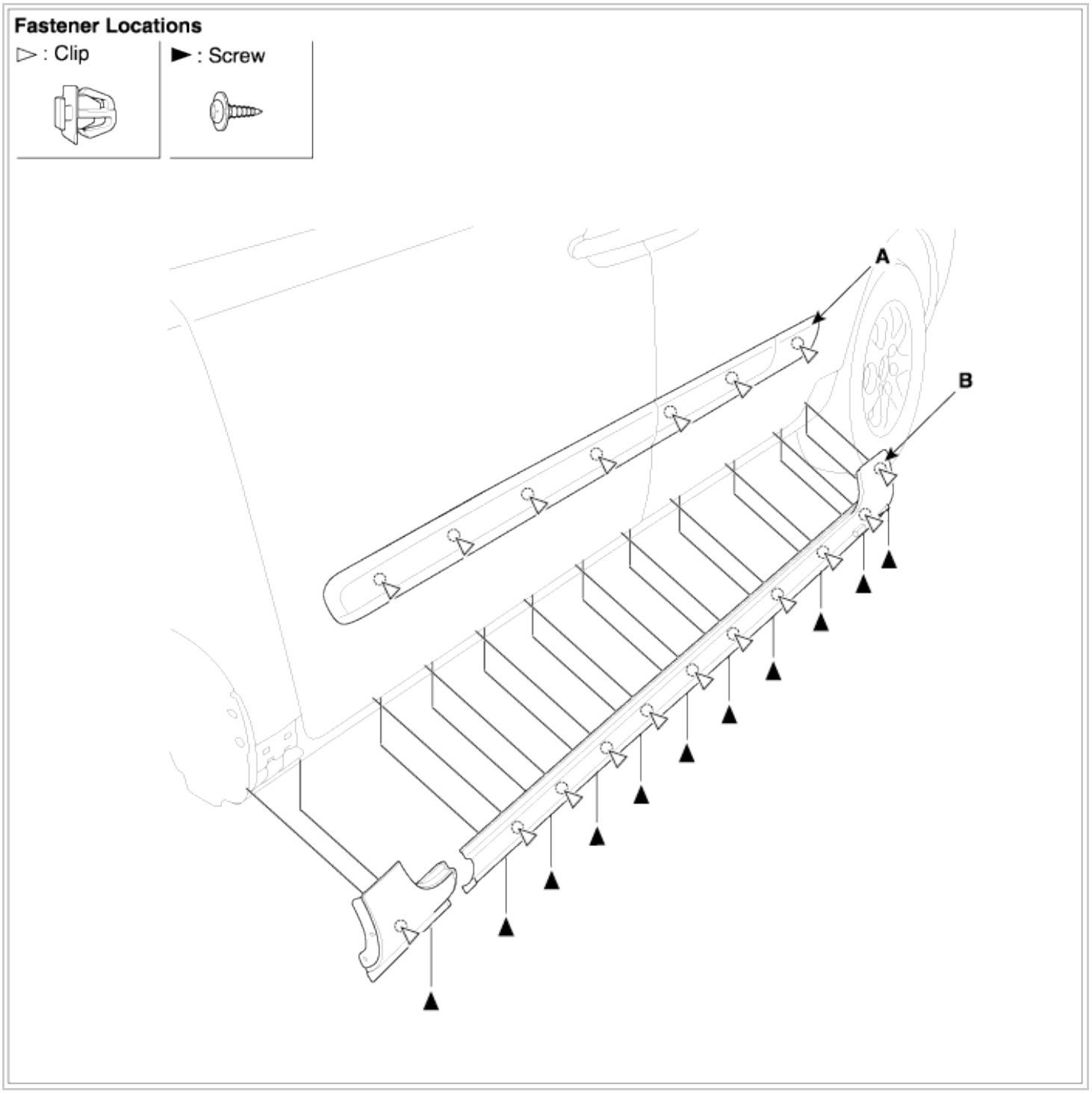
2. Installation is the reverse of removal.

SIDE GARNISH AND SIDE SILL REPLACEMENT

NOTICE

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

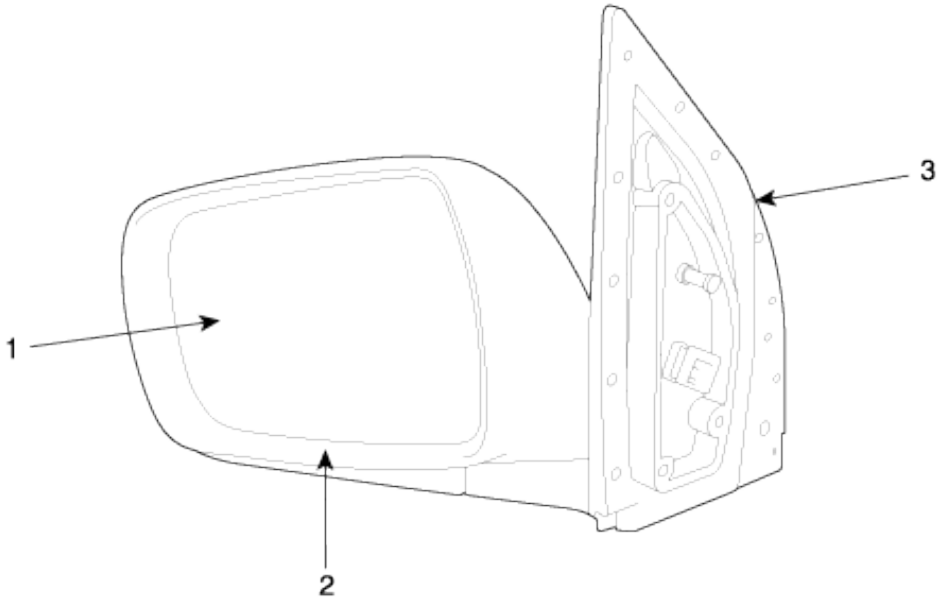
1. Remove all the screw and clips to replace the side garnish and side sill.



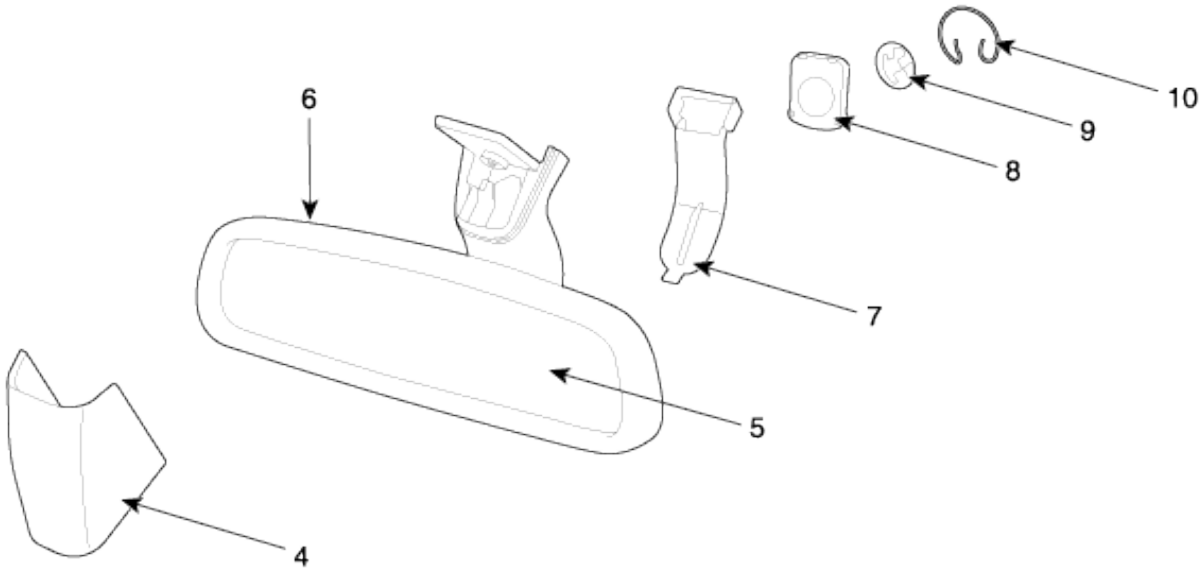
Mirror

COMPONENTS

Outside rearview mirror



Inside rearview mirror



1. Mirror
2. Housing
3. Base
4. Inside mirror cover
5. Mirror
6. Housing
7. Cover
8. Base
9. Retainer
10. Spring

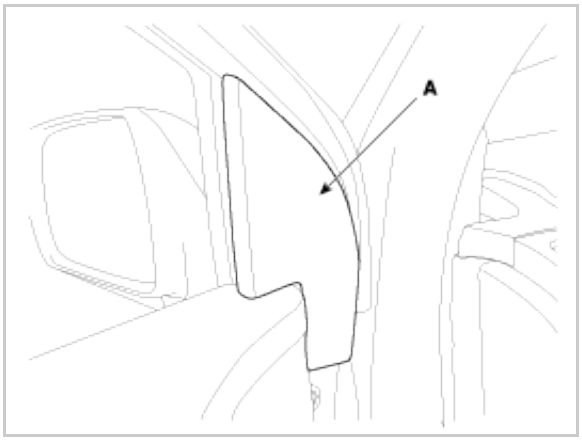
REPLACEMENT

OUTSIDE REAR VIEW MIRROR RELPLACEMENT

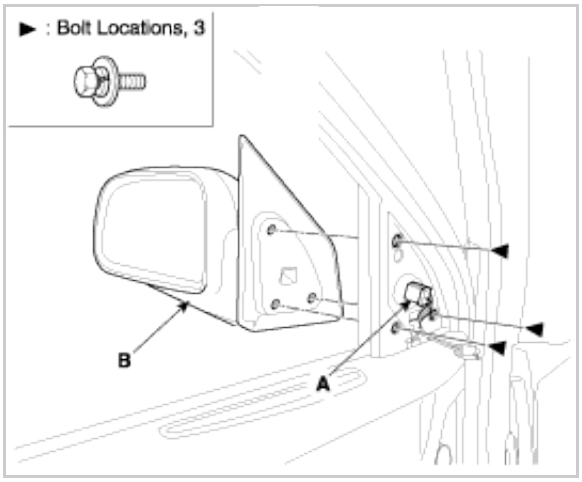
NOTICE

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

1. Remove the quadrant inner cover (A).



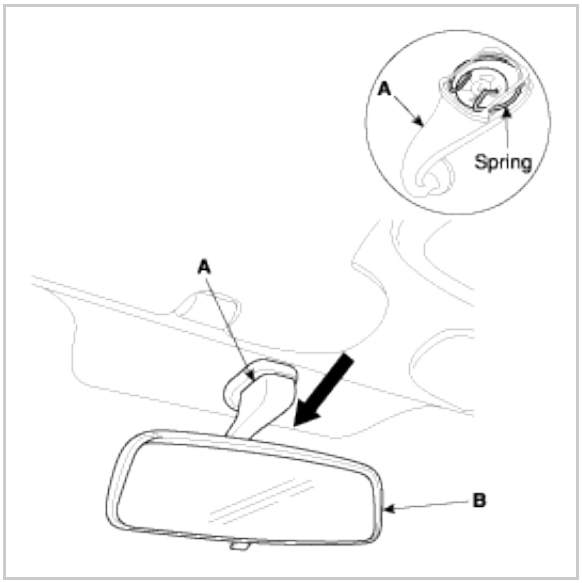
2. Remove the door trim.
3. After disconnecting the connector (A), remove the outside rear view mirror (B).



4. Installation is the reverse of removal.

INSIDE REAR VIEW MIRROR REPLACEMENT

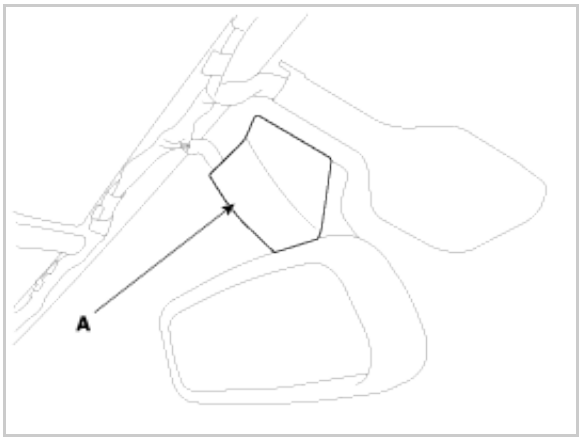
1. Push the inside rear view mirror base (A) down to remove to inside rear view mirror assembly (B).



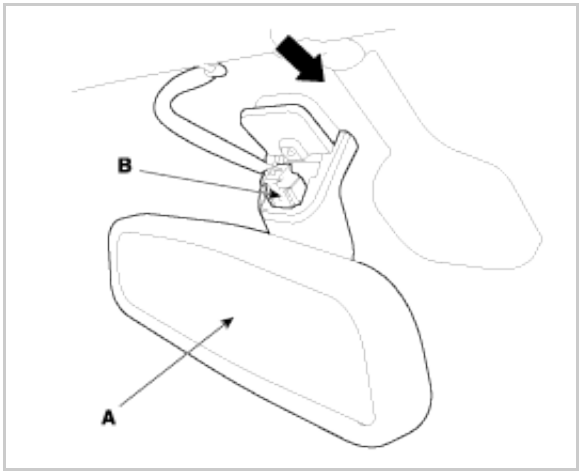
2. Installation is the reverse of removal.

ECM MIRROR REPLACEMENT

1. Remove the ECM mirror cover (A).



2. Remove the cover and connector (A).
3. Push the ECM mirror base down to remove the ECM mirror assembly (B).

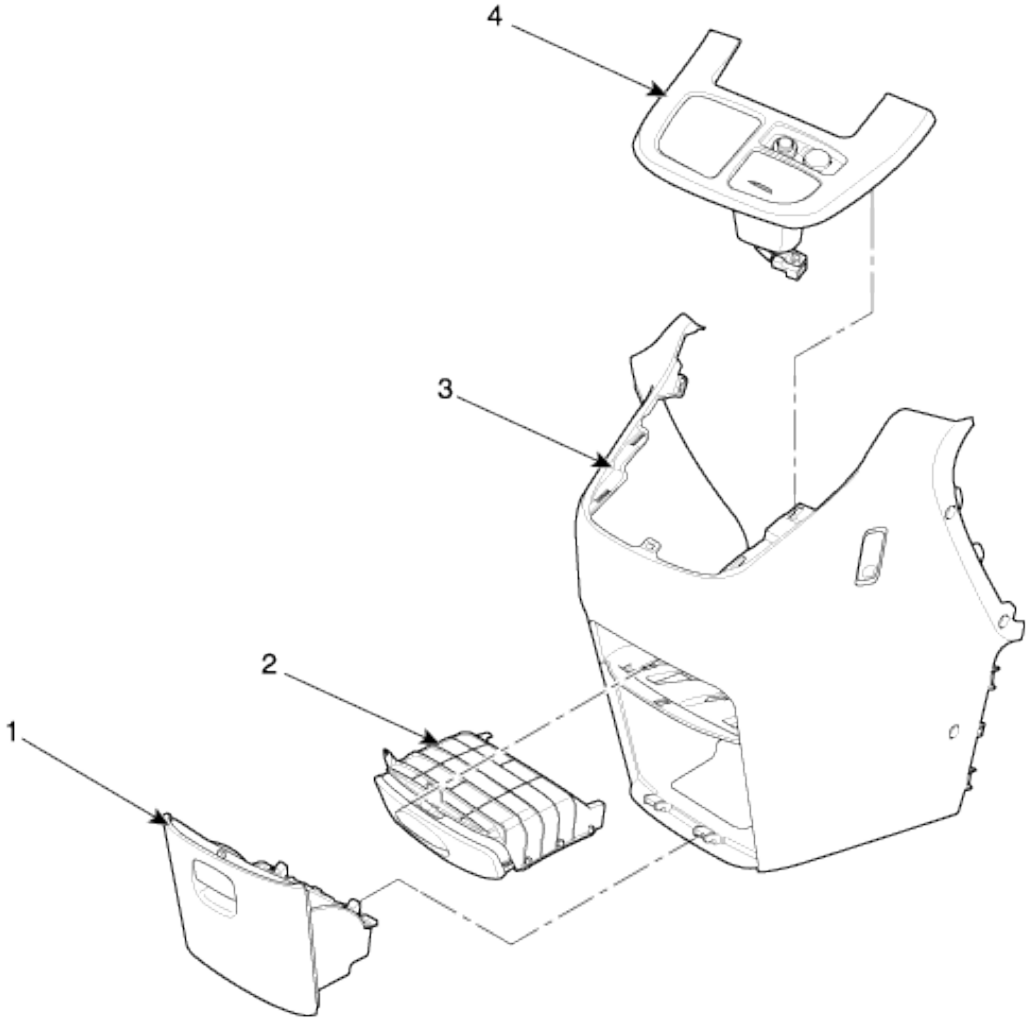


4. Installation is the reverse of removal.

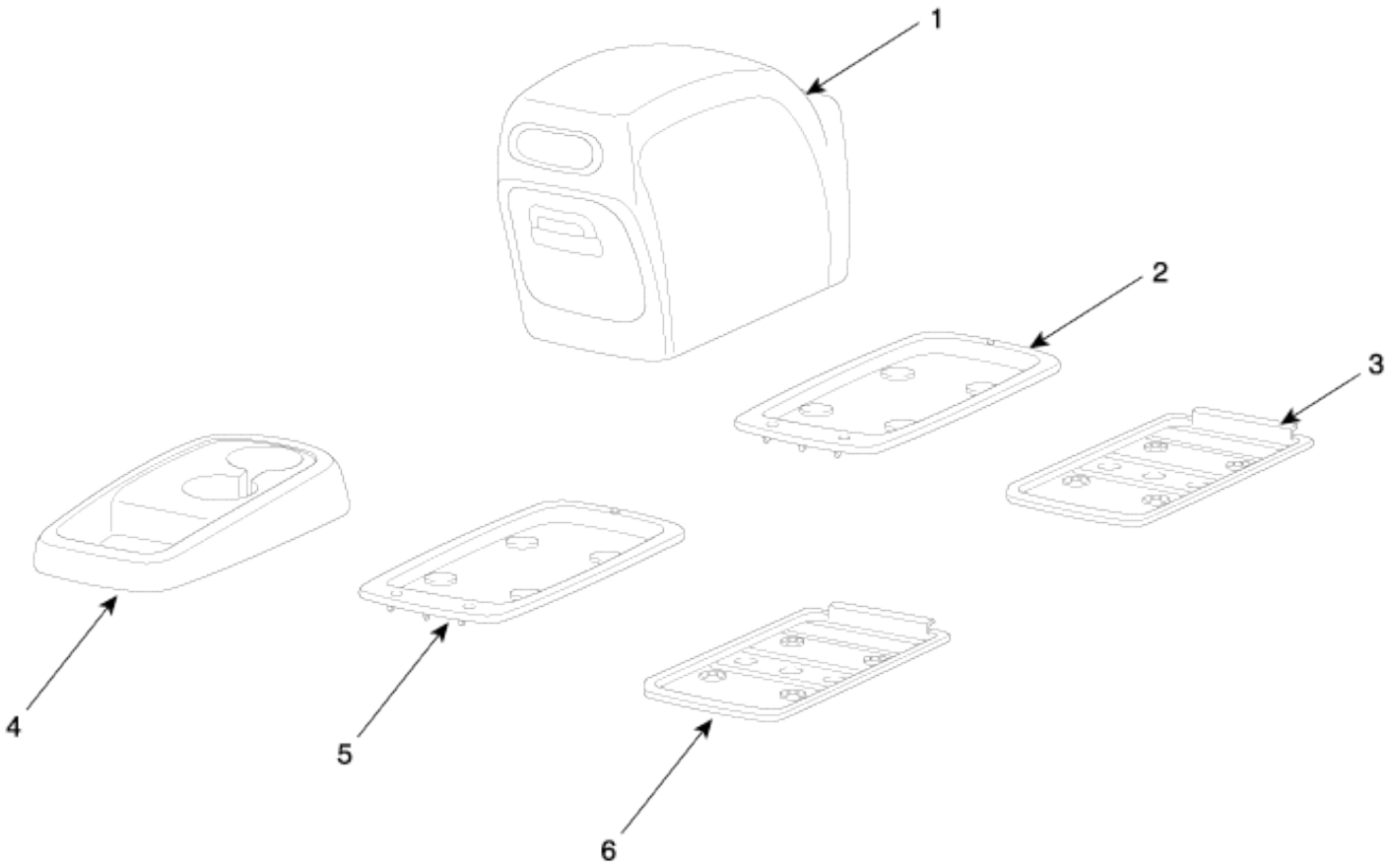
Interior

Console

COMPONENTS



1. Console tray box
2. Cup holder assembly
3. Front console
4. Console upper cover



1. Floor console
2. Floor console tray
3. Console center mounting bracket
4. 2ND - floor console
5. Floor console tray
6. Console rear mounting bracket

REPLACEMENT

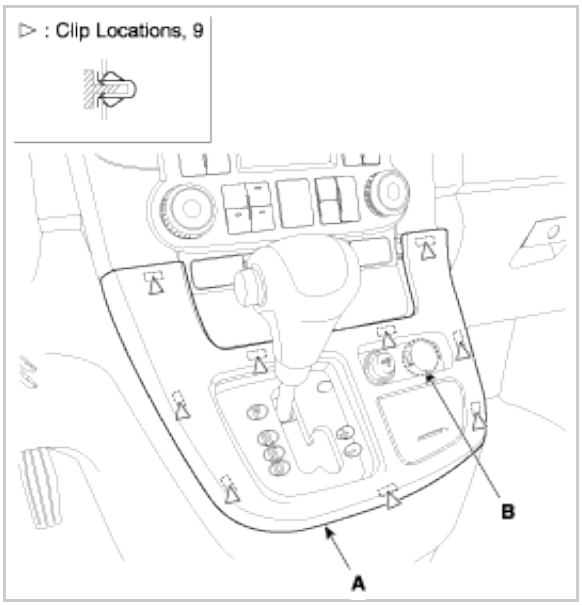
FLOOR CONSOLE REPLACEMENT

NOTICE

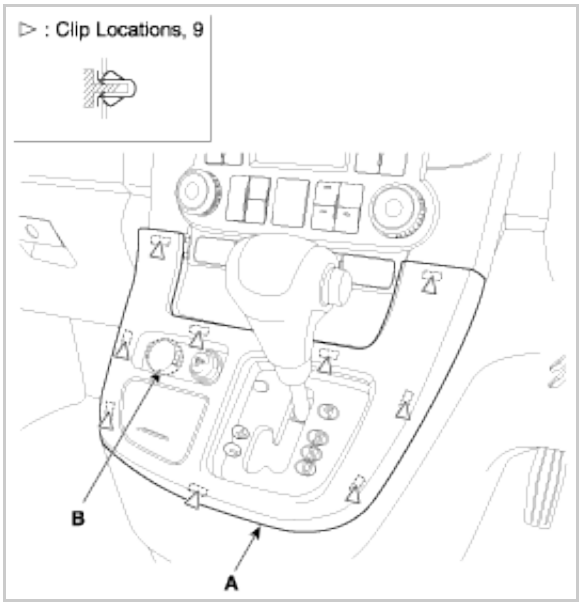
a. When prying with a flat-tipper screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
b. Put on gloves to protect your hands.

1. After the center cover is removed(A), disconnect the connector (B).

[LHD]

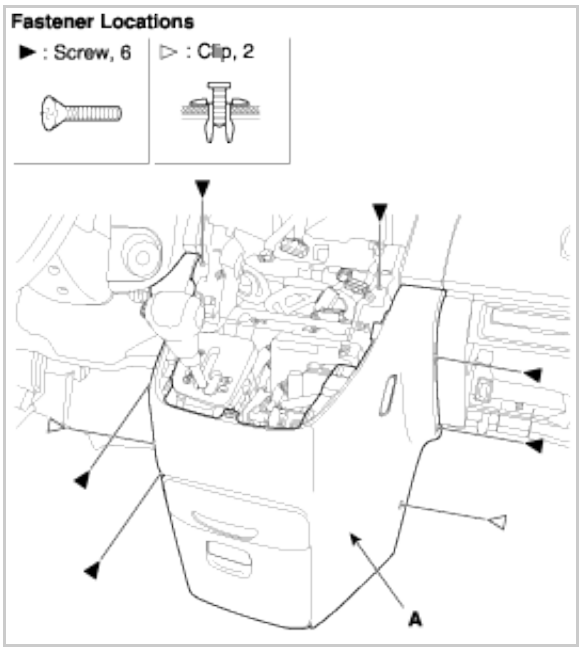


[RHD]

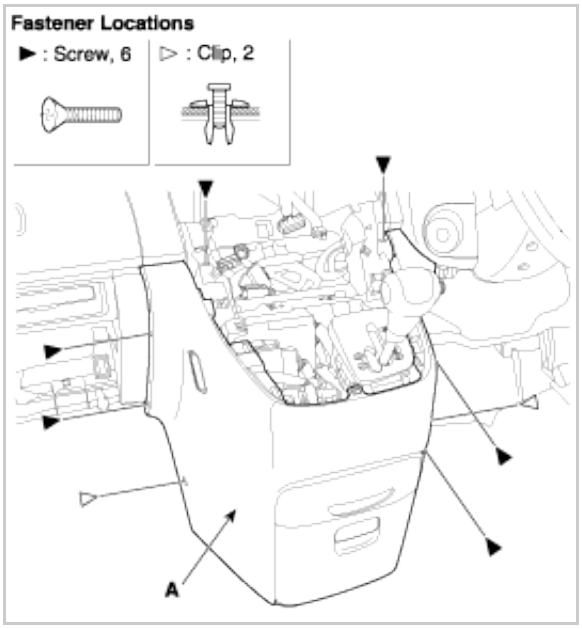


2. Remove the following items.
   a. Crash pad lower panel
   b. Lower bracket
   c. Glove box
   d. Console side cover
3. After loosening the console mounting screw, remove the front console (A).

[LHD]



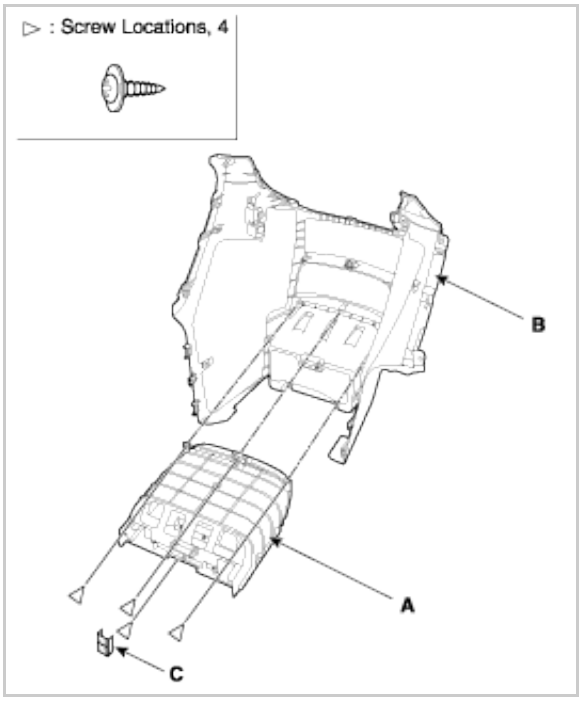
[RHD]



4. Installation is the reverse of removal.

CUP HOLDER ASSEMBLY REPLACEMENT

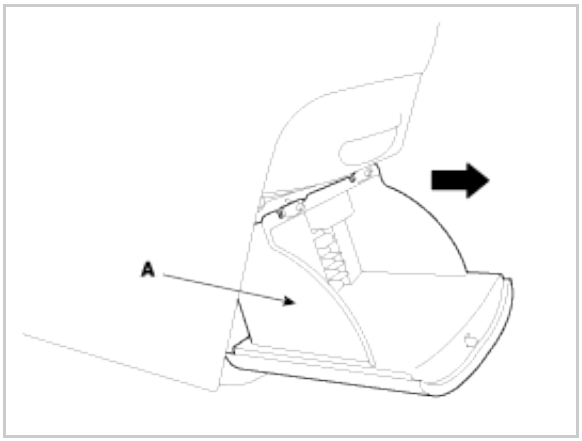
1. Remove the front console assembly.
2. After removing the mounting bracket (A), remove the cup holder assembly (B).



3. Installation is the reverse of removal.

CONSOLE BOX REPLACEMENT

1. Remove the console box (A).

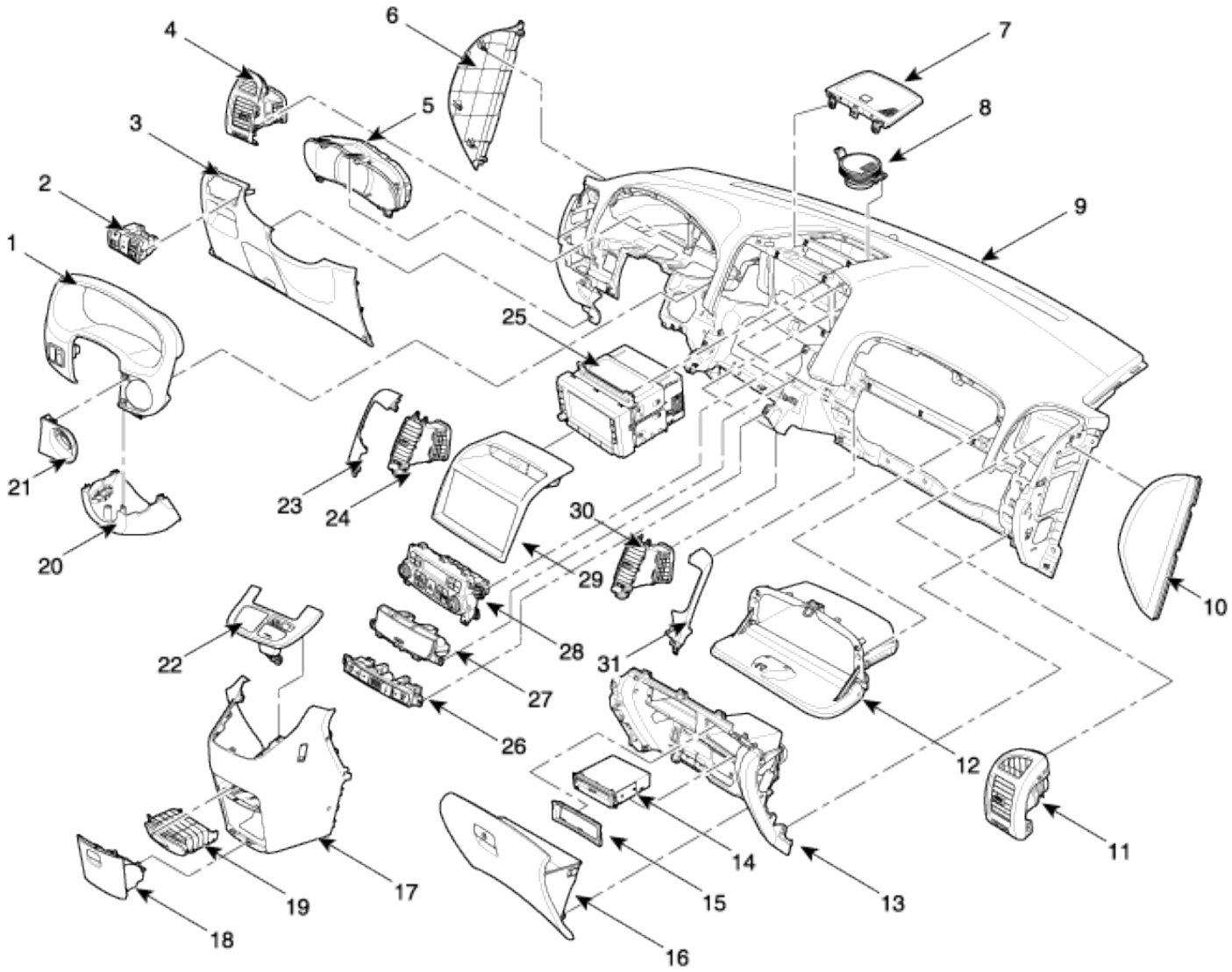


2. Installation is the reverse of removal.

Crash Pad

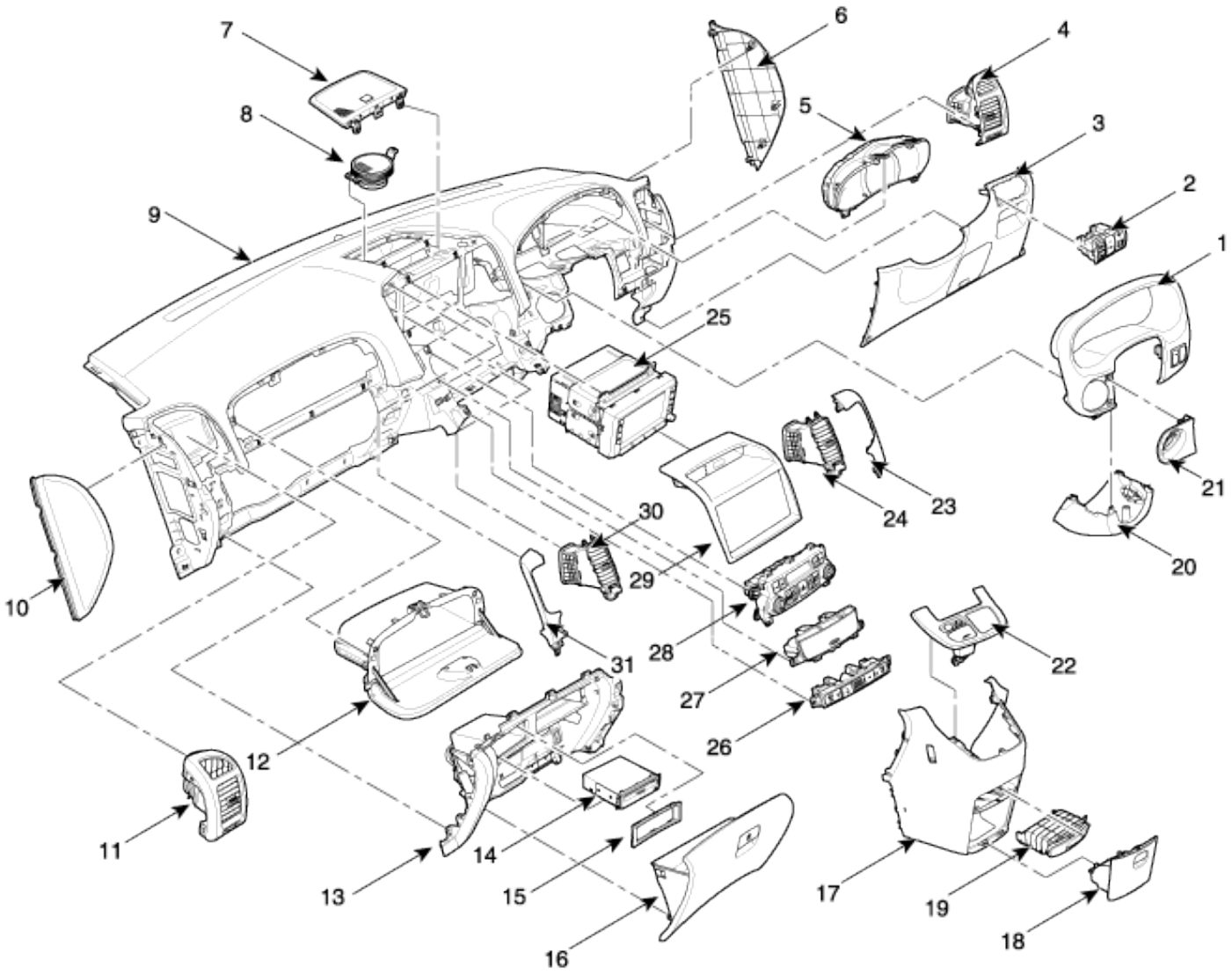
COMPONENTS

[LHD]



1. Cluster facia panel
2. Switch assembly
3. Lower panel
4. Side air vent
5. Cluster
6. Side cover
7. Center speaker cover
8. Center speaker
9. Main crash pad
10. Side cover
11. Side air vent
12. Multi box
13. Lower crash pad panel
14. DVD
15. DVD cover
16. Glove box
17. Front console
18. Consol tray
19. Cup holders
20. Shroud
21. Key box cover
22. Console upper cover
23. Center garnish
24. Center air vent
25. Audio assembly
26. Switch assembly
27. Center tray
28. Heater control unit
29. Center facia panel
30. Center air vent
31. Center garnish

[RHD]



1. Cluster facia panel
2. Switch assembly
3. Lower panel
4. Side air vent
5. Cluster
6. Side cover
7. Center speaker cover
8. Center speaker
9. Main crash pad
10. Side cover
11. Side air vent
12. Multi box
13. Lower crash pad panel
14. DVD
15. DVD cover
16. Glove box
17. Front console
18. Consol tray
19. Cup holders
20. Shroud
21. Key box cover
22. Console upper cover
23. Center garnish
24. Center air vent
25. Audio assembly
26. Switch assembly
27. Center tray
28. Heater control unit
29. Center facia panel
30. Center air vent
31. Center garnish

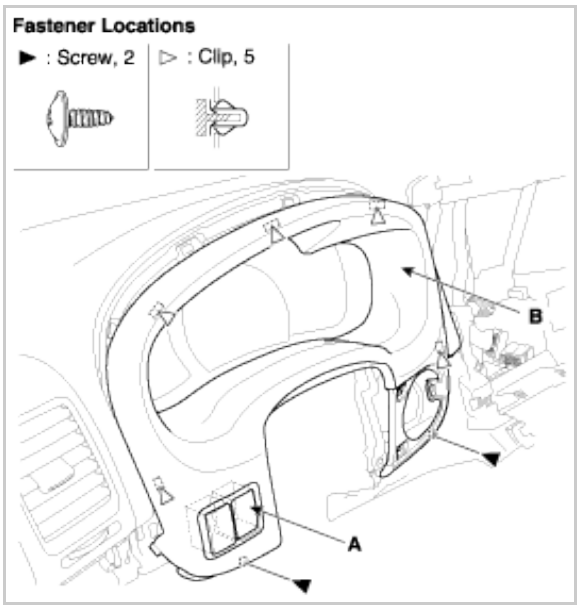
REPLACEMENT

CLUSTER FACIA PANEL REPLACEMENT

NOTICE

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

1. Tilt the steering column down.
2. Remove the screws, and detach the clips.
3. After disconnecting the connector (A), remove the cluster facia panel (B).



4. Installation is the reverse of removal.

NOTICE

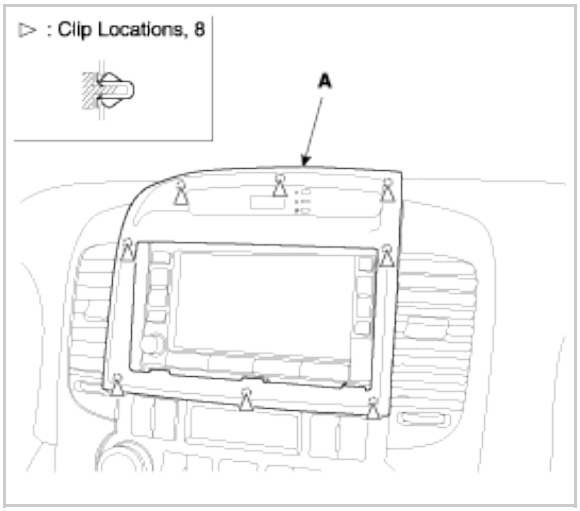
a. Make sure the connector is plugged in properly.

CENTER FACIA PANEL REPLACEMENT

NOTICE

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

1. Detach the clips, then remove the center facia panel (A).

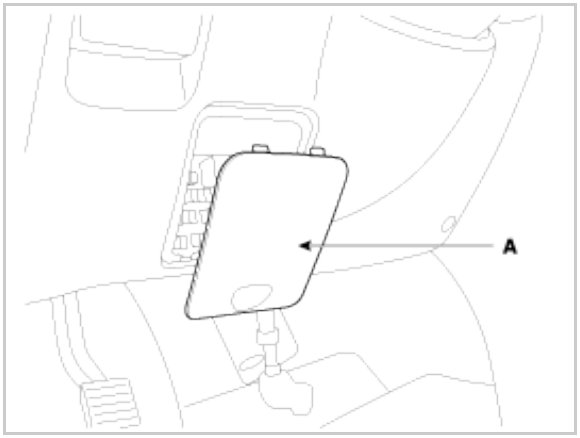


2. Installation is the reverse the removal.

> **NOTICE**
>
> a. Make sure the connector is plugged in properly.

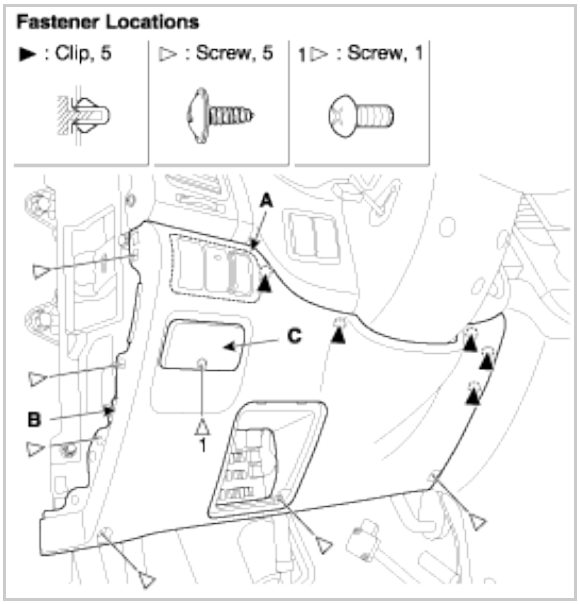
LOWER PANEL REPLACEMENT

1. Remove the crash pad side cover.
2. Remove the fuse box cover (A).

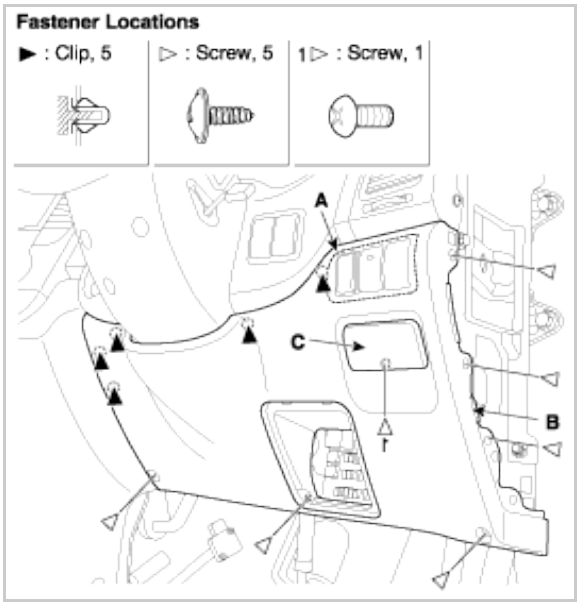


3. After loosening the crash pad lower panel mounting screws, then remove the lower panel (B).
4. Remove the parking brake lever (C).

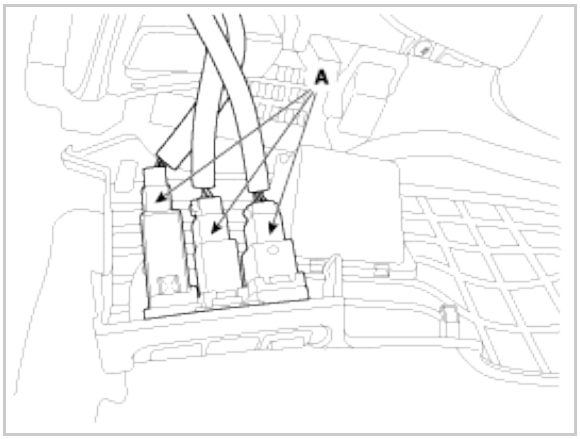
[LHD]



[RHD]



5. Disconnect the connector (A).

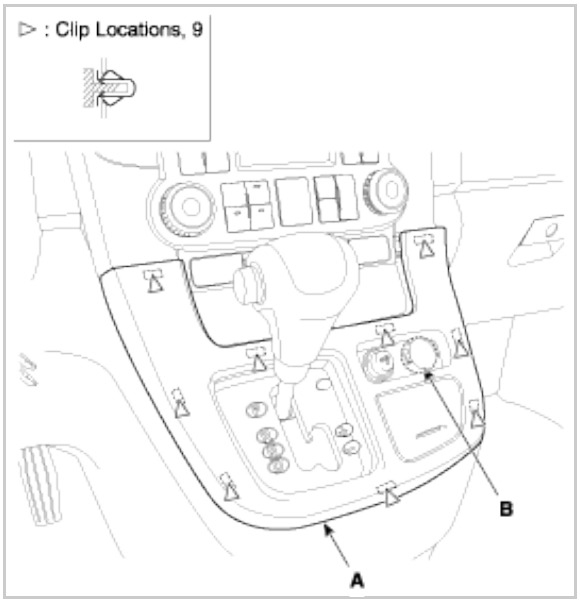


6. Installation is the reverse of removal.

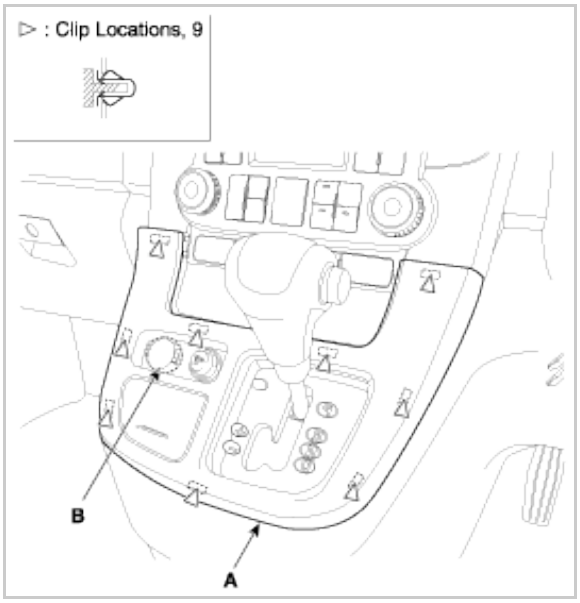
HEATER CONTROL UNIT REPLACEMENT

1. Remove the center facia panel.
2. Remove the console upper cover (A).
3. Disconnect the connector (B).

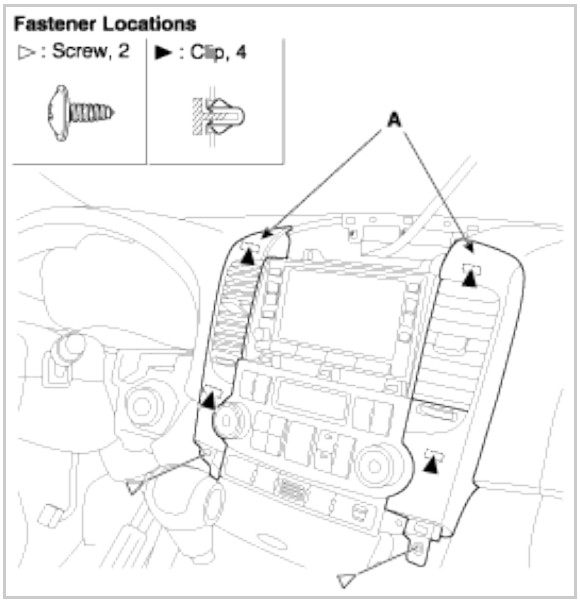
[LHD]



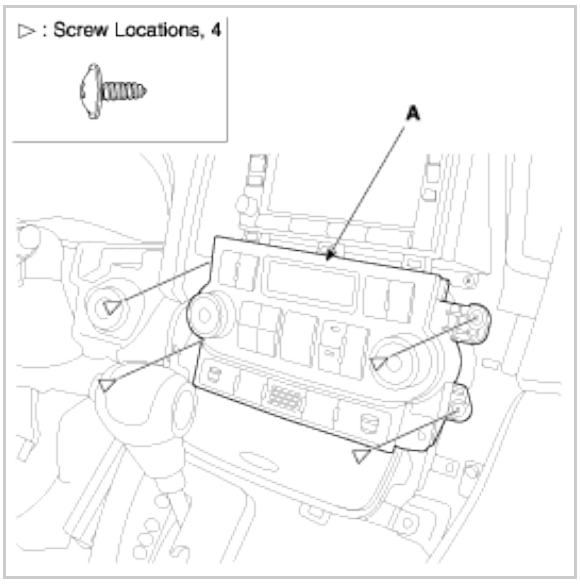
[RHD]



4. Loosen the air vent mounting screw, then remove the air vent (A).



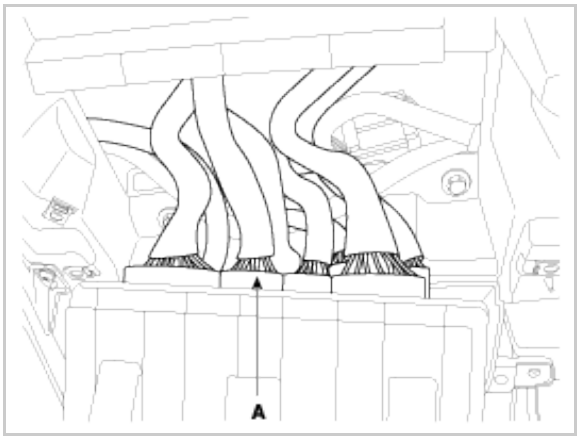
5. After loosening the heater control unit mounting screws, then remove the heater control unit (A).



6. Installation is the reverse of removal.

NOTICE

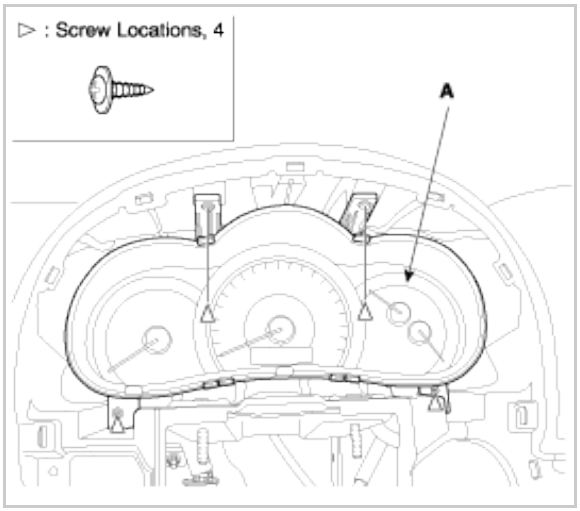
a. Make sure the connector(A) is plugged in properly.



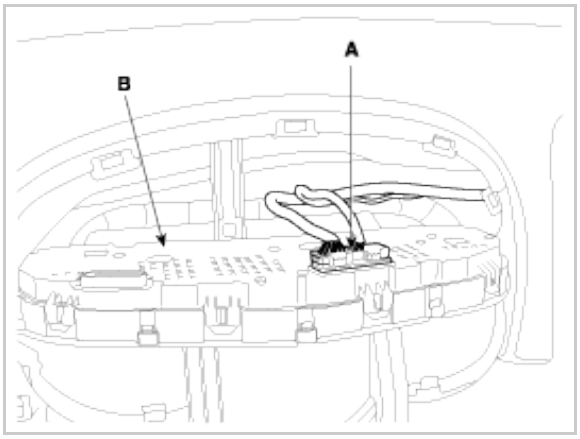


CLUSTER REPLACEMENT

1. Remove the cluster facia panel.
2. Loosen the screws.



3. Disconnect the cluster connectors (A), then remove the cluster (B).



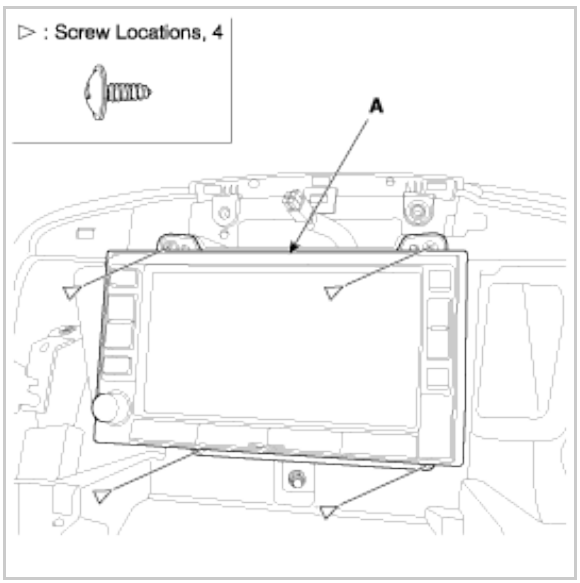
4. Installation is the reverse of removal.

NOTICE

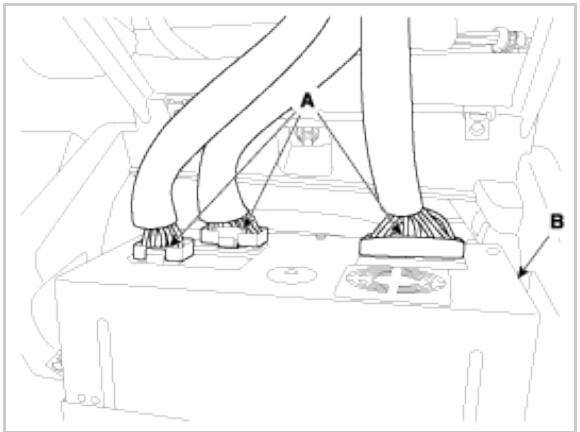
a. Make sure the connector are plugged in properly.

AUDIO ASSEMBLY REPLACEMENT

1. Remove the center facia panel.
2. Loosen the screws.



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



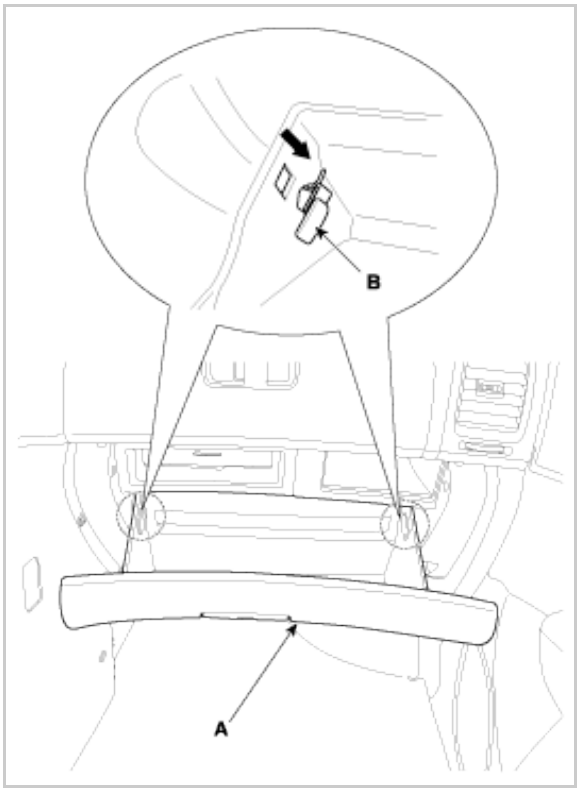
4. Installation is the reverse of removal.

NOTICE

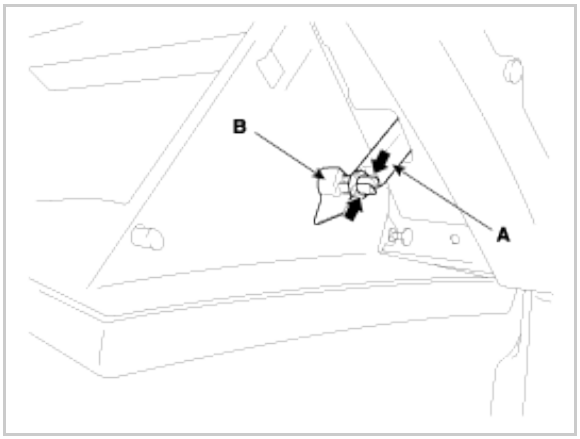
a. Make sure the connector are plugged in properly.

GLOVE BOX REPLACEMENT

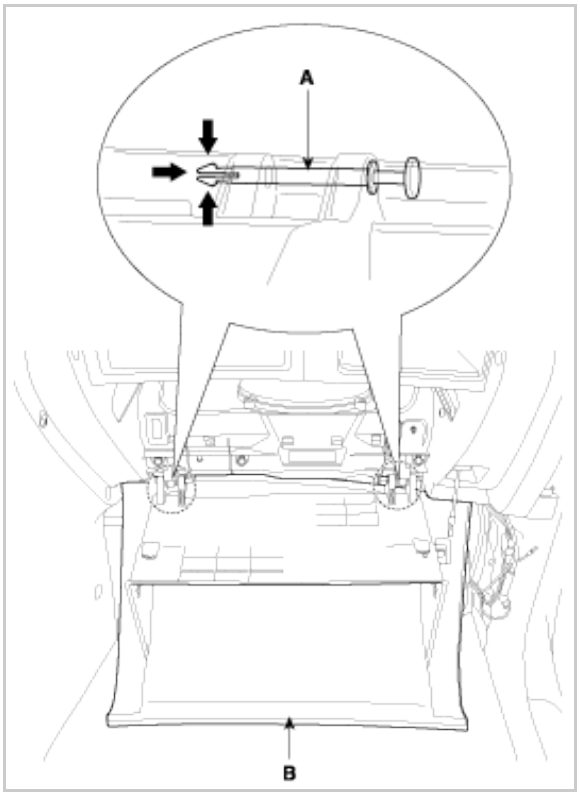
1. Disconnect the damper (B) from the glove box (A).



2. Remove the glove box (A) from the lift (B).



3. Disconnect the pine (A), then remove the glove box (B).



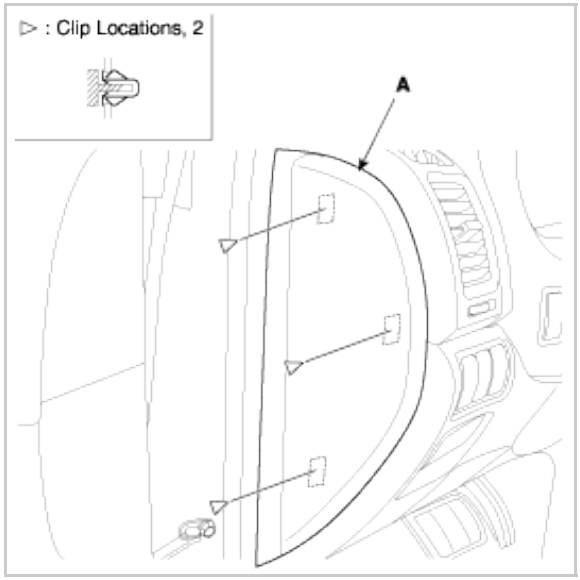
4. Installation is the reverse of removal.

COVER REPLACEMENT

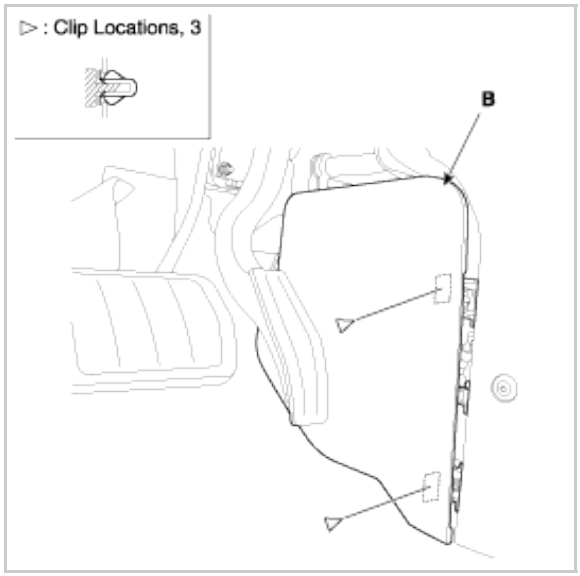
NOTICE

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

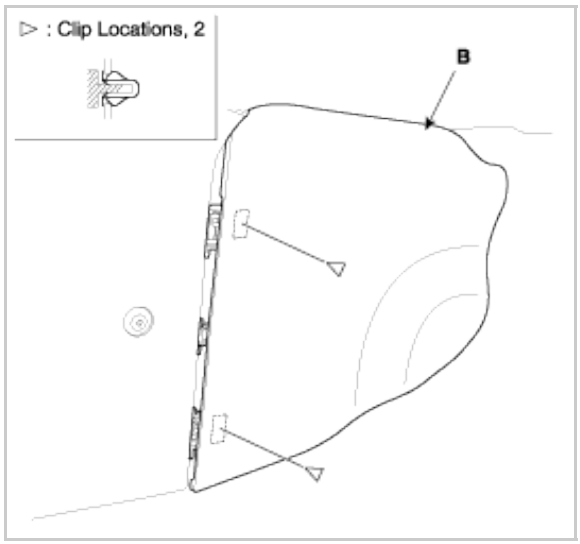
1. Remove the crash pad side cover (A), crash pad center under cover (B).
   (1) Crash pad side cover.



   (2) Front crash pad center under cover, LH.



(3) Front crash pad center under cover, RH.



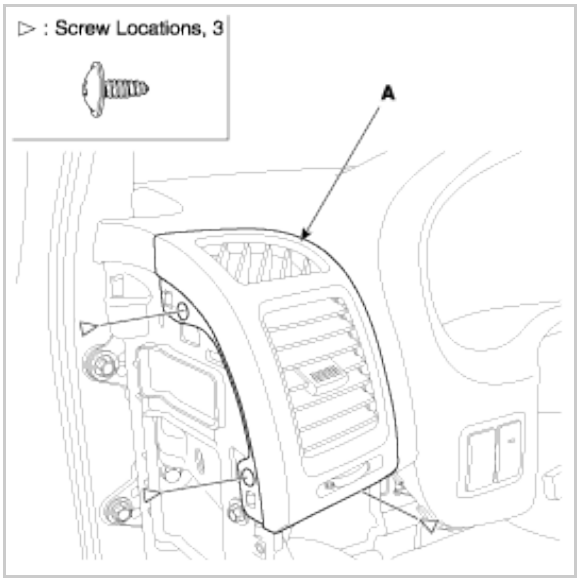
2. Installation is the reverse of removal.

AIR VENT REPLACEMENT

NOTICE

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

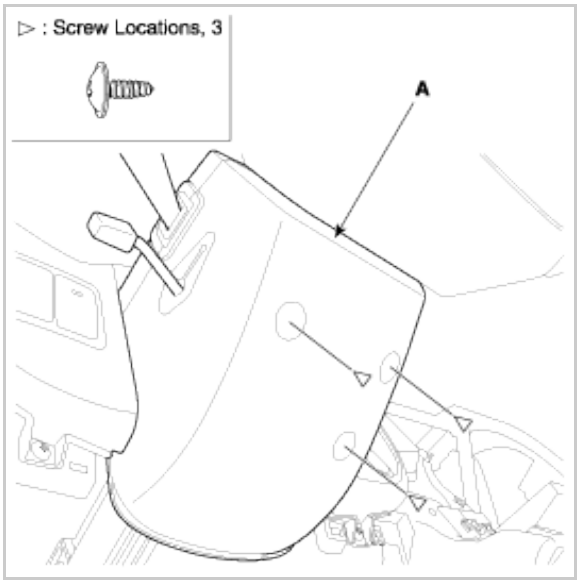
1. Remove the side cover.
2. Loosen the mounting screws, then remove the air vent (A).



3. Installation is the reverse of removal.

SHROUD REPLACEMENT

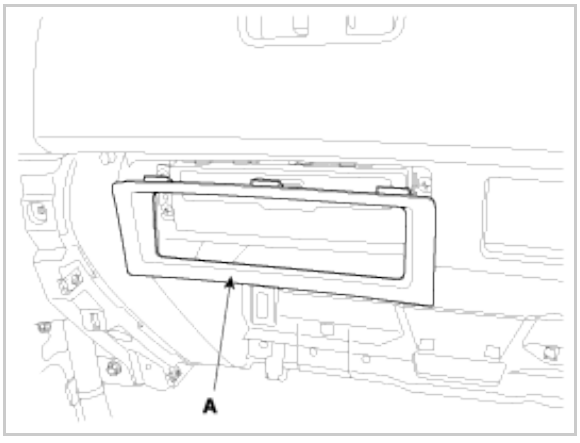
1. Loosen the screws.
2. Disconnect the connector, then remove the shroud assembly (A).



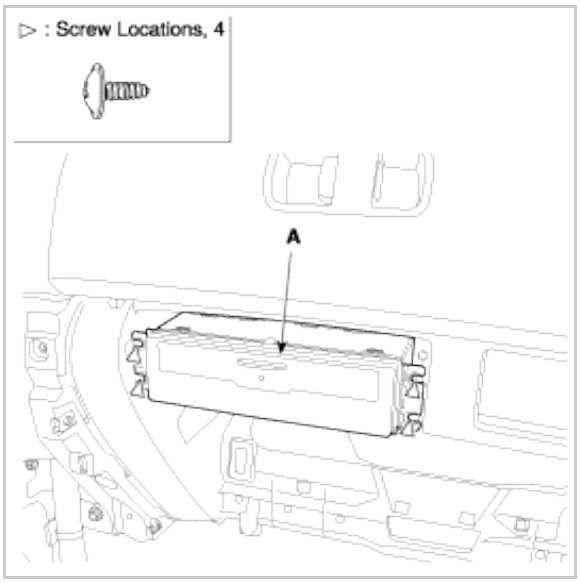
3. Installation is the reverse of removal.

LOWER CRASH PAD PANEL REPLACEMENT

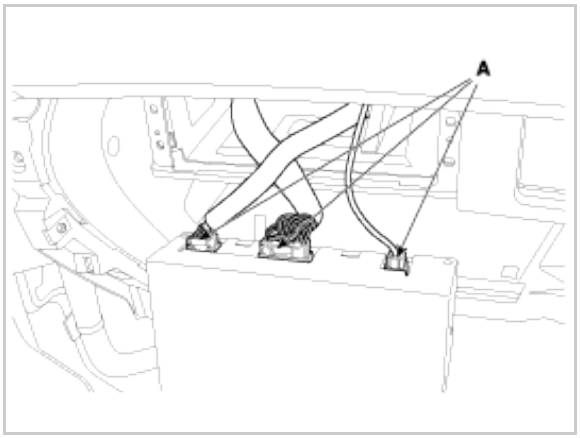
1. Remove the glove box.
2. Remove the side air vent.
3. Remove the DVD cover (A).



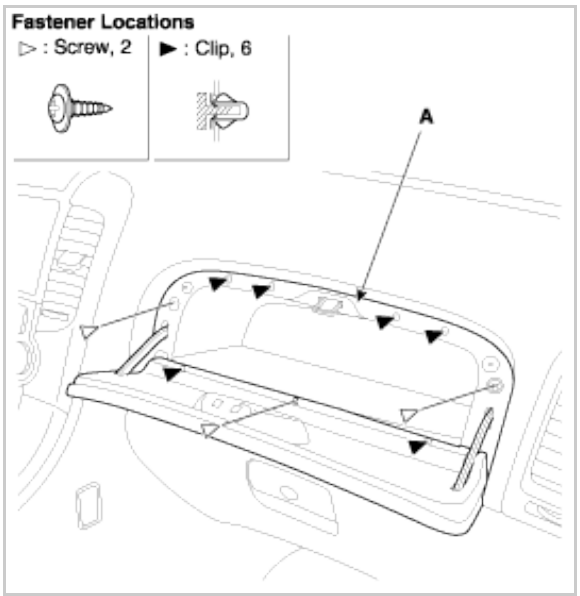
4. Loosen the mounting screws, remove the DVD (A).



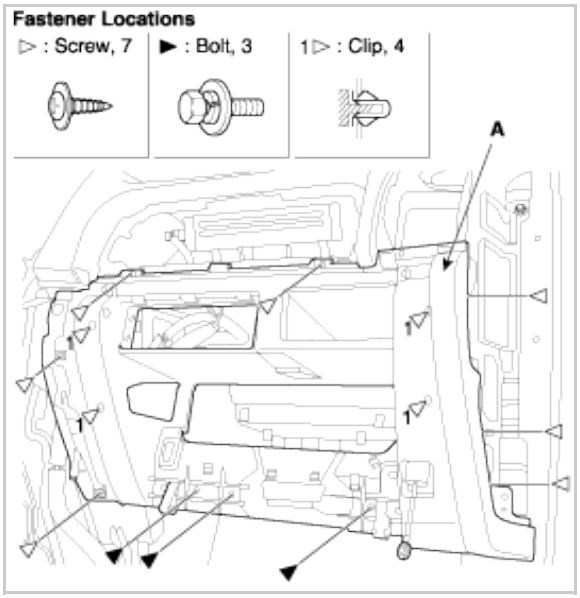
5. Disconnect the connector (A).



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



7. Loosen the panel mounting bolts and screws.
8. After disconnecting the connector, remove the panel (A).



9. Installation is the reverse of removal.

CRASH PAD REPLACEMENT

NOTICE

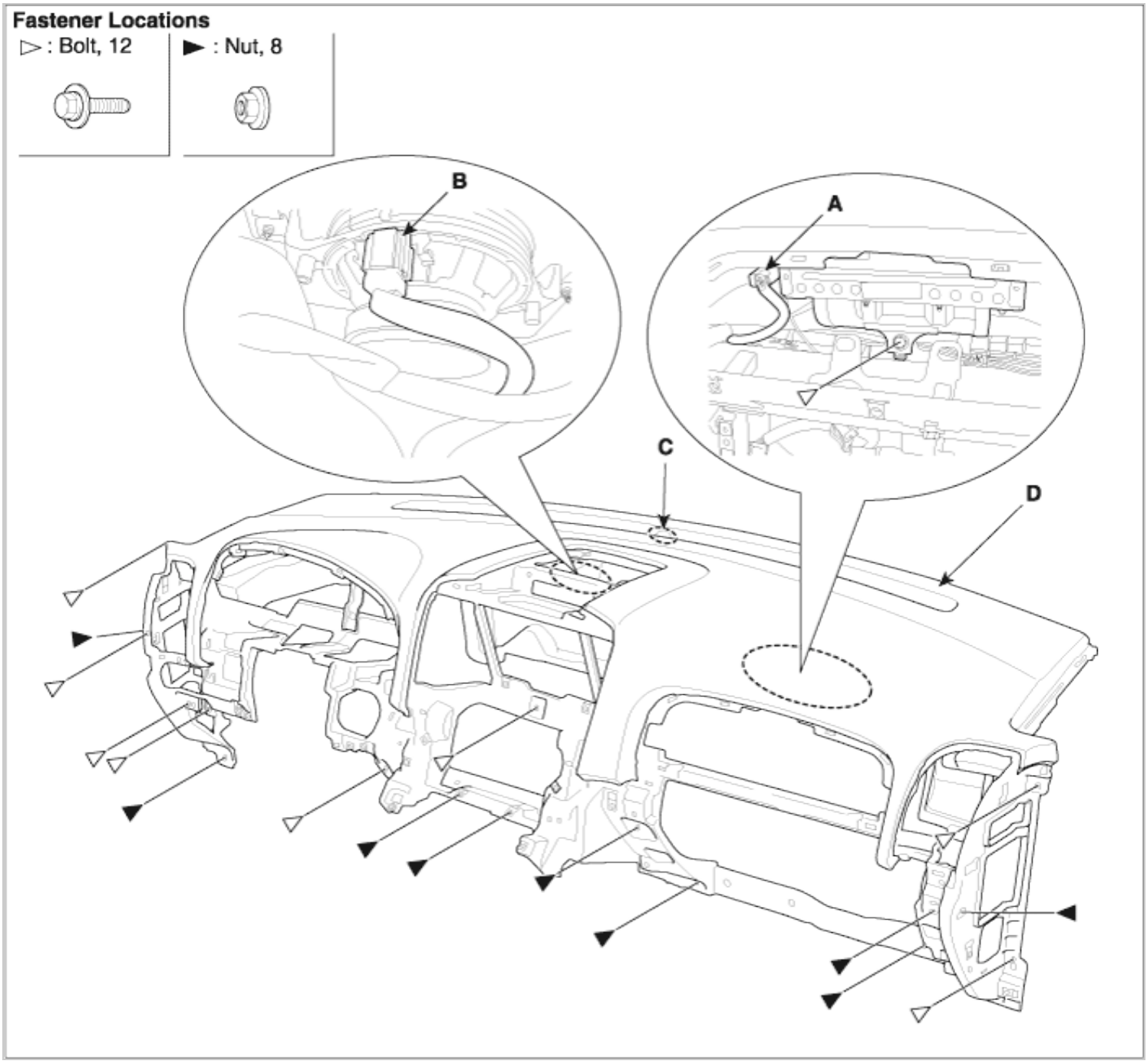
a. When prying with a flat-tipped screwdriver, wrap itwith protective tape, and apply protective tapearound the related parts, to prevent damage.
b. Put on gloves to protect your hands.

1. Remove the following items.
   a. Front seat.
   b. Cluster facia panel, cluster.
   c. Audio assembly.
   d. Glove box.
   e. Side cover, center under cover.
   f. Front pillar trim.
2. Remove the photo sensor (C), speaker connector (B).
3. Disconnect the passenger`s air bag connector (A).
   Loosen the bolt and nut, then remove the crash pad (D).
4. Installation is the reverse of removal.

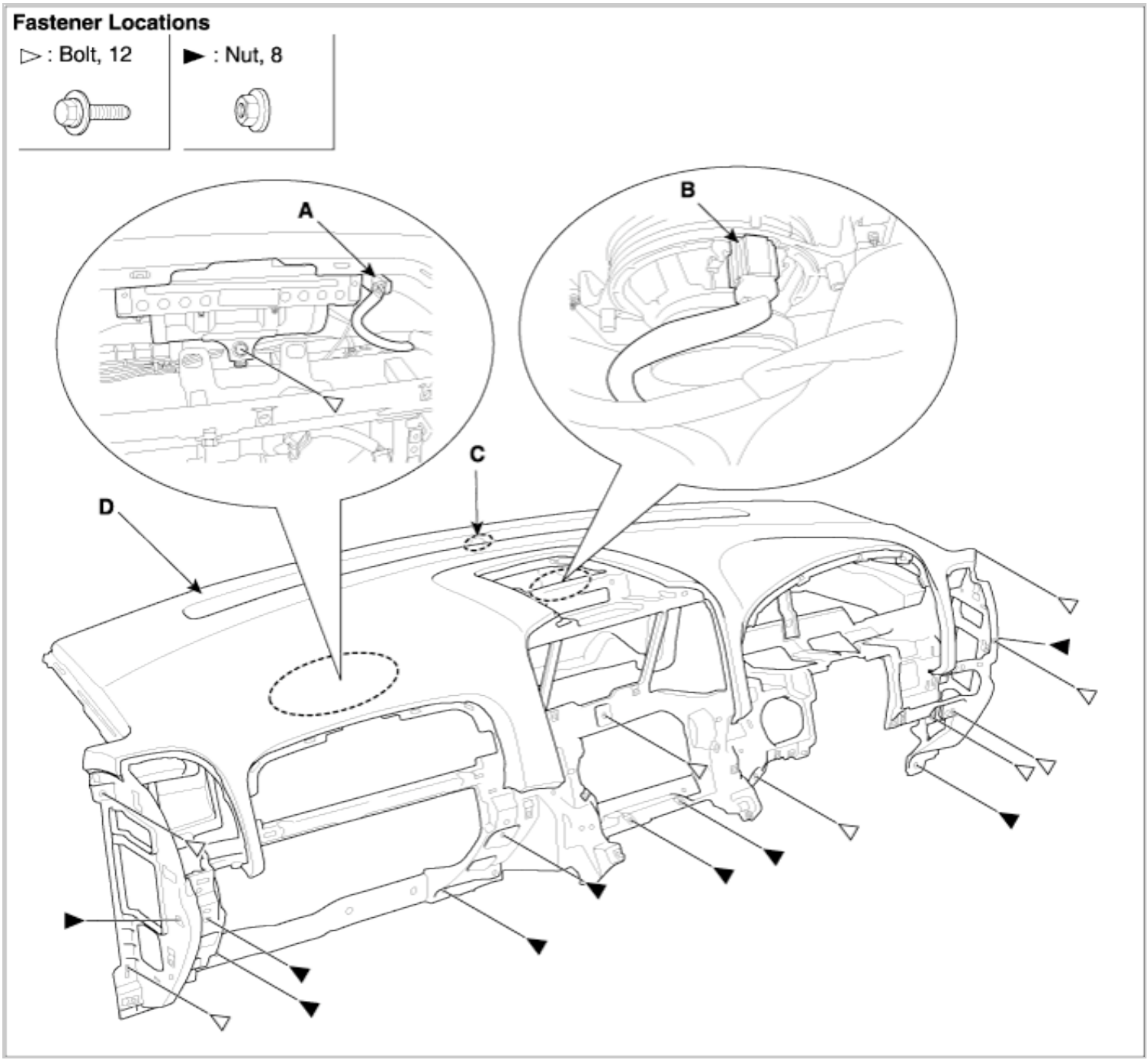
NOTICE

a. Make sure the crash pad fits onto the guide pins correctly.
b. Before tightening the bolts, make sure the crash pad wire harnesses are not pinched.
c. Make sure the connectors are plugged in properly, and the antenna lead is connected properly.
d. Enter the anti- theft code for the radio, then enter.

[LHD]



[RHD]



COWL CROSS BAR ASSEMBLY REPLACEMENT

NOTICE

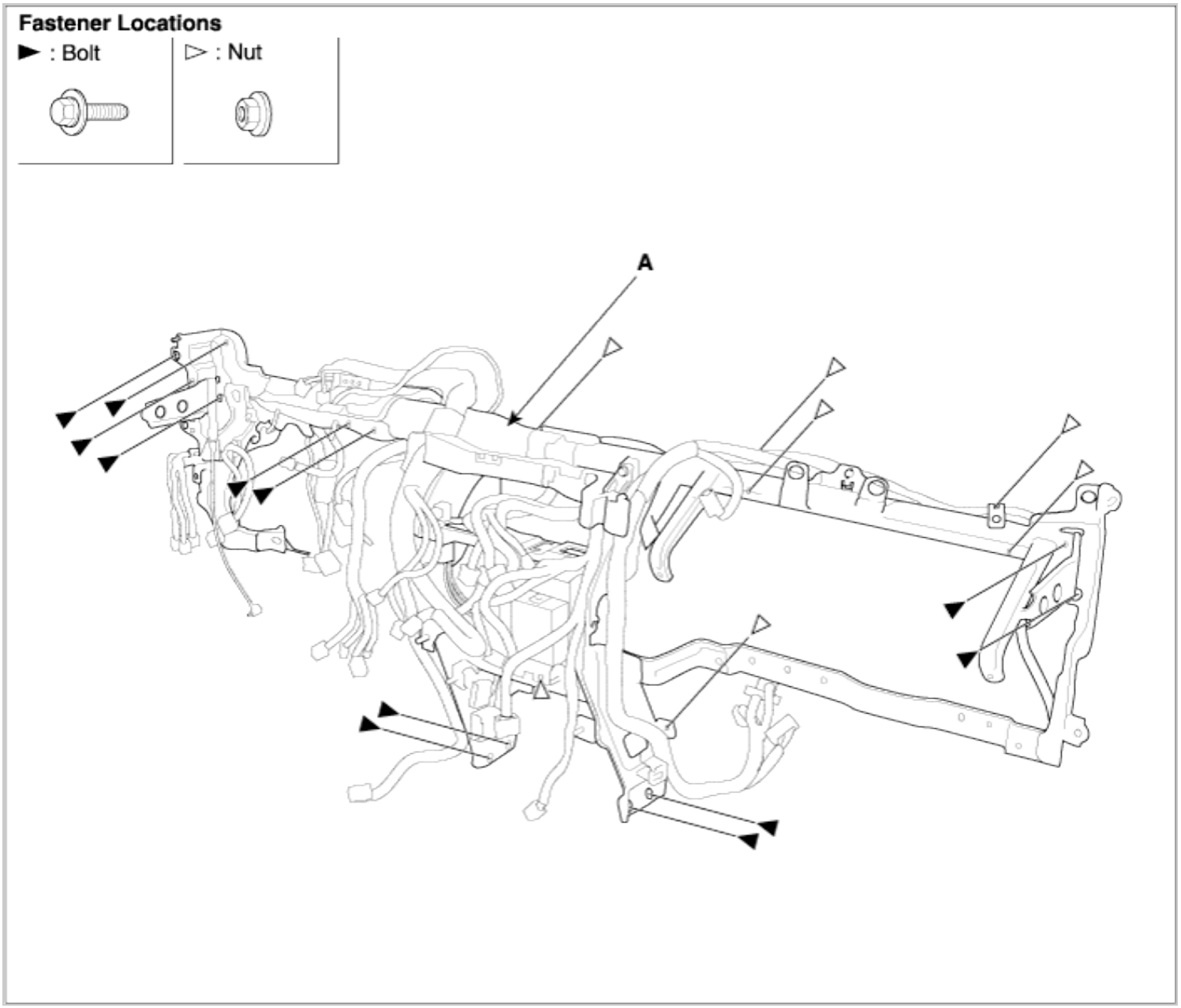
a. When prying with a flat-tipped screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
b. Put on gloves to protect your hands.

1. Remove the crash pad.
2. Remove the connectors.
3. Loosen the bolts and nuts, then remove cowl cross bar assembly (A).
4. Installation is the reverse of removal.

NOTICE

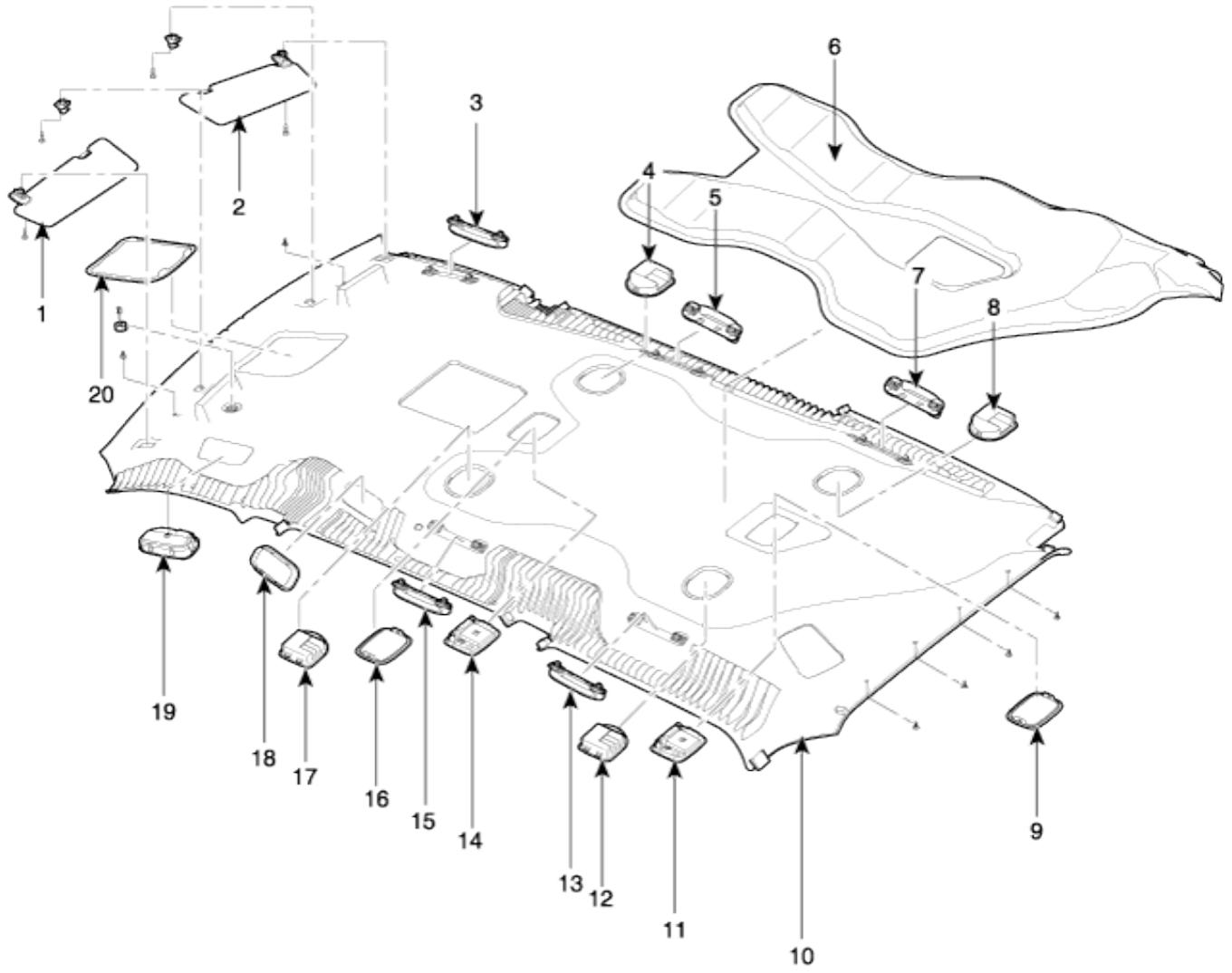
a. Make sure the crash pad fits onto the guide pins correctly.
b. Before tightening the bolts, make sure the crash pad wire harnesses are not pinched.
c. Make sure the connectors are plugged in properly, and the antenna lead is connected properly.

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



Roof Trim

COMPONENTS

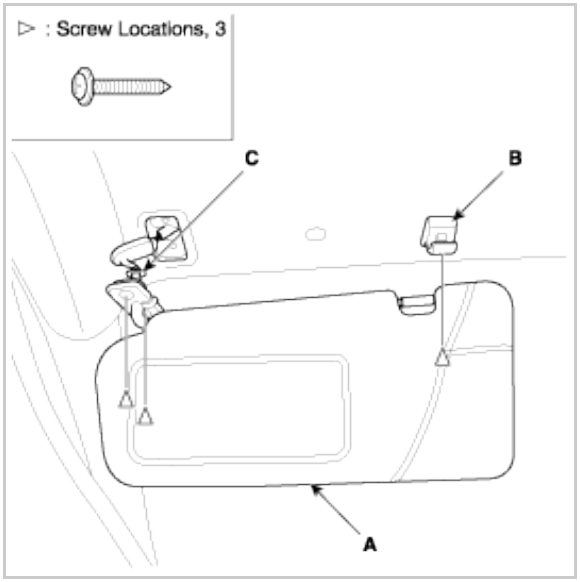


1. Sunvisor
2. Sunvisor
3. Assist handle
4. Roof air vent
5. Assist handle
6. Roof air duct
7. Assist handle
8. Roof air vent
9. Room lamp bracket
10. Roof trim
11. Rear room
12. Roof air vent
13. Assist handle
14. Center room lamp
15. Assist handle
16. Room lamp mounting bracket
17. Roof air vent
18. Heater control unit
19. Side tray
20. Over head console

REPLACEMENT

SUNVISOR REPLACEMENT

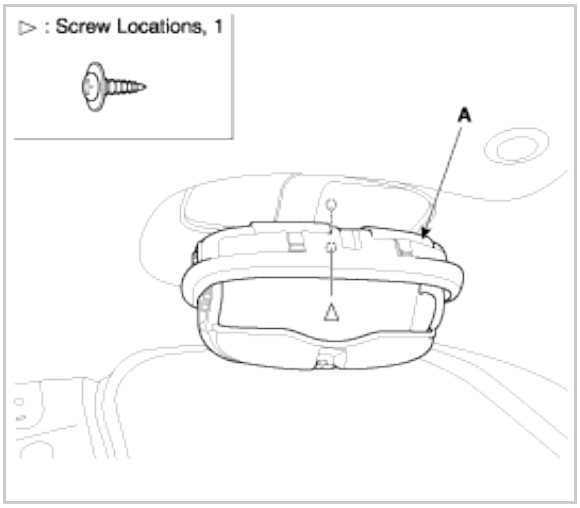
1. Loosen the mounting screws, then sunvisor (A) and holder (B).
2. Disconnect the connector (C).



3. Installation is the reverse of removal.

S/G CASE REPLACEMENT

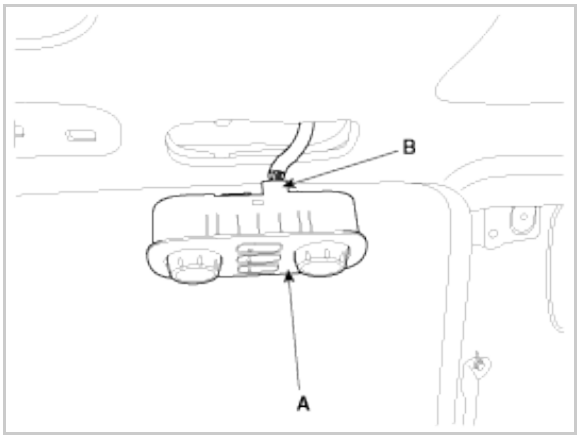
1. Using a screwdriver, remove the side tray (A).



2. Installation is the reverse of removal.

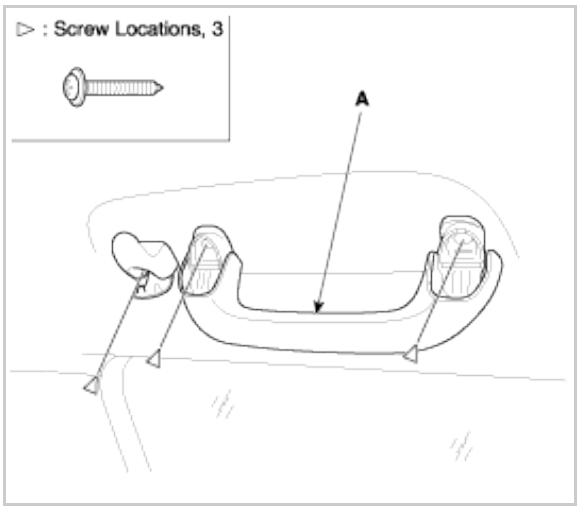
REAR HEATER CONTROL UNIT REPLACEMENT

1. Remove the rear heater control unit (A).
2. Disconnect the connector (B).



ASSIST HANDLE REPLACEMENT

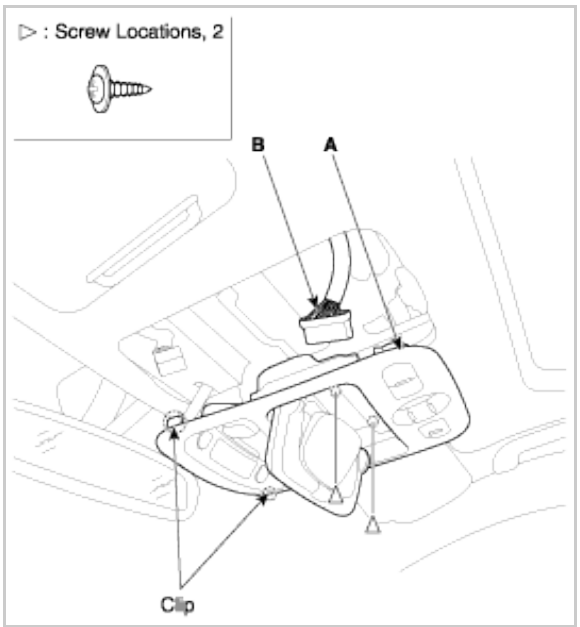
1. Remove the assist handle (A).



2. Installation is the reverse the removal.

OVERHEAD CONSOLE REPLACEMENT

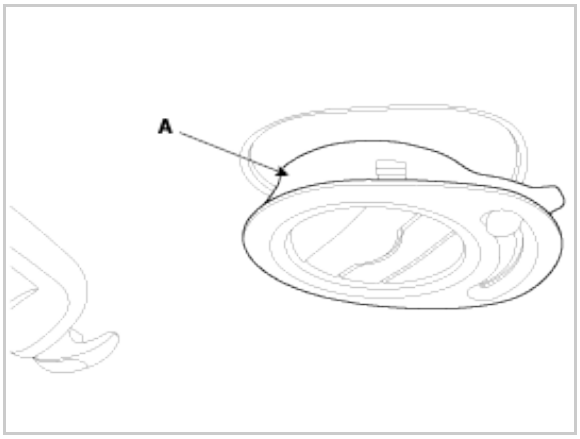
1. Loosen the overhead console mounting screws, remove the overhead console assembly (A).
2. Disconnect the connector (B).



3. Installation is the reverse the removal.

ROOF AIR VENT REPLACEMENT

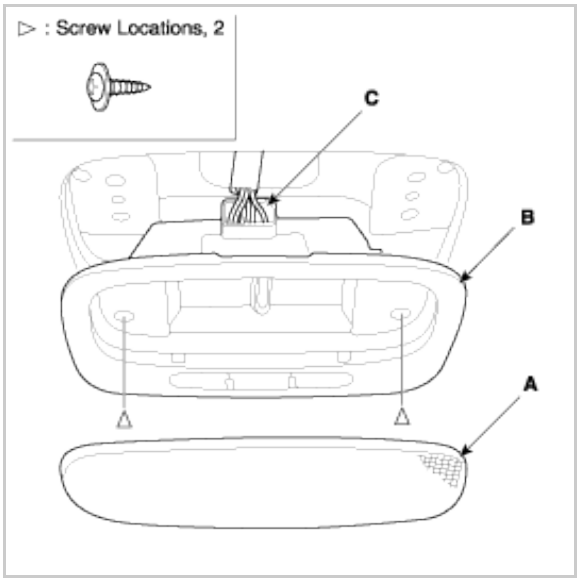
1. Using a screwdriver, remove the roof air vent (A).



2. Installation is the reverse the removal.

ROOM LAMP REPLACEMENT

1. Remove the room lamp.
   a. Remove the lens (A).
   b. Remove the screw.
   c. Pull out the room lamp (B).
   d. Disconnect the connector (C).



2. Installation is the reverse of removal.

ROOF TRIM REPLACEMENT

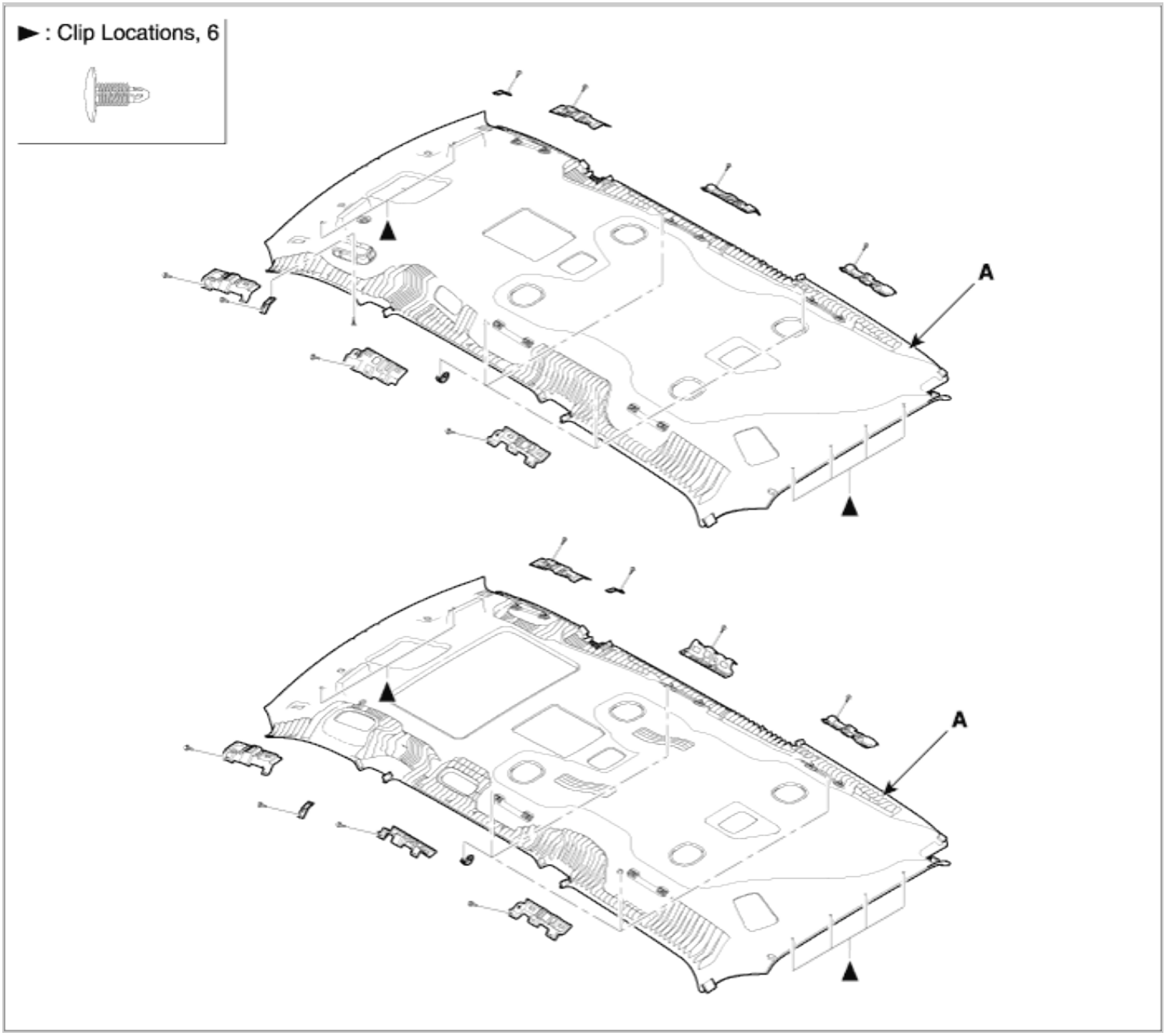
NOTICE

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

1. Remove the following item.
   a. Sunvior.
   b. Assist handle.
   c. Side tray.
2. Using a clip remover, detach the clips, and remove the roof trim (A).
3. Installation is the reverse the removal.

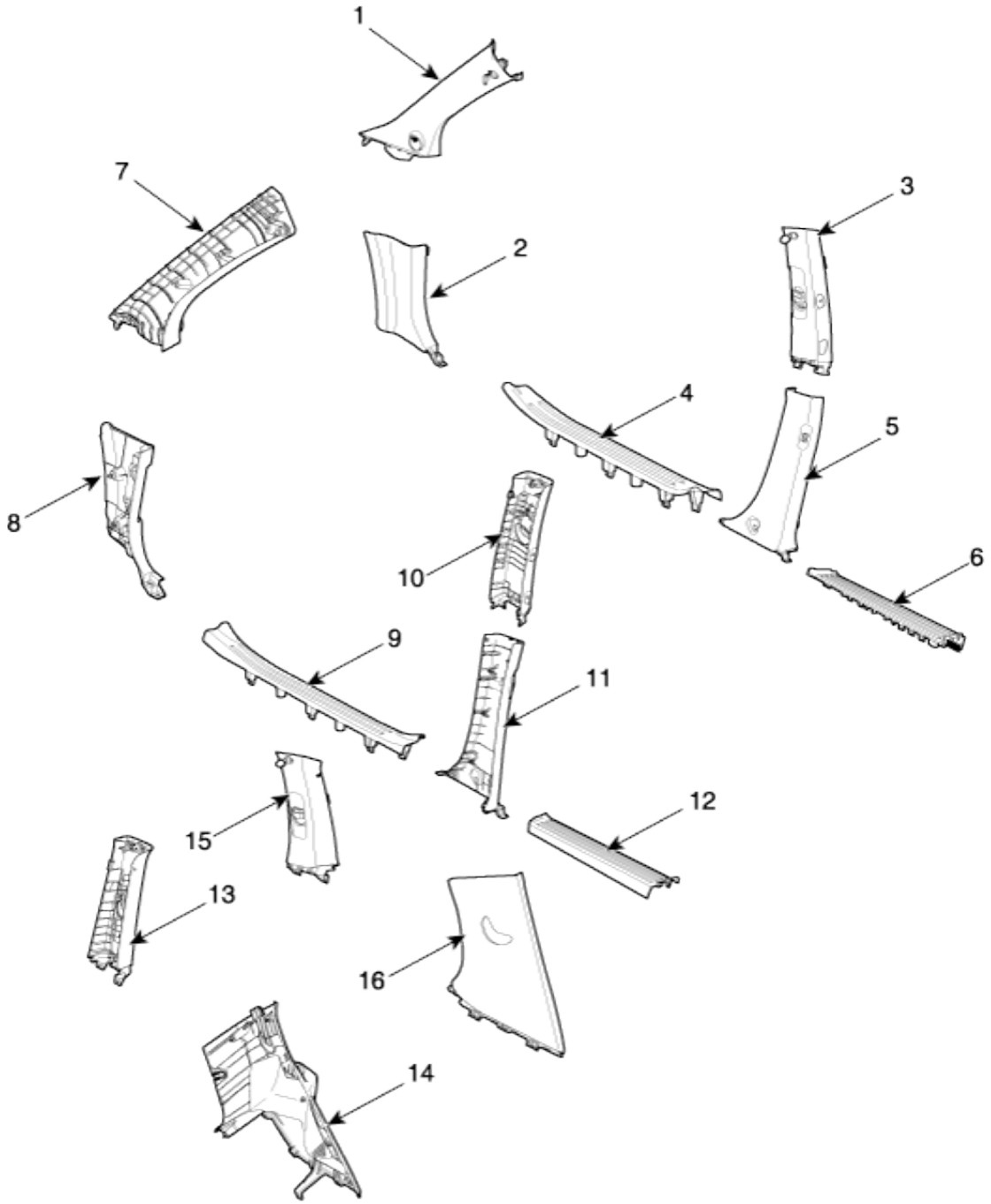
NOTICE

a. Replace any damage clips.


►: Clip Locations, 6
A
A

Interior Trim

COMPONENTS



1. Front pillar trim
2. Cowl side trim
3. Center pillar upper trim
4. Front door scuff trim
5. Center pillar lower trim
6. Rear door scuff trim
7. Front pillar trim
8. Cowl side trim
9. Front door scuff trim
10. Center pillar upper trim
11. Center pillar lower trim
12. Rear door scuff trim
13. C pillar trim
14. D pillar trim
15. C pillar trim
16. D pillar trim

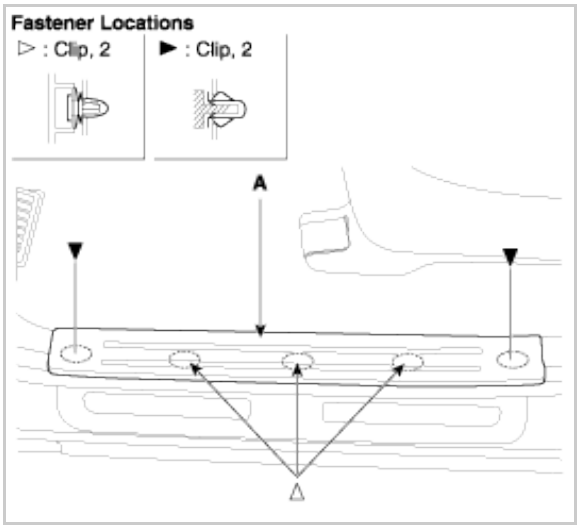
REPLACEMENT

FRONT DOOR SCUFF TRIM REPLACEMENT

NOTICE

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

1. Remove the front door scuff trim (A).



2. Installation is the reverse of removal.

NOTICE

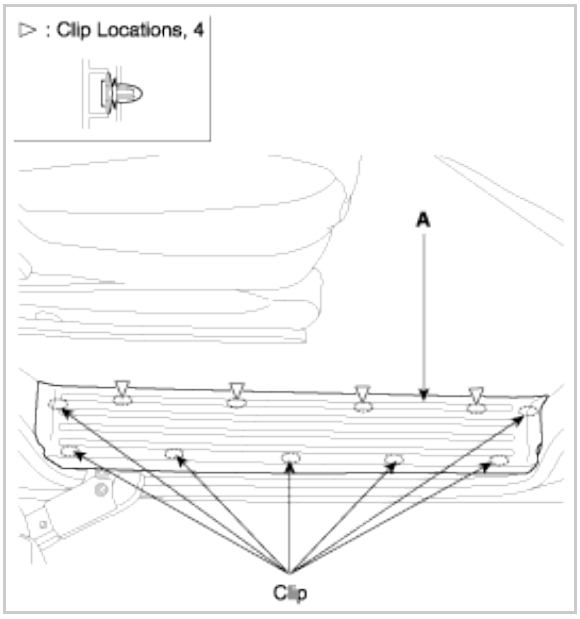
a. Replace any damaged clips.

REAR DOOR SCUFF TRIM REPLACEMENT

NOTICE

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

1. Remove the rear door scuff trim (A).



2. Installation is the reverse of removal.

NOTICE

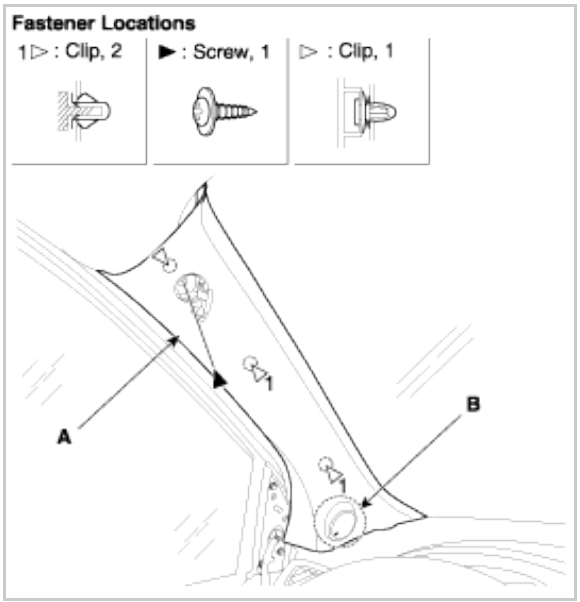
a. Replace any damage clips.

FRONT PILLAR TRIM

NOTICE

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

1. Remove the front pillar trim (A).



2. Installation is the reverse of removal.

NOTICE

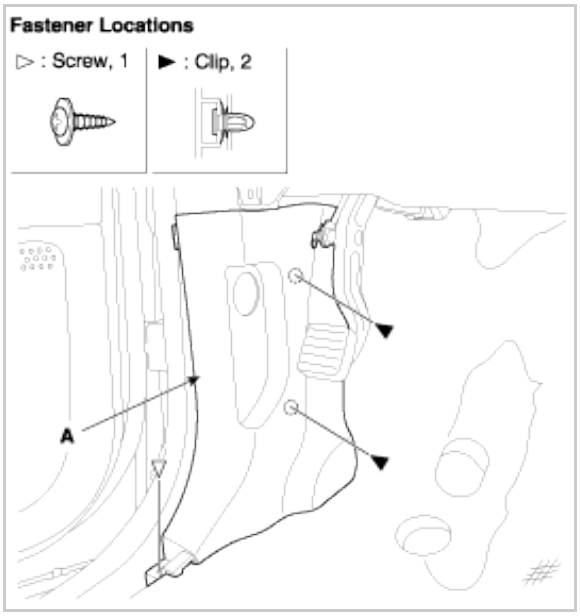
a. Replace any damage clips.

COWL SIDE TRIM REPLACEMENT

NOTICE

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

1. Remove the front door scuff trim.
2. Remove the cowl side trim (A).



3. Installation is the reverse of removal.

NOTICE

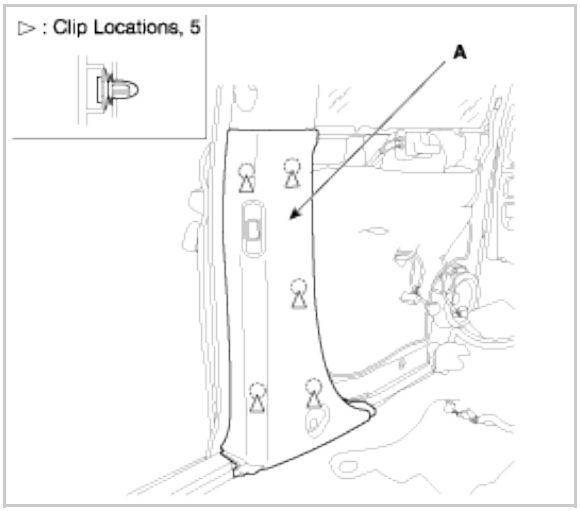
a. Replace any damage clips.

CENTER LOWER PILLAR TRIM REPLACEMENT

NOTICE

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

1. Remove the front seat belt lower anchor.
2. Remove the front door scuff trim.
3. Remove the rear door scuff trim.
4. Remove the center lower pillar trim (A).



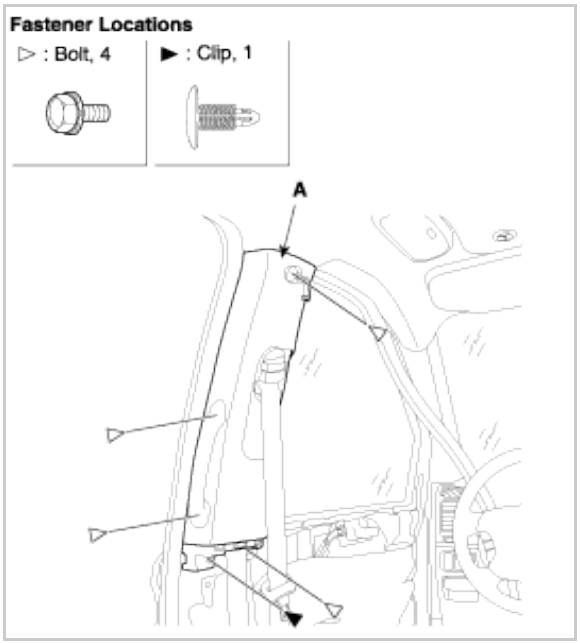
5. Installation is the reverse of removal.

> **NOTICE**
>
> a. Replace any damage clips.

CENTER UPPER PILLAR TRIM REPLACEMENT

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

1. Remove the center lower pillar trim.
2. Remove the center upper pillar trim (A).



3. Installation is the reverse of removal.

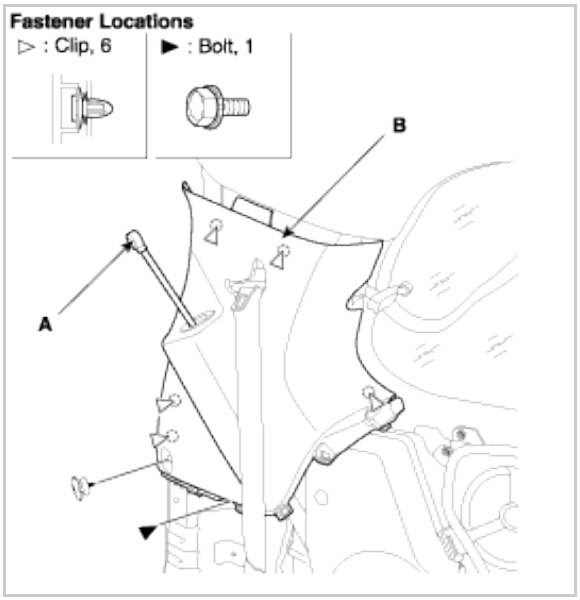
> **NOTICE**
>
> a. Replace any damage clips.

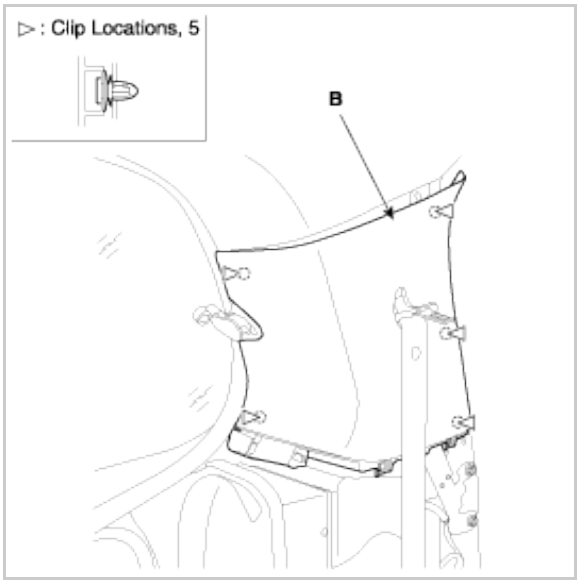
REAR PILLAR TRIM REPLACEMENT

NOTICE

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

1. Remove the luggage trim.
2. Remove the tailgate lift (A).
3. Remove the rear pillar upper trim (B).





4. Installation is the reverse of removal.

NOTICE

a. Replace any damage clips.

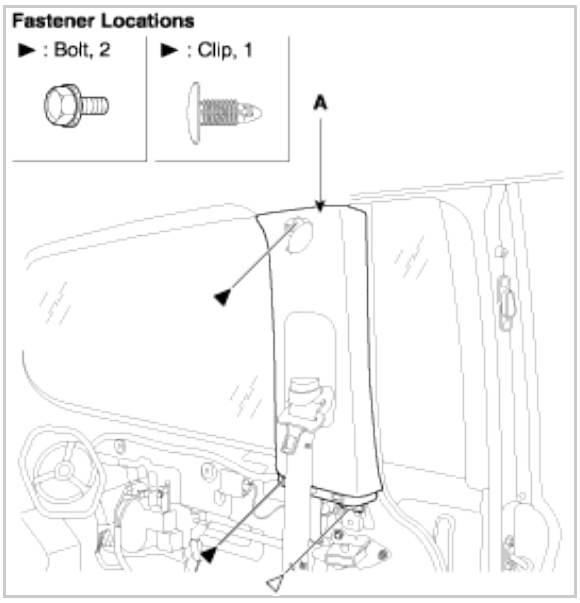
C PILLAR TRIM REPLACEMENT

NOTICE

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

1. Remove the luggage trim.

2. Remove the C pillar trim(A).



LUGGAGE SIDE TRIM REPLACEMENT

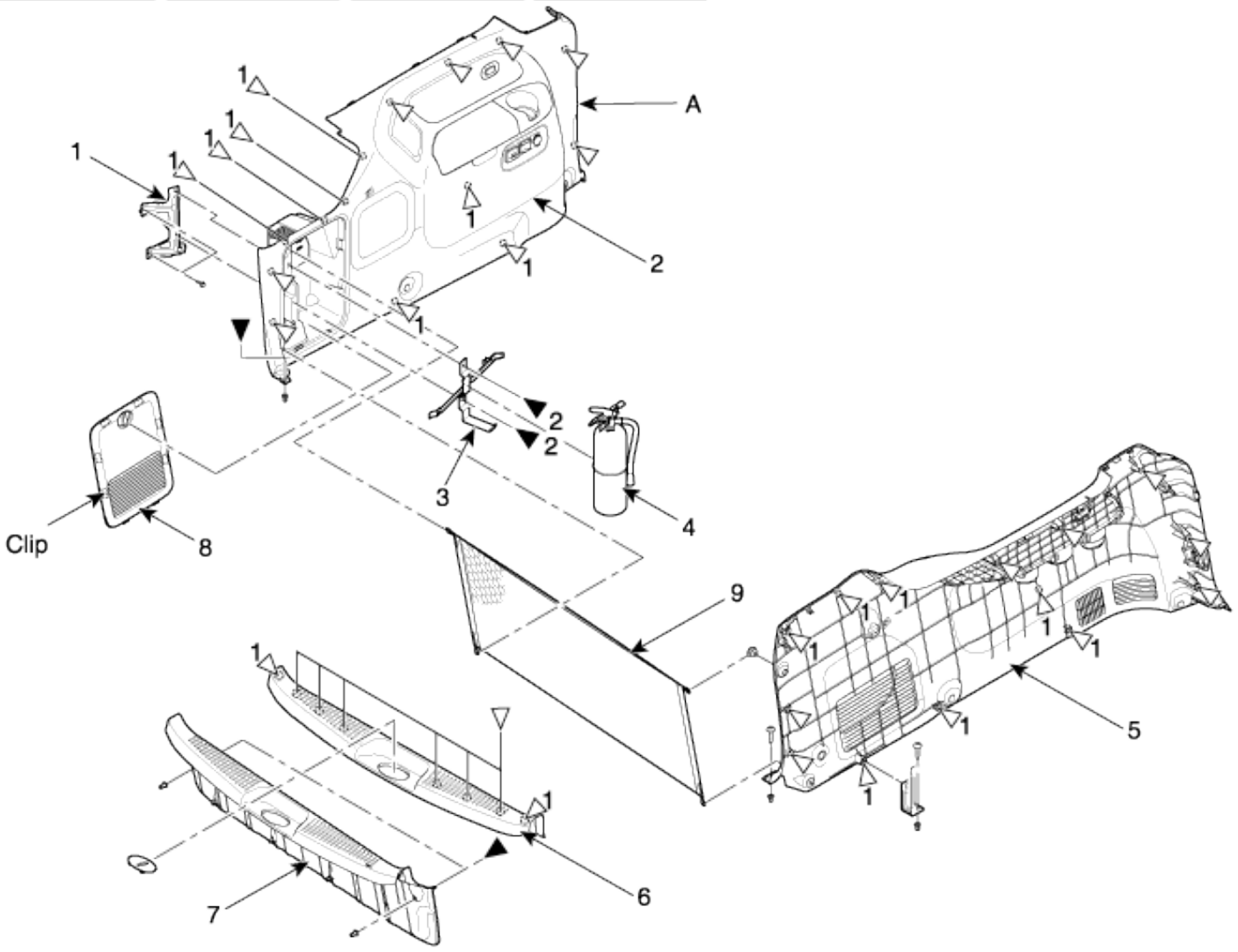
NOTICE

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

1. Remove the rear door scuff trim.
2. Remove the fire extinguisher.
3. Remove the transverse trim.
4. Remove the luggage side trim (A).
5. Installation is the reverse of removal.

Fastener Locations

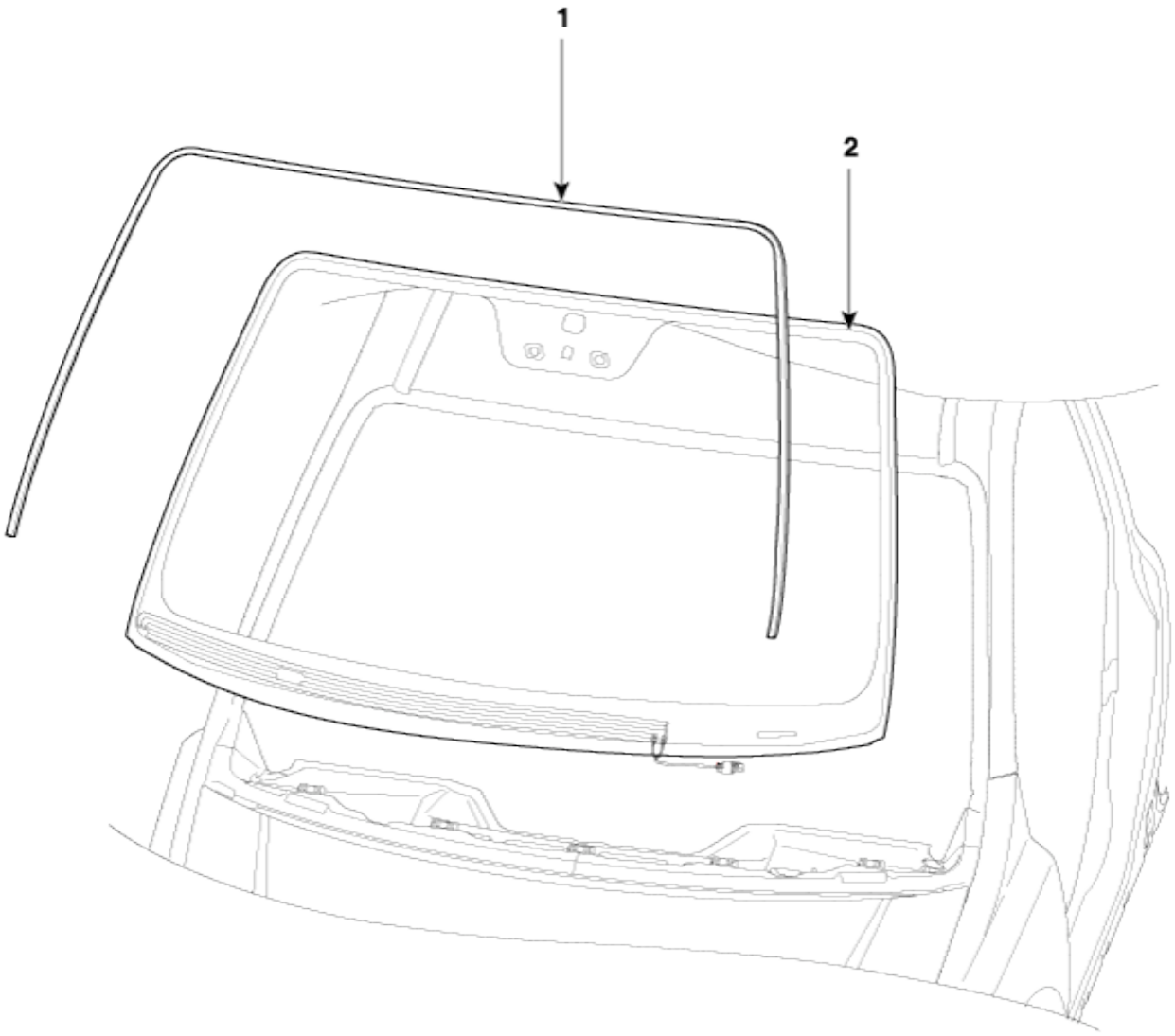
▷ : Clip	► : Screw	1▷ : Clip	2► : Bolt



1. Bracket
2. Luggage side trim
3. Bracket
4. Fire extinguisher
5. Luggage side trim
6. Rear transverse trim
7. Rear transverse trim
8. Cover
9. Luggage cover net

Windshield Glass

COMPONENTS



1. Windshield molding
2. Windshield glass

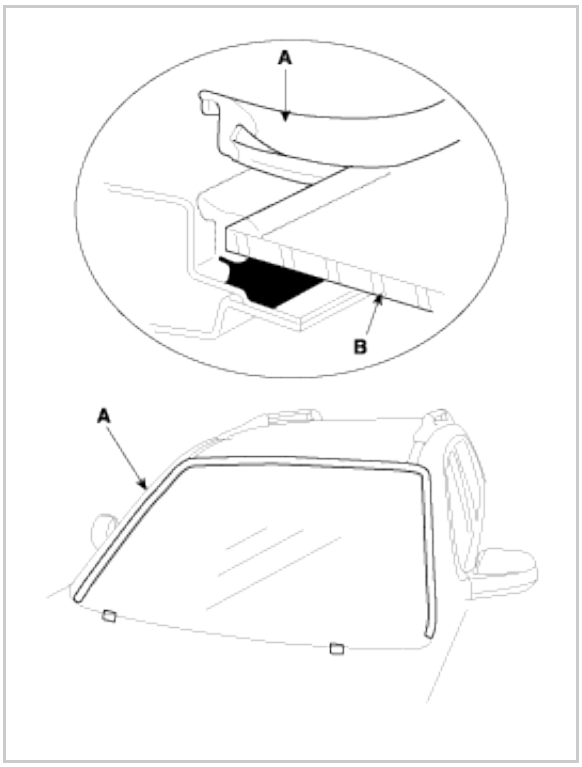
REPLACEMENT

REMOVAL

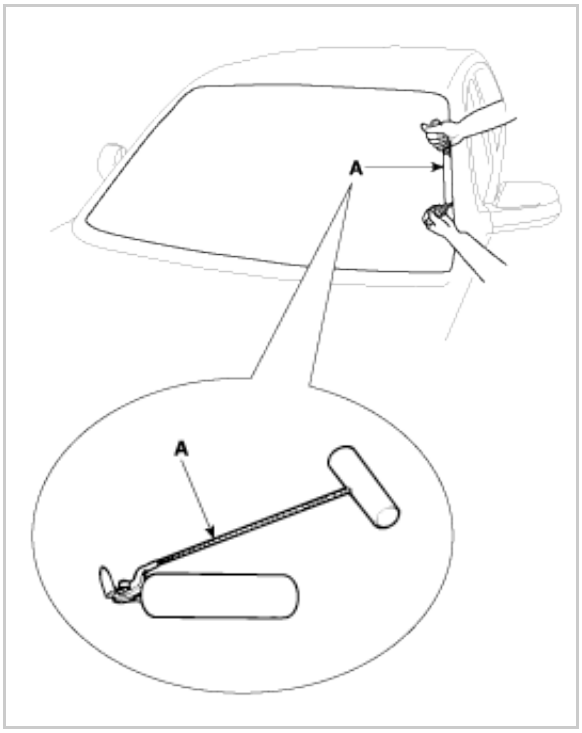
NOTICE

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

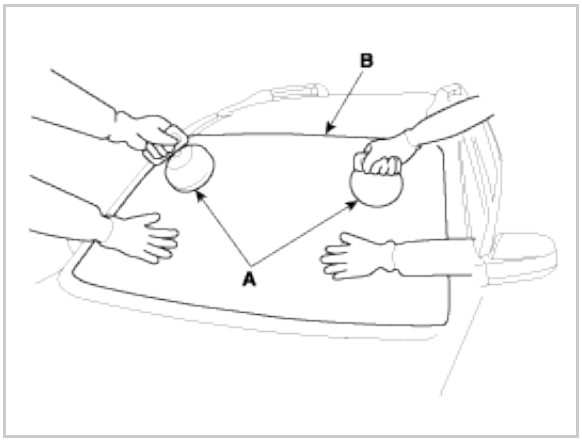
1. Remove the following items.
   a. Front pillar trim, both sides.
   b. Windshield wiper arms and cowl cover (See page BE-“Windshield wiper”).
2. Remove the windshield glass side molding.



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

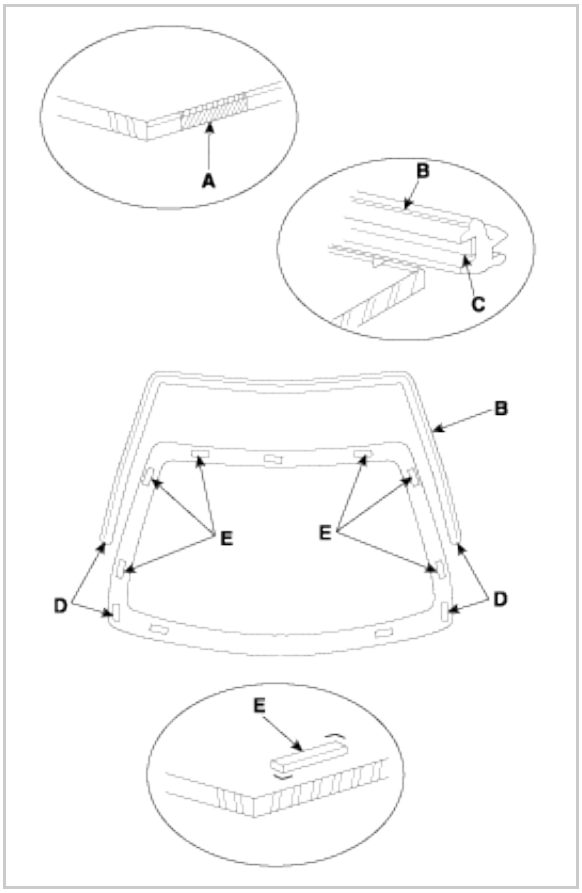


4. Remove the windshield (A) carefully using the glass holder (B)(09861-31100).

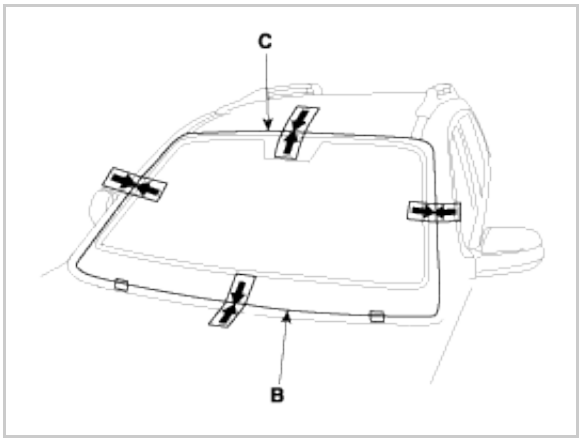


INSTALLATION

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 fastreners from the body.
   c. Mask off surrounding surfaces before painting.
2. Clean the bonding surface with a sponge dampened in alcohol. After cleaning, keep oil, grease and water from getting on the clean surface.
3. Install the windshield (A) upper molding (B) and fasteners (C). Do not allow any gaps.



4. 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).
5. Remove the windshield.



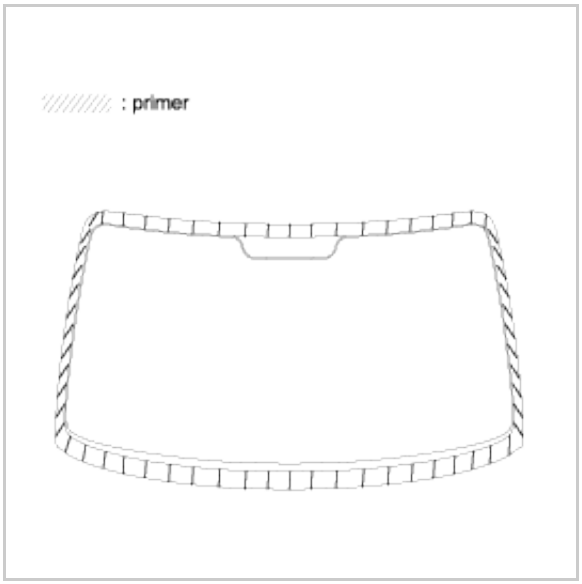
6. With a sponge, apply a light coat of body primer to the original adhesive remaining around the windshield opening flange. Let the body primer dry for at least 10 minutes.
   a. Do not apply glass primer to the body, and be careful not to mix up glass and body primer sponges.
   b. Never touch the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



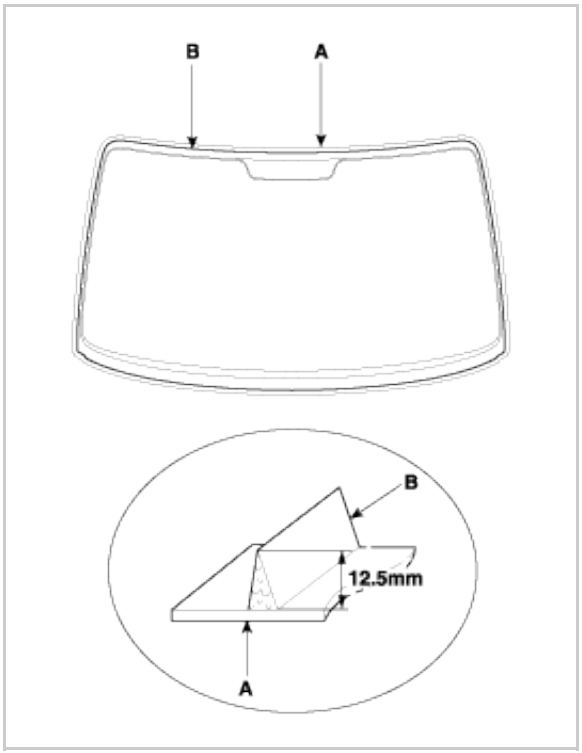
7. Apply a light coat of glass primer to the outside of the fasteners.

NOTICE

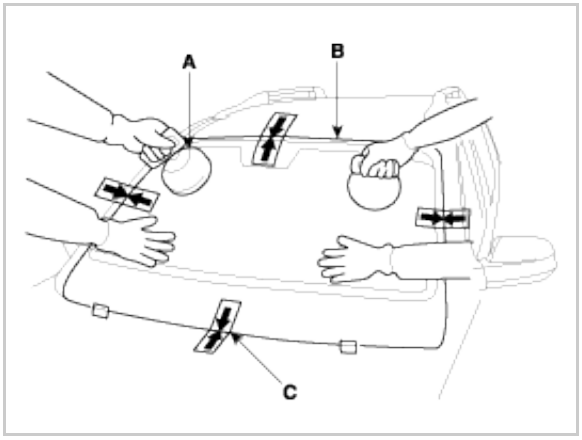
a. Never touch the primed surface with your hand.
   If you do, the adhesive may not bond to the glass Properly, causing a leak after the windshield glass is installed.
b. Do not apply body primer to the glass.
c. Keep water, dust, and abrasive materials away from the primer.



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



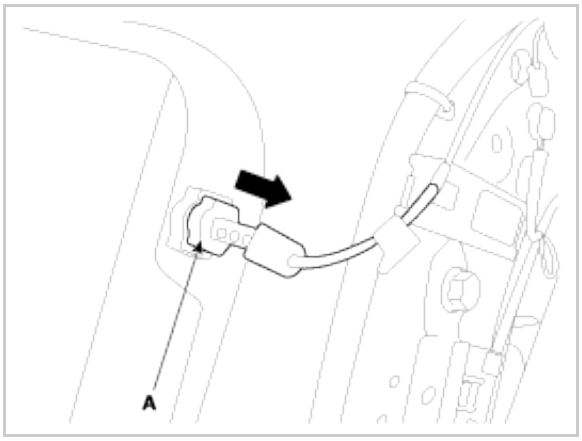
9. Use suction cups (A) to hold the windshield over the opening, align it with the alignment marks (B) made in step 15, and set it down on the adhesive. Lightly push on the windshield until its edges are fully seated on the adhesive all the way around. Do not open or close the doors until the adhesive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



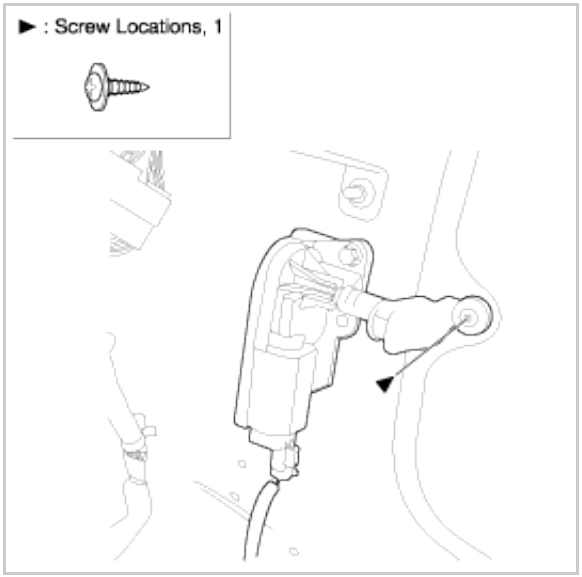
10. Scrape or wipe the excess adhesive off with a putty knife or towel. To remove adhesive from a painted surface or the windshield, wipe with a soft shop towel dampened with alcohol.
11. Let the adhesive dry for at least one hour, then spray water over the windshield and check for leaks. Make leaking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

QUARTER GLASS REPLACEMENT

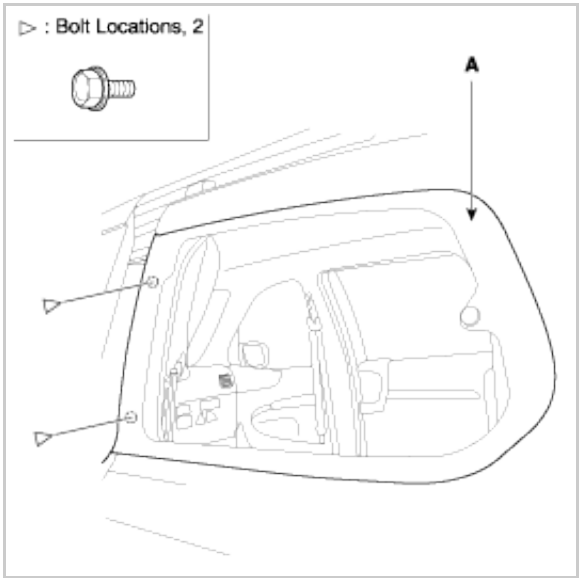
1. Remove the antenna cable (A).



2. Remove the rear pillar trim.
3. Loosen the mounting screw.



4. After loosening the quarter glass mounting bolts, then remove the quarter glass (A).



5. Installation is the reverse of removal.

Bumper

Front Bumper

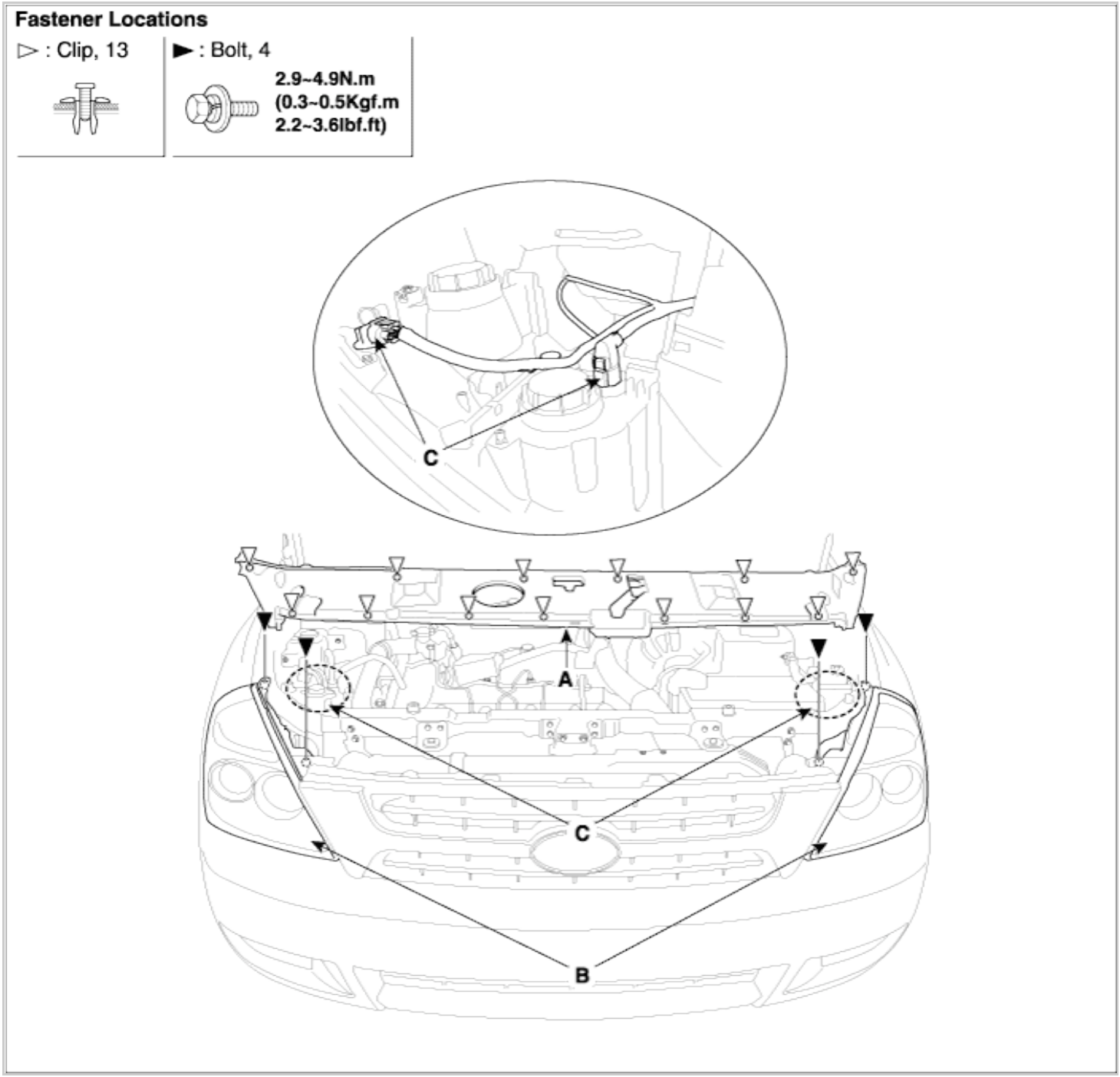
REPLACEMENT

FRONT BUMPER COVER REPLACEMENT

NOTICE

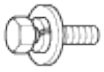
a. Put on gloves to protect your hands.
b. When prying with a flat-tipped screwdriver, wrap it with protective tape to prevent damage.
c. Take care not bend or scratch the cover and other parts.

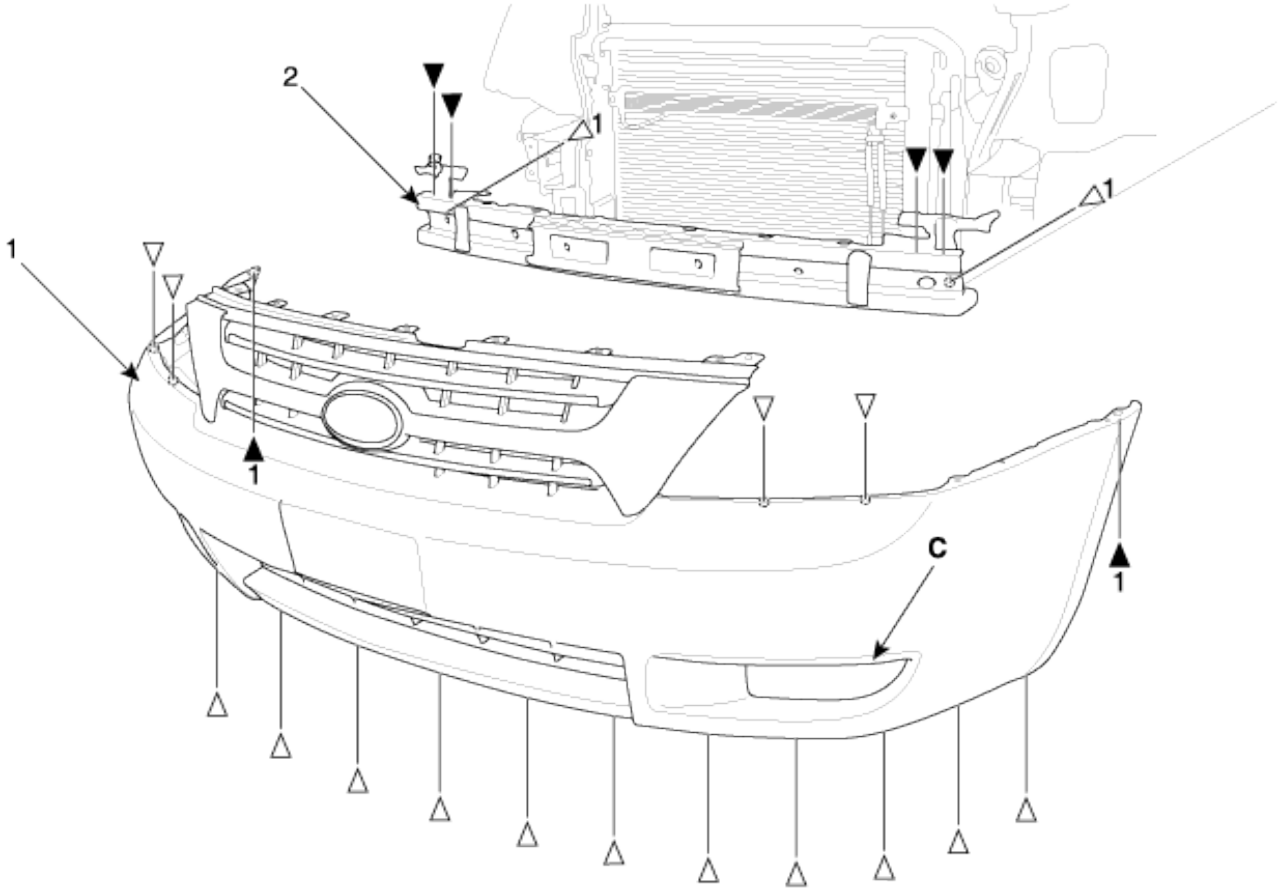
1. Disconnect the connector (C).
2. Remove the headlamp (B), under cover (A).



3. Loosen the front bumper mounting screws and clips.
4. Remove the front bumper.
5. Remove the connector (C).
6. Installation is the reverse of removal.

Fastener Locations

▷ : Clip, 17	► : Bolt, 6	1► : Screw, 2	1▷ : Nut, 2
			



1. Front bumper cover
2. Front bumper rail

Rear Bumper

REPLACEMENT

REAR BUMPER COVER REPLACEMENT

NOTICE

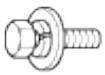
a. When prying with a flat-tipped screwdriver, wrap it with protective tape , and apply protective tape around the related parts your hands.
b. Put on gloves to protect your hands.
c. Take care not bend or scratch the cover and other parts.

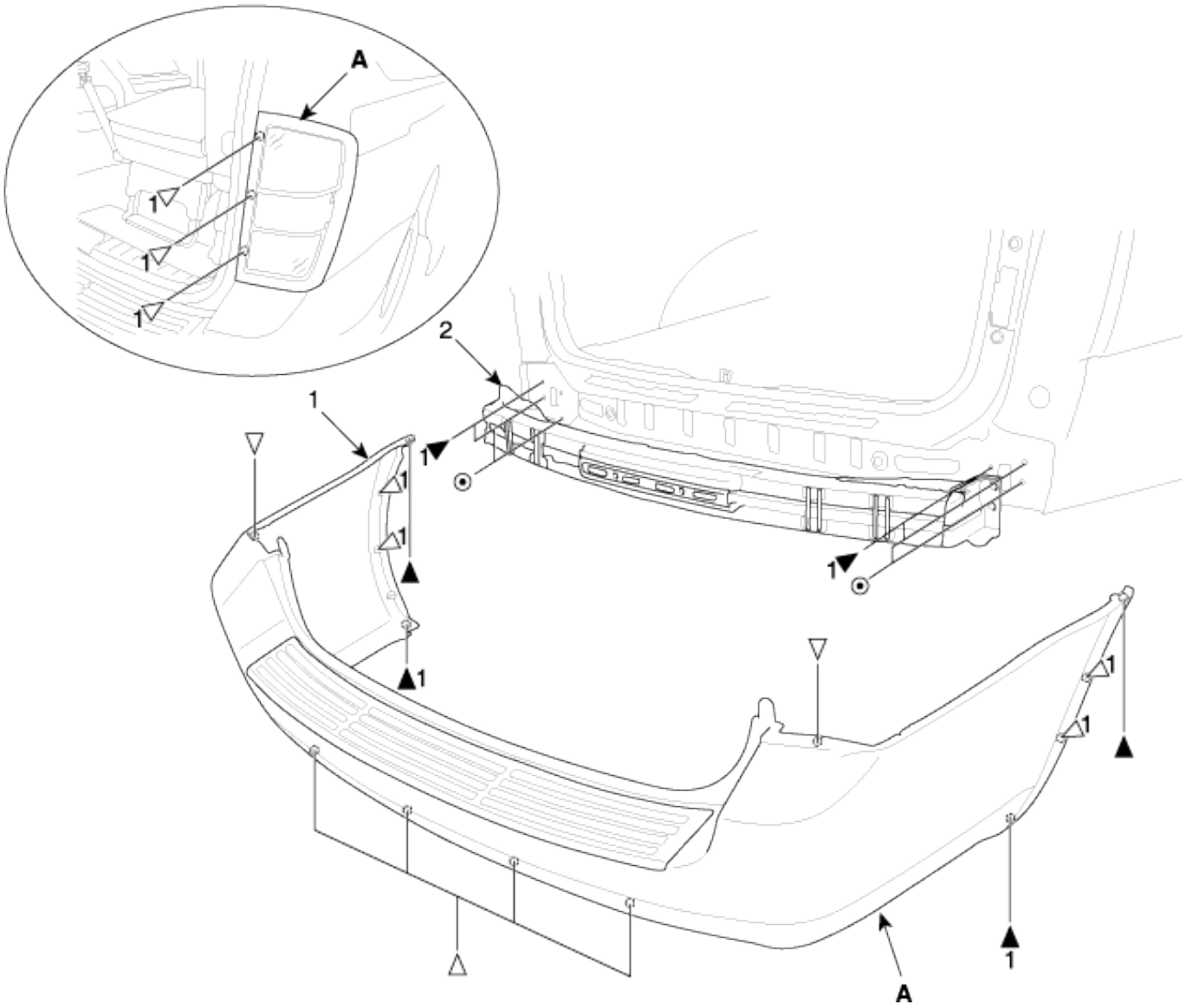
1. Remove the rear combination ramp(A).
2. Loosen the rear bumper screws and clips.
3. Remove the rear bumper.
4. Installation is the reverse of removal.

NOTICE

a. Replace any damage clips.

Fastener Locations

▷ : Clip, 8	► : Screw, 2	1▷ : Screw, 4	1► : Bolt, 4	⊙ : Nut
				



1. Rear bumper cover
2. Rear bumper rail

Seat & Power Seat

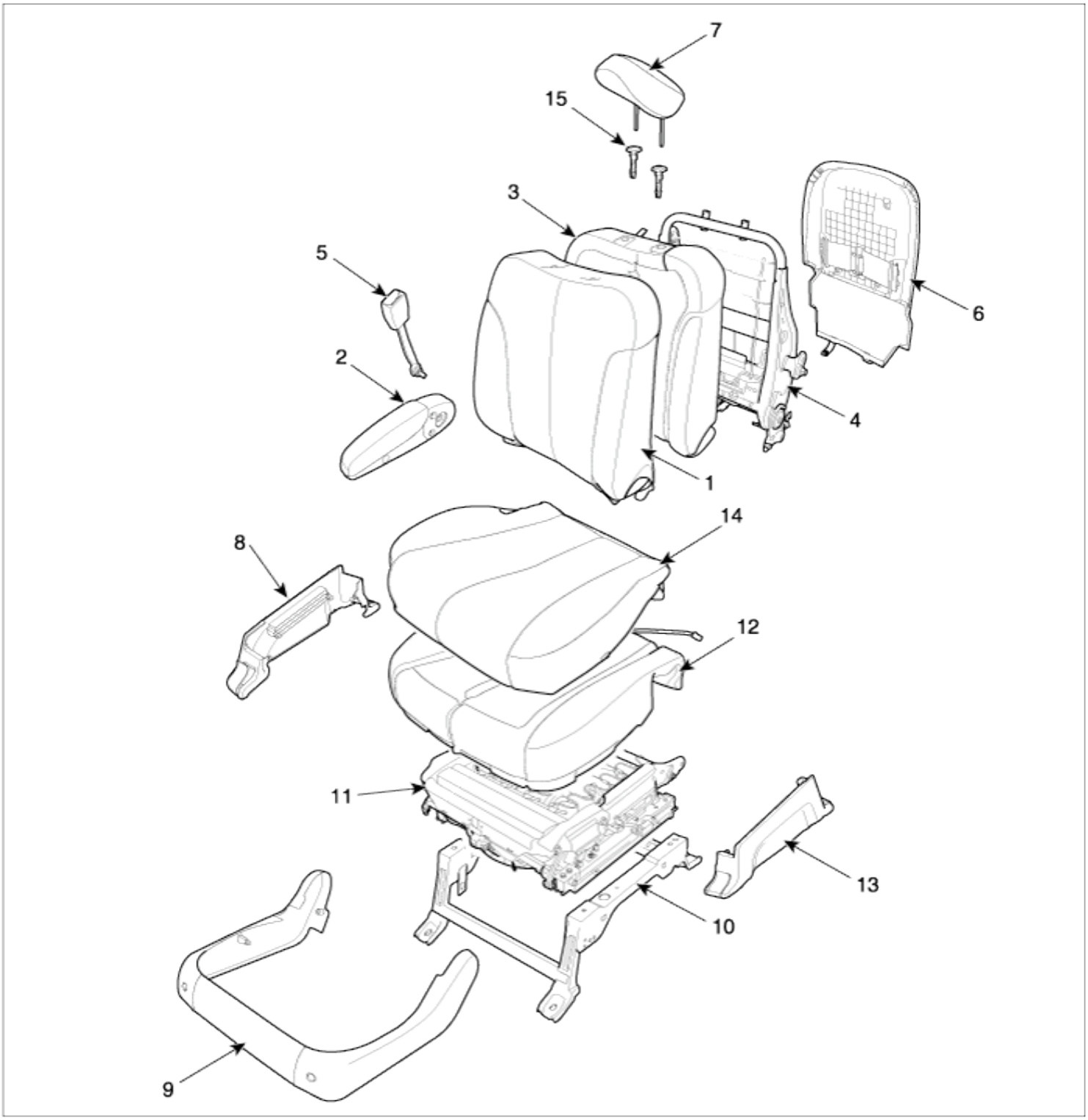
COMPONENT LOCATION



1. Slide motor
2. Front height motor
3. Rear height motor
4. Reclining motor

Front Seat

COMPONENTS



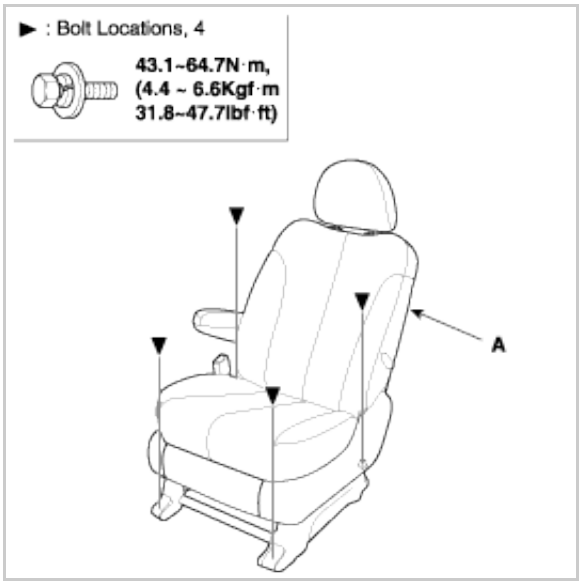
1. Back cover
2. Armrest
3. Seat back pad
4. Back frame
5. Buckle
6. Back panel
7. Headrest
8. Cover
9. Recliner cover
10. Leg frame
11. Seat track assembly
12. Seat cushion pad
13. Cover
14. Seat cushion cover
15. Headrest guide

Rear Seat

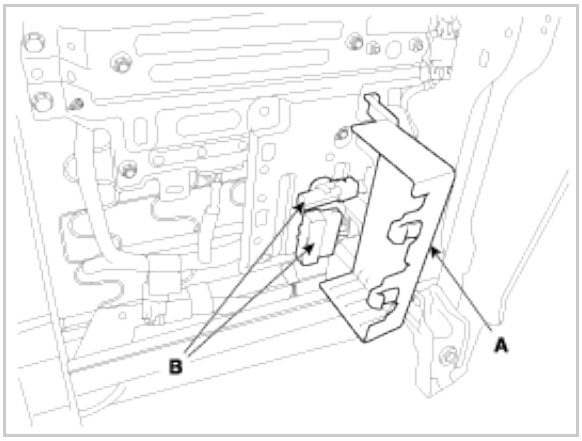
REPLACEMENT

SEAT ASSEMBLY REPLACEMENT

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



3. Open the connector box (A).
4. Disconnect the connector (B), and remove the seat assembly.



5. Installation is the reverse of removal.

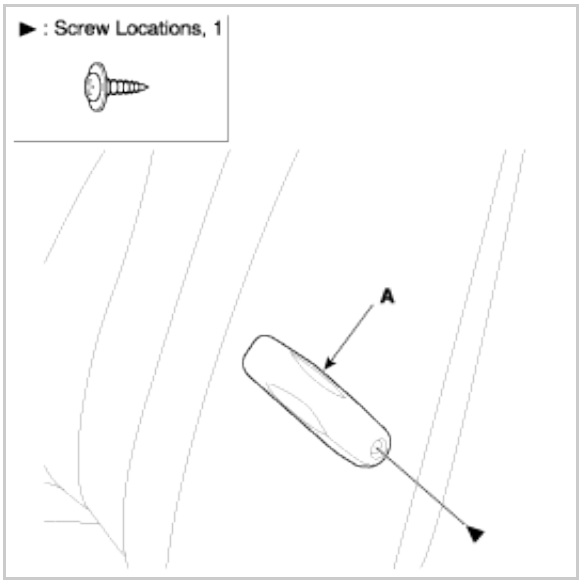
CAUTION

SEAT MOUNTING BOLT INSTALLATION PROCEDURE

a. Set the into the most rearward position.
   Check then each slide is locked, and then Tighten the front mounting bolt temporarily.
b. Set the seat into most forward position.
   Check that each slide is locked, and then Tighten the rear mounting bolt completely.
c. Set the seat into the most rearward position.
   Check the front mounting bolt completely.
d. Check that the seat operates to and fro smoothy and the locking portion locks properly.

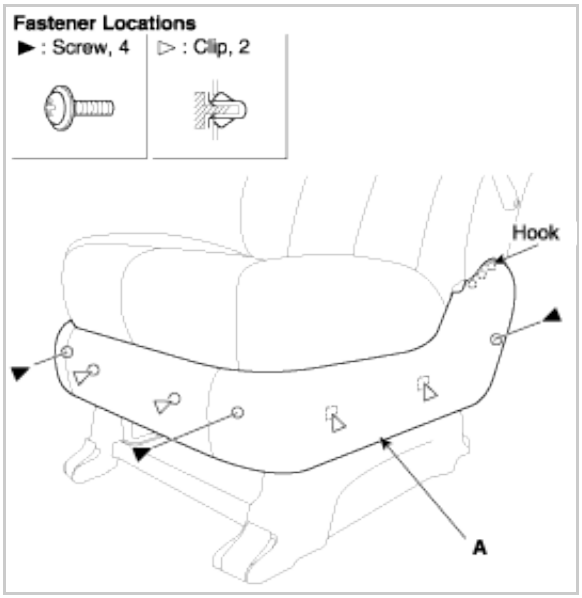
LUMBAR SUPPORT LEVER REPLACEMENT

1. Loosen the lumber support lever mounting screw, remove the lumber support lever (A).
2. Installation is the reverse of removal.

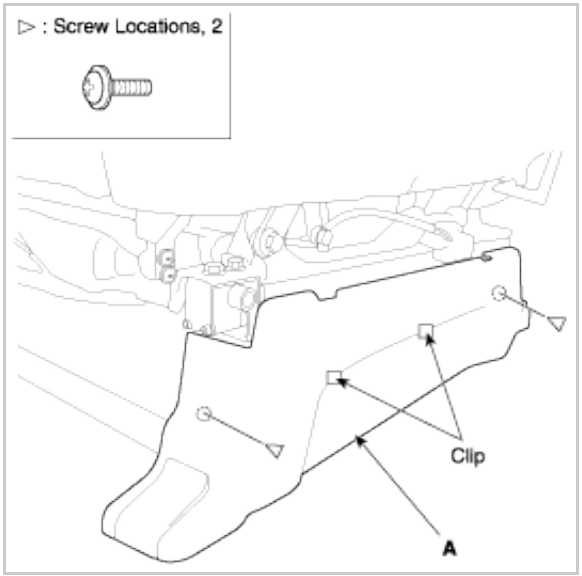


RECLINER COVER REPLACEMENT

1. Remove the cover (A).



2. Loosen the recliner mounting screw and clip, then remove the recliner cover (A).

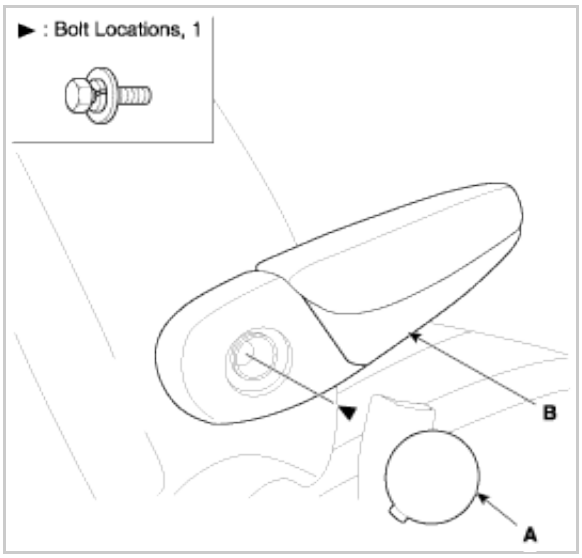


3. Installation is the reverse of removal.

ARMREST REPLACEMENT

1. Remove the cover (A).

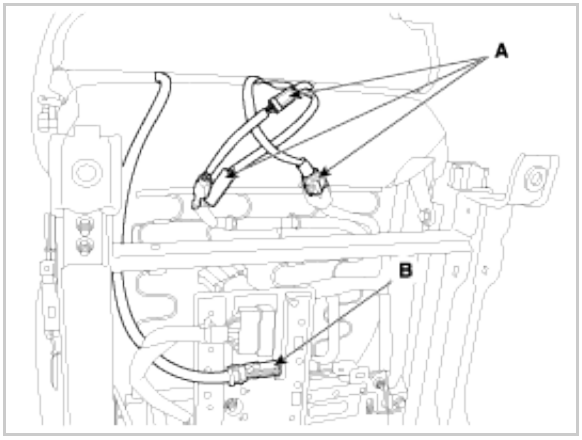
2. After the armrest mounting bolt, then remove the armrest (B).



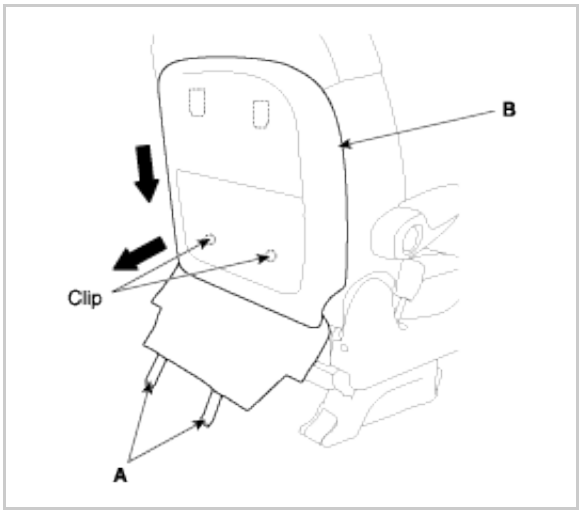
3. Installation is the reverse of removal.

SEAT BACK COVER REPLACEMENT

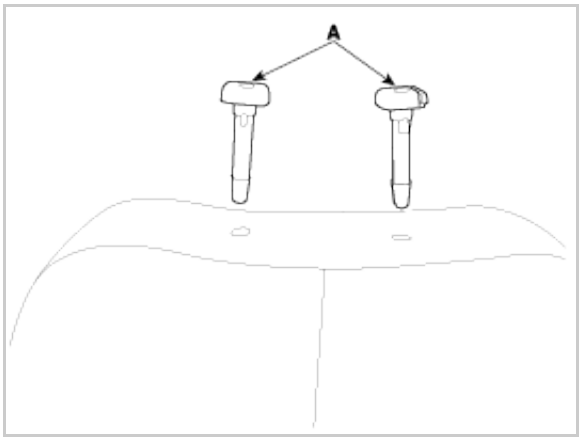
1. Remove front seat assembly.
2. Remove the recliner cover.
3. Remove the armrest.
4. Remove the connector (A), (B).



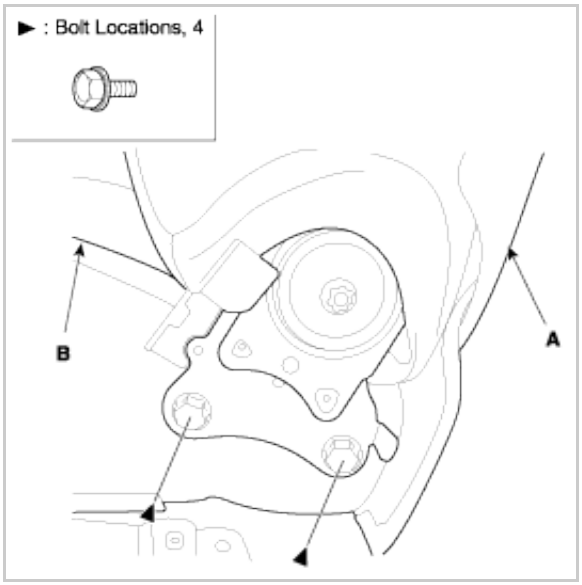
5. After disconnecting the scuff band (A), remove the seat back panel (B).



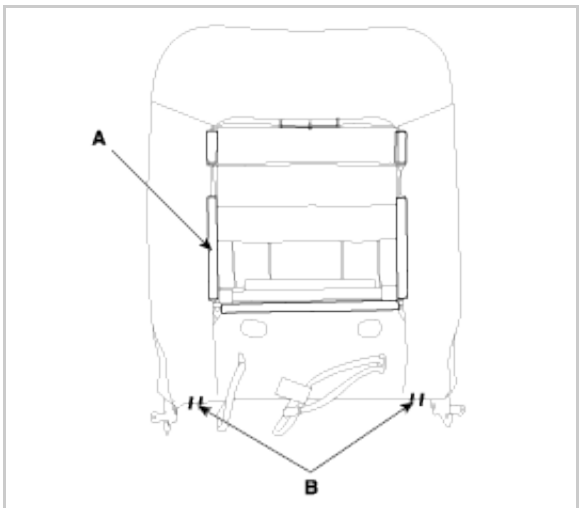
6. Remove the headrest and headrest guide (A).



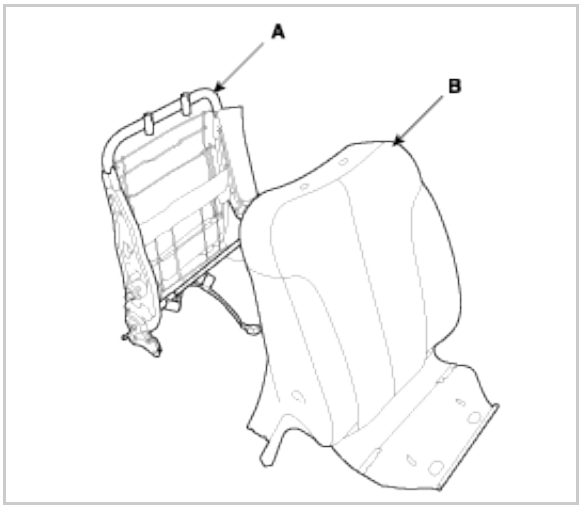
7. Loosen the mounting bolts, then remove the seat back assembly (A).



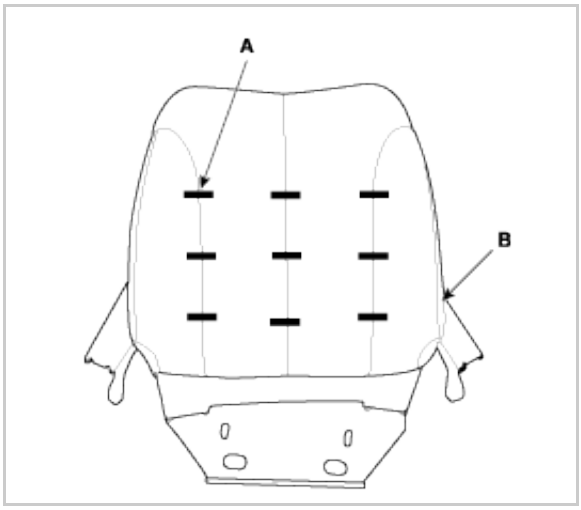
8. Disconnect the protector (A) from the back frame, then remove the hogring clips (B).



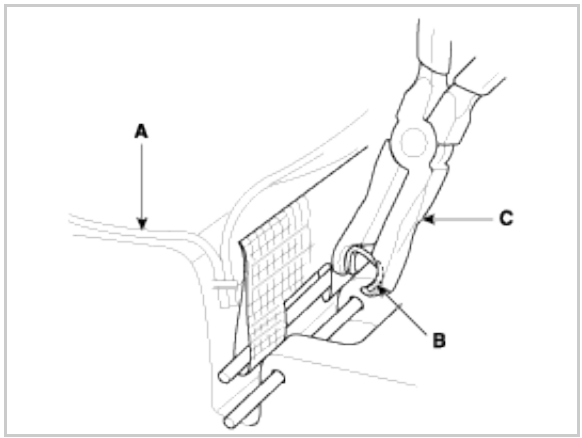
9. Disconnect the seat pad (B) from the back frame (A).



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

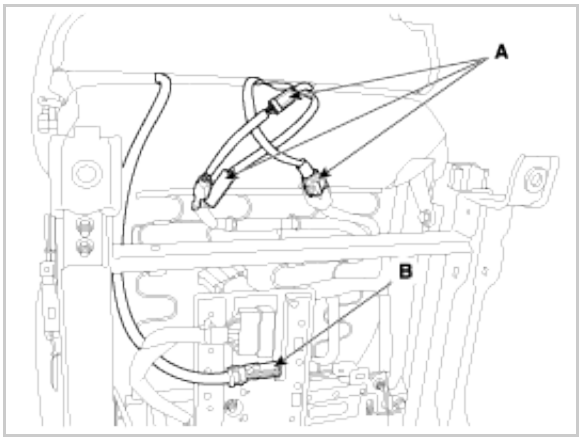


11. Installation is the reverse of removal.
    a. To prevent wrinkles, make sure the material is stretched evenly over the cover (A) before securing the hogring clips (B)
    b. Replace the hogring clips with new ones using special tool (C).

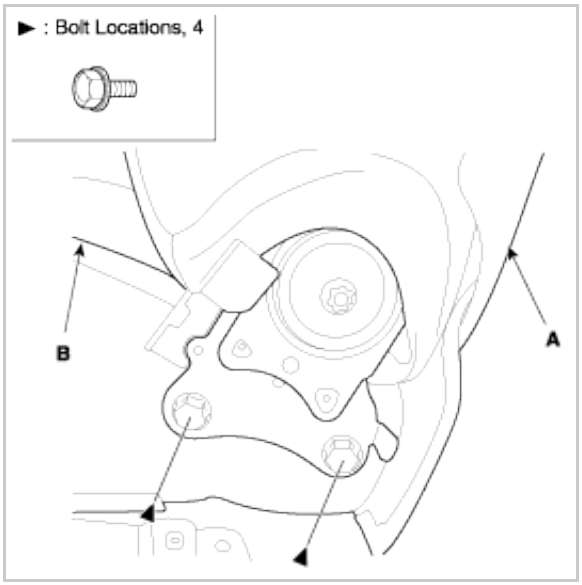


SEAT CUSHION COVER REPLACEMENT

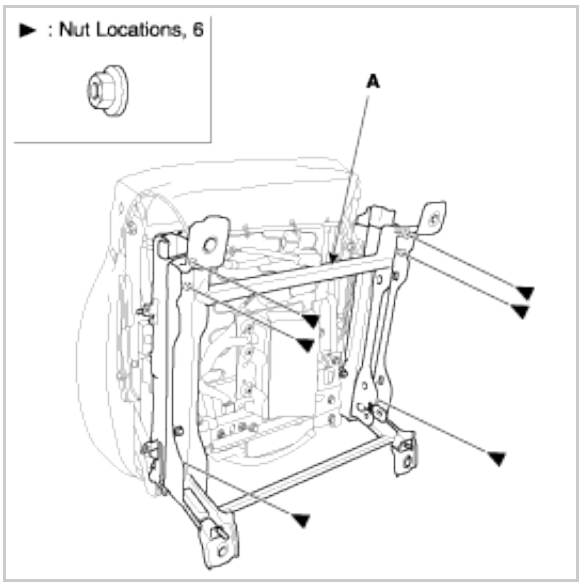
1. Remove front seat assembly.
2. Remove the recliner cover.
3. Disconnect the scuff band.
4. Disconnect the connector (A), (B).



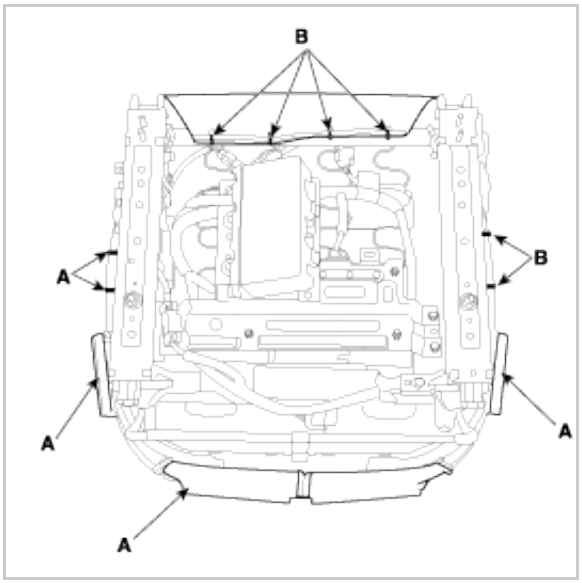
5. Loosen the mounting bolts, then remove the seat back assembly (A).



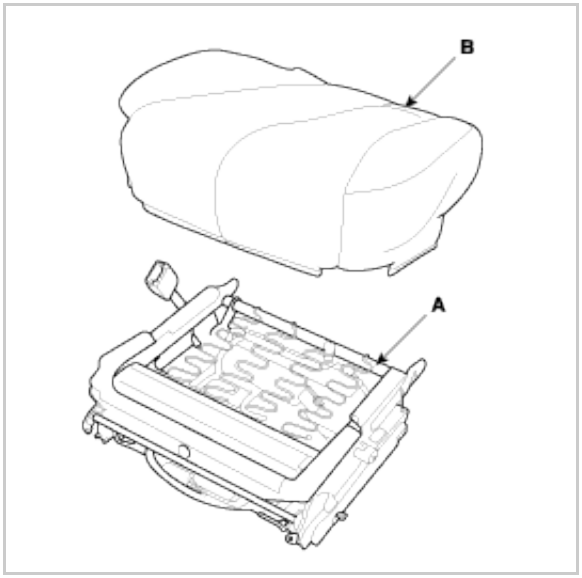
6. Loosen the mounting bolts, then remove the seat leg assembly (A).



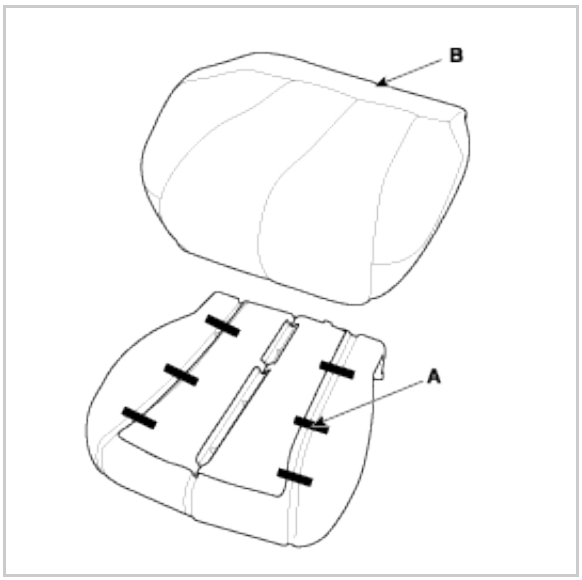
7. Disconnect the protector (A) from the cushion frame, then remove the hog-ring clips (B).



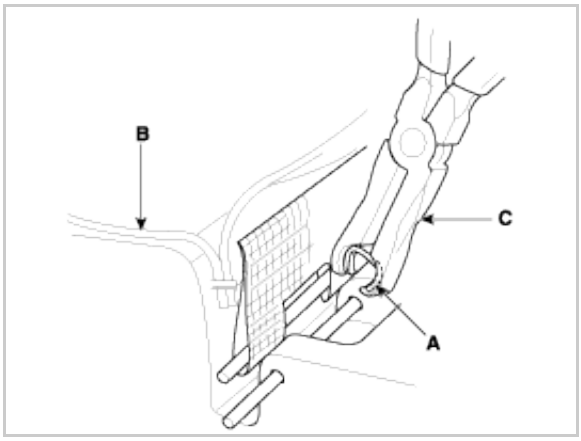
8. Disconnect the seat cushion pad (B) from the track (A).



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



10. Installation is the reverse of removal.
    a. To prevent wrinkles, make sure the material is stretched evenly over the cover (A) before securing the hogring clips (B).
    b. Replace the hogring clips with new ones using special tool (C).

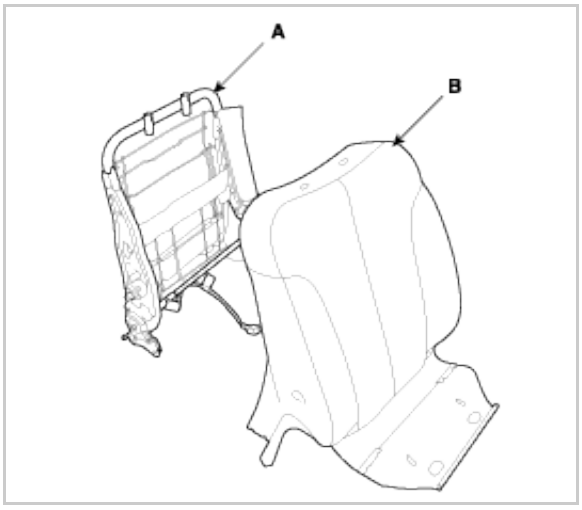


SEAT BACK FRAME REPLACEMENT

1. Remove the following items.
   a. Recliner cover.
   b. Seat back panel.
   c. Headrest guide.
   d. Seat back cover.
2. Remove the pad (A) from frame (B).

CAUTION

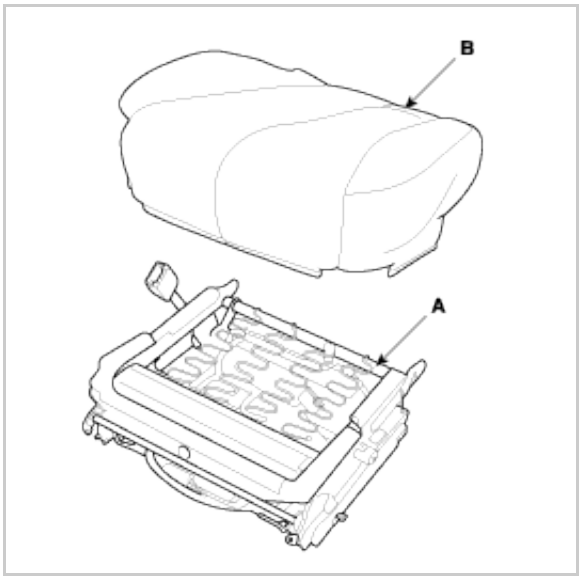
a. Remove the side air bag for replacing side air bag installation seat.
b. Be fore service, be fully aware of precautions and service procedure relevant to air bag (See page RT-Airbag).



3. Installation is the reverse of removal.

SEAT TRACK REPLACEMENT

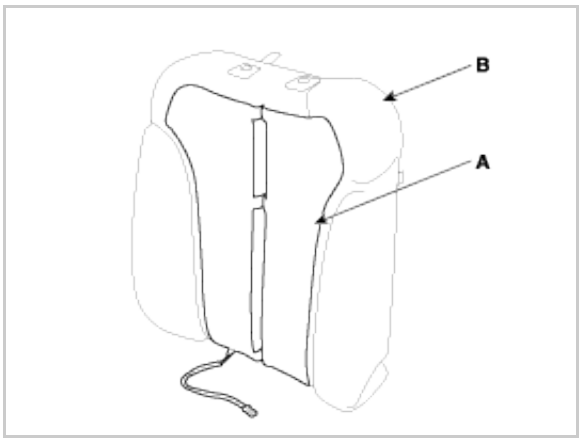
1. Remove the recliner cover.
2. Remove the seat cushion cover.
3. Remove the seat track (A).



4. Installation is the reverse of removal.

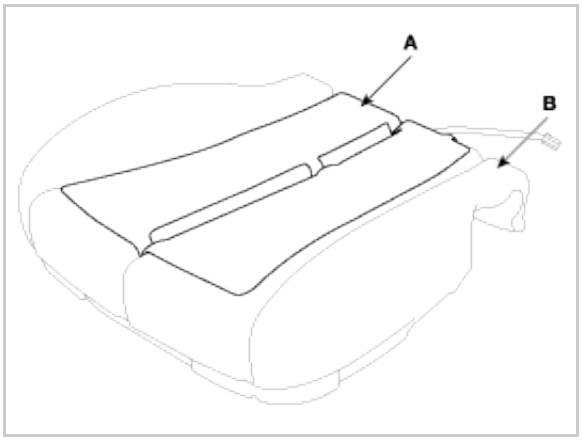
SEAT BACK HEATER REPLACEMENT

1. Remove the seat back cover.
2. Cut the heater (A) attached to the pad (B), as shown in the picture.
3. Take off the paper from the backside of the heater assembly.
4. Attach the heater to the main part of pad.
5. Install the seat back cover.



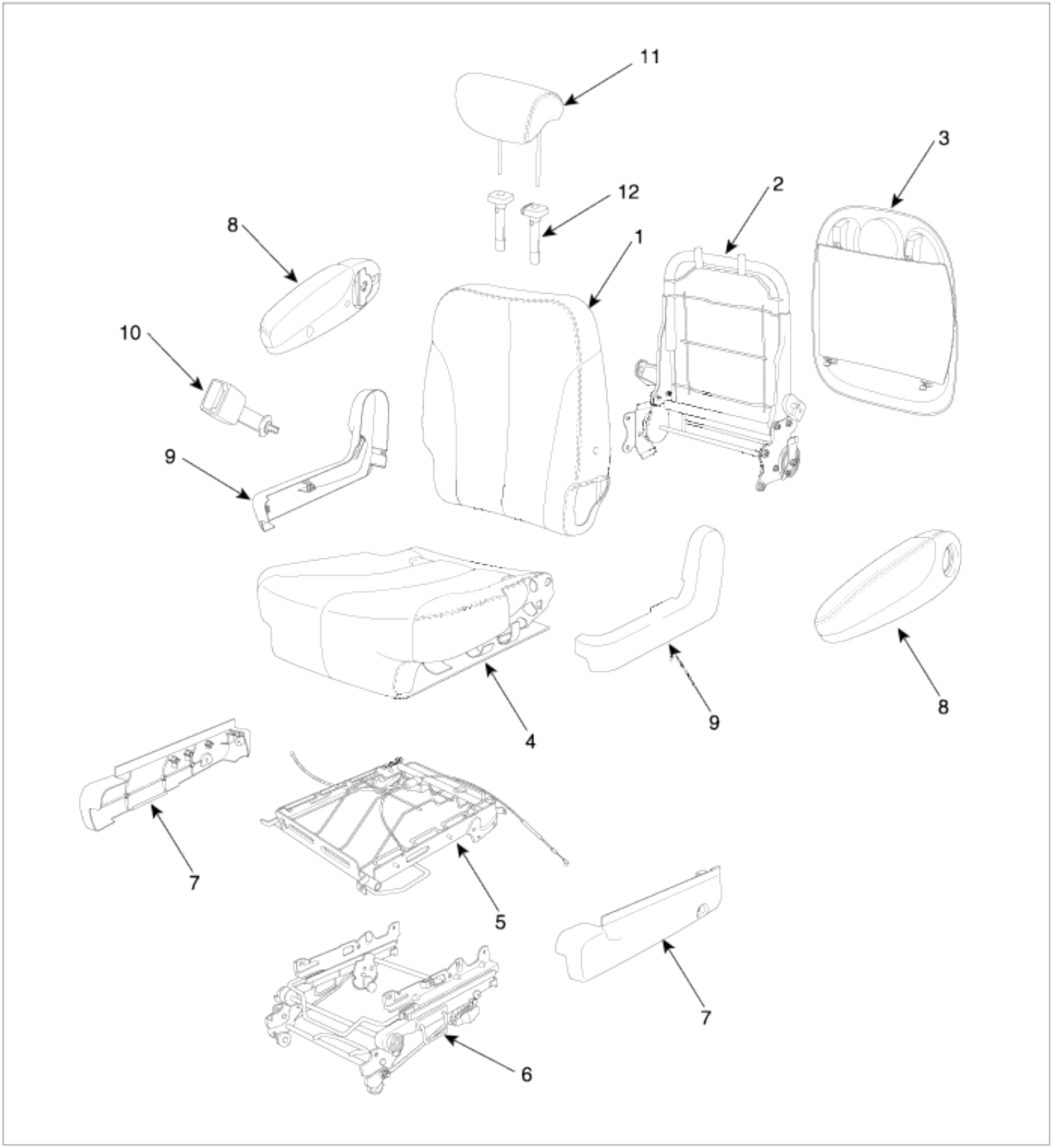
SEAT CUSHION HEATER REPLACEMENT

1. Remove the seat back cover.
2. Cut the heater (A) attached to the pad (B), as shown in the picture.
3. Take off the paper from the backside of the heater assembly.
4. Attach the heater to the main part of pad.
5. Install the seat back cover.


A
B

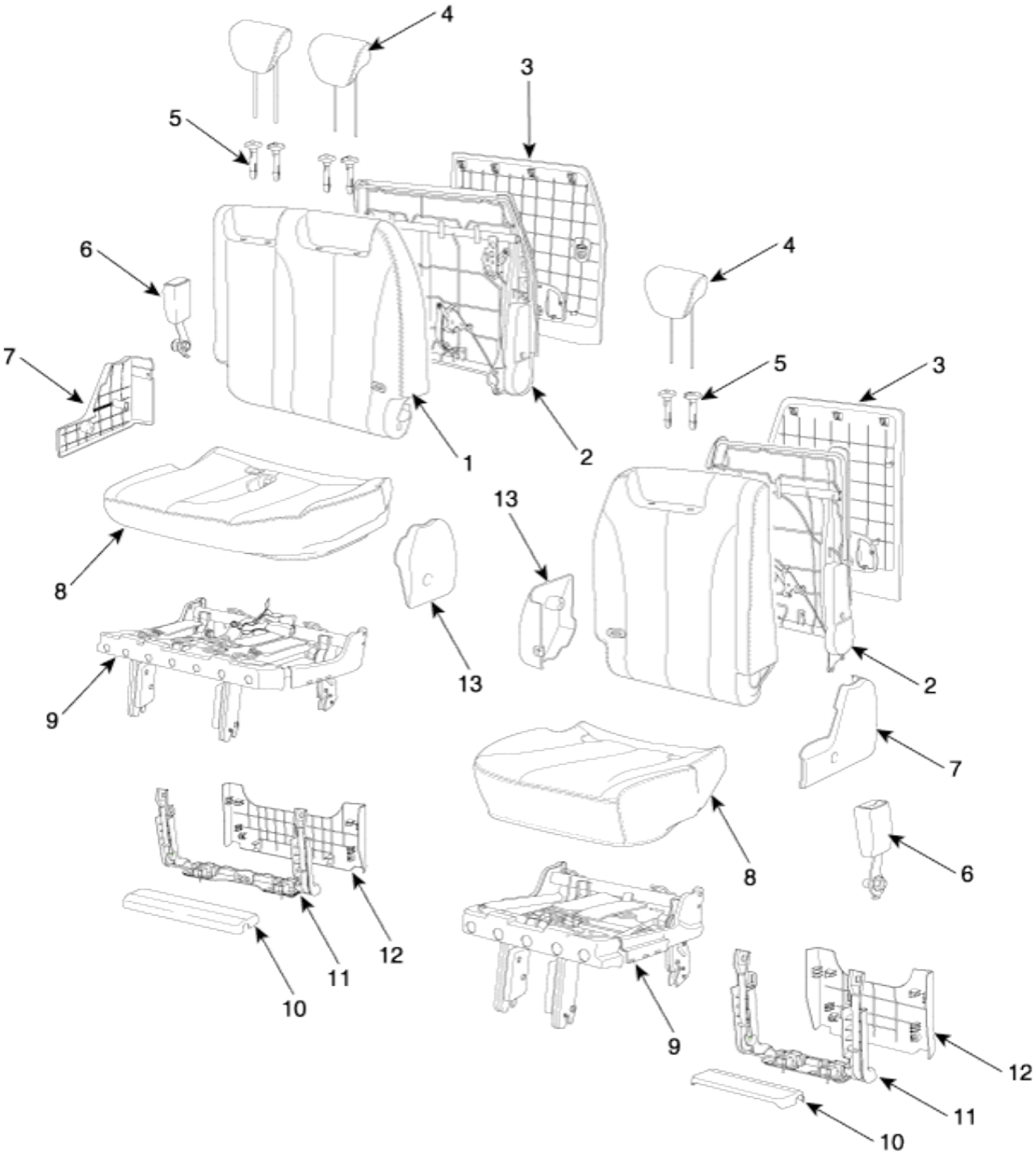
COMPONENTS

SECONDARY SEAT



1. Seat back
2. Back frame
3. Back panel
4. Seat cushion
5. Seat cushion frame
6. Seat track assembly
7. Cover
8. Armrest
9. Recliner cover
10. Buckle
11. Headrest
12. Headrest guide

THIRD SEAT



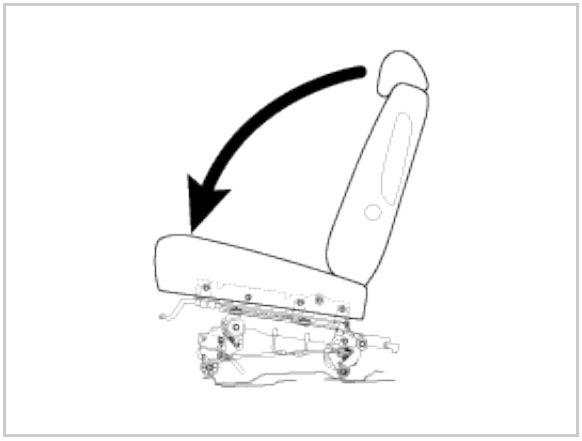
1. Seat back
2. Back frame
3. Back panel
4. Head rest
5. Head rest guide
6. Buckle
7. Recliner cover
8. Seat cushion
9. Cushion frame
10. Cover
11. Mounting bracket
12. Mounting cover
13. Cover

REPLACEMENT

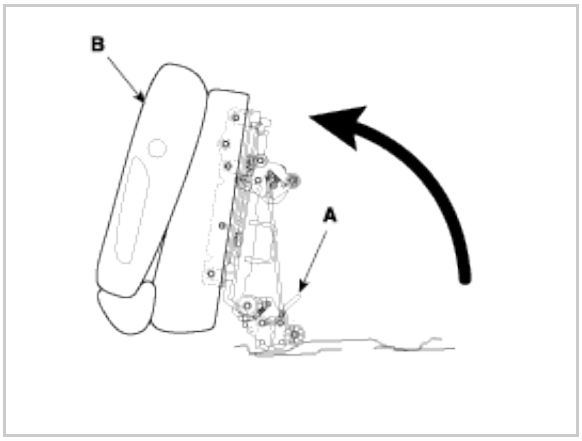
SECONDARY SEAT

REMOVEAL

1. Slide the seat to the rearward.
2. Back seat folding.

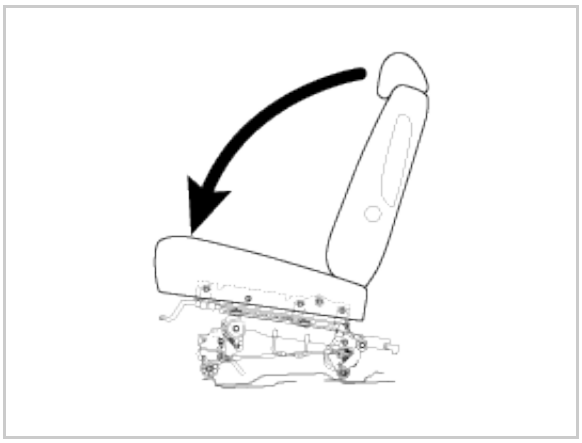


3. Remove the seat assembly (B) after pressing the lever(A).

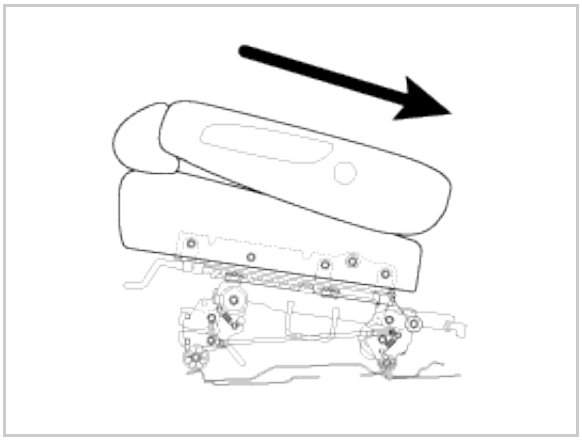


INSTALLATION

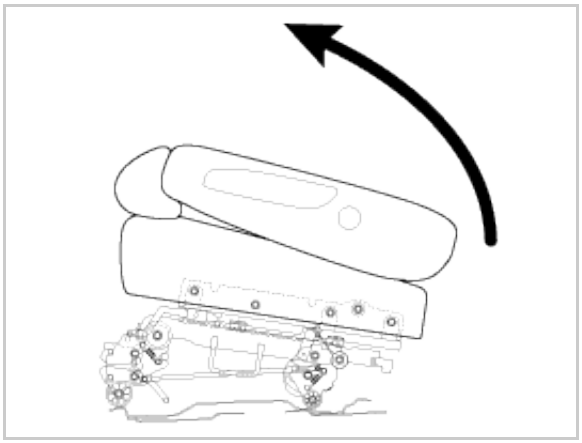
1. Back seat folding.



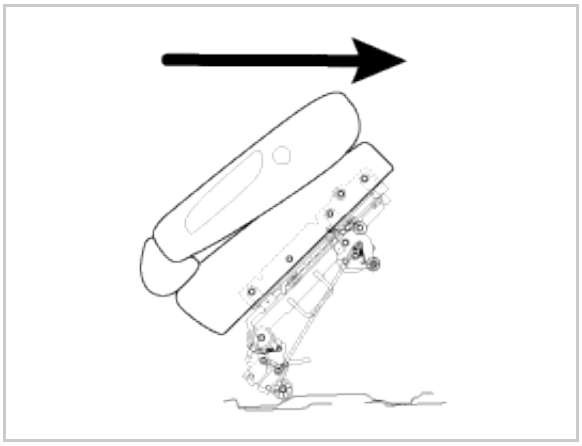
2. Slide the seat to the rearward.



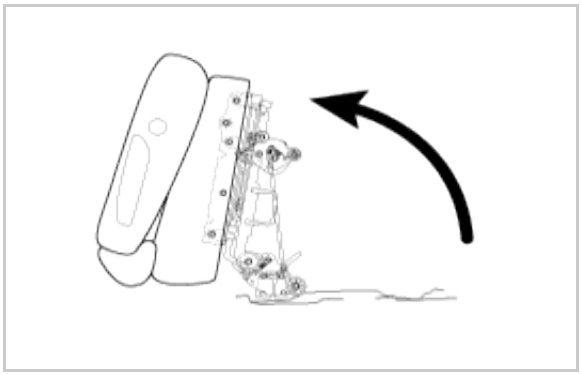
3. Lift the back side of the seat.



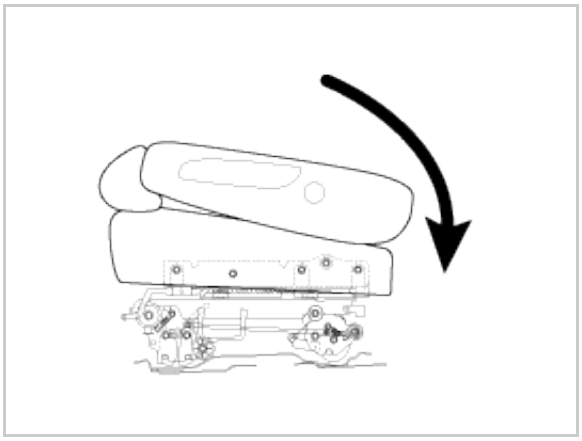
4. Arrange the seat to the rear side of the strike by using the roller.



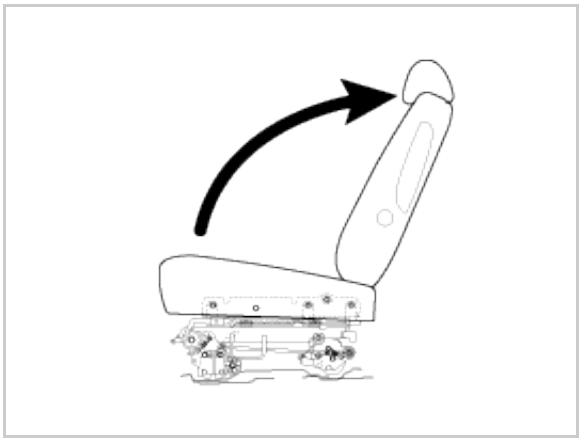
5. Turn the seat to the forward at an angle of about 81 degrees for locking between the plate and striker.



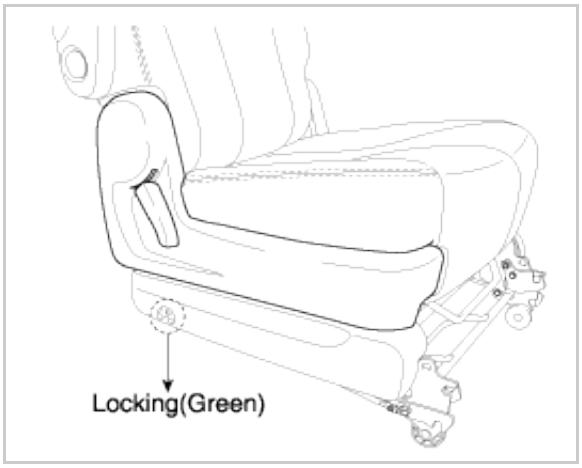
6. Turn the seat to the rearward for locking between the rear latch and striker.



7. Uufold the back of the seat.

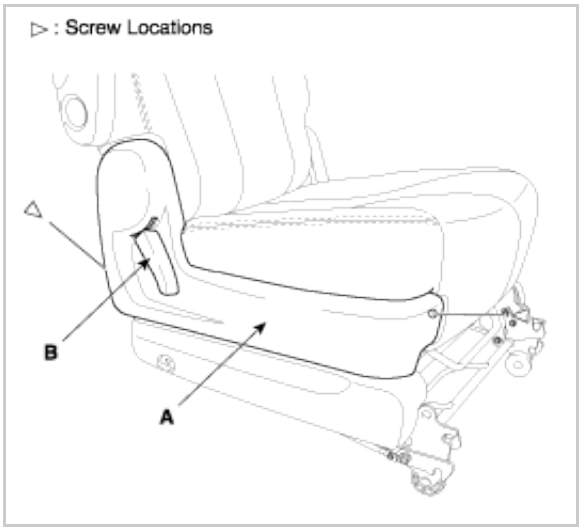


8. The leg cover hole color must be discolored to green.

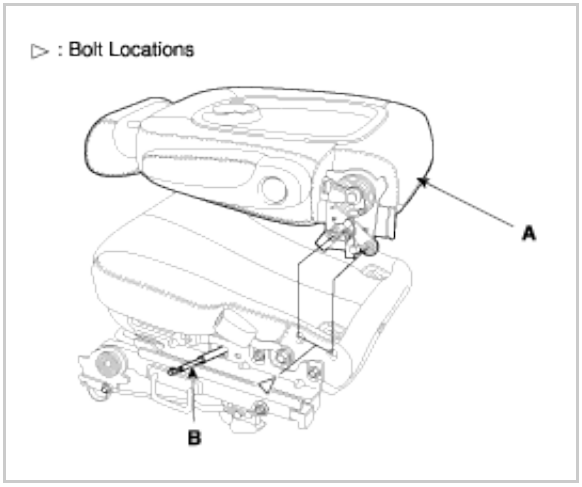


RECLINER COVER REPLACEMENT

1. Remove the recliner lever(B) and cover (A).

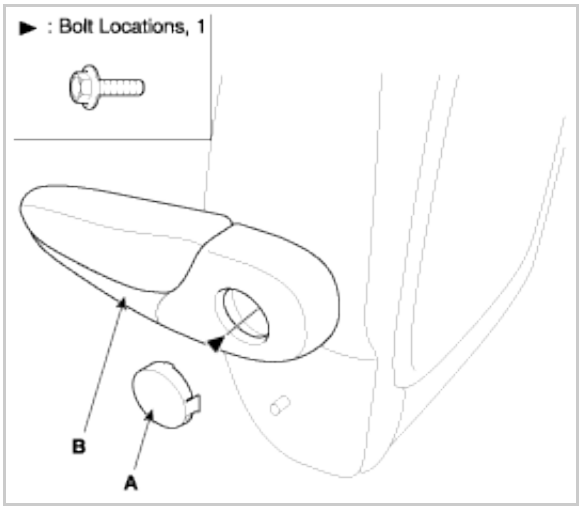


2. Loosen the mounting bolts, then remove the seat back assembly (A).
3. Disconnect the auto tumble cable(B).

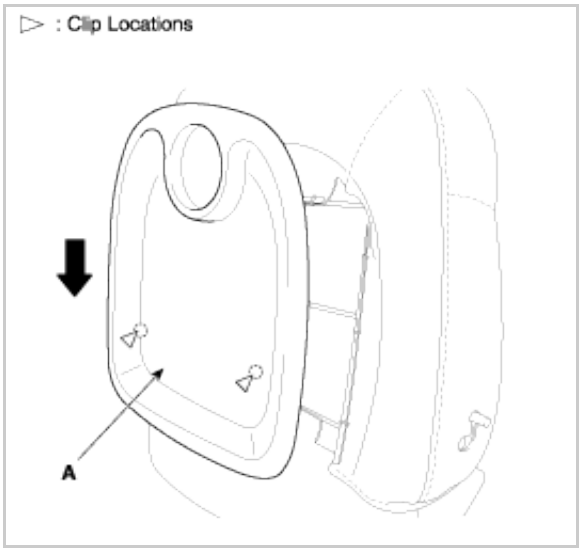


SEAT BACK COVER REPLACEMENT

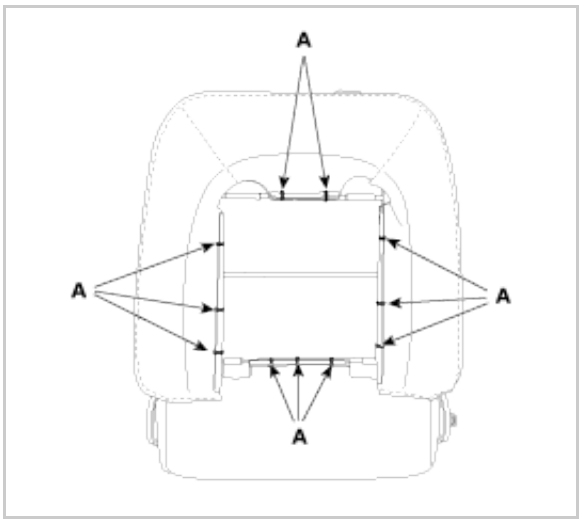
1. Remove the recliner cover.
2. Remove the cover (A).
3. After the armrest mounting bolt, then remove the armrest (B).



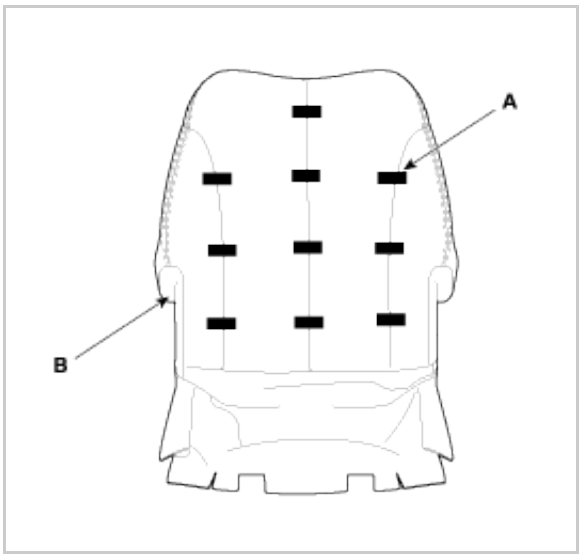
4. Remove the seat back panel (A).



5. Remove the hog-ring clips (A).



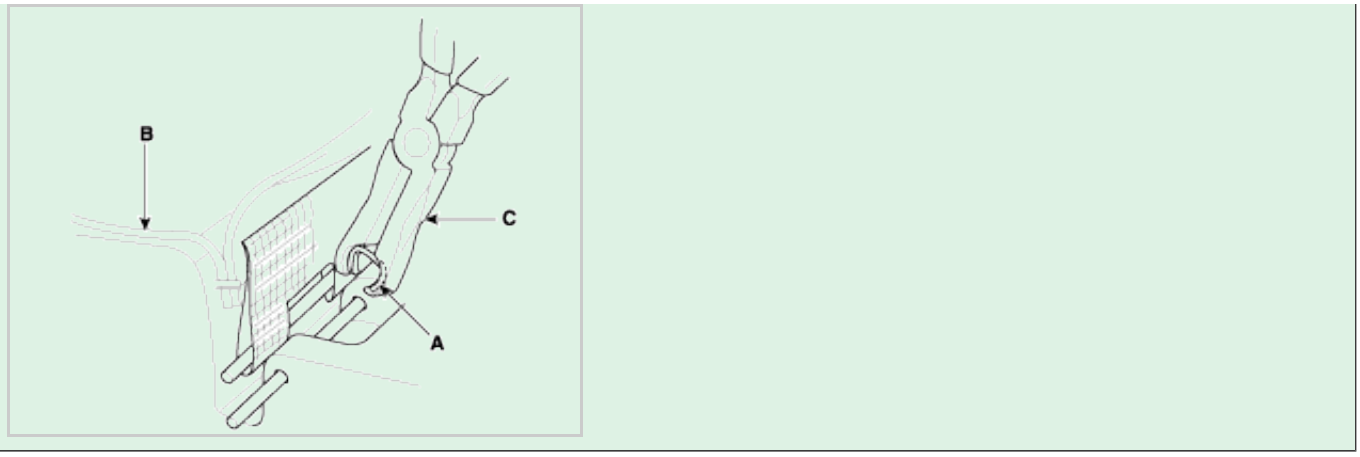
6. Remove the headrest and headrest guide.
7. After removing the hog-ring clips (A) on the front of seat back remove the seat back cover (B).



8. Installation is the reverse of removal.

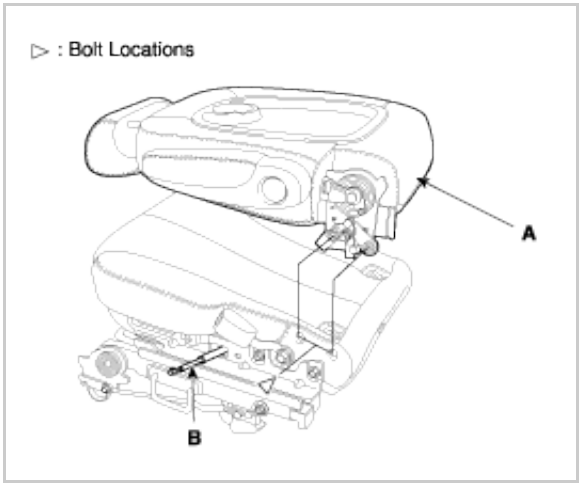
NOTICE

a. To prevent wrinkles, make sure the material is stretched evenly over the cover (A) before securing the hogring clips (B)
b. Replace the hogring clips with new ones using special tool (C).

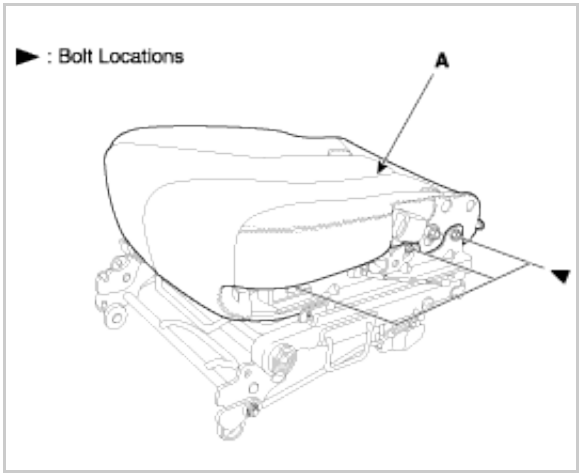


SEAT CUSHION COVER REPLACEMENT

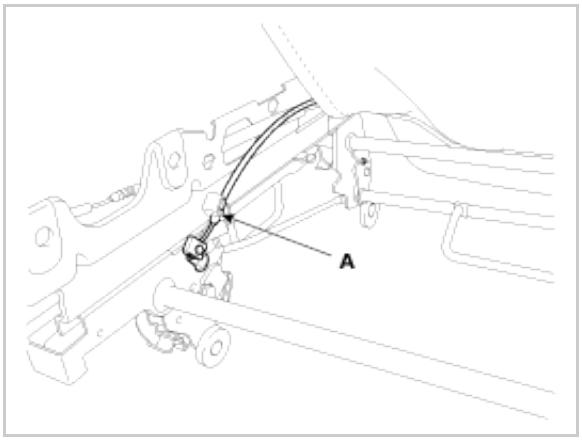
1. Remove the seat assembly.
2. Remove the recliner cover.
3. Loosen the mounting bolts, then remove the seat back assembly (A).



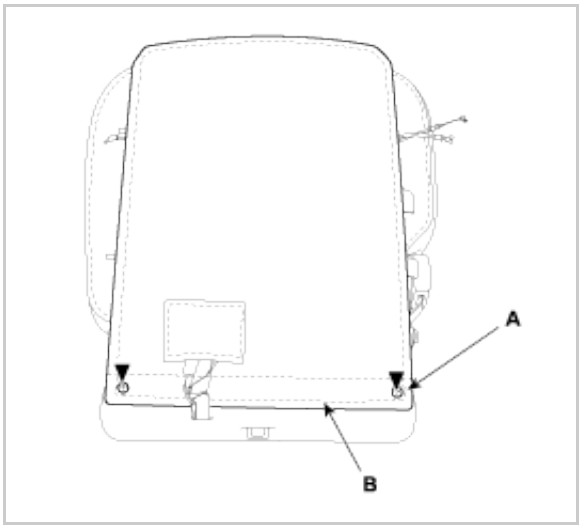
4. Loosen the mounting bolts, then remove the seat cushion (A).



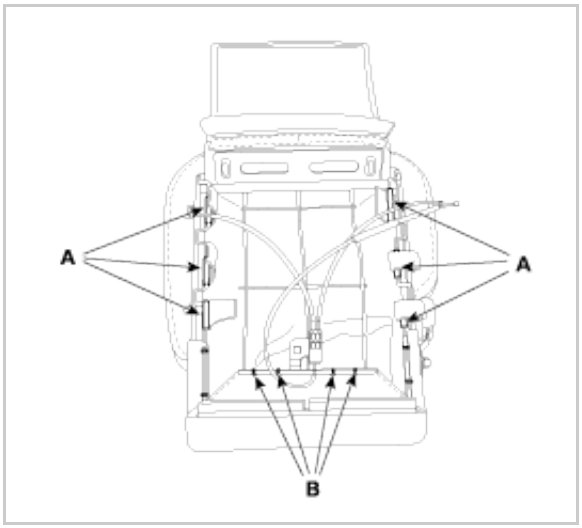
5. Remove the recliner cable (A).



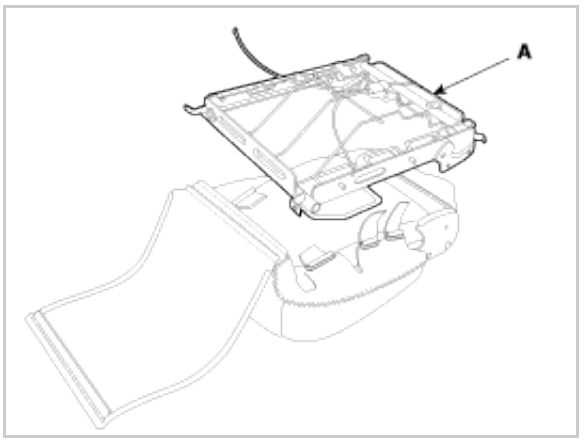
6. Loosen the mounting screw (A), then disconnect the scuff band (B).



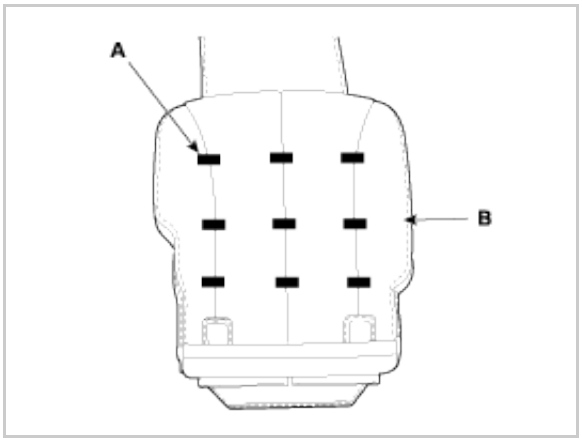
7. Disconnect the protector (A) from the cushion frame, then remove the hog-ring clips (B).



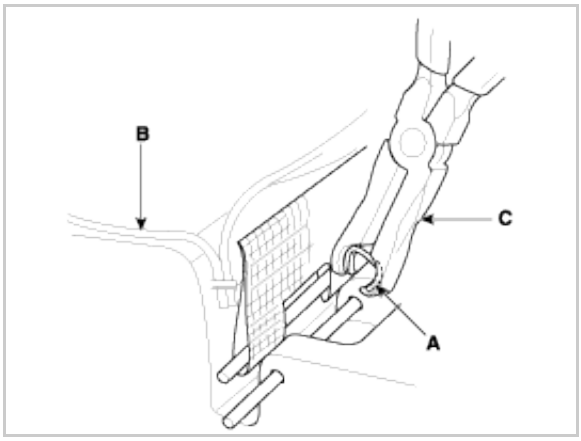
8. Remove the frame (A).



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



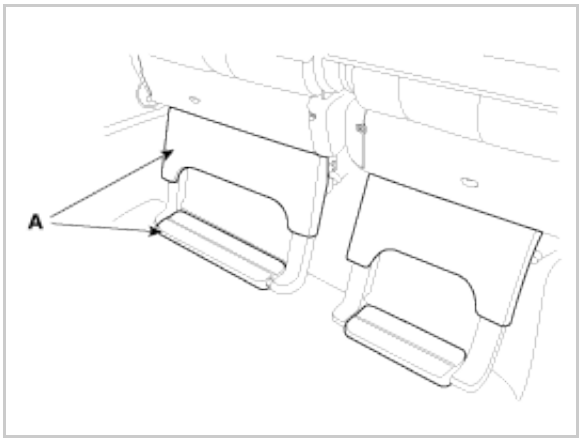
10. Installation is the reverse of removal.
    a. To prevent wrinkles, make sure the material is stretched evenly over the cover (A) before securing the hogring clips (B).
    b. Replace the hogring clips with new ones using special tool (C).



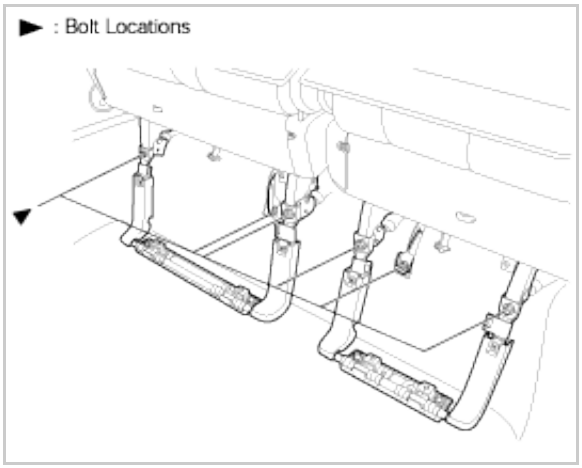
THIRD SEAT

SEAT ASSEMBLY REPLACEMENT

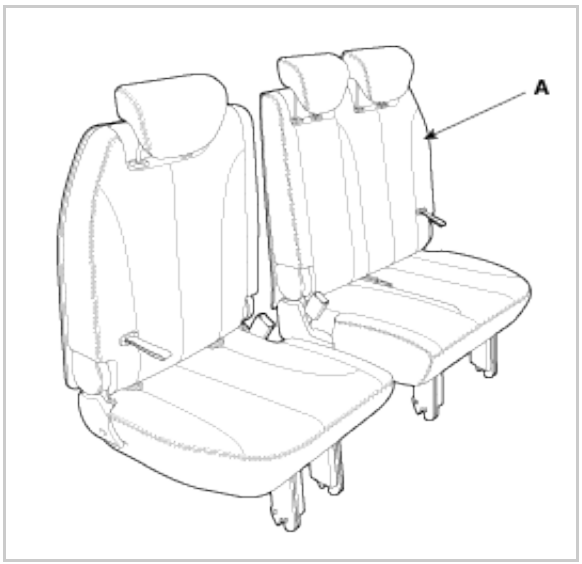
1. Remove the cover (A).



2. Loosen the mounting bolt.



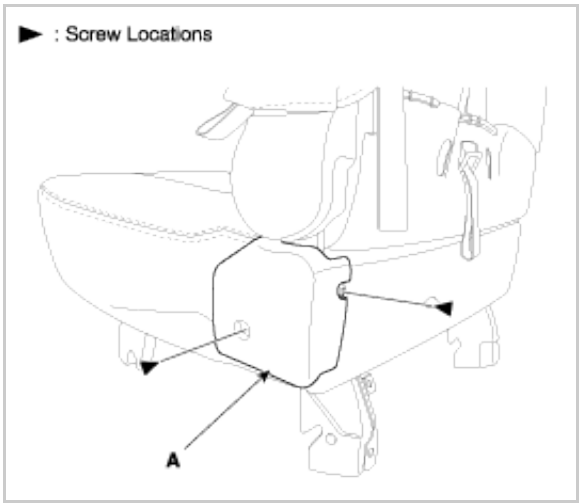
3. Remove the seat assembly (A).

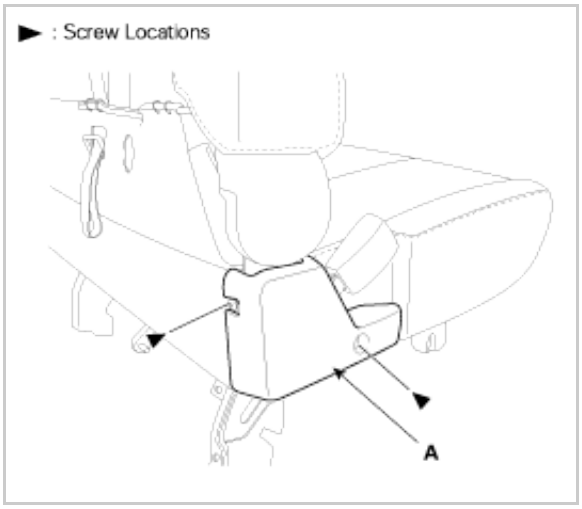


4. Installation is the reverse of removal.

RECLINER COVER REPLACEMENT

1. Remove the recliner cover (A).

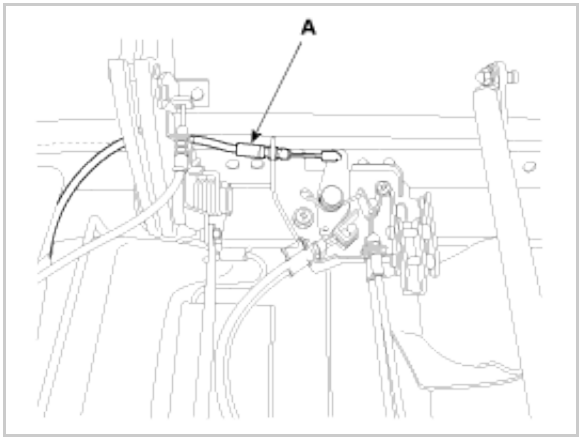




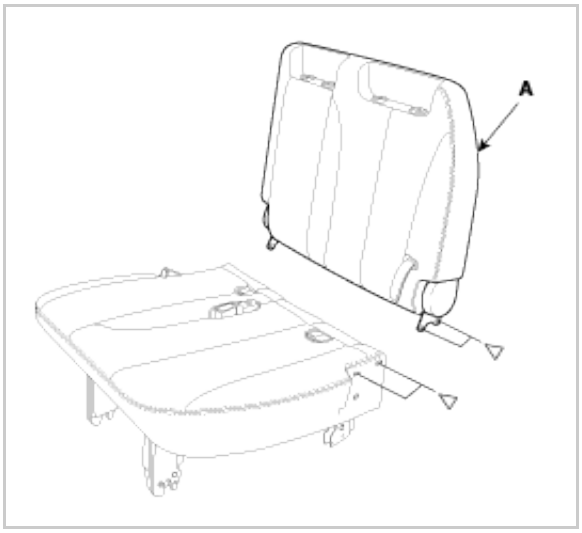
2. Installation is the reverse of removal.

SEAT BACK COVER REPLACEMENT

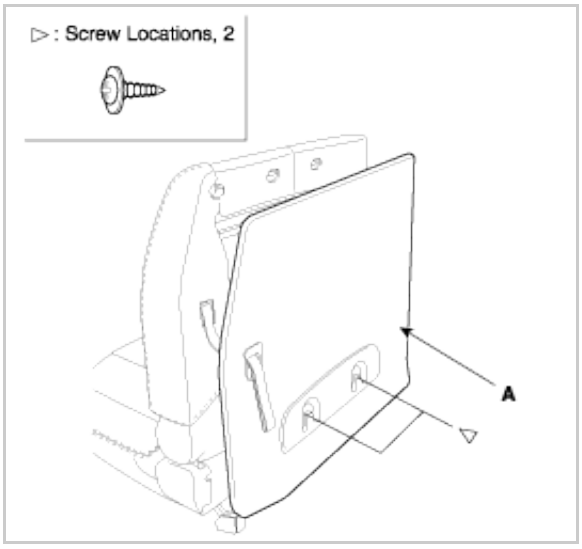
1. Remove the recliner cable (A).



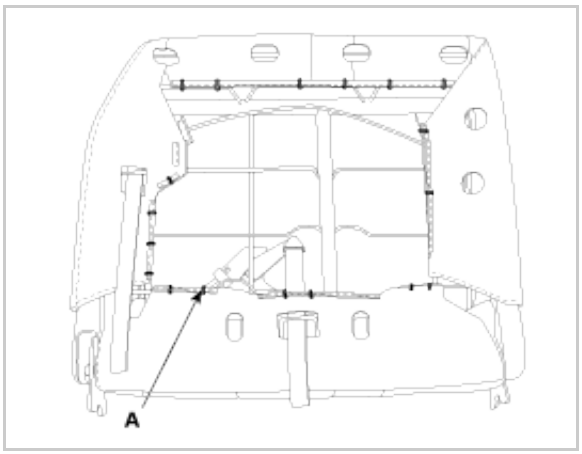
2. Loosen the mounting bolts, then remove the seat back assembly (A).



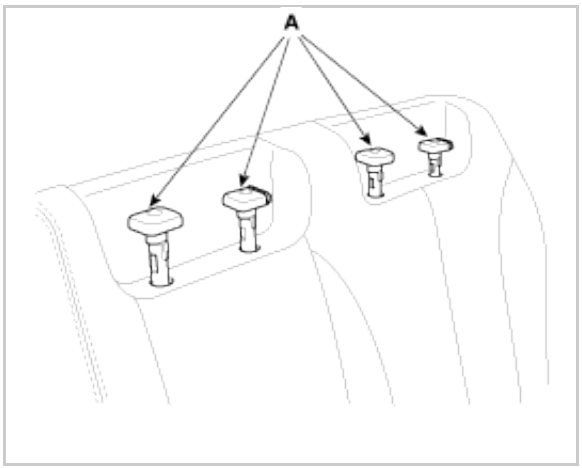
3. Remove the back panel (A).



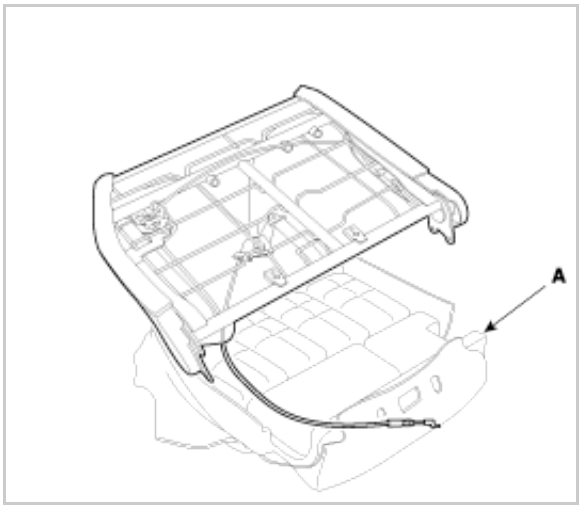
4. Remove the hogring clips (A).



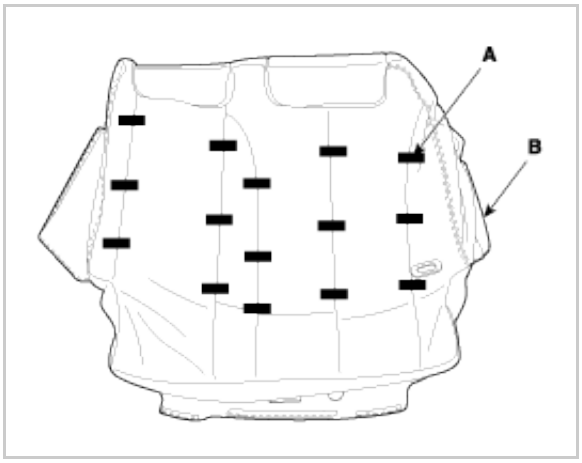
5. Remove the headrest guide (A).



6. Remove the frame (A).



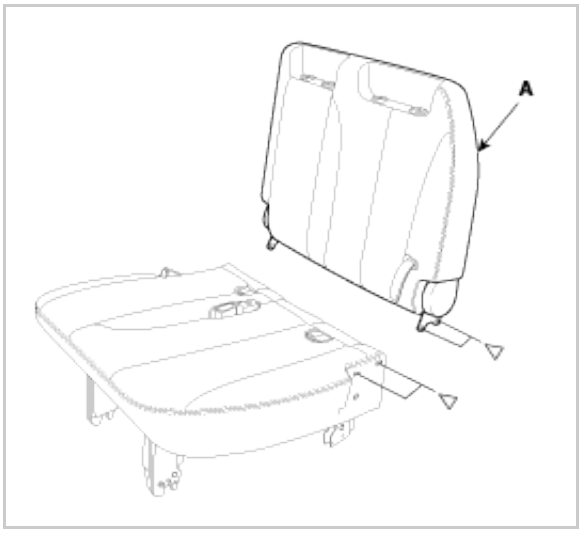
7. After removing the hog-ring clips (A) on the front of seat back remove the seat back cover (B).



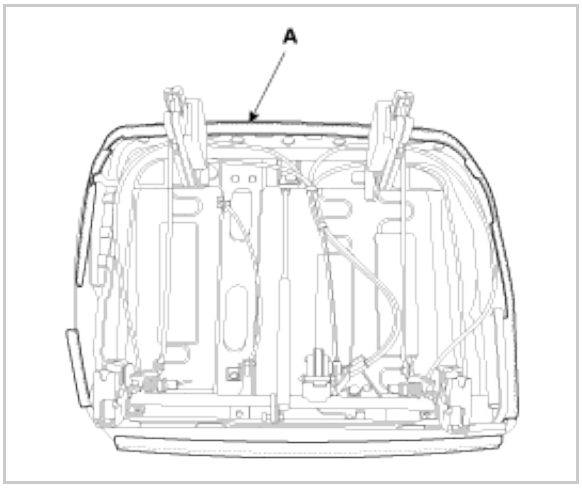
8. Installation is the reverse of removal.

SEAT CUSHION COVER REPLACEMENT

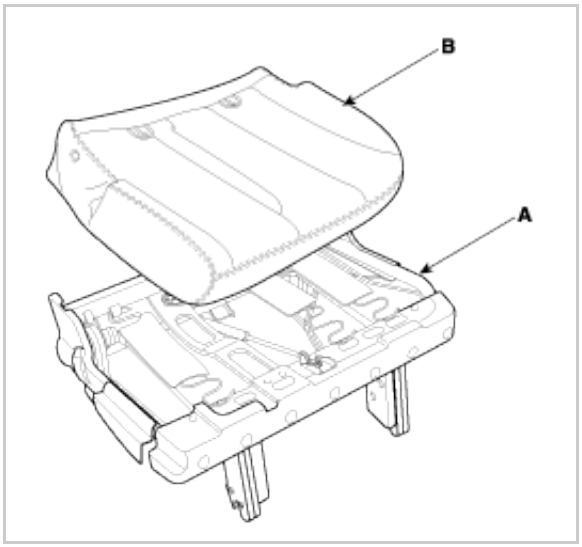
1. Remove the seat assembly.
2. Remove the recliner cover.
3. Loosen the mounting bolts, then remove the seat back assembly (A).



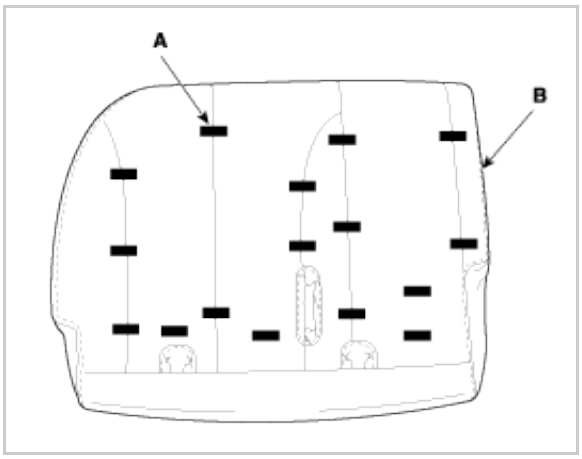
4. Disconnect the protector (A) from the back frame.



5. Disconnect the seat pad (B) from the back frame (A).



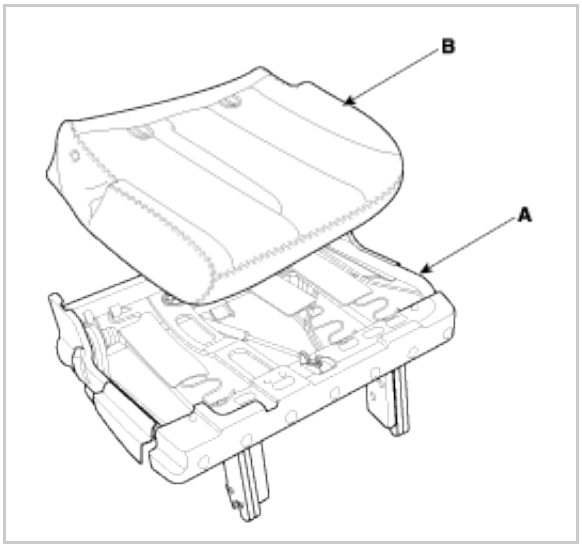
6. After removing the hog-ring clips (A) on the front of seat back remove the seat back cover (B).



7. Installation is the reverse of removal.

SEAT FRAME ASSEMBLY REPLACEMENT

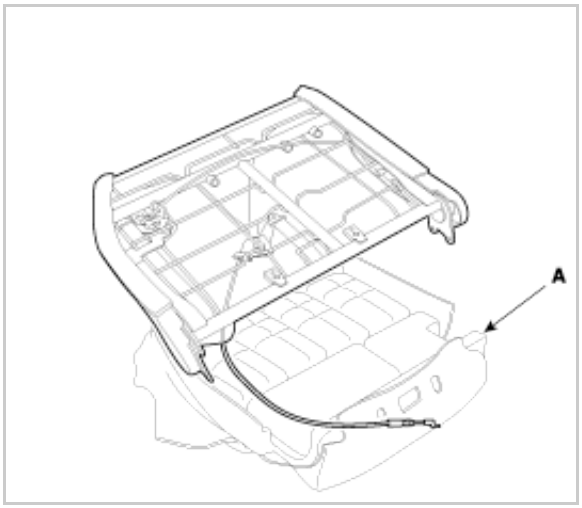
1. Remove the cushion cover(A).



2. Installation is the reverse of removal.

SEAT BACK FRAM REPLACEMENT

1. Remove seat back cover(A).



2. Installation is the reverse of removal.

Seat Belt

Front Seat Belt

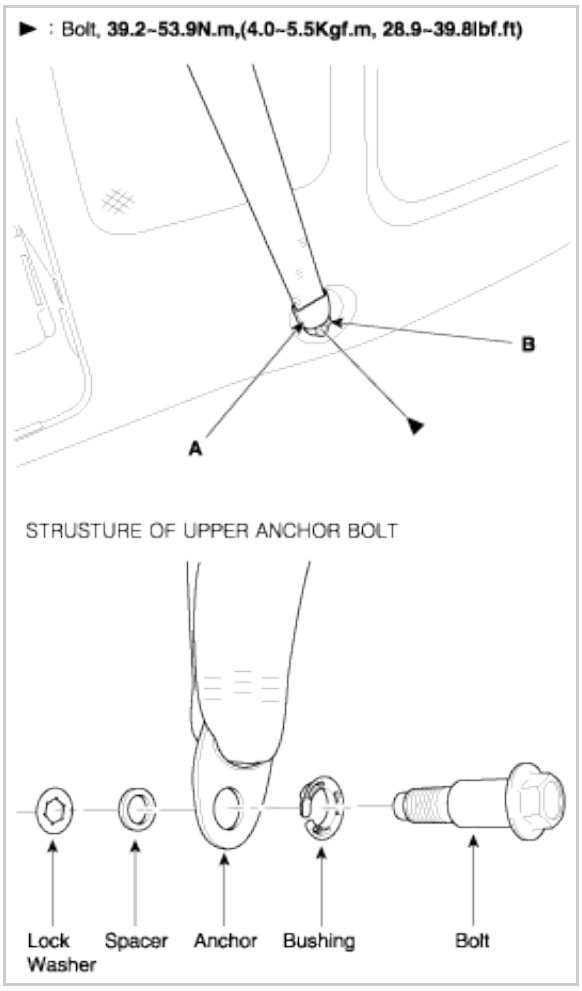
REPLACEMENT

FRONT SEAT BELT REPLACEMENT

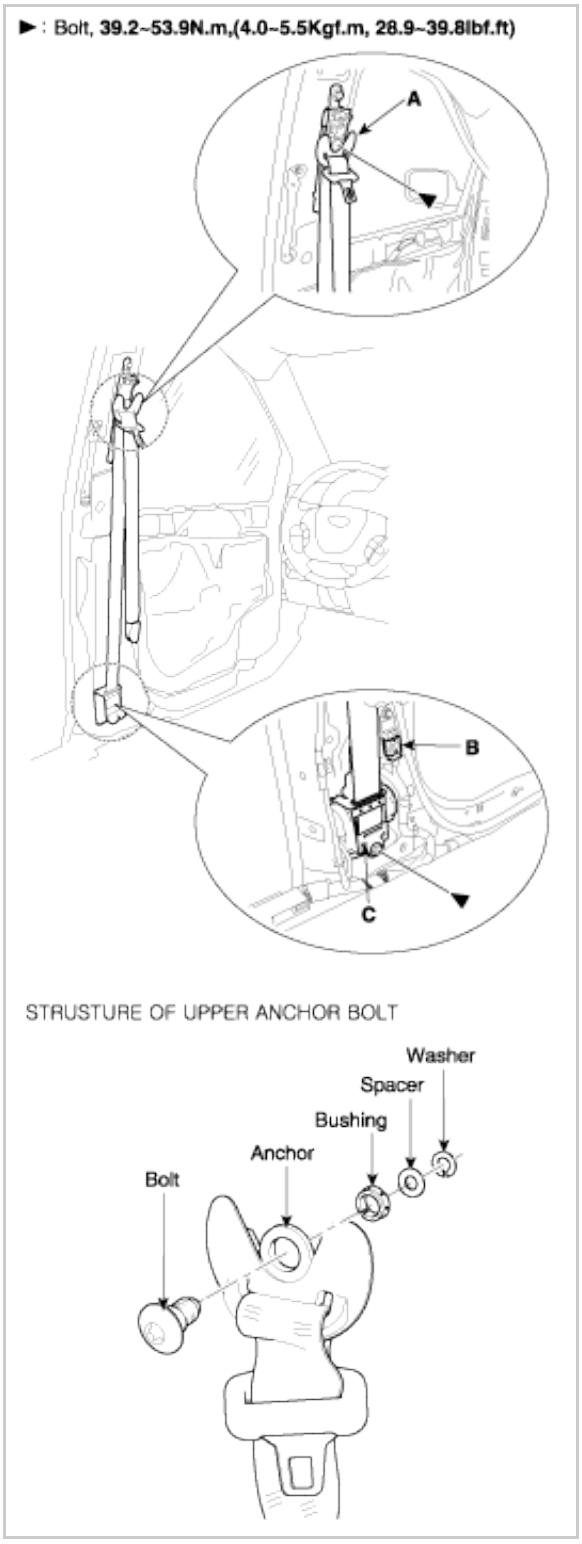
CAUTION

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

1. Remove the following items fist.
   a. Front seat assembly .
   b. Front and rear door scuff trim.
2. After raise the lower anchor cover (A), loosen the lower anchor mounting bolt (B).



3. Remove the center pillar lower trim.
4. Remove the center pillar upper trim.
5. Remove the upper anchor (A).
6. After disconnecting the pretensioner connector lock pin, remove the connector (B), Loosen the mounting bolt, then remove the pretensioner (C).

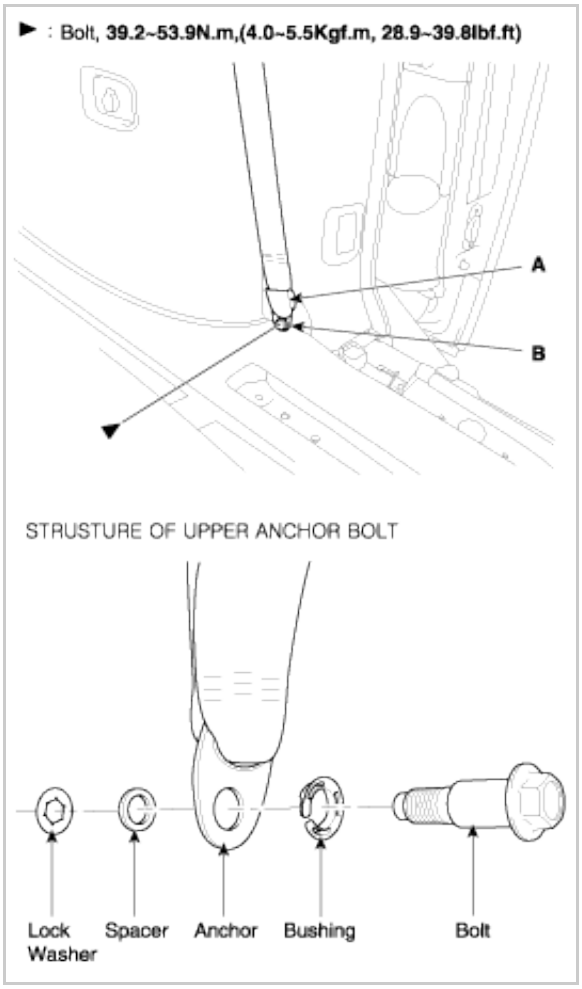


7. Installation is the reverse of removal.

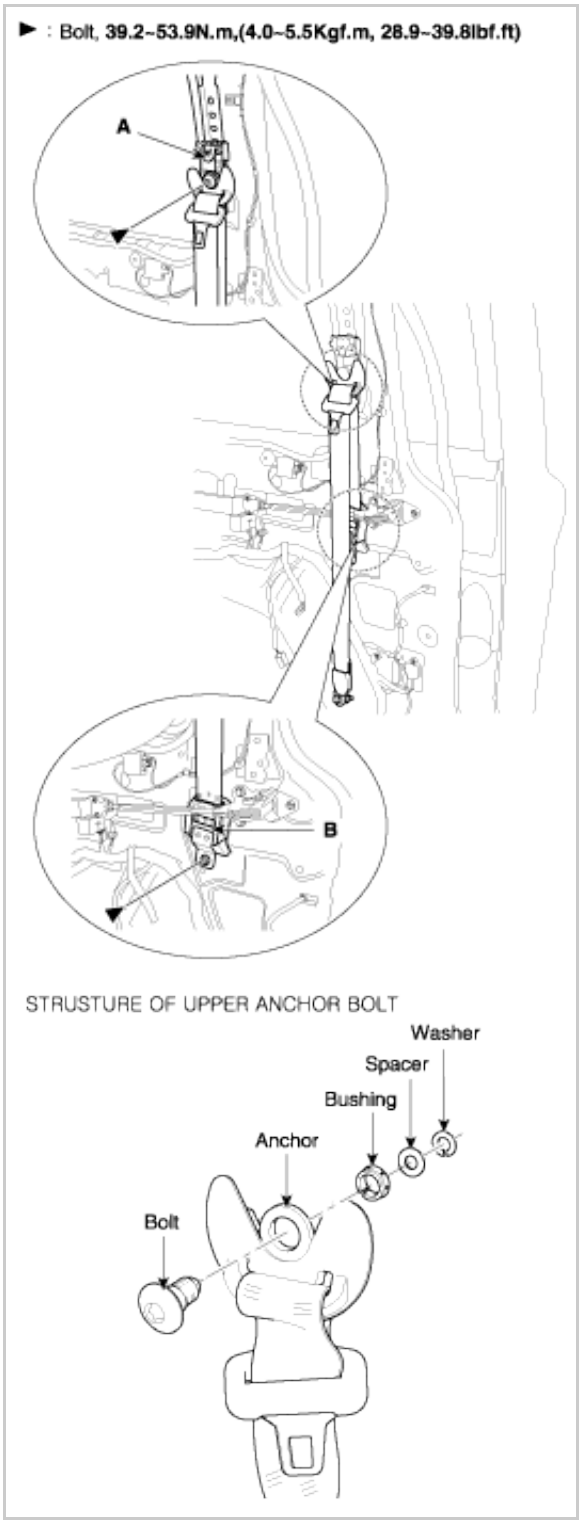
SECONDARY SEAT BELT REPLACEMENT

> **CAUTION**
>
> a. When installing the belt, make sure not to damage the pretensioner.

1. Remove the following items first.
   a. Rear seat assembly.
   b. Front and rear door scuff trim.
   c. Rear filler trim.
2. Remove the lower anchor (A).



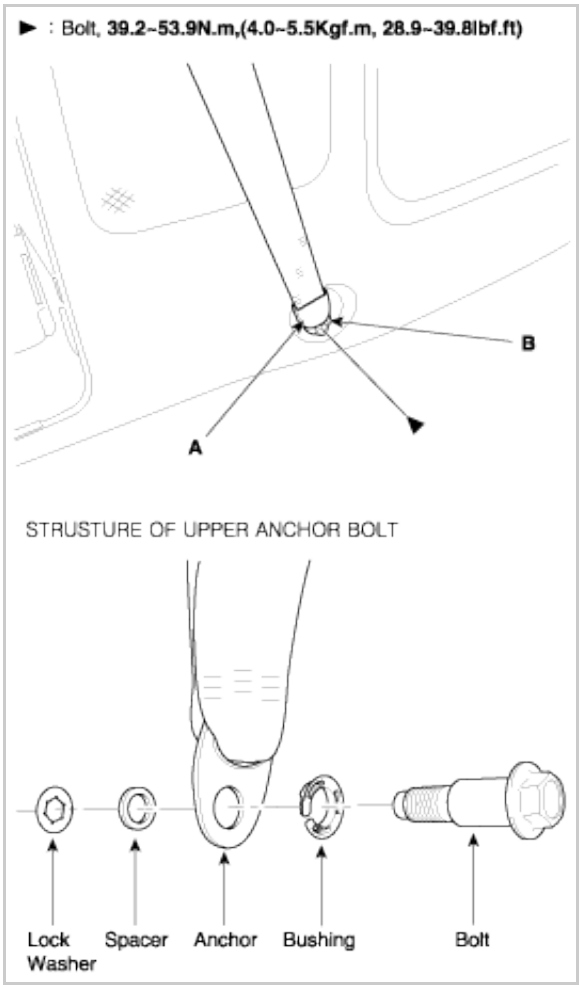
3. Remove the luggage side trim.
4. Remove the D pillar trim.
5. Remove the upper anchor (A).
6. After loosening the retractor (C) mounting bolt, remove the rear seat belt (B).



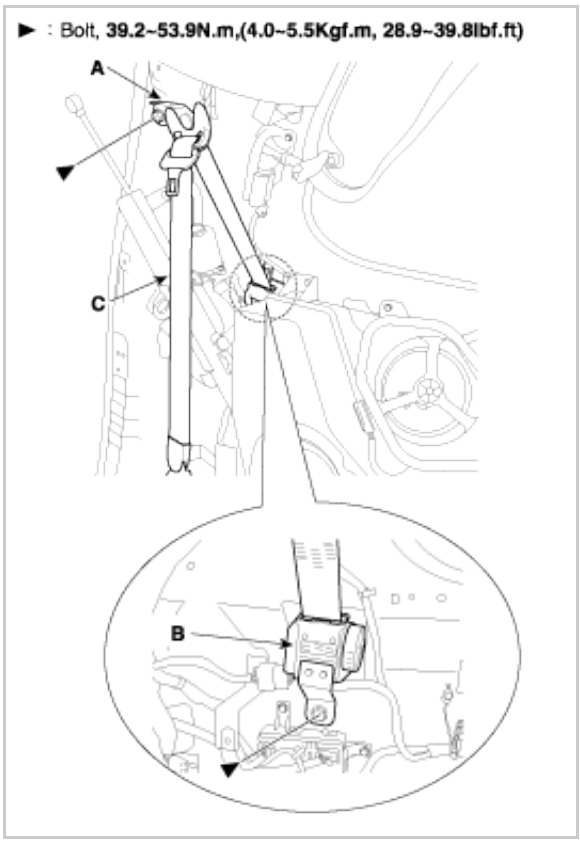
7. Installation is the reverse of removal.

THIRD SEAT BELT REPLACEMENT

1. Remove the following items first.
   a. Rear seat assembly.
   b. Front and rear door scuff trim.
   c. Rear filler trim.
2. Remove the lower anchor (A).



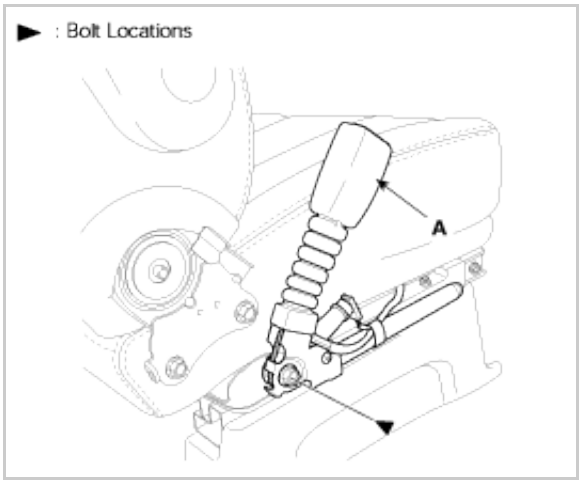
3. Remove the luggage side trim.
4. Remove the C pillar trim.
5. Remove the upper anchor (A).
6. After loosening the retractor (C) mounting bolt, remove the rear seat belt (B).



7. Installation is the reverse of removal.

FRONT SEAT BELT BUCKLE REPLACEMENT

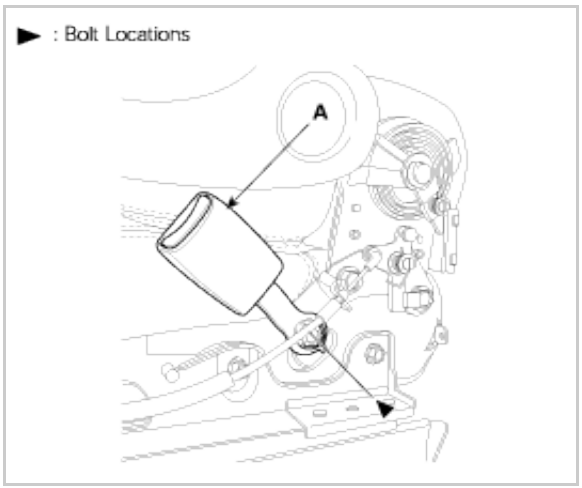
1. Remove the following items first.
   a. Front seat assembly.
   b. Recliner cover.
2. Remove the seat belt buckle (A).



3. Installation is the reverse of removal.

SECONDARY SEAT BELT BUCKLE REPLACEMENT

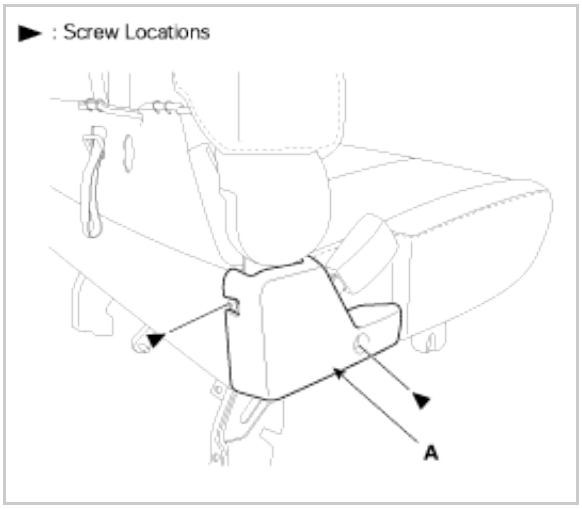
1. Remove the following items first.
   a. Front seat assembly.
   b. Recliner cover.
2. Remove the seat belt buckle (A).



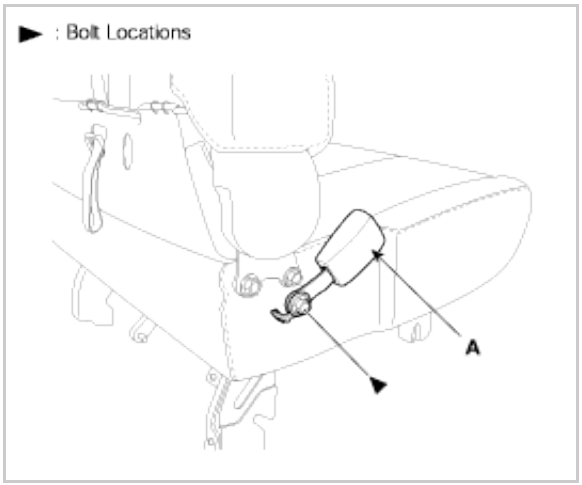
3. Installation is the reverse of removal.

THIRD SEAT BELT BUCKLE REPLACEMENT

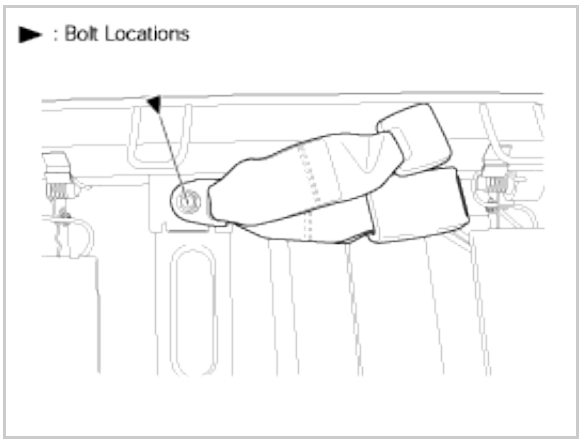
1. Remove the recliner cover (A).



2. Remove the seat belt buckle (A).



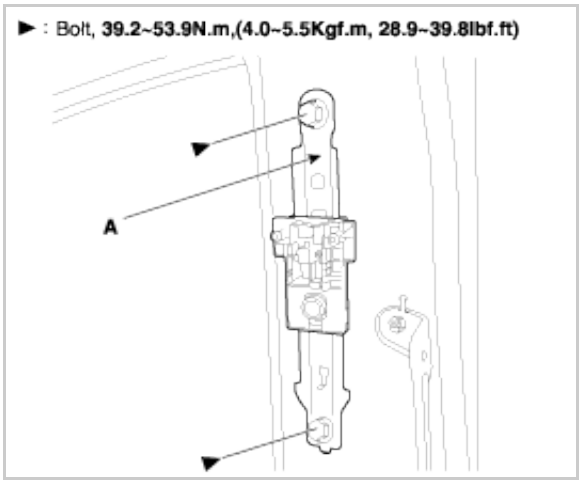
3. Remove the seat belt buckle (A).



4. Installation is the reverse of removal.

HEIGHT ADJUSTER REPLACEMENT

1. Remove the following items first.
   a. Front assembly .
   b. Front and rear door scuff trim .
   c. Front seat belt upper and lower anchor.
   d. Center pillar lower and upper trim.
2. Loosen the mounting bolts, then remove the height adjuster (A).



3. Installation is the reverse of removal.

CHAPTER 15:

Body Electrical System

General information

GENERAL TROUBLESHOOTING INFORMATION

BEFORE TROUBLESHOOTING

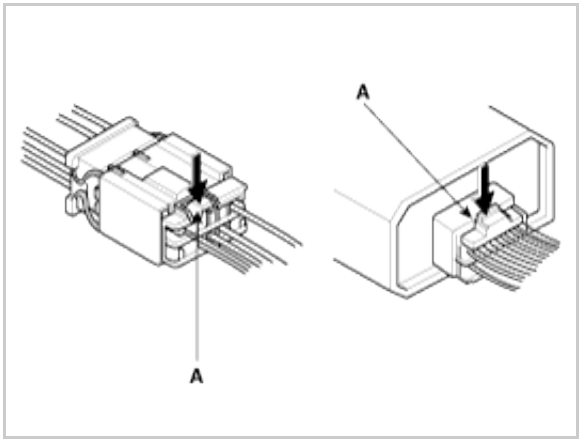
1. Check applicable fuses in the appropriate fuse/relay box.
2. Check the battery for damage, state of charge, and clean and tight connections.

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

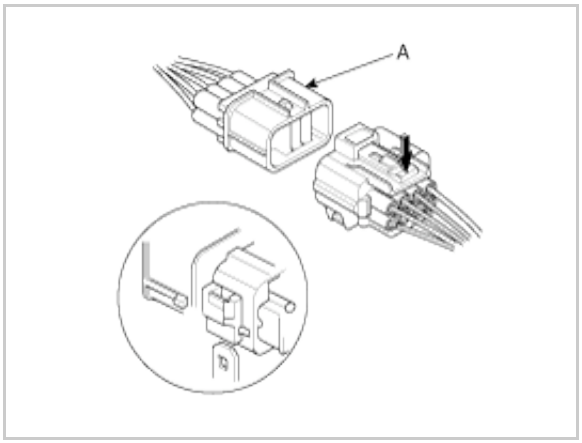
3. Check the generator belt tension.

HANDLING CONNECTORS

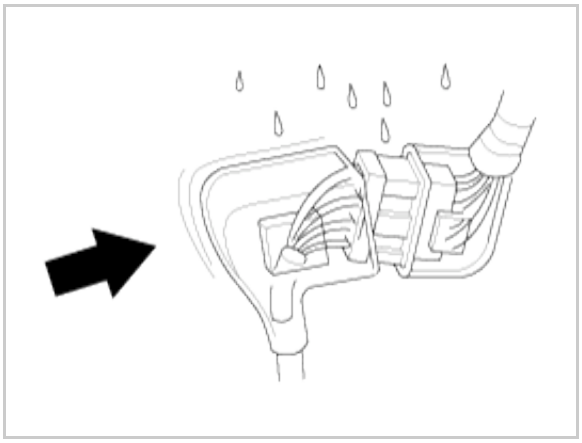
1. Make sure the connectors are clean and have no loose wire terminals.
2. Make sure multiple cavity connectors are packed with grease (except watertight connectors).
3. All connectors have push-down release type locks (A).



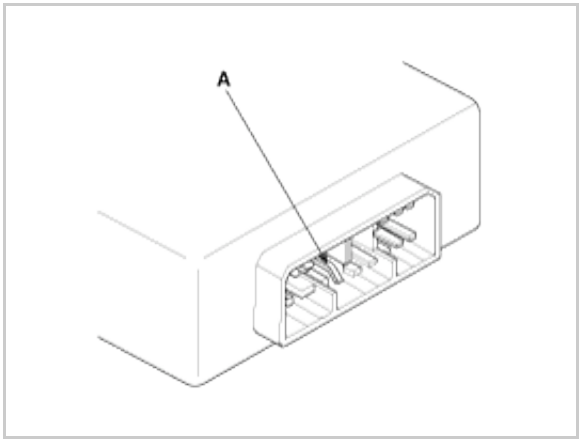
4. Some connectors have a clip on their side used to attach them to a mount bracket on the body or on another component. This clip has a pull type lock.
5. Some mounted connectors cannot be disconnected unless you first release the lock and remove the connector from its mount bracket (A).



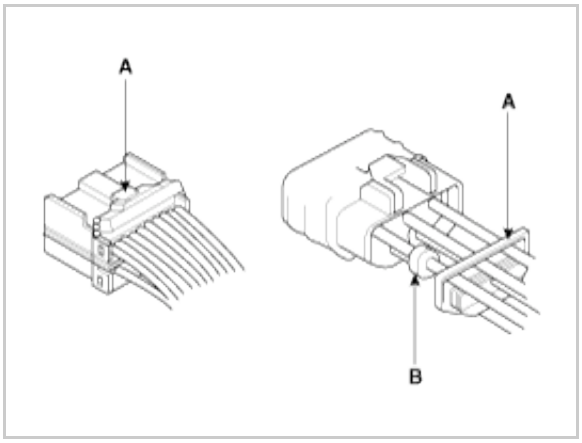
6. Never try to disconnect connectors by pulling on their wires; pull on the connector halves instead.
7. Always reinstall plastic covers.



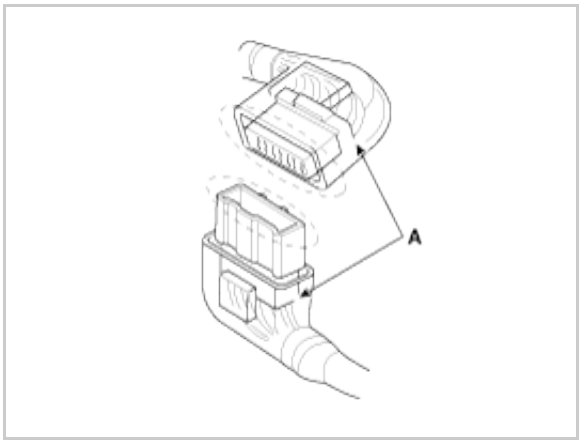
8. Before connecting connectors, make sure the terminals (A) are in place and not bent.



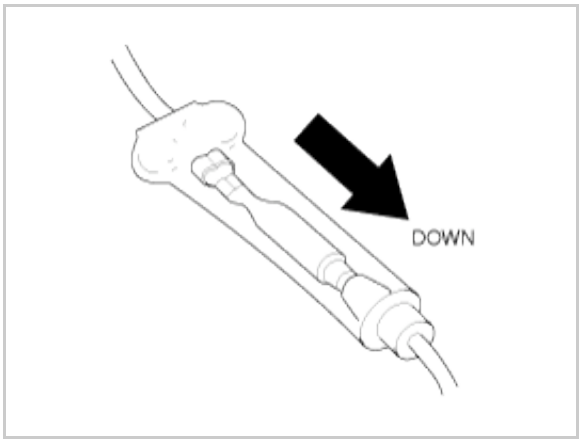
9. Check for loose retainer (A) and rubber seals (B).



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

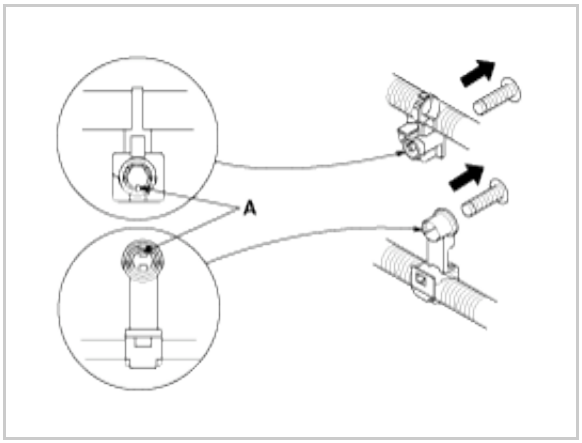


11. Insert the connector all the way and make sure it is securely locked.
12. Position wires so that the open end of the cover faces down.

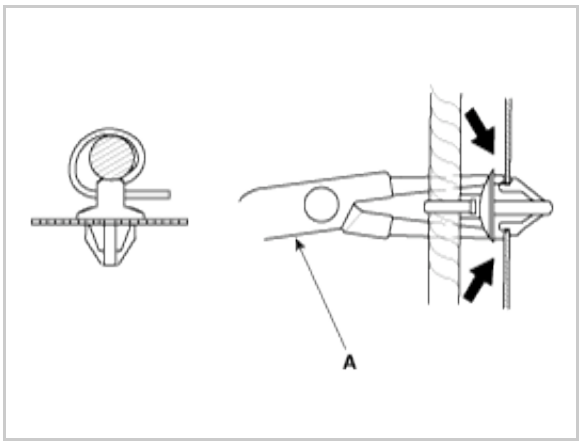


HANDLING WIRES AND HARNESSES

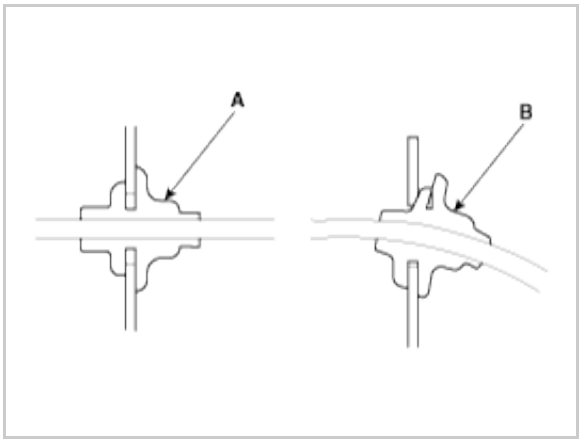
1. Secure wires and wire harnesses to the frame with their respective wire ties at the designated locations.
2. Remove clips carefully; don't damage their locks (A).



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.

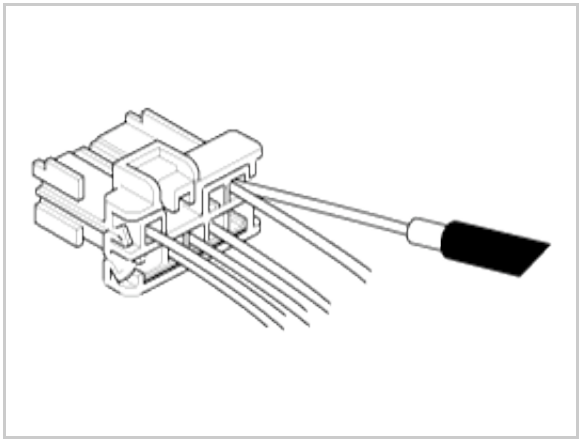


4. After installing harness clips, make sure the harness doesn't interfere with any moving parts.
5. Keep wire harnesses away from exhaust pipes and other hot parts, from sharp edges of brackets and holes, and from exposed screws and bolts.
6. Seat grommets in their grooves properly (A). Do not leave grommets distorted (B).

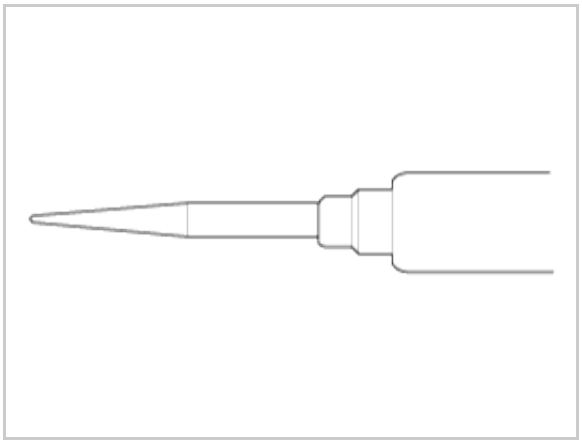


TESTING AND REPAIRS

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 probe of the tester from the wire side (except waterproof connector).



5. Use a probe with a tapered tip.



FIVE-STEP TROUBLESHOOTING

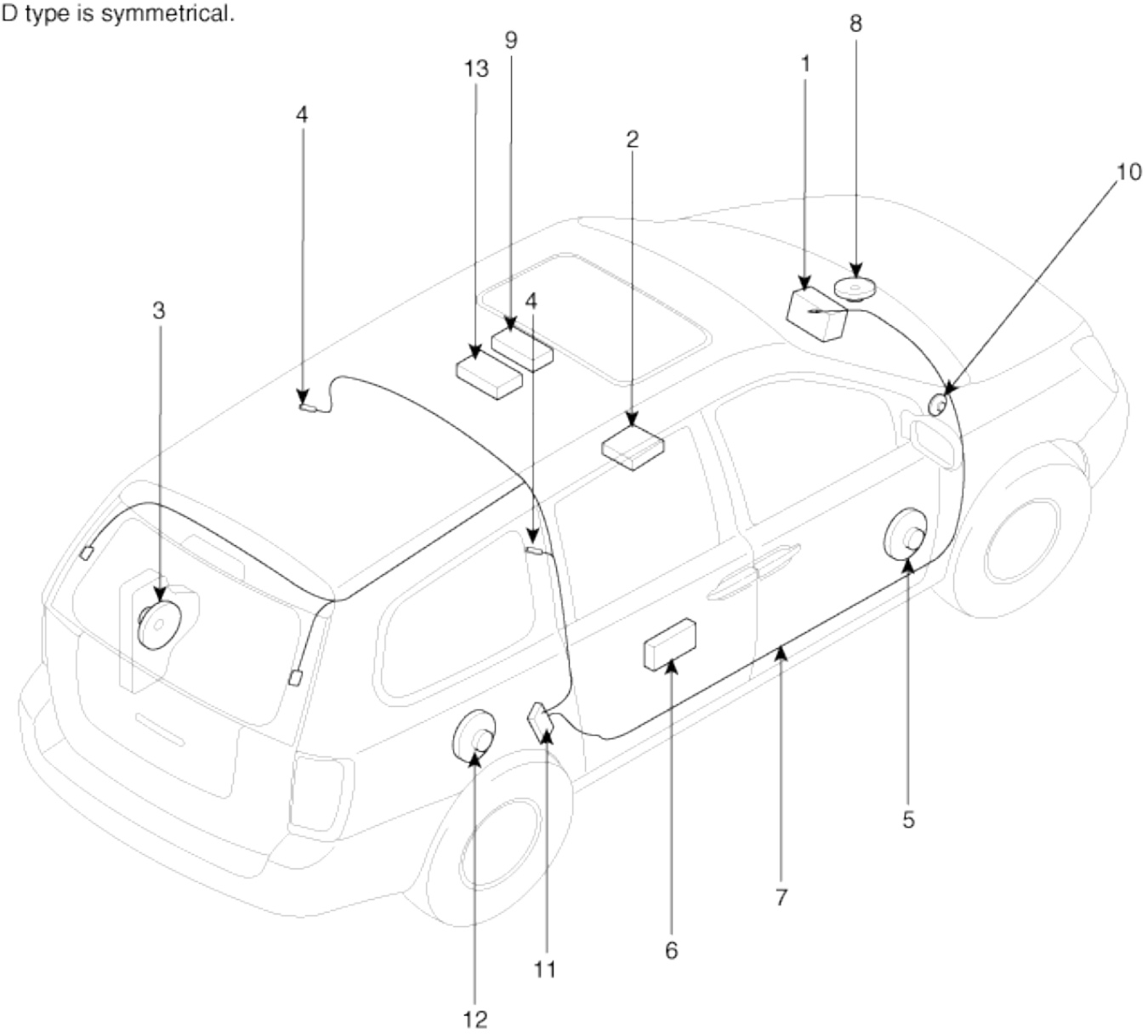
1. Verify the complaint
   Turn on all the components in the problem circuit to verify the customer complaint. Note the symptoms. Do not begin disassembly or testing until you have narrowed down the problem area.
2. Analyze the schematic
   Look up the schematic for the problem circuit.
   Determine 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

Audio

COMPONENT LOCATION

This illustration is shows the LHD type.
RHD type is symmetrical.



1. Audio unit
2. External amplifier
3. Woofer speaker
4. Glass antenna
5. Front door speaker
6. Sliding door speaker
7. Antenna feeder cable
8. Front center speaker
9. RSE (Rear Seat Entertainment)
10. Tweeter speaker
11. Diversity
12. Rear side speaker
13. Rear center speaker

CUSTOMER COMPLAINT ANALYSIS CHECK SHEET

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

TROUBLESHOOTING

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

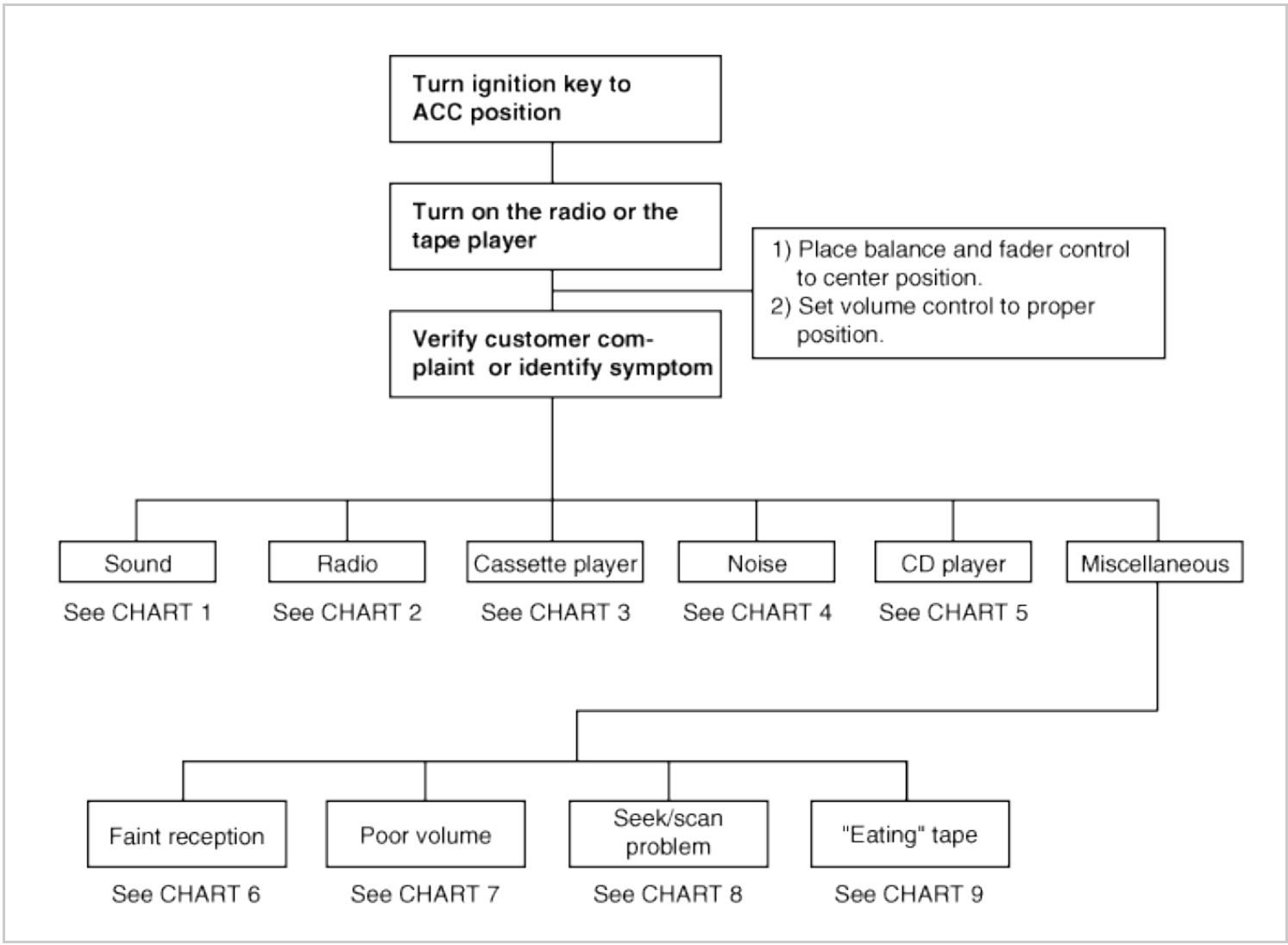
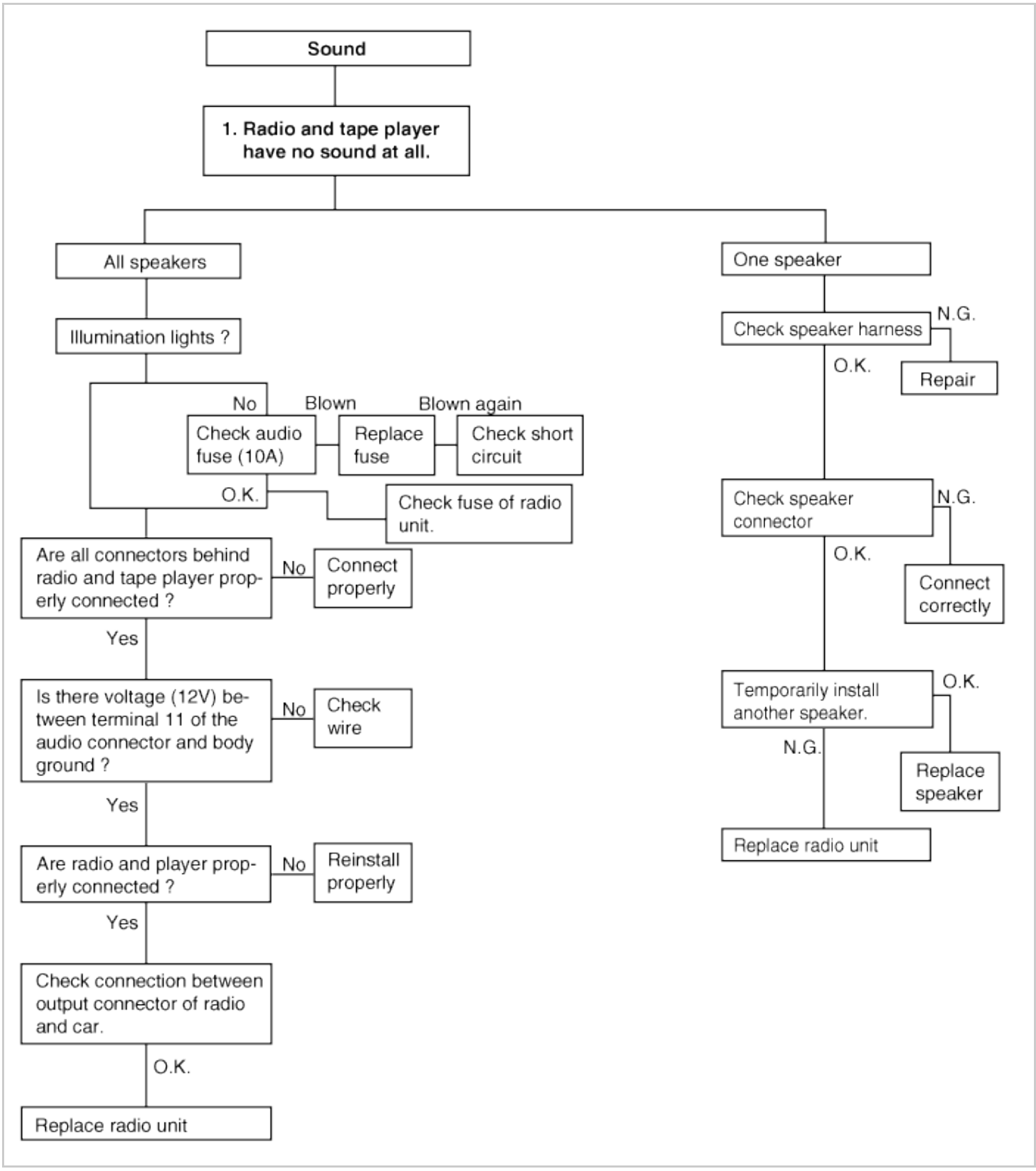

Turn ignition key to ACC position
Turn on the radio or the tape player
1) Place balance and fader control to center position.
2) Set volume control to proper position.
Verify customer complaint or identify symptom
Sound
See CHART 1
Radio
See CHART 2
Cassette player
See CHART 3
Noise
See CHART 4
CD player
See CHART 5
Miscellaneous
Faint reception
See CHART 6
Poor volume
See CHART 7
Seek/scan problem
See CHART 8
"Eating" tape
See CHART 9

CHART 1


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

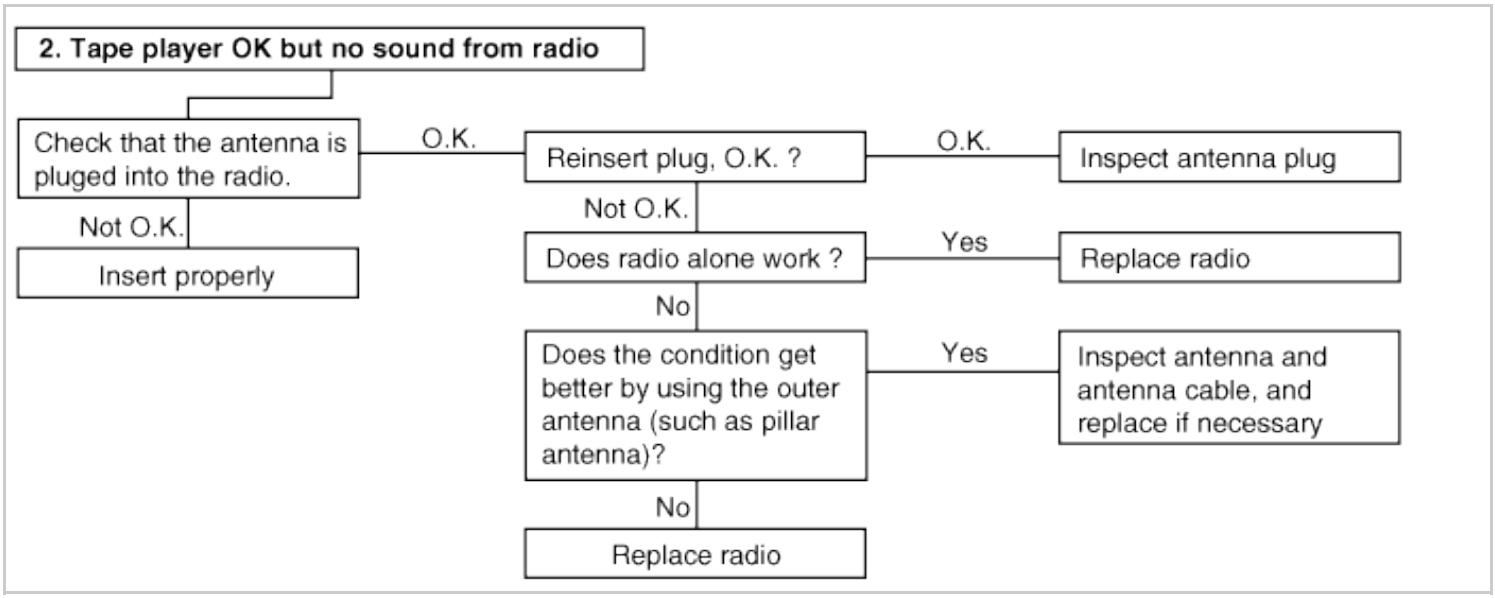


CHART 2

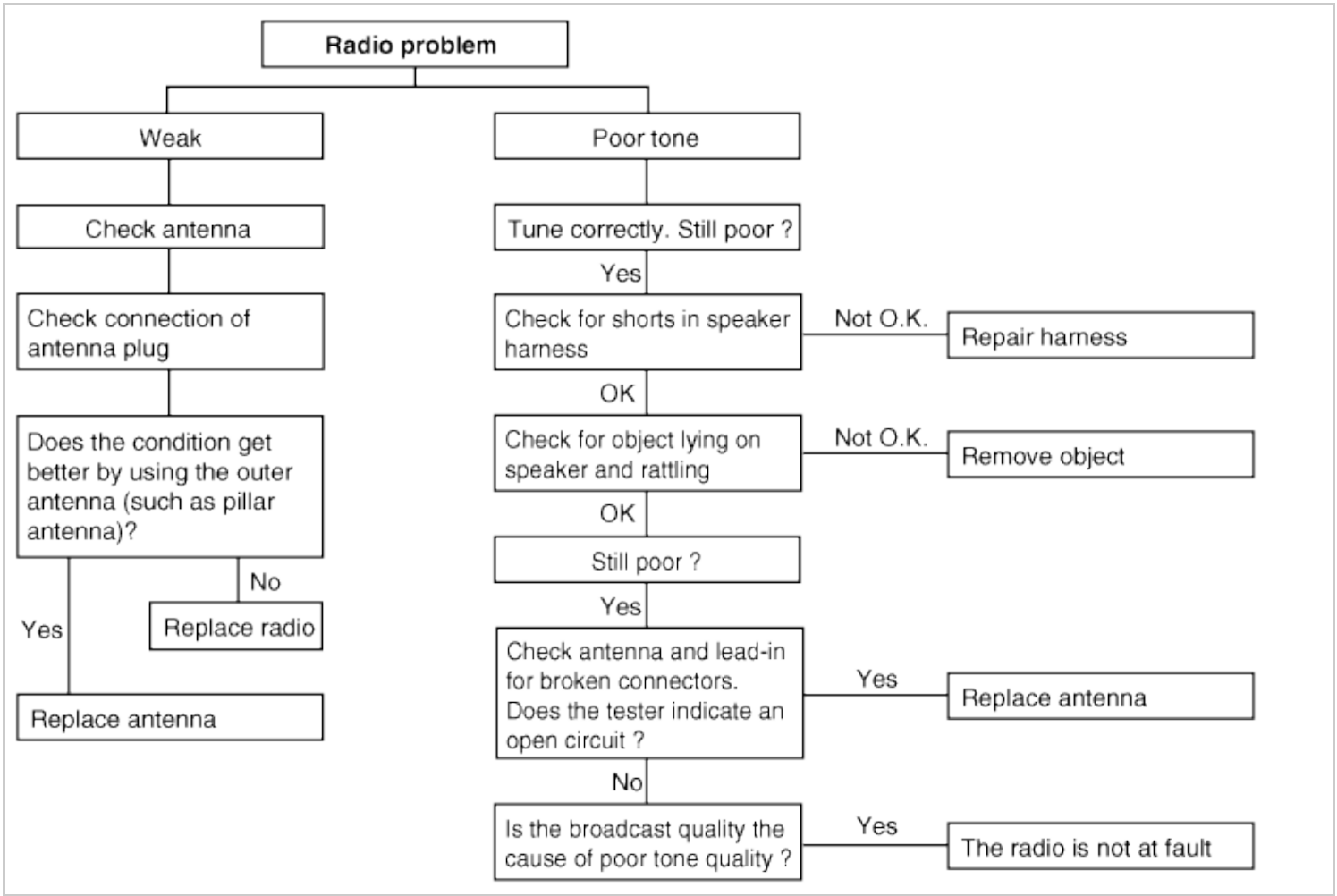


CHART 3

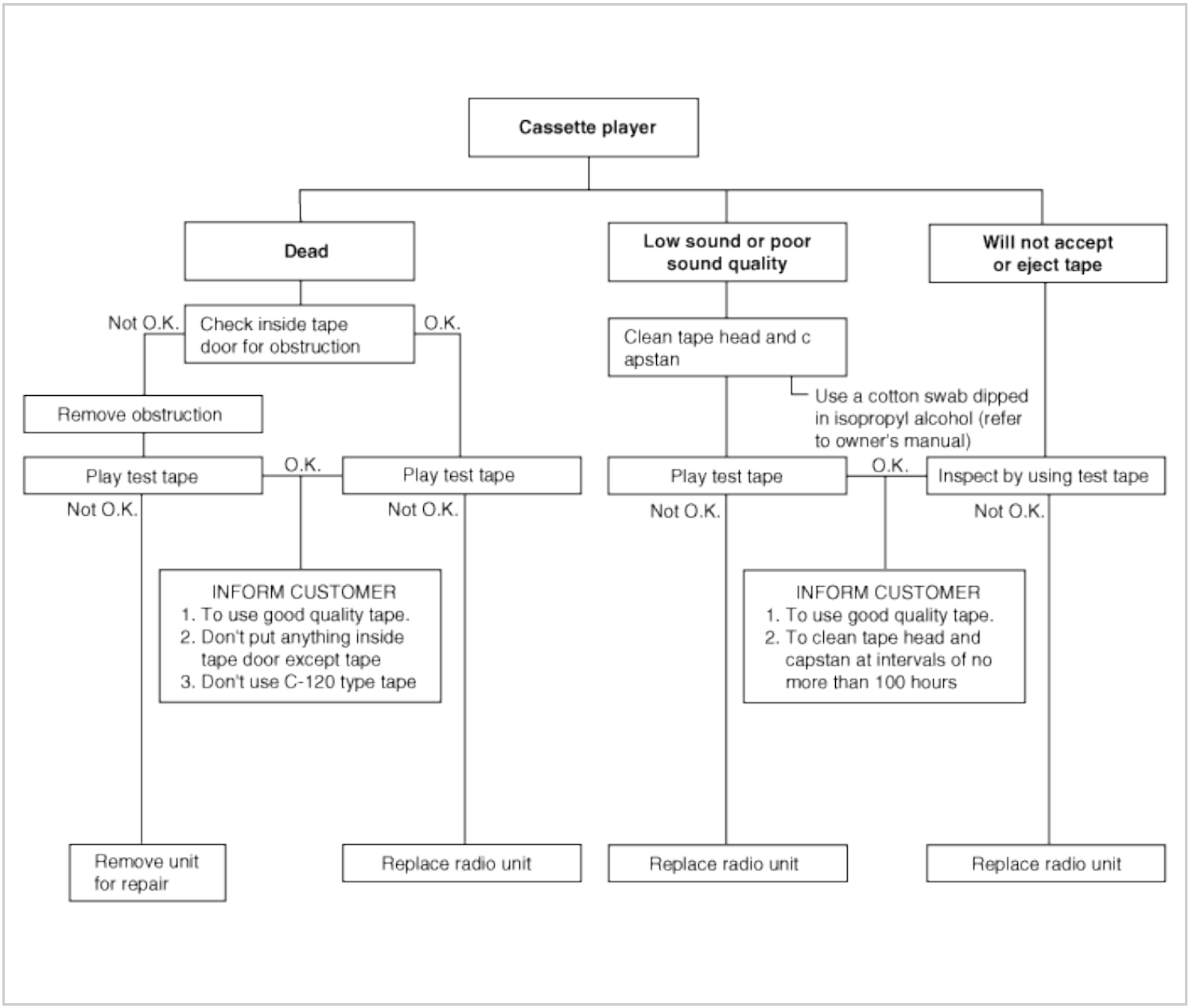
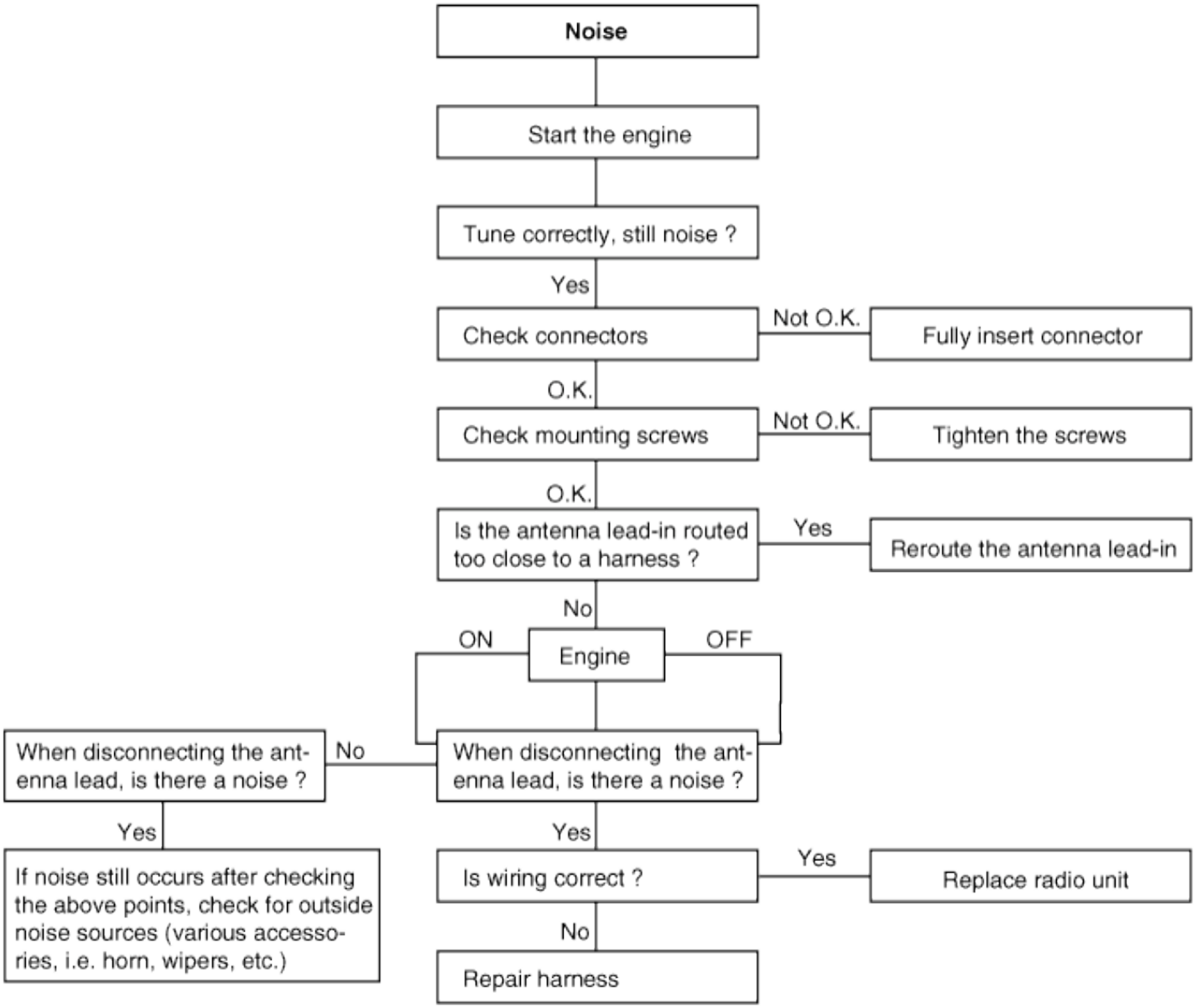

Cassette player
Dead
Low sound or poor sound quality
Will not accept or eject tape
Not O.K.
Check inside tape door for obstruction
O.K.
Clean tape head and c apstan
Use a cotton swab dipped in isopropyl alcohol (refer to owner's manual)
Remove obstruction
Play test tape
O.K.
Play test tape
Play test tape
O.K.
Inspect by using test tape
Not O.K.
Not O.K.
Not O.K.
Not O.K.
INFORM CUSTOMER
1. To use good quality tape.
2. Don't put anything inside tape door except tape
3. Don't use C-120 type tape
INFORM CUSTOMER
1. To use good quality tape.
2. To clean tape head and capstan at intervals of no more than 100 hours
Remove unit for repair
Replace radio unit
Replace radio unit
Replace radio unit

CHART 4

1. RADIO


Noise
Start the engine
Tune correctly, still noise ?
Yes
Check connectors
Not O.K.
Fully insert connector
O.K.
Check mounting screws
Not O.K.
Tighten the screws
O.K.
Is the antenna lead-in routed too close to a harness ?
Yes
Reroute the antenna lead-in
No
ON
Engine
OFF
When disconnecting the antenna lead, is there a noise ?
No
When disconnecting the antenna lead, is there a noise ?
Yes
If noise still occurs after checking the above points, check for outside noise sources (various accessories, i.e. horn, wipers, etc.)
Yes
Is wiring correct ?
Yes
Replace radio unit
No
Repair harness

2. TAPE

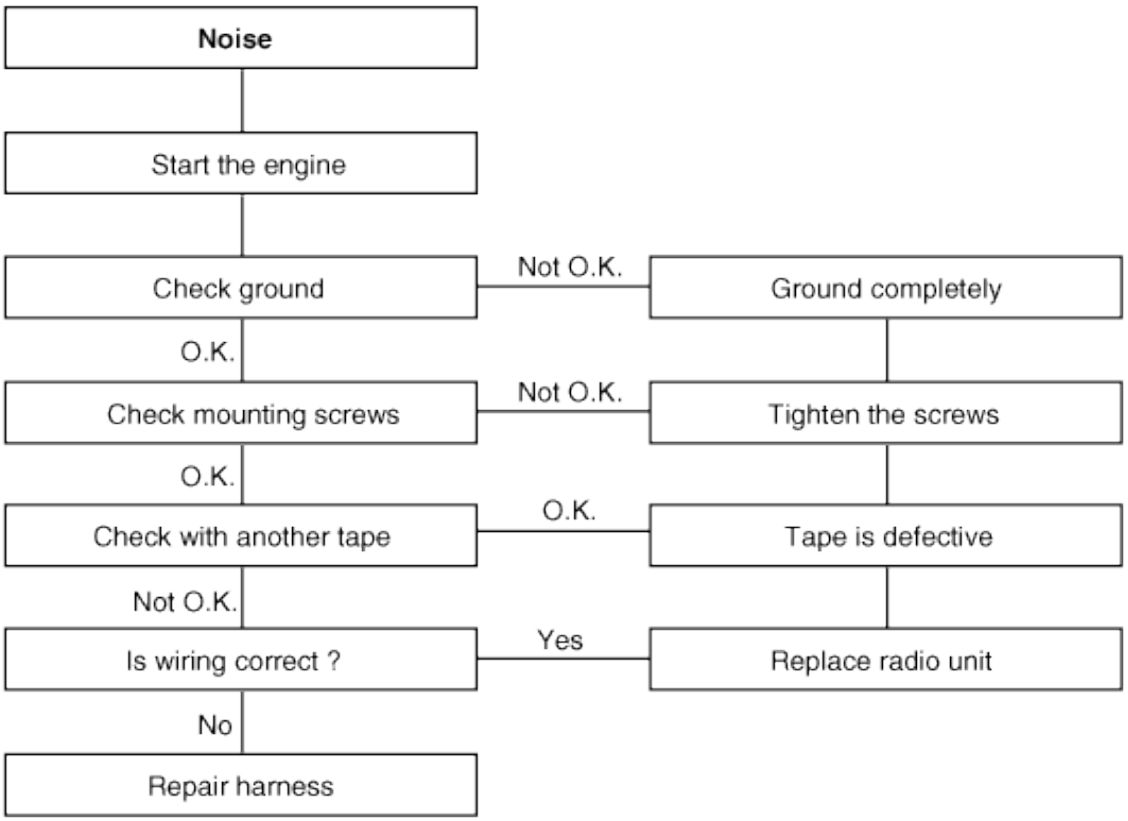
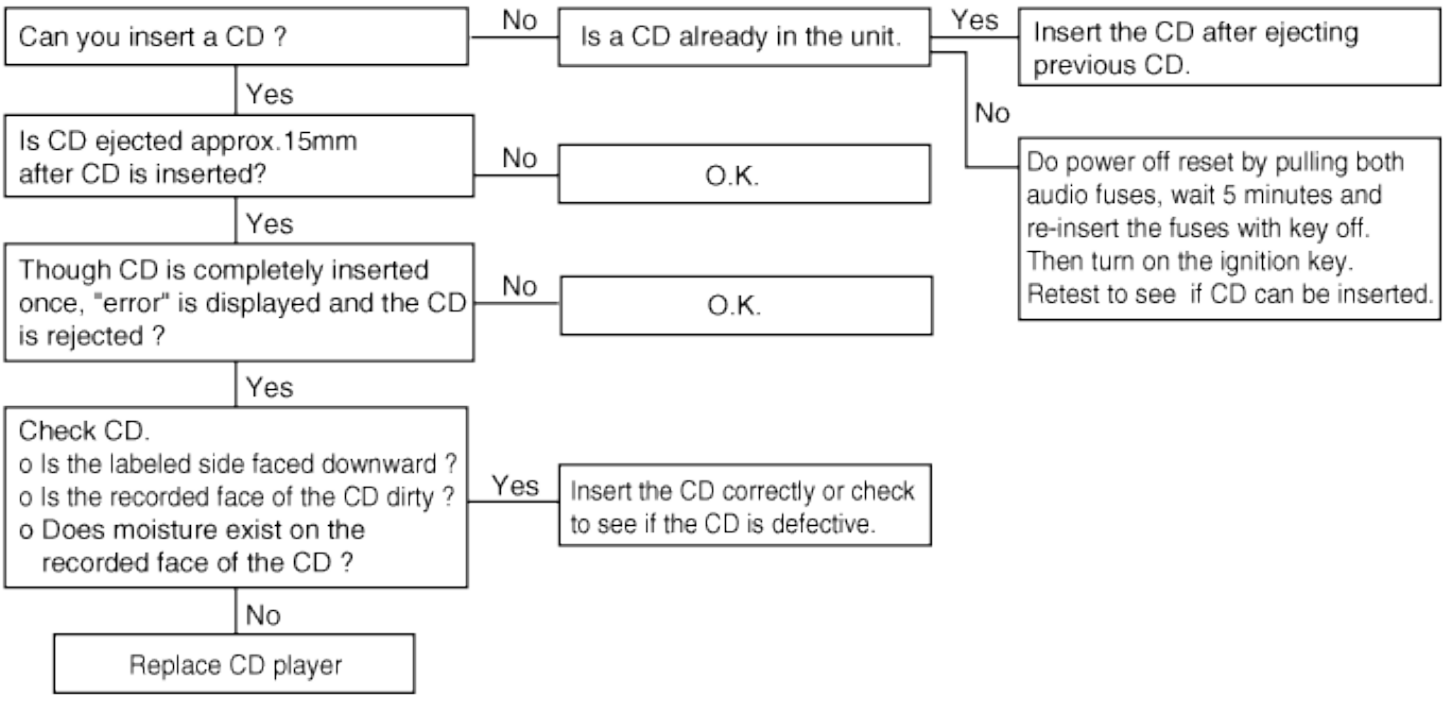
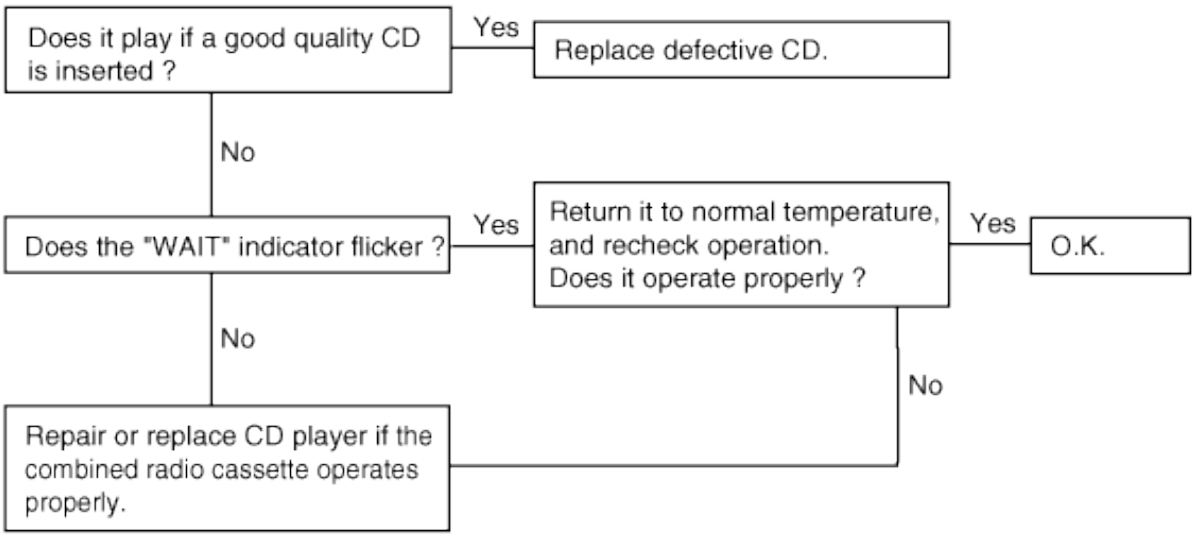


CHART 5

1. CD WILL NOT BE ACCEPTED

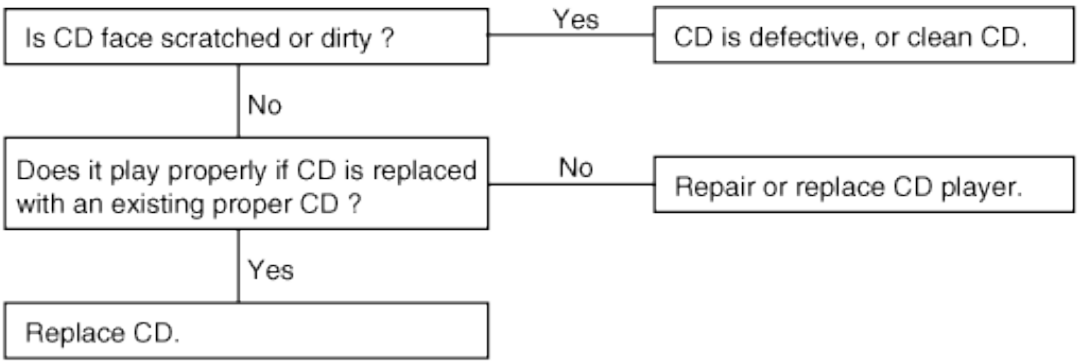


2. NO SOUND

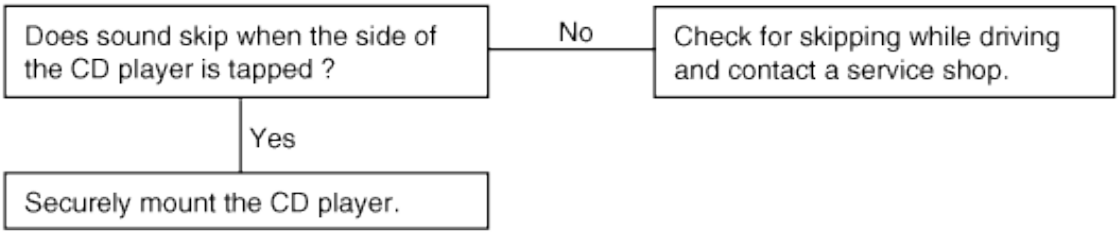


3. CD SOUND SKIPS

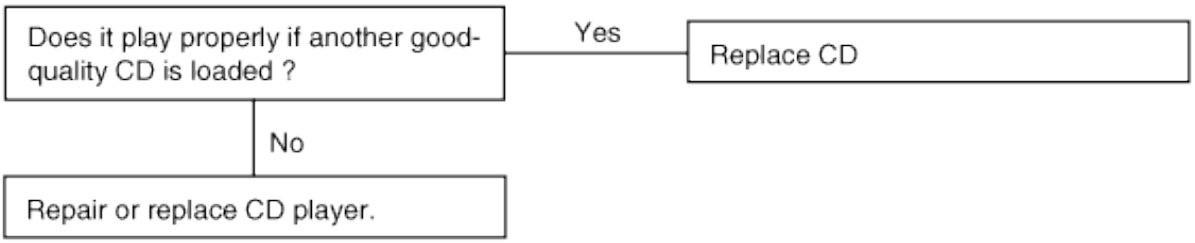
1) Sound sometimes skips when parking.



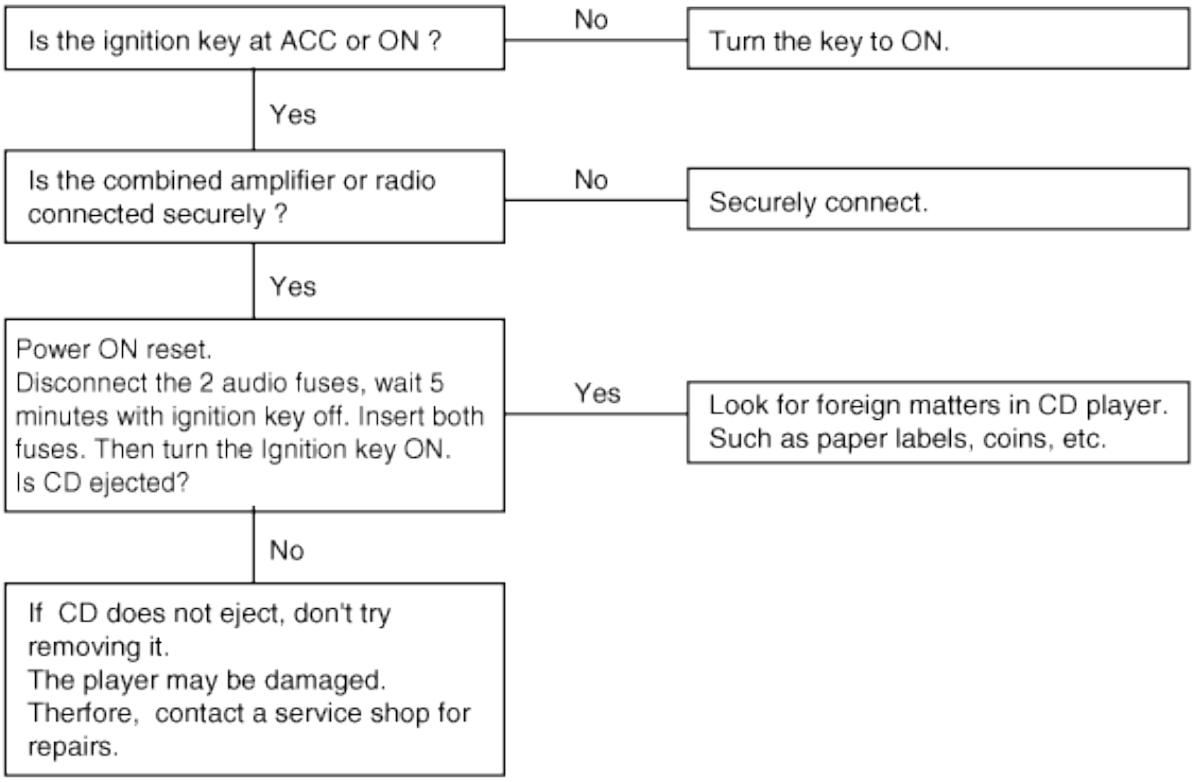
2) Sound sometimes skips when driving.
(Stop vehicle, and check it.)
(Check by using a CD which is free of scratches, dirt or other damage.)



4. SOUND QUALITY IS POOR



5. CD WILL NOT EJECT



6. NO SOUND FROM ONE SPEAKER

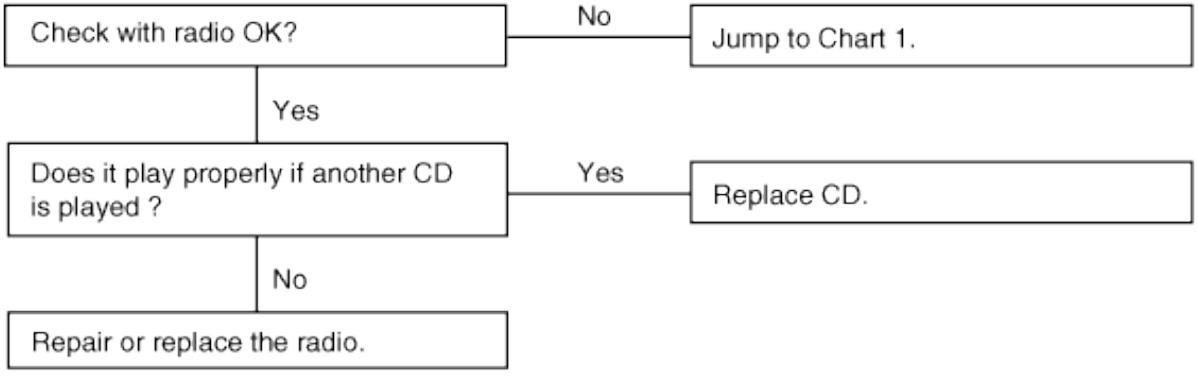


CHART 6

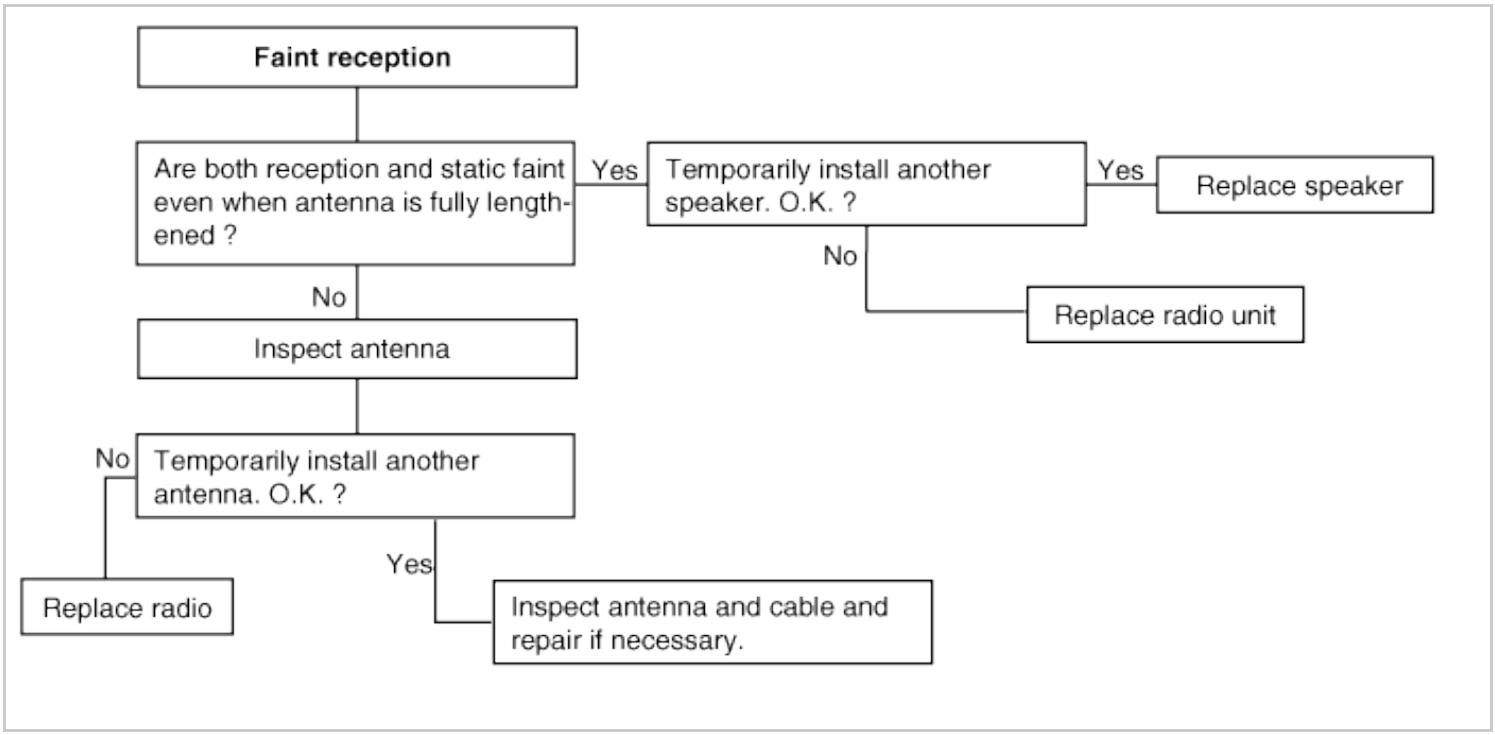


CHART 7

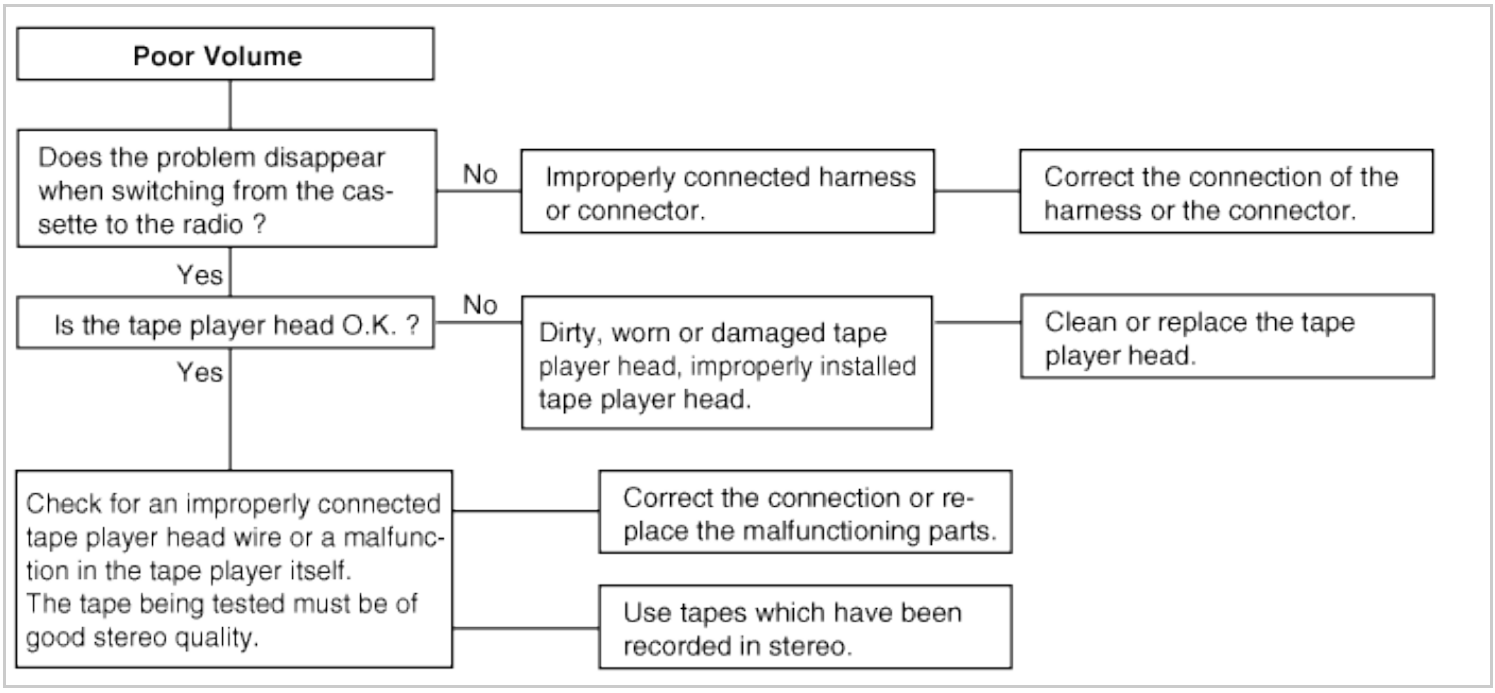


CHART 8

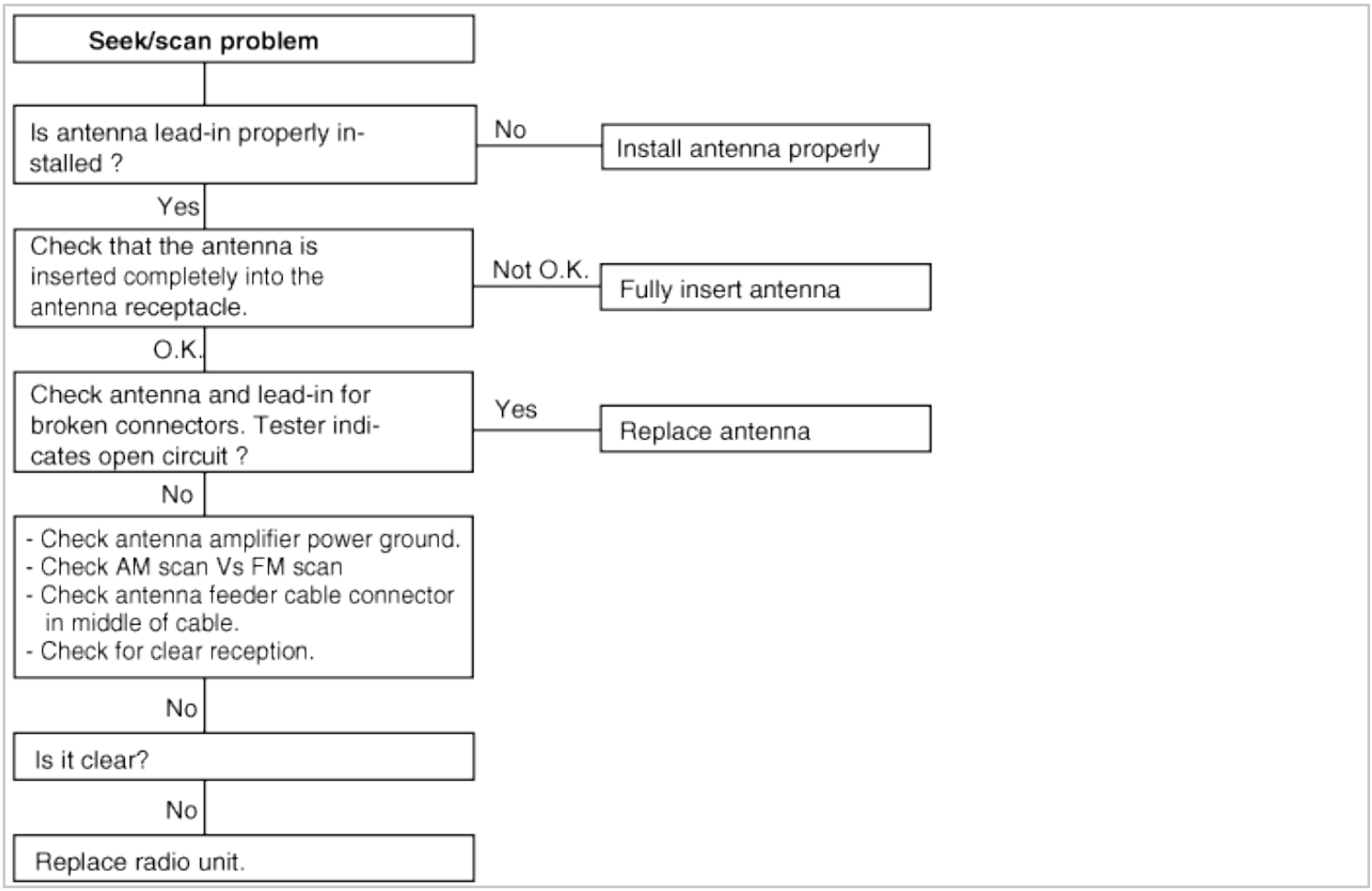
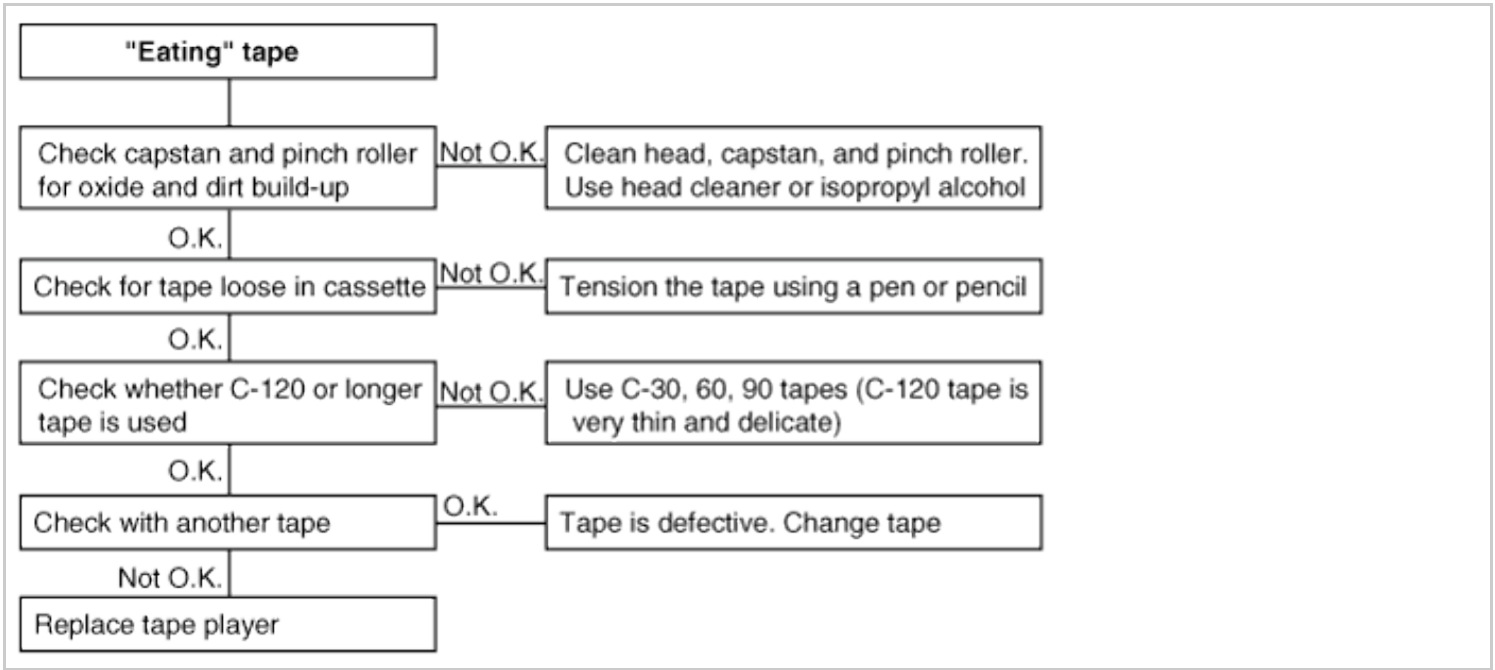

Seek/scan problem
Is antenna lead-in properly installed ?
No
Install antenna properly
Yes
Check that the antenna is inserted completely into the antenna receptacle.
Not O.K.
Fully insert antenna
O.K.
Check antenna and lead-in for broken connectors. Tester indicates open circuit ?
Yes
Replace antenna
No
- Check antenna amplifier power ground.
- Check AM scan Vs FM scan
- Check antenna feeder cable connector in middle of cable.
- Check for clear reception.
No
Is it clear?
No
Replace radio unit.

CHART 9


"Eating" tape
Check capstan and pinch roller for oxide and dirt build-up
Not O.K.
Clean head, capstan, and pinch roller. Use head cleaner or isopropyl alcohol
O.K.
Check for tape loose in cassette
Not O.K.
Tension the tape using a pen or pencil
O.K.
Check whether C-120 or longer tape is used
Not O.K.
Use C-30, 60, 90 tapes (C-120 tape is very thin and delicate)
O.K.
Check with another tape
O.K.
Tape is defective. Change tape
Not O.K.
Replace tape player

SPECIFICATION

AUDIO

Item		Specification		
Model		RADIO/EQ/CD (M445)	RADIO/Cassette/EQ/CD/MP3 (M455)	RADIO/Cassette/EQ/6 CDC/MP3 (M465)
Power supply		DC 14.4V		
Rated output		Max 43W x 4		3.2Vrms
Speaker impedance		4Ω x 4		10Ω
Antenna		80PF 75Ω		
Tuning type		PLL synthesized type		
Frequency range / Channel space	FM	87.5~108 MHz / 100KHz (General) 87.5~108 MHz / 50KHz (Europe)		
	AM	531~160 KHz / 9KHz (General)		

SPEAKER

Item	Specification						
Model	Front	Rear	Tweeter	-	-		
Input power	Max 25W	Max 25W	Max 40W	-	-		
Impedance	4±0.6Ω	4±0.6Ω	4±0.6Ω	-	-		
Audio external amplifier	Front	Rear	Tweeter	Center	Sub woofer		
Input power	Max 25W	Max 25W	Max 40W	Max 32W	Max 64W		
Impedance	2±0.4Ω	2±0.4Ω	4±0.6Ω	2.15±0.25Ω	1.35±0.25Ω		
DVD external amplifier	Front	Rear	Tweeter	Center	Sub woofer	Rear center	Sliding door
Input power	Max 25W	Max 25W	Max 40W	Max 32W	Max 64W	Max 32W	Max 32W
Impedance	4±0.6Ω	4±0.6Ω	4±0.6Ω	2±0.25Ω	1.35±0.25Ω	2±0.25Ω	2±0.6Ω

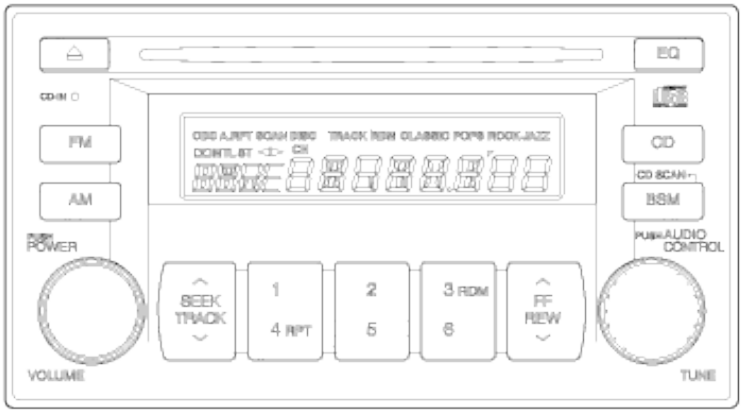
EXTERNAL AMPLIFIER

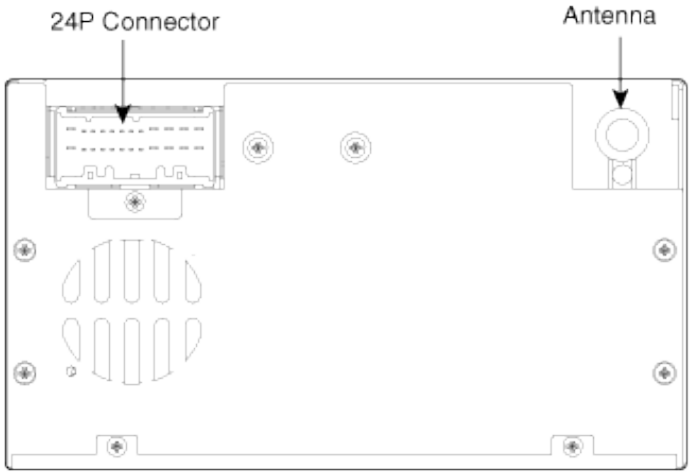
Item	Audio
Power supply	DC 14.4V
Output power	45W x 7ch
Speaker impedance	2 ± 0.6Ω

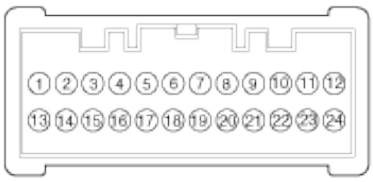
Audio Unit

COMPONENT LOCATION

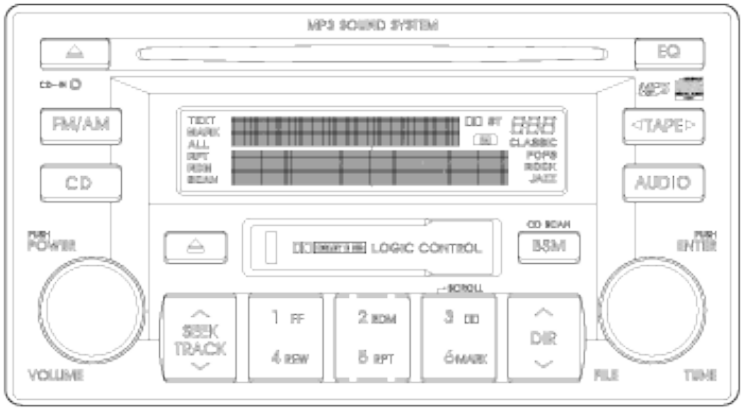
AM/FM/CDP (M445)

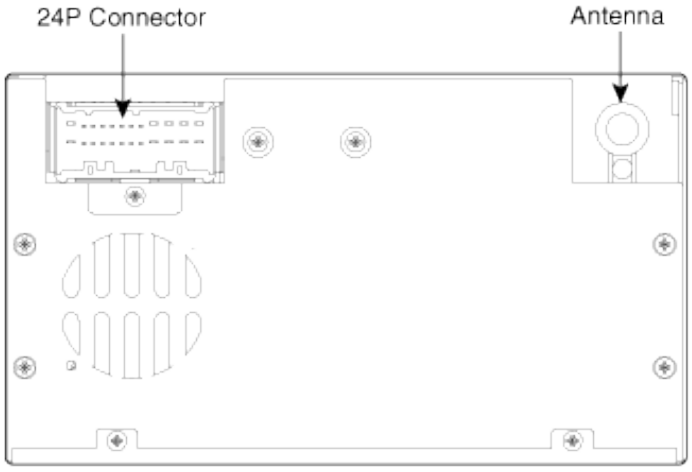


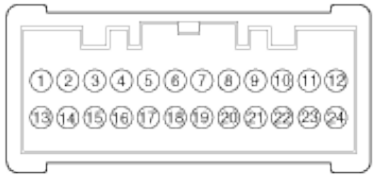


24P Connector	Pin	Description	Pin	Description
	1	Front left speaker (+)	13	Front left speaker (-)
	2	Front right speaker (+)	14	Front right speaker (-)
	3	Rear right speaker (+)	15	Rear right speaker (-)
	4	Rear left speaker (+)	16	Rear left speaker (-)
	5	Illumination (+)	17	Illumination (-)
	6	Steering remote control	18	Remote control ground
	7	-	19	TEL MUTE
	8	-	20	P-GND
	9	-	21	-
	10	-	22	-
	11	ACC	23	Antenna B+
	12	Battery +	24	Ground

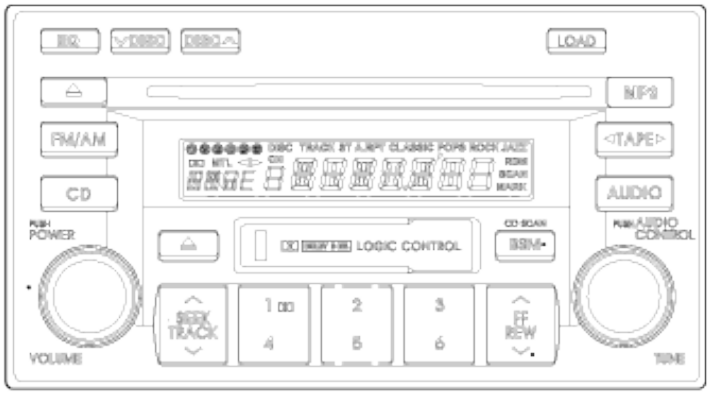
AM/FM/Cassette/MP3 (M455)

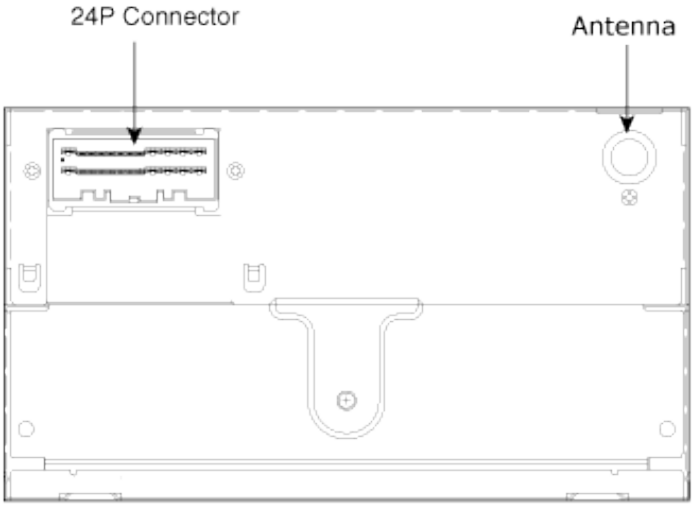


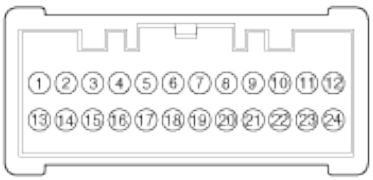


24P Connector	Pin	Description	Pin	Description
	1	Front left speaker (+)	13	Front left speaker (-)
	2	Front right speaker (+)	14	Front right speaker (-)
	3	Rear right speaker (+)	15	Rear right speaker (-)
	4	Rear left speaker (+)	16	Rear left speaker (-)
	5	Illumination (+)	17	Illumination (-)
	6	Steering remote control	18	Remote control ground
	7	-	19	TEL MUTE
	8	-	20	P-GND
	9	-	21	-
	10	-	22	-
	11	ACC	23	Antenna B+
	12	Battery +	24	Ground

AM/FM/Cassette/6CDC/MP3 (M465)



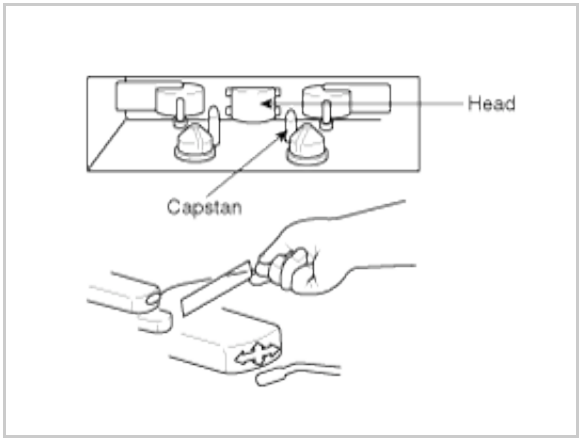


24P Connector	Pin	Description	Pin	Description
	1	Front left speaker (+)	13	Front left speaker (-)
	2	Front right speaker (+)	14	Front right speaker (-)
	3	Rear right speaker (+)	15	Rear right speaker (-)
	4	Rear left speaker (+)	16	Rear left speaker (-)
	5	Illumination (+)	17	Illumination (-)
	6	Steering remote control	18	Remote control ground
	7	Rear- arm remote control	19	TEL MUTE
	8	AUX GND	20	EQ SEL
	9	AUX IN(L)	21	AUX IN(R)
	10	REMOTE	22	SURROUND
	11	ACC	23	Antenna B+
	12	Battery	24	Ground

INSPECTION

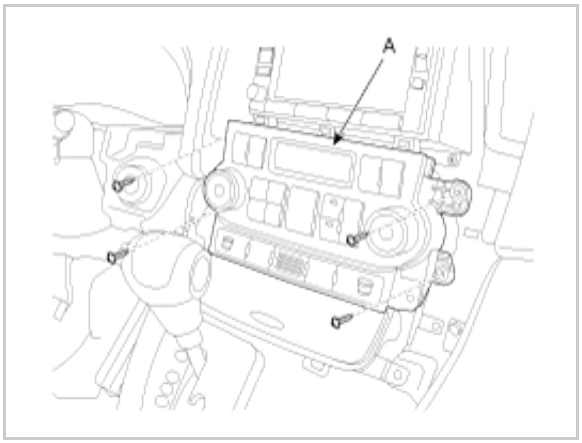
TAPE HEAD AND CAPSTAN CLEANING

1. To obtain optimum performance, clean the head, and capstan as often as necessary, depending on frequency of use and tape cleanness.
2. To clean the tape head and capstan, use a cotton swab dipped in ordinary rubbing alcohol. Wipe the head and capstan.

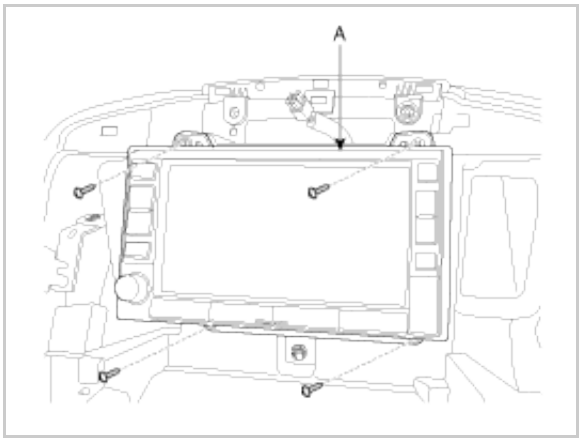


REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the center facia panel, console lower cover, center air vent, switches, tray and heater control panel (A). (Refer to the Body group-Crash pad)



3. Remove the mounting 4 screws then remove the audio unit (A).

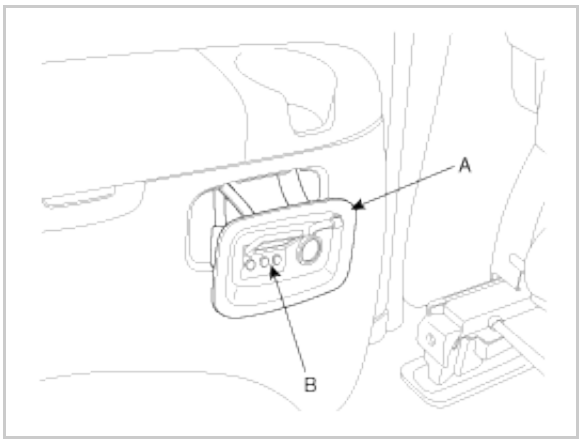


4. Installation is the reverse of removal.

VIDEO JACK (DVD ONLY)

1. Disconnect the negative (-) battery terminal.

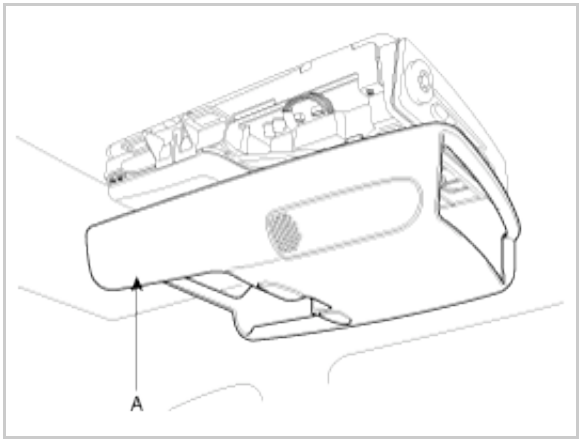
2. Remove the video jack cover (A). And then remove the video jack (B).



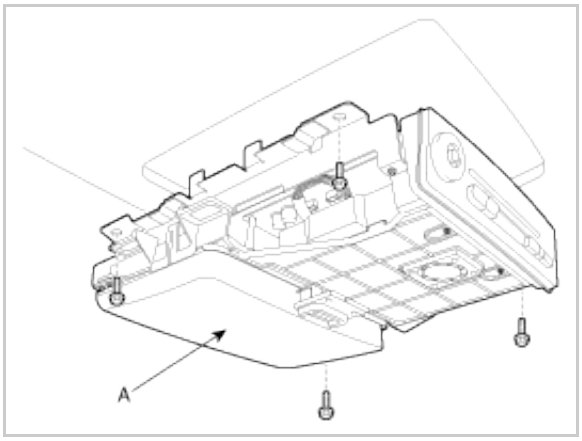
3. Installation is the reverse of removal.

REAR SEAT ENTERTAINMENT (DVD ONLY)

1. Disconnect the negative (-) battery terminal.
2. Remove the DVD rear monitor cover (A) and disconnect the interior lamp connector.



3. Remove the DVD rear monitor (A) mounting screws (4EA) and disconnect the DVD rear monitor connector.



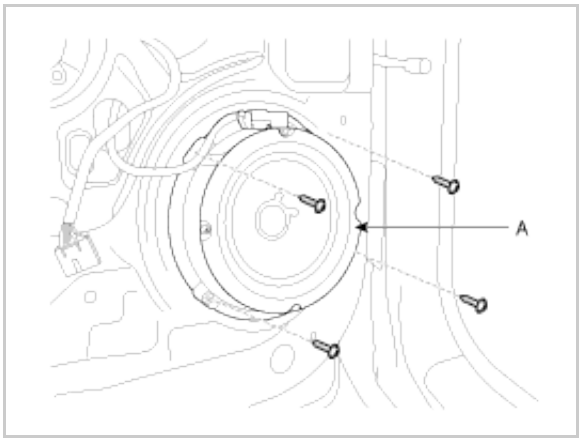
4. Installation is the reverse of removal.

Speakers

REPLACEMENT

FRONT SPEAKER

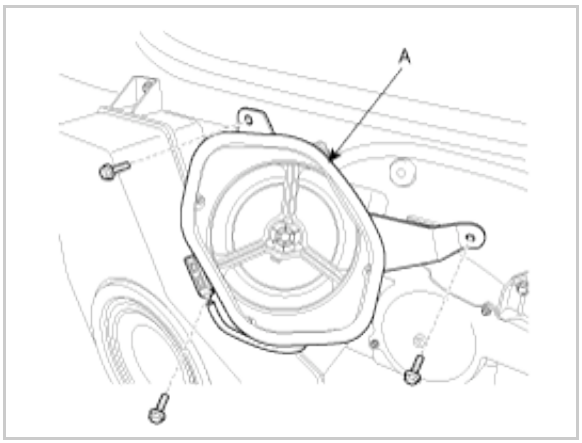
1. Remove the front door trim panel (Refer to the Body group - front door).
2. Remove the front speaker (A) after removing 4 screw.



3. Installation is the reverse of removal.

REAR SIDE SPEAKER

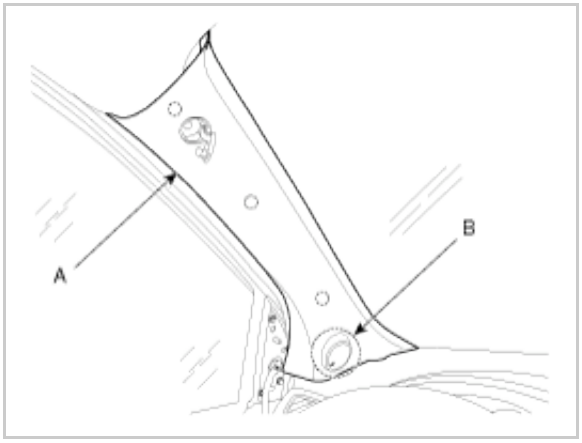
1. Remove the rear seats (Refer to the Body group - Rear seat door).
2. Remove the luggage trim after removing 4 bolts.
3. Remove the rear side speaker(A) (Refer to the Body group - Rear seat).

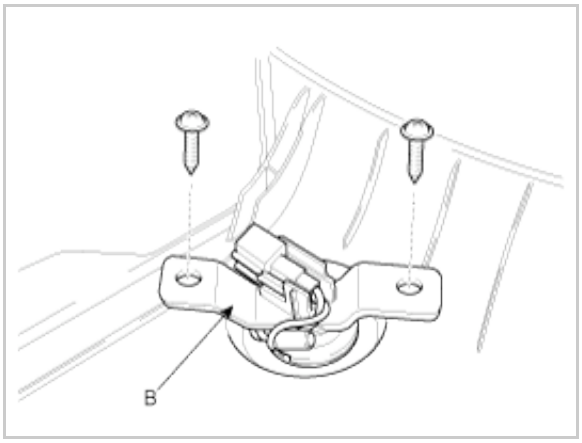


4. Installation is the reverse of removal.

TWEETER SPEAKER

1. Remove the tweeter speaker (B) after removing the front filler trim(A) and disconnecting the connector.

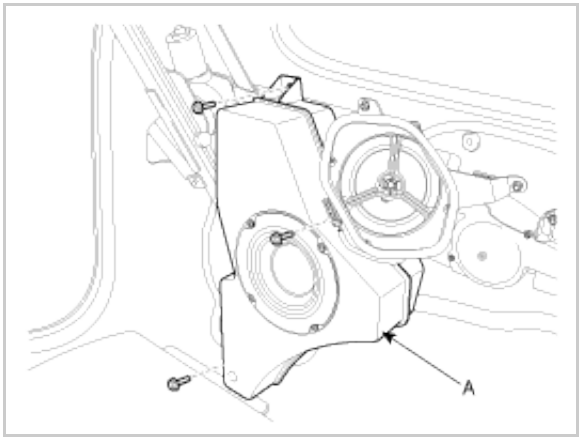




2. Installation is the reverse of removal.

WOOFER SPEAKER

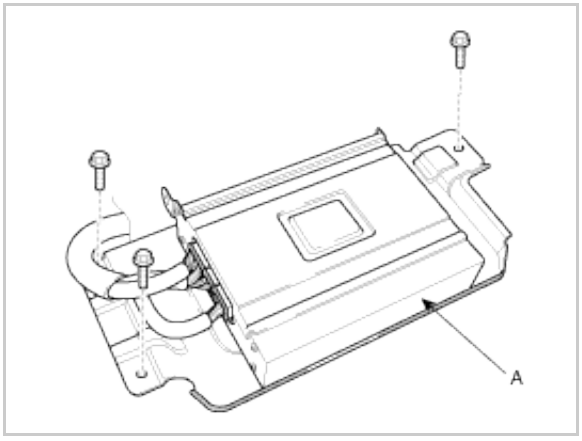
1. Remove the rear seats. (Refer to the Body group - rear seats)
2. Remove the luggage side trim (Refer to the Body group - interior trim)
3. Remove the woofer speaker (A) after removing 4 bolts.



4. Installation is the reverse of removal.

EXTERNAL AMPLIFIER

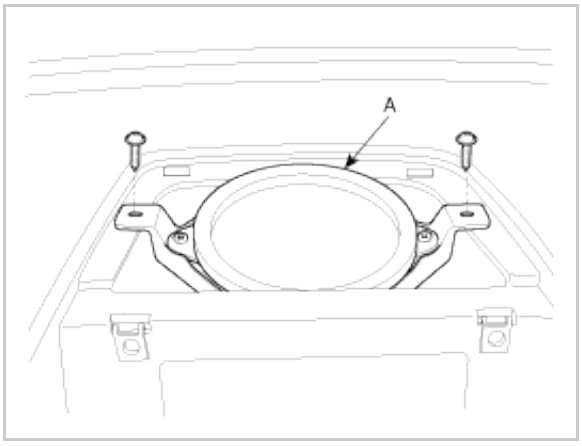
1. Remove the driver seat. (Refer to the Body group - front seats)
2. Remove the external amplifier (A) after removing 3 bolts.



3. Installation is the reverse of removal.

FRONT CENTER SPEAKER

1. Remove the center facia panel.(Refer to the Body group - crash pad)

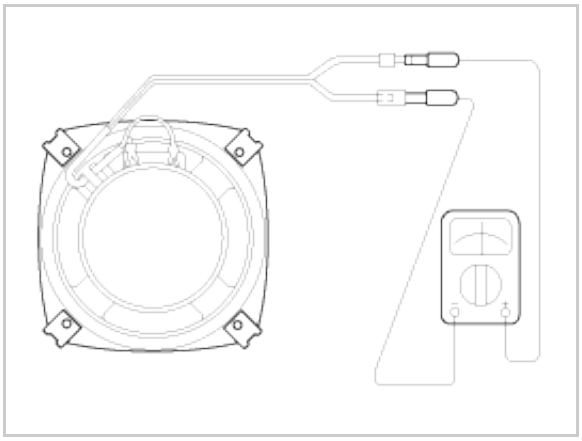


2. Installation is the reverse of removal.

INSPECTION

1. Check the speaker with an ohmmeter. If an ohmmeter indicates the correct impedance of the speaker when checking between the speaker (+) and speaker (-) of the same channel, the speaker is ok.

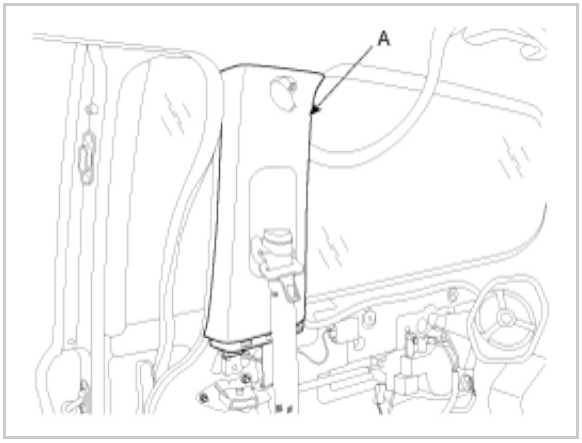
Specified impedance : 2~4 Ω



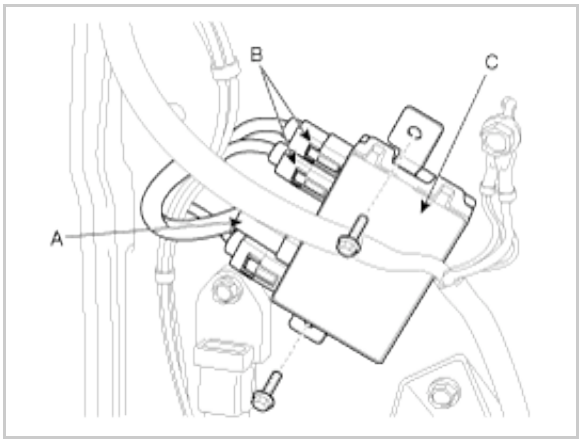
Antenna

REPLACEMENT

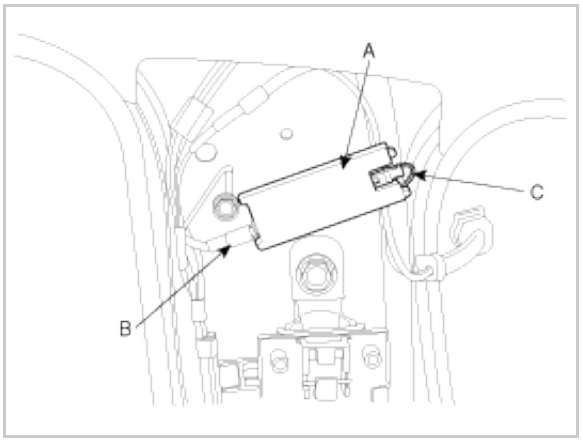
1. Remove the right C filler trim(A) and luggage side trim. (Refer to Body group-Interior trim).



2. Remove the diversity(C) after removing 1P connector (A) and radio feeder cable (B).



3. Remove the glass antenna radio amplifier (A) - Left/Right each 1 ea- after removing radio feeder cable (B) and amplifier wiring (C) from the glass antenna radio amplifier (A).

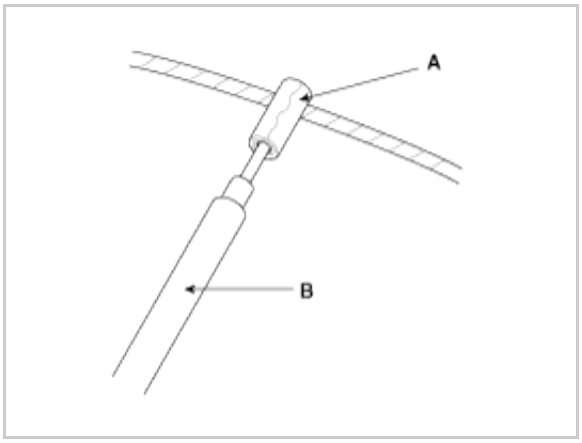


4. Installation is the reverse of removal.

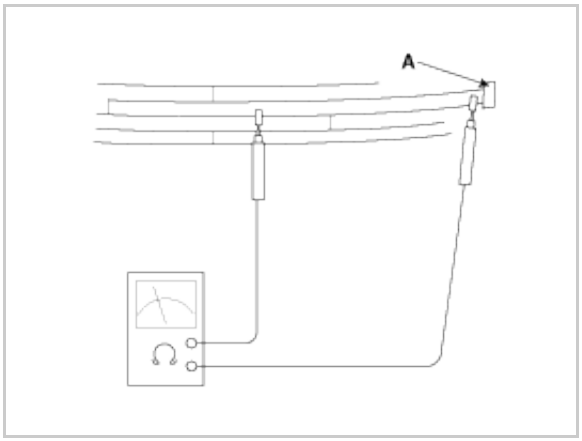
INSPECTION

GLASS ANTENNA TEST

1. Wrap aluminum foil (A) around the tip of the tester probe (B) as shown.



2. Touch one tester probe to the glass antenna terminal (A) hear, and move the other tester probe along the antenna wires to check that continuity exists.

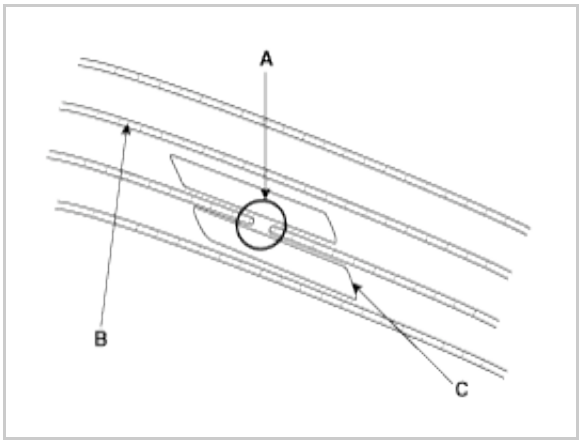


GLASS ANTENNA REPAIR

NOTICE

To make an effective repair, the broken section must be no longer than one inch.

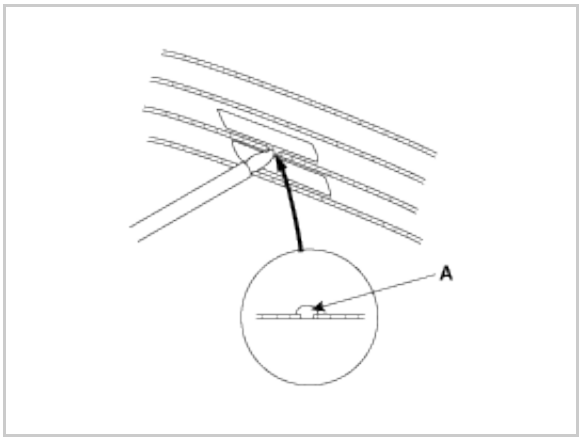
1. Lightly rub the area around the broken section (A) with fine steel wool, and then clean it with alcohol.



2. Carefully mask above and below the broken portion of the glass antenna wire (B) with cellophane tape (C).
3. Using a small brush, apply a heavy coat of silver conductive paint (A) extending about 1/8"on both sides of the break. Allow 30 minutes to dry.

NOTICE

Thoroughly mix the paint before use.

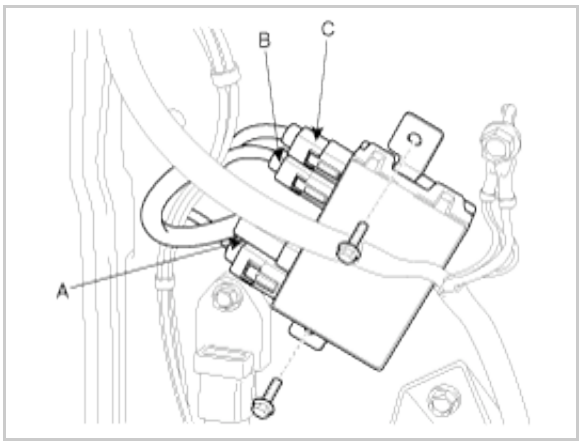


4. Check for continuity in the repaired wire.
5. Apply a second coat of paint in the same way. Let it dry three hours before removing the tape.

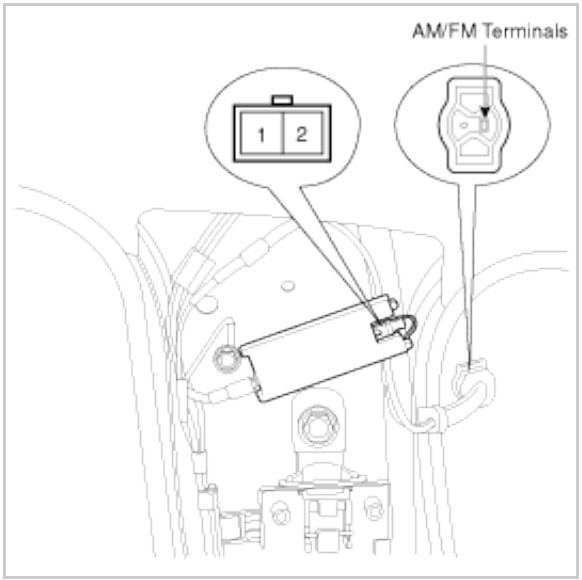
DIVERSITY & RADIO AMPLIFIER INSPECTION

1. Disconnect power connector 1P (A) from the diversity.
2. Turn the radio ON.
   Measure the voltage between the harness side power connector and body ground.

OK : approximately 12V (ACC+)



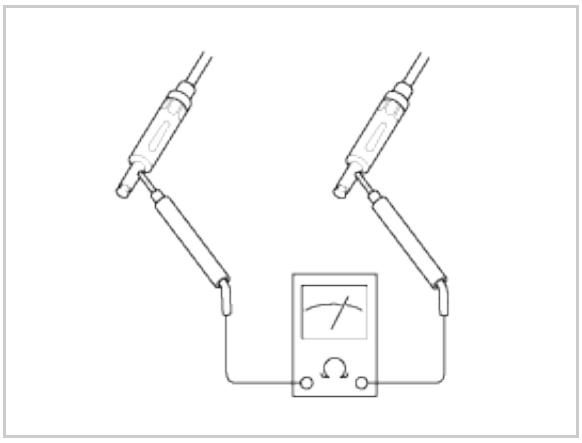
3. Remove the radio feeder cable from the diversity and radio amp.
4. Check for continuity between diversity and right side radio amp feeder cable (B).
5. Check for continuity between diversity and left side radio amplifier feeder cable (C).
6. Disconnect the 2P power connector from the glass antenna radio amplifier.



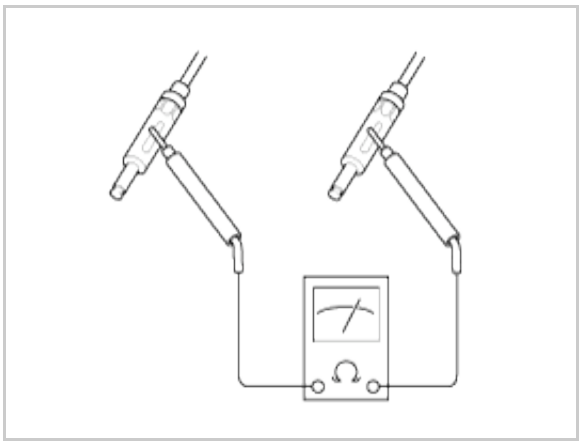
7. Check for continuity between terminals of harness side connector and antenna grid terminals (AM, FM).
8. Check the grid lines for continuity.
9. When a poor radio reception is not repaired through the above inspection methods, replace the amp. If the radio reception is still poor, check the radio cable for short and radio head unit for failure.

ANTENNA CABLE

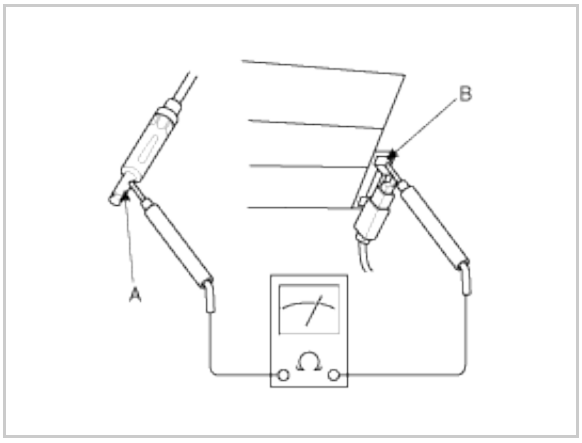
1. Remove the antenna jack from the audio unit and antenna.
2. Check for continuity between the center poles of antenna cable.



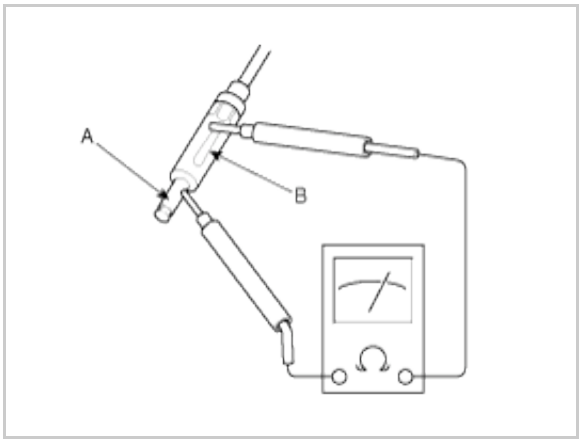
3. Check for continuity between the outer poles of antenna cable. There should be continuity.



4. If there is no continuity, replace the antenna cable.
5. Check for continuity between the center pole of antenna cable and terminal of glass antenna. There should be continuity.



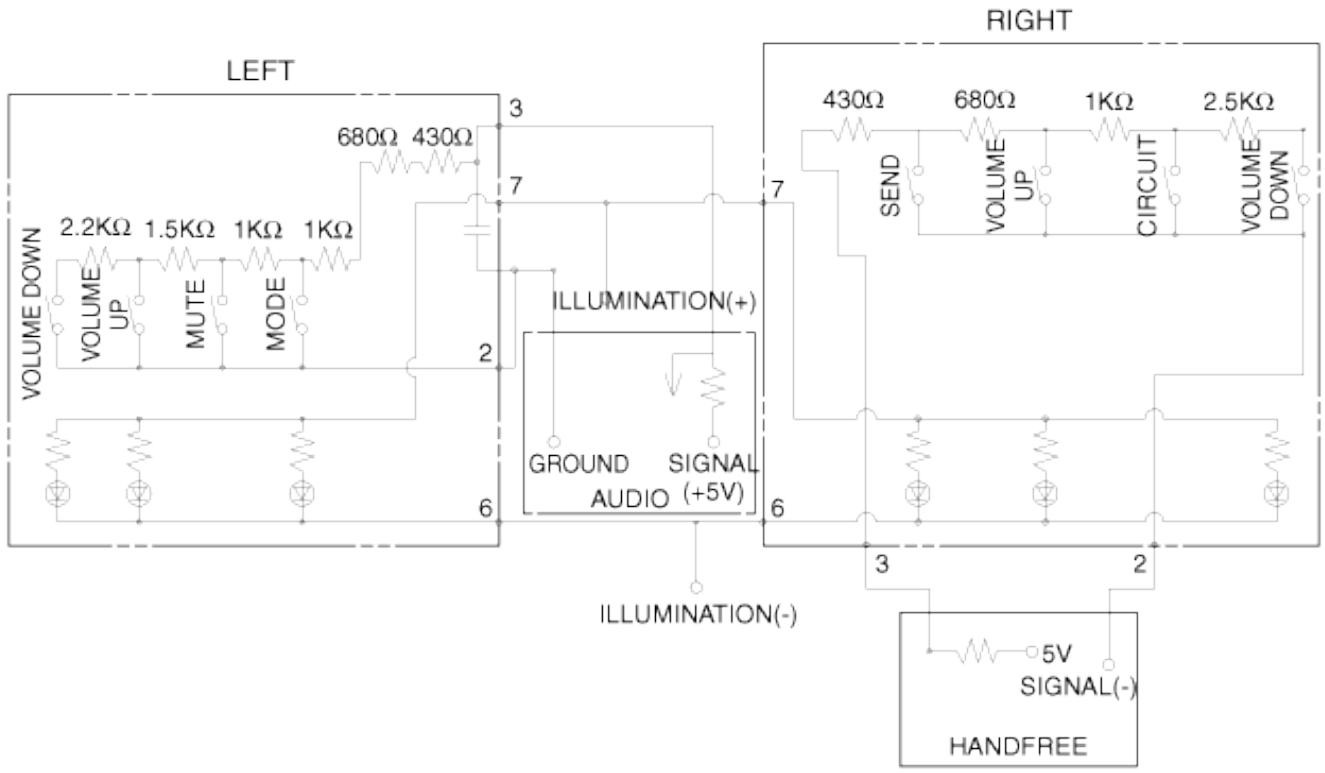
6. If there is no continuity, replace the antenna amplifier.
7. Check for continuity between the center pole (A) and outer pole (B) of antenna cable. There should be no continuity.



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

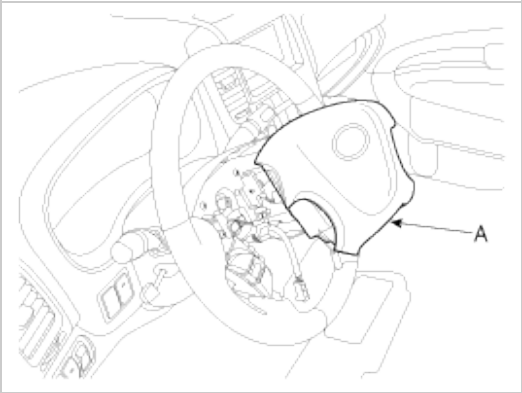
Audio Remote Control

CIRCUIT DIAGRAM

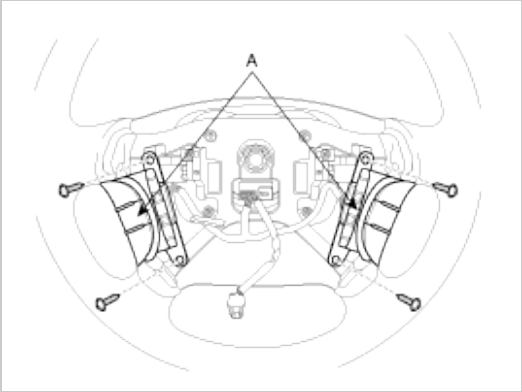


REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the driver airbag module(A). (Refer to the airbag group).



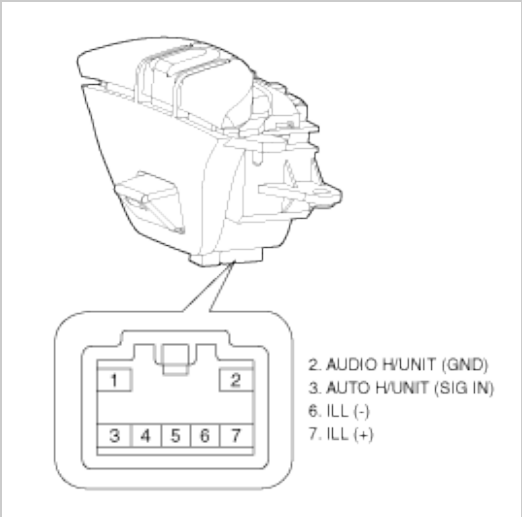
3. Remove the audio remote control switch (A) after removing the steering wheel remote control switch connector and 2 screws.



4. Installation is the reverse of removal.

INSPECTION

1. Check for resistance between No.2 and No.3 terminals in each switch position.

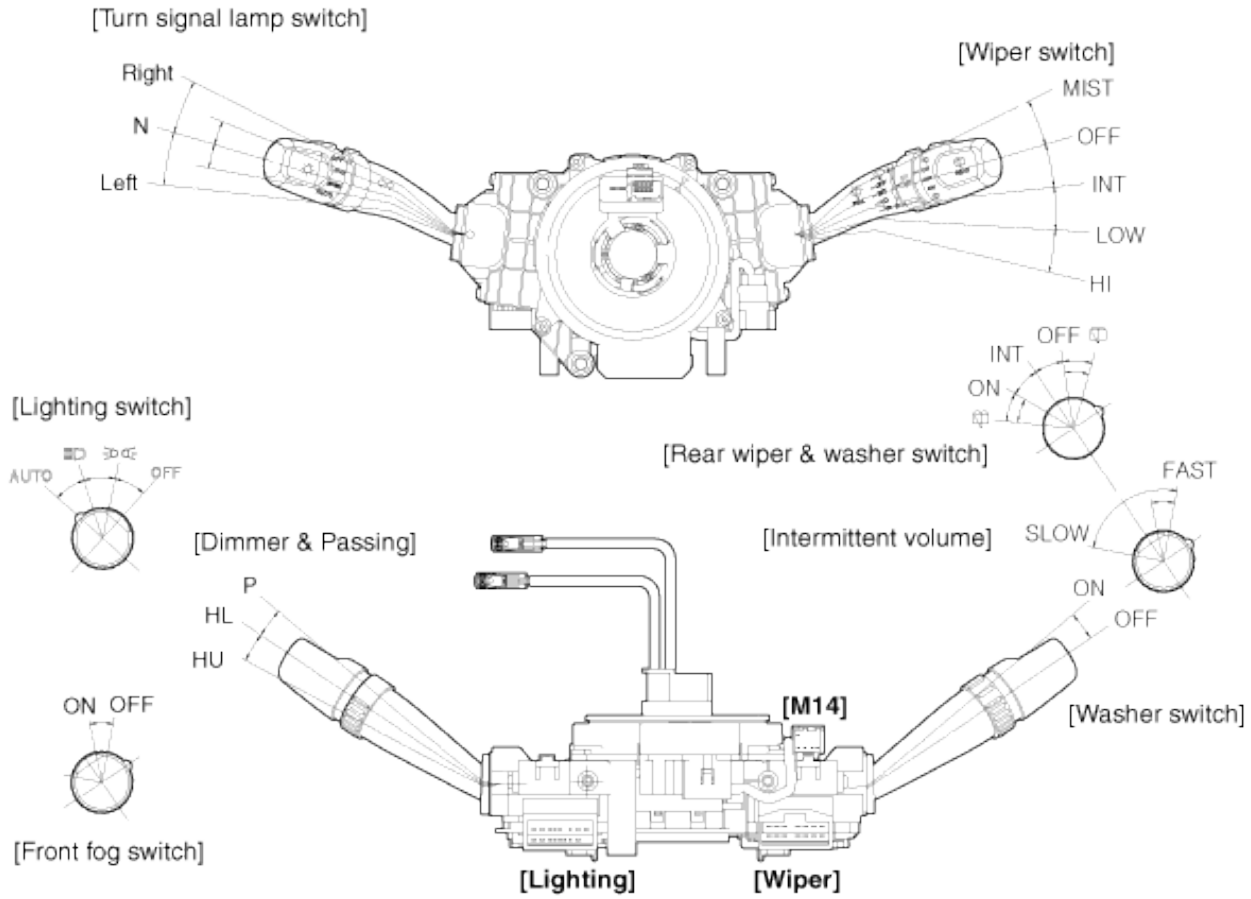


Switch	Connector terminal	Resistance (±5%)
MODE	2 - 3 (Left)	2.11 kΩ
MUTE	2 - 3 (Left)	3.11 kΩ
VOLUME UP	2 - 3 (Left)	4.61 kΩ
VOLUME DOWN	2 - 3 (Left)	5.81 kΩ

Multifunction Switch

COMPONENT LOCATION

[LHD]



[Lighting]

1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18

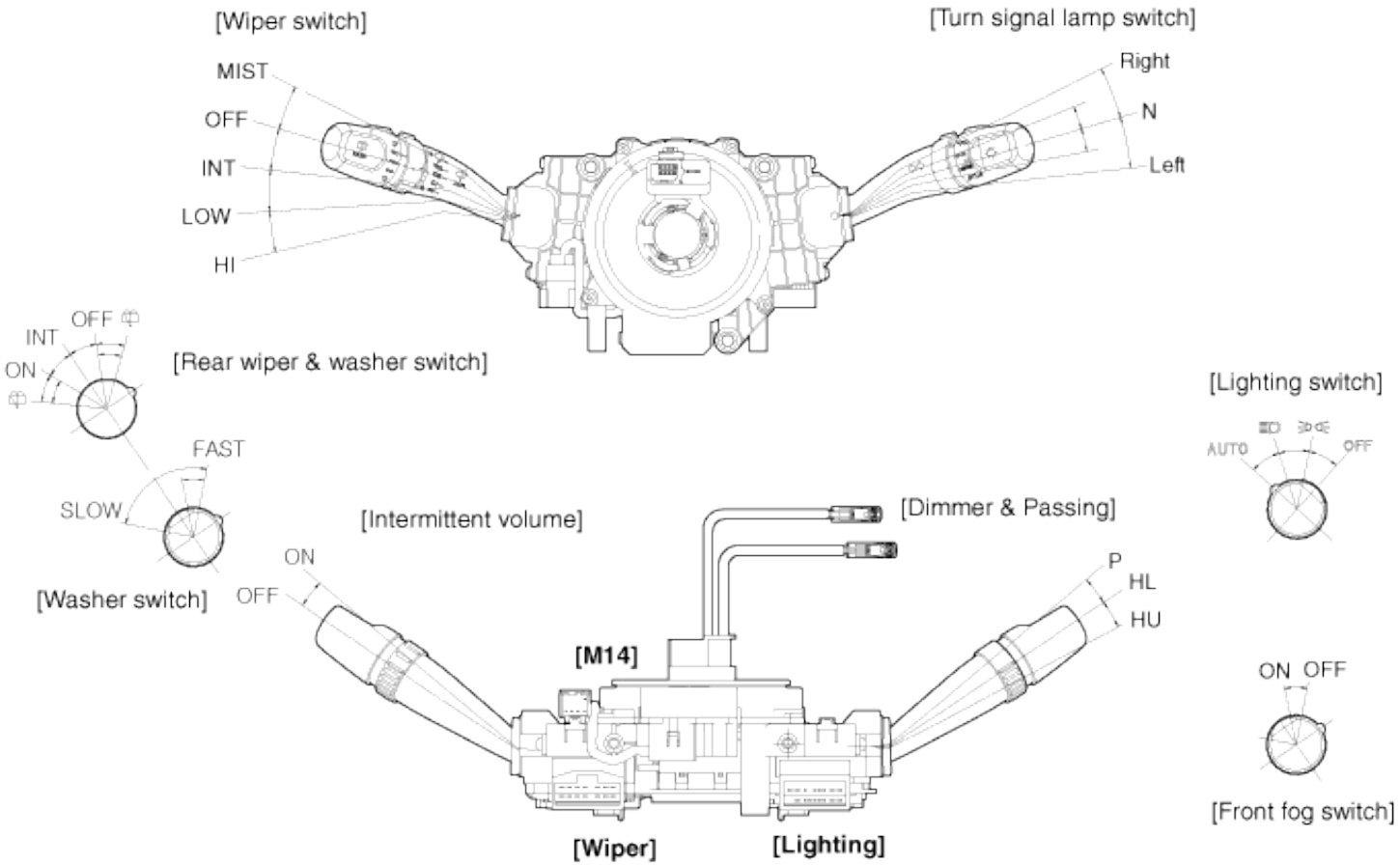
[Wiper]

1	2	3	4	5	6	7
8	9	10	11	12	13	14

Circuit connection

Connector Name	Terminal No.	Description	Connector Name	Terminal No.	Description
Lighting	1	Head lamp passing	Wiper	1	Wiper high speed
	2	Head lamp high beam power		2	Wiper low speed
	7	Turn signal lamp (RH)		3	Wiper parking
	8	Flasher unit power		4	Mist switch
	9	Turn signal lamp (LH)		5	Wiper & washer power
	10	Head lamp low beam power		6	Intermittent wiper
	11	Dimmer & passing ground		7	Front washer switch
	12	Front fog switch		8	-
	13	Front fog switch ground		9	Rear wiper & washer ground
	14	Tail lamp switch		10	Intermittent rear wiper
	15	Head lamp switch		11	Rear wiper
	16	Auto light switch		12	Rear washer
	17	Lighting switch ground		13	Intermittent wiper volume
	18	-		14	Intermittent wiper ground

[RHD]



[Wiper]

1	2	3	4	5	6	7
8	9	10	11	12	13	14

[Lighting]

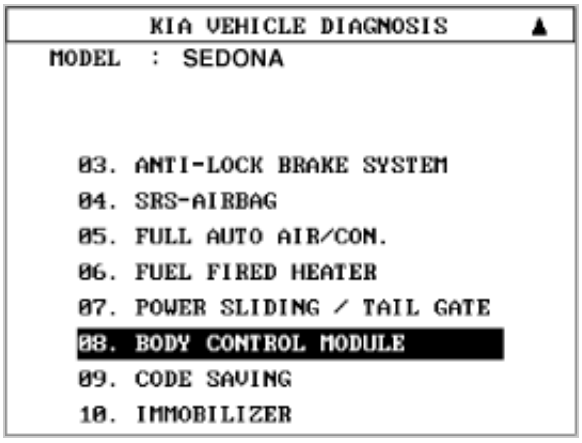
1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18

Circuit connection

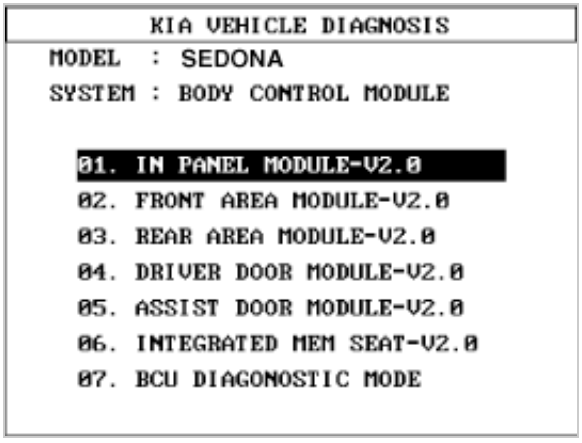
Connector Name	Terminal No.	Description	Connector Name	Terminal No.	Description
Wiper	1	Front washer switch	**Lighting**	1	Turn signal lamp (RH)
	2	Intermittent wiper		2	Flasher unit power
	3	Wiper & washer power		7	Turn signal lamp (LH)
	4	Mist switch		8	Head lamp high beam power
	5	Wiper parking		9	Head lamp passing
	6	Wiper low speed		10	-
	7	Wiper high speed		11	Front fog switch
	8	-		12	Front fog switch ground
	9	Rear wiper & washer ground		13	Tail lamp switch
	10	Intermittent rear wiper		14	Head lamp switch
	11	Rear wiper		15	Auto light switch
	12	Rear washer		16	Lighting switch ground
	13	Intermittent wiper volume		17	Dimmer & passing ground
	14	Intermittent wiper ground		18	Head lamp low beam power

INSPECTION

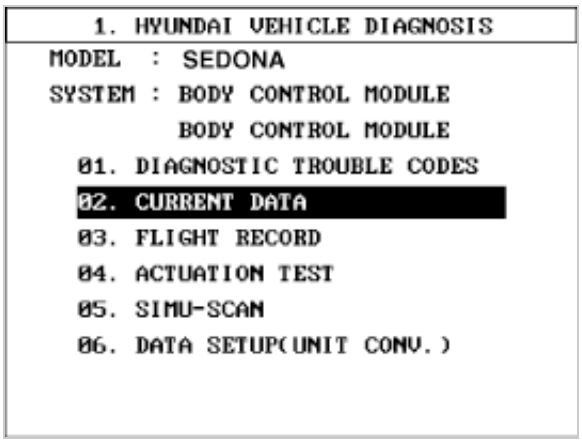
1. Multi function switch operates head lamps and wiper through LIN communication with BCM.
2. Check BCM input/output specification of multi function switch using the scan tool. If the specification is abnormal, replace the head lamp or wiper switch.
3. If diagnosis is required on the multi function switch, select "SEDONA" and "BCM".

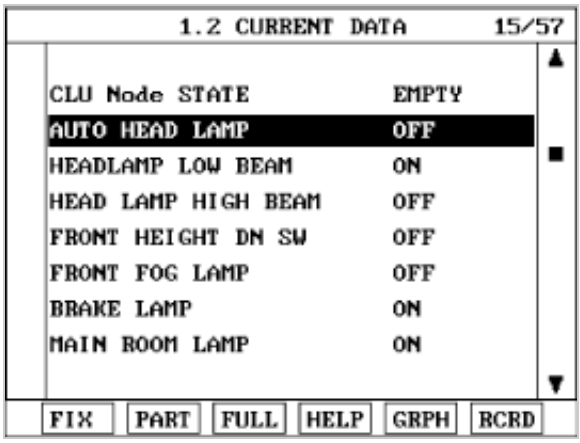


4. Select "In panel Module".



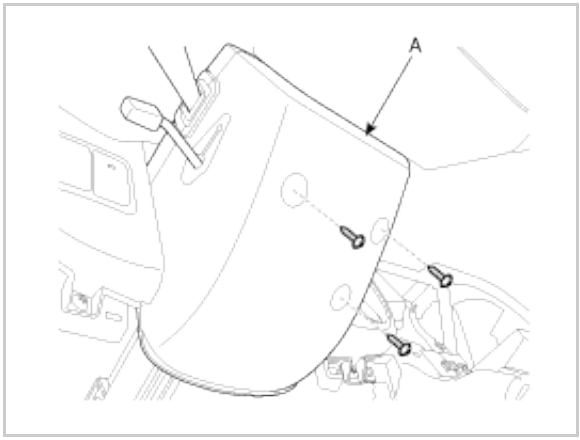
5. Select "Current data" and check the input/output condition of BCM.





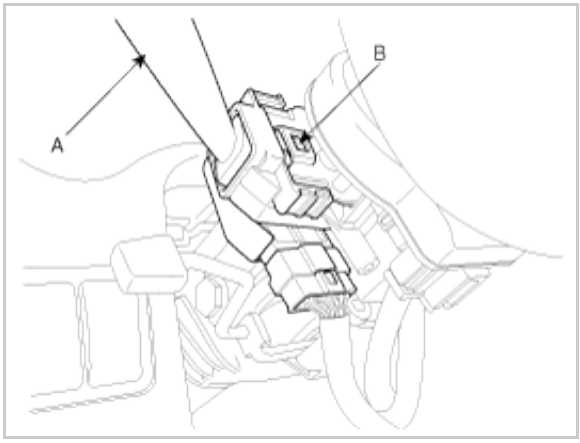
REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the steering column upper and lower shrouds (A) after removing 3 screws.

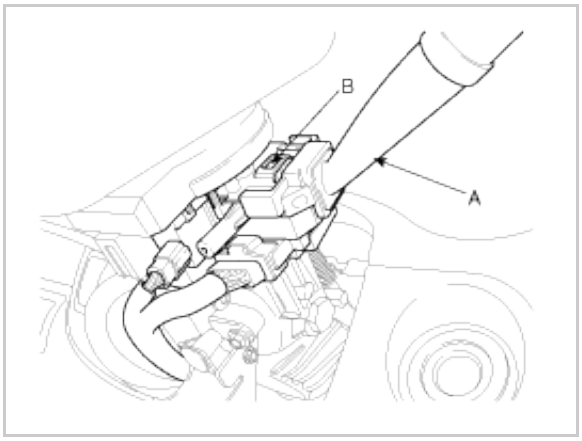


3. Disconnect the light switch(A) connector and pin(B).

[LHD]

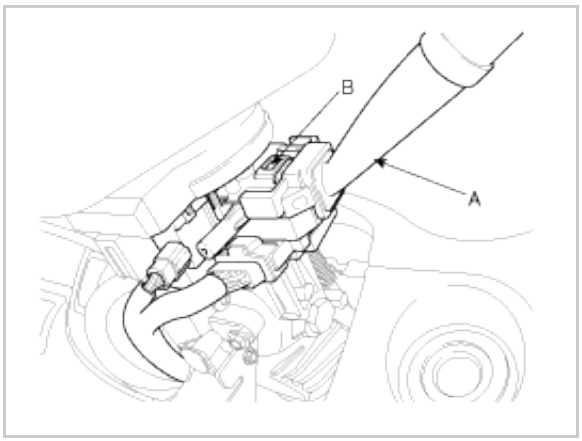


[RHD]

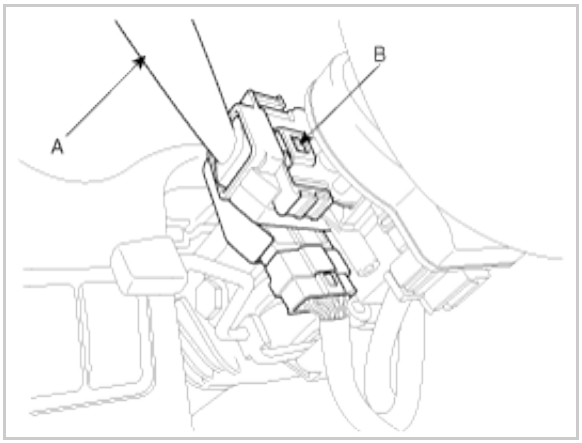


4. Remove the wiper switch (A) after disconnecting the connector and pin(B).

[LHD]



[RHD]

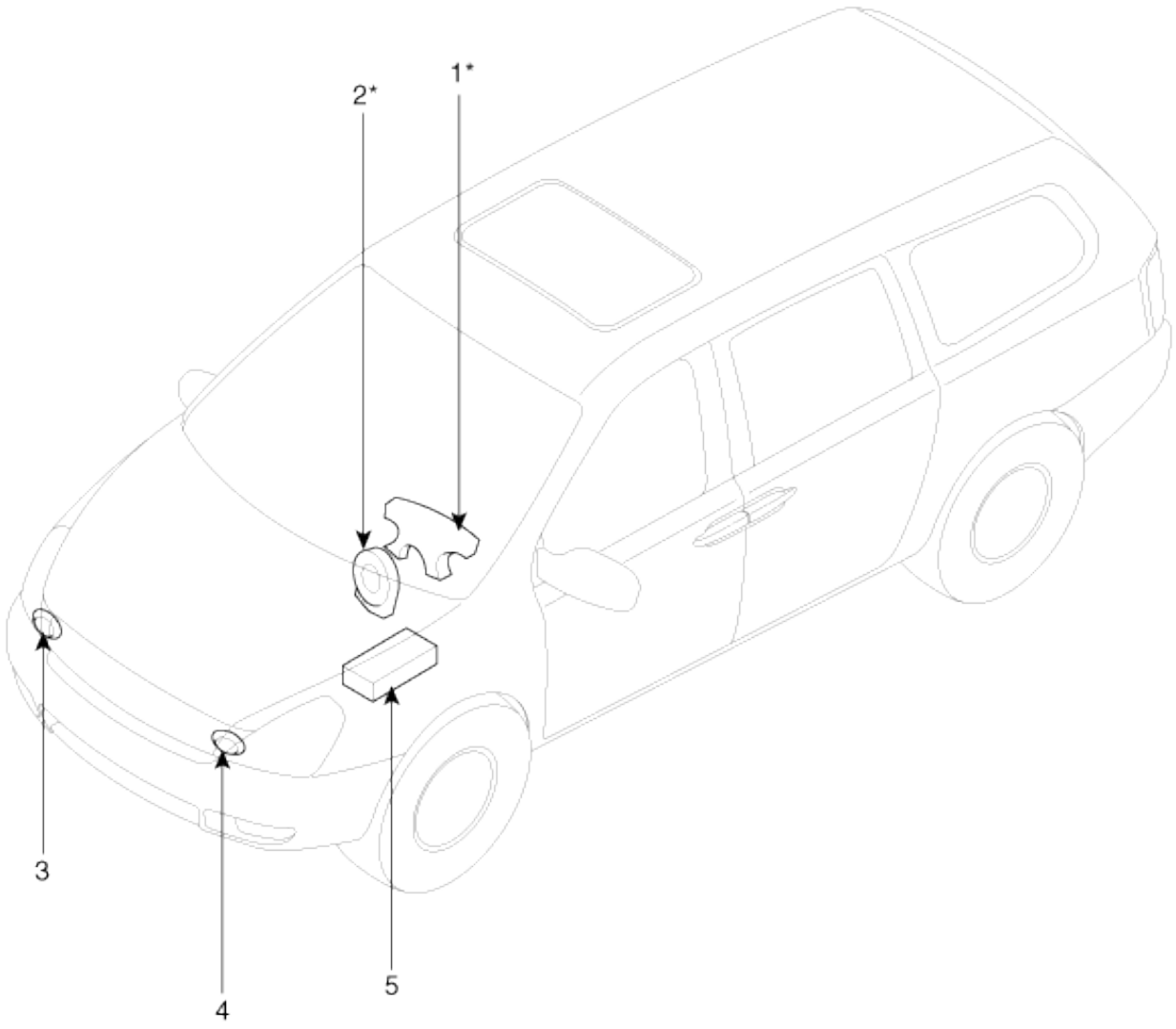


5. Installation is the reverse of removal.

Horn

COMPONENT LOCATION

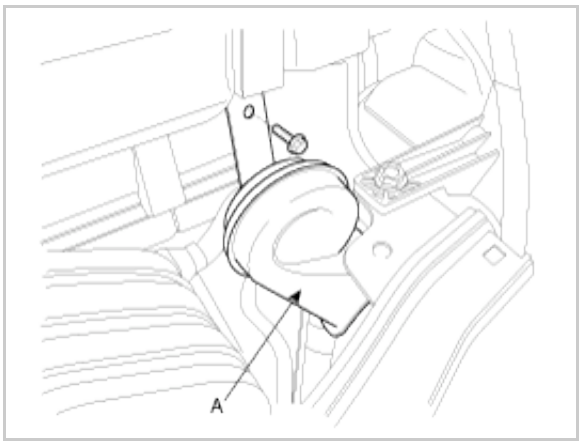
The parts with asterisk(*) :
This illustration is shows the LHD type.
RHD type is symmetrical.



1. Horn switch
2. Clock spring
3. Horn (Low pitch)
4. Horn (High pitch)
5. Horn relay

REPLACEMENT

1. Remove the bolt from the high pitch horn and the low pitch horn and disconnect the horn connector, then remove the horn.



2. Installation is the reverse of removal.

INSPECTION

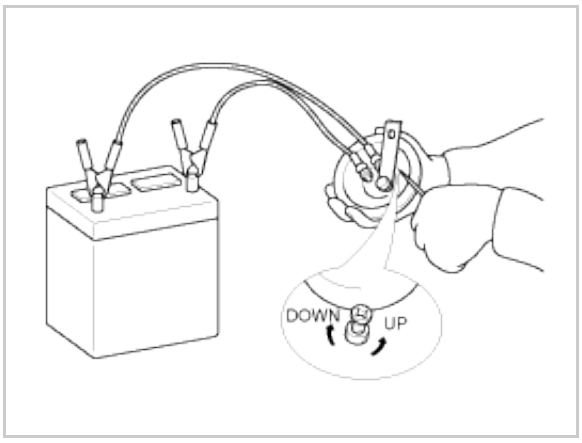
Test the horn by connecting battery voltage to the terminal 1, and ground terminal 2.
The horn should make a sound. If the horn fails to make a sound, replace it.

ADJUSTMENT

Operate the horn, and adjust the tone to a suitable level by turning the adjusting screw.

NOTICE

After adjustment, apply a small amount of paint around the screw head to keep it from loosening.



Keyless Entry
And
Burglar Alarm

DESCRIPTION

KEYLESS ENTRY SYSTEM

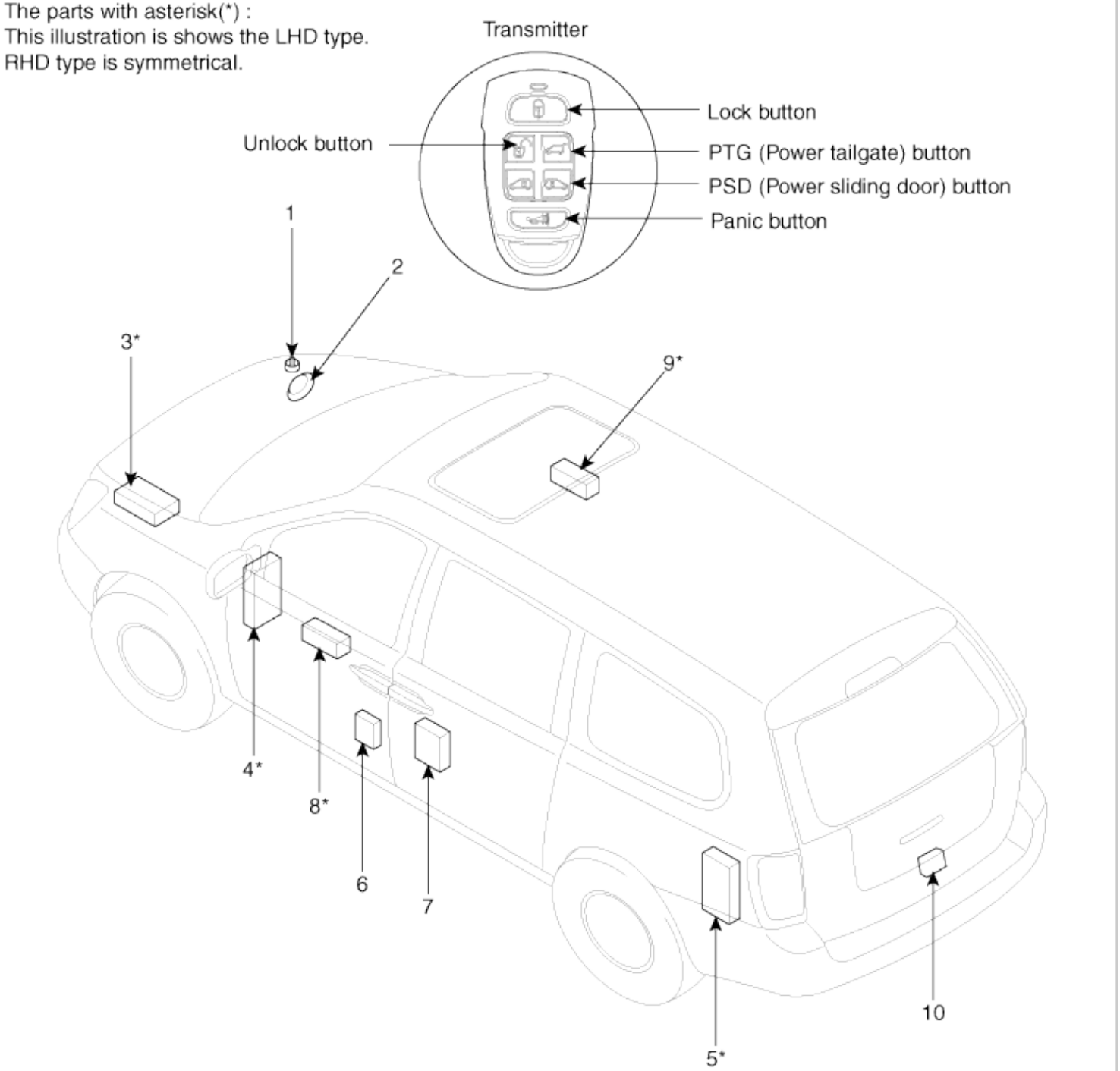
The keyless entry system uses a handheld transmitter and IPM-mounted receiver to control door locks, alarm functions, Power Tail Gate (PTG) and Power Sliding Doors (PSD).

NOTICE

The receiver of the keyless entry system are built-in the IPM(In-Panel Module).

COMPONENT LOCATION

The parts with asterisk(*) :
This illustration is shows the LHD type.
RHD type is symmetrical.

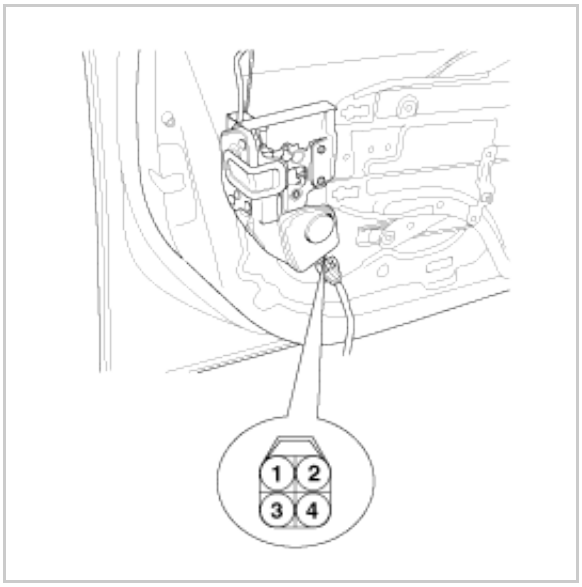


1. Hood switch
2. Burglar horn
3. FAM (Front Area Module)
4. IPM (In-Panel Module)
5. RAM (Rear Area Module)
6. Front door lock actuator
7. Sliding door lock actuator
8. DDM (Driver Door Module)
9. ADM (Assistant Door Module)
10. Tailgate lock actuator

INSPECTION

FRONT DOOR LOCK ACTUATOR

1. Remove the front door trim panel. (Refer to the Body group - front door)
2. Disconnect the 4P connector from the actuator.

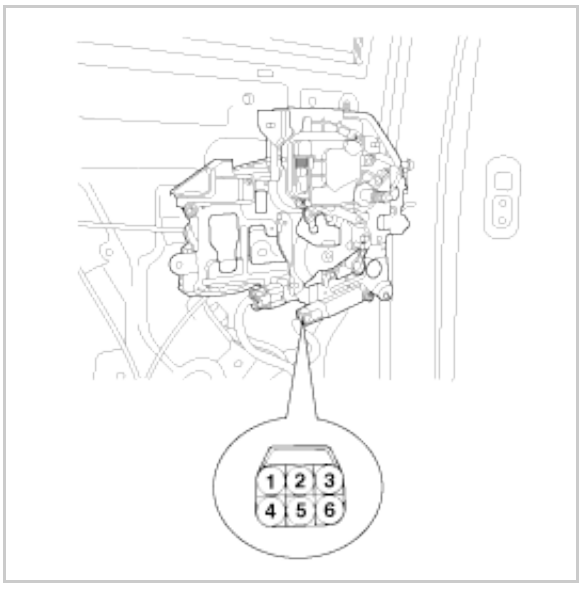


3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal		2	4
Front left	Lock	⊖	⊕
	Unlock	⊕	⊖
Front right	Lock	⊖	⊕
	Unlock	⊕	⊖

SLIDING DOOR LOCK ACTUATOR

1. Remove the sliding door trim panel. (Refer to the Body group - rear door)
2. Disconnect the 6P connector from the actuator.

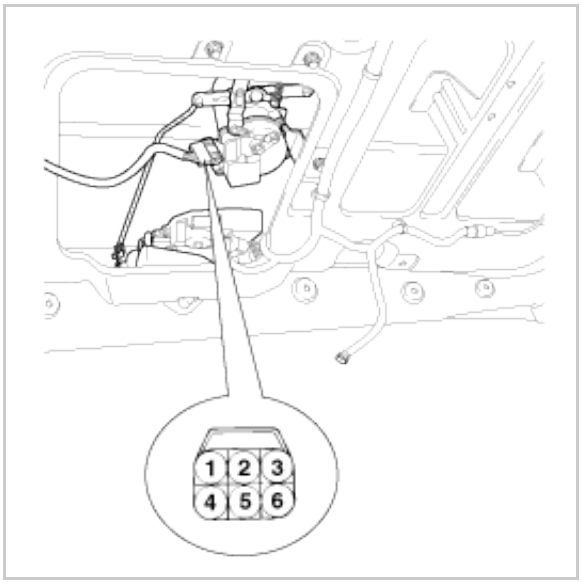


3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal		1	2	3
Left	Lock		⊕	⊖
	Unlock		⊖	⊕
Right	Lock	⊕	⊖	
	Unlock	⊖	⊕	

TAILGATE LOCK ACTUATOR (5DOORS)

1. Remove the tailgate trim panel. (Refer to the Body group - tailgate)
2. Disconnect the 6P connector from the actuator.

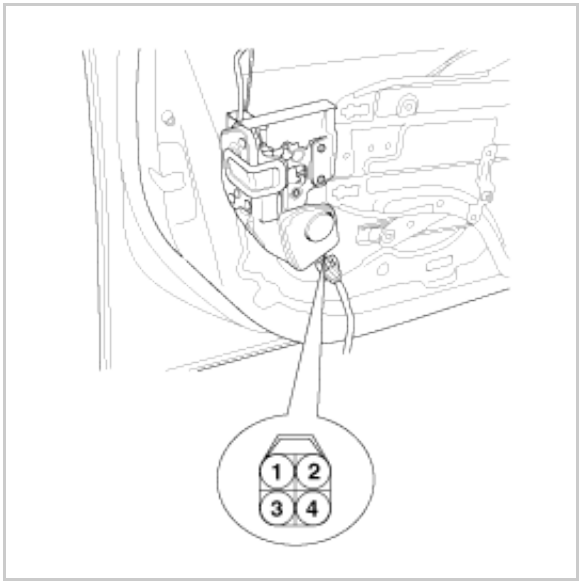


3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal	4	6
LOCK	⊕	⊖
UNLOCK	⊖	⊕

FRONT DOOR LOCK SWITCH

1. Remove the front door trim panel. (Refer to the Body group - front door)
2. Disconnect the 4P connector from the actuator.

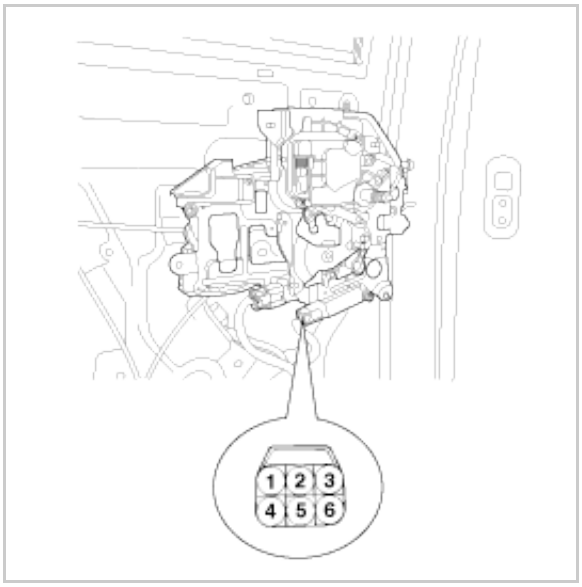


3. Check for continuity between the terminals in each switch position according to the table.

Position \ Terminal		1	2	3
Front left	Lock			
	Unlock	○		○
Front right	Lock			
	Unlock	○		○

SLIDING DOOR LOCK SWITCH

1. Remove the sliding door trim panel. (Refer to the Body group - rear door)
2. Disconnect the 6P connector from the actuator.

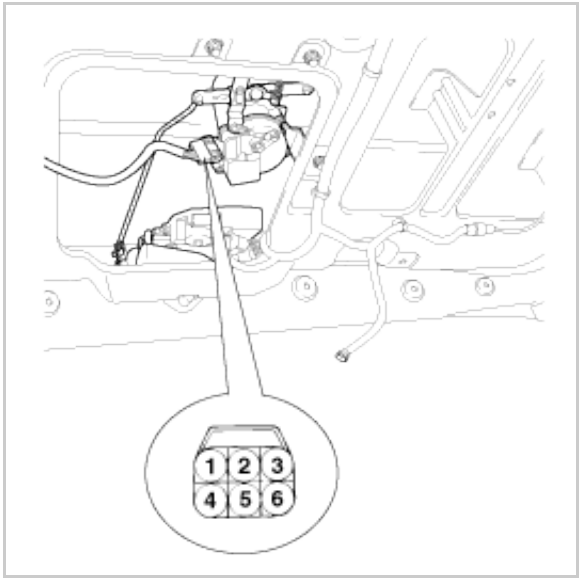


3. Check for continuity between the terminals in each switch position according to the table.

Position \ Terminal		4	5	6
Left	Lock			
	Unlock	○	○	
Right	Lock			
	Unlock		○	○

TAILGATE LOCK SWITCH

1. Remove the tailgate trim panel. (Refer to the Body group - tailgate)
2. Disconnect the 6P connector from the actuator.

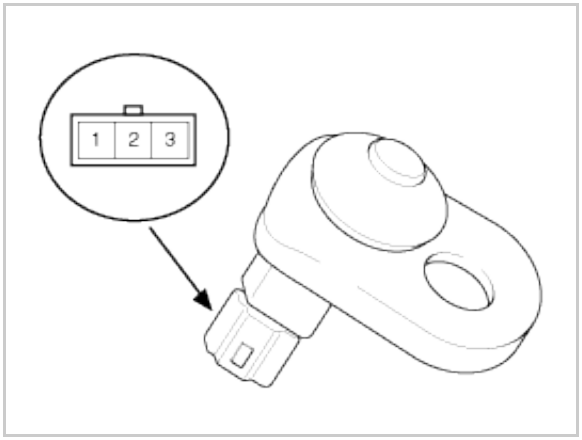


3. Check for continuity between the terminals in each switch position according to the table.

Terminal / Position	1	2
Unlock	○	○

DOOR SWITCH

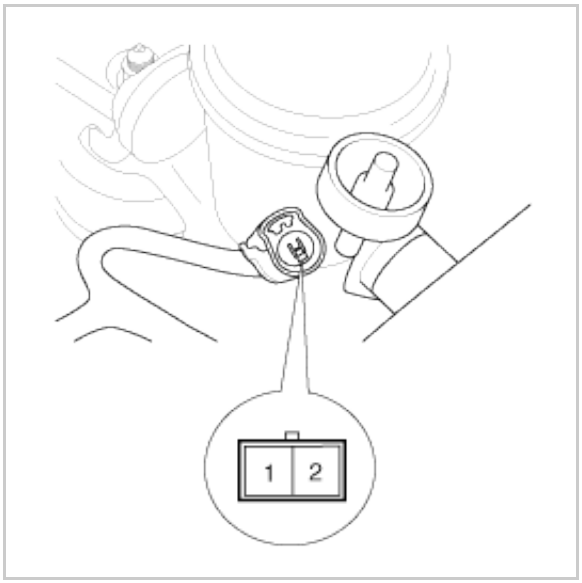
Remove the door switch and check for continuity between the terminals.



Terminal / Position	1	2	Body (Ground)
Free(Door open)	○	○	○
Push(Door close)			

HOOD SWITCH

1. Disconnect the connector from the hood switch.

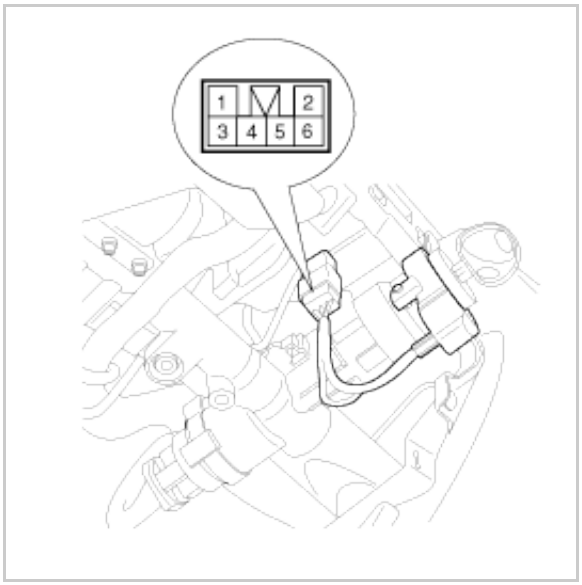


2. Check for continuity between the terminals and ground according to the table.

Terminal / Position	1	2
Hood open (Free)	○	○
Hood close (Push)		

DOOR WARNING SWITCH

1. Remove driver's crash pad lower panel. (Refer to Body group - Crash pad)
2. Disconnect the 6P connector from the door warning switch.

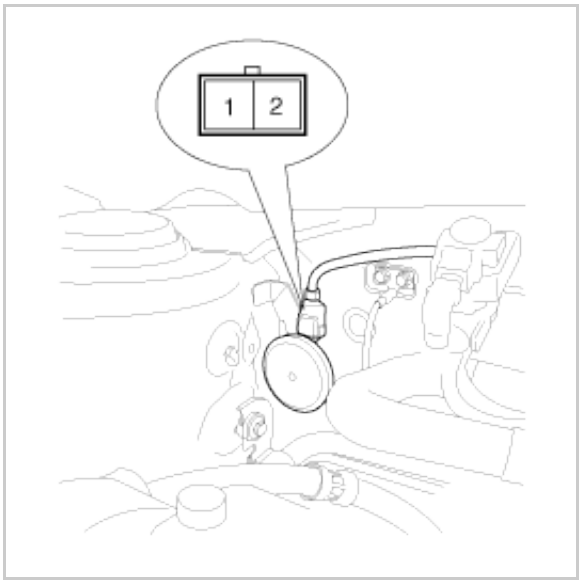


3. Check for continuity between the terminals in each position according to the table.

Terminal / Key position	5	6
Insert	○	○
Removal		

BURGLAR HORN

1. Remove the burglar horn after removing 2 bolts 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.

SPECIFICATION

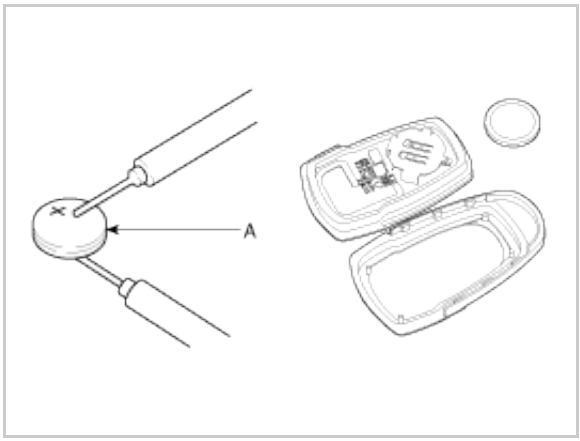
Items	Specifications
Keyless entry transmitter Power source	Lithium 3V battery (1EA)
Transmissible distance	30m or more
Life of battery	2 years or more (at 10 times per day)
Button	Door lock/unlock PSD(Power Sliding Door) open/close (option) PTG(Power Tail Gate) open/close (option) Panic Tailgate open (option)
Transmission frequency	447 MHz (EUROPE, AUSTRAILIA, MIDDLE EAST) 315.00 MHZ (GENERAL)

Transmitter

INSPECTION

1. Check that the red light flickers when the door lock or unlock button is pressed on the transmitter.
2. Remove the battery and check voltage if the red light doesn't flicker.

Standard voltage : 3V



3. Replace the transmitter battery with a new one, if voltage is below 3V then try to lock and unlock the doors with the transmitter by pressing the lock or unlock button five or six times.
4. If the doors lock and unlock, the transmitter is O.K, but if the doors don't lock and unlock, register the transmitter code, then try to lock and unlock the doors.
5. If the transmitter is failure, replace only the transmitter.

Body Control Module (BCM)

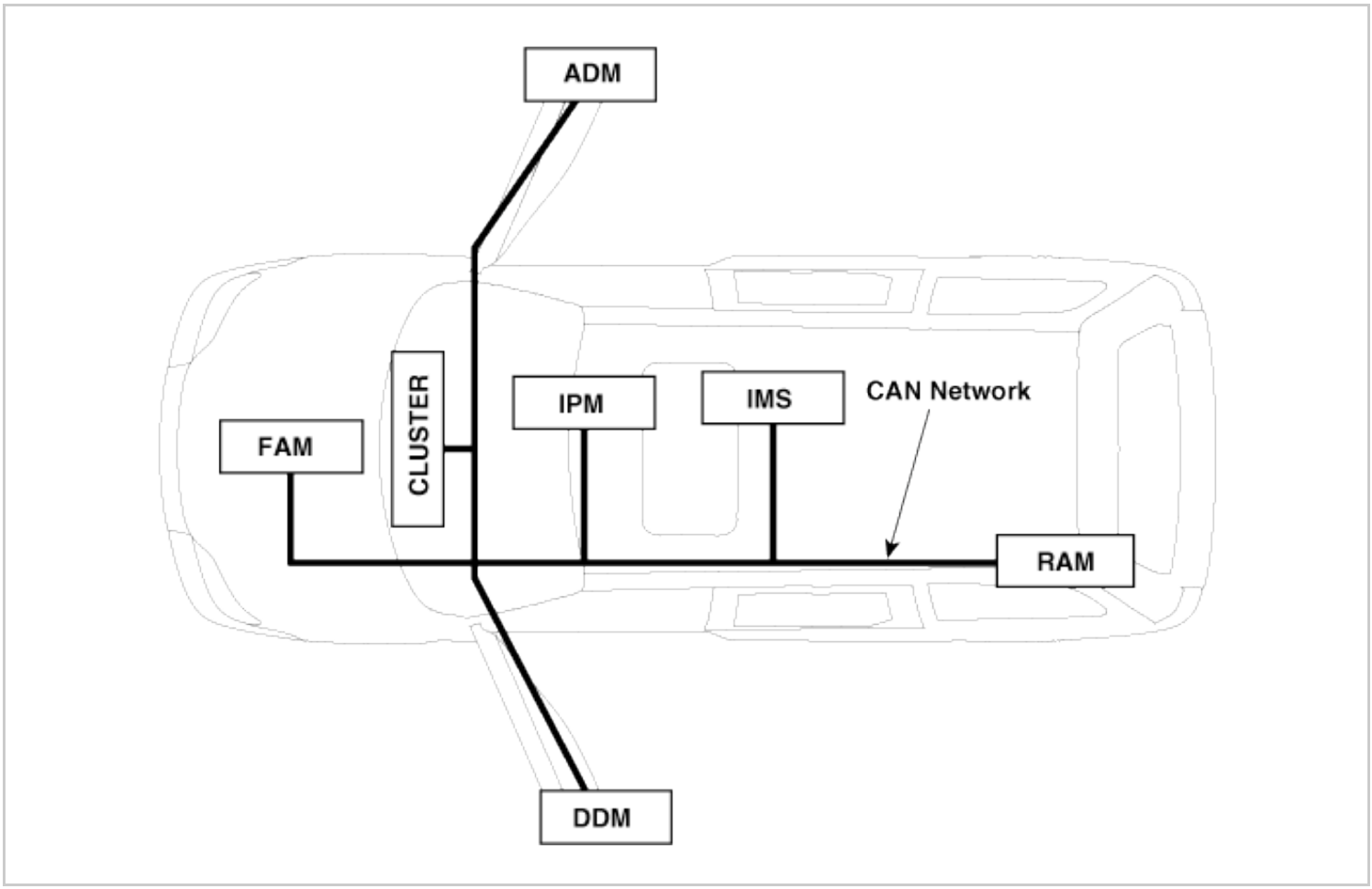
DESCRIPTION

All modules are linked a low speed CAN network.
The input information for the modules is coming from both the CAN network and the hardware components (actuatorsand sensors).

a. FAM (Front Area Module)
a. Headlamp low/high beam control (with DRL)
b. Park lamp control
c. Front fog lamp control
d. Front turn signal lamp control
e. Windshield wiper control
f. Windshield deicer
g. Diagnostics
b. IPM (In-Panel Module)
a. RKE (Remote Keyless Control)
b. VAS (Voice Alarm System)
c. Ignition key hole illumination
d. Switch indicators control
e. Panel light control
f. Seat belt warning
g. Auto light/DRL control (Logic)
h. Windshield/Rear wiper control (Logic)
i. Turn and Hazard lamp control (Logic)
j. Central door lock (Logic)
k. Windshield deicer timer
l. Rear glass defog timer
m. Gateway for ISO-9141 (K-Line)
c. RAM (Rear Area Module)
a. Tail lamp control
b. Turn and Hazard lamp control
c. Back up lamp control
d. Rea fog lamp control
e. Stop lamp outage detection
f. Sliding door power window/Quarter glass control
g. Room lamp control
h. Rear wiper control
i. Rear glass defog
j. Fuel filler door open solenoid control
d. ADM (Assist Drive Module)
e. DDM (Driver Drive Module)

MODULE INTRODUCTION

FAM/IPM/RAM consists of a power board and an electronic board. The power board contains circuit protection devices and switching devices. The electronic board uses Intelligent Power Switching (IPS) for HS/LS load control, logic functions and CAN/K-Line communication. The power board and electronic board are connected with pin blocks for the Front Area Module (FAM) and VCD (Variable Connection Displacement) for the In-Panel Module (IPM) and the Rear Area Module (RAM).



Functions

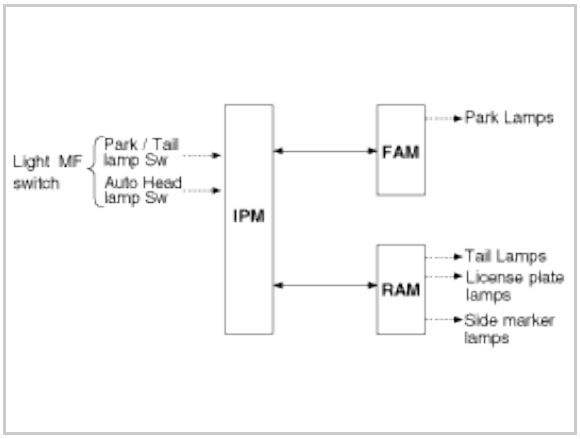
Exterior Lighting Functions

The exterior lighting function has to provide the lighting and signalling of the vehicle; it monitors different available lights in front or at the back of the vehicle:

a. Park and Tail lamps (with Side marker lamps),
b. License plate lamps,
c. Head lamps Low Beam,
d. Head lamps High Beam,
e. Front and Rear fog lamps (with the Rear fog lamp switch indicator),
f. Stop lamps,
g. Backup lamps,
h. Turn signal and side repeater lamps.

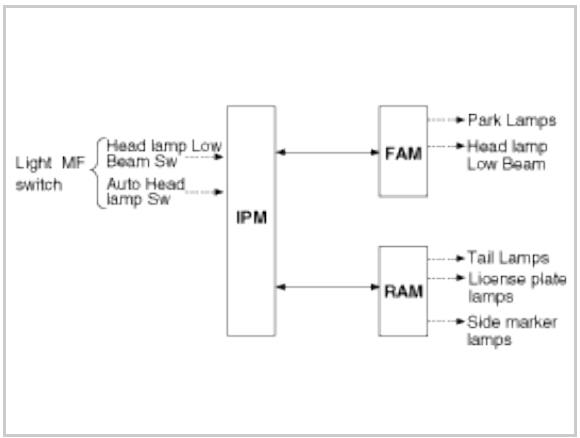
Park/tail Lamps Function

1. Necessary conditions to switch ON :
   a. By putting the Head lamp switch in position 'Park and Tail lamp' or 'Head lamp Low Beam' or Auto light activation or DRL activation
2. Necessary conditions to switch OFF :
   a. If they are released by the Head lamp switch (Auto light function deactivated) and if DRL function is deactivated
   b. If the Auto light function is active but the Auto light Sensor signal status is OFF or Battery Saver function is active.
3. Functional diagram



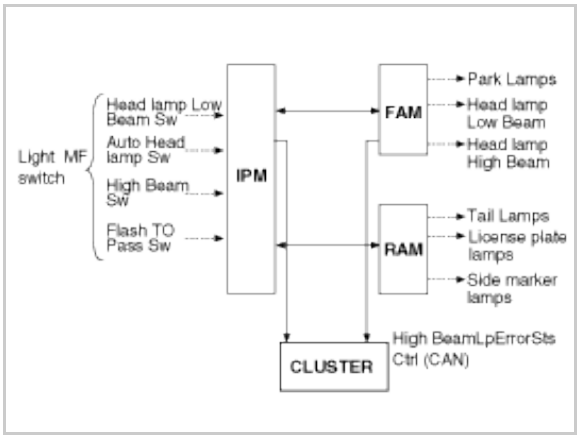
Head Lamps Low Beam Function

1. Necessary conditions to switch ON :
   a. By putting the Head lamp switch in position 'Head lamp Low Beam' or Auto light activation or DRL activation.
2. Necessary conditions to switch OFF :
   a. If they are released by the Head lamp switch (Auto light function deactivated) and if the DRL function is deactivated
   b. If the Auto light function is active but the Auto light sensor signal status is not 'HL ON'.
3. Functional diagram



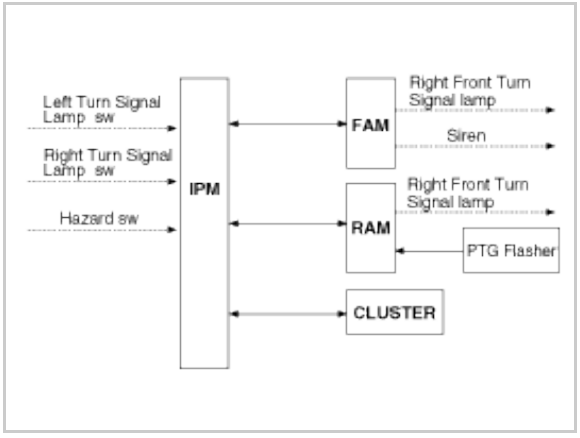
Head Lamps High Beam Function

1. Necessary conditions to switch ON :
   a. By pushing down the High Beam lever switch if
   a. the Head lamp switch is in position 'Head lamp Low Beam' or the Head lamps Low Beam have been turned ON by the Auto light function.
   b. By pulling the High Beam lever switch toward the driver (Flash to pass activation)
   c. By the DRL function activation for Canada.
2. Necessary conditions to switch OFF :
   a. By pulling back the High Beam lever switch (manual reset by the driver) or
   b. If the Head lamps Low Beam are turned OFF or if the Auto light function is active but the Auto light Sensor signal status is not 'HL ON') or
   c. By releasing the Flash To Pass activation and
   d. If the DRL function is deactivated for Canada.
3. Functional diagram



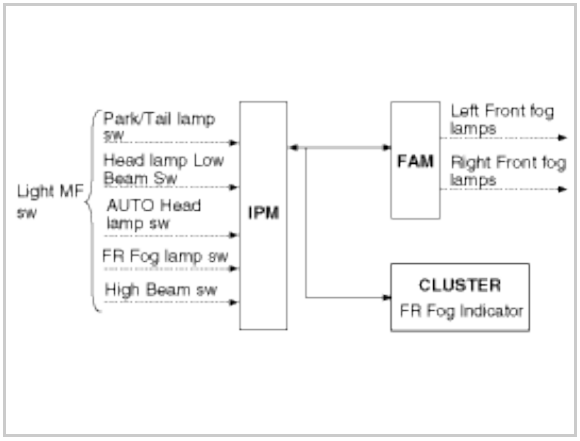
Turn Signal And Side Repeater Lamps Function

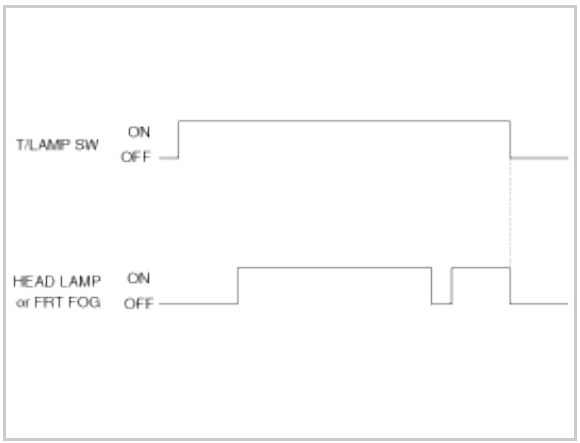
1. Necessary conditions to switch ON(if they are standard) :
   a. By activation of Crash Unlock
   b. During the opening / closing of the Tail gate by the PTG Flasher input
   c. With the Remote Keyless Entry to lock / unlock the vehicle
   d. By alarm activation
   e. By panic activation with the Remote Keyless Entry
   f. By activation of the Hazard Lamp by the hazard switch and ignition is position OFF, ACC or RUN
   g. By using the turn lever switch with the ignition switch in the ON position.
2. Necessary conditions to switch OFF(if they are standard) :
   a. Ignition switch in OFF position for deactivation of crash unlock flashing
   b. Deactivation of the alarm or at the end of the alarm flashing sequence
   c. Deactivation of panic sequence with pushing any button of the Remote Keyless Entry or at the end of the panic flashing sequence
   d. Turn lever switch command in OFF postion or ignition switch in OFF, ACC or START position to stop turn lever flashing.
   e. The hazard switch in OFF position or ignition switch in position START to stop the Hazard flashing.
   f. At the end of the Lock, Unlock and PTG flashing sequence.
3. During the start up of the vehicle (ignition key in position START) :
   a. The Turn signal lamps activated by the turn lever switch are temporarily turned OFF. If the time duration in Start position is more than 10seconds and engine running, the Turn signal lamps are managed again as if the ignition key was in ON position,
   b. The flashing sequence of the hazard lamps is immediately stopped if they have been activated by the hazard button. If the time duration in Start position is more than 10seconds and engine running, the flashing sequence of the hazard lamps are managed again as if the ignition key was in RUN position,
   c. The flashing sequence of the hazard lamps is not stopped if they have been activated by a crash unlock.
4. Functional diagram

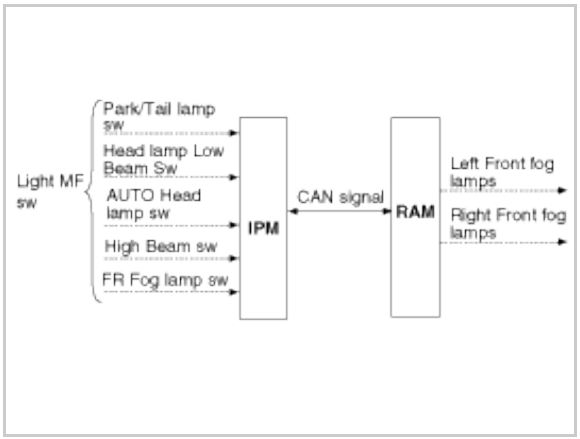


Front Fog Lamps Function

1. Necessary conditions to switch ON :
   a. By using the stalk: Head lamp switch in position 'Head lamp Low Beam' and Front Fog lamp sw ON
   b. When Auto light function activated and Auto light Sensor signal status is 'HL ON' and Front Fog lamp sw ON
2. Necessary conditions to switch OFF :
   a. When Auto light function activated and Auto light Sensor signal status is not ON
   b. When Front fog lamp sw OFF.
3. Functionnal Diagram

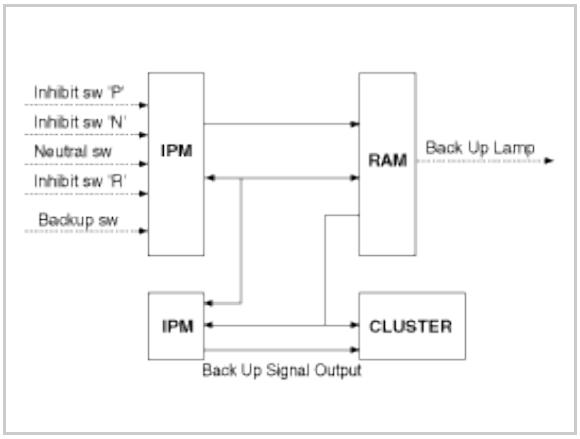






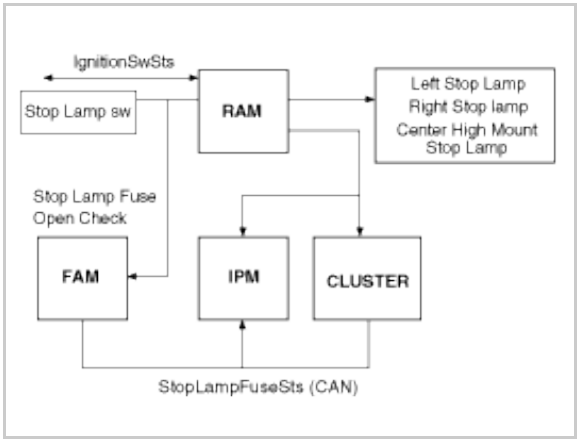
Backup Lamps Function

1. Necessary conditions to switch ON :
   a. When inhibit sw 'R' read by FAM is active and transmitted to RAM by CAN signal.
2. Necessary conditions to switch OFF :
   a. When inhibit sw 'R' read by FAM is not active and transmitted to RAM by CAN signal.
3. Functional diagram



Stop Lamps Function

1. Necessary conditions to switch ON the stop lamps:
   a. Pushing on the brake pedal.
2. Necessary conditions to switch OFF the stop lamps:
   a. Releasing the brake pedal.
3. Functional diagram



Auto Light Function

1. The Auto light function is active when the Head lamp switch is positioned to 'Auto' and the Key is in RUN position. The auto light sensor is powered on the status ACC, START and RUN of the key position. Based on the Auto light sensor values corresponding to the exterior brightness level, it controls automatically the lighting of the Park and tail lamps or / and the Head lamps Low Beam depending on the country.
2. Auto light Sensor detection table

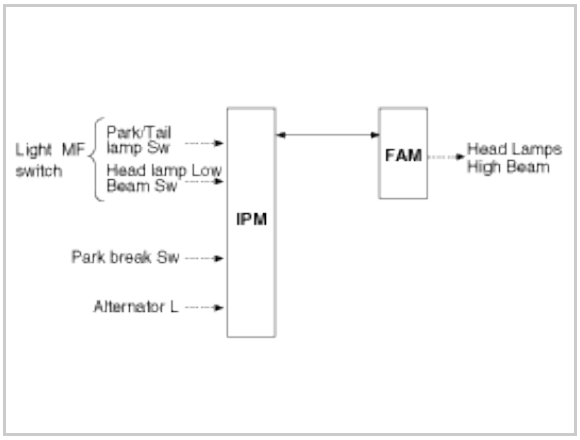
Mode	Tail Lamps		Head Lamps Low Beam	
	Lux (Lux)	Voltage(V)	Lux (Lux)	Voltage(V)
ON	< 24 ± 5.2	<1.77 ± 0.08V	Same as Tail lamps	
OFF	> 48 ± 10.5	> 3.47 ± 0.1V	Same as Tail lamps	

Drl Function

1. The Auto DRL function operates the Head lamps High Beam at 50% of full illumination.
   The park and tail are managed by the auto light sensor.
   The Auto DRL function is active if:
   a. The ignition switch is on RUN position
   b. The engine is running.
   c. The Park brake switch is OFF.
2. The DRL function is inactive when one of above conditions is released.
   When the DRL function is active, the Head lamps High Beam can't be turned ON, except for the Flash To Pass

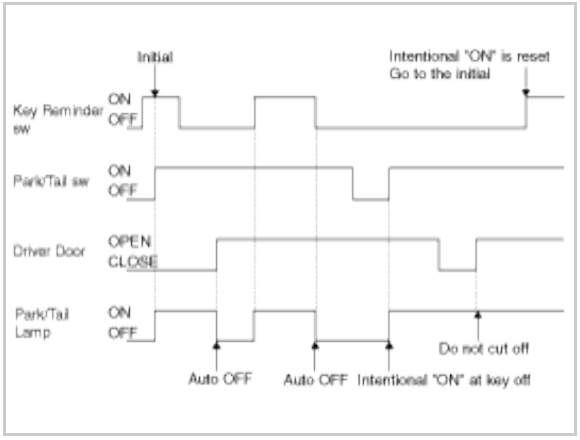
activation.

3. Functional diagram

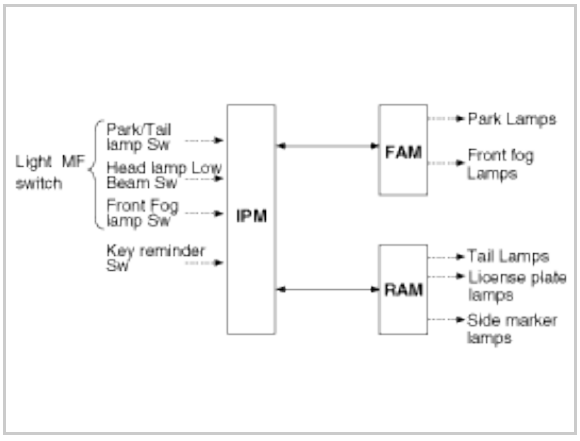


Battery Saver Function

1. Necessary conditions to activate the Battery Saver function:
   a. Do not turn off the Park/Tail Lamp when intentionally turned on.
   b. If Key reminder switch is ON and Park/Tail Lamp switch is ON, Intentional "ON" should be reset
   c. If the driver's door is open and if the key is not in the key hole whereas the Head lamp switch is still in position 'Park and tail lamp' or 'Head lamp Low Beam', the park and tail lamps (and the Front fog lamps if turned on) are immediately turned off.
2. Necessary conditions to cancel the Battery Saver function:
   a. As soon as the Key is input into the IGN Key Cylinder or the Head lamp switch is put to position OFF.



3. Functional diagram

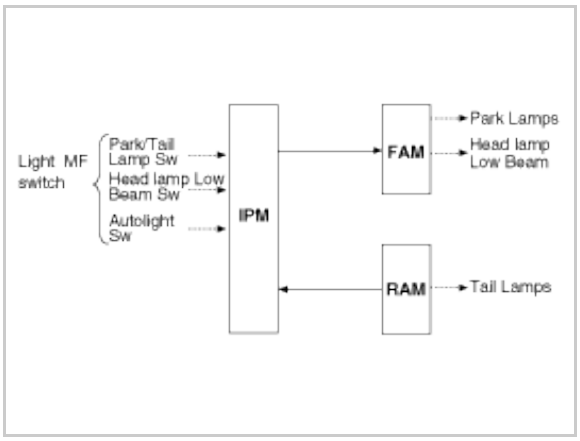


Escort Function

1. If the head lamps low beam are turned on by head lamps low beam switch or by auto light switch when the Ignition switch is turned from the ON to ACC or OFF positions.
2. The head lamps low beam are turned off:
   a. 30s after the driver door is closed

b. When the multifunction switch is not in postion headlamps turned on or autolight
c. 20 mn after the driver door is open
d. 20mn after IGN leaves the positions RUN to ACC or OFF
e. If IPM receives RKE "LOCK" command two times

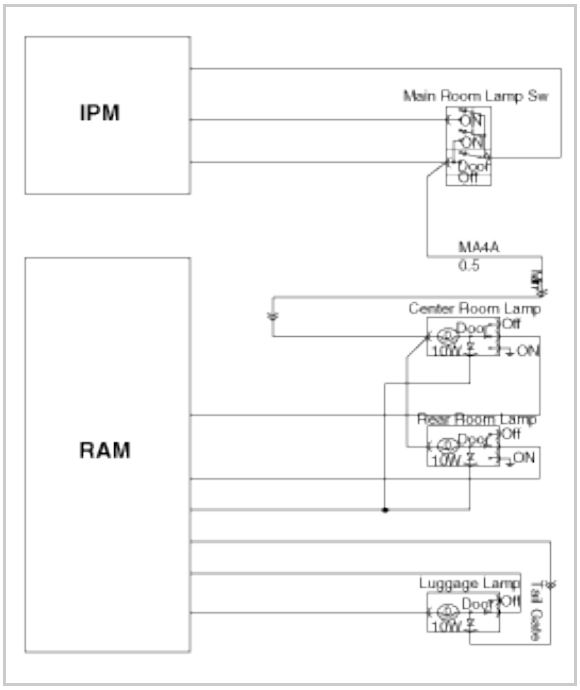
3. Escort function enables only "Head Lamp Low Beam", so Park/Tail lamp should be turned off when driver door is opened at key out (Battery Saver function).
4. Functional Diagram



Interior Lighting Functions

Room Lamps

1. The room lamps are can be controlled manually using the 3-state (ON, DOOR, OFF) switch or by the Rear Area Module (RAM). A main switch, located to the left of the steering wheel, is used as a master control switch. The operating logic of the lamps will vary based on the position of the main switch ON, DOOR, or OFF).
2. Working conditions
   a. The functioning depends on the key position in the key cylinder (OFF, ACC, RUN or START)
   b. When the key goes in RUN or START position while the room lamps are decaying, then the room lamps are turned off immediately.
   c. When the Ignition key position is RUN or START and the last door is closed then the room lamps are OFF.
   d. If the room lamps have been activated using the RKE UNLOCK function, and the ignition switch is turned to the RUN or START position, the room lamps will be immediately turned OFF..
   e. If the Ignition sw status is in RUN or START and Unlock information occurs, then the room lamp status is not changed.
   f. When the system enters to ARM WAIT mode by Remote Key or Mechanical cylinder lock switches the Room lamp should be turned off immediately.
   g. If there is RKE Lock signal at any door open, all doors should be locked first and wait for the all door close. No action is taken while the Open Door status is OPEN and the doors are locked. Then when Open Door status changes from OPEN to CLOSE, Room lamps will be OFF immediately.
   h. The 30sec timer does not depend on the key reminder status.
   i. If the main switch is changed to ON from DOOR after 20minute lamp OFF, all the lamps are turned ON.
   j. If the Open Door status changes from OPEN to CLOSE (all doors close) when ignition switch is on RUN position, room lamps and door courtesy lamps should turn off immediately (Do not decay off).
   k. After 20minute Room Lamp OFF at door open, Room lamps are turned ON again when:
   a. One of the door open switch's status changes. (Open to Close or Close to Open)
   b. Ignition key is in RUN or START Position.
   c. Receiving an UNLOCK event while a door is open and Main Room Lamp Switch is in the DOOR position.
   l. For the room lamps, when the 20m timer is running and any of the side doors is opened the timer is restarted.
3. Functional Diagram



4. Truth table

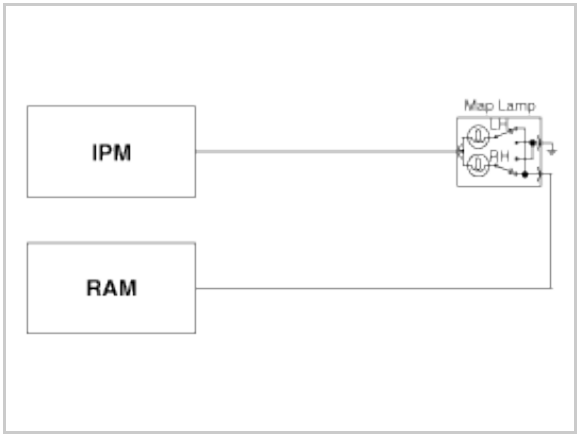
Main Room Lamp sw	Open Door status (RAM)	Luggage interior Lamp (CAN)	Room Lamps LS (Door)	Room Lamps LS (On)	Room Lamp Switch	Room Lamp Switch	Room Lamp Switch
					ON	DOOR	OFF
OFF	Don't care	Don't care	OFF	OFF	OFF	OFF	OFF
ON	Don't care	Don't care	OFF	ON	ON	ON	ON
DOOR	OPEN	OFF (*)	ON during 20 min then directly OFF	OFF	ON	ON during 20 min	OFF
	OPEN	→LOCK (**)	ON during 20 min then directly OFF	OFF		ON during 20 min	
	OPEN	→UNLOCK (***)	ON during 20 min then directly OFF	OFF		ON during 20 min	
	CLOSE	OFF	OFF	OFF		OFF	
	OPEN → CLOSE	Don't care	Decayed OFF	OFF		Decayed OFF	
	OPEN → CLOSE	Don't care	ON during 20 min then directly OFF	OFF		ON during 20 min	
	CLOSE	→LOCK	OFF	OFF		OFF	
	CLOSE	→UNLOCK	ON during 30 min then directly OFF	OFF		ON during 30 min	

(*) : OFF is transmitted when there is no action from Lock/Unlock. It has no impact on the 20mn timer (no restart).
(**) : LOCK transition is sent by IPM only when door status is CLOSE. Thus there is no action on the 20mn timer in this case.
(***) : When transition to UNLOCK is received, 20mn timer is restarted.

Map Lamp

1. The map lamps may be controlled manually or by the Rear Area Module (RAM).

2. Functional Diagram



3. Truth table

Main Room Lamp sw	Open Door status (RAM)	Luggage interior Lamp (CAN)	Map Lamp LS	Map Lamp Switch	Map Lamp Switch
				ON	OFF
OFF	Don't care	Don't care	OFF	ON	OFF
ON	Don't care	Don't care	ON	ON	ON
DOOR	OPEN	OFF (*)	ON during 20 min then directly OFF	ON	ON during 20 min
	OPEN	→ LOCK (**)	ON during 20 min then directly OFF	ON	ON during 20 min
	OPEN	→ UNLOCK (***)	ON during 20 min then directly OFF	ON	ON during 20 min
	CLOSE	OFF	OFF	ON	OFF
	CLOSE	→ LOCK	OFF	ON	OFF
	CLOSE	→UNLOCK	ON during 30 min then directly OFF	ON	ON during 30 min
	OPEN → CLOSE	Don't care	OFf (DECAY)	ON	OFf (DECAY)
	CLOSE → OPEN	Don't care	ON during 20 min then directly OFF	ON	ON during 20 min

(*) : OFF is transmitted when there is no action from Lock/Unlock. It has no impact on the 20mn timer (no restart).
(**) : LOCK transition is sent by IPM only when door status is CLOSE. Thus there is no action on the 20mn timer in this case.
(***) : When transition to UNLOCK is received, 20mn timer is restarted.

Luggage Lamp

1. Working Conditions
   a. The 20min timer does not depend on the key reminder status.
   b. After 20minute Luggage Lamp OFF at tailgate open, luggage lamps are turned ON again when:
   a. Tailgate close and then tailgate is opened again
   b. Ignition key is in RUN or START position.

2. Truth table

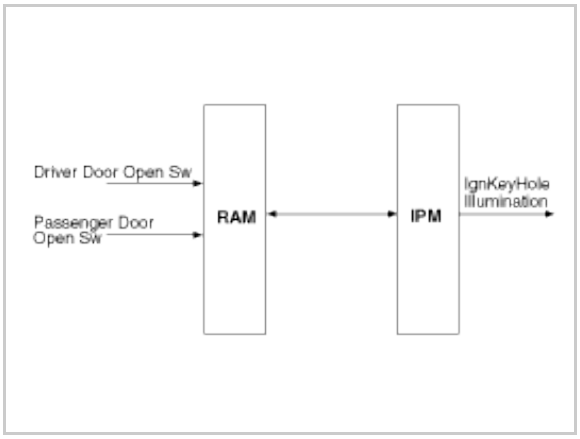
Main Room Lamp sw	Tail Gate status (RAM)	Luggage Lamp LS	Luggage Lamp Switch	Luggage Lamp Switch
			DOOR	OFF
OFF	OPEN	ON	ON	OFF
	CLOSE	OFF	OFF	OFF

ON	Don't care	OFF	ON	ON
DOOR	OPEN	ON during 20 min then directly OFF	ON during 20 min	OFF
	CLOSE	OFF	OFF	
	OPEN → CLOSE	OFF	OFF	
	CLOSE → OPEN	ON during 20 min then directly OFF	ON during 20 min	

Door Courtesy Lamps

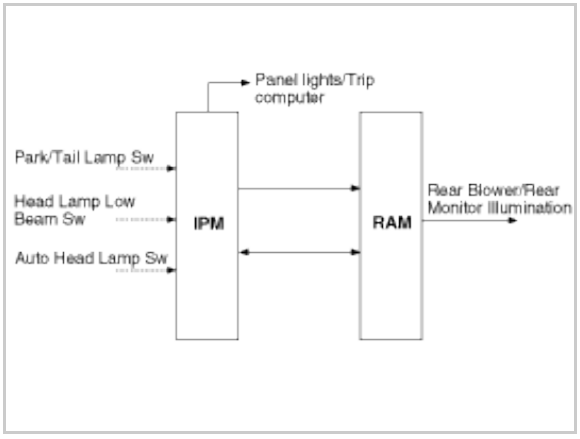
Key Hole Illumination

1. Working Conditions
   The key cylinder is illuminated when the driver and / or the assist door are open.
2. Key hole extinguish conditions:
   a. The key cylinder is turned off 10s after the driver and assist doors are closed.
   b. The key cylinder is turned off immediately if the key is inserted in the hole and put to RUN or START position.
   c. For vehicles equipped with BurglarAlarm, the key cylinder is turned off immediately when the system goes to ARM WAIT mode during the 10s after the driver and assist doors are closed.
   d. For vehicles not equipped with BurglarAlarm, the key cylinder is turned off immediately when RKE lock signal is received from keyfob during the 10s after the driver and assist doors are closed (4).
3. Functional Diagram



Panel Lights, Switch Illumination

1. Working Conditions
   The MF "high beam" and "flash to pass" switches do not influence the management of the Panel Lights and Trip Computer illumination, Rear Blower illumination and Rear Monitor illumination.
2. Functional Diagram

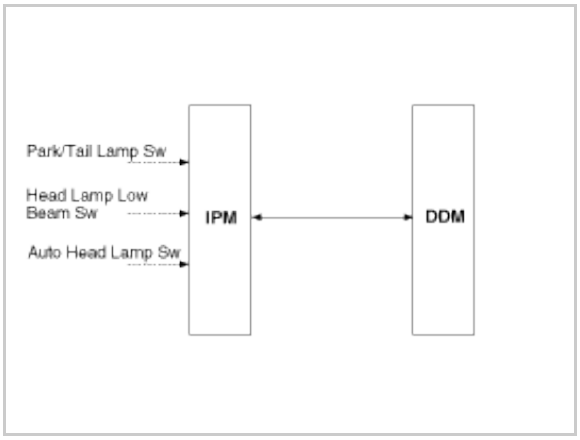


Dimmable Backlighting

1. Working Conditions
   The Dimmable backlighting is directly managed by the rheostat.

Power Seat Switch Illumination

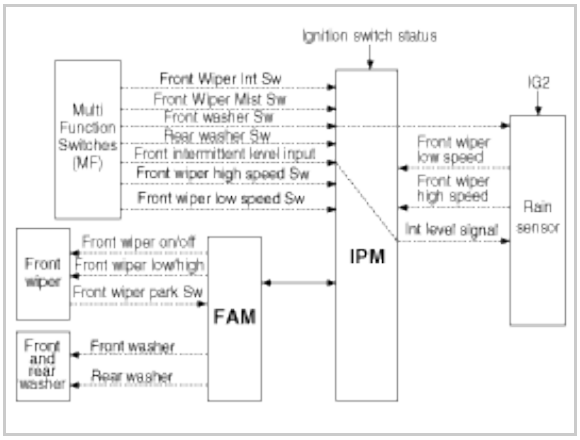
1. Working Conditions
   The IPM sends a CAN message to the DDM so that this module illuminate the power seat switches.
2. Functional Diagram



View Enhancement Function

Front Wiper And Washer

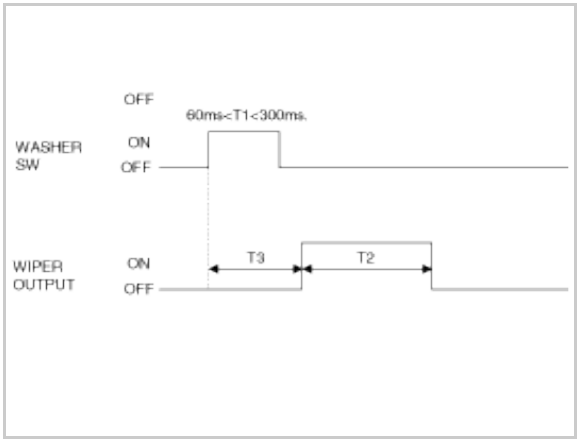
1. Front wiper working conditions
   These functions are active when Ign2 switch ON
   In the OFF and ACC states, the front wiper is not activated. If IGN2 turns OFF during wiper operation, the wiper stops at the current position and will move to the park position on the next IGN2 ON. In these states, the front washer is not active.
2. Front washer working condition
   The front washer functionality is directly available to the driver. It consists in activating the front washer pump, which is located under hood. As long as the driver activates the washer multifunction switch, the front washer is active.
3. Functional diagram



Rear Wiper And Washer

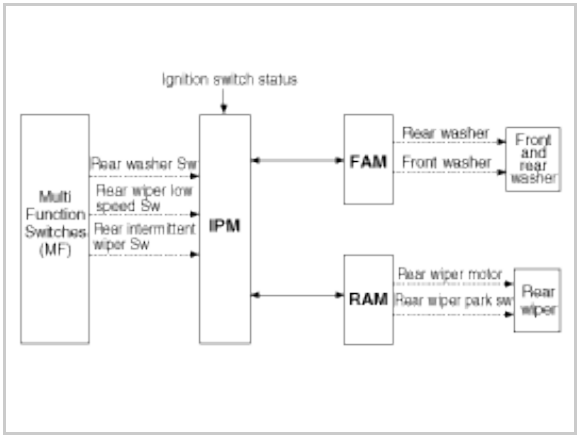
1. Rear wiper working conditions
   a. The rear wiper is available in RUN state.
   b. In the START state, all the wiper and washer outputs are halted and then activated again.
   c. In the OFF and ACC states, the rear wiper stops its movement at current position. The rear wiper will move to the park position at the next IGN ON. In these states, the rear washer is not activated.
2. Rear washer working condition
   a. If the washer signal is active less than 60ms, the signal is neglected.

b. If the washer signal is active for T1 (between 60ms and 300ms), the rear wiper output is turned on for T2 (2.5~3.8 sec.), T3 (300ms) after the washer has been turned ON.
Rear washer activated for T1 : [60ms;300ms]



T1 : 0.06 ~ 0.3 sec.
T2 : 2.5~3.8sec.
T3 : 0.3 sec.

3. Functional diagram

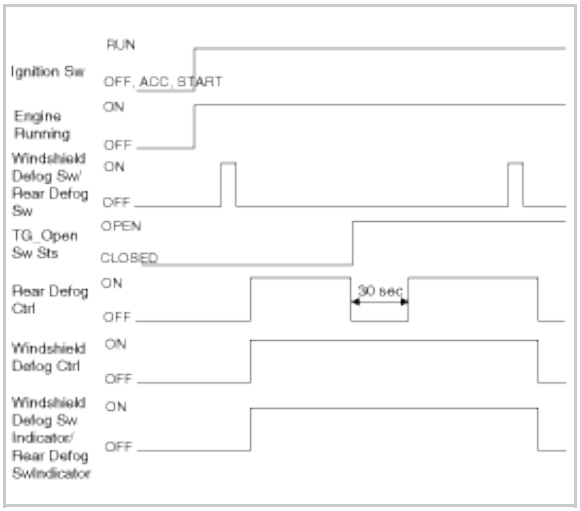


Defog

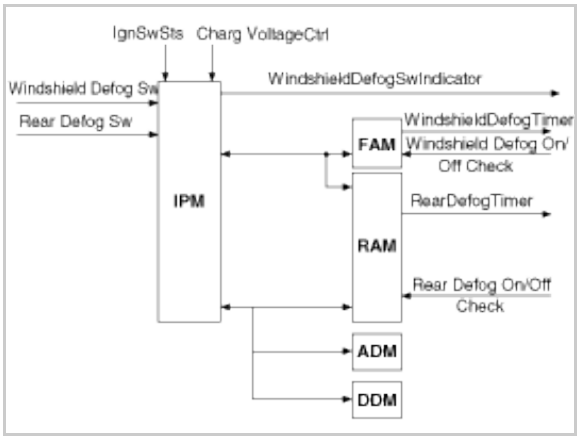
This function controls the heating defog grids on windshield, rear glass, and rear view mirrors.

1. Working Conditions
The defog function can be activated only when engine is running and ignition key is in RUN position.
   a. When windshield defog switch is pushed, windshield defog is activated for 20 minutes.
   b. While windshield defog is on, the windshield defog button is illuminated
   c. If the switch is pushed again while defog is already active, defog stops.
   d. If the engine stops while defog is on, defog stops and it is NOT automatically turned on when the engine is started again
   e. Rear defog works exactly in the same way as windshield defog using the rear defog switch button as input.
   f. When rear defog is active, rear defog switch indicator is ON.
   g. Rear defog ctrl output controls rear glass defog as well as rear view mirrors defog.

2. Rear defog pause
   a. When IPM receives Tailgate Flasher CAN message, rear defog is inhibited for 30s
   b. The 20min rear defog timer is frozen during this pause.
   c. If the user turns on rear defog function while this pause is going on, Rear defog ctrl is set to ON only at the end of the pause.
   d. This pause has no impact on rear defog switch illumination.
   e. When IPM receives Tailgate open CAN message transition to OPEN value, this 30 s rear defog pause is also started, it works the same way as described above.



3. Functional Diagram



Comfort Function

Power Windows

1. The purpose of the power window function is to manage the driver and assist power window motors. This function is entirely implemented in the DDM and ADM (door modules) and DMS role for this function is limited to providing signals through the CAN bus.

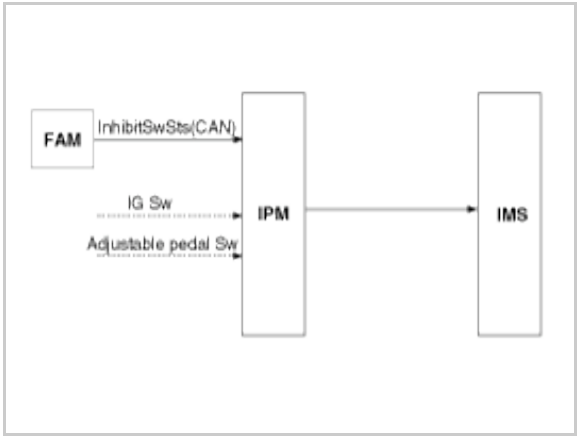
Power Seat With Memory Interface

This function manages the power seat and the associated memorized positions. This function is entirely implemented in the IMS (seat module) and DMS role for this function is limited to providing signals through the CAN bus.

Adjustable Pedal

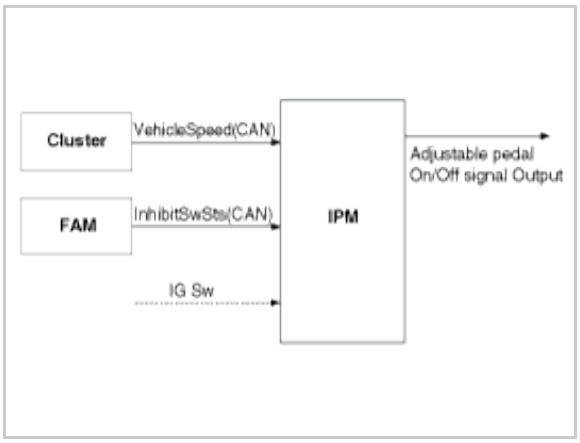
Adjustable Pedal With Memory Interface(ims)

1. This function is implemented by the IMS. This function adjusts the pedal position when the pedal backward/forward switch is pressed.
2. Functional Diagram



Adjustable Pedal(non-ims)

1. Adjust Pedal allows to activate Adjustable Pedal feature for the non-IMS equipped vehicle, IPM needs to control the power source (by relay coil control) of the adjustable Pedal switch unit.
   There is no Adjustable Pedal switch for Non-IMS version.
2. Functional Diagram

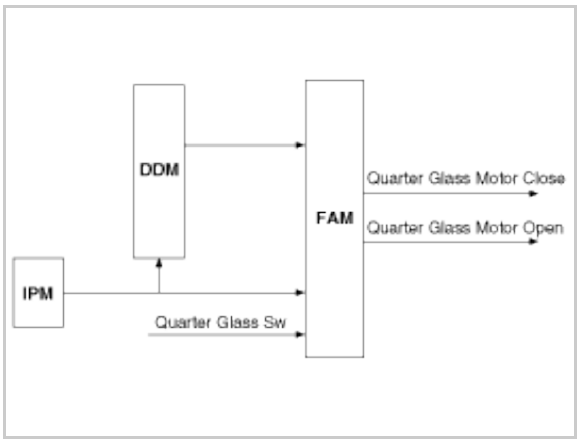


Reverse Drive Exterior Side Mirror

This function is implemented by the DDM. This function turns the 2 external reverse mirrors down when gear box in reverse position.

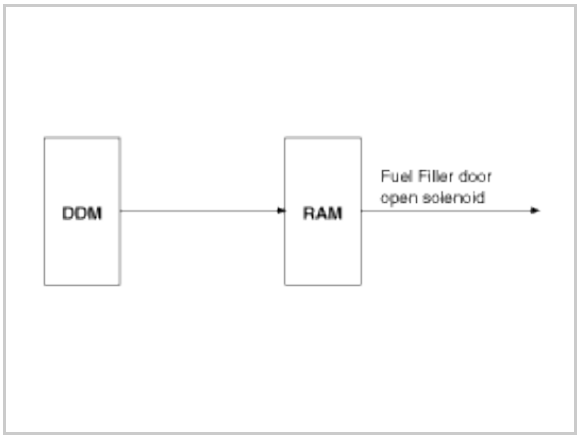
Quarter Glass Open/close

1. Working Conditions
   This Function is available when Ignition key is in RUN position and for 30sec after end of RUN.
   a. Quarter glasses can be controlled by switches situated near driver or switches situated near rear passengers seat (3rd row of seats).
   b. When the switch is pressed the motor output is ON until the switch is released or after 5+/- 1sec. The switch has to be released and pressed again to command the motor output ON again.
   c. If power window lock is activated only driver window is enable by driver side switch and no switches are enable to open quarter glass.
   d. There is no interaction with the sliding doors. It is not forbidden to open the quarter glasses when the sliding door on the same side is open.
   e. No switch information (driver or rear passenger) prevails on the other. If the main switch and the passenger side switch are pressed in opposite direction at the same time, window stops moving.
2. Functional Diagram



Open Fuel Filler Door

1. Functional Diagram



Sun Roof Relay Coil

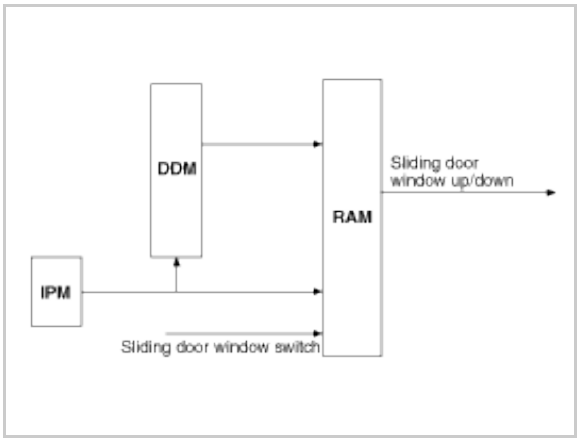
This function defines the condition for switching on or off power feed to sun roof relay coil. This function is available in RUN position and during after run timer ON.

Power Window Timer

This function defines the conditions for allowing use of power windows, quarter glass, and feed to sunroof relay coil.

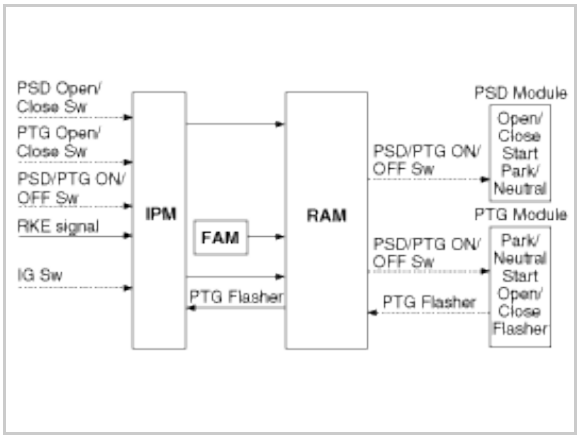
Sliding Doors Power Windows

1. Working Conditions
   This function is available when ignition key is in RUN position and for 30sec after end of RUN. Window operation will be canceled if the driver or assist door is opened during the 30sec period after the key is turned from RUN to ACC or OFF position..
2. Functional Diagram



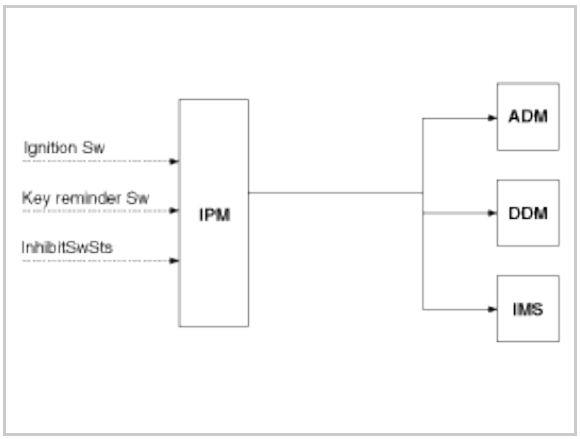
Power Sliding Door & Power Tailgate

1. Description
   There are two sliding doors and one tailgate in the vehicle. A switch is fitted at each B-pillar to permit Power Sliding Door activation.. For the tailgate, there is also one push button switch. These switches are used to send an signal of 200 ms minimum to the PSD module (or PTG module).
2. Functional Diagram



Easy Access

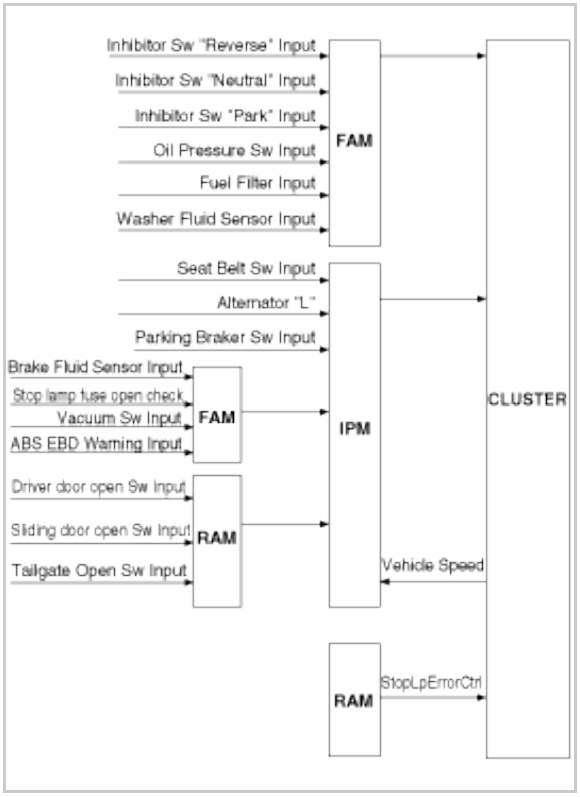
1. Description
   The easy access function permits automatic rearward movement of the driver seat when the key is removed from the cylinder. Automatic forward movement of the driver seat will take place when the key is inserted into the cylinder. This function will be enabled on IMS equipped vehicles when the AUTO button is pressed.
   Inhibit Switch should be in P-Position for the Easy Access operation.
2. Functional Diagram



Driver Information

Cluster Indicators

1. The instument cluster indicators listed below are controlled by the In-Panel Module (IPM), Front Area Module (FAM), or Rear Area Module (RAM) as applicable.
   These indicators are:
   a. Gearbox status
   b. Oil pressure
   c. Sediment fuel filter
   d. Vacuum
   e. Brake fluid
   f. Washer fluid
   g. Seat belt
   h. Park brake
   i. Charging voltage
   j. Turn indicators
   k. High beam
   l. Front fog
   m. Doors open
   n. Tailgate open
   o. Stop lamp failure front and rear
2. Functional Diagram



Gearbox Status

The status of the gearbox is sent on the CAN network when the CAN network is available.

Oil Pressure Switch Status

The status of the oil pressure switch is sent on the CAN network when the CAN network is available.

Fuel Filter Status

The FAM receives on digital input the status of the fuel filter (Fuel Filter Input) and sends it (Fuel filter switch) on the CAN network.

Washer Fluid Sensor Status

The FAM receives on digital input the status of the washer fluid sensor and sends it on the CAN network.
If Washer Fluid Low Input is LOW for more than 10 sec, FAM sends the warning message.

Seat Belt Warning Status

The IPM receives on digital input the status of the seat belt switch and sends the seat belt warning on the CAN network.
If the Ignition switch status is in RUN or START when the Seat Belt Sw Input is FASTENED, the seat belt warning indicator is blinking for 6 seconds.
When Seat Belt switch Input is NOT FASTENED, the seat belt warning indicator is blinking for 6 seconds.
If the Seat Belt switch Input is FASTENED during the 6 seconds, the seat belt warning indicator is blinking till the end of the 6 seconds.
In North America:
the seat belt warning indicator is blinking when Ignition switch is on the status RUN or START and Seat Belt Sw Input is NOT FASTENED.

Parking Brake Indicator

The indicator manages 3 functions: brake fluid sensor, parking brake warning and vacuum switch.
The vacuum function is available for diesel engine only
The FAM receives on digital input the status of the vacuum switch and the ABS EBD warning and sends them on the CAN network.
The status of the vacuum switch and the ABS EBD warning are sent on the CAN network when the CAN network is available.
The FAM receives on digital input the status of the brake fluid sensor and sends it on the CAN network.
The status of the brake fluid sensor is sent on the CAN network when the CAN network is available.
The IPM receives on digital input the status of the parking brake switch and by CAN network the status of the vacuum

switch, the status of the ABS EBD warning, the status of the brake fluid sensor and the speed of the vehicle.
The IPM sends the park brake indicator control on the CAN network.
The indicator is lighted if the vacuum switch or ABS EBD warning are on or brake fluid sensor is low or park brake switch is on.
If the speed of the vehicle is over 10 km/h and ignition switch is on the status RUN the park brake indicator control is blinking at 50% duty in 0.6 second if Parking Brake switch Input is active. In this case Vacuum switch, ABS EBD warning and Brake Fluid sensor are ignored.
The park brake indicator is blinking on the same time that the chime is ringing. If a CAN signal among Vacuum switch, EBD warning or Brake Fluid Sens switch is INVALID, out of range or not received this CAN signal is considered to be OFF.
If VehicleSpeed CAN signal is INVALID or not received, it is considered to be 0 kph.

Charging Voltage Control

The IPM receives on analog input the voltage of generator and sends a warning.
When the voltage of generator L pass strictly above 10V, the state of the CAN variable.

Turn Indicators Status

The status of the turn indicators are sent on the CAN network when the CAN network is available.

High Beam Status

The status of the high beam is sent on the CAN network when the CAN network is available.

Front Fog Lamp Status

The status of the front fog lamp (lightning and state of the bulbs) is sent on the CAN network when the CAN network is available.

Doors Open Warning

The RAM receives on digital input the status of the driver door open switch and sends it on the CAN network.
The RAM receives on digital input the status of the passenger door open switch and sends it on the CAN network.
The RAM receives on digital input the status of the left sliding door open switch and sends it on the CAN network.
The RAM receives on digital input the status of the right sliding door open switch and sends it on the CAN network.
When vehicle speed is under 10 kph, with ignition key not inserted and any door OPEN, DoorsOpenWngCtrl stays ON for 20 min and then is turned OFF.

Tailgate Open Switch Status

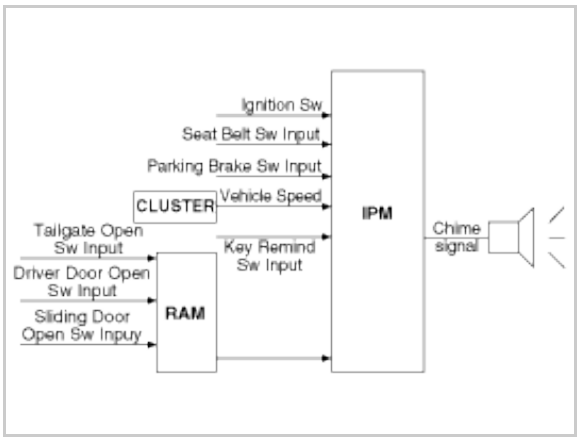
When vehicle speed is under 10 kph, ignition key is inserted and Tailgate open switch is OPEN, Tailgate Open warning stays ON forever (IPM can enter sleep mode).
When vehicle speed is under 10 kph, with ignition key not inserted and lgate open switch is OPEN, Tailgate Open warning stays ON for 20 min and then is turned OFF.

Chime Control

1. The chime warns the driver that a problem is occurred.
   These warning are:
   a. Seat belt
   b. Parking on
   c. Over speed
   d. Key reminder
   e. Light Warning
   f. Doors Open
   g. Tailgate open warning
2. Chime sound priority:
   a. 1st : Seatbelt warning
   b. 2nd : Overspeed warning
   c. 3rd : Door open warning
   d. 4th : T/Gate open warning
   e. 5th : Key operated warning
   f. 6th : Parking Brake warning

g. 7th : Light ON warning
h. 8th : Key learning sound

3. If two different warning condition happen at the same time, chime should work only for the highest warning condition.
4. Cluster indicators should work for two warning behavior.
5. Behavior Description



Seat Belt Warning

The IPM receives on digital input the status of the seat belt switch.
The chime is activated during 6 second when the seat belt is not fastened.
The chime will stop immediately if the seat belt is fastened during the 6 seconds of the chime.

Park Brake Warning

The IPM receives on digital input the status of the parking brake switch.
The IPM receives the speed of the vehicle by the CAN network.
The chime is activated when the parking brake is on, ignition switch is on RUN and speed vehicle is over 10 km/h.
The park brake indicator is blinking at the same time that the chime is ringing.

Over Speed Warning

The IPM receives the overspeed warning by the CAN network.
The chime is actived when the overspeed speed warning is on the state Overspeed.

Key Reminder Warning

The IPM receives the status of the key on digital input.
The IPM receives the status of the driver door open switch by the CAN network.
The chime is activated when key is inserted and the driver door is open.

Light Warning

The IPM receives the status of the driver door open switch by the CAN network.
The light chime warning is activated when the driver door is open and the park and tail lamps are turned on.

Doors Open Warning

The RAM receives on digital input the status of the driver / passenger / left sliding / right sliding door open switch and sends it on the CAn network.
The IPM receives by CAN network the speed of the vehicle.
The doors open warning chime is activated when one or several of the 4 doors is opened and the speed of vehicle is over 10km/h.

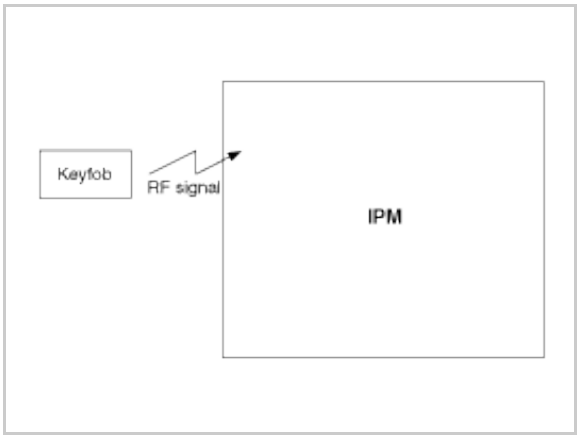
Tailgate Open Warning

The RAM receives on digital input the status of the tailgate open switch and sends it on the CAN network.
The IPM receives by CAN network the speed of the vehicle.
The tailgate open warning chime is activated when the tailgate is opened and the speed of vehicle is over 10km/h.

Safety And Security Function

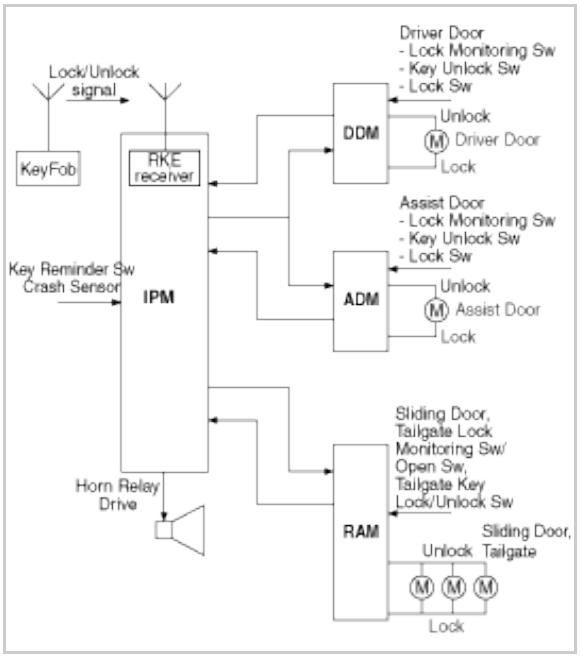
Remote Keyless Entry

1. The aim of this function is to receive the key fob signal and decode it. There are 8 different data included in the radio frequency frame sent by the RKE to the IPM module:
   a. Central door lock
   b. Central door unlock
   c. Panic function
   d. Driver door window close (long press on RKE lock button)
   e. Driver door window open (long press on RKE unlock button)
   f. Left sliding door open/close
   g. Right sliding door open/close
   h. Power tailgate open/close
2. Each vehicle can have at most 2 associated key fobs. The key fob is physically separated from the key itself (separate device).
3. Input/Output Definition and Characteristics



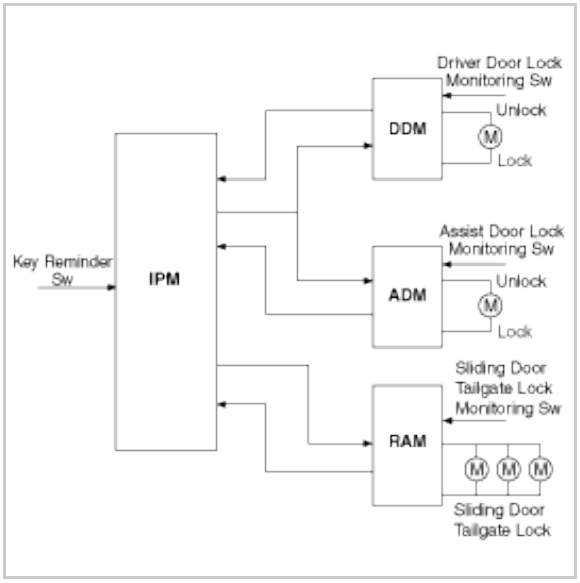
Central Lock/unlock

1. Central locking/unlocking logic is controlled by IPM. Locking/Unlocking inputs are located in ADM, DDM (Lock/Unlock switch, door knobs, door key cylinder) and in IPM (RKE receiver).
2. Locking/Unlocking actuators are located in ADM for passenger door, DDM for driver door and RAM for sliding doors and tailgate.
   There are 5 ways of operating central lock/unlock:
   a. With Key RKE
   b. With Door Lock/Unlock switches located on ADM/DDM
   c. With Door Lock Monitoring switches located on the passenger/driver door
   d. With Door/Tailgate Key Cylinder Lock/Unlock switches located on the tailgate or passenger/driver door.
3. Functional Diagram



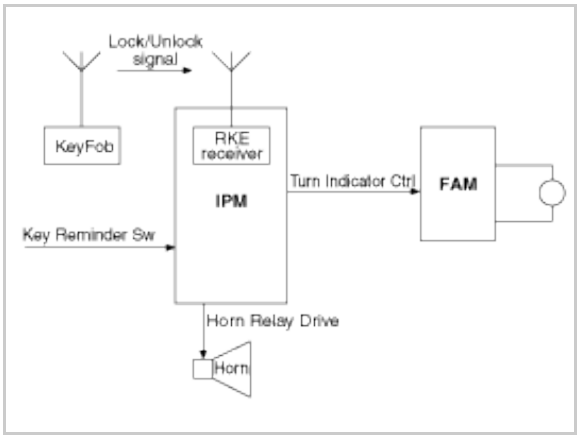
Key Reminder Unlock

1. Key reminder door unlock does not take into account the lock/unlock commands from RKE, key cylinder or door lock switches. It only takes into account the state of the door lock monitoring switch, key reminder switch and door open status in order to proceed with the unlock sequence or not.
2. Functional Diagram



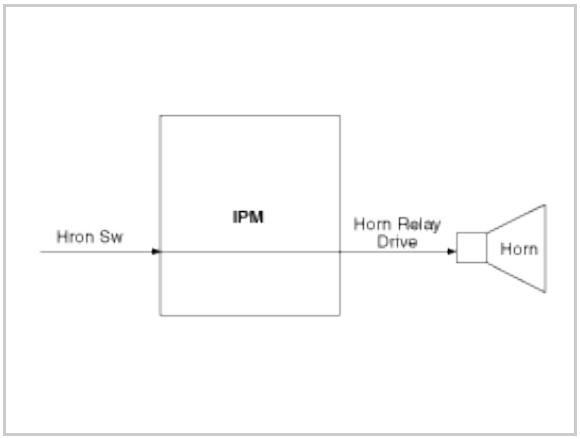
Remote Keyless Entry Panic

1. Working Conditions
   RKE panic function is only active when the key is out of key cylinder.
   Once started, panic operation is not stopped when ignition key is inserted, ignition is ACC, RUN or START, or door is opened or closed.
2. Functional Diagram



Horn

1. Working Conditions
   Required key positions:
   a. At any position of the key in the cylinder for the horn stalk activation,
   b. At Key out from the key cylinder for the horn lock activation or for panic activation.
2. Functional Diagram



Burglar Alarm Function

Burglar Alarm

1. Basic Concept
   a. The following functions are related to the RKE and burglar alarm systems..
   a. Door locking
   b. Door unlocking
   c. PSD open/close (both for left and right)
   d. PTG open/close
   e. Panic
   b. If IGN key is inserted into the key cylinder, the RKE transmitter functions are inoperative..
   c. Door locking by RKE signal:
   a. Whenever this signal is received, door LOCK pulse is always issued.
   b. Hazard lamp flashes one time for 1 second depending on the burglar alarm state.
   c. This signal will make the system possible to enter into the ARM state (or PREARM state depending on the vehicle condition).
   d. Door unlocking by RKE signal.
   a. Whenever this signal is received, door UNLOCK pulse is always issued.
   b. Hazard lamp flashes two times whenever the key fob unlock signal is received.
   c. This signal will make the system possible to enter into the DISARM or 30sec DELAY state depending on Condition A is true or not.
   e. LH or RH PSD open/close by RKE signal.
   a. Only with the information received by RKE, the burglar alarm system cannot distinguish the OPEN signal from

CLOSE signal.

b. RAM will pass this signal to LH PSD and RH PSD then the burglar alarm state is decided depending on the vehicle condition.

f. PTG open/close

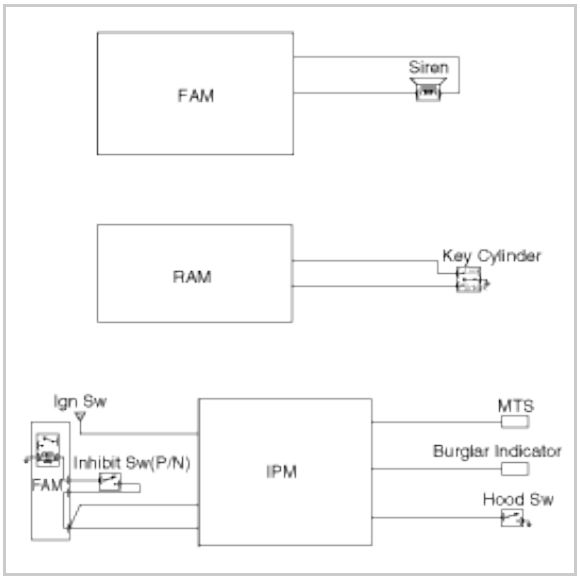
a. Only with the information received by RKE, the burglar alarm system cannot distinguish the OPEN signal from CLOSE signal.

b. RAM will pass this signal to PTG module then the burglar alarm state is decided depending on the vehicle condition.

g. Panic by key fob

a. Whenever this signal is received, the PANIC function is activated (unless the system is already in an ALARM state).

2. Functional Diagram



Arm Mode

a. If 30 second timer is elapsed without any changes from the ARM WAIT mode, then system goes to ARM mode.

b. Whenever RKE lock signal is received in the ARM state, then the system makes a hazard flash (1 second) and sends a door lock pulse.

Prearm Mode

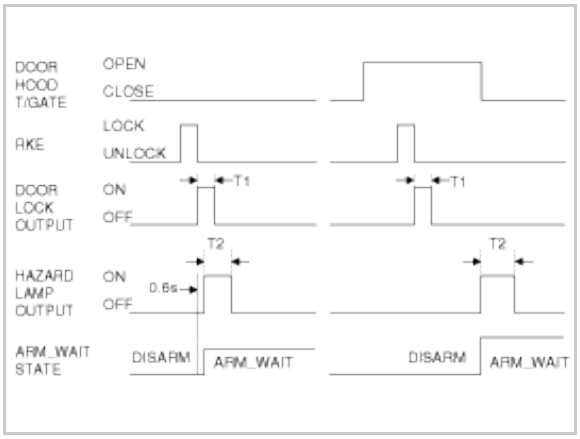
a. If the vehicle is locked using the RKE transmitter, and one or more doors are in an OPEN state, the system issues a LOCK pulse and enters a PREARM state." In the PREARM state, the hazard lamps do not flash".

b. If all doors are closed in the PREARM state, the system enters ARM WAIT mode, and the hazard lamps will flash once.

c. During PREMARM state, if f key reminder switch is ON & IGN 1 & IGN 2 are turned on in this state, the system immediately goes to DISARM state

Arm Wait Mode

a. The ARM WAIT mode is active for 30 seconds. If any entrance (hood, doors, tailgate) is opened, any lock knob is moved to an UNLOCK state, or the ignition switch is turned ON, the system will immediately enter DISARM mode. The system will enter ARM state if none of the previously mention conditions occur during the 30-second ARM WAIT mode.



T1 : 0.5 sec

T2 : 1.0 ± 0.1 sec

Disarm Mode

a. If RKE unlock signal is received, then UNLOCK output is issued together with the flashing of hazard lamp (two times) and the system enters into the DISARM condition.

b. When entering into DISARM from ALARM state, current alarm will be cancelled and burglar alarm relay drive output is turned off.

c. When RKE unlock signal is received again in the DISARM state, UNLOCK output is issued again and hazard lamp is flashed also (two times).

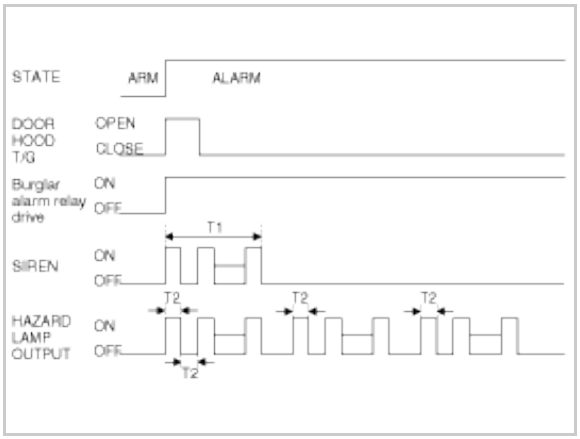
Alarm Mode

a. If one or more of entrances are opened in the ARM or REARM state, then Burglar alarm relay drive output is turned ON in order to inhibit the start condition, and hazard lamp and siren are activated for once of 27 seconds duration.

b. Siren output and hazard lamp should be synchronized to get the same output period.

c. Even though all the doors are closed during alarm, alarm continues to operate it for the remaining time.

d. When there is a new attack (with one of the entrance is still open) in the vehicle after completing the alarm output, alarm should not be started again.



T1 : 27 sec (-0, +3sec)

T2 : 0.5 ± 0.1 sec

After Alarm State

a. If ALARM cycle is elapsed, the system goes into AFTER ALARM state.

b. During this state,

a. Burglar alarm relay drive output maintains ON.

b. Siren and hazard lamp output are stopped.

c. If another entry is opened during the AFTER ALARM state, the burglar alarm relay drive output remains ON, but the siren will not be re-activated.

Rearm State

a. If all entrances are is closed during AFTER ALARM state, the system goes into REARM state.

Battery Removal

a. If the battery is removed with the system in the ARM state, the system will be placed into the ARM state upon battery reconnect.
b. The ALARM state will be re-activated if the battery is disconnected, then reconnected, with the system in an ALARM state.
c. If the battery is disconnected and reconnected with the system in AFTER ALARM state, the alarm will be re-activated.
d. The system will enter DISARM mode if the battery is disconnected during the ALARM WAIT state.

Panic

a. If RKE PANIC signal is received, Siren output and hazard lamp operate for 27 seconds and the system return to the previous state as soon as the PANIC function finishes.
b. The PANIC function will be stopped if any RKE signal is received during PANIC activation..
c. If Key reminder switch is ON during PANIC function is operating, PANIC is stopped immediately.
d. If the system goes to ALARM mode during PANIC function is operating, PANIC is stopped immediately and then ALARM function should be activated.
e. During ALARM state;
   If RKE PANIC signal is received, ALARM mode is maintained and PANIC function should be ignored. ALARM has higher priority than PANIC function.
f. During AFTER_ALARM state;
   If RKE PANIC signal is received, AFTR_ALARM mode is maintained and PANIC function should be activated.

Safe & Rescue Mode

The goal of those modes is to be able to cope with failures that may happen on some of the most critical functionalities (for the driver security) of the system.

Safe Mode

The safe mode is entered in case of system problems such as:

a. Incoherent inputs on monitored signals. In this case, safe mode is the debouncing time before the inputs are considered INVALID. Note that today, we have no way to detect if the rain/light sensor is in working operation or not. It means that a driver action will be required in case of failure of this sensor;
b. Loss of the CAN frame containing the monitored signal:
c. Loss of the CAN network: CAN goes to BUS OFF state, safe mode is the time necessary for detecting the BUS OFF state.

In all cases, the action in safe mode is to maintain the previous state of the system (for lighting and wiping). The list of monitored signals is the same as in rescue mode

Exiting Safe Mode

The software safe mode is exited and the module goes back to the normal mode when:

a. On IPM, hardware inputs return to a coherent state;
b. The lost CAN signal comes back while timeout has not elapsed;
c. The CAN network returns to a normal state without reaching BUS OFF state.

Software safe mode is also exited when the software rescue mode is entered (problem does not disappear).
Hardware safe mode is exited and the module goes back to normal mode if the internal problem disappears (watchdog is properly triggered again). If the problem stays, hardware safe mode is exited to enter hardware rescue mode.

Rescue Modes

The rescue mode consists in activating some safety functions when IGN2 = ON:

a. Switch on the low beams (FAM), park lamps (FAM), tail lamps (RAM) and cluster backlighting (IPM);
b. Unlock of all the doors when the rescue mode is entered with IGN2 = ON
c. Front wipers do not need to be turned on by software in rescue mode because wipers can be turned on by manually setting the MF switch to low speed. The FAM software must keep the same state as before entering the rescue mode.
d. When IGN2 = OFF, low beams, park/tail lamps and cluster backlighting are turned off.

Entering Rescue Modes

Rescue mode is entered when some important CAN signal or hardware input are not available. Rescue mode is entered when one of the following conditions is true:

IPM

a. Timeout on CAN signal InhibitSwSts, to detect loss of CAN connection with FAM.
b. Timeout on CAN signal StopLpErrorSts, to detect loss of CAN connection with RAM.
c. MF Light Switch information is invalid: when the signals coming from MF Light Switch are not coherent for more than 2 s, CAN signal ParkTailHeadLpCtrl is sent with INVALID value and rescue mode is entered.
d. Front Wiper MF Switch information is invalid: when the signals coming from Front Wiper MF Switch are not coherent for more than 2 s, CAN signal FWiperCtrl is sent with INVALID value and rescue mode is entered.
e. CAN is in Bus Off state

RAM

a. Timeout on CAN signal InhibitSwSts, to detect loss of CAN connection with FAM.
b. Timeout on CAN signal ParkTailHeadLpCtrl or FWiperCtrl, to detect loss of CAN connection with IPM.
c. ParkTailHeadLpCtrl = INVALID or unknown value
d. FWiperCtrl = INVALID or unknown value
e. CAN is in Bus Off state

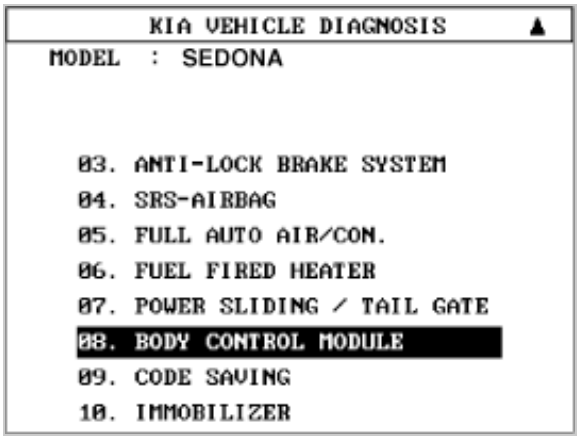
FAM

a. Timeout on CAN signal StopLpErrorSts, to detect loss of CAN connection with RAM
b. Timeout on CAN signal ParkTailHeadLpCtrl or FWiperCtrl, to detect loss of CAN connection with IPM
c. ParkTailHeadLpCtrl = INVALID or unknown value
d. FWiperCtrl = INVALID or unknown value
e. CAN is in Bus Off state

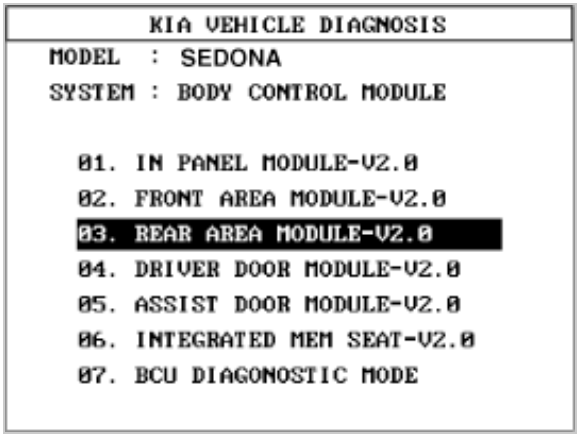
For all CAN signals, timeout duration is 2.5 times signal periodicity.

TROUBLE DIAGNOSTICS WHEN USING DIAGNOSIS TOOL

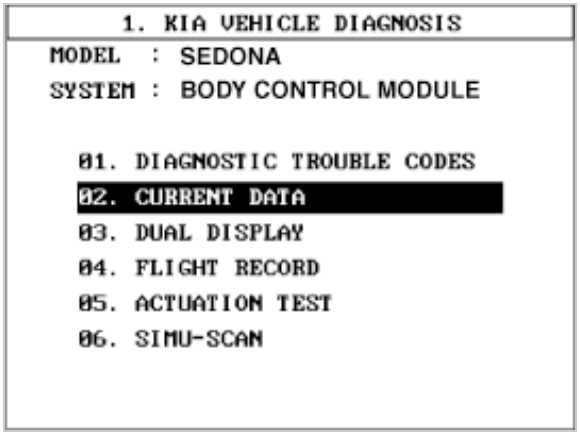
1. The diagnosis tool supports quick diagnosis of supported body electrical systems through input/output monitoring. and actuation testing.
2. To diagnose the BCM function, select the menu of model and body control module.

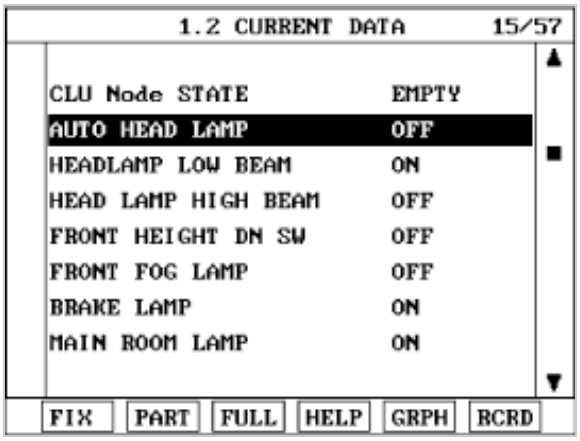


3. Select the module menu to diagnose.

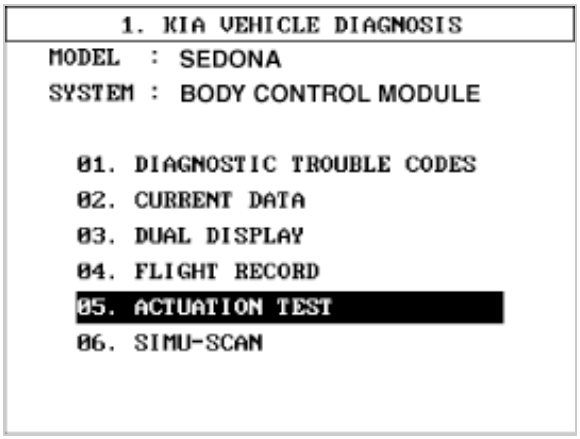


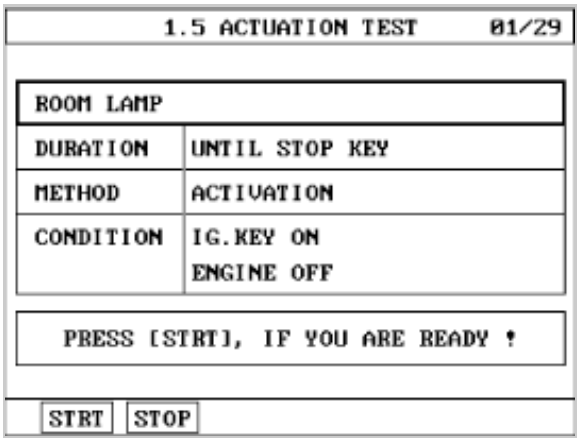
4. The CURRENT DATA function is used to monitor input/output conditions.



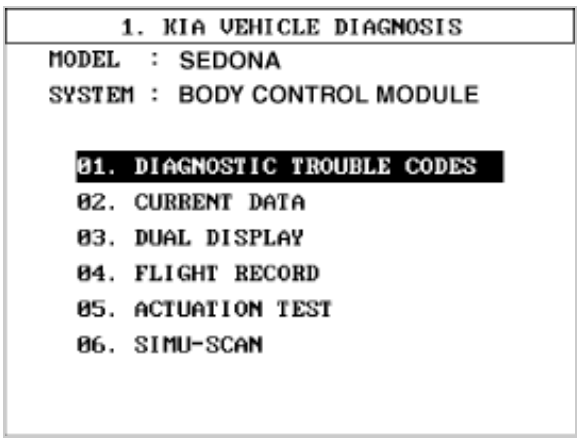


5. Use the ACTUATION TEST mode to force output devices to operate for testing purposes.





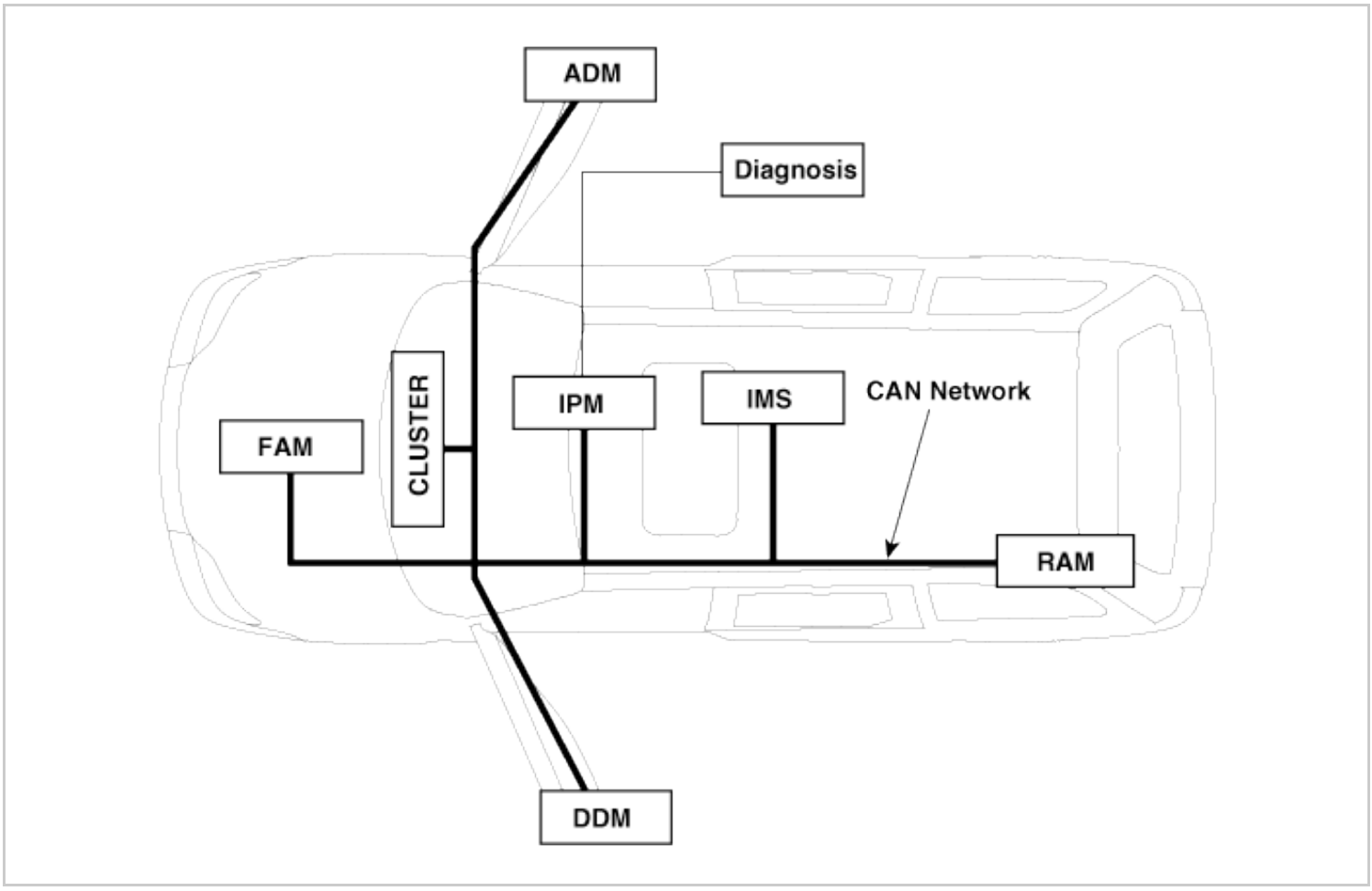
6. Use the "DIAGNOSTIC TROUBLE CODES" mode.



INSPECTION

1. The body network system consists of several ECUs that communicates via a CAN bus. The diagnostic tester is not directly connected to the CAN bus, but utilises a one-wire communication line (K-line) that connects to a gateway in the IPM ECU.

2. The IPM communicates with the diagnostic tester directly. But other units operate self diagnostic, input/output monitoring and actuator operation via the IPM using the CAN communication.



INPUT MONITORING

IPM (In-Panel Module)

No.	Input switch	Unit
1	IPM Node Availability	PRESENT/NOT PRESENT
2	FAM Node Availability	PRESENT/NOT PRESENT
3	RAM Node Availability	PRESENT/NOT PRESENT
4	DDM Node Availability	PRESENT/NOT PRESENT
5	ADM Node Availability	PRESENT/NOT PRESENT
6	IMS Node Availability	PRESENT/NOT PRESENT
7	CLU Node Availability	PRESENT/NOT PRESENT
8	IPM Node Failure	FAILURE/ O.K
9	FAM Node Failurey	FAILURE/ O.K
10	RAM Node Failure	FAILURE/ O.K
11	DDM Node Failure	FAILURE/ O.K
12	ADM Node Failure	FAILURE/ O.K
13	IMS Node Failure	FAILURE/ O.K
14	CLU Node Failure	FAILURE/ O.K
15	Auto Head lamp	ON/OFF
16	Headlamp low beam	ON/OFF
17	High beam	ON/OFF

18	Rear fog lamp	ON/OFF
19	Front fog lamp	ON/OFF
20	Park tail lamp	ON/OFF
21	Main room lamp	ON/OFF
22	Main room lamp door	ON/OFF
23	Left turn signal	ON/OFF
24	Right turn signal	ON/OFF
25	Front wiper low speed(from rain sensor)	ON/OFF
26	Front wiper low speed switch(from multi function switch)	ON/OFF
27	Front wiper high speed(from rain sensor)	ON/OFF
28	Front wiper high speed switch(from multi function switch)	ON/OFF
29	Rear wiper low speed switch	ON/OFF
30	Rear wiper intermittent switch	ON/OFF
31	Front wiper intermittent switch	ON/OFF
32	Front washer	ON/OFF
33	Rear washer	ON/OFF
34	Windshield defog	ON/OFF
35	Rear defog	ON/OFF
36	Parking brake	ON/OFF
37	Hazard switch	ON/OFF
38	Seat-belt	ON/OFF
39	VAS	ON/OFF
40	Front wiper mist switch	ON/OFF
41	Sunroof open(When operating)	OPEN/CLOSED
42	PSD PTG on/off switch signal	ON/OFF
43	Flash to pass	ON/OFF
44	Ignition key reminder	INSERTED/NOT INSERTED
45	LH PSD open/close(Over head console)	ON/OFF
46	PTG open/close(Over head console)	ON/OFF
47	RH PSD open/close(Over head console)	ON/OFF
48	Crash sensor input from airbag unit	ON/OFF
49	Adjustable pedal backward	ON/OFF
50	Adjustable pedal forward	ON/OFF
51	IGN1	ON/OFF
52	IGN2	ON/OFF
53	ACC	ON/OFF
54	MTS unlock input	ON/OFF
55	Hood Open switch	OPEN/CLOSED

FAM (Front Area Module)

No.	Input switch	Unit

1	Inhibitor Switch Neutral	ON/OFF
2	Inhibitor Switch Park	ON/OFF
3	Inhibitor Switch Reverse	ON/OFF
4	Brake Fluid Sensor State	OK/LOW
5	Washer Fluid Sensor State	OK/LOW
6	Fuel Filter State	OK/NG
7	Oil Pressure Switch State	OK/LOW
8	Vacuum Switch State	OK/LOW
9	IGN2	ON/OFF
10	Front Wiper Park Switch State	Park/Out of park
11	Stop lamp fuse check input	OK/NG
12	Windshield defog operation check	OK/NG

RAM (Rear Area Module)

No.	Input switch	Unit
1	Tailgate Flasher Signal(From PTG)	ON/OFF
2	Stop Lamp switch	ON/OFF
3	PSD PTG Door Lock Monitoring Switch	UNLOCKED/LOCKED
4	Passenger Door Open Switch	ON/OFF
5	Driver Door Open Switch	OPEN/CLOSE
6	Tailgate Door Open Switch	OPEN/CLOSE
7	RSD Open Switch	OPEN/CLOSE
8	LSD Open Switch	OPEN/CLOSE
9	RSD Power Window Up Switch	ON/OFF
10	RSD Power Window Down Switch	ON/OFF
11	LSD Power Window Up Switch	ON/OFF
12	LSD Power Window Down Switch	ON/OFF
13	RQG Power Motor Close Switch	ON/OFF
14	RQG Power Motor Open Switch	ON/OFF
15	LQG Power Motor Close Switch	ON/OFF
16	LQG Power Motor Open Switch	ON/OFF
17	IGN2	ON/OFF
18	Rear Wiper Park Switch	Park/Out of park
19	Rear defog operation check input	ON/NG
20	Tailgate Key Cylinder Unlock Switch	ON/OFF
21	Tailgate Key Cylinder Lock Switch	ON/OFF

DDM (Driver door module)

No.	Input switch	Unit
1	Door Lock Monitoring Switch	LOCK/UNLOCK
2	Door Lock Switch	ON/OFF

3	Door Unlock Switch	ON/OFF
4	Key Cylinder Door Lock Switch	ON/OFF
5	Key Cylinder Door Unlock Switch	ON/OFF
6	Fuel Filler Door Open Switch	ON/OFF
7	Power Seat Slide Forward Switch	ON/OFF
8	Power Seat Slide Backward Switch	ON/OFF
9	Power Seat Front Height Up Switch	ON/OFF
10	Power Seat Front Height Down Switch	ON/OFF
11	Power Seat Rear Height Up Switch	ON/OFF
12	Power Seat Rear Height Down Switch	ON/OFF
13	Power Seat Recline Forward Switch	ON/OFF
14	Power Seat Recline Backward Switch	ON/OFF
15	IMS Auto Switch	ON/OFF
16	IMS Mode 1 Switch	ON/OFF
17	IMS Mode 2 Switch	ON/OFF
18	IMS Set Switch	ON/OFF
19	OSRVM side Select Switch	RH/LH/OFF
20	OSRVM direction Select Switch	RIGHT/LEFT/DOWN/UP/OFF
21	IGN 2 Switch	ON/OFF
22	Window Lock Switch	ON/OFF
23	Front Left Window Up Switch	ON/OFF
24	Front Left Window Down Switch	ON/OFF
25	Front Left Window Auto Switch	ON/OFF
26	Front Right Window Up Switch	ON/OFF
27	Front Right Window Down Switch	ON/OFF
28	Left Sliding Door Window UP Switch	ON/OFF
29	Left Sliding Door Window Down Switch	ON/OFF
30	Right Sliding Door Window UP Switch	ON/OFF
31	Right Sliding Door Window Down Switch	ON/OFF
32	Left Quarter Glass Open Switch	ON/OFF
33	Left Quarter Glass Close Switch	ON/OFF
34	Right Quarter Glass Open Switch	ON/OFF
35	Right Quarter Glass Close Switch	ON/OFF

ADM (Assist door module)

No.	Input switch	Unit
1	Door Lock Monitoring Switch	ON/OFF
2	Door Lock Switch	ON/OFF
3	Door Unlock Switch	ON/OFF
4	Key Cylinder Door Lock Switch	ON/OFF
5	Key Cylinder Door Unlock Switch	ON/OFF

6	IGN2 Switch	ON/OFF
7	Front Right Window Up Switch	ON/OFF
8	Front Right Window Down Switch	ON/OFF

IMS Module

No.	Input switch	Unit
1	IGN2 Switch	ON/OFF
2	Slide front manual switch	ON/OFF
3	Slide rear manual switch	ON/OFF
4	Slide front limit switch	ON/OFF
5	Slide rear limit switch	ON/OFF
6	Recline front manual switch	ON/OFF
7	Recline rear manual switch	ON/OFF
8	"P" position switch	ON/OFF

Self-diagnosis

IPM DTC List

No.	DTC Code	DTC	Passiblecause
1	B1102	BATTERY VOLTAGE LOW	Vbat < 9V
2	B1588	FR WIPER/WASHER MF SW	MF switch status is not coherent for more than 2s
3	B1589	RR WIPER/WASHER MF SW	
4	B1590	LIGHT MF SW ERROR	MF switch status is not coherent for more than 2s
5	B1591	TURN SIGNAL MF SW ERROR	
6	B1602	CAN BUS PHYSICAL BUS FAILURE	Physical error indicated by network management
7	B1605	DDM COMM. LOST& BUS FAILURE	DDM is missing in system configuration information reported from network management.
8	B1606	ADM COMM. LOST& BUS FAILURE	ADM is missing in system configuration information reported from network management.
9	B1607	IMS COMM. LOST& BUS FAILURE	IMS is missing in system configuration information reported from network management.
10	B1611	FAM COMM. LOST& BUS FAILURE	FAM is missing in system configuration information reported from network management.
11	B1612	RAM COMM. LOST& BUS FAILURE	RAM is missing in system configuration information reported from network management.
12	B1613	CLU COMM. LOST& BUS FAILURE	CLU is missing in system configuration information reported from network management.
13	B1624	EEPROM FAILURE	Failed attempt to read or write EEPROM
14	B1627	EEPROM CORRUPTION	Data in EEPROM is not coherent
15	B1628	MODULE CONF. CONFLICT	Hardware and software configuration are not coherent

16	B1646	S/W RESCUE MODE	Module enters rescue mode
17	B1647	VAS ERROR	No VAS chip transition from busy to not busy for more than 5 s after a VAS message command has been issued

FAM DTC List

No.	DTC Code	DTC	Passiblecause
1	B1624	EEPROM FAILURE	Failed attempt to read or write EEPROM
2	B1627	EEPROM CORRUPTION	Data in EEPROM is not coherent
3	B1646	S/W RESCUE MODE	As soon as the module enters rescue mode
4	B2119	WINDSHIELD DEFOG RELAY FAIL	Windshield defog relay failure
5	B2521	BRAKE CIRCUIT OPEN OR FUSE FAIL	Stop lamp fuse failure
6	B2535	RIGHT T/SIGNAL LAMP SHORT TO GND	Right turn signal lamp circuit short to ground error
7	B2537	RIGHT T/SIGNAL LAMP OPEN	Right turn signal lamp circuit open error
8	B2539	LEFT T/SIGNAL LAMP SHORT TO GND	Left turn signal lamp circuit short to ground error
9	B2541	LEFT T/SIGNAL LAMP OPEN	Left turn signal lamp circuit open error
10	B2543	RIGHT H/LAMP HIGH SHORT TO GND	Right headlamp high circuit short to ground error
11	B2545	RIGHT H/LAMP HIGH OPEN	Right headlamp high circuit open error
12	B2547	LEFT H/LAMP HIGH SHORT TO GND	Left headlamp high circuit short to ground error
13	B2549	LEFT H/LAMP HIGH OPEN	Left headlamp high circuit open error
14	B2551	RIGHT H/LAMP LOW SHORT TO GND	Right headlamp low circuit short to ground error
15	B2553	RIGHT H/LAMP LOW OPEN	Right headlamp low circuit open error
16	B2555	LEFT H/LAMP LOW SHORT TO GND	Left headlamp low circuit short to ground error
17	B2557	LEFT H/LAMP LOW OPEN	Left headlamp low circuit open error
18	B2559	FR FOG LAMP SHORT TO GND	Right front fog lamp circuit short to ground error
19	B2561	FR FOG LAMP OPEN	Right front fog lamp circuit open error
20	B2563	FL FOG LAMP SHORT TO GND	Left front fog lamp circuit short to ground error
21	B2565	FL FOG LAMP OPEN	Left front fog lamp circuit open error
22	B2571	RIGHT P/LAMP SHORT TO GND	Right parking lamp circuit short to ground error
23	B2573	RIGHT P/LAMP OPEN	Right parking lamp circuit open error
24	B2575	LEFT P/LAMP SHORT TO	Left parking lamp circuit short to ground error

24	B2575	GND	Left parking lamp circuit short to ground error
25	B2577	LEFT P/LAMP OPEN	Left parking lamp circuit open error

RAM DTC List

No.	DTC Code	DTC	Passiblecause
1	B1624	EEPROM FAILURE	Failed attempt to read or write EEPROM
2	B1627	EEPROM CORRUPTION	Data in EEPROM is not coherent
3	B1646	S/W RESCUE MODE	As soon as the module enters rescue mode
4	B2115	REAR DEFOG RELAY FAIL	Command active and check entry not active
5	B2441	RR WIPER P. POS. DETECT FAIL	Command active and park position does not change during 5s
6	B2524	BRAKE LAMP OPEN	Stop lamps open circuit error
7	B2535	RIGHT T/SIGNAL LAMP SHORT TO GND	Right turn signal lamp circuit short to ground error
8	B2537	RIGHT T/SIGNAL LAMP OPEN	Right turn signal lamp circuit open error
9	B2539	LEFT T/SIGNAL LAMP SHORT TO GND	Left turn signal lamp circuit short to ground error
10	B2541	LEFT T/SIGNAL LAMP OPEN	Left turn signal lamp circuit open error
11	B2579	RR TAIL MARKER LAMP SHORT TO GND	Right tail license side marker lamp circuit short to ground error
12	B2581	RR TAIL MARKER LAMP OPEN	Right tail license side marker lamp circuit open error
13	B2583	RL TAIL MARKER LAMP SHORT TO GND	Left tail license side marker lamp circuit short to ground error
14	B2585	RL TAIL MARKER LAMP OPEN	Left tail license side marker lamp circuit open error
15	B2587	BACK UP LAMP SHORT TO GND	Back up lamps for Back Up Warning System unit circuit short to ground error
16	B2589	BACK UP LAMP OPEN	Back up lamps for Back Up Warning System unit circuit open error
17	B2598	RR BLOWER SW ILLU. CIR. OPEN	Rear blower switch illumination circuit open
18	B2599	RR BLOWER SW ILLU. SHORT TO GND	Rear blower switch illumination short to ground

DDM DTC List

No.	DTC Code	DTC	Passiblecause
1	B1910	Left OSM horizontal motor or sensor error	Right OSM horizontal motor circuit open error
2	B1911	Left OSM vertical motor or sensor error	Right OSM horizontal motor circuit open error
3	B1952	OSRVM defogger error	Left OSM deicer circuit open error
4	B2330	Driver door lock actuator error	Assist door lock actuator circuit open error

5	B2331	Driver door unlock actuator error	Assist door unlock actuator circuit open error
6	B2429	Folding motor power feed error	Folding motor power feed circuit open error
7	B2455	Safety power window motor power feed error	Safety power window IGN2 module power circuit open error
8	B2525	Illumination error	Illumination circuit open error
9	B2529	Drive door courtesy lamp error	Driver door courtesy lamp circuit open error

ADM DTC List

No.	DTC Code	DTC	Passiblecause
1	B1912	Right OSM horizontal motor or sensor error	Right OSM horizontal motor circuit open error
2	B1913	Right OSM vertical motor or sensor error	Right OSM horizontal motor circuit open error
3	B1952	OSRVM defogger error	Right OSM deicer circuit open error
4	B2332	Assist door unlock actuator error	Assist door lock actuator circuit open error
5	B2333	Assist door unlock actuator error	Assist door unlock actuator circuit open error
6	B2525	Illumination error	Illumination circuit open error
7	B2533	Assist door courtesy lamp error	Assist door courtesy lamp circuit open error

IMS DTC List

No.	DTC Code	DTC	Passiblecause
1	B1954	Slide motor or sensor error	Lost Communication With Slide motor sensor output for more than 2 s
2	B1955	Recline motor or sensor error	Lost Communication With Recline motor sensor output for more than 2 s
3	B1956	Front height motor or sensor error	Lost Communication With Front right motor sensor output for more than 1 s
4	B1957	Rear height motor or sensor error	Lost Communication With Rear right motor sensor output for more than 1 s
5	B1958	Pedal motor or sensor error	Lost Communication With Pedal motor sensor output for more than 1 s
6	B2456	Seat motor sensor Vcc error	Lost Seat motor sensor Vcc for more than 1 s
7	B2457	Pedal motor sensor Vcc error	Lost Pedal motor sensor Vcc for more than 1 s

Driving Actuator

IPM ACTUATOR LIST

No.	Description	Value	Control
1	Windshield Defog Switch Indicator Output	ON/OFF	Continuously ON

2	Rear Defog Switch Indicator Output	ON/OFF	Continuously ON
3	Rear Fog Lamp Switch Indicator Output	ON/OFF	Continuously ON
4	VAS Switch Indicator Output	ON/OFF	Continuously ON
5	Back Up Signal Output	ON/OFF	Continuously ON
6	Micro Burglar Relay Drive Output	ON/OFF	Continuously ON
7	Ignition Key Hole Illumination	ON/OFF	Continuously ON
8	Adjustable Pedal On Off Signal Output	ON/OFF	Continuously ON
9	Power Feed To Sunroof Relay Coil	ON/OFF	Continuously ON
10	Horn Relay Drive	ON/OFF	0.5 sec ON then OFF
11	Sound Mute Signal Output	ON/OFF	Continuously ON
12	Panel Lights Trip Computer Output	ON/OFF	Continuously ON
13	Micro MTS Burglar Alarm Output	ON/OFF	Continuously ON
14	Auto Light Sensor 5V Ref	ON/OFF	Continuously ON
15	Burglar Alarm Indicator	ON/OFF	Continuously ON
16	AV Tail Output	ON/OFF	Continuously ON
17	VAS	ON/OFF	One Issue of voice alarm message
18	Chime	ON/OFF	Continuously ON with 0.6 sec period

FAM ACTUATOR LIST

No.	Description	Value	Control
1	Front Washer	ON/OFF	1 sec ON then OFF (once)
2	Rear Washer	ON/OFF	2 sec ON then OFF (once)
3	Right Headlamp High	ON/OFF	Continuously ON
4	Right Headlamp Low	ON/OFF	Continuously ON
5	Right Lamp Park	ON/OFF	Continuously ON
6	Right Fog Lamp	ON/OFF	Continuously ON
7	Right Turn Signal	ON/OFF	Contiuously ON with (80 +/- 5) cycles per minute, Duty: 50%
8	Left Headlamp High	ON/OFF	Continuously ON
9	Left Headlamp Low	ON/OFF	Continuously ON
10	Left Lamp Park	ON/OFF	Continuously ON
11	Left Fog Lamp	ON/OFF	Continuously ON
12	Left Turn Signal	ON/OFF	Contiuously ON with (80 +/- 5) cycles per minute, Duty: 50%
13	IGN2 Control	ON/OFF	Continuously ON
14	Windshield Defog Timer	ON/OFF	Continuously ON
15	Wiper On Off	ON/OFF	Continuously ON
16	Wiper Low speed	ON/OFF	3 wiping with LOW speed
17	Wiper High speed	ON/OFF	3 wiping with HIGH speed

18	Burglar Alarm horn	ON/OFF	Contiuously ON with 60 cycles per minute, Duty:50%

RAM ACTUATOR LIST

No.	Description	Value	Control
1	Room Lamp LS	ON/OFF	Continuously ON
2	Room Lamp LS Door	ON/OFF	Continuously ON
3	Luggage Lamp LS	ON/OFF	Continuously ON
4	LQG Motor Close	ON/OFF	3 sec ON then OFF (once)
5	LQG Motor Open	ON/OFF	3 sec ON then OFF (once)
6	RQG Motor Close	ON/OFF	3 sec ON then OFF (once)
7	RQG Motor Open	ON/OFF	3 sec ON then OFF (once)
8	RSD Power Window Up	ON/OFF	3 sec ON then OFF (once)
9	RSD Power Window Down	ON/OFF	3 sec ON then OFF (once)
10	LSD Power Window Up	ON/OFF	3 sec ON then OFF (once)
11	LSD Power Window Down	ON/OFF	3 sec ON then OFF (once)
12	LH PSD Open Close Signal	ON/OFF	0.5 sec ON then OFF (once)
13	RH PSD Open Close Signal	ON/OFF	0.5 sec ON then OFF (once)
14	PTG Open Close Signal	ON/OFF	0.5 sec ON then OFF (once)
15	PSD PTG On Off Signal	ON/OFF	Continuously ON
16	Park Signal	ON/OFF	Continuously ON
17	Start Signal	ON/OFF	Continuously ON
18	Rear Defog	ON/OFF	Continuously ON
19	Rear Fog Lamps	ON/OFF	Continuously ON
20	Right Turn Signal Lamp	ON/OFF	Contiuously ON with (80 +/- 5) cycles per minute, Duty: 50%
21	Left Turn Signal Lamp	ON/OFF	Contiuously ON with (80 +/- 5) cycles per minute, Duty: 50%
22	Back Up Lamp Back Up Warning System Unit	ON/OFF	Continuously ON
23	Left/Right Tail Licence Side Marker	ON/OFF	Continuously ON
24	Door Lock	ON/OFF	0.5 sec ON then OFF (once)
25	Door Unlock	ON/OFF	0.5 sec ON then OFF (once)
26	Rear Wiper Motor	ON/OFF	5 sec ON then OFF (once)
27	Rear Blower Switch & Rear Monitor illumination	ON/OFF	Continuously ON
			0.5 sec ON then OFF

28	Fuel Filler Door Solenoid	ON/OFF	0.5 sec ON then OFF (once)
29	Map Lamp LS	ON/OFF	Continuously ON

DDM ACTUATOR LIST

No.	Description	Value	Control
1	Door Courtesy Lamp	ON/OFF	Continuously ON
2	Door Lock Out	ON/OFF	0.5 sec ON then OFF (once)
3	Door Unlock Out	ON/OFF	0.5 sec ON then OFF (once)
4	OSRVM Up	ON/OFF	3 sec ON then OFF (once)
5	OSRVM Down	ON/OFF	3 sec ON then OFF (once)
6	OSRVM Left	ON/OFF	3 sec ON then OFF (once)
7	OSRVM Right	ON/OFF	3 sec ON then OFF (once)
8	OSRVM Defog	ON/OFF	Continuously ON
9	Folding Motor Power Feed	ON/OFF	Continuously ON
10	Safety Power Window Auto Up Out	ON/OFF	0.2 sec ON then OFF (once)
11	Safety Power Window Up Out	ON/OFF	3 sec ON then OFF (once)
12	Safety Power Window Auto Down Out	ON/OFF	0.2 sec ON then OFF (once)
13	Safety Power Window Down Out	ON/OFF	3 sec ON then OFF (once)
14	Power Window up Out	ON/OFF	3 sec ON then OFF (once)
15	Power Window Down Out	ON/OFF	3 sec ON then OFF (once)
16	Illumination Out	ON/OFF	Continuously ON

ADM ACTUATOR LIST

No.	Description	Value	Control
1	Door Courtesy Lamp	ON/OFF	Continuously ON
2	Door Lock Out	ON/OFF	0.5 sec ON then OFF (once)
3	Door Unlock Out	ON/OFF	0.5 sec ON then OFF (once)
4	OSRVM Up	ON/OFF	3 sec ON then OFF (once)
5	OSRVM Down	ON/OFF	3 sec ON then OFF (once)
6	OSRVM Left	ON/OFF	3 sec ON then OFF (once)
7	OSRVM Right	ON/OFF	3 sec ON then OFF (once)
8	OSRVM Defog	ON/OFF	Continuously ON
9	Power Window up Out	ON/OFF	3 sec ON then OFF (once)
10	Power Window Down Out	ON/OFF	3 sec ON then OFF (once)
11	Illumination Out	ON/OFF	Continuously ON

IMS ACTUATOR LIST

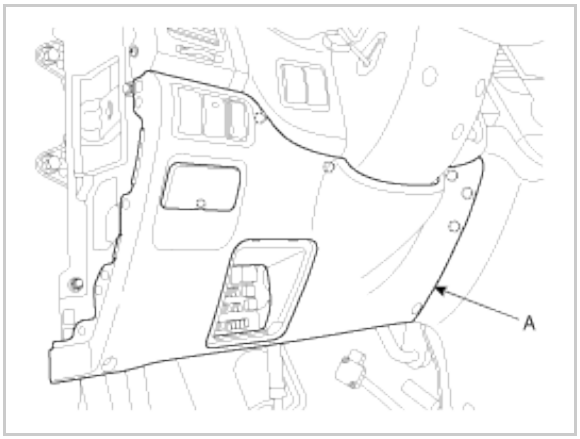
No.	Description	Value	Control
1	Power Seat Slide Forward Motor	ON/OFF	Continuously ON
2	Power Seat Slide Backward Motor	ON/OFF	Continuously ON
3	Power Seat FR Height Up Motor	ON/OFF	Continuously ON
4	Power Seat FR Height Down Motor	ON/OFF	Continuously ON
5	Power Seat RR Height Up Motor	ON/OFF	Continuously ON
6	Power Seat RR Height Down Motor	ON/OFF	Continuously ON
7	Power Seat Recline Forward Motor	ON/OFF	Continuously ON
8	Power Seat Recline Backward Motor	ON/OFF	Continuously ON
9	Pedal Forward Motor	ON/OFF	Continuously ON
10	Pedal Backward Motor	ON/OFF	Continuously ON

REPLACEMENT

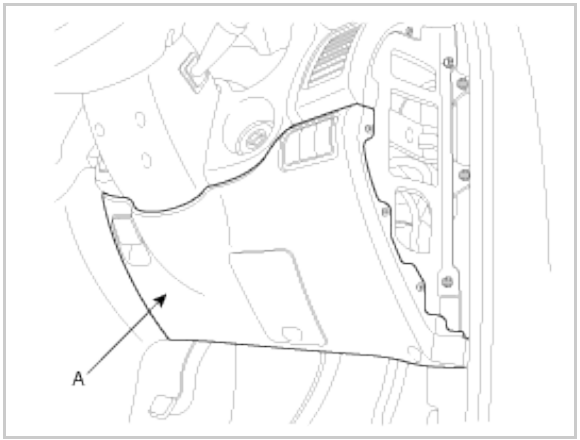
IPM (In-Panel Module)

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad lower panel (A).
   (Refer to the Body group - crash pad)

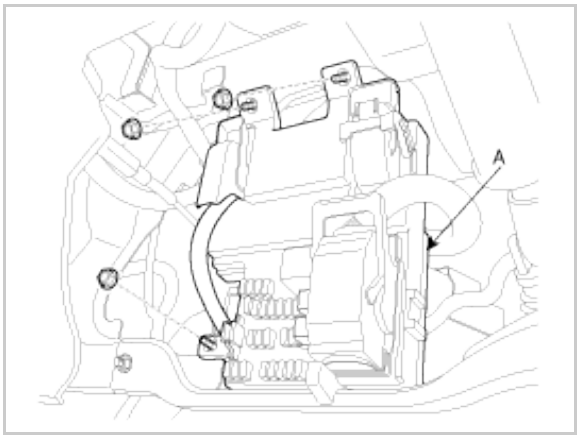
[LHD]



[RHD]



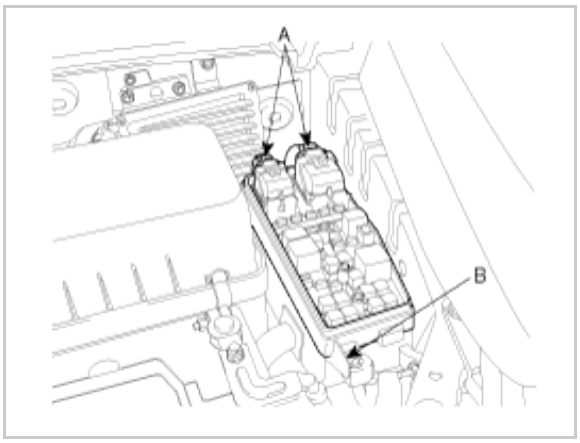
3. Remove the keyless antenna cable and IPM(Instrument Panel Module)(A) after loosening 3 nuts and disconnecting 5 connectors.



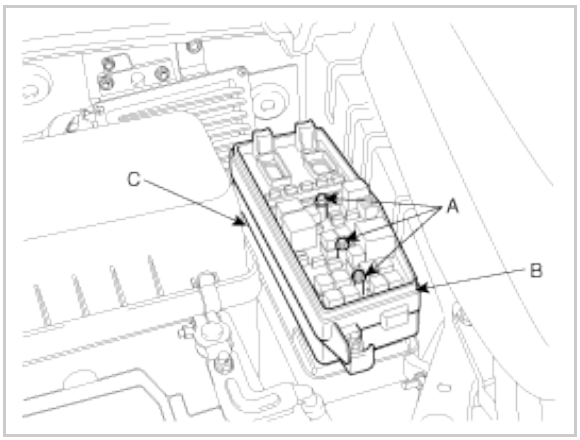
4. Installation is the reverse of removal.

FAM (Front Area Module)

1. Disconnect the negative (-) battery terminal.
2. Remove the FAM cover from the engine room.
3. Remove the 2 FAM connectors(A) and battery terminal nut(B).



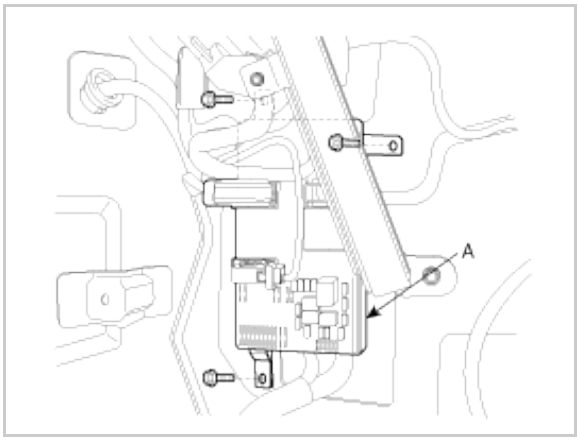
4. Remove the IPM(B) from the splesh shield(C) after loosening the 3 IPM mounting bolts(A) and the IPM mounting clip.



5. Disconnect the connector from the splesh shield.
6. Installation is the reverse of removal.

RAM (Rear Area Module)

1. Disconnect the negative (-) battery terminal.
2. Remove the left luggage side trim
   (Refer to the Body group - interior trim)
3. Remove the RAM(A) after loosening the 7 connectors and the 3 RAM mounting bolts(A).



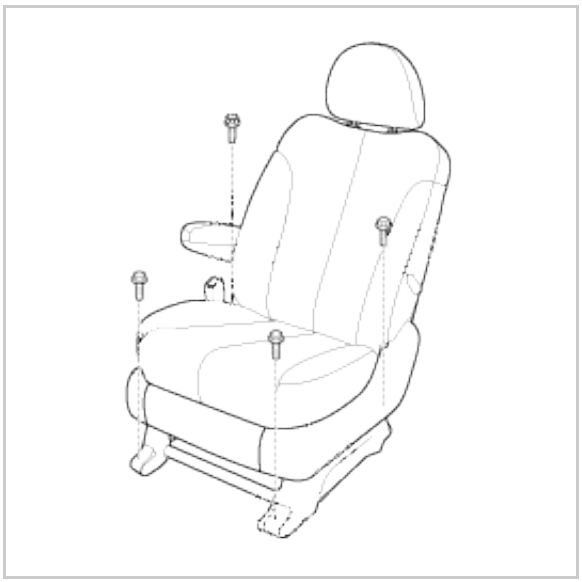
4. Installation is the reverse of removal.

IMS
(Integrated Memory)

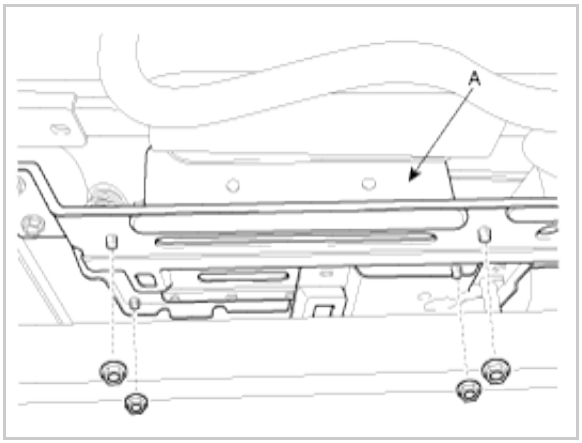
IMS
(Integrated Memory)
Module

REPLACEMENT

1. Remove the negative (-) battery terminal.
2. Remove the seats in the car. (Refer to the Body group - front seats)



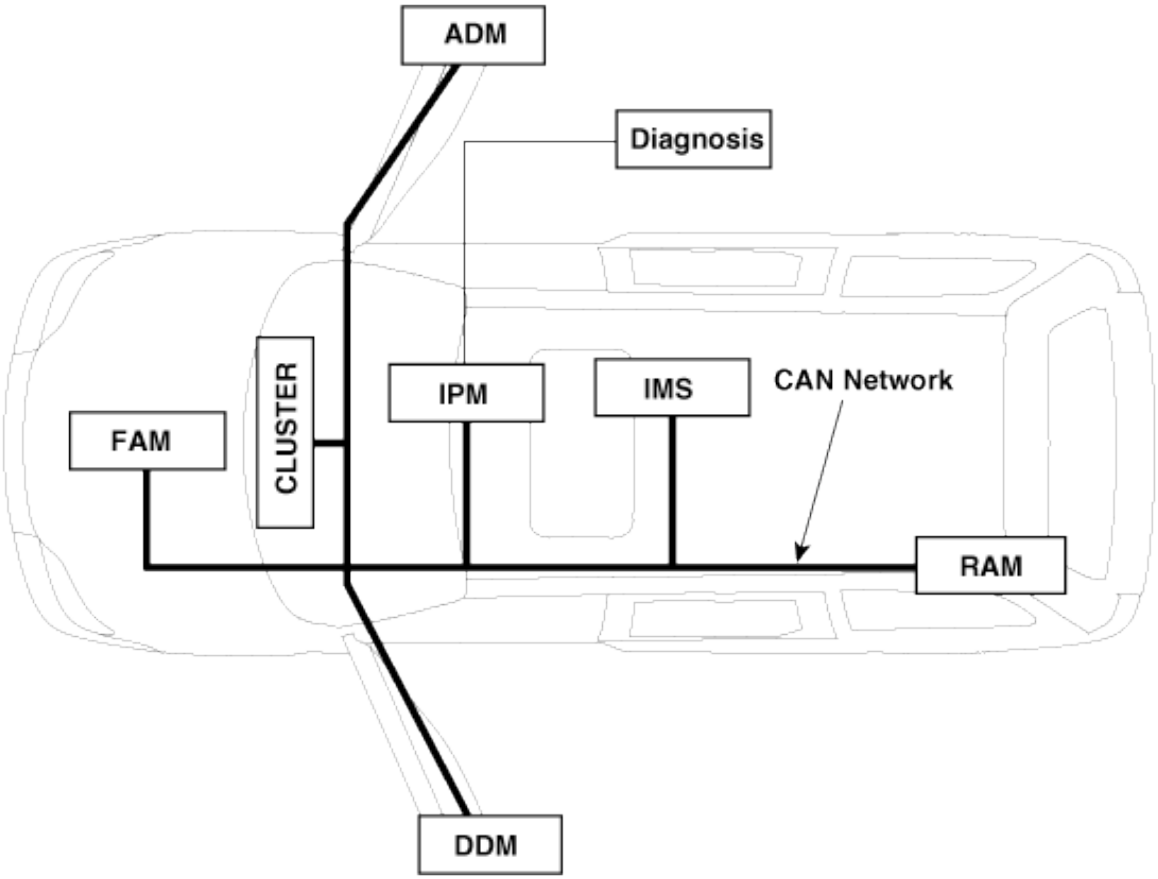
3. Remove the IMS module (A) after loosening 4 nuts and 3 connectors in the bottom of seat.



4. Installation is the reverse of removal.

IMS
(Integrated Memory)
Power Seat Control

CIRCUIT DIAGRAM



DESCRIPTION

An optimal seat position set by a driver can be memorized in P/seat unit by memory SW and position SW, which enables restoration of seat position set by the driver despite seat adjustments.
Furthermore, data is transmitted between P/seat and IPM, DDM, ADM, RAM, FAM, CLUSTER through CAN BUS.
Seat position presets cannot be recalled while driving. An emergency stop function is provided; additional functions are described below.

1. It conducts manual operation of seat by CAN BUS data transmitted by DDM as well as that of adjustable pedal by CAN BUS data transmitted by IPM received when operating SW manually.
2. Manual SW behavior when communication stops (back-up behavior)
   a. Slide front/rear
   b. Recline front/rear
   c. Position control of slide motor is possible by manual SW even in case of congestion in CPU or removal of a fuse for P/seat unit B.
3. 2 memory locations are provided for storing seat, outside mirror, and adjustable pedal presets.
4. The driver seat can be set to slide rearward when the ignition key is removed, and forward when the key is inserted.
5. 2 additional presets for seat, mirror, and adjustable pedal position can be stored with the RKE transmitter.

OPERATION

MANUAL OPERATION

Manual operation of the driver seat and adjustable pedals is possible provided the transaxle is in 'P' range and the vehicle speed is 0 MPH. Operation of the manual controls overrides any automatic operation commanded via CAN.

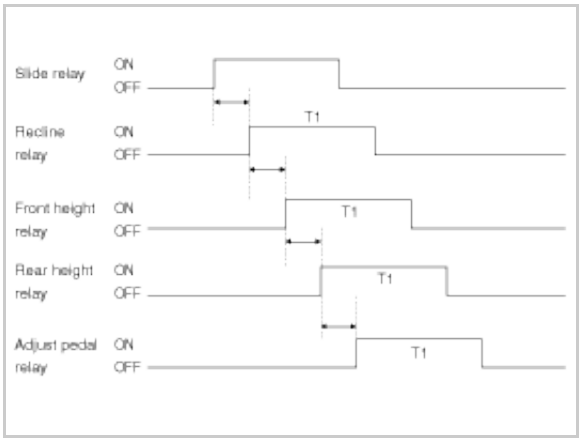
MEMORY OPERATION

1. Pressing the 'M' button on the control panel will place the system into memory storage mode and will result in a single pulse from the output buzzer.
2. If one of the memory location buttons is pressed and held within 5 seconds of pressing the 'M' button, the output buzzer will pulse twice to indicate successful storage of seat, mirror, and adjustable pedal positions.
3. The ignition switch must be in the RUN or START position, the vehicle speed must be 0 MPH, and the transaxle must be in 'P' range to store memory presets.
4. Pressing the 'M' button while recalling a stored preset will halt the preset recall operation.
5. Memory will be cleared if battery is removed.

MEMORY REPLAY OPERATION

1. Pressing one of the memory location buttons will result in the driver seat, outside mirrors, and adjustable pedals being positioned based on the stored preset data.
2. The ignition switch must be in the RUN position, the transaxle must be in 'P' range, the vehicle speed must be 0 MPH, and the manual functions must not be in operation to recall stored presets.
3. Others
   a. Play operation not recorded in the position switch will not be conducted and there will be no buzzer output.
   b. If other data is received during preset recall operation, the most recent preset recall signal will take precedence.
   c. If engine is started during preset recall operation, halt preset recall operation, and resume it toward target position 100ms after Ignition switch is returned to "RUN". However, if the START state lasts over 5 sec., it will not resume even after returning to RUN.
   d. If preset recall order is received during engine start, preset recall operation is inhibited.
   e. If input from manual switch for seat and adjust pedal occurs during preset recall operation of seat and adjust pedal, halt all their preset recall operations.
   f. If an error occurs during manual operation of seat and adjust pedal, delete Memory.

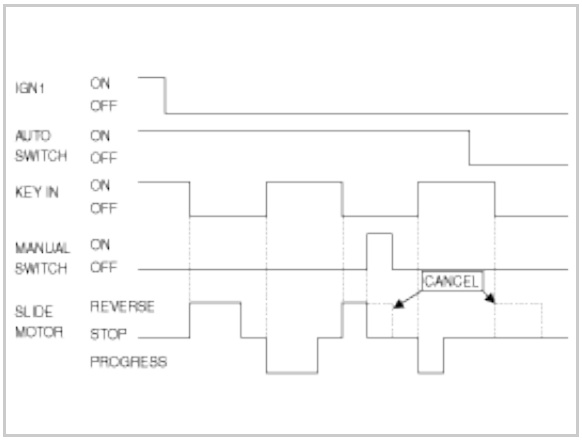
4. Operation control
   a. Prioritization of operations
      Motor starting is delayed for 100ms respectively in case of auto control to prevent rush current from overlap when motors are running, and it follows the following order.
      Slide > recline > front height > rear height > adjust pedal
   b. Memory preset recall is conducted in the following order, and delay time for each motor is as follows.



      T1 : Manimum 0.1 sec.
      Continuous cooperation TIMER value for each motor
      Slide: 15 sec., recline: 30 sec., front height: 5 sec., rear height: 8 sec., adjust pedal: 10 sec.
   c. Control when turning to the opposite direction
      When motor has to be run in a reverse direction during Easy access function or preset recall operation, stop the operation immediately, wait for 100ms and then try operation to the reverse direction.
   d. If the difference between position and the current one is below specified value, motor will not run even though preset recall data is received.
      Slide, recline, front height, rear height : 6PULSE
      Adjust pedal: 3LSB(about 0.06V)
   e. Operation will stop upon reaching Motor's target point when conducting Easy access function or preset recall operation.

EASY ACCESS FUNCTION OPERATION (SLIDE MOTOR ONLY)

1. Easy access function operation is allowed only when auto switch is on, and the operation will be halted if auto switch changes from on to off.
2. If a key is removed and CAN BUS data transmitted from IPM changes from "on" to "off", the seat slide will move 50mm backward based on the IGN off point. If a key off position is farther back than 50mm against the IGN off point, get-off gearing will not be conducted. If slide rear limit becomes off in the middle of backward operation, retreat control will be halted.
3. The following conditions will be identified and processed by IMS, and if any one of the following conditions is met, Easy access function operation will be prevented or halted.
   a. When "P" position switch is not on.
   b. When Vehicle Speed in CAN BUS data transmitted from cluster is "3km/h" or faster.
   c. When seat and pedal is under manual switch operation.
   d. When auto switch is off.
4. When control is halted in the middle of backward operation, the remaining operation will not be completed, and when returning, it will return just as much as it retreated.
5. It will move to IGN off point in case of Get-on gearing by key in despite manual switch input during or after backward operation.
6. After the key is removed, on the condition of SLEEP state, Easy access function operation will be conducted after 150ms if the key is inserted when auto switch is turned ON(OFF) from Off(ON).



MEMORY STORAGE OPERATION BY KEYLESS

1. If "ID1" or "ID2" is received during keyless lock operation, record seat and pedal position in keyless code. (there is no buzzer output during memory storage operation by keyless)
2. Memory storage operation is allowed for a single ID after a change of IG from "on" →"off".
3. Any one of the following conditions will prevent keyless Memory storage operation.
   a. When "P" position switch is not on.
   b. When Vehicle Speed in CAN BUS data transmitted from CLUSTER is "3km/h" or faster.
   c. When seat and pedal is manipulated by CAN BUS and manual switch.
   d. When IG transmitted from IPM is other than off.

PRESET RECALL OPERATION BY KEYLESS

1. When IG is off (CAN BUS data IG transmitted from IPM is "off") and a key is removed (CAN BUS data Key Reminder Switch transmitted from IPM is "off"), and if "ID1" or "ID2" is received during keyless unlock operation, it automatically adjusts seat and pedal positions as memorized in keyless code (there is no buzzer output during preset recall operation by keyless). However, seat slide adjustment position is determined as follows, depending on Auto switch.
   a. When auto switch is on ("IMS Auto Switch" is "on") , the position is automatically adjusted to 50 mm farther back than target position, and if a key is inserted ("Key Reminder Switch" changes from "off" to "on"), it conducts Get-on gearing operation to a target preset recall position.
   b. If auto switch is off ("IMS Auto Switch" is "off"), it moves to the target memory play position.
2. Any one of the following conditions will prevent preset recall operation.
   a. When "P" position switch is not on.
   b. When Vehicle Speed in CAN BUS data transmitted from cluster is "3km/h" or faster.
   c. When seat and pedal is manipulated by CAN BUS and manual switch.
   d. When IG Switch transmitted from IPM is other than off.
   e. When a key is inserted.
3. Playing will be halted during preset recall operation if any of the following conditions is met.
   a. When "P" position switch is not on.
   b. When vehicle speed in CAN BUS data transmitted from cluster is "3km/h" or faster.
   c. When seat and pedal is manipulated by CAN BUS and manual switch.

SETTING LIMIT

1. A limit switch is installed to prevent the seat from traveling beyond the maximum forward/reward positions.
2. No limit switch is installed for the recline, height, or pedal adjustments. Arbitrary limit positions are used for these functions.

DETECTING ERRORS FOR SEAT

Take countermeasure against error if the following conditions occur during manual switch operation.

a. Error when pulse is not fed.

	Slide	Recline	Front height	Rear height

Error condition	Below 6 pulses in 2 sec.	Below 6 pulses in 1 sec.
Prerequisite	FR/RR limit SW on	Limit setting complete

a. Stop the related motor(seat / pedal) if an error is detected during playing or Easy access function operation.
b. Stop the corresponding motor if an error is detected during manual operation (excluding slide motor).
b. If seat sensor Vcc below 1V is detected by 1s
a. Stop all seat motors running if seat sensor Vcc error is detected during playing or Easy access function operation. (no buzzer output)
c. Return if seat sensor Vcc is 4V or more.

DETECTING ERRORS FOR ADJUST PEDAL

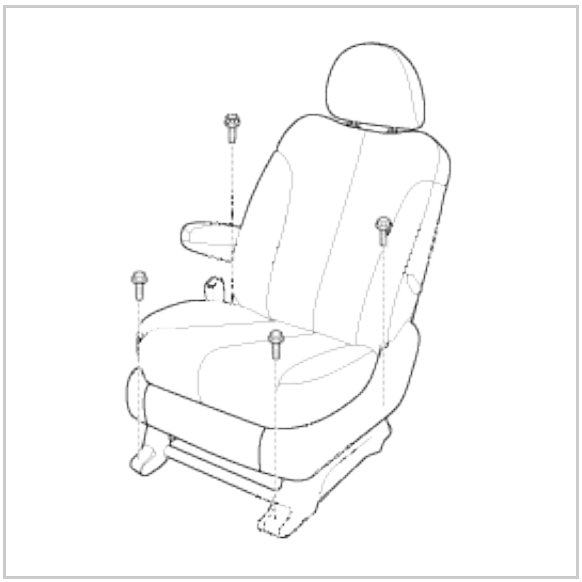
1. If signal change is below 0.06V per sec though motor is running.
   a. Stop the corresponding motor if error is detected during playing or Easy access function operation.
2. If adjust pedal sensor Vcc below 1V is detected by 1s
   a. Stop pedal motor running if pedal sensor Vcc error is detected during playing or Easy access function operation. (no buzzer output)
3. Return if adjust pedal sensor Vcc is 4V or more.

HANDLING ERRORS

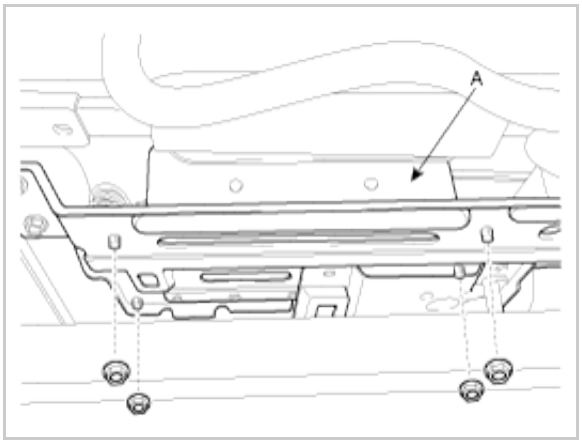
1. If errors are discovered, regard them as harness disconnection or sensor failure, and conduct the following measures.
   a. Stop auto control (play or Easy access function operation) if it is under auto control and set off buzzer 10 times (however, have motors other than the one with an error operate normally).
   b. Set off alarm again in case of recurrence of error after restoration of a motor with an error.
   c. Complete alarm 10 times though it comes back to normal during error alarm.
   d. Stop alarm if receiving memory recall or play order, and set off buzzer in the corresponding function.
   e. Manual operation control is allowed even for a motor with errors.
   f. Set off buzzer if memory or play order is received even during error.
   g. The timing to lift auto control suspension is when repair for the failing motor is completed, and the criteria for the completion point are as follows:
   a. Seat: if signal input is normal with over 6 pulses within a sec. from position sensor of a motor with an error caused by manual switch.
   b. Adjust pedal: if there is change in input of over 3 LSB within 1 sec. from sensor by manual switch.

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the seat back (Refer to Body group - front seat).



3. Remove the power seat module after removing the power seat module mounting nuts (4EA) and connector (3EA).

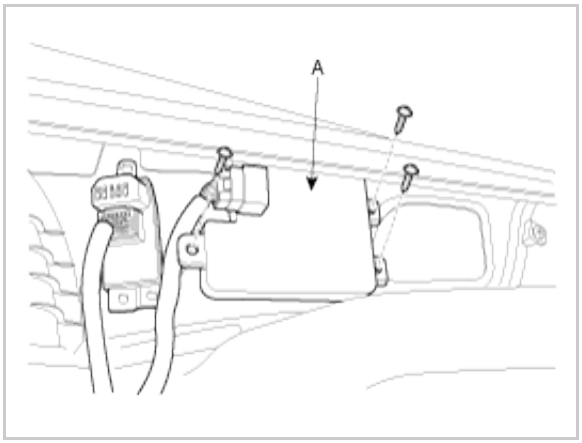


4. Installation is the reverse of removal.

IMS
(Integrated Memory)
Control Switch

REPLACEMENT

1. Remove the negative (-) battery terminal.
2. Remove the front door trim panel in the car. (Refer to the Body group - front door)
3. Remove the switch (A) mounting screws (3EA) after disconnecting the 16pin switch connector.



4. Remove the connector from the front door trim panel.
5. Installation is the reverse of removal.

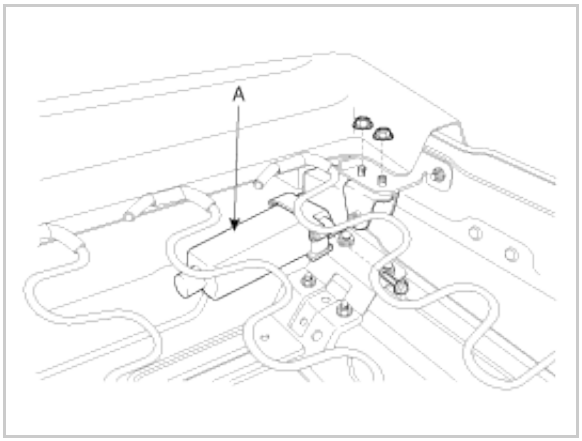
Seat Electrical

Power Seat Motor

REPLACEMENT

FRONT HEIGHT MOTOR

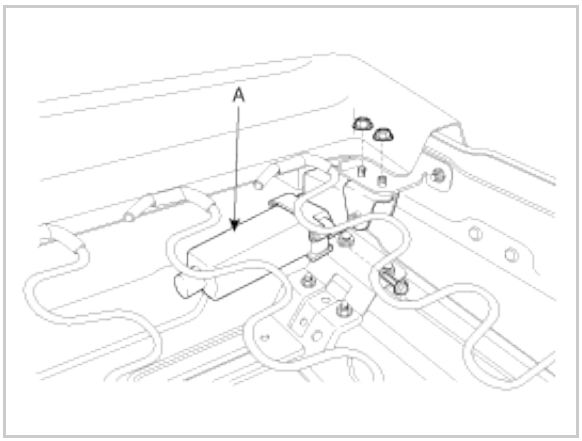
1. Disconnect the negative (-) battery terminal.
2. Remove the seat cushion (Refer to Body group - front seat).
3. Remove the front height motor (A) after loosening the mounting nuts (2EA) , bolt (1EA) and removing connector.



4. Installation is the reverse of removal.

REAR HEIGHT MOTOR

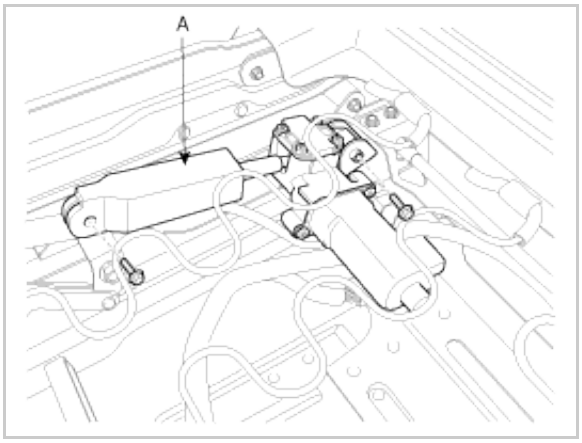
1. Disconnect the negative (-) battery terminal.
2. Remove the seat cushion (Refer to Body group - front seat).
3. Remove the rear height motor (A) after removing the mounting bolt (2EA) and connector.



4. Installation is the reverse of removal.

SLIDE MOTOR

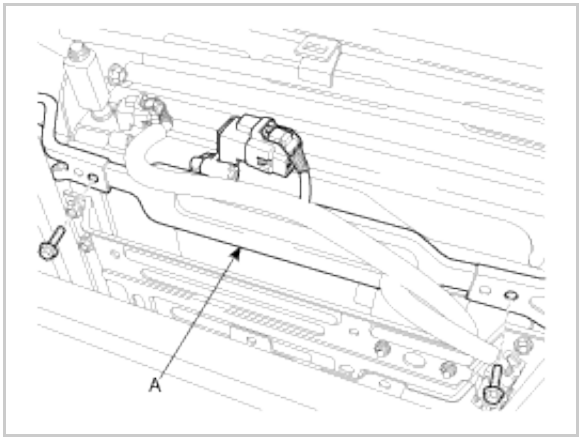
1. Disconnect the negative (-) battery terminal.
2. Remove the seat cushion (Refer to Body group - front seat).
3. Remove the slide motor (A) after removing the mounting bolt (2EA) and connector.



4. Installation is the reverse of removal.

SLIDE MOTOR

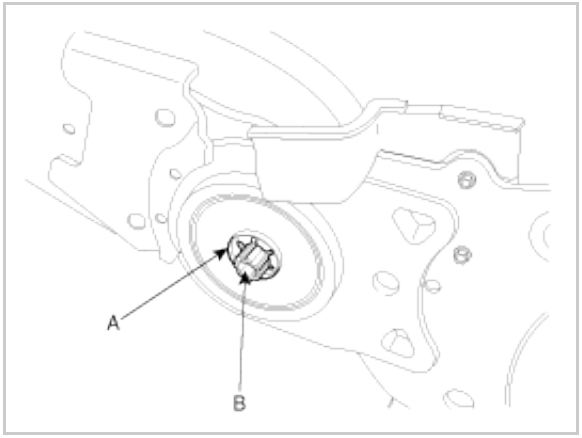
1. Disconnect the negative (-) battery terminal.
2. Remove the seat cushion (Refer to Body group - front seat).
3. Remove the slide motor (A) after removing the mounting bolts (2EA) and connector.



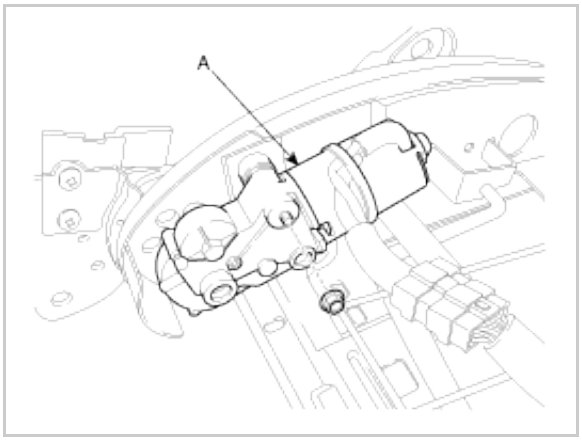
4. Installation is the reverse of removal.

RECLINING MOTOR

1. Disconnect the negative (-) battery terminal.
2. Remove the seat back (Refer to Body group - front seat).
3. Remove the seat shaft fixing clip (A) and seat shaft (B).



4. Remove the relining motor (A) after removing the mounting nut (1EA) and connector.

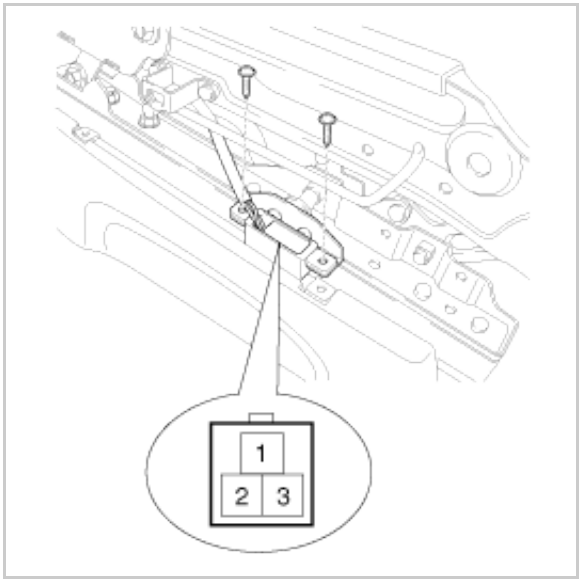


5. Installation is the reverse of removal.

INSPECTION

SLIDE MOTOR LIMIT SWITCH

1. Disconnect the limit switch and operate the limit switch.
2. Check for continuity between the terminals.
3. Make sure that the seat operation is normal in the reverse after the maximum operation.
4. If operation is not correct, replace the limit switch.



Terminal / Position	1	2	3
Front	○	○	
Rear	○		○

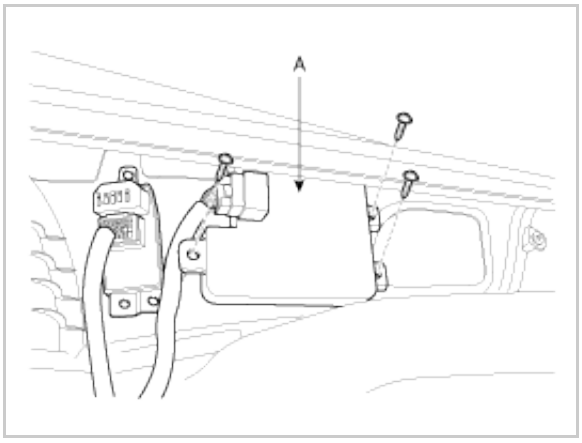
POWER SEAT MOTOR

1. Disconnect the connectors for each motor.
2. With the battery connected directly to the motor terminals, check if the motors run smoothly.
3. Reverse the connections and check that the motor turns in reverse.
4. If operation is not correct, replace the motors.

Power Seat Motor Switch

REPLACEMENT

1. Disconnect the nagative(-) battery terminal.
2. Remove the door trim panel (Refer to Body group - front door).
3. Remove the switch connector (16pin) from the wiring harness, And then loosen the mounting screws (3EA).

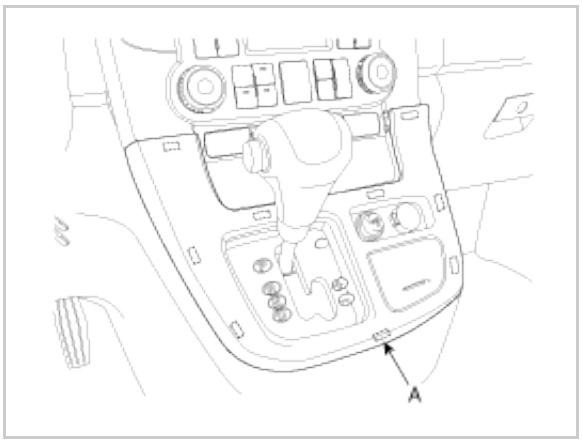


4. Remove the switch from the front door panel.
5. Installation is the reverse of removal.

Seat Heater Switch

INSPECTION

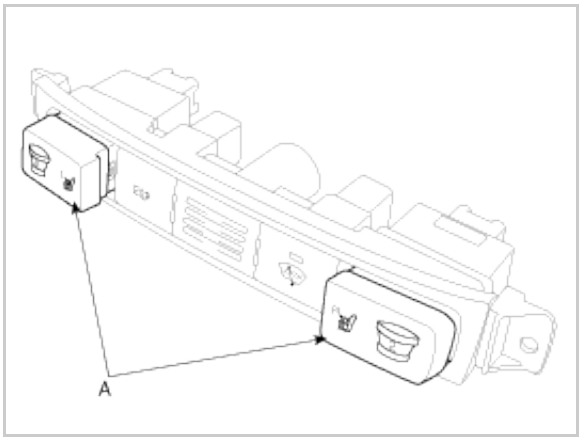
1. Disconnect the negative (-) battery terminal.
2. Remove the seat back (Refer to Body group - front seat).



3. Remove the mounting screw, center facia panel switch and then disconnect connectors.



4. Remove the seat warmer switch (A) from center facia panel switch.

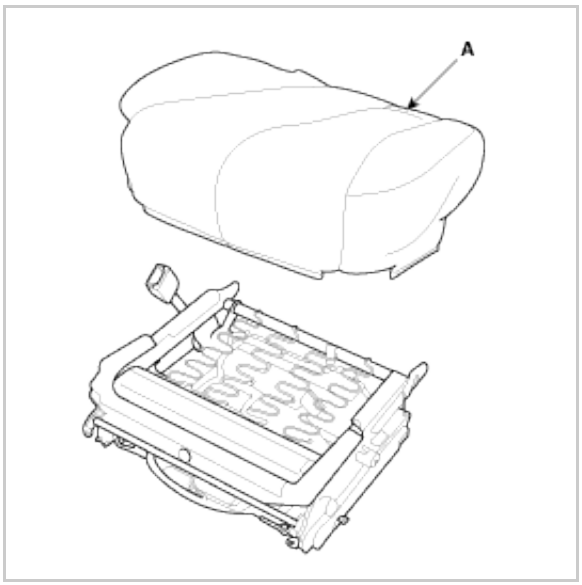


5. Installation is the reverse of removal.

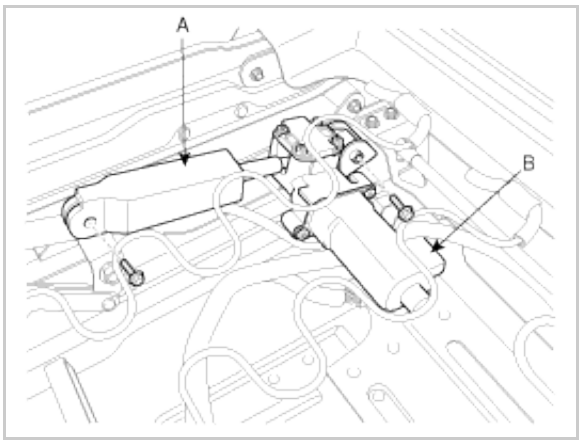
Seat Heater Module

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the seat cushion (A) (Refer to Body group - front seat)



3. Remove the seat heater module (B) after removing seat heater module mounting screw (2EA) and connector from rear height motor (A).

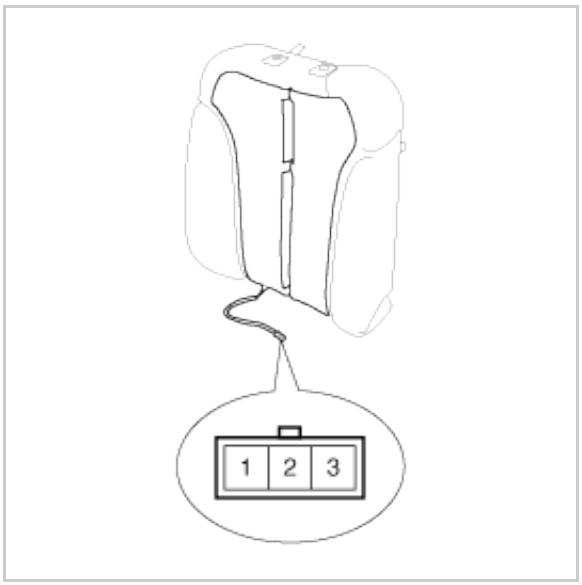


4. Installation is the reverse of removal.

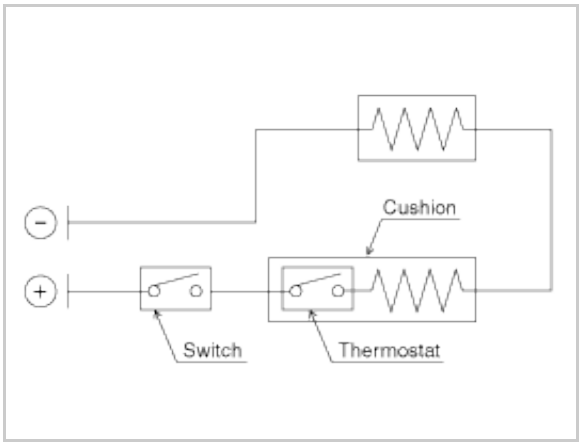
Seat Heater

INSPECTION

1. Replacement of new part refer to Body group - front seat.
2. Check for continuity and measure the resistance between No.1 and NO.3 terminals.



Standard value: 2.45Ω ± 10%
(Cushion: 1.2Ω ± 10%, Back: 1.2Ω ± 10%)



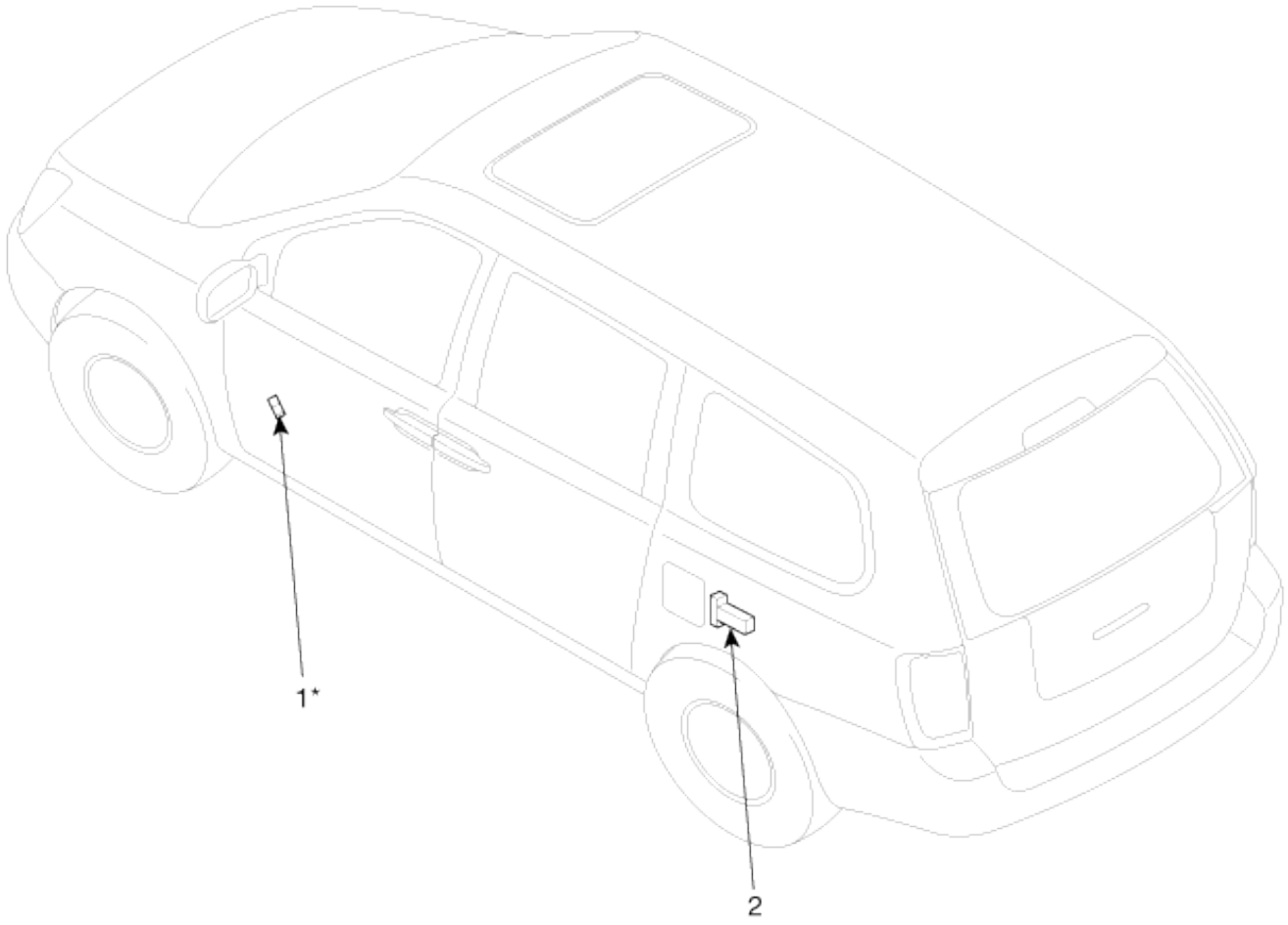
3. Operate the seat warmer after connecting the 3P connector, and then check the thermostat by measuring the temperature of seat surface. Check for continuity between the terminals after disconnecting the 3P connector.

Standard value :
28 ±3.5°C(Continuity), 37 ±3.0°C(Short)

Fuel Filler Door

COMPONENT LOCATION

The parts with asterisk(*) :
This illustration is shows the LHD type.
RHD type is symmetrical.

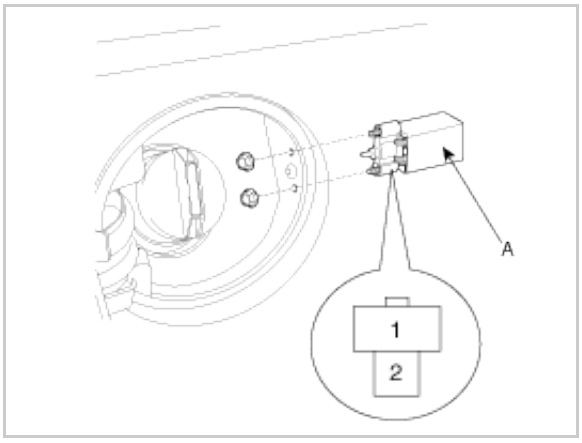


1. Fuel filler door open switch
2. Fuel filler door release actuator

Fuel Filler Door Release Actuator

INSPECTION

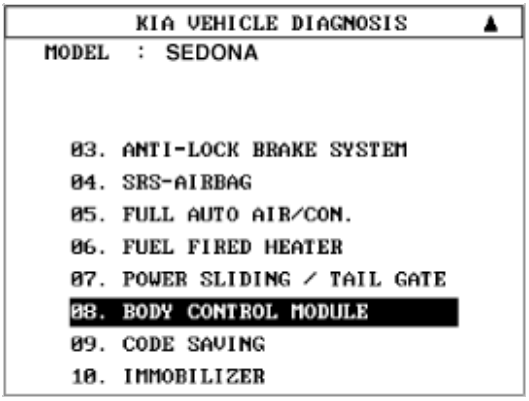
1. Remove the rear seats. (Refer to the Body group - rear seats)
2. Remove the luggage side trim. (Refer to the Body group - interior trim)
3. Open the fuel filler door and disconnect the wiring connector after loosening 2 bolts.
4. Check for continuity between terminal No. 1 and No. 2. If there is no continuity replace the fuel filler door opener.



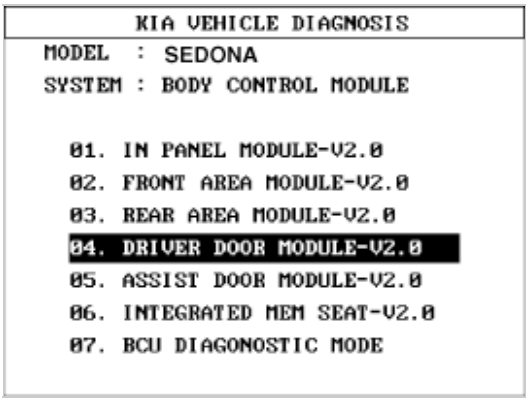
Fuel Filler Door Open Switch

INSPECTION

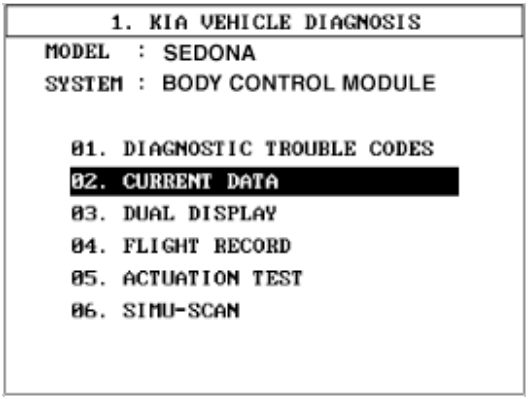
1. Remove the front door trim panel. (Refer to the Body group - front door)
2. To check the Input Value of fuel filler door open switch, select option "09.BODY CONTROL MODULE".

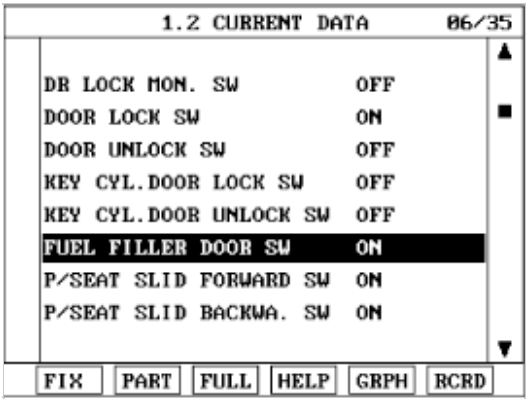


3. Select option "DRIVER DOOR MODULE".



4. Select option "02. CURRENT DATA".

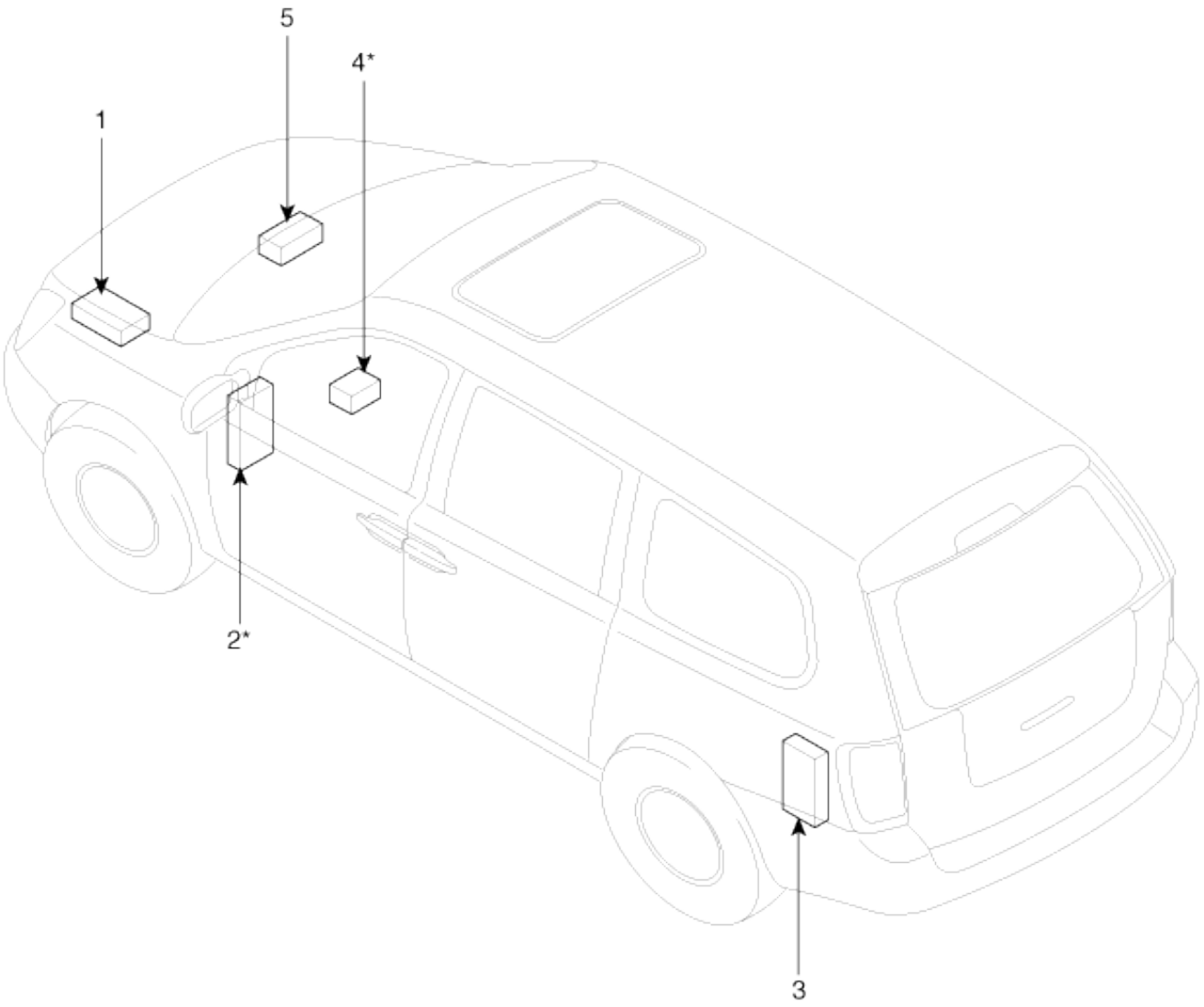




Fuses and Relays

COMPONENT LOCATION

The parts with asterisk(*) :
This illustration is shows the LHD type.
RHD type is symmetrical.



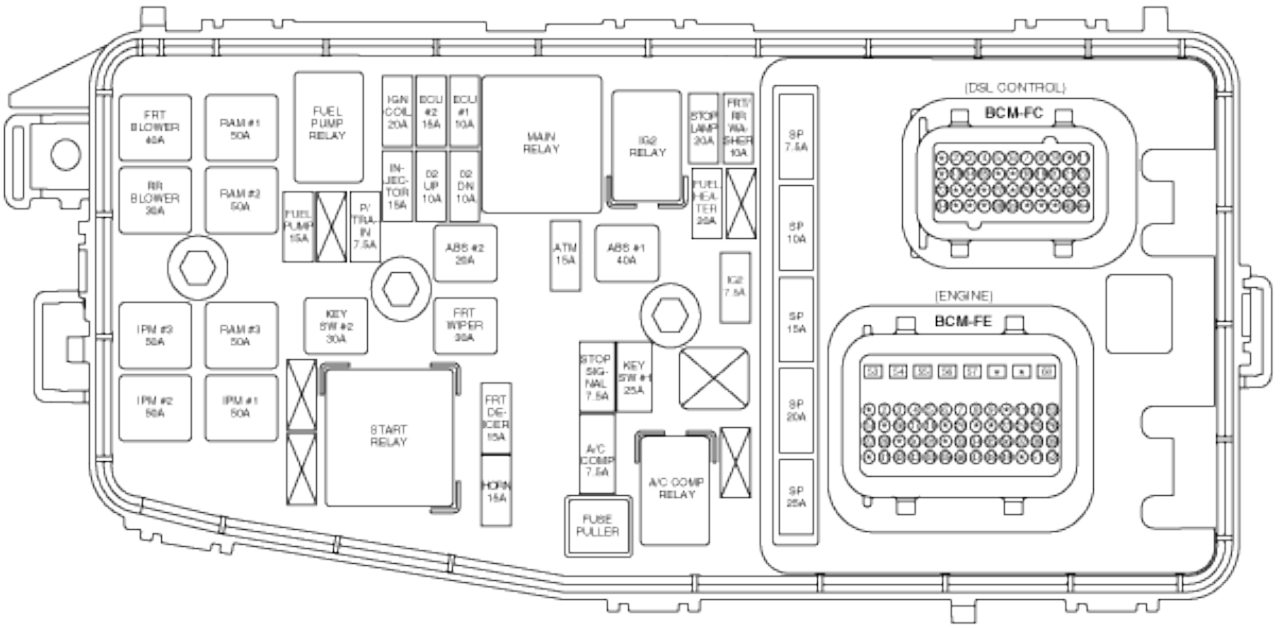
1. Front area module
2. In-Panel module
3. Rear area module
4. ICM relay box
5. Diesel box

Relay Box
(Engine Compartment)

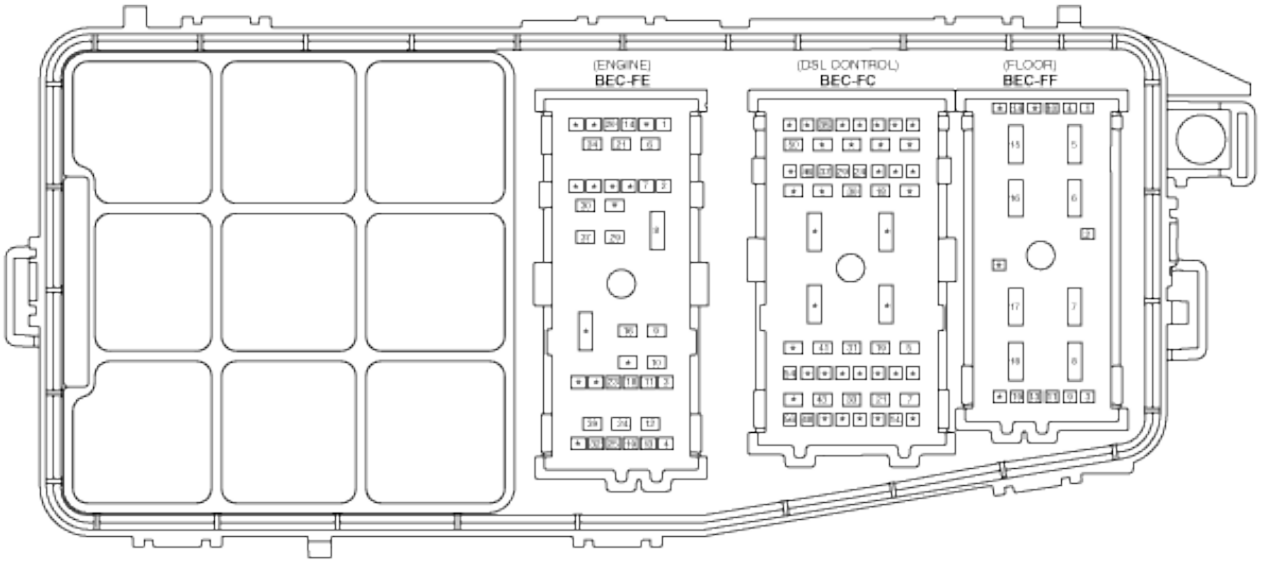
COMPONENTS

FAM (FRONT AREA MODULE)

< FRONT >



< REAR >



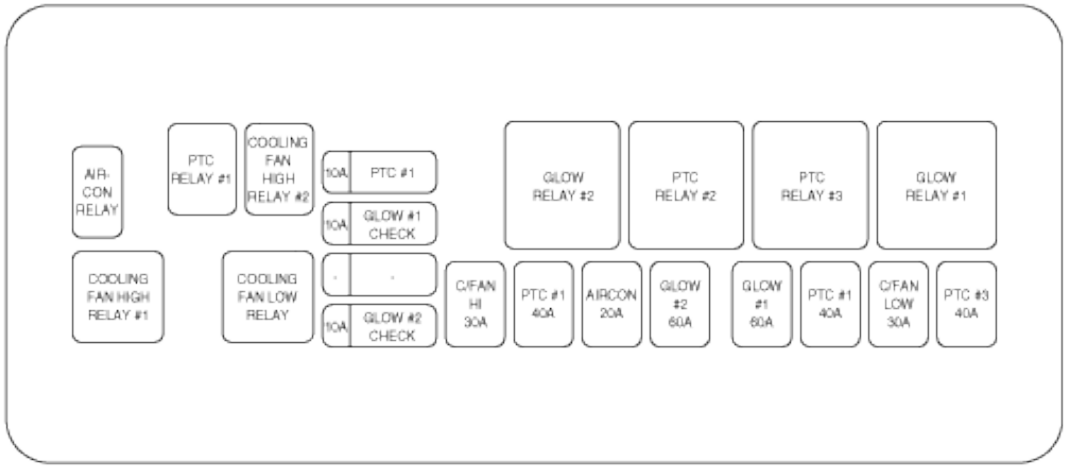
※ USE THE DESIGNATED FUSE ONLY

CIRCUIT

FUSE	(A)	Circuit Protected
FRT/RR WASHER	10A	FRONT WASHER MOTOR RELAY, REAR WASHER MOTOR RELAY
STOP LAMP	20A	STOP LAMP SWITCH
KEY SW #1	25A	IGNITION SWITCH
STOP SIGNAL	7.5A	ABS CONTROL MODULE, ESP CONTROL MODULE, PCM, ECM, TCM
A/C COMP	7.5A	A/C COMP RELAY
ATM	15A	ATM RELAY
FRT DEICER	15A	WINDSHIELD DEFOGGER RELAY
HORN	15A	HORN RELAY
ECU #1	10A	A/C COMP RELAY, PCM, MASS AIR FLOW SENSOR, IMMOBILIZER MODULE, ECM, DIESEL BOX
O2 DN	10A	OXYGEN SENSOR #3, OXYGEN SENSOR #4
ECU #2	10A	PCM, VARIABLE INTAKE MANIFOLD VALVE, COOLING FAN RELAY, PCSV, OCV, ECM
O2 UP	10A	OXYGEN SENSOR #1, OXYGEN SENSOR #2
IGN COIL	20A	IGNITION COIL #1 ~ #6, CONDENSER #1, #2
INJECTOR	15A	INJECTOR #1 ~ #6, PCM, INLET METERING VALVE, EGR SOLENOID VALVE), INTAKE THROTTLE SOLENOID VALVE, ECM, MASS AIR FLOW SENSOR, DIESEL BOX
P/TRAIN	7.5A	MAIN RELAY, BURGLAR HORN RELAY, PCM, TCM, GENERATOR
FUEL PUMP	15A	FUEL PUMP RELAY
ABS #1	40A	ABS CONTROL MODULE, ESP CONTROL MODULE
ABS #2	20A	ABS CONTROL MODULE, ESP CONTROL MODULE
FRT WIPER	30A	FRONT WIPER ON RELAY
KEY SW #2	30A	START RELAY, IGNITION SWITCH
FRT BLOWER	40A	FRONT BLOWER RELAY
RR BLOWER	30A	REAR BLOWER RELAY
IPM #1	50A	INSTRUMENT PANEL MODULE
IPM #2	50A	INSTRUMENT PANEL MODULE
IPM #3	50A	INSTRUMENT PANEL MODULE
RAM #1	50A	REAR AREA MODULE
RAM #2	50A	REAR AREA MODULE
RAM #3	50A	REAR AREA MODULE
IG 2	7.5A	AQS SENSOR
FUEL HEATER	20A	FUEL FILTER HEATER

※ USE THE DESIGNATED FUSE ONLY

< DIESEL BOX >



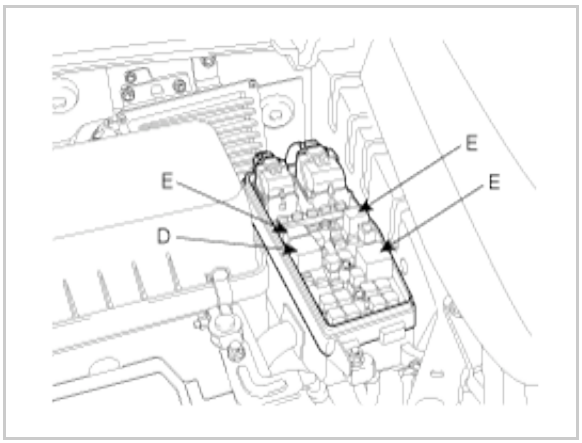
INSPECTION

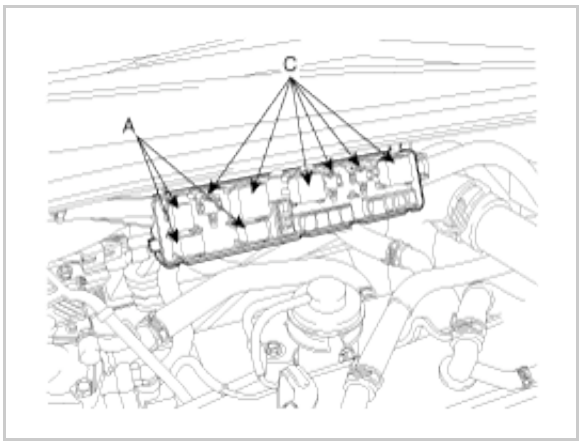
FUSE

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.

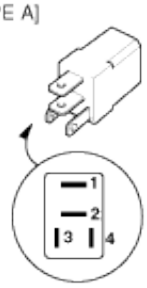
RELAY

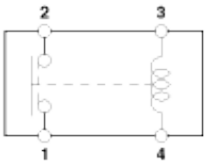
1. Be sure that the relays are held the each module securely.
2. Are the relay types for each circuit correct?



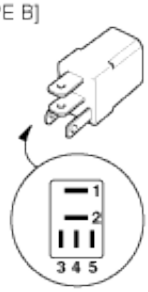


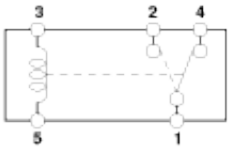
[TYPE A]



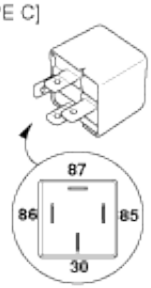


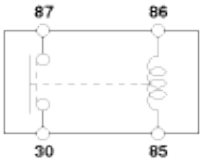
[TYPE B]



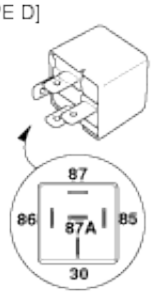


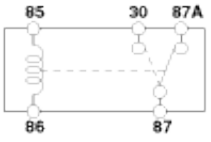
[TYPE C]



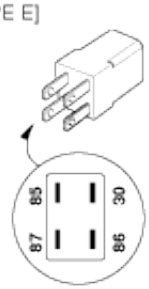


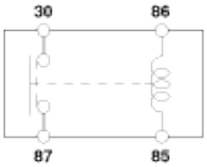
[TYPE D]



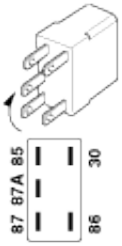


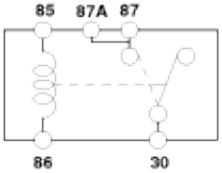
[TYPE E]

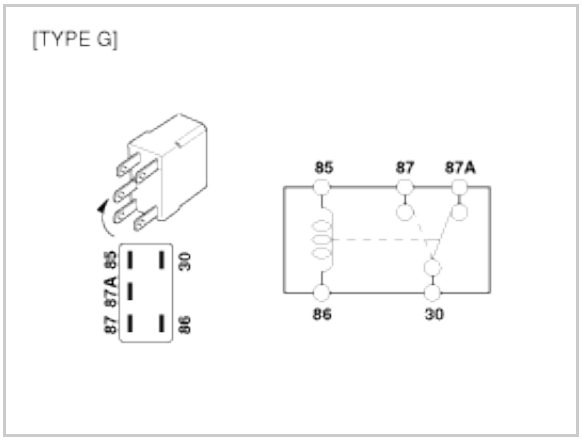




[TYPE F]





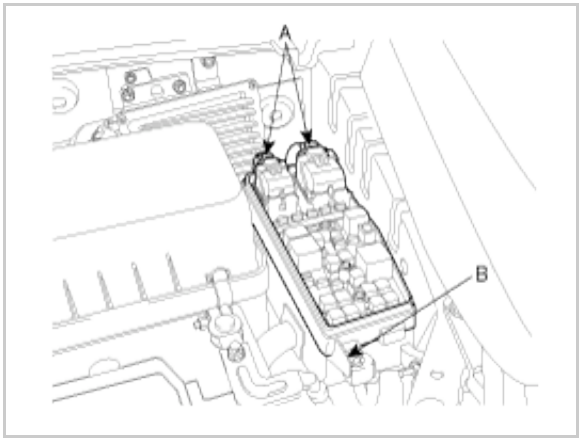


3. If system of some relay is not operate accurately, replace with a new one and check the system.

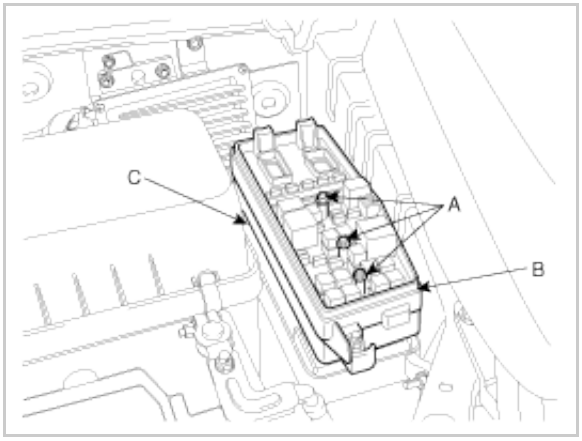
REPLACEMENT

FAM (FRONT AREA MODULE)

1. Disconnect the negative (-) battery terminal.
2. Remove the FAM cover of engine room.
3. Remove the FAM connectors (2EA) (A) and battery terminal nut (1EA) (B).



4. Remove FAM mounting bolts (3EA) (A) and remove the FAM (B) from splash shield (C).

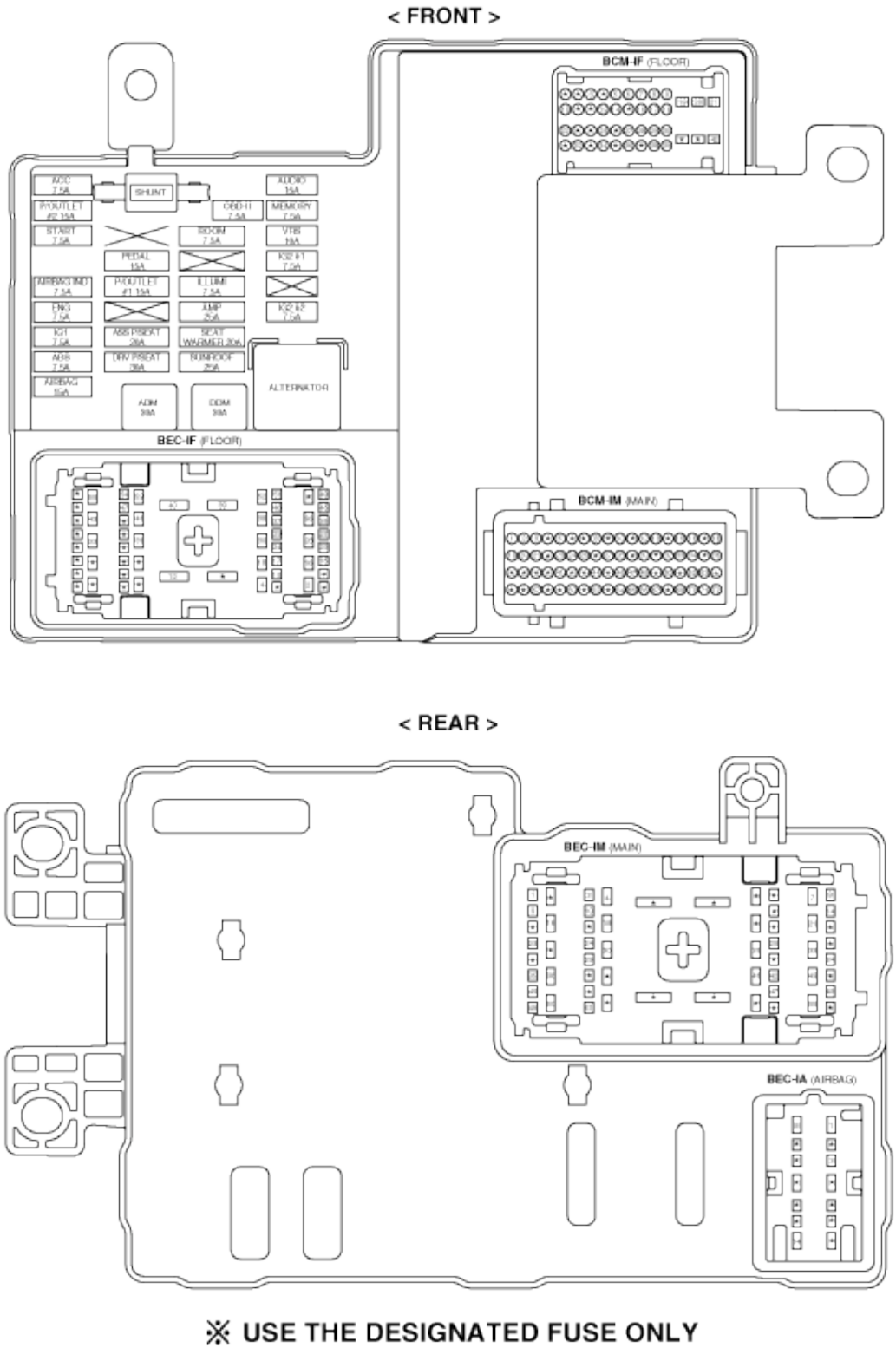


5. Disconnect the connector from splash shield.
6. Installation is the reverse of removal.

Relay Box
(Passenger Compartment)

COMPONENTS

IPM (INSTRUMENT PANEL MODULE)



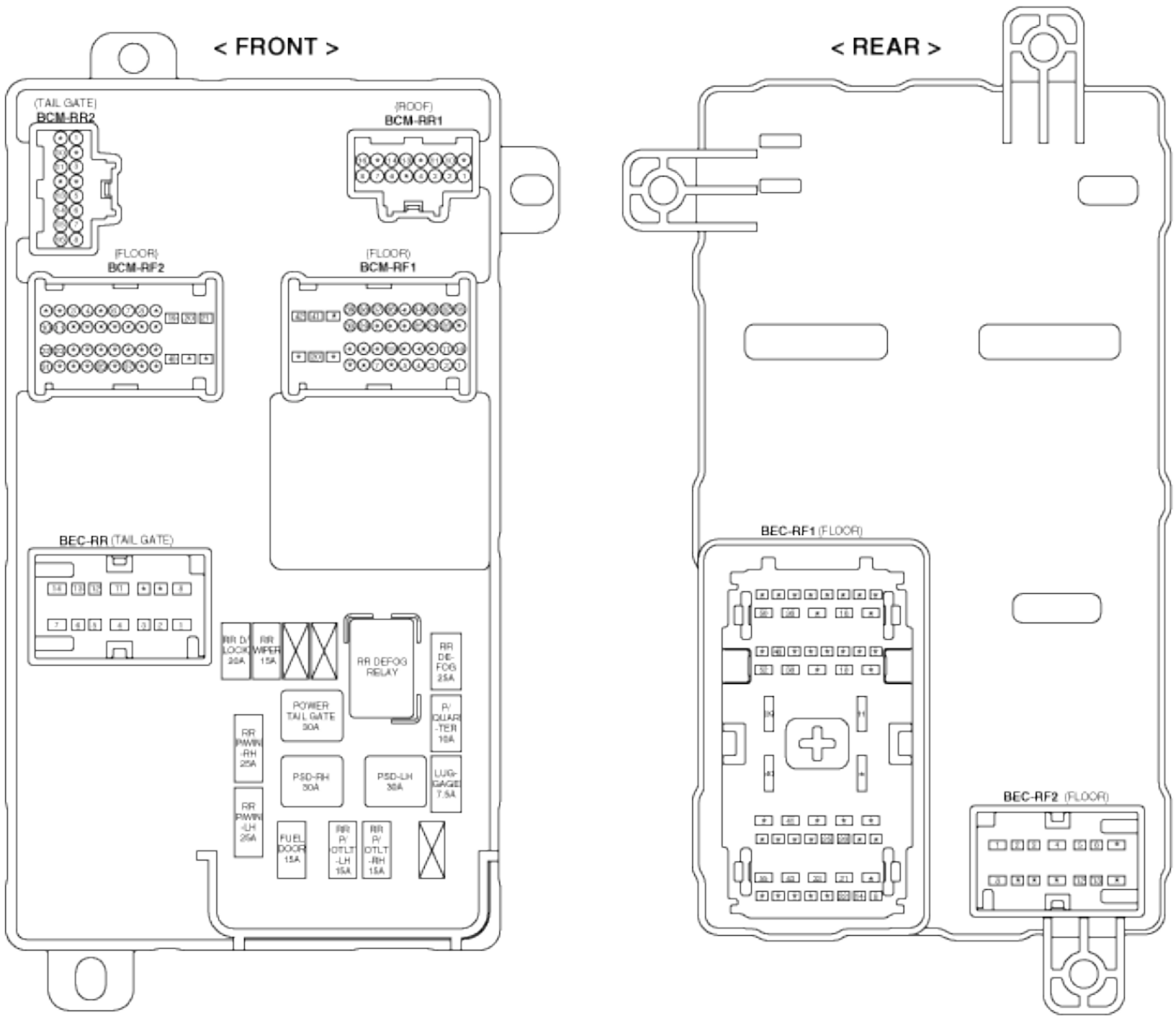
※ USE THE DESIGNATED FUSE ONLY

CIRCUIT

FUSE	(A)	Circuit Protected
ACC	7.5A	POWER OUTSIDE MIRROR & MIRROR FOLDING SWITCH, AUDIO, DIGITAL CLOCK
P/OUTLET #2	15A	CIGARETTE LIGHTER & POWER OUTLET
START	7.5A	BURGLAR ALARM RELAY, TRANSAXLE RANGE SWITCH, ECM
AIRBAG IND	7.5A	INSTRUMENT CLUSTER
ENG	7.5A	ATM LEVER SWITCH, STOP LAMP SWITCH, INPUT SPEED SENSOR, OUTPUT SPEED SENSOR, TRANSAXLE RANGE SWITCH, PCM, VEHICLE SPEED SENSOR, ECM, TCM, BACK-UP LAMP SWITCH, FUEL FILTER WARNING SWITCH
IG1	7.5A	TRIP COMPUTER, BACK WARNING BUZZER, RHEOSTAT, ESP SWITCH, INSTRUMENT CLUSTER, MULTIFUNCTION SWITCH, GENERATOR
ABS	7.5A	ABS CONTROL MODULE, ESP CONTROL MODULE, YAW RATE SENSOR, STEERING ANGLE SENSOR, MULTIPURPOSE CHECK CONNECTOR
AIRBAG	15A	SRS CONTROL MODULE
PEDAL	15A	PEDAL ADJUST RELAY
P/OUTLET #1	15A	CIGARETTE LIGHTER & POWER OUTLET
ASS P/SEAT	20A	PASSENGER POWER SEAT MODULE
DRV P/SEAT	30A	LIMIT SWITCH, DRIVER POWER SEAT MODULE
OBD-II	7.5A	DATA LINK CONNECTOR, MULTIPURPOSE CHECK CONNECTOR
ROOM	7.5A	VANITY LAMP LH(RH), MAP LAMP, A/C CONTROL MODULE, REAR ROOM LAMP SWITCH, OVER HEAD CONSOLE
VRS	10A	VRS SWITCH, VRS MODULE
ILLUMI	7.5A	INSTRUMENT PANEL MODULE
AMP	25A	AMP
SEAT WARMER	20A	SEAT WARMER RELAY
SUNROOF	25A	SUNROOF MODULE
AUDIO	15A	STEP LAMP LH(RH), AUDIO
MEMORY	7.5A	A/C CONTROL MODULE, DIGITAL CLOCK, INSTRUMENT CLUSTER, TRIP COMPUTER, DOOR MODULE, FRONT AREA MODULE, DRIVER POWER SEAT MODULE, POWER TAIL GATE MODULE
IG2 #1	7.5A	MULTIFUNCTION SWITCH, A/C CONTROL MODULE, ELECTRO CHROMIC MIRROR, RAIN SENSOR, RELAY BOX
IG2 #2	7.5A	DOOR MODULE, REAR A/C CONTROL SWITCH, FRONT AREA MODULE, DRIVER POWER SEAT MODULE, POWER TAIL GATE MODULE
DDM	30A	DRIVER DOOR MODULE, SAFETY POWER WINDOW MOTOR
ADM	30A	PASSENGER DOOR MODULE

※ USE THE DESIGNATED FUSE ONLY

RAM (REAR AREA MODULE)



※ USE THE DESIGNATED FUSE ONLY

CIRCUIT

FUSE	(A)	Circuit Protected
PSD-LH	30A	POWER SLIDING DOOR MODULE LH
PSD-RH	30A	POWER SLIDING DOOR MODULE RH
RR DEFOG	25A	RR DEFOG RELAY, REAR DEFOGGER
POWER TAIL GATE	30A	POWER TAIL GATE MODULE
P/QUARTER	10A	QUARTER GLASS OPEN RELAY LH, QUARTER GLASS CLOSE RELAY LH QUARTER GLASS OPEN RELAY RH, QUARTER GLASS CLOSE RELAY RH QUARTER GLASS MOTOR LH, QUARTER GLASS MOTOR RH
RR WIPER	10A	REAR WIPER RELAY, REAR WIPER MOTOR
RR D/LOCK	20A	S/DOOR LOCK RELAY, S/DOOR UNLOCK RELAY SLIDING DOOR LOCK ACTUATOR, TAIL GATE LOCK ACTUATOR
RR P/OTLT-LH	15A	REAR POWER OUTLET LH
RR P/OTLT-RH	15A	REAR POWER OUTLET RH
FUEL DOOR	15A	FUEL FILLER RELAY, FUEL FILLER ACTUATOR
RR P/WIN-LH	25A	S/DOOR WINDOW RELAY (UP) LH, S/DOOR WINDOW RELAY (DN) LH, SLIDING DOOR POWER WINDOW MOTOR LH
RR P/WIN-RH	25A	S/DOOR WINDOW RELAY (UP) RH, S/DOOR WINDOW RELAY (DN) RH, SLIDING DOOR POWER WINDOW MOTOR RH
LUGGAGE	7.5A	LUGGAGE LAMP, POWER TAIL GATE ON/OFF SWITCH

※ USE THE DESIGNATED FUSE ONLY

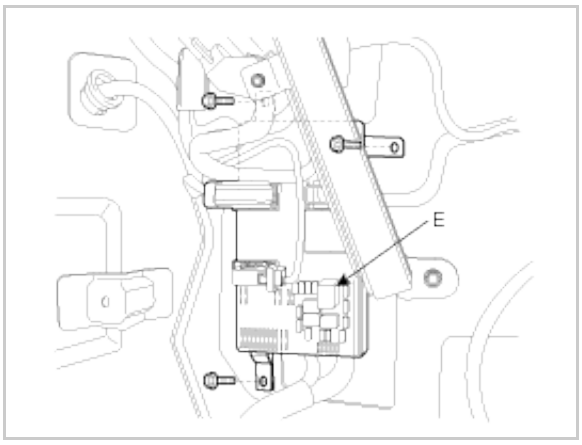
INSPECTION

FUSE

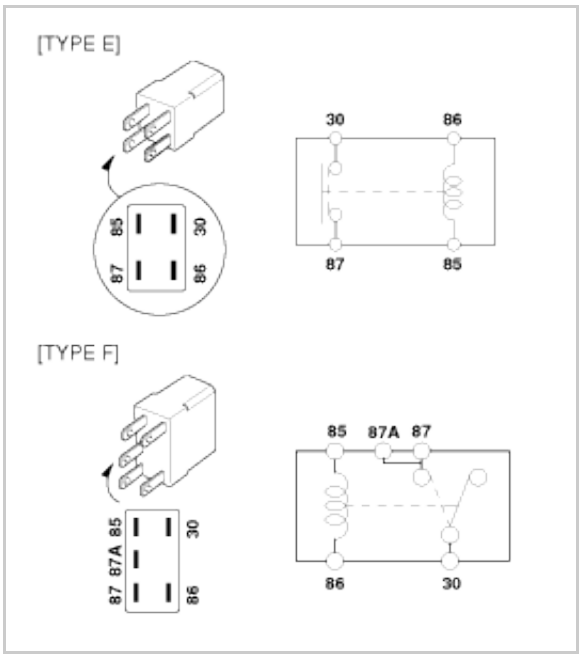
1. Be sure there is no play in the fuse holders, and that the fuses are held securely.
2. Are the fuse capacities for each circuit correct?
3. Are there any blown fuses?
   If a fuse is to be replaced, be sure to use a new fuse of the same capacity. Always determine why the fuse blew first and completely eliminate the problem before installing a new fuse.

RELAY

1. Be sure that the relays are held the each module securely.
2. Are the relay types for each circuit correct?



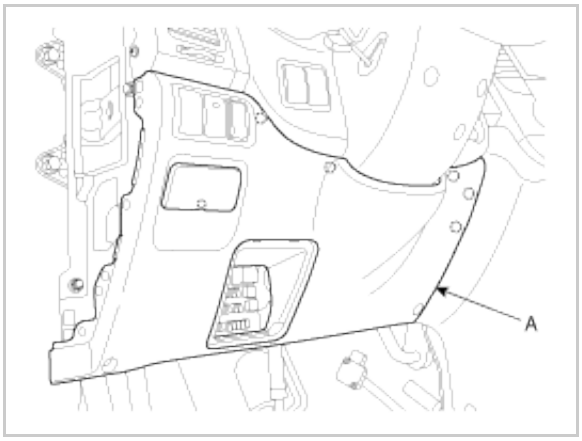
3. If system of some relay is not operate accurately, replace with a new one and check the system.



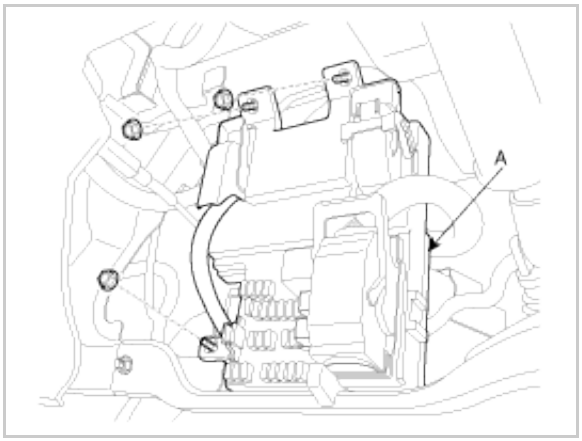
REPLACEMENT

IPM (INSTRUMENT PANEL MODULE)

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad lower panel (A). (Refer to the Body group - Crash pad).



3. Disconnect the receiver antenna cable and connectors (5EA). Remove IPM mounting nuts (3EA) and IPM (A).

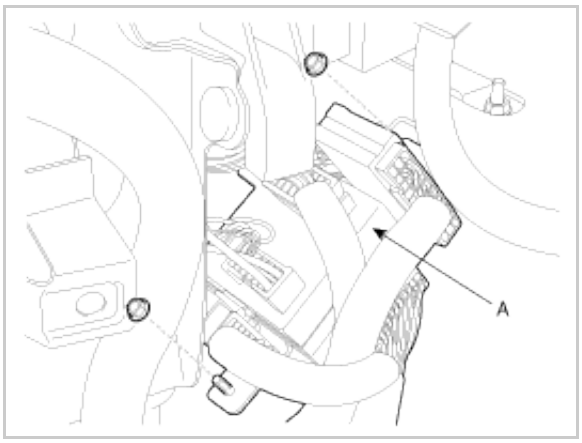


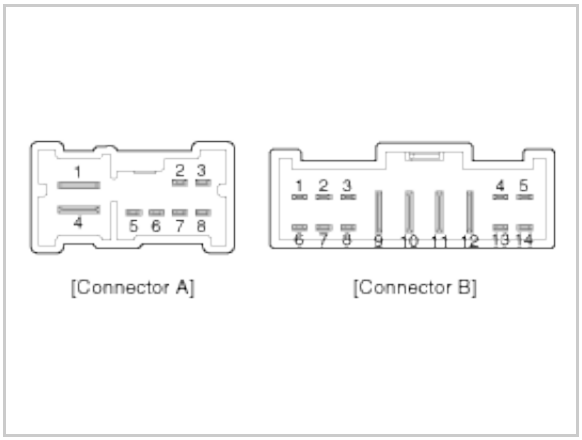
4. Installation is the reverse of removal procedures.

ICM
(Integrated Circuit Module)
Relay Box

DESCRIPTION

The ICM (Integrated circuit module) relay (A) is united with many kinds of relays and installed side of the in-panel module.





[Connector A] [Connector B]

INSPECTION

FRONT BLOWER

Check for continuity between the terminals.

1. There should be continuity between the No.1 in the ICM-A and No.10 in the ICM-B terminals when power and ground are connected to the No.7 in the ICM-A and No.13 terminals in the ICM-B terminals.
2. There should be no continuity between the No.1 in the ICM-A and No.10 terminals in the ICM-B terminals when power is disconnected.

REAR BLOWER

Check for continuity between the terminals.

1. There should be continuity between the No.4 in the ICM-A and No.12 in the ICM-B terminals when power and ground are connected to the No.2 in the ICM-A and No.14 terminals in the ICM-B terminals.
2. There should be no continuity between the No.4 in the ICM-A and No.12 in the ICM-B terminals when power is disconnected.

SEAT HEATER RELAYS

Check for continuity between the terminals.

1. There should be continuity between the No.9 and No.6 terminals when power and ground are connected to the No.7 and No.8 terminals in the ICM-B.
2. There should be no continuity between the No.9 and No.6 terminals when power is disconnected.

KEY INTERLOCK

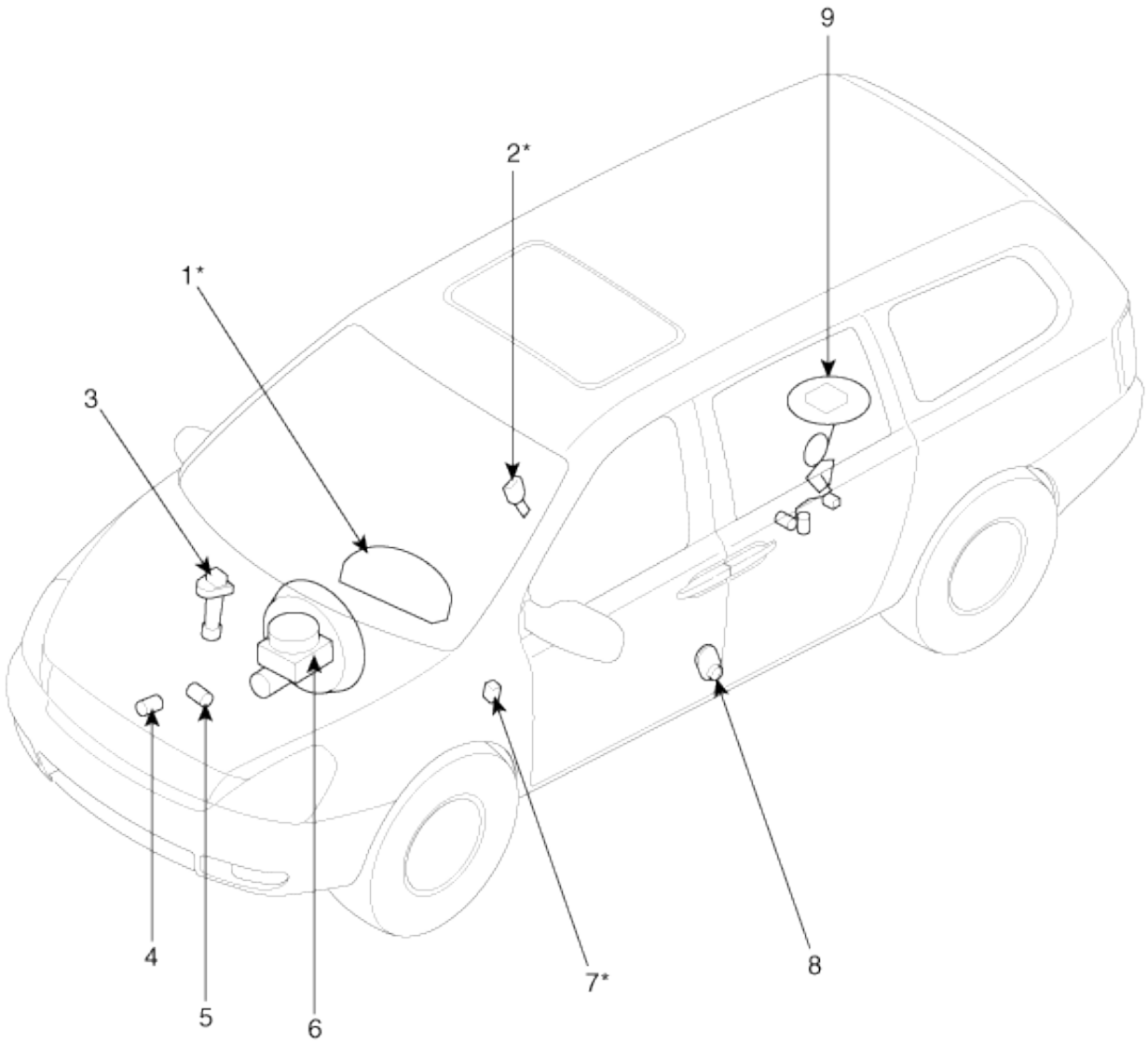
Check for continuity between the terminals.

1. There should be continuity between the No.2 and No.3 terminals when power and ground are connected to the No.4 and No.5 terminals in the ICM-B.
2. There should be no continuity between the No.2 and No.3 terminals when power is disconnected.

Indicators and Gauges

COMPONENT LOCATION

The parts with asterisk(*) :
This illustration is shows the LHD type.
RHD type is symmetrical.



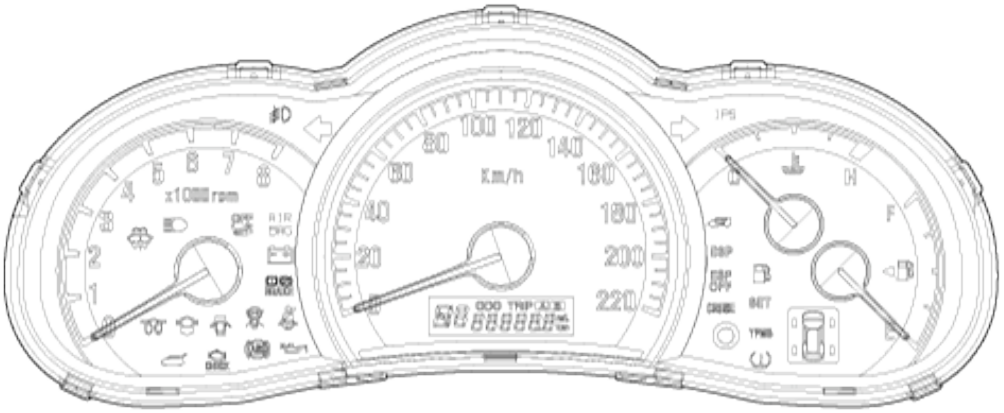
1. Cluster assembly
2. Seat belt switch
3. Vehicle speed sensor
4. Engine coolant temperature sender
5. Oil pressure switch
6. Brake fluid level warning switch
7. Parking brake switch
8. Door switch
9. Fuel gauge sender

Instrument Cluster

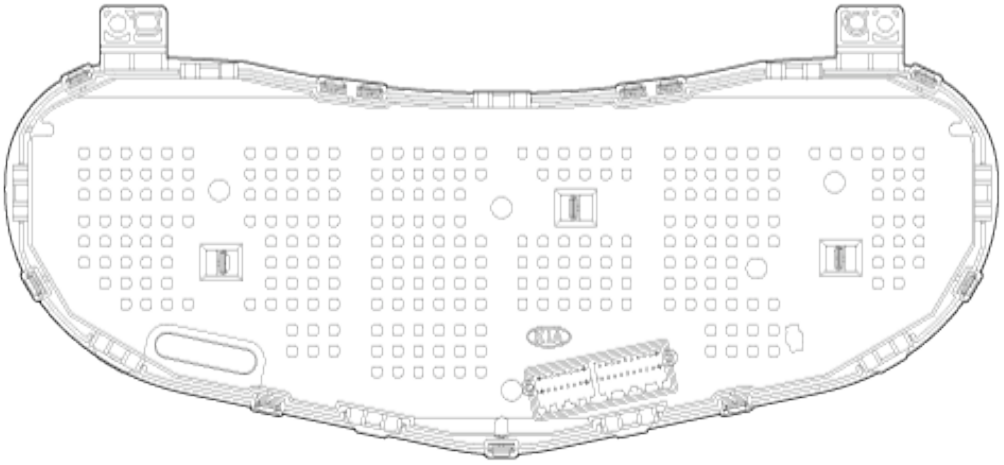
COMPONENTS

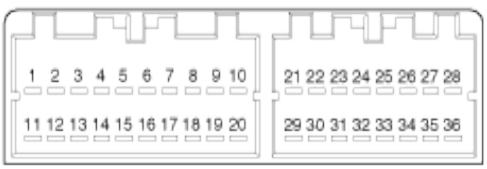


<STANDARD>



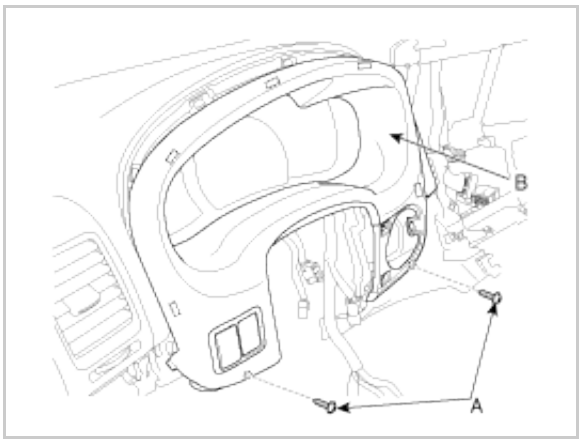
<SUPER VISION>



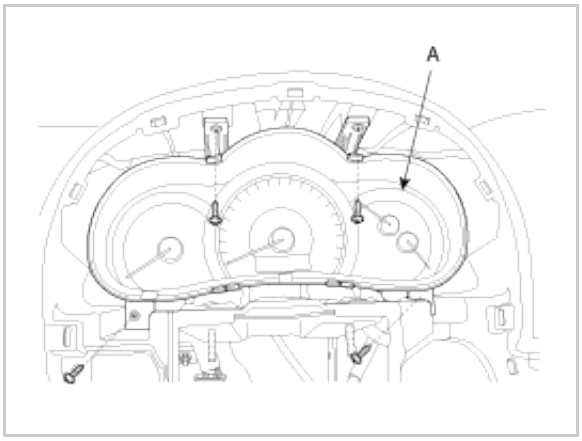


REPLACEMENT

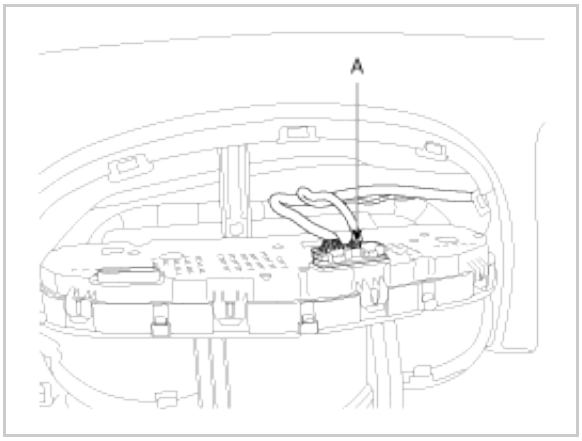
1. Disconnect the negative (-) battery terminal.
2. Remove the cluster facia panel (B) after removing 2 screws (A) and disconnecting trip switch connector.



3. Pull out the cluster (A) from the housing after removing 4 screws.



4. Disconnect the cluster connecter (A) and then remove the cluster.



5. Installation is the reverse of removal.

INSPECTION

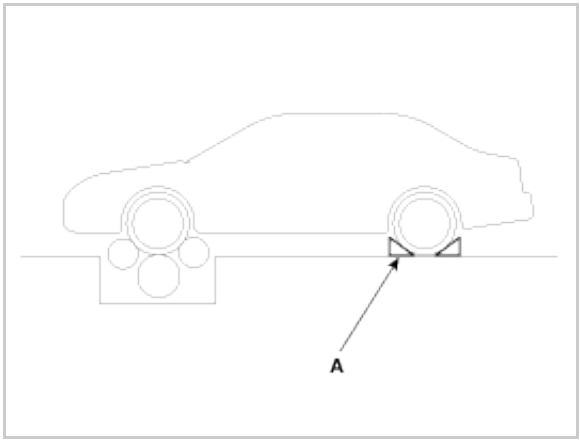
SPEEDOMETER

1. Adjust the pressure of the tires to the specified level.
2. Drive the vehicle onto a speedometer tester. Use wheel chocks 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.

NOTICE

Tire wear and tire over or under inflation will increase the indication error.



[MPH]

Velocity (MPH)	10	20	40	60
Tolerance (MPH)	+1.3 0	+1.7 0	+2.3 0	+3.0 0
Velocity (MPH)	80	100	120	-
Tolerance (MPH)	+4.0 0	+5.0 0	+6.0 0	-

[KPH]

Velocity (KPH)	20	40	60	80	100
Tolerance (KPH)	+2.6 0	+2.9 0	+3.5 0	+4.1 0	+5
Velocity (KPH)	120	140	160	180	220
Tolerance (KPH)	+6 0	+7 0	+8 0	+9 0	+11 0

TACHOMETER

1. Connect the scan tool to the diagnostic link connector or install a tachometer.
2. With the engine started, compare the readings of the tester with that of the tachometer. Replace the tachometer if the tolerance is exceeded.

CAUTION

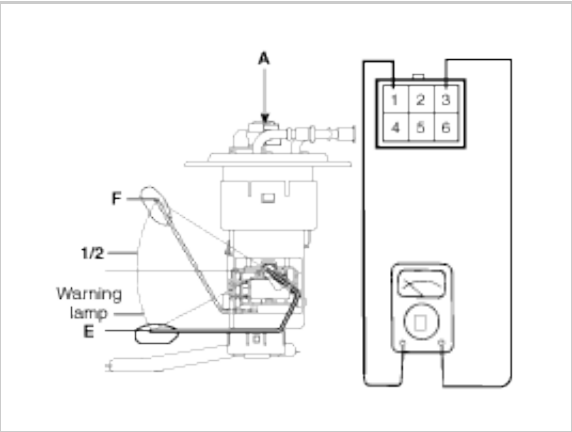
a. Reversing the connections of the tachometer will damage the transistor and diodes inside.
b. When removing or installing the tachometer, be careful not to drop it or subject it to severe shock.

Revolution (rpm)	1,000	2,000	3,000	4,000	Engine
Tolerance (rpm)	±100	±125	±150	±150	Gasoline
	±100	±125	±150	±150	Diesel

Tolerance (rpm)	5,000	6,000	7,000	8,000	Engine
Revolution (rpm)	±150	±180	±210	-	Gasoline
	±150	±150	-	-	Diesel

FUEL GAUGE SENDER

1. Using an ohmmeter, measure the resistance between terminals 1 and 2 of sender connector (A) at each float level.



2. Also check that the resistance changes smoothly when the float is moved from "E" to "F".

Position	Resistance(Ω)
Sender (E)	200
Warning lamp	160
1/2	54.5
Sender (F)	8

CAUTION

If the height resistance is not within specifications, replace the fuel sender as an assembly.
After completing this test, wipe the sender dry and reinstall it in the fuel tank.

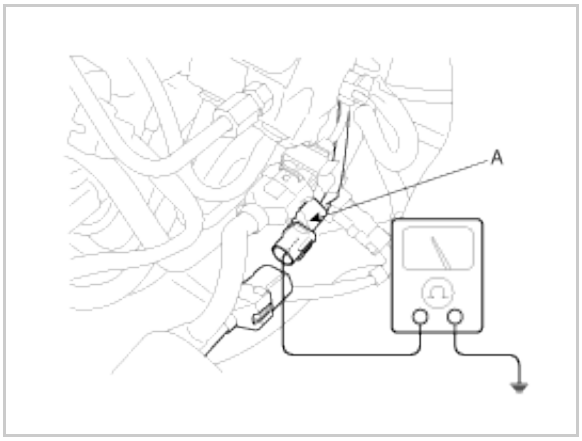
ENGINE COOLANT TEMPERATURE SENDER

1. Using an ohmmeter, measure the resistance between the terminal 2 and ground.

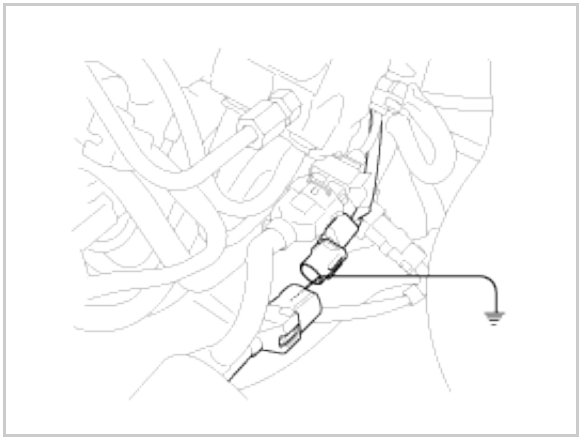
Temperature [°F(°C)]	140 (60)	185 (85)	230 (110)	257 (127.4)	E/G
Resistance (Ω)	128	56.1	25.2	16.1	Gasoline
Temperature [°F(°C)]	120 (49)	160 (71)	230 (110)	260 (127.4)	E/G
Resistance (Ω)	209.6	88.7	24.3	15.9	Diesel

OIL PRESSURE SWITCH

1. Check that there is continuity between the oil press switch terminal and ground with the engine off.
2. Check that there is no continuity between the terminal and ground with the engine running.
3. If operation is not as specified, replace the switch.

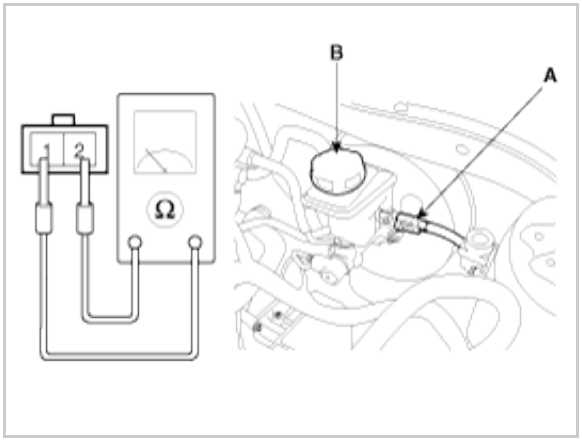


4. Connect the oil pressure switch wire harness.
5. Turn the ignition switch ON. Check that the warning lamp lights up. If the warning lamp doesn't light, test the wire harness.



BRAKE FLUID LEVEL WARNING SWITCH

1. Remove the connector (A) from the switch located at the brake fluid reservoir (B).
2. Verify that continuity exists between switch terminals 1 and 2 while pressing the switch (float) down with a rod.



BRAKE FLUID LEVEL WARNING LAMP

1. Ignition "ON"
2. Release the parking brake.
3. Remove the connector from the brake fluid level warning switch.
4. Ground the connector at the harness side.
5. Verify that the warning lamp lights.

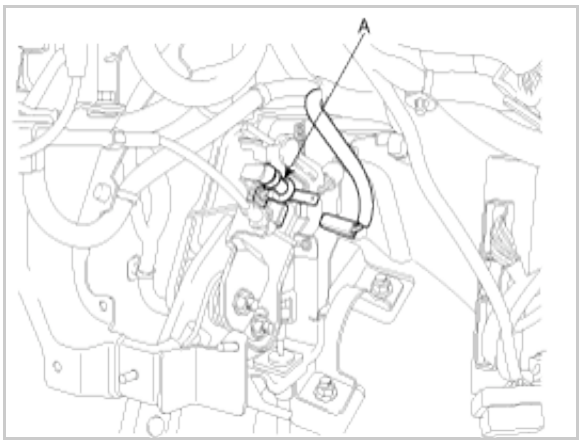
PARKING BRAKE SWITCH

The parking brake switch is a push type. It is located at the side of the parking brake pedal.

1. Check that there is continuity between the terminal and switch body with the switch (A) ON.

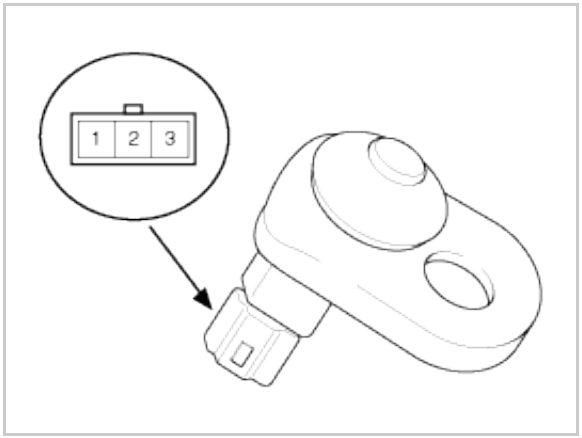
2. Check that there is no continuity between the terminal and switch body with the switch OFF.

If continuity is not as specified, replace the switch or inspect its ground connection.



DOOR SWITCH

Remove the door switch and check for continuity between the terminals. If continuity is not as specified, replace the door switch.

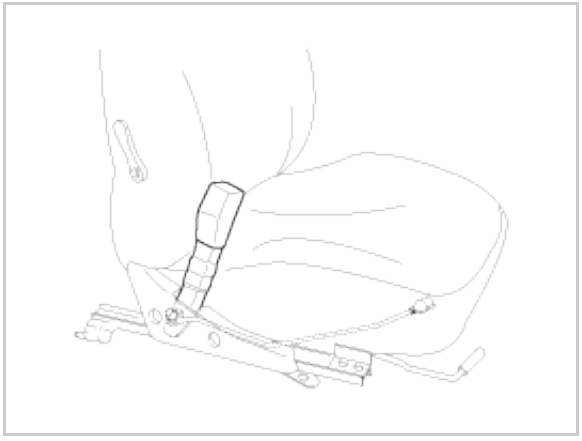


Terminal / Position	1	2	Body (Ground)
Free(Door open)	○	○	○
Push(Door close)			

SEAT BELT SWITCH

1. Remove the connector from the switch.
2. Check for continuity between terminals.

Seat belt condition	Continuity
Fastened	Non-conductive (∞ Ω)
Not fastened	Conductive (0 Ω)



SEAT BELT WARNING LAMP

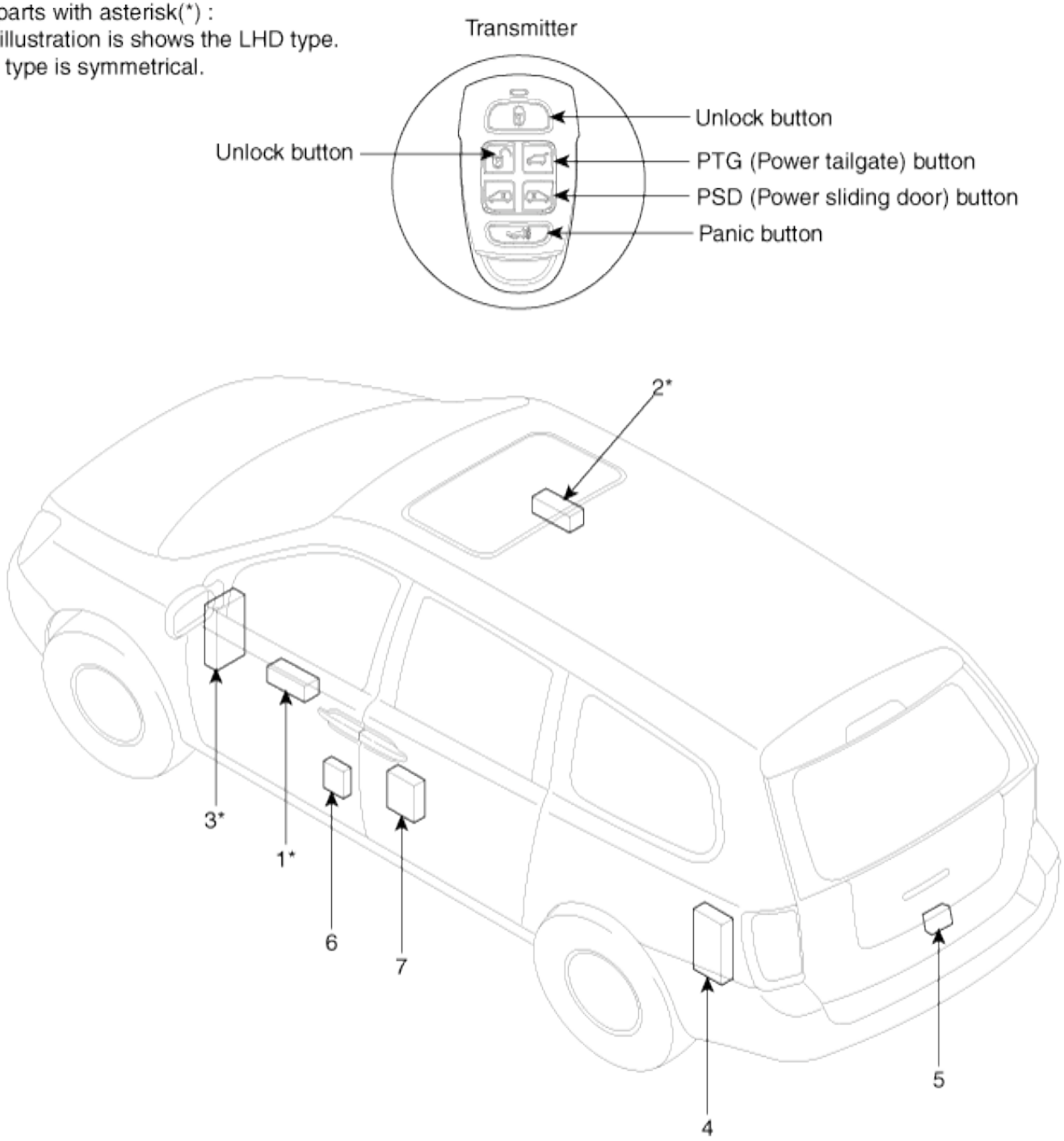
With the ignition switch turned ON, verify that the lamp glows.

Seat belt condition	Warning lamp
Fastened	OFF
Not fastened	ON

Power Door Locks

COMPONENT LOCATION

The parts with asterisk(*) :
This illustration is shows the LHD type.
RHD type is symmetrical.

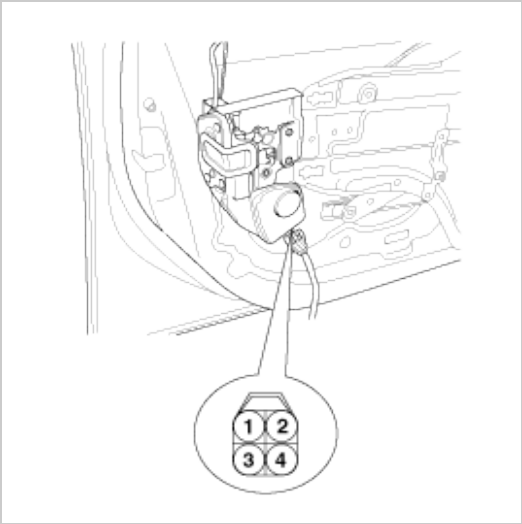


1. DDM (Driver Door Module)
2. ADM (Assistant Door Module)
3. IPM (In-Panel Module)
4. RAM (Rear Area Module)
5. Tailgate lock actuator
6. Front door lock actuator
7. Sliding door lock actuator

INSPECTION

FRONT DOOR LOCK ACTUATOR

1. Remove the front door trim panel. (Refer to the Body group - front door)
2. Disconnect the 4P connector from the actuator.

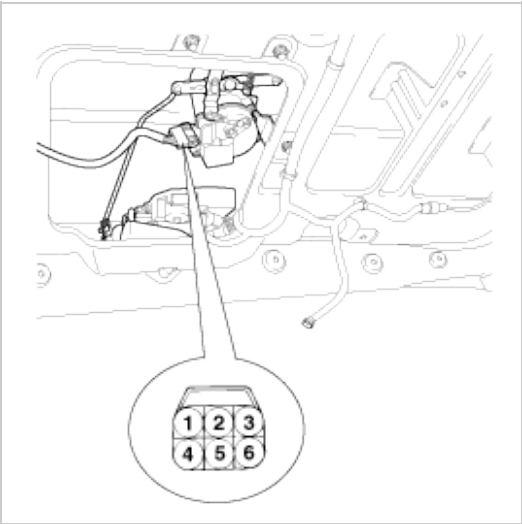


3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal		2	4
Front left	Lock	⊖	⊕
	Unlock	⊕	⊖
Front right	Lock	⊖	⊕
	Unlock	⊕	⊖

SLIDING DOOR LOCK ACTUATOR

1. Remove the sliding door trim panel. (Refer to the Body group - rear door)
2. Disconnect the 6P connector from the actuator.

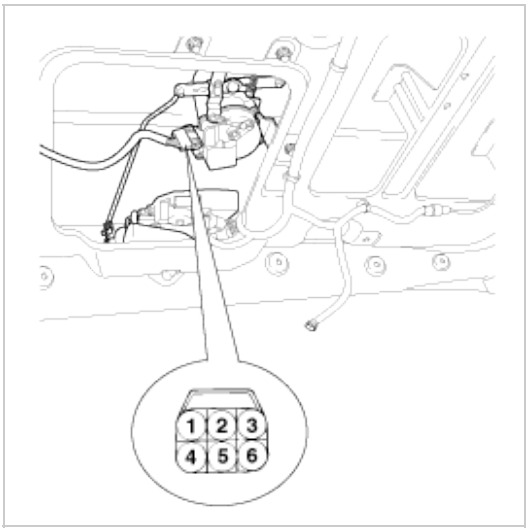


3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal		1	2	3
Left	Lock		⊕	⊖
	Unlock		⊖	⊕
Right	Lock	⊕	⊖	
	Unlock	⊖	⊕	

TAILGATE LOCK ACTUATOR

1. Remove the tailgate trim panel. (Refer to the Body group - tailgate)
2. Disconnect the 6P connector from the actuator.

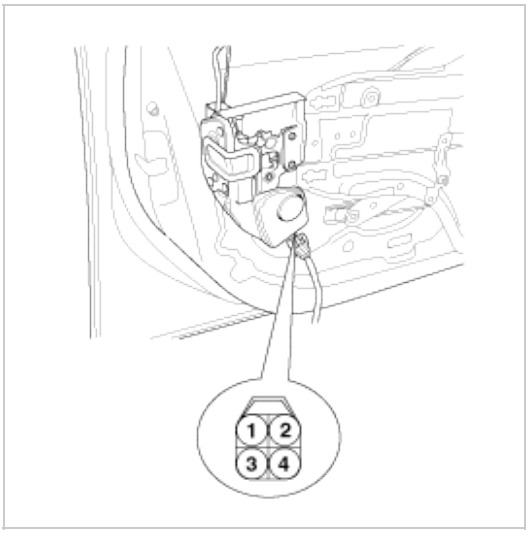


3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal	4	6
LOCK	⊕	⊖
UNLOCK	⊖	⊕

FRONT DOOR LOCK SWITCH

1. Remove the front door trim panel. (Refer to the Body group - Front door)
2. Disconnect the 6P connector from the actuator.

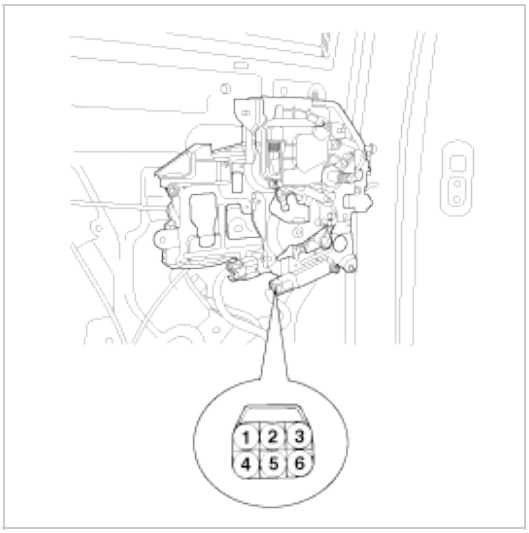


3. Check for continuity between the terminals in each switch position according to the table.

Position \ Terminal		1	2	3
Front left	Lock			
	Unlock	○	—	○
Front right	Lock			
	Unlock	○	—	○

SLIDING DOOR LOCK SWITCH

1. Remove the rear door trim panel. (Refer to the Body group - Rear door)
2. Disconnect the 6P connector from the actuator.

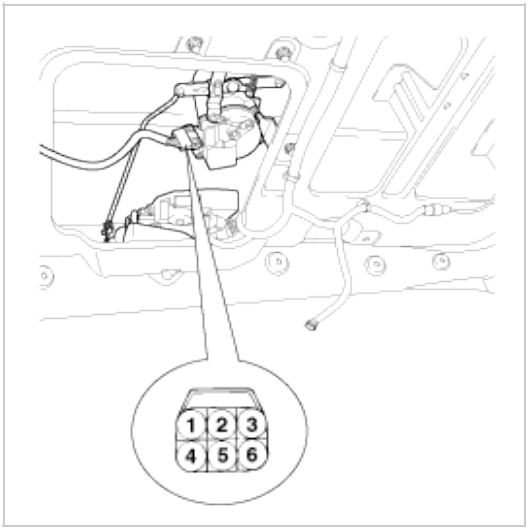


3. Check for continuity between the terminals in each switch position according to the table.

Position \ Terminal		4	5	6
Left	Lock			
	Unlock	○	○	
Right	Lock			
	Unlock		○	○

TAILGATE LOCK SWITCH

1. Remove the tailgate trim panel. (Refer to the Body group - tailgate)
2. Disconnect the 6P connector from the actuator.

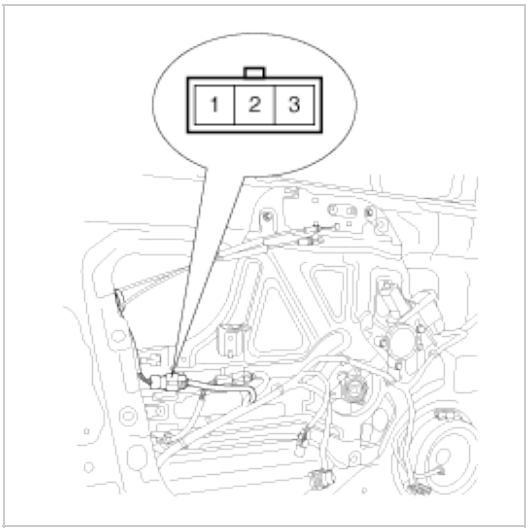


3. Check for continuity between the terminals in each switch position according to the table.

Position \ Terminal	1	2
Unlock	○	○

FRONT DOOR KIEY SWITCH

1. Remove the front door trim panel. (Refer to the Body group - Front door)
2. Disconnect the 3P connector from the actuator.

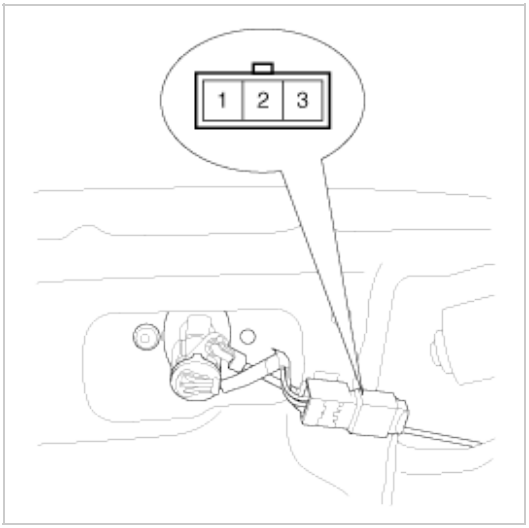


3. Check for continuity between the terminals in each switch position according to the table.

Position \ Terminal		1	2	3
Left	Lock		○	○
	Unlock	○		○
Right	Lock	○		○
	Unlock		○	○

TAILGATE KEY SWITCH

1. Remove the tailgate trim panel. (Refer to the Body group - tailgate)
2. Disconnect the 3P connector from the actuator.



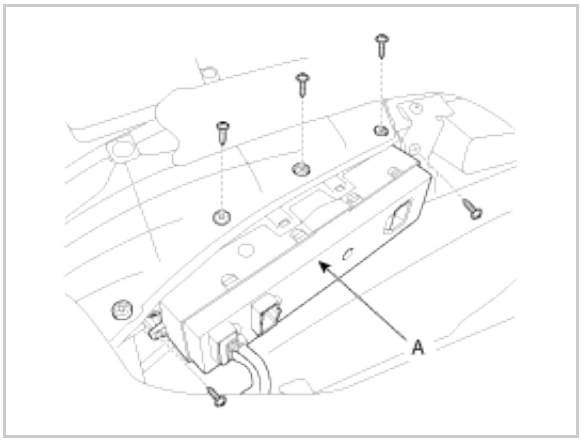
3. Check for continuity between the terminals in each switch position according to the table.

Position \ Terminal	1	2	3
LOCK	○		○
UNLOCK	○	○	

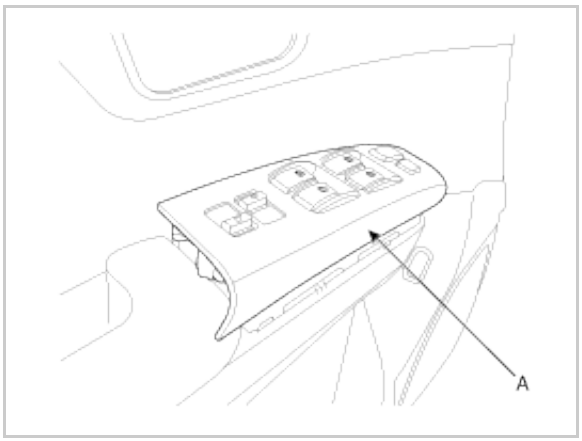
REPLACEMENT

DDM/ADM

1. Disconnect the negative battery terminal.
2. Remove the front door trim panel. (Refer to the Body group - Front door)
3. Remove the door module (A) mounting screws (5EA) after disconnecting the connector (3EA) from the actuator.

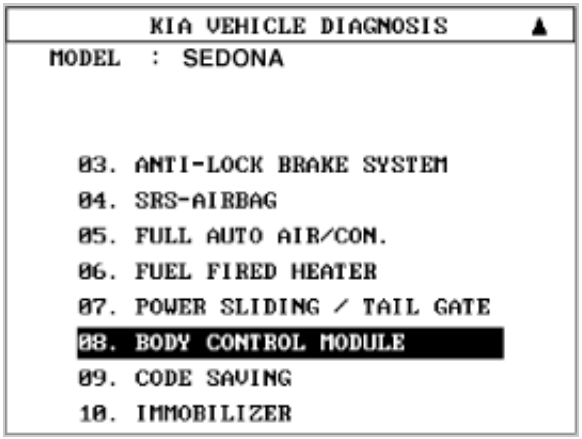


4. Remove the front door modules (DDMDM) from the front door trim panel.

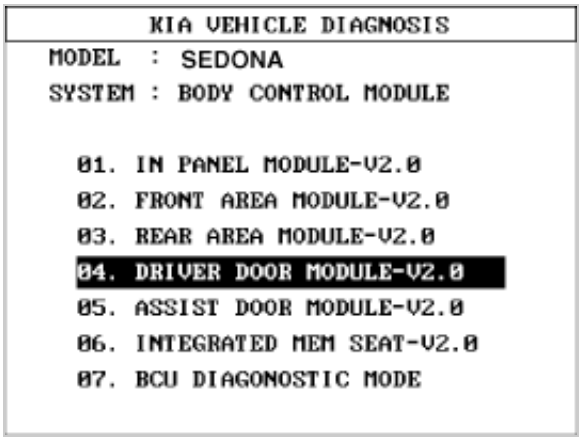


INSPECTION

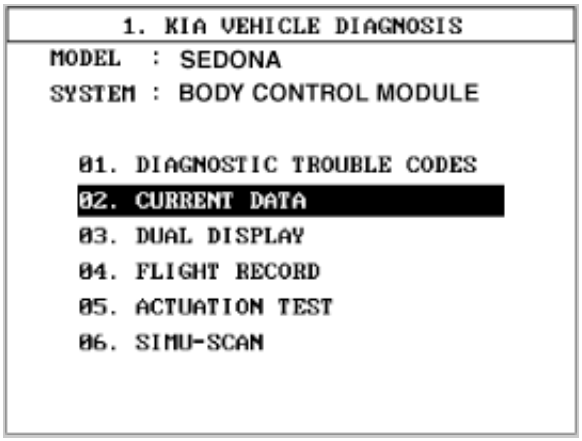
1. The DDM inputs can be checked using the scan tool..
2. To check the Input Value of door lock switch, select option "09. BODY CONTROL MODULE".

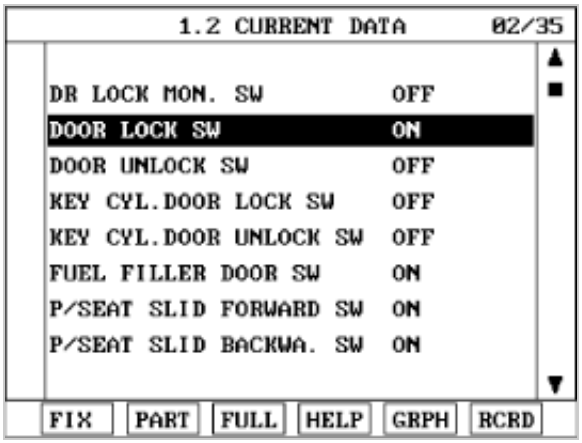


3. Select option "04. DRIVER DOOR MODULE".

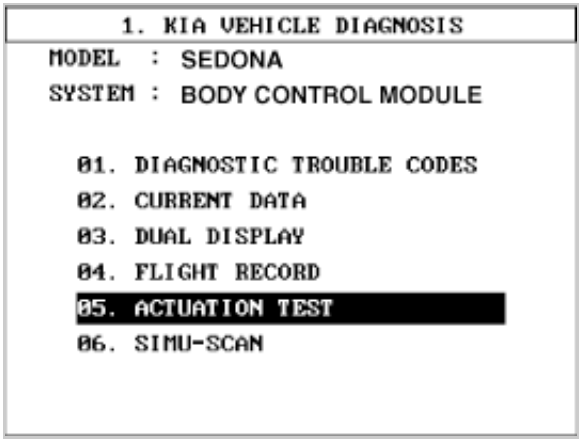


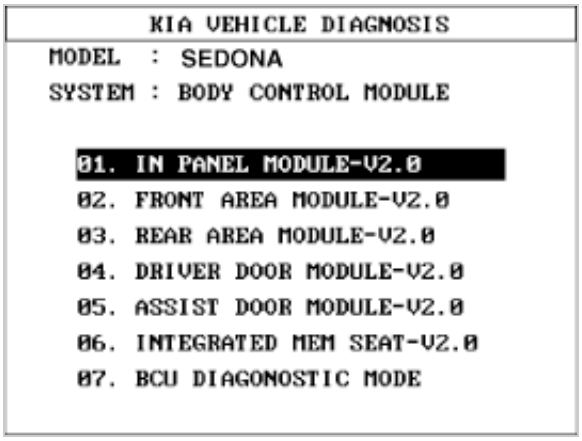
4. Select option "02. CURRENT DATA".





5. To check the Input Value of door lock switch in force mode, select option "05. ACTUATION TEST".



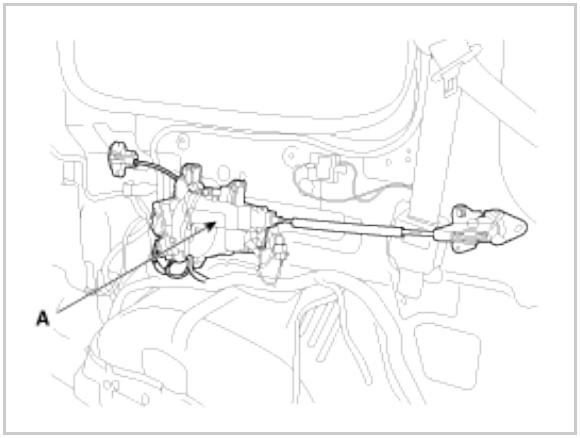

KIA VEHICLE DIAGNOSIS
MODEL : SEDONA
SYSTEM : BODY CONTROL MODULE
01. IN PANEL MODULE-V2.0
02. FRONT AREA MODULE-V2.0
03. REAR AREA MODULE-V2.0
04. DRIVER DOOR MODULE-V2.0
05. ASSIST DOOR MODULE-V2.0
06. INTEGRATED MEM SEAT-V2.0
07. BCU DIAGONOSTIC MODE

Power Sliding Door System

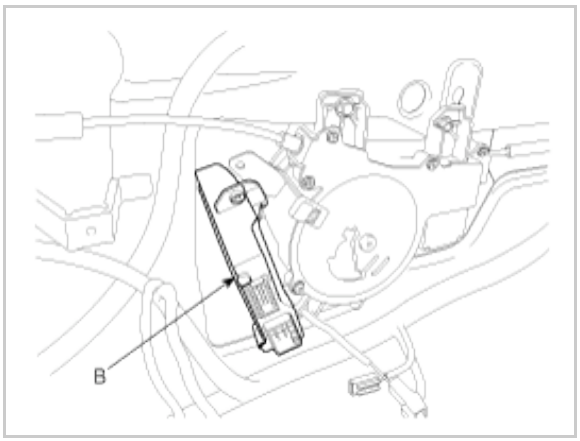
DESCRIPTION

Power Sliding Door is an electro-mechanical system designed to provide power opening and closing of a vehicle's sliding door through the push of a button of the transmitter key or the main control buttons on the overhead console or the sub control buttons on the center pillar trim or inside/outside door handle switch.
The power sliding door will reverse direction of travel if resistance to movement is detected while the door is being closed. If resistance to movement is detected while the power sliding door is being opened, the door will stop moving.

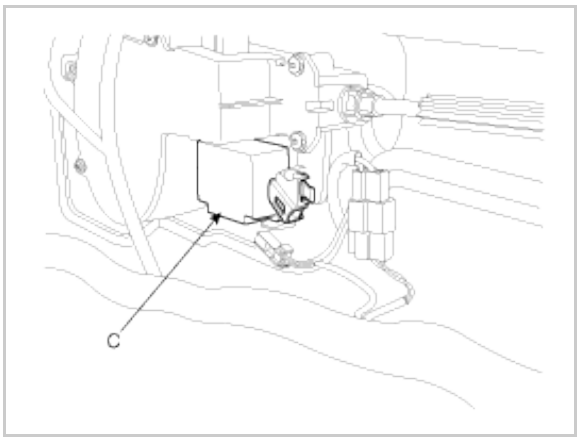
1. DRIVE UNIT
   Drive unit (A) consists of a DC motor, optical sensor, clutch, cables and pulleys and wire harness. The clutch and motor portion of the assembly provides the power and torque required to open or close the sliding door. The clutch assembly is used to connect or disconnect the motor so that the Sliding Door may be moved manually, if desired.



2. POWER SLIDING DOOR CONTROL MODULE (PSDM)
   The PSD System uses a power sliding door control module (microprocessor controller) to operate the drive unit. Signals are received from the vehicle and used to start or stop power open or close operations. The PSDM cannot be adjusted or repaired and if found to be faulty, must be replaced.

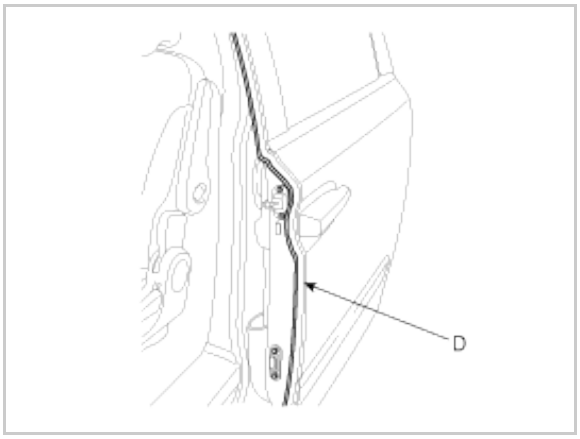


3. SLIDING DOOR CHIME (C)
   When the power sliding door detect the resistance or abnormal operation, the chime will sound.

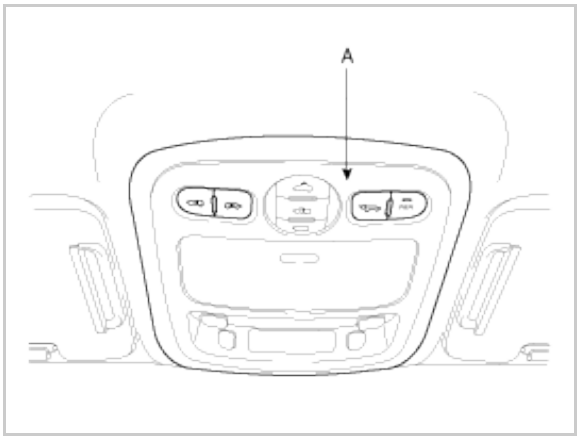


4. ANTI-PINCH STRIP (D)

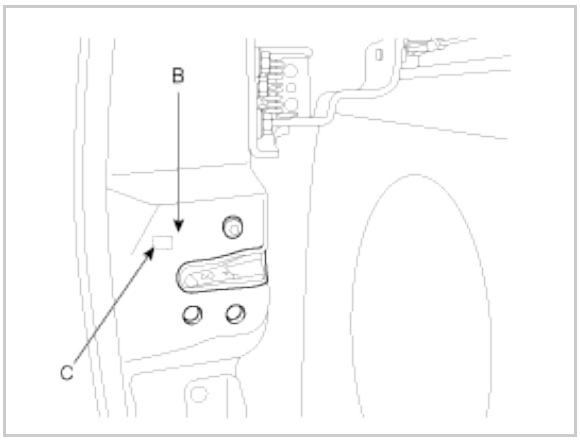
Secondary Obstacle Detection is provided by means of a contact type strip. Strip is composed of two conductive zones separated by an air gap. When strip is compressed, conductive zones make contact, activating the switch signal.
Copper wire is extruded through conductive material to prevent resistive buildup. Terminating resistor is molded into end of strip to detect failures of strip.



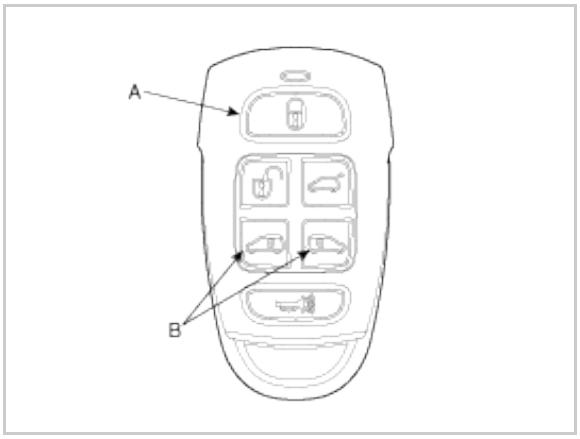
5. OVERHEAD CONSOLE AND REMOTE CONTROL SWITCH (A)
The power sliding doors can be opened and closed automatically with the RKE and the main control button on the overhead console.



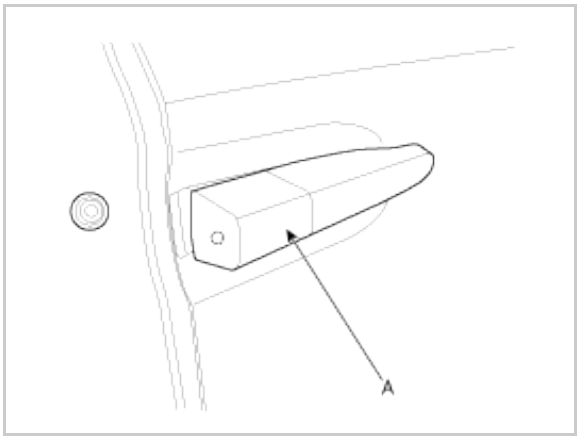
6. DOOR LATCH (B)
The door latch contains a detent switch [C] used to detect the latch state and report the latch state to the power sliding door module.



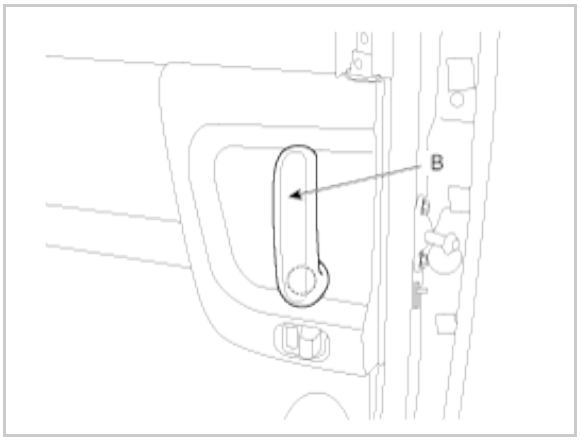
7. KEYLESS ENTRY (A)
Power sliding doors can be opened and closed by pressing the button on the RKE more than 0.5 sec. Open operation shall be reserved when an additional open/close signal is received during power opening.



8. INSIDE/OUTSIDE DOOR HANDLE SWITCH
   Power sliding door can be opened and closed manually/automatically from inside or outside vehicle.
   Outside door handle switch (A)



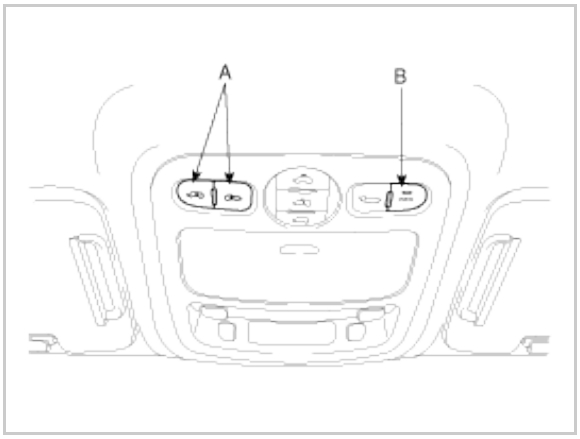
Inside door handle switch (B)



OPERATION

POWER SLIDING DOOR OPEN/CLOSE

1. The right/left sliding door is opened and closed automatically if the main switch (A) is pressed on the overhead console.



2. When the power ON/OFF button (PWR) (B) is ON, the power sliding door and power tailgate can be opened and closed automatically by using trim switch.
3. When the sliding door window is open (more than 3 in/80 mm), the power sliding door will not power open fully but will open to the 3/4 position and the chime will sound 3 times.
4. General rules for chime functions
   a. Chime shall operate when a power operation cannot be performed as requested except handle pull : 1 Time (Duration 0.5 second on)
   b. Chime shall operate when an obstacle has been detected : 3 Time (0.5 sec on, 0.5 sec off)
   c. Chime shall operate if PSD has not reached primary latch position after a power cinch cycle : 3 Time (0.5 sec on, 0.5 sec off)

> WARNING
>
> Do not leave the power sliding door at half-opened position. Close the window and then open the door fully. Half-opened door is held and then released after 10 minutes. The chime sounds 3 times to indicate the door is released. If the vehicle is stopped on a downward slope, it may move and cause an injury.

POWER SLIDING DOOR OPERATING CONDITION

1. The sliding door will not power open when vehicle is moving above 3 mph (5 km/h) or the gearshift lever is not in P (Park) for automatic transaxle.
2. The power sliding door will not open with the transmitter or the main control button when all power sliding doors are locked and closed.
3. The power sliding door will detect the resistance, then stop movement or move to the full open position to allow the object to be cleared.
4. The left sliding door cannot be opened when the fuel filler lid is open.
5. If the automatic stop and reversal feature operates continuously more than twice during one opening or closing operation, the power sliding door may stop at that position. At this time, close the doors manually and operate the door automatically again.
6. The power sliding door can be opened by pulling the outside door handle while the door is unlocked and child safety lock is engaged.

> NOTICE
>
> a. If the fuel filler lid is opened when the left sliding door is not closed completely, the door may be opened. Close the left sliding door before refueling to prevent possible damage to the door or the fuel filler lid.
> b. Sudden starting or accelerating the vehicle while the door is closing could cause it to open the door and result in a serious injury or damage to cargo.
> c. The PSDM will go to a sleep mode and power operation will be disabled if the sliding door is left open longer than 6 hours. Manually close the sliding door to the latched position to reset the PSDM. Power operation will be restored.

CAUTION

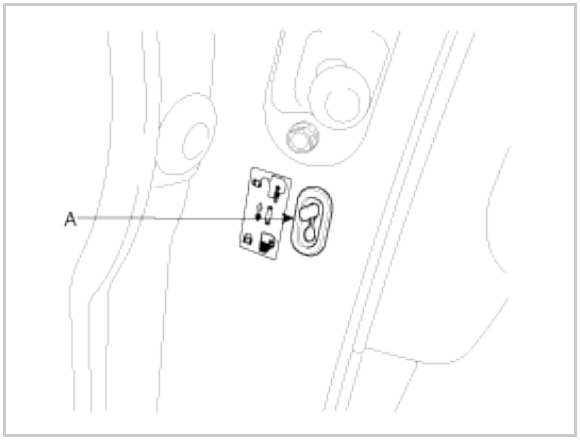
a. The door could suddenly close by itself and cause a serious injury especially when stopping on a down-hill grade.
b. To prevent the battery from being discharged, do not leave the power sliding door and power tailgate at open position for a long time.

WARNING

a. Let the rear passengers get on or off the vehicle after the door is open fully. Sudden closing could cause a serious injury.
b. To prevent power sliding door system, don't use excessive force to open/close the door during operation.

CHILD SAFETY LOCKS

To prevent children from opening the power sliding doors from the inside, the child safety locks (A) should be used whenever children are in the vehicle.



WARNING

Be careful, when the child safety lock is used in an accident, that the passengers are not held in vehicle.

POWER OPERATION

The PSD system shall not open the Sliding Door when the vehicle is moving.
The PSD system shall operate through the full range of Sliding Door travel.
The PSD system shall learn the position of each travel extreme: full open and full closed.

– : No action ● : Close ○ : Open X : Stop

Vehicle Motion	Door Position Zone	ON/OFF	Door Lock Status	Operation			
				RKE Key fob Note 2	PSD main switch	PSD sub switch	Door handle switch
Not Moving	1 or 2	OFF	Any	○	○	X(Chime 1 T)	X
		ON	Not Locked	○	○	○	○
			Locked	○	○	X(Chime 1 T)	X
	3 or 4	OFF	Any	●	●	X(Chime 1 T)	X
		ON	Any	●	●	●	●
	Closing	OFF	Any	○	○	X	X
		ON	Any	○	○	○	○
	Opening 1 or 2	ON/OFF	Any	X	X	X	X
	Opening 3 or 4	OFF	Any	●	●	X	X
		ON	Any	●	●	●	●
Moving	1 or 2	ON/OFF	Any	–	X(Chime 1 T)	X(Chime 1 T)	X
	3 or 4	OFF	Any	–	●	X(Chime 1 T)	●
		ON	Any	–	●	●	●
	Closing	ON/OFF	Any	–	X	X	X
	Opening 1 or 2	ON/OFF	Any	–	X	X	X
	Opening 3 or 4	OFF	Any	–	●	X	X
		ON	Any	–	●	●	●
Any	1 or 2	ON	Any	Manual Move in open/close direction			
			Any				
	3 or 4	ON	Any	Manual Move in open/close direction			
			Any				
	Any	OFF	Any	Manual Move			

1. Vehicle condition
   Moving
   a. (IGN=OFF and Vehicle Speed > 5 km/h) or (IGN= ON and (Vehicle Speed > 5 km/h or PIN - not P/N))
   Not moving
   a. (IGN=OFF and Vehicle Speed < 5 km/h) or (IGN= ON and (Vehicle Speed < 5 km/h and TRANS - P/N))

2. DOOR TRAVEL - ZONES
   The door travel is divided into four zones starting at the full closed and latched position.
   Dimensions are at the rear edge of the door and are approximate.
   Zone 1 - Latching - 0 to 10 mm (primary and secondary latch positions).
   Zone 2 - Near latching position including curved track portion -10 to 300 mm.
   Zone 3 - Straight track - 300 mm to hold open latch.
   Zone 4 - Hold Open - door in hold open latch.

POWER SLIDING DOOR OPERATION

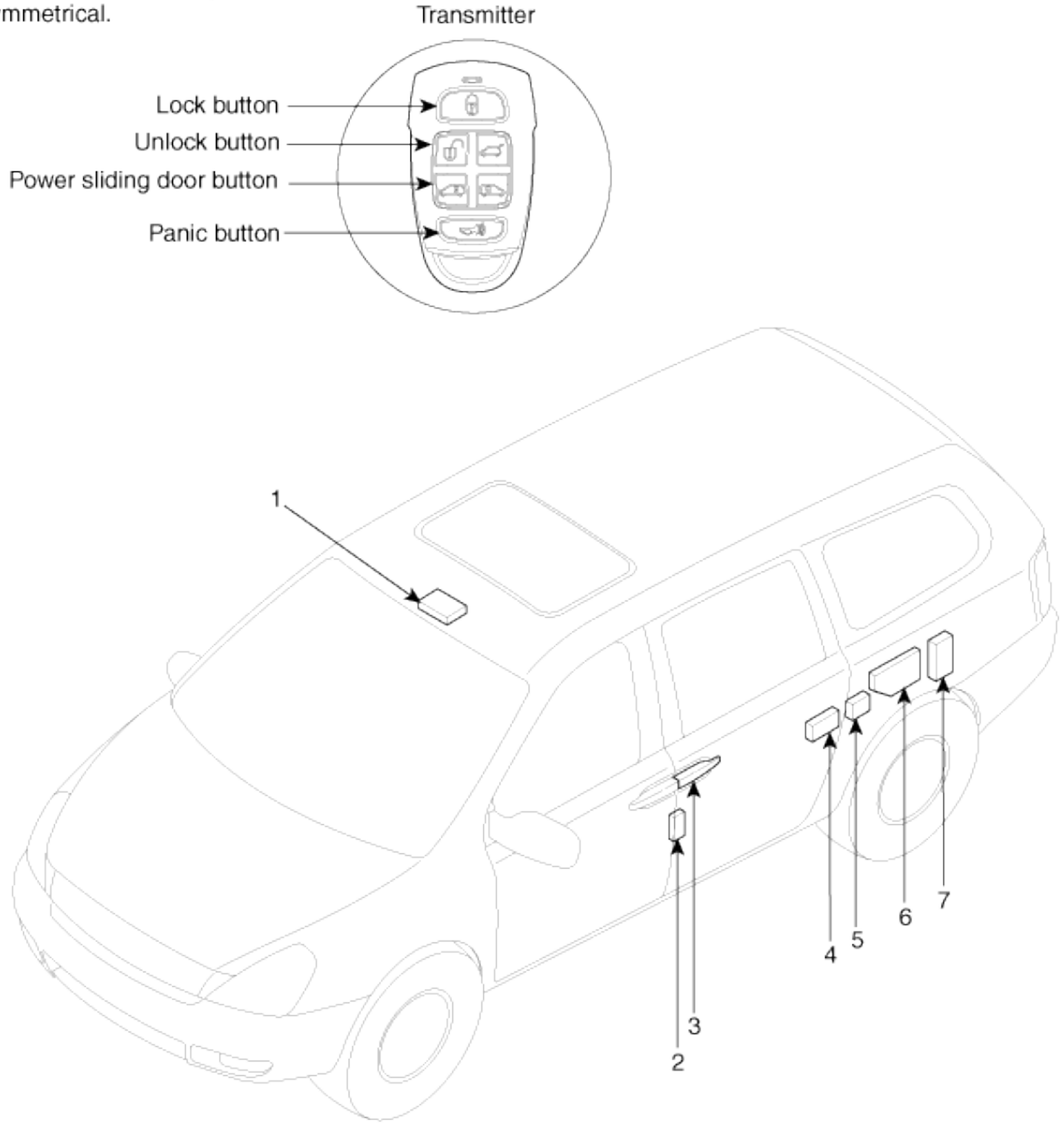
1. Vehicle condition
   Stopping condition
   a. When the ignition switch is in the OFF or ACC position, vehicle is stopped or moving below 5 km/h.
   b. When the ignition switch is in the ON position, vehicle is stopped or moving below 5 km/h (the gearshift lever is in N(Neutral) for manual transaxle, P(Park) for automatic transaxle).
   Driving condition
   a. When the ignition switch is in the OFF or ACC position, vehicle is moving above 5 km/h.
   b. When the ignition switch is in the ON position, vehicle is moving above 5 km/h or the gearshift lever is not in

N(Neutral) for manual transaxle, P(Park) for automatic transaxle.

2. Door position
   If the power sliding door is operated while the door is in slightly-opened position (less than 300mm), the door is automatically opened fully. If the power sliding door is operated while the door is in slightly-opened position (more than 300mm), the door is automatically closed completely.
3. If the door handle is pulled from inside or outside while the door is locked or child safety lock is engaged, the power sliding door is not opened.

COMPONENT LOCATION

This illustration is shows the LHD type.
RHD type is symmetrical.



1. Overhead console switch
2. Power sliding door trim switch
3. In/out door handle switch
4. Latch (including detent switch)
5. Power sliding door chime
6. Power sliding door drive unit
7. Power sliding door module

TROUBLESHOOTING

Check the following items prior to performing Power Sliding Door System service.

1. Manual movement
   Make sure the sliding door moves manually. Place the ON/OFF switch on the overhead console in the OFF position. Move the door manually and check for proper door fit and latch effort. Check for interference with other body parts such as latch striker, trim, and weather seals.
2. Battery voltage
   Make sure the battery is fully charged. The PSD system is an electronic device and requires a minimum battery voltage to operate. The PSDM(Power sliding door module) monitors the battery voltage present at the PSDM input battery input and will not permit operation if the battery voltage is out of range.
3. Fuses
   Two fuses protect the battery supply to the PSDM(Power sliding door module), one for Power, and one for logic. Check that the fuses are intact
4. Repeat Operations
   Make sure the customer has not been operating the PSD repeatedly while the vehicle is turned off. The battery will be discharged and the PSDM(Power sliding door module) will not permit operation.
5. Vehicle on Steep Grade
   Make sure the customer has not been operating the PSD system when the vehicle is parked on a steep grade (greater than 30%). The system will operate but the force of gravity and normal flex of the vehicle body may affect proper operation.
6. Obstacle Detection
   The obstacle detection force is not adjustable. Factors that may affect the force are vehicle grade, battery voltage, or dirt in sliding door tracks.
7. Outside handle response time
   When the vehicle has been parked and OFF, there may be a delay before power operation starts after the outside handle is pulled. This is normal because the PSDM(Power sliding door module) must wake up and check for proper conditions before starting a power open operation.
8. The sliding doors are not identical. Open and close times and obstacle detection efforts may vary when comparing the two doors. This is normal and is caused by vehicle build conditions such as door fit and rolling resistance.
9. Scan tool Diagnostic tool
   Connect Scan tool to the K-line and check status of system.

POWER SLIDING DOOR SYSTEM DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
Sliding Door opens unexpectedly	Accidental activation or failure of open/close command switch	Check for shorted or defective switch
	Failure of latch assembly	Check wiring connections
		Check for diagnostic trouble codes
	Failure of Power Sliding Door or Body Control module	Disconnect then reconnect battery or fuse to reset module and function sliding door. If no function exists check for loose wire connections. See Body Diagnostic Manual for detailed procedures
Sliding Door will not power open or close	Not in Park or false indication	Check switch status with SCAN tool
	Battery voltage at PSDM is too low <9.5V to start operation and <8.0V to continue operation	Check for proper voltage at the PSDM. Charge battery
	Blown fuse	Check for blown fuse
	BCM or sliding door control module	

	BCM or sliding door control module critical fault codes	Check for diagnostic trouble codes
	Failure of latch assembly	Check wire connections and for blown fuse
		Check for foreign matter preventing the operation of latch assembly
	Failure of motor assembly	Test motor assembly
	Binding or sticking of components	Establish location of binding and replace necessary components
	Wiring problems (system or vehicle)	Troubleshoot using electrical schematics Refer to wiring diagrams
Power loss during Sliding Door operation	Wiring problems (system or vehicle)	Troubleshoot using electrical schematics Refer to wiring diagrams
	Battery voltage at PSDM is too low <9.5V to start operation and <8.0V to continue operation	Check for proper voltage at the PSDM. Charge battery
	Failure of Power Sliding Door or Body Control Module	Check for diagnostic trouble codes
	Failure of motor assembly	Test motor assembly
Sliding Door does not close to primary latch position	Door mis-alignment	Check latch and striker alignment
		Check rollers and track alignment
	Binding or sticking of components	Establish location of binding and adjust or replace necessary components
	Failure of Power Sliding Door or Body Control Module	Check for diagnostic trouble codes
	Sliding Door seal force too high	Inspect seals for damage, mis-assembly, foreign matter or other possible obstruction
	Failure of motor assembly	Test motor assembly
Latch will not release from primary position	Not in Park or false indication	Check switch status with SCAN tool
	Battery voltage at PSDM is too low	Check for proper voltage at the PSDM Charge battery
	Blown fuse	Check fuse and replace if required
	Failure of latch assembly	Check switch status with scan tool
		Check for foreign matter or damaged components preventing the operation of latch assembly
		Troubleshoot using body diagnostic manual. Replace latch assembly, if necessary
	Failure of outside or inside handle connection	Check handle connections on brainplate.
	Failure of Power Sliding Door or Body Control Module	Check for diagnostic trouble codes.
	Binding or sticking of components	Establish location of binding and adjust or replace necessary components
Key fob or overhead console switch does not power operate sliding door	Blown Fuse	Check fuse and replace
	Battery voltage at PSDM is too low	Check for proper voltage at the PSDM. Charge battery
		Refer to wiring diagrams

	Wiring problems (system or vehicle)	Refer to wiring diagrams Check for diagnostic trouble codes.
Does Not Power Unlatch	Failure of latch assembly	Check for foreign matter preventing the operation of latch assembly
		Check for diagnostic trouble codes.
		Check Detent switch.
		Troubleshoot using body diagnostic manual
	Failure of Latch Release Actuator	Check actuator and replace if necessary
	Wiring problems (system or vehicle)	Refer to wiring diagrams Check for diagnostic trouble codes.
	Failure of Body Control Module (BCM)	Troubleshoot using body diagnostic manual
		Replace BCM if necessary
	Failure of key fob	Reprogram key fob
		Replace key fob if necessary
	Failure of Power Sliding Door Module	Check for diagnostic trouble codes. See Body Diagnostic Manual for detailed procedures
	Failure of sliding door motor assembly	Check for foreign matter preventing the operation of motor assembly
		Check wire connections
		Drive Unit clutch does not engage. Replace Drive Unit.
		Troubleshoot using Body Diagnostic Manual Replace motor if necessary
Sliding Door does not stay open	Hold Open Latch not working	Check if sliding door powers open to hold open latch
		Check if H-O-L is working
High inside/outside opening effort	Bound cables	Check for smooth manual operation
		Check for broken attachments
	Drive unit jammed or did not disengage	Troubleshoot using Body Diagnostic Manual Replace components, if necessary
	Binding or sticking of components	Establish location of binding and replace necessary components
Sliding Door continues to power close	Failure of latch assembly	Check wire connections and Detent switch
		Check for foreign matter
		Troubleshoot using Body Diagnostic Manual
	Control Module	Check for diagnostic trouble codes
	Wiring problems (system or vehicle)	Troubleshoot using electrical schematics Refer to wiring diagrams
Sliding Door continues to power open	Failure of PSDM	Check for diagnostic trouble codes See Body Diagnostic Manual for detailed procedures
	Wiring problems (system or vehicle)	Troubleshoot using electrical schematics Refer to Wiring Diagrams
Sliding Door opens very slowly	Battery voltage at PSDM is too low	Check for proper voltage at the PSDM Charge battery

	Bound cables	Replace drive unit if necessary
	Binding or sticking of components	Establish location of binding and replace necessary components
	Grade of vehicle too steep for power operation	Operate sliding door manually
	Failure of sliding door motor assembly	Replace motor assembly, if necessary
Squeaks, Noises and rattles	Foreign material in Sliding Door	Remove foreign material
	Worn or Loose components	Check and tighten loose components

DTC LIST

DTC CODE	DISPLAY
B1101	Battery Voltage High
B1102	Battery Voltage Low
B1105	Reference Voltage Fault
B1223	VSS Fault
B1270	Optical Sensor-1 Output Stuck High
B1271	Optical Sensor-1 Output Stuck Low
B1272	Optical Sensor-2 Output Stuck High
B1273	Optical Sensor-2 Output Stuck Low
B1274	Broken Cable(PSD Only)
B1580	Ignition Start Switch Short High
B1586	Chime Open Or Short High
B1621	ECU Fault
B1645	Drive Unit Fault
B2420	Drive Motor Open
B2421	Drive Motor Short High
B2422	Drive Motor Short Low
B2423	Clutch Open Or Short High
B2424	Clutch Short Low
B2425	Pinch strip(PSD) open or Stuck High
B2426	Pinch strip(PSD) Stuck Low
B2450	Unlatch Motor (PSD) Short High
B2451	Unlatch or Cinch Motor (PTG) / Unlatch Motor (PSD) Short Low

INPUT/OUTPUT MONITORING

	BCM DISPLAY	UNIT
1	Battery Logic Voltage	Voltages
2	Battery Power Voltage	Voltages
3	Optical Sensor Power	Voltages
4	Door/Gate Optical Sensor 2-Logical State	LOW/HIGH
5	Door/Gate Optical Sensor 1-Logical State	LOW/HIGH

6	Detent Switch	LOW/HIGH
7	Power Battery Voltage	OUT OF RANGE/ IN RANGE
8	Pinch strip-pinch condition(PSD Only)	Not Pinched/Pinched
9	Park Switch	Out Of Park/Park
10	Ignition Swtich	LOW/HIGH
11	Child Lock Status (PSD Only)	Lock/Unlock
12	Lock Status (PSD Only)	Lock/Unlock
13	Handle Switch (PSD Only)	Not Pressed/Pressed
14	Local Open/Close Switch	Not Pressed/Pressed
15	Master Open/Close Switch	Not Pressed/Pressed
16	Learn Process Complete Status	Not Complete/Complete
17	Vehicle Speed Slow Status	≥5kph / < 5kph
18	On/Off Switch	ON/OFF
19	Start Switch	LOW/HIGH
20	PSD Right Select Status	Left/Right
21	Fuel Filler Door switch	LOW/HIGH
22	Door/Gate Open Feedback	Voltages
23	Door/Gate Close Feedback	Voltages
24	Unlatch Feedback	Voltages
25	Clutch Feedback	Voltages
26	Door/Gate Position Count	-
27	Most Recent Cinch Time	ms
28	2nd Most Recent Cinch Time	ms
29	3rd Most Recent Cinch Time	ms
30	4th Most Recent Cinch Time	ms
31	Left Pinch Strip Voltage	Voltages
32	Right Pinch Strip Voltage	Voltages

ADJUSTMENT

POWER SLIDING DOOR INITIALIZATION

A learn cycle must be performed whenever the power is removed, a Power Sliding Door component is removed or replaced, or a sliding door adjustment is performed. The learn cycle enables the Power Sliding Door control module (PSDM) to learn the range of full travel and effort required to power the Sliding Door which allows it to perform properly and safely.

POWER SLIDING DOOR SYSTEM RESET

Certain conditions may require that the PSD system be reset

1. Remove the MEMORY fuse that provides power to the PSDM.
2. Wait 1 minute. Replace fuse. Initialize PSDM.

INITIALIZATION PROCEDURE

1. Manually close and latch the sliding door.
2. Power the sliding door open using the remote control, Open/Close switch, B-pillar switch, or handle.
3. Power the door close from full open to full closed position.
4. Power the door open again to full open position.

ALTERNATE METHOD

1. Remove the black connector (J2) from the PSDM.
2. Wait a short time. Replace connector. Initialize PSDM.

CAUTION

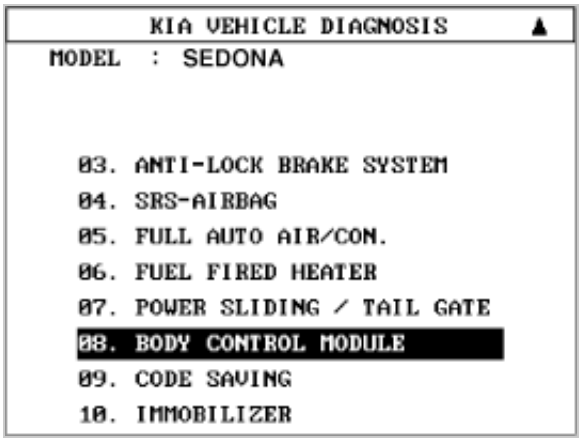
a. The PSD system initialization must start from the primary or secondary latched position.
b. Obstacle detection shall be active during Sliding Door initialization.
c. Work on level ground.

Power Sliding Door Unit

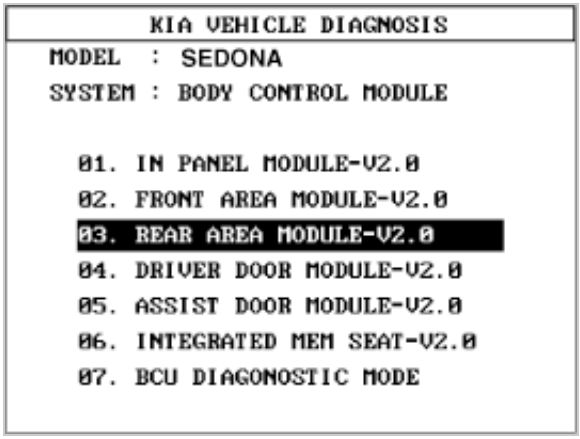
INSPECTION

SLIDING DOOR MOTOR INSPECTION

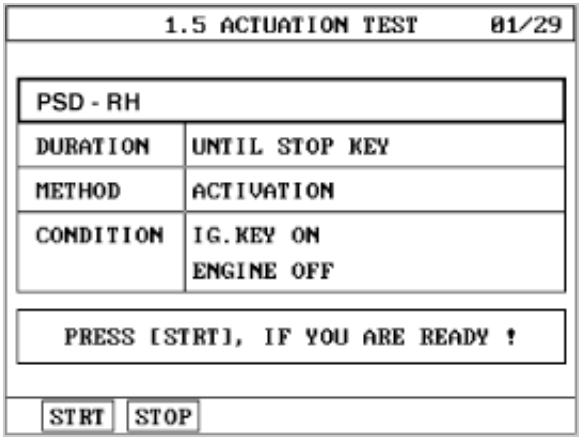
1. It will be able to diagnose defects of PSD motor with scan tool quickly.
2. Select model and menu(BCM).



3. Select "rear area module(RAM)".



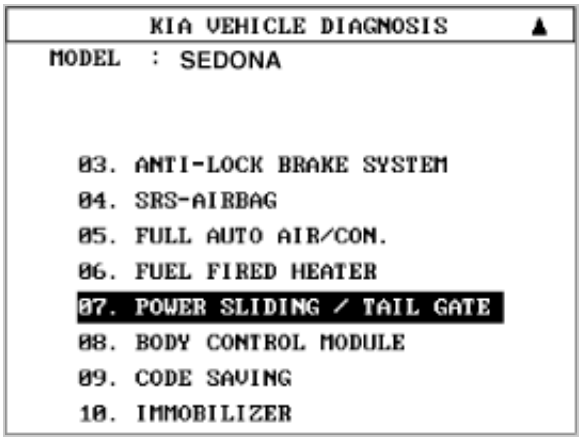
4. Select the "Actuation test" and "PSD open/close" to operate tailgate motor.



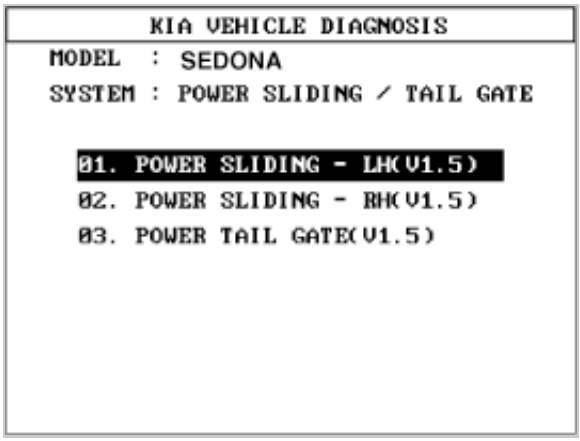
5. Replace the drive unit, if actuator operates abnormal.

DRIVE UNIT CLUTCH INSPECTION

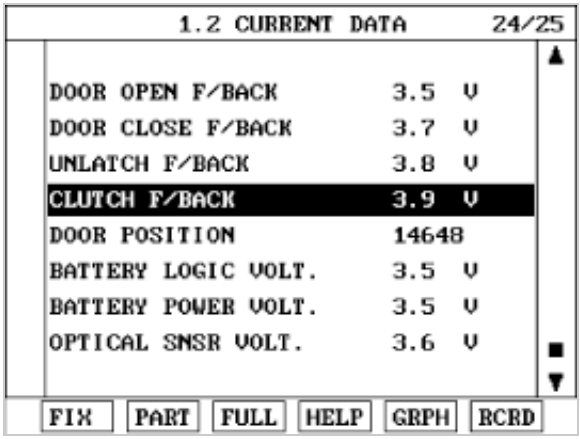
1. Check the power sliding door control module input/output value by using the diagnostic tool. If the operation of power sliding control module is abnormal, replace power sliding door drive unit.
2. When checking the clutch operation, select a vehicle type and "POWER SLIDING/TAILGATE" menu.



3. Select the "POWER SLIDING DOOR" to check.



4. Select the sensor output. And then check the clutch feedback sensor output while operating power sliding door in power mode.

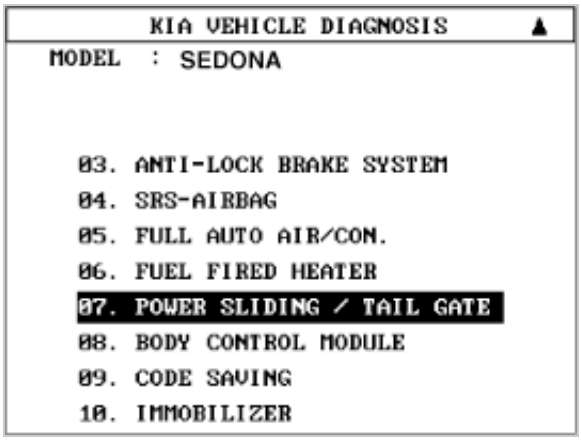


※ Above voltage and numerical value may be different from the real value.

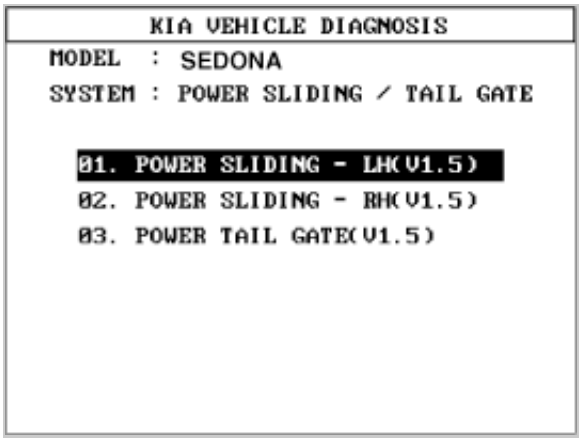
5. Change the drive unit, if there is no change during operation.

OPTICAL SENSOR INSPECTION

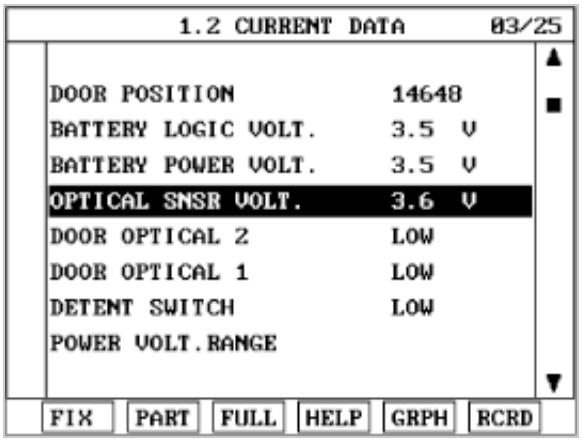
1. Check the power sliding door control module input/output value by using the diagnostic tool.
2. When checking the optical sensor, select a vehicle type and "Power sliding/tailgate" menu.



3. Select the "POWER SLIDING DOOR" to check.



4. Select the sensor output. And then check the optical sensor volt while operating power sliding door in power mode.

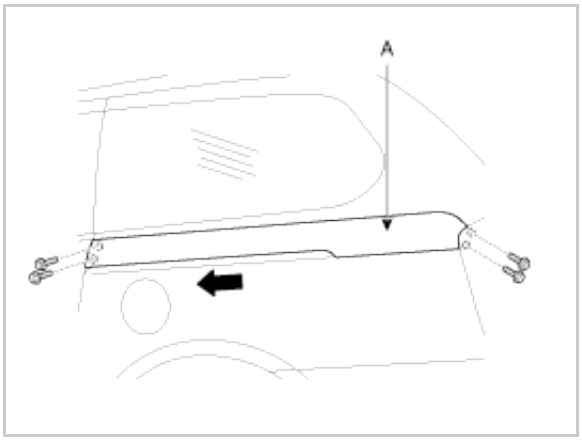


※ Above voltage and numerical value may be different from the real value.

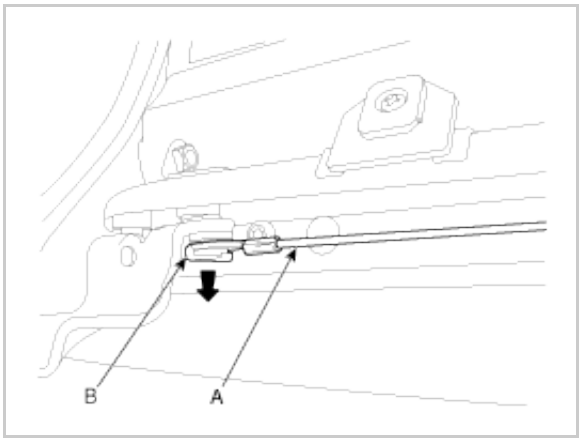
5. Change the drive unit, if there is no change during operation.

REPLACEMENT

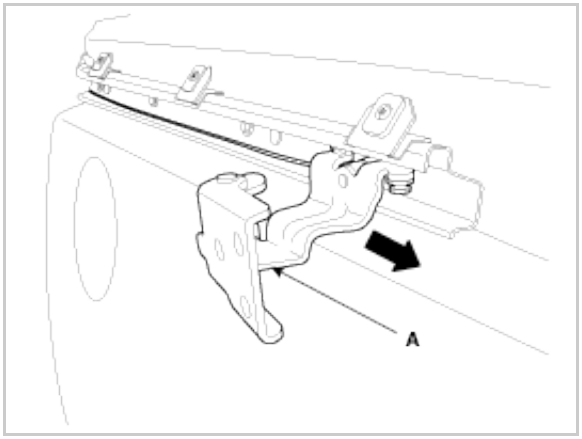
1. Disconnect the negative (-) battery terminal.
2. Remove the rear trim panel (Refer to the Body group - interior trim)
3. Disconnect the connectors (6EA) from the power sliding door drive unit.
4. Remove the rear combination lamp (Refer to the Body group - rear bumper)
5. Remove the mounting bolts (4EA) and rail cover (A).



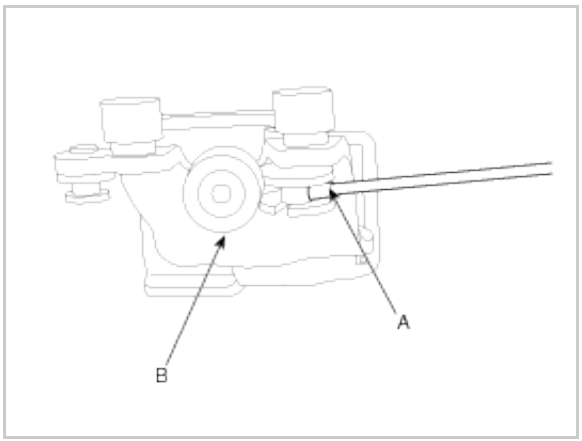
6. Pull the rear cable (A) and draw the cable clip (B) to bottom of roller hinge post and then remove the rear cable (A).



7. Remove the roller hinge bracket assembly (A) as below.

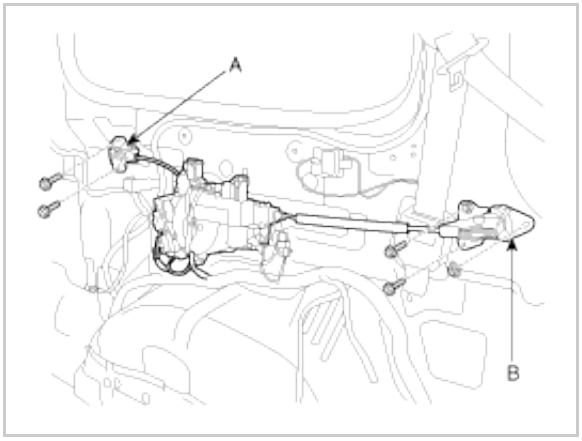


8. Remove the front cable (A) from center roller hinge (B).



9. Loosen the bolts (2EA) and remove the rear pulley bracket (A). And then remove the front pulley bracket (B) after loosening the mounting bolts (2EA) and nut (1EA).

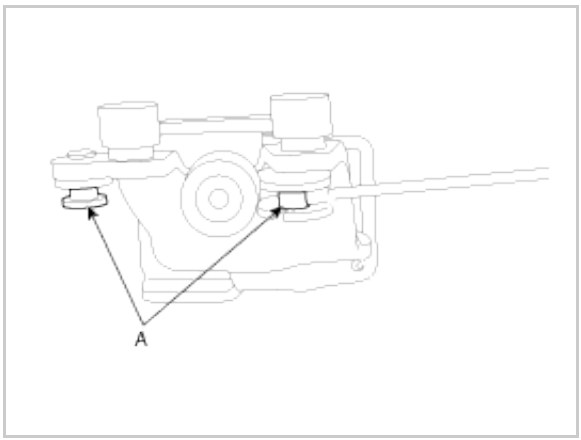
TORQUE : 7 - 11 N.m (0.7 - 1.1 Kg.m)



10. Loosen the mounting bolt (1EA) and nuts (2EA). And then remove the power sliding door drive unit assembly after removing the front cable.

TORQUE : 7 - 11 N.m (0.7 - 1.1 Kg.m)

11. Installation is the reverse of removal.
12. When installation, check the grease on the center roller hinge barrel and club contact part (A).



WARNING

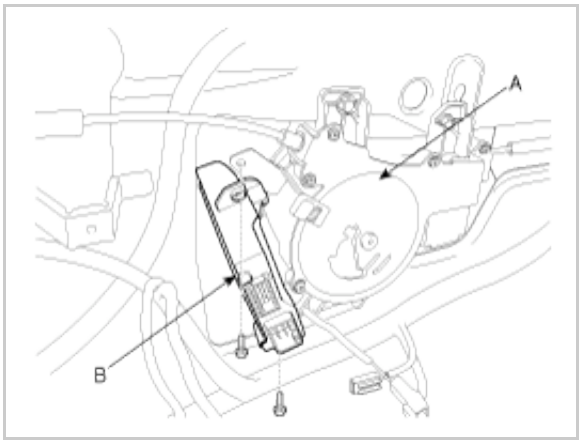
a. A learn cycle must be performed whenever the power is removed.
b. Check the normal operation whenever a power sliding door component is removed or replaced. If the chime sound is heard, check the DTC, wiring harness and cable connections.

Power Sliding Door Control Module

REPLACEMENT

1. Disconnect the negative (-) battery terminal..
2. Remove the rear trim panel (Refer to the Body group - interior trim)
3. Remove the connectors and mounting bolts (2EA) from the power sliding door unit(A). And then remove the power sliding door control module (B).

TORQUE 0.25-0.35N.m(0.025-0.035Kg.m)



4. Installation is the reverse of removal.

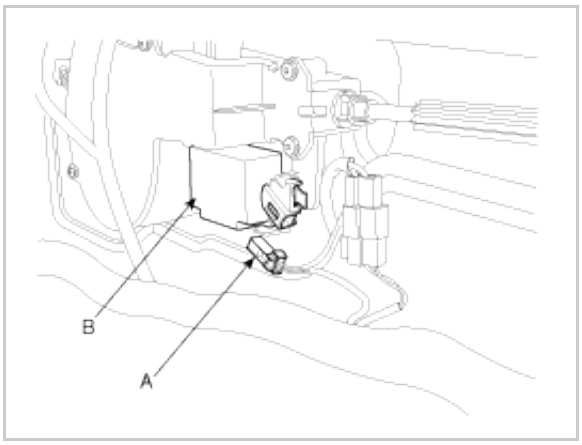
WARNING

a. A learn cycle must be performed whenever the power is removed.
b. Check the normal operation whenever a power sliding door component is removed or replaced. If the chime sound is heard, check the DTC, wiring harness and cable connections.

Power Sliding Door Buzzer

REPLACEMENT

1. Remove the rear side trim (Refer to the Body group - interior trim).
2. Disconnect the sliding door chime connector (A) from chime (B).

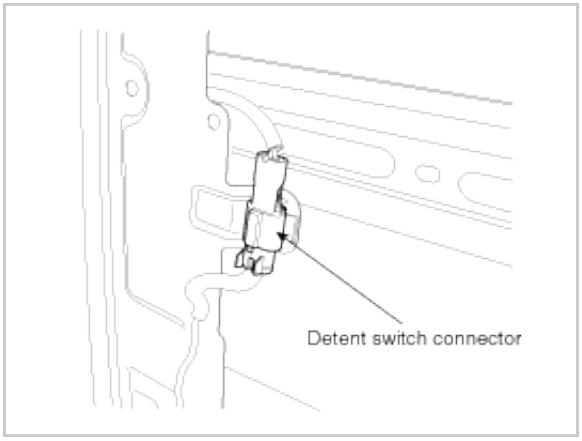


3. Remove the chime from drive unit and replace it with a new one.

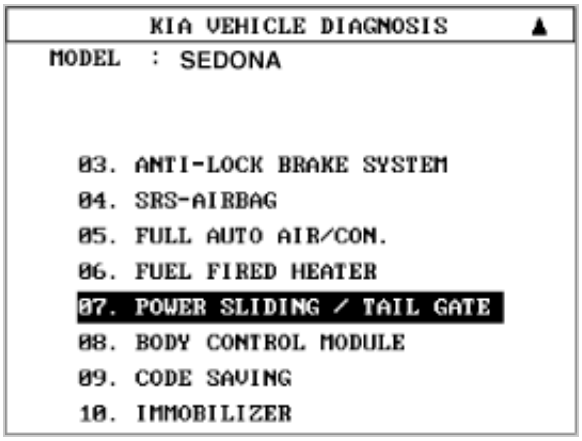
Detent Switch

INSPECTION

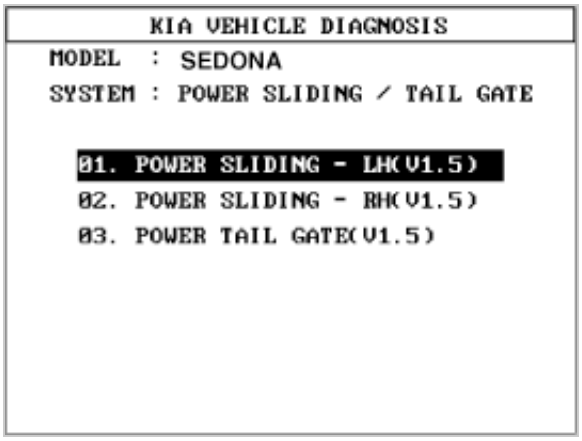
1. Detent switch detect the latch position within latch assembly.



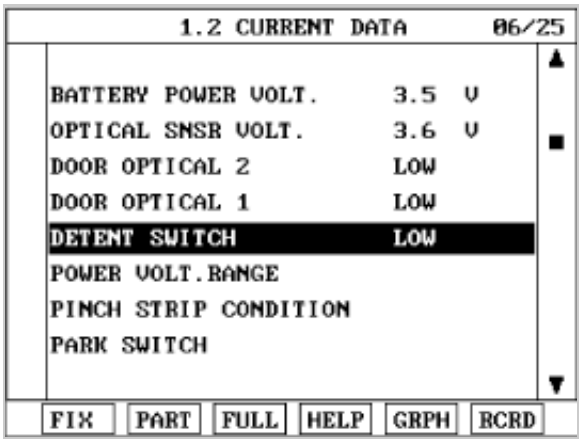
2. Check the power sliding door control module input/output value by using the diagnostic tool.
3. When checking the detent switch, select a vehicle type and "POWER SLIDING/TAIL GATE" menu.



4. Select the "POWER SLIDING DOOR".



5. Select the detent sensor output. And then check the detent switch output with operating power sliding door.



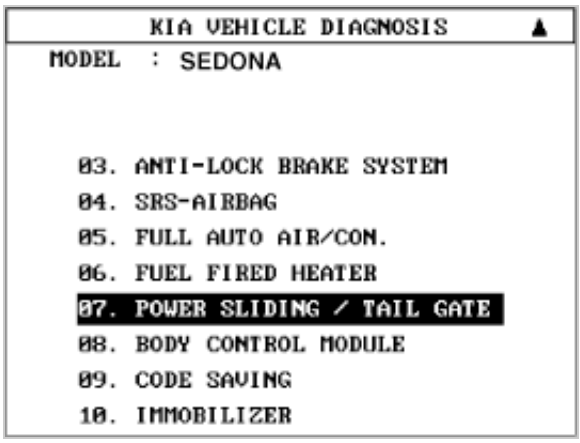
※ Above voltage and numerical value may be different from the real value.

6. If there is no change in output, change the latch assembly.

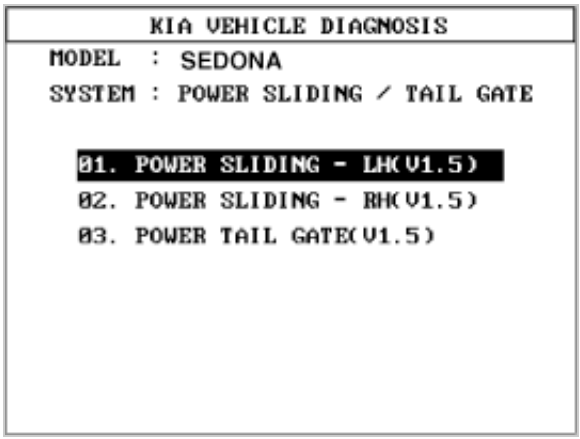
Latch Switch

INSPECTION

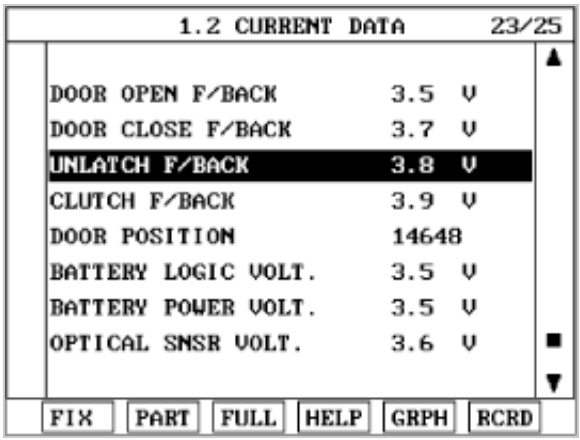
1. Check the power sliding door control module input/output value by using the diagnostic tool.
2. When checking the latch, select a vehicle type and "POWER SLIDING/TAIL GATE" menu.



3. Select the "POWER SLIDING DOOR".



4. Select the sensor output. And then check the unlatch feedback (Unlocked state) voltage while operating power sliding door in power mode.

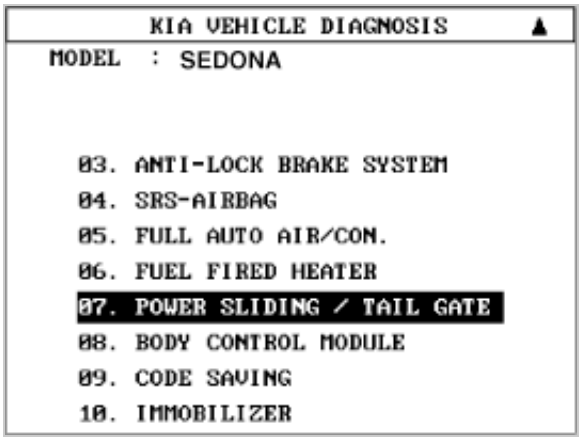


※ Above voltage and numerical value may be different from the real value.

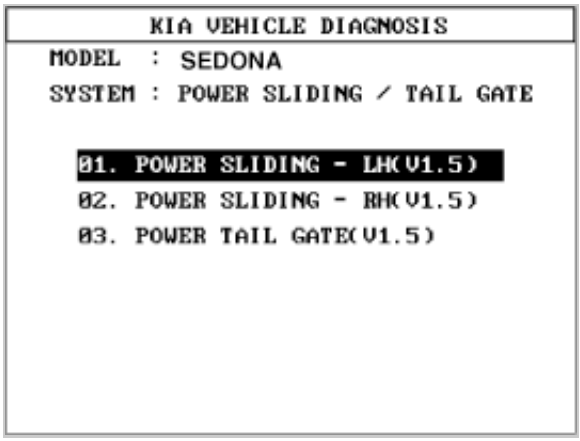
5. If there is no change in voltage, change the latch.

ANTI PINCH STRIP

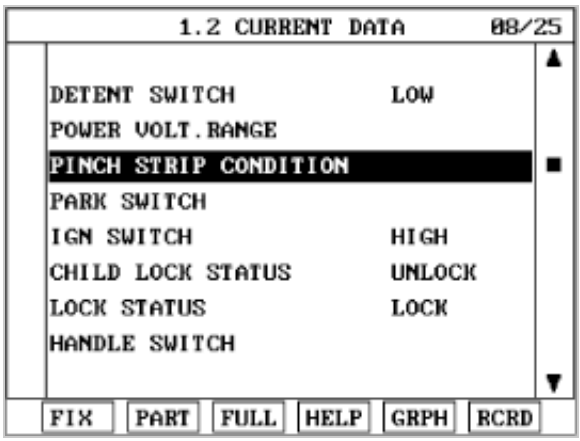
1. Check the power sliding door control module input/output value by using the diagnostic tool. If the operation of door control module is abnormal, replace anti pinch strip control module.
2. When checking the anti pinch strip operation, select a vehicle type and "POWER SLIDING/TAIL GATE" menu.



3. Select power sliding door.



4. Select the sensor output. And then check the anti pinch strip sensor output while operating power sliding door in power mode.



※ Above voltage and numerical value may be different from the real value.

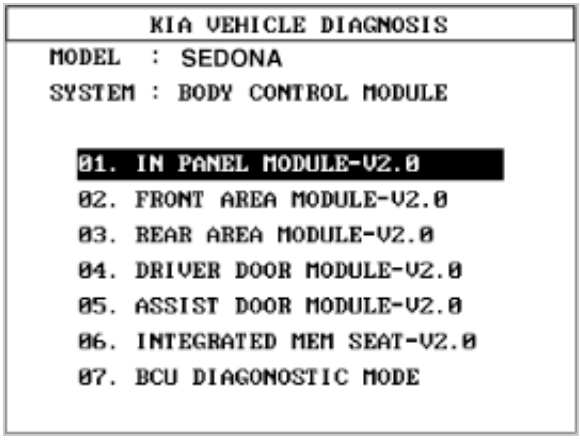
5. Change the anti pinch strip sensor, if there is no change from OFF to ON during operation.

Power Sliding Door Switch

INSPECTION

OVERHEAD CONSOLE DOOR SWITCH INSPECTION

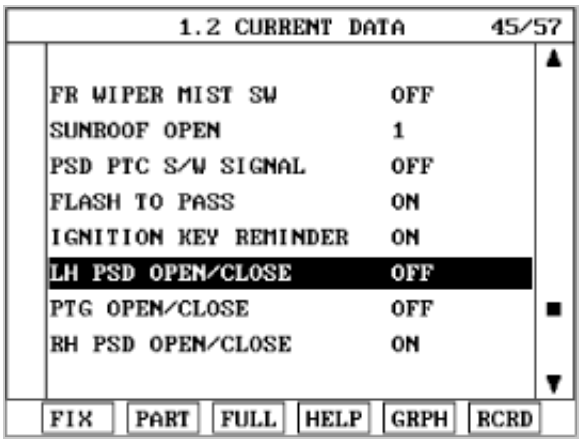
1. Check the overhead console door switch input/output value by using the diagnostic tool. If the operation of overhead console door switch is abnormal, check the IPM and replace.
2. When checking the overhead console switch operation, select a vehicle type and "IPM" menu.



3. Select a in panel module (IPM) and "CURRENT DATA".



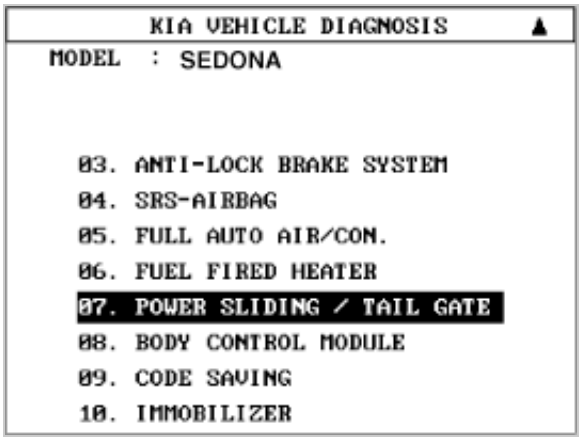
4. Check the PSD PTG power control switch and PSD left/right switch.



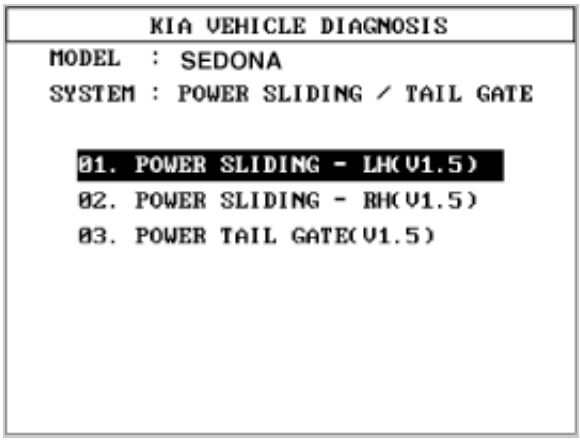
5. Confirm that output is changed by the controlling ON/OFF of each switch on the overhead console.

DOOR HANDLE SWITCH INSPECTION

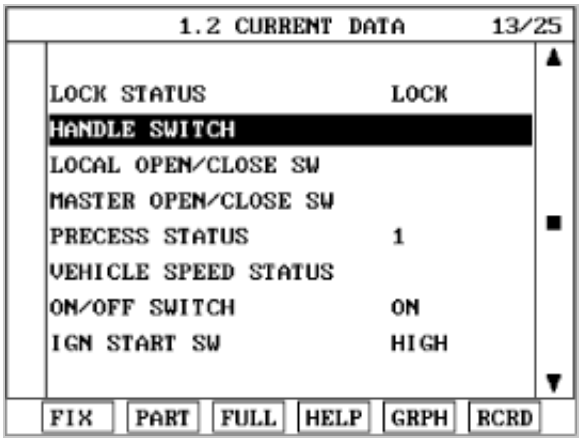
1. Check the power sliding door control module input/output value by using the diagnostic tool. If the operation of door control module is abnormal, replace power sliding door control module.
2. When checking handle switch operation, select a vehicle type and "POWER SLIDING/TAIL GATE" menu.



3. Select the "POWER SLIDING DOOR" menu to check.



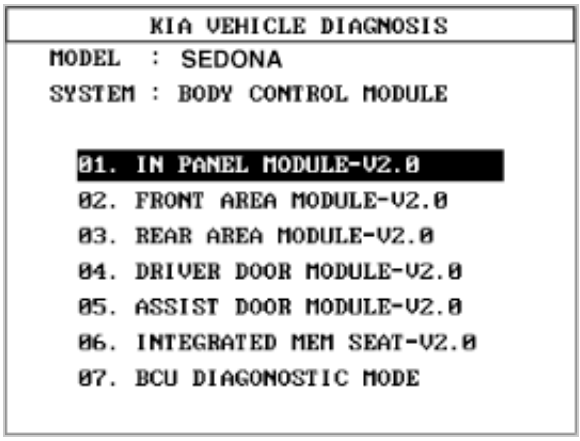
4. Select the sensor output. And then check the handle switch output value changed by the controlling PSD or PTG.



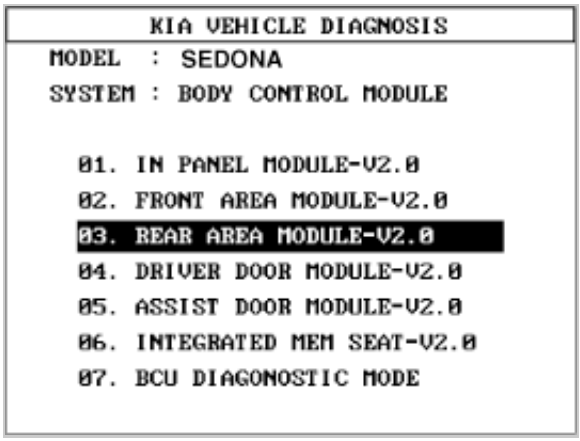
5. Check that the handle switch output changed from OFF to ON during PSD or PTG operation.

TRIM SWITCH INSPECTION

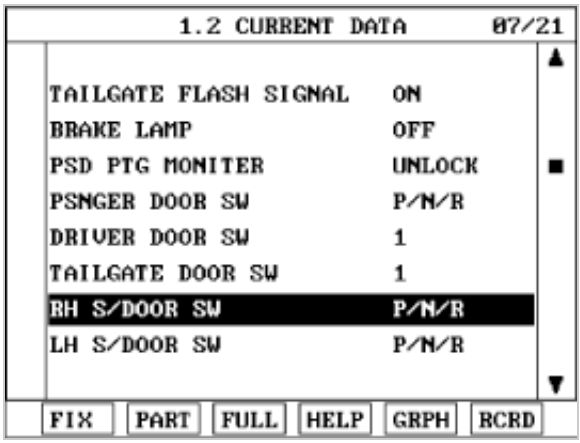
1. Check the trim switch input/output value by using the diagnostic tool. If the operation of rear area module (RAM) is abnormal, replace RAM.
2. When checking the trim switch operation, select a vehicle type and "IPM" menu.



3. Select a rear area module (RAM) and sensor output.



4. Check the value of RSD/LSD, left/right door switch.

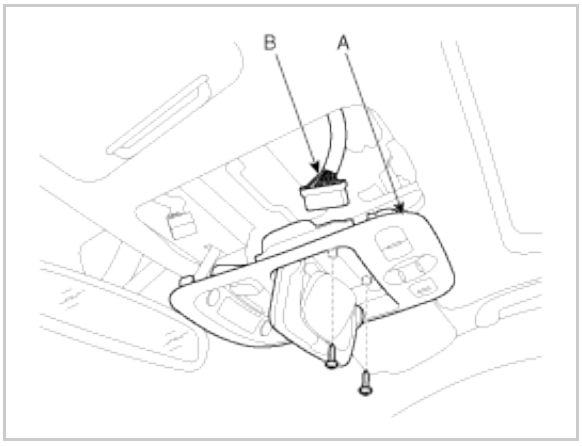


5. Confirm that the door switch output is changed by the controlling ON/OFF switch on center pillar trim.

REPLACEMENT

OVERHEAD CONSOLE SWITCH

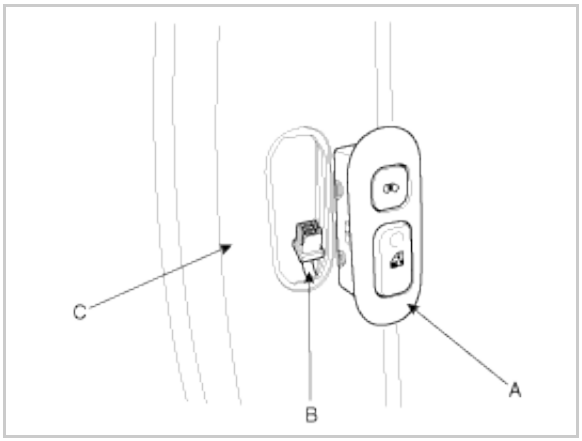
1. Disconnect the negative (-) battery terminal.
2. Open the sunglass case cover from the overhead console then remove the 2 screws holding the overhead console (A). And then disconnect the connector (B).



3. Installation is the reverse of removal.

DOOR TRIM SWITCH

1. Disconnect the negative (-) battery terminal.
2. Remove the connector (B) and door trim switch (A) from the center pillar (C) by using the scraper.

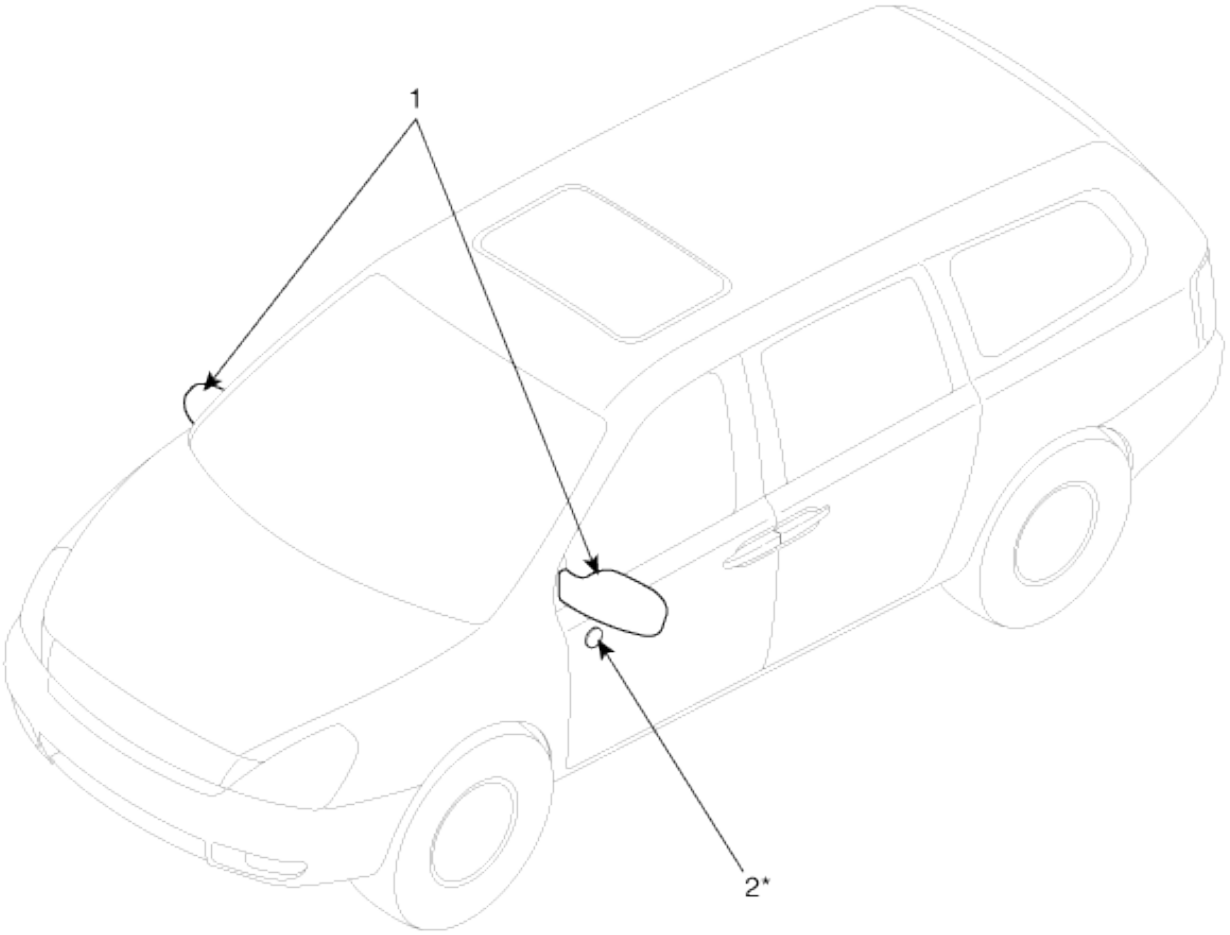


3. Installation is the reverse of removal.

Power Door Mirrors

COMPONENT LOCATION

The parts with asterisk(*) :
This illustration is shows the LHD type.
RHD type is symmetrical.

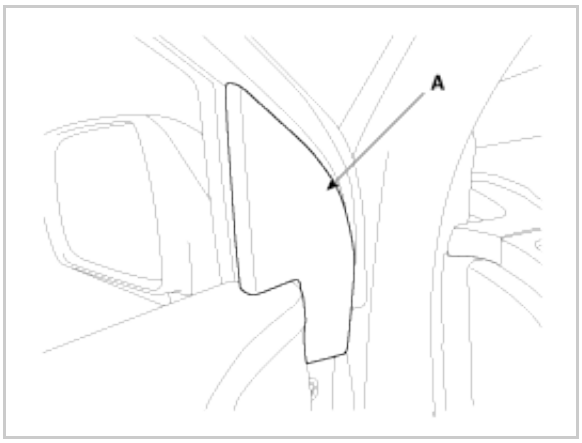


1. Power door mirror
2. Mirror folding switch & Power door mirror switch(DDM)

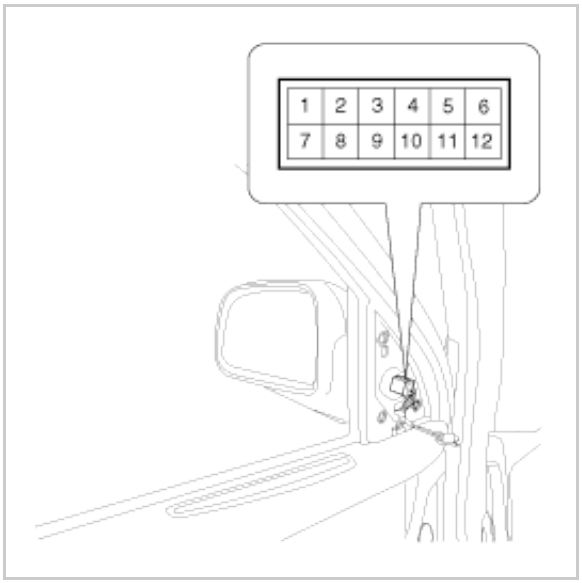
Power Door Mirror Actuator

INSPECTION

1. Remove the front door quadrant inner cover (A). Take care not to damage fixing clips. (Refer to the Body group - front door)



2. Disconnect the power door mirror connector from the harness.
3. Verify that the mirror operates properly as shown in the table.

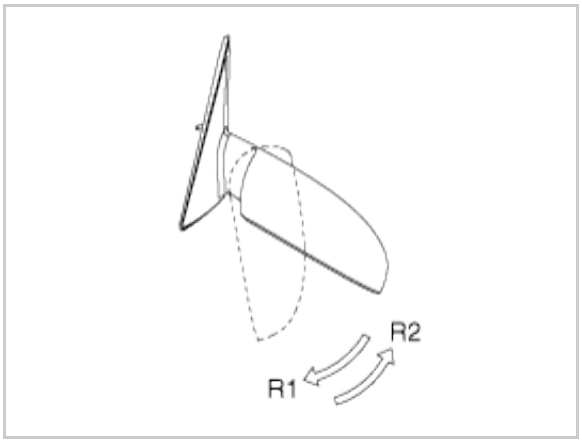


Terminal / Position	1	2	3
UP	⊕	⊕	⊖
DOWN	⊖	⊖	⊕
OFF	⊕	⊕	
LEFT	⊖	⊕	⊖
RIGHT	⊕	⊖	⊕

MIRROR HEATER

Terminal / Position	7	8
Heater	○———	———○

MIRROR FOLDING

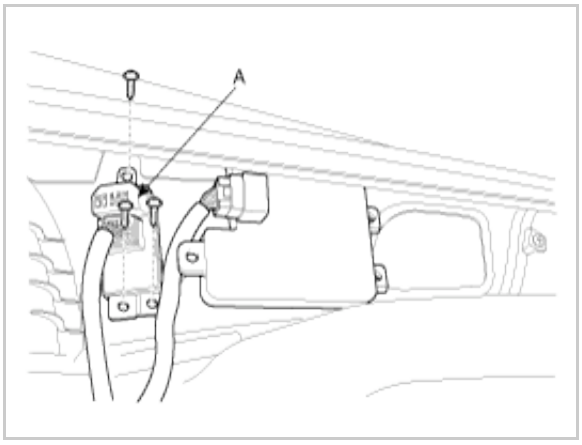


Terminal / Direction	6	7
R1	⊕ — M — ⊖	
R2	⊖ — M — ⊕	

Door Mirror Folding Switch

REPLACEMENT

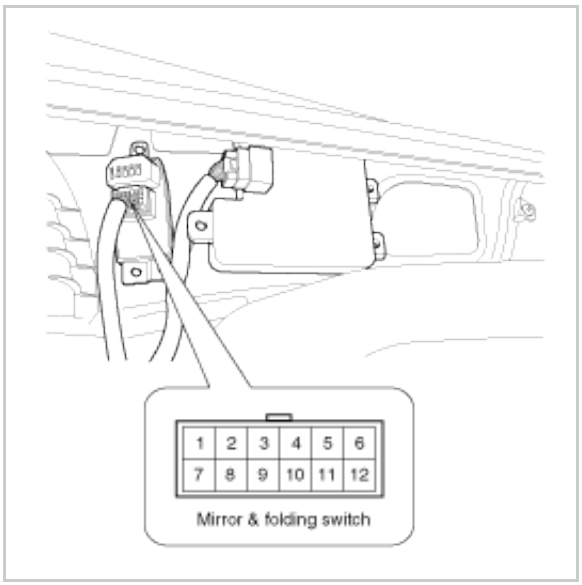
1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim panel. (Refer to the Body group-front door)
3. Remove the power window main switch mounting screws (3EA) (A) after disconnecting the switch connector (12pin) from the switch.



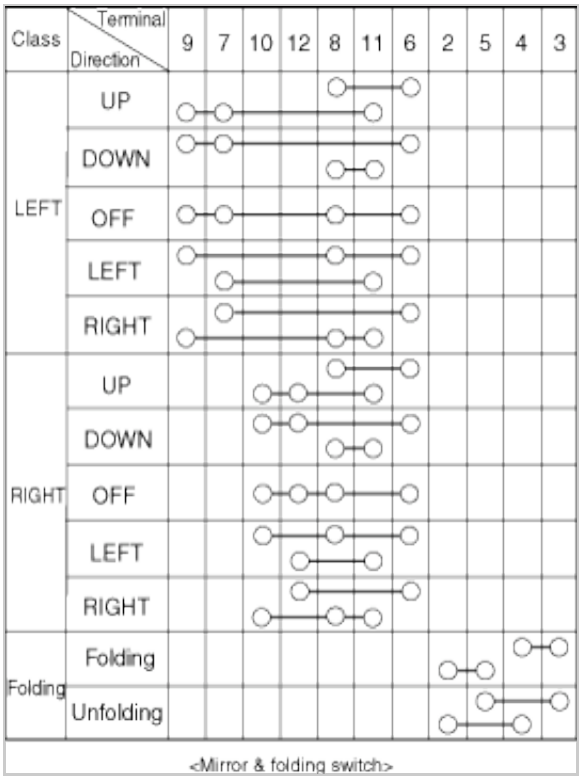
4. Remove the switch from the front door trim panel.
5. Installation is the reverse of removal.

INSPECTION

1. Disconnect the 12P connector from the switch.



2. Check for continuity between the terminals in each switch position according to the table.



<Mirror & folding switch>

Door Tail Gate System

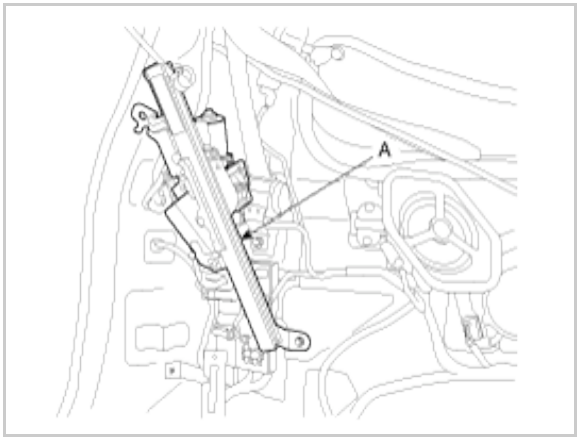
DESCRIPTION

Power tail gate is an electro-mechanical system designed to provide power opening and closing of a vehicle's tail gate through the push of a button of the transmitter key or tail gate handle or the overhead console or switch of the tail gate.

The power tail gate will reverse direction of travel if resistance to movement is detected while the tail gate is being closed. If resistance to movement is detected while the power tail gate is being opened, the tail gate will stop moving.

1. PTG DRIVE UNIT

   Power tailgate drive unit consists of a DC motor, optical sensor, clutch, push rod, rack and wire harness.
   PTG drive unit is located in rear left on D-pillar panel. PTG drive unit opens and closes the tail gate connected push rod automatically.

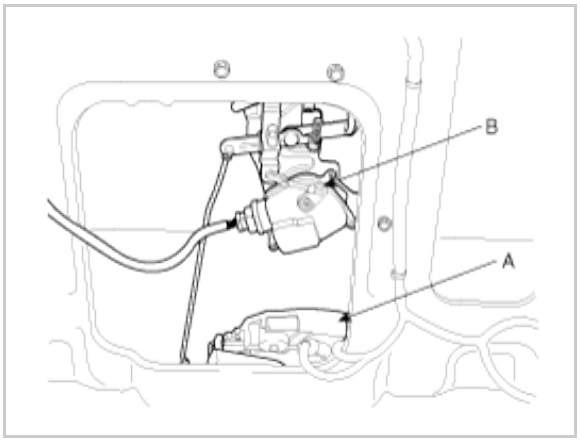


   a. Optical sensor : Provides tail gate velocity and position information

   b. Drive unit clutch : Transmit motor power to push rod through pinion gear.

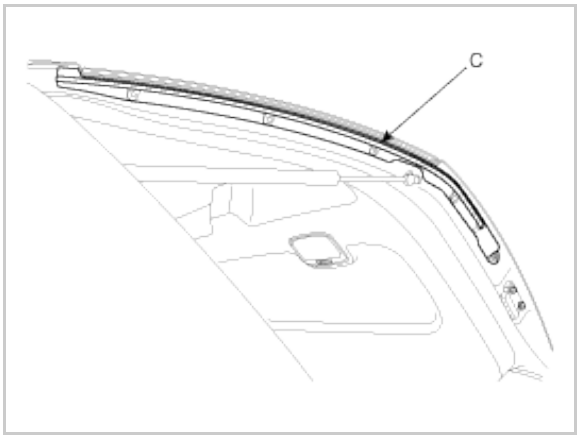
2. POWER LATCH

   Power latch is located in the lower part of tail gate panel. When tail gate located latching position, cinching motor (A) has a cinch electrically. And unlatch motor (B) unlatch the latch electrically when receive the open signal.

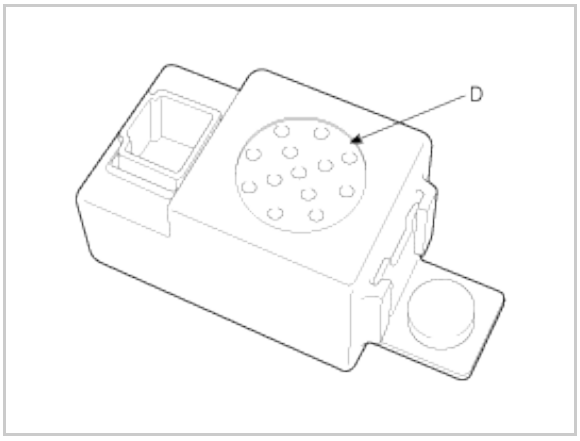


3. ANTI PINCH STRIP (C)

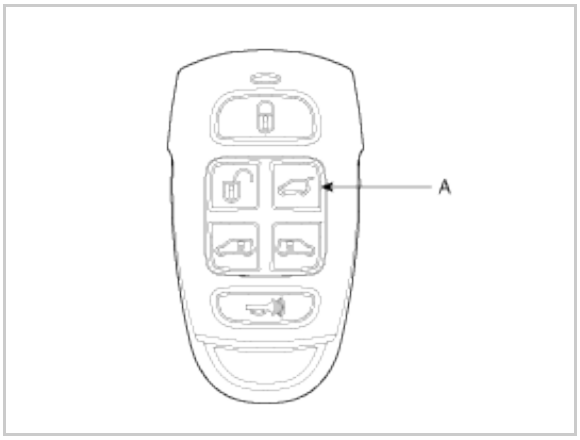
   During power closing or cinching, the PTG system shall reverse to full open if an anti-pinch strip signal is received. However, the anti-pinch strips will not work when the Tailgate is idle in the full closed, full open, or stopped positions.



4. PTG CHIME (D)
   When a power operation cannot be performed as requested or an obstacle has been detected.



5. REMOTE KEYLESS ENTRY (A)



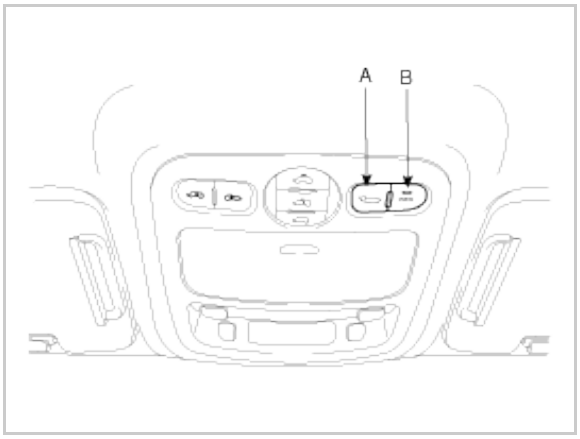
   Push the power tail gate (A) of the remote keyless entry more than 0.5s to open the power tail gate. Power Open operation shall be reversed when an additional Open/Close signal is received during power opening.

6. OPERATING ORDER
   Switch ON → clutch on → motor operation → pinion gear rotation → rack rectilinear motion → push rod motion → tail gate open/close

OPERATION

POWER TAIL GATE OPEN/CLOSE

1. The power tail gate is opened and closed automatically if the main switch (A) is pressed on the overhead console.



2. When the power ON/OFF button (PWR) (B) is ON, the power sliding door and power tailgate can be opened and closed automatically by using the switch.
3. When the power tail gate door will power open/close fully, the warning lamp and the chime will operate 3 times.
4. General rules for chime functions
   a. Chime & tail lamp shall operate prior to and during power opening or closing the Tailgate : 3 Times (0.5 sec on, 0.5 sec off), after 1 chime start opening or closing with two chimes.
   b. Chime shall operate when a power operation cannot be performed as requested except handle pull : 1 Time (Duration 0.5 second on)
   c. Chime shall operate when an obstacle has been detected : 3 Times (0.5 sec on, 0.5 sec off)
   d. Chime shall operate if PTG has not reached primary latch position after a power cinch cycle : 3 Times (0.5 sec on, 0.5 sec off)

POWER TAIL GATE OPERATING CONDITION

1. The tail gate will not power open when vehicle is moving above 3 mph (5 km/h) or the gearshift lever is not in P (Park) for automatic transaxle.
2. The power tail gate will not open with the transmitter or the main control button when all power sliding doors are locked and closed.
3. The power tail gate will detect the resistance, then stop movement or move to the full open position to allow the object to be cleared.
4. If the automatic stop and reversal feature operates continuously more than twice during one opening or closing operation, the power tail gate may stop at that position. At this time, close the tailgate manually and operate the tailgate automatically again.
5. The PTG system is an electronic device and requires a minimum battery voltage to operate. The Electronic Control Unit (ECU) monitors the battery voltage present at the ECU input battery input and will not permit operation if the battery voltage is out of range.
6. If the PTG button is pressed during closing operation, the power tail gate may reverse direction and open fully.
7. Remove the accumulated snow or ice on the power tail gate before operating.

NOTICE

a. To prevent the battery from being discharged, do not leave the power sliding door and power tailgate at open position for a long time.
b. The PTGM will go to a sleep mode and power operation will be disabled if the tail gate is left open longer than 6 hours.
   Manually close the tail gate to the latched position to reset the PTGM. Power operation will be restored.

WARNING

a. Always disconnect the negative battery cable before attempting any power tailgate system service.
b. Never attempt to enter or exit the vehicle with the tailgate in motion. You could be injured or cause damage to the power tailgate system and or components.

POWER OPERATION

The PTG system shall not open the Tailgate when the vehicle is moving.
The PTG system shall operate through the full range of Tailgate travel.
The PTG system shall learn the position of each travel extreme: full open and full closed.

– : No action ● : Close ○ : Open X : Stop

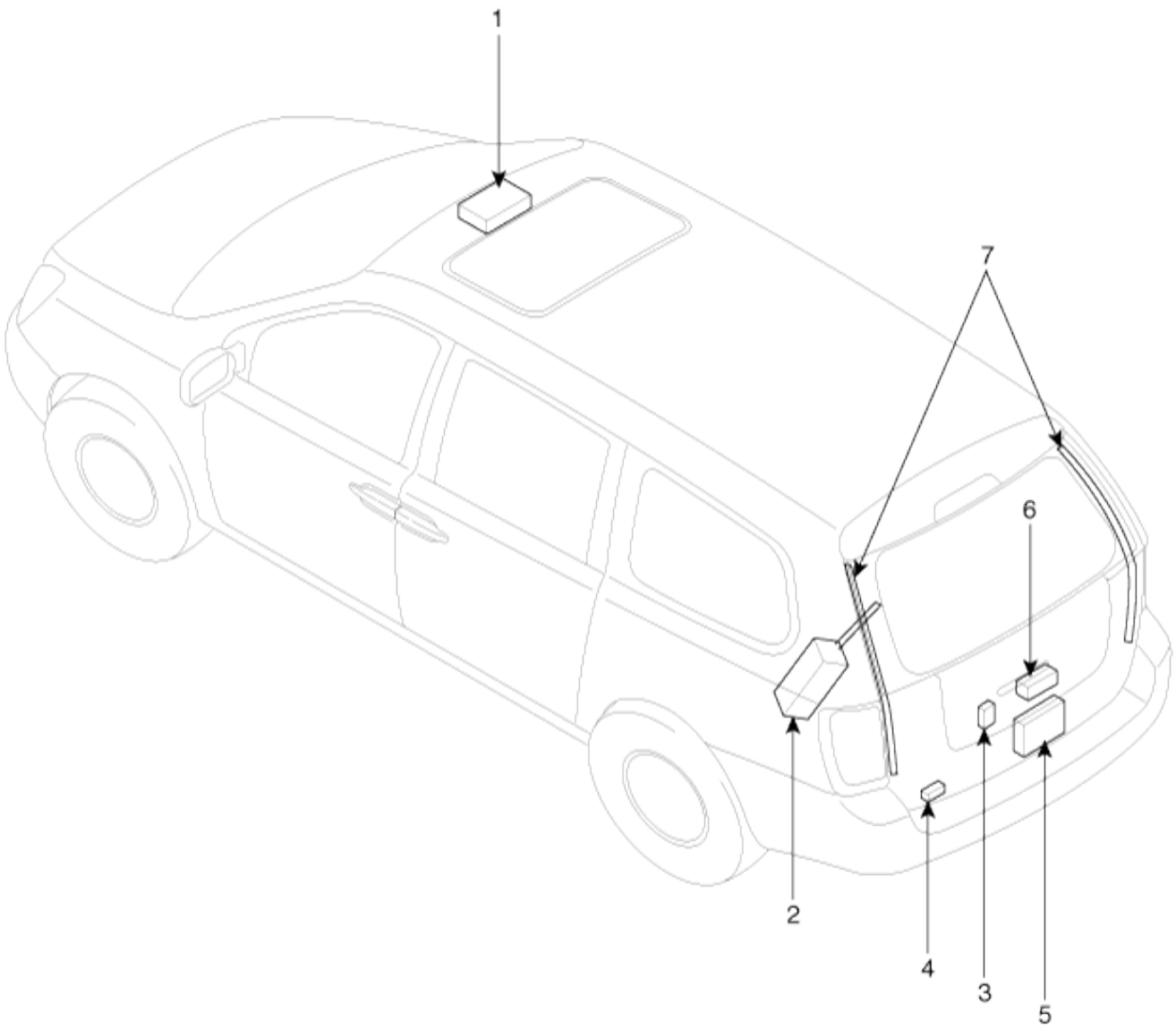
Vehicle Motion	Door Position Zone	ON/OFF	Door Lock Status	Operation			
				RKE Key fob Note 2	PSD main switch	PSD sub switch	Door handle switch
Not Moving	1	OFF	Any	○	○	–	X
		ON	Unlock	○	○	–	○
			Locked	○	○	–	X
	2	OFF	Any	○	○	X(Chime 1 T)	X
		ON	Unlock	○	○	○	X
			Locked	○	○	○	X
	3 or 4	OFF	Any	●	●	X(Chime 1 T)	X
		ON	Any	●	●	●	X
	Closing	OFF	Any	○	○	X	X
		ON	Any	○	○	○	X
	Opening 1 or 2	ON	Any	X	X	X	X
		OFF	Any	X	X	X	X
	Opening 3 or 4	OFF	Any	●	●	X	X
		ON	Any	●	●	●	X
Moving	1 or 2	ON/OFF	Any	X(Chime 1 T)	X(Chime 1 T)	X(Chime 1 T)	X
	3 or 4	OFF	Any	●	●	X(Chime 1 T)	X
		ON	Any	●	●	●	X
	Closing	ON	Any	●	●	●	X
	Opening 1 or 2	OFF	Any	X	X	X	X
		ON	Any	X	X	X	X
	Opening 3 or 4	OFF	Any	●	●	X	X
		ON	Any	●	●	●	X
Any	Any	ON/OFF	Any	Manual Move			

1. Vehicle condition
   Moving
   a. (IGN=OFF and Vehicle Speed > 5 km/h) or (IGN= ON and (Vehicle Speed > 5 km/h or TRANS - not P/N))
   Not moving
   a. (IGN=OFF and Vehicle Speed < 5 km/h) or (IGN= ON and (Vehicle Speed < 5 km/h and TRANS - P/N))

2. TAILGATE TRAVEL ZONES
   The Tailgate travel is divided into four zones starting at the full closed and latched position. Dimensions are at the bottom edge of the Tailgate and are approximate.
   Zone 1 : Power Latching - from primary to secondary latch (0 to 10 mm depending on latch travel).
   Zone 2 : Between Secondary and Crossover Point (Secondary to 20 degrees)
   Zone 3 : Between Crossover Point and Power Off (20 degrees to 79 degrees)
   Zone 4 : Power Off to Full Open - approximately 5° (15 counts from full open)

COMPONENT LOCATION

This illustration is shows the LHD type.
RHD type is symmetrical.



1. Overhead console switch
2. Power tail gate drive unit (Including control module)
3. Power tail gate chime
4. Power tail gate switch
5. Power latch assembly
6. Power tail gate handle
7. Anti pinch strip

DIAGNOSIS AND TESTING - POWER TAILGATE SYSTEM

The power tailgate system is a complex system containing many components. In order to perform conclusive testing, or receive outputs the power tailgate control module must be checked.
The most reliable, efficient, and accurate means to diagnose the power tailgate system requires the use of a scan tool and the proper Body Diagnostic Procedures manual. The scan tool can be used to observe current switch status recorded in the power tailgate control module to help the technician diagnose an inoperative switch.
Before any testing of the power tailgate system is attempted, the battery should be fully charged, all power tailgate system inhibitors read and understood (Refer to power tailgate system description for list).
Following are quick reference diagnostic tables to help when diagnosing and testing the power tailgate system.

CONDITION	POSSIBLE CAUSES	CORRECTION
Tailgate opens unexpectedly	Accidental activation or Failure of open/close command switch	Check for shorted or defective switch
	Failure of latch assembly	Check wiring connections
		Check for trouble codes, replace latch if necessary
	Failure of Power Tailgate or Body Control module	Disconnect then reconnect battery or fuse to reset module, function tailgate, if no function exists check for loose wire connections, see Body Diagnostic Manual for detailed procedures
Tailgate will not power open or close	Not in Park or false indication	Check switch status with SCAN tool
	Battery voltage at PTGM is too low	Check for proper voltage at the PTGM Charge battery
	Blown fuse	Check for blown fuse
	Gas strut failure	Check condition of tailgate gas struts
	BCM or tailgate control module critical fault codes	Check code status with SCAN tool
	Failure of latch assembly	Check wire connections and for blown fuse
		Check for foreign matter preventing the operation of latch assembly
Tailgate will not power open or close	Failure of motor assembly	Test motor assembly
	Binding or sticking of components	Establish location of binding and replace necessary components
	Wiring problems (system or vehicle)	Troubleshoot using electrical schematics Refer to wiring diagrams
Power loss during Tailgate operation	Wiring problems (system or vehicle)	Troubleshoot using electrical schematics. Refer to wiring diagrams
	Battery voltage at PTGM is too low	Check for proper voltage at the PTGM Charge battery
	Failure of Power Tailgate or Body Control Module	Check for diagnostic trouble codes with SCAN tool
	Failure of motor assembly	Test motor assembly
	Failure of latch assembly	Check wire connections and for blown fuse
		Check for diagnostic trouble codes and cycle with SCAN tool
		Troubleshoot using Body Diagnostic Manual.

No power latching in primary and/or secondary positions		Replace latch assembly, if necessary
	Binding or sticking of components	Establish location of binding and replace necessary components
	Failure of Power Tailgate or Body Control Module	Check for diagnostic trouble codes with scan tool
	Tail Gate seal force too high	Inspect seals for damage, mis-assembly, foreign matter or other possible obstruction
	Failure of motor assembly	Test motor assembly
Latch will not release from primary position	Not in Park or false indication	Check switch status with SCAN tool
	Battery voltage at PTGM is too low	Check for proper voltage at the PTGM Charge battery
	Blown fuse	Check fuse and replace if required
	Failure of latch assembly	Check switch status with scan tool
		Check for foreign matter or damaged components preventing the operation of latch assembly
		Troubleshoot using body diagnostic manual. Replace latch assembly, if necessary
	Failure of outside handle connection	Check handle of brainplate.
	Failure of Power Tailgate or Body Control Module	Check for diagnostic trouble codes and cycle with scan tool
	Binding or sticking of components	Establish location of binding and replace necessary components
Key fob or overhead console switch does not power operate tailgate	Blown Fuse	Check fuse and replace
	Battery voltage at PTGM is too low	Check for proper voltage at the PTGM Charge battery
Does Not Power Unlatch	Failure of latch assembly	Check for foreign matter preventing the operation of latch assembly
		Check for diagnostic trouble codes and cycle with scan tool
		Check pawl and/or ratchet switch with SCAN tool
		Troubleshoot using body diagnostic manual
Does Not Power Unlatch	Failure of Power Tailgate Module	Troubleshoot using body diagnostic manual
	Failure of Body Control Module (BCM)	Troubleshoot using body diagnostic manual
		Replace BCM if necessary
	Failure of RAM	Replace RAM if necessary
	Failure of key fob	Reprogram key fob
		Replace key fob if necessary
	Failure of Power Tailgate Module	Check for diagnostic trouble codes with scan tool, see Body Diagnostic Manual for detailed procedures
		Check for foreign matter preventing the operation of motor assembly
		Check wire connections

	Failure of tailgate motor assembly	Motor clutch does not engage, replace assembly
		Full open switch inoperative, replace switch, if necessary
		Troubleshoot using Body Diagnostic Manual Replace motor, if necessary
Tailgate does not stay open	Failure of tailgate gas struts	Replace gas struts
		Check for broken attachments
High inside/outside opening effort	Failure of tailgate gas struts	Replace gas struts
		Check for broken attachments
	Drive unit jammed or did not disengage	Troubleshoot using Body Diagnostic Manual Replace components, if necessary
	Binding or sticking of components	Establish location of binding and replace necessary components
Tailgate continues to cinch closed	Failure of latch assembly	Check wire connections and for blown fuse Check switches with SCAN tool
Tail gate continues to power close	Failure of latch assembly	Check wire connections
		Check for foreign matter
		Troubleshoot using Body Diagnostic Manual
	Control Module	Check for diagnostic trouble codes with Scan tool
	Wiring problems (system or vehicle)	Troubleshoot using electrical schematics Refer to wiring diagrams
Tailgate continues to power open	Failure of PTGM or BCM	Check for diagnostic trouble codes and cycle, see Body Diagnostic Manual for detailed procedures
	Failure of motor assembly	Check for continuous drive condition
	Wiring problems (system or vehicle)	Troubleshoot using electrical schematics Refer to Wiring Diagrams
Tailgate opens very slowly	Battery voltage at PTGM is too low	Check for proper voltage at the PTGM Charge battery
	Failure of tailgate gas struts	Replace gas struts, if necessary
	Binding or sticking of components	Establish location of binding and replace necessary components
	Grade of vehicle too steep for power operation	Operate tailgate manually
	Failure of tailgate motor assembly	Replace motor assembly, if necessary
Squeaks, Noises and rattles	Foreign material in tail gate compartment	Remove foreign material
	Worn/Loose components	Check and tighten loose components

DTC LIST

DTC CODE	DISPLAY
B1101	Battery Voltage High
B1102	Battery Voltage Low

B1105	Reference Voltage Fault
B1223	VSS Fault
B1270	Optical Sensor-1 Output Stuck High
B1271	Optical Sensor-1 Output Stuck Low
B1272	Optical Sensor-2 Output Stuck High
B1273	Optical Sensor-2 Output Stuck Low
B1580	Ignition Start Switch Short High
B1585	Latch Switch Failure
B1621	ECU Defective
B1645	Drive Unit Failure
B2421	Drive Motor Short High
B2422	Drive Motor Short Low
B2423	Clutch Open Or Short High
B2424	Clutch Short Low
B2425	Left pinch strip open or Stuck High
B2426	Left pinch strip stuck Low
B2427	Right Pinch Strip Open Or Stuck High
B2428	Right Pinch Strip Stuck Low
B2450	Unlatch or Cinch Motor short High
B2451	Unlatch or Cinch Motor short Low
B2452	Cinch motor open (PTG Only)

INPUT/OUTPUT MONITORING

[공백문장]	BCM DISPLAY	UNIT
1	Battery Logic Voltage	Voltages
2	Battery Power Voltage	Voltages
3	Optical Sensor Power	Voltages
4	Gate Optical Sensor 2	LOW/HIGH
5	Gate Optical Sensor 1	LOW/HIGH
6	Detent Switch	LOW/HIGH
7	Forkbolt Primary Switch	LOW/HIGH
8	Power Battery Voltage	OUT OF RANGE/IN RANGE
9	Forkbolt Secondary Switch	LOW/HIGH
10	Right Pinch Strip - Pinch Condition	Not Pinched/Pinched
11	Left Pinch Strip - Pinch Condition	Not Pinched/Pinched
12	Park Switch	Out Of Park/Park
13	Ignition Swtich	LOW/HIGH
14	Tail Lamp Flash Feedback	LOW/HIGH
15	Local Open/Close Switch	Not Pressed/Pressed

16	Master Open/Close Switch	Not Pressed/Pressed
17	Spare Switch	LOW/HIGH
18	Learn Process Complete Status	Not Complet/Complete
19	Vehicle Speed Slow Status	≥5kph/<5kph
20	On/Off Switch	ON/OFF
21	Start Switch	LOW/HIGH
22	Gate Open Feedback	Voltages
23	Cinch Feedback (PTG Only)	Voltages
24	Uncinch Feedback (PTG Only)	Voltages
25	Gate Close Feedback	Voltages
26	Unlatch Feedback	Voltages
27	Unlatch Return Feedback	Voltages
28	Clutch Feedback	Voltages
29	Gate Position Count	-
30	Most Recent Cinch Time	ms
31	2nd Most Recent Cinch Time	ms
32	3rd Most Recent Cinch Time	ms
33	4th Most Recent Cinch Time	ms
34	Left Pinch Strip Voltage	Voltages
35	Right Pinch Strip Voltage	Voltages

ADJUSTMENT

POWER TAIL GATE INITIALIZATION

POWER TAILGATE SYSTEM RESET

Certain conditions may require that the PTG system be reset.

1. Remove the MEMORY fuse that provides logic power to the PTGM.
2. Wait 1 minute. Replace fuse. Initialize the PTGM.

INITIALIZATION PROCEDURE

The Power Tailgate system initialization must start from the full closed or latched position. The Tailgate must be powered Open once to fully initialize the system (Obstacle detection shall be active during Tailgate initialization).

1. Manually close and latch the Tailgate.
2. Power the Tailgate open using the Open/Close switch, outside handle or the remote control.

ALTERNATE METHOD

1. Remove the black connector (J2) from the PTGM.
2. Wait a short time. Replace connector. Initialize PTGM.

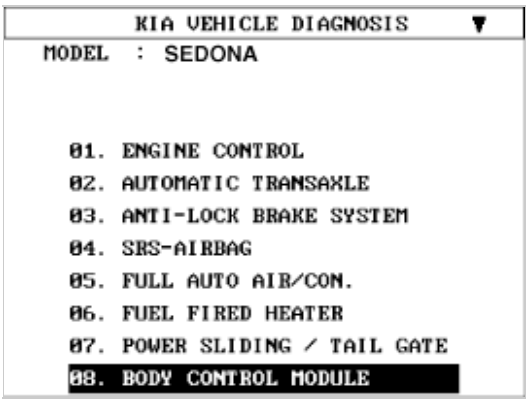
CAUTION

a. The PTG system initialization must start from the primary or secondary latched position.
b. Obstacle detection shall be active during system initialization.

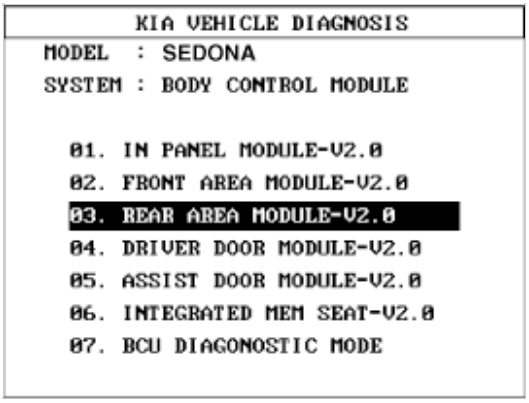
INSPECTION

POWER TAILGATE MOTOR INSPECTION

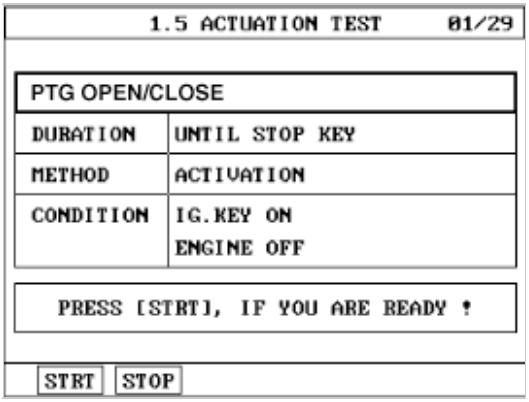
1. Check the power tailgate motor by using the diagnostic tool.
2. Select a vehicle type and "BODY CONTROL MODULE(BCM)".



3. Select the "REAR AREA MODULE"



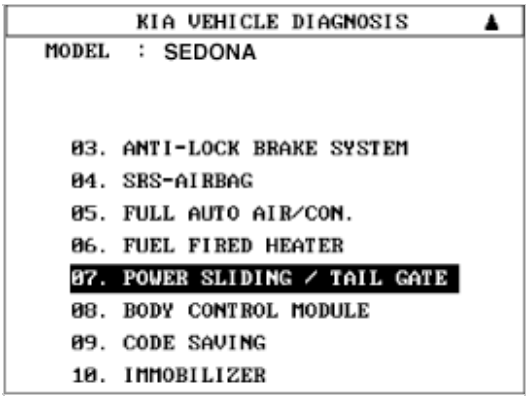
4. Select the "ACTUATION TEST" and "PTG OPEN/CLOSE" to operate tailgate motor.



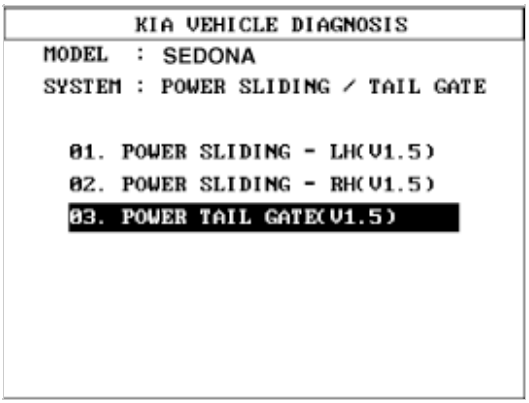
5. If there is no working in actuator, change the drive unit.

OPTICAL SENSOR INSPECTION

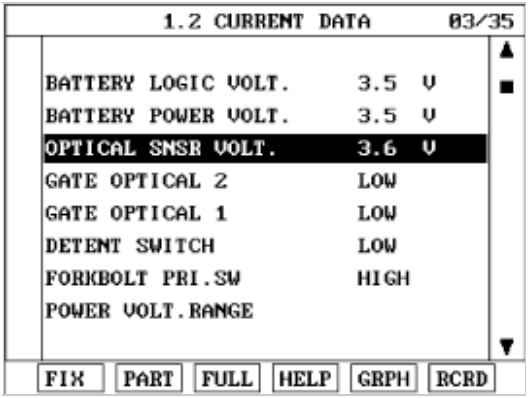
1. Check the power tailgate control module input/output value by using the diagnostic tool. If the operation of tailgate control module is abnormal, replace power tailgate drive unit.
2. When checking the optical sensor, select a vehicle type and "POWER SLIDING/TAILGATE" menu.



3. Select "POWER TAIL GATE".



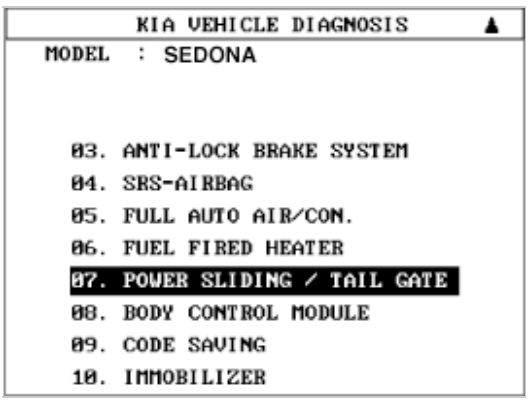
4. Select the sensor output. And then check the optical sensor volt while operating power tailgate in power mode.



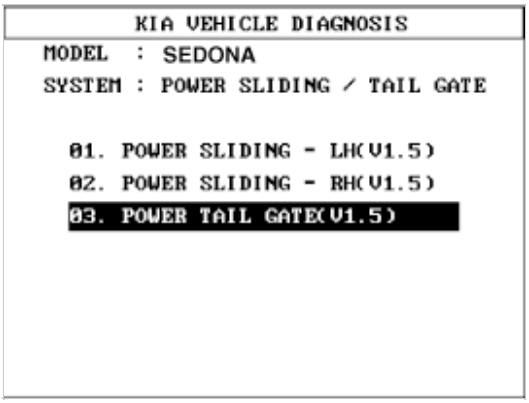
5. Change the drive unit, if there is no change during operation.

DRIVE UNIT CLUTCH INSPECTION

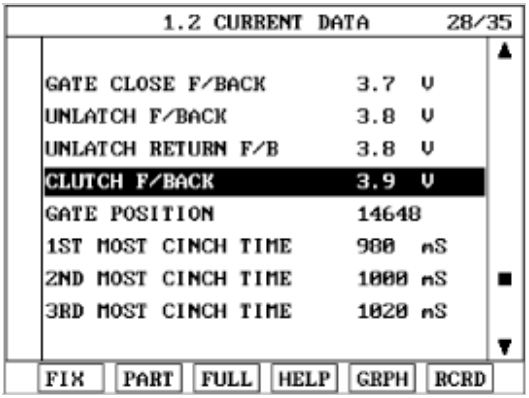
1. Check the power tailgate control module input/output value by using the diagnostic tool. If the operation of tailgate control module is abnormal, replace power tailgate drive unit.
2. To check the clutch operation, select a vehicle type and "POWER SLIDING/TAILGATE" menu.



3. Select power tailgate.



4. Select the sensor output. And then check the clutch feedback sensor output while operating power tailgate in power mode.

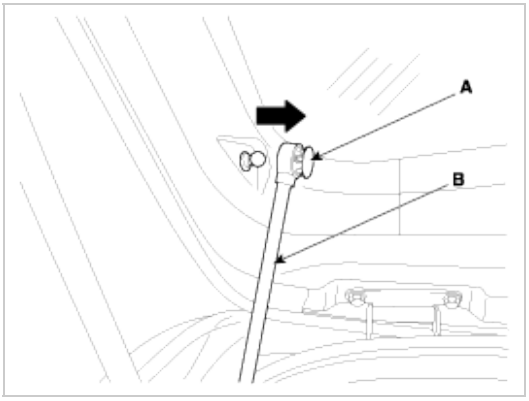


※ Above voltage and numerical value may be different from the real value.

5. Change the drive unit, if there is no change during operation.

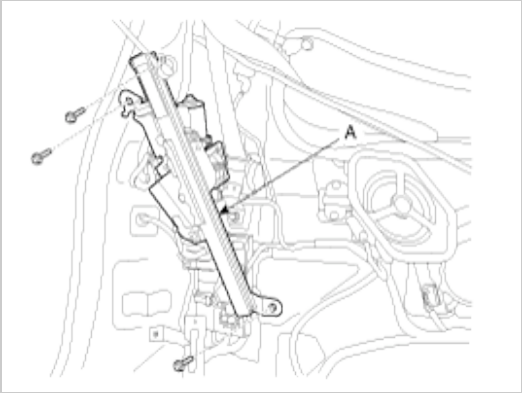
REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the third, fourth seat (Refer to the Body group - seat)
3. Remove the D pillar and luggage side trim (Refer to the Body group - Interior trim).
4. Use a small screw driver to loosen clip (A). But do not remove power tailgate push rod (B).



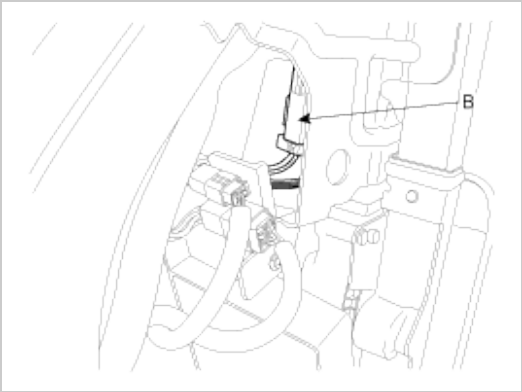
5. Remove the power tail gate motor mounting bolts (3EA) and connectors (4EA). And then remove the power tail gate drive unit(A).

TORQUE : 22-27N.m(2.2-2.7Kg.m)



NOTICE

PTG drive unit bracket connector (B) does not need to be disconnected in this procedure.



6. Installation is the reverse of removal.

NOTICE

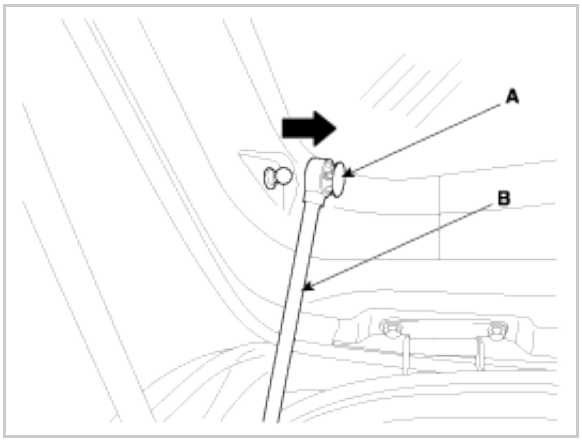
a. Connect the connectors tightly.
b. Check the power tail gate for normal operation correctly.

WARNING

a. A lost drive unit mounting bolt in the vehicle may make a noise.
b. Don't operate the power tail gate when a push rod is removed.
c. A learn cycle must be performed whenever the power is removed.
d. Check the normal operating whenever a power tailgate component is removed or replaced. If the chime sound is heard, check the DTC, wiring harness and cable connections.

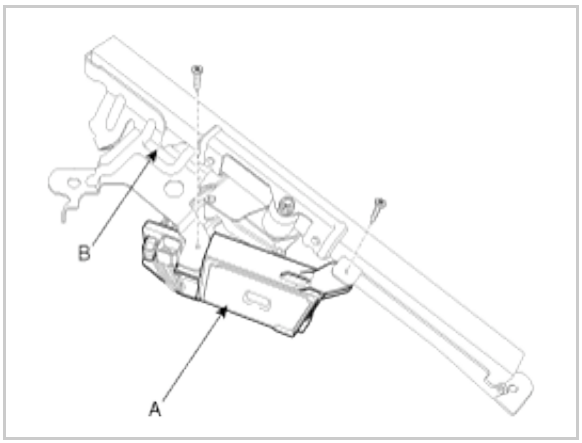
REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the third, fourth seat (Refer to the Body group - seat)
3. Remove the D pillar and luggage side trim (Refer to the Body group - Interior trim).
4. Use a small screw driver to loosen clip (A). But do not remove power tailgate push rod (B).



5. Remove the power tail gate module mounting bolts (2EA) and connectors (2EA). And then remove the power tail gate module (A).

TORQUE : 25-35N.m(2.5-3.5Kg.m)



6. Installation is the reverse of removal

NOTICE

a. Connect the connectors tightly.
b. Check the power tail gate for normal operation correctly.

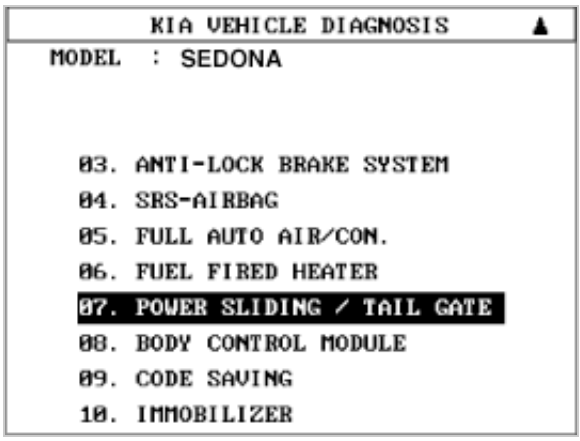
WARNING

a. A lost drive unit mounting bolt in the vehicle may make a noise.
b. Don't operate the power tail gate when a push rod is removed.
c. A learn cycle must be performed whenever the power is removed.
d. Check the normal operating whenever a power tailgate component is removed or replaced. If the chime sound is heard, check the DTC, wiring harness and cable connections.

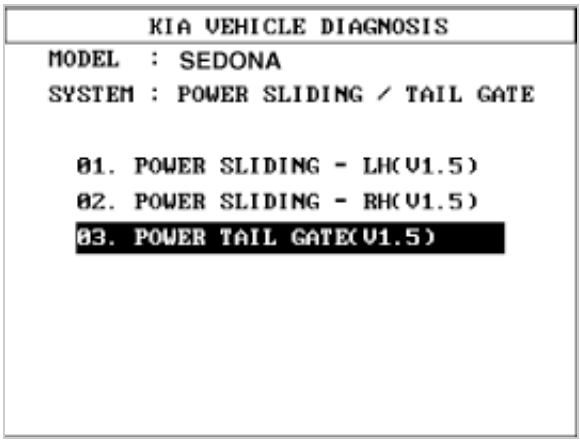
Anti-Pinch Strip

INSPECTION

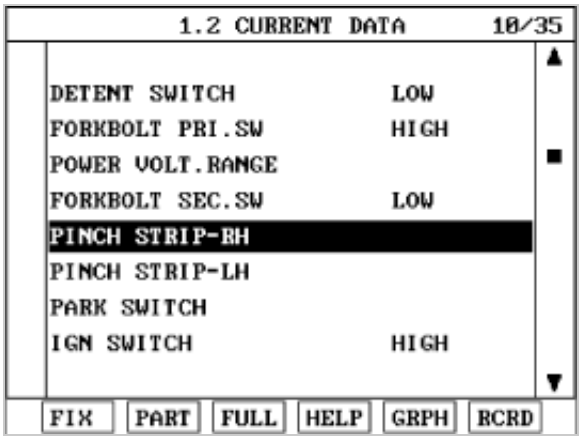
1. Check the power tail gate control module input/output value by using the diagnostic tool. If the operation of tailgate control module is abnormal, replace anti pinch strip control module.
2. When checking the anti pinch strip operation, select a vehicle type and "POWER SLIDING/TAILGATE" menu.



3. Select "POWER TAILGATE".



4. Select the sensor output. And then check the anti pinch strip sensor output while operating power tailgate in power mode.

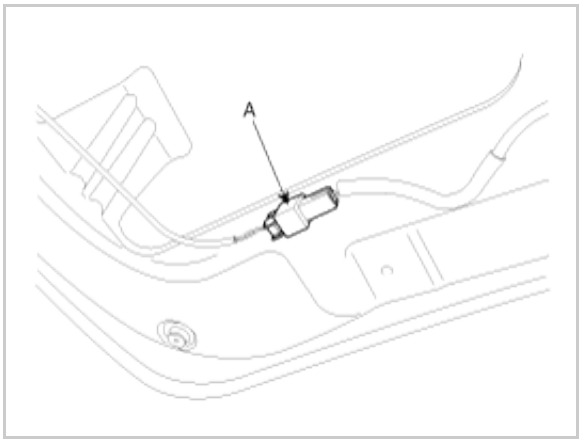


※ Above voltage and numerical value may be different from the real value.

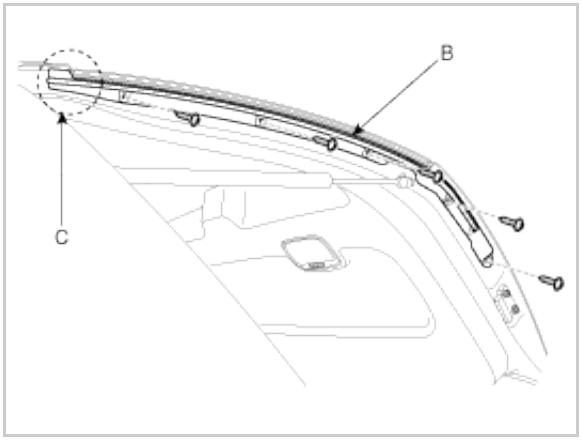
5. Change the anti pinch strip sensor, if there is no change from OFF to ON during operation.

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the tail gate trim (Refer to the Body group - tail gate).
3. Remove the anti-pinch strip sensor connector (A).



4. Remove the left and right side anti-pinch strip sensor (B) after removing the screws (5EA).

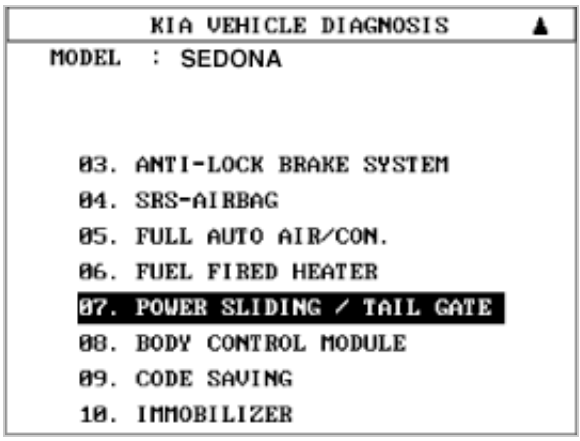


5. Installation is the reverse of removal. Part (C) has to be assembled using the cloth.

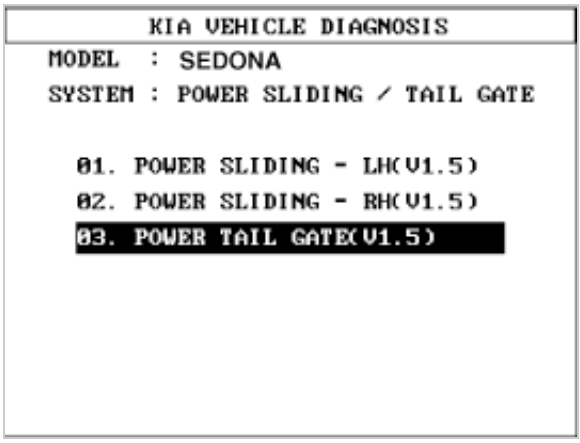
PTG Power Latch

INPECTION

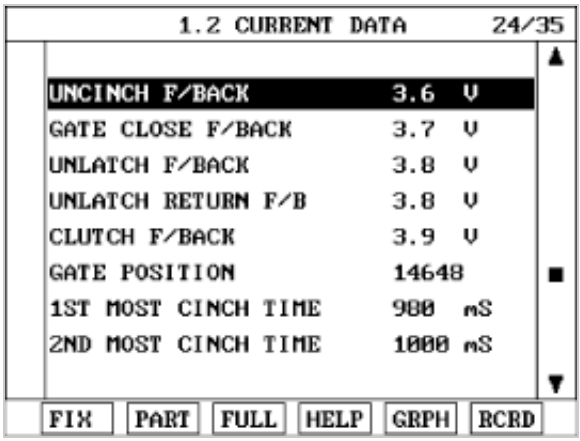
1. Check the power tail gate control module input/output value by using the diagnostic tool. If the operation of tailgate control module is abnormal, replace power latch.
2. To check the power latch operation, select a vehicle type and "POWER SLIDING/TAILGATE" menu.



3. Select "POWER TAILGATE".



4. Select the sensor output. And then check the cinch feedback and unlatch feedback output while operating power tailgate in power mode.

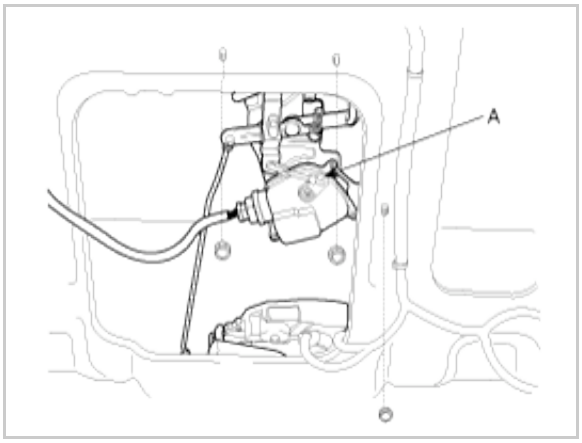


※ Above voltage and numerical value may be different from the real value.

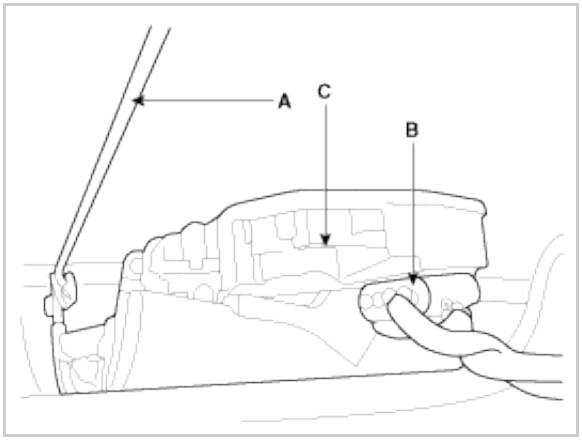
5. Change the anti pinch strip sensor, if there is no change during operation.

REPLACEMENT

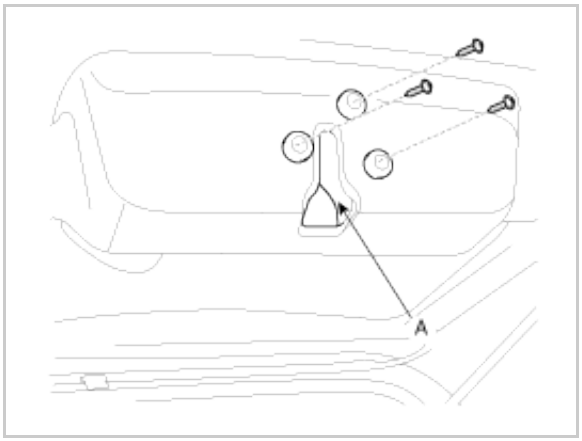
1. Disconnect the negative (-) battery terminal.
2. Remove the tail gate trim (Refer to the Body group - tail gate).
3. Remove the tail gate handle rod, actuator rod and key rod.
4. Remove the unlatch actuator assembly (A) after removing the connector and nuts (3EA).



5. Remove the tail gate handle rod (A) and connector (B) from the cinching latch assembly (C).



6. Remove the latch mounting screws (3EA) and cinching latch assembly (A) from the tail gate.



7. Installation is the reverse of removal.

NOTICE

a. Check the power tail gate for normal operation.

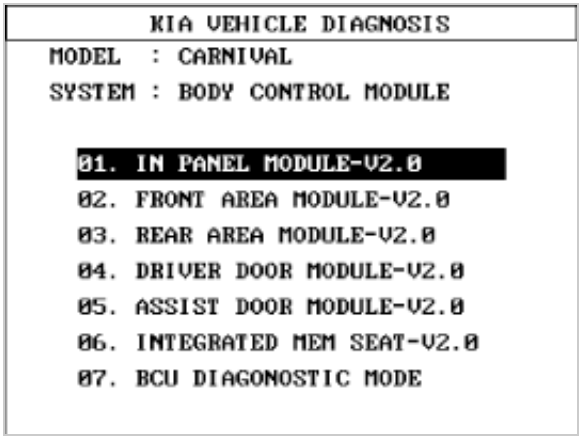
b. Check the normal operating whenever a power tailgate component is removed or replaced. If the chime sound is heard, check the DTC, wiring harness and cable connections.

PTG Switch

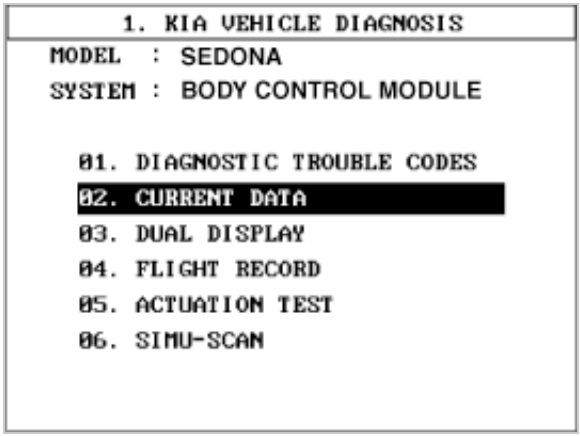
INSPECTION

OVERHEAD CONSOLE DOOR SWITCH INSPECTION

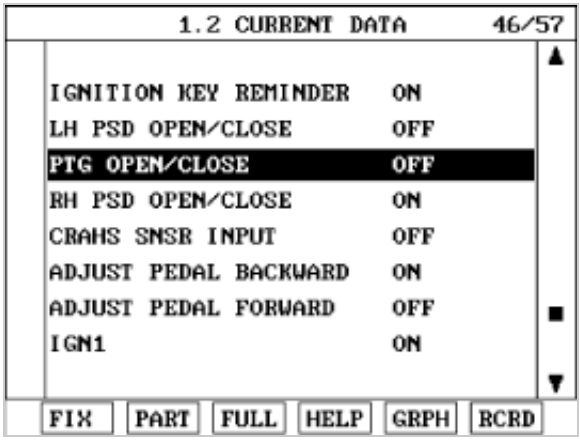
1. Check the overhead console door switch input/output value by using the diagnostic tool. If the operation of overhead console door switch is abnormal, check the IPM and replace.
2. When checking the overhead console switch operation, select a vehicle type and "IPM".



3. Select a in panel module (IPM) and "02. CURRENT DATA".



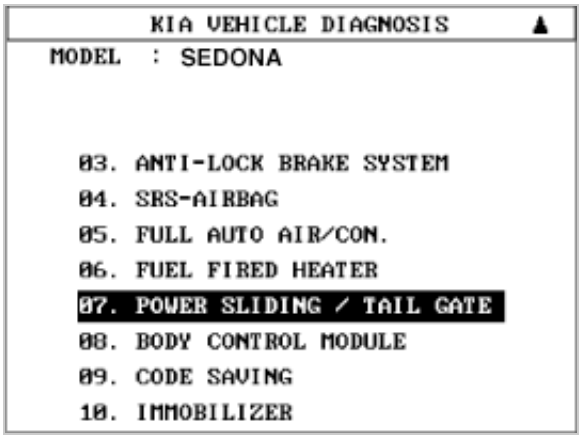
4. Check the PSD PTG power control switch and PTG switch output value.



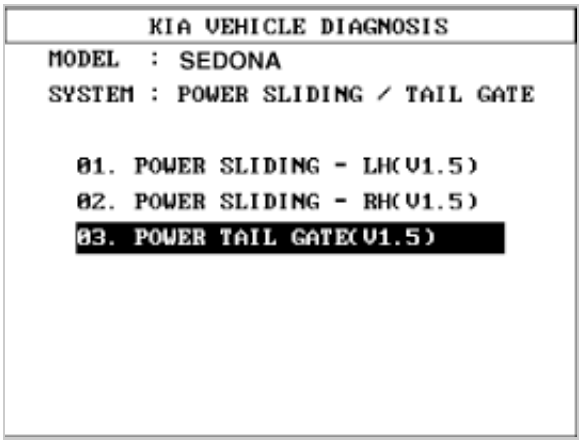
5. Confirm that output is changed by the controlling ON/OFF of each switch on the overhead console.

TAILGATE SWITCH INSPECTION

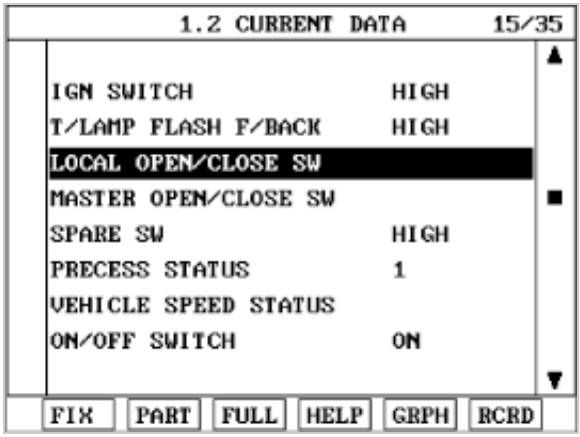
1. Check the power tailgate control module input/output value by using the diagnostic tool. If the operation of tailgate module is abnormal, replace power tailgate switch.
2. When checking tailgate switch operation, select a vehicle type and "POWER SLIDING/TAILGATE" menu.



3. Select the "POWER TAILGATE" menu to check.



4. Select the sensor output. And then check the power tailgate local switch output value changed by the controlling PTG.

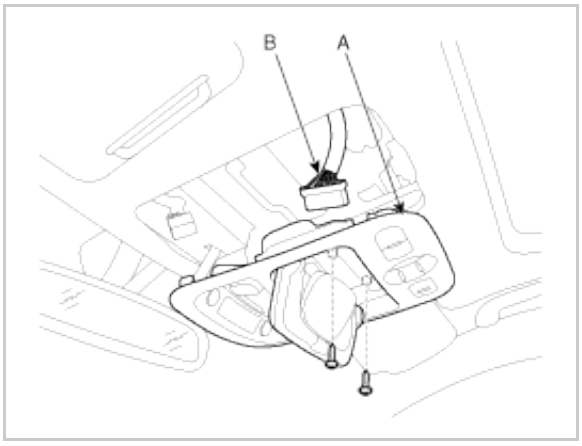


5. If there is no input/output change from OFF to ON during PTG operation, change the power tailgate switch.

REPLACEMENT

OVERHEAD CONSOLE SWITCH

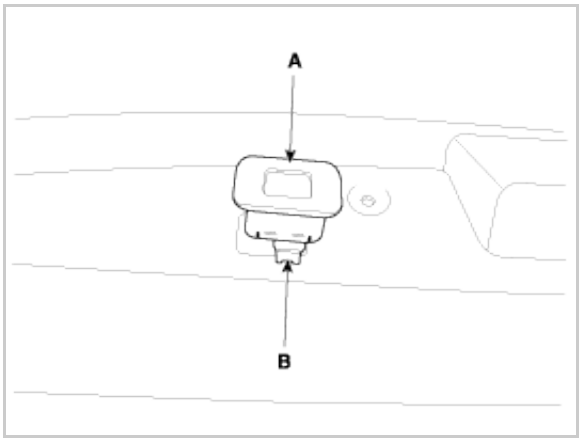
1. Disconnect the negative (-) battery terminal.
2. Open the sunglass case cover from the overhead console then remove the 2 screws holding the overhead console (A). And then disconnect the connector (B).



3. Installation is the reverse of removal.

TAIL GATE SWITCH

1. Disconnect the negative (-) battery terminal.
2. Open the tail gate and remove the tail gate trim switch (A) using the appropriate trim tool. And then remove the connector (B).

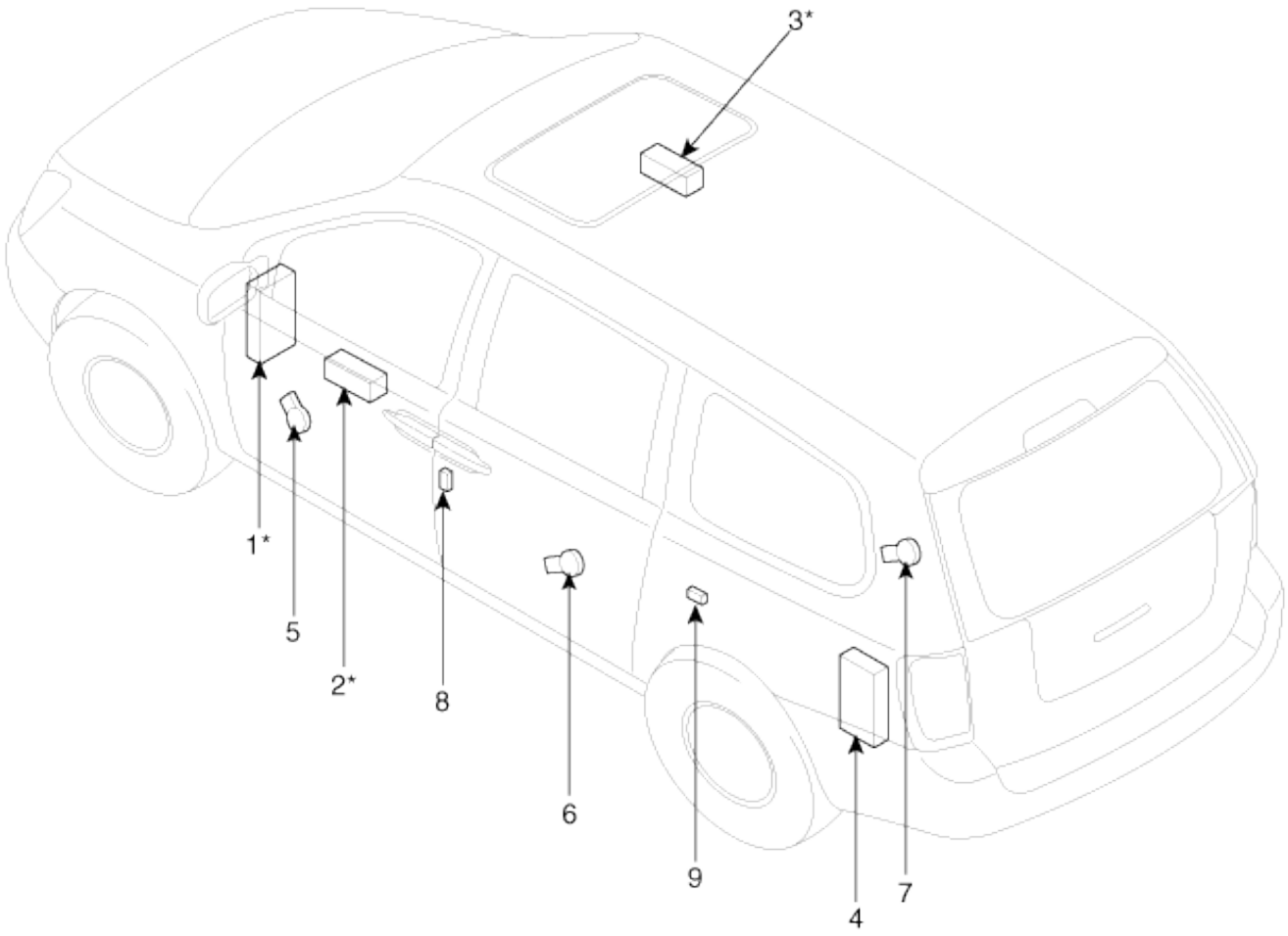


3. Installation is the reverse of removal.

Power Windows

COMPONENT LOCATION

The parts with asterisk(*) :
This illustration is shows the LHD type.
RHD type is symmetrical.



1. IPM (In-Panel module)
2. DDM (Driver door module)
3. ADM (Assist door module)
4. RAM (Rear area module)
5. Front window motor
6. Rear window motor
7. Quarter glass motor
8. Rear window switch
9. Quarter glass switch

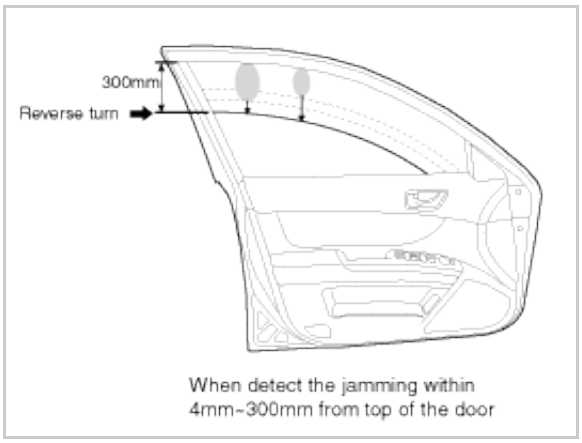
Power Window Motor

OPERATION

FUNCTION OF SAFETY POWER WINDOW

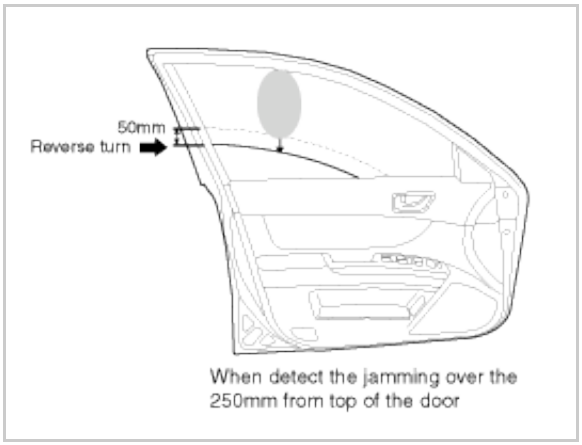
When driver door power window auto-up switch is operated, safety function is activated.

1. Safety function condition
   When the system detects a force of 100N during the window rising, window is reversed.
2. Length of window reversing (except when holding the auto-up switch)
   a. When detect the jamming within 4mm ~ 300mm from top of the door.
   → Window is reversed until 350mm from top of the door.



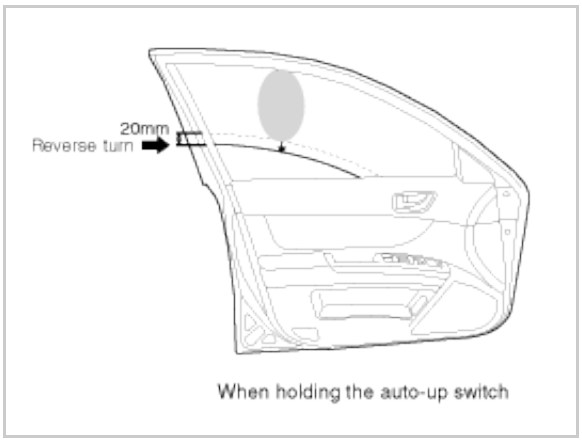
When detect the jamming within 4mm~300mm from top of the door

   b. When detect the jamming over the 300mm from top of the door.
   → Window is reversed until 50mm from jamming position.



When detect the jamming over the 250mm from top of the door

3. Length of window reversing (holding the auto-up switch)
   a. When detect the jamming during holding the auto-up switch.
   → Window is reversed until 20mm from jamming position.



When holding the auto-up switch

4. Safety function is not available area
   Safety function is not available within 4mm from top of the door.

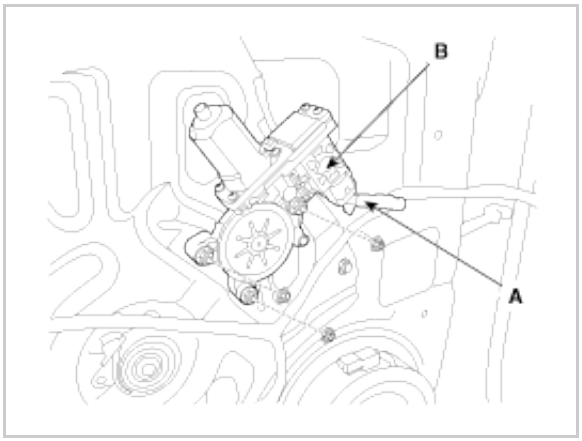
INITIALIZING METHOD OF THE SAFETY POWER WINDOW

1. Initializing of Battery Connection
   (1) Power window operation before initializing
      a. Manual-Up/Down function is available
      b. Auto-Up function is not available
         (When holding the auto-up/down switch, window is operated as a manual-up/down.)
   (2) Initializing method
      Close the window in window open position, and holding the switch in window full close position more than 1 second.

REPLACEMENT

FRONT POWER WINDOW MOTOR

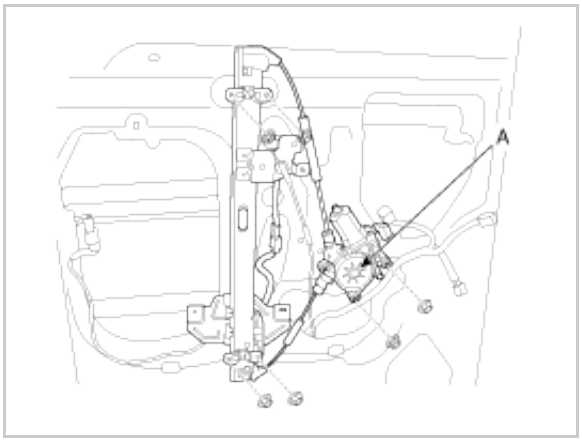
1. Remove (-) negative battery terminal.
2. Remove the front door trim panel. (Refer to the Body group-front door)
3. Remove the window motor (B) after disconnecting the motor connector (A) and mounting nuts.



4. Installation is the reverse of removal.

SLIDING POWER WINDOW MOTOR

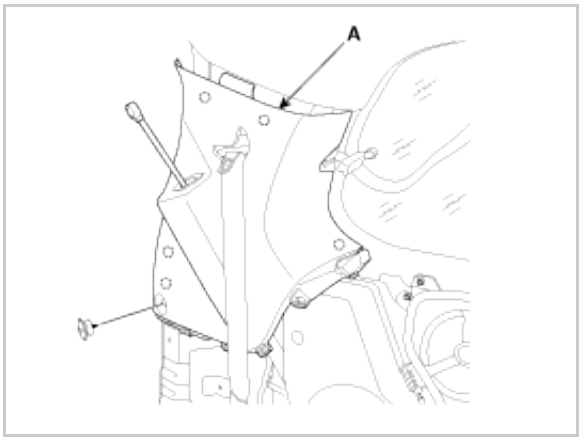
1. Remove (-) negative battery terminal.
2. Remove the sliding door trim panel. (Refer to the Body group-rear door)
3. Remove the door trim seal and glass.
4. Remove the door regulator.
5. Remove the power window motor (A) after disconnecting the motor connector and power window motor mounting nuts.



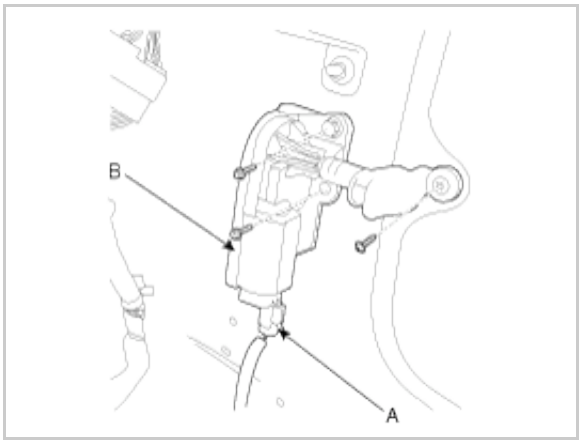
6. Installation is the reverse of removal.

QUARTER GLASS MOTOR

1. Remove (-) negative battery terminal.
2. Remove the D pillar trim panel (A). (Refer to the Body group-interior trim)



3. Remove the quarter glass motor (B) after disconnecting the motor connector (A) and quarter glass motor mounting bolts and screws.

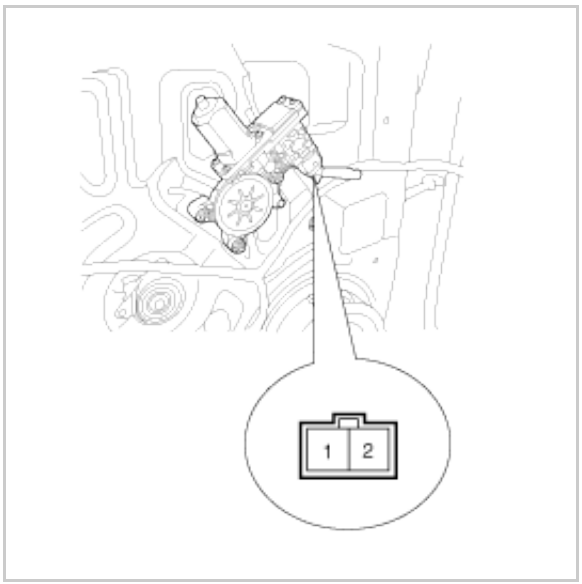


4. Installation is the reverse of removal.

INSPECTION

FRONT POWER WINDOW MOTOR INSPECTION

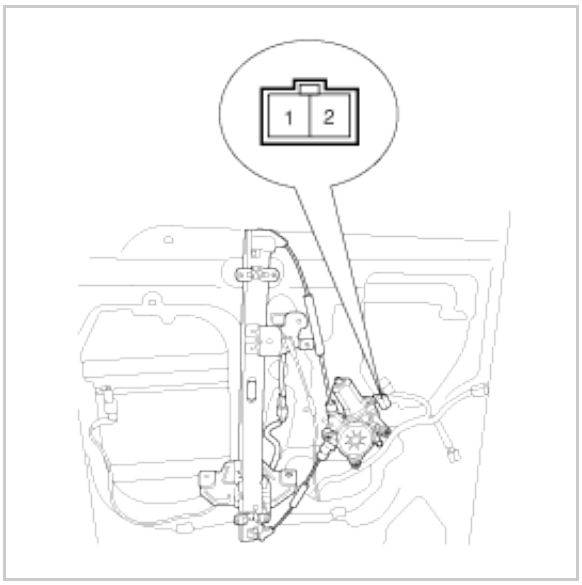
1. Remove (-) negative battery terminal.
2. Remove the rear door trim panel. (Refer to the Body group-front door)
3. Disconnect the motor connector from the motor.



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.

SLIDING POWER WINDOW MOTOR INSPECTION

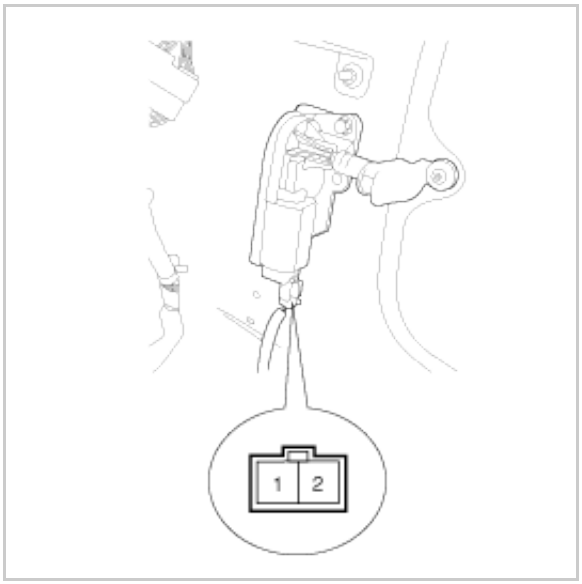
1. Remove (-) negative battery terminal.
2. Remove the sliding door trim panel. (Refer to the Body group-rear door)
3. Disconnect the motor connector from the motor.



4. Connect the motor terminals directly to battery voltage 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.

QUARTER GLASS MOTOR INSPECTION

1. Remove (-) negative battery terminal.
2. Remove the D pillar trim panel (A). (Refer to the Body group-interior trim)
3. Disconnect the motor connector from the motor.



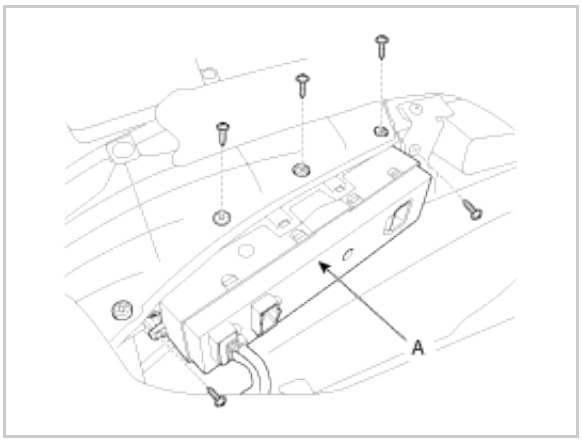
4. Connect the motor terminals directly to battery voltage and check that the motor operates smoothly. Next, reverse the polarity and check that the motor operates smoothly in the reverse direction. If the operation is abnormal, replace the motor.

Power Window Switch

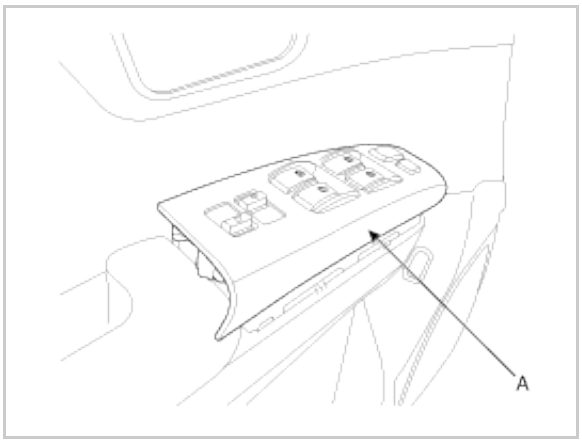
REPLACEMENT

DRIVER/ASSIST DOOR MODULE (DDM/ADM)

1. Remove (-) negative battery terminal.
2. Remove the front door trim panel. (Refer to the Body group-front door)
3. Disconnect the door module mounting screws (5EA) after disconnecting the module connectors (3EA) from the motor.



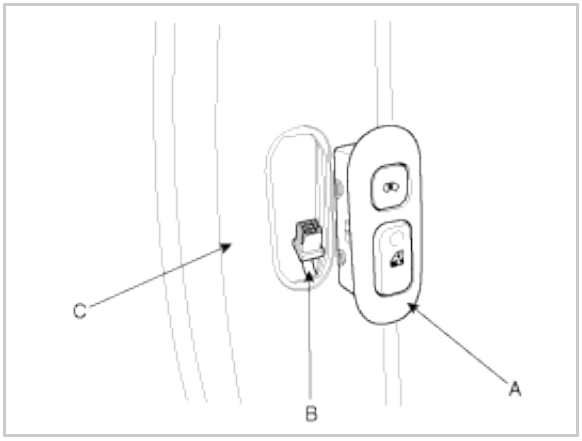
4. Remove the door module (DDM/ADM) (A) from the front door trim panel.



5. Installation is the reverse of removal.

SLIDING POWER WINDOW SWITCH

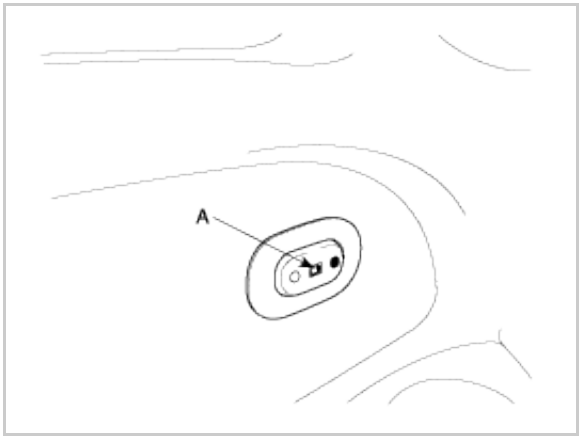
1. Remove (-) negative battery terminal.
2. Disconnect the connector (B) after removing the sliding power window switch (A) from the B pillar trim (C).



3. Installation is the reverse of removal.

QUARTER GLASS SWITCH

1. Remove (-) negative battery terminal.
2. Disconnect the connector (B) after removing the quarter glass switch (A) from the rear cargo area luggage trim.



3. Installation is the reverse of removal.

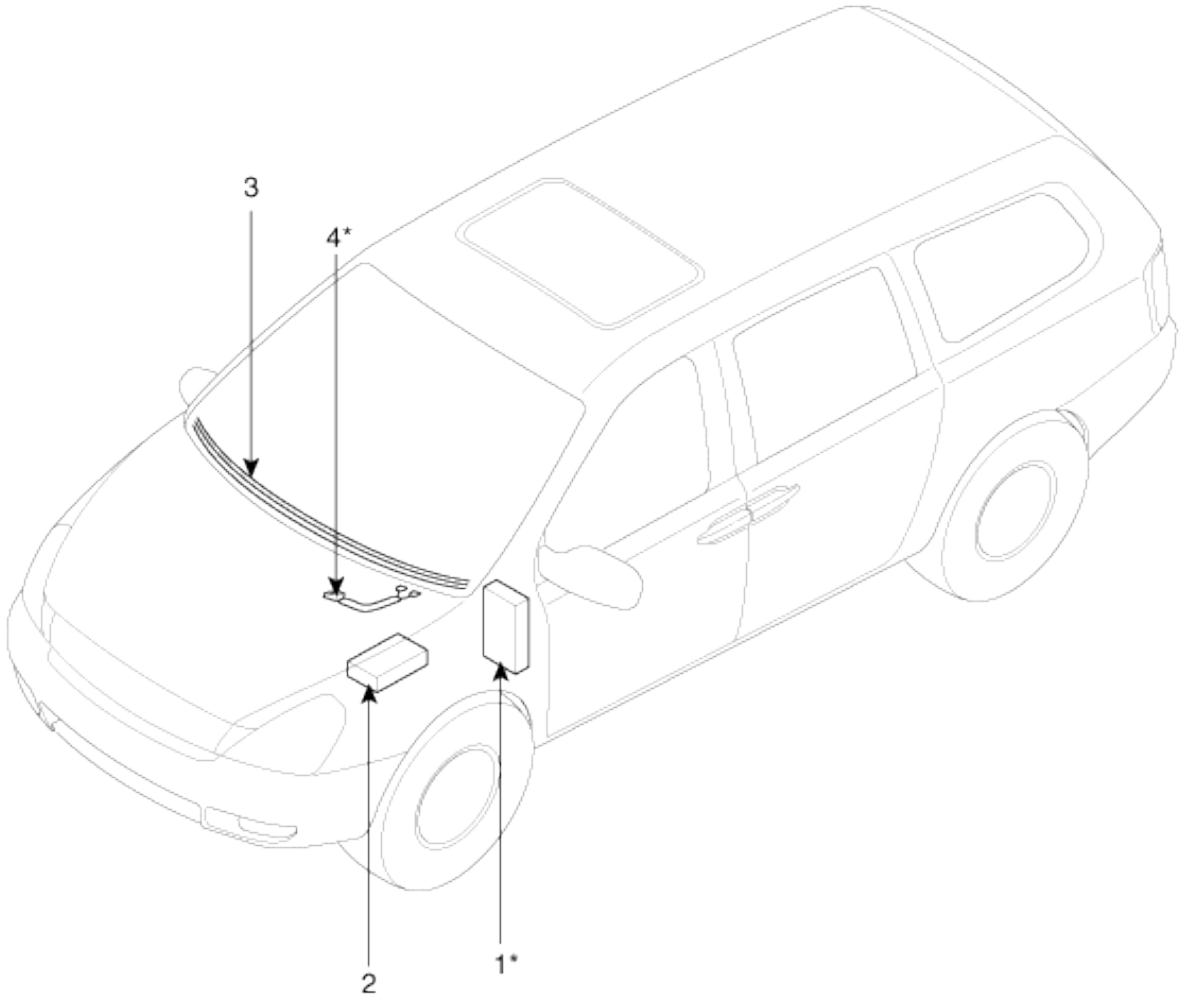
Windshield Deicer

DESCRIPTION

Windshield deicer system prevent windshield wiper from freezing in the winter season. It consists of deicer in the lower part of windshield, switch and relay. FAM receives an input signal from the deicer switch of IPM through CAN communication line and then controls relay. Operating condition is the same that of rear window defogger system. With the engine running and the charging system operating, if the deicer switch is ON, then deicer output is ON for 20 minutes.

COMPONENT LOCATION

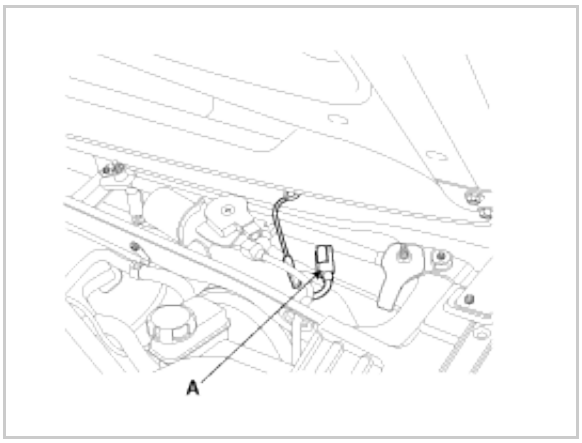
The parts with asterisk(*) :
This illustration is shows the LHD type.
RHD type is symmetrical.



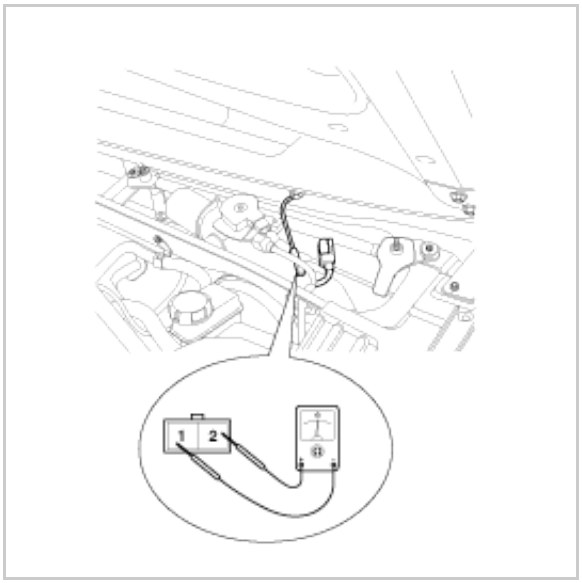
1. IPM (In-Panel module)
2. FAM (Front area module)
3. Windshield deicer
4. Deicer connector(2pin)

INSPECTION

1. Remove the cowl top cover.(Refer to the wiper)
2. Disconnect the windshield deicer connector (A) from the wiper motor linkage.

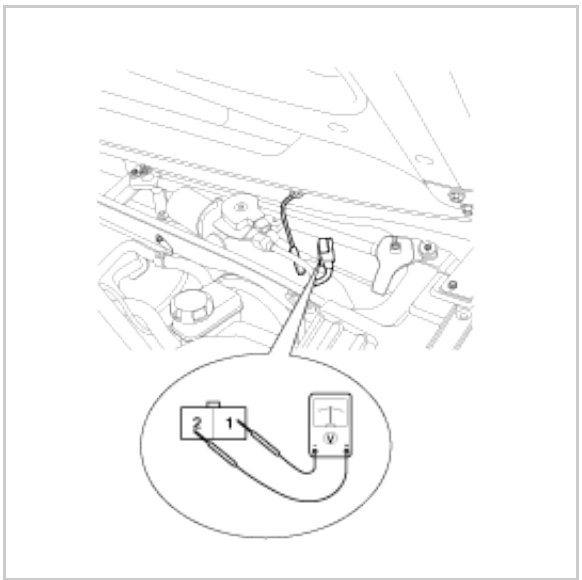


3. Check for continuity between the terminals of deicer lines.



4. Turn the ignition switch ON and the windshield deicer switch ON, then measure the voltage between the terminals of harness side deicer connector.

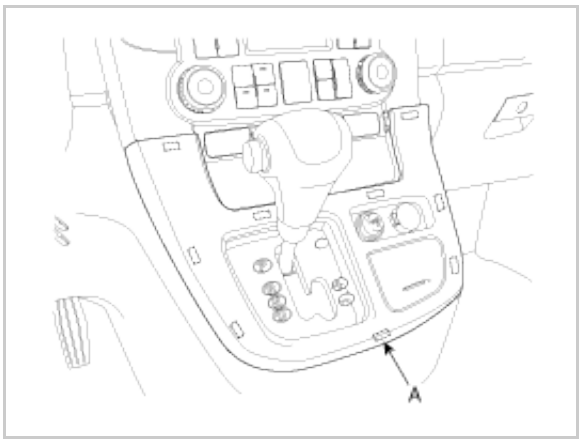
O K: approx. Battery voltage (12V)



Windshield Deicer Switch

INSPECTION

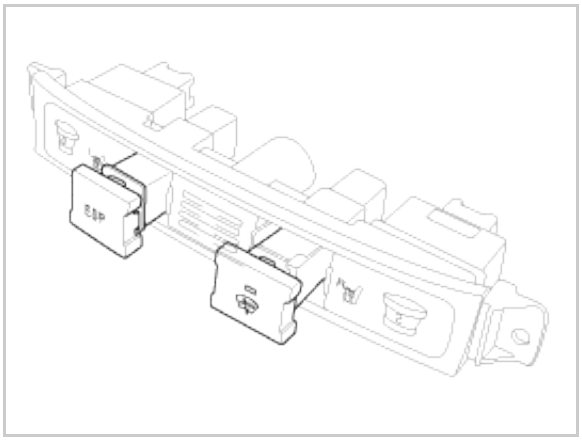
1. Disconnect the negative (-) battery terminal.
2. Remove the console lower cover (A).



3. Remove the center facia panel(A) after loosening screws. Take care not to damage fixing clips.



4. Remove the windshield deicer switch from the center facia panel switch.



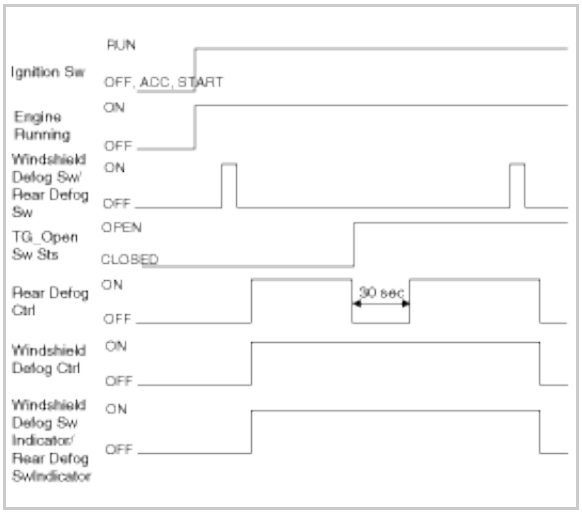
5. Installation is the reverse of removal.

Windshield Deicer Timer

INSPECTION

While operating the components, check whether the operations are normal as shown in the timing chart.

1. Once Generator "L" is ON, if the defogger is switched ON, the defogger will stay ON for 20 minutes duration.
2. If defogger switch is pressed again (see Step 1), or if ignition is switched OFF, the defogger will shut OFF.
3. If Generator "L" is OFF, the defogger will shut OFF.



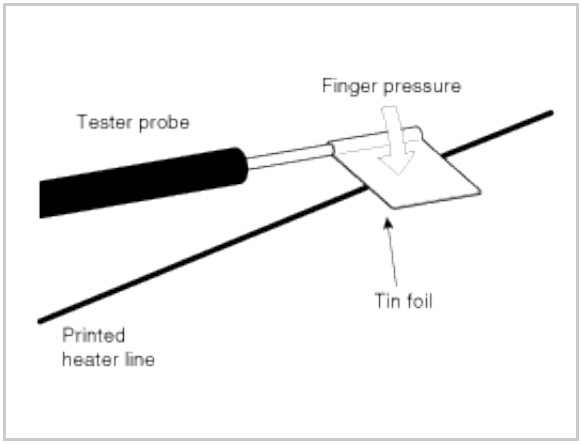
Rear Glass Defogger

Rear Glass Defogger Printed Heater

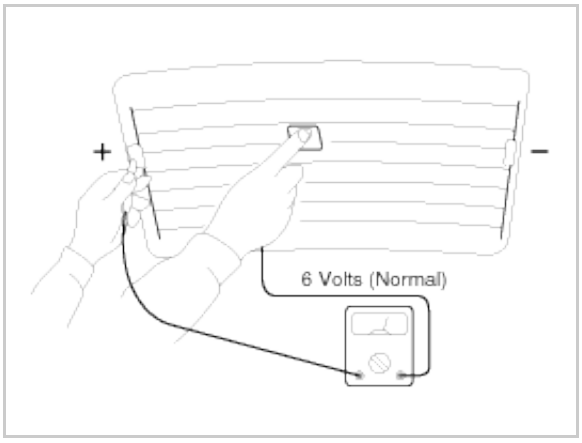
INSPECTION

CAUTION

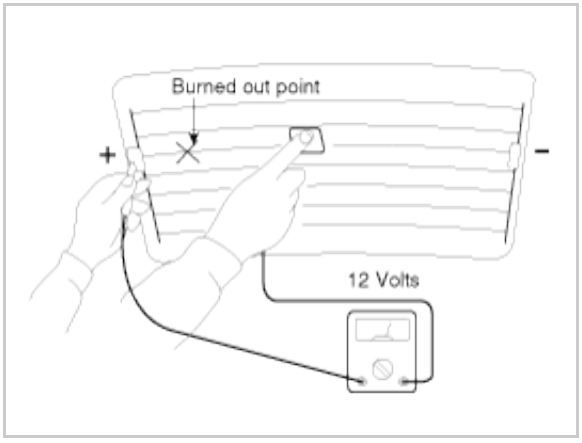
Wrap tin foil around the end of the voltmeter test lead to prevent damaging the heater line. Apply finger pressure on the tin foil, moving the tin foil along the grid line to check for open circuits.



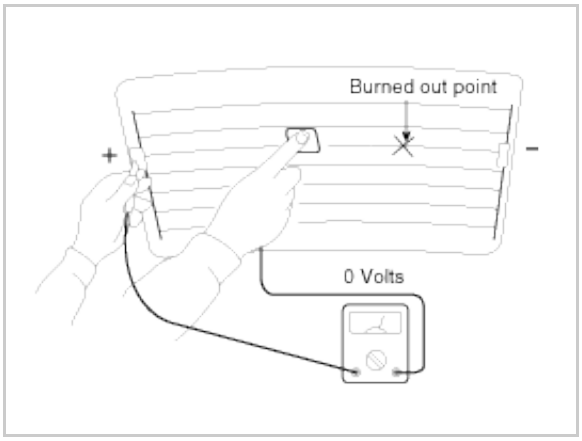
1. Turn on the defogger switch and use a voltmeter to measure the voltage of each heater line at the glass center point. If a voltage of approximately 6V is indicated by the voltmeter, the heater line of the rear window is considered satisfactory.



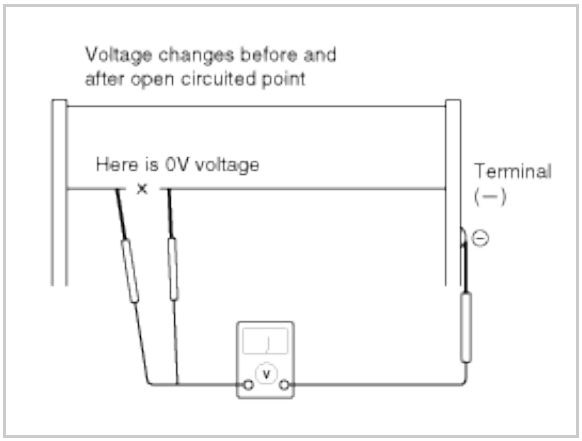
2. If a heater line is burned out between the center point and (+) terminal, the voltmeter will indicate 12V.



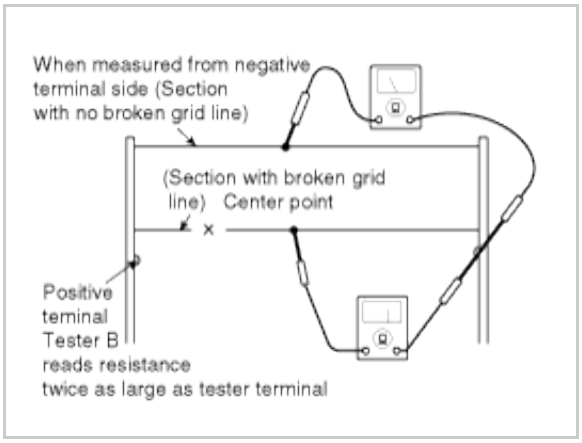
3. If a heater line is burned out between the center point and (-) terminal, the voltmeter will indicate 0V.



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.

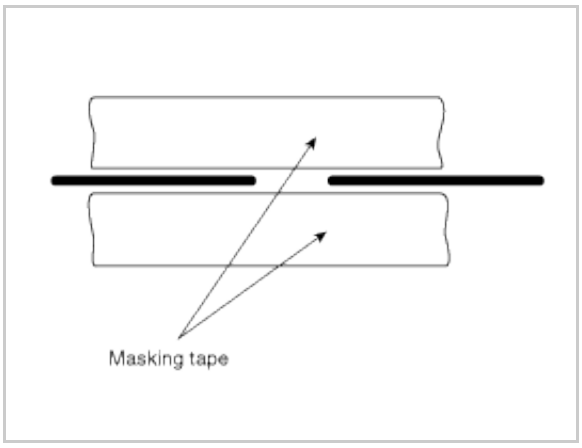


REPAIR OF BROKEN HEATER LINE

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,

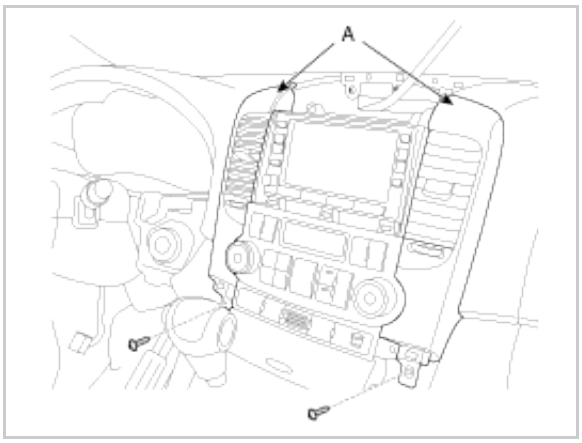
scrape away excess deposits with a knife after the paint has completely dried. (Allow 24 hours).



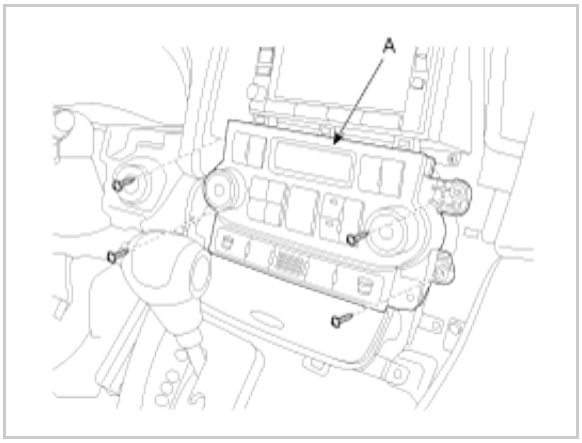
Rear Glass Defogger Switch

INSPECTION

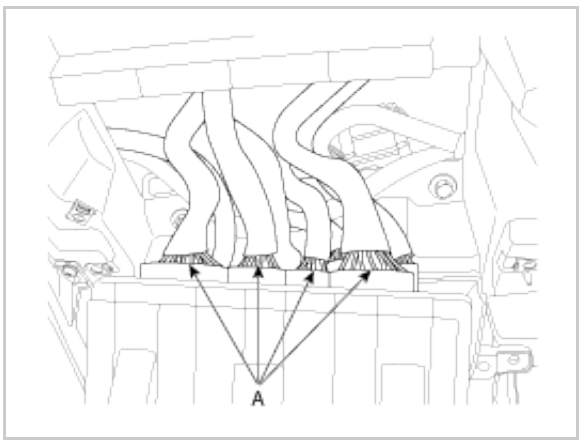
1. Disconnect the negative (-) battery terminal.
2. Remove the center facia panel, console lower cover and center air vent (A) after loosening screws. Take care not to damage fixing clips.



3. Remove the center facia panel switch and air control panel (A) after loosening screws.



4. Disconnect the air control panel connector (A).



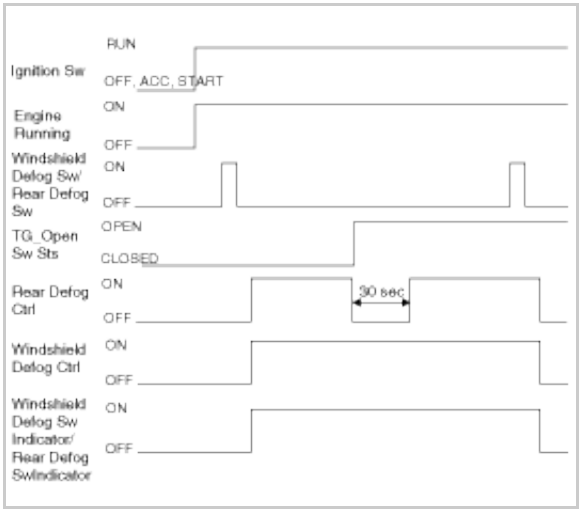
5. Installation is the reverse of removal.

Rear Glass Defogger Timer

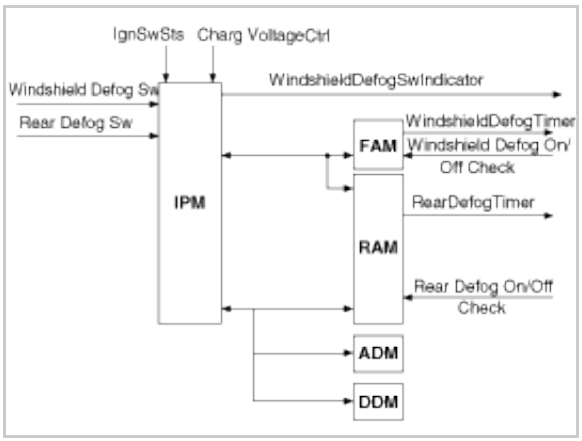
INSPECTION

While operating the components, check whether the operations are normal as shown in the timing chart.

1. The defog function can be activated only when engine is running and ignition key is in RUN position.
   If the defogger is switched ON, the defogger will stay ON for 20 minutes duration.
   While Windshield Defog is on, the windshield defog button is illuminated
   If the switch is pushed again while defog is already active, defog stops.
   If the engine stops while defog is on, defog stops and it is not automatically turned on when the engine is started again.
   Rear defog works exactly in the same way as windshield defog using the Rear Defog Switch button as input.



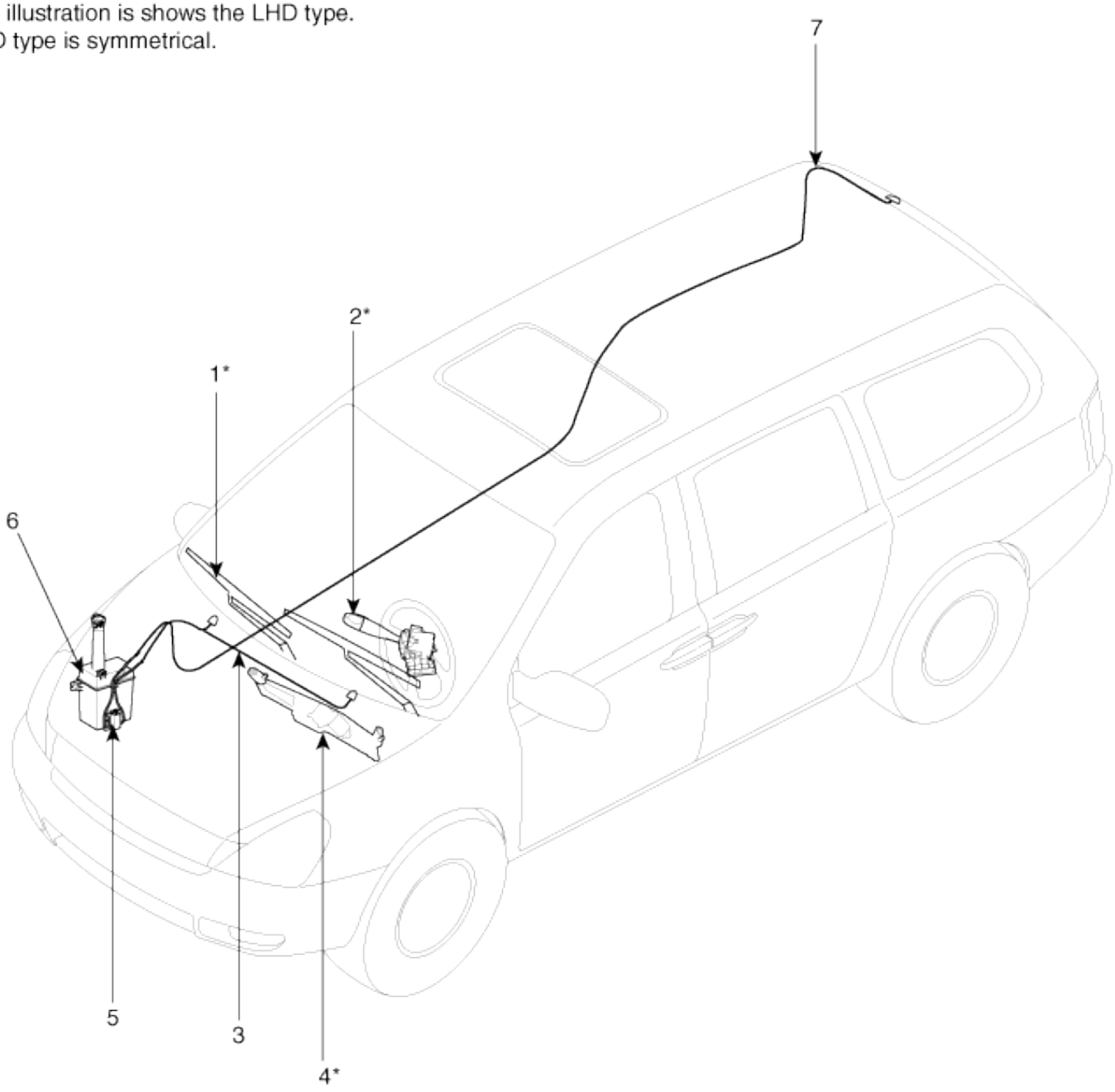
2. Rear Defog Pause
   When IPM receives tailgate flasher control CAN message transition to tailgate flash value, rear defog is inhibited for 30s.
   The 20 min rear defog timer is frozen during this pause.
   If the user turns on rear defog function while this pause is going on, rear defog is set to ON only at the end of the pause.
   This pause has no impact on Rear Defog Switch illumination.
   When IPM receives tail gate open CAN message transition to OPEN value, this 30 s rear defog pause is also started, it works the same way as described above.



Windshield Wiper / Washer

COMPONENT LOCATION

The parts with asterisk(*) :
This illustration is shows the LHD type.
RHD type is symmetrical.

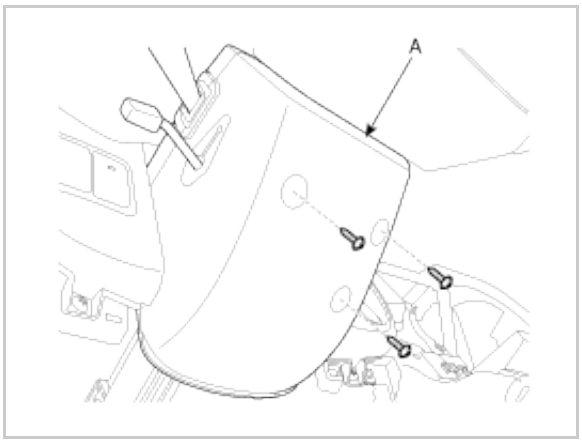


1. Windshield wiper arm & blade
2. Wiper & washer switch
3. Windshield washer hose
4. Windshield wiper motor & linkage
5. Washer motor
6. Washer reservoir
7. Rear washer hose

Windshield Wiper-Washer Switch

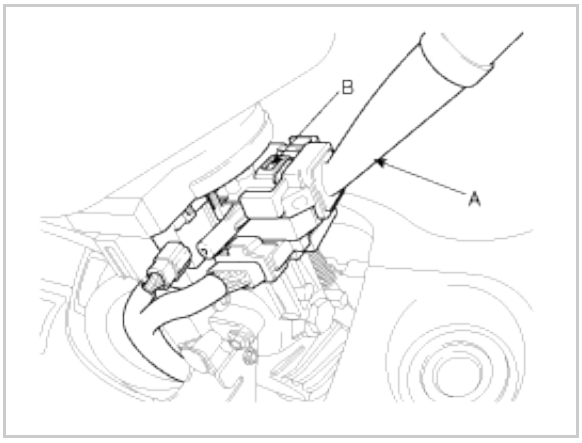
REPLACEMENT

1. Remove the steering column upper and lower shrouds (A) after removing 3 screws.

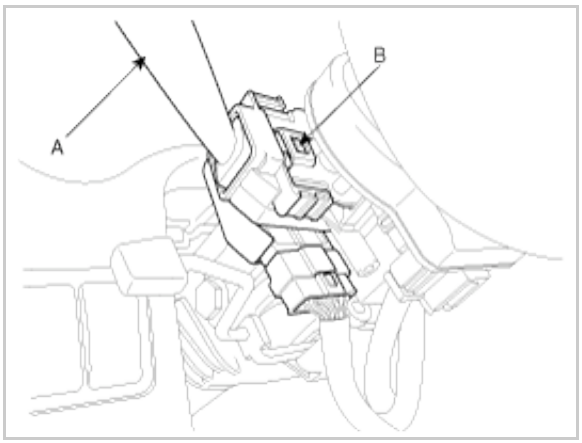


2. Remove the wiper switch (A) by pushing the lock pin (B) after disconnecting the connector.

[LHD]



[RHD]



3. Installation is the reverse of removal.

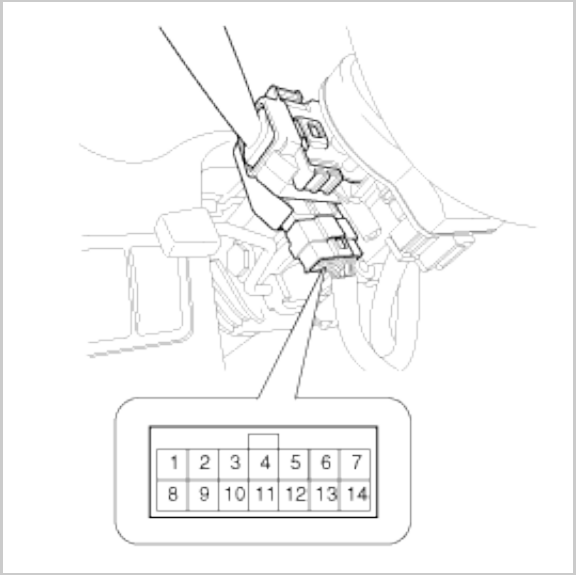
INSPECTION

Check for continuity between the terminals while operating the wiper and washer switch. If it is not normal condition, replace wiper and wiper switch.

[LHD]



[RHD]



WIPER SWITCH

(RHD)

Terminal / Position	1 (7)	2 (6)	3 (5)	4 (4)	5 (3)	6 (2)	13 (13)	14 (14)
MIST				○	○			
OFF		○	○					
INT		○	○		○	○	○	○
LOW		○			○			
HI	○				○			

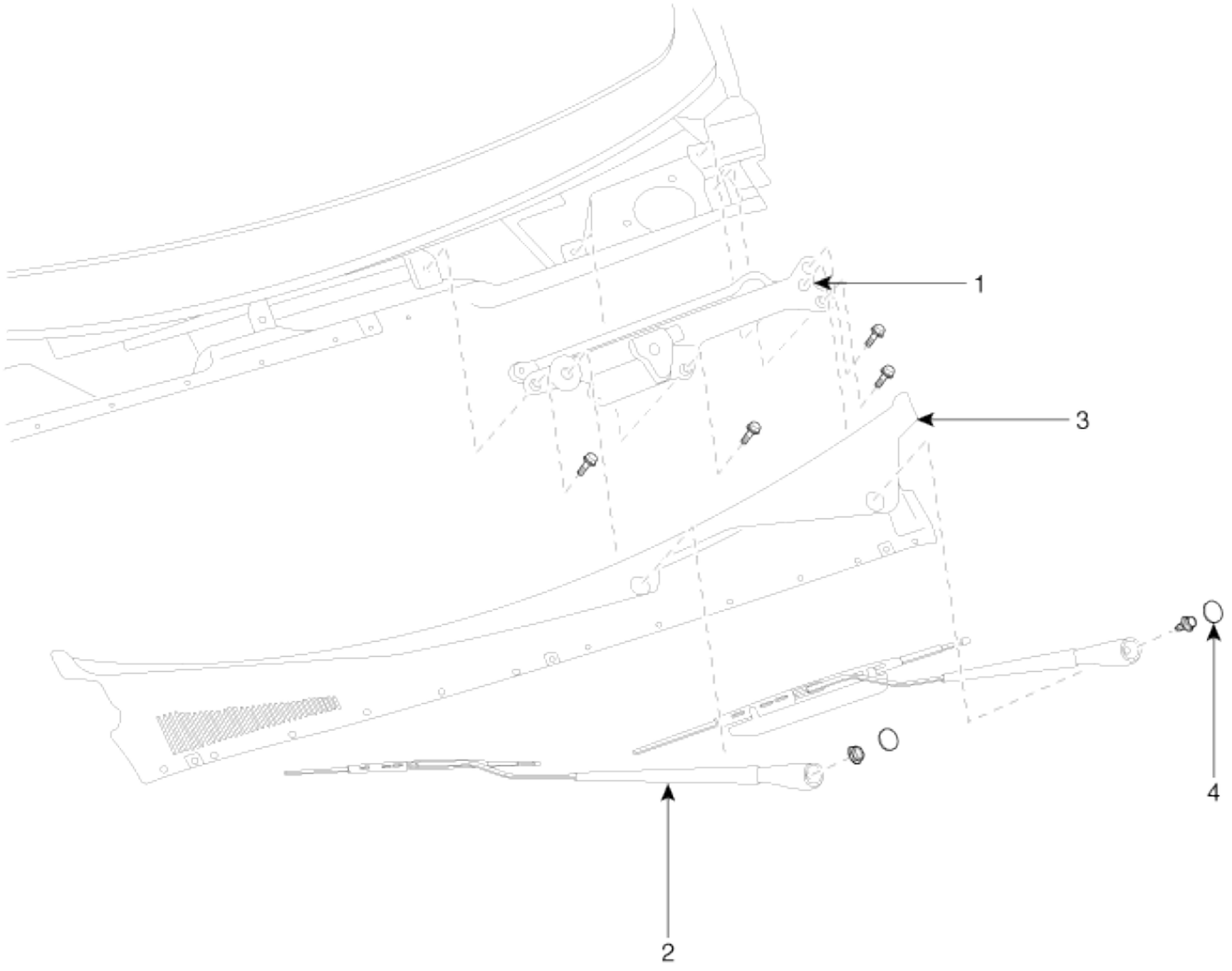
WASHER SWITCH

(RHD)

Terminal / Position	5(3)	7(1)
OFF		
ON	○	○

Front Wiper Motor

COMPONENT LOCATION

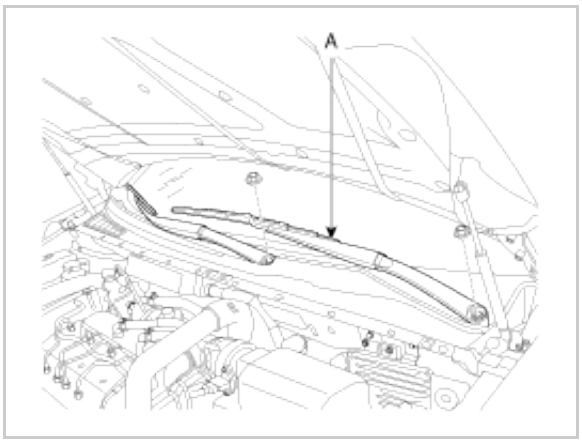


1. Wiper motor & linkage assembly
2. Wiper arm & blade
3. Cowl top cover
4. Cap

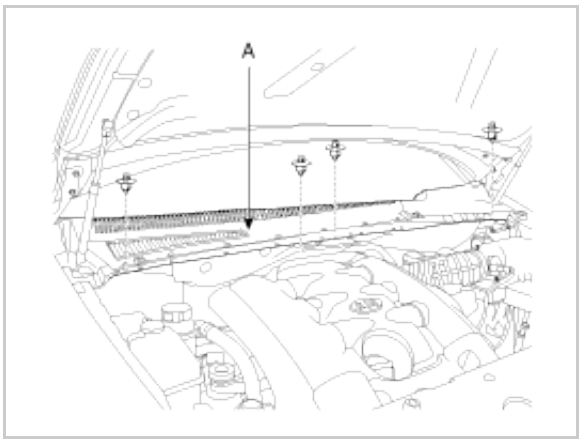
REMOVAL

1. Remove the windshield wiper arm and blade after removing the mounting nut (A).

TORQUE: 28~32 Nm (2.8~3.2 kgf.m, 20~23.1 lbf.ft)

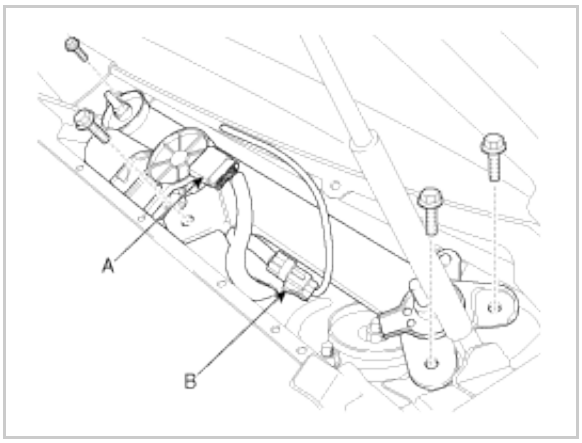


2. Remove the weather strip and the cowl top cover (A) after removing 4 fasteners.



3. Remove the windshield wiper motor and linkage assembly after removing 4 bolts. Disconnect the wiper motor connector (A) and windshield deicer connector (B) from the wiper motor & linkage assembly.

Torque: 7-11Nm (0.7-1.1, kgf.m, 5.0-7.9 lbf.ft)



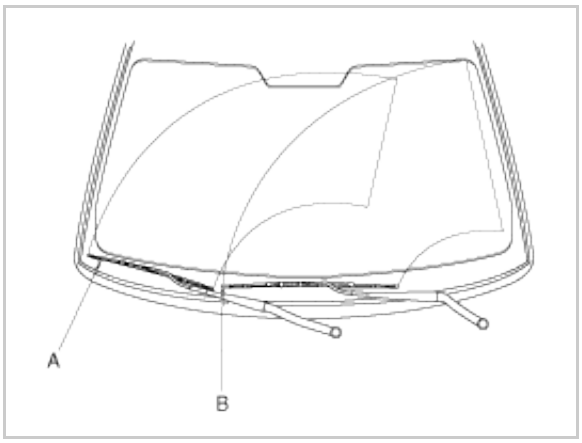
4. Installation is the reverse of removal.

INSTALLATION

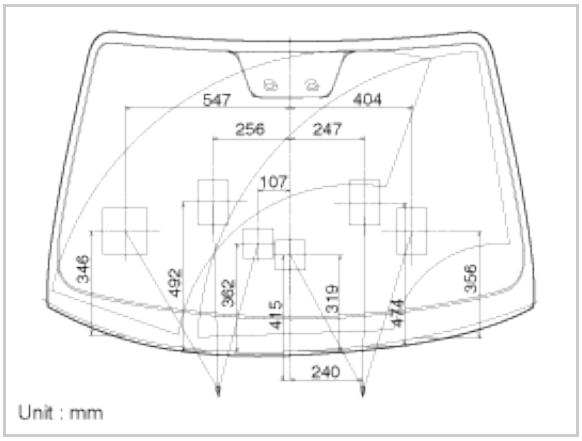
1. Install the wiper arm and blade to the specified position.

Specified position	A	B

Distance[in (mm)]	1.57+0.19/0 (40+5/0)	1.57+0.19/0 (40+5/0)



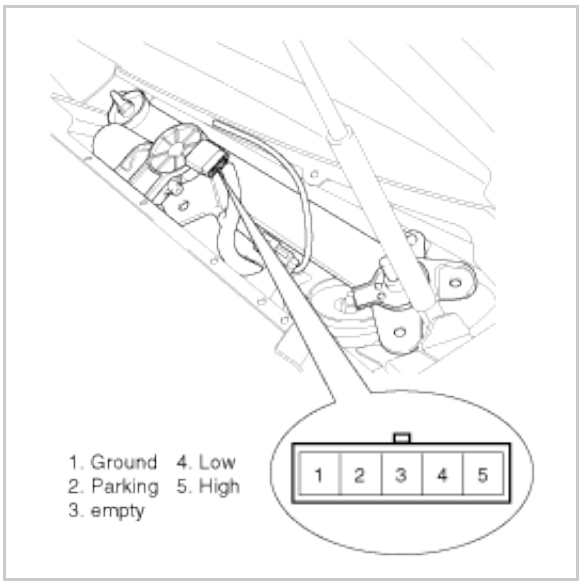
2. Set the washer nozzle on the specified spray position.



INSPECTION

SPEED OPERATION CHECK

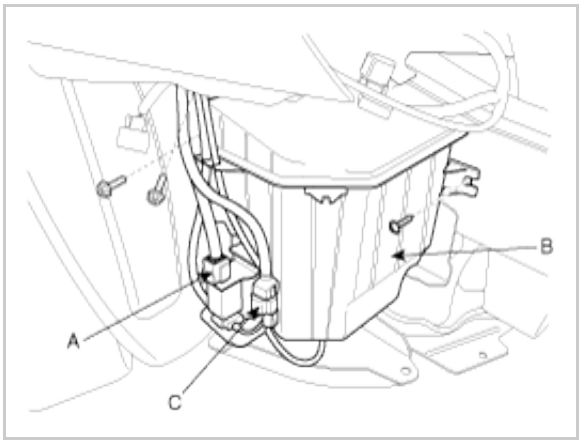
1. Remove the connector from the wiper motor.
2. Attach the positive (+) lead from the battery to terminal 4 and the negative (-) lead to terminal 1.
3. Check that the motor operates at low speed.
4. Connect the positive (+) lead from the battery to terminal 5 and the negative (-) lead to terminal 1.
5. Check that the motor operates at high speed.



Front Washer Motor

REPLACEMENT

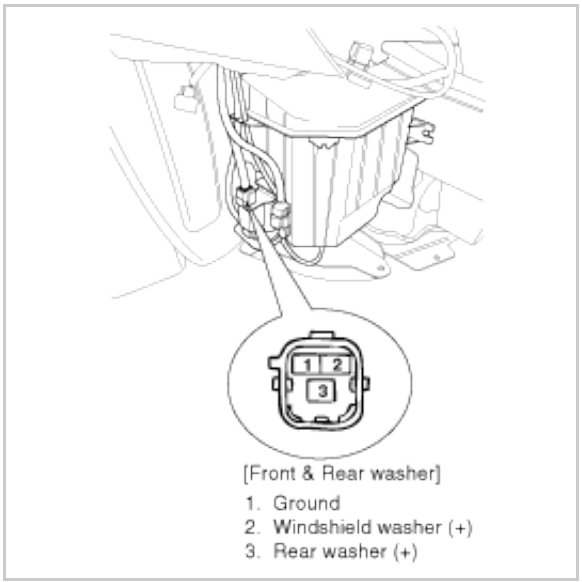
1. Disconnect the negative (-) battery terminal.
2. Remove the front bumper cover. (Refer to Body group - Front bumper)
3. Remove the washer hose, the washer motor connector (A) and washer level sensor connector (C).
4. Remove the washer reservoir after removing 2 bolts and 1 step bolt.

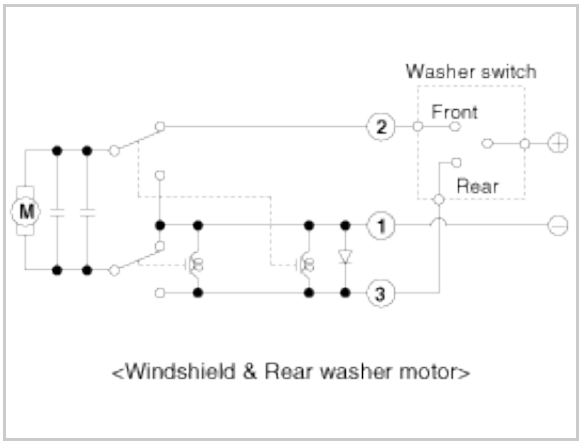


5. Installation is the reverse of removal.

INSPECTION

1. With the washer motor connected to the reservoir tank, fill the reservoir tank with water.
2. Connect positive (+) battery cables to terminal 2 and negative (-) battery cables to terminal 1 respectively.
3. Check that the motor operates normally and the washer motor runs and water sprays from the front nozzles. If they are abnormal, replace the washer motor.



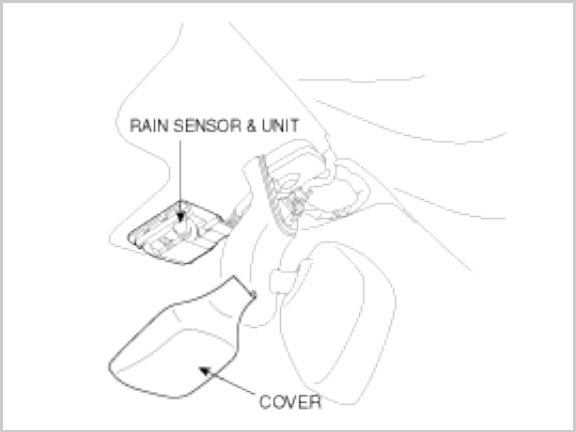


<Windshield & Rear washer motor>

Rain Sensor

DESCRIPTION

The Rain sensing windshield wiper system is a wiper system that, in addition to providing normal wiper functions off, mist, manual low speed, manual high speed, and wash, provides automatic control of automatic intermittent automatic low, and automatic high speeds.
When the ignition key is in the ON position, the rain sensor will be activated.



SYSTEM FUNCTION

BASIC PRINCIPLE

Emitted Beam from luminosity diode is reflected entirely against the windshield exterior, and then turn into photo diode. If there is water on the windshield exterior, beam seperates optically, and the degree of remained beam is measured in the photo diode.
What there is water in the windshield, it means beam is not reflected all, so the degree of lost beam indicates the degree of glass surface wet.

NOTICE

Rainsensor consist of two luminosity diode, two photo diode, optic fiber and coupling pad.

OPERATION CONTROL

Wiper ECU transmits the signal as a rainsesor, and then the rainsensor perceives the rainwater to transmit to the wiping order wiper ECU, wiper ECU controls the wiper motor according to the signal.

CONTACT INFLUENCE

The rain sensor can malfunction due to the following conditions :

a. Contamination of the measurement surface.
b. Air bubbles between the windshield and the coupling pad contact surface.
c. The movement of coupling pad by vibration.
d. Damaged wiper blade.

AUTO OPERATION

1. Operation Condition

Operation mode	Operation condition
Direct mode	Switch AUTO is basic operation condition that rain sensor perceives dry windshield. From this condition, the rain sensor decides the wiper operation mode depend on the quantity and time of measured rainwater
Intermittent mode	Operation pauses between 0.5~5 seconds, then the wipers switch to intermittent mode
Low speed	Operate continuously at low speed
High speed	Operate continuously at high speed

2. Safety Function

a. When there is an ice in the sensing field, the rain sensor cannot recognize the correct working condition.

> **NOTICE**
>
> Do not operate the rain sensing wipers unless the windshield is completely clear of ice and snow.

b. Glass damage : rain sensor cannot perceive the damaged windshield within the sensing field.

c. The rain senson will not operate properly if detached from the windsheld.

d. If the wiper ECU does not transmit any effective data in 5 seconds, the rain sensor turns off LED.

e. If the intermittent wiper signal is interrupted for >2 sec, the wipers are moved to the parking position.

f. If a rain sensor signal communication error lasts for > 5sec, the wipers are moved into the parking position.

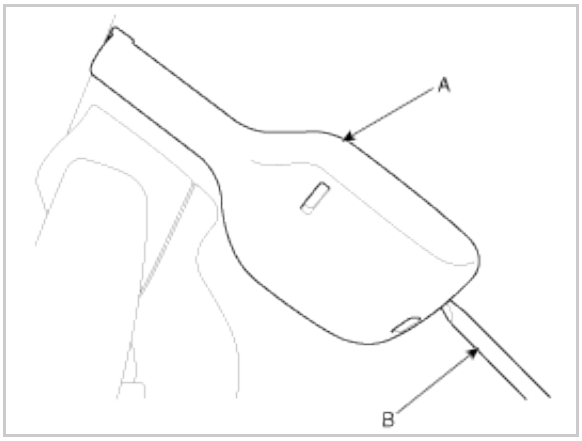
g. If the rain sensor transmits an error to the wiper ECU, the wiper ECU stops the AUTO function after 4.5 seconds.

REMOVAL

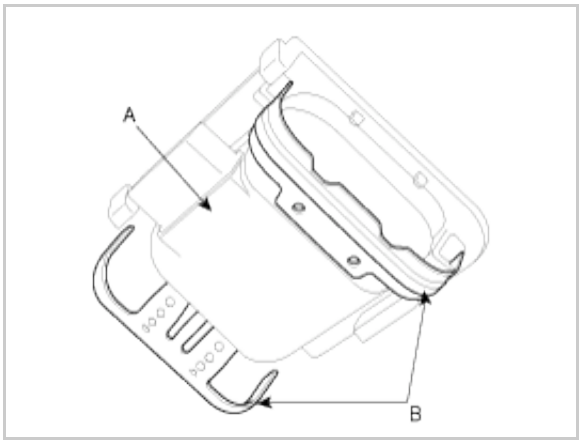
CAUTION

The rain sensor may not operate proprly if contaminated. Protect the rain sensor surface by not removing the cover until installation time. The coupling pad on the rain sensor surface has adhesive strength. Take care when installing the sensor. If the sensor is separated from the windshield by force, the sensor or windshield may be damaged. Take care when removing the sensor.

1. Remove the sensor cover. When removing it, make sure take care to prevent damage. To remove it, press back the locking hook using the cover hole using an appropriate tool.



2. When removing rain sensor from the bracket, open the spring clip using the (-)driver, and then remove.



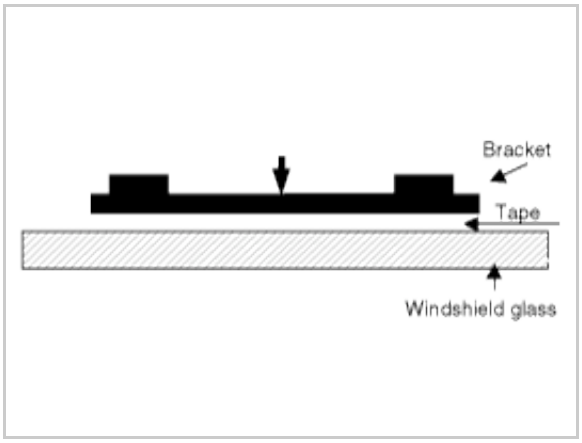
3. Disconnect the wiring harness connector from the sensor.
4. Rain sensor is fitted with 2 spring slides by clip type on the front glass, it can be replaced easily. When replacing the front glass, take away the rain sensor from the existing glass.
   After then attach it to new one again.

INSTALLATION

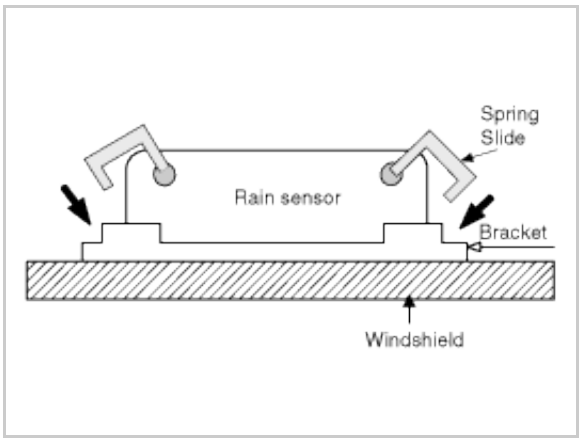
NOTICE

a. In case of the windshield with reflection layer which reflects the infrared rays in sensing field, remove the reflection layer from the rain sensor mounting position prior to installation.
b. Bracket and spring slide need for installing the rainsensor, it is covered by sensor cover.

1. Install the rain sensor bracket to the windshield glass using the tape



2. Rain sensor Installation
   The two springs should be closed simultaneously. Once closed, press the housing forward to ensure proper adhesion of the sensor to the windshield.



3. Connect the rain sensor connector, and then install the sensor cover.

> **CAUTION**
>
> It is very important that the coupling pad pushes against the windshield completely to prevent bubbles from forming at the contact surface.

INSPECTION

1. Wiper blade
   Check the wear of wiper blade. If it is excessively worn, wipe out clean to sense the rain amount accurately.
2. Coupler
   Ensure the coupler surface on the windshield is free of bubbles. Verify that the coupler is properly positioned.
3. Glass
   Check the windshield glass surface beyond the sensing range for the excessive wear, scratch or crack.
   Although the sensor compensates for wear to a certain level, sensor fails to sense accurately if it excceds a certain level. This is confirmed by the self-diagnosis of sensor.
4. Exterior cover
   Ensure the exterior cover of the rain sensor is properly installed.
5. Spring clip
   Check the spring clip after removal of exterior cover if the rain sensor is disconnected from coupler.
6. Connector
   (1) Check the terminal inside the connector and wiring for compression, and check the terminal whether it is inserted and locked correctly.
   (2) In addition, check the wiring connector and rain sensor connector for assembly and confirm to prevent poor connection

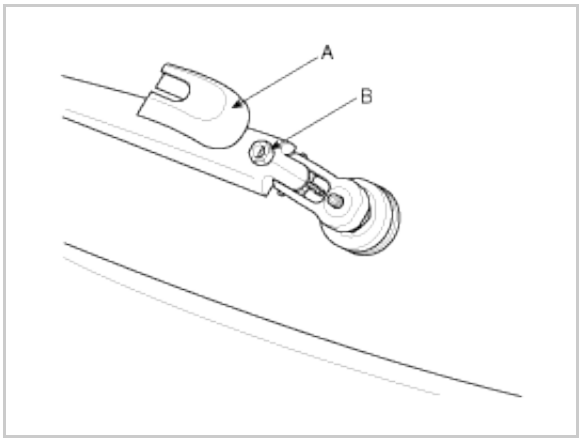
Rear Wiper / Washer

Rear Wiper Motor

REMOVAL

1. Remove the tail gate trim (Refer to the Body group - Tail gate).
2. Detach the wiper cap (A), and then remove the rear wiper arm after removing the mounting nut (B).

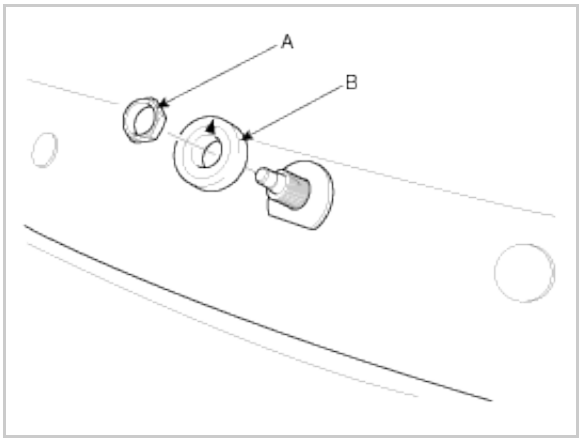
Tightening torque Nut(B) :
10~13 Nm (1.0~1.3 kgf.m, 7.2~9.4 lbf.ft)



3. Detach the wiper motor cover, and then remove the rear wiper cap & pad (B) after removing the mounting nut (A).

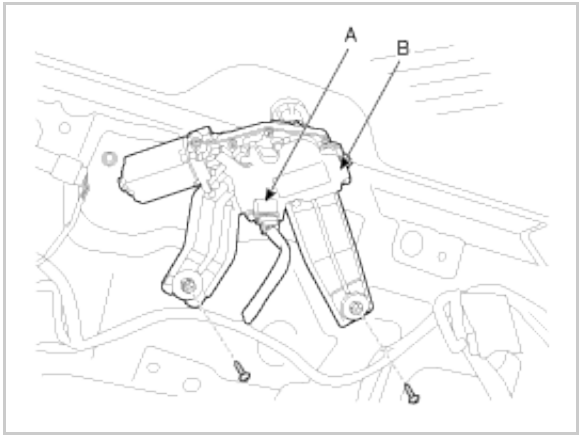
NOTICE

During installation, of the rear wiper cap and pad, ensure the arrow on the cap assembly is pointed upwards.



4. Disconnect the rear wiper motor connector (A) then remove the rear wiper motor (B) after removing 2 bolts.

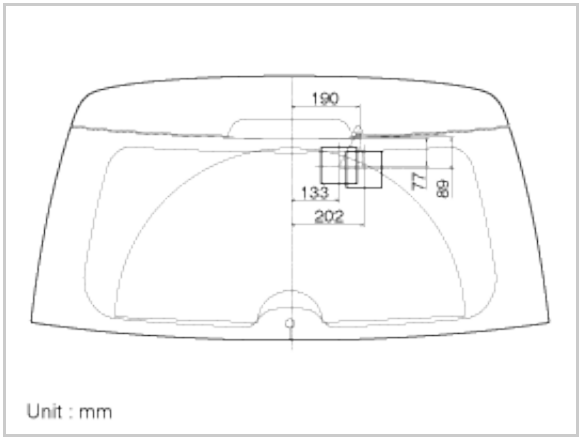
Tightening torque Nut :
7~11 Nm (0.7~1.1 kgf.m, 5.1~8.0lbf.ft)



5. Installation is the reverse of removal.

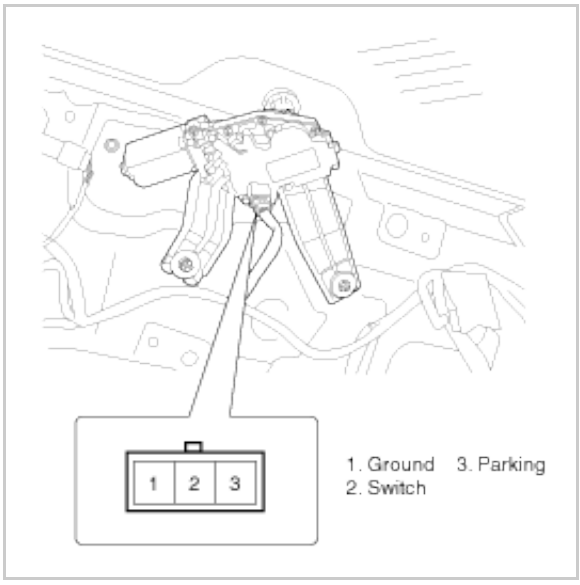
INSTALLATION

1. Install the rear wiper arm and blade to the specified position.
   ※ Specified position : The first defogger line from bottom of the rear window.
2. Set the rear washer nozzle on the specified spray position.



INSPECTION

1. Remove the 3P connector from the rear wiper motor.
2. Connect battery positive (+) and negative (-) cables to terminals 2 and 1 respectively.
3. Check that the motor operates normally. Replace the motor if it operates abnormally.

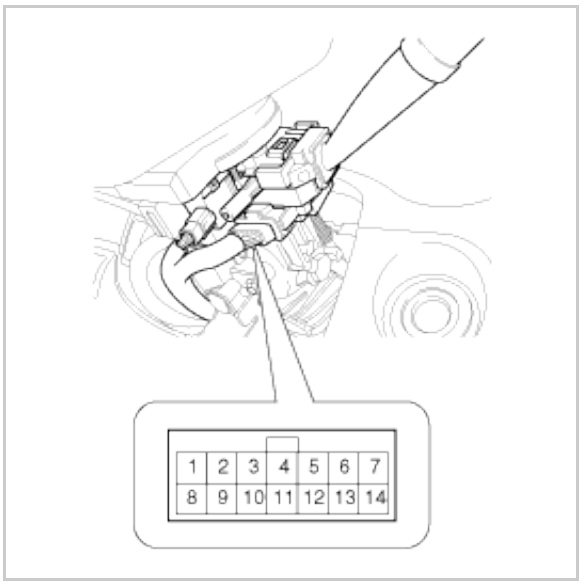


Rear Washer Switch

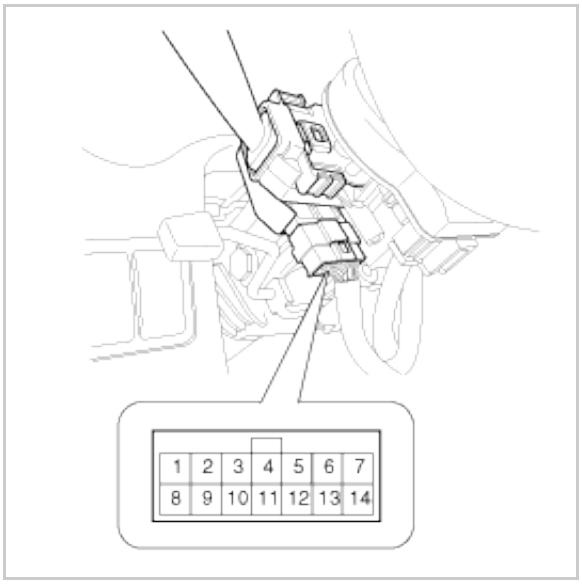
INSPECTION

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

[LHD]



[RHD]



REAR WIPER & WASHER SWITCH

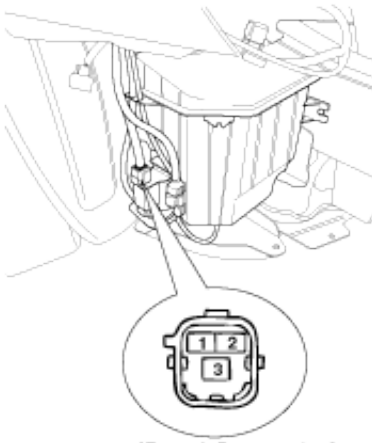
(RHD)

Terminal / Position	9(9)	10(10)	11(11)	12(12)
Rear washer	○	—	—	○
OFF				
INT			○	○
ON		○	—	○
Rear washer	○	—	—	○

Rear Washer Motor

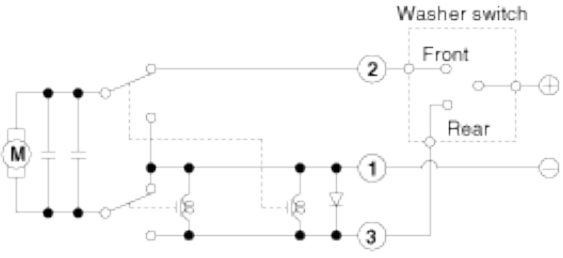
INSPECTION

1. With the washer motor connected to the reservoir tank, fill the reservoir tank with water.
2. Remove the front bumper. (Refer to the Body group- Front bumper)
3. Connect positive (+) and negative (-) battery cables to terminals 3 and 1 respectively to see that the washer motor runs and water is pumped.
4. Check that the motor operates normally.
   Replace the motor if it operates abnormally.



[Front & Rear washer]

1. Ground
2. Windshield washer (+)
3. Rear washer (+)

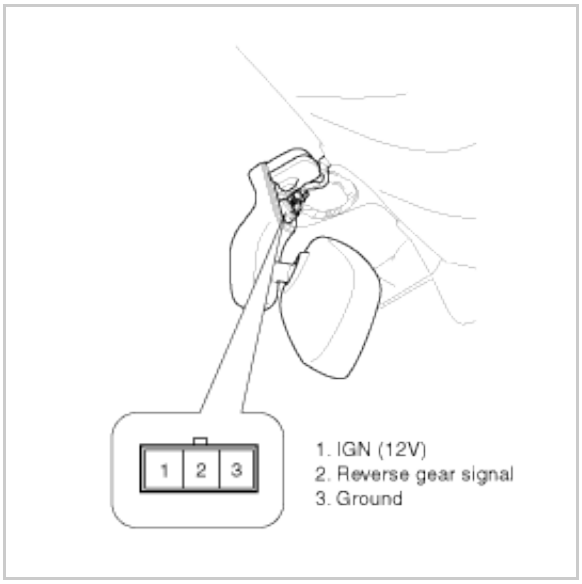


<Windshield & Rear washer motor>

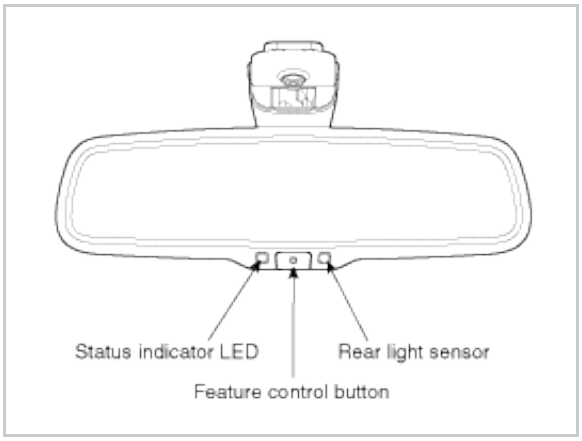
Electro Chromic Inside Rear View Mirror

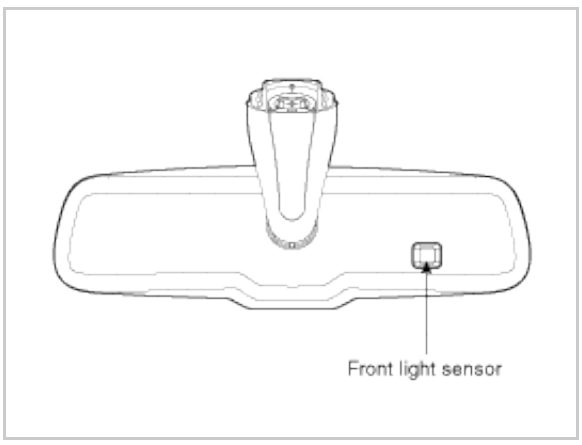
DESCRIPTION

The electrochromatic rear view mirror detects the ambient light using a built-in sensor and adjusts the reflectability of the mirror to prevent excess light (such as the light emitted by a following vehicle's headlights) from reaching the driver's eyes during night driving. To allow for maximum vision while backing up, the electrochromatic functionality of the mirror is deactivated whenever the transaxle is in 'R' range.



1. The front sensor sees if the brightness of the surroundings is low enough for the mirror to operate its function.
2. The rearward looking sensor detects glaring of the reflecting light from a following vehicle.
3. The ECM is darkened to the level as determined by the rearward looking sensor. When the glaring is no longer detected, the mirror stops functioning.





INSPECTION

Check it by the procedure below to see if the function of the ECM is normal.

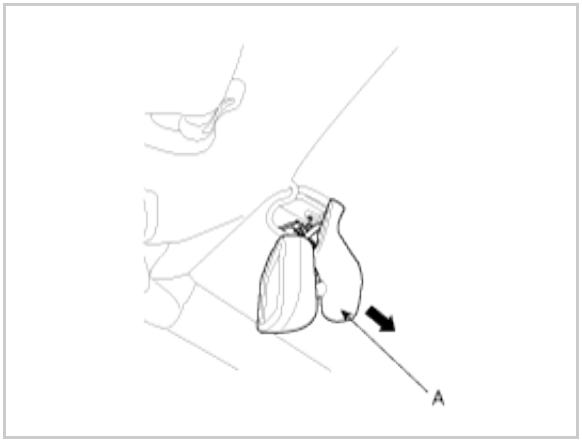
1. Turn the ignition key to the "ON" position.
2. Cover the front sensor to stop functioning.
3. Shine a light at the rear sensor.
4. The ECM should be darkened as soon as the rear sensor detects the light.

> **NOTICE**
>
> If this test is performed in daytime, the mirror may be darkened as soon as the looking sensor is covered.

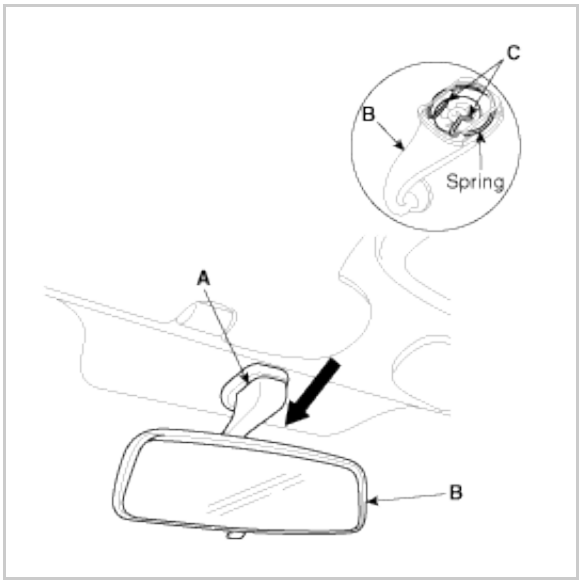
5. When the reverse gear is engaged, the ECM should not be darkened.

REPLACEMENT

1. Push the inside rear view mirror base down to remove the inside rear view mirror assembly (A) after removing the mirror wire cover.



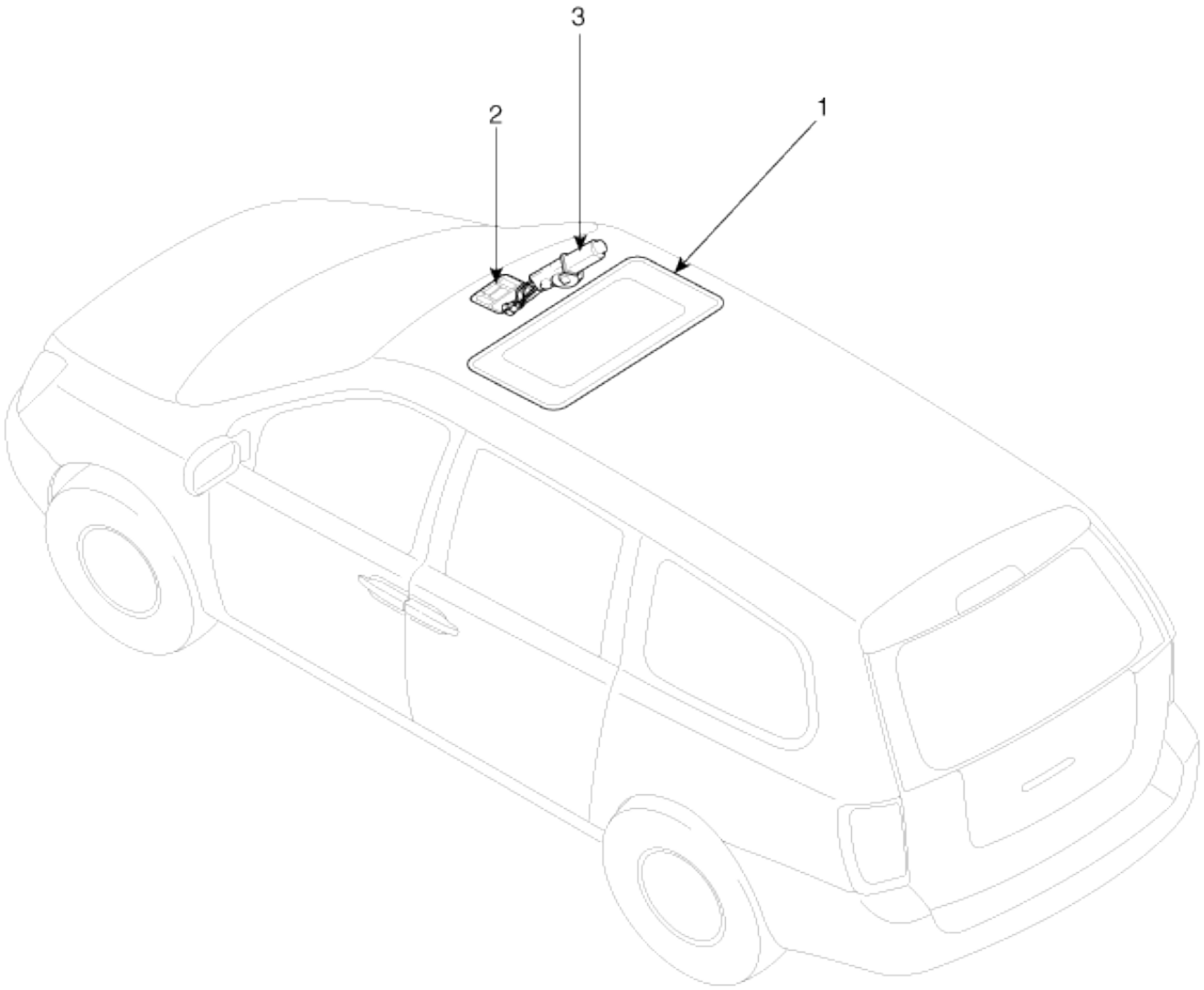
> **NOTICE**
>
> Take care not to damage the mounting bracket during removal.



2. Installation is the reverse of removal.

Sun Roof

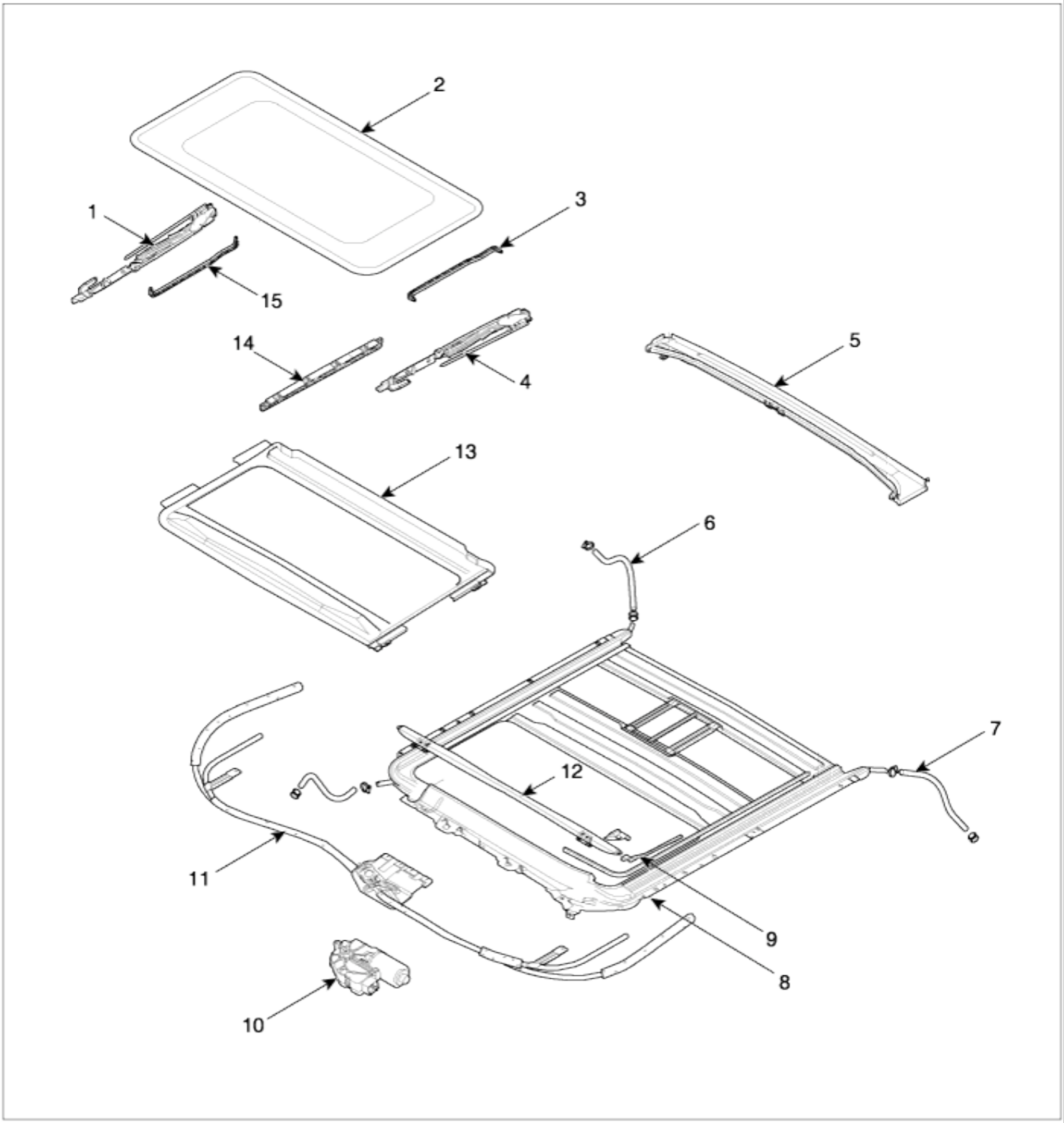
COMPONENT LOCATION



1. Sunroof
2. Sunroof switch
3. Sunroof motor & controller

Sun Roof Assembly

COMPONENTS



1. Guide assembly
2. Glass
3. Drip link
4. Guide assembly
5. Drip rail
6. Drain tube
7. Drain tube
8. Frame
9. Defector link
10. Motor
11. Drive unit
12. Defector
13. Sunshade
14. Decoration cover
15. Drip link

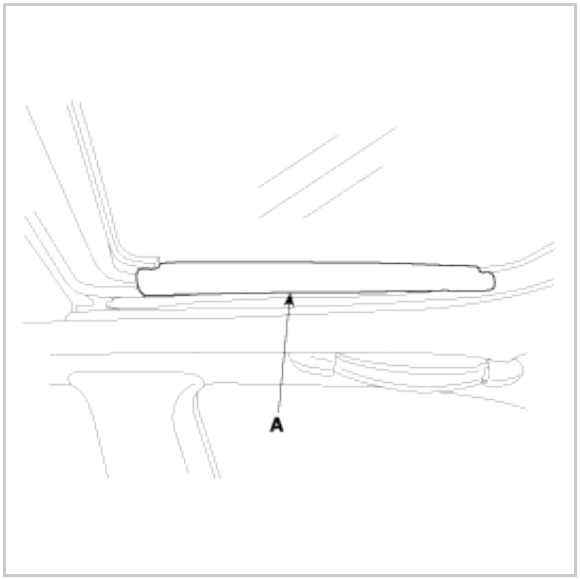
REPLACEMENT

GLASS REPLACEMENT

NOTICE

a. Put on glove to protect your hands.

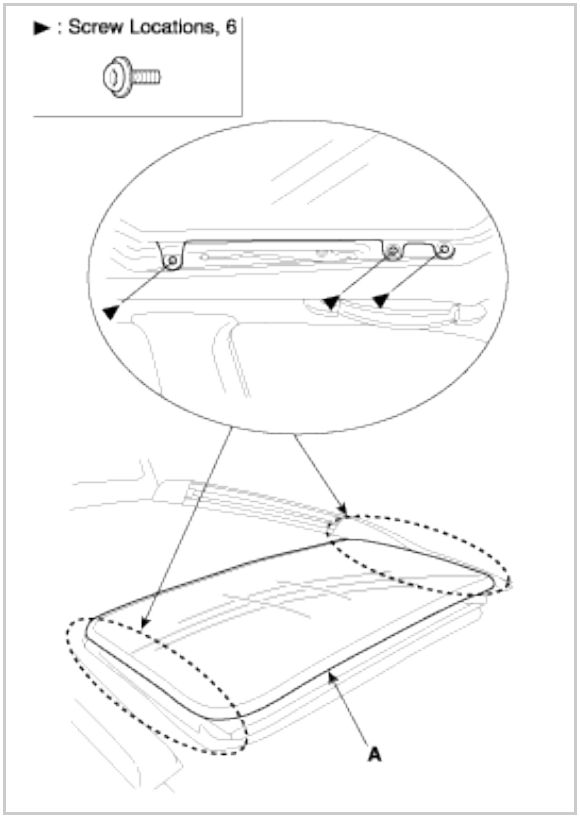
1. Remove both decoration cover (A).



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

NOTICE

a. Do not damage the roof panel.



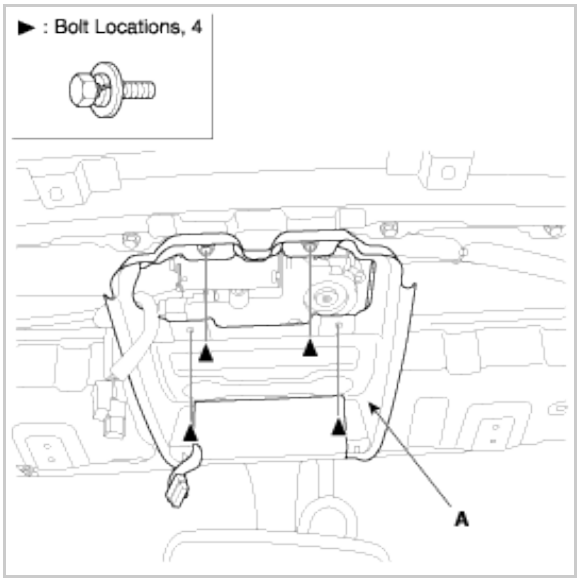
3. Installation is the reverse of removal.

MOTOR REPLACEMENT

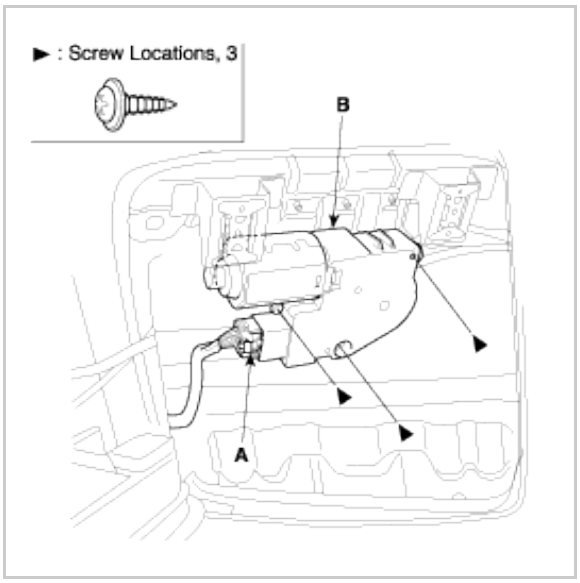
1. Remove the over head console.

NOTICE

a. 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).



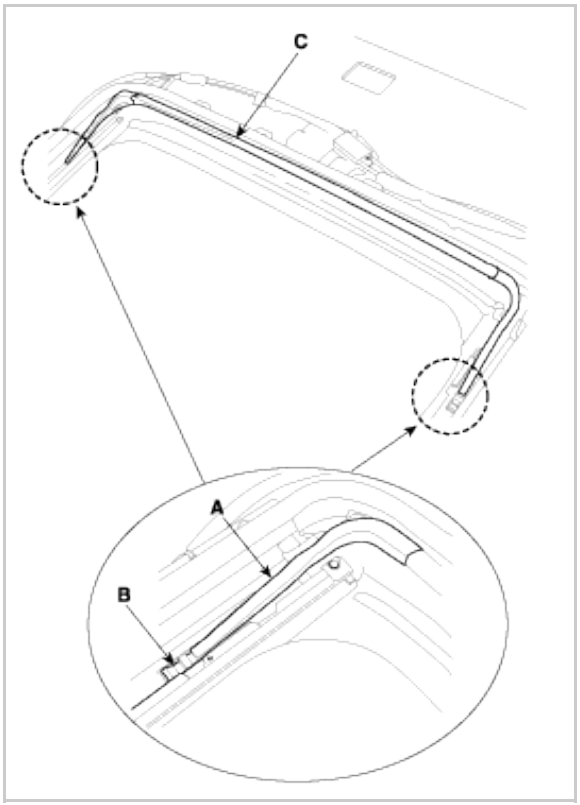
3. Installation is the reverse of removal.

NOTICE

a. 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).



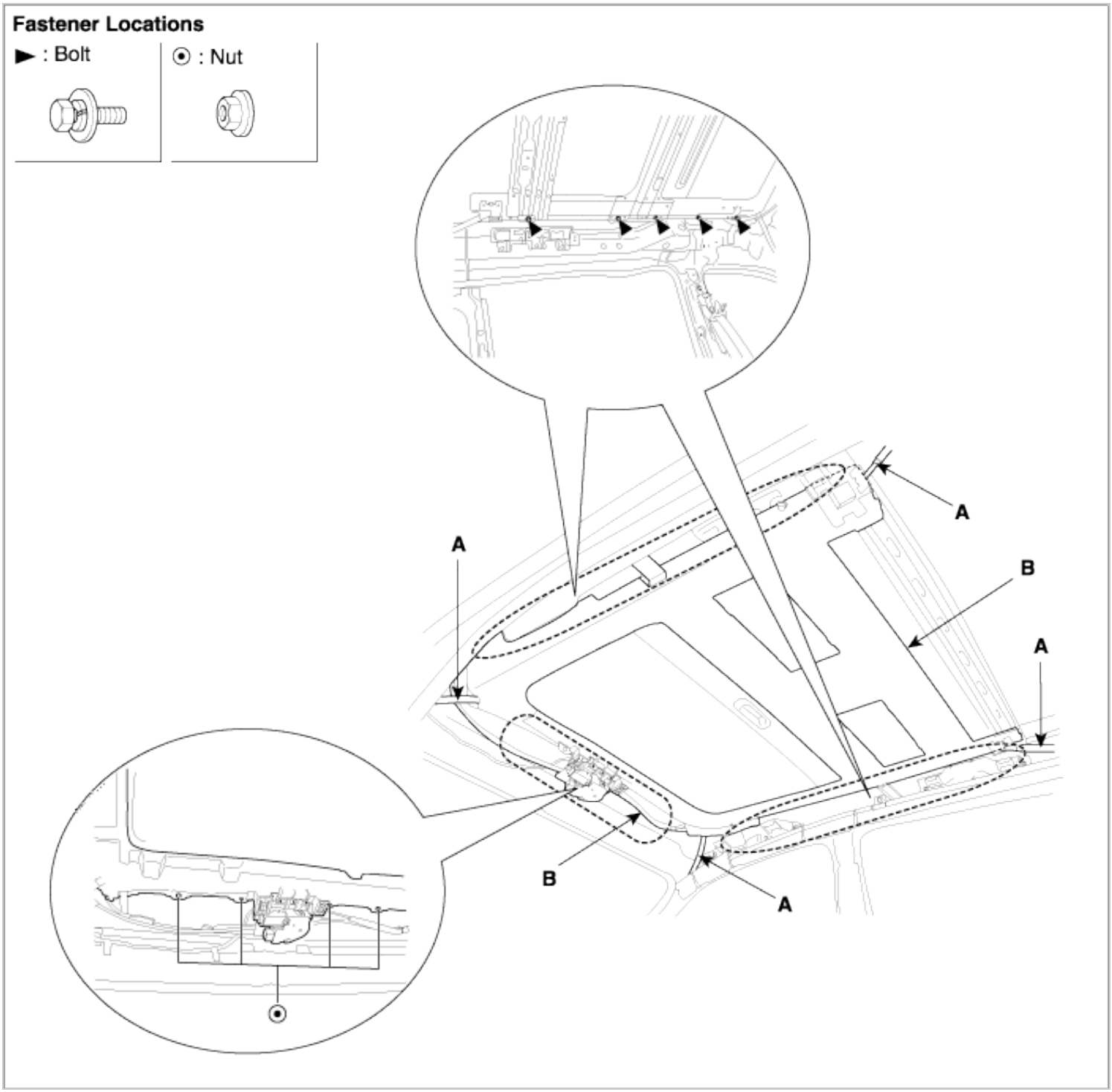
3. Installation is the reverse of removal.

SUNROOF ASSEMBLY REPLACEMENT

1. Remove the follows parts.
   a. Front and rear door scuff trim.
   b. Center upper and lower pillar trim.
   c. Headliner.
   d. Sunroof glass.
2. Disconnect the drain tubes (A).
3. After loosening the mounting bolts and nuts, remove the sunroof assembly (B).

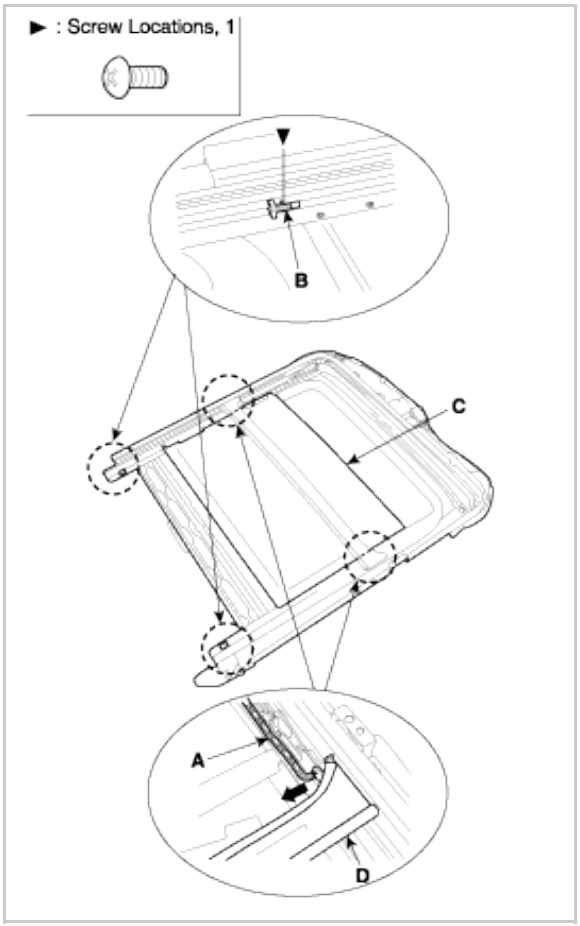
> NOTICE
>
> a. Take care not to scratch the interior trims and other parts.

4. Installation is the reverse of removal.



SUNSHADE AND DRIP RAIL REPLACEMENT

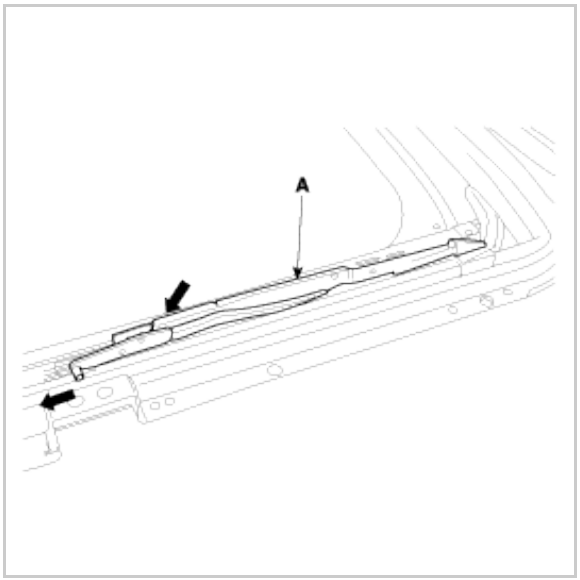
1. Remove the sunroof assembly.
2. Remove the drip link (A) and sunshade stopper (B).
3. Remove the sunshade (C) and drip rail (D).



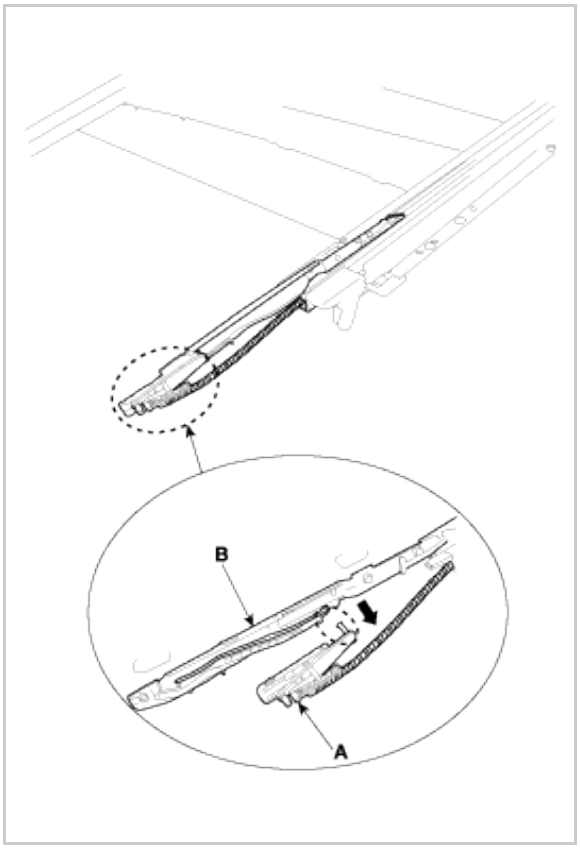
4. Installation is the reverse of removal.

GUIDE ASSEMBLY REPLACEMENT

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



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

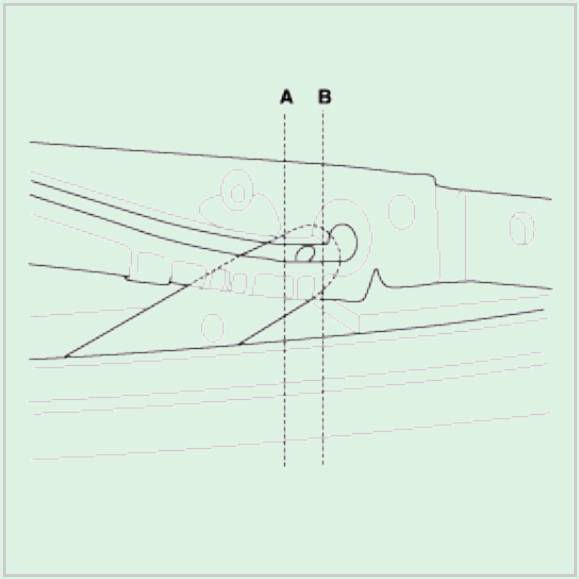


4. Installation is the reverse of removal.

NOTICE

a. Make sure to align the slide with the center of “A” and “B”

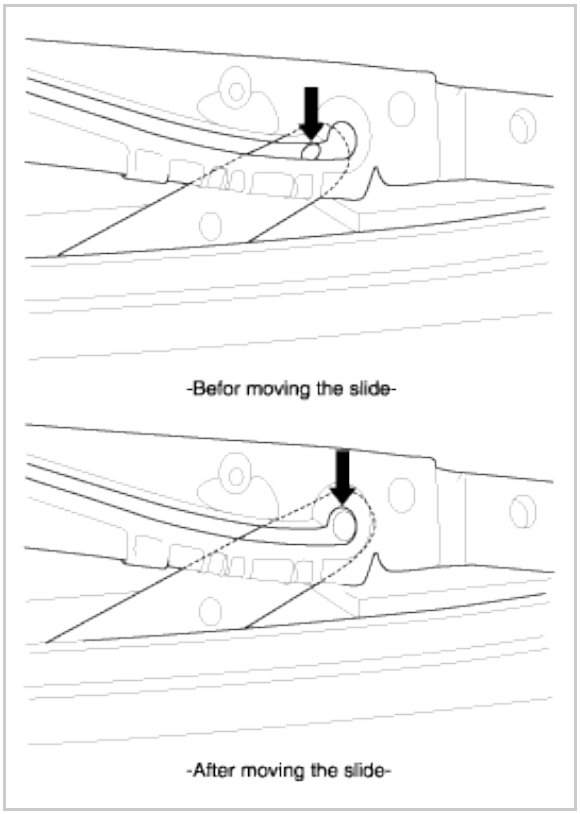
b. Make sure to initialize the motor.



ADJUSTMENT

HOW TO INITIALIZE

1. Check that the glass has been installed.
   a. Finish height adjustment.
2. Push the up switch. (Keep on pushing the switch)
   a. The slide moved 5mm forward after 15 seconds.



3. After moving the slide 5mm forward, release the switch just momentarily.
   a. If the operation above is normal condition, the sunroof opens and closes.
4. When the sunroof is closed completely, turn OFF the UP switch initialize the motor completely.

WHEN TO INITIALIZE THE MOTOR

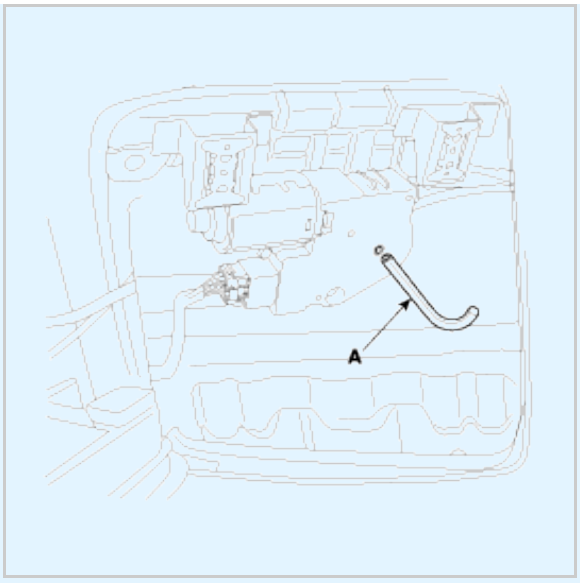
1. First operation the vehicle after manufactured it.
2. Initial value is erased or damaged because of short power electric discharge during operation
3. After using the manual handle.

OPERATING THE SUNROOF EMERGENCY HANDLE

1. Use the sunroof emergency handle to close and open the sunroof manually for the following case only.
   a. To close the sunroof before driving a vehicle in a rainy day or on the highway if the sunroof cannot be closed due to failure of the sunroof motor or controller.
2. Operating method
   a. Remove the overhead console
   b. Push the emergency handle up into the hexagonal drive (A) of the sunroof motor. You must push hard enough to disengage the motor clutch; otherwise the emergency handle will slip due to incomplete fit in the motor.
   c. Carefully turn the emergency handle clockwise to close the sunroof.
   d. After closing the sunroof, wiggle the handle back and forth as you remove the tool from the motor, to ensure the motor clutch reengages.
   e. A 5mm hex socket may be used in place of the emergency handle, with a” Speeder” type handle.

CAUTION

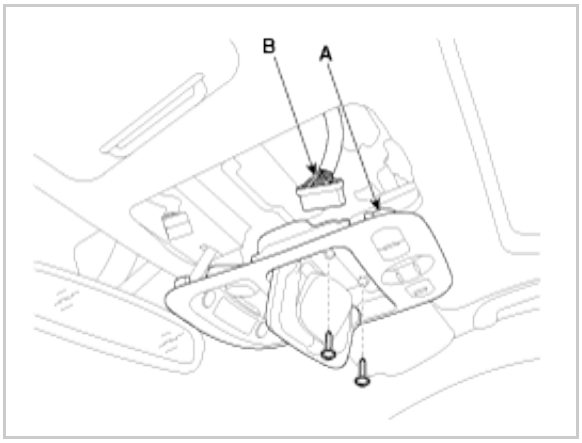
a. Do not use power tools to operate the sunroof.
b. Damage to the components may occur.


A

Sun Roof Switch

INSPECTION

1. Disconnect the negative (-) battery terminal.
2. Remove the lens and open the sunglass case cover from the overhead console then remove the 2 screws holding the overhead console. And disconnect the connector then remove the overhead console lamp assembly from the headliner.



3. Check for continuity between the terminals. If the continuity is not as specified, replace the sunroof switch.



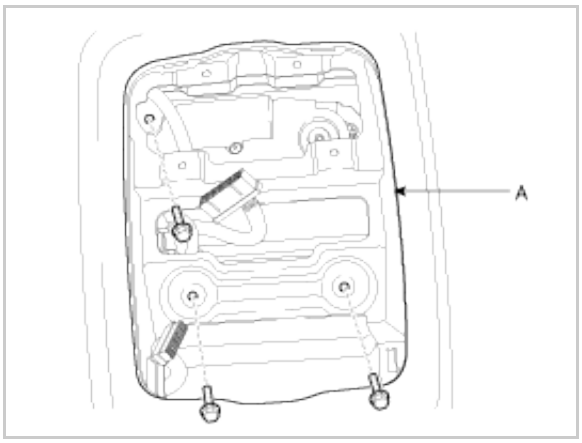
[Switch side connector]

Position \ Terminal	2	6	7	4
SLIDE OPEN	○	—	—	○
CLOSE/DOWN	○	○		
TILT UP	○	—	○	

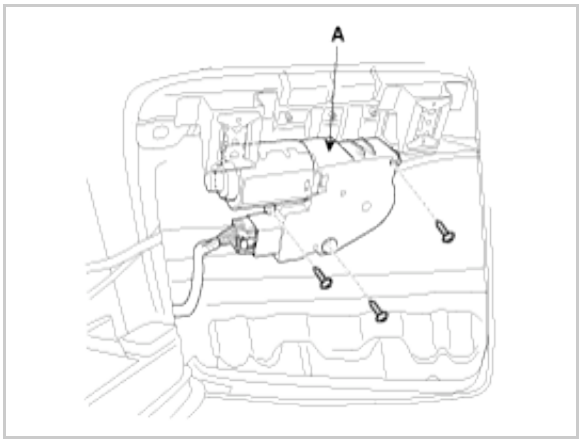
Sun Roof Motor

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the overhead console and loosen sunroof motor bracket (A) mounting bolts (4EA).



3. Remove sunroof motor mounting screw (3EA) and disconnect connector (10pin). And then remove the sun roof motor.



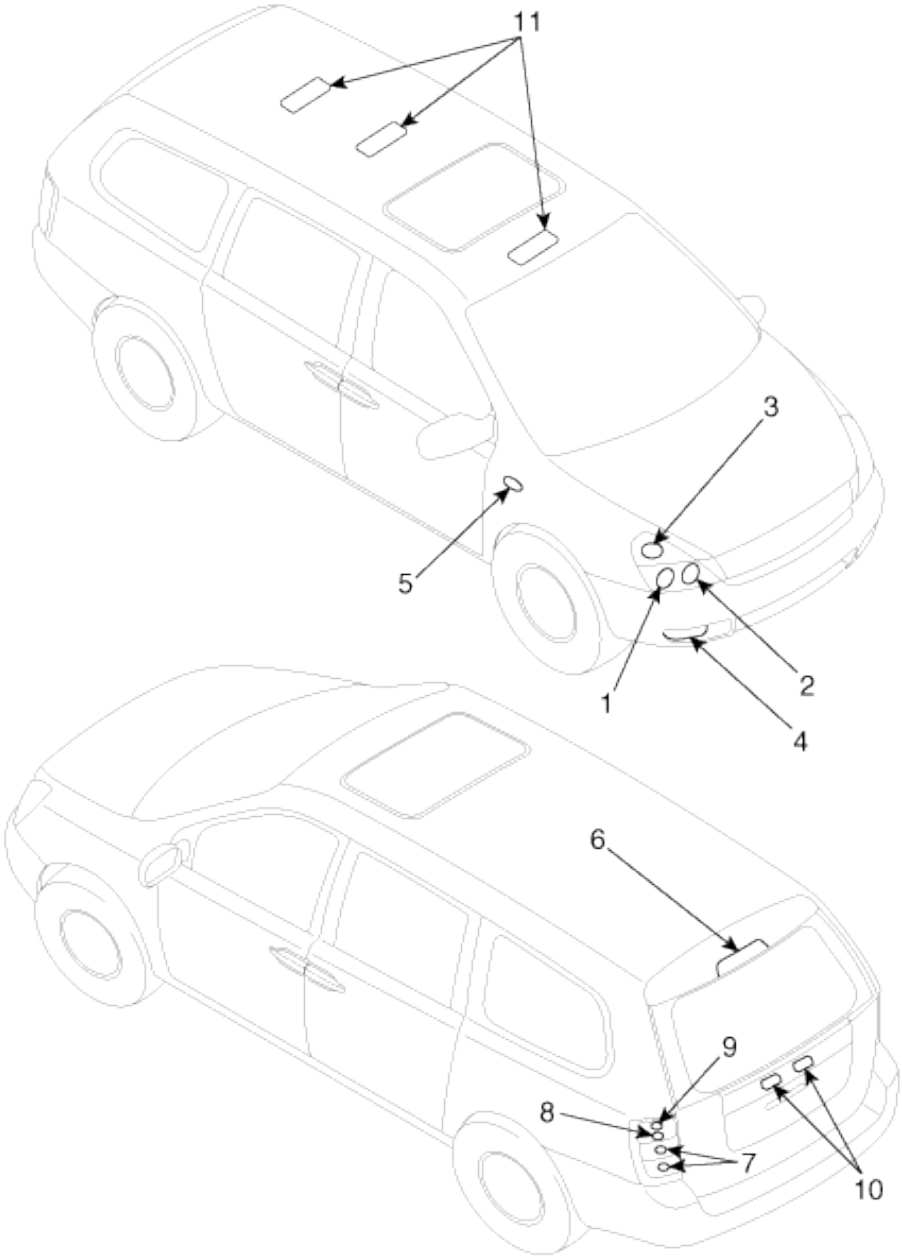
RESETTING THE SUNROOF

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. Press and hold the TILT UP button more than 15s until the sunroof has tilted upward/downward slightly.
2. When this is complete, Press and hold the TILT UP button once again until the sunroof has raised above and returned to the maximum TILT UP position.
   When this is complete, the sunroof system is reset.

Lighting System

COMPONENT LOCATION



1. Head lamp(Low)
2. Head lamp(High)
3. Front turn signal lamp/Position lamp
4. Front fog lamp
5. Side repeater
6. High mounted stop lamp
7. Tail/stop lamp
8. Rear turn signal lamp
9. Back up lamp
10. License plate lamp
11. Room lamp

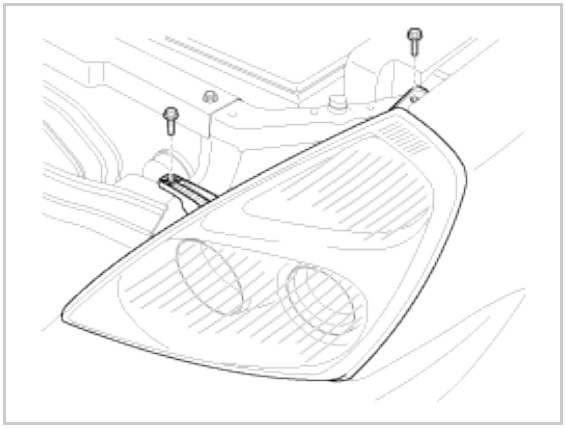
SPECIFICATION

Items	Bulb Watt (W)
Head lamp (High)	55
Head lamp (Low)	55
Front turn signal lamp	28
Front position lamp	8
Front side marker lamp	5
Front fog lamp	35
Rear stop/tail lamp	21/5
Back up lamp	16
Rear turn signal lamp	27
Rear fog lamp	21
License plate lamp	5
Side repeater	5
Room lamp	10
Overhead console lamp	10 x 2
High mounted stop lamp	LED
Glove box lamp	5
Luggage room lamp	5
Door courtesy lamp	5

Head Lamps

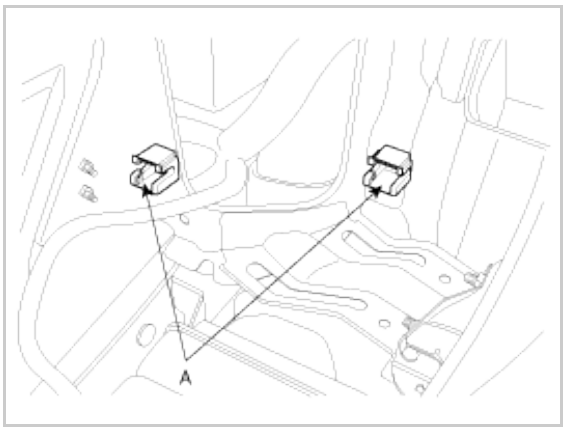
REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Loose the mounting bolts (2EA).

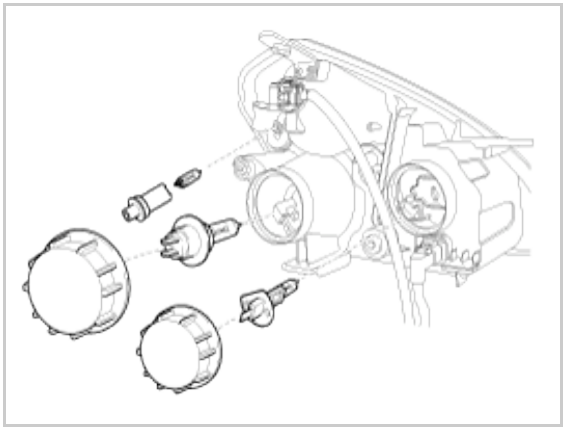


3. Remove the head lamp assembly after disconnecting the lamp connectors.

> NOTICE
>
> Take care that holding clip (A) is not to be damaged.



4. Remove the head lamp rear cover and pulling up head lamp bulb fixing wire clip.



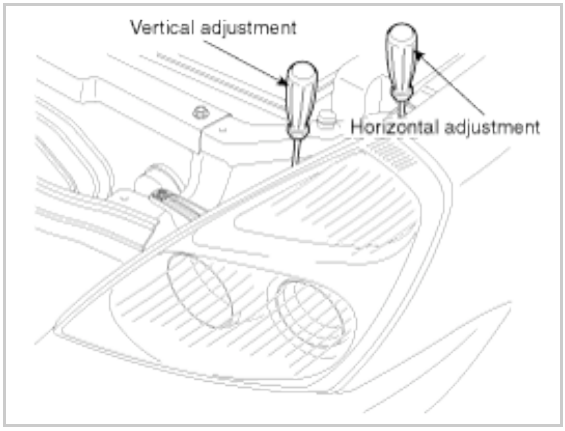
5. Replace the bulb.
6. Installation is the reverse of removal.

HEAD LAMP AIMING INSTRUCTIONS

Alternately turn the adjusting gear to adjust the head lamp aiming. If beam-setting equipment is not available, proceed as follows :

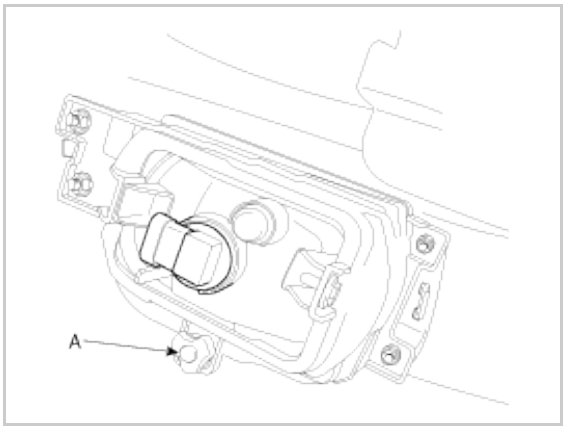
1. Inflate the tires to the specified pressure and remove any loads from the vehicle except the driver, spare tire, and tools.

2. The vehicle should be placed on a flat floor.
3. Check the suspension spring.
4. 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.
5. 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 and horizontal adjustments to the lower beam using the adjusting wheel.

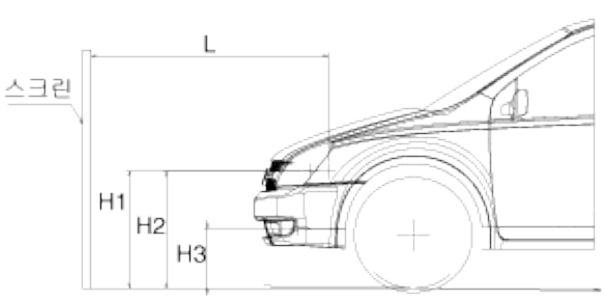


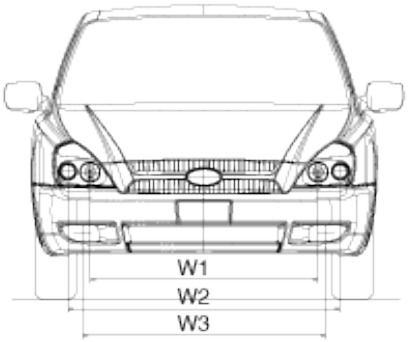
FRONT FOG LAMP AIMING

The front fog lamps should be aimed as the same manner used to adjust the head lamps.
With the front fog lamps and battery normal condition, aim the front fog lamps by turning the adjusting gear (A).



HEAD LAMP AND FOG LAMP AIMING POINT





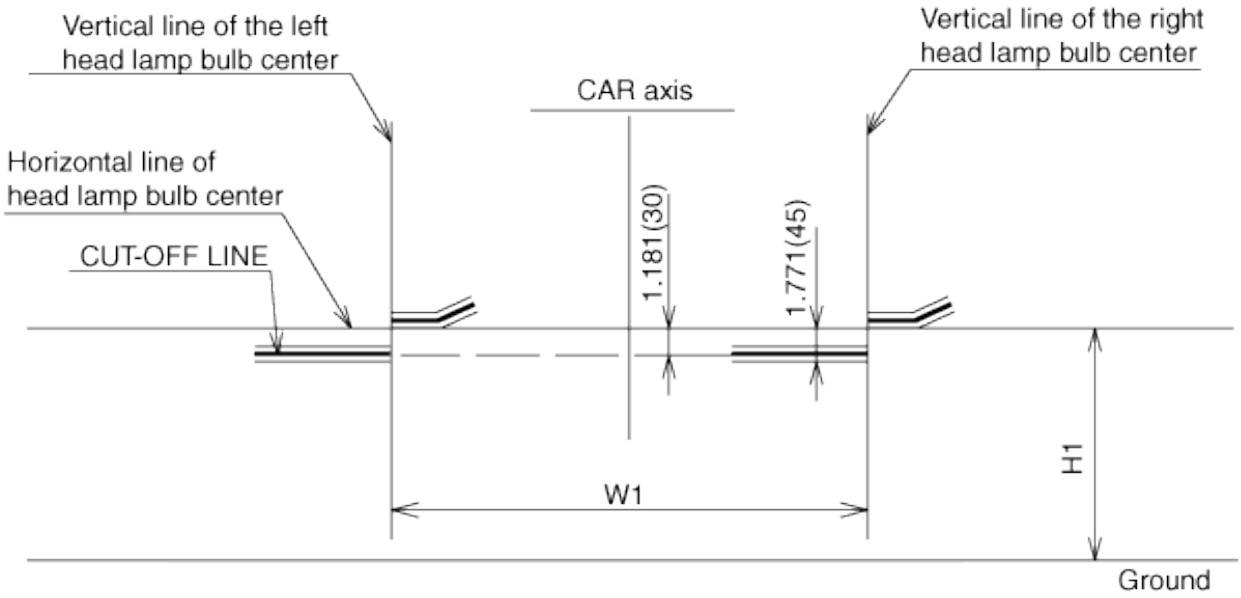
H1 : Height between the head lamp bulb center and ground (High beam)
H2 : Height between the head lamp bulb center and ground (Low beam)
H3 : Height between the fog lamp bulb center and ground
W1 : Distance between the two head lamp bulbs centers (High beam)
W2 : Distance between the two head lamp bulbs centers (Low beam)
W3 : Distance between the two fog lamp bulbs centers
L : Distance between the head lamp bulb center and screen

Unit : mm

Vehicle condition	H1	H2	H3	W1	W2	W3	L
Without driver	28.3(719.5)	28.5(724.5)	14.4(366)	60.0(1,526)	50.3(1,278)	52.5(1,363)	118.1(3,000)
With driver	28.1(714.5)	28.3(719.5)	14.2(361)				

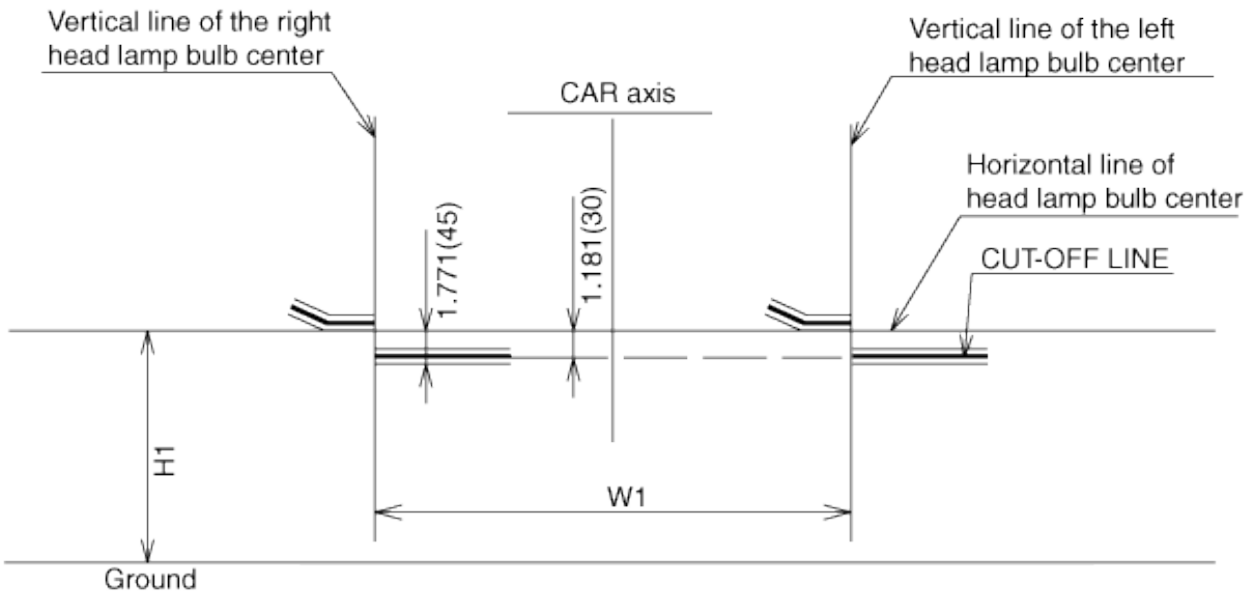
1. Turn the low beam on with driver.
   The cut-off line should be projected in the allowable range (shaded region).

[LHD]



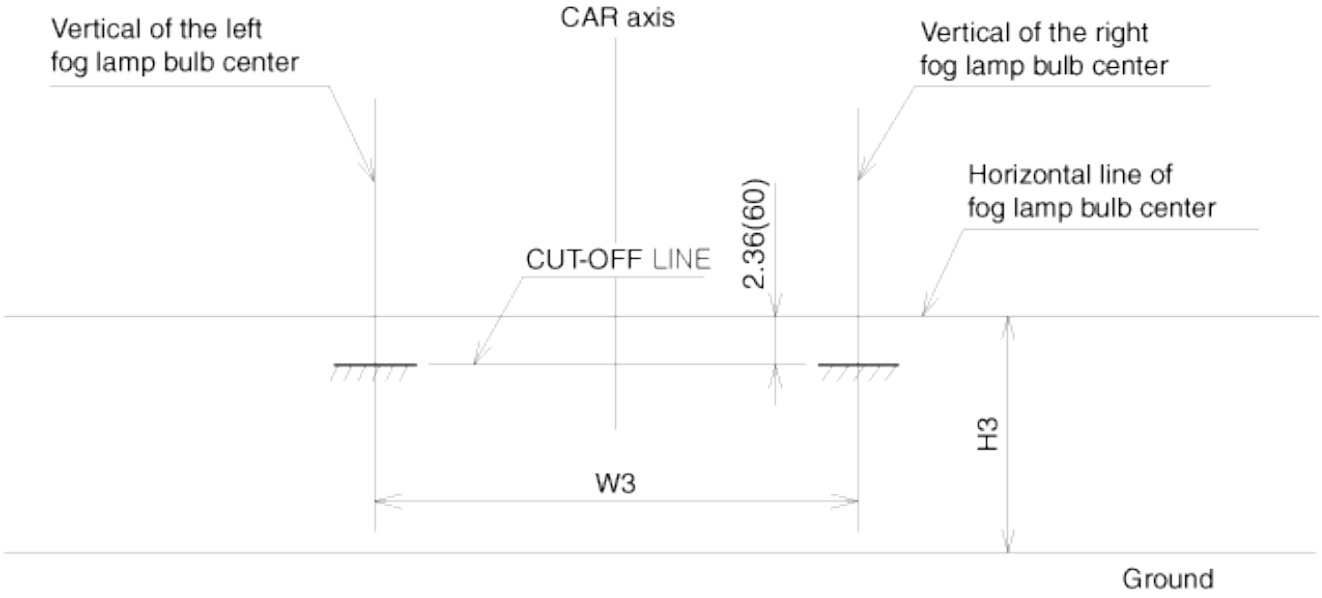
Unit : in.(mm)

[RHD]



Unit : in.(mm)

2. Turn the front fog lamp on with driver.
   The cut-off line should be projected in the allowable range (shaded region)



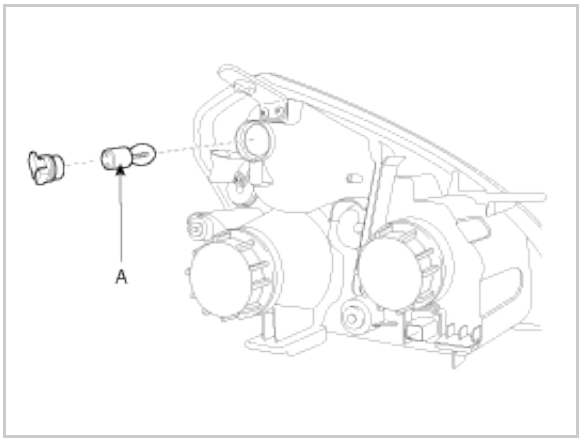
Unit : in.(mm)

Turn Signal Lamp

REPLACEMENT

FRONT TURN SIGNAL LAMP

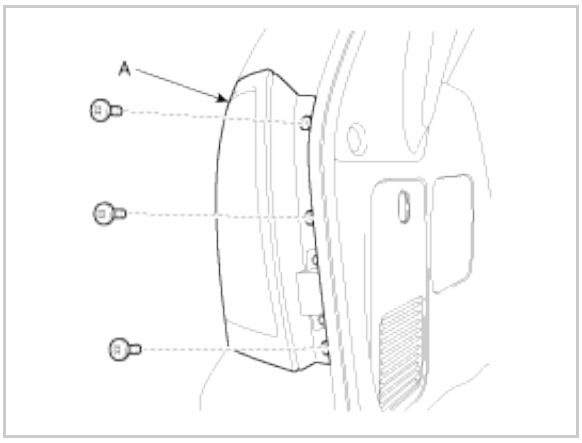
1. Disconnect the negative (-) battery terminal.
2. Remove front lamp assembly.
3. Remove the socket in a counterclockwise direction.



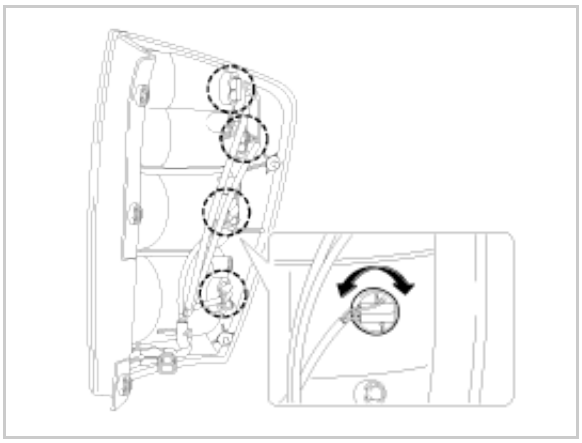
4. Replace the bulb (A).

REAR TURN SIGNAL LAMP

1. Disconnect the negative (-) battery terminal.
2. Remove the rear lamp assembly (A) after removing the mounting screw (3EA) and connector.



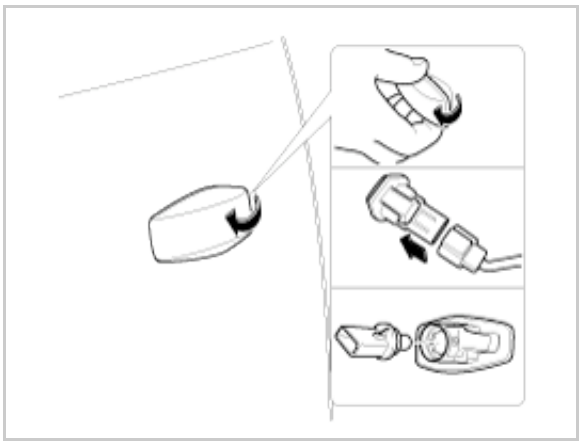
3. Remove the socket in a counterclockwise direction and replace the bulbs.



SIDE TURN SIGNAL LAMP

1. Disconnect the negative (-) battery terminal.
2. Disconnect the connector after removing the lens.

3. Remove the socket in a counterclockwise direction.

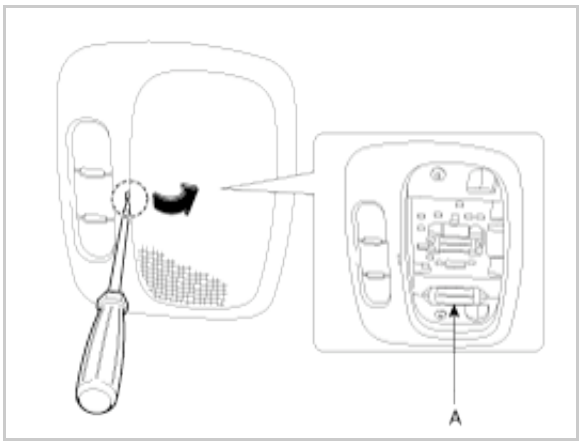


4. Replace the bulb.

Room Lamp

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Detach the lamp lens from the room lamp with a flat-tip screwdriver (-) then replace the bulb.



3. Pull the bulb down and replace it with a new one.

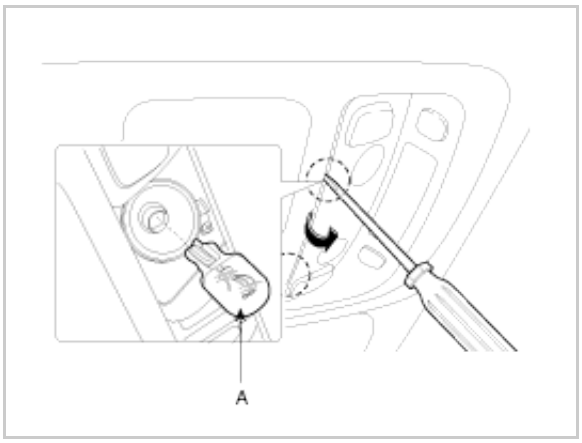
> **NOTICE**
>
> Take care that holding clip (A) is not to be damaged.

4. Installation is the reverse of removal.

Overhead Console Lamp

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Replace the bulb after removing the lens with a flat-tip screwdriver.



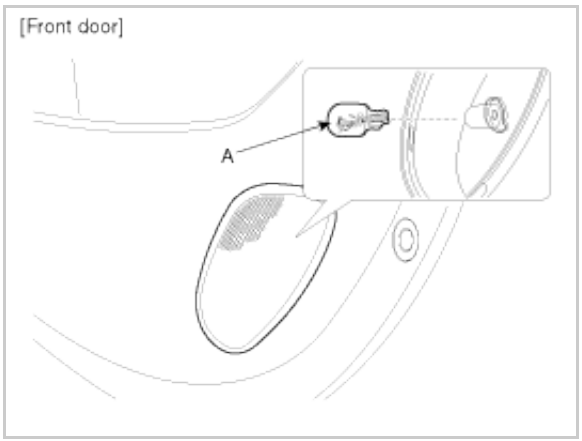
3. Remove the bulb and replace it with a new one

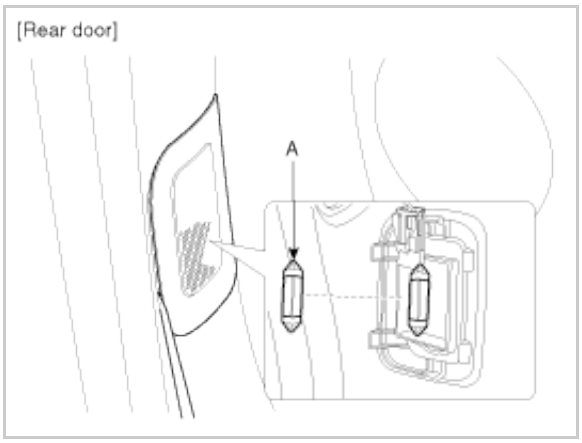
> **NOTICE**
>
> Take care that holding clip (A) is not to be damaged

Courtesy Lamp

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Replace the bulb (A) after removing the lens with a flat-tip screwdriver.





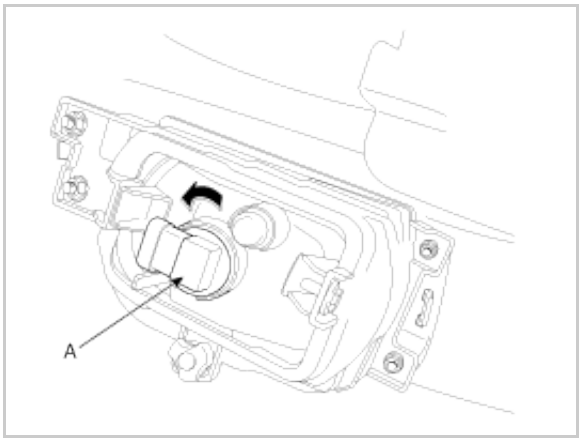
3. Remove the bulb and replace it with a new one.

> **NOTICE**
>
> Take care that holding clip (A) is not to be damaged.

Front Fog Lamps

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the front lamp assembly.
3. Remove connector and the socket in a counterclockwise direction.



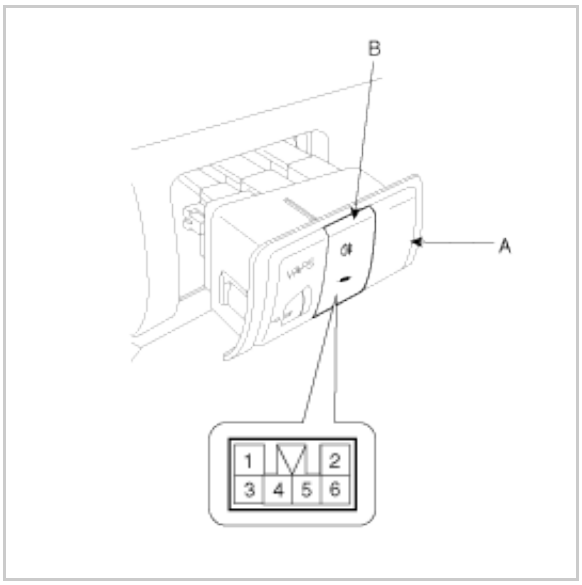
4. Remove the bulb (A) and replace it with a new one.

Rear Fog Lamp

INSPECTION

REAR FOG LAMP SWITCH

1. Disconnect the negative (-) battery terminal.
2. Remove the lower crash pad switch (A) from the side crash pad cover by using the scraper and then disconnect the connectors.
3. Remove the rear fog lamp (B) switch from lower crash pad switch.



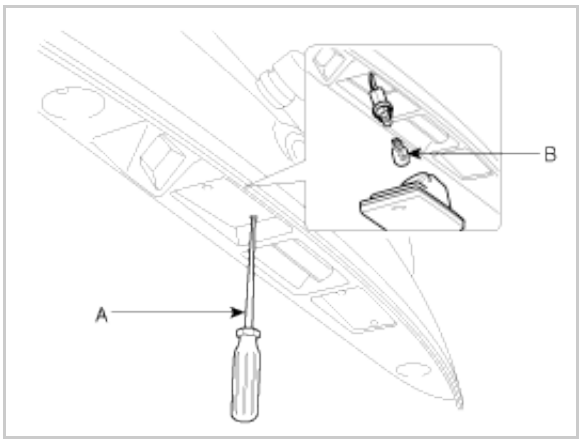
4. Check for continuity between the terminals in each switch position according to the table.

Terminal / Position	2	5	1	4	3
ON		illumination		IND.	
OFF					

License Lamps

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the license plate lamp cover mounting screw with a flat-tip screwdriver.



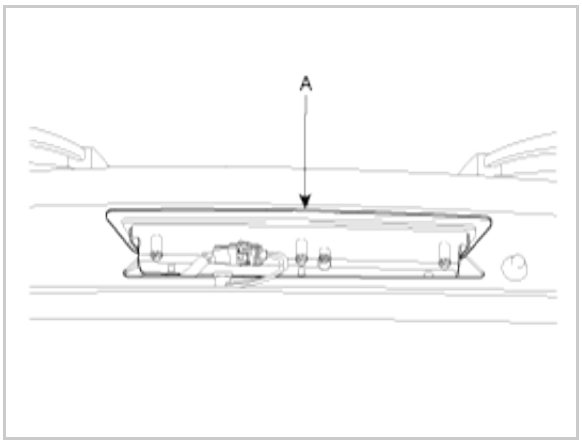
3. Pull the bulb (B) down and replace it with a new one.

High Mounted Stop Lamp

REPLACEMENT

HIGH MOUNTED STOP LAMP

1. Disconnect the nagative (-) battery terminal.
2. Open the tail gate and disconnect the high mounted stop lamp mounting bolts (3EA). And then remove the high mounted stop lamp(A).



3. Installation is the reverse of removal.

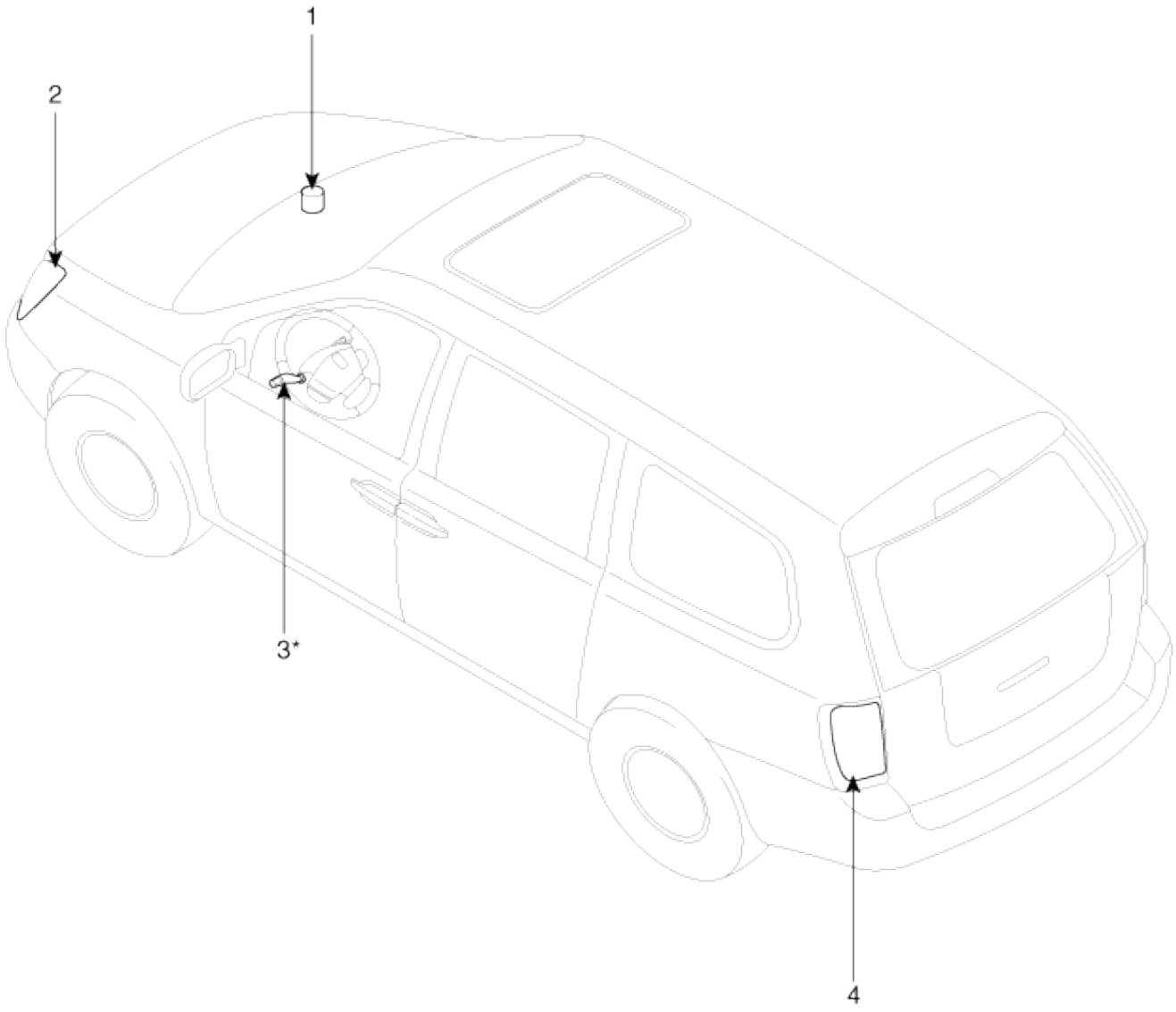
Auto Lighting System

DESCRIPTION

The auto light control system operates by using the auto light switch.
If you set the multi-function switch to "AUTO" position, the tail lamp and head lamp will be turned automatically on or off according to external illumination.

COMPONENT LOCATION

The parts with asterisk(*) :
This illustration is shows the LHD type.
RHD type is symmetrical.



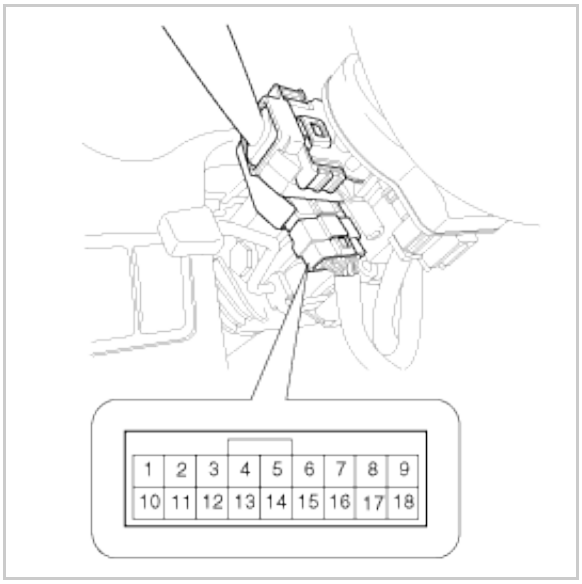
1. Auto light unit
2. Head lamps
3. Lighting switch (AUTO)
4. Tail lamps

Auto Light Switch

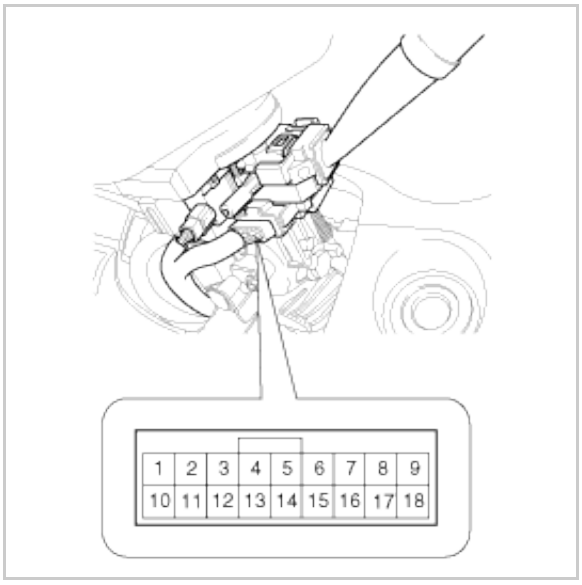
INSPECTION

Check for continuity between terminal and terminal while operating the auto light switch.

[LHD]



[RHD]



(RHD)

Terminal / Position	14(13)	15(14)	16(15)	17(16)
OFF				
I	○			○
II	○	○		○
AUTO			○	○

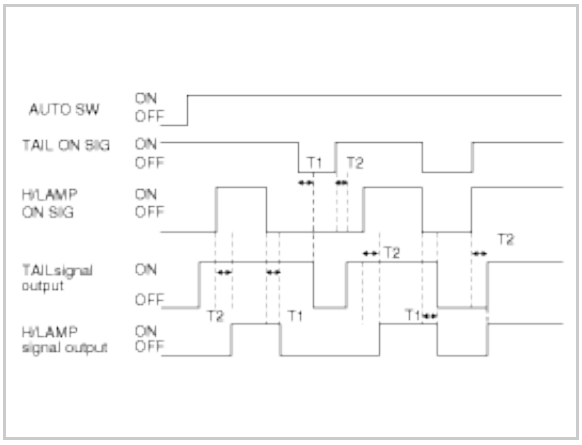
Auto Light Sensor

INSPECTION

While operating the auto light switch, check if the operations are normal as shown in the timing chart.

1. Auto light sensor value is always read at IGN ON.
2. Light is turned ON after 1sec±0.1sec when auto light sensor value is same as light ON input value.
3. Light is turned OFF after 2sec±0.2sec when sensor value is same as light OFF input value.
4. Tail lamp and head lamp are turned ON when sensor value is same as tail lamp ON input value.
5. Light ON value of sensor is based on the below table.
6. Head lamp signal is output when head lamp switch is ON. After head lamp is turned OFF, head lamp signal output is immediately stopped if head lamp OFF luminance condition is met at auto light switch ON.

	TAIL LAMP, AV LAMP	HEAD LAMP (low beam)
ON	1.77V+/-0.08V	0.63V+/-0.06V
OFF	3.47V+/-0.10V	1.02V+/-0.06V

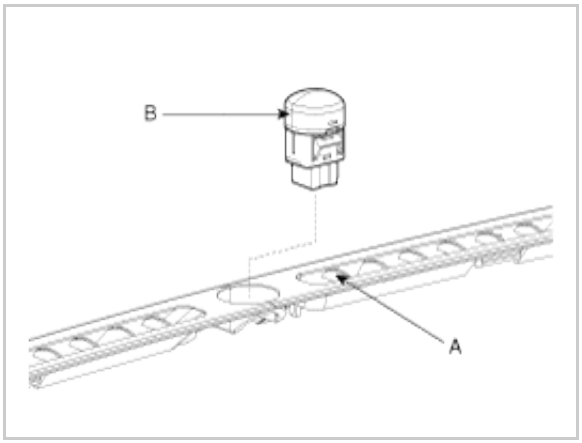


T1 : 2 ± 0.2 sec
T2 : 2 ± 0.2 sec.

REPLACEMENT

Photo & auto light sensor inspection

1. Disconnect the crash pad (Refer to Body group - Crash pad).
2. Remove the Photo & auto light sensor (B) from crash pad.



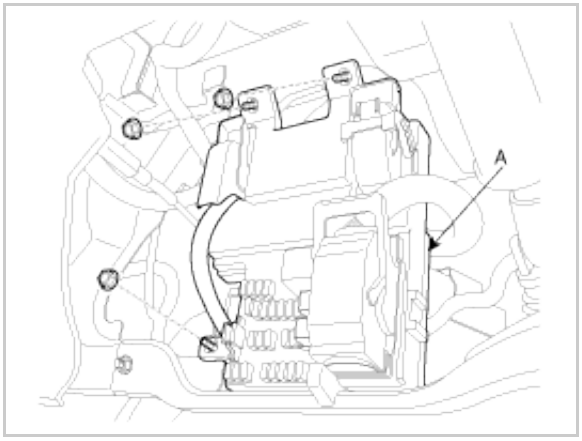
3. Installation is the reverse of removal.

Daytime Running Lights

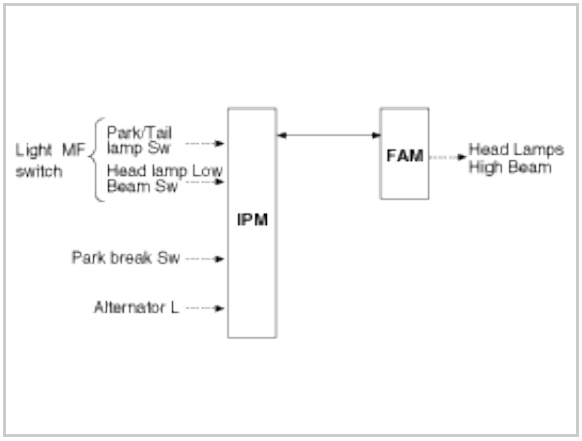
Daytime Running Lights Control Module

INSPECTION

1. The daytime running unit (A) is integrated in the IPM.



2. Functional diagram.



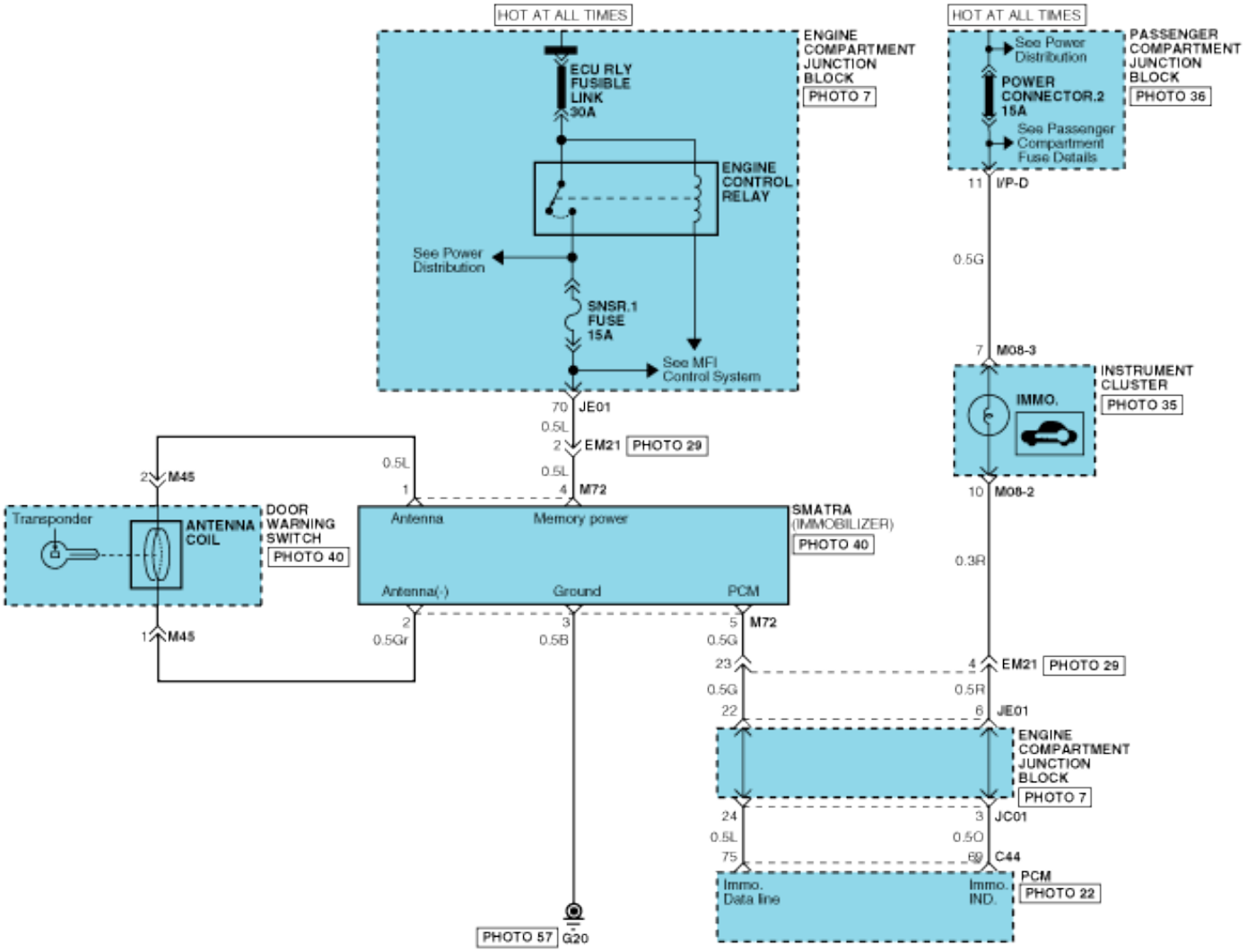
3. The DRL function operates the Head lamps High Beam at 50% of full illumination. The DRL function is active if :
   a. the engine is running
   b. the Head lamp multifunction switch is in OFF position or 'Park and Tail lamp' (Auto light function deactivated)
   c. The Park break switch is OFF.
   When the DRL function is active, the Head lamps High Beam can't be turned ON, except for the Flash To Pass activation.

4. If the daytime running light is not operated well, Inspect the connector and terminals to be sure they are all making good contact.
   If the terminals are bent, loose or corroded, repair them as necessary, and recheck the system.
   If the terminals look OK, go to step 4.

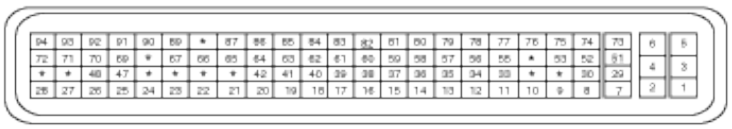
5. Make these input tests at the connector by using ETM.
   If any test indicates a problem, find and correct the cause, then recheck the system.
   If all the input tests prove OK, the IPM (In-panel module) must be faulty; replace it.

Immobilizer System

CIRCUIT DIAGRAM

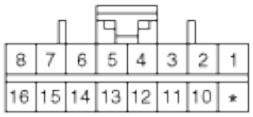


C44



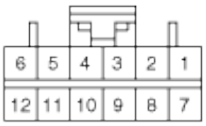
AMP_PCU_94F_B

M08-2



AMP_040M2_16F_B

M08-3



AMP_040M2_12F_B

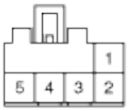
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M45



KET_6901_06M_W

M72



KUM_CDR_05F_W

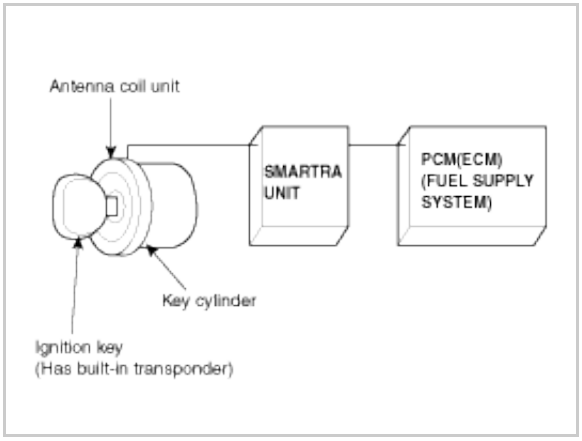
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DESCRIPTION

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.

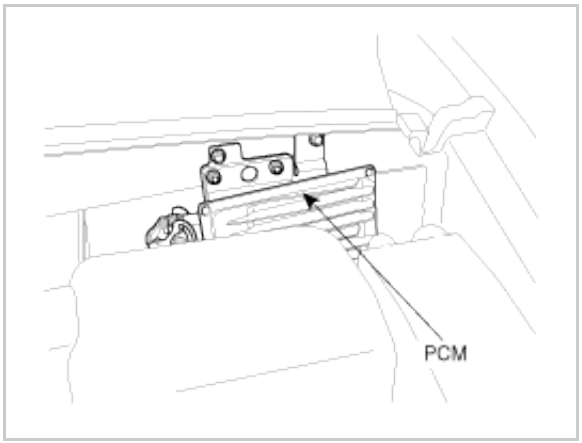
1. SMARTRA type immobilizer
   a. The SMARTRA system consists of a transponder located in the ignition key, an antenna coil, a SMARTRA unit, an indicator light and the PCM(ECM).
   b. The SMARTRA communicates to the PCM(ECM) (Engine Control Module) via a dedicated communications line. Since the vehicle 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 Scan tool (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 four key codes.
   h. If the customer has lost his key, and cannot start the engine, contact motor service station.



COMPONENTS OPERATIONS

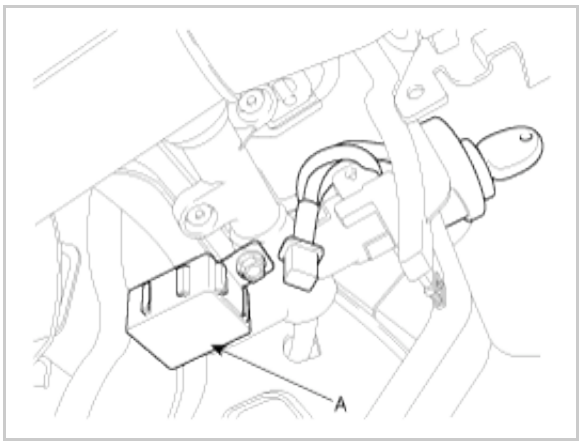
PCM (Power Train Control Module)

1. The PCM(ECM) 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).



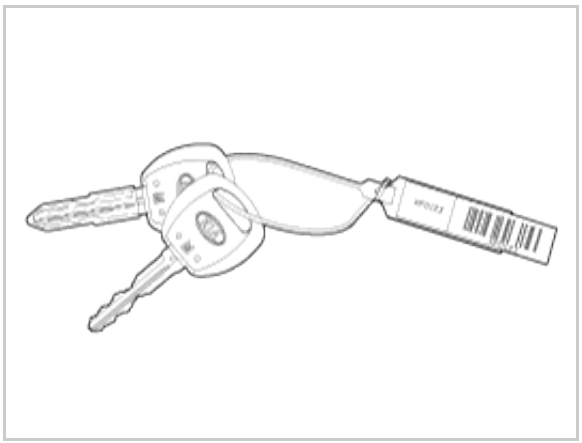
SMARTRA unit

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 crush pad under panel close to the antenna coil for RF transmission and receiving.
The RF signal from the transponder, received by the antenna coil, is converted into messages for serial communication by the SMARTRA device. And, the received messages from the 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 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.

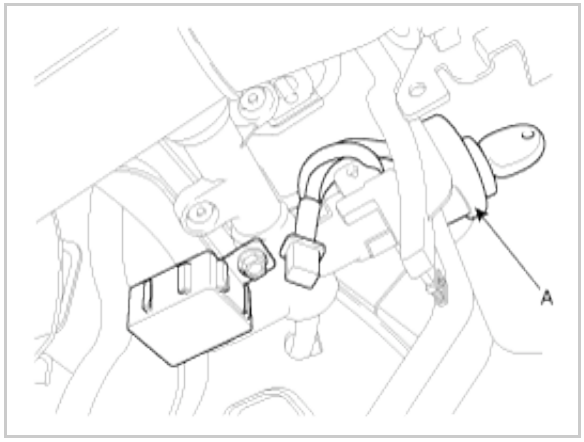


Antenna coil

The antenna coil (A) has the following functions.

a. The antenna coil supplies energy to the transponder.
b. The antenna coil receives signal from the transponder.

c. The antenna coil sends transponder signal to the SMARTRA.
It is located directly in front of the steering handle lock.



DIAGNOSIS OF IMMOBILIZER FAULTS

a. Communication between the PCM(ECM) and the SMARTRA.
b. Function of the SMARTRA and the transponder.
c. Data (stored in the PCM(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	a. Non-Immobilizer-EMS connected to an Immobilizer	P1610
Transponder key fault	a. Transponder not in password mode b. Transponder transport data has been changed.	P1674 (Transponder status error)
Transponder key fault	a. Transponder programming error	P1675 (Transponder programming error)
SMARTRA fault	a. Invalid message from SMARTRA to PCM(ECM)	P1676 (SMARTRA message error)
SMARTRA fault	a. No response from SMARTRA b. Antenna coil error c. Communication line error (Open/Short etc.) d. Invalid message from SMARTRA to PCM(ECM)	P1690 (SMARTRA no response)
Antenna coil fault	a. Antenna coil open/short circuit	P1691 (Antenna coil error)
Immobilizer indicator lamp fault	a. Immobilizer indicator lamp error (Cluster)	P1692 (Immobilizer lamp error)
Transponder key fault	a. Corrupted data from transponder b. More than one transponder in the magnetic field (Antenna coil) c. No transponder (Key without transponder) in the magnetic field (Antenna coil)	P1693 (Transponder no response error/invalid response)
PCM(ECM) fault	a. 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	a. PCM(ECM) internal permanent memory (EEPROM) fault b. Invalid write operation to permanent memory (EEPROM)	P1695 (PCM(ECM) memory error)
Invalid key fault	a. Virgin transponder at PCM(ECM) status "Learnt"Learnt (Invalid) Transponder at PCM(ECM) status "Learnt"(Authentication fail)	P1696 (Authentication fail)
Hi-Scan fault	a. Hi-Scan message error	P1697
Locked by timer	a. Exceeding the maximum limit of Twice IGN ON (≥ 32 times)	P1699 (Twice IG ON over trial)

IMMOBILIZER (SMARTRA) DTC LIST

No.	Fault code	Monitor strategy description	Gasoline	Diesel
1	P1674	Transponder status error	O	-
2	P1675	Transponder programming error	O	O

3	P1676	SMARTRA message error	O	O
4	P1690	SMARTRA no response	O	O
5	P1691	Antenna coil error	O	O
6	P1692	Immobilizer lamp error	O	O
7	P1693	Transponder no response error / Invalid response	O	O
8	P1610	Non-Immobilizer-EMS connected to an immobilizer	-	O
9	P1694	EMS message error	O	-
10	P1695	EMS memory error	O	-
11	P1696	Authentication fail	O	-
12	P1697	HI-SCAN message error	O	-
13	P1699	Twice overtrial	O	-

TEACHING PROCEDURES

1. Key Teaching Procedure

   Key teaching must be done after replacing an inoperative 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).

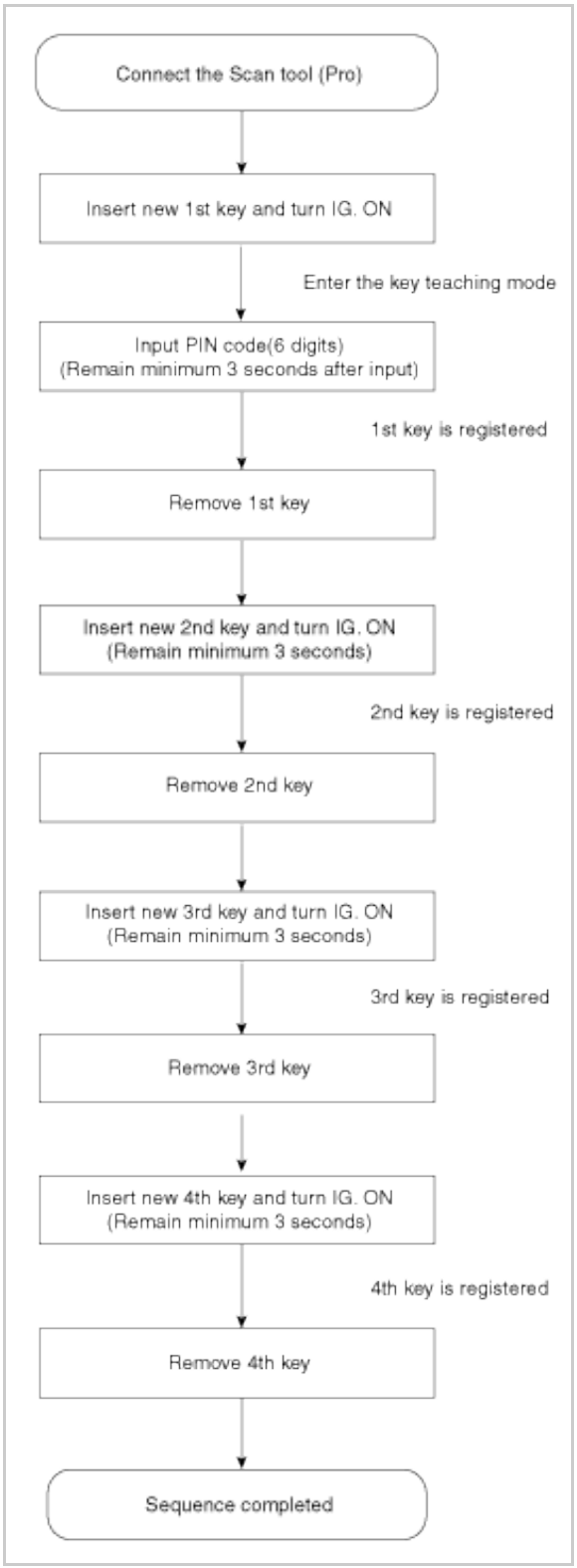
   The attempt to repeatedly teach a key, which has been taught already during the same teaching cycle, is recognized by the PCM(ECM). This rejects the key and a message is sent to the tester.

   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.

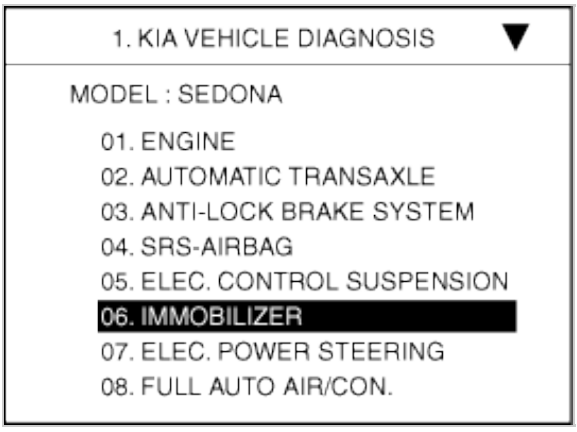
   The maximum number of taught keys is 4

   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).



(1) PCM(ECM) learnt status.



1. KIA VEHICLE DIAGNOSIS

MODEL : SEDONA
SYSTEM : IMMOBILIZER

01. CURRENT DATA
02. PASSWORD TEACHING/CHANGING
03. TEACHING
04. NEUTRAL MODE
05. LIMP HOME MODE

1.3 TEACHING

MODEL : SEDONA
SYSTEM : IMMOBILIZER
STATUS : LEARNT

INPUT PIN OF SIX
FIGURE AND PRESS [ENTER] KEY

CODE : 234567

1.3 TEACHING

MODEL : SEDONA
SYSTEM : IMMOBILIZER
STATUS : LEARNT

1st KEY TEACHING
ARE YOU SURE ? [Y/N]

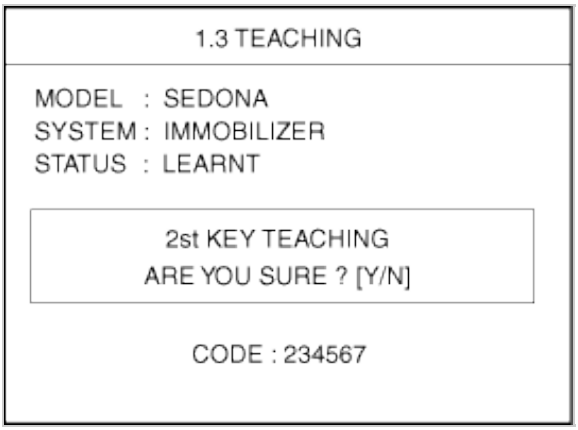
CODE : 234567

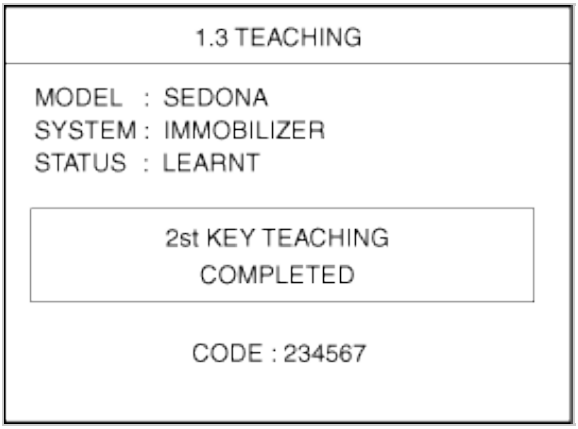
1.3 TEACHING

MODEL : SEDONA
SYSTEM : IMMOBILIZER
STATUS : LEARNT

1st KEY TEACHING
COMPLETED

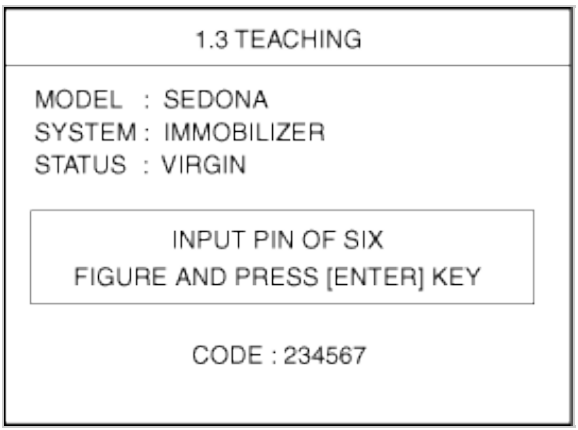
CODE : 234567

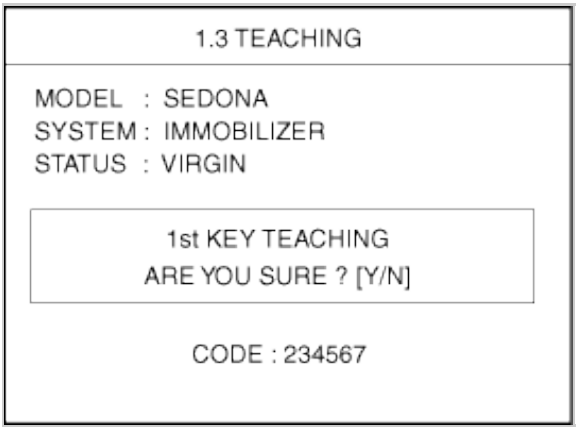


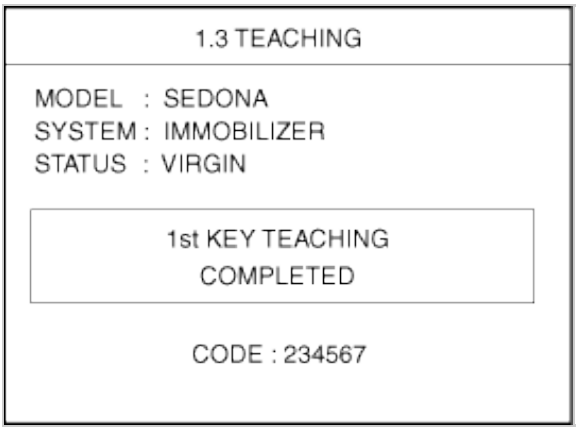


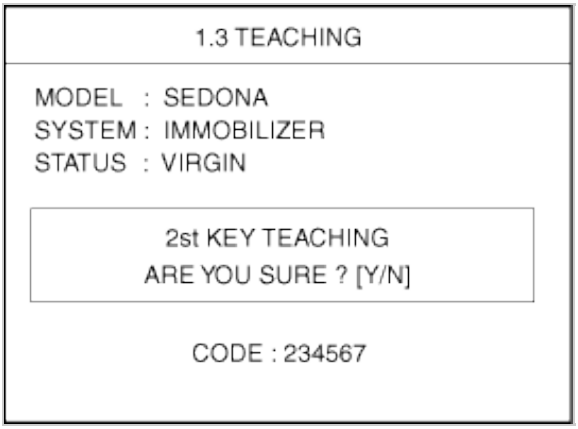
(2) PCM(ECM) virgin status.

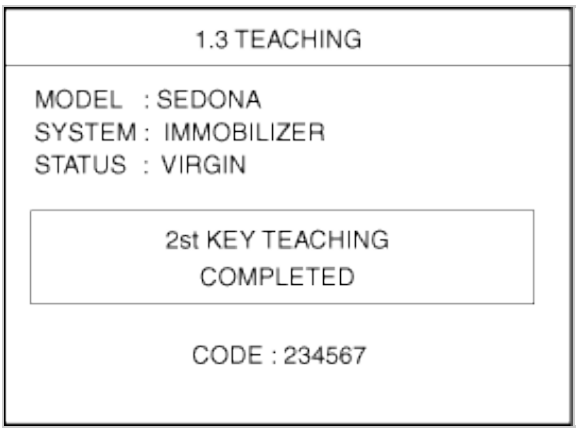
After replacing new "PCM(ECM)" scantool displays that PCM(ECM) is virgin status in Key Teaching mode. "VIRGIN" status means that PCM(ECM) has not matched any PIN code before.











2. User Password Teaching Procedure

The user password for limp home is taught at the service station. The owner of the vehicle can select a number with four digits.

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 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 incorrect user passwords or wrong vehicle specific data have been sent to the PCM(ECM) three times, 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. KIA VEHICLE DIAGNOSIS

MODEL : SEDONA
SYSTEM : IMMOBILIZER

01. CURRENT DATA
02. PASSWORD TEACHING/CHANGING
03. TEACHING
04. NEUTRAL MODE
05. LIMP HOME MODE

1.2 PASSWORD TEACHING/CHANGING

MODEL : SEDONA
SYSTEM : IMMOBILIZER
STATUS : VIRGIN

INPUT NEW PASSWORD OF FOUR FIGURES AND PRESS [ENTER] KEY

NEW PASSWORD :

1.2 PASSWORD TEACHING/CHANGING

MODEL : SEDONA
SYSTEM : IMMOBILIZER
STATUS : VIRGIN

INPUT NEW PASSWORD OF FOUR FIGURES AND PRESS [ENTER] KEY

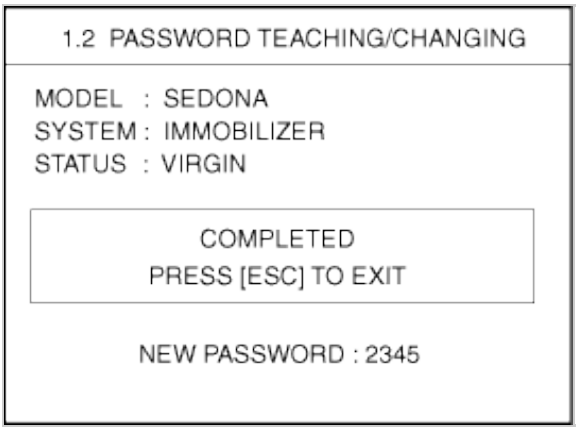
NEW PASSWORD : 2345

1.2 PASSWORD TEACHING/CHANGING

MODEL : SEDONA
SYSTEM : IMMOBILIZER
STATUS : VIRGIN

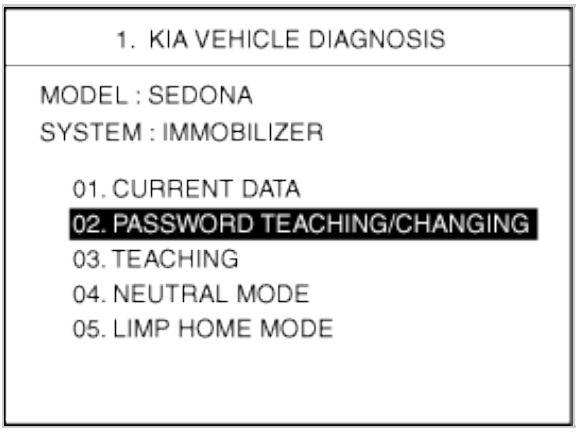
ARE YOU SURE ? [Y/N]

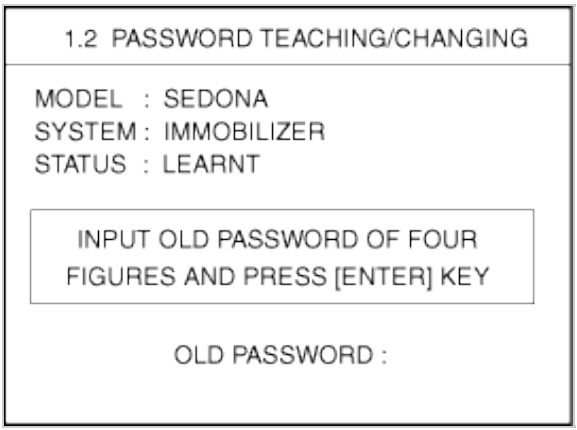
NEW PASSWORD : 2345

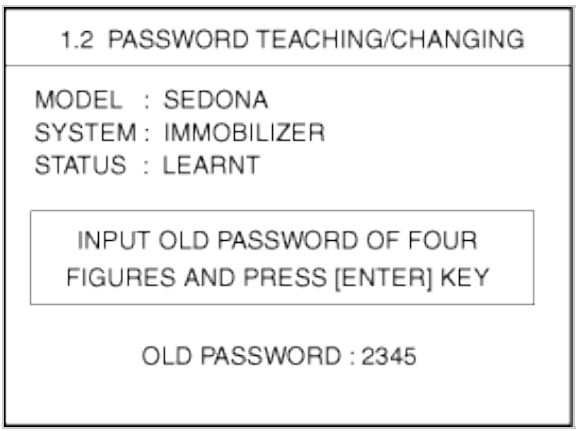


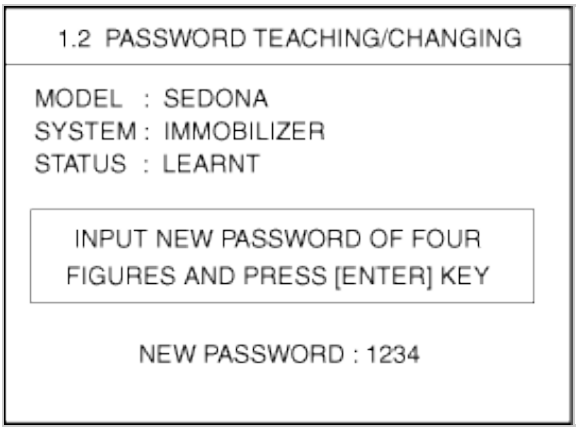
※ If the wrong password is entered, wait 10 seconds, then start again from step 1.

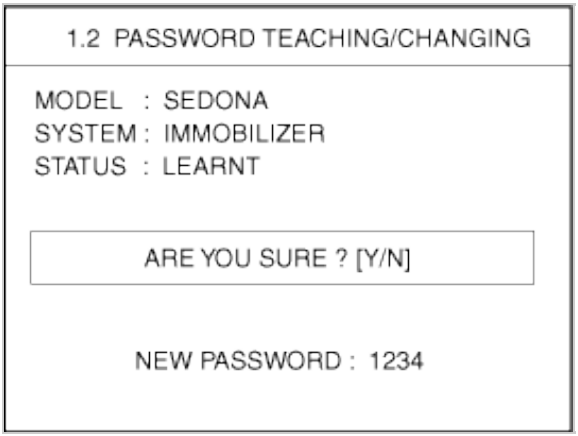
(2) User password changing

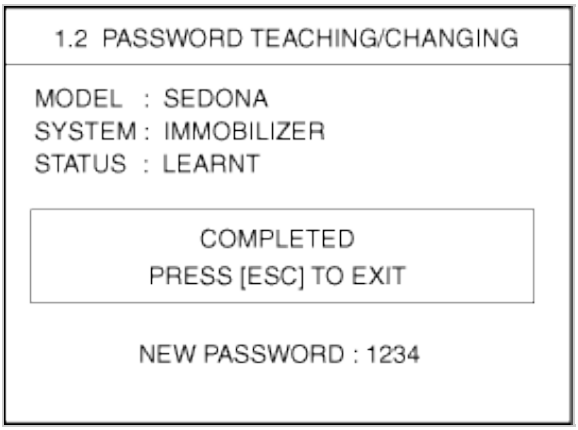






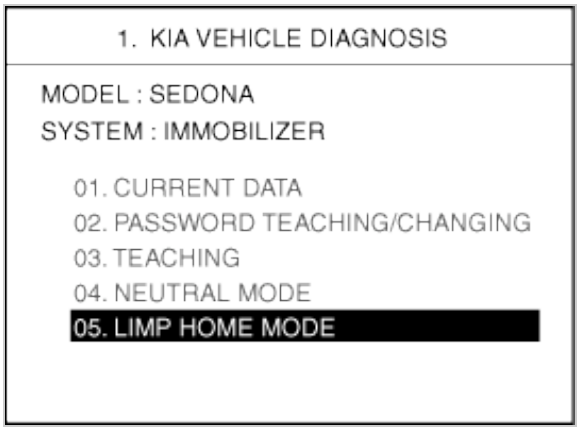


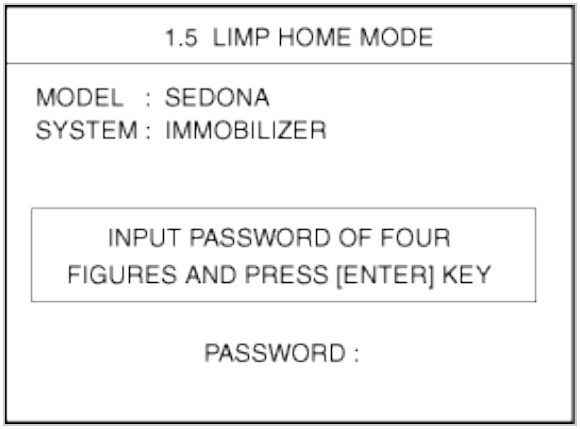


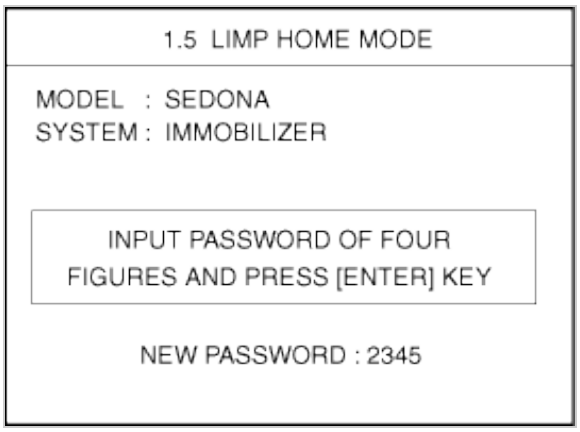


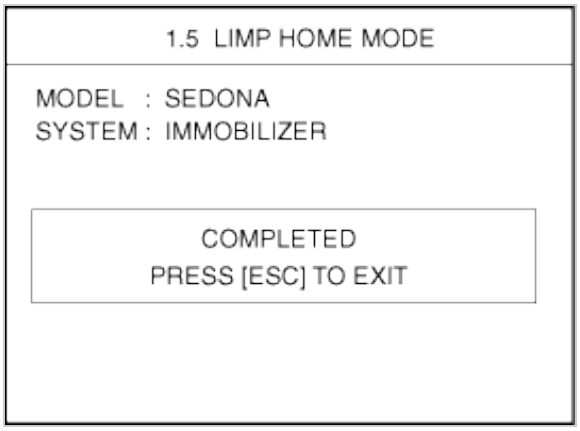
LIMP HOME FUNCTION

1. LIMP HOME BY TESTER
   If the PCM(ECM) detects the fault of the SMARTRA or transponder, the PCM(ECM) will allow limp home function of the immobilizer. Limp home is only possible if the user password (4 digits) has been given to the PCM(ECM) before. This password can be selected by the vehicle owner and is programmed at the service station.
   The user password can be sent to the PCM(ECM) via the special tester menu.
   Only if the PCM(ECM) is in status "learnt" and the user password status is "learnt" and the user password is correct, the PCM(ECM) will be unlocked for a period of time (30 sec.). The engine can only be started during this time. After the time has elapsed, engine start is not possible.
   If the wrong user password is sent, the PCM(ECM) will reject the request of limp home for one hour. Disconnecting the battery or any other action cannot reduce this time. After connecting the battery to the PCM(ECM), the timer starts again for one hour.







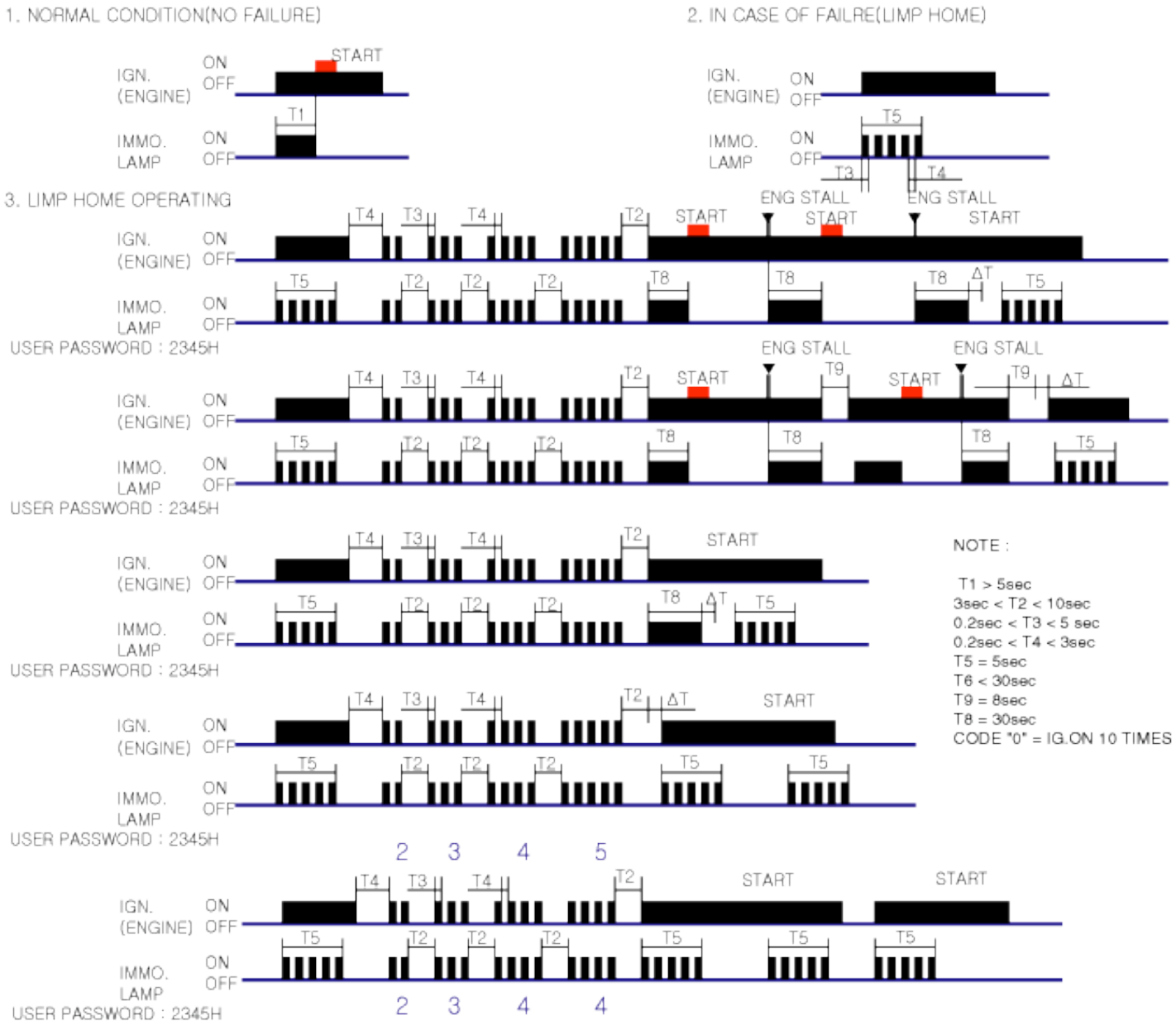


2. LIMP HOME BY IGNITION KEY

   The limp home can be activated also by the ignition key. The user password can be input to the PCM(ECM) by a special sequence of ignition on/off.

   Only if the PCM(ECM) is in status "learnt" and the user password status is "learnt" and the user password is correct, the PCM(ECM) will be unlocked for a period of time (30 sec.). The engine can be started during this time. After the time has elapsed, engine start is not possible. After a new password has been input, the timer (30 sec.) will start again.

   After ignition off, the PCM(ECM) is locked if the timer has elapsed 8 seconds. For the next start, the input of the user password is requested again.



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
PCM(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	NO

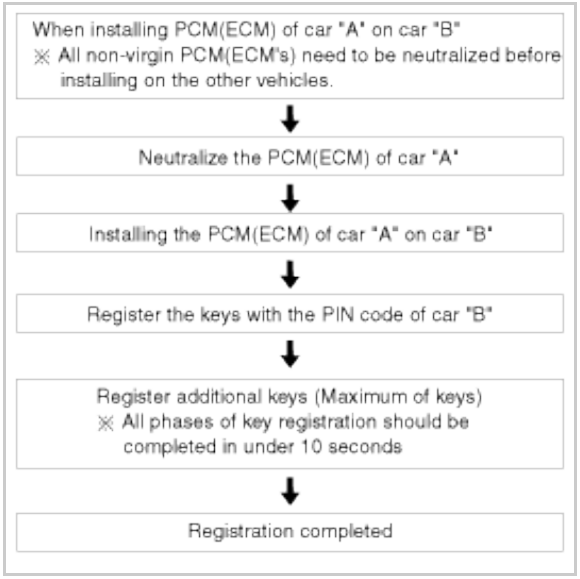
REPLACEMENT OF PCM(ECM) AND SMARTRA

In case of an inoperative PCM(ECM), the unit has to be replaced with a "virgin" or "neutral" PCM(ECM). All keys have to be taught to the new PCM(ECM). Keys, which are not taught to the PCM(ECM), are invalid for the new PCM(ECM) (Refer to key teaching procedure). The vehicle specific data have to be left unchanged due to the unique programming of transponder.

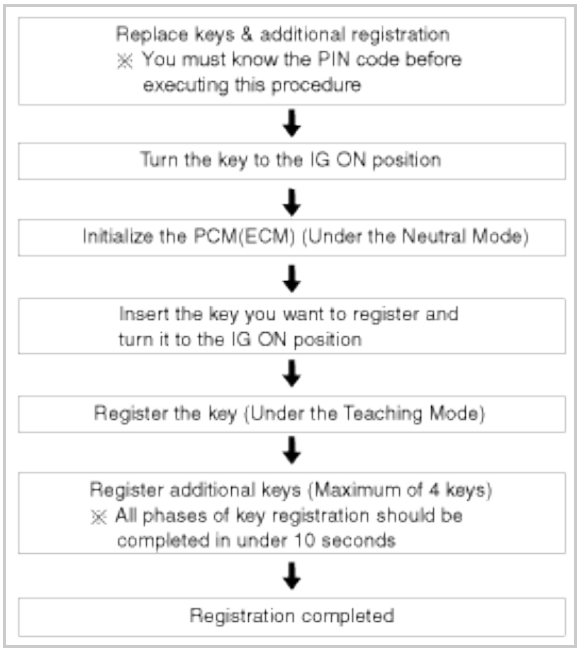
In case of an inoperative SMARTRA, there is no special procedure required. A new SMARTRA device simply replaces

the old one. There are no transponder-related data stored in this device.

1. Things to remember before replacing (PCM(ECM))



2. Things to remember before a replacement (Keys & Additional registration)



NOTICE

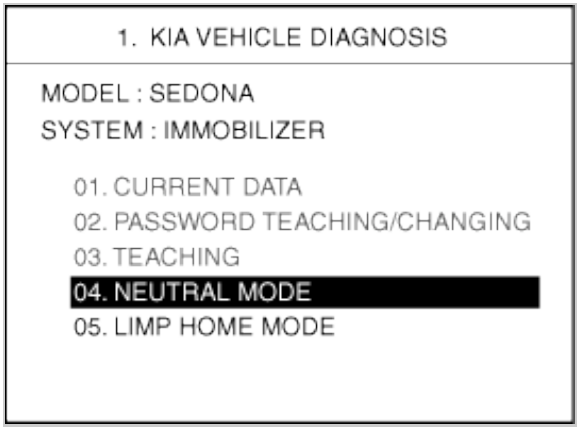
a. When there is only one key registered and you wish to register another key, you need to re-register the key which was already registered.
b. When the key #1 is registered and master key #2 is not registered, Put the key #1 in the IG/ON or the start position and remove it. The engine can be started with the unregistered key #2.
(Note that key #2 must be used within 10 seconds of removing key #1)
c. 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.
d. When you inspect the immobilizer system, refer to the above paragraphs 1, 2 and 3.
Always remember the 10 seconds zone.
e. If the pin code & password are entered incorrectly on three consecutive inputs, the system will be locked for one hour.
f. Be cautious not to overlap the transponder areas.
g. Problems can occur at key registration or vehicle starting if the transponders should overlap.

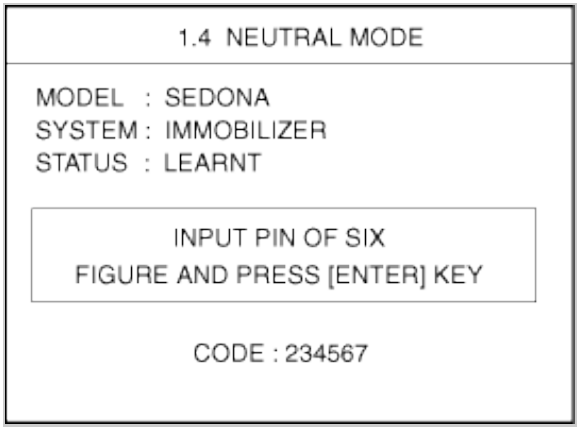
NEUTRALIING OF PCM(ECM)

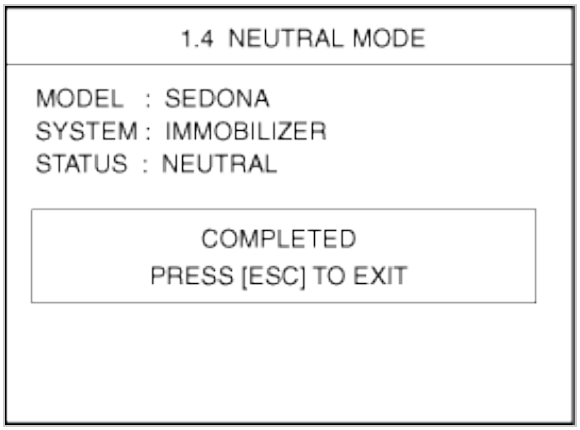
The PCM(ECM) can be set to the "neutral" status by a tester.
A valid ignition key is inserted and after ignition on is recorded, the PCM(ECM) requests the vehicle specific data from the tester. The communication messages are described at "Neutral Mode" After successfully receiving the data, the PCM(ECM) is neutralized.
The PCM(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. A valid ignition key is inserted and after ignition on is recorded, the PCM(ECM) requests the vehicle specific data from the scanner. The communication messages are described at" Neutral Mode". After successfully receiving the data, the PCM(ECM) is neutralized.
The PCM(ECM) remains locked. Neither the limp home mode nor the "twice ignition on" function is accepted by PCM(ECM).
The teaching of keys follows the procedure described for virgin PCM(ECM). The vehicle specific data have to be unchanged due to the unique programming of transponder. If data should be changed, new keys with virgin transponder are requested.

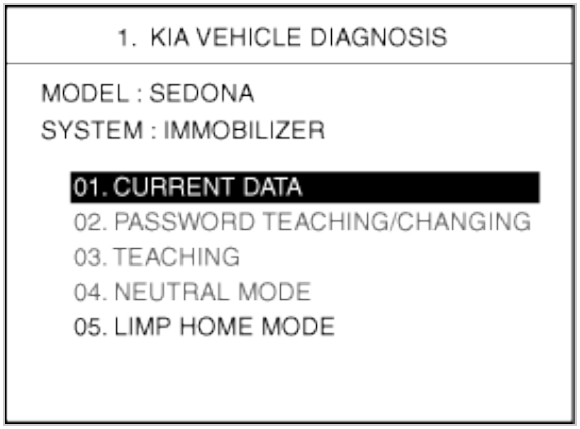
NOTICE

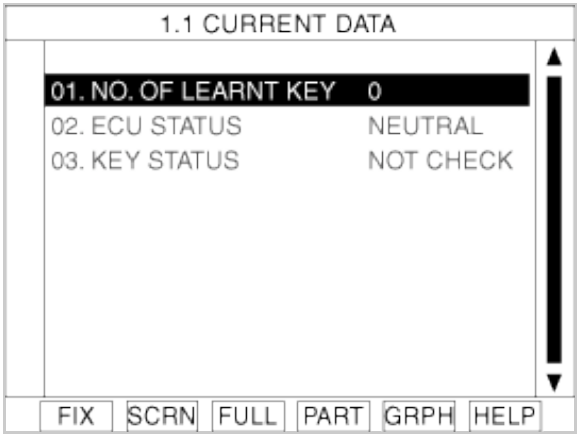
a. Neutralizing setting condition
a. In case of PCM(ECM) status "Learnt" regardless of user password "Virgin or Learnt"
b. Input correct PIN code by scanner.
c. Neutralizing meaning .
: PIN code (6) & user password (4) deletion.
: Locking of PCM(ECM) (except key teaching permission)






1.4 NEUTRAL MODE
MODEL : SEDONA
SYSTEM : IMMOBILIZER
STATUS : NEUTRAL
COMPLETED
PRESS [ESC] TO EXIT

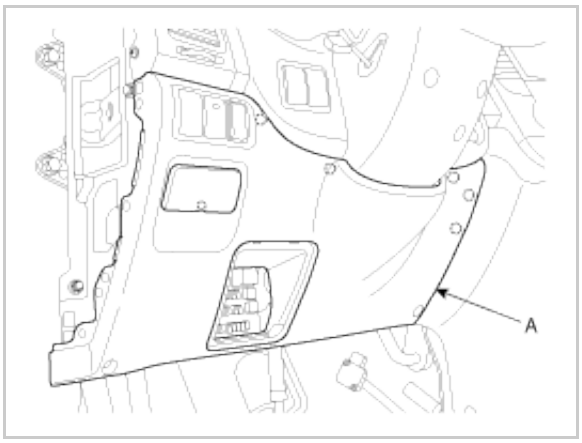

1. KIA VEHICLE DIAGNOSIS
MODEL : SEDONA
SYSTEM : IMMOBILIZER
01. CURRENT DATA
02. PASSWORD TEACHING/CHANGING
03. TEACHING
04. NEUTRAL MODE
05. LIMP HOME MODE


1.1 CURRENT DATA
01. NO. OF LEARNT KEY 0
02. ECU STATUS NEUTRAL
03. KEY STATUS NOT CHECK
FIX
SCRN
FULL
PART
GRPH
HELP

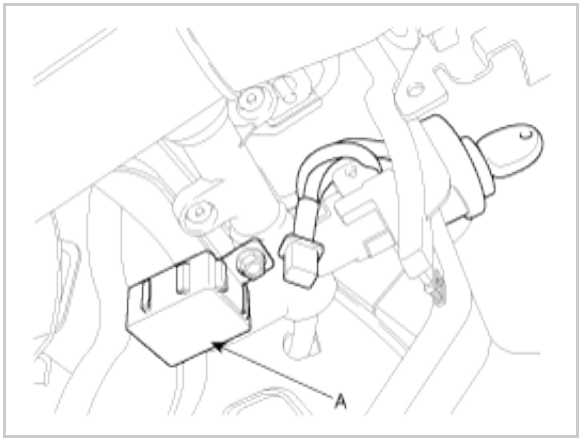
Immobilizer Control Unit

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad lower panel (A).



3. Remove the steering column shaft (Refer to the ST group).
4. Disconnect the 5P connector of the SMARTRA unit and then remove the SMARTRA unit (A) after loosening the screw.

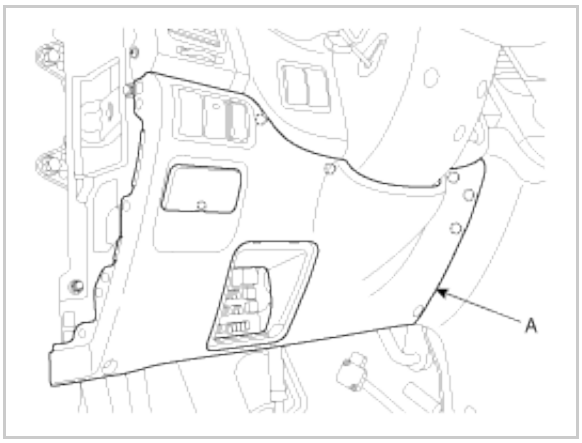


5. Installation is the reverse of removal procedure.

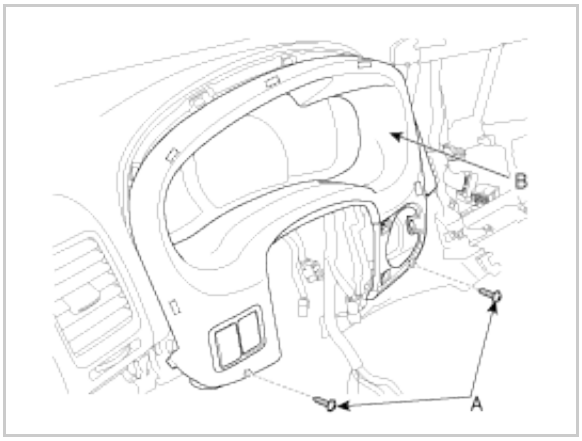
Antenna Coil

REPLACEMENT

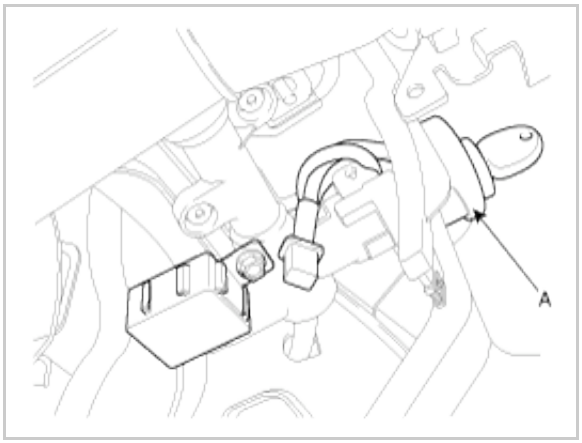
1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad lower panel (A).



3. Remove the cluster facia panel (B) after removing the screws (A) (2EA) and trip switch connector.



4. Disconnect the 6P connector of the coil antenna and then remove the coil antenna (A) after loosening the screw.



5. Installation is the reverse of removal procedure.

Trip Computer

DESCRIPTION

The trip computer displays information related to driving, including compass, distance to empty, elapsed time, average fuel consumption and outside temperature on the display. To change the function as described below, push the MODE button lesser than 2 sec. Distance to empty → elapsed time → average fuel consumption → outside temperature → OFF.

NOTICE

Compass is always displayed except for OFF mode.

OPERATION

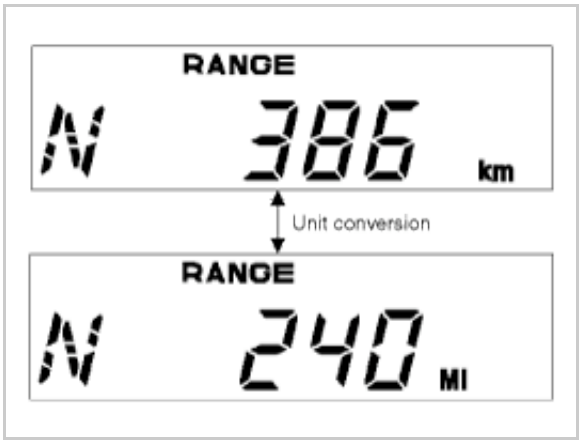
1. COMPASS
   The vehicle compass displays the direction (8 directions) where the vehicle is heading. Compass is displayed when driving.



2. DISTANCE TO EMPTY
   This mode indicates the estimated distance to empty based on the current fuel in the fuel tank and the amount of fuel delivered to the engine. The meter's working range is from 30 to 1500 miles (50 to 1500 km) by the 1km or 1mile.



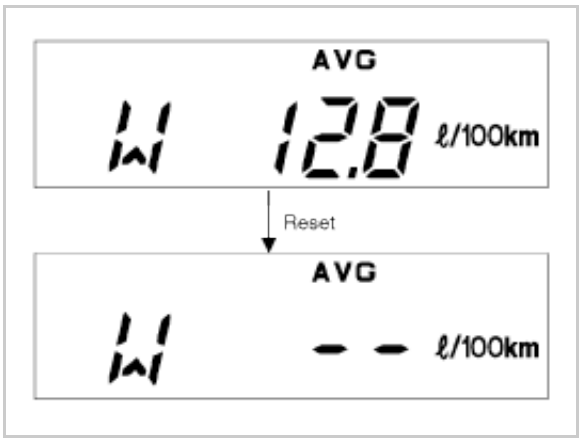
   When the remaining distance is below 30 miles (50km), a blinking "----" symbol will be displayed.
   The unit can be changed by press the reset button for more than 4 sec. If the unit of distance to empty is changed, the unit of average fuel consumption is changed together.



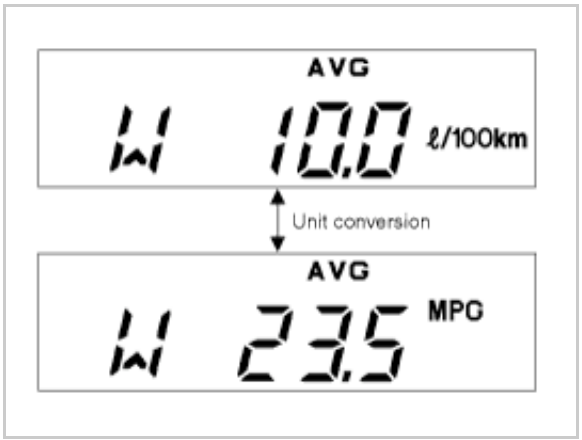
3. ELAPSED TIME
   This mode indicate the total time traveled since the last driving time reset while the engine is running.
   Press the reset button for less than 4sec, clears the driving time to zero.



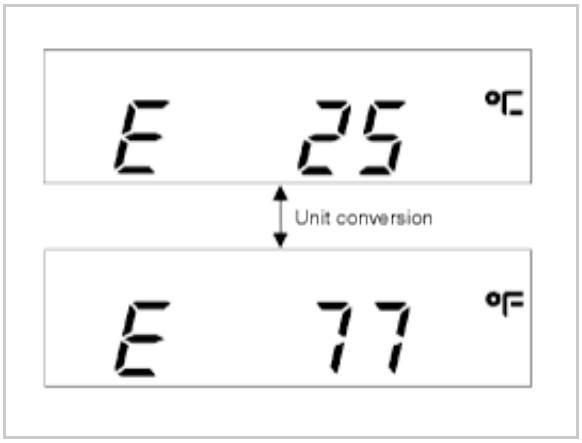
4. AVERAGE FUEL CONSUMPTION
   This mode calculates the average fuel consumption from the total used fuel and the distance. The meter's working range is from 0.0 to 99.9 L/100km or MPG(mile per gallon).
   Press the reset button for less than 4 sec, when the average fuel consumption is being displayed, clears the average fuel consumption to “- -“ until the vehicle is moved to 0.3 miles(500m).



   The unit can be changed by press the reset button for more than 4 sec. If the unit of average fuel consumption is changed, the unit of distance to empty is changed together.



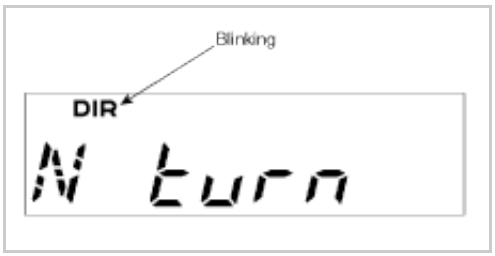
5. OUTSIDE AMBIENT TEMPERATURE
   This mode indicates the outside temperature around the vehicle form -40°C to 60°C (from -40°F to 140°F).
   The unit can be changed by press the reset button for more than 4 sec.


E 25 °C
Unit conversion
E 77 °F

ADUSTMENT

CORRECTION MODE

1. The correction process is necessary for displaying correct direction of by removing the effect of magnetized car body components.
2. Push Mode button for 2 sec - 4.5 sec. And then "turn" is displayed and "DIR" is blinking with 0.5 sec intervals.



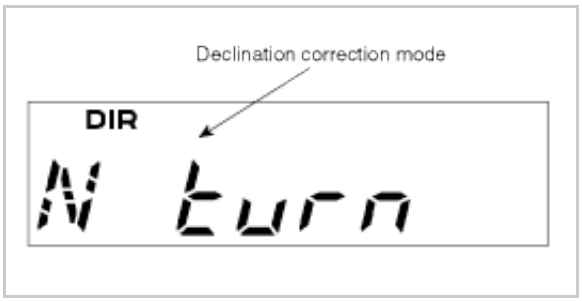
3. Automatic correction is done when the vehicle turns 720° in normal driving condition (the correction is invisible to the driver).

> NOTICE
>
> a. The correction data is updated if the automatic correction data is better than the present correction data.
> b. Turning direction is not important.
> c. If the correction process is not finished after the vehicle turns 720°, turn the vehicle some more degree.

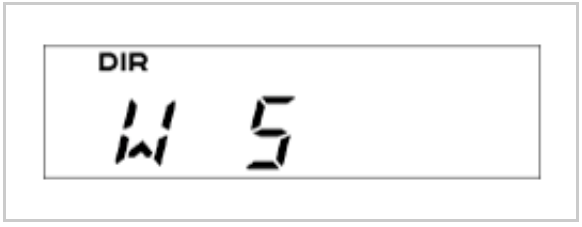
4. After finishing the correction process, the compass displays the present direction.
5. If the correction process is not finished until 5 minutes this mode is cancelled and the compass returns to normal mode with restoring the previous correction data.

DECLINATION CORRECTION (VARIANT REGION CHANGE MODE)

1. Change the "Declination Setting Value" according to the regional declination to synchronize the true north and vehicle's north.
2. Push the mode button longer than 4.5 Sec to enter the declination correction mode. ('DIR' is on)



3. Screen after 4.5 sec.



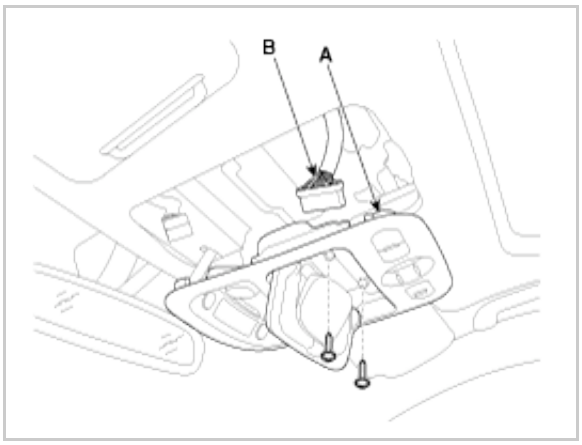
4. Push the reset button longer than 0.1 Sec to change the declination setting Value (Steps by 5° to East. After East 30, wraps to West 30)
5. Push the mode button more than 1sec, new data is stored on EEPROM and VFD displays normal direction.
6. Without any effective input for 30 seconds, the trip computer displays the previous declination angle with blinking for 2 sec and displays normal direction.

NOTICE

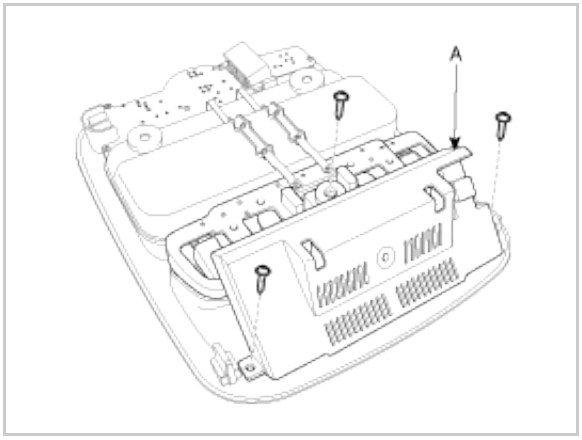
a. Do not install a ski rack, antenna, etc. that are attached to the vehicle using a magnet as anything attached to the roof of the vehicle with a magnet will effect compass operation.
b. If the compass deviates from the correct indication soon after repeated adjustment, have the compass checked at an authorized dealer.
c. The compass may not indicate the correct compass point in tunnels or while driving up or down a steep hill. (The compass returns to the correct compass point when the vehicle moves to an area where the geomagnetism is stabilized.)
a. Declination correction and correction setting value is not deleted during the B(+) OFF.

DISPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the lens and open the sunglass case cover from the overhead console then remove the 2 screws holding the overhead console. And disconnect the connector then remove the overhead console lamp assembly from the headliner.



3. Remove the trip computer(A) mounting screws (3EA), and then disconnect from the overhead console.



4. Installation is the reverse of removal.

Rear Parking Assist System

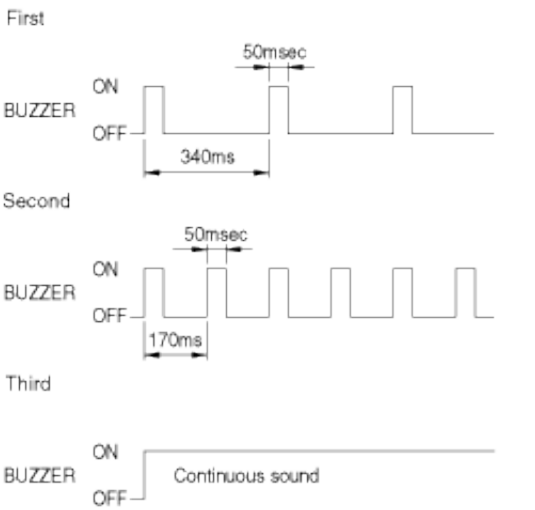
Rear Parking Assist System Control Unit

DESCRIPTION

When reversing, the driver is not easy to find objects in the blind spots and to determine the distance from the object. In order to provide the driver safety and convenience, back warning system will operate upon shifting to "R" Ultrasonic sensor will emit ultrasonic wave rearward and detect the reflected wave. Control unit will calculate distance to the object using the sensor signal input and output buzzer alarm in three steps (first, second and third alarm).

ALARM RANGE

Upon detecting an object at each range out of 3 ranges as stated below within the operation range, it will generate alarm.
First alarm : Object comes near to the sensor located at the rear of vehicle, within 81-120cm ± 15cm
Second alarm : Object comes near to the sensor located at the rear of vehicle, within 41-80cm ± 10cm
Third alarm : Object comes near to the sensor located at the rear of vehicle, within 40cm ± 10cm

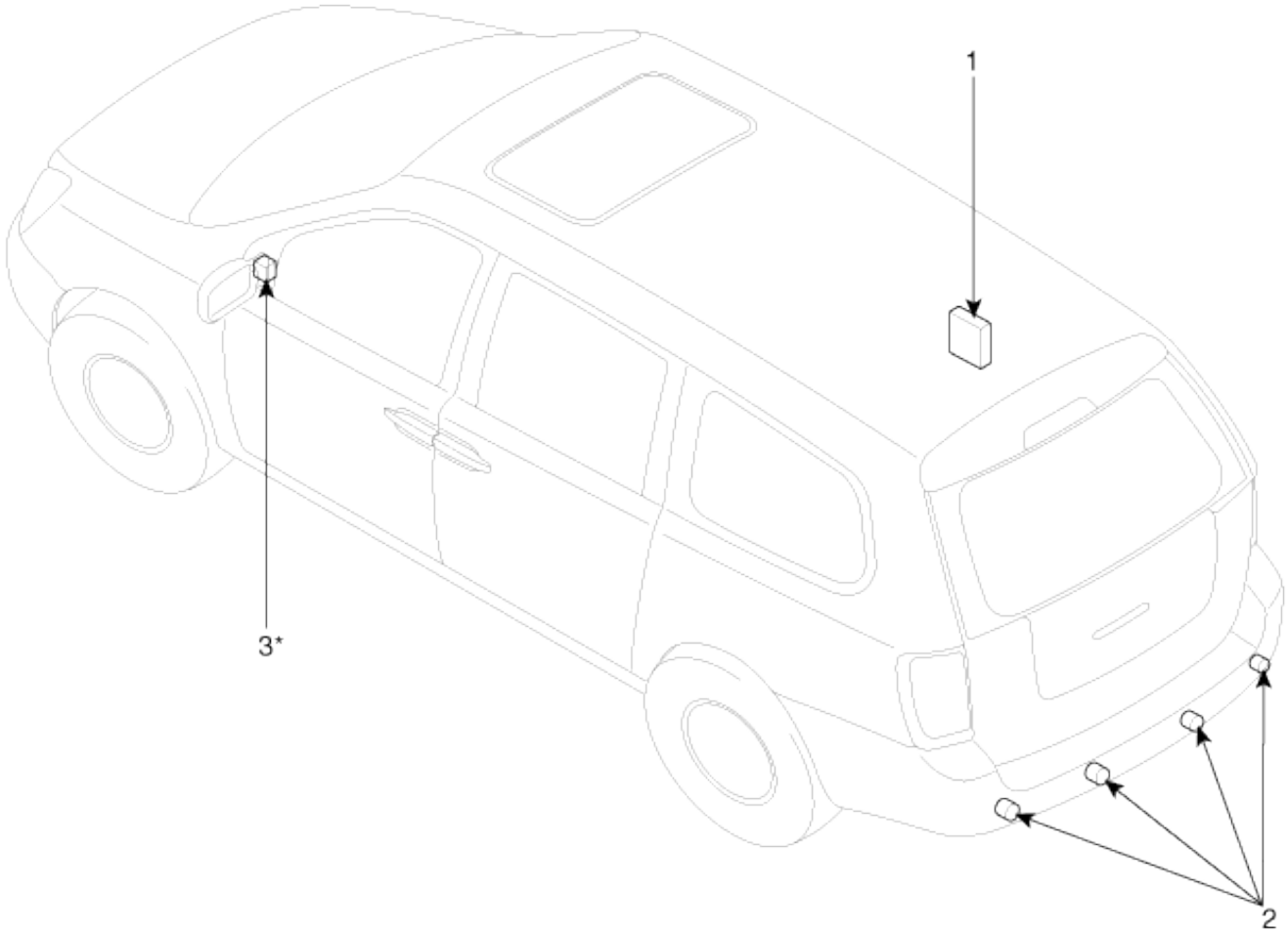


NOTICE

a. Time tolerance of the above waveform : Time ± 10%
b. At nearer distance than 40cm, detection may not occur.
c. Alarm will be generated with vehicle reversing speed 10km/h or less.
For moving target, maximum operation speed shall be target approach speed of 10km/h.
d. When the vehicle or the target is moving, sequential alarm generation or effective alarm may be failed.
e. False alarm, or failure of the alarm to trigger may occur in the following conditions.
a. Irregular road surface, gravel road, reversing toward grass.
b. Horn, motor cycle engine noise, large vehicle air brake, or other object generating ultrasonic wave is near.
c. When a wireless transmitter is used near to the sensor.
d. Dirt on the sensor.
e. Sequential alarm may not occur due to the reversing speed or the target shape.

COMPONENT LOCATION

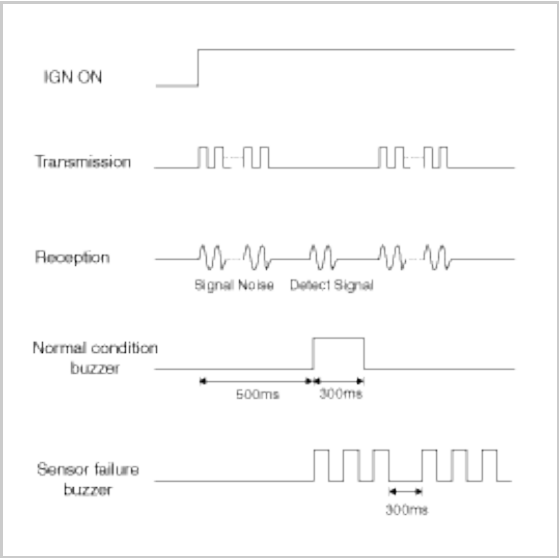
The parts with asterisk(*) :
This illustration is shows the LHD type.
RHD type is symmetrical.



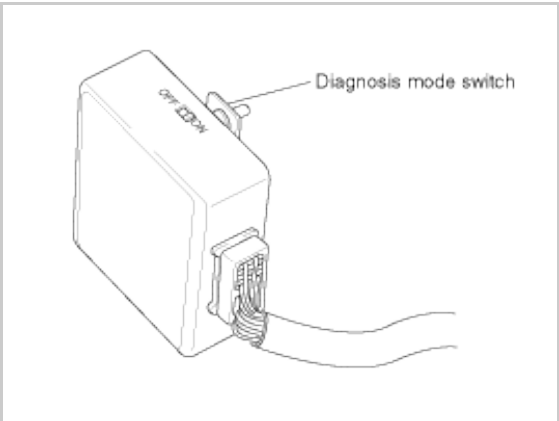
1. Back warning control unit
2. Ultrasonic sensor
3. Buzzer

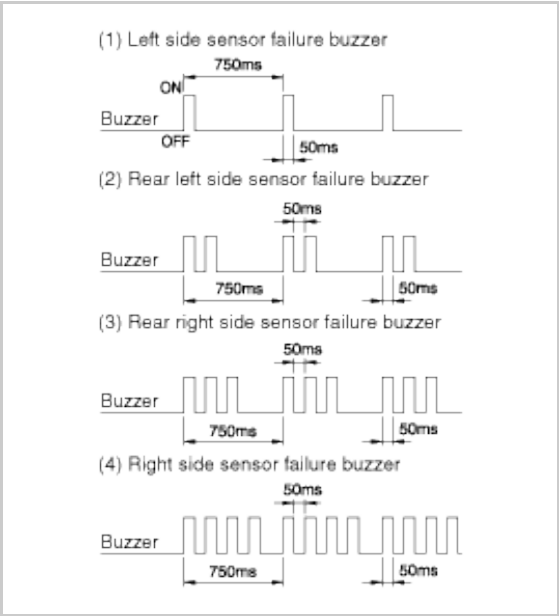
DIAGNOSIS

1. DIAGNOSIS
   Turn the ignition switch ON, then shift the transaxle lever to 'R'. The Back Warning System is then checked.
   If no trouble, it generates buzzer alarm sound for 0.3 seconds after 0.5 seconds from power approval. In case of system failure, buzzer alarm is generated 3 times continuously with the interval of 0.3 seconds.



2. DIAGNOSIS MODE
   Switch on diagnosis mode upon system failure.
   In case of system failure, then it indicates the failed point as follows.

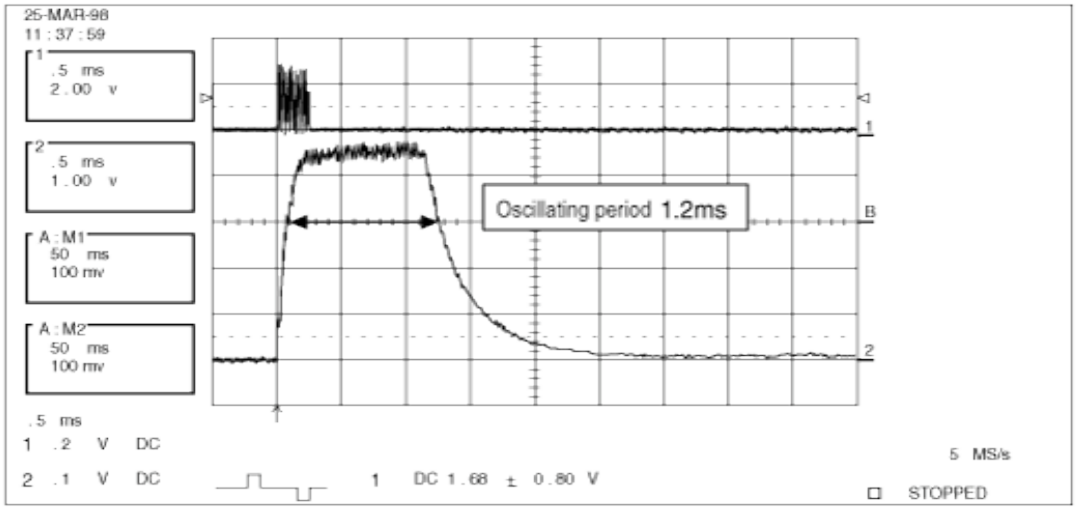




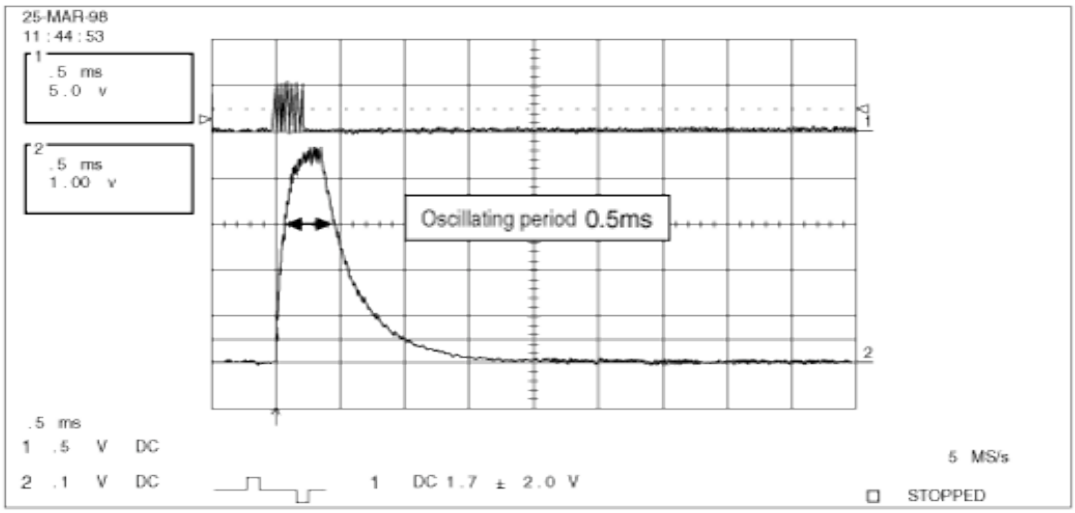
SENSOR CONNECTION CHECKING

Transmit ultrasonic wave to the sensors, boost input signal, and detect wave.
Waveform will be found, oscillating for a certain period of time.

1. Waveform for a normal sensor connection



2. Waveform for a failed sensor connection



NOTICE

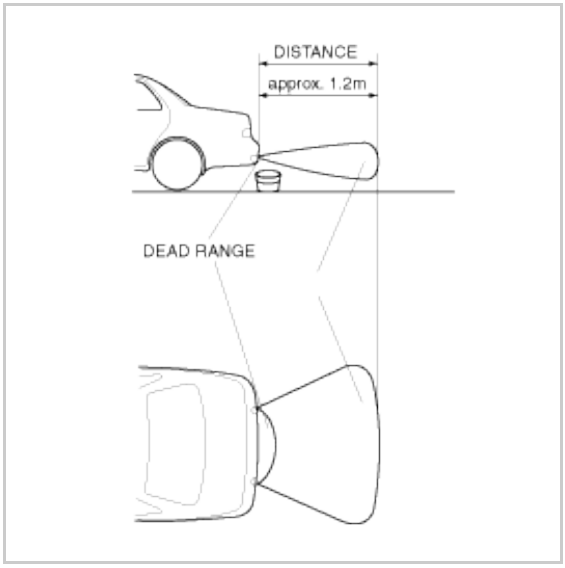
Sensor connection will be checked for oscillating period of input signal 3V. If oscillating period is more than 0.8ms, it is normal.

a. Left sensor failure : beep-beep-beep
b. Right sensor failure : beep beep-beep beep-beep beep
c. Rear-right sensor failure : beep beep beep-beep beep beep-beep beep beep
d. Right side sensor failure : beep beep beep beep-beep beep beep beep-beep beep beep beep

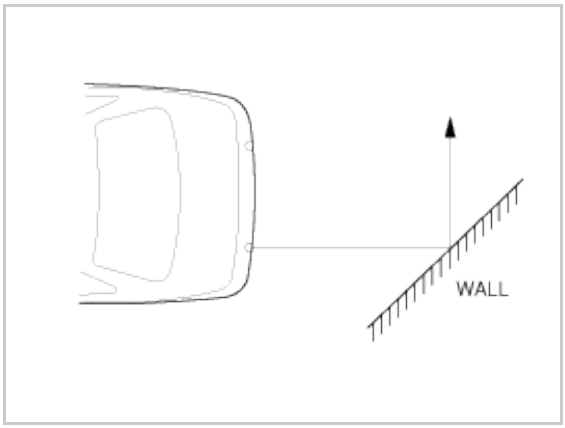
WARNING

1. Range detected by back sensors is limited.
   Watch back before reversing
2. There is a blind spot below the bumper. Low objects (for example boundary barrier) may be detected from minimum 1.5m away unable to detect at nearer.
3. Besides there are some materials unable to be detected even in detection range as follows.
   (1) Needles, ropes, rods, or other thin objects.

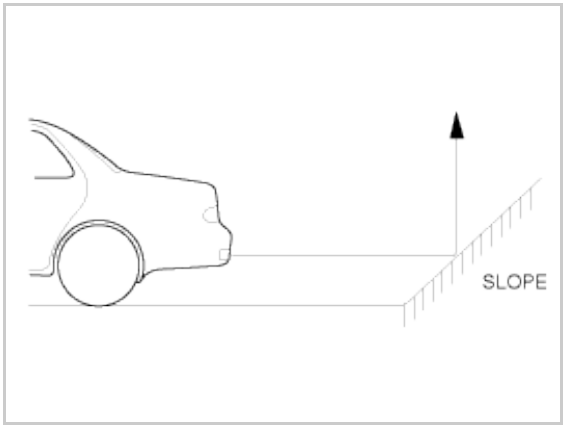
(2) Cotton, snow and other material absorbing ultrasonic wave
(for example, fire extinguisher device covered with snow)



4. Reversing toward the sloped walls.



5. Reversing toward the sloped terrain.



6. False alarm may operate in the following condition: irregular road surface, gravel road, sloped road and grass. Upon alarm generation by grass the alarm may be generated by rock behind grass. Always visually check the area behind the vehicle before backing up.
The sensors cannot discriminate between materials.
7. Sensors may not operate correctly in the below conditions.
Ensure sensors are clean from mud or dirt
(1) When spraying the bumper, the sensor opening is covered with something in order not to be contaminated. If sensor opening is contaminated with mud, snow, or dirt, detection range will be reduced and alarm may not be generated under the crash condition. Dirt accumulated on the sensor opening shall be removed with water. Do not wipe or scrape sensor with a rod or a hard object.
(2) If the sensor is frozen, alarm may not operate until sensor thaws.

(3) If a vehicle stays under extremely hot or cold environment, the detection range may be reduced. It will be restored at the normal temperature.

(4) When heavy cargo is loaded in rear cargo area, it changes the vehicle balance, which reduces the detection range.

(5) When other vehicle's horn, motor cycle engine noise, or other ultra-sonic wave sources are near.

(6) Under heavy rain.

(7) When reversing towards a vertical wall and the gap between the vehicle and the wall is 15cm. (Alarm may sound despite the absence of a barrier)

(8) If radio antenna is installed at the rear.

(9) If the vehicle rear wiring is re-routed or electrical component is added at the rear part.

(10) Vehicle balance is changed due to the replacement of the rear spring.

(11) The unit will operate normally when the vehicle speed is 5km/h or less.
Above this speed, the unit may not operate normally

8. Check the rear bumper for installation condition and deformation. If installed improperly or the sensor orientation is deviated, it may cause malfunction.

9. Be careful not to apply shock during sensor installation on the transmission or reception unit.

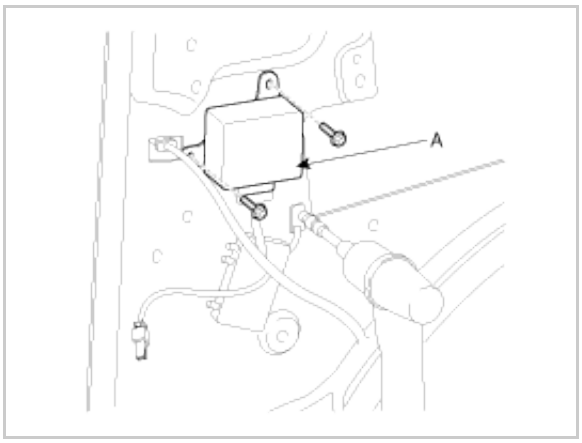
10. When adding electrical devices or modifying harness at the rear body of the vehicle, ensure not to change the transmission and reception unit wiring.
Tagging the transmission side and reception side, it may cause malfunction.

11. High power radio transmitter (above 10W) may cause malfunction. Do not install it on the vehicle.

12. Be careful that excessive heat or sharp objects shall not touch ultrasonic sensor surface.
Do not cover the sensor opening or press the sensor.

REPLACEMENT

1. Remove the right side trim of the trunk (Refer to the Body group - "Interior trim")
2. Loosen the mounting bolts and remove the back warning control unit (A) from the quarter panel.



Parking Assist Sensor

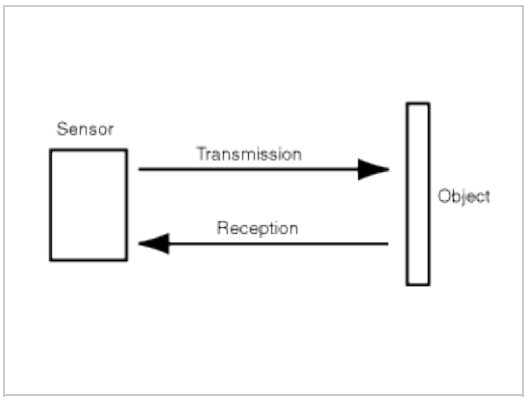
Operation principle

The sensor emits ultrasonic wave to the objects, and it measures the time until reflected wave returns, and calculates the distance to the object.

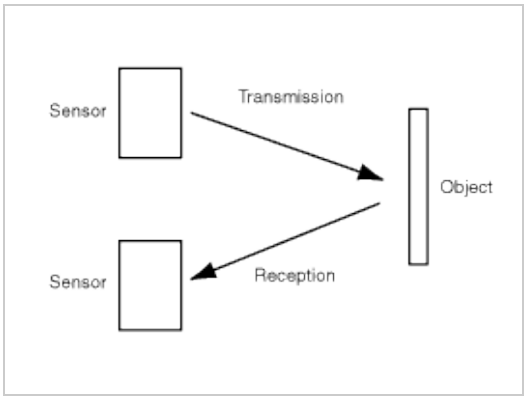
Distance detection type

Direct detection type and indirect detection type are used together for improving effectiveness of the detection.

1. Direct detection type: One sensor transmits and receives signals to measure the distance.



2. Indirect detection type: One sensor transmits signals and the other sensor receives the signals to measure the distance.



Measurement principle

Back warning system (BWS) is a complementary device for reversing. BWS detects objects behind vehicle and provides the driver with buzzer alarm finding objects in a certain area, using ultrasonic wave propagation speed and time.

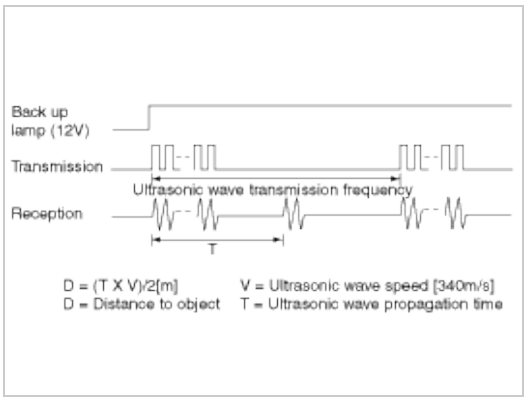
The propagation speed formula of ultrasonic wave in air is following :

v=331.5 + 0.6t (m/s)

v=ultrasonic wave propagation speed

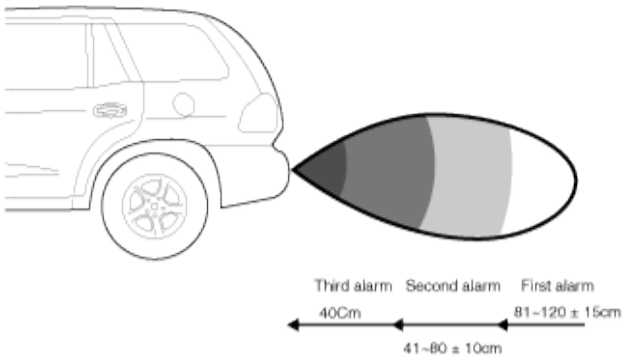
t=ambient temperature

The basic principle of distance measurement using ultrasonic wave is :



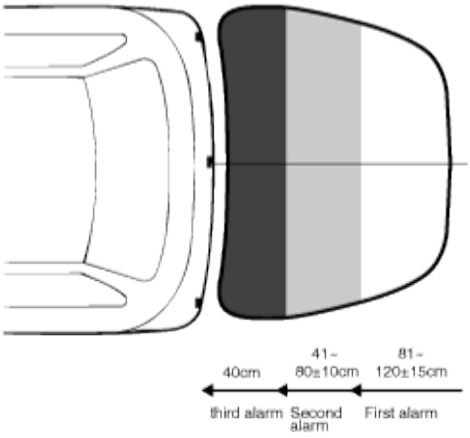
Sensor detection range

[Vertical range]



1. Distance tolerance(Messured at the front of sensor)
   81~120cm : ±15cm
   41~80cm : ±10cm
   40cm : ±10Cm
2. Detection tolerance
   At 40cm :45° ± 15°
   At 80cm : 30° ± 15°
   At 120cm : 20° ± 15°
3. At nearer distance than 40cm detection may occur.
4. Measurement condition : Room temperature (20℃), 90mm diameter, 3m length rod.

[Horizontal range]



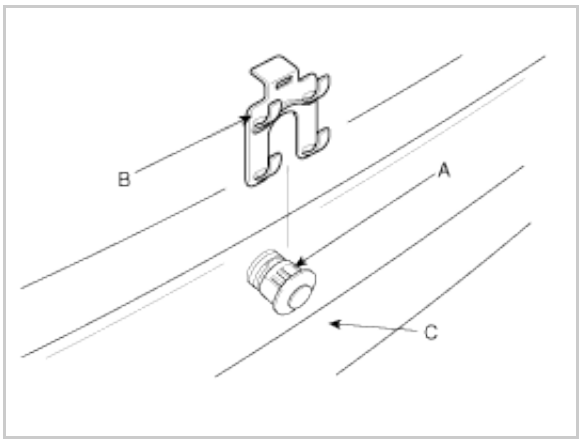
1. Distance tolerance(Messured at the front of sensor)
   81~120cm : ±15cm
   41~80cm : ±10cm
   40cm : ±10cm
2. Detection tolerance
   At 80cm : 90° ± 20°
   At 120cm : 10° ± 20°
3. At nearer distance than 40Cm detection may occur.
4. Measurement condition : Room temperature (20℃), 90mm diameter, 3m length rod.

NOTICE

a. 14cm (Diameter) plastic rod is used for the test target.
b. The test result may differ by a different target object.
c. Detection range may be reduced by dirt accumulated on sensor, and extremely hot or cold weather.
d. The following object may not be detected.
a. Sharp object or thin object like rope.
b. Cotton, sponge, snow or other materials absorbing sonic wave.
c. Smaller objects than 14cm (Diameter), 1m length.

REPLACEMENT

1. Remove the rear bumper (Refer to the Body group - "Rear bumper")
2. Disconnect the sensor connector at the inside of the rear bumper (C), and then remove the sensor (B) from the housing (A).



3. Installation is the reverse of removal procedure.

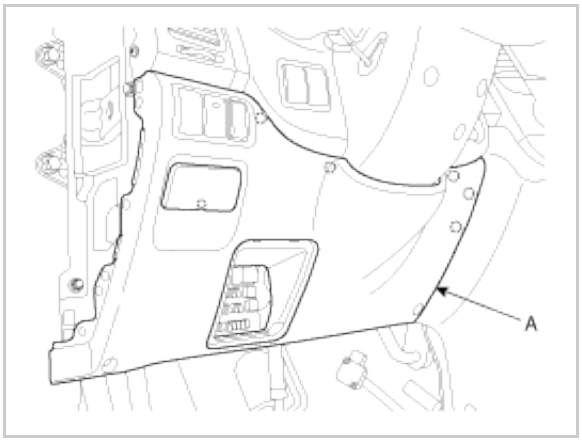
Buzzer

INSPECTION

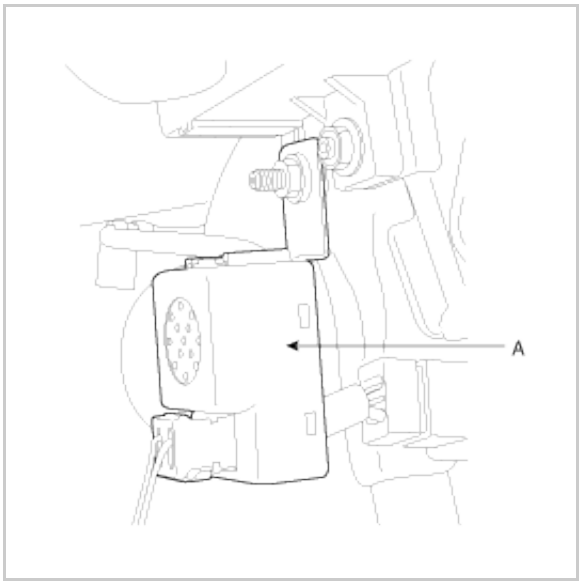
Test the buzzer by connecting battery voltage to terminal 1, and ground terminal 2.
The buzzer should make a sound. If the buzzer fails to make a sound, replace it.

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad lower panel (Refer to the Body group - crash pad).



3. Remove the buzzer (A) after loosening the bolt and disconnecting the connector from the left side of IPM.

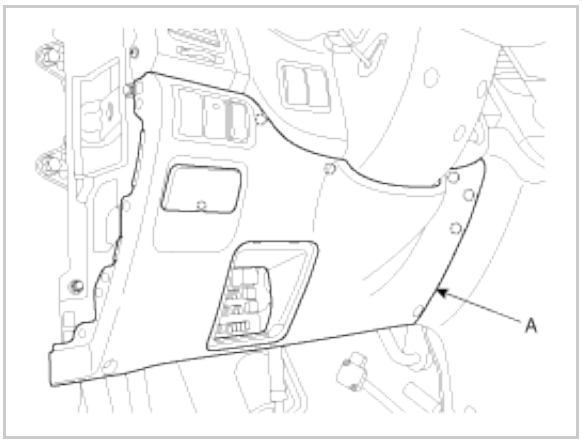


4. Installation is the reverse of removal procedure.

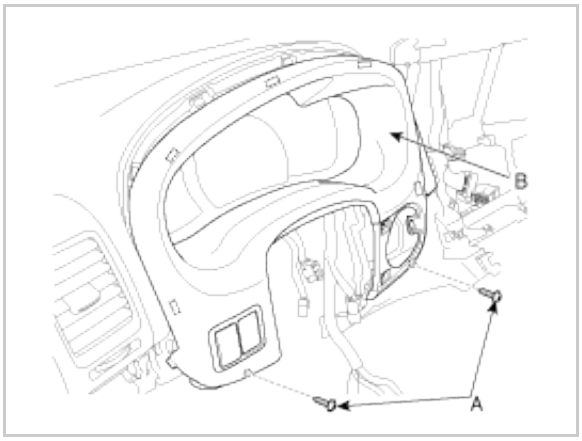
Ignition Switch Assembly

REPLACEMENT

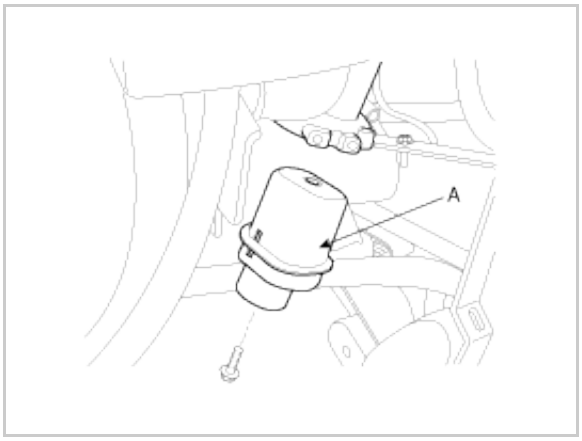
1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad lower panel (Refer to the Body group - crash pad).



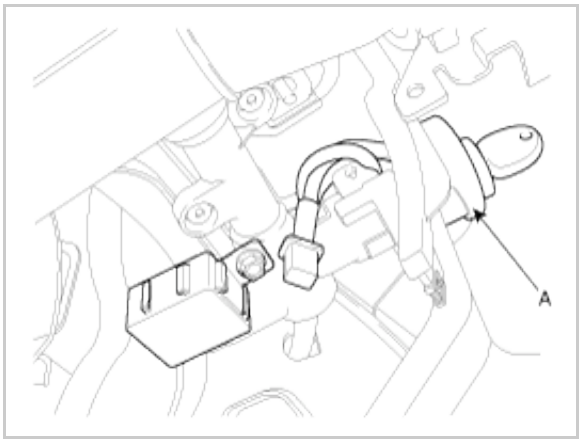
3. Remove the screws (2EA) and trip switch connector. Then remove the crash facia panel (B).



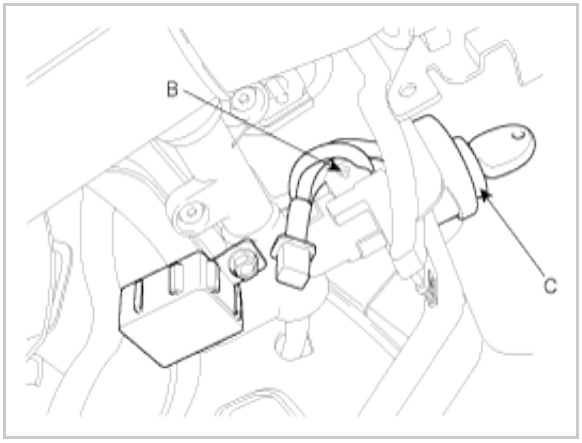
4. Remove the ignition switch (A) after loosening the screw with IG ON and disconnecting the 6P connector.



5. Remove the door warning switch and key illumination lamp (A) after loosening the screws (B) and disconnecting the 6P connector.



6. Remove the key lock cylinder (C) after pushing lock pin (B) with key ACC.



7. Installation is the reverse of removal procedure.

Multiplex Communication

Driver Door Module

DESCRIPTION

The driver door module is a part of a Controller Area Network (CAN), and performs CAN communication with the BCM, FAM, IPM, RAM, ADM, and IMS. Driver controls driver side power window switch button located inside of the driver side door to operate power window, mirror, door lock and unlock.

1. Two manual operations (up and down) for four p/windows. However, on the driver's seat the auto up/down operation must be possible.
2. Opening and closing the quarter glass by the quarter glass switch.
3. Window UP/DOWN operation by RKE.
4. Manually operating the mirror position by the manual switch (Up, Down, Right, and Left)
5. Saving and replacing the mirror position by the MEMORY switch → For 2 persons
6. Saving and replacing the mirror position by RKE → For 2 persons
7. Out side mirror AUTO reverse operation
8. Out side mirror FOLD/UNFOLD power control
9. CENTRAL DOOR LOCK/UNLOCK function
10. DOOR COURTESY LAMP control
11. Out side mirror DEFOG control
12. Illumination control

CONTROL FUNCTION

POWER WINDOW CONTROL

1. This switch controls power window up/down, automatic up/down from driver & assist side.
   a. Driver's power window switch sends input signal through CAN communication by the manual up/down and automatic up/down switch input. At the same time passenger side sends manual up/down and automatic up/down signals to the wires.
   b. Each safety window ECU receives the signal and performs manual up/down and automatic up/down functions.
2. Power window lock
   When the driver's power window lock switch is ON, each safety window ECU receives the power window lock command to prohibit the operation by the passenger side doors except the driver's door.
3. Timer function
   Power window switch can be controlled for 30 seconds after the ignition is turned off. This function stops immediately even within 30 seconds if the front door is opened.

KEY REMINDER

1. If door is locked by using door lock knob after opening door while IGN KEY is inserted to KEY CYLINDER, Unlock output will be for 1sec and there will be a series of three output signals every 0.5sec if door condition is "Lock".
2. If Key Reminder unlock message is "SHORT UNLOCK", DOOR UNLOCK lasts for 0.5sec.
3. If Key Reminder unlock message is "LONG UNLOCK", DOOR UNLOCK lasts for 1sec.
4. Remained action goes on though Key Reminder Unlock message changes to "OFF".

PRIORITY OF DOOR LOCK/UNLOCK

1. Crash Unlock > Auto Door Lock > Key Reminder > Central Door Lock
2. Higher priority signals take precedence, and will override lower priority signals.
3. If the priority is the same or low, it'll be ignored.

OUT SIDE MIRROR CONTROL BY THE SWITCH

1. If the mirror direction switch (up, down, left and right) is pressed when mirror selection switch on driver side power window switch is in outside LH(RH) under ACC ON condition, then mirror motor moves to the corresponding

direction.

OUTSIDE MIRROR MEMORY OPERATION BY THE MEMORY SWITCH

1. If position switch (POS1 or POS2) is pressed within 5 seconds after pressing the memory switch under ignition 2 on, it registers current mirror position. (Switch module sends in LIN communication). (Memory permit status lasts for 5 seconds after memory switch ON. After 5 seconds, memory permits status terminates. In other words, current position is registered if the position switch (POS1 or POS2) is turned on, during the memory permit status). However, RH side mirror position is not registered during the LH side mirror manual switch operation.
2. Memory permit status is released if any of the following conditions is met
   a. If 5 seconds is elapsed after the memory switch is turned on
   b. If the ignition 2 is turned off
   c. When saving is completed
   d. If Ignition switch of the CAN communication data sent by the IPM is not "Run" or "Start".
   e. If Inhibit switch of the CAN communication data sent by the FAM is not "P".
   f. If vehicle speed of the CAN communication data sent by the cluster is "3Km/h" or more.
3. Memory is cleared if the battery is removed.

OUTSIDE MIRROR MEMORY AND REPLAY OPERATION BY KEYLESS

1. Memory operation
   a. Outside mirror LH position is registered in the driver side power window switch when the ignition is turned off from on.
   b. When door is locked by the keyless, outside mirror position is registered corresponding to the keyless code.
   c. Data related to the memory operation is received from BCM in CAN communication.
2. Replay operation
   a. When door is unlocked by the keyless under ignition off state, it replays the position corresponding to the keyless code.
   b. Data related to the replay operation is received from BCM in CAN communication on CAN line.
3. Replay prohibit condition
   a. If the mirror switch on the LH side is pressed
   b. If Ignition switch of the CAN communication data sent by the IPM is not "Run" or "Start".
   c. If Inhibit switch of the CAN communication data sent by the FAM is not "P".
   d. If vehicle speed of the CAN communication data sent by the CLUSTER is "3Km/h" or more.

OUTSIDE MIRROR MEMORY AND REPLAY OPERATION BY KEYLESS

1. Memory operation
   a. Outside mirror LH position is registered in the driver side power window switch when the ignition is turned off from on.
   b. When door is locked by the keyless, outside mirror position is registered corresponding to the keyless code.
   c. Data related to the memory operation is received from BCM in CAN communication.
2. Replay operation
   a. When door is unlocked by the keyless under ignition off state, it replays the position corresponding to the keyless code.
   b. Data related to the replay operation is received from BCM in CAN communication on CAN line.
3. Replay prohibit condition
   a. When the inhibit "P" switch is OFF.
   b. When RH side mirror switch is pressed.
   c. When mirror switch is pressed after ignition on.
   d. When the vehicle speed is over 3km/h

AUTO REVERSE FUNCTION

No.	Operation	Select	Shift Lever	MIR Position		Manipulation	Result

No.	Operation	SW	Level	L	R	Manipulation	Result
1	Basic Operation	LH	P	Position A	Position B	Changing the shift lever from "P" to "R"	MIR L:Auto reverse to position (A-5°) MIR R:Auto reverse to position (B-5°)
2		RH	P	Position A	Position B		MIR L:NO change MIR R:Auto reverse to position (B-5°)
3		N	P	Position A	Position B		MIR L:NO change MIR R:NO change
4	Returning after Basic Operation	LH	R	Result of No.1	Result of No.2	Changing the shift lever from "R" to "P"	MIR L:Return to position (A) MIR R:Return to position (B)
5		RH	R	No.1 is being performed	Result of No.2		MIR L:NO change MIR R:Return to position (B)

FAIL SAFE FUNCTION

1. If the sensor does not move more than 60mV for the input changes (5 second operation) of the position sensor although the motor is operating, automatic control will stop.
2. The mirror operation signal cannot be displayed into the same direction for more than 15 seconds. (When the mirror is replacing to the saved position or the switch is manually pressed)
3. Monitoring the replacing time
   a. If the replacing operation does not stop within 40 seconds, the mirror motor will not outputted and the replacing operation will stop.

IMS SWITCH

1. If it's satisfied with the followings
   (1) Can communication Data ignition switch sent by IPM is "RUN"
   (2) Can communication Data Inhibit switch sent by FAM is "P"
   (3) Can communication Data vehicle speed sent by CLUSTER is under "3Km/h"
2. If SET switch is ON, IMS message is SET.
3. If POSITION switch is ON within 5sec since SET switch is ON, IMS message will be sent to MEMORY1 or MEMORY2.

SEAT MANUAL SWiITCH

If Seat switch is controlled, seat control message is sent to seat.

COURTESY LAMP

1. If driver's door is opened, RAM changes door open Message to ON and Courtesy lamp is ON by DDM.
2. If driver's door is closed, RAM changes door open Message to Off and Courtesy lamp is OFF gradually by DDM.(5±0.5sec)
3. During dim out, If IGN changes to ON or door is closed while Ignition switch is ON, Courtesy lamp is OFF immediately.
4. If Key reminder switch is OFF and door is opened for 20min, Courtesy lamp is OFF immediately.

FUEL FILLER DOOR OPEN

When the fuel filler door open switch is turned on, this data is uploaded to the bus through CAN communication.

DEFOG CONTROL (O/S MIRROR HEAT LINE)

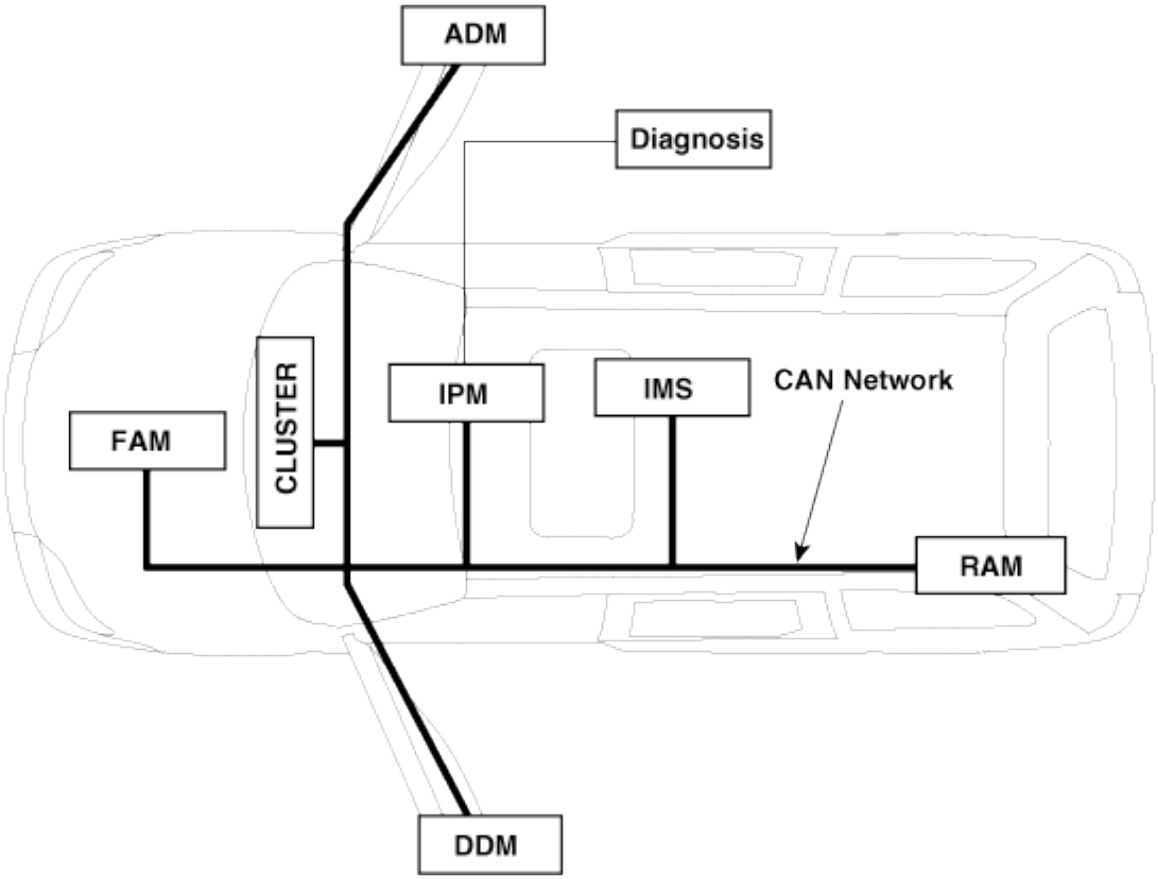
If rear defog switch is on while IGN is ON, rear defog control of IPM is ON and O/S Mirror Defog is ON by DDM,ADM.

RESCUE MODE

1. The condition to run RESCUE MODE is listed below.
   a. Ignition switch Message is in RUN or IGN switch is ON.
   b. Any signal received from of park tail head lamp, front wiper control message is received as INVALID or CAN line from IPM is not normal.
   c. Drive door courtesy lamp control message is sent as INVALID or Can Line from RAM is not normal
2. If RESCUE MODE runs, operation is as follows.
   a. Door unlock is ON for 0.5sec
   b. OSRVM Defogger is ON for 20min.
   c. Illumination is ON continuously.
   d. Other functions are the same as NORMAL mode.
3. If Ignition switch Message is OFF/ACC or IGN switch is OFF or can line from IPM,FAM,RAM is normal, Rescue mode is stopped.

Assist Door Module

COMMUNICATION DIAGRAM



DESCRIPTION

The assist door module is a part of CAN, and performs CAN communication with the BCM, FAM, IPM, RAM, DDM, and IMS. The driver can control the power window, mirror, door(lock/unlock) by using buttons of the ADM on the door of the driver's seat.

1. Operating the power window by buttons
2. Central Door LOCK/UNLOCK function
3. Manually operating the mirror position by the manual SW (Up, Down, Right, and Left)
4. Saving and replacing the mirror position by the memory switch → For 2 persons
5. Out side mirror AUTO reverse operation
6. Door courtesy lamp control
7. Out side mirror defog control
8. Illumination control

CONTROL FUNCTION

POWER WINDOW CONTROL

1. This switch controls power window up/down from assist side.
   a. According to the input of assist Door module window, up/down switch, output window motor up/down.
   b. Power window up/down control from assist side.
2. Timer function
   Power window switch can be controlled for 30 seconds after the ignition is turned off. This function stops immediately even within 30 seconds if the front door is opened.

CRASH UNLOCK

1. Under the condition "IGN ON", if Crash Sensor message from IPM is ON, Door UNLOCK is output.(5 ± 0.5sec)

AUTO DOOR LOCK

1. If the vehicle is under any of the following conditions and the condition lasts for 3sec, all doors is locked.
   If message from IPM is "Door Lock Control = LOCK ALL", it will be locked for 0.5sec.
   a. IGN "RUN" or "START"
   b. ALT L ON (Engine is running)
   c. Speed of the vehicle is 40Km/h
   d. If any door is on "UNLOCK"
2. After LOCK output, if any door is not locked, there will be a series of three Lock output every 0.5sec.
3. If all doors are locked during a series of three output signals, output will be stopped.
4. If any door is not locked after a series of three output signals, output will be stopped.

KEY REMINDER

1. If door is locked by using door lock knob after opening door while IGN KEY is inserted to KEY CYLINDER, Unlock output will be for 1sec and there will be a series of three output signals every 0.5sec if door condition is "Lock".
2. If Key Reminder unlock message is "SHORT UNLOCK", DOOR UNLOCK lasts for 0.5sec.
3. If Key Reminder unlock message is "LONG UNLOCK", DOOR UNLOCK lasts for 1sec.
4. Remained action goes on though Key Reminder Unlock message changes to "OFF".

PRIORITY OF DOOR LOCK/UNLOCK

1. Crash Unlock > Auto Door Lock > Key Reminder > Central Door Lock
2. Higher priority signals take precedence, and will override lower priority signals.
3. If the priority is the same or low, it'll be ignored.

OUT SIDE MIRROR FOLD/UNFOLD POWER CONTROL

1. Supply folding power for 30sec after ACC ON or ACC OFF.
2. FOLD/UNFOLD operation is controlled by fold switch.

OUT SIDE MIRROR CONTROL BY THE SWITCH

1. Manual control of left outside mirror
   If the mirror direction switch (up, down, left and right) is pressed when mirror selection switch on driver side power window switch is in outside LH under ACC ON condition, then mirror motor moves to the corresponding direction.
2. Manual control of right outside mirror
   If the mirror direction switch (up, down, left and right) is pressed when mirror selection switch on driver side power window switch is in outside RH under ACC ON condition, then operating signal is sent to passenger side power window switch through CAN communication.

OUTSIDE MIRROR MEMORY OPERATION BY THE MEMORY SWITCH

1. IMS Message from DDM is sent to RETURN1 or RETURN2, out side mirror returns to the position stored.
2. Memory permit status is released if any of the following conditions is met
   a. If 5 seconds is elapsed after the memory switch is turned on
   b. If the ignition 2 is turned off
   c. When saving is completed
   d. If Ignition switch of the CAN communication data sent by the IPM is not "Run" or "Start".
   e. If Inhibit switch of the CAN communication data sent by the FAM is not "P".
   f. If vehicle speed of the CAN communication data sent by the cluster is "3Km/h" or more.
3. Memory is cleared if the battery is removed

OUTSIDE MIRROR MEMORY AND REPLAY OPERATION BY THE MEMORY SWITCH

1. IMS message from DDM is sent to RETURN1 or RETURN2, O/S MIRROR returns to the position stored.
2. Replacing not stored position doesn't work.
3. If RETURN Message is sent during replacing, the last Message has priority.
4. Replacing Prohibition Conditions.
   (1) If the mirror switch on the LH side is pressed
   (2) If Ignition switch of the CAN communication data sent by the IPM is not "Run".
   (3) If Inhibit switch of the CAN communication data sent by the FAM is not "P".
   (4) If vehicle speed of the CAN communication data sent by the CLUSTER is "3Km/h".

OUTSIDE MIRROR MEMORY AND REPLAY OPERATION BY KEYLESS

1. Memory operation
   a. If the ignition is turned off after being on, the position of the O/S mirror RH is saved in the switch ASSY power window main.
   b. If the door was keyless-locked, the outside mirror RH position is saved corresponding to the keyless code.
2. Replay operation
   a. If the door is keyless-unlocked while the IGN SW is off, replacing is made to the saved position corresponding to the keyless code.
3. Replay prohibit condition
   a. When the inhibit "P" switch is OFF
   b. When RH side mirror switch is pressed
   c. When mirror switch is pressed after ignition on
   d. When the vehicle speed is over 3km/h

AUTO REVERSE FUNCTION

No.	Operation	Select SW	Shift Lever	MIR Position		Manipulation	Result
				L	R		
1	Basic Operation	LH	P	Position A	Position B	Changing the shift lever from "P" to "R"	MIR L:Auto reverse to position (A-5°) MIR R:Auto reverse to position (B-5°)
2		RH	P	Position A	Position B		MIR L:NO change MIR R:Auto reverse to position (B-5°)
					Position		MIR L:NO change

3		N	P	Position A	Position B		MIR L:NO change MIR R:NO change
4	Returning after Basic Operation	LH	R	Result of No.1	Result of No.2	Changing the shift lever from "R" to "P"	MIR L:Return to position (A) MIR R:Return to position (B)
5		RH	R	No.1 is being performed	Result of No.2		MIR L:NO change MIR R:Return to position (B)

FAIL SAFE FUNCTION

1. If the sensor does not move more than 60mV for the input changes (5 second operation) of the position sensor although the motor is operating, it will be considered there is a harness cutting, motor breakdown, or sensor breakdown and automatic control will stop.
2. The mirror operation signal cannot be displayed into the same direction for more than 15 seconds. (When the mirror is replacing to the saved position or the switch is manually pressed)
3. Monitoring the replacing time
   a. If the replacing operation does not stop within 40 seconds, the mirror motor will not outputted and the replacing operation will stop.

COURTESY LAMP

1. If assist's door is opened, RAM changes door open Message to ON and Courtesy lamp is ON by ADM.
2. If assist's door is closed, RAM changes door open Message to Off and Courtesy lamp is OFF gradually by ADM.(5±0.5sec)
3. During dim out, If IGN changes to ON or door is closed while Ignition switch is ON, Courtesy lamp is OFF immediately.
4. If Key reminder switch is OFF and door is opened for 20min, Courtesy lamp is OFF immediately.

DEFOG CONTROL (O/S MIRROR HEAT LINE)

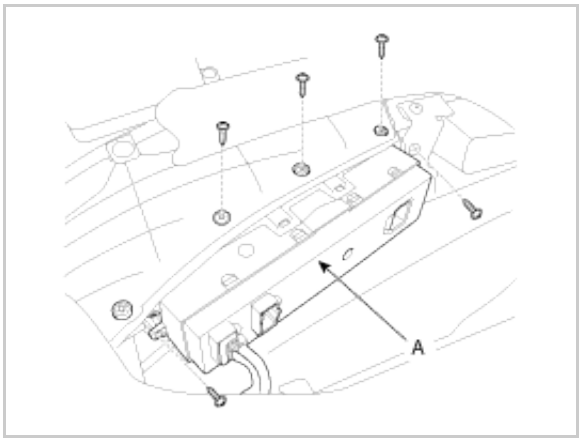
If rear defog switch is on while IGN is ON, rear defog control of IPM is ON and O/S Mirror Defog is ON by DDM, ADM.

RESCUE MODE

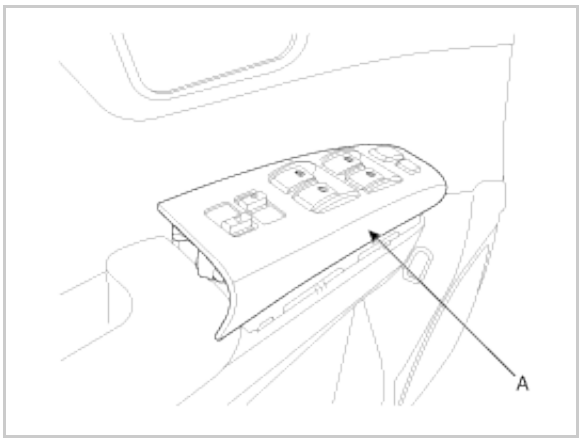
1. The condition to run RESCUE MODE is listed below.
   a. Ignition switch Message is in RUN or IGN switch is ON.
   b. Any signal received from of park tail head lamp, front wiper control message is received as INVALID or CAN line from IPM is not normal.
   c. Drive door courtesy lamp control message is sent as INVALID or Can Line from RAM is not normal.
2. If RESCUE MODE runs, operation is as follows.
   a. Door unlock is ON for 0.5sec
   b. OSRVM Defogger is ON for 20min.
   c. Illumination is ON continuously.
   d. Other functions are the same as NORMAL mode.
3. If Ignition switch Message is OFF/ACC or IGN switch is OFF or can line from IPM,FAM,RAM is normal, Rescue mode is stopped.

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the front door lower panel (Refer to the Body group - front door)
3. Remove the door module (A) mounting screws (5EA) after disconnecting module connector (3EA)



4. Remove the door module (DDM/ADM) (A) from the front door trim panel.



CHAPTER 16:

Clutch System

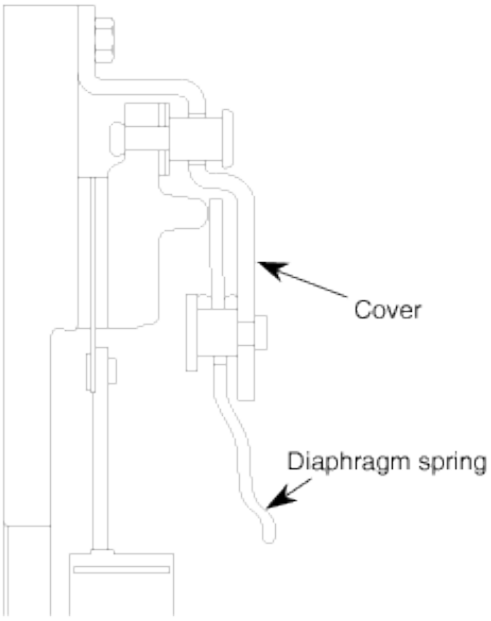
DESCRIPTION

SELF ADJUSTING CLUTCH(S.A.C.) COVER

a. As a clutch disc facing is worn away according to its durability, a cover weight is increasing and a clutch pedal pressure can be more needed.

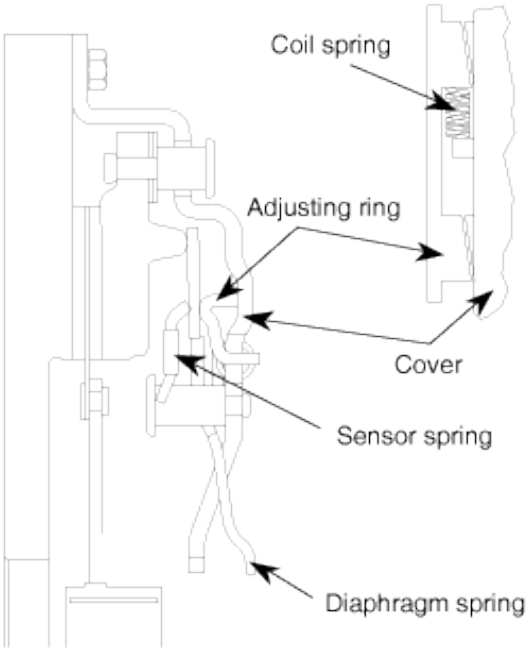
b. To make up for this defect, the self adjusting clutch system makes the requsted pedal pressure minimized so that makes the maintenance cycle longer.

GENERAL CLUTCH COVER



· In a general clutch cover, the diaphragm spring increases the weight to the disc in proportion to abrasion.

SELF ADJUSTING CLUTCH COVER



· In a self adjusting clutch, the adjusting ring prevents the diaphragm spring from being raised to the transmission side in spite of abrasion.

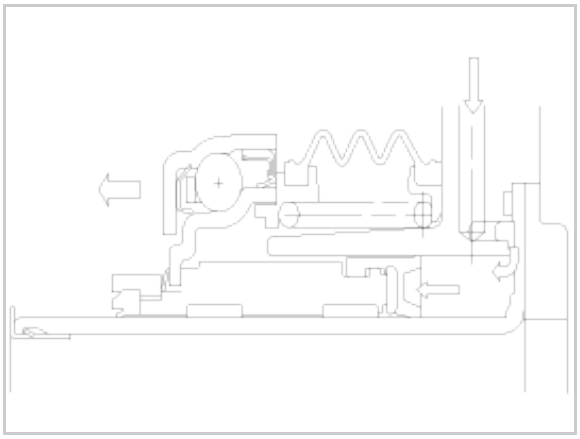
CONCENTRIC SLAVE CYLINDER-C.S.C.

It improves working efficiency and lowers the number and the weight of part by unifing clutch release control parts(clutch release bearing ~ clutch release cylinder) in a manual transaxle.

OPERATION

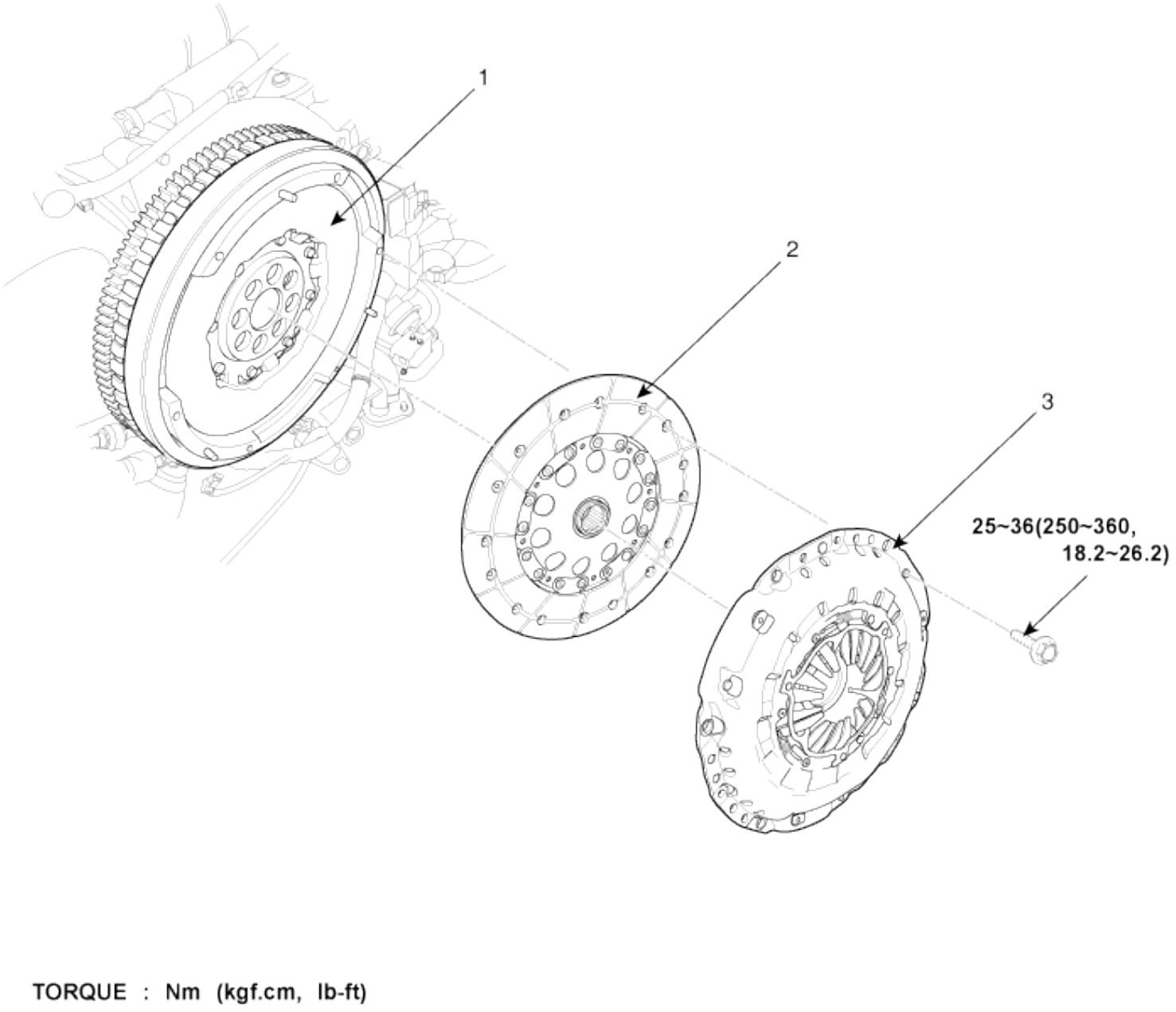
CONCENTRIC SLAVE CYLINDER-C.S.C

When the clutch pedal is pressed, oil pressure is transmitted along the arrow directions shown below and that moves the clutch slave cylinder and the diaphragm spring of the clutch cover.



Clutch Cover And Disc

COMPONENTS

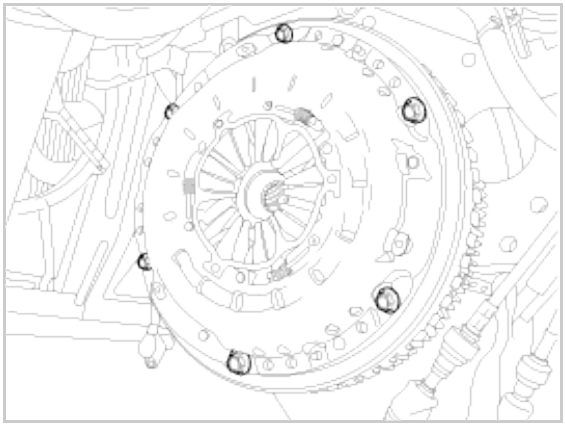


TORQUE : Nm (kgf.cm, lb-ft)

1. Engine flywheel
2. Clutch disc
3. Clutch cover

REPLACEMENT

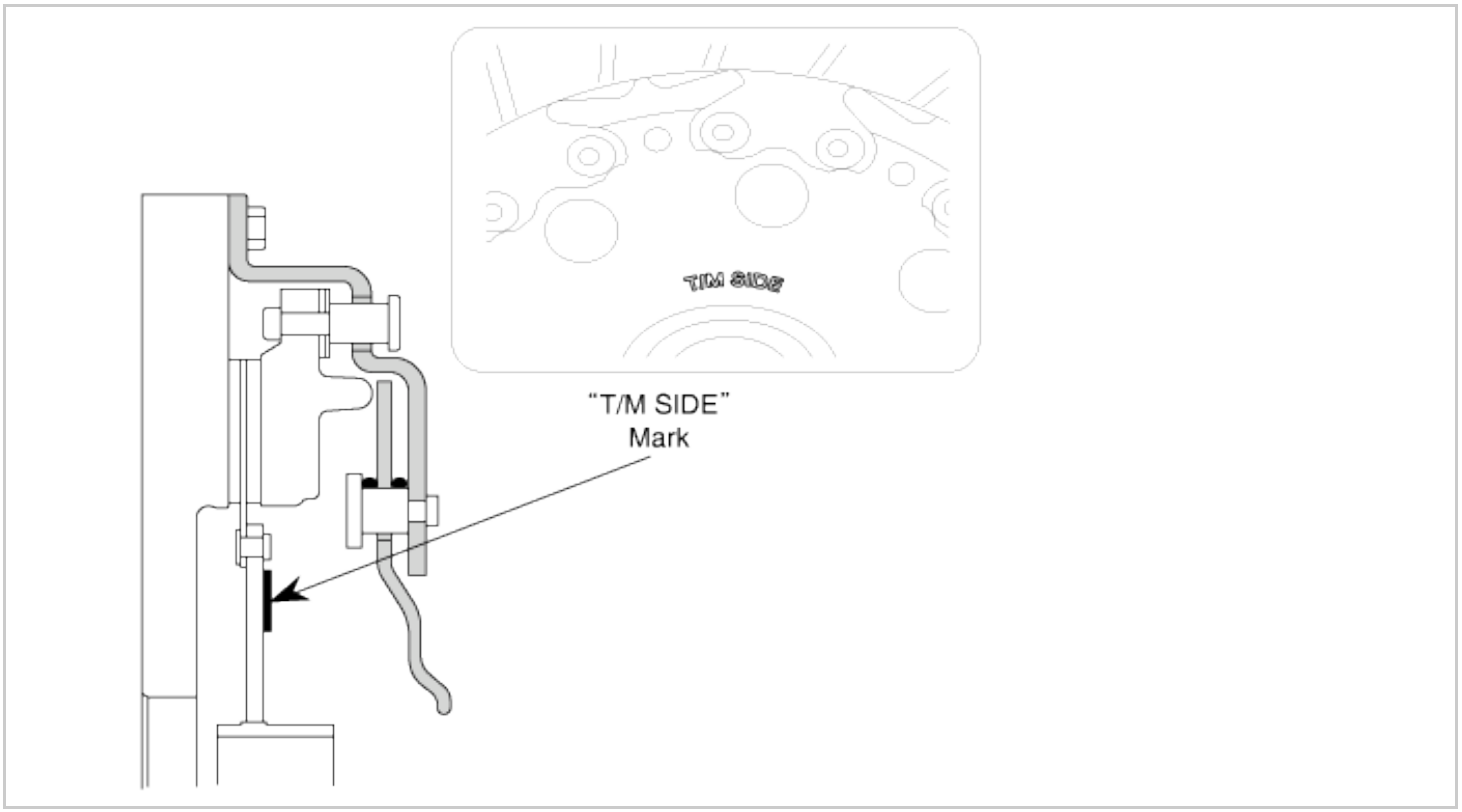
1. Remove a transaxle assembly (refer to 'MT'-group).
2. Remove the clutch cover bolts. Not to be bent or twisted, loosen them in diagonal directions.



3. Remove the clutch cover and disc.
4. Using the SST(09411-43000), install a clutch disc and cover.

CAUTION

a. Replace a clutch cover and disc as a set.
   * Possible problems when not following the caution
a. When replacing only a disc, slip problem can occur because of the initial clamp load loss by the adjusting ring's unusual work.
b. When replacing only a disc, it can be difficult to cut power because the thickness of the disc cannot be permitted.
b. Apply grease on a disc spline part and transmission input shaft spline part as required.
   * Possible problems when not following
a. When not applying: Excessively wear of splines and bad clutch operation
b. When excessively applying: Scattered grease by centrifugal force conteminates the clutch disc. Loss of friction force can cause a slip
c. The 'T/M SIDE' marked surface should face the transaxle.
   → If the surface face the opposite side, there can be an interference between a disc and a flywheel surface.

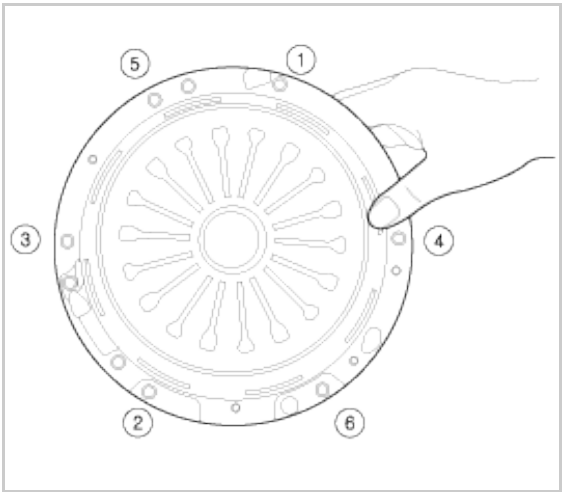


5. Tighten the clutch cover.

TORQUE:
24.5~35.3Nm (250~360kgf.cm, 18.1~26.0lb-ft) (6EA)

CAUTION

When installing the clutch cover, tighten the bolts in diagonal directions not to be bent or twisted.

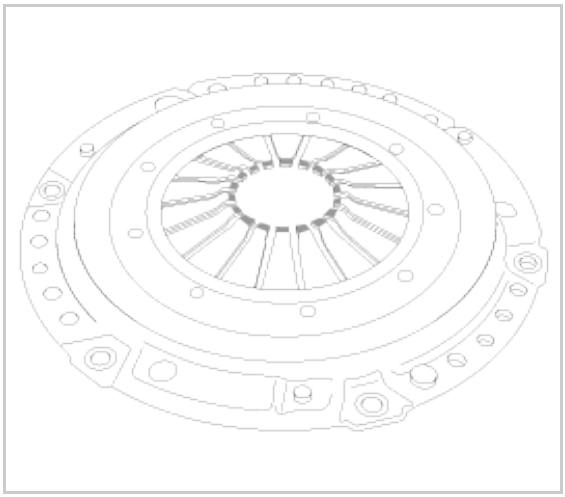


CAUTION

* Possible problems when not following
  a. When tightening the bolt completely at a time: the clutch cover can be twisted and vibration can occur.
  b. On vehicles with self adjusting clutches, it is necessary to follow this caution.
  c. Not following tightening torque: There can be bad torque transmission in clutch and relaxation possibility of bolts.

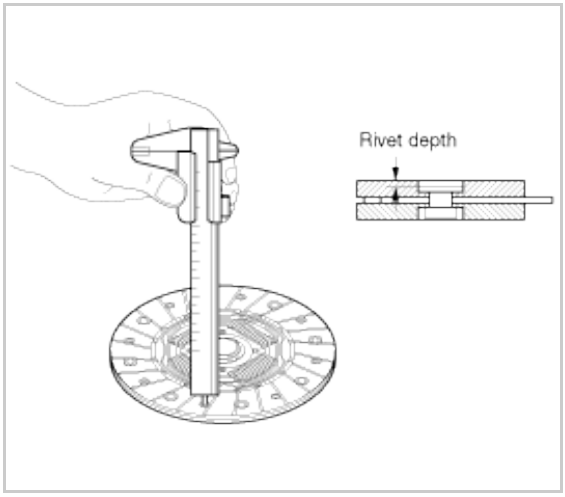
INSPECTION

1. Inspect diaphragm spring wear which is in contact with a concentric slave cylinder bearing.



2. Check the clutch cover and disc surface for wear or crack.
3. Check the clutch disc lining for slipping or oil mark.
4. Measure the depth from a clutch lining surface to a rivet. If the measured value is less than the specification below, replace it.

Specification: 0.3mm(0.0118inch)



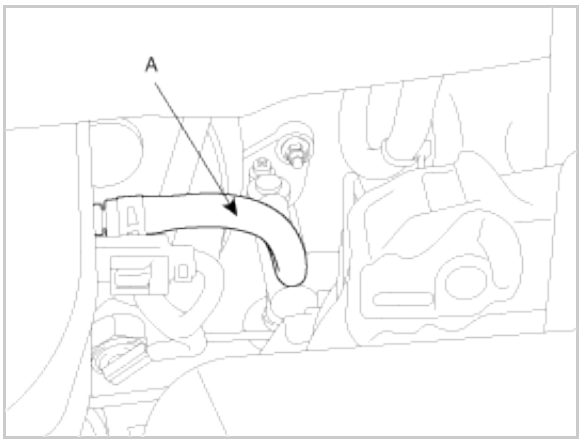
Clutch Master Cylinder

REMOVAL

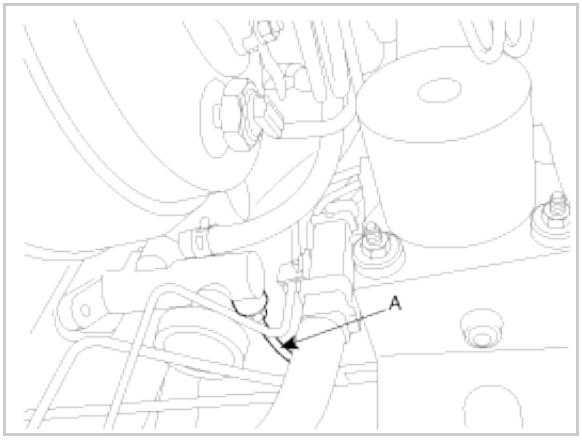
NOTICE

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

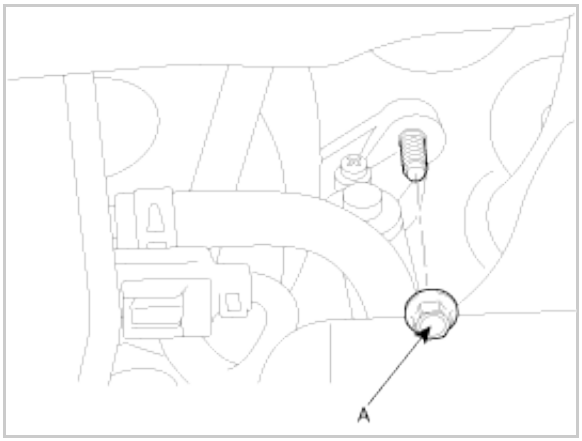
1. Remove the brake fluid fron the clutch master cylinder reservoir with a syringe.
2. Clamp the clutch master cylinder hose(A). If there is no enough room for clamping, you can also clamp the hose from the brake master cylinder side.

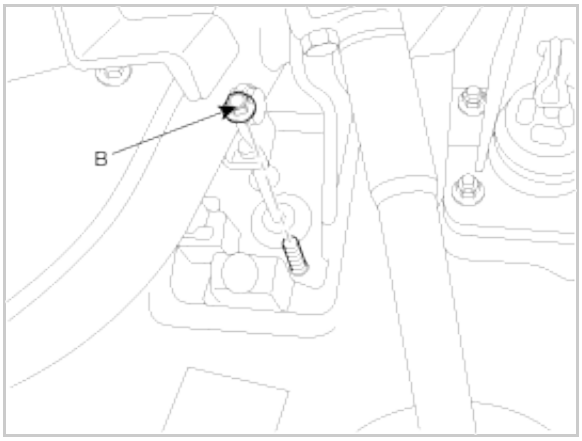


3. Disconnect the hose(A) from the cylinder by releasing the clutch master cylinder clamp.



4. Remove the clutch master cylinder mounting bolts(A,B).
   One is the engine room, the other near the clutch pedal assembly.





5. Remove the pin and washer which connect the clutch pedal with the clutch master cylinder.
6. Remove the clutch master cylinder. It can be helpful to do this step after removing the clutch pedal mounting bracket.

INSTALLATION

Installation is in the reverse order of removal.
After installation, bleed the clutch hydaulic system.

CONCENTRIC SLAVE CYLINDER AIR BLEEDING PROCEDURE

1. After disconnecting a cap from the concentric slave cylinder air bleeder, insert a vinyl hose in the plug.
2. Loosening the plug screw, press and release the clutch pedal about 10 times.

> **NOTICE**
>
> Hold the air bleeder body not to rotate with a spanner(A). The holding is needed when the plug loosened or tightened.

3. Tighten the plug during the clutch pedal pressed. Afterwards, raise the pedal with a hand.

TORQUE :
25~29Nm (250~290Kgf.cm, 18.2~21.1lb-ft)

4. After pressing the clutch pedal 3 times more, loosen the plug and retighten it with the pedal pressed. Raise it again, then.
5. Repeat the step 4 two or three times. (until there is no bubble in the fluid)

> **CAUTION**
>
> a. Do not clamp the pipe of a concentric slave cylinder.
> b. Be careful not to damage O-rings.

Clutch Pedal

ADJUSTMENT PROCEDURE

IGNITION LOCK SWITCH

1. Disconnect 2P-connector from a ignition lock switch.
2. Disconnect the ignition lock switch. (if you can install a tester with the switch fixed, this step can be omissible)
3. Check for continuity between terminals. (refer to the table below)

Clutch pedal position	Ignition lock switch	Continuity
Released	Released	NO
Pressed	Pressed	YES

If there is difference between what tested and the table above, replace the ignition lock switch with a new one. If not, install the ignition lock switch and adjust the clutch pedal.

TORQUE :
8~10Nm (80~100kgf.cm, 5.8~7.2lb-ft)

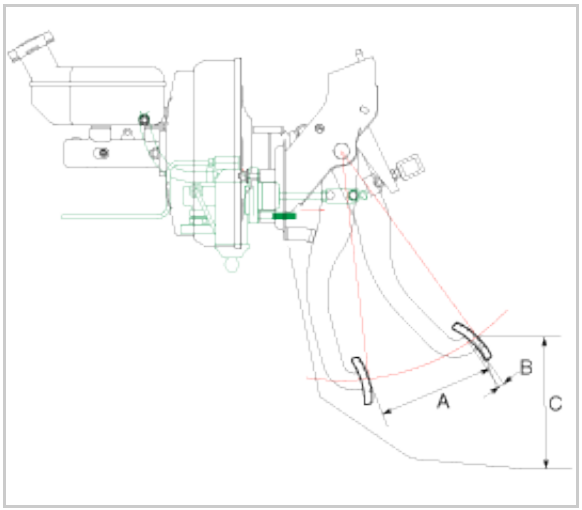
Clutch pedal and Ignition lock switch

NOTICE

a. Inspect a ignition lock switch.
b. Remove the driver's seat mat to adjust a clutch pedal.
c. No gap between a clutch master cylinder pistion and push rod can cause clutch slip.

1. Loosen and draw out the bolt until it is off the pedal surface.
2. Push and pull a clutch master cylinder push rod to satisfy the specification below.

Specification:
Clutch pedal stroke(A) - 150mm(5.91in)
Clutch pedal free play(B) - 6~13mm(0.24~0.51in)
Clutch pedal distance - 234.7mm(9.24in)



3. With no pressure on a clutch pedal, tighten the bolt until it contacts on the pedal.
4. Fix the bolt with a nut.

TORQUE :
14~20Nm (140~200kgf.cm, 10.2~14.5lb-ft)

5. Press the clutch pedal to the seat ground.
6. Adjust the ignition lock switch position with the pedal a little(23~26mm) raised.
7. Install the ignition lock switch firmly.

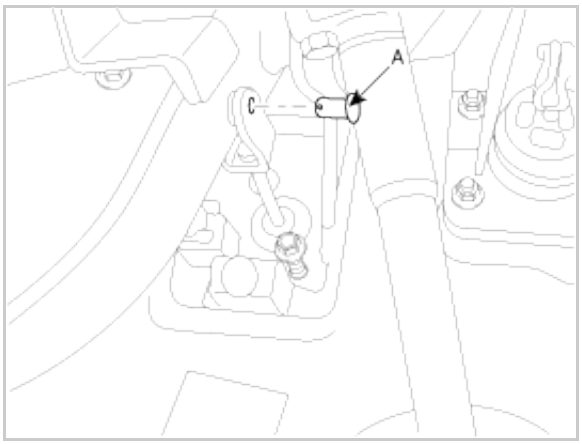
TORQUE:
8~10Nm (80~100kgf.cm, 5.8~7.2lb-ft)

REPLACEMENT

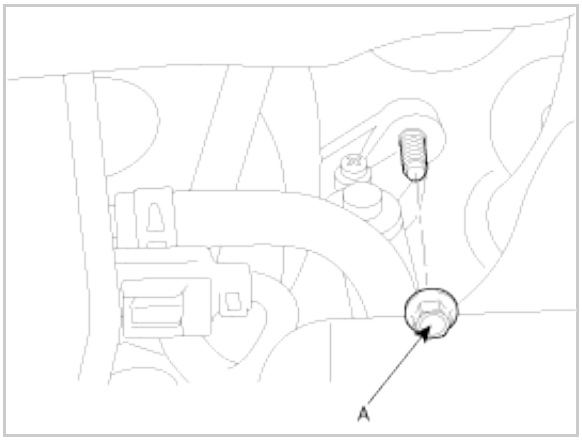
NOTICE

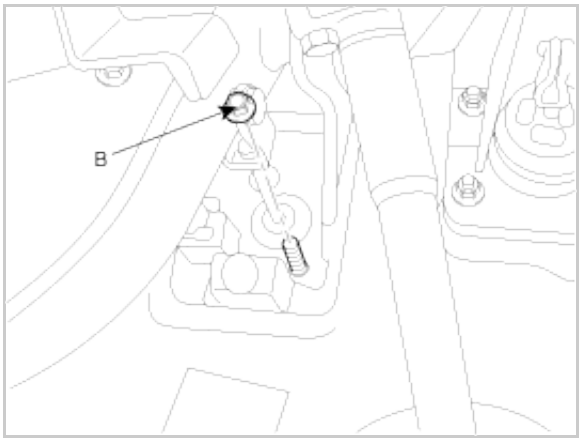
a. Inspect the continuity of the ignition lock switch.
b. Remove the floor mat before adjusting the clutch pedal.

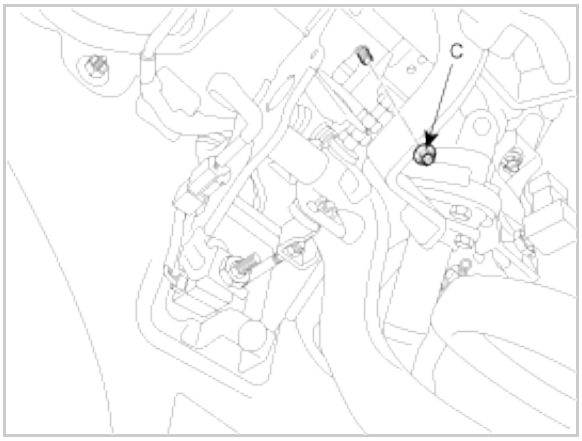
1. Remove the ignition lock switch.
2. Remove the snap pin and the clevis pin(A) connecting the clutch master cylinder push rod and the clutch pedal.



3. Remove the clutch master cylinder mounting nut(A,B) and the clutch pedal mounting nut(C).







4. Remove the clutch pedal.
5. Install a new one by tightening the bolts of the clutch pedal bracket and master cylinder .

TORQUE :
19~26 Nm(19~260 kgf.cm, 13.8~18.9 lb-ft)(Clutch pedal bracket)
12~16 Nm(120~160 kgf.cm, 8.7~11.6 lb-ft)(Clutch master cylinder)

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6. Grease the clevis pin and insert it and the snap pin.
7. Adjust the clutch pedal and the ignition lock switch.