

2004-06 ENGINES

3.5L V6 - Amanti

GENERAL

SPECIFICATION

GENERAL SPECIFICATIONS

Description		Specification (3.5)	Limit
General			
Type		V - type, DOHC	
Number of cylinders		6	
Bore		93.0 mm (3.6614 in.)	
Stroke		85.8 mm (3.3779 in.)	
Total displacement		3,497 cc	
Compression ratio		10.0:1	
Firing order		1-2-3-4-5-6	
Valve timing			
Intake valve	Opens (BTDC)-	16.5°	
	Closes (ABDC)	55.5°	
Exhaust valve	Opens (BBDC)	48.5°	
	Closes (ATDC)	15.5°	
Camshaft			
Cam height	Intake	35.098 - 35.298 mm (1.3818 - 1.3897 in.)	
	Exhaust	34.81 - 35.01 mm (1.3705 - 1.3783 in.)	
Journal diameter		25.951 - 25.970 mm (1.0220 - 1.0224 in.)	
Bearing oil clearance		0.05 - 0.09 mm (0.0007 - 0.0024 in.)	
End play		0.1 - 0.15 mm (0.0039 - 0.0059 in.)	
Cylinder head			
Flatness of gasket surface		Max. 0.03 mm (0.0012 in.)	0.05 mm (0.0020 in)
Flatness of mounting surface	Intake	Max. 0.10 mm (0.0039 in.)	0.10 mm (0.0039 in)
	Exhaust	Max. 0.15 mm (0.0059 in.)	0.15 mm (0.0059 in)
Valve guide hole diameter	0.05 (0.002) OS	12.05 - 12.068 mm (0.474 - 0.475 in.)	

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	0.25 (0.010) OS	12.25 - 12.268 mm (0.482 - 0.483 in.)	
	0.50 (0.020) OS	12.50 - 12.518 mm (0.492 - 0.493 in.)	
Intake valve seat ring hole diameter	0.3 (0.012) OS	36.30 - 36.325 mm (1.429 - 1.430 in.)	
	0.6 (0.024) OS	36.60 - 36.625 mm (1.441 - 1.442 in.)	
Exhaust valve seat ring hole diameter	0.3 (0.012) OS	33.30 - 33.325 mm (1.311 - 1.312 in.)	
	0.6 (0.024) OS	33.60 - 33.625 mm (1.323 - 1.324 in.)	
Valve			
Overall length	Intake	106.28 mm (4.184 in.)	105.78 mm (4.164 in.)
	Exhaust	105.4 mm (4.150 in.)	104.9 mm (4.130 in.)
Stem diameter	Intake	6.565 - 6.580 mm (0.258 - 0.259 in.)	
	Exhaust	6.530 - 6.550 mm (0.257 - 0.258 in.)	
Face angle		45° -45.5°	
Margin	Intake	1.0 mm (0.0394 in.)	0.5 mm (0.0197 in.)
	Exhaust	1.5 mm (0.059 in.)	0.8 mm (0.0315 in.)
Clearance (stem-to- guide)	Intake	0.02 - 0.05 mm (0.0009 - 0.0020 in.)	0.1 mm (0.0039 in.)
	Exhaust	0.05 - 0.085 mm (0.0020 - 0.0033 in.)	0.15 mm (0.0059 in.)
Valve spring			
Free height		46.4 mm (1.8268 in.)	45.4 mm (1.787 in.)
Load		24.0 kg / 37.9 mm (53 lb / 1.492 in.)	-
Out of squareness		Max 2°	4°
Piston			
Diameter (Standard)		92.97 - 92.98 mm (3.6602 - 3.6606 in)	
Clearance (Piston-to-cylinder)		0.03 - 0.05 mm (0.0012 - 0.0020 in)	
Ring groove width	No.1	1.530 - 1.550 mm (0.0602 - 0.0610 in)	
	No.2	1.510 - 1.530 mm (0.0594 - 0.0602 in)	
	Oil	3.010 - 3.030 mm (0.1185 - 0.1193 in)	
Piston for service		0.25 mm (0.010 in), 0.50 mm (0.020 in) Oversize	

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Piston ring

Number of rings per piston		3	
Compression ring		2	
Oil ring		1	
Compression ring type	No.1	Barrel type, steel	
	No.2	Taper type, special cast iron	
Oil ring type		3-piece type	
Ring end gap	No.1	0.20 - 0.30 mm (0.0079 - 0.0118 in.)	0.8 mm (0.0315 in.)
	No.2	0.45 - 0.60 mm (0.0177 - 0.0236 in.)	0.8 mm (0.0315 in.)
	Oil ring side rail	0.2 - 0.7 mm (0.0079 - 0.0276 in.)	1.0 mm (0.0394 in.)
Ring side clearance	No.1	0.04 - 0.08 mm (0.0016 - 0.0031 in.)	0.1 mm (0.0039 in.)
	No.2	0.02 - 0.06 mm (0.0008 - 0.0024 in.)	0.1 mm (0.0039 in.)
Ring for service		0.25 mm (0.010 in.), 0.50 mm (0.020 in.) Oversize	

Connecting rod

Side clearance (Big end)		0.10 - 0.25 mm (0.0039 - 0.0098 in.)	
Bend		0.05 mm or less/100 mm (0.0020 in. or less/3.937 in.)	
Twist		0.1 mm or less/100 mm (0.0039 in. or less/3.937 in.)	
Bearing	Oil clearance	0.022 - 0.040 mm (0.0009 - 0.0016 in.)	0.1 mm (0.0039 in.)
Pin diameter		21.974 - 21.985 mm (0.8651 - 0.8655 in.)	

Crankshaft

Journal O.D.		63.982 - 64.00 mm (2.519 - 2.5197 in.)	
Pin O.D.		54.982 - 55.00 mm (2.165 - 2.1653 in.)	
Out - of - roundness of journal and pin		Max. 0.03 mm (0.0012 in.)	
Taper of journal and pin		Max. 0.005 mm (0.0002 in.)	
End play		0.05 - 0.25 mm (0.002 - 0.0098 in.)	0.3 mm (0.012 in.)

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Main bearing	Oil clearance	0.018 - 0.036 mm (0.0007 - 0.0014 in.)	
Cylinder block			
Cylinder bore		93 mm (3.661 in.)	
Flatness of gasket surface		Max. 0.05 mm (0.002 in.)	
Out - of - round and taper		Max. 0.02 mm (0.0008 in.)	0.05 mm (0.002 in)
Oil pump			
Side clearance	Body clearance	0.100 - 0.181 mm (0.0039 - 0.0071 in.)	
	Side clearance	0.040 - 0.095 mm (0.0016 - 0.0037 in.)	
	Tip clearance	0.06 - 0.018 mm (0.0024 - 0.0071 in.)	
Relief spring			
Free length		46.3 mm (1.823 in.)	
Load		6.9 kg/39.1 mm (15.2 lb. /1.54 in.)	
Oil filter type		Cartridge, full flow	
Engine oil pressure		80 kPa (0.8 kg/cm ² , 11.4 psi) or more (at idle)	
		[Conditions : Oil temperature is 90 to 100° C (194 to 212°F)]	
Cooling method		Engine coolant cooling, forced circulation with electric fan	
Cooling system			
Quantity		10.2 lit (10.78 U.S.qts., 8.9 imp.qts)	
Thermostat			
Type		Wax pellet type with jiggle valve	
Normal opening temperature		82°C (179.6°F)	
Opening temperature range		80°C - 84°C (176 - 183.2°F)	
Wide open temperature		95°C (203°F)	
Radiator cap			
Main valve opening pressure		86.1 - 124.5 kPa (0.98 - 1.27 kg/cm ² , 13.94 - 18.06 psi)	
Main valve closing pressure		83.4 kPa (0.85 kg/cm ² , 12.1 psi)	

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Vacuum valve opening pressure	- 6.86 kPa (- 0.07 kg/cm ² -1.00 psi)	
Air cleaner		
Type	Dry type	
Element	Unwoven cloth type	
Exhaust pipe		
Muffler	Expansion resonance type	
Suspension system	Rubber hangers	

SERVICE STANDARD

Standard value
Coolant concentration
Tropical area : 40%
Other area : 50%

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Fig. 1: Identifying Coolant Concentration
Courtesy of KIA MOTORS AMERICA, INC.

LUBRICANT

Engine coolant	Ethylene glycol base for aluminum radiator
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Fig. 2: Identifying Engine Coolant
Courtesy of KIA MOTORS AMERICA, INC.

SEALANT

Engine coolant temperature sensor	Three bond No.2310 or equivalent LOCTITE 962T or equivalent
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Fig. 3: Identifying Sealant
Courtesy of KIA MOTORS AMERICA, INC.

TIGHTENING TORQUE

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Air Intake Surge Tank Bolt\Nut (to Intake Manifold)	11-15 (15-20)
Auto Tensioner Fixed Bolt	15-20 (20-27)

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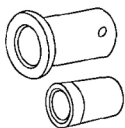
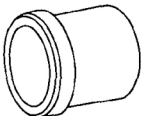
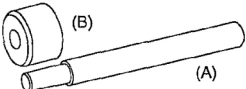
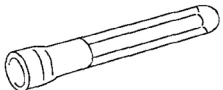
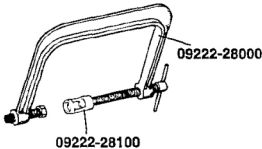
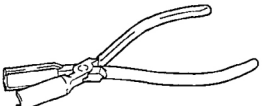
Camshaft Sprocket Bolt	58-72 (79-98)
Catalytic Converter Nut (To Exhaust Manifold)	18-21 (25-29)
Center Muffler Nut (To Front Muffler)	29-43 (39-59)
Connecting Rod Nut	25 (34) Plus Torque Angle 92 Degrees
Crankshaft Pulley Bolt	130-137 (177-186)
Cylinder Head Bolt (Cold Engine)	76-83 (103-113)
Drive Belt Pulley Bolt	25-40 (34-54)
Drive Belt Tensioner Nut	25-40 (34-54)
Drive Plate & Adapter Plate Bolt	53-56 (71-76)
Engine Coolant Temperature Sensor\ Gauge	15-29 (20-40)
Engine Hanger Bracket (To Engine)	20-25 (27-34)
Engine Mount Bracket Bolt (12x55)	43-58 (59-79)
Engine Mount Bracket Nut	43-58 (59-79)
Engine Mount Insulator Bolt (12x115)	65-80 (88-108)
Engine Mount Stay Bolt	36-47 (49-64)
Exhaust Manifold Nut (To Engine)	29-33 (39-44)
Front Muffler Nut (To Catalytic Coverter)	29-43 (39-59)
Front Roll Stopper Bracket Bolt (To Sub Frame)	43-58 (59-79)
Front Roll Stopper Bracket Bolt (To Transaxle)	36-47 (49-64)
Front Roll Stopper Insulator Bolt\Nut (10x90)	36-47 (49-64)
Front Roll Stopper Stay Bolt	29-36 (39-49)
Front Roll Stopper Stay Nut	36-47 (49-64)
Generator Mounting Bracket	13-16 (18-22)
Generator Mounting Nut (Engine Front Case Side)	15-18 (20-25)
Generator Stay	13-16 (18-22)
Intake Manifold Nut (To Engine)	15-17 (20-23)
Main Bearing Cap Bolt	51-58 (67-79)
Main Muffler Nut (To Center Muffler)	29-43 (39-59)
Oil Pan Drain Plug	25-33 (34-44)
Oil Screen Bolt	11-16 (15-22)
Oil Relief Valve Plug	29-36 (39-49)
Oxygen Sensor (To Exhaust Manifold)	29-36 (39-49)
Power Steering Oil Pump Bracket	26-40 (34-54)
Power Steering Oil Pump (To Bracket)	14-20 (19-28)
Rear Roll Stopper Bracket Bolt\Nut	36-47 (49-64)
Rear Roll Stopper Bracket Bolt (To Sub Frame)	36-47 (49-64)
Rear Roll Stopper Bracket Bolt (To Transaxle)	36-47 (49-64)
Starter Bolt (To Engine)	31-40 (42-54)
Surge Tank Stay	11-15 (15-20)
Throttle Body Bolt (To Surge Tank)	15-17 (20-24)

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Timing Belt Idler Pulley Bolt	36-44 (49-59)
Timing Belt Tensioner Arm Fixed Bolt	25-40 (34-54)
Timing Belt Tensioner Pulley Bolt	31-40 (42-54)
Transaxle Mounting Bracket Bolt\Nut	44-58 (59-79)
Transaxle Mounting Insulator Bolt (12x120)	65-80 (88-108)
Transaxle Mounting Stay Bolt	36-47 (49-64)
Upper Oil Pan Bolt (Oil Pan Bolt-To-Housing)	22-30 (29-41)
Water Outlet Fitting Bolt	12-15 (17-20)
INCH Lbs. (N.m)	
Air Cleaner Body Insulation Bolt	62-80 (8-12)
Cylinder Head Cover Bolt	53-62 (8-10)
Delivery Pipe Insulation Bolt	89-115 (10-13)
Engine Coolant Inlet Fitting Attaching Bolt	106-124 (17-20)
Heat Protector Bolt (To Exhaust Manifold)	106-133 (12-15)
Lower Oil Pan Bolt	62-80 (8-12)
Main Muffler Hanger Support Bracket Bolt	89-133 (10-15)
Oil Seal Case	89-106 (10-12)
Oil Filter	9-12 (12-16)
Oil Level Gauge Guide (To Engine)	106-133 (12-15)
Oil Pump Case Bolt	106-133 (12-15)
Oil Pump Cover Screw	71-106 (8-12)
Rear Plate	89-106 (10-12)
Timing Belt Cover Bolt	89-106 (10-12)
Upper Oil Pan Bolt (Long Bolts)	44-62 (5-7)
Upper Oil Pan Bolt (Short Bolts)	62-80 (8-12)

SPECIAL SERVICE TOOLS

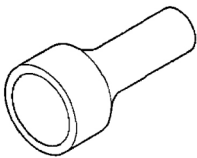
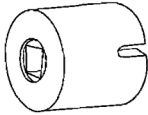
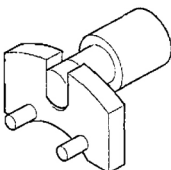
Tool (Number and name)	Illustration	Use
Crankshaft front oil seal installer (09214-33000)		Installation of the crankshaft front oil seal
Camshaft oil seal installer (09221-21000)		Installation of the camshaft oil seal
Valve guide remover (09221-3F000(A)) Valve guide installer (09221-3F000(B))		Removal and installation of the valve guide
Valve stem oil seal installer (09222-28200)		Installation of the valve stem oil seal
Valve spring compressor (09222-28000) Valve spring compressor adapter (09222-28100)		Removal and installation of the intake or exhaust valve
Valve stem oil seal remover (09222-29000)		Removal of the valve stem oil seal

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Fig. 4: Identifying Special Tools (1 of 2)
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Tool (Number and name)	Illustration	Use
Crankshaft rear oil seal installer (09231-33000)		Installation of the crankshaft rear oil seal
Crankshaft wrench (09231-33100)		Used if the crankshaft needs to be rotated to attach the timing belt, etc.
Timing belt tensioner pulley socket wrench (09244-28100)		Used to set timing belt tension.

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Fig. 5: Identifying Special Tools (2 of 2)
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TROUBLESHOOTING

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Symptom	Probable cause	Remedy
Knocking of crankshaft and bearing	Worn main bearing	Replace
	Seized bearing	Replace
	Bent crankshaft	Replace
	Excessive crankshaft end play	Replace thrust bearing
Piston and connecting rod knock	Worn bearing	Replace
	Seized bearing	Replace
	Worn piston pin	Replace piston and pin or connecting rod
	Worn piston in cylinder	Recondition cylinder
	Broken piston ring	Repair or replace
	Improper connecting rod alignment	Replace
Noisy valves	Faulty auto-lash adjuster	Replace
	Thin or diluted engine oil (low oil pressure)	Change
	Worn or damaged valve stem or valve guide	Replace
Excessively worn cylinder and piston	Shortage of engine oil	Add or replace Check oil level on daily basis
	Dirty engine oil	Replace
	Poor quality of engine oil	Use proper oil
	Improperly assembled piston and connecting rod	Repair or replace
	Improper piston ring end clearance	Replace
	Dirty air cleaner	Clean air cleaner assembly and replace the air filter
Connecting rod and main bearing noise	Insufficient oil supply	Check engine oil level
	Thin or diluted engine oil	Change and determine cause
	Excessive bearing clearance	Replace
Damaged crankshaft bearing	Shortage of engine oil	Add or replace Check oil level on daily basis
	Low oil pressure	Adjust or repair
	Poor quality of engine oil	Use proper engine oil
	Worn or out-of-round of crankshaft journal	Replace
	Restricted oil passage in crankshaft	Clean
	Worn bearing	Replace bearing and check engine oil and lubrication system
	Bearing improperly installed	Replace
	Non-concentric crankshaft or bearing	Replace
Timing belt noise	Incorrect belt tension	Replace

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Fig. 6: Engine Troubleshooting (1 of 3)
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Symptom	Probable cause	Remedy
Low compression	Blown cylinder head gasket	Replace gasket
	Worn or damaged piston rings	Replace rings
	Worn piston or cylinder	Repair or replace piston and/or cylinder block
	Worn or damaged valve seat	Repair or replace valve and/or seat ring
Low oil pressure	Low engine oil level	Check engine oil level
	Faulty oil pressure switch	Replace
	Clogged oil filter	Replace
	Worn oil pump gears or cover	Replace
	Thin or diluted engine oil	Change and determine cause
	Oil relief valve stuck (open)	Repair
	Excessive bearing clearance	Replace
High oil pressure	Oil relief valve stuck (closed)	Repair
Excessive engine rolling and vibration	Loose engine roll stopper (front, rear)	Re-tighten
	Loose transaxle mount bracket	Re-tighten
	Loose engine mount bracket	Re-tighten
	Loose center member	Re-tighten
	Broken transaxle mount insulator	Replace
	Broken engine mount insulator	Replace
	Broken engine roll stopper insulator	Replace
Low coolant level	Leakage of coolant Damaged radiator core joint Corroded or cracked hoses (Radiator hose, heater hose, etc)	Replace Replace
	Faulty radiator cap valve or setting of spring	Replace
	Faulty thermostat	Replace
	Faulty engine coolant pump	Replace
Clogged radiator	Foreign material in coolant	Replace
Abnormally high coolant temperature	Faulty thermostat	Replace parts
	Faulty radiator cap	Replace
	Restriction of flow in cooling system	Replace
	Loose or missing drive belt	Adjust or replace
	Faulty engine coolant pump	Replace
	Faulty temperature gauge or wiring	Repair or replace
	Faulty electric fan	Repair or replace
	Faulty thermo-sensor on radiator	Replace
Abnormally low coolant temperature	Insufficient coolant	Refill coolant
	Faulty thermostat	Replace
	Faulty temperature gauge or wiring	Repair or replace

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Fig. 7: Engine Troubleshooting (2 of 3)
Courtesy of KIA MOTORS AMERICA, INC.

Symptom	Probable cause	Remedy
Leakage from oil cooling system	Loose hose and pipe connection	Replace
	Blocked or collapsed hose and pipe	Repair or replace
Inoperative electrical cooling fan	Damaged	Replace or repair
Exhaust gas leakage	Loose connections	Re-tighten
	Broken pipe or muffler	Repair or replace
Abnormal noise	Detached baffle plate in muffler	Replace
	Broken rubber hanger	Replace
	Pipe or muffler contacting vehicle body	Correct
	Broken pipe or muffler	Repair or replace

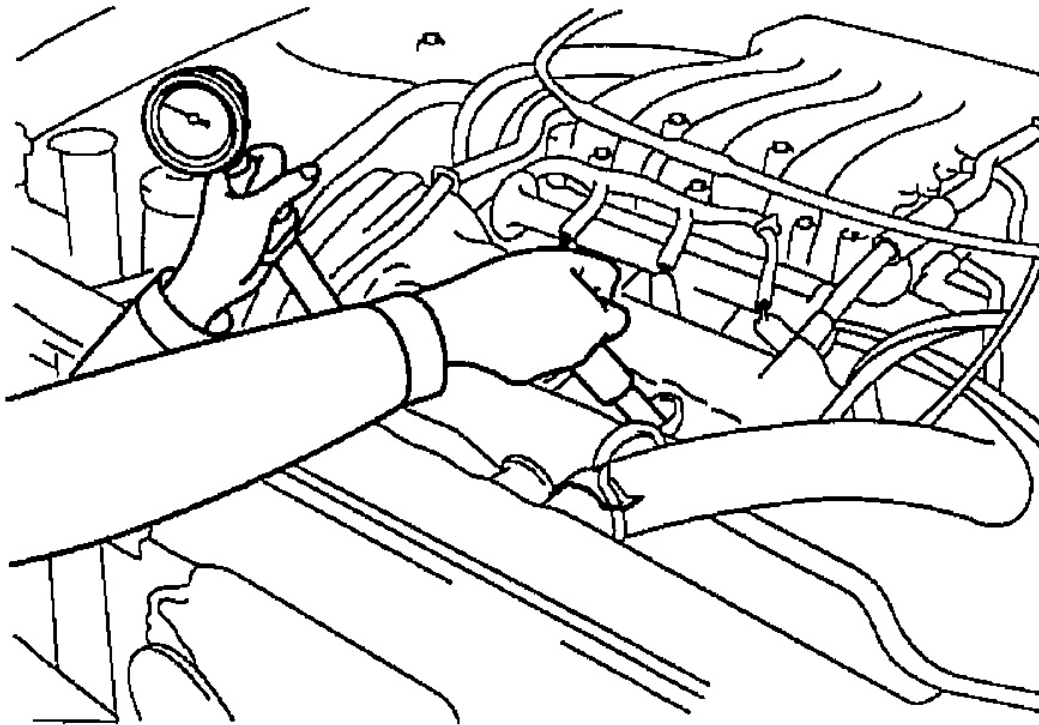
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Fig. 8: Engine Troubleshooting (3 of 3)

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SERVICING**COMPRESSION TEST**

1. Before checking engine compression, check the engine oil level. Also check that the starter motor and battery are all in normal operating condition.
2. Check the DTC and note it. Use the scan tool to clear the ECM'S memory.
3. Start the engine and wait until engine coolant temperature reaches 80-90°C (176-205°F).
4. Disconnect the fuel pump connector.
5. Turn off engine and disconnect the spark plug cables.
6. Remove the spark plugs.
7. Disconnect the ignition Coil connector.
8. Crank the engine to remove any foreign material in the cylinders.
9. Insert the compression gauge into the spark plug hole.



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Fig. 9: Testing Engine Compression
Courtesy of KIA MOTORS AMERICA, INC.

10. Depress the accelerator pedal to open the throttle fully.
11. Crank the engine and read the gauge.

Standard value : 1275 kpa (13.0 kg/cm² , 185 psi)

Limit : 1128 kpa (11.5 kg/cm² , 164 psi)

12. Repeat steps 9 to 11 over all cylinders, ensuring that the pressure differential for each of the cylinders is within the specified limit.

Limit :

Max 98 kpa (1.0 kg/cm² , 14 psi) between cylinders

13. If a cylinder's compression or pressure differential is outside the specification, add a small amount of oil through the spark plug hole, and repeat steps 9 to 12.
 1. If the addition of oil makes the compression to rise, it is likely that there may be wear between the

piston ring and cylinder wall.

2. If compression remains the same, valve seizure, poor valve seating or a compression leak from the cylinder head gasket are all possible causes.

Tightening torque

Spark plug : 19.6-29.4 Nm (2-3 kg.m, 14.5-21.7 lb.ft)

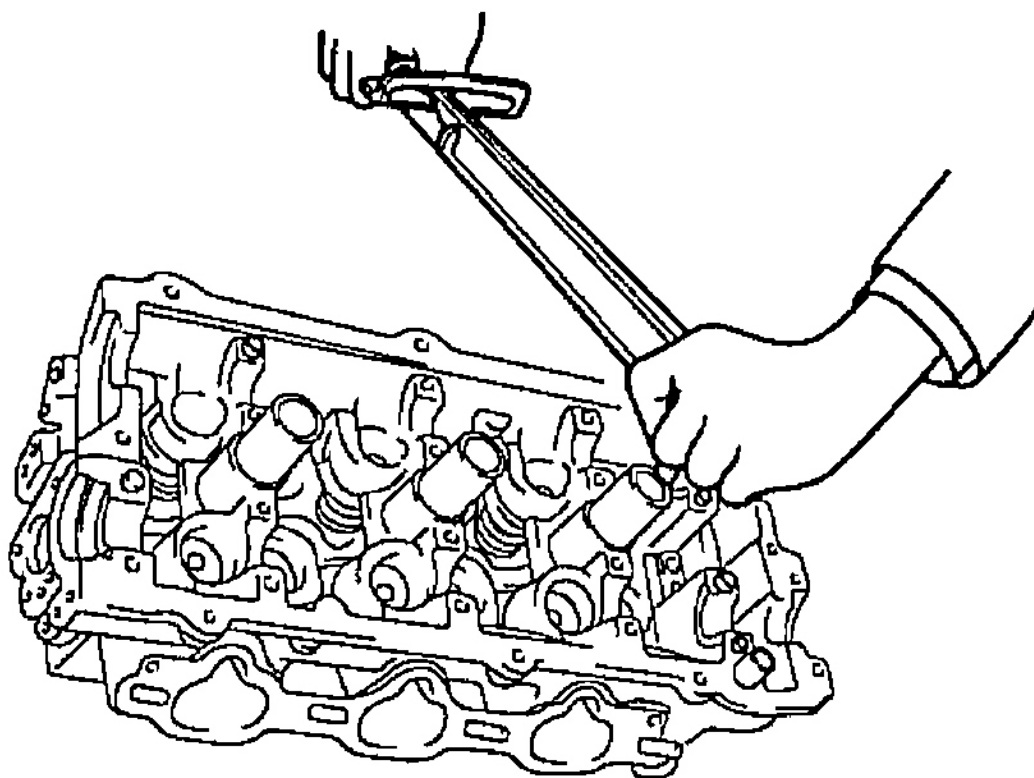
TIGHTENING CYLINDER HEAD BOLTS

1. First loosen slightly and then tighten to the specified torque.

Tightening torque

Cylinder head bolts cold [Engine temperature approximately 20°C (68°F)] :

103.0-112.8 Nm (10.5-11.5 kg.m, 75.9-83.2 lb.ft)



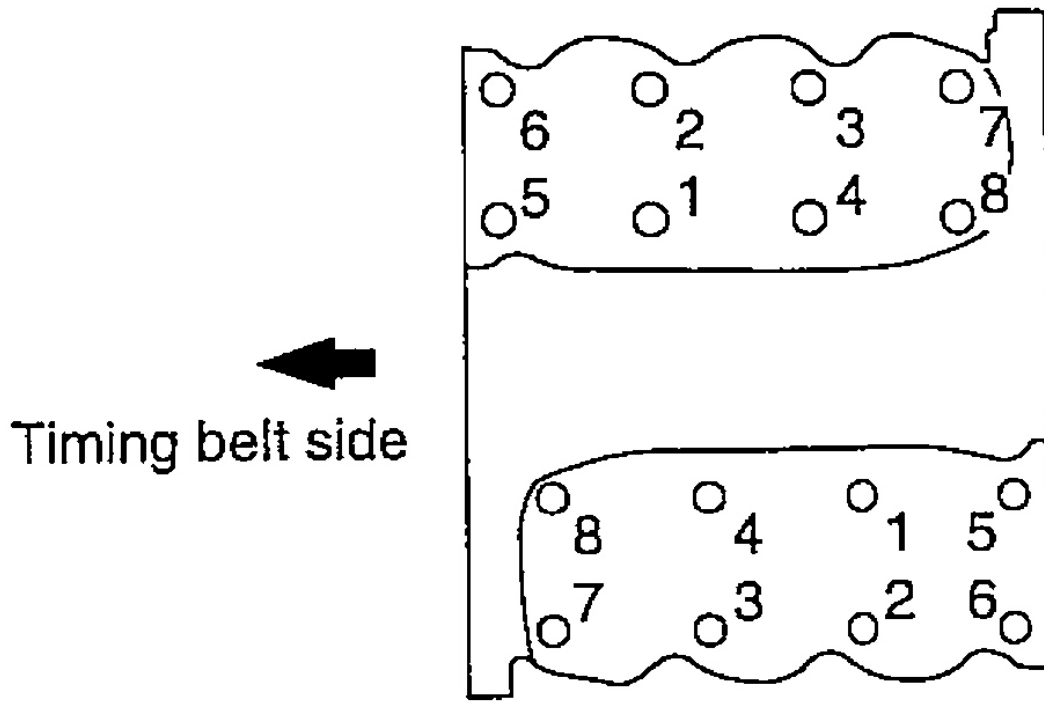
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Fig. 10: Tightening Cylinder Head Bolts

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2. Be sure to follow the specific torque sequence as shown in the illustration.

NOTE: Run the engine to normal operating temperature and let it cool, then re-torque the bolts to specifications.



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Fig. 11: Cylinder Head Tightening Sequence
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ADJUSTING VALVE CLEARANCE

As the intake and exhaust valves are equipped with hydraulic lash adjusters, there is no need to adjust the valve clearance. The proper function of the hydraulic lash mechanism may be determined by checking for tappet noise. When there is a tappet noise or any unusual noise, check the hydraulic lash adjuster by removing and bleeding or replacing it.

CHECKING ENGINE OIL

1. Position vehicle on a level surface.
2. Turn off the engine.

NOTE: In the case of a vehicle that has not been used for a prolonged period, run the engine for several minutes. Turn off the engine and wait for 5 minutes at least, then check the oil level.

3. Check that the engine oil level is within the level range indicated on the oil dipstick. If the oil level is found to have fallen to the lower limit (the "L" mark), refill to the "F" mark.

NOTE: When refilling, use the proper grade of engine oil.

4. Check that the oil is not dirty or mixed with coolant or gasoline, and that it has the proper viscosity.

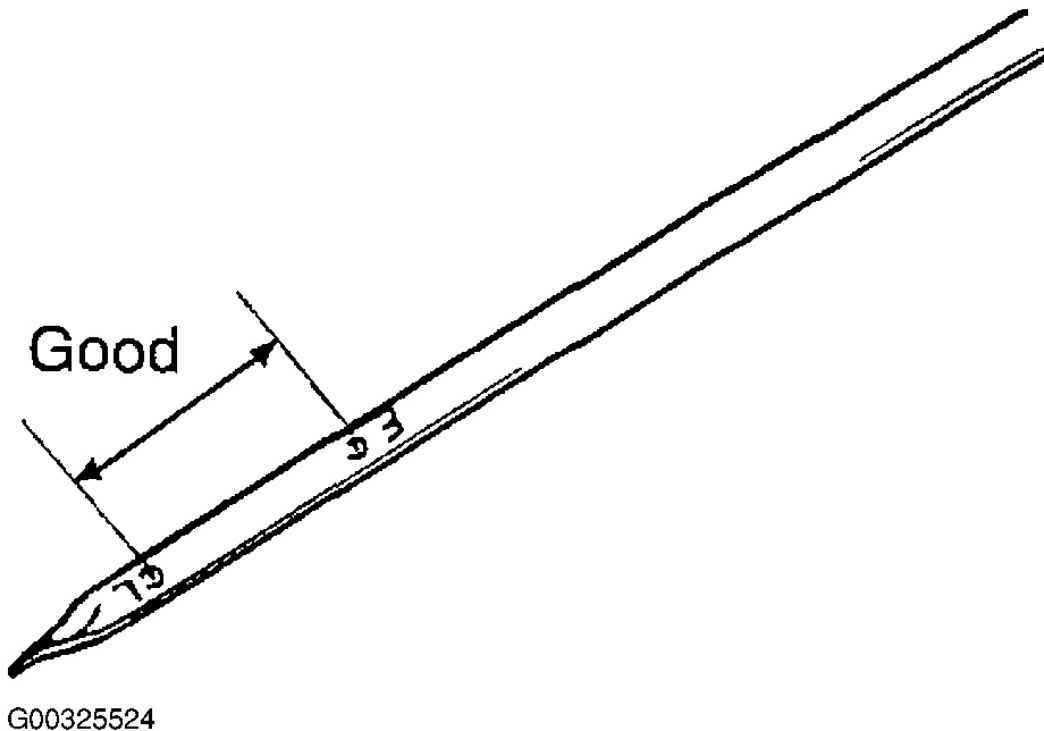


Fig. 12: Checking Engine Oil Level
Courtesy of KIA MOTORS AMERICA, INC.

SELECTION OF ENGINE OIL

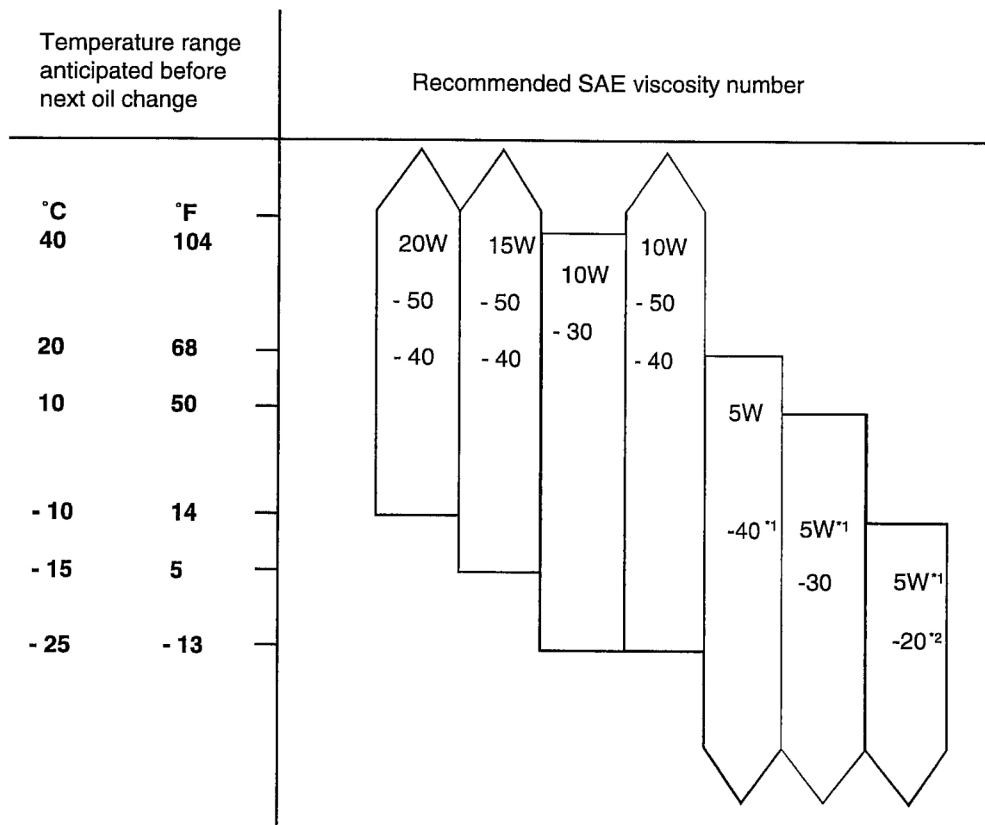
Recommended API classification: SG OR ABOVE [For General]

Recommended API classification: SH OR ABOVE [For North America, Europe]

Recommended SAE viscosity grades:

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*1 Restricted by driving condition and environment.

*2 Not recommended for sustained high speed vehicle operation

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Fig. 13: Illustrating Oil Recommendations
Courtesy of KIA MOTORS AMERICA, INC.

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

1. Satisfy the requirements of the API classification.
2. Have the proper SAE grade number for expected ambient temperature range.

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

CHANGING ENGINE OIL

1. Run the engine until it reaches normal operating temperature.
2. Turn off the engine.
3. Remove the oil filler cap and then drain plug. Drain the engine oil.

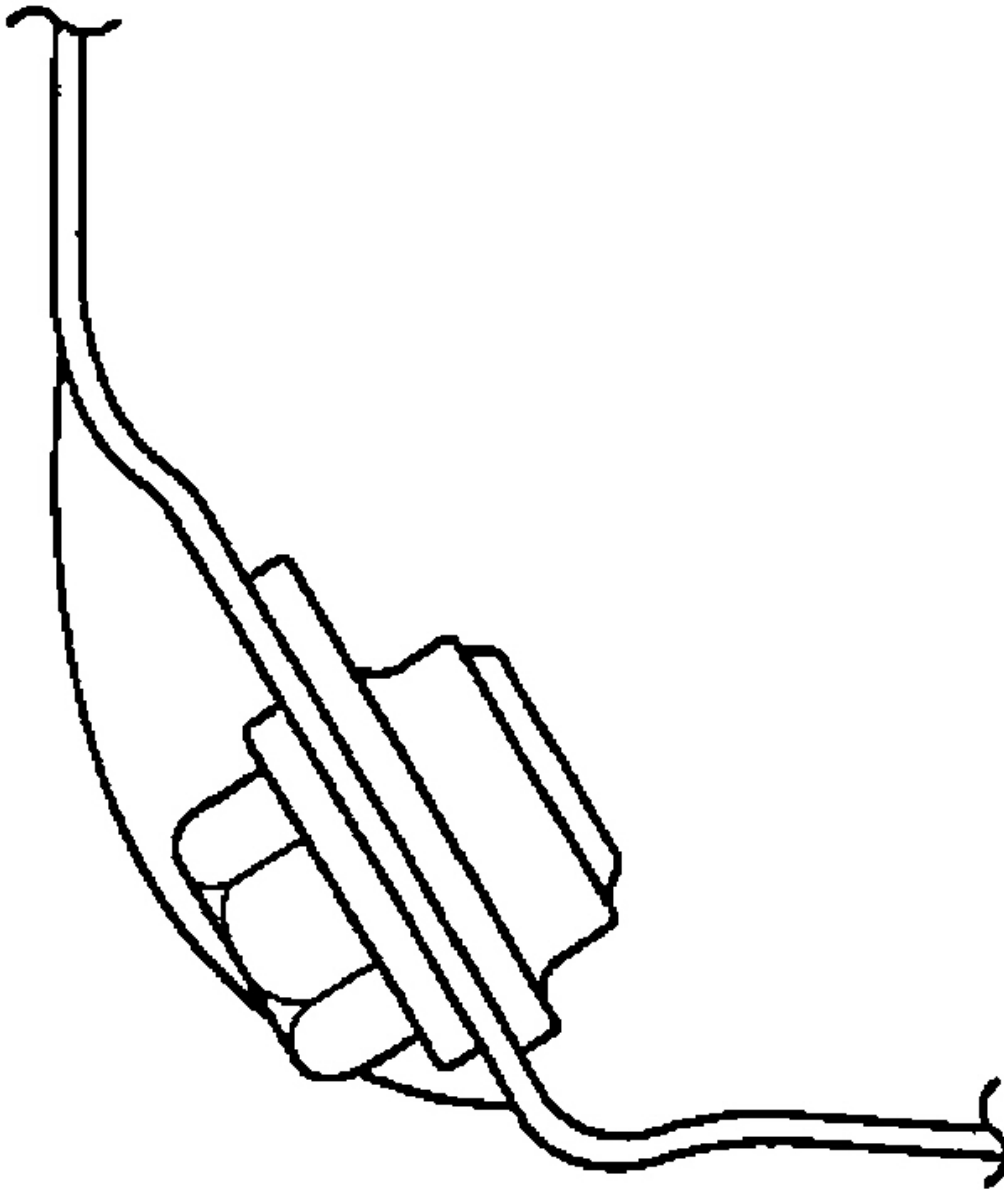
4. Replace the oil filter.
5. Tighten the drain plug to the specified torque.

Tightening torque

Oil pan drain plug :

34.3-44.1 Nm (3.5-4.5 kg.m, 25.3-32.5 lb.ft)

NOTE: **Whenever tightening the oil drain plug, use a new drain plug gasket.**



G00325526

Fig. 14: Replacing Drain Plug Gasket
Courtesy of KIA MOTORS AMERICA, INC.

6. Fill the new engine oil through the oil filler cap.

Drain and Refill

Oil quantity : 4.3 lit (4.5 U.S qts., 3.8 Imp. qts.)

NOTE: Do not over fill. This will cause oil aeration and loss of oil pressure.

7. Install the oil filler cap.
8. Start and run the engine.
9. Turn off the engine and then check the oil level. Add oil if necessary.

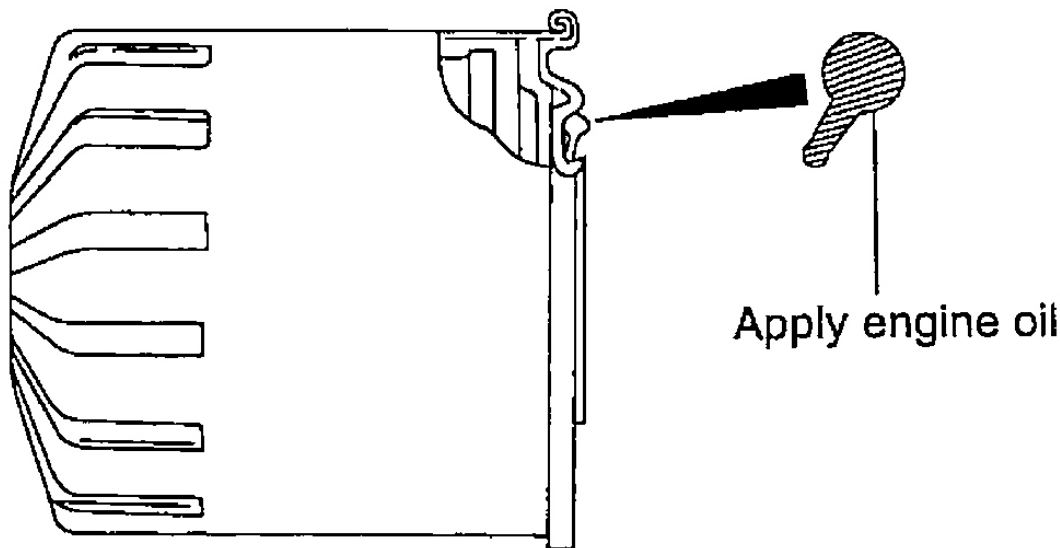
REPLACING OIL FILTER

1. Use a filter wrench to remove the oil filter.
2. Before installing a new oil filter on the engine, apply clean engine oil to the surface of the rubber gasket.
3. Tighten the oil filter of the specified torque.

Tightening torque

Oil filter : 11.8-15.7 Nm (1.2-1.6 kg.m, 8.7-11.6 lb.ft)

4. Start and run the engine and check engine oil leaks.
5. After stopping the engine, check the oil level and add oil as necessary.



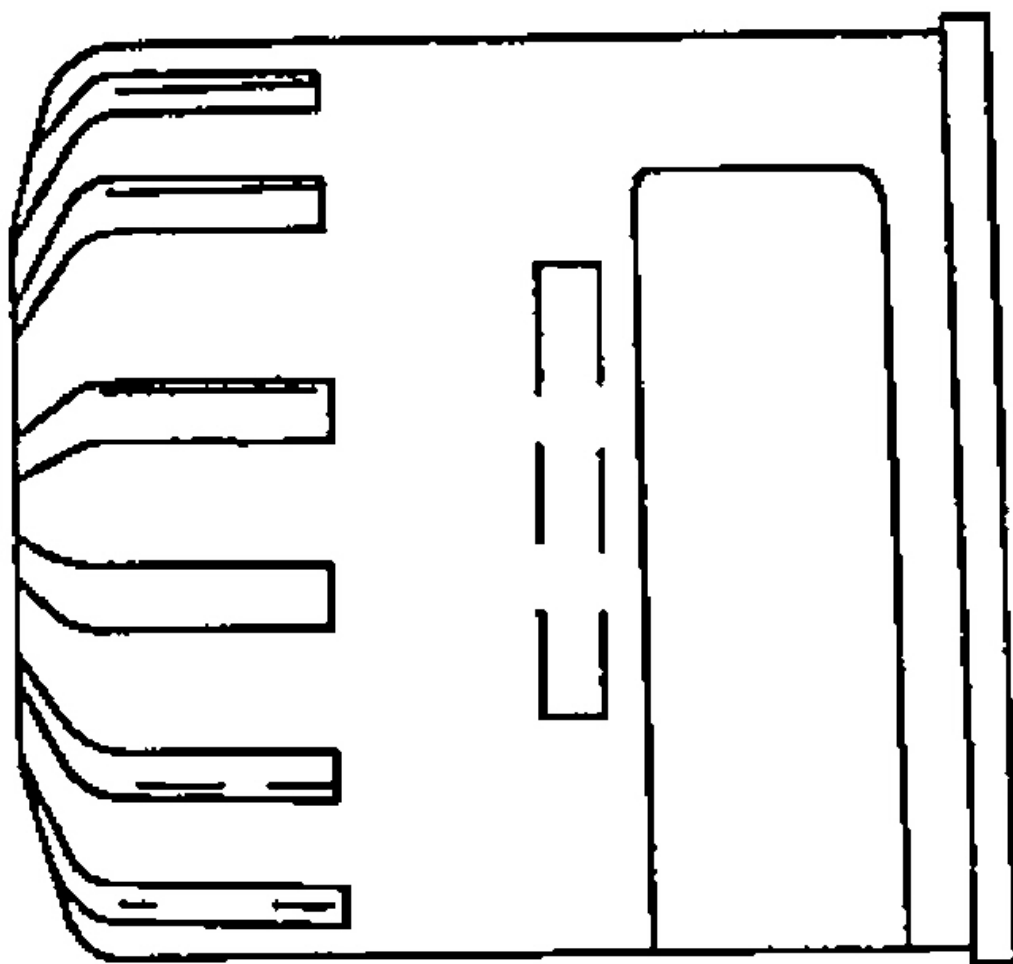
G00325528

Fig. 15: Replacing Oil Filter
Courtesy of KIA MOTORS AMERICA, INC.

REPLACEMENT OIL FILTER**FILTER SELECTION**

All Kia Motors Corporation engines are equipped with a high quality, disposable oil filter. This filter is recommended as a replacement filter for all vehicles. The quality of after market replacement filters varies considerably.

A high quality replacement filter should be used to assure the most efficient service. Make sure that the rubber gasket from the old oil filter is completely removed from the contact surface on the engine block before installing a new filter.



G00325527

Fig. 16: Identifying Oil Filter

Courtesy of KIA MOTORS AMERICA, INC.

CHECKING COOLANT LEAK

Antifreeze	Mixture ratio of antifreeze in coolant
ETHYLENE GLYCOL BASE FOR ALUMINUM	50% [Except tropical areas] 40% [Tropical areas]

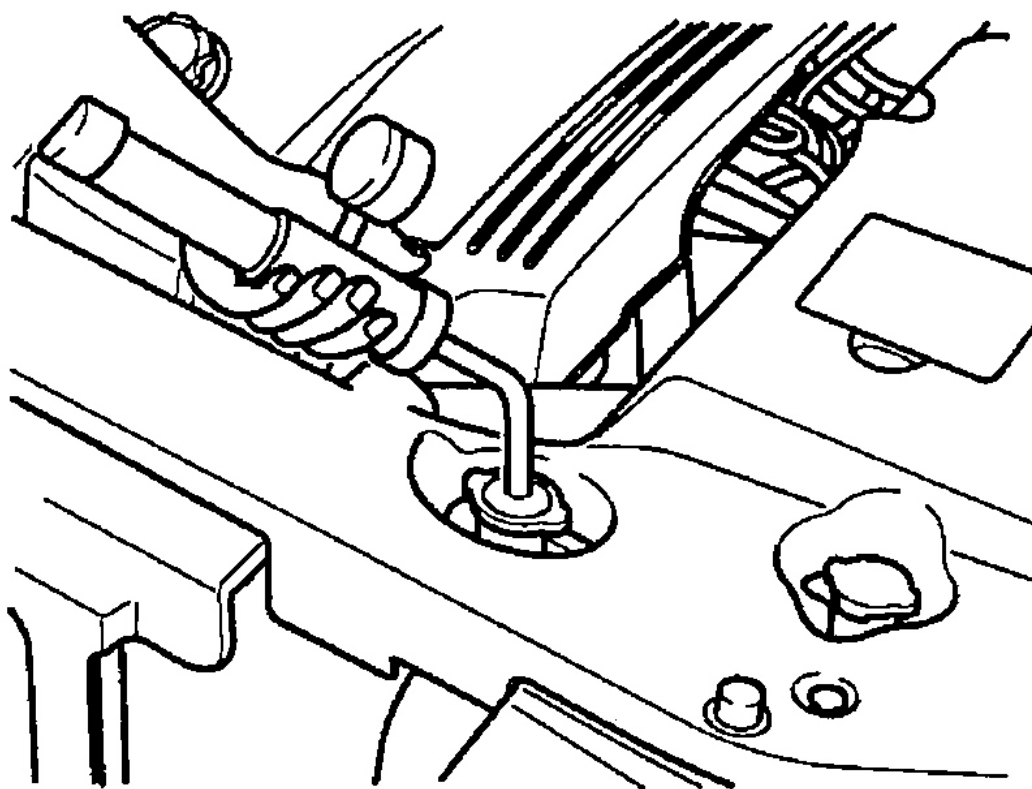
G00325533

Fig. 17: Mixing Coolant Chart

Courtesy of KIA MOTORS AMERICA, INC.

- CAUTION:**
1. Radiator coolant may be extremely hot. Do not open the system while hot, or scalding engine coolant could gush out, causing personal injury. Allow the vehicle to cool before servicing this system.
 2. When the tester is removed, be careful not to spill any coolant from it.
 3. Be sure to clean away completely any coolant from the area.
 4. Be careful, when installing and removing the tester and when testing, not to deform the filler neck of the radiator.

1. Loosen the radiator cap.
2. Confirm that the coolant level is up to the filler neck.
3. Install a radiator cap tester to the radiator filler neck and apply 150 KPa (21psi, 1.53 kg/cm²) pressure. Hold for two minutes, then check for leakage from the radiator, hoses or connections.



G00325529

Fig. 18: Pressurizing Cooling System
Courtesy of KIA MOTORS AMERICA, INC.

4. If there is leakage, repair or replace with the appropriate part.

RADIATOR CAP PRESSURE TEST

1. Use an adapter to attach the cap to the tester.
2. Increase the pressure until the indicator of the gauge stops moving.

Main valve opening pressure :

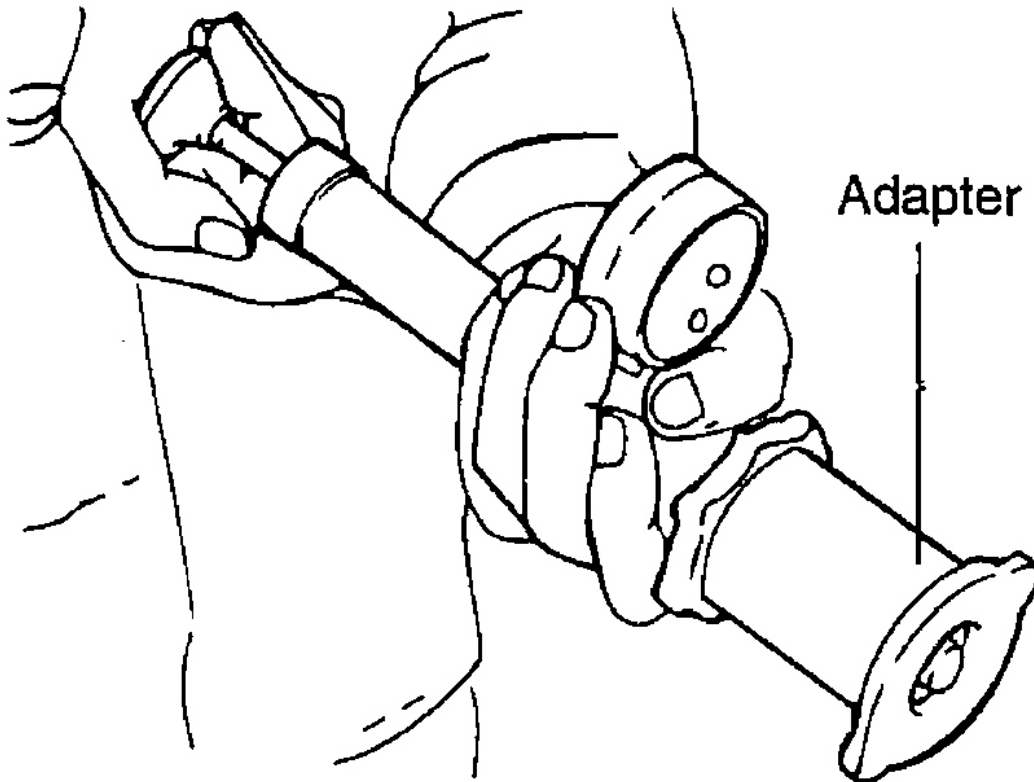
107.9+/-14.7 kPa (1.1+/-0.15 kg/cm² , 15.64+/-2.13 psi)

Main valve closing pressure :

83.4 kPa (0.85 kg/cm² , 12.1 psi)

3. Check that the pressure level is maintained at or above the limit.
4. Replace the radiator cap if the reading does not remain at or above the limit.

NOTE: Be sure that the cap is clean before testing, since rust or other foreign material on the cap seal will cause an incorrect reading.

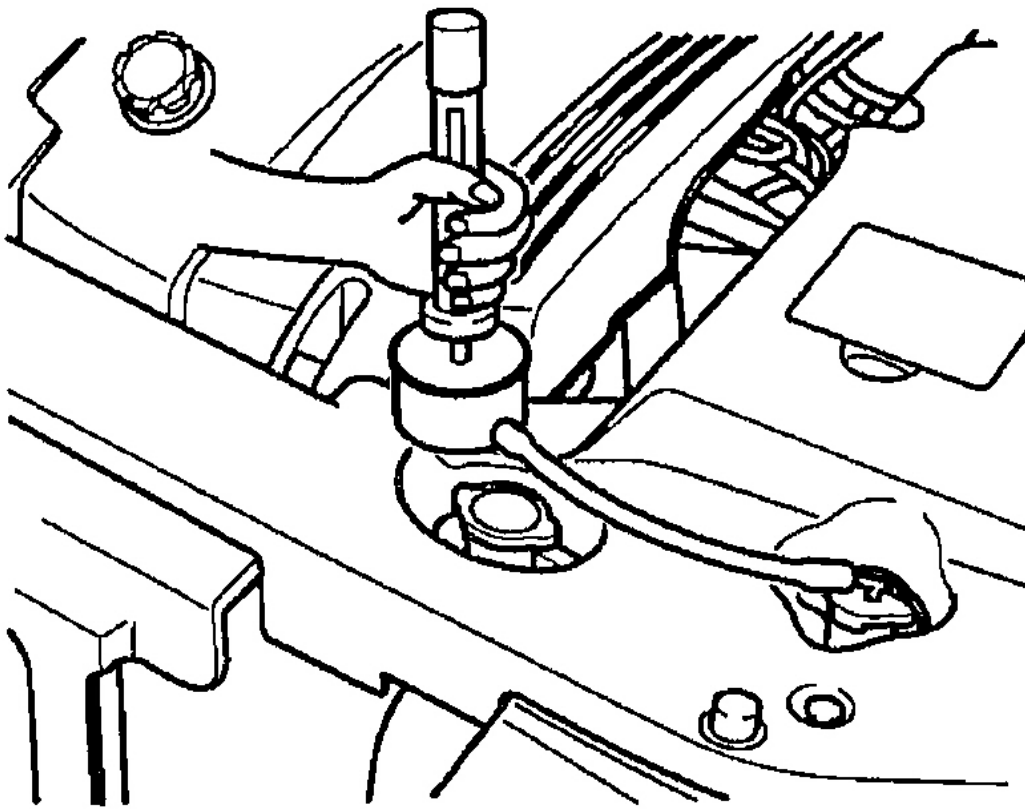


G00325530

Fig. 19: Testing Coolant Cap
Courtesy of KIA MOTORS AMERICA, INC.

SPECIFIC GRAVITY TEST

1. Measure the specific gravity of the coolant with a hydrometer.
2. Measure the coolant temperature and calculate the concentration from the relation between the specific gravity and temperature. Use the following table for reference.



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Fig. 20: Measuring Coolant Concentration
 Courtesy of KIA MOTORS AMERICA, INC.

RELATION BETWEEN COOLANT CONCENTRATION AND SPECIFIC GRAVITY

Coolant temperature °C (°F) and specific gravity					Freezing temperature °C (°F)	Safe operating temperature °C (°F)	Coolant concentration (Specific volume)
10 (50)	20 (68)	30 (86)	40 (104)	50 (122)			
1.054	1.050	1.046	1.042	1.036	-16 (3.2)	-11 (12.2)	30%
1.063	1.058	1.054	1.049	1.044	-20 (-4)	-15 (5)	35%
1.071	1.067	1.062	1.057	1.052	-25 (-13)	-20 (-4)	40%
1.079	1.074	1.069	1.064	1.058	-30 (-22)	-25 (-13)	45%
1.087	1.082	1.076	1.070	1.064	-36 (-32.8)	-31 (-23.8)	50%
1.095	1.090	1.084	1.077	1.070	-42 (-44)	-37 (-35)	55%
1.103	1.098	1.092	1.084	1.076	-50 (-58)	-45 (-49)	60%

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Fig. 21: Coolant Specific Gravity Chart
Courtesy of KIA MOTORS AMERICA, INC.

EXAMPLE

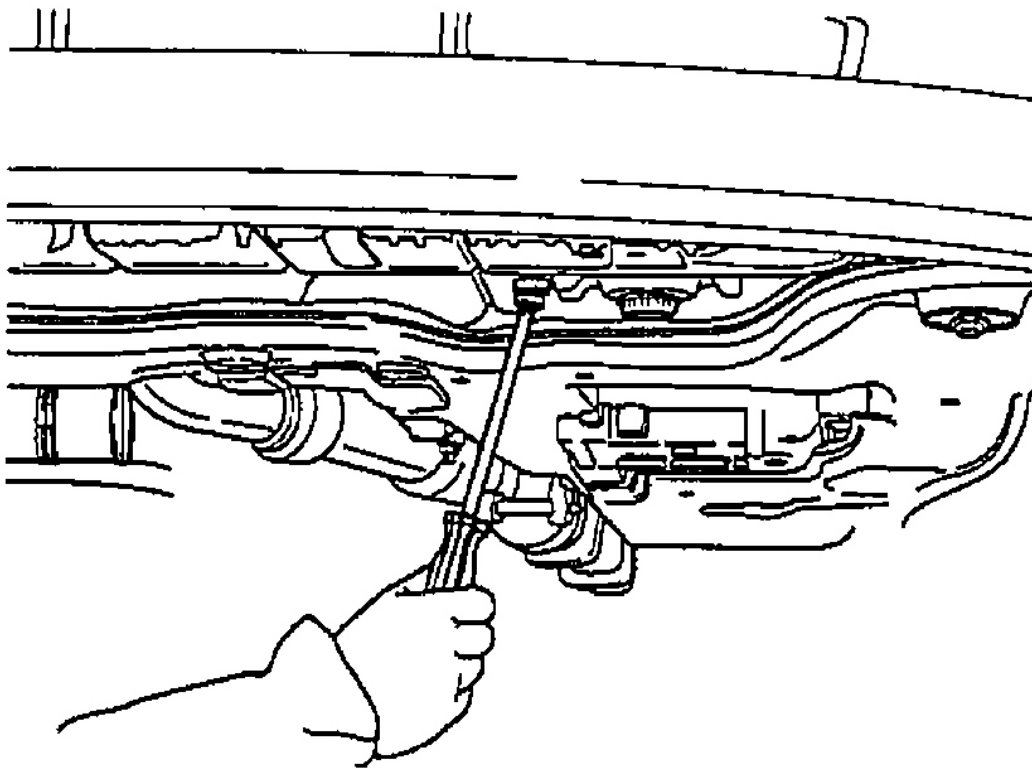
The safe operating temperature is -15°C (5°F) when the measured specific gravity is 1.058 at coolant temperature of 20°C (68°F).

- CAUTION:**
1. If the concentration of the coolant is below 30%, its anti-corrosion property will be adversely affected.
 2. If the concentration is above 60%, the engine cooling property will decrease, affecting the engine adversely. For these reasons, be sure to maintain the concentration level within the specified range.
 3. Do not mix types of anti - freeze.

CHANGING ENGINE COOLANT

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

1. Set the heater temperature control lever to maximum heat. Make sure the engine and radiator are cool to the touch.
2. Remove the radiator cap.
3. Loosen the drain plug, and drain the coolant.



G00325534

Fig. 22: Loosening Coolant Drain Plug
Courtesy of KIA MOTORS AMERICA, INC.

4. Tighten the radiator drain plug securely.
5. Remove the coolant reserve tank. Drain the coolant and reinstall the coolant reserve tank.
6. Fill the coolant reserve tank to the MAX mark with the coolant.
7. Pour the coolant into the radiator to the base of the filler neck, and install the radiator cap loosely

Coolant capacity : 10.2 liters (10.78 US qt, 8.9 Imp qt)

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

ADJUSTING DRIVE BELT AND TENSIONER

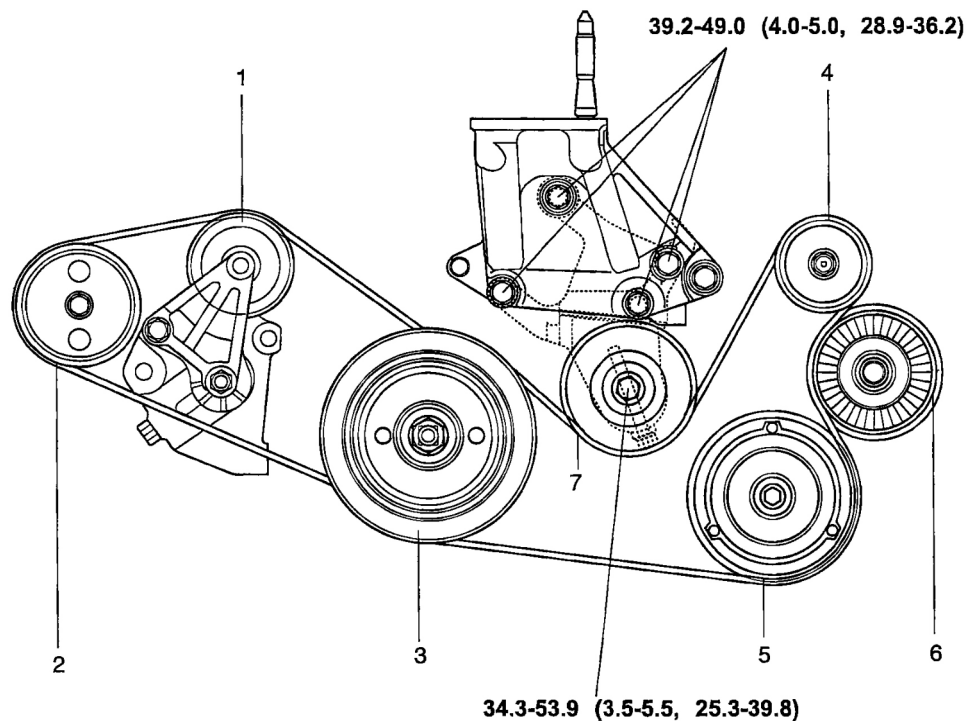
1. Hang the belt on the pulley of the tensioner and install the tensioner.

If the tensioner is already installed, loosen its mounting bolts to allow belt installation.

Tightening torque

Tensioner assembly bolt :

39.2-49.0 Nm (4.0-5.0 kg.m, 28.9-36.2 lb.ft)



TORQUE : N·m (kg·m, lb·ft)

- 1. Tension pulley
- 2. Power steering pulley
- 3. Crankshaft pulley
- 4. Generator pulley

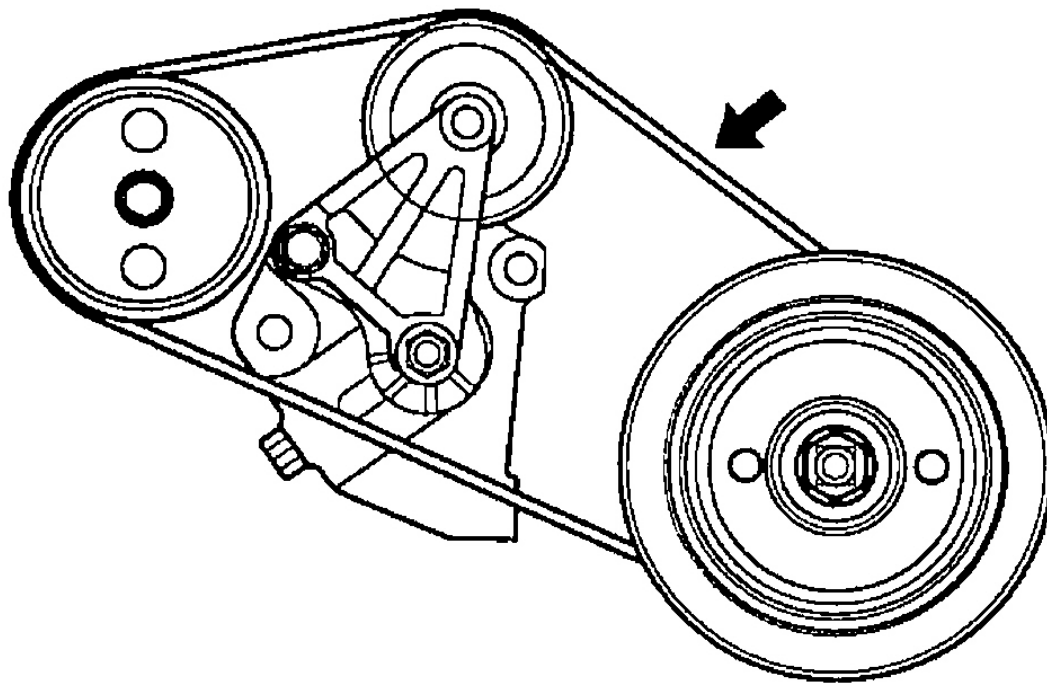
- 5. Air conditioner pulley
- 6. Idler pulley
- 7. Tension pulley

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Fig. 23: Drive Belt Routing

Courtesy of KIA MOTORS AMERICA, INC.

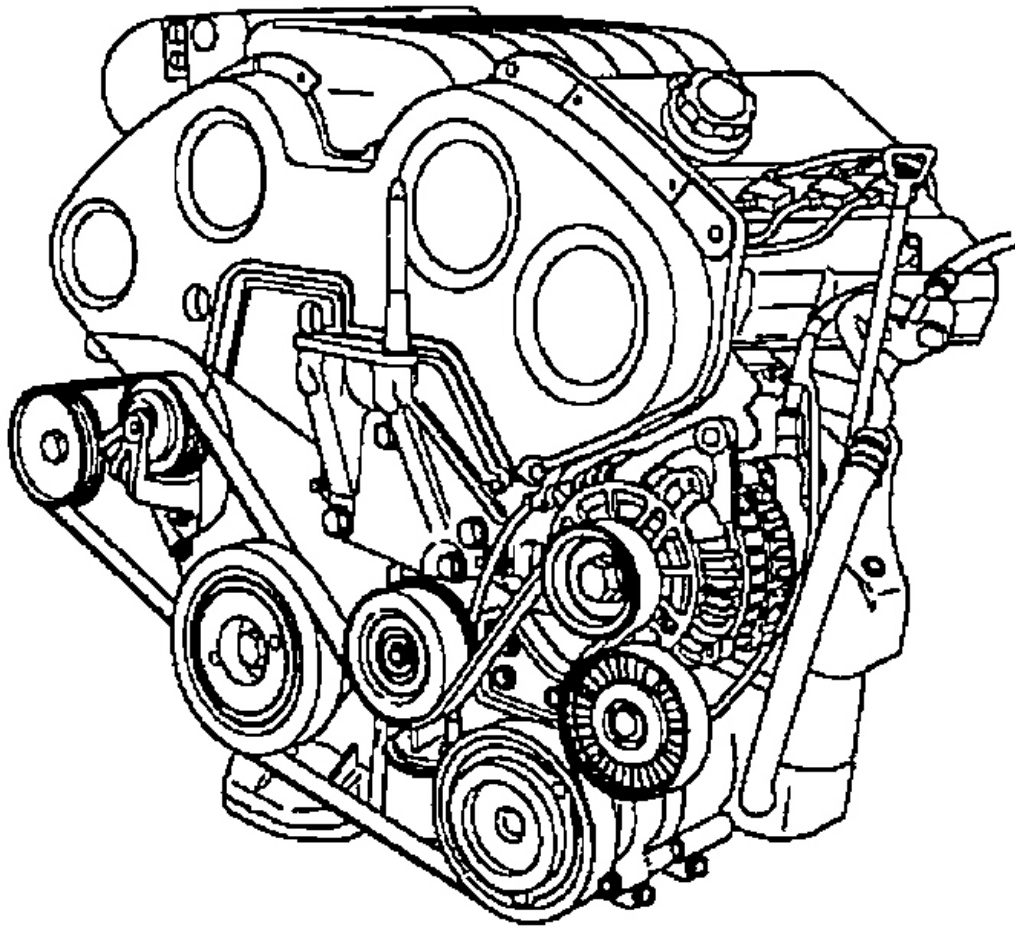
- 2. Install power steering belt.



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Fig. 24: Installing Power Steering Belt
Courtesy of KIA MOTORS AMERICA, INC.

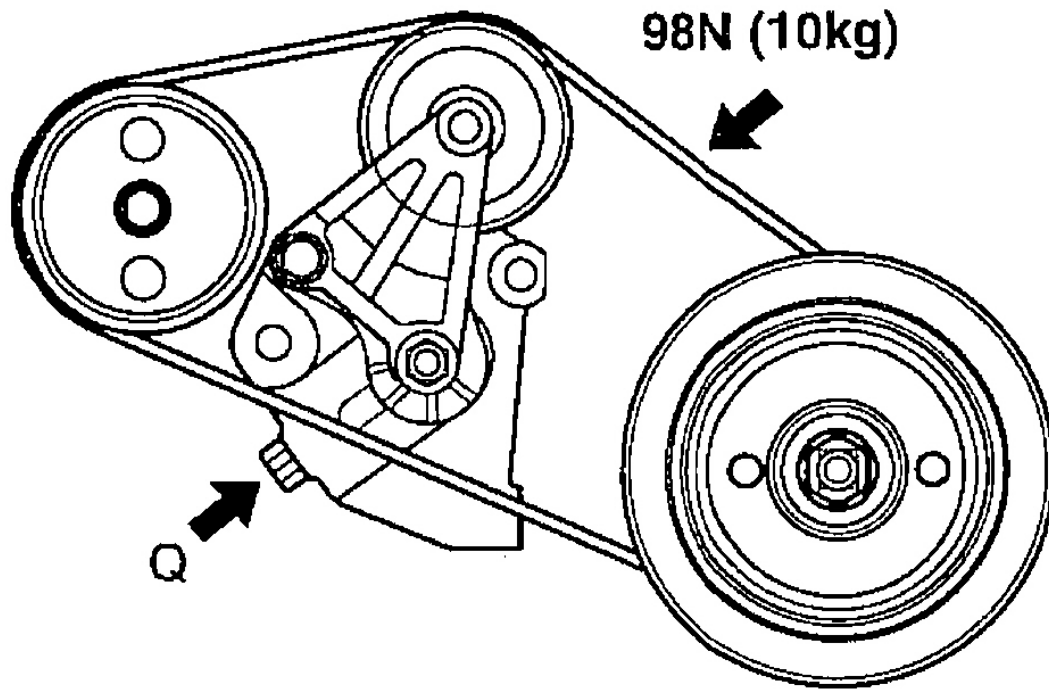
3. Install drive belt.



G00325540

Fig. 25: Installing Main Drive Belt
Courtesy of KIA MOTORS AMERICA, INC.

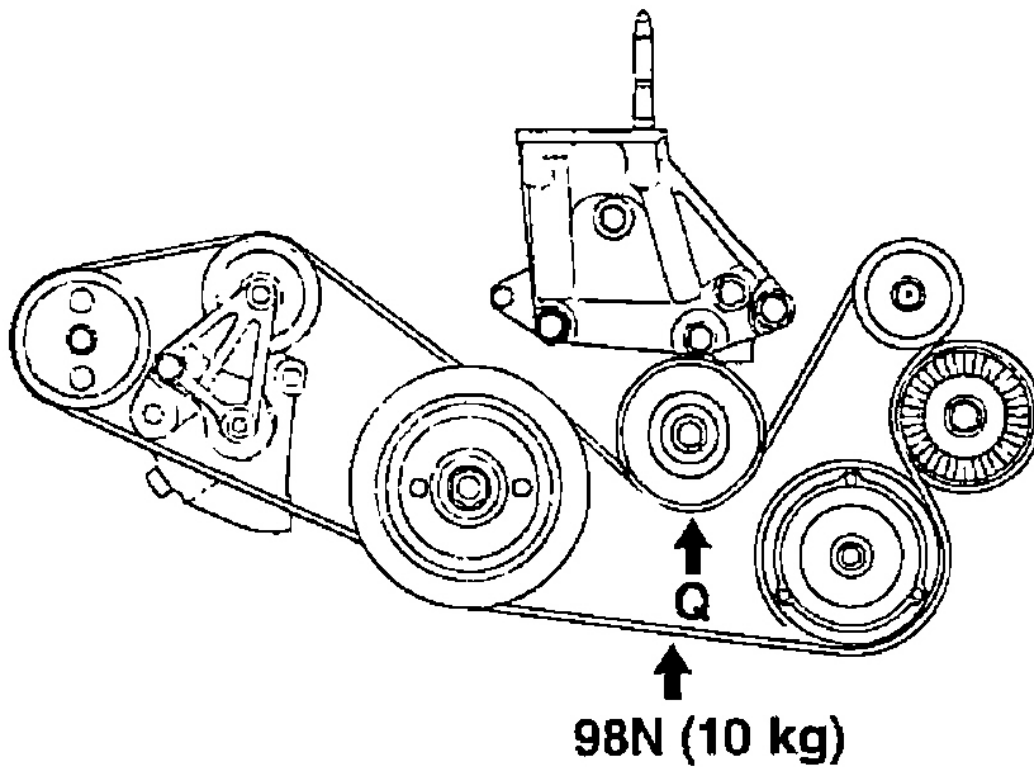
4. Adjust the power steering belt tension to specification by turning the adjusting bolt (Q) clockwise or counter-clockwise



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Fig. 26: Adjusting Power Steering Belt Tension
Courtesy of KIA MOTORS AMERICA, INC.

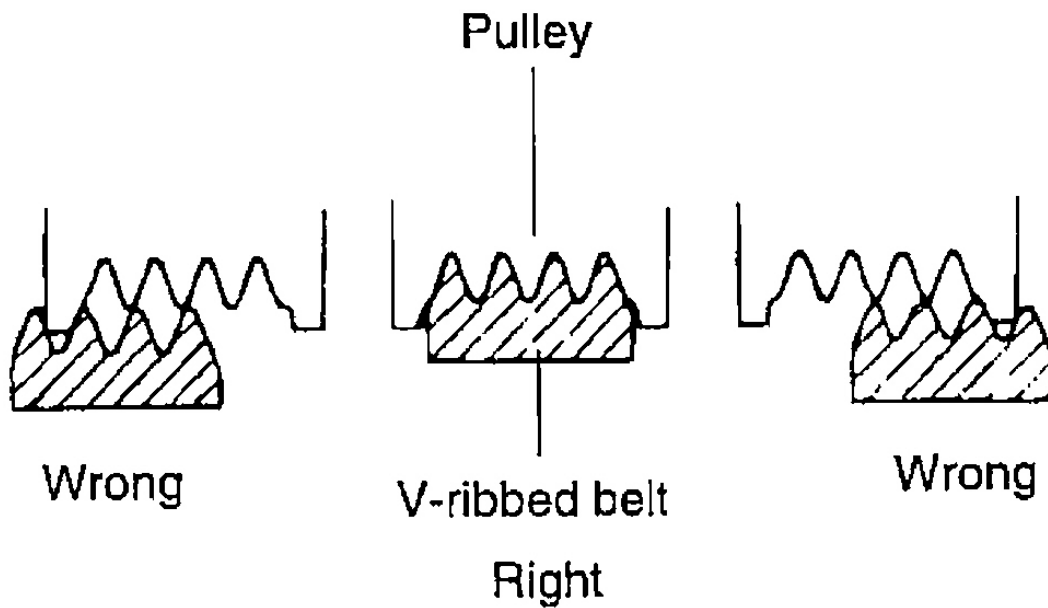
5. Adjust the drive belt tension to specification by turning the adjusting bolt (Q) clockwise or counterclockwise.



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Fig. 27: Adjusting Main Drive Belt Tension
Courtesy of KIA MOTORS AMERICA, INC.

6. When installing the belt on the pulley, make sure it is centered on the pulley.



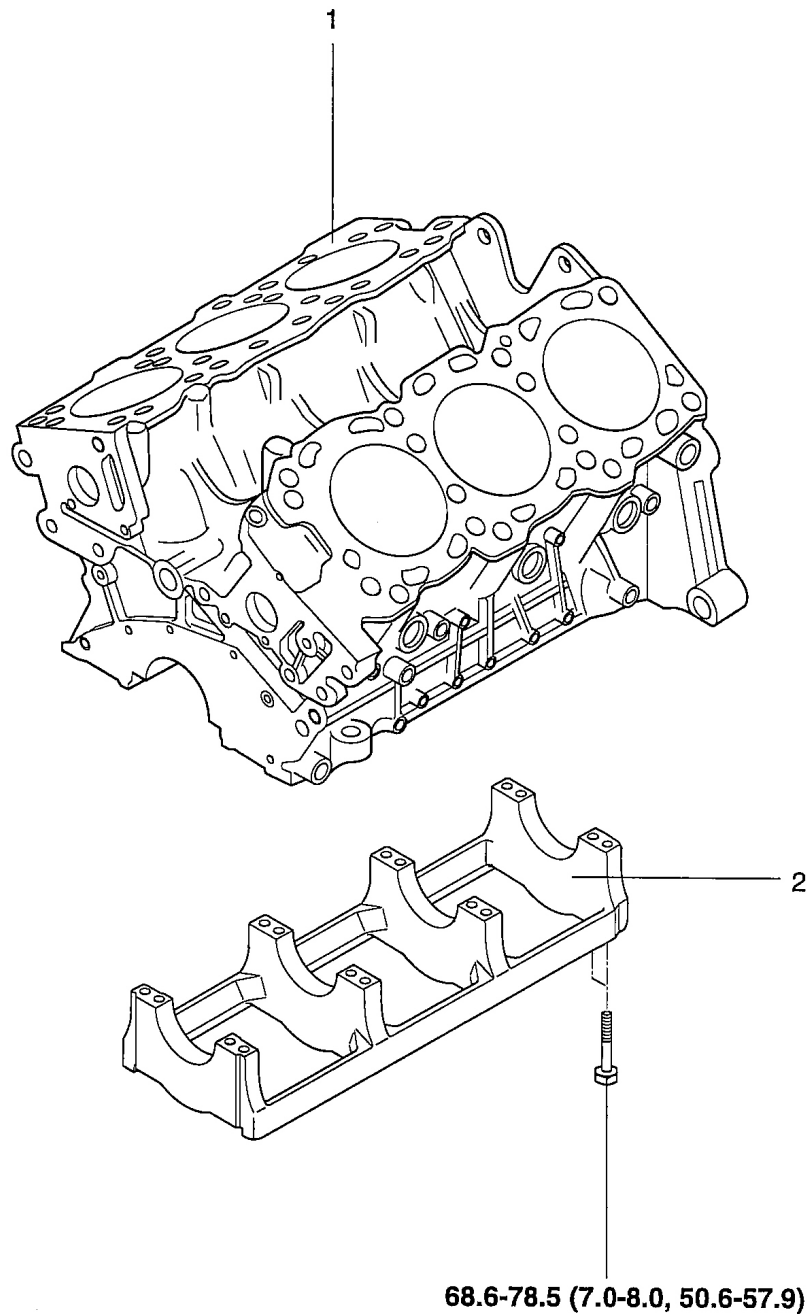
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Fig. 28: Positioning Drive Belt

Courtesy of KIA MOTORS AMERICA, INC.

ENGINE ASSEMBLY

ENGINE BLOCK



TORQUE : N·m (kg·m, lb·ft)

- 1. Cylinder block
- 2. Main bearing cap

G00325544

Fig. 29: Identifying Engine Block
Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

Remove the timing belt, cylinder head assembly, drive plate, transaxle mounting plate, oil pan and oil pump case. See **MAIN MOVING SYSTEM**.

INSPECTION

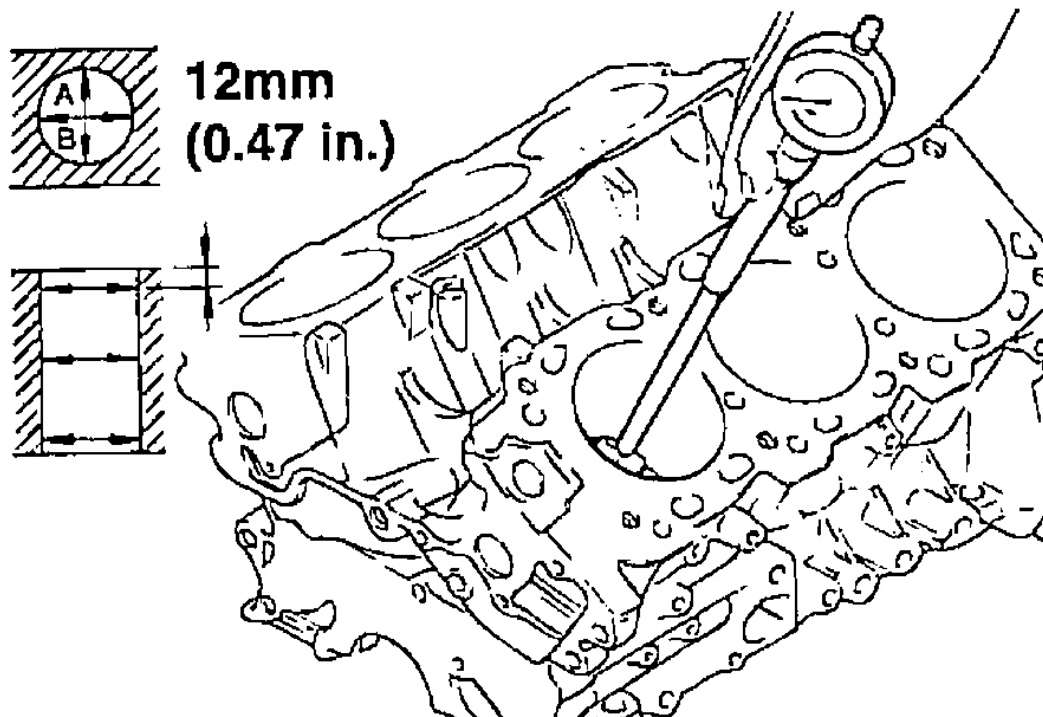
CYLINDER BLOCK

1. Check the cylinder block for scores, rust and corrosion. Also check for cracks or any other defects. Replace the block if defective.
2. Measure the cylinder bore with a cylinder gauge at the three levels indicated, in the directions A and B.

Level 1 : No.1 piston ring position at TDC

Level 2: Center of cylinder

Level 3 : Bottom of cylinder



G00325545

Fig. 30: Measuring Cylinder Bore
Courtesy of KIA MOTORS AMERICA, INC.

3. If the cylinder bores show more than the specified out-of-round or taper, or if the cylinder walls are badly

scuffed or scored, the cylinder block should be rebored and honed. New oversize pistons and rings should be installed.

Standard value

Cylinder bore : 93 - 93.03 mm (3.6614 - 3.6626 in.)

Out - of - round and taper of cylinder bore :

Max. 0.02 mm (0.0008 in.)

4. If a ridge exists at the top of the cylinder, cut it off with a ridge reamer.
5. Oversize pistons are available in four sizes.

Piston service size and mark mm (in.)

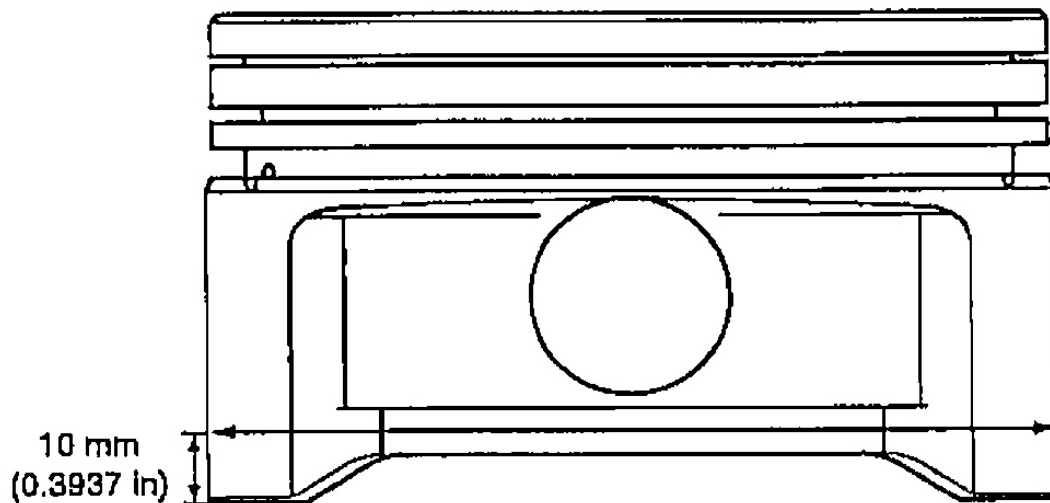
0.25 (0.010) O.S : 0.25

0.50 (0.020) O.S : 0.50

6. To rebore the cylinder bore to the oversize, maintain the specified clearance between the oversize piston and the bore and make sure that all used pistons are the same oversize. The standard measurement of the piston outside diameter is taken at a level of 10mm (0.39 in.) above the bottom of the piston skirt and across the thrust faces.

Piston-to-cylinder clearance :

0.03 - 0.05 mm (0.0012 - 0.0020 in.)



G00325546

Fig. 31: Measuring Piston-To-Cylinder Clearance
 Courtesy of KIA MOTORS AMERICA, INC.

7. Check for damage or cracks in the cylinders.
8. Check the top surface of the cylinder block for flatness. If the top surface exceeds the limit, grind to the minimum limit or replace.

Standard value

Flatness of gasket surface :

Max. 0.03 mm (0.0012 in.)

Service limit

Flatness of gasket surface : 0.05 mm (0.0020 in.)

CAUTION: When the cylinder head is assembled, grinding less than 0.2mm (0.008in.) is permissible.

BORING CYLINDER

1. Oversize pistons should be selected according to the largest bore cylinder.

Identification Mark	Size
0.25	0.25 mm (0.010 in.)
0.50	0.50 mm (0.020 in.)

G00325548

Fig. 32: Piston Chart

Courtesy of KIA MOTORS AMERICA, INC.

NOTE: The size of piston is stamped on top of the piston.

2. Measure the outside diameter of the piston to be used.
3. According to the measured O.D., calculate the new bore size.

New bore size = Piston O.D + 0.03 to 0.05 mm (0.0012 to 0.0020 in.) (clearance between piston and cylinder) -0.01 mm (0.0004 in.) (honing margin.)

4. Bore each of the cylinders to the calculated size.

CAUTION: To prevent distortion that may result from temperature rise during honing, bore the cylinder holes in the firing order.

5. Hone the cylinders, finishing them to the proper dimension (piston outside diameter + gap with cylinder).
6. Check the clearance between the piston and cylinder.

Standard : 0.03 - 0.05 mm (0.0012 - 0.0020 in.)

NOTE: When boring the cylinders, finish all of the cylinders to the same oversize. Do not bore only one cylinder to the oversize.

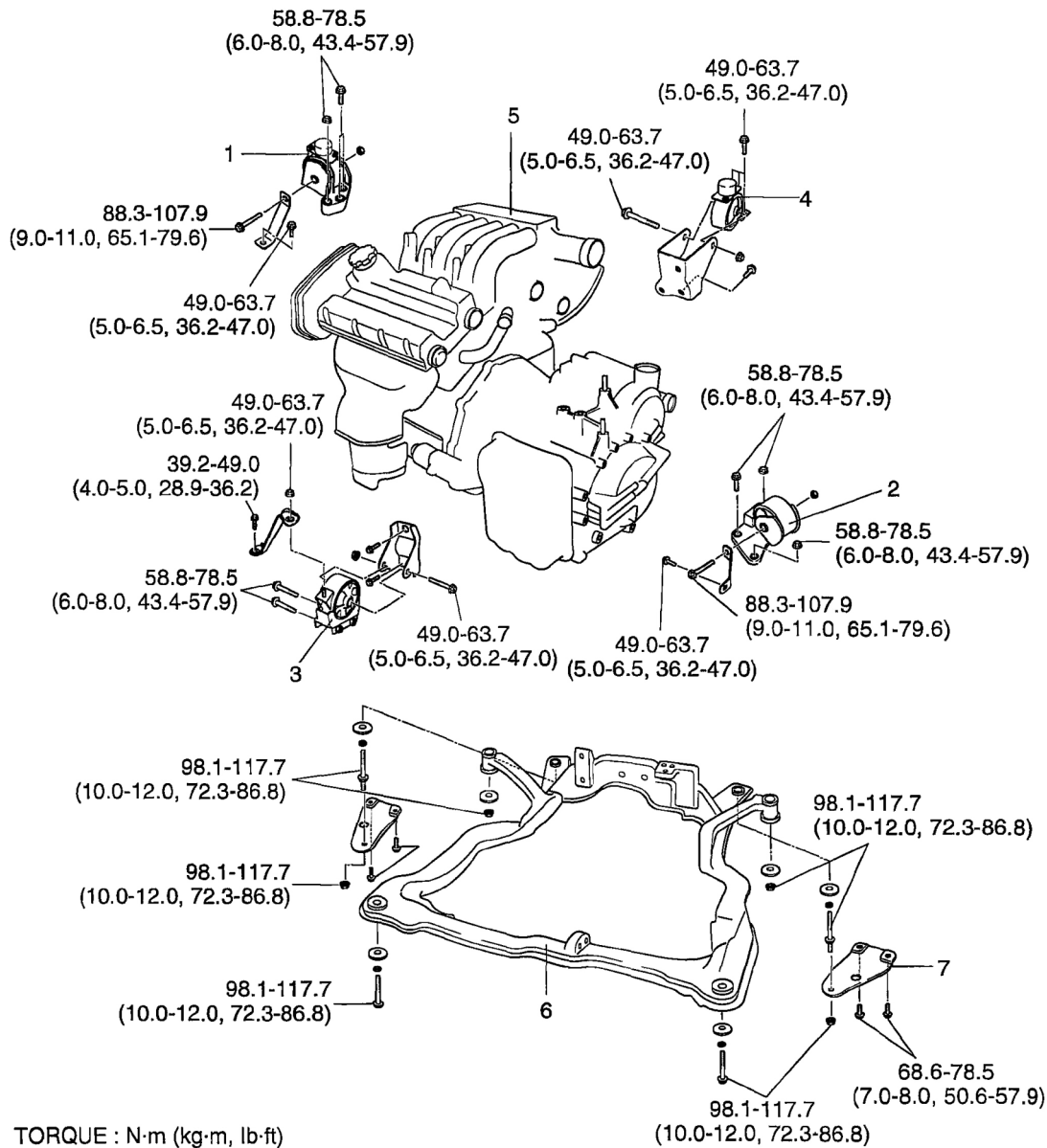
REASSEMBLY

Install the following parts by referring to their respective sections.

1. Crankshaft
2. Drive plate
3. Piston
4. Cylinder head
5. Timing belt

6. Oil pump case

ENGINE MOUNTS



- 1. Engine mounting
- 2. Transaxle mounting
- 3. Front roll stopper
- 4. Rear roll stopper

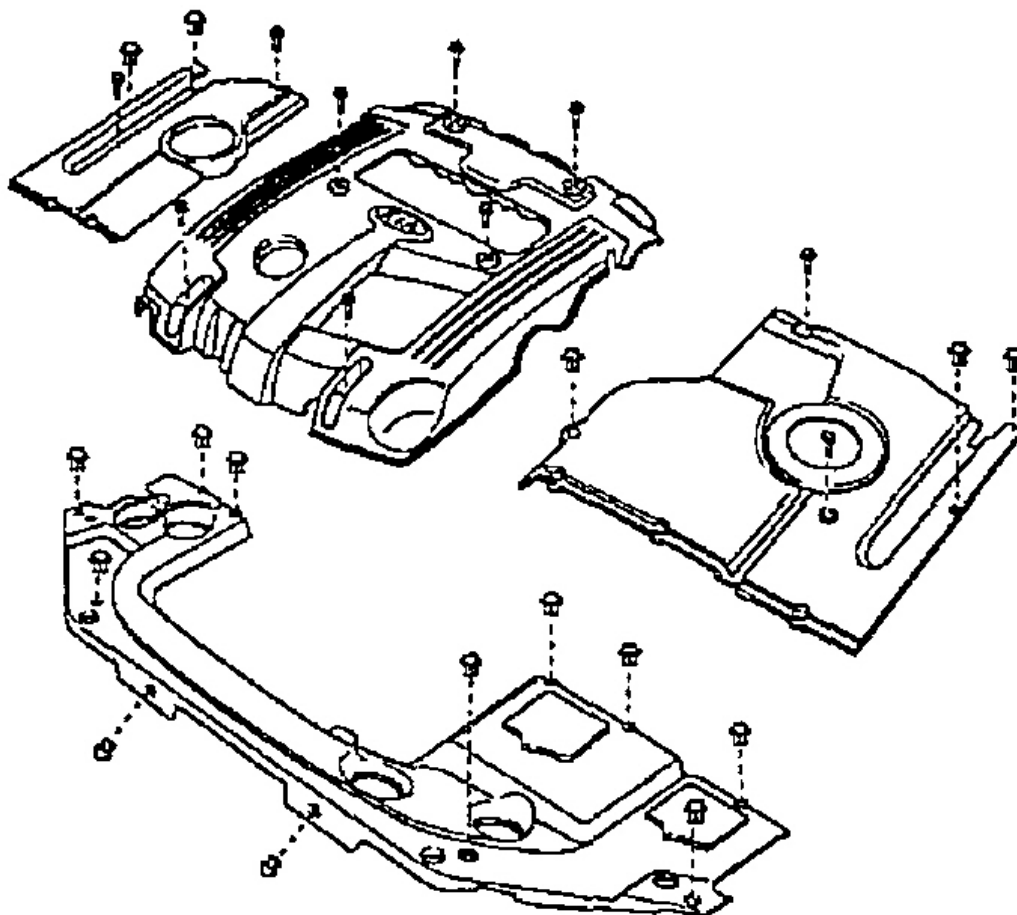
- 5. Engine and transaxle assembly
- 6. Sub frame
- 7. Sub frame stay

G00325549

Fig. 33: Identifying Engine Mount Components
Courtesy of KIA MOTORS AMERICA, INC.

ENGINE AND TRANSAXLE ASSEMBLY**REMOVAL**

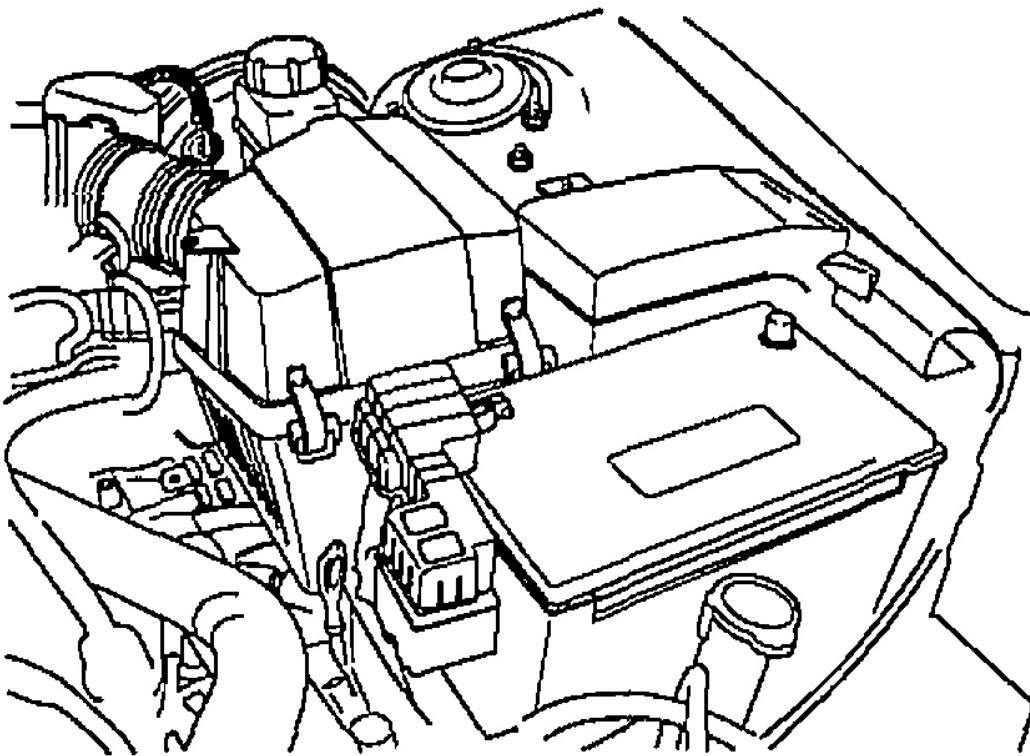
1. Remove the engine cover.



G00325550

Fig. 34: Removing Engine Cover
Courtesy of KIA MOTORS AMERICA, INC.

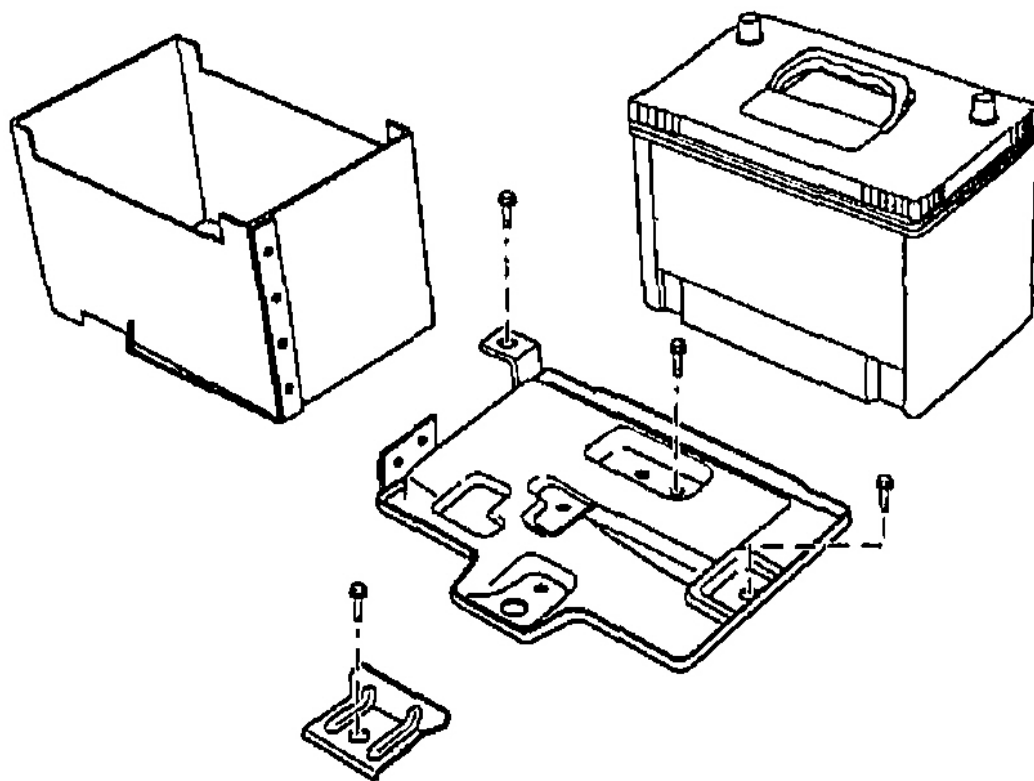
2. Disconnect the battery terminals.



G00325551

Fig. 35: Disconnecting Battery Terminals
Courtesy of KIA MOTORS AMERICA, INC.

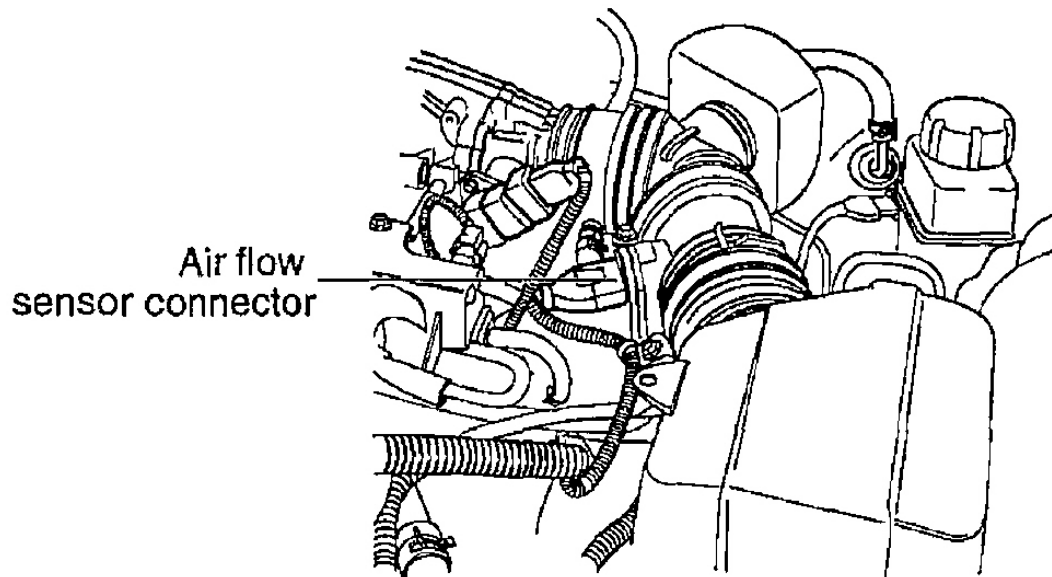
3. Remove the battery and the battery tray.



G00325552

Fig. 36: Removing Battery & Tray
Courtesy of KIA MOTORS AMERICA, INC.

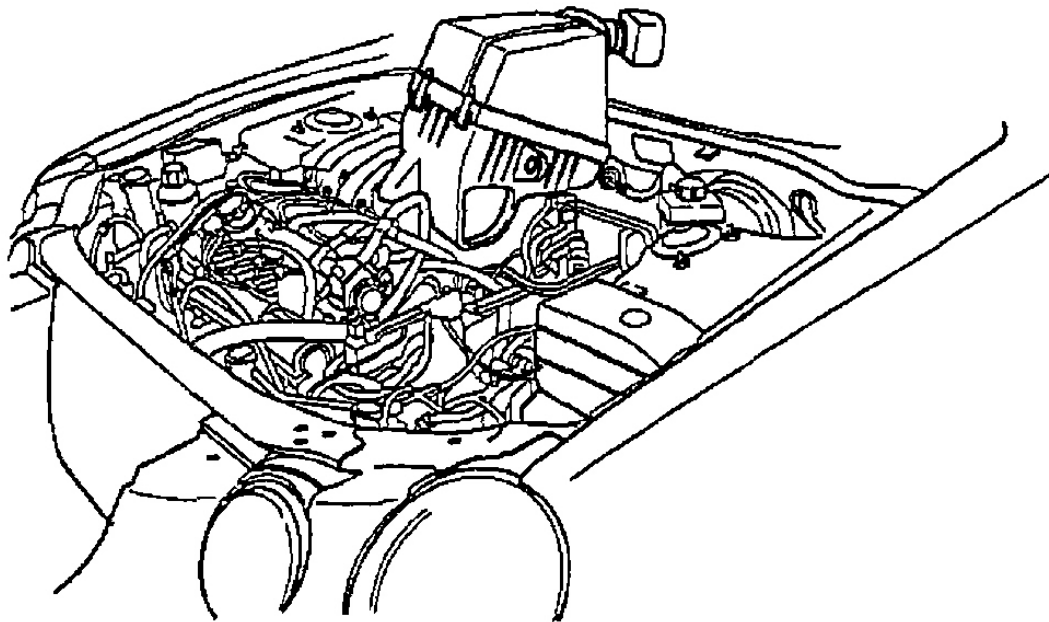
4. Disconnect the air flow sensor connector and the vacuum hose from the air intake hose.



G00325553

Fig. 37: Disconnecting Air Flow Sensor
Courtesy of KIA MOTORS AMERICA, INC.

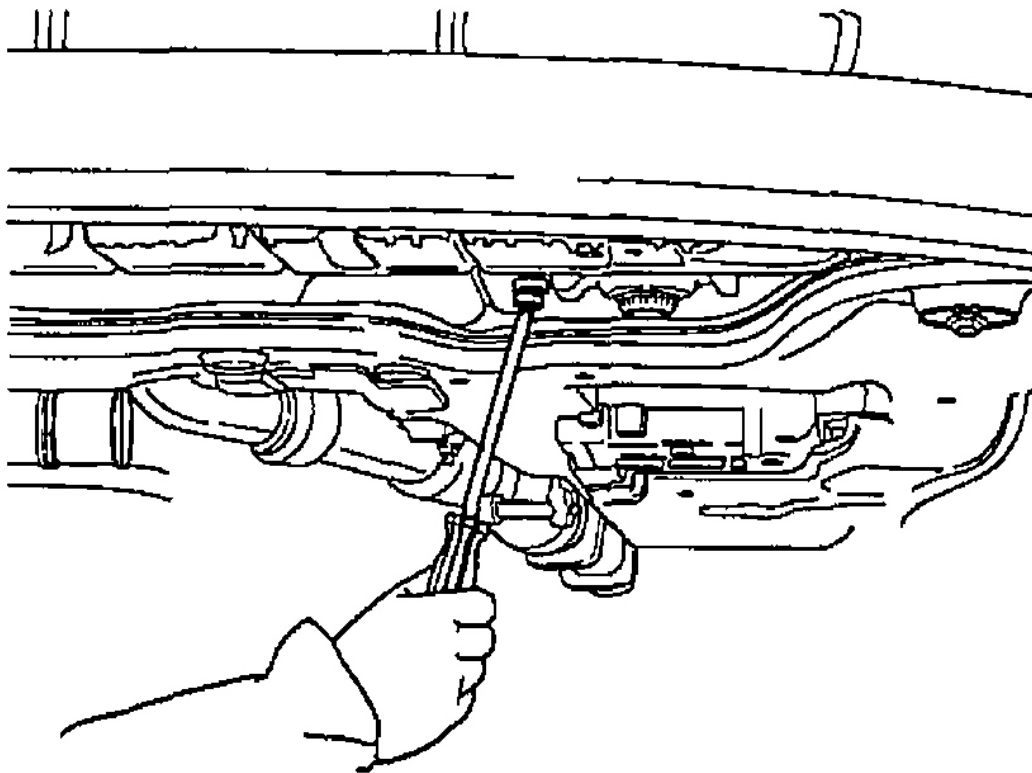
5. Remove the air cleaner assembly after removing the air intake hose clamp and fixing bolt (3ea).



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Fig. 38: Removing Air Cleaner Assembly
Courtesy of KIA MOTORS AMERICA, INC.

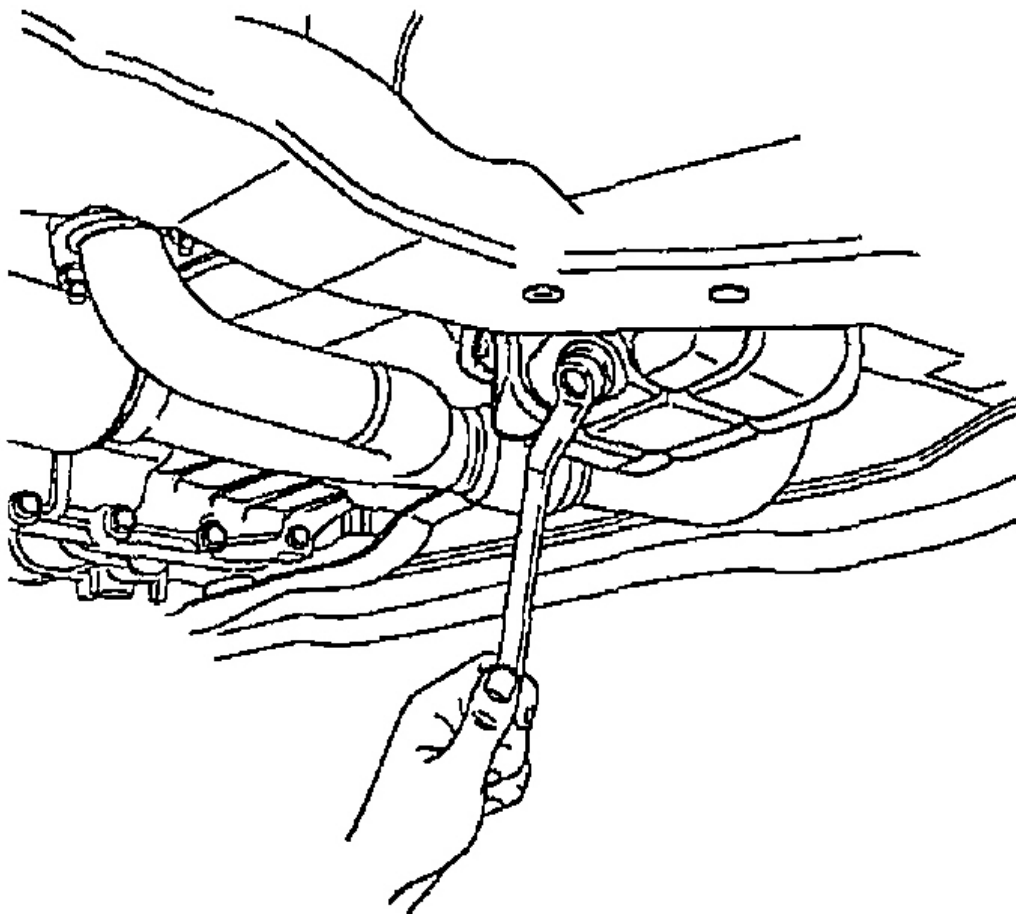
6. Drain the engine coolant.



G00325555

Fig. 39: Draining Engine Coolant
Courtesy of KIA MOTORS AMERICA, INC.

7. Drain the engine oil.

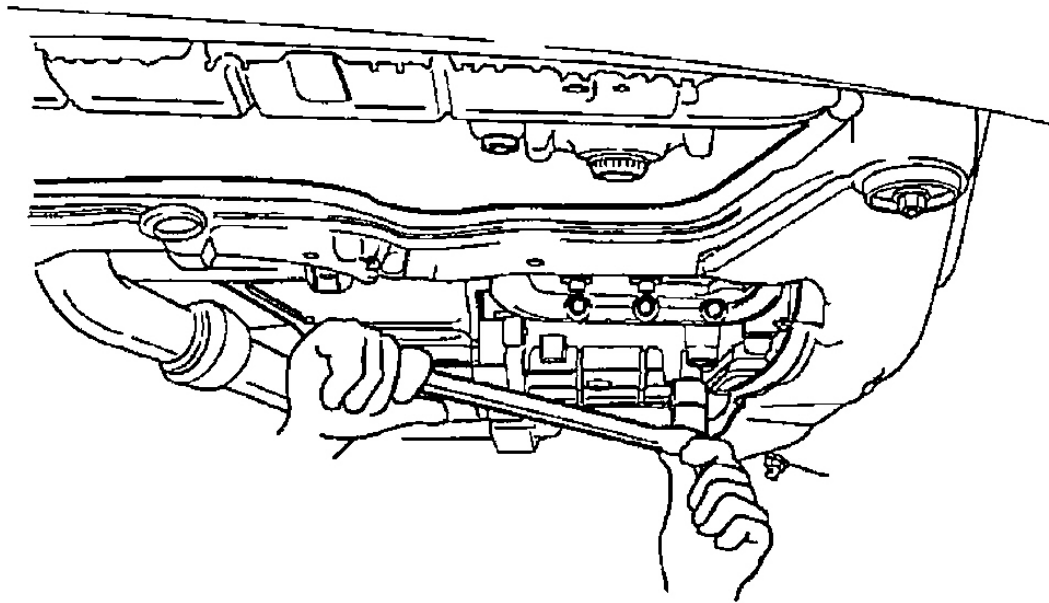


G00325556

Fig. 40: Draining Engine Oil

Courtesy of KIA MOTORS AMERICA, INC.

8. Drain the transaxle oil.



G00325557

Fig. 41: Draining Transaxle Oil
Courtesy of KIA MOTORS AMERICA, INC.

9. Disconnect the alternator B terminal, the alternator connector and the oil pressure switch connector.

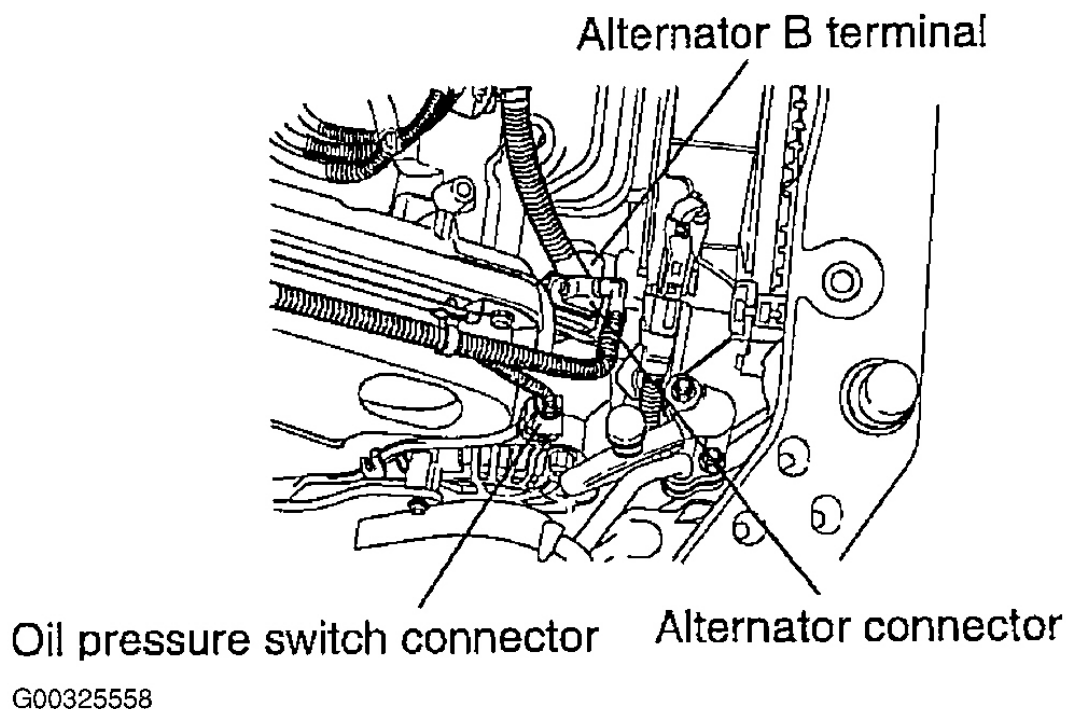
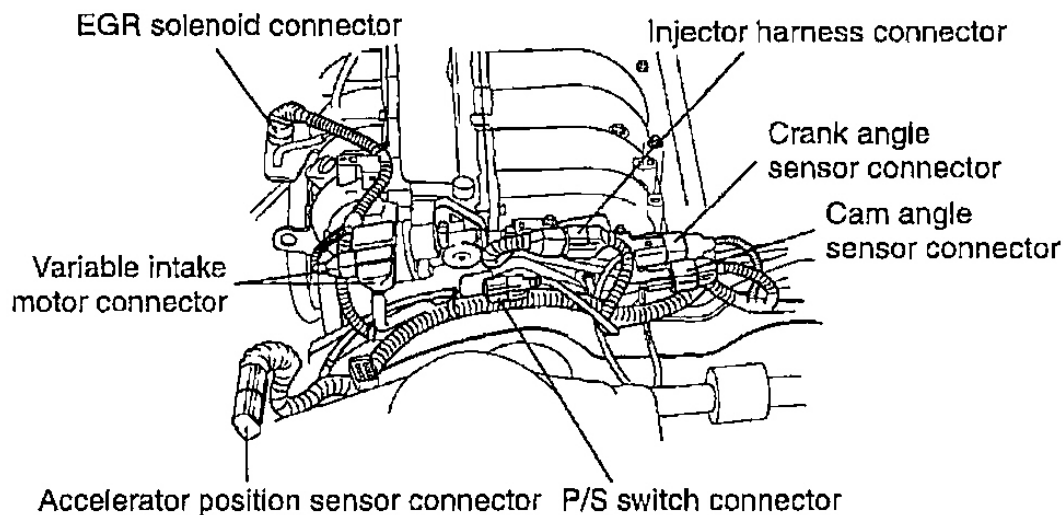


Fig. 42: Disconnecting Alternator & Oil Pressure Switch
Courtesy of KIA MOTORS AMERICA, INC.

10. Disconnect the crank angle sensor connector, the cam angle sensor connector, the injector harness connector, the power steering switch connector, the variable intake motor connector (2ea), the accelerator position sensor connector and the EGR solenoid connector.



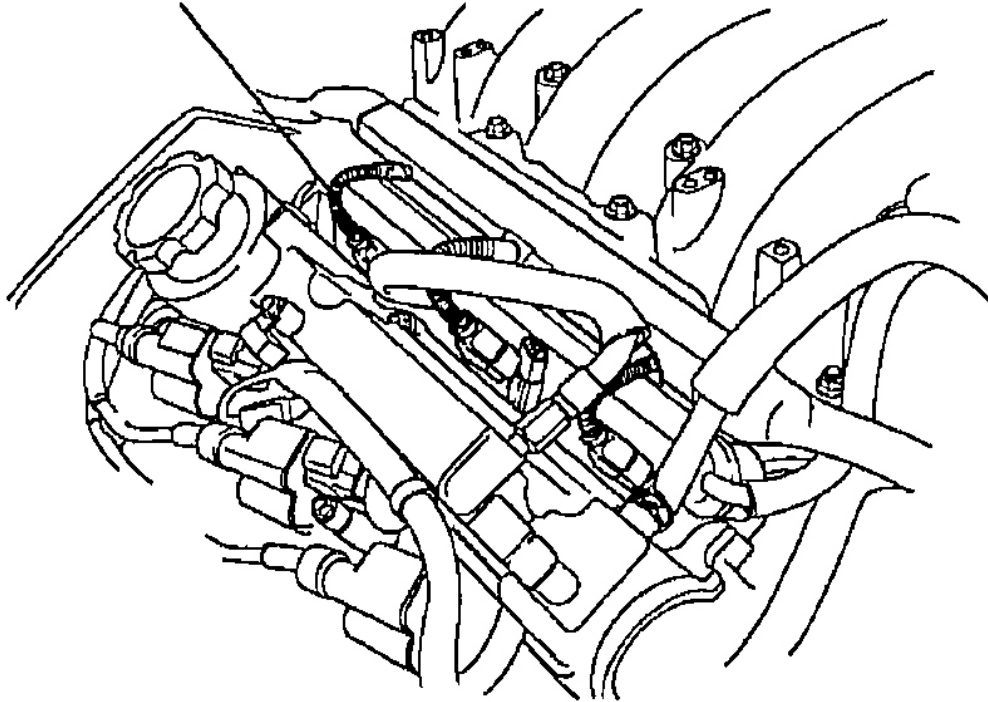
G00325559

Fig. 43: Disconnecting Engine Sensors & Switches
Courtesy of KIA MOTORS AMERICA, INC.

11. Disconnect the injector connector after removing the injector harness bracket bolt (2ea).

CAUTION: When disconnecting the injector connector, lift the fuel delivery pipe and injector assembly upward appropriately. At this time, unscrew the mounting-bolt to lift the fuel delivery pipe. Reinstall the delivery pipe and injector assembly.

Injector connector



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Fig. 44: Installing Injector Pipe
Courtesy of KIA MOTORS AMERICA, INC.

12. Disconnect the ignition coil harness connector, the oxygen sensor (front) connector and the knock sensor connector.

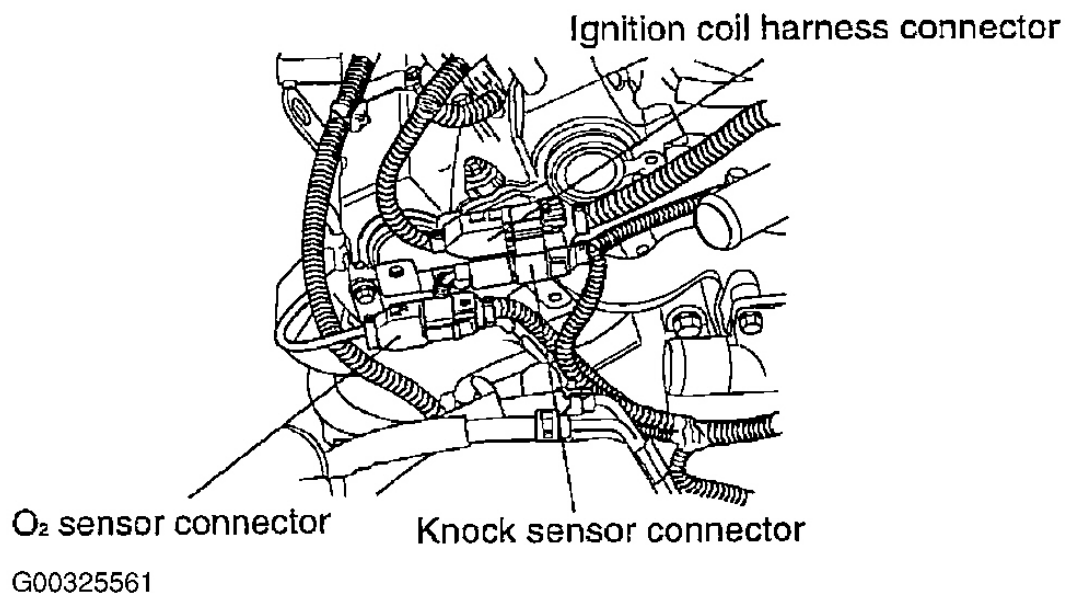


Fig. 45: Disconnecting Ignition & Engine Sensors

Courtesy of KIA MOTORS AMERICA, INC.

13. Disconnect the throttle position sensor connector, the ETS (Electronic throttle system) motor connector, the limp-home connector and the purge solenoid valve connector.

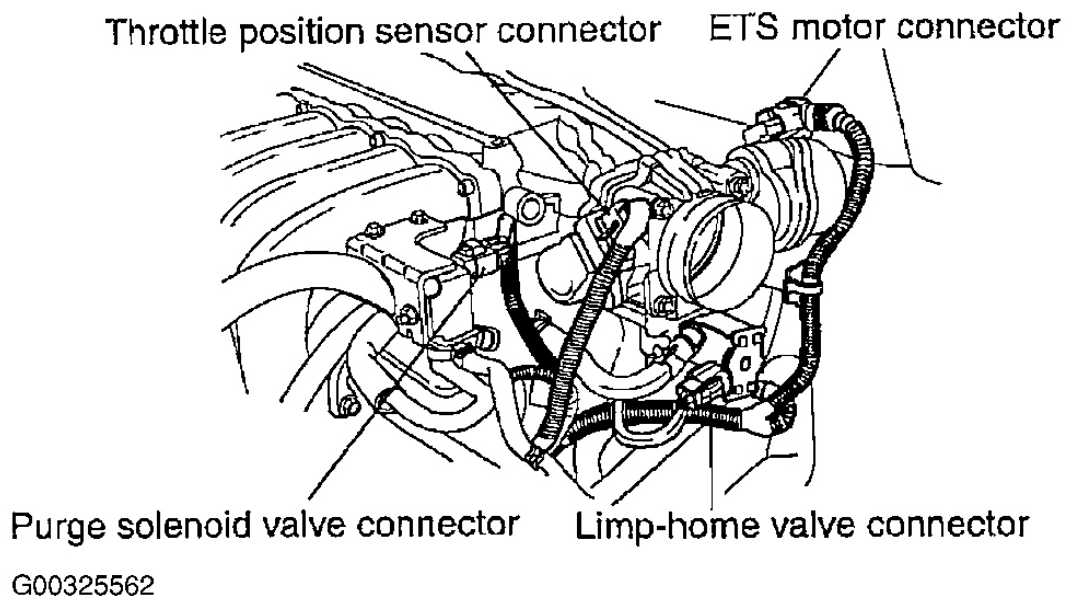
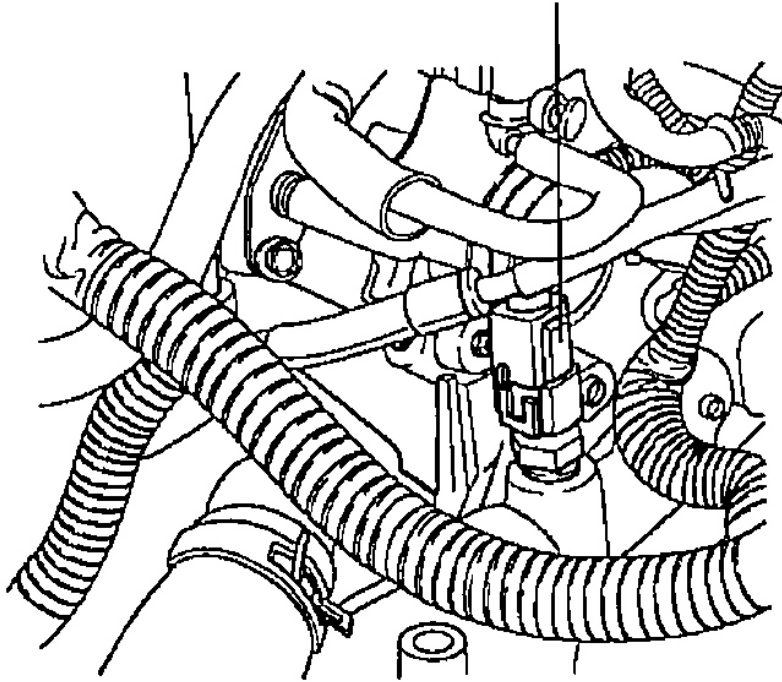


Fig. 46: Disconnecting Throttle, Limp & Purge Valve Connectors
Courtesy of KIA MOTORS AMERICA, INC.

14. Disconnect the water temperature sensor connector.

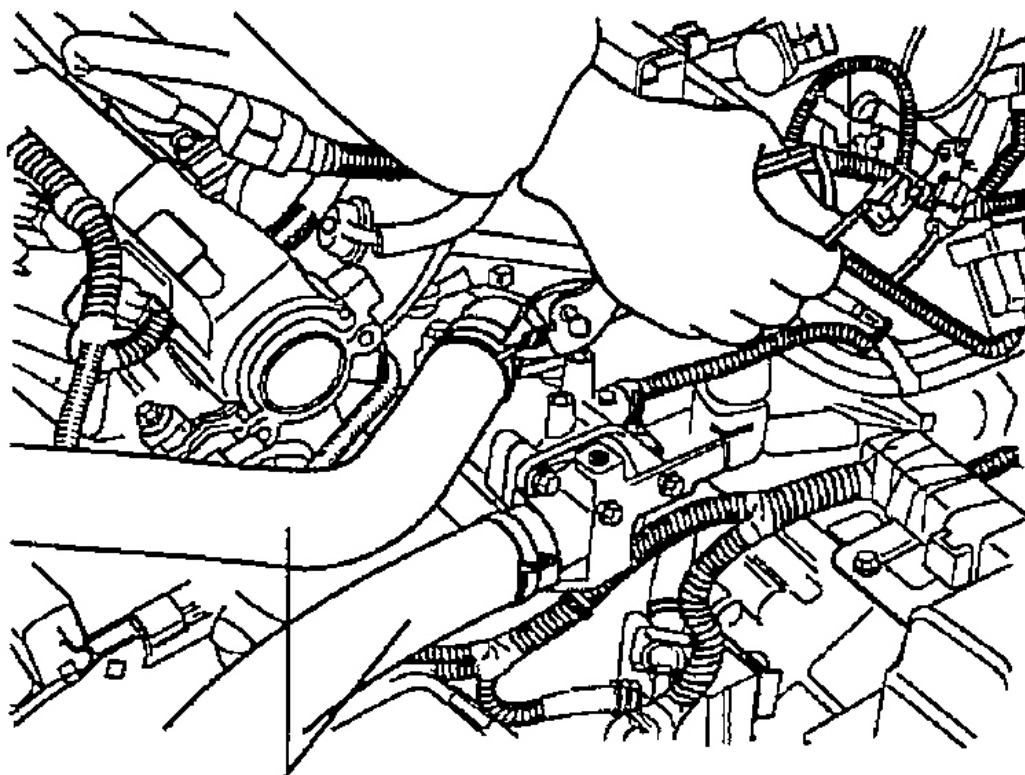
Water temperature sensor connector



G00325563

Fig. 47: Disconnecting Water Temperature Sensor
Courtesy of KIA MOTORS AMERICA, INC.

15. Disconnect the radiator upper hose and lower hose.



Radiator hose

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Fig. 48: Disconnecting Radiator Hoses

Courtesy of KIA MOTORS AMERICA, INC.

16. Remove the ground wire from the fuse box and the body frame.

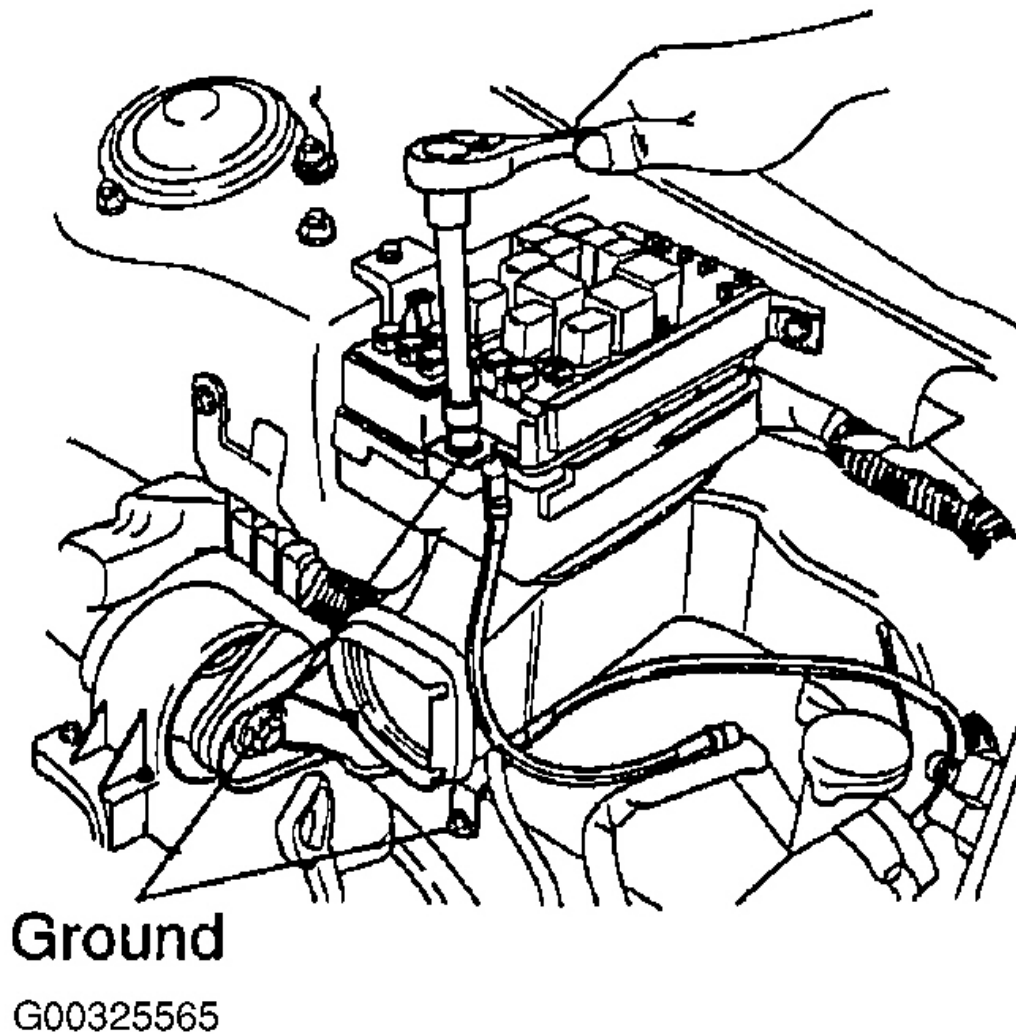
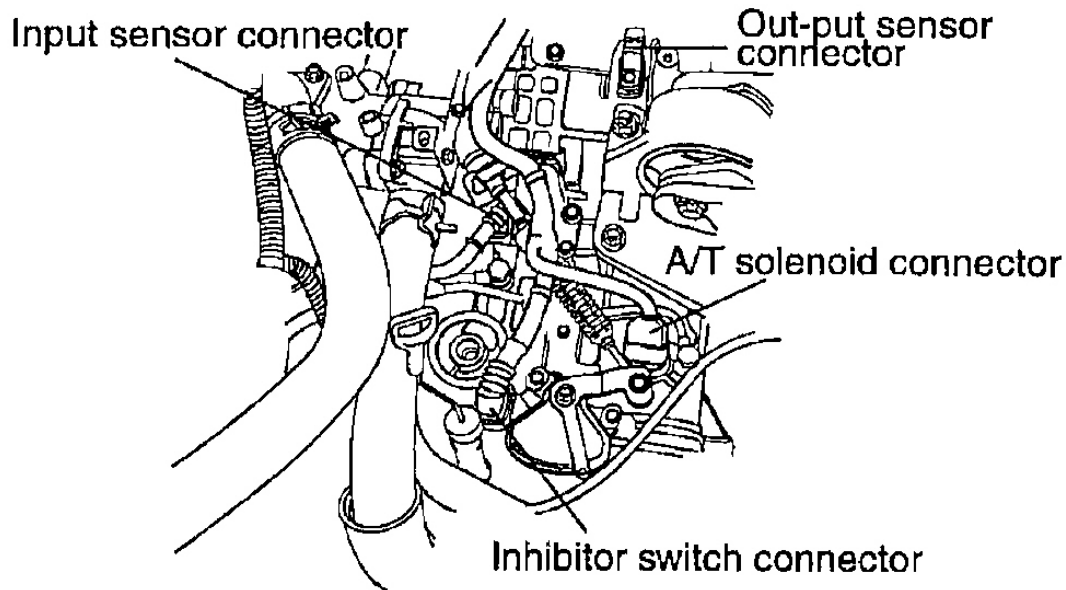


Fig. 49: Removing Electrical Ground
Courtesy of KIA MOTORS AMERICA, INC.

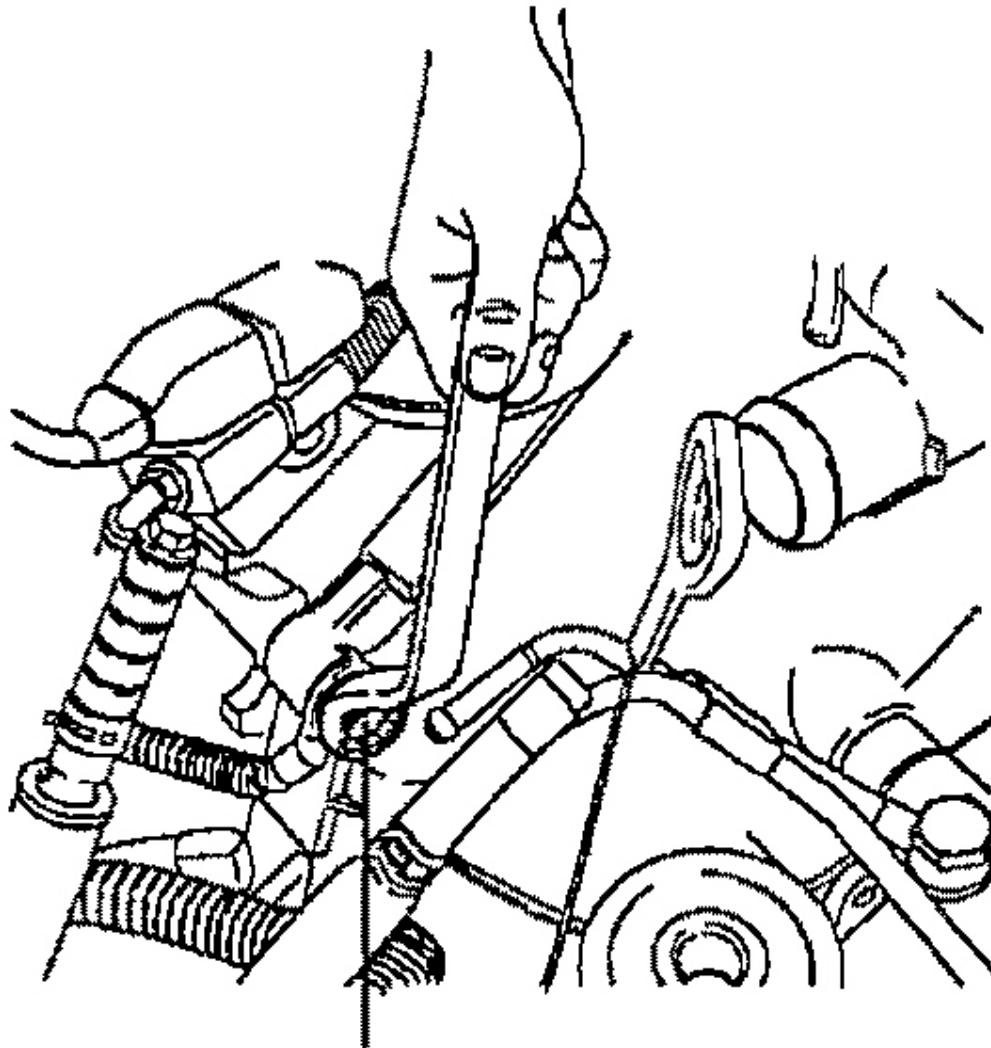
17. Disconnect the inhibitor switch connector, the A/T solenoid connector, the input sensor, the output sensor and the speed sensor connector from the transaxle.



G00325566

Fig. 50: Disconnecting Input/Output, Speed & A/T Solenoid Sensor Connectors
Courtesy of KIA MOTORS AMERICA, INC.

18. Remove the shift cable after removing the clip and nut.
19. Remove the ground wire from the transaxle assembly.

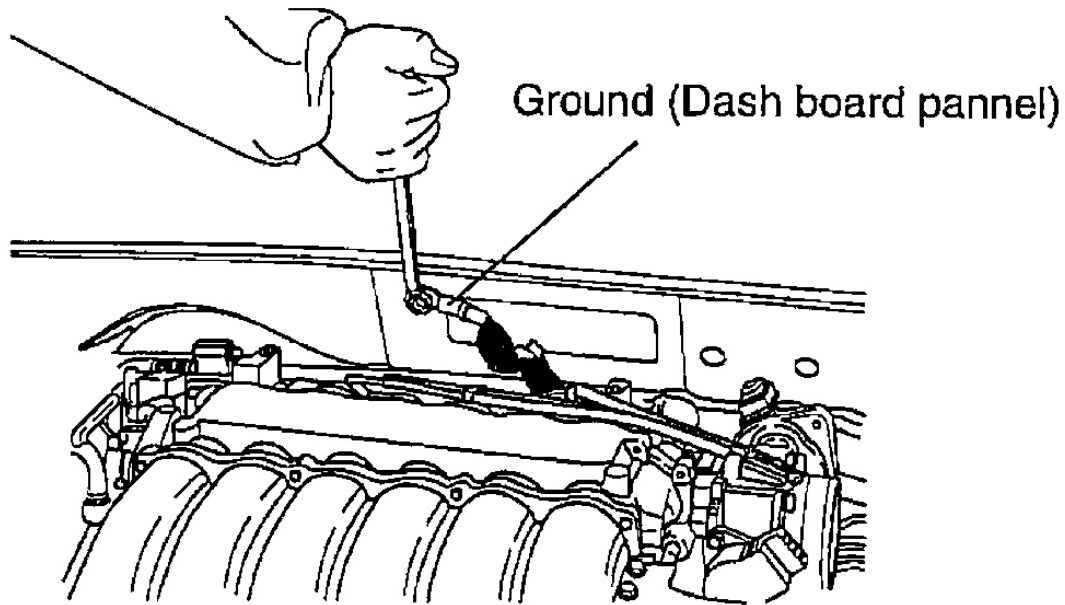


Ground (transaxle)

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Fig. 51: Removing Transaxle Ground
Courtesy of KIA MOTORS AMERICA, INC.

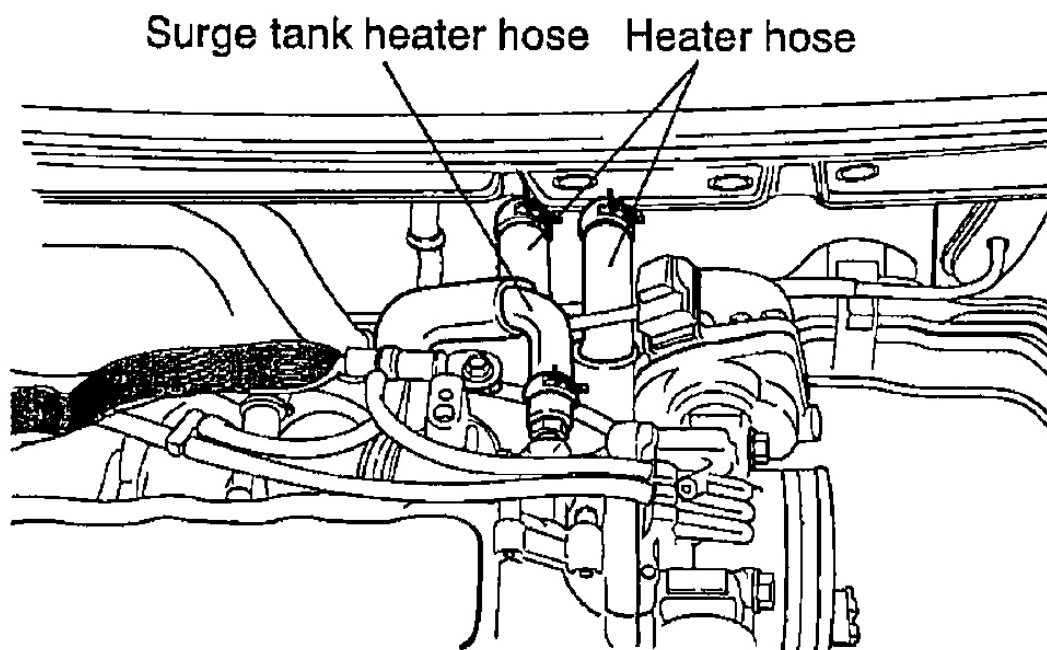
20. Remove the ground wire from the dash board panel.



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Fig. 52: Removing Dash Board Ground
Courtesy of KIA MOTORS AMERICA, INC.

21. Disconnect the heater hose from surge tank, and disconnect the heater hose (in, out) from dash board panel.

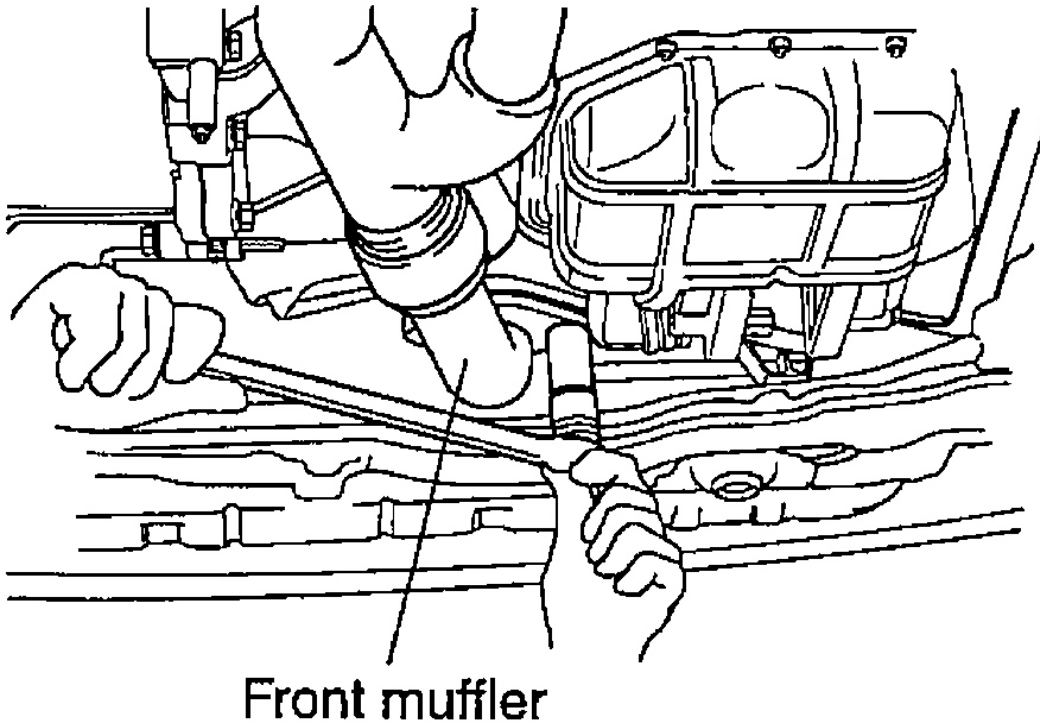


G00325569

Fig. 53: Disconnecting Heater Hoses

Courtesy of KIA MOTORS AMERICA, INC.

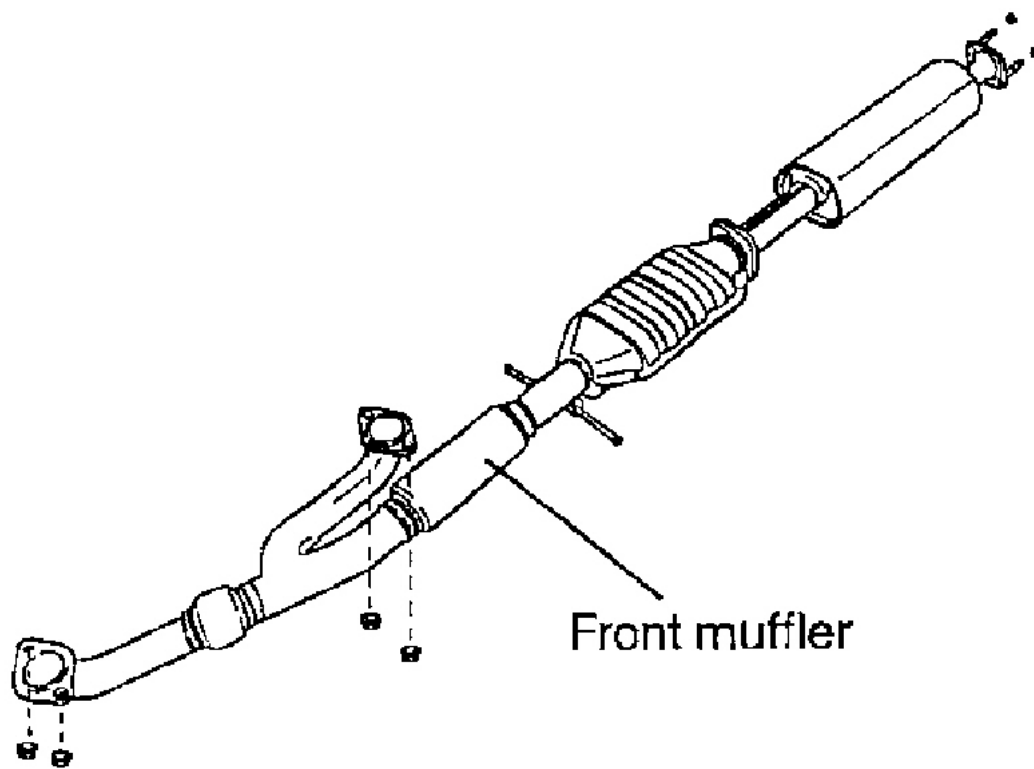
22. Remove the mounting nut between the front muffler and the catalytic converter.



G00325570

Fig. 54: Removing Catalytic Converter/Muffler Mounting Nut
Courtesy of KIA MOTORS AMERICA, INC.

23. Remove the mounting nut between the center muffler and the rear muffler. Remove the front muffler and center muffler assembly.



G00325571

Fig. 55: Removing Center & Rear Mufflers
Courtesy of KIA MOTORS AMERICA, INC.

24. Disconnect the starter motor B terminal and connect after removing the starter motor cover.

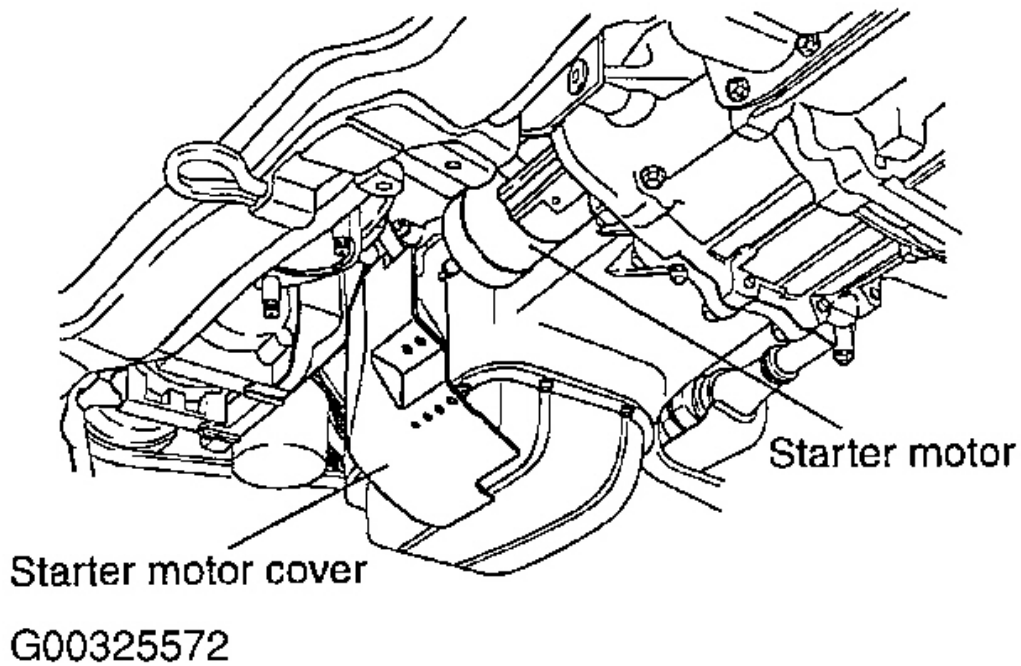
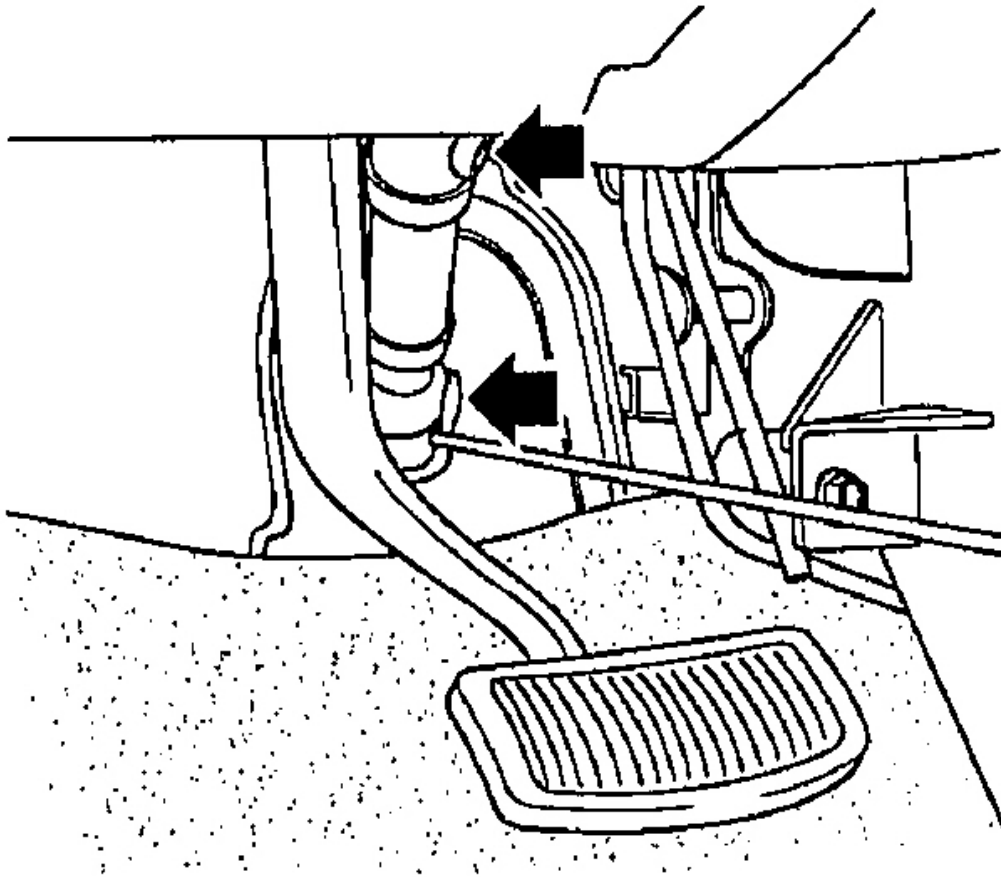


Fig. 56: Disconnecting Starter Motor Connectors
Courtesy of KIA MOTORS AMERICA, INC.

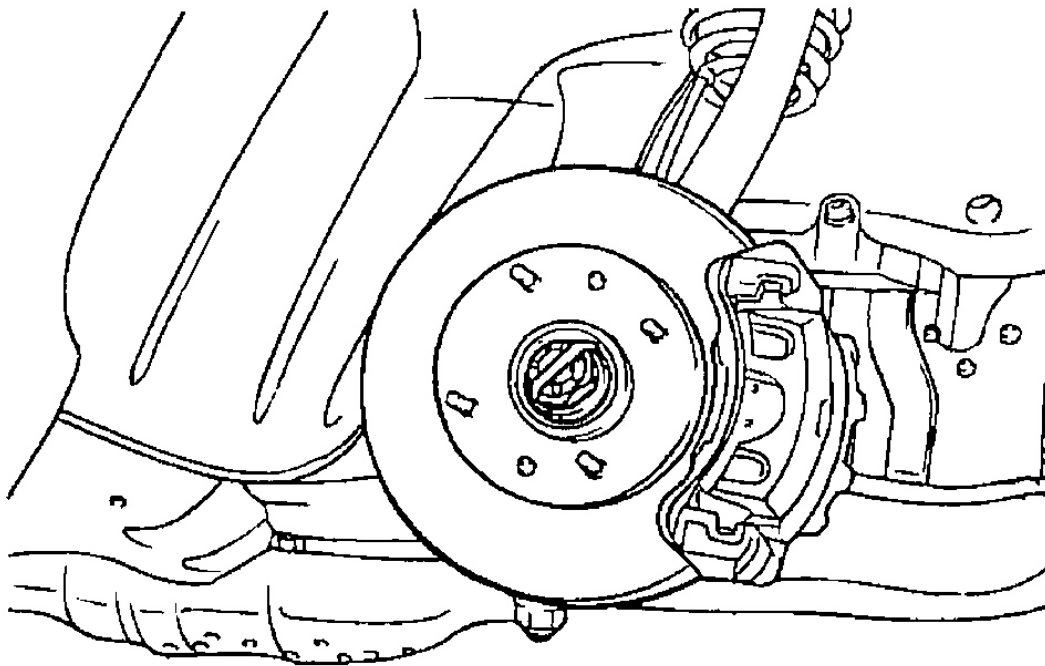
25. Disconnect the power steering gear connector and remove the intermediate shaft.



G00325573

Fig. 57: Disconnecting Power Steering Connector & Removing Intermediate Shaft
Courtesy of KIA MOTORS AMERICA, INC.

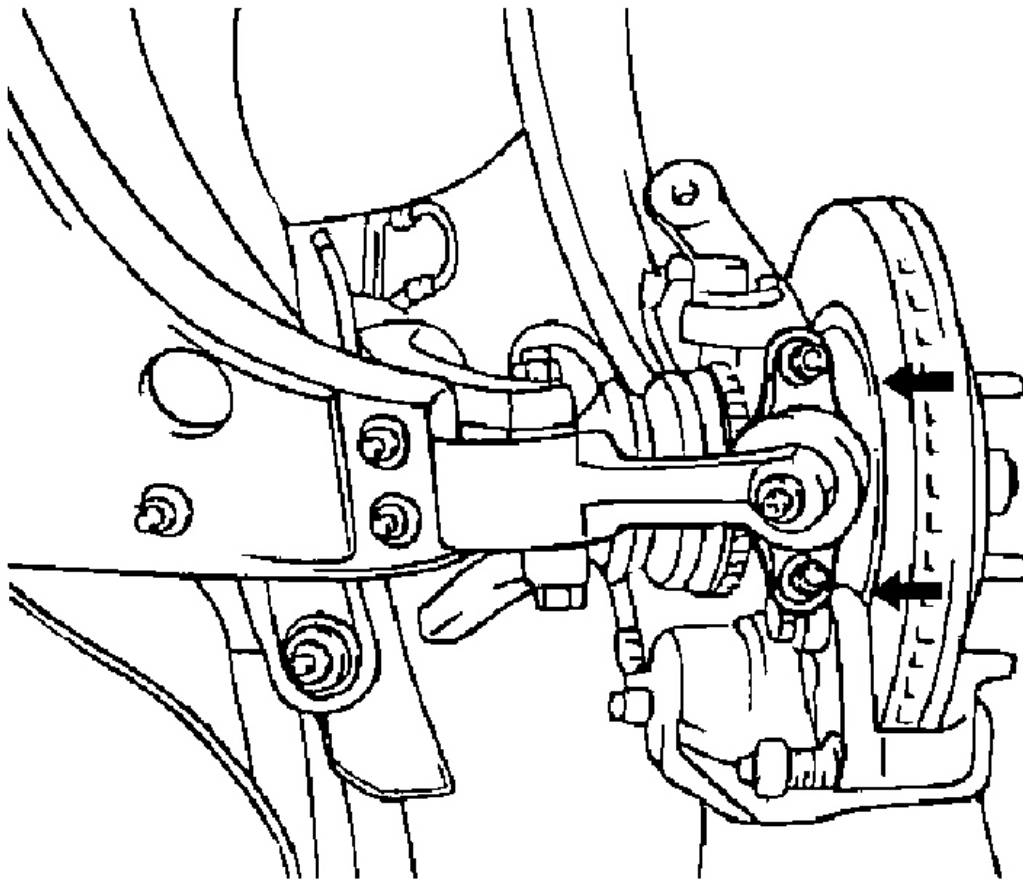
26. Remove the wheel and tire.
27. Remove the drive shaft nut after removing a split pin from the front hub.



G00325574

Fig. 58: Removing Split Pin & Drive Shaft Nut
Courtesy of KIA MOTORS AMERICA, INC.

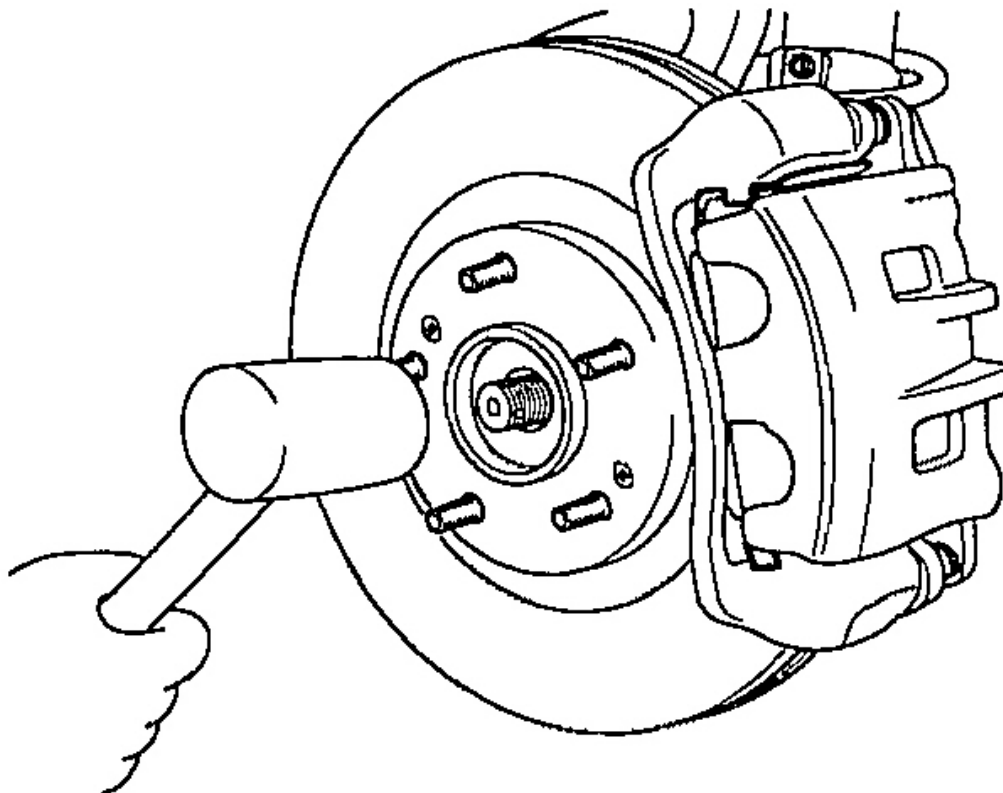
28. Remove the lower arm ball joint mounting bolt (2ea) from the knuckle.



G00325575

Fig. 59: Removing Lower Ball Joint Bolt
Courtesy of KIA MOTORS AMERICA, INC.

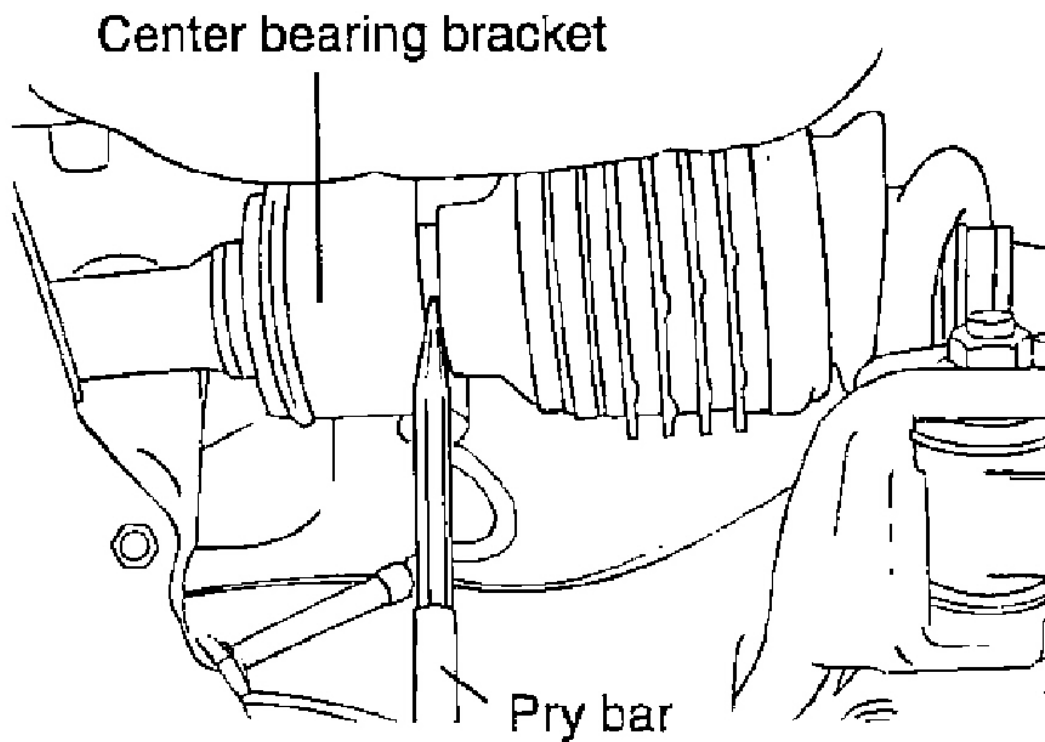
29. Remove the tie rod end ball joint and sensor.
30. Remove the drive shaft from axle hub.



G00325576

Fig. 60: Removing Drive Shaft From Hub
Courtesy of KIA MOTORS AMERICA, INC.

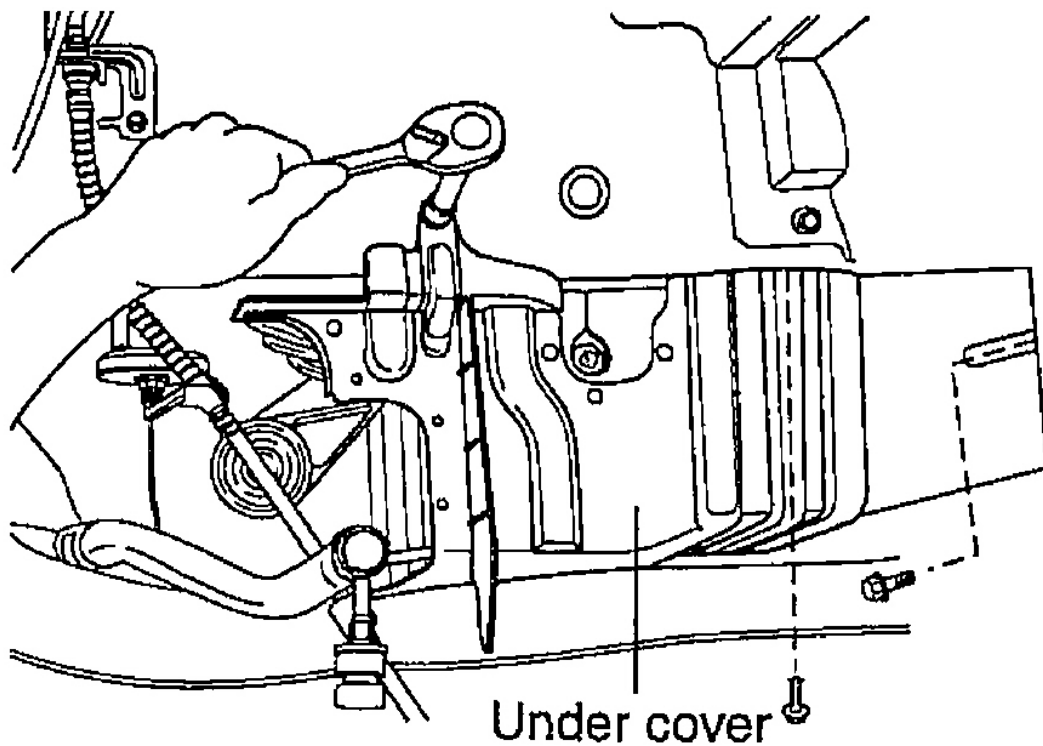
31. Remove the drive shaft from the transaxle.



G00325577

Fig. 61: Removing Drive Shaft From Transaxle
Courtesy of KIA MOTORS AMERICA, INC.

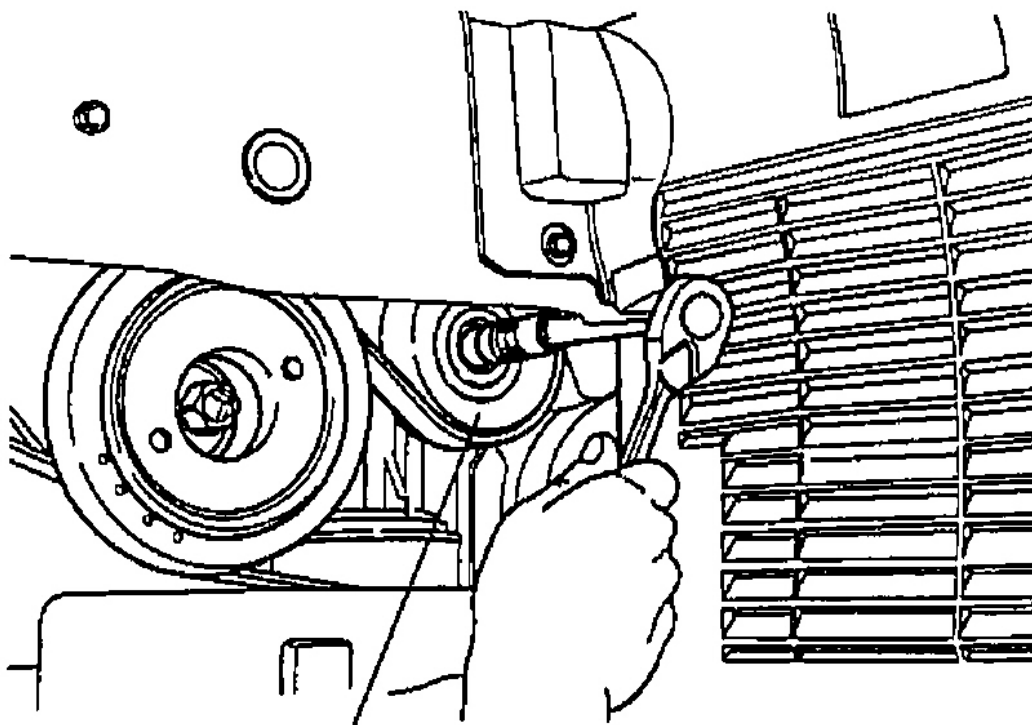
32. Remove the under cover (bolt 3ea) in the right tire side.



G00325578

Fig. 62: Removing Under Cover Bolts
Courtesy of KIA MOTORS AMERICA, INC.

33. Loosen the fixing bolt of the drive belt tensioner.

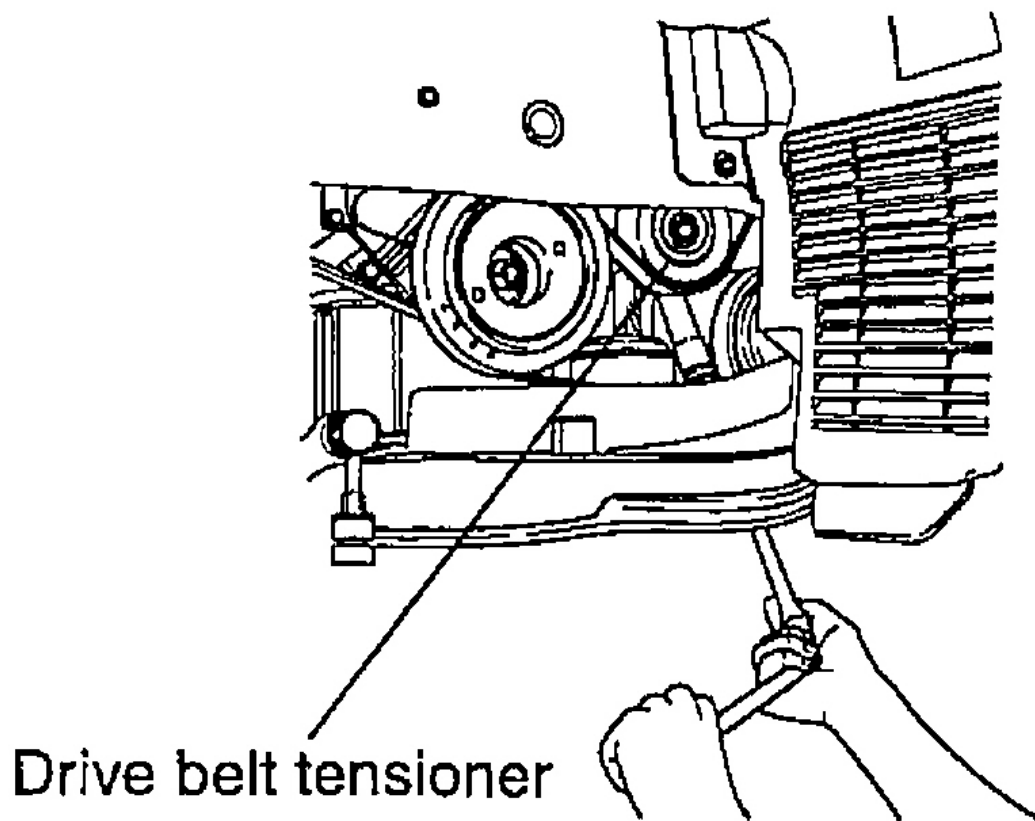


Drive belt tensioner

G00325579

Fig. 63: Removing Drive Belt Tensioner Bolt
Courtesy of KIA MOTORS AMERICA, INC.

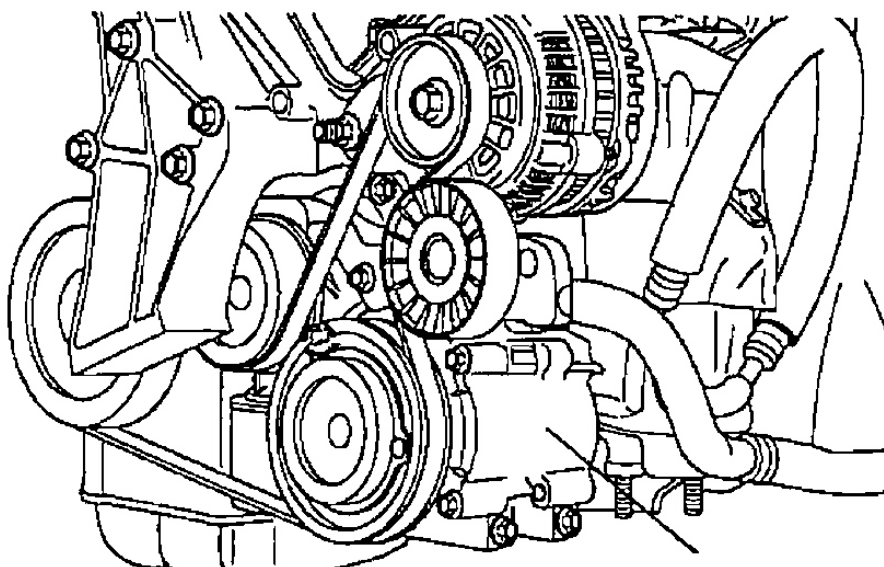
34. Loosen the drive belt tension by screwing the adjusting bolt of the drive belt tensioner.



G00325580

Fig. 64: Loosening Drive Belt Tensioner
Courtesy of KIA MOTORS AMERICA, INC.

35. Fix the air conditioner compressor to the body frame by using a wire after removing air conditioner compressor mounting bolt (4ea).

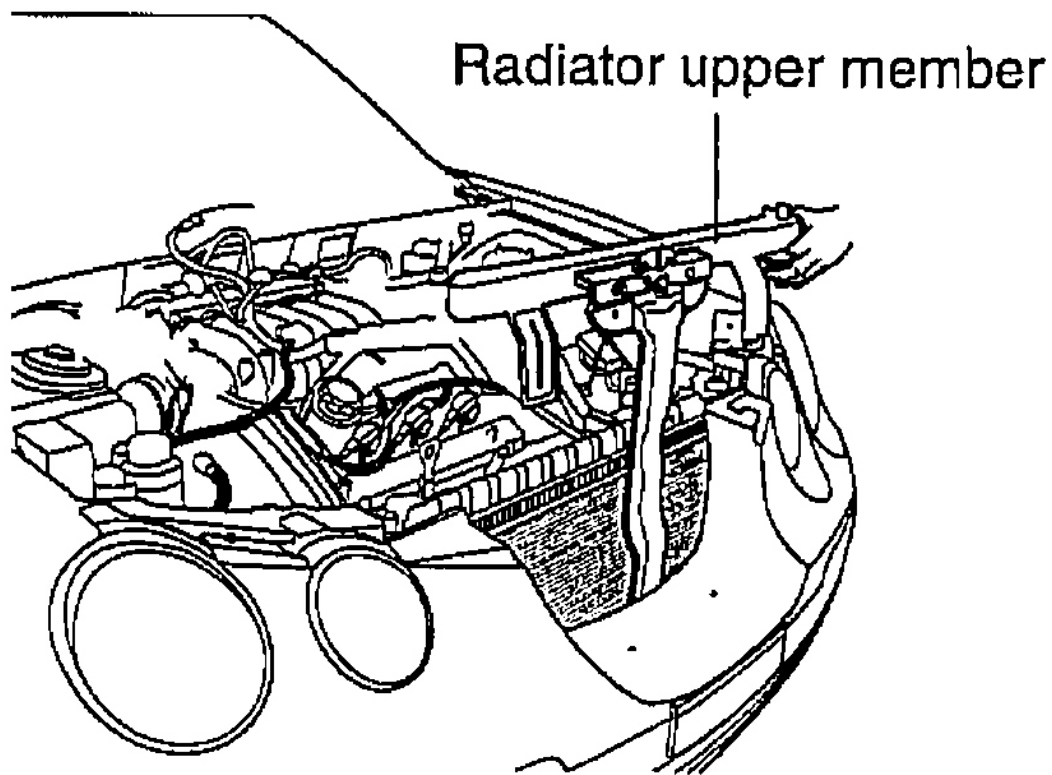


Air conditioner compressor

G00325581

Fig. 65: Suspending A/C Compressor
Courtesy of KIA MOTORS AMERICA, INC.

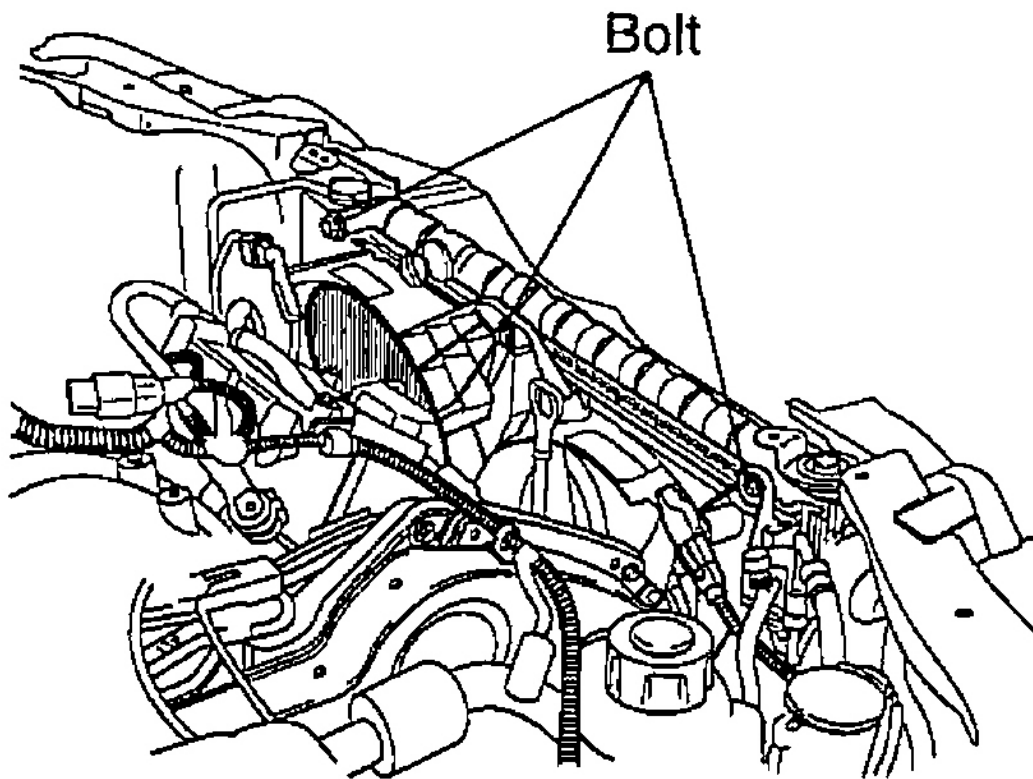
36. Remove the radiator upper member mounting bolt and the bonnet release cable.
37. Remove the radiator upper member from engine room, after disconnecting the horn connector.



G00325582

Fig. 66: Removing Radiator Support
Courtesy of KIA MOTORS AMERICA, INC.

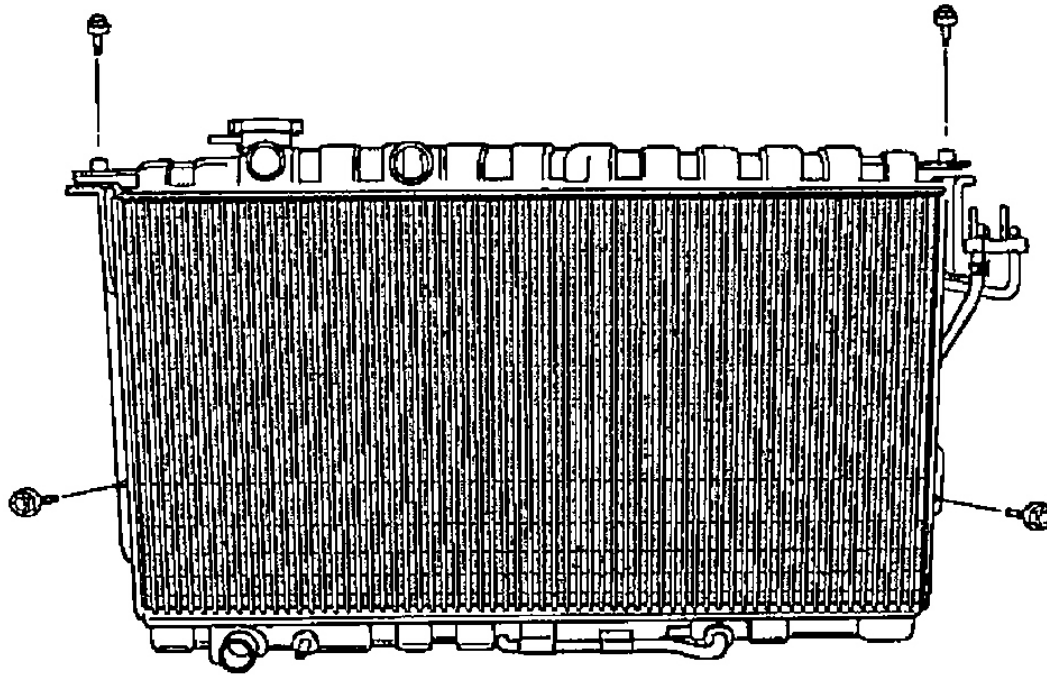
38. Disconnect the cooling fan connector and the air condenser fan connector. Remove the fan assembly from engine room, after removing the fan assembly mounting bolt.



G00325583

Fig. 67: Removing Cooling Fan Assembly
Courtesy of KIA MOTORS AMERICA, INC.

39. Remove the radiator mounting bolt (4ea) from the air conditioner condenser.

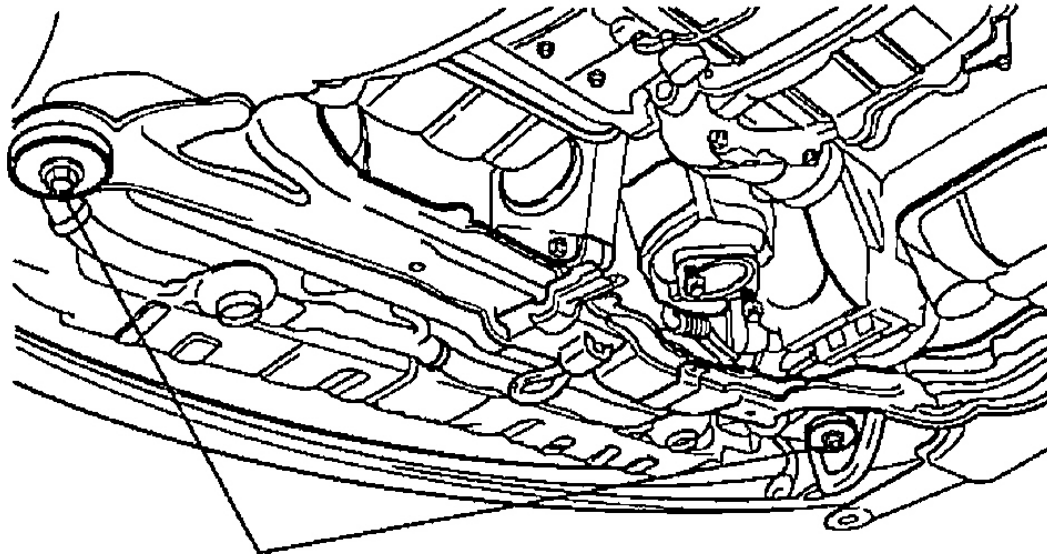


G00325584

Fig. 68: Removing Radiator

Courtesy of KIA MOTORS AMERICA, INC.

40. Remove the radiator from engine room, after disconnecting the radiator reserve hose.
41. Disconnect the fuel hoses.
42. Remove the sub frame mounting bolts and nuts.
 - Front

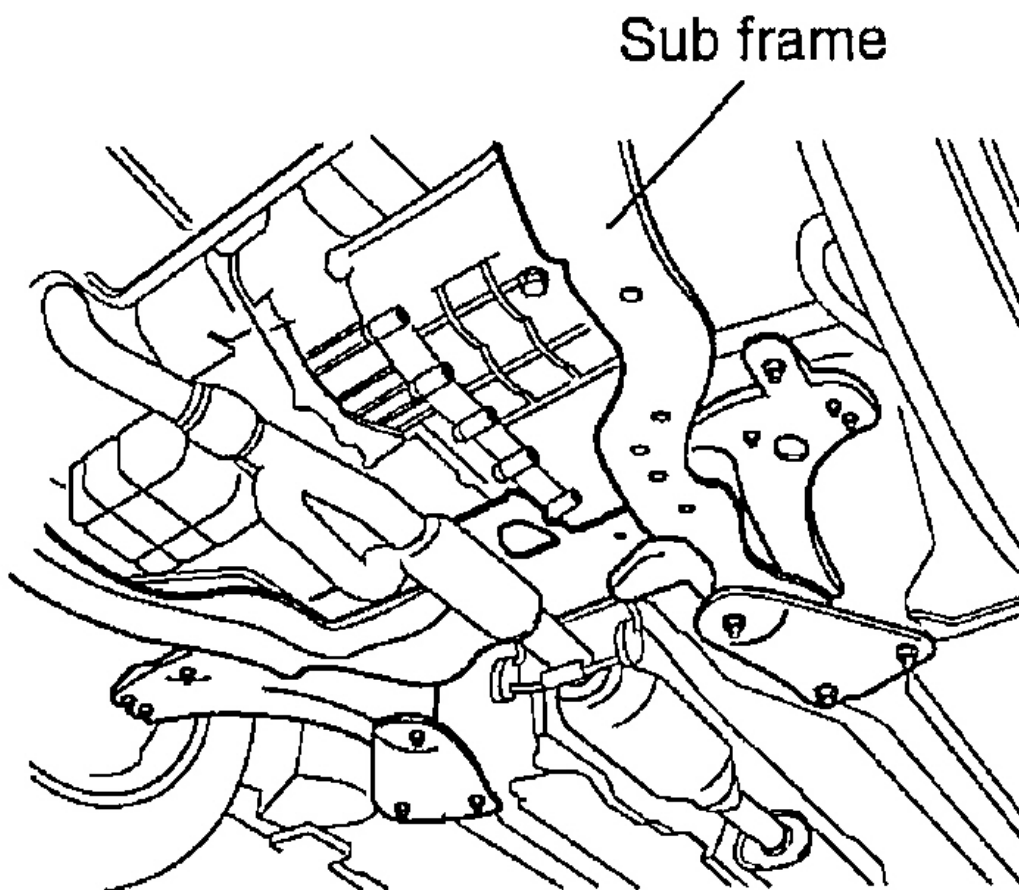


Sub frame bolt

G00325585

Fig. 69: Removing Front Sub Frame Bolts
Courtesy of KIA MOTORS AMERICA, INC.

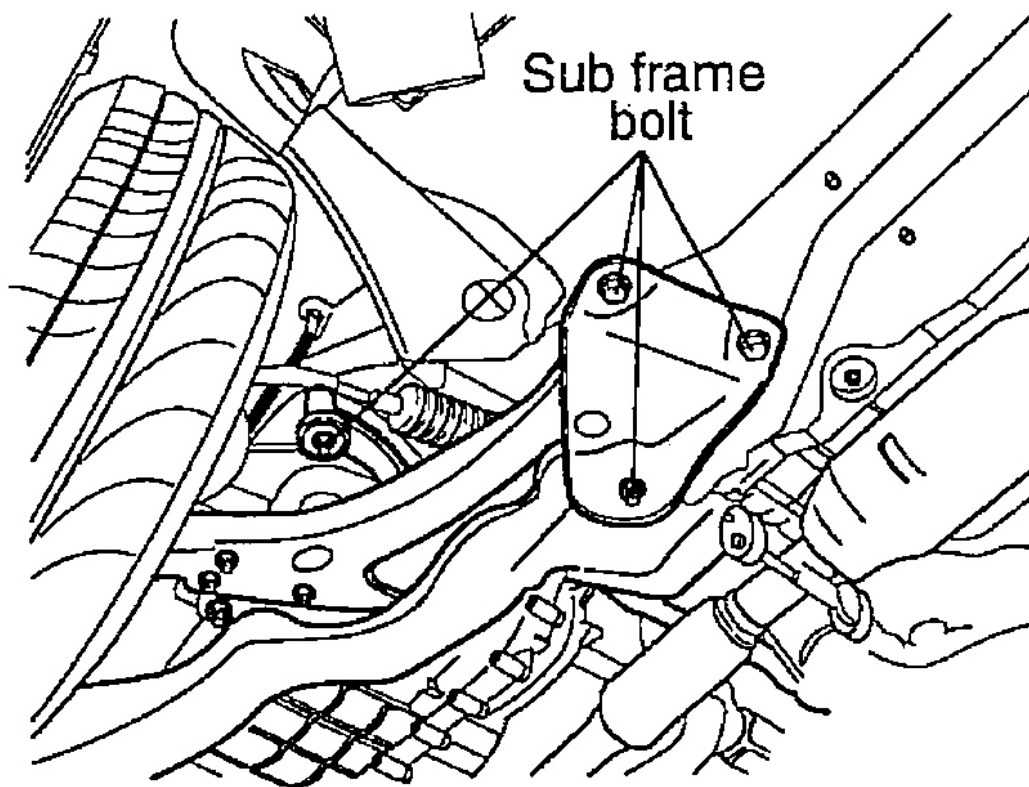
- Rear



G00325586

Fig. 70: Identifying Rear Sub Frame Bolts
Courtesy of KIA MOTORS AMERICA, INC.

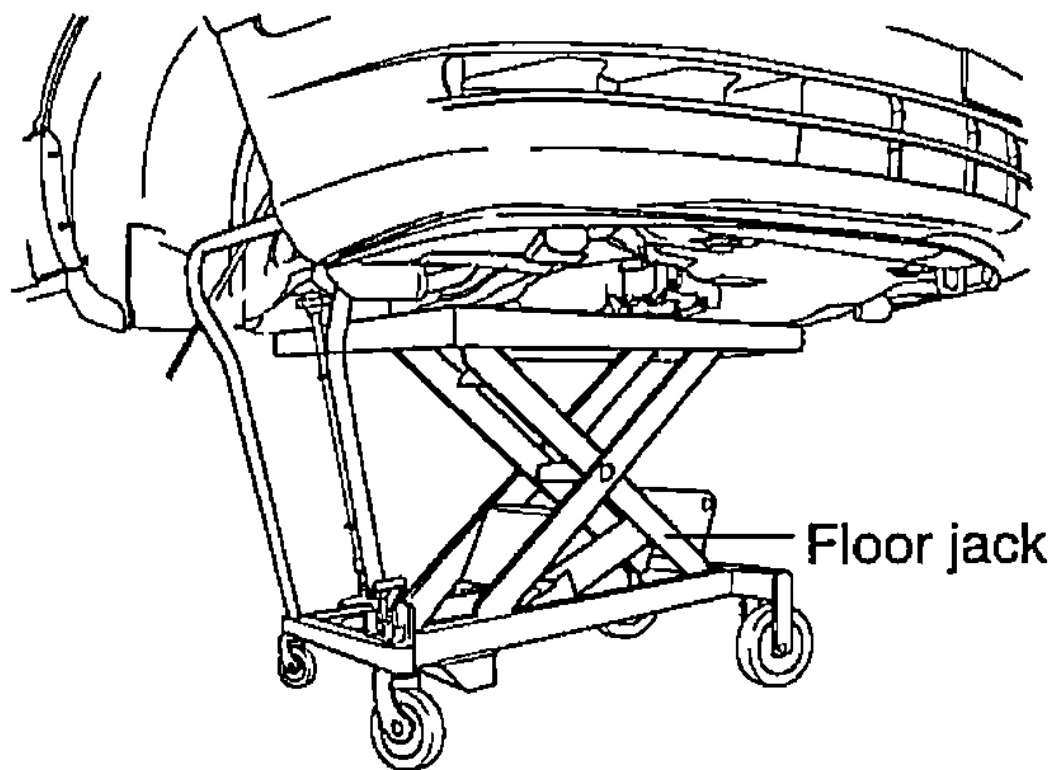
- Rear



G00325587

Fig. 71: Removing Rear Sub Frame Bolts
Courtesy of KIA MOTORS AMERICA, INC.

43. Support the sub frame with a floor jack.



G00325588

Fig. 72: Supporting Sub Frame

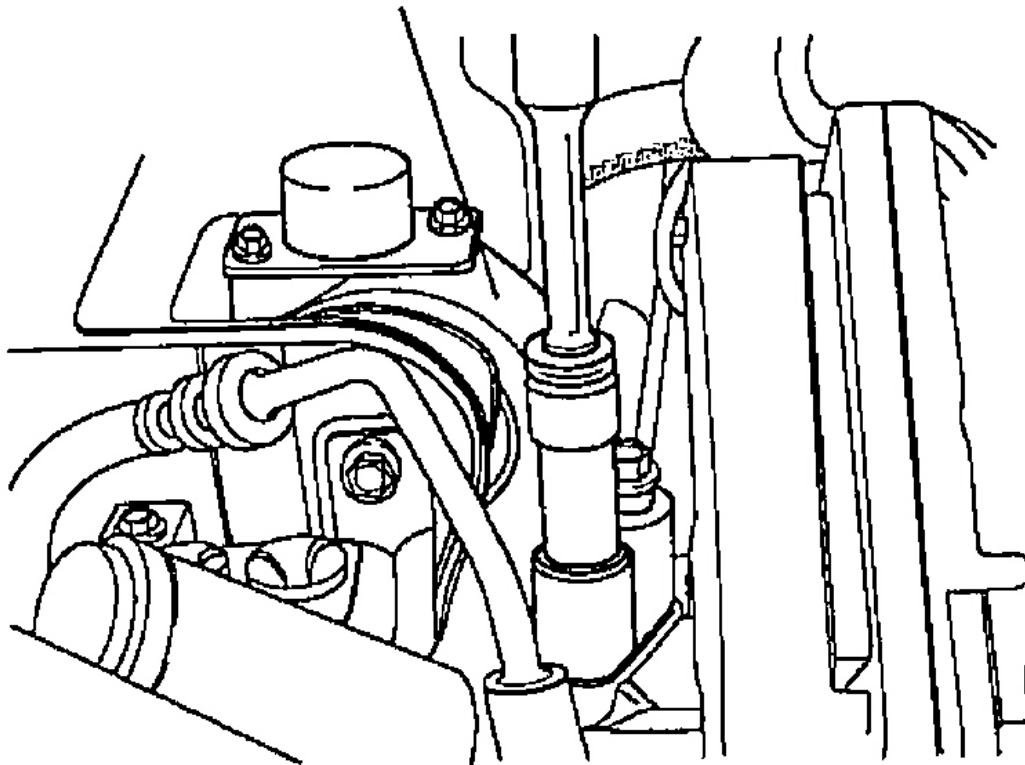
Courtesy of KIA MOTORS AMERICA, INC.

CAUTION: After removing the mounting bolt (engine and transaxle), the engine and transaxle assembly may fall downward, and so support them securely with floor jack.

Verify that the hoses and connectors are disconnected before removing the engine and the transaxle assembly.

44. Remove the engine mounting bolt and nut.

Engine mounting

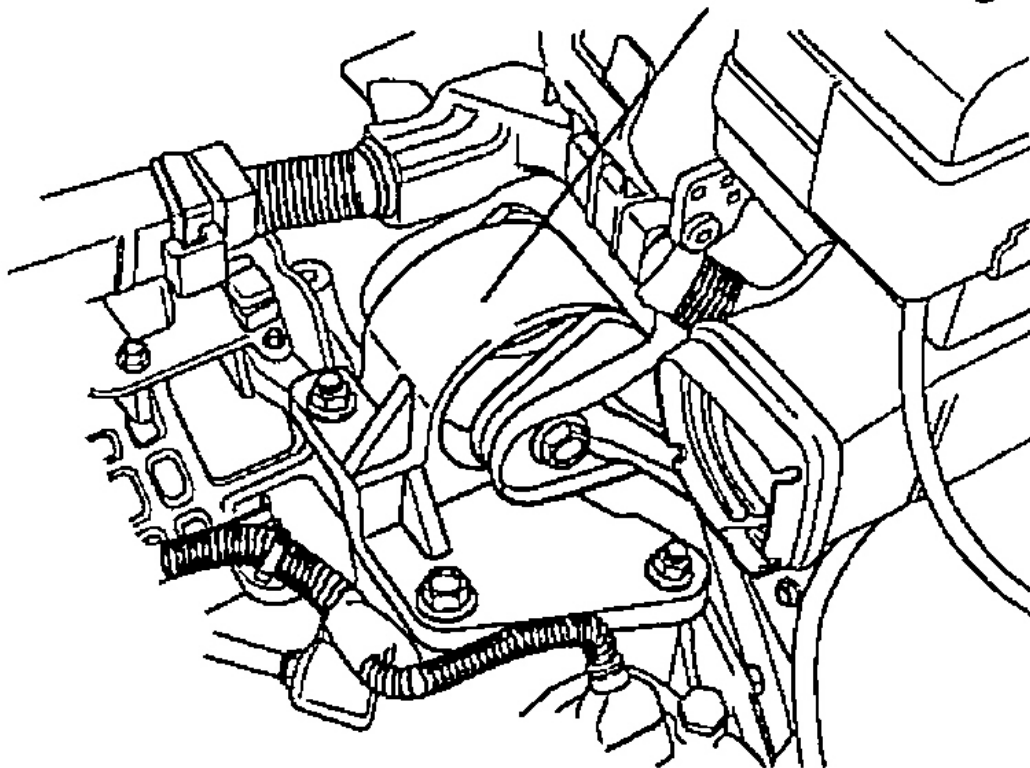


G00325589

Fig. 73: Removing Engine Mounting Bolts
Courtesy of KIA MOTORS AMERICA, INC.

45. Remove the transaxle mounting bolt and nut.

Transaxle mounting



G00325590

Fig. 74: Removing Transaxle Mounting Bolts
Courtesy of KIA MOTORS AMERICA, INC.

46. Remove the sub frame, engine and transaxle assembly by lifting vehicle.

INSTALLATION

1. Install the sub frame, engine and transaxle assembly to engine room.
2. Install the transaxle mounting bolt and nut.

Tightening torque :

58.8~78.5 N-m (6~8 kg-m, 43.4~57.9 lb-ft)

3. Install the engine mounting bolt and nut.

Tightening torque :

58.8~78.5 N-m (6~8 kg-m, 43.4~57.9 lb-ft)

4. Install the sub frame bolt and nut.

Tightening torque :

98.1~117.7 N-m (10~12 kg-m, 72.3~86.8 lb-ft)

5. Reconnect the fuel hoses.
6. Install the radiator to vehicle and reconnect the radiator reserve hose.
7. Install the radiator mounting bolts (4ea) to the air conditioner condenser.
8. Install the cooling fan and the air conditioner condenser fan. And then reconnect the connectors.
9. Install the radiator upper member to vehicle, and then reconnect the horn connector.
10. Install the air conditioner compressor to the engine. (mounting bolt 4ea)
11. Install the drive belt and then apply tension by screwing the tension adjusting bolt.
12. Tighten the fixing bolt of the drive belt tensioner.
13. Install the under cover (bolt 3ea).
14. Install the drive shaft to the transaxle.
15. Install the drive shaft to the axle hub.
16. Install the tie rod end ball joint to the knuckle.

Tightening torque :

23.5~33.3 N-m (2.4~3.4 kg-m, 17.4~24.6 lb-ft)

17. Install the lower arm ball joint mounting bolt (2ea) to the knuckle.

Tightening torque :

98.1~117.7 N-m (10~12 kg-m, 72.3~86.8 lb-ft)

18. Install the drive shaft nut and install a split pin to the front hub.

Tightening torque :

196.1~274.6N-m (20~28 kg-m, 144.7~202.5 lb-ft)

19. Install the intermediate shaft and reconnect the power steering gear connector.
20. Reconnect the starter motor B terminal and connector, and then install the starter motor cover.
21. Install the front muffler and center muffler assembly. And tighten the mounting nut between the center muffler and the rear muffler

Tightening torque :

39.2~58.8 N-m (4~6 kg-m, 28.9~43.4 lb-ft)

22. Tighten the mounting nut between the catalytic converter and the front muffler.

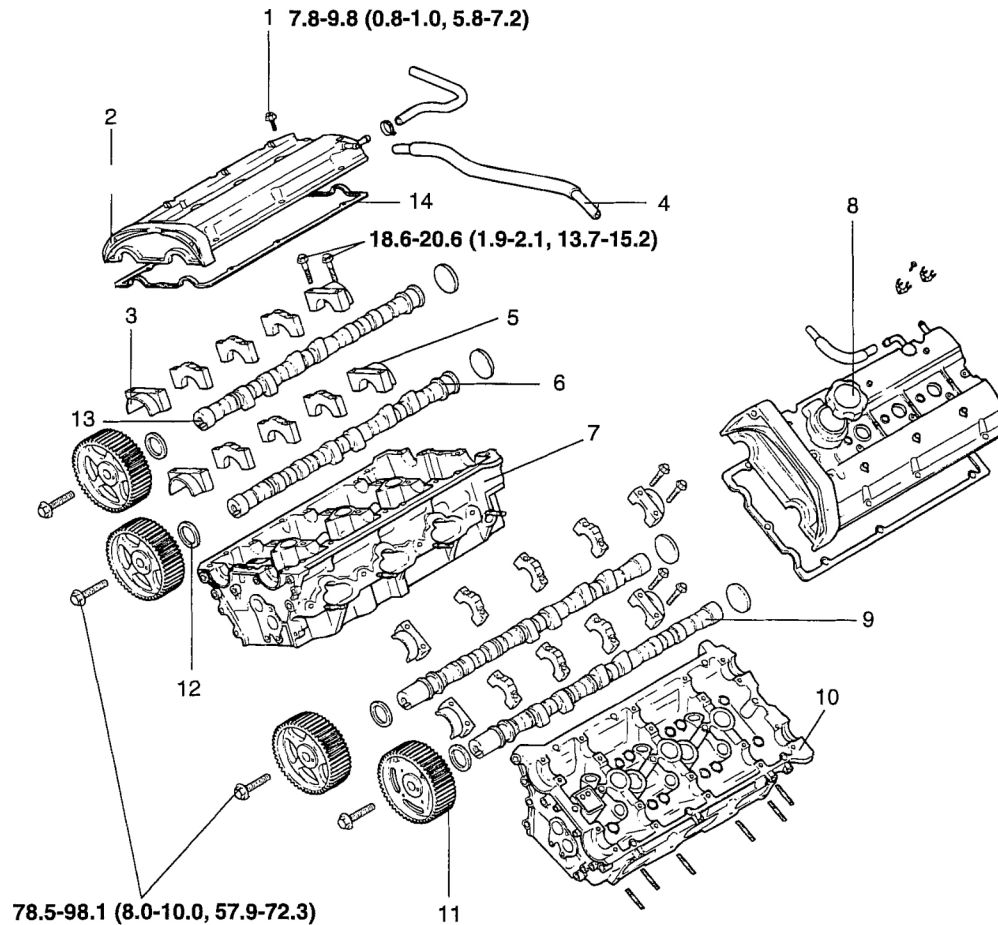
Tightening torque :

39.2~58.8 N-m (4~6 kg-m, 28.9~43.4 lb-ft)

23. Reconnect the heater hose to surge tank, and reconnect the heater hose (in, out) to dash board panel.
24. Install the ground wire to the dash board panel.
25. Install the ground wire to the transaxle assembly.
26. Install the shift cable with the clip and nut.
27. Reconnect the inhibitor switch connector, the A/T solenoid connector, the input sensor, the output sensor and the speed sensor connector to the transaxle.
28. Install the ground wire to the fuse box and the body frame.
29. Reconnect the radiator upper hose and lower hose.
30. Reconnect the water temperature sensor connector.
31. Reconnect the throttle position sensor connector, the ETS (Electronic throttle system) motor connector, the limp-home connector and the purge solenoid valve connector.
32. Reconnect the ignition coil harness connector, the oxygen sensor (front) connector and the knock sensor connector.
33. Reconnect the injector connector and install the injector harness bracket bolt (2ea).
34. Reconnect the crank angle sensor connector, the cam angle sensor connector, the injector harness connector, the power steering switch connector, the variable intake motor connector (2ea), the accelerator position sensor connector and the EGR solenoid connector.
35. Reconnect the alternator B terminal, the alternator connector and the oil pressure switch connector.
36. Install the air cleaner assembly with the air intake hose clamp and fixing bolt (3ea).
37. Reconnect the air flow sensor connector and the vacuum hose to the air intake hose.
38. Install the battery and the battery tray.
39. Refill the engine coolant, the engine oil and the transaxle oil.
40. Reconnect the battery terminal.
41. Install the engine cover.

MAIN MOVING SYSTEM

CAMSHAFT



TORQUE : N·m (kg·m, lb·ft)

- | | |
|-----------------------------|------------------------|
| 1. Cylinder head cover bolt | 8. Oil filler cap |
| 2. Cylinder head cover | 9. Camshaft (EX) |
| 3. Bearing cap (Front) | 10. Cylinder head (LH) |
| 4. PCV hose | 11. Camshaft sprocket |
| 5. Bearing cap (Rear) | 12. Camshaft oil seal |
| 6. Camshaft (IN) | 13. Camshaft (EX) |
| 7. Cylinder head (RH) | 14. Gasket |

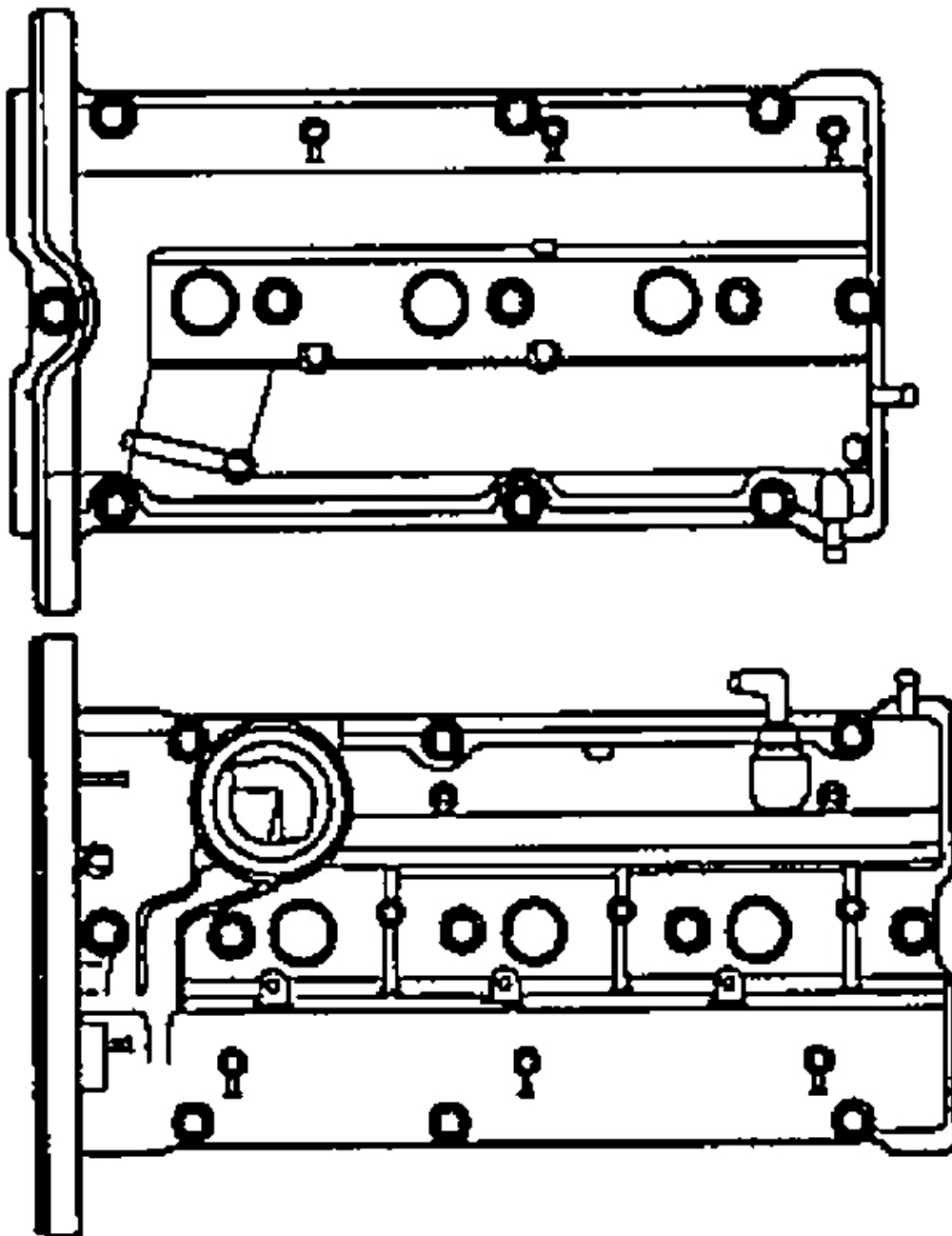
G00325591

Fig. 75: Identifying Valvetrain Components
 Courtesy of KIA MOTORS AMERICA, INC.

DISASSEMBLY

1. Remove the engine cover and intake manifold.
2. Disconnect the breather hose and the engine harness.
3. Remove the power steering pulley, air conditioner pulley, crankshaft pulley, idler pulley and tensioner pulley.
4. Remove the timing belt cover.

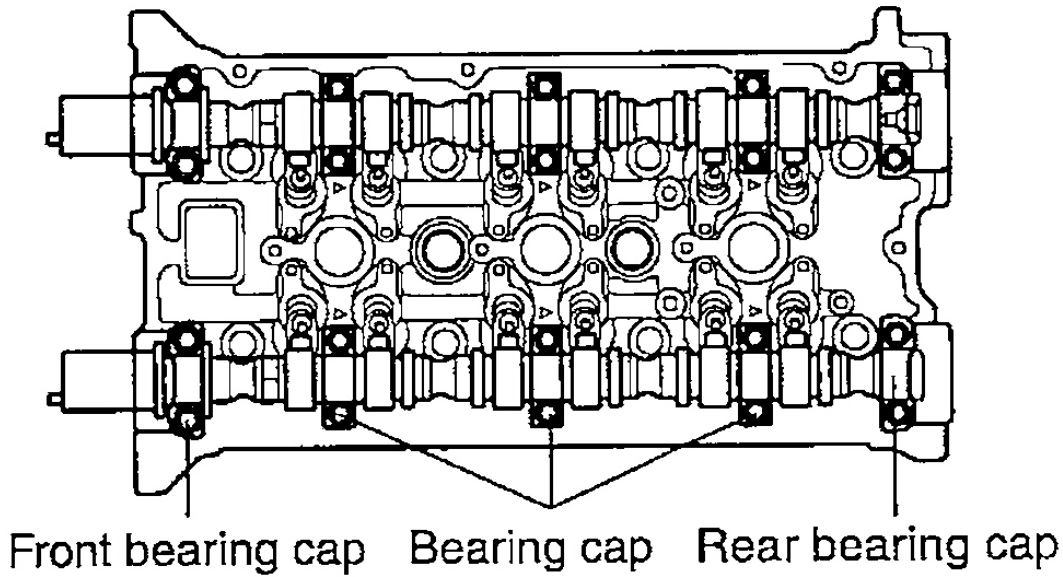
5. Loosen the auto tensioner.
6. Remove the timing belt from the camshaft sprocket.
7. Remove the spark plug cables.
8. Loosen the cylinder head cover bolts and then remove it.



G00325592

Fig. 76: Loosening Cylinder Head Cover Bolt
Courtesy of KIA MOTORS AMERICA, INC.

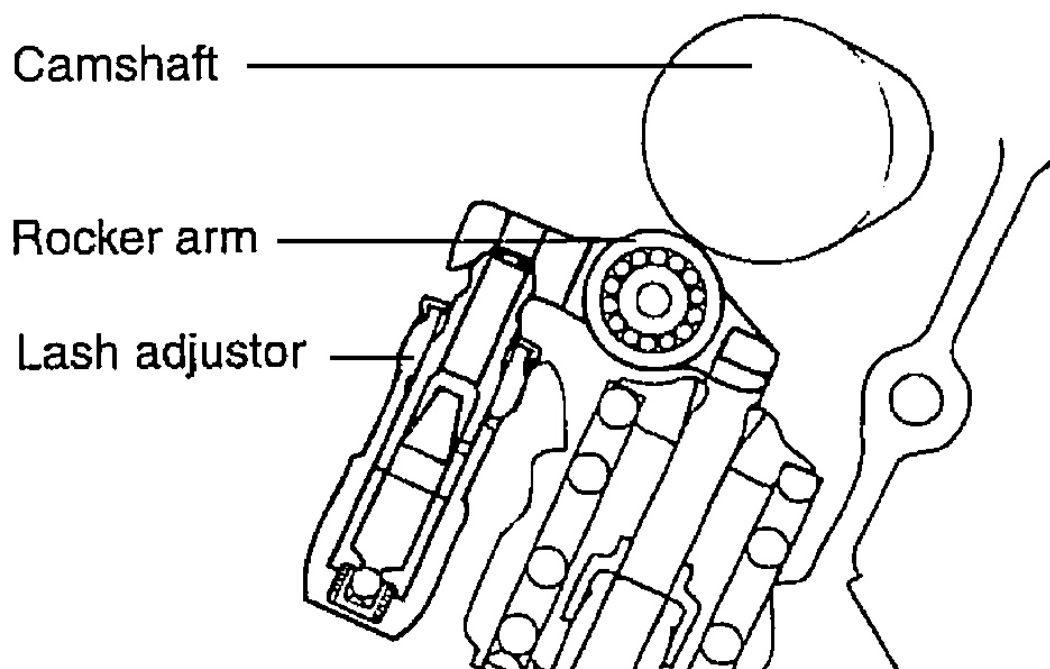
9. Remove the camshaft sprockets.
10. Remove the camshaft bearing caps.



G00325593

Fig. 77: Removing Camshaft Bearing Caps
Courtesy of KIA MOTORS AMERICA, INC.

11. Remove the camshafts.



G00325594

Fig. 78: Identifying Camshaft Components
Courtesy of KIA MOTORS AMERICA, INC.

INSPECTION

CAMSHAFTS

1. Check the camshaft journals for wear. If the journals are badly worn out, replace the camshaft.
2. Check the cam lobes for damage. If the lobe is damaged or excessively worn out, replace the camshaft.

Cam height

Standard

Intake : 35.098 - 35.298 mm (1.3818 - 1.3897 in.)

Exhaust : 34.81 - 35.01 mm (1.3705 - 1.3783 in.)

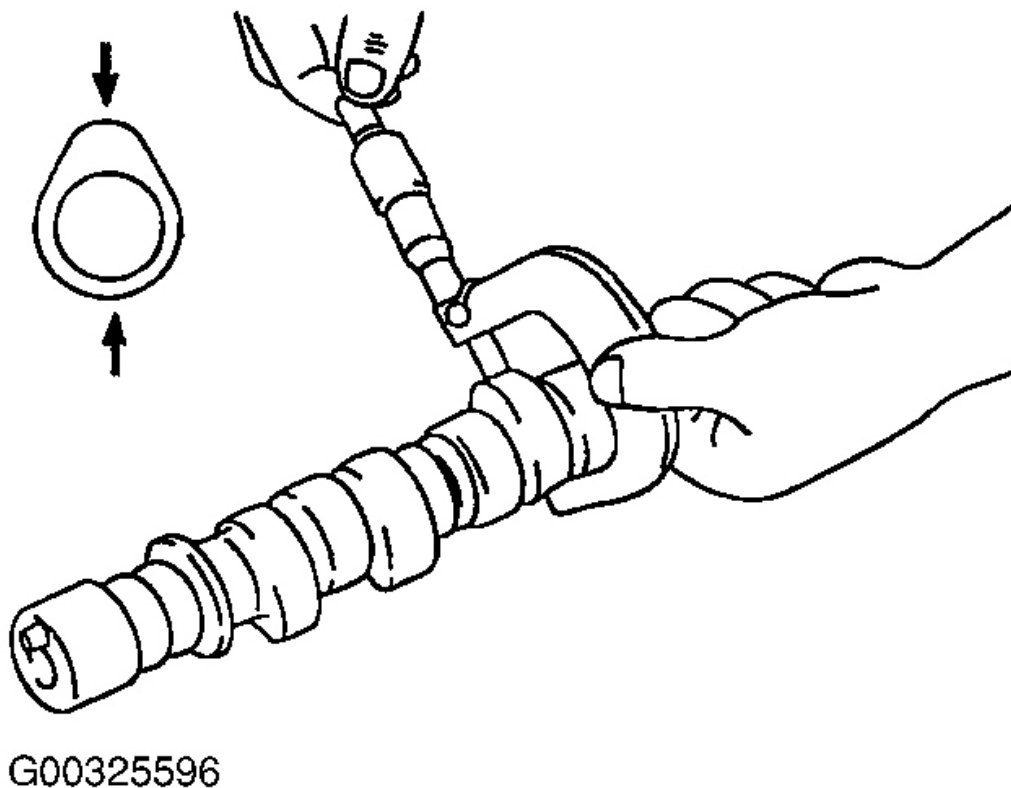


Fig. 79: Measuring Camshaft Lobes
Courtesy of KIA MOTORS AMERICA, INC.

3. Check the cam surface for abnormal wear or damage, and replace if necessary.
4. Check each bearing for damage. If the bearing surface is excessively damaged, replace the cylinder head assembly or camshaft bearing cap, as necessary.

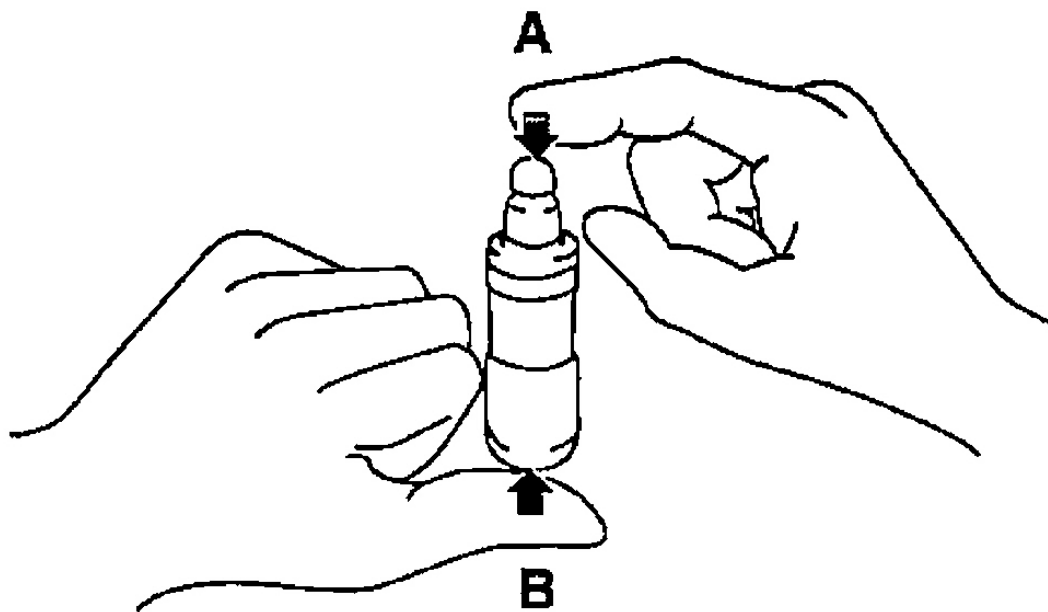
Camshaft end play : 0.1 - 0.15 mm (0.0039 - 0.0059 in.)

OIL SEAL (CAMSHAFT FRONT)

1. Check the lips for wear. If lip threads are worn out, replace the oil seal with new one.
2. Check a contact surface of oil seal lip on camshaft. If there stratified wear, replace the camshaft.

HLA (HYDRAULIC LASH ADJUSTER)

With the HLA filled with engine oil, hold A and press B by hand. If B moves, replace the HLA.



G00325595

Fig. 80: Testing Lash Adjuster
Courtesy of KIA MOTORS AMERICA, INC.

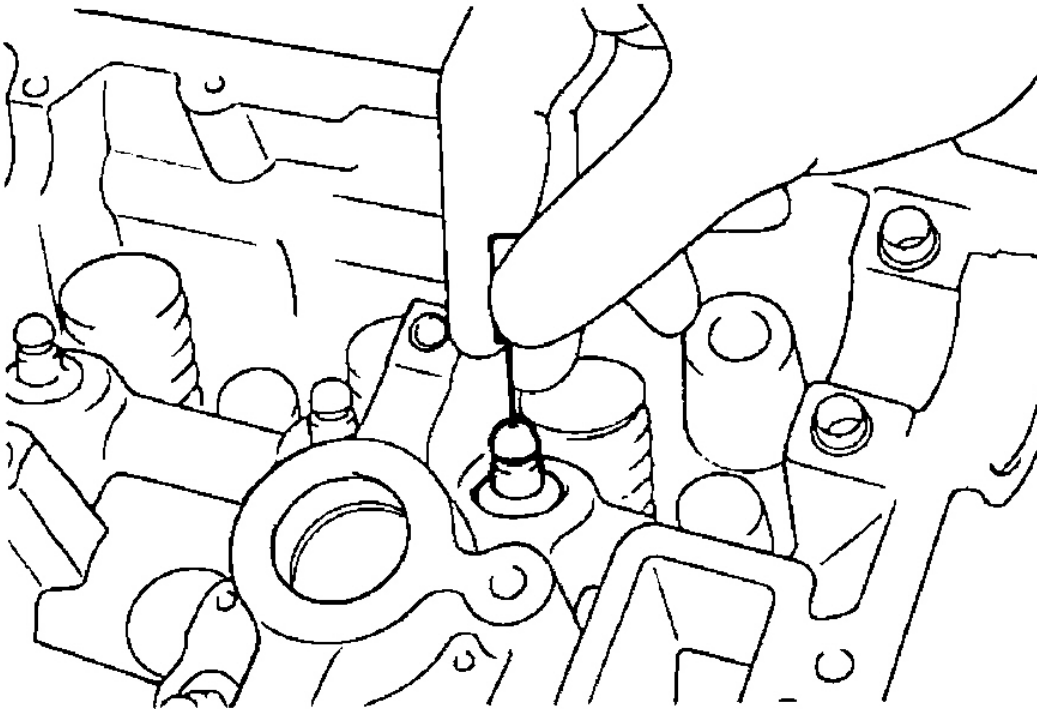
Problem	Possible cause	Action
Temporary noise when starting a cold engine	Normal	This noise will disappear after the oil in the engine reaches the normal pressure.
Continuous noise when the engine is started after parking more than 48 hours.	Oil leakage of the high pressure chamber on the HLA,allowing air to get in.	Noise will disappear within 15 minutes when engine runs at 2000-3000 rpm. If it doesn't disappear, refer to step 7 below.
Continuous noise when the engine is first started after rebuilding cylinder head.	Insufficient oil in cylinder head oil gallery.	 CAUTION <i>Do not run engine at a speed higher than 3000 rpm, as this may damage the HLA.</i>
Continuous noise when the engine is started after excessively cranking the engine by the starter motor or band.	Oil leakage of the high-pressure chamber in the HLA, allowing air to get in. Insufficient oil in the HLA.	
Continuous noise when the engine is running after changing the HLA.		
Continuous noise during idle after high engine speed.	Engine oil level too high or too low.	Check oil level. Drain or add oil as necessary.
	Excessive amount of air in the oil at high engine speed.	Check oil supply system.
	Deteriorated oil.	Check oil quality. If deteriorated, replace with specified type.
Noise continues for more than 15 minutes.	Low oil pressure.	Check oil pressure and oil supply system of each part of engine.
	Faulty HLA.	Remove the cylinder head cover and press HLA down by hand. If it moves, replace the HLA.  CAUTION <i>Be careful with the hot HLAS.</i>

G00325597

Fig. 81: Valvetrain Troubleshooting Chart
Courtesy of KIA MOTORS AMERICA, INC.

AUTO LASH ADJUSTER

1. Check auto - lash adjusters for free play by inserting a small wire through the air bleed hole in the rocker arm and push the auto lash adjuster check ball down very lightly.
2. While lightly holding the check ball down move the rocker arm up and down to check for free play. If there is no play, replace the auto- lash adjuster.



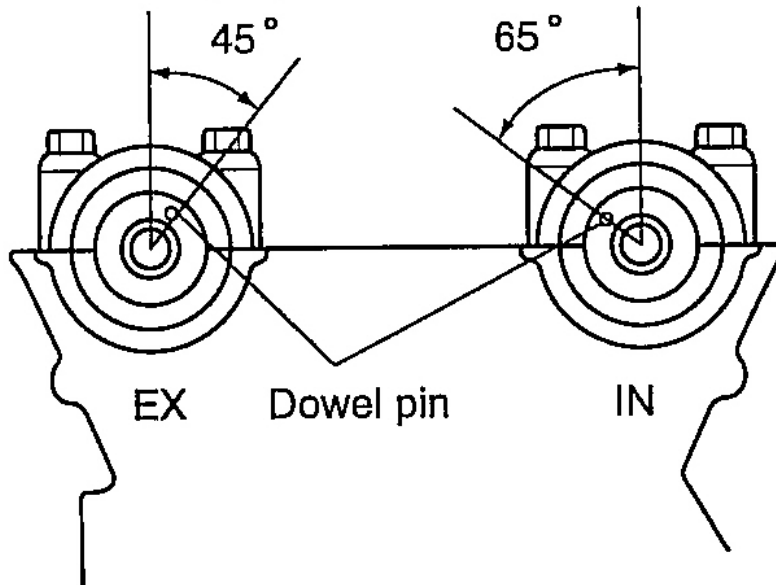
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Fig. 82: Checking Lash Adjuster
Courtesy of KIA MOTORS AMERICA, INC.

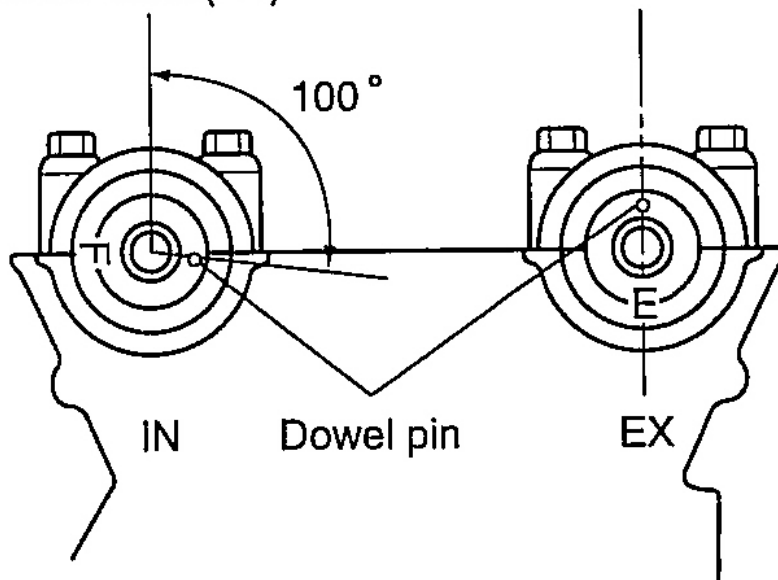
REASSEMBLY**CAMSHAFT AND BEARING CAP**

1. Rotate the crankshaft and No. 1 cylinder is in TDC (Compression stroke).
2. Check the position of the rocker arm whether it is exactly installed on the lash adjuster and valve or not.
3. Install the camshaft dowel pin as illustration.

Cylinder head(RH)



Cylinder head(LH)



G00325599

Fig. 83: Positioning Camshafts

Courtesy of KIA MOTORS AMERICA, INC.

4. The left and right banks of the camshafts are different and you should be careful not to confuse them.

Identification mark

Left bank

Intake (IN) : I

Exhaust (Ex) : E

Right bank

Intake (IN) : J

Exhaust (Ex) : H

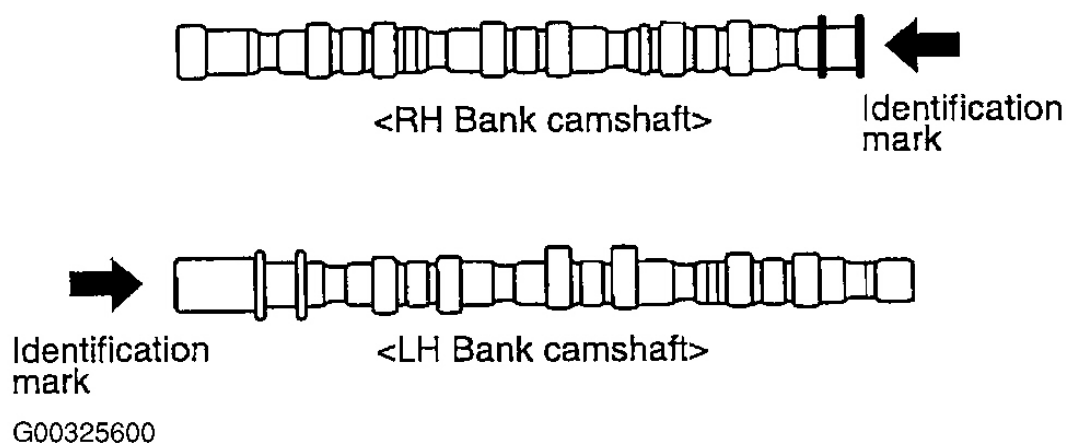


Fig. 84: Identifying Camshafts

Courtesy of KIA MOTORS AMERICA, INC.

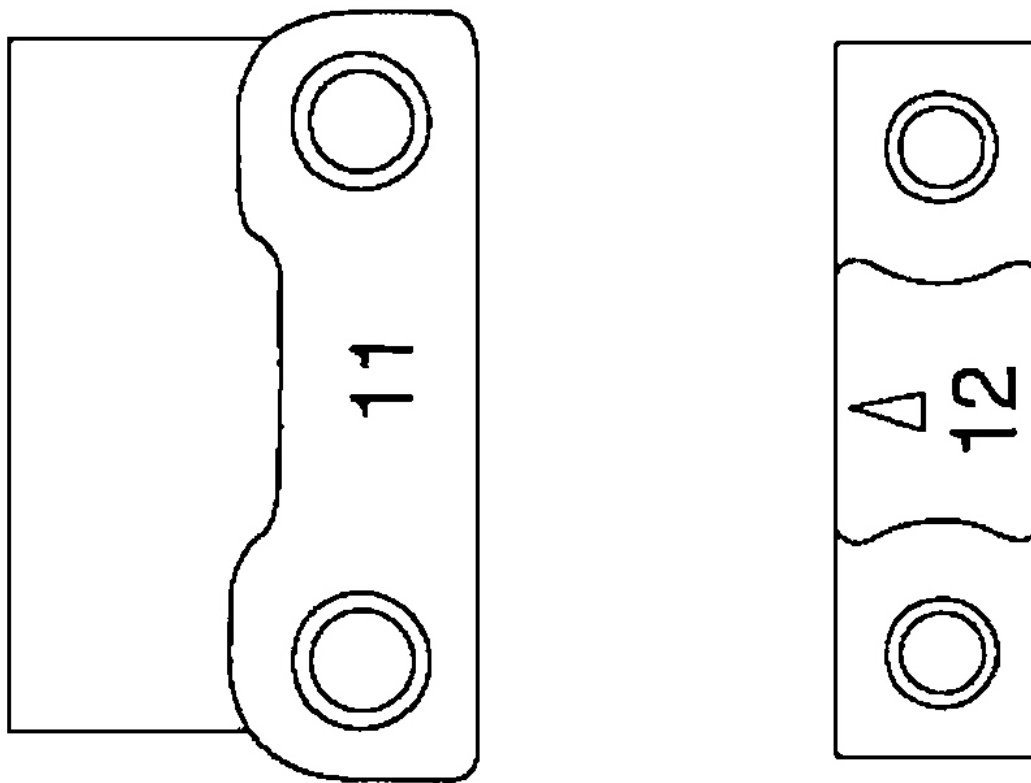
5. Confirm the identification mark and the number.

Bearing caps of No.2, No.3 and No.4 have the front mark and arrange the front mark upon the cylinder head while installing the bearing caps.

Identification mark

Intake : I

Exhaust : E



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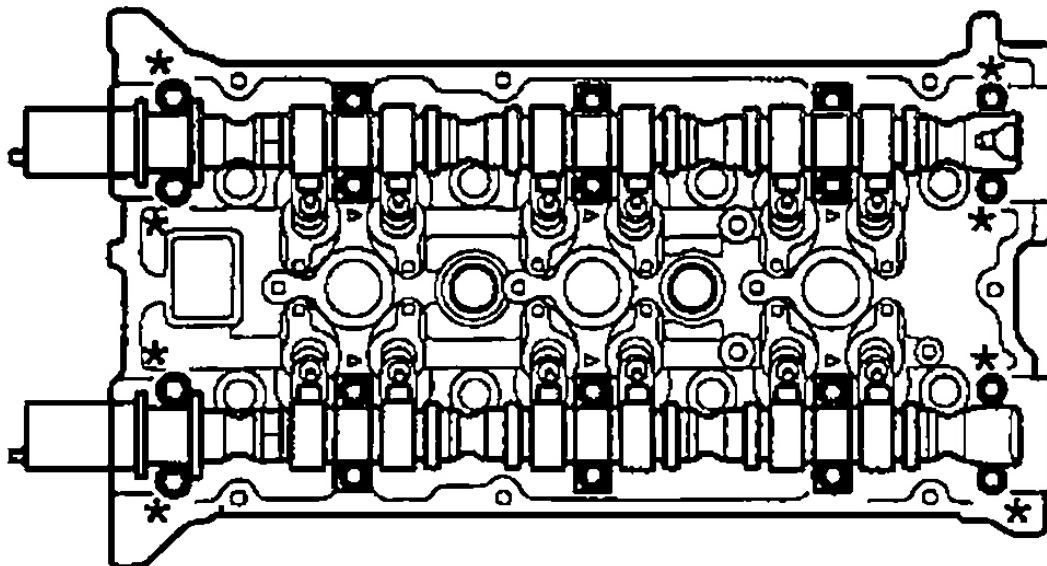
Fig. 85: Identifying Camshaft Bearing Caps
Courtesy of KIA MOTORS AMERICA, INC.

6. Tighten the bearing cap by 2 or 3 steps.

Tightening Torque

Outer (*) 16EA : 18.6-20.6 N.m (1.9.2.1 kg-m, 13.7-15.2 lb-ft)

Inner 24 EA : 9.8-11.8 N.m (1.0-1.2 kg-m, 7.2-8.7 lb-ft)



G00325602

Fig. 86: Identifying Camshaft Bearing Cap Positions

Courtesy of KIA MOTORS AMERICA, INC.

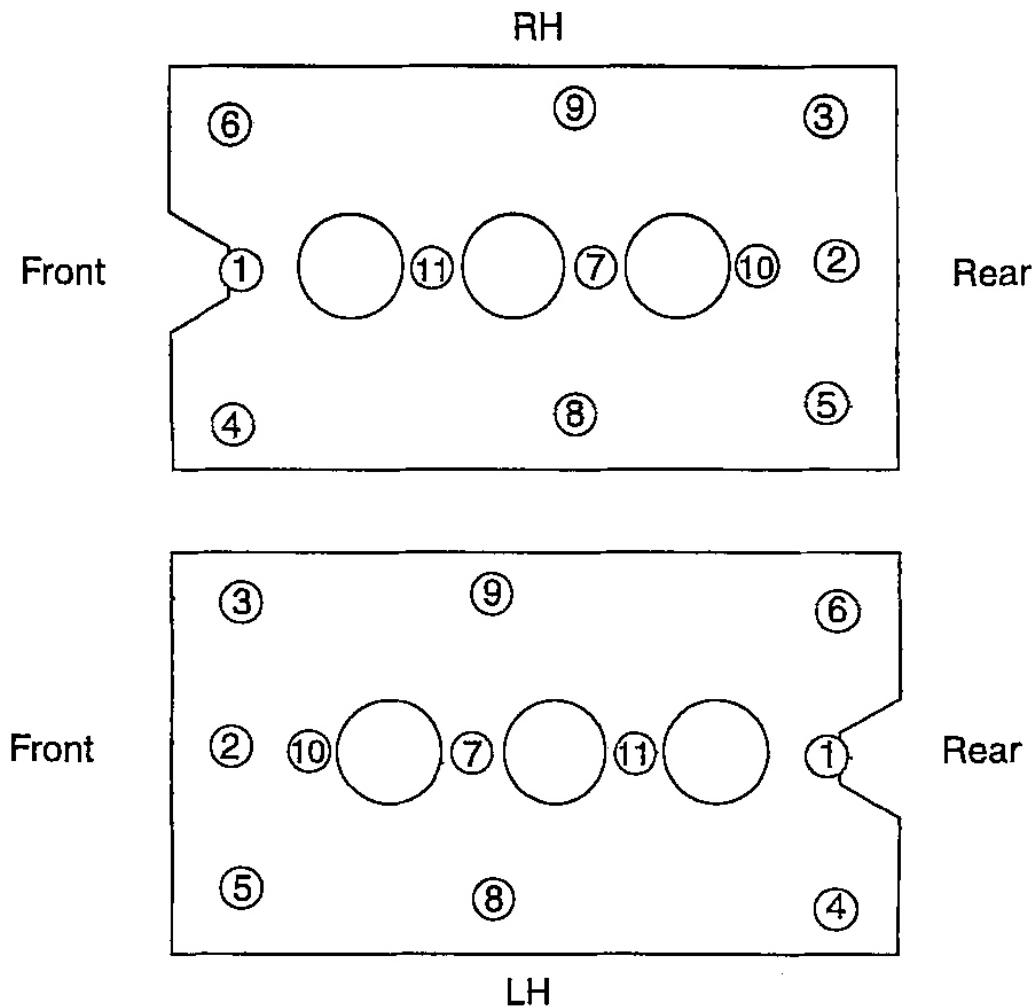
CYLINDER HEAD COVER

1. Install the cylinder head cover.
 1. Install the gasket to the cylinder head cover correctly.
 2. Clean sealing surface on camshaft cap.

NOTE: Clean sealing surface with use plastic scraper, to prevent oil leak.

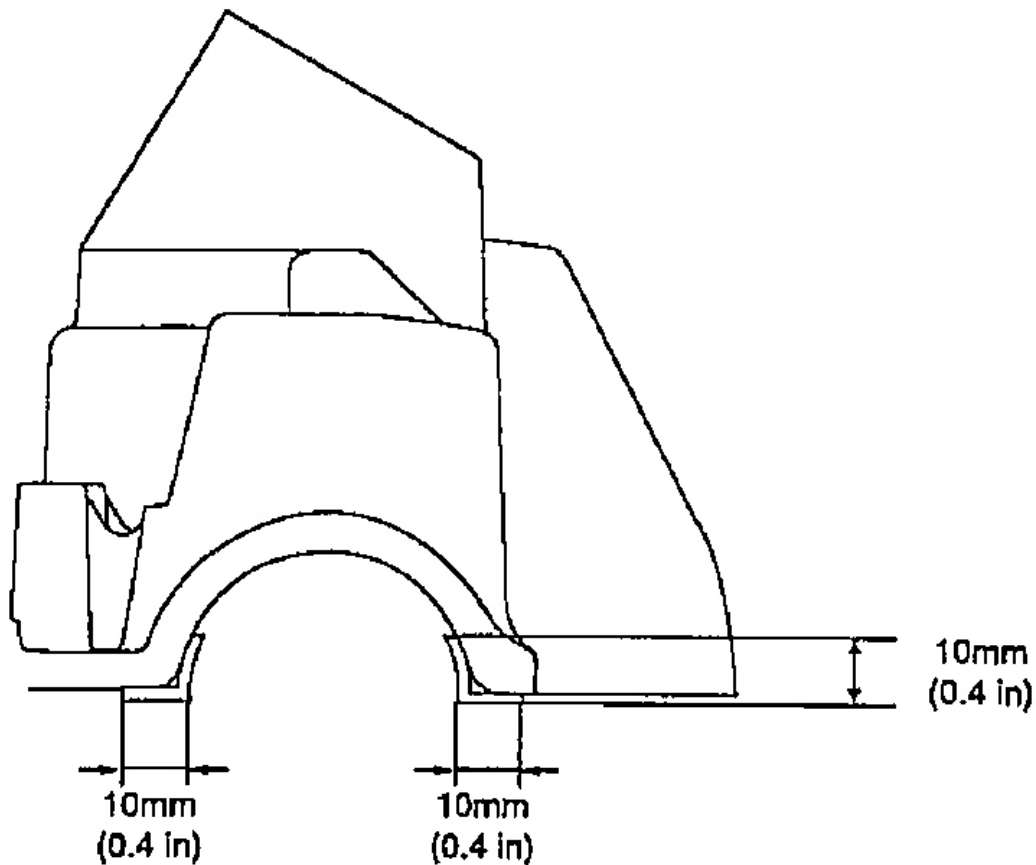
3. Apply sealant to the sealing surface on cylinder head cover and camshaft cap.

Sealant type : LT 5900



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Fig. 87: Cylinder Head Cover Tightening Sequence
 Courtesy of KIA MOTORS AMERICA, INC.



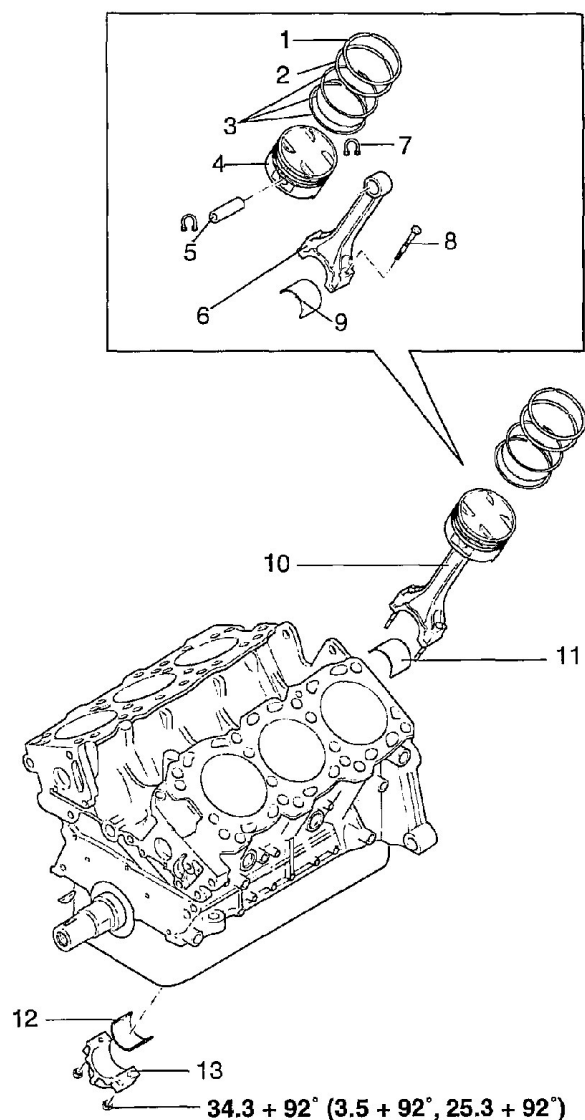
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Fig. 88: Applying Sealant

Courtesy of KIA MOTORS AMERICA, INC.

NOTE: Be careful of gasket escapement when installing the cylinder head cover. You must use the washer when installing the cylinder head cover bolts.

PISTON



TORQUE : N·m (kg·m, lb·ft)

1. No. 1 Piston ring
2. No. 2 Piston ring
3. Oil ring
4. Piston
5. Piston pin
6. Connecting rod
7. Retainer ring

8. Connecting rod bolt
9. Connecting rod bearing
10. Piston and connecting rod assembly
11. Connecting rod upper bearing
12. Connecting rod lower bearing
13. Connecting rod cap

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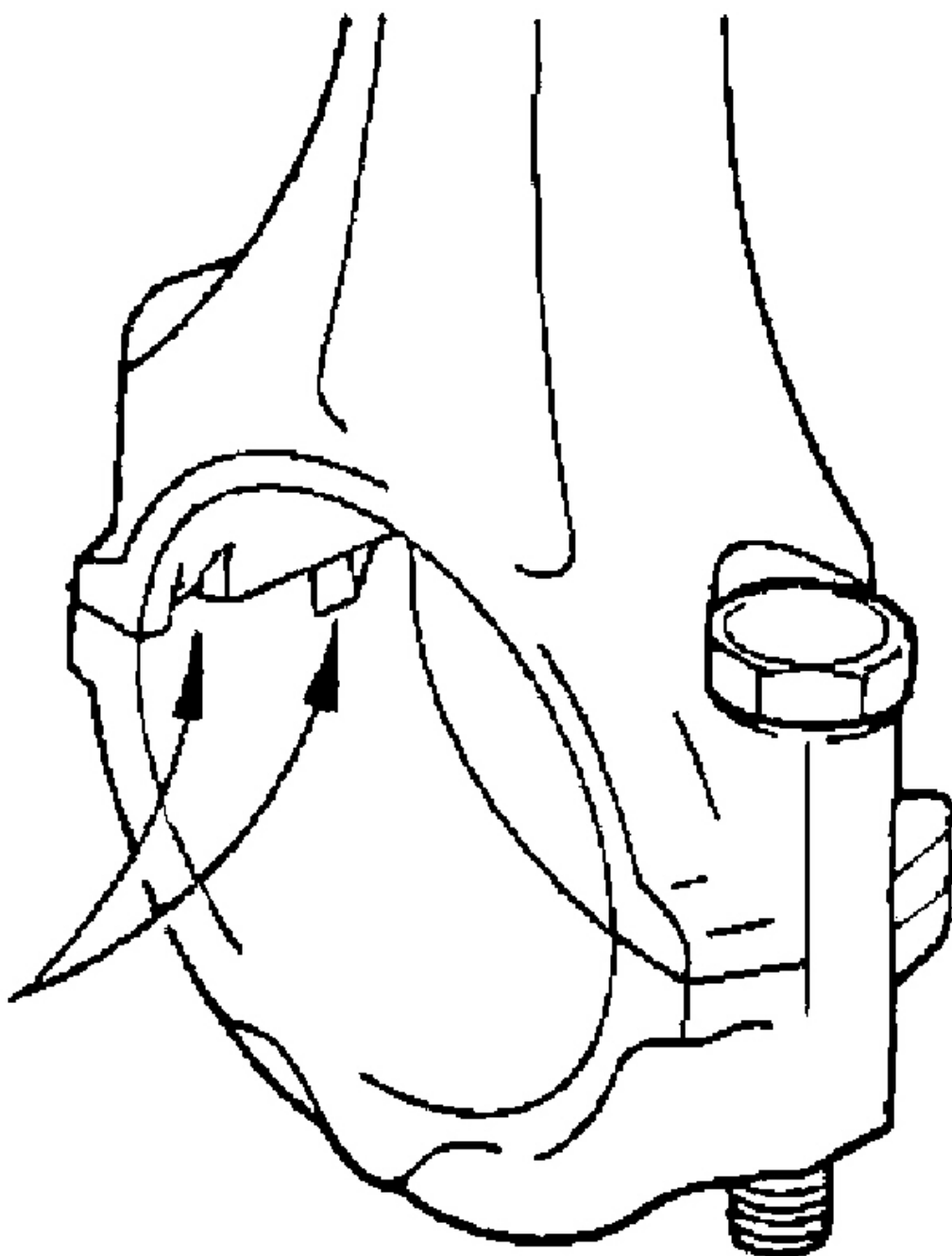
Fig. 89: Identifying Piston & Connecting Rod Components
Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

CONNECTING ROD CAP

CAUTION: Keep the bearings in order with their corresponding connecting rods (according to cylinder numbers) for proper reassembly.

1. Remove the connecting rod cap bolts, then remove the caps and the big end lower bearing mark for reassembly.
2. Push each piston connecting rod assembly toward the top of the cylinder.



G00325606

Fig. 90: Removing Connecting Rod Cap Bolts
Courtesy of KIA MOTORS AMERICA, INC.

INSPECTION**PISTONS AND PISTON PINS**

1. Check each piston for scuffing, scoring, wear and other defects. Replace any piston that is defective.
2. Check each piston ring for breakage, damage and abnormal wear. Replace the defective rings. When the piston requires replacement, its rings should also be replaced.
3. Check that the piston pin fits in the piston pin hole. Replace any piston and pin assembly that is defective. The piston pin must be pressed smoothly by hand into the pin hole (at room temperature).

PISTON RINGS

1. Measure the piston ring side clearance. If the measured value exceeds the service limit, insert a new ring in the ring groove to measure the side clearance. If the clearance still exceeds the service limit, replace the piston and rings together. If it is less than the service limit, replace only the piston rings.

Piston ring side clearance

No.1 : 0.04 - 0.08 mm (0.0016 - 0.0031 in.)

No.2 : 0.02 - 0.06 mm (0.0008 - 0.0024 in.)

2. 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.

PISTON RING END GAP

Standard dimensions

No.1 : 0.20 - 0.30 mm (0.0079 - 0.0118 in.)

No.2 : 0.45 - 0.60 mm (0.0177 - 0.0236 in.)

Oil ring side rail : 0.2 - 0.7 mm (0.0079 - 0.0276 in.)

When replacing the ring without correcting the cylinder bore, check the gap with the ring situated at the lower part of cylinder that is less worn out.

PISTON RING SERVICE SIZE AND MARK

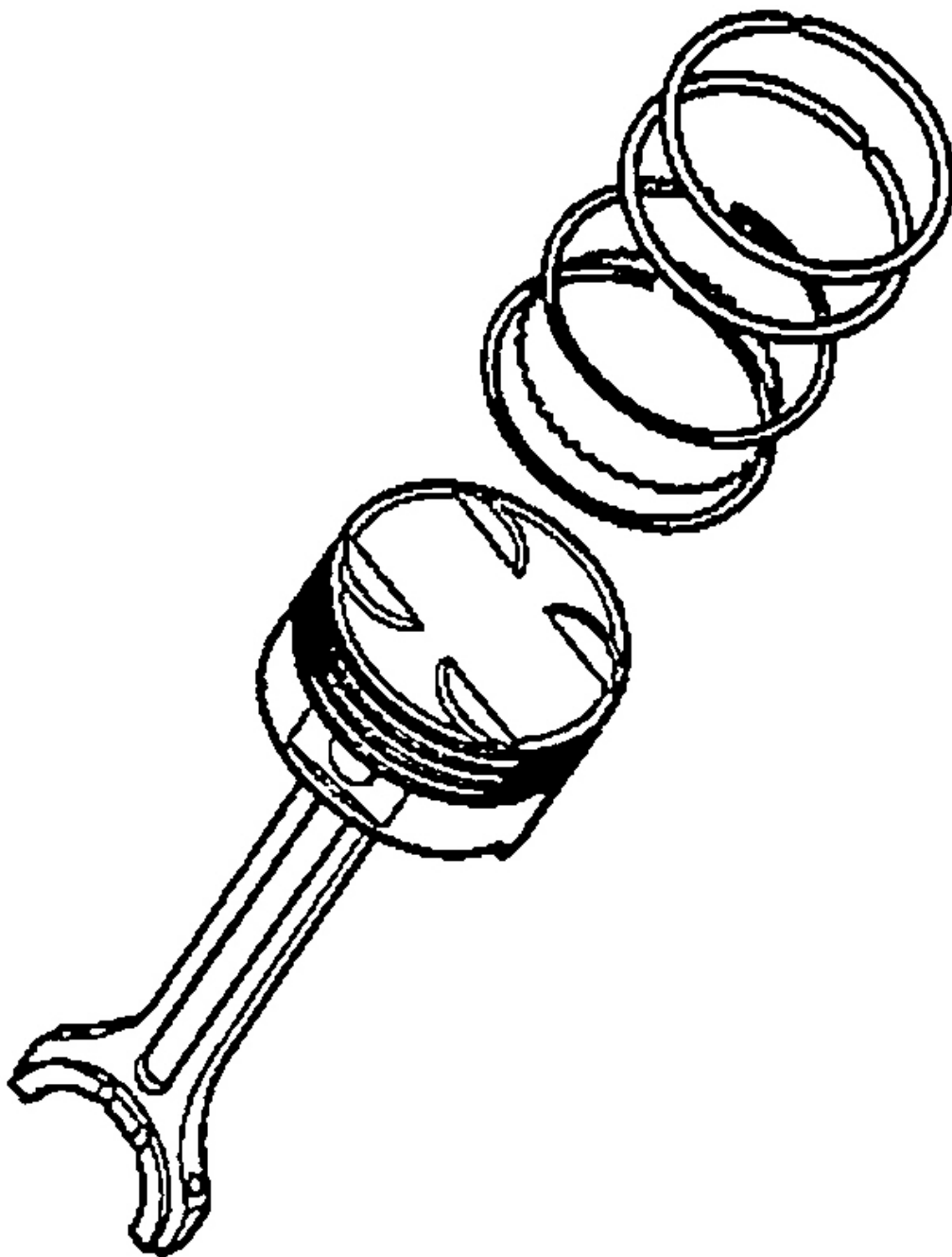
Standard	None
0.25 mm (0.010 in.) O.S	25
0.50 mm (0.020 in.) O.S	50

G00325607

Fig. 91: Identifying Piston Rings

Courtesy of KIA MOTORS AMERICA, INC.

NOTE: The mark can be found on the upper side of the ring next to the end.

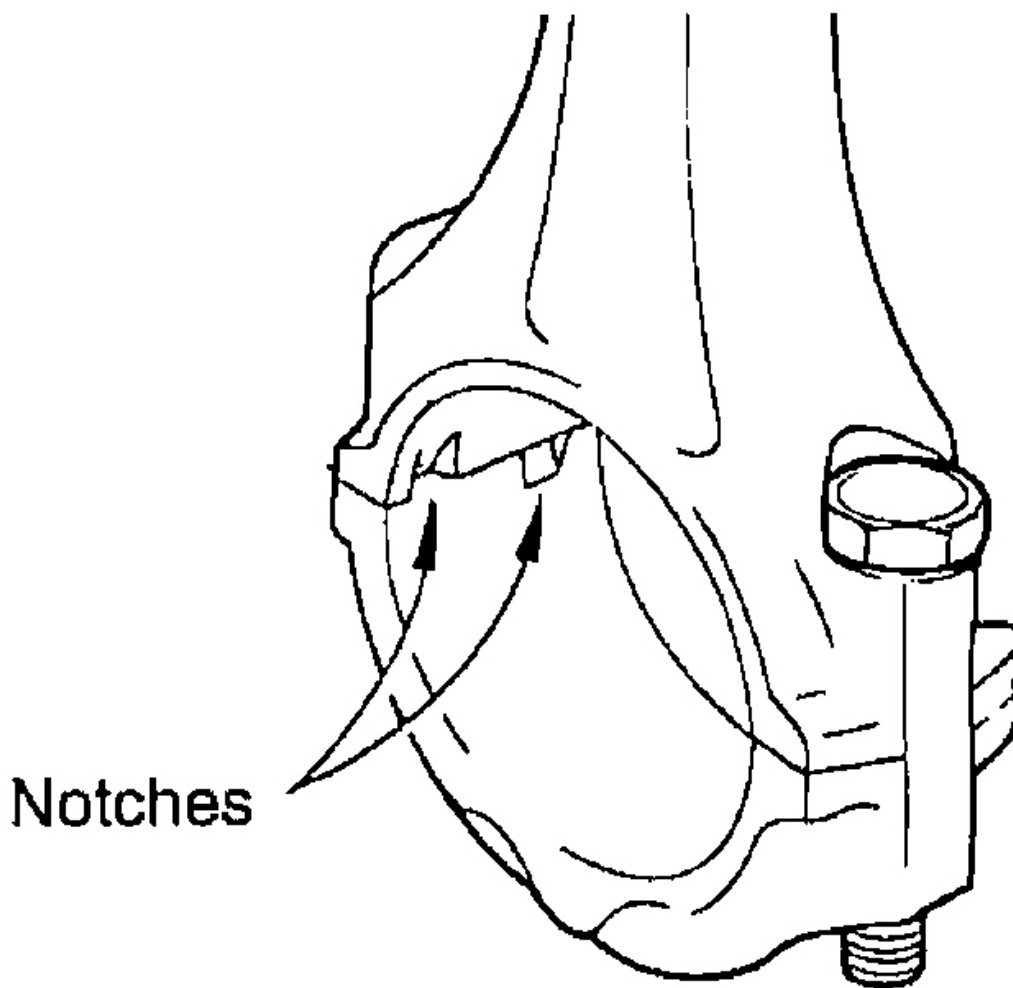


G00325608

Fig. 92: Positioning Piston Rings
Courtesy of KIA MOTORS AMERICA, INC.

CONNECTING RODS

1. When the connecting rod cap is installed, make sure that the cylinder numbers, marked on rod end cap at disassembly, match. When a new connecting rod is installed, make sure that the notches holding the bearing in place are on the same side.
2. Replace the connecting rod if it is damaged at either end of the thrust faces. If it has a stratified wear, or if the surface of the inside diameter of the small end is severely rough, replace the rod.



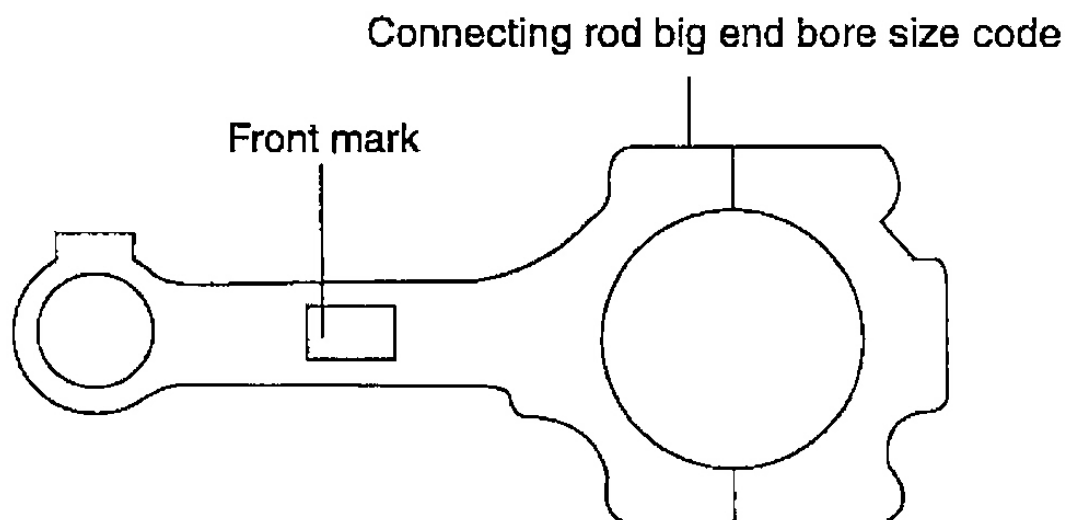
G00325609

Fig. 93: Positioning Connecting Rod Cap
Courtesy of KIA MOTORS AMERICA, INC.

REPLACEMENT**CONNECTING ROD BEARING**

1. Check the connecting rod big-end bore size code.

NOTE: Record the connecting rod big-end bore size code letters on connecting rod cap as shown.



G00325617

Fig. 94: Identifying Connecting Rod Big-End Size Code
 Courtesy of KIA MOTORS AMERICA, INC.

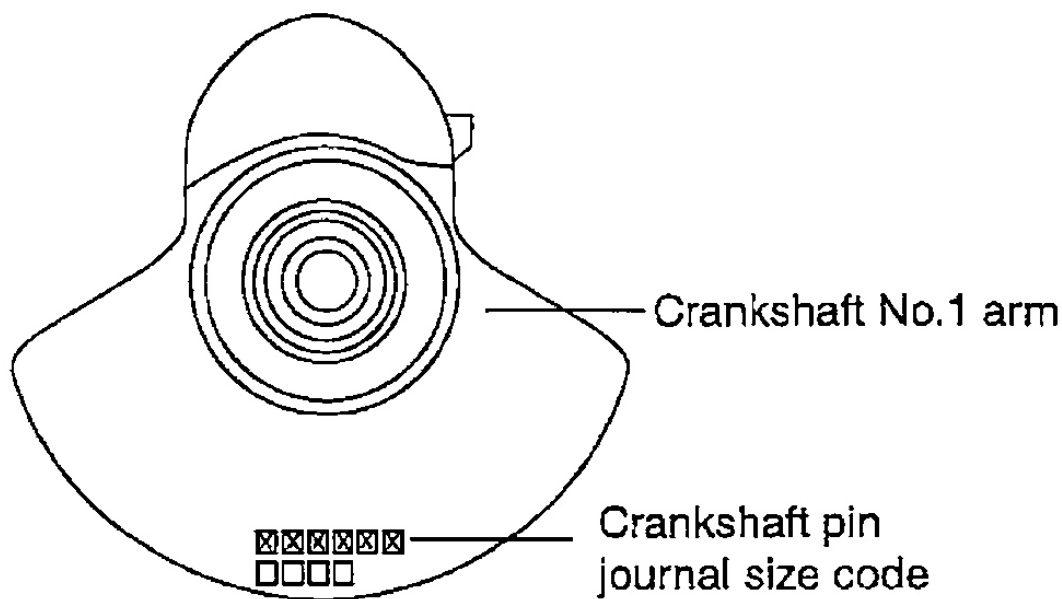
Code	Connecting rod big-end diameter mm (in)
0	58.000 - 58.006 (2.2835 ~ 2.2837)
1	58.006 - 58.012 (2.2837 ~ 2.2839)
2	58.012 - 58.018 (2.2839 ~ 2.2842)

G00325618

Fig. 95: Connecting Rod Big-End Diameter
Courtesy of KIA MOTORS AMERICA, INC.

2. Check the crankshaft pin journal size code.

NOTE: Record the pin journal size code letters on the crankshaft balance weight. Reading order is from left to right as shown, with No. 1 pin journal size code shown first.



G00325619

Fig. 96: Identifying Crankshaft Pin Journal Size Code
Courtesy of KIA MOTORS AMERICA, INC.

Code	Crankshaft pin journal diameter mm (in)
I	54.994 - 55.000 (2.1651 ~ 2.1654)
II	54.988 - 54.994 (2.1649 ~ 2.1651)
III	54.982 - 54.988 (2.1646 ~ 2.1649)

G00325620

Fig. 97: Crankshaft Pin Journal Diameter
Courtesy of KIA MOTORS AMERICA, INC.

3. Choose proper connecting rod bearing in below table.

		Connecting rod big-end bore size code		
		0	1	2
Crankshaft pin journal size code	I	Pink	Red	None
	II	Red	None	Black
	III	None	Black	Brown

G00325621

Fig. 98: Connecting Rod Bearing Selection Table
Courtesy of KIA MOTORS AMERICA, INC.

Connecting rod bearing oil clearance :

0.026-0.044 mm (0.0010-0.0017 in)

Color	Connecting rod bearing thickness mm(in)
Pink	1.484 - 1.487 (0.0584- 0.0585)
Red	1.487 - 1.490 (0.0585 - 0.0587)
None	1.490 - 1.493 (0.0587 - 0.0588)
Black	1.493 - 1.496 (0.0588 - 0.0589)
Brown	1.496 - 1.499 (0.0589 - 0.0590)

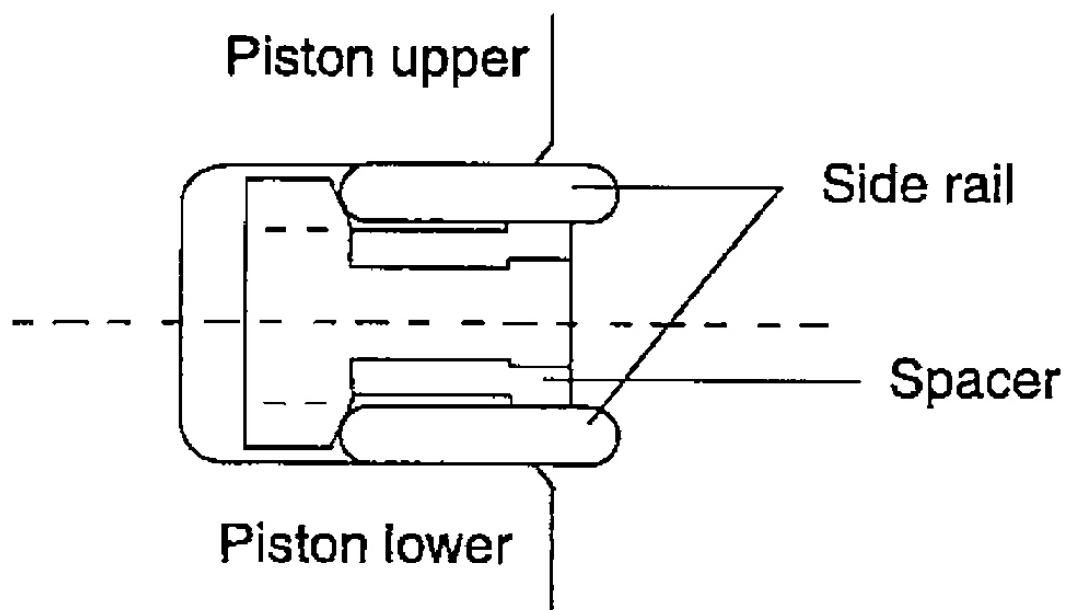
G00325622

Fig. 99: Connecting Rod Bearing Thickness (Reference Data)

Courtesy of KIA MOTORS AMERICA, INC.

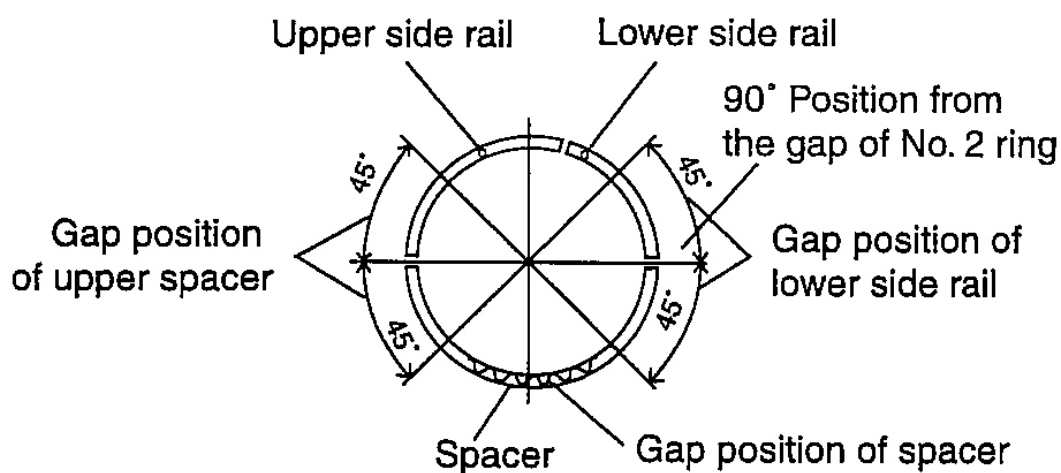
REASSEMBLY

1. Install the spacer.



G00325610

Fig. 100: Positioning Piston Bottom Ring Spacer
 Courtesy of KIA MOTORS AMERICA, INC.



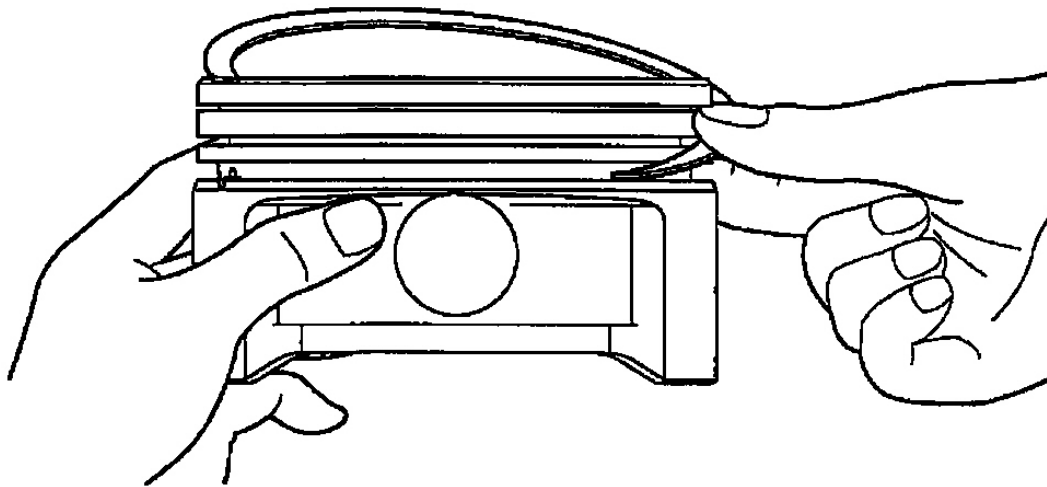
G00325611

Fig. 101: Positioning Piston Bottom Ring On Piston
 Courtesy of KIA MOTORS AMERICA, INC.

2. Install the upper side rail. To install the side rail, first put one end of the side rail between the piston ring groove and spacer, hold it firmly, and press down with finger on the portion to be inserted into the groove (as illustrated).

CAUTION: Do not use a piston ring expander when installing the side rail.

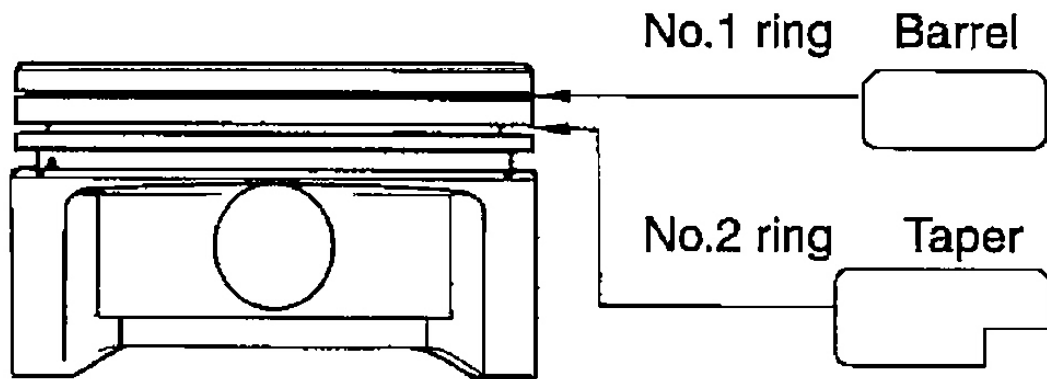
3. Install the lower side rail by the same procedure described above.



G00325612

Fig. 102: Installing Bottom Piston Ring Side Rail
Courtesy of KIA MOTORS AMERICA, INC.

4. Apply engine oil around the piston and piston grooves.
5. Using a piston ring expander, install the No.2 piston ring.
6. Install the No. 1 piston ring.

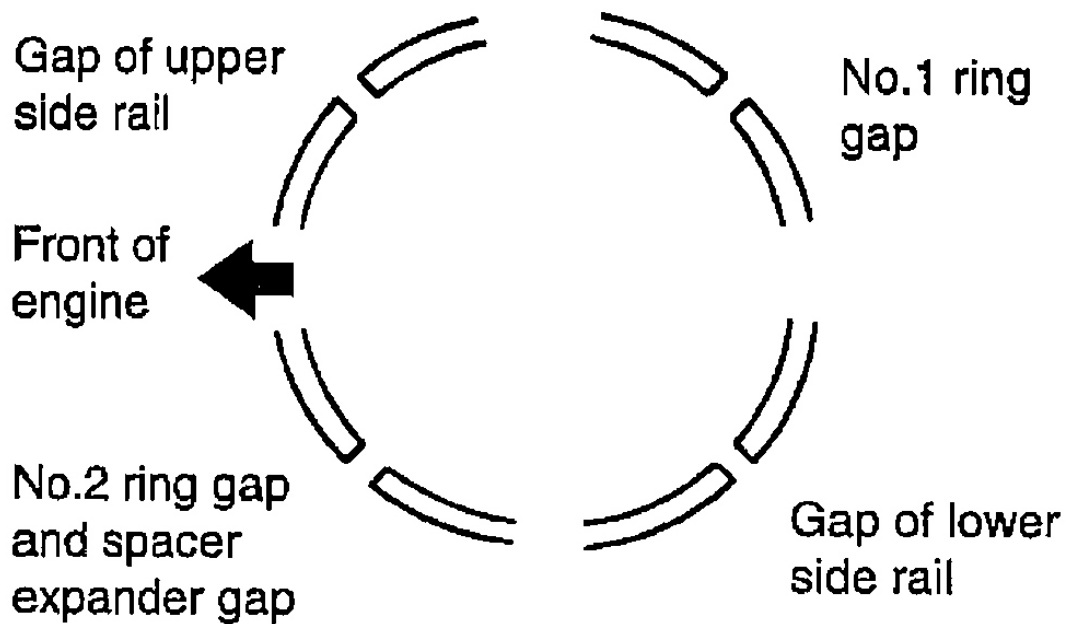


G00325613

Fig. 103: Identifying Piston Rings

Courtesy of KIA MOTORS AMERICA, INC.

7. Position each piston ring end gap as far away from its neighboring gaps as possible. Make sure that the gaps are not positioned in the thrust and pin directions.
8. Hold the piston rings firmly with a piston ring compressor as they are inserted into cylinder.



G00325614

Fig. 104: Positioning Piston Rings On Piston

Courtesy of KIA MOTORS AMERICA, INC.

9. Install the upper connecting rod bearings in the connecting rod.
10. Install the lower connecting rod bearings in the connecting rod caps.
11. Make sure that the front mark of the piston and the front mark (identification mark) of the connecting rod are directed toward the front of the engine.
12. When the connecting rod cap is installed, make sure that any cylinder numbers placed on the rod and cap at disassembly match.
13. When a new connecting rod is installed, make sure that the notches for holding the bearing in place are on the same side.
14. When assembling, bolts should be fastened using the plastic angle technique as follows.
 1. Apply oil to the threads and matching areas.
 2. Tighten the connecting rod bolt.

Tightening torque

Connecting rod bolt :

34.3 N.m (3.5 kg.m, 25.3 lb.ft)+92°

**CAUTION: After removing the connecting rod bolt, do not use it again.
When using a new bolt, do not tighten the bolt more than 3 times.**

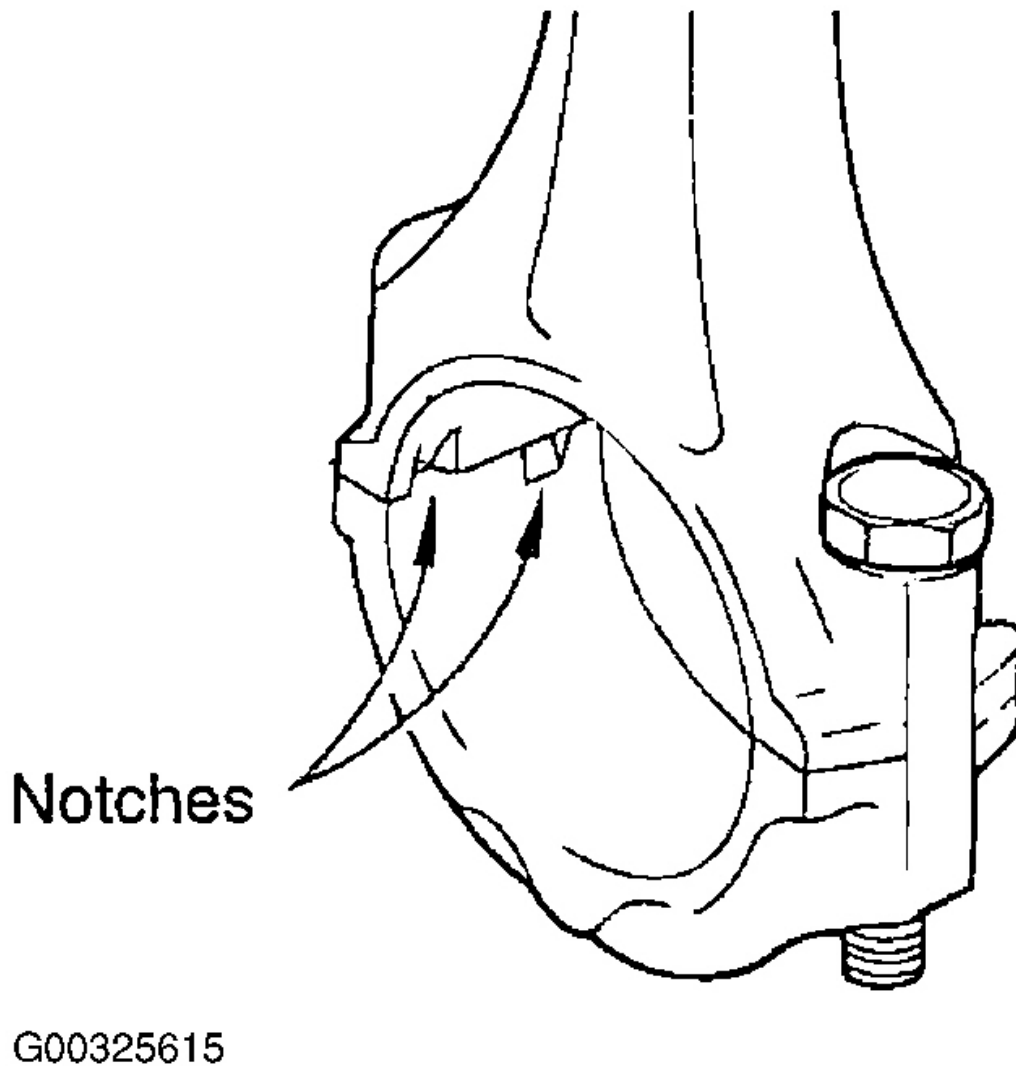


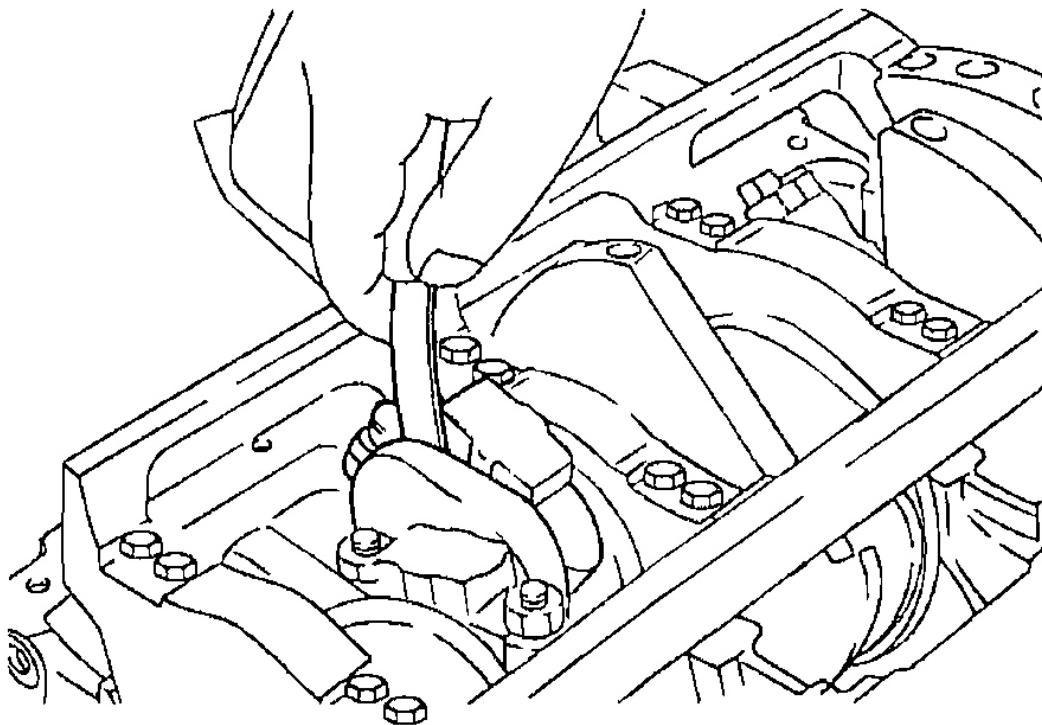
Fig. 105: Positioning Connecting Rod Cap
Courtesy of KIA MOTORS AMERICA, INC.

15. Check the connecting rod side clearance.

Connecting rod side clearance

Standard : 0.10-0.25 mm (0.0039-0.0098 in.)

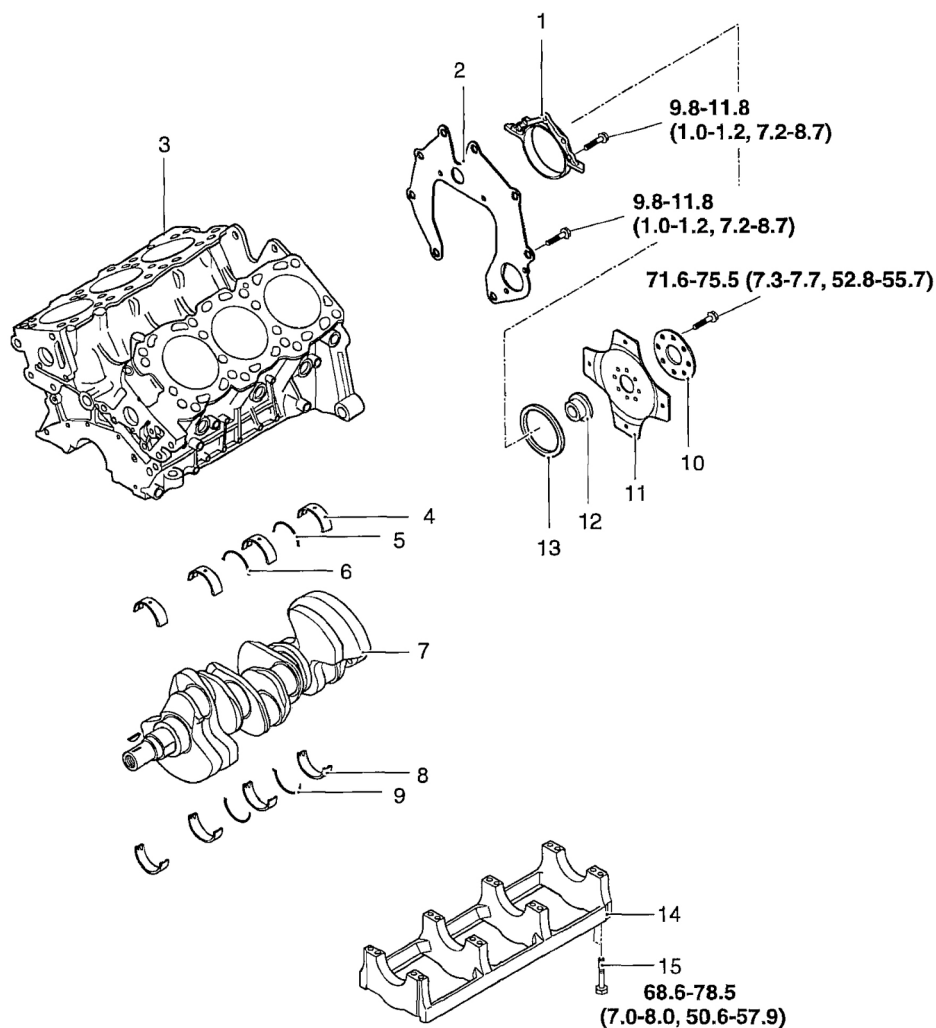
Limit : 0.4 mm (0.0157 in.)



G00325616

Fig. 106: Measuring Connecting Rod Side Clearance
Courtesy of KIA MOTORS AMERICA, INC.

CRANK SHAFT



TORQUE : N·m (kg·m, lb·ft)

- | | |
|-------------------|---------------------------|
| 1. Oil seal case | 9. Thrust bearing |
| 2. Rear plate | 10. Adapter plate |
| 3. Cylinder block | 11. Drive plate |
| 4. Upper bearing | 12. Crankshaft bush |
| 5. Thrust bearing | 13. Rear oil seal |
| 6. Thrust bearing | 14. Main bearing cap |
| 7. Crankshaft | 15. Main bearing cap bolt |
| 8. Lower bearing | |

G00325623

Fig. 107: Identifying Crankshaft Components
Courtesy of KIA MOTORS AMERICA, INC.

DISASSEMBLY

1. Remove the timing belt train, front case, cylinder head assembly and oil pan. See **MAIN MOVING SYSTEM**.
2. Remove the rear plate and the rear oil seal.

3. Remove the connecting rod caps.

NOTE: **Mark the main bearing caps to be able to reassemble in the original position and direction.**

4. Remove the main bearing caps and remove the crankshaft. Keep the bearings in order according to the cap number.

INSPECTION

CRANKSHAFT

Check the crankshaft journals and pins for damage, uneven wear and cracks. Also check the oil holes for restrictions. Repair or replace any defective parts.

1. Inspect the crankshaft journal and pin for out-of-round and taper.

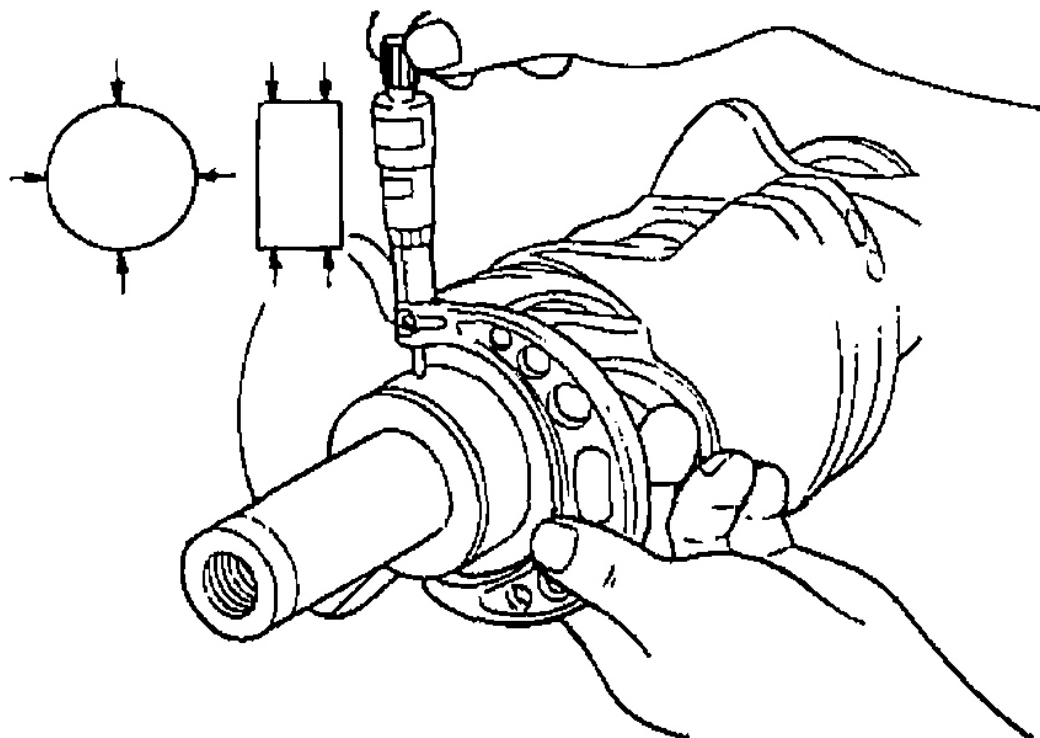
Standard value

Crankshaft journal O.D :

63.982 - 64.000 mm (2.519 - 2.5197 in.)

Crankshaft pin O.D :

54.982 - 55.000 mm (2.165 - 2.1653 in.)



G00325624

Fig. 108: Measuring Crankshaft Journal
Courtesy of KIA MOTORS AMERICA, INC.

MAIN BEARINGS AND CONNECTING ROD BEARINGS

Visually inspect each bearing for peeling, melting, seizure and improper contact. Replace any defective bearings.

MEASURING OIL CLEARANCE

MEASURING METHOD

Check for oil clearance by measuring the outside diameter of the crankshaft journal and the inside diameter of the bearing. The clearance can be obtained by calculating the difference between the measured outside diameters.

Standard value

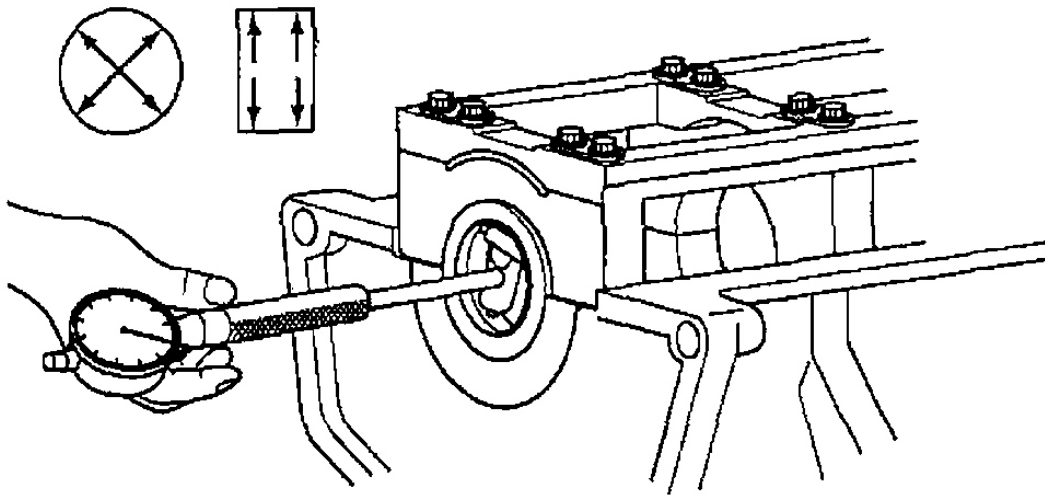
Oil clearance

Crankshaft main bearing :

0.018 - 0.036 mm (0.0007 - 0.0014 in.)

Connecting rod bearing :

0.022 - 0.048 mm (0.0009 - 0.0020 in.)



G00325625

Fig. 109: Measuring Oil Clearance

Courtesy of KIA MOTORS AMERICA, INC.

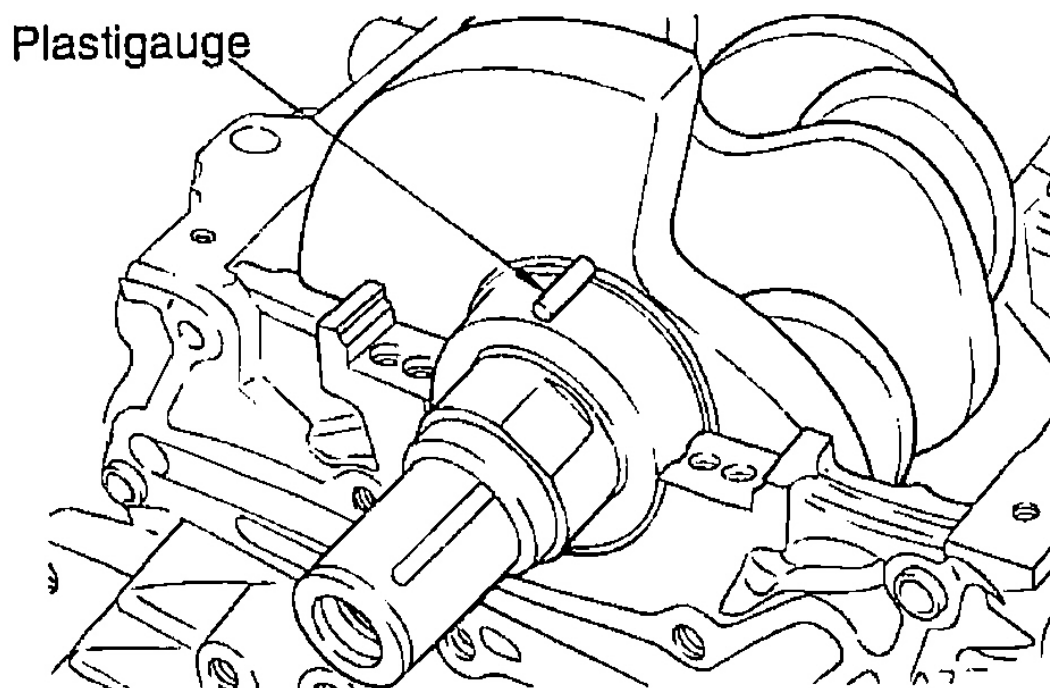
PLASTIGAGE METHOD

Plastigage may be used to measure the clearance.

1. Remove oil, grease and any other dirt from the bearings and journals.
2. Cut the plastigage the same length and the width of the bearing and place it in parallel with the journal, avoiding the oil holes.
3. Install the crankshaft, bearings and caps and tighten them to the specified torques. During this operation, do not turn the crankshaft. Remove the caps. Measure the width of the plastigage at the widest part by using the scale printed on the gauge package.

If the clearance exceeds the service limit, the bearing should be replaced or an undersize bearing should be used. When installing a new crankshaft, be sure to use standard size bearings.

If the standard clearance can not be obtained even after replacing the bearing, the journal and pin should be ground to the undersize and a bearing of the corresponding size should be installed.



G00325626

Fig. 110: Measuring Bearing Clearance
Courtesy of KIA MOTORS AMERICA, INC.

OIL SEAL

Check the front and rear oil seals for damage or worn surfaces. Replace any seat that is defective.

DRIVE PLATE (A/T)

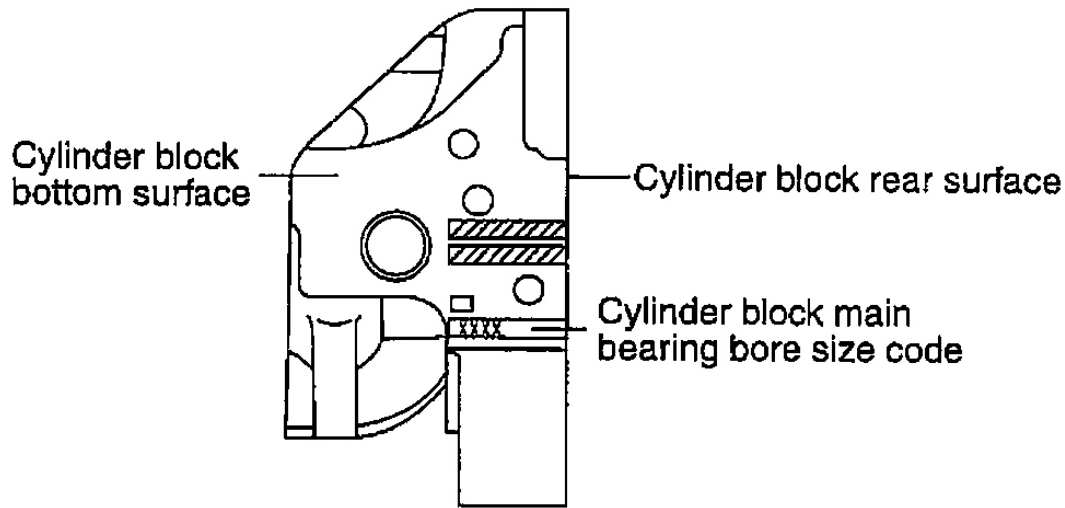
Replace distorted, damaged, or cracked drive plates.

REPLACEMENT

CRANKSHAFT MAIN BEARING (3.5)

1. Check the cylinder block main bearing bore size code.

NOTE: Record the cylinder block main bearing bore size code letters on cylinder block as shown.
Reading order is from left to right with front main bearing bore size code shown first.



G00325632

Fig. 111: Identifying Cylinder Block Main Bearing Bore Size
 Courtesy of KIA MOTORS AMERICA, INC.

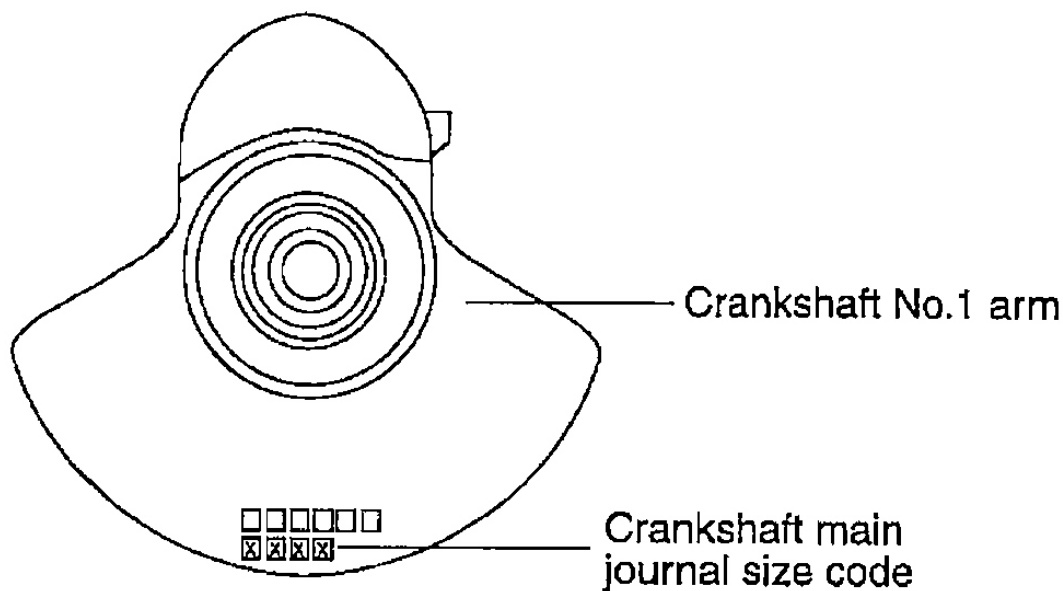
Code	Cylinder block main bearing bore diameter mm (in)
A	68.000 ~ 68.006 (2.6772 ~ 2.6774)
B	68.006 ~ 68.012 (2.6774 ~ 2.6776)
C	68.012 ~ 68.018 (2.6776 ~ 2.6779)

G00325633

Fig. 112: Cylinder Block Main Bearing Bore Diameter
 Courtesy of KIA MOTORS AMERICA, INC.

2. Check the crankshaft main journal size code.

NOTE: Record the main journal size code letters on the crankshaft balance weight.
 Reading order is from left to right as shown with No. 1 main journal size code shown first.



G00325634

Fig. 113: Identifying Crankshaft Main Journal Size
 Courtesy of KIA MOTORS AMERICA, INC.

Code	Crankshaft main journal diameter mm (In)
1	63.994 ~ 64.000 (2.5194 ~ 2.5197)
2	63.988 ~ 63.994 (2.5192 ~ 2.5194)
3	63.982 ~ 63.988 (2.5190 ~ 2.5192)

G00325635

Fig. 114: Crankshaft Main Journal Diameter
 Courtesy of KIA MOTORS AMERICA, INC.

- Choose proper main journal bearing in below table.

		Cylinder block main bearing bore size code		
		A	B	C
Crankshaft main journal size code	1	Pink	Red	None
	2	Red	None	Black
	3	None	Black	Brown

G00325636

Fig. 115: Main Journal Bearing Selection Election Table
 Courtesy of KIA MOTORS AMERICA, INC.

Main journal bearing oil clearance :

0.022-0.040 mm (0.0009 - 0.0016 in)

Color	Main journal bearing thickness mm (in)
Pink	1.986 ~1.989 (0.0782 ~ 0.0783)
Red	1.989 ~ 1.992 (0.0783 ~ 0.0784)
None	1.992 ~ 1.995 (0.0784 ~ 0.0785)
Black	1.995 ~ 1.998 (0.0785 ~ 0.0787)
Brown	1.998~ 2.001 (0.0787 ~ 0.0788)

G00325637

Fig. 116: Main Journal Bearing Thickness (Reference Data)
 Courtesy of KIA MOTORS AMERICA, INC.

REASSEMBLY

1. Install a grooved main bearing (upper bearing) on the cylinder block side.

2. Install a grooveless main bearing (lower bearing) on the main bearing cap side.
3. Install the crankshaft. Apply engine oil to journal and pin.
4. Install the bearing caps with the arrow mark directed toward the front of the engine. Cap number must be correct.
5. Tighten the main bearing cap bolts to the specified torque.

Tightening torque

Main bearing cap bolts :

68.6-78.5 Nm (7.0-8.0 kg.m, 50.6-57.9 lb.ft)

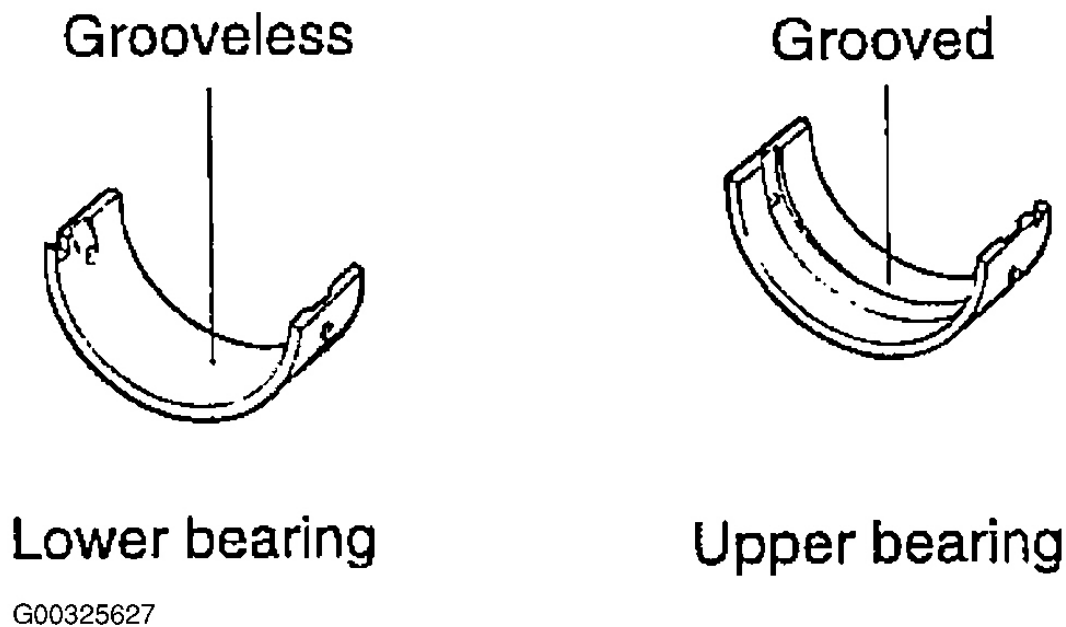


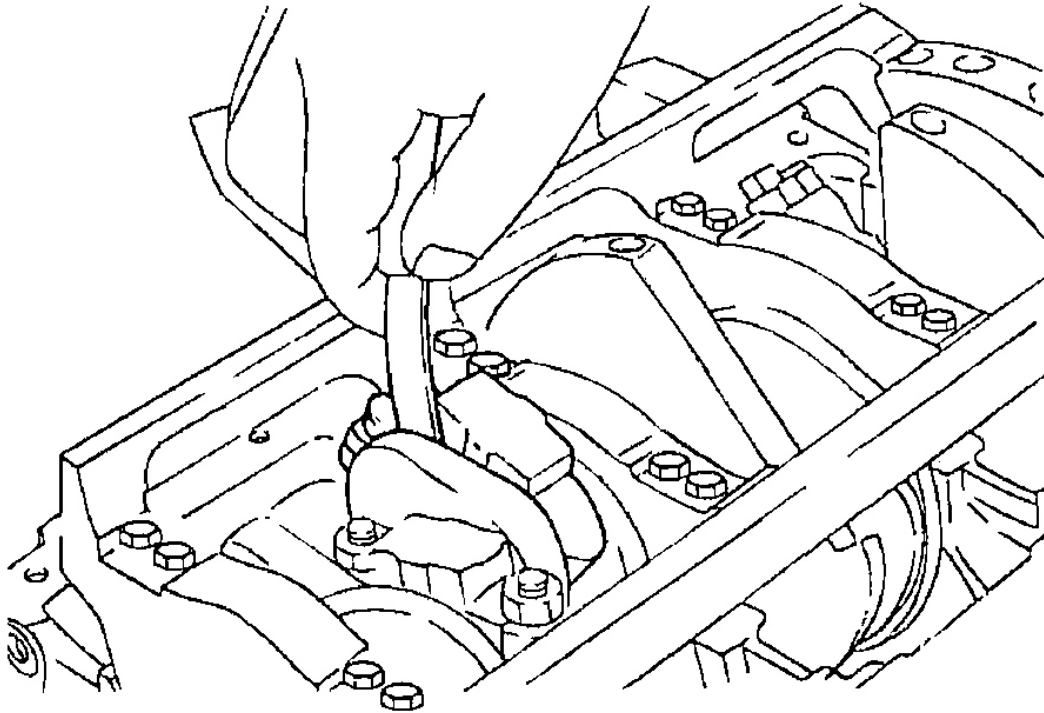
Fig. 117: Positioning Main Cap Bearings
Courtesy of KIA MOTORS AMERICA, INC.

6. Cap bolts should be tightened evenly in stages 4 to 5 increments before they are tightened to the specified torque.
7. Make certain that crankshaft turns freely and check the end play of the crankshaft.

Crankshaft end play

Standard : 0.070-0.250mm (0.0028-0.0098 in.)

Limit : 0.35 mm (0.014 in.)



G00325628

Fig. 118: Measuring Crankshaft End Play
Courtesy of KIA MOTORS AMERICA, INC.

8. Using special tool (09231-33000), install the rear oil seal in oil seal case.
9. Apply sealant to the area shown in the illustration. Install the oil seal case in the cylinder block.

Tightening torque

Oil seal case bolt :

9.8-11.8 Nm (1.0-1.2 kg.cm, 7.2-8.7 lb.ft)

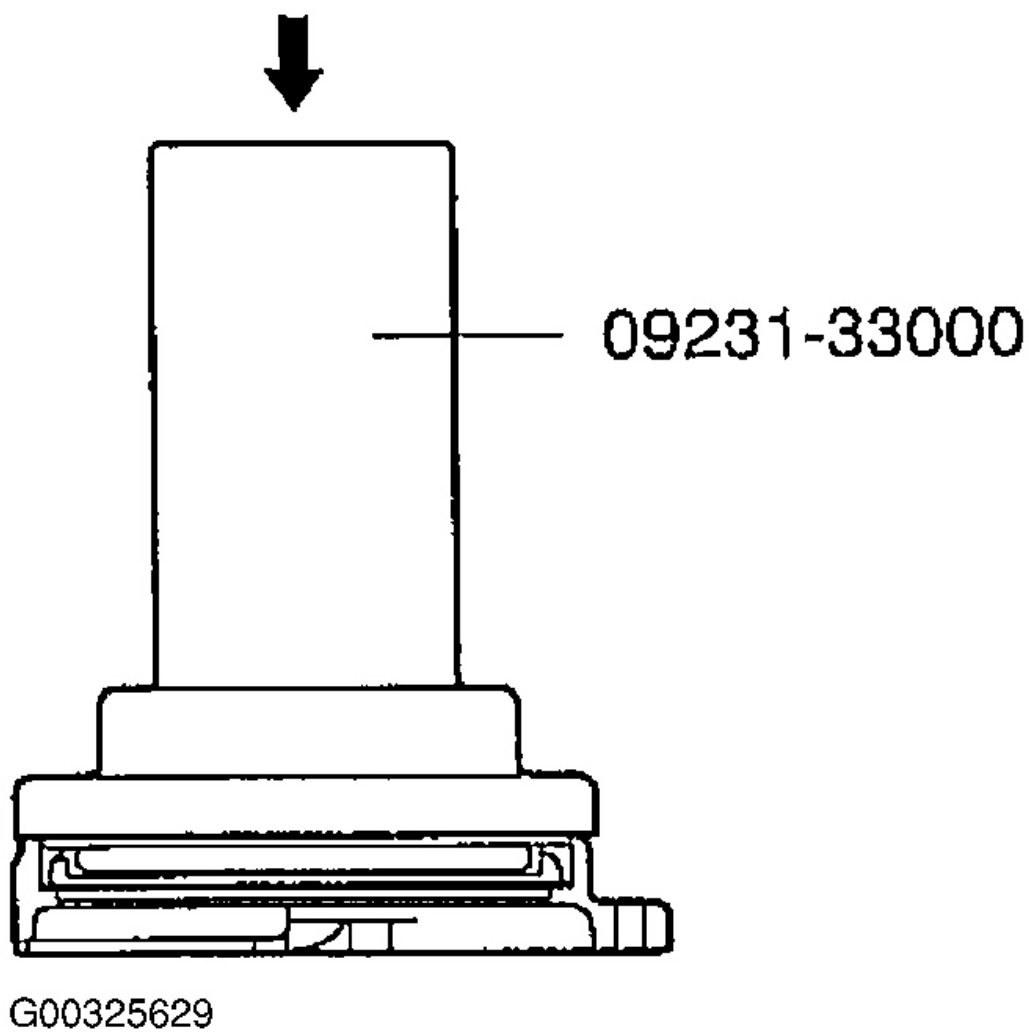
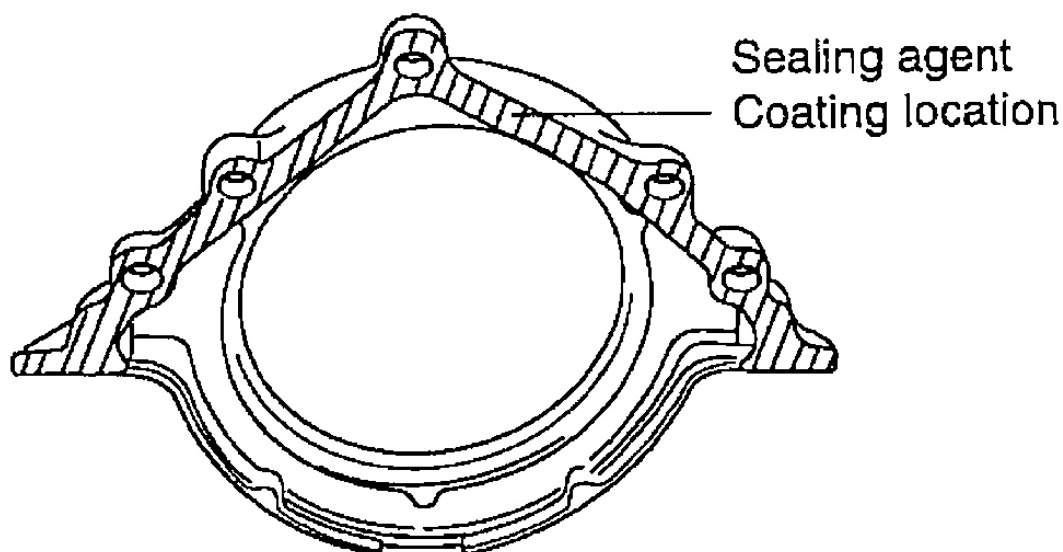


Fig. 119: Installing Oil Seal
Courtesy of KIA MOTORS AMERICA, INC.



G00325630

Fig. 120: Sealing Oil Seal Case**Courtesy of KIA MOTORS AMERICA, INC.**

10. Tighten the rear plate to the specified torque.

Tightening torque

Rear plate : 9.8-11.8 Nm (1.0-1.2 kg.m, 7.2-8.7 lb.ft)

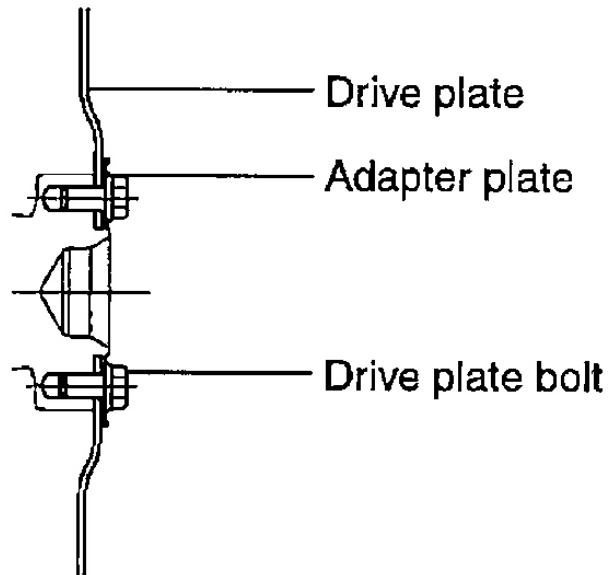
11. Tighten the drive plate and the adapter plate (A/T).

Tightening torque

Drive plate and adapter plate bolt :

71.6-75.5 Nm (7.3-7.7 kg.m, 52.8-55.7 lb.ft)

(A/T)



G00325631

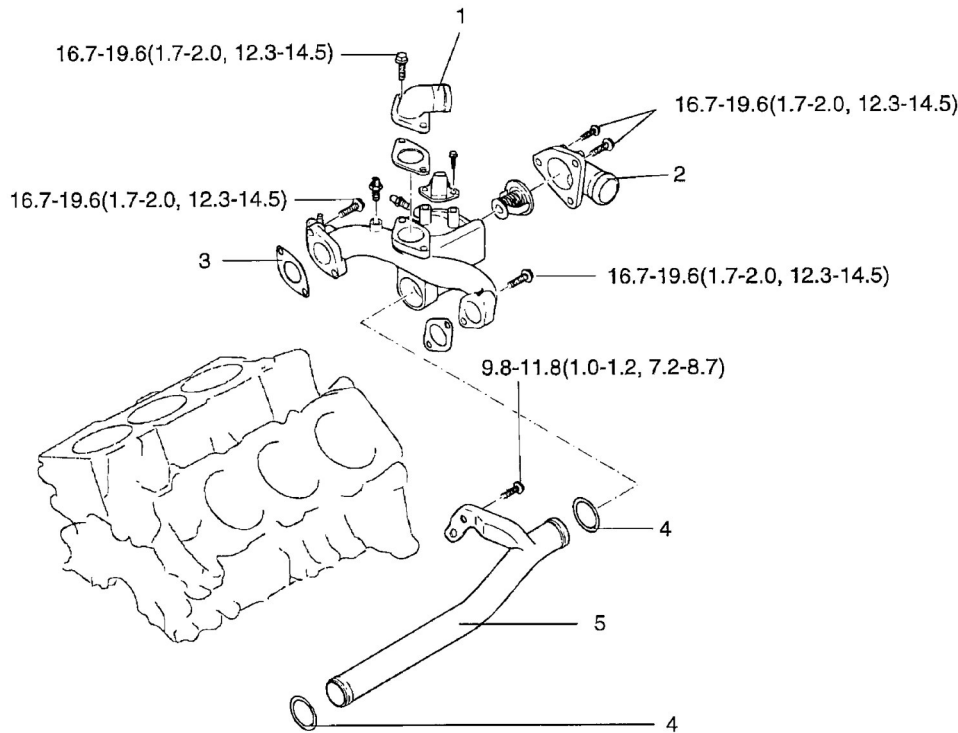
Fig. 121: Tightening Drive Plate

Courtesy of KIA MOTORS AMERICA, INC.

COOLING SYSTEM

ENGINE COOLANT HOSE/PIPES

REMOVAL



TORQUE : Nm (kg.m, lb.ft)

- 1. Water outlet fitting
- 2. Water inlet fitting
- 3. Gasket

- 4. O - ring
- 5. Water inlet pipe

G00325638

Fig. 122: Identifying Engine Cooling System Components
 Courtesy of KIA MOTORS AMERICA, INC.

INSPECTION

Check the engine coolant pipe and hose for cracks, damage and restrictions. Replace if necessary.

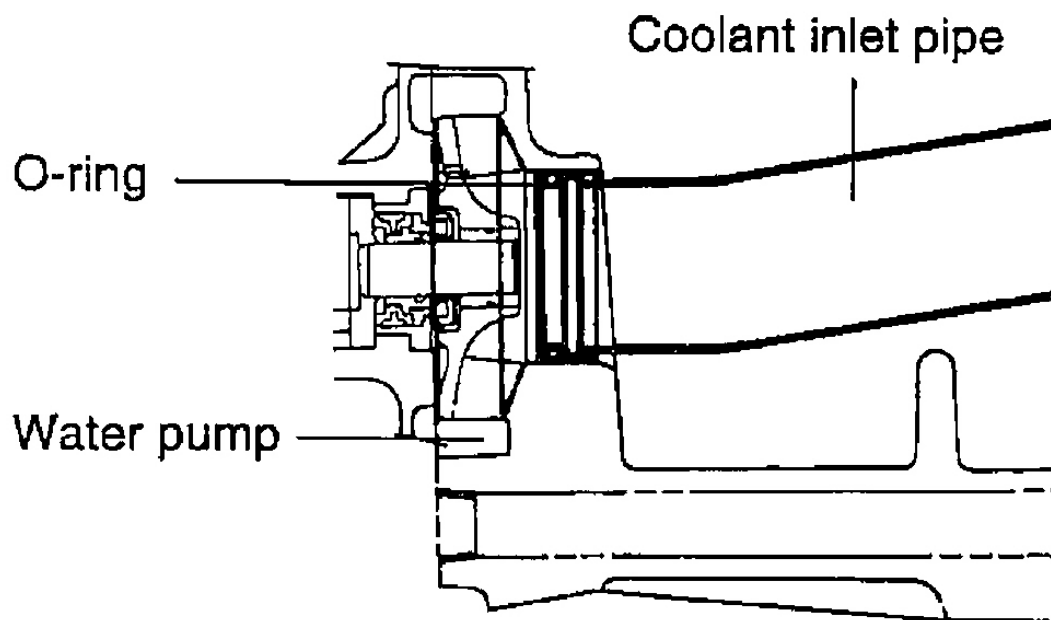
REASSEMBLY

Fit the O-ring in the groove of the engine coolant inlet pipe end. Wet the periphery of the O-ring with water and insert the engine coolant inlet pipe.

NOTE:

- Do not apply oil or grease to the engine coolant pipe O-ring.
- Keep the engine coolant pipe connections free of sand, dust, etc.
- Insert the engine coolant pipe into the end of the engine coolant pump inlet.

- Whenever installing the engine coolant inlet pipe, always replace the O-ring with a new one.



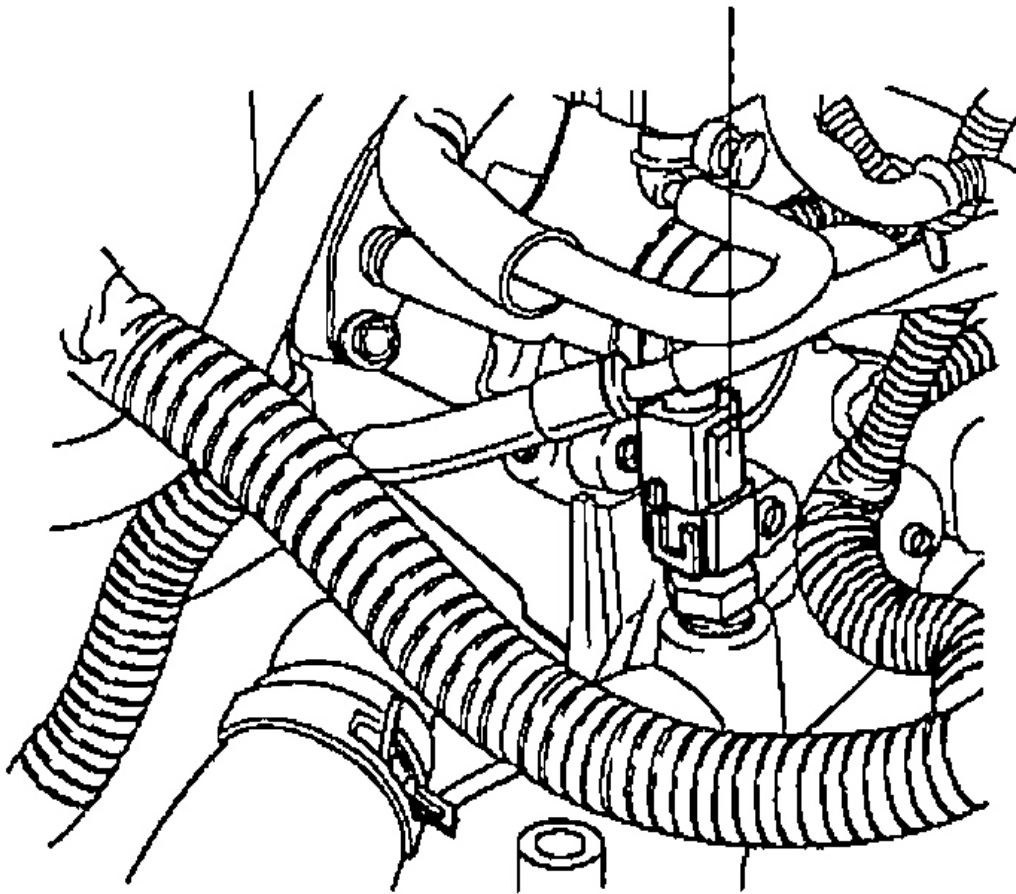
G00325639

Fig. 123: Installing Coolant Pipe

Courtesy of KIA MOTORS AMERICA, INC.

COOLANT TEMPERATURE SENSOR**REMOVAL**

1. Drain the engine coolant.
2. Remove the engine harness after disconnecting the ground cable of the battery.
3. Remove the engine coolant sensor.



G00325640

Fig. 124: Removing Coolant Sensor

Courtesy of KIA MOTORS AMERICA, INC.

INSTALLATION

1. Apply sealant to the sensor's threads. Tighten it to the specified torque.

Recommended sealant :

Three bond No. 2310 or LOCTITE 962T

Tightening torque

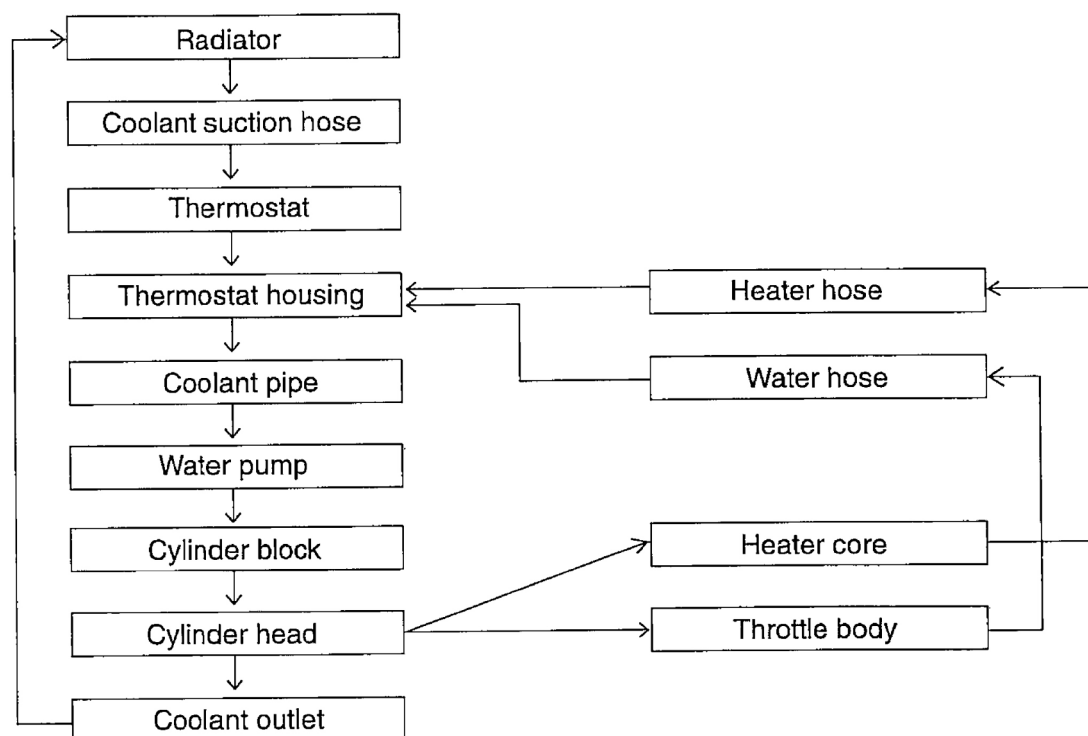
The coolant sensor :

19.6-39.2Nm (2-4 kg.m, 14.5-28.9 lb.ft)

2. Connect the coolant sensor to the harness.
3. Connect the ground cable of battery.
4. Refill the coolant.

SCHEMATIC DIAGRAM

INLET CONTROL



G00325641

Fig. 125: Inlet Control Schematic
 Courtesy of KIA MOTORS AMERICA, INC.

FLOW CHART

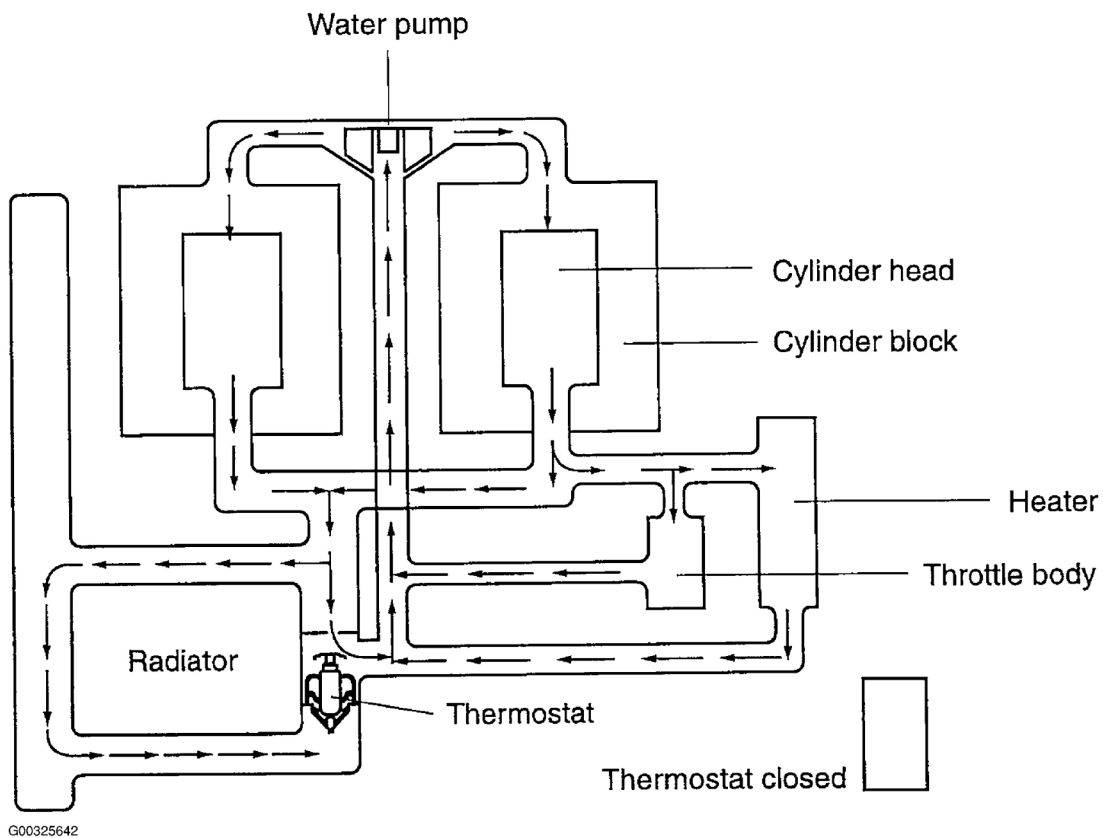
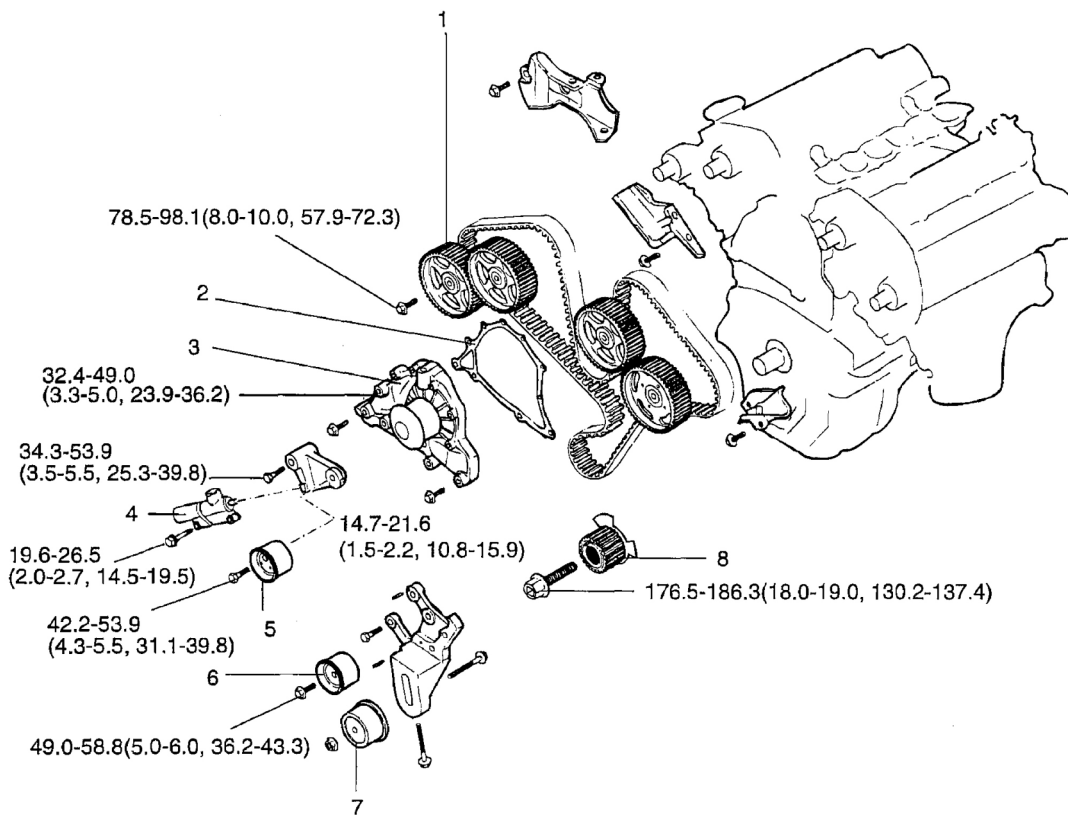


Fig. 126: Coolant Flow Chart
Courtesy of KIA MOTORS AMERICA, INC.

ENGINE COOLANT PUMP



TORQUE : N·m (kg·m, lb·ft)

- | | |
|-----------------------|--------------------------------|
| 1. Cam shaft sprocket | 5. Timing belt tension bearing |
| 2. Gasket | 6. Timing belt idler bearing |
| 3. Water pump | 7. Drive belt tensioner pulley |
| 4. Auto tensioner | 8. Crank shaft sprocket |

G00325643

Fig. 127: Identifying Coolant Pump Components
Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

1. Using the drain plug, drain the coolant.
2. Remove the drive belt and the engine coolant pump pulley.
3. Remove the timing belt cover, the auto tensioner and idler pulley.
4. Remove the engine coolant pump mounting bolts.
5. Remove the engine coolant pump assembly from the cylinder block.

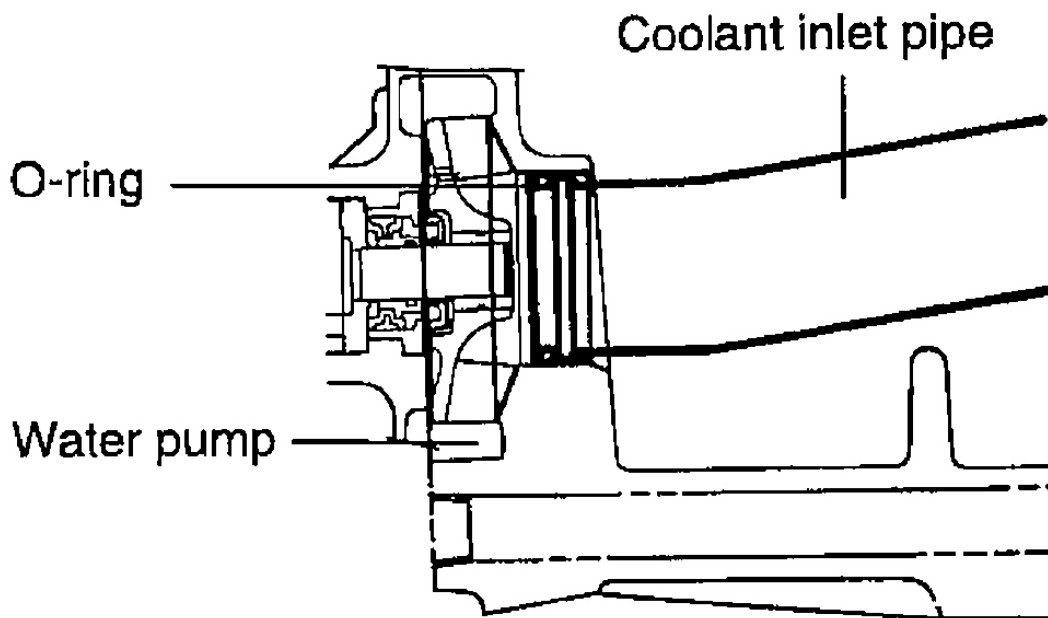
INSPECTION

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

3. Check the seal it for leaks and replace the pump assembly if necessary.

INSTALLATION

1. Clean the gasket surfaces of the engine coolant pump body and the cylinder block.



G00325644

Fig. 128: Installing Coolant Pump
Courtesy of KIA MOTORS AMERICA, INC.

2. Install the new engine coolant pump gasket and pump assembly. Tighten the bolts to the specified torque.

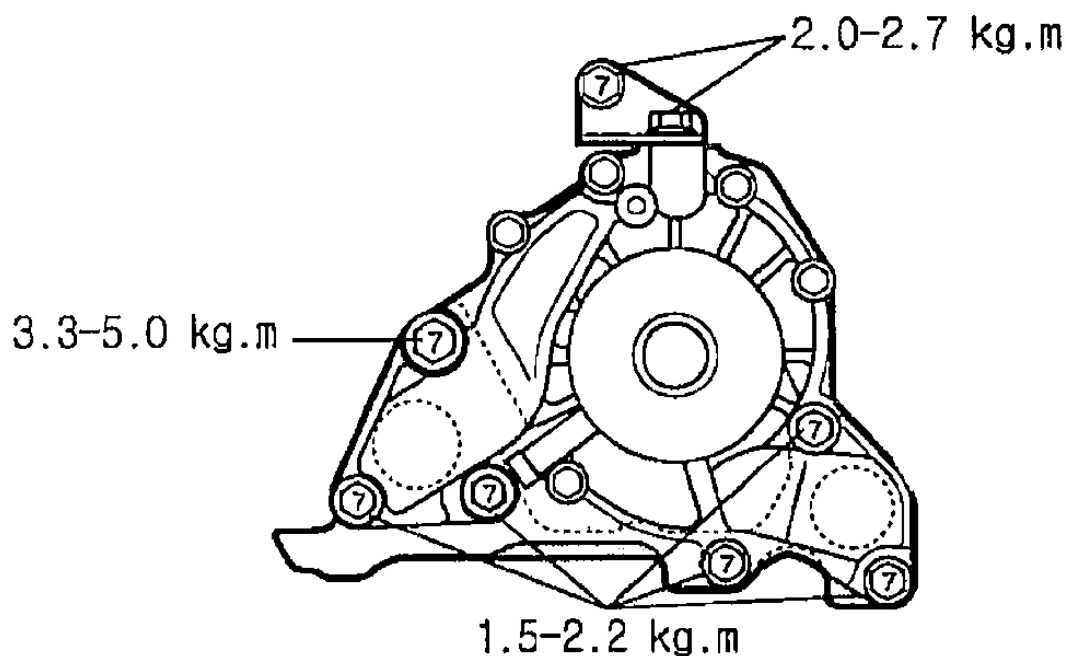
Tightening torque

Engine coolant pump bolt

8x28mm bolt : 14.7-21.6 N.m (1.5-2.2 kg.m, 10.8-15.9 lb.ft)

8x14mm bolt : 19.6-26.5 N.m (2.0-2.7 kg.m, 14.5-19.5 lb.ft)

10x40mm bolt : 32.4-49.0 N.m (3.3-5.0 kg.m, 23.9-36.2 lb.ft)

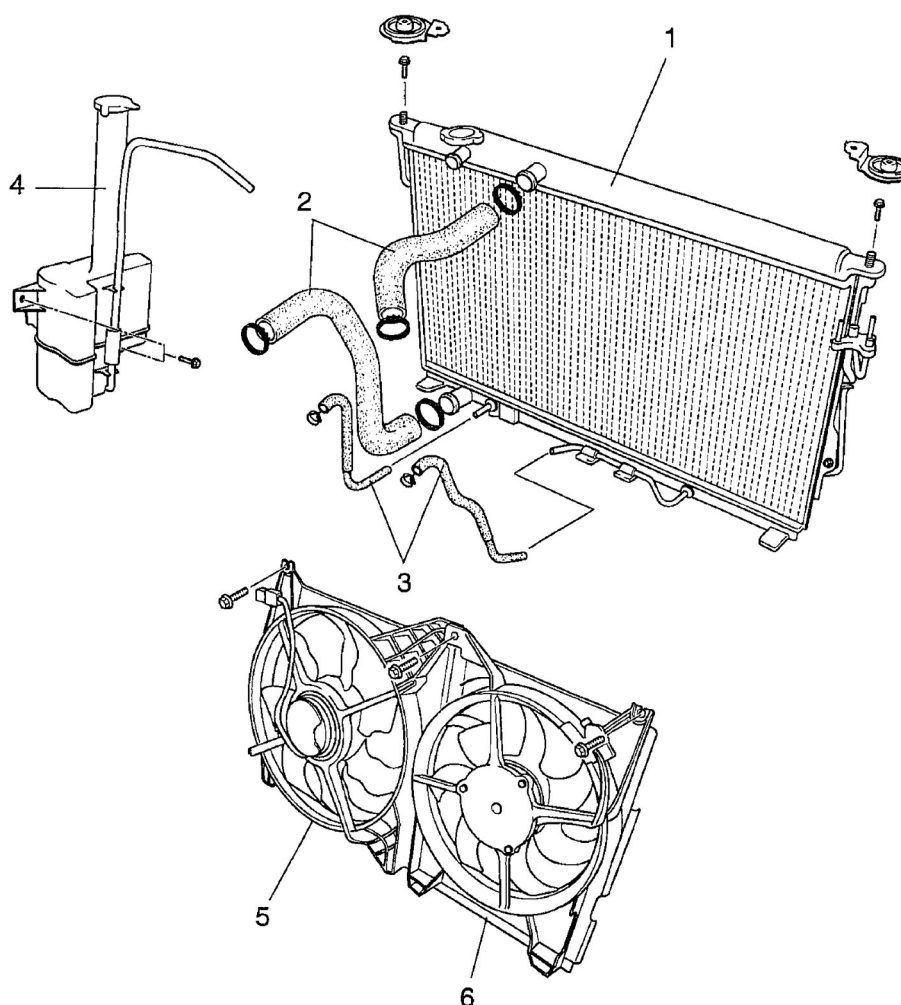


G00325645

Fig. 129: Coolant Pump Tightening Sequence
Courtesy of KIA MOTORS AMERICA, INC.

3. Install the auto tensioner and timing belt. Adjust the timing belt tension, then install the timing belt cover. See **TIMING SYSTEM**.
4. Install the drive belt, coolant pump pulley and then adjust the auto tensioner.
5. Refill the coolant.
6. Run the engine and check for leaks.

RADIATOR



- 1. Radiator
- 2. Radiator hose
- 3. A/T oil cooler hose

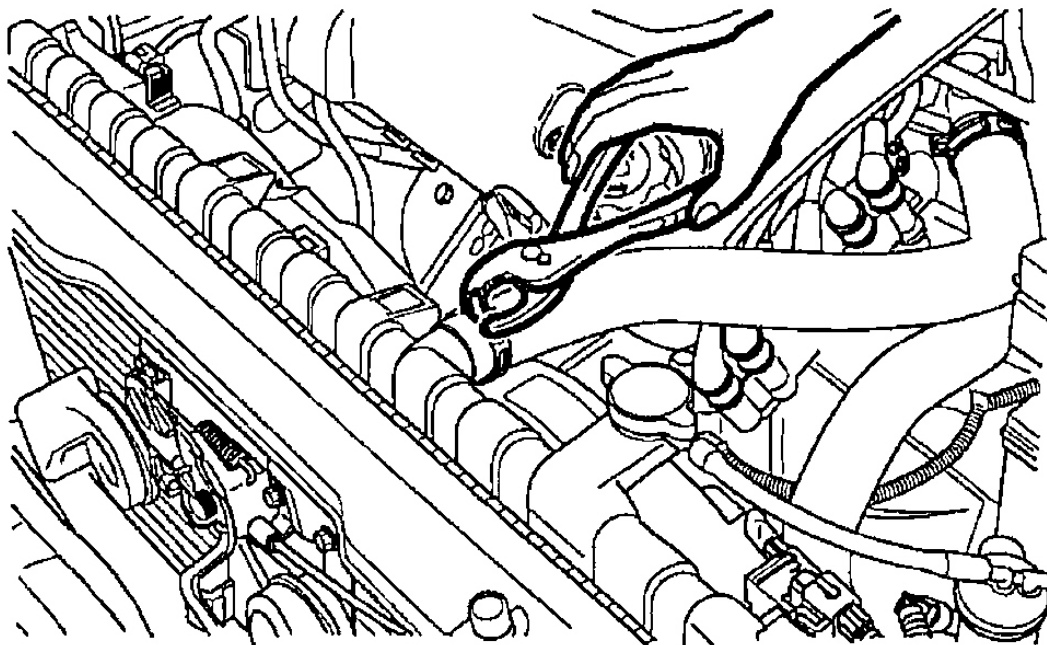
- 4. Coolant reservoir tank
- 5. Radiator cooling fan
- 6. Air conditioner condenser fan

G00325646

Fig. 130: Identifying Radiator Components
 Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

1. Disconnect the upper and lower hoses and overflow tube after marking the radiator hose and the hose clamp to easy reinstall.



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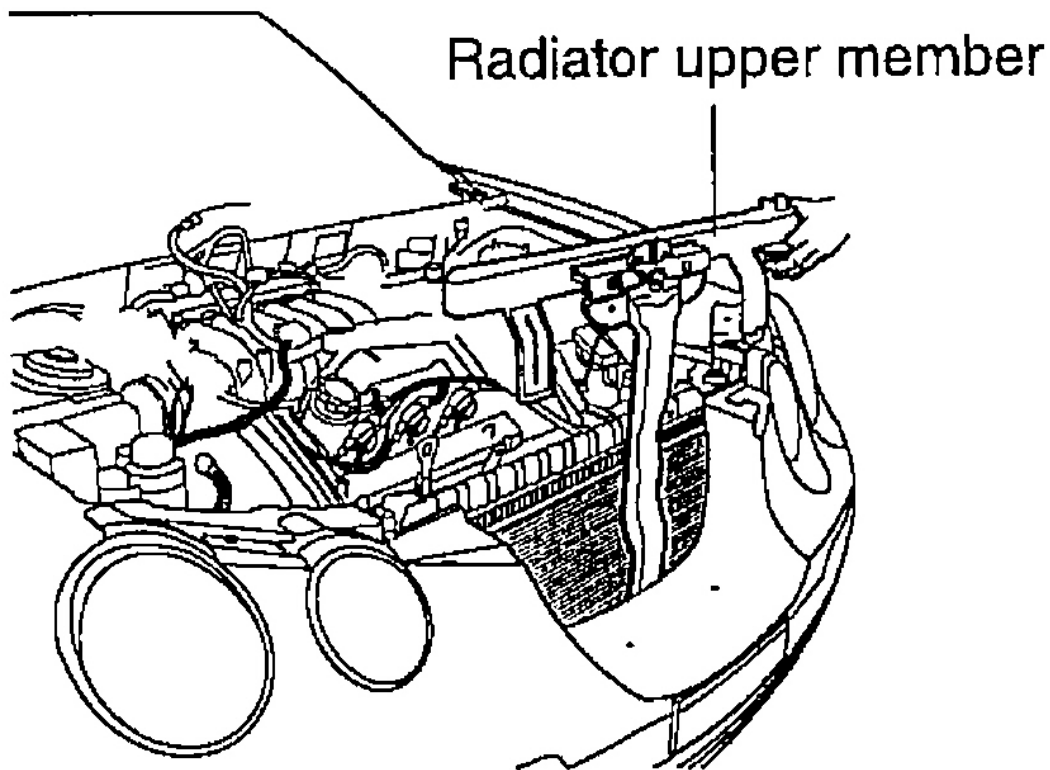
Fig. 131: Removing Radiator Hoses

Courtesy of KIA MOTORS AMERICA, INC.

NOTE: For vehicles with automatic transaxles, disconnect the oil cooler hoses from the automatic transaxle.

CAUTION: Cover or plug the hose and inlets of the radiator so that dust and other foreign material etc. can not enter after the hose is disconnected from the radiator.

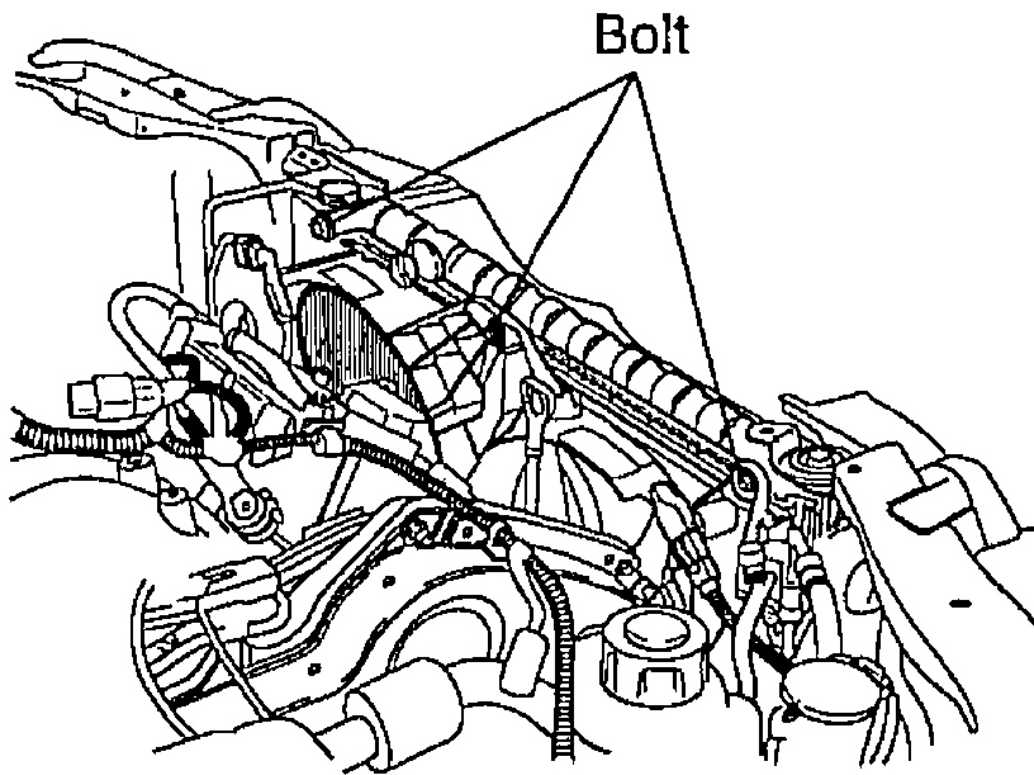
2. Remove the radiator upper member mounting bolt and disconnect the bonnet release cable.
3. Remove the radiator upper member from engine room, after disconnecting the horn connector.



G00325648

Fig. 132: Removing Upper Radiator Support Member
Courtesy of KIA MOTORS AMERICA, INC.

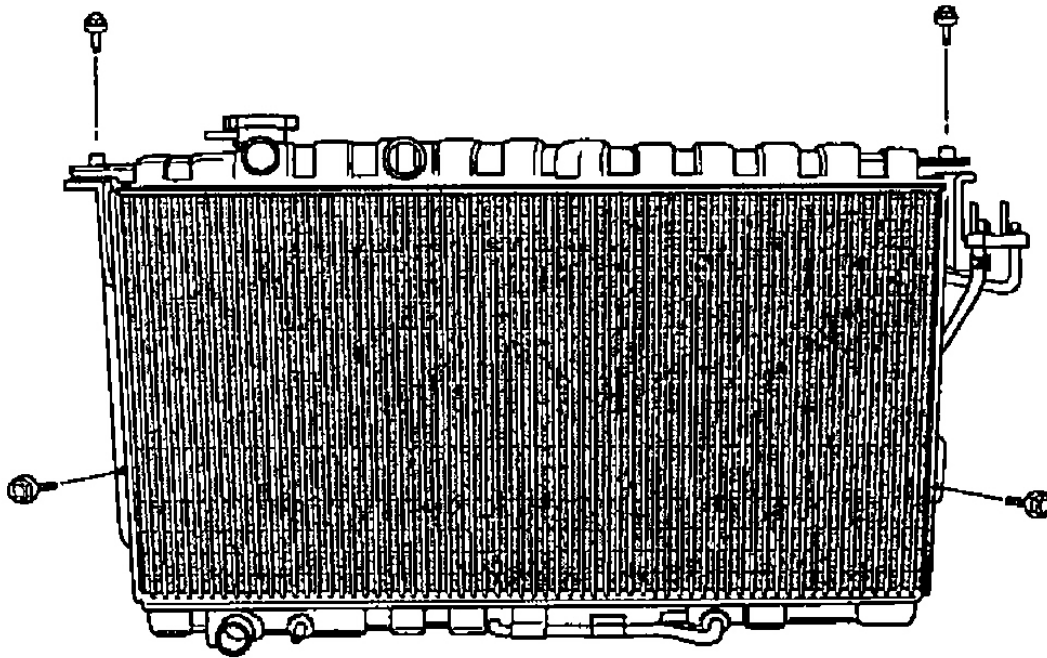
4. Disconnect the cooling fan connector and the air condenser fan connector. Remove the fan assembly from engine room, after removing the fan assembly mounting bolt.



G00325649

Fig. 133: Removing Cooling Fan Assembly
Courtesy of KIA MOTORS AMERICA, INC.

5. Remove the radiator mounting bolt (4ea) from the air conditioner condenser.



G00325650

Fig. 134: Removing Radiator
Courtesy of KIA MOTORS AMERICA, INC.

6. Remove the radiator from engine room, after disconnecting the radiator reserve hose.

INSPECTION

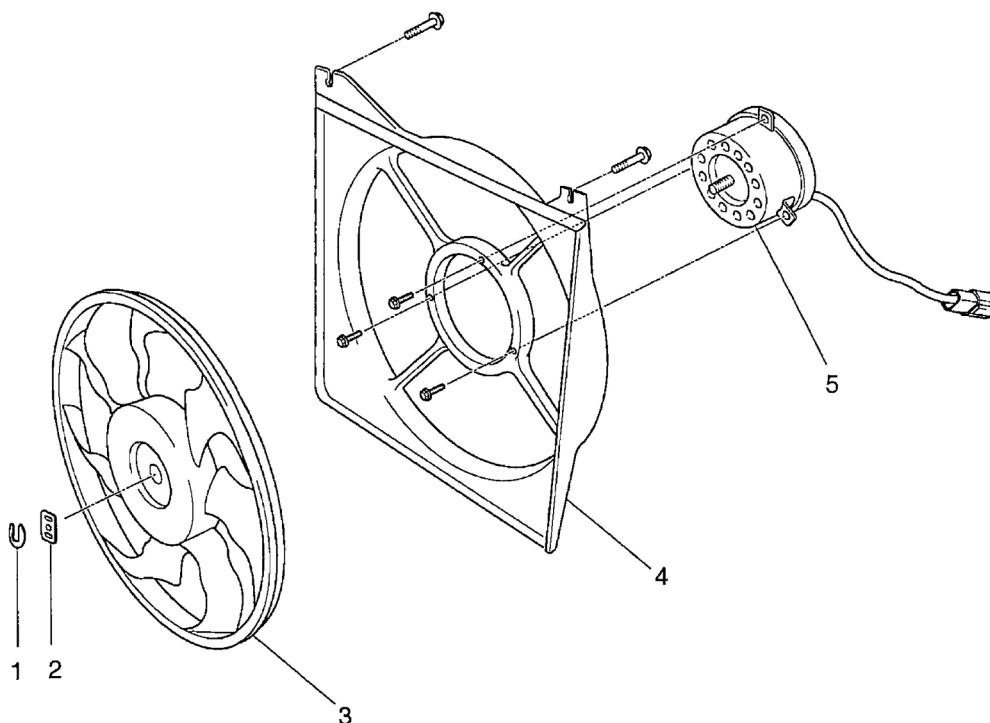
1. Check for foreign material between the radiator fins.
2. Check the radiator fins for damage and straighten if necessary.
3. Check the radiator for corrosion, damage, rust or scale.
4. Check the radiator hoses for cracks, damage or deterioration.
5. Check the reservoir tank for damage.
6. Check the automatic transaxle oil cooler hoses for cracking, damage or deterioration (only A/T).

INSTALLATION

1. Fill the radiator and reservoir tank with a clean coolant mixture.
2. Run the engine until the coolant warms up enough so that the thermostat valve opens and then turn off the engine.
3. Remove the radiator cap and pour the coolant up to the filler neck of the radiator. Fill the reservoir tank to the upper level.

4. Check that there are no leaks from the radiator, hoses or connections.

RADIATOR FAN MOTOR



1. Fan mounting clip
2. Fan mounting
3. Fan

4. Shroud
5. Radiator fan motor

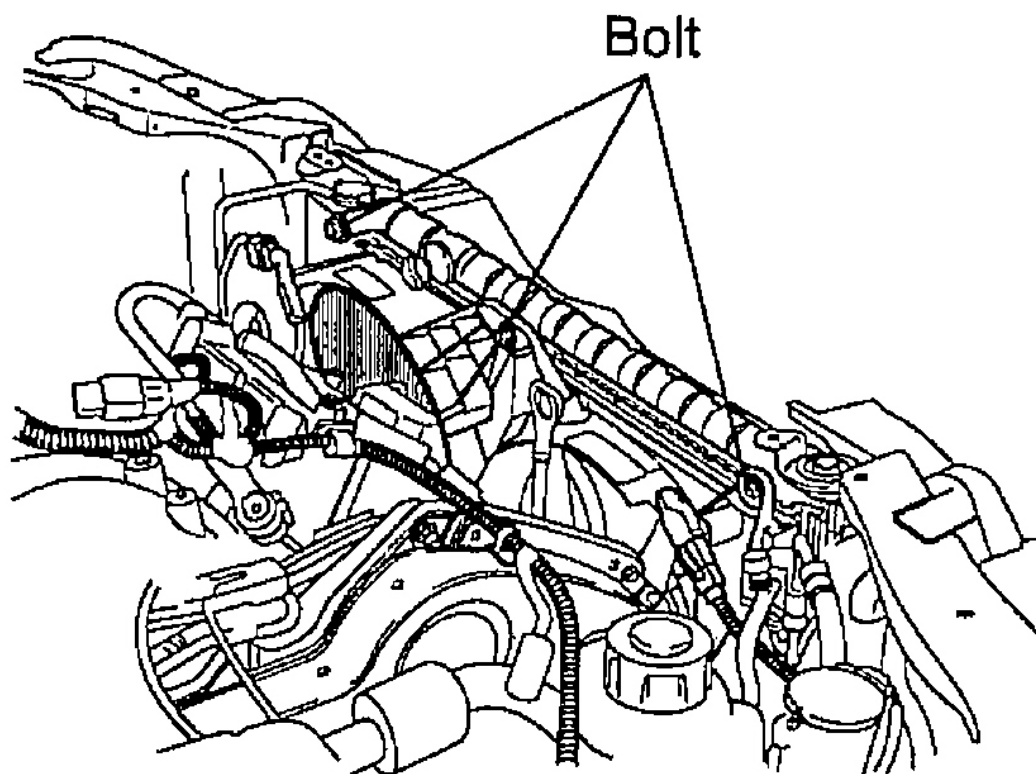
G00325651

Fig. 135: Identifying Radiator Fan Motor Components

Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

1. Disconnect the ground cable from the battery cable.
2. Disconnect the fan motor connector.



G00325652

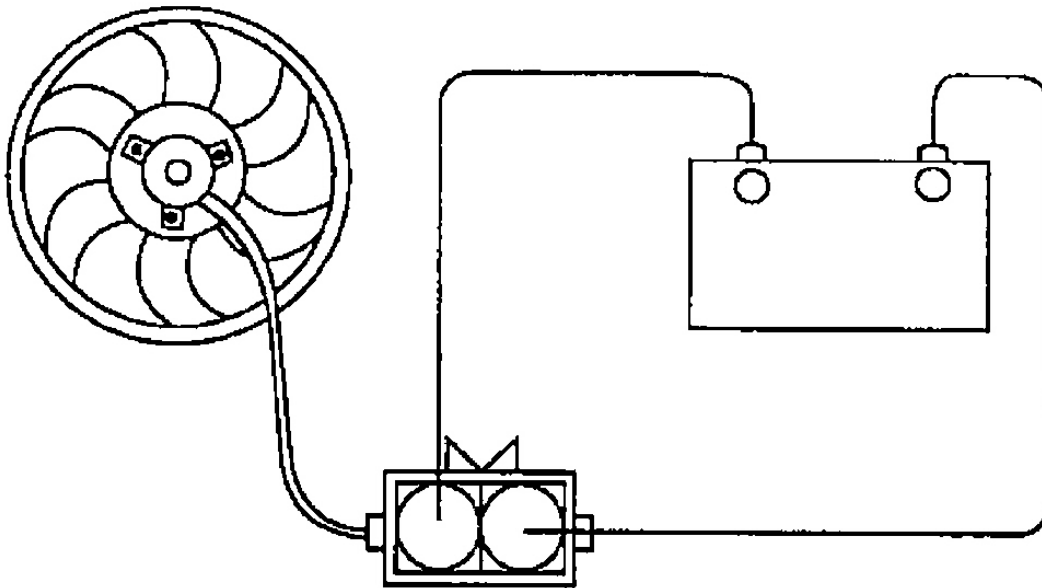
Fig. 136: Removing Shroud Bolts
Courtesy of KIA MOTORS AMERICA, INC.

3. Remove the shroud mounting bolt (3ea).
4. Remove the shroud and fan motor assembly.
5. Remove the fan mounting clip and remove the fan.
6. Remove the fan motor from the shroud.

INSPECTION

RADIATOR FAN MOTOR

1. Check that the radiator fan rotates when battery voltage is applied between the terminals.
2. Check that there are not abnormal noises while the motor is running.



G00325653

Fig. 137: Testing Fan Motor
Courtesy of KIA MOTORS AMERICA, INC.

RADIATOR FAN MOTOR RELAY

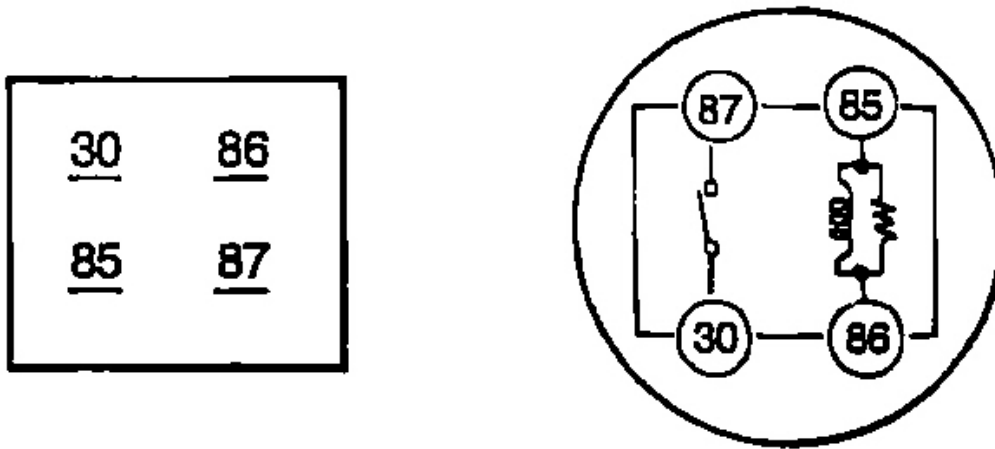
1. Remove the radiator fan motor relay from the relay box in the engine room.
2. Check continuity with an ohmmeter.

Terminal	Continuity
30 - 87	No
85 - 86	Yes

G00325654

Fig. 138: Testing Relay Continuity
Courtesy of KIA MOTORS AMERICA, INC.

3. Apply 12V to terminal 85 and ground to terminal 86. Check for continuity between terminals 30 and 87.



G00325655

Fig. 139: Testing Relay Continuity With Voltage Applied
Courtesy of KIA MOTORS AMERICA, INC.

4. If there is no continuity, replace fan motor relay.

RADIATOR FAN OPERATING LOGIC

A/C	Pressure [psi(kg/cm²)]	Vehicle Speed [MPH(km/h)]	Fan	Coolant temperature[°C (°F)]			
				-30(-22)	95(203)	100(212)	107(224.6)
ON	above 220(15.5)		RAD	HIGH			
			COND	HIGH			
	below 220(15.5)	V<28(45)	RAD	LOW	HIGH		
			COND	LOW	HIGH		
		28(45)≤V<50(80)	RAD	OFF	LOW	HIGH	
			COND	OFF	LOW	HIGH	
OFF		50(80)<V	RAD	OFF		HIGH	
			COND	OFF		HIGH	
		28(45)≤V<50(80)	RAD	OFF	LOW		HIGH
			COND	OFF	LOW		HIGH
		V<28(45)	RAD	OFF	LOW		HIGH
			COND	OFF	LOW		HIGH

G00325656

Fig. 140: Radiator Fan Operating Logic Chart
Courtesy of KIA MOTORS AMERICA, INC.

NOTE:

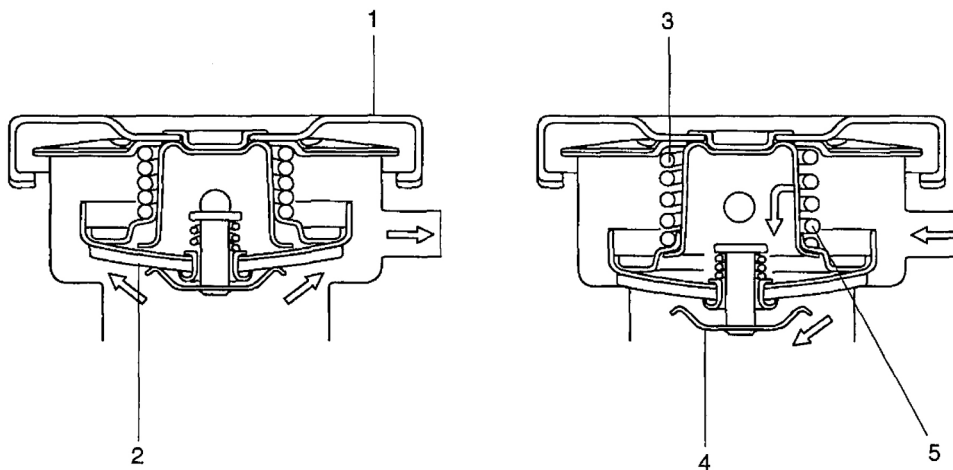
- Temperature: 5°C (41°F)
- Vehicle speed: 3 MPH (5 km/h)
- Both condenser and radiator are operated with high speed when coolant temperature failure.
- Compressor cut off: 115°C+/-7°C (239°F+/-44.6°F)

INSTALLATION

Installation is the reverse of removal.

NOTE:

After installation, make sure there is no unusual noise or vibration when the fan is rotating.

RADIATOR CAP

Pressure : 107.9±14.7 (1.1±0.15, 15.64±2.13)

Pressure : 83.4 (0.85, 12.1)

PRESSURE : Kpa (kg/cm², psi)

1. Radiator cap
2. High pressure valve
3. Spring

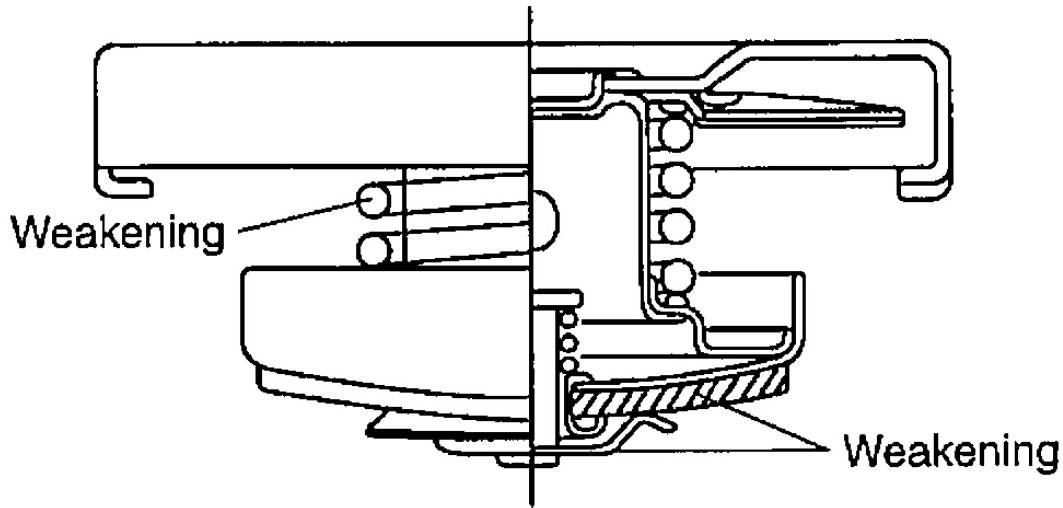
4. Bent valve
5. Vacuum spring

G00325657

Fig. 141: Identifying Radiator Cap
Courtesy of KIA MOTORS AMERICA, INC.

INSPECTION

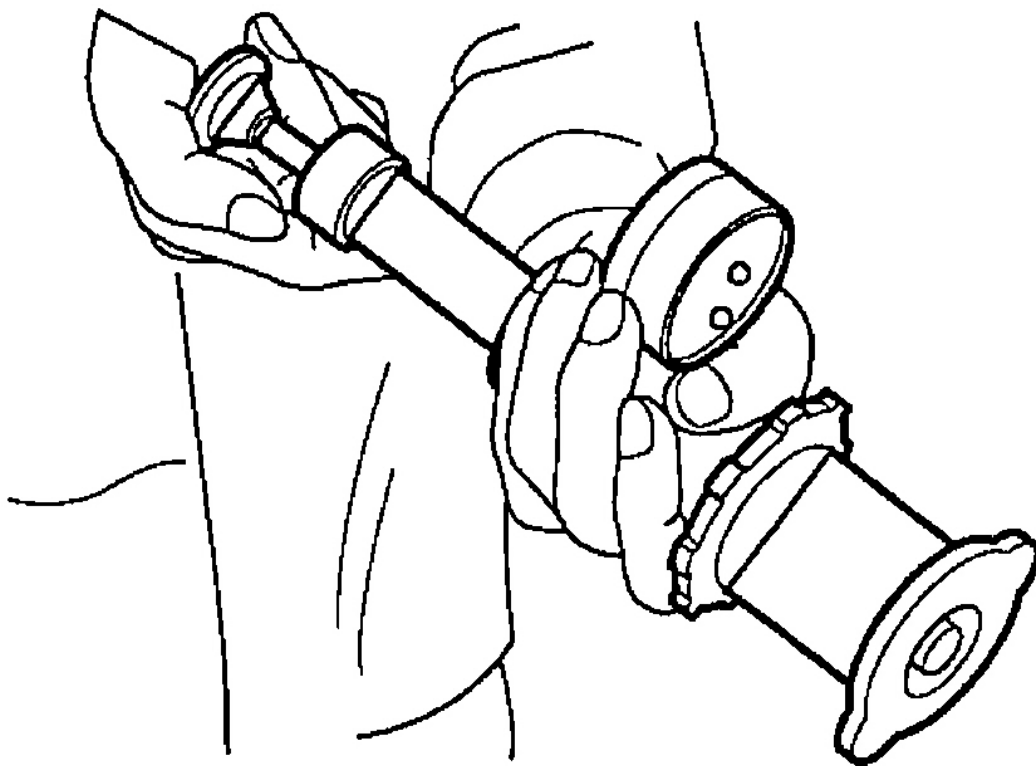
1. Check the radiator cap for damage, cracks or weakening.



G00325658

Fig. 142: Inspecting Radiator Cap
 Courtesy of KIA MOTORS AMERICA, INC.

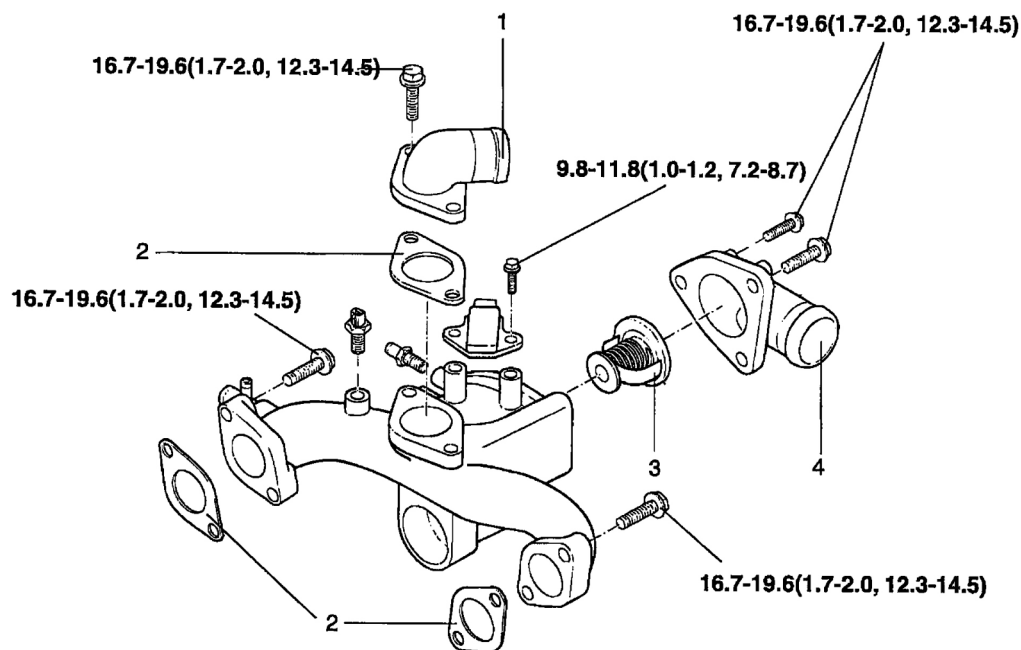
2. Connect the tester to the radiator cap.
3. Increase the pressure until the indicator of the gauge stops moving.
4. Replace the radiator cap if the reading does not hold steady for about 10 seconds.



G00325659

Fig. 143: Testing Radiator Cap
Courtesy of KIA MOTORS AMERICA, INC.

THERMOSTAT



TORQUE : Nm (kg.m, lb.ft)

- 1. Water outlet fitting
- 2. Gasket

- 3. Thermostat
- 4. Water outlet fitting

G00325660

Fig. 144: Identifying Thermostat Components
Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

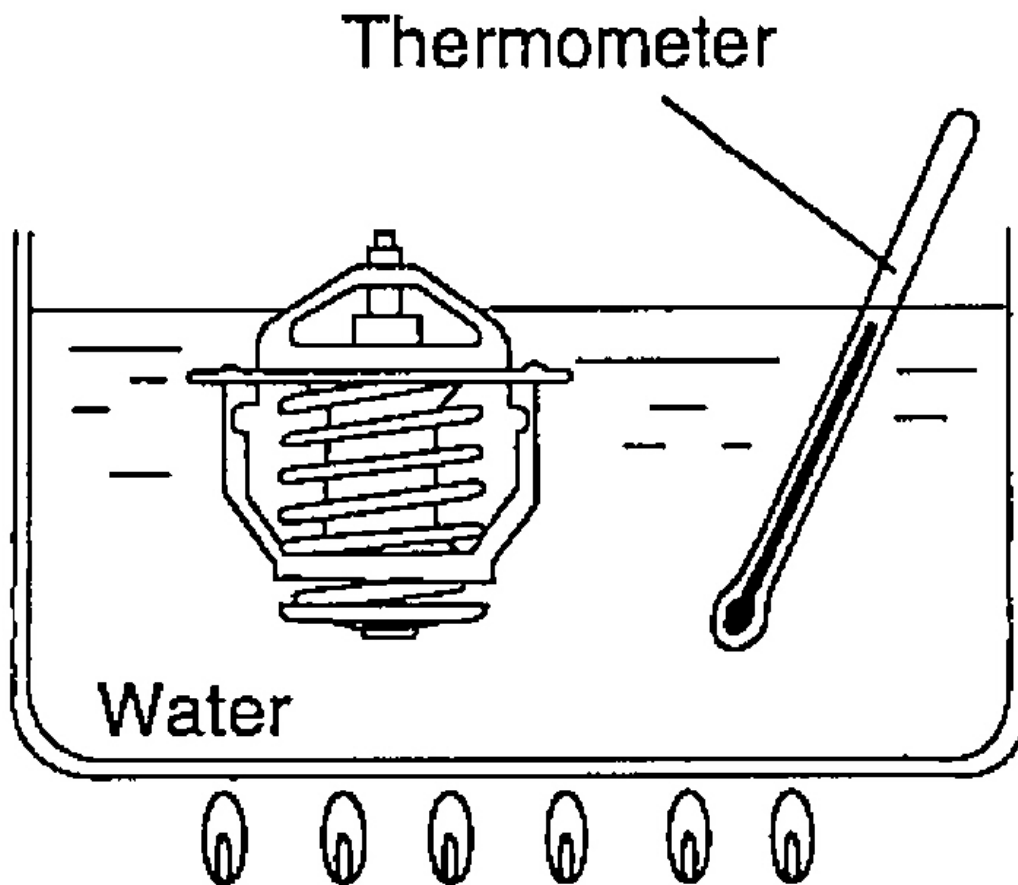
1. Drain the coolant to thermostat level or below.
2. Remove the inlet fitting and gasket.
3. Remove the thermostat.

INSPECTION

1. Heat the thermostat as shown in the illustration.
2. Check that the valve operates properly.
3. Verify the temperature at which the valve begins to open.

Valve opening temperature : 80-84°C (176-183.2°F)

Full opening temperature : 95°C (203°F)

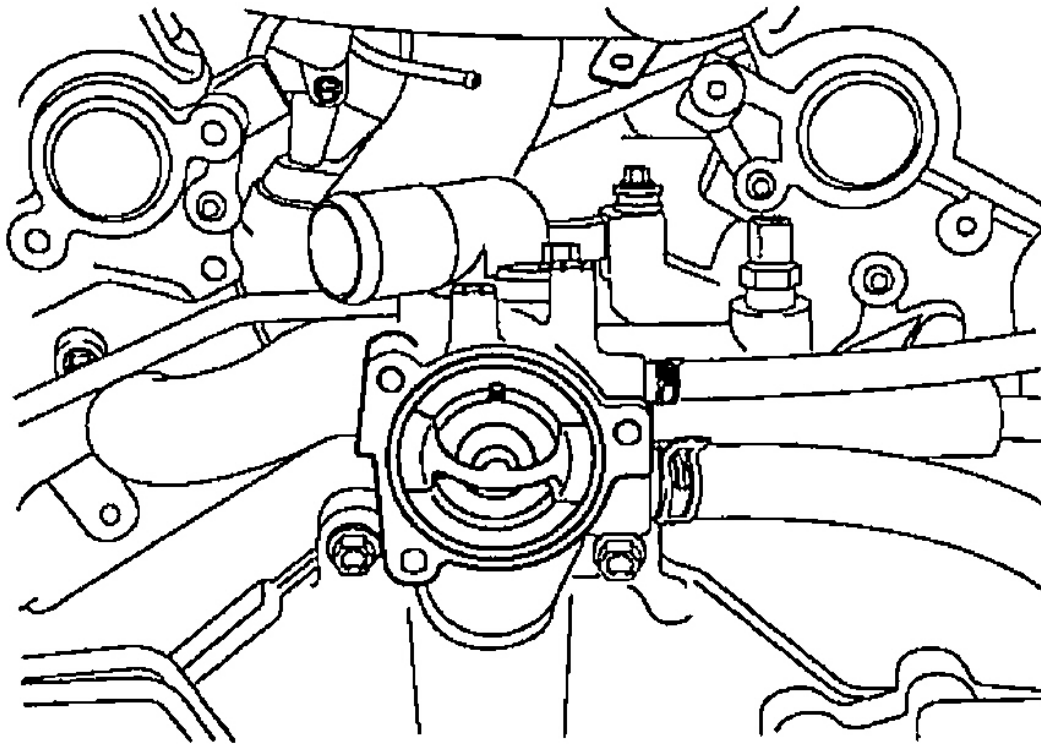


G00325661

Fig. 145: Testing Thermostat Operation
Courtesy of KIA MOTORS AMERICA, INC.

INSTALLATION

1. Check that the flange of the thermostat is correctly placed in the socket of the thermostat housing.



G00325662

Fig. 146: Installing Thermostat
Courtesy of KIA MOTORS AMERICA, INC.

2. Install the inlet fitting.

Tightening torque

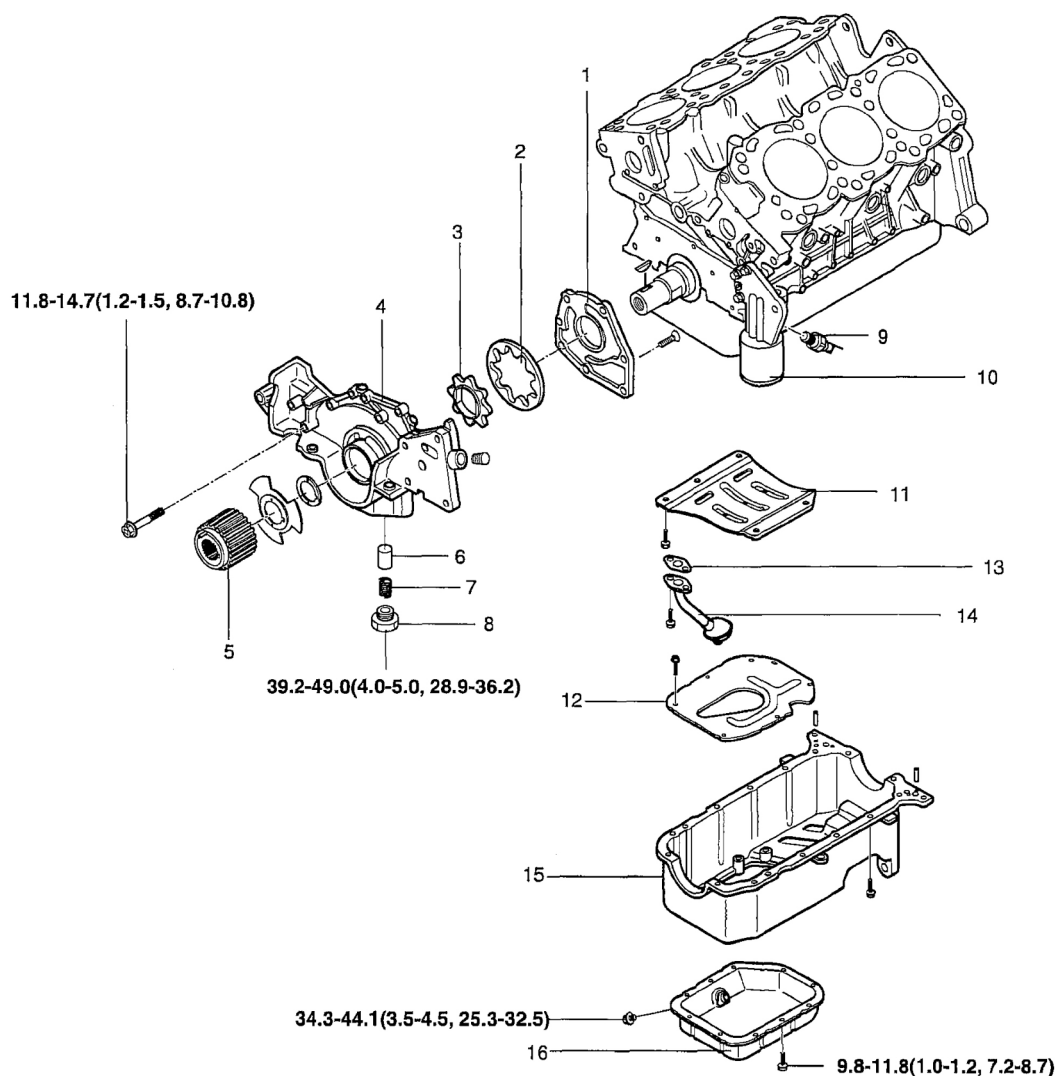
Engine coolant inlet fitting bolt :

17-20 Nm (1.7-2.0 kg.m, 12-14 lb.ft)

3. Refill the coolant.

LUBRICATION SYSTEM

OIL PUMP & OIL PAN



TORQUE : Nm (kg-m, lb.ft)

- | | |
|-------------------------|------------------------|
| 1. Oil pump cover | 9. Oil pressure switch |
| 2. Oil pump outer rotor | 10. Oil filter |
| 3. Oil pump inner rotor | 11. Upper baffle plate |
| 4. Oil pump case | 12. Lower baffle plate |
| 5. Crankshaft sprocket | 13. Gasket |
| 6. Relief valve plunger | 14. Oil screen |
| 7. Relief valve spring | 15. Upper oil pan |
| 8. Relief valve plug | 16. Lower oil pan |

G00325663

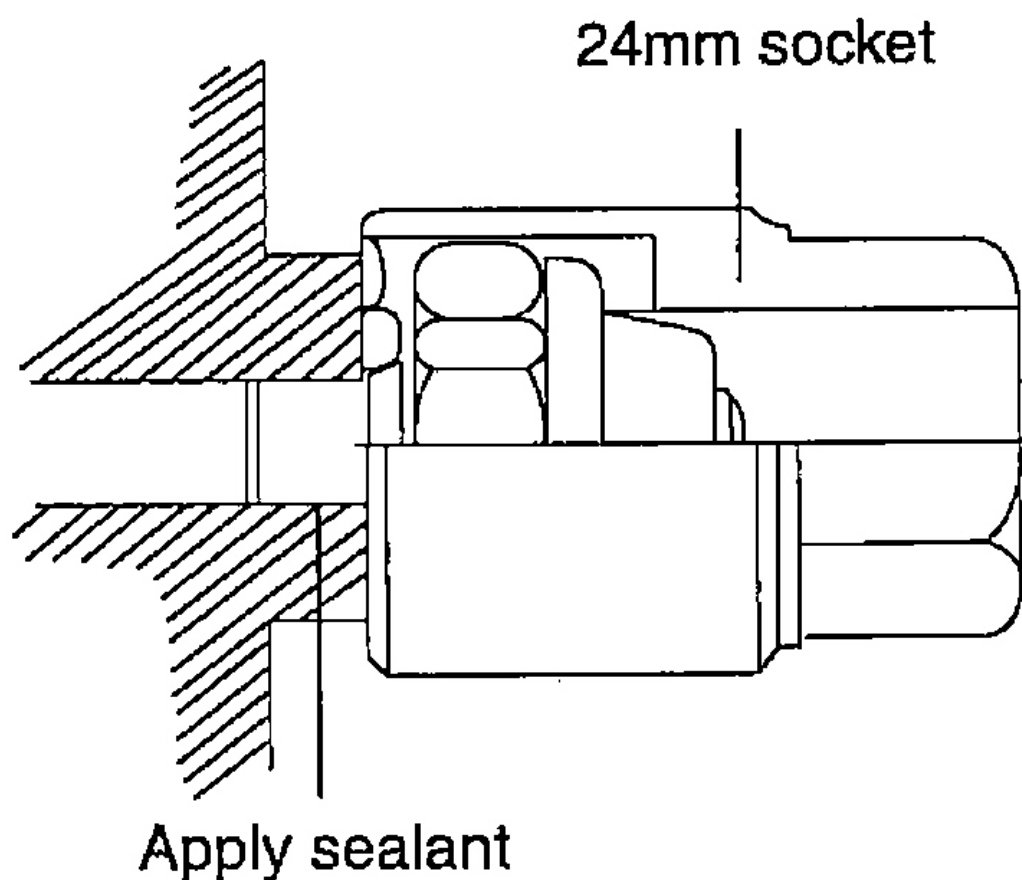
Fig. 147: Identifying Lubrication System
Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

1. Remove the oil pressure switch, using 24 mm deep socket.

NOTE: Since a sealant is used on the threaded area, be careful not to damage the oil pressure switch.

2. Remove the oil filter and the oil pan.
3. Remove the oil screen and gasket.
4. Remove the three bracket securing bolts and remove the oil filter bracket and gasket.
5. Remove the oil relief valve plug from the oil pump case.
6. Remove the oil pump case.



G00325664

Fig. 148: Removing Oil Pressure Switch
Courtesy of KIA MOTORS AMERICA, INC.

INSPECTION

OIL PUMP

1. Visually check the parts of the oil pump case for cracks and damage.
2. Assemble the rotor on the oil pump and then check the clearance with a thickness gauge.

Oil pump side clearance

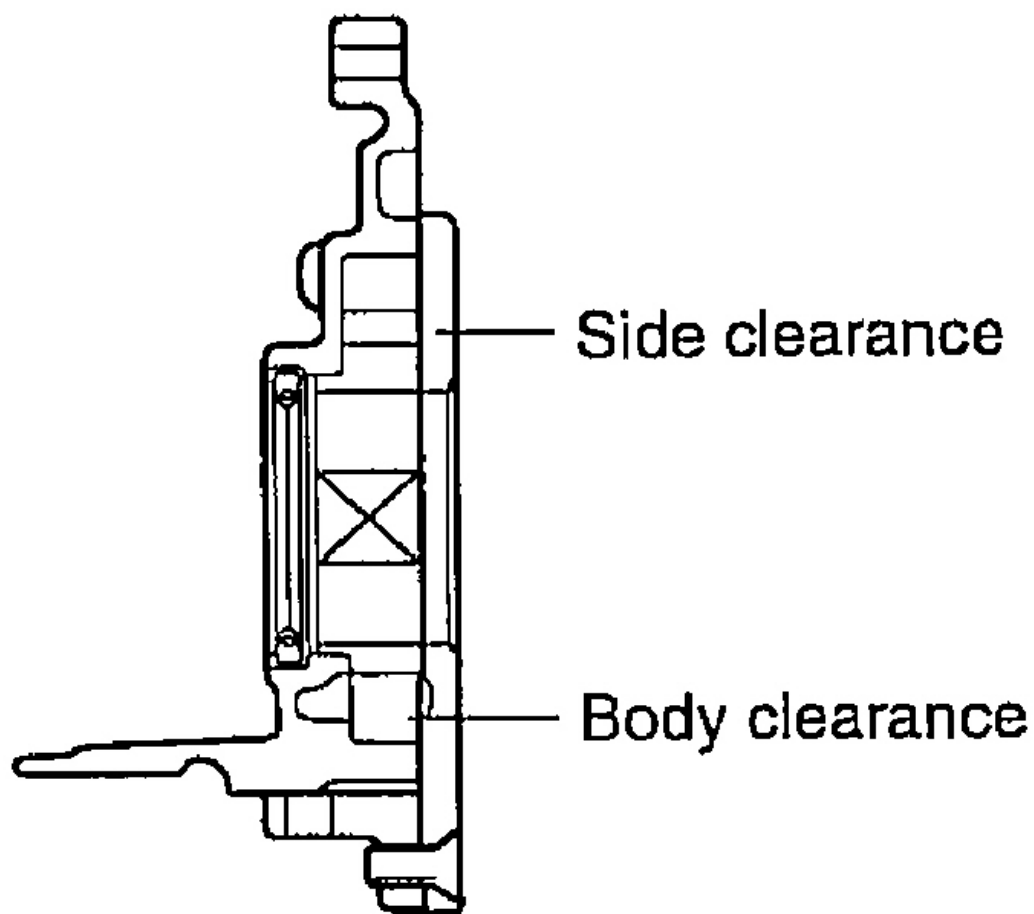
Standard value

Body clearance: 0.100-0.181mm (0.0039-0.0071 in.)

Side clearance: 0.040-0.095mm (0.0016-0.0037 in.)

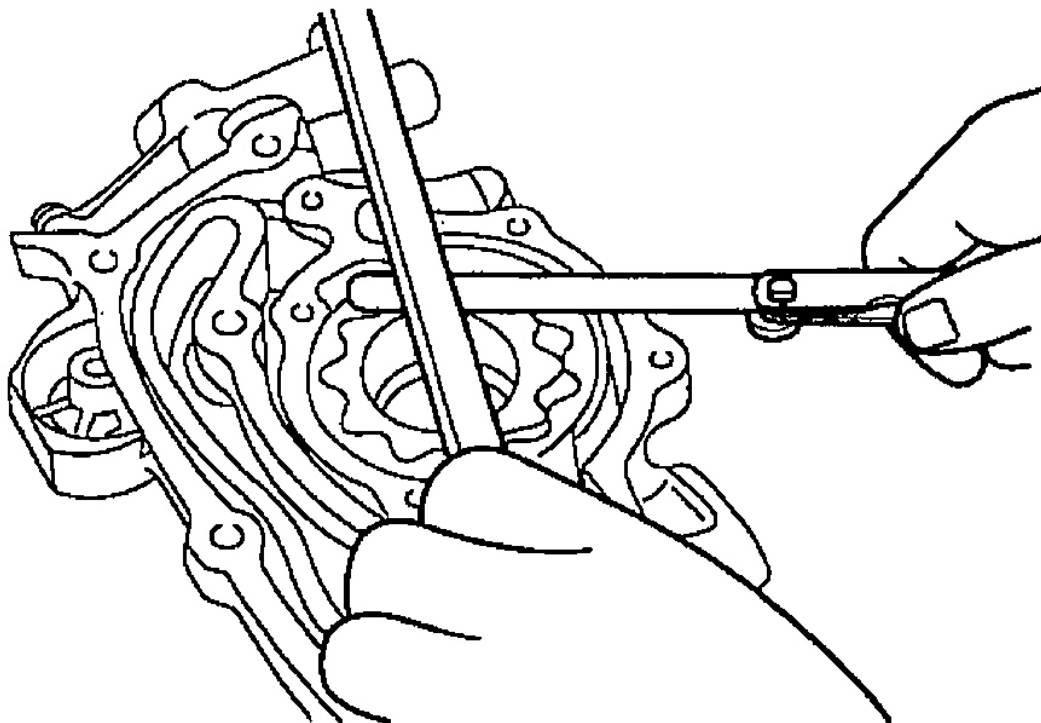
Oil pump tip clearance

0.06 - 0.18 mm (0.0024 - 0.0071 in.)



G00325665

Fig. 149: Identifying Clearance Measuring Position
Courtesy of KIA MOTORS AMERICA, INC.



G00325666

Fig. 150: Measuring Oil Pump Clearance
Courtesy of KIA MOTORS AMERICA, INC.

RELIEF PLUNGER AND SPRING

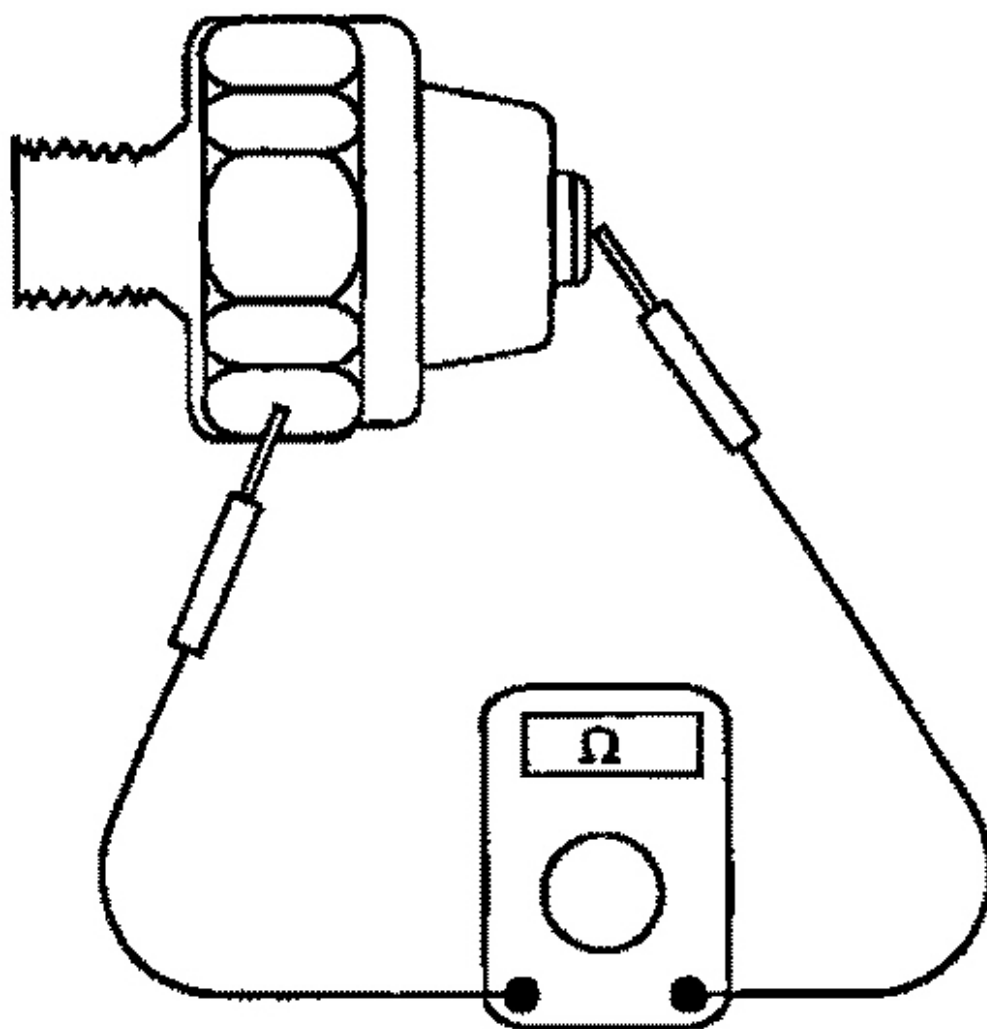
1. Check the relief plunger for smooth operation.
2. Check the relief spring for deformation or breaks.

OIL FILTER BRACKET

1. Make sure that there is no damage on the surface that mates with the oil filter.
2. Check the oil filter bracket for oil leaks or cracks.

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.

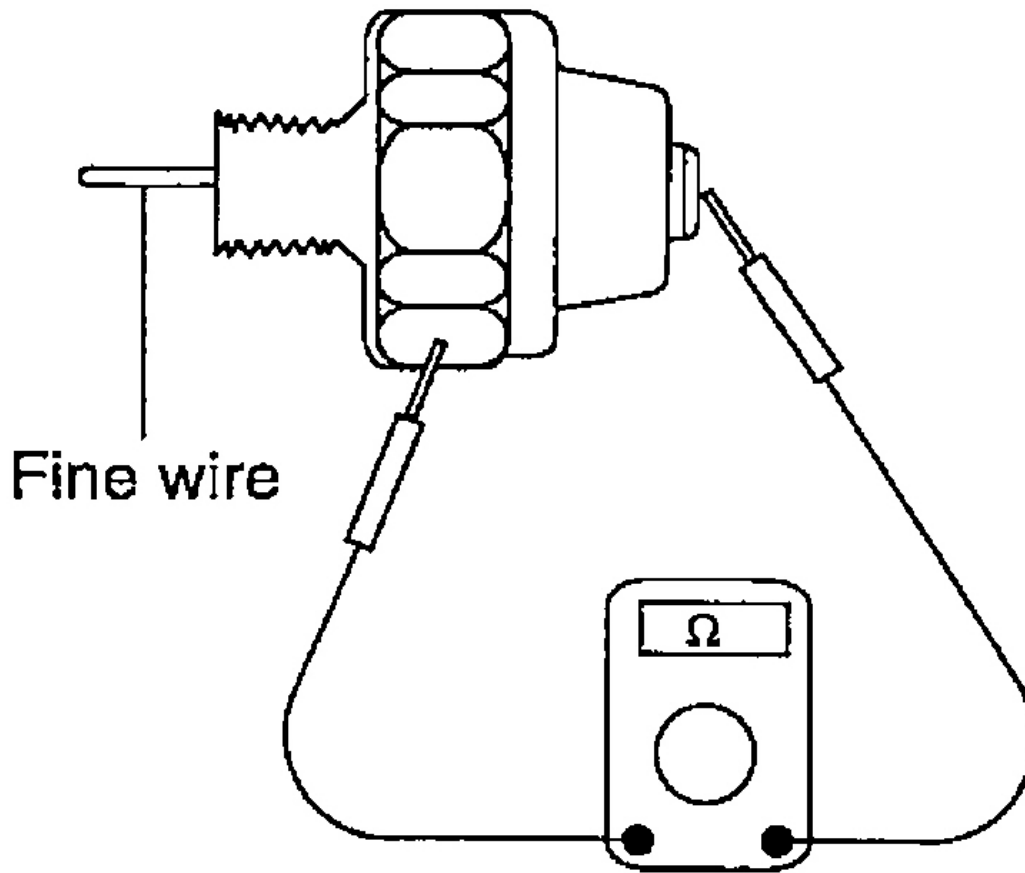


G00325667

Fig. 151: Testing Oil Pressure Switch Continuity
Courtesy of KIA MOTORS AMERICA, INC.

2. Check the continuity between the terminal and the body when the wire is pushed. If there is continuity even when the wire is pushed, replace the switch.
3. If there is no continuity when a 50 kpa (kg/cm² , 7 psi) vacuum is applied through the oil hole, the switch is operating properly.

Check for air leakage. If air leaks, the diaphragm is broken. Replace it.



G00325668

Fig. 152: Testing Oil Pressure Switch Continuity With Pressure
Courtesy of KIA MOTORS AMERICA, INC.

Operation Pressure

Oil pressure switch :

19.6-39.2 kpa (0.2-0.4 kg/cm² , 2.8-5.7 psi)

REASSEMBLY

1. Install the oil pump case with the gasket.

Tightening torque

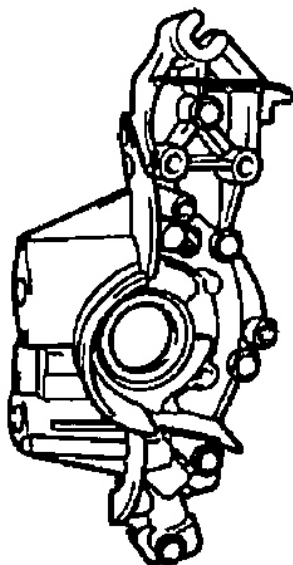
Oil pump case bolt :

11.8-14.7 Nm (1.2-1.5 kg.m, 8.7-10.8 lb.ft)

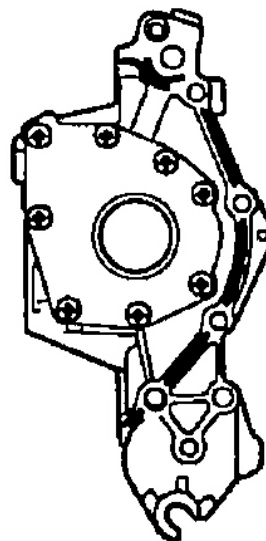
Oil pump cover screw :

7.8-11.8 Nm (0.8-1.2 kg.m, 5.8-8.7 lb.ft)

<Front view>



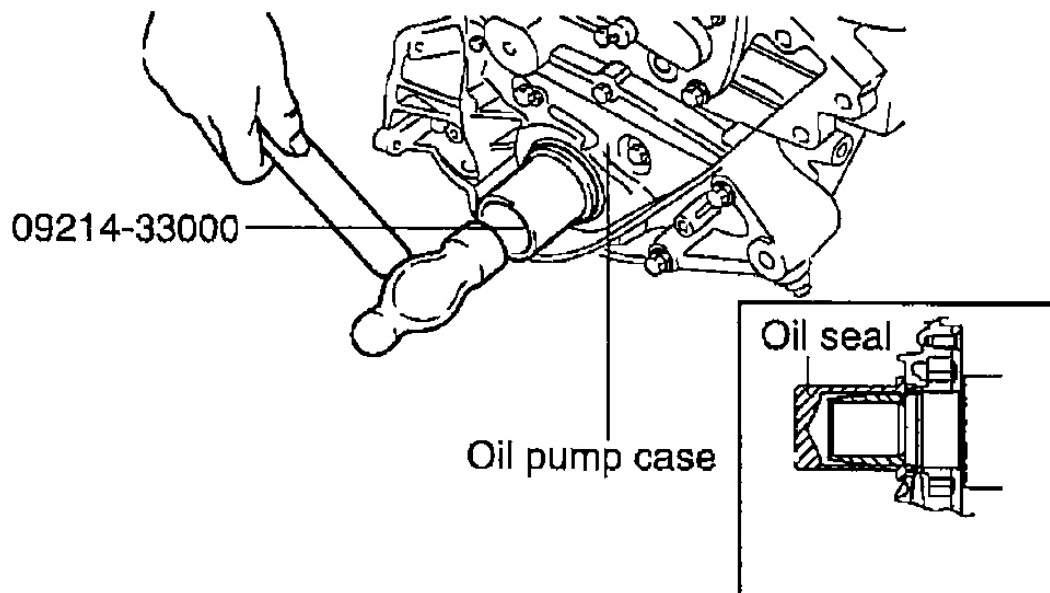
<Rear view>



G00325669

Fig. 153: Identifying Oil Pump Case
Courtesy of KIA MOTORS AMERICA, INC.

2. Install the oil seal into the oil pump case as tightly as possible, using the special tool (09214-33000).



G00325670

Fig. 154: Installing Oil Case Seal

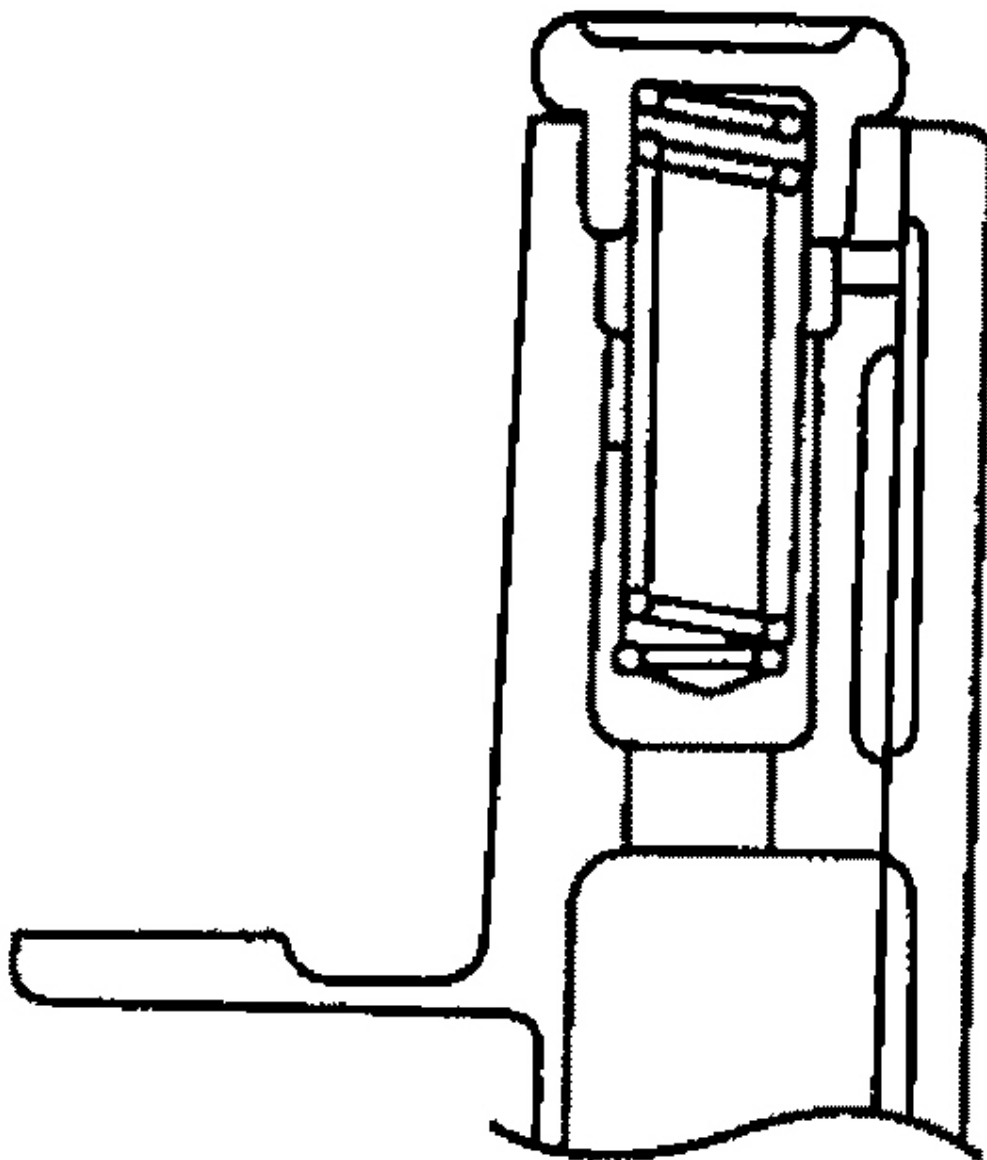
Courtesy of KIA MOTORS AMERICA, INC.

3. Install the relief plunger and spring, and tighten the oil relief valve plug to the specified torque.

Tightening torque

Oil relief valve plug :

39.2-49.0 Nm (4.0-5.0 kg.m, 28.9-36.2 lb.ft)



G00325671

Fig. 155: Installing Oil Pressure Relief Plunger
Courtesy of KIA MOTORS AMERICA, INC.

4. Install the oil screen and a new gasket.

Tightening torque

Oil screen bolt :

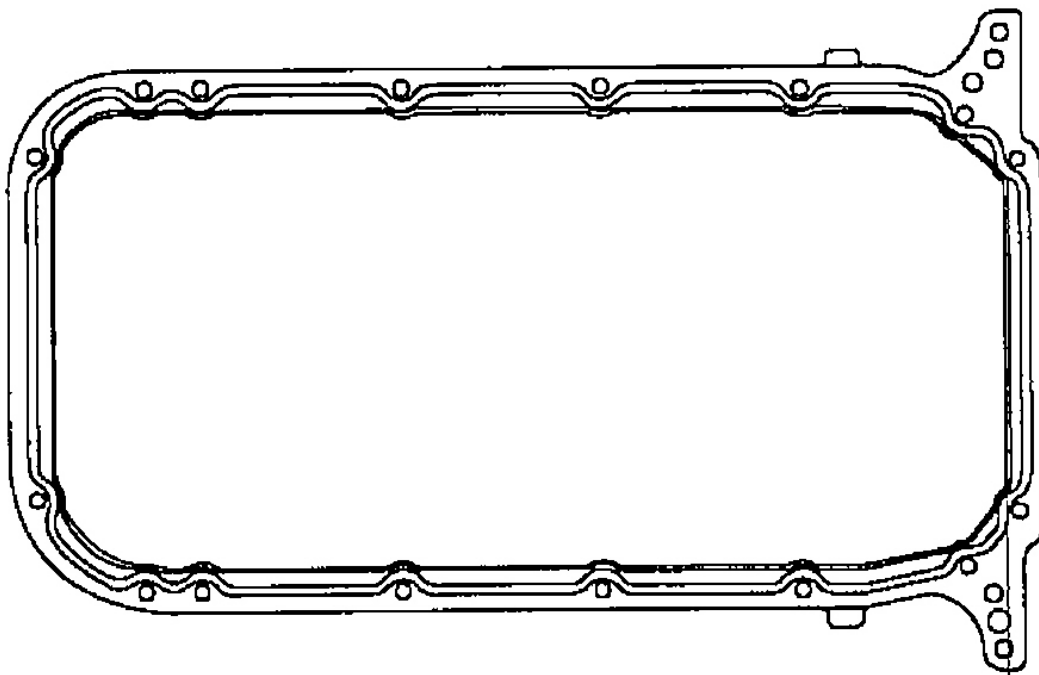
14.7-21.6 Nm (1.5-2.2 kg.m, 10.8-15.9 lb.t)

5. Clean the gasket surfaces of the cylinder block and the oil pan.
6. Apply sealant to the groove of the oil pan flange.

NOTE:

- **Make the first cut approx. 4 mm from the end of the nozzle furnished with sealant. After application of the sealant, do not exceed 15 minutes before installing the oil pan.**
- **Make sure that the sealant doesn't enter the inside of the oil pan.**

3.5



G00325672

Fig. 156: Sealing Oil Pan

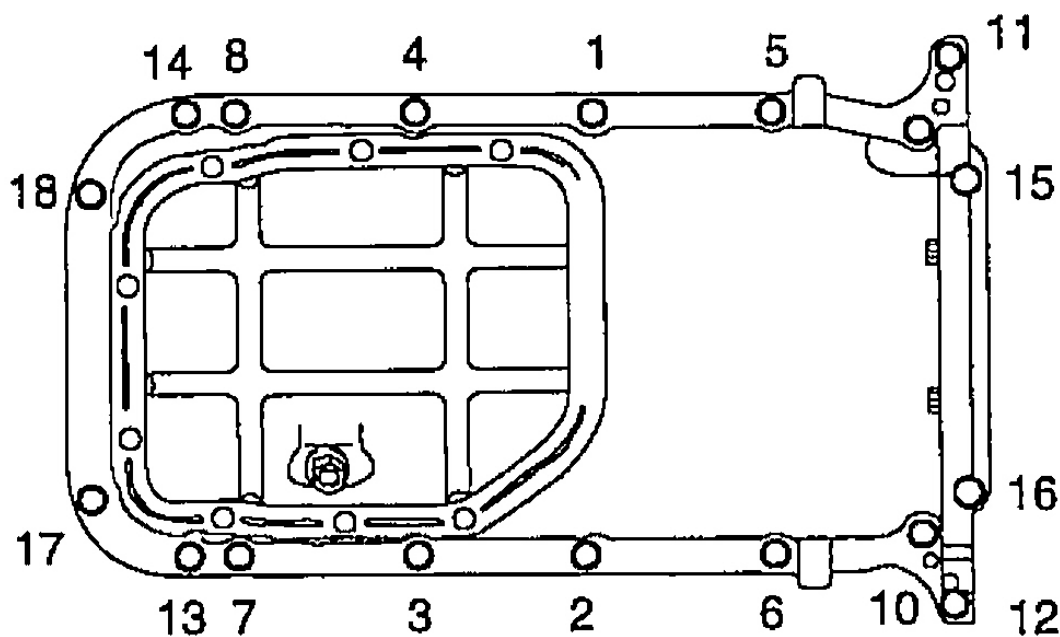
Courtesy of KIA MOTORS AMERICA, INC.

7. Install the oil pan and tighten the bolts as shown in the illustration.

Tightening torque

Oil pan bolt (Except No. 15, 16): 9.8-11.8 Nm (1.0-1.2 kg.m, 7.2-8.7 lb.ft)

Oil pan bolt (No. 15, 16): 4.9-6.9 Nm (0.5-0.7 kg.m, 3.6-5.1 lb.ft)



G00325673

Fig. 157: Upper Oil Pan Tightening Sequence
Courtesy of KIA MOTORS AMERICA, INC.

8. Tighten the transaxle mounting bolts from oil pan.

Tightening torque :

29.4-41.2 Nm (3.0-4.2 kg.m, 21.7-30.4 lb.ft)

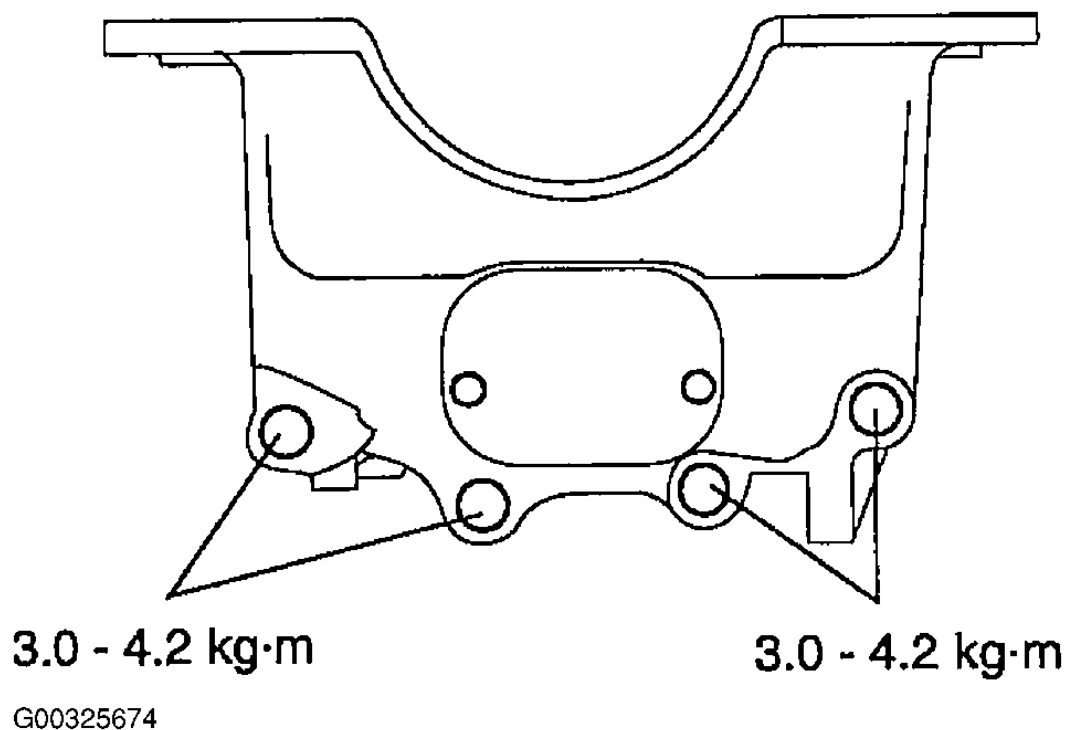


Fig. 158: Identifying Transaxle Mounting Bolt
Courtesy of KIA MOTORS AMERICA, INC.

9. Using a 24 mm deep socket, install the oil pressure switch after applying sealant to the threaded area.

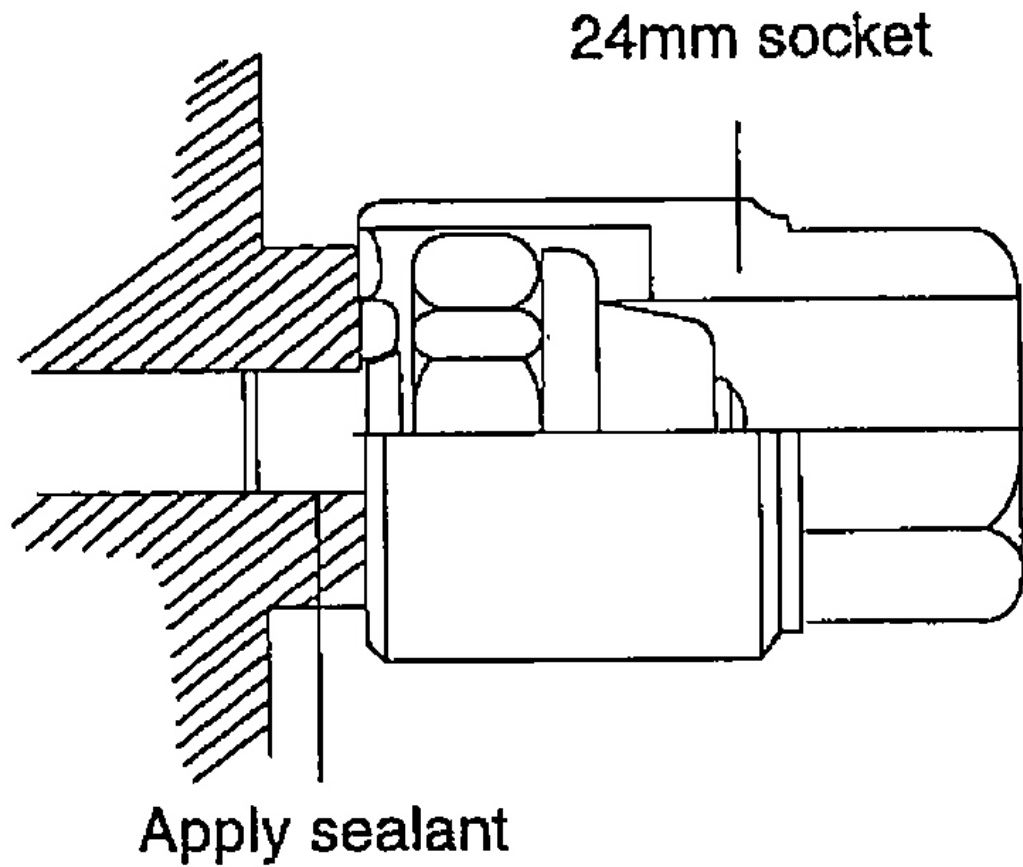
Sealant : LOCTITE 5900 or equivalent

NOTE: **Do not torque the oil pressure switch too much.**

Tightening torque

Oil pressure switch :

7.8-11.8 Nm (0.8-1.2 kg.m, 5.8-8.7 lb.ft)



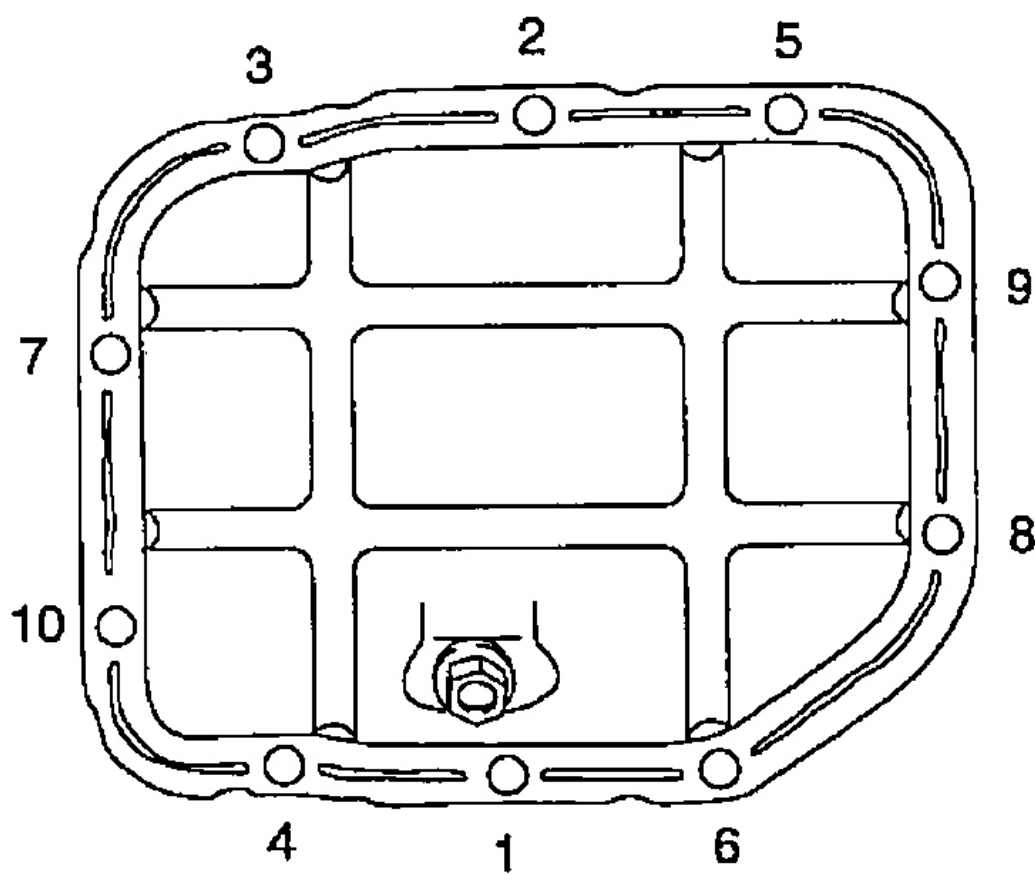
G00325675

Fig. 159: Installing Oil Pressure Switch
Courtesy of KIA MOTORS AMERICA, INC.

10. Tighten the lower oil pan bolts as shown in figure.

Tightening torque :

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

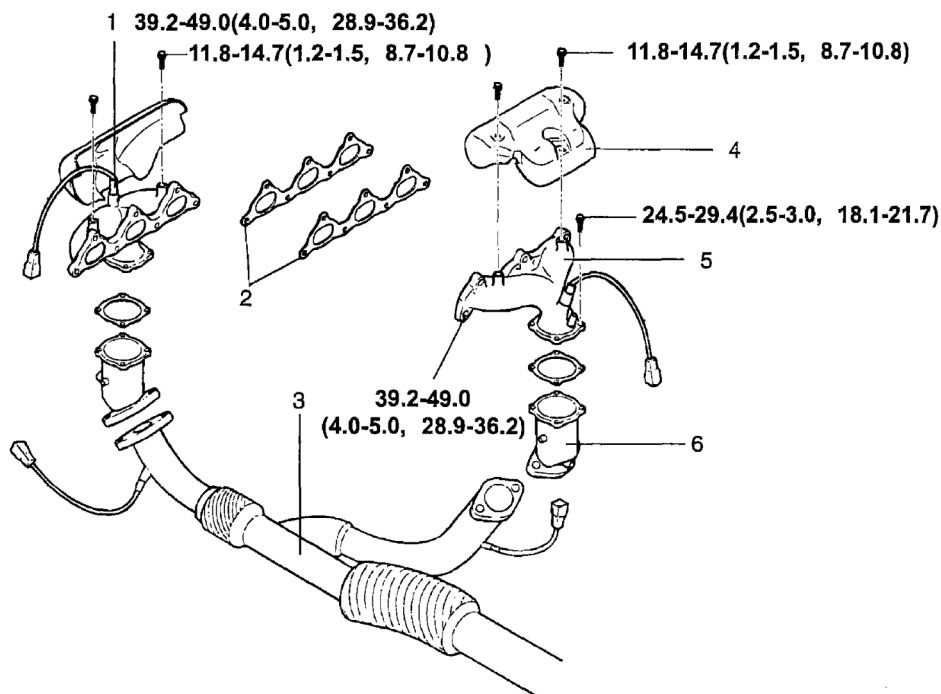


G00325676

Fig. 160: Lower Oil Pan Tighten Sequence
Courtesy of KIA MOTORS AMERICA, INC.

INTAKE AND EXHAUST SYSTEM

EXHAUST MANIFOLD



TORQUE : Nm (kg. m, lb.ft)

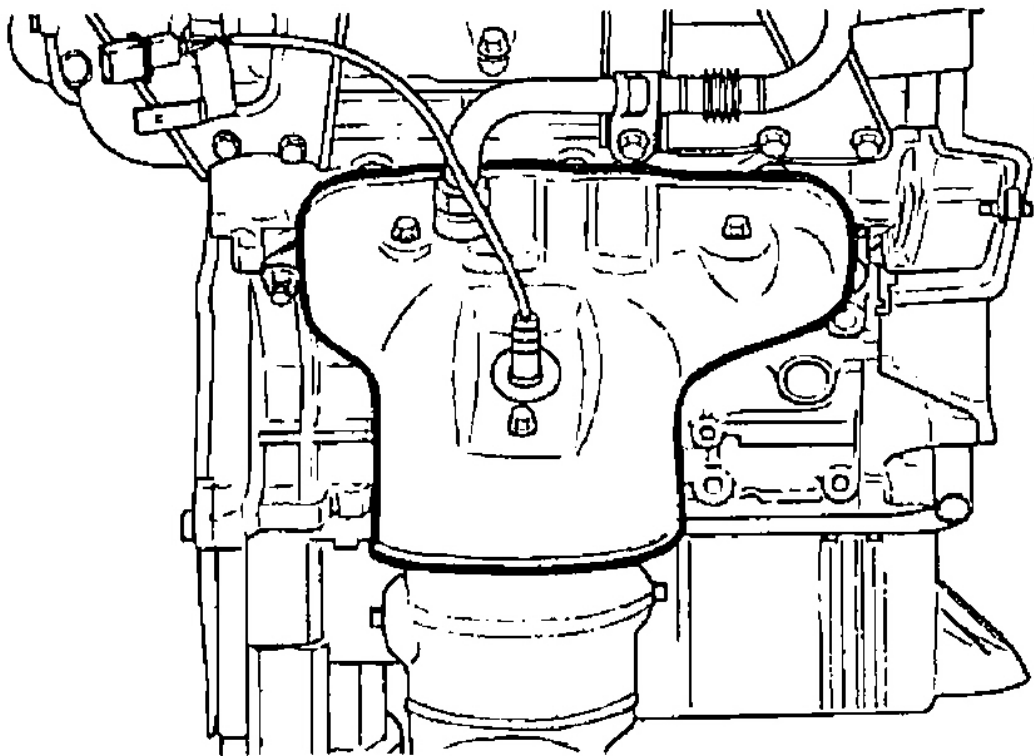
- | | |
|---|--------------------------------------|
| 1. O ₂ sensor | 4. Heat protector |
| 2. Gasket | 5. Exhaust manifold |
| 3. Front muffler assembly
(Front pipe and underbody
catalyst converter) | 6. MCC (Manifold Catalyst converter) |

G00325677

Fig. 161: Identifying Exhaust Manifold Components
 Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

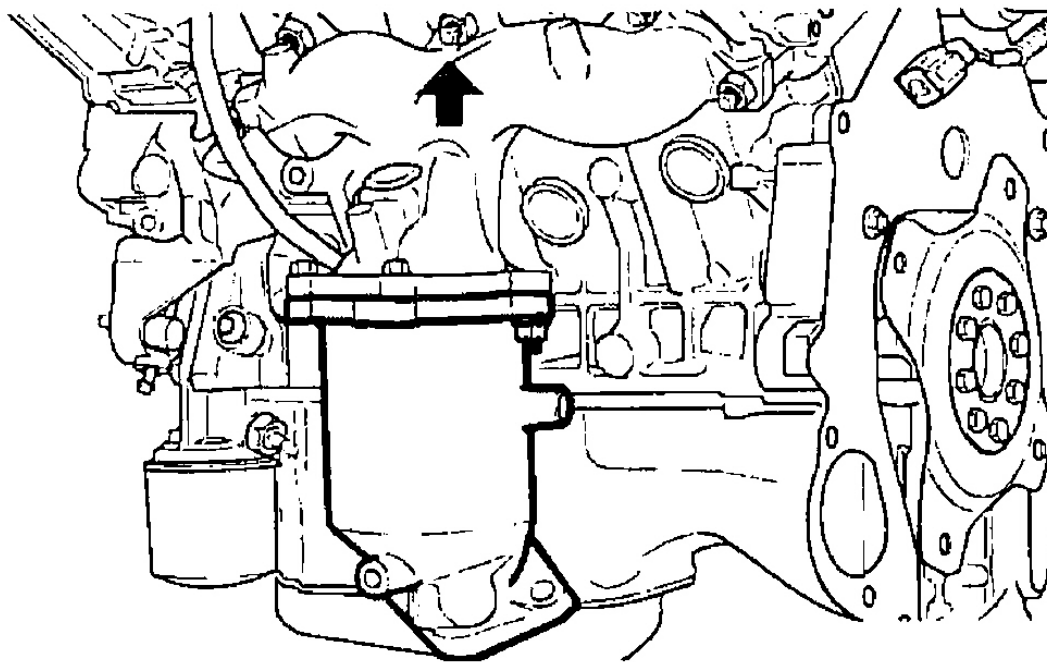
1. Remove the heat protector.



G00325678

Fig. 162: Removing Heat Protector
Courtesy of KIA MOTORS AMERICA, INC.

2. Remove the EGR pipe (RH manifold).
3. Remove the exhaust manifold.



G00325679

Fig. 163: Removing Exhaust Manifold
Courtesy of KIA MOTORS AMERICA, INC.

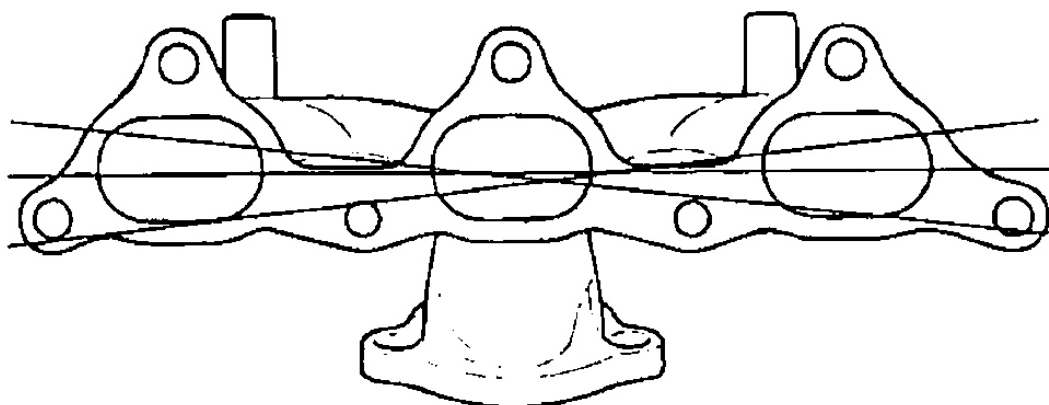
4. Remove the exhaust manifold gasket.

INSPECTION

1. Check for damage or cracks.
2. Using a straight edge and feeler gauge, check for distortion on the cylinder head matching surface.

Standard value : 0.15 mm (0.006 in.) or less

Service limit : 0.3 mm (0.012 in.) or less



G00325680

Fig. 164: Measuring Exhaust Manifold Flatness
Courtesy of KIA MOTORS AMERICA, INC.

3. Check the exhaust manifold for damage and cracks.

INSTALLATION

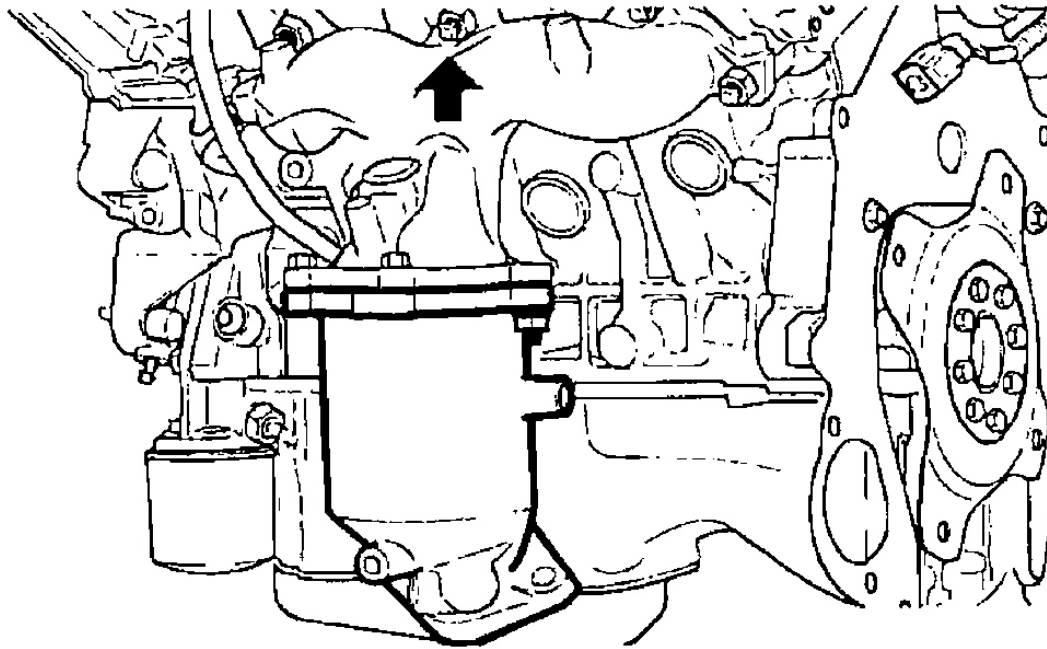
1. Install the exhaust manifold with gasket.

Tightening torque

Exhaust manifold :

39.2-49.0 N.m (4.0-5.0 kg.m, 28.9-36.2 lb.ft)

NOTE: Do not re - use an exhaust manifold gasket.



G00325681

Fig. 165: Installing Exhaust Manifold
Courtesy of KIA MOTORS AMERICA, INC.

2. Install the EGR pipe.

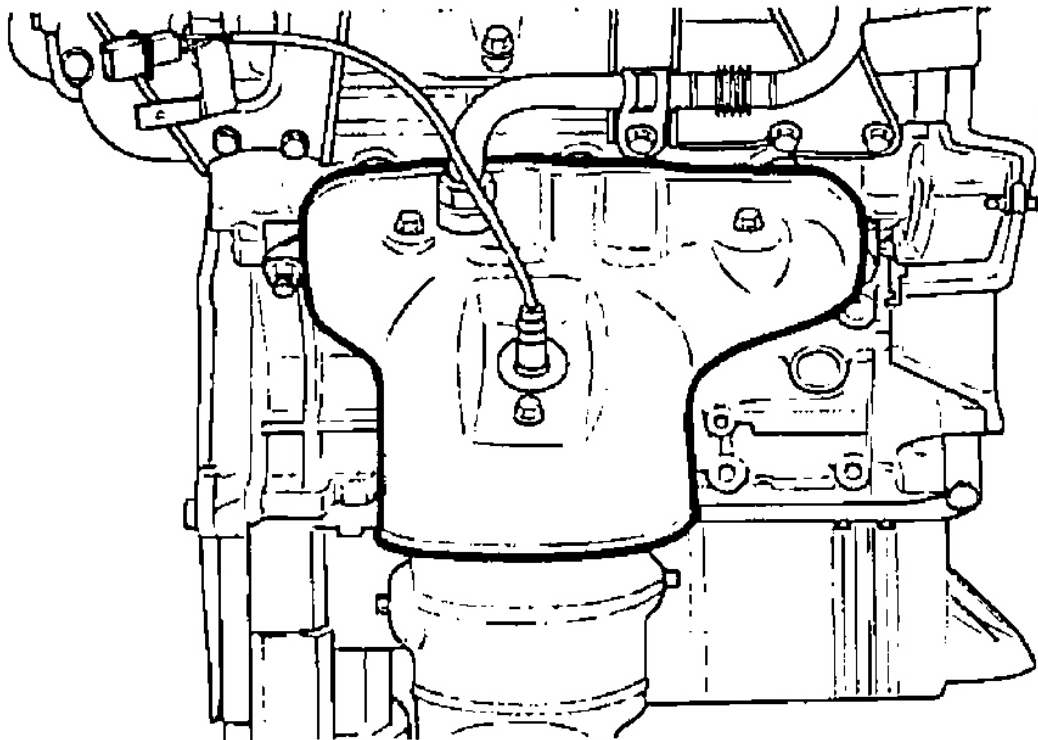
Tightening torque :

49.0-68.6 Nm (5-7 kg.m, 36.2-50.6 lb.ft)

3. Install the heat protector.

Tightening torque :

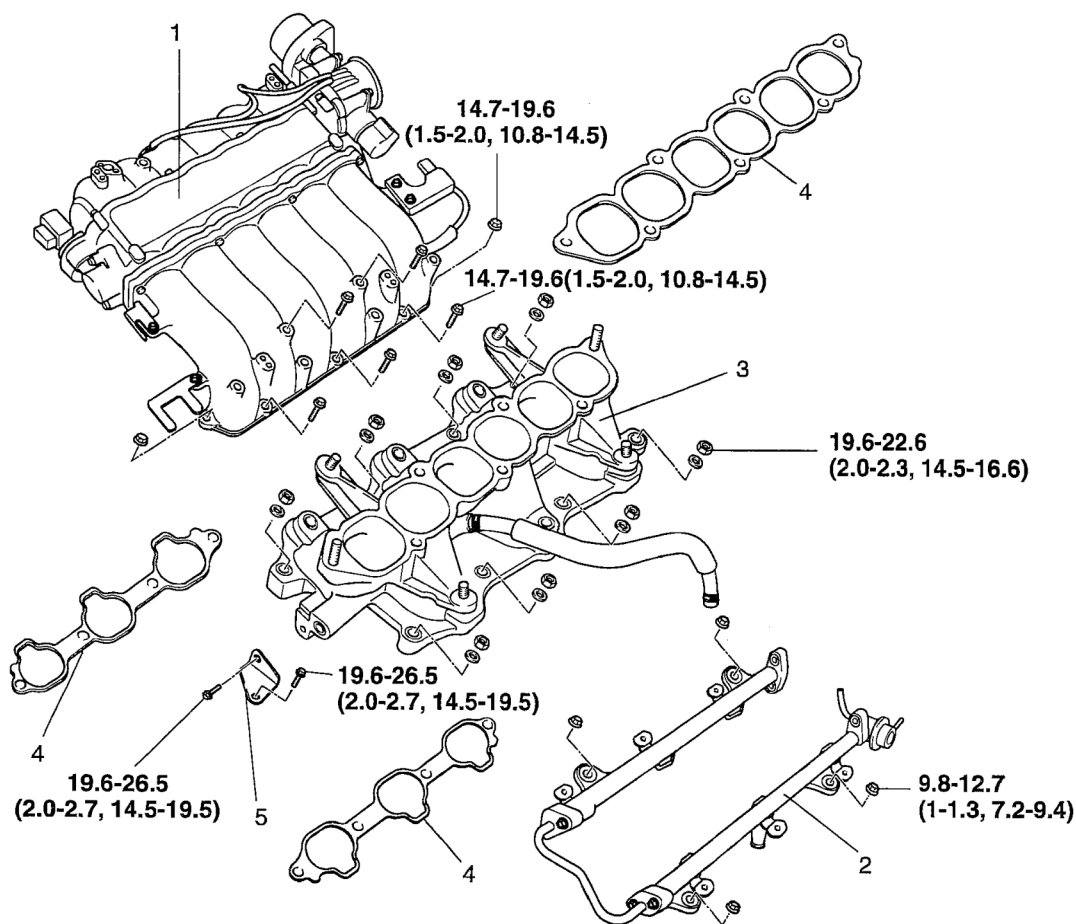
11.8-14.7 Nm (1.2-1.5 kg.m, 8.7-10.8 lb.ft)



G00325682

Fig. 166: Installing Heat Protector
Courtesy of KIA MOTORS AMERICA, INC.

INTAKE MANIFOLD



TORQUE : N·m (kg·m, lb·ft)

- 1. Surge tank assembly
- 2. Delivery pipe
- 3. Intake manifold

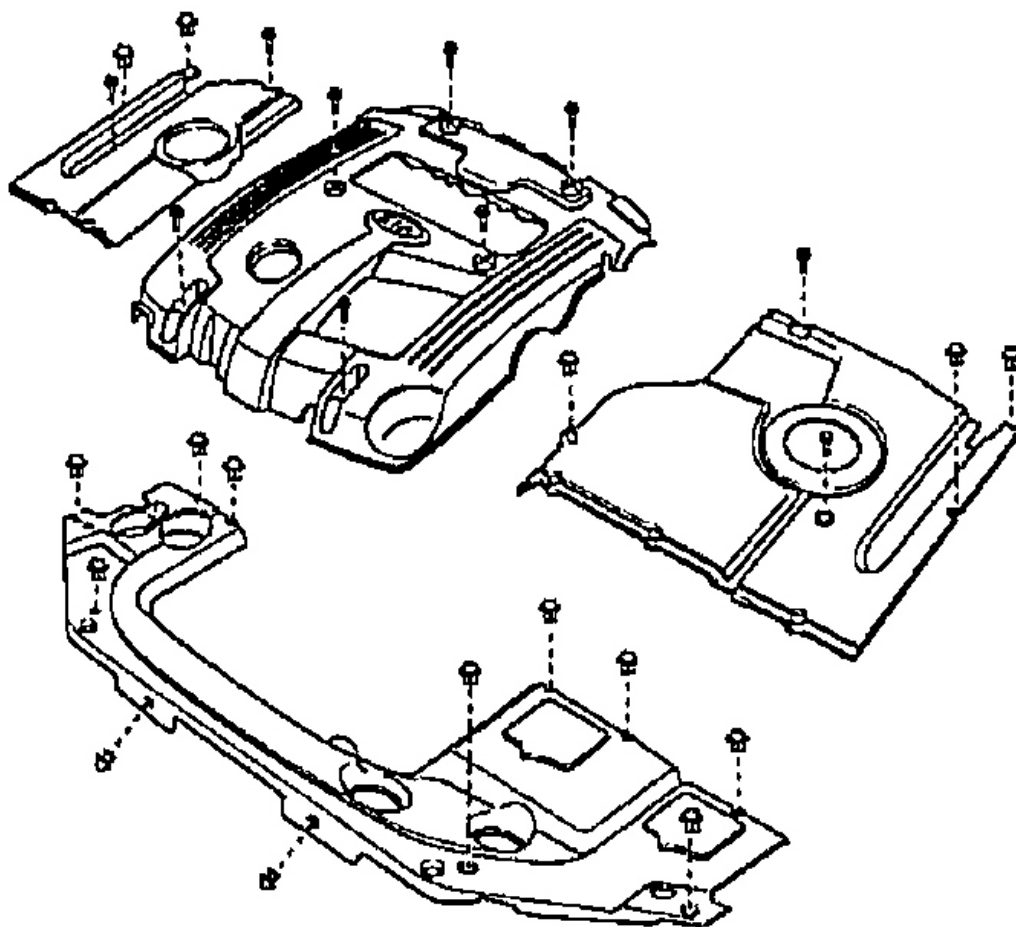
- 4. Gasket
- 5. Water pump bracket

G00325683

Fig. 167: Identifying Intake Manifold Components
Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

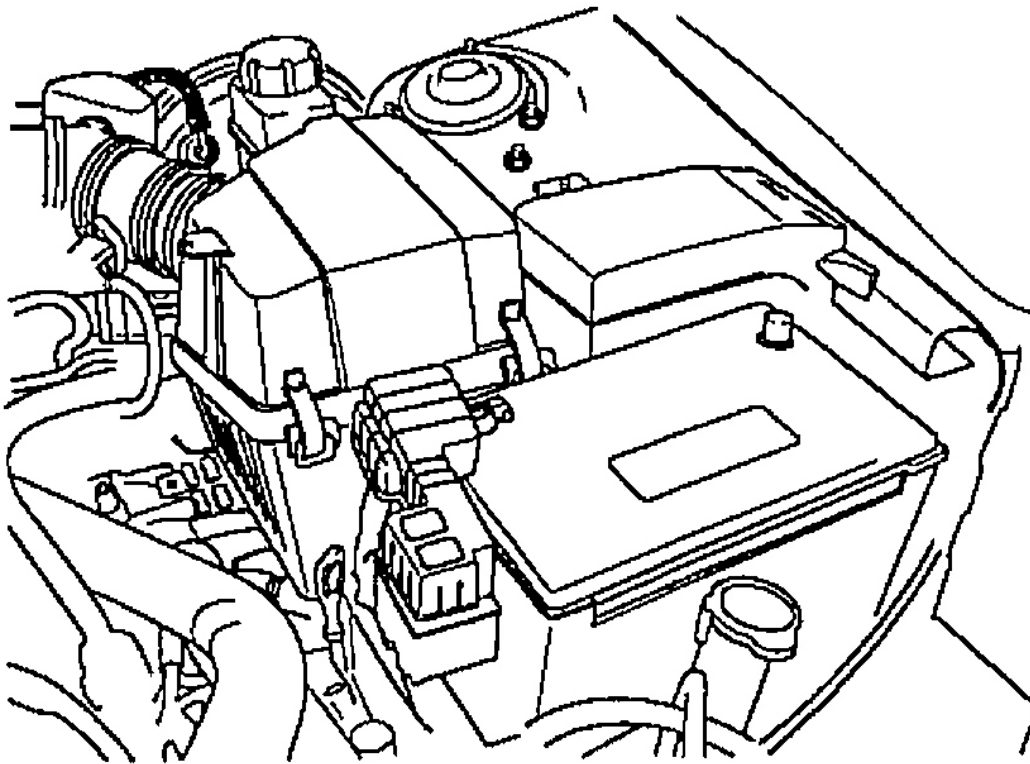
1. Remove the engine cover.



G00325684

Fig. 168: Removing Engine Cover
 Courtesy of KIA MOTORS AMERICA, INC.

2. Disconnect the battery terminal.

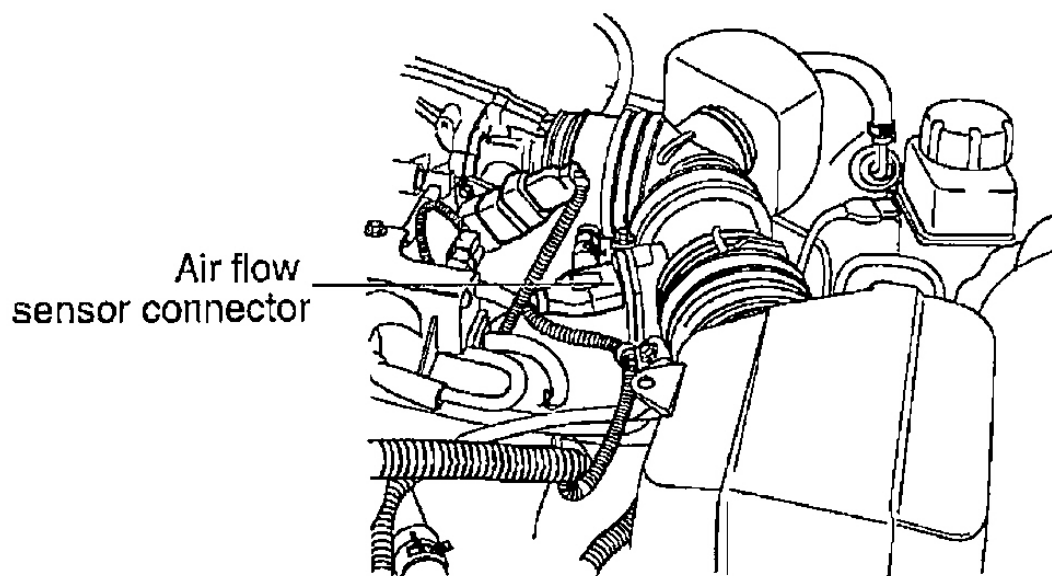


G00325685

Fig. 169: Disconnecting Battery

Courtesy of KIA MOTORS AMERICA, INC.

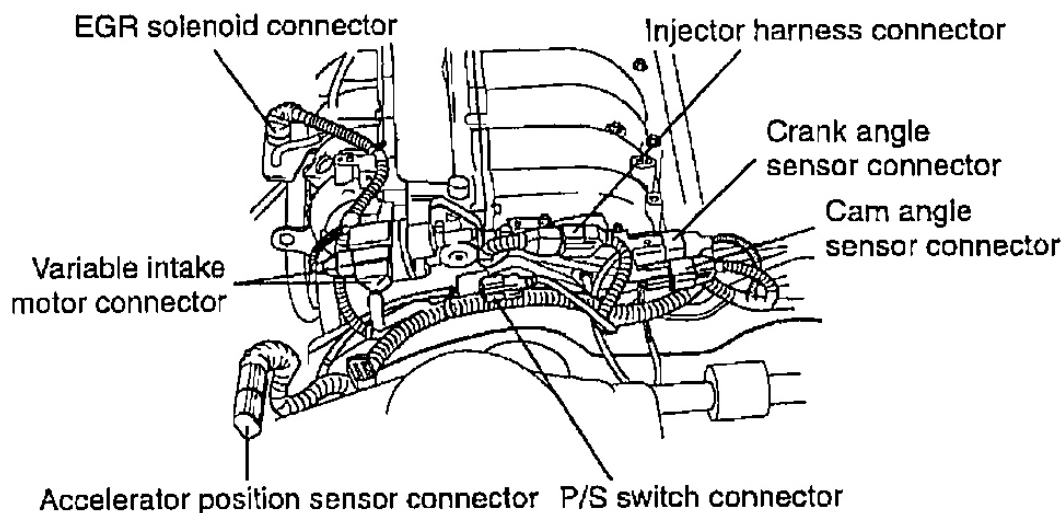
3. Disconnect the air flow sensor connector and the vacuum hose from the air intake hose.



G00325686

Fig. 170: Disconnecting Air Flow Sensor & Vacuum Hose
Courtesy of KIA MOTORS AMERICA, INC.

4. Remove the air cleaner assembly after removing the air intake hose clamp and fixing bolt (3ea).
5. Disconnect the crank angle sensor connector, the cam angle sensor connector, the injector harness connector, the power steering switch connector, the variable intake motor connector (2ea), the accelerator position sensor connector and the EGR solenoid connector.



G00325687

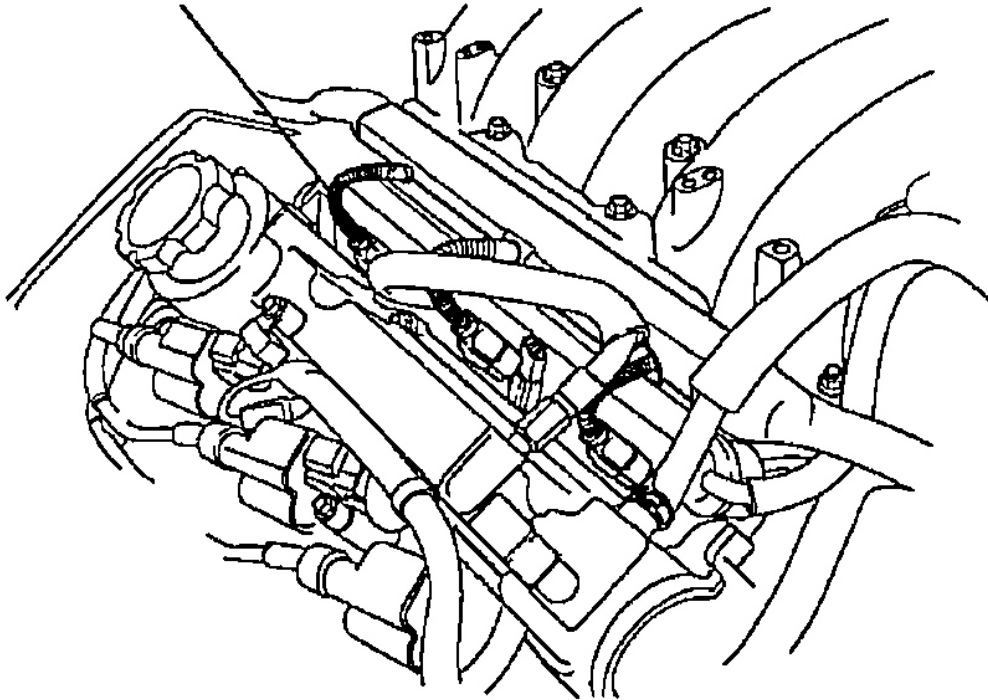
Fig. 171: Disconnecting Engine Sensors and Injector Harness

Courtesy of KIA MOTORS AMERICA, INC.

6. Disconnect the injector connector after removing the injector harness bracket bolt (2ea).

CAUTION: When disconnect the injector connector, lift the fuel delivery pipe and injector assembly upward appropriately. At this time unscrew the mounting bolt to lift the fuel delivery pipe. Reinstall the delivery pipe and injector assembly.

Injector connector



G00325688

Fig. 172: Disconnecting Injector Connector
Courtesy of KIA MOTORS AMERICA, INC.

7. Disconnect the throttle position sensor connector, the ETS (Electronic throttle system) motor connector, the limp-home connector and the purge solenoid valve connector.

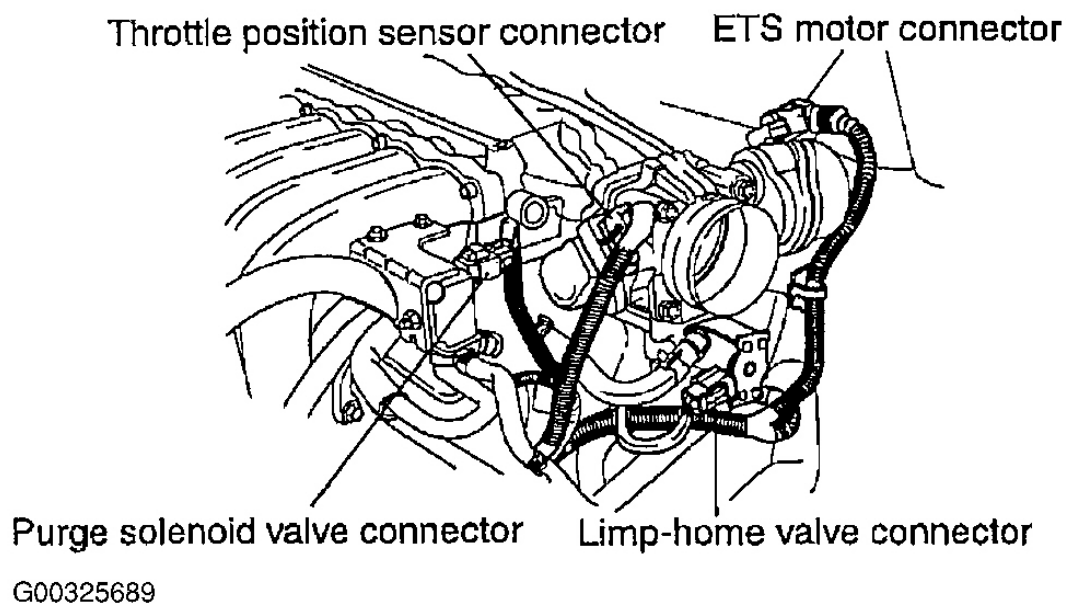
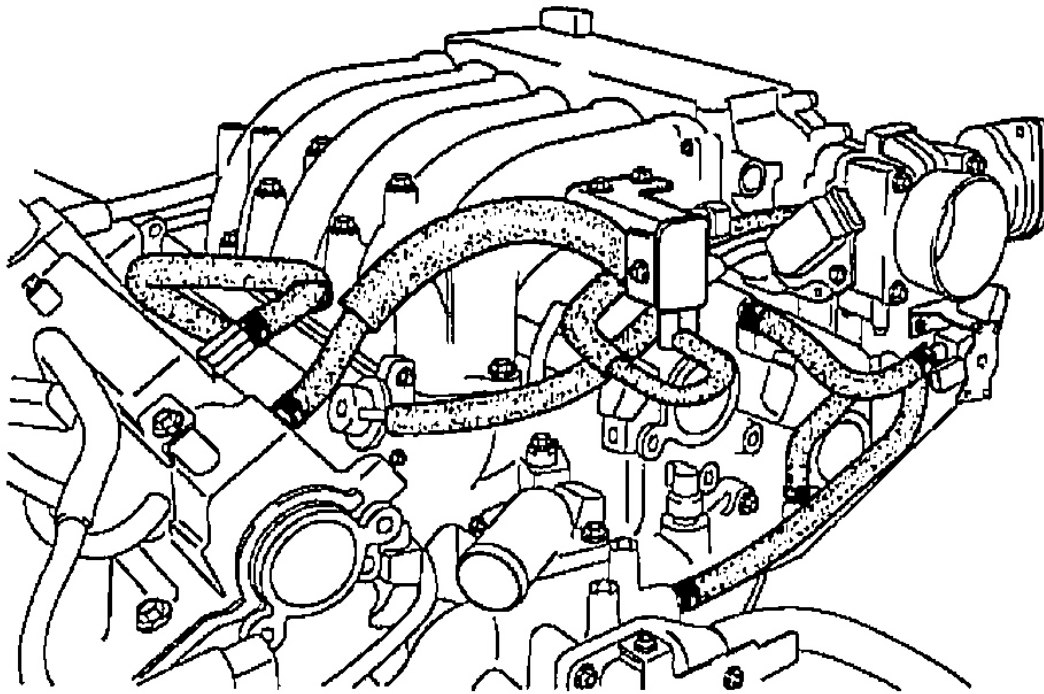


Fig. 173: Disconnecting Throttle & Purge Solenoid Valve
Courtesy of KIA MOTORS AMERICA, INC.

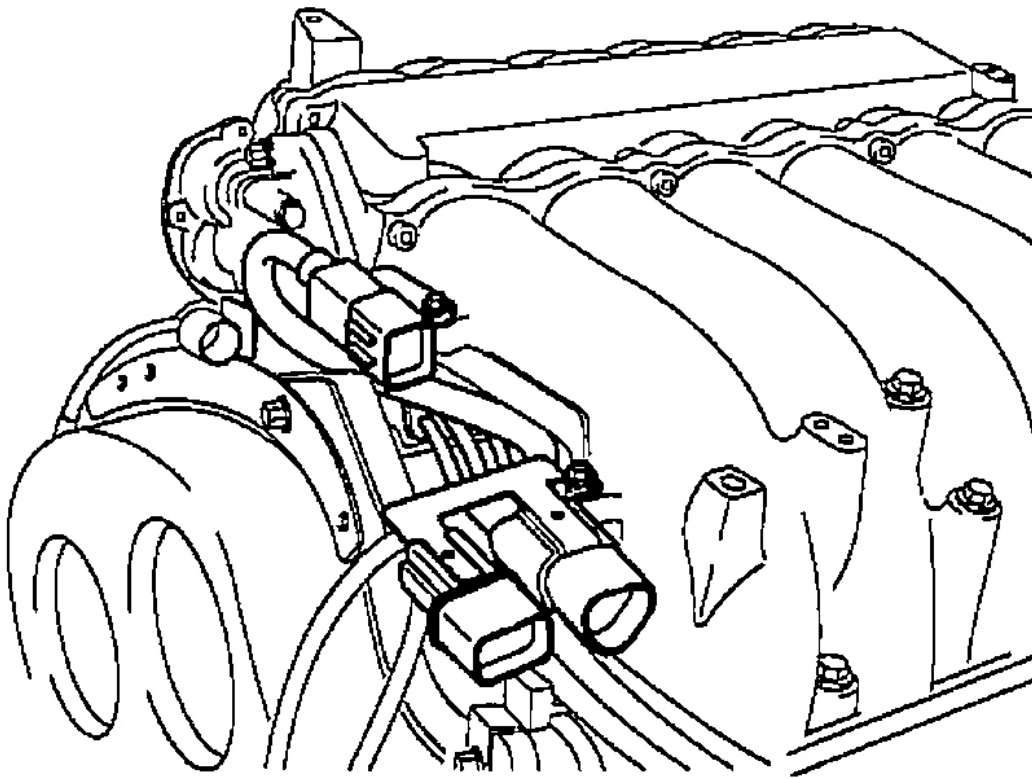
8. Disconnect the vacuum hoses between the cylinder head cover and the intake manifold. Disconnect the fuel pressure regulator vacuum hose, the purge control solenoid valve hose and the throttle body heater hose.



G00325690

Fig. 174: Disconnecting Vacuum Hoses
Courtesy of KIA MOTORS AMERICA, INC.

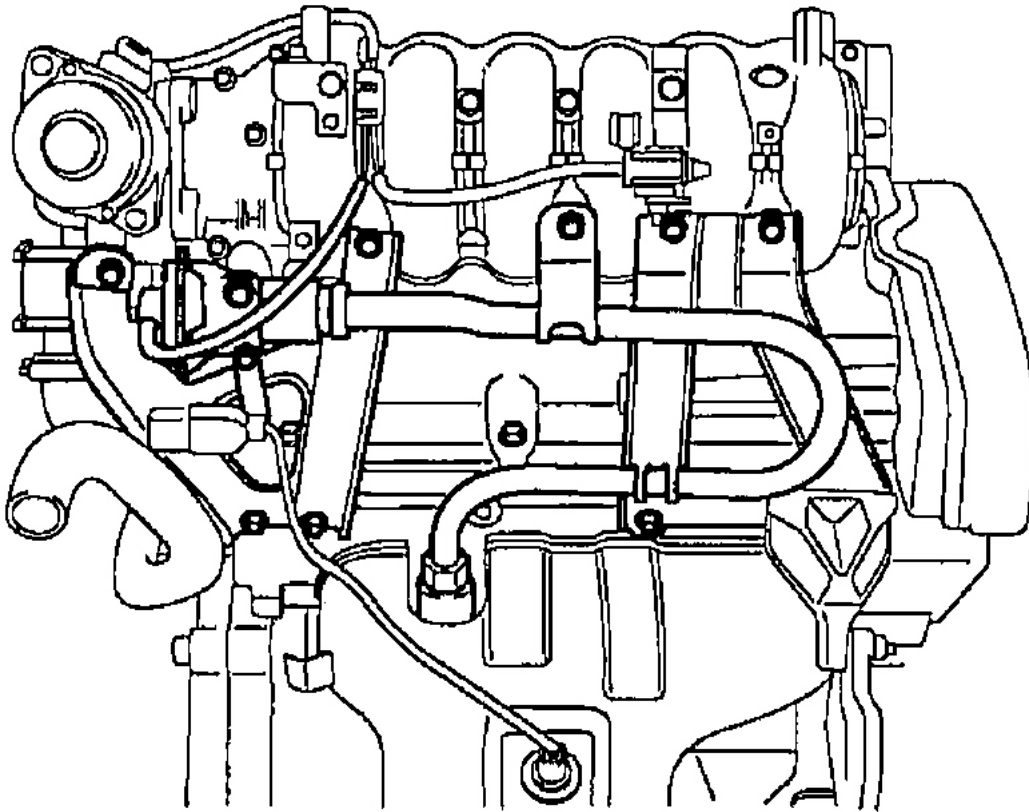
9. Remove the bracket of the injector harness connector, the crank angle sensor connector and the cam angle sensor connector.



G00325691

Fig. 175: Removing Injector Bracket & Crankshaft/Camshaft Sensor Connectors
Courtesy of KIA MOTORS AMERICA, INC.

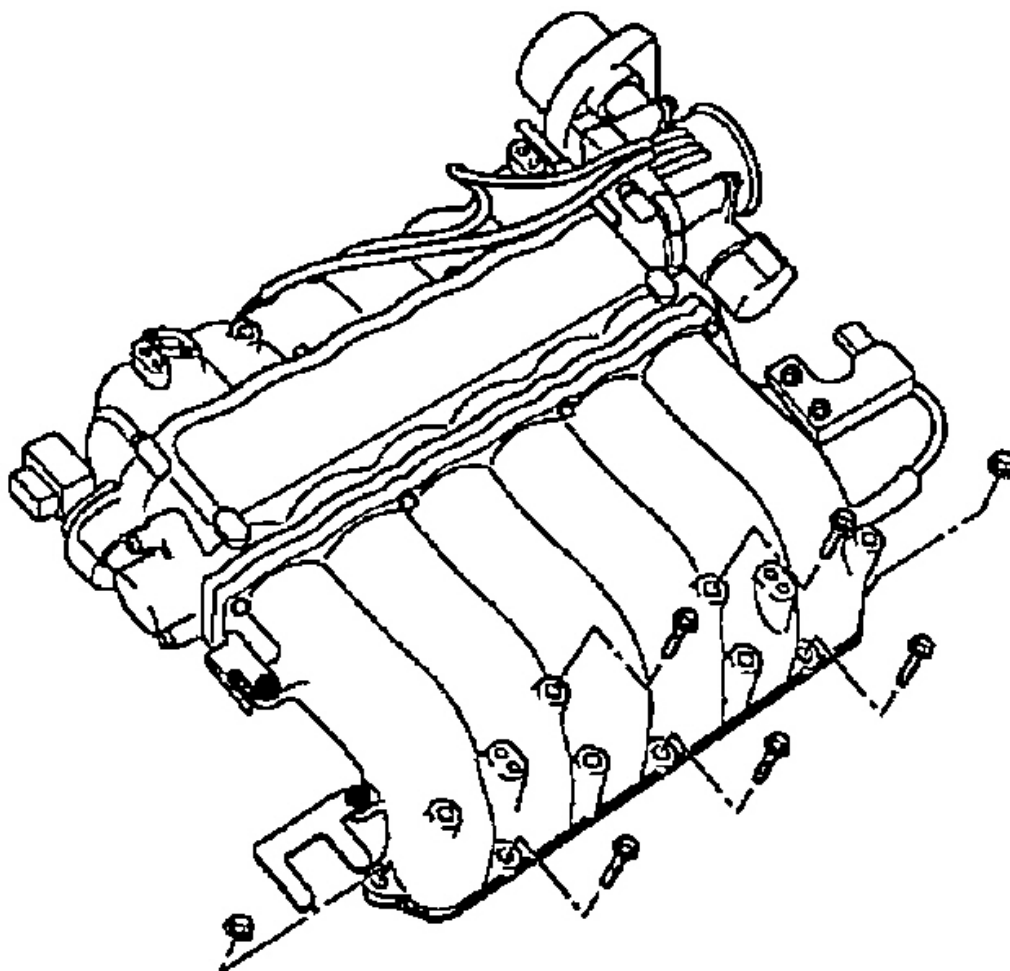
10. Remove the EGR valve hose, the EGR valve mounting bolts, the EGR pipe fixing bracket bolt and the surge tank stay mounting bolts.



G00325692

Fig. 176: Removing EGR Valve Hose, Mounting Bolts, Pipe Bracket & Surge Tank Stay
Courtesy of KIA MOTORS AMERICA, INC.

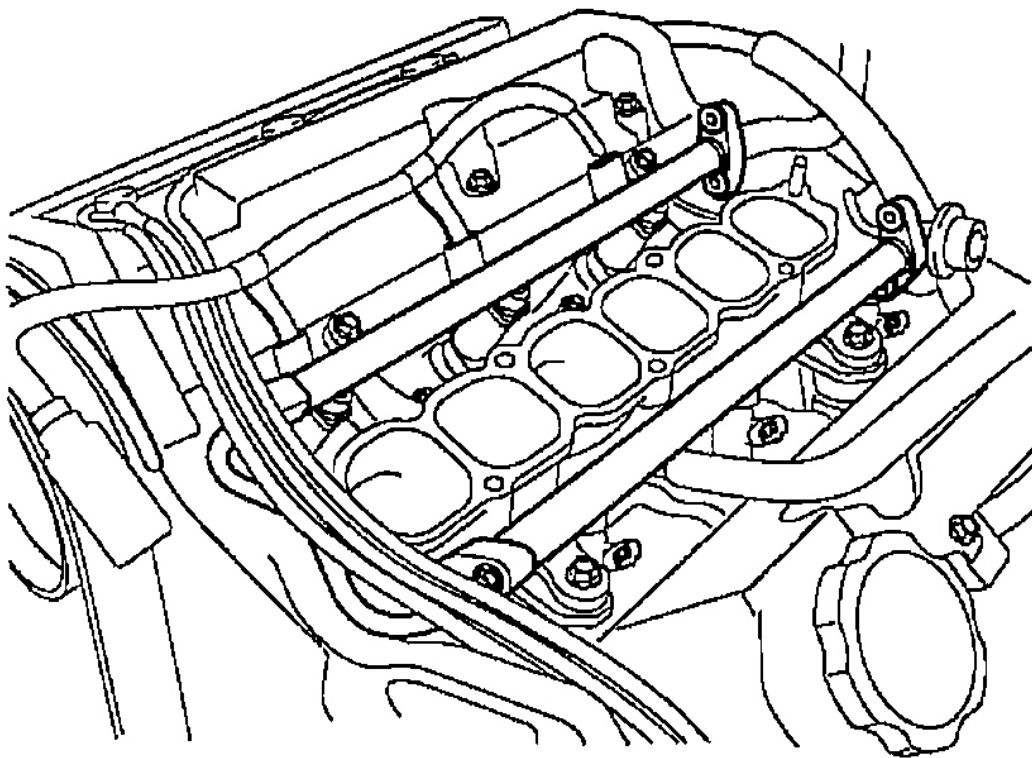
11. Remove the surge tank assembly after unscrewing the surge tank mounting bolts and nuts.



G00325693

Fig. 177: Removing Surge Tank Assembly
Courtesy of KIA MOTORS AMERICA, INC.

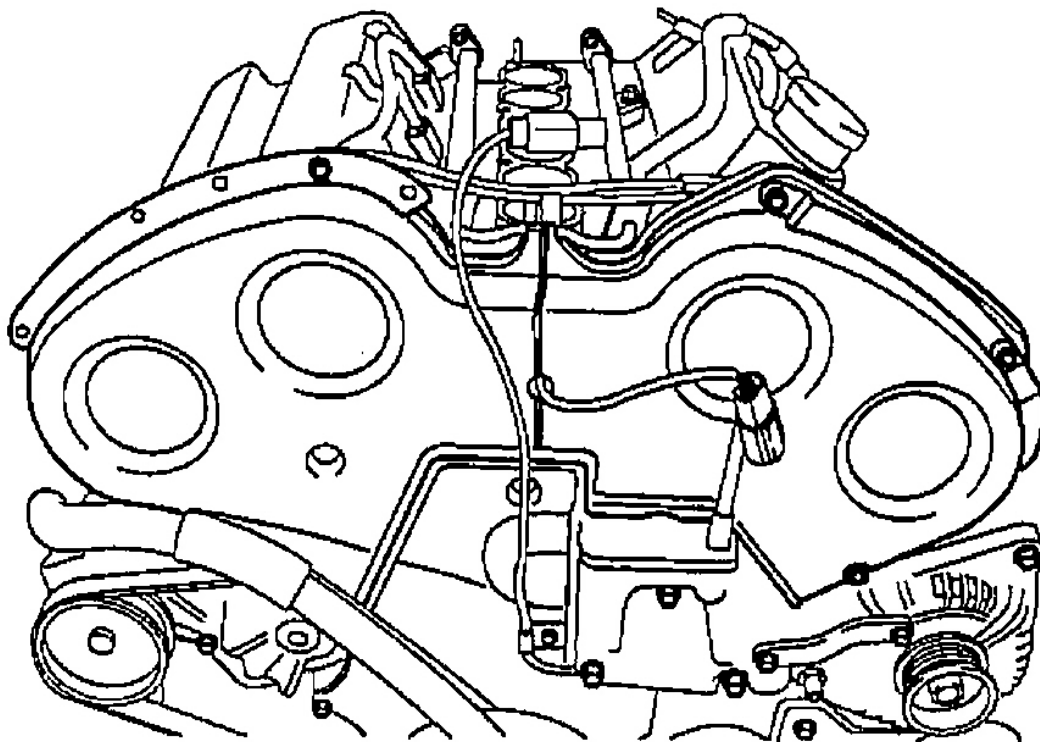
12. Remove the delivery pipe and injector assembly after unscrewing bolts.



G00325694

Fig. 178: Removing Delivery Pipe
Courtesy of KIA MOTORS AMERICA, INC.

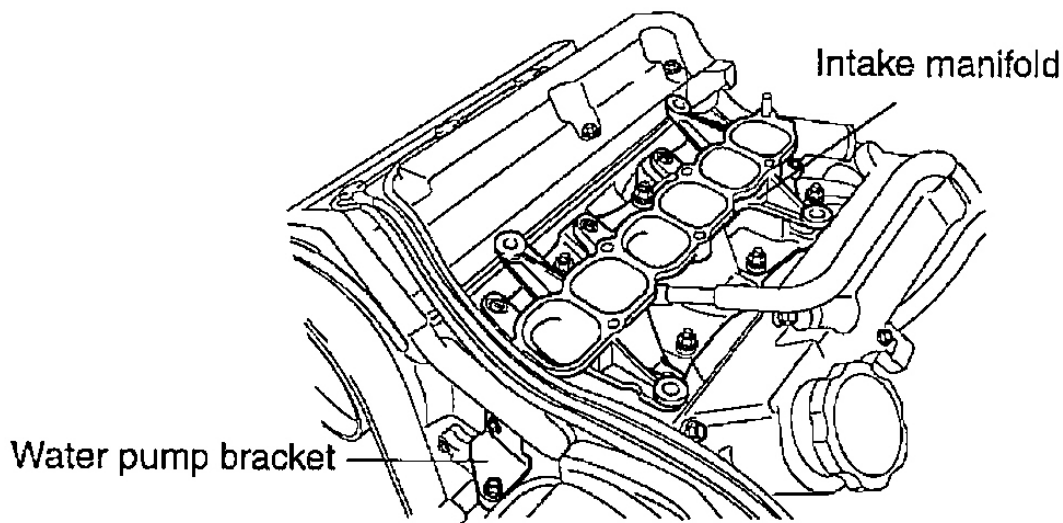
13. Remove the timing belt cover.



G00325695

Fig. 179: Removing Timing Belt Cover
Courtesy of KIA MOTORS AMERICA, INC.

14. Remove the water pump bracket mounting bolts and the intake manifold mounting nuts.



G00325696

Fig. 180: Removing Water Pump Bracket Mounting Bolts & Intake Manifold Mounting Nuts
Courtesy of KIA MOTORS AMERICA, INC.

15. Remove the intake manifold.

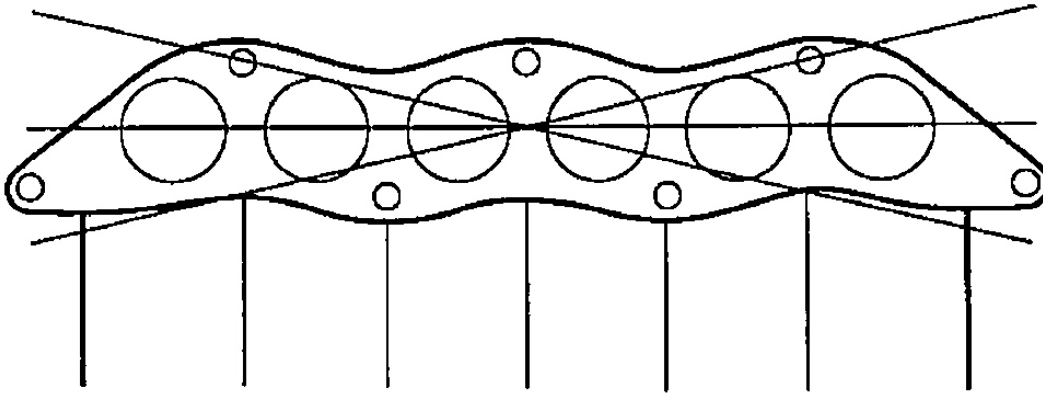
INSPECTION

SURGE TANK AND INTAKE MANIFOLD

1. Check the surge tank and intake manifold for damage, cranking or restriction of the vacuum outlet port, water or gas passages.
2. Check for distortion on the surface using a straight edge and feeler gauge.

Standard value : 0.15mm (0.006in) or less

Service limit : 0.2mm (0.0078in)



G00325697

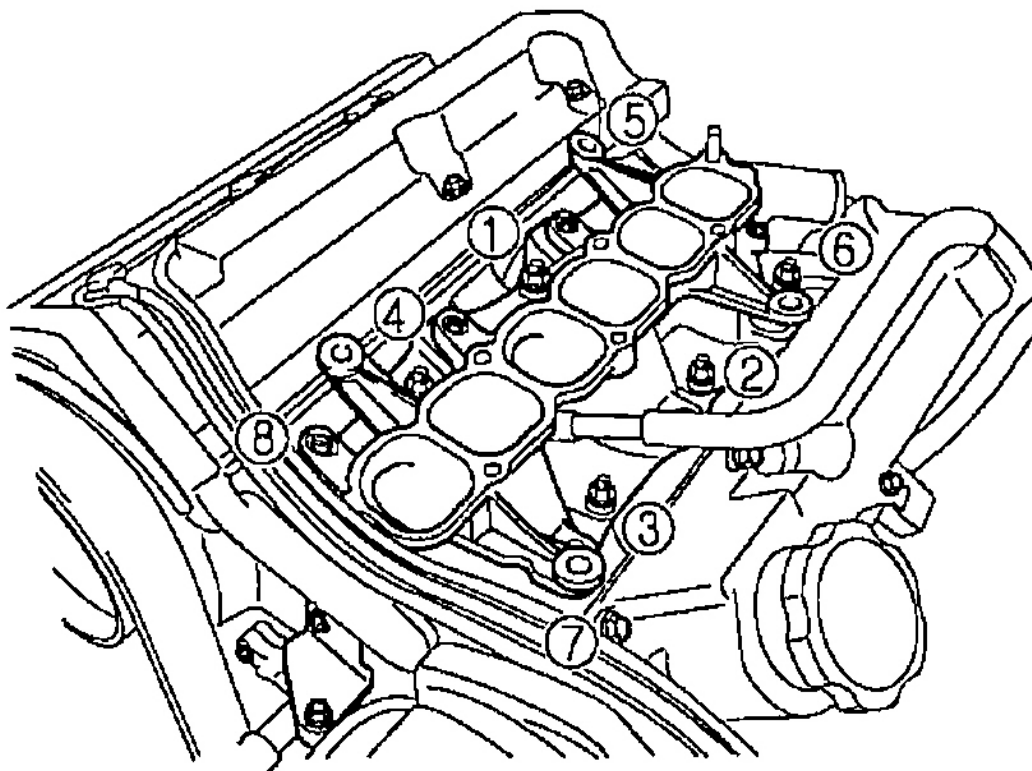
Fig. 181: Measuring Intake Manifold Flatness
Courtesy of KIA MOTORS AMERICA, INC.

INSTALLATION

1. Install the intake manifold with new gasket and tighten nuts in order as shown in figure.

Tightening torque:

19.6~22.6 N-m (2.0~2.3 kg-m, 14.5~16.6 lb-ft)



G00325698

Fig. 182: Intake Manifold Tightening Sequence
Courtesy of KIA MOTORS AMERICA, INC.

2. Install the water pump bracket.

Tightening torque:

19.6~26.5 N-m (2.0~2.7 kg-m, 14.5~19.5 lb-ft)

3. Install the timing belt covers.

Tightening torque:

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

4. Install the delivery pipe and injector assembly.

Tightening torque:

9.8~12.7 N-m (1.0~1.3 kg-m, 7.2~9.4 lb-ft)

5. Install the surge tank assembly.

Tightening torque:

14.7~19.6 N-m (1.5~2.0 kg-m, 10.8~14.5 lb-ft)

6. Install the EGR valve hose, the EGR valve mounting bolts, the EGR pipe fixing bracket bolt and the surge tank stay mounting bolts.

Tightening torque:

Surge tank stay :

14.7~19.6 N-m (1.5~2.0 kg-m, 10.8~14.5 lb-ft)

EGR pipe bracket :

14.7~19.6 N-m (1.5~2.0 kg-m, 10.8~14.5 lb-ft)

EGR valve :

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

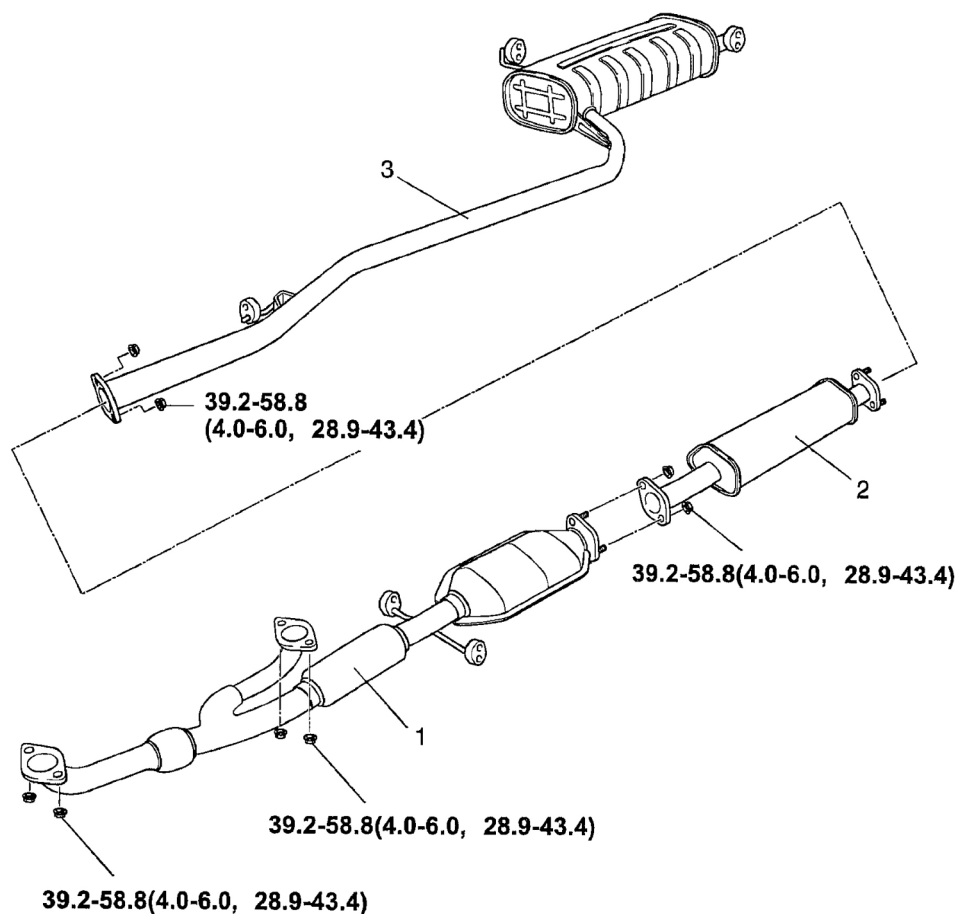
7. Install the bracket of the injector harness connector, the crank angle sensor connector and the cam angle sensor connector.
8. Reconnect the vacuum hoses between the cylinder head cover and the intake manifold. Reconnect the fuel pressure regulator vacuum hose, the purge control solenoid valve hose and the throttle body heater hose.
9. Reconnect the throttle position sensor connector, the ETS (Electronic throttle system) motor connector, the limp-home connector and the purge solenoid valve connector.
10. Reconnect the crank angle sensor connector, the cam angle sensor connector, the injector harness connector, the power steering switch connector, the variable intake motor connector (2ea), the accelerator position sensor connector, the EGR solenoid connector and the injector connector.
11. Install the air cleaner assembly bolt (3ea).

Tightening torque:

7.8~9.8 N-m (0.8~1.0 kg-m, 5.8~7.2 lb-ft)

12. Reconnect the air flow sensor connector and the vacuum hose to the air intake hose. And then clamp the hose with the air hose clamp.
13. Reconnect the battery terminal.
14. Install the engine cover.

MUFFLER



TORQUE : N·m (kg·m, lb·ft)

- | | |
|---|-------------------|
| 1. Front muffler assembly
(Front pipe and Underbody catalyzer converter) | 2. Center muffler |
| | 3. Main muffler |

G00325699

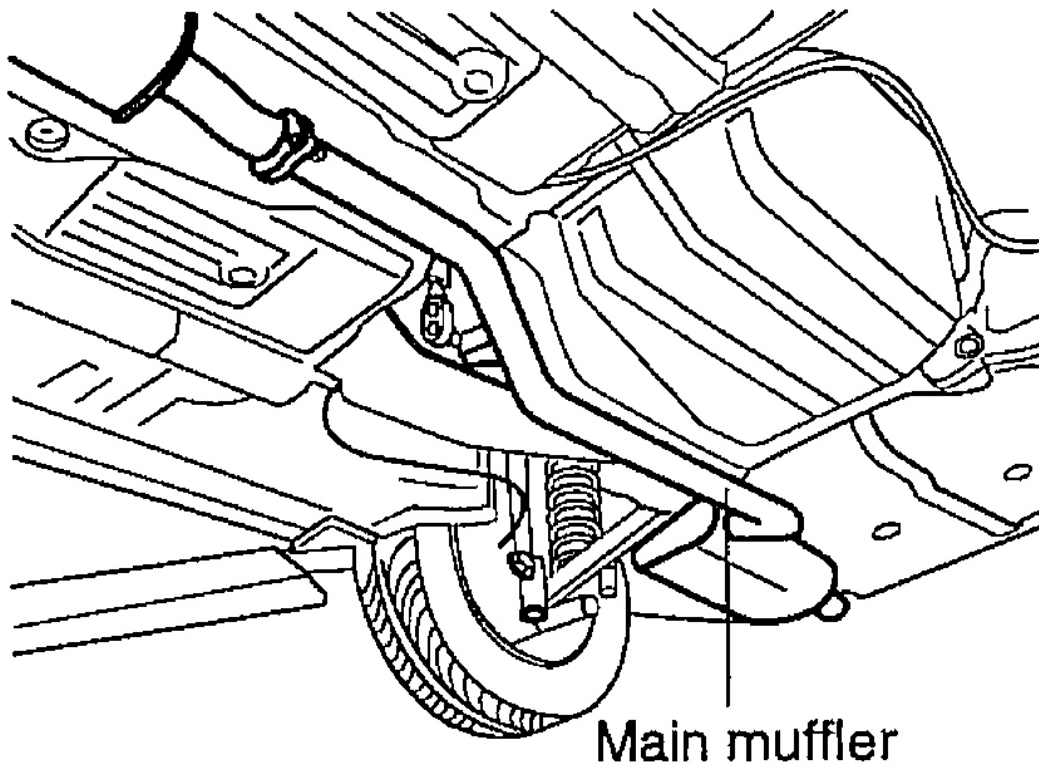
Fig. 183: Identifying Exhaust System Components
Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

MAIN MUFFLER

CAUTION: Before removing or inspecting the exhaust system, ensure that the exhaust system is cool.

1. Remove nuts between the main muffler and the center muffler.



G00325700

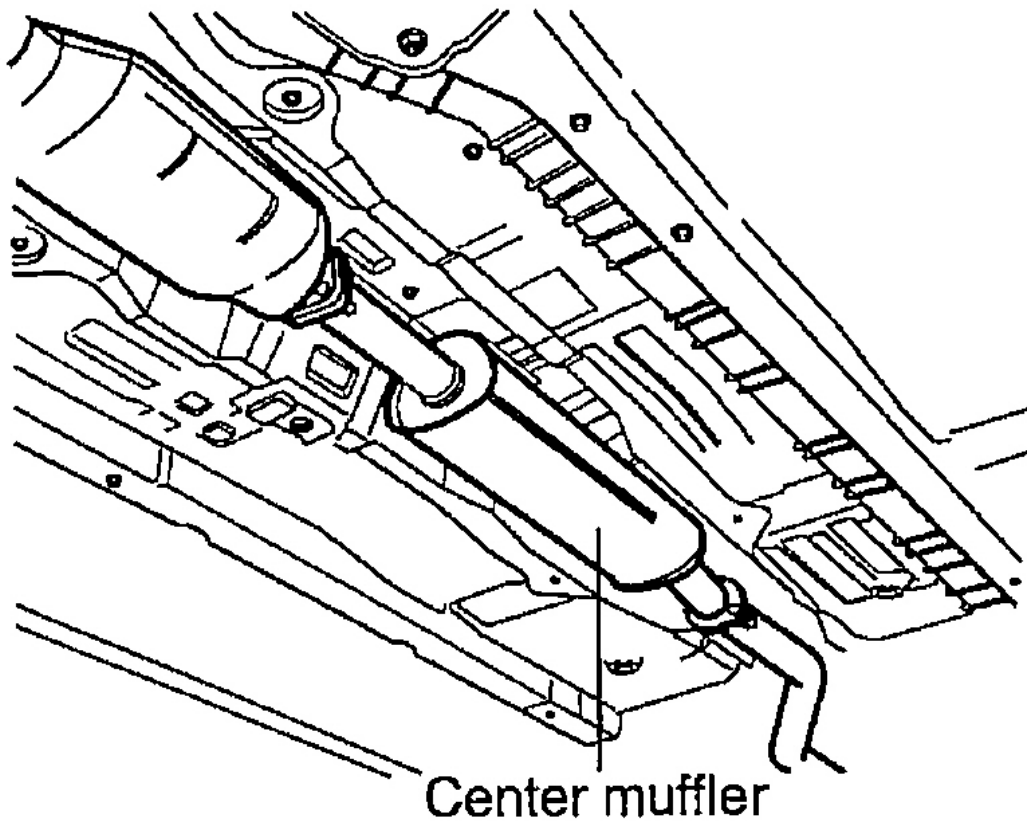
Fig. 184: Identifying Main Muffler

Courtesy of KIA MOTORS AMERICA, INC.

2. Remove the main muffler after removing rubber hanger.

CENTER MUFFLER

1. Remove nuts between the main muffler and the center muffler.



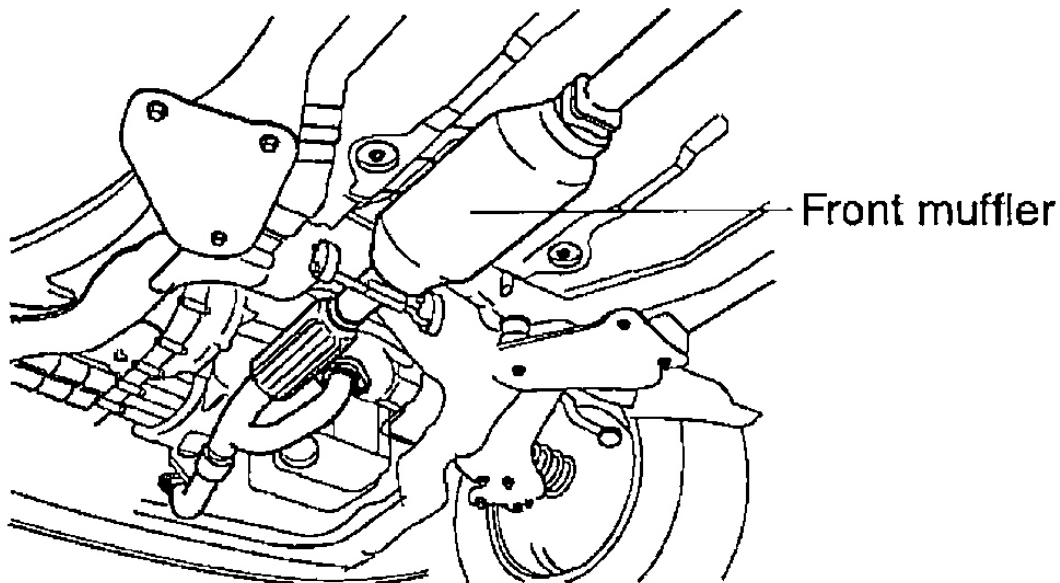
G00325701

Fig. 185: Identifying Center Muffler
Courtesy of KIA MOTORS AMERICA, INC.

2. Remove nuts between the front muffler and the center muffler. And then remove the center muffler.

FRONT MUFFLER

1. Remove nuts between the front muffler and the center muffler.



G00325702

Fig. 186: Identifying Front Muffler

Courtesy of KIA MOTORS AMERICA, INC.

2. Remove nuts between the front muffler and the catalytic converter.
3. Remove the front muffler after removing rubber hanger.

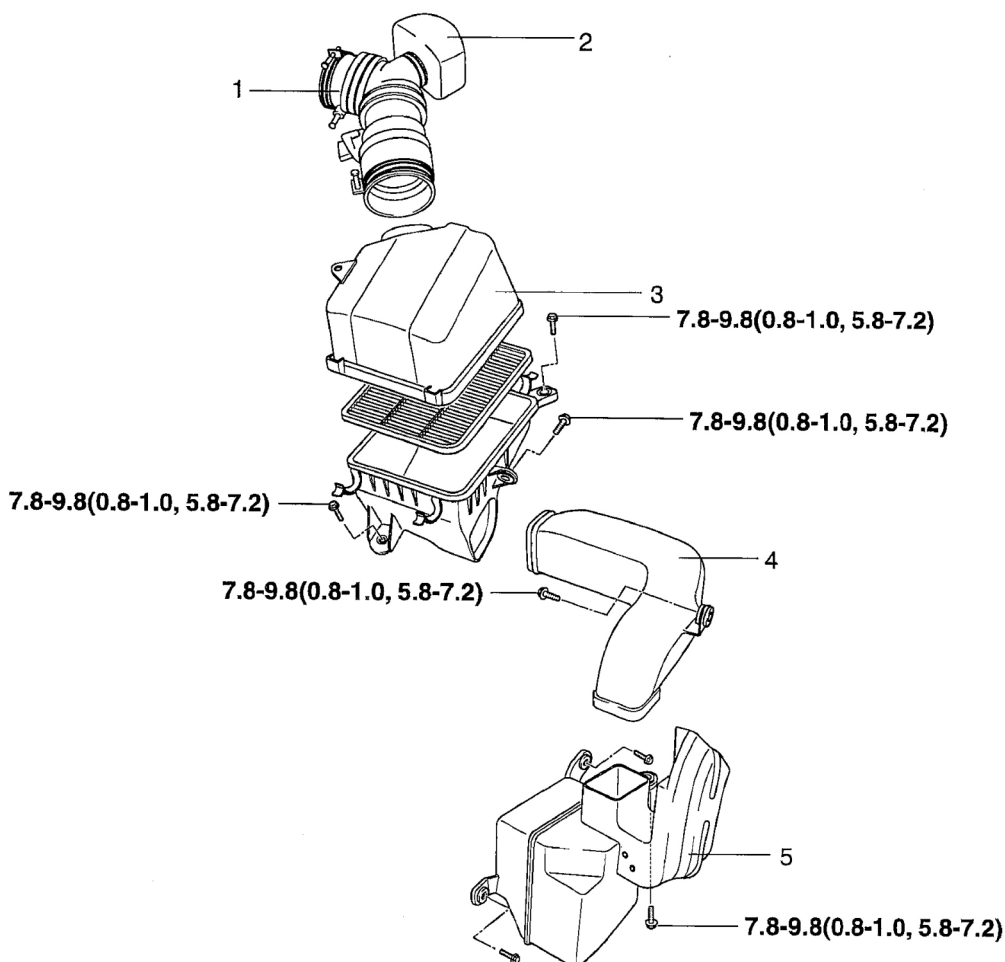
INSPECTION

1. Check the mufflers and pipes for leaks, corrosion and damage.
2. Check the rubber hangers for deterioration and cracks.

INSTALLATION

1. Temporarily install the front muffler, the center muffler and main muffler in this order.
2. Install the rubber hangers so that they hang equally left and right.
3. Tighten the parts securely and then confirm that there is no interference with any components.

AIR CLEANER (ACL)



TORQUE : N·m (kg·m, lb·ft)

- 1. Air intake hose
- 2. Resonator
- 3. Air cleaner assembly

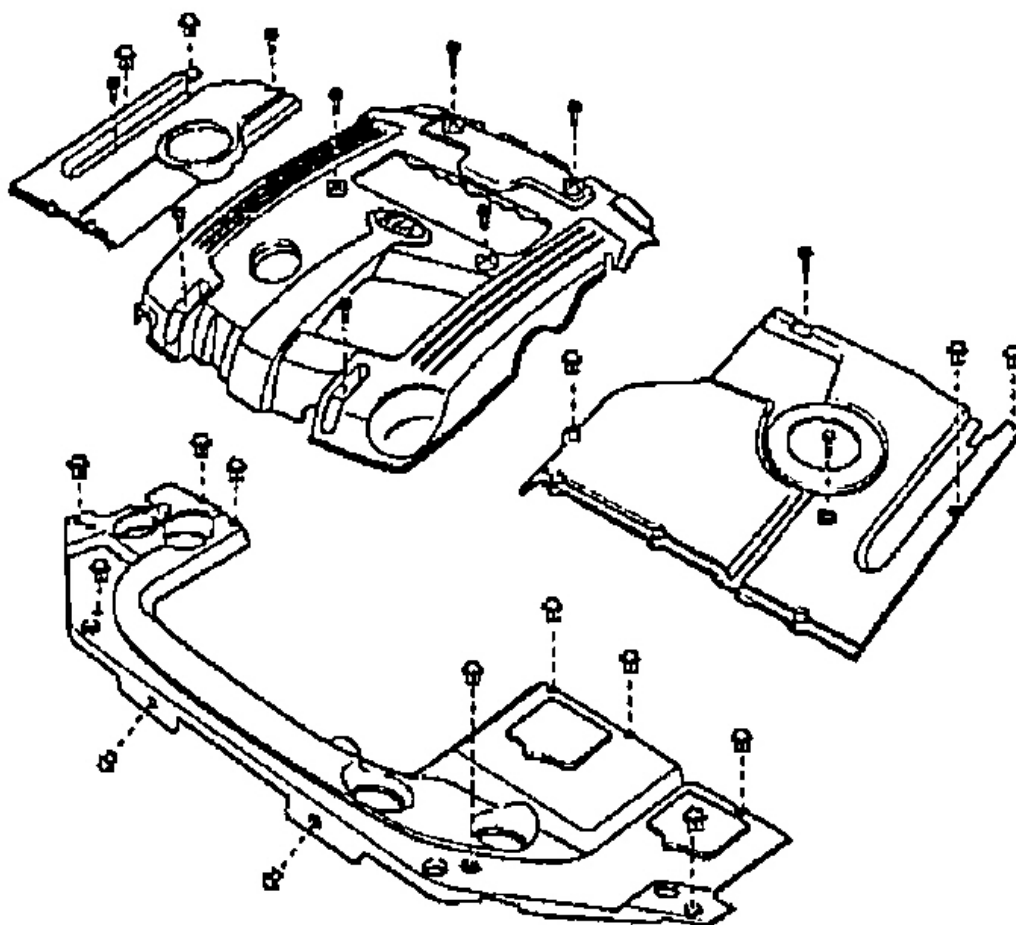
- 4. Air duct
- 5. Extension duct

G00325703

Fig. 187: Identifying Air Cleaner Components
Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

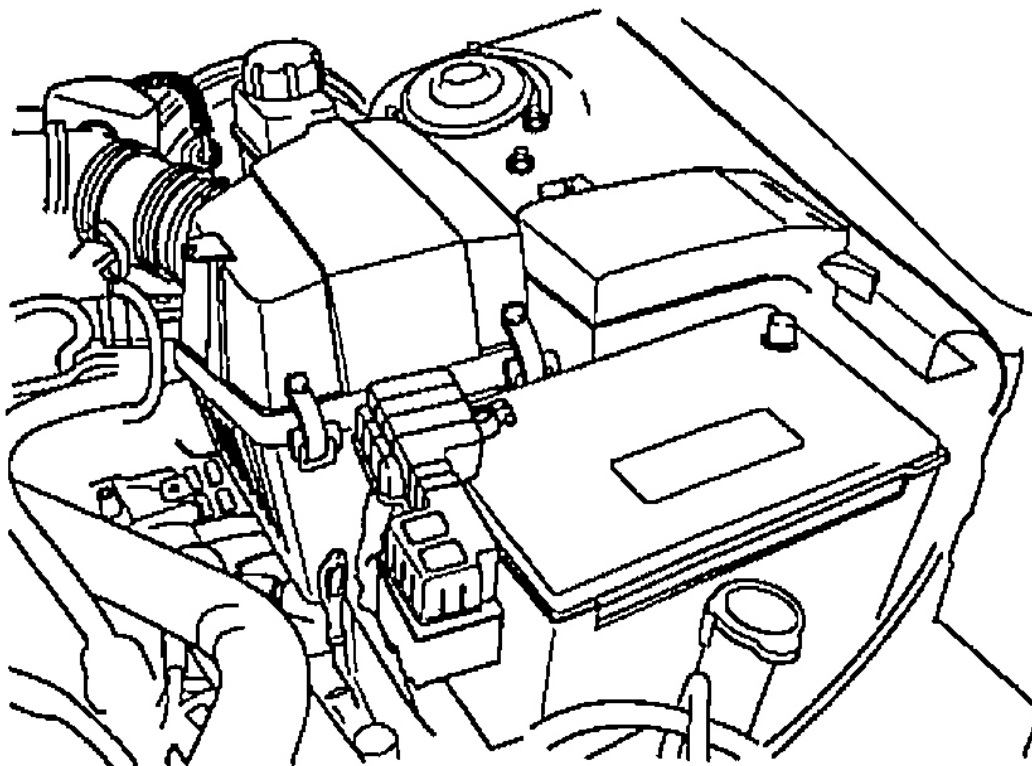
1. Remove the engine cover.



G00325704

Fig. 188: Removing Engine Cover
 Courtesy of KIA MOTORS AMERICA, INC.

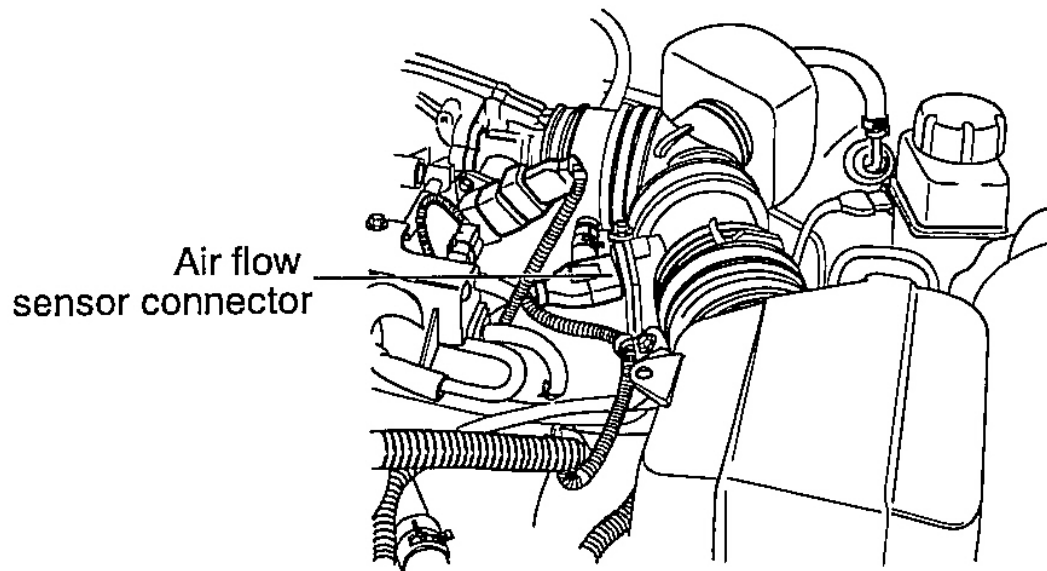
2. Disconnect the battery terminal.



G00325705

Fig. 189: Disconnecting Battery Terminal
Courtesy of KIA MOTORS AMERICA, INC.

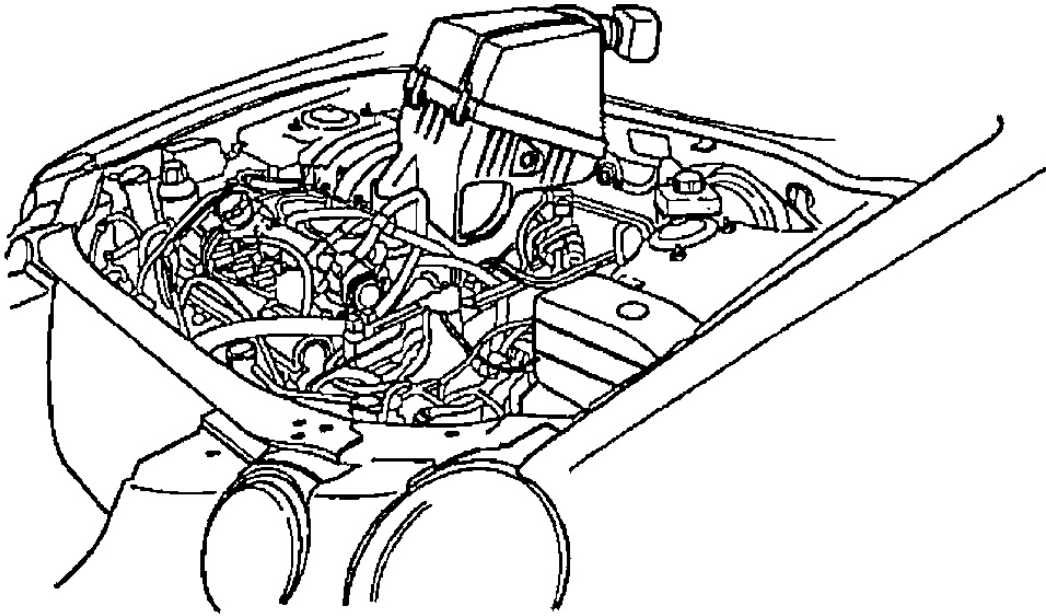
3. Disconnect the air flow sensor connector and the vacuum hose from the air intake hose.



G00325706

Fig. 190: Disconnecting Air Flow Sensor Connector
Courtesy of KIA MOTORS AMERICA, INC.

4. Remove the air cleaner assembly after removing the air intake hose clamp and fixing bolt (3ea).



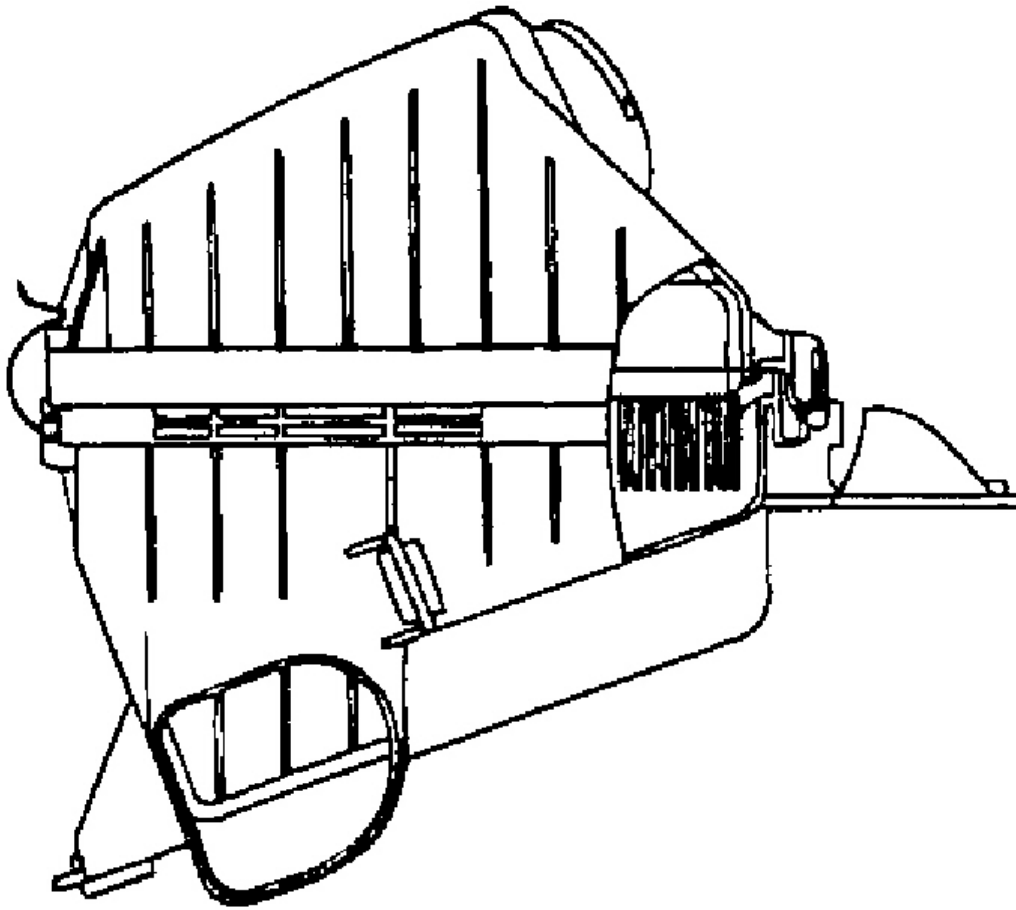
G00325707

Fig. 191: Removing Air Cleaner Assembly
Courtesy of KIA MOTORS AMERICA, INC.

5. Lift the fuse box after removing the fuse box mounting bolts.
6. Remove the air duct bolt (1ea).
7. Remove the wheel and tire.
8. Remove the wheel housing cover.
9. Remove the extension duct bolts (3ea).

INSPECTION

1. Check the air intake hose, air cleaner cover for damage.
2. Check the air duct for damage.



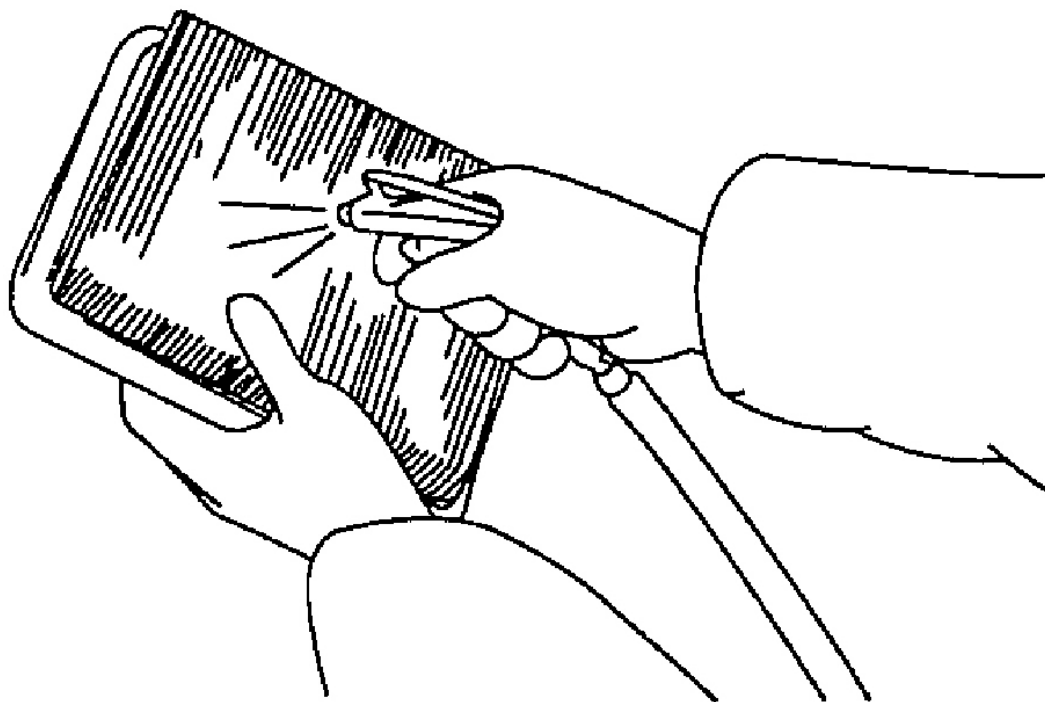
G00325708

Fig. 192: Inspecting Air Duct

Courtesy of KIA MOTORS AMERICA, INC.

3. Check the air cleaner element for restriction, contamination or damage.

If the element is slightly restricted, remove dust and debris by blowing compressed air from the inside of the element. Replace the element if it cannot be cleaned.



G00325709

Fig. 193: Cleaning Air Filter Element
Courtesy of KIA MOTORS AMERICA, INC.

INSTALLATION

1. Install the extension duct bolts (3ea).

Tightening torque :

7.8~9.8 N-m (0.8~1.0 kg-m, 5.8~7.2 lb-ft)

2. Install the wheel housing cover.
3. Install the wheel and tire.

Tightening torque :

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

4. Install the air duct.

Tightening torque :

7.8~9.8 N-m (0.8~1.0 kg-m, 5.8~7.2 lb-ft)

5. Install the fuse box.
6. Install the air cleaner assembly.

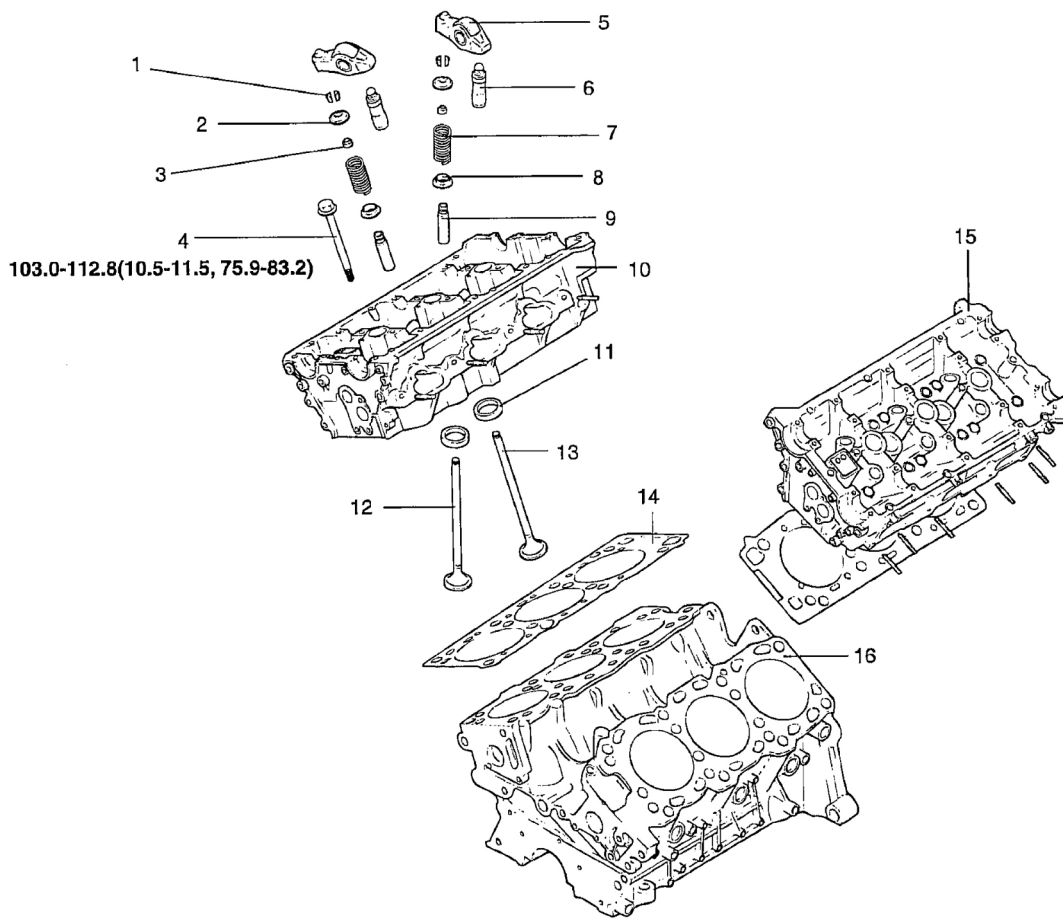
Tightening torque :

7.8~9.8 N-m (0.8~1.0 kg-m, 5.8~7.2 lb-ft)

7. Reconnect the air flow sensor connector and the vacuum hose to the air intake hose. And then clamp the hose with the air hose clamp.
8. Reconnect the battery terminal.
9. Install the engine cover.

CYLINDER HEAD ASSEMBLY

CYLINDER HEAD



TORQUE : Nm (kg.m, lb.ft)

- | | |
|--------------------------|-----------------------------|
| 1. Retainer lock | 9. Valve guide |
| 2. Valve spring retainer | 10. Cylinder head (RH) |
| 3. Valve stem seal | 11. Exhaust valve seat ring |
| 4. Cylinder head bolt | 12. Intake valve |
| 5. Rocker arm | 13. Exhaust valve |
| 6. Lash adjuster | 14. Gasket |
| 7. Valve spring | 15. Cylinder head (LH) |
| 8. Spring seat | 16. Cylinder block |

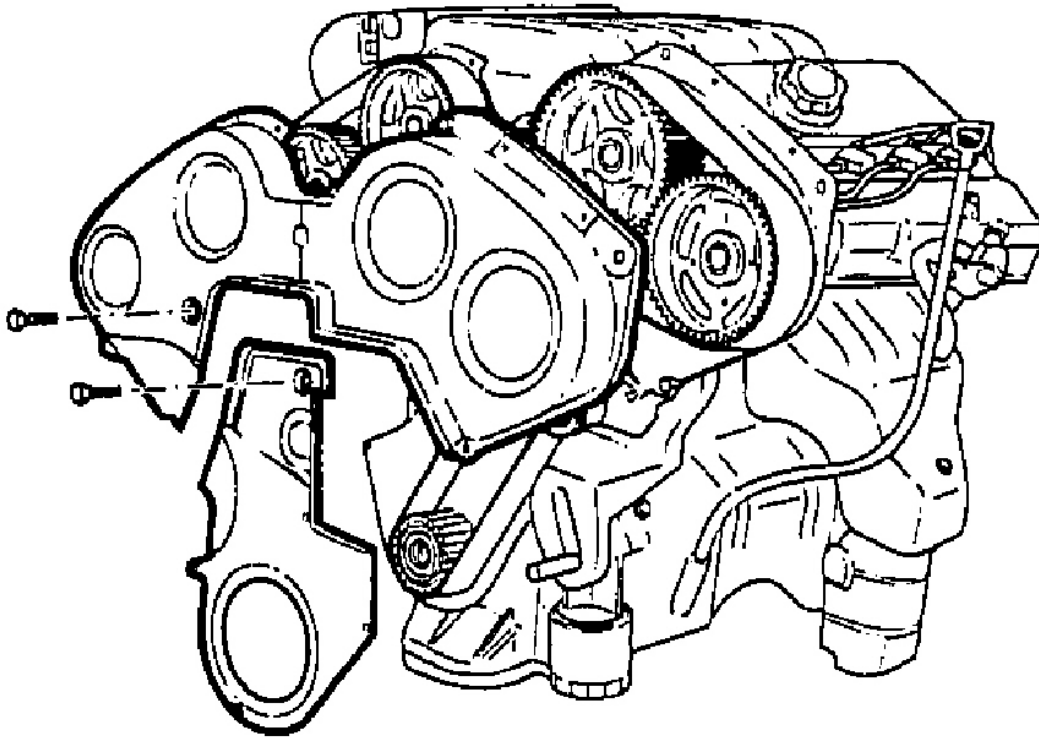
G00325710

Fig. 194: Identifying Cylinder Head Components
Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

1. Drain the coolant and disconnect the upper radiator hose.
2. Remove the breather hose and air-intake hose.
3. Remove the vacuum hose, fuel hose and coolant hose.
4. Remove the intake manifold.
5. Remove the cables from the spark plugs. The cables should be removed by holding the boot portion.

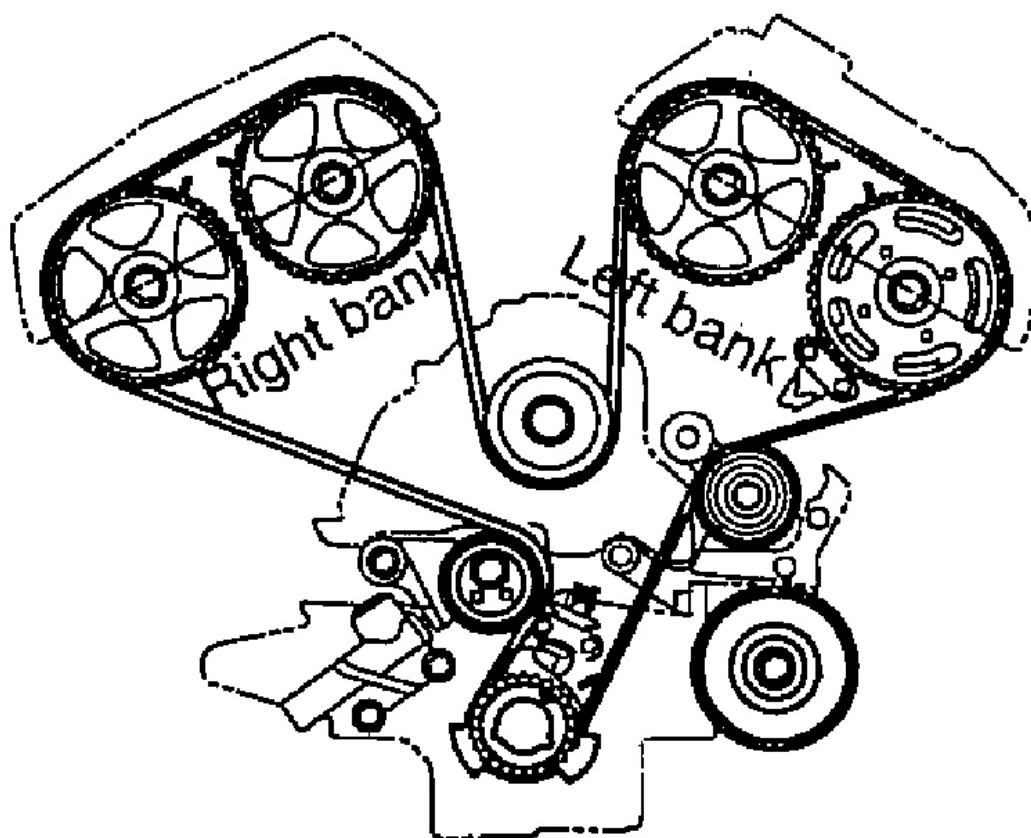
6. Remove the ignition coil.
7. Remove the upper and lower timing belt cover.



G00325711

Fig. 195: Removing Upper & Lower Timing Belt Cover
Courtesy of KIA MOTORS AMERICA, INC.

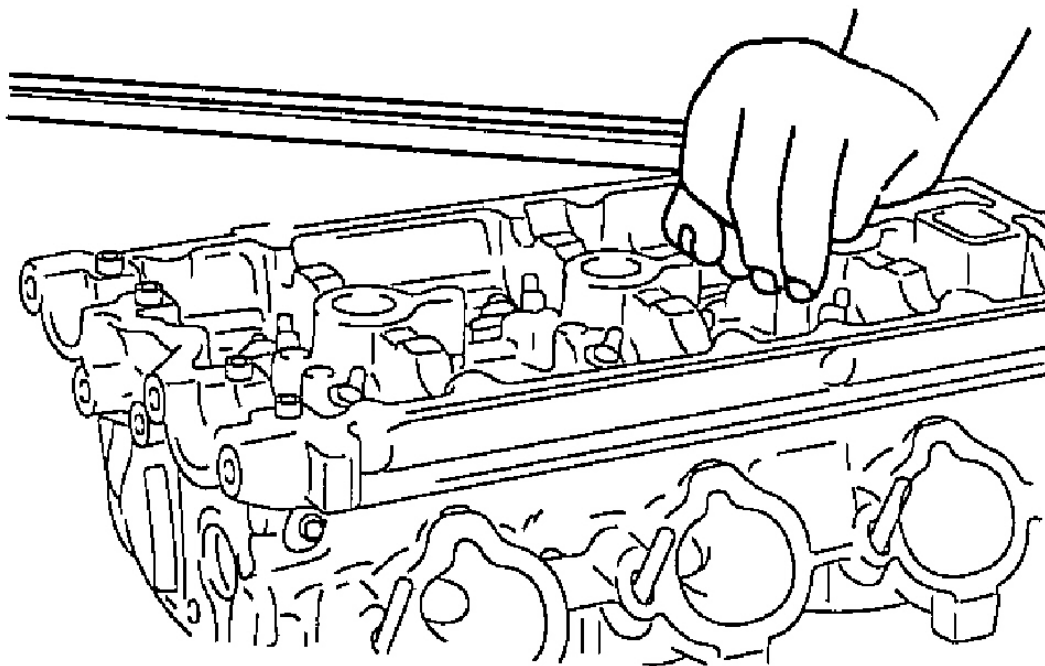
8. Remove the timing belt and camshaft sprockets.



G00325712

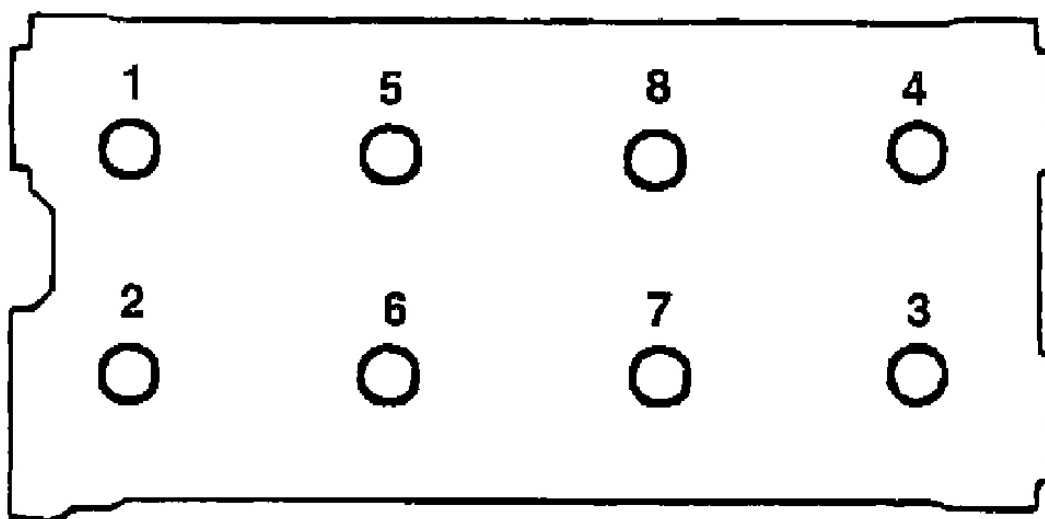
Fig. 196: Removing Timing Belt & Camshaft Sprockets
Courtesy of KIA MOTORS AMERICA, INC.

9. Remove the heat protector and exhaust manifold assembly.
10. Remove the coolant pump pulley and head cover.
11. Remove the intake and exhaust camshaft.
12. Remove the cylinder head assembly. The cylinder head bolts should be removed using the 12 mm socket, in two or three steps.



G00325713

Fig. 197: Removing Cylinder Head Assembly
Courtesy of KIA MOTORS AMERICA, INC.



G00325714

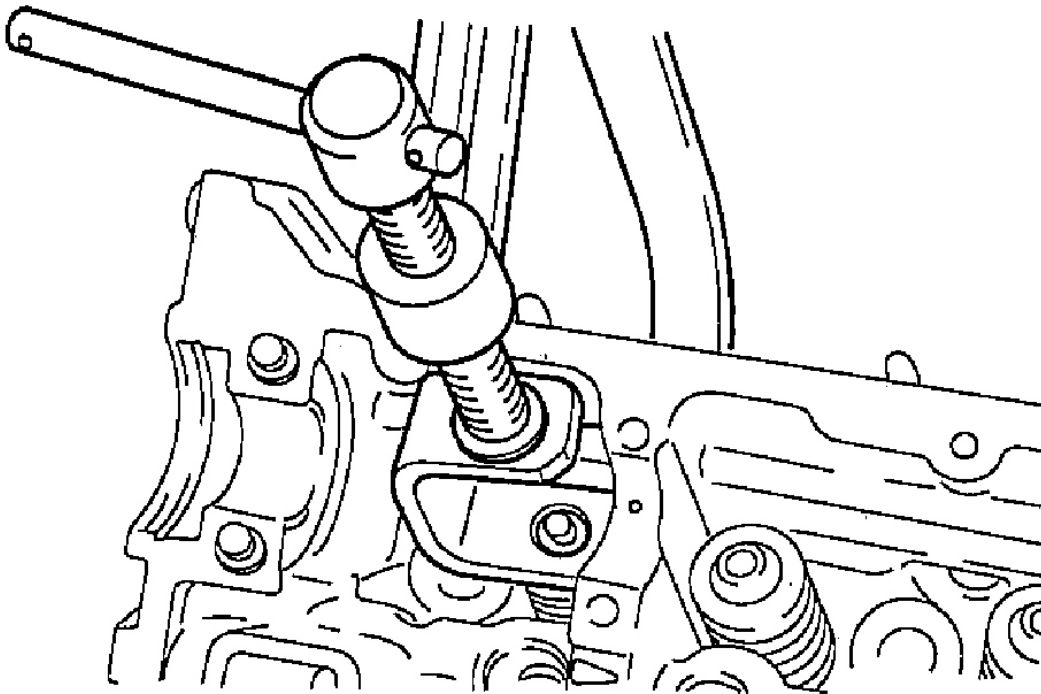
Fig. 198: Cylinder Head Removing Sequence
Courtesy of KIA MOTORS AMERICA, INC.

13. Clean the gasket pieces from the cylinder block top surface and cylinder head bottom surface.

NOTE: Make sure that fragments from the gasket do not fall in the engine.

DISASSEMBLY

1. Compress the valve spring using special tool. (09222 - 28000, 09222 - 28100)
2. Remove the retainer lock.



G00325715

Fig. 199: Removing Valve Spring Retaining Lock
Courtesy of KIA MOTORS AMERICA, INC.

INSPECTION

CYLINDER HEAD

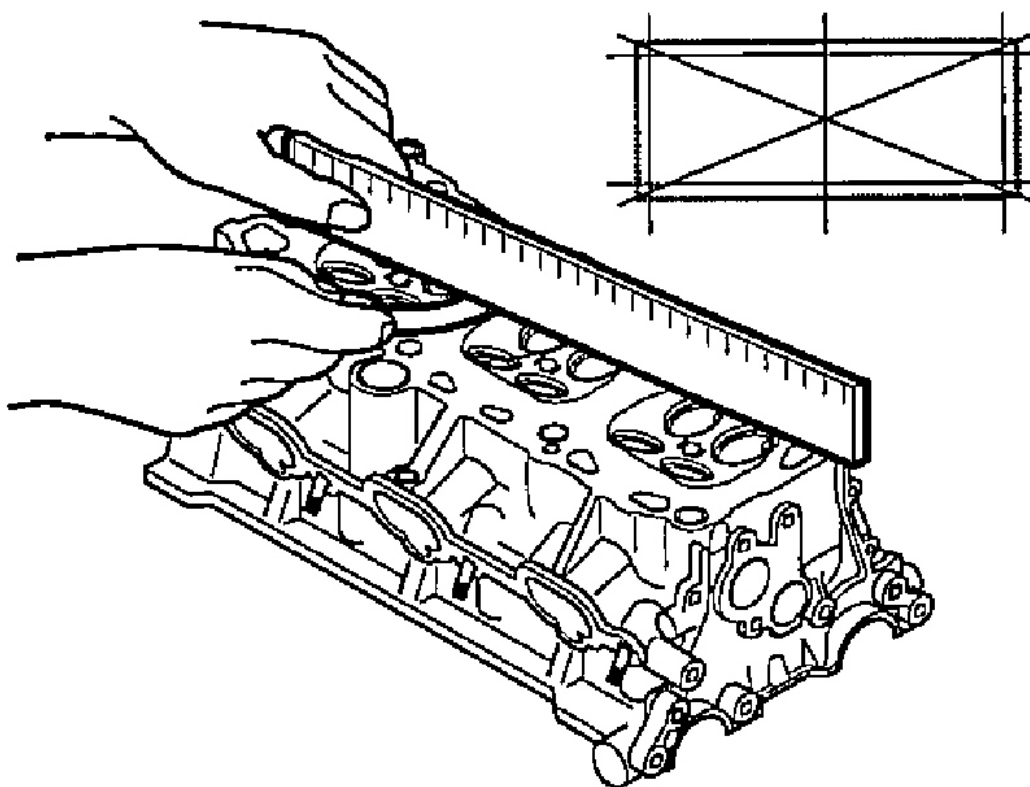
1. Remove scale, sealing compound and carbon deposits. After cleaning oil passages, apply compressed air to make certain that the passages are not clogged.

2. Visually check the cylinder head for cracks, damage or water leakage.
3. Check the cylinder head surface for flatness with a straight edge and feeler gauge as shown in the illustration.

Cylinder head flatness

Standard dimensions : Max. 0.03mm(0.0059 in.)

Service limit : 0.05mm(0.0020 in.)



G00325716

Fig. 200: Measuring Cylinder Head Flatness
 Courtesy of KIA MOTORS AMERICA, INC.

VALVE GUIDES

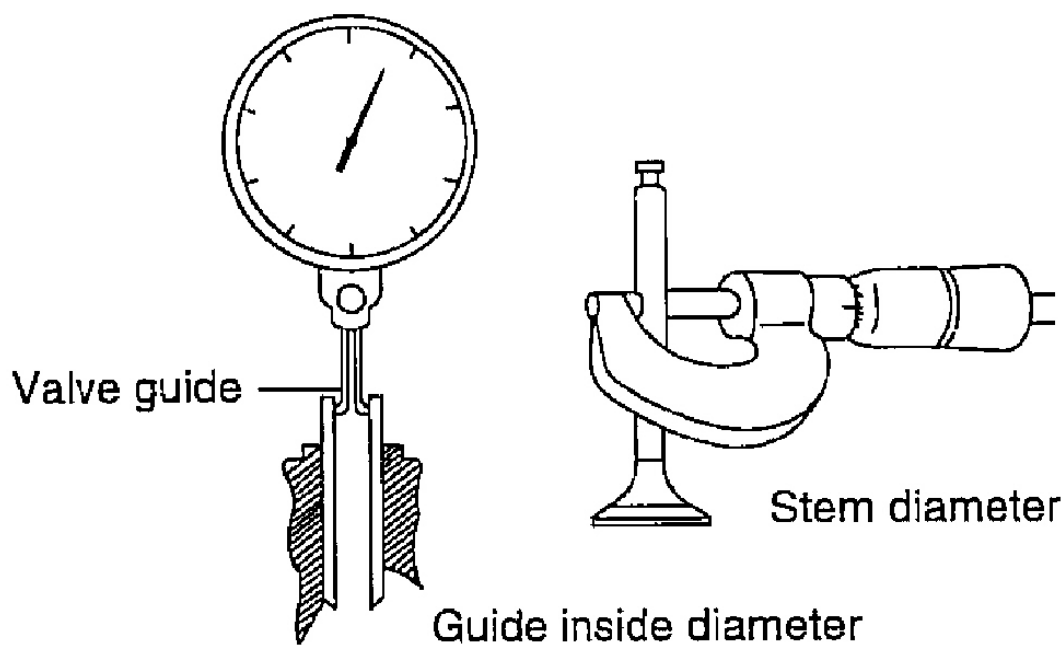
Check the valve stem-to-guide clearance. If the clearance exceeds the service limit, replace the valve guide with a new oversize guide.

Valve stem-to-guide clearance

Standard value

Intake : 0.02 - 0.05 mm (0.0009 - 0.0020 in.)

Exhaust : 0.050 - 0.085 mm (0.0020 - 0.0033 in.)



G00325717

Fig. 201: Measuring Valve Stem & Guide Diameter

Courtesy of KIA MOTORS AMERICA, INC.

VALVE

1. Replace the valve if its stem is bent, worn or damaged. Also replace it if the stem end (the surface contacting the hydraulic-lash adjuster) is hollowed out.
2. Check the valve face contact area, and recondition or replace as necessary.

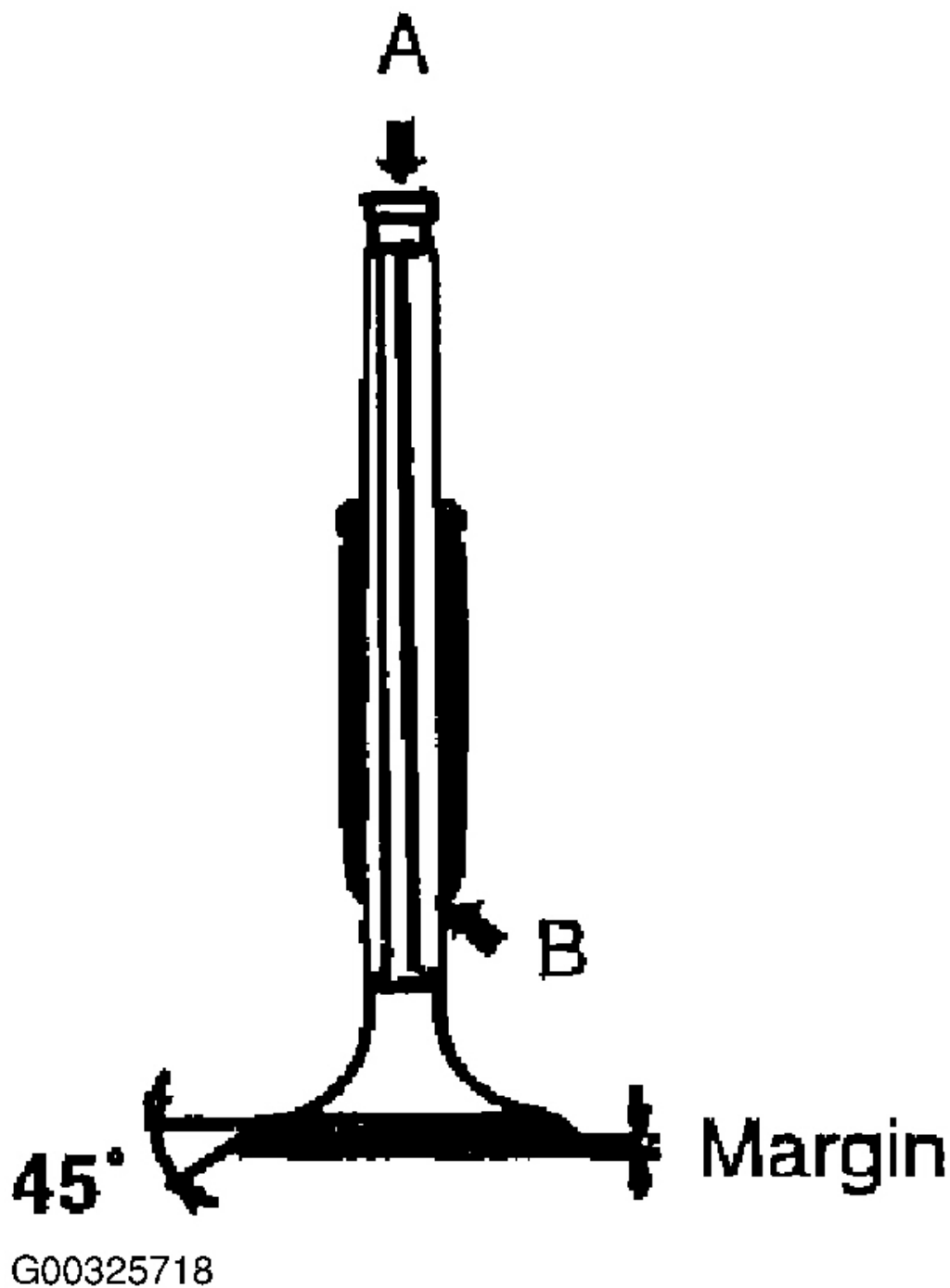


Fig. 202: Measuring Valve Width & Margin
Courtesy of KIA MOTORS AMERICA, INC.

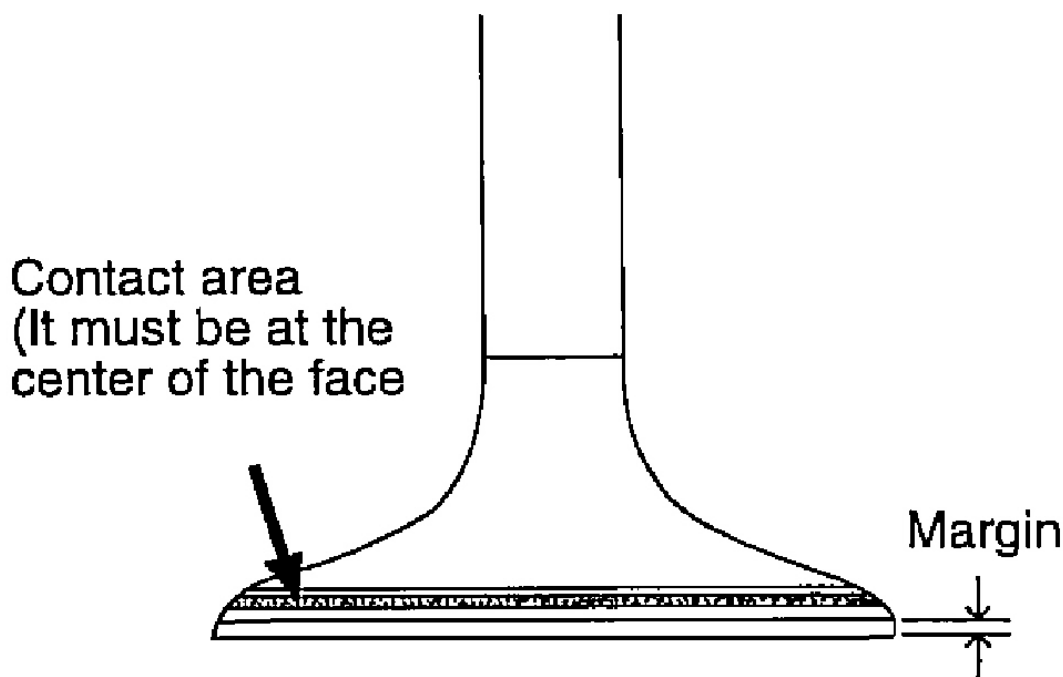
3. Replace the valve if the width of the margin (thickness of the valve head) is less than the minimum specified.

Valve margin

Standard value

Intake : 1.0mm(0.0394 in.)

Exhaust : 1.5mm(0.059 in.)



G00325719

Fig. 203: Measuring Valve Face Margin
 Courtesy of KIA MOTORS AMERICA, INC.

VALVE SPRING

1. Check the free height of each valve spring and replace if necessary.
2. Using a square, test the squareness of each valve spring. If the spring is excessively out-of-square, replace it.

Valve spring

Standard value

Free height : 46.4 mm (1.8268 in.)

Load : 24 kg / 37.9 mm (53 lb / 1.492 in.)

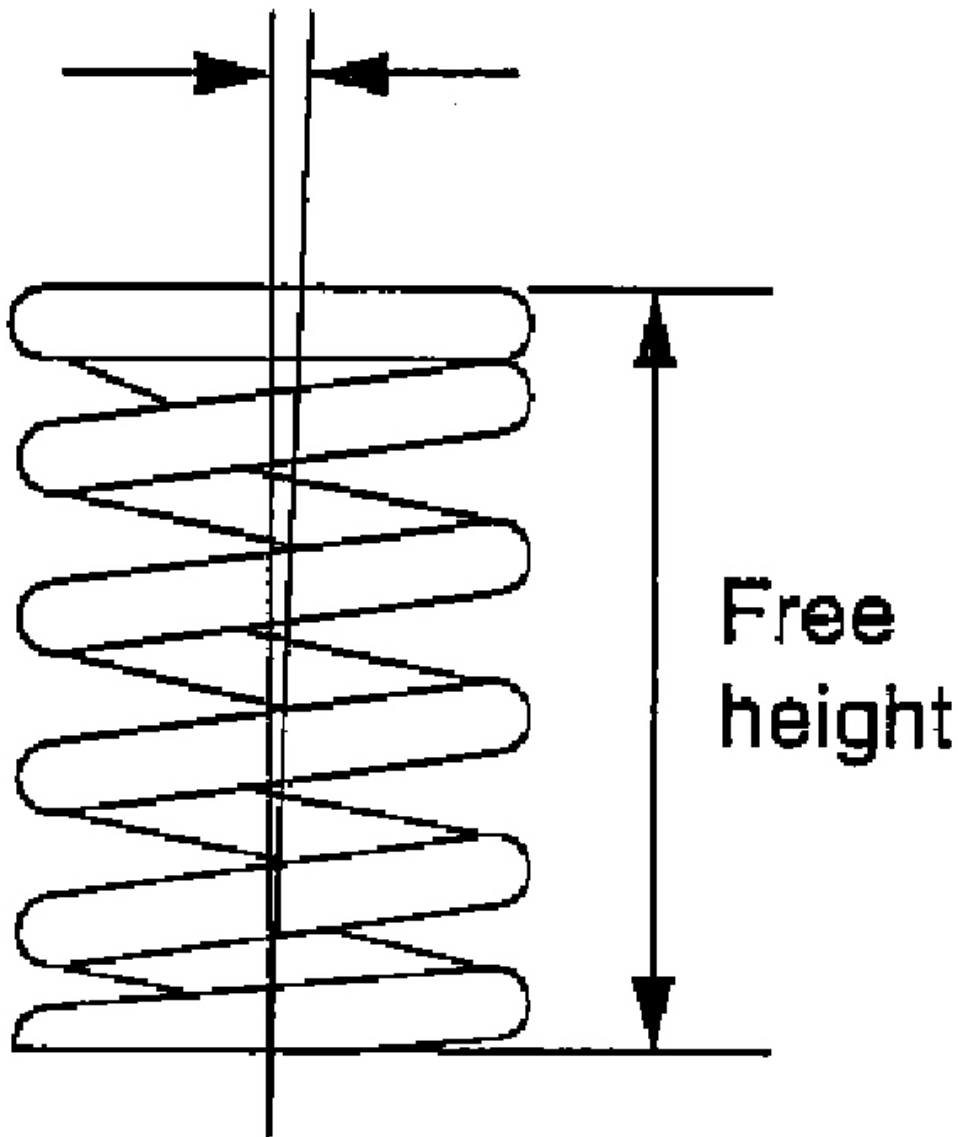
Out - of - square : Max. 2°

Service limit

Free height : 45.4 mm (1.787 in.)

Out - of - square : Max. 4°

Out-of-square (2°)



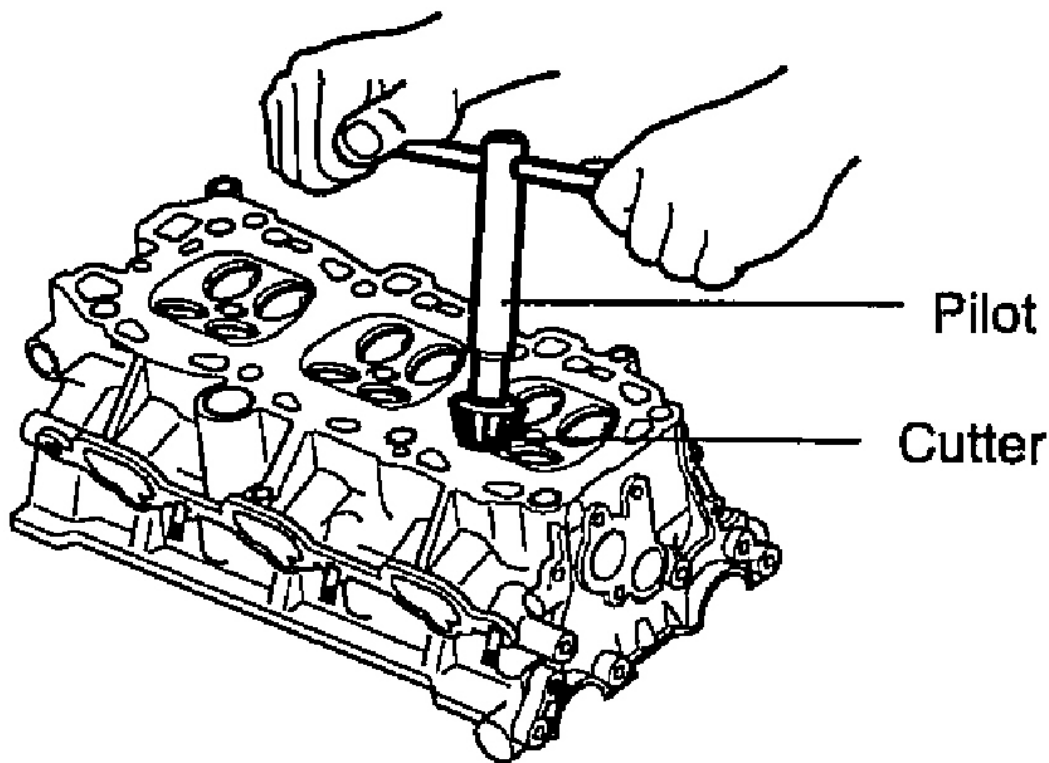
G00325720

Fig. 204: Measuring Valve Spring & Squareness
Courtesy of KIA MOTORS AMERICA, INC.

RECONDITIONING

RECONDITIONING VALVE SEAT

1. Before reconditioning, check the valve guide for wear. Replace worn guides if necessary and then recondition the valve seats.
2. Recondition the valve seat using the Valve Seat Cutter and Pilot.
3. After reconditioning, the valve and valve seat should be lapped lightly with a lapping compound.



G00325721

Fig. 205: Reconditioning Valve Seat
Courtesy of KIA MOTORS AMERICA, INC.

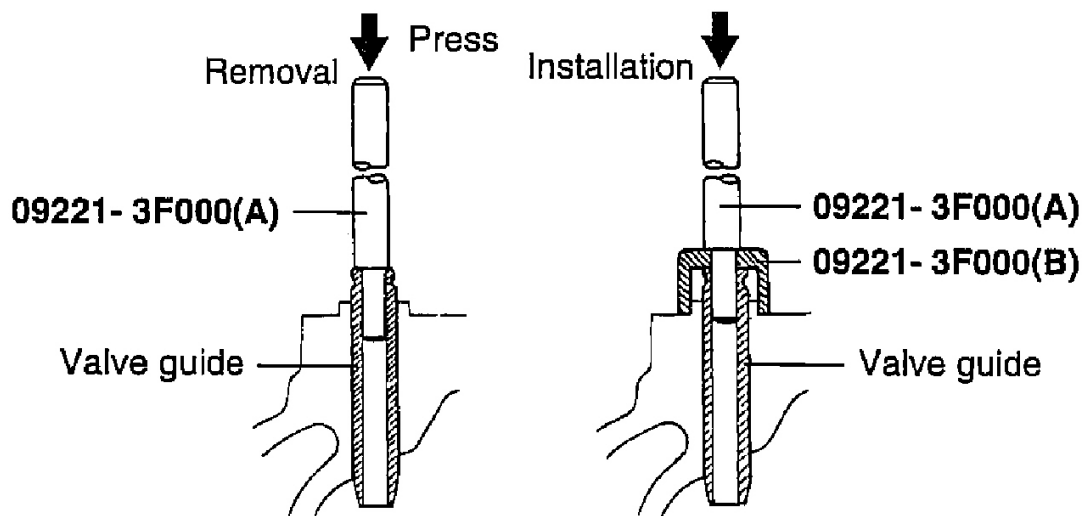
REPLACING VALVE GUIDE

1. Using the special tool (09221-3F000(A)), withdraw the old valve guide out the bottom of the cylinder head.
2. Recondition the valve guide hole so that it can receive the newly press-fitted oversize valve guide.

Size mm (in.)	Size Mark	Oversize valve guide hole size mm (in.)
0.05 (0.002) O.S.	5	12.05 - 12.068 (0.474 - 0.475)
0.25 (0.010) O.S.	25	12.25 - 12.268 (0.482 - 0.483)
0.50 (0.020) O.S.	50	12.50 - 12.518 (0.492 - 0.493)

G00325722

Fig. 206: Valve Guide Oversize Chart
 Courtesy of KIA MOTORS AMERICA, INC.



G00325723

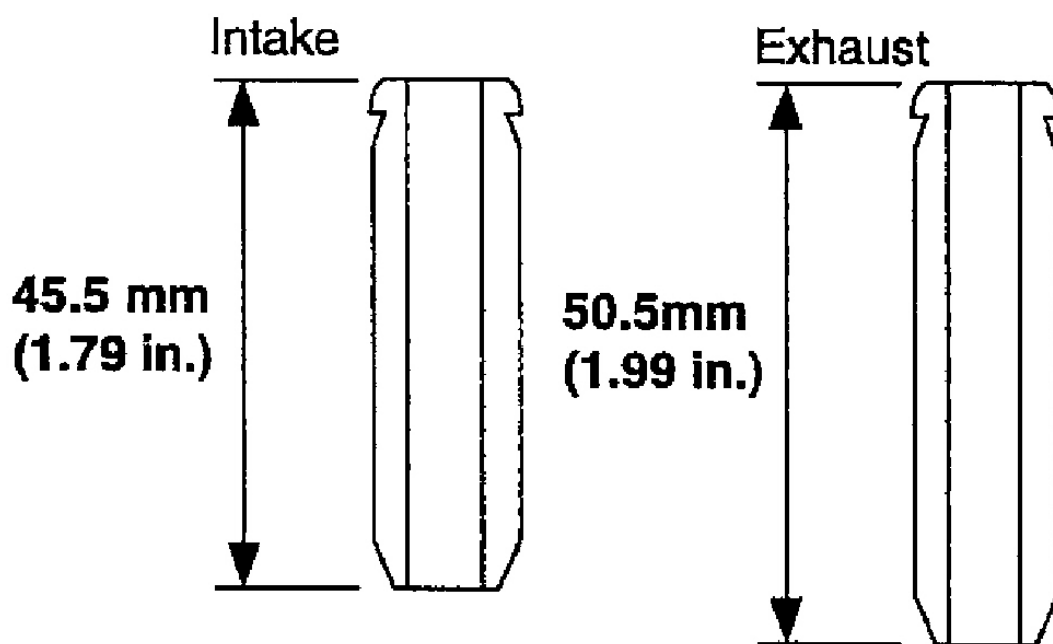
Fig. 207: Removing & Installing Valve Guide
 Courtesy of KIA MOTORS AMERICA, INC.

- Using the special tool (09221-3F000(A), 09221-3F000(B)) press-fit the valve guide. The valve guide must be press-fitted from the upper side of the cylinder head. Keep in mind that the intake and exhaust

valve guides are different in length.

4. After the valve guide is press-fitted, insert a new valve and check for proper clearance.
5. After the valve guide is replaced, check that the valve is fully seated. Recondition the valve seats as necessary.

NOTE: Do not install a valve guide unless it is oversize.

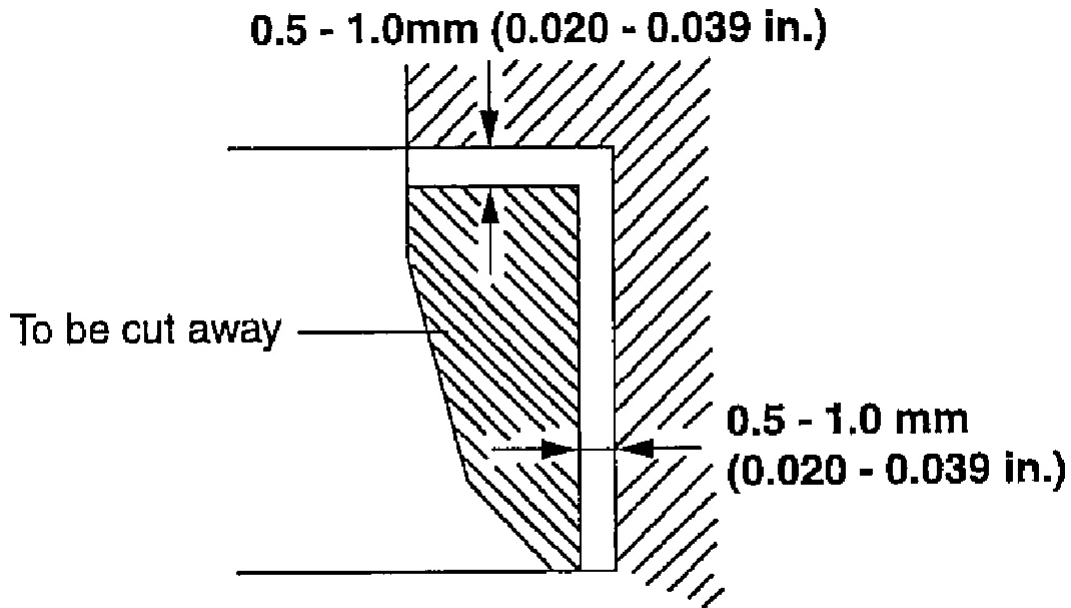


G00325724

Fig. 208: Measuring Valve Guide
Courtesy of KIA MOTORS AMERICA, INC.

REPLACING VALVE SEAT RING

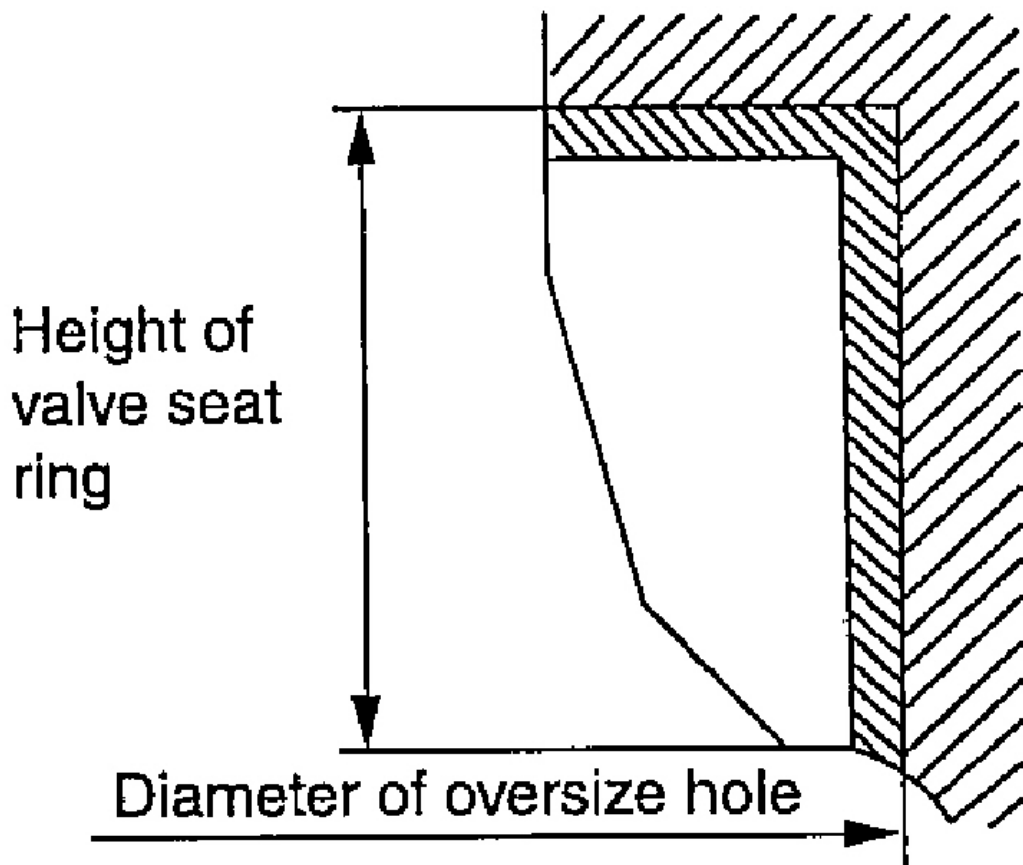
1. Cut away the inner face of the valve seat to reduce the wall thickness.



G00325725

Fig. 209: Measuring Valve Seat
Courtesy of KIA MOTORS AMERICA, INC.

2. Enlarge the diameter of the valve seat so that it matches the specified hole diameter of the new valve seat ring.



G00325726

Fig. 210: Measuring Valve Seat Ring
 Courtesy of KIA MOTORS AMERICA, INC.

Description	Size mm (in.)	Size Mark	Seat ring height H mm (in.)	Oversize hole diameter I.D. mm (in.)
Intake valve seat ring	0.3 (0.012) O.S.	30	7.9 - 8.1 (0.311 - 0.319)	36.300 - 36.325 (1.429 - 1.430)
	0.6 (0.024) O.S.	60	8.2 - 8.4 (0.323 - 0.331)	36.600 - 36.625 (1.441 - 1.442)
Exhaust valve seat ring	0.3 (0.012) O.S.	30	7.9 - 8.1 (0.311 - 0.319)	33.30 - 33.325 (1.311 - 1.312)
	0.6 (0.024) O.S.	60	8.2 - 8.4 (0.323 - 0.331)	33.600 - 33.625 (1.323 - 1.324)

G00325727

Fig. 211: Valve Seat Ring Oversize Chart
 Courtesy of KIA MOTORS AMERICA, INC.

- Heat the cylinder head to about 250°C (480°F) and press-fit an oversize seat ring for the bore in the

cylinder head.

4. Using lapping compound, lap the valve to the new seat.

Valve seat contact width

Intake : 0.9 - 1.3 mm (0.035 - 0.051 in.)

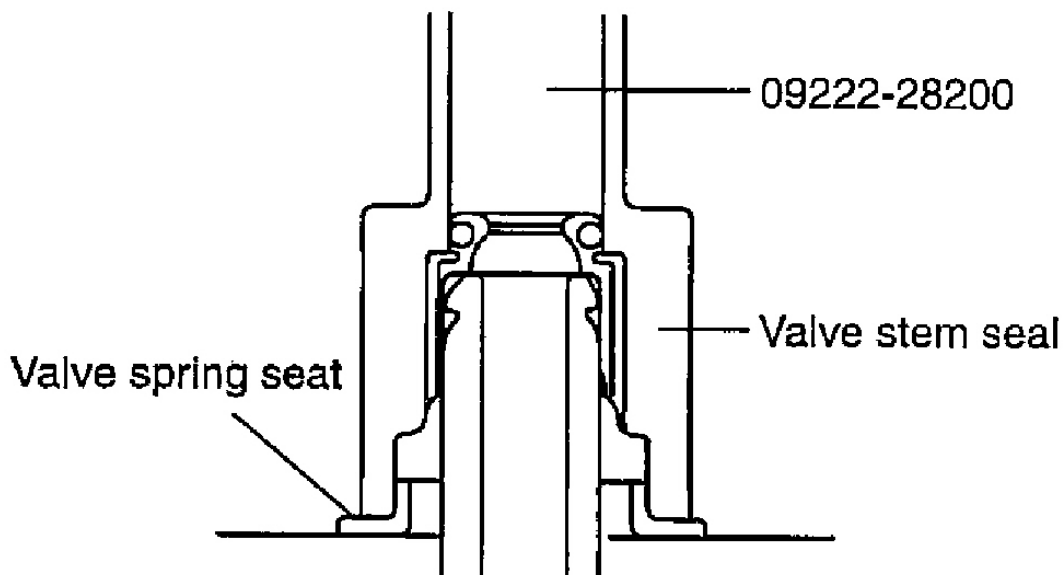
Exhaust : 0.9 - 1.3 mm(0.035 - 0.051 in.)

REASSEMBLY

1. Install the spring seats.
2. Using special tool (09222-28200), lightly tap the seal in position.

NOTE:

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



G00325728

Fig. 212: Positioning Valve Stem Seal
Courtesy of KIA MOTORS AMERICA, INC.

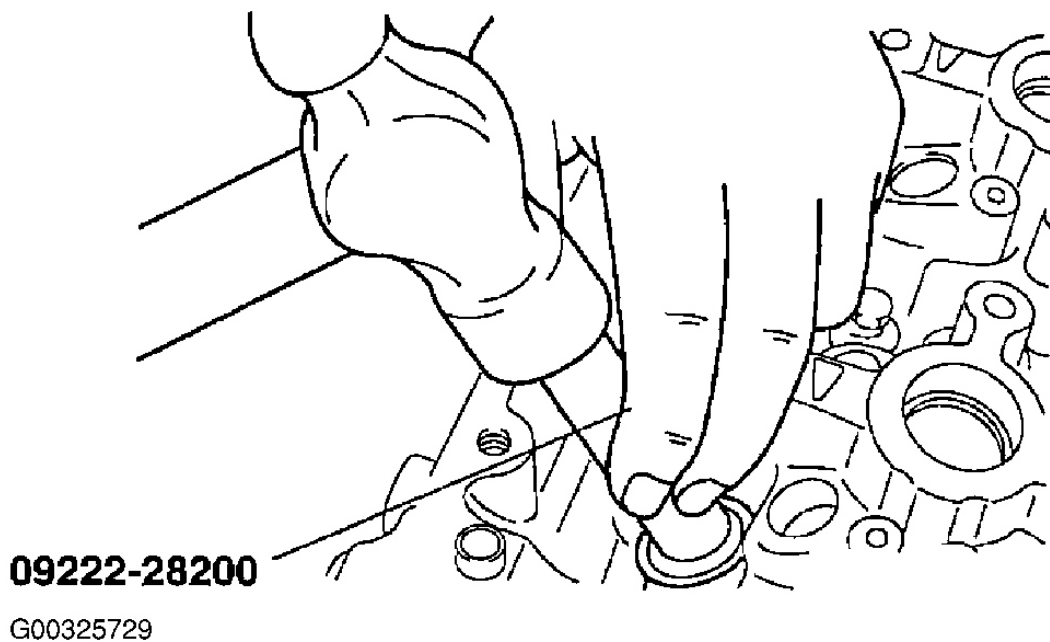
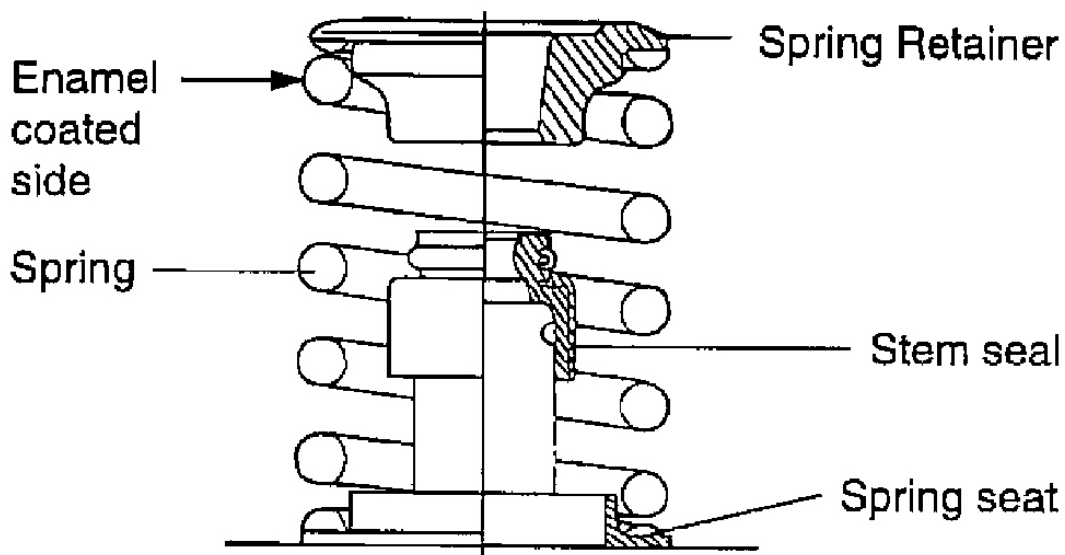


Fig. 213: Installing valve Stem Seal

Courtesy of KIA MOTORS AMERICA, INC.

3. Apply engine oil to each valve. Insert the valve into their guides. Avoid pushing the valve into the seal by force. After installing the valve, check that it moves smoothly.
4. Place valve springs so that the side coated with enamel faces toward the valve spring retainer.

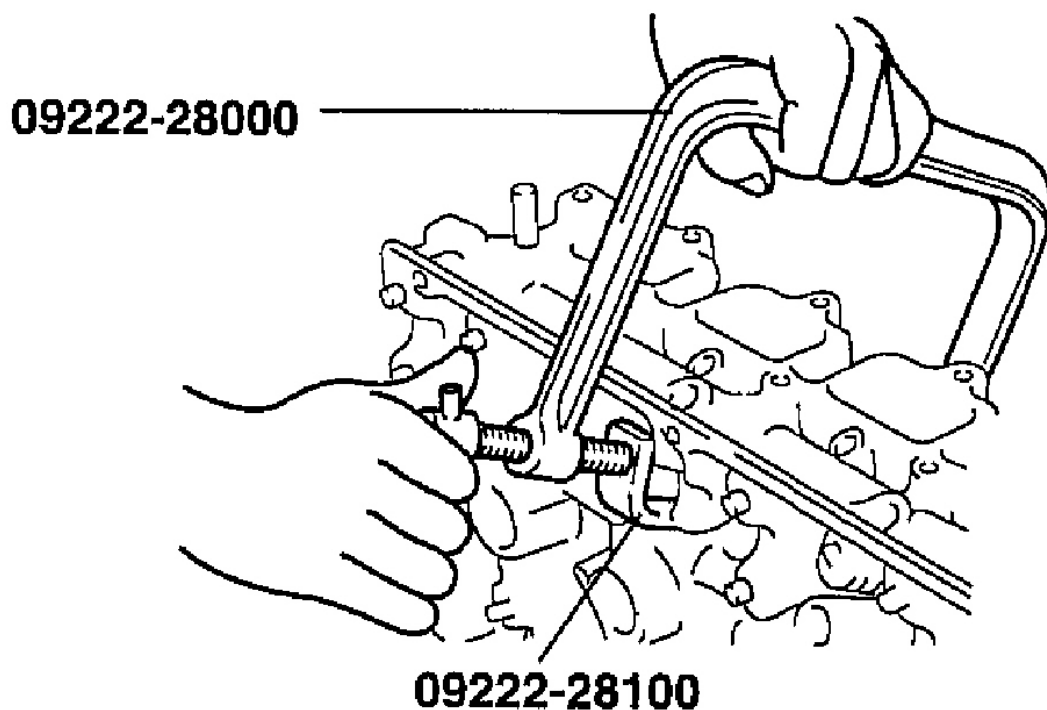


G00325730

Fig. 214: Positioning Valve Spring
Courtesy of KIA MOTORS AMERICA, INC.

5. Using the special tool (09222-28000, 09222-28100), compress the spring and install the retainer locks. After installing the valves, ensure that the retainer locks are correctly in place before releasing the valve spring compressor.

NOTE: When the spring is compressed, check that the valve stem seal is not pressed against the bottom of the retainer.



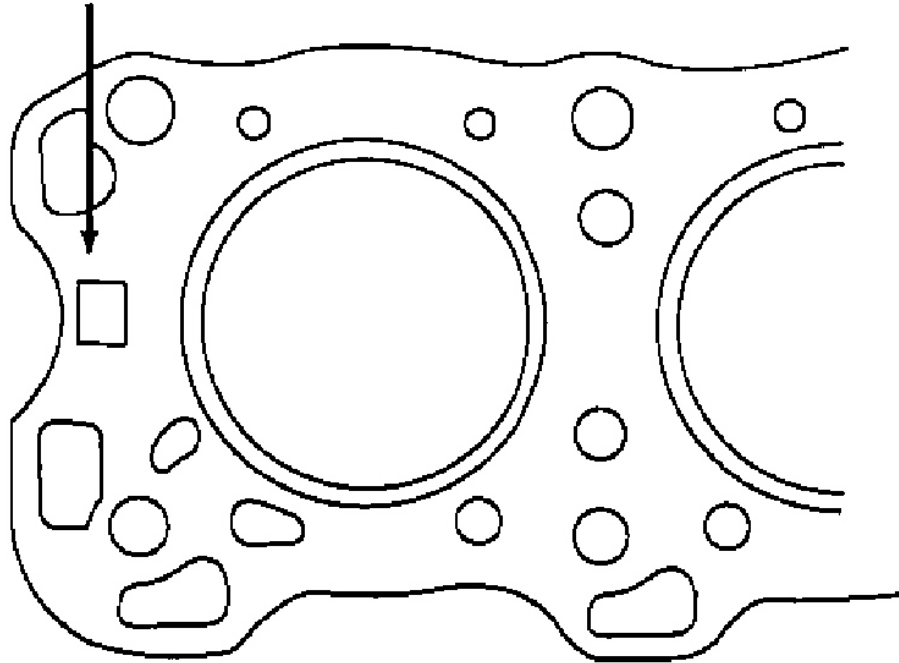
G00325731

Fig. 215: Compressing Valve Spring
Courtesy of KIA MOTORS AMERICA, INC.

6. Clean both gasket surfaces of the cylinder head and cylinder block.
7. Verify the identification marks on the cylinder head gasket.
8. Install the gasket so that the surface with the identification mark faces toward the cylinder head.

NOTE: Do not apply sealant to these surfaces.

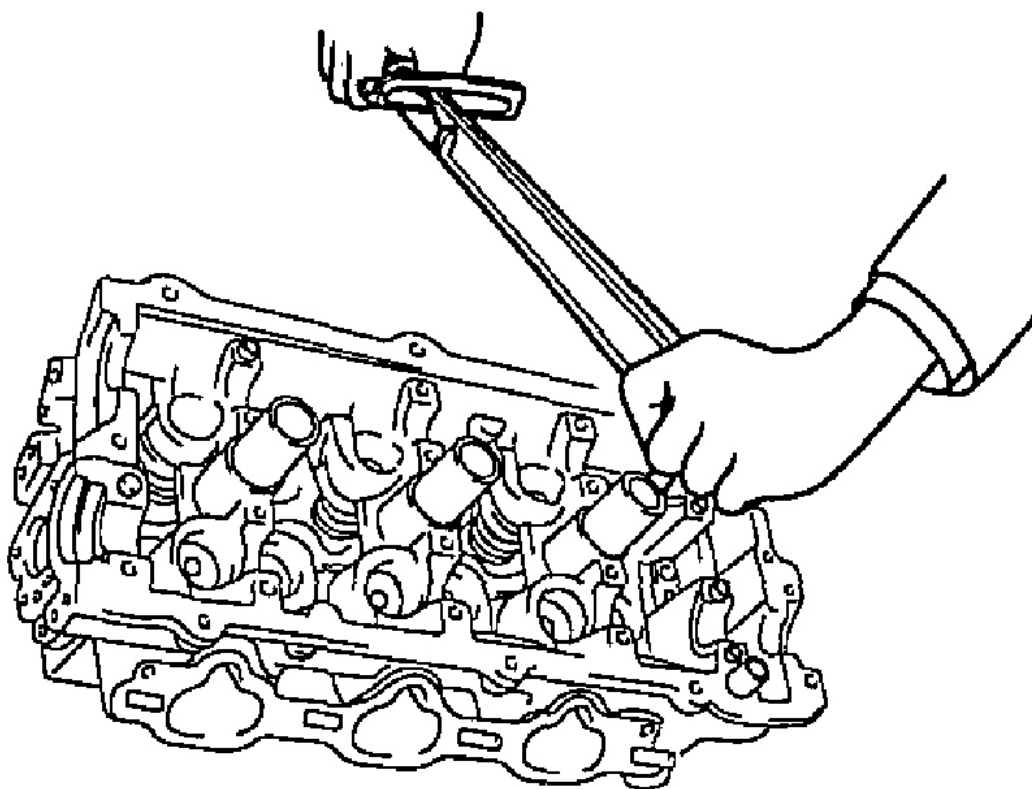
Identification mark



G00325732

Fig. 216: Positioning Head Gasket
Courtesy of KIA MOTORS AMERICA, INC.

9. Tighten the cylinder head bolts in the sequence shown in the illustration with a torque wrench.



G00325733

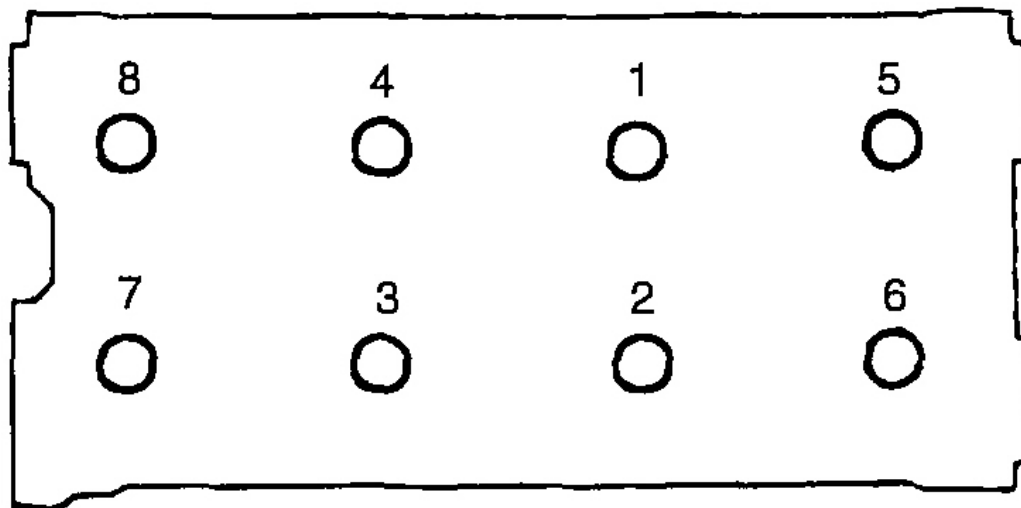
Fig. 217: Tightening Cylinder Head Bolt
Courtesy of KIA MOTORS AMERICA, INC.

10. Tighten the cylinder head bolts. Starting at top center, tighten all cylinder head bolts in sequence as shown in the illustration, using the 12 mm socket.

Tightening procedure

Cylinder head bolt :

103.0-112.8 Nm (10.5 - 11.5 kg.m, 75.9-83.2 lb.ft)

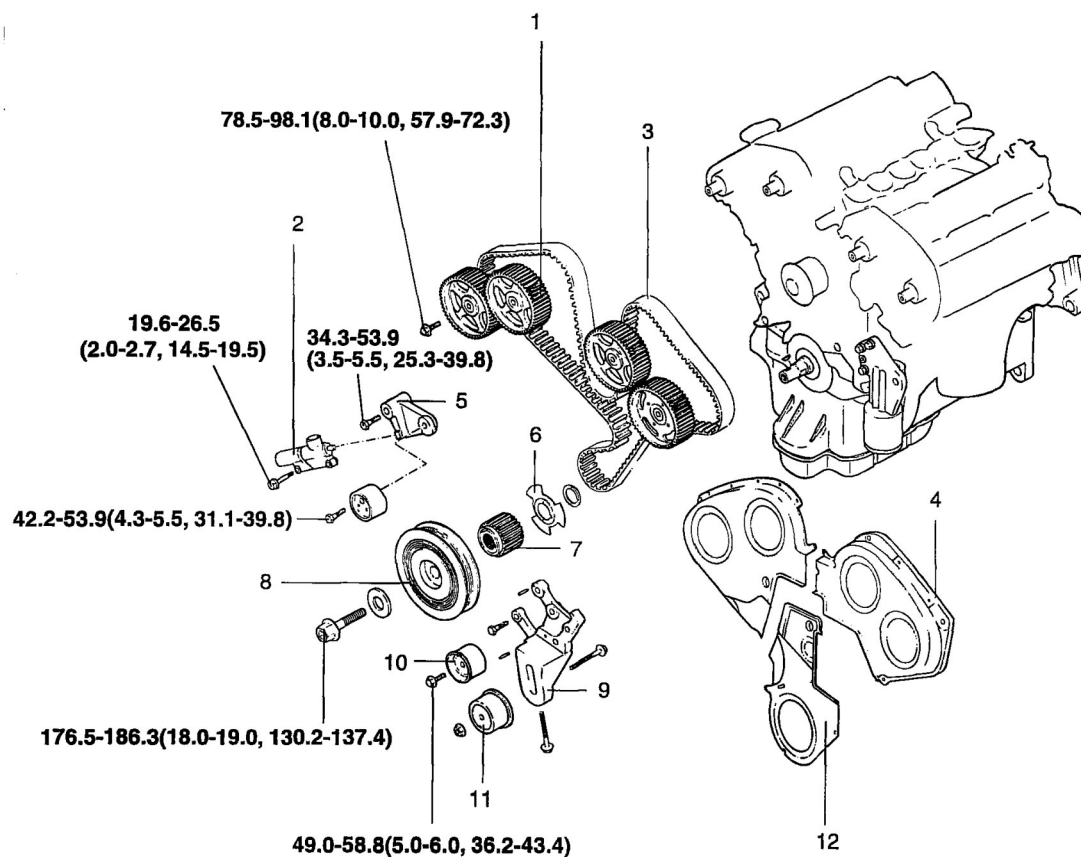


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Fig. 218: Cylinder Head Tightening Sequence
Courtesy of KIA MOTORS AMERICA, INC.

TIMING SYSTEM

TIMING BELT



TORQUE : Nm (kg.m, lb.ft)

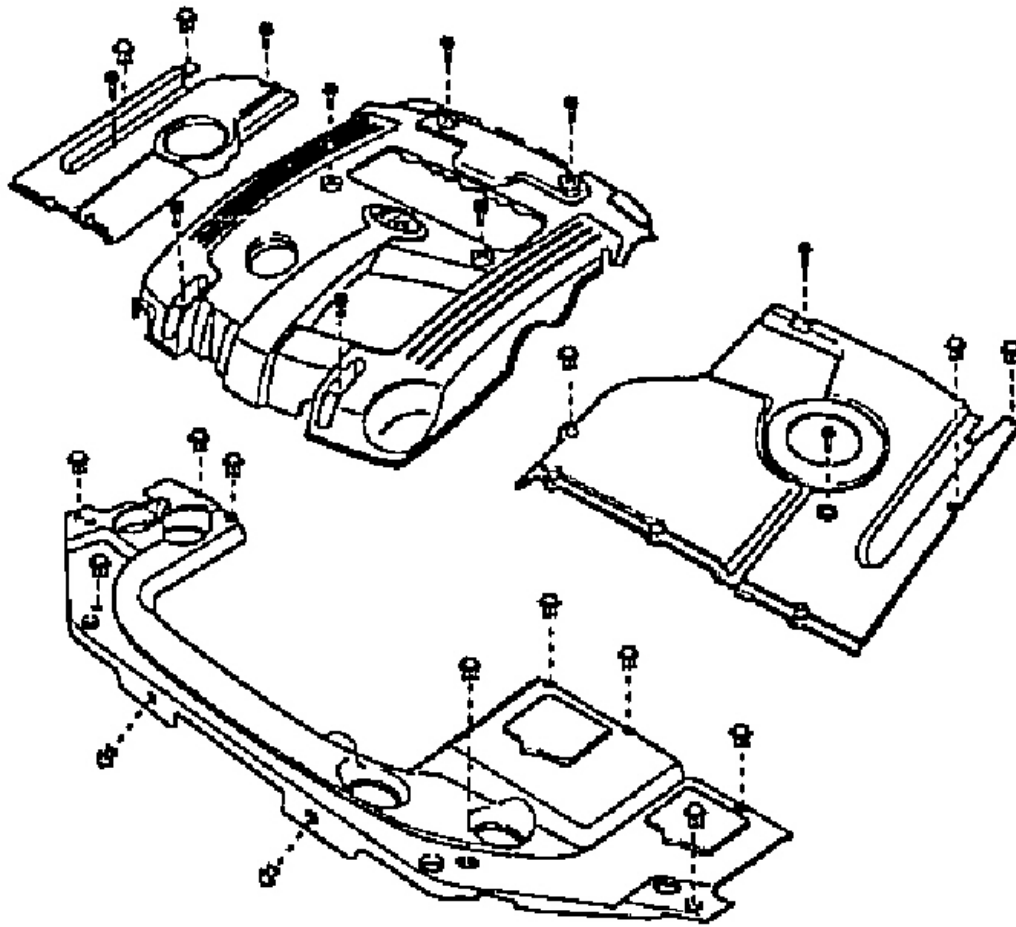
- | | |
|----------------------------|---------------------------------|
| 1. Camshaft sprocket | 7. Crankshaft sprocket |
| 2. Auto tensioner | 8. Crankshaft pulley |
| 3. Timing belt | 9. Engine support lower bracket |
| 4. Timing belt upper cover | 10. Timing belt idler bearing |
| 5. Tensioner arm | 11. Drive belt tensioner pulley |
| 6. Sensing blade | 12. Timing belt lower cover |

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Fig. 219: Identifying Timing Belt Components
Courtesy of KIA MOTORS AMERICA, INC.

DISASSEMBLY

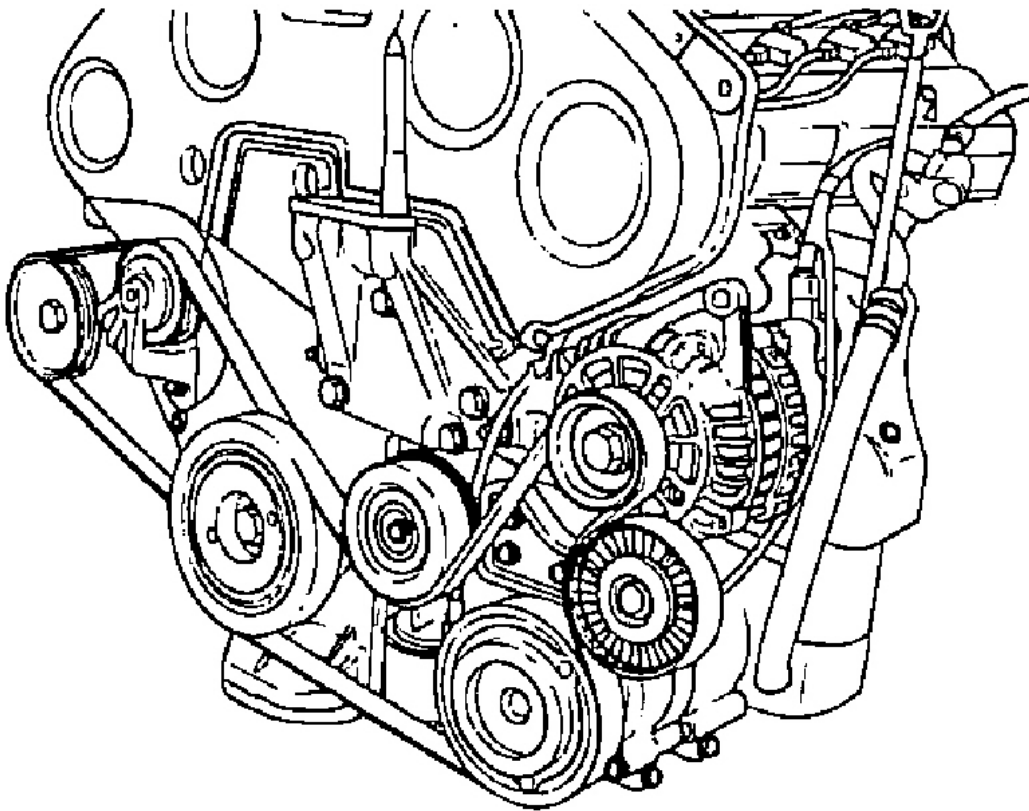
1. Remove the engine cover.



G00325736

Fig. 220: Removing Engine Cover
Courtesy of KIA MOTORS AMERICA, INC.

2. Using a 16 mm socket, rotate the tensioner arm clockwise (about 14°) and remove the belt from the pulley.
3. Remove the power steering pump pulley, idler pulley, tensioner pulley and crankshaft pulley.

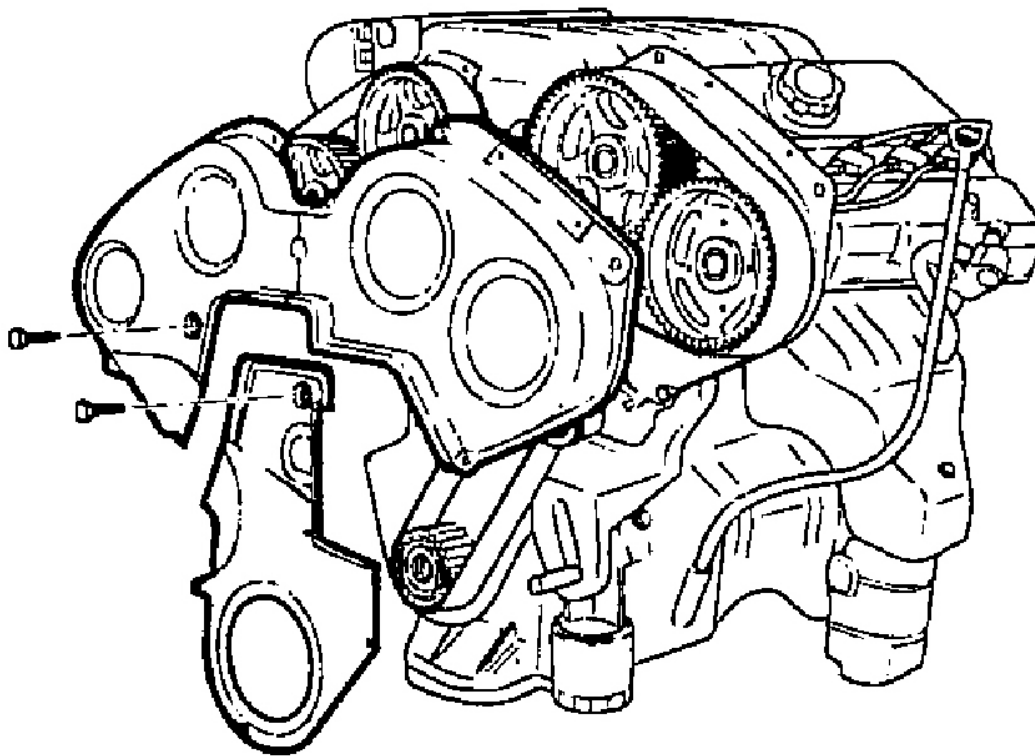


G00325737

Fig. 221: Removing The Power Steering Pump Pulley, Idler Pulley, Tensioner Pulley And Crankshaft Pulley

Courtesy of KIA MOTORS AMERICA, INC.

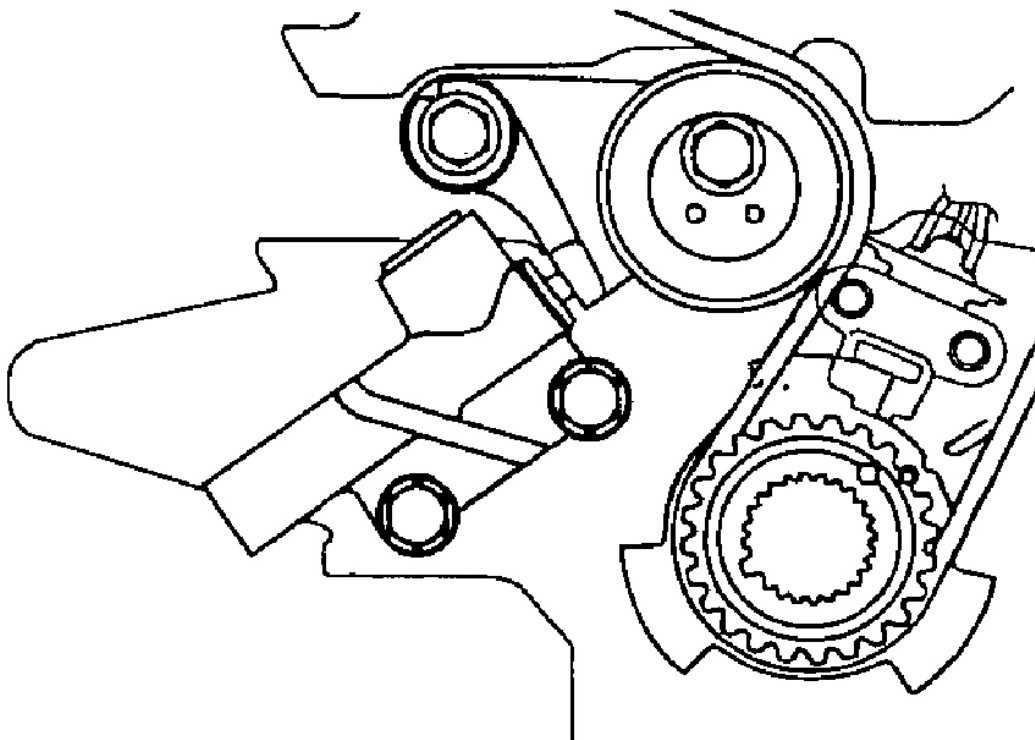
4. Remove the upper and lower timing belt covers.



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Fig. 222: Removing The Upper And Lower Timing Belt Cover
Courtesy of KIA MOTORS AMERICA, INC.

5. Remove the auto tensioner.

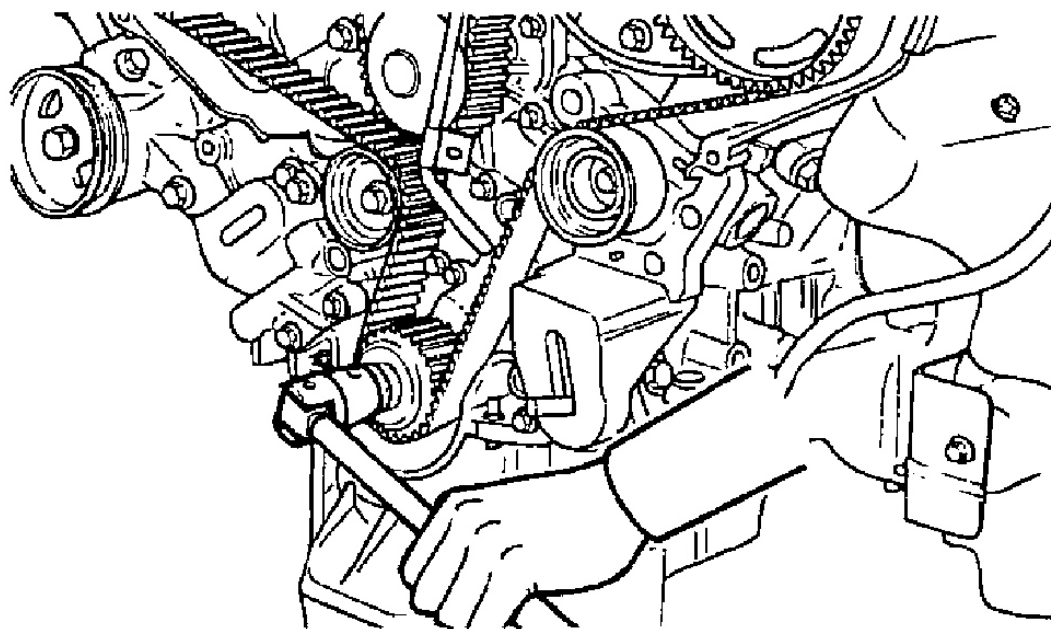


G00325739

Fig. 223: Remove The Auto Tensioner
Courtesy of KIA MOTORS AMERICA, INC.

NOTE: Rotate the crankshaft clockwise and align the timing mark to set the No. 1 cylinder's piston to TDC (compression stroke).

At this time, the timing marks of the camshaft sprocket and cylinder head cover should coincide with each other.



G00325740

Fig. 224: Adjusting Timing Marks
Courtesy of KIA MOTORS AMERICA, INC.

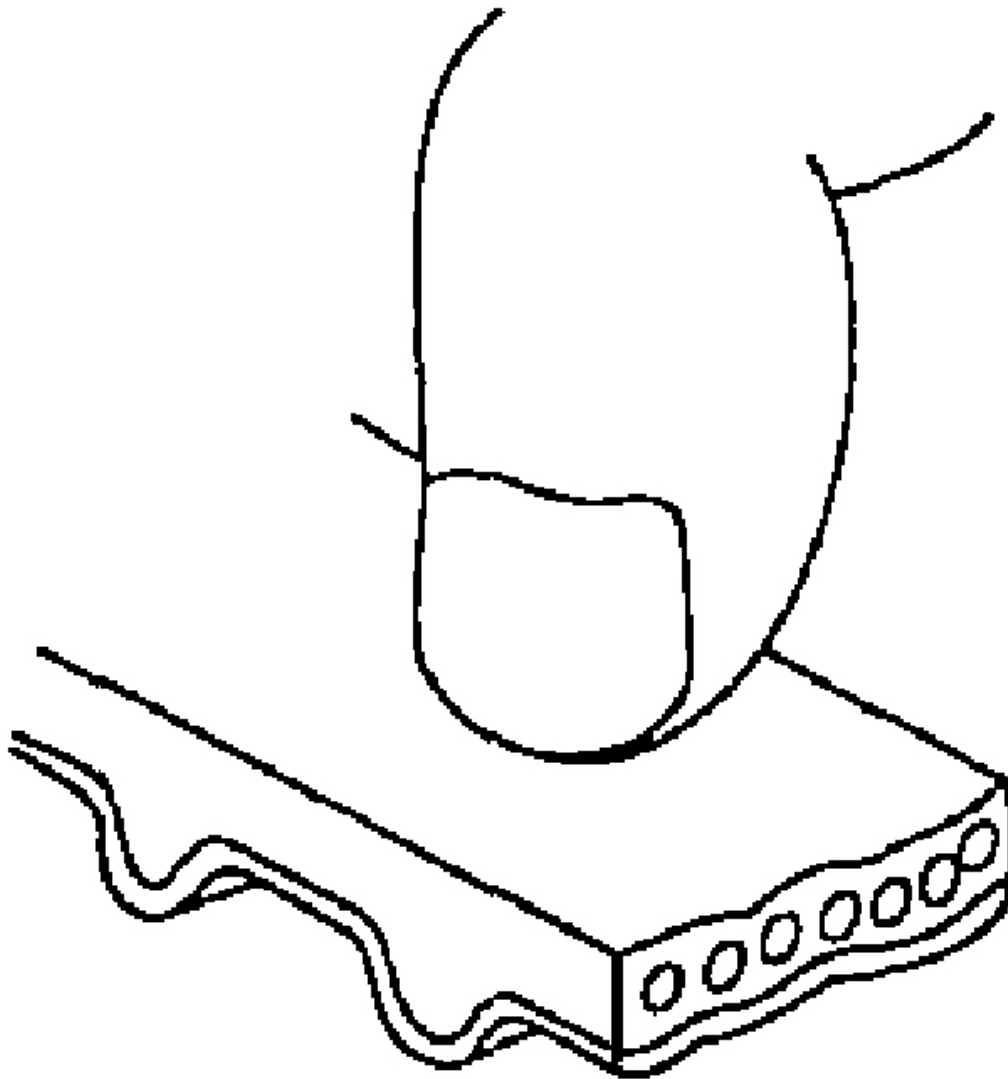
6. Unbolt the tensioner to remove the timing belt.

NOTE: If you plan to use the timing belt again, mark the rotation direction on the belt so you reinstall it correctly.

INSPECTION

1. Inspect the belt closely. If the following problems are evident, replace the belt with a new one.
 1. Hardened back surface of rubber

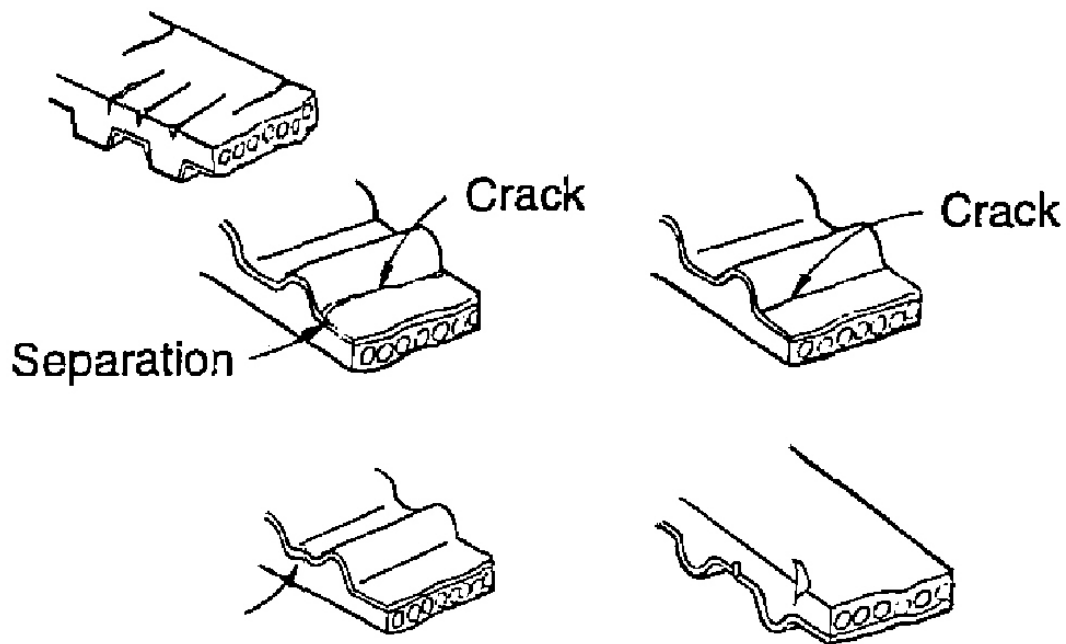
Back surface is glossing, non-elastic and so hard that when the nail of your finger is pressed into it, no mark is produced.



G00325741

Fig. 225: Testing Timing Belt
Courtesy of KIA MOTORS AMERICA, INC.

2. Cracked back surface of rubber.

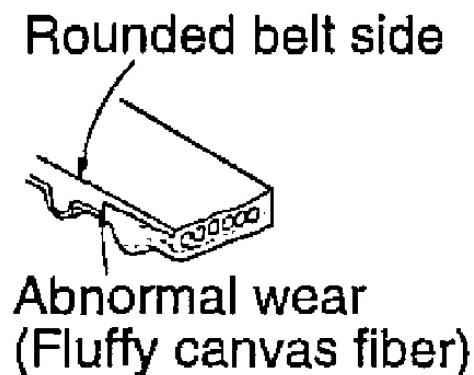
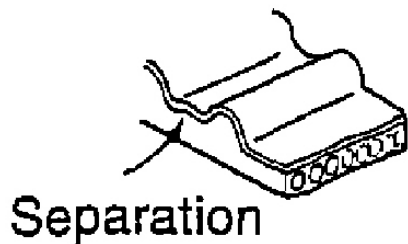


G00325742

Fig. 226: Inspecting Timing Belt For Cracks
Courtesy of KIA MOTORS AMERICA, INC.

3. Side of belt is badly worn.

NOTE: A belt in good condition should have clear-cut sides as if it were cut with a sharp knife.



G00325743

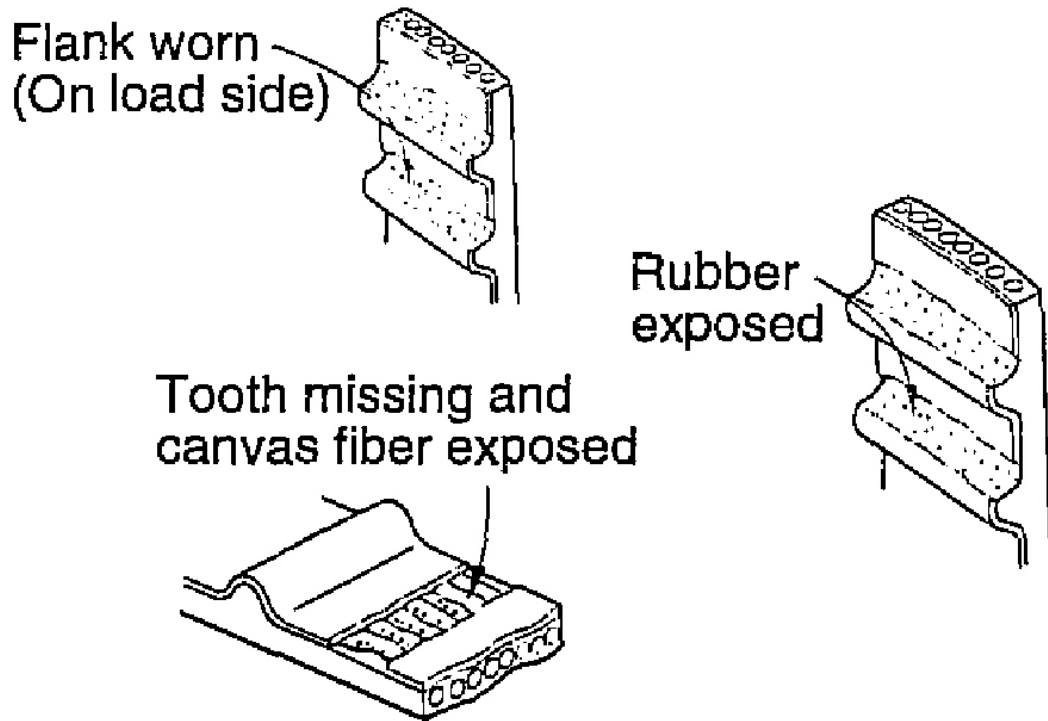
Fig. 227: Inspecting Timing Belt Sides
Courtesy of KIA MOTORS AMERICA, INC.

4. Teeth are badly worn out.

Initial stage : Canvas on load side of the tooth flank worn (fluffy canvas fibers, rubber gone, color changed to white, and unclear canvas texture)

Last stage : Canvas on the load side of the tooth flank worn down and rubber exposed (tooth width reduced).

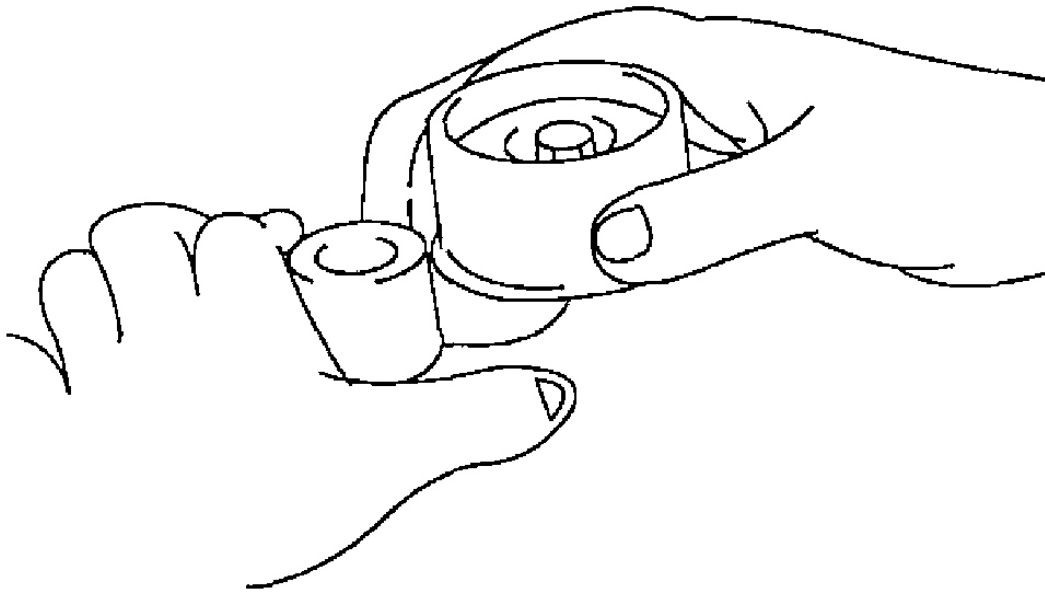
5. Missing tooth



G00325744

Fig. 228: Inspecting Timing Belt Teeth
Courtesy of KIA MOTORS AMERICA, INC.

2. If backlash or an irregular noise is observed when rotating the pulley, replace the timing belt tensioner and idler pulley.

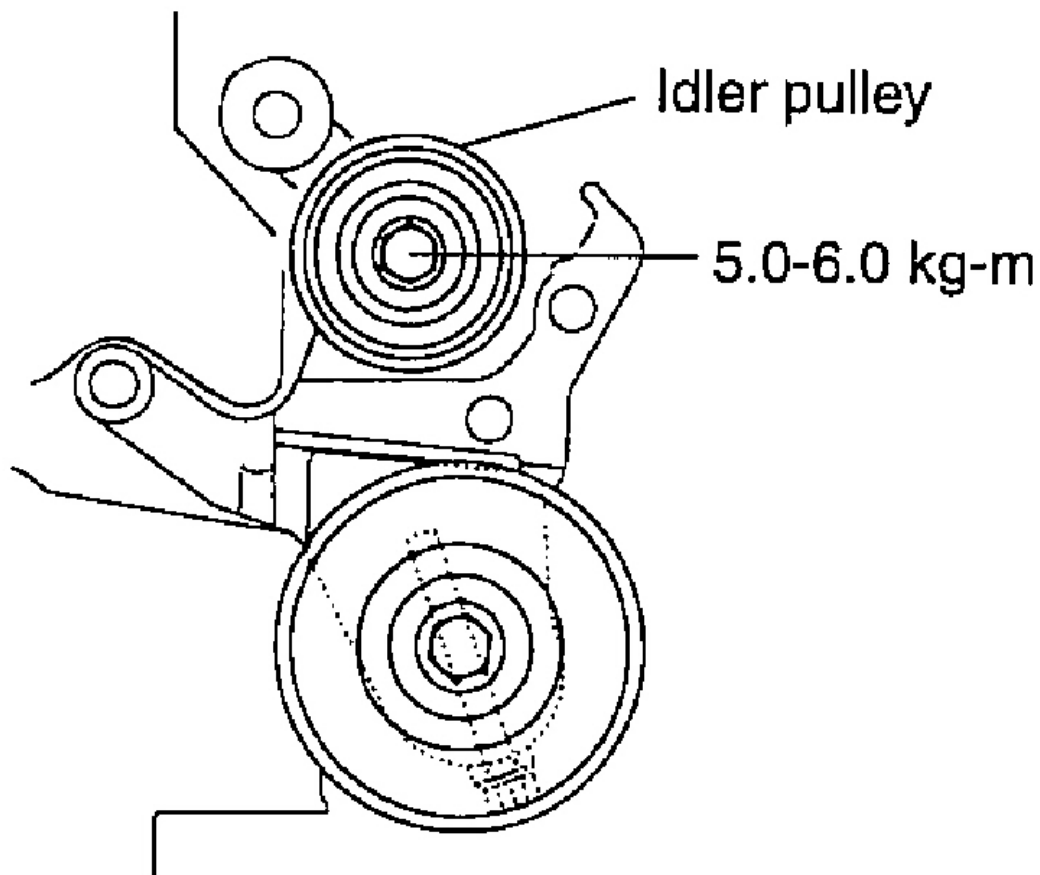


G00325745

Fig. 229: Inspecting Belt Tensioner
Courtesy of KIA MOTORS AMERICA, INC.

INSTALLATION

1. Install idler pulley to engine support lower bracket.



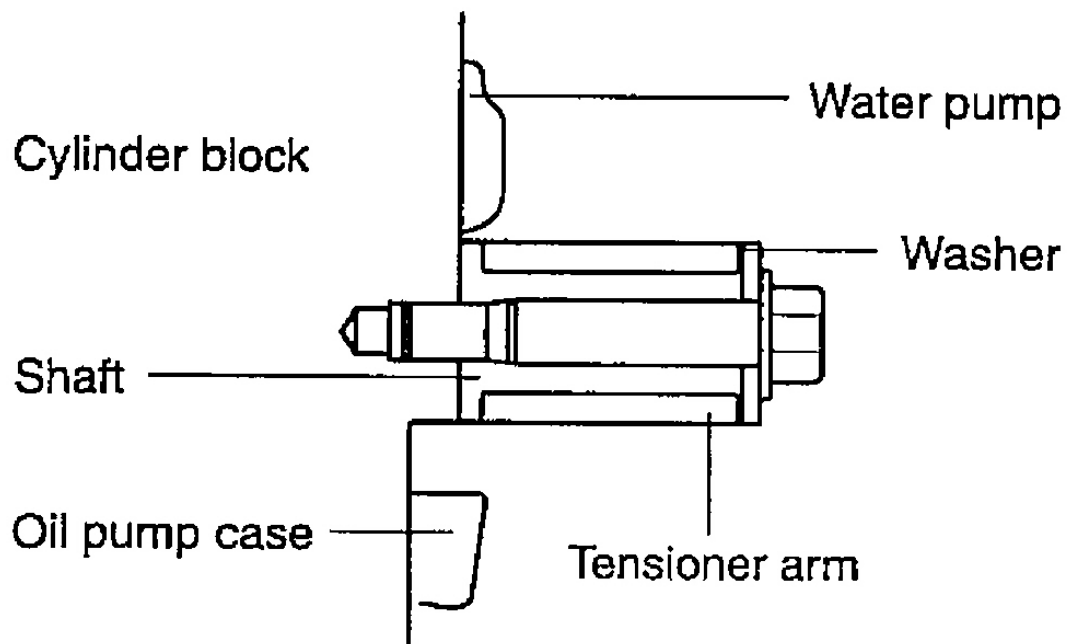
G00325747

Fig. 230: Installing Idler Pulley
Courtesy of KIA MOTORS AMERICA, INC.

2. Install tensioner arm, shaft and plane washer to cylinder block.

Tightening torque :

34.3 - 53.9 Nm (3.5-5.5 kg.m, 25.3-39.8 lb.ft)

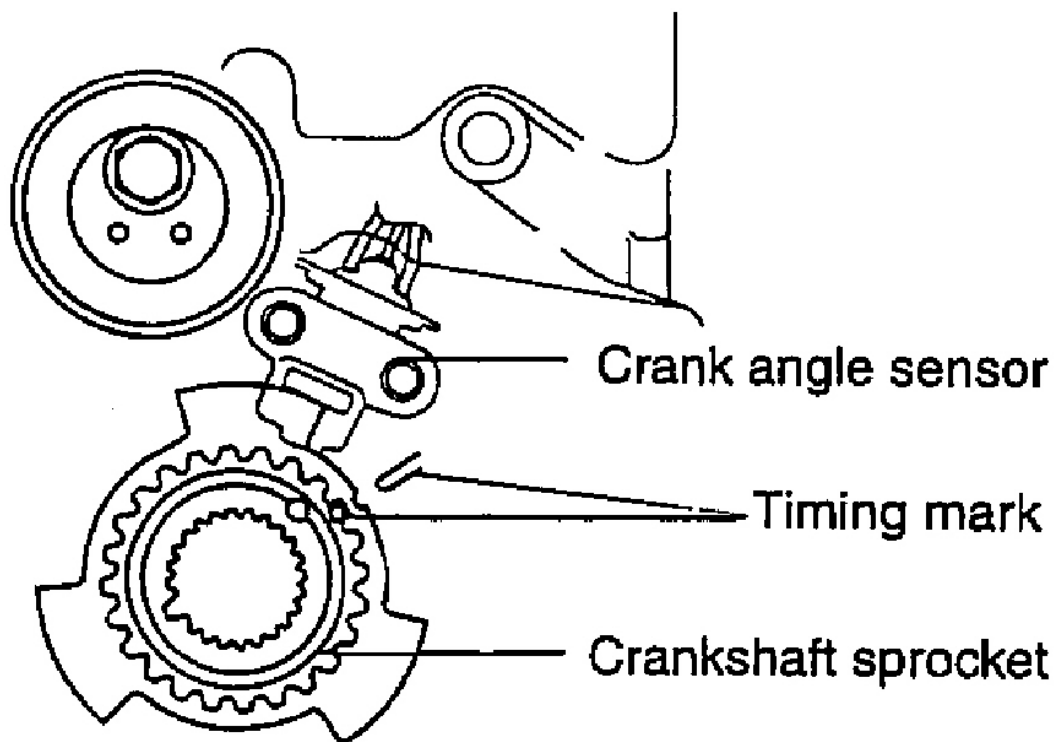


G00325748

Fig. 231: Installing tensioner arm

Courtesy of KIA MOTORS AMERICA, INC.

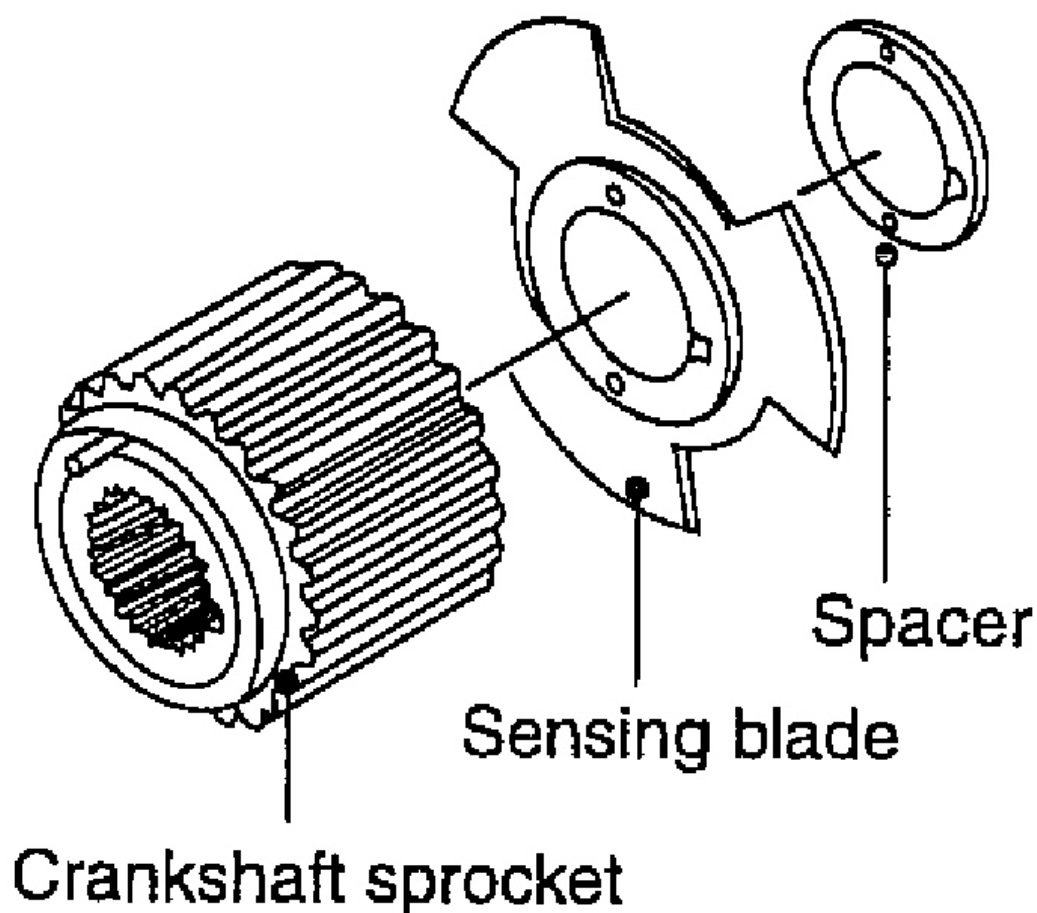
3. Install crankshaft sprocket and align the timing mark.



G00325749

Fig. 232: Installing Crankshaft Sprocket And Aligning Timing Mark
Courtesy of KIA MOTORS AMERICA, INC.

CAUTION: Be careful not to bend crankshaft sensing blade.

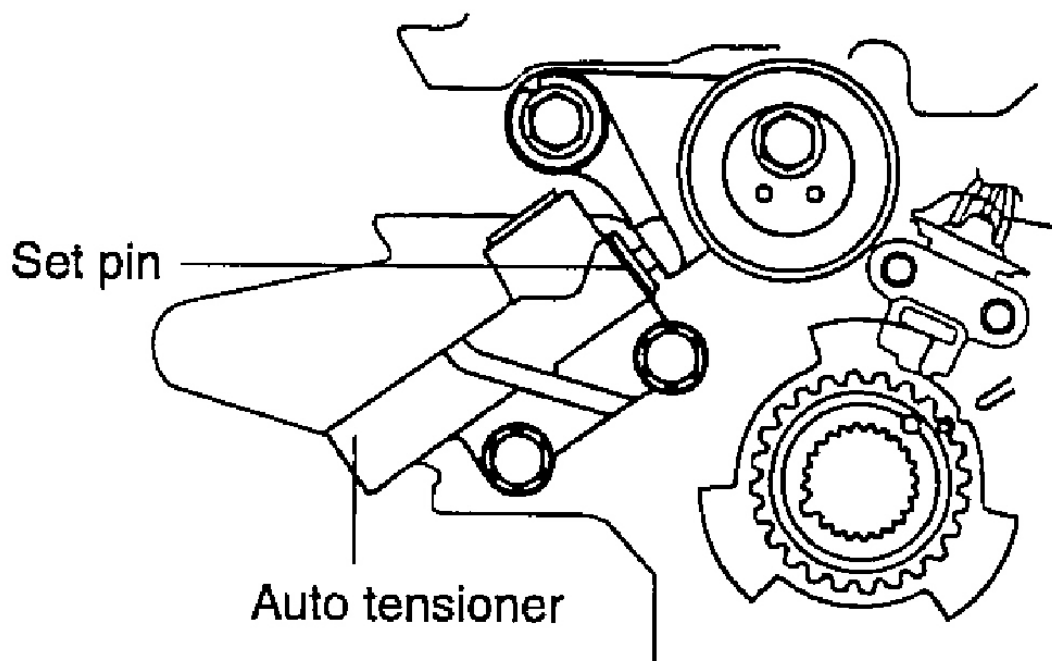


G00325750

Fig. 233: Identifying Sensing Blade & Spacer
Courtesy of KIA MOTORS AMERICA, INC.

4. Install camshaft sprocket.
5. Install auto tensioner to oil pump case.

NOTE: At this time auto tensioner's set pin should be assembled completely.

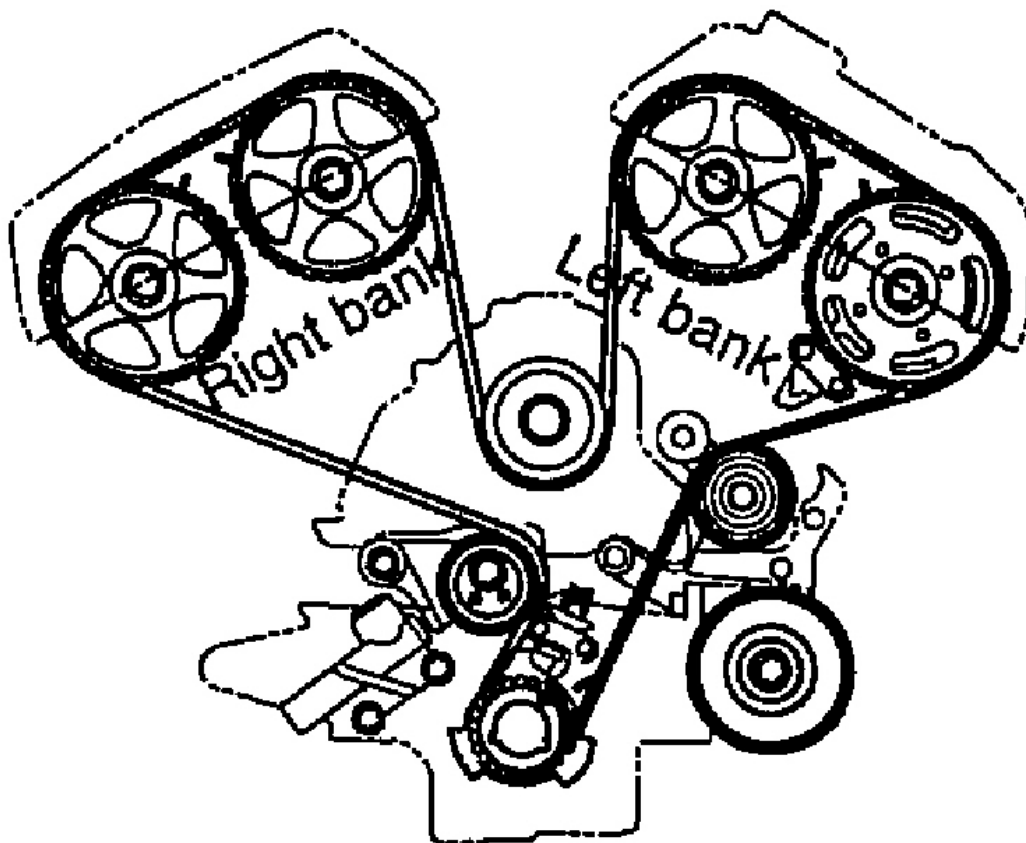


G00325751

Fig. 234: Assembling Auto Tensioner
Courtesy of KIA MOTORS AMERICA, INC.

6. Align the timing marks of each sprocket and install the timing belt in this order.

Crankshaft sprocket --> Idler pulley --> Exhaust camshaft sprocket (LH) --> Intake camshaft sprocket (LH) --> Water pump pulley --> Intake camshaft sprocket (RH) --> Exhaust camshaft sprocket (RH) --> Tensioner pulley



G00325752

Fig. 235: Installing Timing Belt & Aligning Timing Marks
Courtesy of KIA MOTORS AMERICA, INC.

NOTE:

- In this step, No. 1 is in TDC (Compression stroke)
- Do not insert fingers.

7. After installing the timing belt, reconfirm the timing mark.
8. Rotate the crankshaft 1/4 rotation counterclockwise and then rotate the crankshaft clockwise with align the timing mark.
9. Loosen the center bolt of tensioner pulley.

Apply tension for timing belt by rotating the tensioner pulley with SST (09244--28100) and torque wrench.

Tension torque : 0.5 kg.m

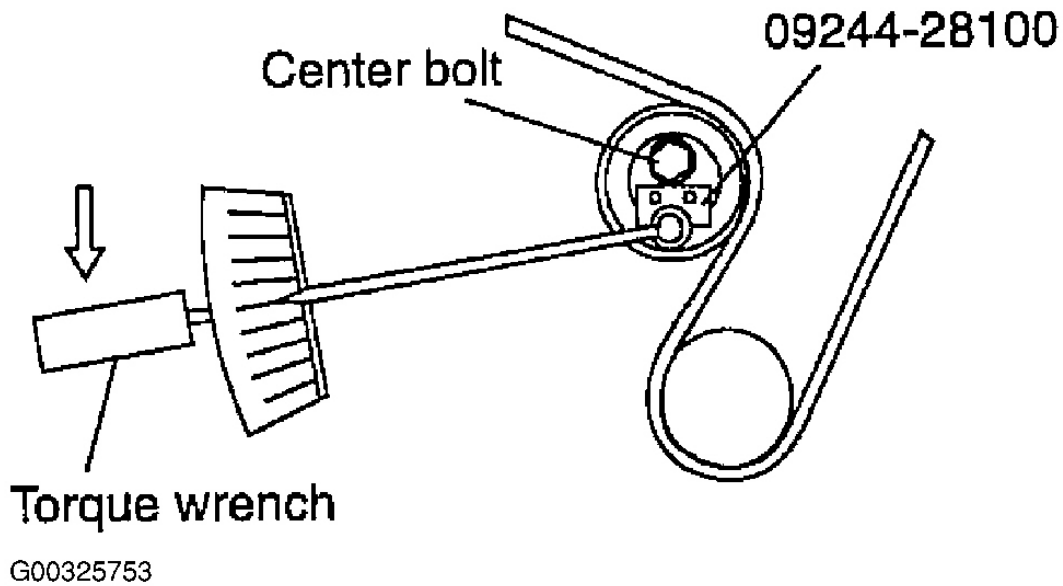
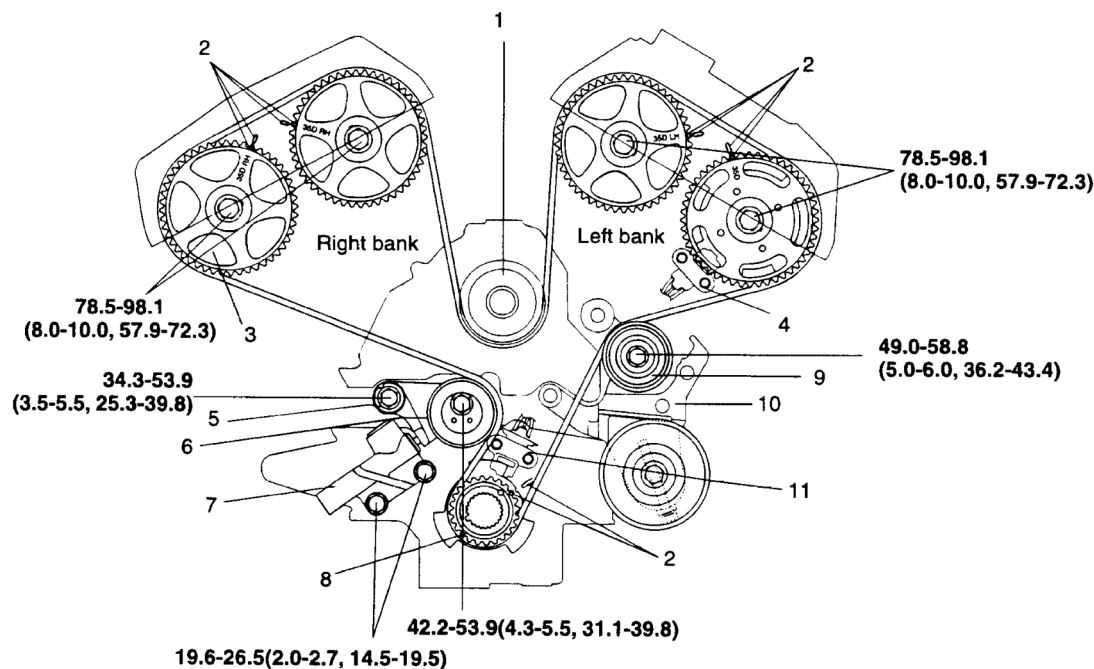


Fig. 236: Adjusting Auto Tensioner
Courtesy of KIA MOTORS AMERICA, INC.

10. Tighten the center bolt of tensioner pulley.

Tightening torque : 4.3 ~ 5.5 kg.m

11. Pull out the set pin of auto tensioner.



TORQUE : N·m (kg·m, lb·ft)

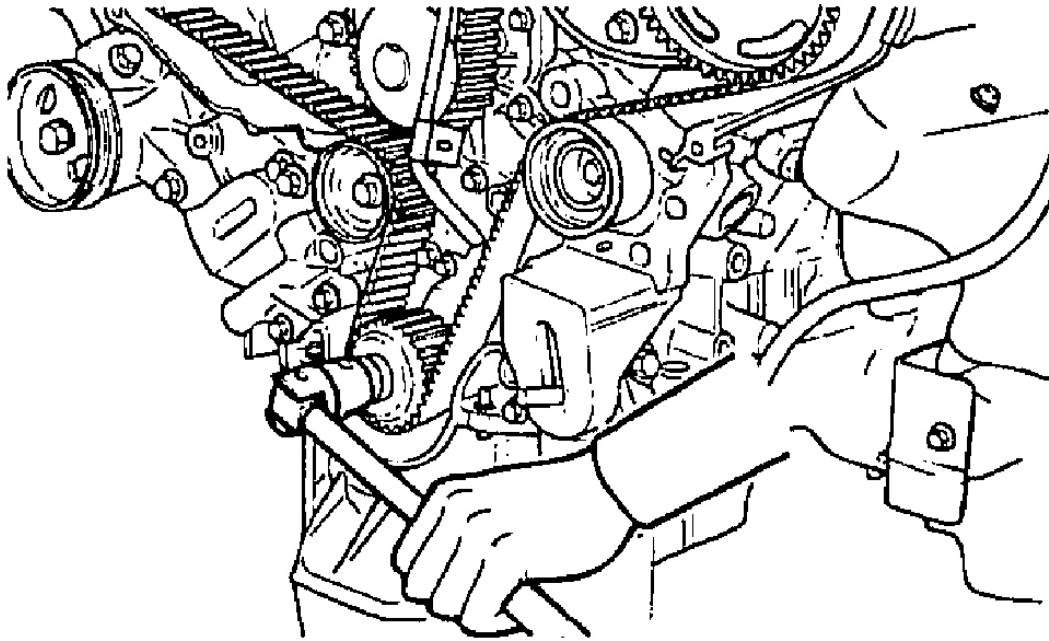
- | | |
|-----------------------------|----------------------------------|
| 1. Water pump pulley | 7. Auto tensioner |
| 2. Timing mark | 8. Crankshaft sprocket |
| 3. Camshaft sprocket | 9. Timing belt idler pulley |
| 4. Cam Position Sensor(CPS) | 10. Engine support lower bracket |
| 5. Tensioner arm | 11. Crank Angle Sensor(CAS) |
| 6. Tensioner pulley | |

G00325746

Fig. 237: Timing Belt System Tightening Specifications
Courtesy of KIA MOTORS AMERICA, INC.

ADJUSTING TIMING BELT TENSION

1. Rotate the crankshaft 2 rotation clockwise and measure the projected load of auto tensioner in the TDC (# 1 Compression stroke) after 5 minutes.



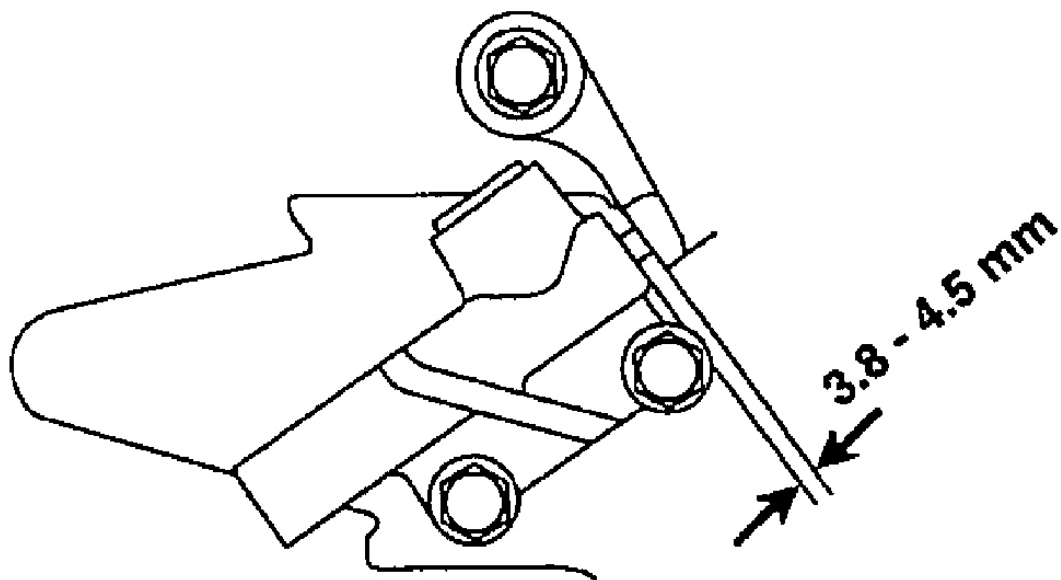
G00325754

Fig. 238: Rotating Crankshaft

Courtesy of KIA MOTORS AMERICA, INC.

2. Check the projected length is 3.8 - 4.5 mm (0.15-0.18 in).
3. Check again if the timing marks of each sprocket is with in specified position.

NOTE: If not within specified position, repeat procedure 5 in the method of installing timing belt and auto tensioner. See INSTALLATION.



G00325755

Fig. 239: Measuring Auto Tensioner Load
Courtesy of KIA MOTORS AMERICA, INC.