

2004-05 ENGINES

2.7L V6 - Optima & Magentis (Canadian)

GENERAL

SPECIFICATIONS

Engine Specifications

Description	Specification	Limit
General		
Type	V-type, DOHC	
Number of cylinders	6	
Bore		
[2.5 L]	84 mm (3.3071 in.)	
[2.7 L]	86.7 mm (3.4134 in.)	
Stroke	75 mm (2.9528 in.)	
Total displacement		
[2.5 L]	2,493cc	
[2.7 L]	2,656cc	
Compression ratio	10.0 : 1	
Firing order	1-2-3-4-5-6	
Idle R.R.M	700±100	
Ignition timing at idling speed	BTDC 12°±5°	
Valve timing		
Intake valve		
Opens (BTDC)	6°	
Closes (ABDC)	46°	
Exhaust valve Opens (BBDC)	44°	
Closes (ATDC)	8°	
Valve overlap	14°	
Intake valve duration	232°	
Exhaust valve duration	232°	
Camshaft		
Drive mechanism	Cogged type belt	
Cam height	43.95-44.15 mm (1.7303-1.7382 in.)	
Journal diameter	25.964-25.980 mm (1.0222-1.0228 in.)	
Bearing oil clearance	0.02-0.061 mm (0.0007-0.0024 in.)	
End play	0.1-0.15 mm (0.0039-0.0059 in.)	43.45 mm (1.7106 in.) 25.914 mm (1.0202 in.) 0.1 (0.0039 in.)
Cylinder head		
Flatness of gasket surface	Max. 0.03 mm (0.0012 in.)	0.05 mm (0.0020 in.)
Flatness of manifold mounting surface		
Intake	Max. 0.15 mm (0.0059 in.)	0.15 mm (0.0059 in.)

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Exhaust	Max. 0.15 mm (0.0059 in.)	0.15 mm (0.0059 in.)
Valve guide hole diameter		
0.05 (0.002) O.S.	11.05-11.068 mm (0.435-0.4357 in.)	
0.25 (0.010) O.S.	11.25-11.268 mm (0.443-0.4436 in.)	
0.50 (0.020) O.S.	11.50-11.518 mm (0.453-0.4535 in.)	
Intake valve seat ring hole diameter		
0.3 (0.012) O.S.	33.300-33.325 mm (1.311-1.312 in.)	
Exhaust valve seat ring hole diameter		
0.3 (0.012) O.S.	28.600-28.621 mm (1.126-1.127 in.)	
Valve		
Overall length		
Intake	96.1 mm (3.7835 in.)	
Exhaust	97.15 mm (3.8248 in.)	
Stem diameter		
Intake	5.965-5.98 mm (0.2348-0.2354 in.)	
Exhaust	5.95-5.965 mm (0.2343-0.2348 in.)	
Face angle	45°-45.5°	
Margin		
Intake	1.0 mm (0.0394 in.)	0.5 mm (0.0197 in.)
Exhaust	1.3 mm (0.0512 in.)	0.8 mm (0.0315 in.)
Clearance (stem-to-guide)		
Intake	0.02-0.05 mm (0.0008-0.0020 in.)	0.10 mm (0.0038 in.)
Exhaust	0.035-0.065 mm (0.0014-0.0026 in.)	0.15 mm (0.0059 in.)
Valve spring		
Free height	42.5 mm (1.6732 in.)	41.5 mm (1.6339 in.)
Load	21.9 kg / 35 mm (48.4lb / 1.3780 in.)	21.9kg / 34 mm (48.4lb / 1.3386 in.)
Out of squareness	Max 1.5°	Max 3°
Piston		
Diameter (Standard)		
[2.5 L]	83.98-84.01 mm (3.3063-3.3075 in.)	
[2.7 L]	86.68-86.71 mm (3.4126-3.4138 in.)	
Clearance (Piston-to-cylinder)	0.010-0.030 mm (0.0004-0.0012 in.)	
Ring groove width		
No.1 Q00327902	1.230-1.250 mm (0.0484-0.0492 in.)	
No.2	1.2200-1.240 mm (0.0480-0.0488 in.)	
Oil	2.515-2.535 mm (0.0990-0.0998 in.)	
Piston for service	0.25 mm (0.010 in.), 0.50 mm (0.020 in.), Oversize	
Piston ring		
Number of rings per piston	3	
Compression rings	2	
Oil ring	1	

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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	0.20-0.35 mm (0.0079-0.0138 in.) 0.8 mm (0.031 in.)
No.2	0.37-0.52 mm (0.0146-0.0205 in.) 0.8 mm (0.031 in.)
Oil ring type	0.2-0.7 mm (0.0079-0.0276 in.) 1.0 mm (0.039 in.)
Ring end gap	
No.1	0.04-0.08 mm (0.0016-0.0031 in.) 0.1 mm (0.004 in.)
No.2	0.03-0.07 mm (0.0012-0.0028 in.) 0.1 mm (0.004 in.)
Rings for service	0.25 mm (0.010 in.), 0.50 mm (0.020 in.), Oversize
Connecting rod	
Piston pin press-in load	2,450-12,255N (250-1,250 kg, 551-2,755 lb)
Side clearance (Big end)	0.10-0.25 mm (0.0039-0.0098 in.) 0.4 mm (0.016 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	0.018-0.036 mm (0.0007-0.0014 in.) 0.1 mm (0.004 in.)
Crankshaft	
Journal O.D	61.982-62.000 mm (2.4402-2.4409 in.)
Pin O.D	47.982-48.000 mm (1.8891-1.8898 in.)
Out-of roundness of journal and pin	Max. 0.003 mm (0.00012 in.)
Taper of journal and pin	Max 0.005 mm (0.0002 in.)
End play	0.070-0.250 mm (0.0028-0.0098 in.) 0.3 mm (0.012 in.)
Main bearing	
Oil clearance	0.004-0.022 mm (0.0002-0.0009 in.) 0.1 mm (0.004 in.)
Cylinder block	
Cylinder bore	
[2.5 L]	84.00-84.03 mm (3.3071-3.3083 in.)
[2.7 L]	86.7 mm (3.4134 in.) 0.05 mm (0.002 in.)
Flatness of gasket surface	Max. 0.03 mm (0.0012 in.)
Out-of-roundness and taper	Max. 0.02 mm (0.0008 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.)
Relief spring	
Free length	43.8 mm (1.724 in.)
Load	3.7 kg / 40.1 mm (8.2lb, 1.579 in.)

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Oil filter	
Type	Cartridge, full flow
Engine oil pressure	80 kPa (11.4 psi) or more [Conditions: Oil temperature is 75 to 90°C (167 to 194°F)]
Cooling method	Engine coolant cooling, forced circulation with electric fan
Cooling system	
Quantity	7.1 lit (7.5 U.S. qts., 6.2 imp. qts.) [For V6]
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	93.2-122.6 kPa (0.95-1.25 kg/cm ² , 13.51-17.78 psi)
Main valve closing pressure	83.4 kPa (0.85 kg/cm ² , 12.1 psi)
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 Service Standard Specifications
Courtesy of KIA MOTORS AMERICA, INC.

LUBRICANT

Engine coolant

Ethylene glycol base for aluminum radiator

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Fig. 2: Identifying Engine Coolant Lubricants
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SEALANT

Engine coolant temperature sender

Three bond No.2310 or equivalent

Engine coolant temperature sensor

LOCTITE 962T or equivalent

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Fig. 3: Identifying Cooling System Component Sealants

Courtesy of KIA MOTORS AMERICA, INC.

TORQUE SPECIFICATIONS**TORQUE SPECIFICATIONS**

Application	Ft. Lbs. (N.m)
Air Intake Surge Tank-To-Intake Manifold Bolt/Nut	11-14 (15-19)
Auto Tensioner Fixed Bolt	15-20 (20-27)
Camshaft Sprocket Bolt	66-81 (90-110)
Catalytic Converter-To-Center Exhaust Pipe Nuts	22-30 (30-40)
Center Exhaust Pipe-To-Main Muffler Nuts	22-30 (30-40)
Connecting Rod Bolts	
Step 1	12-15 (16-20)
Step 2	Tighten An Additional 90-95 Degrees
Crankshaft Pulley Bolt	133-140 (180-190)
Cylinder Head Bolts (Cold Engine) ⁽¹⁾	
Step 1	18 (25)
Step 2	Tighten An Additional 60-64 Degrees
Step 3	Tighten An Additional 45-49 Degrees
Drive Belt Pulley Bolt	26-41 (35-55)
Drive Belt Tensioner Bolt	15-20 (20-27)
Drive Plate & Adapter Plate Bolt	54-57 (73-77)
Engine Coolant Inlet Fitting Attaching Bolts	13-15 (17-20)
Engine Coolant Pump-To-Cylinder Block Nut	11-16 (15-22)
Engine Coolant Temperature Sensor	15-30 (20-40)
Engine Hanger Bracket-To-Engine Bolt	15-20 (20-27)
Engine Mounting Bracket Bolts/Nuts	44-59 (60-80)
Engine Mounting Insulator Bolt	66-81 (90-110)
Exhaust Manifold-To-Cylinder Head Nuts	18-22 (25-30)
Flywheel Bolt	54-57 (73-77)
Front Exhaust Pipe-To-Catalytic Converter Bolts	30-44 (40-60)
Front Exhaust Pipe-To-Exhaust Manifold Nuts	22-30 (30-40)

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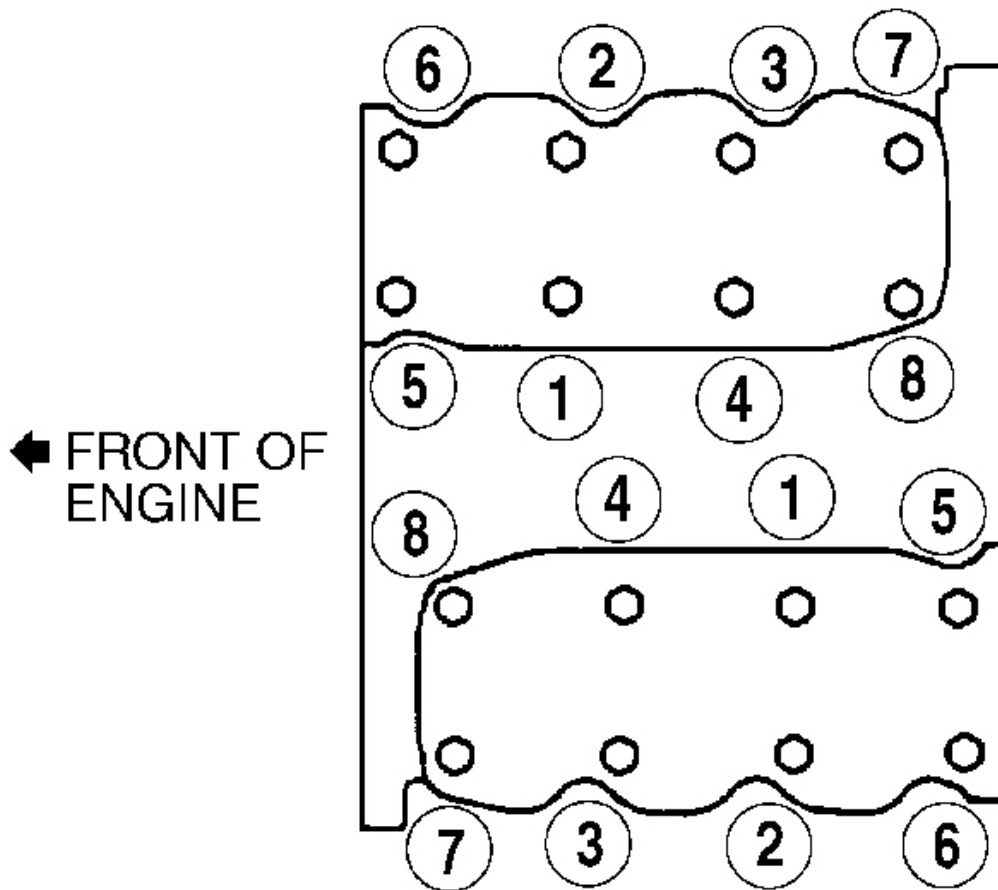
Front Roll Stopper Bracket-To-Sub Frame Bolts	44-59 (60-80)
Front Roll Stopper Bracket-To-Transaxle Bolts	44-59 (60-80)
Front Roll Stopper Insulator Bolt & Nut	37-48 (50-65)
Generator Mount Bolt (Generator Mount Bracket Side)	15-22 (20-30)
Generator Mount Bracket-To-Engine Bolt	15-22 (20-30)
Generator Mount Nut (Engine Front Case Side)	15-22 (20-30)
Intake Manifold-To-Cylinder Head Nuts	15 (20)
Main Bearing Cap Bolts	
M8	
Step 1	10-14 (13-19)
Step 2	Tighten An Additional 90-95 Degrees
M10	
Step 1	20-24 (27-33)
Step 2	Tighten An Additional 90-95 Degrees
Oil Filter	13-18 (17-25)
Oil Pan Drain Plug	26-33 (35-45)
Oil Relief Valve Plug	30-37 (40-50)
Oil Screen Bolt	11-16 (15-22)
Oxygen Sensor-To-Exhaust Manifold	30-37 (40-50)
Power Steering Oil Pump Bracket-To-Front Cylinder Head Assembly Bolt	13-19 (17-26)
Power Steering Oil Pump-To-Bracket Bolt	13-19 (17-26)
Rear Roll Stopper Bracket-To-Sub Frame Bolts	37-48 (50-65)
Rear Roll Stopper Bracket-To-Transaxle Bolts	37-48 (50-65)
Rear Roll Stopper Insulator Bolt/Nut	37-48 (50-65)
Starter-To-Engine	
Bolt	20-25 (27-34)
Nut	15-22 (20-30)
Surge Tank Stay Bolt	11-15 (15-20)
Throttle Body-To-Surge Tank Bolts	11-15 (15-20)
Timing Belt Idler Pulley Bolt	37-44 (50-60)
Timing Belt Tensioner Arm Fixed Bolt	26-41 (35-55)
Timing Belt Tensioner Bolt	15-20 (20-27)
Timing Belt Tensioner Pulley Bolt	32-41 (43-55)
Transaxle Mounting Bracket Bolts	44-59 (60-80)
Transaxle Mounting Insulator Bolt	66-81 (90-110)
Transaxle Mounting Sub Bracket Nut	44-59 (60-80)
Upper Oil Pan Bolts ⁽²⁾	
8 x 22 mm	14-21 (19-28)
10 x 38 mm	22-31 (30-42)

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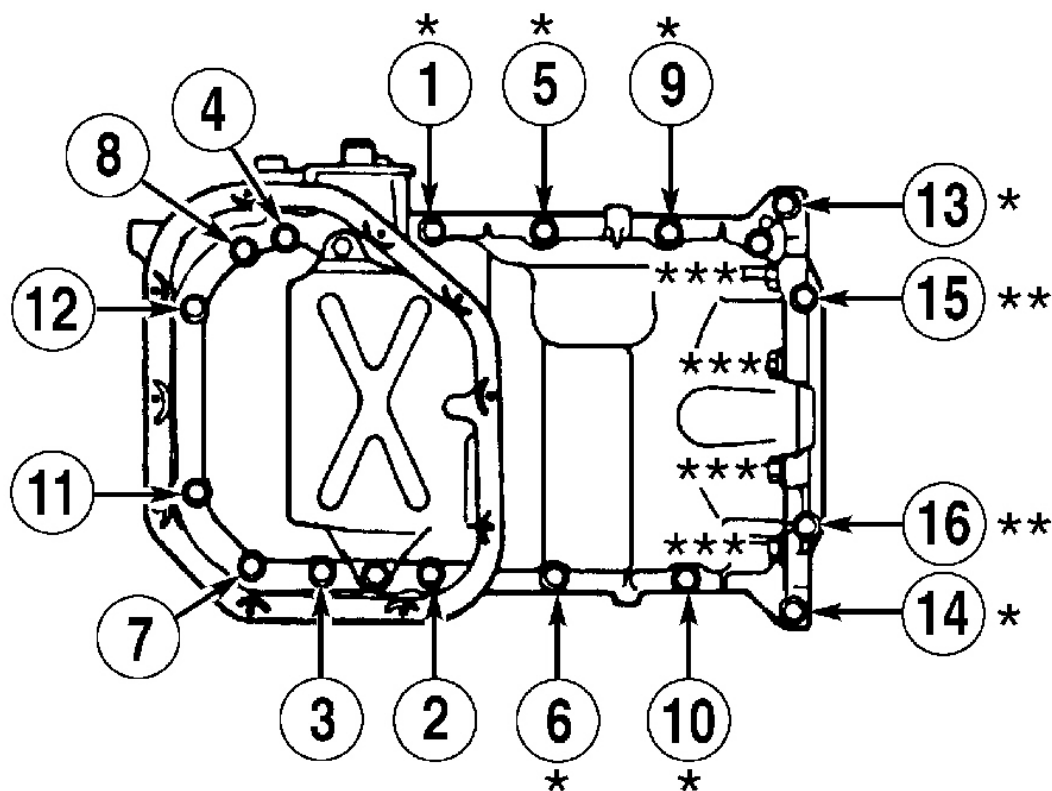
Water Outlet Fitting Bolt	13-15 (17-20)
	INCH Lbs. (N.m)
Air Cleaner Body Installation Bolt	71-106 (8-12)
Air Cleaner Mounting Bolts	71-106 (8-12)
Crankshaft Position Sensor Wheel Screw	44-53 (5-6)
Cylinder Head Cover Bolts ⁽³⁾	
Step 1	(4)
Step 2	44-53 (5-6)
Delivery Pipe Installation Bolts	89-133 (10-15)
Distributor Adapter Assembly-To-Engine Bolt	106-133 (12-15)
Exhaust Manifold Heat Protector-To-Exhaust Manifold Bolts	106-133 (12-15)
Fuel Hose Clamp-To-Rear Cylinder Head Assembly Bolt	106-133 (12-15)
Lower Oil Pan Bolt	89-106 (10-12)
Main Muffler Hanger Support Bracket Bolts	89-133 (10-15)
Oil Level Gauge Guide-To-Engine Bolt	106-133 (12-15)
Oil Pressure Switch	71-106 (8-12)
Oil Pump Case Bolts	106-133 (12-15)
Oil Pump Cover Screw	71-106 (8-12)
Oil Seal Case Bolt	89-106 (10-12)
Rear Plate Bolt	71-89 (8-10)
Timing Belt Cover Bolt	89-106 (10-12)
Transaxle Mounting Plate Bolt	89-106 (10-12)
Upper Oil Pan Bolts ⁽²⁾	44-62 (5-7)

- (1) Tighten cylinder head bolts in sequence. See **Fig. 4**.
- (2) Tighten oil pan bolts in sequence. See **Fig. 5**.
- (3) Tighten bolts in sequence. See **Fig. 6**.
- (4) Tighten bolts to approximately half torque in sequence. See **Fig. 6**.



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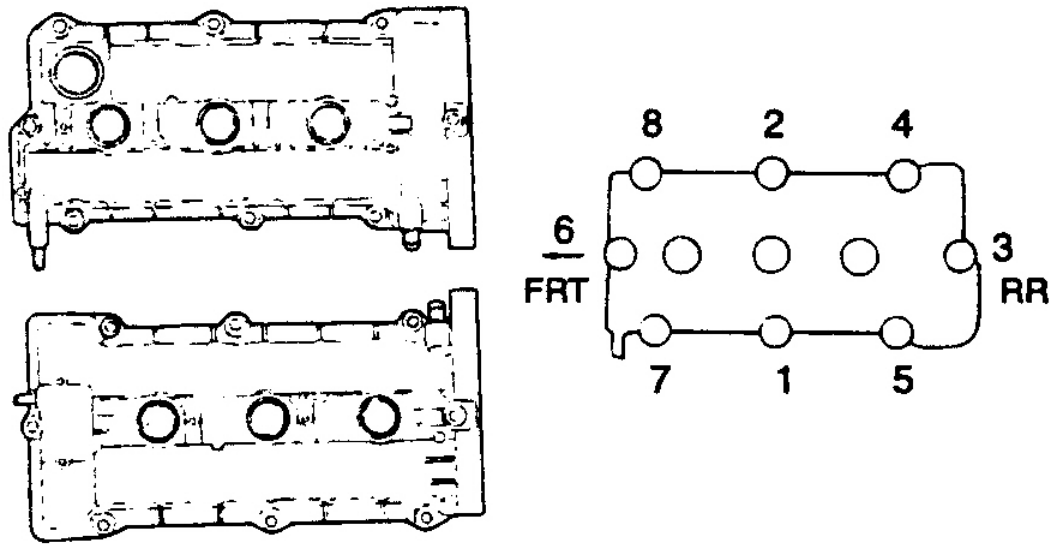
Fig. 4: Cylinder Head Bolt Tightening Sequence
 Courtesy of HYUNDAI MOTOR CO.



- * 14-20 ft. lbs. (19-28 N.m)
 ** 4-5 ft. lbs. (5-7 N.m)
 *** 22-30 ft. lbs. (30-42 N.m)

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Fig. 5: Oil Pan Bolt Tightening Sequence
 Courtesy of HYUNDAI MOTOR CO.



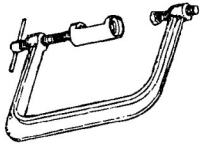
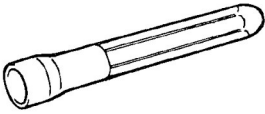
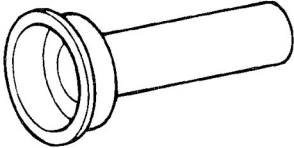
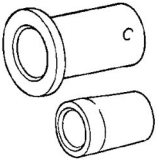
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Fig. 6: Cylinder Head Cover Bolt Tightening Sequence
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SPECIAL SERVICE TOOLS

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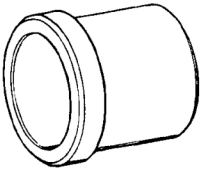
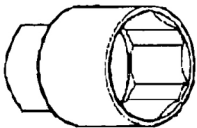
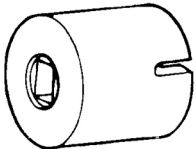
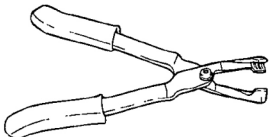
Tool (Number and name)	Illustration	Use
09222-28000 /0K993 120 001 Valve spring compressor		Removal and installation of the intake or exhaust valve
09222-22001 Valve stem oil seal installer		Installation of the valve stem oil seal
09221-22000A 09221-29000 Valve guide installer		Removal and installation of the valve guide
09231-33000 Crankshaft rear oil seal installer		Installation of the crankshaft rear oil seal
09214-33000 Crankshaft front oil seal installer		Installation of the crankshaft front oil seal

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Fig. 7: Identifying Special Service Tools (1 Of 2)
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Tool (Number and name)	Illustration	Use
09221-21000 /09221-M2000 Camshaft oil seal installer		Installation of circular packing
09260-32000 Oil pressure switch wrench		Removal and installation of oil pressure switch
09231-33100 Crankshaft wrench		Used if the crankshaft needs to be rotated to attach the timing belt, etc.
09222-29000 Valve stem oil seal remover		Removal of valve stem oil seal

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Fig. 8: Identifying Special Service Tools (2 Of 2)
Courtesy of KIA MOTORS AMERICA, INC.

TROUBLESHOOTING

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2004-05 ENGINES 2.7L V6 - Optima & Magentis (Canadian)

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 knocking	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 everyday
	Dirty engine oil	Replace
	Poor oil quality	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 find out cause
	Excessive bearing clearance	Replace
Damaged crankshaft bearing	Shortage of engine oil	Add or replace Check oil level everyday
	Low oil pressure	Adjust or repair
	Poor quality engine oil	Use proper engine oil
	Worn or out-of round crankshaft journal	Replace
	Restricted oil passage in crankshaft	Clean
	Worn bearing	Replace bearing and check engine oil lubrication system
	Bearing improperly installed	Replace
	Non-concentric crankshaft or bearing	Replace
Timing belt noise	Incorrect belt tension	Replace

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Fig. 9: Troubleshooting Chart (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
Oil pressure drop	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 find out 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	Replace
	Damaged radiator core joint Corroded or cracked hoses (Radiator hose, heater hose, etc)	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
	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
	Insufficient coolant	Refill coolant
Abnormally low coolant temperature	Faulty thermostat	Replace
	Faulty temperature gauge or wiring	Repair or replace

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Fig. 10: Troubleshooting Chart (2 Of 3)
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2004 Kia Optima EX

2004-05 ENGINES 2.7L V6 - Optima & Magentis (Canadian)

Symptom	Probable cause	Remedy
Leakage from oil cooling system	Loose hose and pipe connection	Retighten
	Blocked or collapsed hose and pipe	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. 11: Troubleshooting Chart (3 Of 3)
Courtesy of KIA MOTORS AMERICA, INC.

ADJUSTING VALVE CLEARANCE

As the intake and exhaust valves are equipped with auto-lash adjustment mechanisms, there is no need to adjust the valve clearance. The proper function of the auto-lash mechanism may be determined by checking for tappet noise. When there is tappet noise or any unusual noise, first check the engine oil pressure. If the engine oil pressure is okay, check the auto-lash by removing and bleeding or replacing it.

TIGHTENING CYLINDER HEAD BOLTS

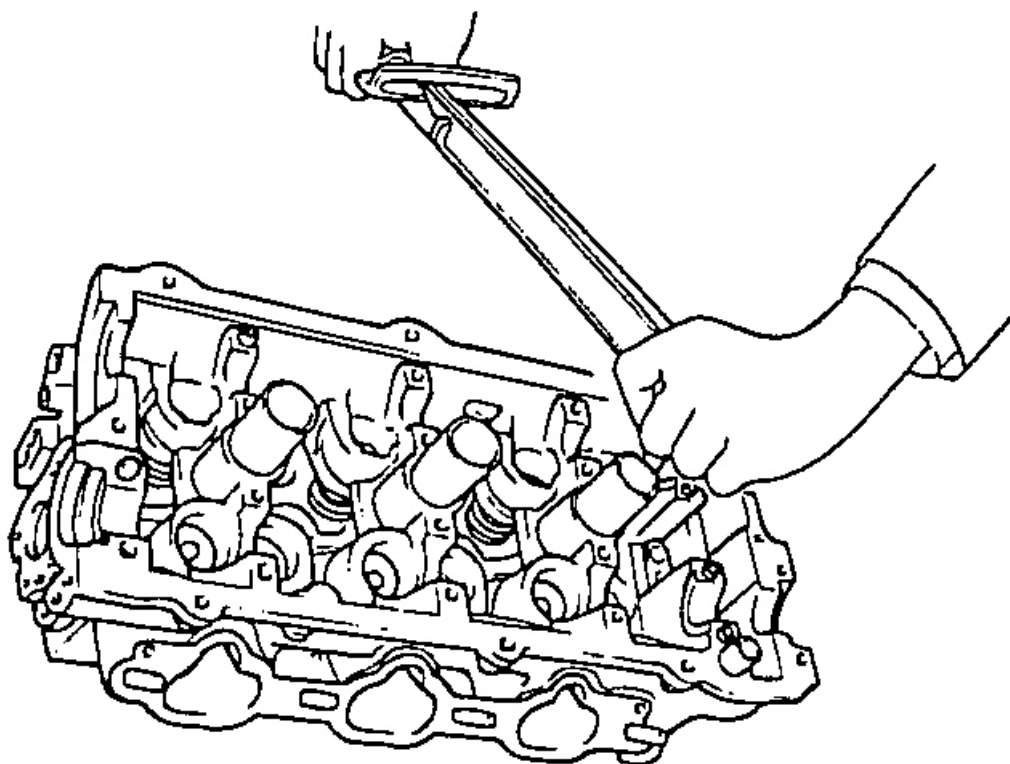
1. First loosen slightly and then tighten to the specified torque.

Tightening torque

Cylinder head bolts

Cold [Engine temperature approximately 20°C (68°F)]:

25 Nm (250 kg.cm, 18 lb.ft)+(58°~62°)+(43°~47°)



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Fig. 12: Installing Cylinder Head Bolts
Courtesy of KIA MOTORS AMERICA, INC.

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

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

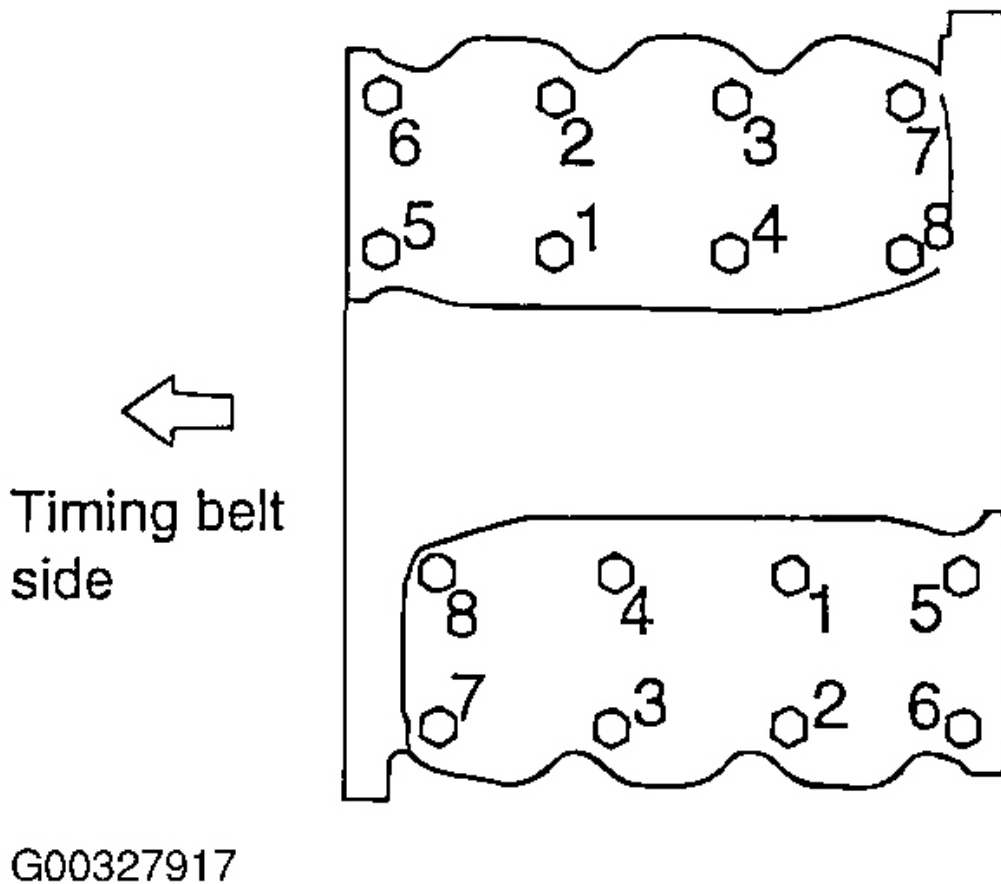


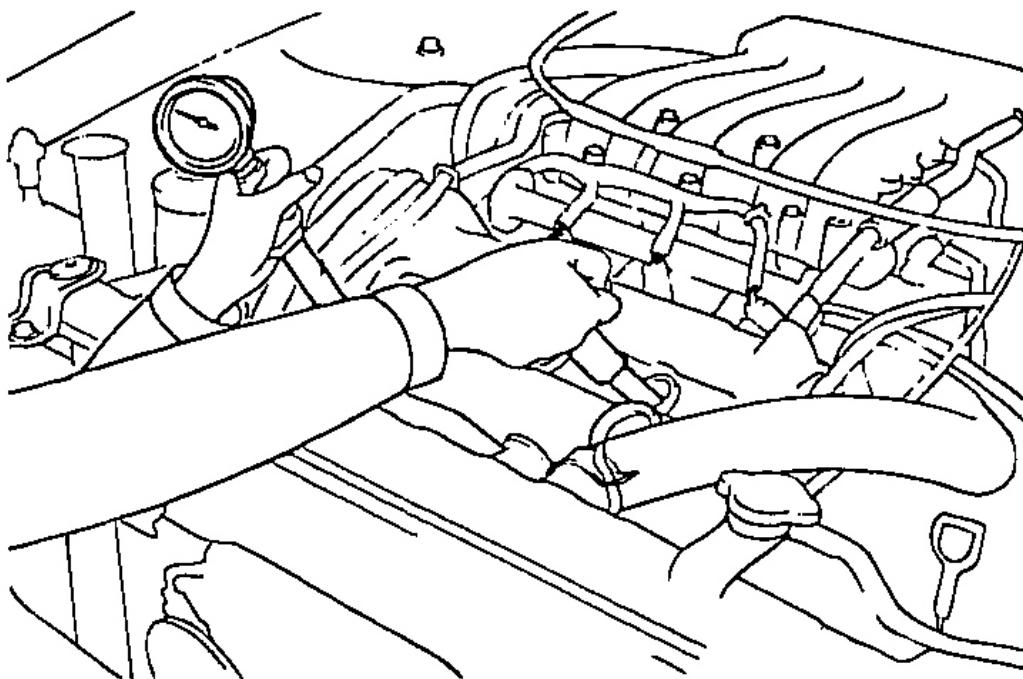
Fig. 13: Identifying Cylinder Head Bolt Torque Sequence
Courtesy of KIA MOTORS AMERICA, INC.

CHECKING COMPRESSION PRESSURE

1. Before checking compression, check the engine oil level and that the starter motor and battery are all in normal operating condition.
2. Start the engine and wait until engine coolant temperature reaches 80°C~95°C (176°F~205°F).
3. Stop the engine and disconnect the spark plug cables.
4. Remove the spark plugs.
5. Crank the engine to remove any foreign material in the cylinders.
6. Attach the compression gauge to a spark plug hole.
7. Depress the accelerator pedal to fully open the throttle.
8. Crank the engine and read the gauge.

Standard value: 12.2 kg/cm² (1220 kPa, 170 psi)

Limit: 10.7 kg/cm² (1050 kPa, 149 psi)



G00327918

Fig. 14: Checking Compression Pressure
Courtesy of KIA MOTORS AMERICA, INC.

9. Repeat steps 6-8 on all cylinders, ensuring that the pressure differential for each of the cylinders is within the specified limit.

Limit:

Max. 1.0 kg/cm² (100 kPa, 14 psi) between cylinders

10. If a cylinder's compression or pressure differential is below the specification, add a small amount of oil through the spark plug hole and repeat steps from 6-9.
 1. 1) If the addition of oil brings the compression up, it is possible that there is 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: 20-30 Nm (200-300 kg.cm, 14-22 lb.ft)

CHECKING ENGINE OIL

1. Position a vehicle on a level surface.
2. Stop the engine.

NOTE: In the case of a vehicle that has been out of service for a prolonged period, run the engine for several minutes. Stop 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 MIN mark), refill to the "MAX" mark.

NOTE: When refilling, use the same type of engine oil as the one currently being used.

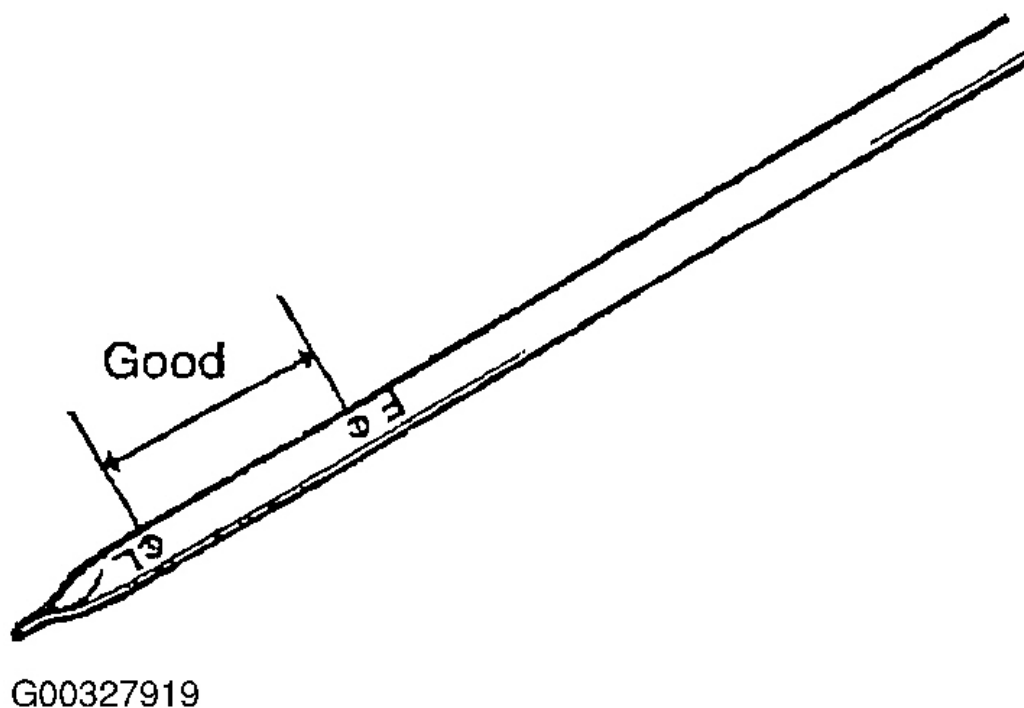


Fig. 15: Checking Engine Oil Level
Courtesy of KIA MOTORS AMERICA, INC.

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

SELECTION OF ENGINE OIL

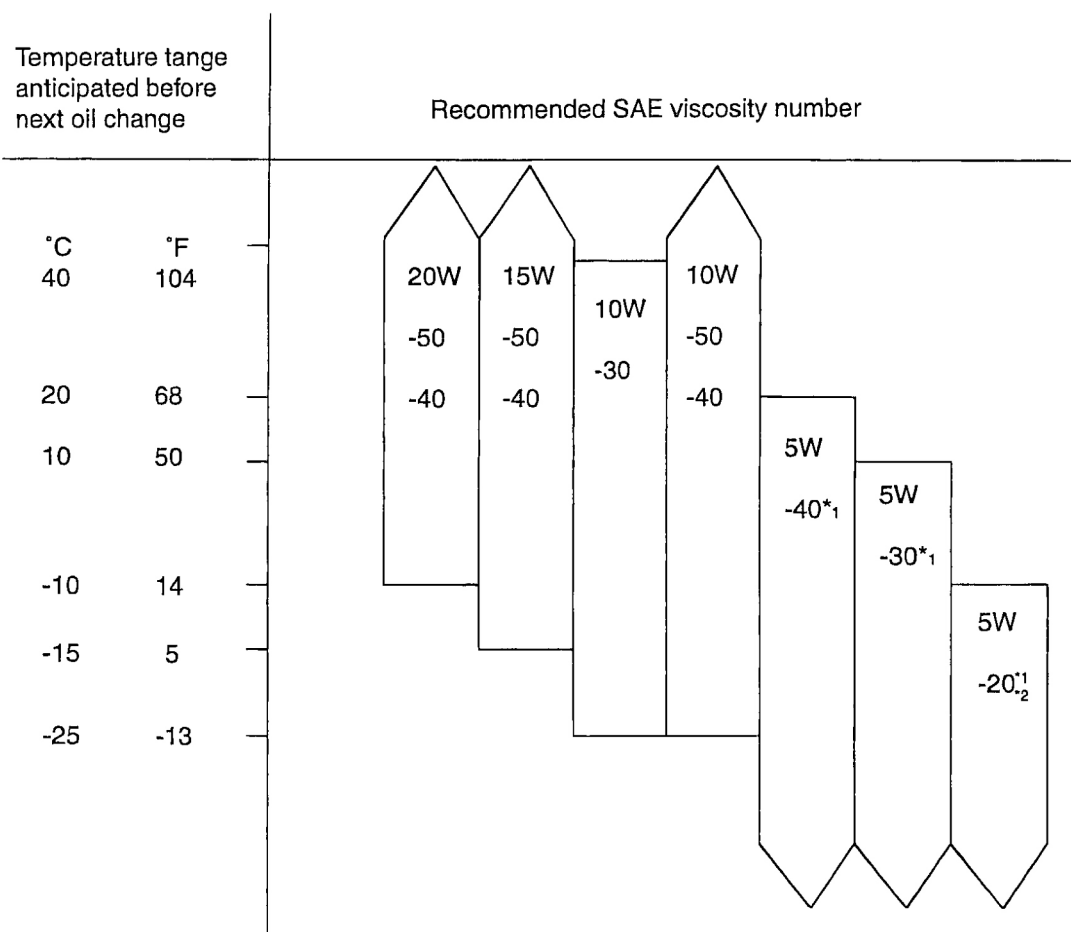
NOTE: For best performance and for maximum protection for all types of operation, select only those lubricants which:

- Confirm the requirements of the API classification.
- Have proper SAE grade number for expected ambient temperature range. Lubricants which do not have both a SAE grade number and an API service classification on the container should not be used.

Recommended API classification

SG or SG/CD, SH or SH/CD

Recommended SAE viscosity grades

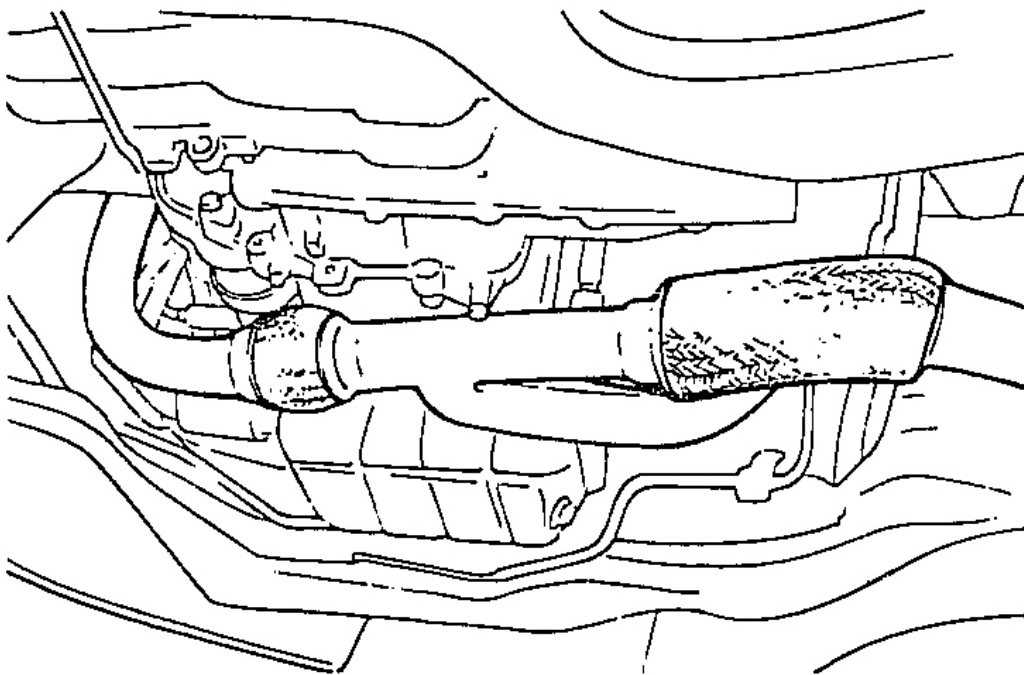


G00327920

Fig. 16: Identifying Society Of Automotive Engineers (SAE) Viscosity Identification Chart
Courtesy of KIA MOTORS AMERICA, INC.

CHANGING ENGINE OIL

1. Run the engine until it reaches normal operating temperature.
2. Stop the engine.
3. Remove the oil filler cap (on rocker cover) and the drain plug (on the oil pan). Drain the engine oil.



G00327921

Fig. 17: Locating Oil Pan Drain Plug
Courtesy of KIA MOTORS AMERICA, INC.

4. Re-install and tighten the drain plug to the specified torque.

Tightening torque

Drain plug : 35-45 Nm (350-450 kg. cm., 25-33 lb. ft.)

CAUTION: Whenever tightening oil drain plug, use a new drain plug gasket.

5. Fill the crankcase with fresh engine oil through the oil filler cap opening.

Refill Specifications

Without oil filter; 4.5 lit (4.76 U.S.qts., 3.95 Imp.qts.)

With oil filter; 4.8 lit (5.07 U.S.qts., 4.22 Imp.qts.)

CAUTION: Do not overfill the crankcase. This will cause oil aeration and loss of oil pressure.

6. Install the oil filler cap.
7. Start and run the engine.
8. Stop the engine and then check the oil level. Add oil if necessary.

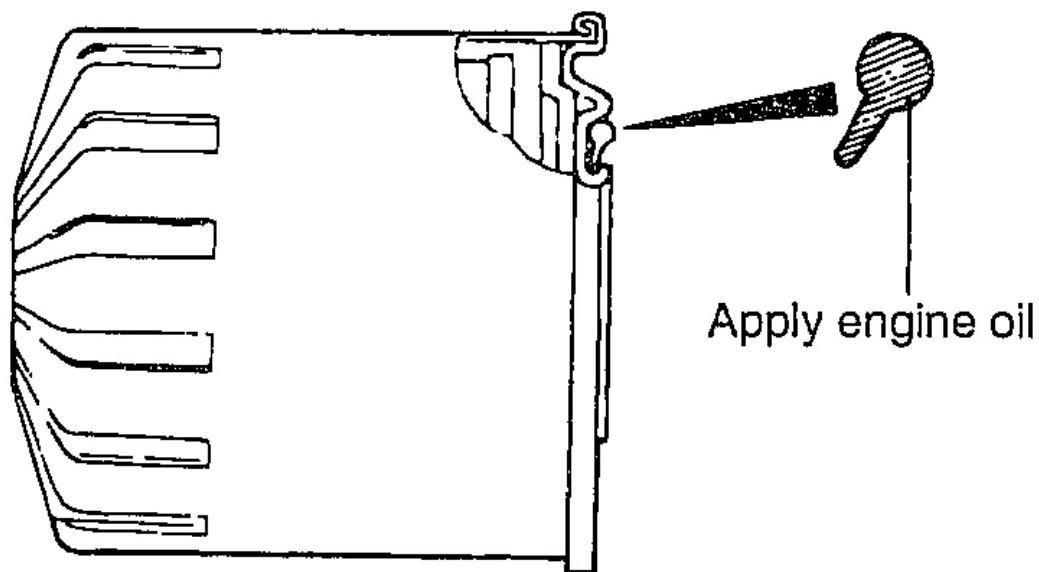
REPLACING OIL FILTER

Filter Selection

All Kia engines are equipped with a high quality, throw-away oil filter. The filter is recommended as a replacement filter on all vehicles. The quality of replacement filters varies considerably. Only high quality filters 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 mating surface on the engine block, before installing the new filter.

Procedure for Replacing Oil Filter

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



G00327923

Fig. 18: Installing Engine Oil Filter

Courtesy of KIA MOTORS AMERICA, INC.

3. Tighten the oil filter to the specified torque.

Tightening torque

Oil filter: 17-25 Nm (170-250 kg.cm, 12-18 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.

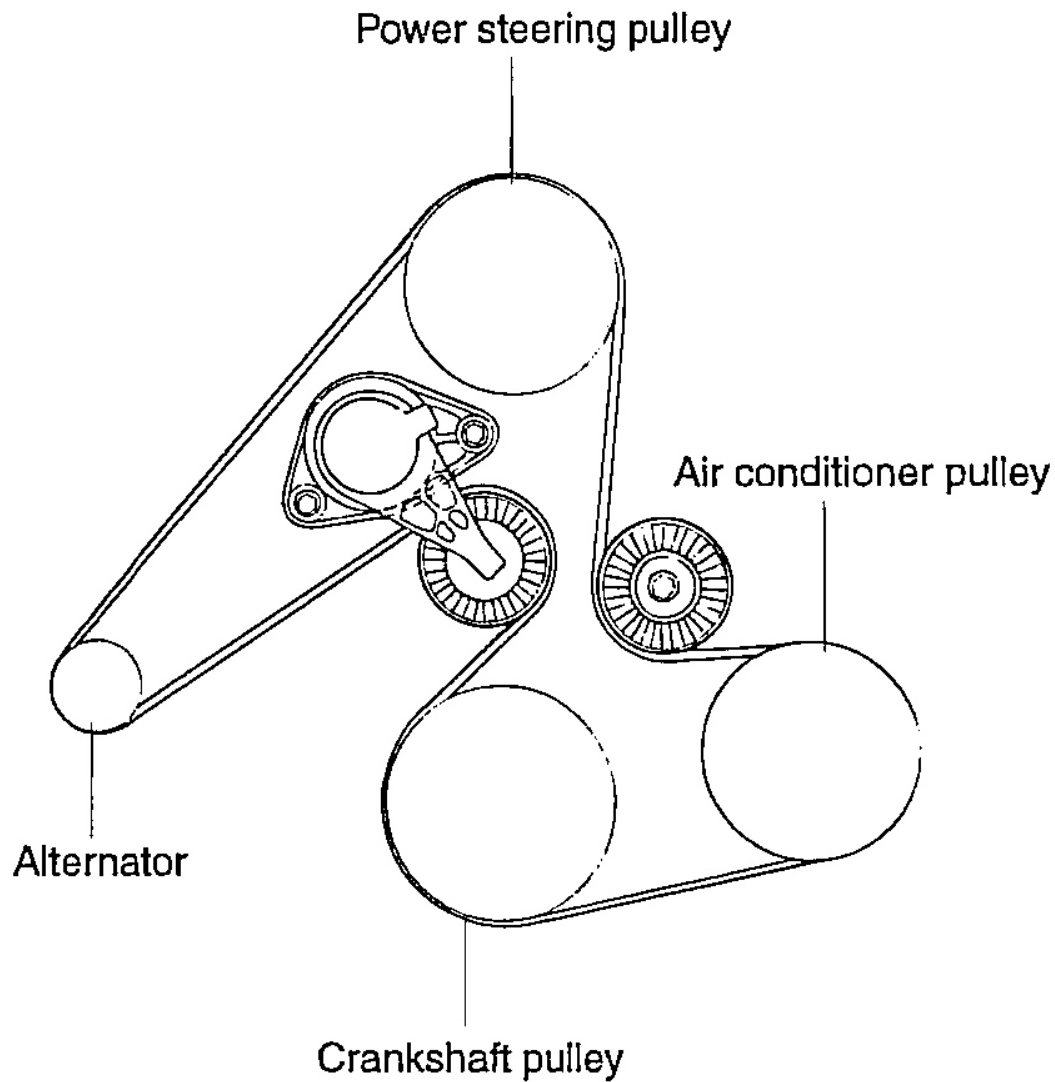
ADJUSTING DRIVE BELT AND TENSIONER

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

Tightening torque

Tensioner assembly bolt :

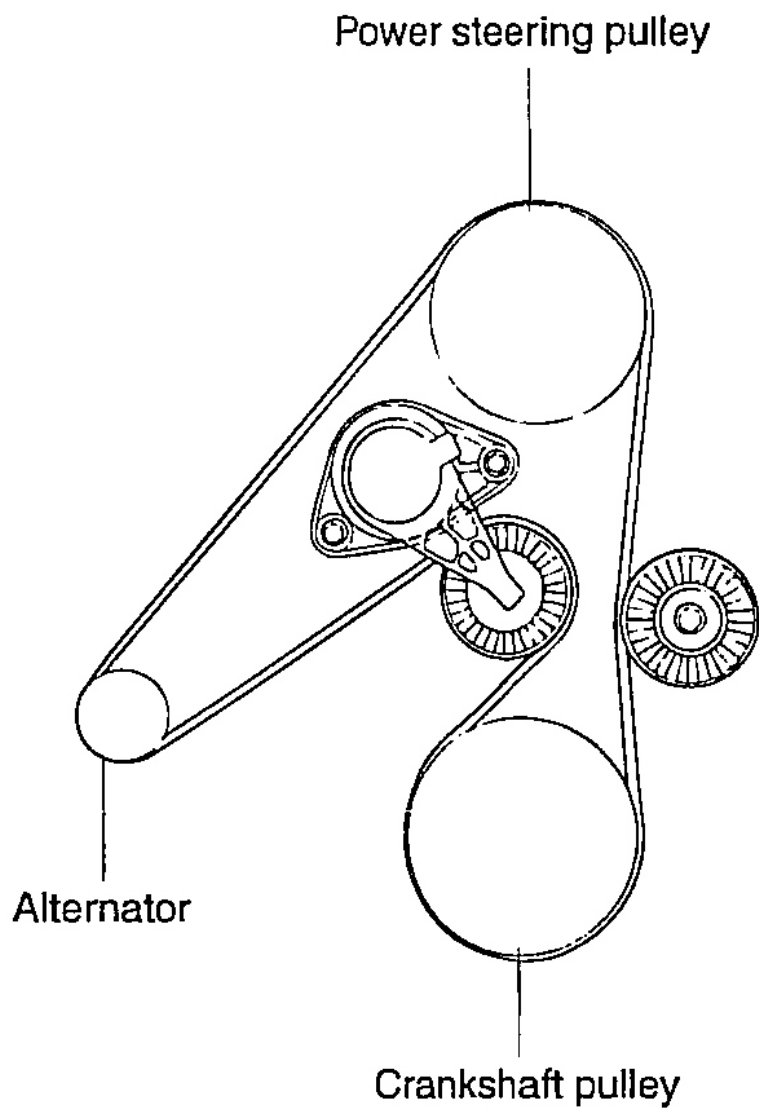
20-27 Nm (200-270 kg.cm, 14-20lb.ft)



<With Air conditioner>

G00327924

Fig. 19: Drive Belt Routing (With Air Conditioner)
Courtesy of KIA MOTORS AMERICA, INC.



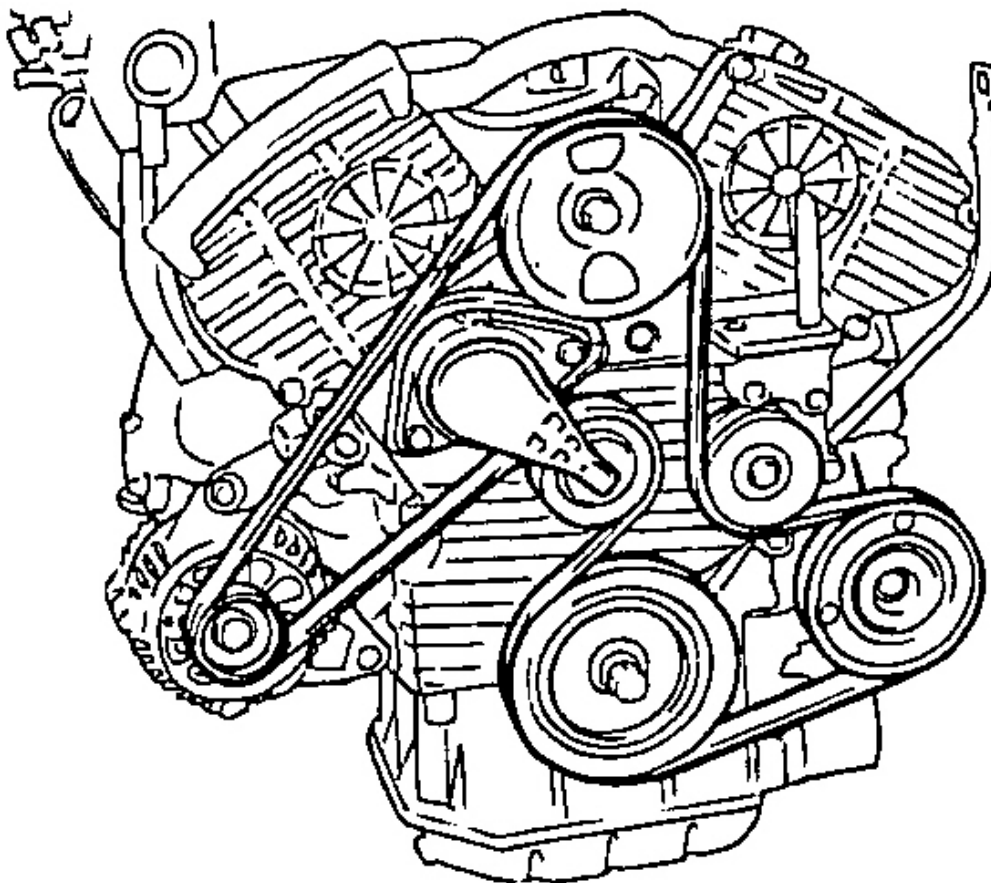
<Without Air conditioner>

G00327925

Fig. 20: Drive Belt Routing (Without Air Conditioner)
Courtesy of KIA MOTORS AMERICA, INC.

2. Install the belt in following order.

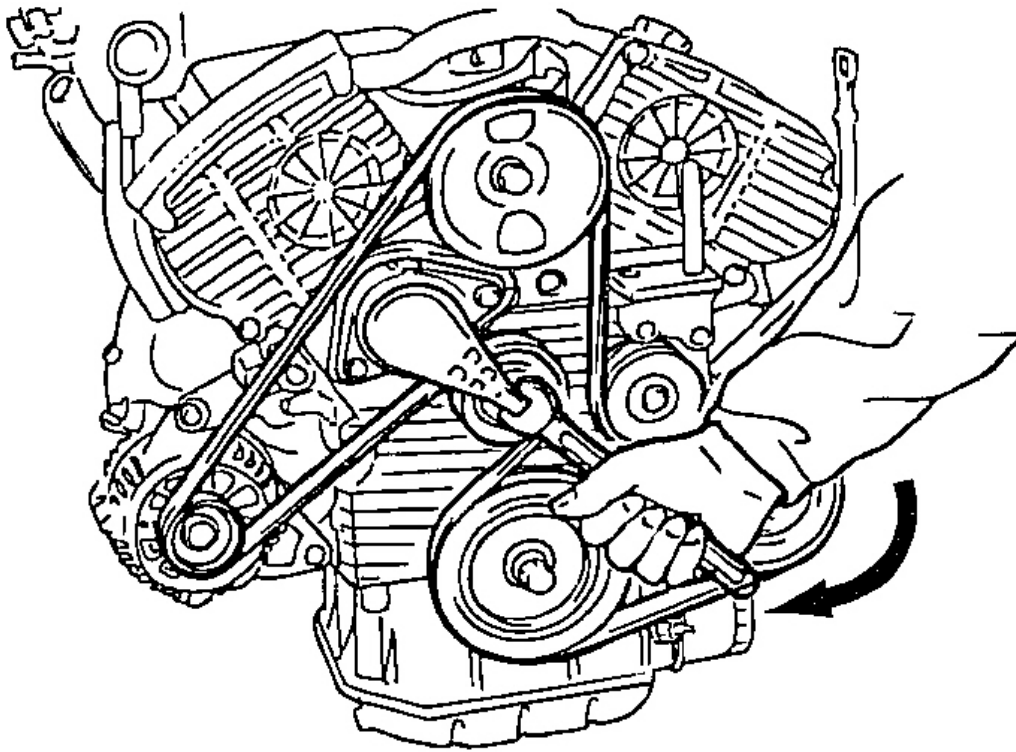
[Alternator -> Power steering -> Crankshaft pulley -> Air conditioner pulley -> Idler pulley.]



G00327926

Fig. 21: Installing Drive Belt (1 Of 3)
Courtesy of KIA MOTORS AMERICA, INC.

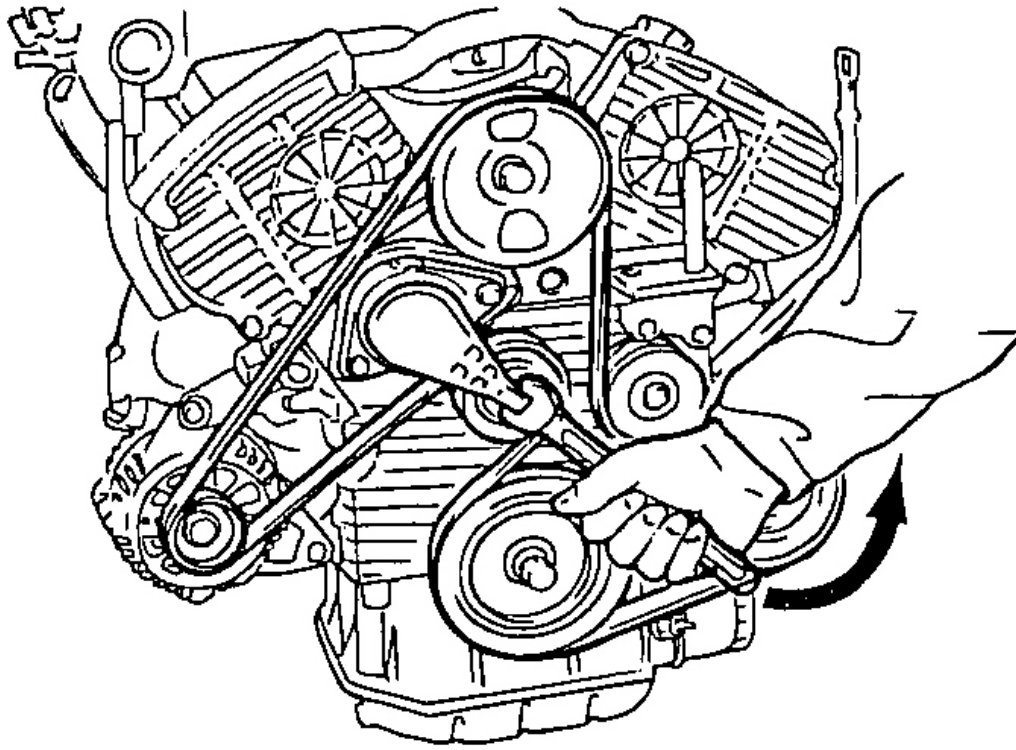
3. Rotate the tensioner arm clockwise (about 14°) with spanner (16 mm) and hang the belt to the idler pulley.



G00327927

Fig. 22: Installing Drive Belt (2 Of 3)
Courtesy of KIA MOTORS AMERICA, INC.

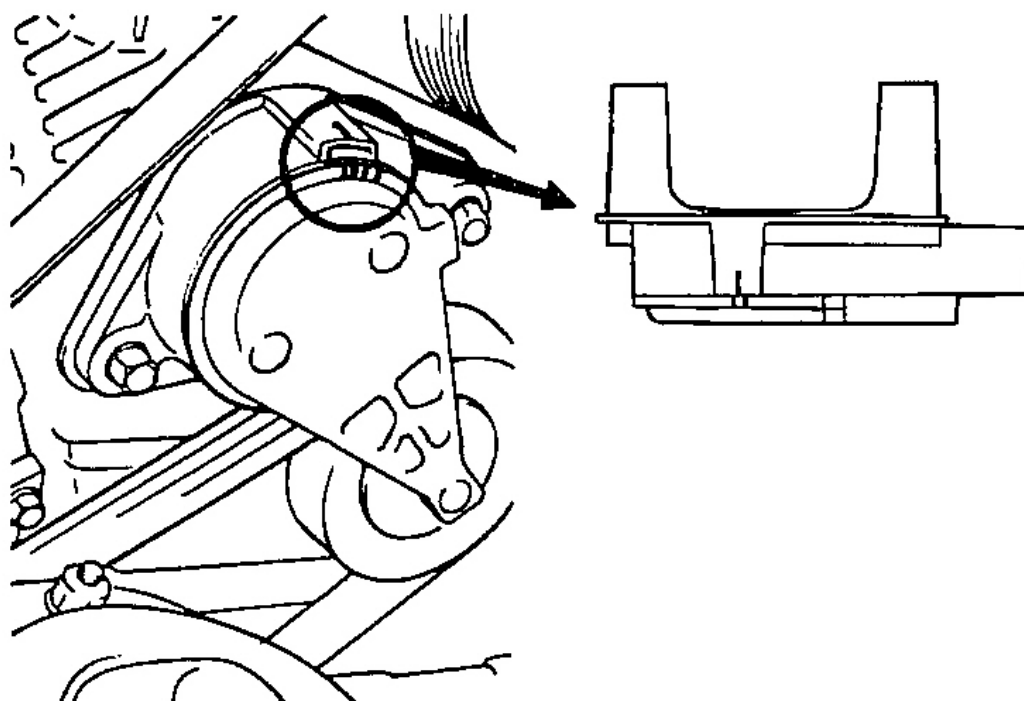
4. When installing the belt on the hole of pulley, make sure there is no tooth gap of belt.



G00327928

Fig. 23: Installing Drive Belt (3 Of 3)
Courtesy of KIA MOTORS AMERICA, INC.

5. The tensioner mark should be between MIN. and MAX. position, if not, replace the belt.

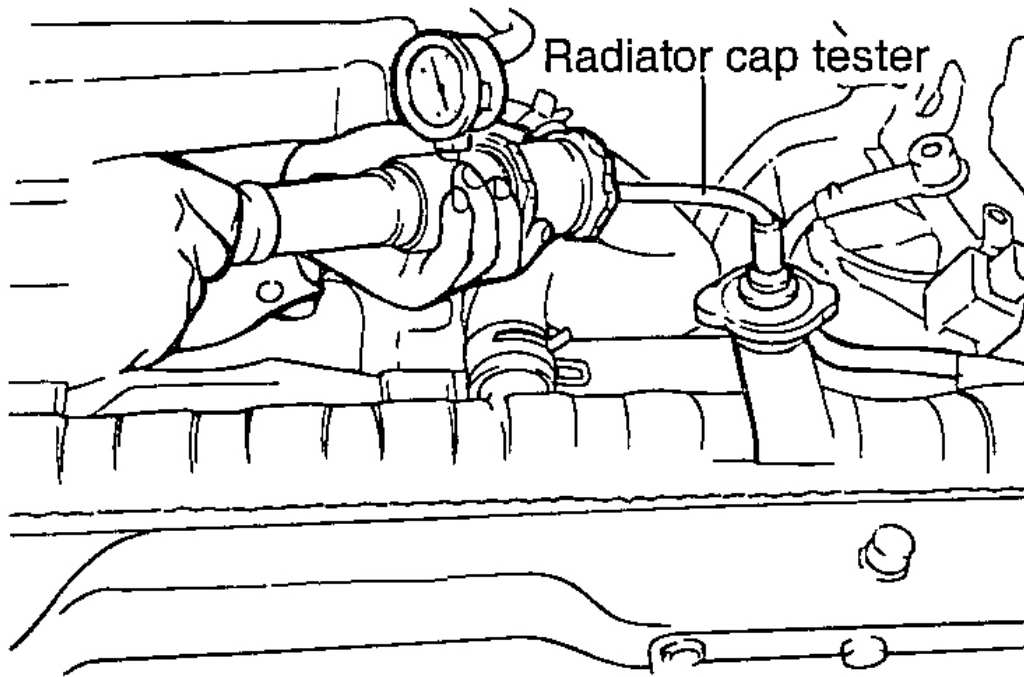


G00327929

Fig. 24: Locating Tensioner Mark Of Auto Tensioner
Courtesy of KIA MOTORS AMERICA, INC.

CHECKING COOLANT LEAK

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 (21 psi, 1.53 kg/cm²) pressure. Hold for two minutes in that condition, while checking for leakage from the radiator, hose or connections.



G00327930

Fig. 25: Checking Cooling System For Leaks
Courtesy of KIA MOTORS AMERICA, INC.

WARNING:

- Radiator coolant may be extremely hot. Do not open the system while hot, or scalding Engine coolant could spray out causing severe burns and blindness. Allow the vehicle to cool to ambient air temperature before servicing this system.
- Be sure to completely clean away any moisture from the places checked.
- When the tester is removed, be careful not to spill any coolant from it.
- Be careful, when installing and removing the tester and when testing, not to deform the filler neck of the radiator.

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

RADIATOR CAP PRESSURE TEST

1. Use an adapter to attach the cap to the tester.

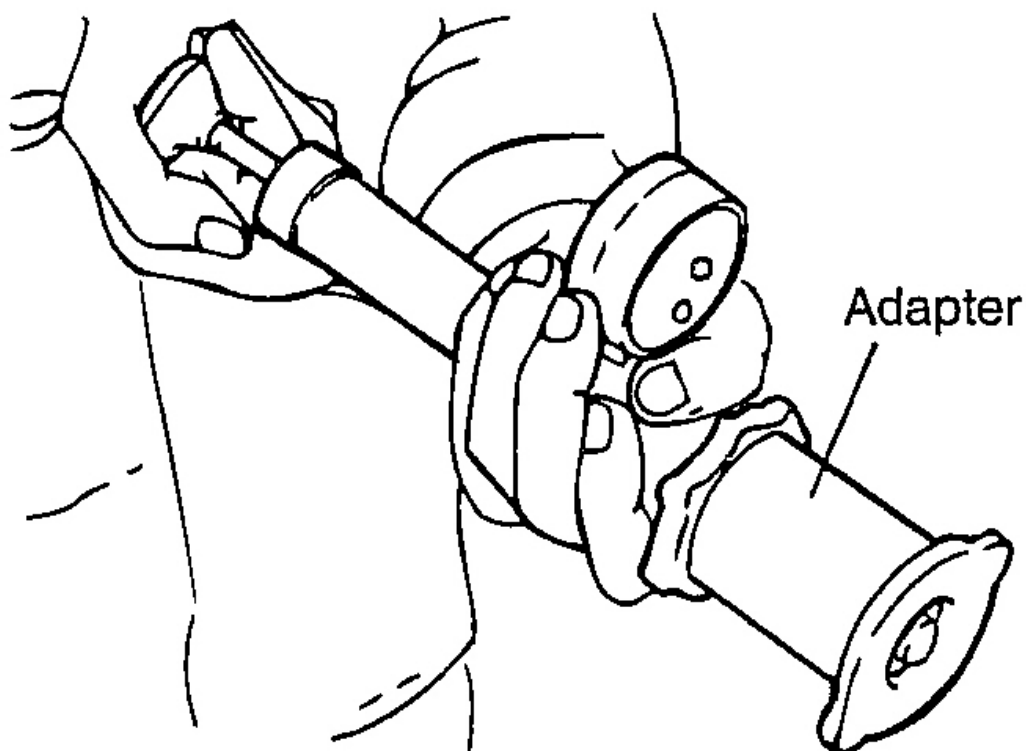
2. Increase the pressure until the indicator of the gauge stops moving.

Main valve opening pressure :

93.2-122.6 kPa (0.95-1.25 kg/m² , 13.51-17.78 psi)

Main valve closing pressure :

83.4kPa (0.85 kg/cm² ,12.1 psi)



G00327931

Fig. 26: Testing Radiator Cap
Courtesy of KIA MOTORS AMERICA, INC.

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.

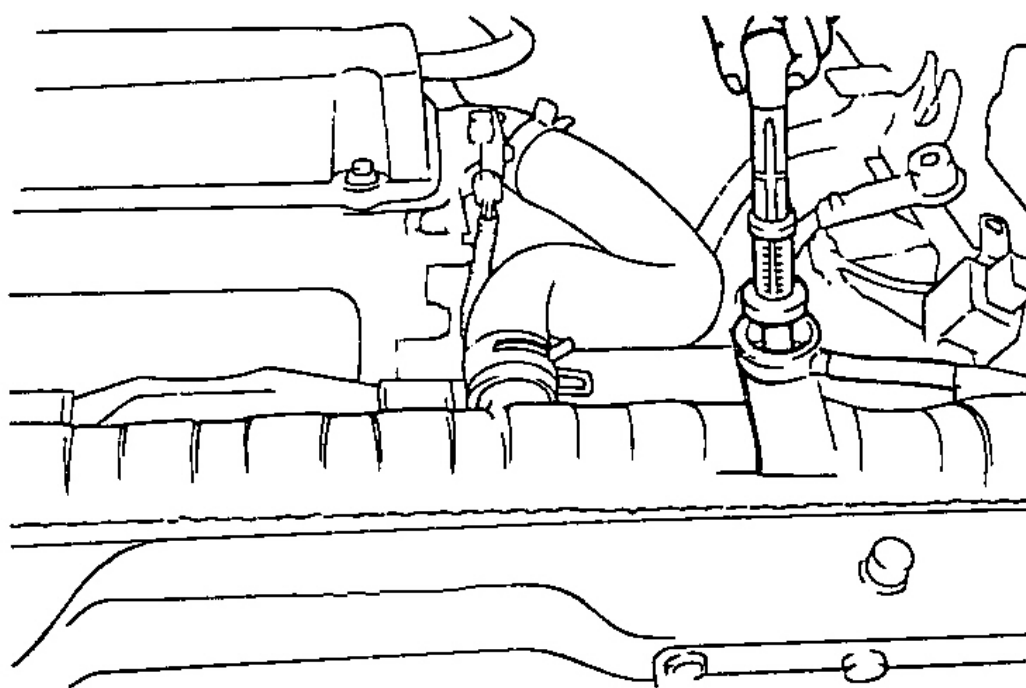
NOTE: Be sure that the cap is clean before testing, since rust or other foreign

material on the cap seal will cause an improper indication.

ENGINE COOLANT

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, using the following illustration for reference.



G00327932

Fig. 27: Checking Specific Gravity Of Engine Coolant
Courtesy of KIA MOTORS AMERICA, INC.

RELATION BETWEEN COOLANT CONCENTRATION AND SPECIFIC GRAVITY

2004 Kia Optima EX

2004-05 ENGINES 2.7L V6 - Optima & Magentis (Canadian)

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%

G00327933

Fig. 28: Identifying Engine Coolant Concentration & Specific Gravity Relationship 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:

- If the concentration of the coolant is below 30%, the anti-corrosion property will be adversely affected.
- If the concentration is above 60%, both the anti-freeze and engine cooling properties will decrease, affecting the engine adversely. For these reasons, be sure to maintain the concentration level within the specified range.
- Do not use different bands of coolant.

RECOMMENDED COOLANT

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

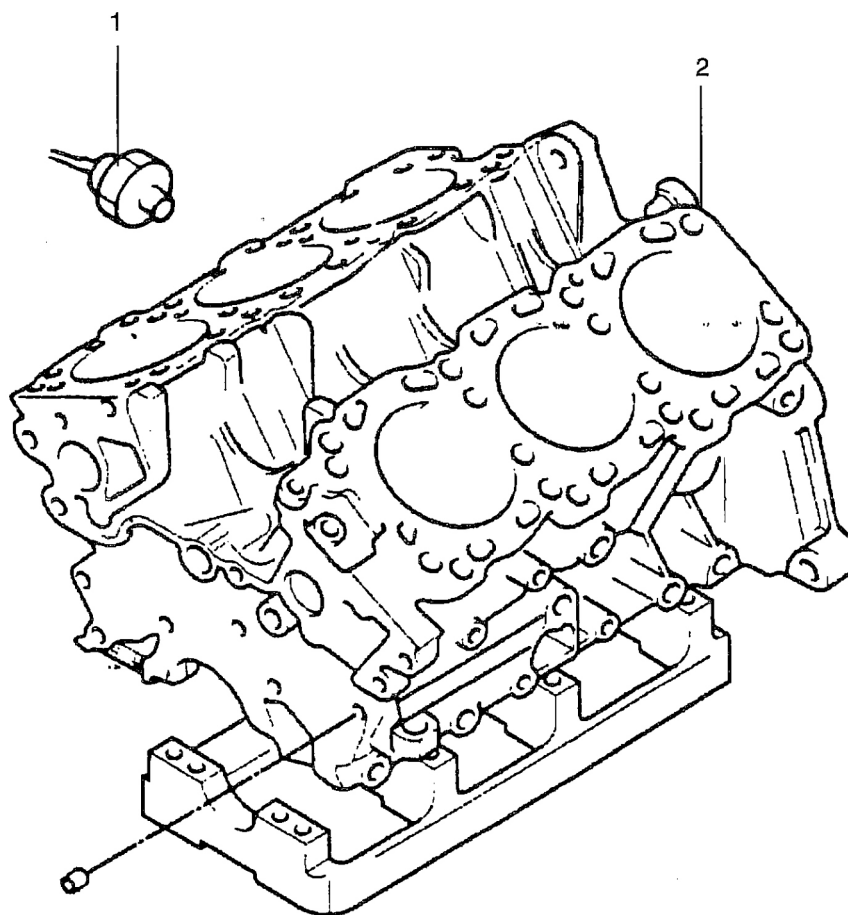
G00327934

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

ENGINE BLOCK

ENGINE BLOCK

COMPONENTS



- 1. Oil pressure switch
- 2. Cylinder block

G00327935

Fig. 30: Identifying Cylinder Block & Oil Pressure Switch
Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

Remove the timing belt, cylinder head assembly, drive plate, transaxle mounting plate, oil pan and the oil pump case.

For further details, refer to their respective procedures.

INSPECTION

Cylinder Block

1. Visually check the cylinder block for scores, rust and corrosion. Also check for cracks or any other

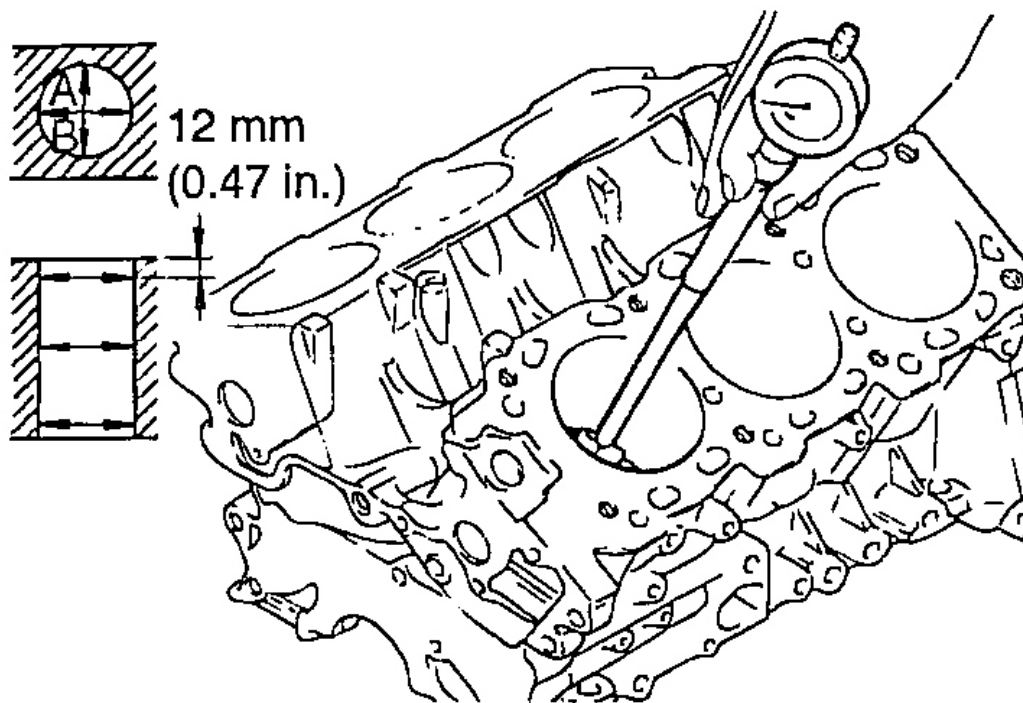
defects. Repair or replace the block if defective.

2. Measure the cylinder bore with a cylinder gauge at the three levels indicated in the directions of A and B as shown in illustration.

Level 1: No.1 piston ring position with piston at TDC

Level 2: Center of cylinder

Level 3: Bottom of cylinder



G00327936

Fig. 31: Checking 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 re-bored and honed. New oversize pistons and rings should be installed.

Standard value

Cylinder bore : [2.4L] 84.00-84.04 mm

(3.3071-3.3087 in.)

[2.7L] 86.7 mm (3.41 in)

Out-of-roundness 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 away with a ridge reamer.
5. Oversize pistons are available in two sizes.

Piston service size and mark mm (in.)

0.25 mm (0.010 in.) O.S. : 0.25 mm

0.50 mm (0.020 in.) O.S. : 0.50 mm

6. To rebore the cylinder to the oversize, keep the specified clearance between the oversize piston and the bore, and make sure that all pistons used are of the same oversize. The standard measurement of the piston outside diameter is taken at a level 12 mm (0.47 in.) above the bottom of the piston skirt and across the thrust faces.

Piston-to-cylinder wall clearance :

0.010-0.030 mm (0.0004-0.0012 in.)

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 limits, grind to the minimum limit or replace.

Standard value

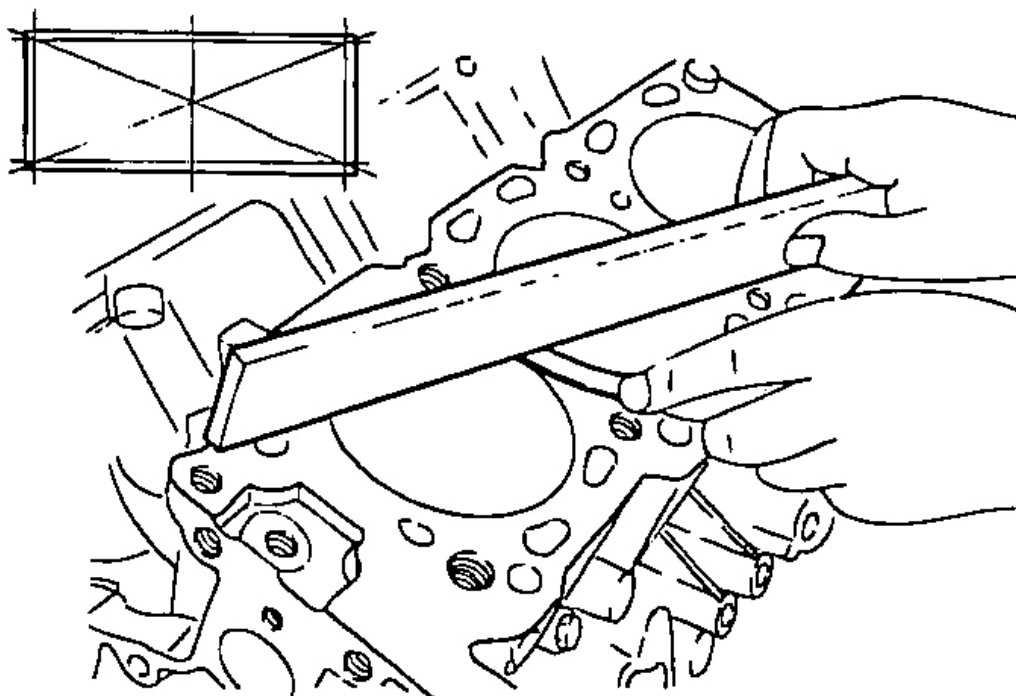
Flatness of gasket surface :

Max. 0.03 mm (0.0012 in.)

Service limit

Flatness of gasket surface : 0.05 mm (0.0002 in.)

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



G00327937

Fig. 32: Checking Flatness Of Gasket Surface
Courtesy of KIA MOTORS AMERICA, INC.

Boring Cylinder

1. Oversize pistons used should be determined on the base of the largest bore cylinder.

Size	Identification mark
0.25 mm (0.010 in.) O.S.	0.25
0.50 mm (0.020 in.) O.S.	0.50

G00327938

Fig. 33: Identifying Oversize Piston Identification Chart

Courtesy of KIA MOTORS AMERICA, INC.

NOTE: Size mark is stamped on top of the piston.

2. Measure the outside diameter of the piston to be used.

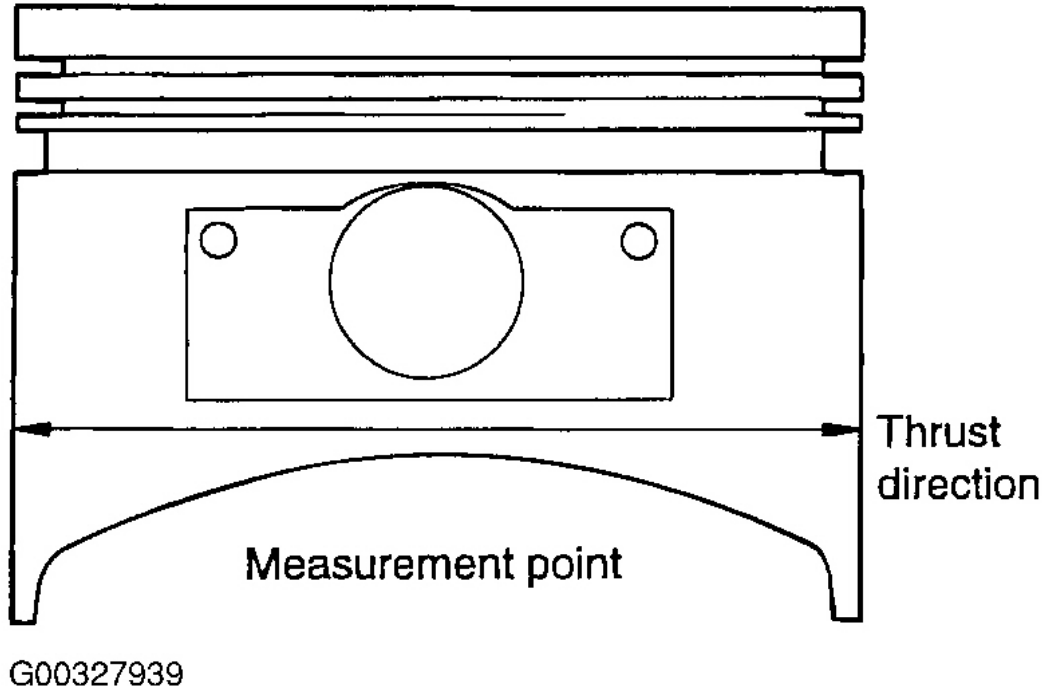


Fig. 34: Identifying Piston Outside Diameter Measuring Point
Courtesy of KIA MOTORS AMERICA, INC.

3. On the base of the measured O.D., calculate the boring finish dimension.

Boring finish dimension = Piston O.D + 0.01 to 0.03 mm (0.0004 to 0.0012 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 sequence.

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 : 0.01-0.03 mm (0.0004-0.0012 in.)

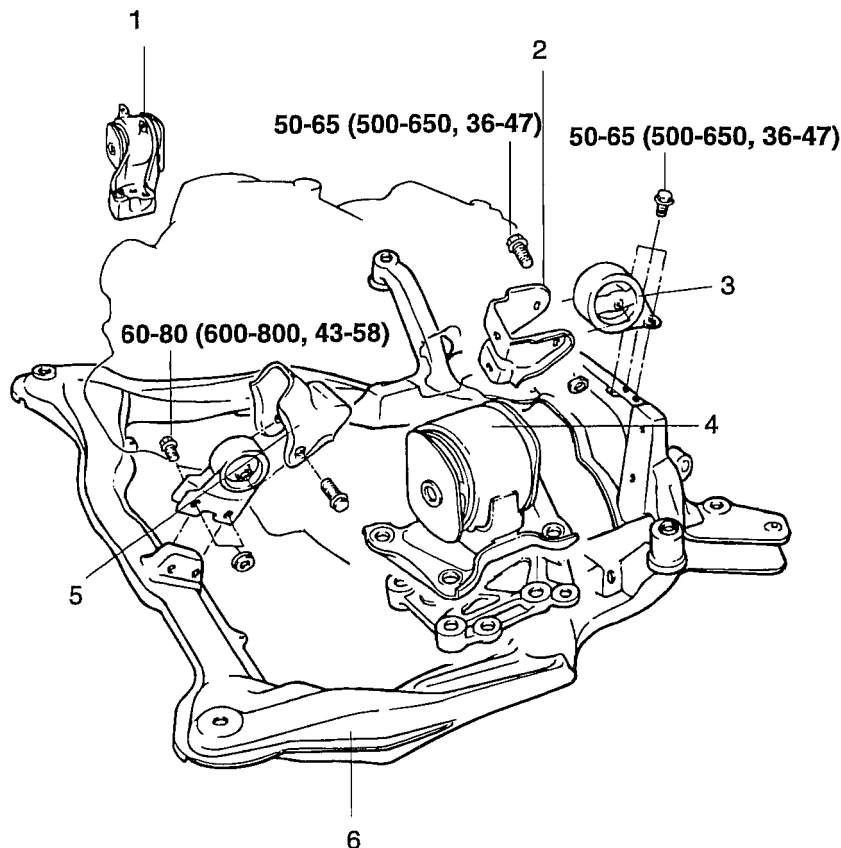
NOTE: **When boring the cylinders, finish all of the cylinders to the same oversize.
Do not bore only one cylinder to the oversize.**

REASSEMBLY

1. Install the following parts by referring to their respective procedures.
 1. **CRANK SHAFT**
 2. Drive plate
 3. **CONNECTING ROD & PISTON**
 4. **CYLINDER HEAD**
 5. **TIMING BELT**
 6. **OIL PUMP CASE**

ENGINE MOUNTS

COMPONENTS



TORQUE : Nm (kg-cm, lb-ft)

- 1. Engine mounting bracket
- 2. Rear roll stopper bracket
- 3. Rear roll stopper

- 4. Transaxle mounting bracket
- 5. Front roll stopper bracket
- 6. Sub-frame

G00327940

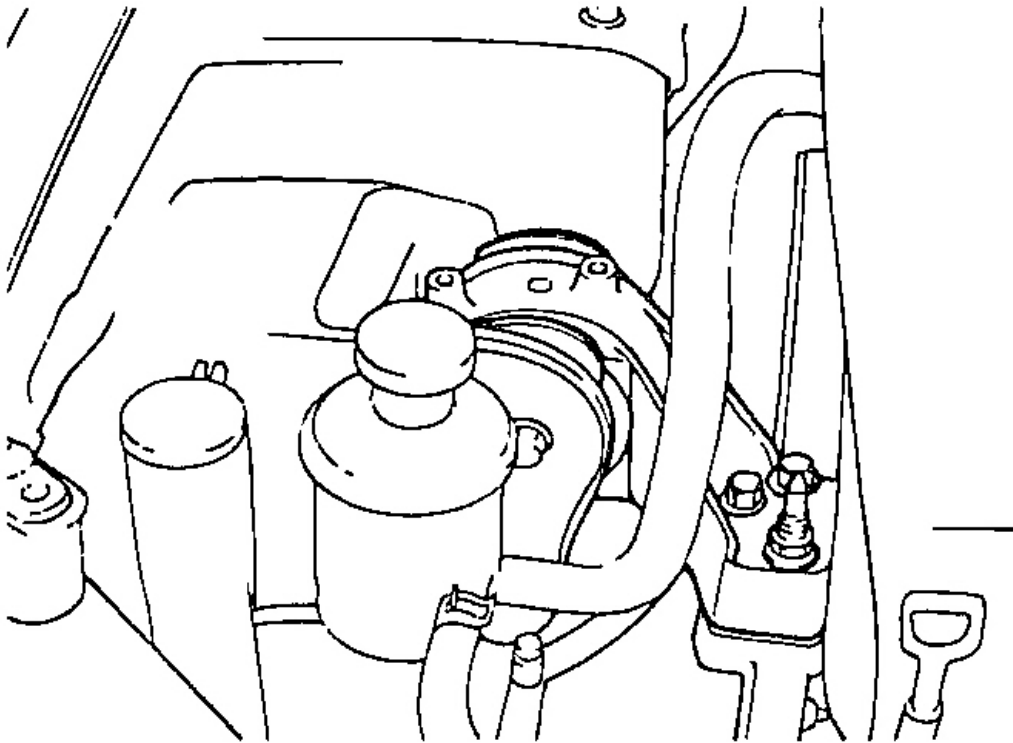
Fig. 35: Removing & Installing Engine Mounts
 Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

Attach a cable or chain to the engine hooks, and then lift engine enough so that there is no pressure on the insulators.

Engine Mounting

1. Remove the engine mount insulator bolts.
2. Remove the engine mount bracket from the engine.

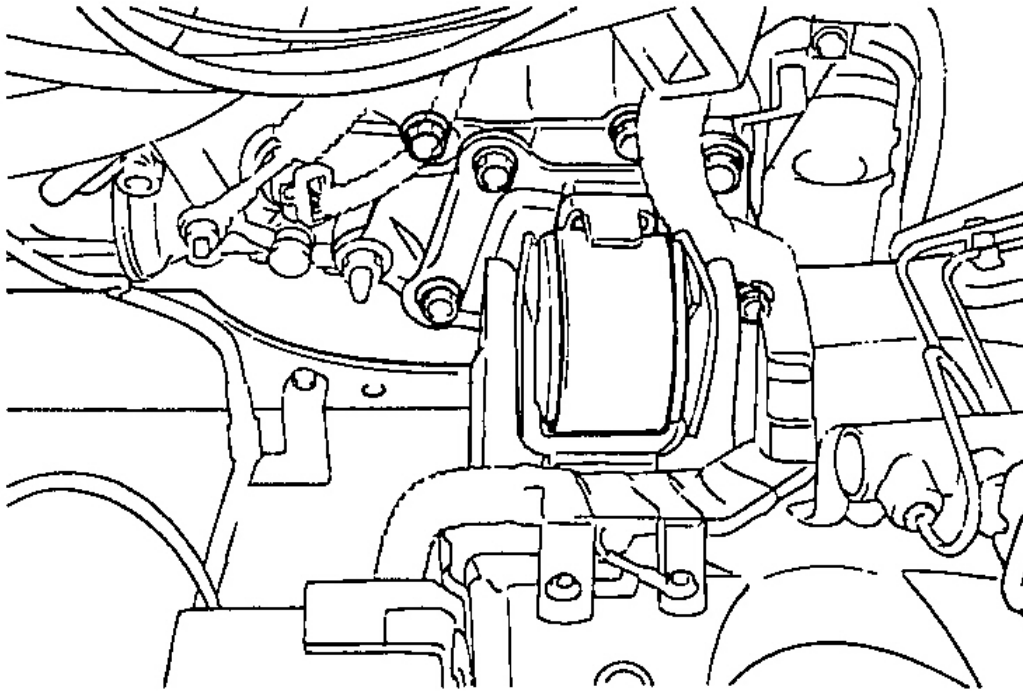


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Fig. 36: Removing Engine Mount
Courtesy of KIA MOTORS AMERICA, INC.

Transaxle Mounting

1. Remove the transaxle mounting bolt.
2. Remove the transaxle bracket.

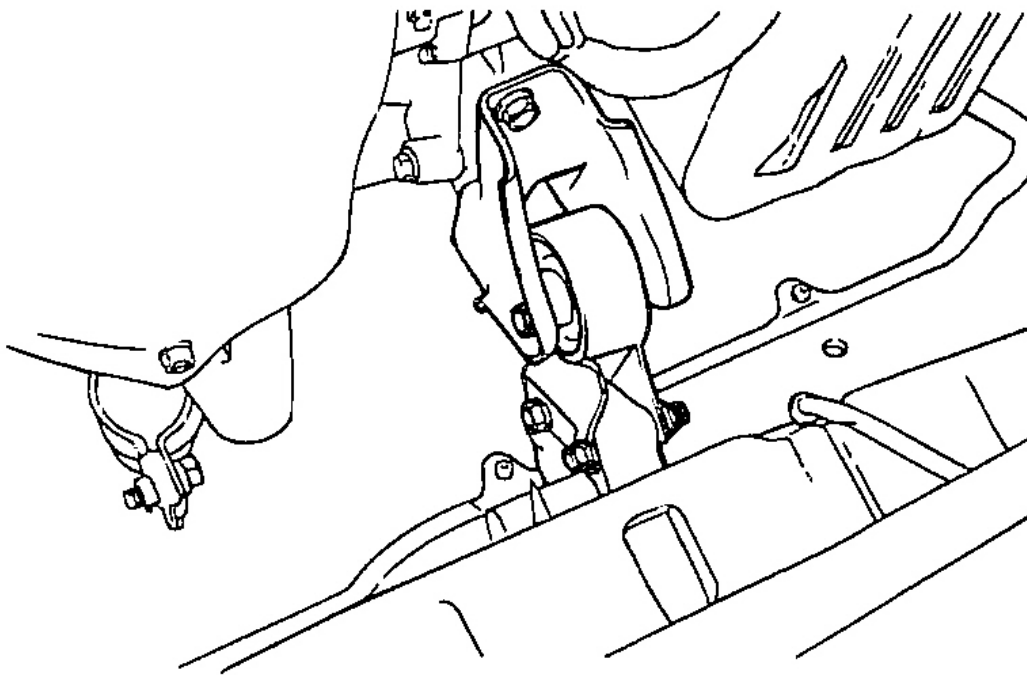


G00327942

Fig. 37: Removing Transaxle Mount
Courtesy of KIA MOTORS AMERICA, INC.

Front Roll Stopper

1. Remove the front roll stopper upper and lower bolts.
2. Remove the front roll rod assembly.

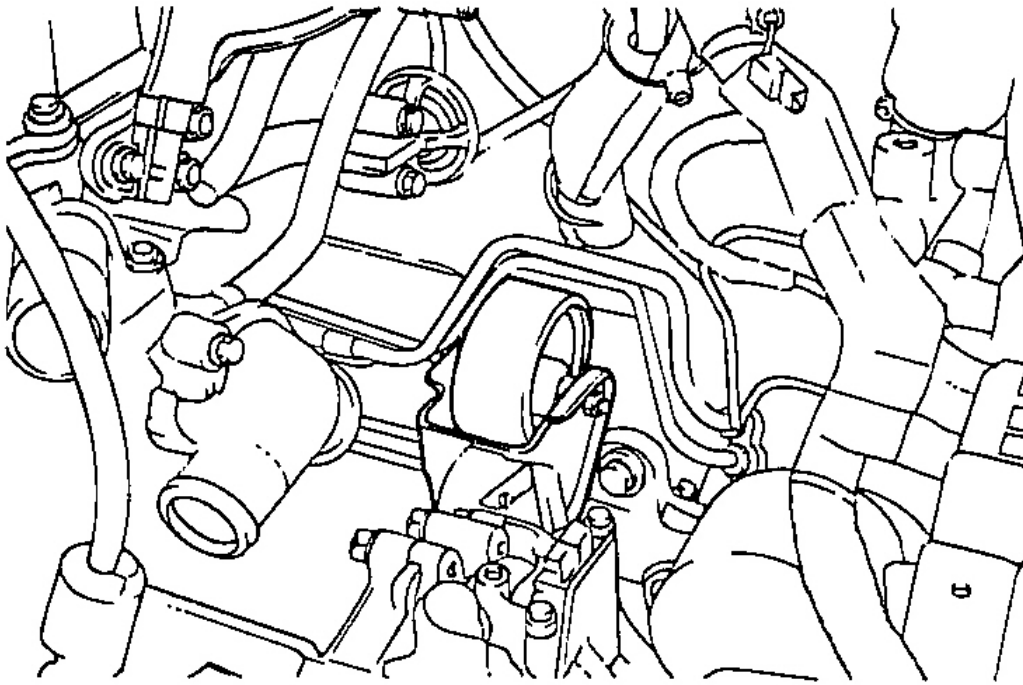


G00327943

Fig. 38: Removing Front Roll Stopper
Courtesy of KIA MOTORS AMERICA, INC.

Rear Roll Stopper

1. Remove the bolt from the rear roll stopper.
2. Remove the rear roll stopper from the sub-frame.

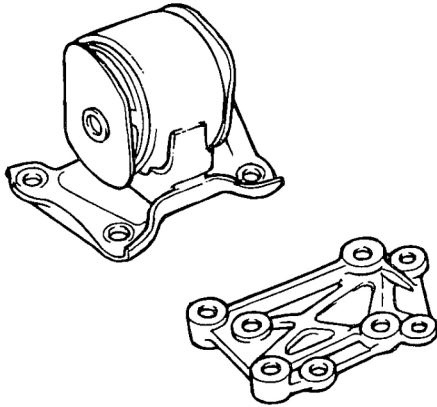


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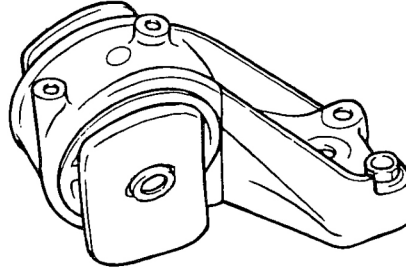
Fig. 39: Removing Rear Roll Stopper
Courtesy of KIA MOTORS AMERICA, INC.

INSPECTION ITEMS

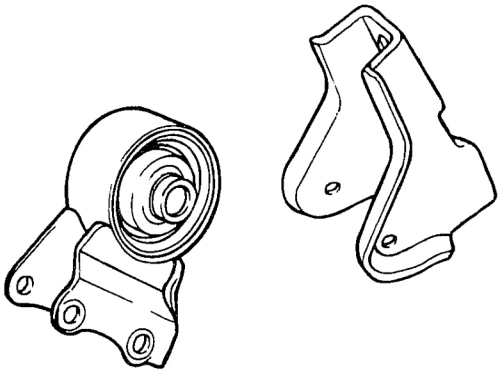
Transaxle mount



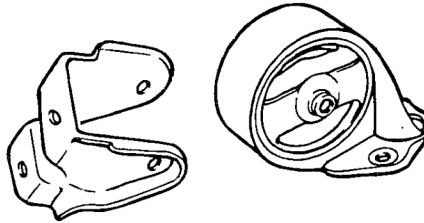
Engine mount



Front roll stopper assembly



Rear roll stopper assembly

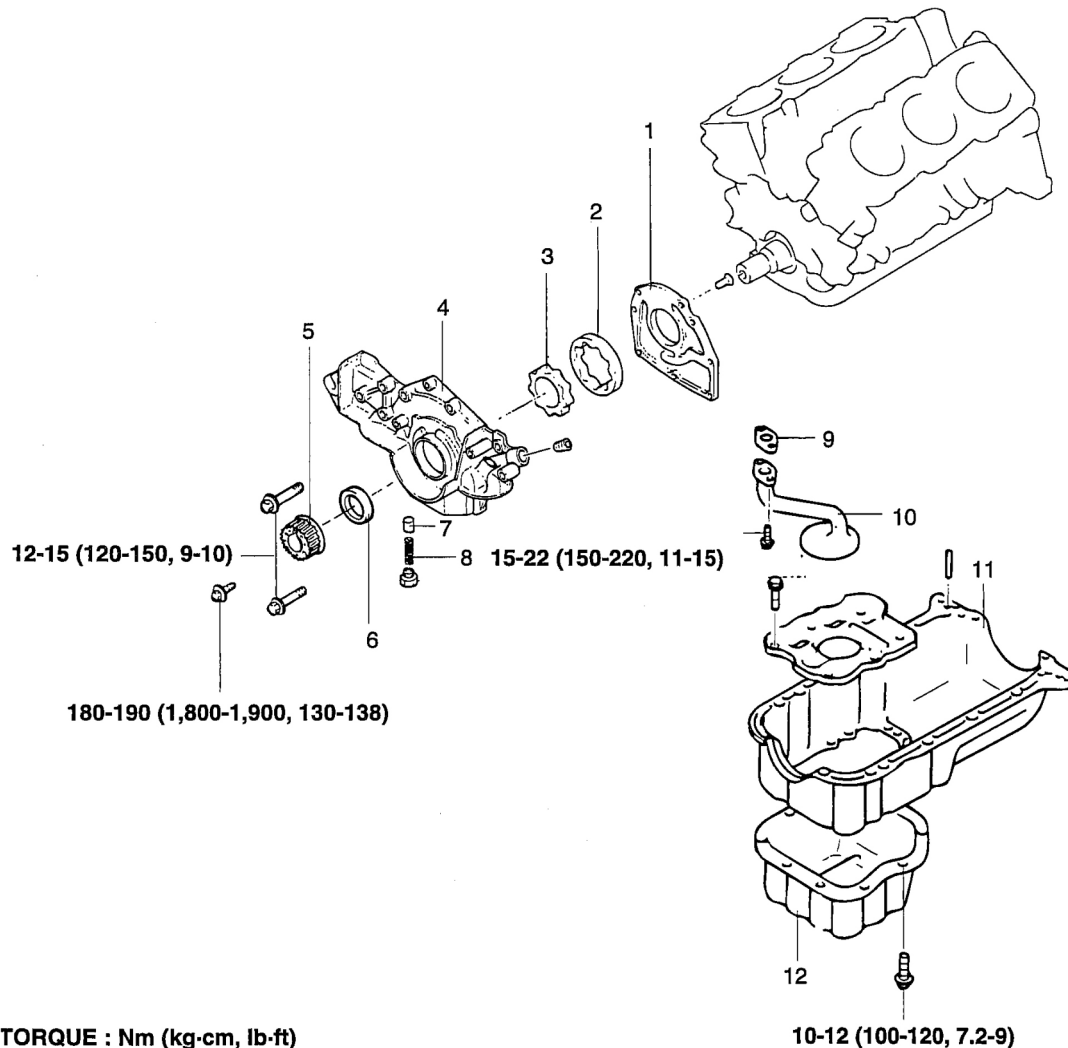


G00327945

Fig. 40: Identifying Engine Mounts
Courtesy of KIA MOTORS AMERICA, INC.

OIL PUMP CASE

COMPONENTS



1. Oil pump cover
2. Oil pump outer rotor
3. Oil pump inner rotor
4. Oil pump case
5. Crank shaft sprocket
6. Crank shaft oil seal

7. Relief plunger
8. Relief spring
9. Oil screen gasket
10. Oil screen
11. Upper oil pan
12. Lower oil pan

G00327946

Fig. 41: Removing & Installing Oil Pump Case
 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.

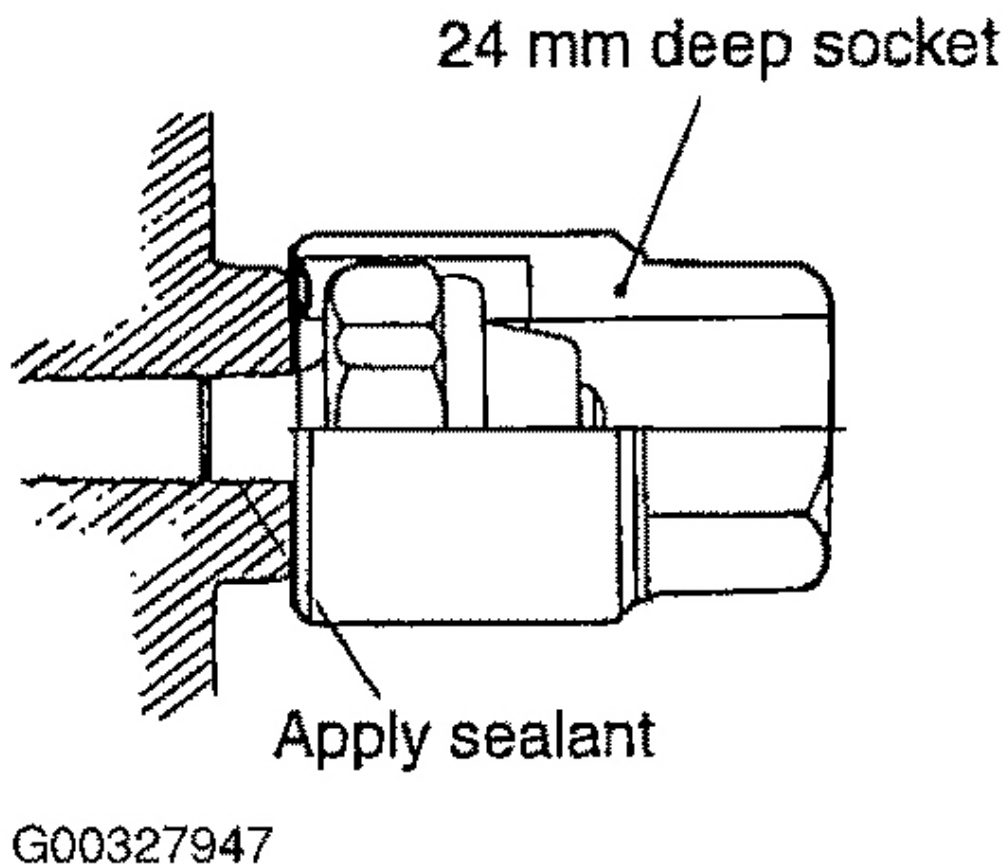


Fig. 42: Removing Oil Pressure Switch
Courtesy of KIA MOTORS AMERICA, INC.

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.

INSPECTION

Oil Pump

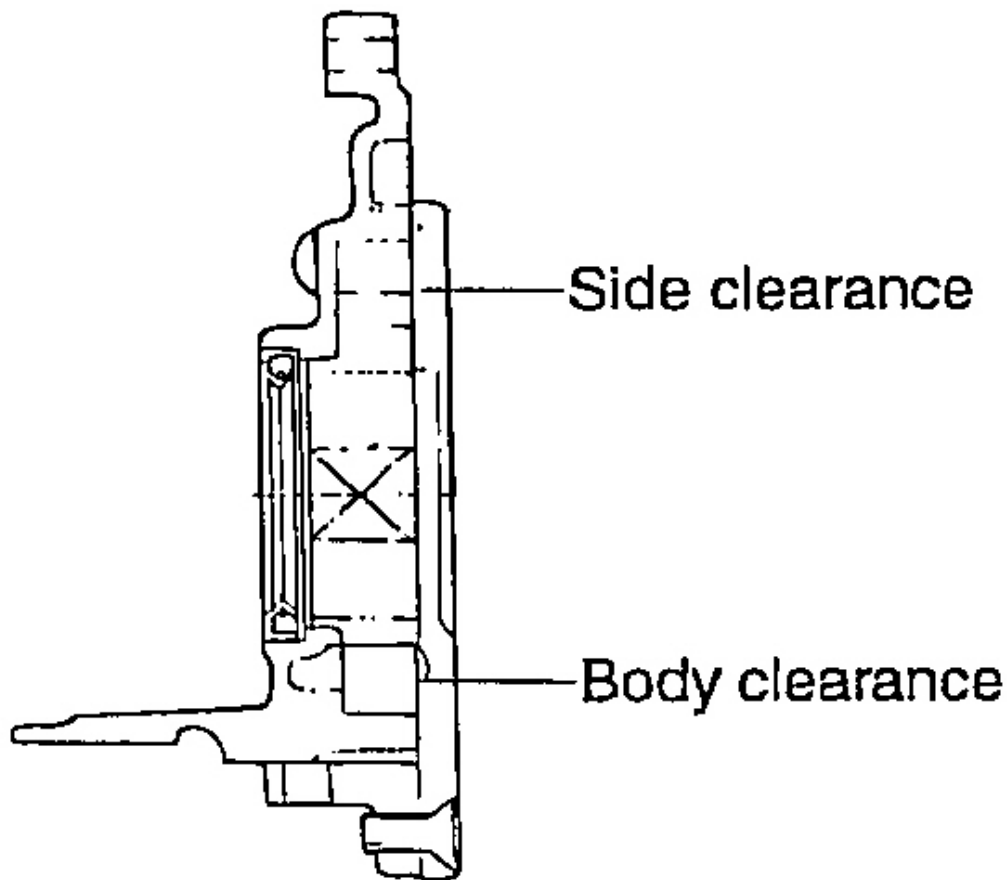
1. Visually check the parts of the oil pump case for cracks and damage.
2. Assemble the rotor on the oil pump and then check the clearance with a thickness gauge.

Oil pump side clearance

Standard value

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

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



G00327948

Fig. 43: Checking Oil Pump

Courtesy of KIA MOTORS AMERICA, INC.

Relief Plunger and Spring

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

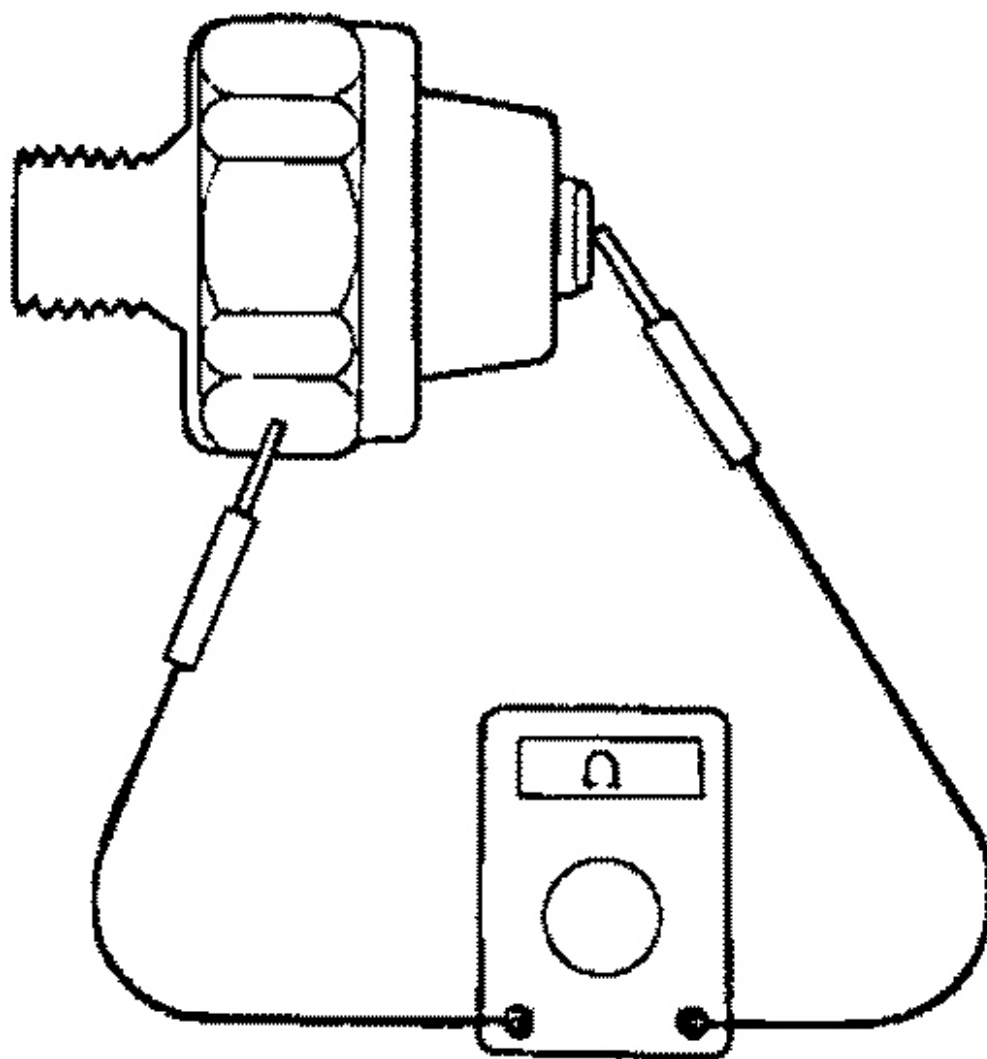
Oil Filter Bracket

1. Make sure that there is no damage on the oil filter installation surface.
2. Check the oil filter bracket for oil leak 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.



G00327949

Fig. 44: Checking Oil Pressure Switch (1 Of 2)

Courtesy of KIA MOTORS AMERICA, INC.

2. Check the continuity between the terminal and the body when the fine wedge is pushed. If there is continuity even when the fine wedge is pushed, replace it.

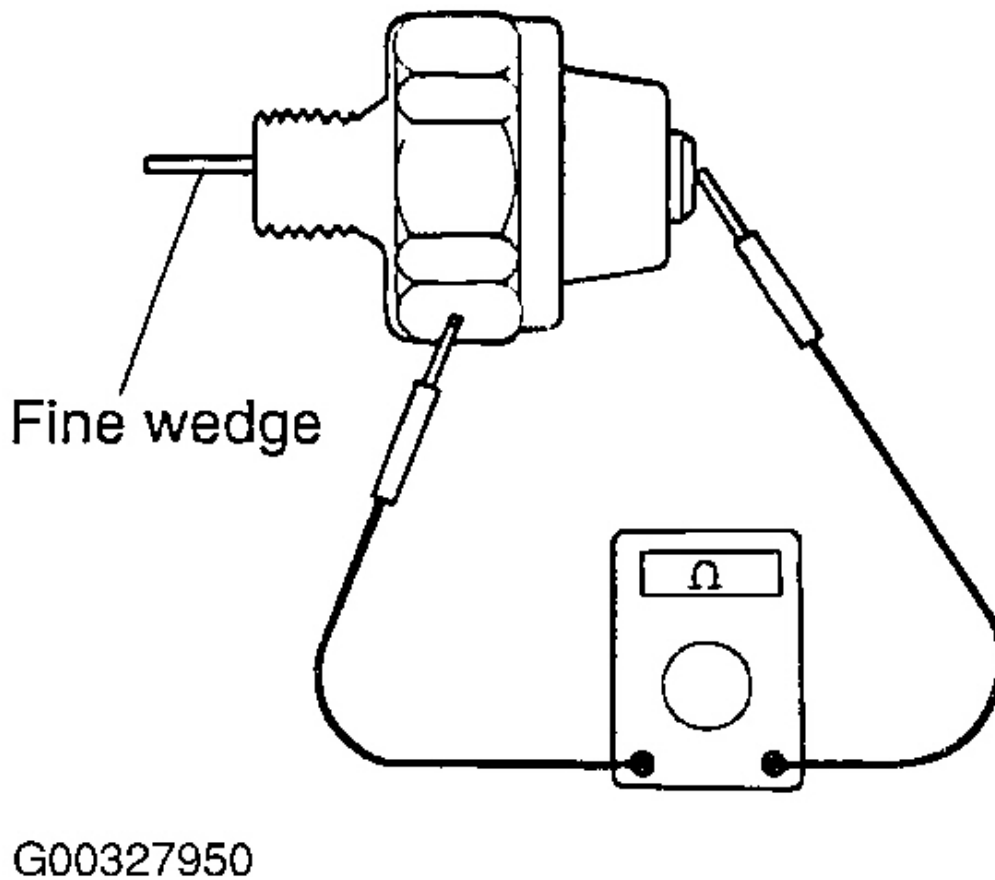


Fig. 45: Checking Oil Pressure Switch (2 Of 2)

Courtesy of KIA MOTORS AMERICA, INC.

3. Or, if there is no continuity when a 50 kPa (7 psi) vacuum is applied through the oil hole, the switch is operating properly. Check that air doesn't leak. If air leaks, the diaphragm is broken. Replace switch.

INSTALLATION

1. Install the oil pump case with the gasket.

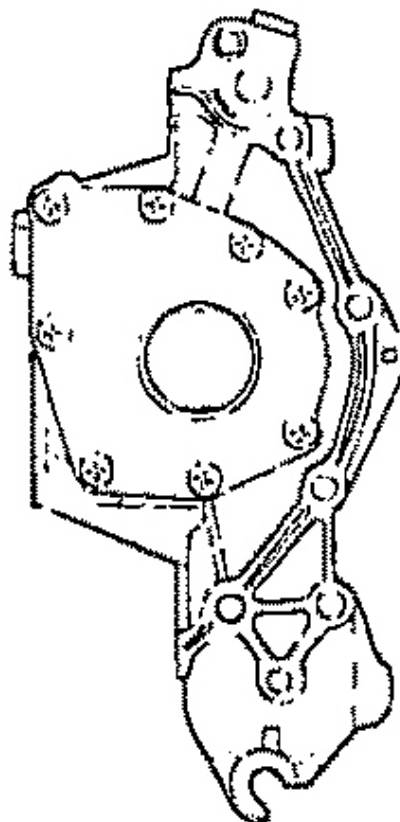
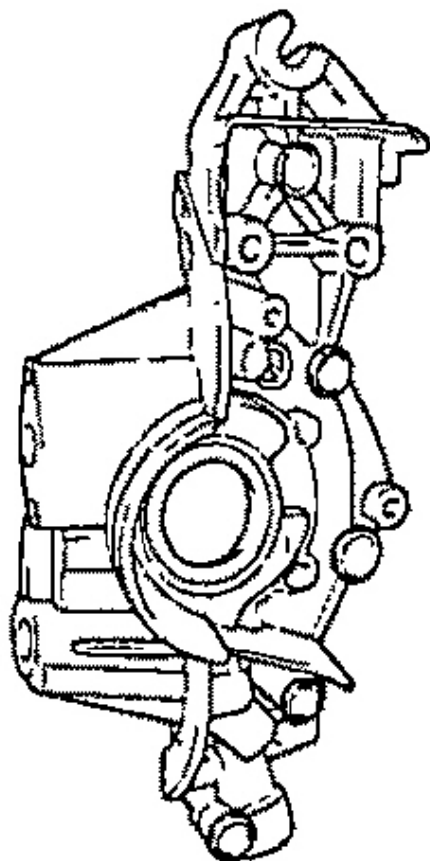
Tightening torque

Oil pump case bolt :

12-15 Nm (120-150 kg.cm, 9-10 lb.ft)

Oil pump cover screw :

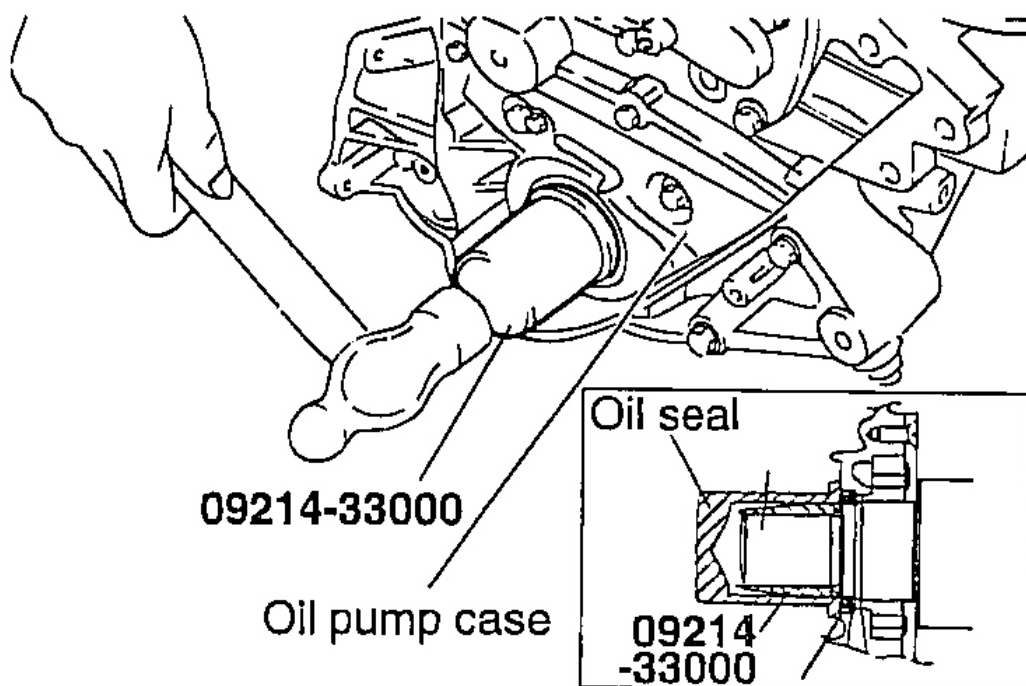
8-12 Nm (80-120 kg.cm, 5.8-8.6 lb.ft)



G00327951

Fig. 46: Installing Oil Pump Case
Courtesy of KIA MOTORS AMERICA, INC.

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



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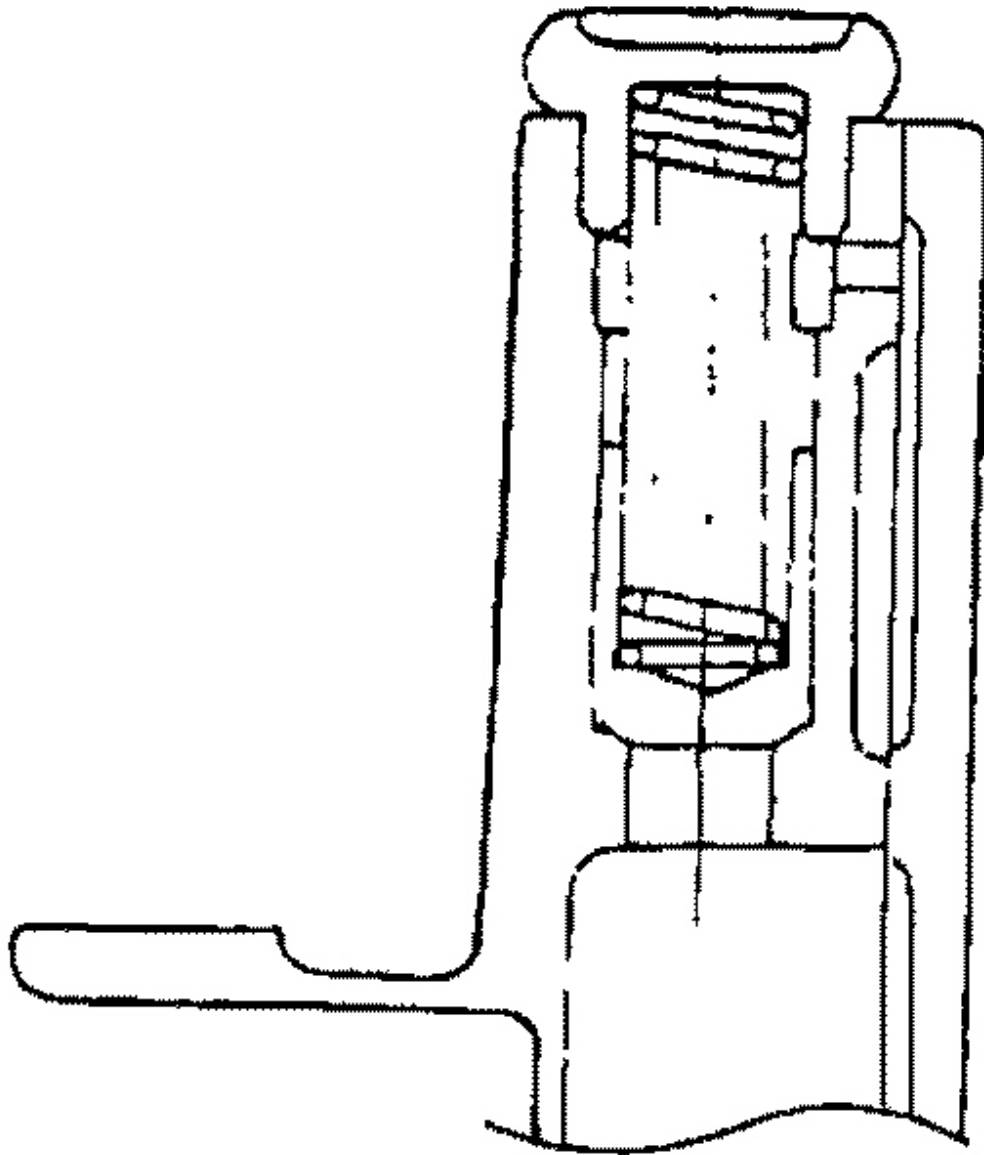
Fig. 47: Installing Oil Seal**Courtesy of KIA MOTORS AMERICA, INC.**

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

Tightening torque

Oil relief valve plug :

40-50 Nm (400-500 kg.cm, 29-36 lb.ft)



G00327953

Fig. 48: Installing Oil Relief Valve Plug
Courtesy of KIA MOTORS AMERICA, INC.

4. Install the oil screen and a new gasket.

Tightening torque

Oil screen bolt :

15-22 Nm (150-220 kg.cm, 11-15 lb.ft)

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:

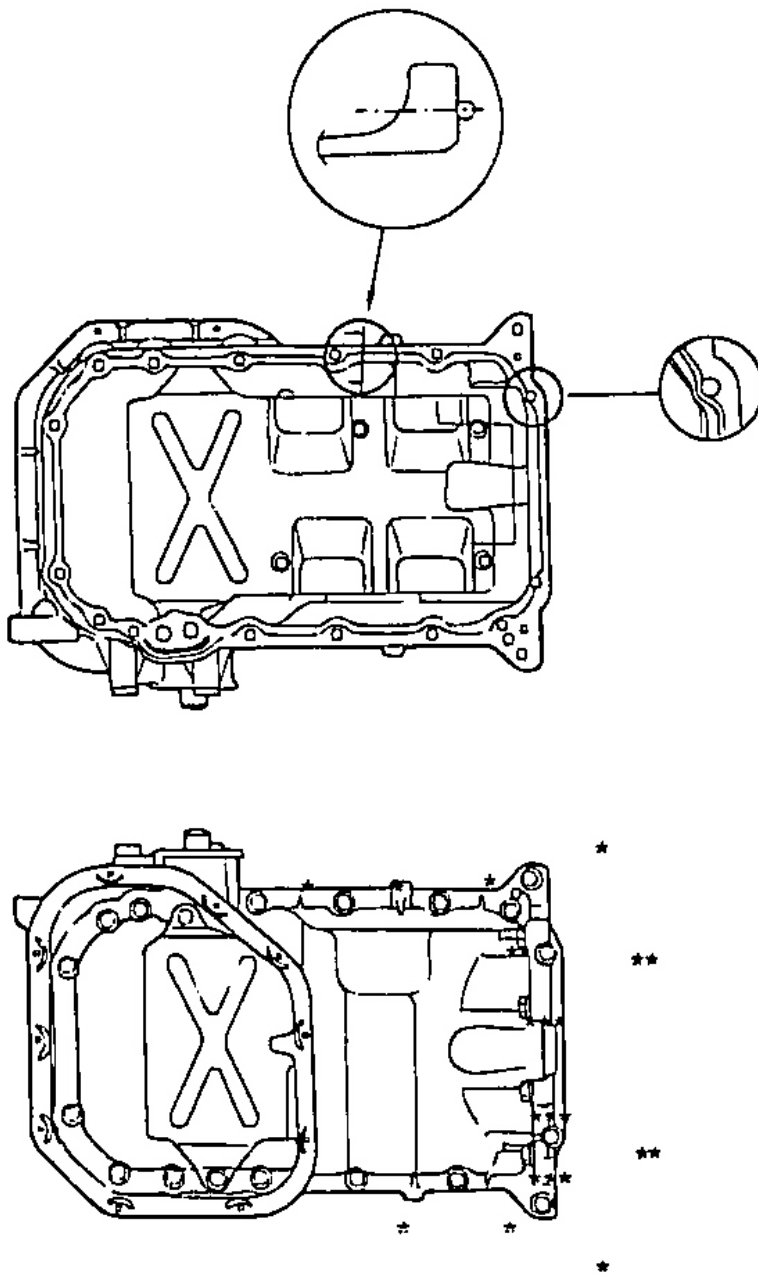
- 1. Make the first cut from the end of the nozzle furnished with the sealant about 4 mm. After application of the sealant, do not exceed 15 minutes before installing the oil pan.**
- 2. Do not apply the sealant to the range A shown in the illustration on the oil pan flange.**

7. Install the oil pan and tighten the bolts to the specified torque.

Tightening torque

Oil pan bolt :

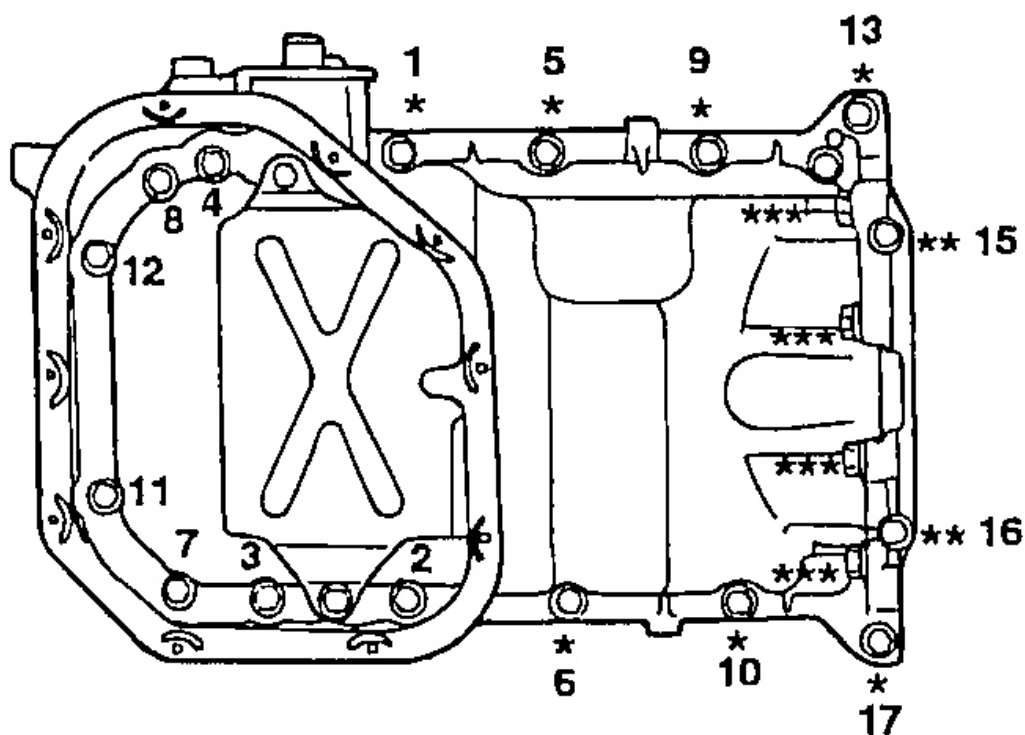
1. 19-28 Nm (190-280 kg.cm, 13.75-20.27 lb. ft.)
2. 5-7 Nm (50-70 kg.cm, 3.7-5.0 lb.ft)
3. 30-42 Nm (300-420 kg.cm, 21.70-30.40 lb.ft)



G00327954

Fig. 49: Installing Oil Pan (1 Of 2)
 Courtesy of KIA MOTORS AMERICA, INC.

8. Tighten the oil pan bolt as shown in illustration.



G00327955

Fig. 50: Installing Oil Pan (2 Of 2)

Courtesy of KIA MOTORS AMERICA, INC.

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

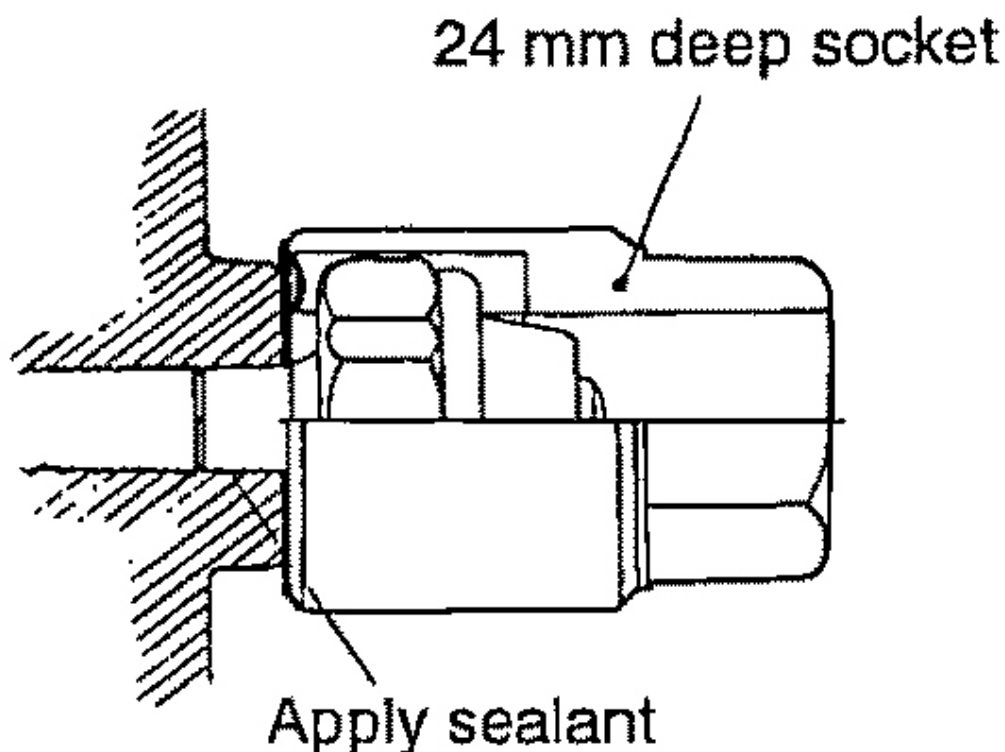
Sealant: Threebond 1104 or equivalent

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

Tightening torque

Oil pressure switch:

8-12 Nm (80-120 kg.cm, 5.8-8.6 lb.ft)



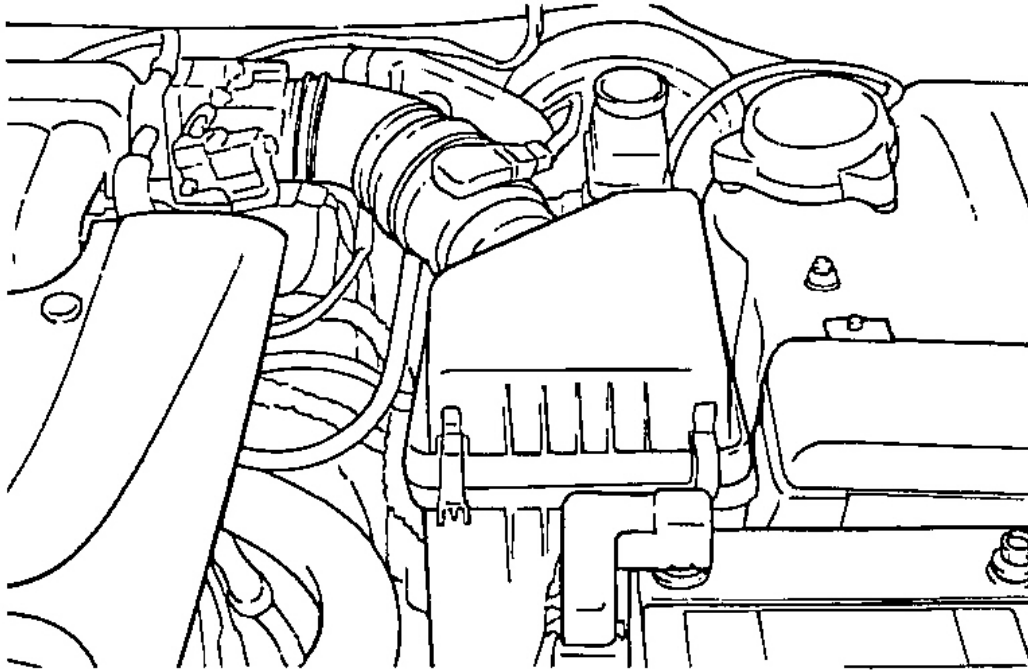
G00327956

Fig. 51: Installing Oil Pressure Switch

Courtesy of KIA MOTORS AMERICA, INC.

ENGINE AND TRANSAXLE ASSEMBLY**REMOVAL**

1. Reduce the internal pressure of the fuel lines and hoses.
 1. Disconnect the fuel pump harness connector in the trunk room.
 2. Start the engine and, after it stops, turn the ignition switch to OFF.
 3. Disconnect the battery negative (-) terminal.
 4. Connect the fuel pump harness connector.
2. Remove the battery and engine cover.
3. Detach the air cleaner.



G00327957

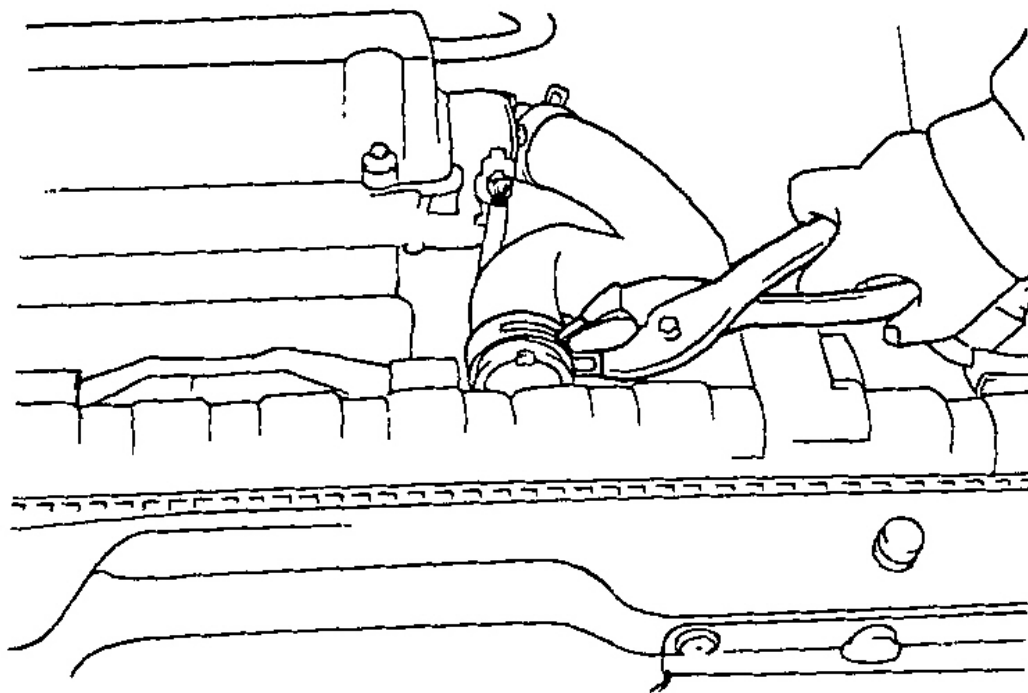
Fig. 52: Removing Air Cleaner
Courtesy of KIA MOTORS AMERICA, INC.

4. Disconnect the connectors for the engine harness.
5. Disconnect the connectors for the alternator harness, the oil pressure switch and the oil pressure sensor.
6. Drain the engine coolant.
7. Disconnect the transaxle oil cooler hoses.

NOTE: When disconnecting the hoses, make identification marks to avoid making any mistakes when installing them.

CAUTION: Be careful not to spill any of the oil or fluid out of the hoses. Plug the openings to prevent the entry of foreign material.

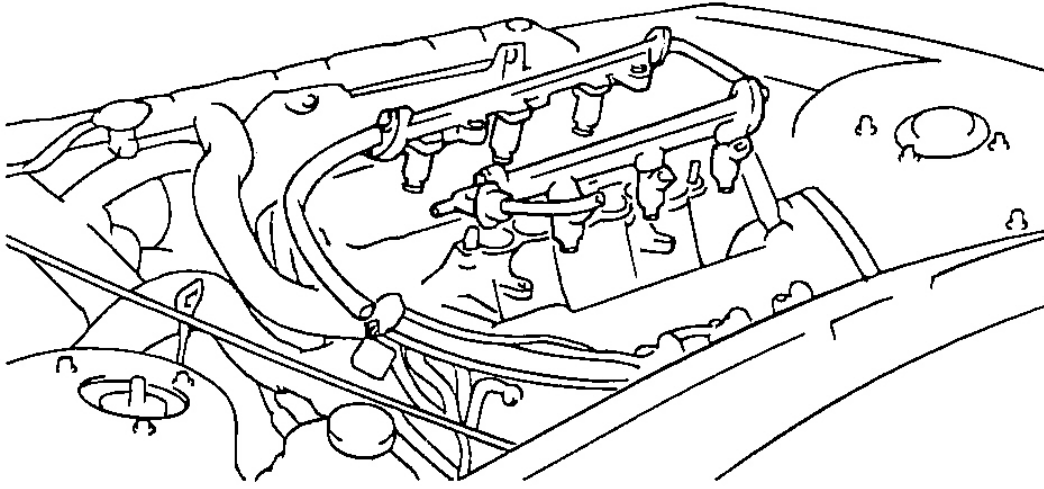
8. Disconnect the radiator upper and lower hoses on the engine side, and then remove the radiator assembly.



G00327958

Fig. 53: Disconnecting Upper & Lower Radiator Hoses
Courtesy of KIA MOTORS AMERICA, INC.

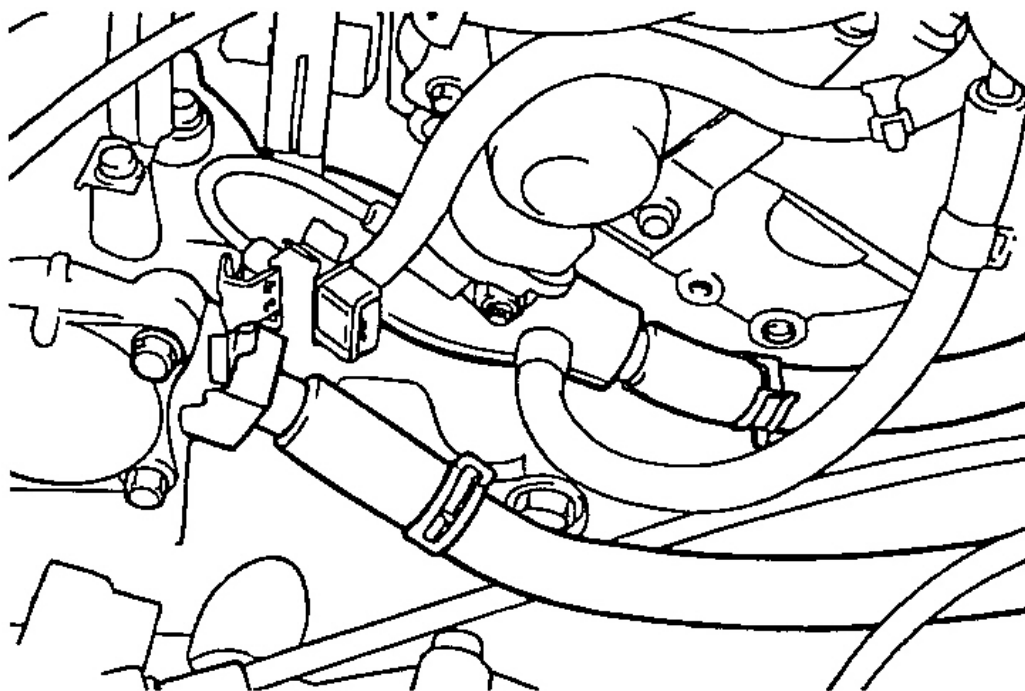
9. Disconnect the high tension cable and all wires to the distributor from the ignition coil.
10. Disconnect the engine ground.
11. Disconnect the brake booster vacuum hose.
12. Remove the main fuel line, and the return and vapor hoses from the engine side.



G00327959

Fig. 54: Removing Main Fuel Line, Return & Vapor Hoses
Courtesy of KIA MOTORS AMERICA, INC.

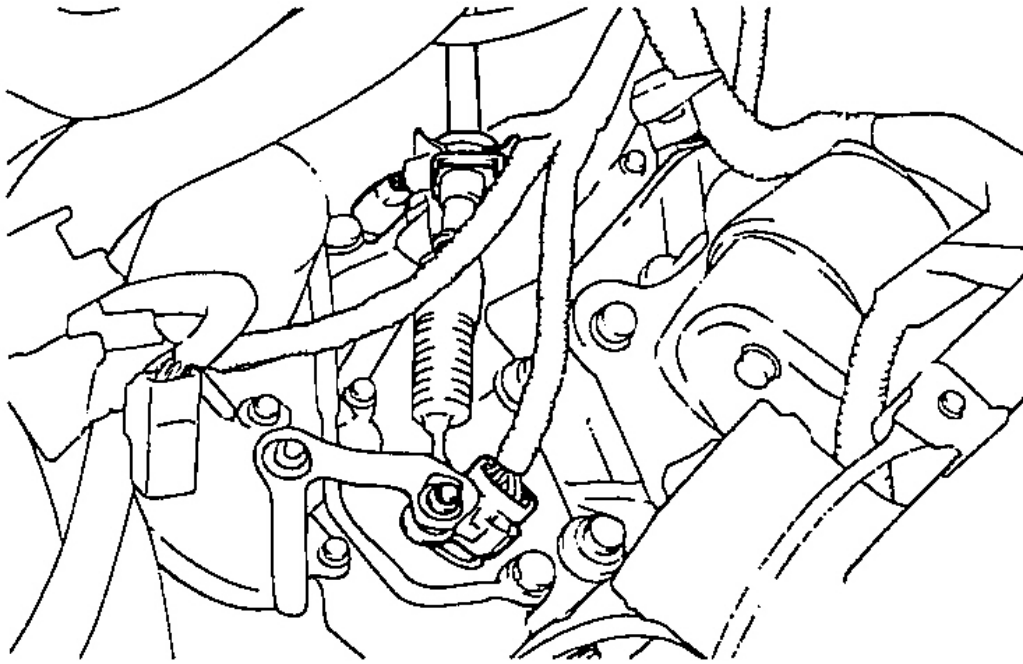
13. Disconnect the heater hoses (inlet and outlet) on the engine side.



G00327960

Fig. 55: Disconnecting The Inlet & Outlet Heater Hoses
Courtesy of KIA MOTORS AMERICA, INC.

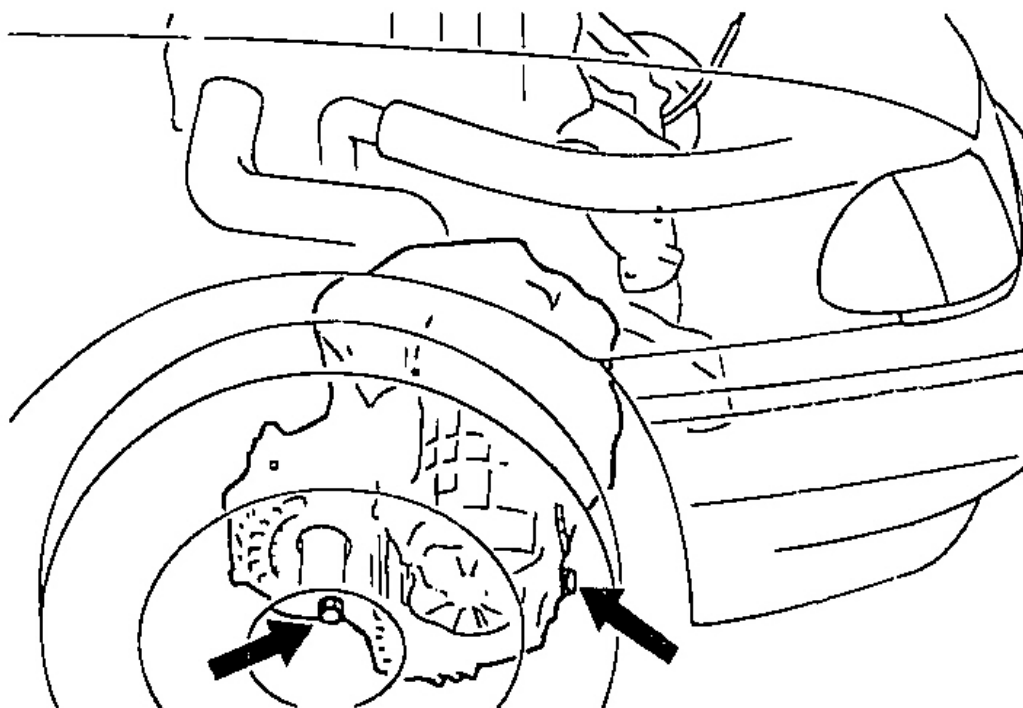
14. Disconnect the accelerator cable and cruise control cable at the engine side.
15. Remove the control cable from the transaxle.
16. Disconnect the speedometer cable from the transaxle.



G00327961

Fig. 56: Disconnecting Speedometer Cable
Courtesy of KIA MOTORS AMERICA, INC.

17. Remove the power steering oil pump hose.
18. Raise the vehicle.
19. Remove the oil pan shield.
20. Drain the transaxle oil.



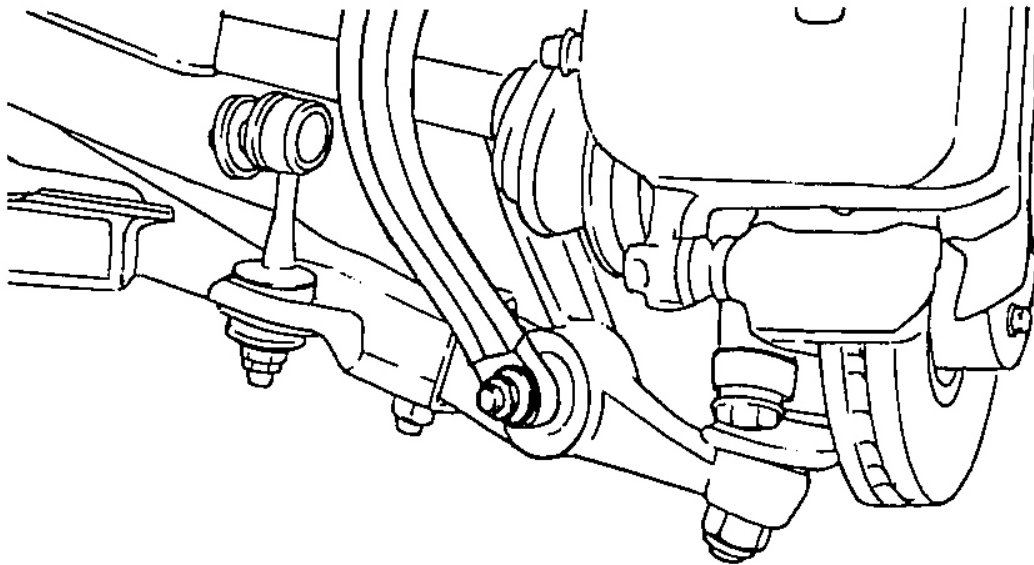
G00327962

Fig. 57: Draining Transaxle Fluid
Courtesy of KIA MOTORS AMERICA, INC.

21. Disconnect the front exhaust pipe from the manifold.

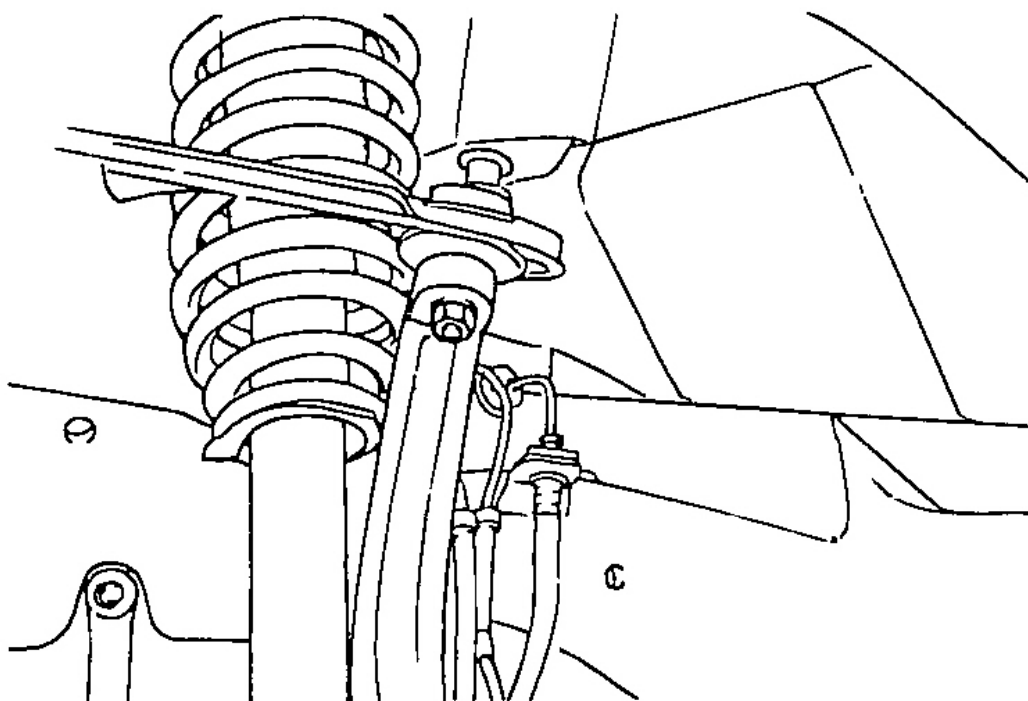
NOTE: Use a wire to suspend the exhaust pipe from the bottom of the vehicle.

22. Remove the lower arm ball joint bolts and upper arm bolt from the knuckle.



G00327963

Fig. 58: Removing Lower Arm Ball Joint
Courtesy of KIA MOTORS AMERICA, INC.

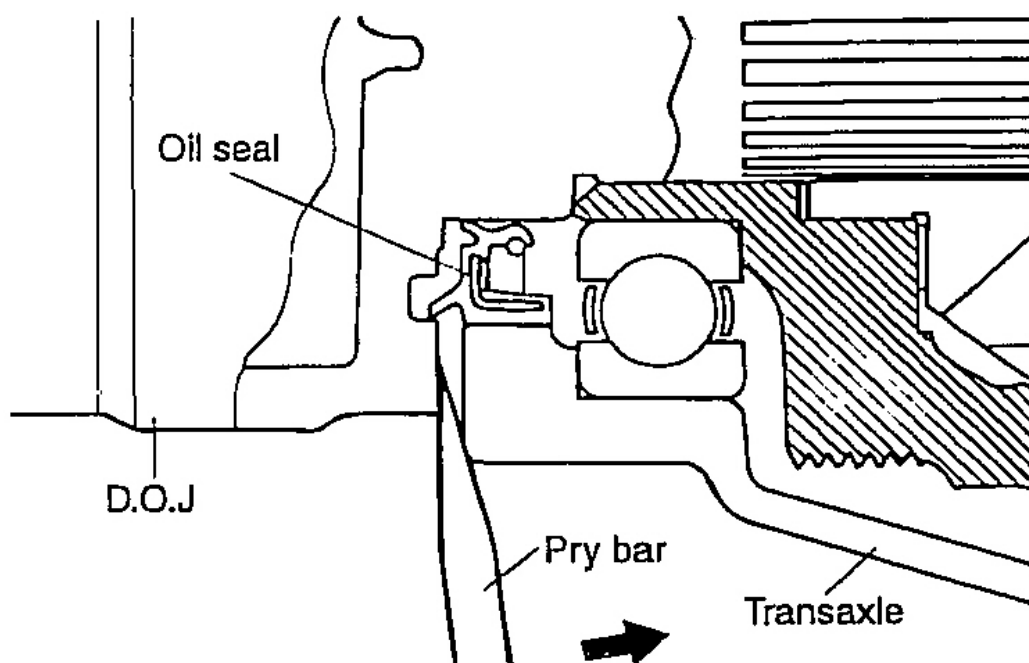


G00327964

Fig. 59: Removing Upper Arm Bolt From Knuckle
Courtesy of KIA MOTORS AMERICA, INC.

23. Remove the axle shafts from the transaxle housing.

- CAUTION:**
1. Plug up the holes of the transaxle case to prevent entry of foreign material.
 2. The circlips on the axle shafts should be replaced when installing again.

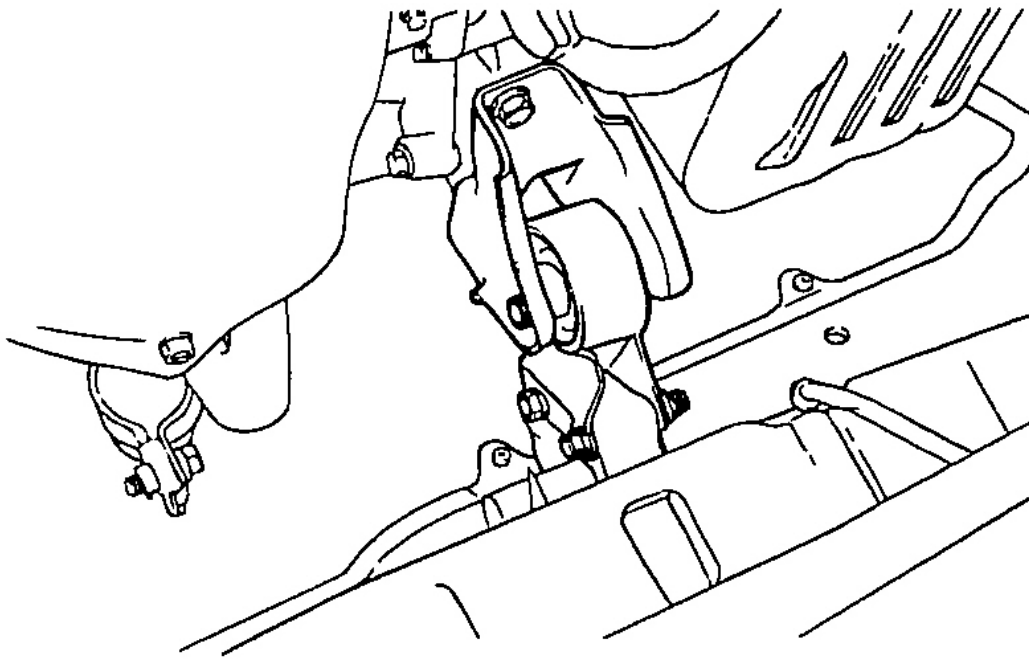


G00327965

Fig. 60: Removing Axle Shafts

Courtesy of KIA MOTORS AMERICA, INC.

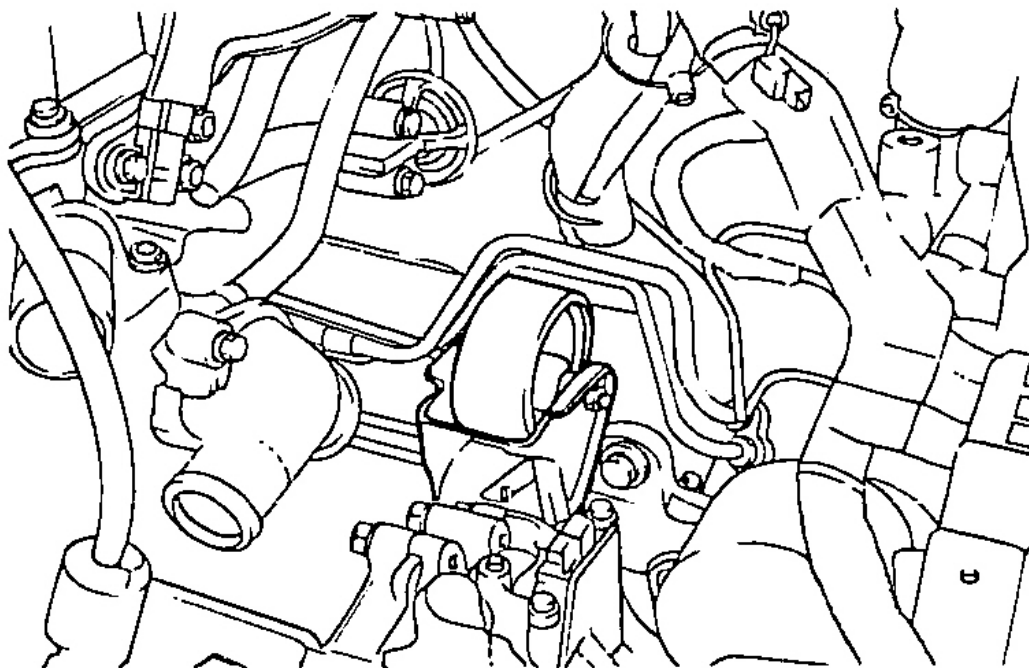
24. Attach a cable to the engine, and use a chain hoist to lift the engine only enough to pull the cable tight.
25. Remove the front roll stopper.



G00327966

Fig. 61: Removing Front Roll Stopper
Courtesy of KIA MOTORS AMERICA, INC.

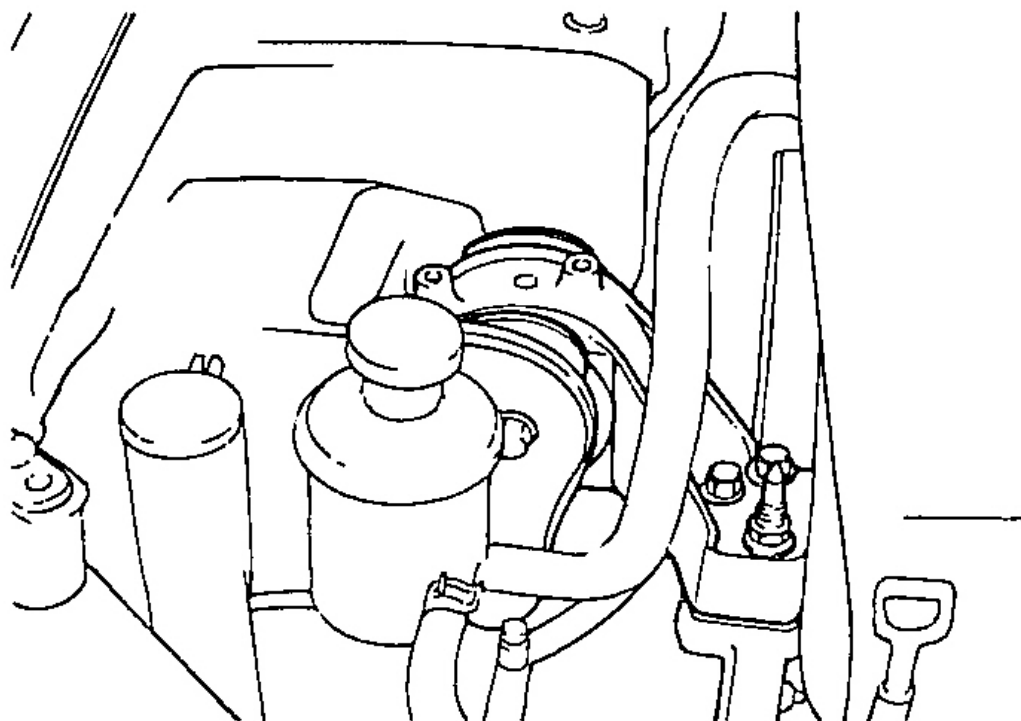
26. Remove the rear roll stopper.



G00327967

Fig. 62: Removing Rear Roll Stopper
Courtesy of KIA MOTORS AMERICA, INC.

27. Disconnect the connector of starter motor harness.
28. Remove the engine mount bolts.
29. Remove the bolts and nuts that fasten the engine mount bracket to the body.



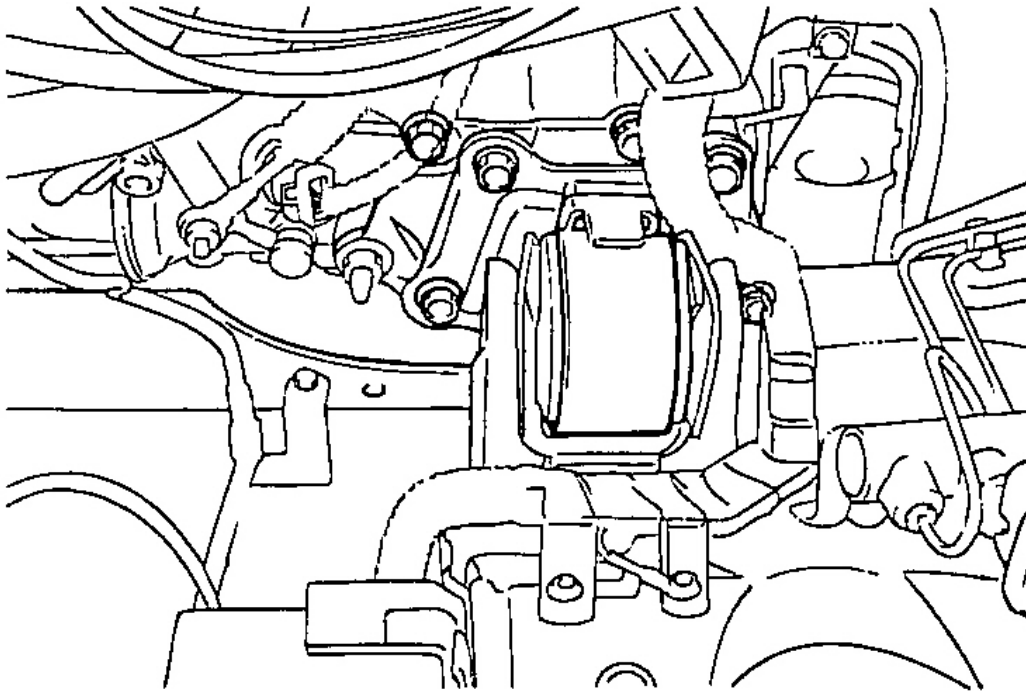
G00327968

Fig. 63: Removing Engine Mount Bracket
Courtesy of KIA MOTORS AMERICA, INC.

30. Slowly raise the engine and transaxle and temporarily hold it in the raised condition.

CAUTION: Confirm that all of the cables, hoses, harnesses, connectors etc., are disconnected from the engine.

31. Remove the transaxle mounting bracket bolts.



G00327969

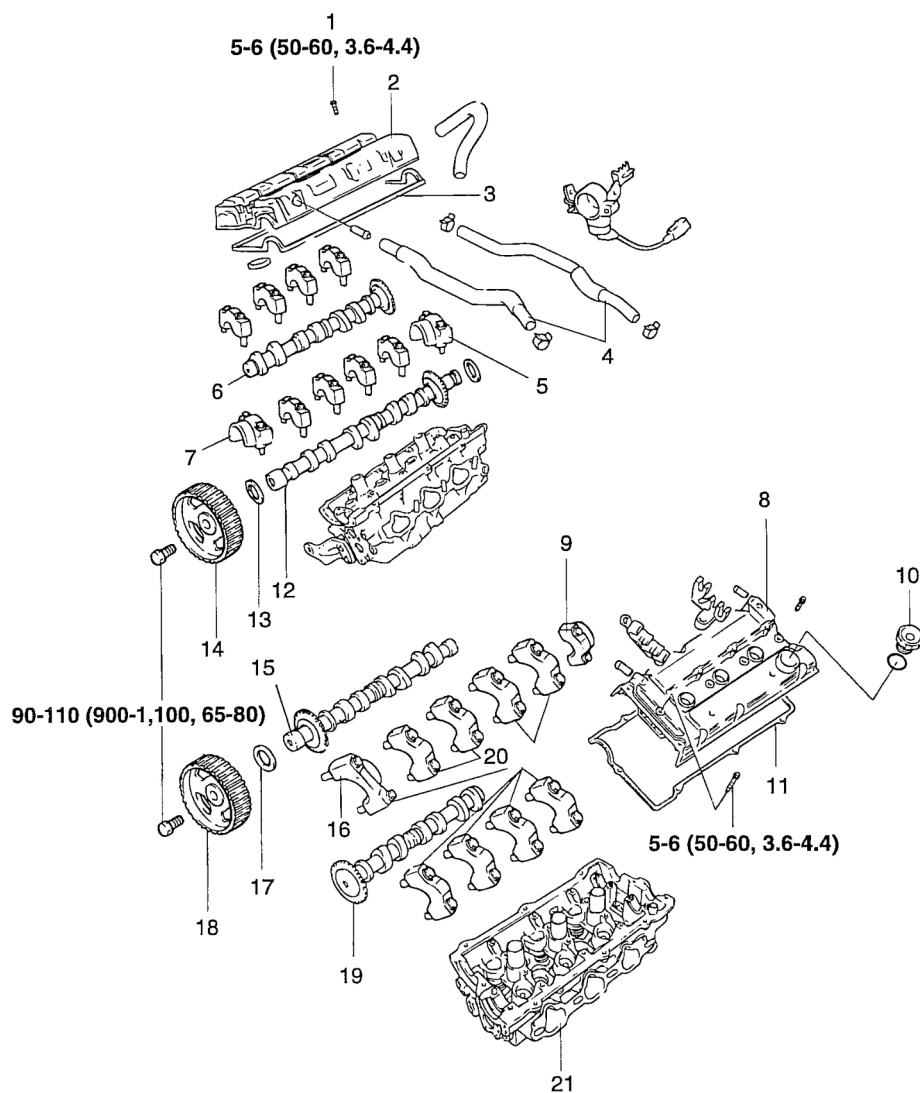
Fig. 64: Removing Transaxle Mounting Bracket
Courtesy of KIA MOTORS AMERICA, INC.

32. Remove the left mount insulator bolt.
33. While directing the transaxle side downward, lift the engine and transaxle assembly up out of the vehicle.

MAIN MOVING SYSTEM

CAMSHAFT

COMPONENTS



TORQUE : Nm (kg-cm lb-ft)

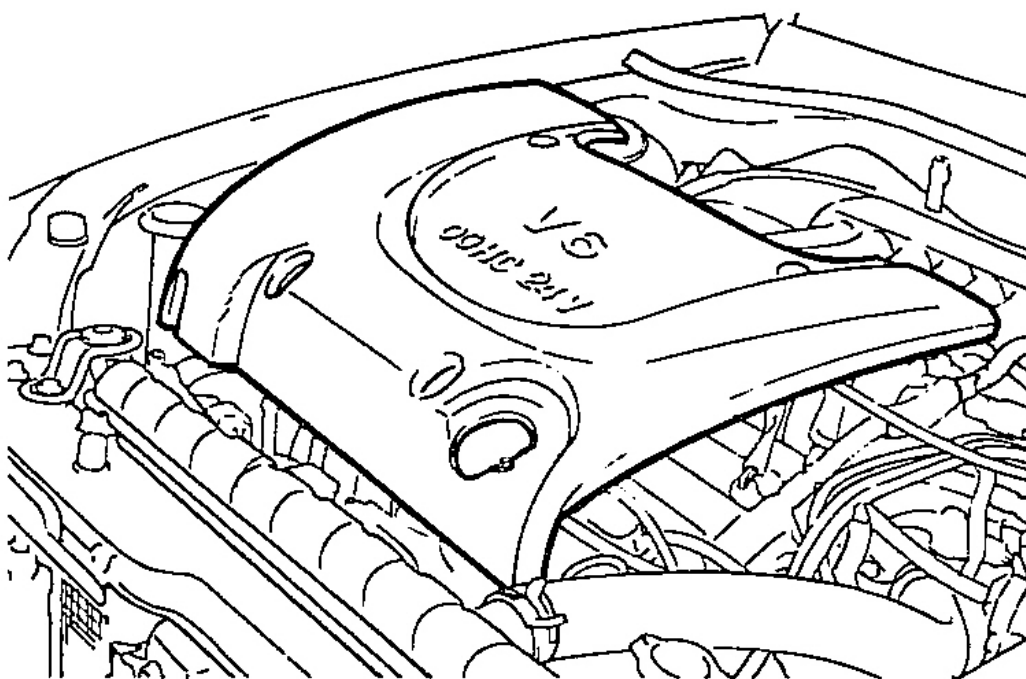
- | | | |
|-----------------------------|------------------------|-------------------------|
| 1. Cylinder head cover bolt | 8. Cylinder head cover | 15. Camshaft (IN) |
| 2. Cylinder head cover | 9. Bearing cap (Rear) | 16. Bearing cap (Front) |
| 3. Gasket | 10. Oil filler cap | 17. Camshaft oil seal |
| 4. PCV hose | 11. Gasket | 18. Camshaft sprocket |
| 5. Bearing cap (Rear) | 12. Camshaft (IN) | 19. Camshaft (EX) |
| 6. Camshaft (EX) | 13. Camshaft oil seal | 20. Bearing cap |
| 7. Bearing cap (Front) | 14. Camshaft sprocket | 21. Cylinder head |

G00327970

Fig. 65: Removing & Installing Camshafts
 Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

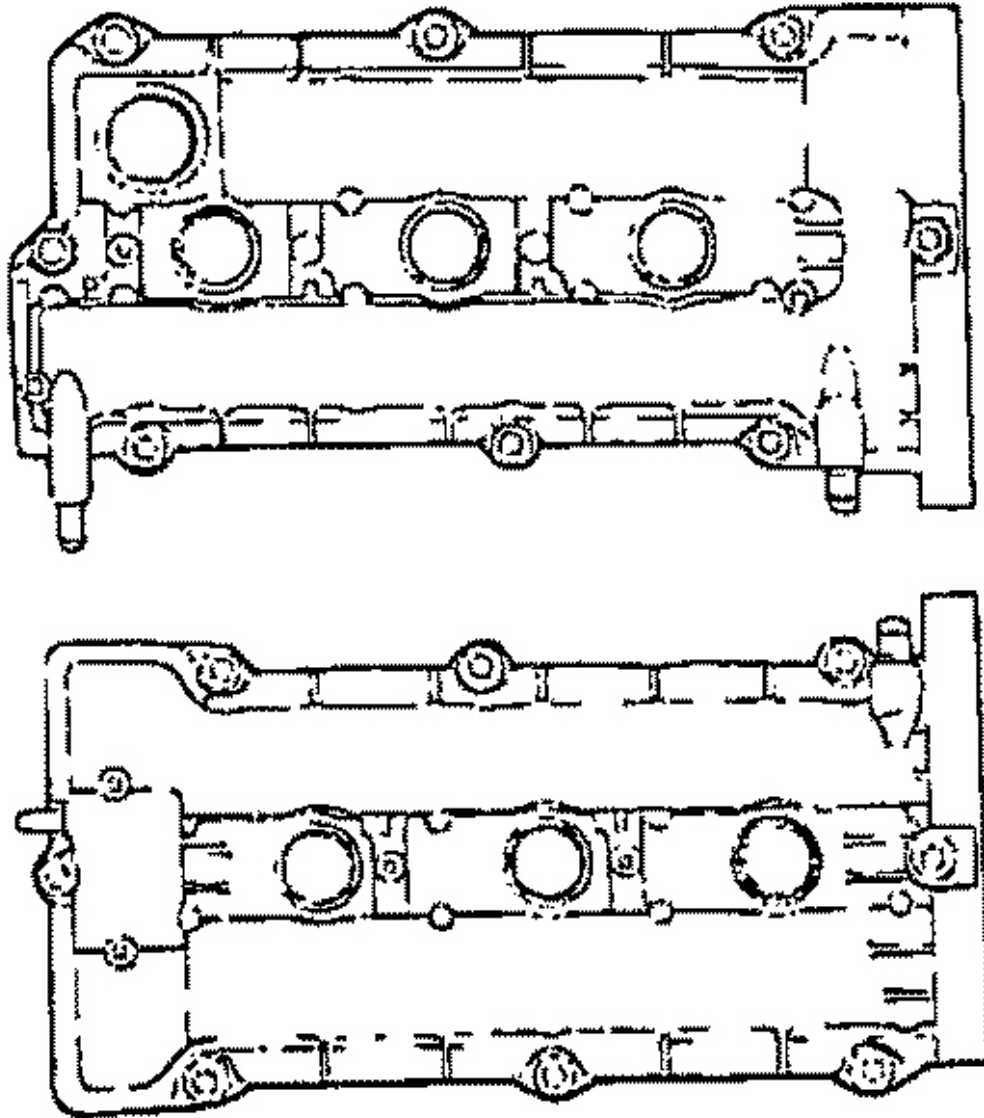
1. Remove the engine cover and intake manifold.



G00327971

Fig. 66: Removing Engine Cover & Intake Manifold
Courtesy of KIA MOTORS AMERICA, INC.

2. Disconnect the breather hose and the engine harness.
3. Remove the coolant pump pulley, crankshaft pulley, idler pulley and tensioner pulley.
4. Remove the coolant pump pulley, crankshaft pulley, idler pulley and tensioner pulley.
5. Loosen the timing belt tensioner pulley, and temporarily secure it.
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.

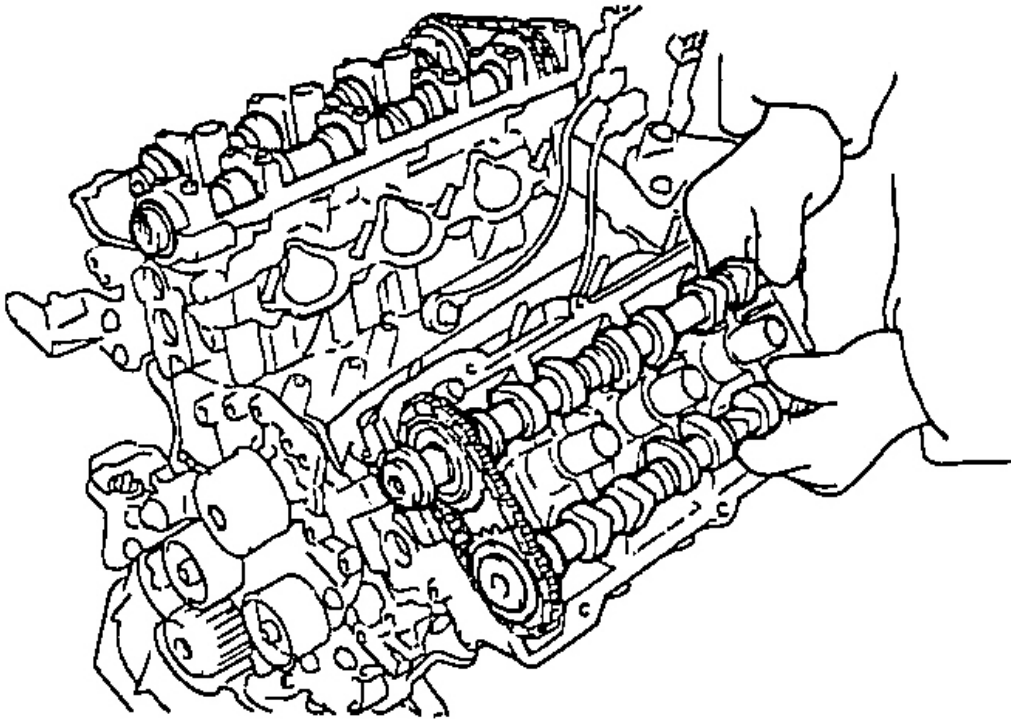


G00327972

Fig. 67: Removing Cylinder Head Cover
Courtesy of KIA MOTORS AMERICA, INC.

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

11. Remove the camshaft.



G00327973

Fig. 68: Removing Camshaft

Courtesy of KIA MOTORS AMERICA, INC.

INSPECTION

Camshaft

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

Cam height

[Standard]

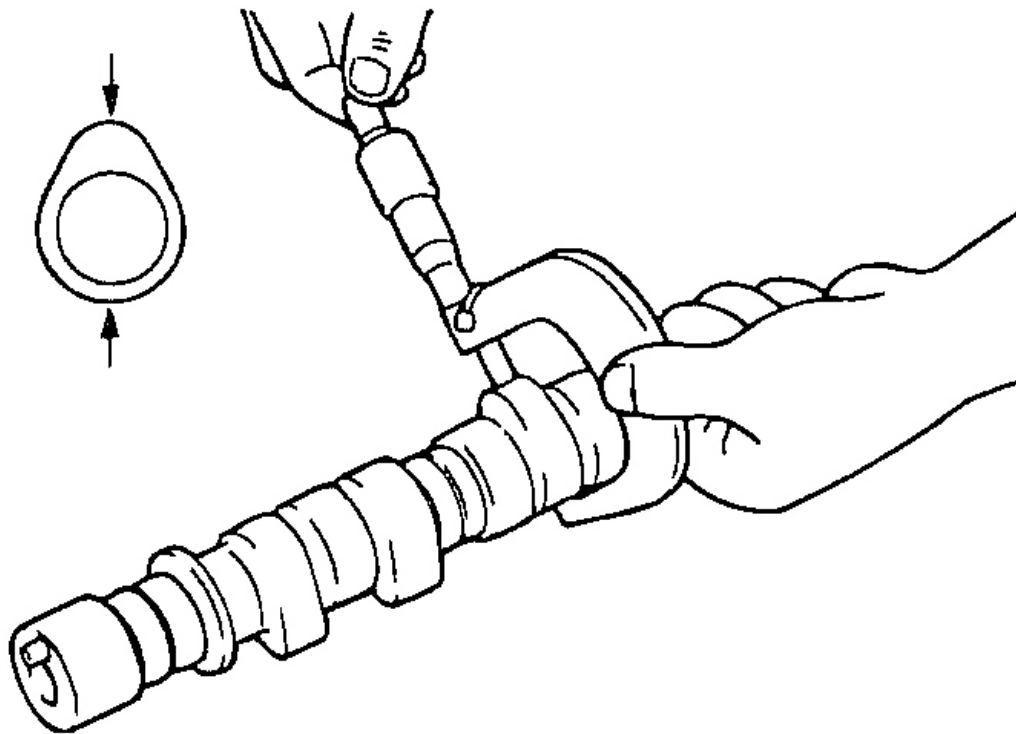
Intake : 43.95-44.15 mm (1.7303-1.7382) in.)

Exhaust: 43.95-44.15 mm (1.7303-1.7382) in.)

[Limit]

Intake : 43.45 mm (1.7106 in.)

Exhaust : 43.45 mm (1.7106 in.)



G00327974

Fig. 69: Checking Camshafts

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.)

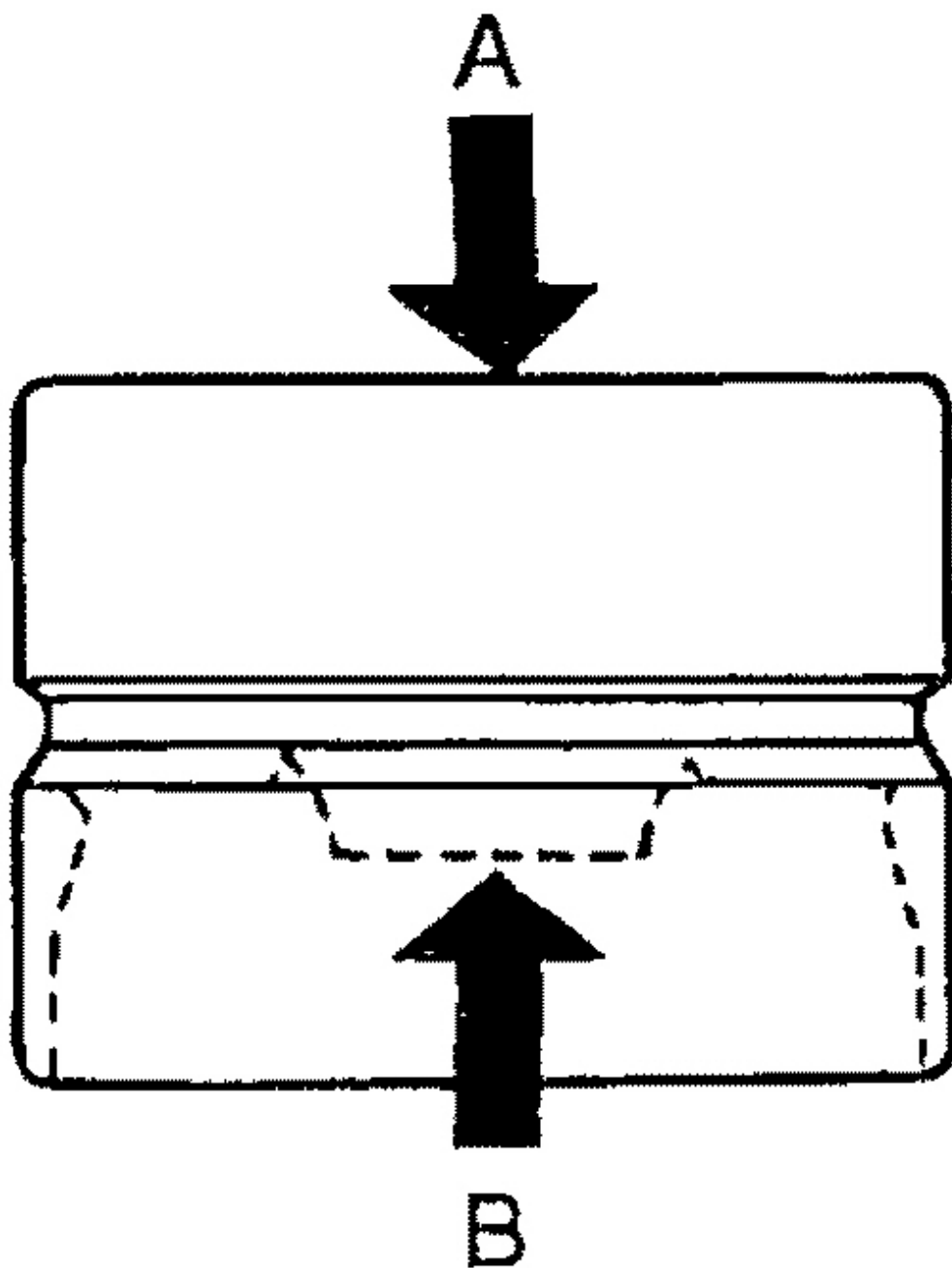
Oil Seal (Camshaft Front)

1. Check the lips for wear. If lip threads are worn, replace.

2. Check the oil seal lip contacting surface or camshaft. If it is worn in stages, replace the camshaft.

Hydraulic Lash Adjuster (HLA)

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



G00327975

Fig. 70: Identifying Hydraulic Lash Adjuster
Courtesy of KIA MOTORS AMERICA, INC.

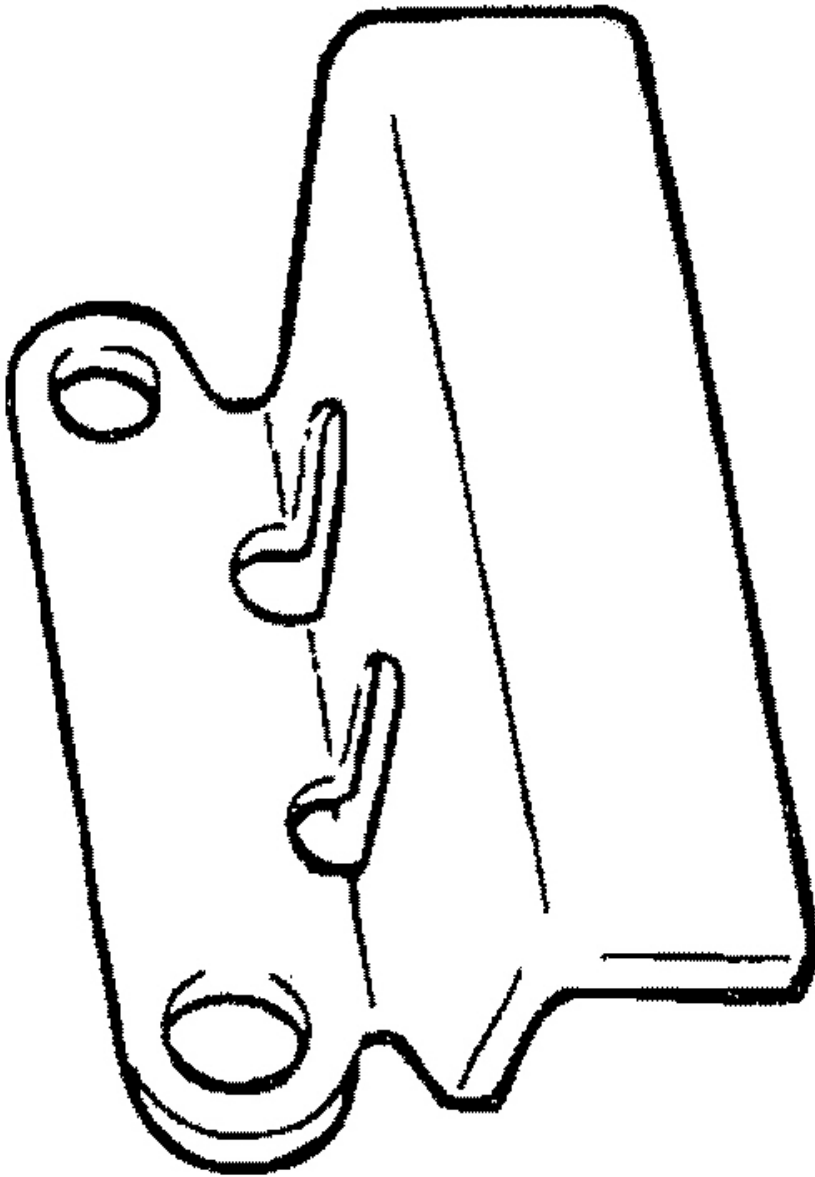
Problem	Possible cause	Action
Temporary noise on starting a cold engine	Normal	This noise will disappear after the oil in the engine reaches normal pressure.
Continuous noise when engine is started after longer than 48 hours parking.	Oil leakage of the high pressure chamber on HLA, allowing air to get in.	Noise will disappear within 15 minutes when engine runs at 2000-3000 rpm. If doesn't disappear, refer to item 7 below
Continuous noise when engine is first started after rebuilding cylinder head.	Insufficient oil in cylinder head oil gallery.	 CAUTION <i>Do not run engine all a speed higher than 3000 rpm as this may damage HLA.</i>
Continuous noise when engine is after excessive cranking the engine by starter motor or band.	Oil leakage of the high-pressure chamber in HLA, allowing air to get in.	
Continuous noise when engine is running after changing HLA.		
Continuous noise during idle after high speed running	Engine oil level too high or too low.	
	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 and amount of oil.
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 down HLA by band. If it moves, replace HLA.  WARNING Be careful with hot HLA.

G00327976

Fig. 71: Identifying Hydraulic Lash Adjuster Troubleshooting Chart
Courtesy of KIA MOTORS AMERICA, INC.

Camshaft Timing Chain Guide

1. Check the chain guide for bend, cracks or damage. Replace if necessary.



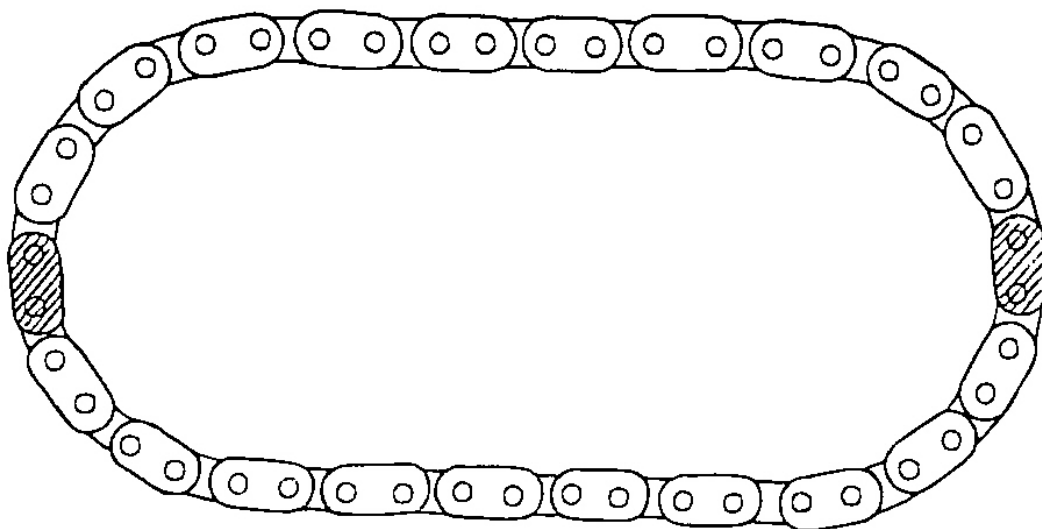
G00327977

Fig. 72: Checking Camshaft Timing Chain Guide
Courtesy of KIA MOTORS AMERICA, INC.

2. Check the rubber part of chain guide for abnormal wear. Replace if necessary.

Camshaft Timing Chain

Check the bushing and plate of timing chain for wear. Replace if there is severe wear.

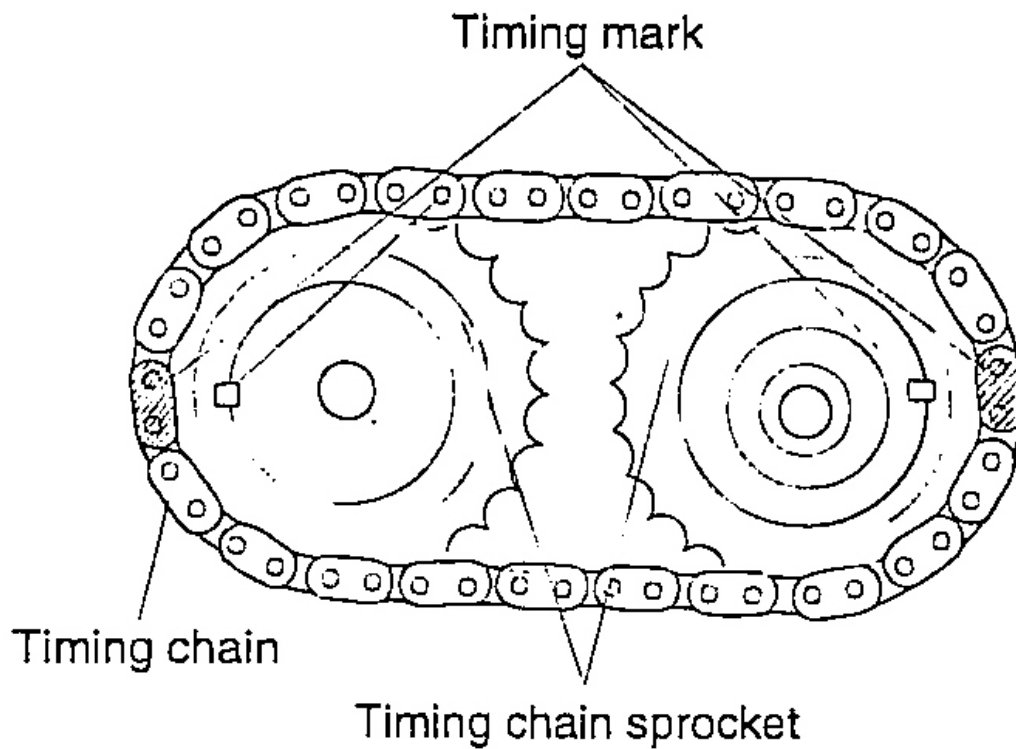


G00327978

Fig. 73: Checking Camshaft Timing Chain
Courtesy of KIA MOTORS AMERICA, INC.

INSTALLATION

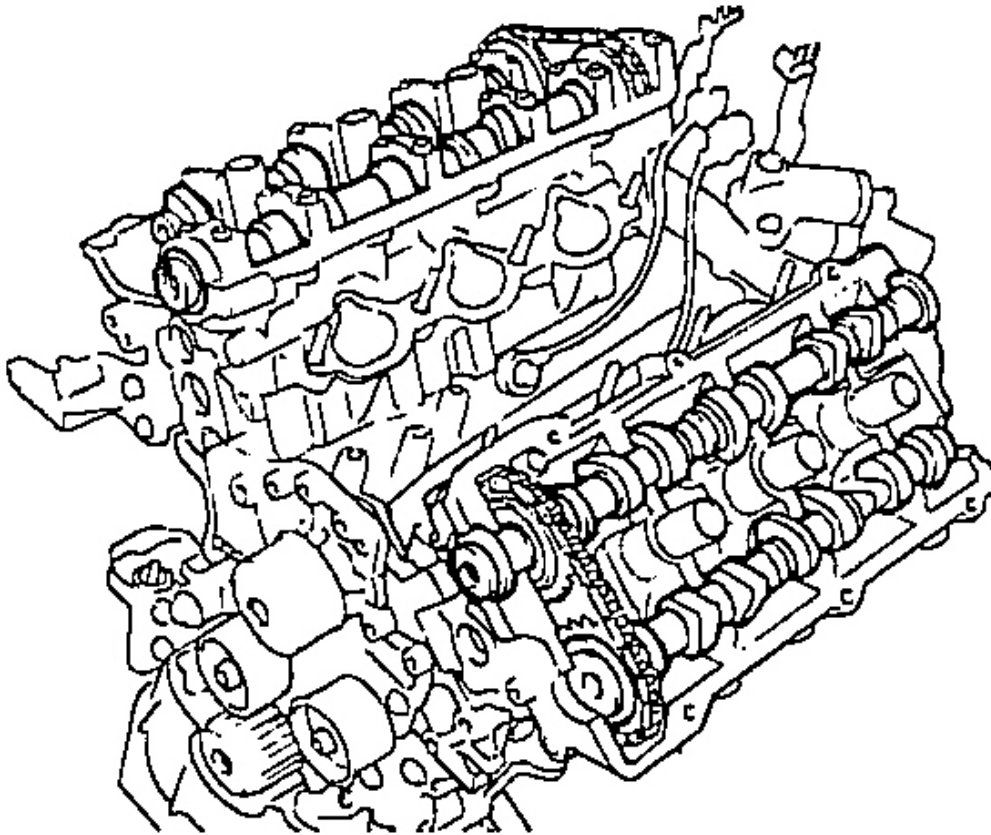
1. Install the HLA.
2. Align the camshaft timing chain with the intake timing chain sprocket and exhaust timing chain sprocket as shown in illustration.



G00327979

Fig. 74: Aligning Camshaft Timing Chain
Courtesy of KIA MOTORS AMERICA, INC.

3. Install the camshaft after lubricating the journal of camshaft with engine oil.



G00327980

Fig. 75: Installing Camshafts

Courtesy of KIA MOTORS AMERICA, INC.

4. Install the bearing caps. Check the markings on the caps for intake/exhaust identification symbol.

I : Intake camshaft

E : Exhaust camshaft

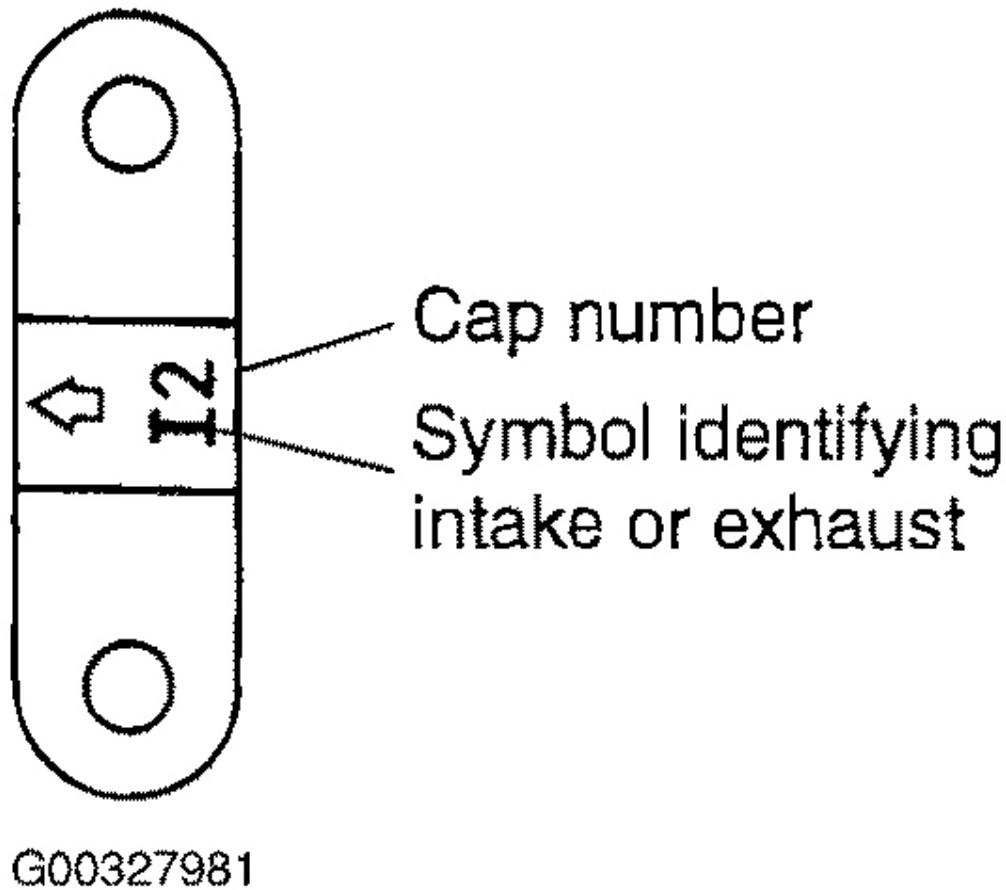
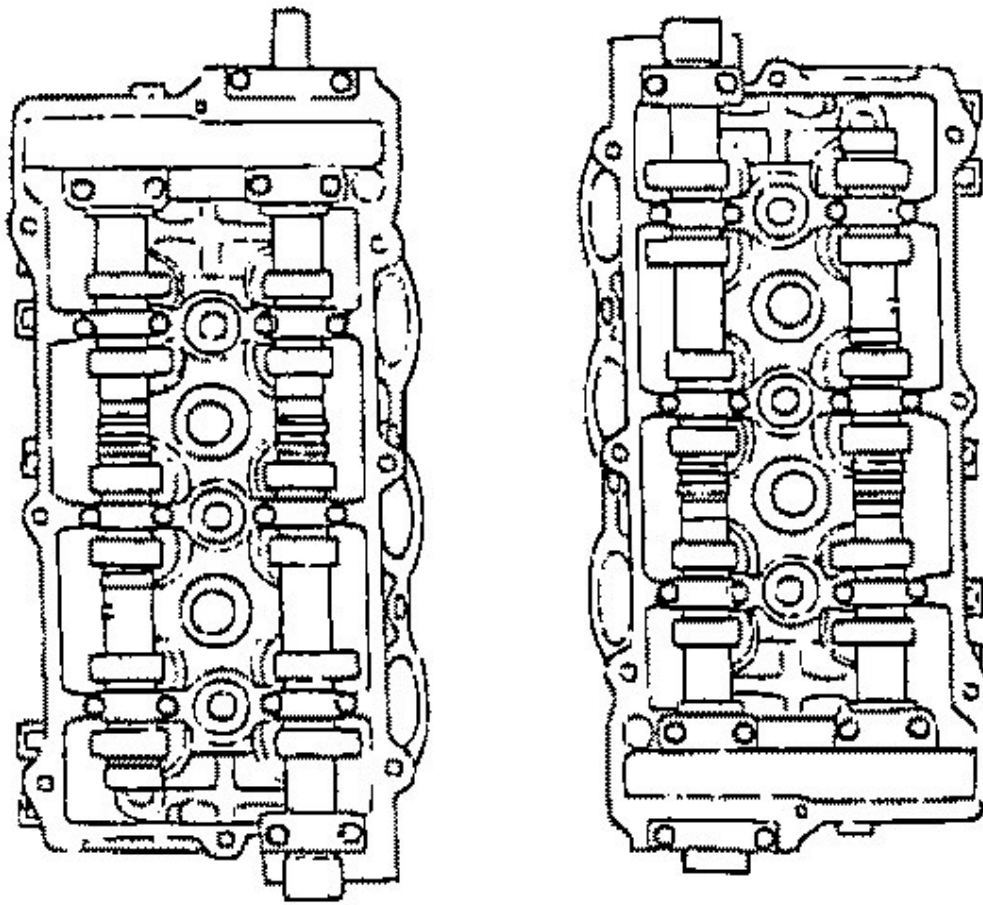


Fig. 76: Identifying Bearing Cap Identification Marks
Courtesy of KIA MOTORS AMERICA, INC.

5. Tighten the bearing caps to the specified torque in two or three steps as shown in illustration.

Tightening torque

Bearing cap bolt: 14-15 Nm (140-150kg.cm, 10-11 lb.ft)



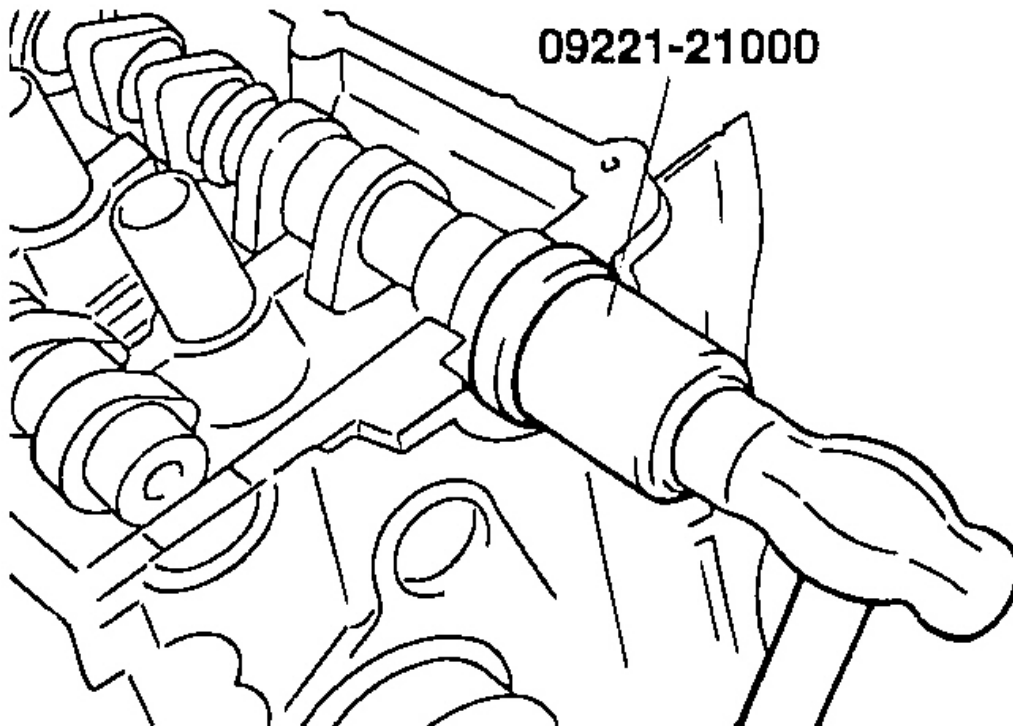
G00327982

Fig. 77: Installing Bearing Caps

Courtesy of KIA MOTORS AMERICA, INC.

6. Using the special tool, camshaft oil seal installer (09221-21000), press fit the camshaft oil seal. Be sure to apply engine oil to the external surface of the oil seal.

Insert the oil seal along the camshaft front end and install by driving the installer with a hammer until the oil seal pulley is seated.



G00327983

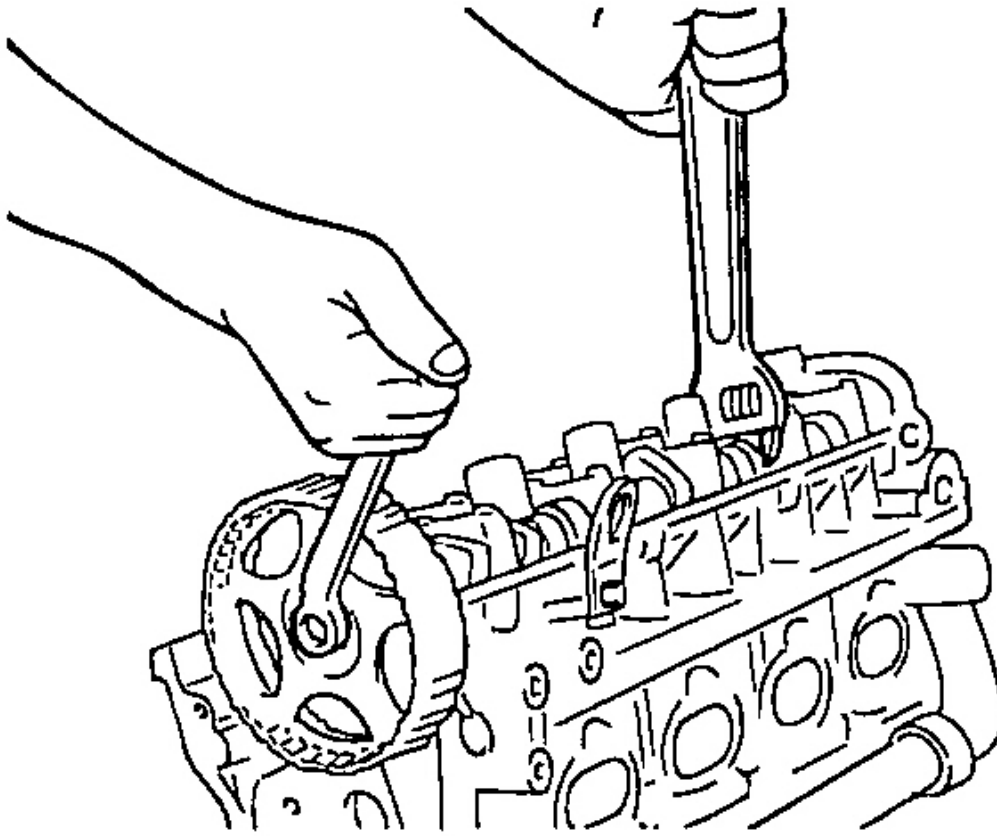
Fig. 78: Identifying Camshaft Oil Seal Installer (09221-21000)
Courtesy of KIA MOTORS AMERICA, INC.

7. Install the camshaft sprocket to the specified torque.

Tightening torque

Camshaft sprocket bolt:

90-110 Nm (900-1100 kg.cm, 65-80 lb.ft)



G00327984

Fig. 79: Installing Camshaft Sprockets
Courtesy of KIA MOTORS AMERICA, INC.

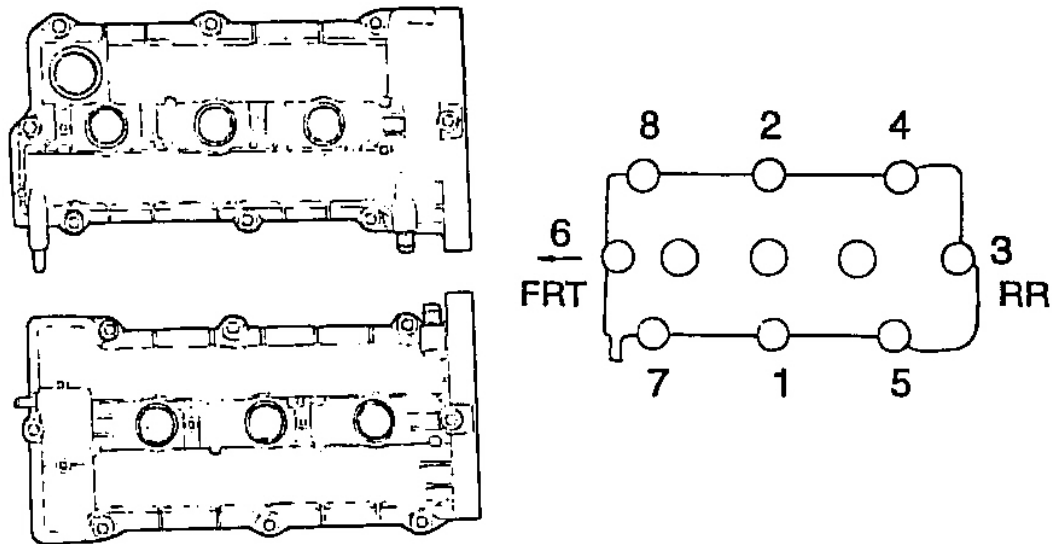
8. Install the cylinder head cover.

Tightening torque

Cylinder head cover bolts: 5-6 Nm (50-60 kg.cm, 3.6-4.4 lb.ft)

Tightening procedure

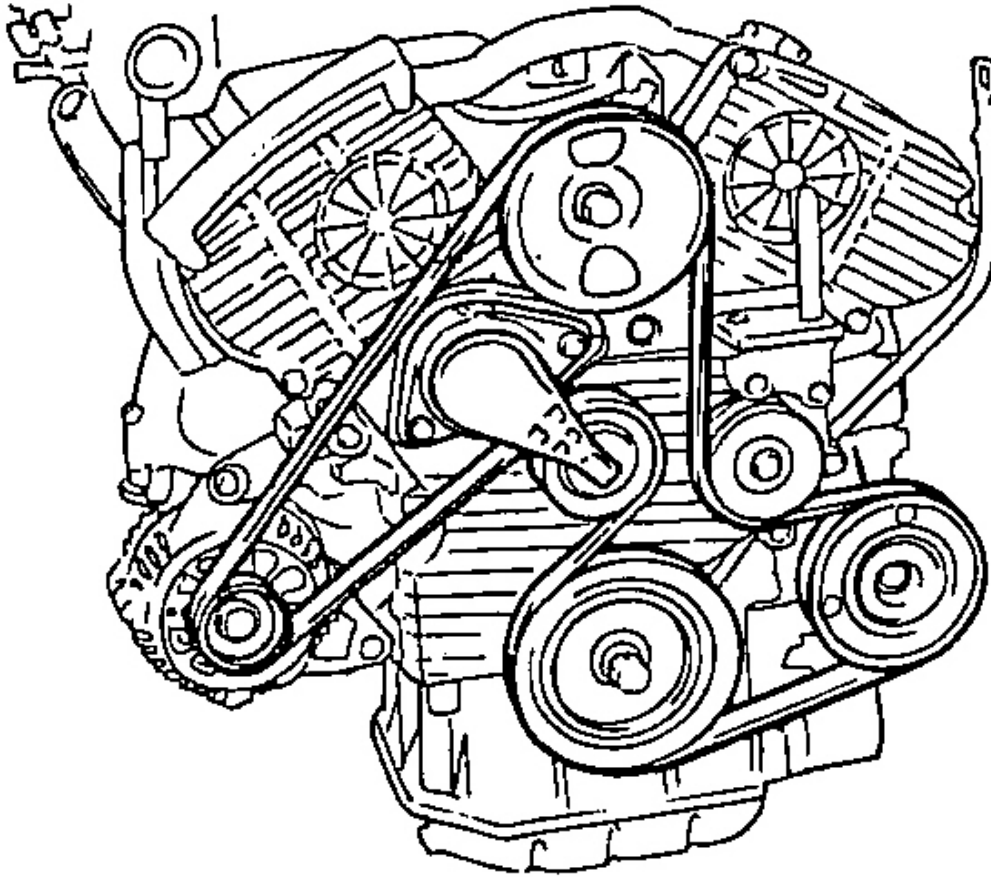
1. Tighten all bolts with temporary torque (half of the standard torque) in sequence. See **Fig. 80**.
2. Tighten all bolts with standard torque.



G00327985

Fig. 80: Identifying Cylinder Head Cover Tightening Sequence
Courtesy of KIA MOTORS AMERICA, INC.

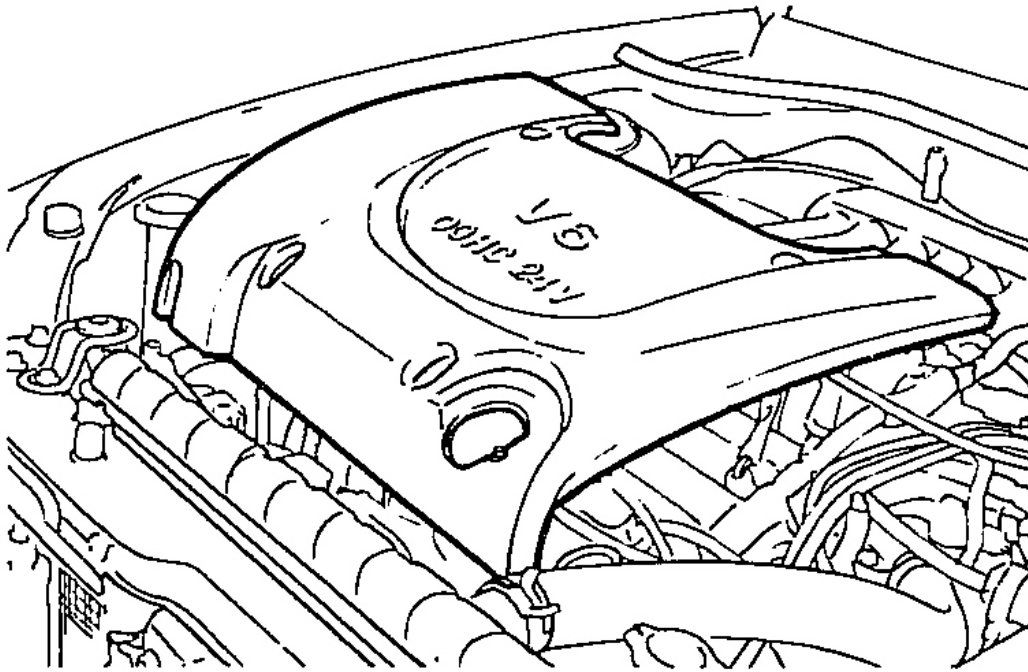
9. Install the spark plug cables, center cover.
10. Install the timing belt and then tighten the timing belt tensioner pulley.
11. Install the timing belt cover.
12. Install the coolant pump pulley and crankshaft pulley, and tensioner pulley.



G00327986

Fig. 81: Identifying Drive Belt Routing
Courtesy of KIA MOTORS AMERICA, INC.

13. Install the intake manifold and engine cover.



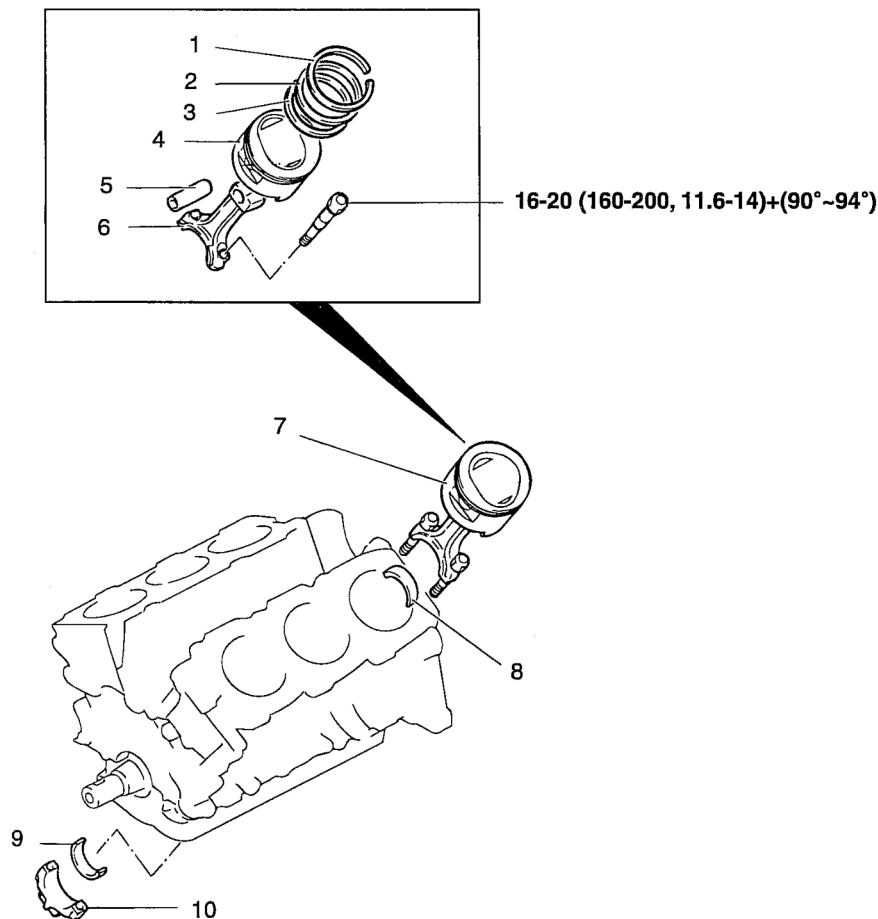
G00327987

Fig. 82: Installing Intake Manifold & Engine Cover
Courtesy of KIA MOTORS AMERICA, INC.

14. Install the oil filler cap.
15. Connect the breather hose and engine harness.

CONNECTING ROD & PISTON

COMPONENTS



TORQUE : Nm (kg·cm, lb·ft)

- | | |
|---------------------|---------------------------------------|
| 1. No.1 piston ring | 6. Connecting rod |
| 2. No.2 piston ring | 7. Piston and connecting rod assembly |
| 3. Oil ring | 8. Connecting rod bearing (upper) |
| 4. Piston | 9. Connecting rod bearing (lower) |
| 5. Piston pin | 10. Connecting rod cap |

G00327988

Fig. 83: Removing & Installing Connecting Rod
 Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

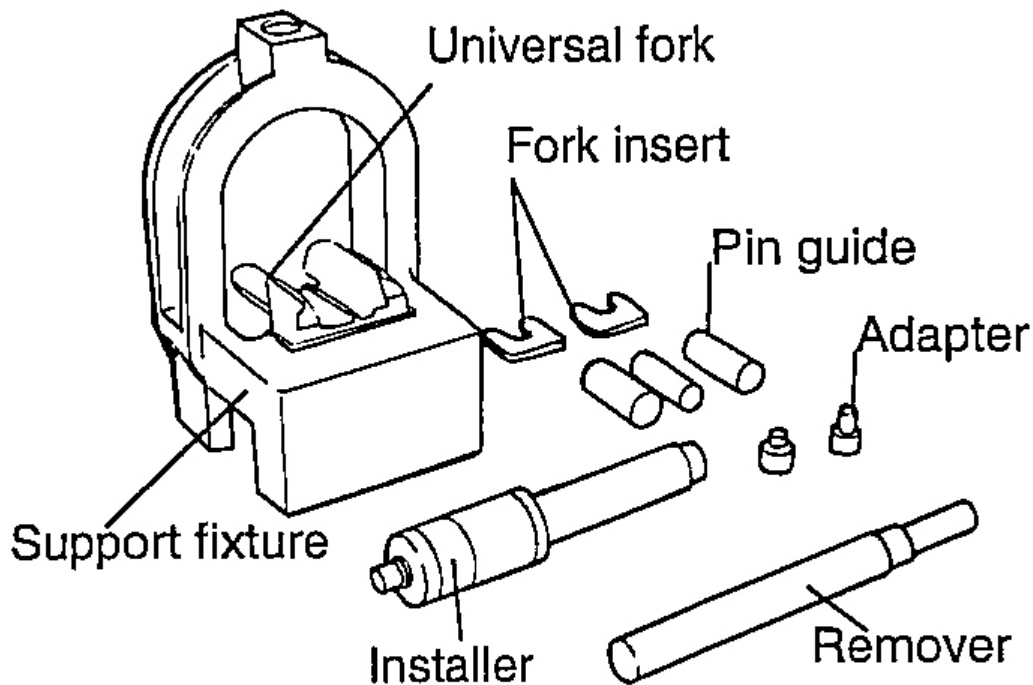
CONNECTING ROD CAP

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

1. Remove the connecting rod cap nuts and then remove the caps and the big end lower bearing.
2. Push each piston-connecting rod assembly toward the top of the cylinder.

PISTON PIN

1. Use the special tools (09234-33001) to disassemble and re-assemble the piston and connecting rod.

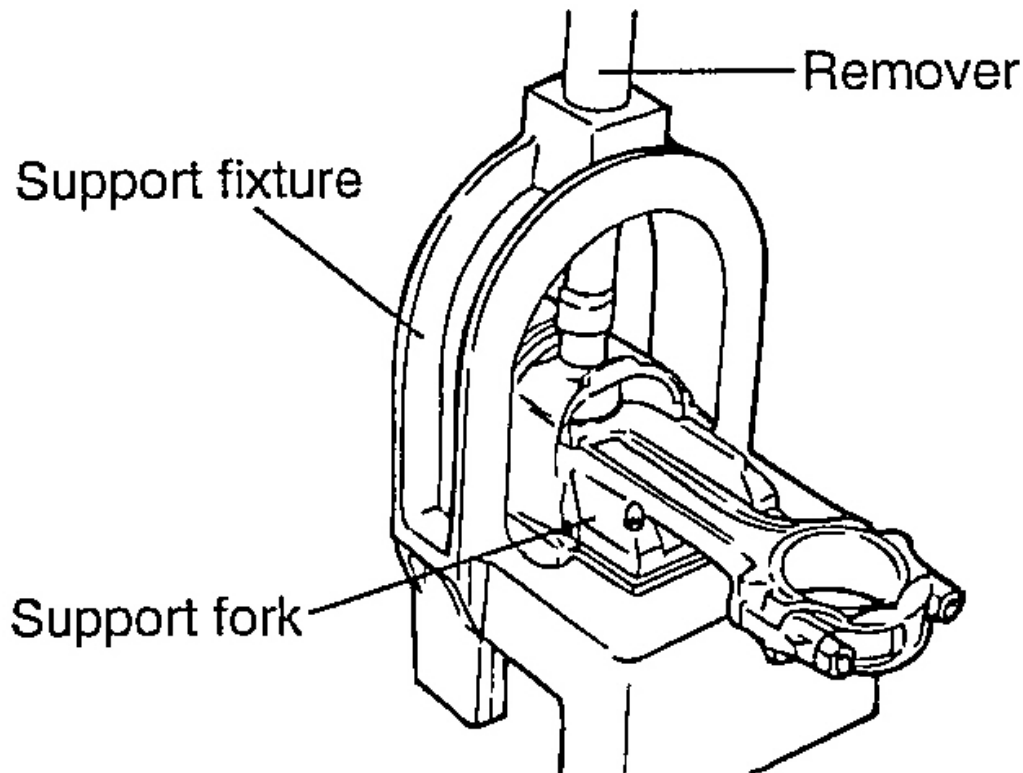


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Fig. 84: Identifying Special Tools (09234-33001)
Courtesy of KIA MOTORS AMERICA, INC.

2. Place the proper insert in the fork of the tool. Position the insert between the connecting rod and the piston.
3. Insert the proper removal tool through the hole in the arch of the tool.

CAUTION: Center the piston, rod and pin assembly with the removal arbor.



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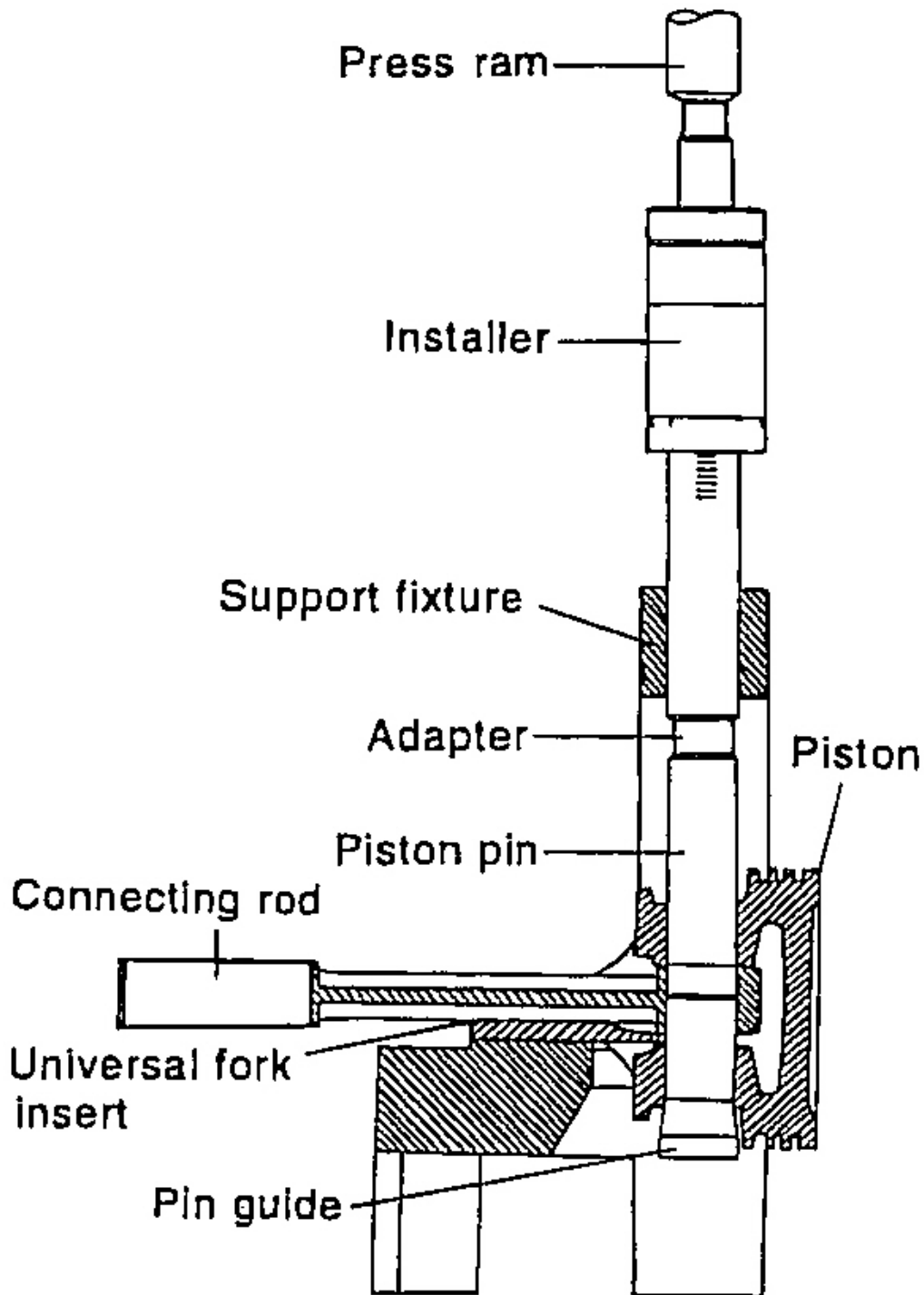
Fig. 85: Removing Piston Pin (1 Of 2)

Courtesy of KIA MOTORS AMERICA, INC.

4. Press the piston pin out of the connecting rod.
5. Install the proper pin guide (refer to application chart in illustration) through the piston and into the connecting rod. Hand tap the pin guide into the piston for proper retention. Drop the piston pin into the other side of the piston.

CAUTION: The pin guide centers the connecting rod in the piston. When the piston, connecting rod, piston pin and pin guide assembly are positioned on the fork of the tool, the pin guide will also center this assembly in the tool. If a pin guide that is too small is used, the piston assembly will not be located centrally in the tool, and damage may occur to the fork and/or the insert of the tool.

6. Install piston assembly onto fork assembly of a tool. The tool will support connecting rod at the piston pin. Be sure that piston assembly is slid onto the fork until the pin guide contacts the fork insert.



G00327991

Fig. 86: Removing Piston Pin (2 Of 2)**Courtesy of KIA MOTORS AMERICA, INC.**

7. Adjust the installing arbor to the proper length by turning the numbered sleeve on the lettered shaft until the specified alphanumeric setting from the application chart in illustration is obtained. Turn knurled nut to lock numbered sleeve on shaft.
8. Insert the installing arbor through the hole in the arch of the tool. Press piston pin into the connecting rod until the sleeve on the installing arbor contacts the top of the tool arch. The pin guide will fall out of the connecting rod as the piston pin is pressed in.

CAUTION: Do not exceed 1250 kg of force when installing the arbor sleeve against the arch.

INSPECTION**Connecting Rod**

1. When the connecting rod cap is installed, make sure that cylinder numbers put on the rod end cap at disassembly match.

When a new connecting rod is installed, make sure that the notches for holding the bearing in place are on the same side.

2. Replace the connecting rod if it is damaged on the thrust faces at either end, and also if it has a step wear in, or severely rough surface of the inside diameter of the small end.

Piston 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 smoothly pressed 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 a 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 the piston rings only.

Piston ring side clearance

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

No.2 : 0.03-0.07 mm (0.0012-0.0028 in.)

[Limit]

No.1 : 0.1 mm (0.004 in.)

No.2 : 0.1 mm (0.004 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 dimension]

No.1 : 0.20-0.35 mm (0.0079-0.0138 in.)

No.2 : 0.37-0.52 mm (0.0146-0.0205 in.)

Oil ring side rail : 0.20-0.7 mm (0.0079-0.0276 in.)

[Limit]

No.1, No.2 : 0.8 mm (0.031 in.)

Oil ring side rail : 1.0 mm (0.039 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.

When replacing a ring, be sure to use a ring of the same size.

Piston ring service size and mark

STD : None

0.25 mm (0.010 in.) O.S. : 25

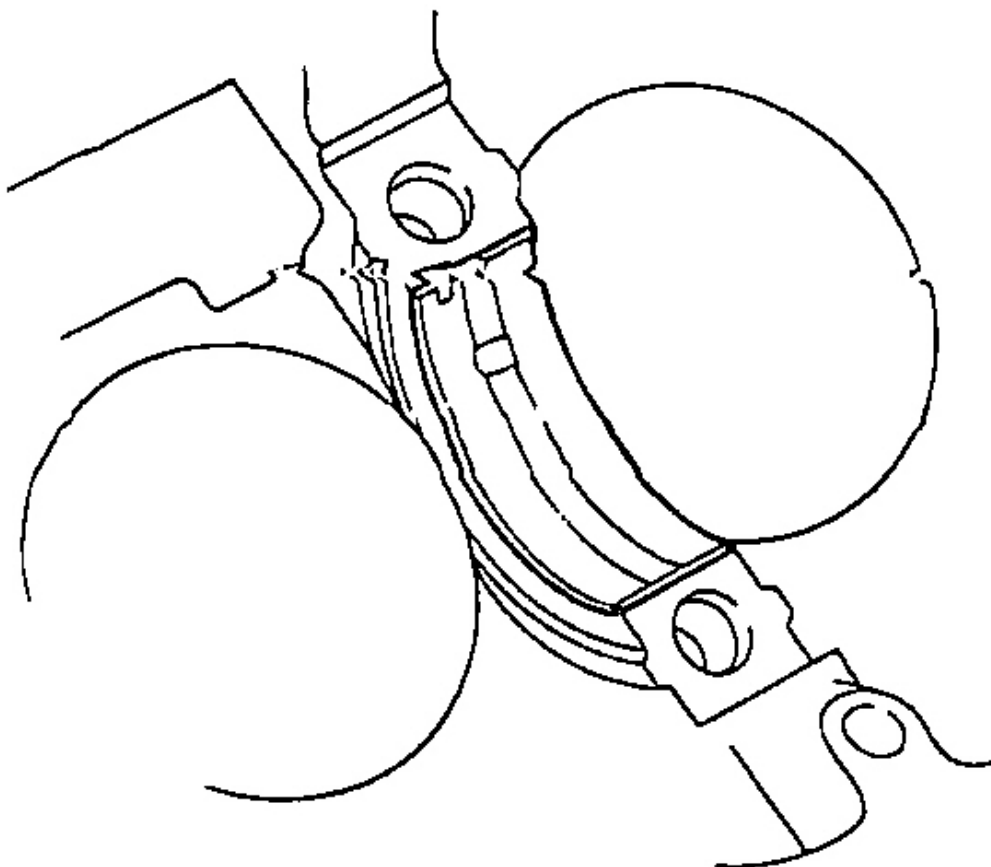
0.50 mm (0.020 in.) O.S. : 50

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

INSTALLATION

Connecting Rod

1. Install the upper main bearings in the cylinder block.



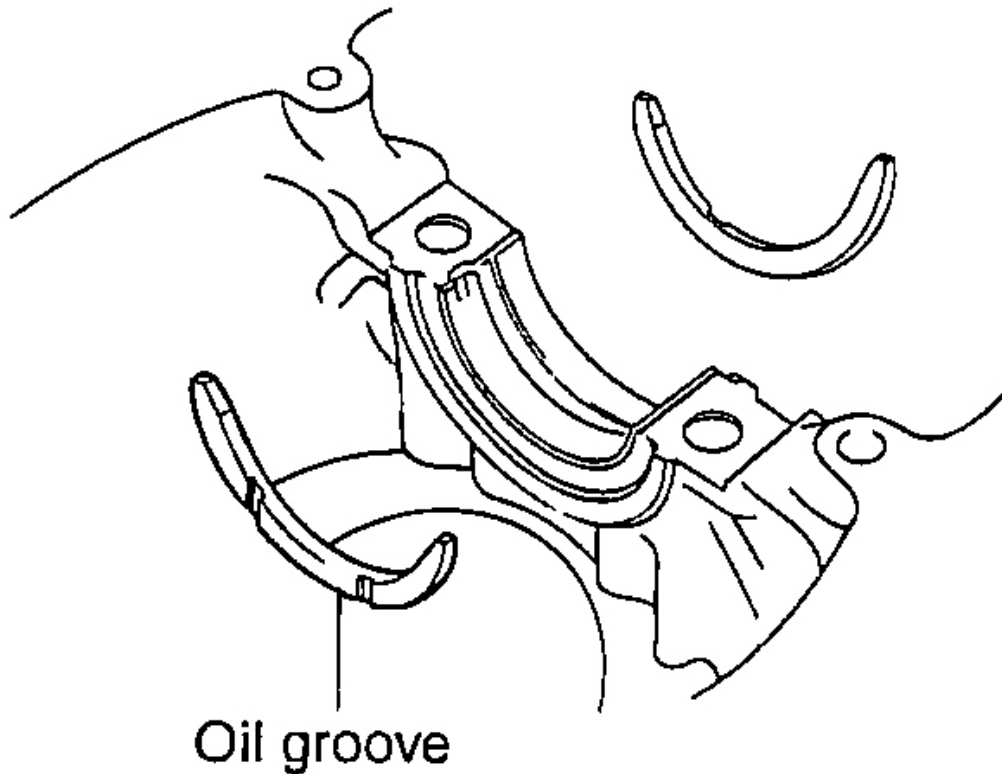
G00327992

Fig. 87: Installing Upper Main Bearings
Courtesy of KIA MOTORS AMERICA, INC.

2. Install the lower main bearings in the main bearing caps.

CAUTION: Install the bearing with the oil hole in the block.

3. Install the thrust washers in the No. 3 main bearing cap with the oil grooves facing outward.



G00327993

Fig. 88: Installing Thrust Washers
Courtesy of KIA MOTORS AMERICA, INC.

4. 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.
5. When the connecting rod cap is installed, make sure that the cylinder numbers put on the rod and cap at disassembly match.
6. When a new connecting rod is installed, make sure that the notches for holding the bearing in place are on the same side.
7. When assembling, bolts should be fastened by plastic region angle - controlled method as follows.
 1. Apply oil to the thread of nuts and spot areas.
 2. Tighten the connecting rod bolt.

Tightening torque

Connecting rod bolt :

16-20 Nm (160-200 kg.cm, 11.6-14 lb.ft) +(90°~94°)

CAUTION: After removing the connecting rod bolt, do not use bolt again.

8. Check the bearing clearance as follows:

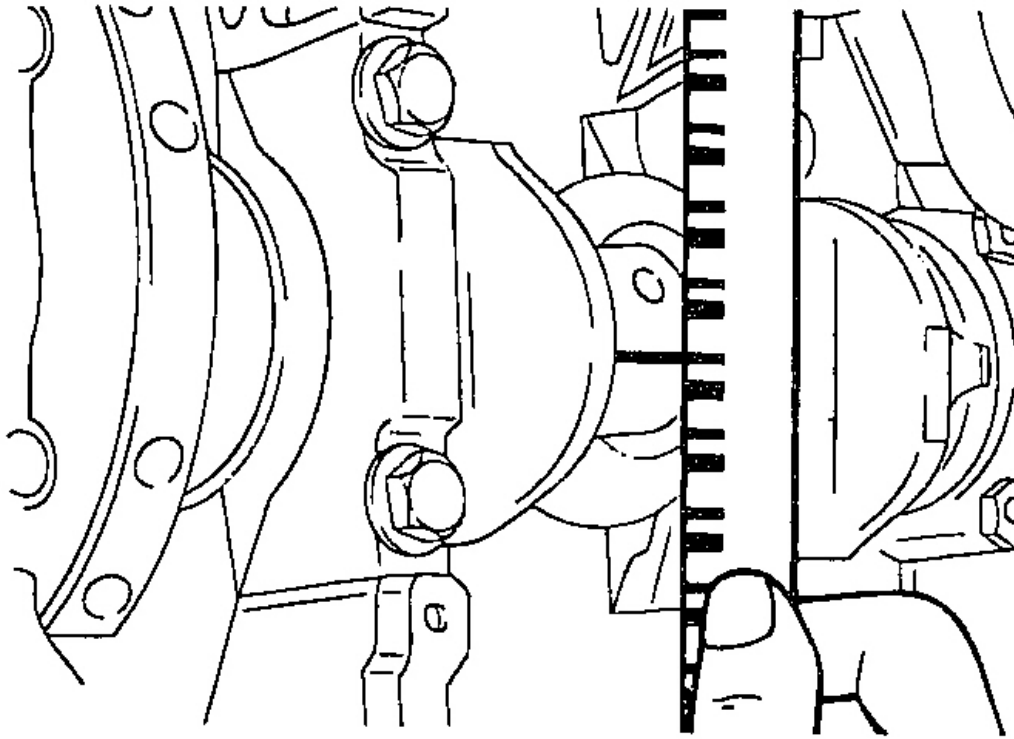
1. Remove oil and dirt from the bearings and journals.
2. Cut plastic gauge to the same length as the width of the bearing and place it in parallel with the journal, avoiding the oil holes.
3. Install the bearing and cap. Tighten to the specified torque. During this operation, do NOT turn the crankshaft.
4. Remove the cap, measure the width of the plastic gauge at the widest part by using the scale printed on the plastic gauge package.

Connecting rod cap

Bearing clearance

Standard : 0.018-0.036 mm (0.0007-0.0014 in.)

Limit : 0.1 mm (0.0039 in.)



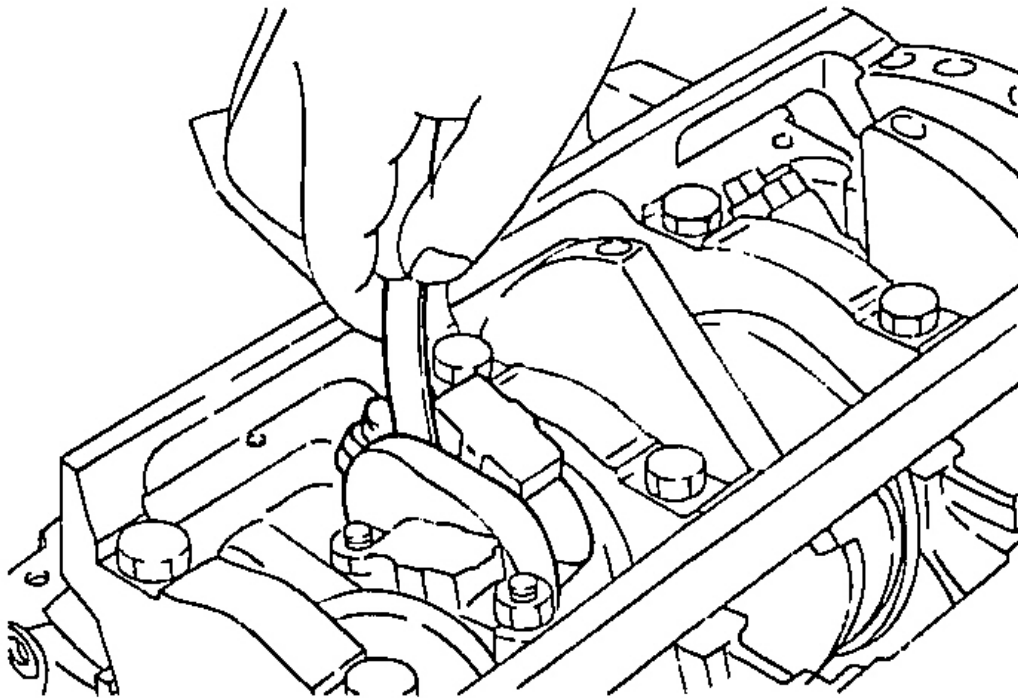
G00327994

Fig. 89: Checking Bearing Clearance (1 Of 2)
Courtesy of KIA MOTORS AMERICA, INC.

9. Check the connecting rod side clearance.

Side clearance : 0.10-0.25 mm (0.0039-0.0098 in.)

Limit : 0.4 mm (0.016 in.)

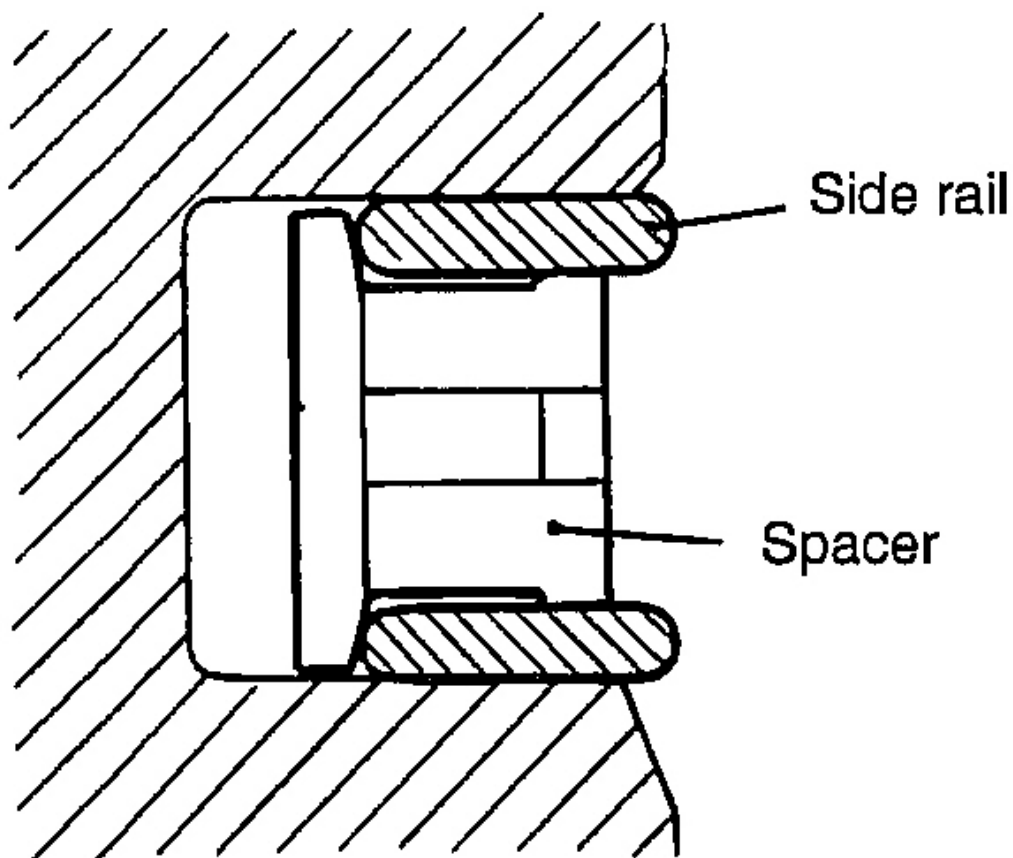


G00327995

Fig. 90: Checking Bearing Clearance (2 Of 2)
Courtesy of KIA MOTORS AMERICA, INC.

Piston

1. Install the spacer.



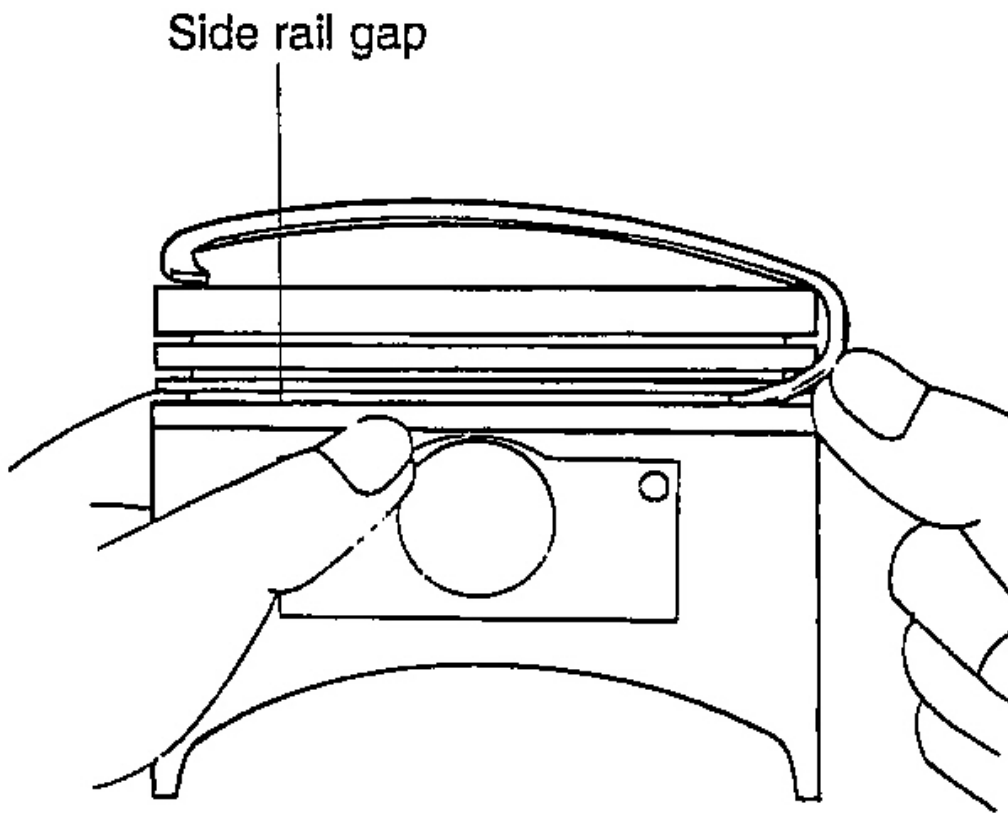
G00328006

Fig. 91: Installing Spacer

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 down firmly, and then press down on the portion which is to be inserted into the groove with a finger as shown in illustration.

CAUTION: Do not use a piston ring expander when installing side rail in order to protect side rail.

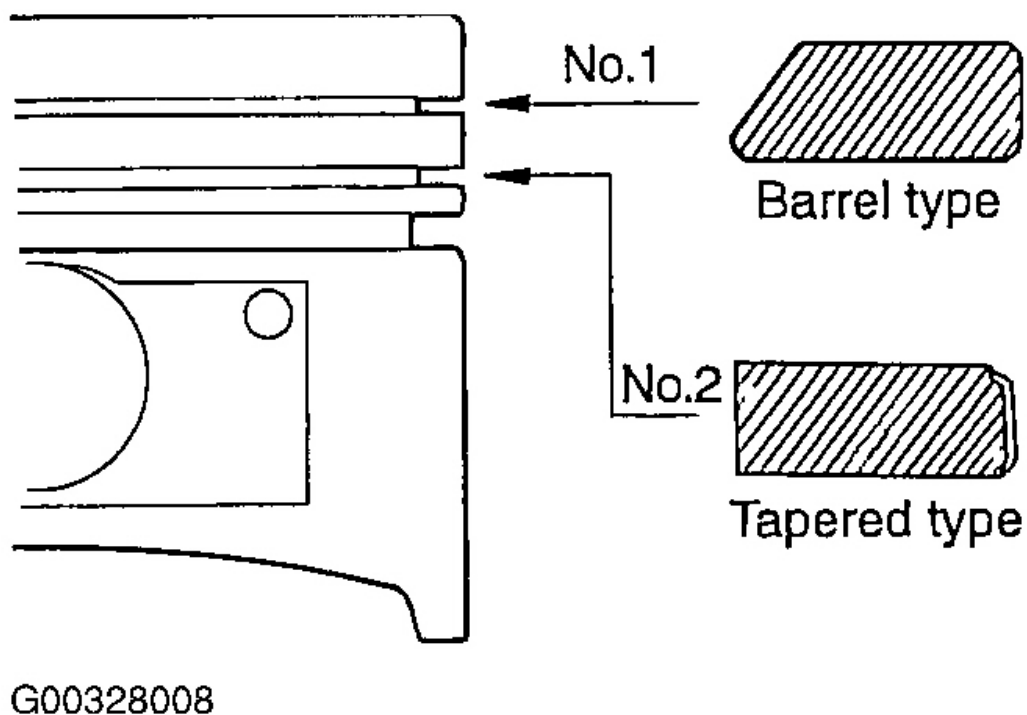


G00328007

Fig. 92: Installing Side Rail

Courtesy of KIA MOTORS AMERICA, INC.

3. Install the lower side rail by the same procedure as Step 2.
4. Apply engine oil around the piston and piston rings.
5. Using a piston ring expander, install the No. 2 piston ring.

**Fig. 93: Installing Piston Rings**

Courtesy of KIA MOTORS AMERICA, INC.

6. Install the No. 1 piston ring.
7. Position each piston ring end gap as far away from neighboring gaps as possible. Make sure that the gaps are not positioned in the thrust and pin directions.

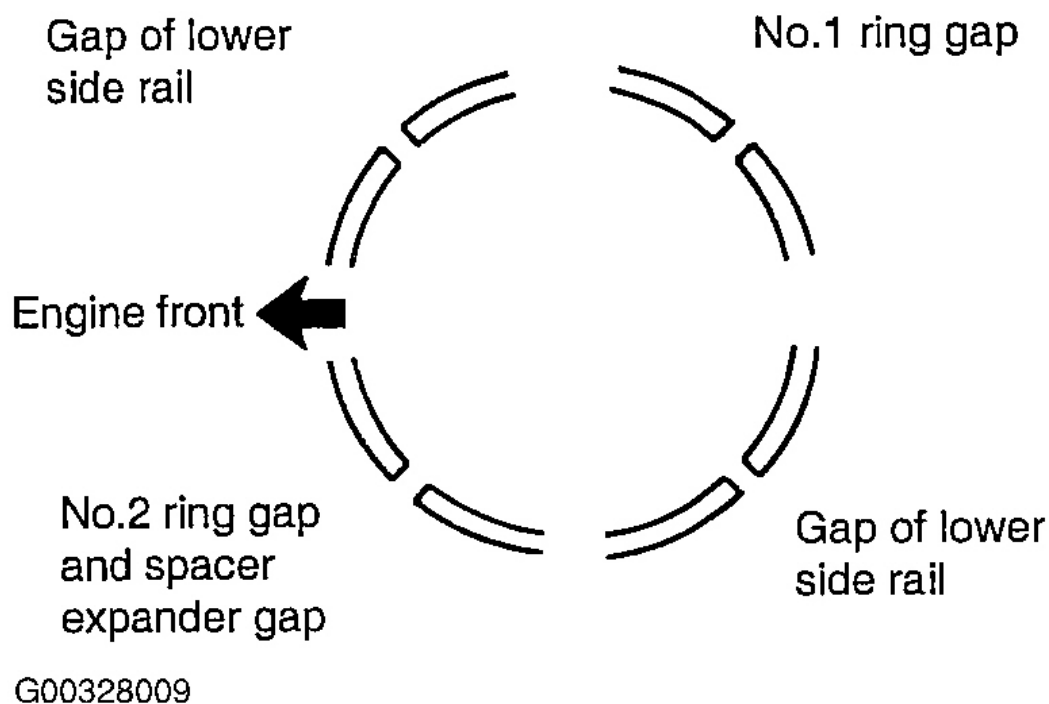


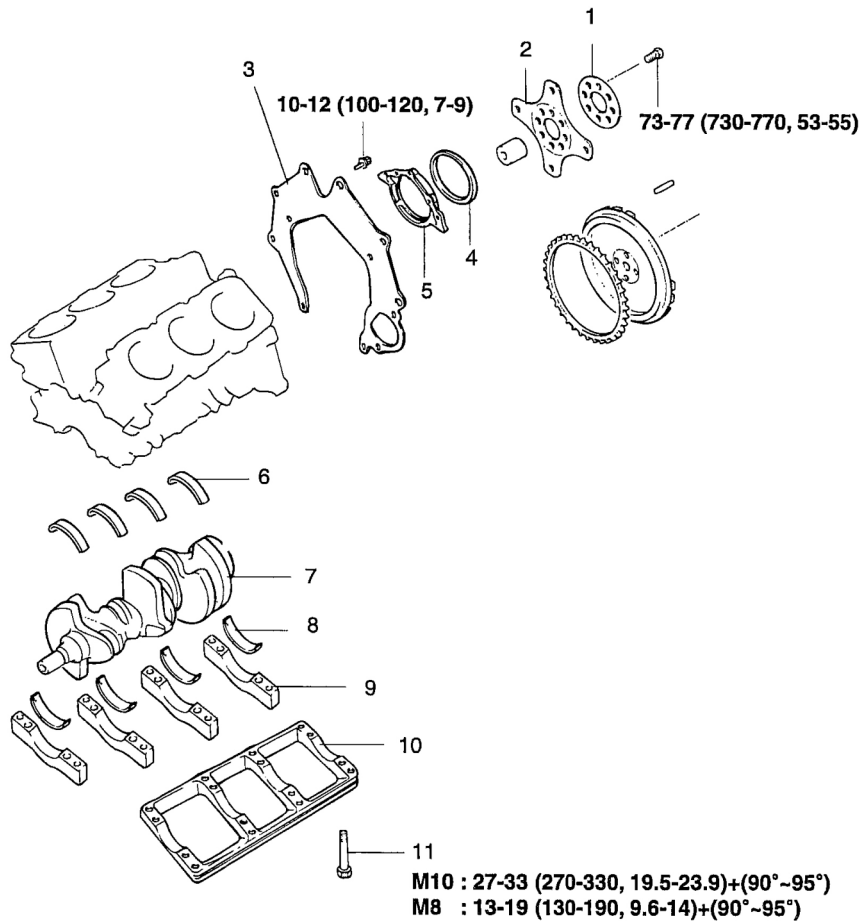
Fig. 94: Identifying Piston Gaps

Courtesy of KIA MOTORS AMERICA, INC.

8. Hold piston rings firmly in a piston ring compressor as they are inserted into cylinder.

CRANKSHAFT

COMPONENTS



TORQUE : Nm (kg·cm, lb·ft)

- | | |
|-----------------------------|---------------------------|
| 1. Adaptor plate | 7. Crank shaft |
| 2. Drive plate | 8. Lower bearing |
| 3. Transaxle mounting plate | 9. Thrust bearing |
| 4. Rear oil seal | 10. Main bearing cap |
| 5. Oil seal case | 11. Main bearing cap bolt |
| 6. Upper bearing | |

G00327996

Fig. 95: Removing & Installing Crankshaft
Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

1. Remove the timing belt, cylinder head assembly, drive plate, transaxle mounting plate oil pan. For details, refer to their respective procedures.
2. Remove the oil seal case 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 by cap number.

INSPECTION**Crankshaft**

1. Check the crankshaft journals and pins for damage, uneven wear and cracks. Also check the oil holes for restrictions. Repair or replace any defective part.
2. Inspect for out-of-roundness and taper of the crankshaft journal and pin.

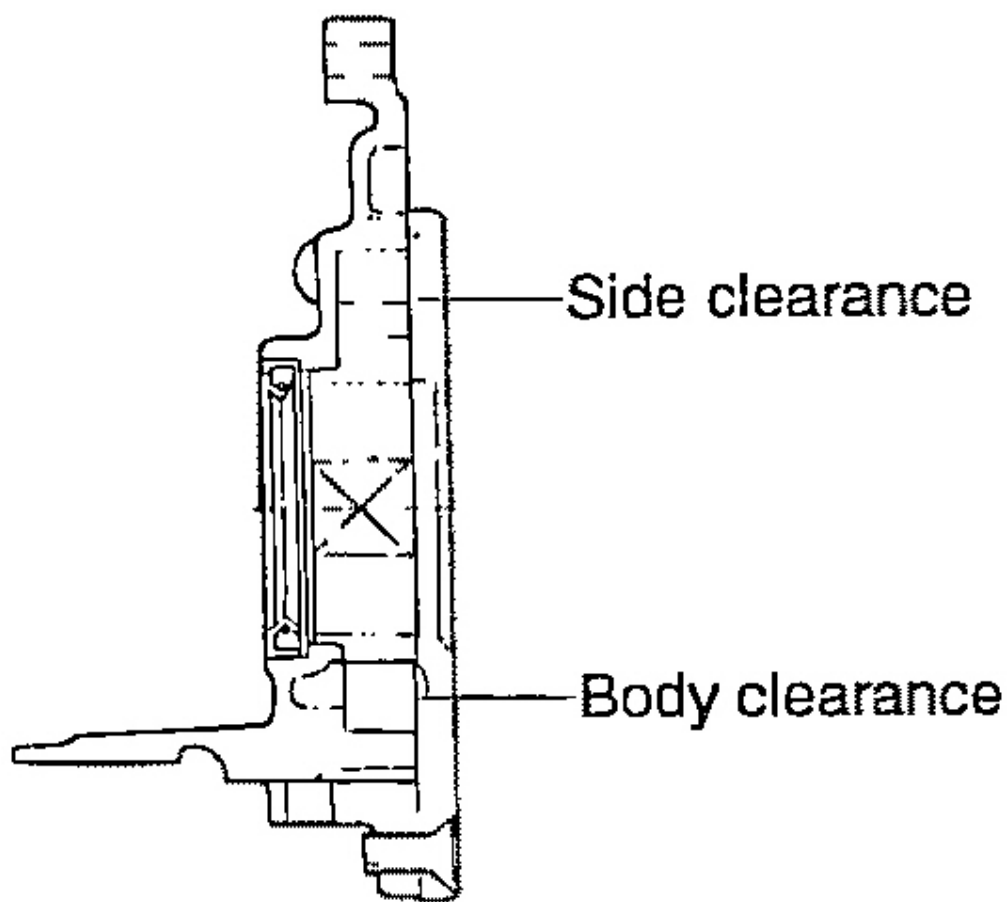
Standard value

Crankshaft journal O.D. :

61.982-62.000 mm (2.4402-2.4409 in.)

Crankshaft pin O.D. :

47.982-48.000 mm (1.8891-1.8898 in.)



G00327997

Fig. 96: Checking Crankshaft

Courtesy of KIA MOTORS AMERICA, INC.

Main Bearings and Connecting Rod Bearings

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

Measuring Oil Clearance

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 and inside diameters.

Standard value

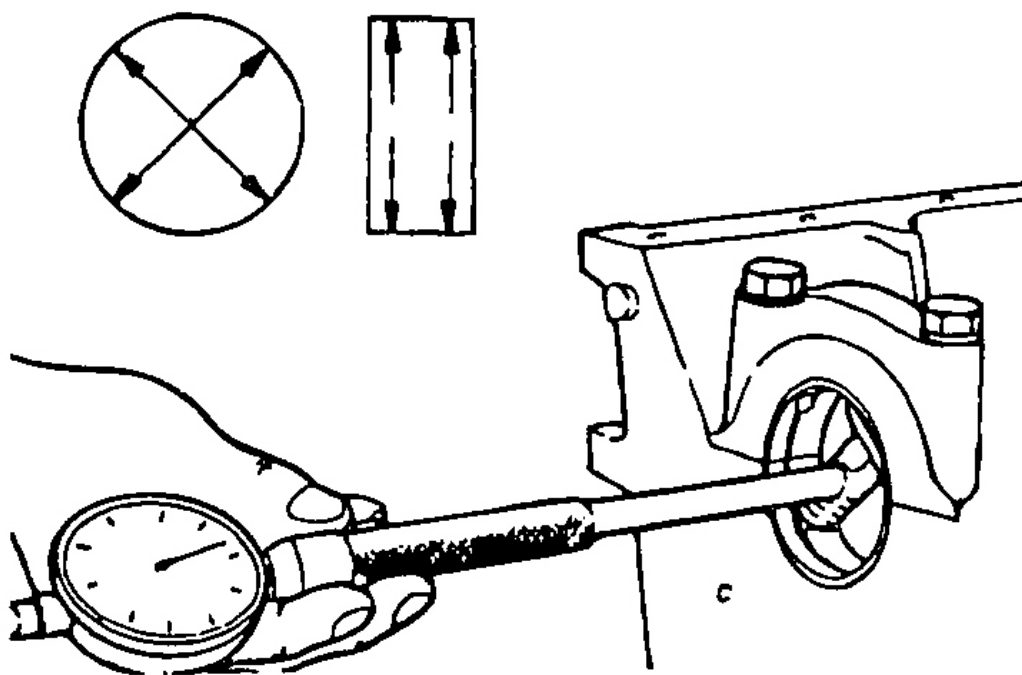
Oil clearance

Crankshaft main bearing :

0.004-0.022 mm (0.0002-0.0009 in.)

Connecting rod bearing :

0.018-0.036 mm (0.0007-0.0014 in.)



G00327998

Fig. 97: Measuring Oil Clearance

Courtesy of KIA MOTORS AMERICA, INC.

Plastic gauge Method

Plastic gauge may be used to measure the clearance.

1. Remove oil and grease and any other dirt from the bearings and journals.
2. Cut the plastic gauge to the same length as the width of the bearing and place it in parallel with the

journal, avoiding the oil holes.

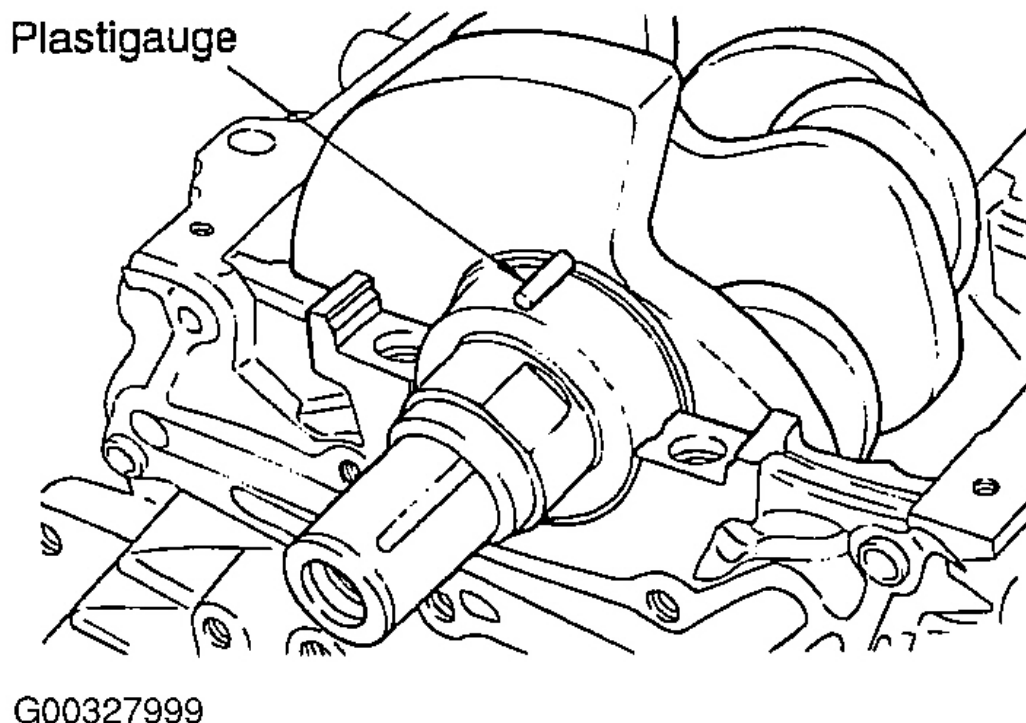


Fig. 98: Identifying Plastic Gauge

Courtesy of KIA MOTORS AMERICA, INC.

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 plastic gauge 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.

Should the standard clearance 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.

Oil Seal

Check the front and rear oil seals for damage or worn surfaces.

Replace any seal that is defective.

Drive Plate

Replace distorted, damaged, or cracked drive plates.

INSTALLATION

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

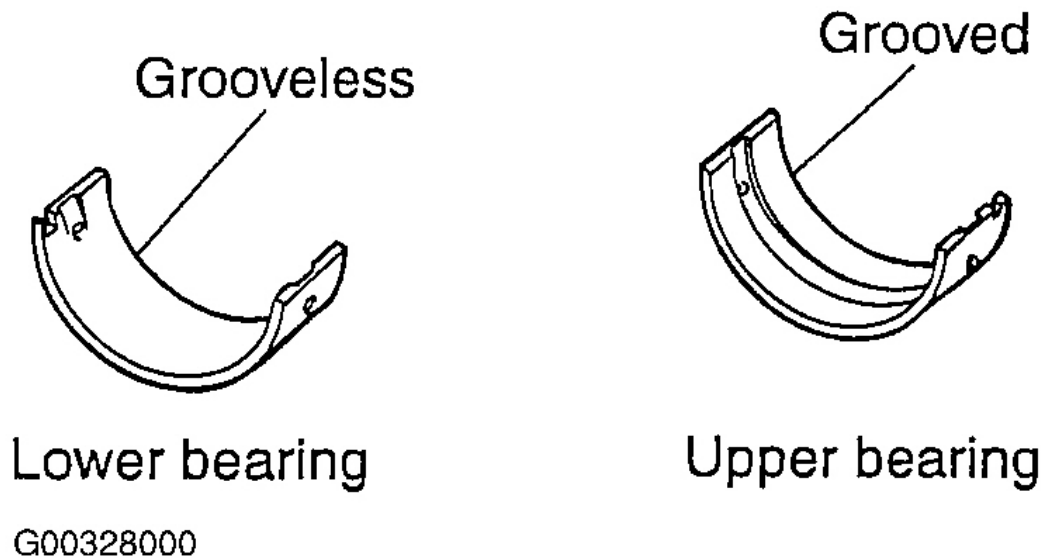
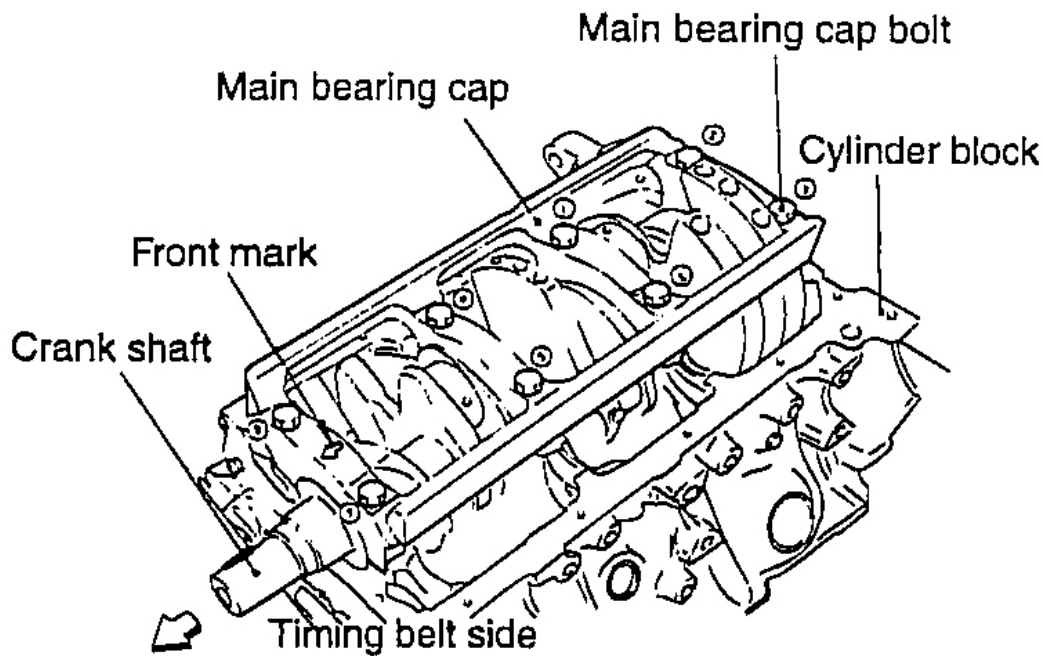


Fig. 99: Installing Main Bearings
Courtesy of KIA MOTORS AMERICA, INC.

2. Install the grooveless main bearing (lower bearing) on the main bearing cap side.
3. Install the crankshaft. Apply engine oil to the journal and pin.
4. Caps should be installed with the arrow mark directed toward the front of the engine. The cap number sequence must be correct.



G00328001

Fig. 100: Installing Main Bearing Caps
 Courtesy of KIA MOTORS AMERICA, INC.

5. Tighten all cap bolts to the specified torque and then rotate all bolts to specified angle.

Tightening torque

Main bearing cap bolts :

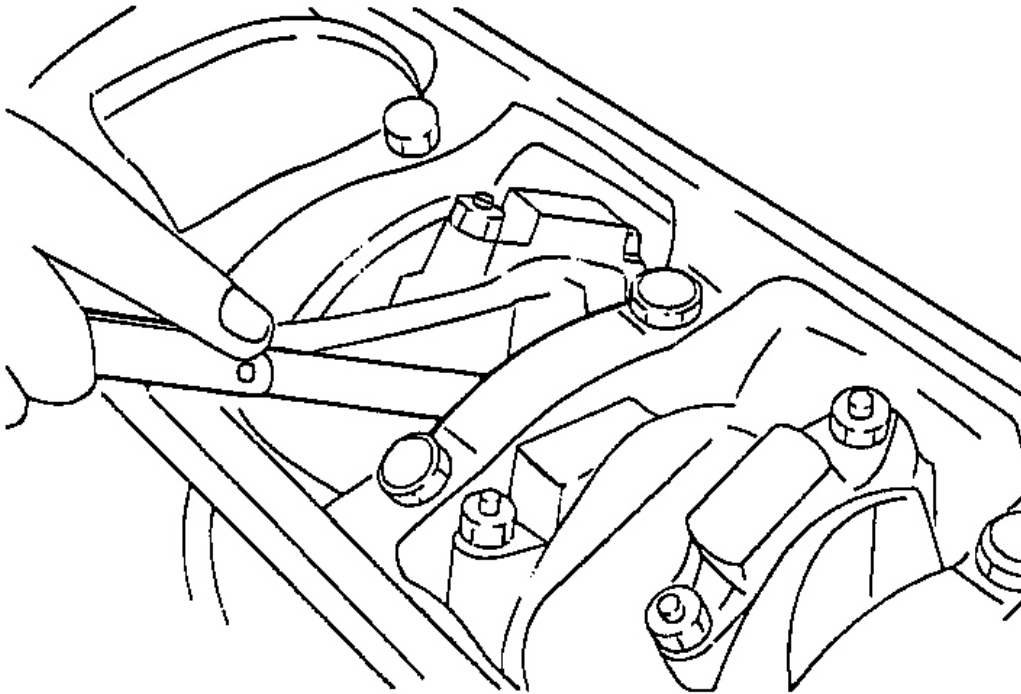
M8:14-18 Nm (140-180 kg.cm, 10-13 lb.ft) + (90°~94°) M10: 27-33 Nm (270-330 kg.cm, 19.5-23.9 lb.ft) + (90°~94°)

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

Crankshaft end play

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

Limit : 0.35 mm (0.014 in.)



G00328002

Fig. 101: Checking Crankshaft End Play
Courtesy of KIA MOTORS AMERICA, INC.

8. Using the special tool (09231-33000), install the rear oil seal in the oil seal case.

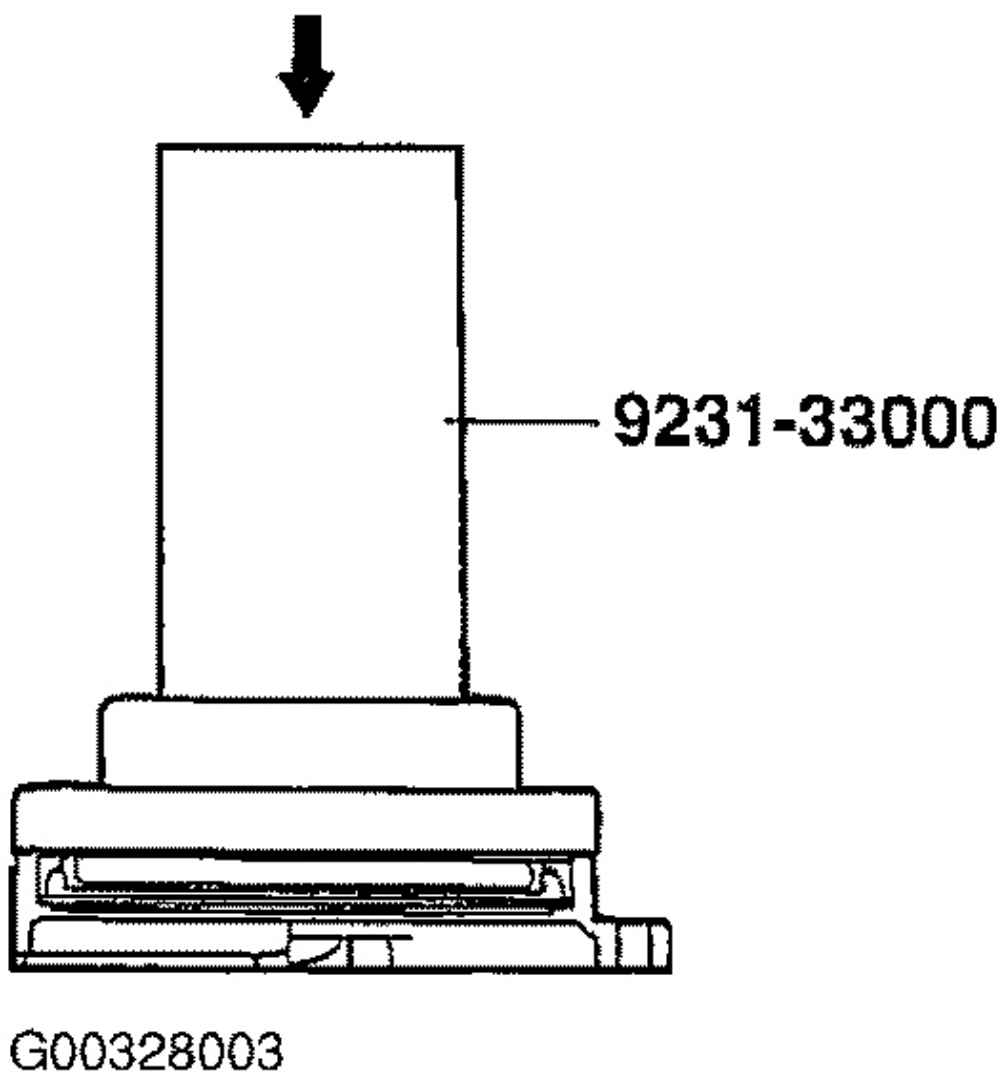


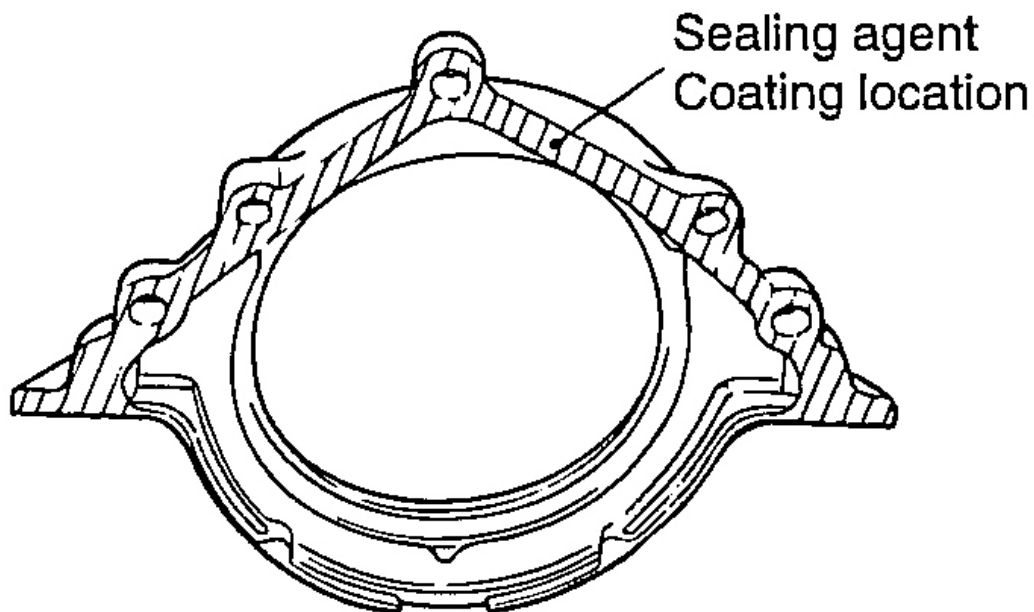
Fig. 102: Identifying Crankshaft Rear Oil Seal Installer (09231-33000)
Courtesy of KIA MOTORS AMERICA, INC.

9. Apply sealant to the area shown in the illustration. Install the oil seal case on the cylinder block.

Tightening torque

Oil seal case bolt :

10-12 Nm (100-120 kg.cm, 7.3-8.6 lb.ft)



G00328004

Fig. 103: Installing Oil Seal Case
Courtesy of KIA MOTORS AMERICA, INC.

10. Tighten the transaxle mounting plate to the specified torque.

Tightening torque

Transaxle mounting plate bolt:

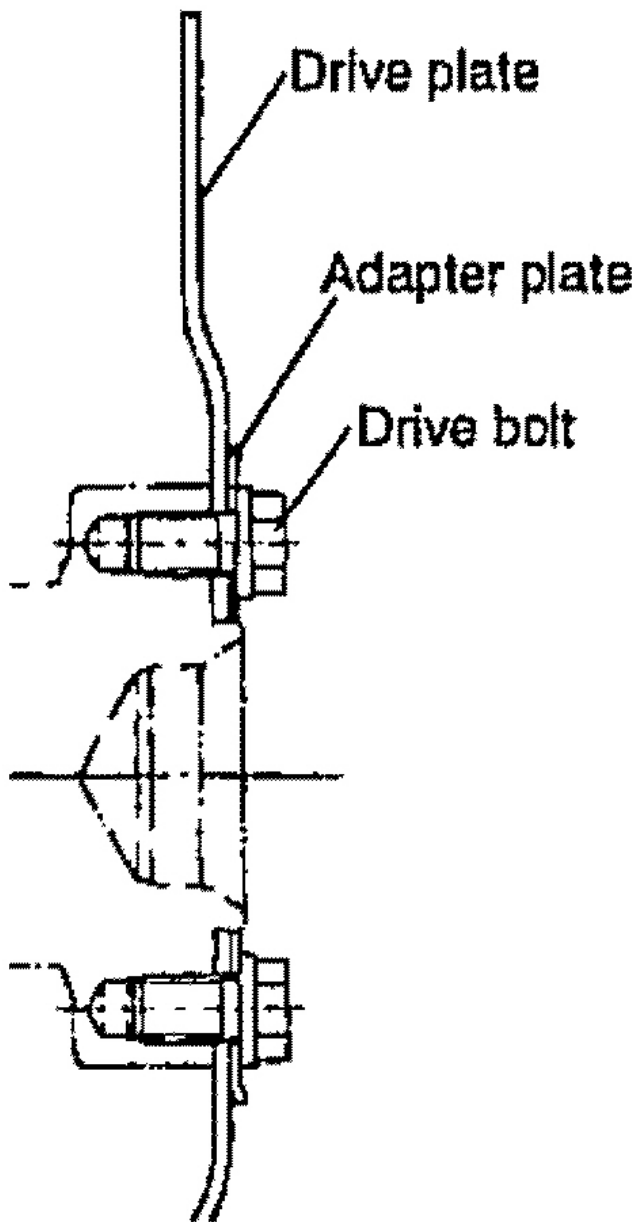
10-12 Nm (100-120 kg.cm, 7.3-8.6 lb.ft)

11. Tighten the drive plate and the adapter plate.

Tightening torque

Drive plate and adaptor plate bolt :

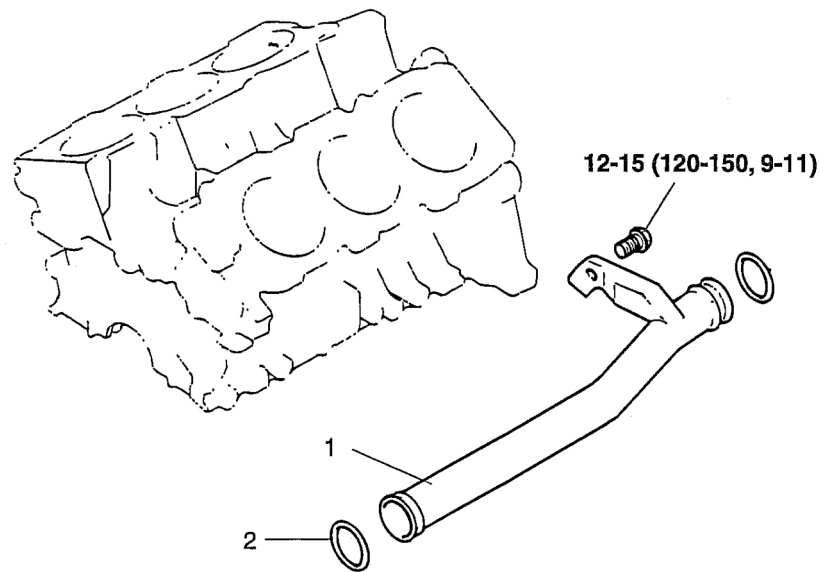
73-77 Nm (730-770 kg.cm, 53-55 lb.ft)



G00328005

Fig. 104: Installing Drive Plate & Adapter Plate
Courtesy of KIA MOTORS AMERICA, INC.

COOLING SYSTEM

ENGINE COOLANT HOSE/PIPES**COMPONENTS****[V-6 ENGINE]****TORQUE : Nm (kg·cm, lb·ft)**

1. Inlet engine coolant hose pipe
2. O-ring

G00328010

Fig. 105: Installing Engine Coolant Hose/Pipes
Courtesy of KIA MOTORS AMERICA, INC.

INSPECTION

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

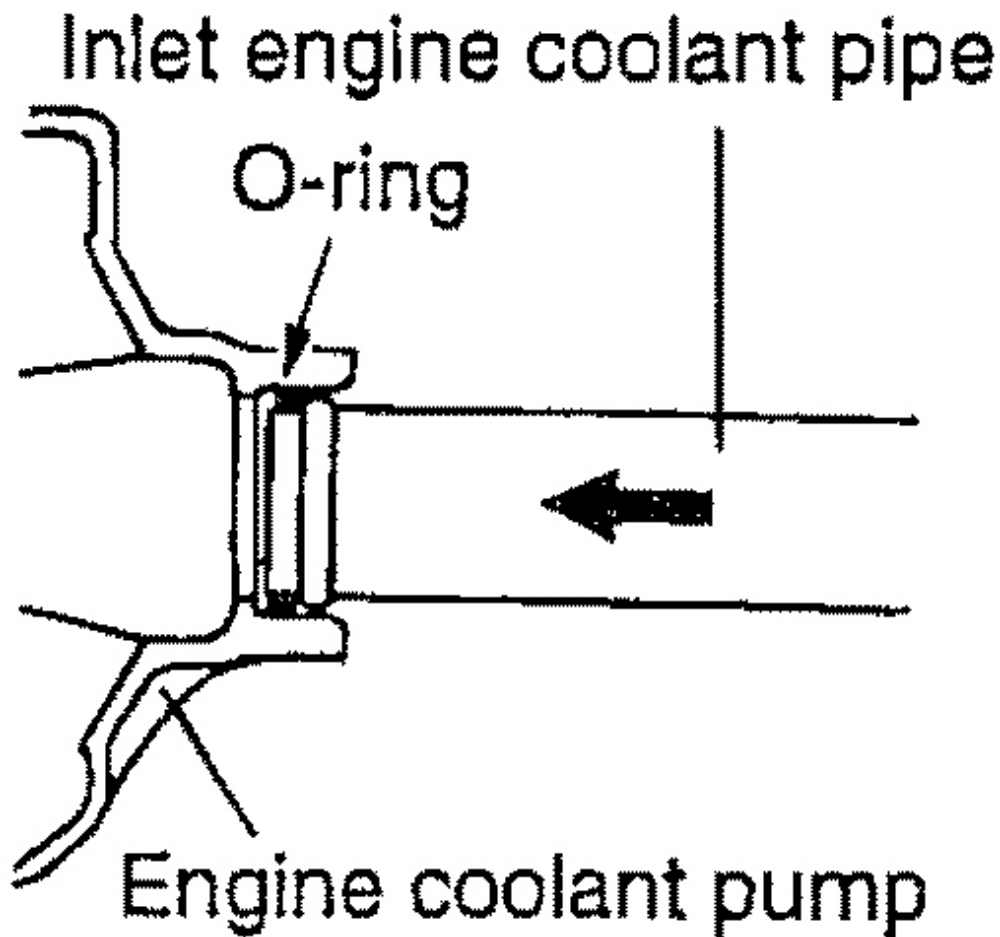
INSTALLATION

Fit O-ring in the groove provided at engine coolant inlet pipe end, wet the periphery of O-ring and insert engine coolant inlet pipe.

NOTE:

1. Do not apply oils or greases to Engine coolant pipe O-ring.
2. Keep the Engine coolant pipe connections free of sand, dust, etc.
3. Insert Engine coolant pipe to its end bottoms.
4. While installing the engine coolant inlet pipe, always replace the O-ring

with a new one.

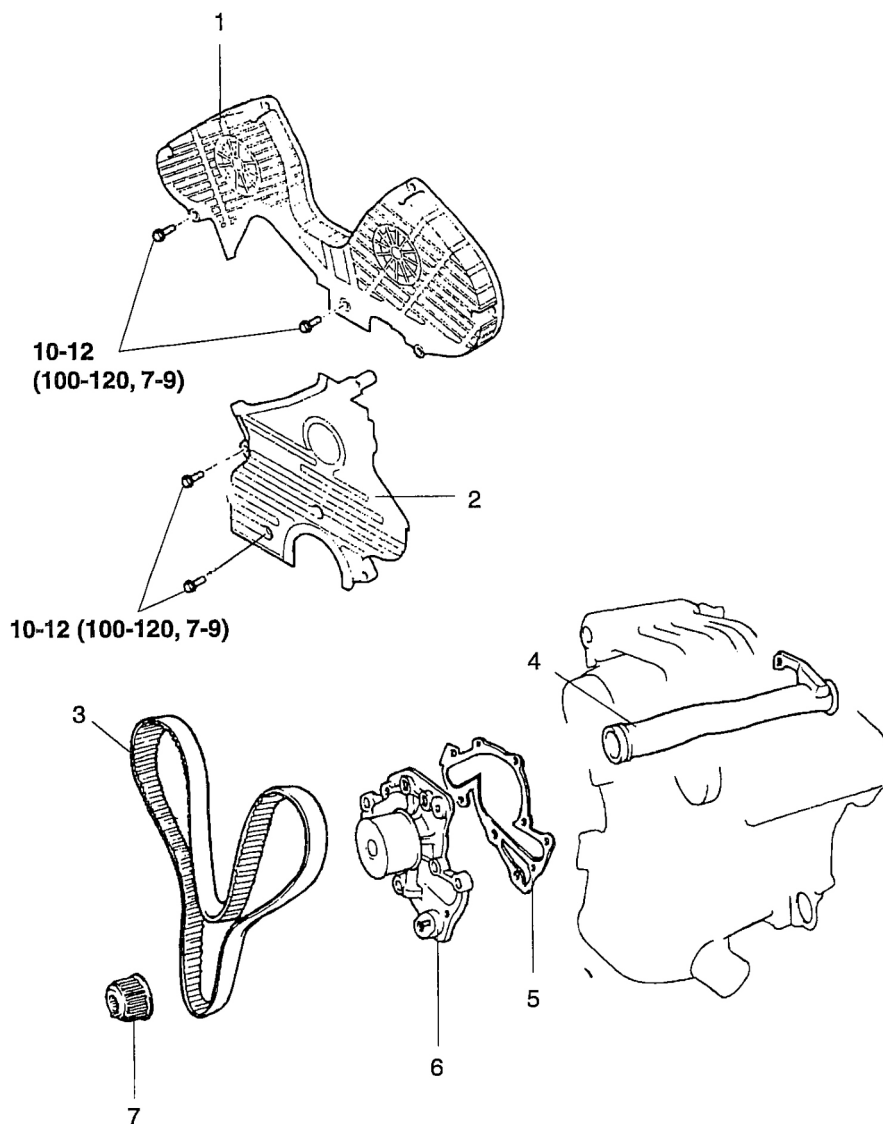


G00328011

Fig. 106: Installing Engine Coolant Inlet Pipe O-Ring
Courtesy of KIA MOTORS AMERICA, INC.

ENGINE COOLANT PUMP

COMPONENTS



TORQUE : Nm (kg-cm, lb-ft)

- 1. Timing belt upper cover outer
- 2. Timing belt lower cover
- 3. Timing belt
- 4. Inlet engine coolant pipe

- 5. Gasket
- 6. Engine coolant pump
- 7. Crank shaft sprocket

G00328012

Fig. 107: Removing Engine Coolant Pump
Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

1. Using the drain plug, drain the coolant.

2. Remove the drive belt and engine coolant pump pulley.
3. Remove the timing belt covers, the timing belt tensioner and idler.
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 engine coolant pump assembly if necessary.
2. Check the bearing for damage, abnormal noise and sluggish rotation, and replace the engine coolant pump assembly if necessary.
3. Check the seal unit for leaks, and replace the engine coolant pump assembly if necessary.
4. Check engine coolant leakage. If engine coolant leaks from hole "A" seal unit is defective. Replace the engine coolant pump assembly.

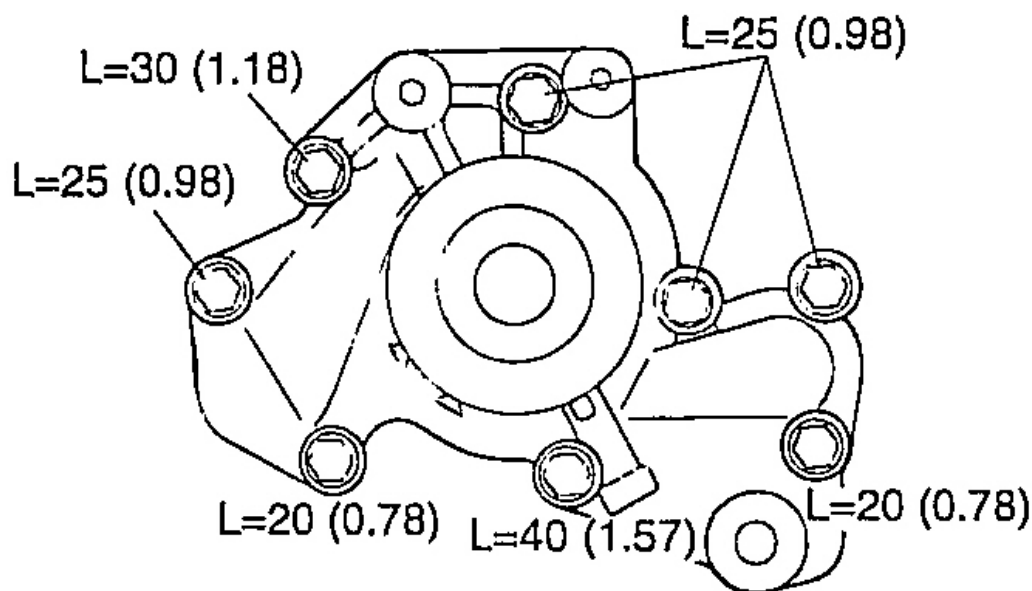
INSTALLATION

1. Clean the gasket surfaces of the engine coolant pump body and the cylinder block.
2. Install the new Engine coolant pump gasket and Engine coolant pump assembly. Tighten the bolts to specified torque.

Tightening torque

Engine coolant pump bolt :

15-22 Nm (150-220 kg.cm, 11-16 lb.ft)



L=Length of bolt mm (in.)

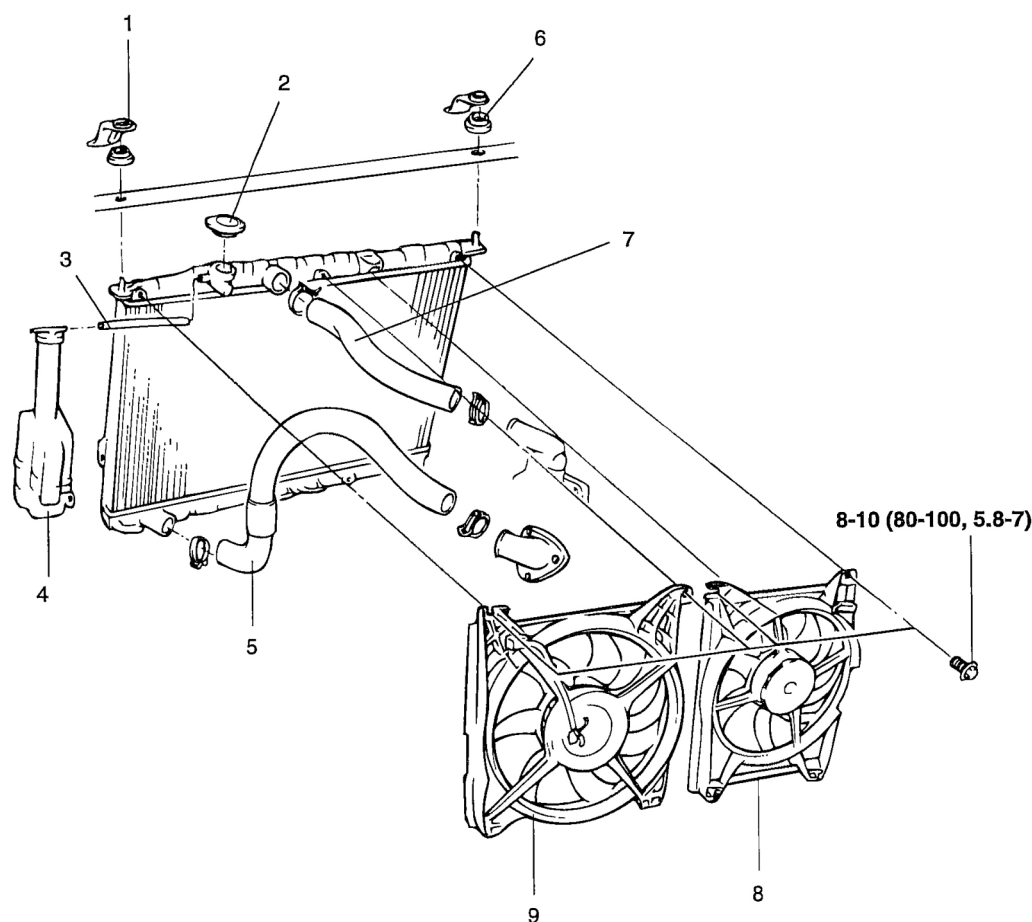
G00328014

Fig. 108: Installing Coolant Pump Assembly
Courtesy of KIA MOTORS AMERICA, INC.

3. Install the timing belt tensioner and timing belt. Adjust the timing belt tension, and then install the timing belt covers.
4. Install the drive belt, and then adjust the auto tension.
5. Refill the coolant.
6. Run the engine and check for leak.

RADIATOR

COMPONENTS



TORQUE : Nm (kg·cm, lb·ft)

1. Upper insulator
2. Radiator cap
3. Overflow tube
4. Reservoir tank
5. Radiator lower hose

6. Upper insulator
7. Radiator upper hose
8. Condenser fan motor assembly
9. Radiator fan motor assembly

G00328015

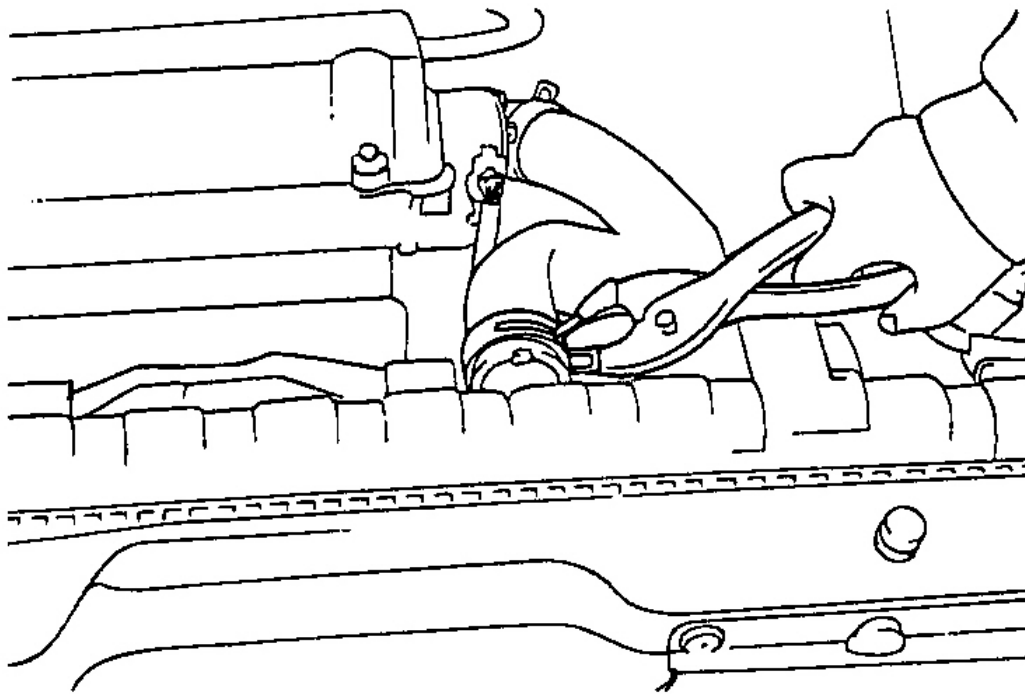
Fig. 109: Removing & Installing Radiator
Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

WARNING: Never open or disassemble any portion of the cooling system until the engine temperature has dropped to ambient air temperature. Engine coolant escaping under heat and resulting pressure can cause severe burns and blindness.

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

3. Loosen the radiator drain plug to drain the coolant.
4. Disconnect the upper and lower hoses and overflow tube after making marks on the radiator hose and the hose clamp.



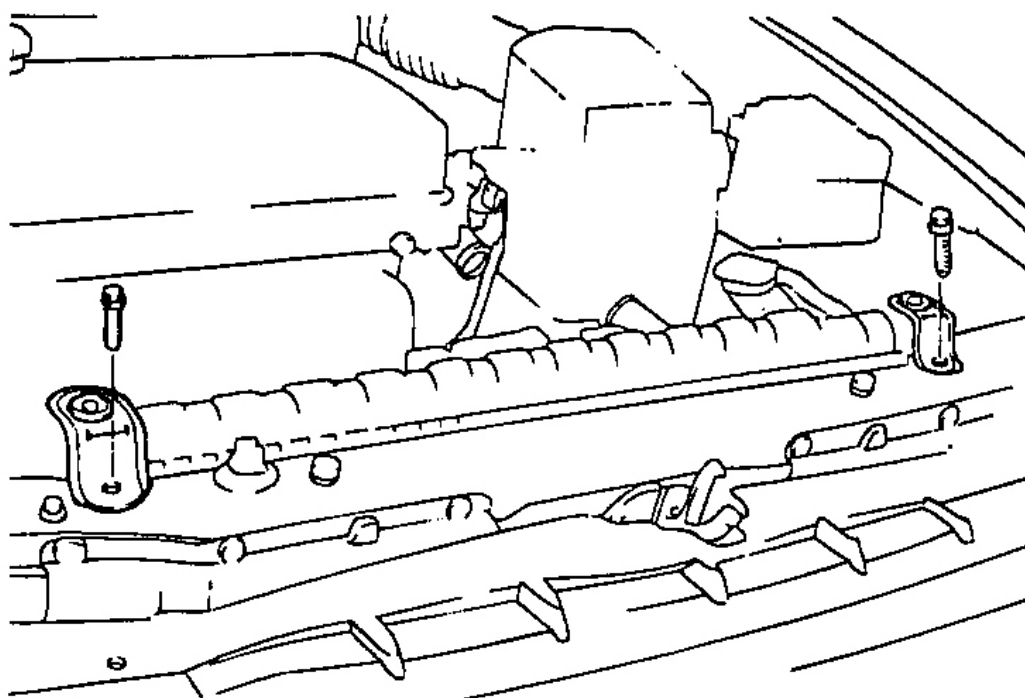
G00328016

Fig. 110: Removing Upper & Lower Radiator Hoses
Courtesy of KIA MOTORS AMERICA, INC.

5. For vehicles with automatic transaxle, disconnect the oil cooler hoses from the automatic transaxle.

CAUTION: Cover or plug the hose and nipple part of the radiator so that dust, foreign material etc. do not enter after the hose is disconnected from the radiator.

6. Remove the radiator mounting bolt.



G00328017

Fig. 111: Removing Radiator Mounting Bolts
Courtesy of KIA MOTORS AMERICA, INC.

7. Remove the radiator together with the fan motor.
8. Remove the radiator fan motor and condenser fan motor from the radiator.

INSPECTION

1. Check for foreign material between 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 reserve tank for damage.
6. Check the automatic transaxle oil cooler hoses for cracking, damage or deterioration.

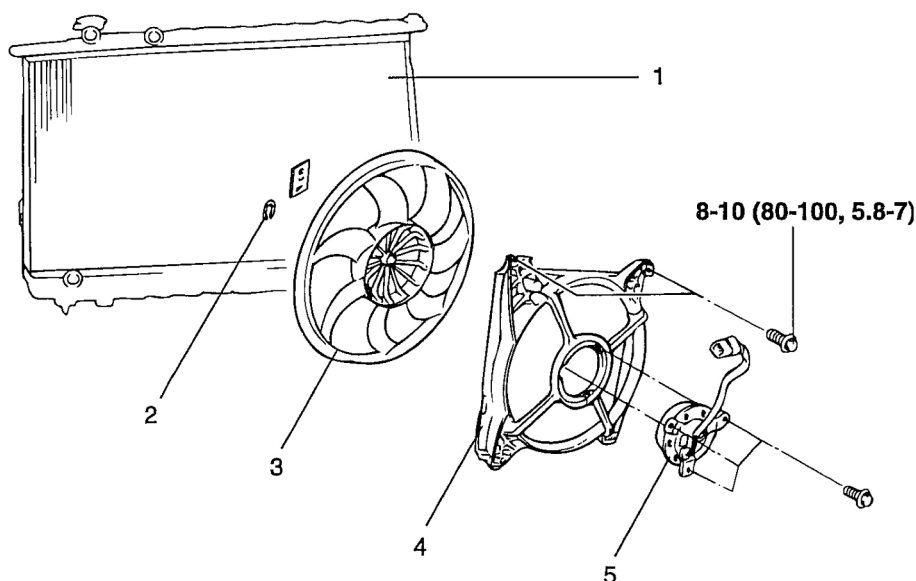
INSTALLATION

1. To install, reverse removal procedures.
2. Fill the radiator and reservoir tank with clean coolant mixture.

3. Run the engine until the coolant warms up enough so that the thermostat valve opens, and then stop the engine.
4. Remove the radiator cap and pour the coolant up to the filler neck of the radiator. Fill the reservoir tank to the upper level.
5. Check that there is no leakage from the radiator, hoses or connections.

RADIATOR FAN MOTOR

COMPONENTS



TORQUE : Nm (kg-cm, lb·ft)

- 1. Radiator
- 2. Fan mounting clip
- 3. Fan

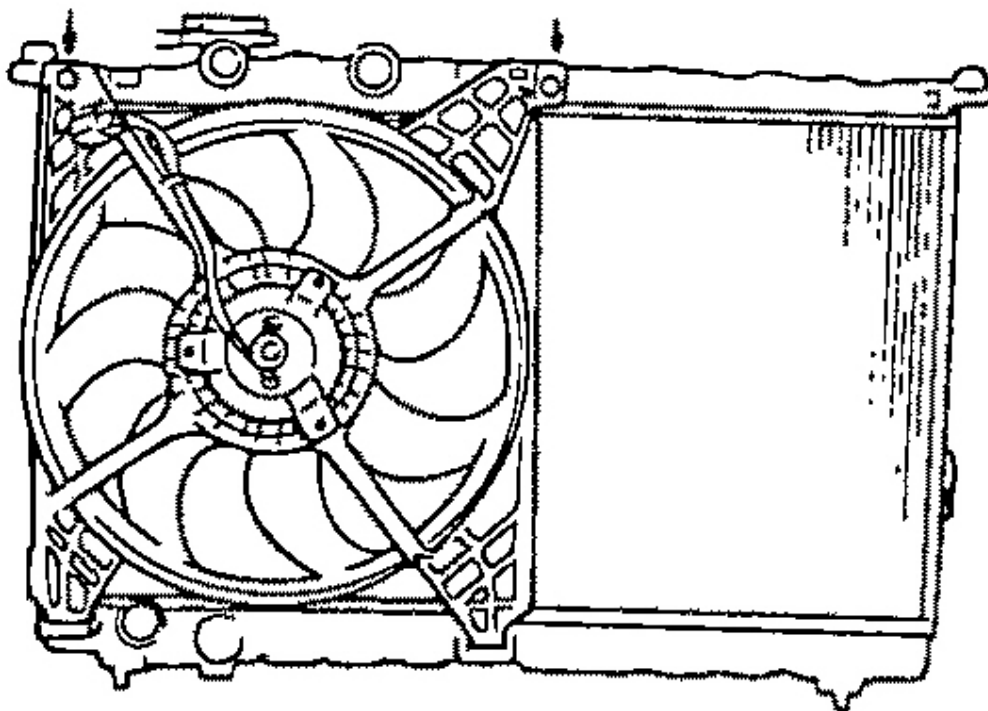
- 4. Shroud
- 5. Radiator fan motor

G00328018

Fig. 112: Removing & Installing Radiator Fan Motor
Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

1. Disconnect the ground cable from battery cable.
2. Disconnect the connectors from the fan motor and the harness from shroud.
3. For vehicles with automatic transaxle, remove the oil cooler hose from the shroud.
4. Remove the four shroud mounting bolts.



G00328019

Fig. 113: Removing Radiator Fan Shroud Mounting Bolts
Courtesy of KIA MOTORS AMERICA, INC.

5. Remove the shroud with the fan motor.
6. Remove the fan mounting clip and detach the fan from fan motor.
7. Remove the three screws and detach the fan motor.

INSTALLATION

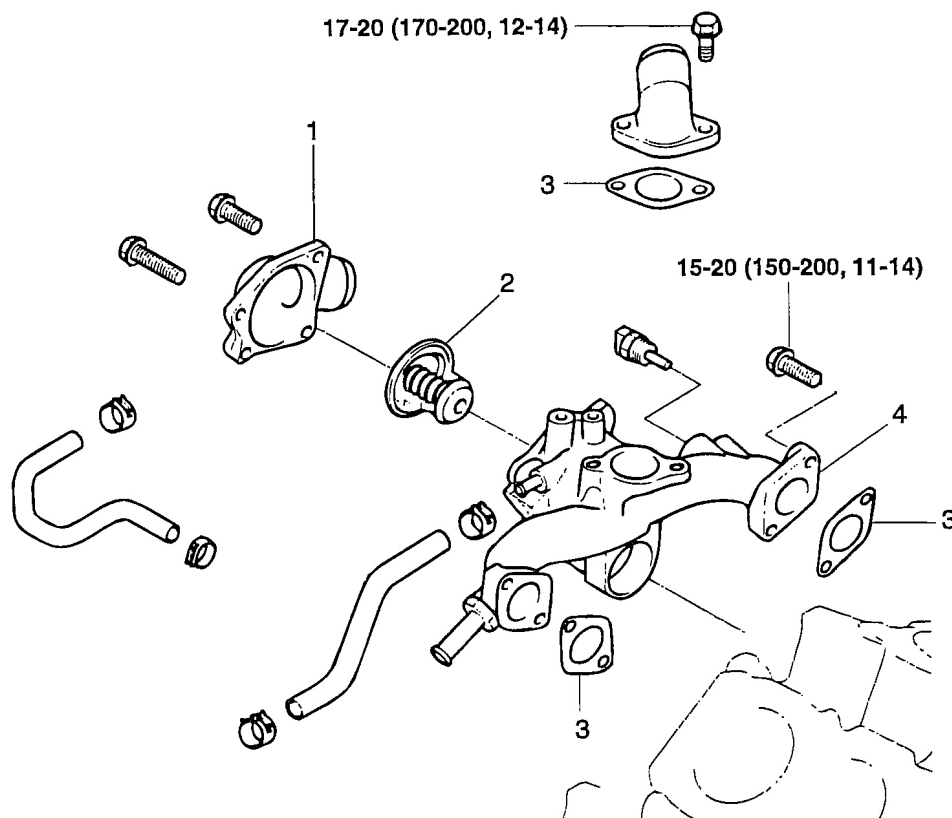
Installation is in the reverse order of removal procedures.

- CAUTION:**
1. Make sure the cooling fan does not come into contact with the shroud when installed.
 2. After installation, make sure there is no unusual noise or vibration when fan is rotated.

THERMOSTAT

COMPONENTS

[V-6 ENGINE]



TORQUE : Nm (kg-cm, lb-ft)

- 1. Coolant outlet fitting
- 2. Thermostat

- 3. Gasket
- 4. Engine coolant outlet fitting

G00328021

Fig. 114: Removing & Installing Thermostat
Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

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

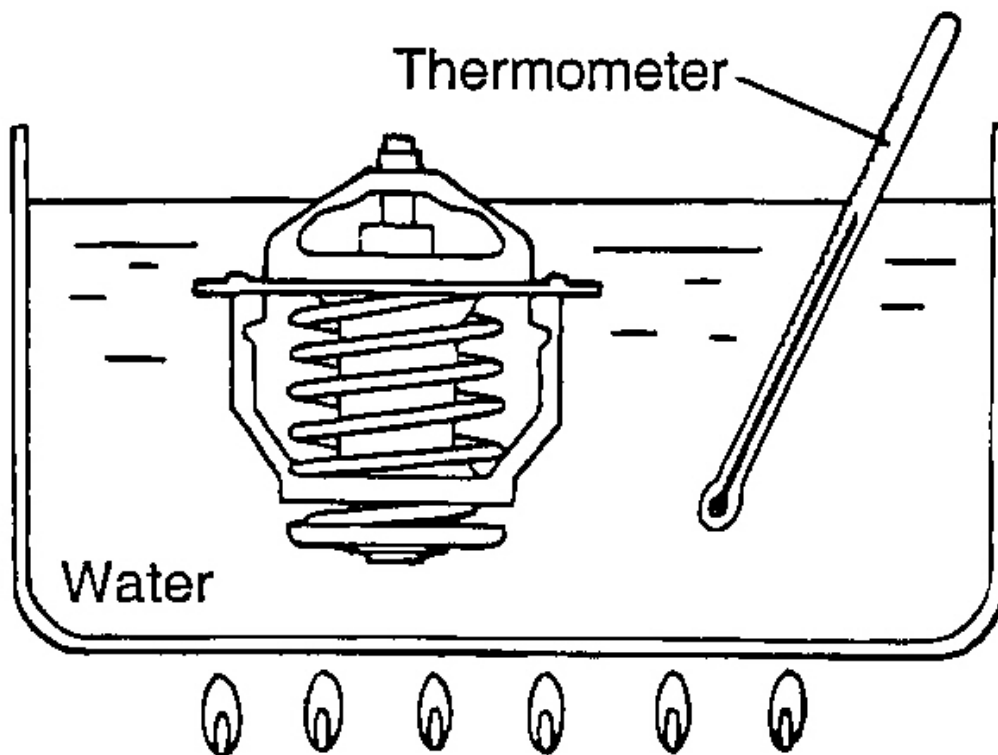
3. Remove the thermostat.

INSPECTION

1. Heat the thermostat as shown in the illustration.
2. Check that the valve operates properly.
3. Check to determine 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)



G00328022

Fig. 115: Checking Thermostat
Courtesy of KIA MOTORS AMERICA, INC.

INSTALLATION

1. Check that the flange of the thermostat is correctly seated in the socket of the thermostat housing.
2. Install the engine coolant inlet fitting.

Tightening torque

Engine coolant inlet fitting bolt :

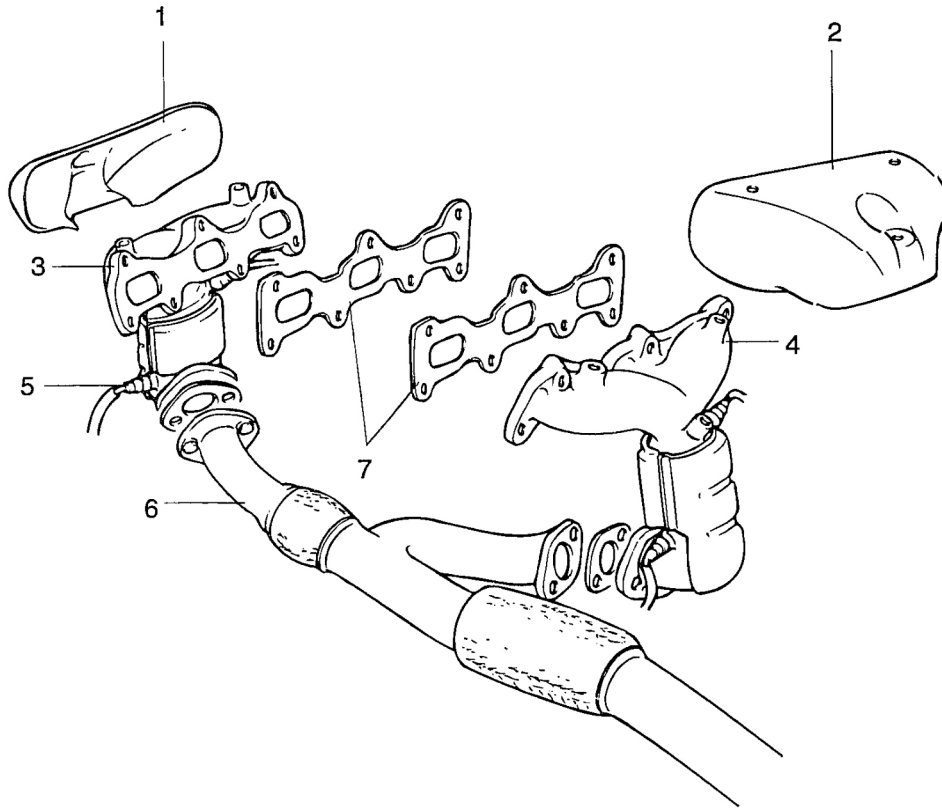
17-20 Nm (170-200 kg.cm, 12-14 lb.ft)

3. Refill the coolant.

INTAKE AND EXHAUST SYSTEM

EXHAUST MANIFOLD

COMPONENTS

**TORQUE : Nm (kg.cm, lb.ft)**

- | | |
|--|-----------------------|
| 1. Exhaust manifold heat protector (Front) | 5. Oxygen sensor |
| 2. Exhaust manifold heat protector (Rear) | 6. Front exhaust pipe |
| 3. Exhaust manifold (Front) | 7. Gasket |
| 4. Exhaust manifold (Rear) | |

G00328023

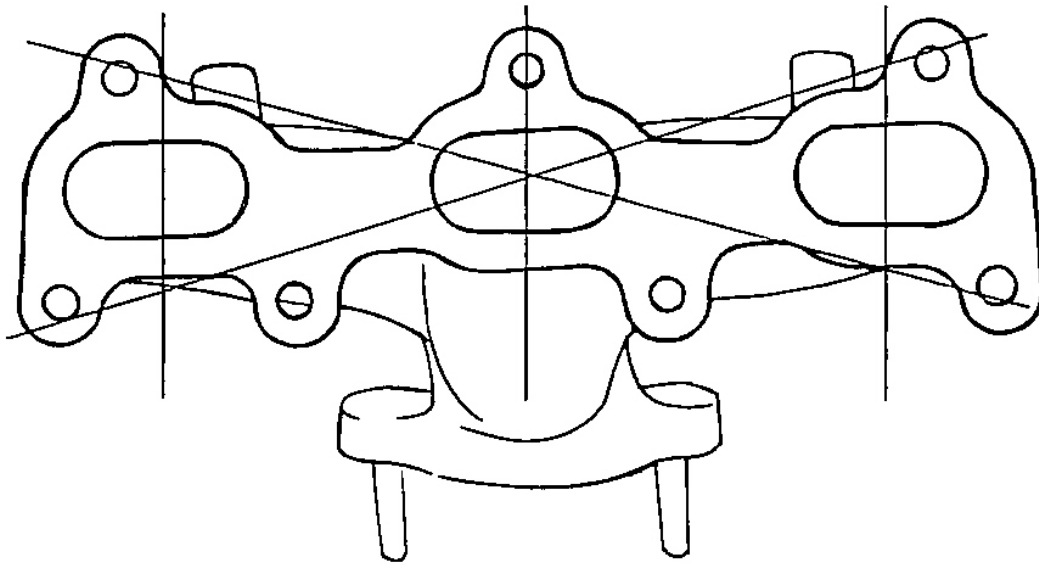
Fig. 116: Removing & Installing Exhaust Manifold
Courtesy of KIA MOTORS AMERICA, INC.

INSPECTION

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

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

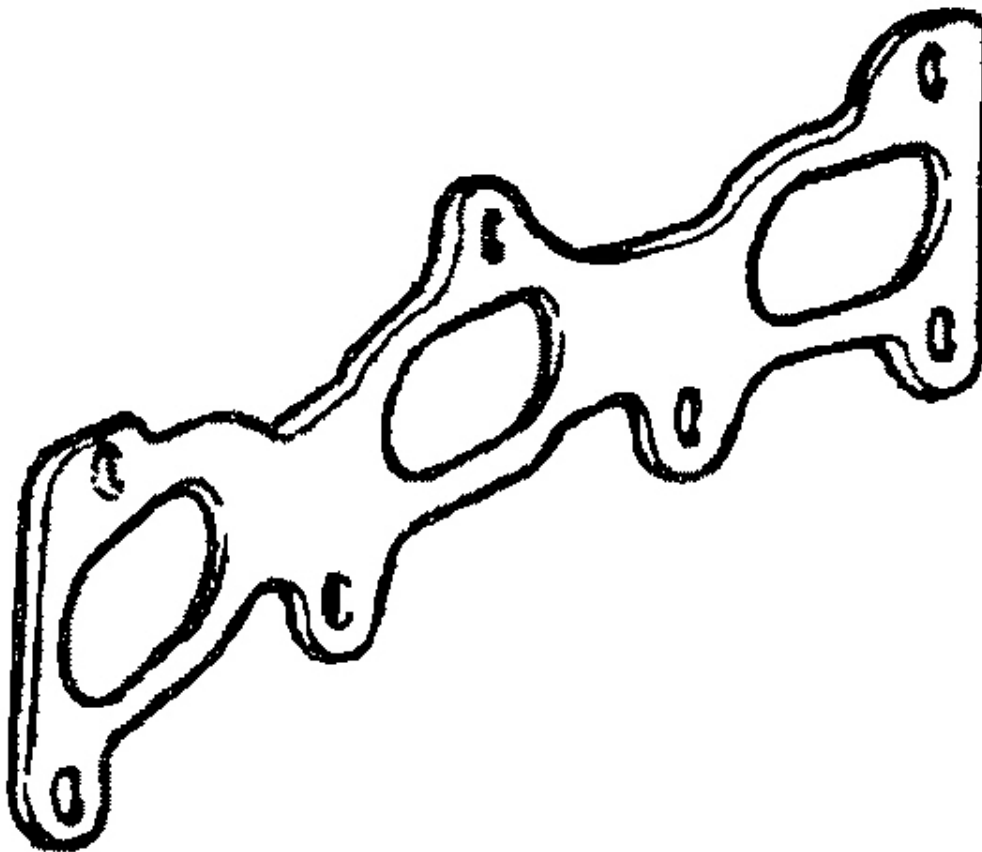
Service limit: 0.3 mm (0.012 in.) or less



G00328024

Fig. 117: Checking Exhaust Manifold Mating Surface
Courtesy of KIA MOTORS AMERICA, INC.

CAUTION: Do not use the used exhaust manifold gasket.

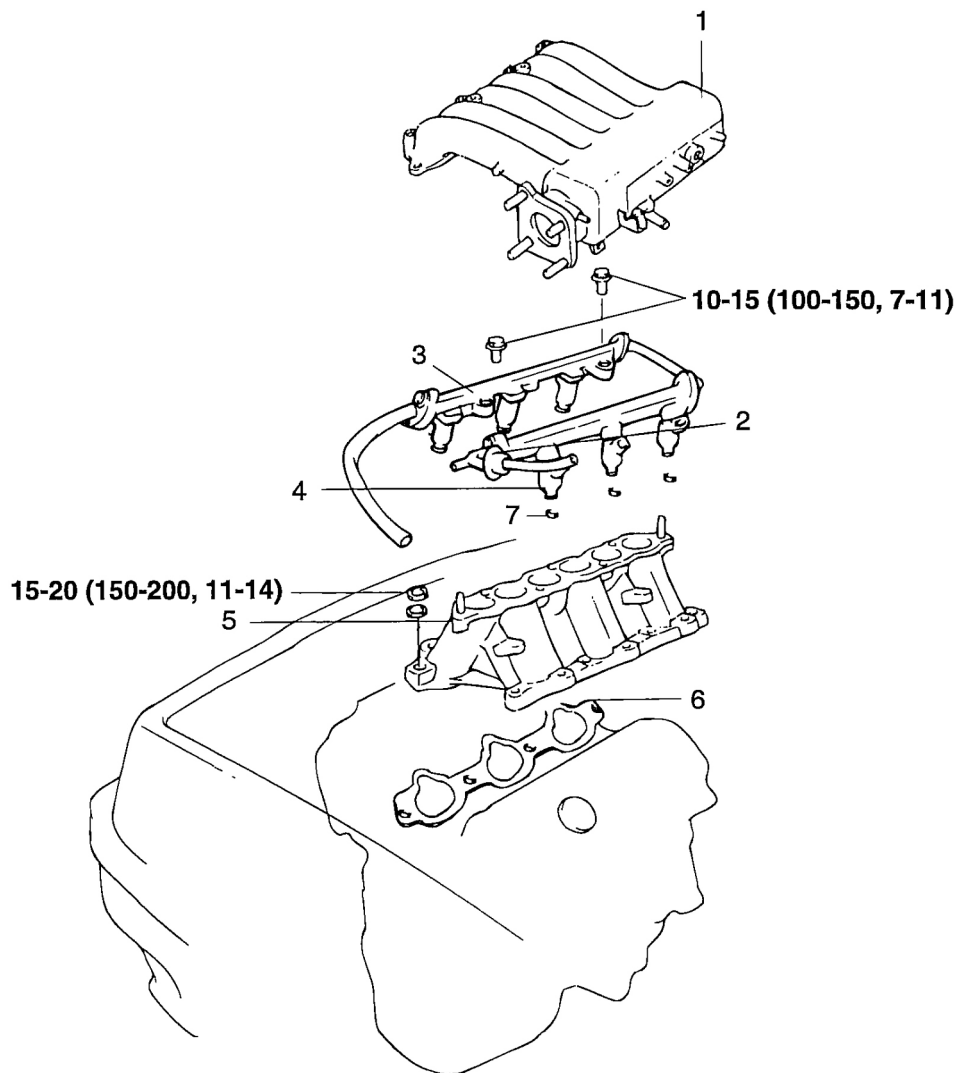


G00328025

Fig. 118: Identifying Exhaust Manifold Gasket
Courtesy of KIA MOTORS AMERICA, INC.

INTAKE MANIFOLD

COMPONENTS



TORQUE : Nm (kg-cm, lb-ft)

- 1. Air intake surge tank
- 2. Pressure regulator
- 3. Delivery pipe
- 4. Fuel injector

- 5. Intake manifold
- 6. Gasket
- 7. Insulator

G00328026

Fig. 119: Removing & Installing Intake Manifold
Courtesy of KIA MOTORS AMERICA, INC.

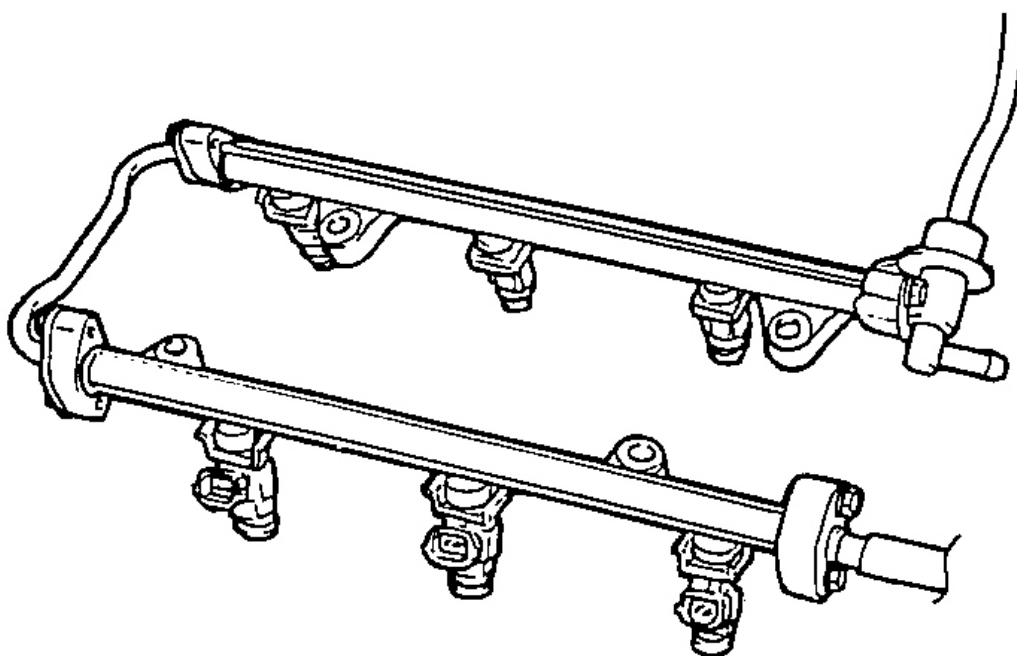
REMOVAL

CAUTION: Reduce the internal pressure of the high pressure fuel hose prior to disconnecting.

1. Remove the high pressure fuel hose as follows.
 - Disconnect the fuel pump harness connector after removing the rear seat cushion.
 - Start the engine and after it stalls, turn the ignition switch to the OFF position.
 - Disconnect the battery negative (-) terminal.
 - Connect the fuel pump harness connector.
2. Remove the air intake surge tank.
3. Disconnect the fuel return hose.
4. Remove the delivery pipe with the fuel injector.

NOTE: Be careful not to drop the injector when removing the delivery pipe.

CAUTION: Be aware that fuel may flow out when removing the injector.



G00328027

Fig. 120: Removing Delivery Pipe & Injectors
Courtesy of KIA MOTORS AMERICA, INC.

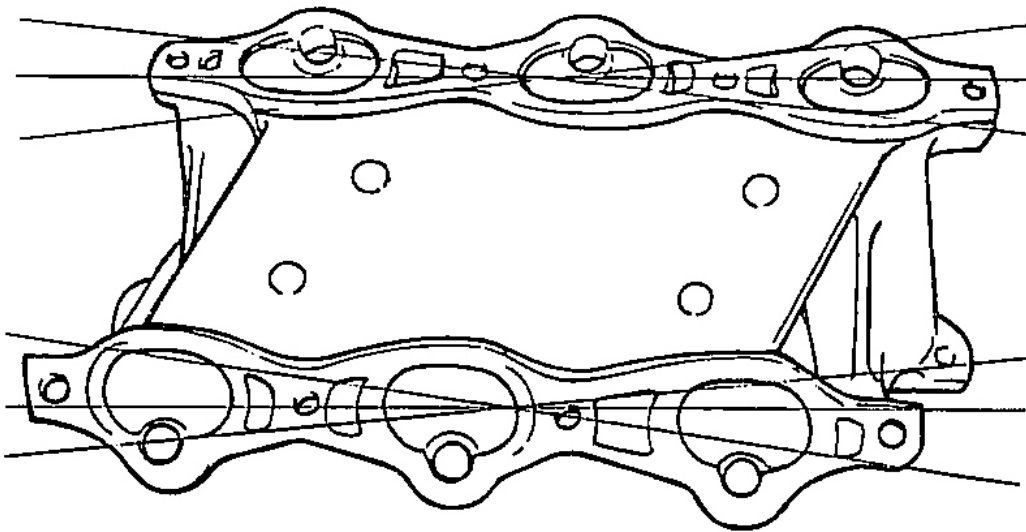
5. Remove the intake manifold and gasket.

INSPECTION

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

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

Service limit value : 0.2 mm (0.0078 in.)



G00328028

Fig. 121: Checking Intake Manifold Mating Surface

Courtesy of KIA MOTORS AMERICA, INC.

INSTALLATION

1. Install the intake manifold and delivery pipe according to the reverse order of removal.

CAUTION: Do not use the used intake manifold gasket.

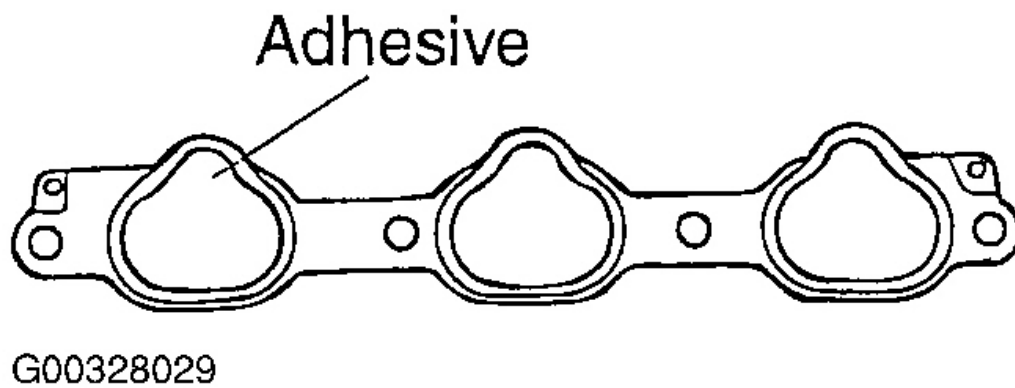
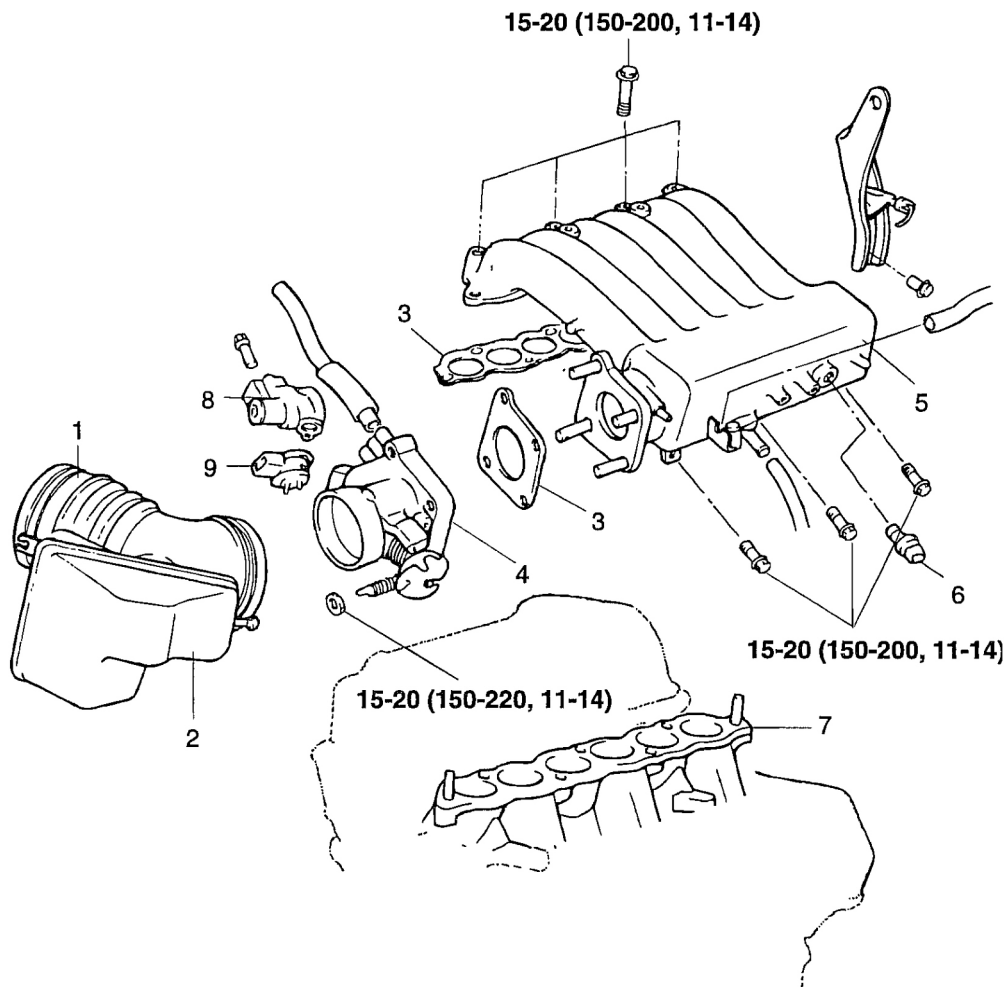


Fig. 122: Identifying Intake Manifold Gasket
Courtesy of KIA MOTORS AMERICA, INC.

SURGE TANK

COMPONENTS



TORQUE : N·m (kg·cm, lb·ft)

- 1. Air intake hose
- 2. Resonator
- 3. Gasket
- 4. Throttle body
- 5. Air intake surge tank

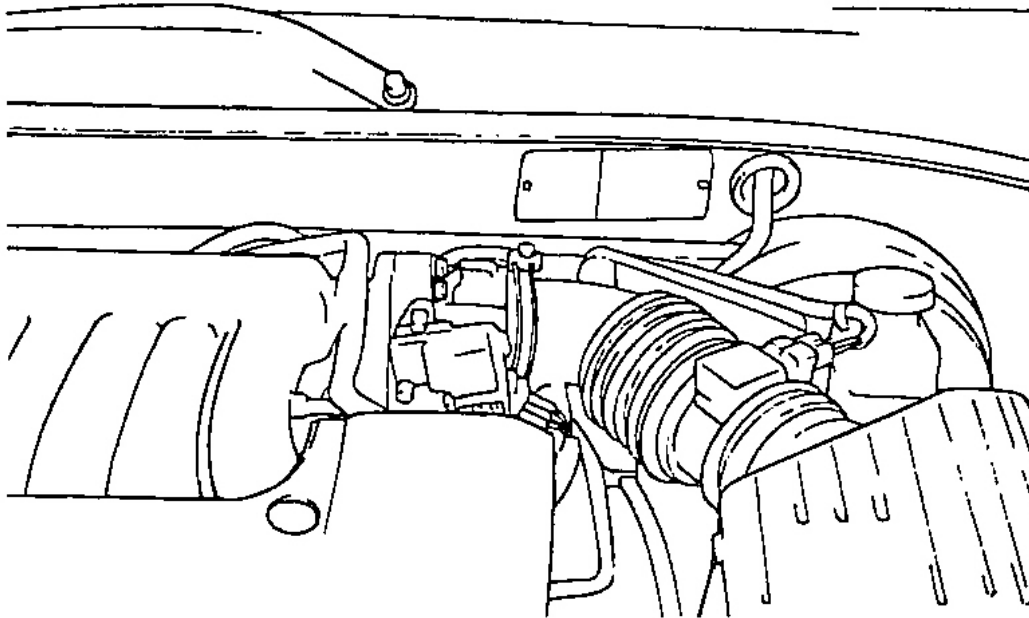
- 6. Air temperature sensor
- 7. Intake manifold
- 8. I.S.A
- 9. T.P.S

G00328030

Fig. 123: Removing & Installing Surge Tank
 Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

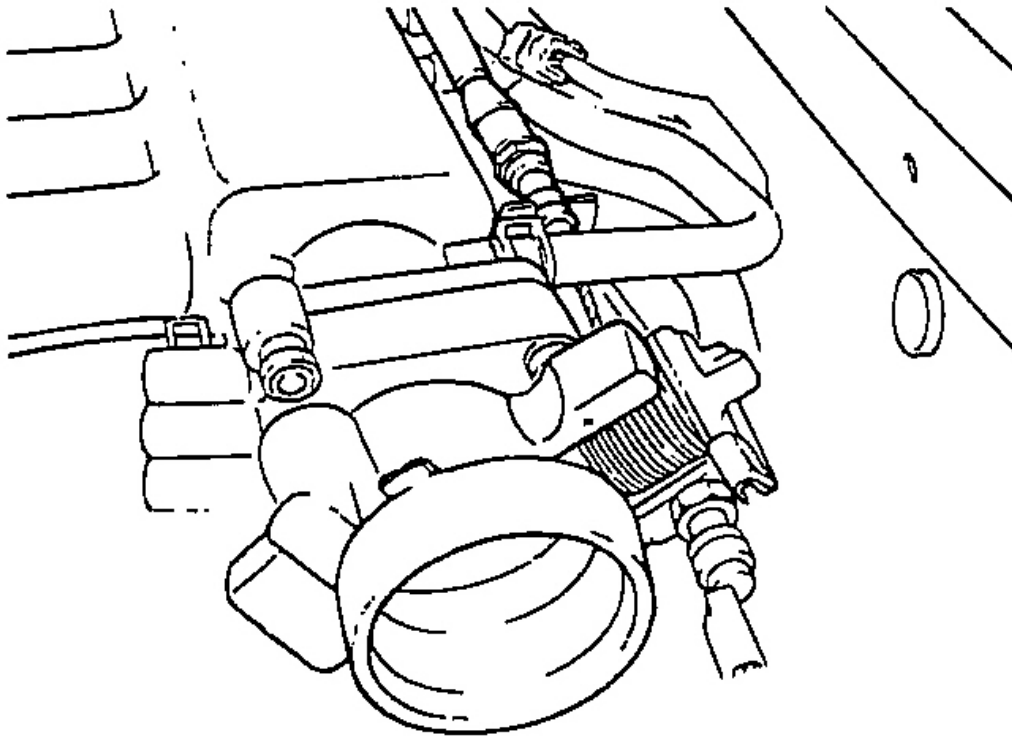
1. Remove the air intake hose connected to the throttle body.



G00328031

Fig. 124: Removing Air Intake Hose
Courtesy of KIA MOTORS AMERICA, INC.

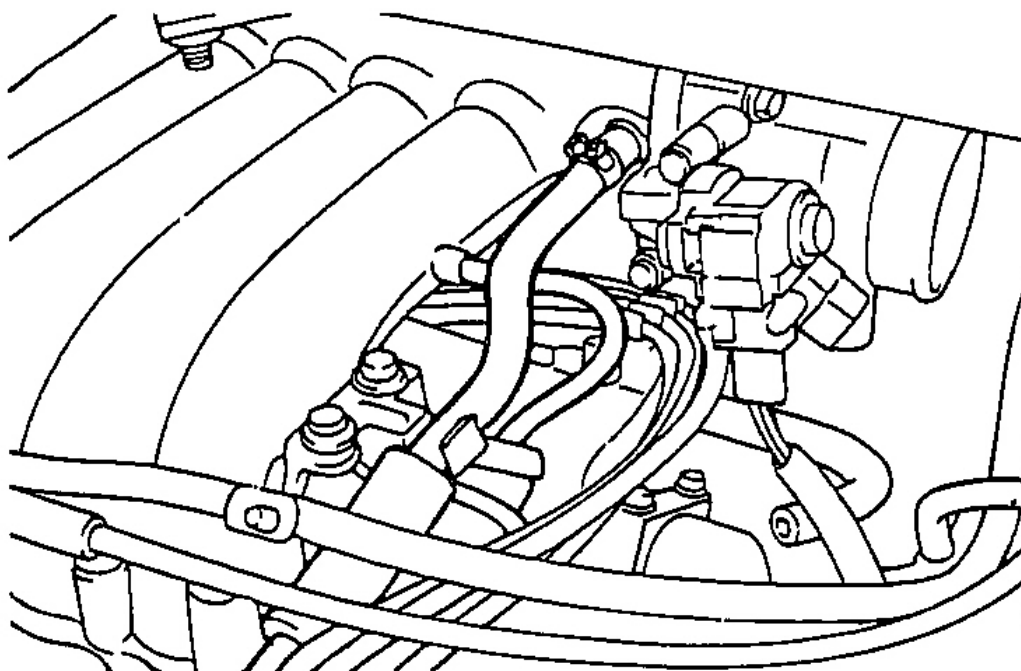
2. Remove the accelerator and cruise control cables.



G00328032

Fig. 125: Removing Accelerator & Cruise Control Cables
Courtesy of KIA MOTORS AMERICA, INC.

3. Remove the engine coolant hose.
4. Remove the PCV. hose and brake booster vacuum hoses.



G00328033

Fig. 126: Removing PCV Hose & Brake Booster Vacuum Hoses
Courtesy of KIA MOTORS AMERICA, INC.

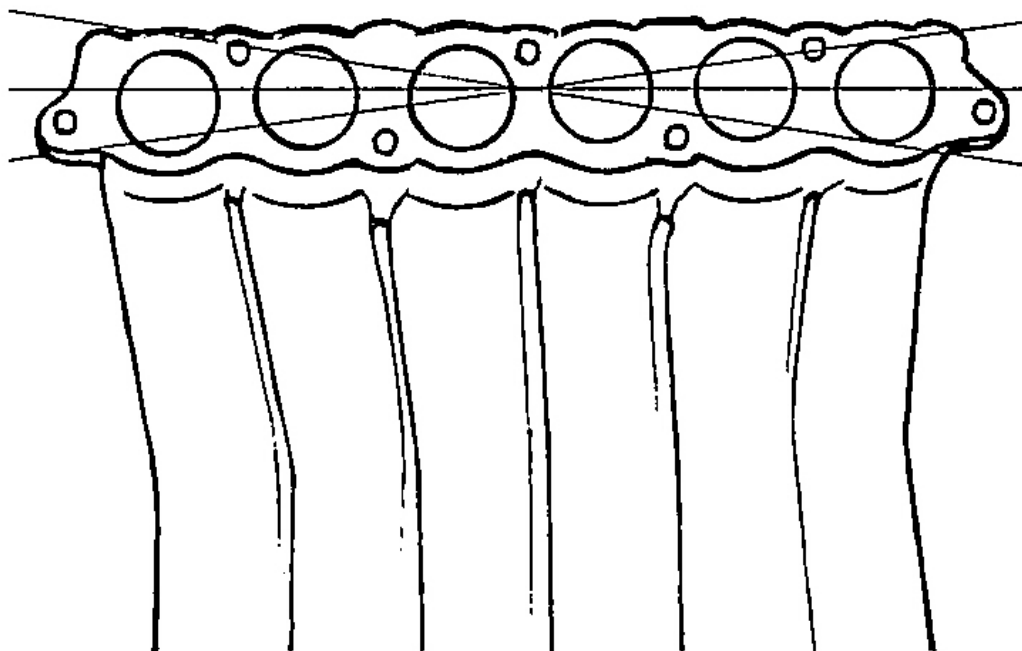
5. Disconnect the vacuum hose connections.
6. Remove the ISA, TPS and ATS connector.
7. Remove the surge tank stay.
8. Remove the air intake surge tank and surge tank gasket.

INSPECTION

1. Check the intake surge tank for defect or cracks. Replace if defective.
2. Check coolant passage ways for restrictions. Clean if necessary.
3. Check deflection of installation surface with straight edge and feeler gauge.

Standard value : Within 0.15 mm (0.006 in.)

Service limit: 0.2 mm (0.008 in.)

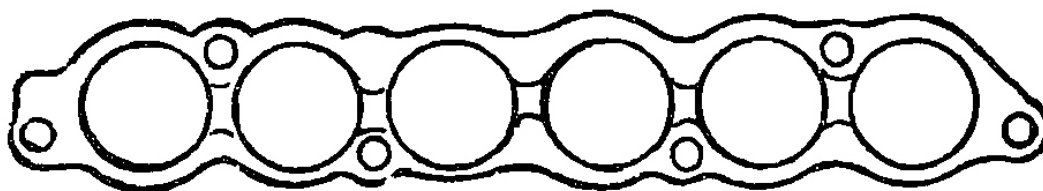


G00328034

Fig. 127: Checking Intake Surge Tank Surface
Courtesy of KIA MOTORS AMERICA, INC.

INSTALLATION

1. Install the surge tank and throttle body according to the reverse order of removal.



G00328035

Fig. 128: Identifying Intake Surge Tank Gasket
Courtesy of KIA MOTORS AMERICA, INC.

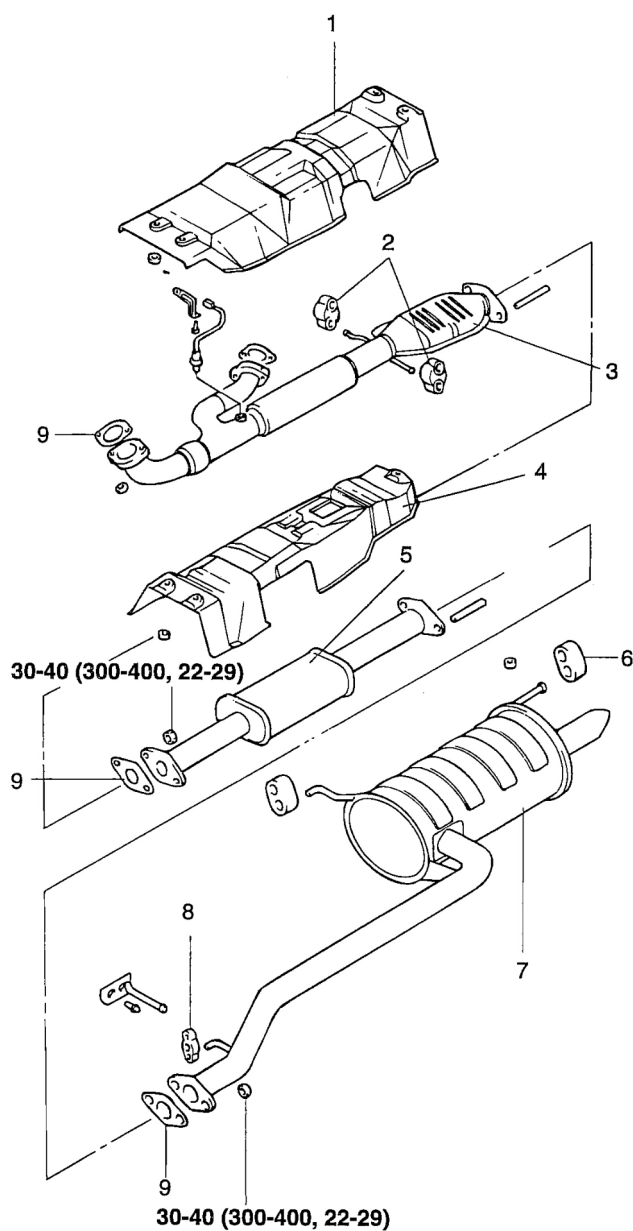
2004 Kia Optima EX

2004-05 ENGINES 2.7L V6 - Optima & Magentis (Canadian)

CAUTION: Do not use the used surge tank gasket.

MUFFLER

COMPONENTS



TORQUE : N·m (kg·cm, lb·ft)

- | | |
|-------------------------------|-------------------|
| 1. Front floor heat protector | 6. Rubber hangers |
| 2. Rubber hangers | 7. Main muffler |
| 3. Front exhaust pipe | 8. Rubber hangers |
| 4. Rear floor heat protector | 9. Gasket |
| 5. Center exhaust pipe | |

G00328037

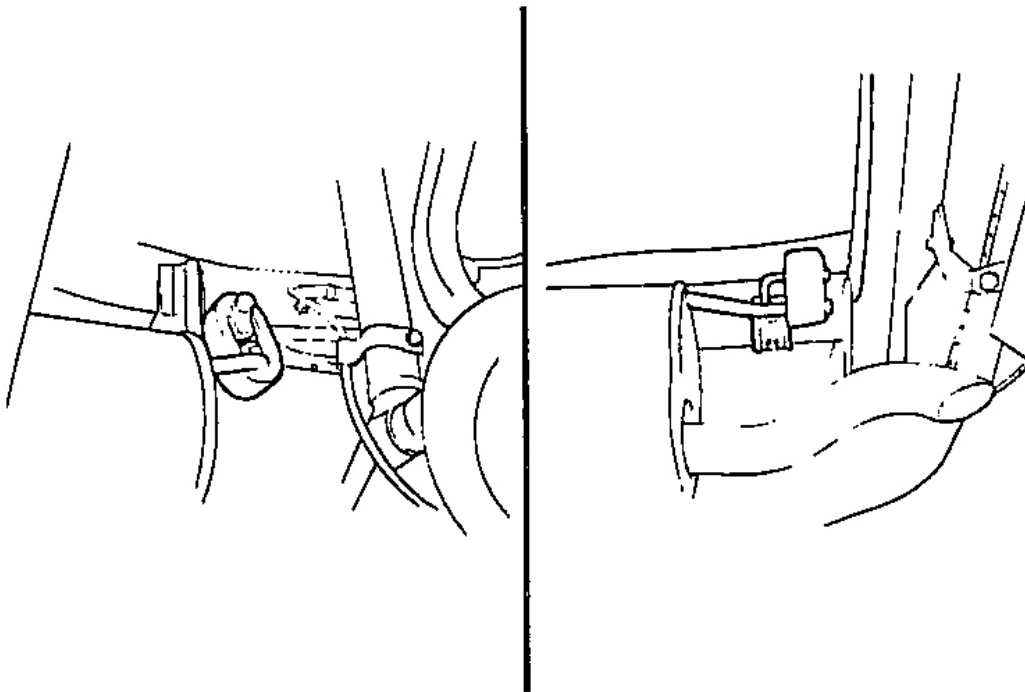
Fig. 129: Removing & Installing Muffler
 Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

Main Muffler

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

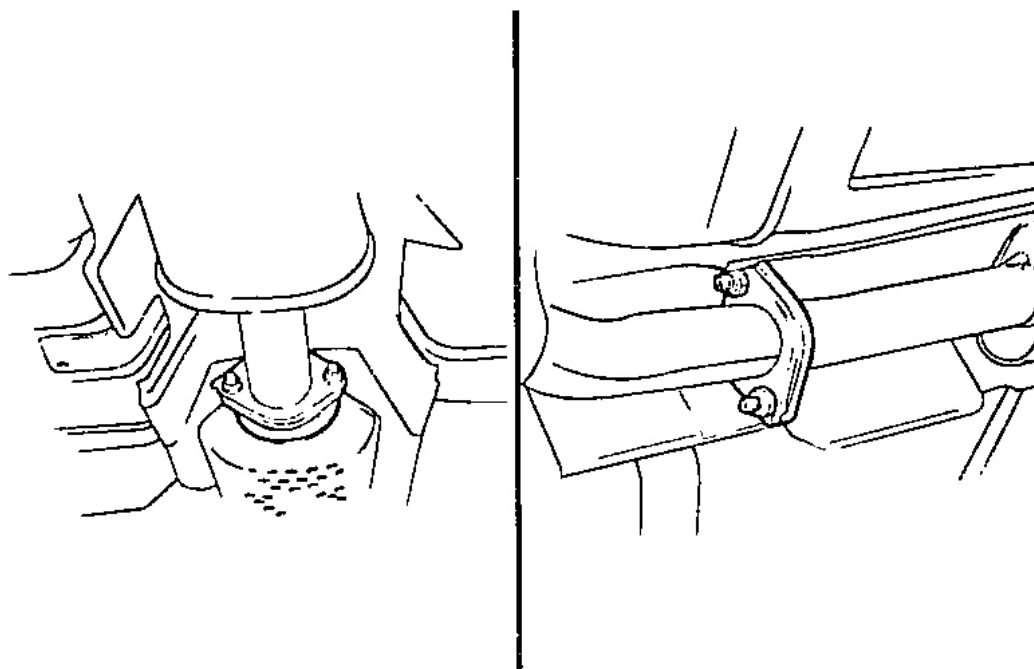
1. Disconnect the main muffler from the center exhaust pipe.
2. Remove the rubber hangers and take out the main muffler.



G00328038

Fig. 130: Removing Main Muffler**Courtesy of KIA MOTORS AMERICA, INC.****Center Exhaust Pipe**

1. Disconnect the center exhaust pipe from the main muffler.
2. After disconnecting from the front exhaust pipe, remove the center exhaust pipe.

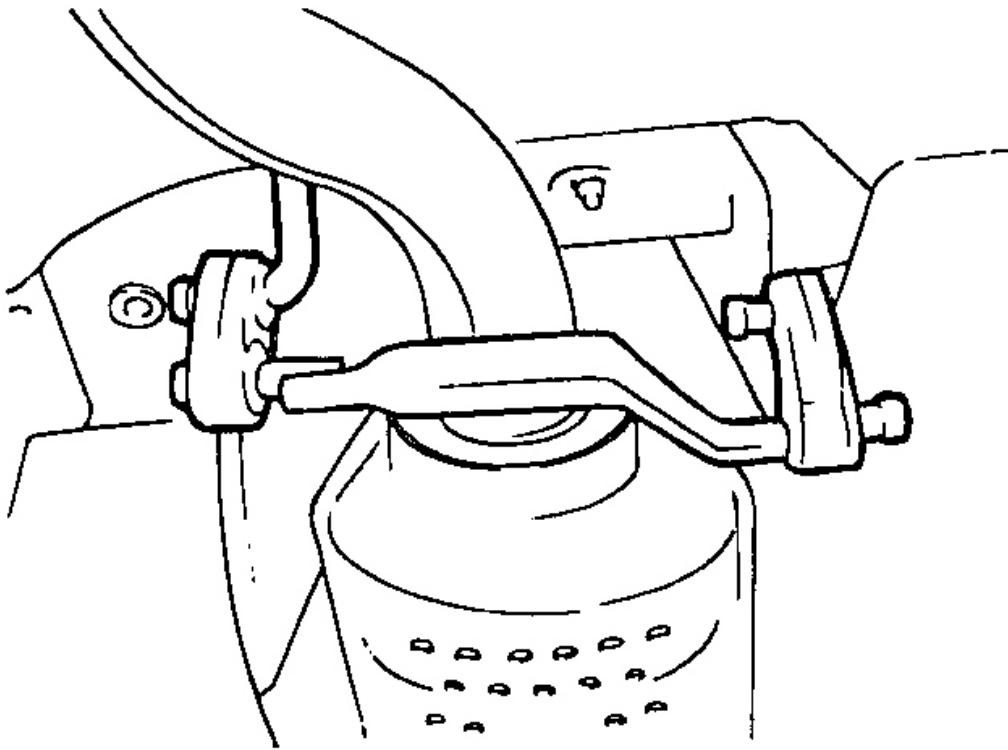


G00328039

Fig. 131: Removing Center Exhaust Pipe
Courtesy of KIA MOTORS AMERICA, INC.

Front Exhaust Pipe (Including Catalytic Converter)

1. Remove the front exhaust pipe from the center exhaust pipe.
2. Remove the front exhaust pipe from the exhaust manifold (Including catalytic converter)
3. Remove the front exhaust pipe from the rubber hanger.

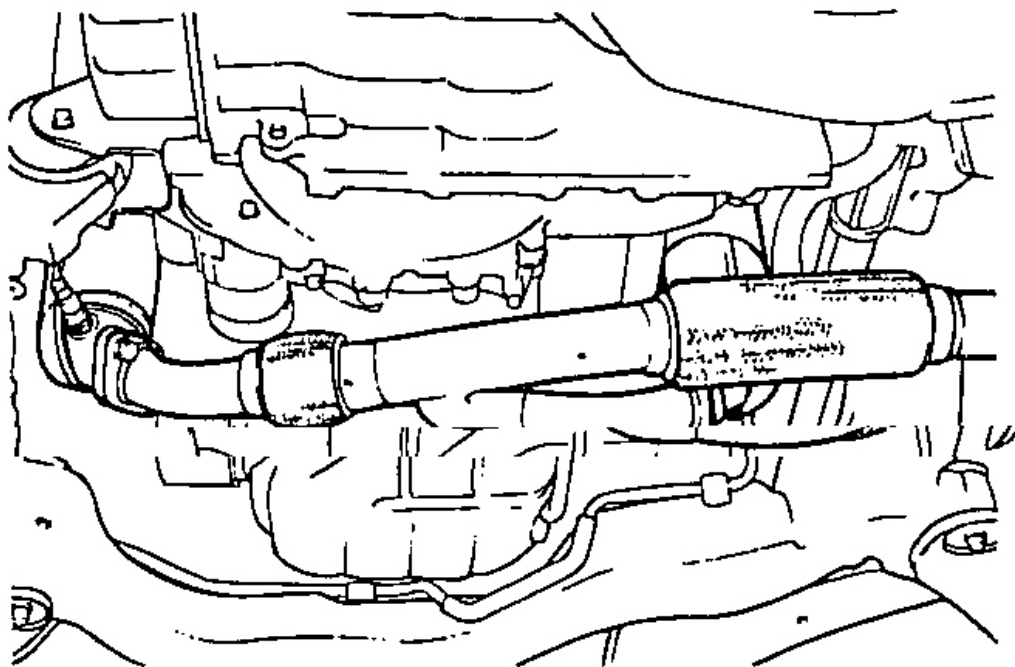


G00328040

Fig. 132: Removing Front Exhaust Pipe (Including Catalytic Converter)
Courtesy of KIA MOTORS AMERICA, INC.

INSPECTION

1. Check the mufflers and pipes for corrosion and damage.



G00328041

Fig. 133: Checking Mufflers & Pipes
Courtesy of KIA MOTORS AMERICA, INC.

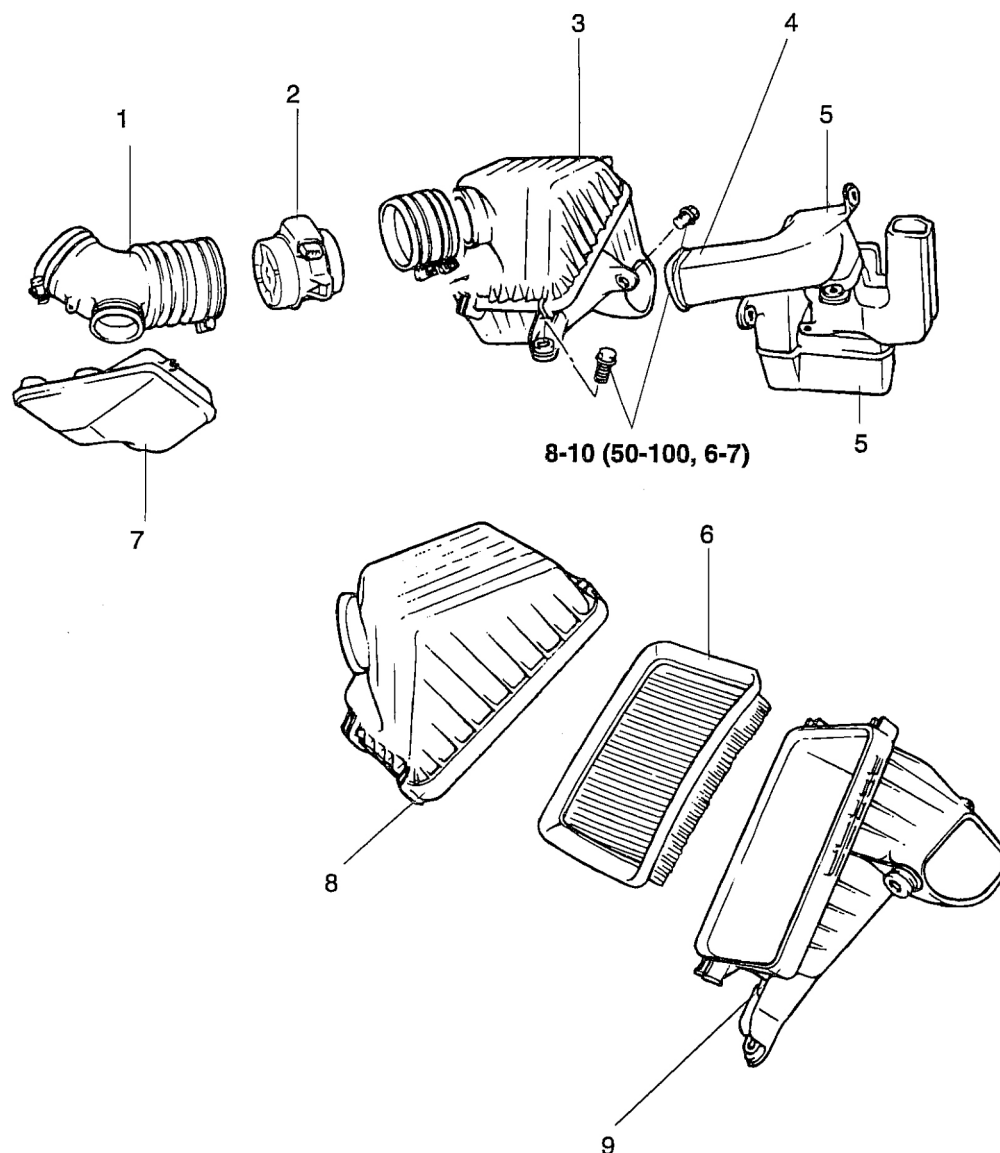
2. Check the rubber hangers for deterioration and cracks.

INSTALLATION

1. Temporarily install the front exhaust pipe, the catalytic converter assembly, the center exhaust pipe, and the main muffler in this order.
2. Install the rubber hangers so that they can be identical (left and right) in length.
3. Tighten the parts securely, and then confirm that there is no interference with any body components.

AIR CLEANER (ACL)

COMPONENTS



TORQUE : Nm (kg-cm, lb-ft)

1. Air intake hose
2. Air flow sensor
3. Air cleaner
4. Air cleaner body
5. Air duct

6. Air cleaner element
7. Resonator
8. Air cleaner cover
9. Air cleaner body

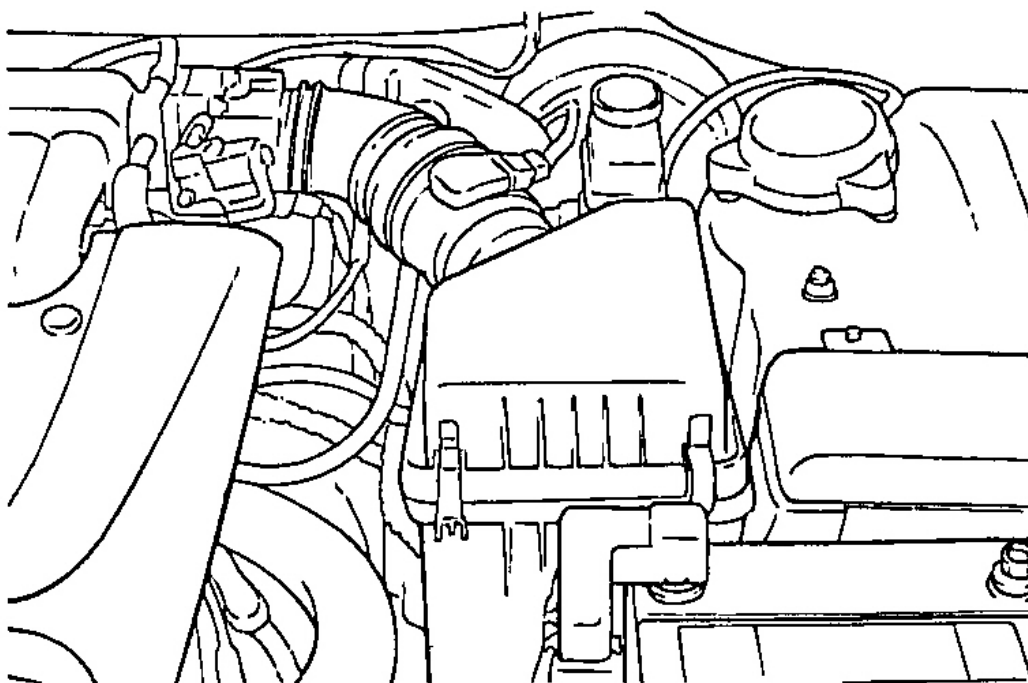
G00328042

Fig. 134: Removing & Installing Air Cleaner
Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

1. Disconnect the air flow sensor connector.

2. Remove the air intake hose and air duct connected to the air cleaner.
3. Remove the three bolts attaching the air cleaner body.
4. Remove the air cleaner.



G00328043

Fig. 135: Removing Air Cleaner

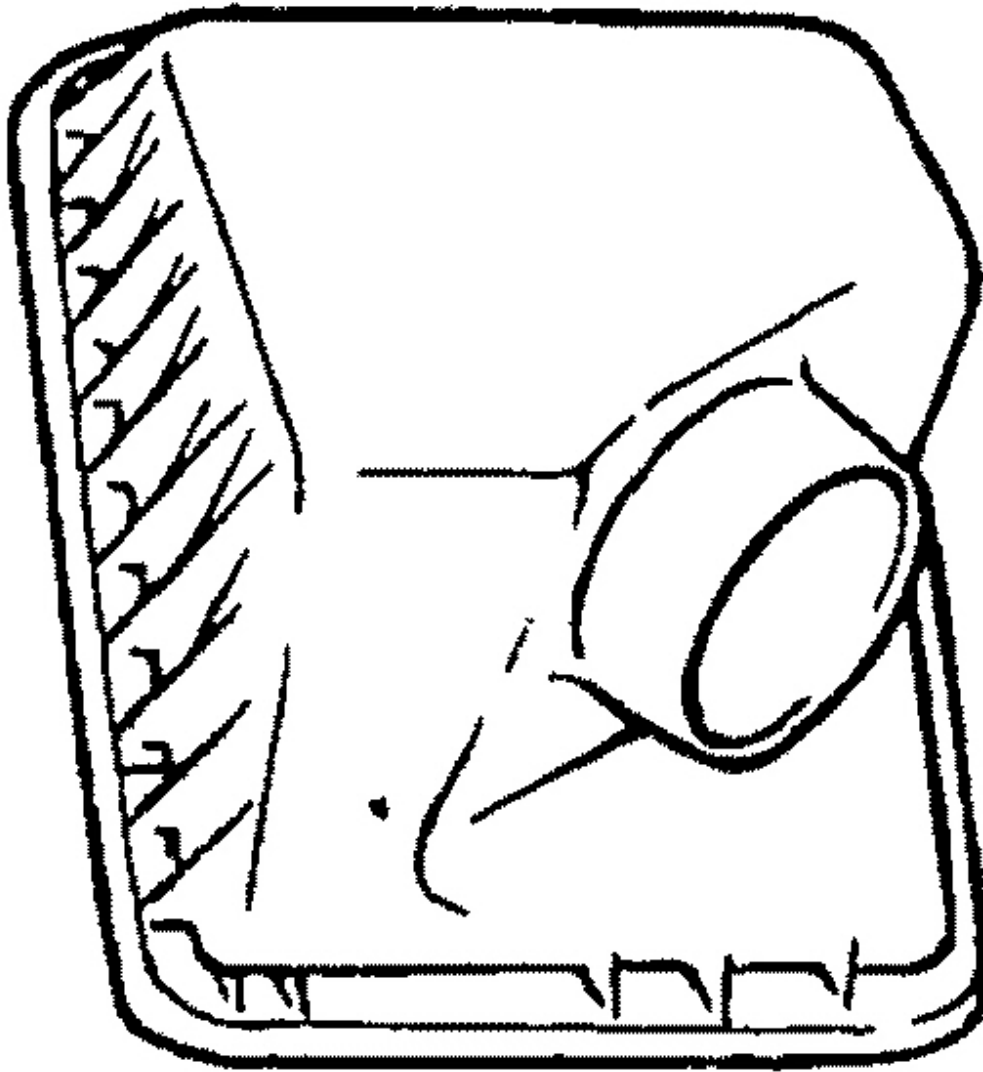
Courtesy of KIA MOTORS AMERICA, INC.

5. Remove the air flow sensor from the air cleaner hose.

CAUTION: Do not pull the air flow sensor harness.

INSPECTION

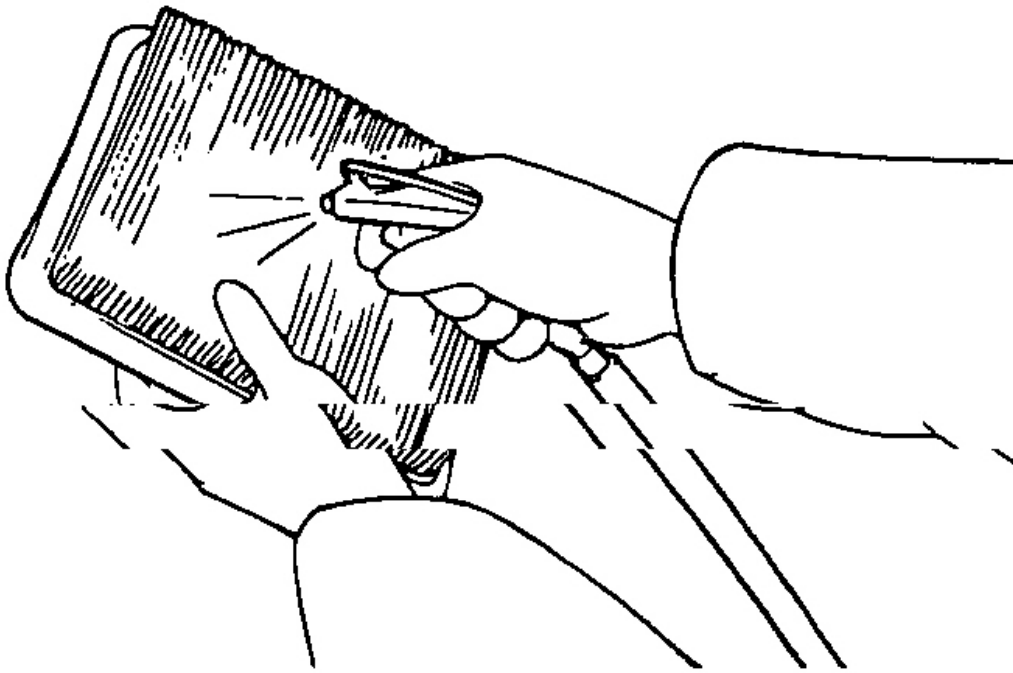
1. Check the air intake hose, air cleaner cover for damage.
2. Check the air intake duct for damage.



G00328044

Fig. 136: Identifying Air Intake 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 the inside of the element. Replace the element if it cannot be cleaned.



G00328045

Fig. 137: Removing Dust & Debris From Air Cleaner Element
Courtesy of KIA MOTORS AMERICA, INC.

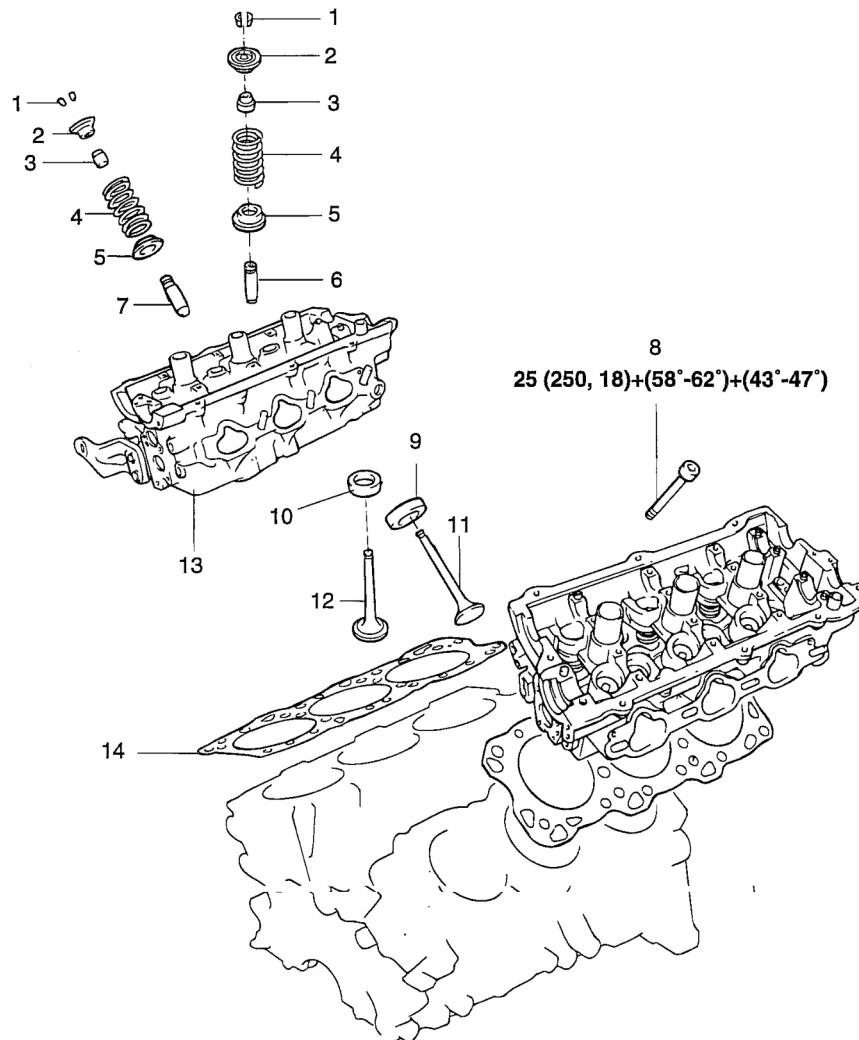
INSTALLATION

1. Blow the air inside of air cleaner to remove dust and debris.
2. Install the air cleaner according to the reverse order of removal.

CYLINDER HEAD ASSEMBLY

CYLINDER HEAD

COMPONENTS



TORQUE : Nm (kg-cm, lb-ft)

1. Retainer lock
2. Valve spring retainer
3. Valve stem seal
4. Valve spring
5. Valve spring seat
6. Inlet valve guide
7. Exhaust valve guide

8. Cylinder head bolt
9. Exhaust valve seat
10. Inlet valve seat
11. Exhaust valve
12. Inlet valve
13. Cylinder head
14. Cylinder head gasket

G00328046

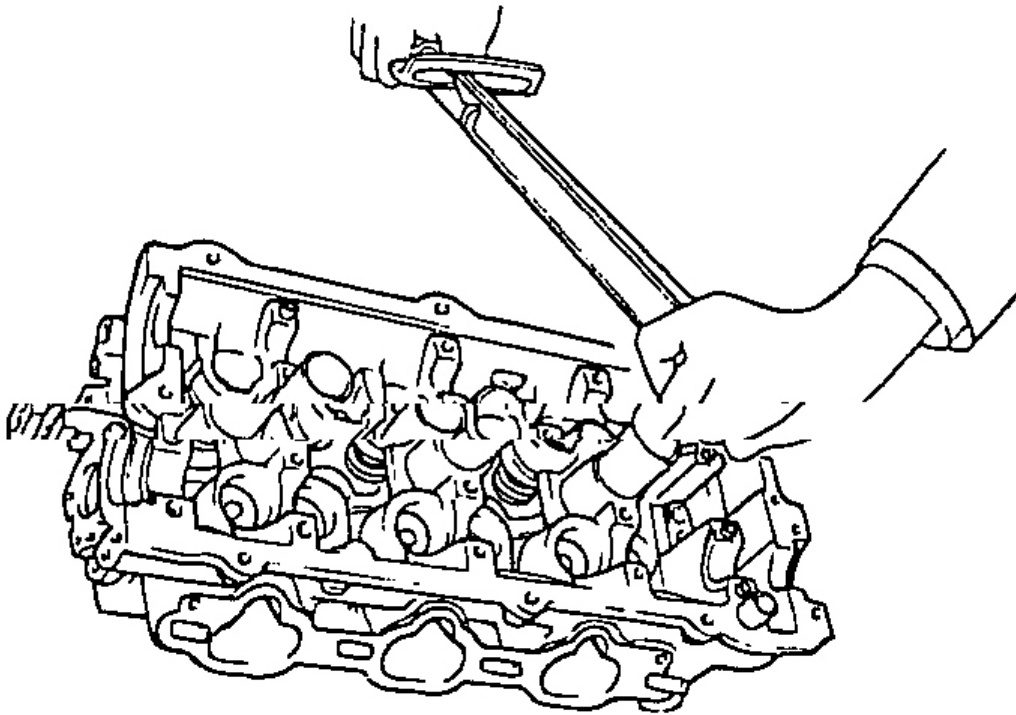
Fig. 138: Removing & Installing Cylinder Head
Courtesy of KIA MOTORS AMERICA, INC.

DISASSEMBLY

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.
8. Remove the timing belt and camshaft sprockets.
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, in the sequence as shown in the illustration in two or three steps.
13. Remove 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.



G00328048

Fig. 139: Removing Cylinder Head Bolts
Courtesy of KIA MOTORS AMERICA, INC.

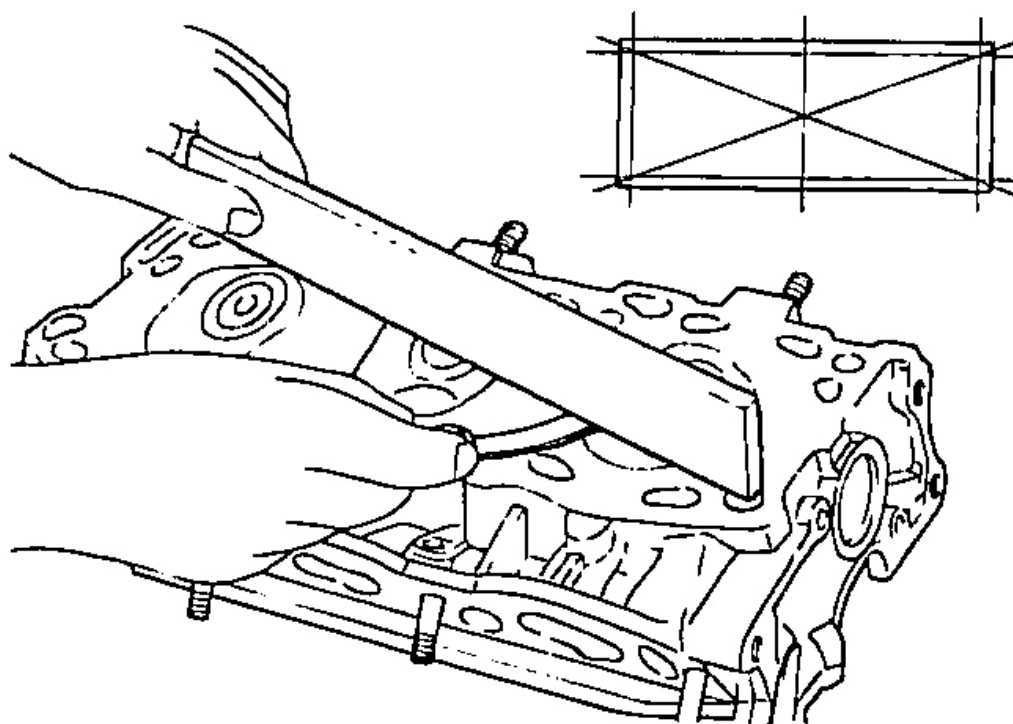
INSPECTION

1. Remove scale, sealing compound and carbon deposits completely. 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 gasket surface for flatness with a straight edge and feeler as shown in illustration.

Cylinder head flatness:

Standard dimension : Max. 0.03 mm (0.0012 in.)

Service limit : 0.05 mm (0.002 in.)



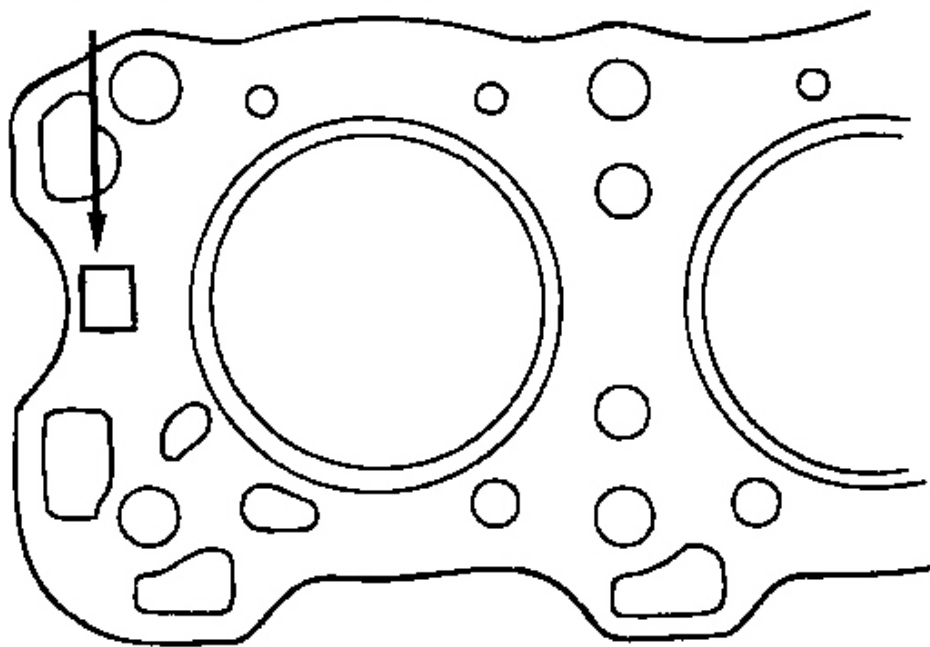
G00328049

Fig. 140: Checking Cylinder Head Flatness
Courtesy of KIA MOTORS AMERICA, INC.

INSTALLATION

1. Clean both gasket surfaces of the cylinder head and cylinder block.
2. Verify the identification marks on the cylinder head gasket.

Identification mark



G00328050

Fig. 141: Identifying Cylinder Head Gasket Identification Marks
Courtesy of KIA MOTORS AMERICA, INC.

3. Position the gasket surface to have the identification mark towards the cylinder head.

NOTE: **Do not apply sealant to these surfaces.**

4. Torque the cylinder head bolts in the sequence shown in the illustration.

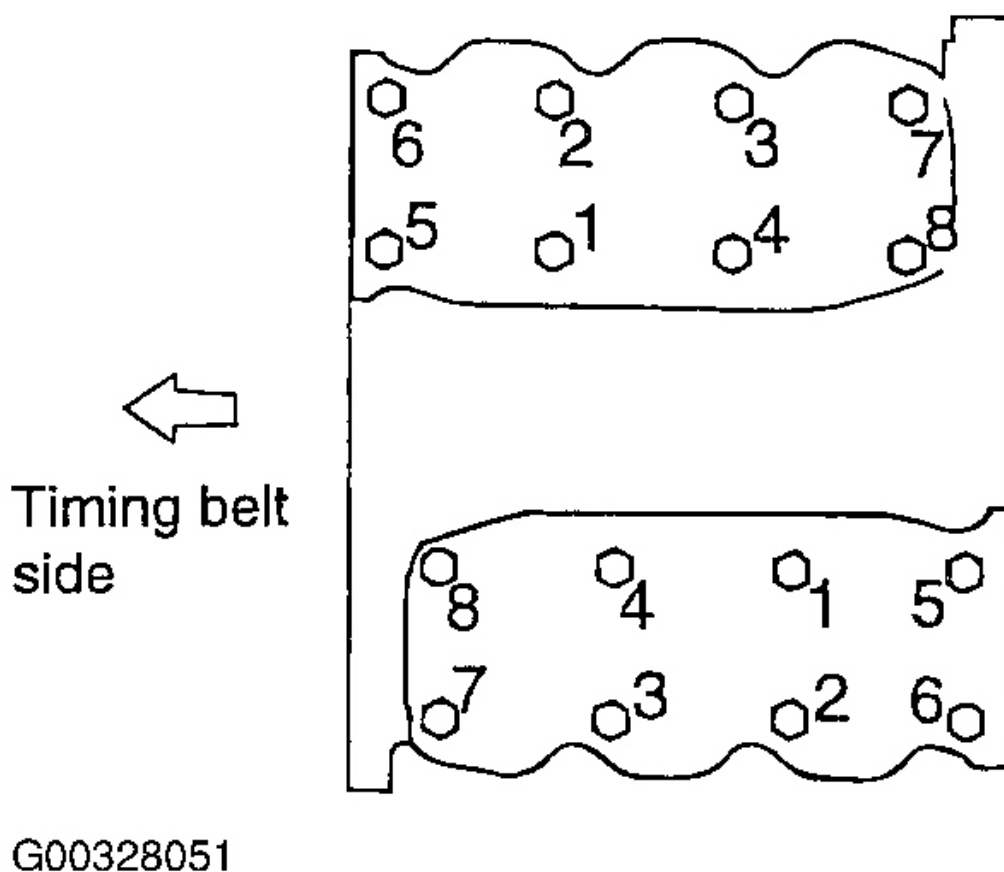


Fig. 142: Identifying Cylinder Head Bolt Tightening Sequence
Courtesy of KIA MOTORS AMERICA, INC.

5. Install the cylinder head bolts. Starting at top center, tighten all cylinder head bolts in sequence as shown in illustration. Repeat the procedures, tightening all cylinder head bolt to the specified torque again.

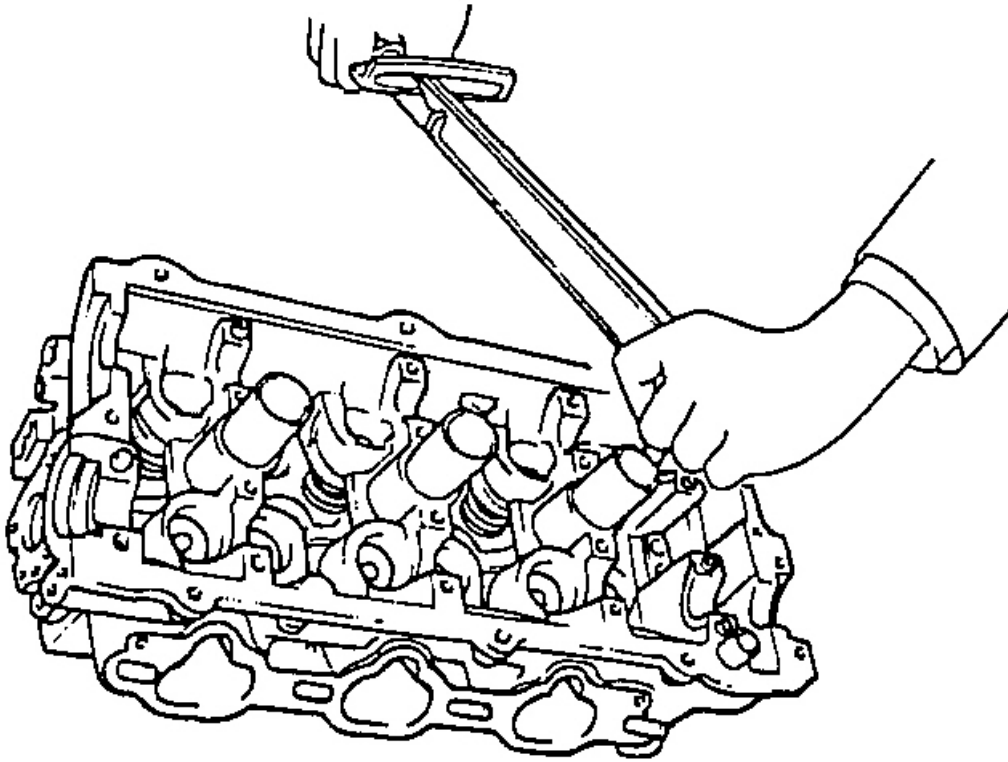
Tightening procedure.

(1) Tighten all bolts (1 - 8):

25 Nm (250 kg.cm, 18 lb.ft)

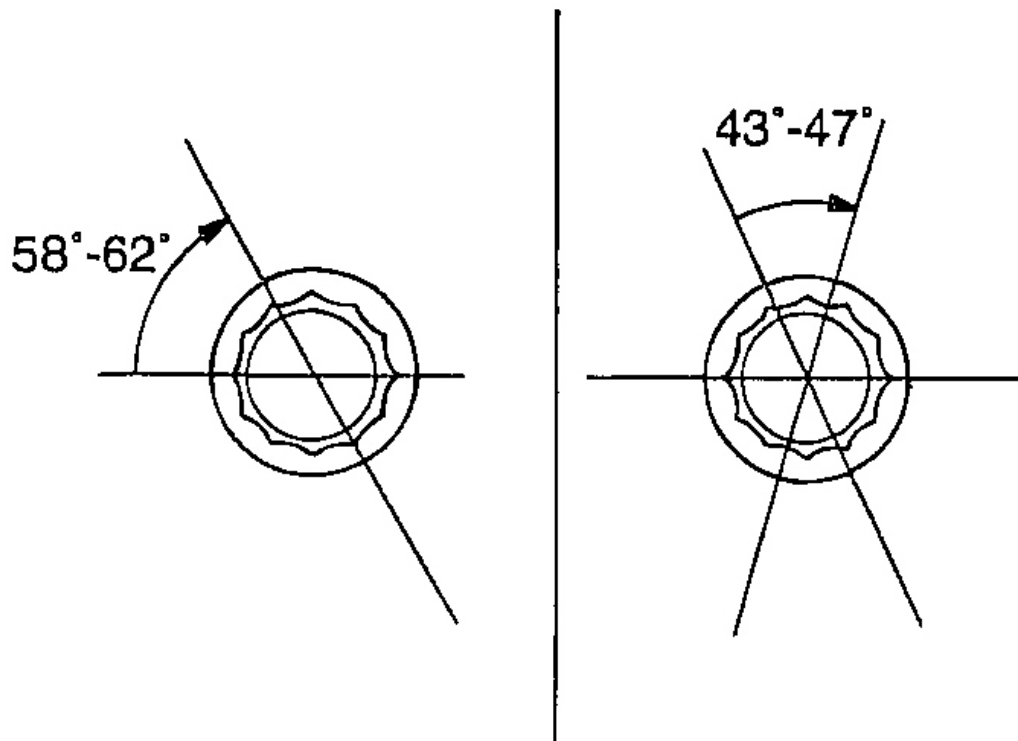
(2) Tighten all bolts (1 - 8): 58°~ 62° of a turn

(3) Tighten all bolts (1 - 8): 43°~ 47° of a turn



G00328052

Fig. 143: Installing Cylinder Head Bolts (1 Of 2)
Courtesy of KIA MOTORS AMERICA, INC.

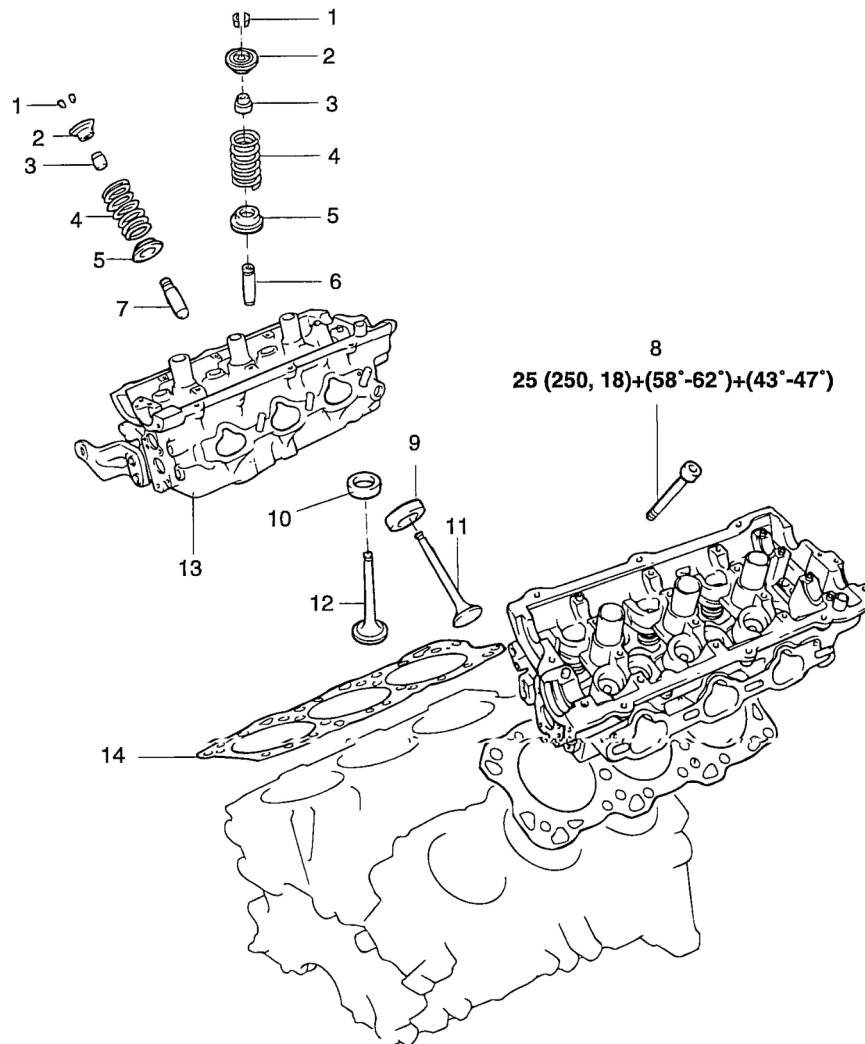


G00328053

Fig. 144: Installing Cylinder Head Bolts (2 Of 2)
Courtesy of KIA MOTORS AMERICA, INC.

VALVES

COMPONENTS



TORQUE : Nm (kg-cm, lb-ft)

1. Retainer lock
2. Valve spring retainer
3. Valve stem seal
4. Valve spring
5. Valve spring seat
6. Inlet valve guide
7. Exhaust valve guide

8. Cylinder head bolt
9. Exhaust valve seat
10. Inlet valve seat
11. Exhaust valve
12. Inlet valve
13. Cylinder head
14. Cylinder head gasket

G00328054

Fig. 145: Removing & Installing Valves
Courtesy of KIA MOTORS AMERICA, INC.

INSPECTION

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**

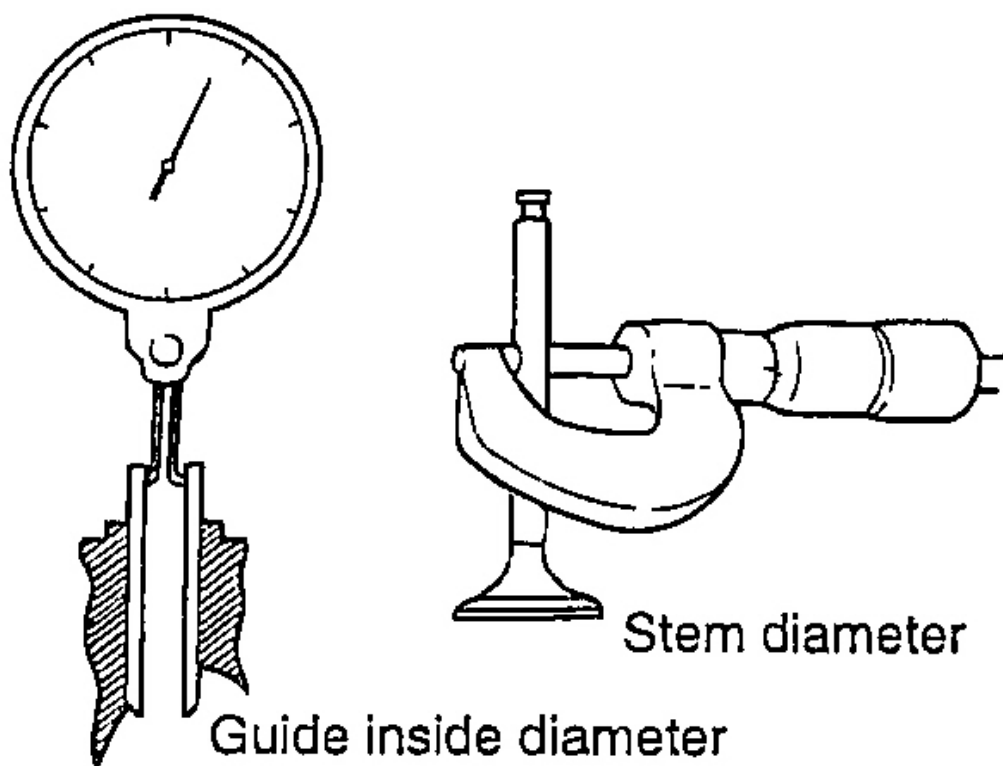
Intake : 0.02-0.05 mm (0.0009-0.0020 in.)

Exhaust: 0.035-0.065 mm (0.0014-0.0026 in.)

Service limit

Intake : 0.10 mm (0.0039 in.)

Exhaust : 0.15 mm (0.0059 in.)



G00328055

Fig. 146: Checking Valve Stem-To-Guide Clearance
Courtesy of KIA MOTORS AMERICA, INC.

Valve

1. Replace the valve stem if it is worn (stepped, worn or damaged). Also replace it if the stem end (the surface contacting the auto-lash adjuster) is recessed.

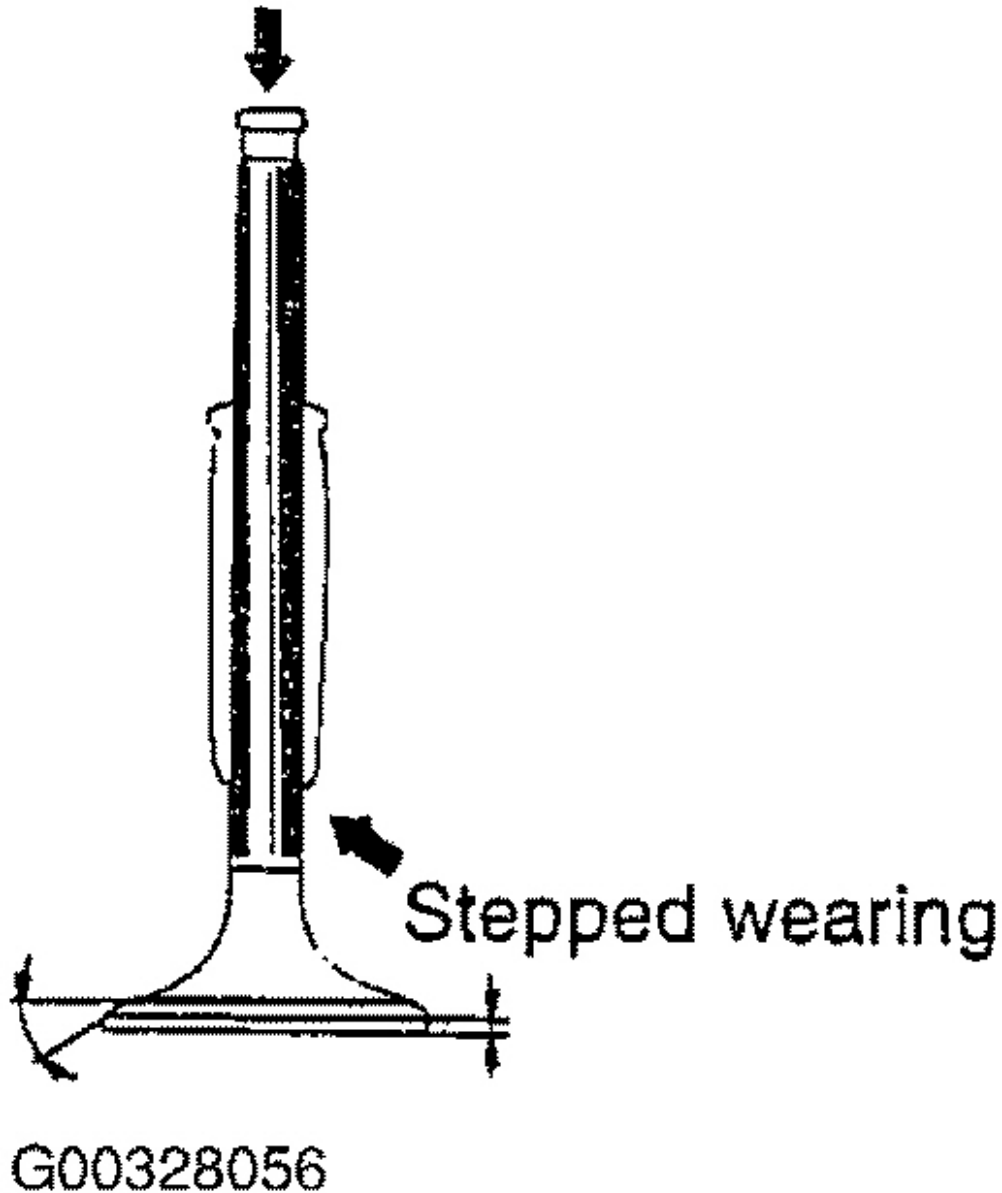


Fig. 147: Checking Valve Stem

Courtesy of KIA MOTORS AMERICA, INC.

2. Check the valve face contact area, and recondition or replace as necessary.
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

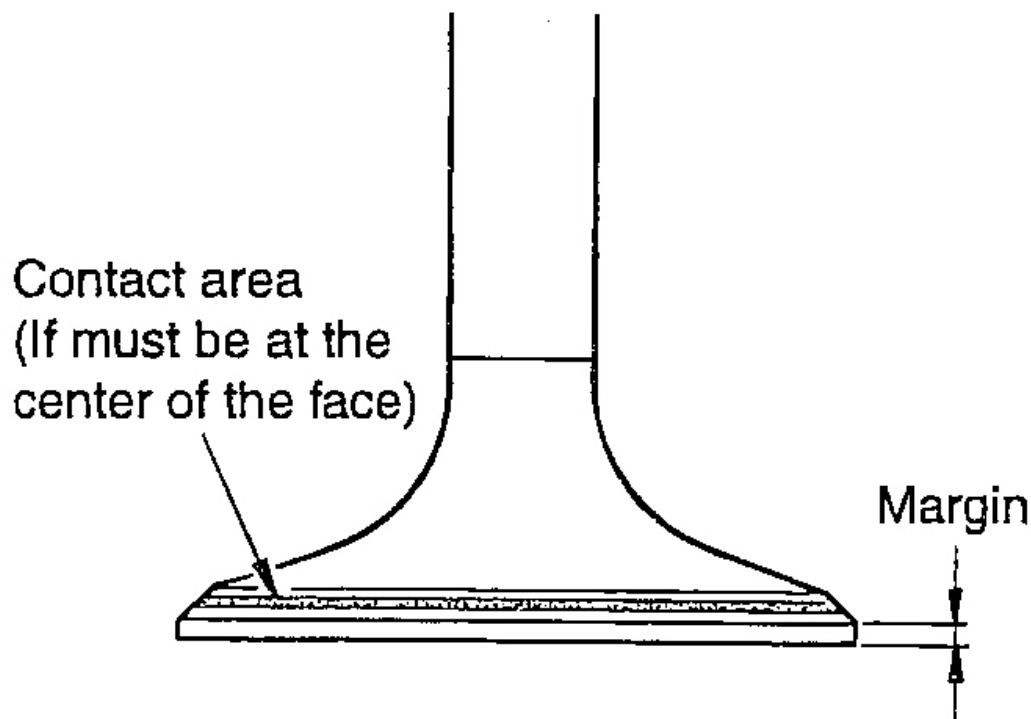
Intake side : 1.0 mm (0.0394 in.)

Exhaust side : 1.3 mm (0.0512 in.)

Service limit

Intake side : 0.5 mm (0.0197 in.)

Exhaust side : 0.8 mm (0.0315 in.)



G00328057

Fig. 148: Checking Valve Margin

Courtesy of KIA MOTORS AMERICA, INC.

Valve Springs

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

Valve spring

Standard value

Free height : 42.5 mm (1.6732 in.)

Load : 21.9 kg/35 mm (49 lb/1.3780 in.)

Out of squareness : Max. 1.5°

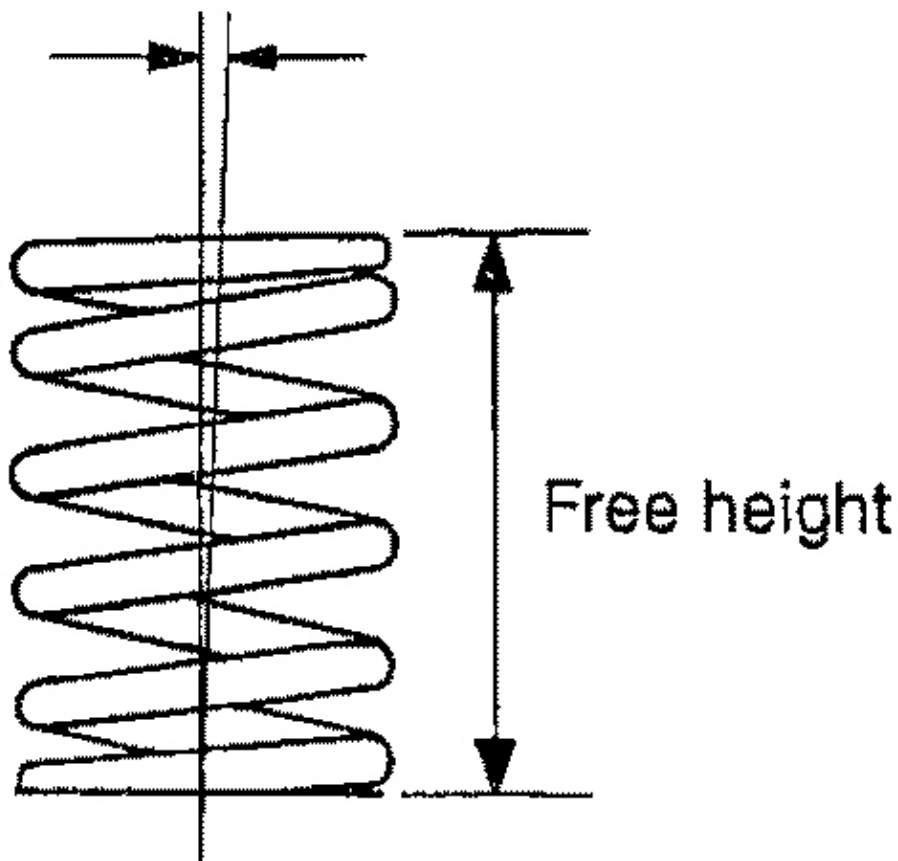
Service limit

Free height: 41.5 mm (1.6339 in.)

Load : 21.9 kg/34 mm (49 lb/1.3386 in.)

Out of squareness : Max. 3°

Out of squareness



G00328058

Fig. 149: Checking Valve Spring
Courtesy of KIA MOTORS AMERICA, INC.

REPLACEMENT

Reconditioning Valve Seat

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

Replacing Valve Guide

1. Using the Special tool (09222-32200), press down the old valve guide toward the bottom of cylinder head.

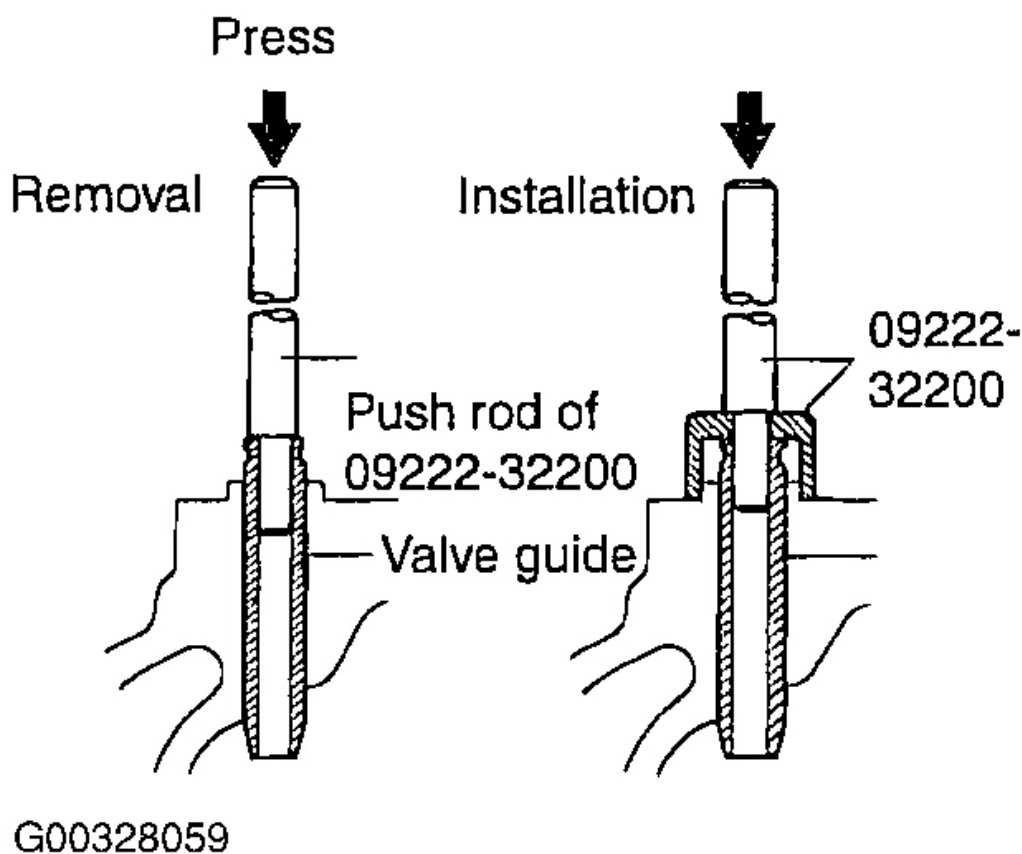


Fig. 150: Identifying Special Tool (09222-32200)
Courtesy of KIA MOTORS AMERICA, INC.

2. Recondition the valve guide hole so that it matches the newly press-fit oversize valve guide.

Size mm (in.)	Size mark	Cylinder head hole size mm (in.)
0.05 (0.002) O.S.	5	11.050-11.068 (0.435-0.4357)
0.25 (0.010) O.S.	25	11.250-11.268 (0.443-0.4436)
0.50 (0.020) O.S.	50	11.500-11.518 (0.453-0.4535)

G00328060

Fig. 151: Identifying Valve Guide Insert Oversizes
Courtesy of KIA MOTORS AMERICA, INC.

- Using the special tool (09221-29000A), 09221-22000B)) 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 valve guides are different in length.

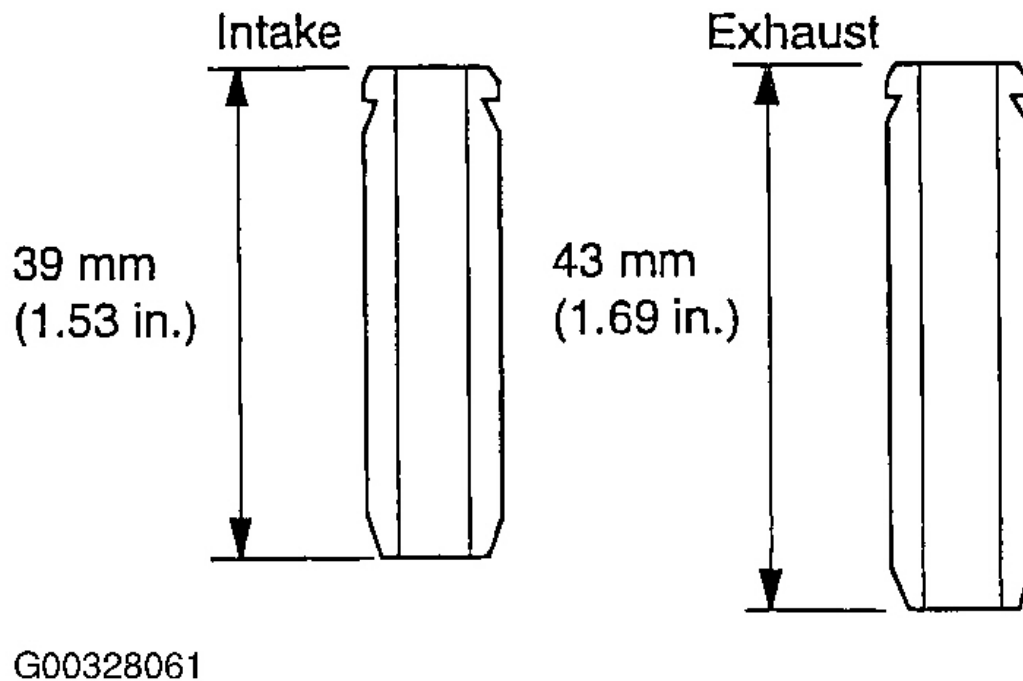


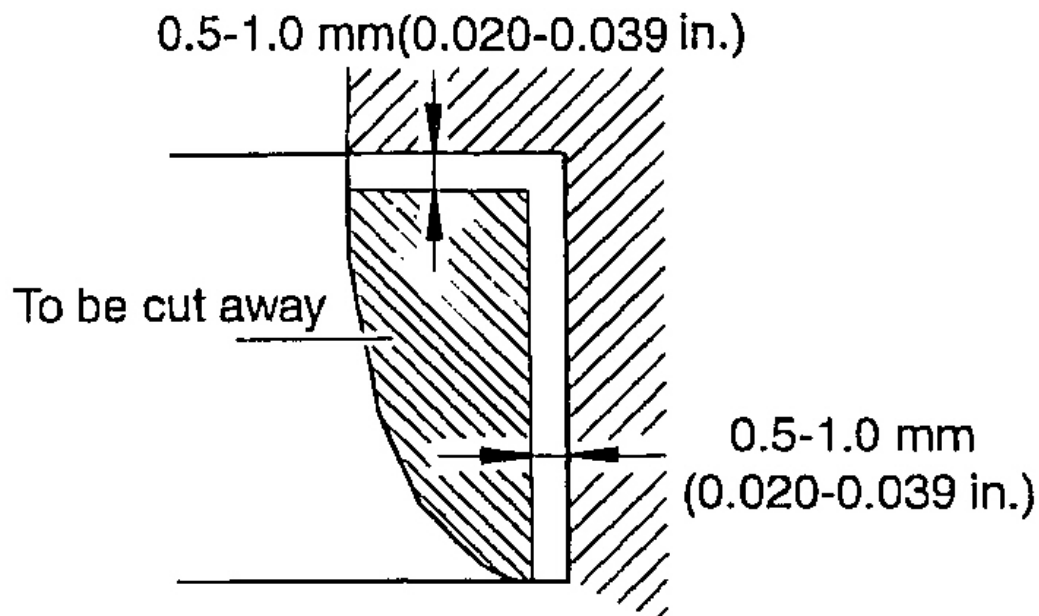
Fig. 152: Identifying Intake & Exhaust Valve Guide Lengths
Courtesy of KIA MOTORS AMERICA, INC.

4. After the valve guide is press-fit, insert a new valve and check for proper clearance.
5. After the valve guide has been replaced, check proper valve face to valve seat contact.

NOTE: Do not install a valve guide of the same size again.

Replacing Valve Seat Insert

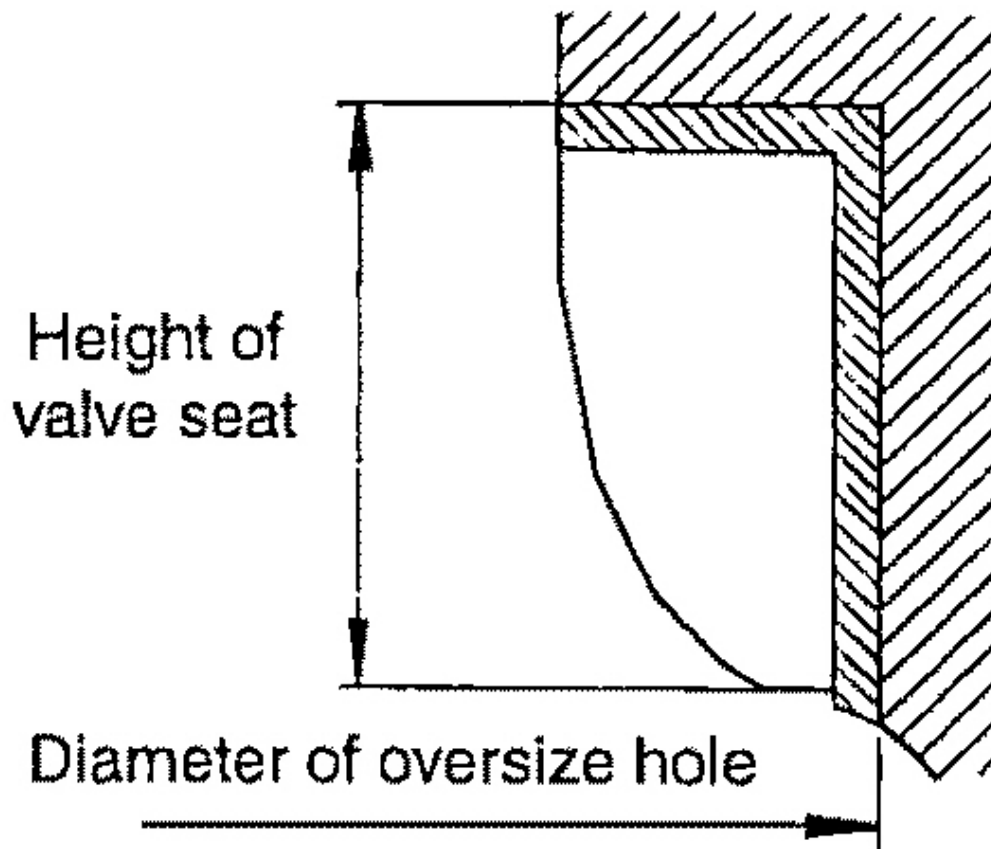
1. Cut away the inner face of the valve seat to reduce thickness.



G00328062

Fig. 153: Replacing Valve Seat Insert (1 Of 3)
Courtesy of KIA MOTORS AMERICA, INC.

2. Adjust the press fit diameter of the valve seat on the cylinder head side so that it can match the diameter of the oversize valve seat.



G00328063

Fig. 154: Replacing Valve Seat Insert (2 Of 3)
Courtesy of KIA MOTORS AMERICA, INC.

Description	Intake valve seat insert	Exhaust valve seat insert
Size mm (in.)	0.3 (0.012) O.S.	0.3 (0.012) O.S.
Size mark	30	30
Seat insert height H mm (in.)	7.9-8.1 (0.311-0.319)	7.9-8.1 (0.311-0.319)
Cylinder head I.D. mm (in.)	33.300-33.325 (1.311-1.312)	28.600-28.621 (1.126-1.127)

G00328064

Fig. 155: Replacing Valve Seat Insert (3 Of 3)
Courtesy of KIA MOTORS AMERICA, INC.

- Heat the cylinder head to about 250°C (480°F) and press an oversize seat insert fit for the insert bore in the cylinder head at normal temperature.
- Use the lapping compound, and lap the valve.

Valve seat contact width

Intake : 1.1-1.5 mm (0.043-0.059 in.)

Exhaust : 1.3-1.7 mm (0.051-0.067 in.)

INSTALLATION

- Install the spring seats.
- Using the special tool (09222-22001), lightly tap the seal into place. The seal is installed in the specified position, using the special tool.

NOTE:

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

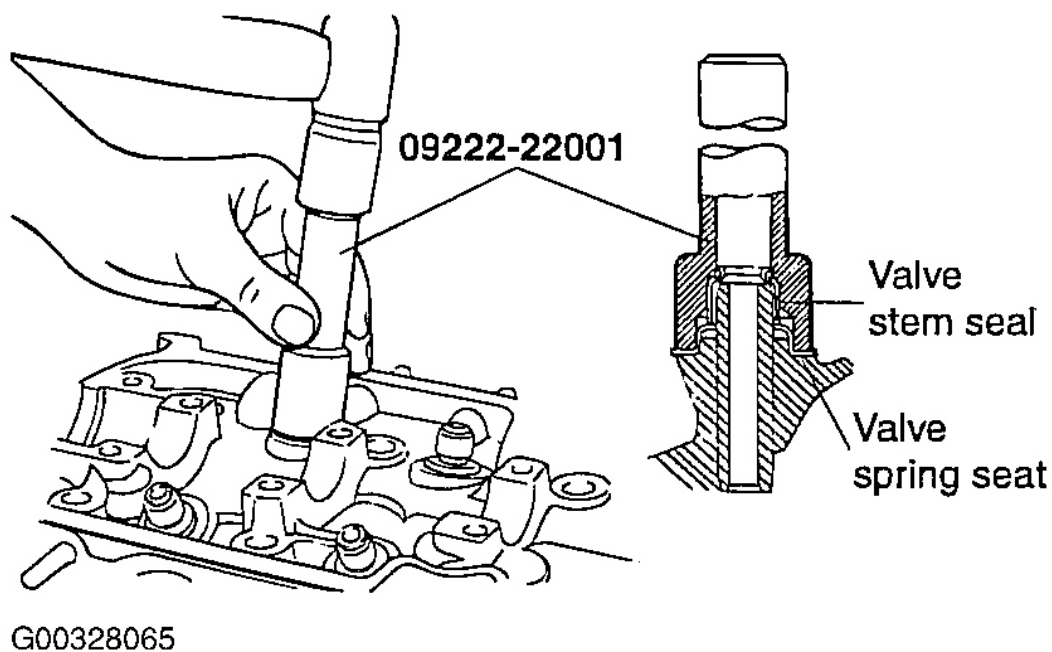
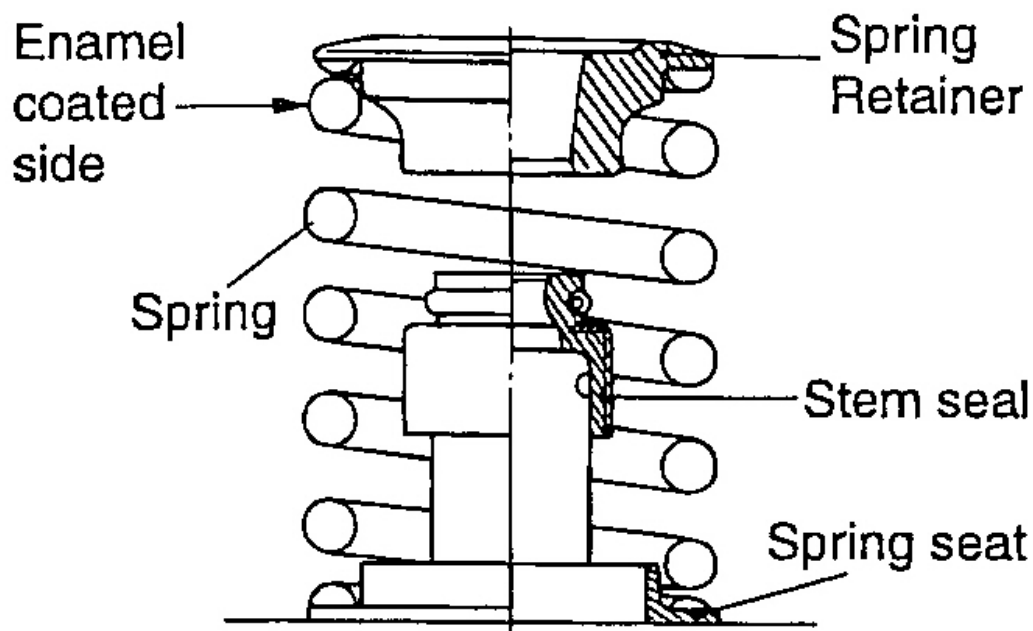


Fig. 156: Identifying Valve Stem Oil Seal Installer (09222-22001)

Courtesy of KIA MOTORS AMERICA, INC.

3. Apply engine oil to each valve. Insert valves into guides. Avoid forcing the valve into the seal. After installing the valve, check that it moves smoothly.
4. Valve springs should be installed with the enamel coated side toward the valve spring retainer.



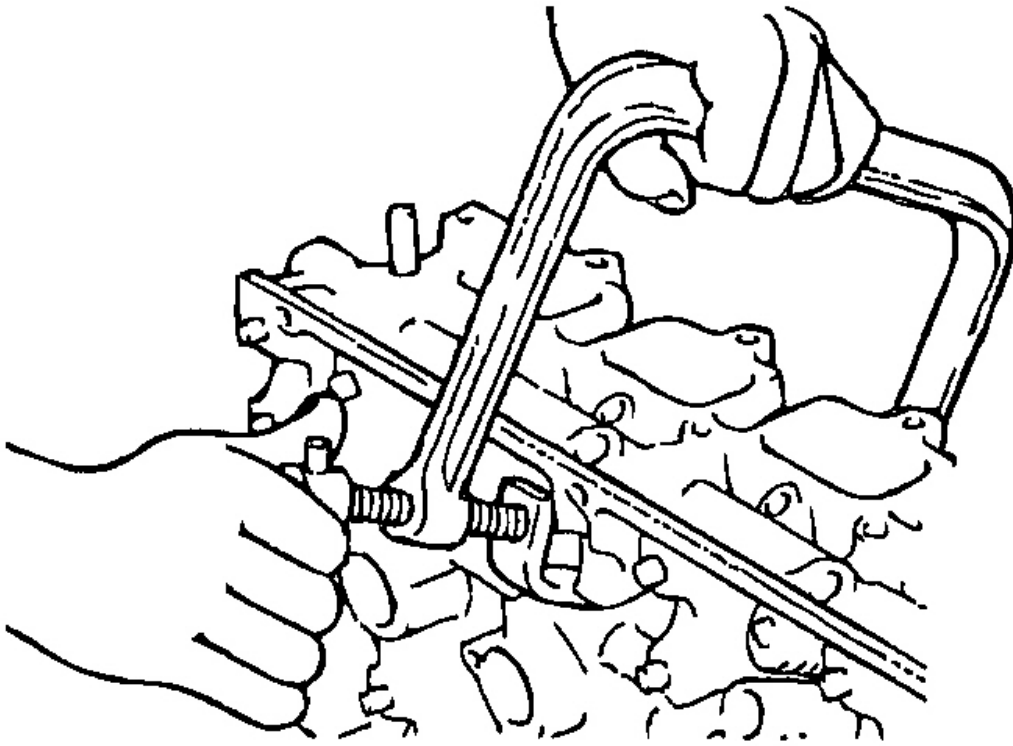
G00328066

Fig. 157: Installing Valve Springs

Courtesy of KIA MOTORS AMERICA, INC.

5. Using the special tool (09222-28000), compress the spring and install the retainer locks. After installation of the valves, make certain 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 retainer.



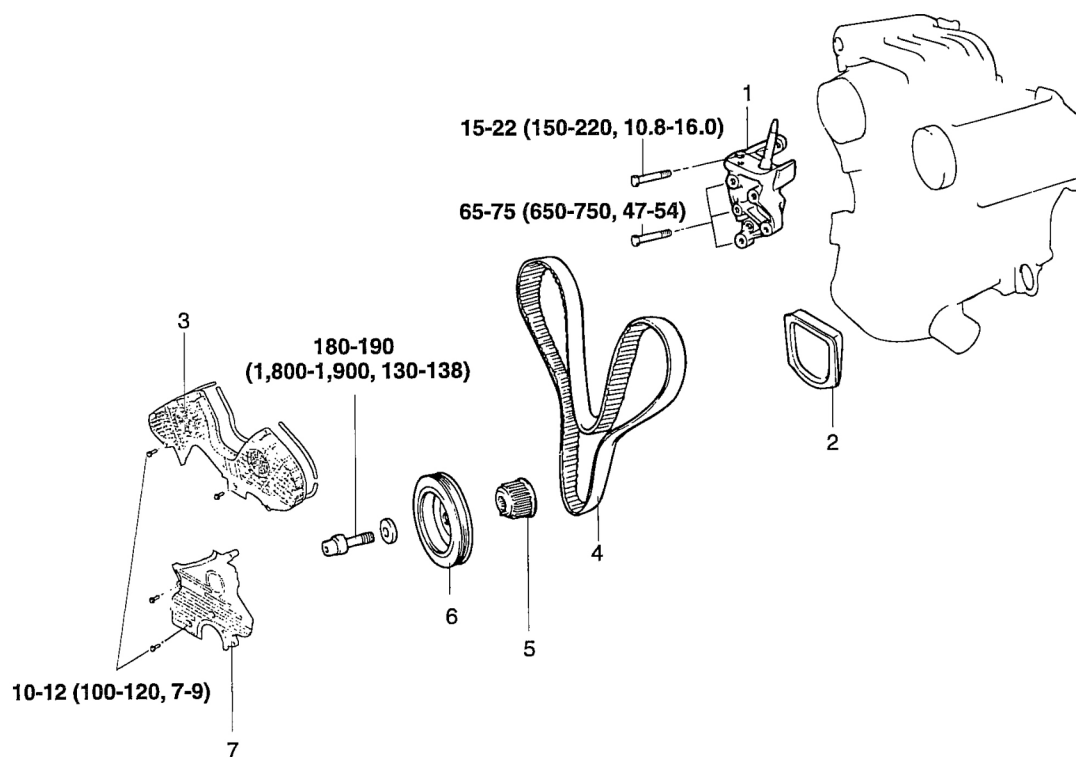
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Fig. 158: Identifying Valve Spring Compressor (09222-28000)
Courtesy of KIA MOTORS AMERICA, INC.

TIMING SYSTEM

TIMING BELT

COMPONENTS



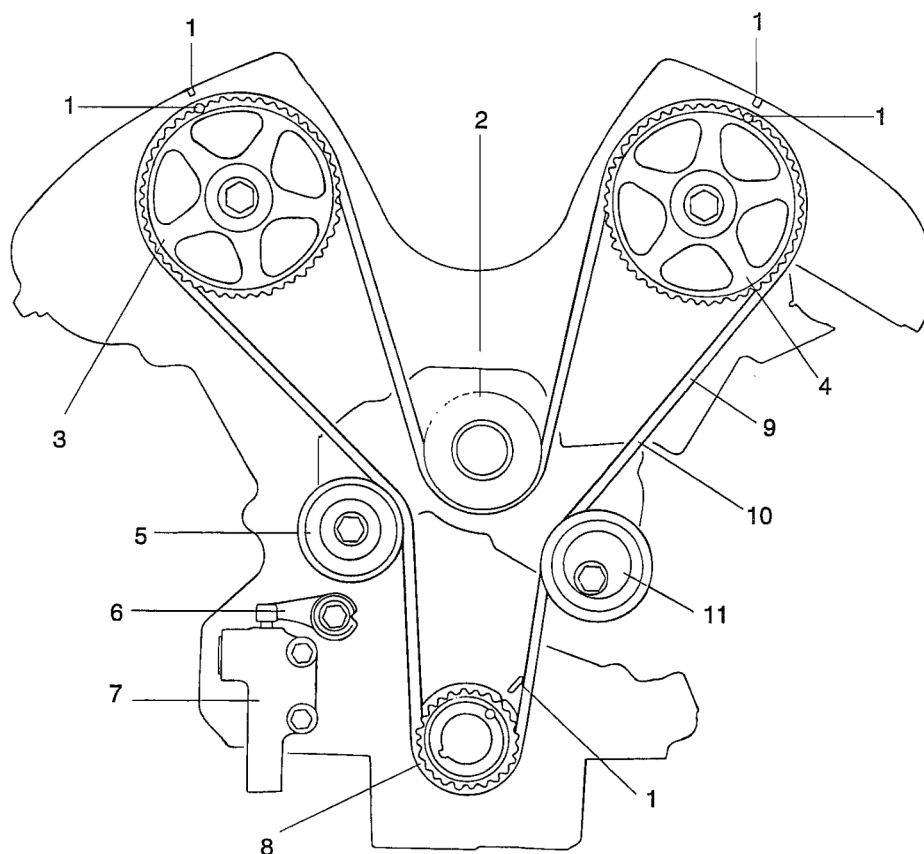
TORQUE : Nm (kg-cm, lb-ft)

- | | |
|----------------------------|----------------------------|
| 1. Engine support bracket | 5. Crank shaft sprocket |
| 2. Under cover panel | 6. Crank shaft pulley |
| 3. Timing belt upper cover | 7. Timing belt lower cover |
| 4. Timing belt | |

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Fig. 159: Exploded View Of Timing Belt Components
 Courtesy of KIA MOTORS AMERICA, INC.

TIMING BELT



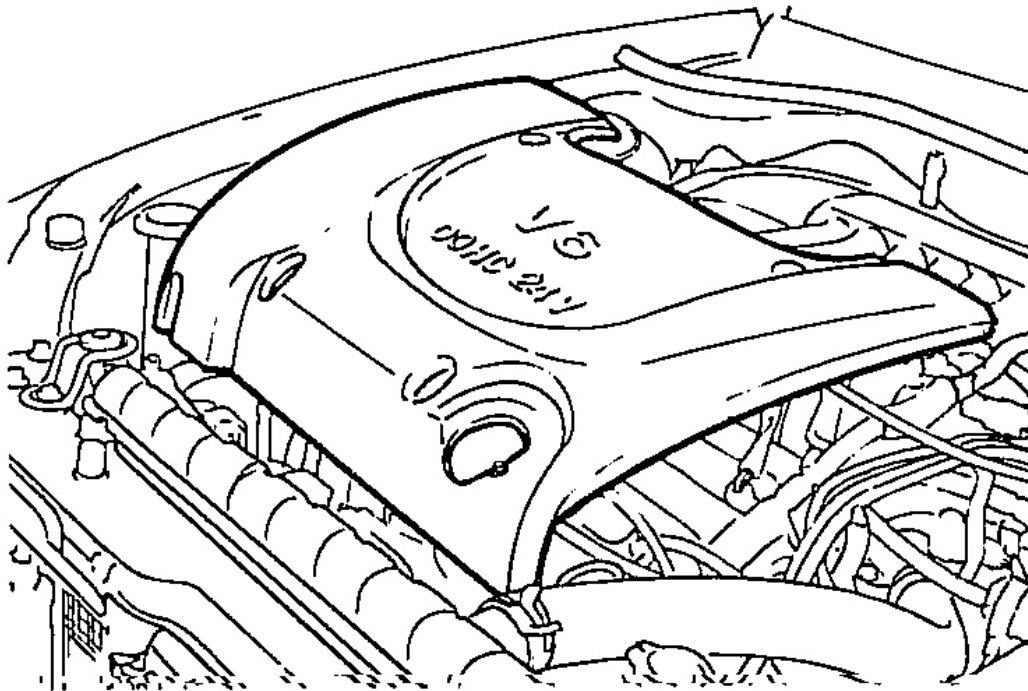
- | | |
|-----------------------------------|------------------------|
| 1. Timing mark | 7. Auto tensioner |
| 2. Engine coolant pump pulley | 8. Crankshaft sprocket |
| 3. Camshaft sprocket (Front side) | 9. Timing belt |
| 4. Camshaft sprocket (Rear side) | 10. Tension side |
| 5. Timing belt tensioner | 11. Idler pulley |
| 6. Tensioner arm | |

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Fig. 160: Removing & Installing Timing Belt
Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

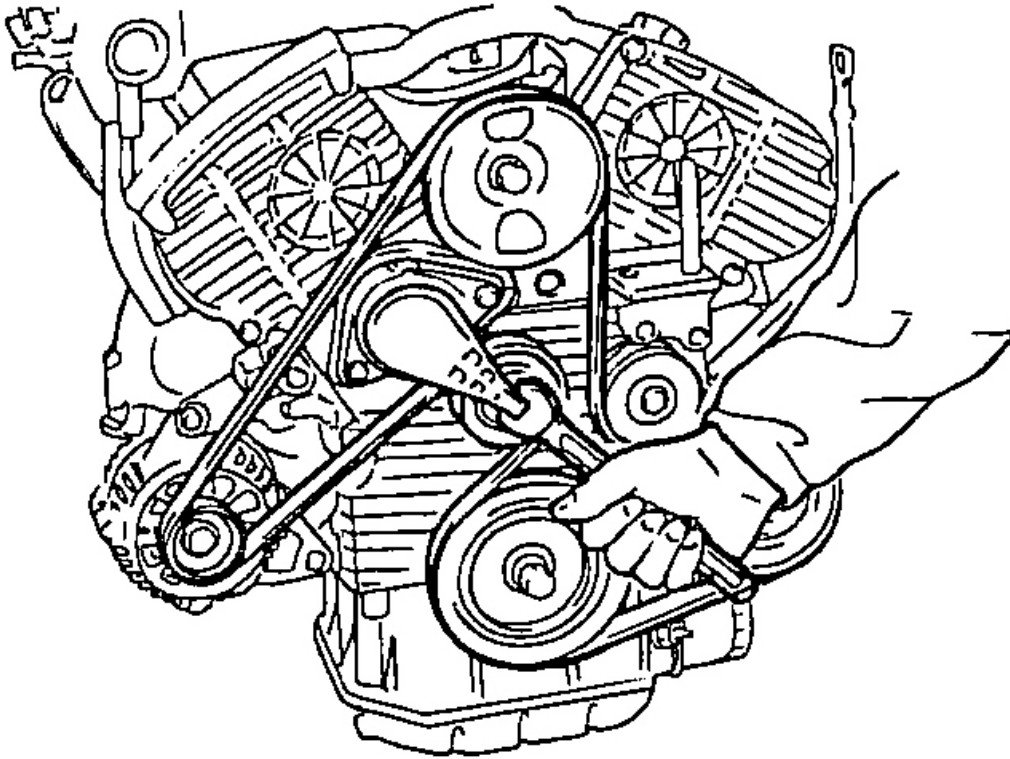
1. Remove the engine cover.



G00328070

Fig. 161: Removing Engine Cover
Courtesy of KIA MOTORS AMERICA, INC.

2. Using the spanner [16 mm], rotate the tensioner arm clockwise (about 14°) and remove the belt from pulley.

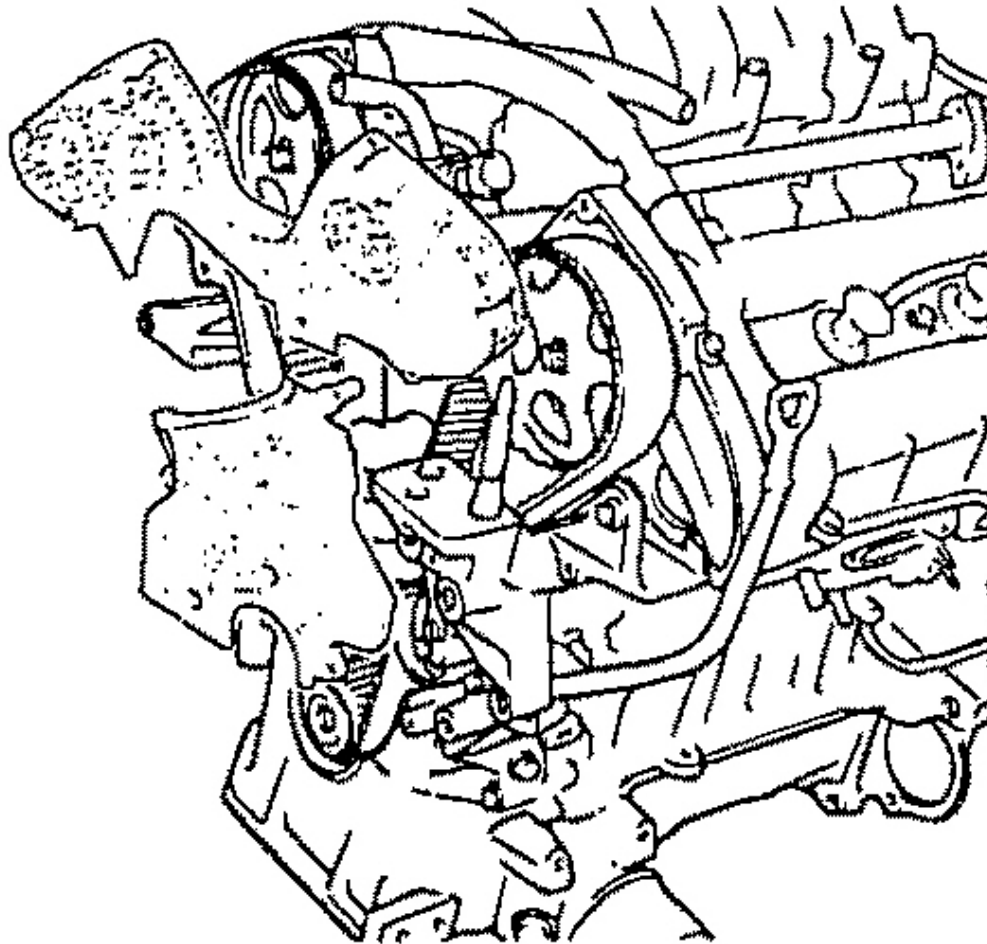


G00328071

Fig. 162: Removing Drive Belt

Courtesy of KIA MOTORS AMERICA, INC.

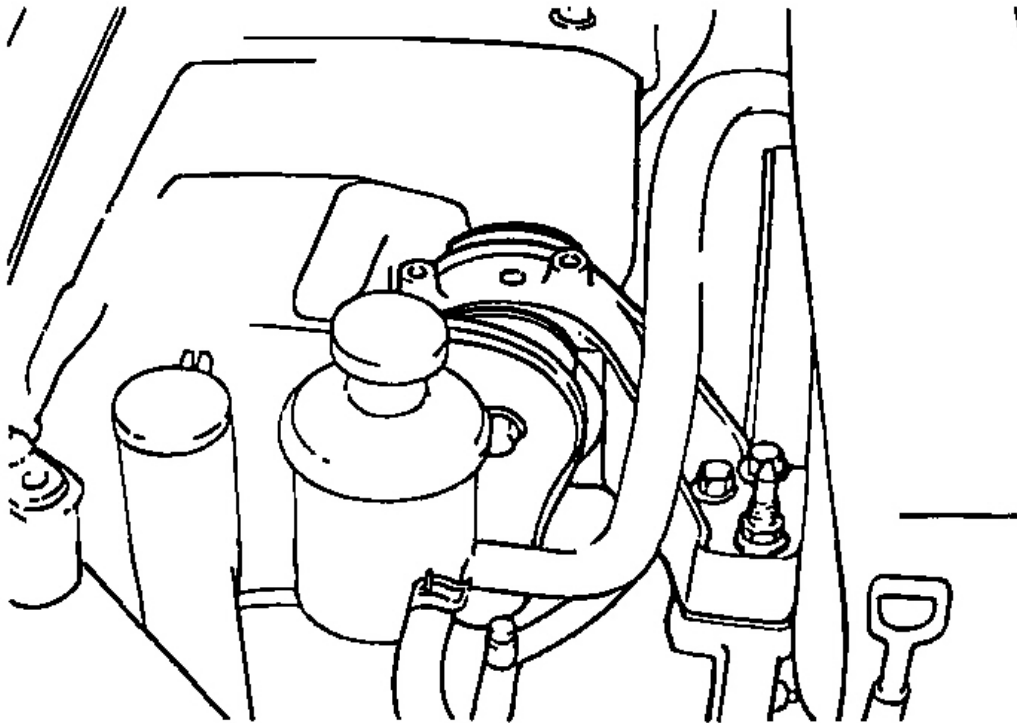
3. Remove the coolant pump pulley, idler pulley, tensioner pulley and crankshaft pulley.
4. Remove the upper and lower timing belt covers.



G00328072

Fig. 163: Removing Upper & Lower Timing Belt Covers
Courtesy of KIA MOTORS AMERICA, INC.

5. Support the engine with garage jack or wooden block and remove the engine mounting insulator.
6. Remove the engine mount bracket from the engine.

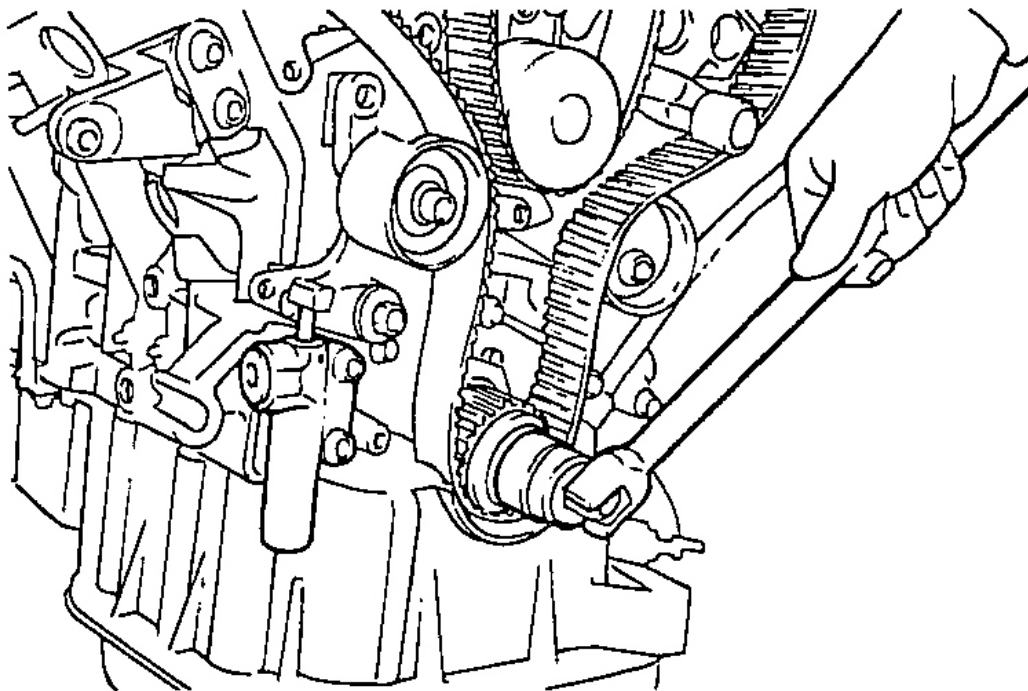


G00328073

Fig. 164: Removing Engine Mount Bracket
Courtesy of KIA MOTORS AMERICA, INC.

7. Remove the auto tensioner.

NOTE: Rotate the crankshaft clockwise and align the timing mark to get the No. 1 cylinder's piston to be in TDC position (compression stroke). At this time, the timing mark of camshaft sprocket and cylinder head cover should coincide each other.

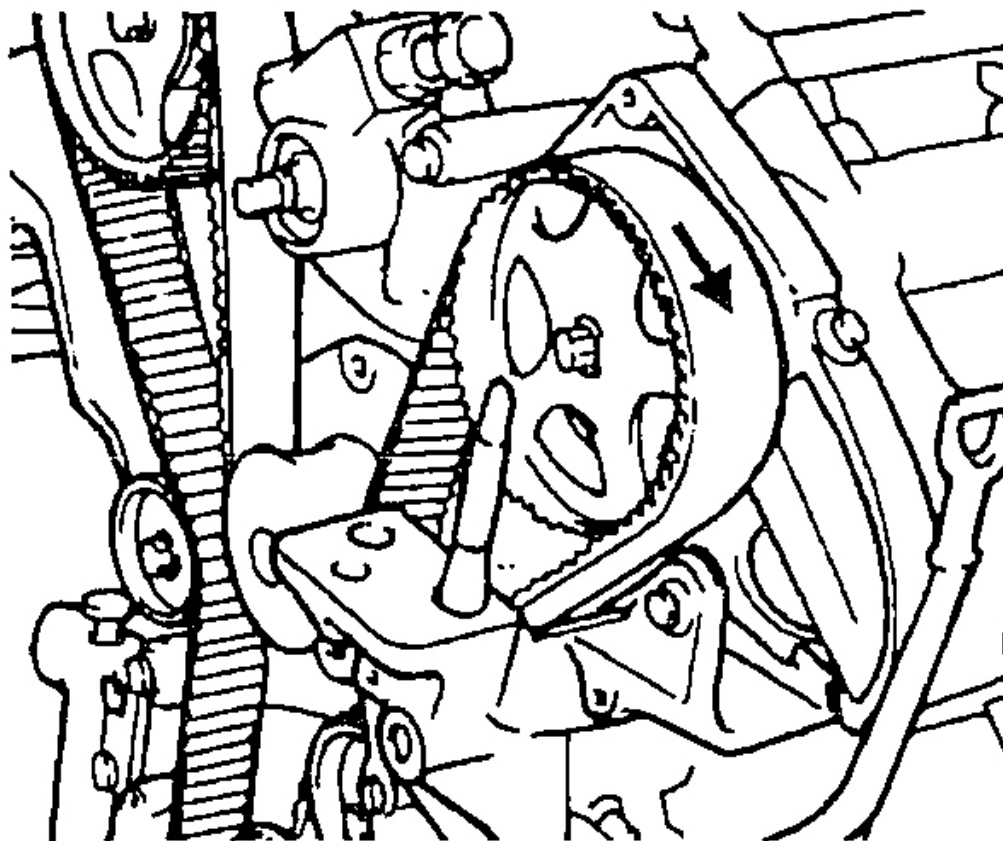


G00328074

Fig. 165: Removing Auto Tensioner
Courtesy of KIA MOTORS AMERICA, INC.

8. Remove the timing belt.

NOTE: When using the timing belt again, make sure of marking the rotating direction on the belt so as to install correctly.

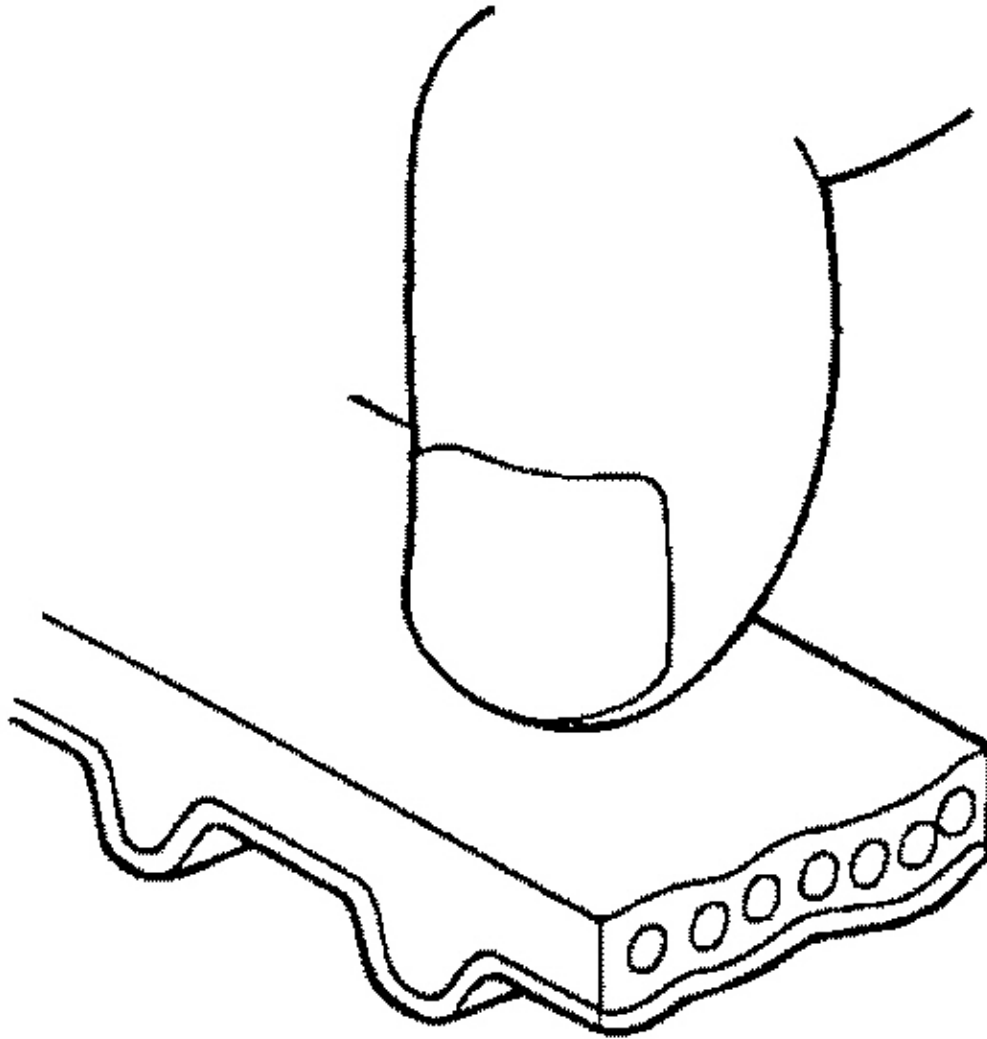


G00328075

Fig. 166: Identifying Timing Belt Rotating Direction
Courtesy of KIA MOTORS AMERICA, INC.

INSPECTION

1. Closely inspect the belt. If the following problems are evident, replace the belt with a new one.
 1. Hardened back surface rubber, back surface glossy. Non-elastic and so hard that even if a finger nail is forced into it, no mark is produced.



G00328076

Fig. 167: Checking Timing Belt (1 Of 4)
Courtesy of KIA MOTORS AMERICA, INC.

2. Cracked surface rubber

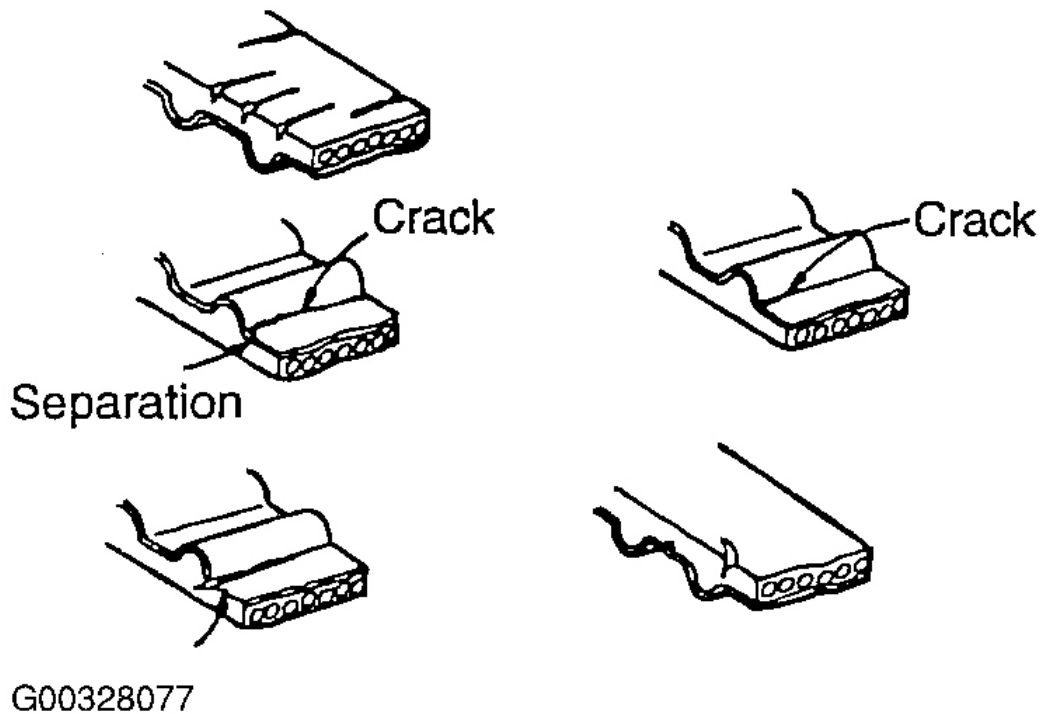
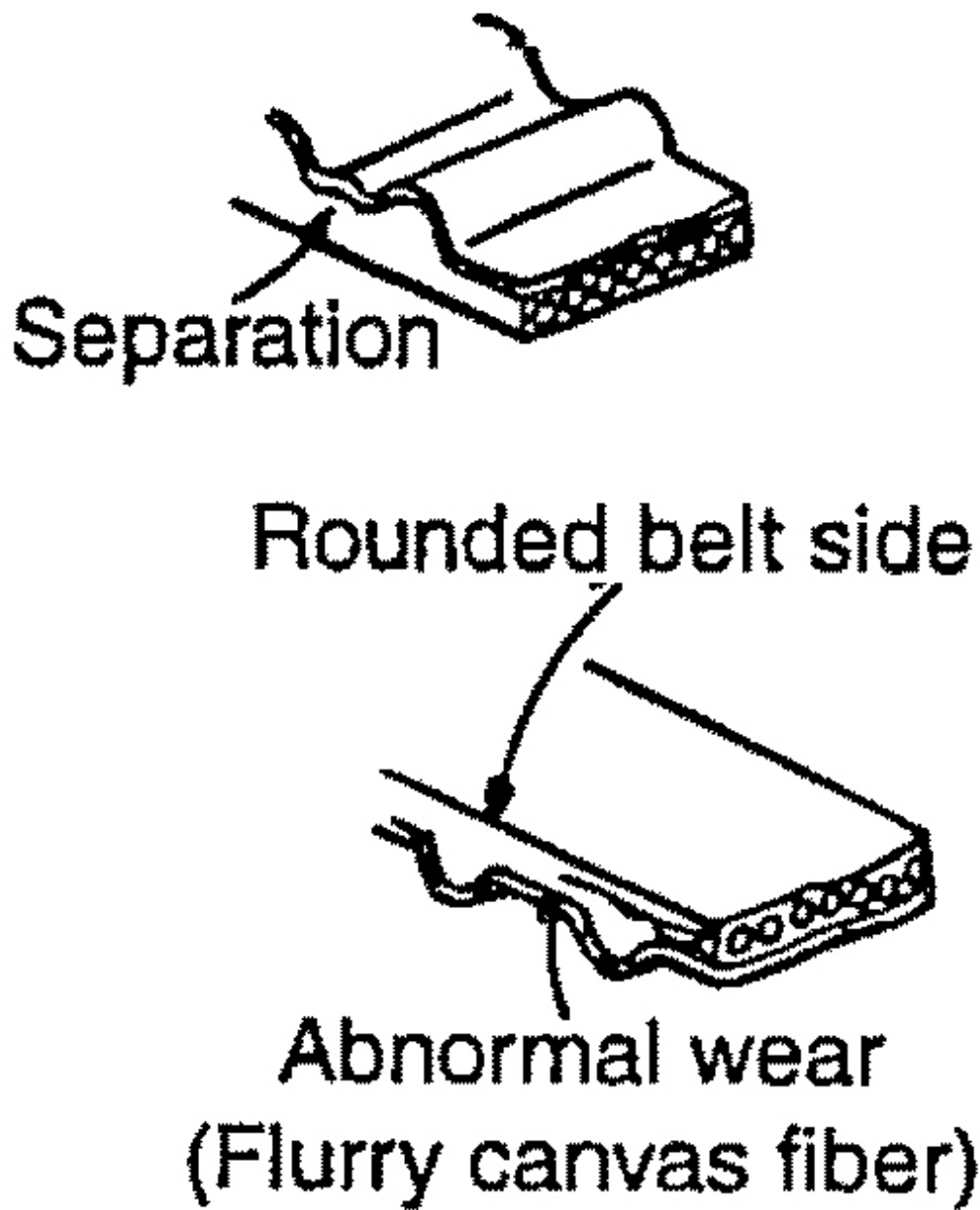


Fig. 168: Checking Timing Belt (2 Of 4)
Courtesy of KIA MOTORS AMERICA, INC.

3. Side of belt badly worn

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



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Fig. 169: Checking Timing Belt (3 Of 4)
Courtesy of KIA MOTORS AMERICA, INC.

4. Teeth badly worn

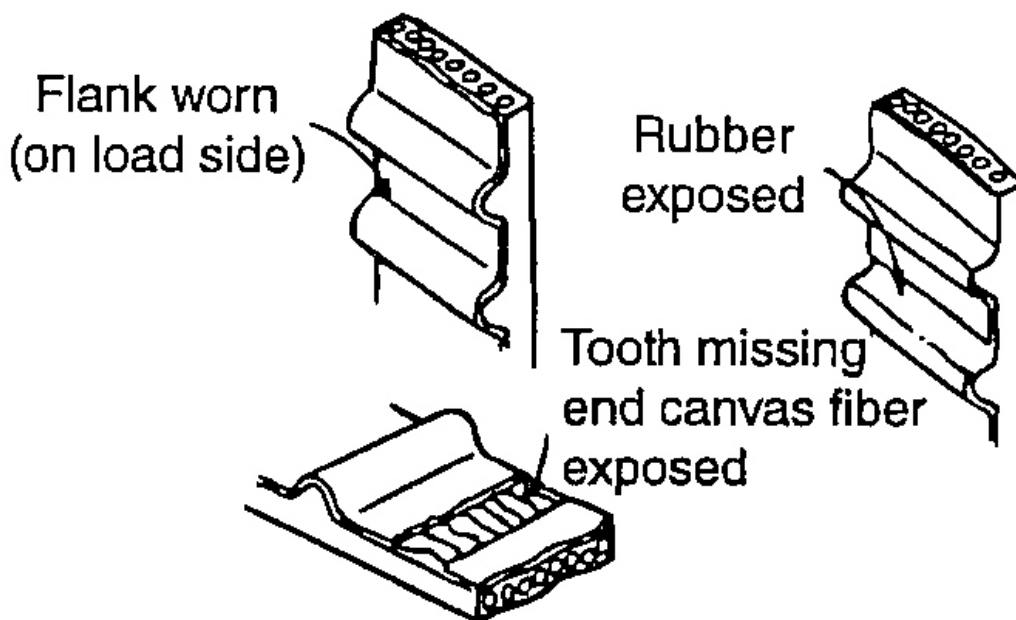
Initial stage:

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

Last stage:

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

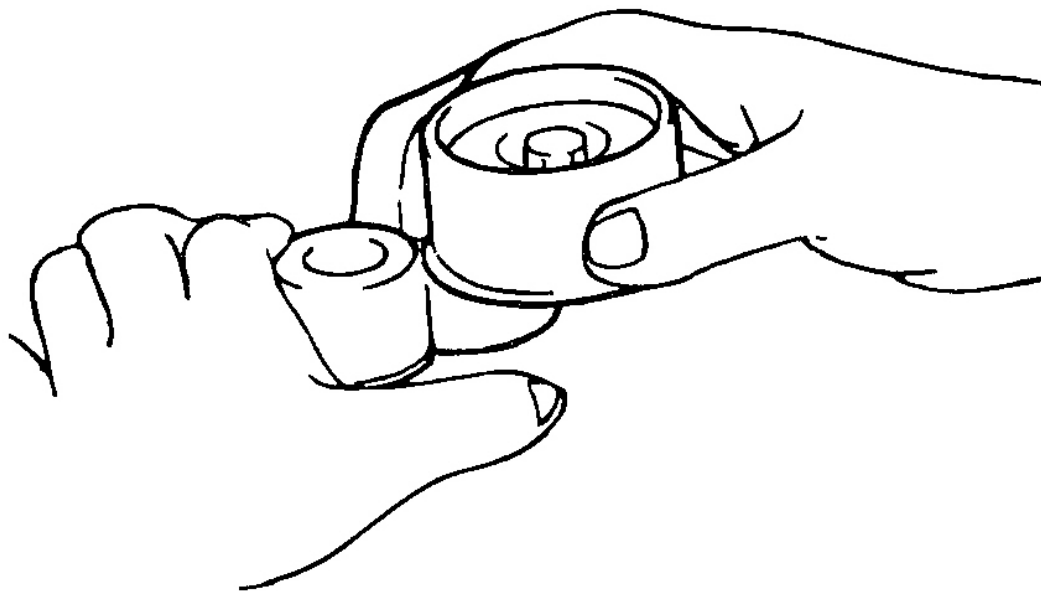
5. Missing tooth



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Fig. 170: Checking Timing Belt (4 Of 4)
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.



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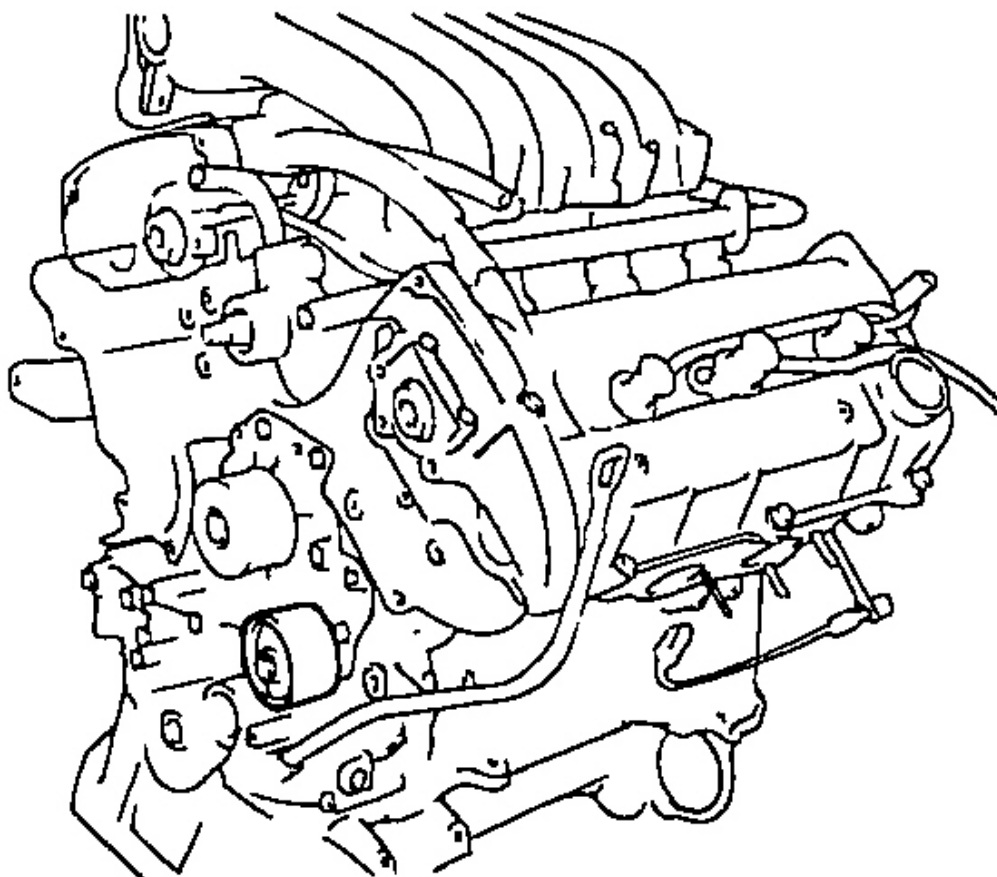
Fig. 171: Checking Timing Belt Tensioner
Courtesy of KIA MOTORS AMERICA, INC.

INSTALLATION

Installing Timing belt and Auto tensioner

1. Install idler pulley to water pump boss.

NOTE: Insert and install idler pulley to the pin spring that is pressed and inserted in the water pump boss.



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Fig. 172: Installing Idler Puller

Courtesy of KIA MOTORS AMERICA, INC.

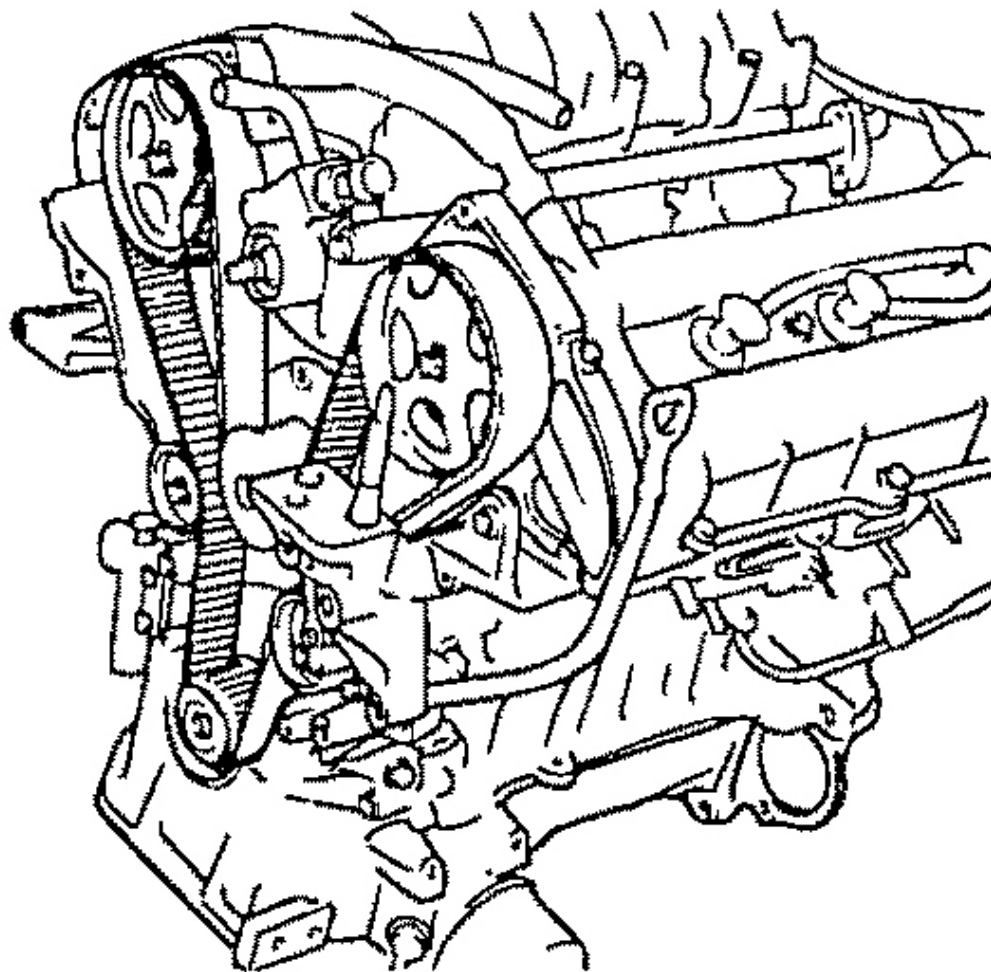
2. Install tensioner arm and plane washer to cylinder block.
3. Install tensioner pulley to the tensioner arm.
4. Install sprockets and align the timing mark.

NOTE:

- When installing camshaft sprocket, fasten the sprocket tightly while holding the hexagonal part of the camshaft.
- Before installing timing belt, if the timing marks of cam sprocket and cylinder head cover do not coincide, do not rotate the cam sprocket more than 3 teeth of sprocket in any direction. Rotating sprocket

more than 3 teeth might make valve and piston touch each other.

- In case of rotating the cam sprocket unavoidably more than 3 teeth, rotate the cam sprocket after rotating 3 teeth in the side of crank counter-clockwise on the base of timing mark.



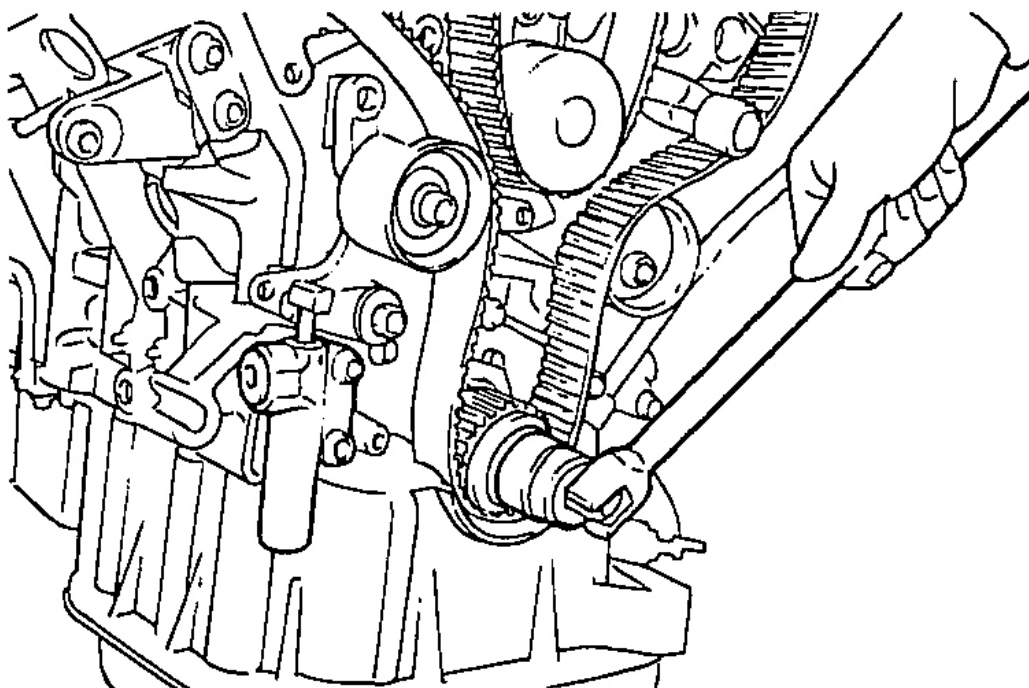
G00328082

Fig. 173: Installing Timing Belt (1 Of 2)

Courtesy of KIA MOTORS AMERICA, INC.

5. Install the auto tensioner to the front case.

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



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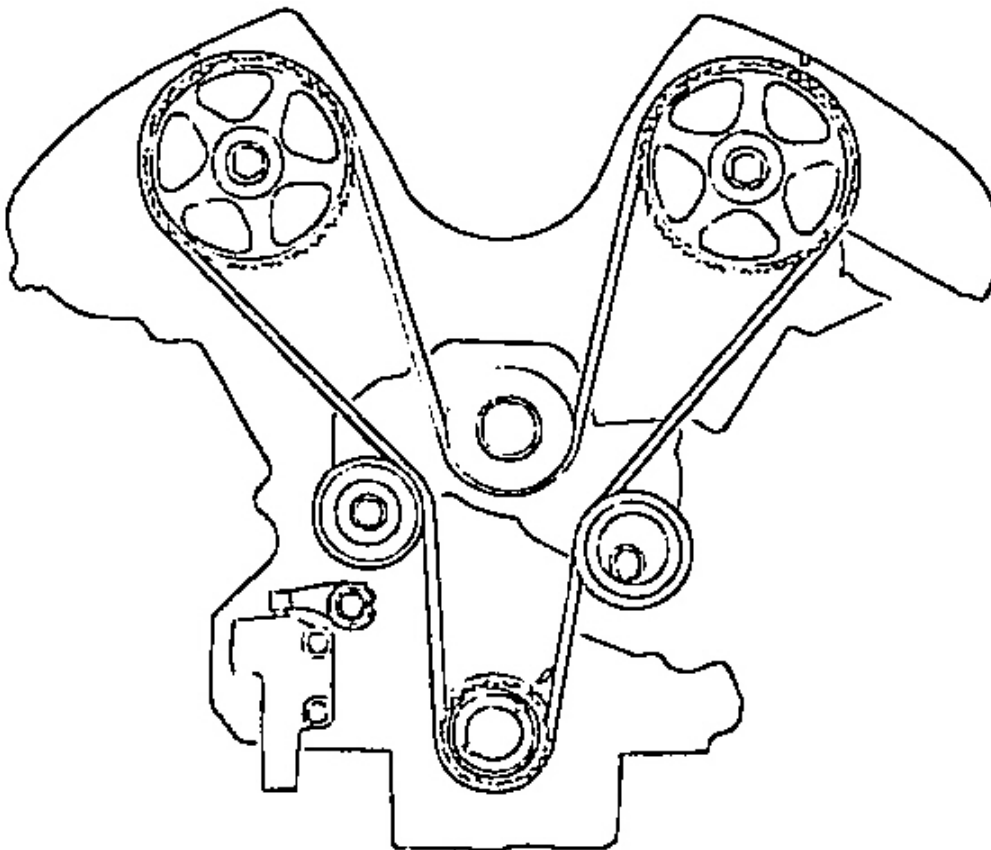
Fig. 174: Installing Timing Belt (2 Of 2)

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 -> Intake cam sprocket (LH side) -> Water pump pulley -> Intake cam sprocket (RH side) -> Tensioner pulley.

NOTE:

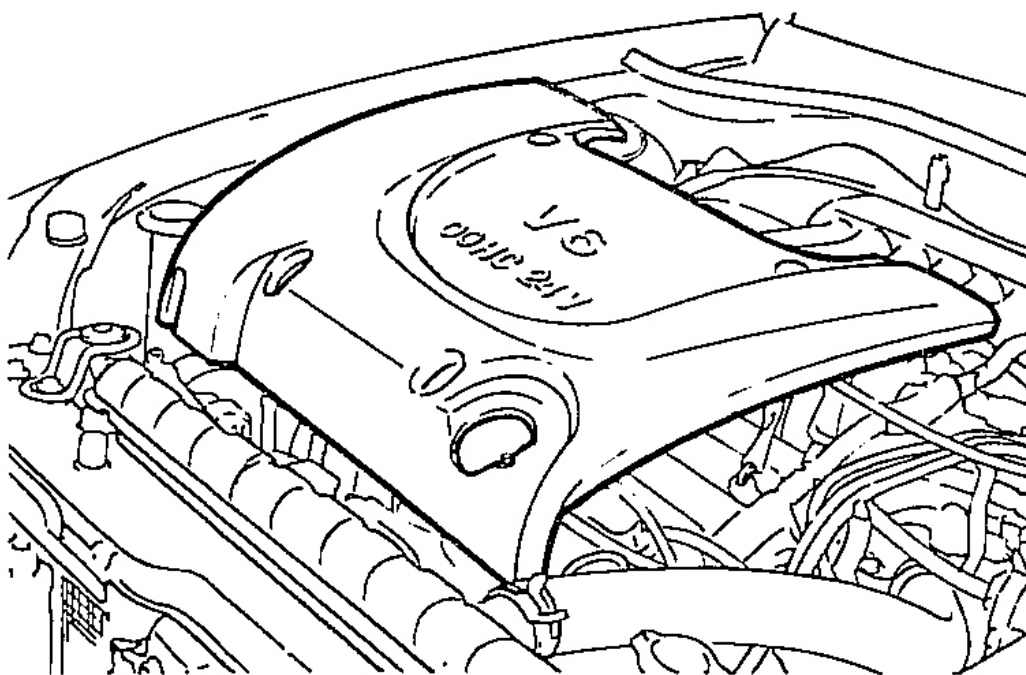
- In this step, No. 1 is in TDC (Compression stroke)
- Do not insert fingers.



G00328084

Fig. 175: Identifying Timing Belt Routing
Courtesy of KIA MOTORS AMERICA, INC.

7. Pull out the set pin of the auto tensioner.
8. Install the engine mount bracket from the engine.
9. Install the engine mounting insulator.
10. Install the upper and lower timing belt covers.
11. Install the coolant pump pulley, idler pulley, tensioner pulley and crankshaft pulley.
12. Using the spanner [16 mm], rotate the tensioner arm clockwise (about 14°) and uninstall the belt from pulley.
13. Install the engine cover.



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Fig. 176: Installing Engine Cover
Courtesy of KIA MOTORS AMERICA, INC.

14. Install the oil filler cap.

Adjusting The Tension Of Timing Belt

1. Rotate the crankshaft in 2 turns clockwise and measure the projected load of auto tensioner in the TDC (#1 Compression stroke) after 5 minutes.
2. Check the projected length is 6-8 mm.
3. Check again if the timing marks of each sprocket are in specified position.

NOTE: If not within specified position, redo procedure from step 6 in the method of installing timing belt and auto tensioner.