

2009 ENGINES

Engine Mechanical - Spectra & Spectra5

GENERAL

SPECIFICATIONS

GENERAL SPECIFICATIONS

Description		Specifications (2.0 CVVT)	Limit
General			
Type		In-line, DOHC	
Number of cylinders		4	
Bore		82 mm (3.2283 in)	
Stroke		93.5 mm (8.6811 in)	
Total displacement		1,975 cc (120.5 cu.in)	
Compression ratio		10.1 : 1	
Firing order		1-3-4-2	
Valve timing			
Intake valve	Opens (ATDC)	11°	
	Closes (ABDC)	59°	
Exhaust valve	Opens (BBDC)	42°	
	Closes (ATDC)	6°	
Cylinder head			
Flatness of gasket surface		Less than 0.03 mm (0.0012 in)	0.06 mm (0.0024 in)
Flatness of manifold mounting surface	Intake	Less than 0.15 mm (0.0059 in)	0.30 mm (0.0118 in)
	Exhaust	Less than 0.15 mm (0.0059 in)	0.30 mm (0.0118 in)
Valve guide hole diameter (Intake, Exhaust)	STD	11.000 ~ 11.018 mm (0.4331 ~ 0.4338 in)	
	0.05 OS	11.050 ~ 11.068 mm (0.4350 ~ 0.4357 in)	
	0.25 OS	11.250 ~ 11.268 mm (0.4429 ~ 0.4436 in)	
	0.50 OS	11.500 ~ 11.518 mm (0.4528 ~ 0.4535 in)	
Intake valve seat ring hole diameter	STD	33.000 ~ 33.025 mm (1.2992 ~ 1.3002 in)	
	0.3 OS	33.300 ~ 33.325 mm (1.3110 ~ 1.3120 in)	

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	0.6 OS	33.600 ~ 33.625 mm (1.3228 ~ 1.3238 in)	
Exhaust valve seat ring hole diameter	STD	28.500 ~ 28.521 mm (1.1220 ~ 1.1229 in)	
	0.3 OS	28.800 ~ 28.821 mm (1.1339 ~ 1.1347 in)	
	0.6 OS	29.100 ~ 29.121 mm (1.1457 ~ 1.1465 in)	
Camshaft			
Cam height	Intake	44.518 ~ 44.718 mm (1.7527 ~ 1.7605 in)	
	Exhaust	44.418 ~ 44.618 mm (1.7487 ~ 1.7566 in)	
Journal outer Diameter (Intake, Exhaust)		27.964 ~ 27.980 mm (1.1009 ~ 1.1016 in)	
Bearing oil clearance		0.02 ~ 0.061 mm (0.0008 ~ 0.0024 in)	0.1 mm (0.0039 in)
End play		0.10 ~ 0.20 mm (0.0039 ~ 0.0079 in)	
Valve			
Valve length	Intake	114.34 mm (4.5016 in)	
	Exhaust	116.8 mm (4.5984 in)	
Stem outer diameter	Intake	5.965 ~ 5.980 mm (0.2348 ~ 0.2354 in)	
	Exhaust	5.950 ~ 5.965 mm (0.2343 ~ 0.2348 in)	
Face angle		45° ~ 45°30'	
Thickness of Valve head (margin)	Intake	1.15 mm (0.0453 in)	0.8 mm (0.0315 in)
	Exhaust	1.35 mm (0.0531 in)	1.0 mm (0.0394 in)
Valve stem to Valve guide clearance	Intake	0.020 ~ 0.050 mm (0.0008 ~ 0.0020 in)	0.10 mm (0.0039 in)
	Exhaust	0.035 ~ 0.065 mm (0.0014 ~ 0.0026 in)	0.13 mm (0.0051 in)
Valve guide			
Length	Intake	45.8 ~ 46.2 mm (1.8031 ~ 1.8189 in)	
	Exhaust	54.3 ~ 54.6 mm (2.1378 ~ 2.1496 in)	
Valve seat			
Width of seat contact	Intake	1.1 ~ 1.5 mm (0.0433 ~ 0.0591 in)	
	Exhaust	1.3 ~ 1.7 mm (0.0512 ~ 0.0669 in)	
	Intake	45° ~ 45°30'	

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Seat angle	Exhaust	45° ~ 45°30'	
Valve spring			
Free length		48.86 mm (1.9236 in)	
Load		18.8 ± 0.9 kg/39.0 mm (41.4 ± 2.0 lb/1.5354 in)	
		41.0 ± 1.5 kg/30.5 mm (90.4 ± 3.3 lb/1.2008 in)	
Out of squareness		Less than 1.5°	3°
Valve clearance			
Cold (20°C ± 5°C) (68°F ± 9°F)	Intake	0.20 mm (0.0079 in)	0.12~0.28 mm (0.0047~0.0110 in)
	Exhaust	0.28 mm (0.0110 in)	0.20~0.38 mm (0.0079~0.0150 in)
Hot (80°C (176°F)) :only for reference	Intake	0.29 mm (0.0114 in)	
	Exhaust	0.34 mm (0.0134 in)	
Cylinder block			
Cylinder bore		82.00 ~ 82.03 mm (3.2283 ~ 3.2295 in)	
Flatness of gasket surface		Total: Less than 0.05 mm (0.0020 in) Bore to bore : Less than 0.03 mm (0.0012 in)	
Piston			
Piston outer diameter		81.970 ~ 82.000 mm (3.2272 ~ 3.2283 in)	
Piston to cylinder clearance		0.020 ~ 0.040 mm (0.0008 ~ 0.0016 in)	
Ring groove width	No. 1 ring groove	1.23 ~ 1.25 mm (0.0484 ~ 0.0492 in)	
	No. 2 ring groove	1.22 ~ 1.24 mm (0.0480 ~ 0.0488 in)	
	Oil ring groove	2.51 ~ 2.53 mm (0.0988 ~ 0.0996 in)	
Piston ring			
Side clearance	No. 1 ring	0.04 ~ 0.08 mm (0.0016 ~ 0.0031 in)	0.1 mm (0.0039 in)
	No. 2 ring	0.03 ~ 0.07 mm (0.0012 ~ 0.0028 in)	0.1 mm (0.0039 in)
	Oil ring	0.06 ~ 0.15 mm (0.0024 ~ 0.0059 in)	0.2 mm (0.0079 in)
End gap	No. 1 ring	0.23 ~ 0.38 mm (0.0091 ~ 0.0150 in)	1.0 mm (0.0394 in)
	No. 2 ring	0.33 ~ 0.48 mm (0.0130 ~ 0.0189 in)	1.0 mm (0.0394 in)

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	Oil ring	0.20 ~ 0.60 mm (0.0079 ~ 0.0236 in)	1.0 mm (0.0394 in)
Piston pin			
Piston pin outer diameter		20.001 ~ 20.006 mm (0.7874 ~ 0.7876 in)	
Piston pin hole inner diameter		20.016 ~ 20.021 mm (0.7880 ~ 0.7882 in)	
Piston pin hole clearance		0.010 ~ 0.020 mm (0.0004 ~ 0.0008 in)	
Connecting rod small end hole inner diameter		19.974 ~ 19.985 mm (0.7864 ~ 0.7868 in)	
Connecting rod small end hole clearance		-0.032 ~ -0.016 mm (-0.0013 ~ -0.0006 in)	
Piston pin press-in load		350 ~ 1,350 kg (772 ~ 2,976 lb)	
Connecting rod			
Connecting rod big end inner diameter		48.000 ~ 48.018 mm (1.8898 ~ 1.8905 in)	
Connecting rod bearing oil clearance		0.024 ~ 0.044 mm (0.0009 ~ 0.0017 in)	
Side clearance		0.10 ~ 0.25 mm (0.0039 ~ 0.0098 in)	0.4 mm (0.0157 in)
Crankshaft			
Main journal outer diameter		56.942 ~ 56.962 mm (2.2418 ~ 2.2426 in)	
Pin journal outer diameter		44.946 ~ 44.966 mm (1.7695 ~ 1.7703 in)	
Main bearing oil clearance		0.028 ~ 0.048 mm (0.0011 ~ 0.0019 in)	0.1 mm (0.0039 in)
End play		0.06 ~ 0.260 mm (0.0024 ~ 0.0102 in)	0.3 mm (0.0118 in)
Flywheel			
Runout		0.1 mm (0.0039 in)	0.13 mm (0.0051 in)
Oil pump			
Side clearance	Inner rotor	0.040 ~ 0.085 mm (0.0016 ~ 0.0033 in)	
	Outer rotor	0.040 ~ 0.090 mm (0.0016 ~ 0.0035 in)	
Body clearance		0.120 ~ 0.185 mm (0.0047 ~ 0.0073 in)	
Relief valve opening pressure		490 ± 49.0 kpa (5 ± 0.5 kg/cm ² , 71 ± 7.1 psi)	
	Free length	43.8 mm (1.7244 in)	
	Load	3.7 ± 0.4 kg/40.1 mm	

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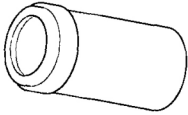
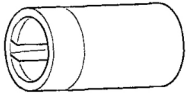
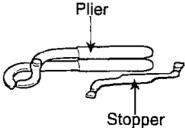
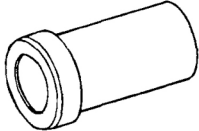
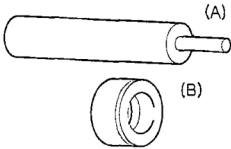
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Relief spring		(8.2 ± 0.9 lb/1.5787 in) 9.7 ± 0.4 kg/34.3 mm (21.4 ± 0.9 lb/1.3504 in)	
Engine oil			
Oil quantity (Total)		4.0 L (4.23 US qt, 3.52 lmp qt)	
Oil quantity (Oil pan)		3.7 L (3.91 US qt, 3.26 lmp qt)	
Oil quantity (Oil filter)		0.3 L (0.32 US qt, 0.26 lmp qt)	
Oil quality		Above SH	
Oil pressure (Idle)		156.9 kpa (1.6 kg/cm ² , 22.8 psi)	
Cooling system			
Cooling method		Forced circulation with cooling fan	
Coolant quantity		8.14 L (8.60 US qt, 7.16 lmp qt)	
Thermostat	Type	Wax pellet type	
	Opening temperature	82 ± 1.5°C (179.6 ± 2.7° F)	
	Pull opening temperature	95°C (203°F)	
Radiator cap	Main valve opening pressure	93.16 ~ 122.58 kpa (0.95 ~ 1.25kg/cm ² , 13.51 ~ 17.78 psi)	
	Vacuum valve opening pressure	0.98 ~ 4.90 kpa (0.01 ~ 0.05 kg/cm ² , 0.14 ~ 0.71 psi)	
Water temperature sensor			
Type		Thermistor type	
Resistance	20°C (68°F)	2.45 ± 0.14 kohms	
	80°C (176°F)	0.3222 kohms	

SPECIAL SERVICE TOOLS

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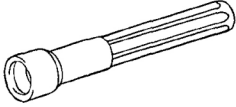
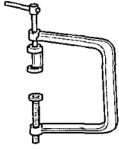
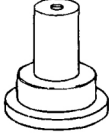
Tool (Number and name)	Illustration	Use
Crankshaft front oil seal installer (09214-32000)		Installation of the front oil seal
Crankshaft front oil seal guide (09214-32100)		Installation of the front oil seal
Valve clearance adjust tool set (09220-2D000)		Removal and installation of the tappet shim
Camshaft oil seal installer (09221-21000)		Installation of the camshaft oil seal
Valve guide remover (09221-3F100 (A)) Valve guide installer (09221-3F100 (B))		Removal and installation of the valve guide

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Fig. 1: Identifying Service Tools (1 Of 2)
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Tool (Number and name)	Illustration	Use
Valve stem oil seal installer (09222-22001)		Installation of the valve stem oil seal
Valve spring compressor (09222-28000) Valve spring compressor adaptor (09222-28100)		Removal and installation of the intake or exhaust valve
Crankshaft rear oil seal installer (09231-21000)		Installation of the crankshaft rear oil seal

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

TROUBLESHOOTING

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Symptom	Suspect area	Remedy
Engine misfire with abnormal internal lower engine noises.	Loose or improperly installed engine flywheel.	Repair or replace the flywheel as required.
	Worn piston rings. (Oil consumption may or may not cause the engine to misfire.)	Inspect the cylinder for a loss of compression. Repair or replace as required.
	Worn crankshaft thrust bearings.	Replace the crankshaft and bearings as required.
Engine misfire with abnormal valve train noise.	Stuck valves. (Carbon buildup on the valve stem can cause the valve not to close properly.)	Repair or replace as required.
	Excessive worn or mis-aligned timing chain.	Replace the timing chain and sprocket as required.
	Worn camshaft lobes.	Replace the camshaft and valve lifters.
Engine misfire with coolant consumption	- Faulty cylinder head gasket and/or cracking or other damage to the cylinder head and engine block cooling system. - Coolant consumption may or may not cause the engine to overheat.	- Inspect the cylinder head and engine block for damage to the coolant passages and/or a faulty head gasket. - Repair or replace as required.
Engine misfire with excessive oil consumption	Worn valves, valve guides and/or valve stem oil seals.	Repair or replace as required.
	Worn piston rings. (Oil consumption may or may not cause the engine to misfire)	Inspect the cylinder for a loss of compression Repair or replace as required.
Engine noise on start-up, but only lasting a few seconds.	Incorrect oil viscosity.	Drain the oil. Refill with the correct viscosity oil.
	Worn crankshaft thrust bearing.	Inspect the thrust bearing and crankshaft. Repair or replace as required.
Upper engine noise, regardless of engine speed.	Low oil pressure.	Repair or replace as required.
	Broken valve spring.	Replace the valve spring.
	Worn or dirty valve lifters.	Replace the valve lifters.
	Stretched or broken timing chain and/or damaged sprocket teeth.	Replace the timing chain and sprockets.
	Worn timing chain tensioner, if applicable.	Replace the timing chain tensioner as required.
	Worn camshaft lobes.	Inspect the camshaft lobes. Replace the camshaft and valve lifters as required.
	Worn valve guides or valve stems.	Inspect the valves and valve guides, then repair as required.
	Stuck valves. (Carbon on the valve stem or valve seat may cause the valve to stay open.)	Inspect the valves and valve guides, then repair as required.

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Fig. 3: Troubleshooting Symptom Chart (1 Of 3)
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Symptom	Suspect area	Remedy
Lower engine noise, regardless of engine speed.	Low oil pressure.	Repair or replace damaged components as required.
	Loose or damaged flywheel.	Repair or replace the flywheel.
	Damaged oil pan, contacting the oil pump screen.	Inspect the oil pan. Inspect the oil pump screen. Repair or replace as required.
	Oil pump screen loose, damaged or restricted.	Inspect the oil pump screen. Repair or replace as required.
	Excessive piston-to-cylinder bore clearance.	Inspect the piston and cylinder bore. Repair as required.
	Excessive piston pin-to-bore clearance.	Inspect the piston, piston pin and the connecting rod. Repair or replace as required.
	Excessive connecting rod bearing clearance.	Inspect the following components and repair as required. • The connecting rod bearings. • The connecting rods. • The crankshaft. • The crankshaft journal.
	Excessive crankshaft bearing clearance.	Inspect the following components and repair as required. • The crankshaft bearings. • The crankshaft journals.
	Incorrect piston, piston pin and connecting rod installation.	Verify the piston pins and connecting rods are installed correctly. Repair as required.
Engine noise under load.	Low oil pressure.	Repair or replace as required.
	Excessive connecting rod bearing clearance.	Inspect the following components and repair as required. • The connecting rod bearings. • The connecting rods. • The crankshaft.
	Excessive crankshaft bearing clearance.	Inspect the following components and repair as required. • The crankshaft bearings. • The crankshaft journals. • The cylinder block crankshaft bearing bore.

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Fig. 4: Troubleshooting Symptom Chart (2 Of 3)
Courtesy of KIA MOTORS AMERICA, INC.

Symptom	Suspect area	Remedy
Engine will not crank. (crankshaft will not rotate)	Hydraulically locked cylinder. - Coolant/antifreeze in cylinder. - Oil in cylinder. - Fuel in cylinder.	Remove spark plugs and check for fluid. Inspect for broken head gasket. Inspect for cracked engine block or cylinder head. Inspect for a sticking fuel injector and/or leaking fuel regulator.
	Broken timing chain and/or timing chain gears.	Inspect timing chain and gears. Repair as required.
	Foreign material in cylinder. - Broken valve. - Piston material. - Foreign material.	Inspect cylinder for damaged components and/or foreign materials. Repair or replace as required.
	Seized crankshaft or connecting rod bearings.	Inspect crankshaft and connecting rod bearing. Repair or replace as required.
	Bent or broken connecting rod.	Inspect connecting rods. Repair or replace as required.
	Broken crankshaft.	Inspect crankshaft. Repair or replace as required.

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Fig. 5: Troubleshooting Symptom Chart (3 Of 3)
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COMPRESSION PRESSURE INSPECTION

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

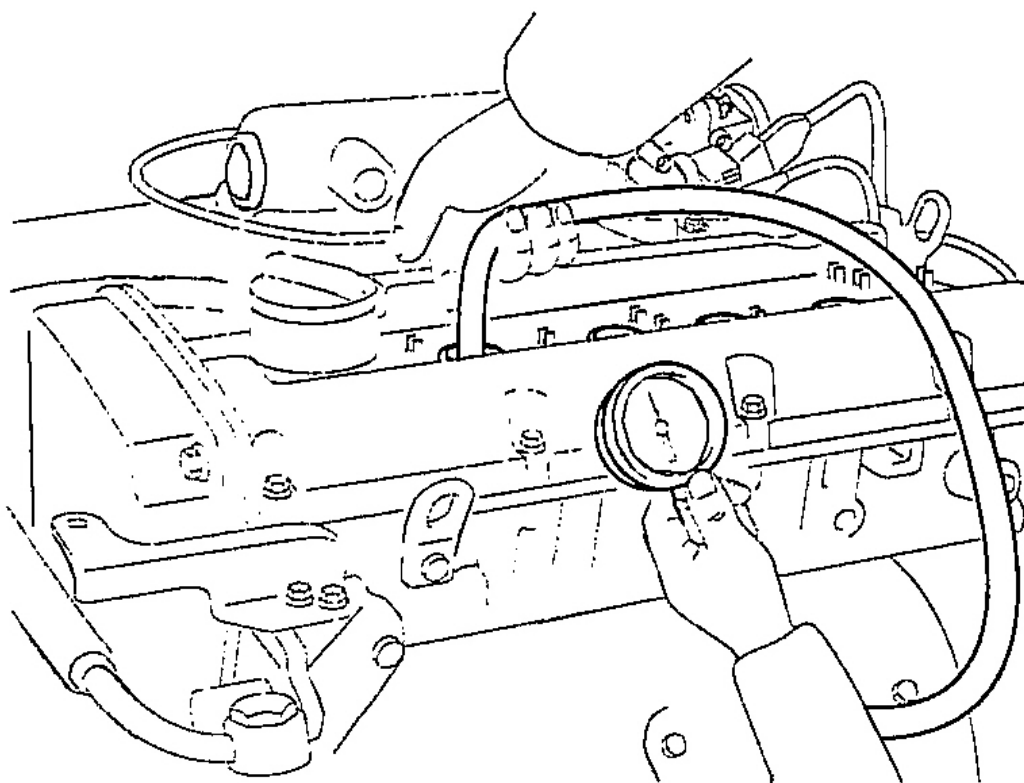
1. Warm up and stop engine.

Allow the engine to warm up to normal operating temperature.

2. Remove ignition coils.
3. Remove spark plugs.

Using a 16mm plug wrench, remove the 4 spark plugs.

4. Check the cylinder compression pressure.
 - a. Insert a compression gauge into the spark plug hole.



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Fig. 6: Testing Cylinder Compression
Courtesy of KIA MOTORS AMERICA, INC.

- b. Fully open the throttle.
- c. While cranking the engine, measure the compression pressure.

NOTE: Always use a fully charged battery to obtain engine speed of 250 RPM or more.

- d. Repeat step (1) through (3) for each cylinder.

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

Compression pressure: 1,422 kPa (14.5 kg/cm² , 206 psi) (250-400 RPM)

Minimum pressure: 1,275 kPa (13.0 kg/cm² , 185 psi)

Difference between each cylinder: 98 kPa (1.0 kg/cm² , 14 psi) or less

- e. If the cylinder compression in 1 or more cylinders is low, pour a small amount of engine oil into the cylinder through the spark plug hole and repeat step (1) through (3) for cylinders with low compression.

NOTE:

- If adding oil helps the compression, it is likely that the piston rings and/or cylinder bore are worn or damaged.
- If pressure stays low, a valve may be sticking or seating improperly, or there may be leakage past the gasket.

5. Reinstall the spark plugs.
6. Connect the ignition coil connectors and the spark plug cables.

TIMING BELT TENSION ADJUSTMENT

1. Remove the engine cover.

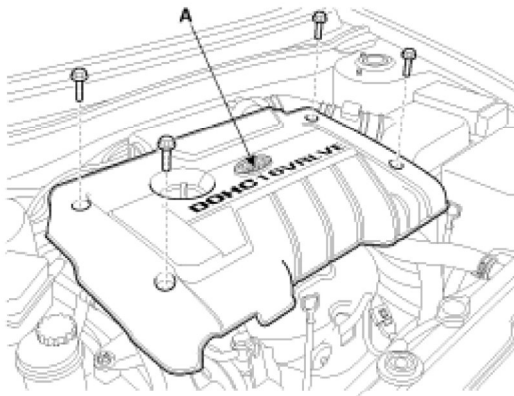
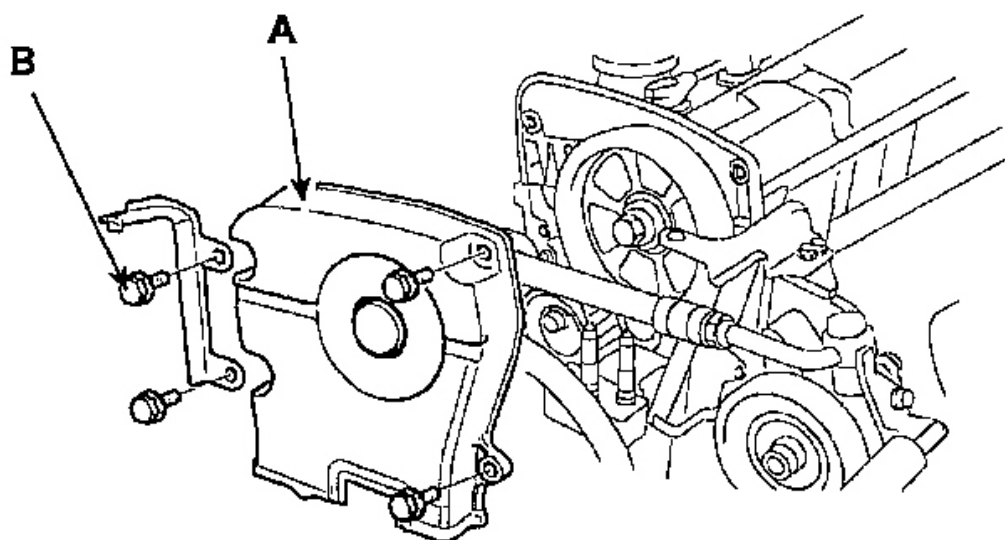


Fig. 7: Removing/Installing Engine Cover
Courtesy of KIA MOTORS AMERICA, INC.

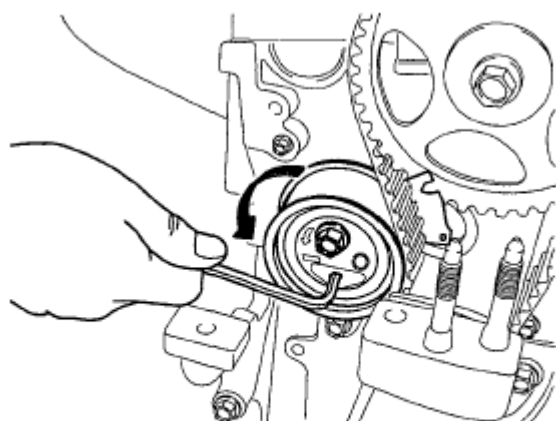
2. Remove the RH front wheel.
3. Remove the RH side cover bolts (B) and cover (A).
4. Remove the 4bolts (B) and timing belt upper cover (A).



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Fig. 8: Removing Timing Belt Upper Cover
Courtesy of KIA MOTORS AMERICA, INC.

5. Using a hex wrench, turn the adjuster counterclockwise to make the indicator of the arm (A) located at the center of the base notch.



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Fig. 9: Checking Timing Belt Tension
Courtesy of KIA MOTORS AMERICA, INC.

6. Tightening tensioner bolt with fixing the indicator not to move.

Tightening torque

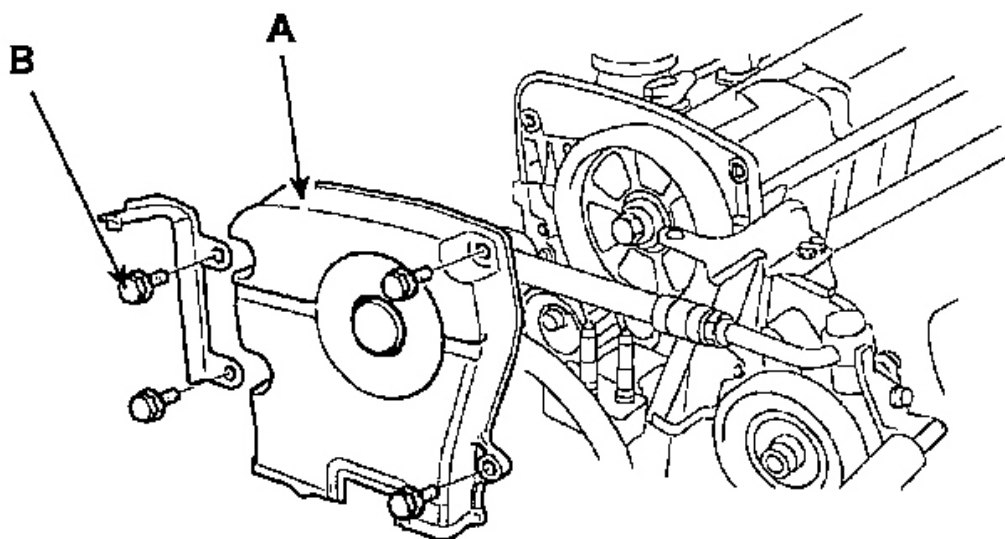
Tensioner bolt :

22.6 ~ 28.4 Nm (2.3 ~ 2.9 kgf.m, 16.6 ~ 21.0 lb-ft)

7. Turn the crankshaft two revolutions in the operating direction (clockwise) and check that the indicator is in the center of base.
8. If the indicator is not located at the center of base, slacken the bolt and repeat the above procedure.
9. Install the timing belt upper cover (A) with the four bolts (B).

Tightening torque :

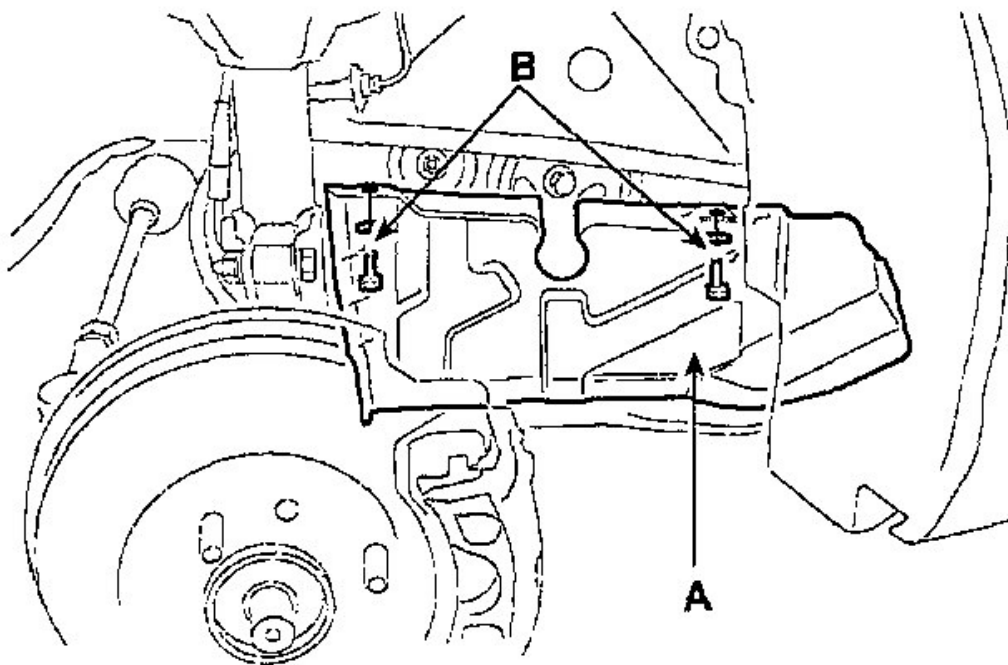
7.8 ~ 9.8 Nm (0.8 ~ 1.0 kgf.m, 5.8 ~ 7.2 lb-ft)



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Fig. 10: Removing Timing Belt Upper Cover
Courtesy of KIA MOTORS AMERICA, INC.

10. Install the RH side cover (A).



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Fig. 11: Installing RH Side Cover
Courtesy of KIA MOTORS AMERICA, INC.

11. Install the RH front wheel.
12. Install engine cover (A) with the four bolts.

Tightening torque :

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

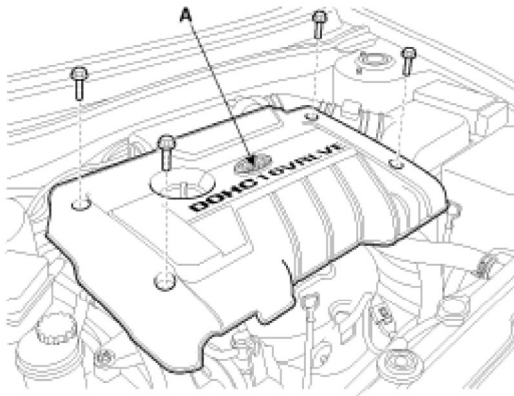


Fig. 12: Removing/Installing Engine Cover
Courtesy of KIA MOTORS AMERICA, INC.

VALVE CLEARANCE INSPECTION & ADJUSTMENT

INSPECTION

MLA (MECHANICAL LASH ADJUSTER)

NOTE: Inspect and adjust the valve clearance when the engine is cold (Engine coolant temperature: $20^{\circ}\text{C} \pm 5^{\circ}\text{C}$ [$68^{\circ}\text{F} \pm 9^{\circ}\text{F}$]) and cylinder head is installed on cylinder block.

1. Remove the engine cover (A).

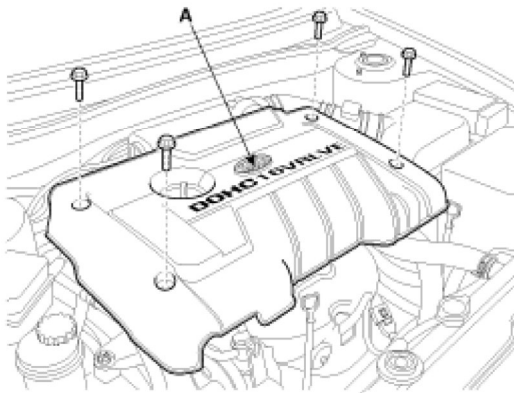
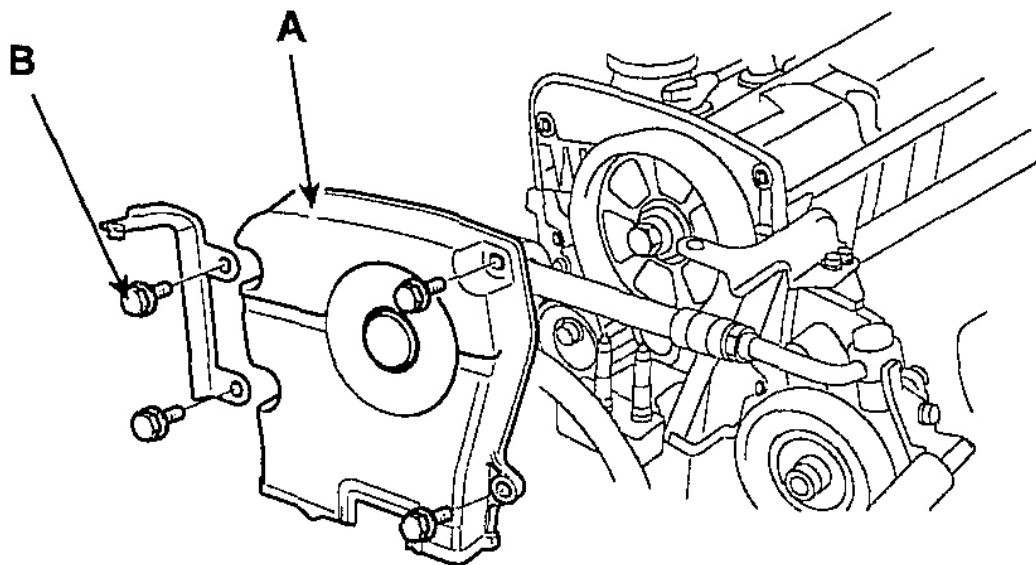


Fig. 13: Removing/Installing Engine Cover
Courtesy of KIA MOTORS AMERICA, INC.

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



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Fig. 14: Removing Timing Belt Upper Cover
Courtesy of KIA MOTORS AMERICA, INC.

3. Remove the cylinder head cover.
 - a. Disconnect the spark plug cables and do not pull on the cable by force.

NOTE: Pulling on or bending the cables may damage the conductor inside.

- b. Remove the PCV (Positive Crankcase Ventilation) hose (A) and the breather hose (B) from the cylinder head cover.

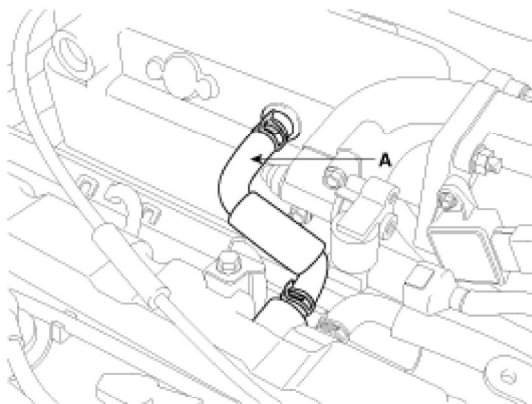
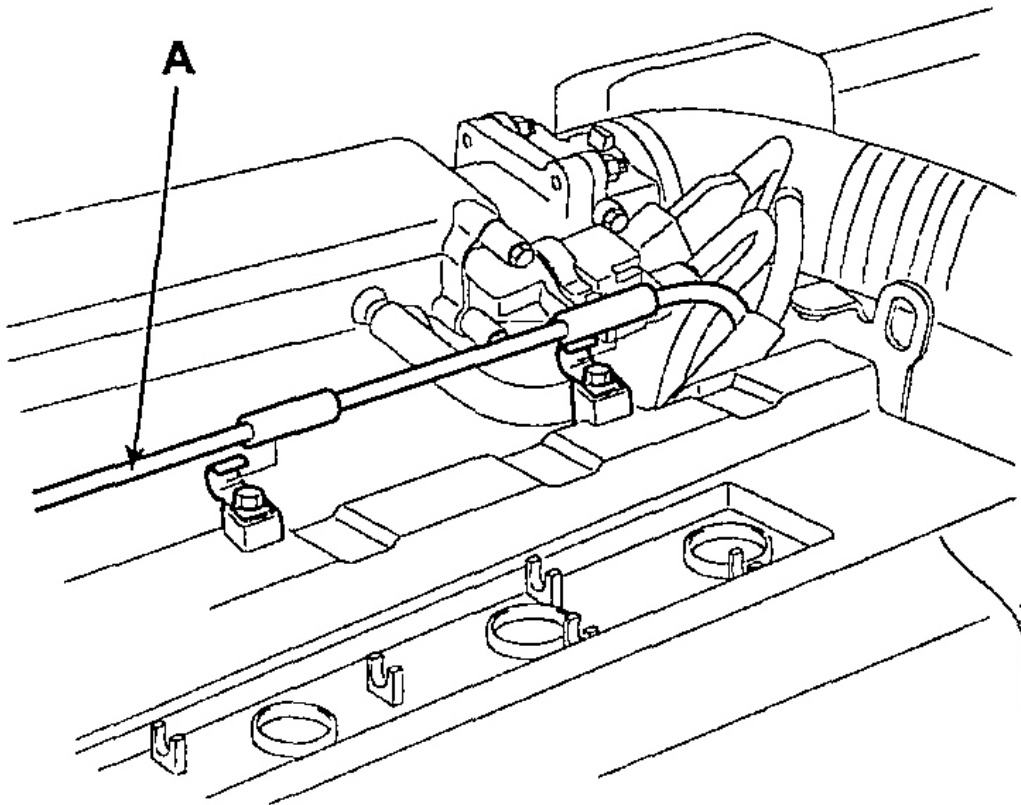


Fig. 15: PCV Hose
Courtesy of KIA MOTORS AMERICA, INC.

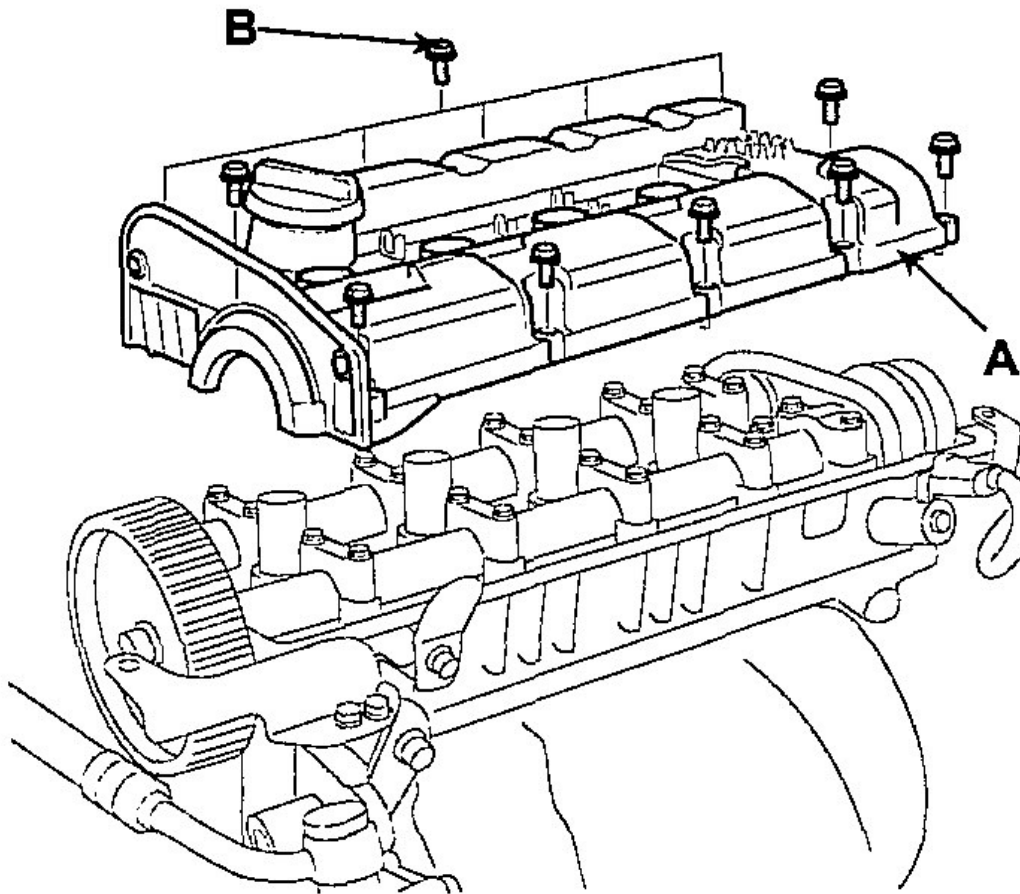
- c. Remove the accelerator cable (A) from the cylinder head cover.



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Fig. 16: Removing Accelerator Cable
Courtesy of KIA MOTORS AMERICA, INC.

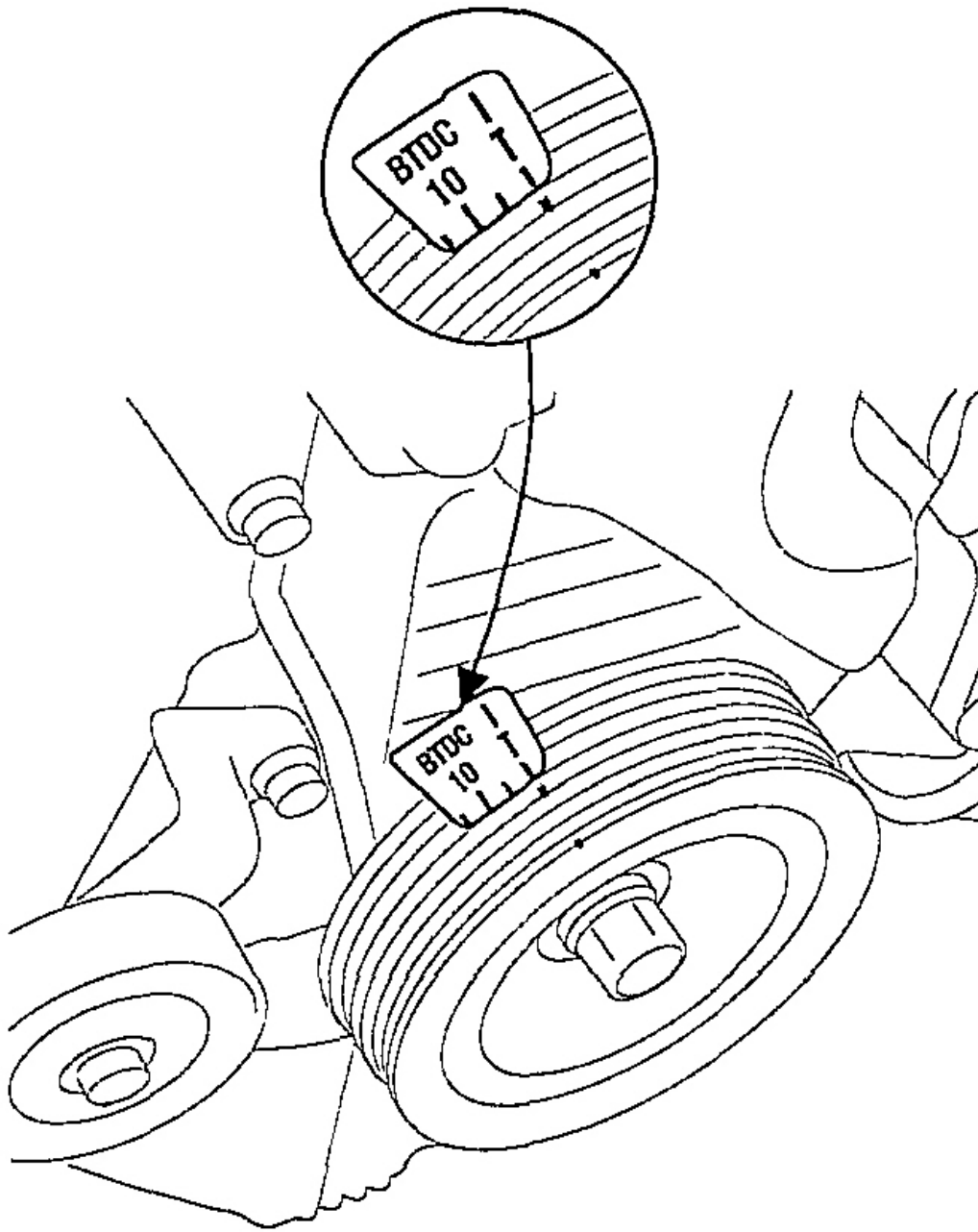
- d. Loosen the cylinder head cover bolts (B) and then remove the cover (A) and gasket.



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Fig. 17: Loosening Cylinder Head Cover Bolts
Courtesy of KIA MOTORS AMERICA, INC.

4. Set No. 1 cylinder to TDC/compression.
 - a. Turn the crankshaft pulley and align its groove with the timing mark " T" of the lower timing belt cover.

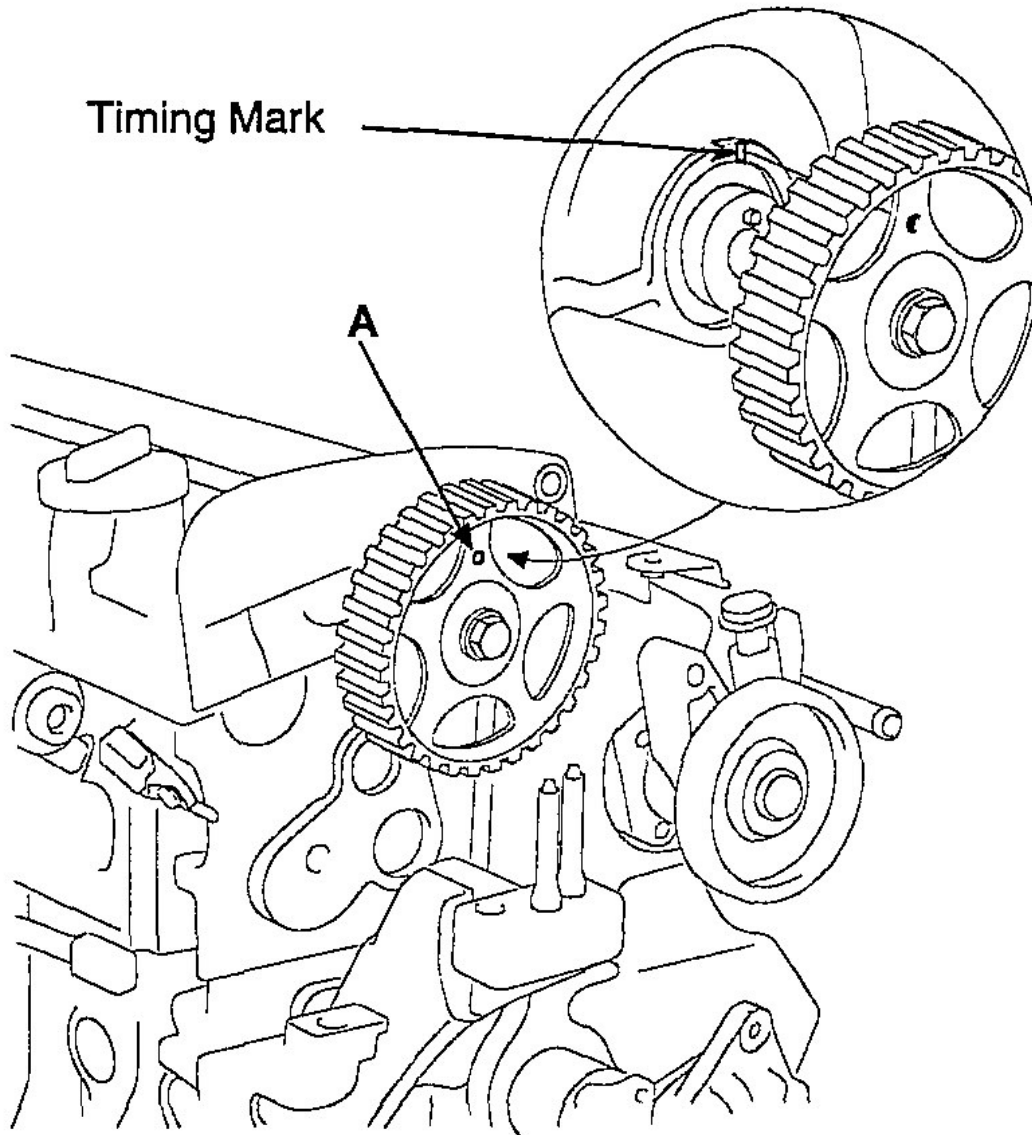


G00718957

Fig. 18: Aligning Timing Marks
Courtesy of KIA MOTORS AMERICA, INC.

- b. Check that the hole of the camshaft timing pulley (A) is aligned with the timing mark of the bearing

cap. If not, turn the crankshaft one revolution (360°).



G00718958

Fig. 19: Aligning Camshaft Timing Marks
Courtesy of KIA MOTORS AMERICA, INC.

5. Inspect the valve clearance.
 - a. Check only the valve indicated. [No. 1 cylinder: TDC/compression]. Measure the valve clearance.
 - Using a thickness gauge, measure the clearance between the tappet shim and the base circle

of camshaft.

- Record the out-of-specification valve clearance measurements. They will be used later to determine the required replacement adjusting shim.

- **Valve clearance**

Specification

Engine coolant temperature: (20°C +/- 5°C [68°F +/- 9°F])

Intake: 0.20 mm (0.0079 in)

Exhaust: 0.28 mm (0.0110 in)

Limit

Intake : 0.17 ~ 0.23mm (0.0067 ~ 0.091in.)

Exhaust : 0.25 ~ 0.31mm (0.0098 ~ 0.0122 n.)

Reference Data

Engine coolant temperature: 80°C [176°F]

Intake: 0.29 mm (0.0114 in)

Exhaust: 0.34 mm (0.0134 in)

- b. Turn the crankshaft pulley one revolution (360°) and align the groove with the timing mark "T" of lower timing belt cover.
 - c. Check only valves indicated in illustration. [No. 4 cylinder: TDC/compression]. Measure the valve clearance.
6. Adjust the intake and exhaust valve clearance.
 - a. Turn the crankshaft so that the cam lobe of the camshaft on the adjusting valve is upward.
 - b. Using the Service Tool (09220 - 2D000), press down the valve lifter and place the stopper between the camshaft and valve lifter and remove the special tool.

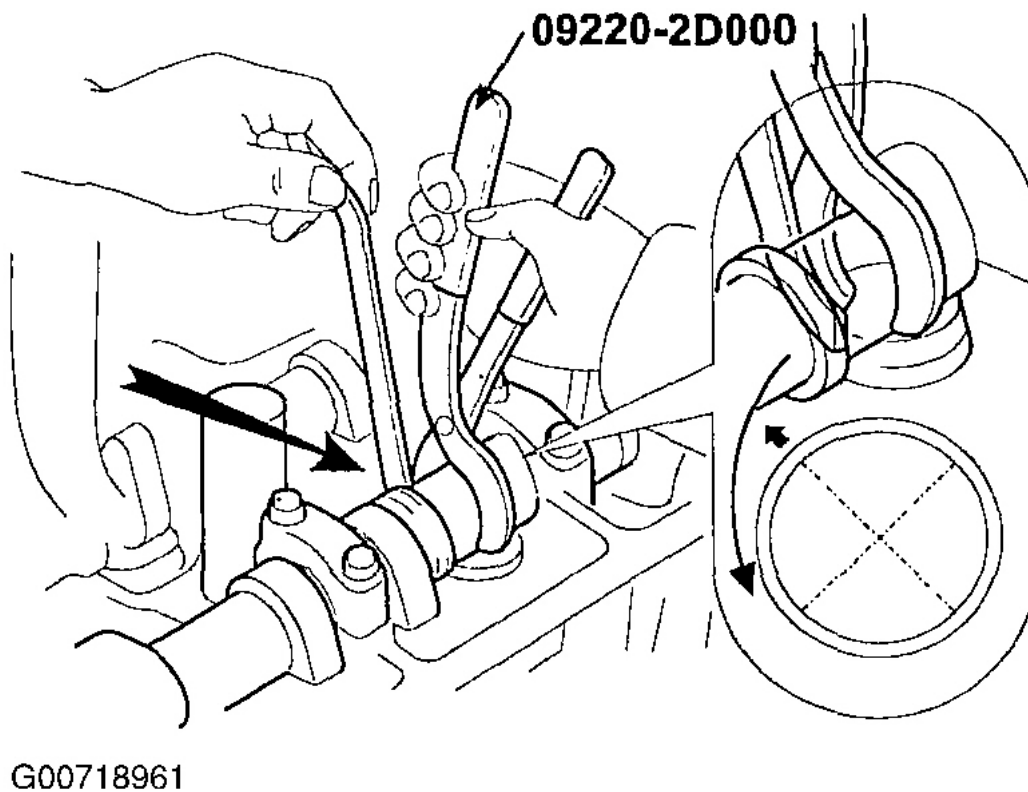
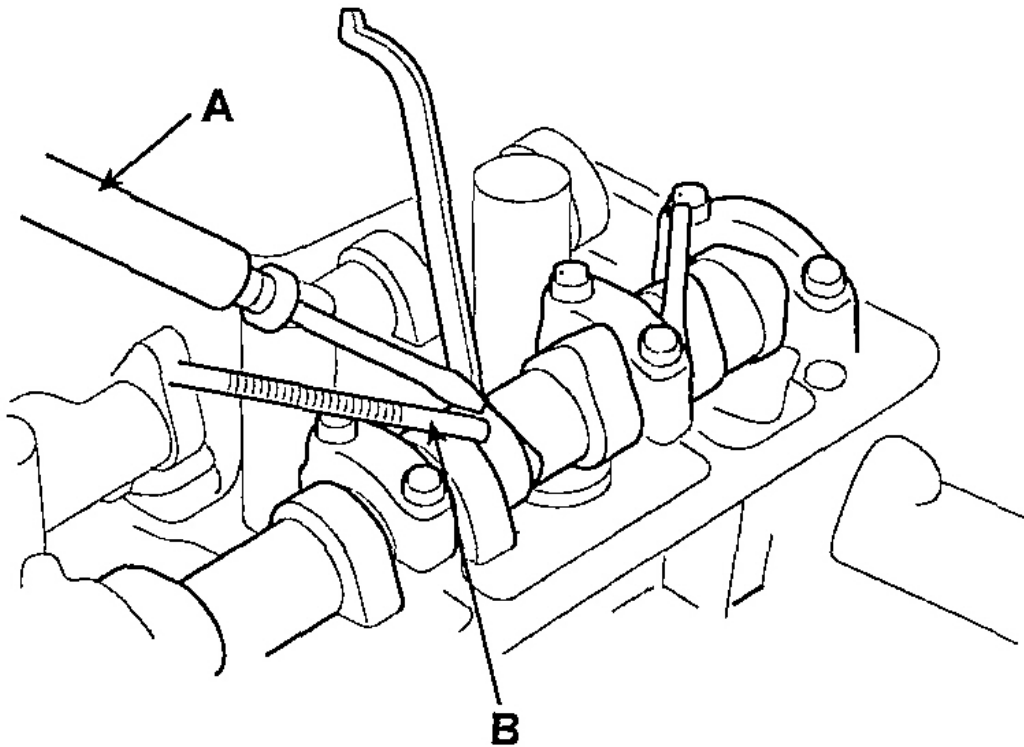


Fig. 20: Depressing Valve Lifter
Courtesy of KIA MOTORS AMERICA, INC.

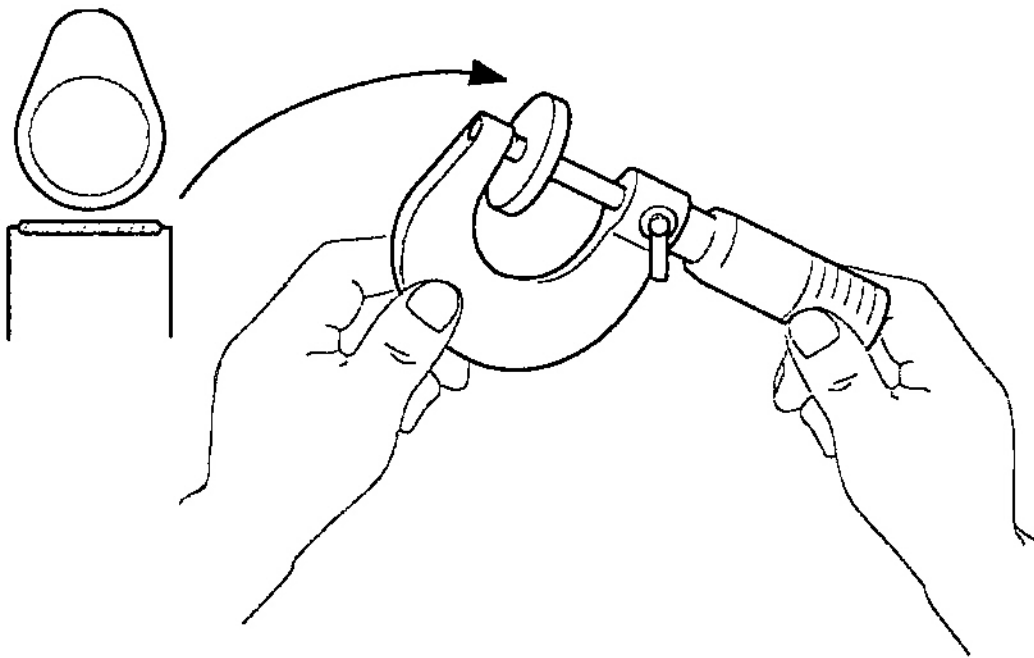
- c. Remove the adjusting shim with a small screw driver (A) and magnet (B).



G00718962

Fig. 21: Removing Adjusting Shim
Courtesy of KIA MOTORS AMERICA, INC.

- d. Measure the thickness of the removed shim using a micrometer.



G00718963

Fig. 22: Measuring Shim Thickness
Courtesy of KIA MOTORS AMERICA, INC.

- e. Calculate the thickness of a new shim so that the valve clearance comes within the specified value.

Valve clearance

Engine coolant temperature: (20°C +/- 5°C [68°F +/- 9°F])

T: Thickness of removed shim

A: Measured valve clearance

N: Thickness of new shim

Intake: $N = T + [A - 0.20 \text{ mm (0.0079 in)}]$

Exhaust: $N = T + [A - 0.28 \text{ mm (0.0110 in)}]$

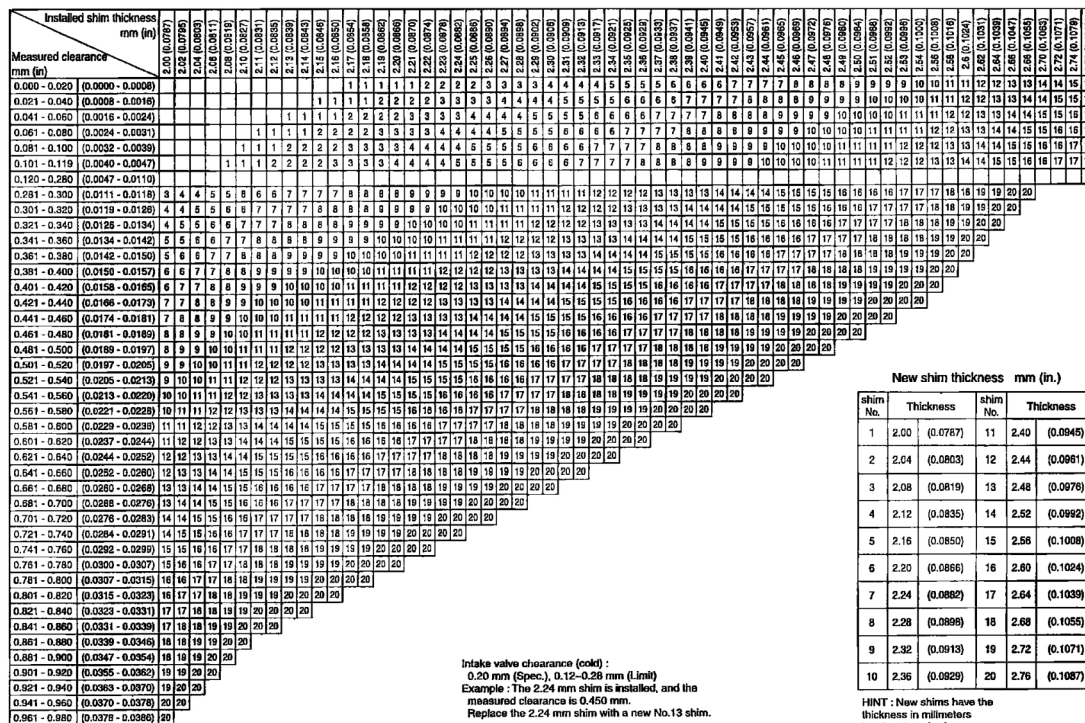
- f. Select a new shim with a thickness as close as possible to the calculated value. See **Fig. 23** and **Fig. 24**.

NOTE: Shims are available in 20 size increments of 0.04 mm (0.0016 in) from 2.00 mm (0.0787 in) to 2.7 mm (0.1087 in).

- g. Place a new adjusting shim on the valve lifter.
h. Using the Service Tool (09220 - 2D000), press down the valve lifter and remove the stopper.

2009 Kia Spectra SX

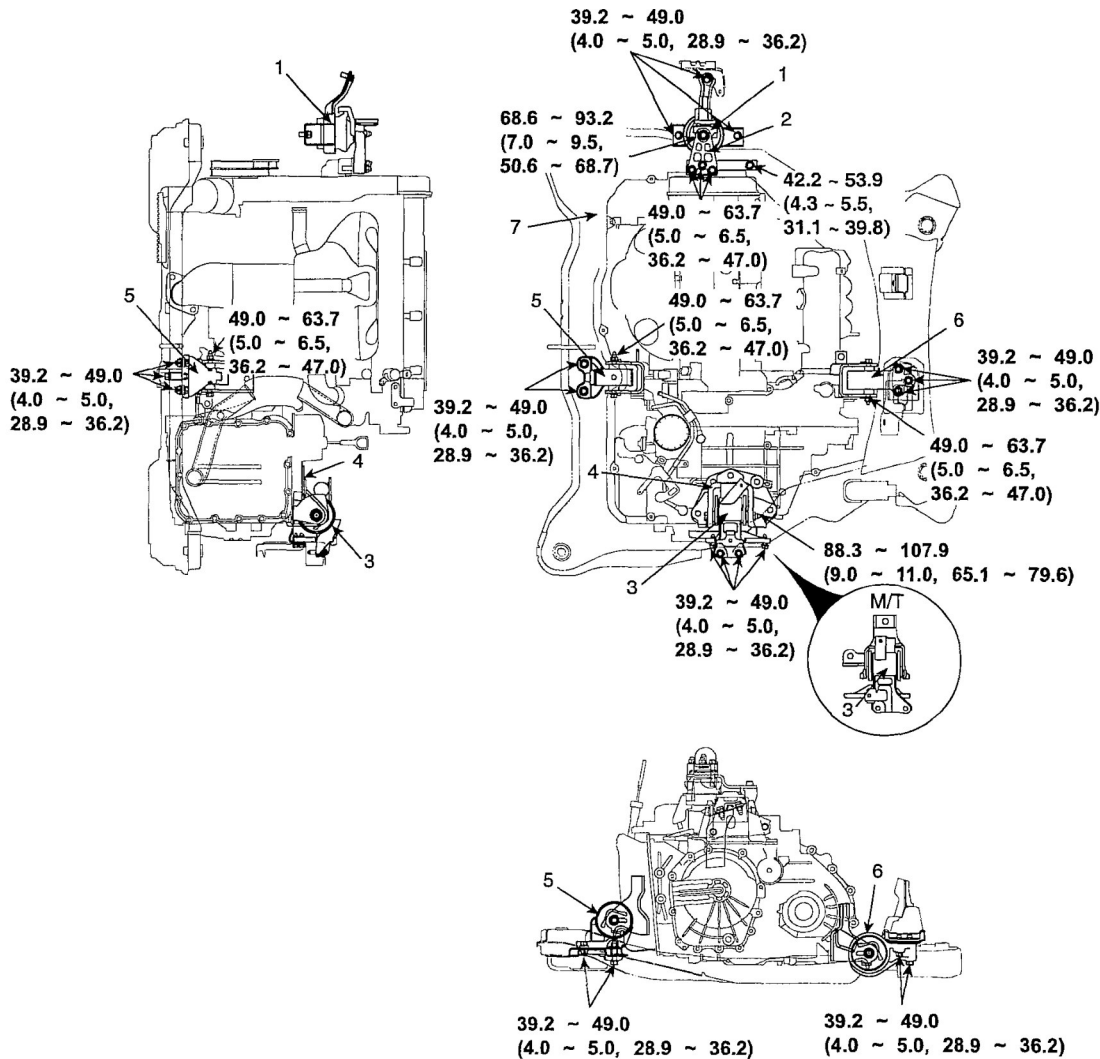
2009 ENGINES Engine Mechanical - Spectra & Spectra5



G00718965

Fig. 24: Adjusting Shim Selection Chart (Intake)
Courtesy of KIA MOTORS AMERICA, INC.

ENGINE & TRANSAXLE ASSEMBLY COMPONENT



TORQUE : N-m (kg-m, lb-ft)

- | | |
|------------------------------------|-----------------------|
| 1. Engine mounting bracket | 5. Front roll stopper |
| 2. Engine mounting support bracket | 6. Rear roll stopper |
| 3. Transaxle mounting bracket | 7. Sub frame |
| 4. Transaxle support bracket | |

G00719086

Fig. 25: Identifying Engine & Transaxle Mounts With Torque Specifications
 Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

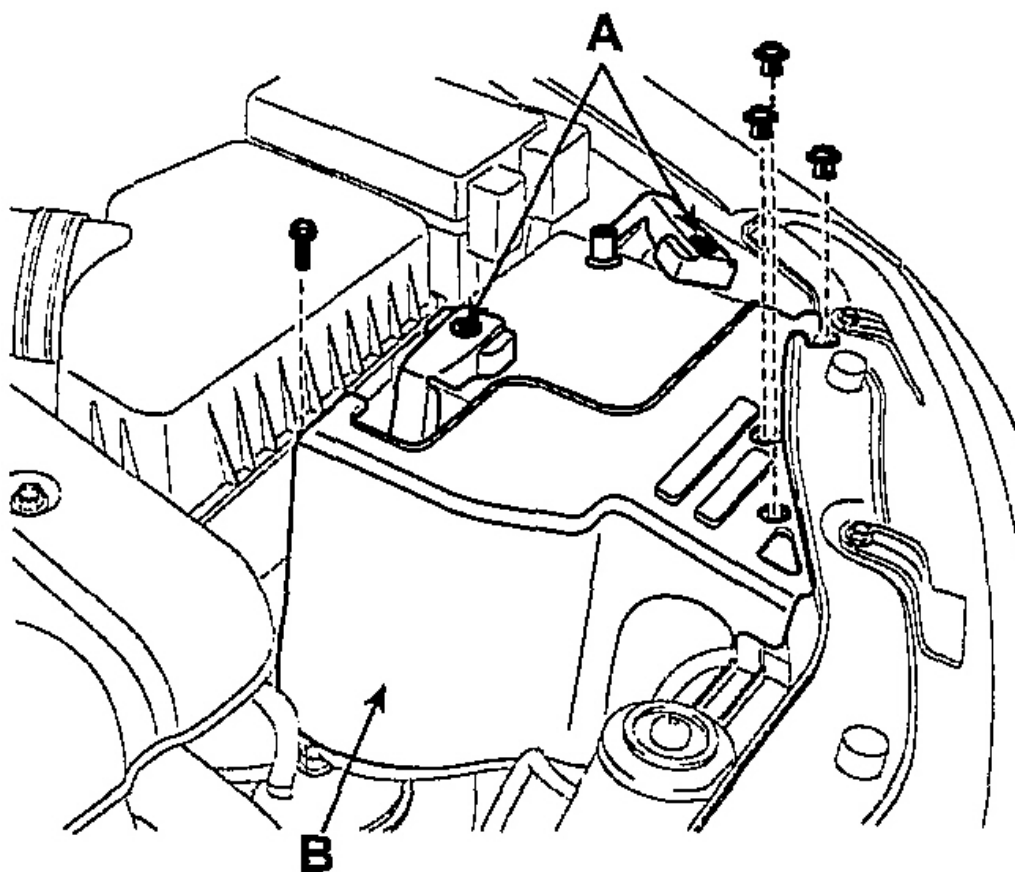
CAUTION:

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

NOTE:

- Mark all wiring and hoses to avoid wrong connections.
- Inspect the timing belt before removing the cylinder head.
- Turn the crankshaft pulley so that the No. 1 piston is at top dead center.

1. Remove the heat shield (A) first, and remove the battery terminal (B) and the battery (C).



G00719087

Fig. 26: Disconnecting Battery Terminals & Removing Heat Shield
Courtesy of KIA MOTORS AMERICA, INC.

2. Remove the engine cover (A).

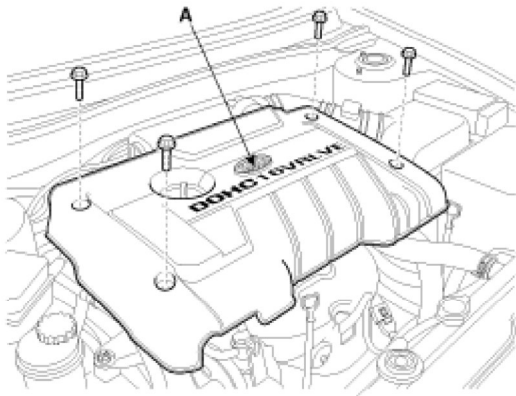
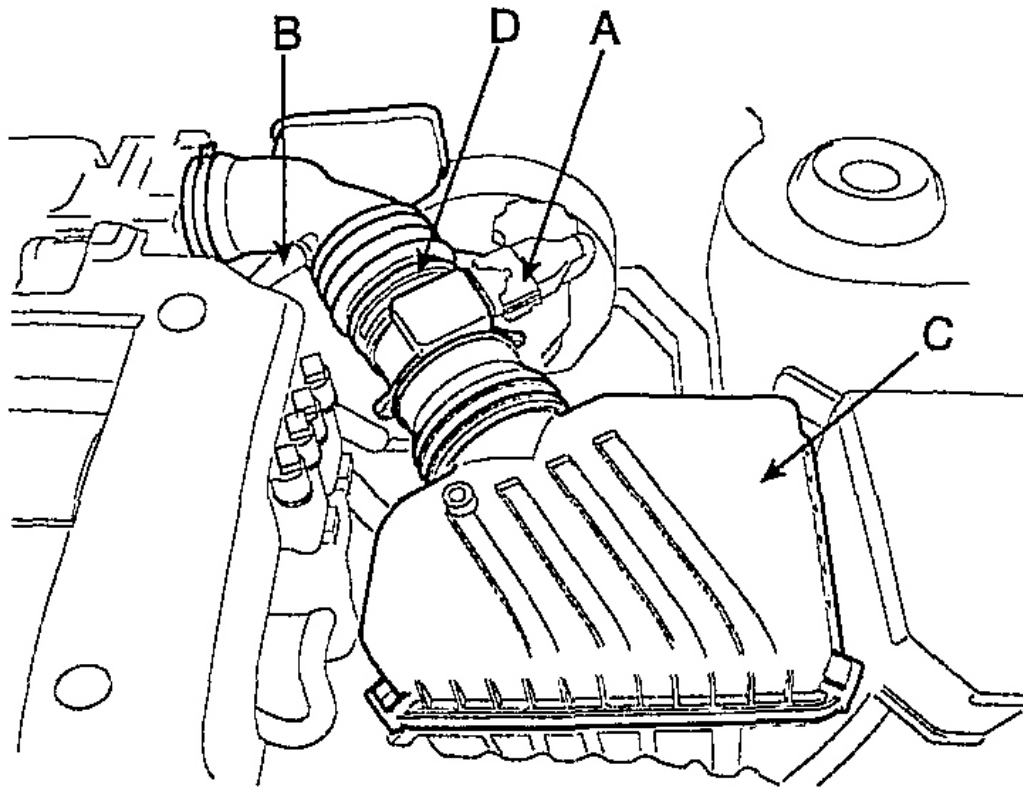


Fig. 27: Removing/Installing Engine Cover
Courtesy of KIA MOTORS AMERICA, INC.

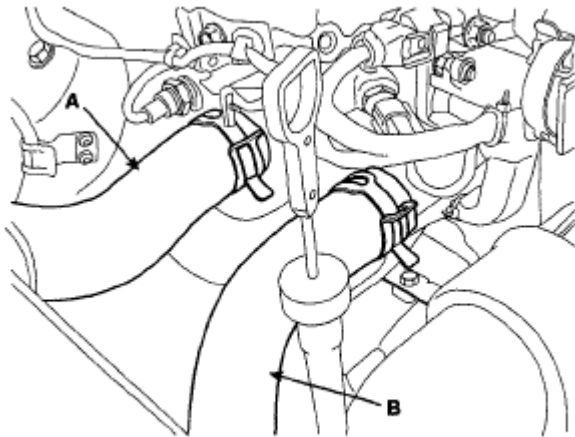
3. Remove the radiator cap to speed draining.
4. Remove the under cover.
5. Remove the intake air hose and air cleaner assembly.
 - a. Disconnect the MAF connector (A).
 - b. Disconnect the breather hose (B) from air cleaner hose (D).
 - c. Remove the intake air hose and air cleaner (C).



G00719090

Fig. 28: Removing Intake Air Hose & AFS Connector
Courtesy of KIA MOTORS AMERICA, INC.

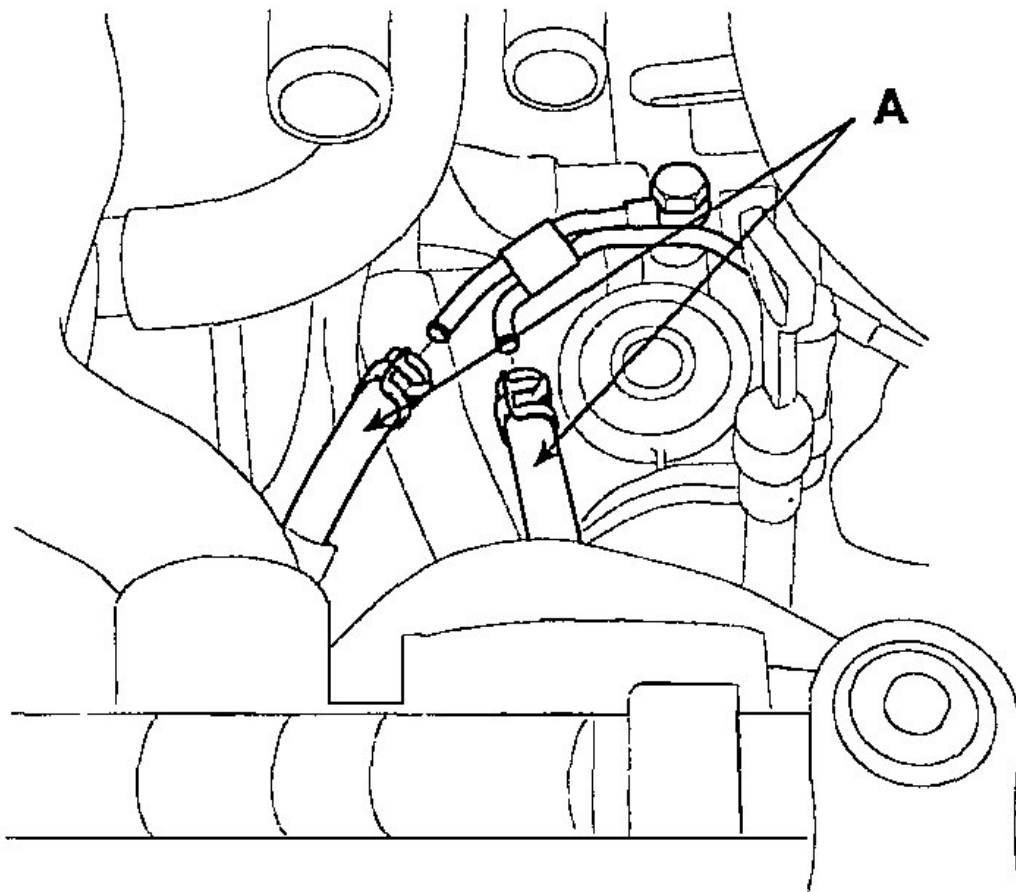
6. Remove the upper radiator hose (A) and lower radiator hose (B).



SHDM16006L

Fig. 29: Locating Upper Radiator Hose And Lower Radiator Hose
Courtesy of KIA MOTORS AMERICA, INC.

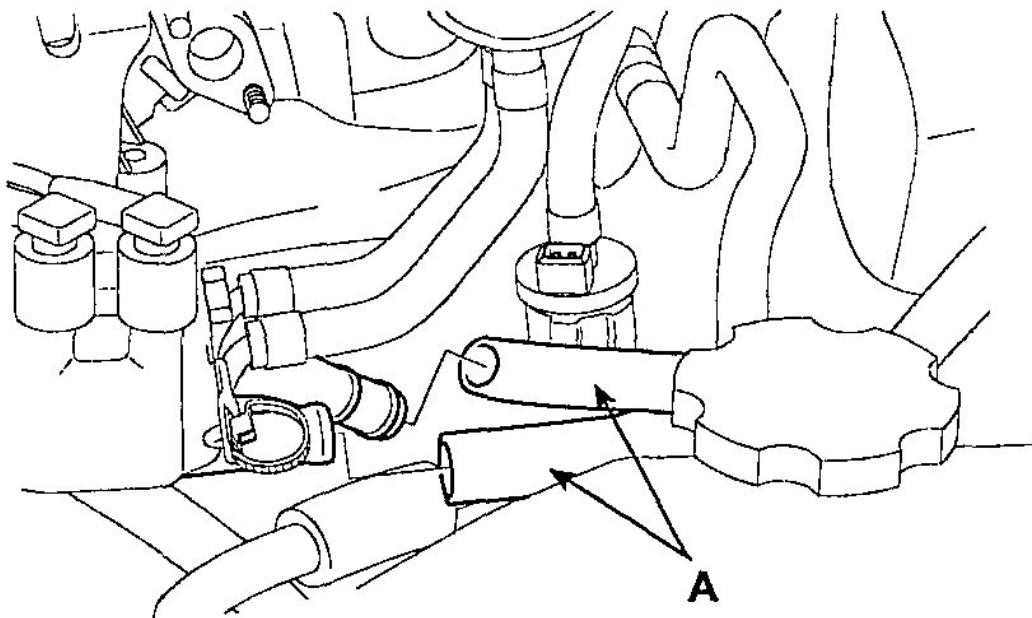
7. Remove the ATF (Automatic transaxle fluid) cooler hose (A).



G00719093

Fig. 30: Removing/Installing ATF Cooler Hoses
Courtesy of KIA MOTORS AMERICA, INC.

8. Remove the radiator. See **COOLING SYSTEM**.
9. Remove the heater hose (A).

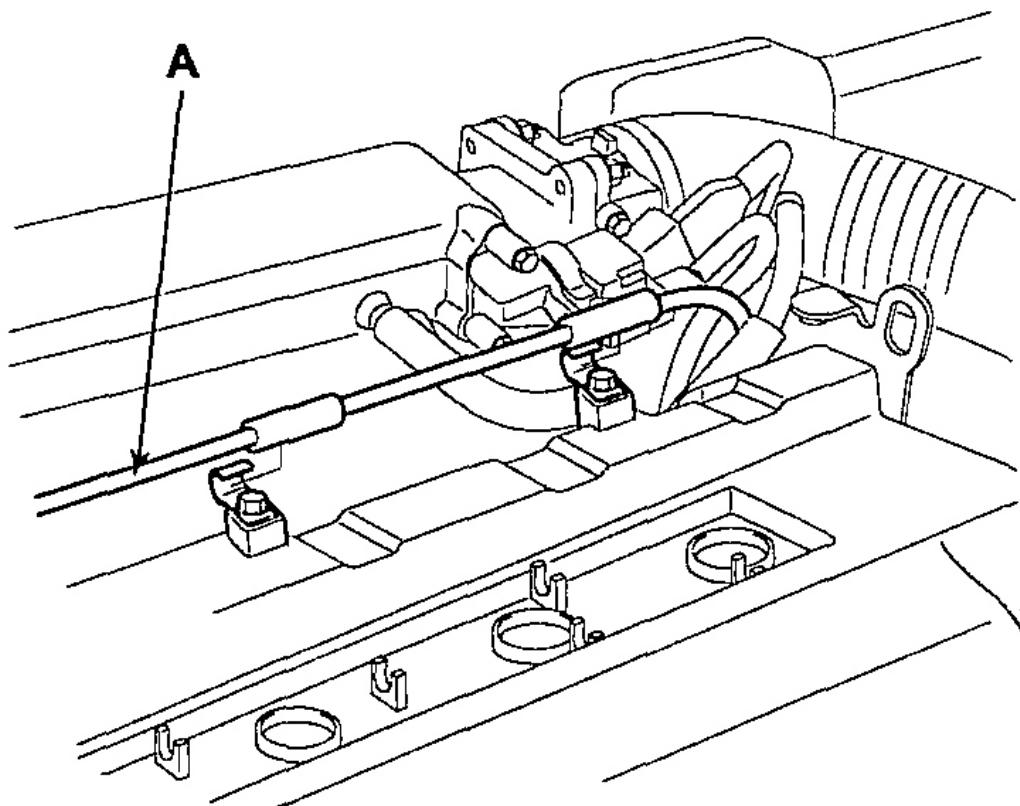


G00719094

Fig. 31: Removing Heater Hose

Courtesy of KIA MOTORS AMERICA, INC.

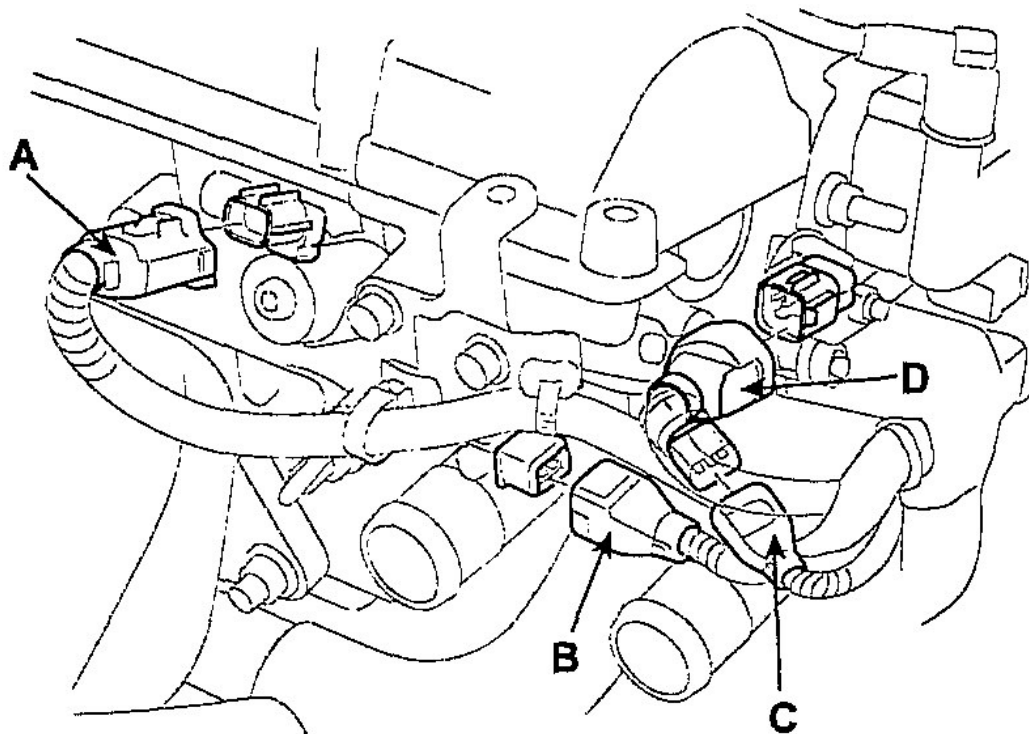
10. Remove the accelerator cable (A).



G00719095

Fig. 32: Removing Accelerator Cable
Courtesy of KIA MOTORS AMERICA, INC.

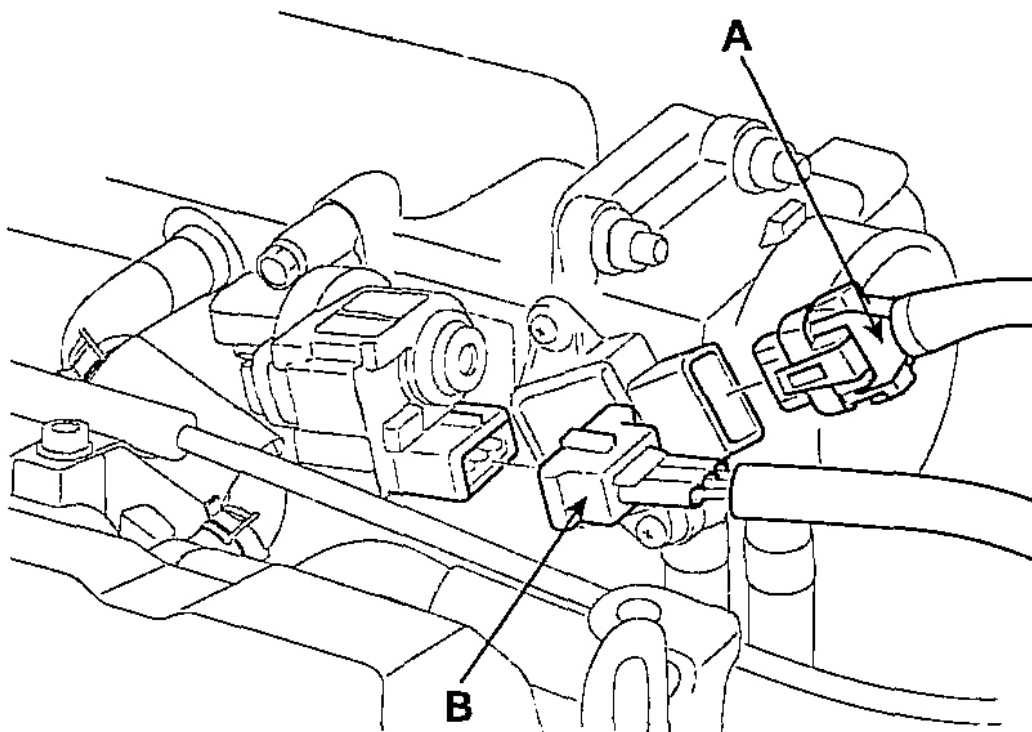
11. Remove the engine wire harness connectors and wire harness clamps from the cylinder head and the intake manifold.
 - a. Disconnect the OCV (Oil Control Valve) connector (A).
 - b. Disconnect the oil temperature sensor connector (B).
 - c. Disconnect the ECT (Engine Coolant Temperature) sensor connector (C).
 - d. Disconnect the ignition coil connector (D).



G00719096

Fig. 33: Disconnecting Engine Sensors
Courtesy of KIA MOTORS AMERICA, INC.

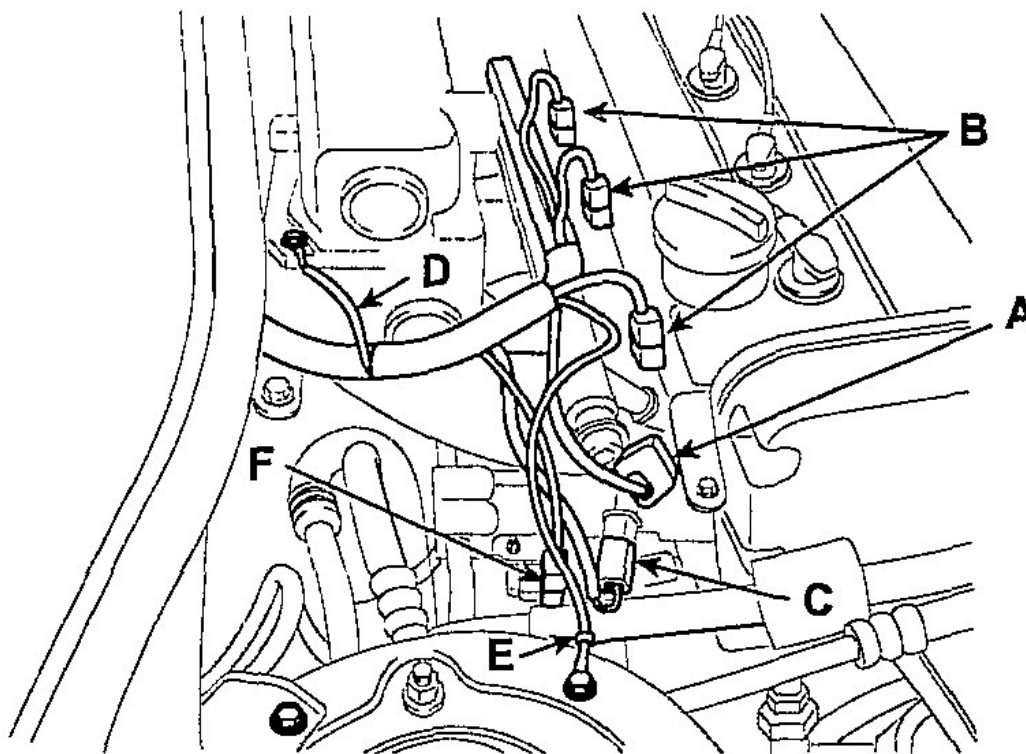
- e. Disconnect the TPS (Throttle Position Sensor) connector (A).
- f. Disconnect the ISA (Idle Speed Actuator) connector (B).



G00719097

Fig. 34: Disconnecting the TPS & ISA Connectors
Courtesy of KIA MOTORS AMERICA, INC.

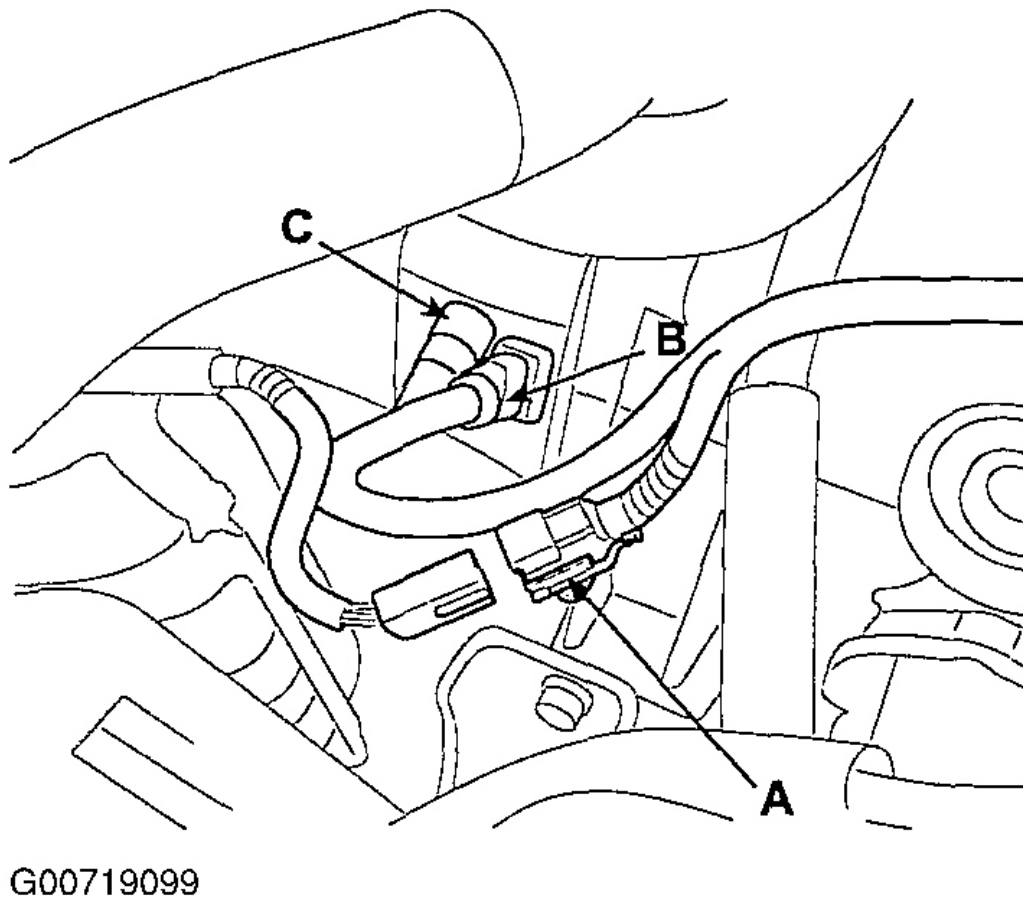
- g. Disconnect the CMP (Camshaft Position Sensor) connector (A).
- h. Disconnect the four fuel injector connectors (B).
- i. Disconnect the knock sensor connector (C).
- j. Disconnect the ground cables (D, E) from the intake manifold and vehicle's body.
- k. Disconnect the air conditioner compressor switch (F).



G00719098

Fig. 35: Disconnecting Engine Sensors & Grounds
Courtesy of KIA MOTORS AMERICA, INC.

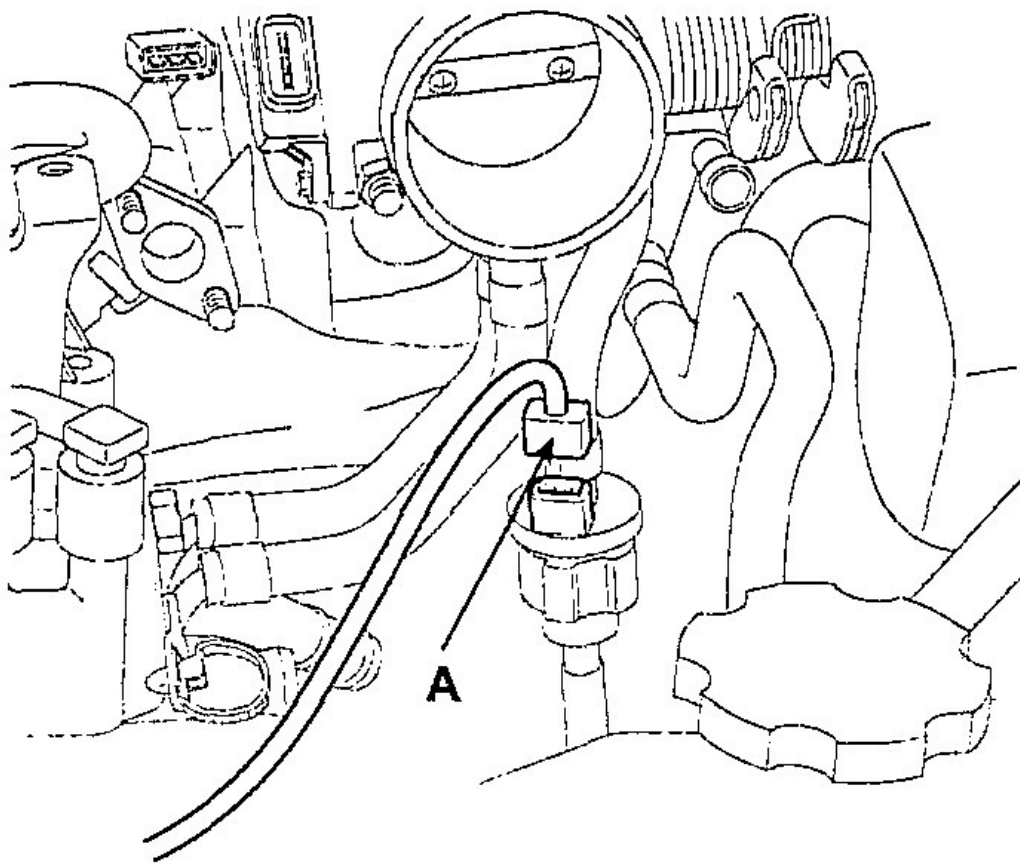
- l. Disconnect the front heated oxygen sensor connector (A).
- m. Disconnect the CKP (Crankshaft Position Sensor) connector (B).
- n. Disconnect the oil pressure switch connector (C).



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Fig. 36: Disconnecting Oil Pressure Switch Connector
Courtesy of KIA MOTORS AMERICA, INC.

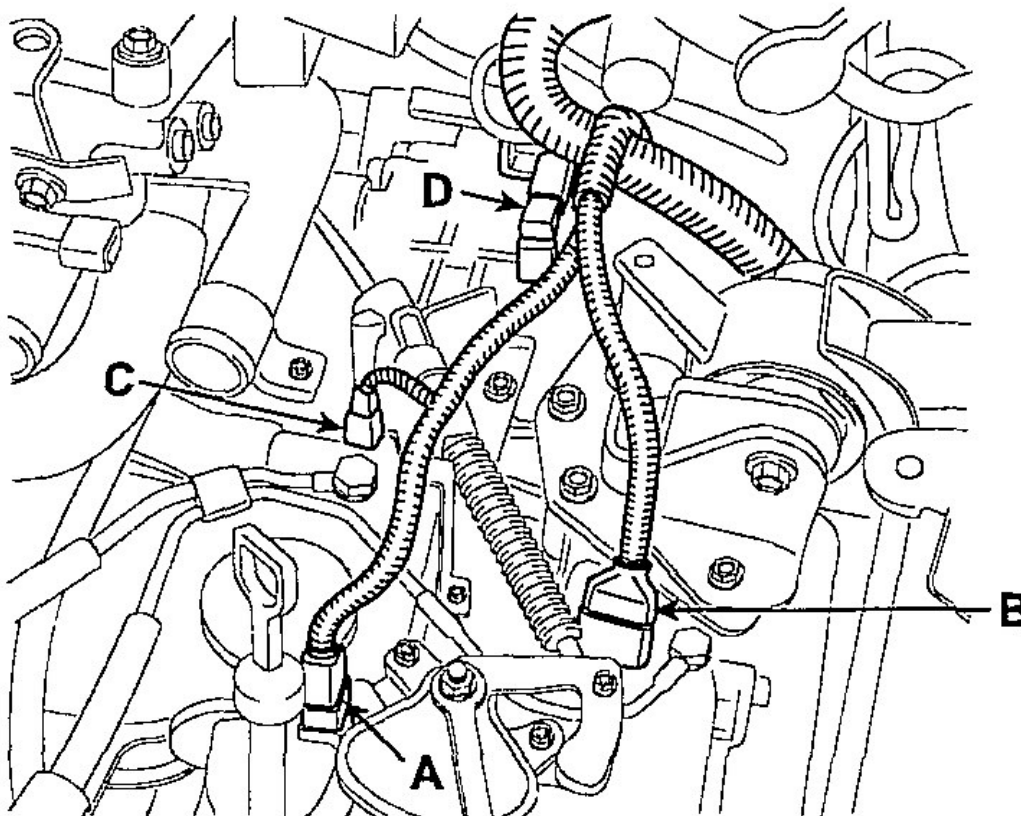
- o. Disconnect the PCSV (Purge Control Solenoid Valve) connector (A).



G00719100

Fig. 37: Disconnecting PCSV Connector
Courtesy of KIA MOTORS AMERICA, INC.

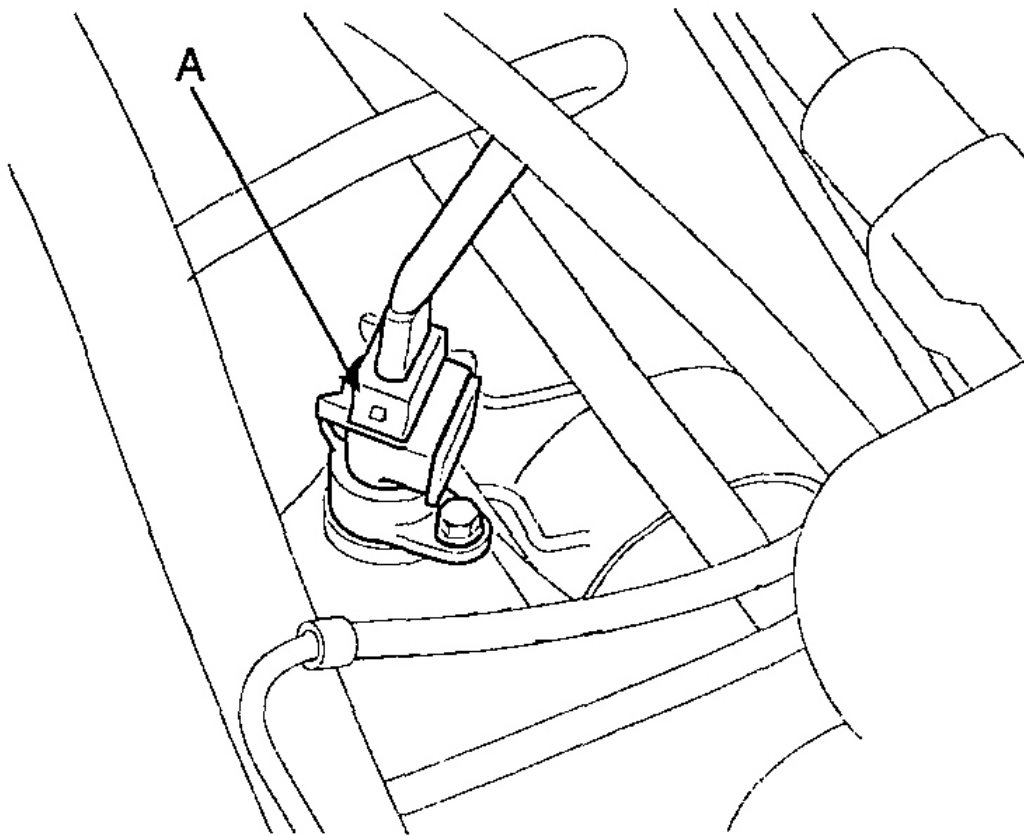
12. Remove the transaxle wire harness connectors and control cable from transaxle (A/T).
 - a. Disconnect the transaxle range switch connector (A).
 - b. Disconnect the solenoid valve connector (B).
 - c. Disconnect the input shaft speed sensor connector (C).
 - d. Disconnect the output shaft speed sensor connector (D).



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Fig. 38: Disconnecting Input & Output Shaft Speed Sensor Connectors
Courtesy of KIA MOTORS AMERICA, INC.

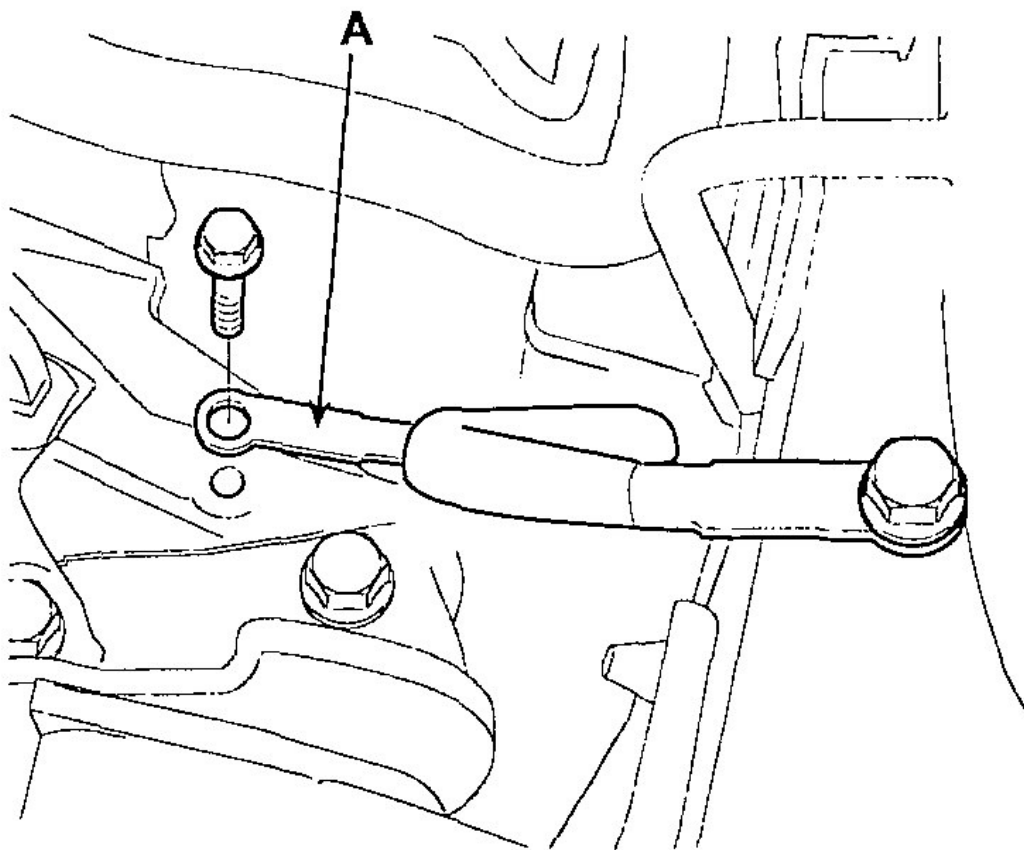
- e. Disconnect the vehicle speed sensor connector (A).



G00719102

Fig. 39: Disconnecting Vehicle Speed Sensor Connector
Courtesy of KIA MOTORS AMERICA, INC.

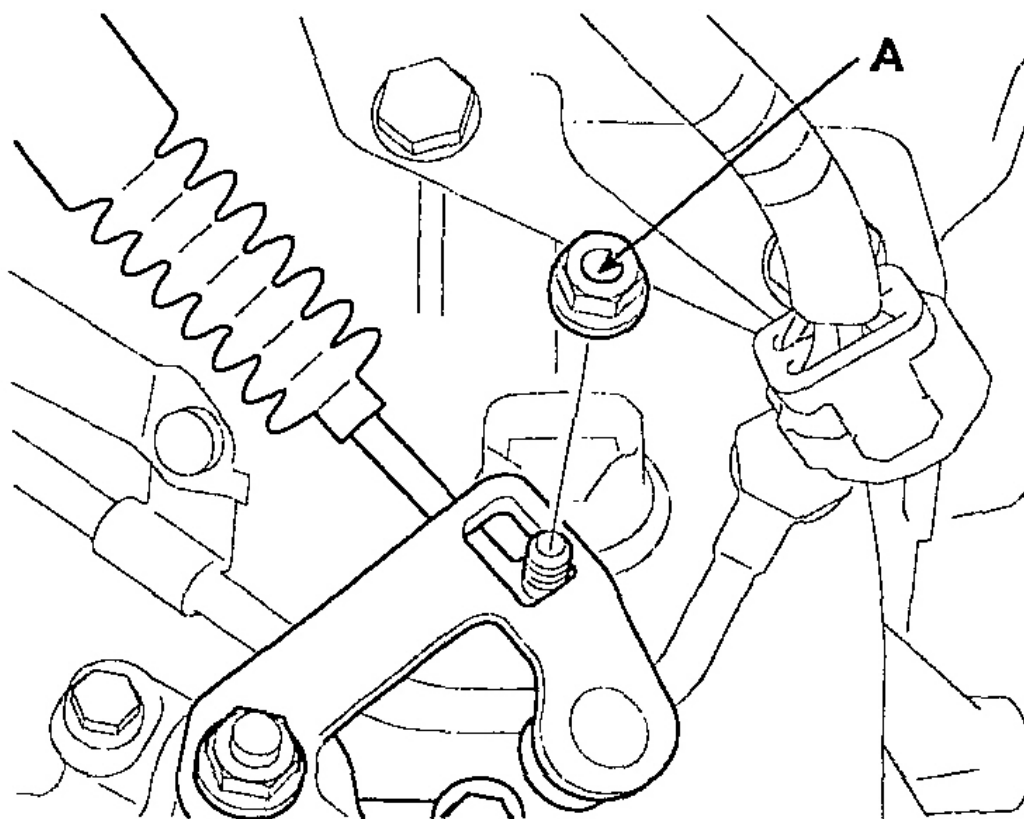
- f. Remove the transaxle ground cable (A).



G00719103

Fig. 40: Removing Transaxle Ground Cable
Courtesy of KIA MOTORS AMERICA, INC.

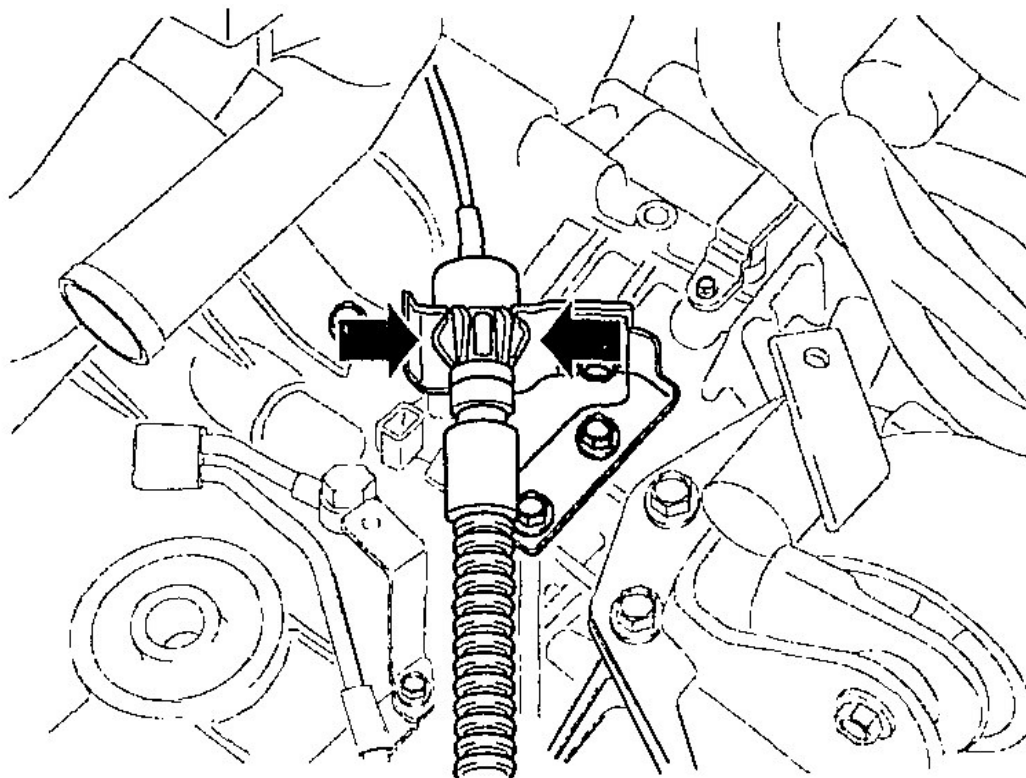
- g. Remove the control cable nut (A) from transaxle range switch.



G00719104

Fig. 41: Removing Control Cable Nut
Courtesy of KIA MOTORS AMERICA, INC.

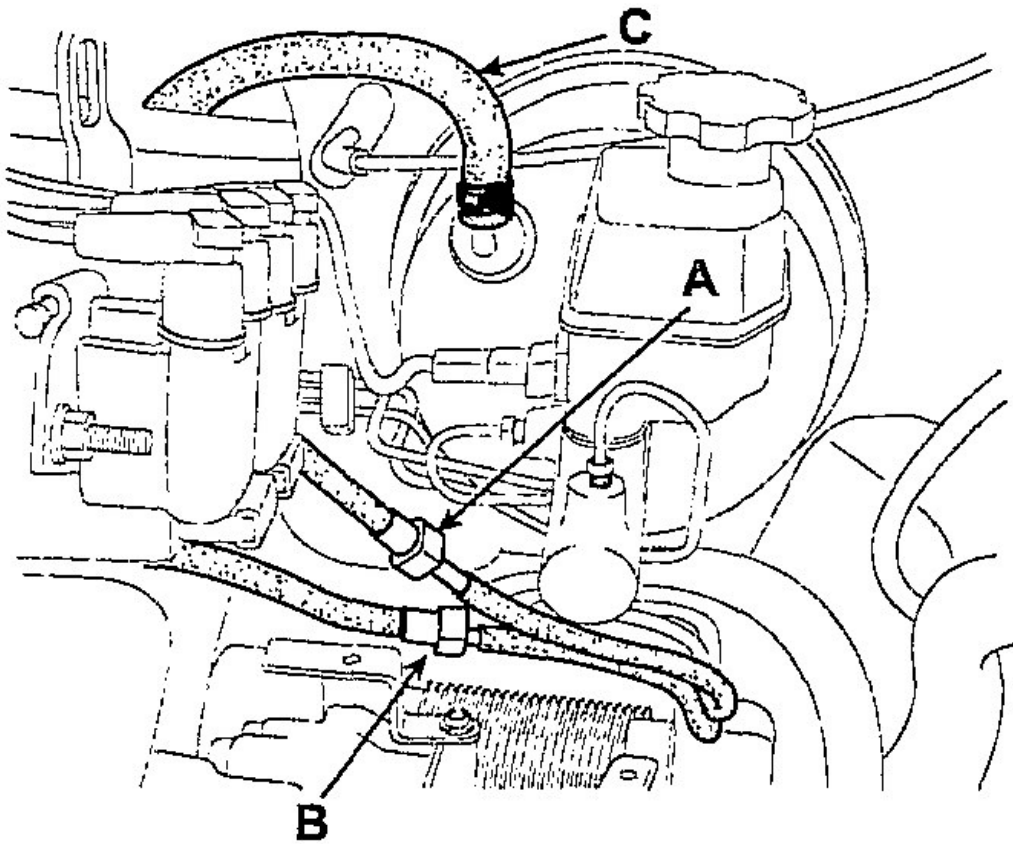
- h. Remove the control cable.



G00719105

Fig. 42: Removing Control Cable
Courtesy of KIA MOTORS AMERICA, INC.

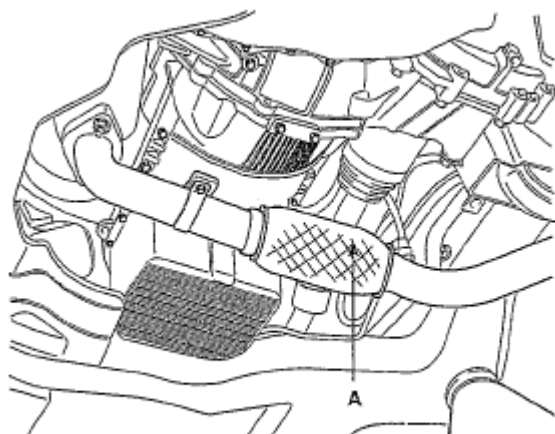
13. Disconnect the fuel inlet hose (A) of the delivery pipe side.
14. Disconnect the hose (B) of the PCSV (Purge Control Solenoid Valve) side.
15. Remove the brake booster vacuum hose (C).



G00719106

Fig. 43: Removing Brake Booster Vacuum Hose
Courtesy of KIA MOTORS AMERICA, INC.

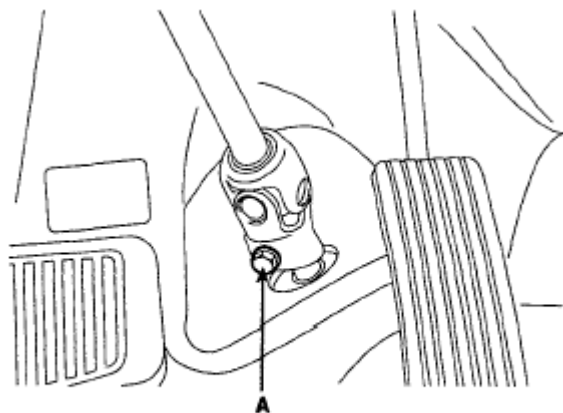
16. Remove the front wheel (RH, LH).
17. Remove the power steering pump and use a wire to secure the pump to the vehicle so that it is out of the way.
18. Remove the air conditioner compressor and fix the compressor to vehicle with a wire. (See HA group - air conditioner compressor).
19. Install the engine jack to the engine and transaxle assembly.
20. Remove the lower arm ball joint mounting bolts.
21. Disconnect the tie-rod from the knuckle.
22. Disconnect the stabilizer bar link from the strut.
23. Remove the front muffler (A).



SLDM18003D

Fig. 44: Identifying Front Muffler
Courtesy of KIA MOTORS AMERICA, INC.

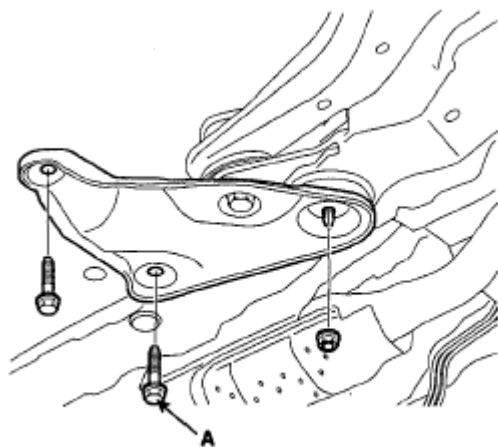
24. Remove the steering u-joint mounting bolt (A).



ECKD616A

Fig. 45: Identifying Steering U-Joint Mounting Bolt
Courtesy of KIA MOTORS AMERICA, INC.

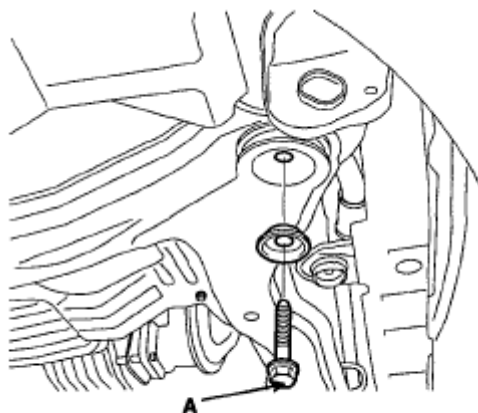
25. Remove the sub frame bolts (A).



ECKD617A

Fig. 46: Identifying Sub Frame

Courtesy of KIA MOTORS AMERICA, INC.



ECKD618A

Fig. 47: Identifying Bolt

Courtesy of KIA MOTORS AMERICA, INC.

INSTALLATION

Installation is in the reverse order of removal.

Perform the following:

- Adjust the shift cable.
- Adjust the throttle cable.
- Refill the engine with engine oil.
- Refill the transaxle with fluid.
- Refill the radiator and reservoir tank with engine coolant.
- Bleed air from the cooling system with the heater valve open.

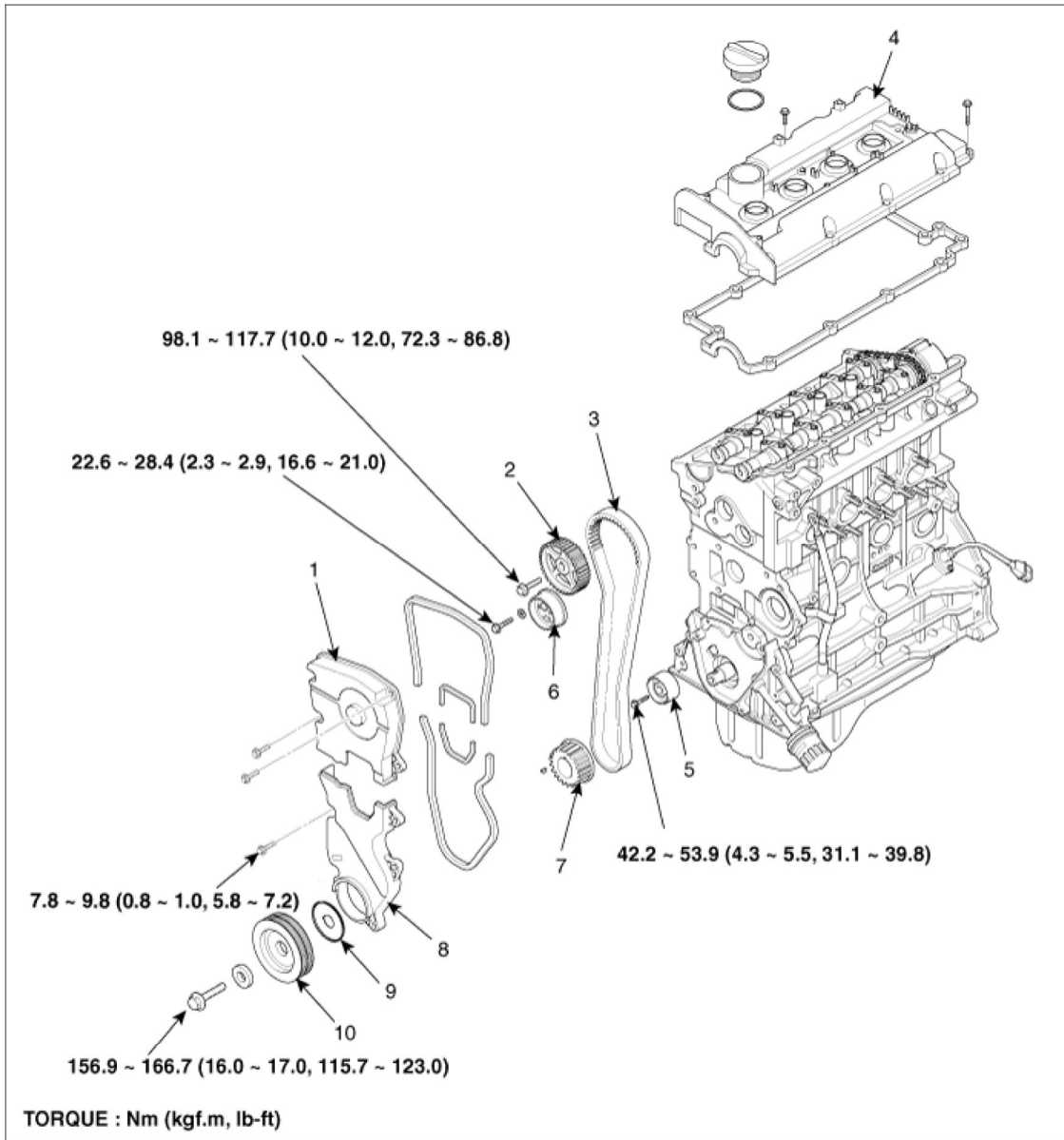
- Clean battery posts and cable terminals with sandpaper assemble them, then apply grease to prevent corrosion.
- Clean the battery posts and cable terminals with sandpaper assemble them, then apply grease to prevent corrosion.
- Inspect for fuel leakage.

After assembling the fuel line, turn on the ignition switch (do not operate the starter) so that the fuel pump runs for approximately two seconds and fuel line pressurizes.

Repeat this operation two or three times, then check for fuel leakage at any point in the fuel line.

TIMING BELT

COMPONENT



- | | |
|----------------------------|----------------------------|
| 1. Timing belt upper cover | 6. Tensioner |
| 2. Camshaft sprocket | 7. Crankshaft sprocket |
| 3. Timing belt | 8. Timing belt lower cover |
| 4. Cylinder head cover | 9. Flange |
| 5. Idler | 10. Crankshaft pulley |

Fig. 48: Exploded View Of Timing Belt Components With Torque Specifications
 Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

NOTE: Engine removal is not required for this procedure.

1. Remove the engine cover.

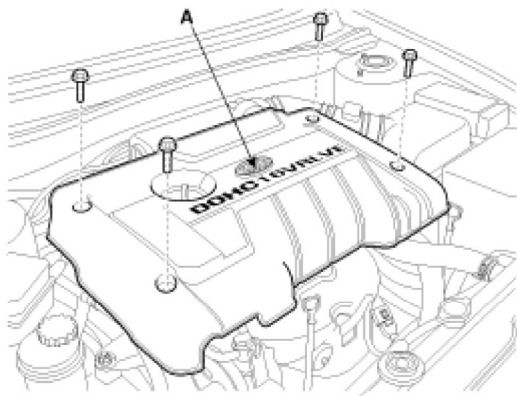
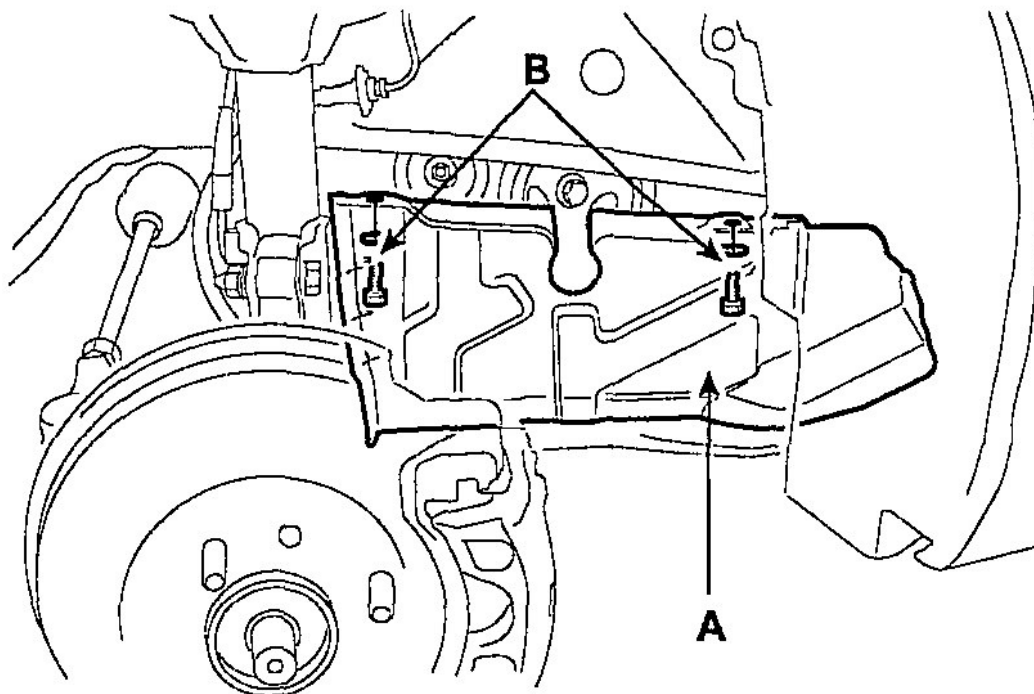


Fig. 49: Removing/Installing Engine Cover
Courtesy of KIA MOTORS AMERICA, INC.

2. Remove the RH front wheel.
3. Remove the 2 bolts (B) and RH side cover (A).

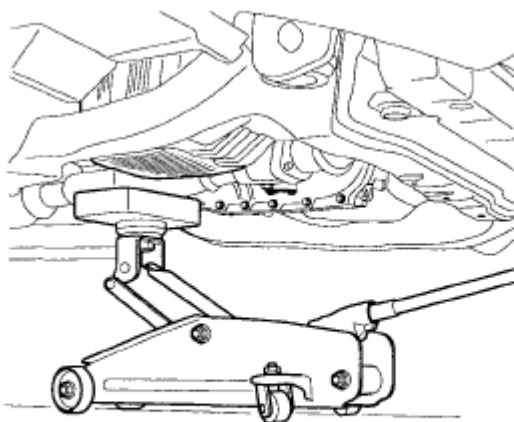


G00718973

Fig. 50: Remove RH Side Cover
Courtesy of KIA MOTORS AMERICA, INC.

4. Remove the engine mount bracket.

- a. Set the jack to the engine oil pan.



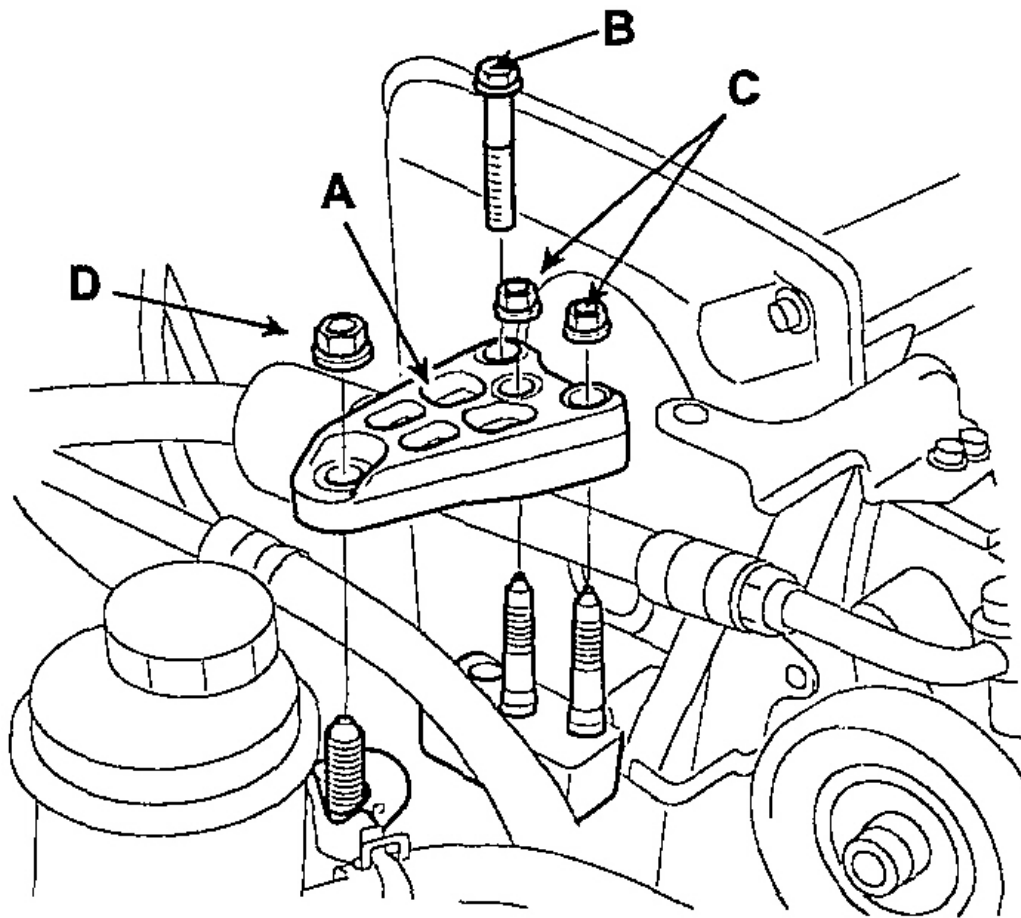
ECKD102A

Fig. 51: Lifting Vehicle

Courtesy of KIA MOTORS AMERICA, INC.

NOTE: Place wooden block between the jack and engine oil pan.

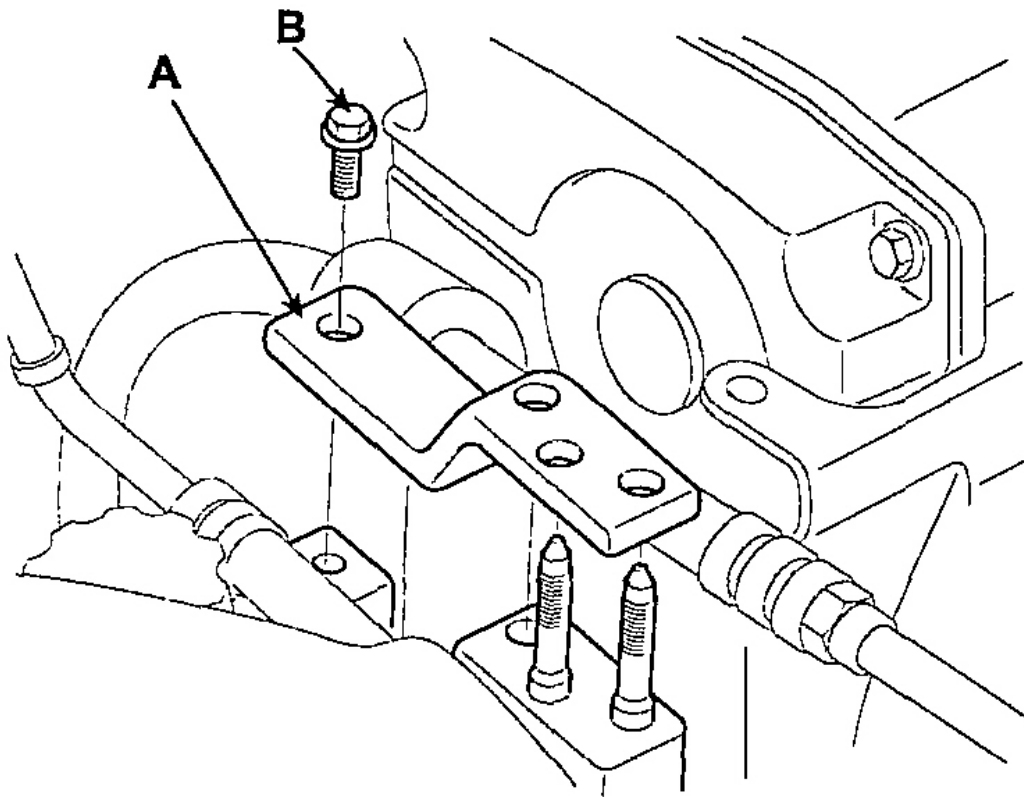
- b. Remove the bolt (B), three nuts (C, D) and engine mount bracket (A).



G00718975

Fig. 52: Removing Engine Mounting Support Bracket
Courtesy of KIA MOTORS AMERICA, INC.

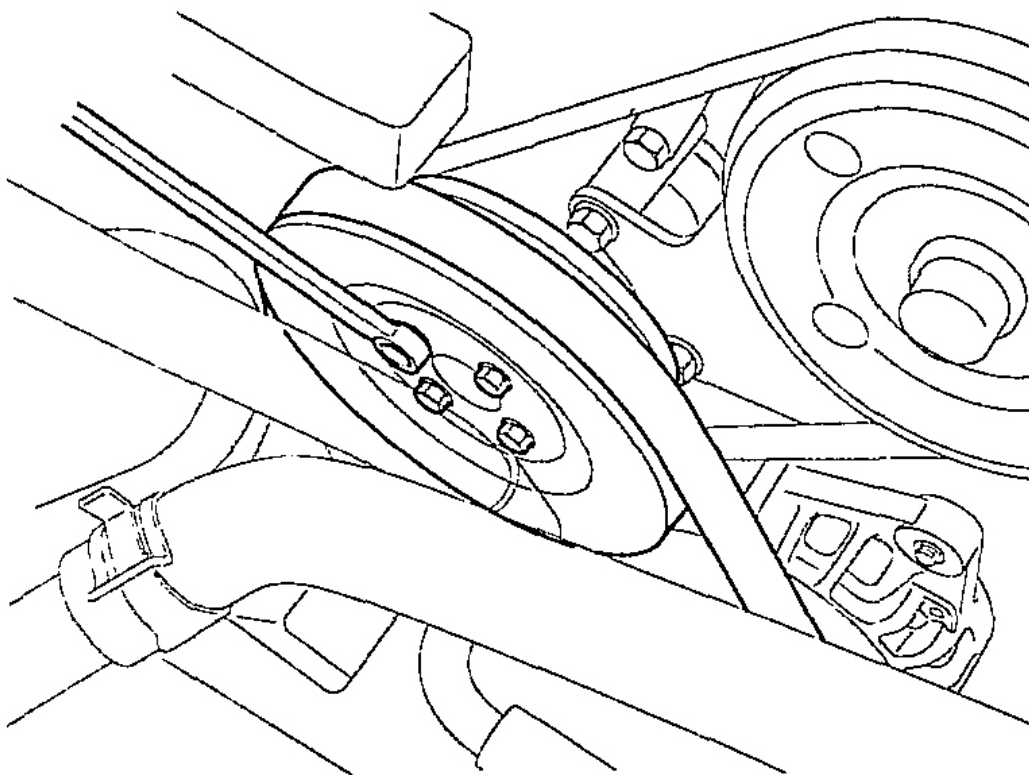
- c. Remove the bolt (B) and engine support bracket stay plate (A).



G00718976

Fig. 53: Removing Engine Support Bracket Stay Plate
Courtesy of KIA MOTORS AMERICA, INC.

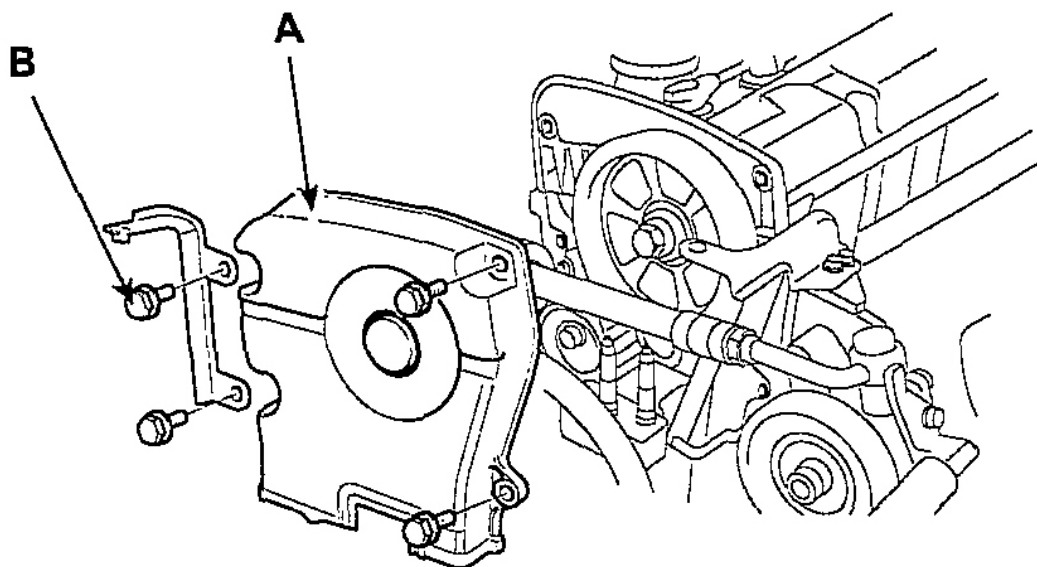
5. Temporarily loosen the water pump pulley bolts.



G00718977

Fig. 54: Loosening Water Pump Pulley Bolts
Courtesy of KIA MOTORS AMERICA, INC.

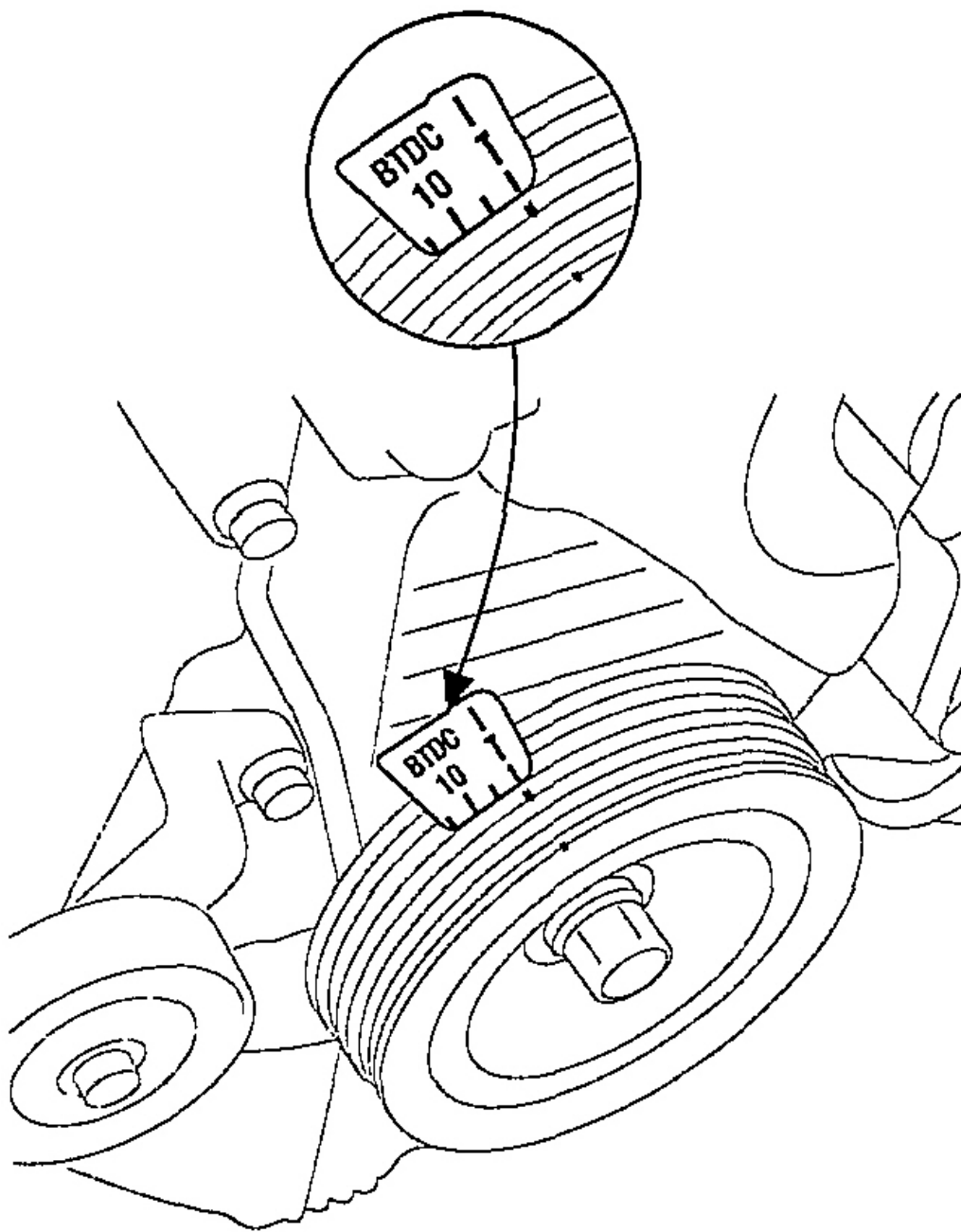
6. Remove alternator belt.
7. Remove air compressor belt.
8. Remove power steering belt.
9. Remove four bolts and water pump pulley.
10. Remove the four bolts (B) and timing belt upper cover (A).



G00718978

Fig. 55: Removing Timing Belt Upper Cover
Courtesy of KIA MOTORS AMERICA, INC.

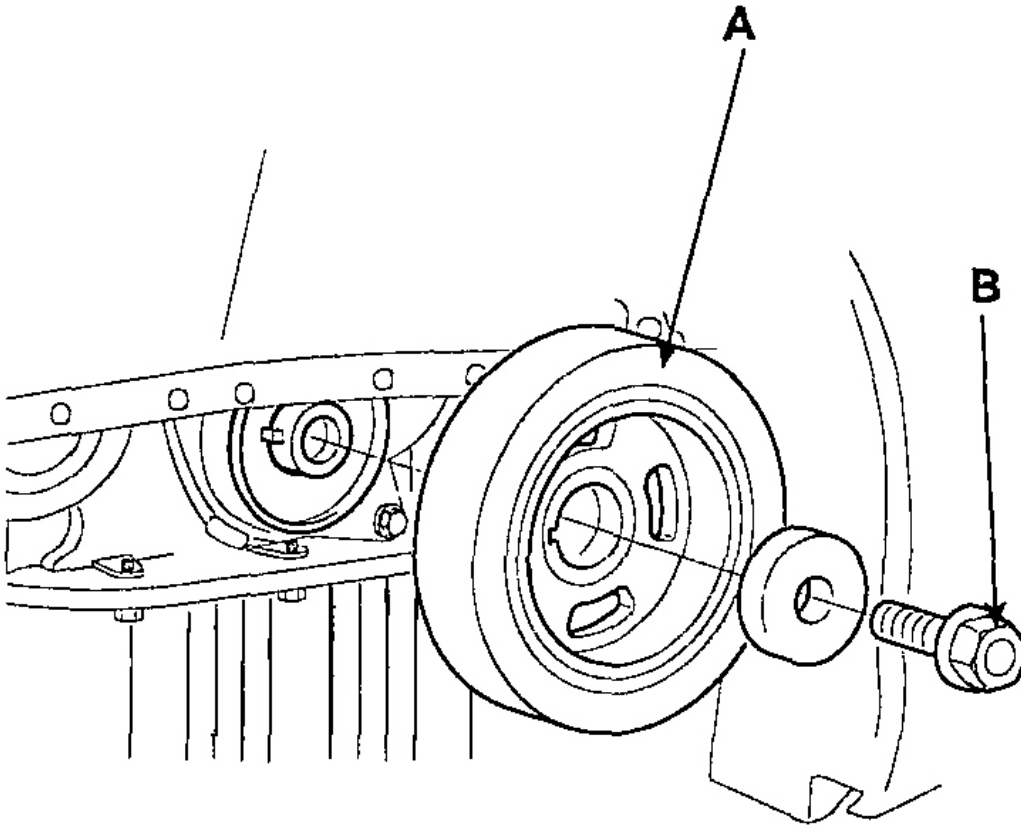
11. Turn the crankshaft pulley, and align its groove with timing mark "T" of the timing belt cover. Check that the timing mark of camshaft sprocket is aligned with the timing mark of cylinder head cover (No. 1 cylinder compression TDC position).



G00718979

Fig. 56: Aligning Timing Mark
Courtesy of KIA MOTORS AMERICA, INC.

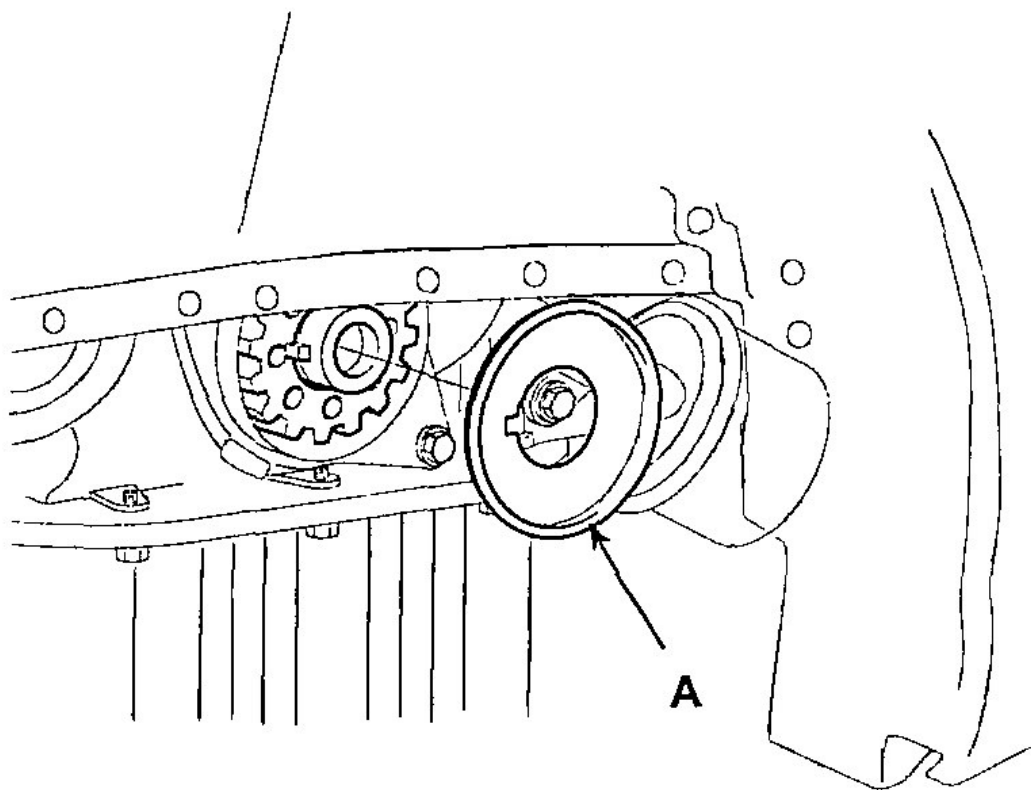
12. Remove the crankshaft pulley bolt (B) and crankshaft pulley (A).



G00718981

Fig. 57: Removing Crankshaft Pulley
Courtesy of KIA MOTORS AMERICA, INC.

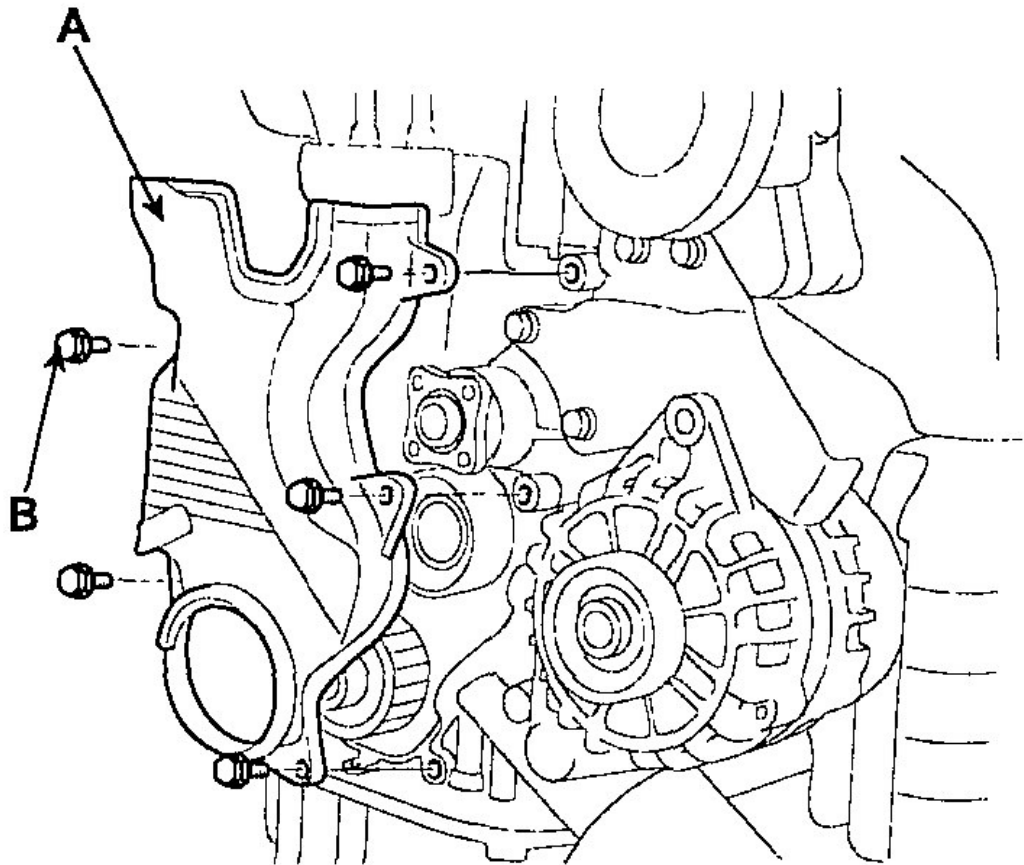
13. Remove the crankshaft flange (A).



G00718982

Fig. 58: Removing Crankshaft Flange
Courtesy of KIA MOTORS AMERICA, INC.

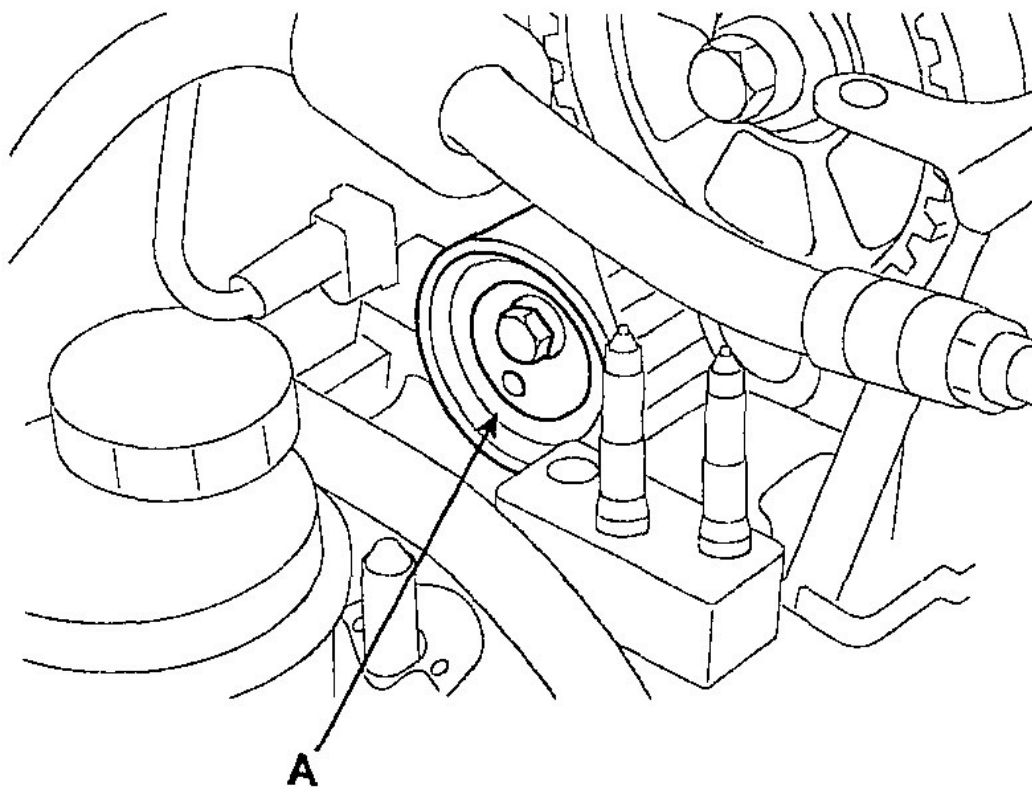
14. Remove the 5 bolts (B) and timing belt lower cover (A)



G00718983

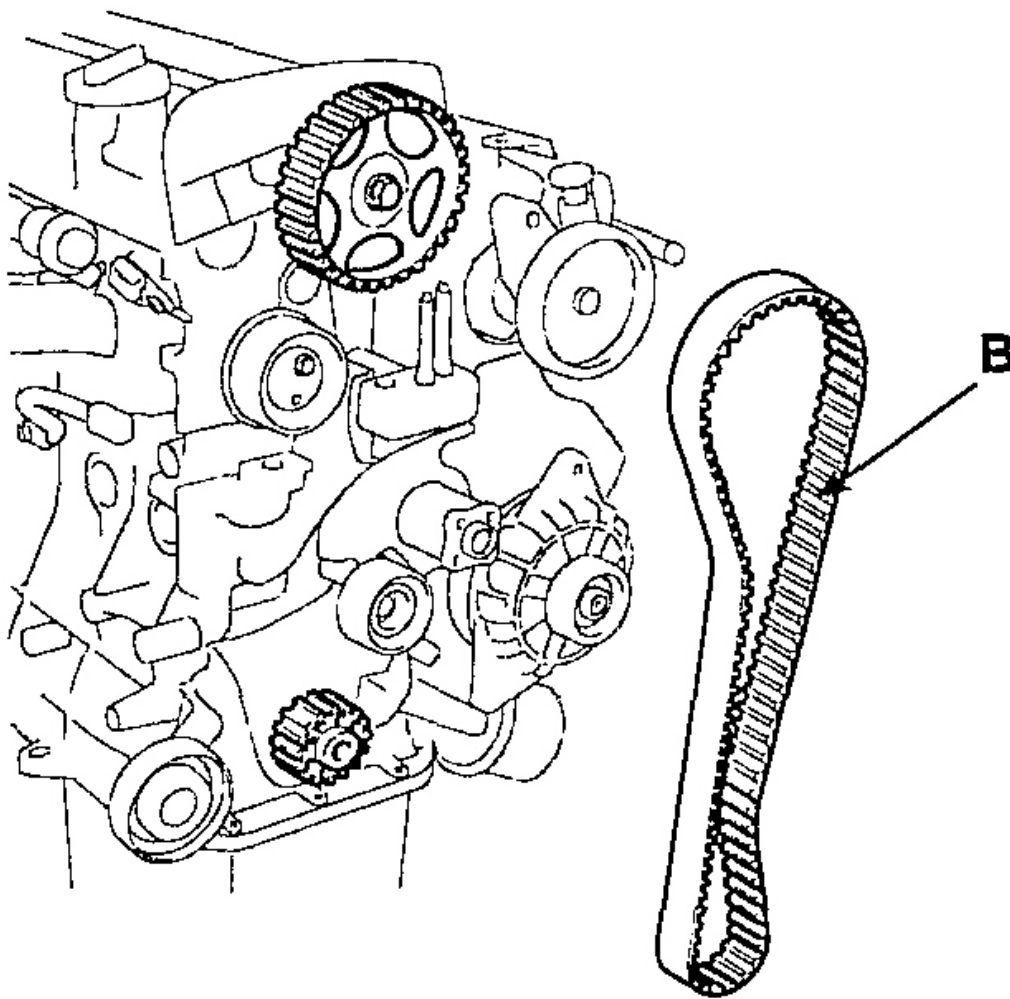
Fig. 59: Removing Timing Belt Lower Cover
Courtesy of KIA MOTORS AMERICA, INC.

15. Remove the timing belt tensioner (A) and timing belt (B).



G00718984

Fig. 60: Removing Timing Belt Tensioner
Courtesy of KIA MOTORS AMERICA, INC.



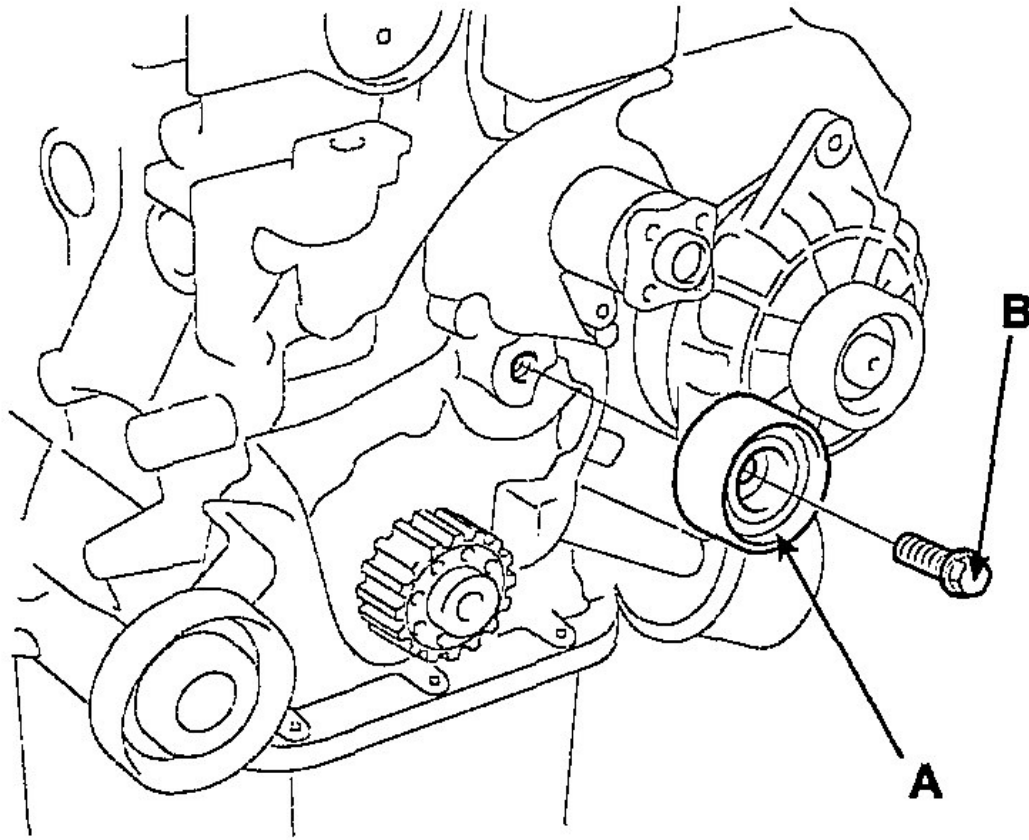
G00718985

Fig. 61: Removing Timing Belt

Courtesy of KIA MOTORS AMERICA, INC.

NOTE: If the timing belt is going to be reused, make an arrow indicating the turning direction to make sure that the belt is reinstalled in the same direction as before.

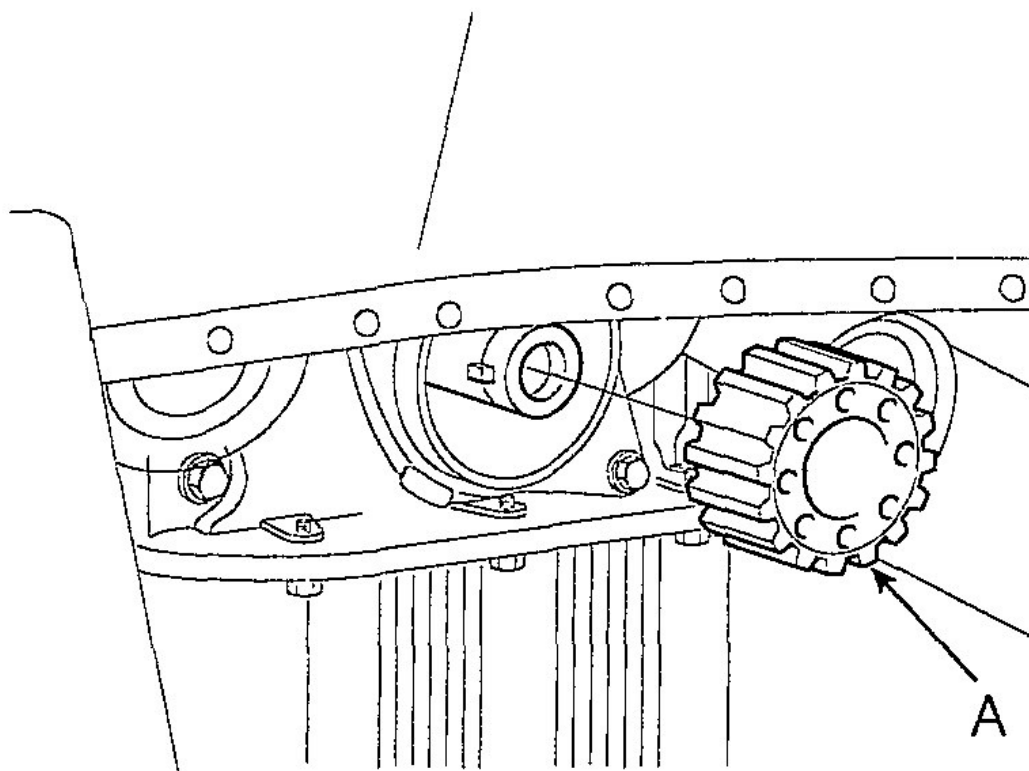
16. Remove the bolt (B) and timing belt idler (A).



G00718986

Fig. 62: Removing Timing Belt Idler
Courtesy of KIA MOTORS AMERICA, INC.

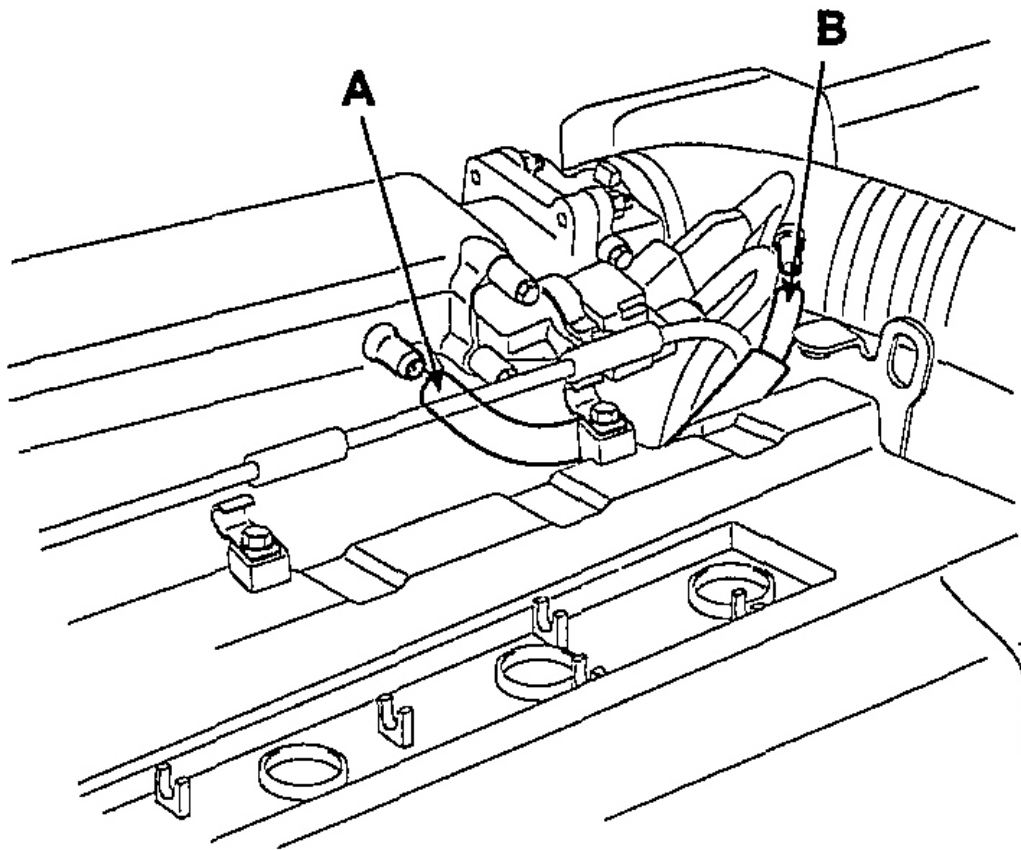
17. Remove the crankshaft sprocket (A).



G00718987

Fig. 63: Removing Crankshaft Sprocket
Courtesy of KIA MOTORS AMERICA, INC.

18. Remove the cylinder head cover.
 - a. Remove the spark plug cable.
 - b. Remove the accelerator cable and the auto-cruise cable from the cylinder head cover.
 - c. Remove the PCV (Positive Crankcase ventilation) hose (A) and breather hose (B).

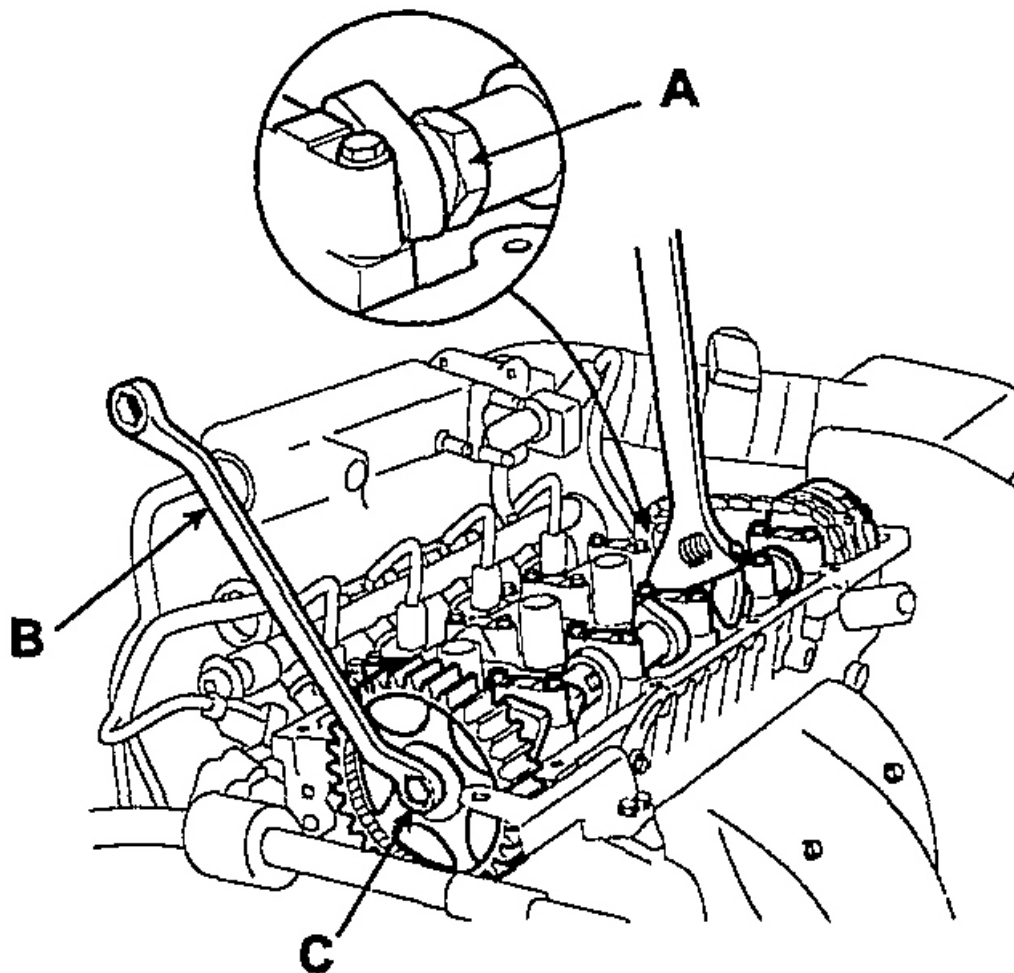


G00718989

Fig. 64: Removing PCV Hose & Breather Hose From Cylinder Head Cover.
Courtesy of KIA MOTORS AMERICA, INC.

- d. Remove the bolts and cylinder head cover.

CAUTION: Be careful not to damage the cylinder head and valve lifter with the wrench.



G00718992

Fig. 65: Removing Camshaft Sprocket
Courtesy of KIA MOTORS AMERICA, INC.

19. Remove the bolts and cylinder head cover.
 1. Hold the hexagonal head wrench (A) portion of the camshaft with a wrench (B), and remove the bolt and camshaft sprocket (C).

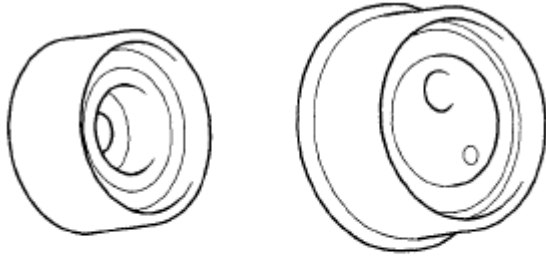
INSPECTION

SPROCKETS, TENSIONER, IDLER

1. Check the camshaft sprocket, crankshaft sprocket, tensioner pulley, and idler pulley for abnormal wear,

cracks, or damage. Replace as necessary.

2. Inspect the tensioner pulley and the idler pulley for easy and smooth rotation and check for play or noise. Inspect the pulley for a grease leak from its bearing. Replace as necessary.



ECKD115A

Fig. 66: Identifying Tensioner Pulley And Idler Pulley
Courtesy of KIA MOTORS AMERICA, INC.

3. Replace the pulley if there is a grease leak from its bearing.

TIMING BELT

1. Check the belt for oil or dust deposits. Replace, if necessary.

NOTE: Small deposits of oil or dust should be wiped away with a dry cloth or paper. Do not clean with solvent.

2. When the engine is overhauled or belt tension adjusted, check the belt carefully. If any damage is found, replace the belt.

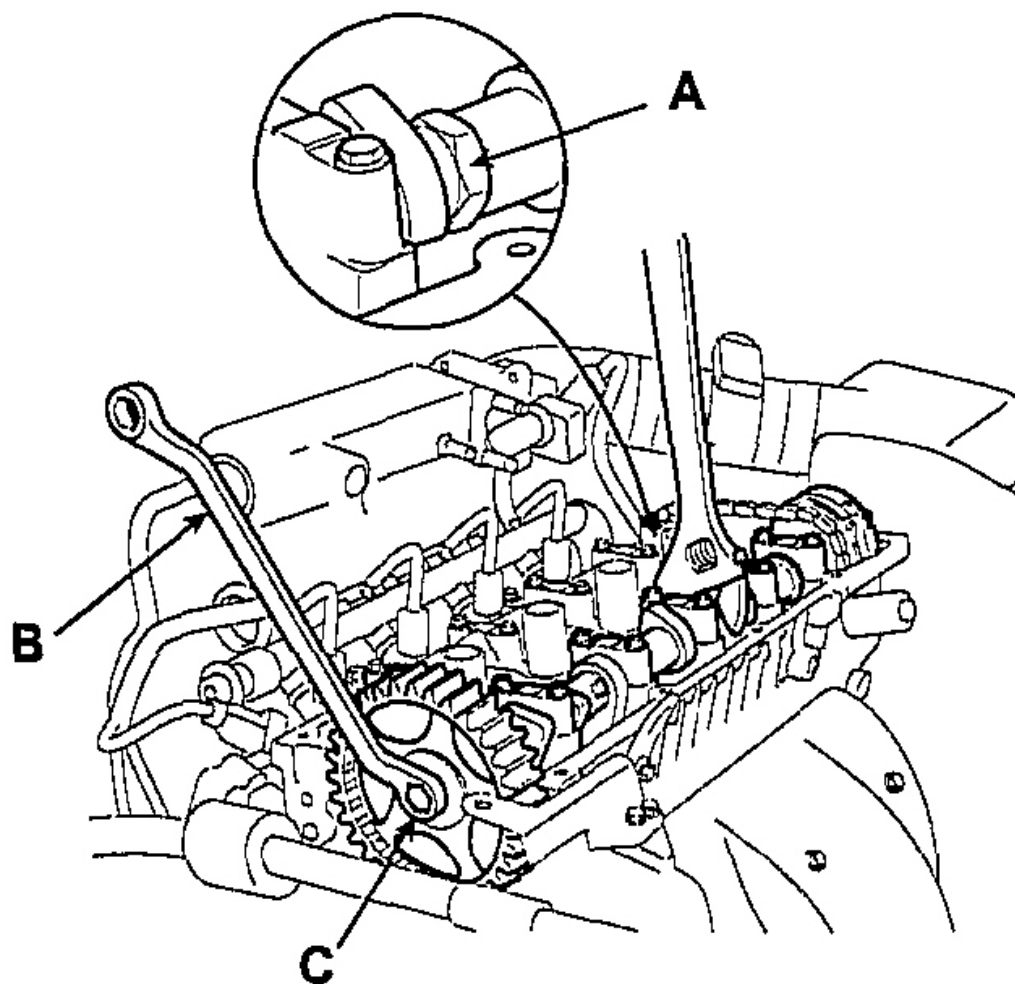
NOTE:

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

INSTALLATION

1. Install the camshaft sprocket and tighten the bolt to the specified torque.
 - a. Temporarily install the camshaft sprocket bolt (C).
 - b. Hold the portion (A) of the camshaft with a hexagonal wrench, and tighten the bolt (C) with a wrench (B).

Tightening torque: 98.1-117.7 N.m (10-12 kg-m, 72.3-86.8 lb-ft)

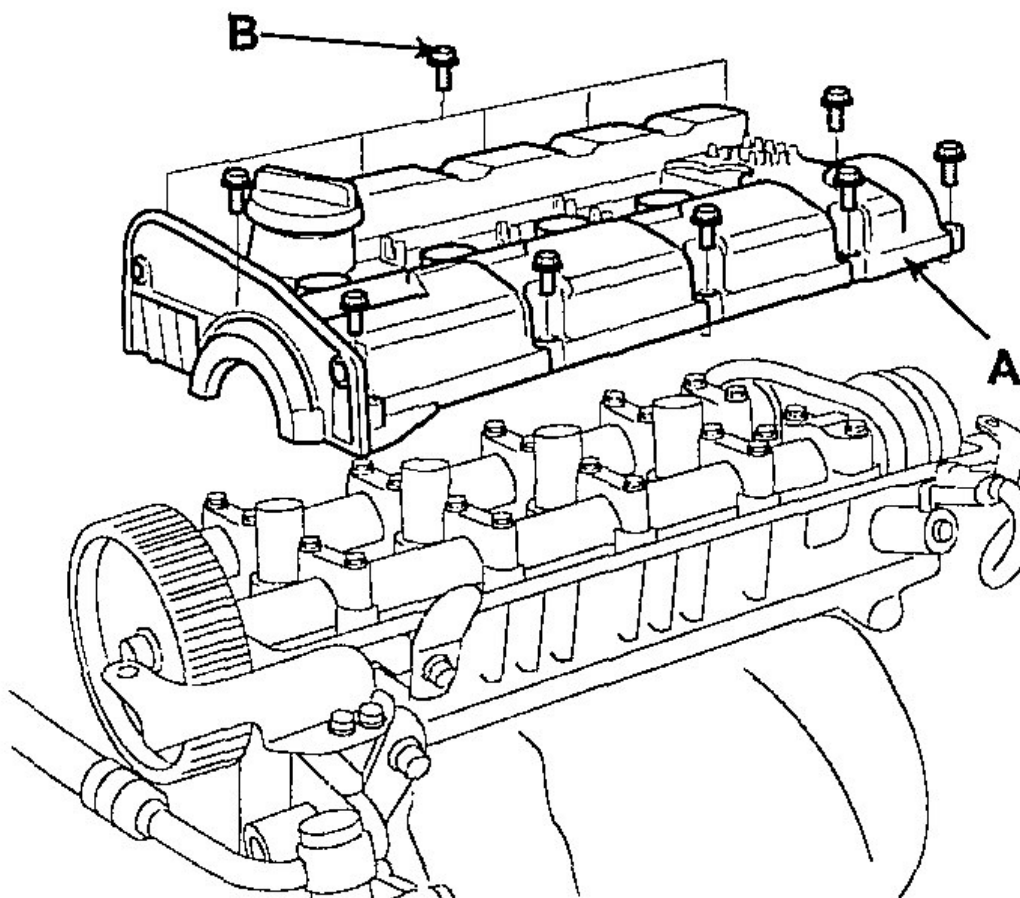


G00718994

Fig. 67: Installing Camshaft Sprocket
Courtesy of KIA MOTORS AMERICA, INC.

2. Install the cylinder head cover.
 - a. Install the cylinder head cover (A) and bolts (B).

Tightening torque: 7.8-9.8 N.m (0.8-1.0 kg-m, 5.8-7.2 lb-ft)



G00718995

Fig. 68: Installing Cylinder Head Cover
Courtesy of KIA MOTORS AMERICA, INC.

- b. Install the PCV (Positive Crankcase Ventilation) hose (A) and breather hose (B) to the cylinder head cover.

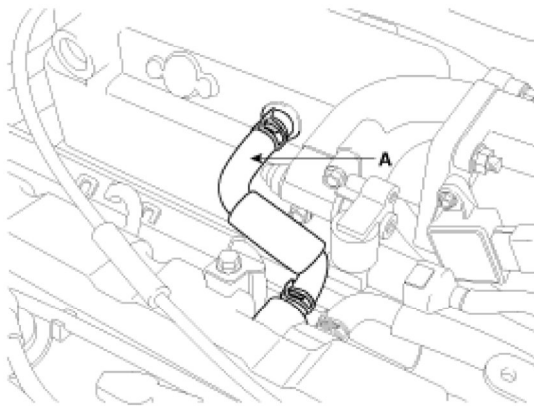
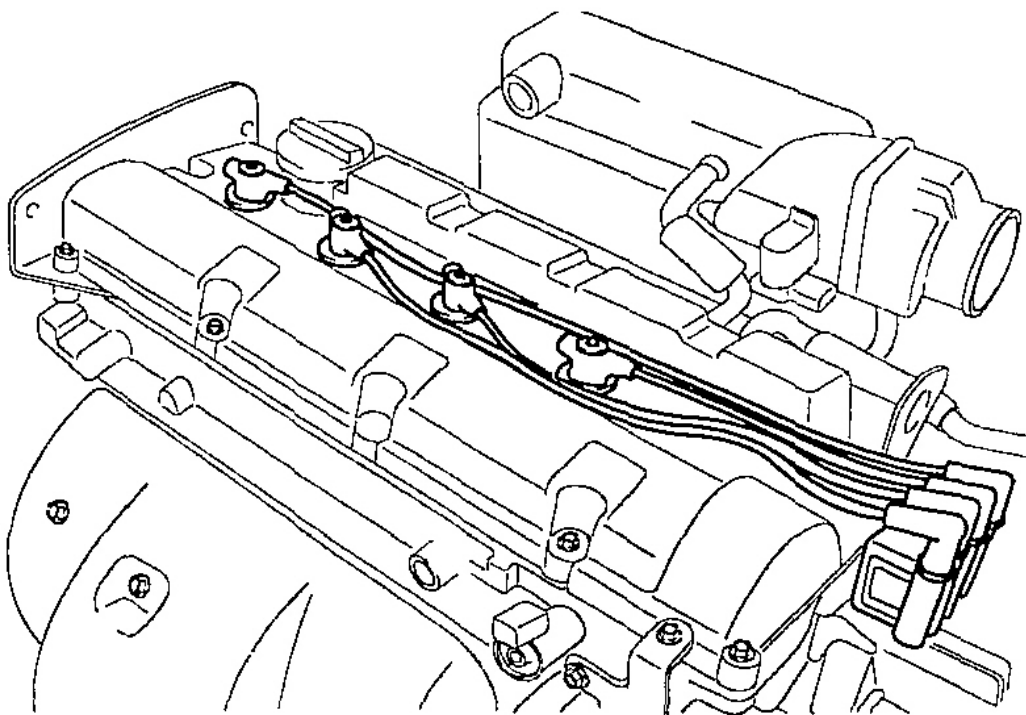


Fig. 69: PCV Hose

Courtesy of KIA MOTORS AMERICA, INC.

- c. Install the spark plug cables.

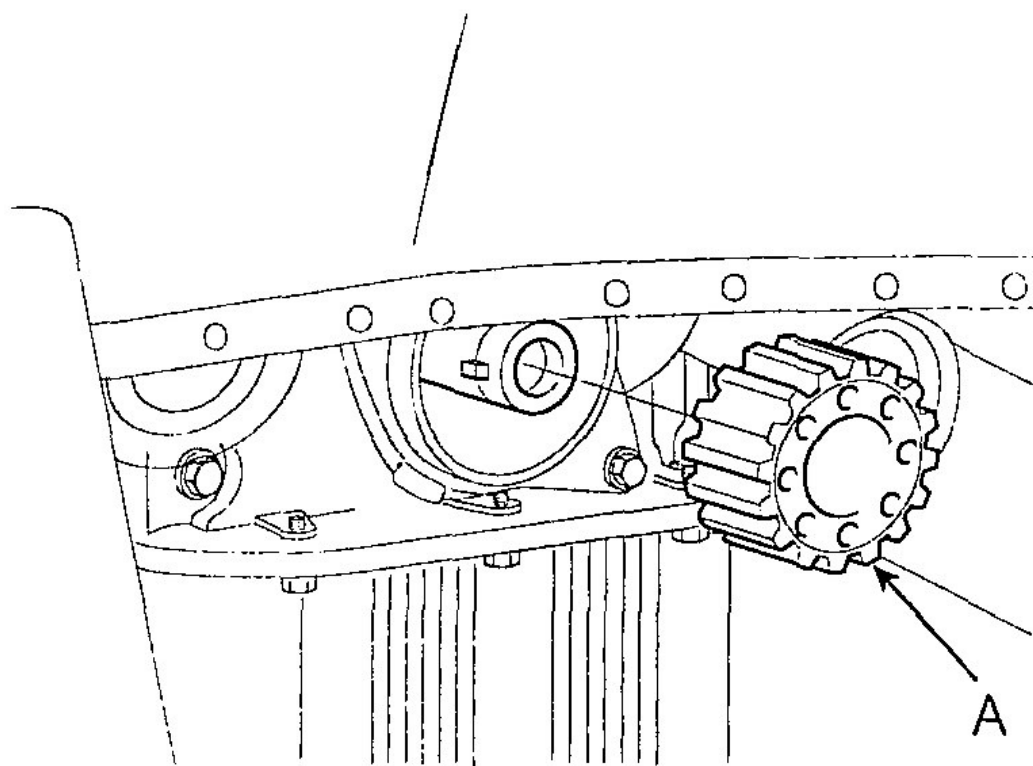


G00718998

Fig. 70: Installing Spark Plug Cables

Courtesy of KIA MOTORS AMERICA, INC.

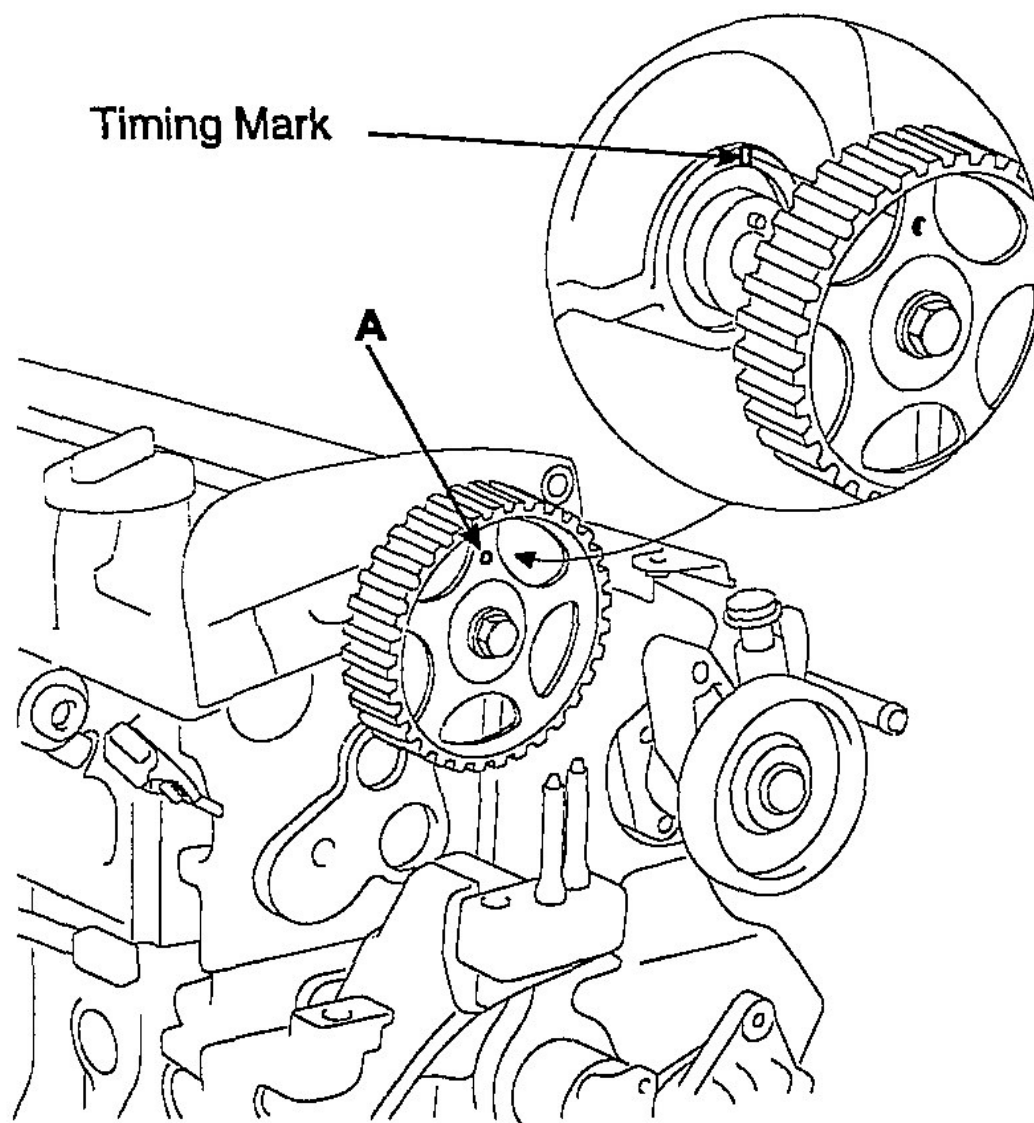
- 3. Install the crankshaft sprocket (A).



G00718999

Fig. 71: Installing Crankshaft Sprocket
Courtesy of KIA MOTORS AMERICA, INC.

4. Align the timing marks of the camshaft sprocket (A) and crankshaft sprocket (B) with the No. 1 piston placed at top dead center and its compression stroke.



G00719000

Fig. 72: Aligning Camshaft Timing Marks
Courtesy of KIA MOTORS AMERICA, INC.

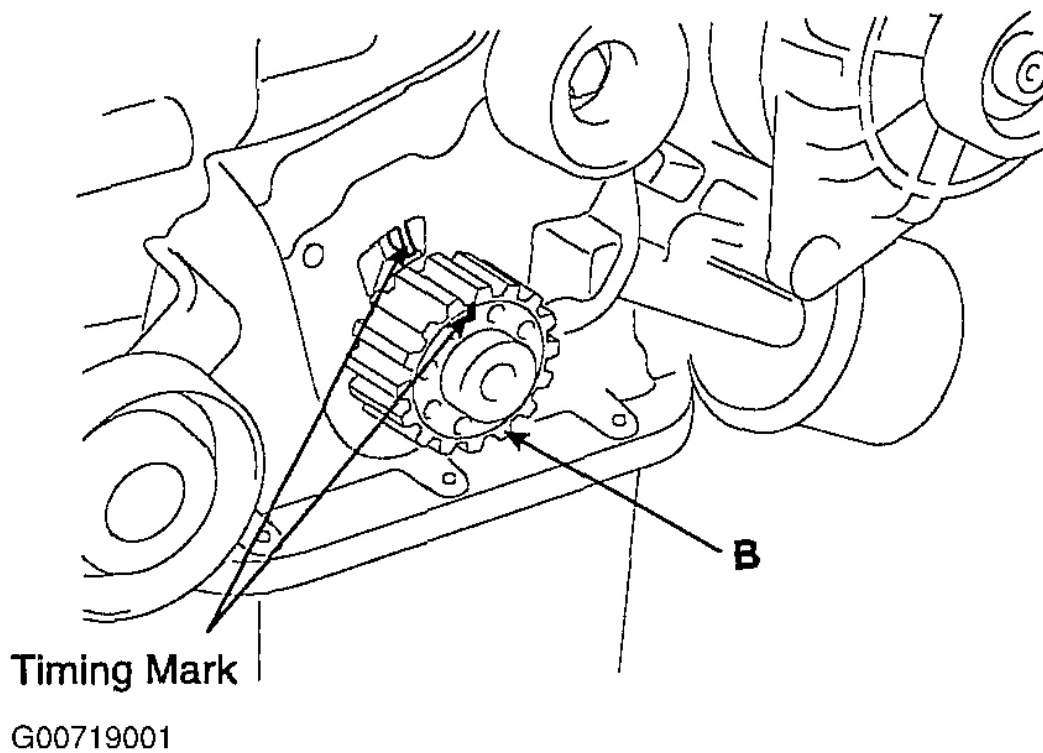
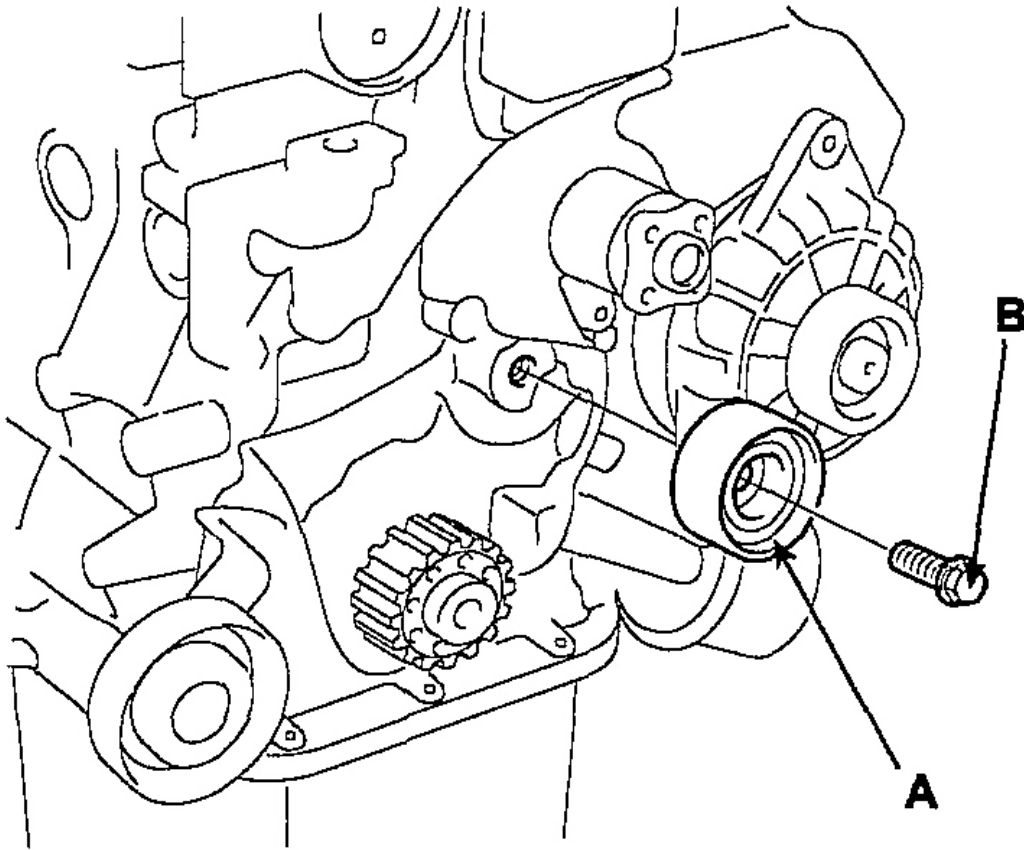


Fig. 73: Aligning Crankshaft Timing Marks
Courtesy of KIA MOTORS AMERICA, INC.

5. Install the idler pulley (A) and tighten the bolt (B) to the specified torque.

Tightening torque: 42.2-53.9 N.m (4.3-5.5 kg-m, 31.1-39.8 lb-ft)

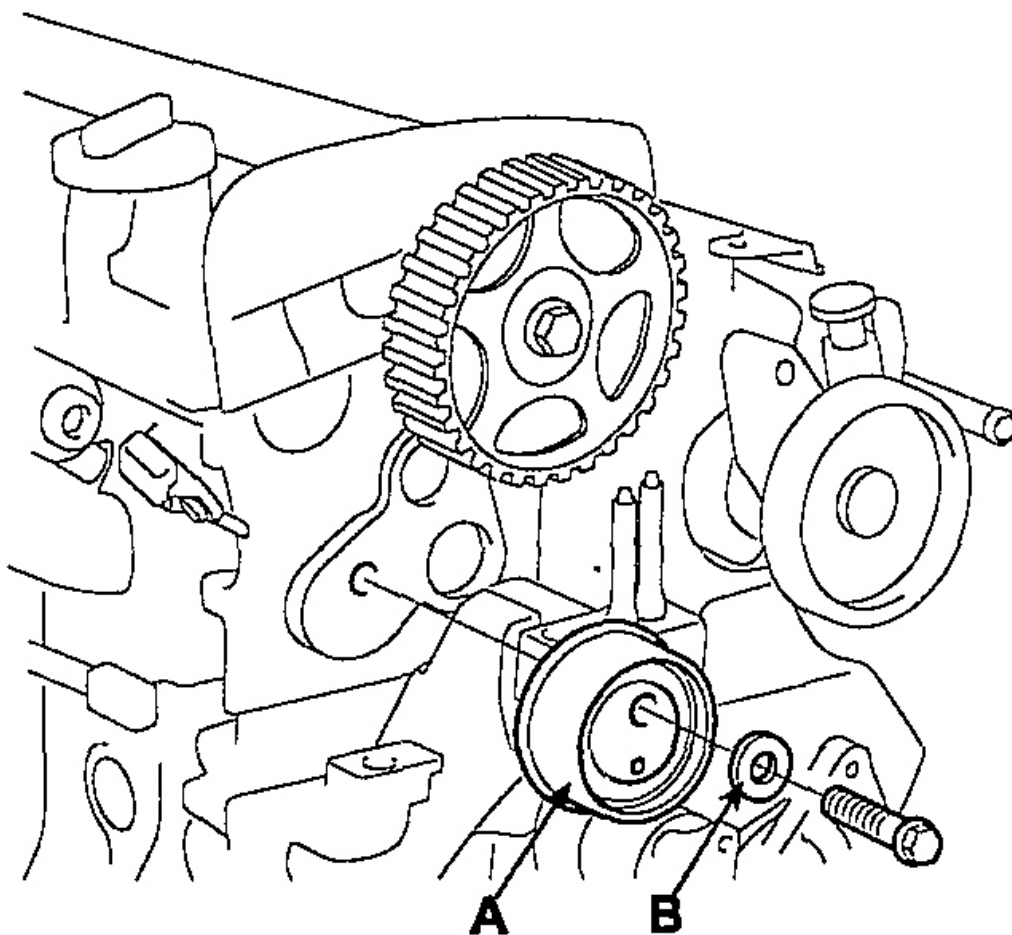


G00719002

Fig. 74: Installing Idler Pulley

Courtesy of KIA MOTORS AMERICA, INC.

6. Temporarily install the timing belt tensioner (A) with plain washer (B).

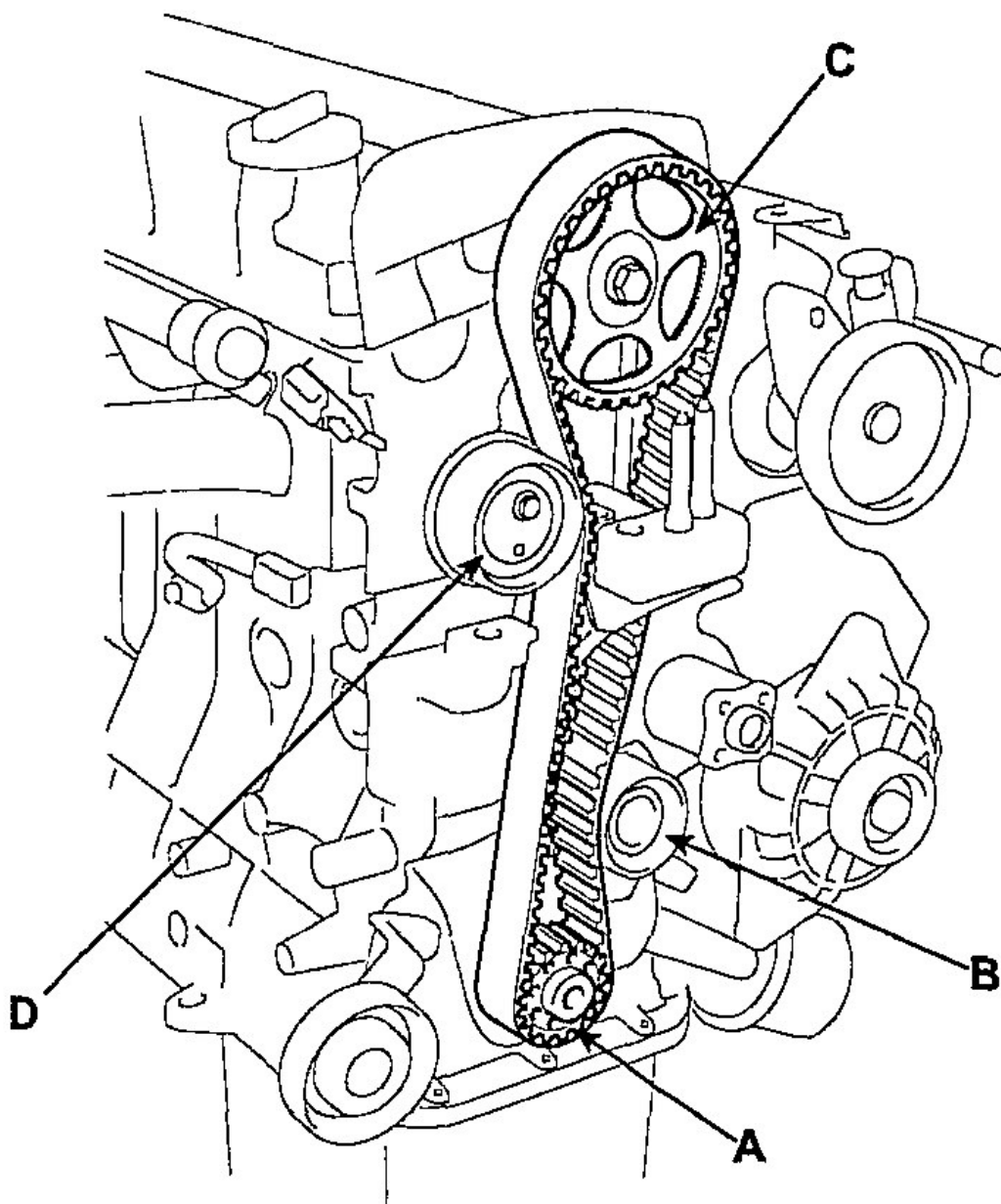


G00719003

Fig. 75: Temporarily Installing Timing Belt Tensioner
Courtesy of KIA MOTORS AMERICA, INC.

7. Install the timing belt on pulleys. See **Fig. 76**.

Crankshaft sprocket (A) --> idler pulley (B) --> camshaft sprocket (C) --> timing belt tensioner (D).

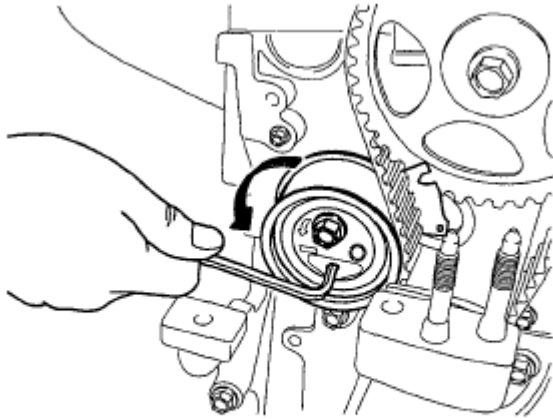


G00719004

Fig. 76: Illustrating Timing Belt Installation Sequence
Courtesy of KIA MOTORS AMERICA, INC.

8. Check the alignment of the timing marks on each sprocket.
9. Remove the pin fixing the tensioner arm.

10. Using a hex wrench, turn the adjuster counterclockwise to make the indicator of the arm (A) located at the center of the base notch.



SHDEM7002N

Fig. 77: Checking Timing Belt Tension
Courtesy of KIA MOTORS AMERICA, INC.

CAUTION: Do not rotate the adjuster clockwise.

It will result in auto tensioner's functional problem.

11. Tightening tenbolt with fixing the indicator not to move.

Tightening torque

Tensioner bolt :

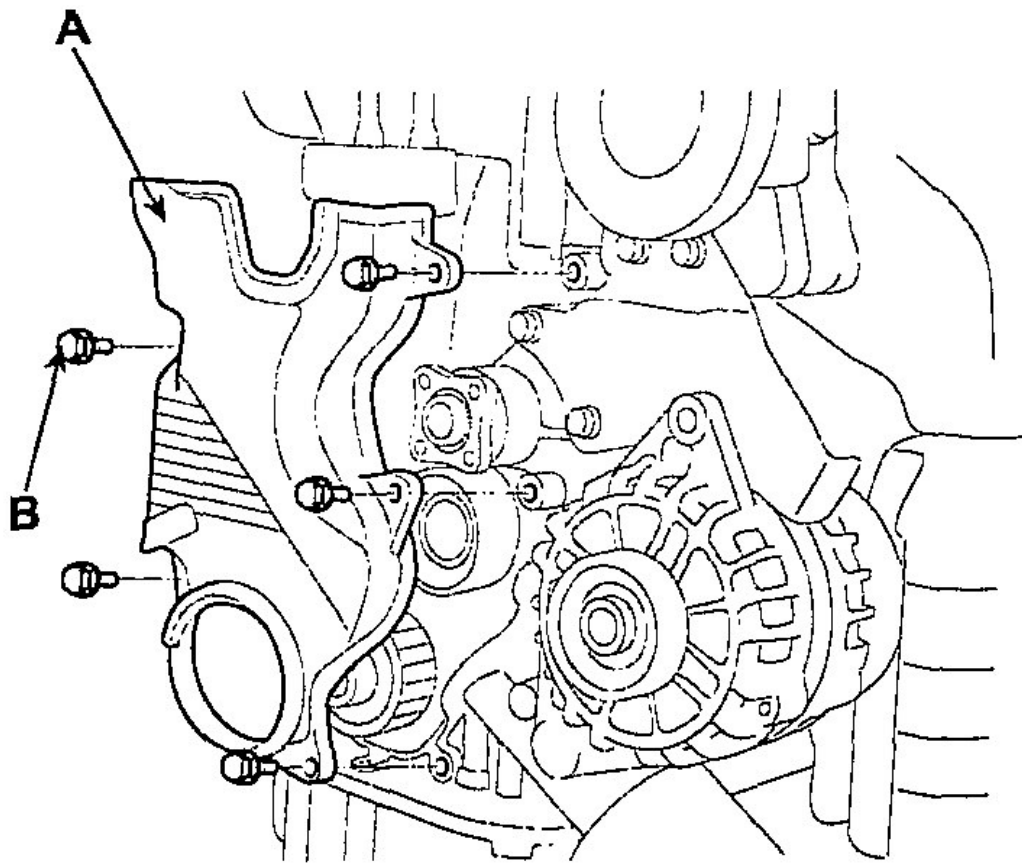
22.6 ~ 28.4Nm (2.3 ~ 2.9kgf.m, 16.6 ~ 21.0lb-ft)

12. Turn the crankshaft two revolutions in the operating direction (clockwise) and check that the indicator is in the center of base.
13. If the indicator is not located at the center of base, slacken the bolt and repeat the procedure.
14. Install the timing belt lower cover (A) with 5 bolts (B).

Tightening torque

Timing belt cover bolt :

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



G00719008

Fig. 78: Installing Timing Belt Lower Cover
Courtesy of KIA MOTORS AMERICA, INC.

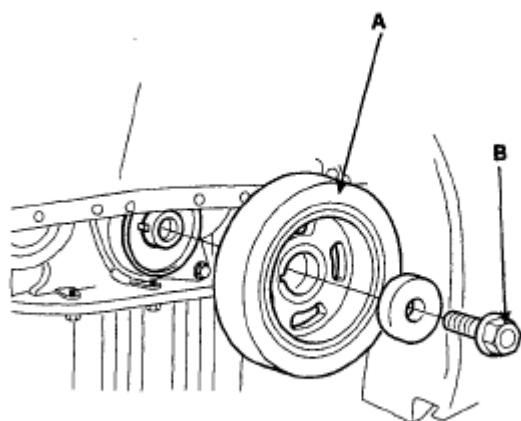
15. Install the flange and crankshaft pulley (A).

Make sure that crankshaft sprocket pin fits the small hole in the pulley.

Tightening torque

Crankshaft pulley bolt :

156.9 ~ 166.7N.m (16.0 ~ 17.0kgf.m, 115.7 ~ 123.0lb-ft)



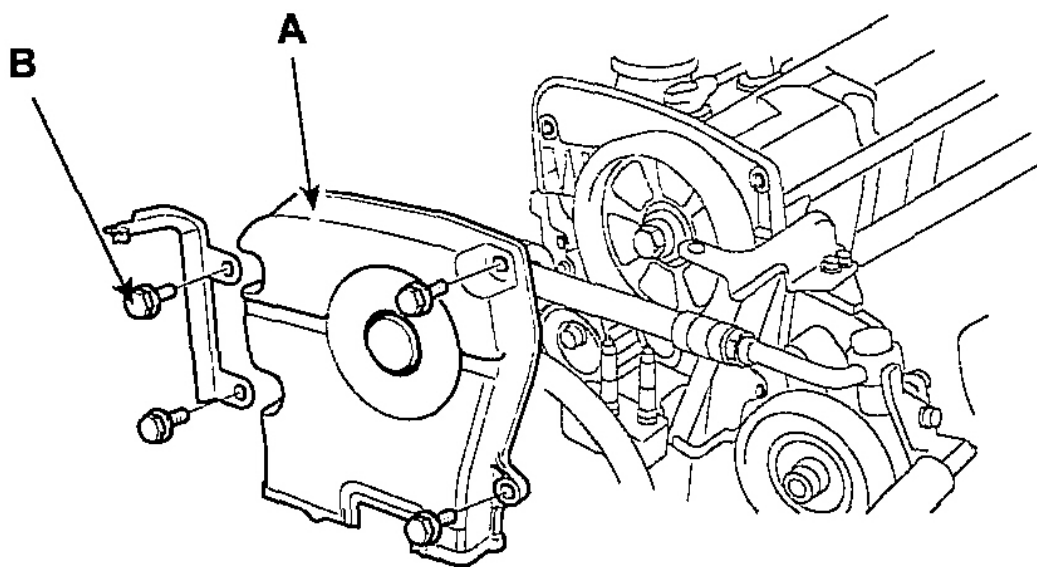
ECKD107A

Fig. 79: Locating Crankshaft Pulley Bolt And Crankshaft Pulley
Courtesy of KIA MOTORS AMERICA, INC.

16. Install the timing belt upper cover (A) with 4bolts (B).

Tightening torque :

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



G00719010

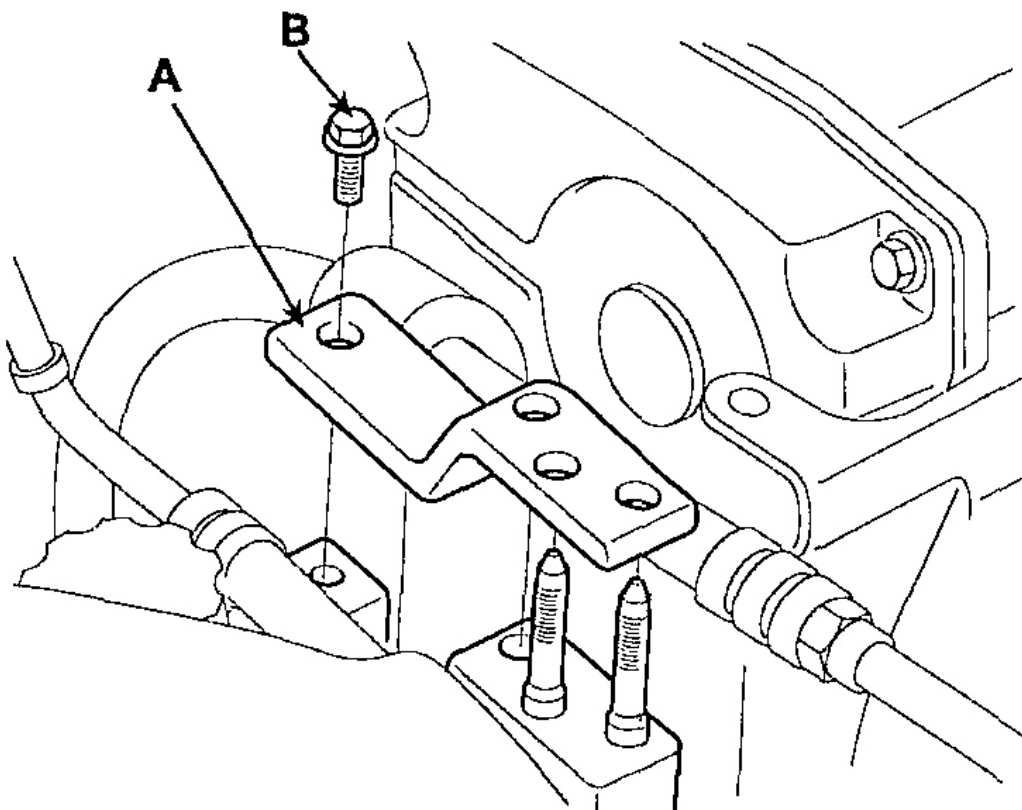
Fig. 80: Installing Front Upper Cover
Courtesy of KIA MOTORS AMERICA, INC.

17. Install the coolant pump pulley with 4bolts.
18. Install power steering belt.
19. Install air compressor bolt.
20. Install alternator belt.
21. Install the engine mount bracket
 1. Install the stay plate (A) with bolt (B).

Tightening torque

Stay plate bolt :

42.2 ~ 53.9Nm (4.3 ~ 5.5kgf.m 31.1 ~ 39.8lb-ft)



G00719011

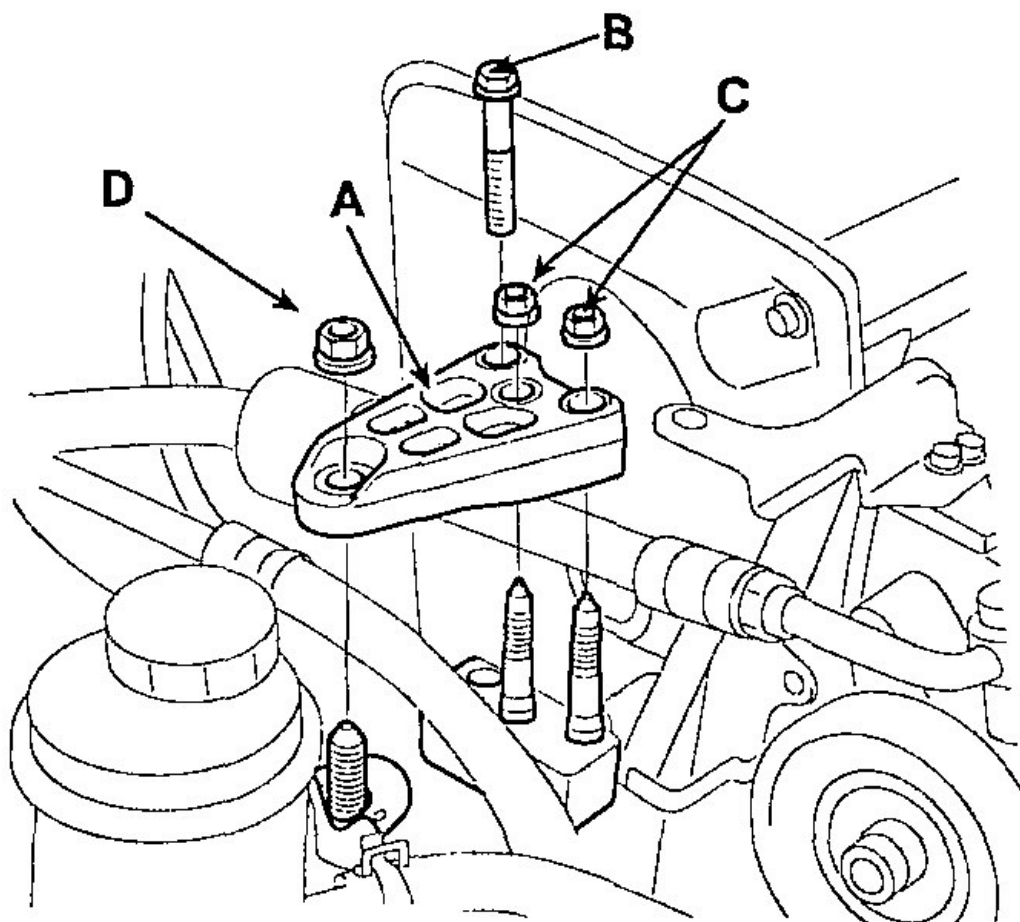
Fig. 81: Installing Engine Mounting Support Bracket Stay Plate
Courtesy of KIA MOTORS AMERICA, INC.

2. Install the engine mounting support bracket (A) with nuts (C, D) and bolt (B).

Tightening torque:

Nut (D): 68.6-93.2 N.m (7.0-9.5 kg-m, 50.6-68.7 lb-ft)

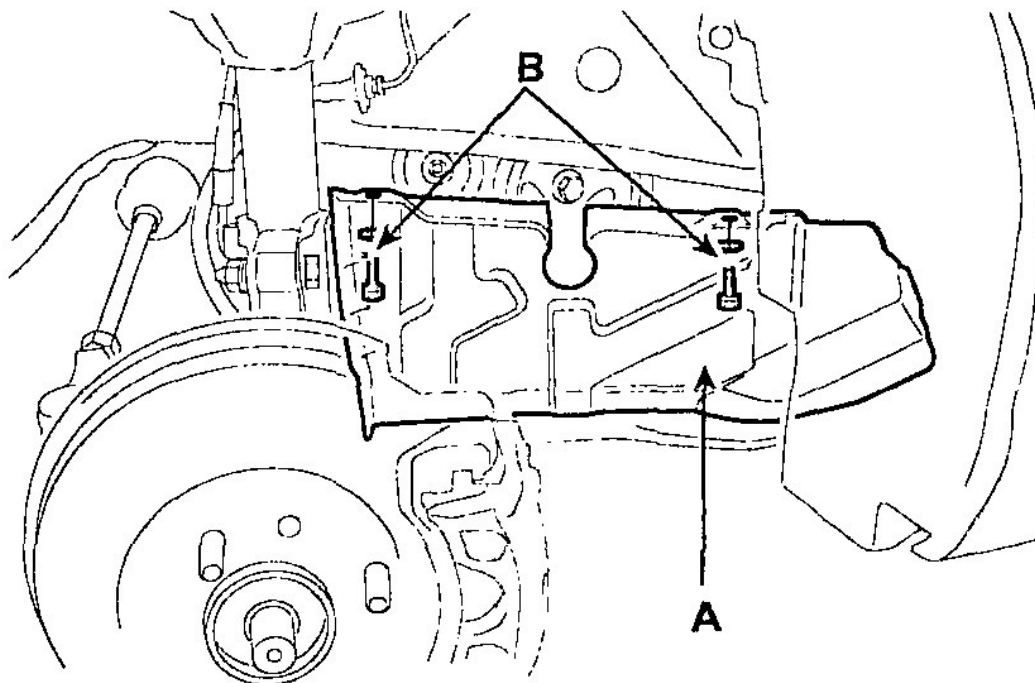
Nut (C) and bolt (B): 49.0-63.7 N.m (5.0-6.5 kg-m, 36.2-47.0 lb-ft)



G00719012

Fig. 82: Installing Engine Mounting Support Bracket
Courtesy of KIA MOTORS AMERICA, INC.

22. Install the RH side cover (A) with 2 bolts (B).



G00719013

Fig. 83: Installing RH Side Cover
Courtesy of KIA MOTORS AMERICA, INC.

23. Install the RH front wheel.

Tightening torque: 88.3-98.1 N.m (9.0-10.0 kg-m, 65.1-72.3 lb-ft)

24. Install the engine cover with bolts.

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

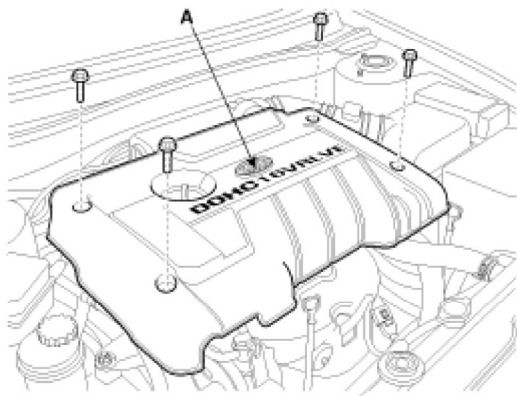
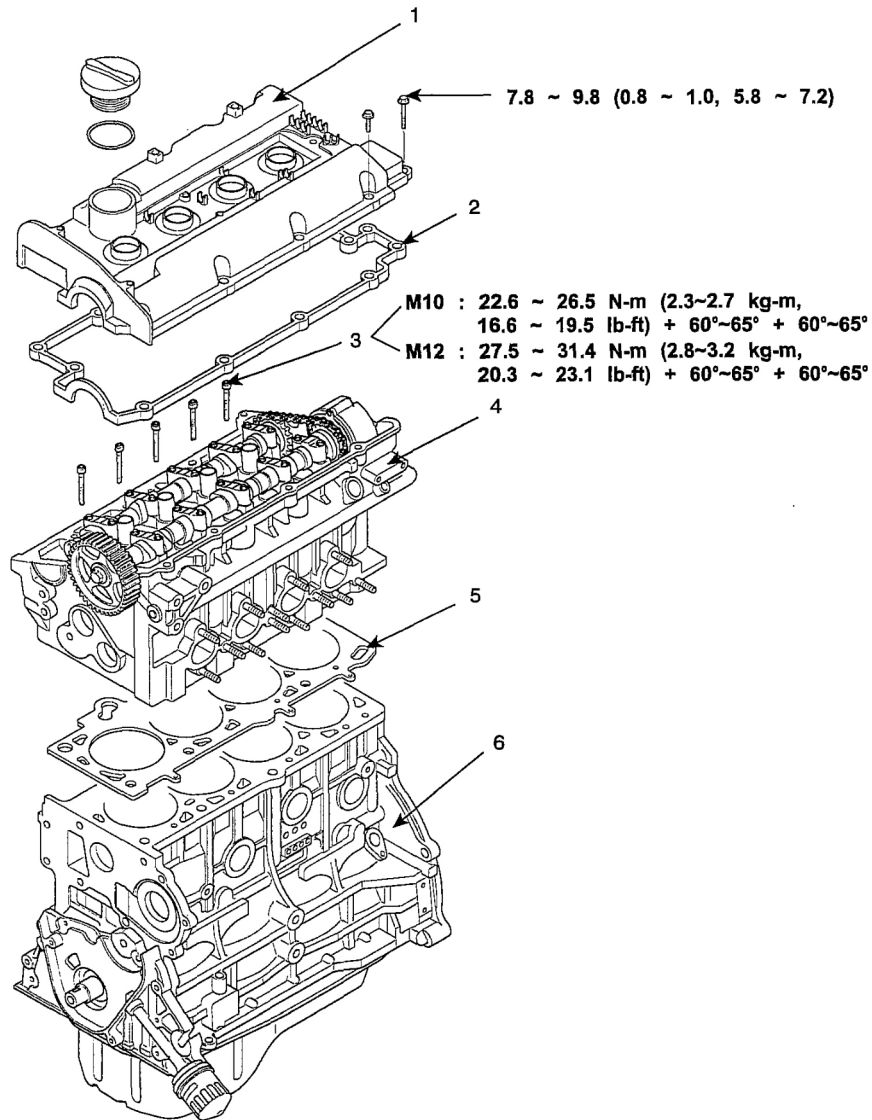


Fig. 84: Removing/Installing Engine Cover
Courtesy of KIA MOTORS AMERICA, INC.

CYLINDER HEAD ASSEMBLY

COMPONENT



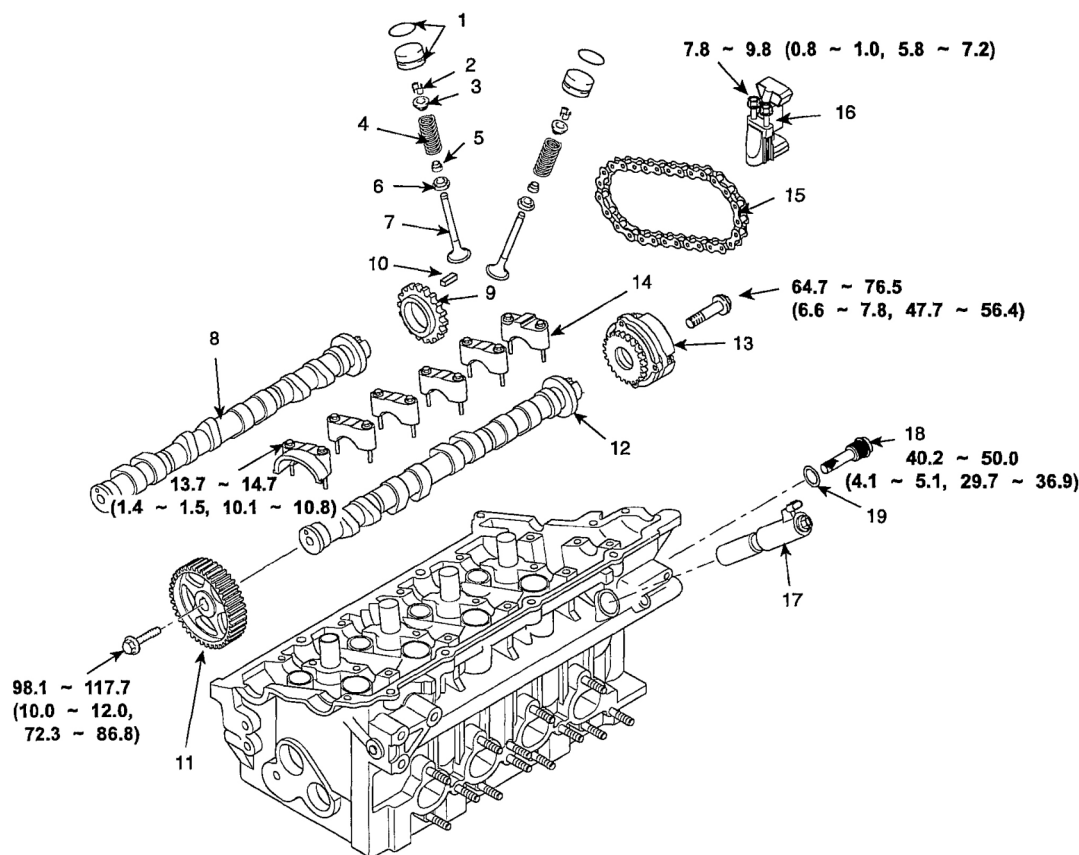
TORQUE : N-m (kg-m, lb-ft)

- 1. Cylinder head cover
- 2. Gasket
- 3. Cylinder head bolt

- 4. Cylinder head
- 5. Cylinder head gasket
- 6. Cylinder block

G00719015

Fig. 85: Identifying Cylinder Head Assembly Components With Torque Specifications (1 Of 2)
 Courtesy of KIA MOTORS AMERICA, INC.



TORQUE : N-m (kg-m, lb-ft)

- | | |
|------------------------------------|--|
| 1. MLA (Mechanical Lash Adjuster) | 11. Camshaft sprocket |
| 2. Retainer lock | 12. Exhaust camshaft |
| 3. Retainer | 13. CVVT (Continuously Variable Valve Timing) assembly |
| 4. Valve spring | 14. Camshaft bearing cap |
| 5. Stem seal | 15. Timing chain |
| 6. Spring seat | 16. Auto tensioner |
| 7. Valve | 17. OCV (Oil Control Valve) |
| 8. Intake camshaft | 18. OCV (Oil Control Valve) filter |
| 9. Chain sprocket | 19. Washer |
| 10. Key | |

G00719016

Fig. 86: Identifying Cylinder Head Assembly Components With Torque Specifications (2 Of 2)
Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

NOTE: Engine removal is not required for this procedure.

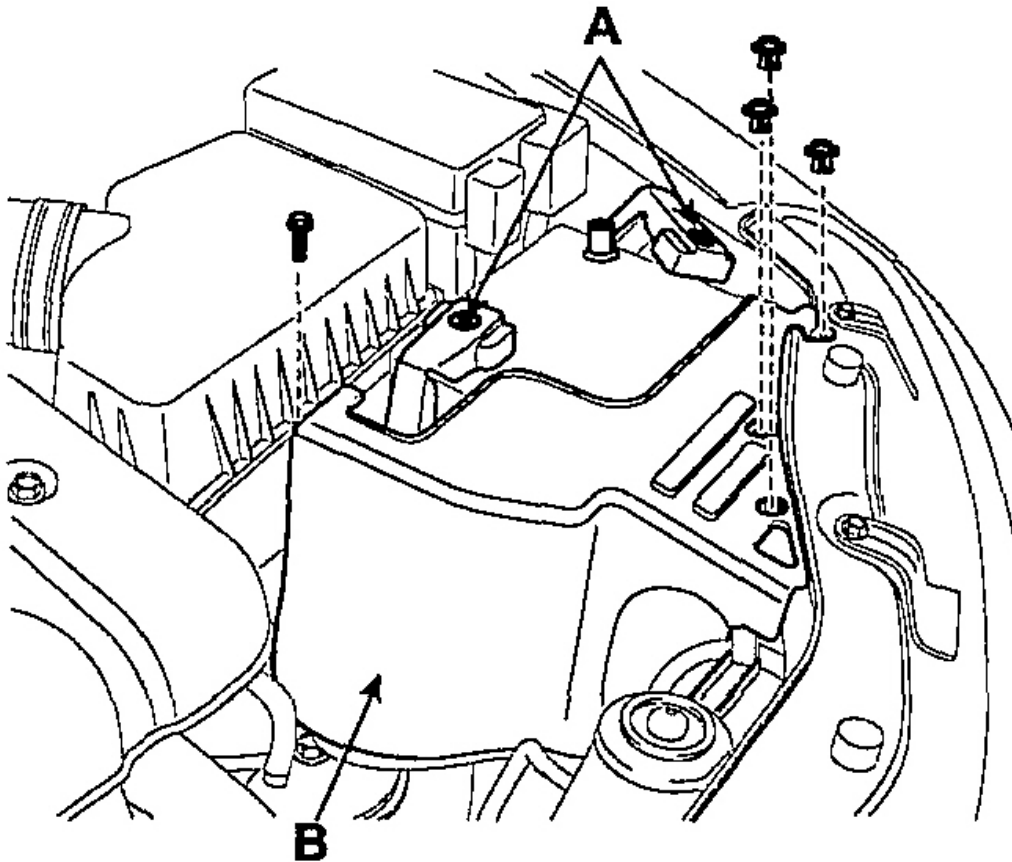
- CAUTION:**
- Use Fender cover to avoid damaging painted surfaces.
 - To avoid damaging the cylinder head, wait until the engine coolant temperature drops below normal temperature before removing it.

- When handling a metal gasket, take care not to fold the gasket or damage the contact surface of the gasket.
- To avoid damage, unplug the wiring connectors carefully while holding the connector portion.

NOTE:

- Mark all wiring and hoses to avoid misconnection.
- Inspect the timing belt before removing the cylinder head.
- Turn the crankshaft pulley so that the No. 1 piston is at top dead center.

1. Disconnect the terminals (A) from battery and remove the heat shield (B).



G00719017

Fig. 87: Disconnecting Battery Terminals
 Courtesy of KIA MOTORS AMERICA, INC.

2. Remove the engine cover.

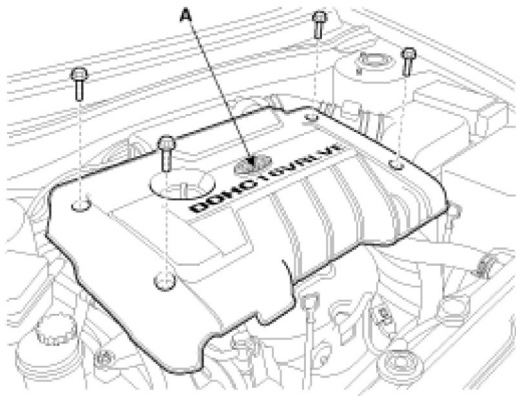


Fig. 88: Removing/Installing Engine Cover
Courtesy of KIA MOTORS AMERICA, INC.

3. Remove the radiator cap to speed draining.
4. Loosen the radiator drain plug.

and drain engine coolant.
5. Remove the intake air hose and air cleaner assembly.
 - a. Disconnect the MAF connector (A).
 - b. Disconnect the breather hose (B) from air cleaner hose (D).
 - c. Remove the intake air hose and air cleaner assembly (C).

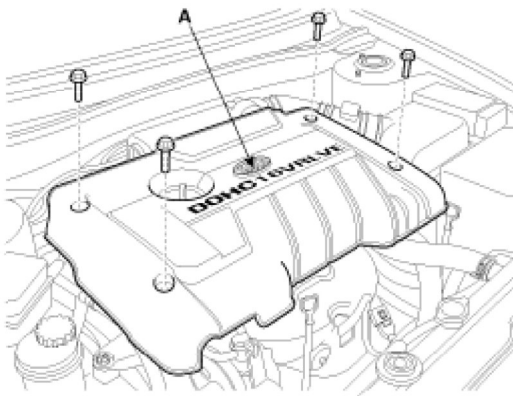
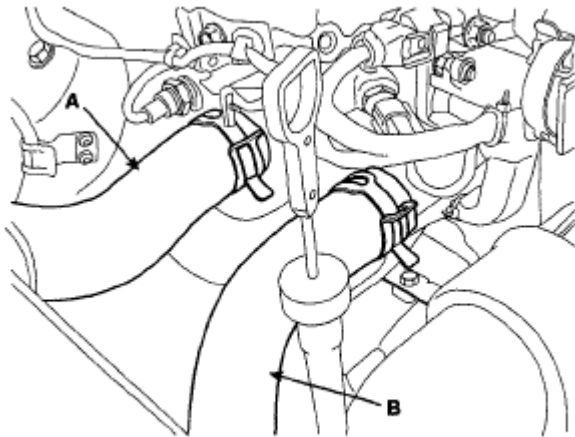


Fig. 89: Removing/Installing Engine Cover
Courtesy of KIA MOTORS AMERICA, INC.

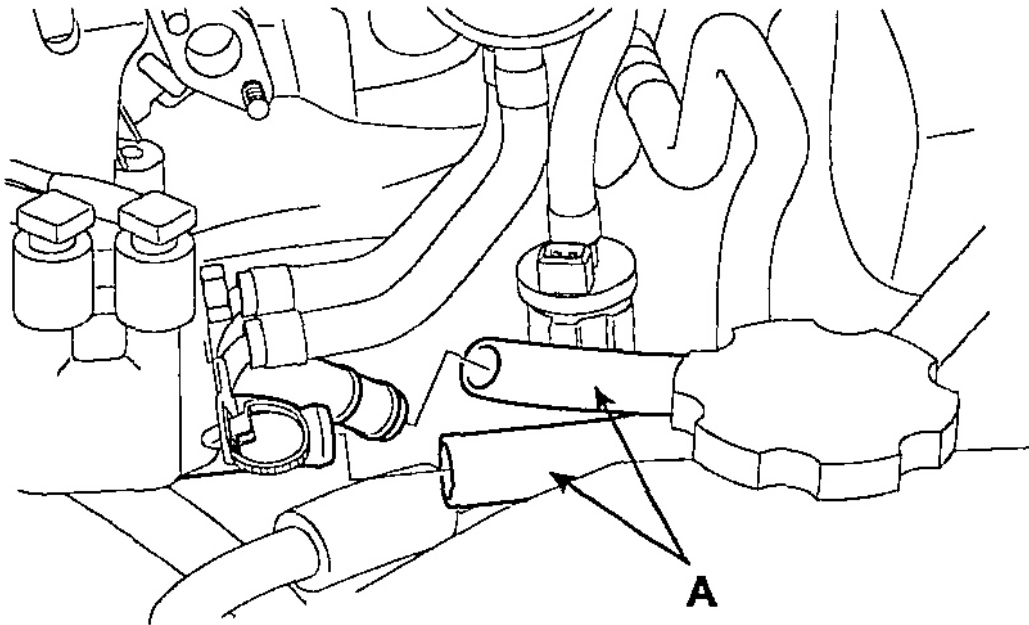
6. Remove the upper radiator hose (A) and lower radiator hose (B).



SHDM16006L

Fig. 90: Locating Upper Radiator Hose And Lower Radiator Hose
 Courtesy of KIA MOTORS AMERICA, INC.

7. Remove the heater hoses (A).

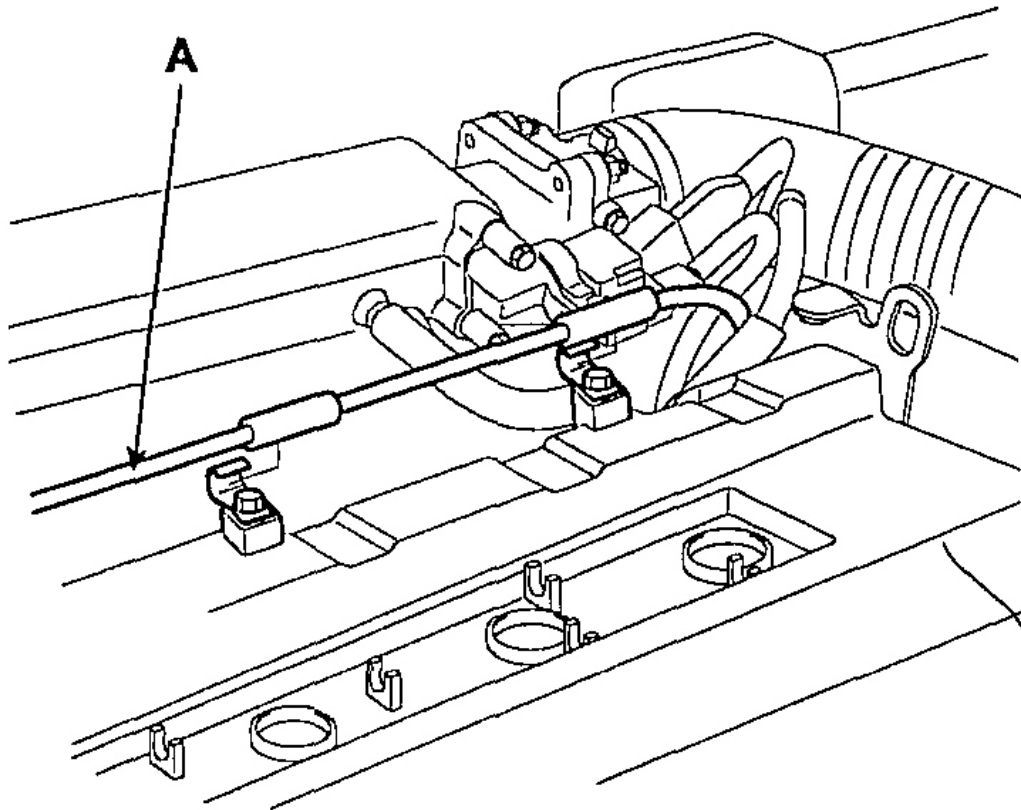


G00719022

Fig. 91: Removing Heater Hoses
 Courtesy of KIA MOTORS AMERICA, INC.

8. Remove the accelerator cable (A) by loosening the lock-nut, then slip the cable end out of the throttle

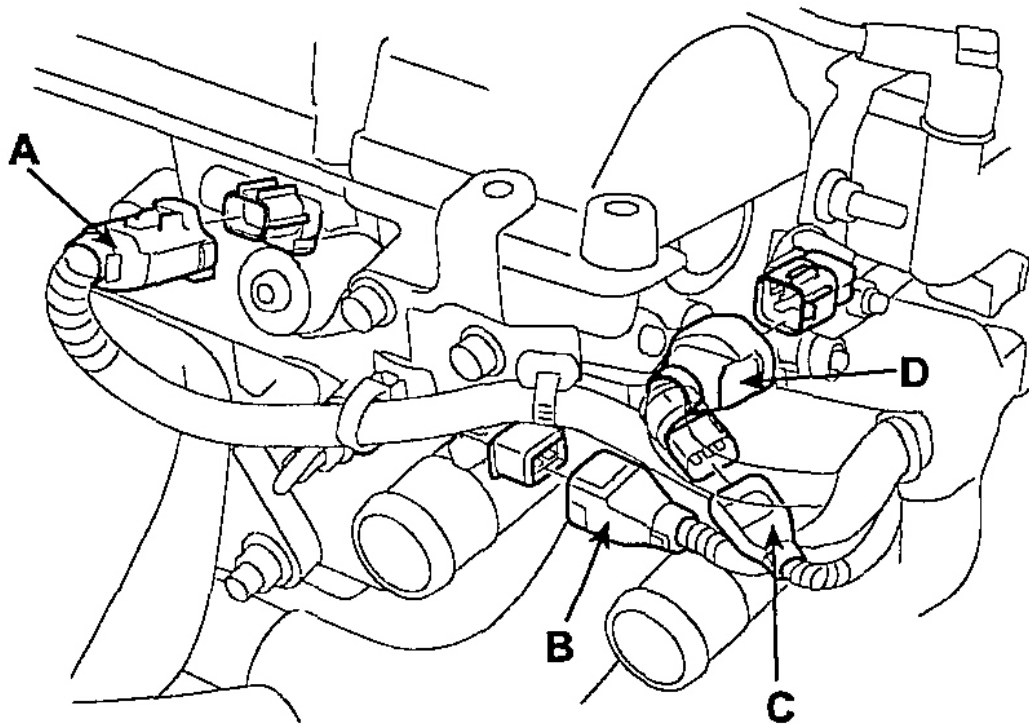
linkage.



G00719023

Fig. 92: Removing Accelerator Cable
Courtesy of KIA MOTORS AMERICA, INC.

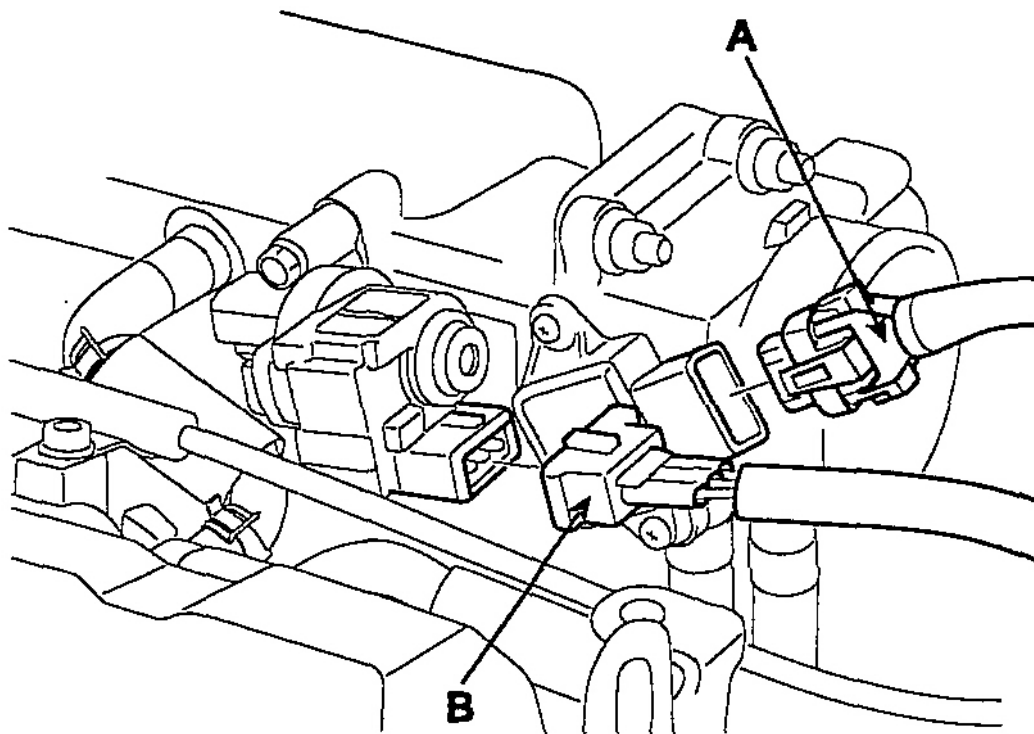
9. Remove the engine wire harness connectors and wire harness clamps from the cylinder head and the intake manifold.
 1. OCV (Oil control Valve) connector (A).
 2. Oil temperature sensor (OTS) connector (B).
 3. Engine coolant temperature (ECT) sensor connector (C).
 4. Ignition coil connector (D).



G00719024

Fig. 93: Disconnecting Engine Sensors
Courtesy of KIA MOTORS AMERICA, INC.

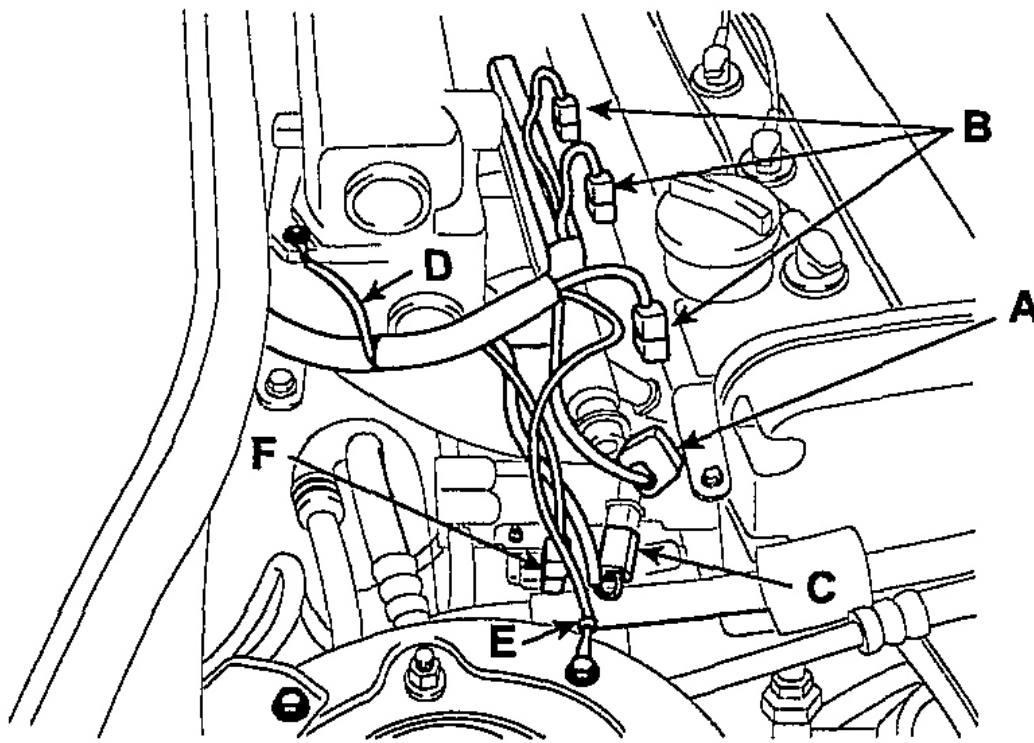
5. TPS (Throttle Position Sensor) connector (A).
6. ISA (Idle Speed Actuator) connector (B).



G00719025

Fig. 94: Disconnecting TPS & ISA Connectors
Courtesy of KIA MOTORS AMERICA, INC.

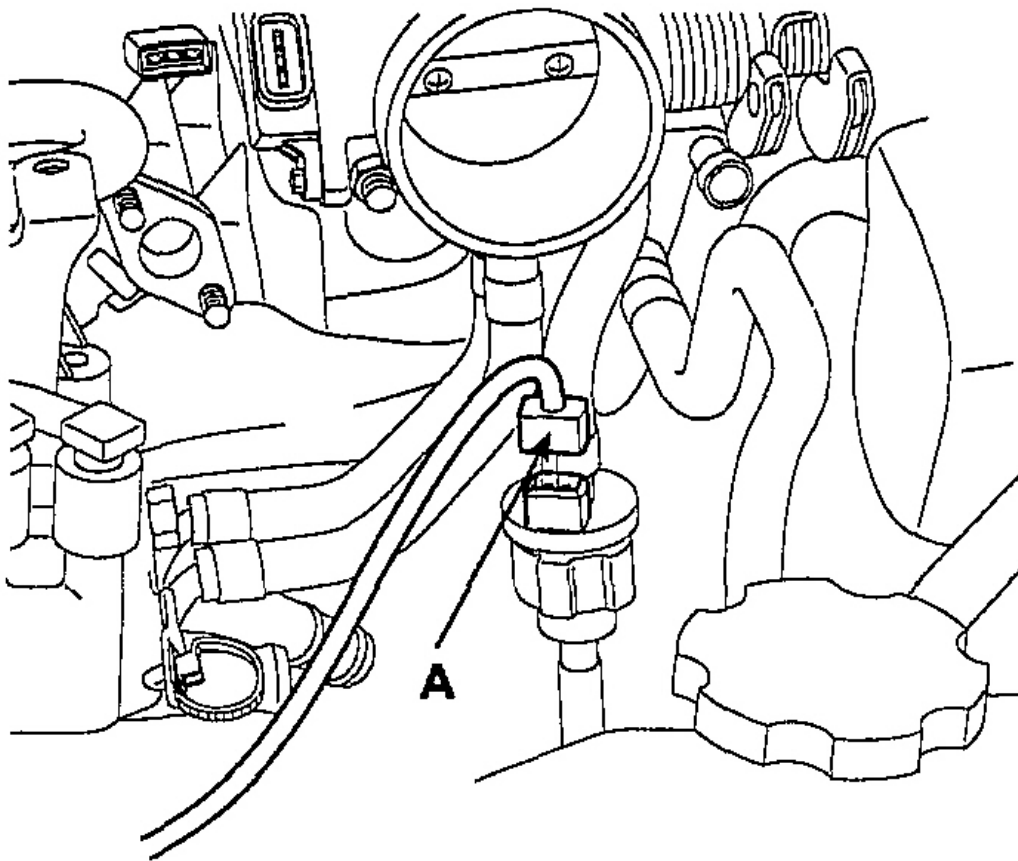
7. CMP (Camshaft Position Sensor) connector (A).
8. Four fuel injector connectors (B).
9. Knock sensor connector (C) and the ground cable (D).



G00719026

Fig. 95: Disconnecting Engine Sensor Connectors & Ground Cables
Courtesy of KIA MOTORS AMERICA, INC.

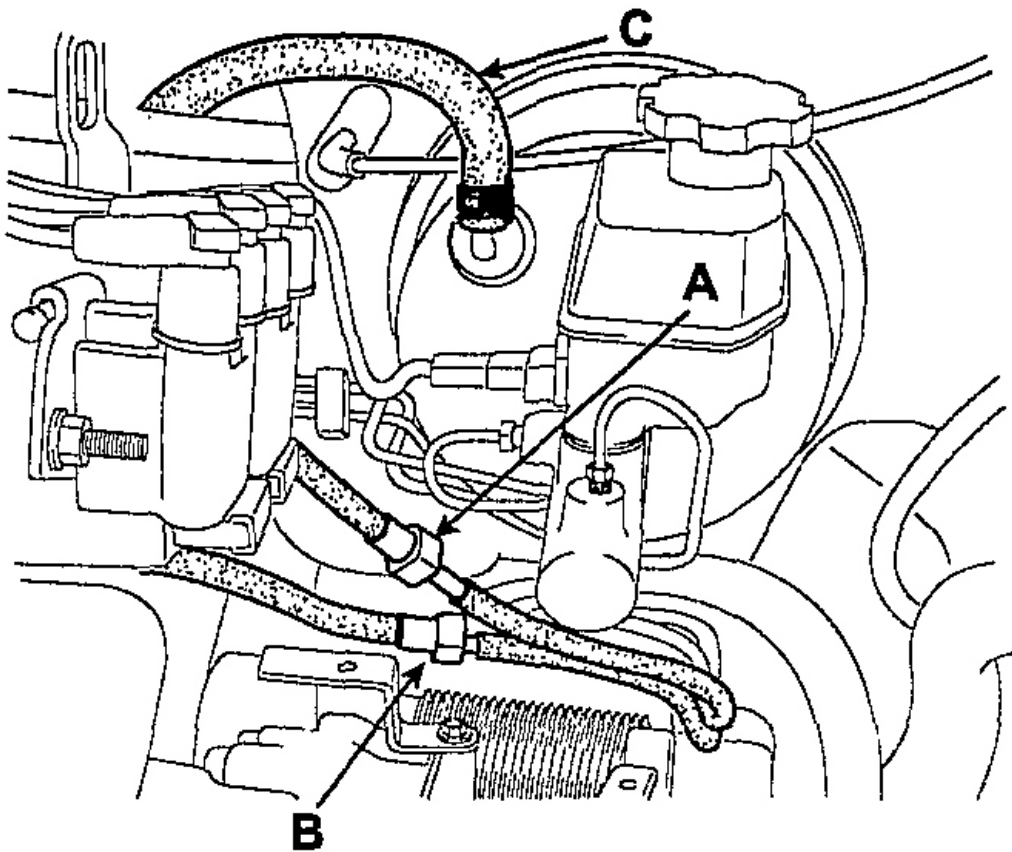
10. PCSV (Purge Control Solenoid Valve) connector (E).



G00719028

Fig. 96: Disconnecting the PCSV
Courtesy of KIA MOTORS AMERICA, INC.

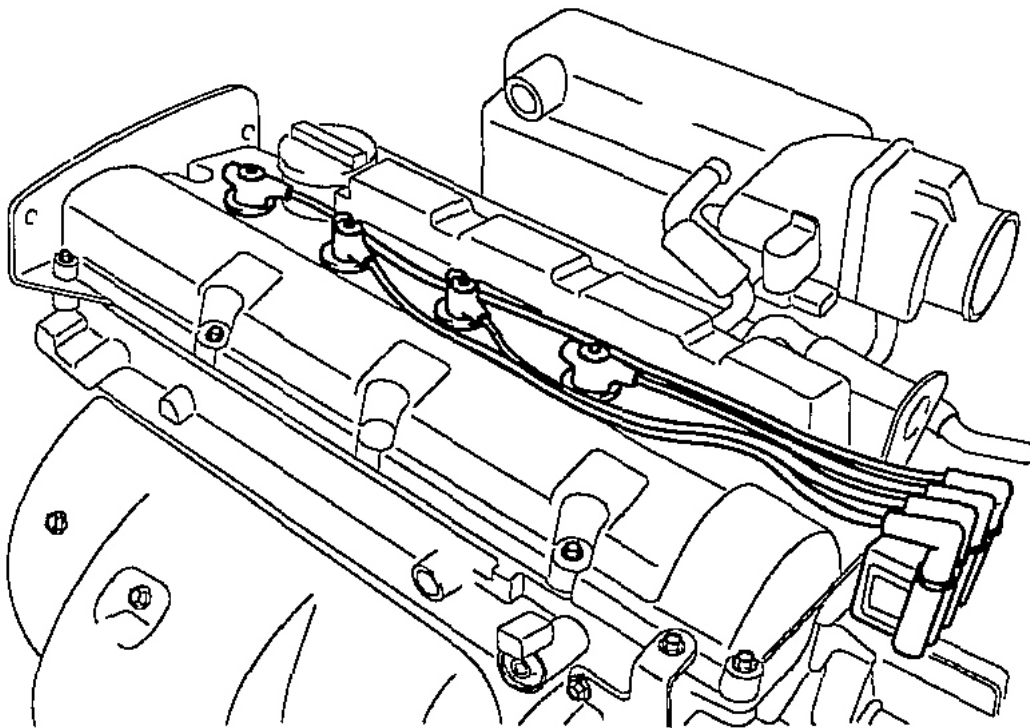
11. Front heated oxygen sensor connector.
10. Remove the fuel inlet hose (A) from delivery pipe.
11. Remove the PCSV hose (B).
12. Remove the brake booster vacuum hose (C).



G00719029

Fig. 97: Disconnecting Fuel & Vacuum Hoses
Courtesy of KIA MOTORS AMERICA, INC.

13. Remove the spark plug cables.



G00719031

Fig. 98: Removing Spark Plug Cables
Courtesy of KIA MOTORS AMERICA, INC.

14. Remove the Positive Crankcase Ventilation (PCV) hose (A).

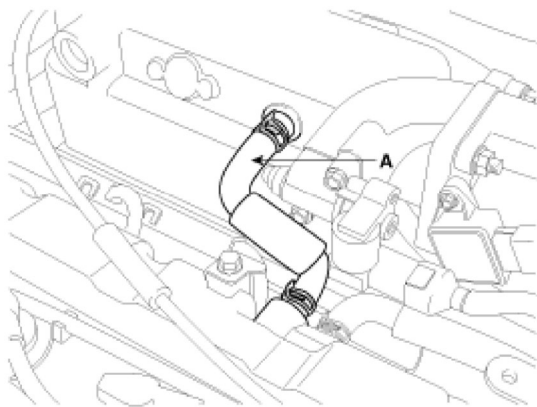
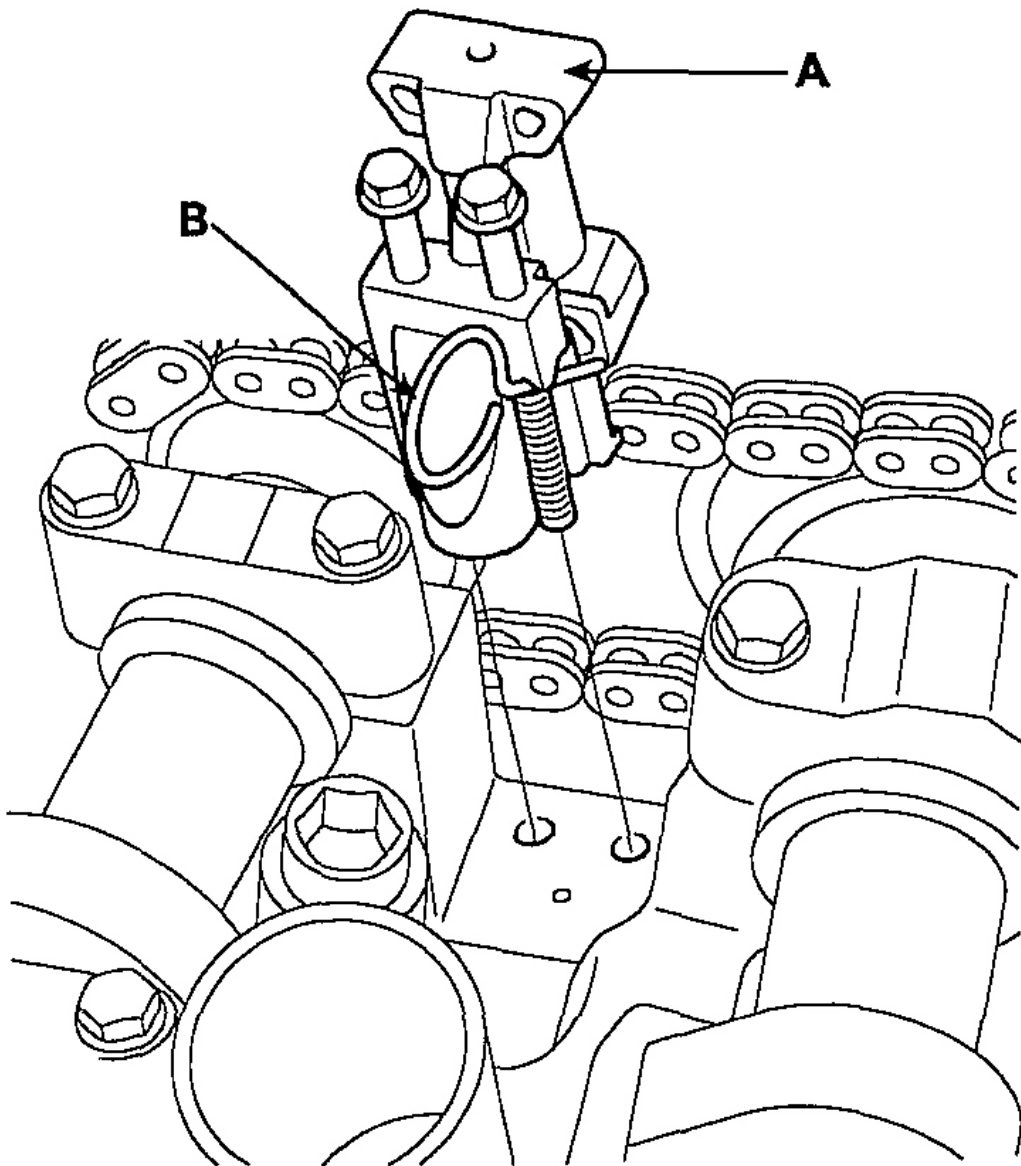


Fig. 99: PCV Hose
Courtesy of KIA MOTORS AMERICA, INC.

15. Remove the cylinder head cover.

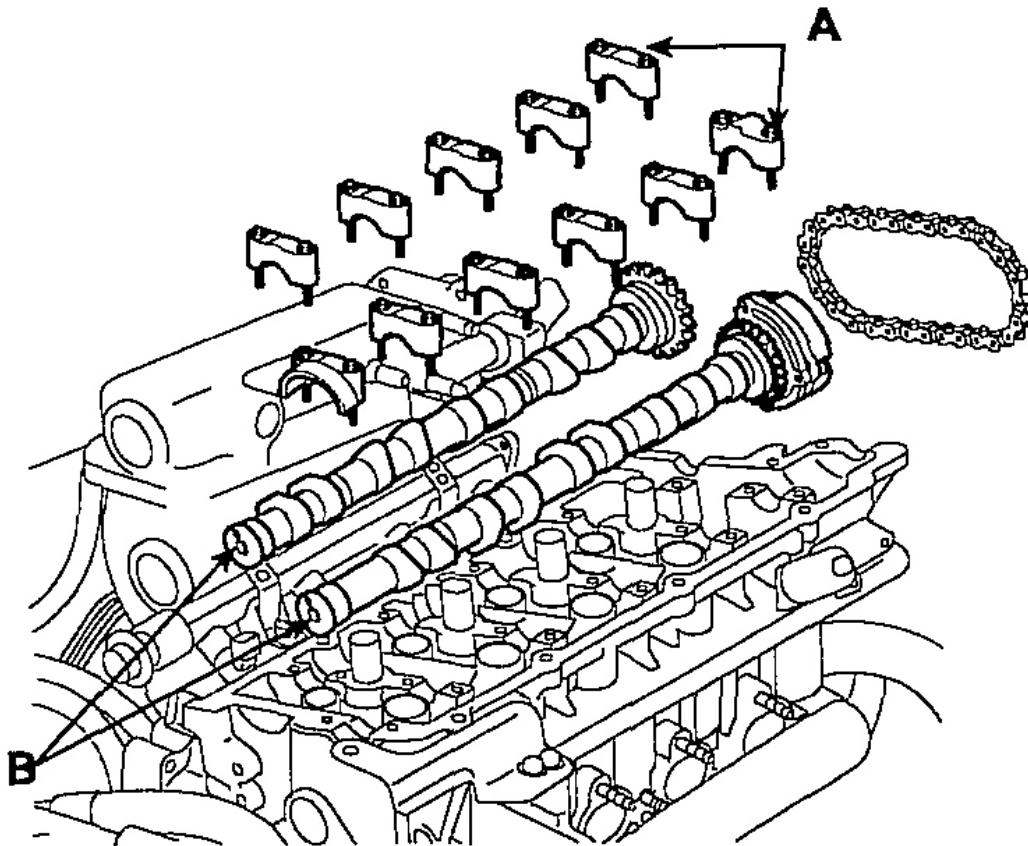
16. Remove the timing belt.
17. Remove the exhaust manifold.
18. Remove the intake manifold.
19. Remove the camshaft sprocket.
20. Remove the timing chain auto tensioner (A).



G00719032

Fig. 100: Removing Auto Tensioner
Courtesy of KIA MOTORS AMERICA, INC.

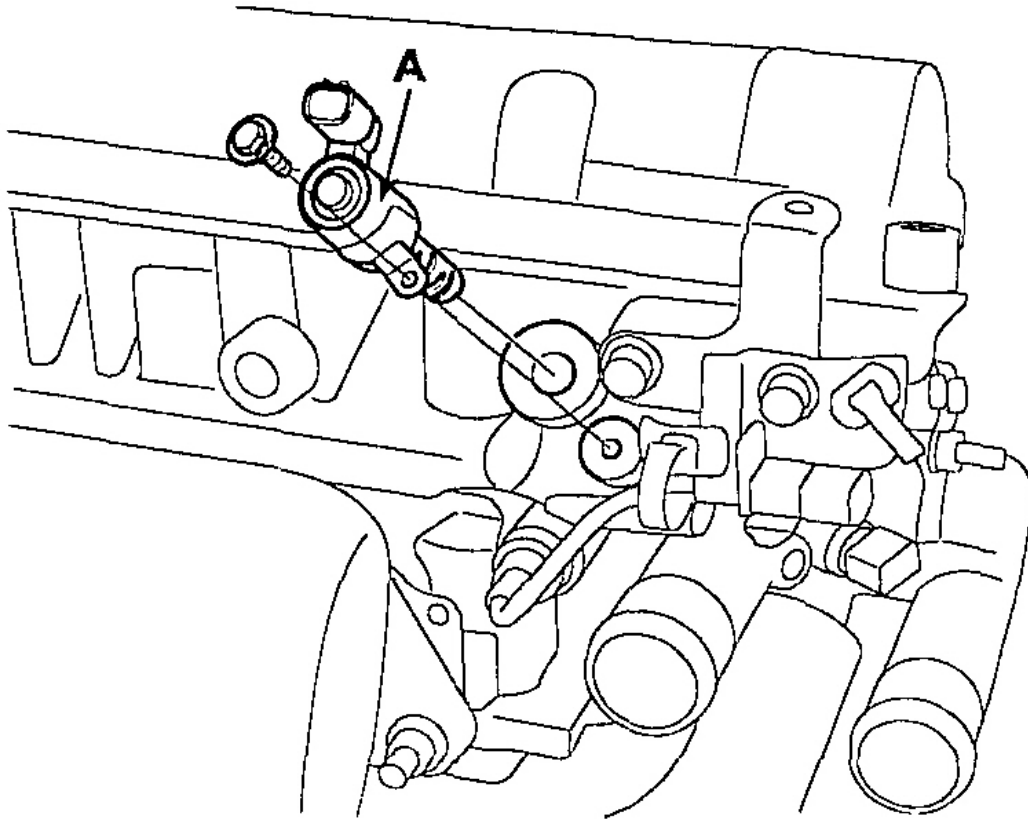
21. Remove the camshaft bearing caps (A) and camshafts (B).



G00719033

Fig. 101: Removing Camshaft Bearing Caps
Courtesy of KIA MOTORS AMERICA, INC.

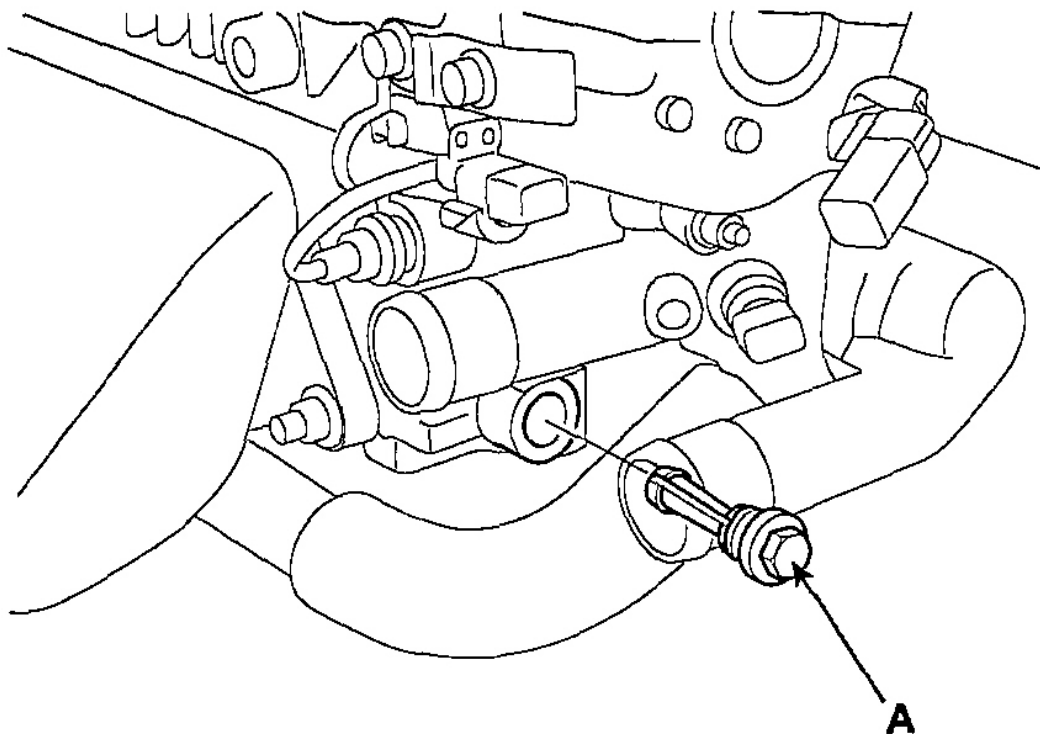
22. Remove the OCV (Oil Control Valve) (A).



G00719034

Fig. 102: Removing Oil Control Valve
Courtesy of KIA MOTORS AMERICA, INC.

23. Remove the OCV (Oil Control Valve) filter (A).



G00719035

Fig. 103: Removing Oil Control Valve Filter
Courtesy of KIA MOTORS AMERICA, INC.

24. Remove the cylinder head bolts, then remove the cylinder head.

CAUTION: Head warpage or cracking could result from removing bolts in an incorrect order.

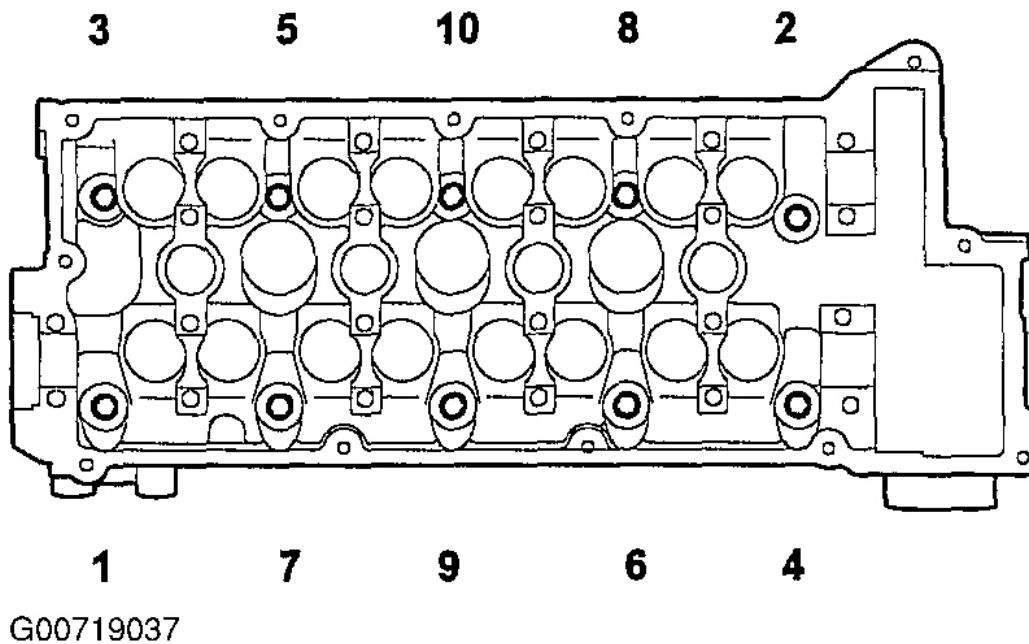


Fig. 104: Cylinder Head Bolt Removal Sequence

Courtesy of KIA MOTORS AMERICA, INC.

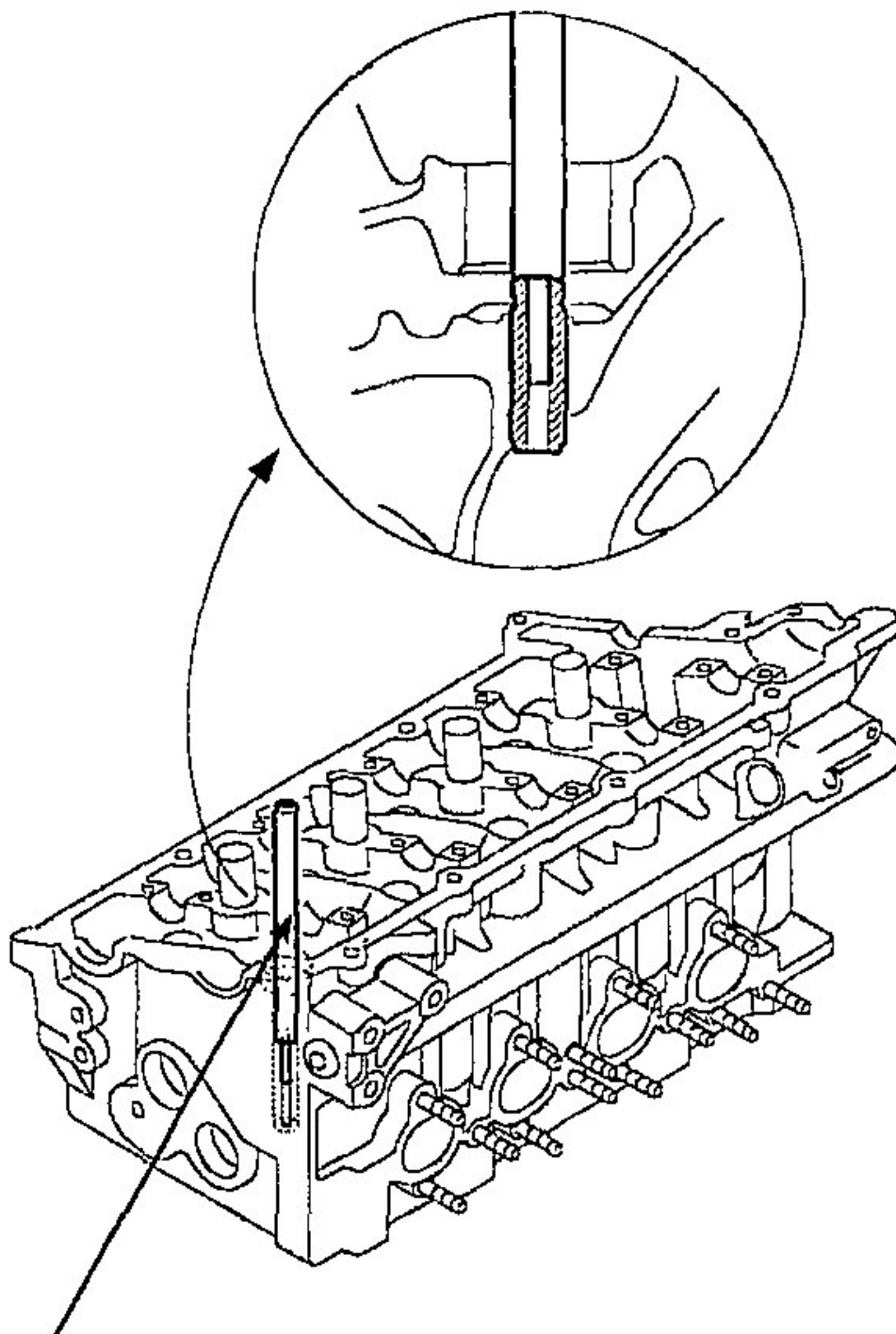
- a. Using 8 mm and 10 mm hexagon wrench, uniformly loosen and remove the 10 cylinder head bolts, in several passes, in the sequence shown in illustration. Remove the 10 cylinder head bolts and plate washers.
- b. Lift the cylinder head from the dowels on the cylinder block and place the cylinder head on wooden blocks on a bench.

CAUTION: Be careful not to damage the contact surfaces of the cylinder head and cylinder block.

REPAIR

VALVE GUIDE

1. Using the Service Tool (09221 - 3F100A), withdraw the old valve guide toward the bottom of cylinder head.



09221-3F100A

G00719052

Fig. 105: Removing Valve Guide

Courtesy of KIA MOTORS AMERICA, INC.

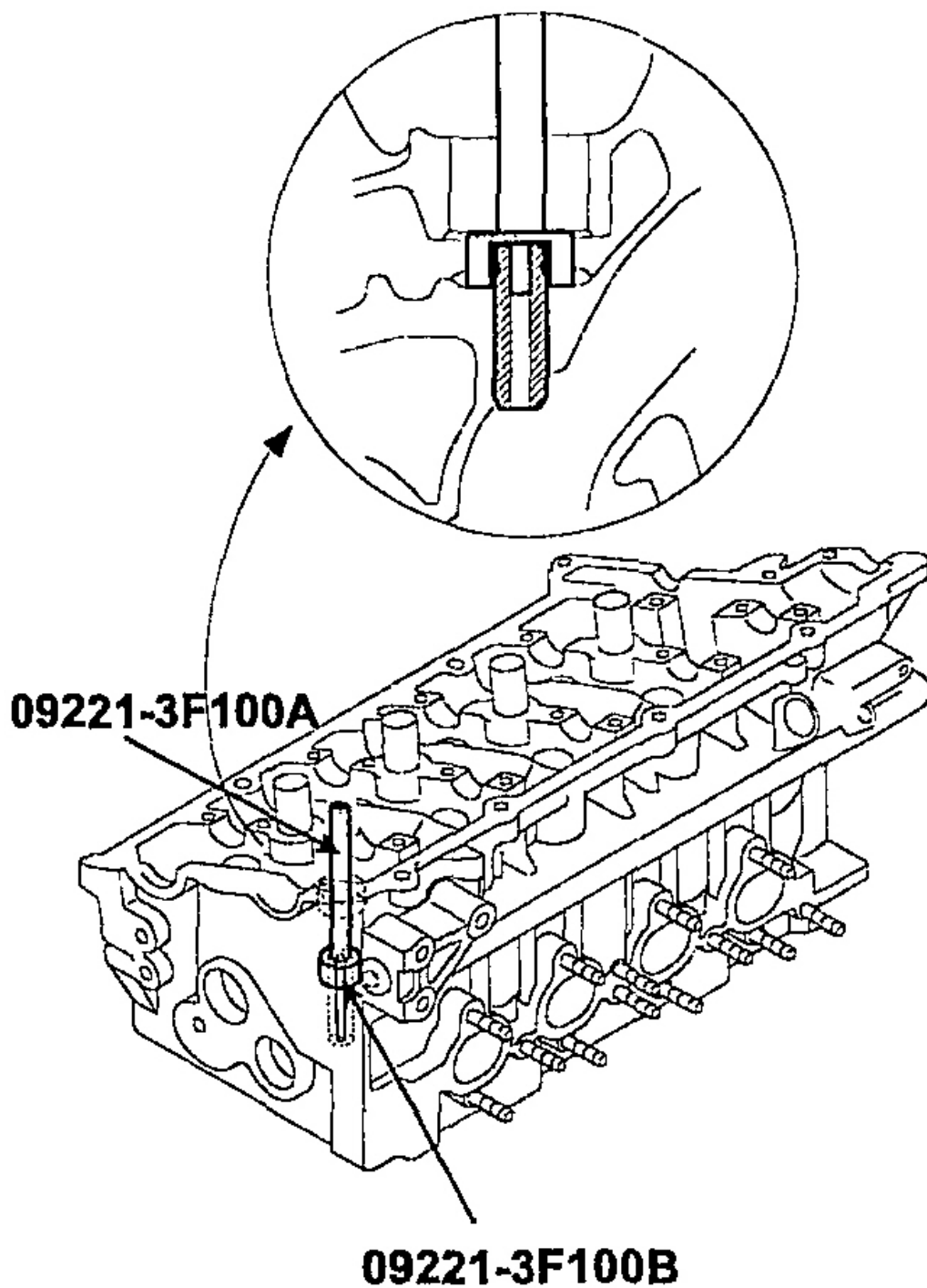
2. Recondition the valve guide hole of cylinder head so that it can match the newly press-fitted oversize valve guide.
3. Using the Service Tool (09221 - 3F100 A/B), press-fit the valve guide. The valve guide must be press-fitted from the upper side of the cylinder head. Keep in mind that the intake and exhaust valve guides are different in length.

Over size mm (in.)	Size mark	Oversize valve guide hole size mm (in.)
0.05 (0.002)	5	11.05 ~ 11.068 (0.4350 ~ 0.4357)
0.25 (0.010)	25	11.25 ~ 11.268 (0.4429 ~ 0.4436)
0.50 (0.020)	50	11.50 ~ 11.518 (0.4528 ~ 0.4535)

Valve guide length

Intake : 46mm (1.8in.)

Exhaust : 54.5mm (2.15in.)



G00719053

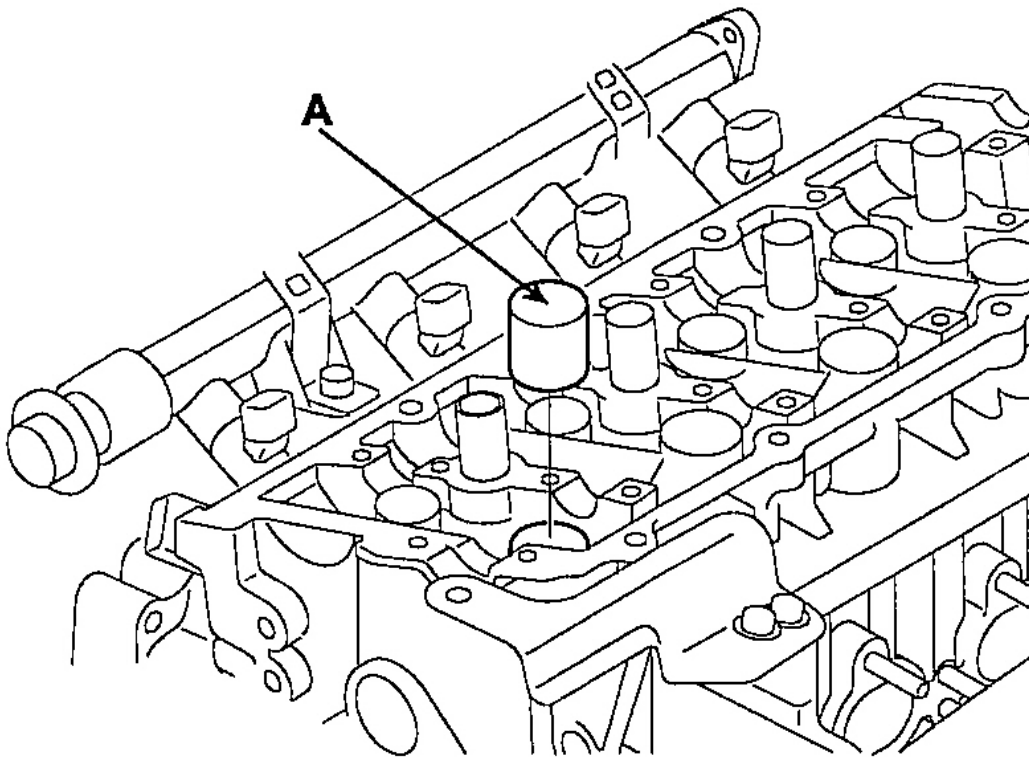
Fig. 106: Installing Valve Guide**Courtesy of KIA MOTORS AMERICA, INC.**

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

DISASSEMBLY

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

1. Remove the MLA's (A).

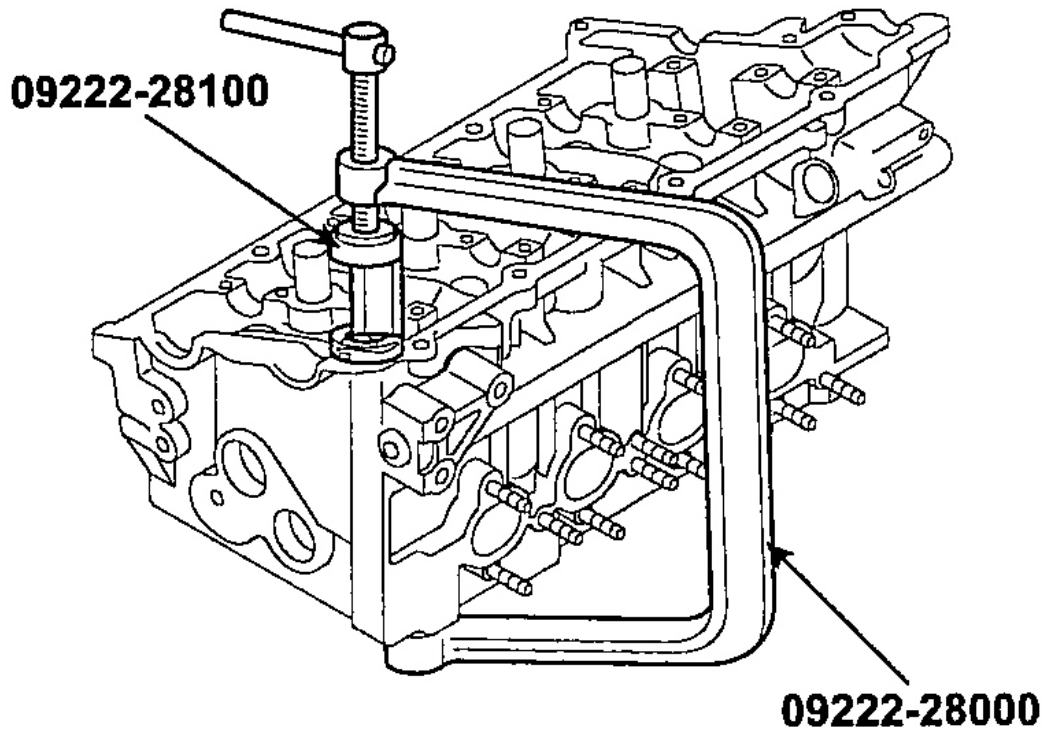


G00719038

Fig. 107: Removing Mechanical Lash Adjusters**Courtesy of KIA MOTORS AMERICA, INC.**

2. Remove the valves.

1. Using the Service Tools (09222 - 28000, 09222 - 28100), compress the valve spring and remove the retainer lock.



G00719039

Fig. 108: Compressing Valve Springs & Removing Retainers Locks
Courtesy of KIA MOTORS AMERICA, INC.

2. Remove the spring retainer.
3. Remove the valve spring.
4. Remove the valve.
5. Using a needle-nose pliers, remove the oil seal.
6. Using a magnetic finger, remove the spring seat.

INSPECTION

CYLINDER HEAD

1. Inspect for flatness.

Using a precision straight edge and feeler gauge, measure the surface the contacting the cylinder block

and the manifolds for warpage.

Flatness of cylinder head gasket surface

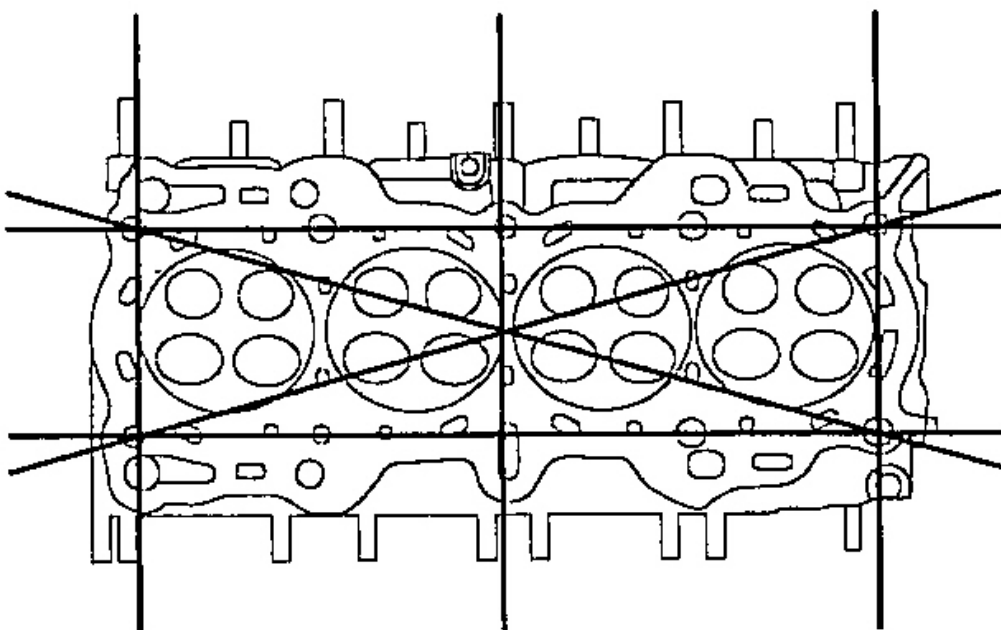
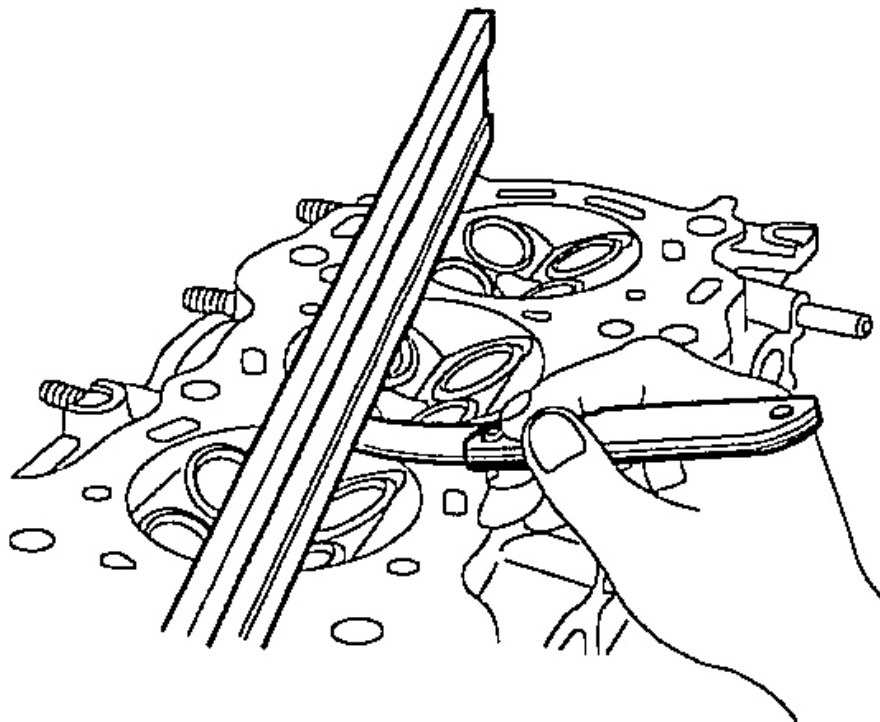
Standard: Less than 0.03 mm (0.0012 in)

Limit: 0.05 mm (0.0020 in)

Flatness of manifold mating surface

Standard: Less than 0.15 mm (0.0059 in)

Limit: 0.30 mm (0.0118 in)



G00719040

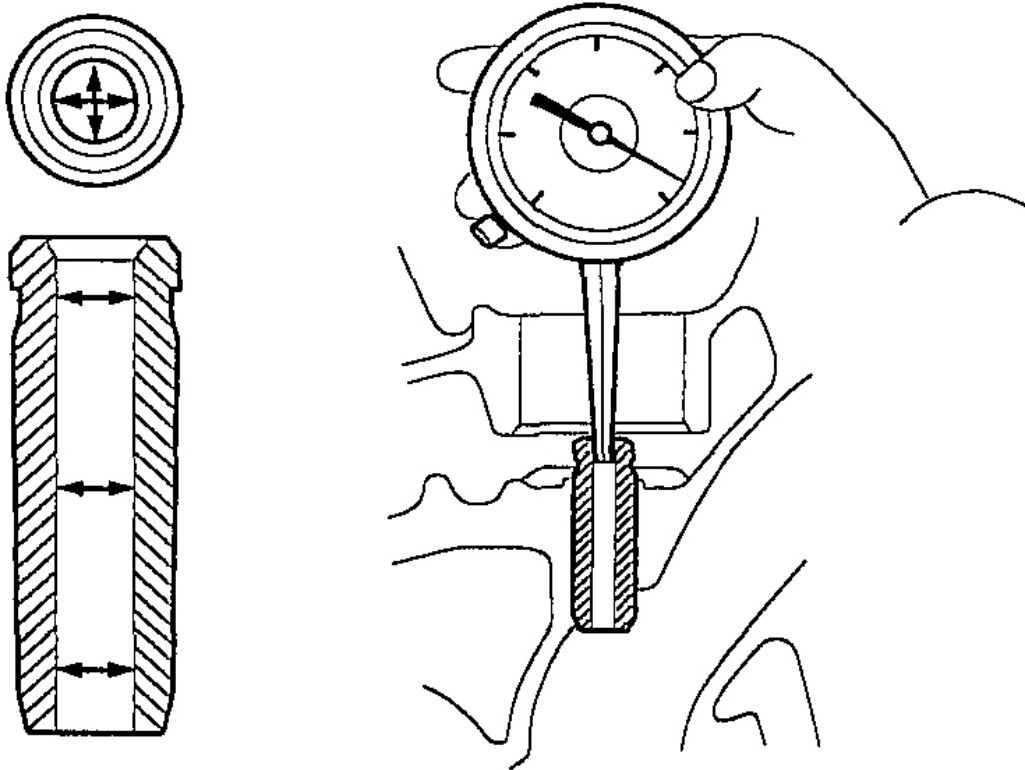
Fig. 109: Measuring Cylinder Head Flatness
Courtesy of KIA MOTORS AMERICA, INC.

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

VALVE AND VALVE SPRING

1. Inspect the valve stems and valve guides.
 - a. Using a caliper gauge, measure the inner diameter of valve guide.

Valve guide inner diameter: 6.000-6.015 mm (0.2362-0.2368 in)



G00719041

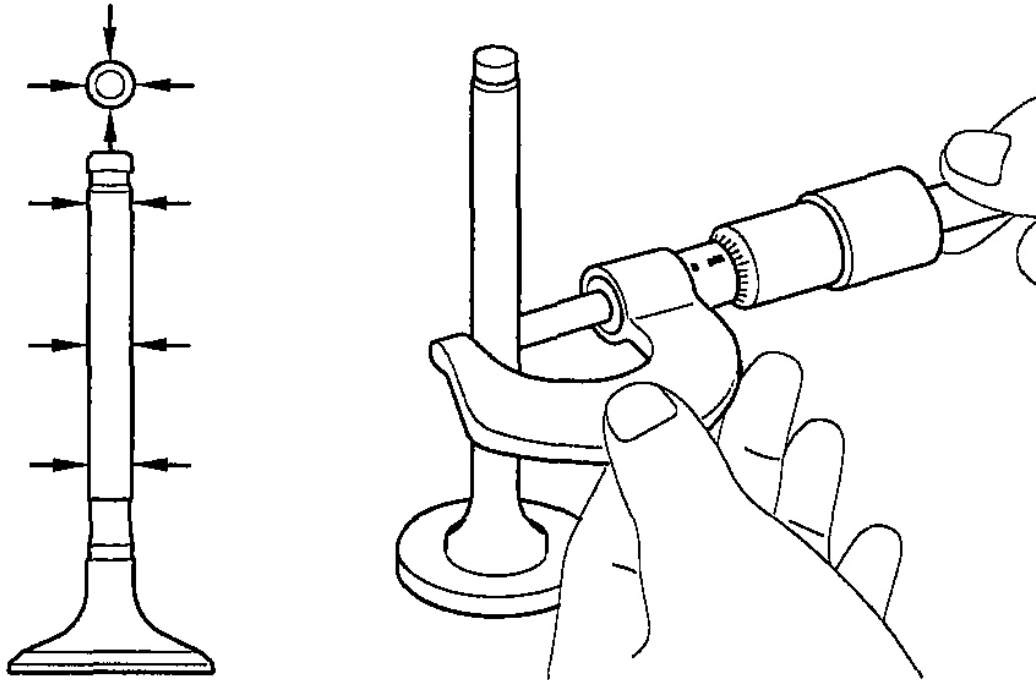
Fig. 110: Measuring Valve Guide Clearance
Courtesy of KIA MOTORS AMERICA, INC.

- b. Using a micrometer, measure the outer diameter of valve stem.

Valve stem outer diameter:

Intake: 5.965-5.980 mm (0.2348-0.2354 in)

Exhaust: 5.950-5.965 mm (0.2343-0.2348 in)



G00719042

Fig. 111: Measuring Valve Stem Diameter
Courtesy of KIA MOTORS AMERICA, INC.

- c. Subtract the valve stem outer diameter measurement from the valve guide inner diameter measurement.

Valve stem- to-guide clearance

Standard

Intake: 0.020-0.050 mm (0.0008-0.0020 in)

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

Limit

Intake: 0.10 mm (0.0039 in)

Exhaust: 0.13 mm (0.0051 in)

If the clearance is greater than maximum, replace the valve and valve guide.

2. Inspect the valves.

- a. Check the valve is ground to the correct valve face angle.
- b. Check the surface of the valve face for damage or wear.

If the valve face is damaged or worn, replace the valve.

- c. Check the valve head margin thickness.

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

Margin Standard

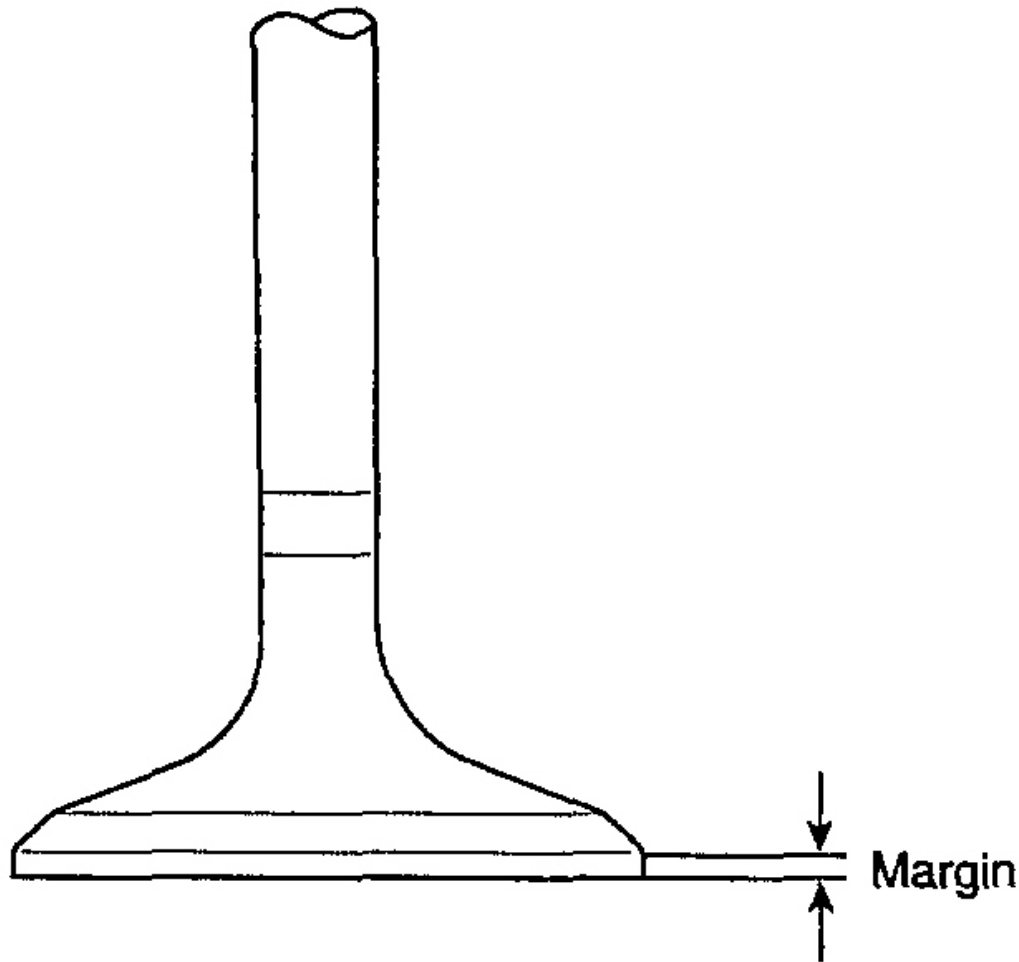
Intake : 1.6 mm (0.0630 in)

Exhaust : 1.8 mm (0.0709 in)

Limit

Intake : 1.45 mm (0.0571 in)

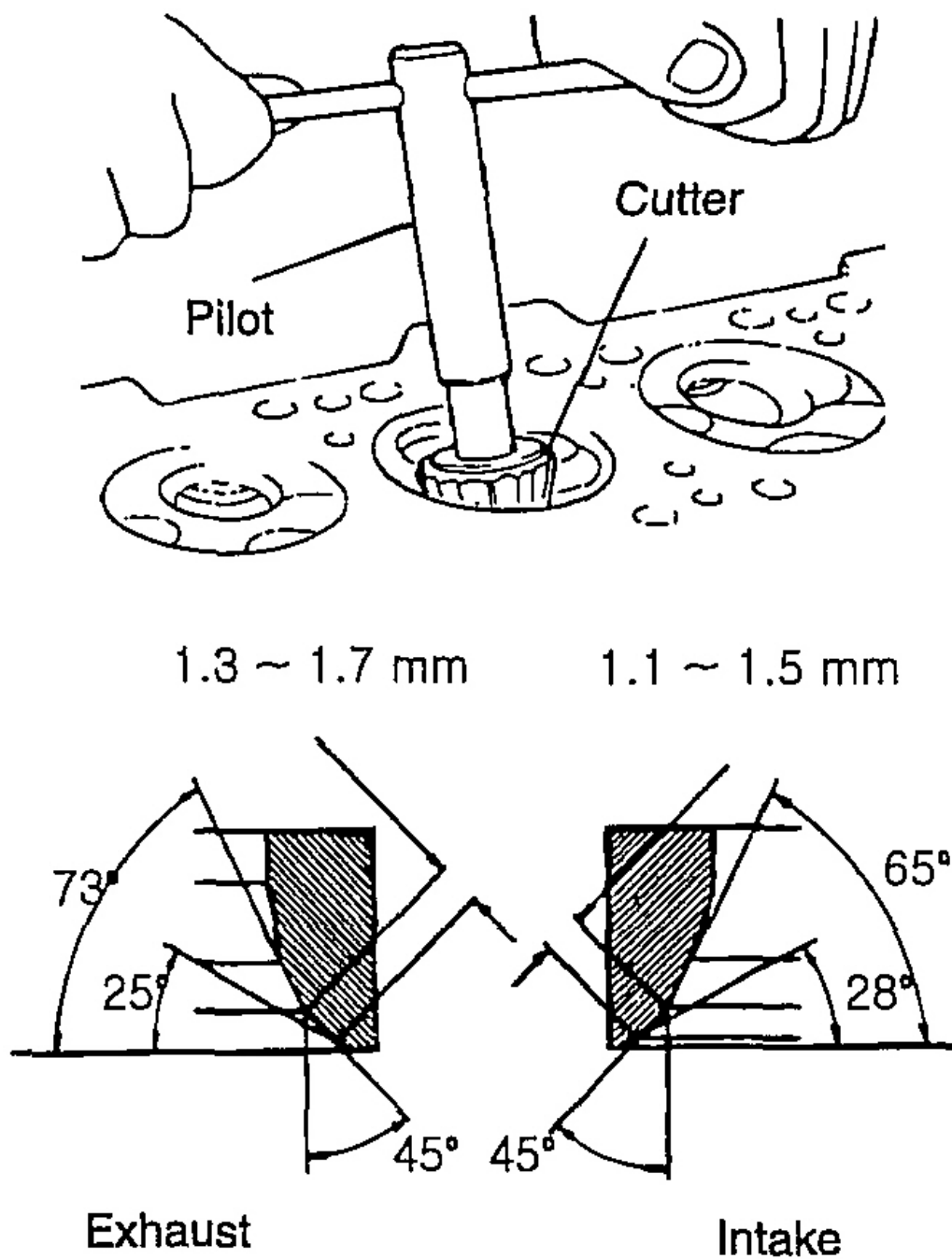
Exhaust : 1.65 mm (0.0650 in)



G00719043

Fig. 112: Measuring Valve Margin
Courtesy of KIA MOTORS AMERICA, INC.

- d. Check the surface of valve stem tip for wear. If the valve stem tip is worn, replace the valve.
3. Inspect the valve seats.
 - a. Check the valve seat for evidence of overheating and improper contact with the valve face. Replace the seat if necessary.
 - b. Before reconditioning the seat, check the valve guide for wear. If the valve guide is worn, replace it, then recondition the seat.
 - c. Recondition the valve seat with a valve seat grinder or cutter. The valve seat contact width should be within specifications and centered on the valve face.



G00719044

Fig. 113: Reconditioning Valve Seat
Courtesy of KIA MOTORS AMERICA, INC.

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

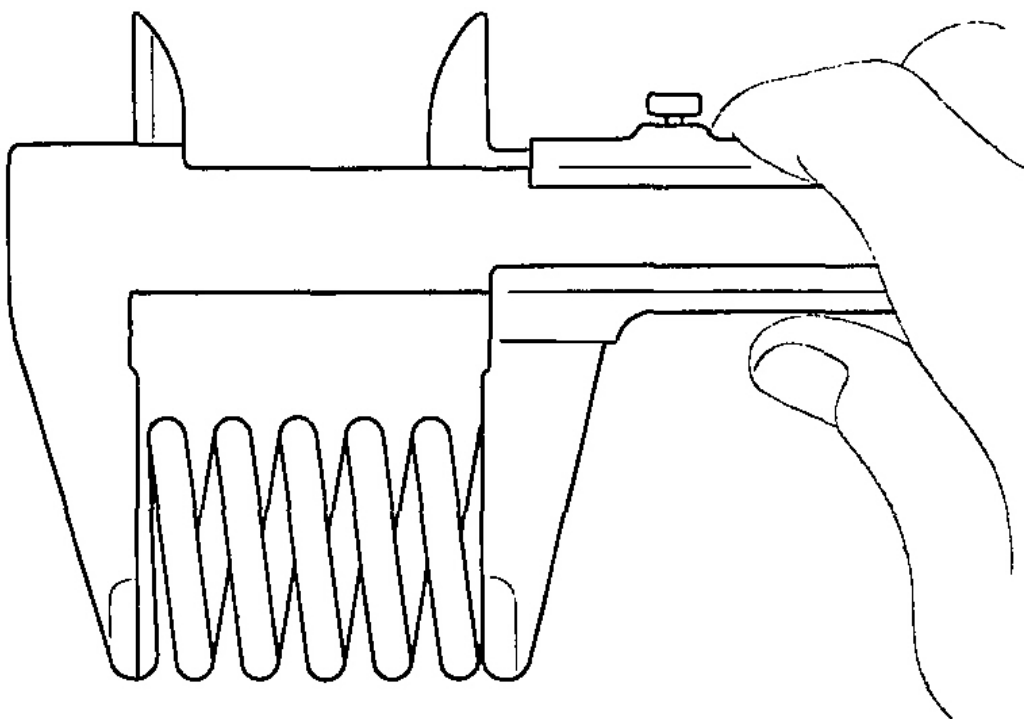
Valve spring standard

Free height: 48.8 6 mm (1.9236 in)

Load: 18.8+/-0.9 kg/39.0 mm (41.4+/-2.0 lb/1.5354 in) 41.0+/-1.5 kg/30.5 mm (90.4+/-3.3 lb/1.2008 in)

Out of square: Less than 1.5°

Limit: Out of square: 3°



G00719045

Fig. 114: Measuring Valve Springs
Courtesy of KIA MOTORS AMERICA, INC.

If the loads is not as specified, replace the valve spring.

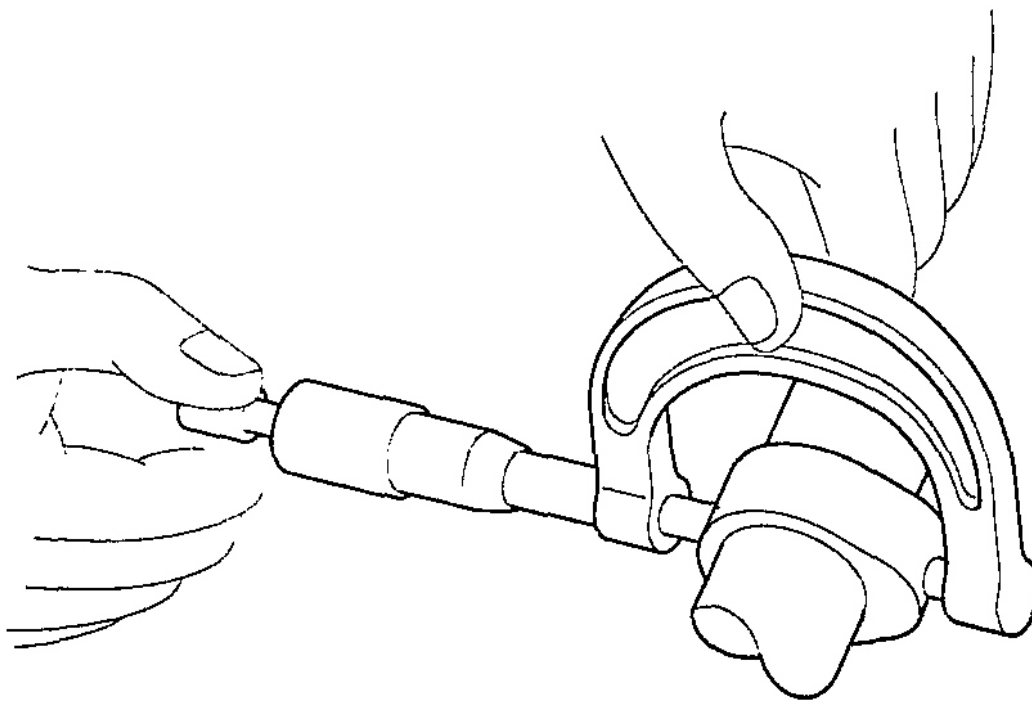
CAMSHAFT

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

Cam height

Intake: 44.518-44.718 mm (1.7527-1.7605 in)

Exhaust: 44.418-44.618 mm (1.7487-1.7566 in)



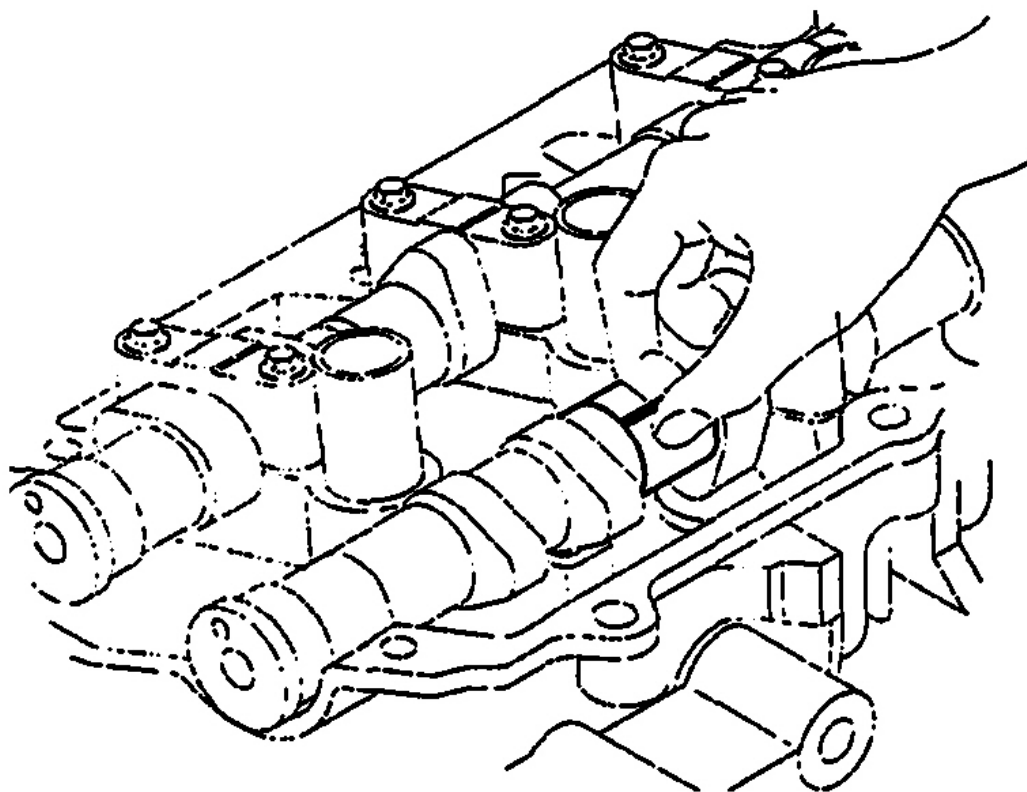
G00719046

Fig. 115: Measuring Cam Lobe

Courtesy of KIA MOTORS AMERICA, INC.

If the cam lobe height is less than minimum, replace the camshaft.

2. Inspect the camshaft journal clearance.
 - a. Clean the bearing caps and camshaft journals.
 - b. Place the camshafts on the cylinder head.
 - c. Lay a strip of plastigage across each of the camshaft journal.



G00719047

Fig. 116: Applying Plastigage
Courtesy of KIA MOTORS AMERICA, INC.

- d. Install the bearing caps and tighten the bolts with specified torque.

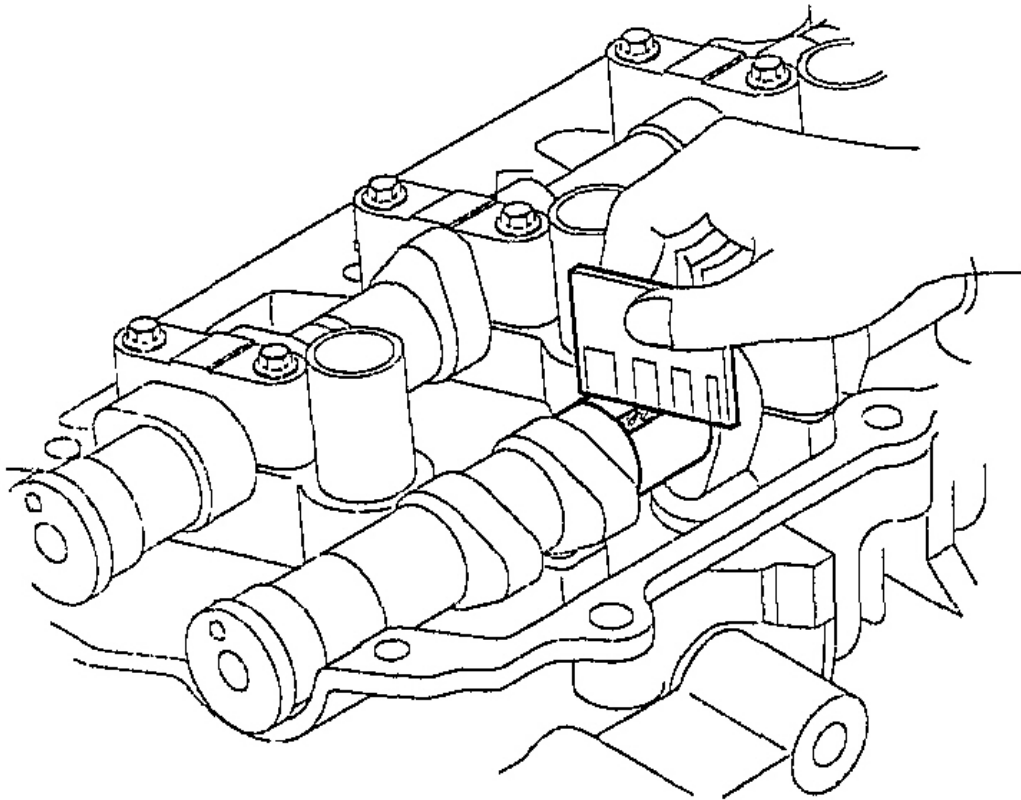
CAUTION: Do not turn the camshaft.

- e. Remove the bearing caps.
- f. Measure the plastigage at its widest point.

Bearing oil clearance

Standard: 0.020-0.061 mm (0.0008-0.0024 in)

Limit: 0.1 mm (0.0039 in)



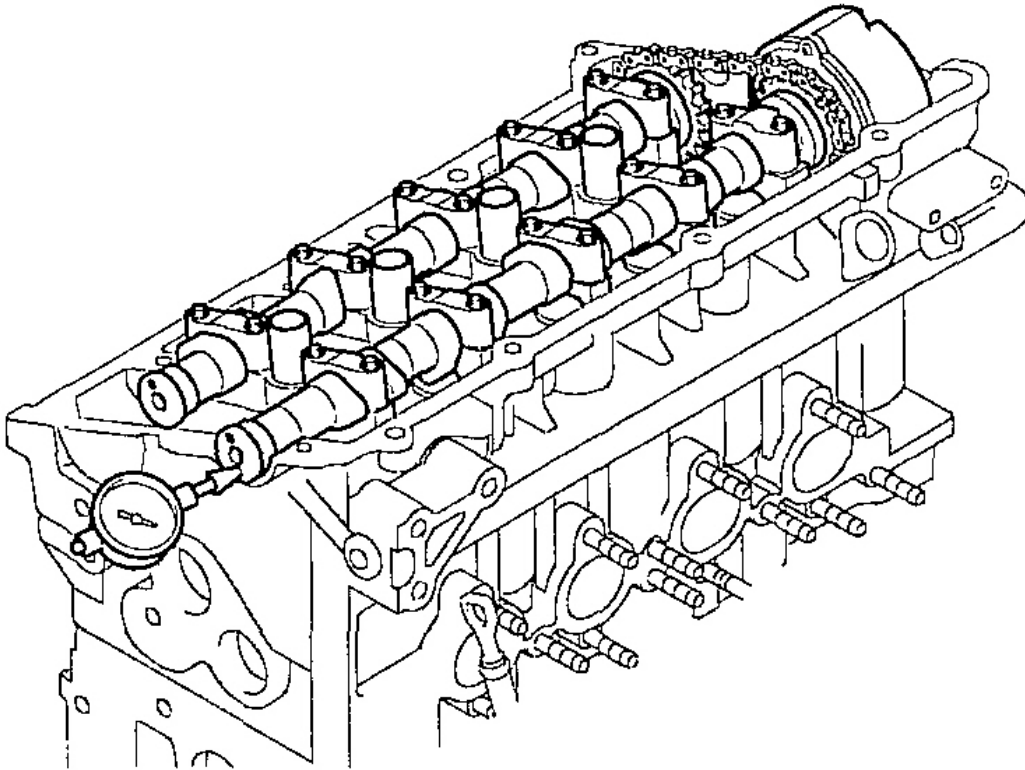
G00719048

Fig. 117: Measuring Camshaft Journal Clearance
Courtesy of KIA MOTORS AMERICA, INC.

If the oil clearance is greater than maximum, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.

- g. Completely remove the plastigage.
- h. Remove the camshafts.
- 3. Inspect the camshaft end play.
 - a. Install the camshafts.
 - b. Using a dial indicator, measure the end play while moving the camshaft back and forth.

Camshaft end play. Standard: 0.1-0.2 mm (0.0039-0.0079 in)



G00719049

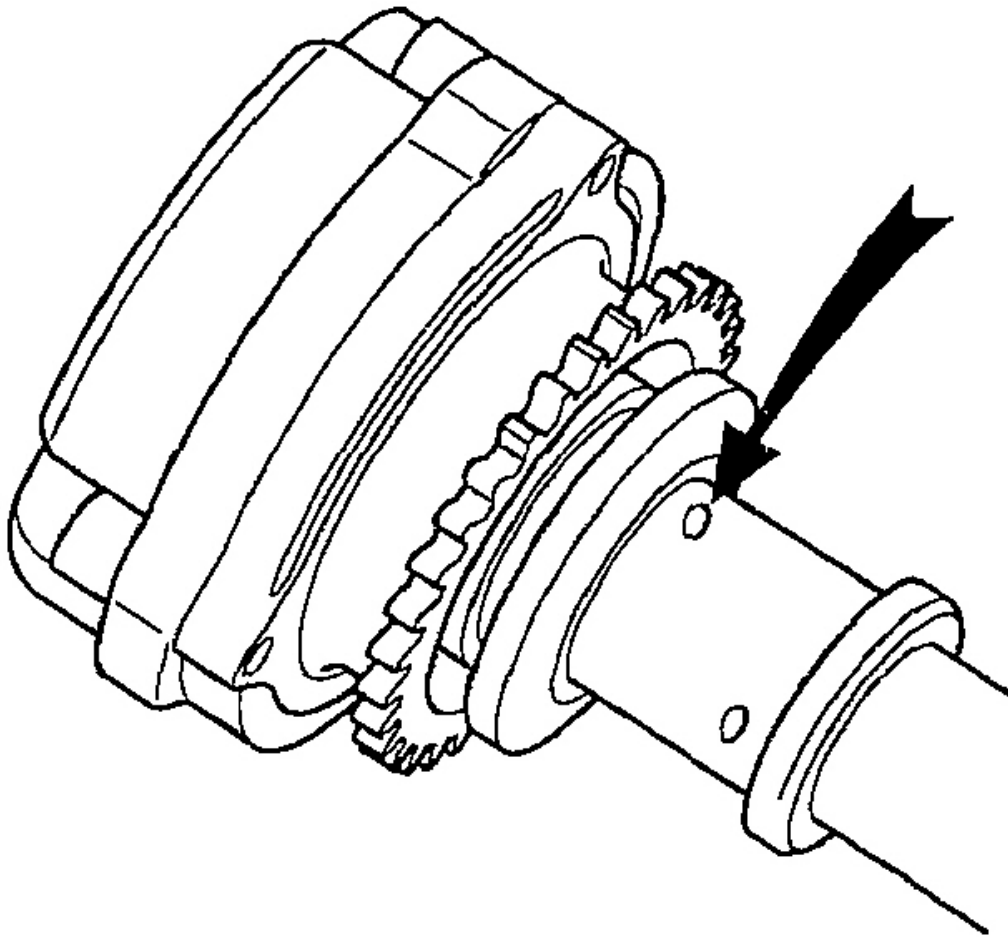
Fig. 118: Measuring Camshaft End Play
Courtesy of KIA MOTORS AMERICA, INC.

If the end play is greater than maximum, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.

- c. Remove the camshafts.

CVVT (CONTINUOUS VARIABLE VALVE TIMING) ASSEMBLY

1. Inspect the CVVT (Continuous Variable Valve Timing) assembly.
 - a. Check that the CVVT (Continuous Variable Valve Timing) assembly will not turn.
 - b. Apply vinyl tape to all the parts except the one indicated by the arrow in the illustration.



G00719050

Fig. 119: Vinyl Tape Application
Courtesy of KIA MOTORS AMERICA, INC.

- c. Wind tape around the tip of the air gun and apply air of approx. 100kpa (1kgf/cm, 14psi) to the port of the camshaft.

NOTE: When the oil splashes, wipe it off with a shop rag and the likes.

- d. Under the condition of (3), turn the CVVT assembly to the advance angle side (the arrow marked direction in the illustration) with your hand.

Depending on the air pressure, the CVVT assembly will turn to the advance side without applying

force by hand. Also, under the condition that the pressure can be hardly applied because of the air leakage from the port, there may be the case that the lock pin could be hardly released.

- e. Except the position where the lock pin meets at the maximum delay angle, let the CVVT assembly turn back and forth and check the movable range and that there is no disturbance.

Standard: Movable smoothly in the range about 20°

- f. Turn the CVVT by hand and make sure it locks in the maximum delay angle position.

REASSEMBLY

NOTE:

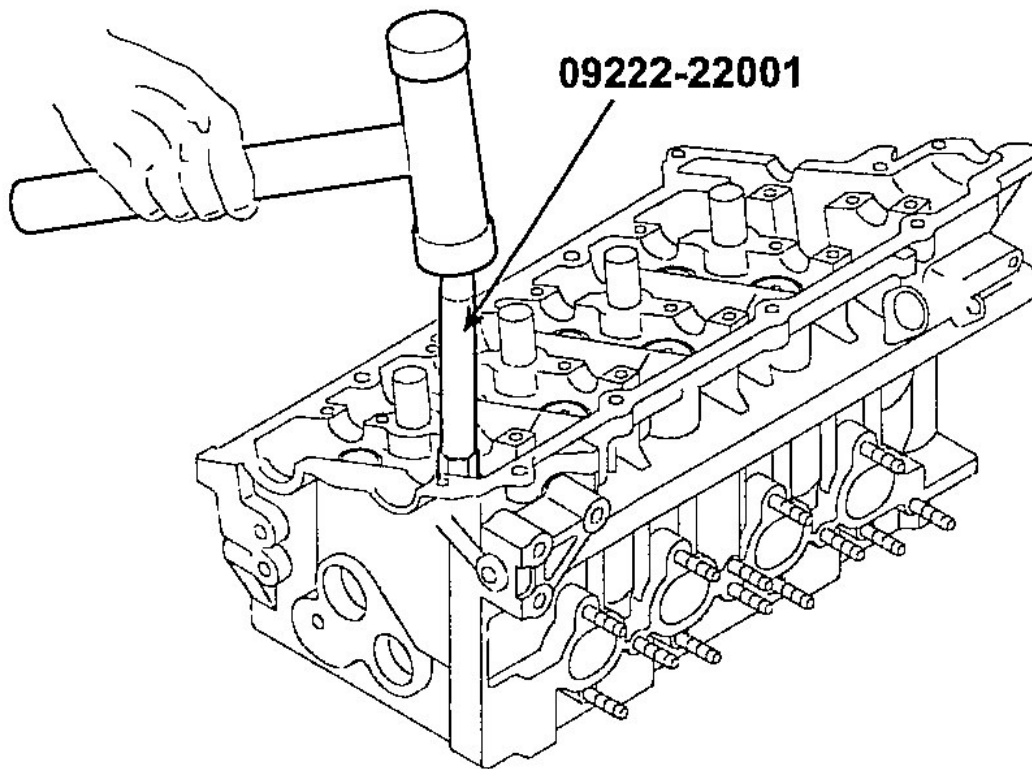
- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply fresh engine oil to all sliding and rotating surface.
- Replace oil seals with new ones.

1. Install the valves

- a. Install the spring seats.
- b. Using the Service Tool (09222 - 22001), push in a new oil seal.

NOTE:

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



G00719057

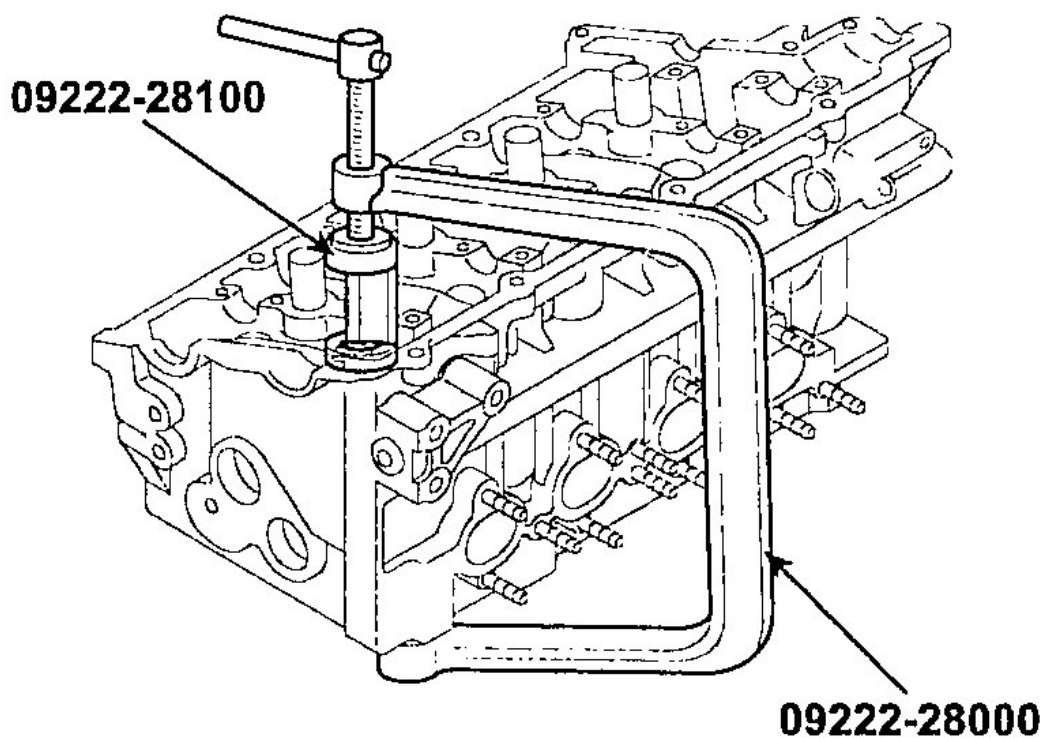
Fig. 120: Installing Oil Seal

Courtesy of KIA MOTORS AMERICA, INC.

- c. Install the valve, valve spring and spring retainer.

NOTE: Place the valve springs so that the side coated with enamel faces toward the valve spring retainer and then installs the retainer.

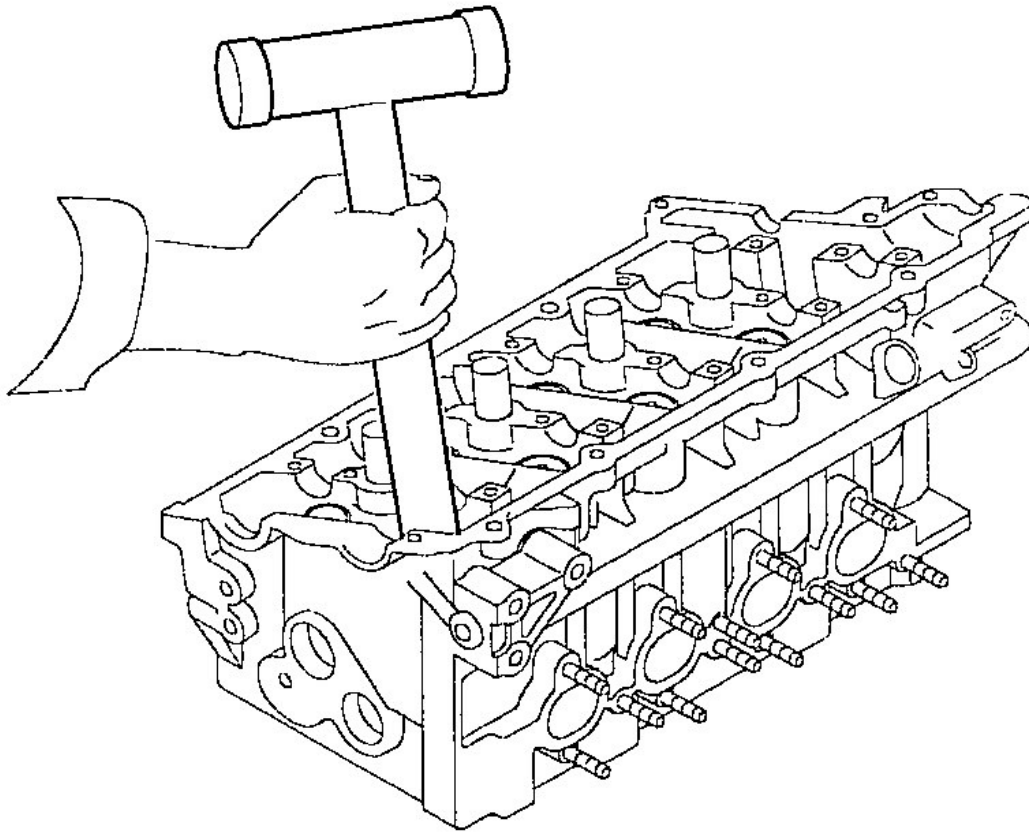
- d. Using the Service Tool (09222 - 28000, 09222 - 28100), compress the spring and install the retainer locks. After installing the valves, ensure that the retainer locks are correctly in place before releasing the valve spring compressor.



G00719058

Fig. 121: Compressing Valve Spring
Courtesy of KIA MOTORS AMERICA, INC.

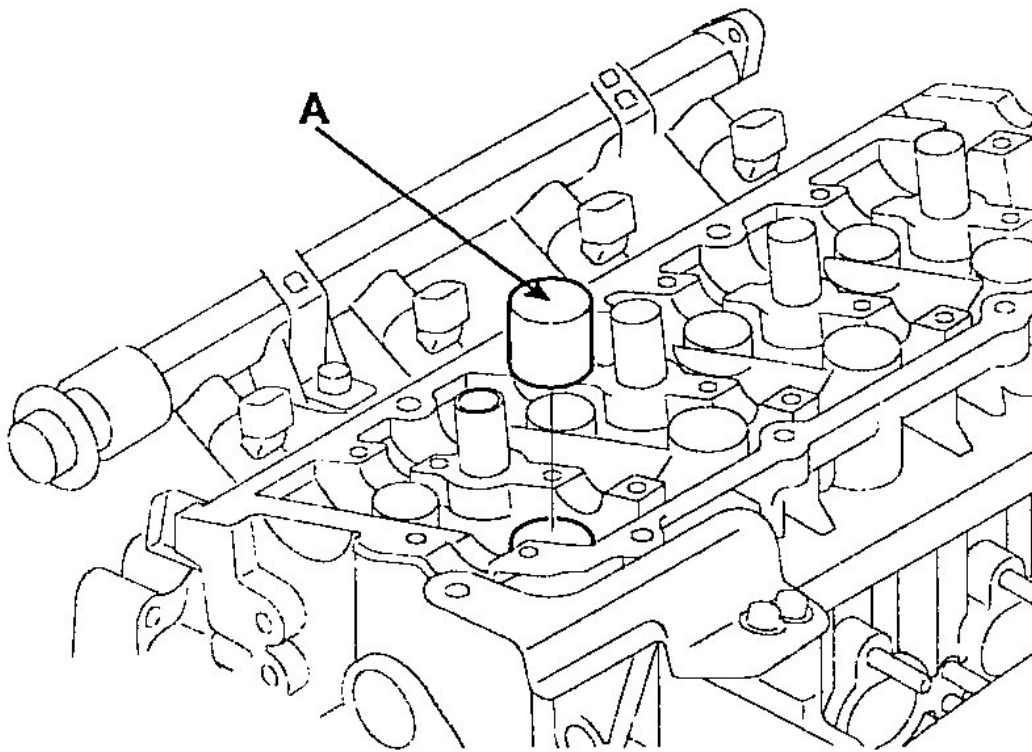
- e. Lightly tap the end of each valve stem two or three times with the wooden handle of a hammer to ensure proper seating of the valve and retainer lock.



G00719059

Fig. 122: Seating Valve Spring Retainer
Courtesy of KIA MOTORS AMERICA, INC.

2. Install the MLA's (Mechanical Lash Adjusters). Check that the MLA rotates smoothly by hand.



G00719060

Fig. 123: Installing Mechanical Lash Adjuster
Courtesy of KIA MOTORS AMERICA, INC.

INSTALLATION

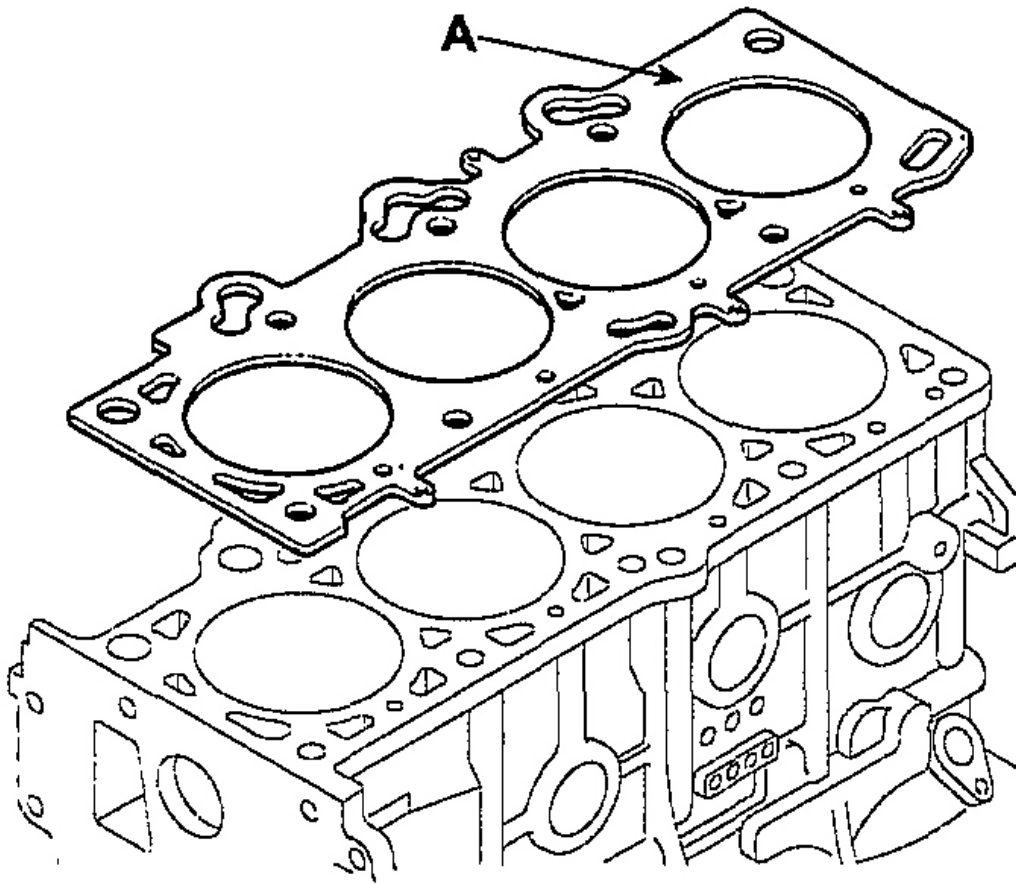
NOTE:

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

1. Install the cylinder head gasket (A) on the cylinder block.

NOTE:

Be careful of the installation direction.



G00719061

Fig. 124: Illustrating Head Gasket Direction
Courtesy of KIA MOTORS AMERICA, INC.

2. Place the cylinder head onto the block carefully in order to prevent damaging the gasket. If the gasket is damaged, fluid leakage could occur.
3. Install the cylinder head bolts.
 - a. Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.
 - b. Using 8 mm and 10 mm hexagon wrench, install and tighten the 10 cylinder head bolts and plate washers, in several passes, in sequence. See **Fig. 125**.

Tightening torque:

M10: 22.6-26.5 N.m (2.3-2.7 kg-m, 16.6-19.5 lb-ft) +60° -65° + 60° -65°

M12: 27.5-31.4 N.m (2.8-3.2 kg-m, 20.3-23.1 lb-ft) +60° -65° + 60° -65°

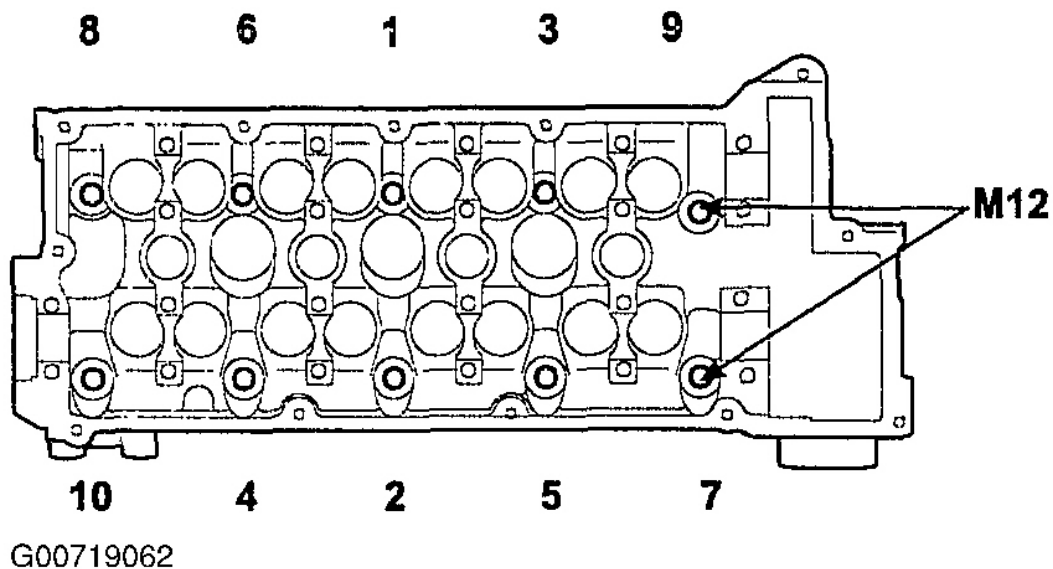
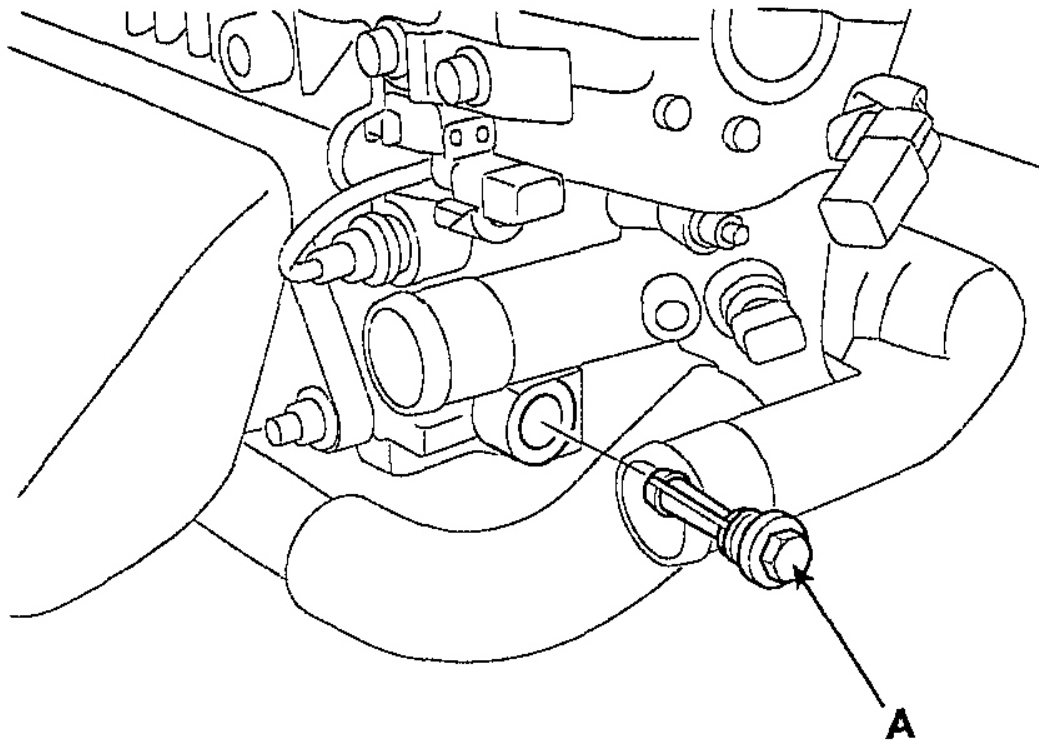


Fig. 125: Cylinder Head Tightening Sequence
Courtesy of KIA MOTORS AMERICA, INC.

NOTE:

- Always use a new OCV (Oil Control Valve) filter gasket.
- Keep the OCV filter clean.



G00719063

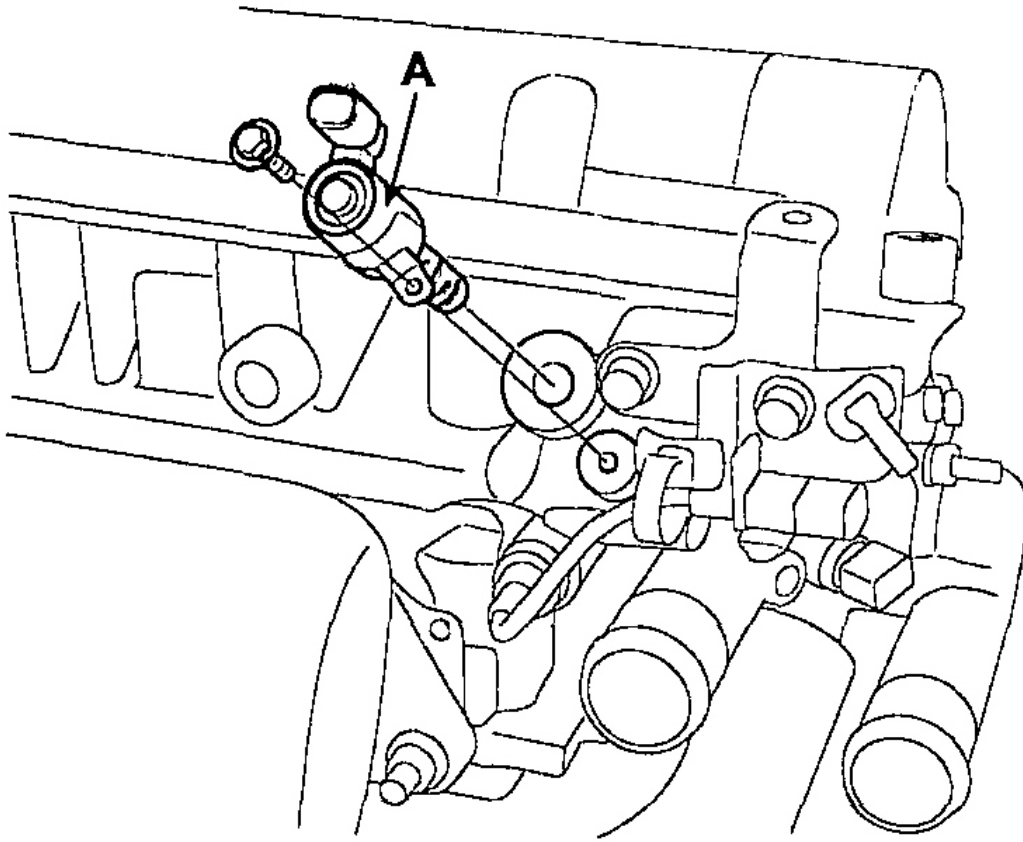
Fig. 126: Installing Oil Control Valve Filter
Courtesy of KIA MOTORS AMERICA, INC.

4. Install the OCV (Oil Control Valve) filter (A).

Tightening torque: 40.2-50.0 N.m (4.1-5.1 kg-m, 29.7-36.9 lb-ft)

5. Install the OCV (Oil Control Valve) (A).

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



G00719064

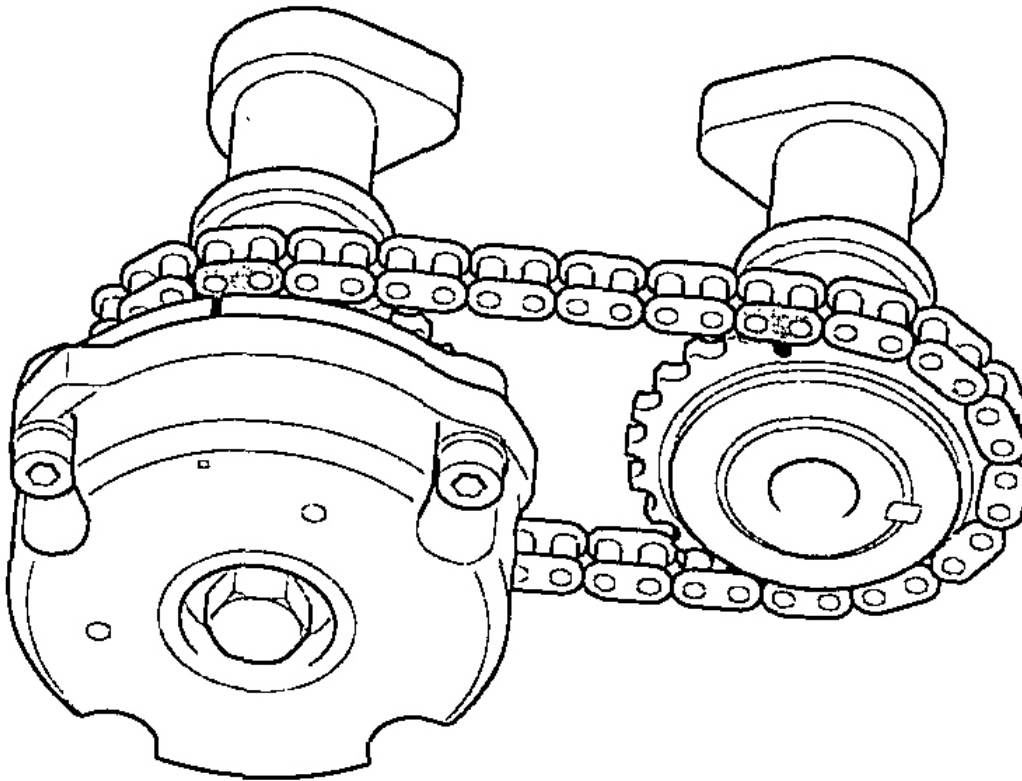
Fig. 127: Installing Oil Control Valve
Courtesy of KIA MOTORS AMERICA, INC.

CAUTION:

- Do not reuse the OCV (Oil Control Valve) when dropped.
- Keep the OCV clean.
- Do not hold the OCV (Oil Control Valve) sleeve during servicing.
- When the OCV is installed on the engine, be careful not to rotate the engine while holding the yoke.

6. Install the camshafts.

- a. Align the camshaft timing chain with the intake timing chain sprocket and exhaust timing chain sprocket as shown.

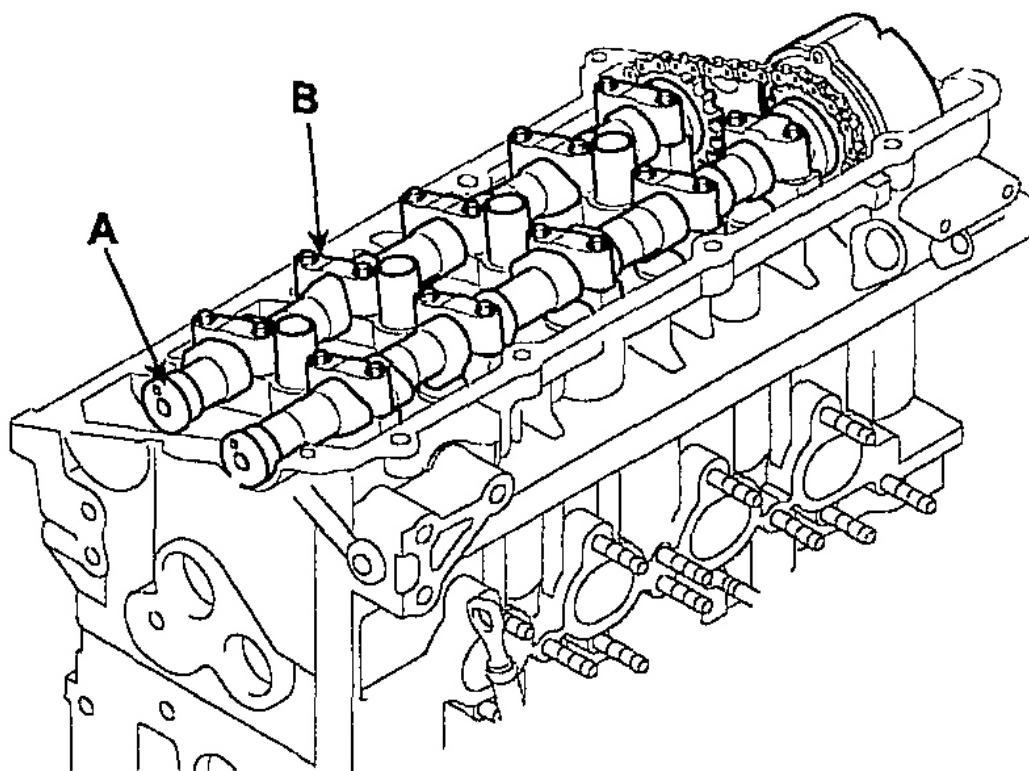


G00719065

Fig. 128: Aligning Timing Chains
Courtesy of KIA MOTORS AMERICA, INC.

- b. Install the camshaft (A) and bearing caps (B).

Tightening torque: 13.7-14.7 N.m (1.4-1.5 kg-m, 10.1-10.8 lb-ft)

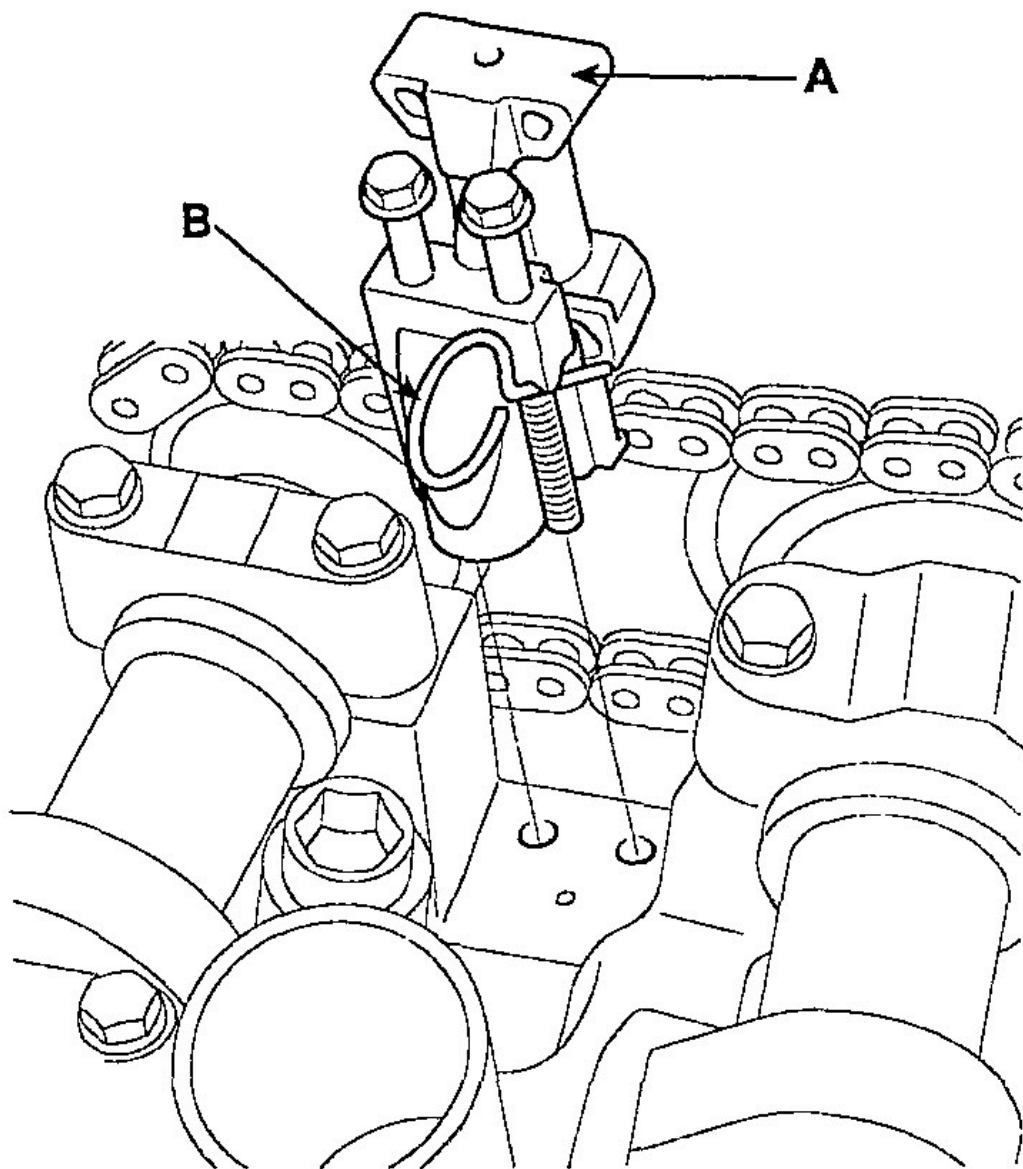


G00719066

Fig. 129: Installing Camshaft Bearing Caps
Courtesy of KIA MOTORS AMERICA, INC.

- c. Install the timing chain auto tensioner (A).

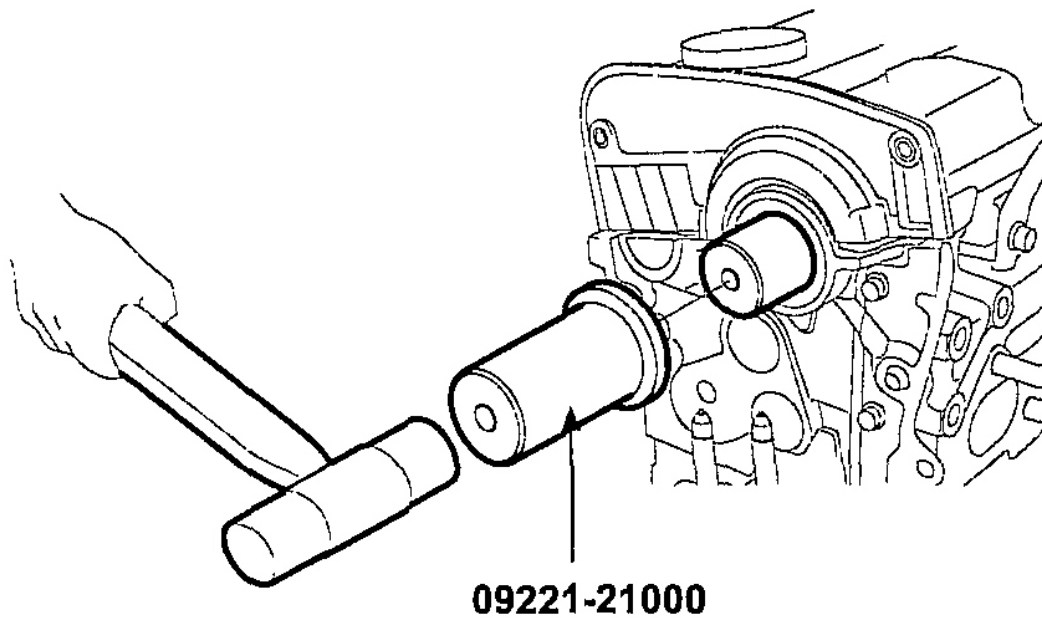
Tightening torque: 7.8-9.8 N.m (0.8-1.0 kg-m, 5.8-7.2 lb-ft)



G00719067

Fig. 130: Installing Timing Chain Auto Tensioner
Courtesy of KIA MOTORS AMERICA, INC.

- d. Remove the auto tensioner stopper pin (B).
7. Check and adjust valve clearance. See **VALVE CLEARANCE INSPECTION & ADJUSTMENT**.
8. Using the Service Tool (09221 - 21000), install the camshaft bearing oil seal.



G00719068

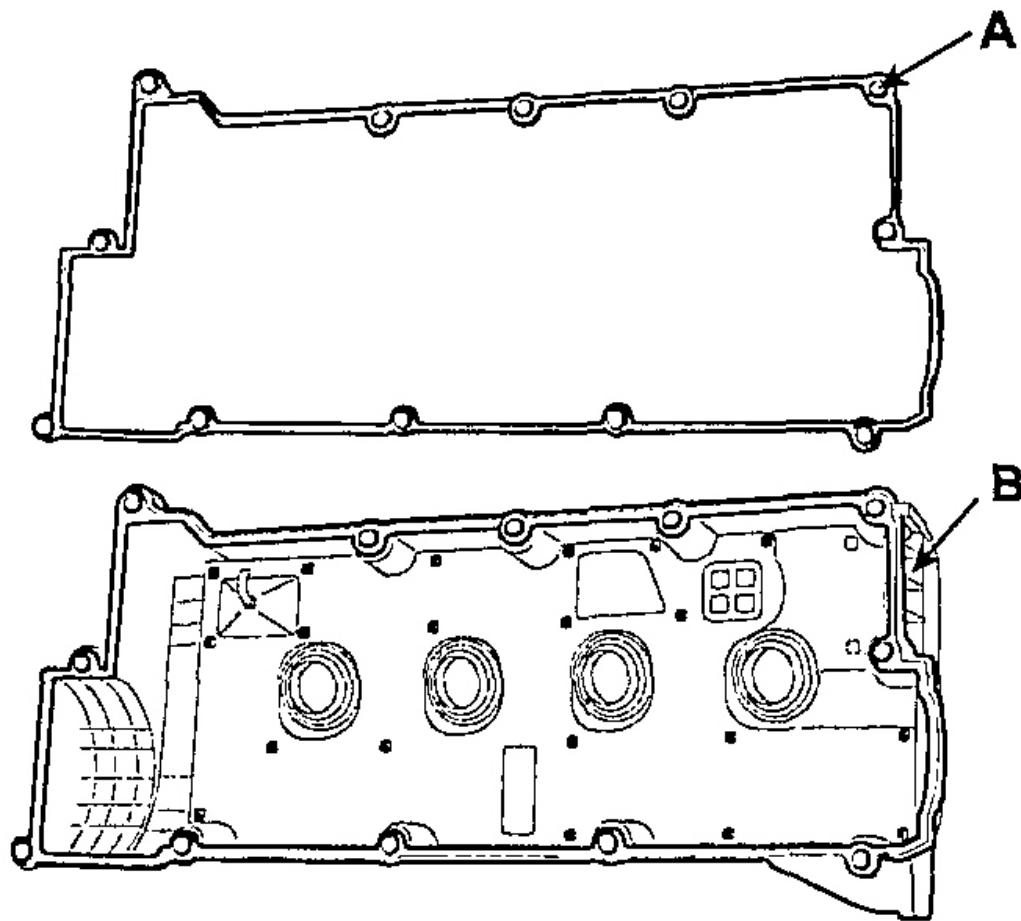
Fig. 131: Installing Camshaft Bearing Oil Seal
Courtesy of KIA MOTORS AMERICA, INC.

9. Install the camshaft sprocket.
10. Install the timing belt.

NOTE:

- Before installing the cylinder head cover gasket, thoroughly clean the cylinder head cover and the groove.
- When installing, make sure the cylinder head cover gasket is seated securely in the corners of the recesses with no gap.

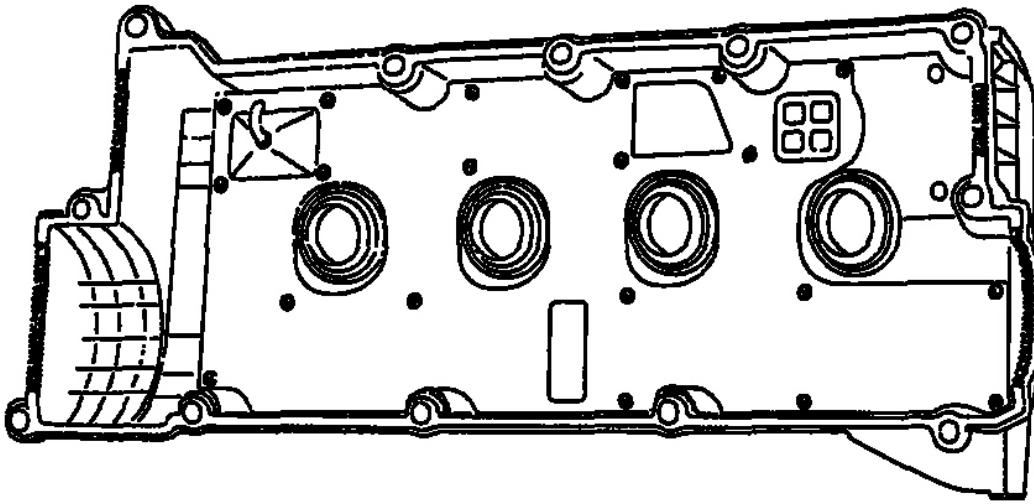
11. Install the cylinder head cover.
 - a. Install the cylinder head cover gasket (A) in the groove of the cylinder head cover (B).



G00719069

Fig. 132: Installing Cylinder Head Cover Gasket
Courtesy of KIA MOTORS AMERICA, INC.

- b. Apply liquid gasket to the head cover gasket at the corners of the recess.



G00719070

Fig. 133: Applying Gasket Sealant

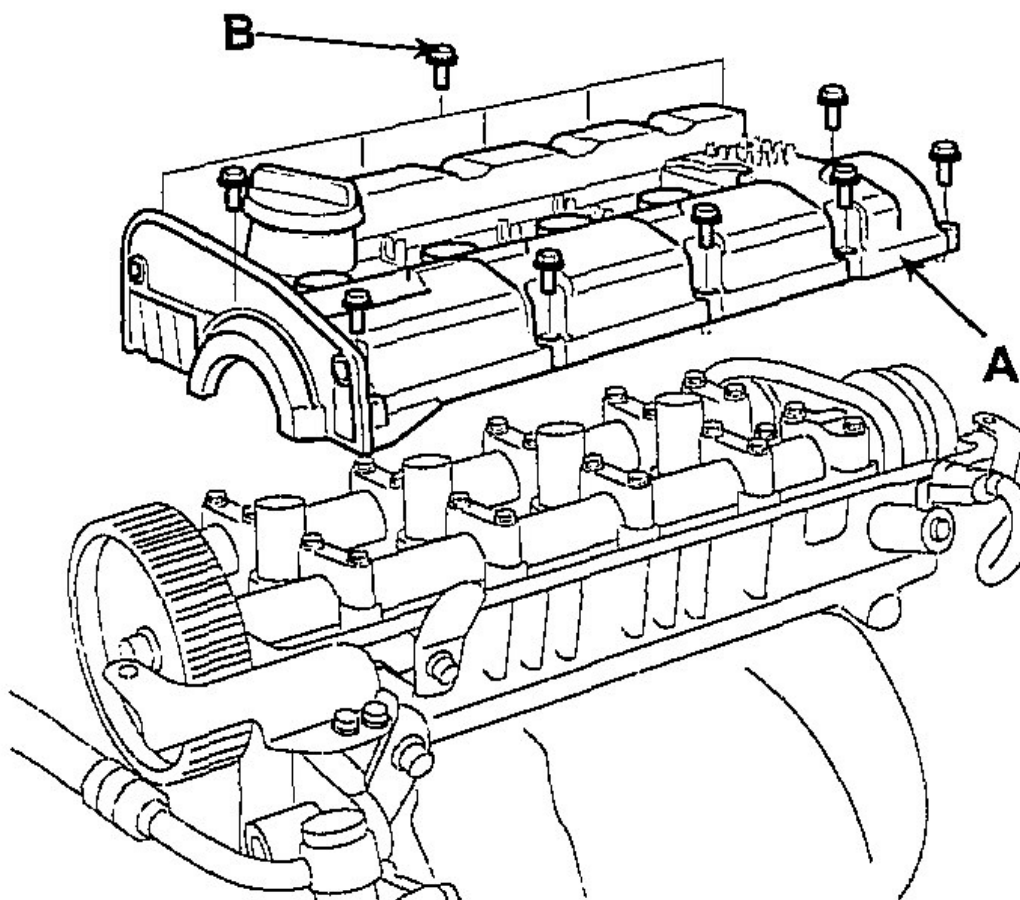
Courtesy of KIA MOTORS AMERICA, INC.

NOTE:

- Use liquid gasket, Loctite No. 5999.
- Check that the mating surfaces are clean and dry before applying liquid gasket.
- After assembly, wait at least 30 minutes before filling the engine with oil.

- c. Install the cylinder head cover (A) with the 12 bolts (B). Uniformly tighten the bolts in several passes.

Tightening torque: 7.8-9.8 N.m (0.8-1.0 kg-m, 5.8-7.2 lb-ft)



G00719071

Fig. 134: Installing Cylinder Head Cover
Courtesy of KIA MOTORS AMERICA, INC.

12. Install the intake manifold.
13. Install the exhaust manifold.
14. Install the Positive Crankcase Ventilation (PCV) (A).

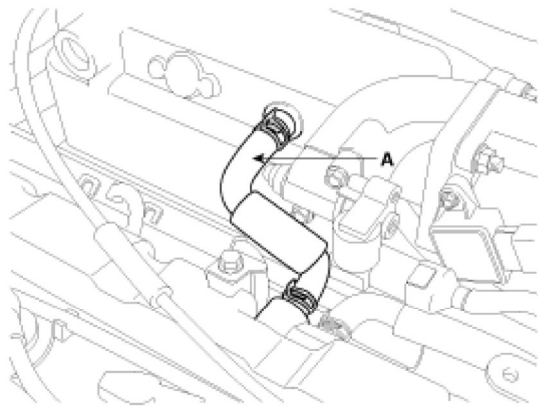
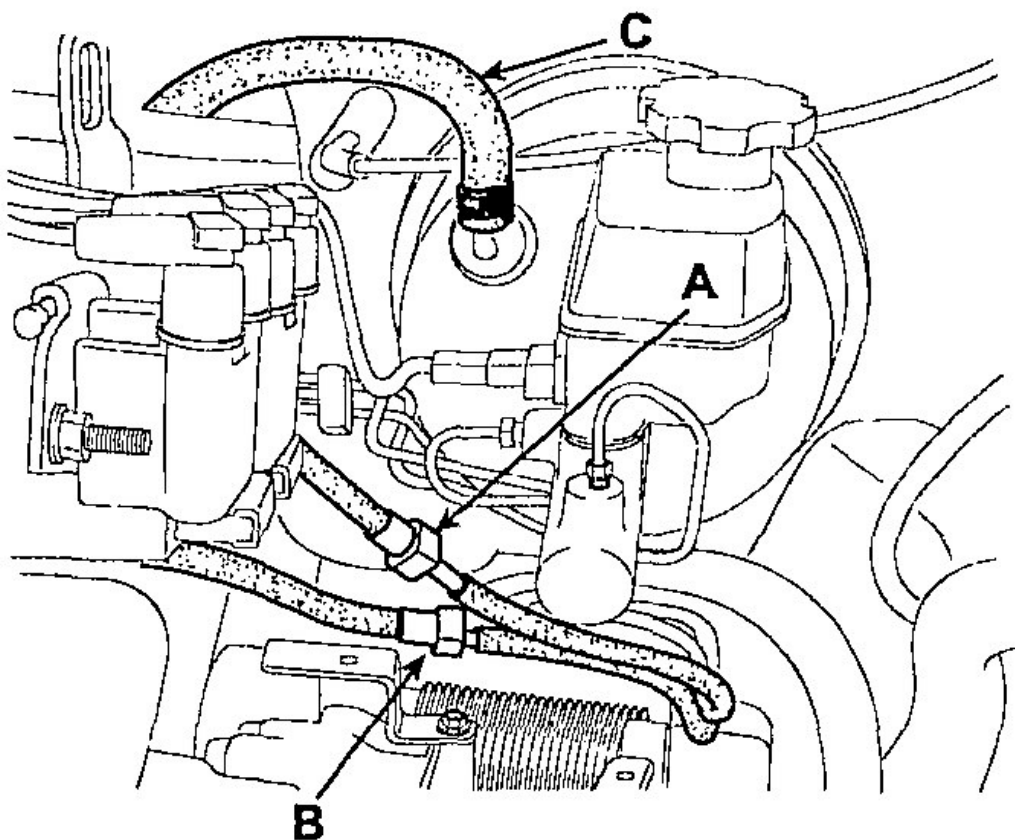


Fig. 135: Positive Crankcase Ventilation
Courtesy of KIA MOTORS AMERICA, INC.

15. Install the spark plug cable.
16. Install the accelerator cable and the auto-cruse cables.
17. Install the bake booster hose (C).
18. Install the Purge Control Solenoid Valve (PCSV) hose (B).
19. Install the fuel inlet hose (A).



G00719074

Fig. 136: Connecting Fuel Hoses

Courtesy of KIA MOTORS AMERICA, INC.

20. Install the engine wire harness connectors and wire harness clamps to the cylinder head and the intake manifold.
 1. Front heated oxygen sensor connector.
 2. Knock sensor connector (C) and the ground cable (D).
 3. Four fuel injector connectors (B).
 4. CMP connector (A).

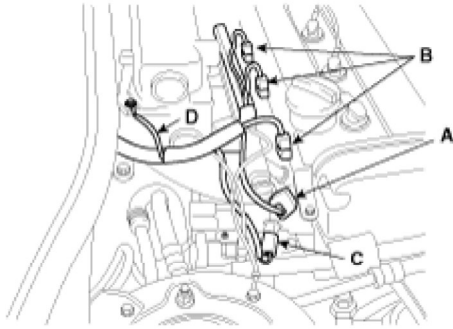
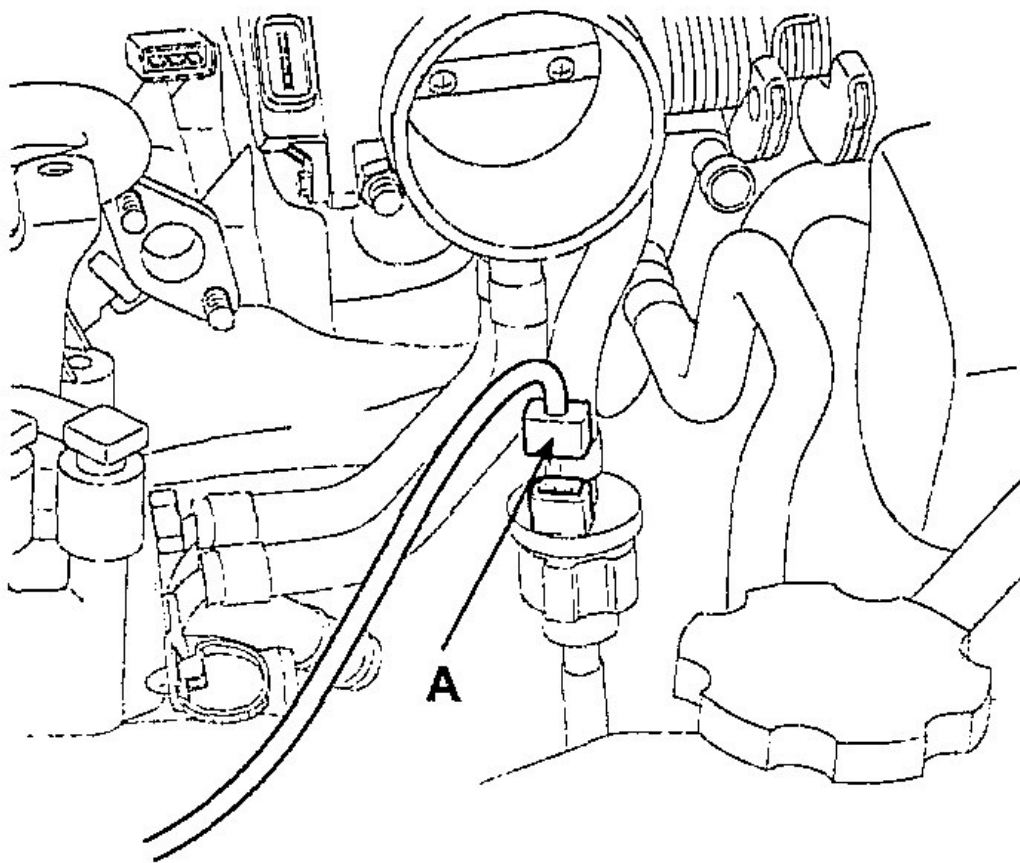


Fig. 137: Connecting Oil Pressure Switch Connector
Courtesy of KIA MOTORS AMERICA, INC.

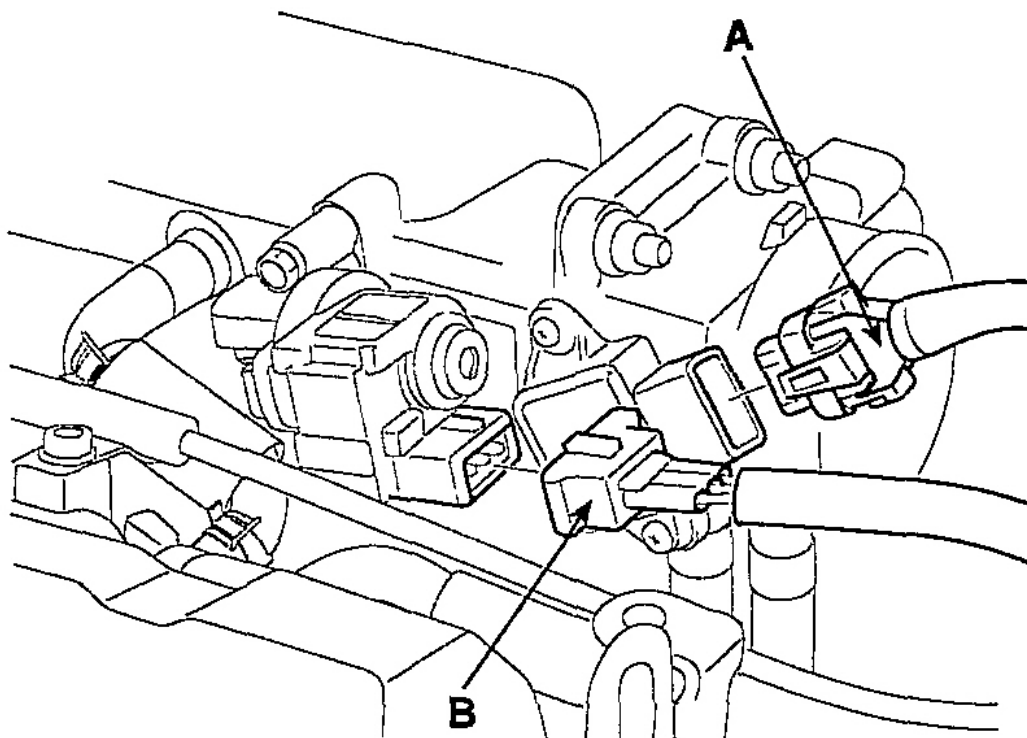
5. Purge Control Solenoid Valve (PCSV) connector (E).



G00719100

Fig. 138: Disconnecting PCSV Connector
Courtesy of KIA MOTORS AMERICA, INC.

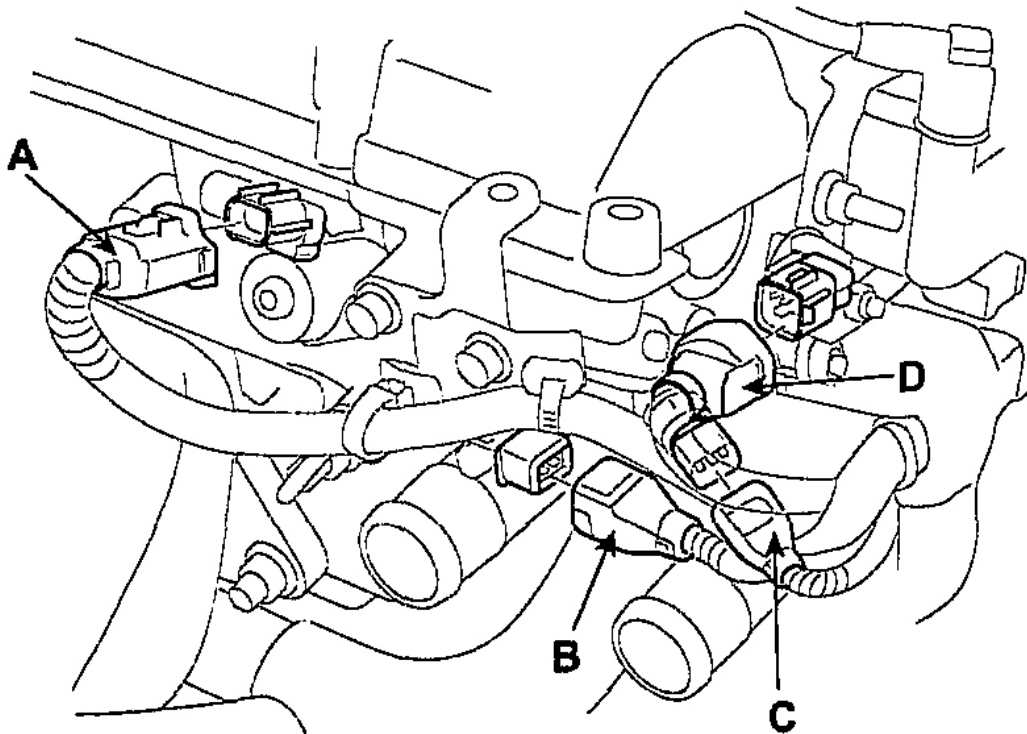
6. Idle Speed Control Actuator (ISCA) connector (B).
7. Throttle Position Sensor (TPS) connector (A).



G00719078

Fig. 139: Connecting ISA & TPS Connectors
Courtesy of KIA MOTORS AMERICA, INC.

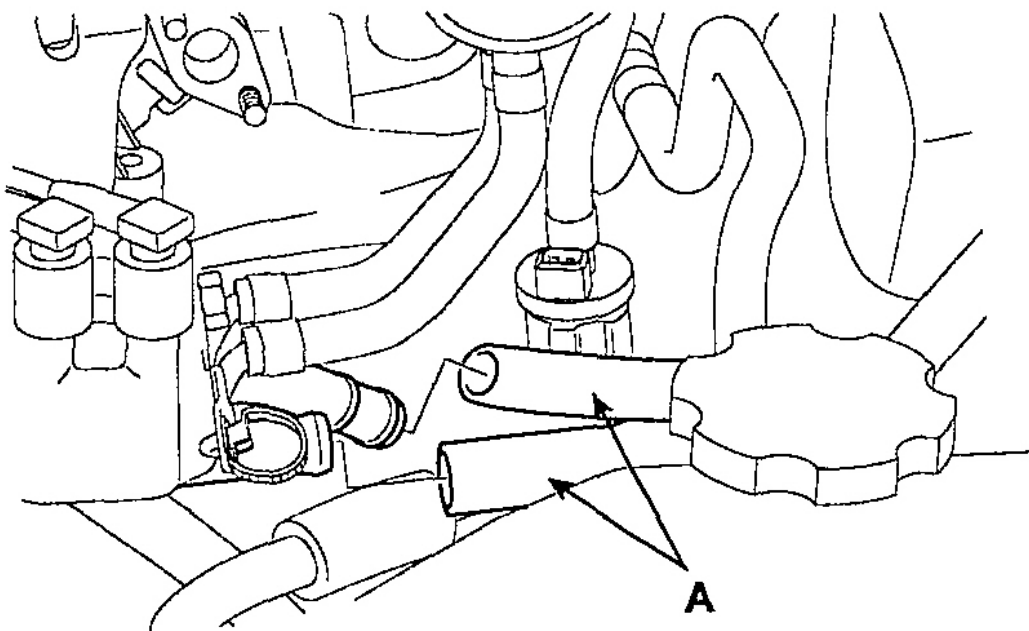
8. Connect the ignition coil connector (D).
9. Connect the ECT (Engine Coolant Temperature Sensor) connector (C).
10. Connect the oil temperature sensor connector (B).
11. Connect the OCV (Oil Control Valve) connector (A).



G00719079

Fig. 140: Connecting Oil Control Valve
Courtesy of KIA MOTORS AMERICA, INC.

21. Install the heater hose (A).

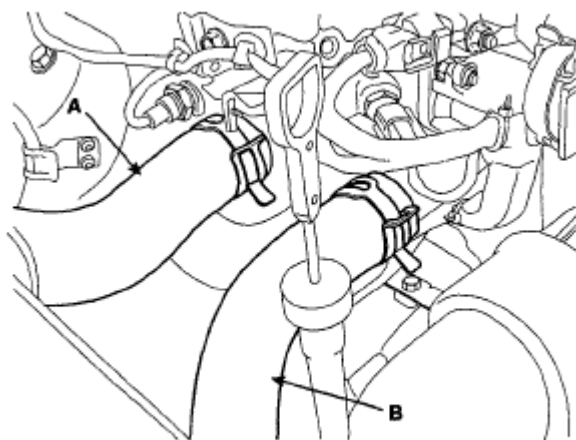


G00719080

Fig. 141: Installing Heater Hose

Courtesy of KIA MOTORS AMERICA, INC.

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



SHDM16006L

Fig. 142: Locating Upper Radiator Hose And Lower Radiator Hose

Courtesy of KIA MOTORS AMERICA, INC.

23. Install the intake air hose and air cleaner assembly.

24. Install the engine cover (A).

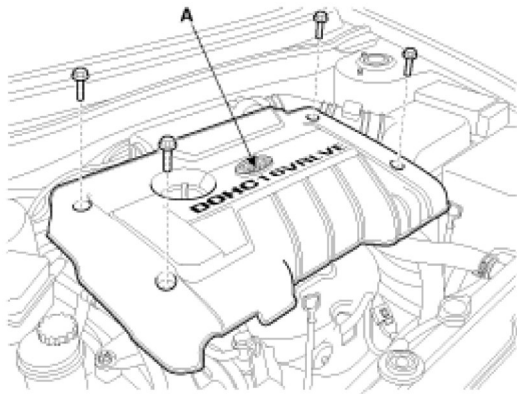
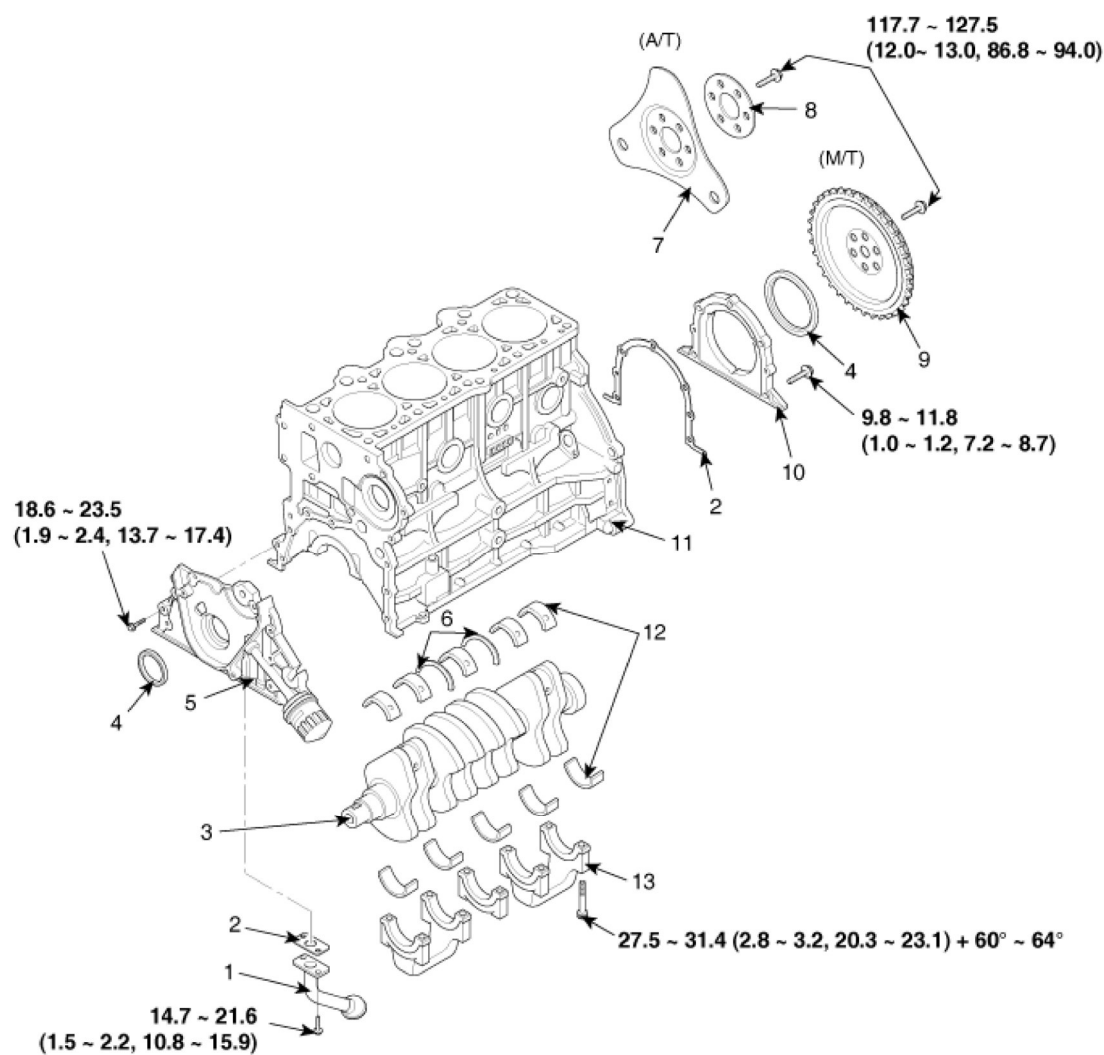


Fig. 143: Removing/Installing Engine Cover
Courtesy of KIA MOTORS AMERICA, INC.

25. Connect the negative terminal to the battery.
26. Fill with engine coolant.
27. Start the engine and check for leaks.
28. Recheck engine coolant level and oil level.

ENGINE BLOCK

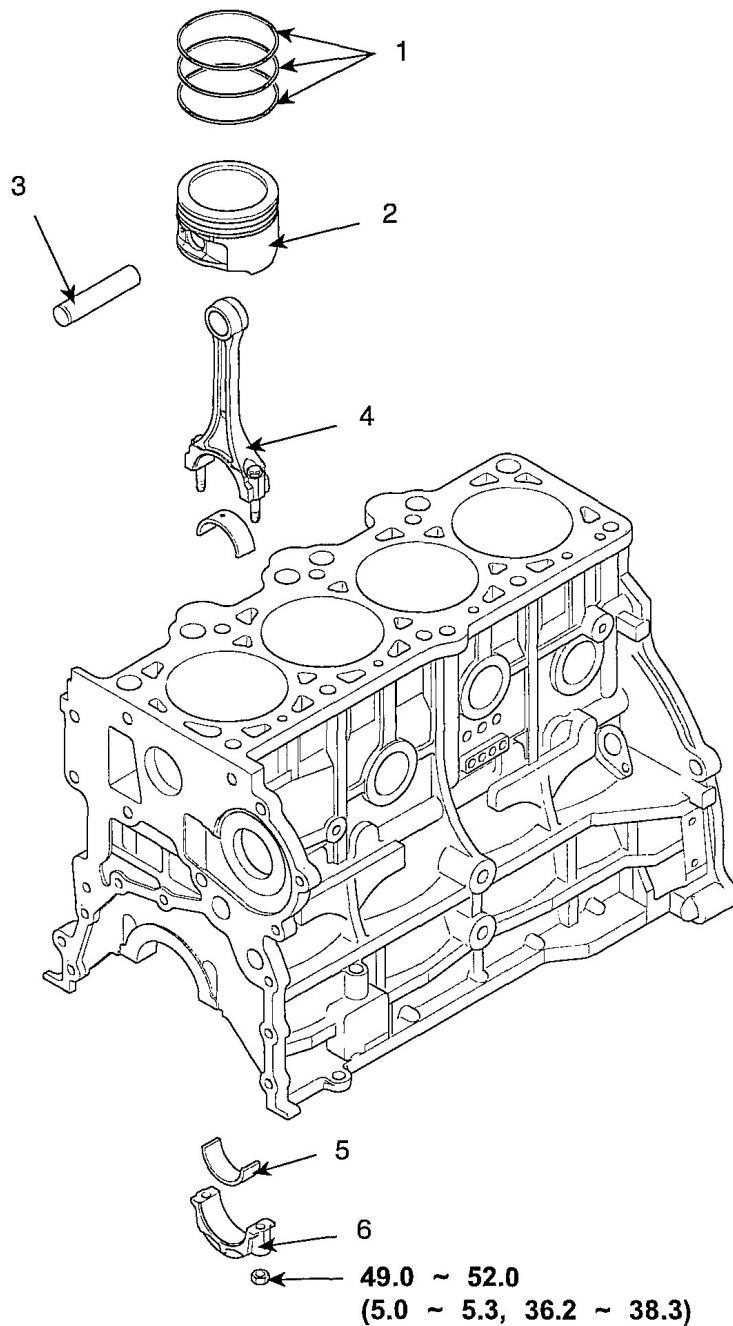
COMPONENT



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

- | | |
|-------------------|------------------------|
| 1. Oil screen | 8. Washer |
| 2. Gasket | 9. Adapter plate |
| 3. Crankshaft | 10. Rear oil seal case |
| 4. Oil seal | 11. Cylinder block |
| 5. Front case | 12. Main bearing |
| 6. Thrust bearing | 13. Main bearing cap |
| 7. Drive plate | |

Fig. 144: Exploded View Of Block Assembly With Torque Specifications (1 Of 2)
 Courtesy of KIA MOTORS AMERICA, INC.



TORQUE : N-m (kg-m, lb-ft)

- 1. Piston ring
- 2. Piston
- 3. Piston pin

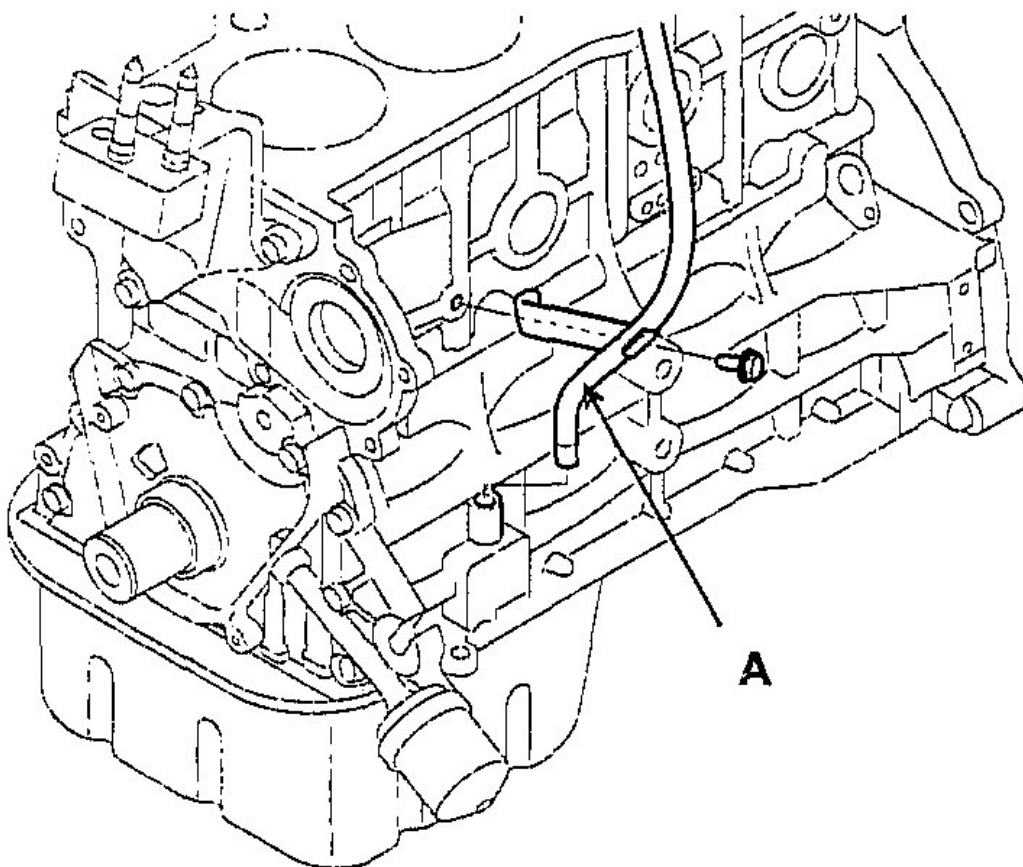
- 4. Connecting rod
- 5. Connecting rod bearing
- 6. Connecting rod bearing cap

G00719119

Fig. 145: Exploded View Of Block Assembly With Torque Specifications (2 Of 2)
 Courtesy of KIA MOTORS AMERICA, INC.

DISASSEMBLY

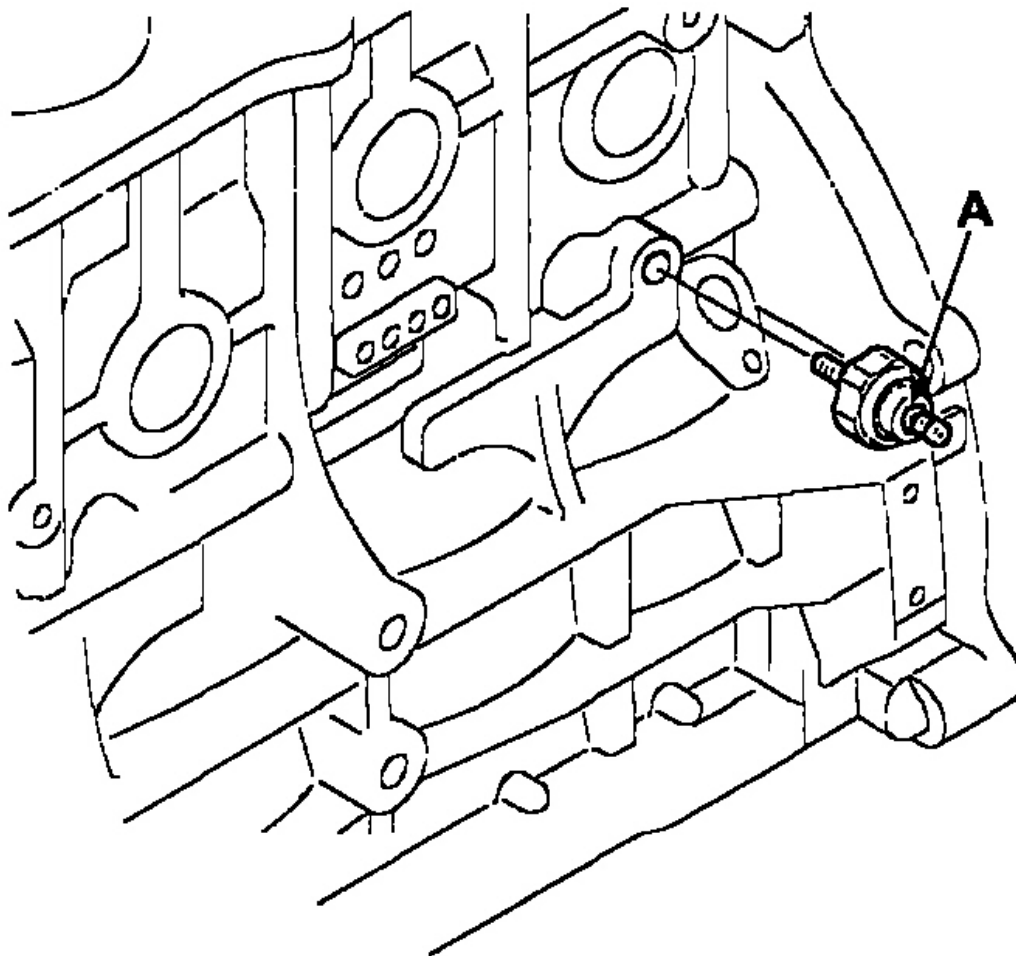
1. M/T: Remove the flywheel.
2. A/T: Remove the driveplate.
3. Install the engine block onto an engine stand for disassembly.
4. Remove the timing belt. See **REMOVAL**.
5. Remove the cylinder head. See **REMOVAL**.
6. Remove the oil level gauge tube (A).



G00719120

Fig. 146: Removing Oil Level Gauge Tube
Courtesy of KIA MOTORS AMERICA, INC.

7. Remove knock sensor.
8. Remove the oil pressure switch (A).

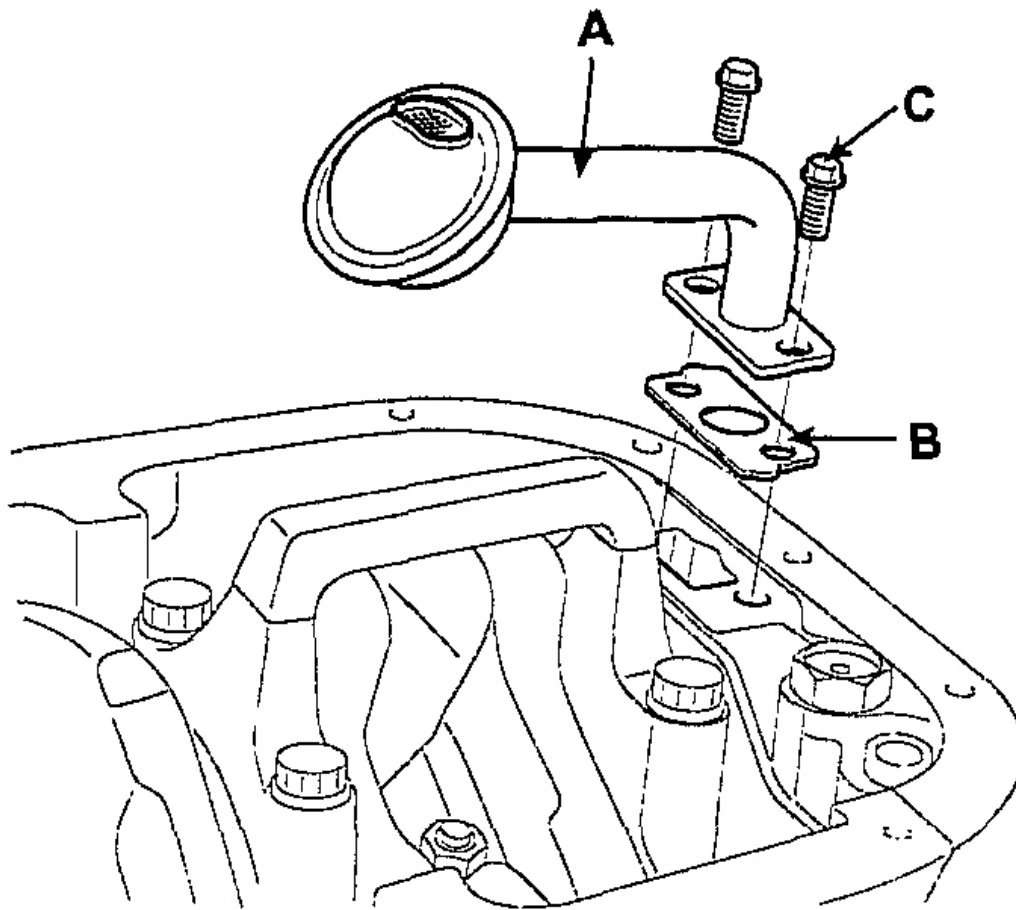


G00719122

Fig. 147: Removing Oil Pressure Switch
Courtesy of KIA MOTORS AMERICA, INC.

9. Remove the water pump.
10. Remove the oil pan (A).
11. Remove the oil screen.

Remove the 2 bolts (C), oil screen (A) and gasket (B).



G00719124

Fig. 148: Removing Oil Screen

Courtesy of KIA MOTORS AMERICA, INC.

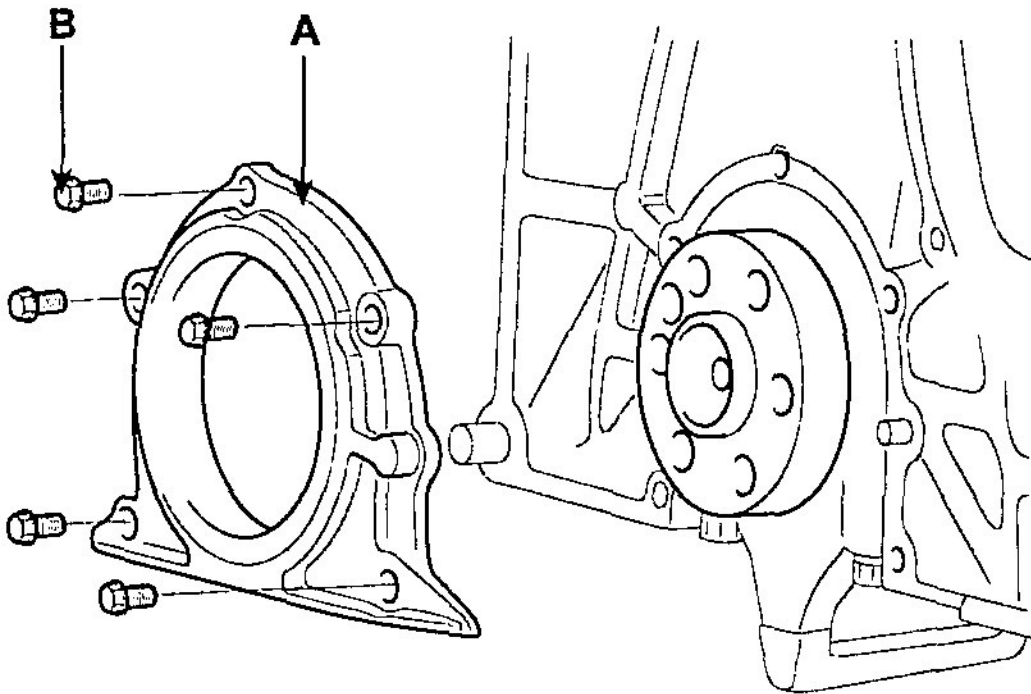
12. Check the connecting rod end play.
13. Remove the connecting rod caps and check oil clearance.
14. Remove the piston and connecting rod assemblies.
 - a. Using a ridge reamer, remove all the carbon from the top of the cylinder.
 - b. Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.

NOTE:

- **Keep the bearings, connecting rod and cap together.**
- **Arrange the piston and connecting rod assemblies in the correct order.**

15. Remove the front case.
16. Remove the rear oil seal case.

Remove the 5 bolts (B) and rear oil seal case (A).

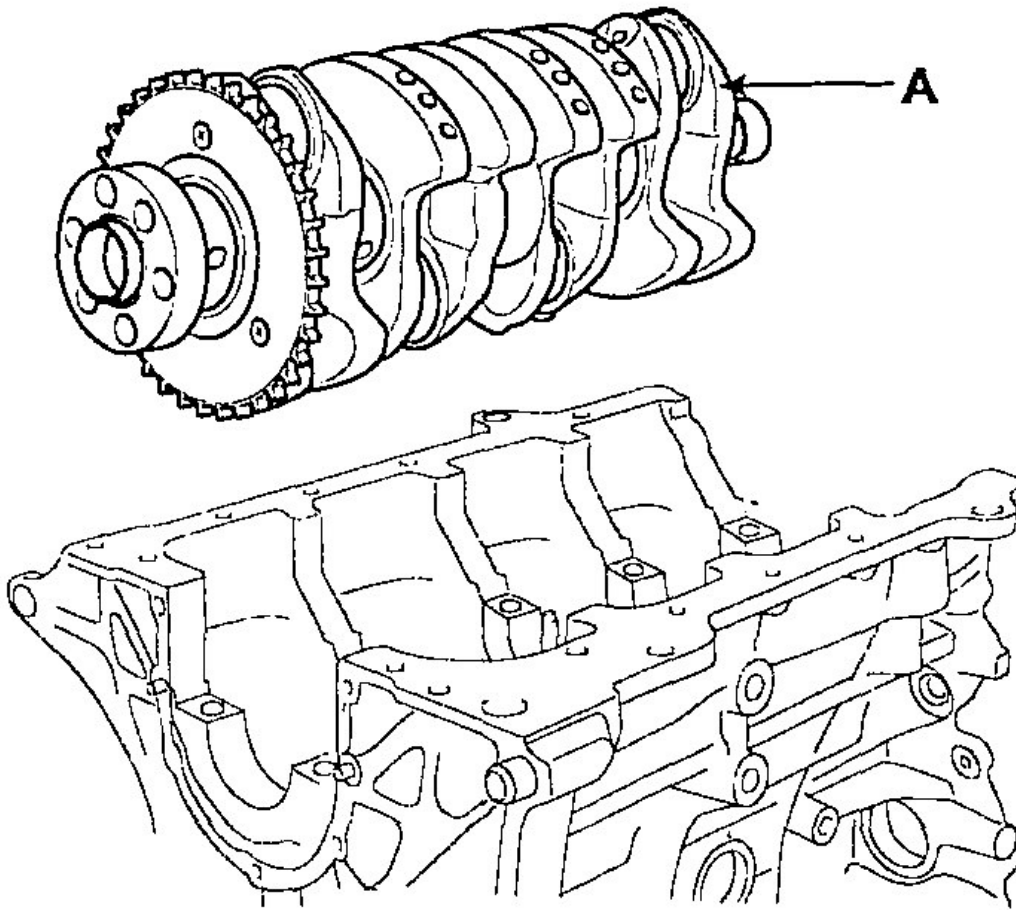


G00719125

Fig. 149: Removing Rear Oil Seal Case
 Courtesy of KIA MOTORS AMERICA, INC.

17. Remove the crankshaft bearing cap and check oil clearance.
18. Check the crankshaft end play.
19. Lift the crankshaft (A) out of the engine, being careful not to damage journals.

NOTE: Arrange the main bearings and thrust bearings in the correct order.



G00719126

Fig. 150: Removing Crankshaft

Courtesy of KIA MOTORS AMERICA, INC.

20. Check fit between piston and piston pin. Try to move the piston back and forth on the piston pin. If any movement is felt, replace the piston and pin as a set.
21. Remove the piston rings.
 - a. Using a piston ring expander, remove the 2 compression rings.
 - b. Remove the 2 side rails and oil ring by hand.

NOTE: Arrange the piston rings in the correct order only.

22. Disconnect connecting rod from piston.

INSPECTION & REPAIR**CONNECTING ROD AND CRANKSHAFT**

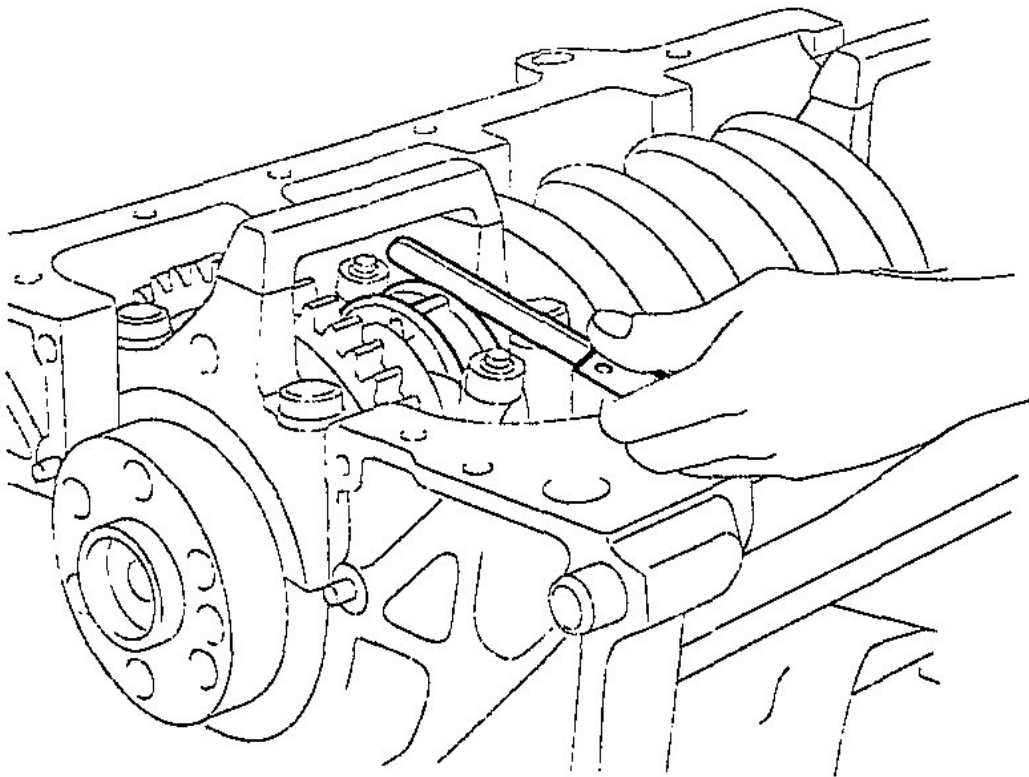
1. Check the connecting rod end play.

Using feeler gauge, measure the end play while moving the connecting rod back and forth.

End play

Standard: 0.1-0.25 mm (0.0039-0.0098 in)

Maximum: 0.4 mm (0.0157 in)



G00719127

Fig. 151: Measuring Connecting Rod End Play
Courtesy of KIA MOTORS AMERICA, INC.

- If out-of-tolerance, install a new connecting rod.

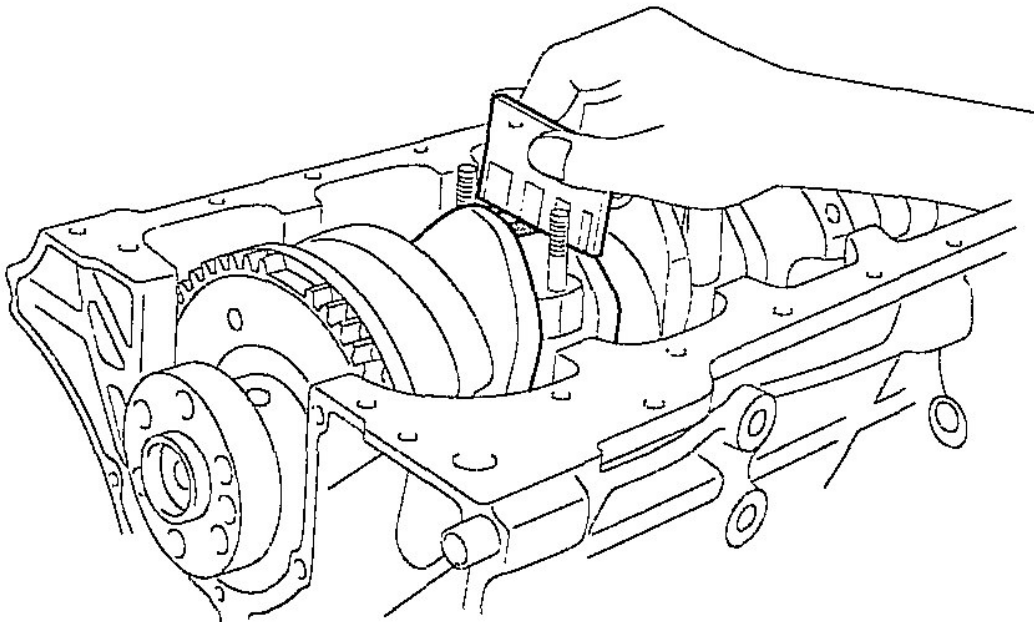
- If still out-of-tolerance, replace the crankshaft.
2. Check the connecting rod bearing oil clearance.
 - a. Check that the match marks on the connecting rod and cap are aligned to ensure correct reassembly.
 - b. Remove the 2 connecting rod cap nuts.
 - c. Remove the connecting rod cap and lower bearing.
 - d. Clean the crankshaft pin journal and bearing.
 - e. Place a plastigage across the crankshaft pin journal.
 - f. Reinstall the lower bearing and cap, and tighten the nuts.

Tightening torque: 49.0-52.0 N.m (5.0-5.3 kg-m, 36.2-38.3 lb-ft)

NOTE: Do not turn the crankshaft.

- g. Remove the 2 nuts, connecting rod cap and lower bearing.
 - h. Measure the plastigage at its widest point.

Standard oil clearance: 0.024-0.044 mm (0.0009-0.0017 in)



G00719128

Fig. 152: Measuring Connecting Rod Bearing Clearance
Courtesy of KIA MOTORS AMERICA, INC.

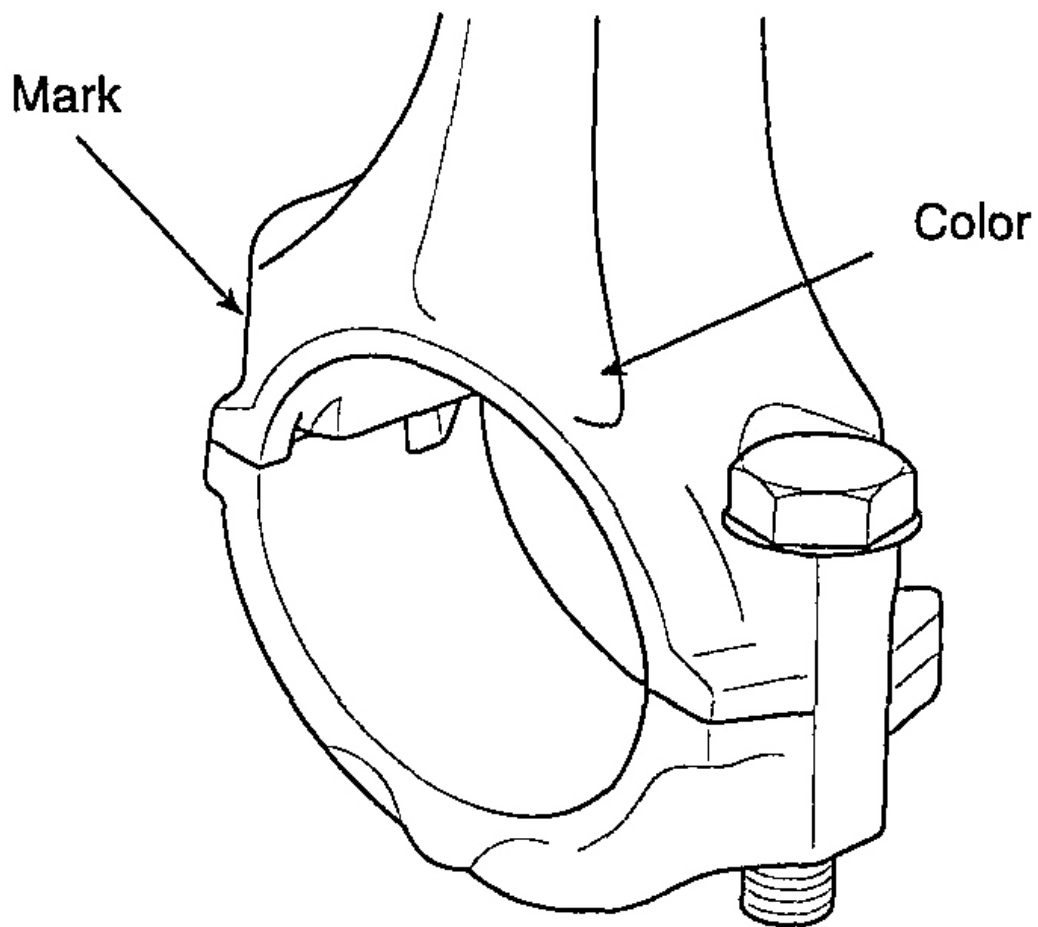
- i. If the plastigage measures too wide or too narrow, remove the upper and lower bearing and then install a new bearings with the same color mark. Recheck the oil clearance.

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

- j. If the plastigage shows the clearance is still incorrect, try the next larger or smaller bearing. Recheck the oil clearance.

NOTE: If the proper clearance cannot be obtained by using the appropriate larger or smaller bearings, machine or replace the crankshaft and start over.

CAUTION: If the alignment marks are unreadable because of an accumulation of grease or grime, don't clean with a wire brush or abrasive cleaner. Clean only with correct cleaning solvent or detergent.



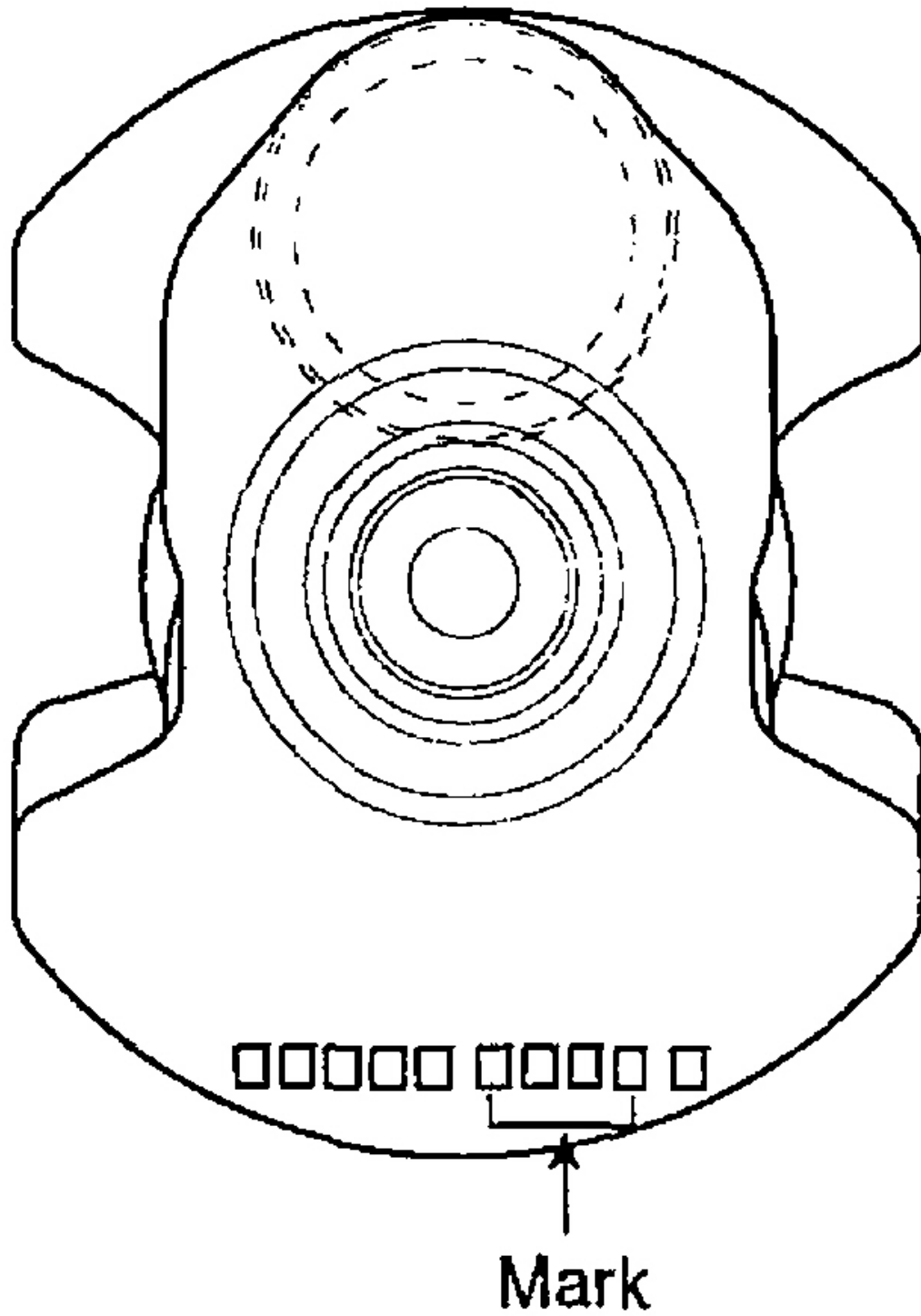
G00719129

Fig. 153: Identifying Connecting Rod Mark Locations
Courtesy of KIA MOTORS AMERICA, INC.

Mark	Color	Connecting rod big-end inner diameter
A	White	48.000 ~ 48.006mm (1.8898 ~ 1.8900in)
B	None	48.006 ~ 48.012mm (1.8900 ~ 1.8902in)
C	Yellow	48.012 ~ 48.018mm (1.8902 ~ 1.8905in)

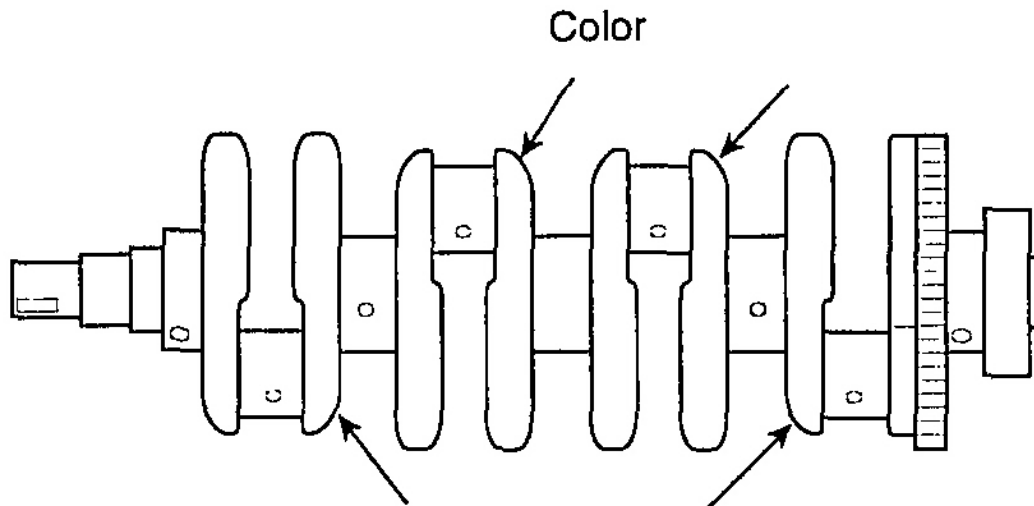
G00719130

Fig. 154: Identifying Connecting Rod Chart
Courtesy of KIA MOTORS AMERICA, INC.



G00719131

Fig. 155: Identifying Crankshaft Pin Journal Mark Location
 Courtesy of KIA MOTORS AMERICA, INC.



G00719132

Fig. 156: Identifying Crankshaft Color Location
 Courtesy of KIA MOTORS AMERICA, INC.

Mark	Color	Crankshaft pin journal outer diameter
1	Yellow	44.960 ~ 44.966mm (1.7701 ~ 1.7703in)
2	None	44.952 ~ 44.960mm (1.7698 ~ 1.7701in)
3	White	44.946 ~ 44.952mm (1.7695 ~ 1.7698in)

G00719133

Fig. 157: Identifying Crankshaft Pin Journal Chart

Courtesy of KIA MOTORS AMERICA, INC.

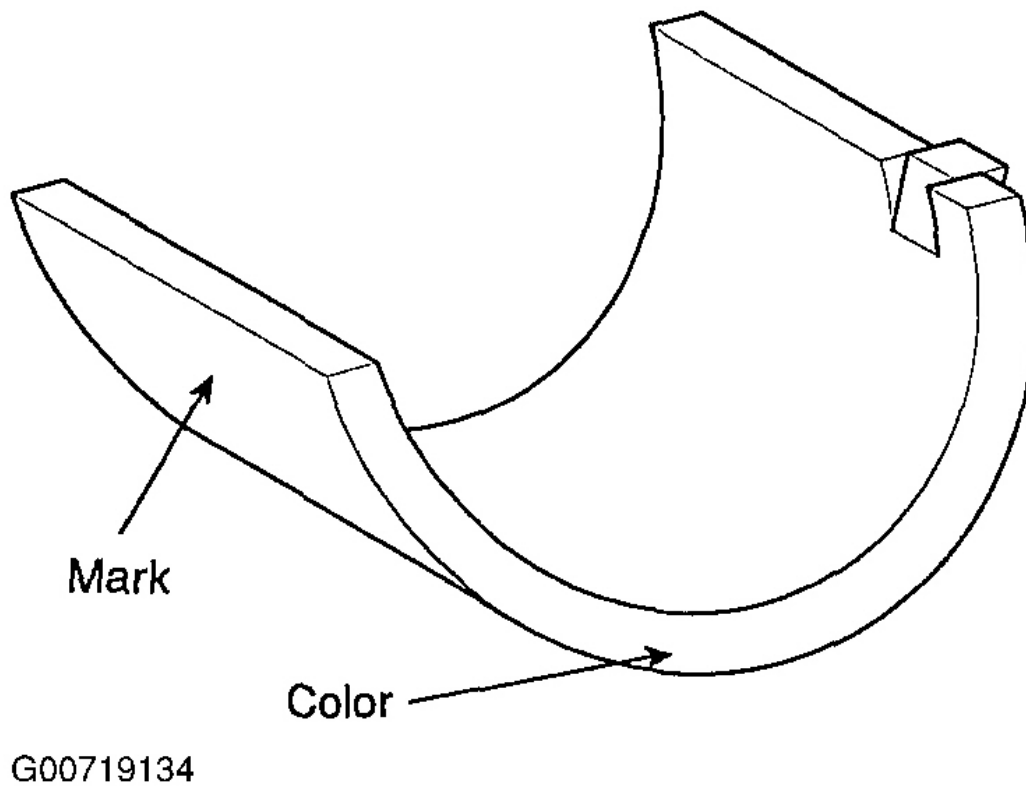


Fig. 158: Identifying Connecting Rod Bearing Mark Location
Courtesy of KIA MOTORS AMERICA, INC.

Mark	Color	Connecting rod bearing thickness
AA	Blue	1.514 ~ 1.517mm (0.0596 ~ 0.0597in)
A	Black	1.511 ~ 1.514mm (0.0595 ~ 0.0596in)
B	None	1.508 ~ 1.511mm (0.0594 ~ 0.0595in)
C	Green	1.505 ~ 1.508mm (0.0593 ~ 0.0594in)
D	Yellow	1.502 ~ 1.505mm (0.0591 ~ 0.0593in)

G00719135

Fig. 159: Identifying Connecting Rod Bearing Chart
 Courtesy of KIA MOTORS AMERICA, INC.

- k. Select the bearing by using selection table.

		Connecting rod mark		
		A (White)	B (None)	C (Yellow)
Crank shaft pin journal mark	1 (Yellow)	D (Yellow)	C (Green)	B (None)
	2 (None)	C (Green)	B (None)	A (Black)
	3 (White)	B (None)	A (Black)	AA (Blue)

G00719136

Fig. 160: Identifying Rod Bearing Selection Table
 Courtesy of KIA MOTORS AMERICA, INC.

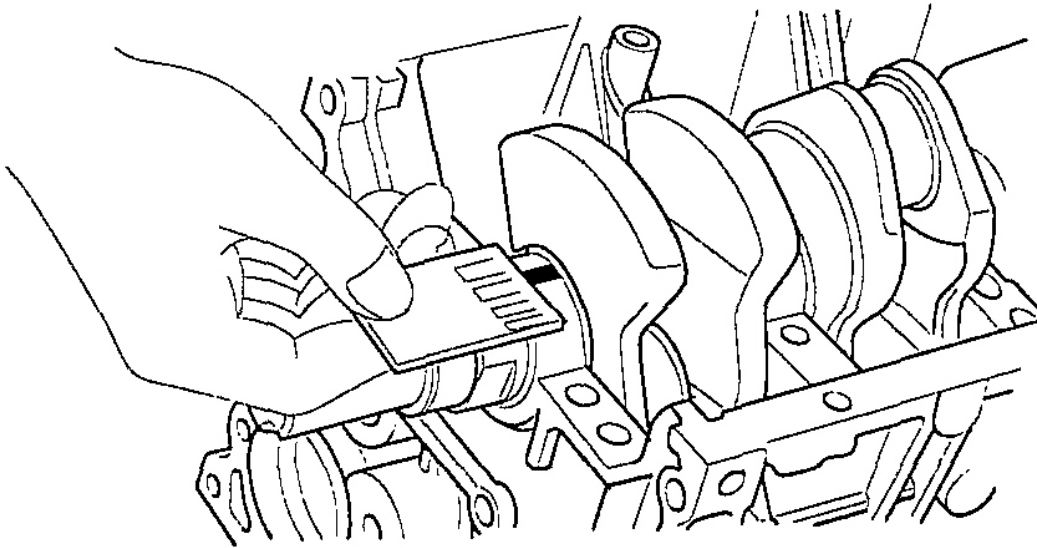
3. Check the crankshaft bearing oil clearance.
 - a. To check main bearing-to-journal oil clearance, remove the main bearing caps and lower bearings.
 - b. Clean each main journal and lower bearing with a clean shop towel.
 - c. Place one strip of plastigage across each main journal.
 - d. Reinstall the lower bearings and caps, then tighten the bolts.

Tightening torque: 27.5-31.4 N.m (2.8-3.2 kg-m, 20.3-23.1 lb-ft)+60°-64°

NOTE: Do not turn the crankshaft.

- e. Remove the cap and lower bearing again, and measure the widest part of the plastigage.

Standard oil clearance: 0.028-0.048 mm (0.0011-0.0019 in)



G00719137

Fig. 161: Measuring Main Bearing Clearance
Courtesy of KIA MOTORS AMERICA, INC.

- f. If the plastigage measures too wide or too narrow, remove the upper and lower bearing and then install a new bearings with the same color mark. Recheck the oil clearance.

CAUTION: Do not file, shim, or scrape the bearings or the cap to adjust clearance.

- g. If the plastigage shows the clearance is still incorrect, try the next larger or smaller bearing.

Recheck the oil clearance.

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

CAUTION: If the alignment marks are unreadable because of accumulation of grease or grime, don't clean with a wire brush or abrasive cleaner. Clean only with correct cleaning solvent or detergent.

CONNECTING RODS

1. When reinstalling, make sure that cylinder numbers put on the connecting rod and cap at disassembly match. When a new connecting rod is installed, make sure that the notches for holding the bearing in

place are on the same side.

2. Replace the connecting rod if it is damaged on the thrust faces at either end. Also if step wear or a severely rough surface of the inside diameter of the small end is apparent, the rod must be replaced as well.
3. Using a connecting rod aligning tool, check the rod for bend and twist. If the measured value is close to the repair limit, correct the rod by a press. Any connecting rod that has been severely bent or distorted should be replaced.

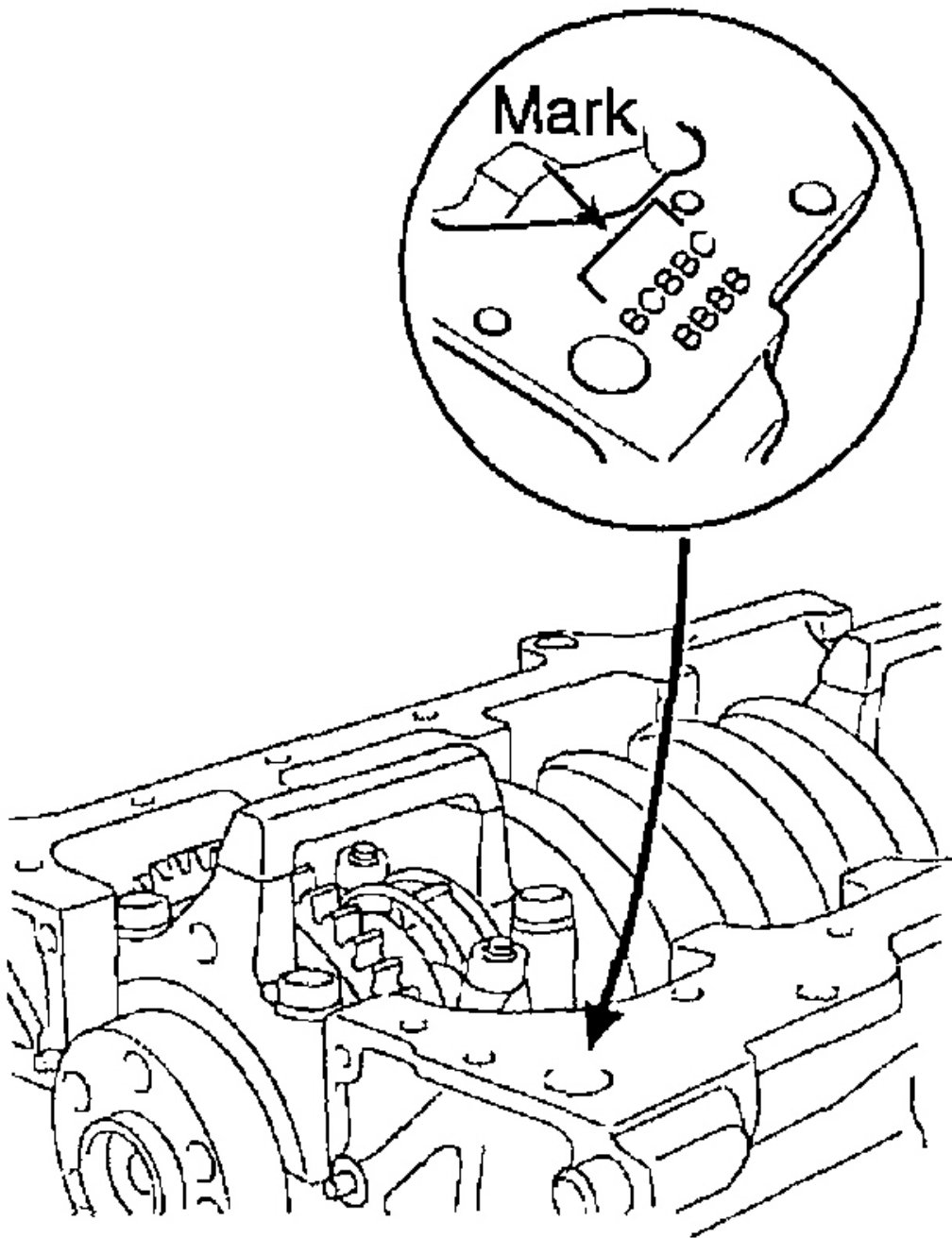
Allowable bend of connecting rod :

0.05mm / 100mm (0.0020 in./3.94 in) or less

Allowable twist of connecting rod :

0.1mm / 100mm (0.0039 in./3.94 in) or less

Letters have been stamped on the end of the block as a mark for the size of each of the 5 main journal bores.



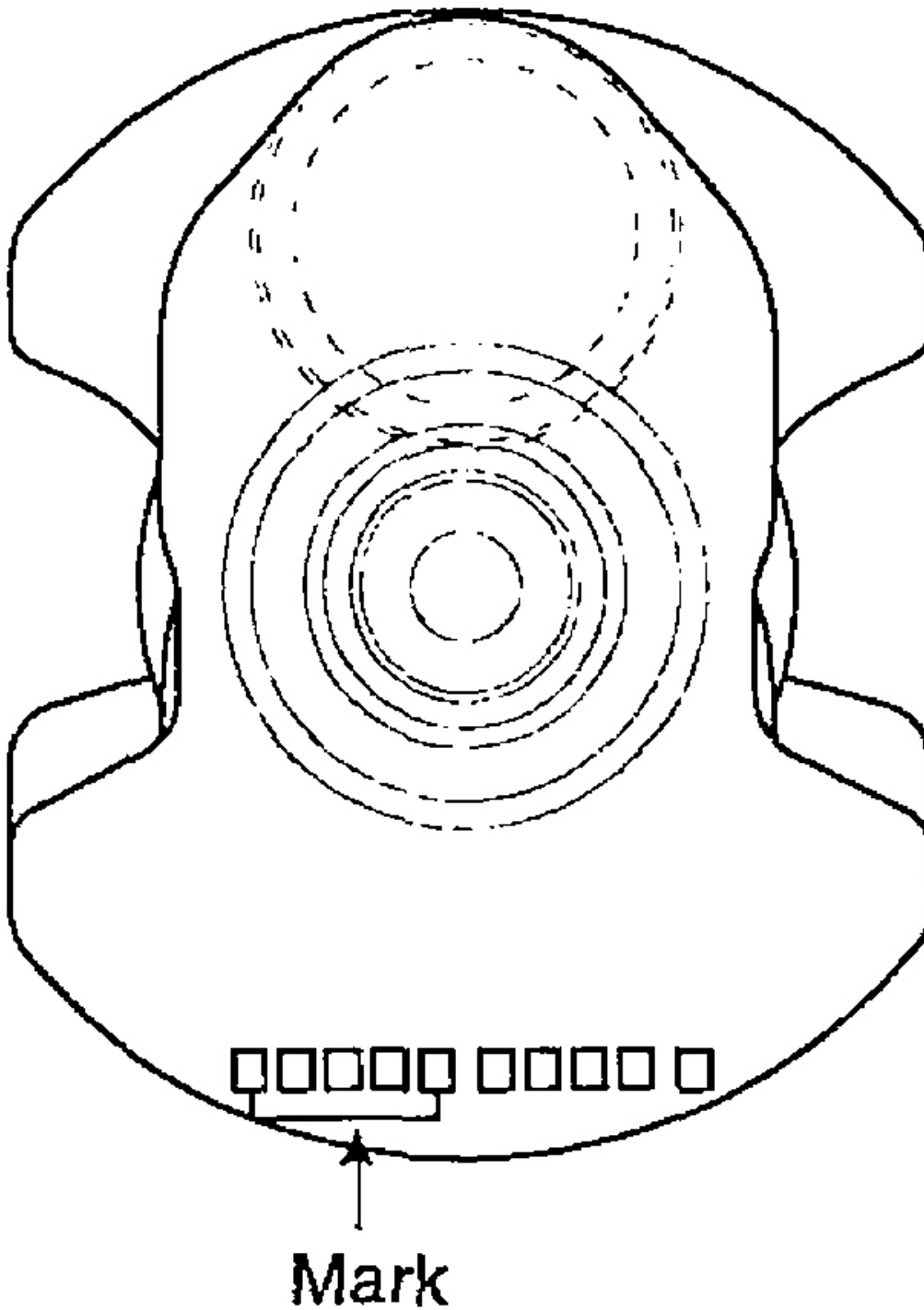
G00719138

Fig. 162: Identifying Crankshaft Journal Bore Mark Location
Courtesy of KIA MOTORS AMERICA, INC.

Discrimination of cylinder block

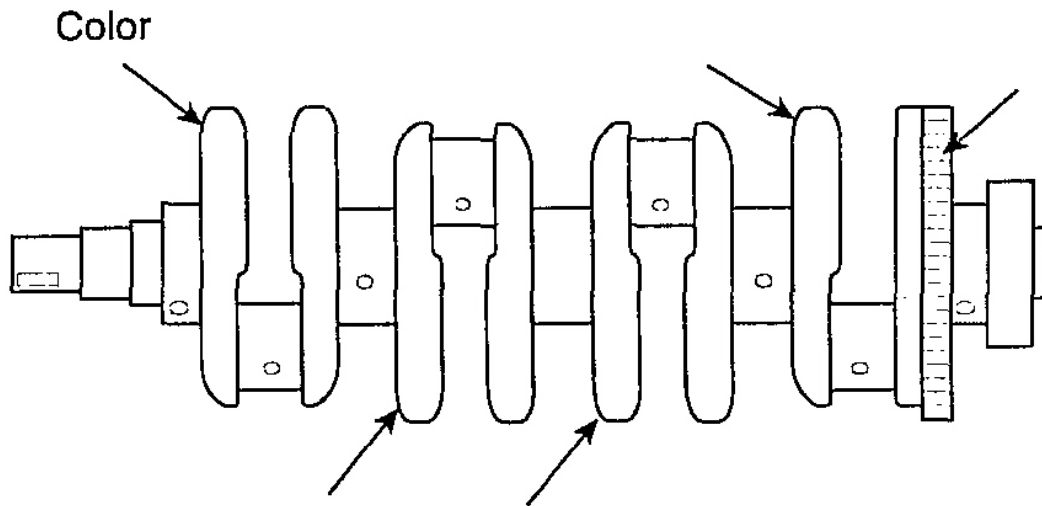
CLASS	MARK	INSIDE DIAMETER
a	A	59.000 ~ 59.006mm (2.3228 ~ 2.3230in.)
b	B	59.006 ~ 59.012mm (2.3230 ~ 2.3233in.)
c	C	59.012 ~ 59.018mm (2.3233 ~ 2.3235in.)

Crankshaft journal mark location



G00719140

Fig. 163: Identifying Crankshaft Main Journal Mark Location
 Courtesy of KIA MOTORS AMERICA, INC.



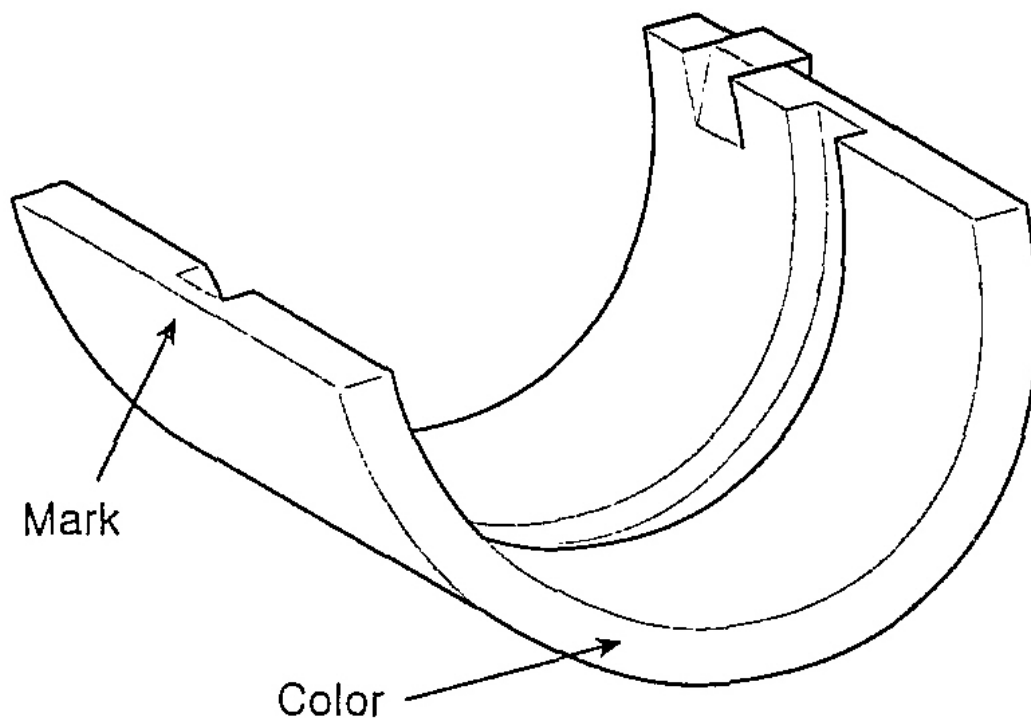
G00719141

Fig. 164: Identifying Crankshaft Color Location
 Courtesy of KIA MOTORS AMERICA, INC.

Discrimination of crankshaft

CLASS	MARK	OUTSIDE DIAMETER OF JOURNAL
I	YELLOW	54.956 ~ 54.962mm (2.1636 ~ 2.1638in.)
II	NONE	54.950 ~ 54.956mm (2.1633 ~ 2.1636in.)
III	WHITE	54.944 ~ 54.950mm (2.1631 ~ 2.1633in.)

Place of identification mark (Crankshaft bearing)



G00719143

Fig. 165: Identifying Crankshaft Main Bearing Mark Location

Courtesy of KIA MOTORS AMERICA, INC.

Discrimination of crankshaft bearing

Mark	Color	Crankshaft main bearing thickness
AA	Blue	2.014 ~ 2.017mm (0.0793 ~ 0.0794in)
A	Black	2.011 ~ 2.014mm (0.0792 ~ 0.0793in)
B	None	2.008 ~ 2.011mm (0.0791 ~ 0.0792in)
C	Green	2.005 ~ 2.008mm (0.0789 ~ 0.0791in)
D	Yellow	2.002 ~ 2.005mm (0.0788 ~ 0.0789in)

G00719144

Fig. 166: Identifying Crankshaft Main Bearing Chart
 Courtesy of KIA MOTORS AMERICA, INC.

Selection

		Cylinder block crankshaft journal bore mark		
		A	B	C
Crank shaft main journal mark	1 (Yellow)	D (Yellow)	C (Green)	B (None)
	2 (None)	C (Green)	B (None)	A (Black)
	3 (White)	B (None)	A (Black)	AA (Blue)

G00719145

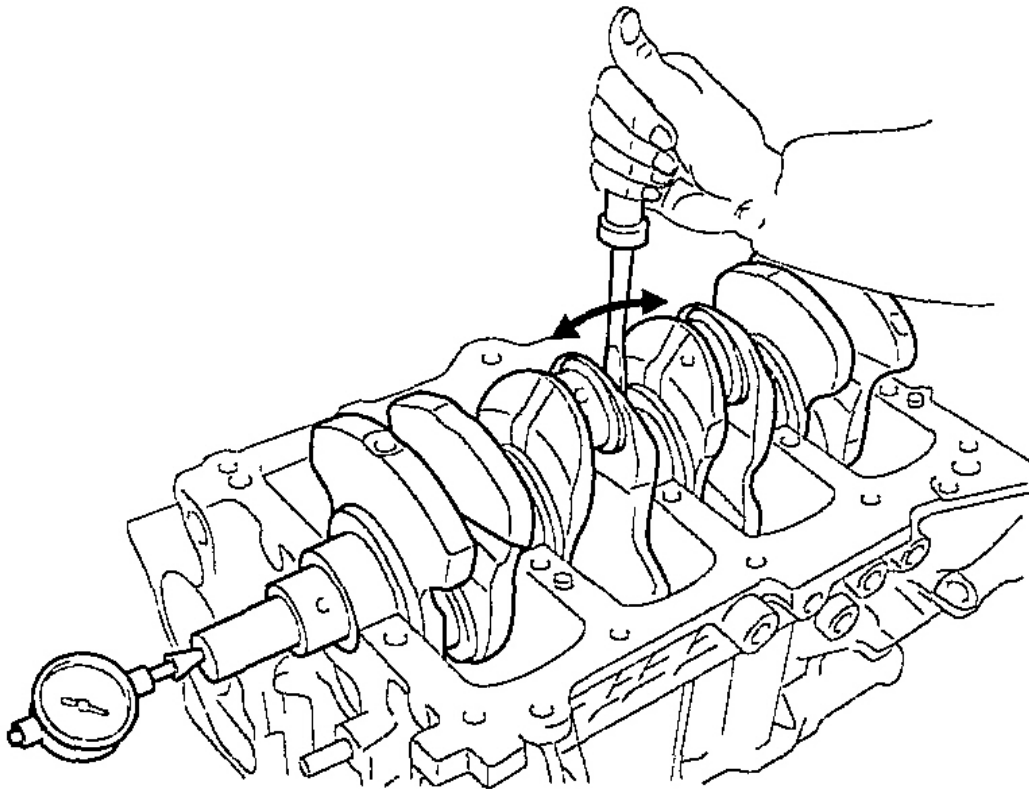
Fig. 167: Identifying Crankshaft Main Bearing Selection Table
 Courtesy of KIA MOTORS AMERICA, INC.

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

End play:

Standard: 0.06-0.26 mm (0.0024-0.0102 in)

Limit: 0.30 mm (0.0118 in)



G00719146

Fig. 168: Measuring Crankshaft End Play
Courtesy of KIA MOTORS AMERICA, INC.

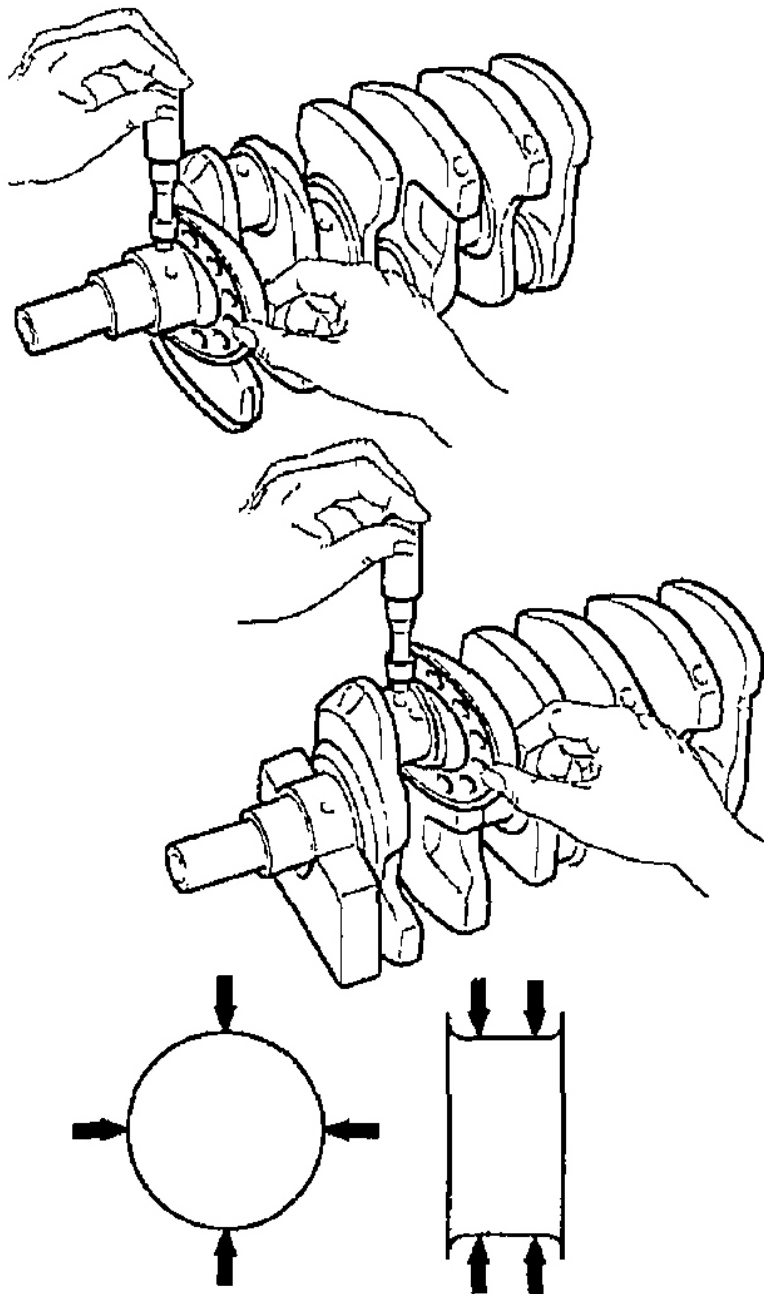
If the end play is greater than maximum, replace the thrust bearings as a set.

Thrust bearing thickness: 2.44-2.77 mm (0.0961-0.0972 in)

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

Main journal diameter: 56.942-56.962 mm (2.2418-2.2426 in)

Pin journal diameter: 44.946-44.966 mm (1.7695-1.7703 in)



G00719147

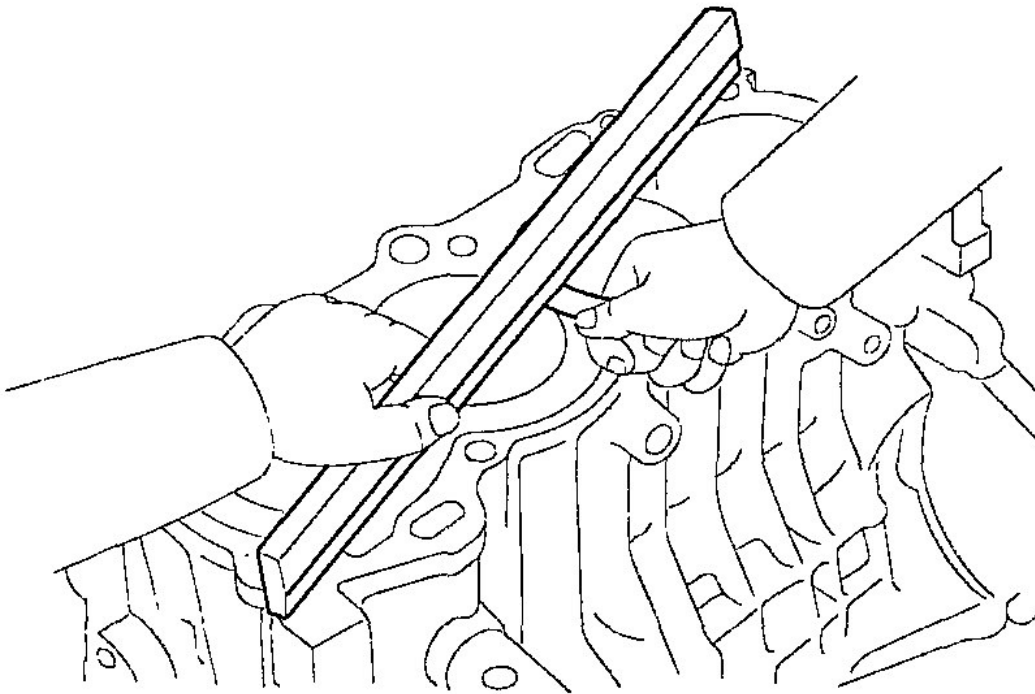
Fig. 169: Measuring Crankshaft Journal Diameter
 Courtesy of KIA MOTORS AMERICA, INC.

CYLINDER BLOCK

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

Flatness of cylinder block gasket surface

Standard : 0.05 mm (0.0020 in)

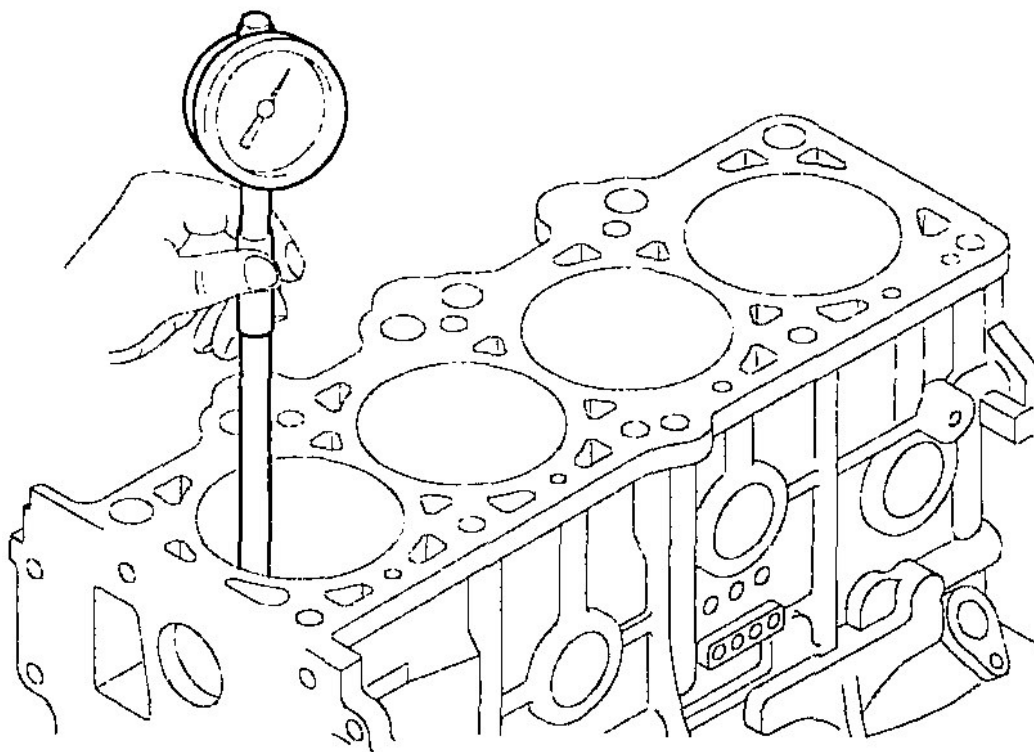


G00719148

Fig. 170: Measuring Cylinder Block Flatness
Courtesy of KIA MOTORS AMERICA, INC.

4. Inspect the cylinder bore. Visually check the cylinder for vertical scratches. If deep scratches are present, replace the cylinder block.
5. Inspect the cylinder bore diameter. Using a cylinder bore gauge, measure the cylinder bore diameter at position in the thrust and axial direction.

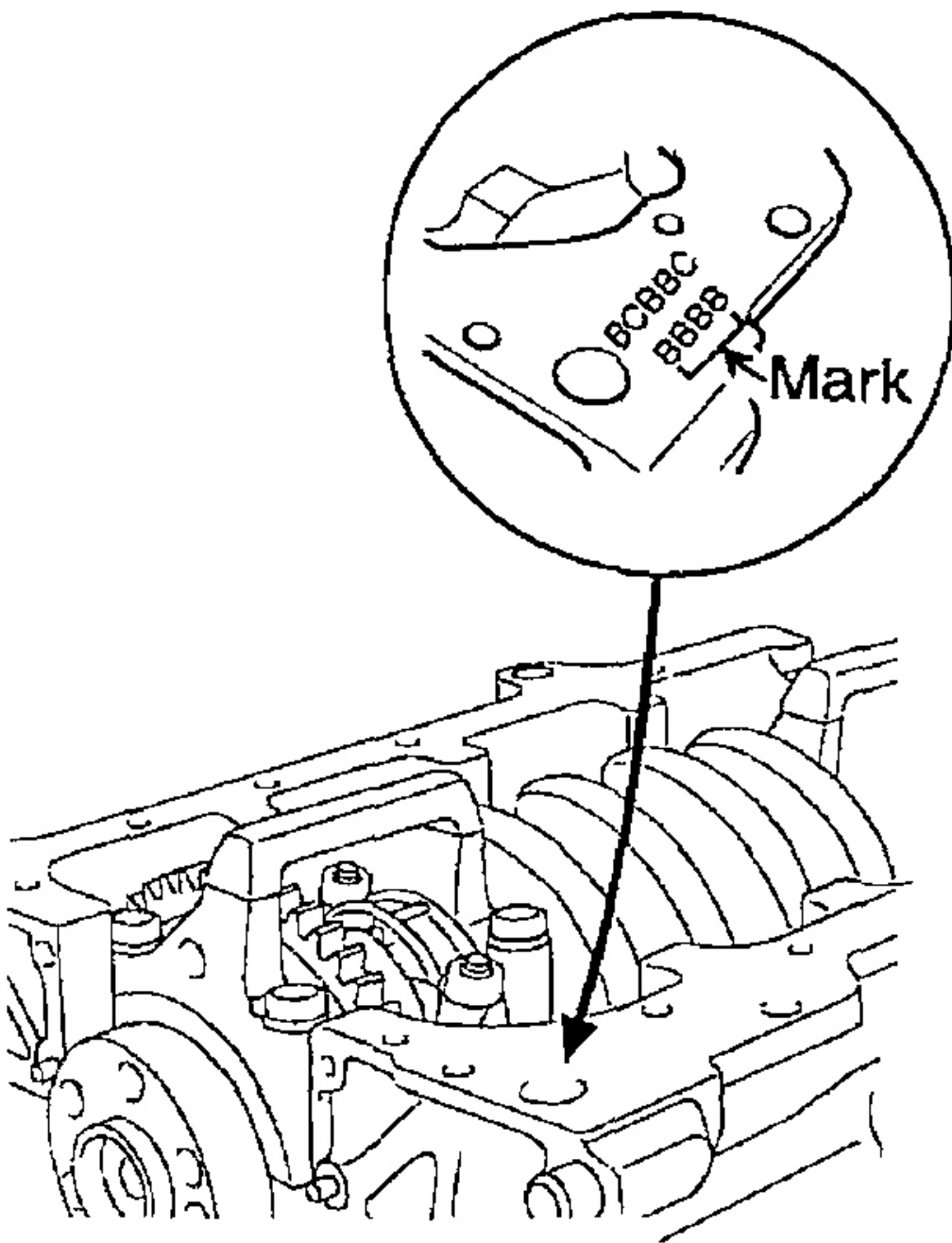
Standard diameter: 82.00-82.03 mm (3.2283-3.2295 in)



G00719149

Fig. 171: Measuring Cylinder Bore Diameter
Courtesy of KIA MOTORS AMERICA, INC.

6. Check the cylinder bore size code on the cylinder block bottom face.



G00719150

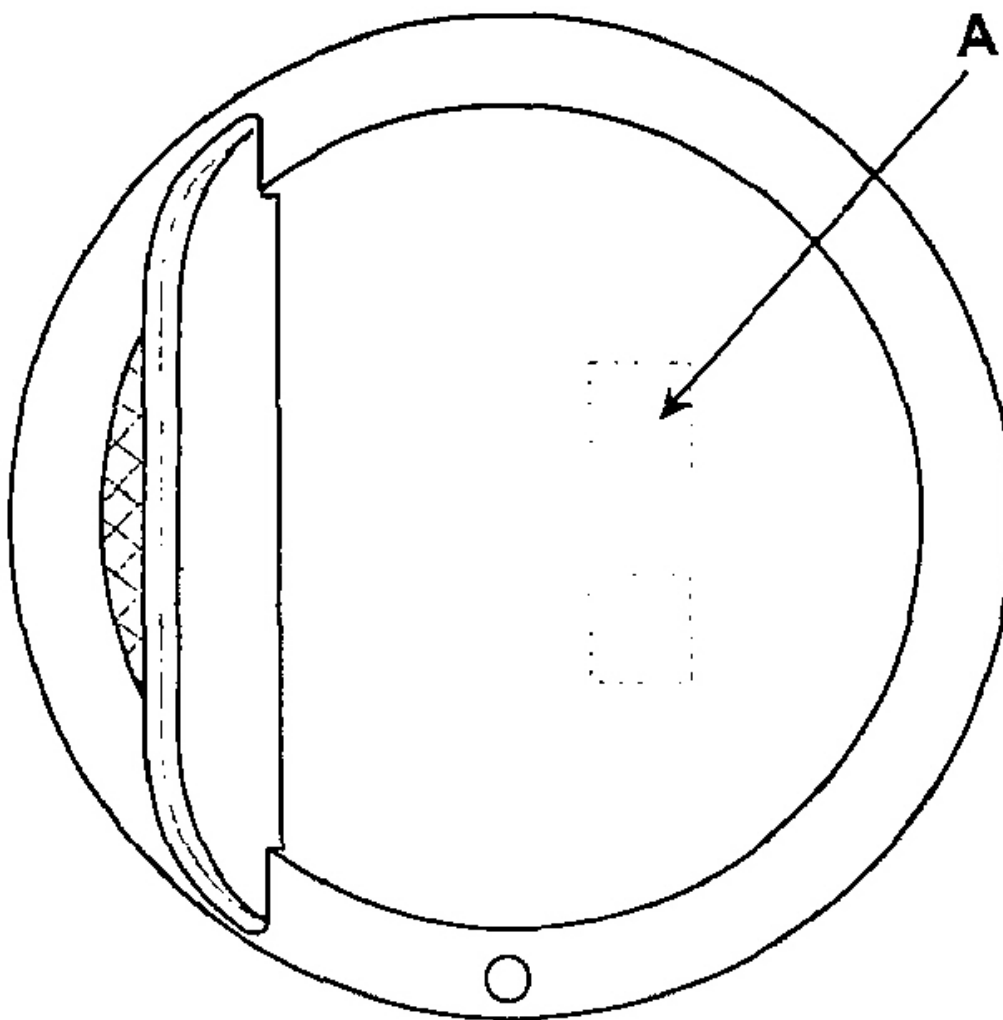
Fig. 172: Identifying Cylinder Bore Size Code
Courtesy of KIA MOTORS AMERICA, INC.

Mark	Cylinder bore inner diameter
A	82.00 ~ 82.01mm (3.2283 ~ 3.2287in)
B	82.01 ~ 82.02mm (3.2287 ~ 3.2291in)
C	82.02 ~ 82.03mm (3.2291 ~ 3.2295in)

G00719151

Fig. 173: Identifying Cylinder Bore Size Chart
Courtesy of KIA MOTORS AMERICA, INC.

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



G00719152

Fig. 174: Identifying Piston Size Location
Courtesy of KIA MOTORS AMERICA, INC.

Mark	Piston outer diameter
A	81.97 ~ 81.98mm (3.2272 ~ 3.2276in)
None	81.98 ~ 81.99mm (3.2276 ~ 3.2279in)
C	81.99 ~ 82.00mm (3.2279 ~ 3.2283in)

G00719153

Fig. 175: Identifying Piston Outer Diameter Chart
 Courtesy of KIA MOTORS AMERICA, INC.

8. Select the piston related to cylinder bore class.

Piston-to-cylinder clearance: 0.02-0.04 mm (0.0008-0.0016 in)

CYLINDER BORE

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

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

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

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

NOTE: New bore size = piston O.D + 0.02 to 0.04 mm (0.0008 to 0.0016 in)
 (clearance between piston and cylinder) - 0.01 mm (0.0004 in) (honing margin.)

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

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

5. Hone the cylinders, finishing them to the proper dimension (piston outside diameter + gap with cylinder).
6. Check the clearance between the piston and cylinder. Standard: 0.02-0.04 mm (0.0008-0.0016 in)

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

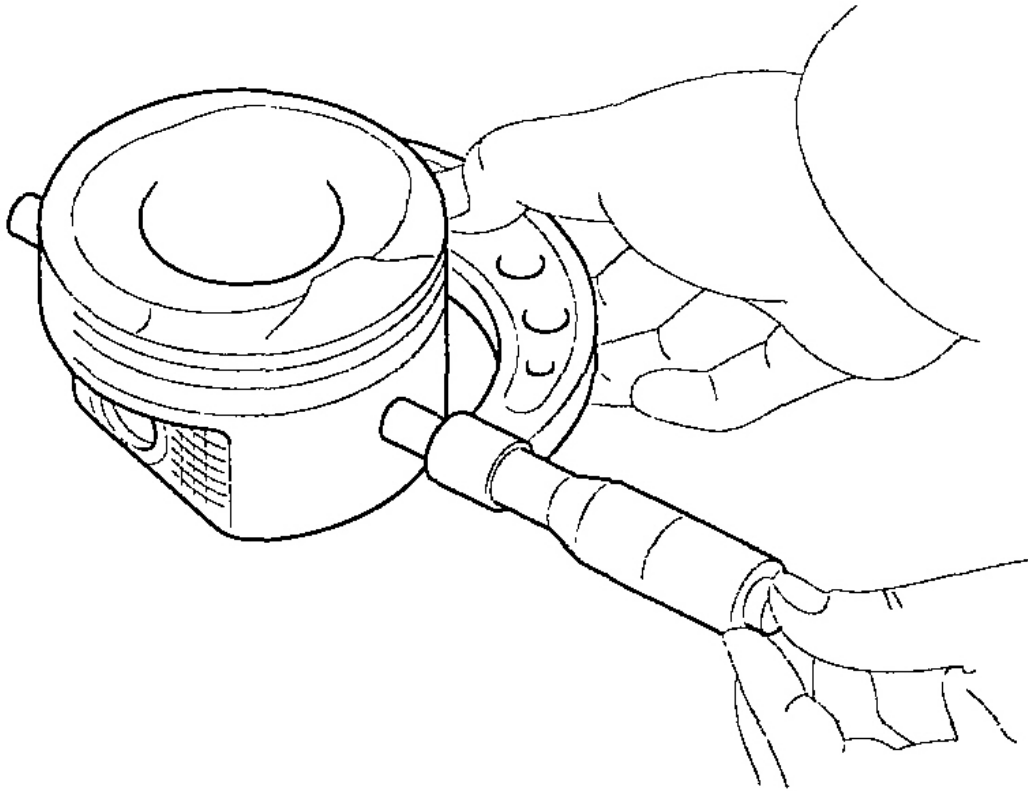
PISTON AND PISTON RINGS

- a. Clean the piston.
 - a. Using a gasket scraper, remove the carbon from the piston top.
 - b. Using a groove cleaning tool or broken ring, clean the piston ring grooves.
 - c. Using solvent and a brush, thoroughly clean the piston.

NOTE: **Do not use a wire brush.**

- b. The standard measurement of the piston outside diameter is taken 47 mm (1.85 in) from top land of the piston.

Standard diameter: 81.97-82.00 mm (3.2272-3.228 in)



G00719154

Fig. 176: Measuring Piston Diameter
Courtesy of KIA MOTORS AMERICA, INC.

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

Piston-to-cylinder clearance: 0.02-0.04 mm (0.0008-0.0016 in)

- d. Inspect the piston ring side clearance. Using a feeler gauge, measure the clearance between new piston ring and the wall of ring groove.

Piston ring side clearance:

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

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

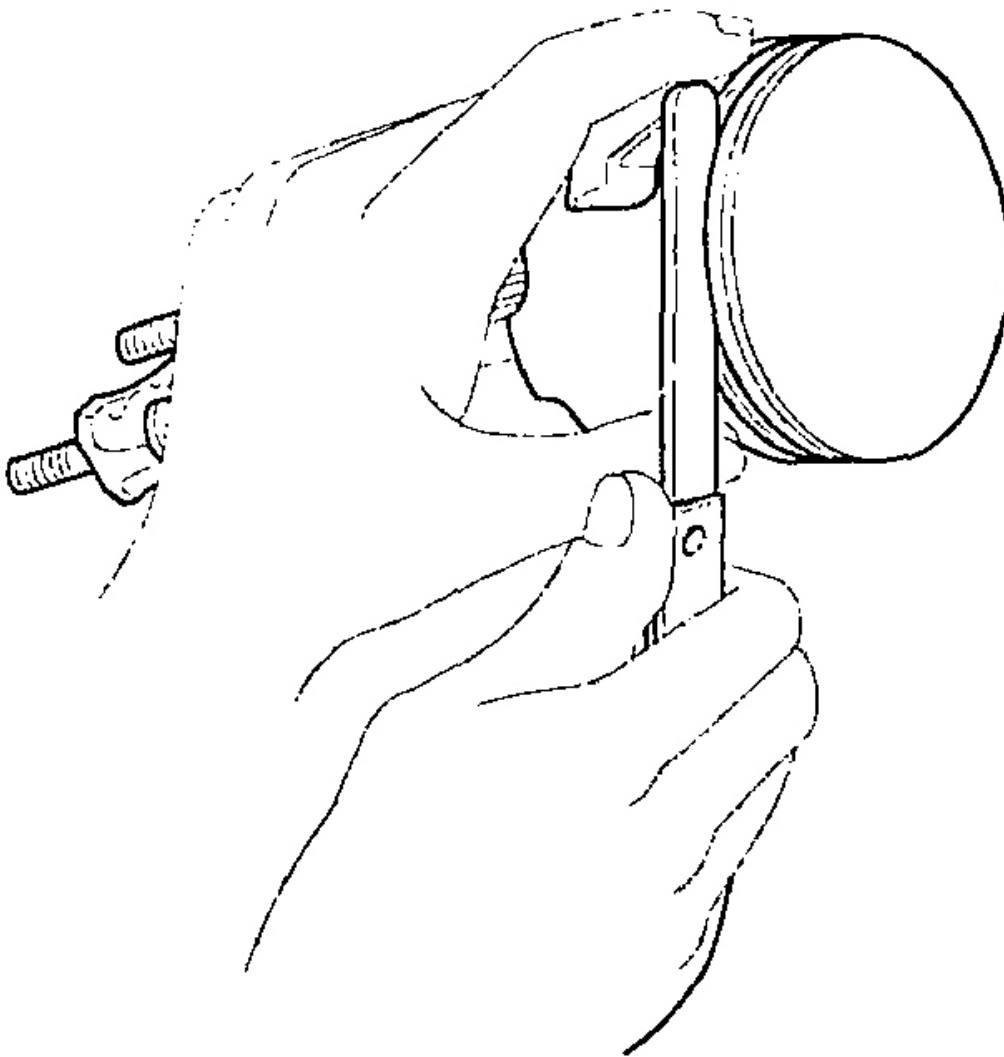
Oil ring: 0.06-0.15 mm (0.0024-0.0059 in)

Limit:

No. 1: 0.1 mm (0.0039 in)

No. 2: 0.1 mm (0.0039 in)

Oil ring: 0.2 mm (0.0079 in)



G00719155

Fig. 177: Measuring Piston Ring Side Clearance
Courtesy of KIA MOTORS AMERICA, INC.

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

- e. Inspect the piston ring end gap.

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

CYLINDER BORE.

Piston ring end gap standard:

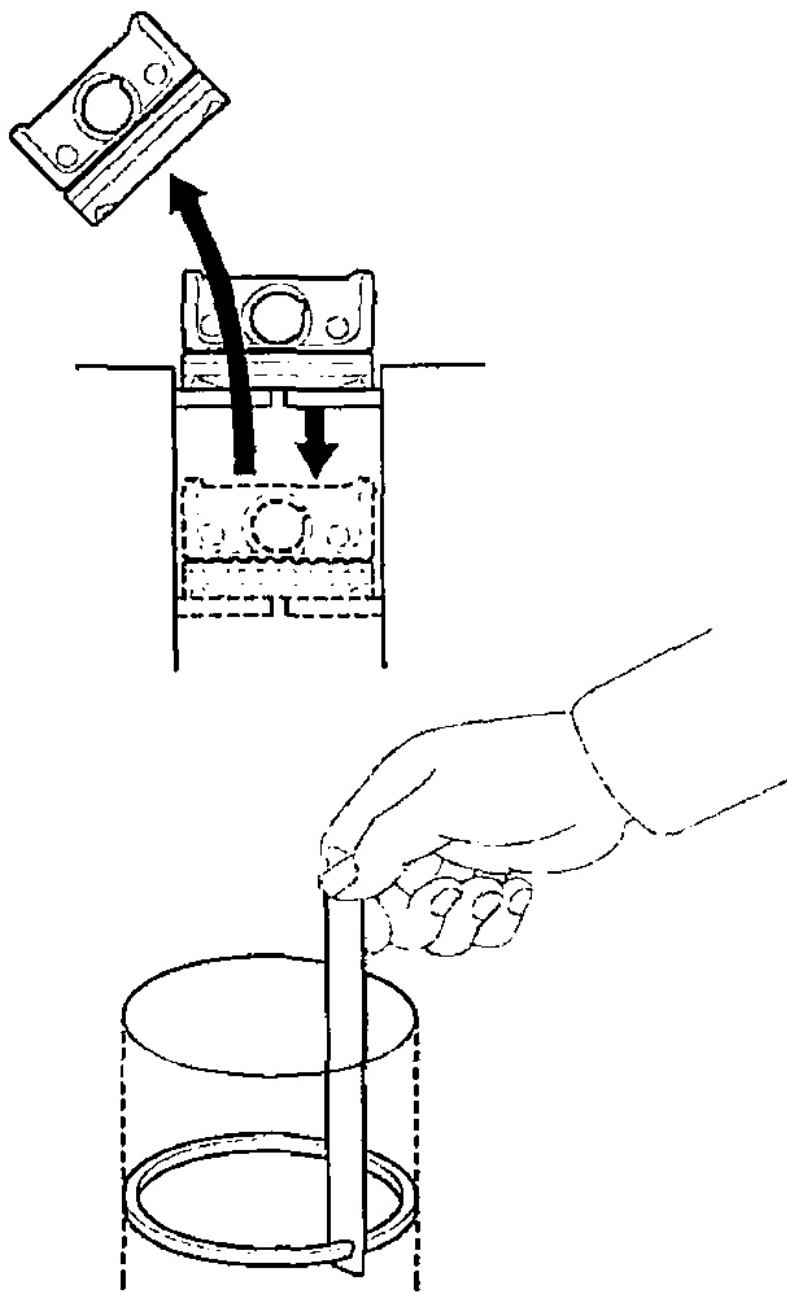
No. 1 : 0.20 ~ 0.35mm (0.0079 ~ 0.0138 in)

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

Oil ring : 0.20 ~ 0.60 mm (0.0079 ~ 0.0236 in)

Limit:

No. 1, 2, oil ring: 1.0 mm (0.039 in)



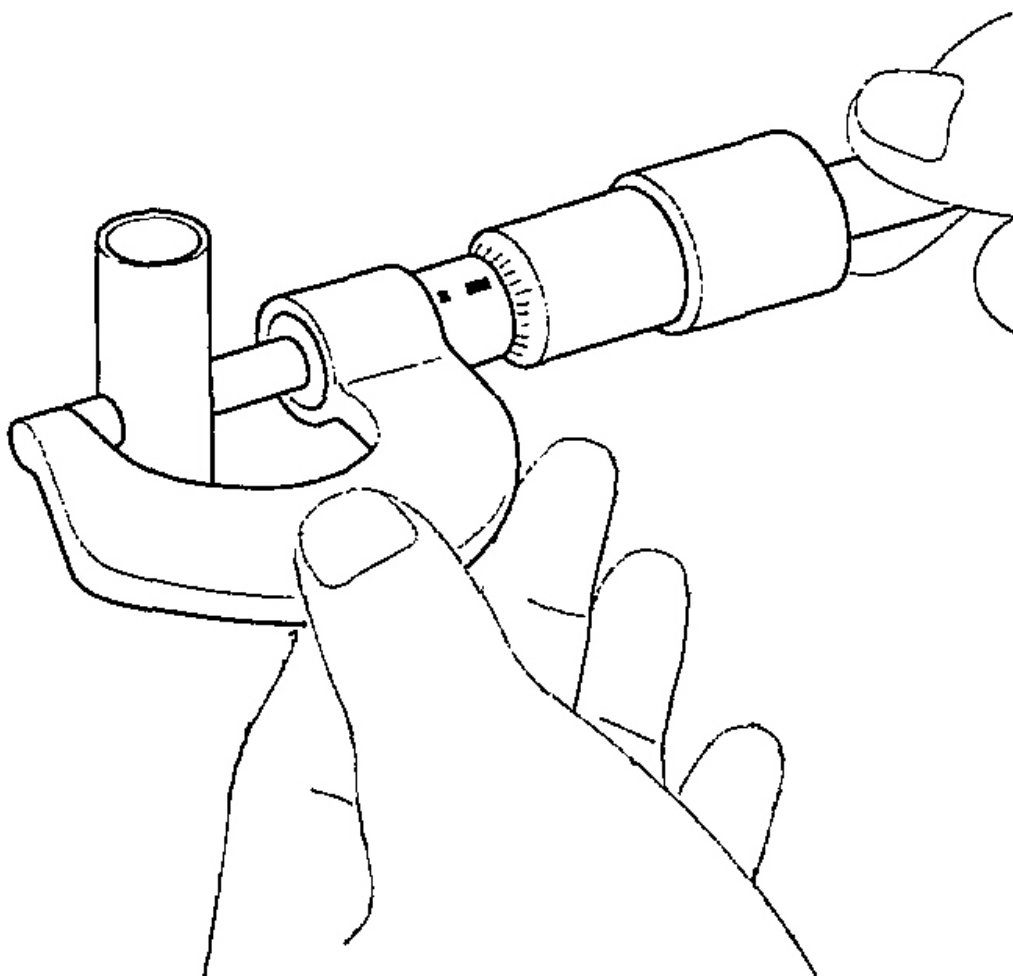
G00719156

Fig. 178: Measuring Piston Ring End Gap
Courtesy of KIA MOTORS AMERICA, INC.

PISTON PINS

1. Measure the outer diameter of piston pin.

Piston pin diameter: 20.001-20.006 mm (0.7874-0.7876 in)



G00719157

Fig. 179: Measuring Outer Diameter Of Piston Pin
Courtesy of KIA MOTORS AMERICA, INC.

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

Piston pin-to-piston clearance: 0.01-0.02 mm (0.0004-0.0008 in)

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

diameter.

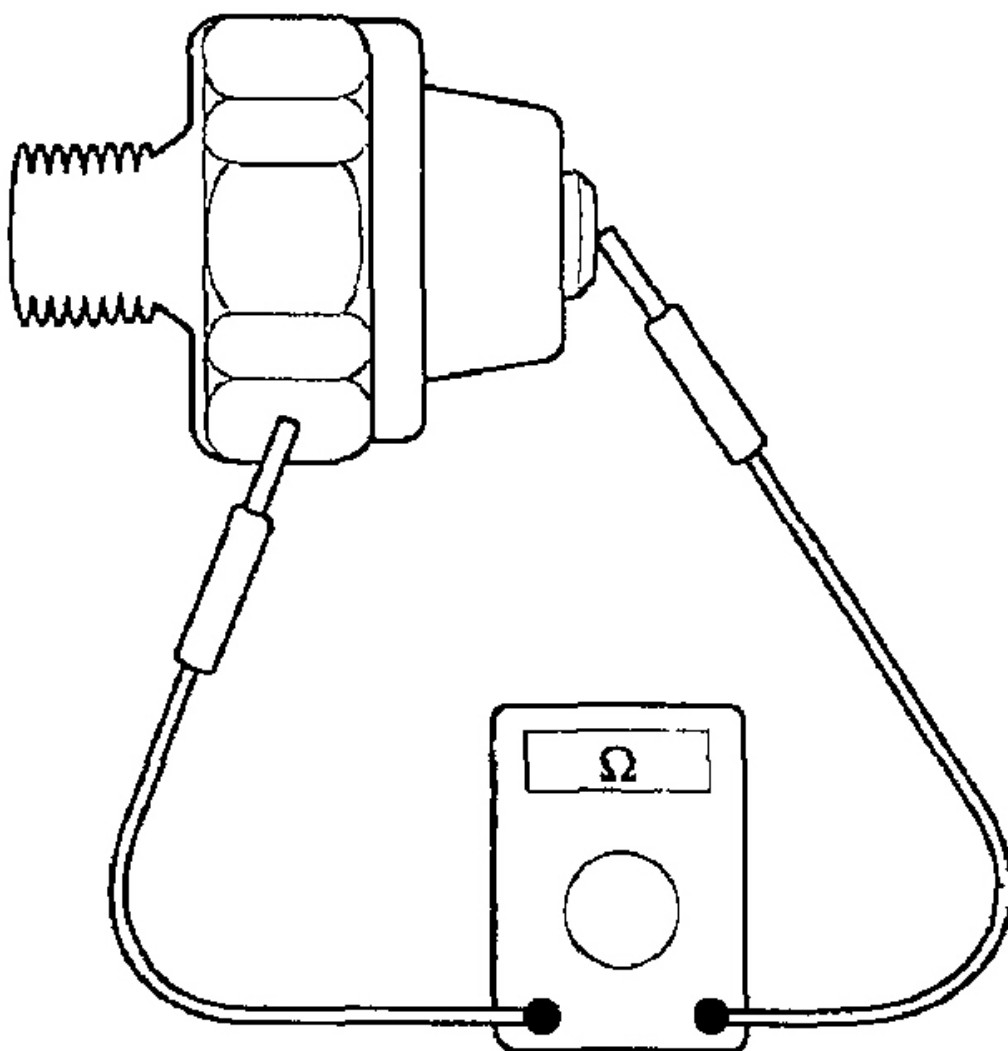
Piston pin-to-connecting rod interference: -0.032 mm to 0.016 mm (-0.0013 in. to 0.0006 in)

OIL PRESSURE SWITCH

1. Check the continuity between the terminal and the body with an ohmmeter.

If there is no continuity, replace the oil pressure switch.

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

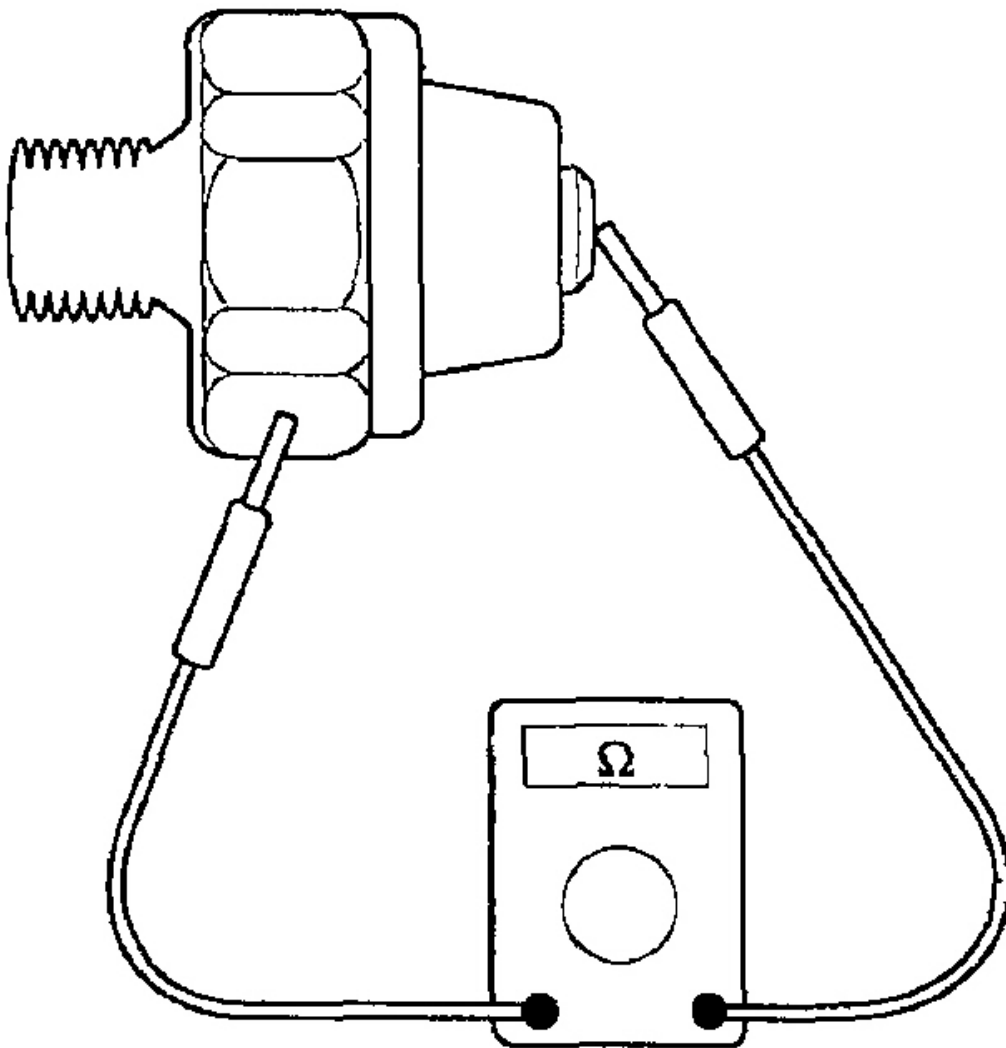


G00719158

Fig. 180: Measuring Oil Pressure Switch Continuity
Courtesy of KIA MOTORS AMERICA, INC.

3. If there is no continuity when a 50kpa (7psi) vacuum is applied through the oil hole, the switch is operating properly.

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



G00719158

Fig. 181: Measuring Oil Pressure Switch Continuity
Courtesy of KIA MOTORS AMERICA, INC.

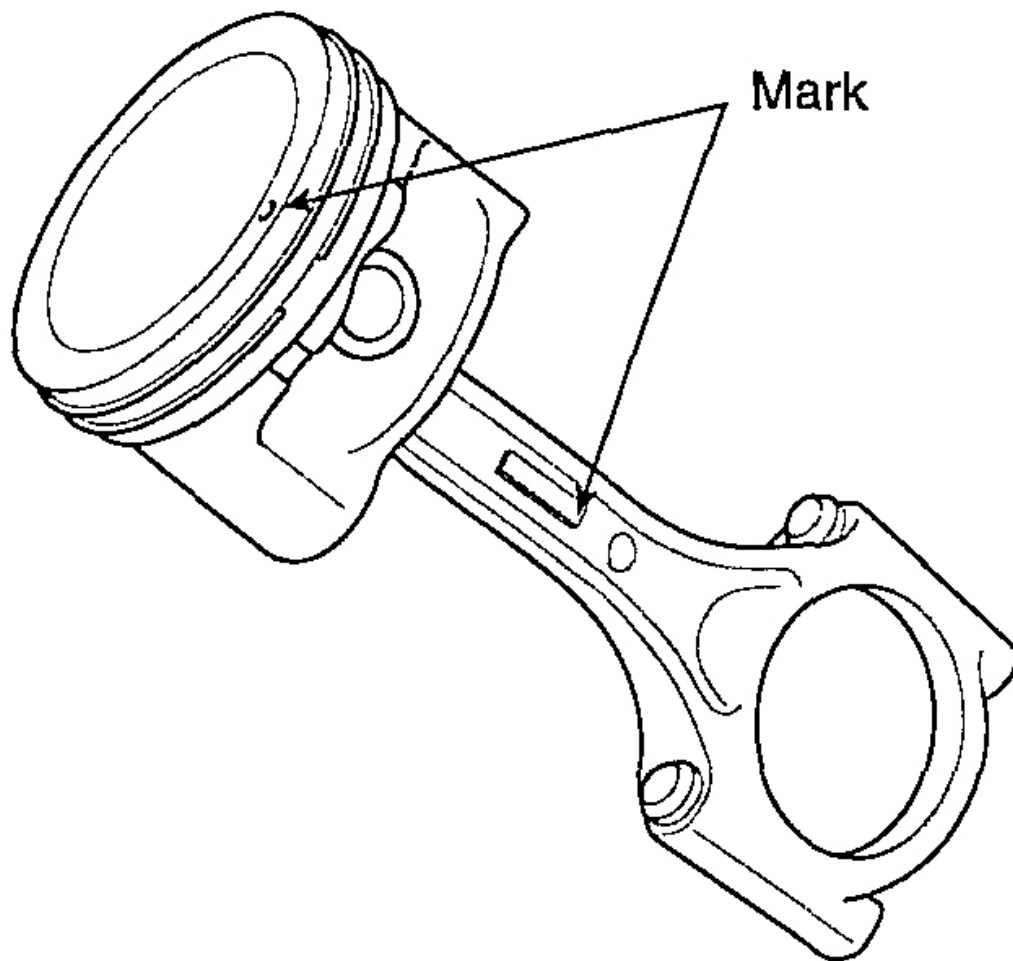
REASSEMBLY

NOTE:

- Thoroughly clean all parts to assembled.
- Before installing the parts, apply fresh engine oil to all sliding and rotating surfaces.

- **Replace all gaskets, O-rings and oil seals with new parts.**

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

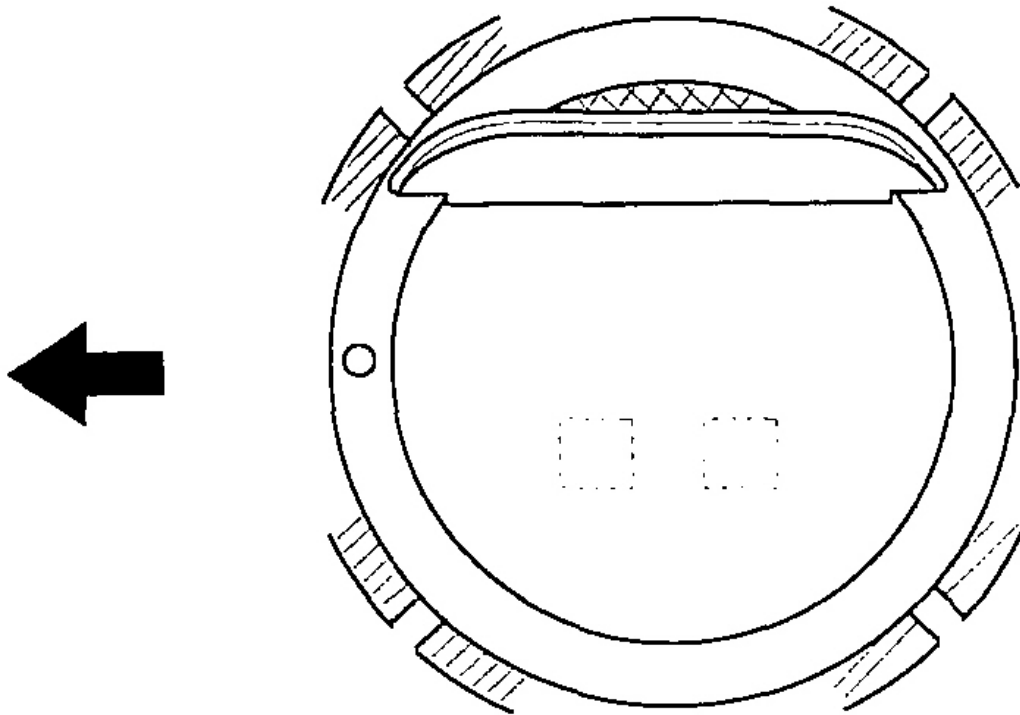


G00719160

Fig. 182: Positioning Piston-To-Connecting Rod
Courtesy of KIA MOTORS AMERICA, INC.

2. Install the piston rings.

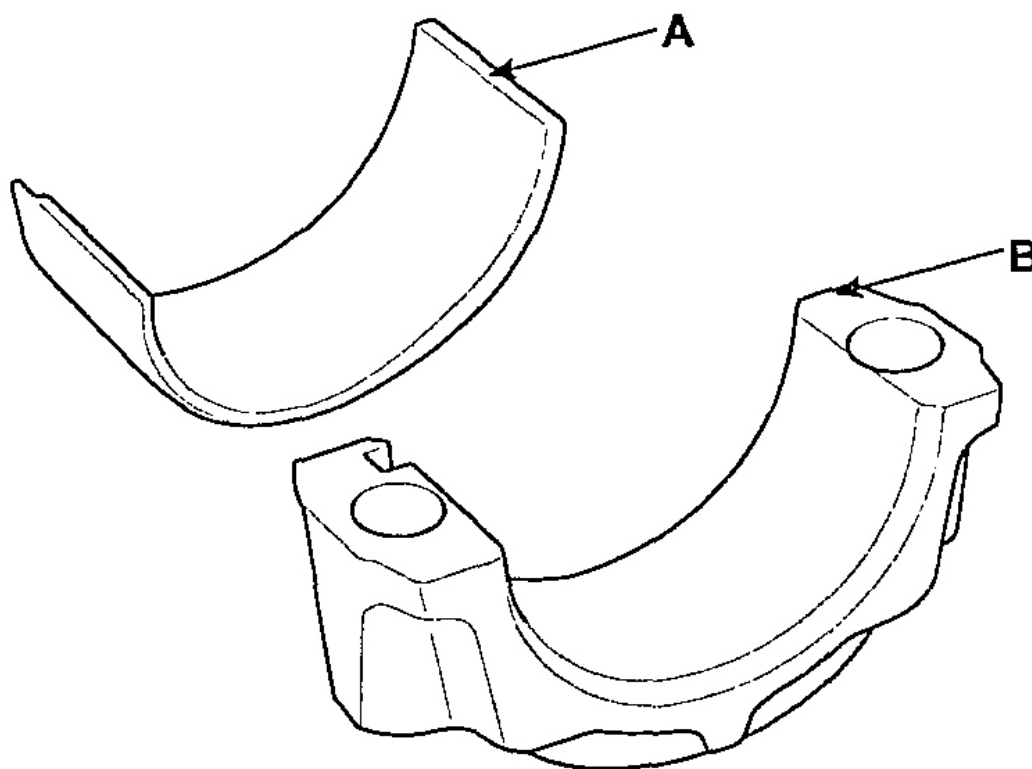
- a. Install the oil ring expander and 2 side rails by hand.
- b. Using a piston ring expander, install the 2 compression rings with the code mark facing upward.
- c. Position the piston rings so that the ring ends are as shown. See **Fig. 183**.



G00719161

Fig. 183: Positioning Piston Rings
Courtesy of KIA MOTORS AMERICA, INC.

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



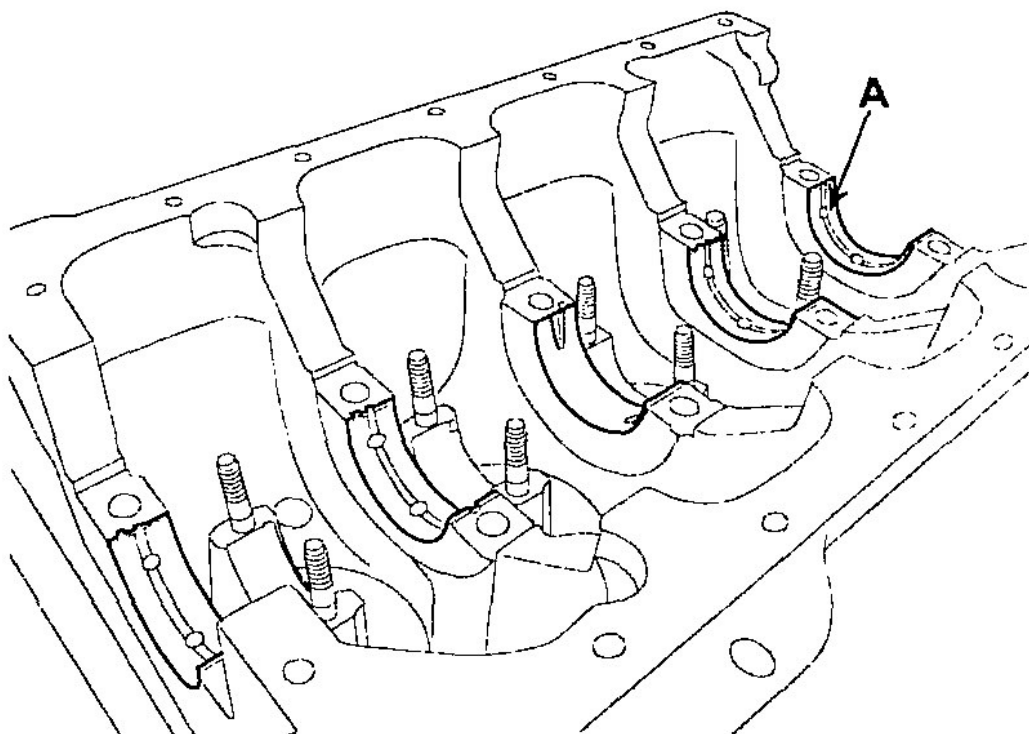
G00719162

Fig. 184: Installing Connecting Rod Bearings
Courtesy of KIA MOTORS AMERICA, INC.

4. Install the crankshaft main bearings.

NOTE: Upper 1, 2, 4, 5 bearings have an oil groove or oil holes; Lower bearings do not.

- a. Align the bearing claw with the claw groove of the cylinder block, push in the 5 upper bearings (A).

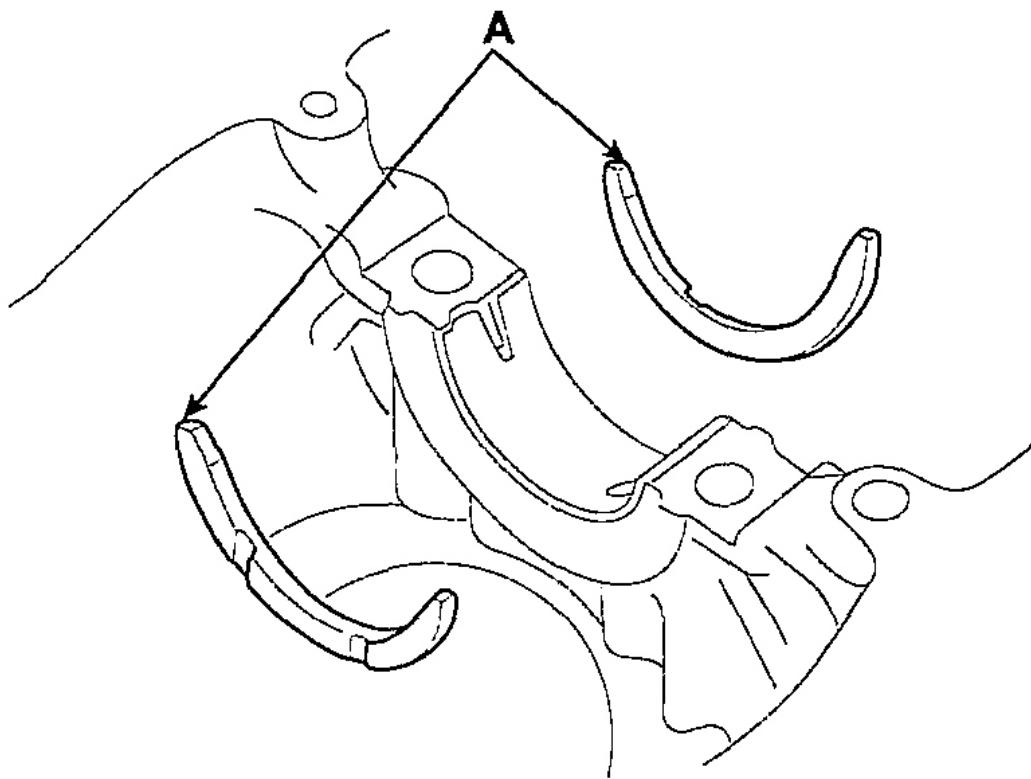


G00719163

Fig. 185: Installing Upper Main Bearings
Courtesy of KIA MOTORS AMERICA, INC.

- b. Align the bearing claw with the claw groove of the main bearing cap, and push in the 5 lower bearings.
5. Install the thrust bearings.

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



G00719164

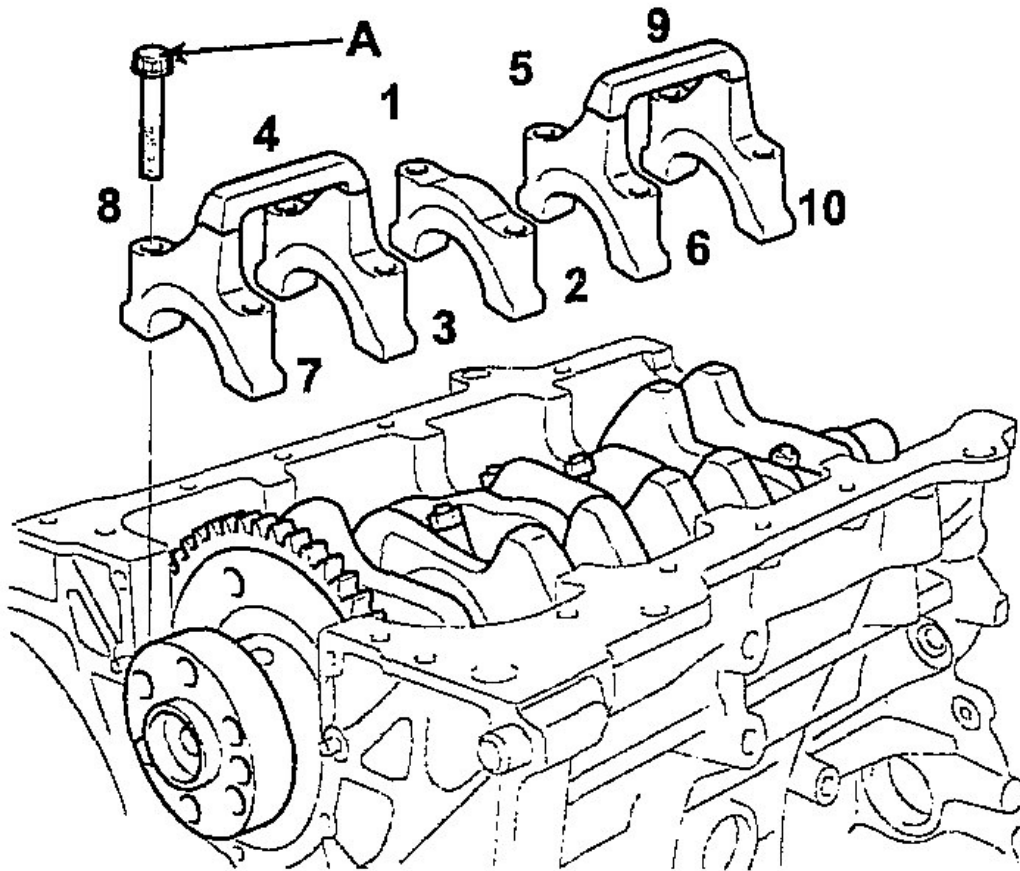
Fig. 186: Installing Thrust Bearing
Courtesy of KIA MOTORS AMERICA, INC.

6. Place the crankshaft on the cylinder block.
7. Place the main bearing caps on the cylinder block.
8. Install the main bearing cap bolts.

NOTE:

- The main bearing cap bolts are tightened in 2 progressive steps.
 - If any of the bearing cap bolts is broken or deformed, replace it.
- a. Apply a light coat of engine oil on the threads and under the bearing cap bolts.
 - b. Install and uniformly tighten the 10 bearing cap bolts (A), in several passes, in sequence. See **Fig. 187**.

Tightening torque: 27.5-31.4 N.m (2.8-3.2 kg-m, 20.3-23.1 lb-ft) + 60° - 64°



G00719165

Fig. 187: Installing Main Bearing Cap Bolts
 Courtesy of KIA MOTORS AMERICA, INC.

- c. Check that the crankshaft turns smoothly.
- 9. Check the crankshaft end play.
- 10. Install the piston and connecting rod assemblies.

NOTE: Before installing the piston, apply a coat of engine oil to the ring grooves and cylinder bores.

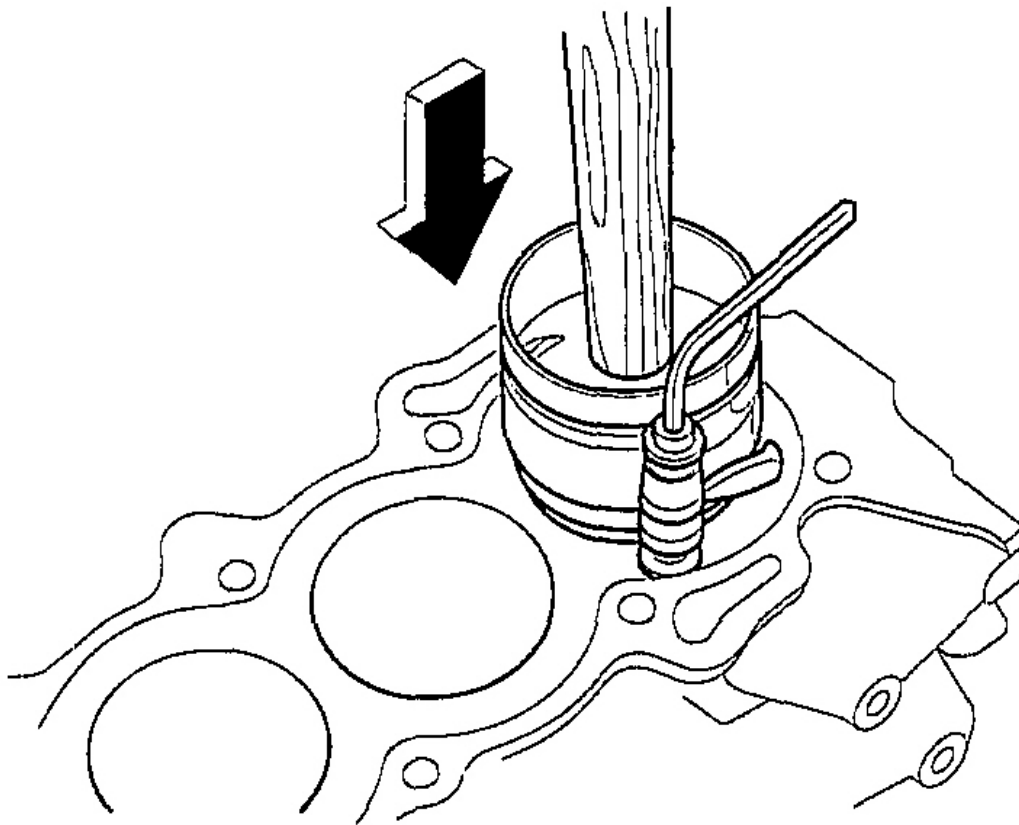
- a. Remove the connecting rod caps, and slip short sections of rubber hose over the threaded ends of the connecting rod bolts.

NOTE: Maintain downward force on the ring compressor to prevent

the rings from expanding before entering the cylinder bore.

- b. Install the ring compressor, check that the rings are securely in place, then position the piston in the cylinder, and tap it in using the wooden handle of a hammer.
- c. Stop after the ring compressor pops free, and check the connecting rod-to-crank journal alignment before pushing the piston into place.
- d. Apply engine oil to the bolt threads. Install the rod caps with bearings, and tighten the nuts.

Tightening torque: 49.0-52.0 N.m (5.0-5.3 kg-m, 36.2-38.3 lb-ft)



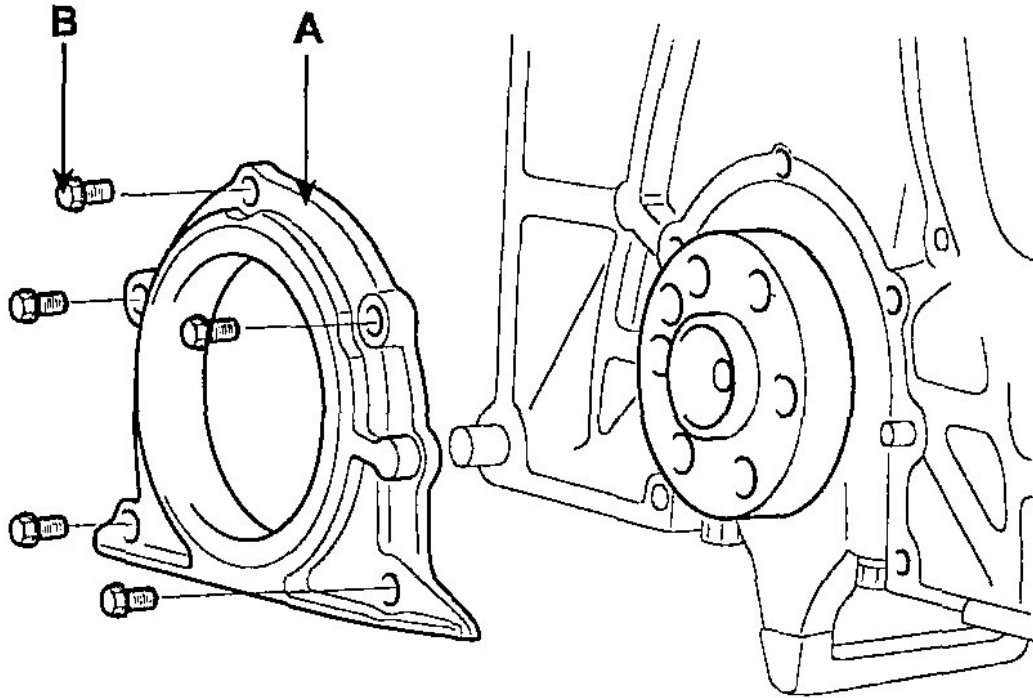
G00719166

Fig. 188: Installing Piston

Courtesy of KIA MOTORS AMERICA, INC.

11. Install a new gasket and rear oil seal case (A) with 5 bolts (B).

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

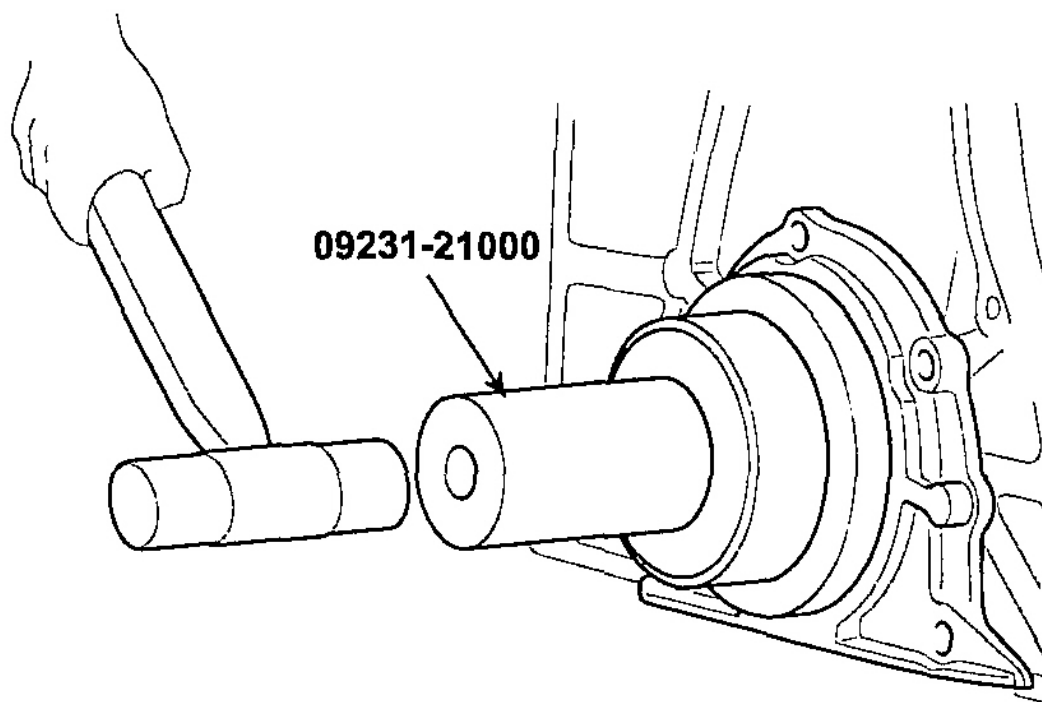


G00719167

Fig. 189: Installing A New Gasket And Rear Oil Seal Case
Courtesy of KIA MOTORS AMERICA, INC.

NOTE: Check that the mating surfaces are clean and dry.

12. Install the rear oil seal.
 - a. Apply engine oil to a new oil seal lip.
 - b. Using the Service Tool (09231-21000) and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.



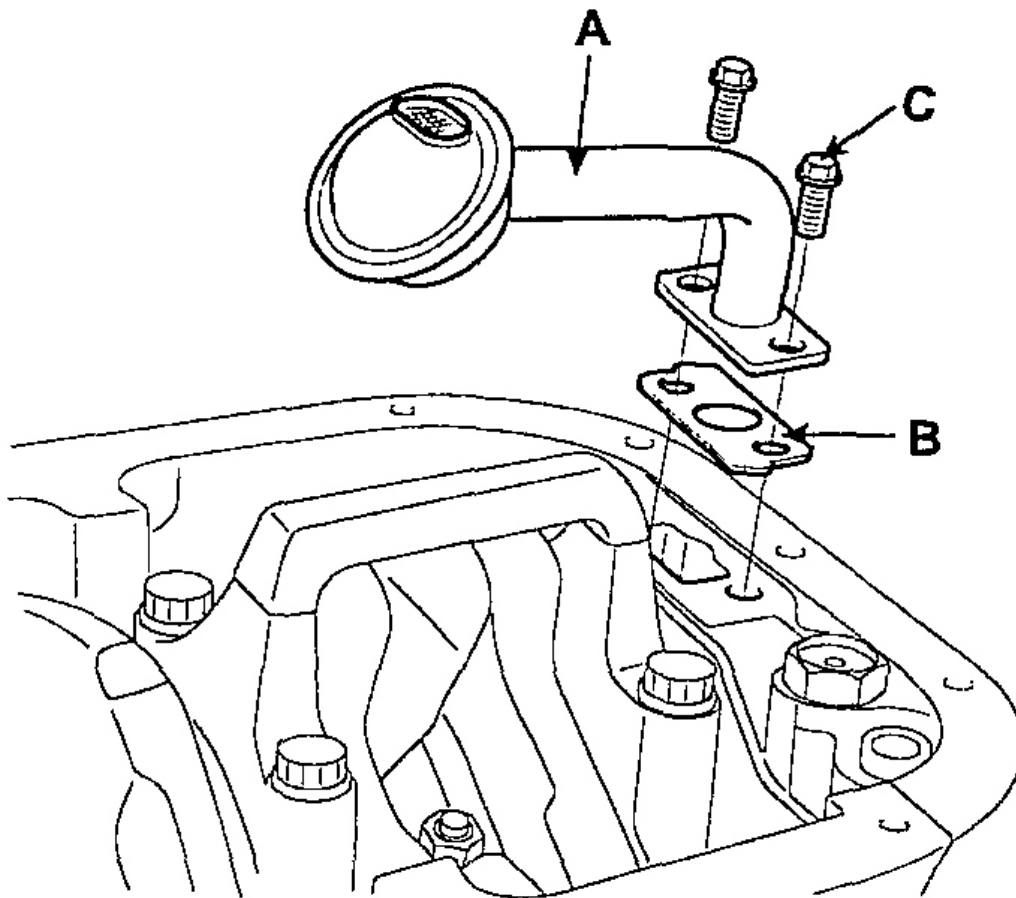
G00719168

Fig. 190: Installing Rear Oil Seal
Courtesy of KIA MOTORS AMERICA, INC.

13. Install the front case.
14. Install the oil screen.

Install a new gasket (B) and oil screen (A) with 2 bolts (C).

Tightening torque: 14.7-21.6 N.m (1.5-2.2 kg-m, 10.8-15.9 lb-ft)



G00719169

Fig. 191: Installing Oil Screen

Courtesy of KIA MOTORS AMERICA, INC.

15. Install the oil pan.
 - a. Using a razor blade and gasket scraper, remove all the old packing material from the gasket surfaces

NOTE: Check that the mating surfaces are clean and dry before applying liquid gasket.

- b. Apply liquid gasket as an even bead, centered between the edges of the mating surface. Liquid gasket: MS 721-40A or equivalent.

NOTE:

- **To prevent leakage of oil, apply liquid gasket to the inner threads of the bolt holes.**
- **Do not install the parts if five minutes or more have elapsed since applying the liquid gasket. Instead, reapply liquid gasket after removing the residue. After assembly, wait at least 30 minutes before filling the engine with oil.**

c. Install the oil pan (A) with the bolts. Uniformly tighten the bolts in several passes.

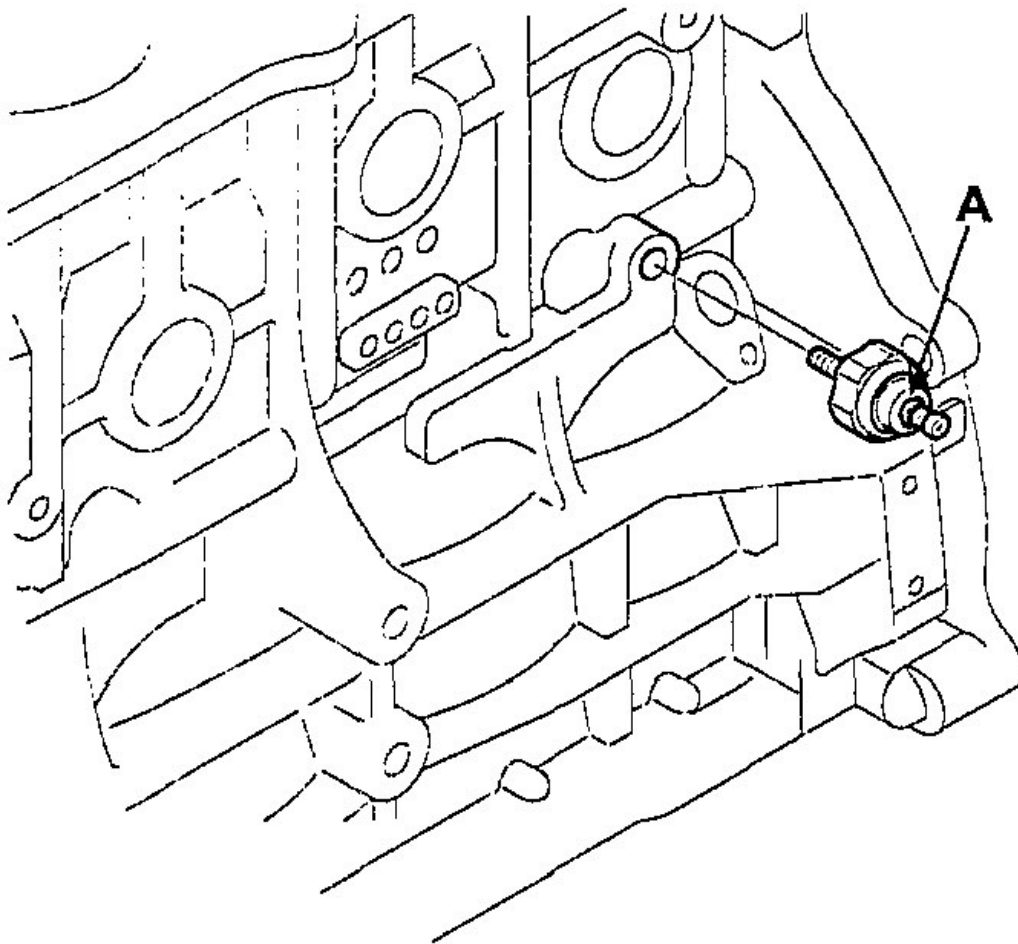
Tightening torque: 9.8-11.8 N.m (1.0-1.2 kg-m, 7.2-8.7 lb-ft)

16. Install the water pump.

17. Install the oil pressure switch.

- a. Apply adhesive to 2 or 3 threads. Adhesive: MS 721-39 (B) or equivalent.
- b. Install the oil pressure switch (A).

Tightening torque: 14.7-21.6 N.m (1.5-2.2 kg-m, 10.8-15.9 lb-ft)



G00719171

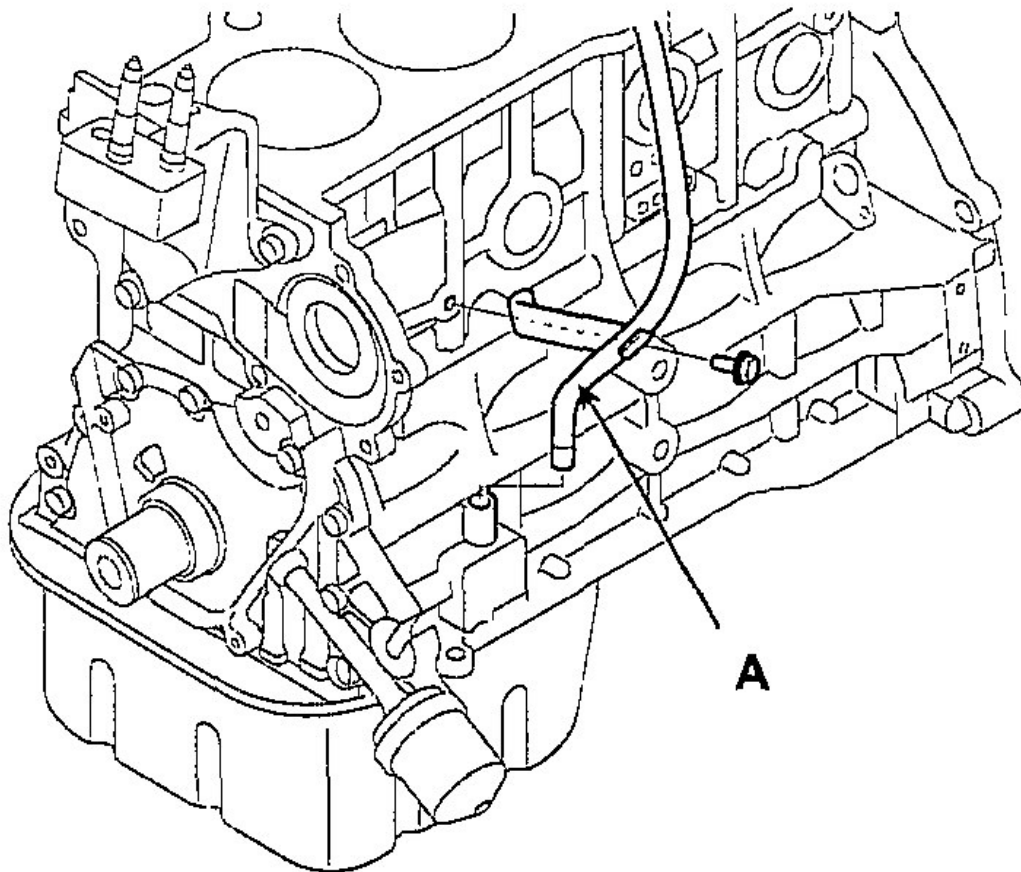
Fig. 192: Installing Oil Pressure Switch
Courtesy of KIA MOTORS AMERICA, INC.

18. Install the knock sensor (A).

Tightening torque: 16.7-26.5 N.m (1.7-2.7 kg-m, 12.3-19.5 lb-ft)

19. Install the oil level gauge tube (A).
- Install a new O-ring on the oil level gauge tube.
 - Apply engine oil on the O-ring.
 - Install the oil level gauge tube (A) with the bolt.

Tightening torque: 11.8-14.7 N.m (1.2-1.5 kg-m, 8.7-10.8 lb-ft)

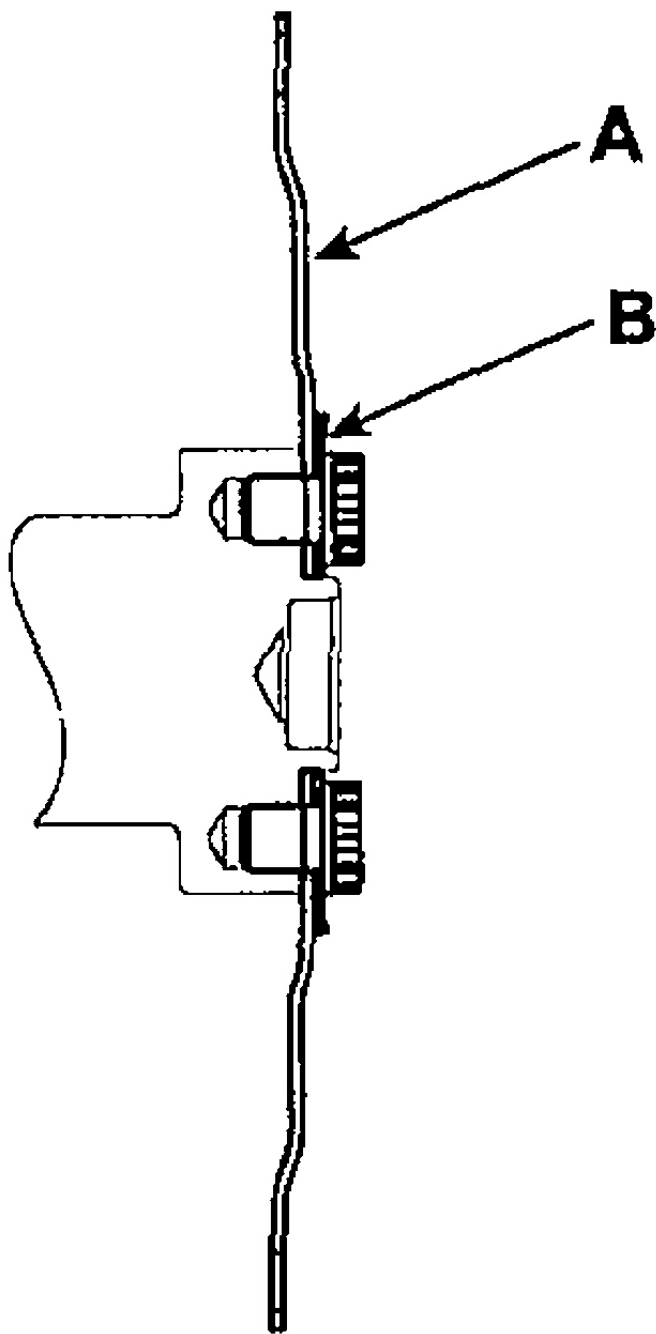


G00719173

Fig. 193: Installing Oil Level Gauge Tube
Courtesy of KIA MOTORS AMERICA, INC.

20. Install the cylinder head. See **INSTALLATION**.
21. Install the timing belt. See **INSTALLATION**.
22. Remove the engine stand.
23. A/T: install the drive plate (A) and washer (B).

Tightening torque: 117.7-127.5 N.m (12.0-13.0 kg-m, 86.8-94.0 lb-ft)



G00719174

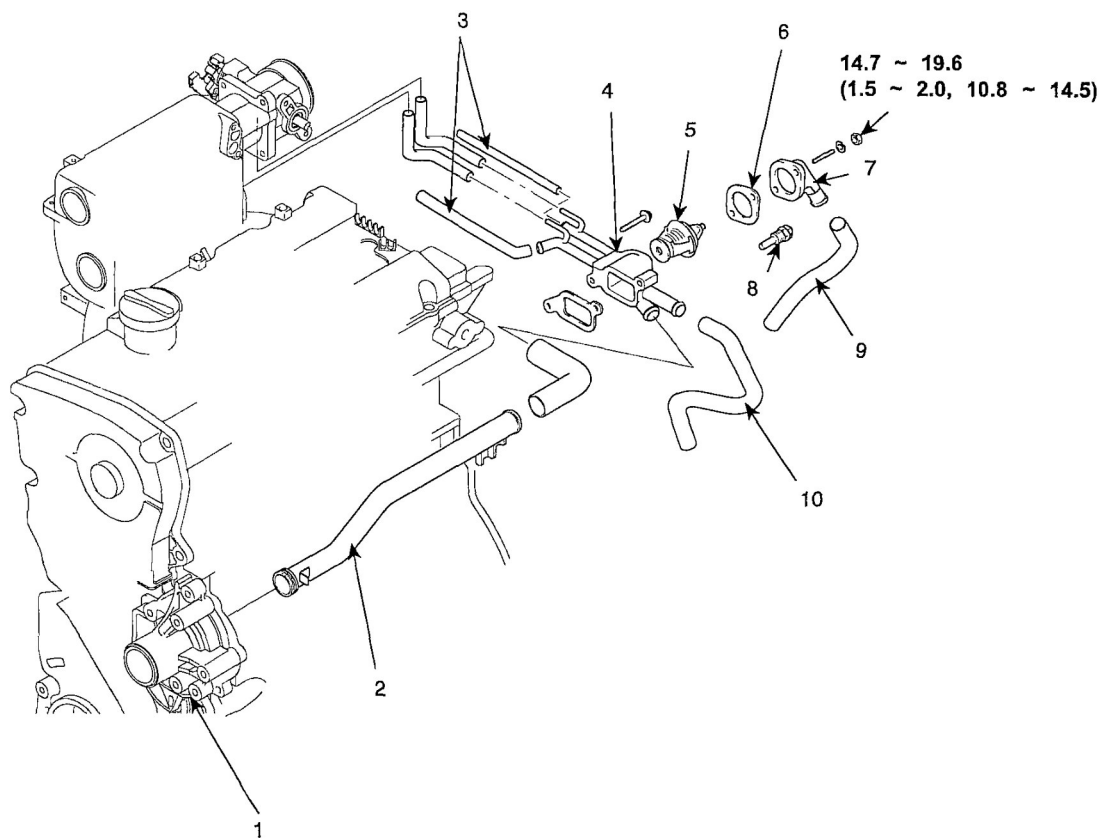
Fig. 194: Installing Drive Plate
Courtesy of KIA MOTORS AMERICA, INC.

24. M/T: install the flywheel.

Tightening torque: 117.7-127. N.m (12.0-13.0 kg-m, 86.8-94.0 lb-ft)

COOLING SYSTEM

COMPONENT



TORQUE : N-m (kg-m, lb-ft)

- | | |
|-----------------------|-----------------------------|
| 1. Water pump | 6. Gasket |
| 2. Water inlet pipe | 7. Water inlet fitting |
| 3. Heater hoses | 8. Water temperature sensor |
| 4. Thermostat housing | 9. Radiator lower hose |
| 5. Thermostat | 10. Radiator upper hose |

G00719176

Fig. 195: Identifying Cooling System Components With Torque Specifications
 Courtesy of KIA MOTORS AMERICA, INC.

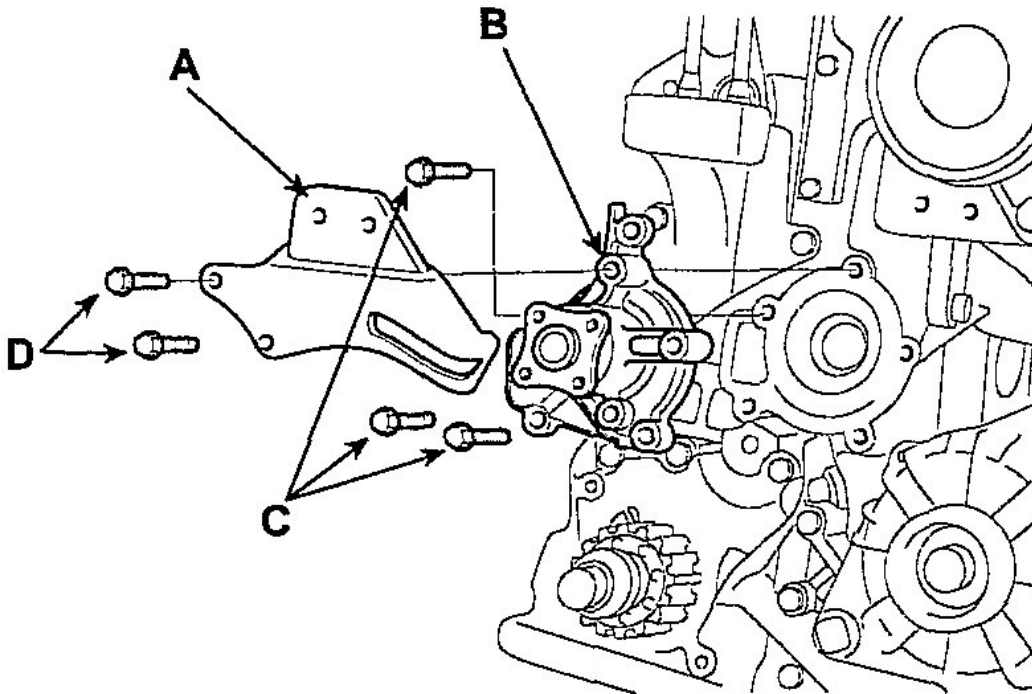
REMOVAL

WATER PUMP

1. Drain the engine coolant.

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

2. Remove the drive belts.
3. Remove the timing belt.
4. Remove the timing belt idler.
5. Remove the power steering pump and the power steering pump bracket (Refer to **MECHANICAL POWER STEERING SYSTEM**).
6. Remove the water pump.
 - a. Remove the 4 bolts and pump pulley.
 - b. Remove the 2 bolts (C), then remove the alternator brace (A).
 - c. Remove the water pump (B) and gasket.



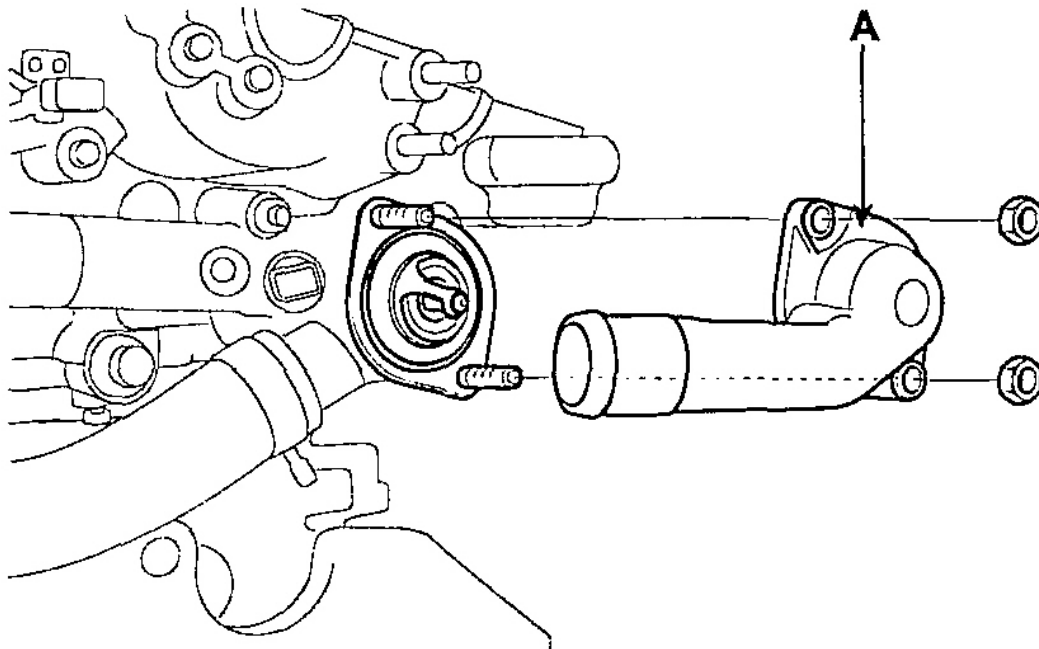
G00719182

Fig. 196: Removing Water Pump
Courtesy of KIA MOTORS AMERICA, INC.

THERMOSTAT

NOTE: Disassembly of the thermostat would have an adverse effect, causing a lowering of cooling efficiency.

1. Drain the engine coolant so its level is below thermostat.
2. Remove the water inlet fitting (A), gasket and thermostat.

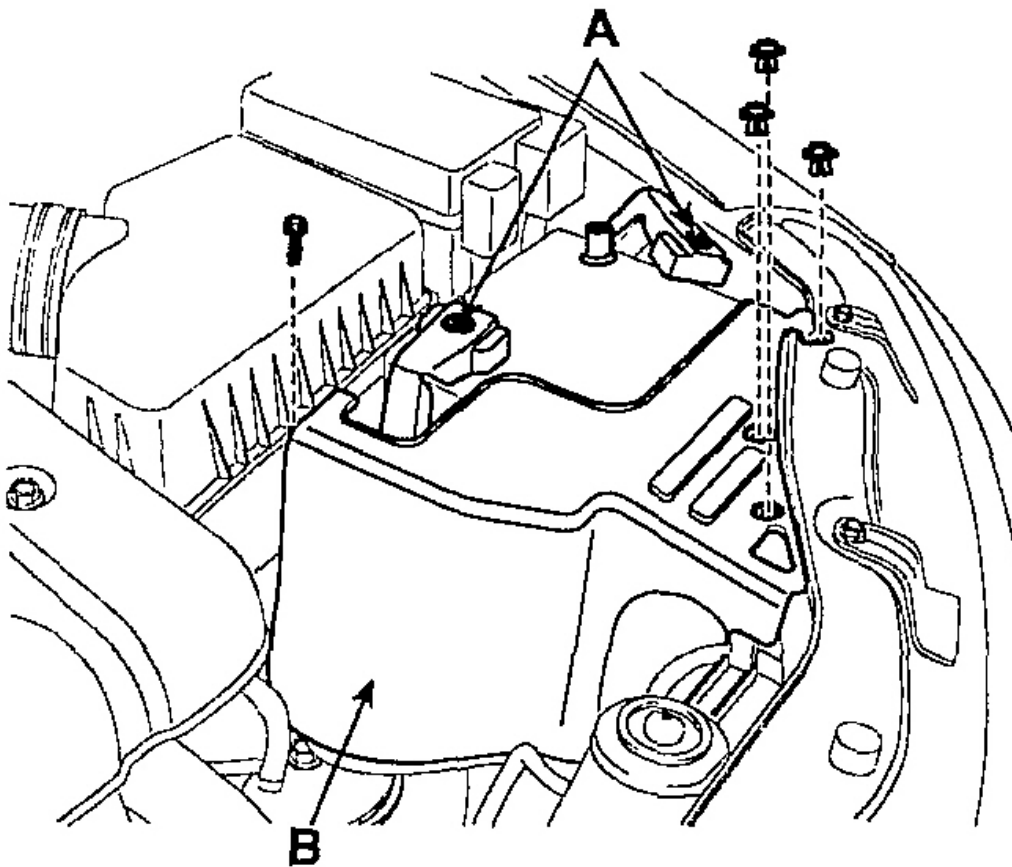


G00719183

Fig. 197: Removing Thermostat
Courtesy of KIA MOTORS AMERICA, INC.

RADIATOR

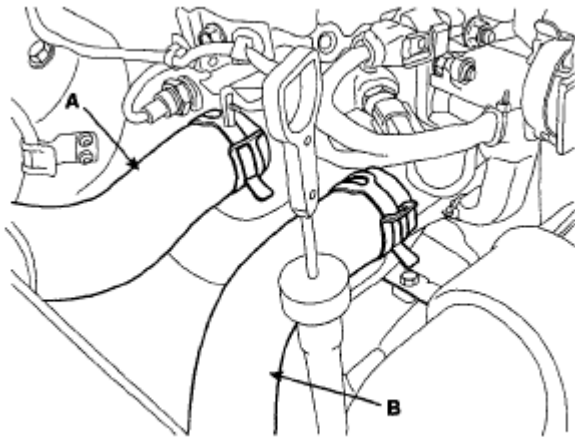
1. Drain the engine coolant.
2. Remove the battery terminals (A) and heat shield (B).



G00719184

Fig. 198: Removing Battery Terminals
Courtesy of KIA MOTORS AMERICA, INC.

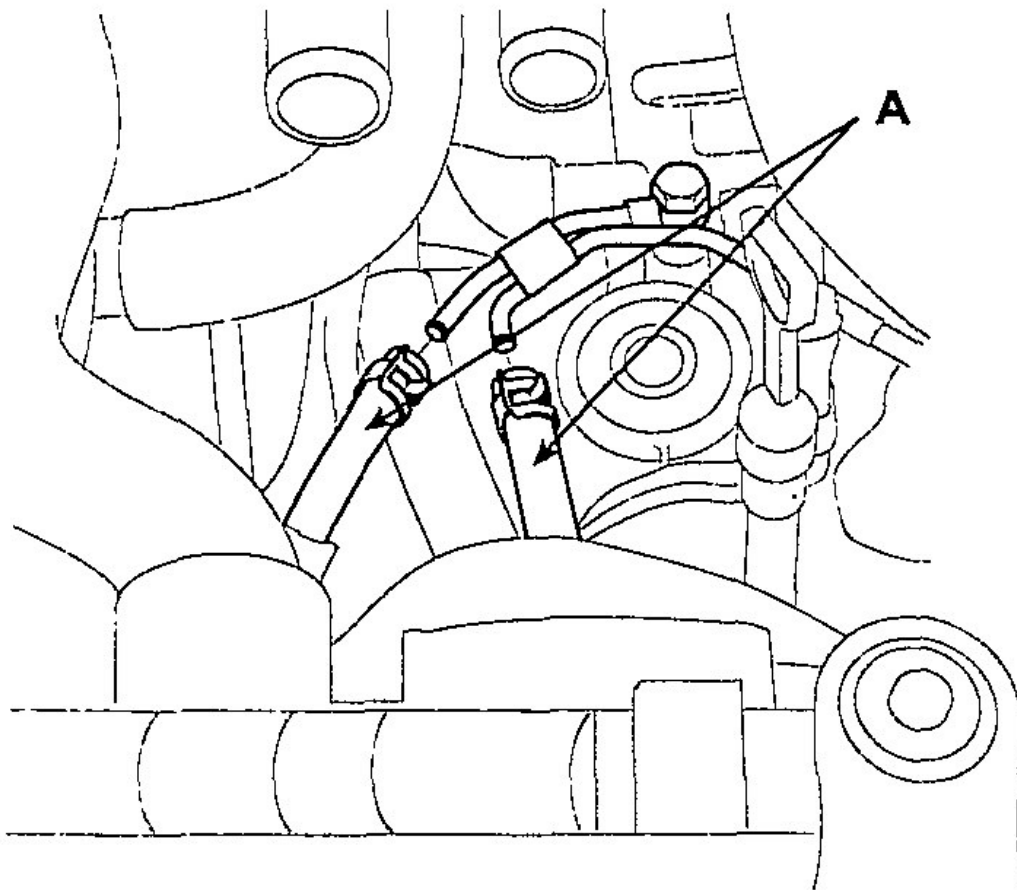
3. Remove the battery and battery tray.
4. Remove the upper radiator hose (A) and lower radiator hose (B).



SHDM16006L

Fig. 199: Locating Upper Radiator Hose And Lower Radiator Hose
Courtesy of KIA MOTORS AMERICA, INC.

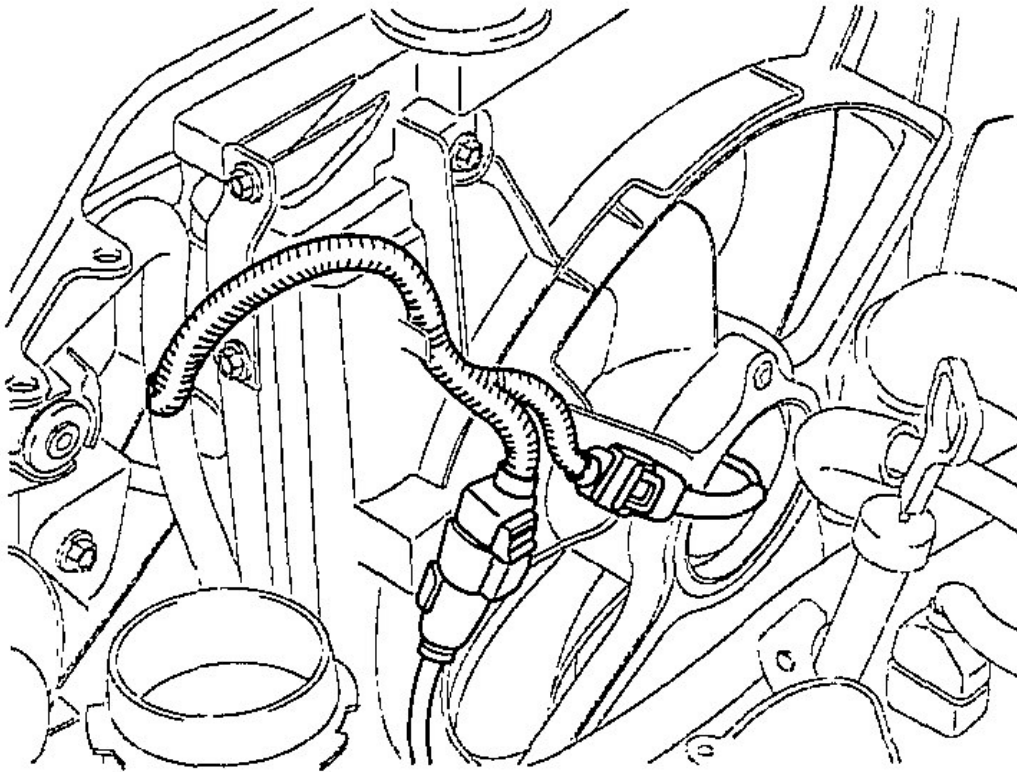
5. Remove the ATF (Automatic Transaxle Fluid) cooler hose (A).



G00719187

Fig. 200: Removing Automatic Transaxle Fluid Cooler Hose
Courtesy of KIA MOTORS AMERICA, INC.

6. Disconnect the fan motor connector.

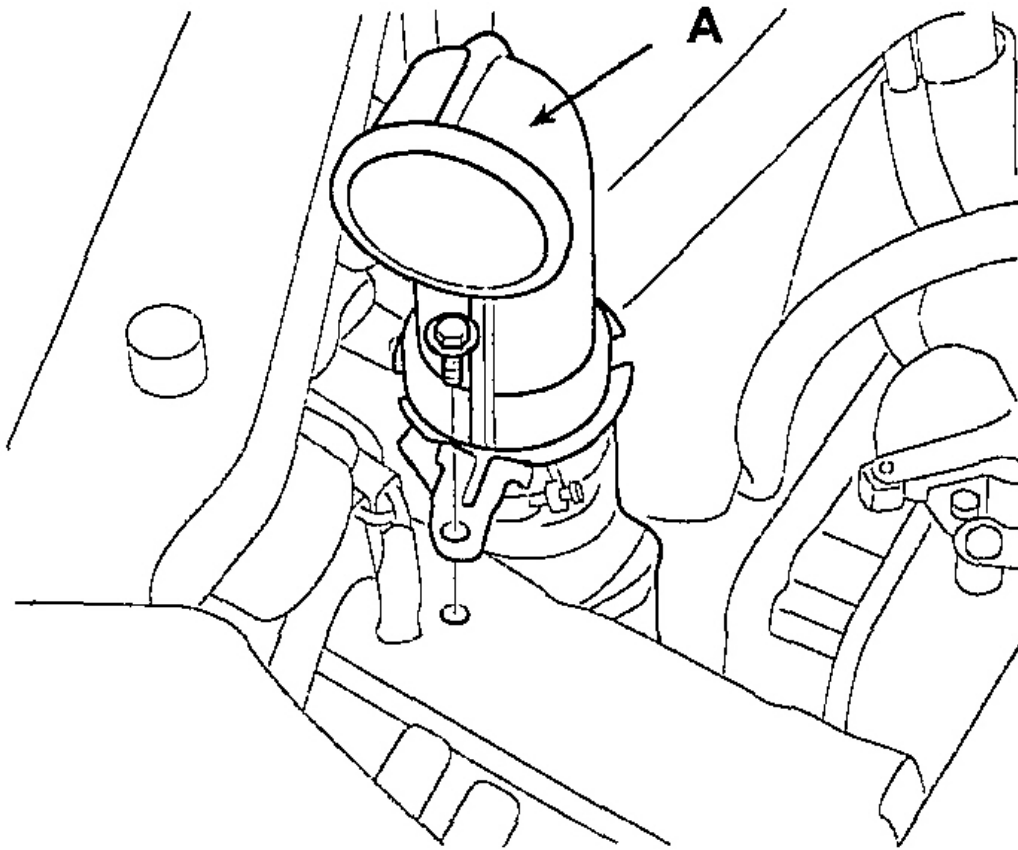


G00719188

Fig. 201: Fan Motor Connector

Courtesy of KIA MOTORS AMERICA, INC.

7. Remove the radiator.
 - a. Remove the air duct (A) to allow for radiator removal.



G00719190

Fig. 202: Removing/Installing Air Duct
Courtesy of KIA MOTORS AMERICA, INC.

- b. Remove the reservoir tank (A) to allow clearance when removing the radiator.

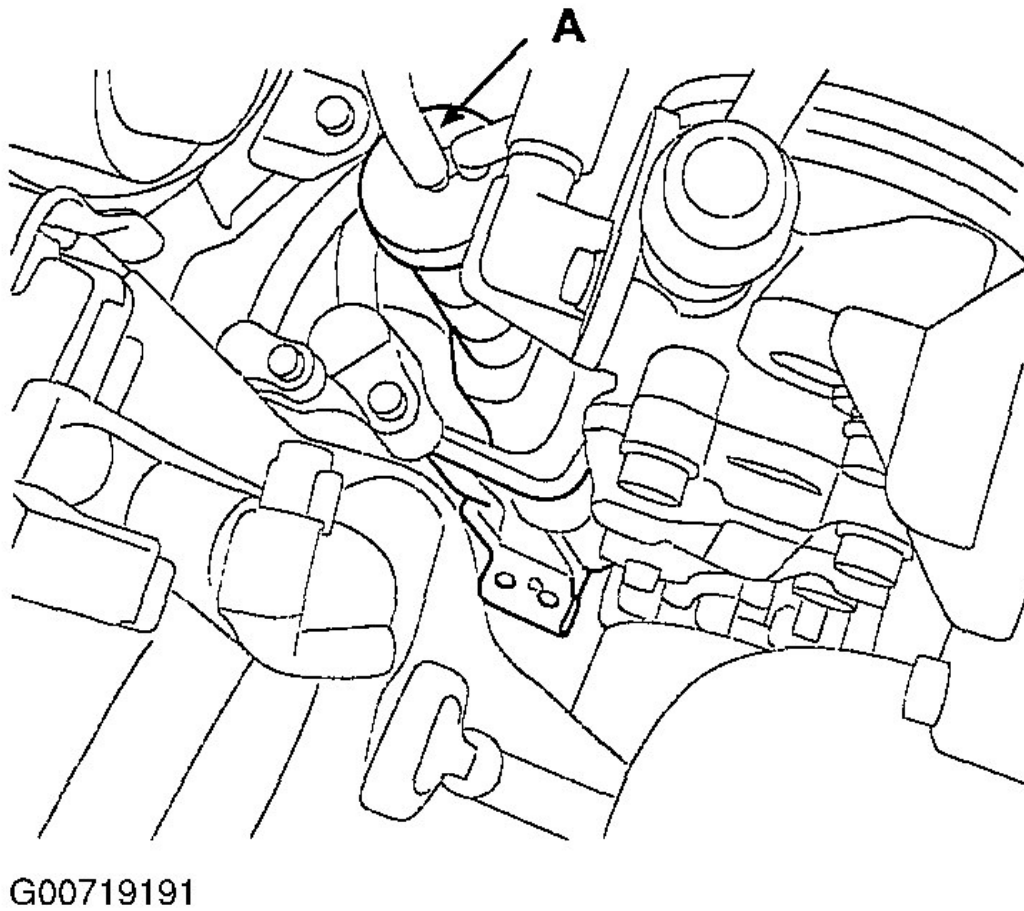


Fig. 203: Removing/Installing Reservoir Tank
Courtesy of KIA MOTORS AMERICA, INC.

- c. Remove the radiator mounting bolts and remove the radiator from condenser.

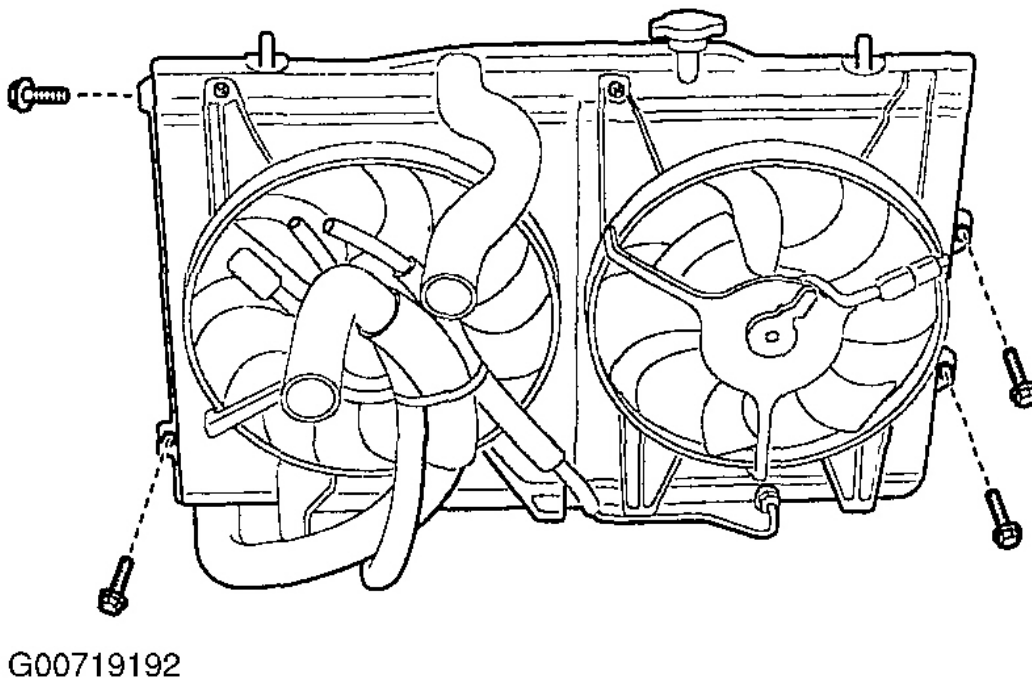
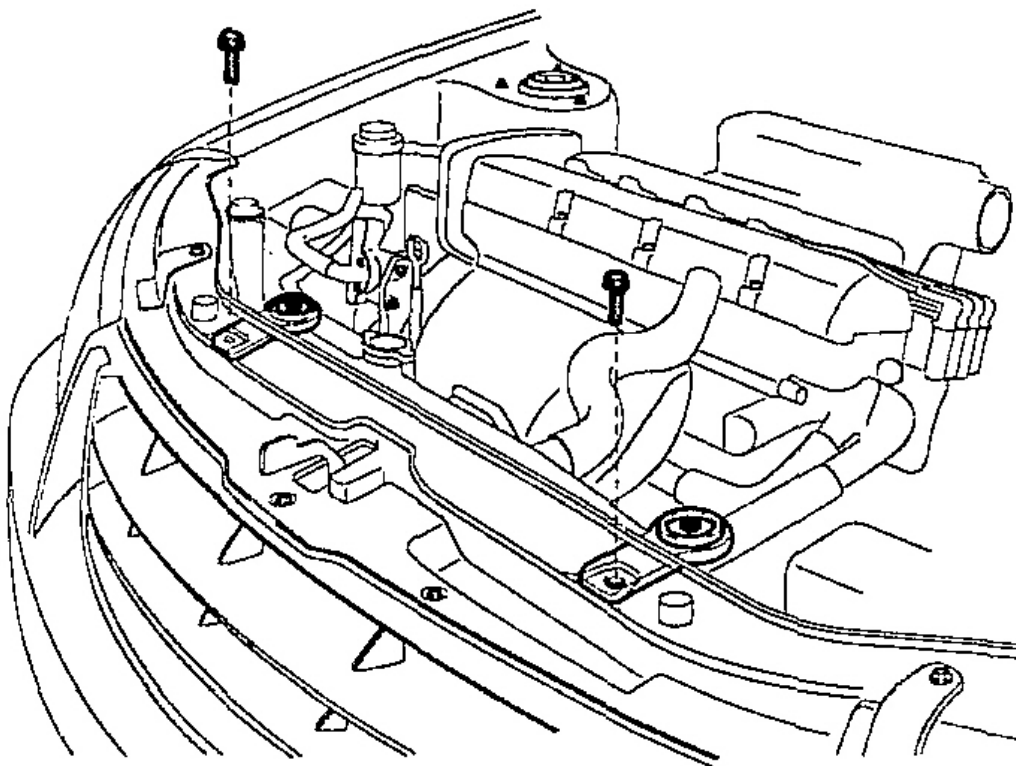


Fig. 204: Removing Radiator From Condenser
Courtesy of KIA MOTORS AMERICA, INC.

8. Remove the radiator upper bracket, then pull up the radiator.



G00719193

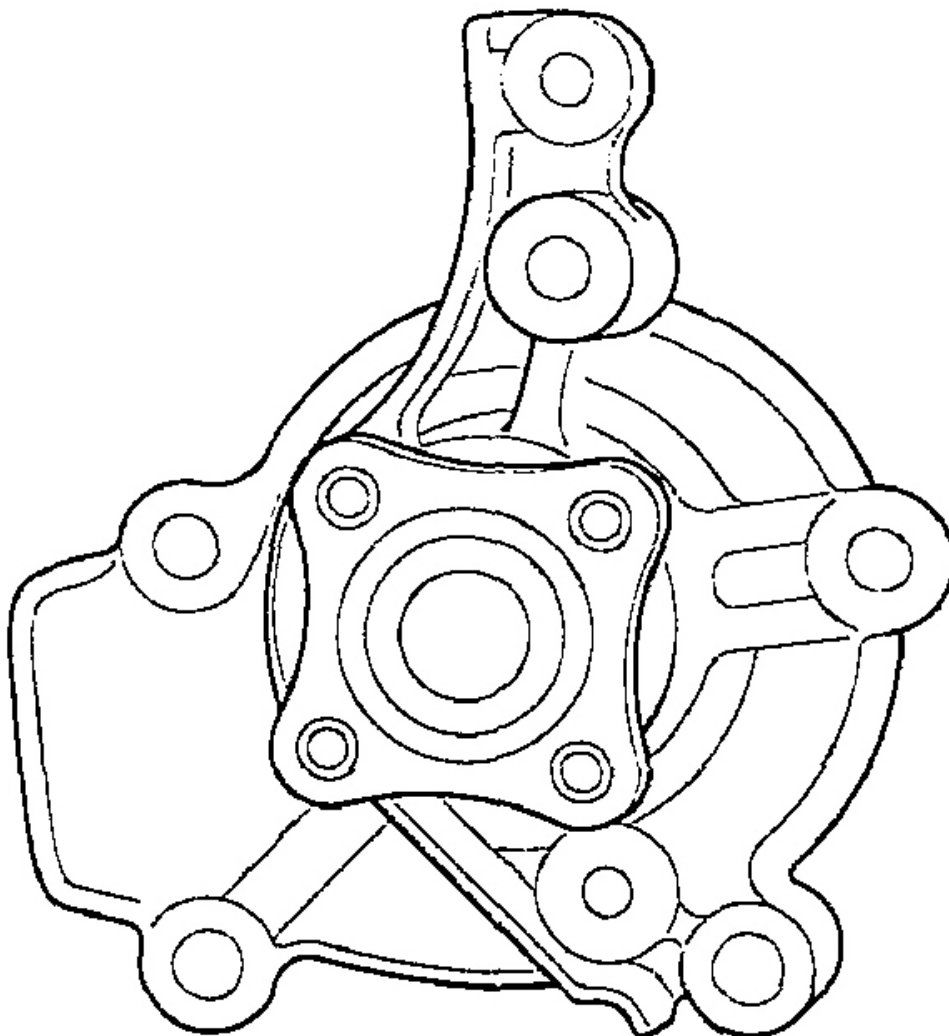
Fig. 205: Removing Radiator Upper Bracket
Courtesy of KIA MOTORS AMERICA, INC.

9. Remove the cooling fan from the radiator.

INSPECTION

WATER PUMP

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



G00719194

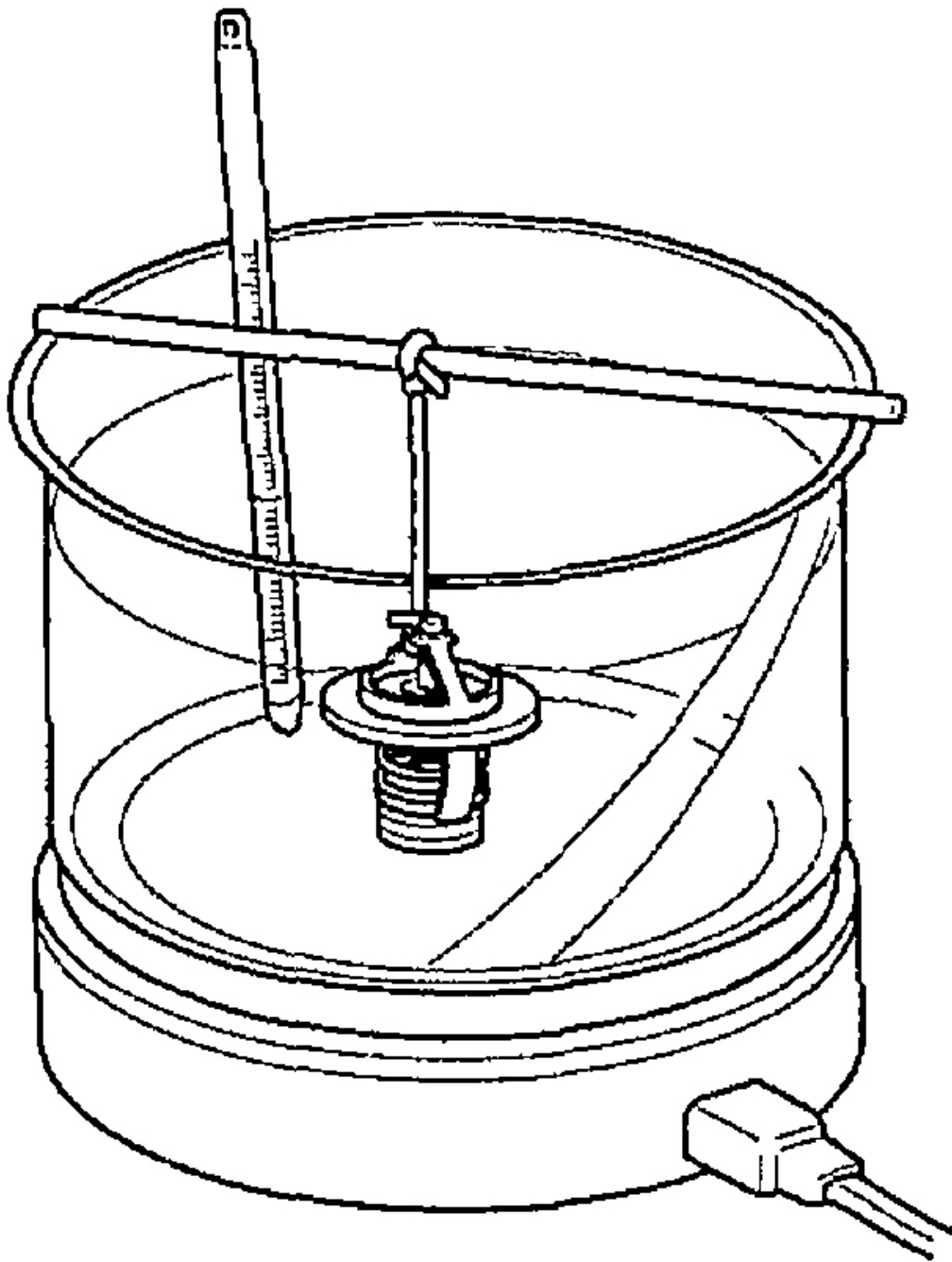
Fig. 206: Inspecting Coolant Pump
Courtesy of KIA MOTORS AMERICA, INC.

3. Check for coolant leakage. If coolant leaks from hole, the seal is defective. Replace the coolant pump assembly.

NOTE: A small amount of "weeping" from the bleed hole is normal.

THERMOSTAT

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



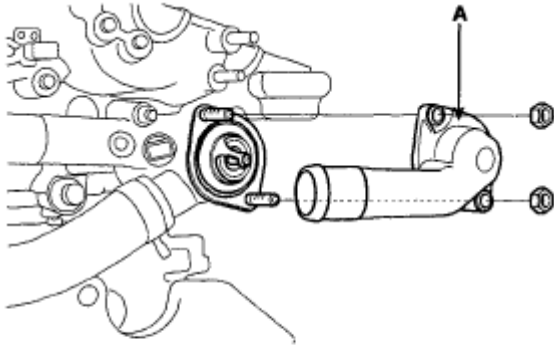
G00719195

Fig. 207: Testing Thermostat
Courtesy of KIA MOTORS AMERICA, INC.

2. Check the valve opening temperature.

Valve opening temperature: 82 °C (177 °F)

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



ECKD501B

Fig. 208: Locating Water Inlet
Courtesy of KIA MOTORS AMERICA, INC.

If the valve opening temperature is not as specified, replace the thermostat.

3. Check the valve lift.

Valve lift: 8 mm (0.3 in) or more at 95°C (203°F)

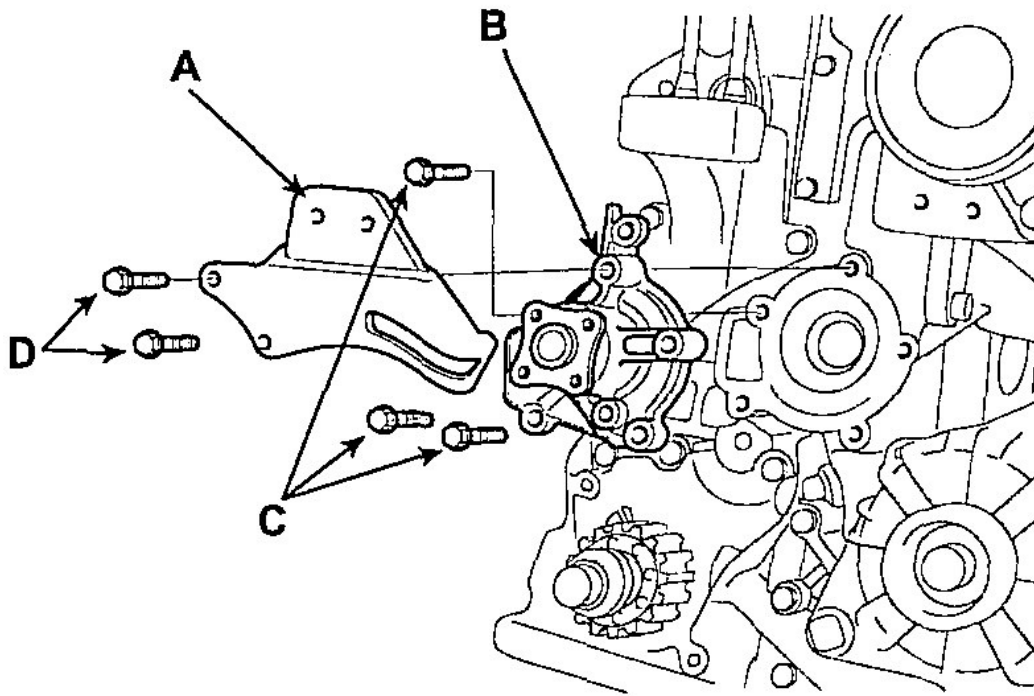
If the valve lift is not as specified, replace the thermostat.

INSTALLATION

WATER PUMP

1. Install the water pump.
 - a. Install the water pump (B) and a new gasket with the 3 bolts (C).

Tightening torque: 11.8-14.7 N.m (1.2-1.5 kg-m, 8.7-10.8 lb-ft)



G00719196

Fig. 209: Installing Water Pump
Courtesy of KIA MOTORS AMERICA, INC.

- b. Install the alternator brace (A) with the 2 bolts (D).

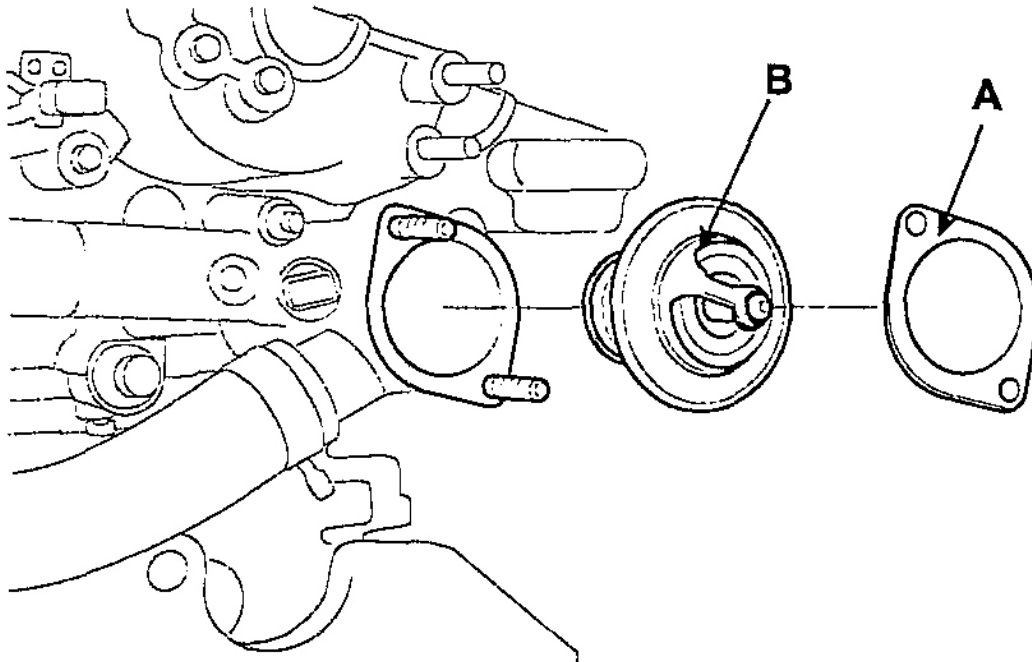
Tightening torque: 19.6-26.5 N.m (2.0-2.7 kg-m, 14.5-19.5 lb-ft)

- 2. Install the power steering pump and the power steering bracket.
- 3. Install the timing belt idler.
- 4. Install the timing belt.
- 5. Install drive belts.
- 6. Fill with engine coolant.
- 7. Start engine and check for leaks.
- 8. Recheck engine coolant level.

THERMOSTAT

- 1. Place the thermostat in thermostat housing.
 - a. Install the thermostat (B) with the jiggle valve upward.

- b. Install a new gasket (A) to the thermostat (B).

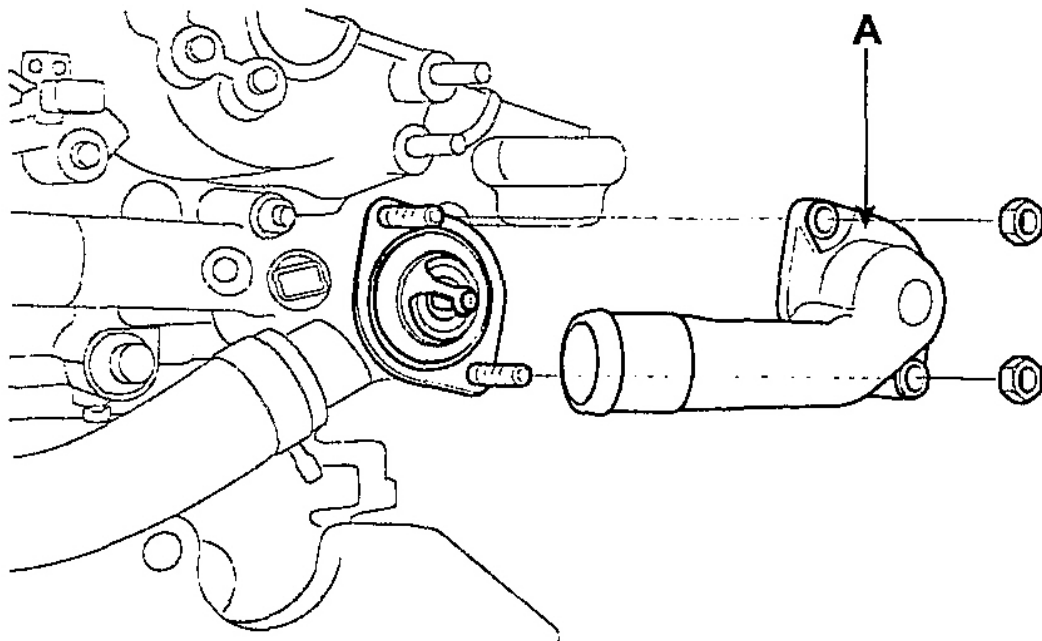


G00719198

Fig. 210: Installing Thermostat
Courtesy of KIA MOTORS AMERICA, INC.

2. Install the water inlet fitting (A).

Tightening torque: 14.7-19.6 N.m (1.5-2.0 kg-m, 10.8-14.5 lb-ft)



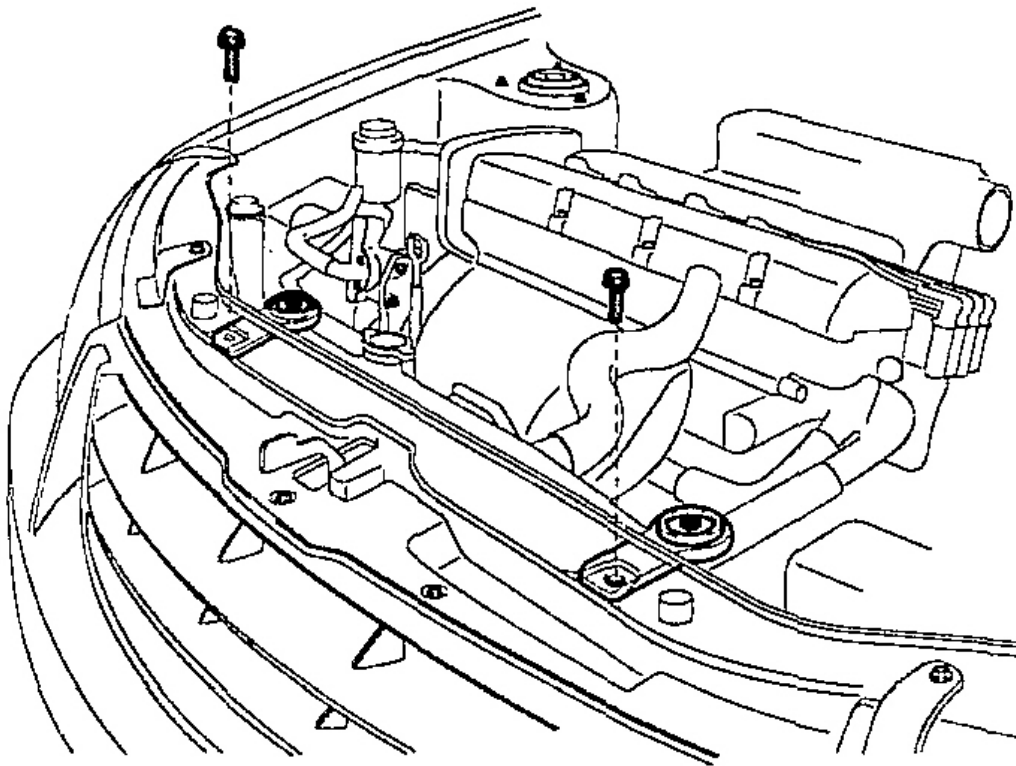
G00719199

Fig. 211: Installing Water Inlet Fitting
Courtesy of KIA MOTORS AMERICA, INC.

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

RADIATOR

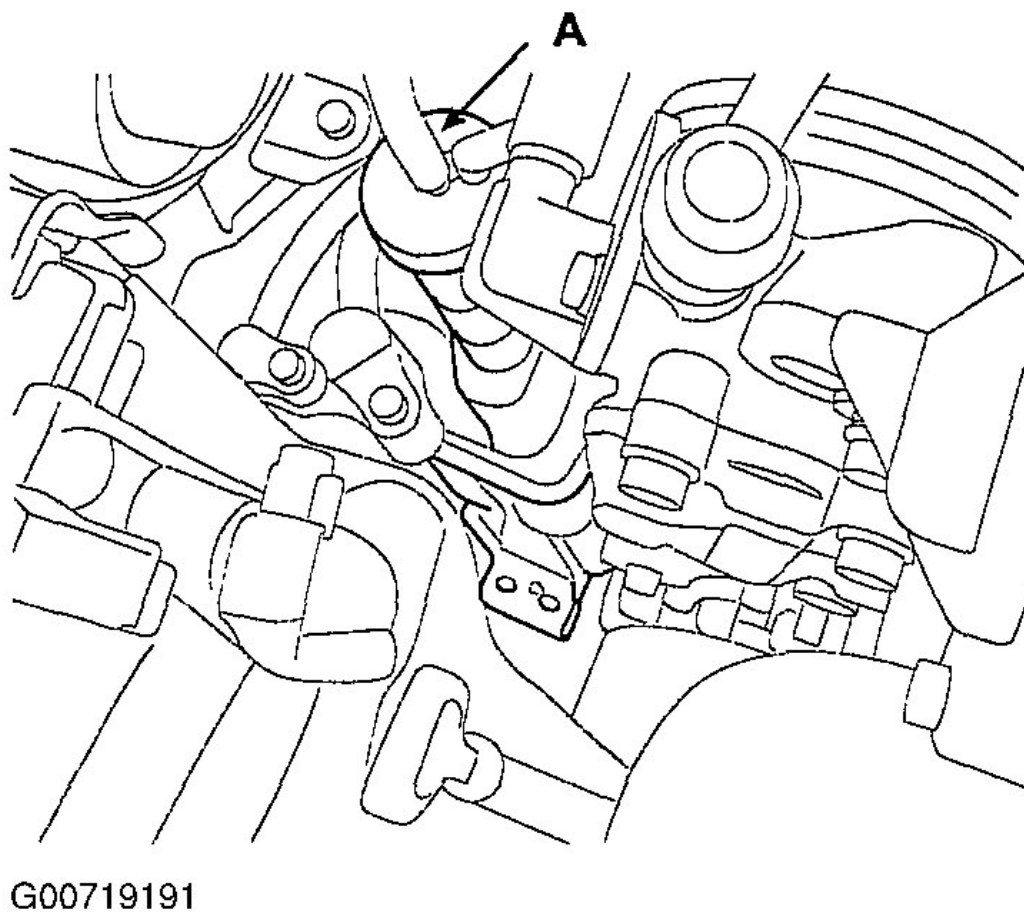
1. Install the cooling fan assembly to the radiator and then fix the assembly to the condenser in engine.
2. Install the radiator upper bracket.



G00719193

Fig. 212: Removing/Installing Radiator Upper Bracket
Courtesy of KIA MOTORS AMERICA, INC.

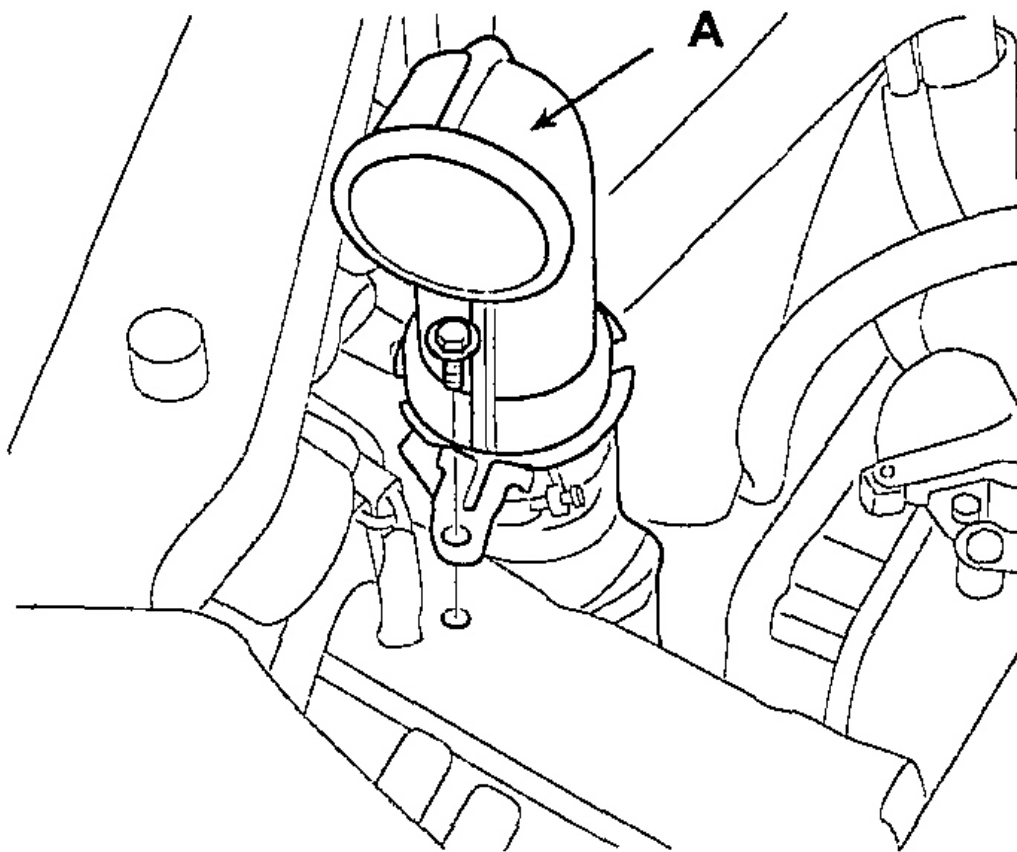
3. Install the reservoir tank (A).



G00719191

Fig. 213: Removing/Installing Reservoir Tank
Courtesy of KIA MOTORS AMERICA, INC.

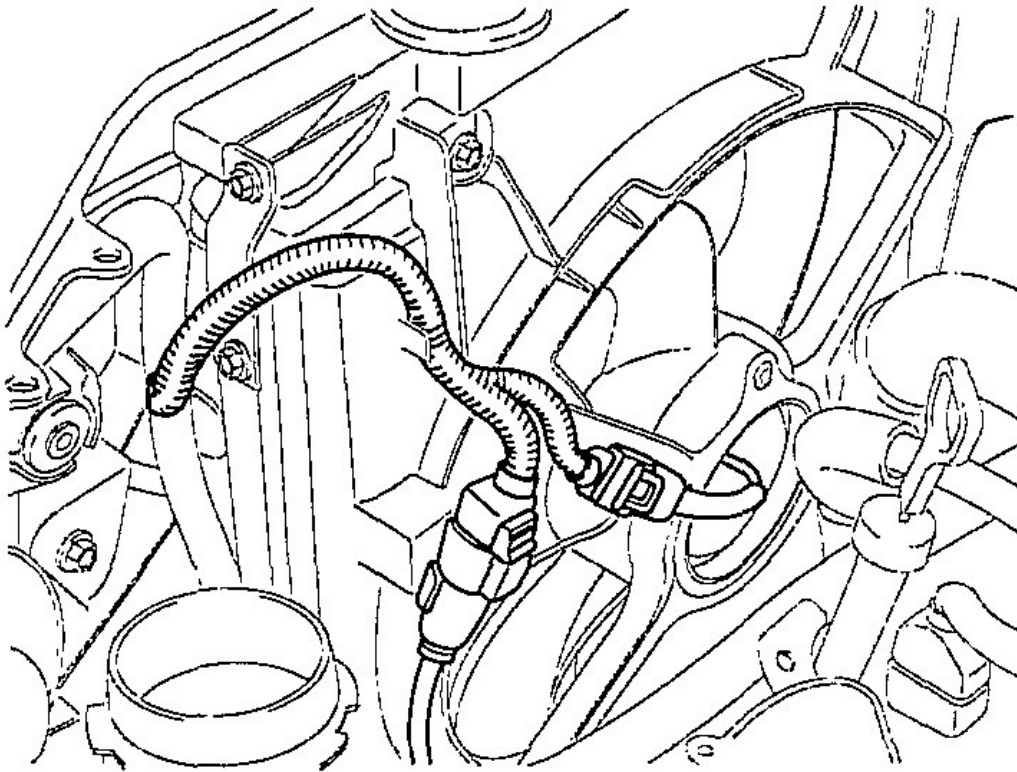
4. Install the air duct (A).



G00719190

Fig. 214: Removing/Installing Air Duct
Courtesy of KIA MOTORS AMERICA, INC.

5. Connect the cooling fan motor connector.

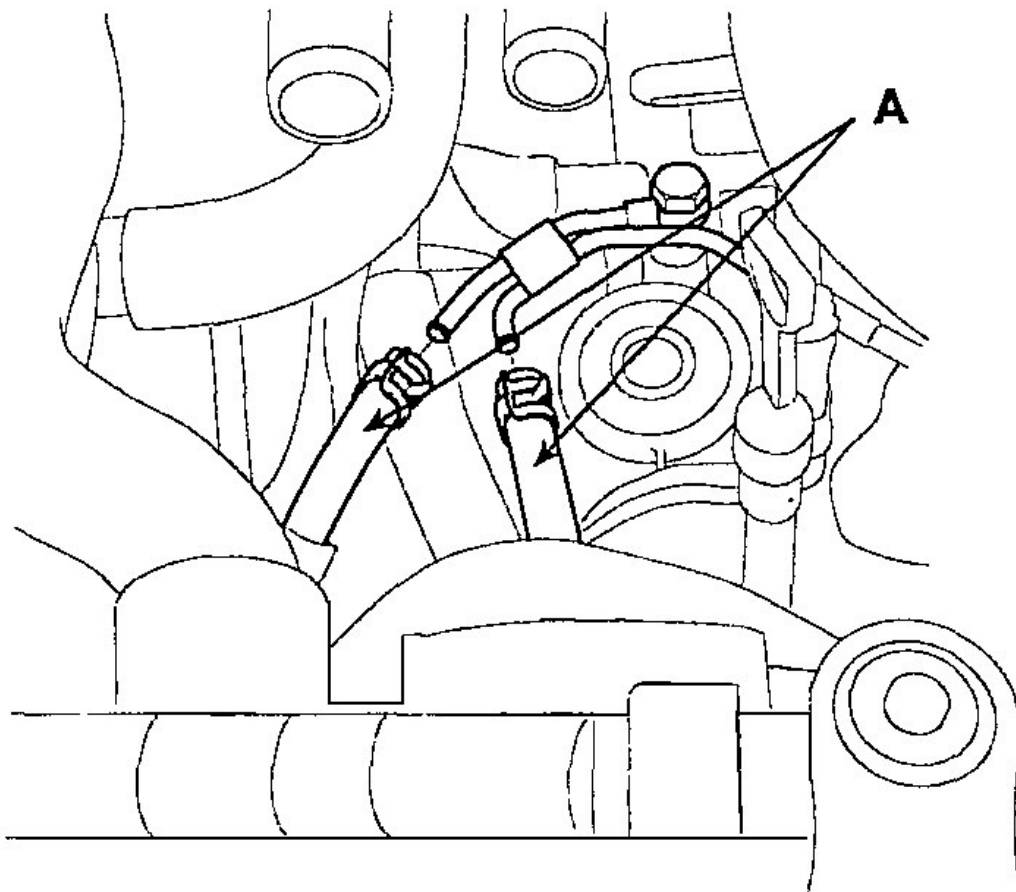


G00719188

Fig. 215: Fan Motor Connector

Courtesy of KIA MOTORS AMERICA, INC.

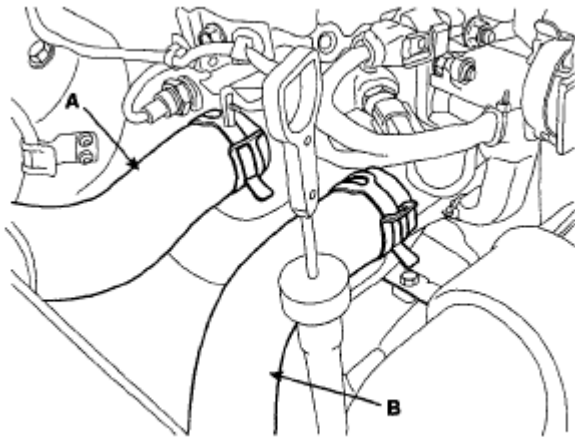
6. Install the ATF (Automatic Transaxle Fluid) cooling hose (A).



G00719093

Fig. 216: Removing/Installing ATF Cooler Hoses
Courtesy of KIA MOTORS AMERICA, INC.

7. Install the radiator upper (A) / lower hose (B).



SHDM16006L

Fig. 217: Locating Upper Radiator Hose And Lower Radiator Hose
Courtesy of KIA MOTORS AMERICA, INC.

8. Install the battery and battery tray.
9. Install the battery terminal and the heat shield.
10. Fill with engine coolant.

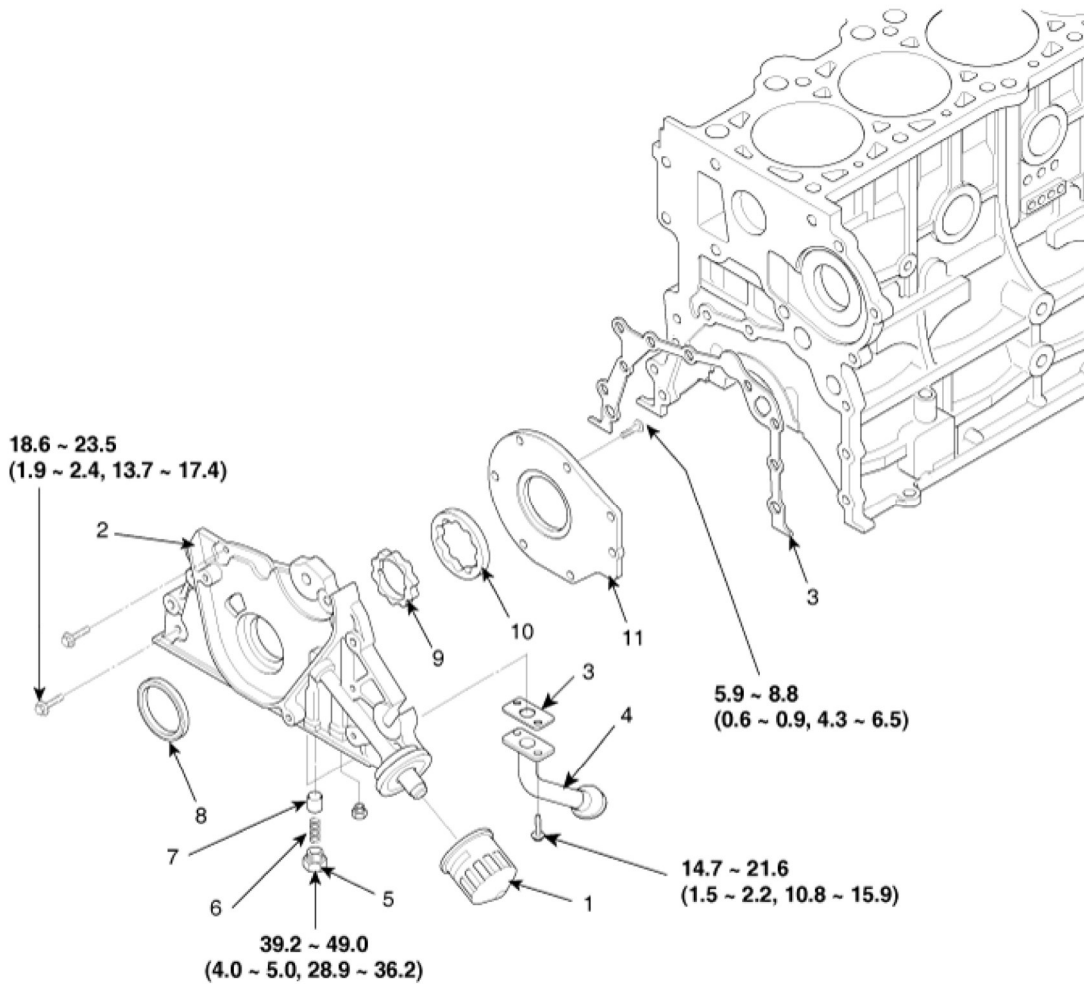
Quantity :

6.5 ~ 6.6L (6.87 ~ 6.97US qt, 5.72 ~ 5.81imp qt)

11. Start engine and check for leaks.

LUBRICATION SYSTEM

COMPONENT



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

- | | |
|------------------|-------------------|
| 1. Filter | 7. Relief plunger |
| 2. Front case | 8. Oil seal |
| 3. Gasket | 9. Inner rotor |
| 4. Oil screen | 10. Outer rotor |
| 5. Plug | 11. Pump cover |
| 6. Relief spring | |

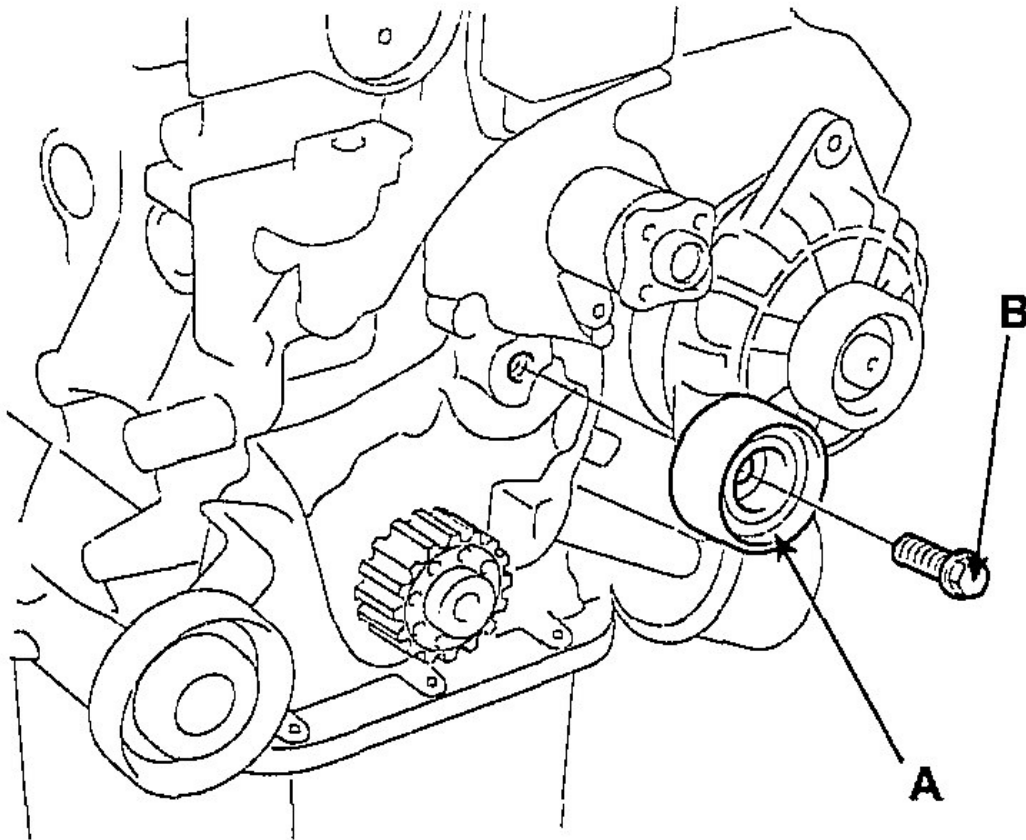
Fig. 218: Identifying Lubrication System Components With Torque Specifications
 Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

OIL PUMP

1. Drain the engine oil.
2. Remove the drive belts.
3. Turn the crankshaft pulley, and align its groove with timing mark "T" of the timing belt cover.

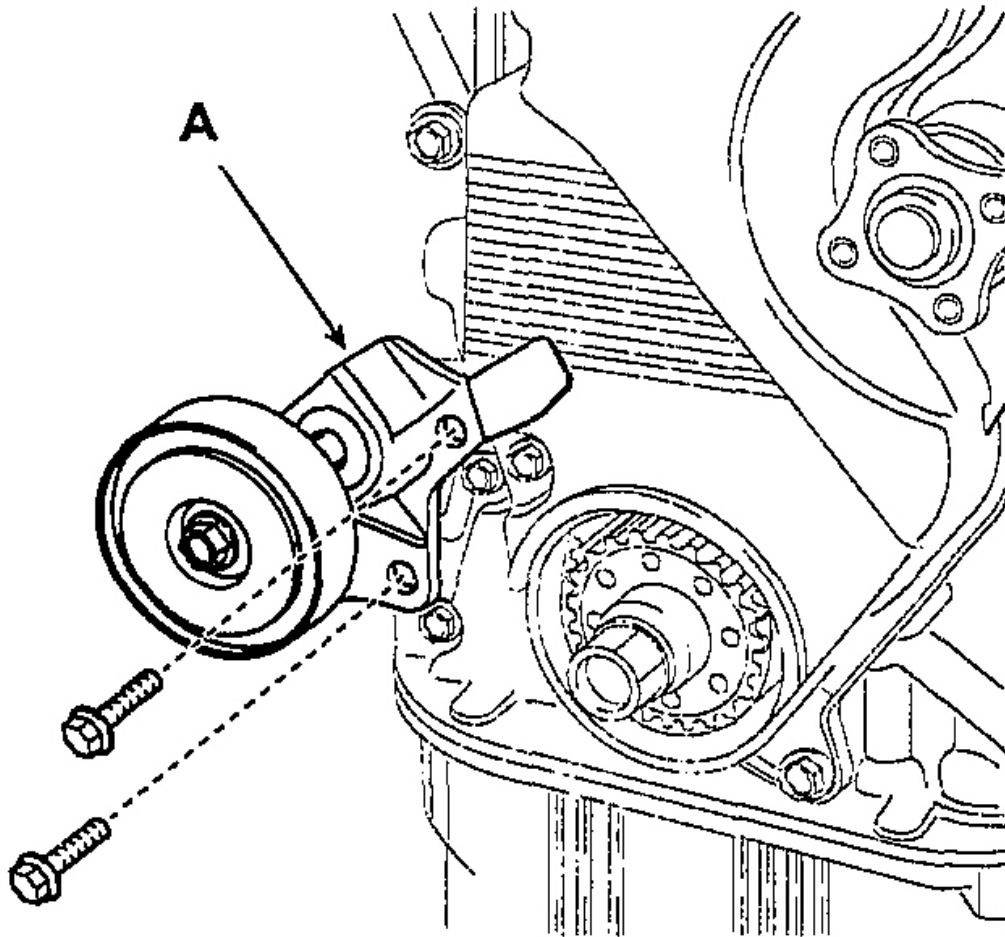
4. Remove the timing belt.
5. Remove the timing belt idle mounting bolt (B) and the idle (A).



G00719207

Fig. 219: Removing Timing Belt Idler
Courtesy of KIA MOTORS AMERICA, INC.

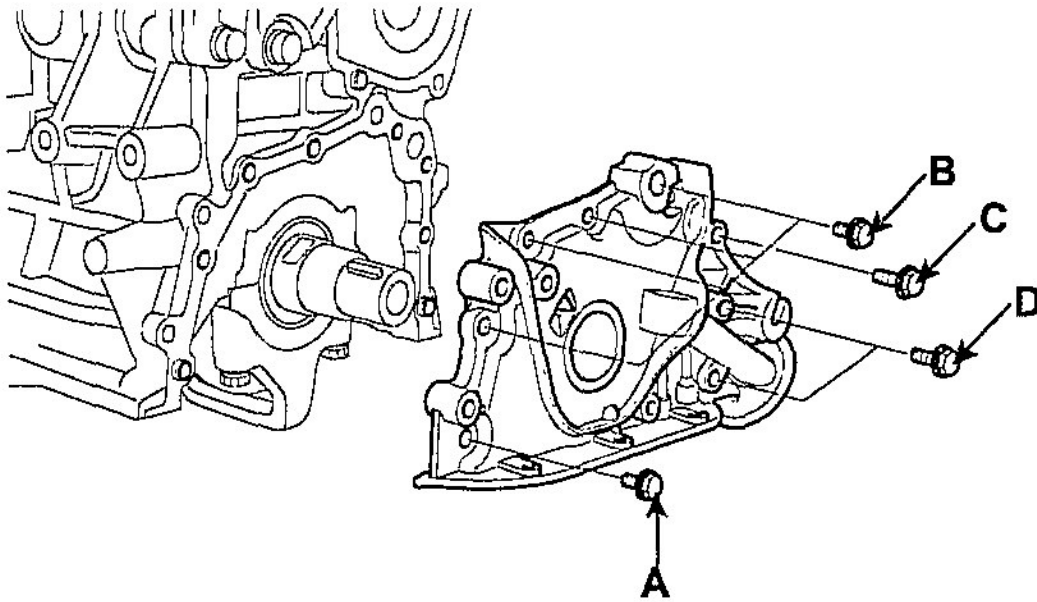
6. Remove the oil pan and oil screen.
7. Remove the alternator.
8. Remove the air conditioner compressor tensioner bracket (A).



G00719208

Fig. 220: Removing Air Conditioner Compressor Tensioner Bracket
Courtesy of KIA MOTORS AMERICA, INC.

9. Remove the bolts (A, B, C, D) and front case.

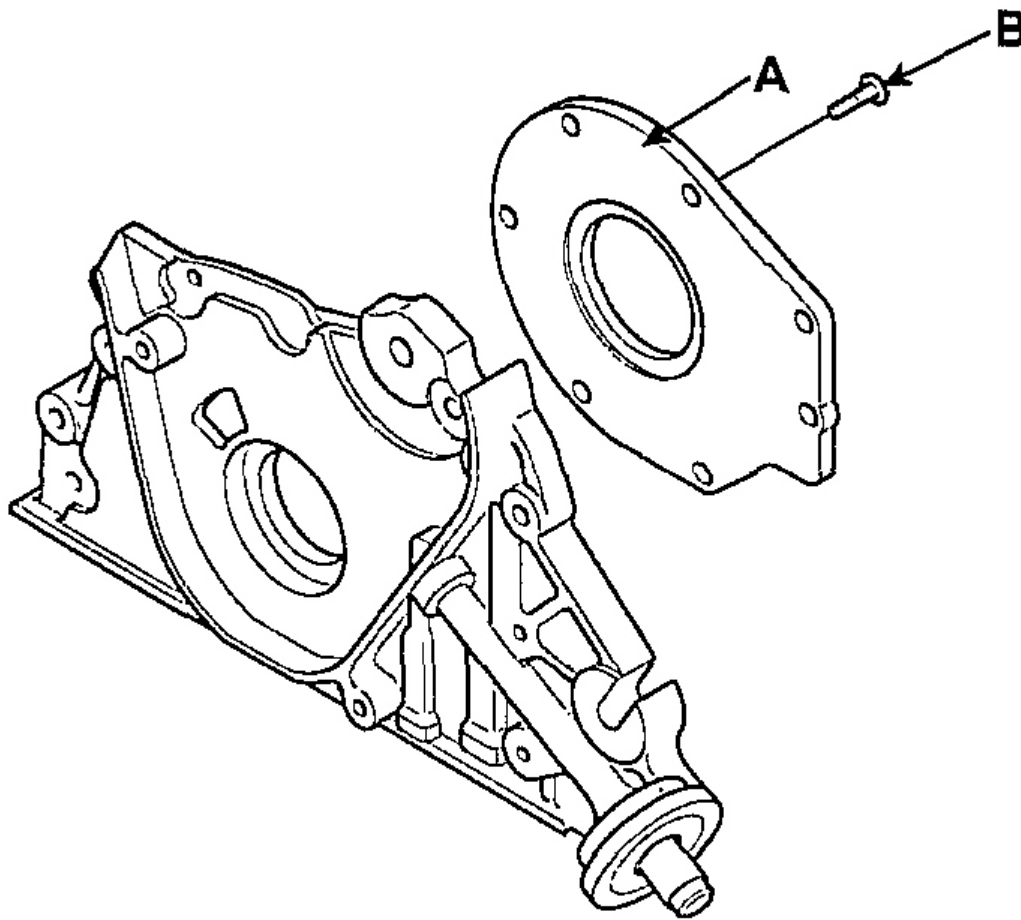


G00719209

Fig. 221: Removing Front Case

Courtesy of KIA MOTORS AMERICA, INC.

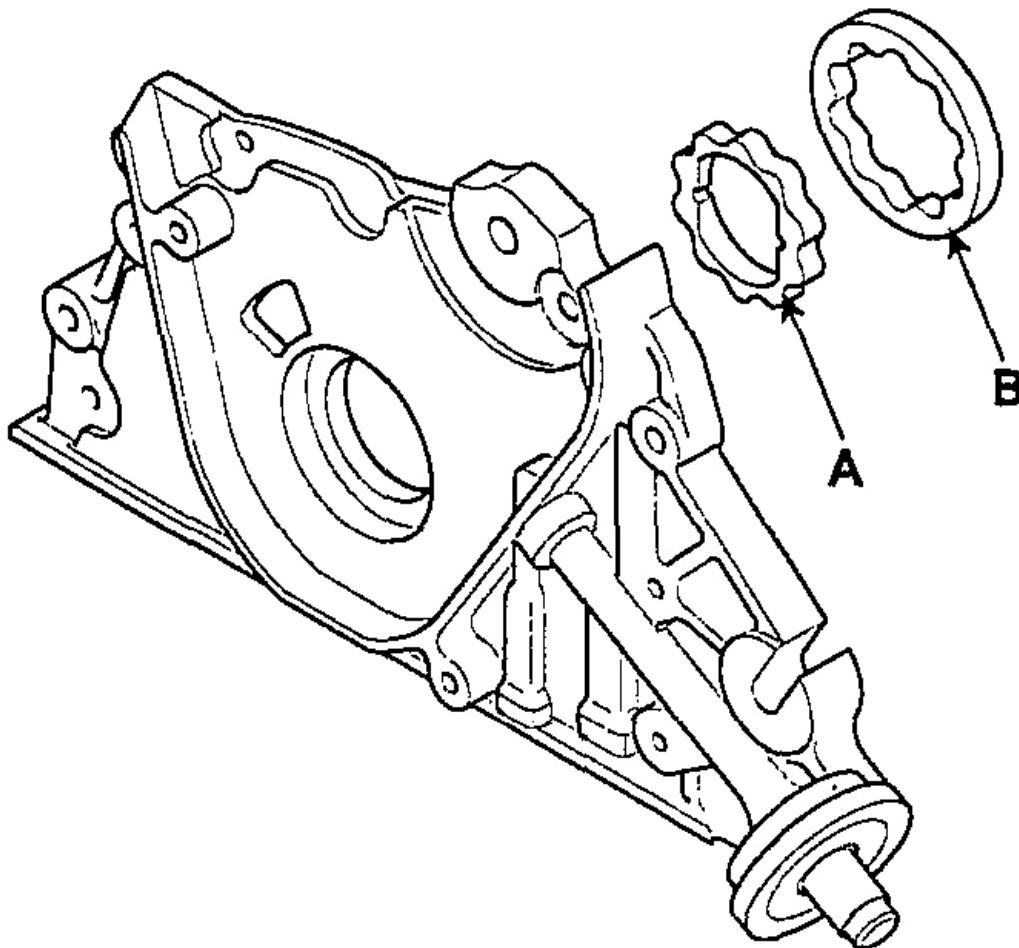
- a. Remove the screw (B) from the pump housing, then separate the housing and cover (A).



G00719210

Fig. 222: Separating Housing & Cover
Courtesy of KIA MOTORS AMERICA, INC.

- b. Remove the inner rotor (A) and outer rotor (B).

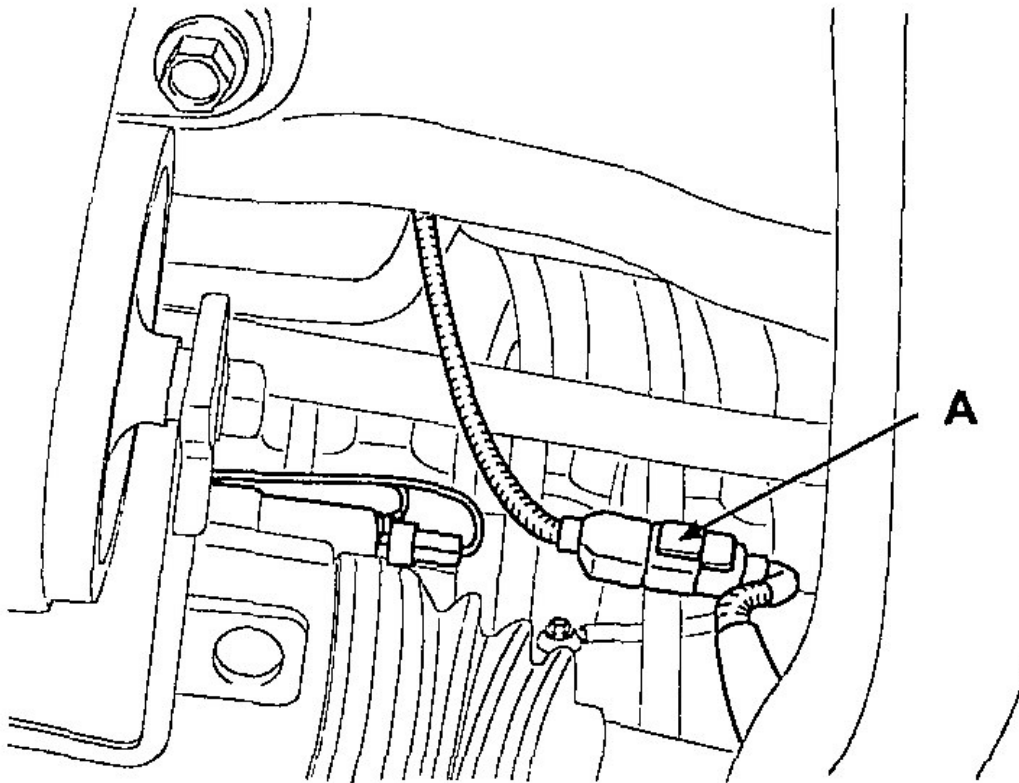


G00719211

Fig. 223: Removing Inner & Outer Rotor
Courtesy of KIA MOTORS AMERICA, INC.

OIL PAN

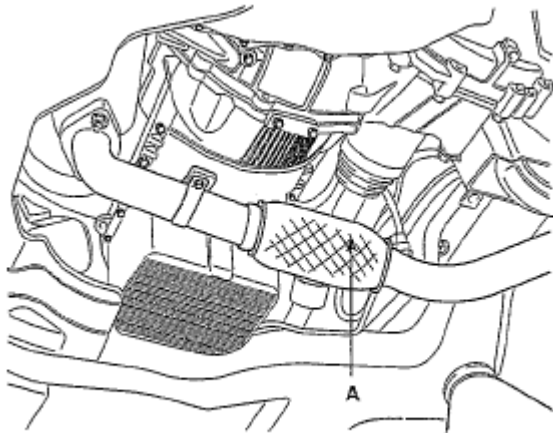
1. Drain the engine oil.
2. Disconnect the rear oxygen sensor connector (A).



G00719203

Fig. 224: Disconnecting Rear Oxygen Sensor Connector
Courtesy of KIA MOTORS AMERICA, INC.

3. Remove the front muffler (A).



SLDM18003D

Fig. 225: Identifying Front Muffler
Courtesy of KIA MOTORS AMERICA, INC.

4. Remove the front muffler bracket.
5. Remove the oil pan.

OIL & FILTER REPLACEMENT

CAUTION:

- Prolonged and repeated contact with mineral oil will result in the removal of natural fats from the skin, leading to dryness, irritation and dermatitis. In addition, used engine oil contains potentially harmful contaminants which may cause skin cancer.
- Exercise caution in order to minimize the length and frequency of contact of your skin to used oil. Wear protective clothing and gloves. Wash your skin thoroughly with soap and water, or use waterless hand cleaner, to remove any used engine oil. Do not use gasoline, thinners, or solvents.
- In order to preserve the environment, used oil and used oil filter must be disposed of only at designated disposal sites.

1. Drain the engine oil.
 - a. Remove the oil filler cap.
 - b. Remove the oil drain plug, and drain the oil into a container.
2. Replace the oil filter.
 - a. Remove the oil filter.
 - b. Check and clean the oil filter installation surface.
 - c. Check the part number of the new oil filter to ensure it is the same as the original one.
 - d. Apply clean engine oil to the gasket of a new oil filter.
 - e. Lightly screw the oil filter into place, and tighten it until the gasket contacts the seat.
 - f. Tighten it an additional 3/4 turn.

3. Refill with engine oil.
 - a. Clean and install the oil drain plug with a new gasket.

Tightening torque: 39.2-44.1 N.m (4.0-4.5 kg-m, 28.9-32.5 lb-ft)

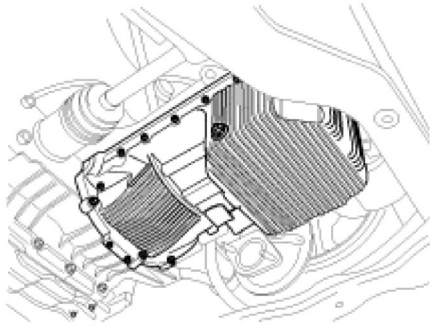


Fig. 226: Oil Pan
Courtesy of KIA MOTORS AMERICA, INC.

- b. Fill with fresh engine oil.

Oil Capacity

Total: 4.0L (4.23 US qt, 3.52 Imp. qt)

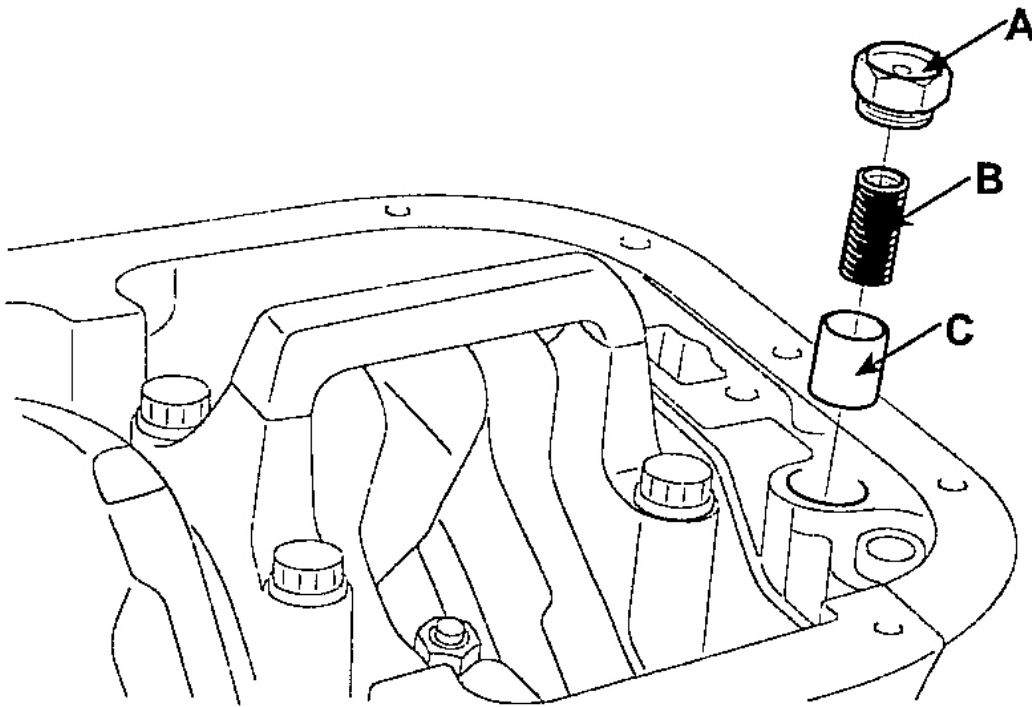
Oil pan: 3.7L (3.91 US qt, 3.26 Imp. qt)

Oil filter: 0.3L (0.32 US qt, 0.26 Imp. qt)

- c. Install the oil filler cap.
 4. Start engine and check for oil leaks.
 5. Recheck the engine oil level.

DISASSEMBLY

Remove the relief plunger. Remove the plug (A), spring (B) and relief plunger (C).



G00719212

Fig. 227: Removing Relief Plunger
 Courtesy of KIA MOTORS AMERICA, INC.

INSPECTION

1. Inspect the relief plunger.

Coat the plunger with engine oil and check that it falls smoothly into the plunger hole by its own weight. If it does not, replace the relief plunger. If necessary, replace the front case.

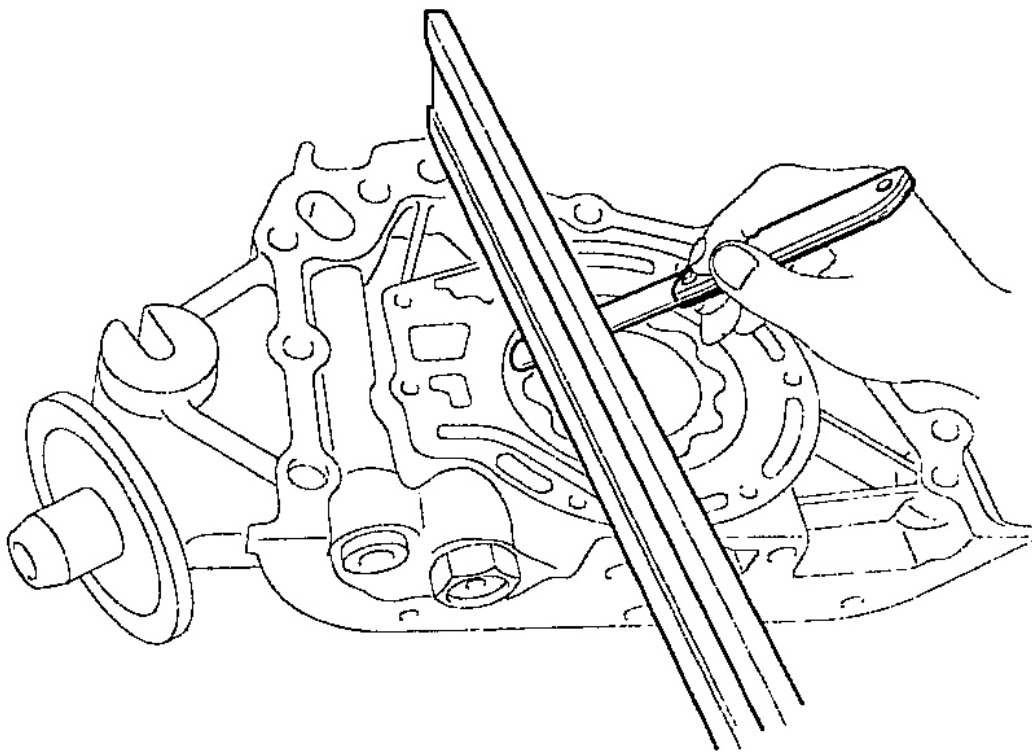
2. Inspect the relief valve spring. Inspect for distorted or broken relief valve spring.

Standard value:

Free height: 43.8 mm (1.724 in)

Load: 3.7+/-0.4 kg/40.1 mm (8.2+/-0.9 lb/1.579 in) 9.7+/-0.4 kg/34.3 mm (21.4+/-0.9 lb/1.350 in)

3. Inspect the rotor side clearance. Using a feeler gauge and precision straight edge, measure the clearance between the rotors and precision straight edge.



G00719214

Fig. 228: Measuring Rotor Side Clearance
 Courtesy of KIA MOTORS AMERICA, INC.

Side clearance	Outer rotor	0.04 ~ 0.09mm (0.0016 ~ 0.0035in)
	Inner rotor	0.04 ~ 0.085mm (0.0016 ~ 0.0033in)

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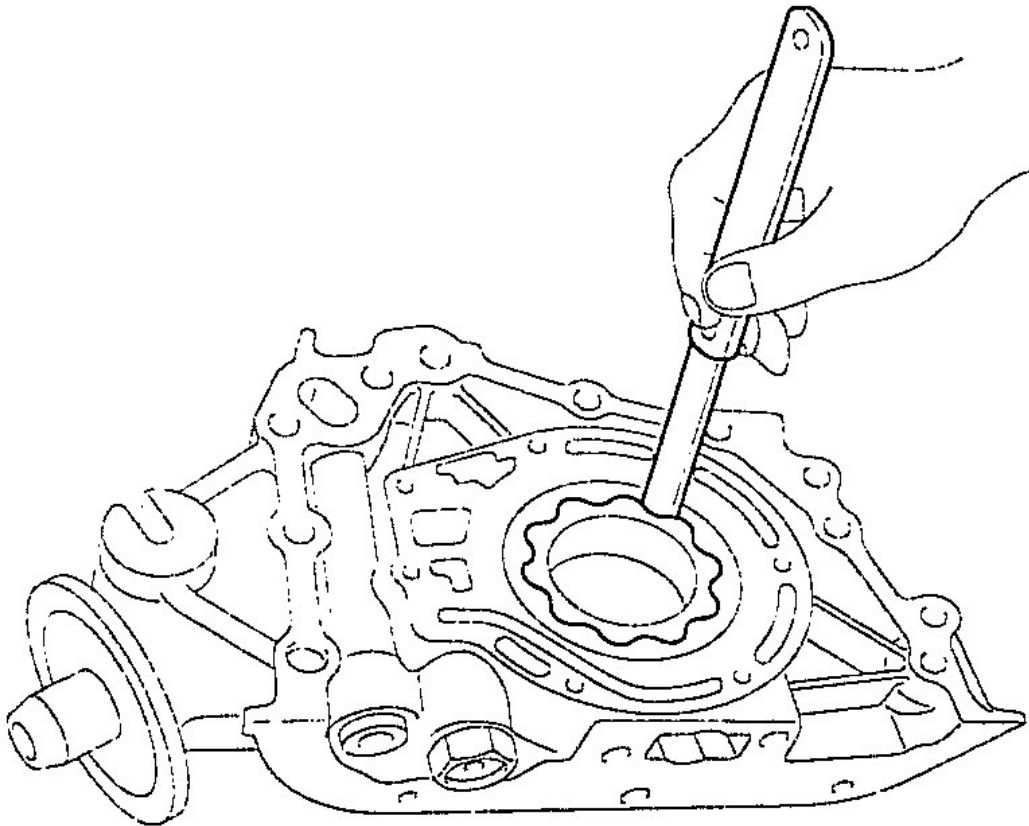
Fig. 229: Identifying Rotor Side Clearance Specification Chart
 Courtesy of KIA MOTORS AMERICA, INC.

If the side clearance is greater than maximum, replace the rotors as a set. If necessary, replace the front

case.

4. Inspect the rotor tip clearance. Using a feeler gauge, measure the tip clearance between the inner and outer rotor tips.

Tip clearance: 0.025-0.069 mm (0.0010-0.0027 in)



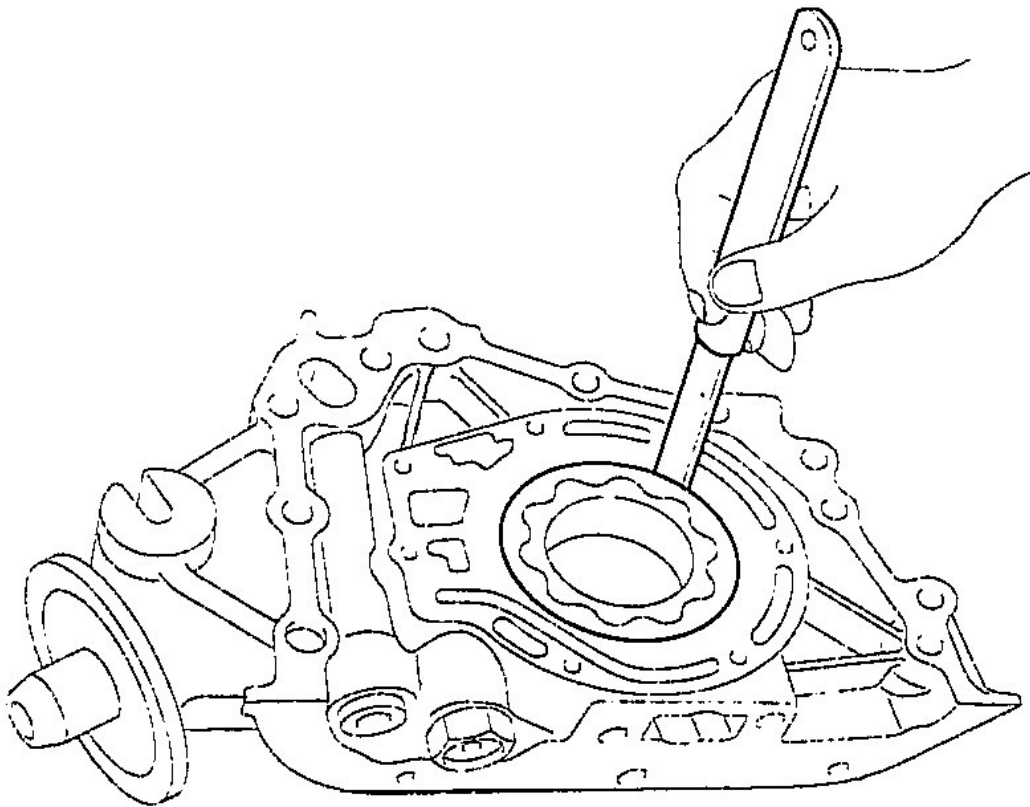
G00719215

Fig. 230: Measuring Rotor Tip Clearance
Courtesy of KIA MOTORS AMERICA, INC.

If the tip clearance is greater than maximum, replace the rotors as a set.

5. Inspect the rotor body clearance. Using a feeler gauge, measure the clearance between the outer rotor and body.

Body clearance: 0.120-0.185 mm (0.0047-0.0073 in)



G00719216

Fig. 231: Measuring Rotor Body Clearance
Courtesy of KIA MOTORS AMERICA, INC.

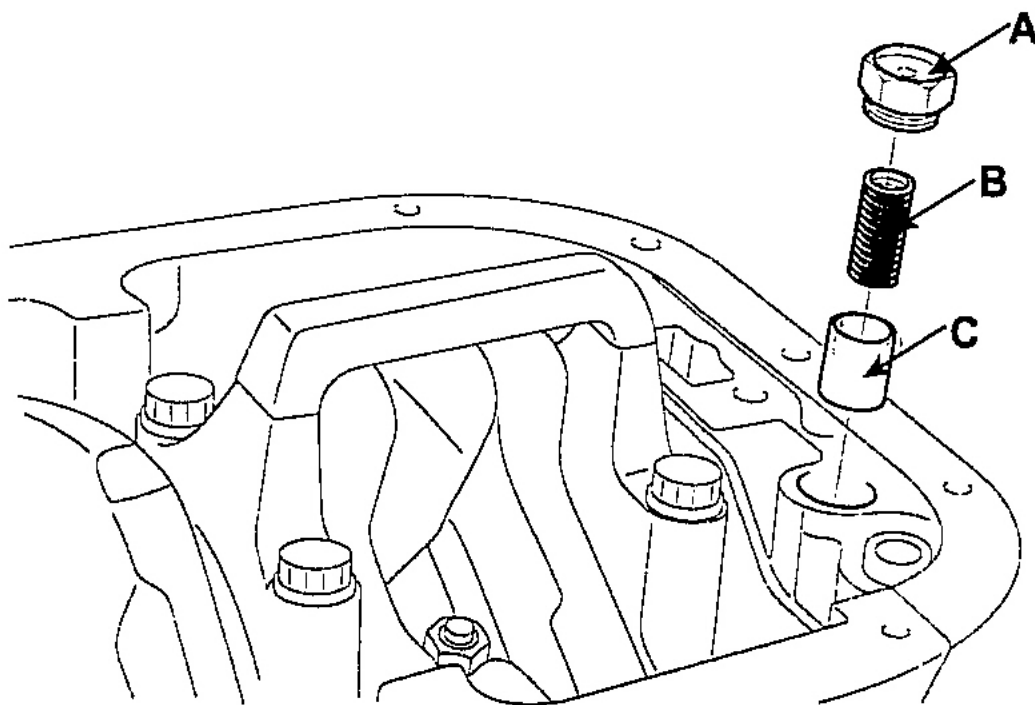
If the body clearance is greater than maximum, replace the rotors as a set. If necessary, replace the front case.

REASSEMBLY

RELIEF PLUNGER

Install the relief plunger. Install relief plunger (C) and spring (B) into the front case hole, and install the plug (A).

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



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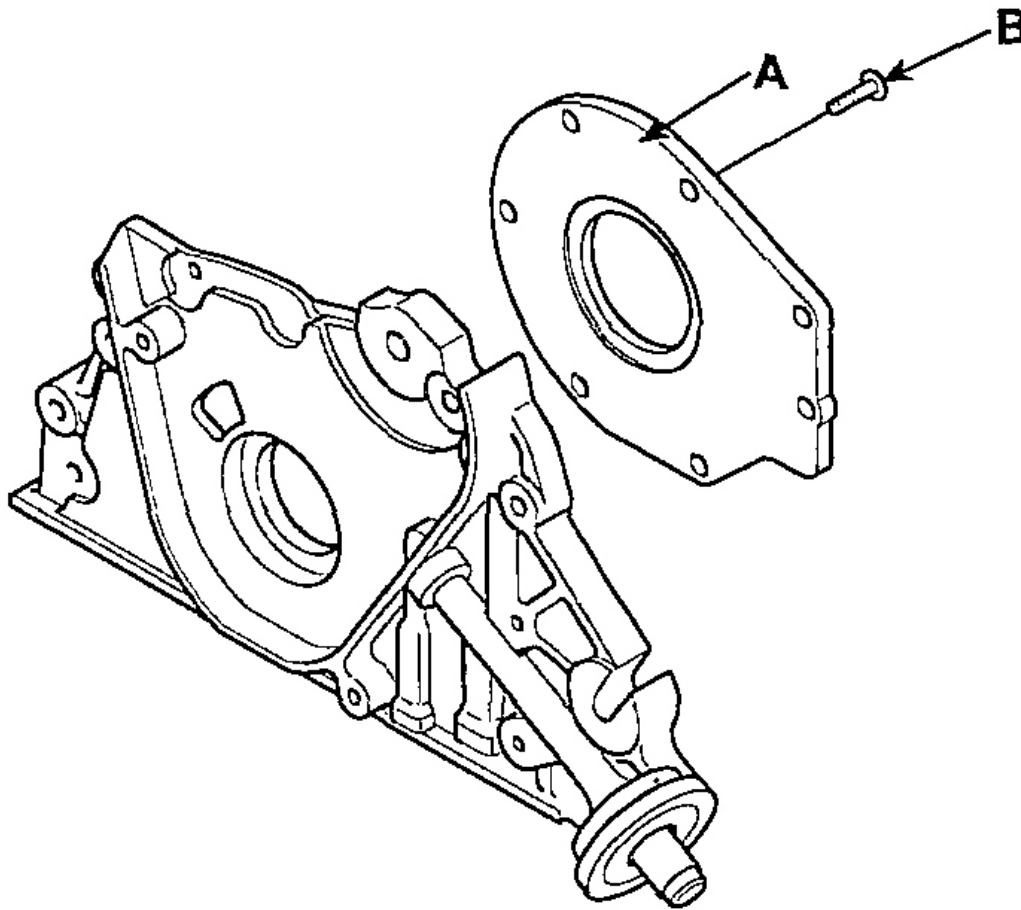
Fig. 232: Installing Relief Plunger

Courtesy of KIA MOTORS AMERICA, INC.

INSTALLATION**OIL PUMP**

1. Install the oil pump.
 - a. Place the inner and outer rotors into front case with the marks facing the oil pump cover side.
 - b. Install the oil pump cover (A) to front case with the 7 screws (B).

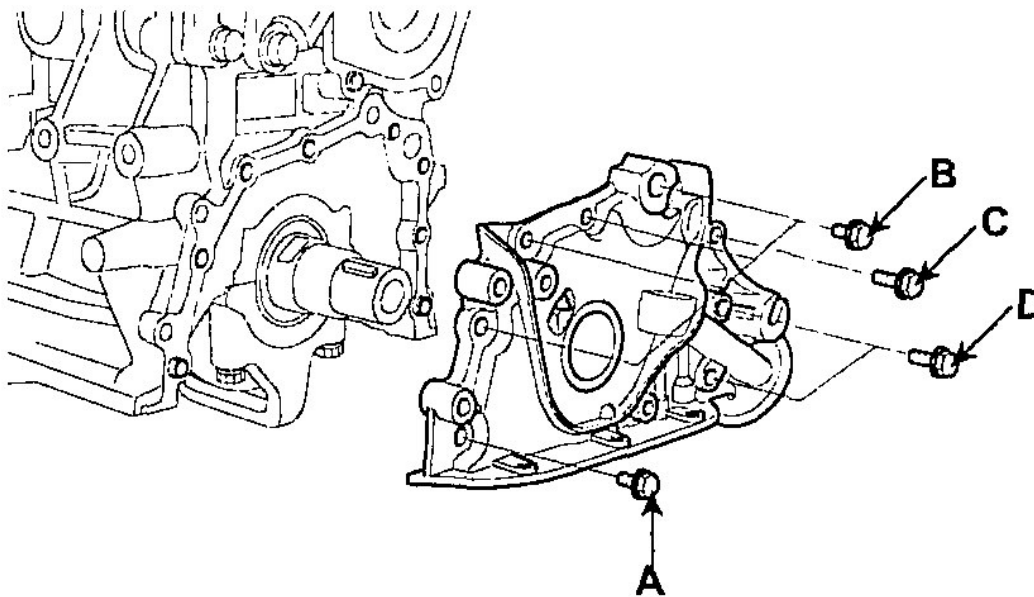
Tightening torque: 5.9-8.8 N.m (0.6-0.9 kg-m, 4.3-6.5 lb-ft)



G00719218

Fig. 233: Installing Oil Pump Cover
 Courtesy of KIA MOTORS AMERICA, INC.

2. Check that the oil pump turns freely.
3. Install the oil pump on the cylinder block.
 - a. Place a new front case gasket on the cylinder block.
 - b. Apply engine oil to the lip of the oil pump seal. Then, install the oil pump onto the crankshaft.
 - c. When the pump is in place, clean any excess grease off the crankshaft and check that the oil seal lip is not distorted.



G00719219

Fig. 234: Identifying Oil Pump Bolts
Courtesy of KIA MOTORS AMERICA, INC.

Bolt length:

(A) : 25mm (0.98 in)

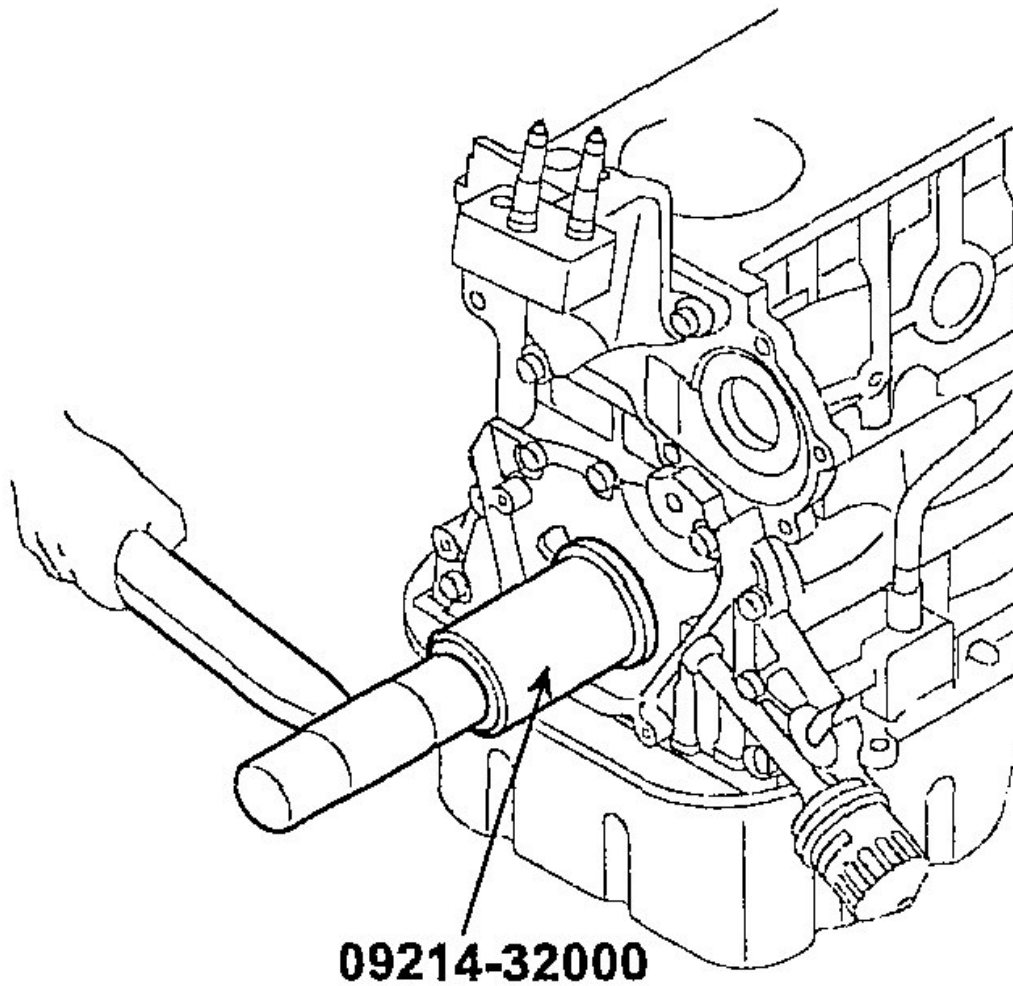
(B) : 20mm (0.787 in)

(C) : 38mm (1.496 in)

(D) : 45mm (1.771 in)

Tightening torque: 19.6-26.5 N.m (2.0-2.7 kg-m, 14.5-19.5 lb-ft)

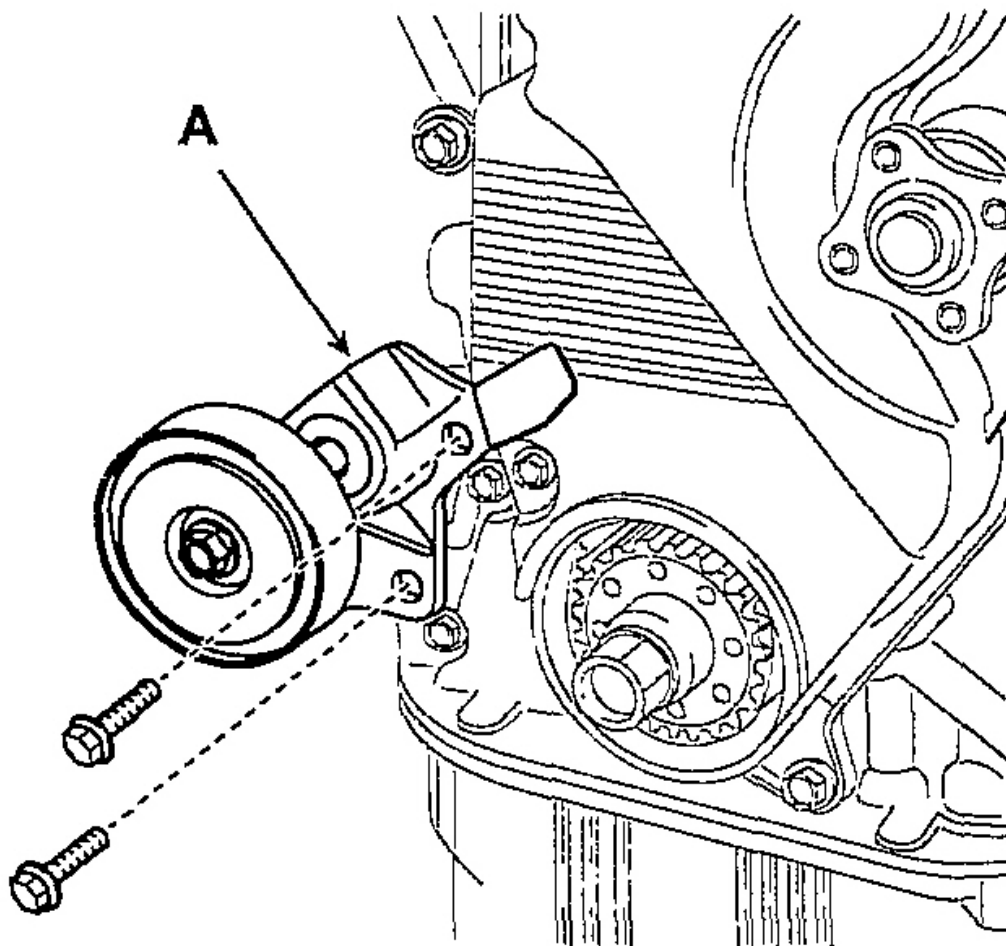
4. Apply a light coat of oil to the front case oil seal lip.
5. Using the Service Tool (09214-32000), install the front case oil seal.



G00719220

Fig. 235: Installing Front Case Oil Seal
Courtesy of KIA MOTORS AMERICA, INC.

6. Install the air conditioner compressor tensioner bracket (A).



G00719221

Fig. 236: Installing A/C Tensioner
Courtesy of KIA MOTORS AMERICA, INC.

7. Install the alternator.
8. Install the oil screen.

Tightening torque: 14.7-21.6 N.m (1.5-2.2 kg-m, 10.8-15.9 lb-ft)

9. Install the oil pan.

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

NOTE: Clean the oil pan gasket mating surfaces.

10. Install the timing belt idler.

Tightening torque: 42.2-53.9 N.m (4.3-5.5 kg-m, 31.1-39.8 lb-ft)

11. Install the timing belt.
12. Install the drive belts.
13. Fill with engine oil.

OIL PAN

1. Install the oil pan.
 - a. Using a razor blade and gasket scraper, remove all the old packing material from the gasket surfaces.

NOTE: Check that the mating surfaces are clean and dry before applying liquid gasket.

- b. Apply liquid gasket as an even bead, centered between the edges of the mating surface.

Liquid gasket: MS 721-40A or equivalent

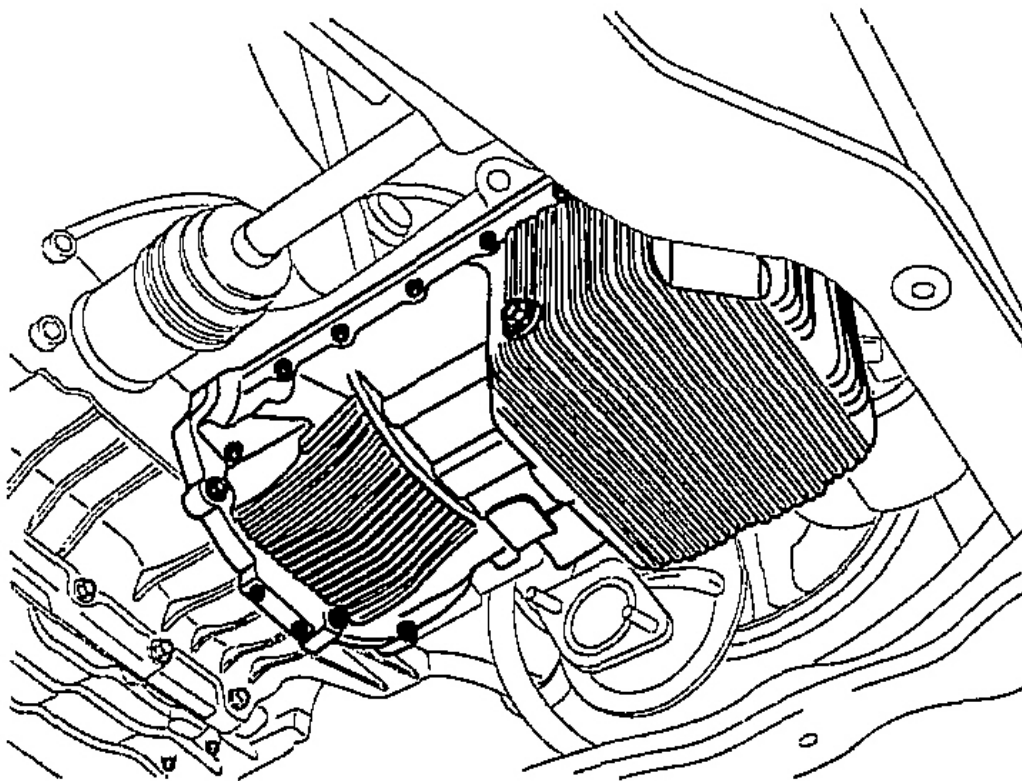
NOTE:

- To prevent leakage of oil, apply liquid gasket to the inner threads of the bolt holes.
- Do not install the parts if five minutes or more have elapsed since applying the liquid gasket.
- After assembly, wait at least 30 minutes before filling the engine with oil.

- c. Install the oil pan with the bolts.

Uniformly tighten the bolts in several passes.

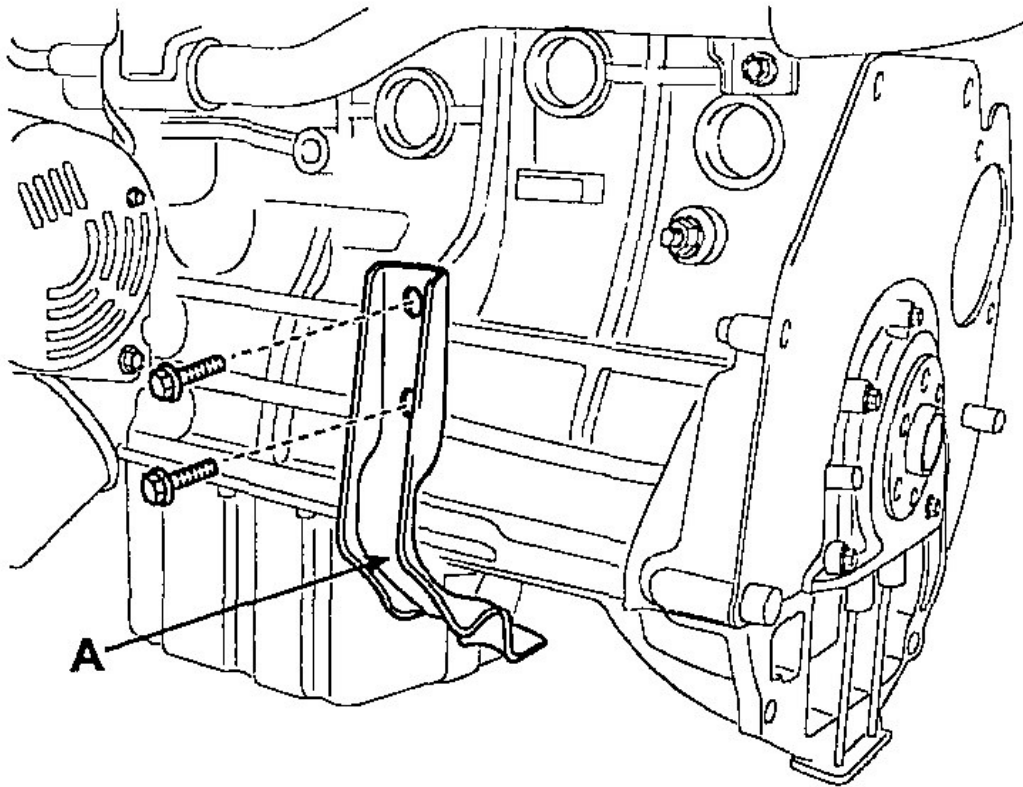
Tightening torque: 9.8-11.8 N.m (1.0-1.2 kg-m, 7.2-8.7 lb-ft)



G00719222

Fig. 237: Installing Oil Pan
Courtesy of KIA MOTORS AMERICA, INC.

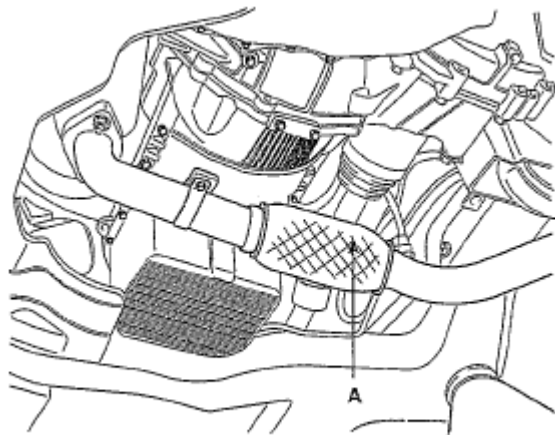
2. Install the front muffler bracket (A).



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Fig. 238: Installing Front Muffler Bracket
Courtesy of KIA MOTORS AMERICA, INC.

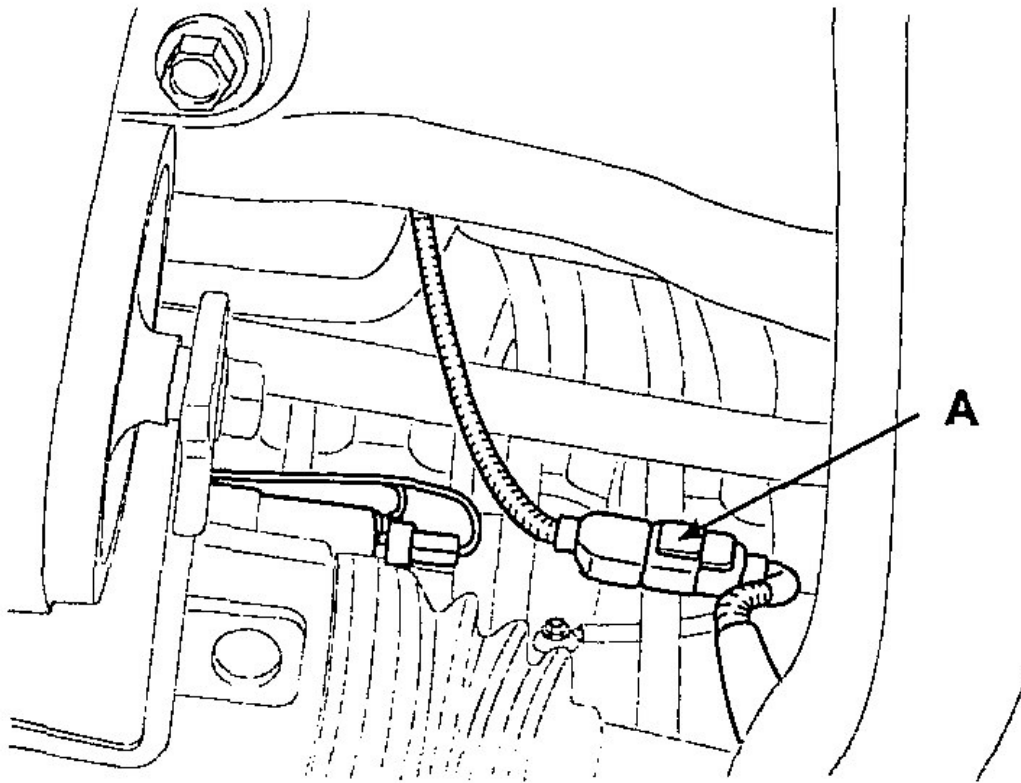
3. Install the exhaust manifold.
4. Install the front muffler (A).



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Fig. 239: Identifying Front Muffler
Courtesy of KIA MOTORS AMERICA, INC.

5. Connect the rear oxygen sensor connector (A).



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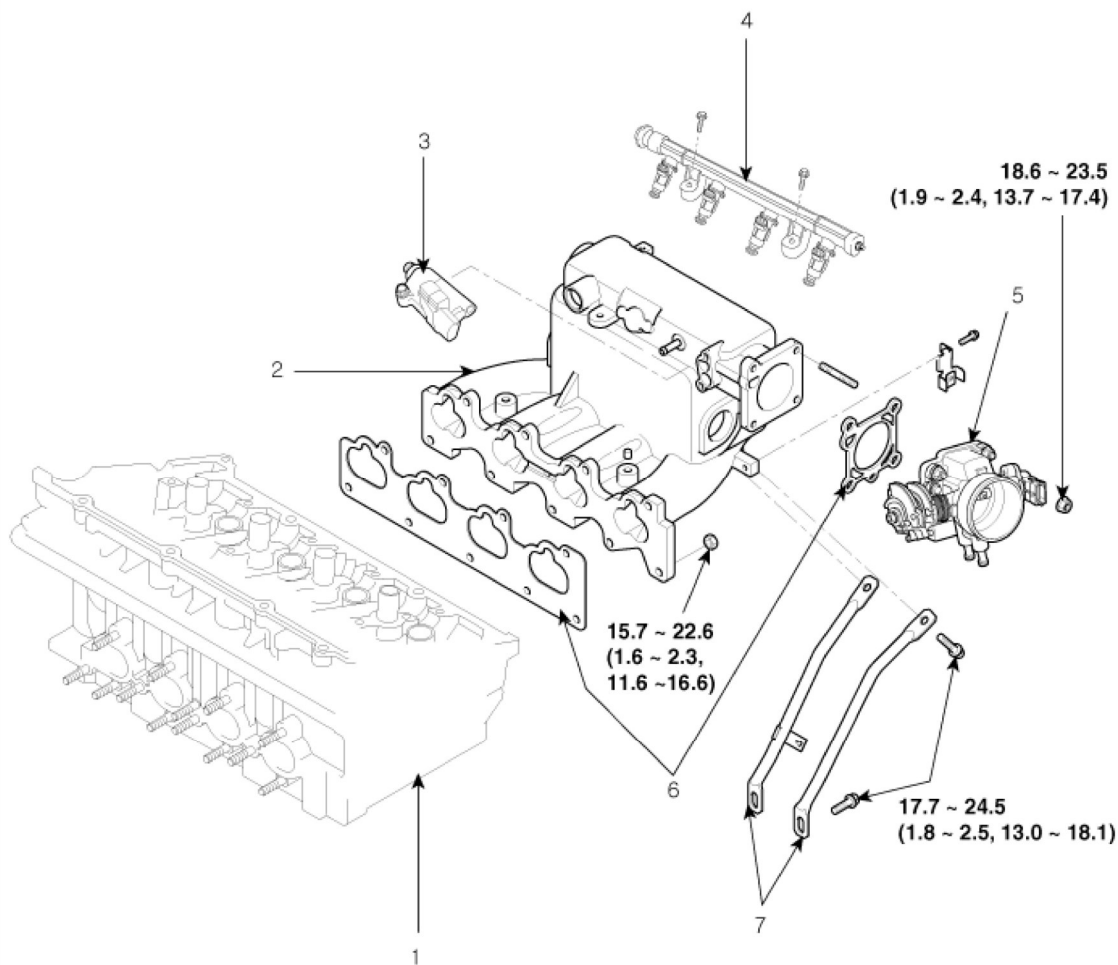
Fig. 240: Connecting Rear Oxygen Sensor Connector
Courtesy of KIA MOTORS AMERICA, INC.

6. Fill with engine oil

INTAKE AND EXHAUST SYSTEM

INTAKE MANIFOLD

COMPONENT



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

- | | |
|------------------------------|---------------------------|
| 1. Cylinder head | 5. Throttle body assembly |
| 2. Intake manifold | 6. Gasket |
| 3. Idle speed actuator (ISA) | 7. Intake manifold stay |
| 4. Delivery pipe assembly | |

Fig. 241: Identifying Intake Manifold Components With Torque Specifications
 Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

1. Remove the engine cover.

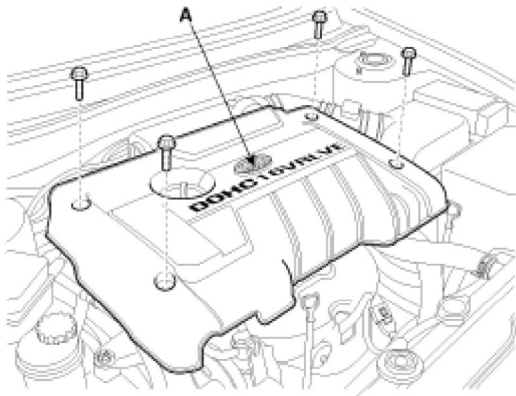
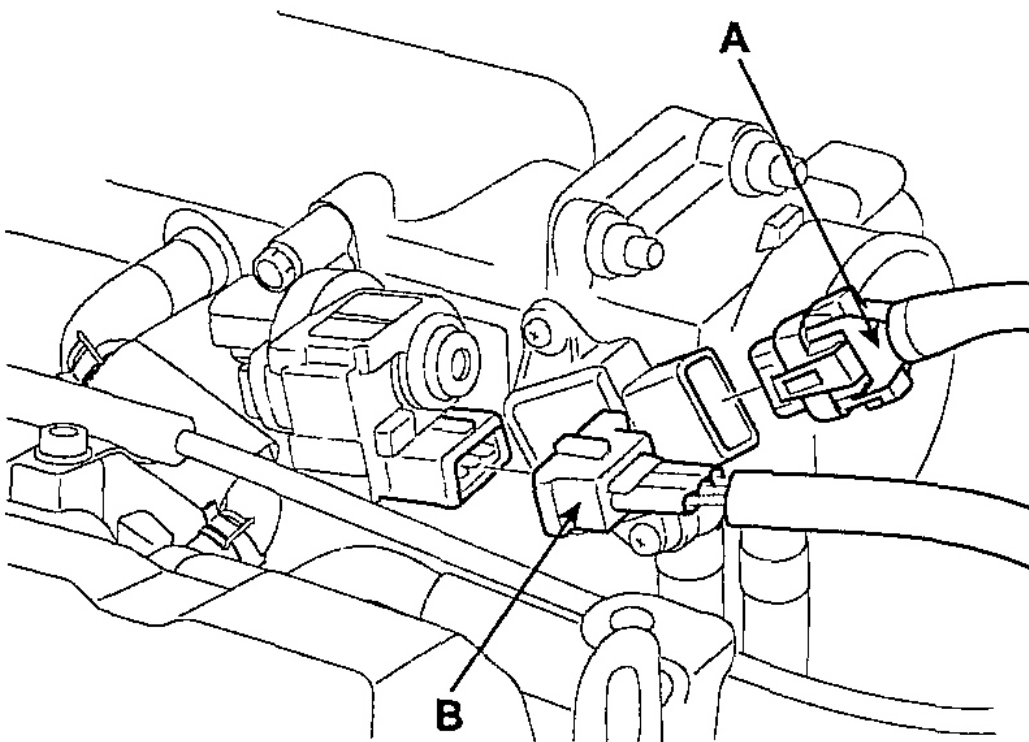


Fig. 242: Removing/Installing Engine Cover
Courtesy of KIA MOTORS AMERICA, INC.

2. Disconnect the TPS (Throttle Position Sensor) connector (A) and ISA (Idle Speed Actuator) connector (B).



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Fig. 243: Disconnect TPS & ISA Connector
Courtesy of KIA MOTORS AMERICA, INC.

3. Disconnect the PCV (Positive Crankcase Ventilation) hose (A) and breather hose (B).

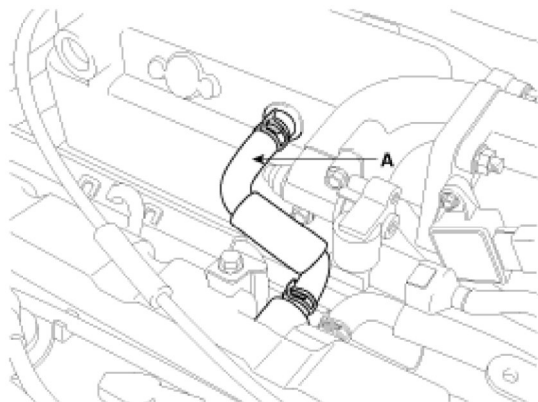
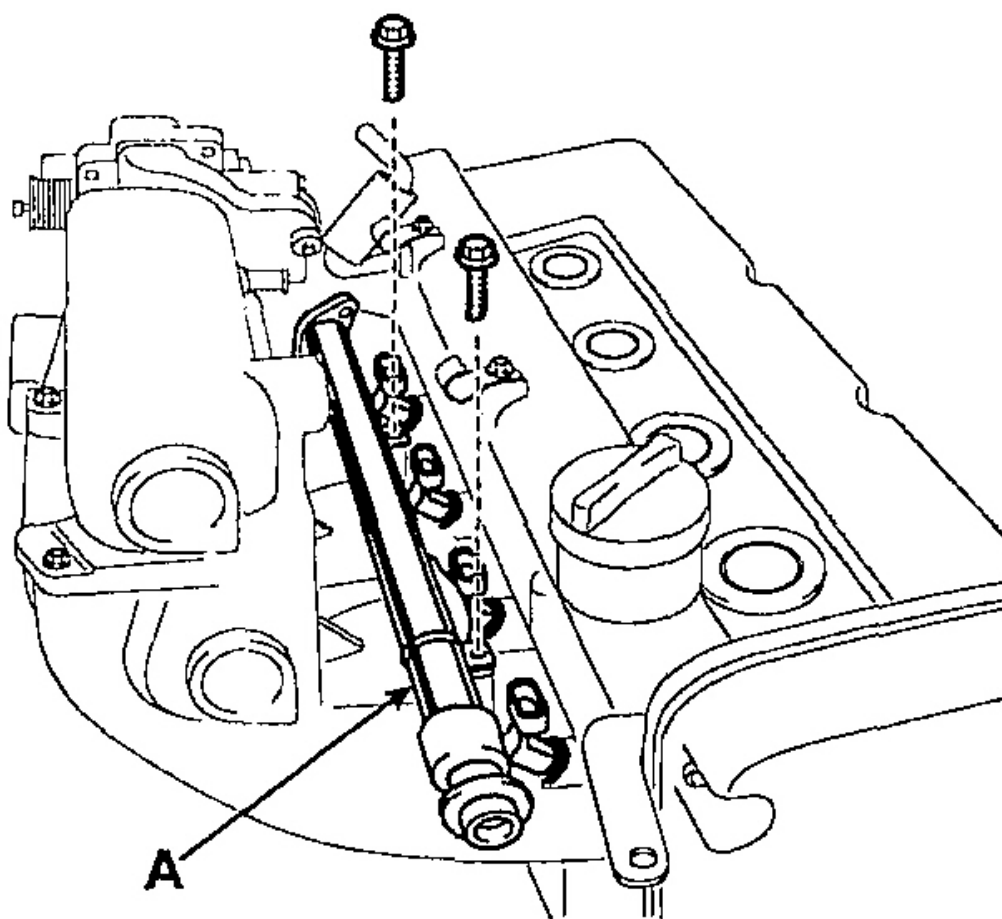


Fig. 244: PCV Hose

Courtesy of KIA MOTORS AMERICA, INC.

4. Disconnect the accelerator cable.
5. Remove the delivery pipe (A).

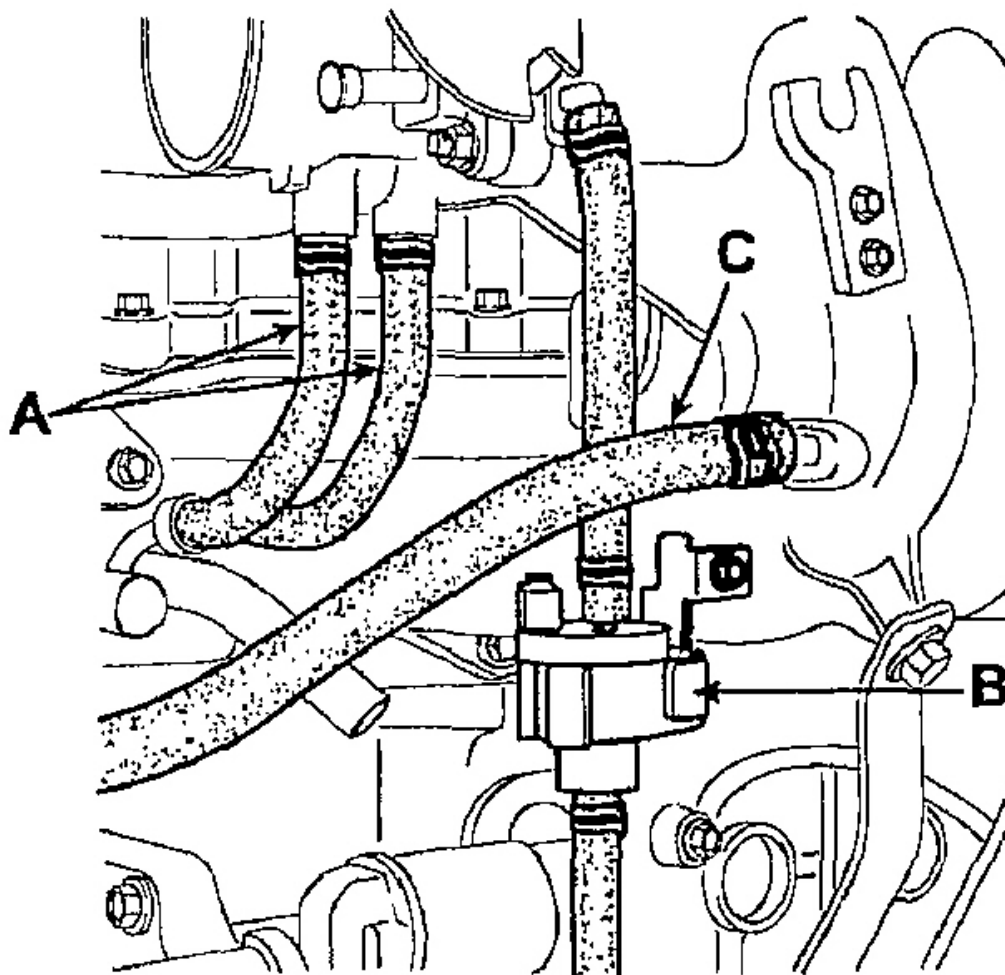
Tightening torque: 18.6-27.5 N.m (1.9-2.8 kg-m, 13.7-20.3 lb-ft)



G00719230

Fig. 245: Removing Delivery Pipe
Courtesy of KIA MOTORS AMERICA, INC.

6. Remove the heater hose (A), PCSV (Purge Control Solenoid Valve) (B) and the brake vacuum hose (C) from throttle body and intake manifold.

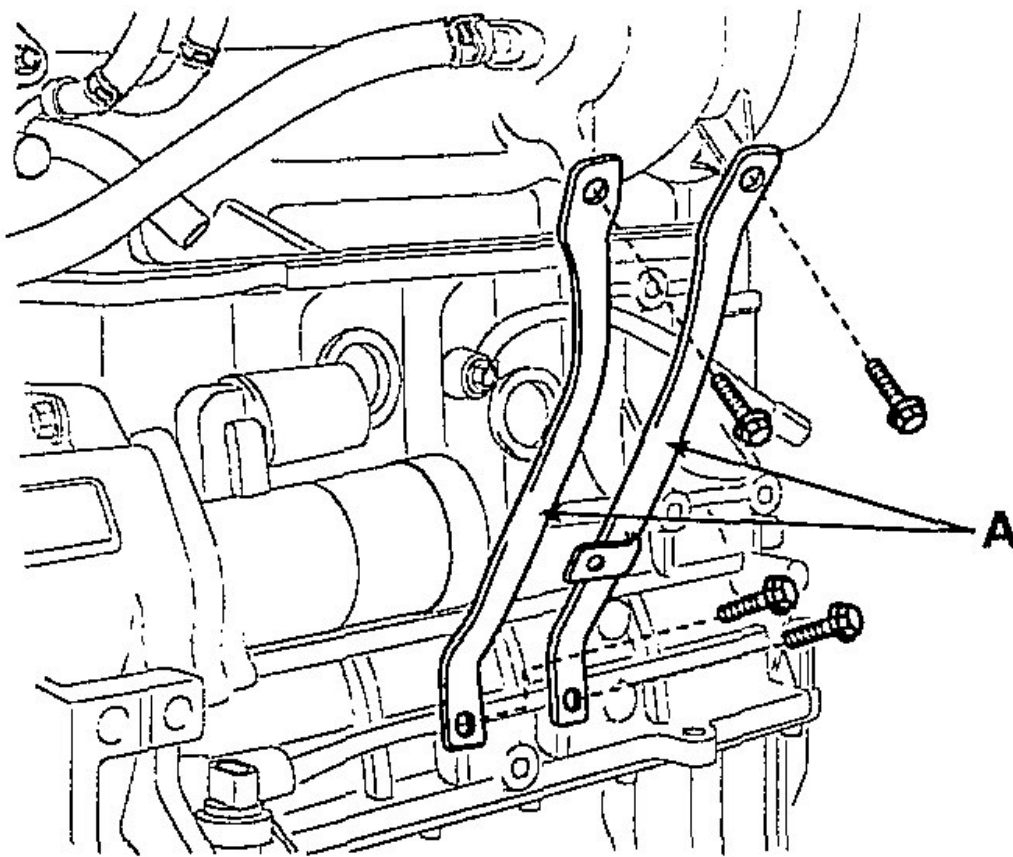


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Fig. 246: Removing Heater Hose, PCSV & Brake Vacuum Hose
Courtesy of KIA MOTORS AMERICA, INC.

7. Remove the intake manifold stay (A).

Tightening torque: 17.7-24.5 N.m (1.8-2.5 kg-m, 13.0-18.1 lb-ft)

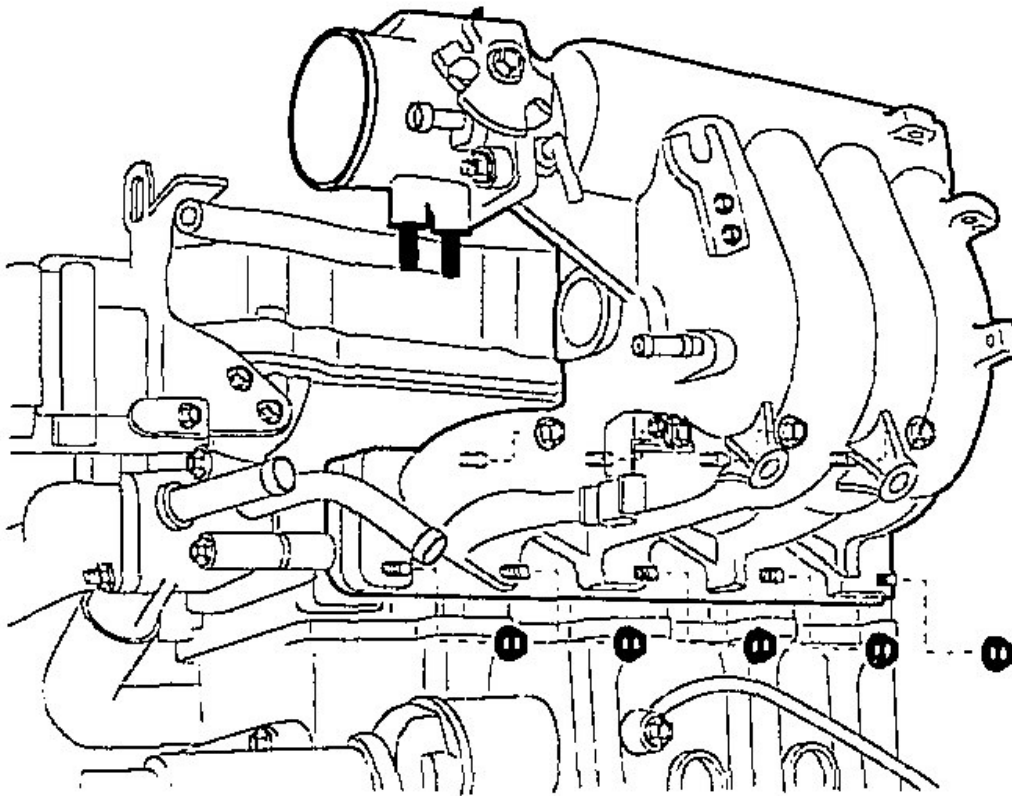


G00719232

Fig. 247: Removing Intake Manifold Stay
Courtesy of KIA MOTORS AMERICA, INC.

8. Remove the intake manifold.

Tightening torque: 15.7-22.6 N.m (1.6-2.3 kg-m, 11.6-16.6 lb-ft)

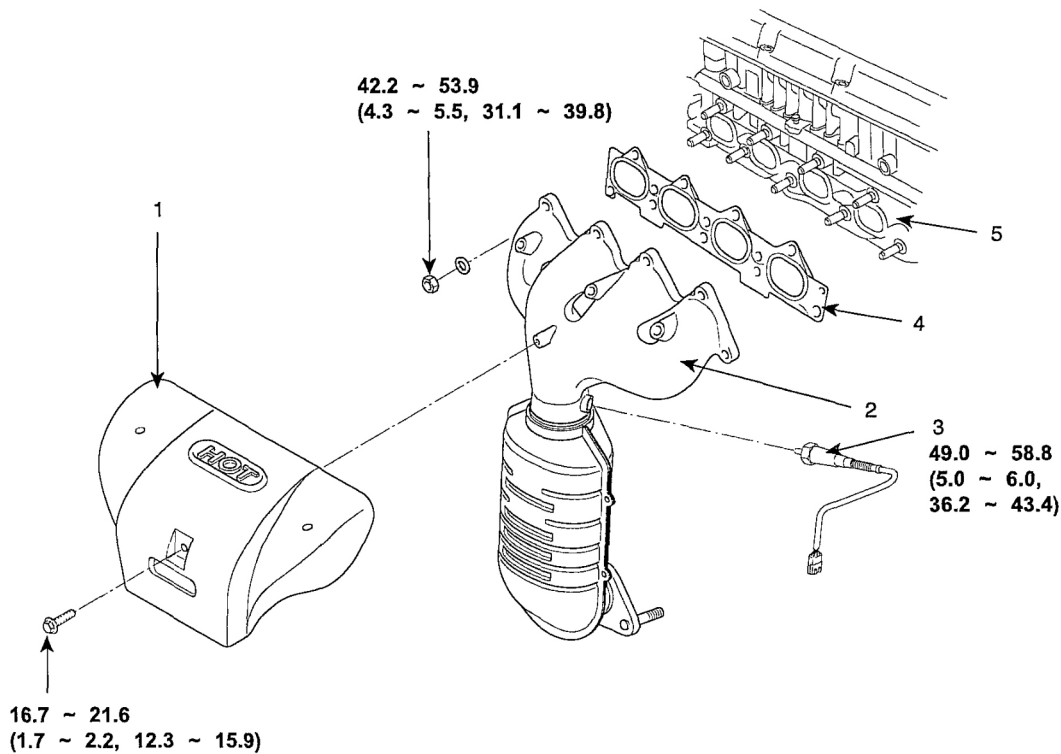


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Fig. 248: Removing Intake Manifold
Courtesy of KIA MOTORS AMERICA, INC.

EXHAUST MANIFOLD

COMPONENT



TORQUE : N-m (kg-m, lb-ft)

- 1. Heat protector
- 2. Exhaust manifold
- 3. Front oxygen sensor

- 4. Gasket
- 5. Cylinder head

G00719234

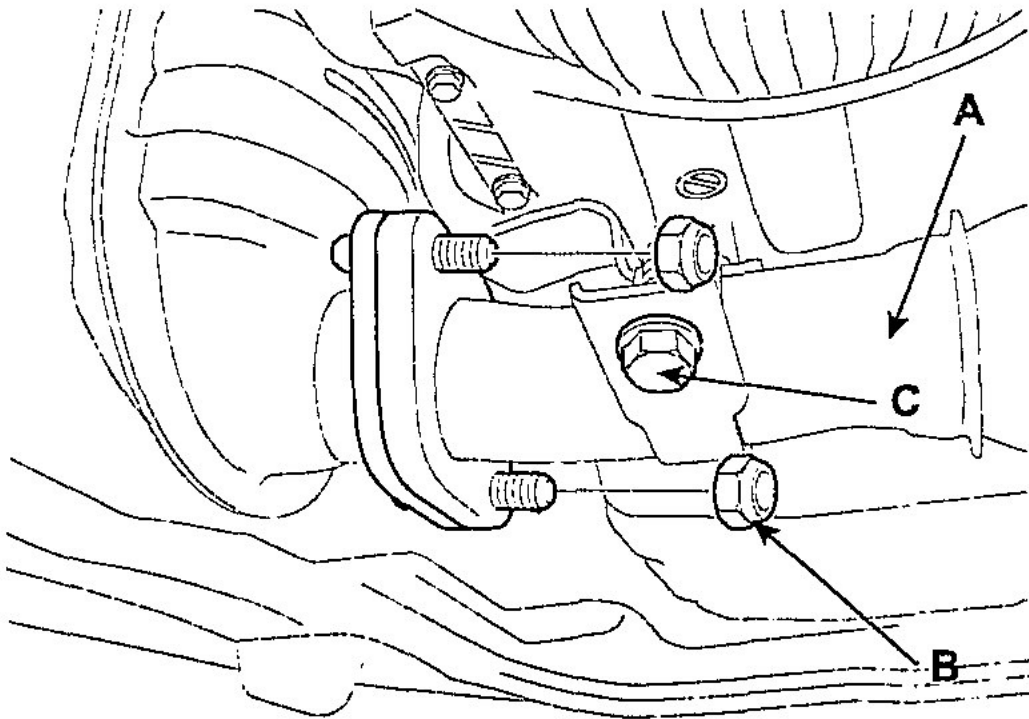
Fig. 249: Identifying Exhaust Manifold Components With Torque Specifications
 Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

1. Remove the engine cover.
2. Disconnect the front oxygen sensor connector.
3. Remove the front muffler (A).

Tightening torque:

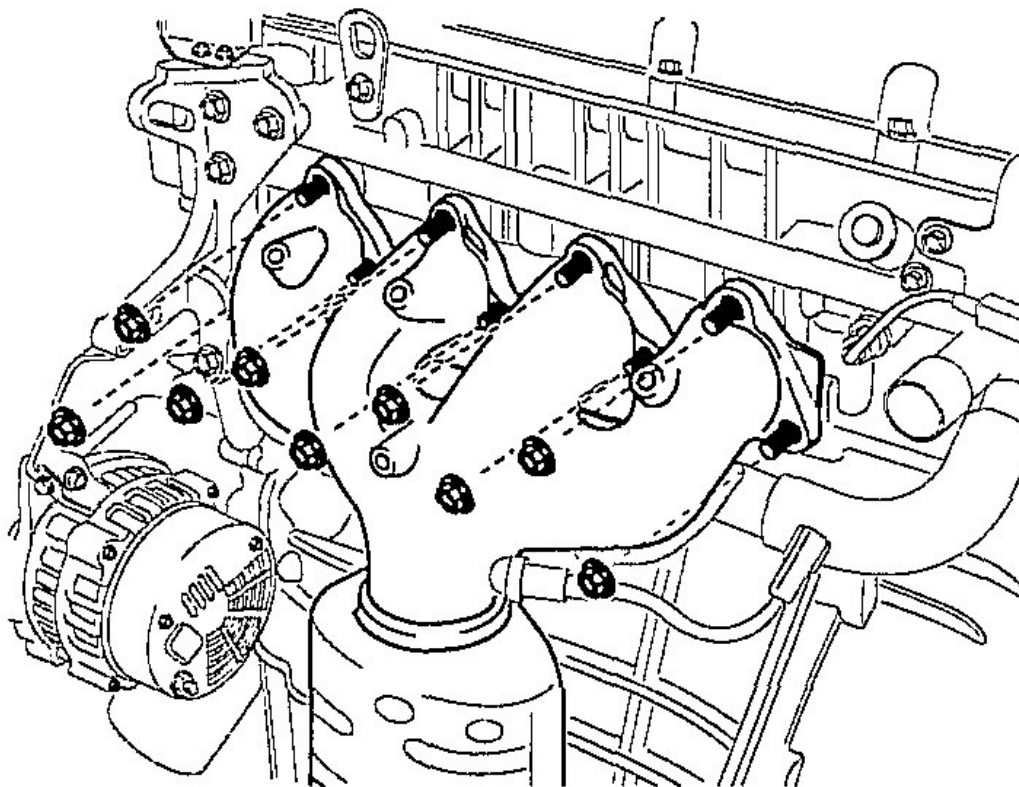
39.2 ~ 58.8 N.m (4.0 ~ 6.0 kgf.m, 28.9 ~ 43.4 lb-ft)



G00719236

Fig. 250: Removing Front Muffler
Courtesy of KIA MOTORS AMERICA, INC.

4. Remove the heat protector.
5. Remove the exhaust manifold and catalytic converter assembly (A).



G00719238

Fig. 251: Removing Exhaust Manifold & Catalytic Converter Assembly
Courtesy of KIA MOTORS AMERICA, INC.

6. To install, reverse the removal procedure with new gaskets.

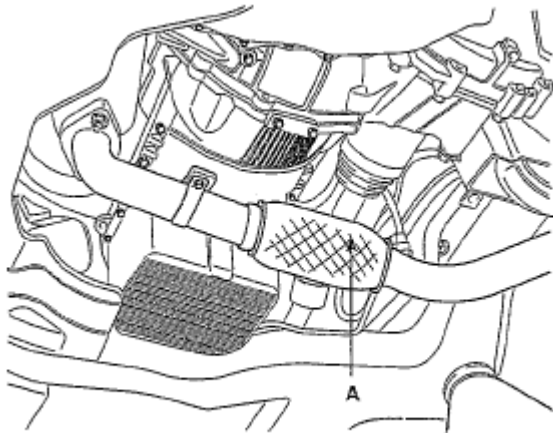
FRONT EXHAUST PIPE

REMOVAL

1. Remove the front muffler (A).

Tightening torque

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



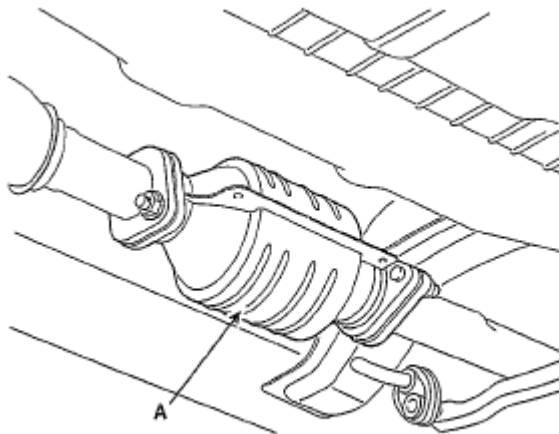
SLDM18003D

Fig. 252: Identifying Front Muffler
Courtesy of KIA MOTORS AMERICA, INC.

2. Remove the catalytic converter (A).

Tightening torque

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



SLDEM7027D

Fig. 253: Identifying Catalytic Converter
Courtesy of KIA MOTORS AMERICA, INC.

3. Remove the center muffler (A).

Tightening torque

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

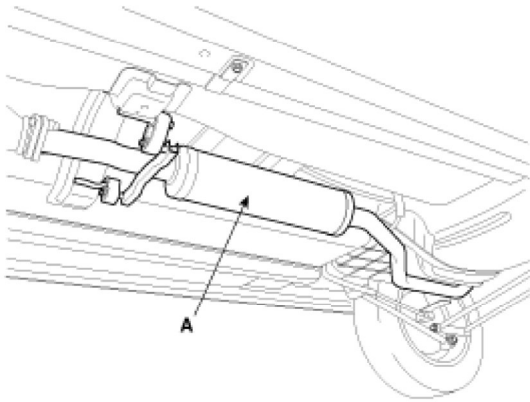


Fig. 254: Identifying Center Muffler
Courtesy of KIA MOTORS AMERICA, INC.

4. Remove the main muffler (A).

Tightening torque

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

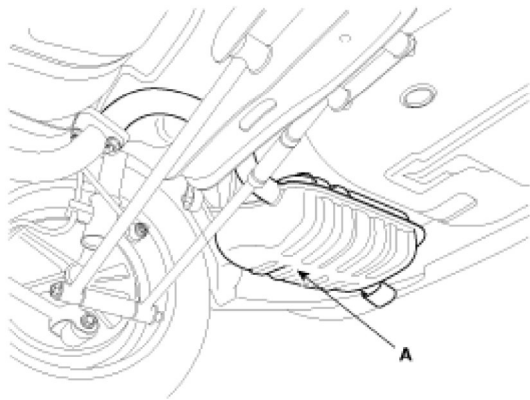


Fig. 255: Identifying Main Muffler
Courtesy of KIA MOTORS AMERICA, INC.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Camshaft Bearing Cap Bolts	10-11 (14-15)
Camshaft Sprocket Bolt	72-87 (98-118)
Connecting Rod Nut	36-38 (49-52)
Crankshaft Main Bearing Cap Bolt ⁽¹⁾	20-23 (27-31)
Crankshaft Pulley Bolt	123-130 (167-177)
Crankshaft Sprocket Bolt	72-87 (98-118)
Cylinder Head Bolts ⁽²⁾	

2009 Kia Spectra SX

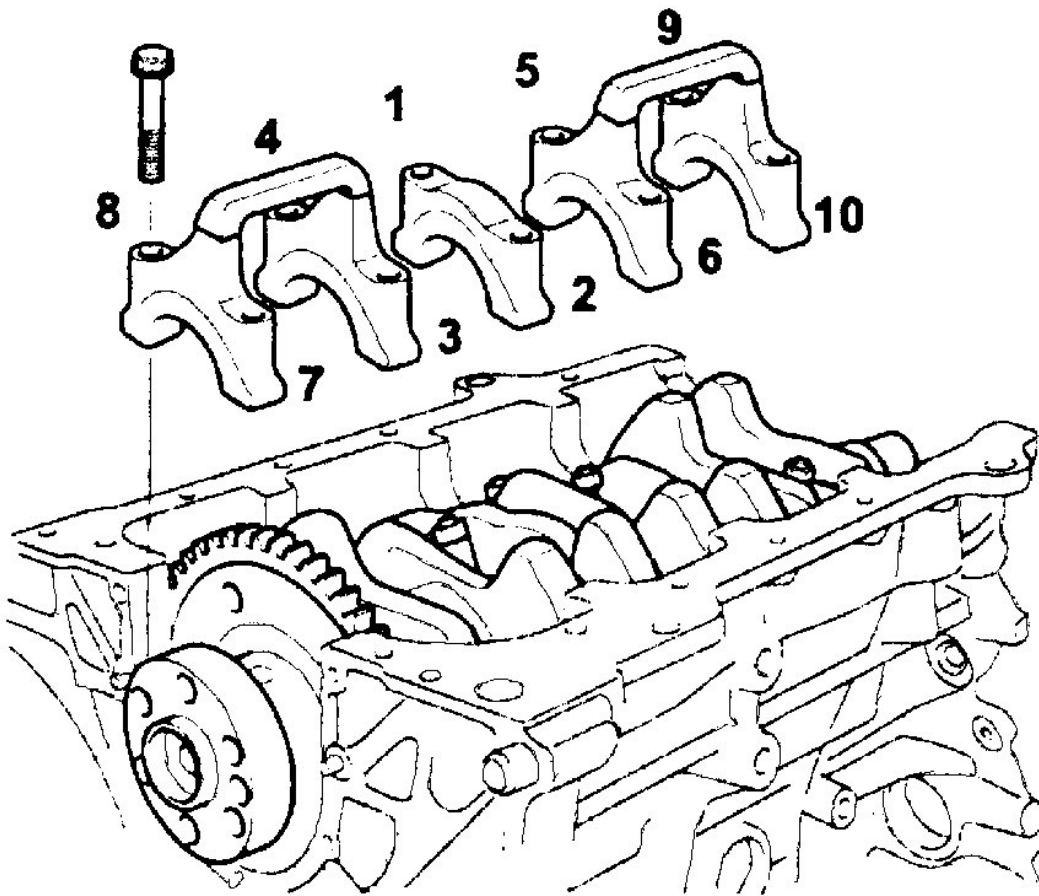
2009 ENGINES Engine Mechanical - Spectra & Spectra5

M10	17-20 (23-27)
M12	21-23 (28-31)
Drive Plate/Flywheel Bolt	87-94 (118-128)
Engine Mounting Bracket & Body Fixing Bolts	29-36 (39-49)
Engine Mounting Insulator & Engine Mounting Support Bracket Fixing Nuts	51-69 (69-93)
Engine Mounting Support Bracket & Engine Support Bracket Fixing Bolts & Nuts	36-47 (49-64)
Engine Support Bracket Bolts	25-36 (34-49)
Engine Support Bracket Stay Plate Bolt	31-40 (42-54)
Exhaust Camshaft & CVVT Assembly Fixing Bolt	48-57 (65-77)
Exhaust Manifold & Cylinder Head Fixing Nut	31-40 (42-54)
Exhaust Manifold & Front Muffler Fixing Bolt	29-44 (39-59)
Exhaust Manifold Heat Cover & Exhaust Manifold Fixing Bolt	12-16 (17-22)
Front Case Bolts	15-20 (20-27)
Front & Center Muffler Fixing Nut	29-44 (39-59)
Front Muffler Fixing Clip Bolt	21-29 (29-39)
Front Roll Stopper Bracket & Sub Frame Fixing Bolts	29-36 (39-49)
Front Roll Stopper Insulator & Rear Roll Stopper Support Bracket Fixing Bolt & Nut	36-47 (49-64)
Intake Manifold & Cylinder Head Fixing Nut	12-17 (16-23)
Intake Manifold Stay Bolt	13-18 (18-25)
Oil Control Valve (OVC) Filter	30-37 (41-50)
Oil Filter	9-12 (12-16)
Oil Pan Drain Bolt	29-32 (39-44)
Oil Pan & Transaxle Fixing Bolt	22-30 (30-41)
Oil Pressure Switch	11-16 (15-22)
Oil Pump Bolt	14-19 (19-26)
Oil Screen Bolt	11-16 (15-22)
O2 Sensor-To-Exhaust Manifold	36-44 (49-59)
Rear Roll Stopper Bracket & Sub Frame Fixing Bolts	29-36 (39-49)
Rear Roll Stopper Insulator & Rear Roll Stopper Support Bracket Fixing Bolt & Nut	36-47 (49-64)
Thermostat Housing Bolt & Nut	11-15 (15-20)
Timing Belt Tensioner & Idler Bolt	31-40 (42-54)
Transaxle Mounting Bracket & Body Fixing Bolt	29-36 (39-49)
Transaxle Mounting Insulator & Transaxle Support Bracket Fixing Bolt	65-80 (88-108)
Water Inlet Fitting Nut	11-15 (15-20)
Water Temperature Sensor	15-29 (20-39)
Water Pump Alternator Brace & Fixing Bolt	15-20 (20-27)
Water Pump & Alternator Brace & Cylinder Block Fixing Bolt	9-11 (12-15)

2009 Kia Spectra SX

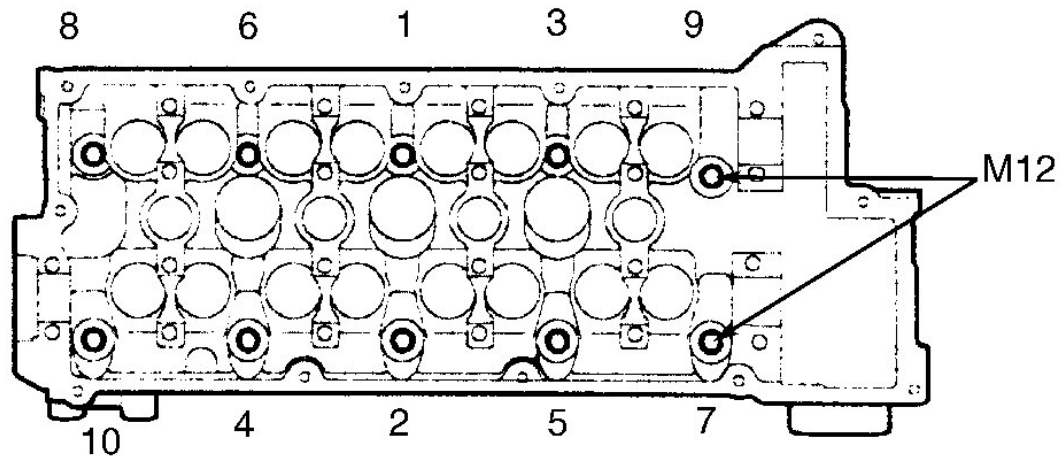
2009 ENGINES Engine Mechanical - Spectra & Spectra5

Water Pump Bolts	9-11 (12-15)
	INCH Lbs. (N.m)
Air Cleaner Lower Cover Fixing Bolt	71-89 (8-10)
Air Duct Fixing Bolt	71-89 (8-10)
Cylinder Head Cover Bolt	71-80 (8-9)
Engine Cover Bolt	35-53 (4-6)
Oil Control Valve (OVC) Bolt	89-106 (10-12)
Oil Pan Bolts	89-106 (10-12)
Timing Belt Cover Bolts	71-89 (8-10)
Timing Belt Under Cover Bolt	89-106 (10-12)
Timing Chain Auto Tensioner Bolt	71-89 (8-10)
Water Pump Pulley Bolt	71-89 (8-10)
(1) Tighten in several passes, in sequence. See Fig. 256 .	
(2) Tighten in several passes, in sequence. See Fig. 257 .	



G00351837

Fig. 256: Main Bearing Cap Bolt Tightening Sequence
 Courtesy of KIA MOTORS AMERICA, INC.



G00351838

Fig. 257: Cylinder Head Bolt Tightening Sequence
Courtesy of KIA MOTORS AMERICA, INC.