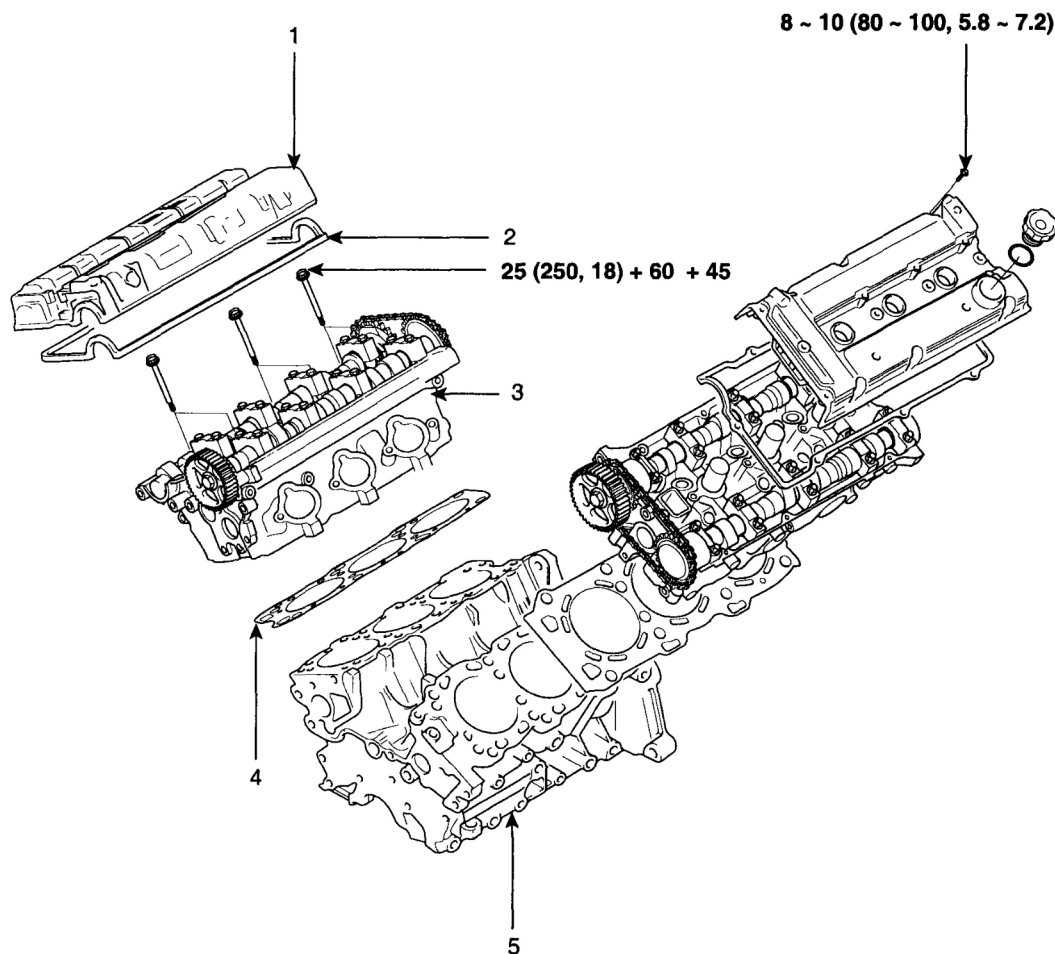


2008 ENGINE

Cylinder Head Assembly - 2.7L - Sportage

COMPONENTS

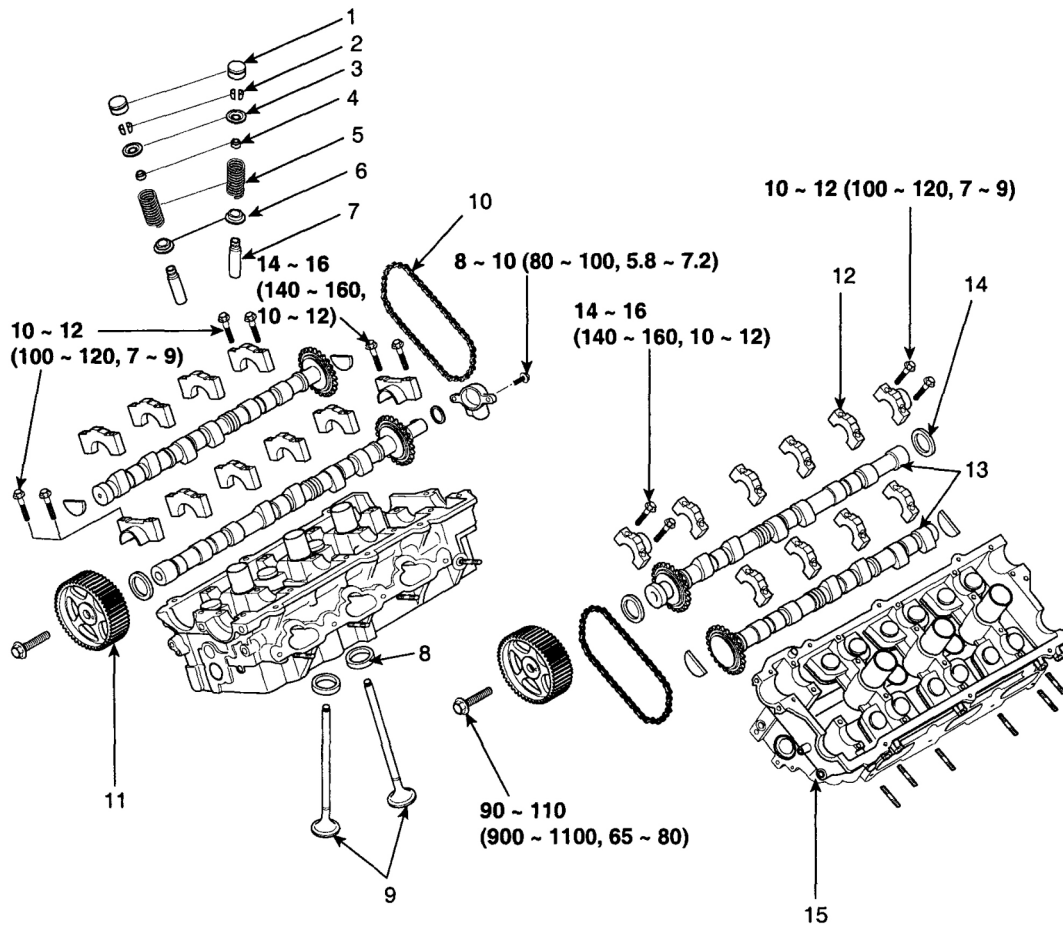


TORQUE : N.m (kgf.cm, lb-ft)

- | | |
|------------------------|-------------------------|
| 1. Cylinder head cover | 4. Cylinder head gasket |
| 2. Gasket | 5. Cylinder block |
| 3. Cylinder head | |

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



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

- | | |
|-------------------------------|--------------------------|
| 1. HLA | 9. Valve |
| 2. Valve spring retainer lock | 10. Timing chain |
| 3. Valve spring retainer | 11. Camshaft sprocket |
| 4. Valve stem seal | 12. Camshaft bearing cap |
| 5. Valve spring | 13. Camshaft |
| 6. Valve spring seat | 14. Oil seal |
| 7. Valve guide | 15. Cylinder head |
| 8. Valve seat | |

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

REMOVAL

Engine removal is not required for this procedure.

- CAUTION:**
- Use fender covers to avoid damaging painted surfaces.
 - To avoid damaging the cylinder head, wait until the engine coolant

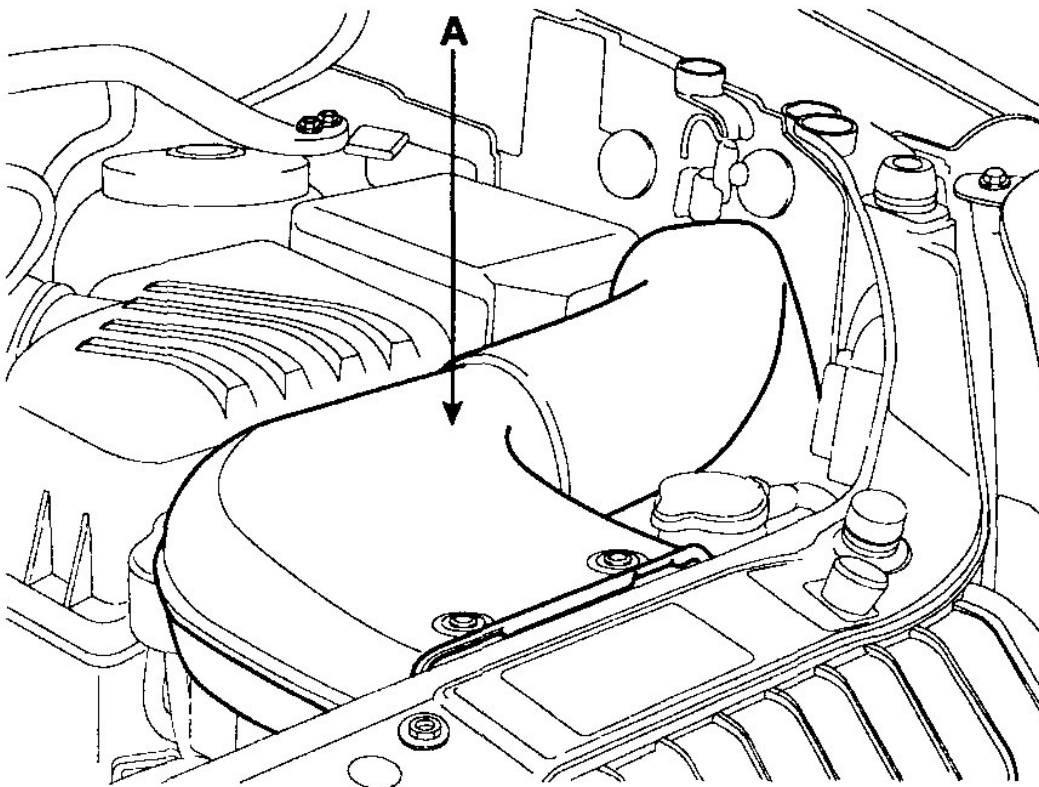
temperature drops below normal temperature before removing it.

- 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. (See **REMOVAL**).

1. Remove the air duct (A).

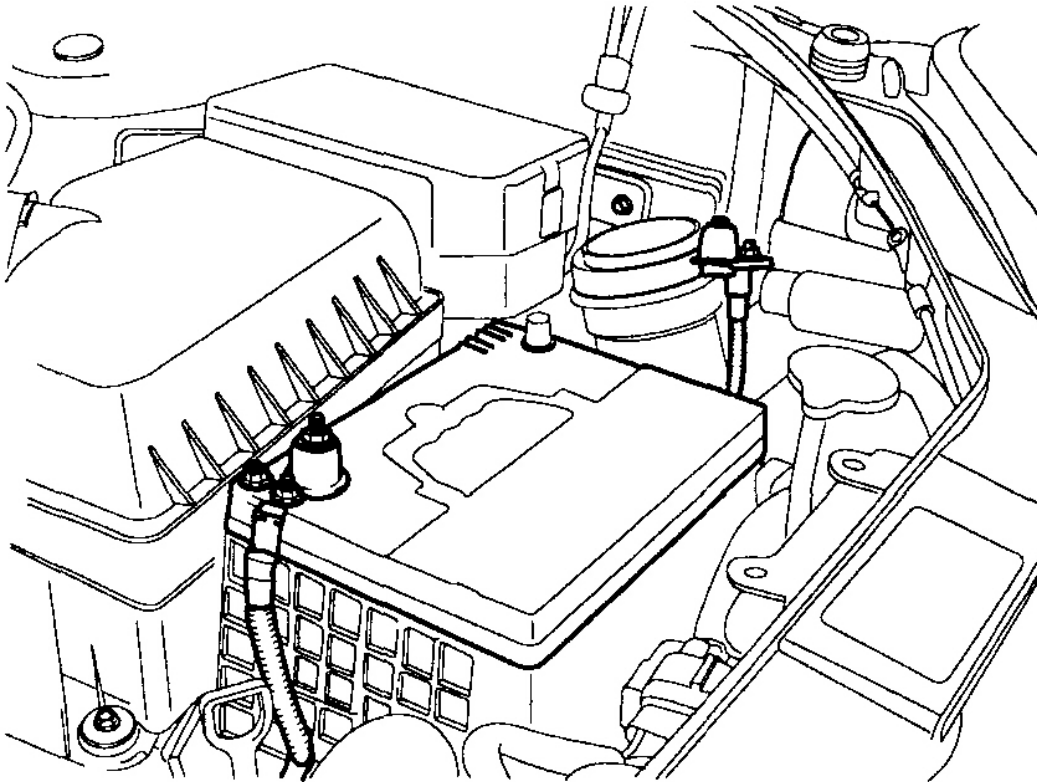


G03821289

Fig. 3: Removing Air Duct**Courtesy of KIA MOTORS AMERICA, INC.**

2. Remove the cowl grill and wiper motor. (Refer to **FRONT WIPER MOTOR**)

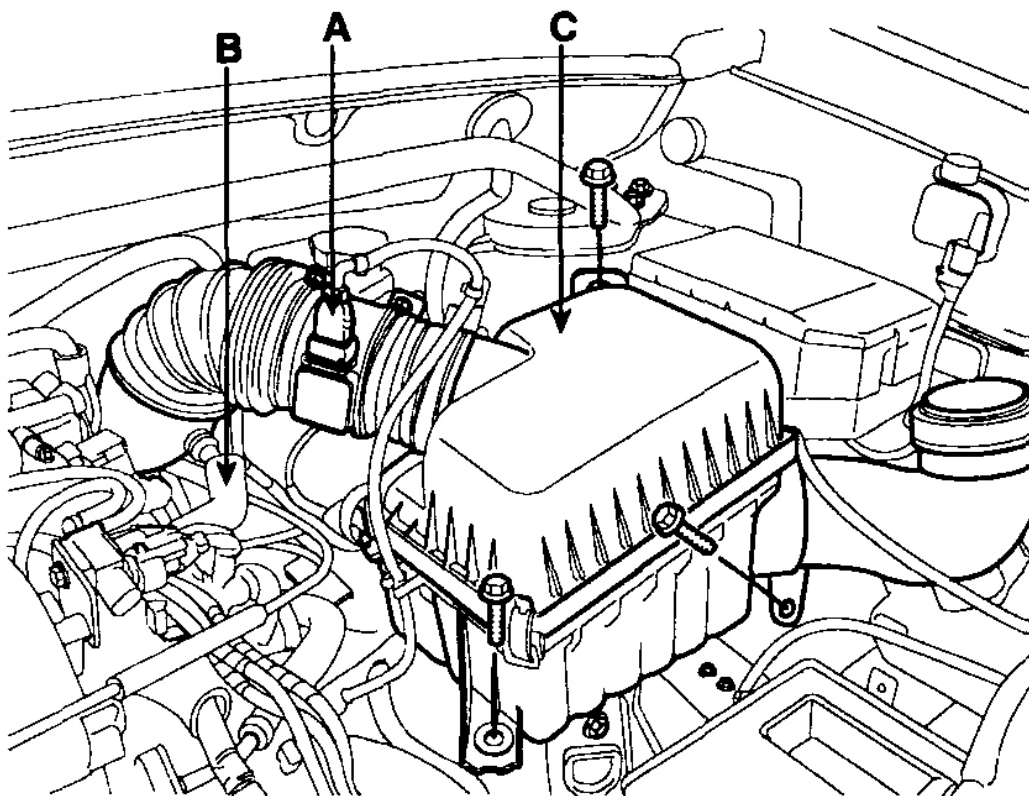
3. Remove the strut bar.
4. Disconnect the negative terminal from the battery.



G03821290

Fig. 4: Disconnecting Negative Terminals From Battery
Courtesy of KIA MOTORS AMERICA, INC.

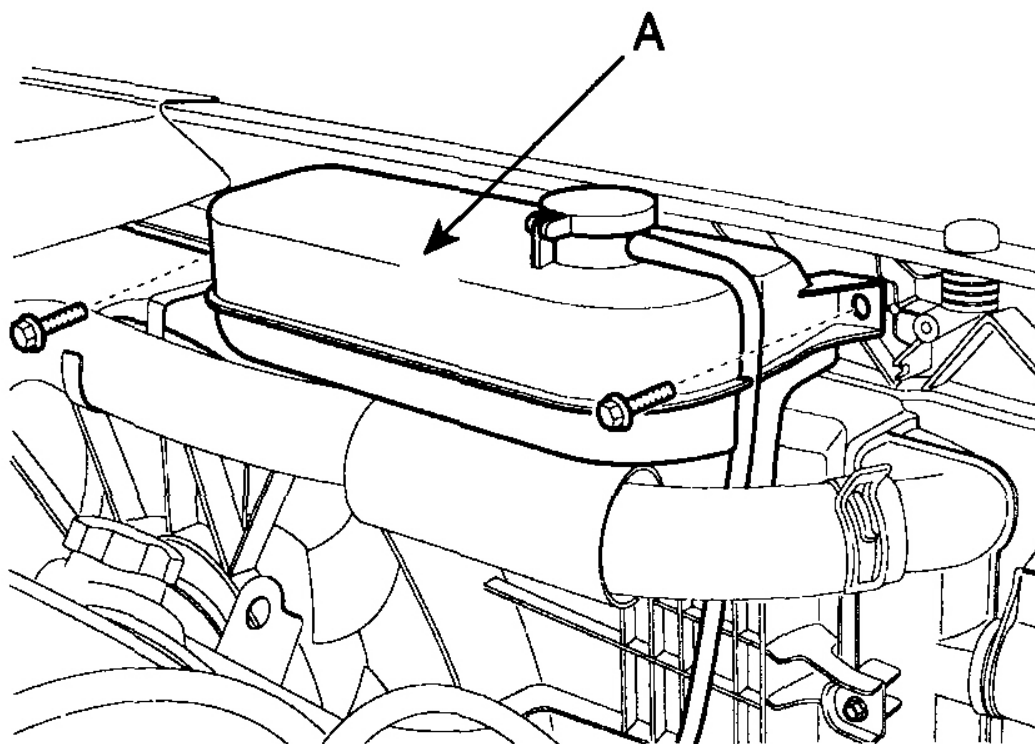
5. Drain the engine coolant. (See **ENGINE COOLANT REFILLING AND BLEEDING**) Remove the radiator cap to speed draining.
6. Remove the engine cover.
7. Remove the intake air hose and air cleaner assembly.
 1. Disconnect the AFS connector (A).
 2. Disconnect the breather hose (B) from air cleaner hose.
 3. Remove the intake air hose and air cleaner assembly (C).



G03821291

Fig. 5: Removing Intake Air Hose And Air Cleaner Assembly
Courtesy of KIA MOTORS AMERICA, INC.

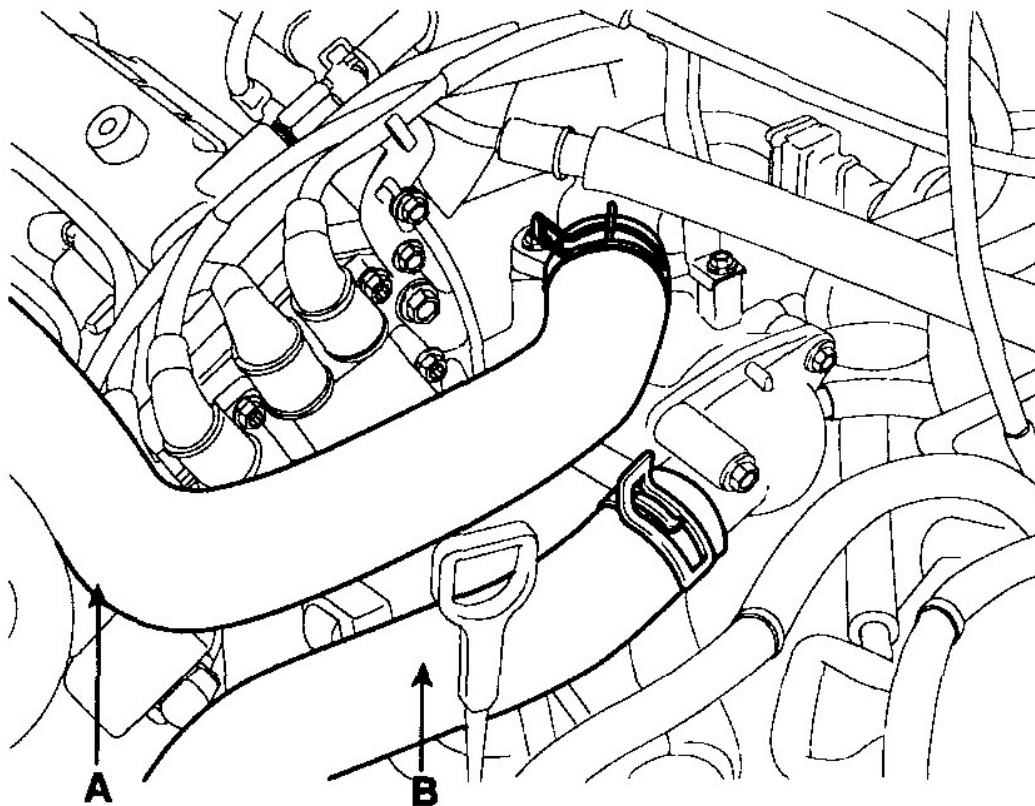
8. Remove the coolant reservoir tank (A).



G03821292

Fig. 6: Removing Coolant Reservoir Tank
Courtesy of KIA MOTORS AMERICA, INC.

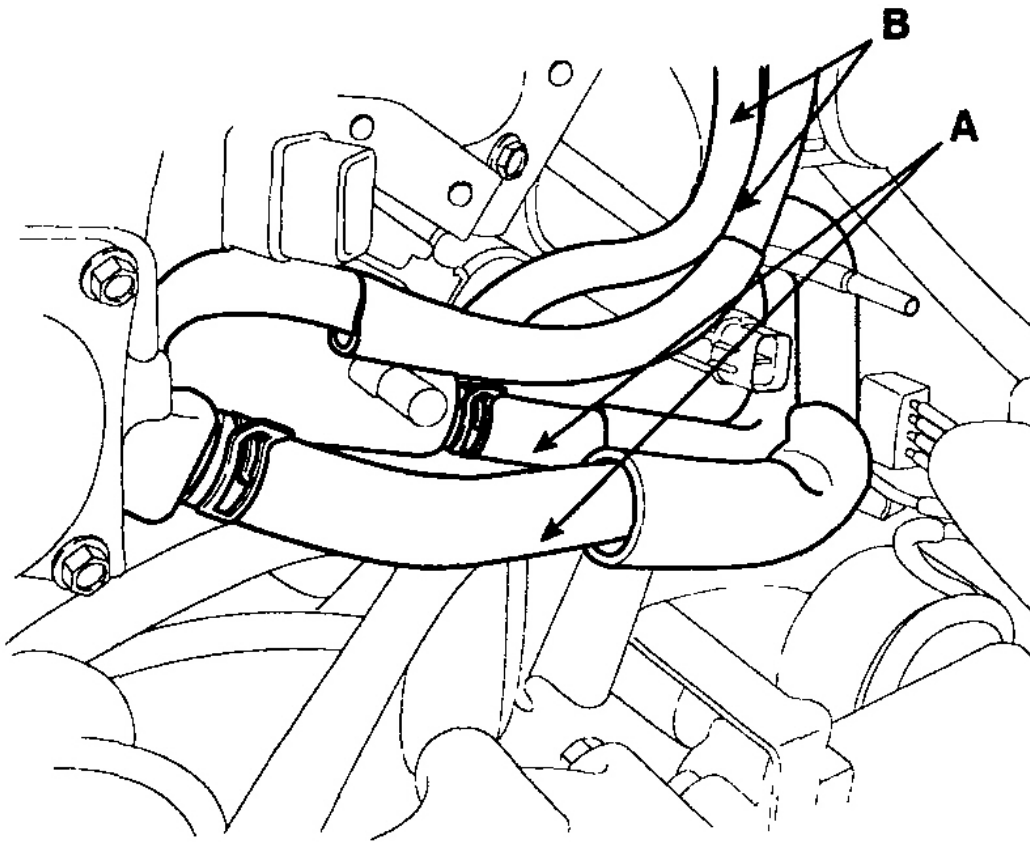
9. Remove the upper radiator hose (A) and lower radiator hose (B).



G03821293

Fig. 7: Removing Upper And Lower Radiator Hose
Courtesy of KIA MOTORS AMERICA, INC.

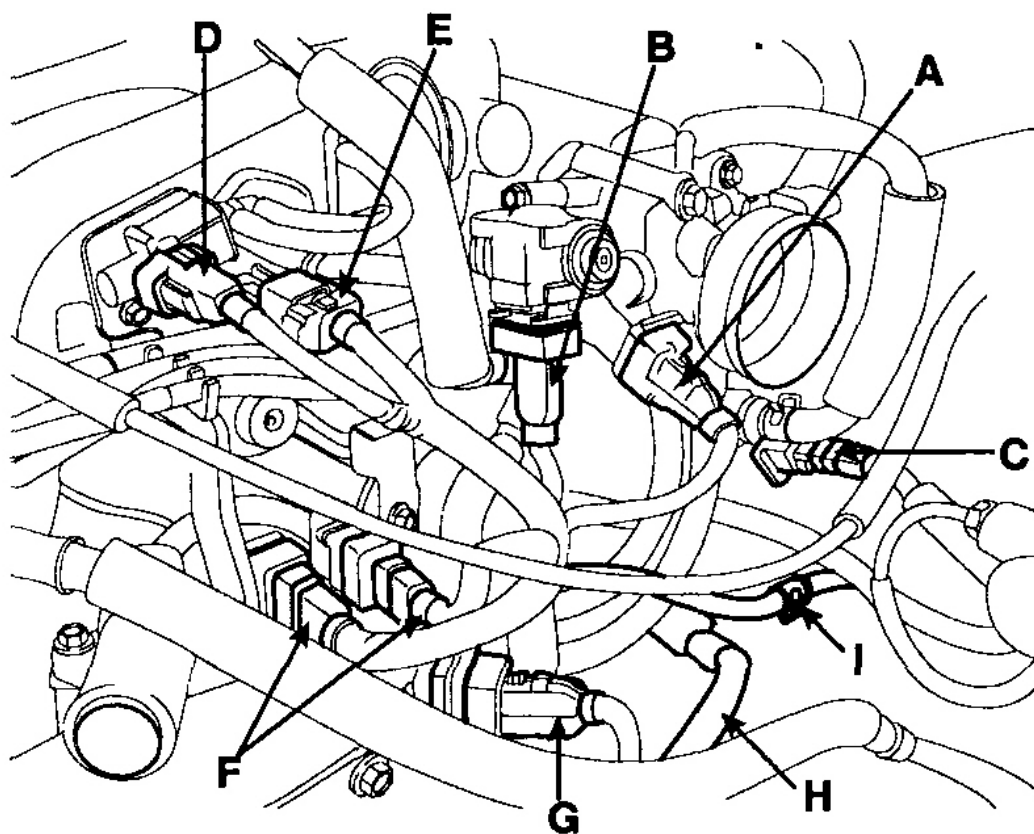
10. Remove the heater hoses (A) and throttle body heater hose (B).



G03821294

Fig. 8: Removing Heater Hoses And Throttle Body Heater Hose
Courtesy of KIA MOTORS AMERICA, INC.

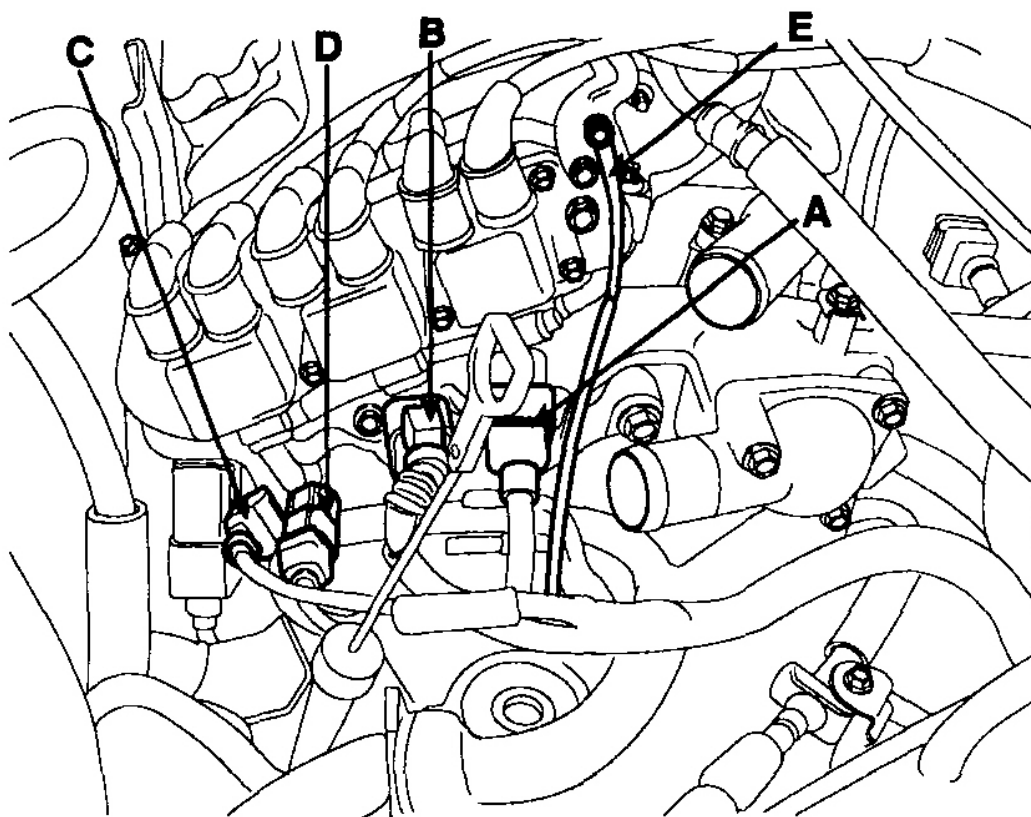
11. Remove the engine wire harness connectors and wire harness clamps from the cylinder head and the intake manifold.
 1. TPS (Throttle Position Sensor) connector (A).
 2. ISA (Idle Speed Actuator) connector (B).
 3. PCSV (Purge Control Solenoid Valve) connector (C).
 4. VIS actuator connector (D).
 5. Injector connector (E).
 6. Knock sensor connectors (F).
 7. CMP (Camshaft Position Sensor) connector (G).
 8. Oxygen sensor (rear 1st) connector (H).
 9. PCSV (Purge Control Solenoid Valve) hose (I).



G03821295

Fig. 9: Removing TPS, ISA, PCSV, VIS, CMP And Injector Connector And PCSV Hose
Courtesy of KIA MOTORS AMERICA, INC.

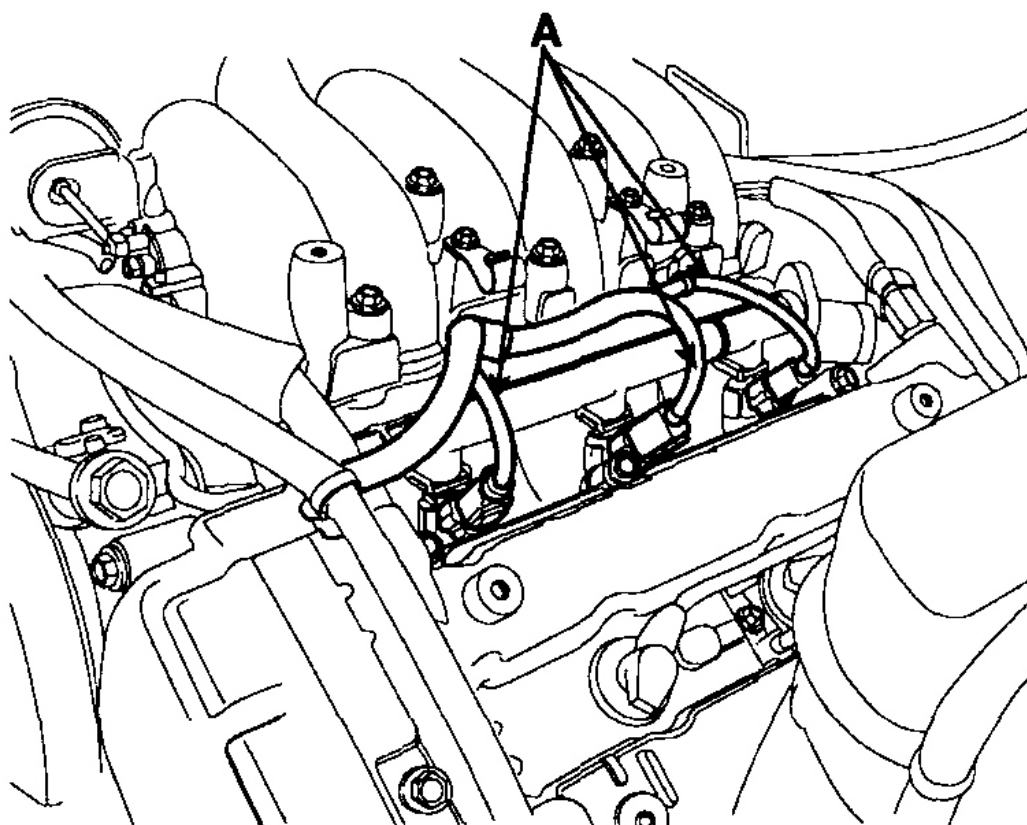
10. ECT (Engine Coolant Temperature) sensor connector (A).
11. Ignition coil connector (B).
12. Crankshaft position sensor connector (C).
13. Oxygen sensor (Front 2nd) connector (D).
14. Ground cable (E).



G03821296

Fig. 10: Removing ECT, CPS, Oxygen Sensor And Ignition Coil Connector
Courtesy of KIA MOTORS AMERICA, INC.

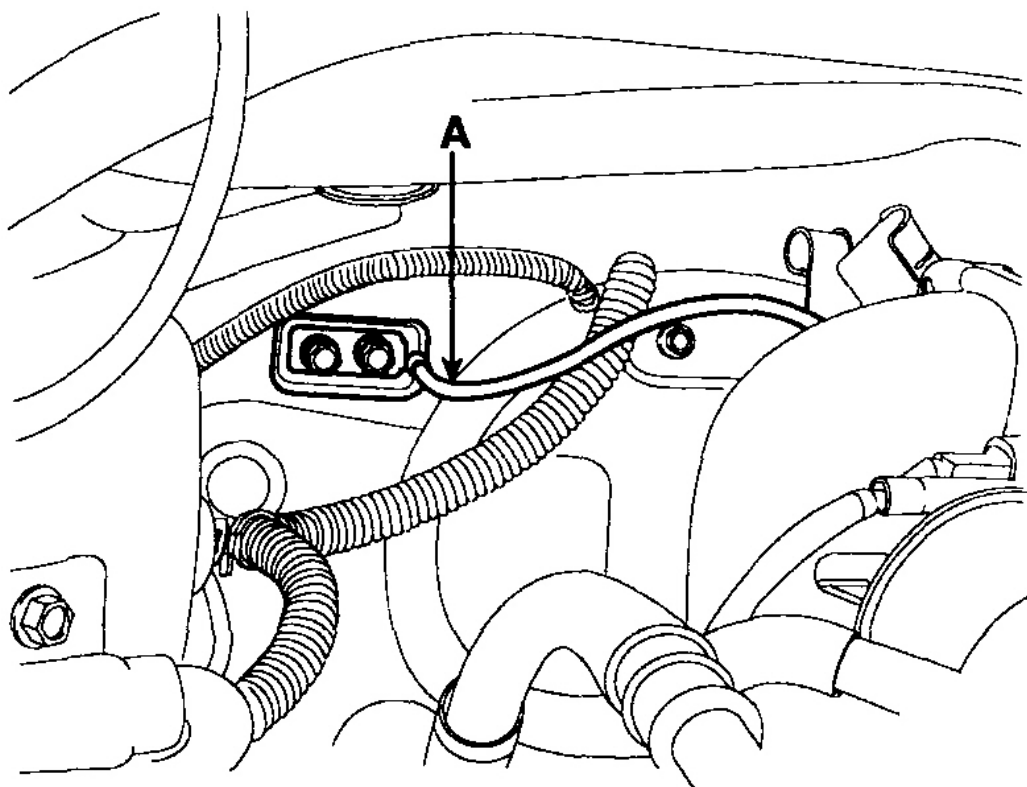
15. Three fuel injector connectors (A).



G03821297

Fig. 11: Removing Fuel Injector Connectors
Courtesy of KIA MOTORS AMERICA, INC.

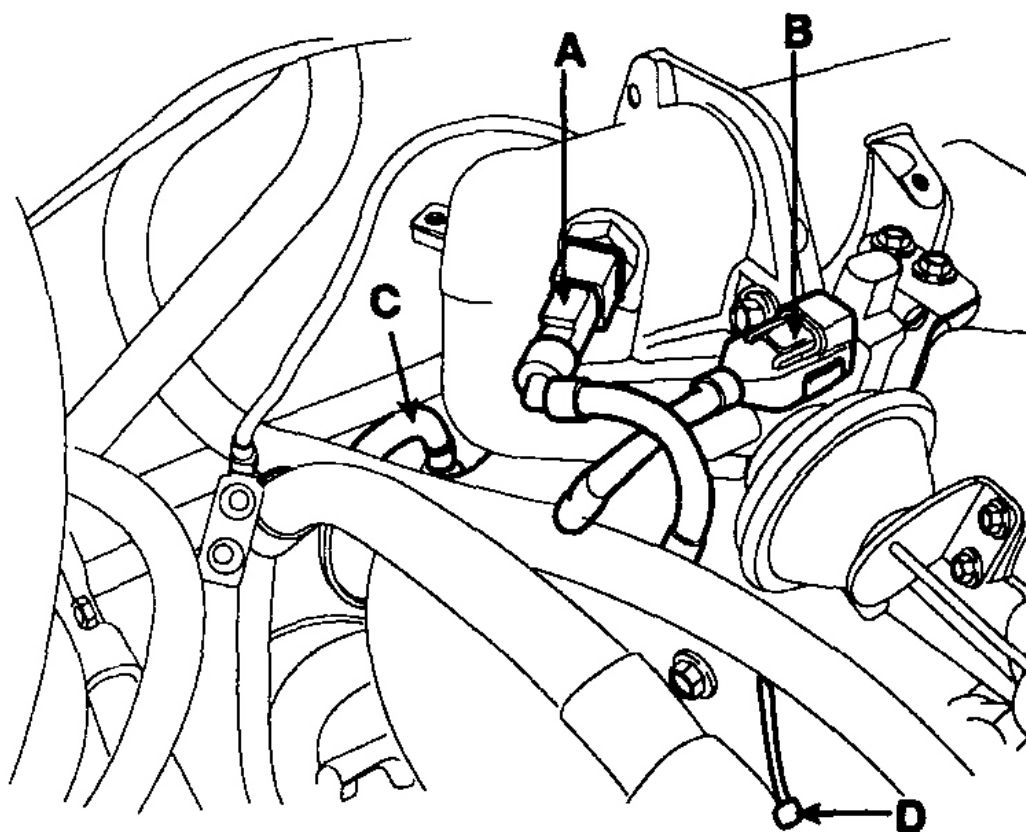
16. Disconnect ground cable (A) from the cowl panel.



G03821298

Fig. 12: Disconnecting Ground Cable From Cowl Panel
Courtesy of KIA MOTORS AMERICA, INC.

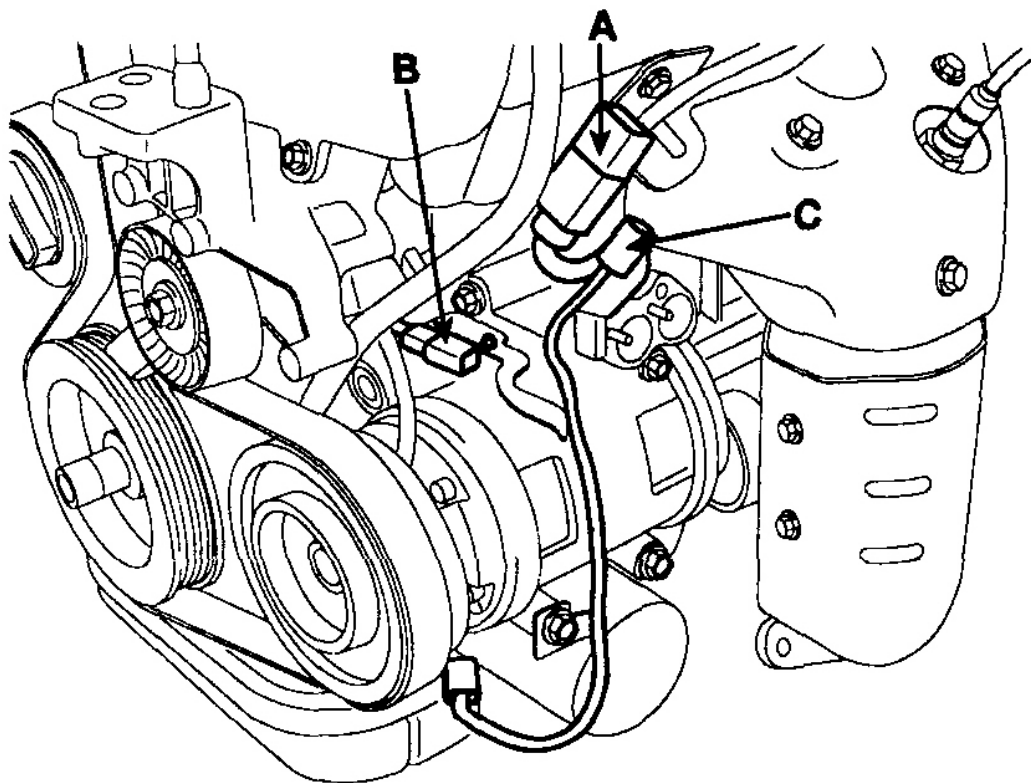
- 17. IAT (Intake Air Temperature) sensor connector (A).
- 18. VIS actuator connector (B).
- 19. Oxygen sensor (rear 2nd) connector (C).
- 20. Power steering pump switch (D).



G03821299

Fig. 13: Removing IAT, VIS, Oxygen Sensor Connector And Power Steering Pump Switch
Courtesy of KIA MOTORS AMERICA, INC.

21. Oxygen sensor (Front 1st) connector (A).
22. Air conditioner compressor switch connector (B).
23. Oil pressure sensor connector (C).

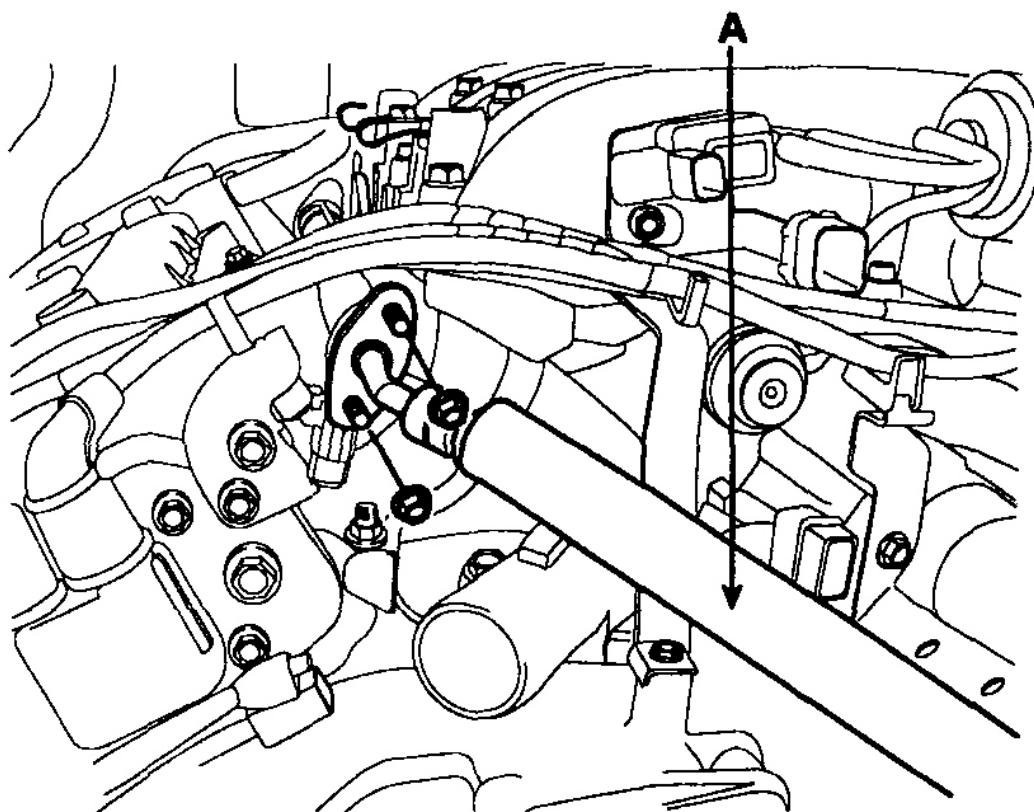


G03821300

Fig. 14: Removing Oxygen Sensor, Air Conditioner Compressor Switch And Oil Pressure Sensor Connector

Courtesy of KIA MOTORS AMERICA, INC.

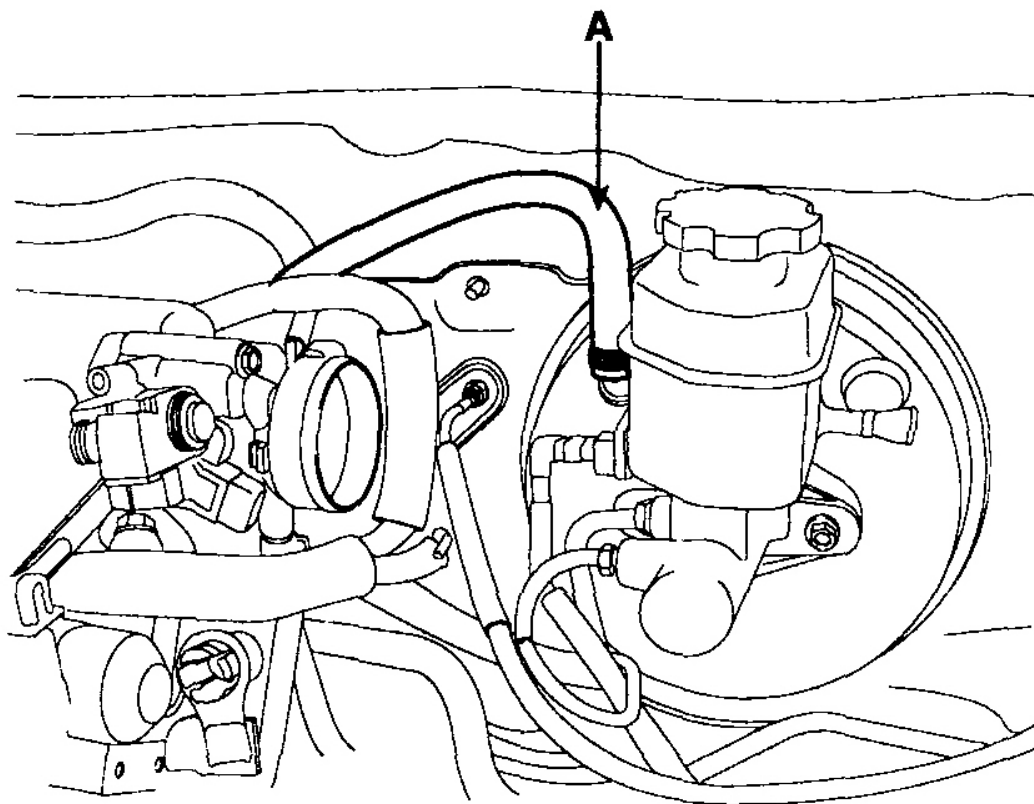
12. Remove the fuel inlet hose (A) from delivery pipe.



G03821301

Fig. 15: Removing Fuel Inlet Hose From Delivery Pipe
Courtesy of KIA MOTORS AMERICA, INC.

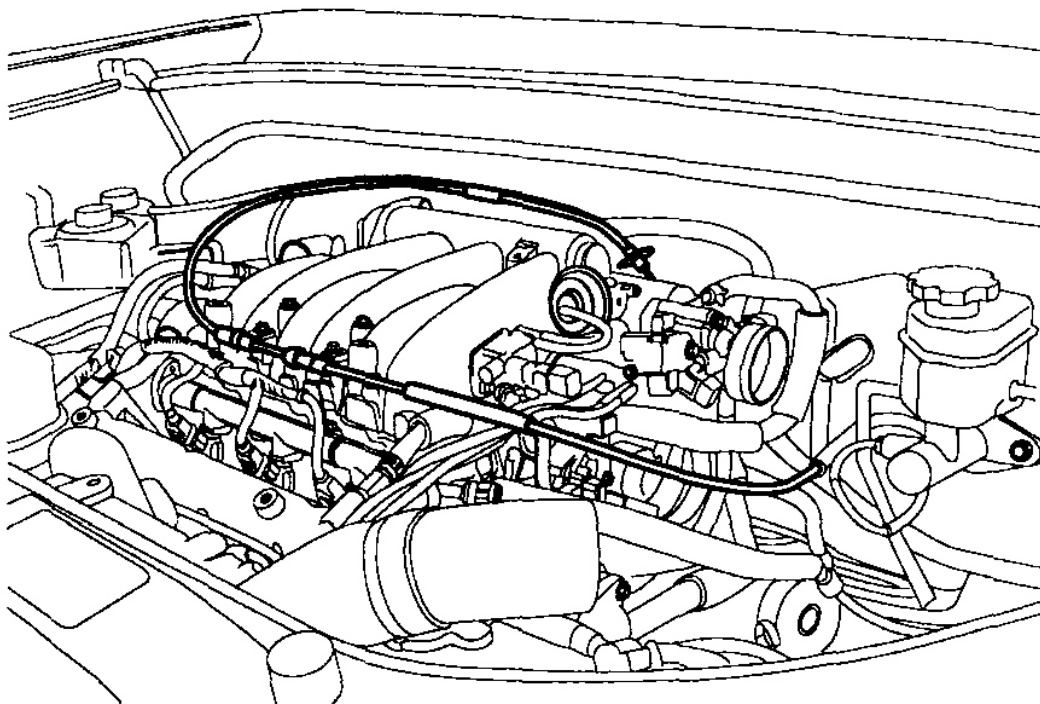
13. Remove the brake booster vacuum hose (A).



G03821302

Fig. 16: Removing Brake Booster Vacuum Hose
Courtesy of KIA MOTORS AMERICA, INC.

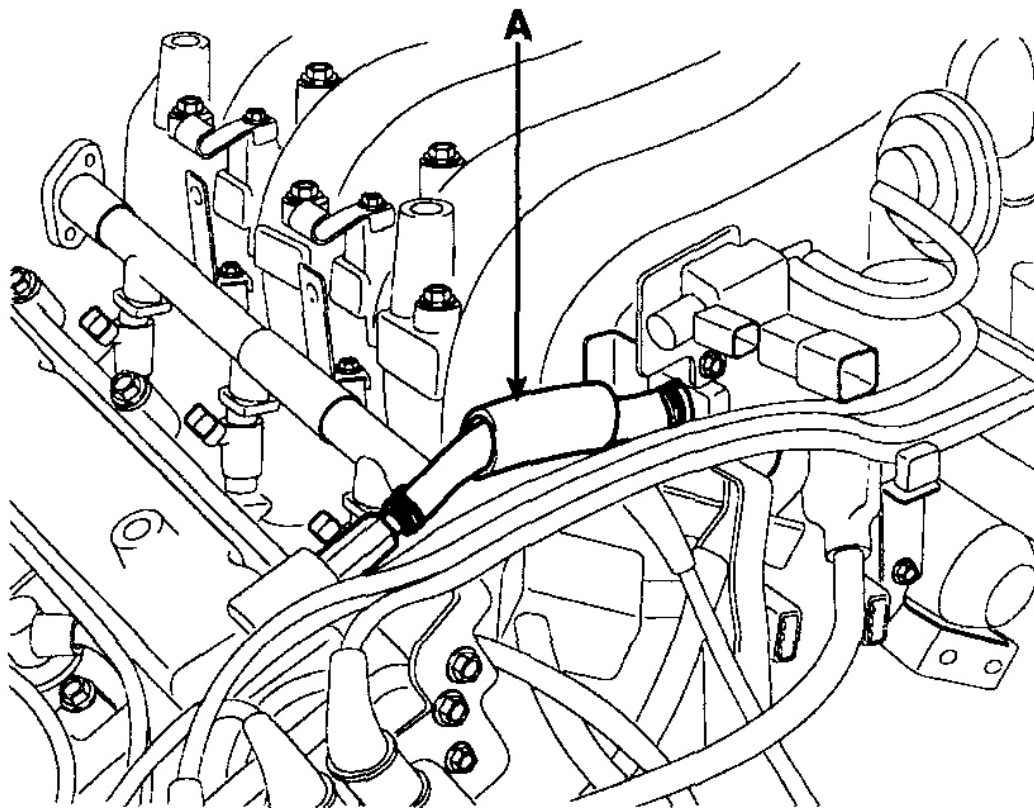
14. Remove the accelerator cable by loosening the lock-nut, then slip the cable end out of the throttle linkage.



G03821303

Fig. 17: Removing Accelerator Cable
Courtesy of KIA MOTORS AMERICA, INC.

15. Remove the PCV hose (A).

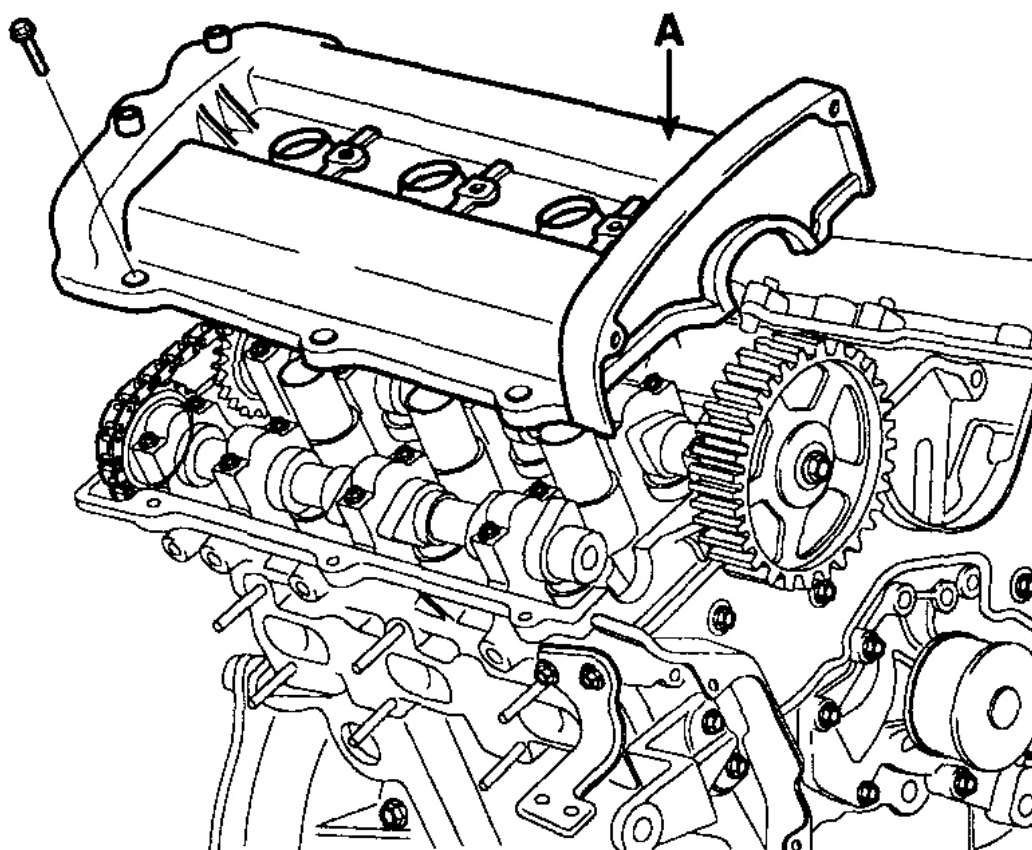


G03821304

Fig. 18: Removing PCV Hose

Courtesy of KIA MOTORS AMERICA, INC.

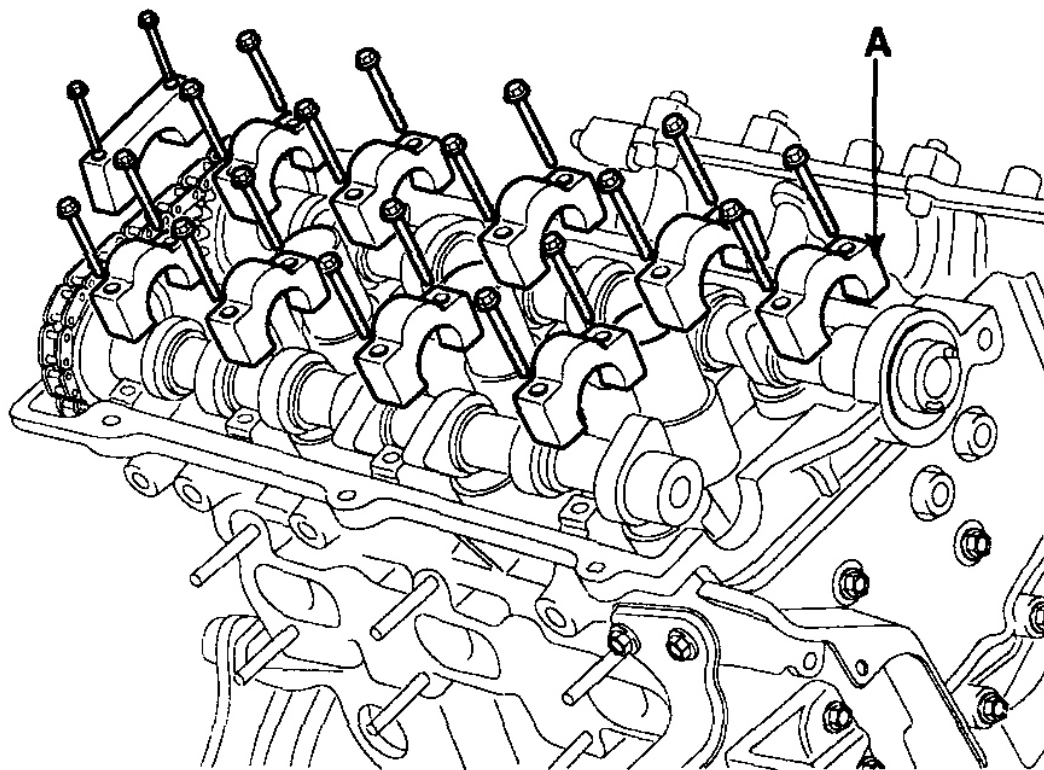
16. Remove the intake manifold. (See **INTAKE AND EXHAUST SYSTEM - 2.7L**)
17. Remove the power steering pump. (**POWER STEERING OIL PUMP**).
18. Remove the exhaust manifold. (See **INTAKE AND EXHAUST SYSTEM - 2.7L**)
19. Remove the timing belt. (See **TIMING SYSTEM - 2.7L**)
20. Remove the spark plug cable. (See **IGNITION SYSTEM**)
21. Remove the cylinder head covers (A).



G03821305

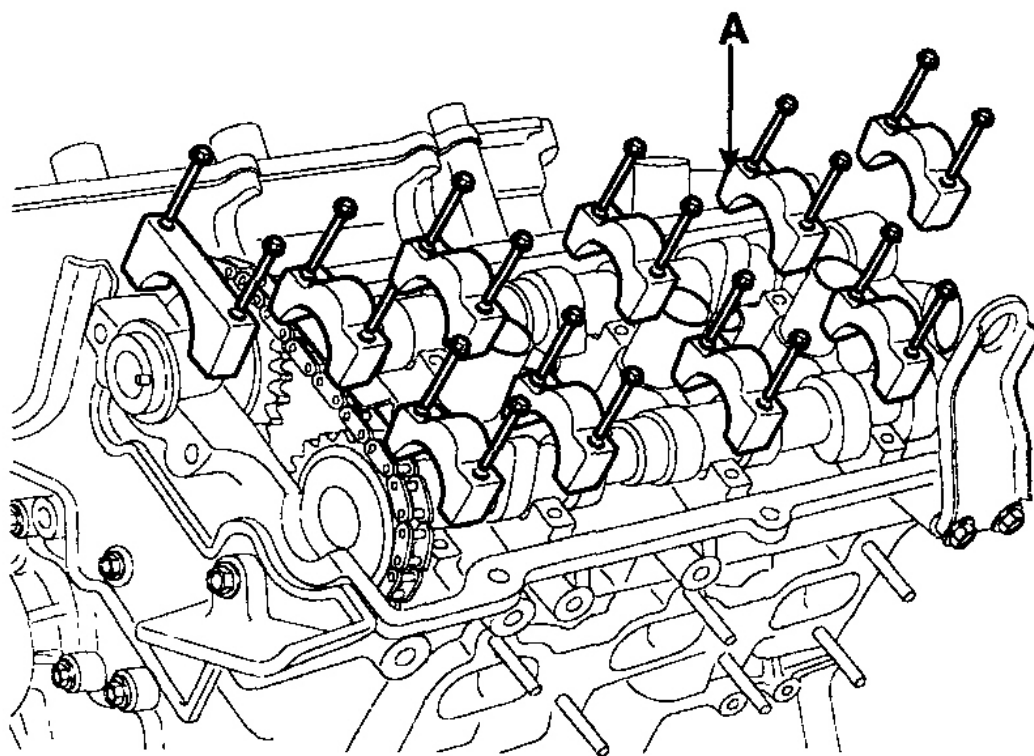
Fig. 19: Removing Cylinder Head Covers
Courtesy of KIA MOTORS AMERICA, INC.

22. Remove the camshaft sprocket.
23. Remove the camshaft bearing caps (A).



G03821306

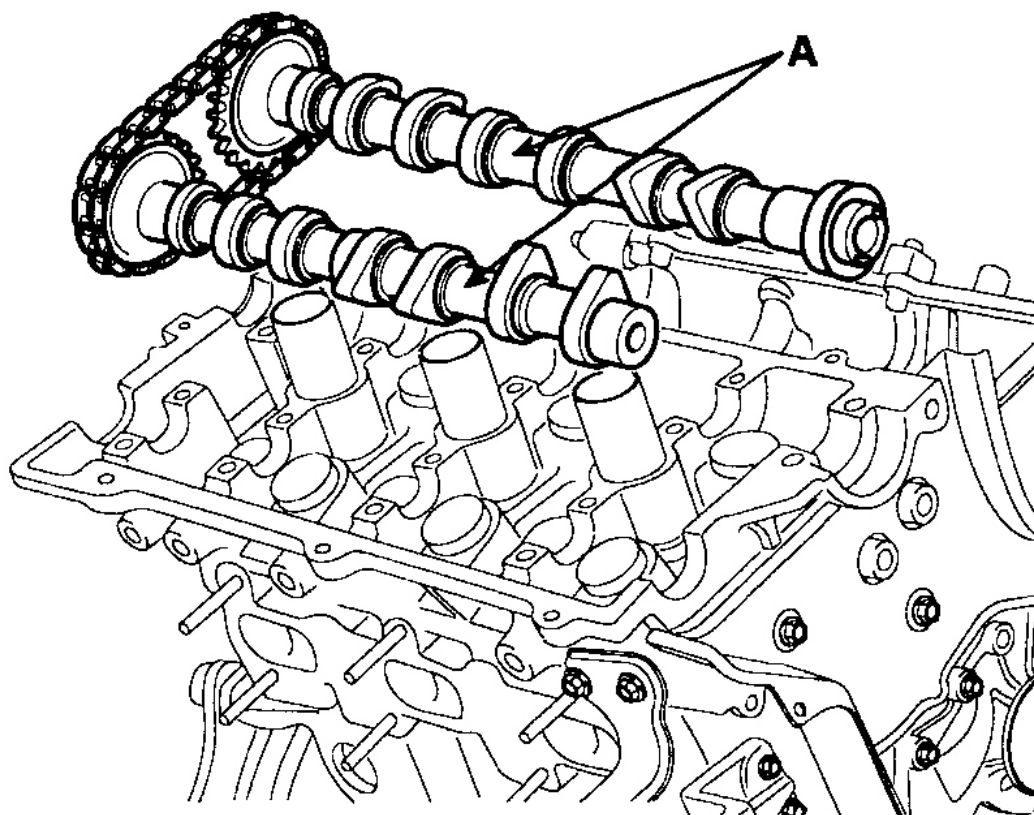
Fig. 20: Removing Camshaft Bearing Caps (1 Of 2)
Courtesy of KIA MOTORS AMERICA, INC.



G03821307

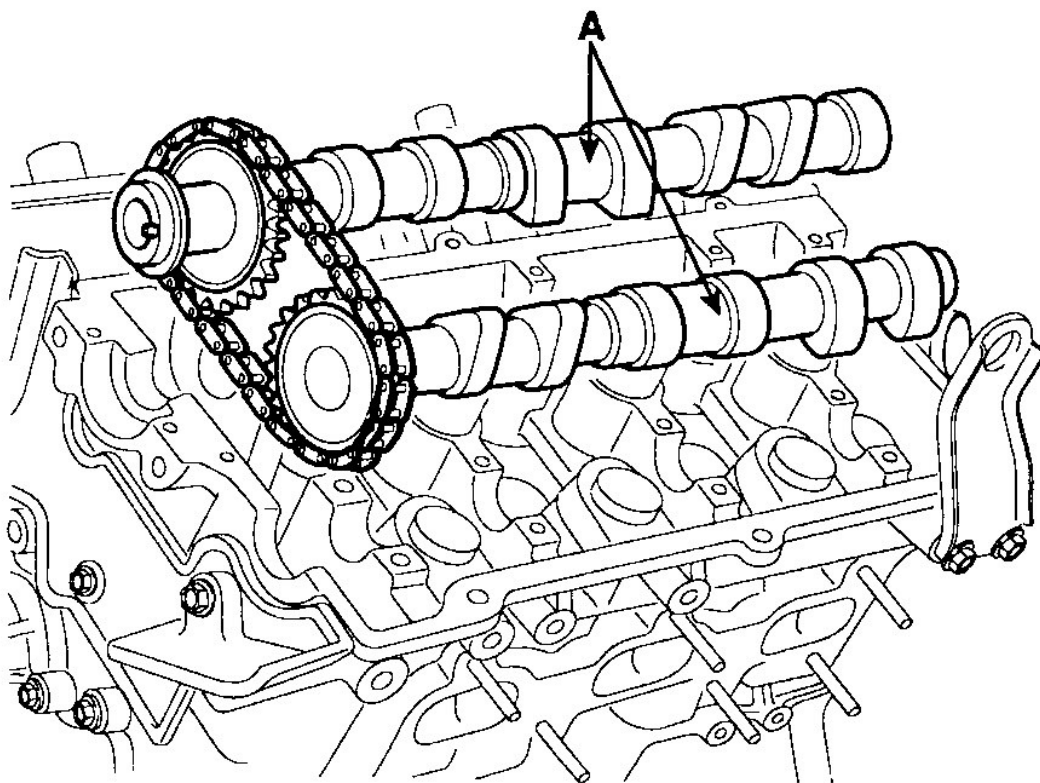
Fig. 21: Removing Camshaft Bearing Caps (2 Of 2)
Courtesy of KIA MOTORS AMERICA, INC.

24. Remove the camshafts (A).



G03821308

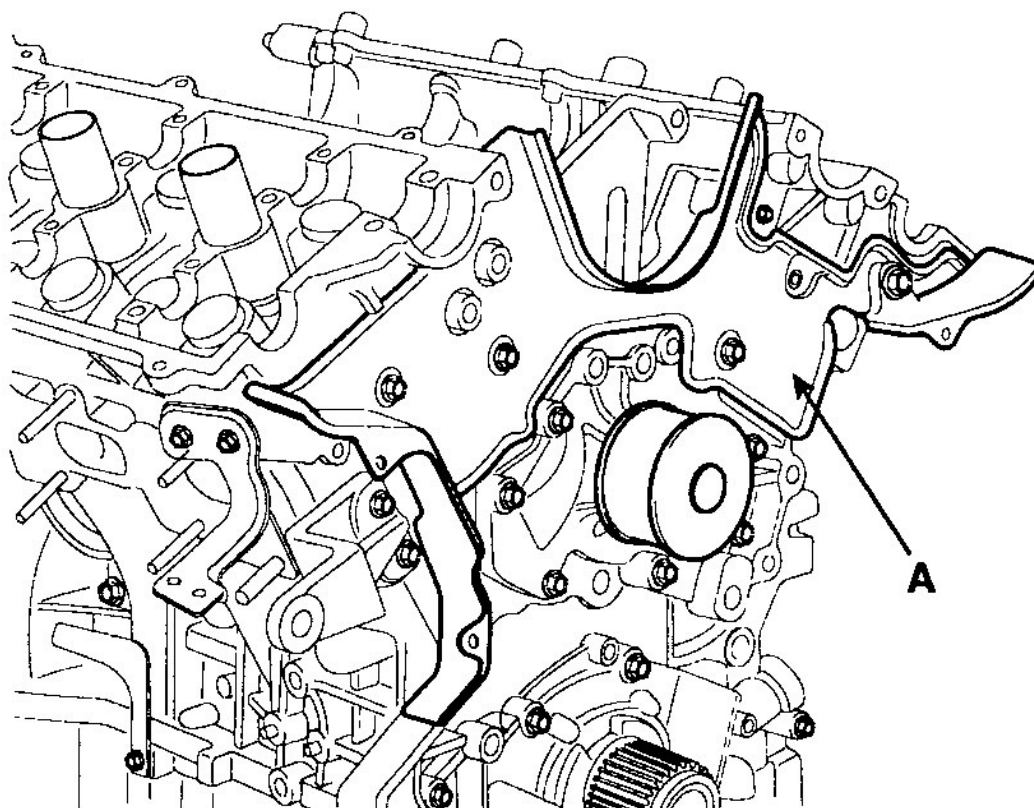
Fig. 22: Removing Camshafts (1 Of 2)
Courtesy of KIA MOTORS AMERICA, INC.



G03821309

Fig. 23: Removing Camshafts (2 Of 2)
Courtesy of KIA MOTORS AMERICA, INC.

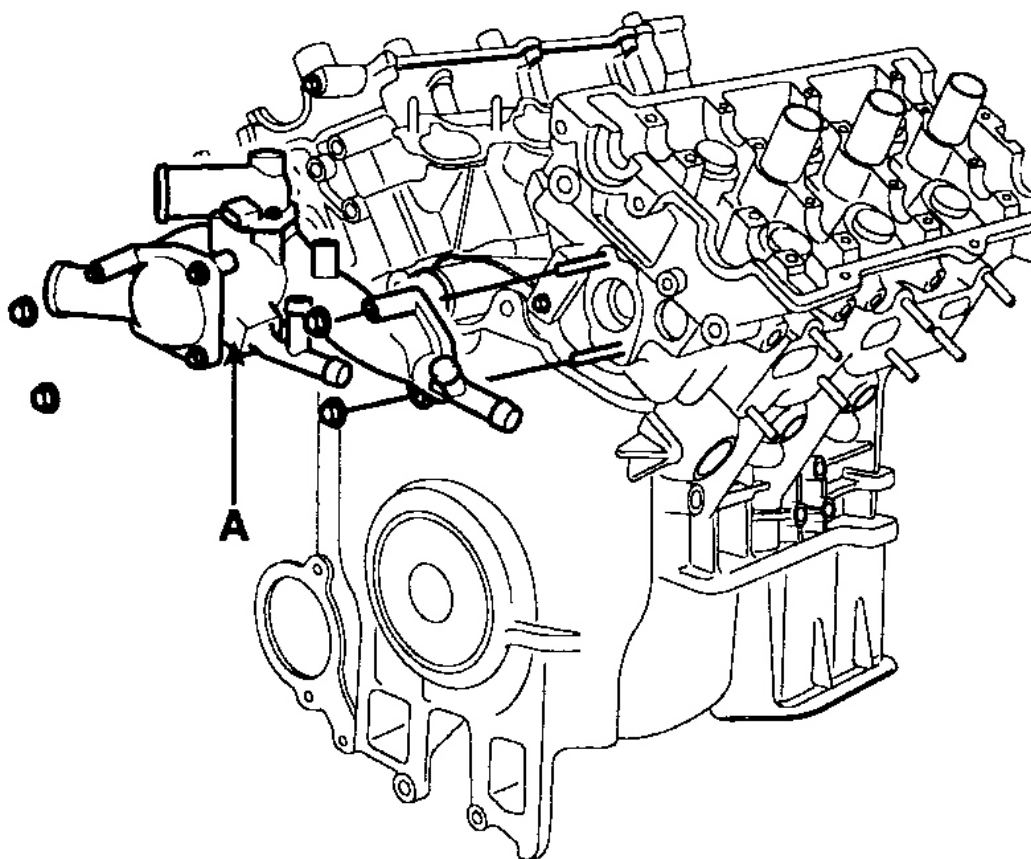
25. Remove the timing belt rear cover (A).



G03821310

Fig. 24: Removing Timing Belt Rear Cover
Courtesy of KIA MOTORS AMERICA, INC.

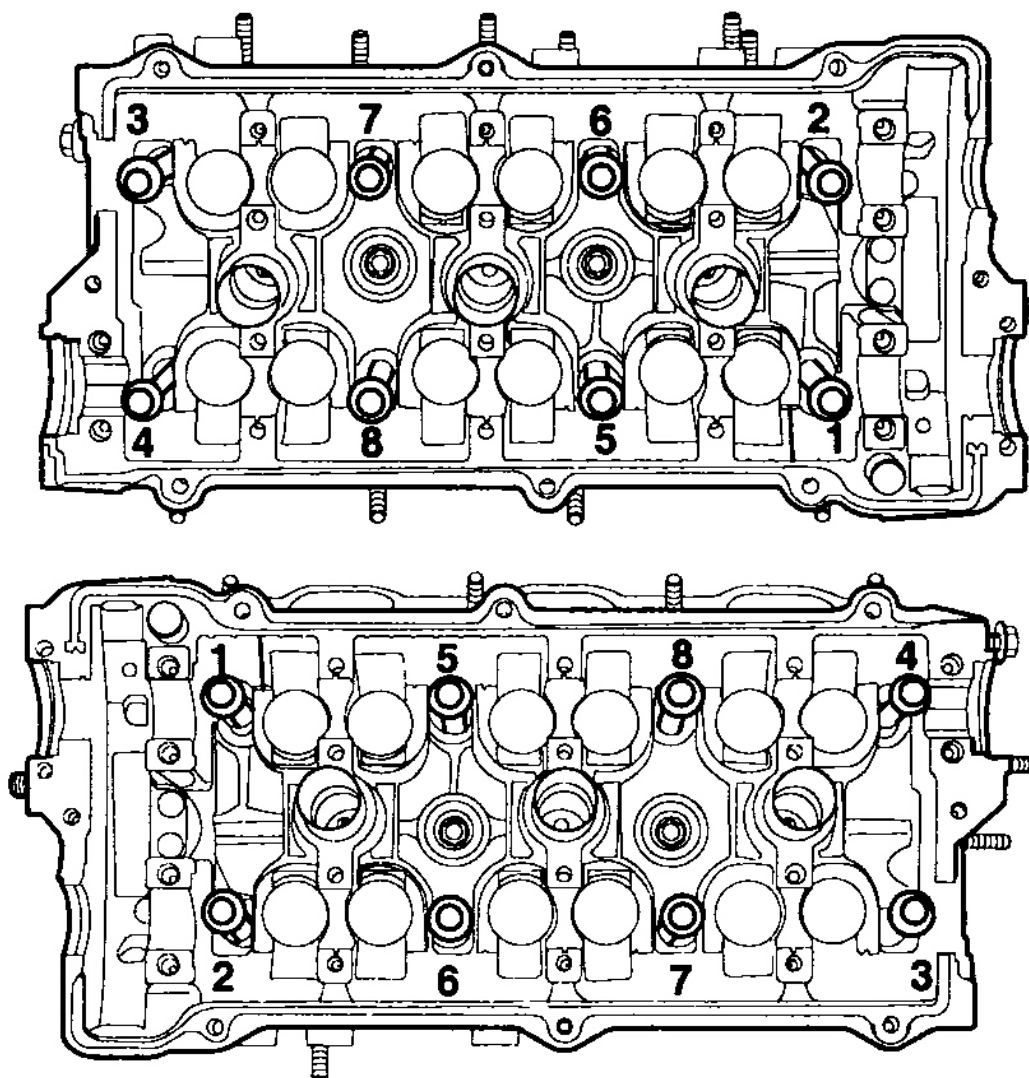
26. Remove the water temperature control assembly (A) and water pipe.



G03821311

Fig. 25: Removing Water Temperature Control Assembly And Water Pipe
Courtesy of KIA MOTORS AMERICA, INC.

27. Remove the cylinder head bolts, then remove the cylinder heads.
 1. Uniformly loosen and remove the 8 cylinder head bolts on each cylinder head in several passes and in the sequence shown, then repeat for the other side, as shown. Remove the 16 cylinder head bolts and plate washer.



G03821312

Fig. 26: Cylinder Head Bolt Removal Sequence
Courtesy of KIA MOTORS AMERICA, INC.

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

2. Lift the cylinder head from the dowels on the cylinder block and place the cylinder head on wooden blocks on a bench.

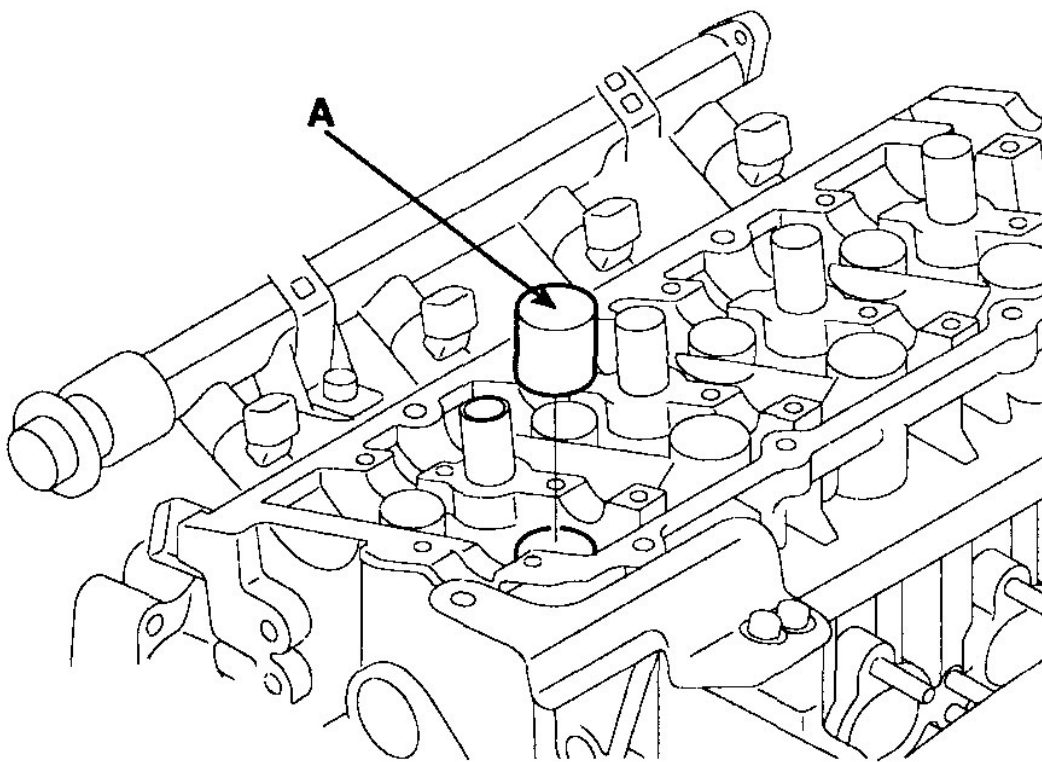
CAUTION: Be careful not to damage the contact surfaces of the cylinder

head and cylinder block.

DISASSEMBLY

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

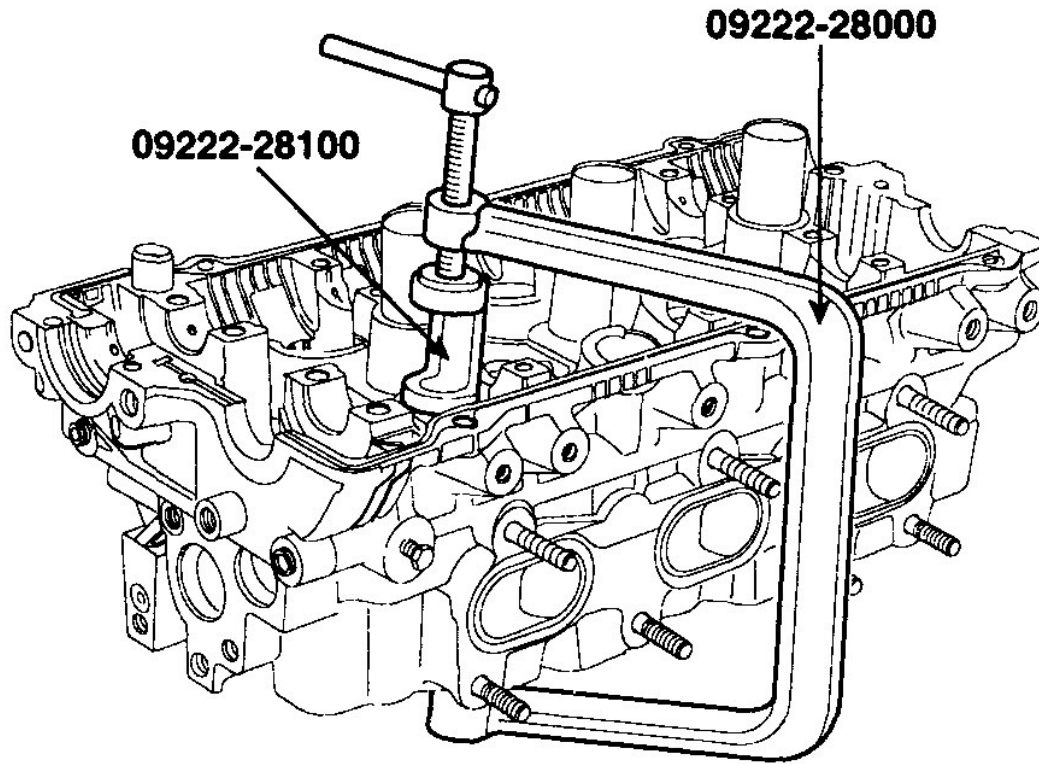
1. Remove HLAs (A).



G03821313

Fig. 27: Removing Hydraulic Lash Adjuster
Courtesy of KIA MOTORS AMERICA, INC.

2. Remove valves.
 1. Using SST(09222-28000, 09222-28100), compress the valve spring and remove retainer lock.



G03821314

Fig. 28: Compressing Valve Spring And Removing Retainer Lock
Courtesy of KIA MOTORS AMERICA, INC.

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

INSPECTION

CLEANING

1. Clean top surfaces of pistons and cylinder block.
 1. Turn the crankshaft, and bring each piston to top dead center (TDC).

Using a gasket scraper, remove all the carbon from the piston top surface.

2. Using a gasket scraper, remove all the gasket material from the cylinder block surface.
3. Using compressed air, blow carbon and oil from the bolt holes.
2. Remove gasket material.

Using a gasket scraper, remove all the gasket material from the cylinder block contact surface.

CAUTION: Be careful not to scratch the cylinder block contact surface.

3. Clean combustion cambers.

Using a wire brush, remove all the carbon from the combustion cambers.

CAUTION: Be careful not to scratch the cylinder block contact surface.

4. Clean cylinder heads.

Using a soft brush and solvent, thoroughly clean the cylinder head.

5. Clean valves.
 1. Using a gasket scraper, chip off any carbon from the valve head.
 2. Using a wire brush thoroughly clean the valve.

CYLINDER HEAD

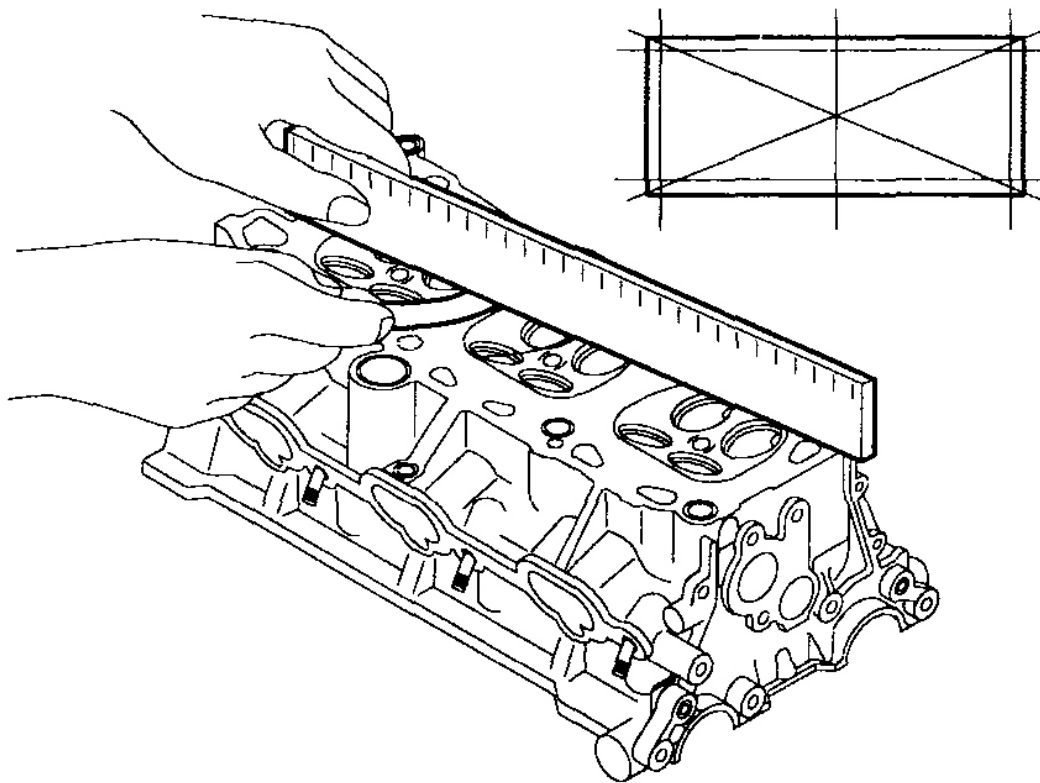
1. Inspect for flatness.

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

Flatness of cylinder head gasket surface

Standard: Less than 0.03mm(0.0012 in.)

Limit: 0.05mm (0.0020 in.)



G03821315

Fig. 29: Measuring Cylinder Block Warpage
Courtesy of KIA MOTORS AMERICA, INC.

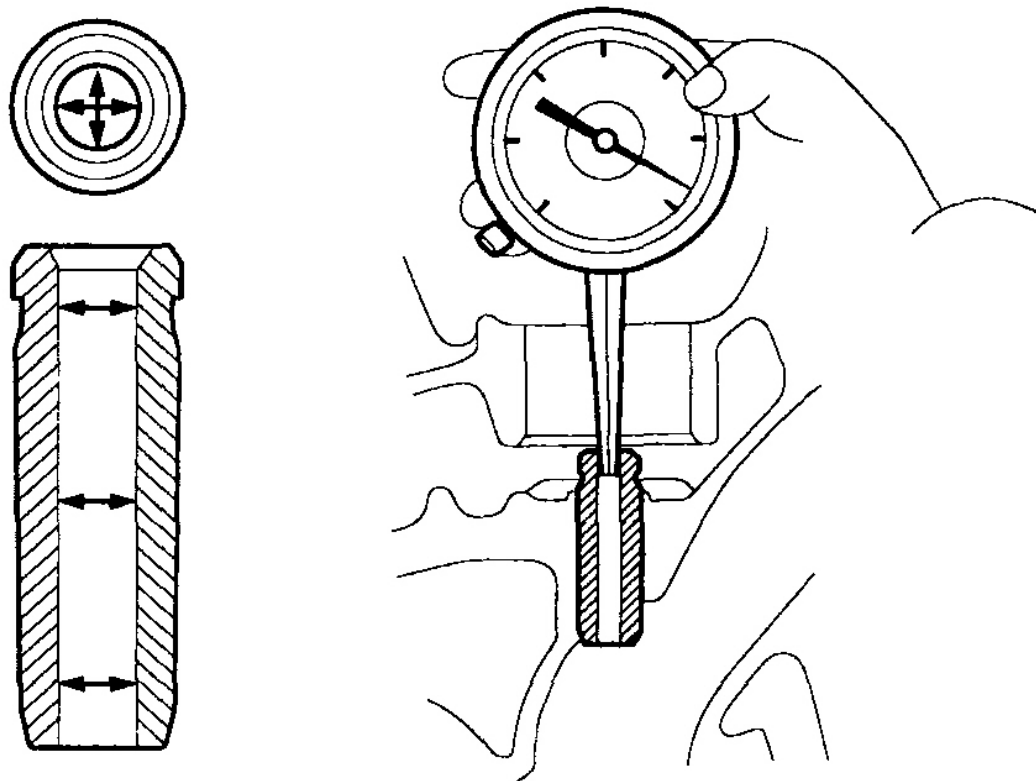
2. Inspect for cracks.

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

Valve guide inside.



G03821316

Fig. 30: Measuring Valve Guide Inside Diameter
Courtesy of KIA MOTORS AMERICA, INC.

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

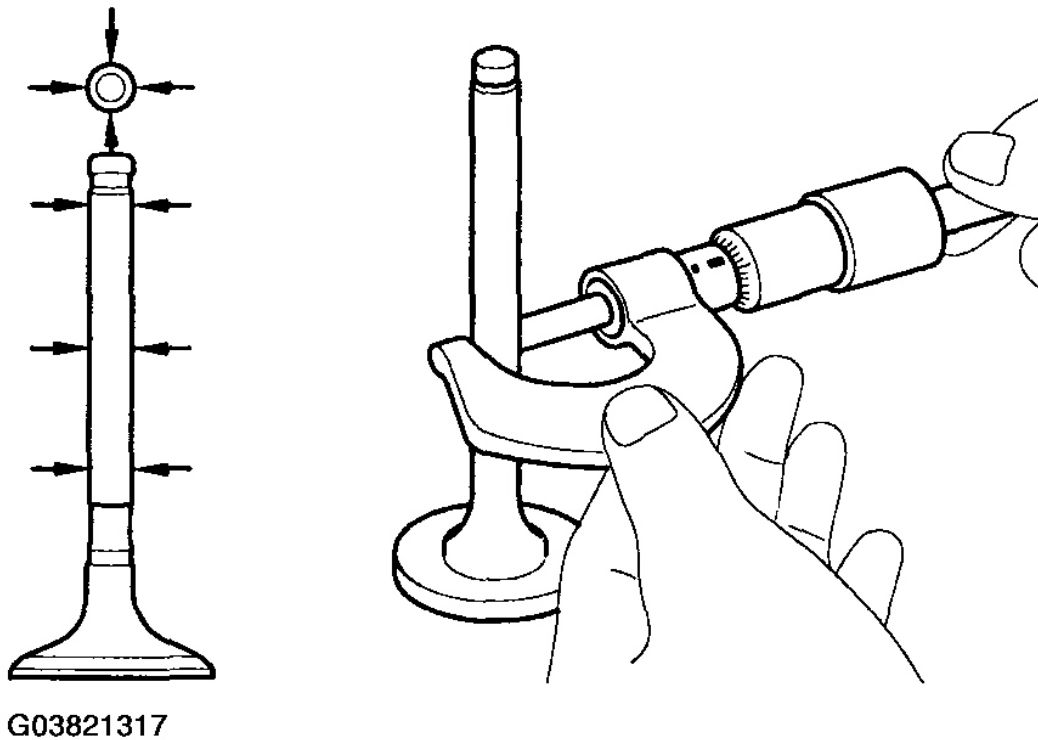


Fig. 31: Measuring Valve Stem Diameter
Courtesy of KIA MOTORS AMERICA, INC.

3. Subtract the valve stem diameter measurement from the valve guide inside diameter measurement.

Valve stem-to-guide clearance

[Standard]

Intake: 0.02 ~ 0.05mm (0.0008 ~ 0.0020in.)

Exhaust: 0.030 ~ 0.065mm (0.0012 ~ 0.0026in.)

[Limit]

Intake: 0.1mm (0.0040in.)

Exhaust: 0.13mm (0.0051in.)

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

2. Inspect valves.

1. Check the valve is ground to the correct valve face angle.
2. Check that the surface of the valve for wear. If the valve face is worn, replace the valve.
3. Check the valve head margin thickness.

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

Margin

[Standard]

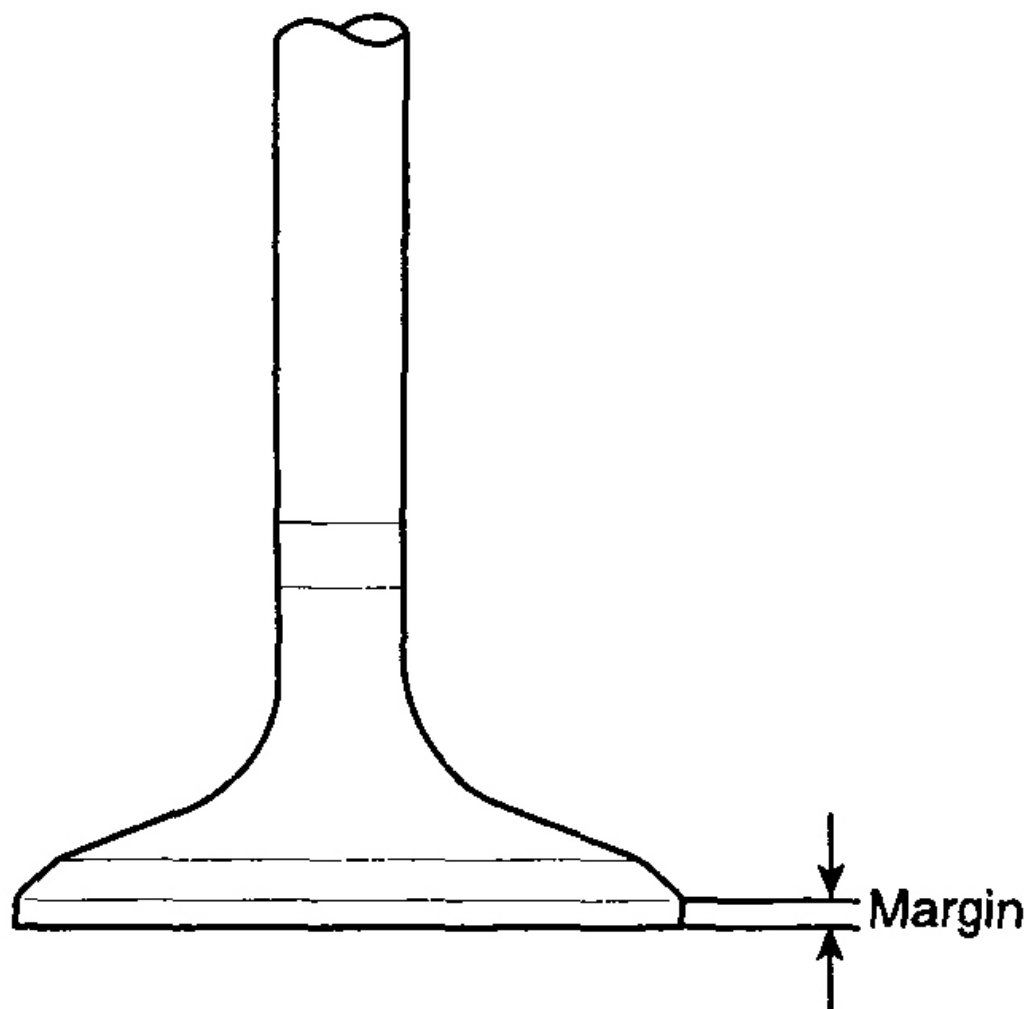
Intake: 1.0mm (0.0394in.)

Exhaust: 1.3mm (0.0512in.)

[Limit]

Intake: 0.5mm (0.0197in.)

Exhaust: 0.8mm (0.0315in.)



G03821318

Fig. 32: Measuring Valve Head Margin Thickness
Courtesy of KIA MOTORS AMERICA, INC.

4. Check the surface of the valve stem tip for wear. If the valve stem tip is worn, replace the valve.
3. Inspect valve seats

Check the valve seat for evidence of overheating and improper contact with the valve face.

Replace the seat if necessary.

Before reconditioning the seat, check the valve guide for wear. If the valve guide is worn, replace it, then

recondition the seat. Recondition the valve seat with a valve seat grinder or cutter. The valve seat contact width should be within specifications and centered on the valve face.

4. Inspect valve springs.

1. Using a steel square, measure the out-of-square of the valve spring.
2. Using a vernier calipers, measure the free length of the valve spring.

Valve spring

[Standard]

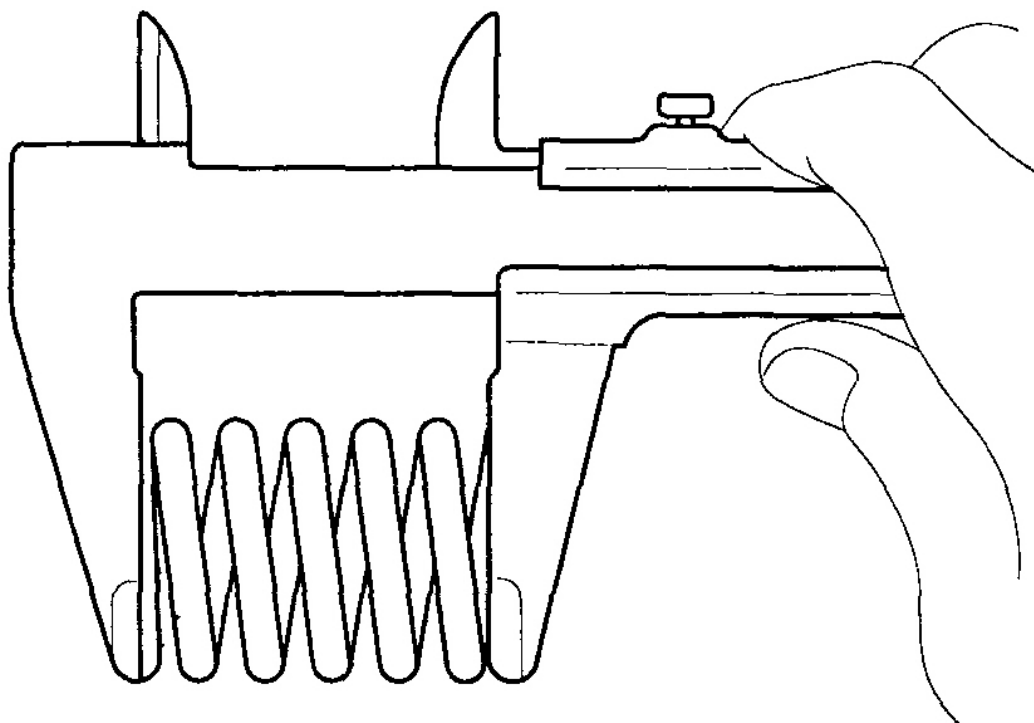
Free height: 42.5mm (1.6732in.)

Load: 21kg/35mm (48.4kg/1.378mm)

[Limit]

Free height: -1.0mm (-0.0394 in.)

Out-of-square: 3°



G03821319

Fig. 33: Measuring Valve Spring Free Length
Courtesy of KIA MOTORS AMERICA, INC.

If the free length is not as specified, replace the valve spring.

CAMSHAFT

1. Inspect cam lobes.

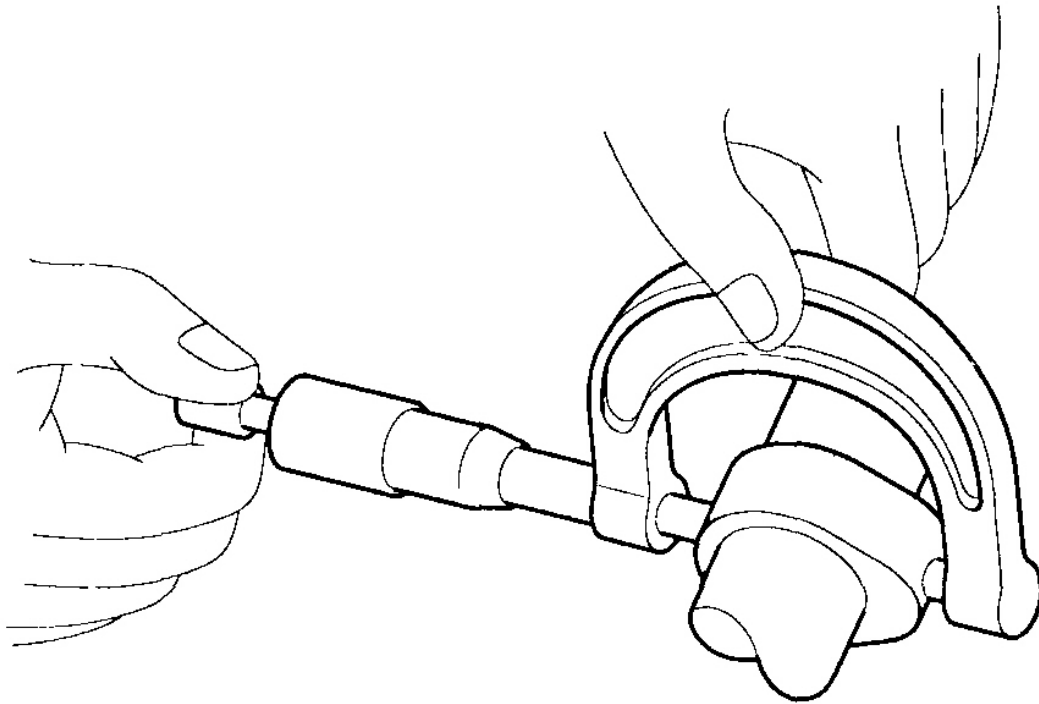
Using a micrometer, measure the cam lobe height.

Cam height

[Standard value]

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

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



G03821320

Fig. 34: Measuring Cam Lobe Height
Courtesy of KIA MOTORS AMERICA, INC.

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

2. Inspect cam journals.

Using a micrometer, measure the journal diameter.

Journal diameter

Standard value

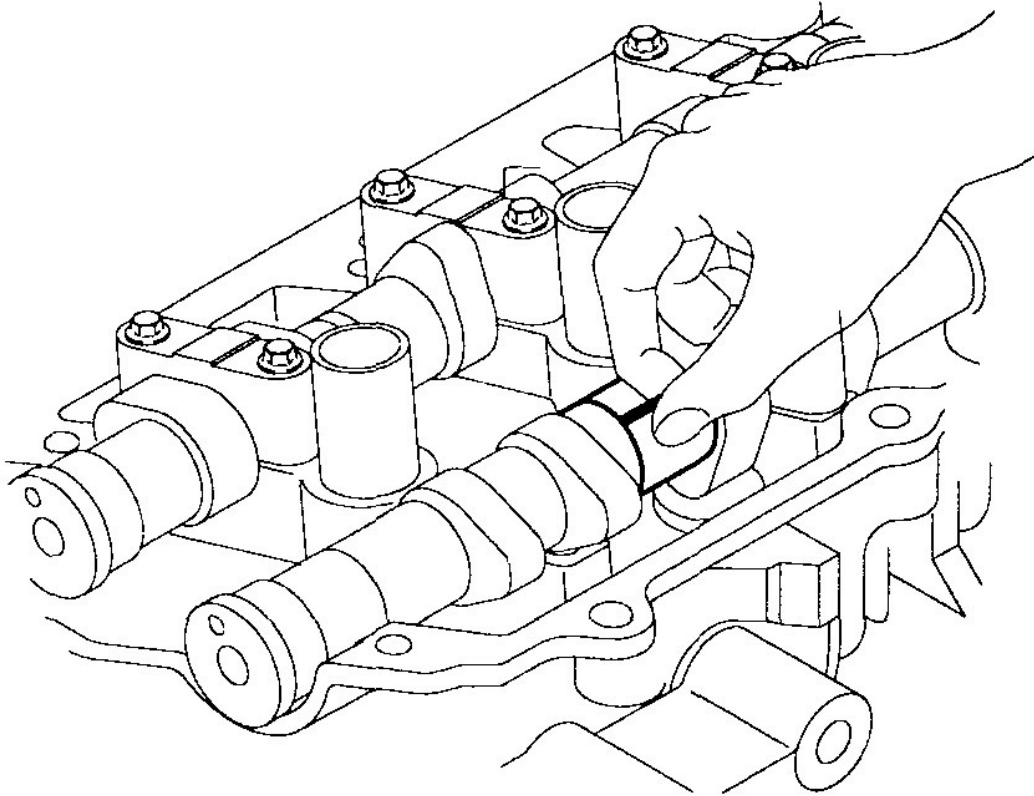
25.964 ~ 25.980mm (1.0222 ~ 1.0228in.)

If the journal diameter is not as specified, check the oil clearance.

3. Inspect camshaft bearings.

Check that bearing for flaking and scoring. If the bearings are damaged, replace the bearing caps and cylinder head as a set.

4. Inspect camshaft journal oil clearance.
 1. Clean the bearing caps and camshaft journals.
 2. Place the camshafts on the cylinder head.
 3. Lay a strip of plastigage across each of the camshaft journal.



G03821321

Fig. 35: Inspecting Camshaft Journal Oil Clearance
Courtesy of KIA MOTORS AMERICA, INC.

4. Install the bearing caps. (See **INSTALLATION**)

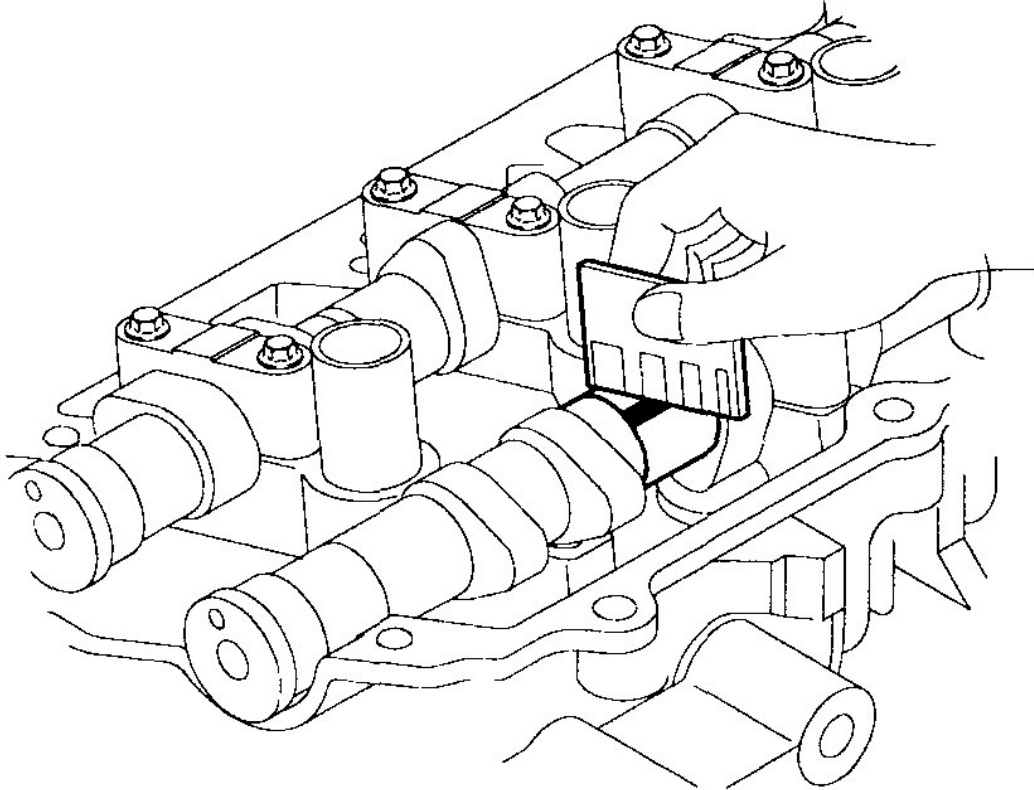
CAUTION: Do not turn the camshaft.

5. Remove the bearing caps.
6. Measure the plastigage at its widest point.

Bearing oil clearance

Standard value: 0.02 ~ 0.061mm (0.0008 ~ 0.0024in.)

Limit: 0.1mm (0.0039in.)



G03821322

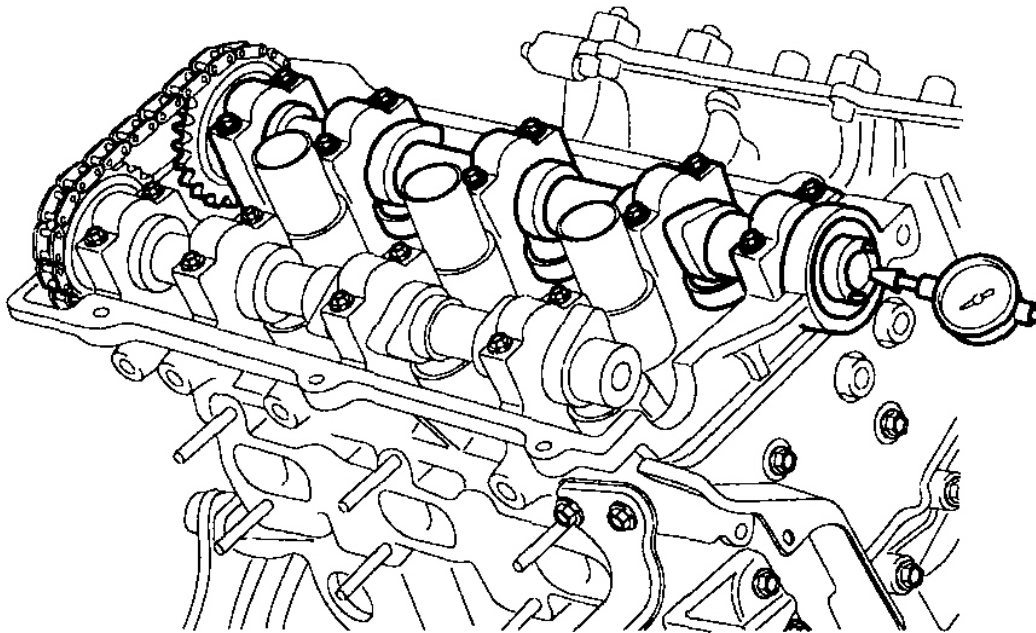
Fig. 36: Measuring Plastigage At Widest Point
Courtesy of KIA MOTORS AMERICA, INC.

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

7. Completely remove the plastigage.
8. Remove the camshafts.
5. Inspect camshaft end play.
 1. Install the camshafts. (See **INSTALLATION**).
 2. Using a dial indicator, measure the end play while moving the camshaft back and forth.

Camshaft end play

Standard value: 0.1 ~ 0.15mm (0.004 ~ 0.0059in.)



G03821323

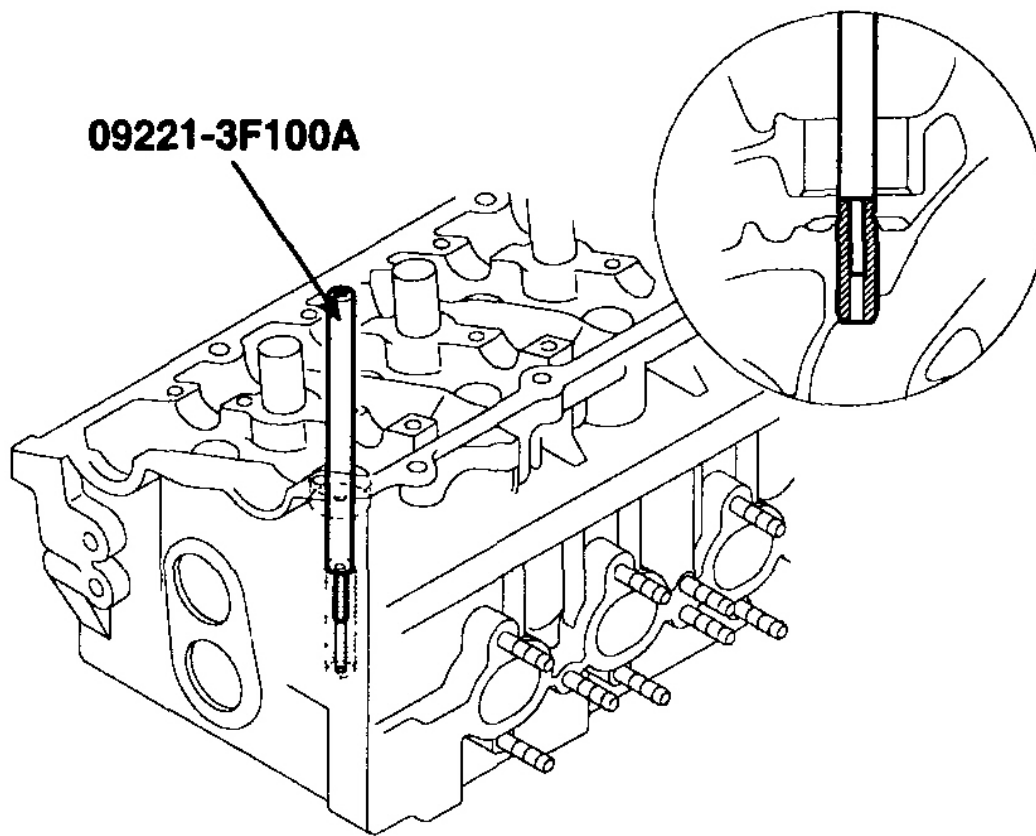
Fig. 37: Inspecting Camshaft End Play
Courtesy of KIA MOTORS AMERICA, INC.

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

3. Remove the camshafts.

REPLACEMENT**VALVE GUIDE**

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



G03821324

Fig. 38: Removing Valve Guide

Courtesy of KIA MOTORS AMERICA, INC.

2. Recondition the valve guide hole so that it can match the newly press-fitted oversize valve guide.
3. Using the SST(09221-3F100A/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.

OVERSIZE VALVE GUIDE SPECIFICATIONS

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: 39mm (1.535in.)

Exhaust: 43mm (1.693in.)

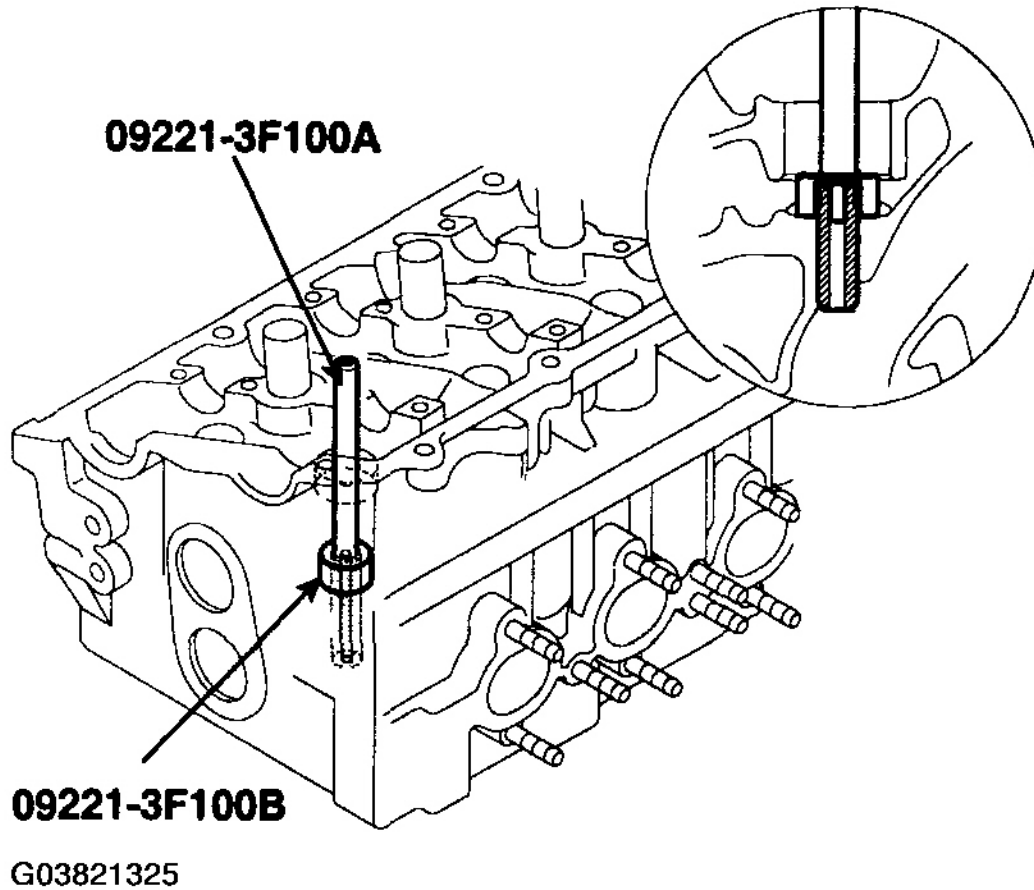


Fig. 39: Installing Valve Guide

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.

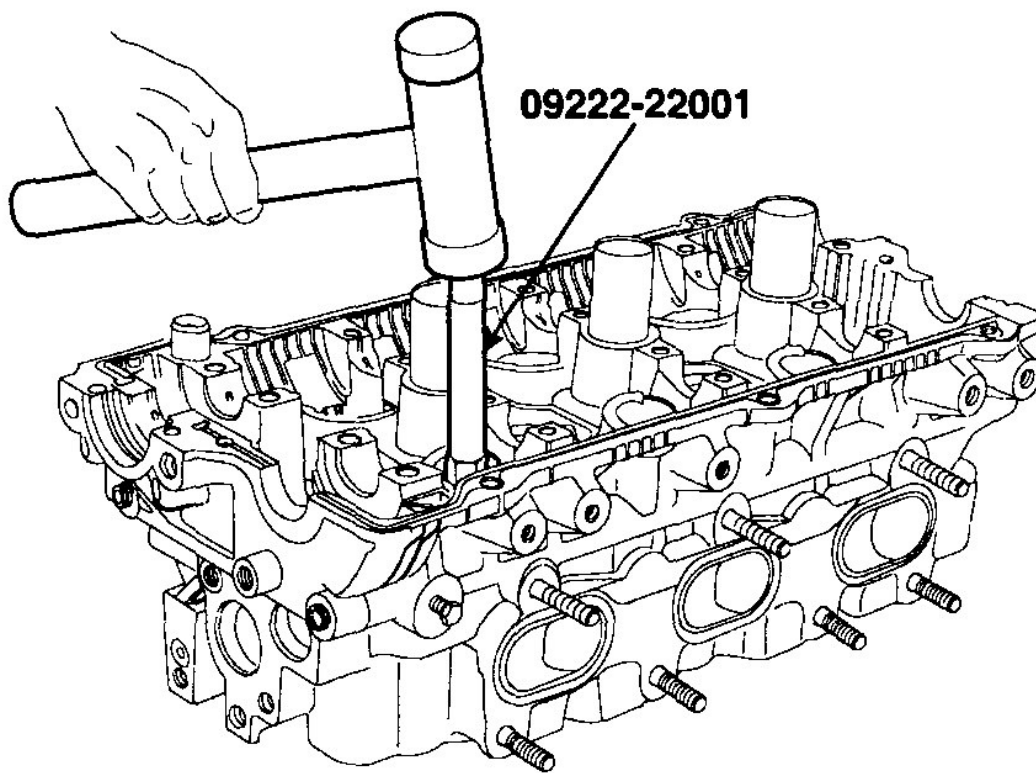
REASSEMBLY

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

ones.

1. Install valves.
 1. Install the spring seats.
 2. Using SST(09222-22001), push in a new oil seal.

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



G03821326

Fig. 40: Installing Valves
Courtesy of KIA MOTORS AMERICA, INC.

3. Install the valve, valve spring and spring retainer.

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

4. Using the SST(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.

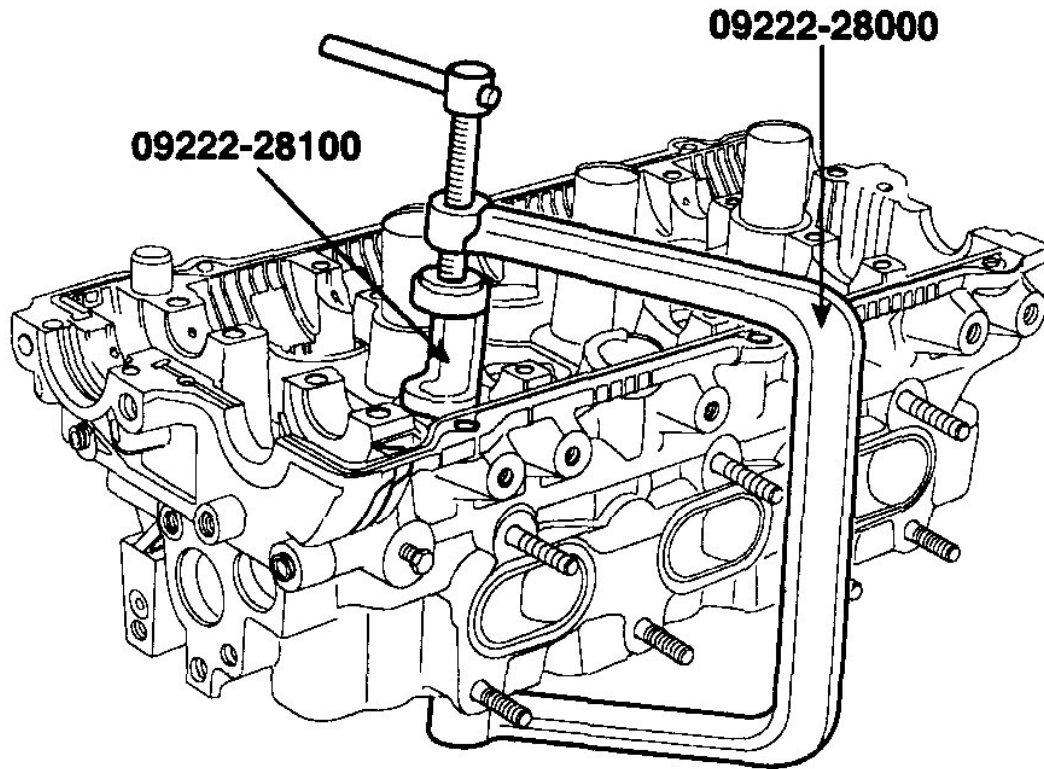
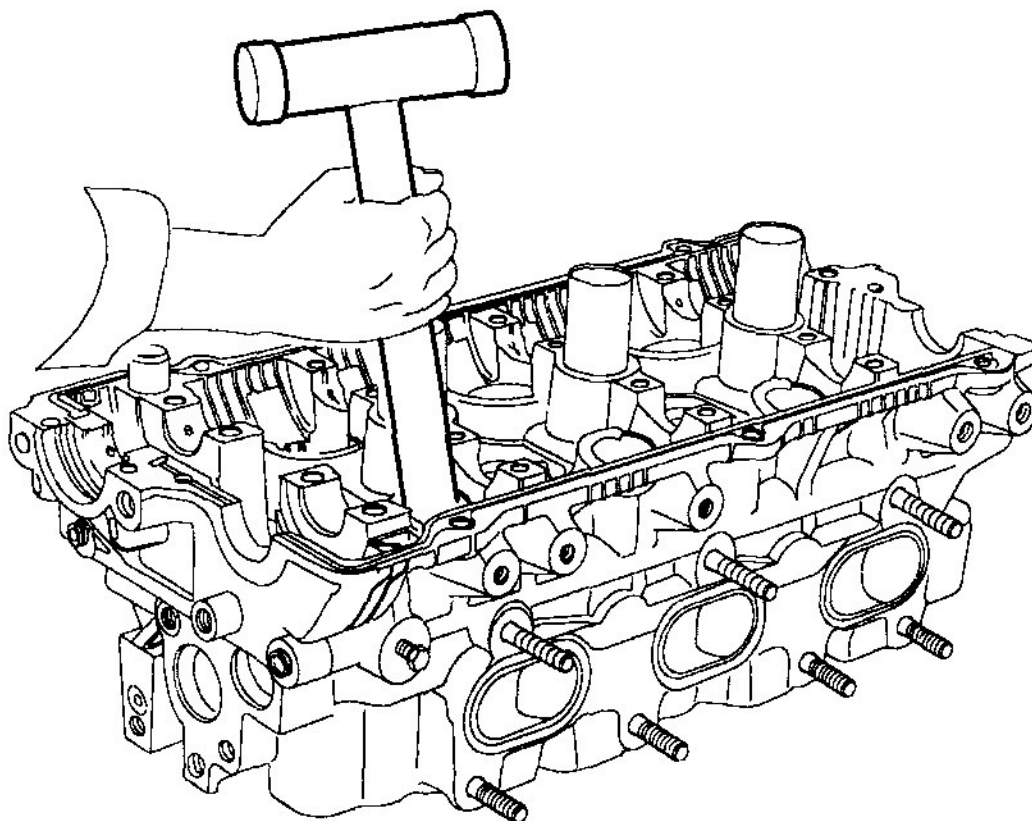


Fig. 41: Compressing Spring And Installing Retainer Locks
Courtesy of KIA MOTORS AMERICA, INC.

5. 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.

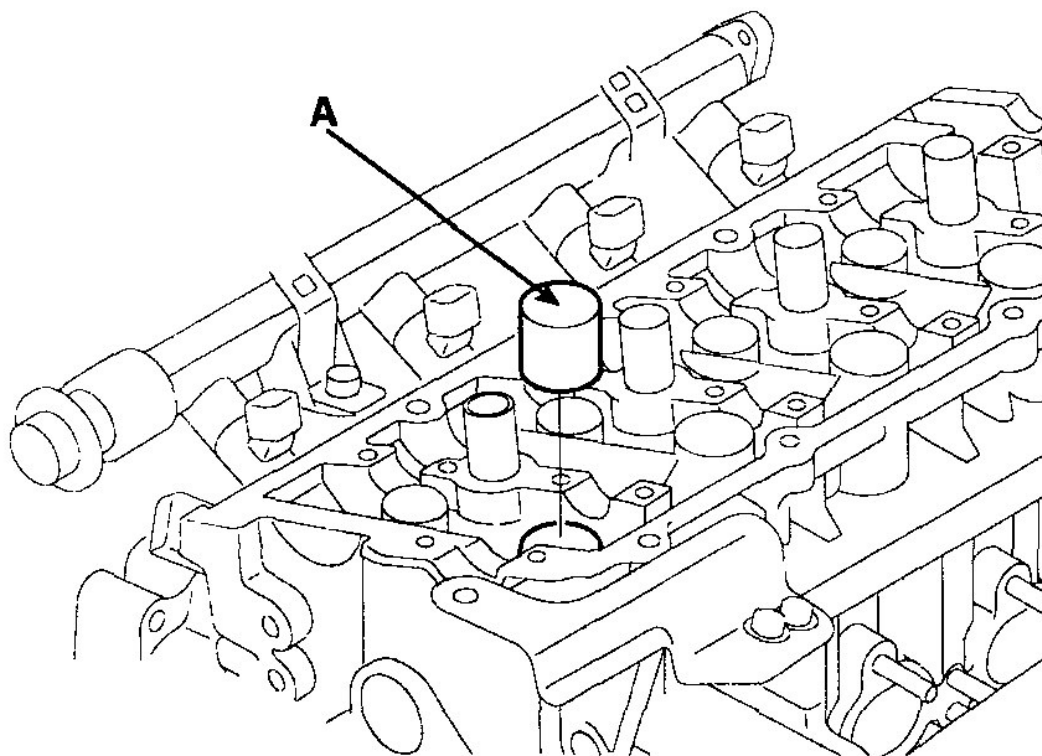


G03821328

Fig. 42: Tapping Valve Stem End
Courtesy of KIA MOTORS AMERICA, INC.

2. Install HLAs.

Check that the HLA rotates smoothly by hand.



G03821329

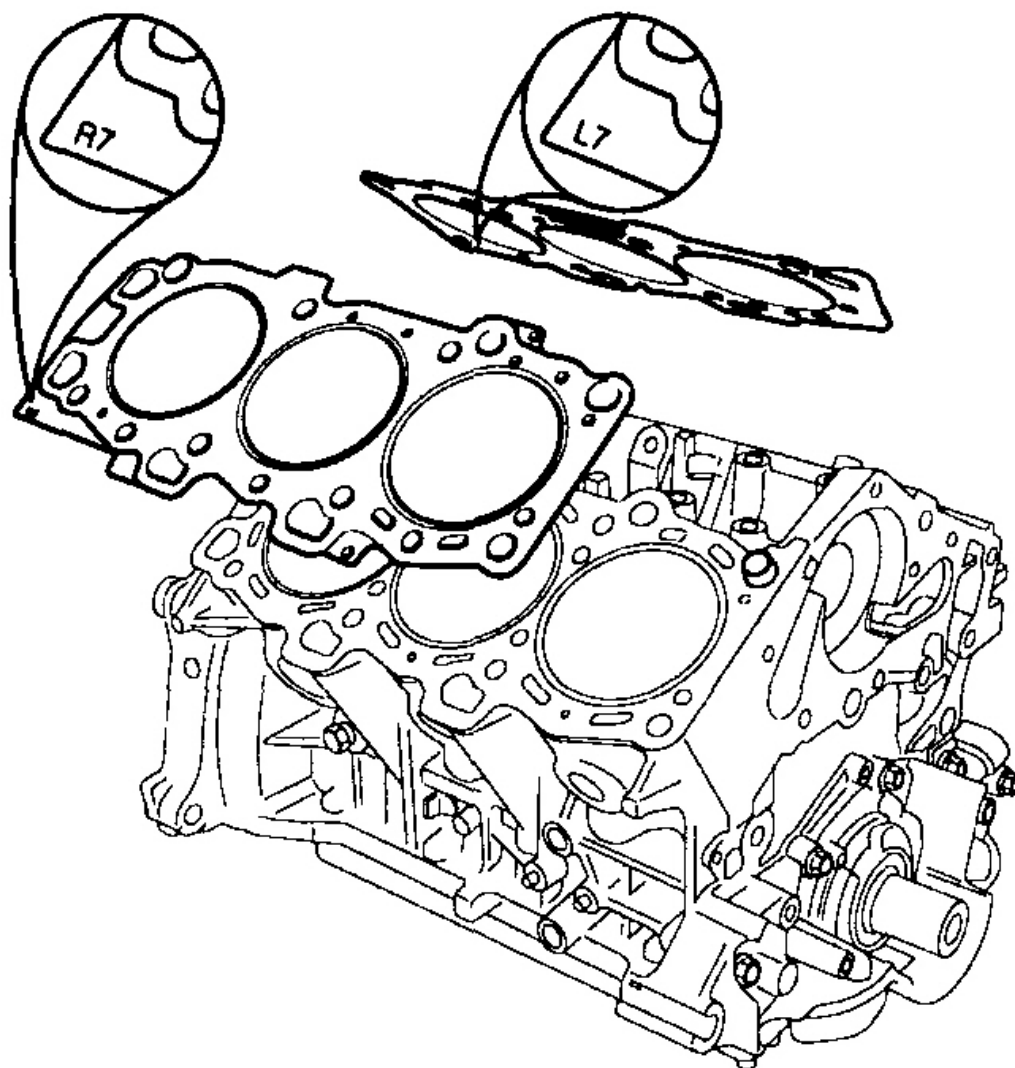
Fig. 43: Installing Hydraulic Lash Adjuster
Courtesy of KIA MOTORS AMERICA, INC.

INSTALLATION

NOTE:

- Thoroughly clean all parts to be assembled.
- Always use a new 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. (See REMOVAL).

1. Install the cylinder head gaskets on the cylinder block.



G03821330

Fig. 44: Installing Cylinder Head Gaskets On Cylinder Block
Courtesy of KIA MOTORS AMERICA, INC.

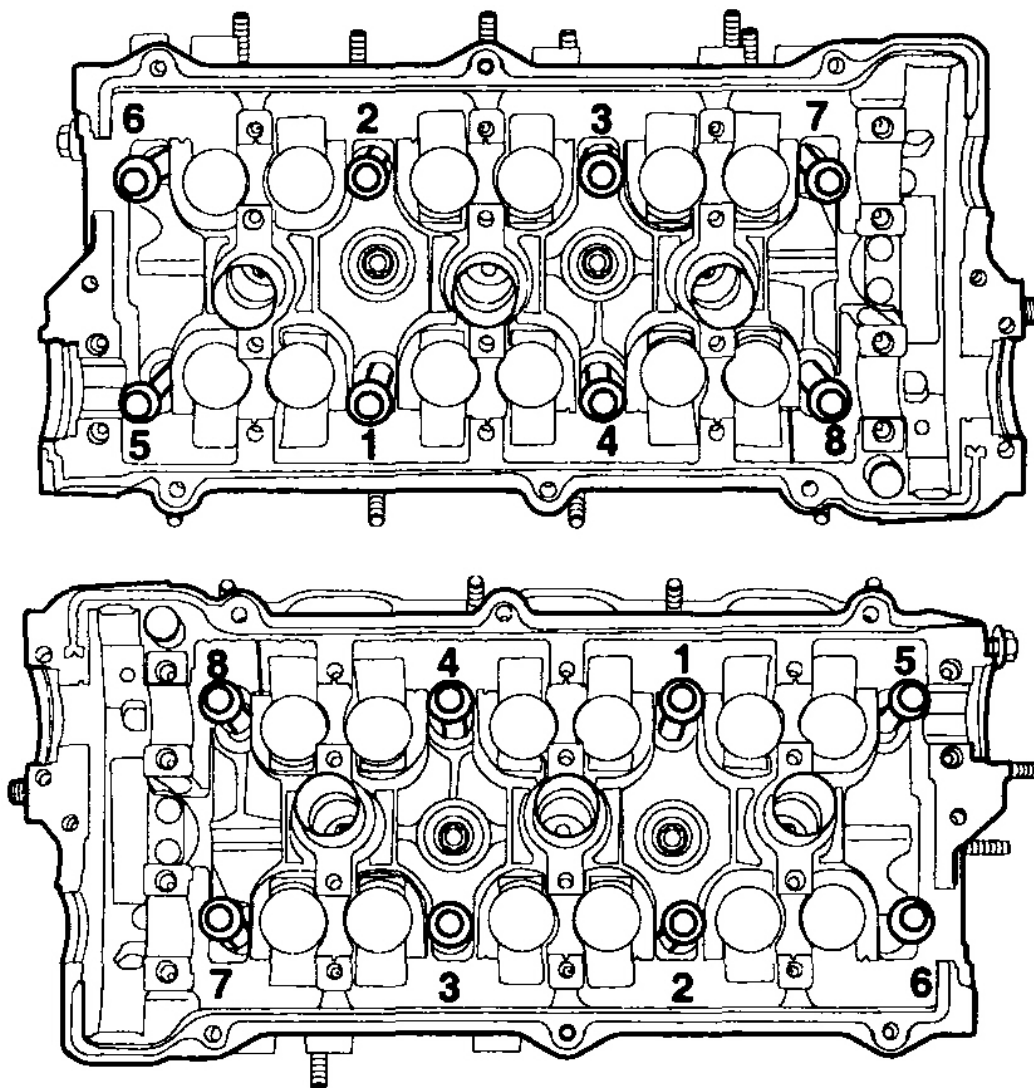
NOTE: Be careful of the installation direction.

2. Place the cylinder head quietly in order not to damage the gasket with the bottom part of the end.
3. Install cylinder head bolts.

Tightening torque

25N.m (250kgf.cm, 18lb-ft) + 60° + 45°

1. Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.
2. Install the plate washer to the cylinder head bolt.
3. Install and uniformly tighten the cylinder head bolts on each cylinder head in several passes and in the sequence shown, then repeat for the other side, as shown.

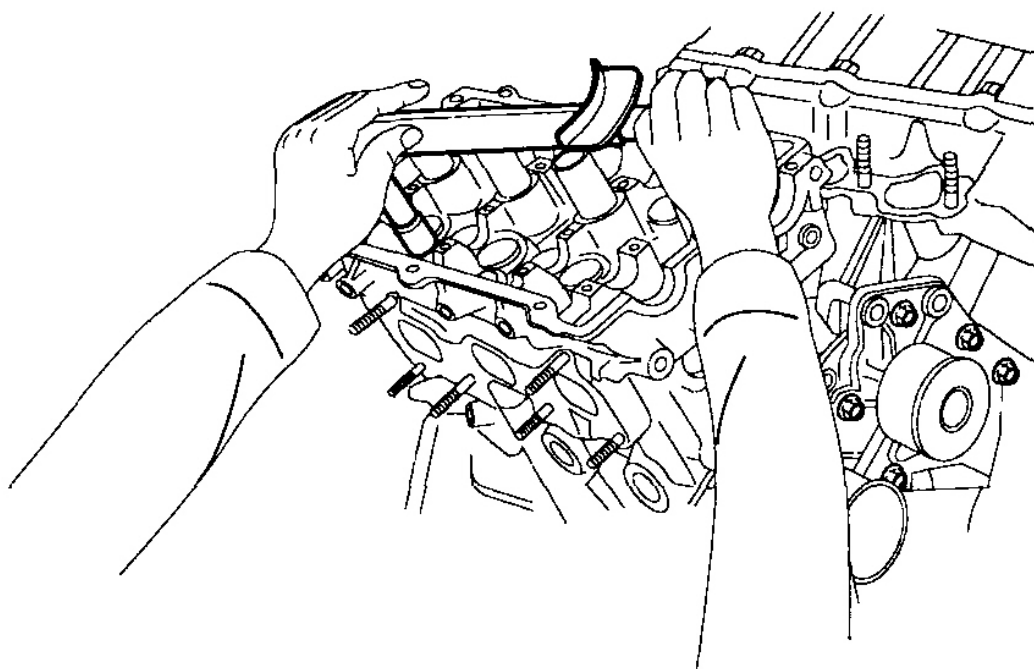


G03821331

Fig. 45: Cylinder Head Bolt Torque Sequence
 Courtesy of KIA MOTORS AMERICA, INC.

If any of the cylinder head bolts dose not meet the torque specification, repeat the cylinder head bolt torque tightening sequence.

Torque: 25N.m (250kgf.cm, 18lb-ft)



G03821332

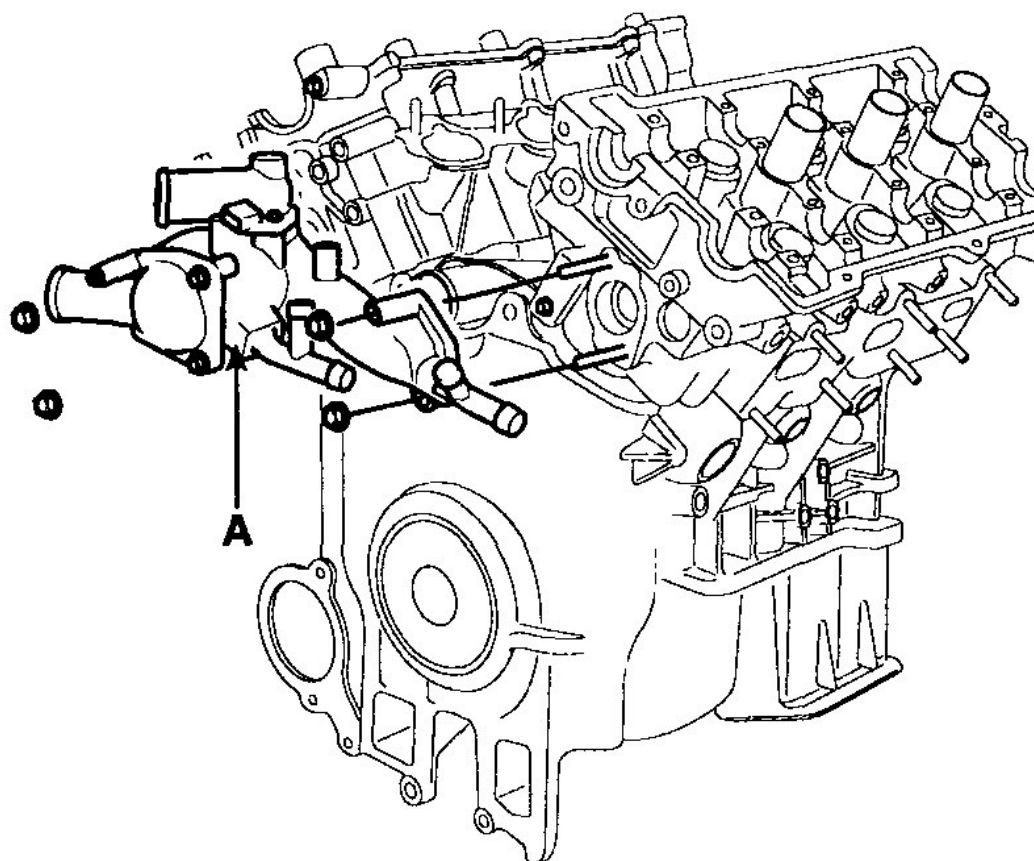
Fig. 46: Installing Cylinder Head Bolts
Courtesy of KIA MOTORS AMERICA, INC.

4. Retighten the cylinder head bolts by 60° in the numerical order shown.
5. Retighten the cylinder head bolts by 45° in the numerical order shown.
4. Install the water pipe and water temperature control assembly (A).

Tightening torque

Water temperature control

15 ~ 20N.m (150 ~ 200kgf.cm, 11 ~ 14lb-ft)



G03821333

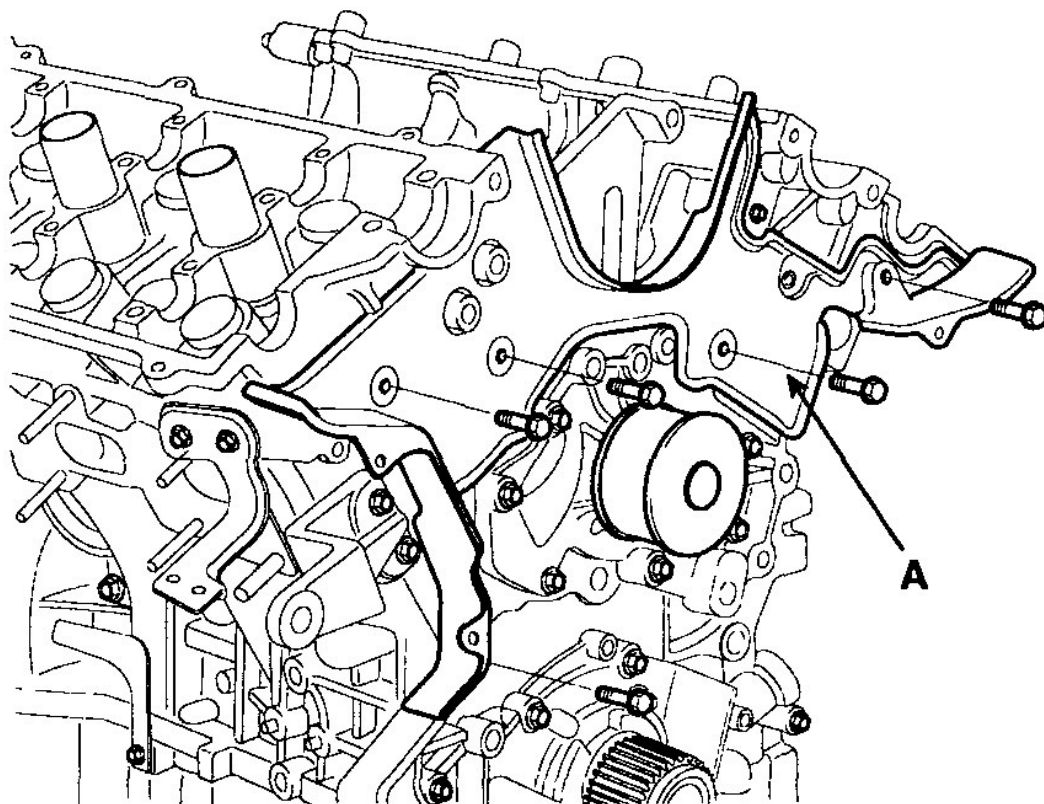
Fig. 47: Installing Water Pipe And Water Temperature Control Assembly
Courtesy of KIA MOTORS AMERICA, INC.

5. Install the timing belt rear cover (A).

Tightening torque

Timing belt rear cover

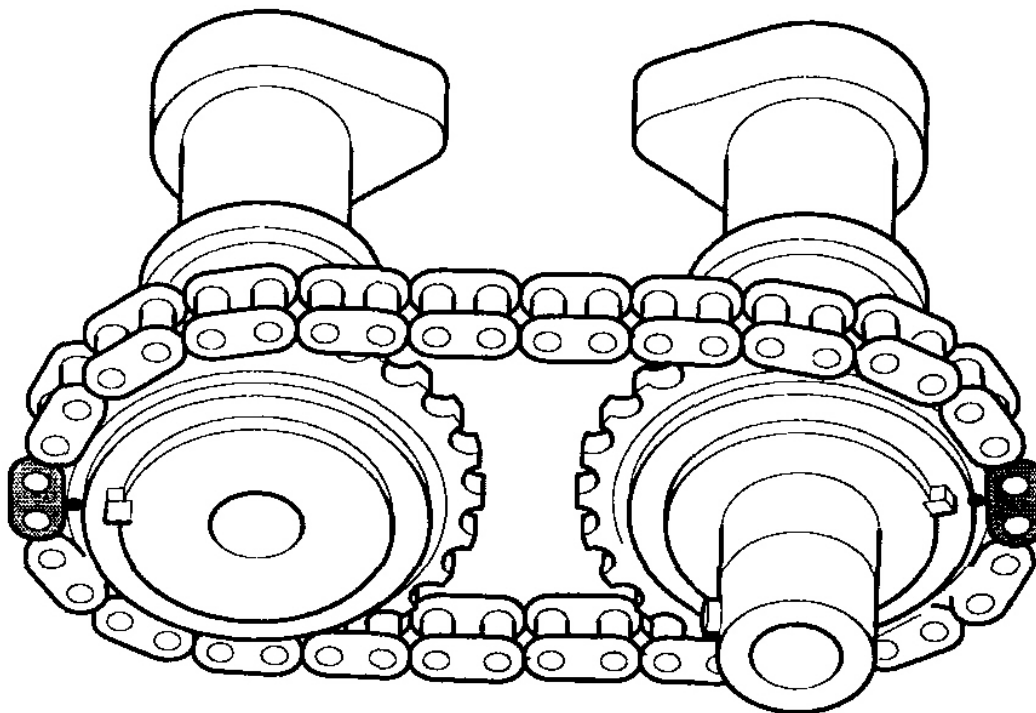
10 ~ 12N.m (100 ~ 120kgf.cm, 7 ~ 9lb-ft)



G03821334

Fig. 48: Installing Timing Belt Rear Cover
Courtesy of KIA MOTORS AMERICA, INC.

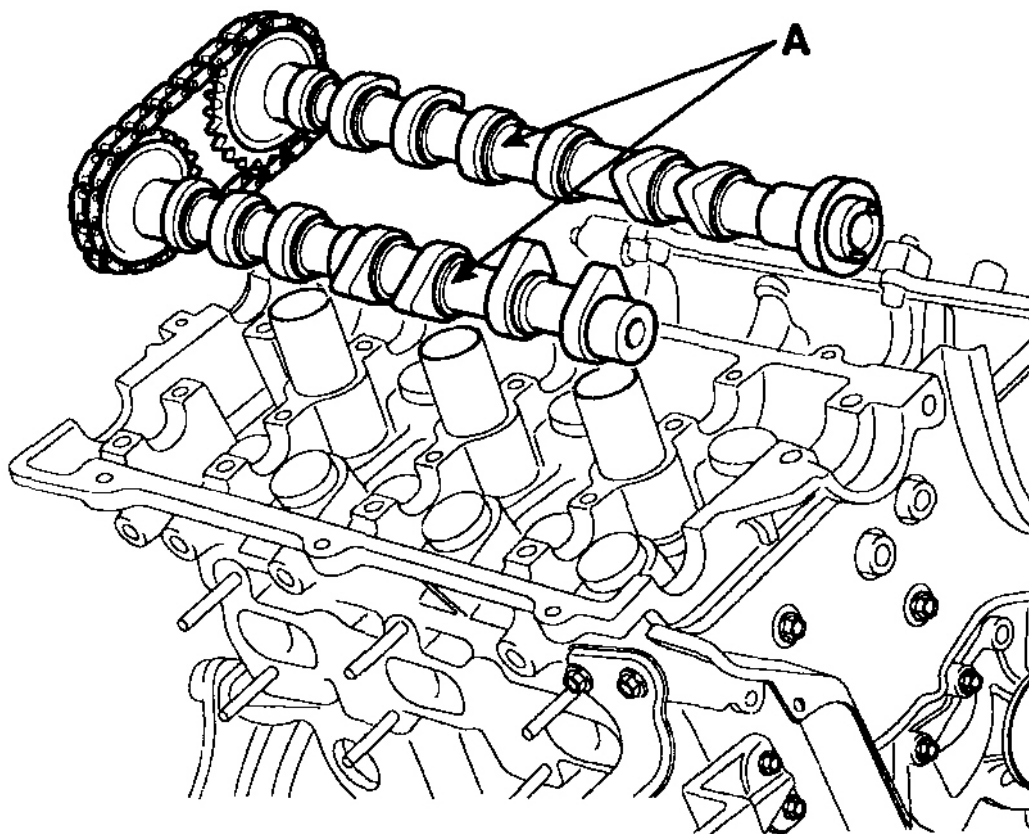
6. Install the camshafts.
 1. Align the camshaft timing chain with the intake timing chain sprocket and exhaust timing chain sprocket as shown.



G03821335

Fig. 49: Aligning Camshaft Timing Chain With Intake And Exhaust Timing Chain Sprocket
Courtesy of KIA MOTORS AMERICA, INC.

2. Install the camshaft (A).



G03821336

Fig. 50: Installing Camshaft
Courtesy of KIA MOTORS AMERICA, INC.

3. Install the camshaft bearing caps (A).

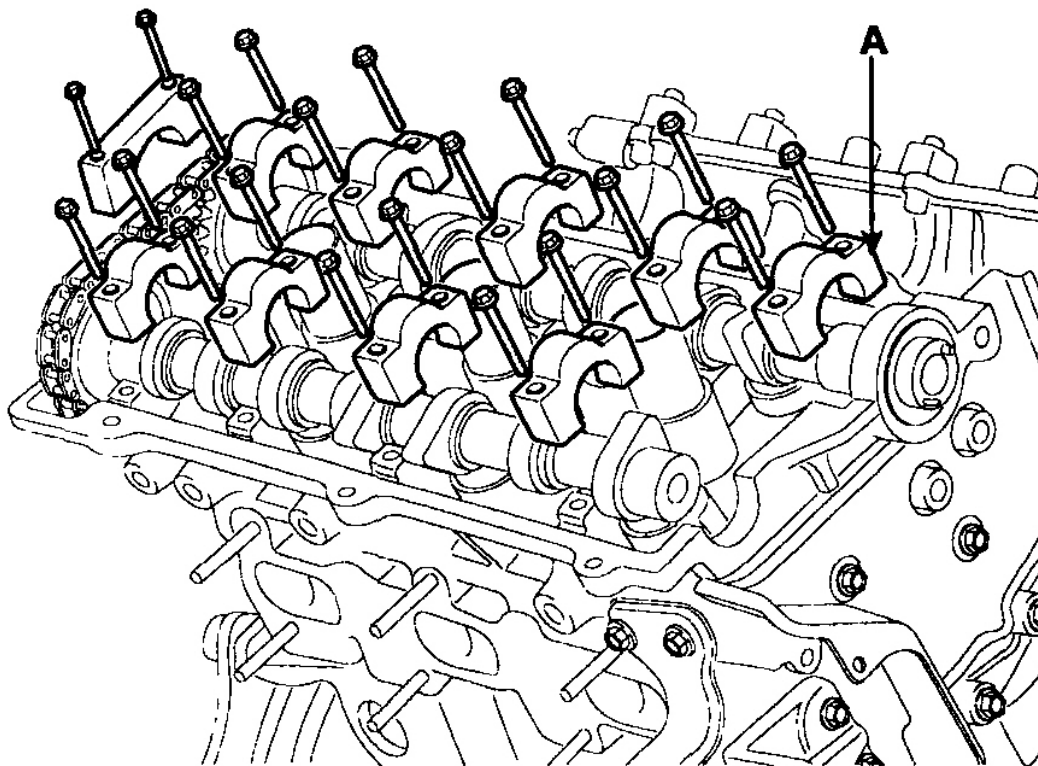
Tightening torque

M6(38mm): 10 ~ 12N.m

(100 ~ 120kgf.cm, 7 ~ 9lb-ft)(Mark7)

M6(50mm): 14 ~ 16N.m

(140 ~ 160kgf.cm, 10 ~ 12lb-ft)(Mark10)



G03821337

Fig. 51: Installing Camshaft Bearing Caps
Courtesy of KIA MOTORS AMERICA, INC.

NOTE:

- Apply new engine oil to the thrust portion and journal of the camshafts.
- Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.

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

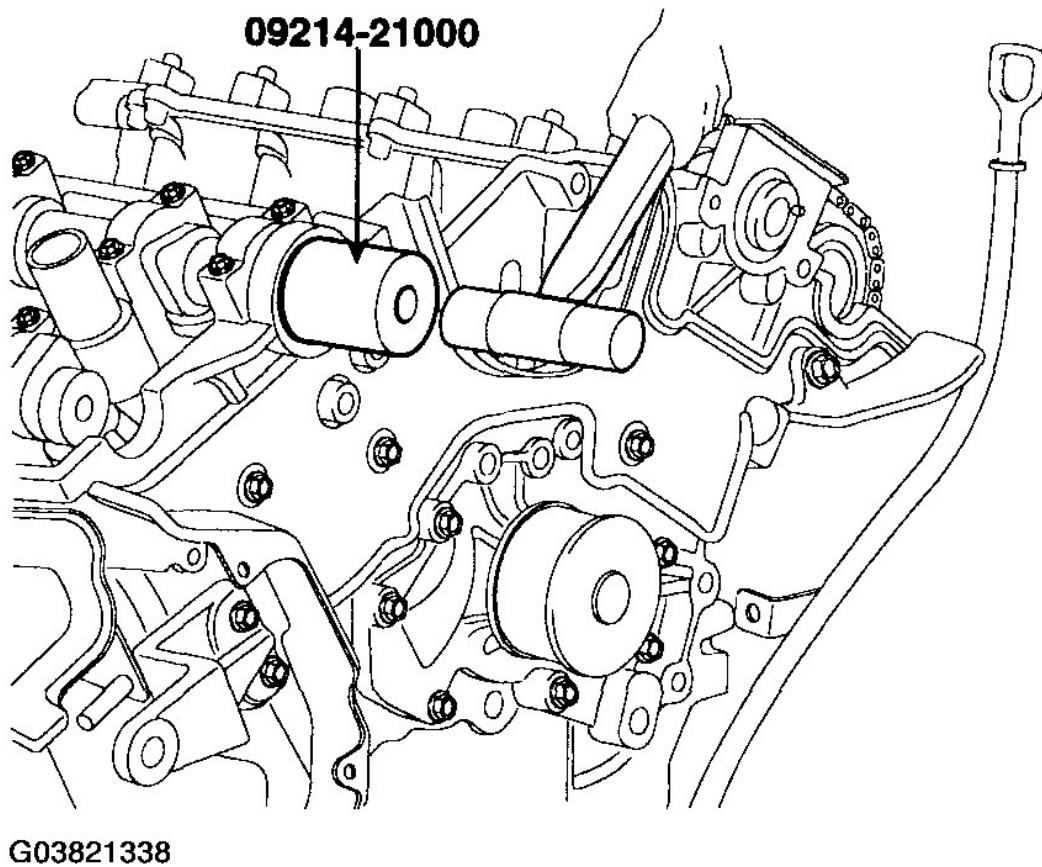


Fig. 52: Installing Camshaft Bearing Oil Seal
 Courtesy of KIA MOTORS AMERICA, INC.

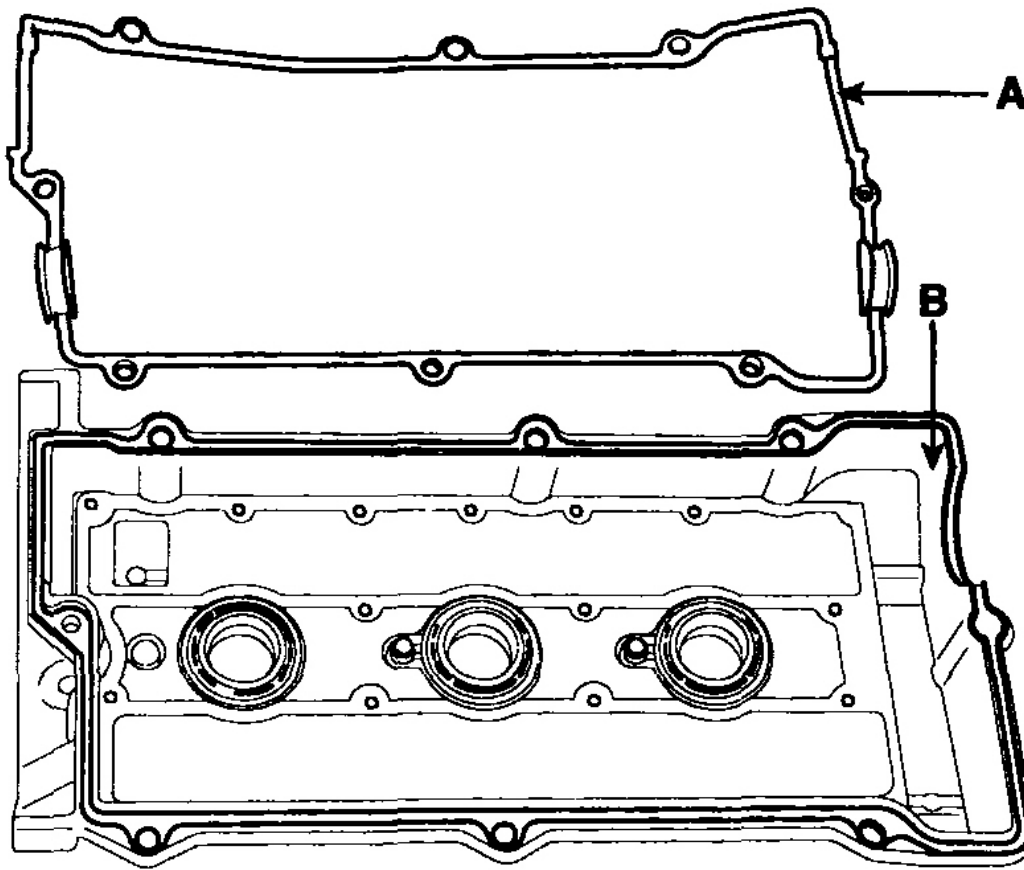
8. Install the camshaft sprocket.
 1. Temporarily install the camshaft sprocket bolts.
 2. Hold the hexagonal head wrench portion of the camshaft with a wrench, and tighten the camshaft sprocket bolts.

Tightening torque

Camshaft sprocket bolt

90 ~ 110N.m (900 ~ 1100kgf.cm, 65 ~ 80lb-ft)

9. Install semi-circular packing.
10. Install the cylinder head cover.
 1. Install the cylinder head cover gasket (A) in the groove of the cylinder head cover (B).



G03821339

Fig. 53: Installing Cylinder Head Cover Gasket In Cylinder Head Cover Groove
Courtesy of KIA MOTORS AMERICA, INC.

NOTE:

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

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

NOTE:

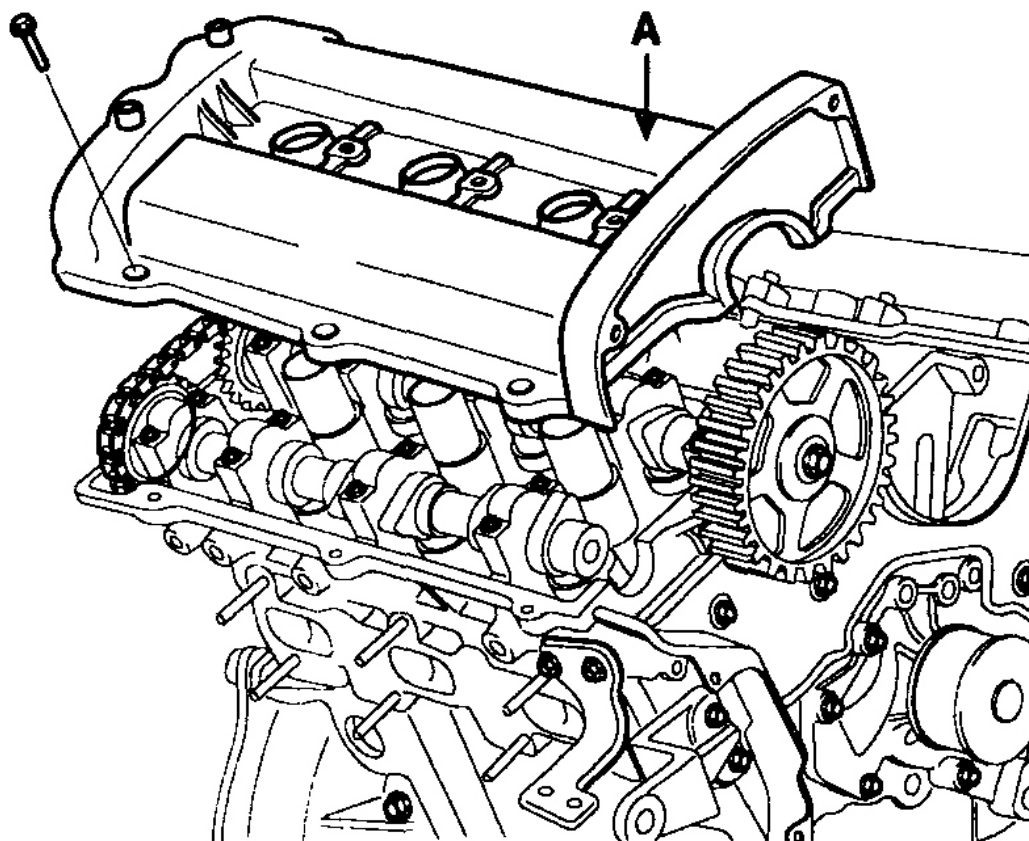
- Use liquid gasket, loctite No.5699.
- Check that the mating surfaces are clean and dry before applying liquid gasket.
- After assembly, wait at least 30 minutes before filling the engine

with oil.

3. Install the cylinder head covers (A) with the 16bolts. Uniformly tighten the bolts in several passes.

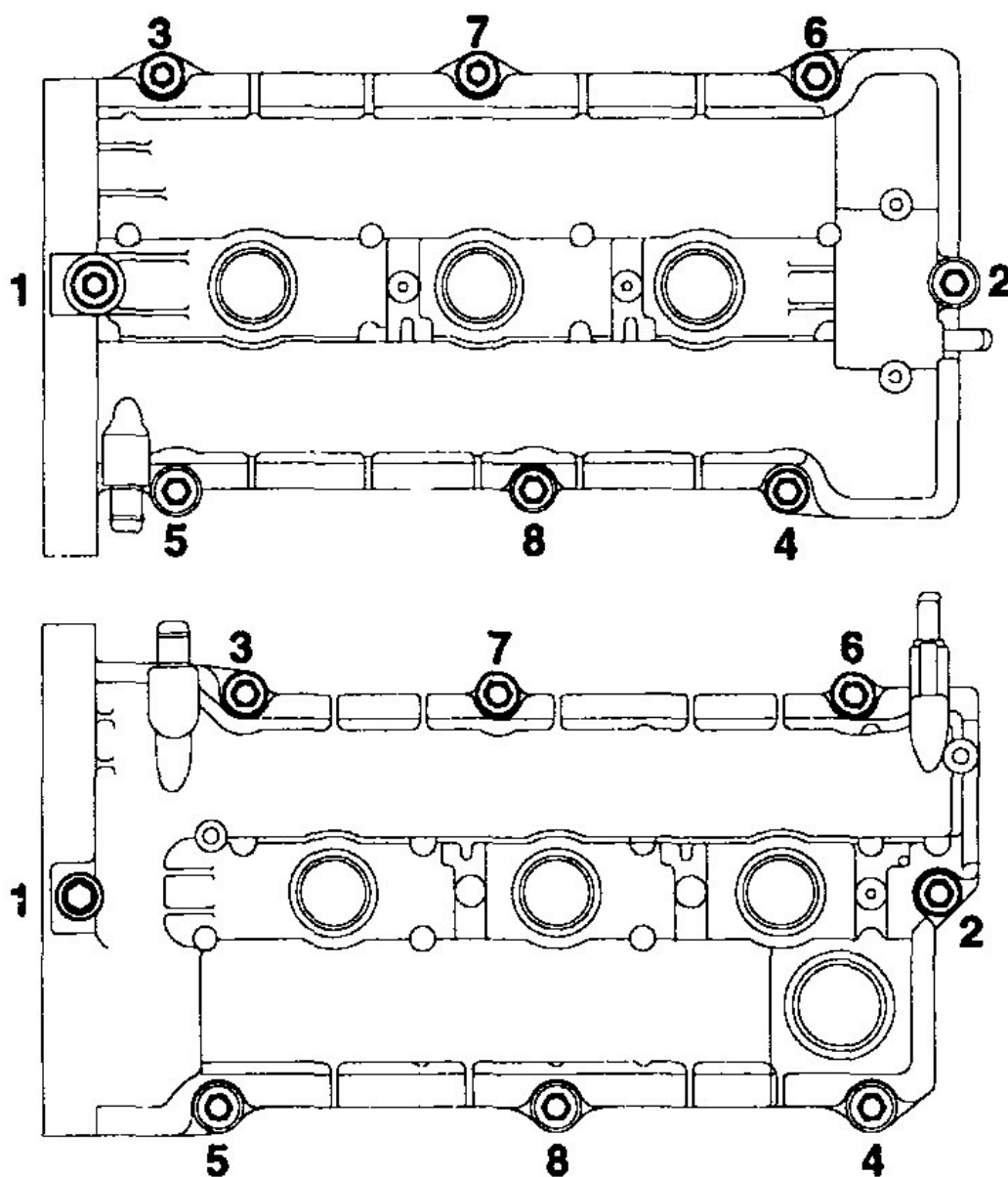
Tightening torque

8 ~ 10N.m (80 ~ 100kgf.cm, 6 ~ 7.4lb-ft)



G03821340

Fig. 54: Installing Cylinder Head Cover
Courtesy of KIA MOTORS AMERICA, INC.

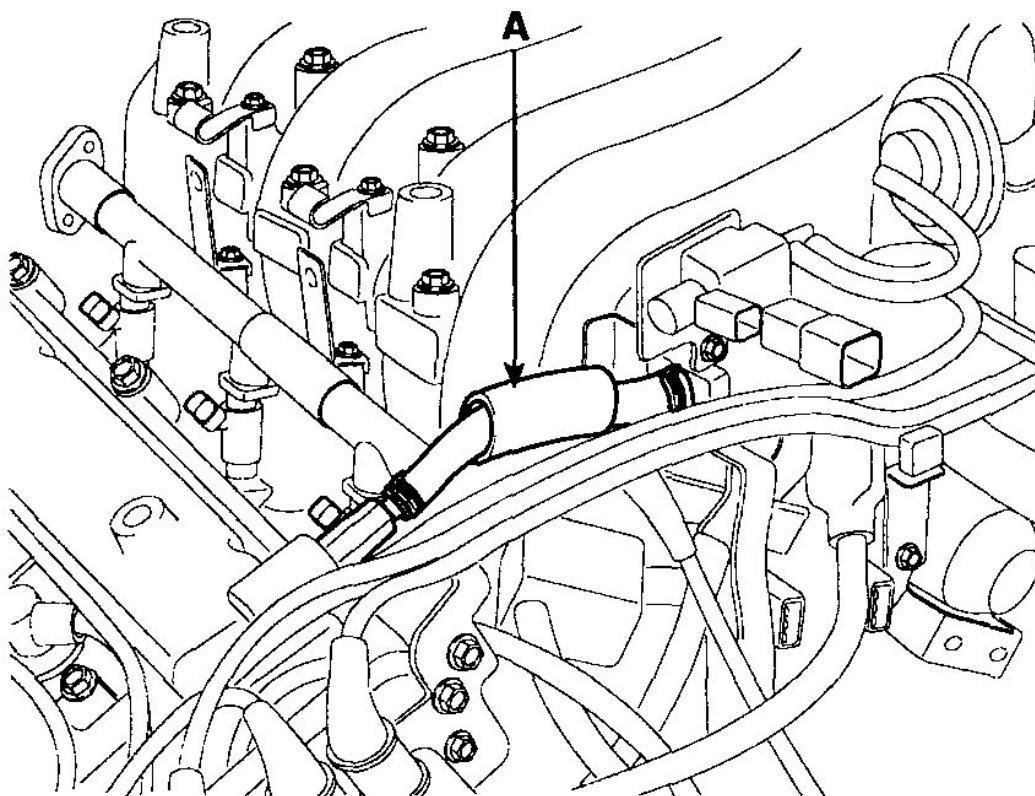


G03821341

Fig. 55: Cylinder Head Cover Bolt Torque Sequence
Courtesy of KIA MOTORS AMERICA, INC.

11. Install the spark plug cable. (See **IGNITION SYSTEM**)
12. Install the timing belt. (See **TIMING SYSTEM - 2.7L**).
13. Install the exhaust manifold. (See **INTAKE AND EXHAUST SYSTEM - 2.7L**)

14. Install the power steering pump. (**POWER STEERING OIL PUMP**)
15. Install the intake manifold. (See **INTAKE AND EXHAUST SYSTEM - 2.7L**)
16. Install the PCV hose (A).

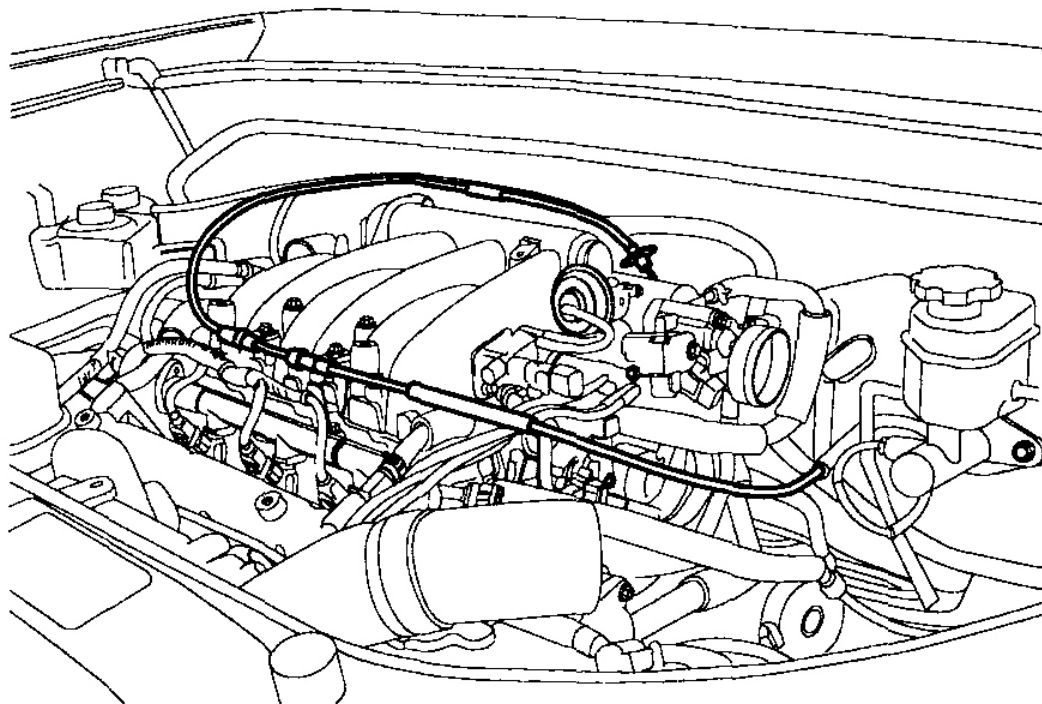


G03821342

Fig. 56: Installing PCV Hose

Courtesy of KIA MOTORS AMERICA, INC.

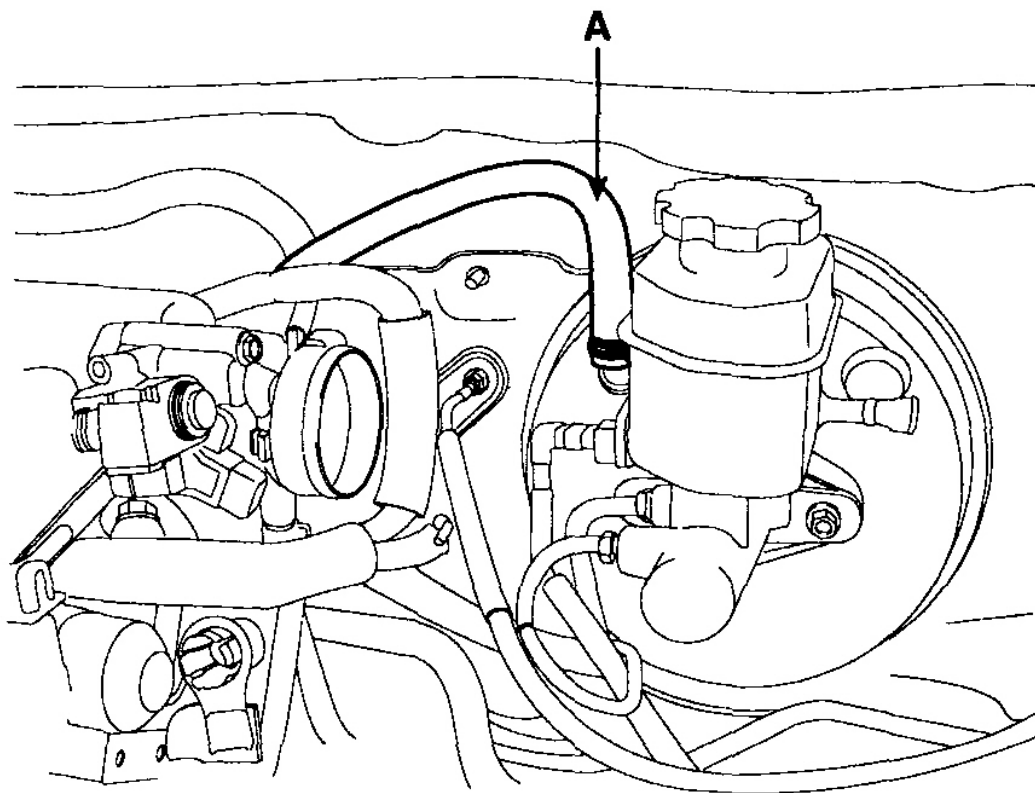
17. Install the accelerator cable.



G03821343

Fig. 57: Installing Accelerator Cable
Courtesy of KIA MOTORS AMERICA, INC.

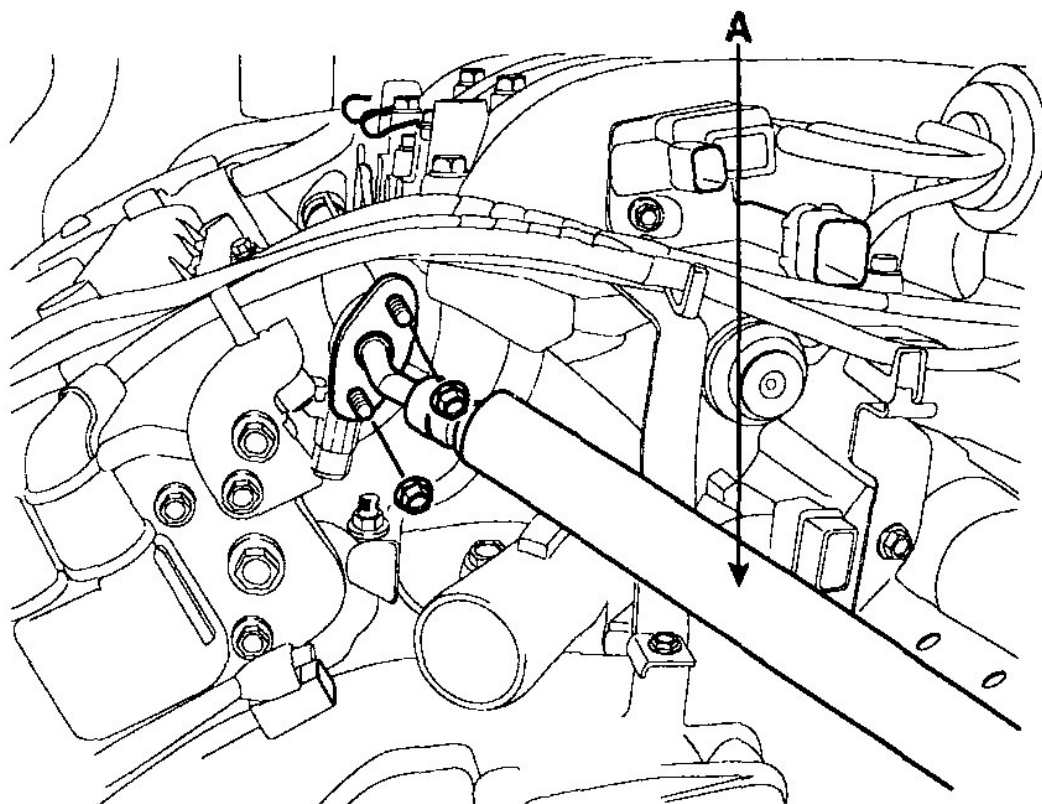
18. Install the brake booster vacuum hose (A).



G03821344

Fig. 58: Installing Brake Booster Vacuum Hose
Courtesy of KIA MOTORS AMERICA, INC.

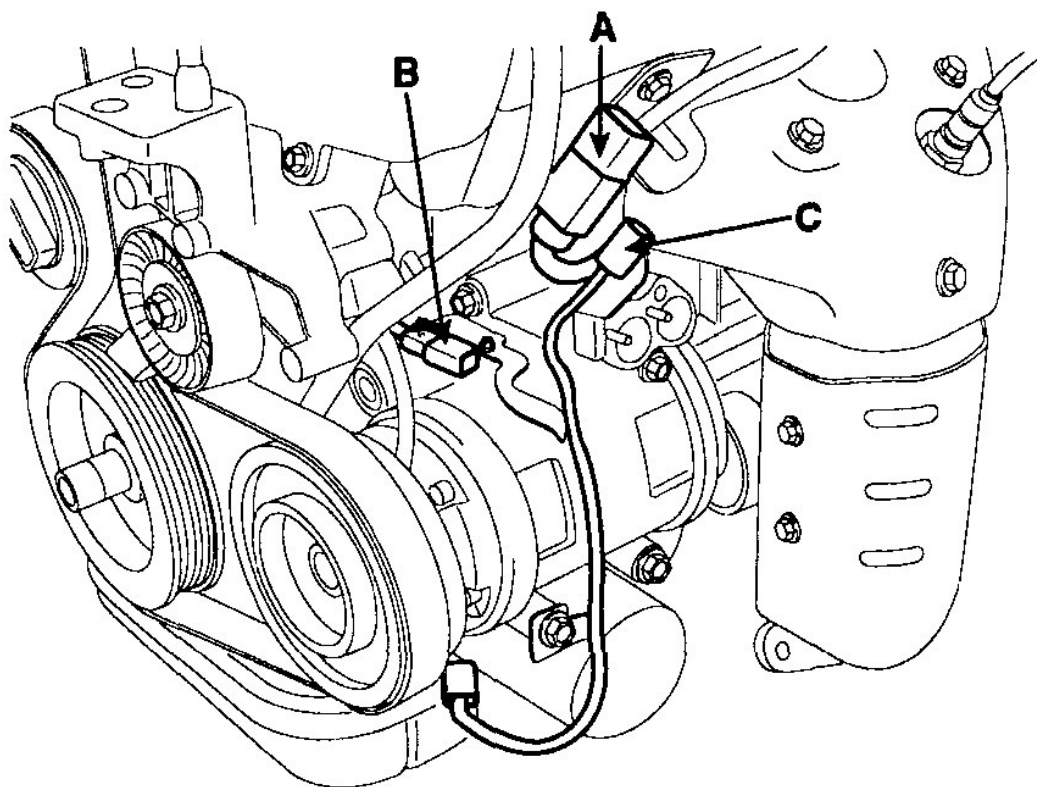
19. Install the fuel inlet hose (A).



G03821345

Fig. 59: Installing Fuel Inlet Hose
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. Oil pressure sensor connector (C).
 2. Air conditioner compressor switch connector (B).
 3. Oxygen sensor (Front 1st) connector (A).

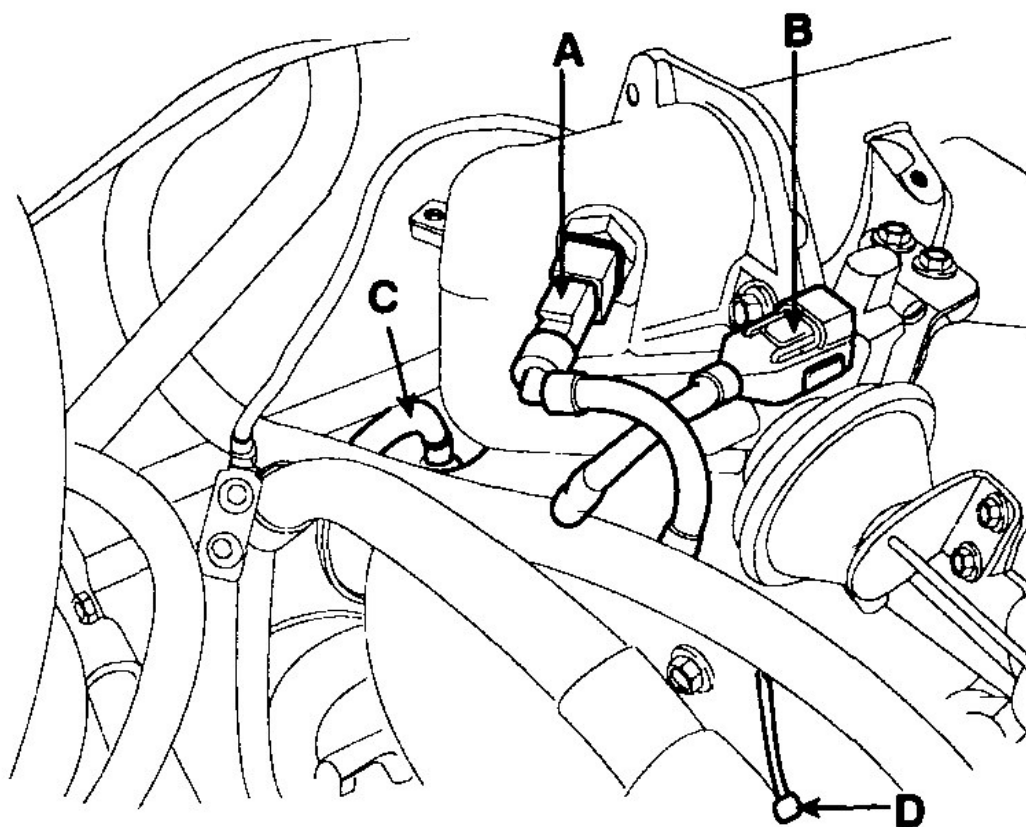


G03821346

Fig. 60: Connecting Connectors

Courtesy of KIA MOTORS AMERICA, INC.

4. Power steering pump switch (D).
5. Oxygen sensor (rear 2nd) connector (C).
6. VIS actuator connector (B).
7. IAT (Intake Air Temperature) sensor connector (A).

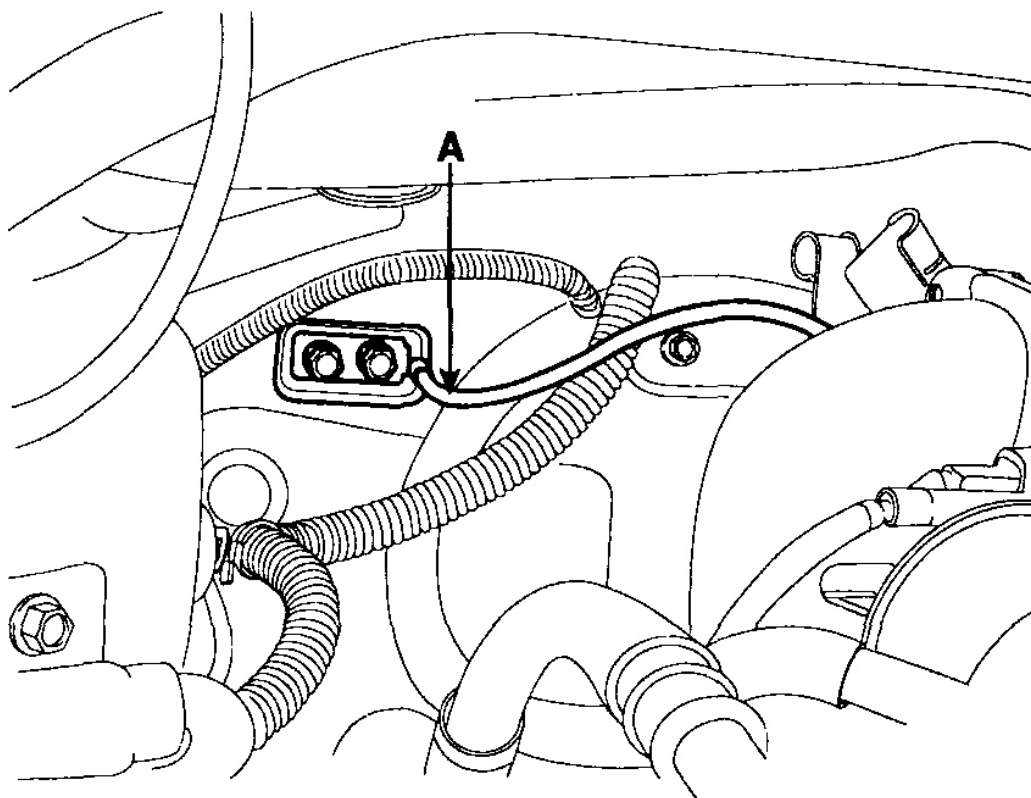


G03821347

Fig. 61: Connecting Power Steering Pump Switch, Oxygen Sensor, VIS Actuator And IAT Sensor Connector

Courtesy of KIA MOTORS AMERICA, INC.

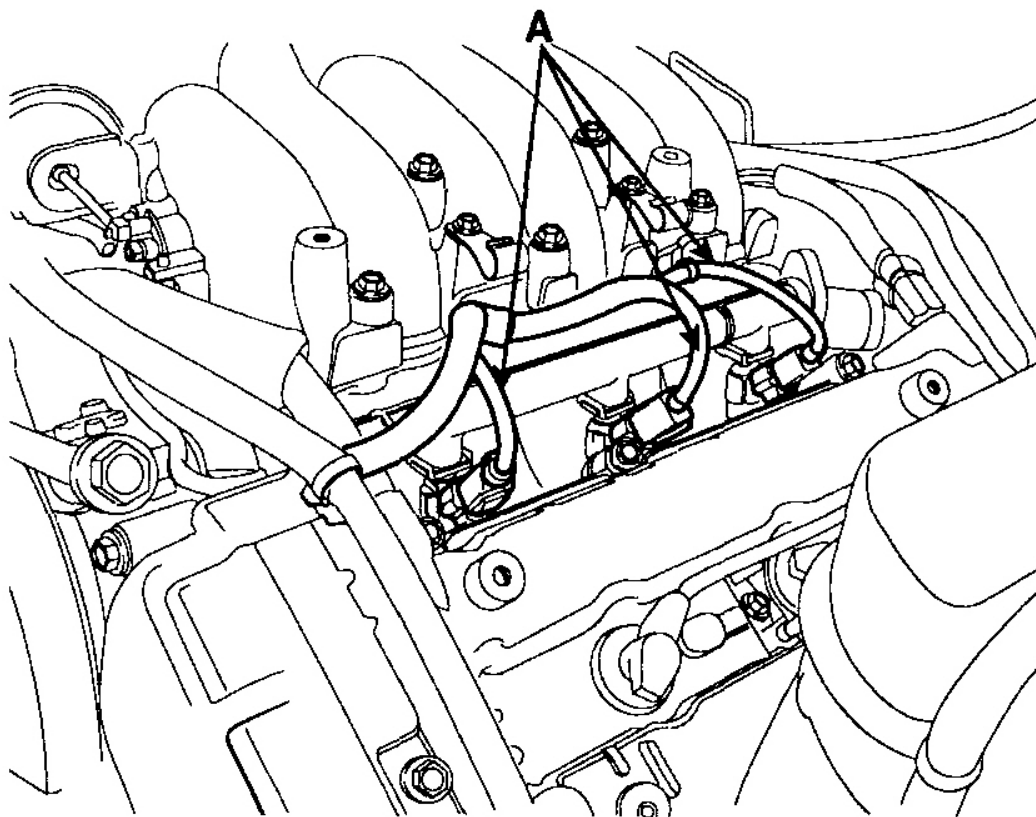
8. Connect the ground cable (A) to the cowl panel.



G03821348

Fig. 62: Connecting Ground Cable To Cowl Panel
Courtesy of KIA MOTORS AMERICA, INC.

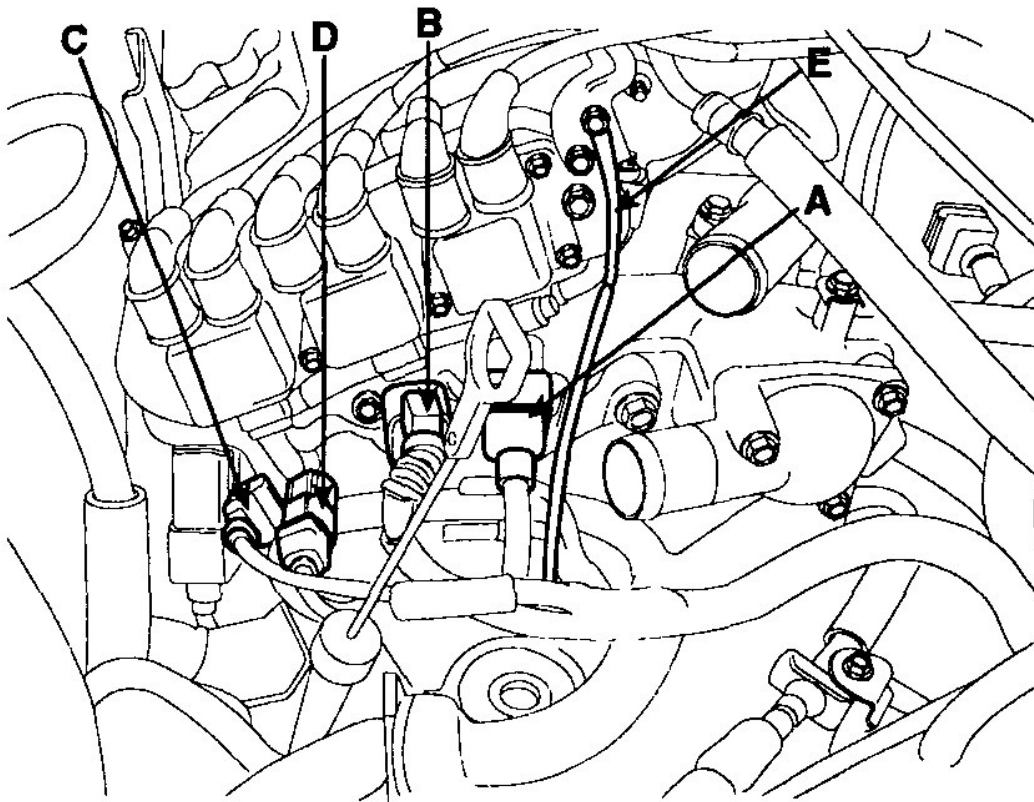
9. Three fuel injector connectors (A).



G03821349

Fig. 63: Connecting Fuel Injector Connectors
Courtesy of KIA MOTORS AMERICA, INC.

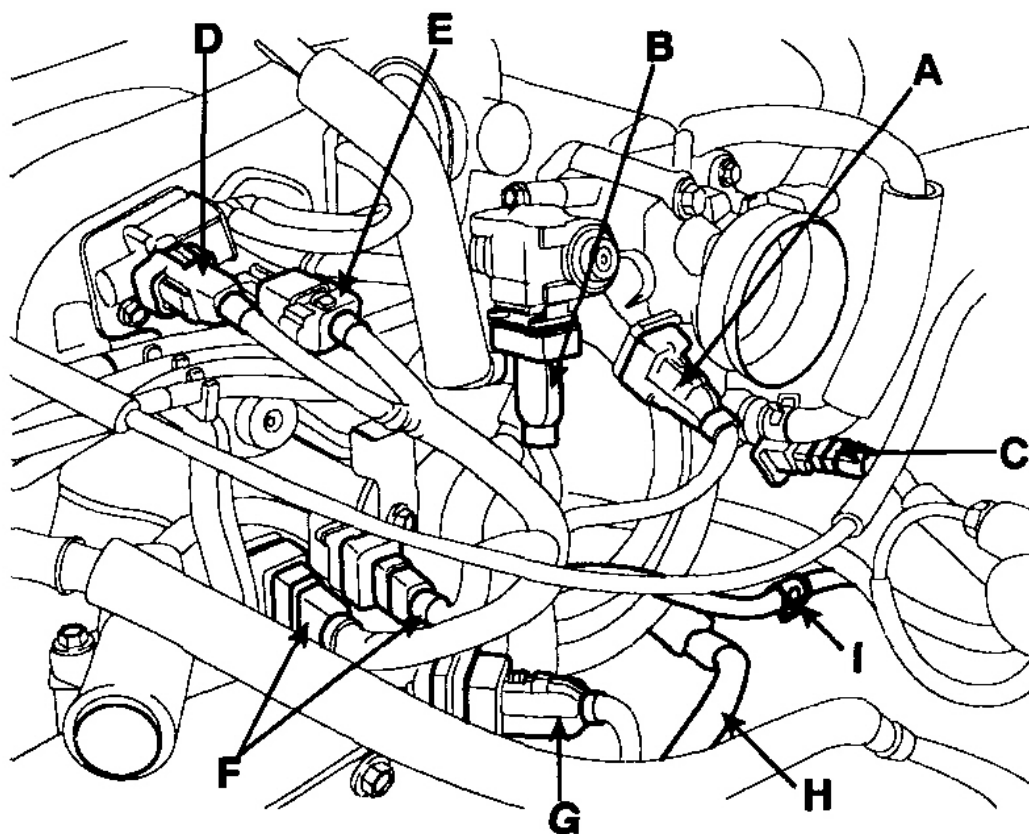
- 10. Ground cable (E).
- 11. Oxygen sensor connector (D).
- 12. Crankshaft position sensor connector (C).
- 13. Ignition coil connector (B).
- 14. ECT sensor connector (A).



G03821350

Fig. 64: Connecting ECT, CPS, Oxygen Sensor And Ignition Coil Connector
Courtesy of KIA MOTORS AMERICA, INC.

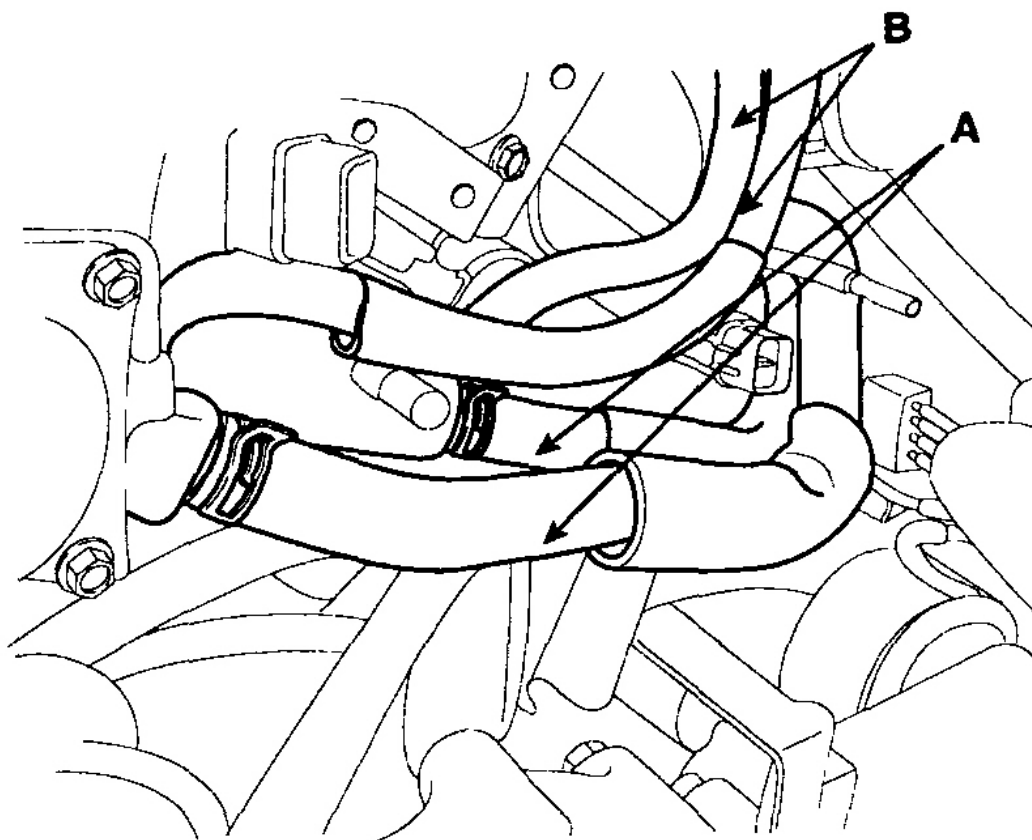
15. PCSV (Purge Control Solenoid Valve) hose (I).
16. Oxygen sensor (rear 1st) connector (H).
17. CMP (Camshaft position sensor) connector (G).
18. Knock sensor connector (F).
19. Injector connector (E).
20. VIS actuator connector (D).
21. PCSV (Purge Control Solenoid Valve) connector (C).
22. ISA connector (B).
23. TPS connector (A).



G03821351

Fig. 65: Connecting TPS, ISA, PCSV, VIS, CMP And Injector Connector And PCSV Hose
 Courtesy of KIA MOTORS AMERICA, INC.

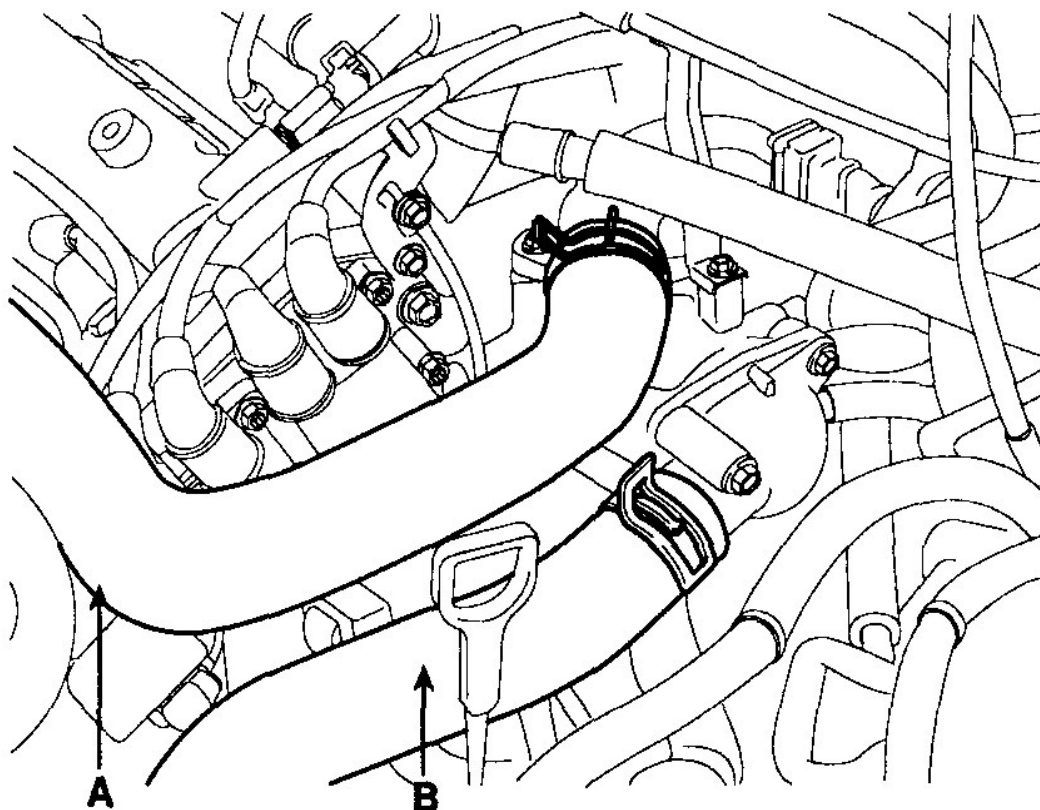
21. Install the heater hoses (A) and throttle body heater hose (B).



G03821352

Fig. 66: Installing Heater Hoses And Throttle Body Heater Hose
Courtesy of KIA MOTORS AMERICA, INC.

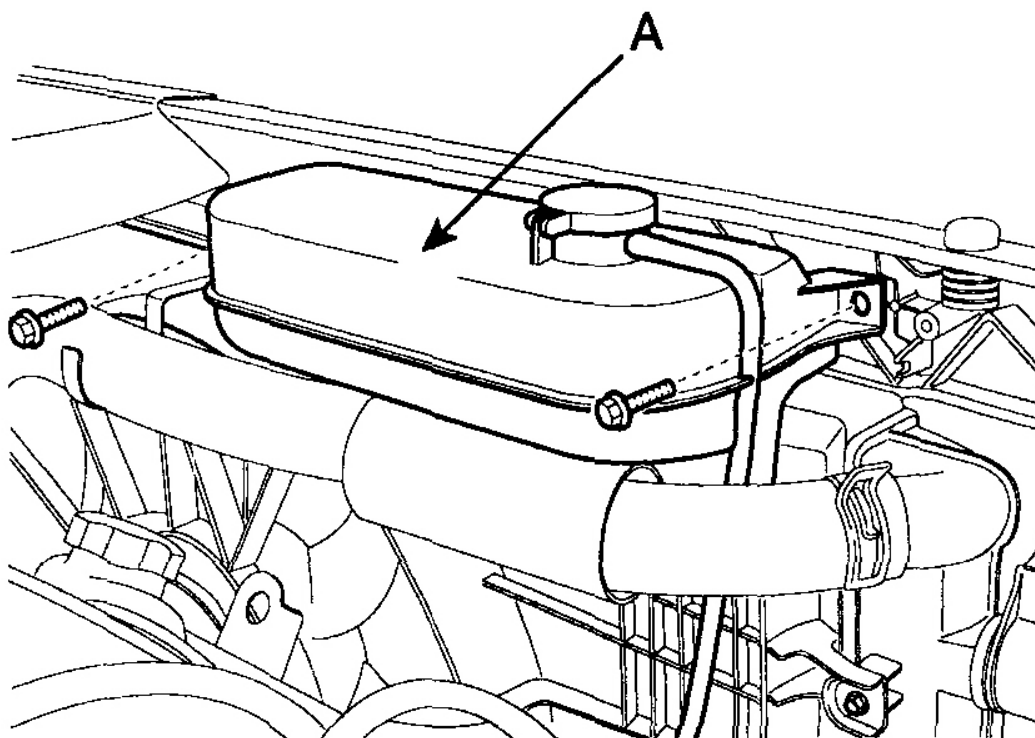
22. Install the upper radiator hose (A) and lower radiator hose (B).



G03821353

Fig. 67: Installing Upper And Lower Radiator Hose
Courtesy of KIA MOTORS AMERICA, INC.

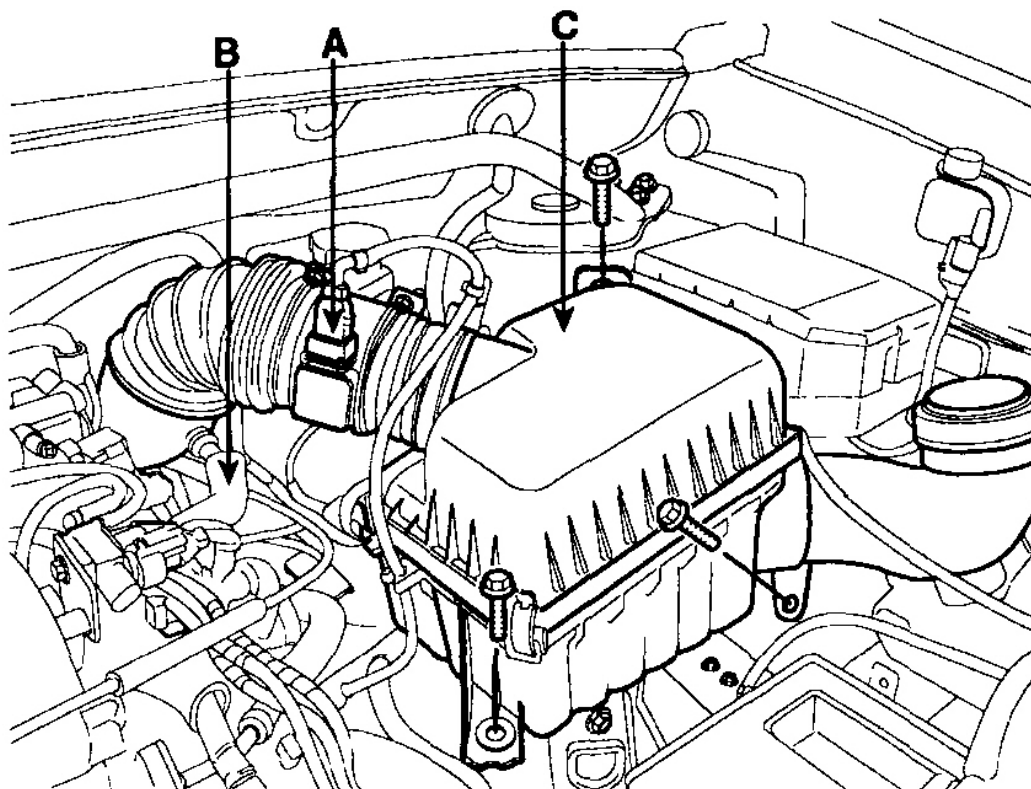
23. Install the coolant reservoir tank (A).



G03821354

Fig. 68: Installing Coolant Reservoir Tank
Courtesy of KIA MOTORS AMERICA, INC.

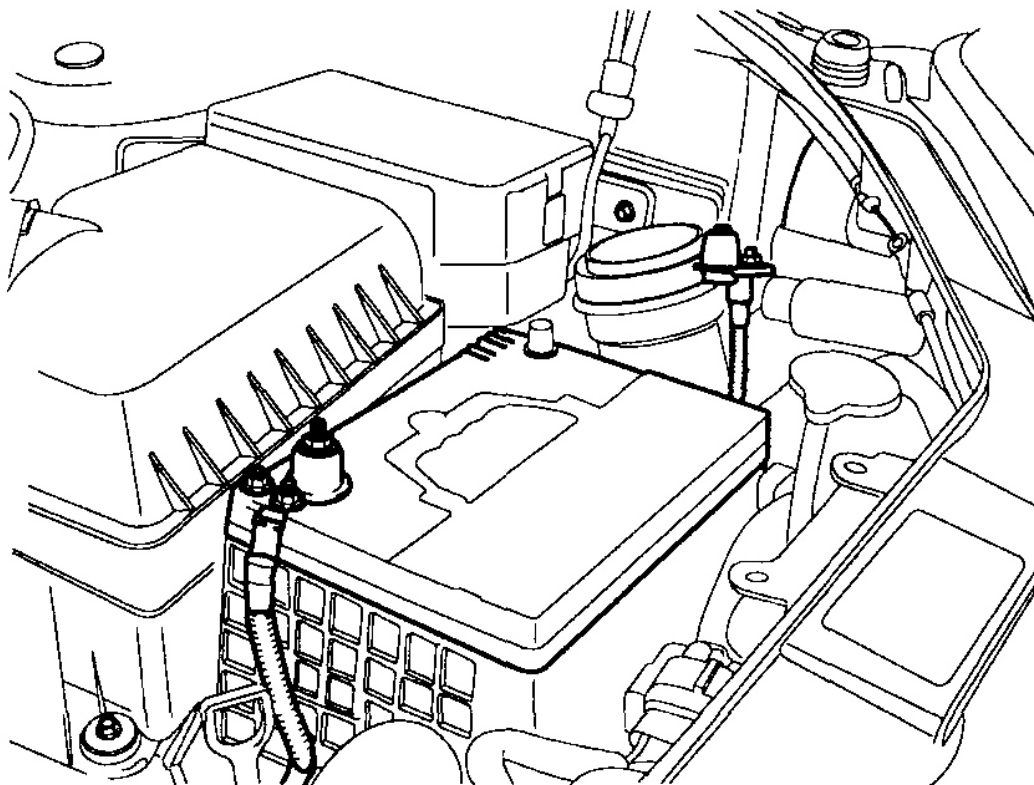
24. Install the intake air hose and air cleaner assembly.
 1. Install the intake air hose and air cleaner assembly (C).
 2. Connect the breather hose (B) from air cleaner hose.
 3. Connect the AFS connector (A).



G03821355

Fig. 69: Installing Intake Air Hose And Air Cleaner Assembly
Courtesy of KIA MOTORS AMERICA, INC.

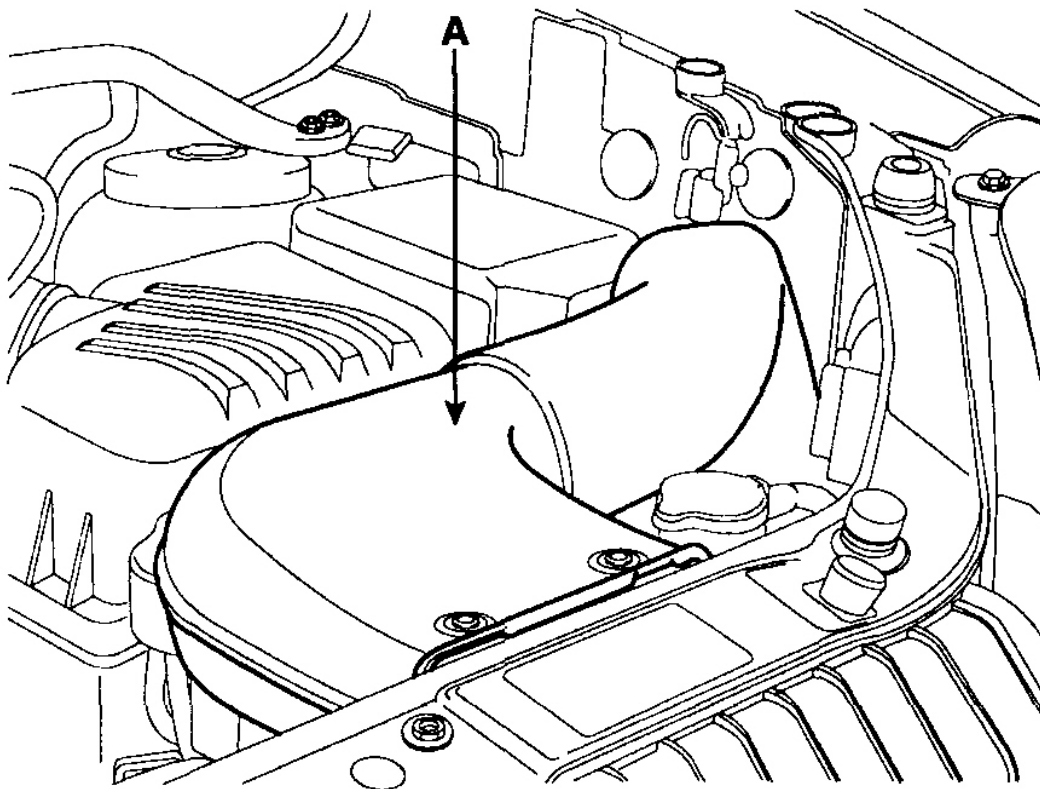
25. Install the engine cover.
26. Connect the negative terminal to the battery.



G03821356

Fig. 70: Connecting Negative Terminal To Battery
Courtesy of KIA MOTORS AMERICA, INC.

27. Install the strut bar.
28. Install the cowl grill and wiper motor. (Refer to **FRONT WIPER MOTOR**)
29. Install the air duct (A).



G03821357

Fig. 71: Installing Air Duct

Courtesy of KIA MOTORS AMERICA, INC.

30. Fill with engine coolant.
31. Start the engine and check for leaks.
32. Recheck engine coolant level and oil level.

2008 Kia Sportage LX

2008 ENGINE Engine Block - 2.7L - Sportage

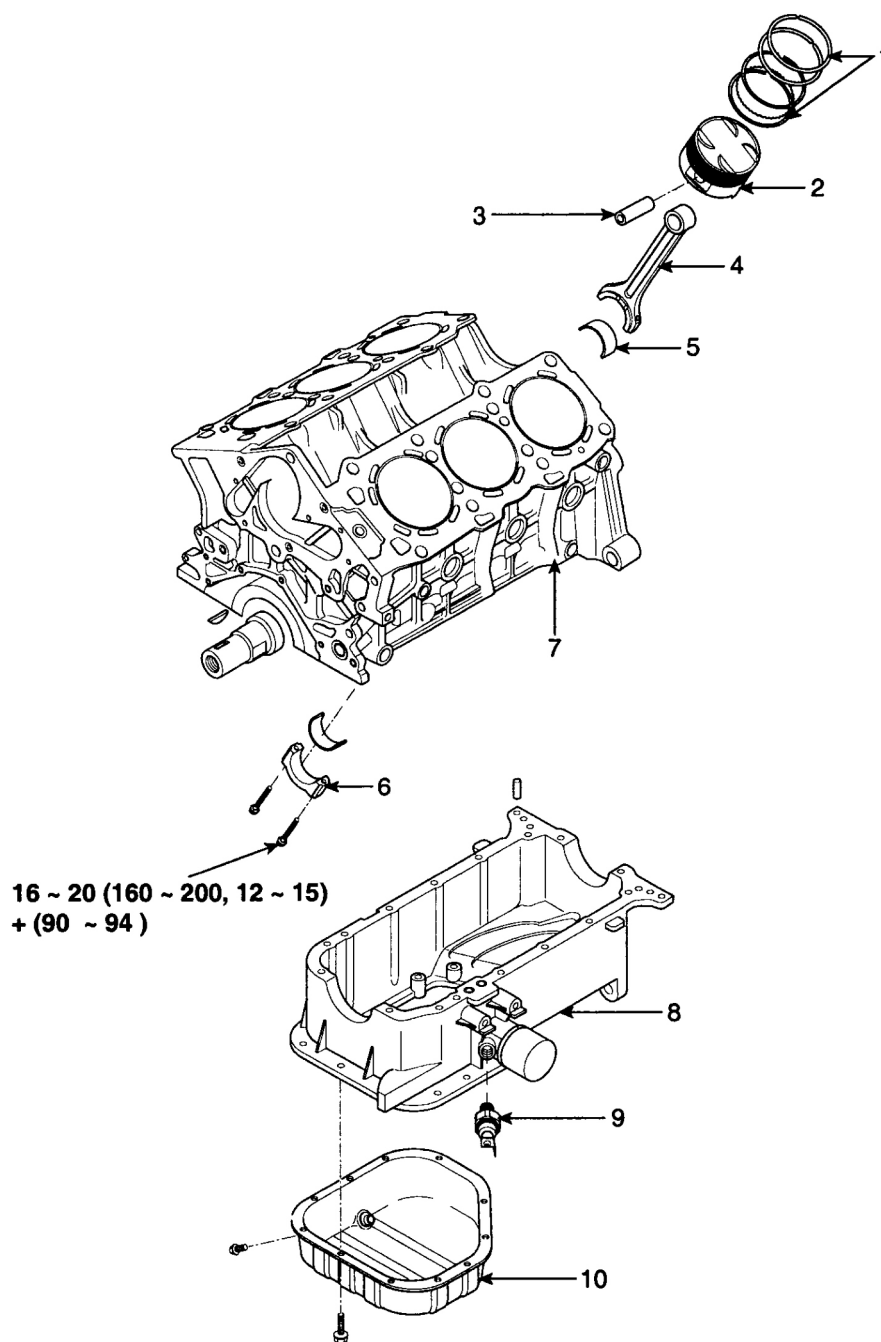
2008 ENGINE

Engine Block - 2.7L - Sportage

COMPONENT

2008 Kia Sportage LX

2008 ENGINE Engine Block - 2.7L - Sportage



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

1. Piston ring
2. Piston
3. Piston pin
4. Connecting rod
5. Connecting rod bearing

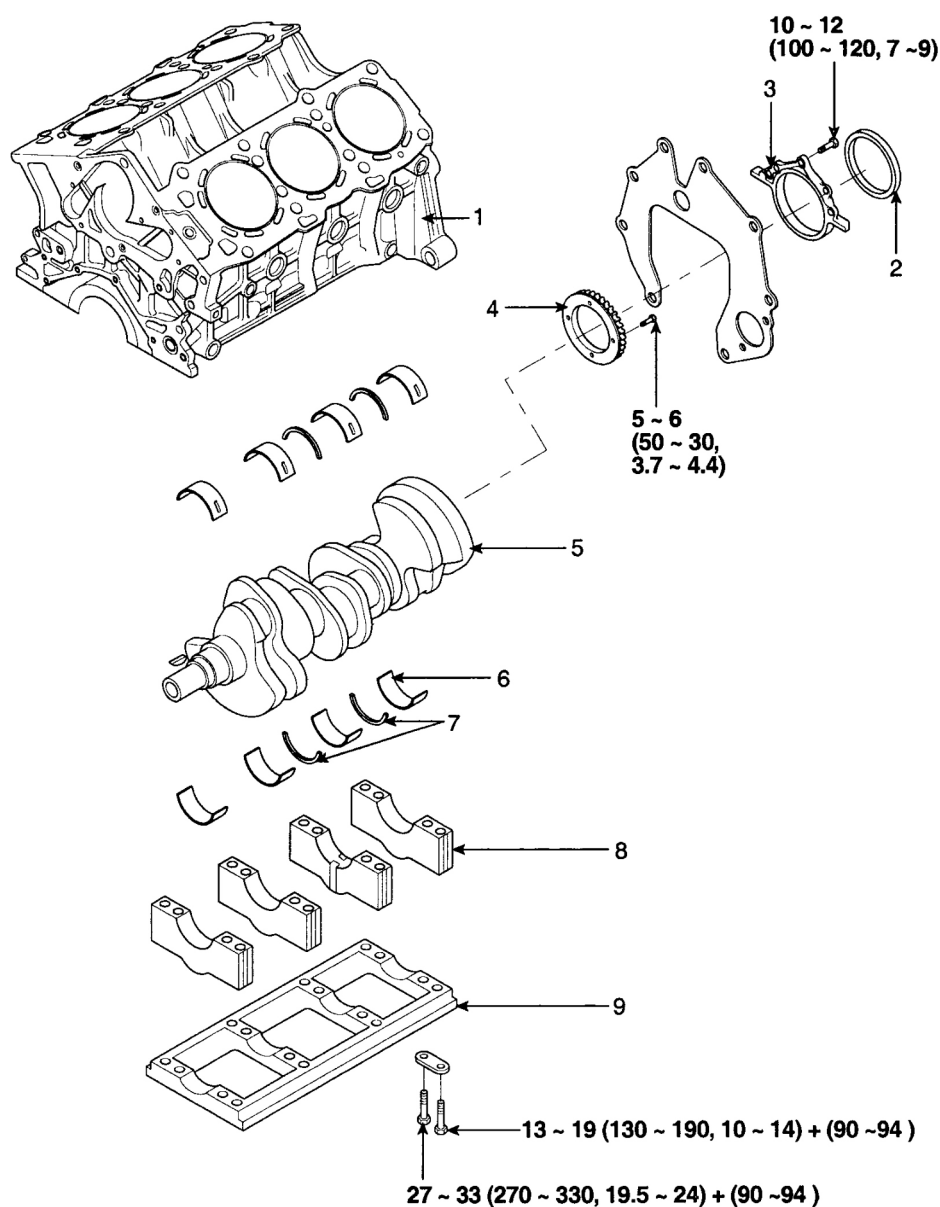
6. Bearing cap
7. Cylinder block
8. Upper oil pan
9. Oil pressure switch
10. Lower oil pan

G03821392

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

2008 Kia Sportage LX

2008 ENGINE Engine Block - 2.7L - Sportage



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

- 1. Cylinder block
- 2. Oil seal
- 3. Oil seal case
- 4. Crankshaft position sensor wheel
- 5. Crankshaft

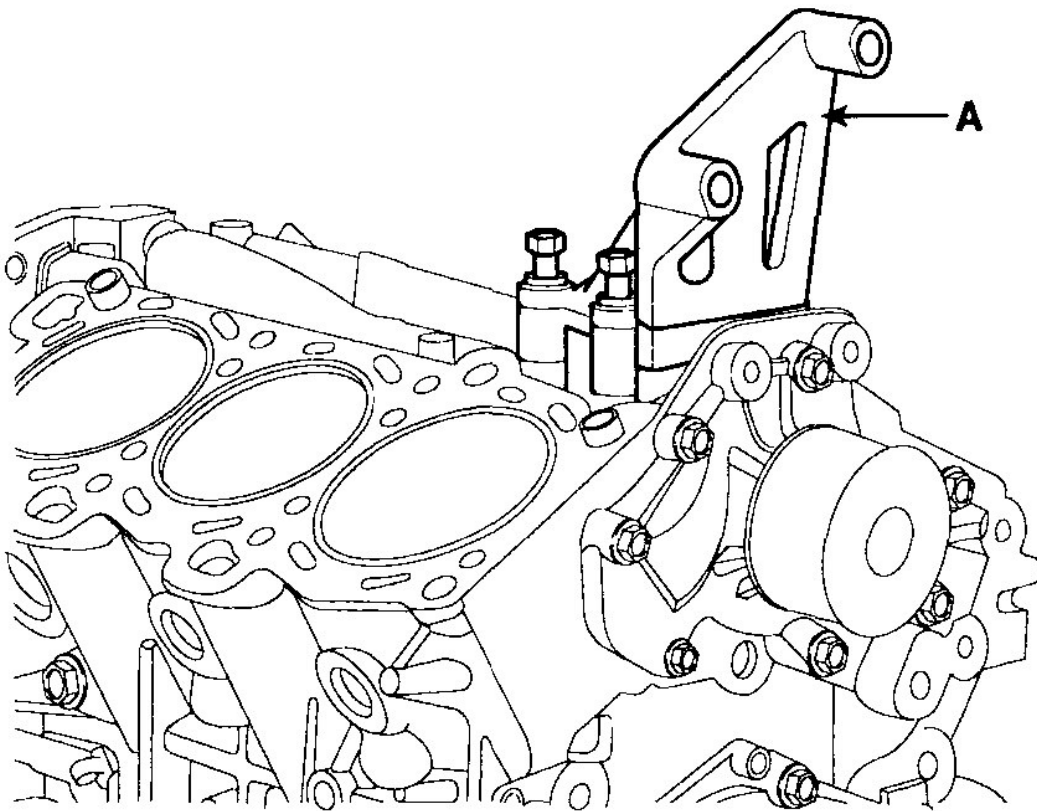
- 6. Main bearing
- 7. Thrust bearing
- 8. Main bearing cap
- 9. Bearing cap bridge

G03821393

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

DISASSEMBLY

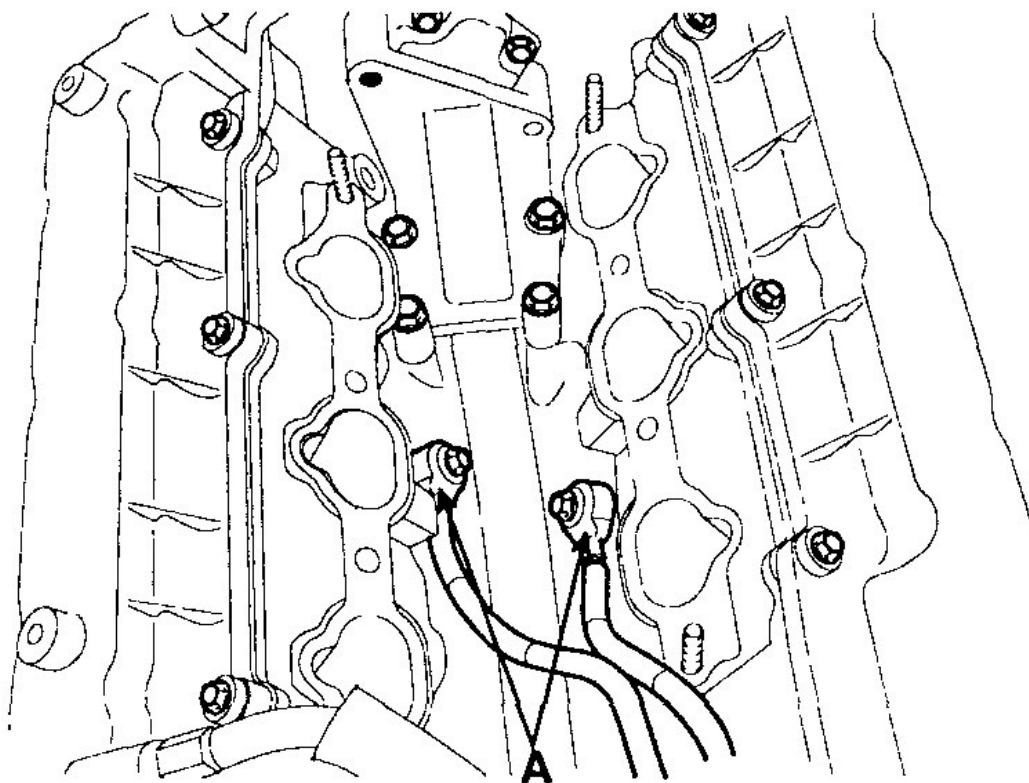
1. A/T: remove drive plate.
2. Install engine to engine stand for disassembly (A).
3. Remove timing belt. (See **REMOVAL**).
4. Remove cylinder head. (See **CYLINDER HEAD ASSEMBLY - 2.7L**)
5. Remove oil level gauge assembly.
6. Remove the alternator. (See **ALTERNATOR**).
7. Remove the air compressor. (See **HEATING, VENTILATION & AIR CONDITIONING**)
8. Remove the power steering pump bracket (A).



G03821394

Fig. 3: Removing Power Steering Pump Bracket
Courtesy of KIA MOTORS AMERICA, INC.

9. Remove water pump. (See **COOLING SYSTEM**)
10. Remove knock sensors (A).

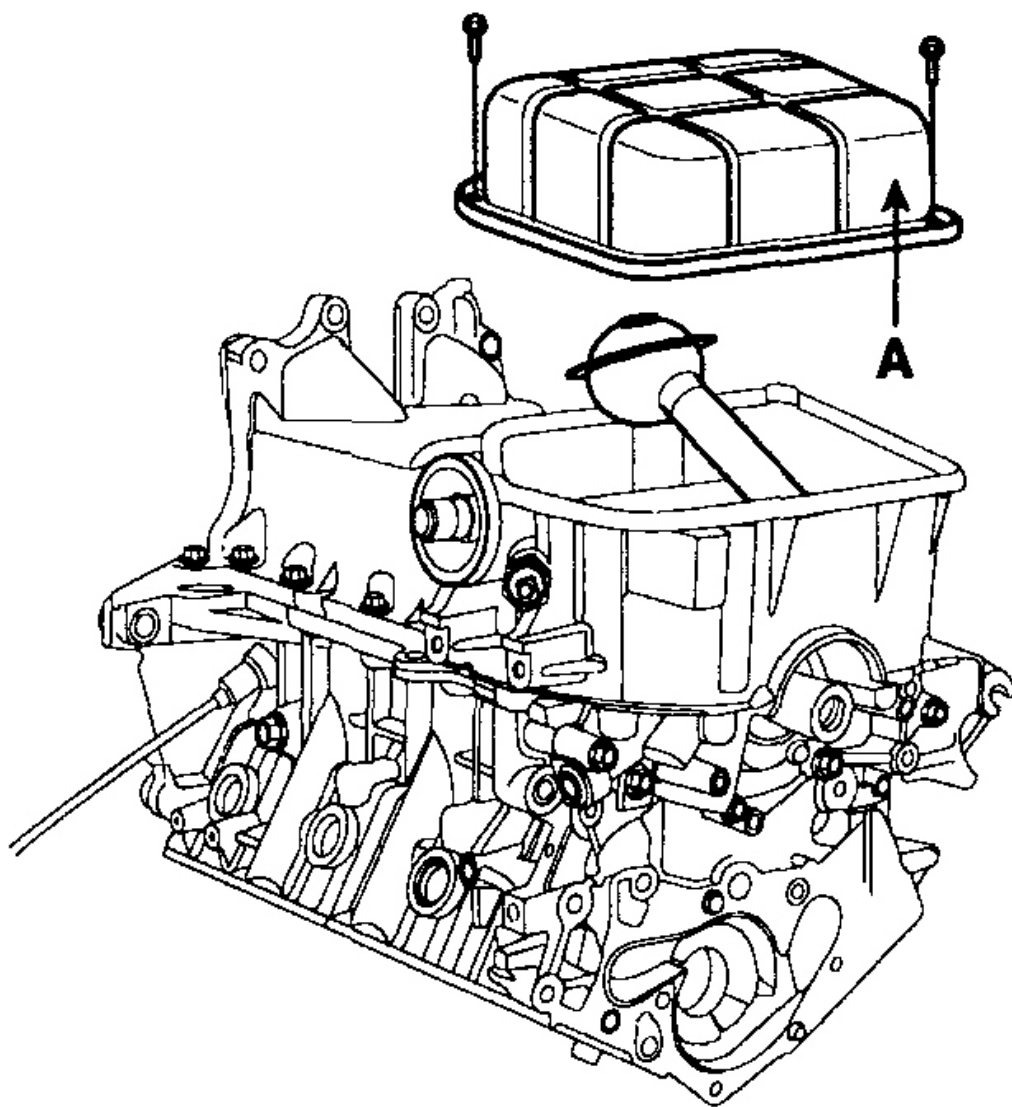


G03821395

Fig. 4: Removing Knock Sensor

Courtesy of KIA MOTORS AMERICA, INC.

11. Remove the lower oil pan (A).



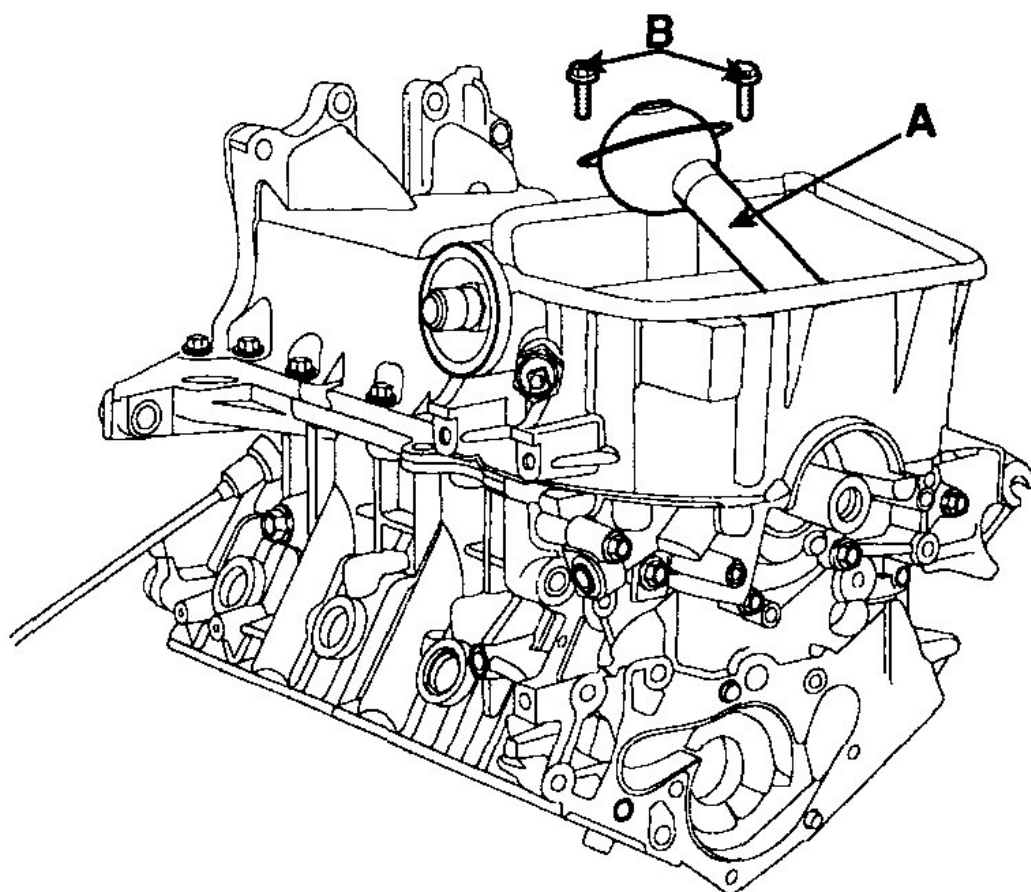
G03821396

Fig. 5: Removing Lower Oil Pan

Courtesy of KIA MOTORS AMERICA, INC.

12. Remove oil screen.

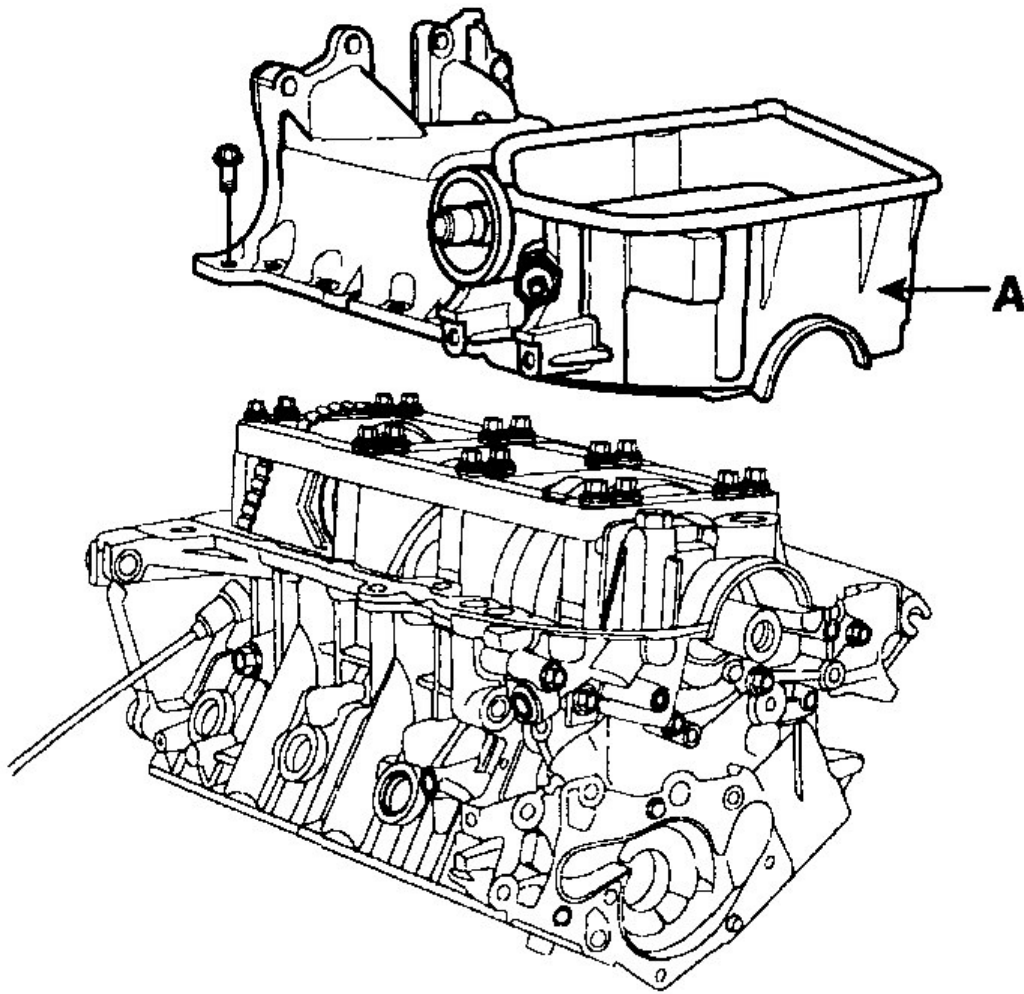
Remove the 2bolts (B), oil screen (A) and gasket.



G03821397

Fig. 6: Removing Oil Screen And Gasket
Courtesy of KIA MOTORS AMERICA, INC.

13. Remove the upper oil pan (A).



G03821398

Fig. 7: Removing Upper Oil Pan

Courtesy of KIA MOTORS AMERICA, INC.

14. Check the connecting rod end play. (See **INSPECTION**)
15. Remove the connecting rod caps and check oil clearance. (See **INSPECTION**)
16. Remove piston and connecting rod assemblies.
 1. Using a ridge reamer, remove all the carbon from the top of the cylinder.
 2. Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.

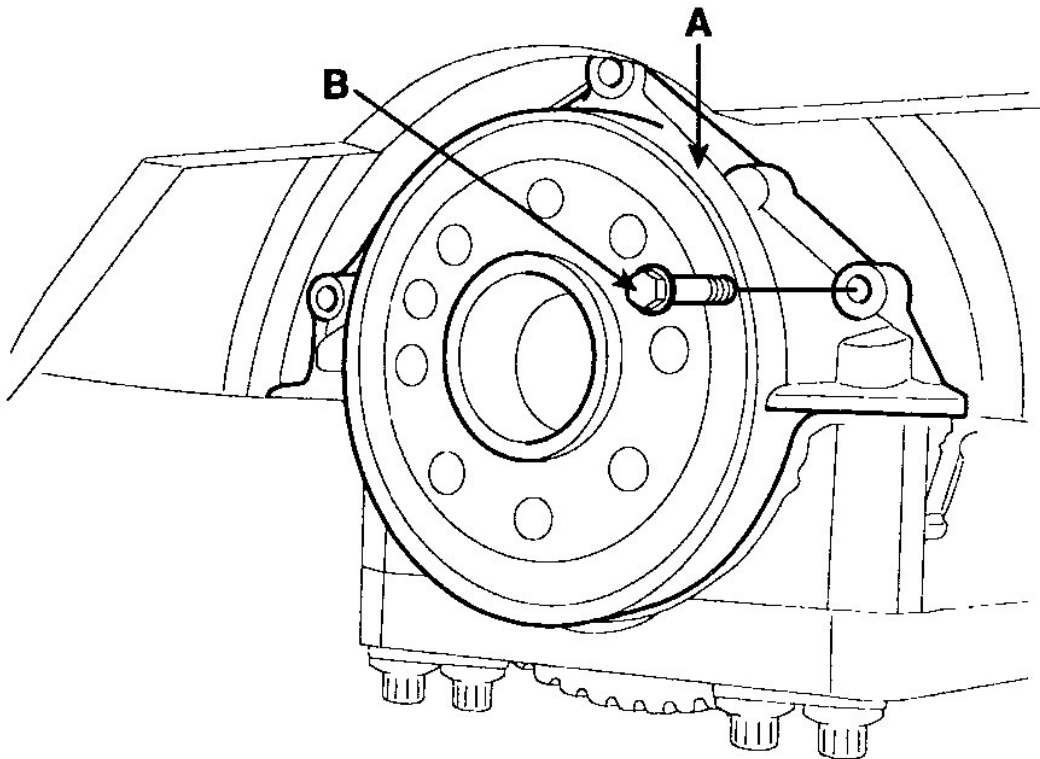
NOTE:

- **Keep the bearings, connecting rod and cap together.**

- Arrange the piston and connecting rod assemblies in the correct order.

17. Remove front case. (See LUBRICATION SYSTEM - 2.7L)
18. Remove oil seal case.

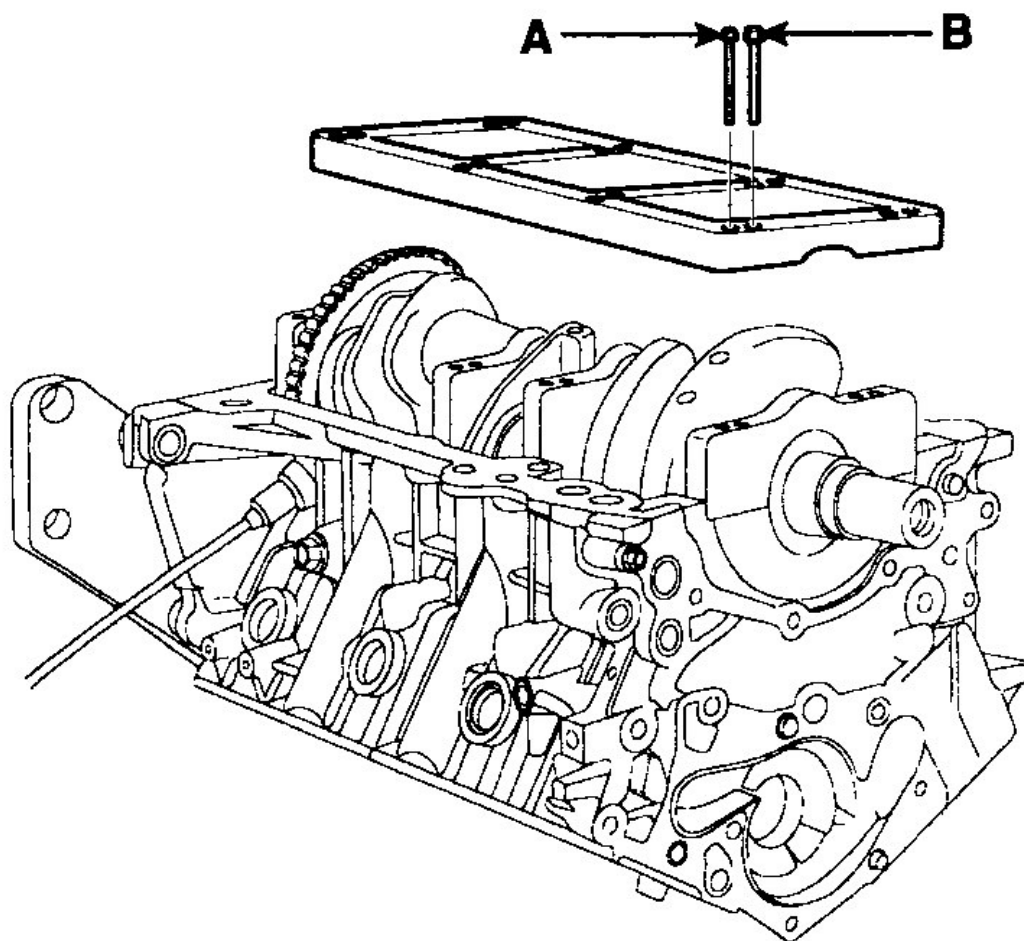
Remove the 3 bolts (B) and oil seal case (A).



G03821399

Fig. 8: Removing Oil Seal Case
Courtesy of KIA MOTORS AMERICA, INC.

19. Check the crankshaft end play. (See CRANKSHAFT)
20. Remove crankshaft bearing cap and check oil clearance. (See CONNECTING ROD AND CRANKSHAFT)

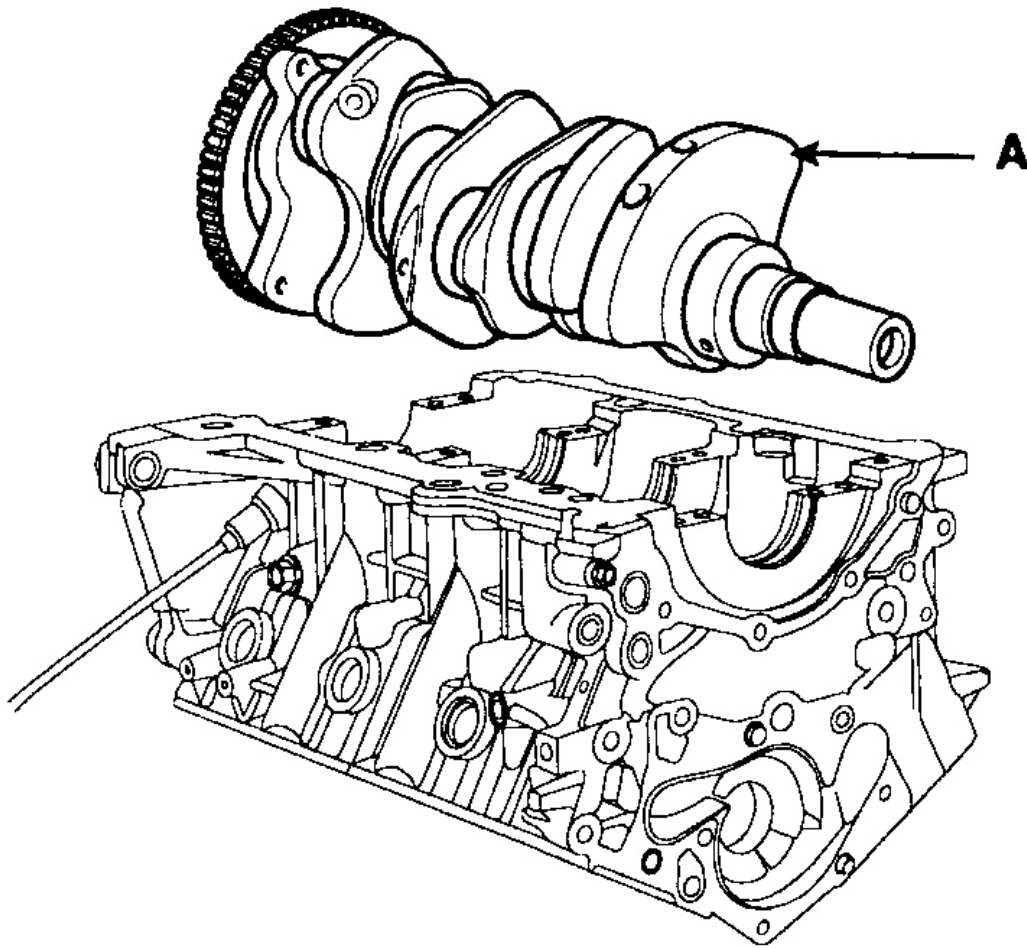


G03821400

Fig. 9: Removing Crankshaft Bearing Cap
Courtesy of KIA MOTORS AMERICA, INC.

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

NOTE: **Arrange the main bearings and trust washers in the correct order.**



G03821401

Fig. 10: Removing Crankshaft From Engine
Courtesy of KIA MOTORS AMERICA, INC.

22. 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.

23. Remove piston rings.
1. Using a piston ring expander, remove the 2 compression rings.
 2. Remove the 2 side rails and oil ring by hand.

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

24. Disconnect connecting rod from piston.

INSPECTION

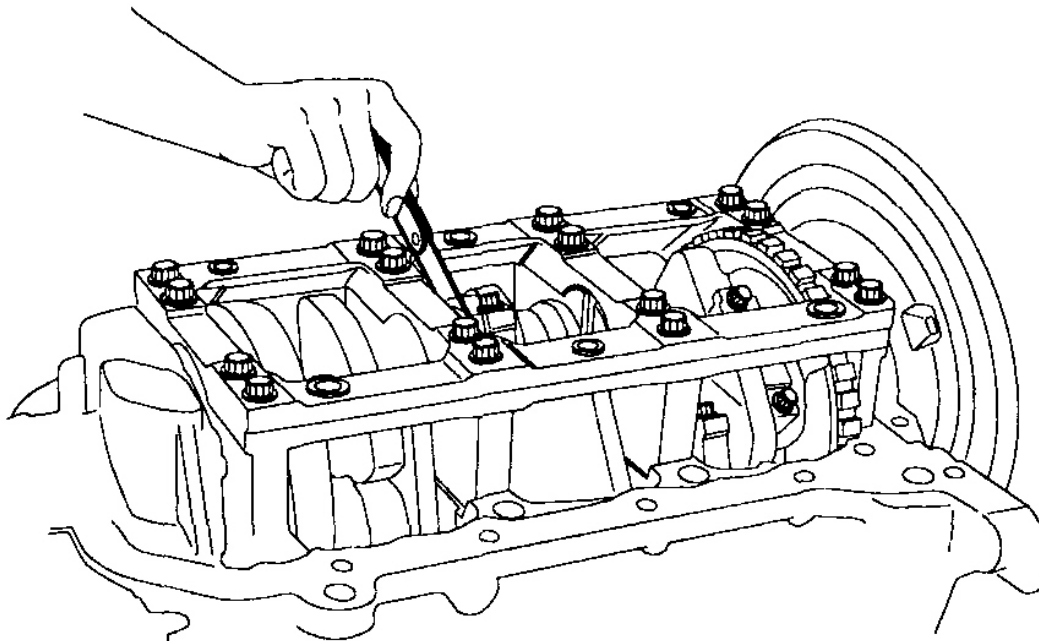
CONNECTING ROD AND CRANKSHAFT

1. Check the connecting rod end play.

Using a dial indicator, measure the end play while moving the connecting rod back and forth.

Standard end play: 0.1 ~ 0.25mm(0.004 ~ 0.010in.)

Maximum end play: 0.4mm(0.016in.)



G03821402

Fig. 11: Measuring Connecting Rod End Play
Courtesy of KIA MOTORS AMERICA, INC.

- If out-of-tolerance, replace the connecting rod assembly.
 - If still out-of-tolerance, replace the crankshaft.
2. Check the connecting rod bearing oil clearance.
 1. Check the matchmarks on the connecting rod and cap are aligned to ensure correct reassembly.

2. Remove the 2 connecting rod cap bolts.
3. Remove the connecting rod cap and bearing half.
4. Clean the crank pin and bearing.
5. Place plastigage across the crank pin.
6. Reinstall the bearing half and cap, and torque the bolts.

Tightening torque

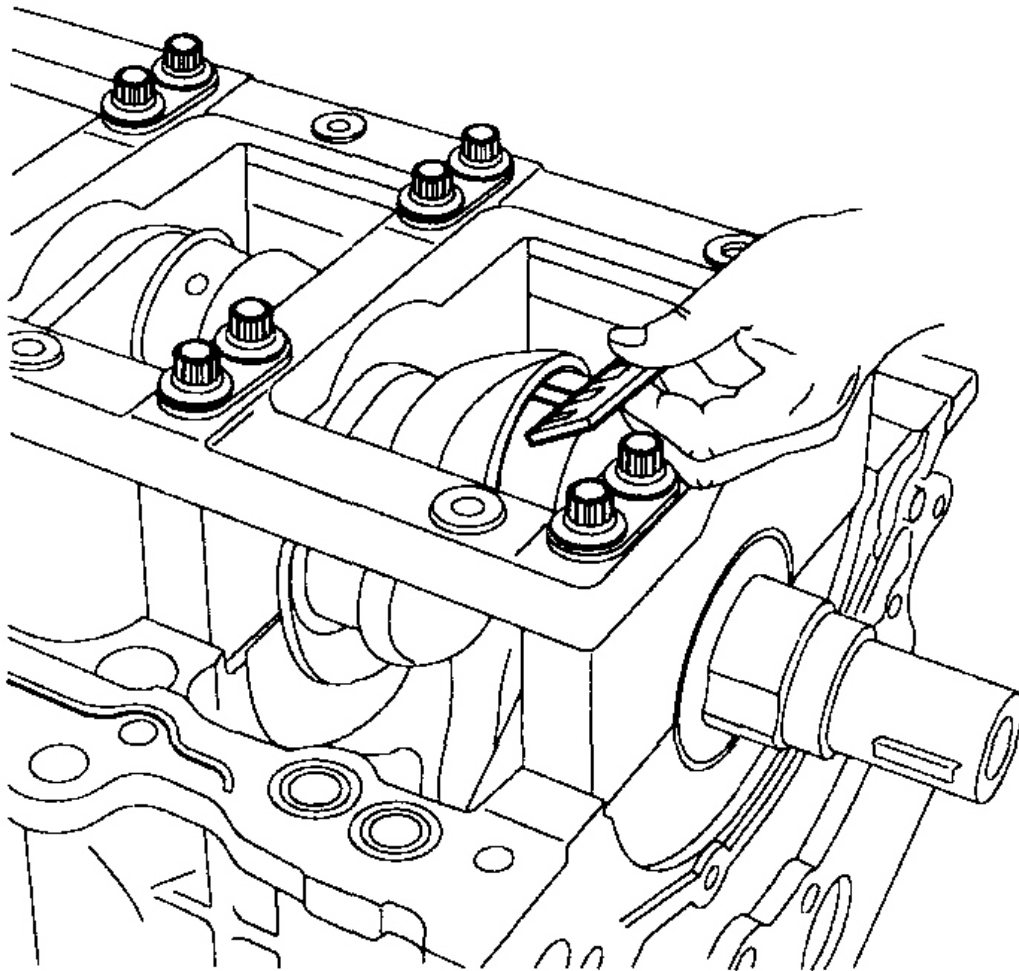
16 ~ 20N.m (160 ~ 200kgf.cm, 12 ~ 15lb-ft) + 90°

NOTE: Do not turn the crankshaft.

7. Remove the 2bolts, connecting rod cap and bearing half.
8. Measure the plastigage at its widest point.

Standard oil clearance

0.018 ~ 0.036mm(0.0007 ~ 0.0014in.)



G03821403

Fig. 12: Measuring Plastigage At Widest Point
Courtesy of KIA MOTORS AMERICA, INC.

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

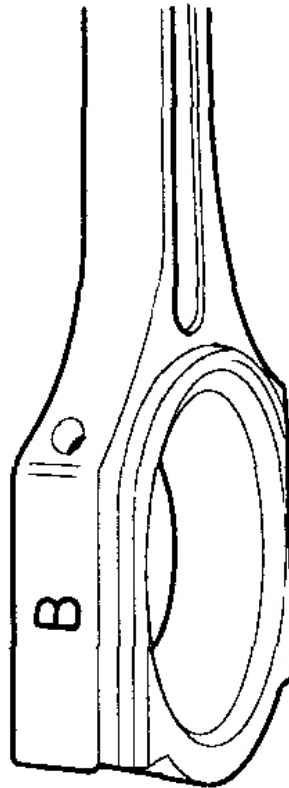
CAUTION: Do not file, shim, or scrape the bearings or the caps to adjust clearance.

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

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

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

CONNECTING ROD MARK LOCATION



G03821404

Fig. 13: Locating Connecting Rod Mark
Courtesy of KIA MOTORS AMERICA, INC.

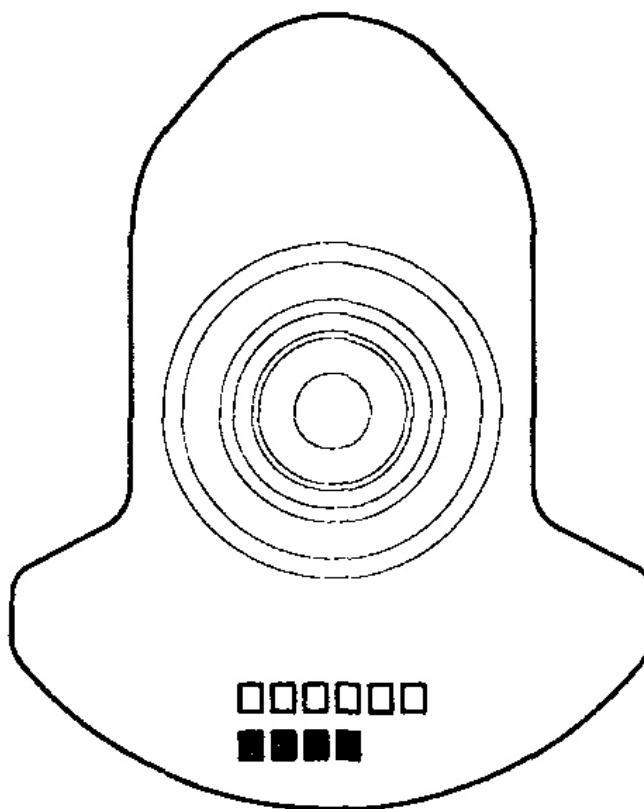
DISCRIMINATION OF CONNECTING ROD

CONNECTING ROD DISCRIMINATION DETAILS



CLASS	MARK	INSIDE DIAMETER
0	A	51.000 ~ 51.006mm (2.0079 ~ 2.0081 in.)
1	B	51.006 ~ 51.012mm (2.0081 ~ 2.0083in.)
2	C	51.012 ~ 51.018mm (2.0083 ~ 2.0086in.)

CRANKSHAFT PIN MARK LOCATION



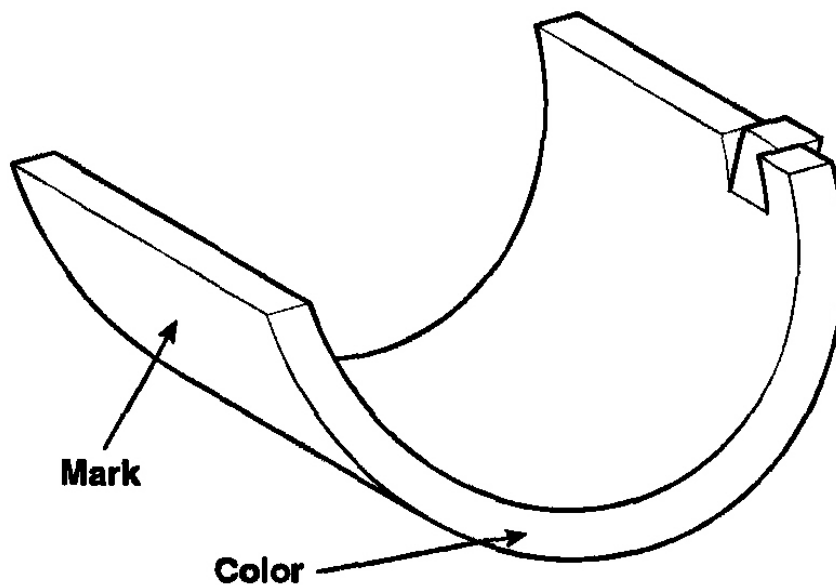
G03821405

Fig. 14: Locating Crankshaft Pin Mark
Courtesy of KIA MOTORS AMERICA, INC.

DISCRIMINATION OF CRANKSHAFT

CRANKSHAFT DISCRIMINATION DETAILS

CLSASS	MARK	OUTSIDE DIAMETER OF PIN
I	A	47.994 ~ 48.000mm (1.8895 ~ 1.8898in.)
II	B	47.988 ~ 47.994mm (1.8893 ~ 1.8895in.)
III	C	47.982 ~ 47.988mm (1.8890 ~ 1.8893in.)

PLACE OF IDENTIFICATION MARK (CONNECTING ROD BEARING)

G03821406

Fig. 15: Identifying Connecting Rod Bearing Marks And Color
 Courtesy of KIA MOTORS AMERICA, INC.

DISCRIMINATION OF CONNECTING ROD BEARING**CONNECTING ROD BEARING DISCRIMINATION DETAILS**

CLASS	MARK	THICKNESS OF BEARING
A	BLUE	1.500 ~ 1.503mm (0.0590 ~ 0.0591 in.)
		1.497 ~ 1.500mm

2008 Kia Sportage LX

2008 ENGINE Engine Block - 2.7L - Sportage

B	BLACK	(0.0589 ~ 0.0590in.)
C	NON	1.494 ~ 1.497mm (0.0588 ~ 0.0589in.)
D	GREEN	1.491 ~ 1.494mm (0.0587 ~ 0.0588in.)
E	YELLOW	1.488 ~ 1.491mm (0.0586 ~ 0.0587in.)

11. Selection

CONNECTING ROD BEARING AND CRANKSHAFT IDENTIFICATION DETAILS

CRANKSHAFT IDENTIFICATION MARK	CONNECTING ROD IDENTIFICATION MARK	ASSEMBLING CLASSIFICATION OF BEARING
I (A)	0 (A)	E (YELLOW)
	1 (B)	D (GREEN)
	2 (C)	C (NONE)
II (B)	0 (A)	D (GREEN)
	1 (B)	C (NONE)
	2 (C)	B (BLACK)
III (C)	0 (A)	C (NONE)
	1 (B)	B (BLACK)
	2 (C)	A (BLUE)

3. Check the crankshaft bearing oil clearance.

1. To check main bearing-to-journal oil clearance, remove the main caps and bearing halves.
2. Clean each main journal and bearing half with a clean shop towel.
3. Place one strip of plastigage across each main journal.
4. Reinstall the bearings and caps, then torque the bolts.

Tightening torque

M8

13 ~ 19N.m (130 ~ 190kgf.cm, 10 ~ 14lb-ft) + 90°

M10

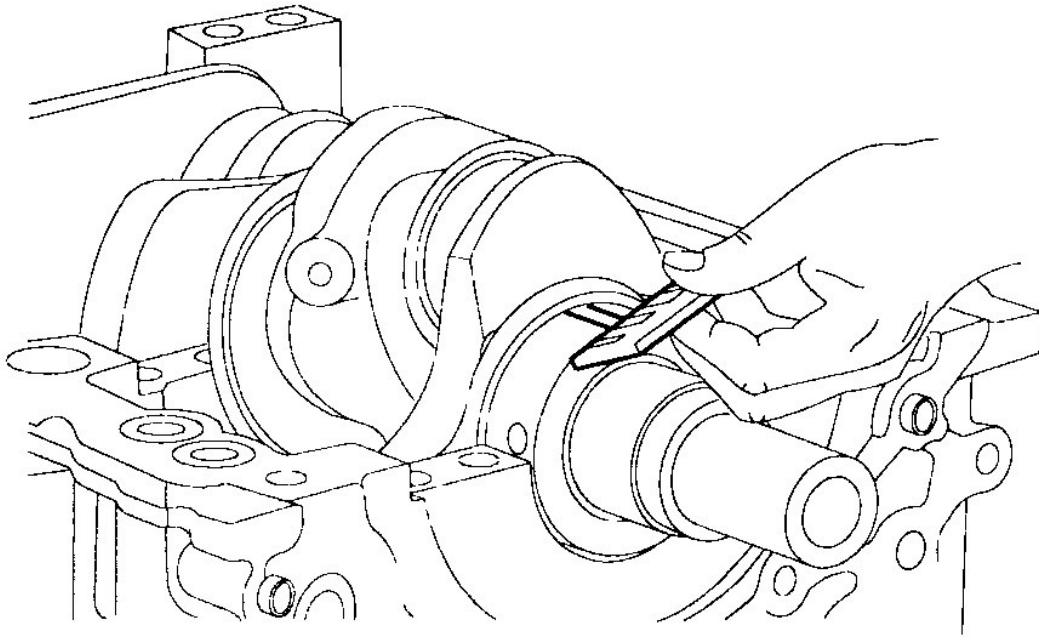
27 ~ 33N.m (270 ~ 330kgf.cm, 19.5 ~ 24lb-ft) + 90°

NOTE: Do not turn the crankshaft.

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

Standard oil clearance

0.004 ~ 0.022mm (0.00016 ~ 0.00087in.)



G03821407

Fig. 16: Measuring Widest Part Of Plastigage
Courtesy of KIA MOTORS AMERICA, INC.

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

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

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

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

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

only with solvent or detergent.

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

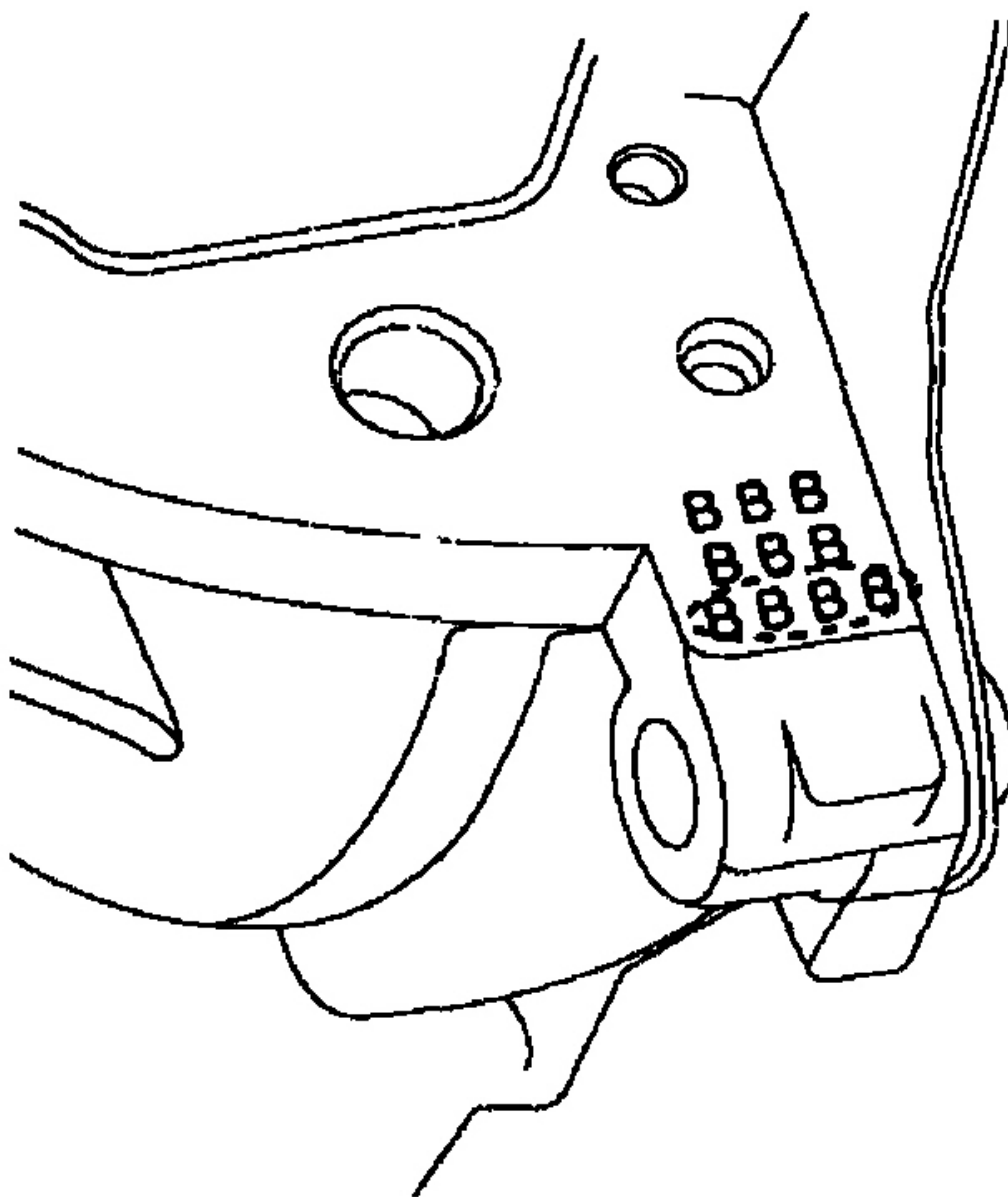
Allowable twist of connecting rod

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

Crankshaft bore mark location

Letters have been stamped on the end of the block as a mark for the size of each of the 4 main journal bores.

Use them, and the numbers or bar stamped on the crank (marks for main journal size), to choose the correct bearings.



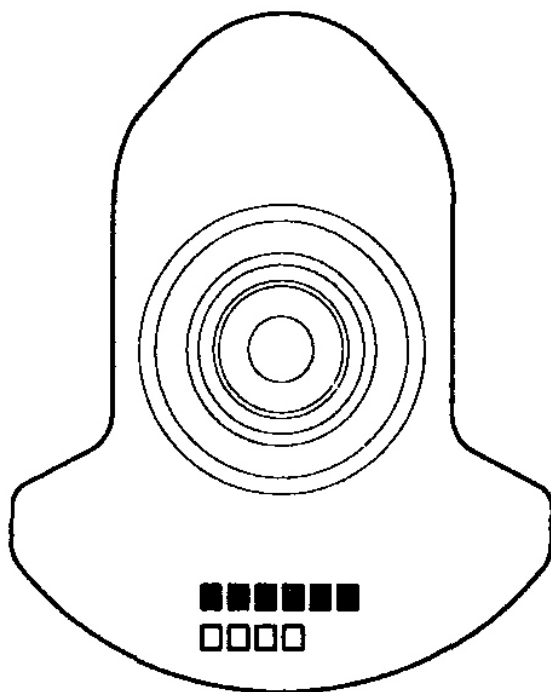
G03821408

Fig. 17: Locating Crankshaft Bore Mark
Courtesy of KIA MOTORS AMERICA, INC.

DISCRIMINATION OF CYLINDER BLOCK

CYLINDER BLOCK DISCRIMINATION DETAILS

CALSS	MARK	INSIDE DIAMETER
a	A	66.000 ~ 66.006mm (2.5984 ~ 2.5986in.)
b	B	66.006 ~ 66.012mm (2.5986 ~ 2.5989in.)
c	C	66.012 ~ 66.018mm (2.5989 ~ 2.5991 in.)

CRANKSHAFT JOURNAL MARK LOCATION

G03821409

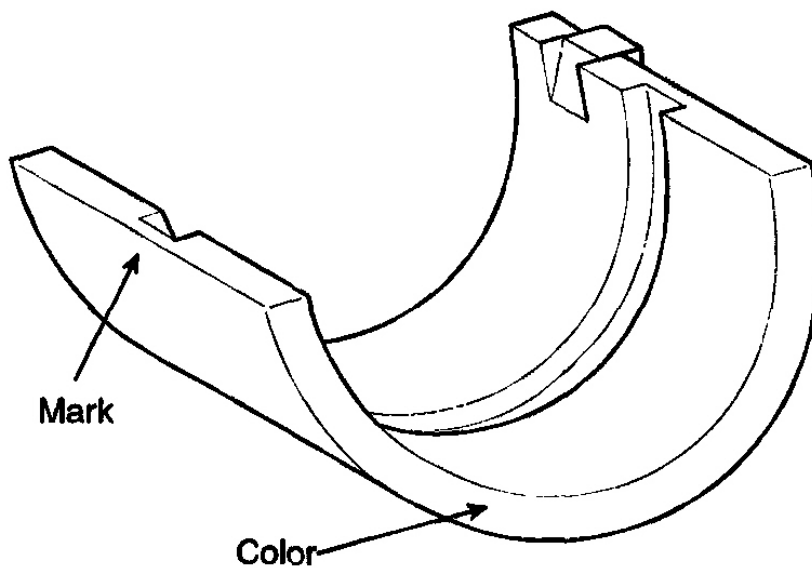
Fig. 18: Locating Crankshaft Journal Mark
 Courtesy of KIA MOTORS AMERICA, INC.

DISCRIMINATION OF CRANKSHAFT**CRANKSHAFT DISCRIMINATION DETAILS**

CLASS	MARK	OUTSIDE DIAMETER OF JOURNAL
I	A	61.994 ~ 62.000mm

		(2.4407 ~ 2.4409in.)
II	B	61.988 ~ 61.994mm (2.4405 ~ 2.4407in.)
III	C	61.982 ~ 61.988mm (2.4402 ~ 2.4405in.)

PLACE OF IDENTIFICATION MARK (CRANKSHAFT BEARING)



G03821410

Fig. 19: Identifying Crankshaft Bearing Color And Marks
Courtesy of KIA MOTORS AMERICA, INC.

DISCRIMINATION OF CRANKSHAFT BEARING

CRANKSHAFT BEARING DISCRIMINATION DETAILS

CLASS	MARK	THICKNESS OF BEARING
A	BLUE	2.007 ~ 2.010mm (0.0790 ~ 0.0791 in.)
B	BLACK	2.004 ~ 2.007mm (0.0789 ~ 0.0790in.)
C	NONE	2.001 ~ 2.004mm (0.0788 ~ 0.0789in.)
D	GREEN	1.998 ~ 2.001mm

		(0.0787 ~ 0.788in.)
E	YELLOW	1.995 ~ 1.998mm (0.0785 ~ 0.0787in.)

SELECTION

CRANKSHAFT AND CRANKSHAFT BORE IDENTIFICATION DETAILS

CRANKSHAFT IDENTIFICATION MARK	CRANKSHAFT BORE IDENTIFICATION MARK	ASSEMBLING CLASSIFICATION OF BEARING
I (A)	a (A)	E (YELLOW)
	b (B)	D (GREEN)
	c (C)	C (NONE)
II (B)	a (A)	D (GREEN)
	b (B)	C (NONE)
	c (C)	B (BLACK)
III (C)	a (A)	C (NONE)
	b (B)	B (BLACK)
	c (C)	A (BLUE)

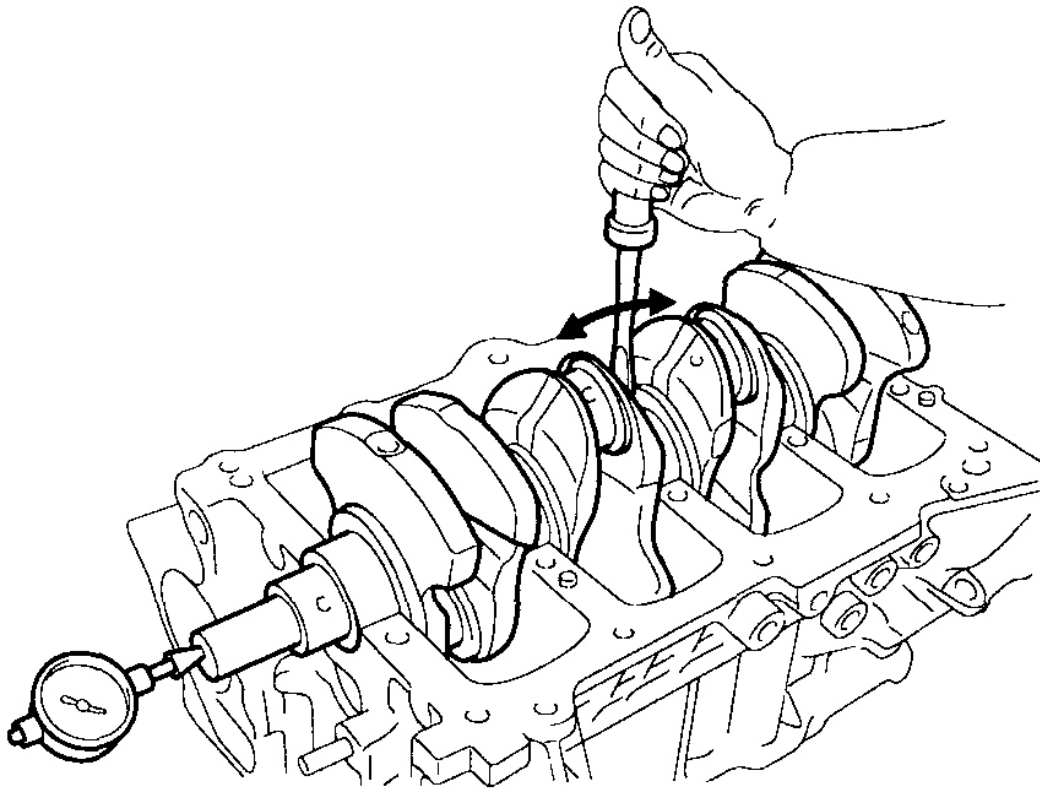
4. Check crankshaft end play.

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

Standard end play

0.07 ~ 0.25mm (0.0027 ~ 0.0098in.)

Limit: 0.30mm (0.0118in.)



G03821411

Fig. 20: 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

2.05 ~ 2.09mm (0.081 ~ 0.082in.)

5. Inspect main journals and crank pins

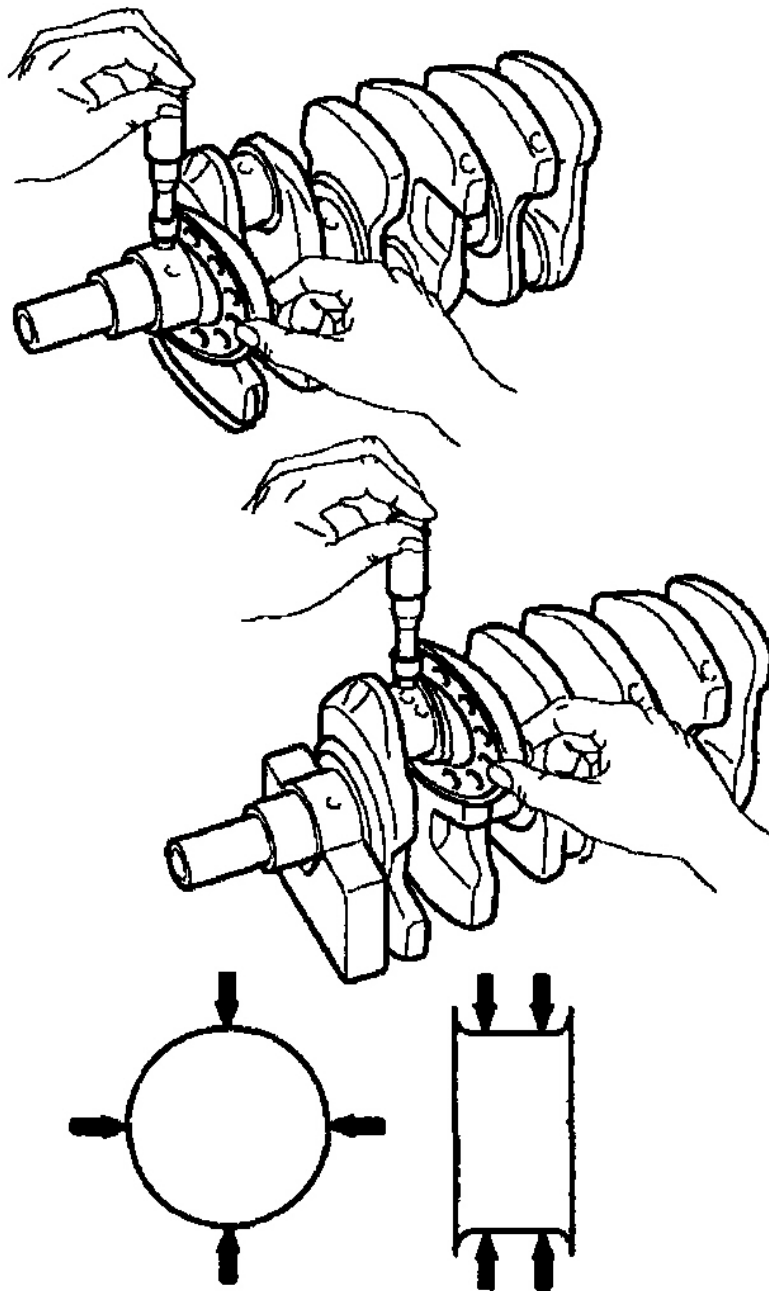
Using a micrometer, measure the diameter of each main journal and crank pin.

Main journal diameter

61.982 ~ 62.000mm (2.4402 ~ 2.4409in.)

Crank pin diameter

47.982 ~ 48.000mm (1.8890 ~ 1.8898in.)



G03821412

Fig. 21: Inspecting Main Journals And Crank Pins
 Courtesy of KIA MOTORS AMERICA, INC.

CYLINDER BLOCK

1. Remove gasket material.

Using a gasket scraper, remove all the gasket material from the top surface of the cylinder block.

2. Clean cylinder block

Using a soft brush and solvent, thoroughly clean the cylinder block.

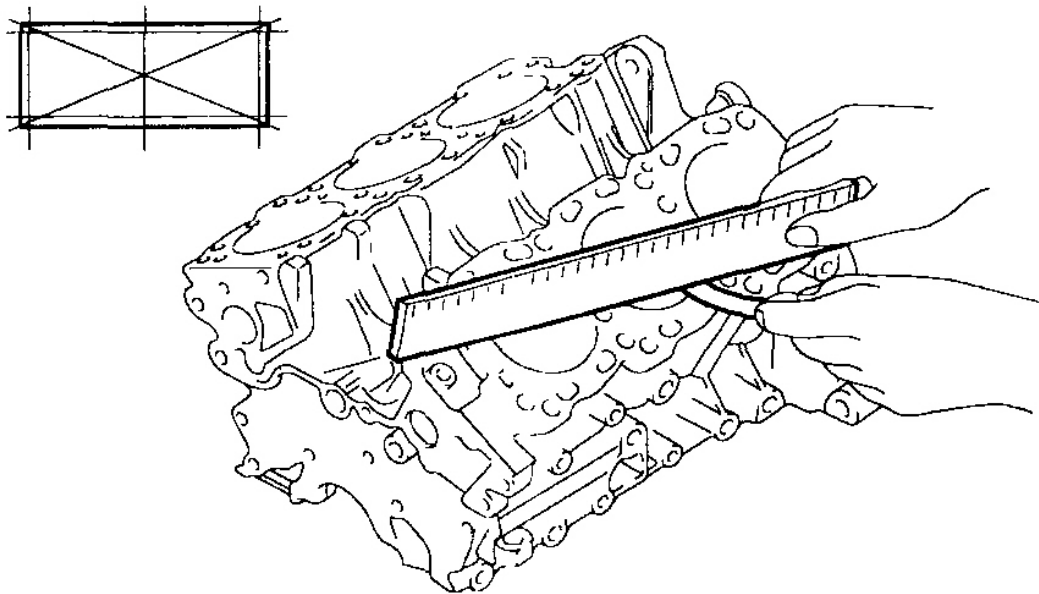
3. Inspect top surface of cylinder block for flatness.

Using a precision straight edge and feeler gauge, measure the surface contacting the cylinder head gasket for warpage.

Flatness of cylinder block gasket surface

Standard: Less than 0.03mm(0.0012 in.)

Limit: 0.05 mm (0.0020 in.)



G03821413

Fig. 22: Inspecting Cylinder Block Top Surface Flatness
Courtesy of KIA MOTORS AMERICA, INC.

4. Inspect cylinder bore diameter

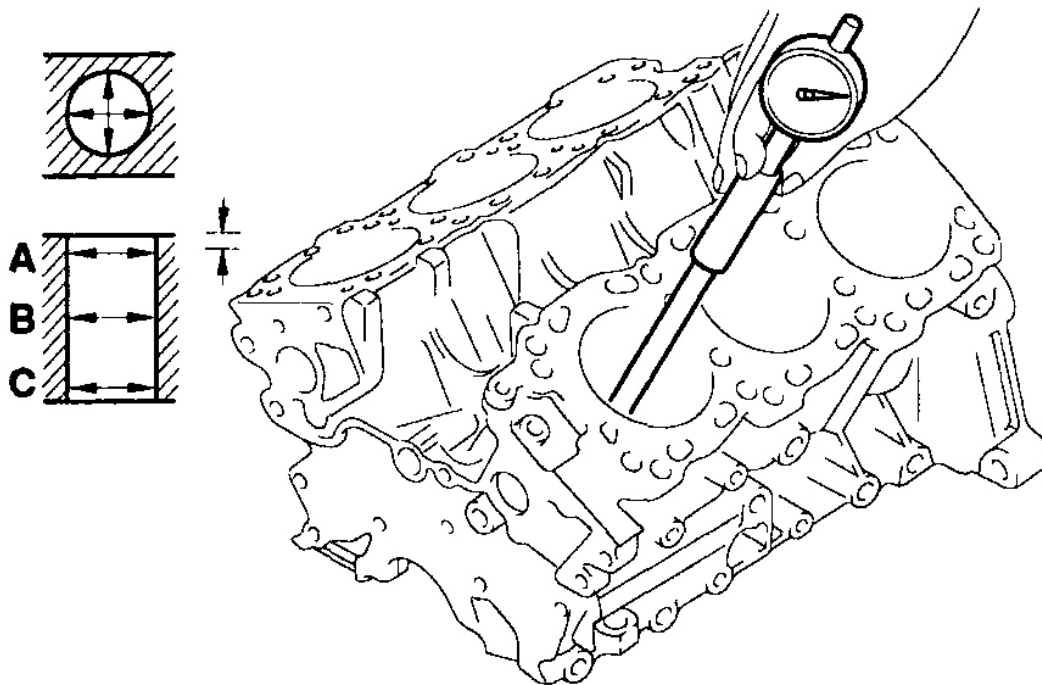
Visually check the cylinder for vertical scratches. If deep scratches are present, replace the cylinder liner.

5. Inspect cylinder bore diameter

Using a cylinder bore gauge, measure the cylinder bore diameter at position A, B and C in the thrust and axial directions.

Standard diameter

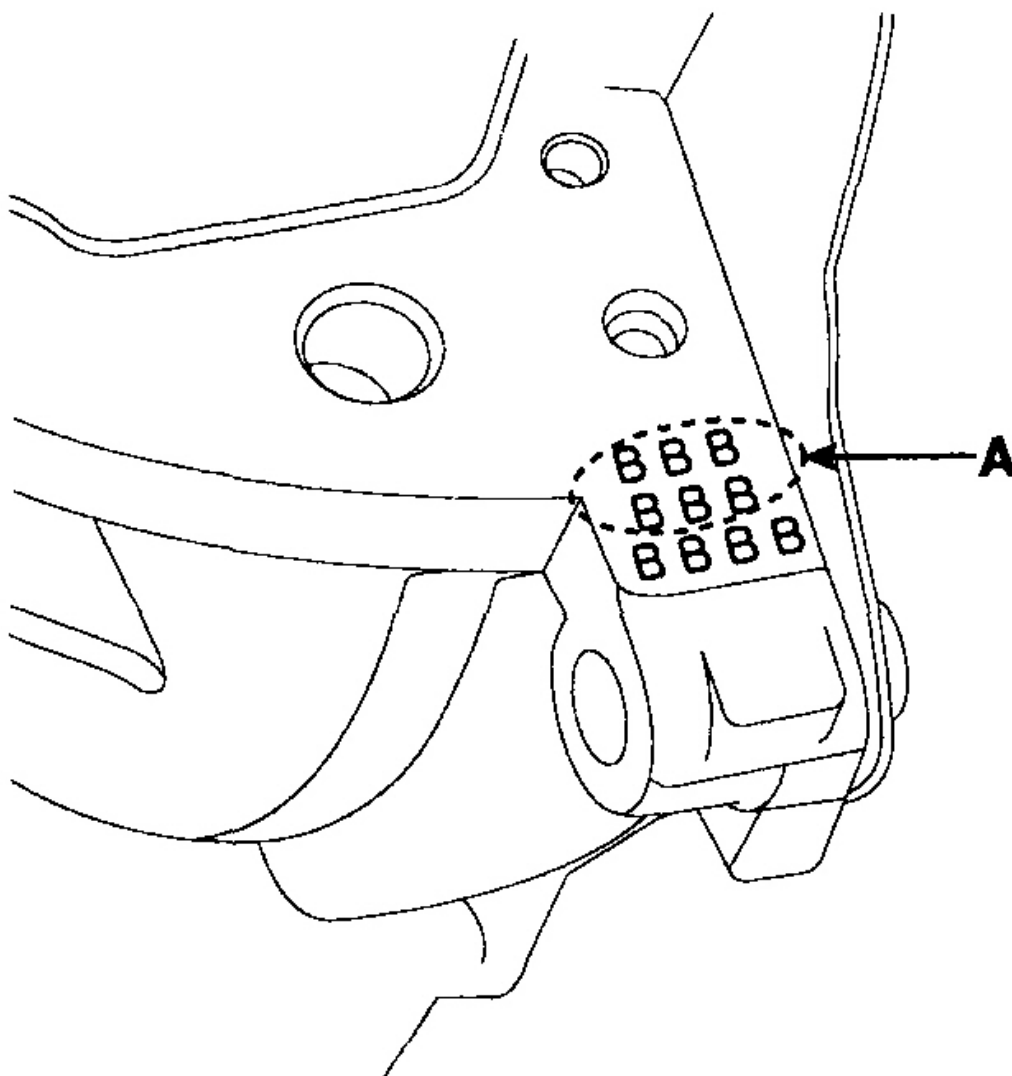
86.70 ~ 86.73mm (3.4134 ~ 3.4145in.)



G03821414

Fig. 23: Measuring Cylinder Bore Diameter
Courtesy of KIA MOTORS AMERICA, INC.

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



G03821415

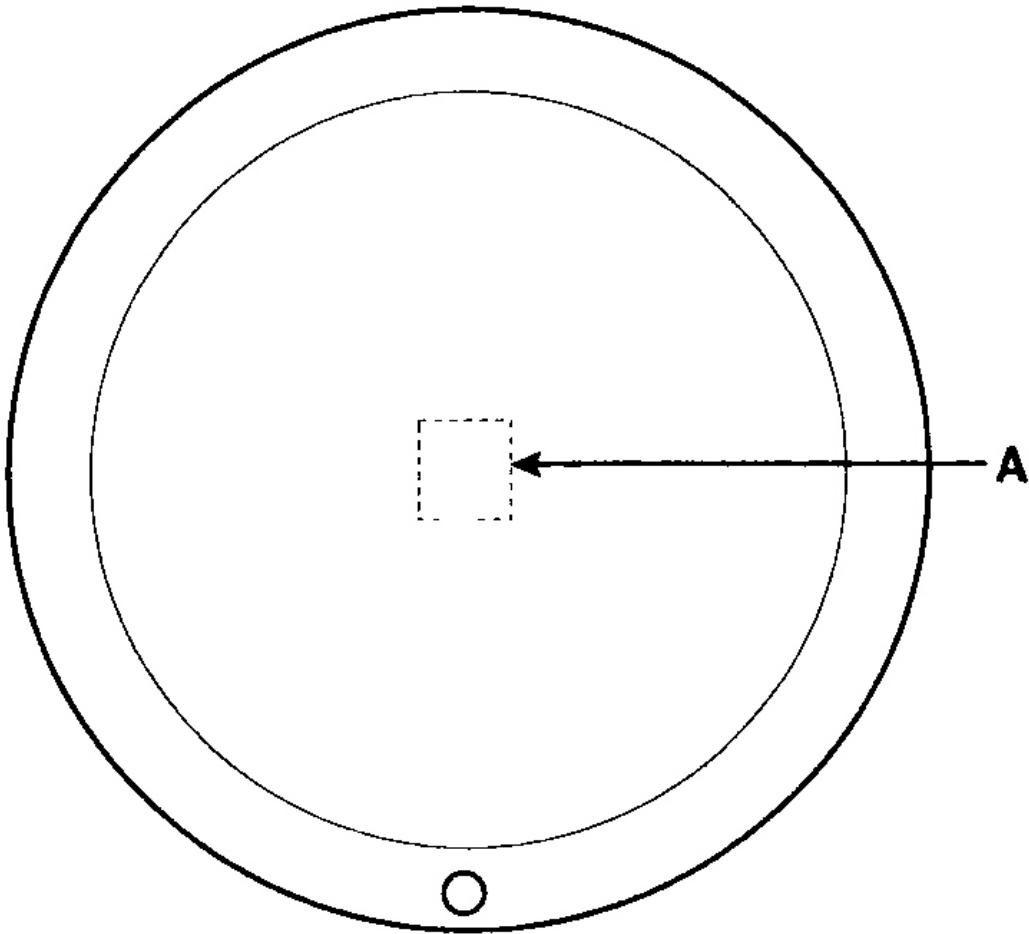
Fig. 24: Identifying Cylinder Bore Size Code
 Courtesy of KIA MOTORS AMERICA, INC.

CYLINDER BORE INNER DIAMETER SPECIFICATIONS

Class	Cylinder bore inner diameter	Size code
A	86.70 ~ 86.71mm (3.4133 ~ 3.4137in.)	A
B	86.71 ~ 86.72mm	B

	(3.4137 ~ 3.4141 in.)	
C	86.72 ~ 86.73mm	C
	(3.4141 ~ 3.4145in.)	

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



G03821416

Fig. 25: Locating Piston Size Code
Courtesy of KIA MOTORS AMERICA, INC.

NOTE: Stamp the grade mark of basic diameter with rubber stamp.

PISTON DIAMETER SPECIFICATIONS

Class	Piston diameter	Size code
-------	-----------------	-----------

A	86.68 ~ 86.69mm (3.4126 ~ 3.4130in.)	A
B	86.69 ~ 86.70mm (3.4130 ~ 3.4133in.)	None
C	86.70 ~ 86.71mm (3.4133 ~ 3.4137in.)	C

- Select the piston related to cylinder bore class.

Clearance: 0.01 ~ 0.03mm (0.0004 ~ 0.0012in.)

BORING CYLINDER

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

PISTONS BORE SIZE SPECIFICATIONS

Identification Mark	Size
0.25	0.25mm (0.010in.)
0.50	0.50mm (0.0250in.)

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

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

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

- 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.

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

Standard: 0.01 ~ 0.03mm (0.0004 ~ 0.0012 in.)

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

PISTON AND RINGS

- Clean piston

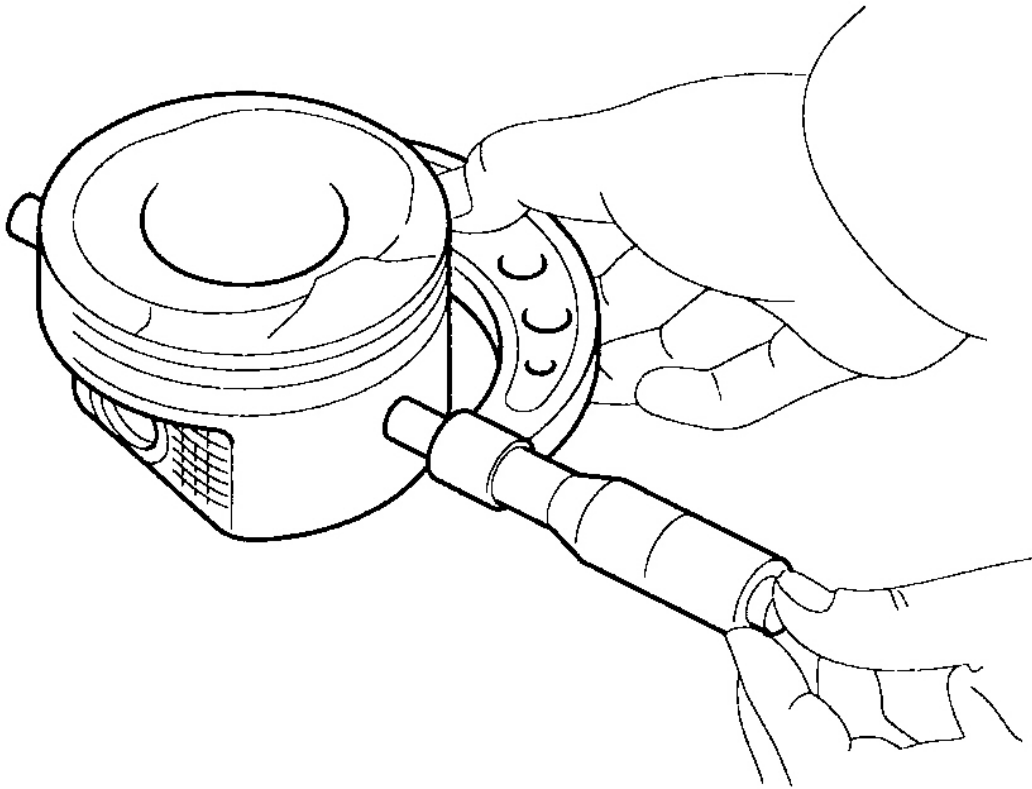
1. Using a gasket scraper, remove the carbon from the piston top.
2. Using a groove cleaning tool or broken ring, clean the piston ring grooves.
3. Using solvent and a brush, thoroughly clean the piston.

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

2. The standard measurement of the piston outside diameter is taken 38.5mm (1.516in.) from the top land of the piston.

Standard diameter

86.68 ~ 86.71mm (3.4126 ~ 3.4138in.)



G03821417

Fig. 26: Measuring Piston Outside Diameter
Courtesy of KIA MOTORS AMERICA, INC.

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

Piston-to-cylinder clearance

0.01 ~ 0.03mm(0.0004 ~ 0.0012in.)

4. Inspect the piston ring side clearance.

Using a feeler gauge, measure the clearance between new piston ring and the wall of the 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.)

Limit

No. 1: 0.1mm (0.004in.)

No. 2: 0.1mm (0.004in.)

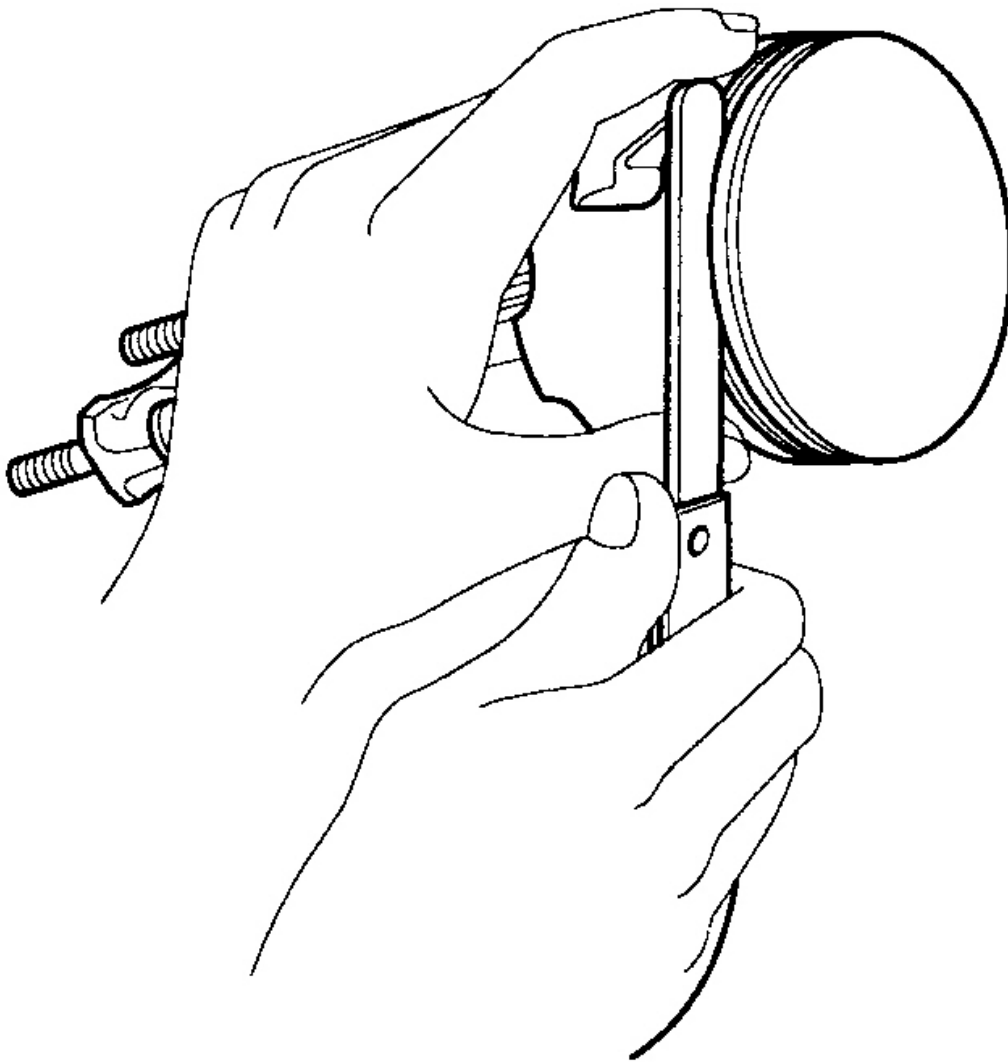
**G03821418**

Fig. 27: Inspecting Piston Ring Side Clearance
Courtesy of KIA MOTORS AMERICA, INC.

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

5. Inspect piston ring end gap.

To measure the piston ring end gap, insert a piston ring into the cylinder bore. Position the ring at right angles to the cylinder wall by gently pressing it down with a piston. Measure the gap with a feeler gauge.

If the gap exceeds the service limit, replace the piston ring. If the gap is too large, recheck the cylinder bore diameter against the wear limits on **CYLINDER BLOCK**. If the bore is over the service limit, the cylinder block must be rebored. (See **CYLINDER BLOCK**).

Piston ring end gap

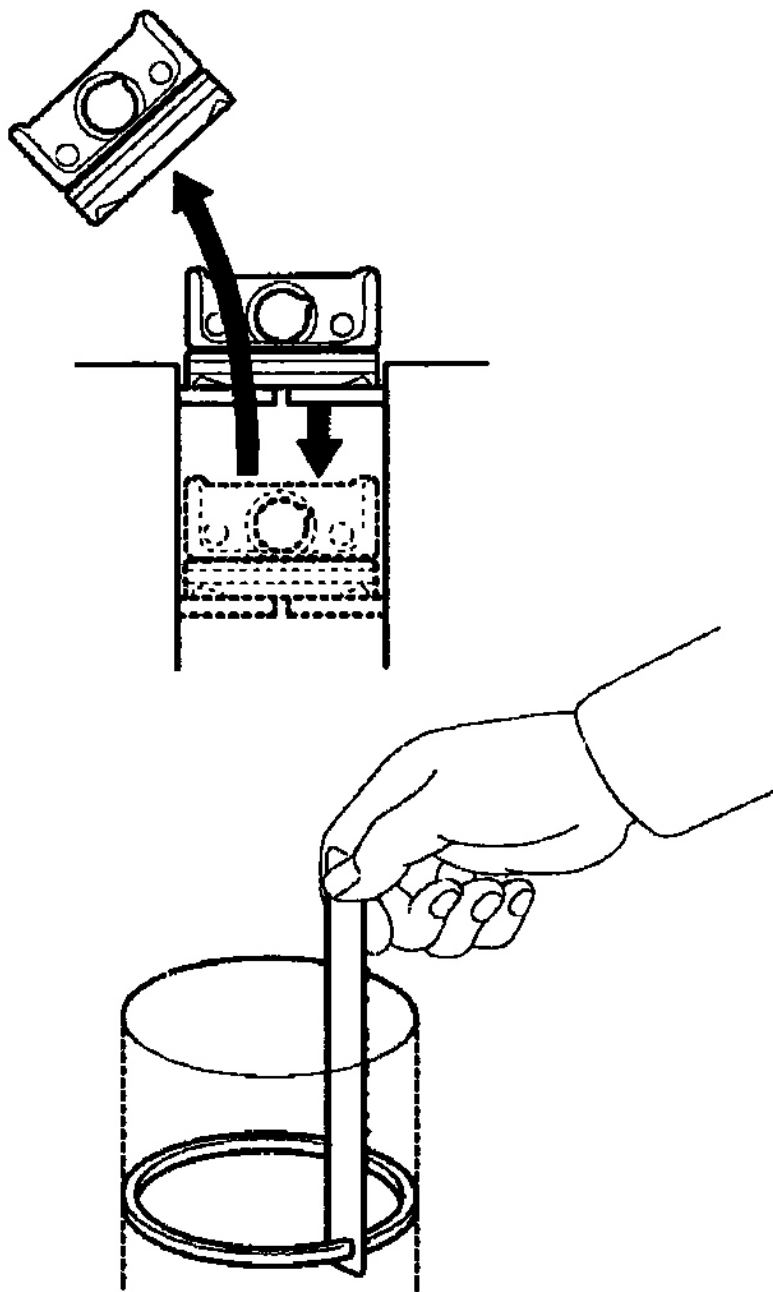
Standard

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

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

Limit

Oil ring: 0.2 ~ 0.7mm (0.0079 ~ 0.0276in.)



G03821419

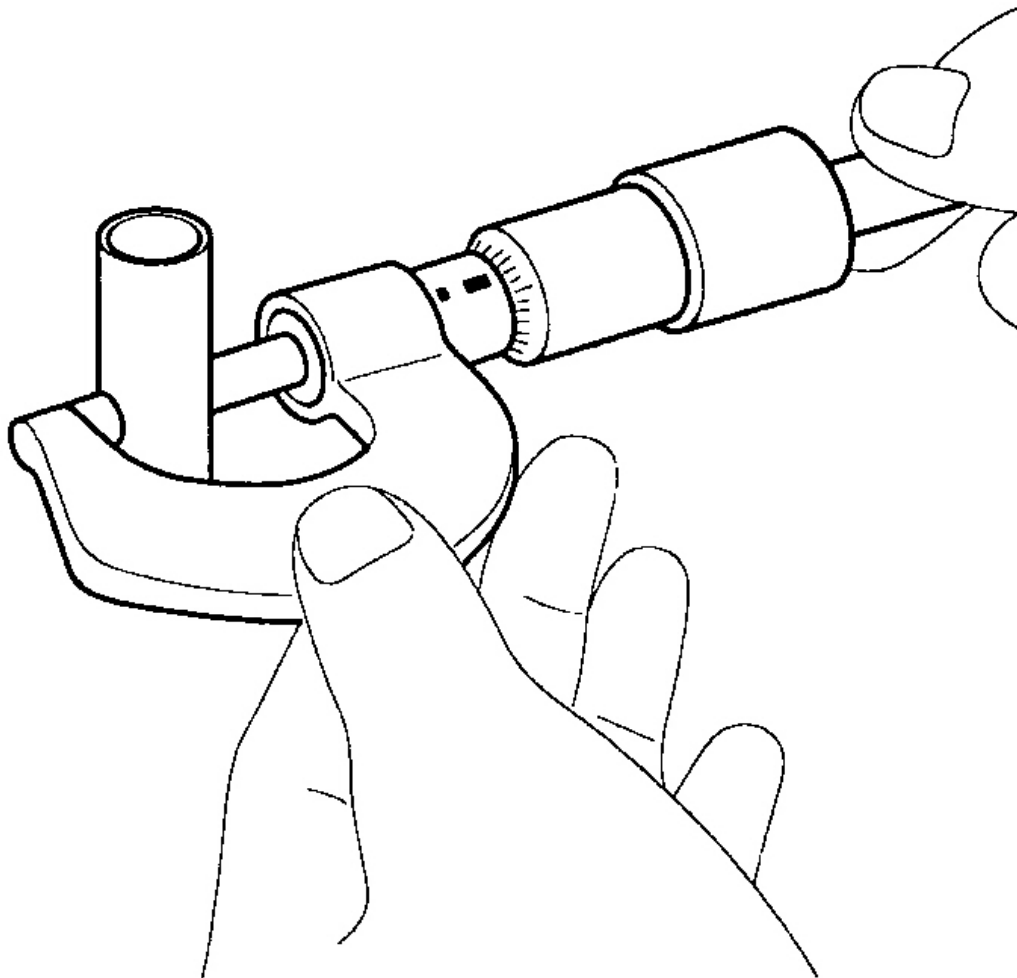
Fig. 28: Inspecting Piston Ring End Gap
Courtesy of KIA MOTORS AMERICA, INC.

PISTON PINS

1. Measure the diameter of the piston pin.

Piston pin diameter

21.001 ~ 21.007mm (0.8268 ~ 0.8270in.)



G03821420

Fig. 29: Measuring Piston Pin Diameter
Courtesy of KIA MOTORS AMERICA, INC.

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

Piston pin-to-piston clearance

0.007 ~ 0.022mm (0.00027 ~ 0.00086in.)

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

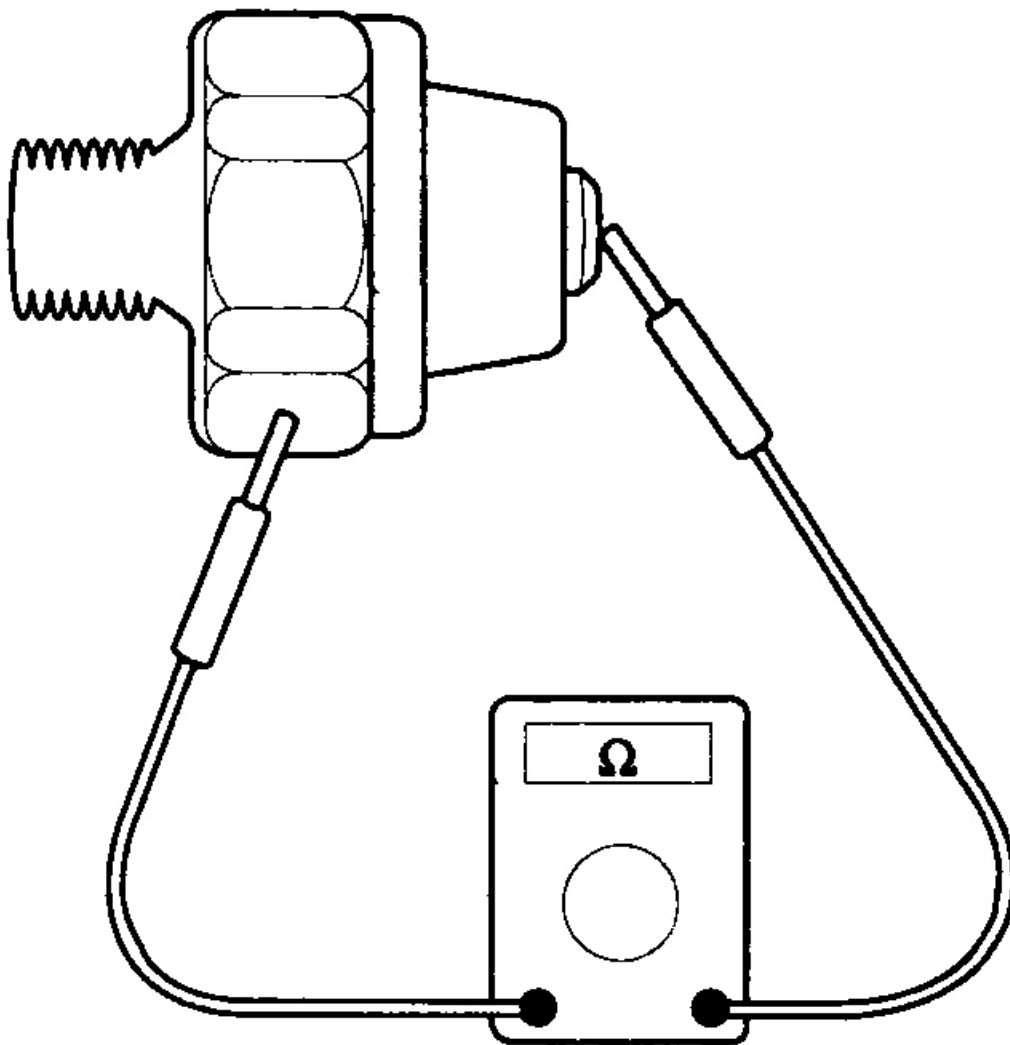
Piston pin-to-connecting rod interference

0.016 ~ 0.033mm (0.00063 ~ 0.00130in.)

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.

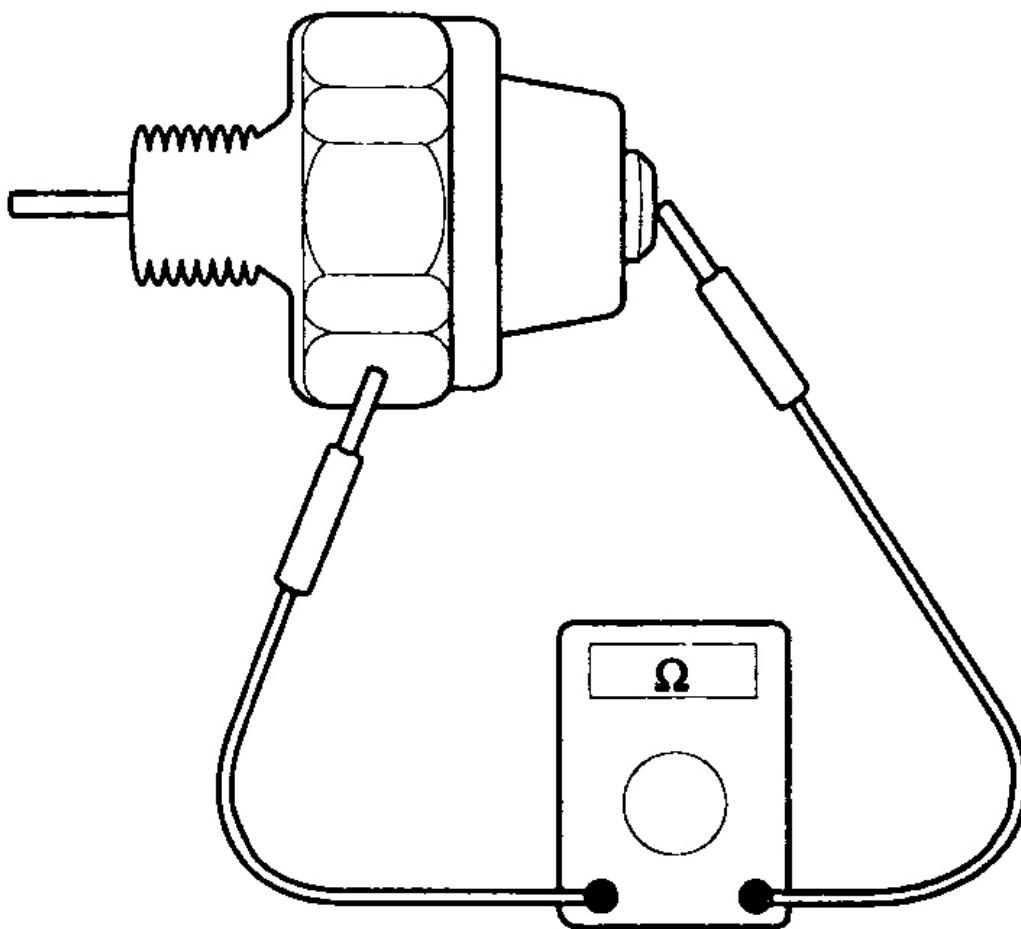


G03821421

Fig. 30: Checking Continuity Between Oil Pressure Switch Terminal And Body (1 Of 2)
Courtesy of KIA MOTORS AMERICA, INC.

2. Check the continuity between the terminal and the body when the fine wire is pushed. If there is continuity even when the fine wire is pushed, replace the switch.
3. If there is no continuity when a 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.



G03821422

Fig. 31: Checking Continuity Between Oil Pressure Switch Terminal And Body (2 Of 2)
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 piston and connecting rod.
 1. Use a hydraulic press for installation.

2. The piston front mark (A) and the connecting rod front mark (B) must face the timing belt side of the engine.

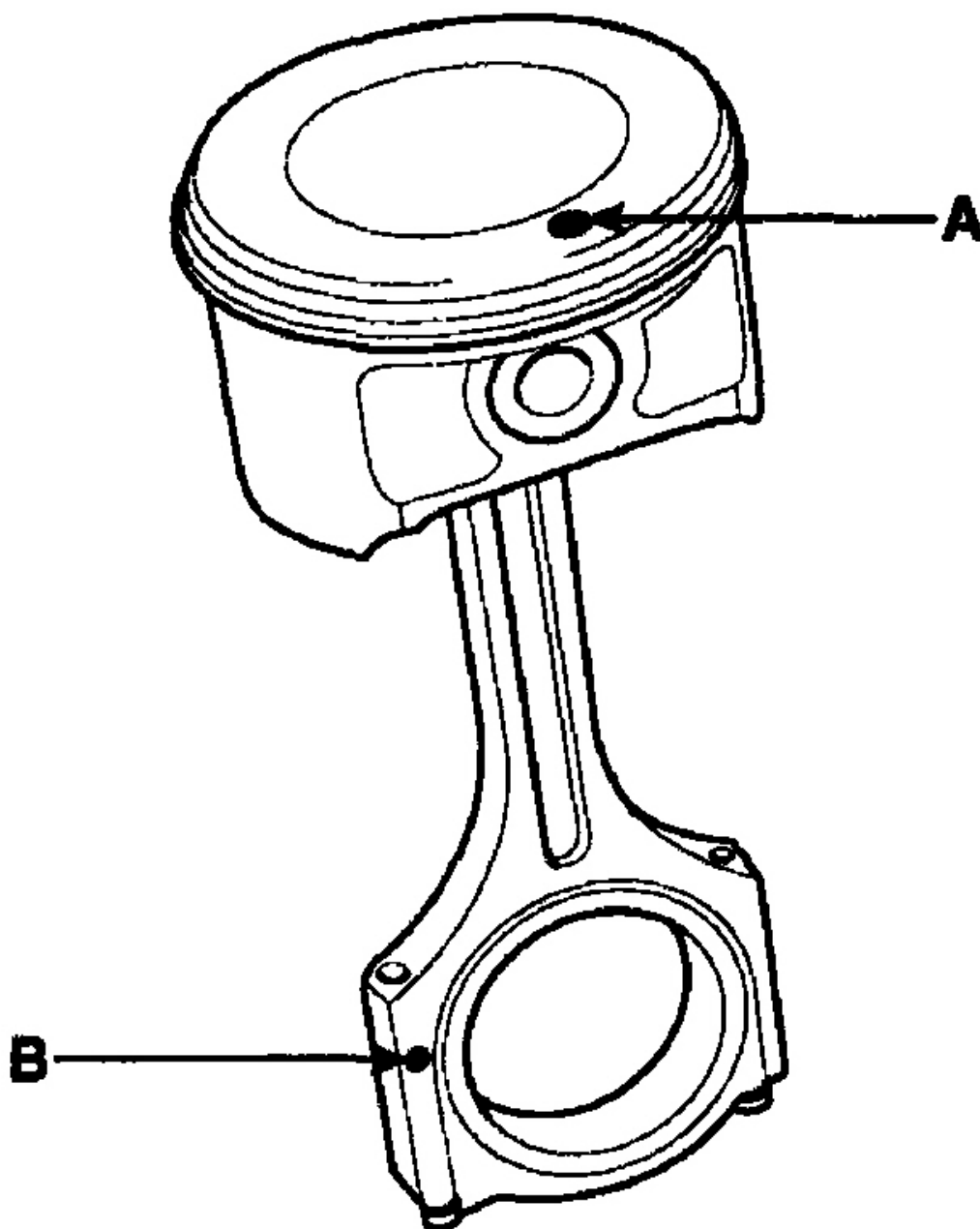
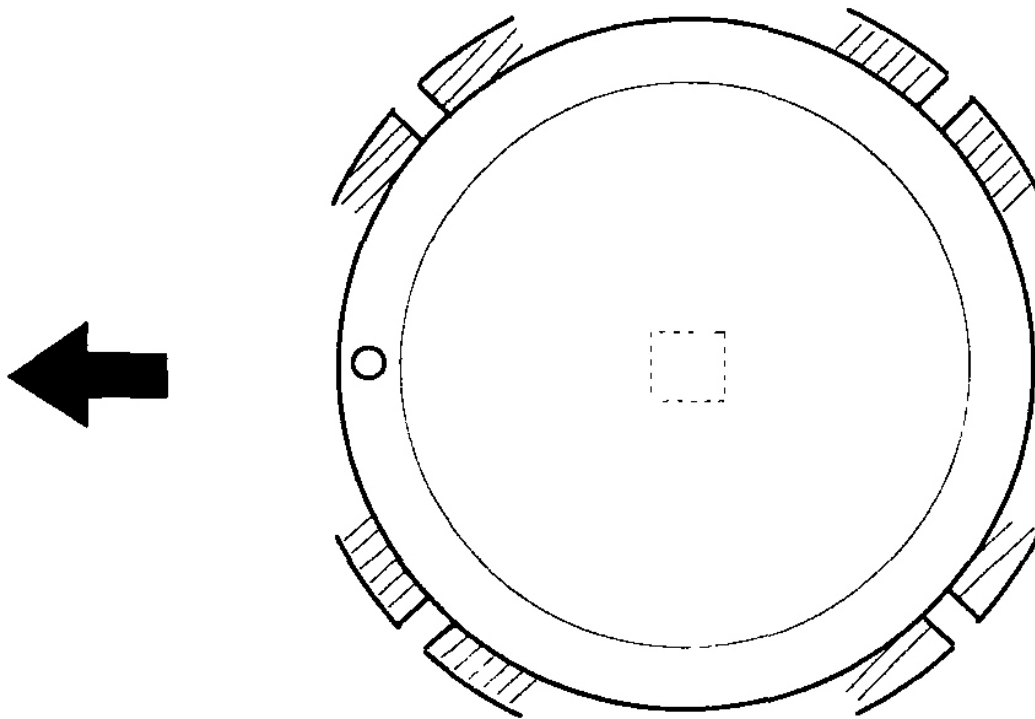
**G03821423**

Fig. 32: Assembling Piston And Connecting Rod
Courtesy of KIA MOTORS AMERICA, INC.

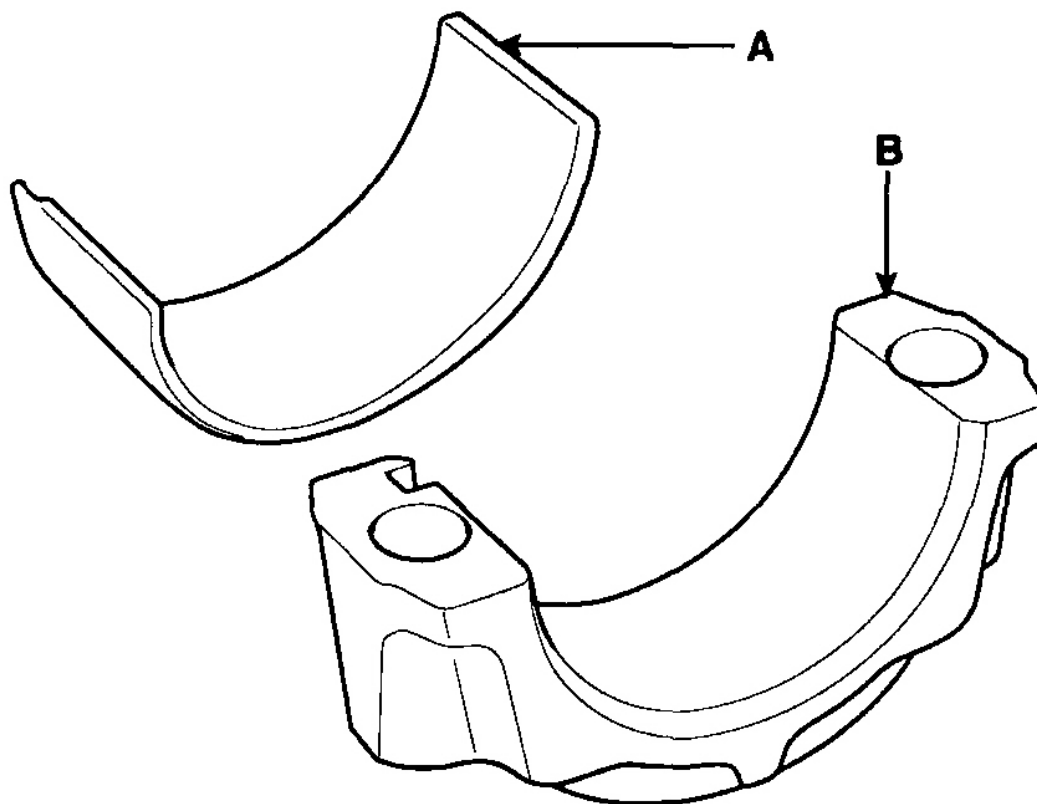
2. Install piston rings.
 1. Install the oil ring expander and 2 side rails by hand.
 2. Using a piston ring expander, install the 2 compression rings with the code mark facing upward.
 3. Position the piston rings so that the ring ends are as shown.



G03821424

Fig. 33: View Of Piston Ring
Courtesy of KIA MOTORS AMERICA, INC.

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



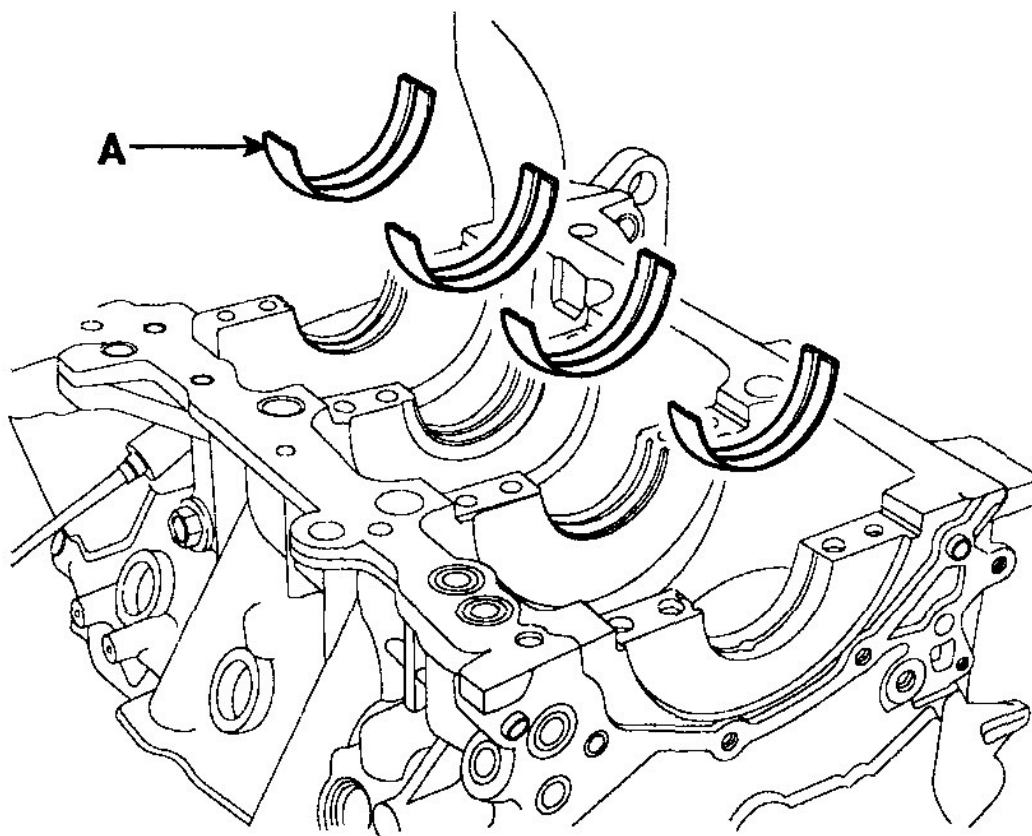
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Fig. 34: Installing Connecting Rod Bearings
Courtesy of KIA MOTORS AMERICA, INC.

4. Install main bearings.

NOTE: Upper 1, 2, 3, 4 bearings have an oil groove of oil holes; Lower bearings do not.

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

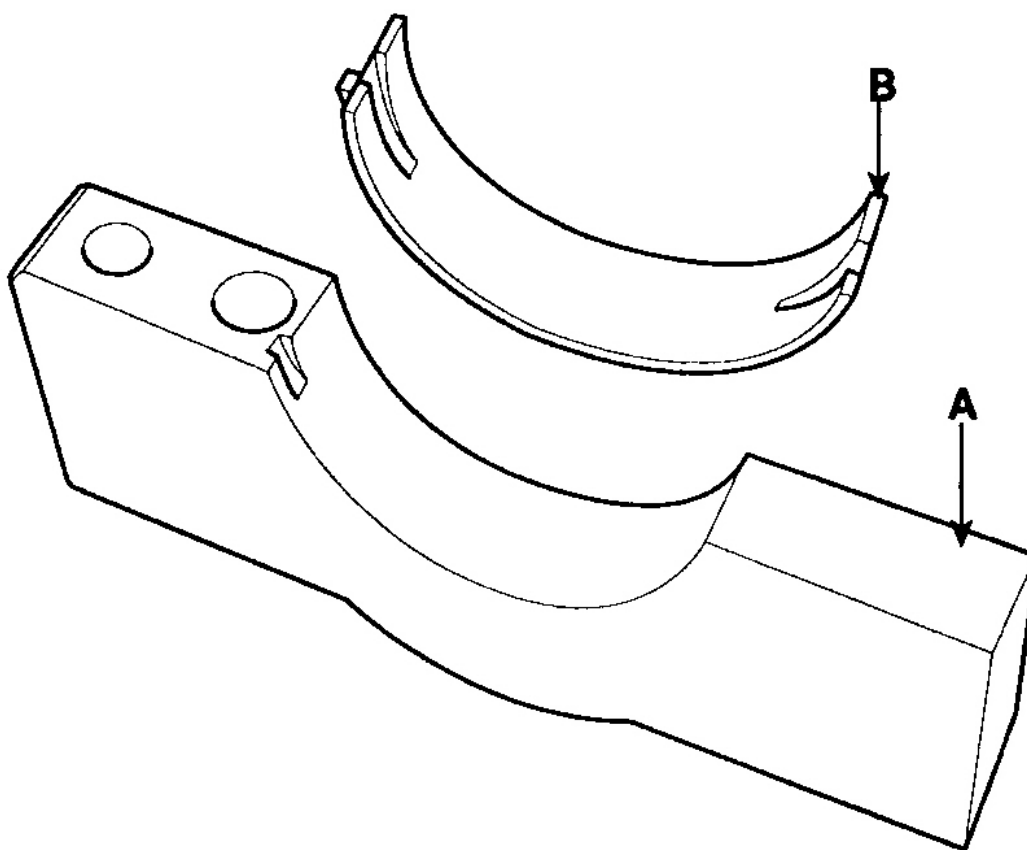


G03821426

Fig. 35: Installing Main Bearings

Courtesy of KIA MOTORS AMERICA, INC.

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

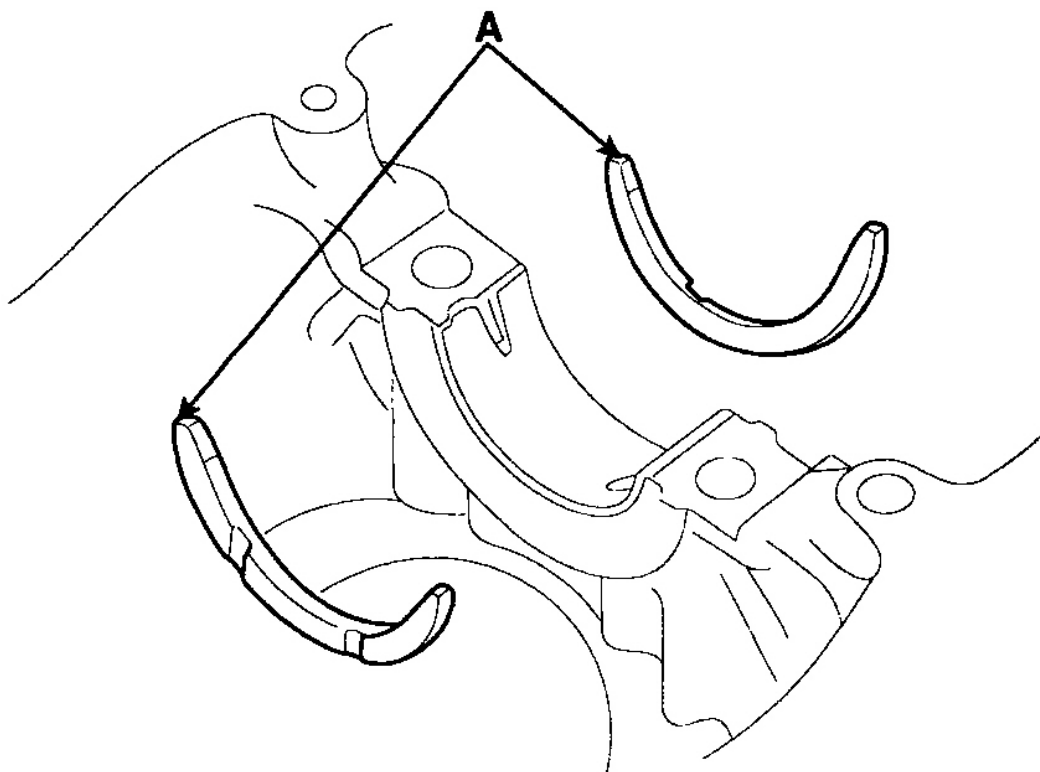


G03821427

Fig. 36: Aligning Bearing Claw With Claw Groove Of Main Bearing Cap
Courtesy of KIA MOTORS AMERICA, INC.

5. Install thrust bearings.

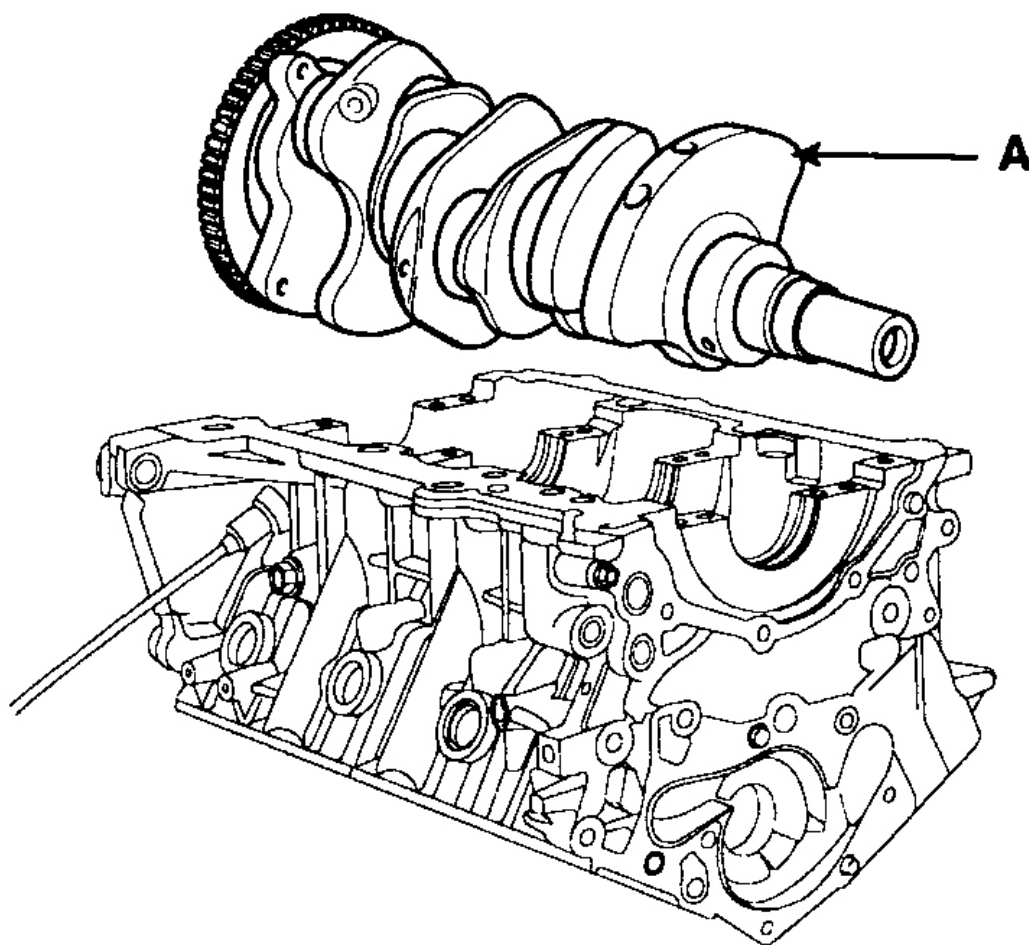
Install the 2 thrust bearings (A) under the No.3 journal position of the cylinder block with the oil grooves facing outward.



G03821428

Fig. 37: Installing Thrust Bearings
Courtesy of KIA MOTORS AMERICA, INC.

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



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Fig. 38: Placing Crankshaft On Cylinder Block
Courtesy of KIA MOTORS AMERICA, INC.

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

NOTE:

- The main bearing cap bolts are tightened in 2 progressive steps.
- If any of the bearing cap bolts in broken or deformed, replace it.

Tightening torque

Main bearing cap bolt

M8: 13 ~ 19N.m

(130 ~ 190kgf.cm, 10 ~ 14lb-ft) + 90° ~ 94°

M10: 27 ~ 33N.m

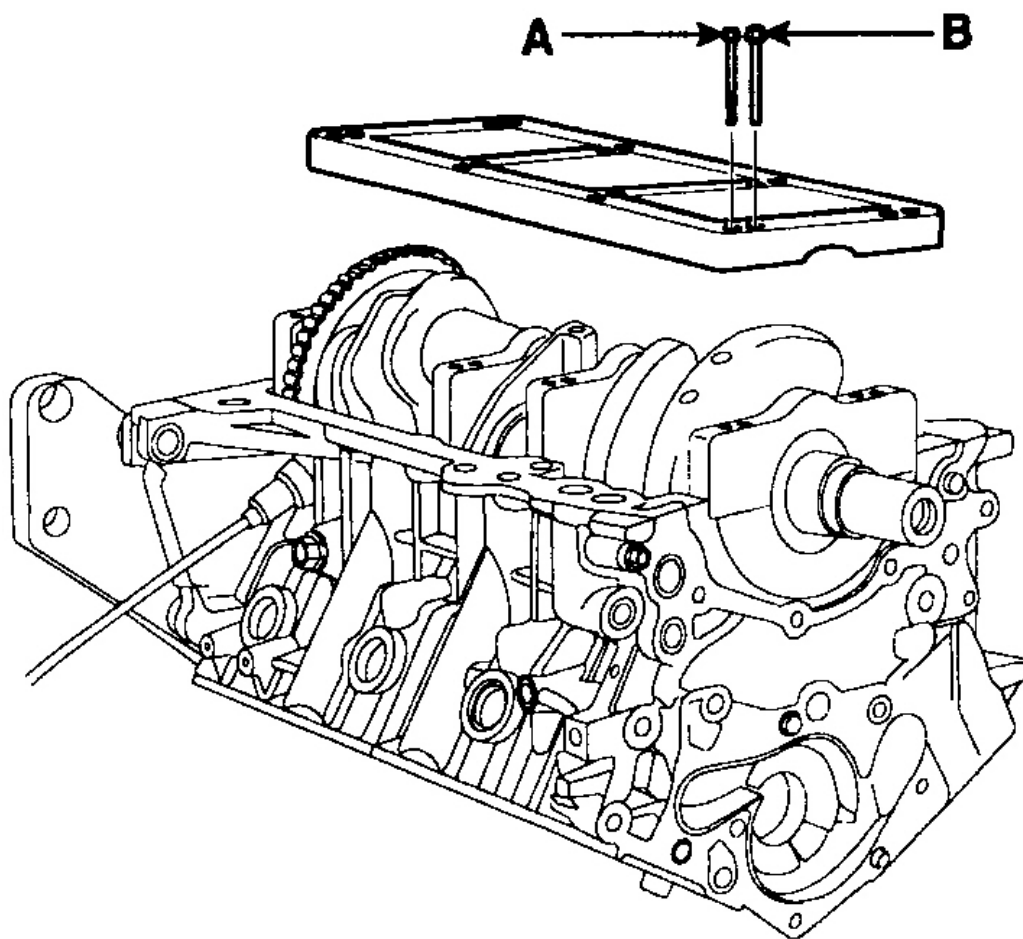
(270 ~ 330kgf.cm, 19.5 ~ 24lb-ft) + 90° ~ 94°

1. Apply a light coat of engine oil on the threads and under the bearing cap bolts.
2. Install and uniformly tighten the 16 bearing cap bolts, in several passes, in the sequence shown.

Tightening torque

M8 (A): 13 ~ 19N.m (130 ~ 190kgf.cm, 10 ~ 14lb-ft)

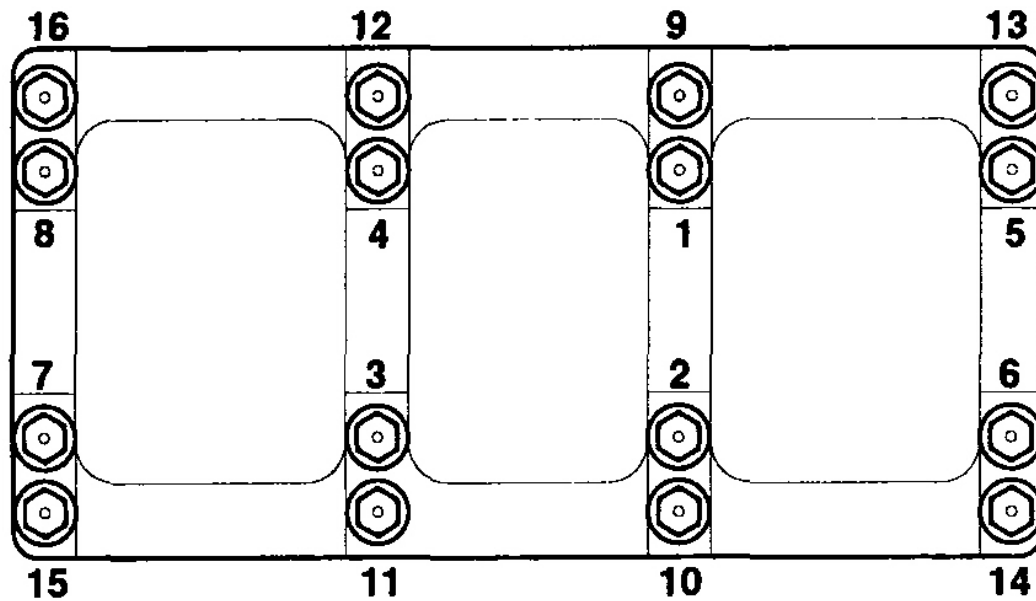
M10 (B): 27 ~ 33N.m (270 ~ 330kgf.cm, 19.5 ~ 24lb-ft)



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Fig. 39: Installing Main Bearing Cap Bolt
Courtesy of KIA MOTORS AMERICA, INC.

3. Retighten the bearing cap bolts by $90^{\circ} \sim 94^{\circ}$ in the numerical order shown.



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Fig. 40: Main Bearing Cap Bolts Tightening Sequence
 Courtesy of KIA MOTORS AMERICA, INC.

4. Check that the crankshaft turns smoothly.
9. Check crankshaft end play. (See **CRANKSHAFT** table)
10. Install piston and connecting rod assemblies.

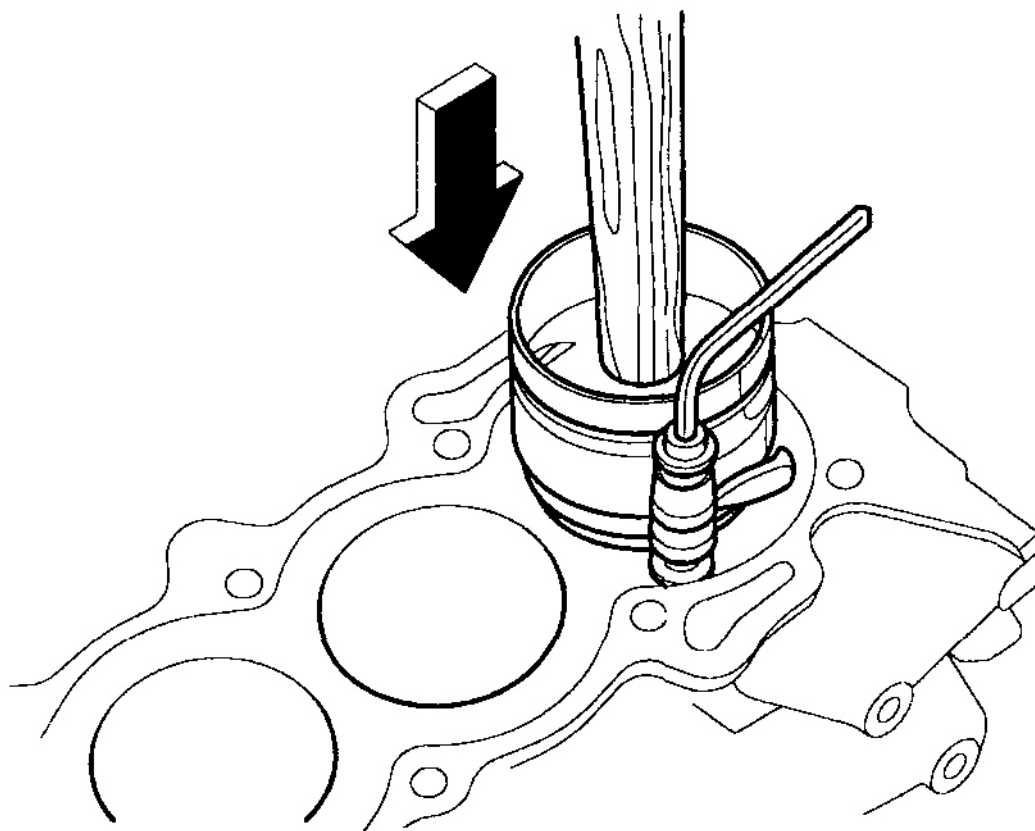
NOTE: Before installing the pistons, apply a coat of engine oil to the ring grooves and cylinder bores.

1. Remove the connecting rod caps, and slip short sections of rubber hose over the threaded ends of the connecting rod bolts.
2. Install the ring compressor, check that the bearing is securely in place, then position the piston in the cylinder, and tap it in using the wooden handle of a hammer.
3. Stop after the ring compressor pops free, and check the connecting rod-to-check journal alignment before pushing the piston into place.
4. Apply engine oil to the bolt threads. Install the rod caps with bearings, and torque the bolts.

Tightening torque

16 ~ 20N.m (160 ~ 200kgf.cm, 12 ~ 15lb-ft) + 90° ~ 94°

NOTE: Maintain downward force on the ring compressor to prevent the rings from expanding before entering the cylinder bore.



G03821432

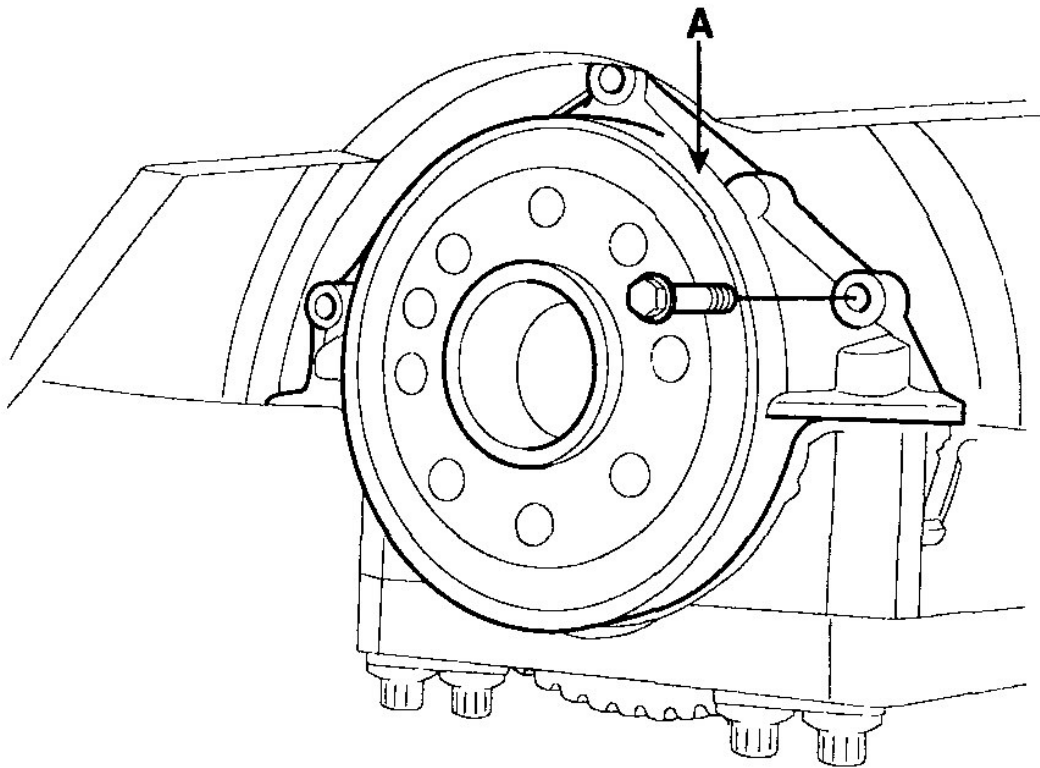
Fig. 41: Installing Piston

Courtesy of KIA MOTORS AMERICA, INC.

11. Apply liquid gasket to the oil seal case and install the oil seal case (A).

Tightening torque

10 ~ 12N.m (100 ~ 120kgf.cm, 7.3 ~ 8.8lb-ft)



G03821433

Fig. 42: Installing Oil Seal Case

Courtesy of KIA MOTORS AMERICA, INC.

NOTE:

- Use liquid gasket MS721-40A or equivalent
- Check that the mating surfaces are clean and dry.

12. Install rear oil seal.

1. Apply engine oil to a new oil seal lip.
2. Using SST(09231-33000) and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.

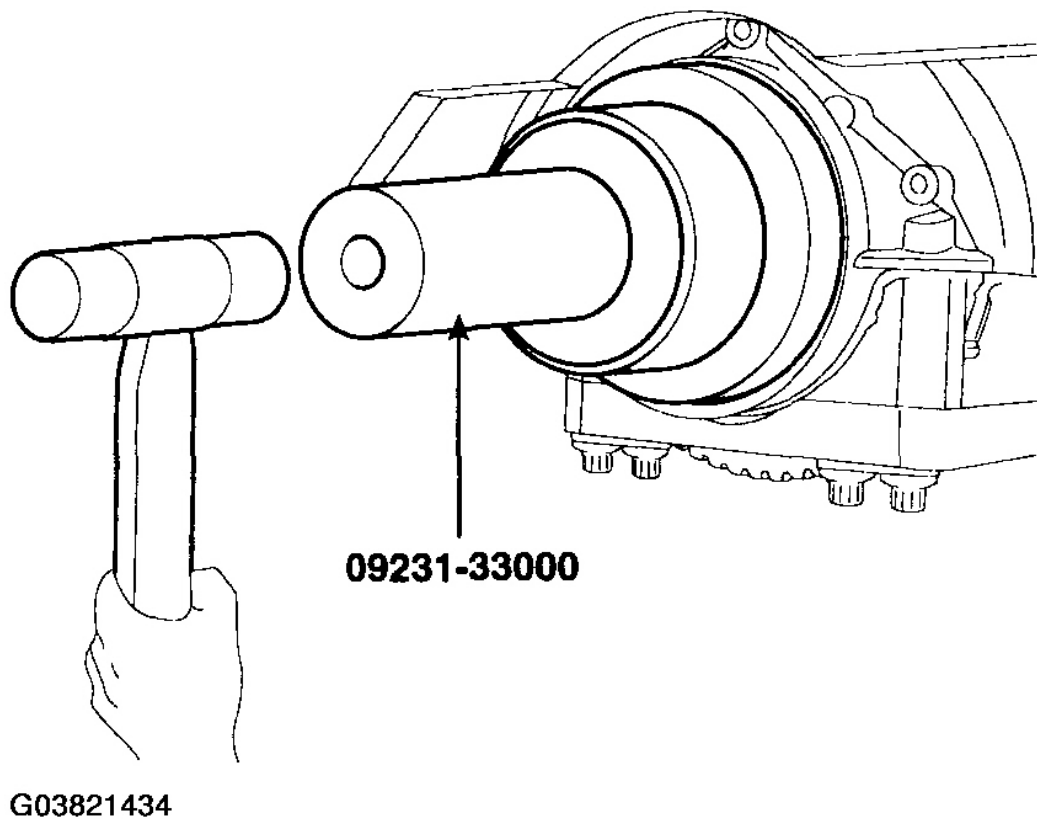


Fig. 43: Installing Rear Oil Seal
Courtesy of KIA MOTORS AMERICA, INC.

13. Install front case. (See **LUBRICATION SYSTEM - 2.7L**)
14. Install the upper oil pan.
 1. Using a razor blade and gasket scraper, remove all the old packing material from the gasket surfaces.

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

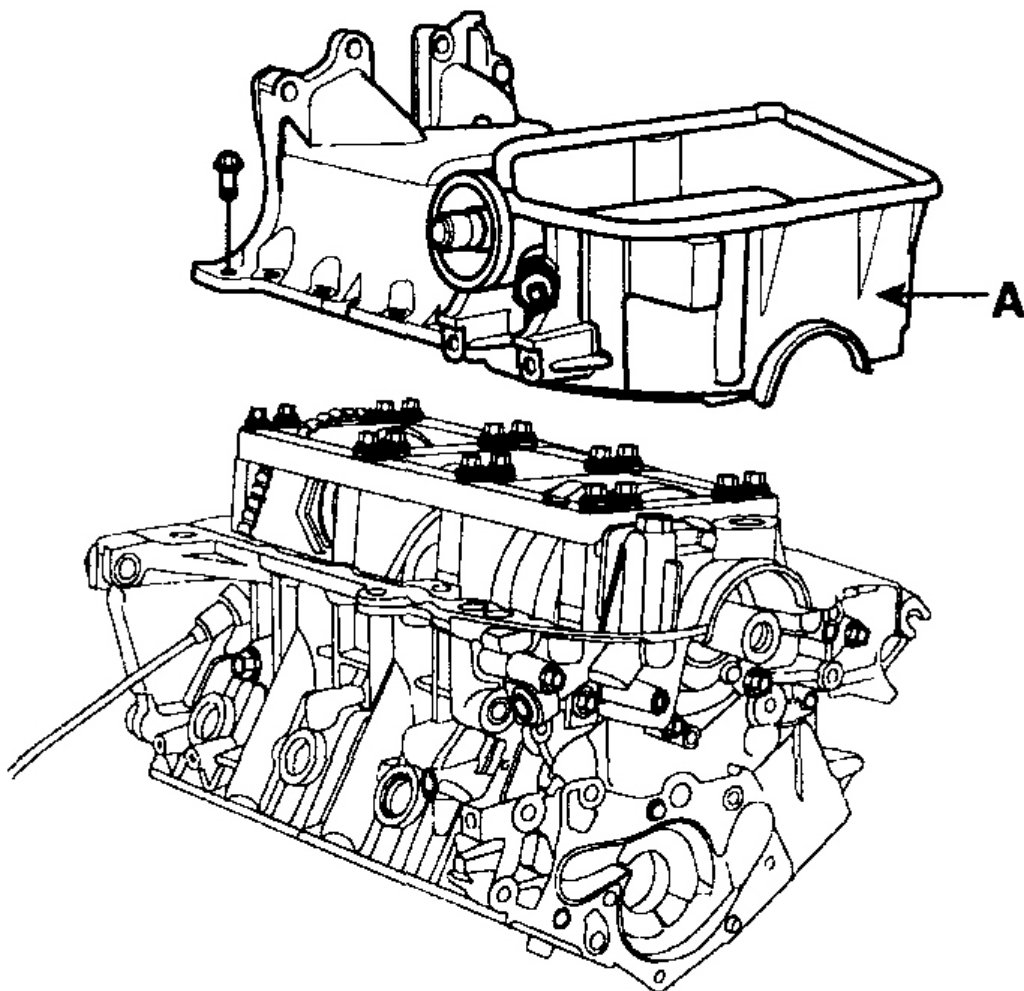
2. Install the oil pan (A) with the 17bolts.

Uniformly tighten the bolts in several passes.

Tightening torque

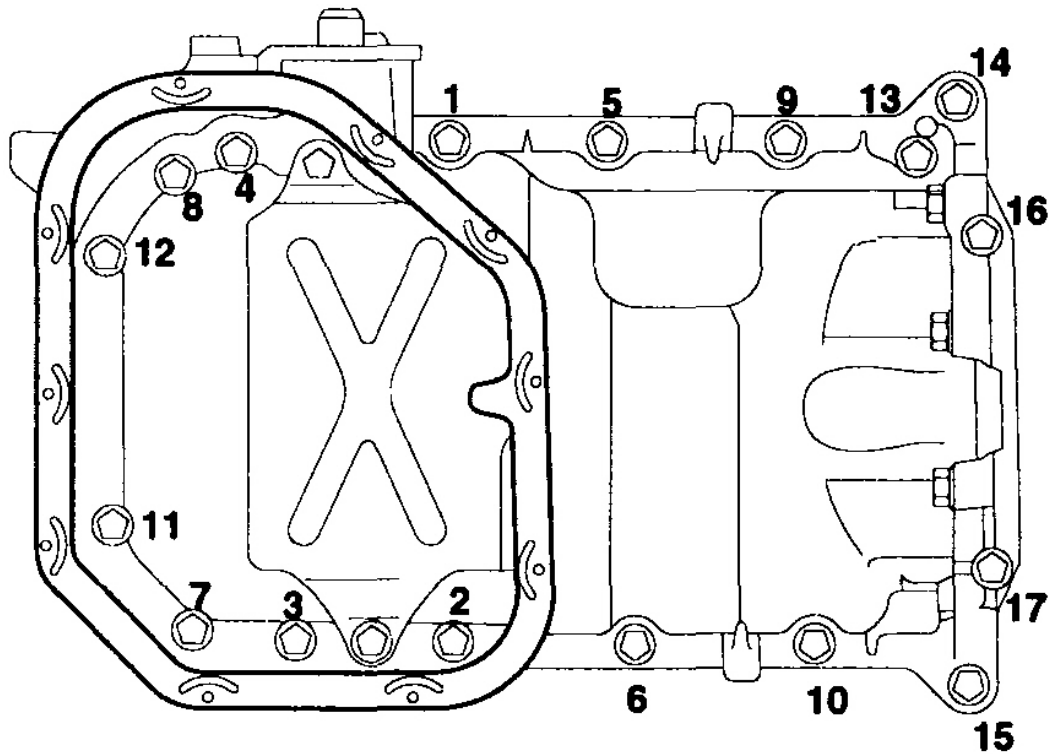
19 ~ 28N.m (190 ~ 280kgf.cm, 14 ~ 20lb-ft): (1 ~ 15)

5 ~ 7N.m (50 ~ 70kgf.cm, 4 ~ 5lb-ft): (16,17)



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Fig. 44: Installing Upper Oil Pan
Courtesy of KIA MOTORS AMERICA, INC.



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Fig. 45: Upper Oil Pan Bolt Tightening Sequence

Courtesy of KIA MOTORS AMERICA, INC.

NOTE:

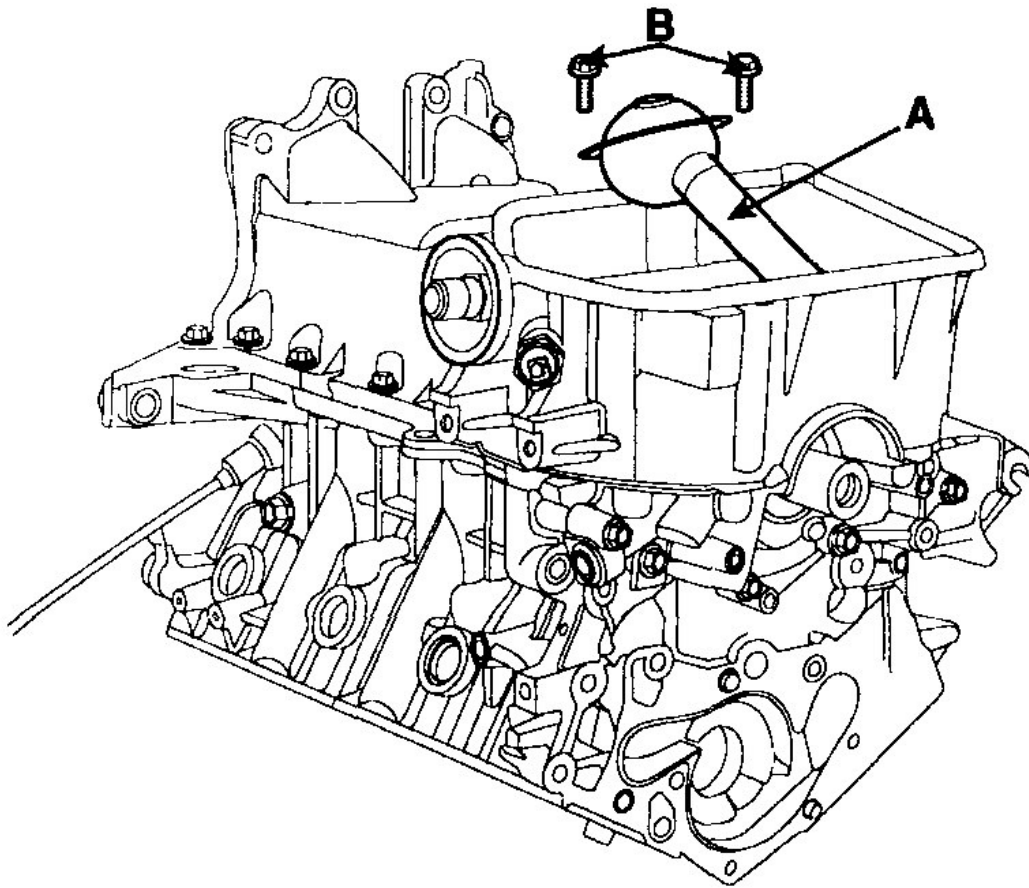
- To prevent leakage of oil, apply liquid gasket to the inner threads of the bolt holes.
- Do not install the parts if five minutes or more have elapsed since applying the liquid gasket. Instead, reapply liquid gasket after removing the residue.
- After assembly, wait at least 30 minutes before filling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

15. Install oil screen.

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

Tightening torque

15 ~ 22N.m (150 ~ 220kgf.cm, 11 ~ 16lb-ft)



G03821437

Fig. 46: Installing Oil Screen And Gasket
Courtesy of KIA MOTORS AMERICA, INC.

16. Install the lower oil pan.
 1. Apply liquid gasket as an even bead, centered between the edges of the mating surface.

Use 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

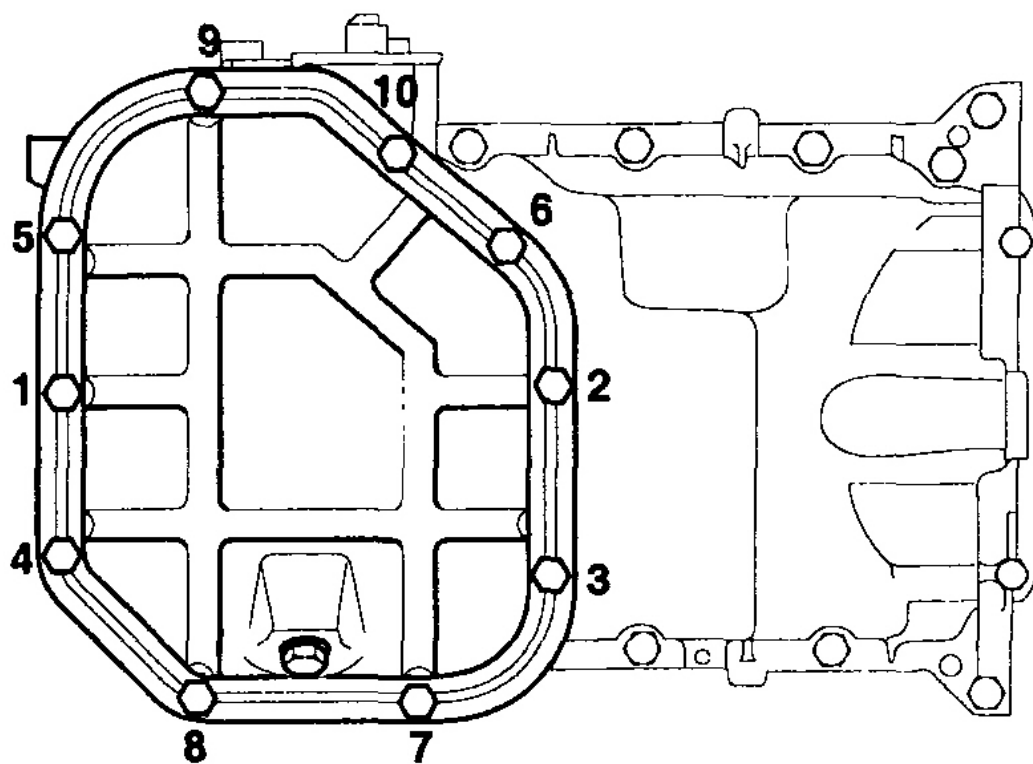
with oil.

2. Install the lower oil pan 10 bolts.

Uniformly tighten the bolts several passes

Tightening torque

10 ~ 12N.m (100 ~ 120kgf.cm, 7.3 ~ 8.8lb-ft)



G03821438

Fig. 47: Lower Oil Pan Bolts Tightening Sequence
Courtesy of KIA MOTORS AMERICA, INC.

17. Install oil pressure sensor.

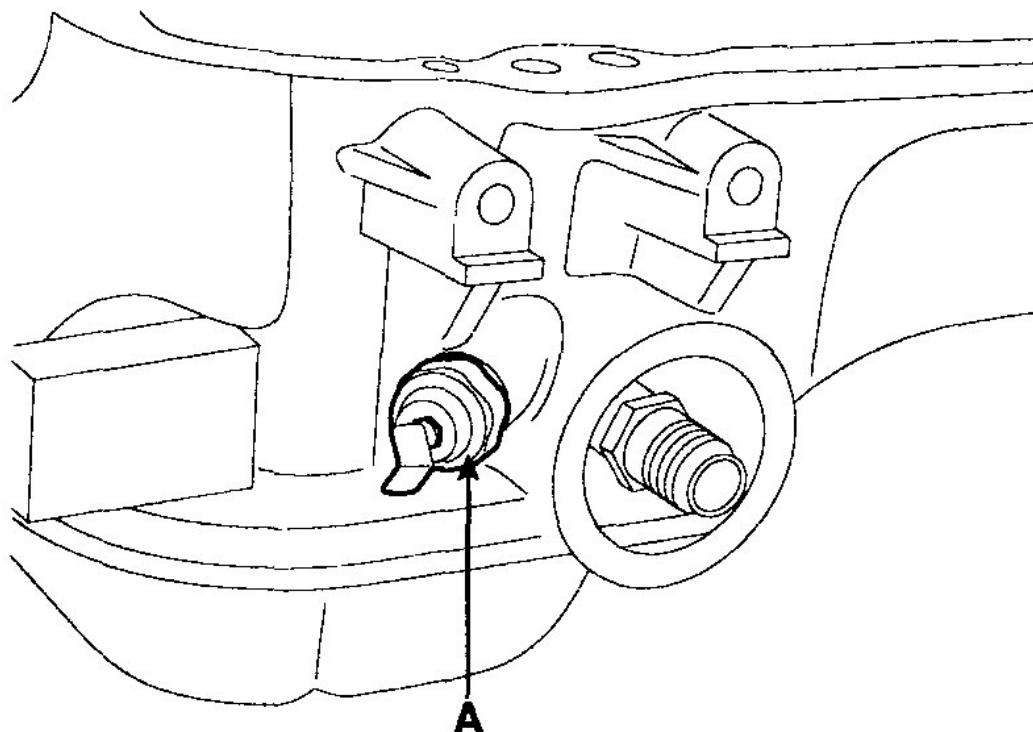
1. Apply adhesive to 2 or 3 threads.

Adhesive: THREE BOND TB2403 or equivalent.

2. Install the oil pressure sensor (A).

Tightening torque

15 ~ 22N.m (150 ~ 220kgf.cm, 11 ~ 16lb-ft)



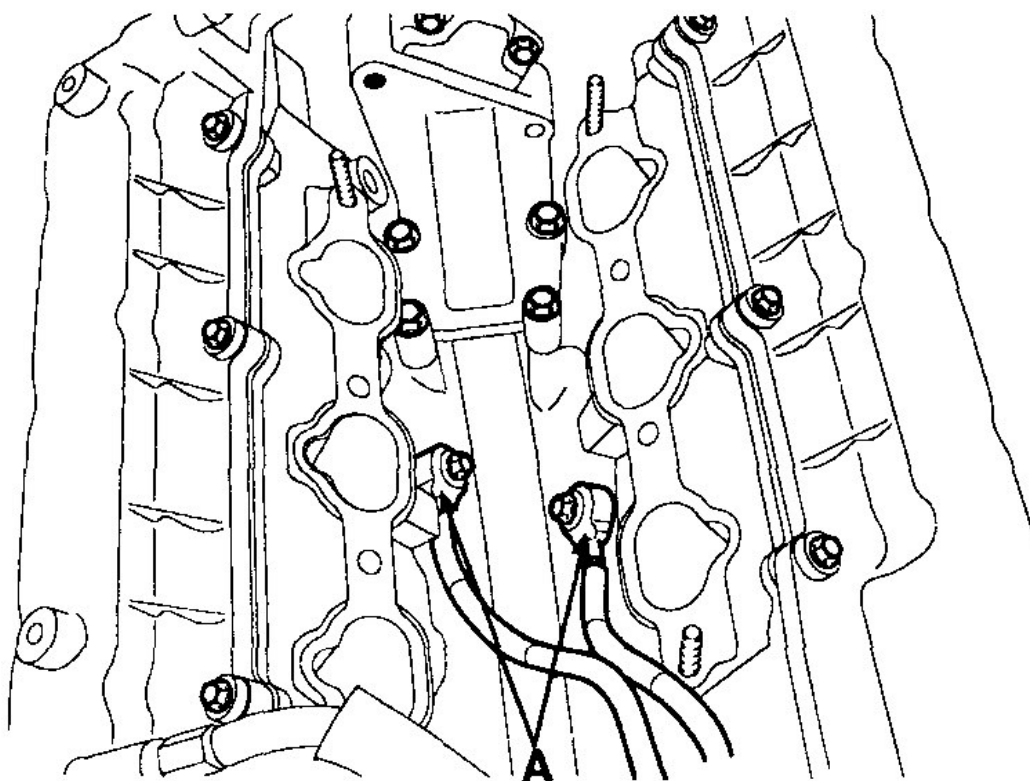
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Fig. 48: Installing Oil Pressure Sensor
Courtesy of KIA MOTORS AMERICA, INC.

18. Install knock sensor (A)

Tightening torque

17 ~ 26N.m (170 ~ 260kgf.cm, 12.5 ~ 19lb-ft)



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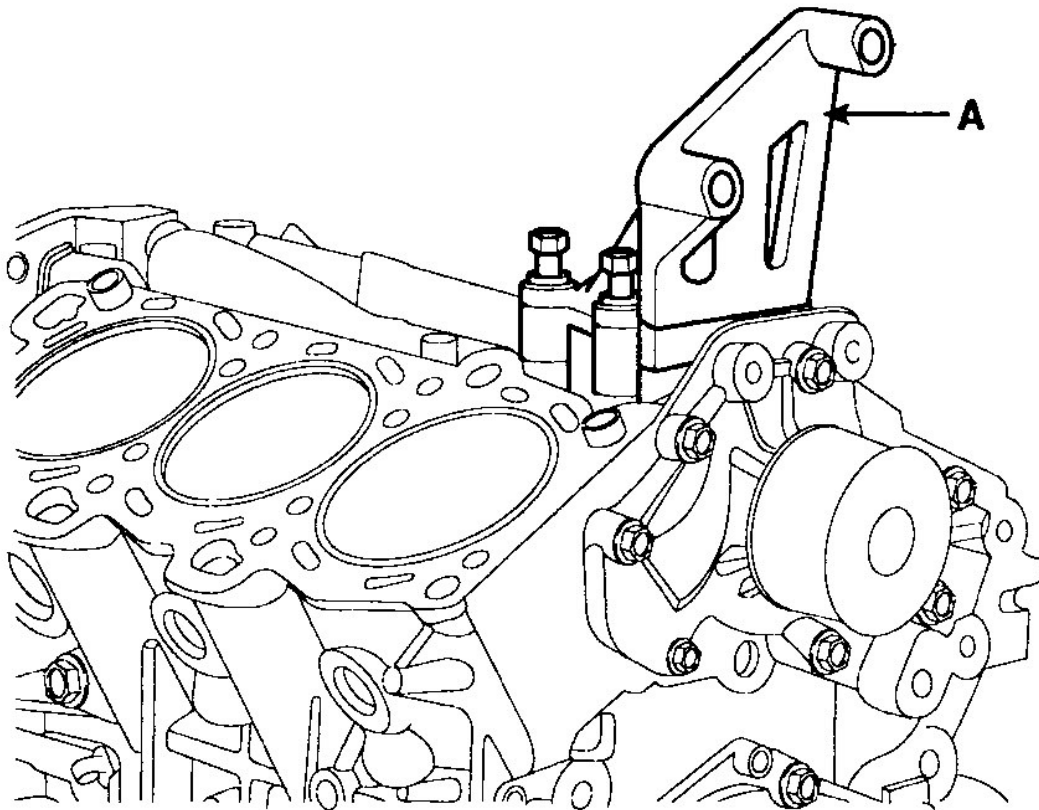
Fig. 49: Installing Knock Sensor

Courtesy of KIA MOTORS AMERICA, INC.

19. Install water pump. (See **COOLING SYSTEM**)
20. Install the power steering pump bracket (A).

Tightening torque

35 ~ 55N.m (350 ~ 550kgf.cm, 25.8 ~ 40.6lb-ft)



G03821441

Fig. 50: Installing Power Steering Pump Bracket
Courtesy of KIA MOTORS AMERICA, INC.

21. Install the air compressor. (See **HEATING, VENTILATION & AIR CONDITIONING**)
22. Install the alternator. (See **ALTERNATOR**)
23. Install oil level gauge assembly.
 1. Install a new O-ring on the oil level gauge.
 2. Apply engine oil on the O-ring.
 3. Install the oil level gauge assembly (A) with the bolt.

Tightening torque

12 ~ 15N.m (120 ~ 150kgf.cm, 9 ~ 11lb-ft)

24. Install cylinder head. (See **CYLINDER HEAD ASSEMBLY - 2.7L**)
25. Install timing belt. (See **INSTALLATION**)

- 26. Remove engine stand.
- 27. Install drive plate.

Tightening torque

73 ~ 77N.m (730 ~ 770kgf.cm, 53 ~ 56lb-ft)