

## 2008 ENGINES

## Engine Mechanical - Spectra &amp; Spectra5

## GENERAL

## SPECIFICATIONS

## GENERAL SPECIFICATIONS

| Description                                 |               | Specifications (2.0 CVVT)               | Limit               |
|---------------------------------------------|---------------|-----------------------------------------|---------------------|
| <b>General</b>                              |               |                                         |                     |
| 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                                 |                     |
| <b>Valve timing</b>                         |               |                                         |                     |
| Intake valve                                | Opens (ATDC)  | 11°                                     |                     |
|                                             | Closes (ABDC) | 59°                                     |                     |
| Exhaust valve                               | Opens (BBDC)  | 42°                                     |                     |
|                                             | Closes (ATDC) | 6°                                      |                     |
| <b>Cylinder head</b>                        |               |                                         |                     |
| 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<br>(1.3228 ~ 1.3238 in) |                     |
| Exhaust valve seat ring<br>hole diameter | STD     | 28.500 ~ 28.521 mm<br>(1.1220 ~ 1.1229 in) |                     |
|                                          | 0.3 OS  | 28.800 ~ 28.821 mm<br>(1.1339 ~ 1.1347 in) |                     |
|                                          | 0.6 OS  | 29.100 ~ 29.121 mm<br>(1.1457 ~ 1.1465 in) |                     |
| <b>Camshaft</b>                          |         |                                            |                     |
| Cam height                               | Intake  | 44.518 ~ 44.718 mm<br>(1.7527 ~ 1.7605 in) |                     |
|                                          | Exhaust | 44.418 ~ 44.618 mm<br>(1.7487 ~ 1.7566 in) |                     |
| Journal outer Diameter (Intake, Exhaust) |         | 27.964 ~ 27.980 mm<br>(1.1009 ~ 1.1016 in) |                     |
| Bearing oil clearance                    |         | 0.02 ~ 0.061 mm (0.0008<br>~ 0.0024 in)    | 0.1 mm (0.0039 in)  |
| End play                                 |         | 0.10 ~ 0.20 mm (0.0039<br>~ 0.0079 in)     |                     |
| <b>Valve</b>                             |         |                                            |                     |
| 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<br>(0.2348 ~ 0.2354 in)   |                     |
|                                          | Exhaust | 5.950 ~ 5.965 mm<br>(0.2343 ~ 0.2348 in)   |                     |
| Face angle                               |         | 45° ~ 45°30'                               |                     |
| Thickness of Valve head<br>(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<br>guide clearance   | Intake  | 0.020 ~ 0.050 mm<br>(0.0008 ~ 0.0020 in)   | 0.10 mm (0.0039 in) |
|                                          | Exhaust | 0.035 ~ 0.065 mm<br>(0.0014 ~ 0.0026 in)   | 0.13 mm (0.0051 in) |
| <b>Valve guide</b>                       |         |                                            |                     |
| Length                                   | Intake  | 45.8 ~ 46.2 mm (1.8031<br>~ 1.8189 in)     |                     |
|                                          | Exhaust | 54.3 ~ 54.6 mm (2.1378<br>~ 2.1496 in)     |                     |
| <b>Valve seat</b>                        |         |                                            |                     |
| Width of seat contact                    | Intake  | 1.1 ~ 1.5 mm (0.0433 ~<br>0.0591 in)       |                     |
|                                          | Exhaust | 1.3 ~ 1.7 mm (0.0512 ~<br>0.0669 in)       |                     |
|                                          | Intake  | 45° ~ 45°30'                               |                     |

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|                                       |                   |                                                                                            |                                    |
|---------------------------------------|-------------------|--------------------------------------------------------------------------------------------|------------------------------------|
| Seat angle                            | Exhaust           | 45° ~ 45°30'                                                                               |                                    |
| <b>Valve spring</b>                   |                   |                                                                                            |                                    |
| Free length                           |                   | 48.86 mm (1.9236 in)                                                                       |                                    |
| Load                                  |                   | 18.8 ± 0.9 kg/39.0 mm<br>(41.4 ± 2.0 lb/1.5354 in)                                         |                                    |
|                                       |                   | 41.0 ± 1.5 kg/30.5 mm<br>(90.4 ± 3.3 lb/1.2008 in)                                         |                                    |
| Out of squareness                     |                   | Less than 1.5°                                                                             | 3°                                 |
| <b>Valve clearance</b>                |                   |                                                                                            |                                    |
| Cold (20°C ± 5°C) (68°F ± 9°F)        | Intake            | 0.20 mm (0.0079 in)                                                                        | 0.12~0.28 mm<br>(0.0047~0.0110 in) |
|                                       | Exhaust           | 0.28 mm (0.0110 in)                                                                        | 0.20~0.38 mm<br>(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)                                                                        |                                    |
| <b>Cylinder block</b>                 |                   |                                                                                            |                                    |
| Cylinder bore                         |                   | 82.00 ~ 82.03 mm<br>(3.2283 ~ 3.2295 in)                                                   |                                    |
| Flatness of gasket surface            |                   | Total: Less than 0.05 mm<br>(0.0020 in) Bore to bore :<br>Less than 0.03 mm<br>(0.0012 in) |                                    |
| <b>Piston</b>                         |                   |                                                                                            |                                    |
| Piston outer diameter                 |                   | 81.970 ~ 82.000 mm<br>(3.2272 ~ 3.2283 in)                                                 |                                    |
| Piston to cylinder clearance          |                   | 0.020 ~ 0.040 mm<br>(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)                                                        |                                    |
| <b>Piston ring</b>                    |                   |                                                                                            |                                    |
| 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)  |
| <b>Piston pin</b>                            |             |                                                            |                     |
| 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)                            |                     |
| <b>Connecting rod</b>                        |             |                                                            |                     |
| 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)  |
| <b>Crankshaft</b>                            |             |                                                            |                     |
| 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)  |
| <b>Flywheel</b>                              |             |                                                            |                     |
| Runout                                       |             | 0.1 mm (0.0039 in)                                         | 0.13 mm (0.0051 in) |
| <b>Oil pump</b>                              |             |                                                            |                     |
| 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 <sup>2</sup> , 71 ± 7.1 psi) |                     |
|                                              | Free length | 43.8 mm (1.7244 in)                                        |                     |
|                                              | Load        | 3.7 ± 0.4 kg/40.1 mm                                       |                     |

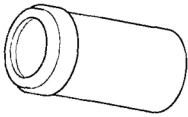
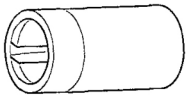
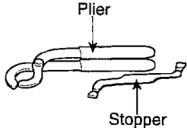
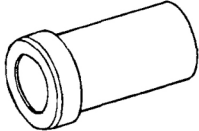
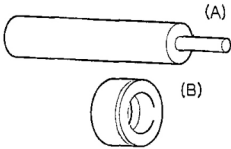


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|                                 |                                  |                                                                               |  |
|---------------------------------|----------------------------------|-------------------------------------------------------------------------------|--|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

### SPECIAL SERVICE TOOLS

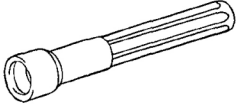
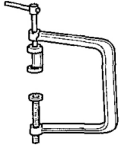
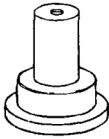
| Tool (Number and name)                                                                 | Illustration                                                                        | Use                                         |
|----------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------|
| Crankshaft front oil seal installer<br>(09214-32000)                                   |    | Installation of the front oil seal          |
| Crankshaft front oil seal guide<br>(09214-32100)                                       |    | Installation of the front oil seal          |
| Valve clearance adjust tool set<br>(09220-2D000)                                       |    | Removal and installation of the tappet shim |
| Camshaft oil seal installer<br>(09221-21000)                                           |  | Installation of the camshaft oil seal       |
| Valve guide remover<br>(09221-3F100 (A))<br>Valve guide installer<br>(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<br>(09222-22001)                                                  |  | Installation of the valve stem oil seal                    |
| Valve spring compressor<br>(09222-28000)<br>Valve spring compressor<br>adaptor<br>(09222-28100) |  | Removal and installation of the intake<br>or exhaust valve |
| Crankshaft rear oil seal<br>installer<br>(09231-21000)                                          |  | Installation of the crankshaft rear oil seal               |

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**Fig. 2: Identifying Service Tools (2 Of 2)**  
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## TROUBLESHOOTING

## 2008 Kia Spectra EX

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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.<br>(Oil consumption may or may not cause the engine to misfire.)                                                                                                                                                           | Inspect the cylinder for a loss of compression.<br>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.<br>(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                    | <ul style="list-style-type: none"> <li>Faulty cylinder head gasket and/or cracking or other damage to the cylinder head and engine block cooling system.</li> <li>Coolant consumption may or may not cause the engine to overheat.</li> </ul> | <ul style="list-style-type: none"> <li>Inspect the cylinder head and engine block for damage to the coolant passages and/or a faulty head gasket.</li> <li>Repair or replace as required.</li> </ul> |
| Engine misfire with excessive oil consumption              | Worn valves, valve guides and/or valve stem oil seals.                                                                                                                                                                                        | Repair or replace as required.                                                                                                                                                                       |
|                                                            | Worn piston rings.<br>(Oil consumption may or may not cause the engine to misfire)                                                                                                                                                            | Inspect the cylinder for a loss of compression<br>Repair or replace as required.                                                                                                                     |
| Engine noise on start-up, but only lasting a few seconds.  | Incorrect oil viscosity.                                                                                                                                                                                                                      | Drain the oil.<br>Refill with the correct viscosity oil.                                                                                                                                             |
|                                                            | Worn crankshaft thrust bearing.                                                                                                                                                                                                               | Inspect the thrust bearing and crankshaft.<br>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.<br>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.<br>Inspect the oil pump screen.<br>Repair or replace as required.                                                                                                                                             |
|                                                 | Oil pump screen loose, damaged or restricted.                 | Inspect the oil pump screen.<br>Repair or replace as required.                                                                                                                                                                     |
|                                                 | Excessive piston-to-cylinder bore clearance.                  | Inspect the piston and cylinder bore.<br>Repair as required.                                                                                                                                                                       |
|                                                 | Excessive piston pin-to-bore clearance.                       | Inspect the piston, piston pin and the connecting rod.<br>Repair or replace as required.                                                                                                                                           |
|                                                 | Excessive connecting rod bearing clearance.                   | Inspect the following components and repair as required. <ul style="list-style-type: none"><li>• The connecting rod bearings.</li><li>• The connecting rods.</li><li>• The crankshaft.</li><li>• The crankshaft journal.</li></ul> |
|                                                 | Excessive crankshaft bearing clearance.                       | Inspect the following components and repair as required. <ul style="list-style-type: none"><li>• The crankshaft bearings.</li><li>• The crankshaft journals.</li></ul>                                                             |
|                                                 | Incorrect piston, piston pin and connecting rod installation. | Verify the piston pins and connecting rods are installed correctly.<br>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. <ul style="list-style-type: none"><li>• The connecting rod bearings.</li><li>• The connecting rods.</li><li>• The crankshaft.</li></ul>                                   |
|                                                 | Excessive crankshaft bearing clearance.                       | Inspect the following components and repair as required. <ul style="list-style-type: none"><li>• The crankshaft bearings.</li><li>• The crankshaft journals.</li><li>• The cylinder block crankshaft bearing bore.</li></ul>       |

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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.<br>(crankshaft will not rotate) | Hydraulically locked cylinder. <ul style="list-style-type: none"> <li>Coolant/antifreeze in cylinder.</li> <li>Oil in cylinder.</li> <li>Fuel in cylinder.</li> </ul> | Remove spark plugs and check for fluid.<br>Inspect for broken head gasket.<br>Inspect for cracked engine block or cylinder head.<br>Inspect for a sticking fuel injector and/or leaking fuel regulator. |
|                                                        | Broken timing chain and/or timing chain gears.                                                                                                                        | Inspect timing chain and gears.<br>Repair as required.                                                                                                                                                  |
|                                                        | Foreign material in cylinder. <ul style="list-style-type: none"> <li>Broken valve.</li> <li>Piston material.</li> <li>Foreign material.</li> </ul>                    | Inspect cylinder for damaged components and/or foreign materials.<br>Repair or replace as required.                                                                                                     |
|                                                        | Seized crankshaft or connecting rod bearings.                                                                                                                         | Inspect crankshaft and connecting rod bearing.<br>Repair or replace as required.                                                                                                                        |
|                                                        | Bent or broken connecting rod.                                                                                                                                        | Inspect connecting rods.<br>Repair or replace as required.                                                                                                                                              |
|                                                        | Broken crankshaft.                                                                                                                                                    | Inspect crankshaft.<br>Repair or replace as required.                                                                                                                                                   |

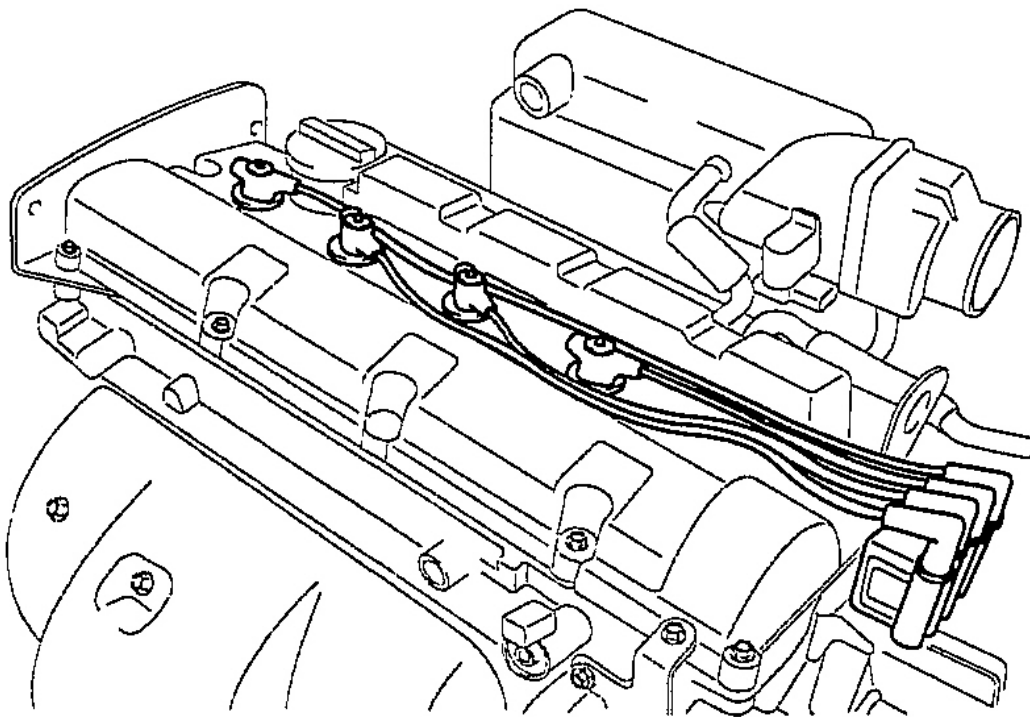
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**Fig. 5: Troubleshooting Symptom Chart (3 Of 3)**  
**Courtesy of KIA MOTORS AMERICA, INC.**

## COMPRESSION PRESSURE INSPECTION

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

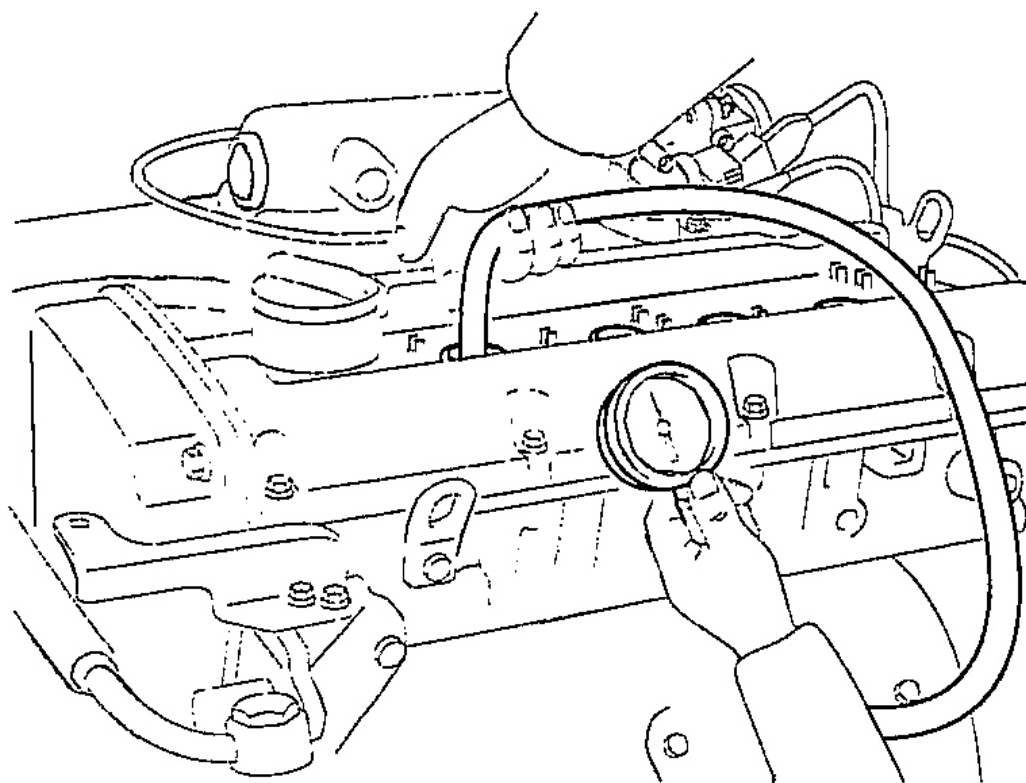
1. Start the engine and allow to warm up to operating temperature (about five minutes). Stop the engine.
2. Disconnect the ignition coil connectors and the spark plug cables.



G00718932

**Fig. 6: Identifying Spark Plug Position**  
Courtesy of KIA MOTORS AMERICA, INC.

3. Remove the four spark plugs using a 16 mm spark plug wrench.
4. Check the cylinder compression pressure.
  - a. Insert a compression gauge into the spark plug hole.



G00718933

**Fig. 7: 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/cm<sup>2</sup> , 206 psi) (250-400 RPM)

Minimum pressure: 1,275 kPa (13.0 kg/cm<sup>2</sup> , 185 psi)



Difference between each cylinder: 98 kPa (1.0 kg/cm<sup>2</sup> , 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.

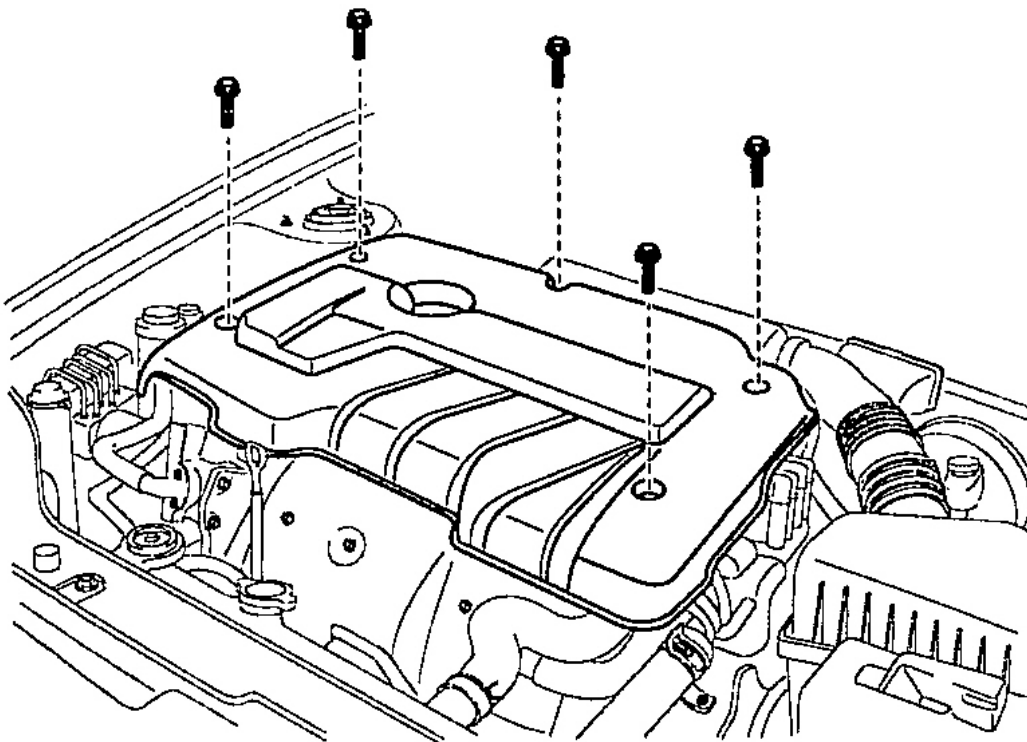
**NOTE:**

- 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**

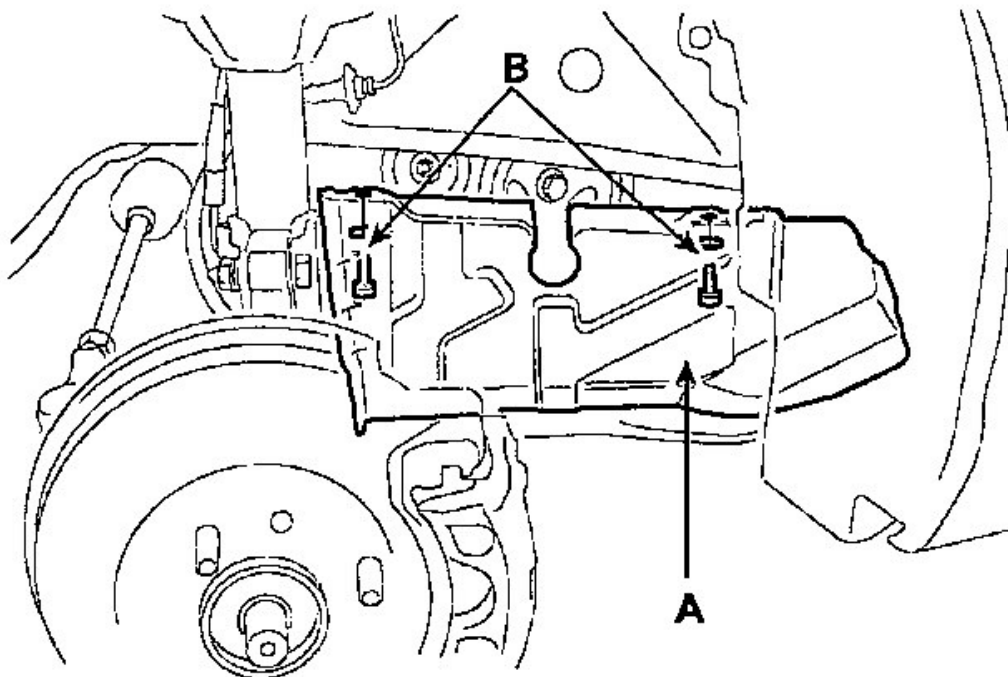
1. Remove the engine cover.



G00718934

**Fig. 8: Removing Engine Cover****Courtesy of KIA MOTORS AMERICA, INC.**

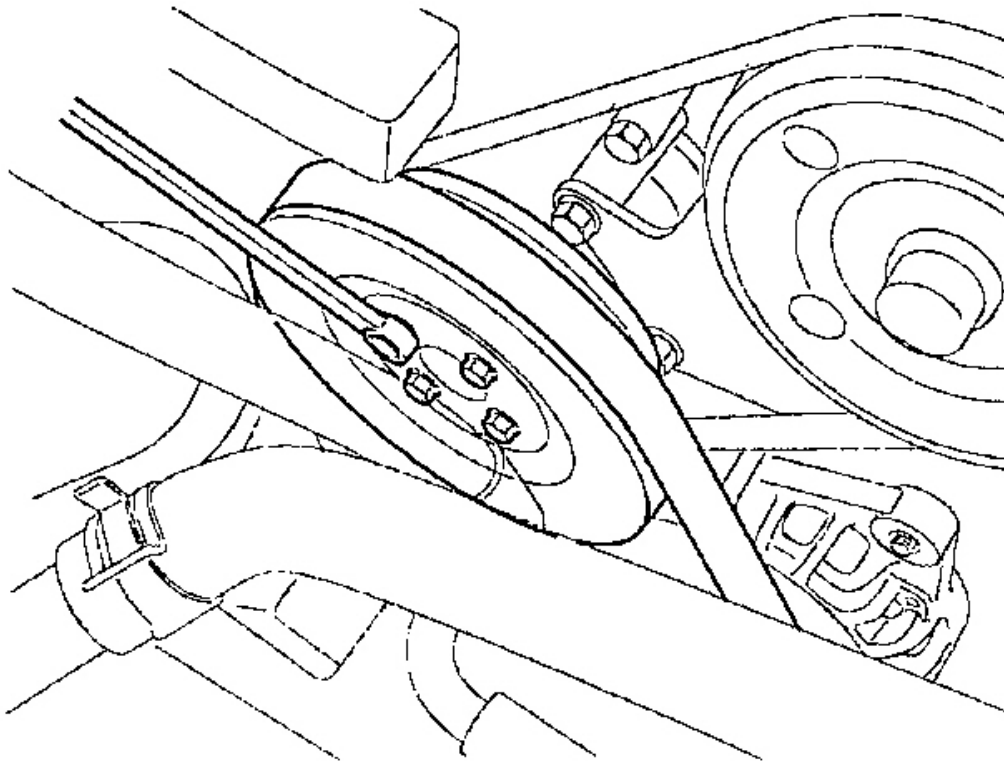
2. Remove the RH front wheel.
3. Remove the bolts (B) and RH side cover (A).



G00718935

**Fig. 9: Removing RH Side Cover****Courtesy of KIA MOTORS AMERICA, INC.**

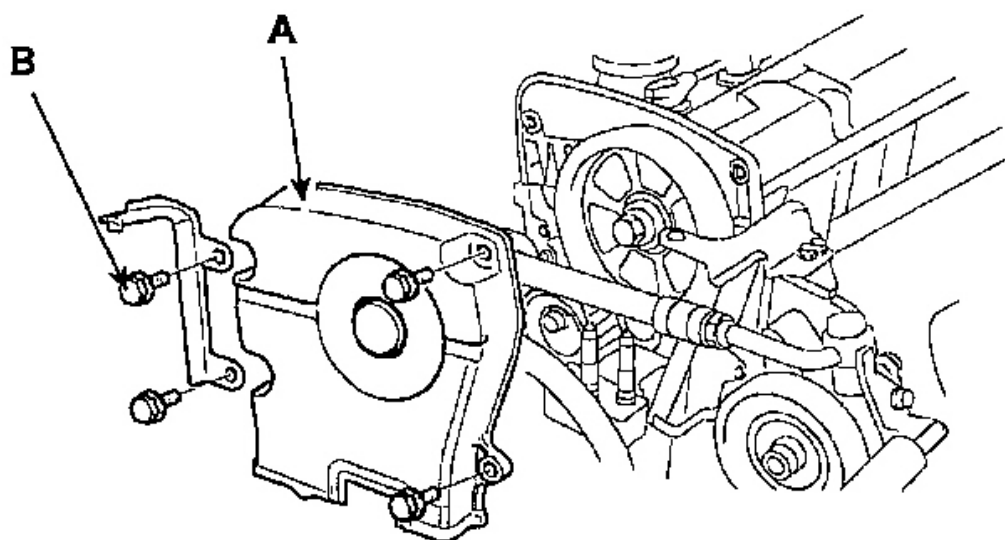
4. Loosen the water pump pulley bolts.



G00718936

**Fig. 10: Loosening Water Pump Pulley Bolt**  
Courtesy of KIA MOTORS AMERICA, INC.

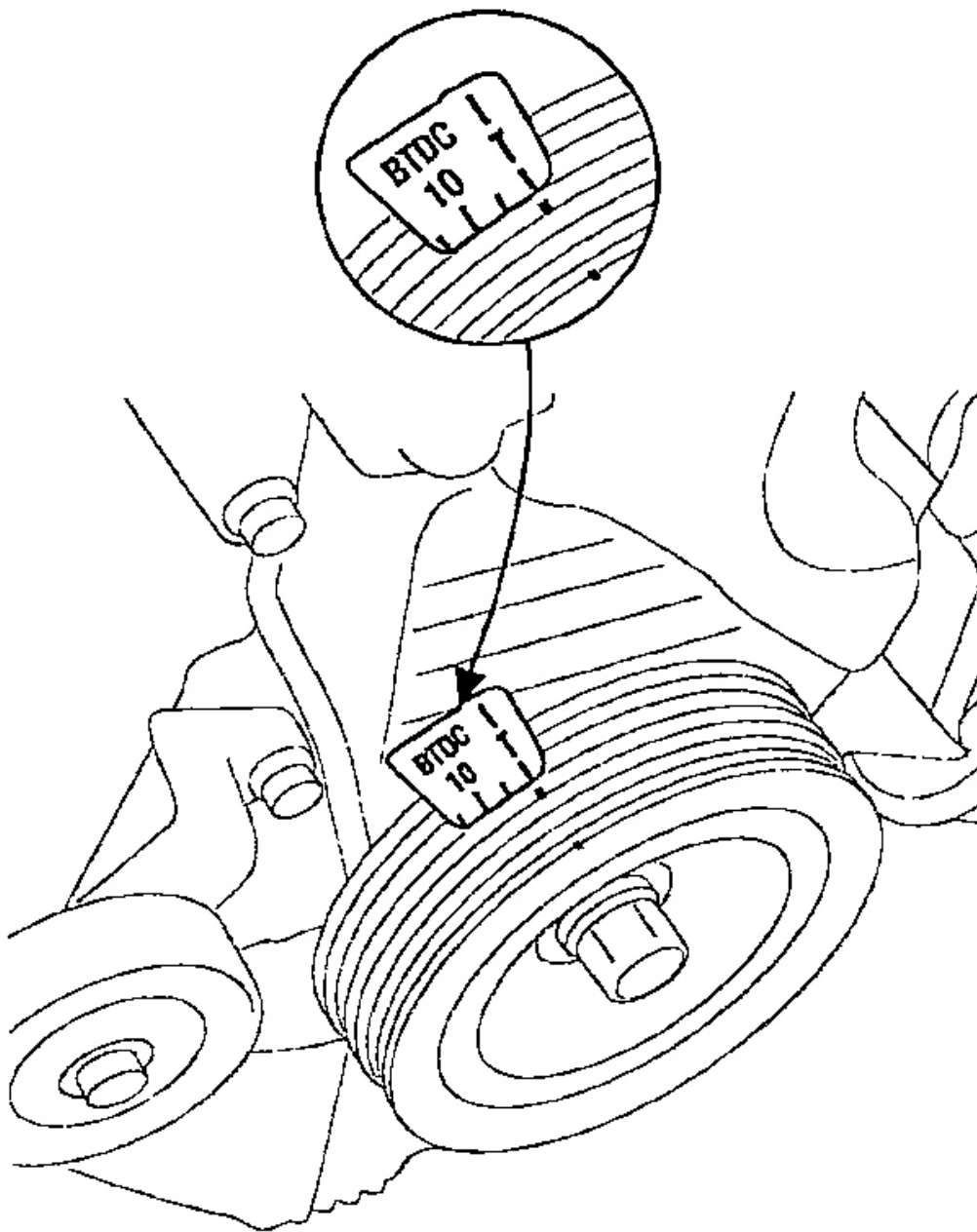
5. Remove the alternator drive belt. See **ALTERNATOR BELT INSPECTION & ADJUSTMENT**
6. Remove the air conditioner compressor drive belt. See **DRIVE BELT** .
7. Remove the power steering pump drive belt. See **CHECKING POWER STEERING BELT TENSION** .
8. Remove the water pump pulley.
9. Remove the 4 bolts (B) and timing belt upper cover (A).



G00718937

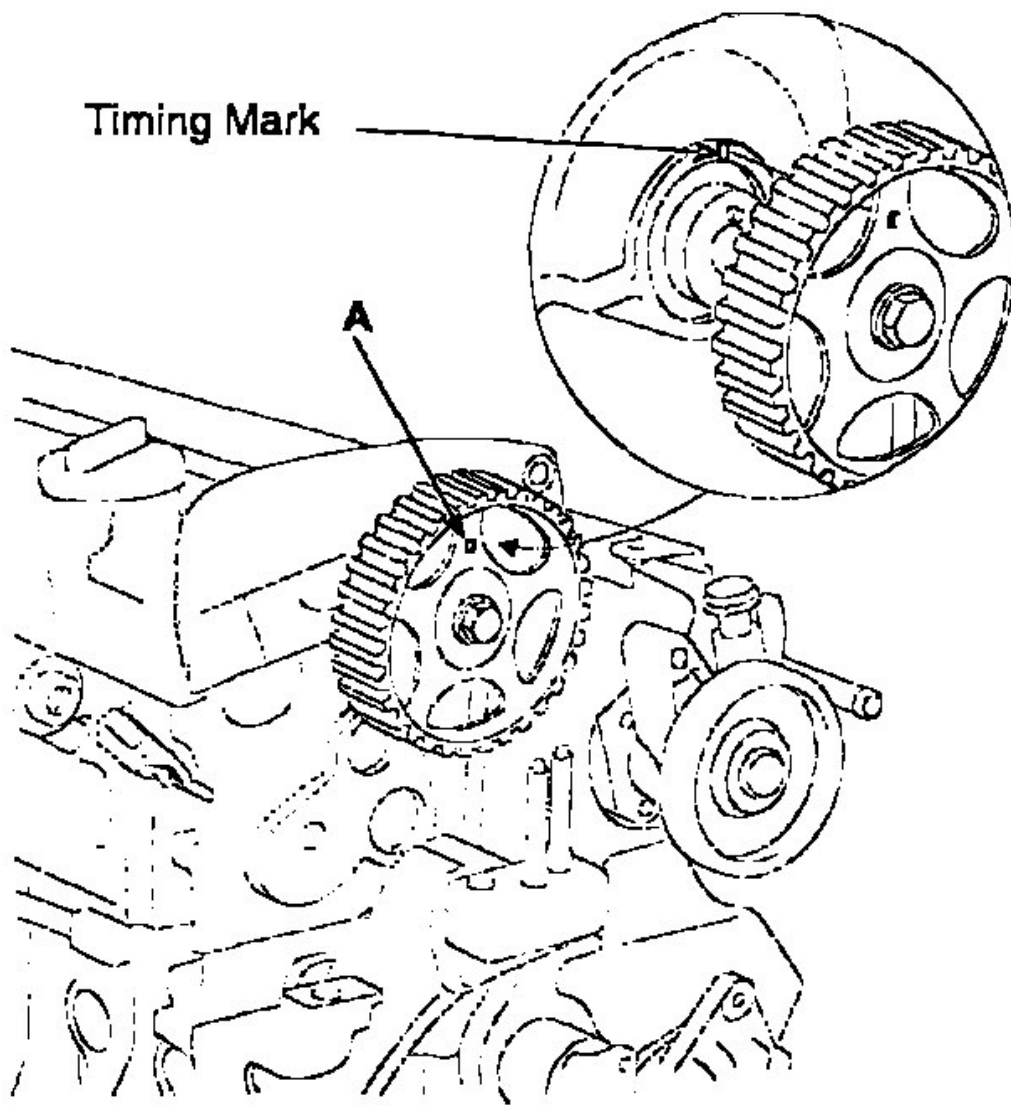
**Fig. 11: Removing Timing Belt Upper Cover**  
Courtesy of KIA MOTORS AMERICA, INC.

10. 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).



G00718938

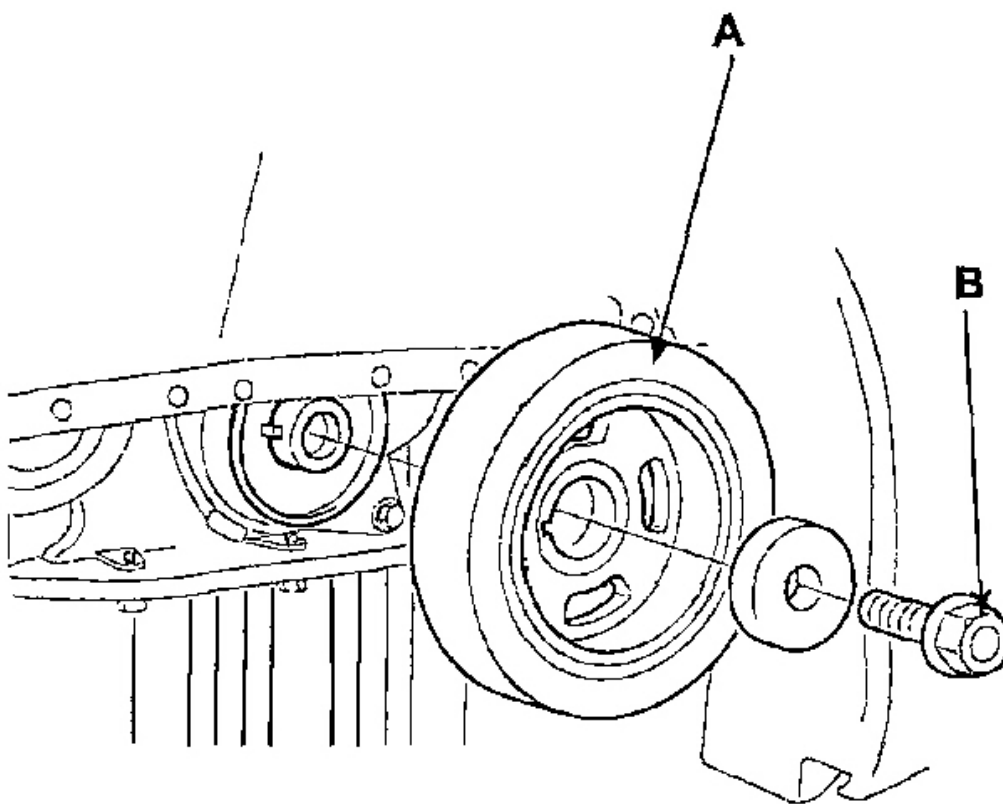
**Fig. 12: Aligning Timing Marks**  
Courtesy of KIA MOTORS AMERICA, INC.



G00718939

**Fig. 13: Illustrating Camshaft Timing Marks**  
Courtesy of KIA MOTORS AMERICA, INC.

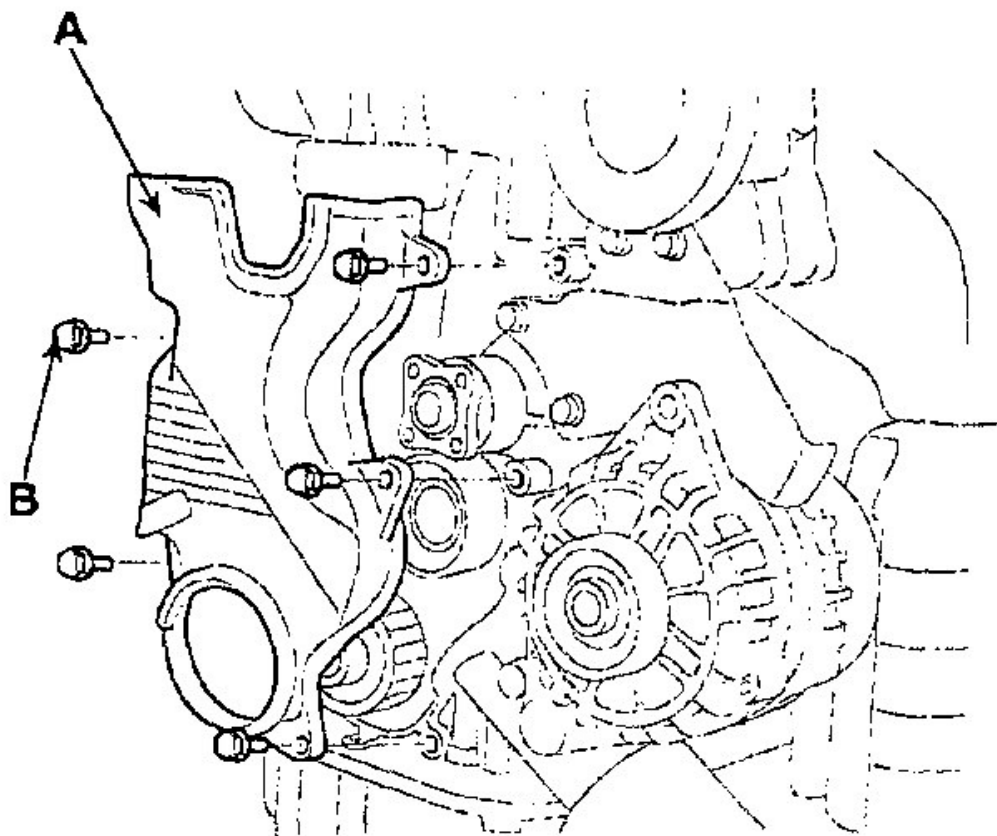
11. Remove the crankshaft pulley bolt (B) and crankshaft pulley (A).



G00718940

**Fig. 14: Removing Crankshaft Pulley**  
Courtesy of KIA MOTORS AMERICA, INC.

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

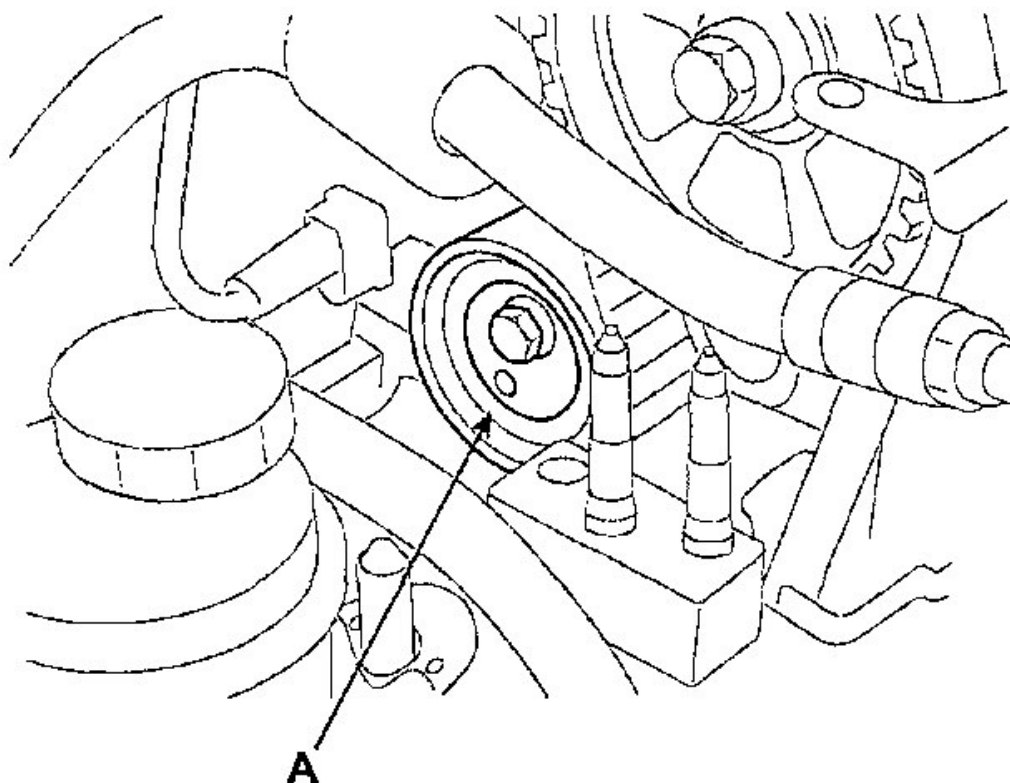


G00718941

**Fig. 15: Removing Timing Belt Lower Cover**  
Courtesy of KIA MOTORS AMERICA, INC.

13. Temporarily loosen the tensioner pulley (A) by center bolt.

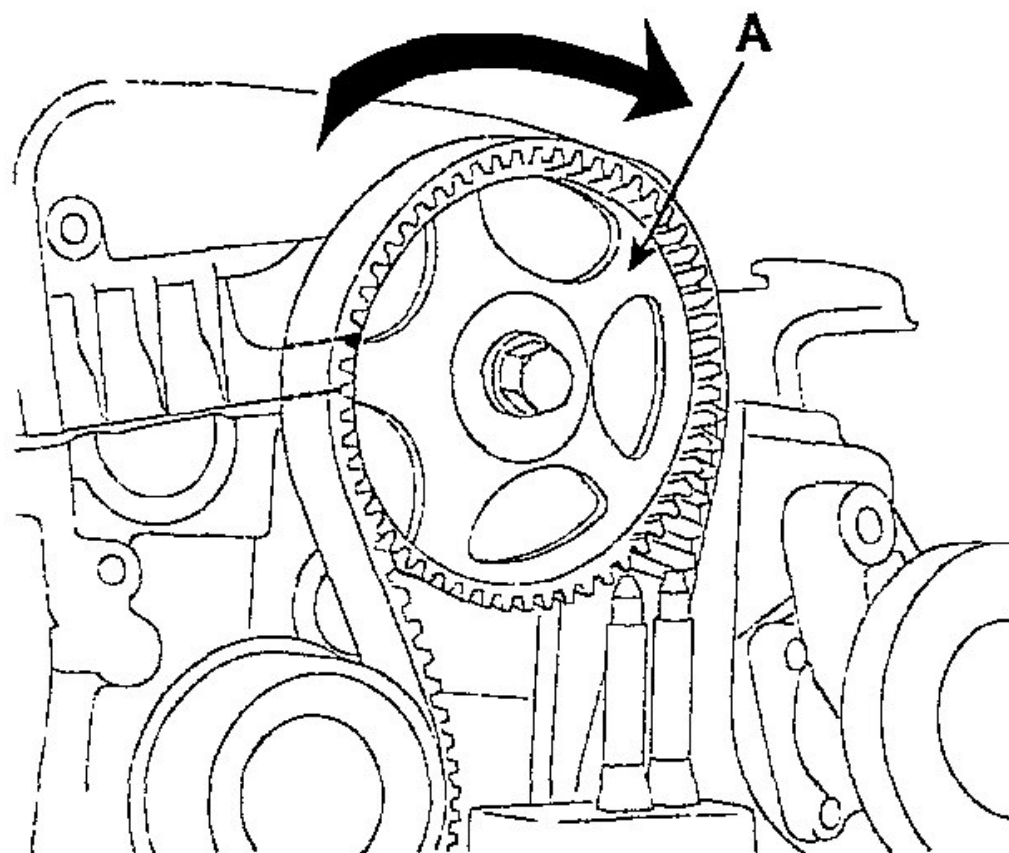




G00718942

**Fig. 16: Temporarily Loosening Tensioner Pulley**  
Courtesy of KIA MOTORS AMERICA, INC.

14. Adjust the timing belt tension.
  - a. Rotate the crankshaft clockwise (view from the front) through angle equivalent to two teeth (18°) of camshaft sprocket (A).

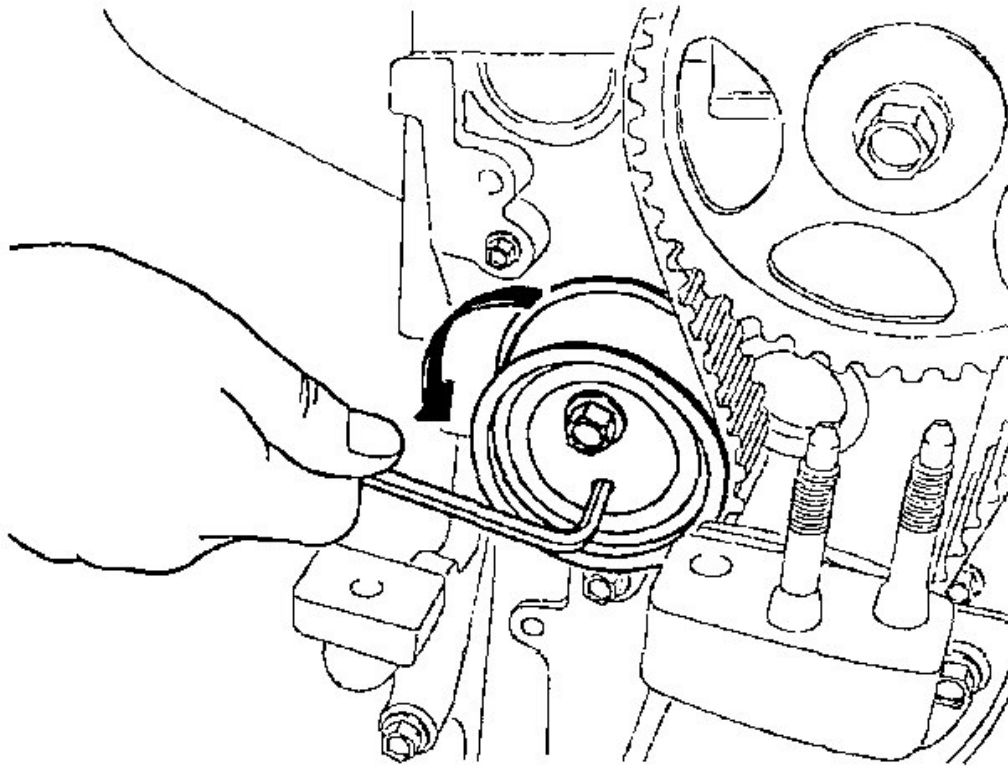


G00718943

**Fig. 17: Rotating Crankshaft**

Courtesy of KIA MOTORS AMERICA, INC.

- b. Using a hex-wrench, apply tension to the timing belt in the clockwise direction so that there is no slack in the belt on the tension side.

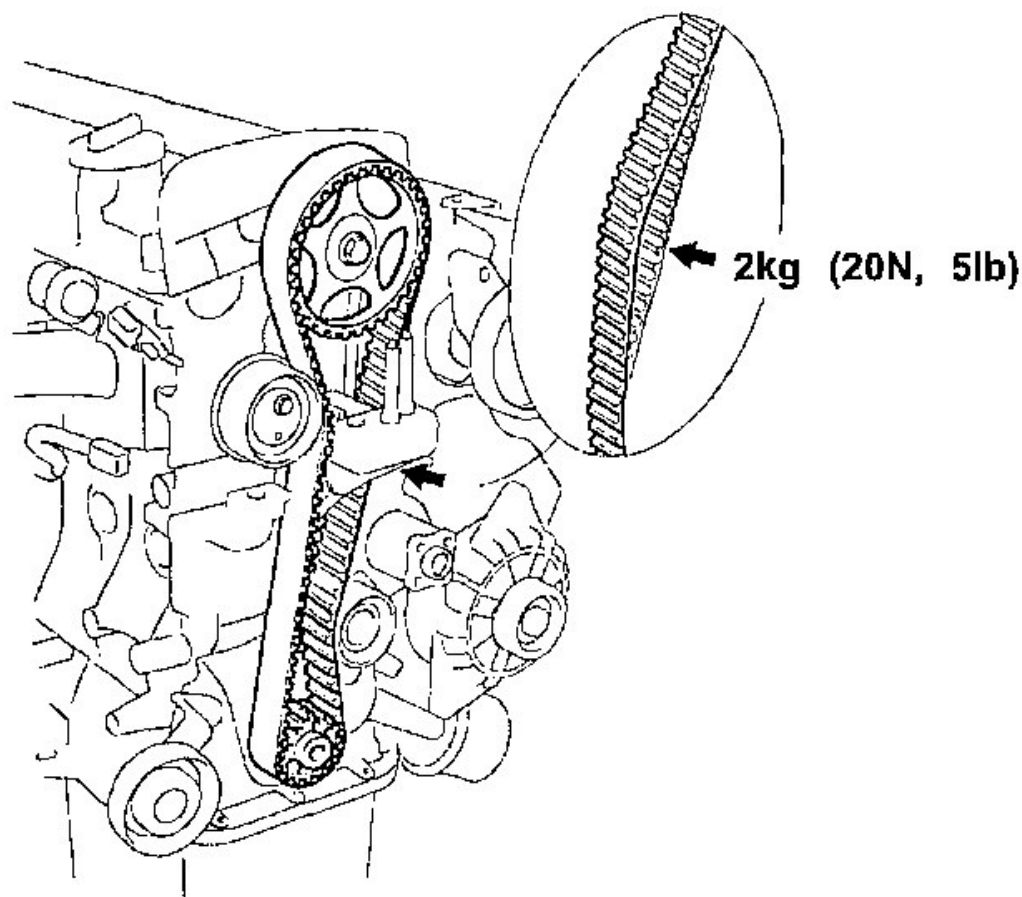
**G00718944**

**Fig. 18: Applying Tension To Timing Belt Tensioner**  
**Courtesy of KIA MOTORS AMERICA, INC.**

- c. Tighten the tensioner bolt.

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

- d. Recheck the belt tension. When applying about 5 lbs of force, the belt should move no more than 0.16 to 0.24 inch (4 to 6 mm).

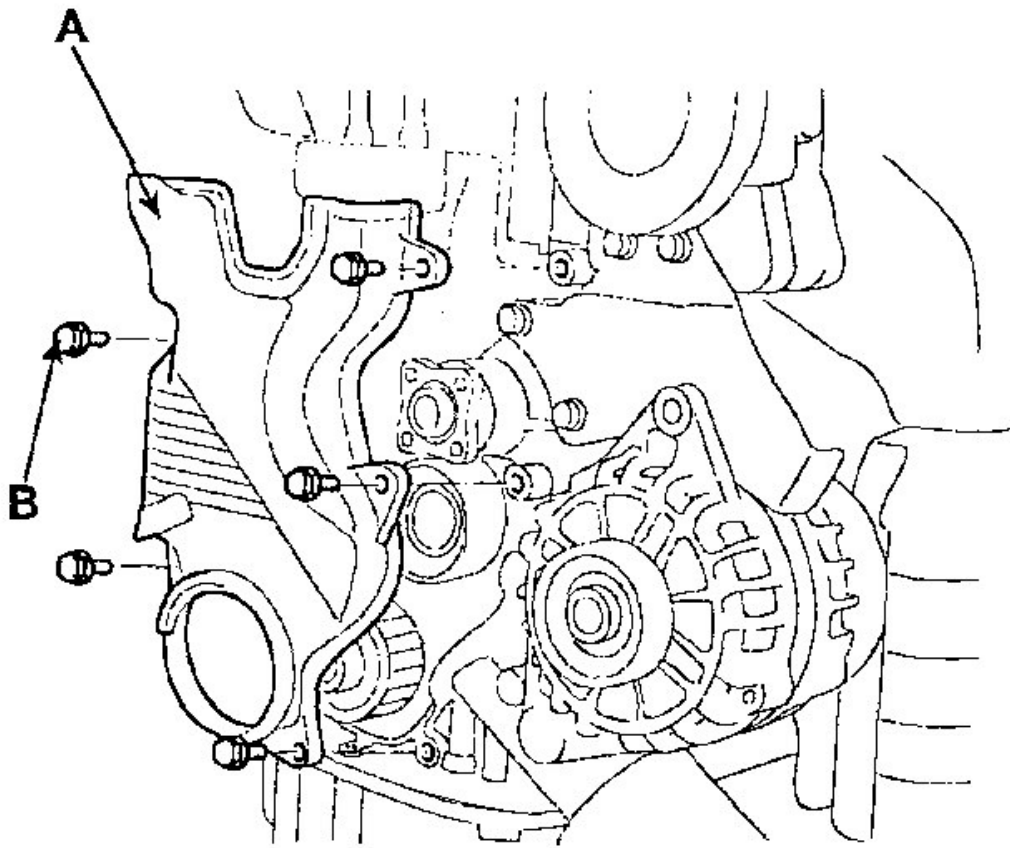


G00718945

**Fig. 19: Measuring Timing Belt Tension**  
Courtesy of KIA MOTORS AMERICA, INC.

15. Turn the crankshaft two turns in the operating direction (clockwise) and realign the crankshaft sprocket and camshaft sprocket timing mark.
16. Install the timing belt lower cover (A) with bolts (B).

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

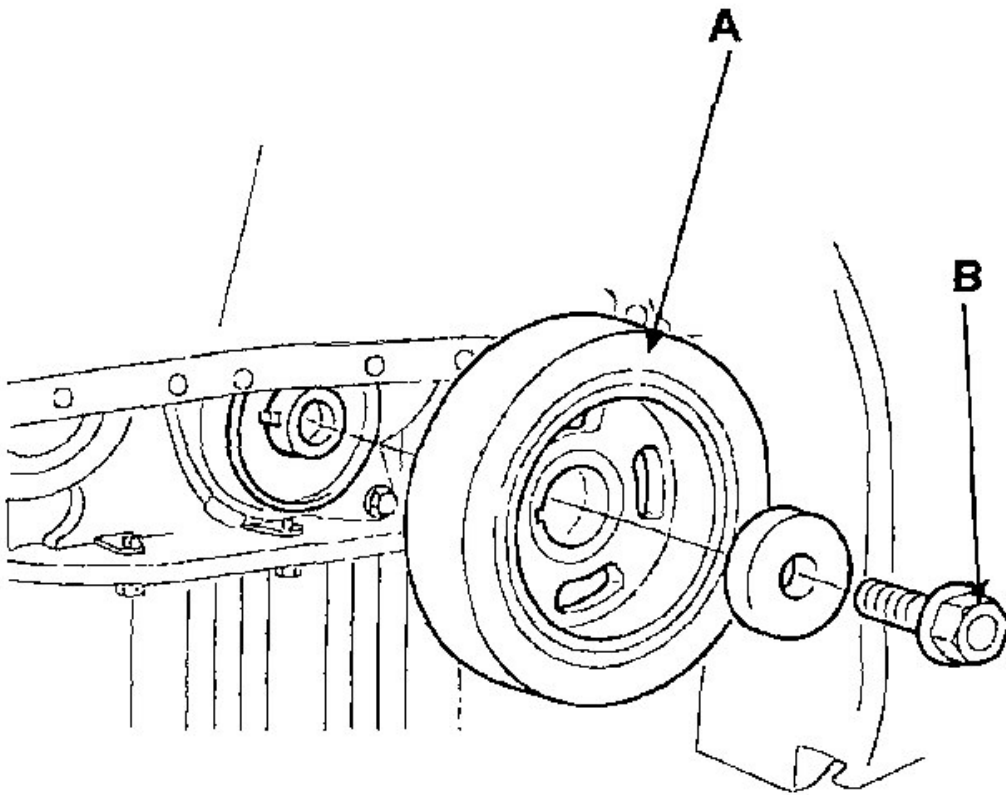


G00718946

**Fig. 20: Installing Timing Belt Lower Cover**  
Courtesy of KIA MOTORS AMERICA, INC.

17. Install the crankshaft pulley (A) with bolt (B).

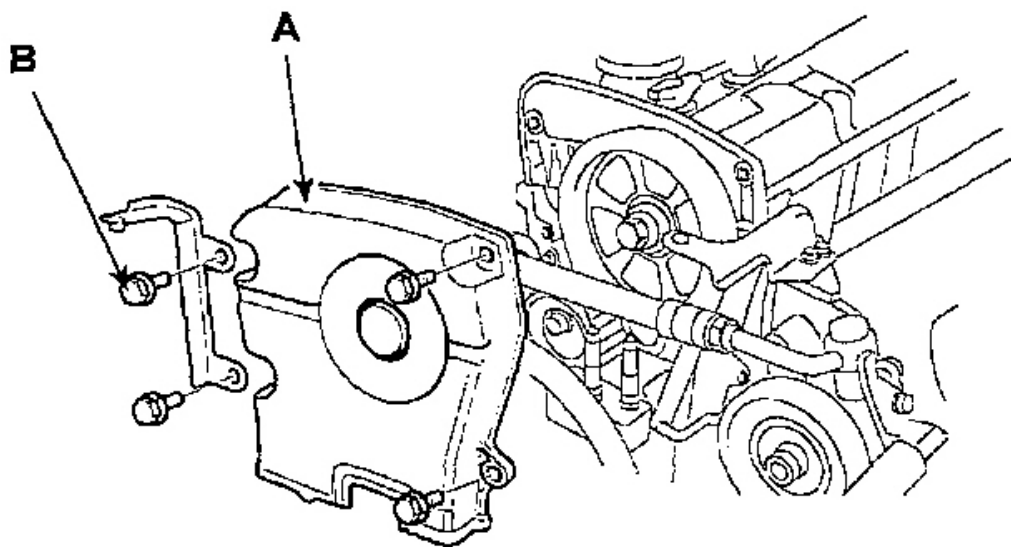
Tightening torque: 166.7-176.5 N.m (17.0-18.0 kg-m, 123.0-130.2 lb-ft)

**G00718947**

**Fig. 21: Installing Crankshaft Pulley**  
**Courtesy of KIA MOTORS AMERICA, INC.**

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

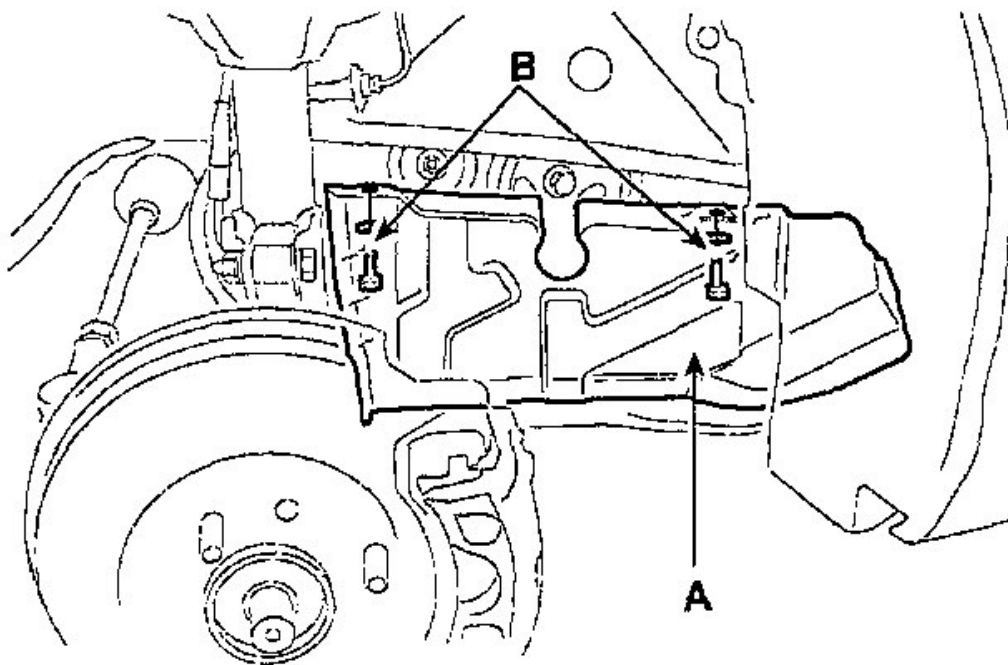
Tightening torque: 7.8-9.8 N.m (0.8-1.0 kg-m, 5.8-7.2 lb-ft)



G00718948

**Fig. 22: Installing Timing Belt Upper Cover**  
Courtesy of KIA MOTORS AMERICA, INC.

19. Install the water pump pulley.
20. Install the power steering pump drive belt. See **CHECKING POWER STEERING BELT TENSION** .
21. Install the air conditioner compressor drive belt. See **DRIVE BELT** .
22. Install the alternator drive belt. See **ALTERNATOR BELT INSPECTION & ADJUSTMENT** .
23. Install the RH side cover (A) with bolts (B)

**G00718949**

**Fig. 23: Installing RH Side Cover**  
Courtesy of KIA MOTORS AMERICA, INC.

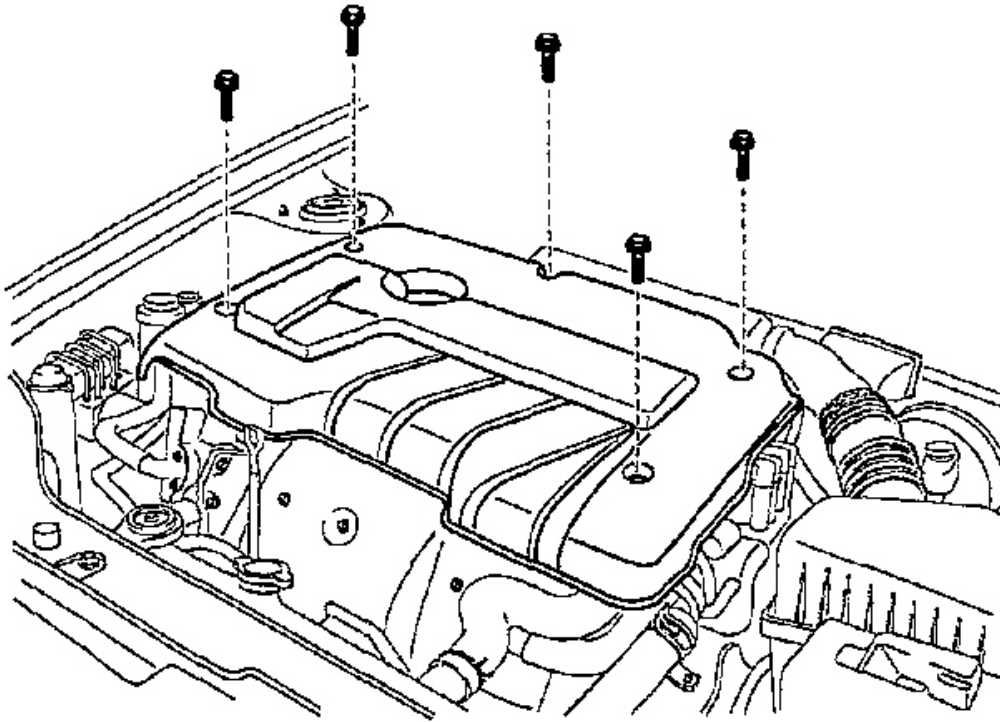
24. Install the RH front wheel.

Tightening torque 88.3-107.9 N.m (9-11 kg-m, 65.1-79.6 lb-ft)

25. Install the engine cover (A) with bolts.

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





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**Fig. 24: Installing Engine Cover**  
Courtesy of KIA MOTORS AMERICA, INC.

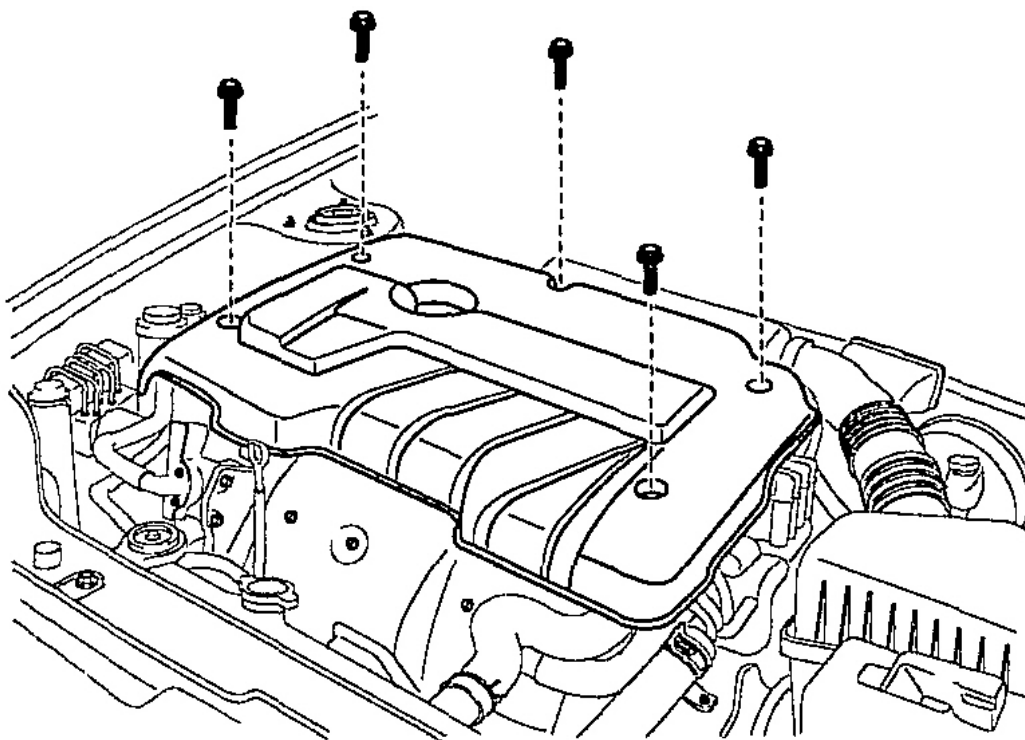
## VALVE CLEARANCE INSPECTION & ADJUSTMENT

### 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.

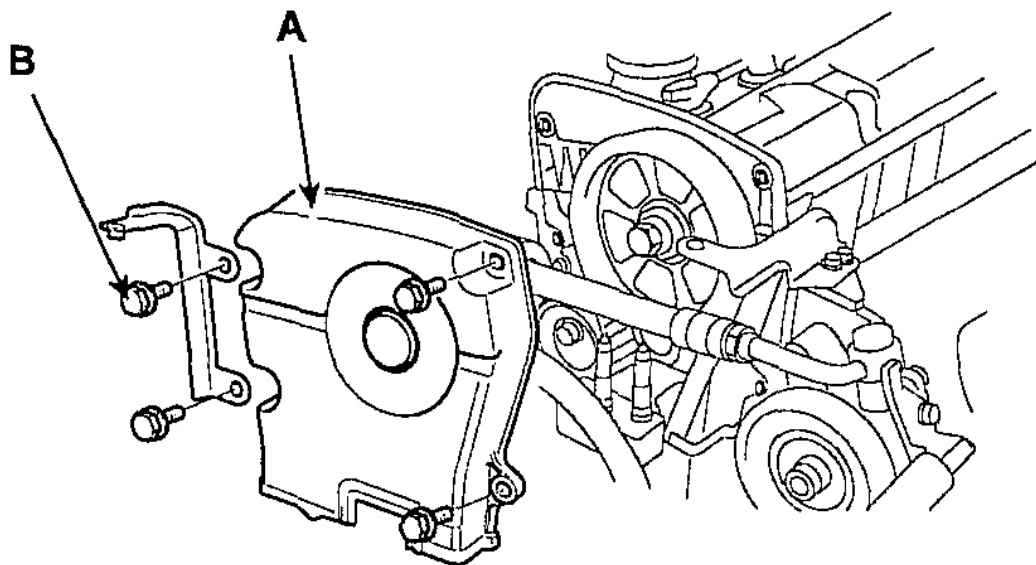
1. Remove the engine cover.



G00718951

**Fig. 25: Removing Engine Cover**  
Courtesy of KIA MOTORS AMERICA, INC.

2. Remove the bolts (B) and timing belt upper cover (A).

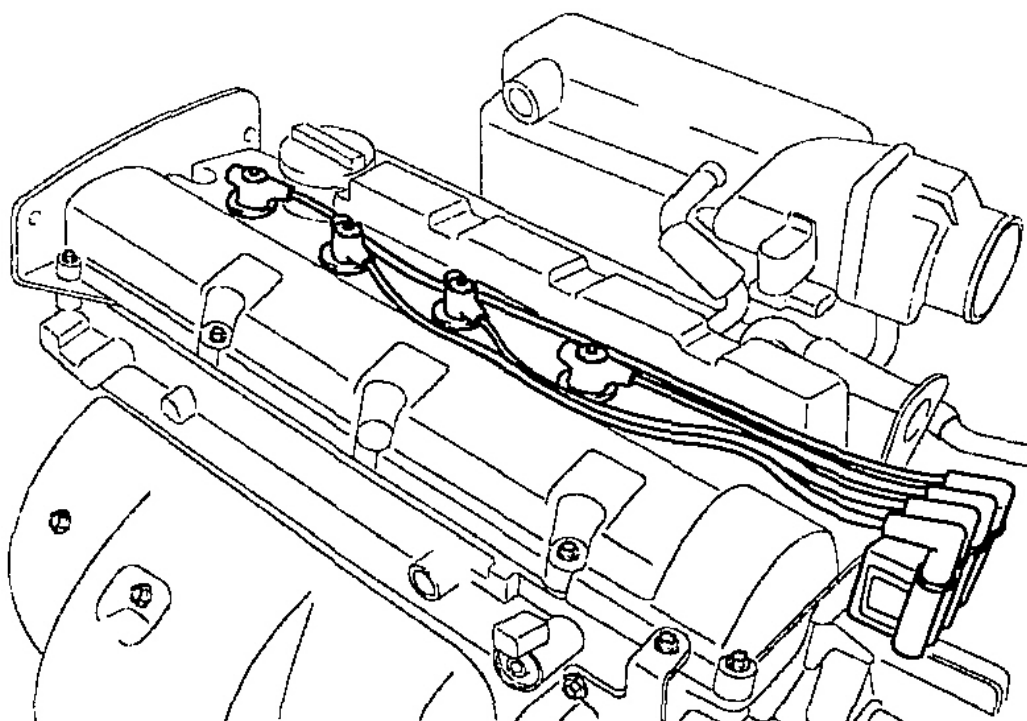


G00718952

**Fig. 26: 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.

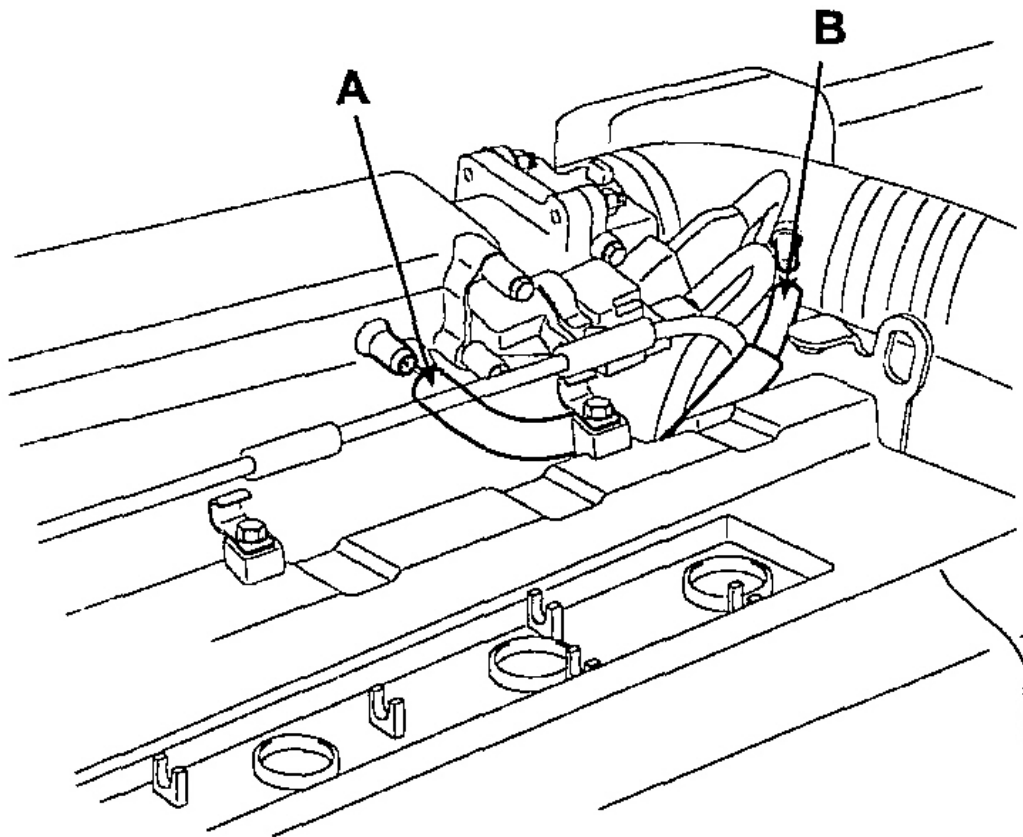
**NOTE:** Pulling on or bending the cables may damage the conductor inside.



G00718953

**Fig. 27: Disconnecting Spark Plug Wires**  
Courtesy of KIA MOTORS AMERICA, INC.

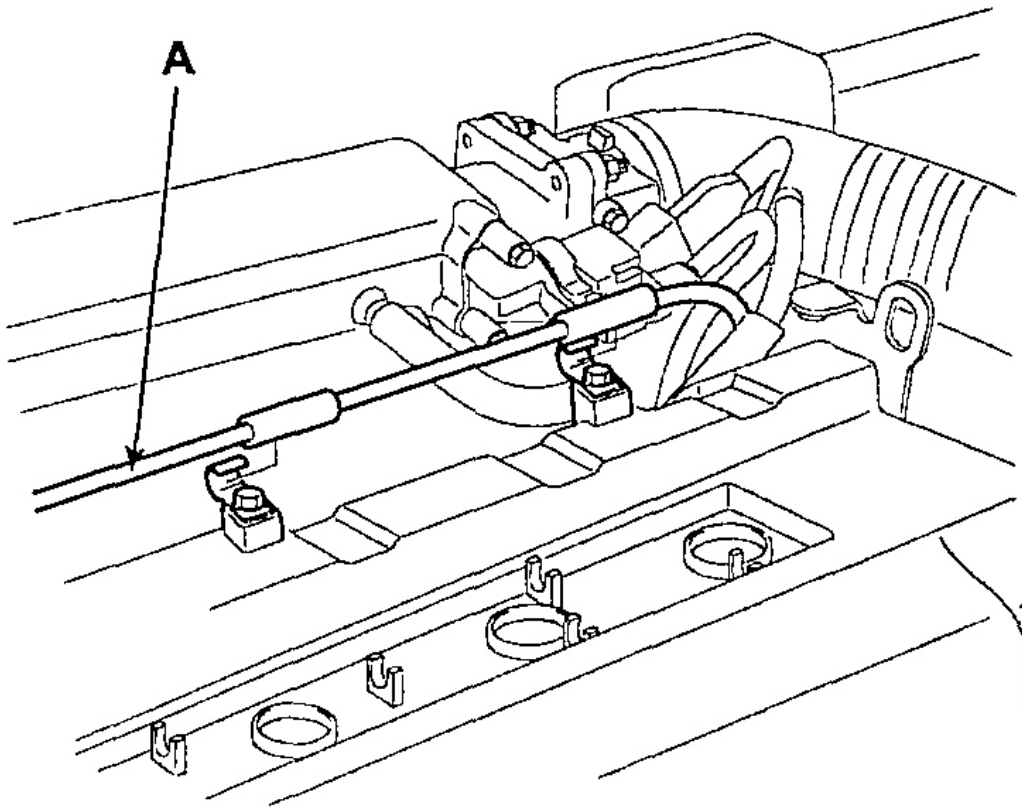
- b. Remove the PCV (Positive Crankcase Ventilation) hose (A) and the breather hose (B) from the cylinder head cover.



G00718954

**Fig. 28: Removing PCV Hose**  
Courtesy of KIA MOTORS AMERICA, INC.

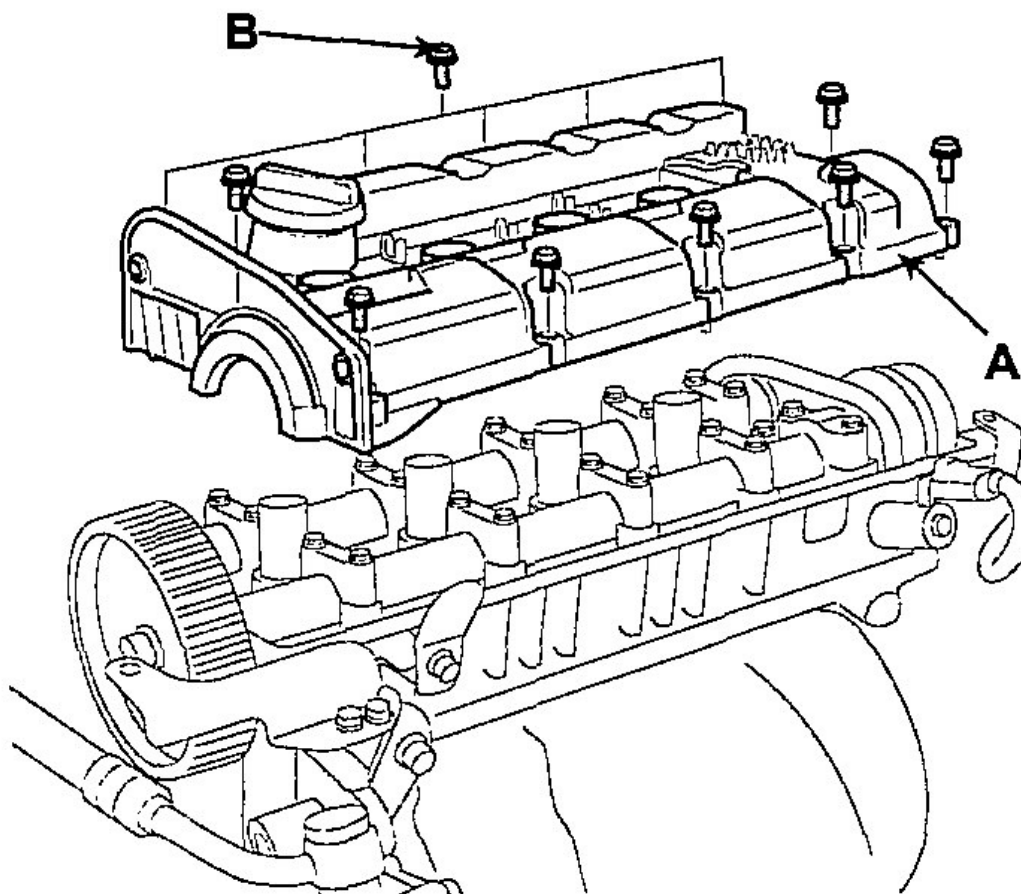
- c. Remove the accelerator cable (A) from the cylinder head cover.



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**Fig. 29: Removing Accelerator Cable**  
Courtesy of KIA MOTORS AMERICA, INC.

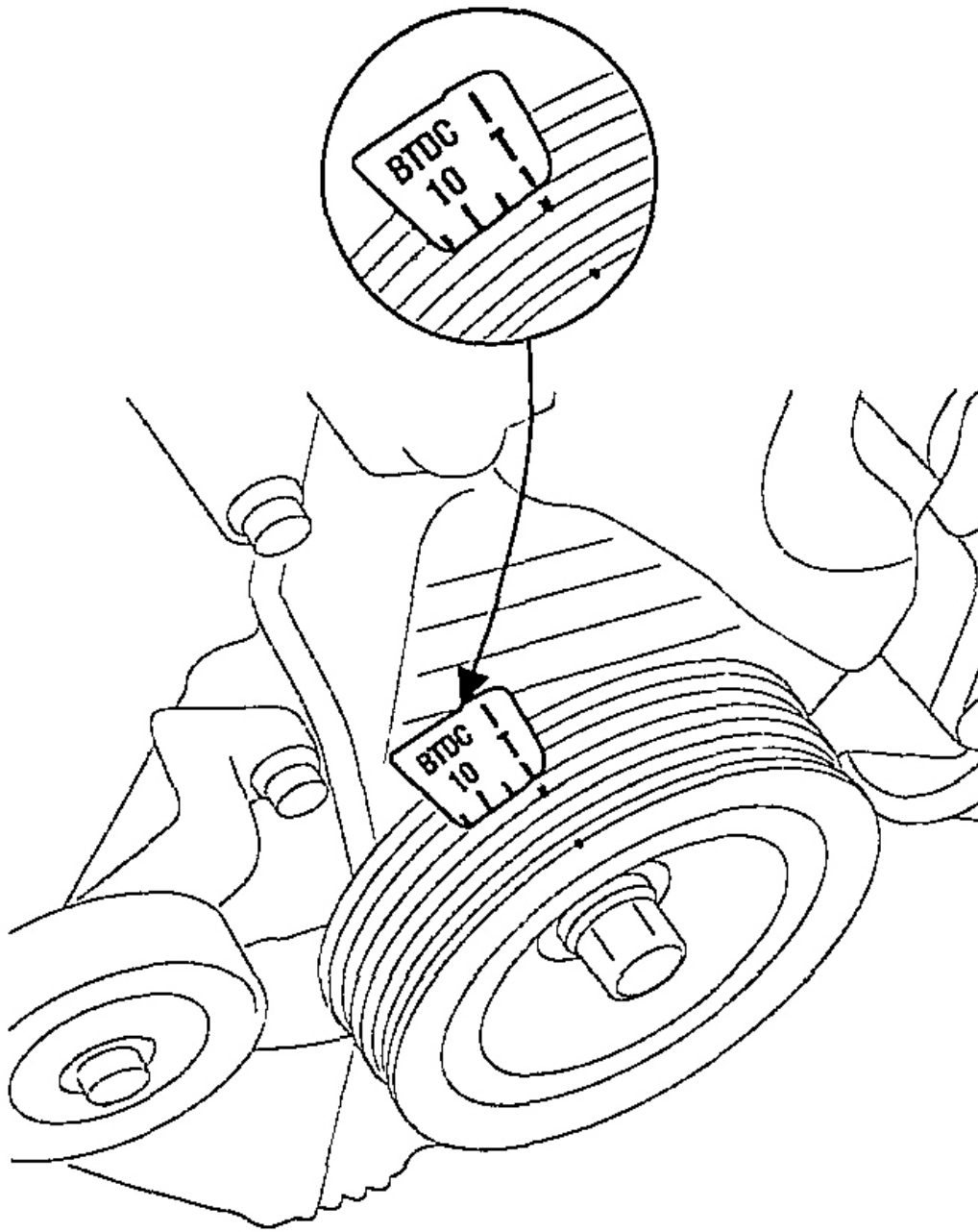
- d. Loosen the cylinder head cover bolts (B) and then remove the cover (A) and gasket.



G00718956

**Fig. 30: 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.



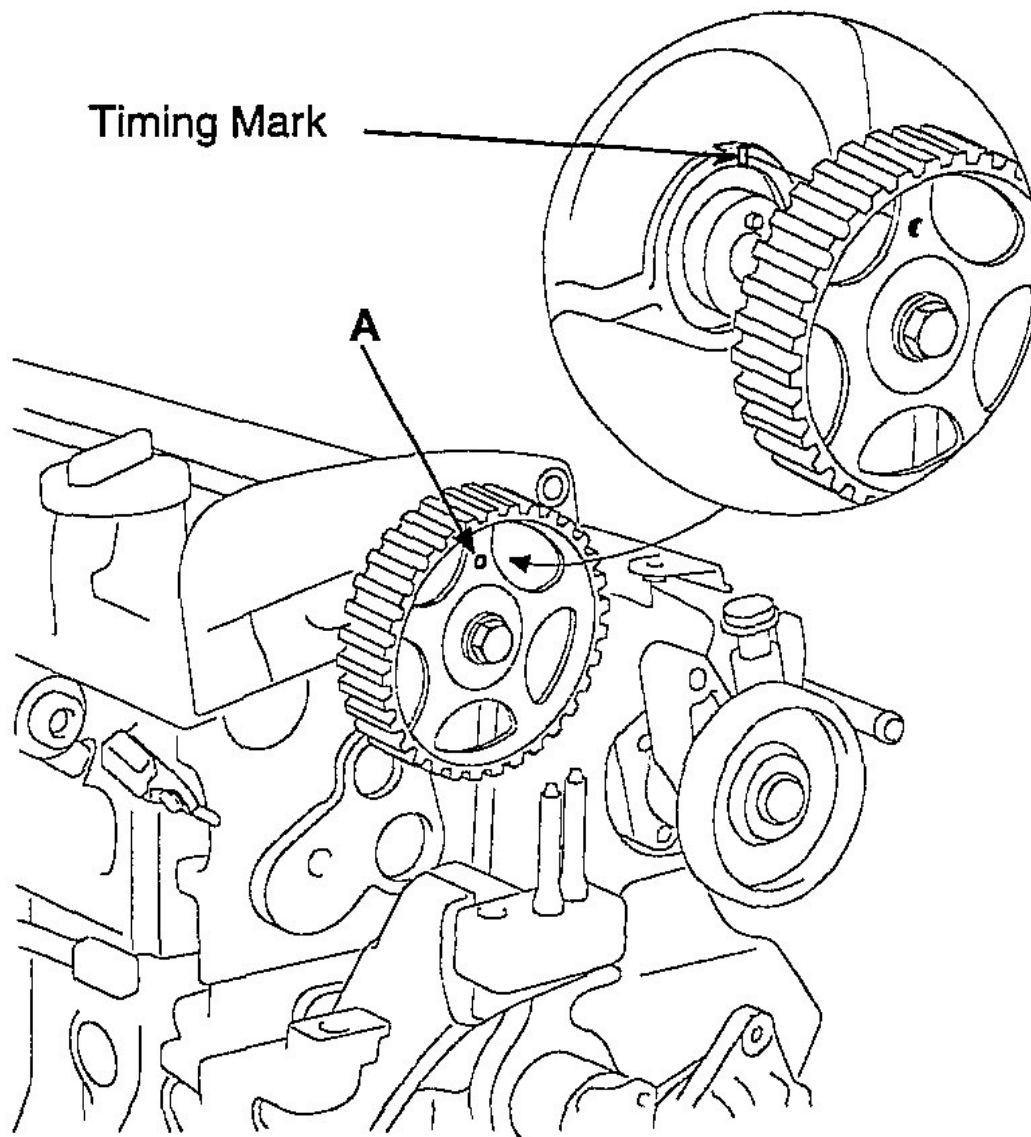
G00718957

**Fig. 31: 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. 32: 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: 0.12-0.28 mm (0.0047-0.0110 in)

Exhaust: 0.20-0.38 mm (0.0079-0.0150 in)

Reference Data

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

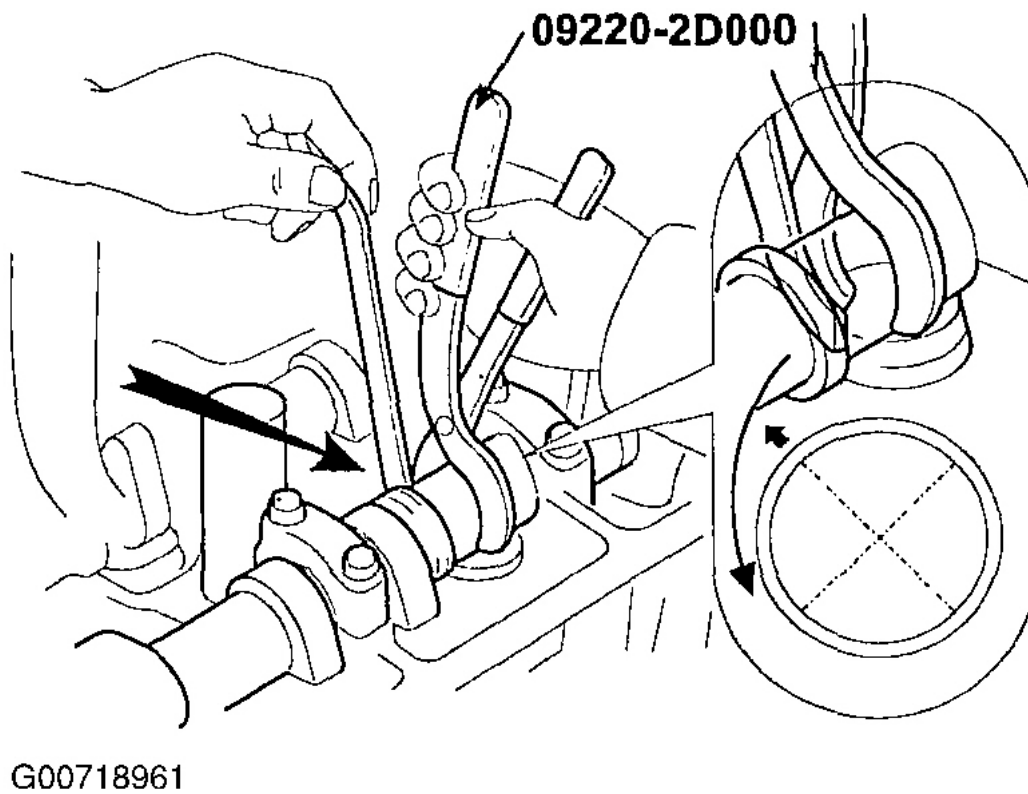
Intake: 0.29 mm (0.0114 in)

Exhaust: 0.34 mm (0.0134 in)

- Turn the crankshaft pulley one revolution (360°) and align the groove with the timing mark "T" of lower timing belt cover.
- Check only valves indicated in illustration. [No. 4 cylinder: TDC/compression]. Measure the valve clearance.

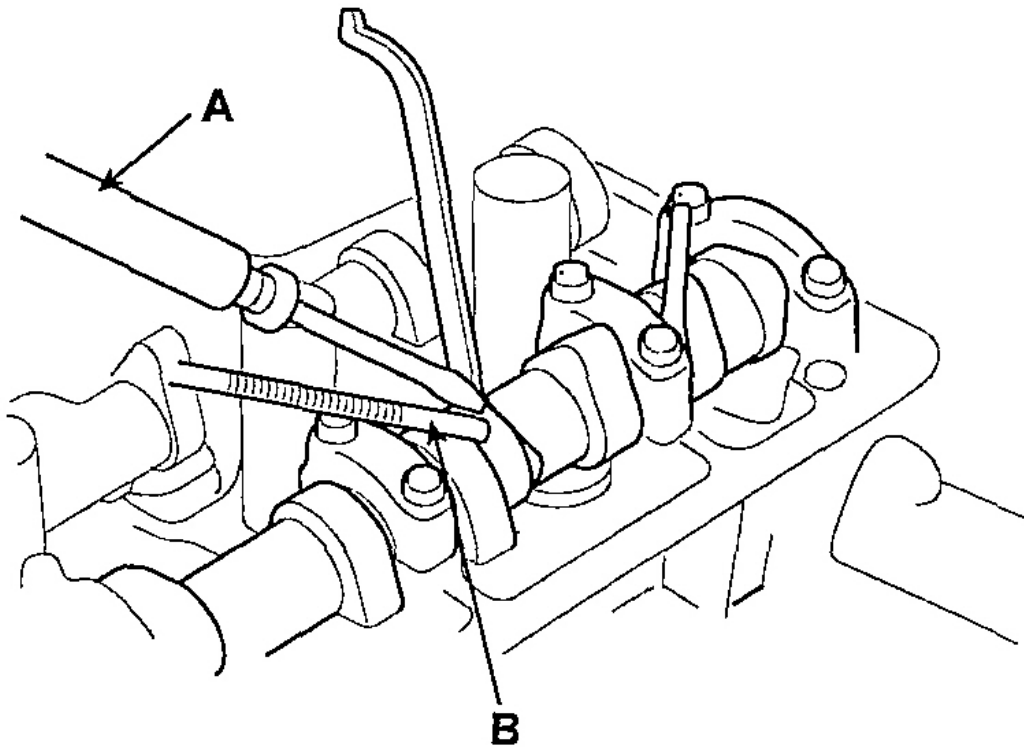
## ADJUSTMENTS

- Adjust the intake and exhaust valve clearance.
  - Turn the crankshaft so that the cam lobe of the camshaft on the adjusting valve is upward.
  - 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. 33: Depressing Valve Lifter**  
Courtesy of KIA MOTORS AMERICA, INC.

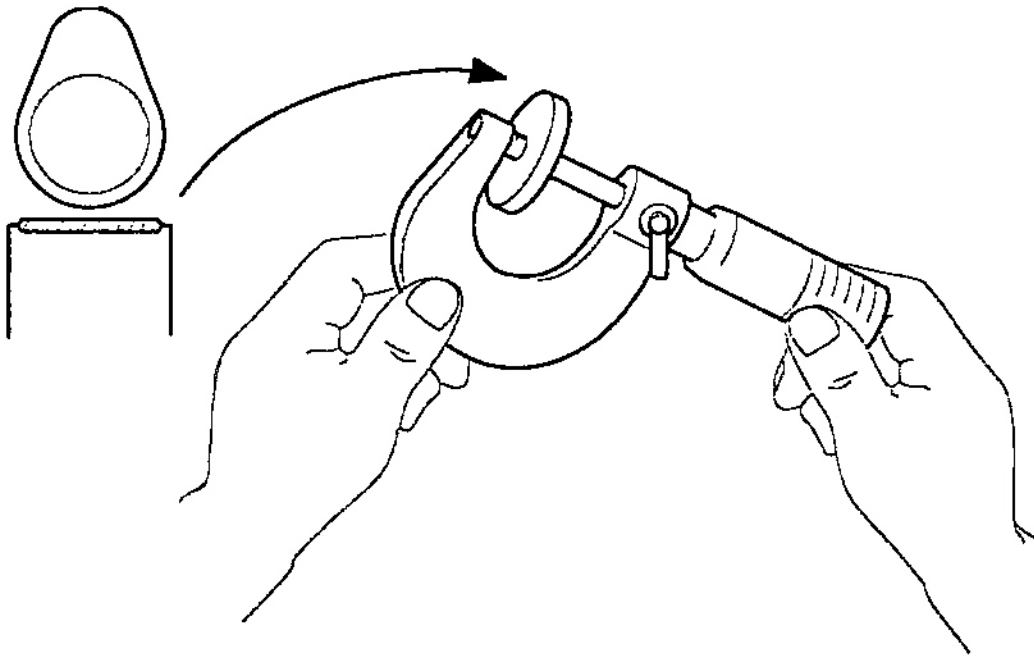
- c. Remove the adjusting shim with a small screw driver (A) and magnet (B).



G00718962

**Fig. 34: Removing Adjusting Shim**  
Courtesy of KIA MOTORS AMERICA, INC.

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



G00718963

**Fig. 35: 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. 36** and **Fig. 37**.

**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).

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

4. Recheck the 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: 0.12-0.28 mm (0.0047-0.0110 in)

Exhaust: 0.20-0.38 mm (0.0079-0.0150 in)

| Installed shim thickness<br>mm (in) |                 |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |
|-------------------------------------|-----------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Measured clearance<br>mm (in)       |                 | 2.00(0.787) | 2.02(0.795) | 2.04(0.803) | 2.06(0.811) | 2.08(0.819) | 2.10(0.827) | 2.11(0.831) | 2.12(0.835) | 2.14(0.843) | 2.16(0.851) | 2.18(0.859) | 2.20(0.867) | 2.22(0.875) | 2.24(0.883) | 2.26(0.891) | 2.28(0.899) | 2.30(0.907) | 2.32(0.915) | 2.34(0.923) | 2.36(0.931) |
| 0.000-0.020                         | (0.000-0.0009)  |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |
| 0.021-0.040                         | (0.001-0.0016)  |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |
| 0.041-0.060                         | (0.0016-0.0024) |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |
| 0.061-0.080                         | (0.0024-0.0031) |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |
| 0.081-0.100                         | (0.0032-0.0039) |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |
| 0.101-0.120                         | (0.0040-0.0047) |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |
| 0.121-0.140                         | (0.0048-0.0055) |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |
| 0.141-0.160                         | (0.0056-0.0063) |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |
| 0.161-0.180                         | (0.0063-0.0071) |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |
| 0.181-0.199                         | (0.0071-0.0078) |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |
| 0.200-0.380                         | (0.0078-0.0142) |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |
| 0.381-0.380                         | (0.0142-0.0150) | 3           | 4           | 5           | 6           | 7           | 8           | 9           | 10          | 11          | 12          | 13          | 14          | 15          | 16          | 17          | 18          | 19          | 20          | 21          | 22          |
| 0.381-0.400                         | (0.0150-0.0157) | 4           | 5           | 6           | 7           | 8           | 9           | 10          | 11          | 12          | 13          | 14          | 15          | 16          | 17          | 18          | 19          | 20          | 21          | 22          | 23          |
| 0.401-0.420                         | (0.0157-0.0165) | 5           | 6           | 7           | 8           | 9           | 10          | 11          | 12          | 13          | 14          | 15          | 16          | 17          | 18          | 19          | 20          | 21          | 22          | 23          | 24          |
| 0.421-0.440                         | (0.0165-0.0173) | 5           | 6           | 7           | 8           | 9           | 10          | 11          | 12          | 13          | 14          | 15          | 16          | 17          | 18          | 19          | 20          | 21          | 22          | 23          | 24          |
| 0.441-0.460                         | (0.0173-0.0181) | 5           | 6           | 7           | 8           | 9           | 10          | 11          | 12          | 13          | 14          | 15          | 16          | 17          | 18          | 19          | 20          | 21          | 22          | 23          | 24          |
| 0.461-0.480                         | (0.0181-0.0189) | 6           | 7           | 8           | 9           | 10          | 11          | 12          | 13          | 14          | 15          | 16          | 17          | 18          | 19          | 20          | 21          | 22          | 23          | 24          | 25          |
| 0.481-0.500                         | (0.0189-0.0197) | 6           | 7           | 8           | 9           | 10          | 11          | 12          | 13          | 14          | 15          | 16          | 17          | 18          | 19          | 20          | 21          | 22          | 23          | 24          | 25          |
| 0.501-0.520                         | (0.0197-0.0205) | 7           | 8           | 9           | 10          | 11          | 12          | 13          | 14          | 15          | 16          | 17          | 18          | 19          | 20          | 21          | 22          | 23          | 24          | 25          | 26          |
| 0.521-0.540                         | (0.0205-0.0213) | 7           | 8           | 9           | 10          | 11          | 12          | 13          | 14          | 15          | 16          | 17          | 18          | 19          | 20          | 21          | 22          | 23          | 24          | 25          | 26          |
| 0.541-0.560                         | (0.0213-0.0221) | 8           | 9           | 10          | 11          | 12          | 13          | 14          | 15          | 16          | 17          | 18          | 19          | 20          | 21          | 22          | 23          | 24          | 25          | 26          | 27          |
| 0.561-0.580                         | (0.0221-0.0229) | 8           | 9           | 10          | 11          | 12          | 13          | 14          | 15          | 16          | 17          | 18          | 19          | 20          | 21          | 22          | 23          | 24          | 25          | 26          | 27          |
| 0.581-0.600                         | (0.0229-0.0238) | 9           | 10          | 11          | 12          | 13          | 14          | 15          | 16          | 17          | 18          | 19          | 20          | 21          | 22          | 23          | 24          | 25          | 26          | 27          | 28          |
| 0.601-0.620                         | (0.0237-0.0244) | 9           | 10          | 11          | 12          | 13          | 14          | 15          | 16          | 17          | 18          | 19          | 20          | 21          | 22          | 23          | 24          | 25          | 26          | 27          | 28          |
| 0.621-0.640                         | (0.0242-0.0252) | 10          | 11          | 12          | 13          | 14          | 15          | 16          | 17          | 18          | 19          | 20          | 21          | 22          | 23          | 24          | 25          | 26          | 27          | 28          | 29          |
| 0.641-0.660                         | (0.0252-0.0260) | 10          | 11          | 12          | 13          | 14          | 15          | 16          | 17          | 18          | 19          | 20          | 21          | 22          | 23          | 24          | 25          | 26          | 27          | 28          | 29          |
| 0.661-0.680                         | (0.0260-0.0268) | 10          | 11          | 12          | 13          | 14          | 15          | 16          | 17          | 18          | 19          | 20          | 21          | 22          | 23          | 24          | 25          | 26          | 27          | 28          | 29          |
| 0.681-0.700                         | (0.0268-0.0276) | 11          | 12          | 13          | 14          | 15          | 16          | 17          | 18          | 19          | 20          | 21          | 22          | 23          | 24          | 25          | 26          | 27          | 28          | 29          | 30          |
| 0.701-0.720                         | (0.0276-0.0283) | 12          | 13          | 14          | 15          | 16          | 17          | 18          | 19          | 20          | 21          | 22          | 23          | 24          | 25          | 26          | 27          | 28          | 29          | 30          | 31          |
| 0.721-0.740                         | (0.0284-0.0291) | 12          | 13          | 14          | 15          | 16          | 17          | 18          | 19          | 20          | 21          | 22          | 23          | 24          | 25          | 26          | 27          | 28          | 29          | 30          | 31          |
| 0.741-0.760                         | (0.0292-0.0303) | 13          | 14          | 15          | 16          | 17          | 18          | 19          | 20          | 21          | 22          | 23          | 24          | 25          | 26          | 27          | 28          | 29          | 30          | 31          | 32          |
| 0.761-0.780                         | (0.0300-0.0307) | 13          | 14          | 15          | 16          | 17          | 18          | 19          | 20          | 21          | 22          | 23          | 24          | 25          | 26          | 27          | 28          | 29          | 30          | 31          | 32          |
| 0.781-0.800                         | (0.0307-0.0315) | 14          | 15          | 16          | 17          | 18          | 19          | 20          | 21          | 22          | 23          | 24          | 25          | 26          | 27          | 28          | 29          | 30          | 31          | 32          | 33          |
| 0.801-0.820                         | (0.0315-0.0323) | 14          | 15          | 16          | 17          | 18          | 19          | 20          | 21          | 22          | 23          | 24          | 25          | 26          | 27          | 28          | 29          | 30          | 31          | 32          | 33          |
| 0.821-0.840                         | (0.0323-0.0331) | 15          | 16          | 17          | 18          | 19          | 20          | 21          | 22          | 23          | 24          | 25          | 26          | 27          | 28          | 29          | 30          | 31          | 32          | 33          | 34          |
| 0.841-0.860                         | (0.0331-0.0339) | 15          | 16          | 17          | 18          | 19          | 20          | 21          | 22          | 23          | 24          | 25          | 26          | 27          | 28          | 29          | 30          | 31          | 32          | 33          | 34          |
| 0.861-0.880                         | (0.0339-0.0346) | 16          | 17          | 18          | 19          | 20          | 21          | 22          | 23          | 24          | 25          | 26          | 27          | 28          | 29          | 30          | 31          | 32          | 33          | 34          | 35          |
| 0.881-0.900                         | (0.0347-0.0354) | 16          | 17          | 18          | 19          | 20          | 21          | 22          | 23          | 24          | 25          | 26          | 27          | 28          | 29          | 30          | 31          | 32          | 33          | 34          | 35          |
| 0.901-0.920                         | (0.0355-0.0362) | 17          | 18          | 19          | 20          | 21          | 22          | 23          | 24          | 25          | 26          | 27          | 28          | 29          | 30          | 31          | 32          | 33          | 34          | 35          | 36          |
| 0.921-0.940                         | (0.0363-0.0370) | 17          | 18          | 19          | 20          | 21          | 22          | 23          | 24          | 25          | 26          | 27          | 28          | 29          | 30          | 31          | 32          | 33          | 34          | 35          | 36          |
| 0.941-0.960                         | (0.0370-0.0378) | 18          | 19          | 20          | 21          | 22          | 23          | 24          | 25          | 26          | 27          | 28          | 29          | 30          | 31          | 32          | 33          | 34          | 35          | 36          | 37          |
| 0.961-0.980                         | (0.0378-0.0386) | 18          | 19          | 20          | 21          | 22          | 23          | 24          | 25          | 26          | 27          | 28          | 29          | 30          | 31          | 32          | 33          | 34          | 35          | 36          | 37          |
| 0.981-1.000                         | (0.0386-0.0394) | 19          | 20          | 21          | 22          | 23          | 24          | 25          | 26          | 27          | 28          | 29          | 30          | 31          | 32          | 33          | 34          | 35          | 36          | 37          | 38          |
| 1.001-1.020                         | (0.0394-0.0402) | 19          | 20          | 21          | 22          | 23          | 24          | 25          | 26          | 27          | 28          | 29          | 30          | 31          | 32          | 33          | 34          | 35          | 36          | 37          | 38          |
| 1.021-1.040                         | (0.0402-0.0410) | 20          | 21          | 22          | 23          | 24          | 25          | 26          | 27          | 28          | 29          | 30          | 31          | 32          | 33          | 34          | 35          | 36          | 37          | 38          | 39          |
| 1.041-1.060                         | (0.0410-0.0417) | 20          | 21          | 22          | 23          | 24          | 25          | 26          | 27          | 28          | 29          | 30          | 31          | 32          | 33          | 34          | 35          | 36          | 37          | 38          | 39          |

Exhaust valve clearance (cold):  
0.28 mm (Spec.), 0.20-0.38 mm (Limit)

Example: The 2.24 mm shim is installed, and the measured clearance is 0.450 mm.

Replace the 2.24 mm shim with a new No.11 shim.

Hint: New shims have the thickness in millimeters printed on their faces

| New shim thickness mm (in.) |               |          |               |
|-----------------------------|---------------|----------|---------------|
| shim No.                    | Thickness     | shim No. | Thickness     |
| 1                           | 2.00 (0.0787) | 11       | 2.40 (0.0945) |
| 2                           | 2.04 (0.0803) | 12       | 2.44 (0.0961) |
| 3                           | 2.08 (0.0819) | 13       | 2.48 (0.0976) |
| 4                           | 2.12 (0.0835) | 14       | 2.52 (0.0992) |
| 5                           | 2.16 (0.0850) | 15       | 2.56 (0.1008) |
| 6                           | 2.20 (0.0866) | 16       | 2.60 (0.1024) |
| 7                           | 2.24 (0.0882) | 17       | 2.64 (0.1039) |
| 8                           | 2.28 (0.0898) | 18       | 2.68 (0.1055) |
| 9                           | 2.32 (0.0913) | 19       | 2.72 (0.1071) |
| 10                          | 2.36 (0.0929) | 20       | 2.76 (0.1087) |

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**Fig. 36: Adjusting Shim Selection Chart (Exhaust)**  
**Courtesy of KIA MOTORS AMERICA, INC.**

## 2008 ENGINES Engine Mechanical - Spectra &amp; Spectra5

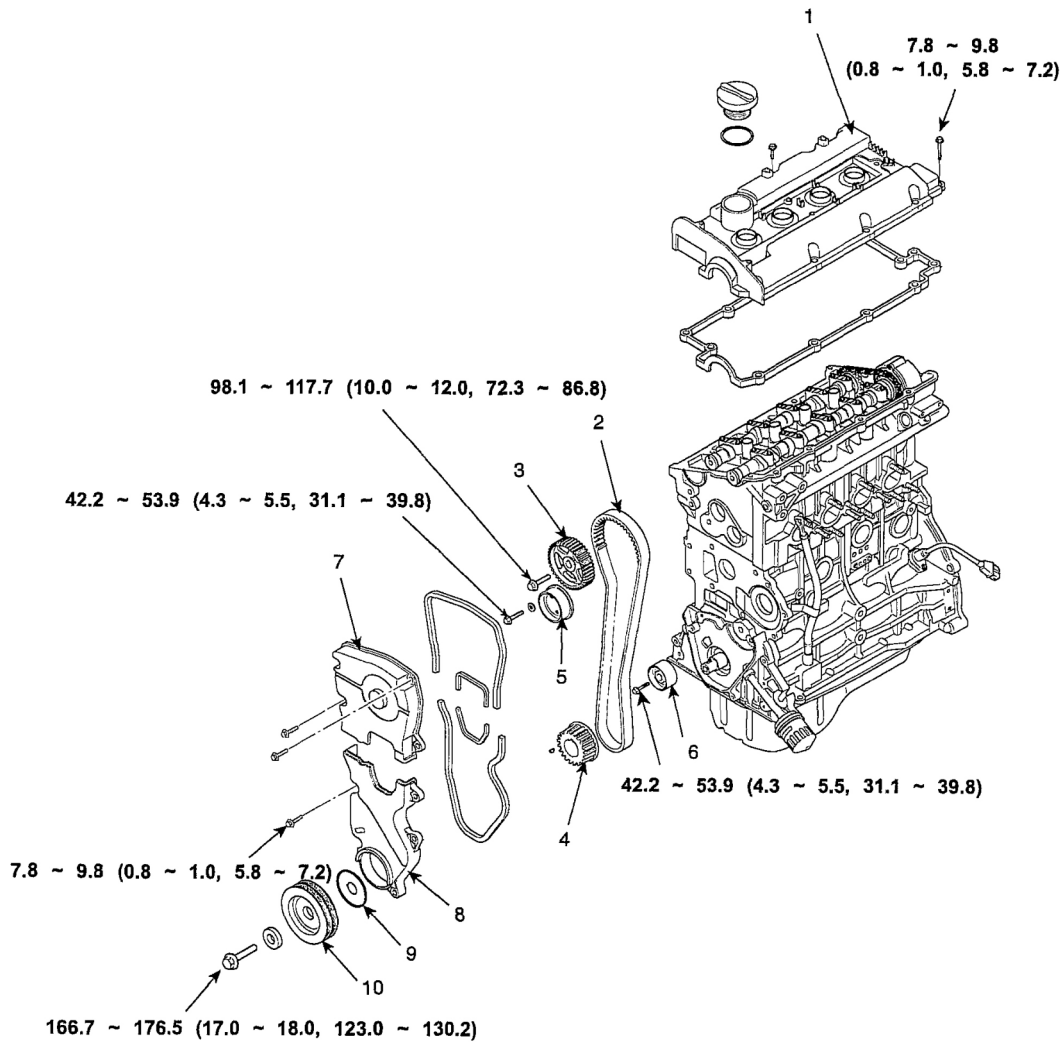
| Installed shim thickness<br>mm (in) | 1.00 (0.0394) | 1.25 (0.0492) | 1.50 (0.0591) | 1.75 (0.0689) | 2.00 (0.0787) | 2.25 (0.0885) | 2.50 (0.0984) | 2.75 (0.1082) | 3.00 (0.1181) | 3.25 (0.1279) | 3.50 (0.1378) | 3.75 (0.1476) | 4.00 (0.1575) | 4.25 (0.1673) | 4.50 (0.1772) | 4.75 (0.1870) | 5.00 (0.1969) | 5.25 (0.2067) | 5.50 (0.2166) | 5.75 (0.2264) | 6.00 (0.2363) | 6.25 (0.2461) | 6.50 (0.2560) | 6.75 (0.2658) | 7.00 (0.2757) | 7.25 (0.2855) | 7.50 (0.2954) | 7.75 (0.3052) | 8.00 (0.3151) | 8.25 (0.3249) | 8.50 (0.3348) | 8.75 (0.3446) | 9.00 (0.3545) | 9.25 (0.3643) | 9.50 (0.3742) | 9.75 (0.3840) | 10.00 (0.3939) | 10.25 (0.4037) | 10.50 (0.4136) | 10.75 (0.4234) | 11.00 (0.4333) | 11.25 (0.4431) | 11.50 (0.4530) | 11.75 (0.4628) | 12.00 (0.4727) | 12.25 (0.4825) | 12.50 (0.4924) | 12.75 (0.5022) | 13.00 (0.5121) | 13.25 (0.5219) | 13.50 (0.5318) | 13.75 (0.5416) | 14.00 (0.5515) | 14.25 (0.5613) | 14.50 (0.5712) | 14.75 (0.5810) | 15.00 (0.5909) | 15.25 (0.6007) | 15.50 (0.6106) | 15.75 (0.6204) | 16.00 (0.6303) | 16.25 (0.6401) | 16.50 (0.6500) | 16.75 (0.6598) | 17.00 (0.6697) | 17.25 (0.6795) | 17.50 (0.6894) | 17.75 (0.6992) | 18.00 (0.7091) | 18.25 (0.7189) | 18.50 (0.7288) | 18.75 (0.7386) | 19.00 (0.7485) | 19.25 (0.7583) | 19.50 (0.7682) | 19.75 (0.7780) | 20.00 (0.7879) | 20.25 (0.7977) | 20.50 (0.8076) | 20.75 (0.8174) | 21.00 (0.8273) | 21.25 (0.8371) | 21.50 (0.8470) | 21.75 (0.8568) | 22.00 (0.8667) | 22.25 (0.8765) | 22.50 (0.8864) | 22.75 (0.8962) | 23.00 (0.9061) | 23.25 (0.9159) | 23.50 (0.9258) | 23.75 (0.9356) | 24.00 (0.9455) | 24.25 (0.9553) | 24.50 (0.9652) | 24.75 (0.9750) | 25.00 (0.9849) | 25.25 (0.9947) | 25.50 (1.0046) | 25.75 (1.0144) | 26.00 (1.0243) | 26.25 (1.0341) | 26.50 (1.0440) | 26.75 (1.0538) | 27.00 (1.0637) | 27.25 (1.0735) | 27.50 (1.0834) | 27.75 (1.0932) | 28.00 (1.1031) | 28.25 (1.1129) | 28.50 (1.1228) | 28.75 (1.1326) | 29.00 (1.1425) | 29.25 (1.1523) | 29.50 (1.1622) | 29.75 (1.1720) | 30.00 (1.1819) | 30.25 (1.1917) | 30.50 (1.2016) | 30.75 (1.2114) | 31.00 (1.2213) | 31.25 (1.2311) | 31.50 (1.2410) | 31.75 (1.2508) | 32.00 (1.2607) | 32.25 (1.2705) | 32.50 (1.2804) | 32.75 (1.2902) | 33.00 (1.3001) | 33.25 (1.3099) | 33.50 (1.3198) | 33.75 (1.3296) | 34.00 (1.3395) | 34.25 (1.3493) | 34.50 (1.3592) | 34.75 (1.3690) | 35.00 (1.3789) | 35.25 (1.3887) | 35.50 (1.3986) | 35.75 (1.4084) | 36.00 (1.4183) | 36.25 (1.4281) | 36.50 (1.4380) | 36.75 (1.4478) | 37.00 (1.4577) | 37.25 (1.4675) | 37.50 (1.4774) | 37.75 (1.4872) | 38.00 (1.4971) | 38.25 (1.5069) | 38.50 (1.5168) | 38.75 (1.5266) | 39.00 (1.5365) | 39.25 (1.5463) | 39.50 (1.5562) | 39.75 (1.5660) | 40.00 (1.5759) | 40.25 (1.5857) | 40.50 (1.5956) | 40.75 (1.6054) | 41.00 (1.6153) | 41.25 (1.6251) | 41.50 (1.6350) | 41.75 (1.6448) | 42.00 (1.6547) | 42.25 (1.6645) | 42.50 (1.6744) | 42.75 (1.6842) | 43.00 (1.6941) | 43.25 (1.7039) | 43.50 (1.7138) | 43.75 (1.7236) | 44.00 (1.7335) | 44.25 (1.7433) | 44.50 (1.7532) | 44.75 (1.7630) | 45.00 (1.7729) | 45.25 (1.7827) | 45.50 (1.7926) | 45.75 (1.8024) | 46.00 (1.8123) | 46.25 (1.8221) | 46.50 (1.8320) | 46.75 (1.8418) | 47.00 (1.8517) | 47.25 (1.8615) | 47.50 (1.8714) | 47.75 (1.8812) | 48.00 (1.8911) | 48.25 (1.9009) | 48.50 (1.9108) | 48.75 (1.9206) | 49.00 (1.9305) | 49.25 (1.9403) | 49.50 (1.9502) | 49.75 (1.9600) | 50.00 (1.9699) | 50.25 (1.9797) | 50.50 (1.9896) | 50.75 (1.9994) | 51.00 (2.0093) | 51.25 (2.0191) | 51.50 (2.0290) | 51.75 (2.0388) | 52.00 (2.0487) | 52.25 (2.0585) | 52.50 (2.0684) | 52.75 (2.0782) | 53.00 (2.0881) | 53.25 (2.0979) | 53.50 (2.1078) | 53.75 (2.1176) | 54.00 (2.1275) | 54.25 (2.1373) | 54.50 (2.1472) | 54.75 (2.1570) | 55.00 (2.1669) | 55.25 (2.1767) | 55.50 (2.1866) | 55.75 (2.1964) | 56.00 (2.2063) | 56.25 (2.2161) | 56.50 (2.2260) | 56.75 (2.2358) | 57.00 (2.2457) | 57.25 (2.2555) | 57.50 (2.2654) | 57.75 (2.2752) | 58.00 (2.2851) | 58.25 (2.2949) | 58.50 (2.3048) | 58.75 (2.3146) | 59.00 (2.3245) | 59.25 (2.3343) | 59.50 (2.3442) | 59.75 (2.3540) | 60.00 (2.3639) | 60.25 (2.3737) | 60.50 (2.3836) | 60.75 (2.3934) | 61.0 |
|-------------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|------|
|-------------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|------|

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**Fig. 37: Adjusting Shim Selection Chart (Intake)**  
**Courtesy of KIA MOTORS AMERICA, INC.**

## TIMING BELT

## COMPONENT



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

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

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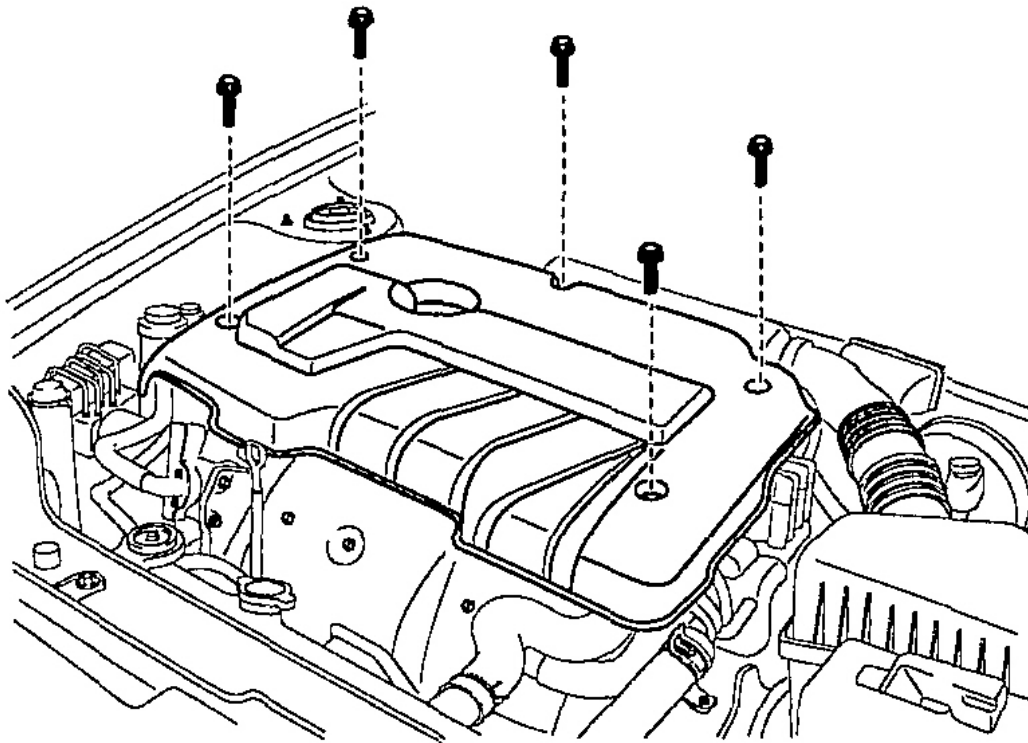
**Fig. 38: Exploded View Of Timing Belt Components With Torque Specifications**  
Courtesy of KIA MOTORS AMERICA, INC.

**REMOVAL**

**NOTE:** Engine removal is not required for this procedure.

1. Remove the engine cover.

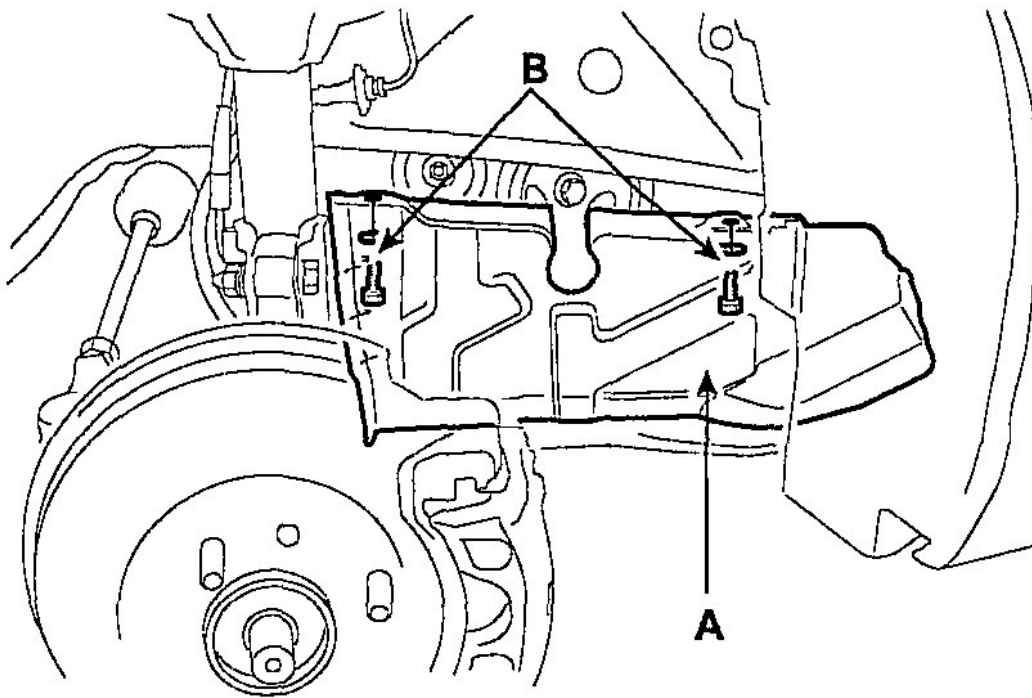




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**Fig. 39: Removing Engine Cover**  
Courtesy of KIA MOTORS AMERICA, INC.

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

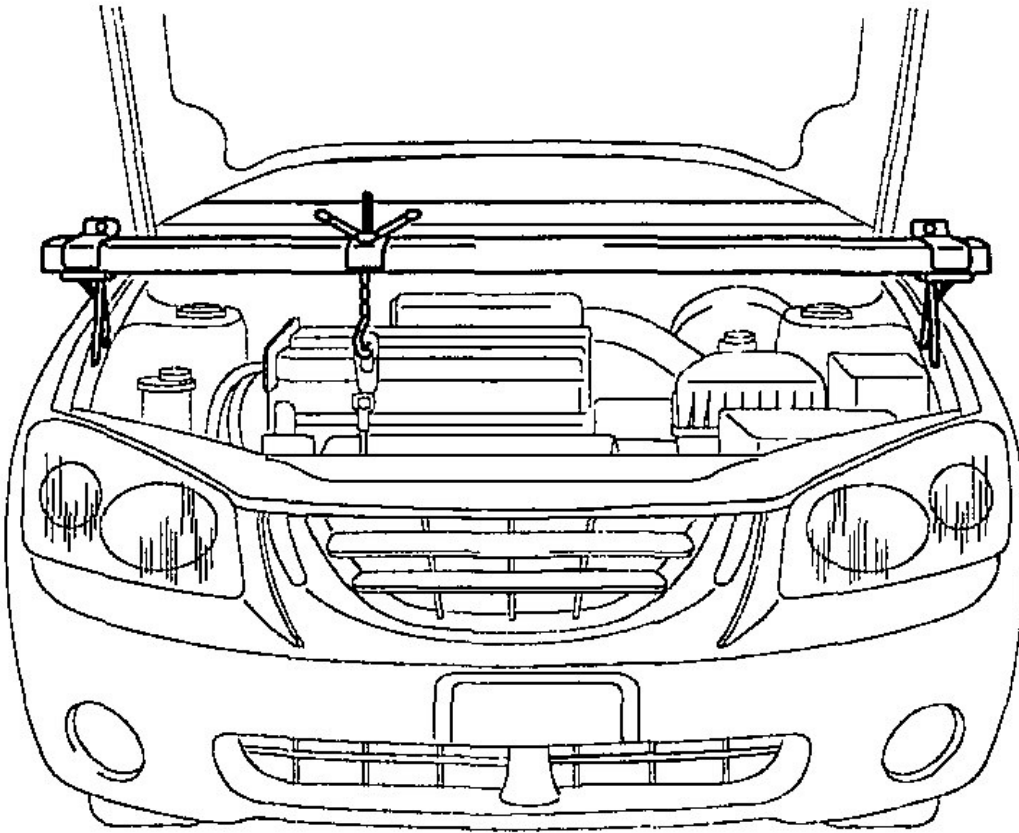


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**Fig. 40: Remove RH Side Cover**

Courtesy of KIA MOTORS AMERICA, INC.

4. Remove the engine mounting support bracket.
  - a. Install the engine hanger.

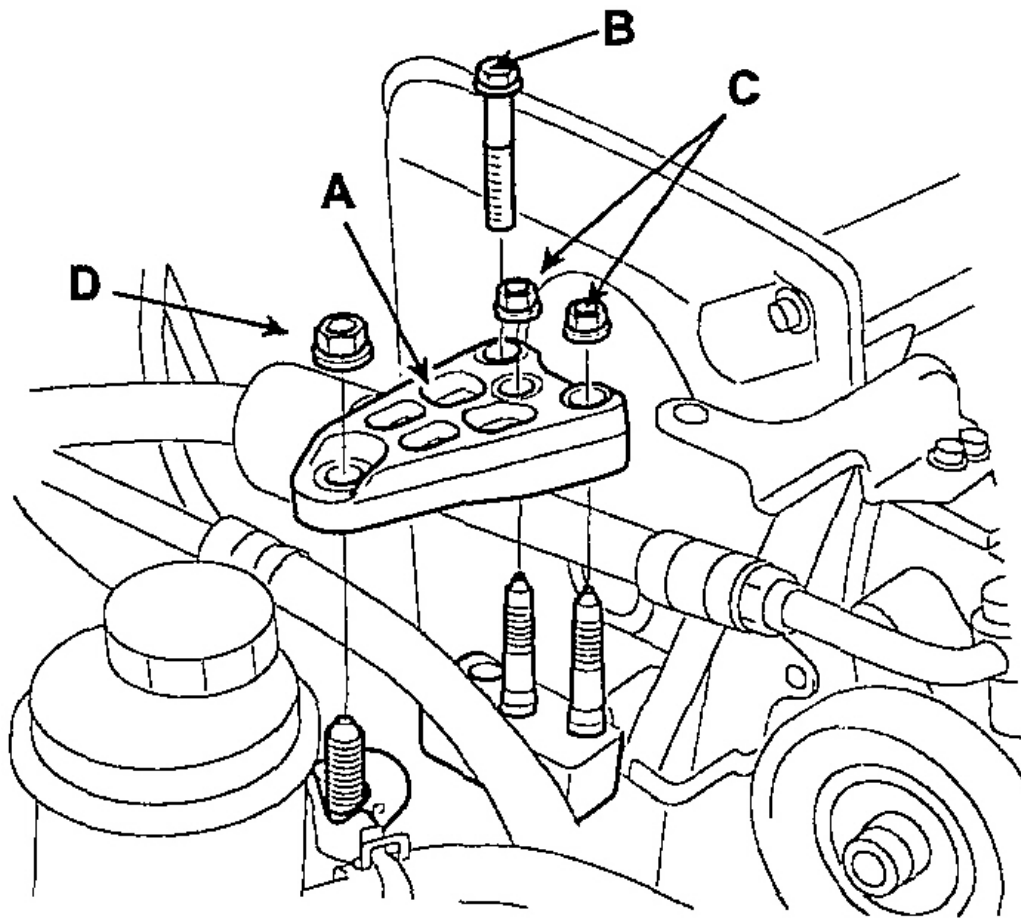


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**Fig. 41: Installing Engine Hanger**

Courtesy of KIA MOTORS AMERICA, INC.

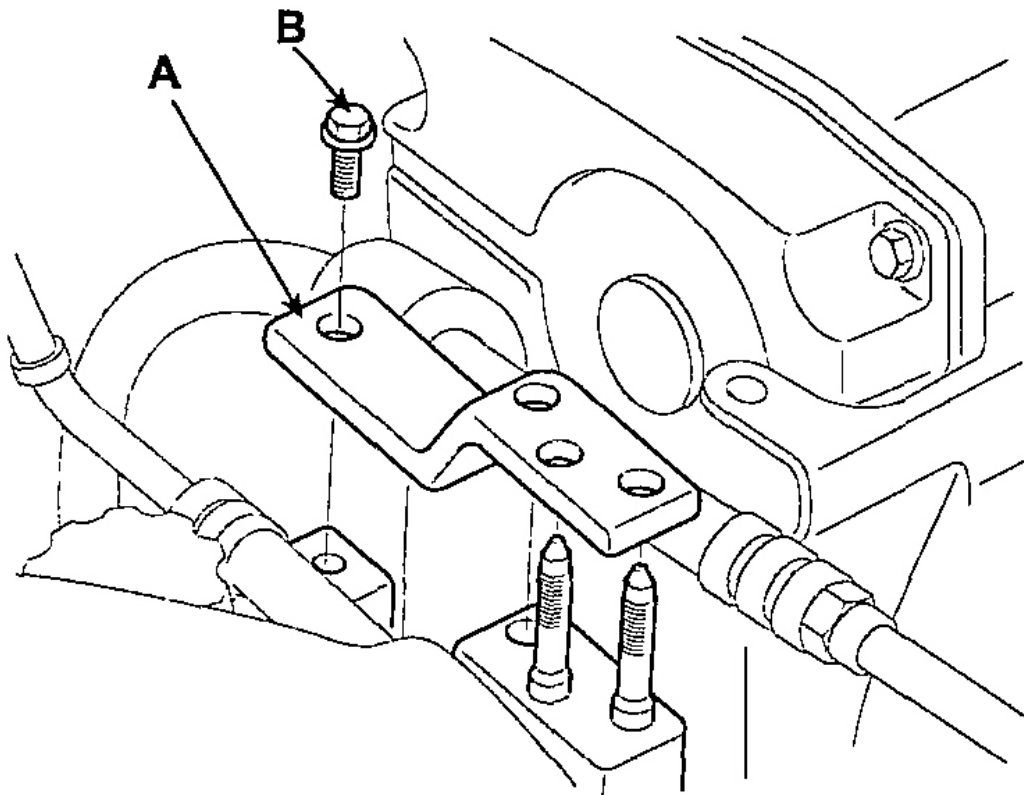
- b. Remove the bolt (B), nuts (C, D) and engine mounting support bracket (A).



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**Fig. 42: Removing Engine Mounting Support Bracket**  
Courtesy of KIA MOTORS AMERICA, INC.

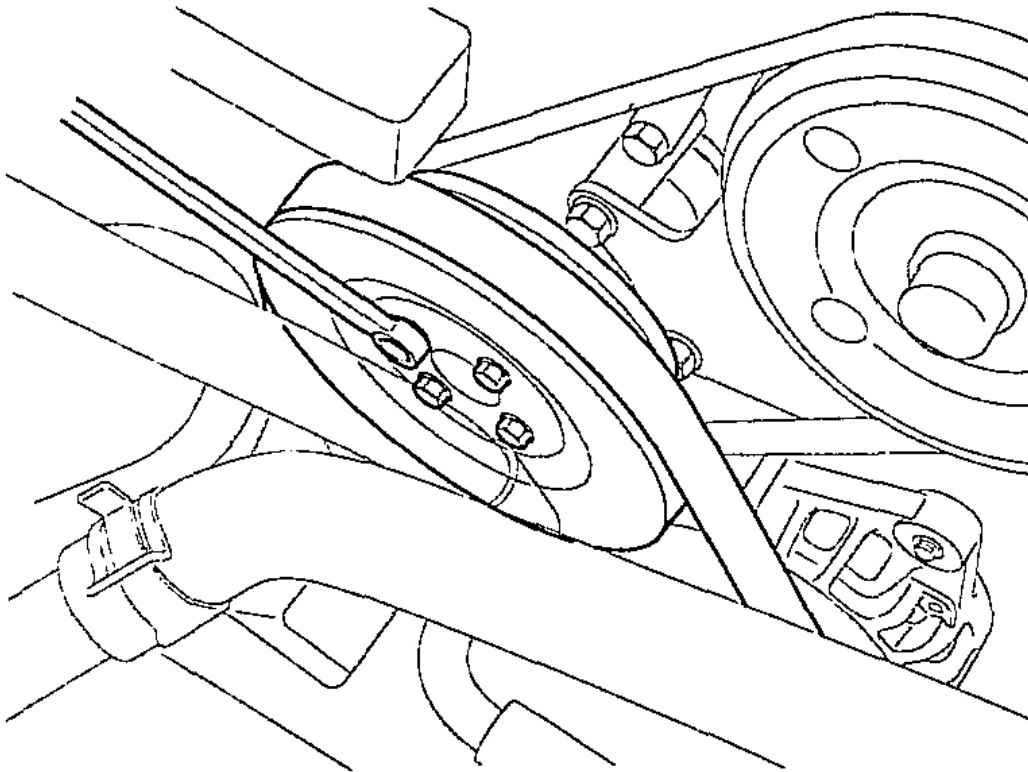
- c. Remove the bolt (B) and engine support bracket stay plate (A).



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**Fig. 43: Removing Engine Support Bracket Stay Plate**  
Courtesy of KIA MOTORS AMERICA, INC.

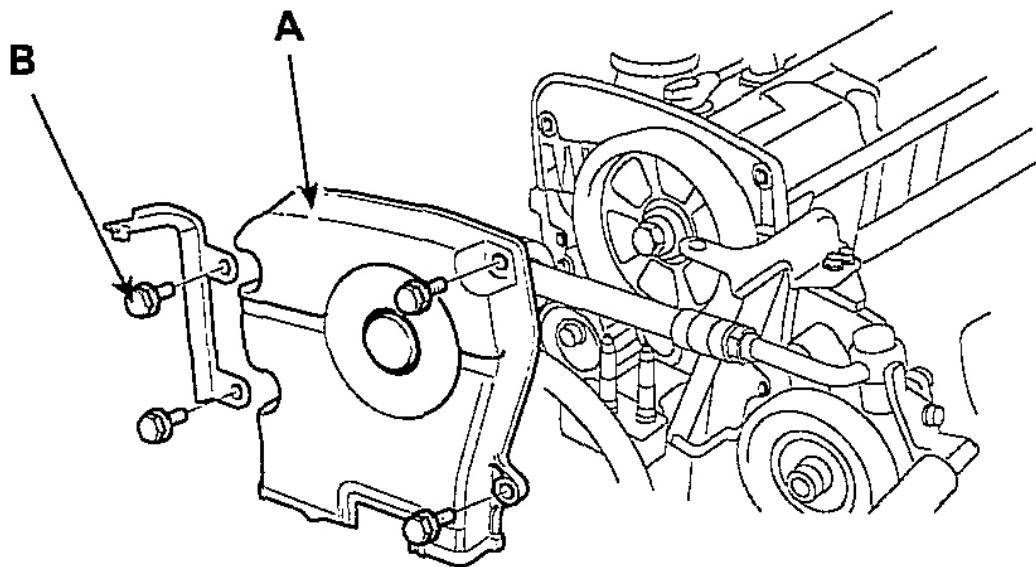
5. Temporarily loosen the water pump pulley bolts.



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**Fig. 44: Loosening Water Pump Pulley Bolts**  
Courtesy of KIA MOTORS AMERICA, INC.

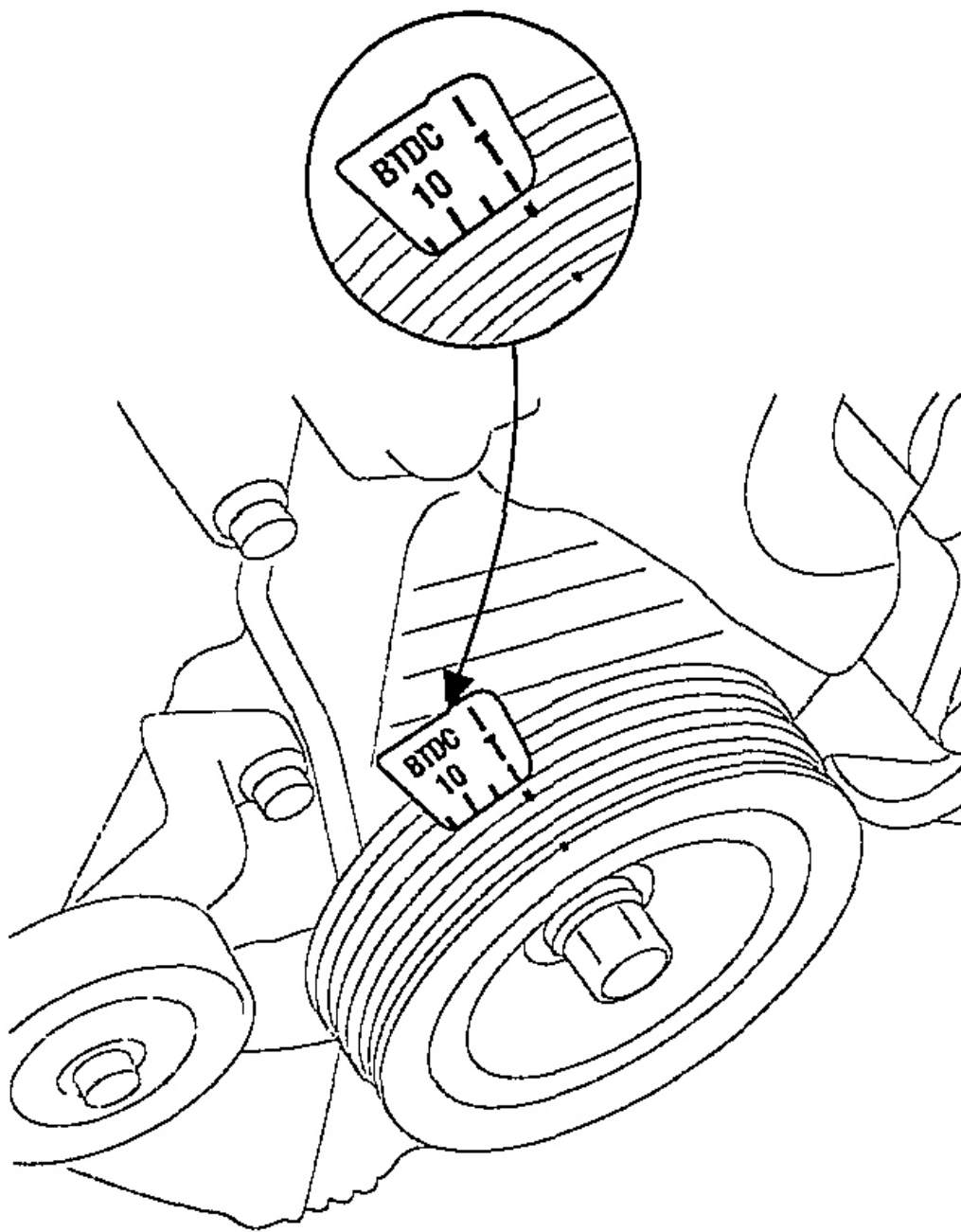
6. Remove the alternator drive belt. See **ALTERNATOR BELT INSPECTION & ADJUSTMENT** .
7. Remove the air conditioner compressor drive belt. See **DRIVE BELT** .
8. Remove the power steering pump drive belt. See **CHECKING POWER STEERING BELT TENSION** .
9. Remove the 4 bolts and water pump pulley.
10. Remove the 4 bolts (B) and timing belt upper cover (A).



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**Fig. 45: Removing Timing Belt Upper Cover**  
Courtesy of KIA MOTORS AMERICA, INC.

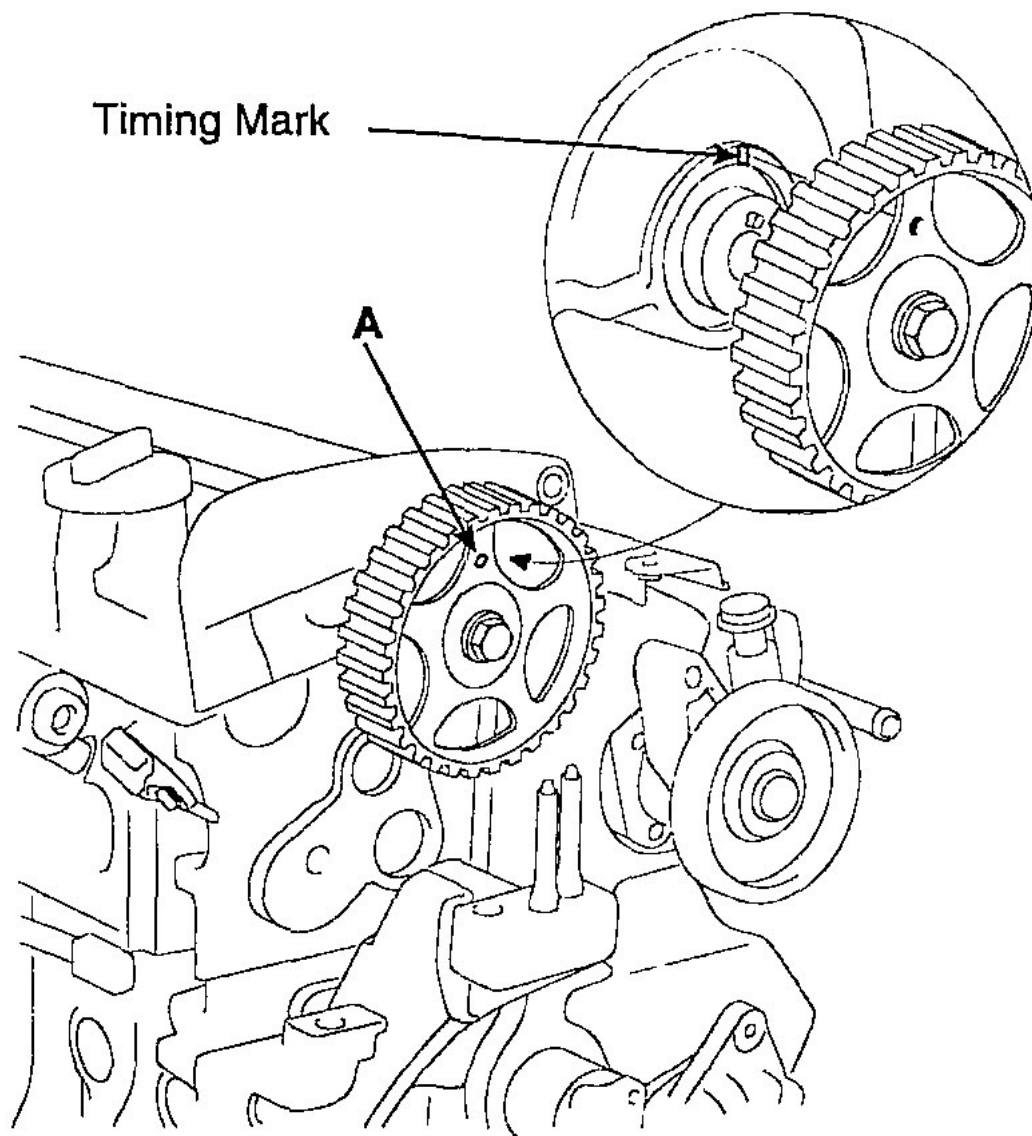
11. Turn the crankshaft pulley, and align its groove with timing mark "T" of the timing belt cover. Check that the timing mark of camshaft sprocket is aligned with the timing mark of cylinder head cover (No. 1 cylinder compression TDC position).



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**Fig. 46: Aligning Timing Mark**  
Courtesy of KIA MOTORS AMERICA, INC.

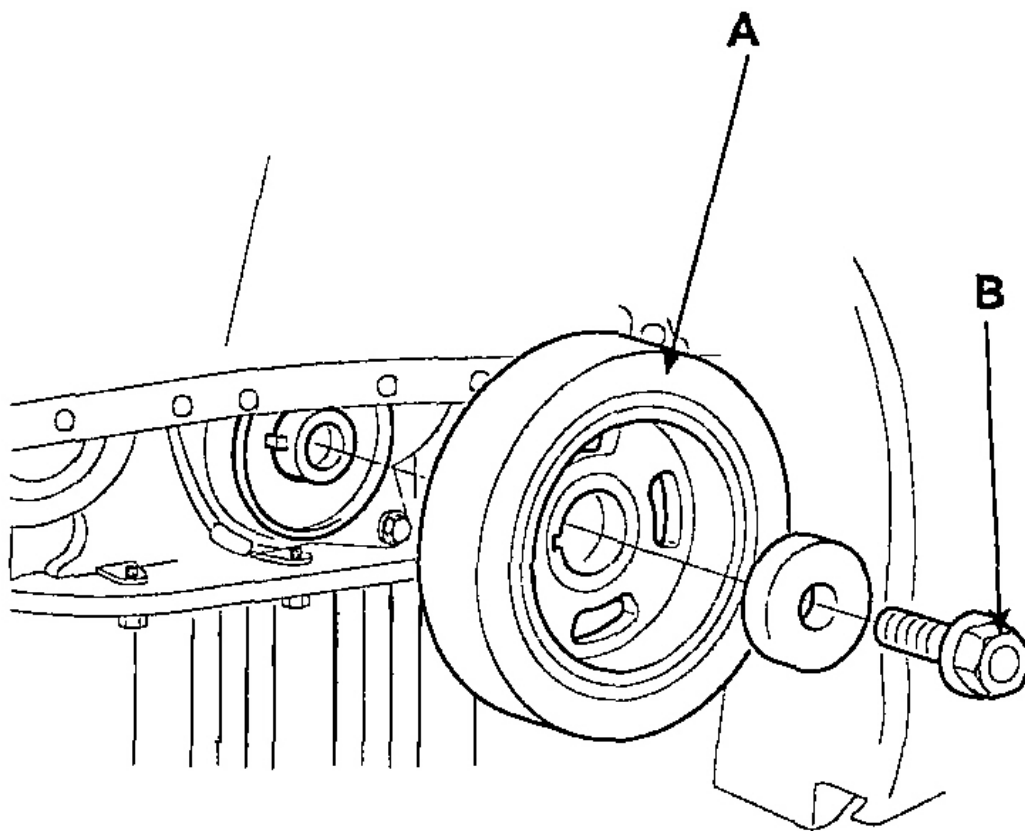




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**Fig. 47: Aligning Camshaft Timing Mark**  
Courtesy of KIA MOTORS AMERICA, INC.

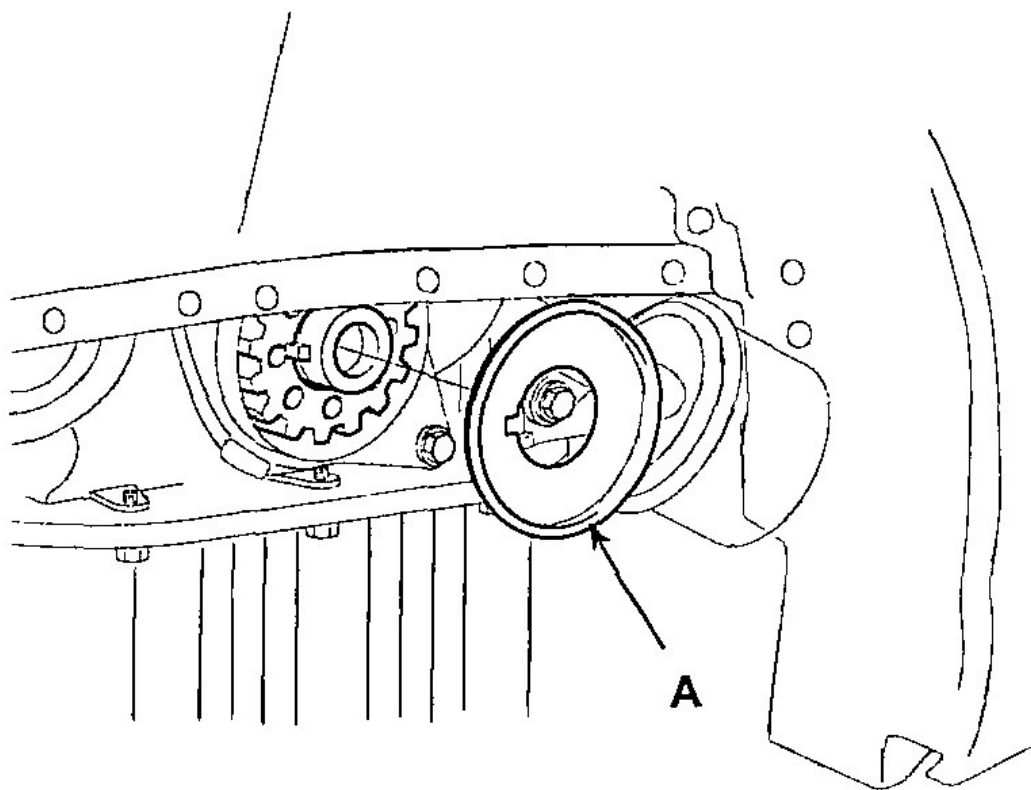
12. Remove the crankshaft pulley bolt (B) and crankshaft pulley (A).



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**Fig. 48: Removing Crankshaft Pulley**  
Courtesy of KIA MOTORS AMERICA, INC.

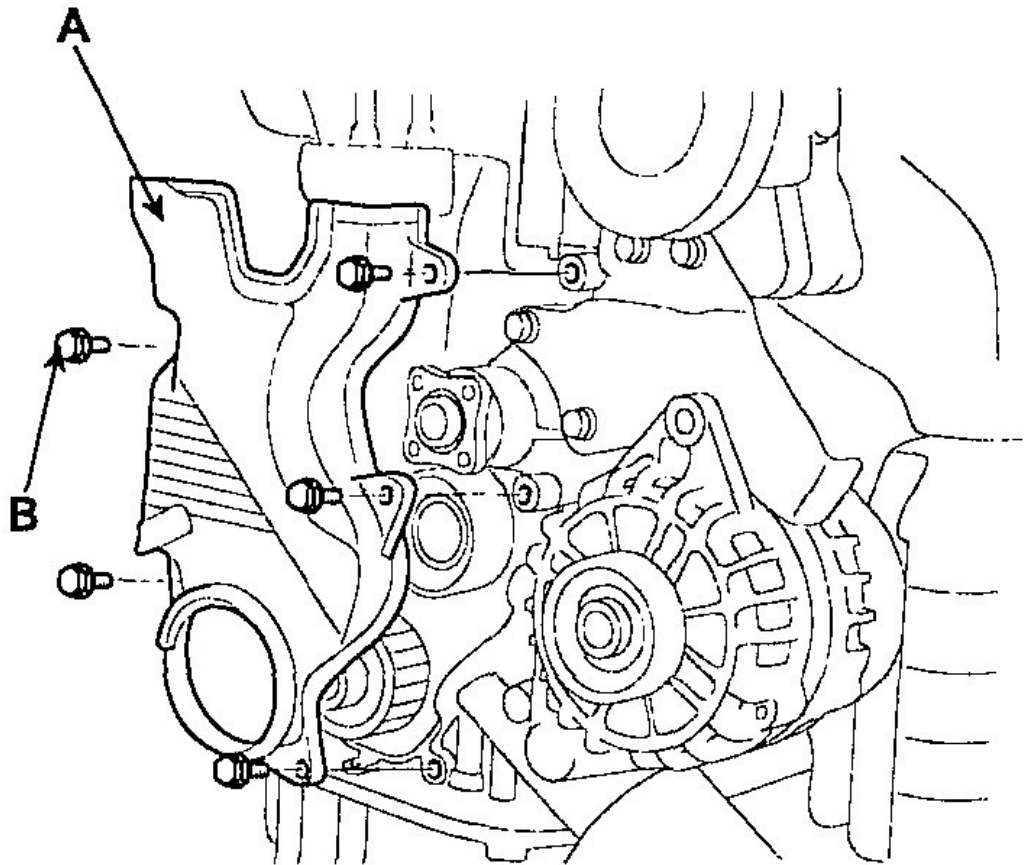
13. Remove the crankshaft flange (A).



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**Fig. 49: Removing Crankshaft Flange**  
Courtesy of KIA MOTORS AMERICA, INC.

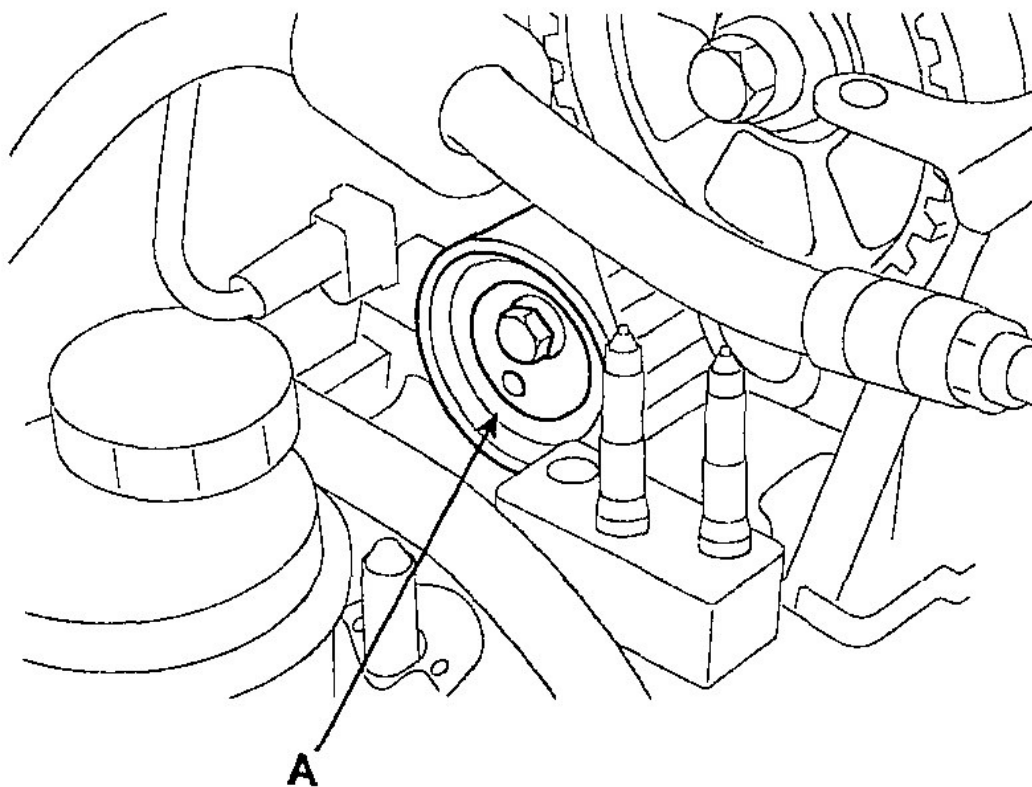
14. Remove the 5 bolts (B) and timing belt lower cover (A)



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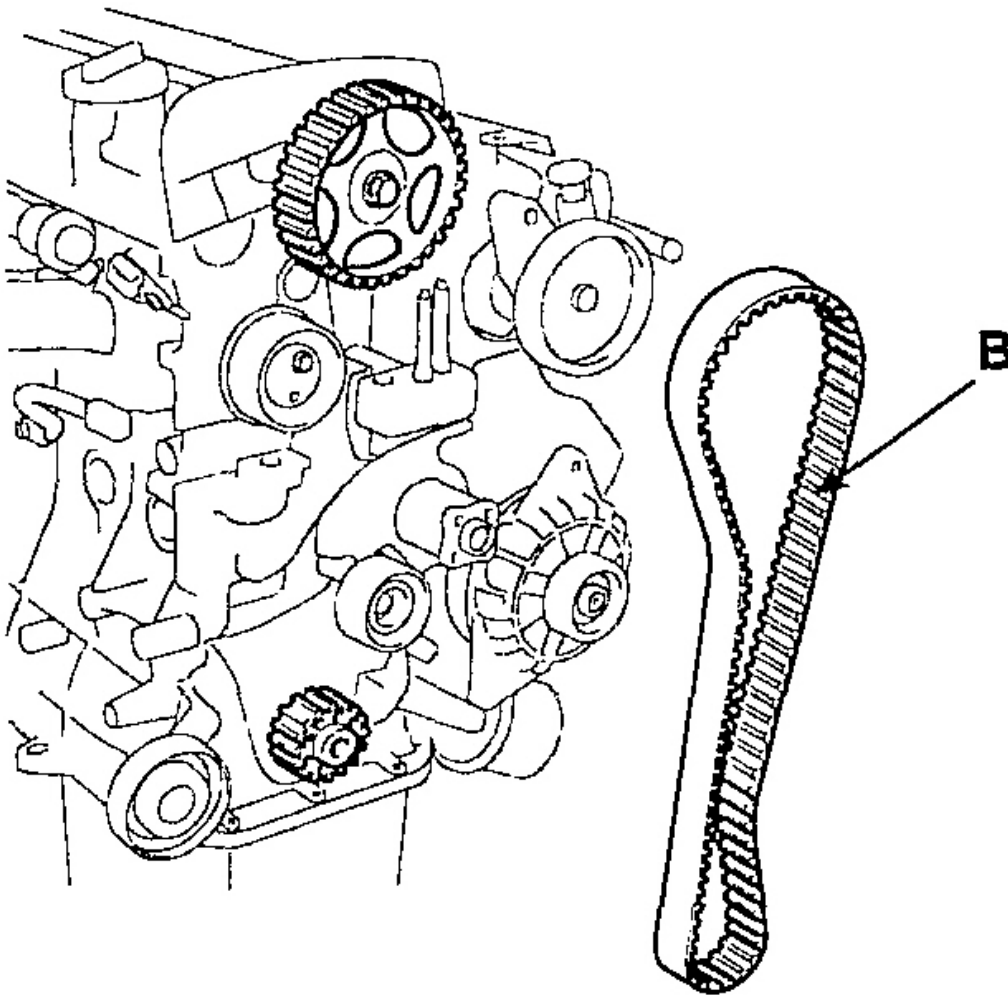
**Fig. 50: Removing Timing Belt Lower Cover**  
Courtesy of KIA MOTORS AMERICA, INC.

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



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**Fig. 51: Removing Timing Belt Tensioner**  
Courtesy of KIA MOTORS AMERICA, INC.

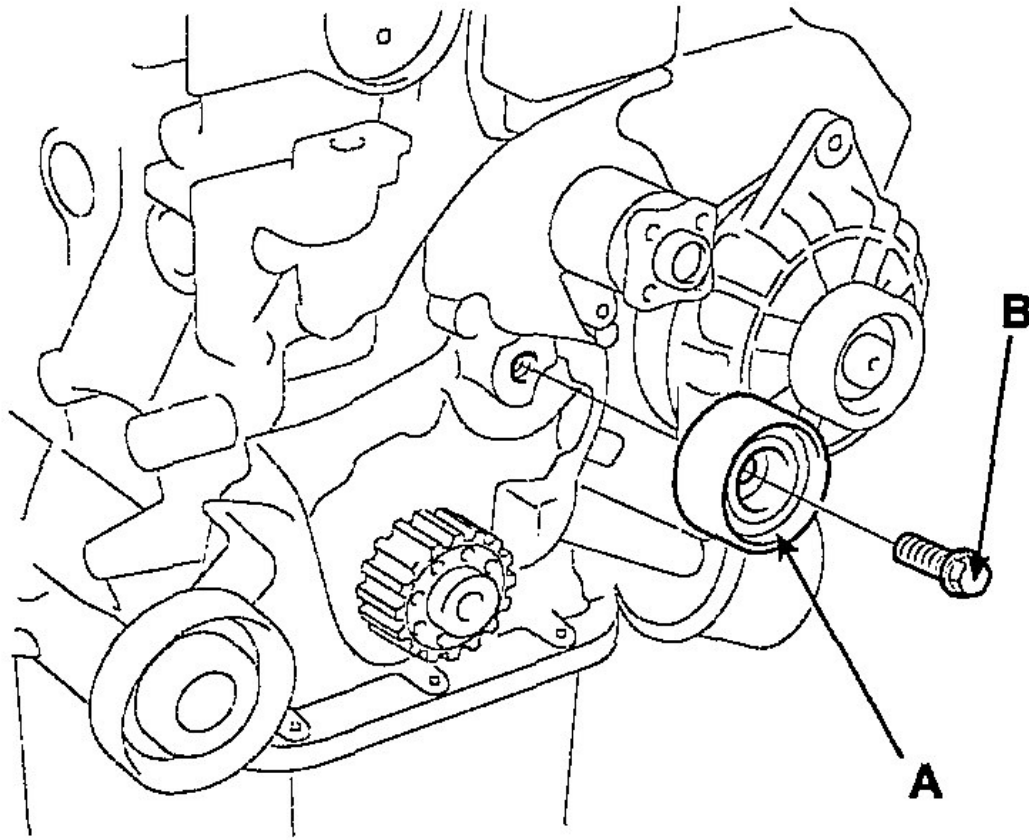


G00718985

**Fig. 52: 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.

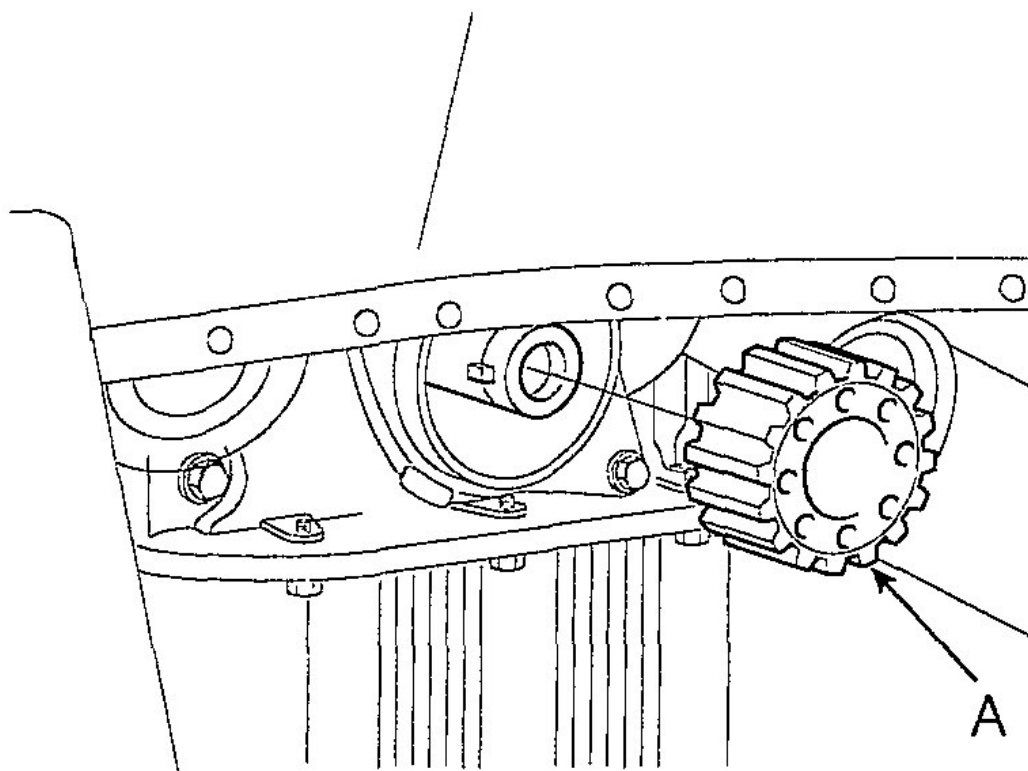
16. Remove the bolt (B) and timing belt idler (A).



G00718986

**Fig. 53: Removing Timing Belt Idler**  
Courtesy of KIA MOTORS AMERICA, INC.

17. Remove the crankshaft sprocket (A).



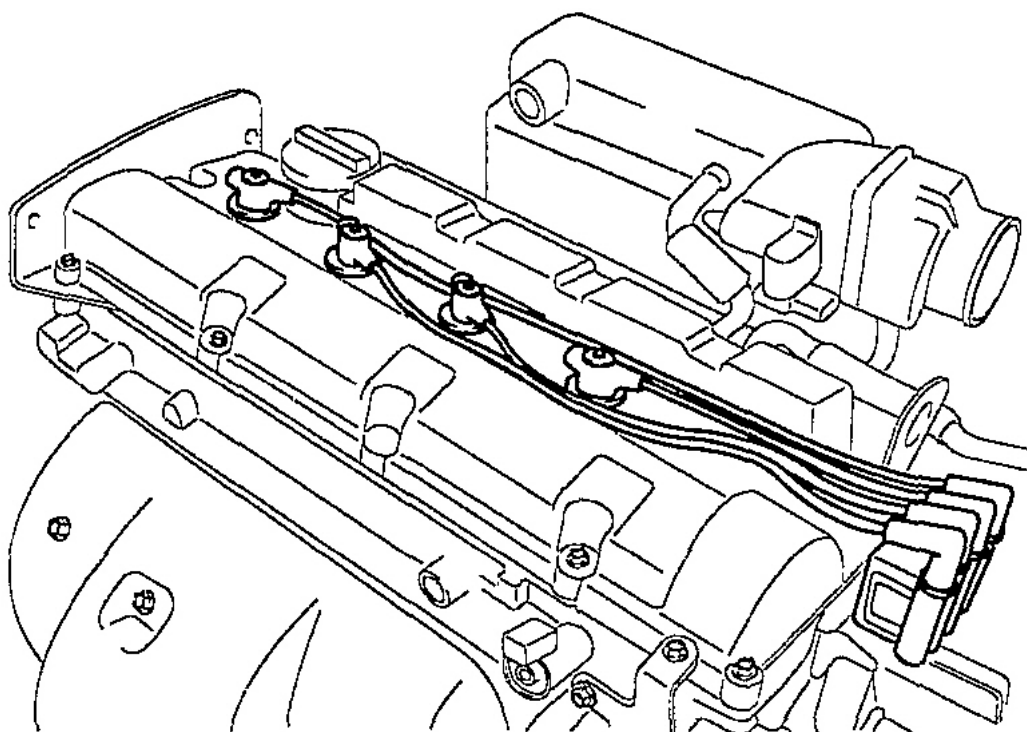
G00718987

**Fig. 54: Removing Crankshaft Sprocket**  
Courtesy of KIA MOTORS AMERICA, INC.

18. 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.

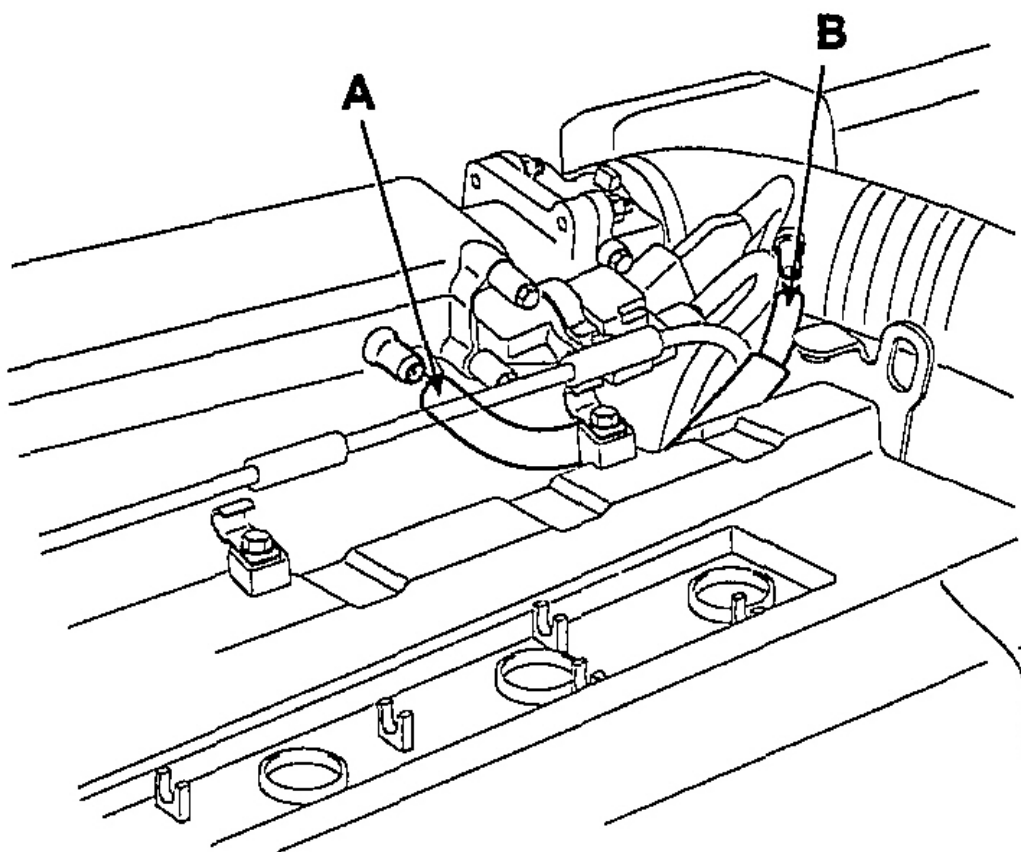




G00718988

**Fig. 55: Disconnecting Spark Plug Cables**  
Courtesy of KIA MOTORS AMERICA, INC.

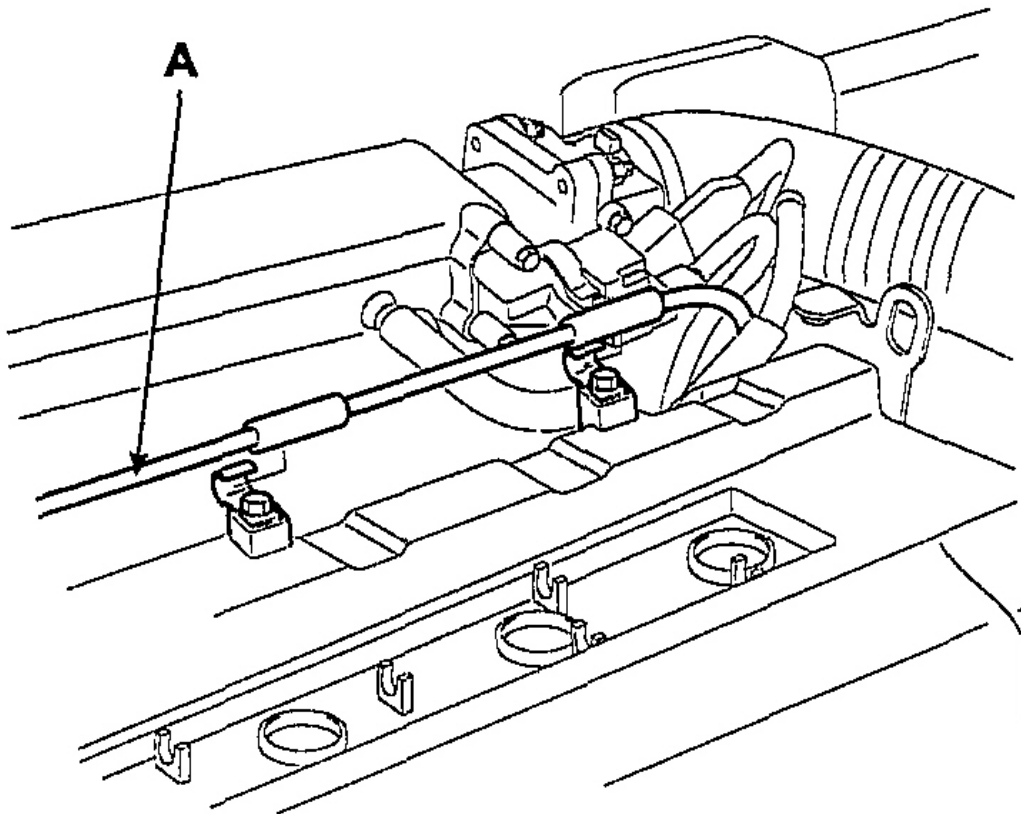
- b. Remove the PCV (Positive Crankcase Ventilation) hose (A) and the breather hose (B) from the cylinder head cover.



G00718989

**Fig. 56: Removing PCV Hose & Breather Hose From Cylinder Head Cover.**  
Courtesy of KIA MOTORS AMERICA, INC.

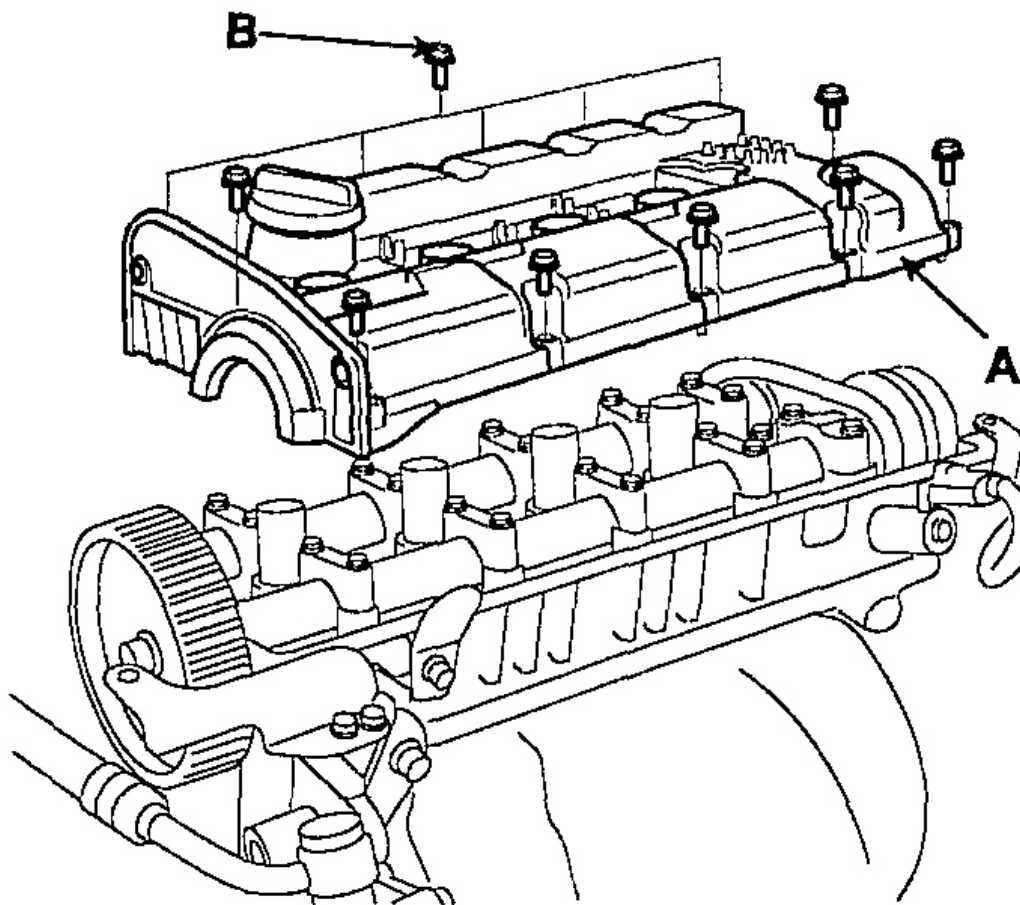
- c. Remove the accelerator cable (A) from the cylinder head cover.



G00718990

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

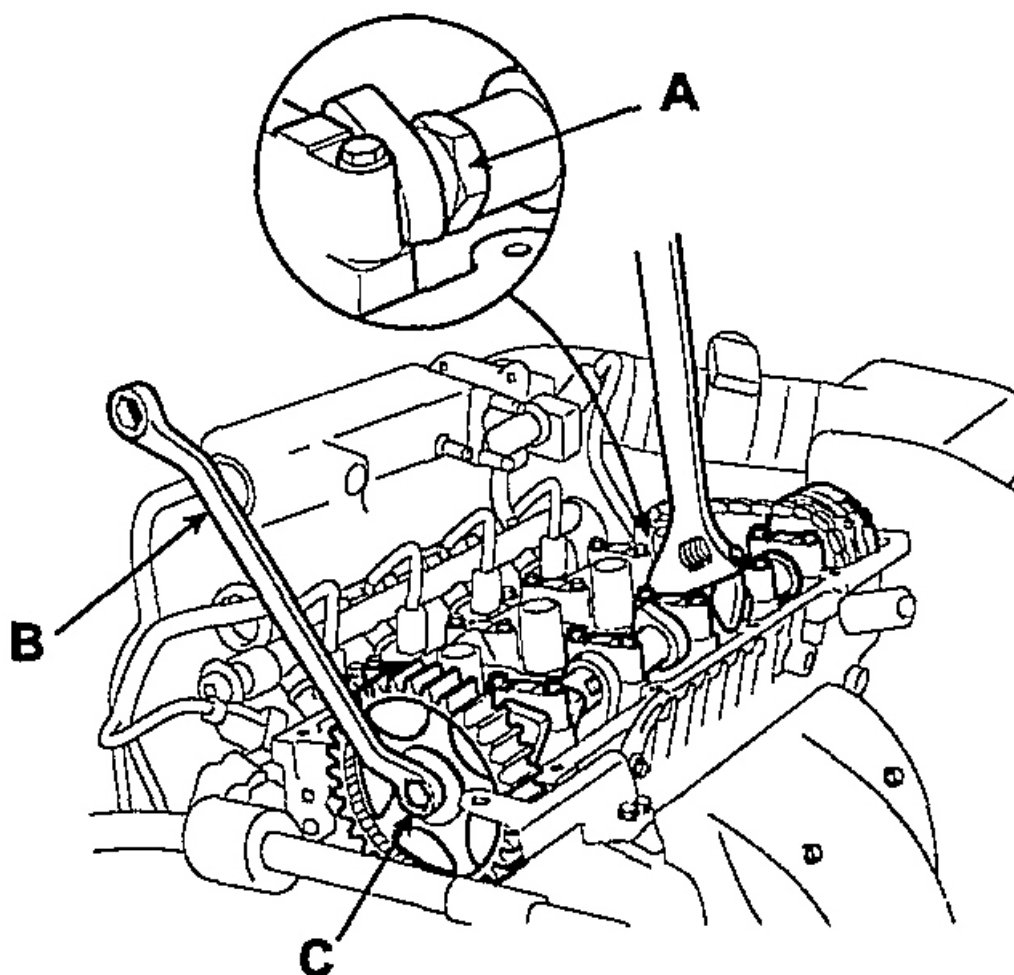
- d. Loosen the cylinder head cover bolts (B) and then remove the cover (A) and gasket.



G00718991

**Fig. 58: Removing Cylinder Head Cover**  
Courtesy of KIA MOTORS AMERICA, INC.

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



G00718992

**Fig. 59: Removing Camshaft Sprocket**  
Courtesy of KIA MOTORS AMERICA, INC.

19. Remove the camshaft sprocket. Hold the portion (A) of the camshaft with a hexagonal wrench. Remove the bolt (C) with a wrench (B) and remove the camshaft sprocket.

## 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.

**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.

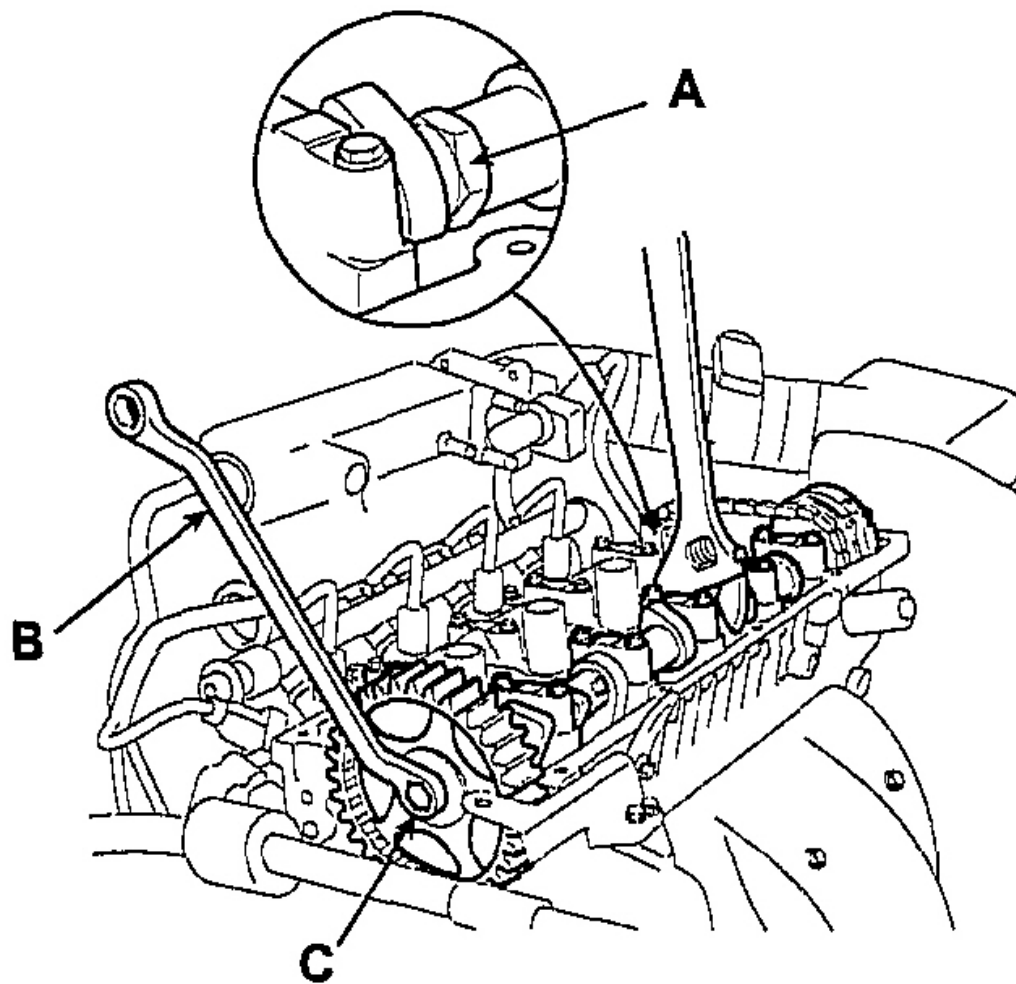
**NOTE:**

- **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)

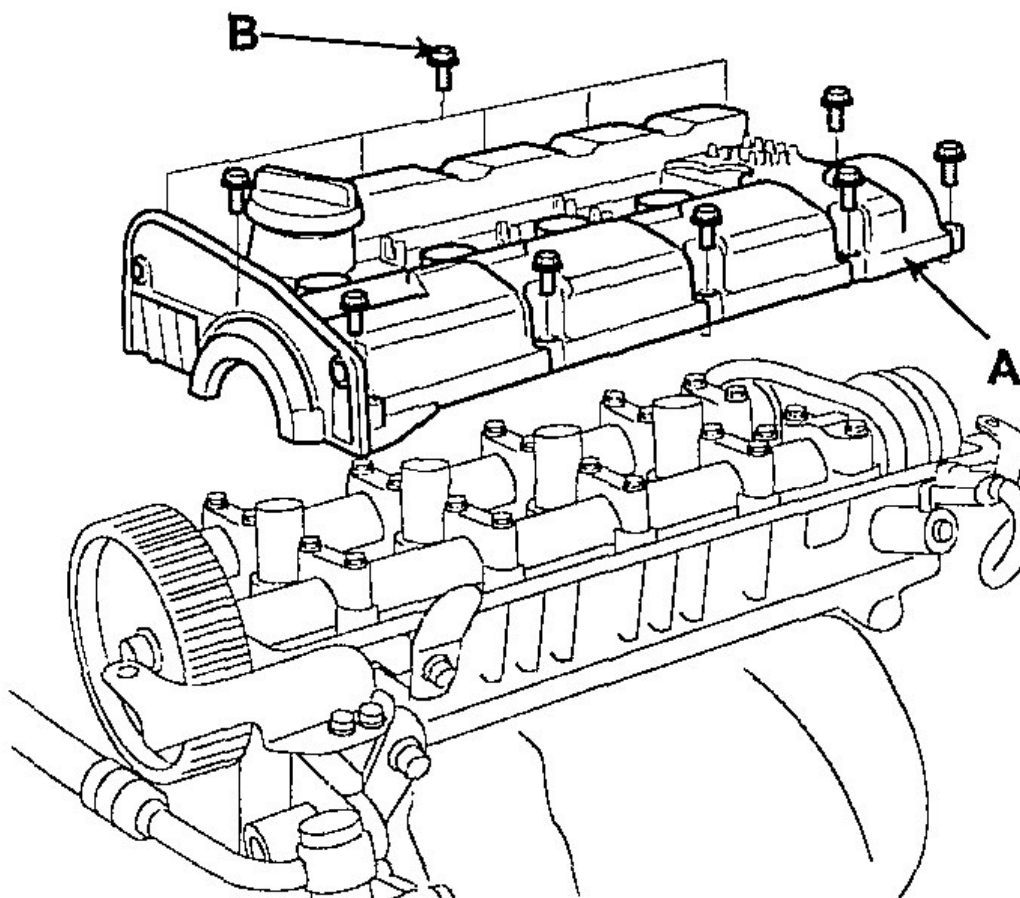


G00718994

**Fig. 60: 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)

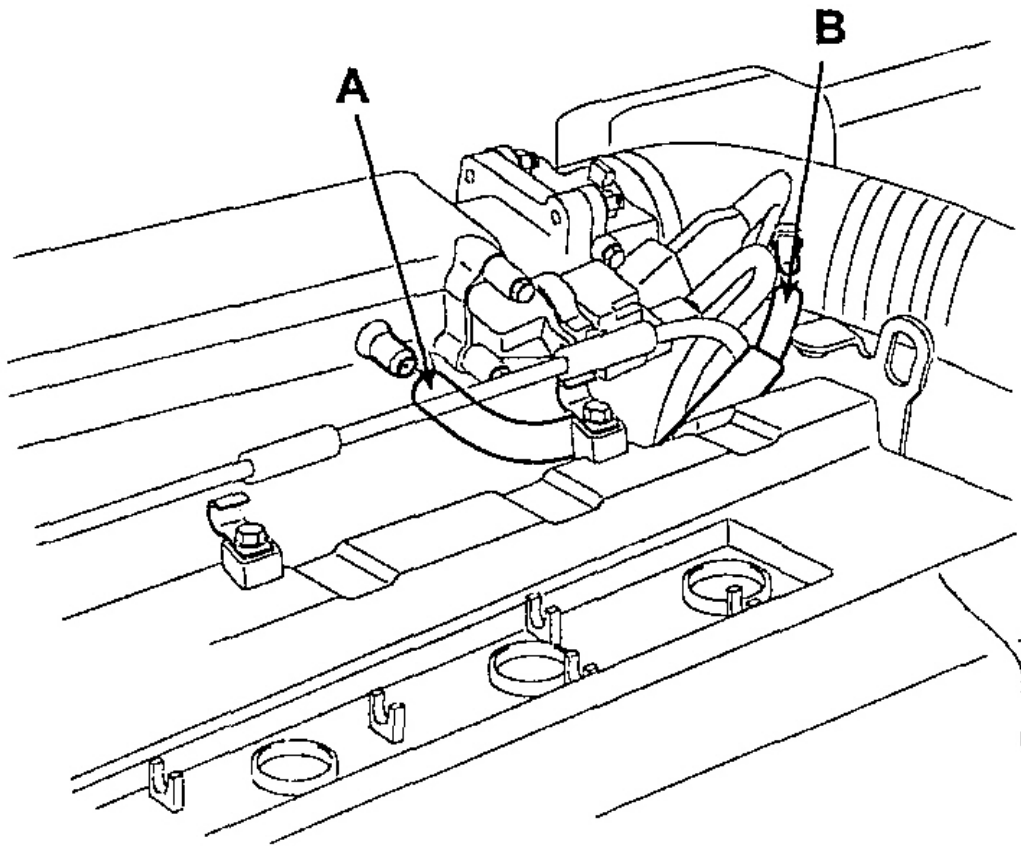


G00718995

**Fig. 61: 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.

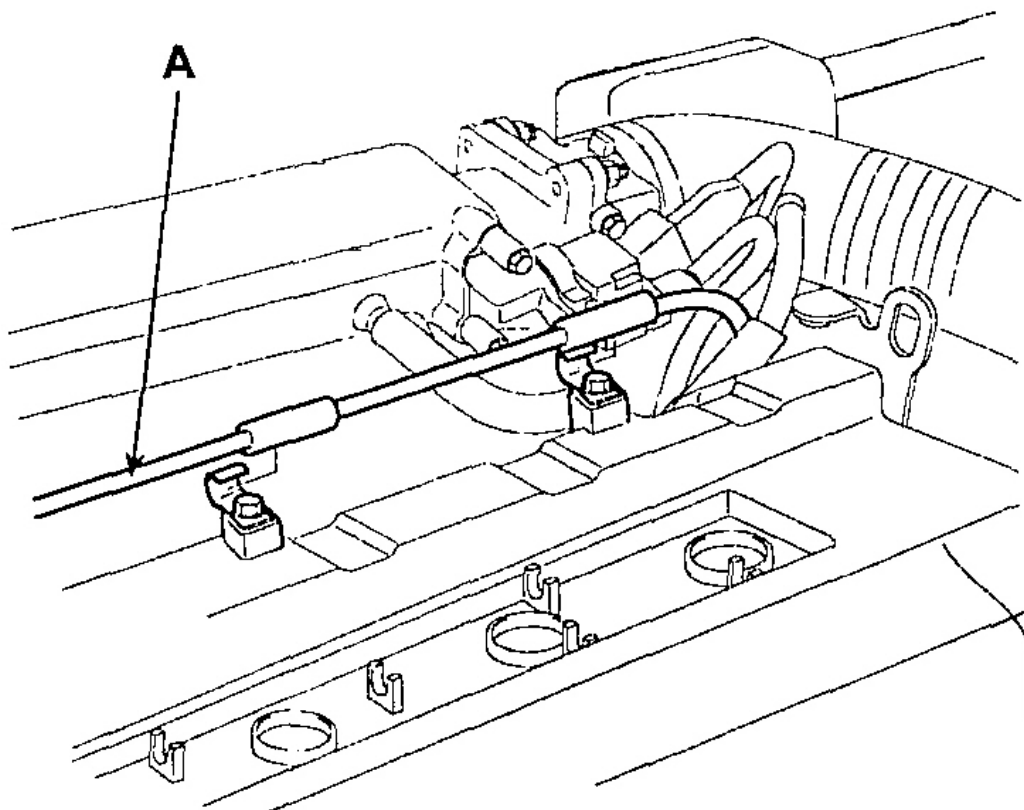




G00718996

**Fig. 62: Installing PCV Hose & Breather Hose To Cylinder Head Cover**  
Courtesy of KIA MOTORS AMERICA, INC.

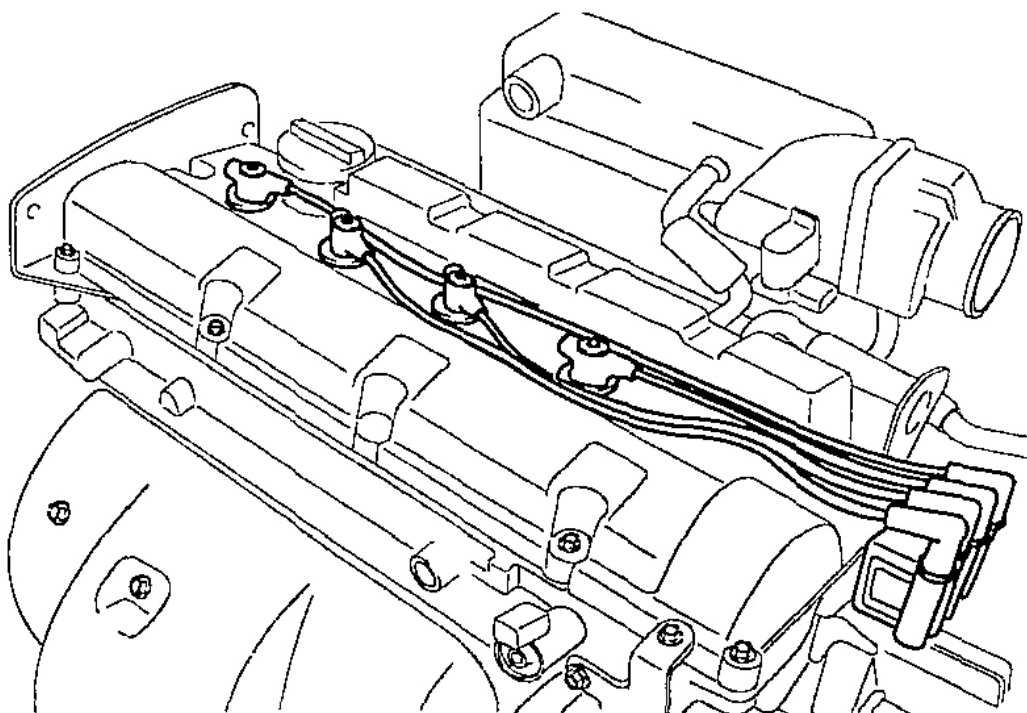
- c. Install the accelerator cable (A) to the cylinder head cover.



G00718997

**Fig. 63: Installing Accelerator Cable**  
Courtesy of KIA MOTORS AMERICA, INC.

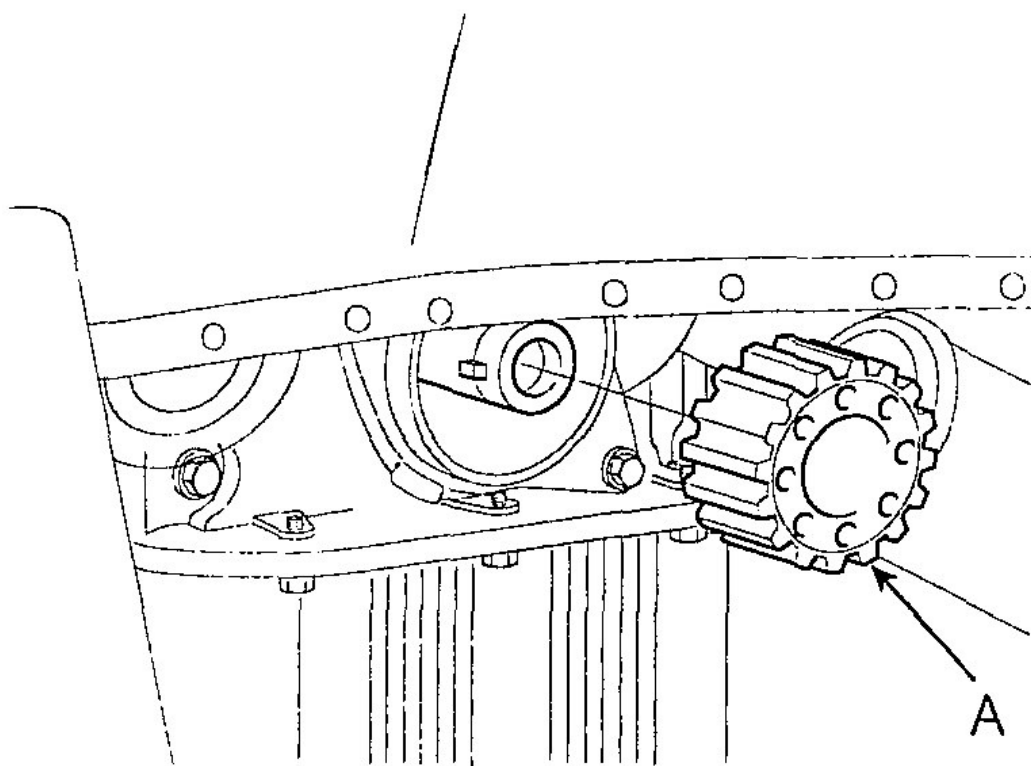
- d. Install the spark plug cables.



G00718998

**Fig. 64: Installing Spark Plug Cables**  
Courtesy of KIA MOTORS AMERICA, INC.

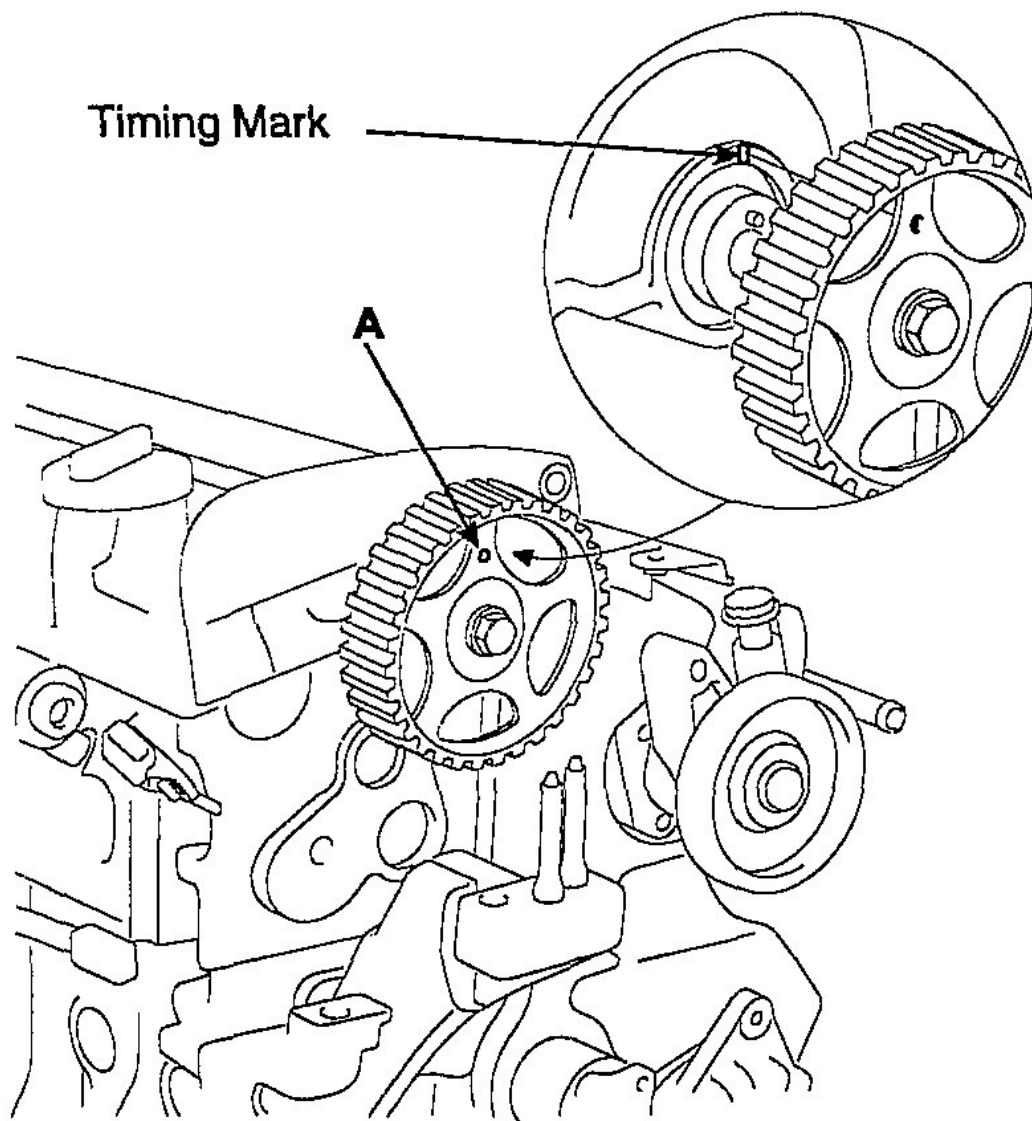
3. Install the crankshaft sprocket (A).



G00718999

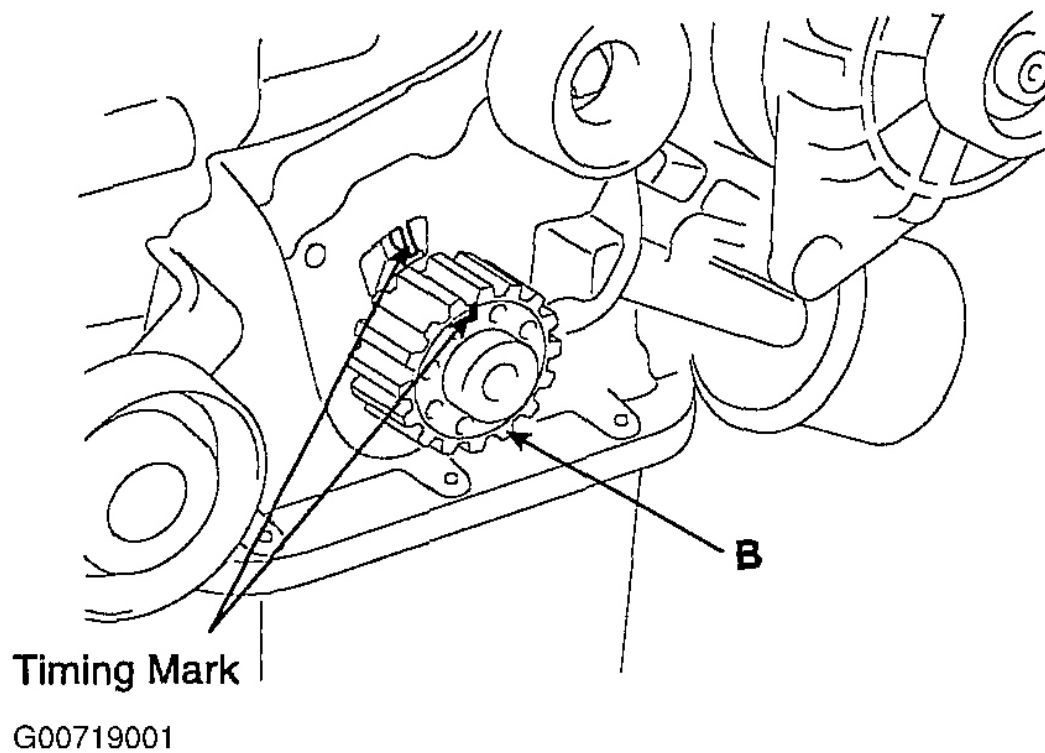
**Fig. 65: Installing Crankshaft Sprocket**  
Courtesy of KIA MOTORS AMERICA, INC.

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

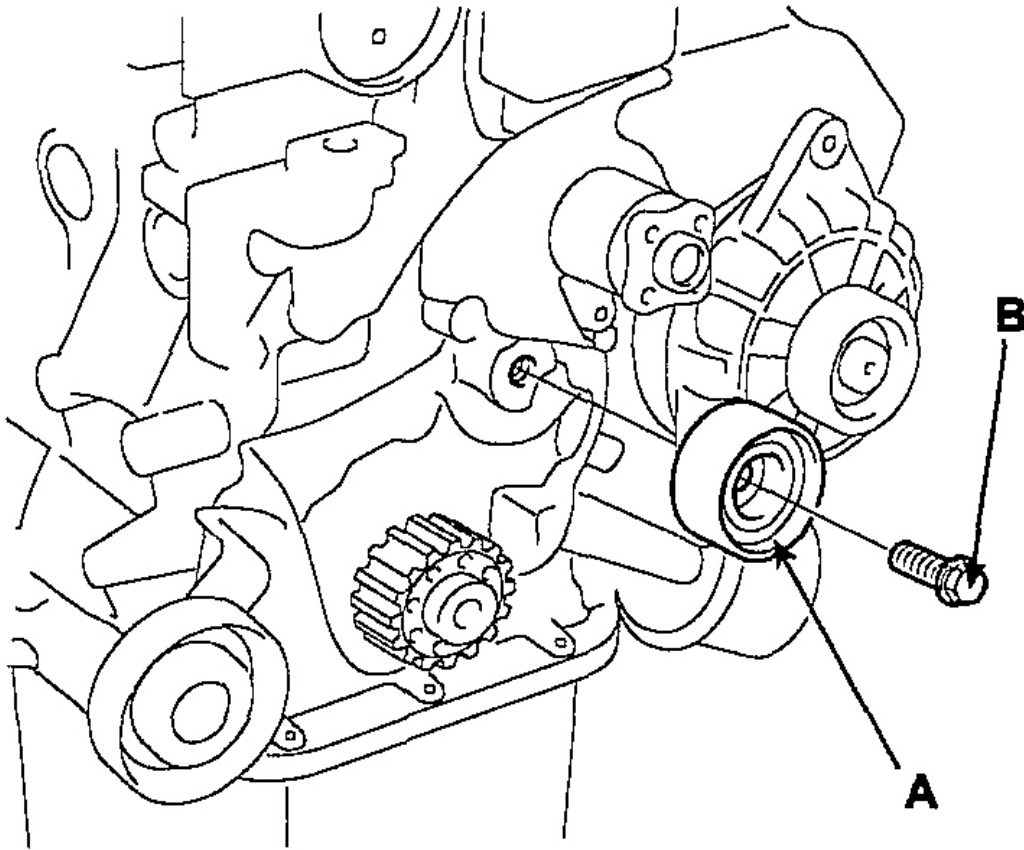
**Fig. 66: Aligning Camshaft Timing Marks**  
Courtesy of KIA MOTORS AMERICA, INC.



**Fig. 67: 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)

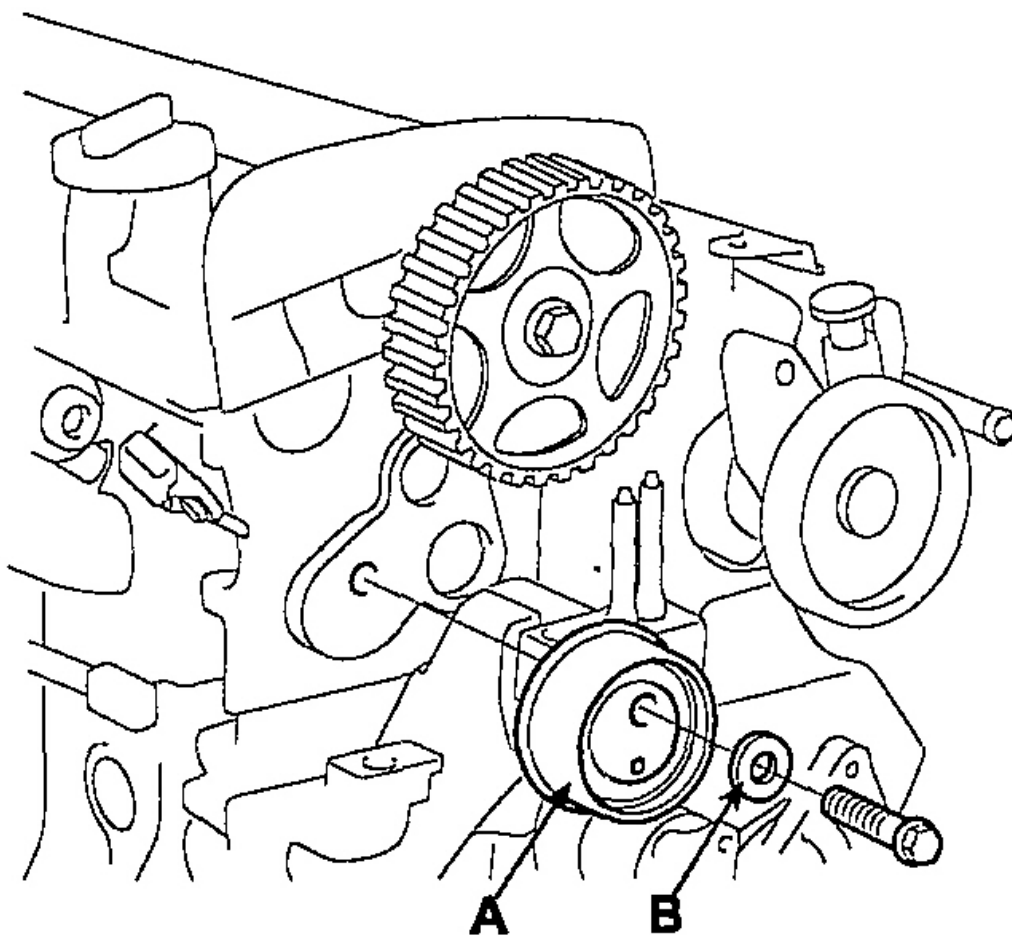


G00719002

**Fig. 68: Installing Idler Pulley**

Courtesy of KIA MOTORS AMERICA, INC.

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



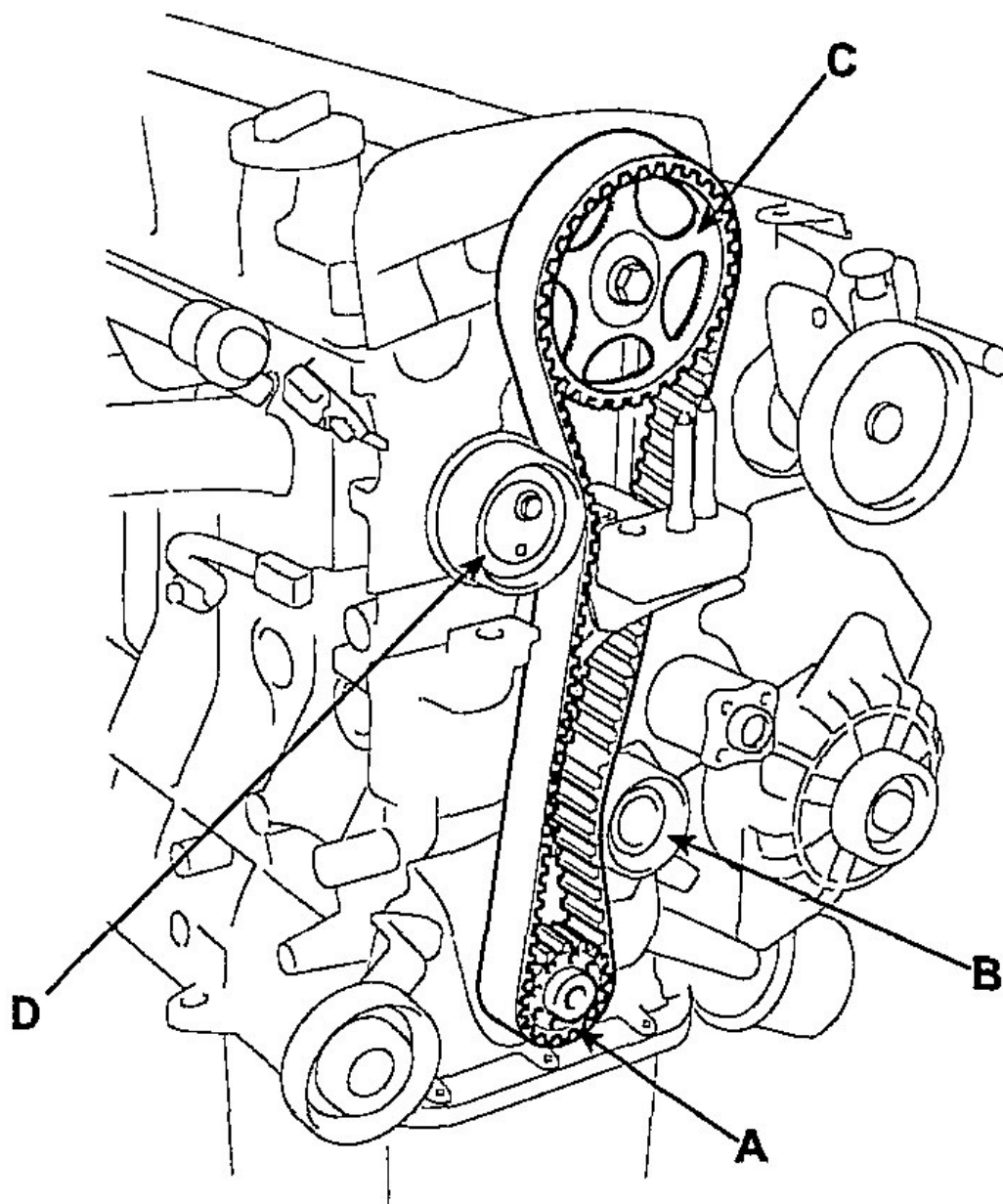
G00719003

**Fig. 69: Temporarily Installing Timing Belt Tensioner**  
Courtesy of KIA MOTORS AMERICA, INC.

7. Install the timing belt on pulleys. See **Fig. 70**.

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



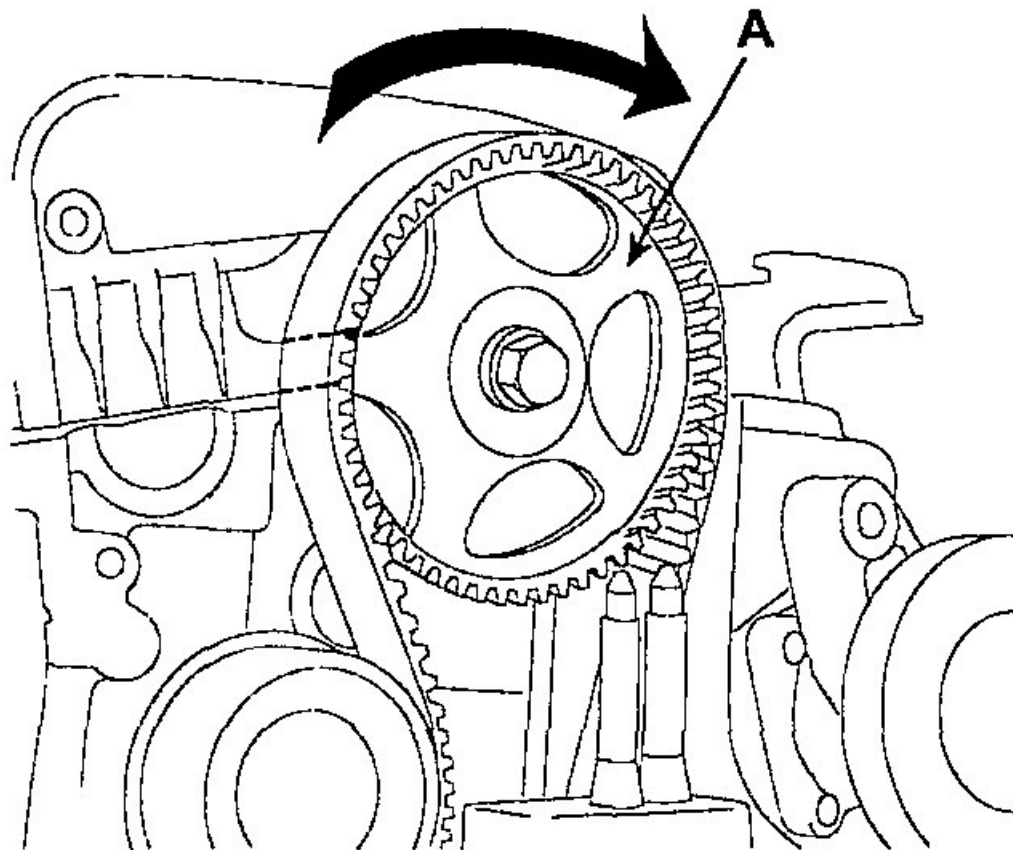


G00719004

**Fig. 70: Illustrating Timing Belt Installation Sequence**  
Courtesy of KIA MOTORS AMERICA, INC.

8. Temporarily install tensioner pulley using center bolt to add tension force to the belt.
9. Adjust the timing belt tension.

- a. Rotate the crankshaft clockwise (view from front) through angle equivalent to two teeth (18°) of camshaft sprocket (A).

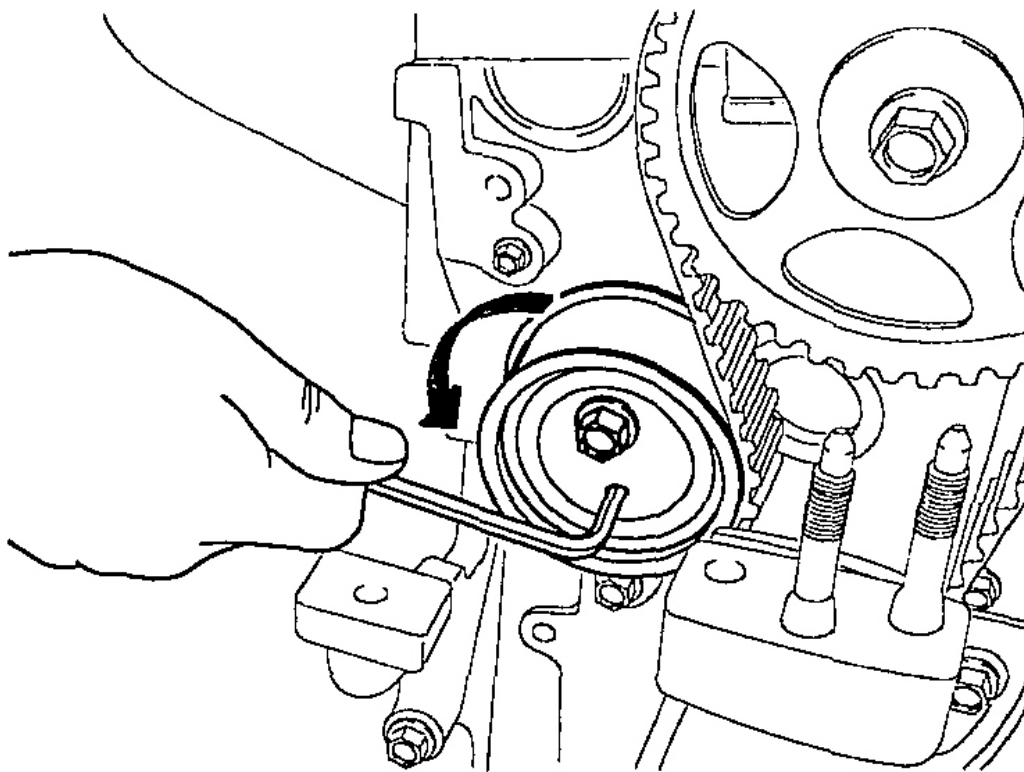


G00719005

**Fig. 71: Rotating Crankshaft**

Courtesy of KIA MOTORS AMERICA, INC.

- b. Using a hex-wrench, apply tension to the timing belt in the clockwise direction so that there is no slack in the belt on the tension side.



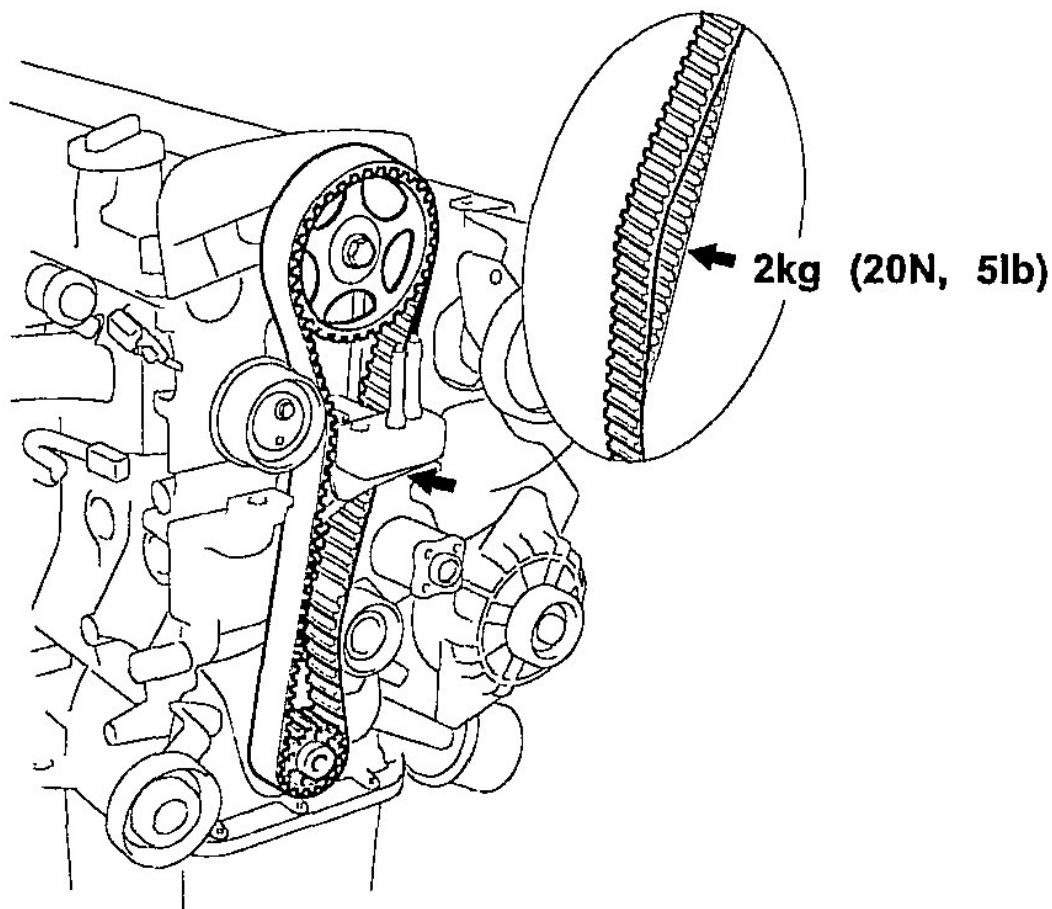
G00719006

**Fig. 72: Applying Tension To Timing Belt**  
Courtesy of KIA MOTORS AMERICA, INC.

- c. Tighten the tensioner bolt.

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

- d. Recheck the belt tension. When the tension side of timing belt is pushed horizontally with a moderate force [approx. 2 kg (20N, 5 lb)], the timing belt cog end sags in approx. 4-6 mm (0.16-0.24 in).

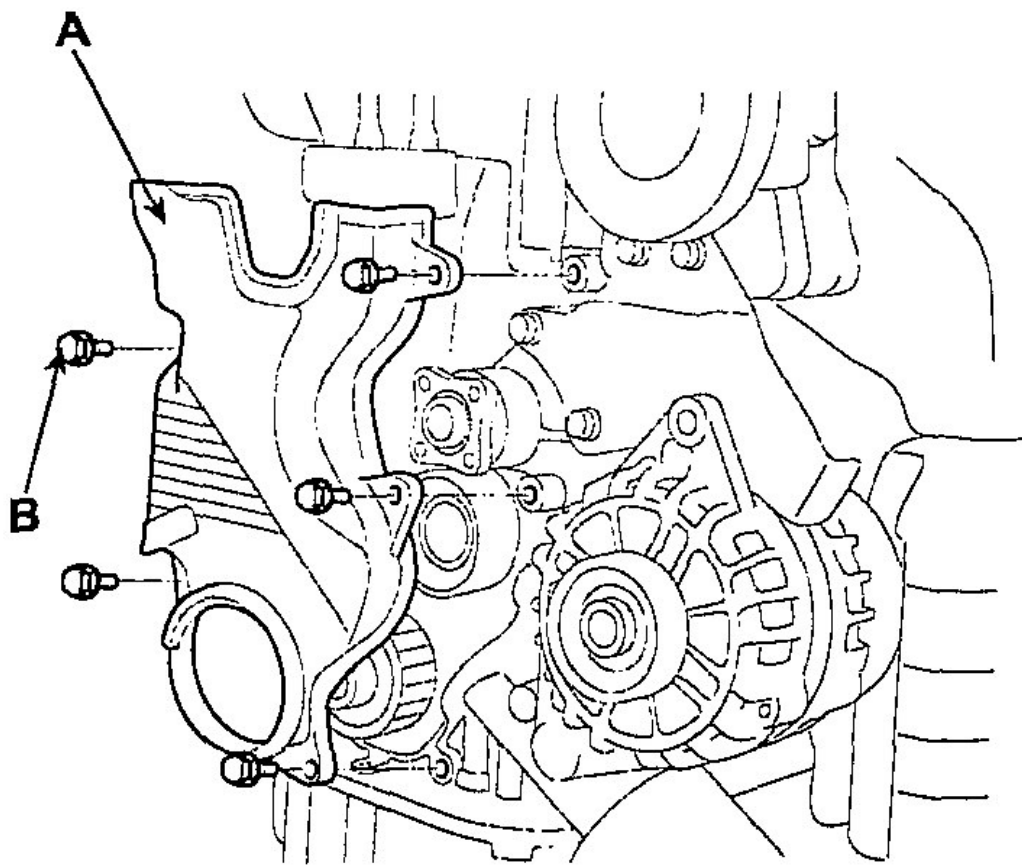


G00719007

**Fig. 73: Measuring Timing Belt Tension**  
Courtesy of KIA MOTORS AMERICA, INC.

10. Turn the crankshaft two turns in the operating direction (clockwise) and realign crankshaft sprocket and camshaft sprocket timing mark.
11. Install the timing belt lower cover (A) with 5 bolts (B).

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

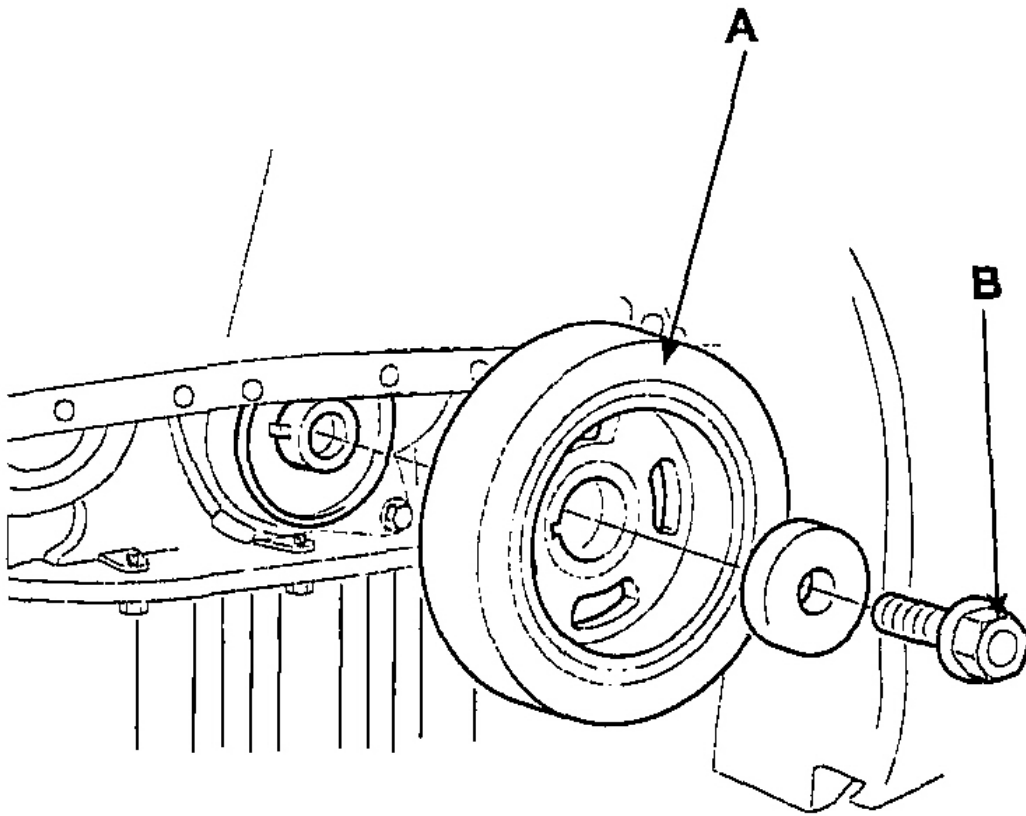


G00719008

**Fig. 74: Installing Timing Belt Lower Cover**  
Courtesy of KIA MOTORS AMERICA, INC.

12. Install the flange and crankshaft pulley (A), and then tighten crankshaft pulley bolt (B). Make sure that the crankshaft sprocket pin fits into the small hole in the pulley.

Tightening torque: 166.7-176.5 N.m (17-18 kg-m, 123.0-130.2 lb-ft)

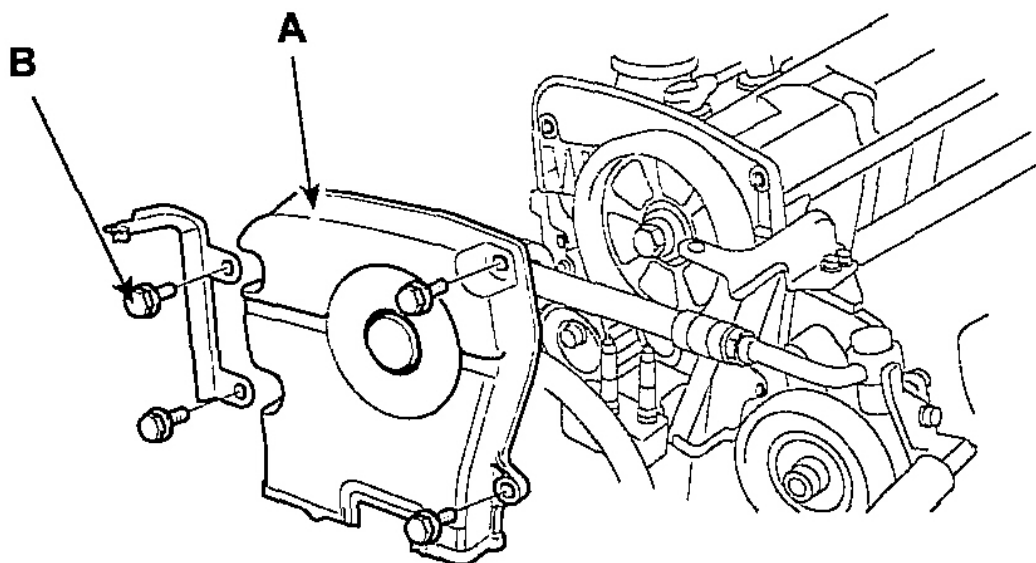


G00719009

**Fig. 75: Installing Flange & Crankshaft Pulley**  
Courtesy of KIA MOTORS AMERICA, INC.

13. Install the front upper cover.

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

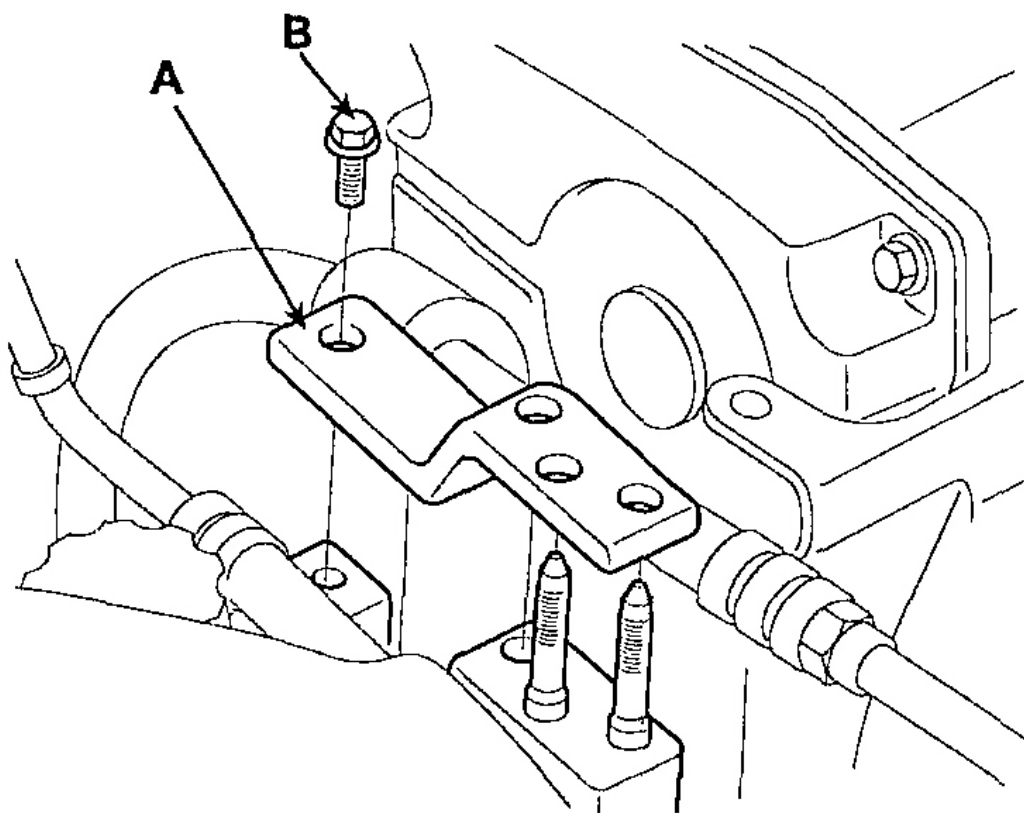


G00719010

**Fig. 76: Installing Front Upper Cover**  
Courtesy of KIA MOTORS AMERICA, INC.

14. Install the water pump pulley and 4 bolts.
15. Install the power steering pump drive belt. See **CHECKING POWER STEERING BELT TENSION** .
16. Install the air conditioner compressor drive belt. See **DRIVE BELT** .
17. Install the alternator drive belt. See **ALTERNATOR BELT INSPECTION & ADJUSTMENT** .
18. Tighten the bolts of water pump pulley.
19. Install the engine mounting support bracket.
  - a. Install the engine mounting support bracket stay plate (A) with bolt (B).

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



G00719011

**Fig. 77: Installing Engine Mounting Support Bracket Stay Plate**  
Courtesy of KIA MOTORS AMERICA, INC.

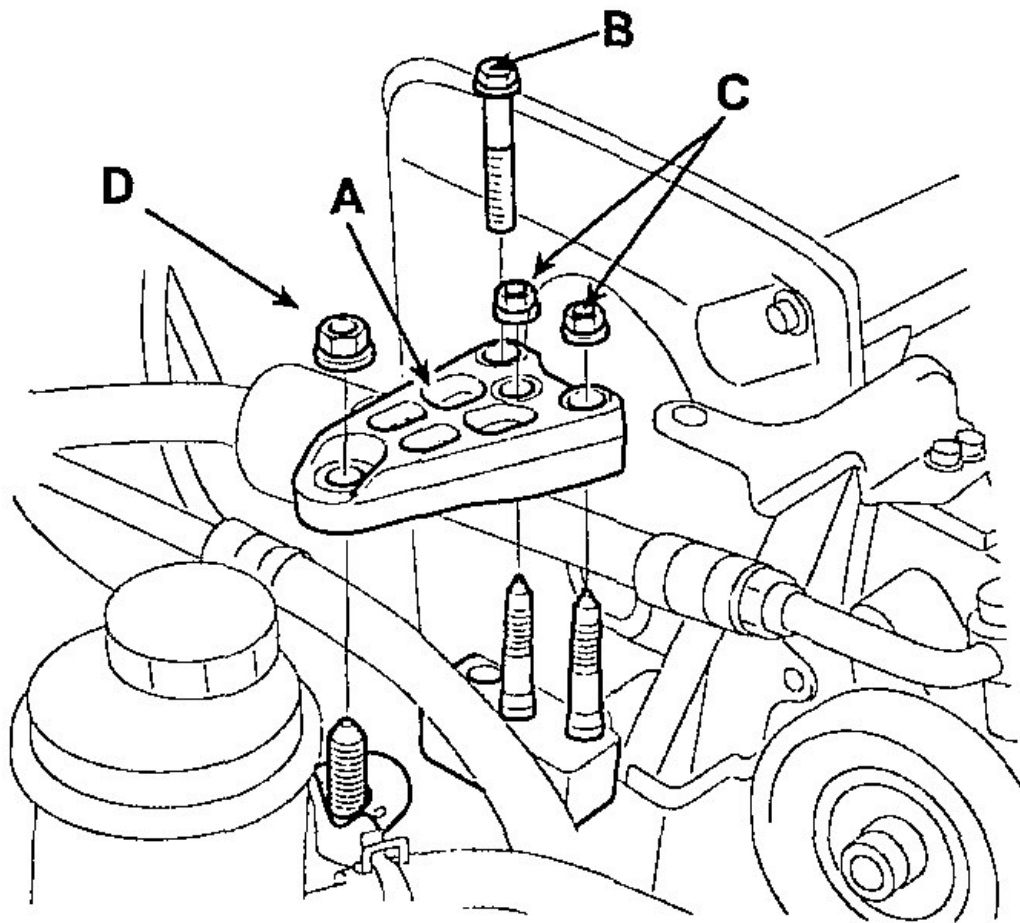
- b. Install the engine mounting support bracket (A) with nuts (C, D) and bolt (B).

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)

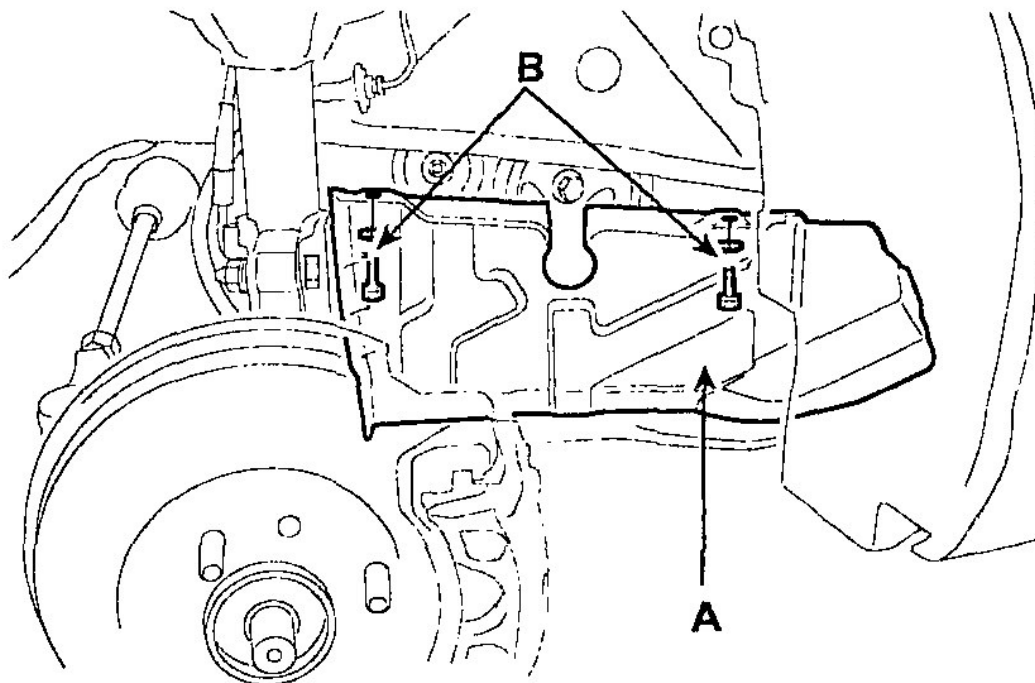




G00719012

**Fig. 78: Installing Engine Mounting Support Bracket**  
Courtesy of KIA MOTORS AMERICA, INC.

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



G00719013

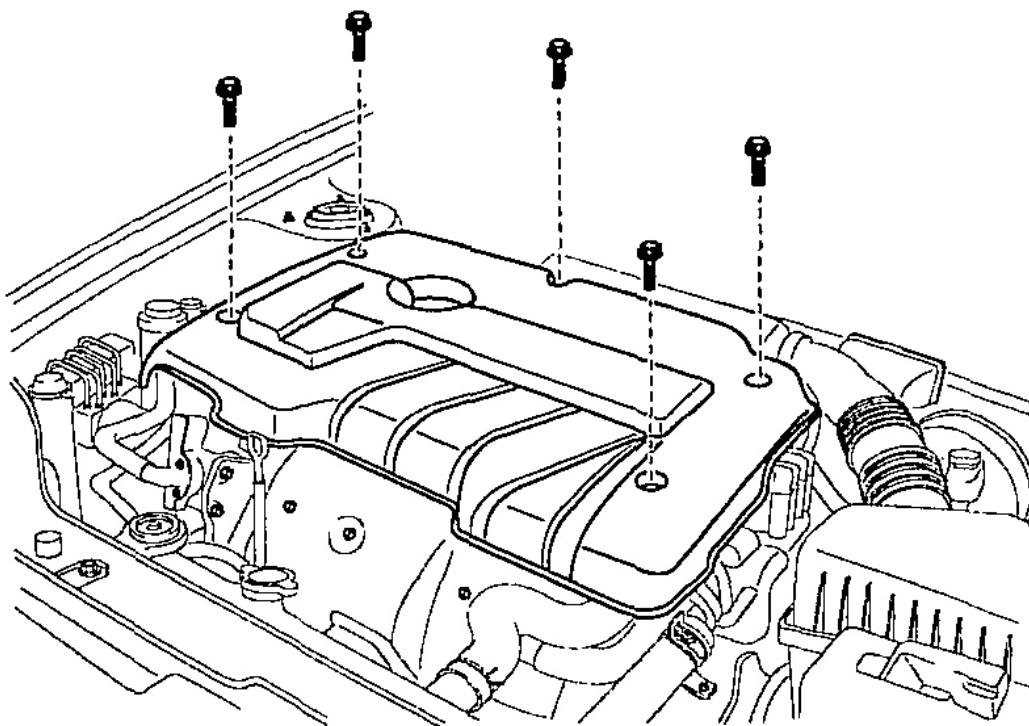
**Fig. 79: Installing RH Side Cover**  
Courtesy of KIA MOTORS AMERICA, INC.

21. 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)

22. 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)



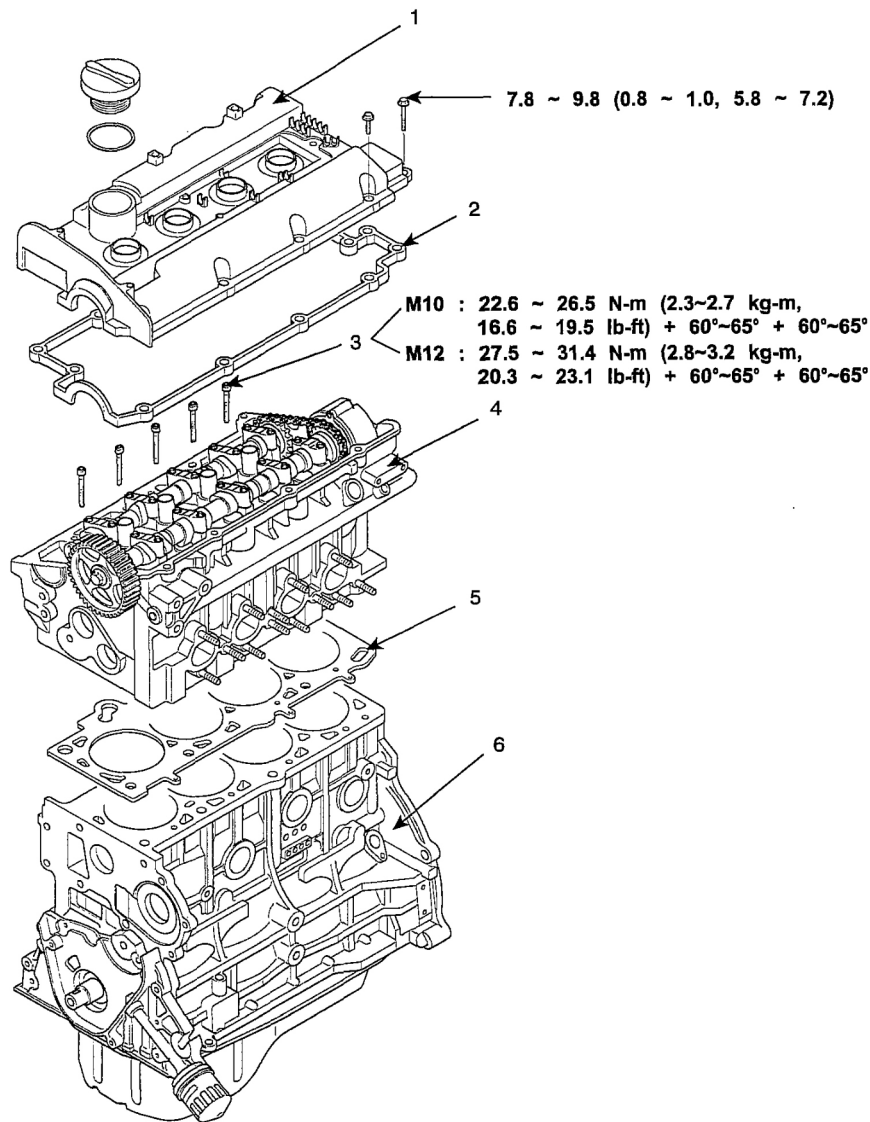
G00719014

**Fig. 80: Installing Engine Cover**

Courtesy of KIA MOTORS AMERICA, INC.

## CYLINDER HEAD ASSEMBLY

### COMPONENT



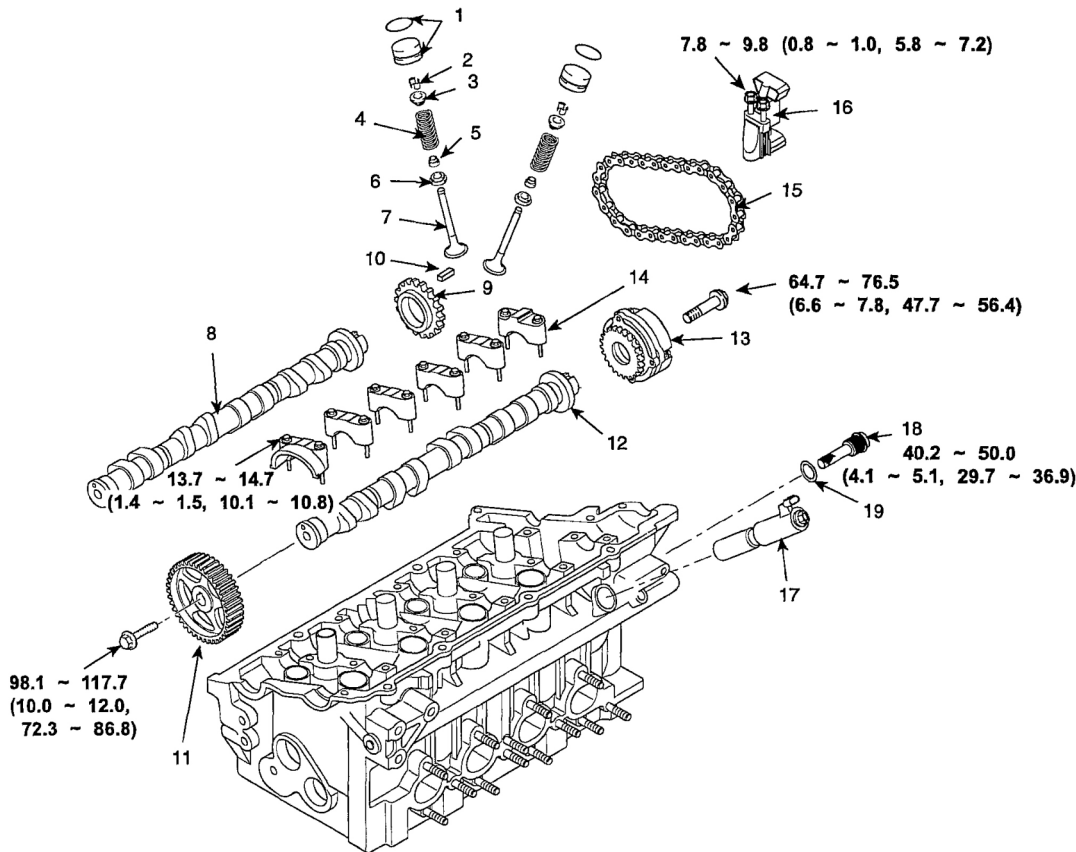
### TORQUE : N-m (kg-m, lb-ft)

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

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

G00719015

**Fig. 81: 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. 82: 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.

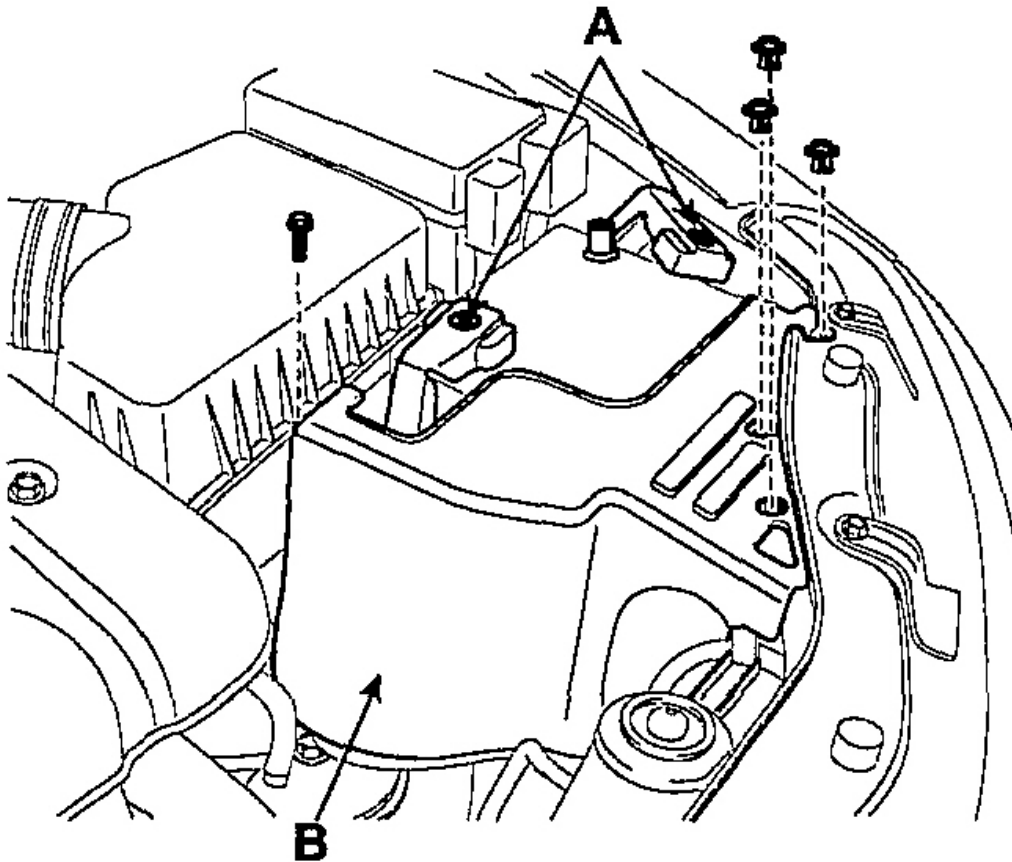
- CAUTION:**
- Use Fender cover to avoid damaging painted surfaces.
  - To avoid damaging the cylinder head, wait until the engine coolant temperature drops below normal temperature before removing it.

- 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.

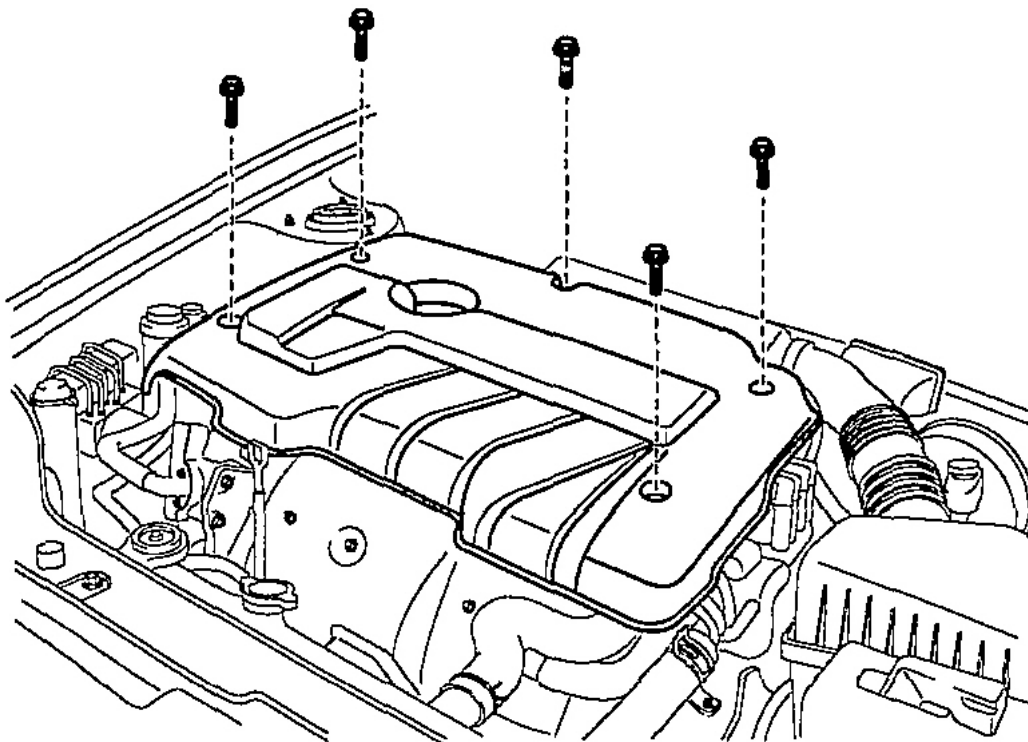
1. Disconnect the terminals (A) from battery and remove the heat shield (B).



G00719017

**Fig. 83: Disconnecting Battery Terminals**  
Courtesy of KIA MOTORS AMERICA, INC.

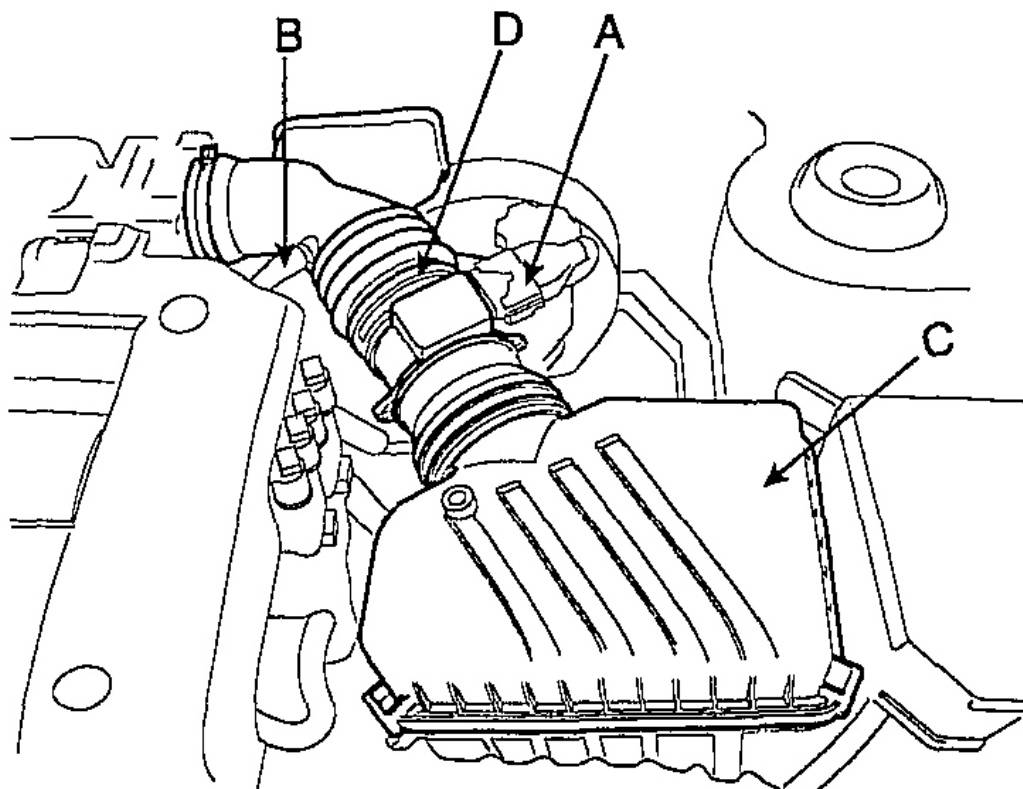
2. Remove the engine cover.



G00719018

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

3. Drain the engine coolant (remove radiator cap to speed draining).
4. Remove the intake air hose and air cleaner assembly.
  - a. Disconnect the AFS (Air Flow Sensor) connector (A).
  - b. Disconnect the breather hose (B) from intake air hose (D).
  - c. Remove the intake air hose (D) and air cleaner upper cover (C).

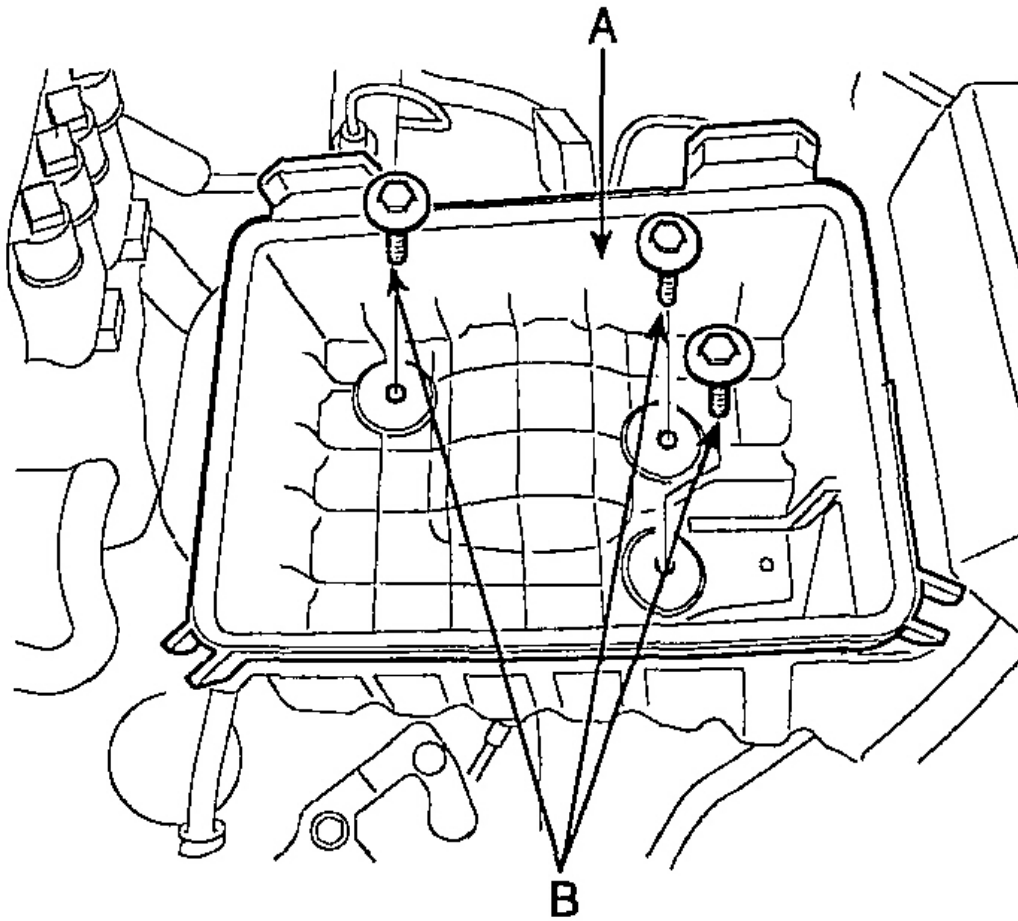


G00719019

**Fig. 85: Removing AFS & Intake Air Hose**  
Courtesy of KIA MOTORS AMERICA, INC.

- d. Remove the air cleaner element.
- e. Remove the bolts (B) and air cleaner lower cover (A).

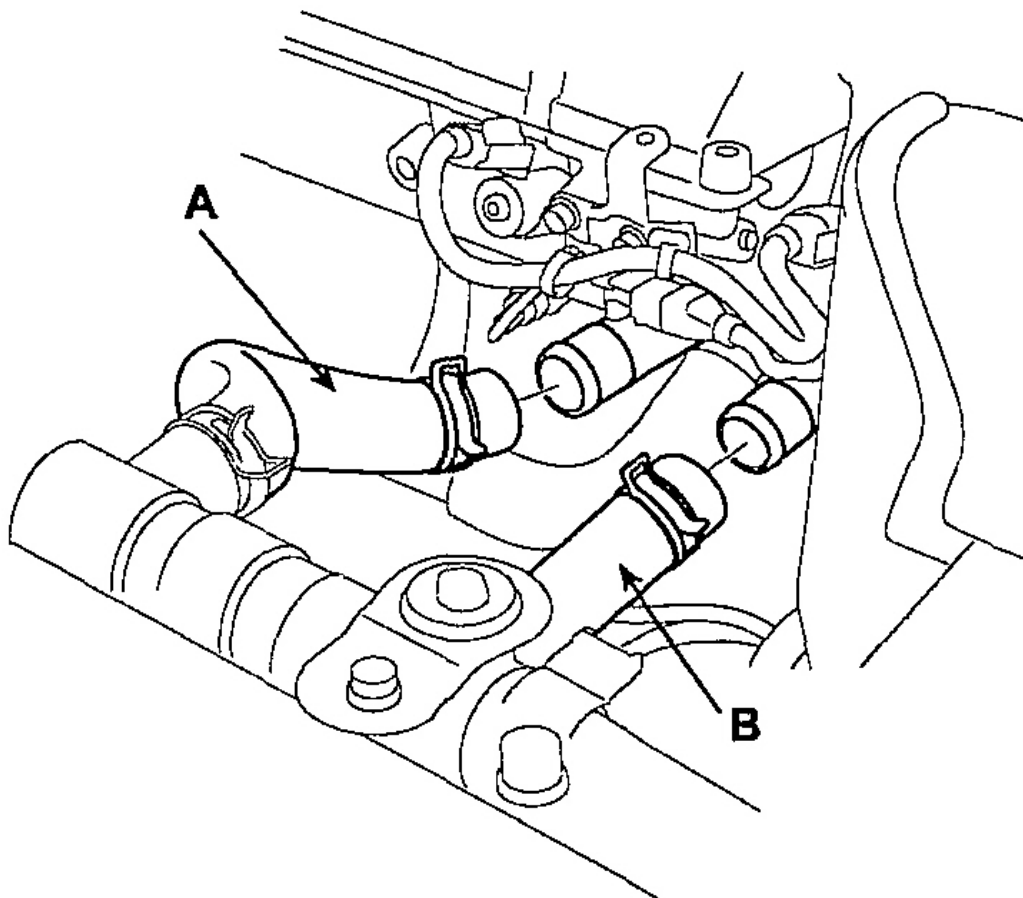




G00719020

**Fig. 86: Removing Air Cleaner Lower Cover**  
Courtesy of KIA MOTORS AMERICA, INC.

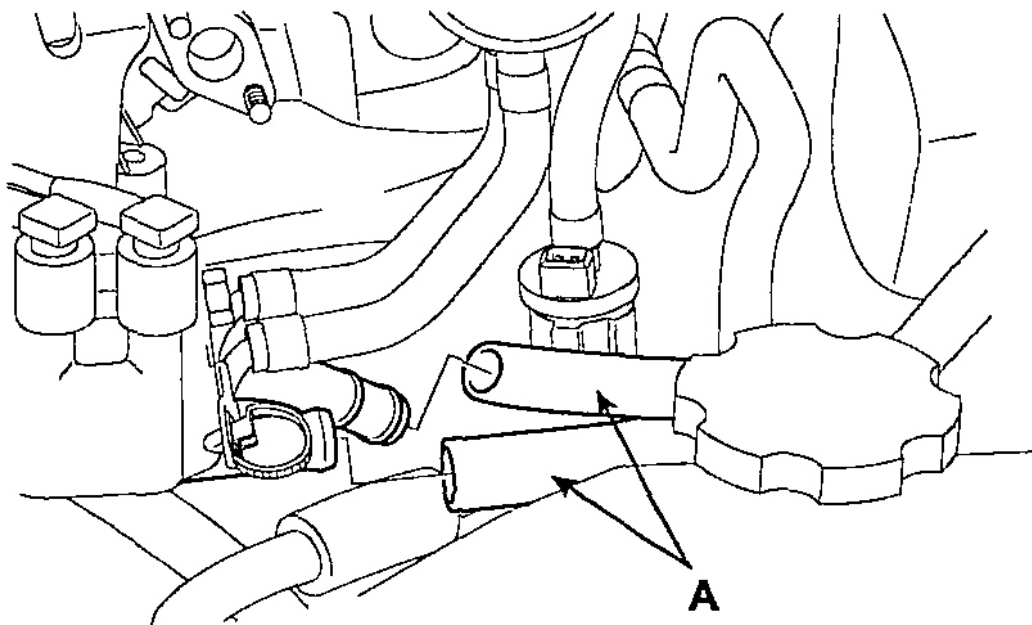
5. Remove the upper radiator hose (A) and lower radiator hose (B).



G00719021

**Fig. 87: Removing Upper & Lower Radiator Hoses**  
Courtesy of KIA MOTORS AMERICA, INC.

6. Remove the heater hoses (A).

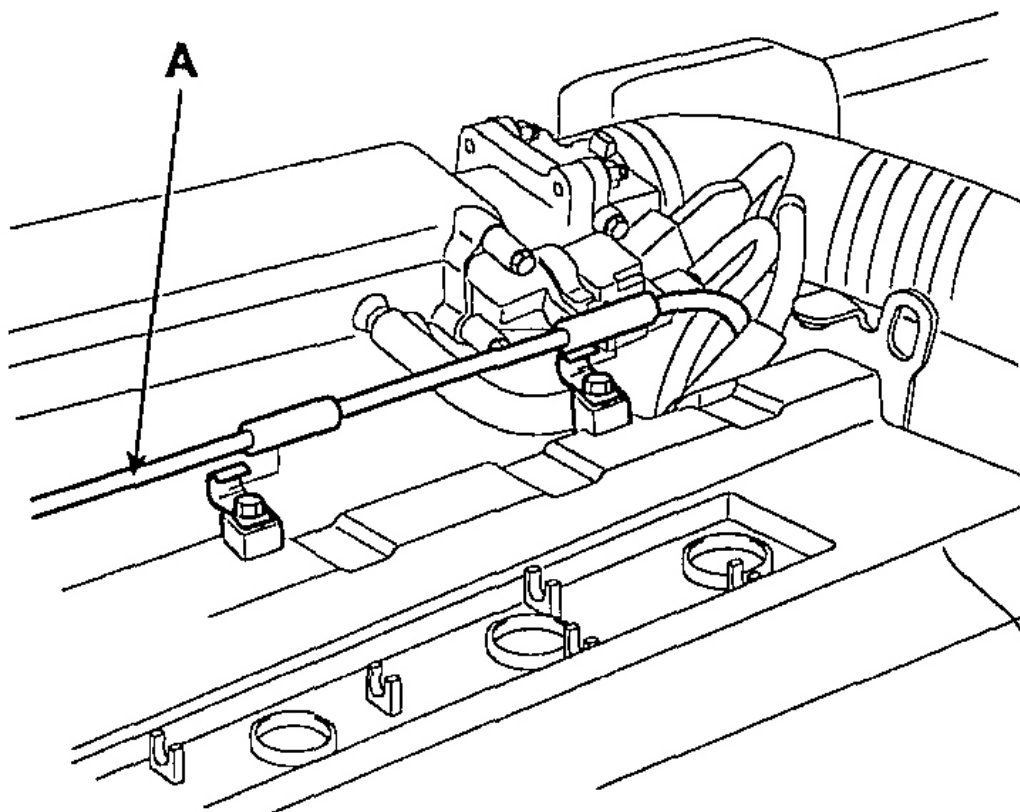


G00719022

**Fig. 88: Removing Heater Hoses**

Courtesy of KIA MOTORS AMERICA, INC.

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

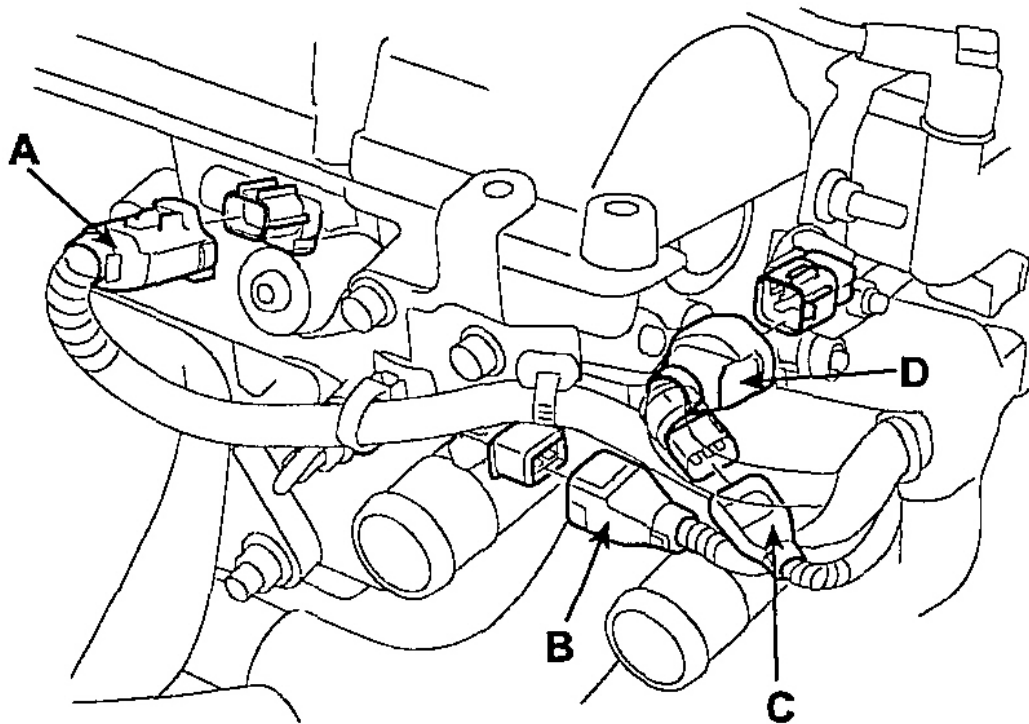


G00719023

**Fig. 89: Removing Accelerator Cable**

Courtesy of KIA MOTORS AMERICA, INC.

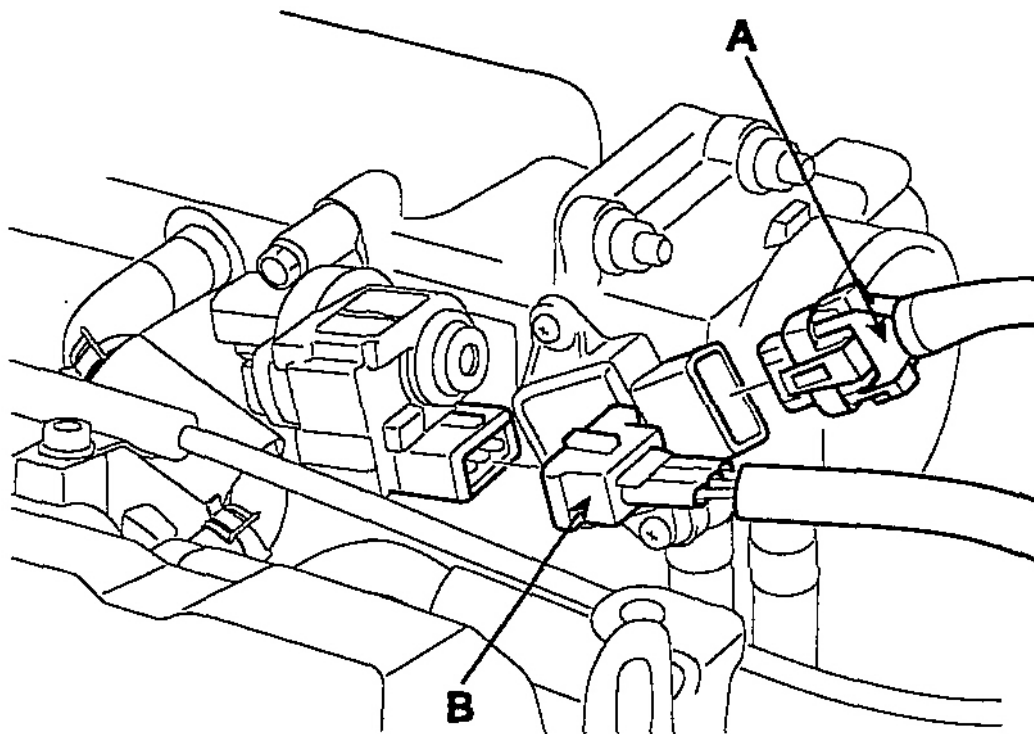
8. Remove the engine wire harness connectors and wire harness clamps from cylinder head and the intake manifold.
  - a. Disconnect the OCV (Oil Control Valve) connector (A).
  - b. Disconnect the oil temperature sensor connector (B).
  - c. Disconnect the ECT (Engine Coolant Temperature) sensor connector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



G00719024

**Fig. 90: Disconnecting Engine Sensors**  
Courtesy of KIA MOTORS AMERICA, INC.

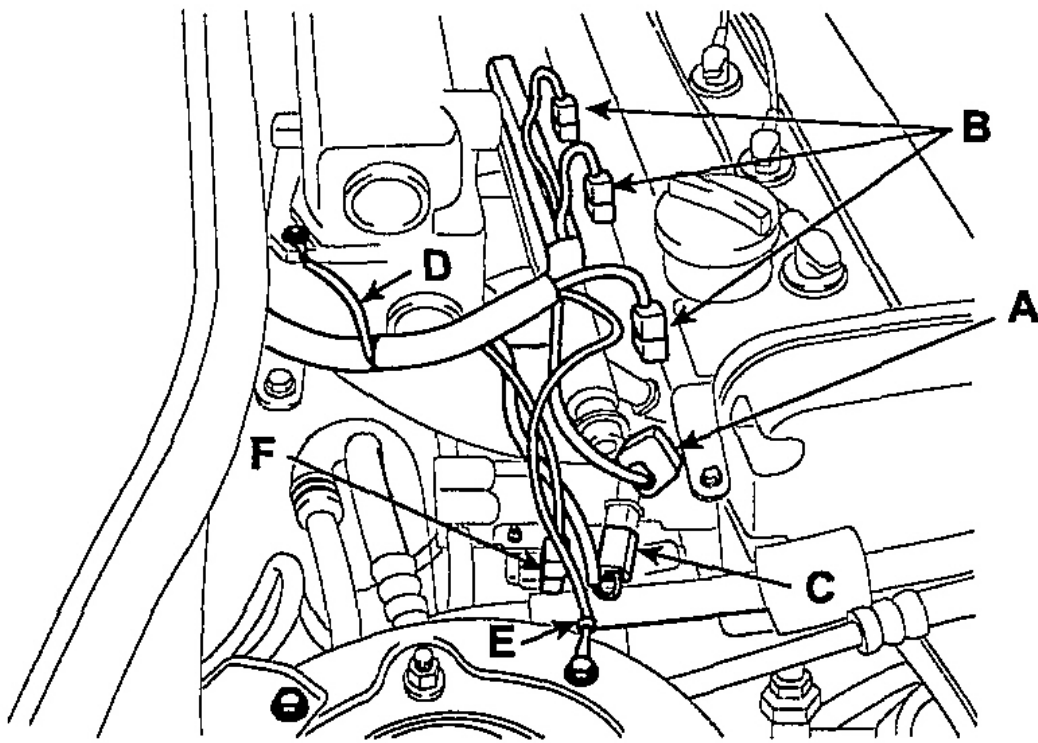
- e. Disconnect the TPS (Throttle Position Sensor) connector (A).
- f. Disconnect the ISA (Idle Speed Actuator) connector (B).



G00719025

**Fig. 91: Disconnecting TPS & ISA Connectors**  
Courtesy of KIA MOTORS AMERICA, INC.

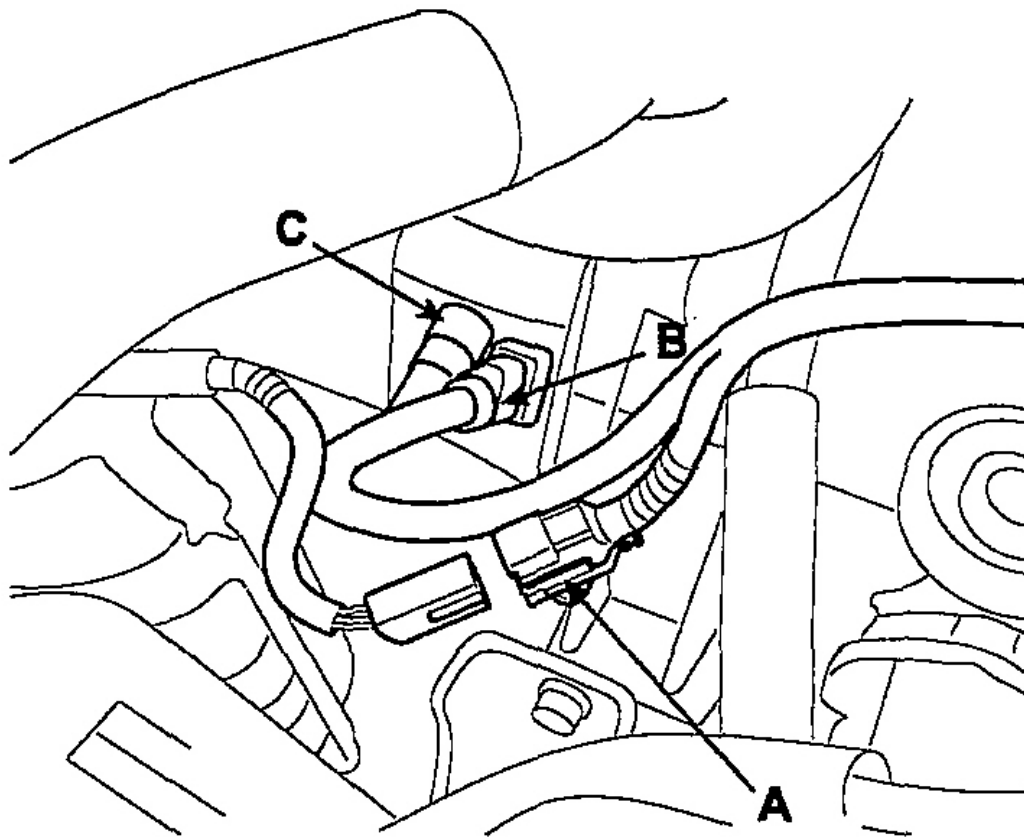
- g. Disconnect the CMP (Camshaft Position Sensor) connector (A).
- h. Disconnect the four injector connectors (B).
- i. Disconnect the knock sensor connector (C).
- j. Disconnect the ground cables (D, E) from the intake manifold and vehicle's body.
- k. Disconnect the air conditioner compressor switch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



G00719026

**Fig. 92: Disconnecting Engine Sensor Connectors & Ground Cables**  
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).

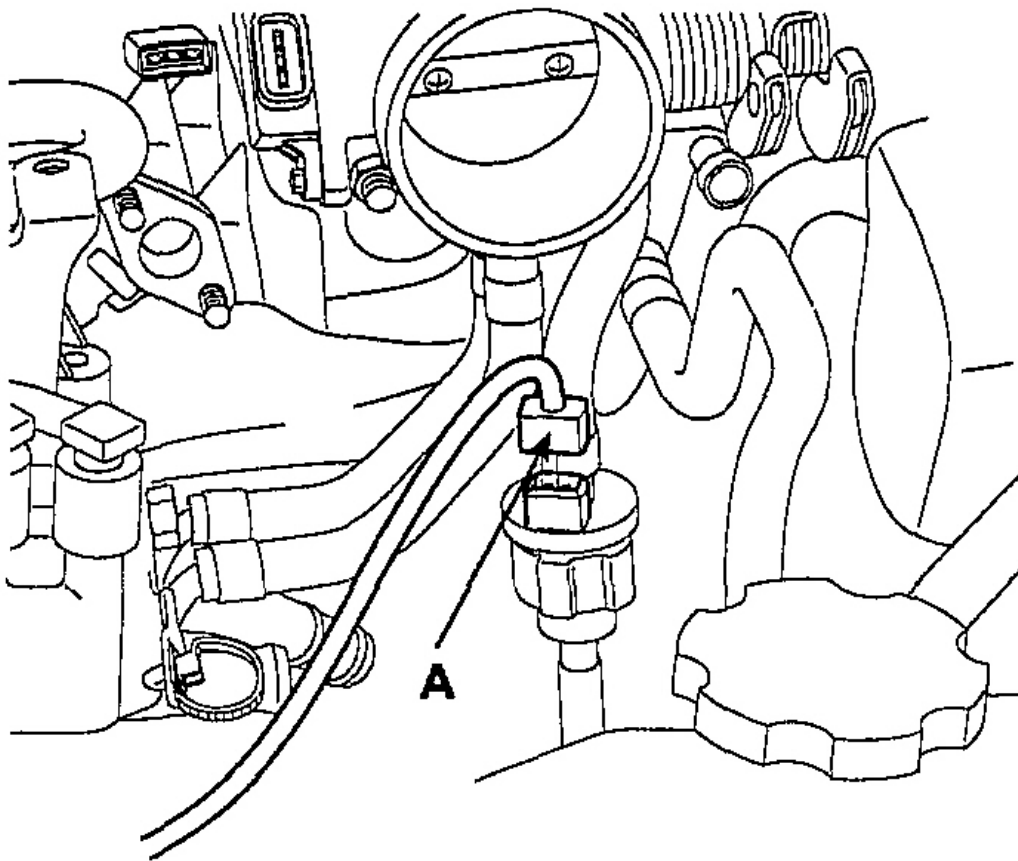


G00719027

**Fig. 93: Disconnecting Oil Pressure Switch Connector**  
Courtesy of KIA MOTORS AMERICA, INC.

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

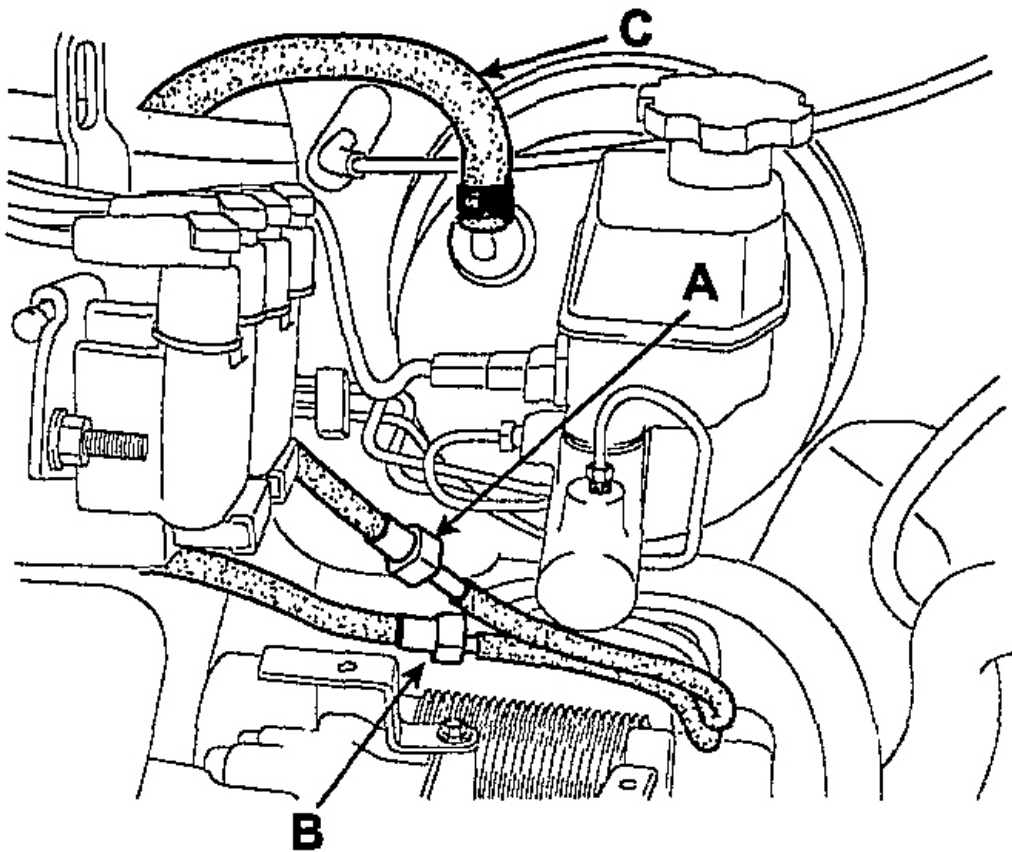




G00719028

**Fig. 94: Disconnecting the PCSV**  
Courtesy of KIA MOTORS AMERICA, INC.

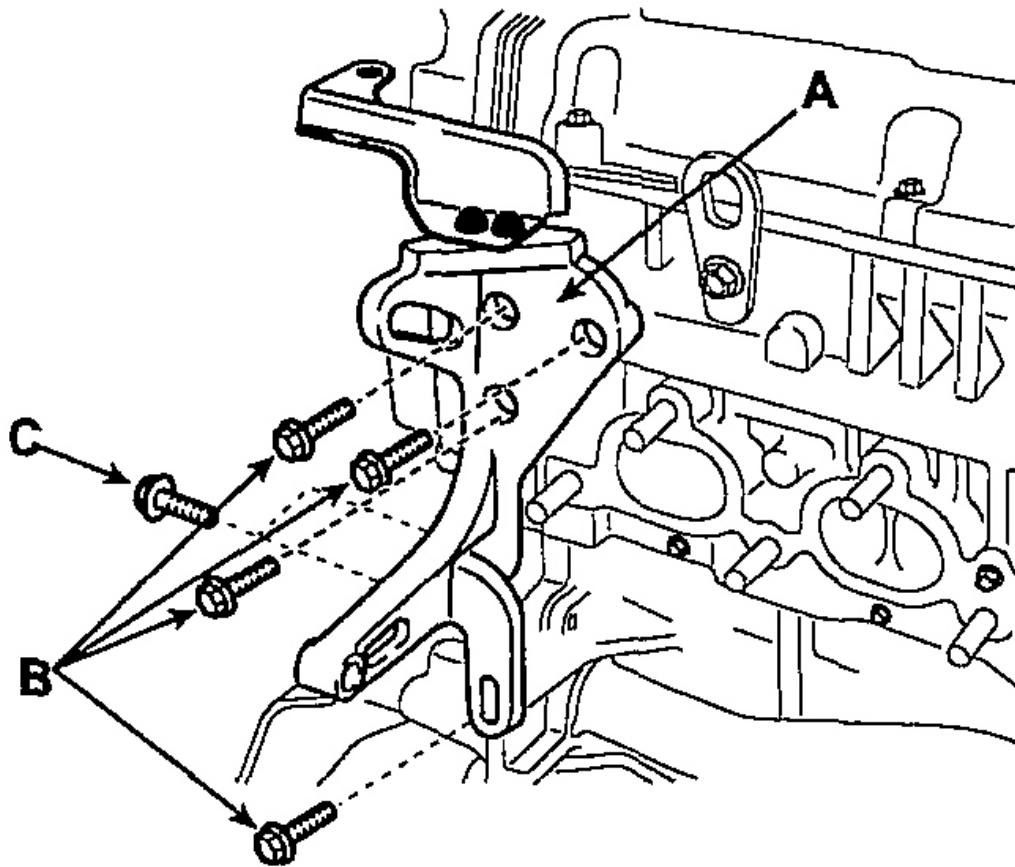
9. Disconnect the fuel inlet hose (A) of the delivery pipe side.
10. Disconnect the hose (B) of the PCSV (Purge Control Solenoid Valve) side.
11. Remove the brake booster vacuum hose (C).



G00719029

**Fig. 95: Disconnecting Fuel & Vacuum Hoses**  
Courtesy of KIA MOTORS AMERICA, INC.

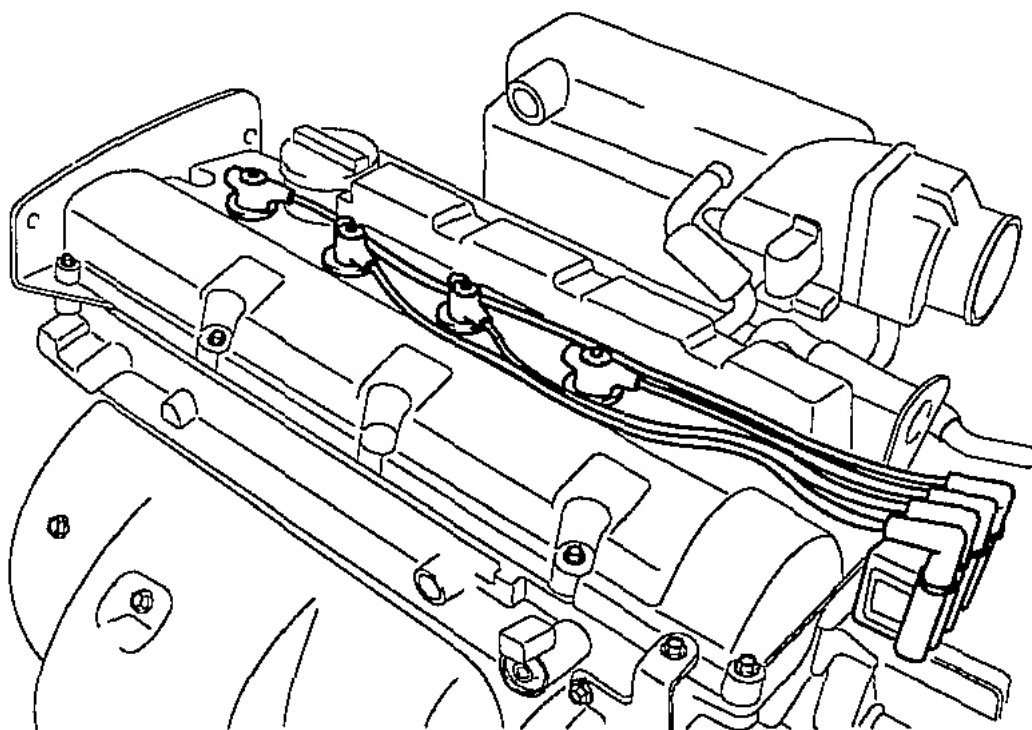
12. Remove the power steering pump drive belt.
13. Remove the power steering pump and fix the pump to vehicle with a wire.
14. Remove the bolts (B, C) and power steering pump bracket (A).



G00719030

**Fig. 96: Removing Power Steering Pump & Bracket**  
 Courtesy of KIA MOTORS AMERICA, INC.

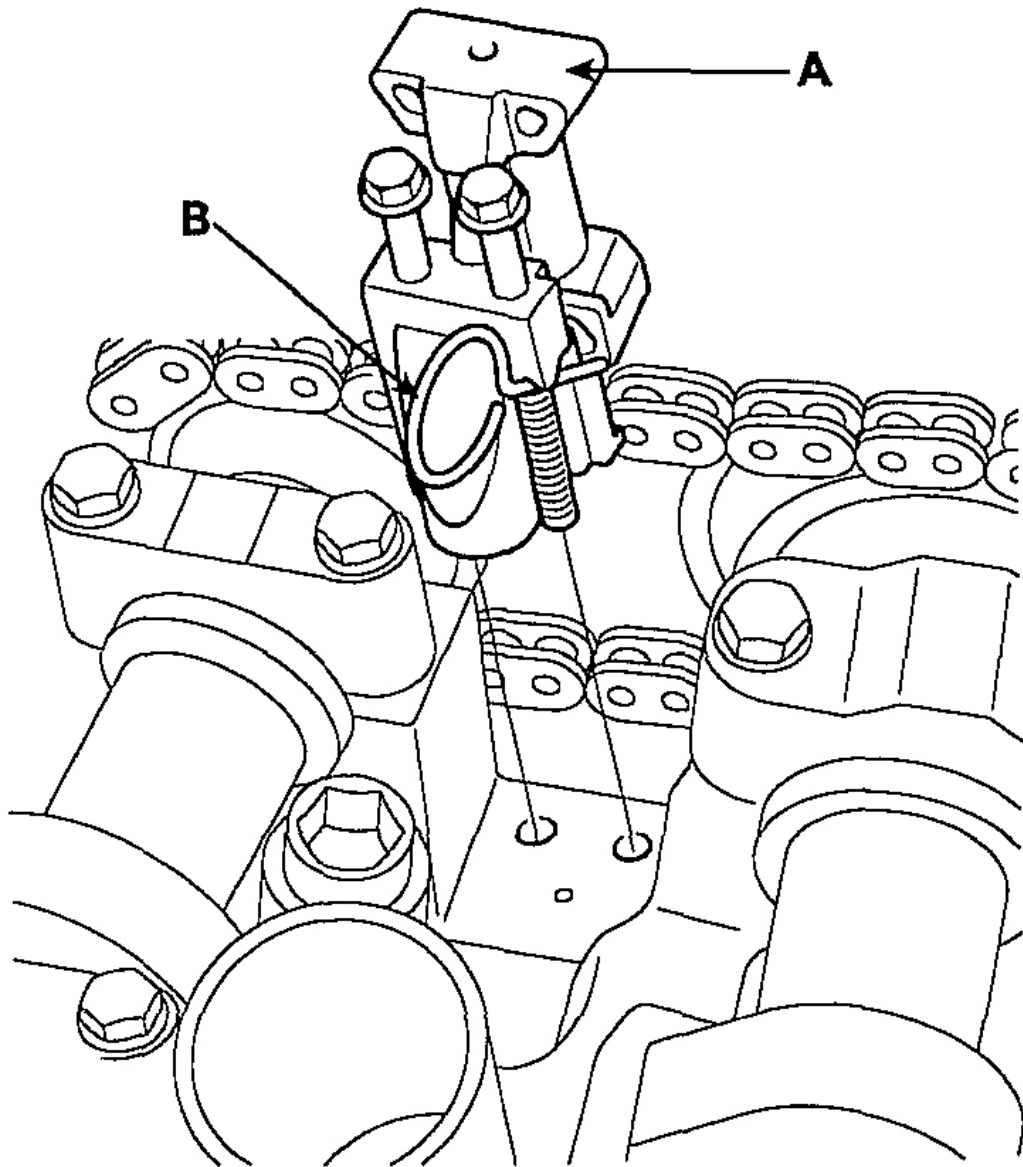
15. Remove the spark plug cables.



G00719031

**Fig. 97: Removing Spark Plug Cables**  
Courtesy of KIA MOTORS AMERICA, INC.

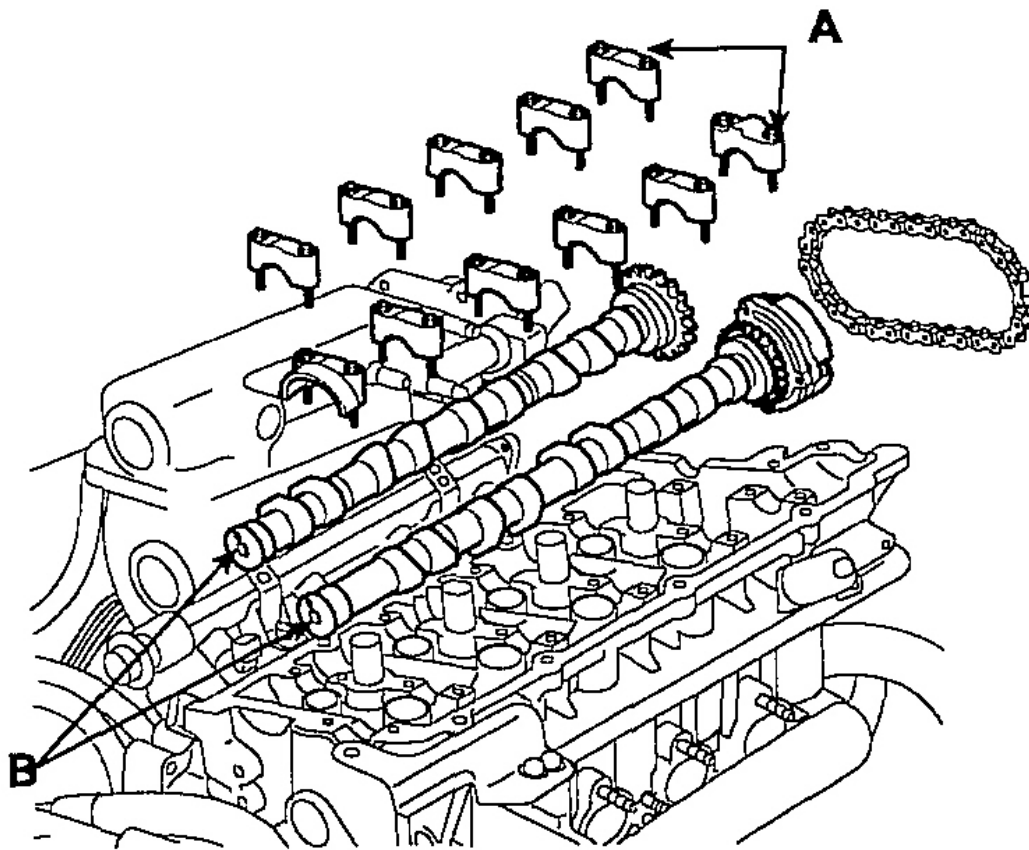
16. Remove the exhaust manifold. See **EXHAUST MANIFOLD**.
17. Remove the intake manifold. See **INTAKE MANIFOLD**.
18. Remove the timing belt. See **TIMING BELT**.
19. Remove the PCV (Positive Crankcase Ventilation) hose.
20. Remove the cylinder head cover. See **TIMING BELT**.
21. Remove the camshaft sprocket. See **TIMING BELT**.
22. Insert a stopper pin or other device into timing chain auto tensioner and remove the auto tensioner.



G00719032

**Fig. 98: Removing Auto Tensioner**  
Courtesy of KIA MOTORS AMERICA, INC.

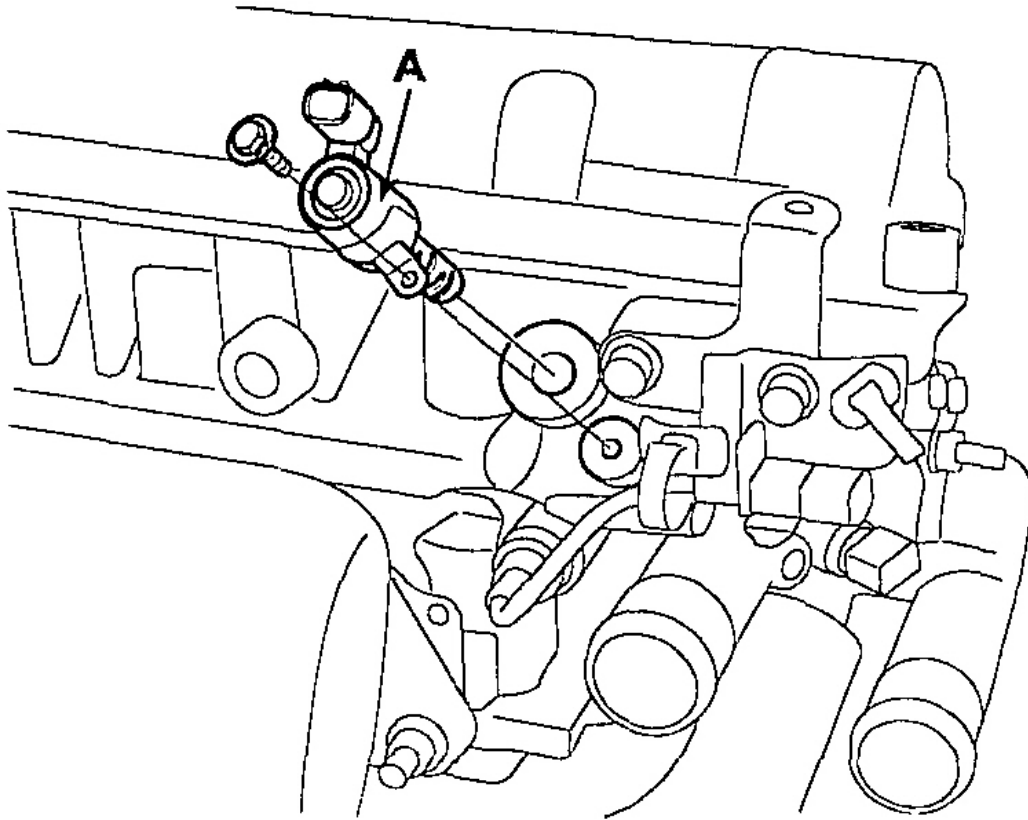
23. Remove the camshaft bearing caps (A) and camshafts (B).



G00719033

**Fig. 99: Removing Camshaft Bearing Caps**  
Courtesy of KIA MOTORS AMERICA, INC.

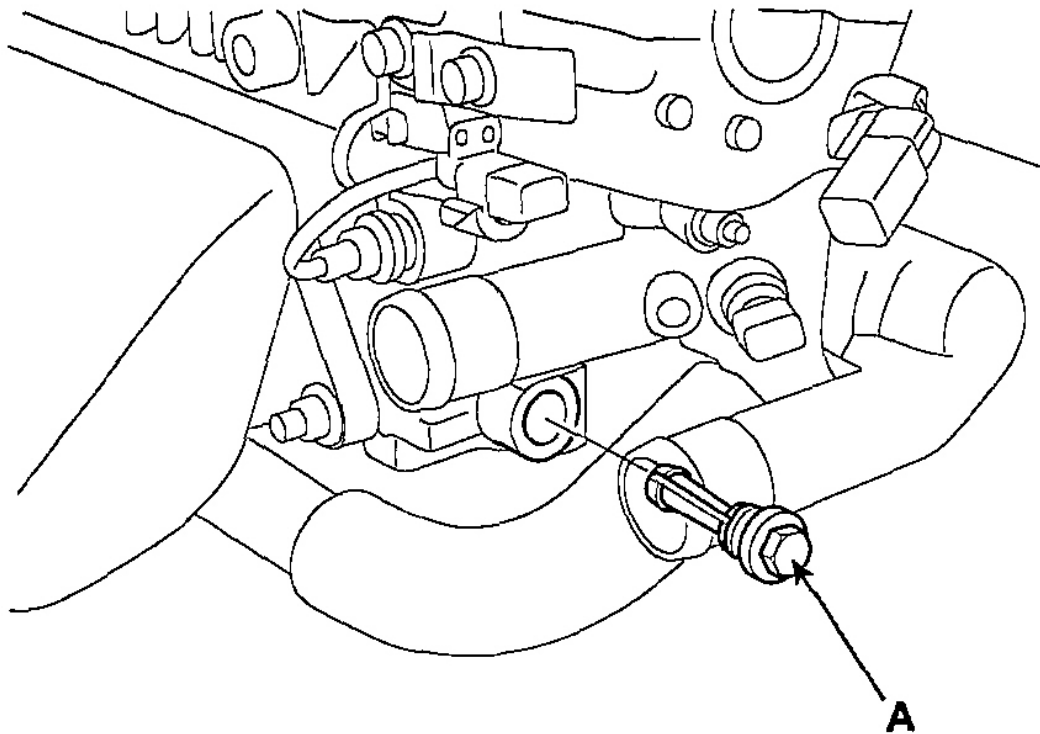
24. Remove the OCV (Oil Control Valve) (A).



G00719034

**Fig. 100: Removing Oil Control Valve**  
Courtesy of KIA MOTORS AMERICA, INC.

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

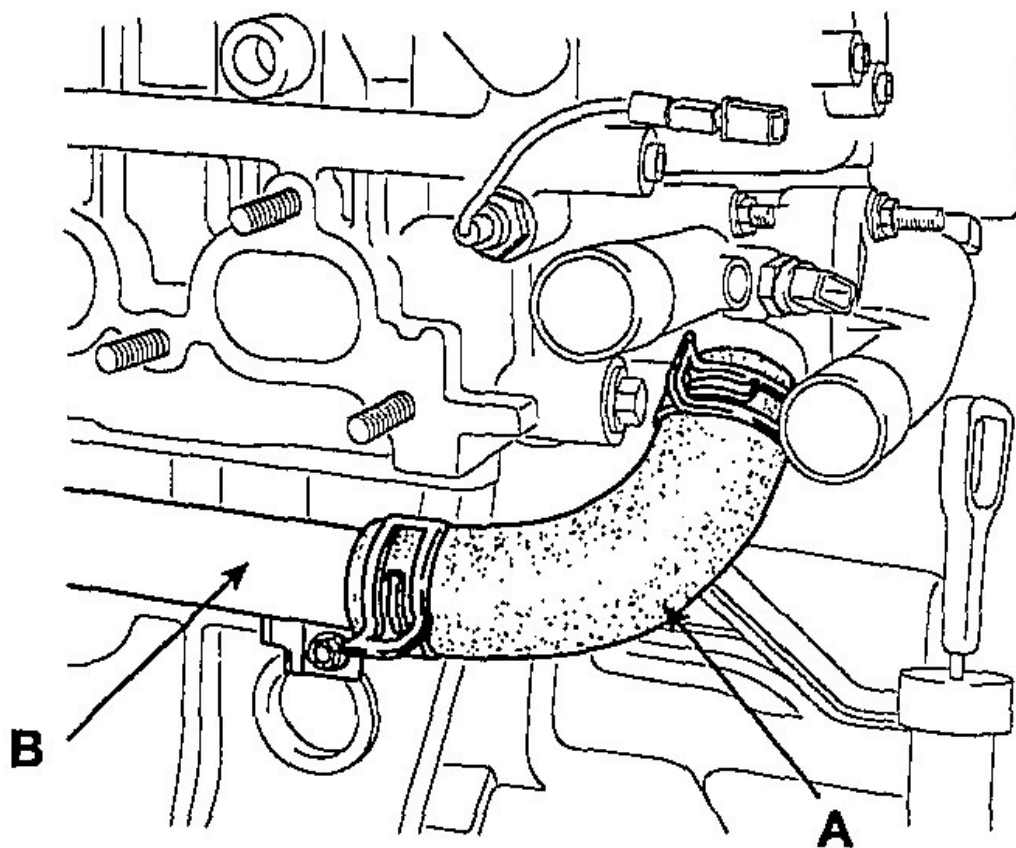


G00719035

**Fig. 101: Removing Oil Control Valve Filter**  
Courtesy of KIA MOTORS AMERICA, INC.

26. Remove the water hose (A) from water pipe (B).





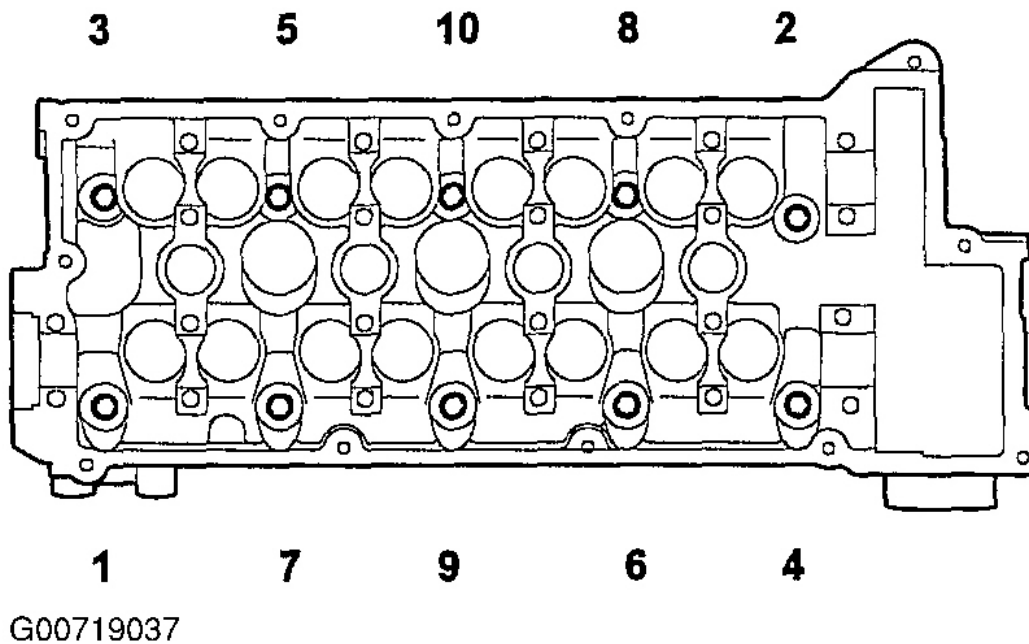
G00719036

**Fig. 102: Removing Water Hose**

Courtesy of KIA MOTORS AMERICA, INC.

27. 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. 103: Cylinder Head Bolt Removal Sequence**

Courtesy of KIA MOTORS AMERICA, INC.

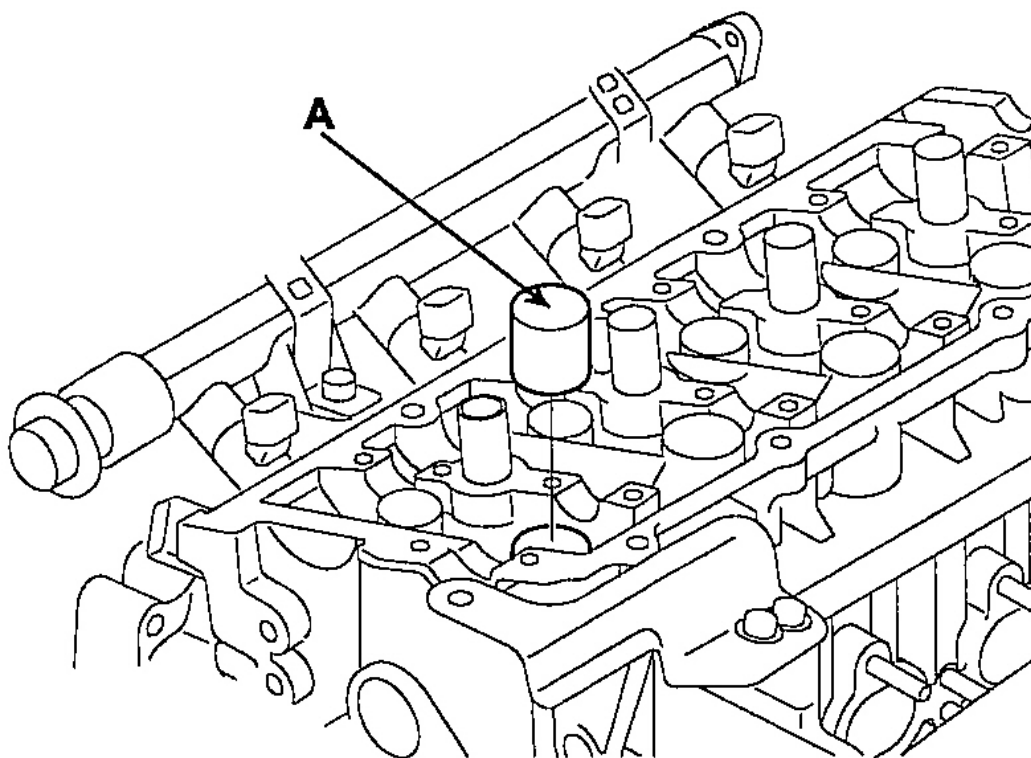
- Using 8 mm and 10 mm hexagon wrench, uniformly loosen and remove the 10 cylinder head bolts, in several passes, in the sequence shown in illustration. Remove the 10 cylinder head bolts and plate washers.
- Lift the cylinder head from the dowels on the cylinder block and place the cylinder head on wooden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

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

## DISASSEMBLY

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

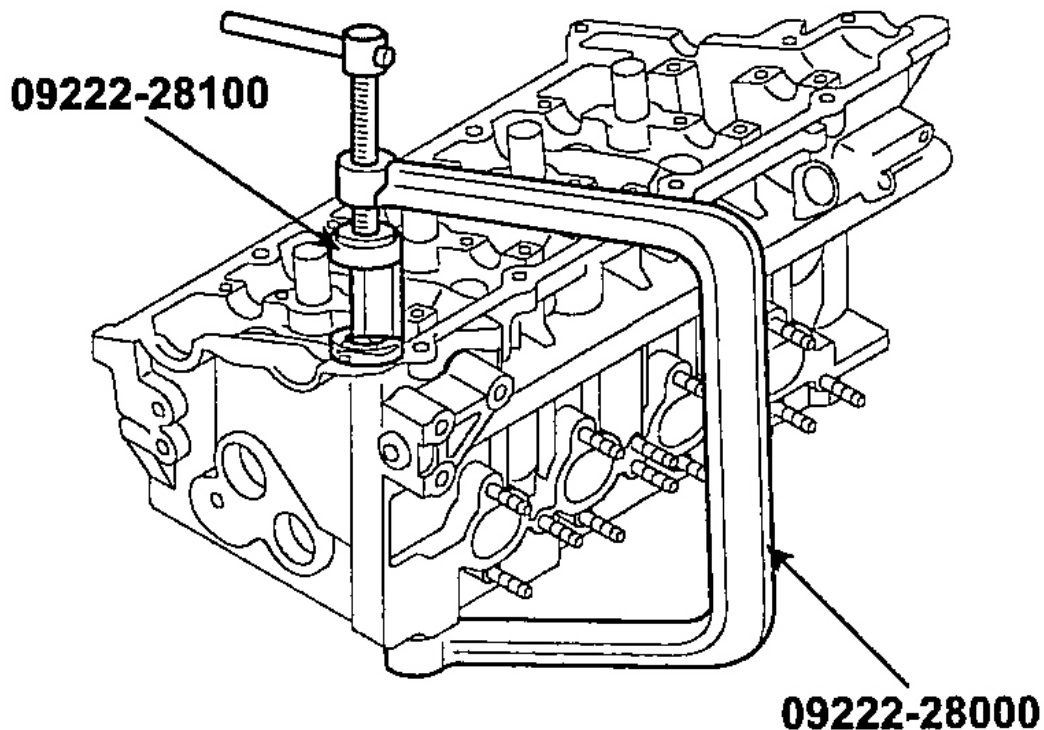
- Remove the MLA's (A).



G00719038

**Fig. 104: Removing Mechanical Lash Adjusters**  
**Courtesy of KIA MOTORS AMERICA, INC.**

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



G00719039

**Fig. 105: Compressing Valve Springs & Removing Retainers Locks**  
Courtesy of KIA MOTORS AMERICA, INC.

- b. Remove the spring retainer.
- c. Remove the valve spring.
- d. Remove the valve.
- e. Using a needle-nose pliers, remove the oil seal.
- f. 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**

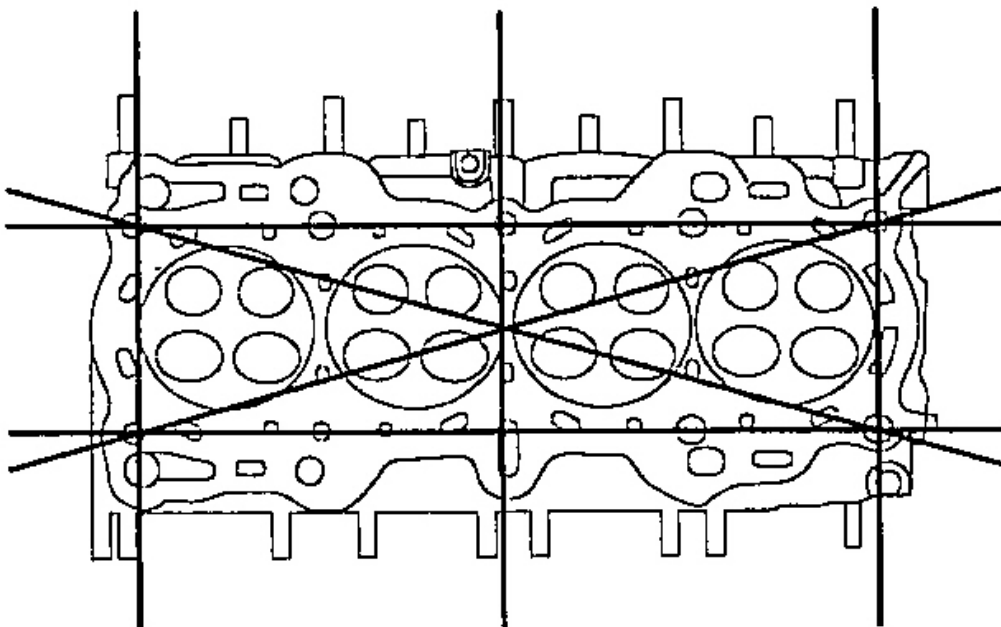
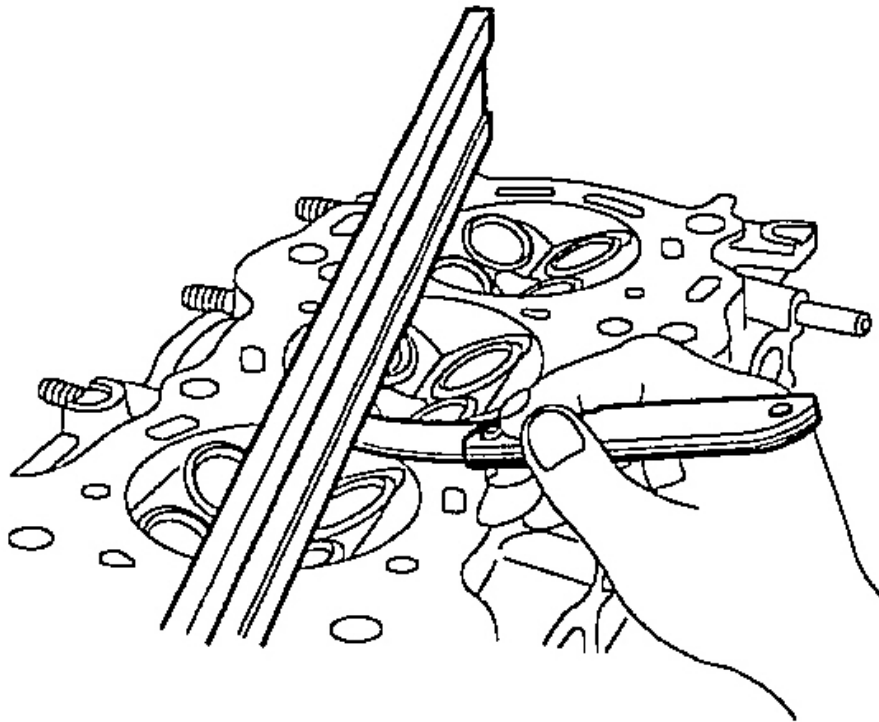
Standard: Less than 0.03 mm (0.0012 in)

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

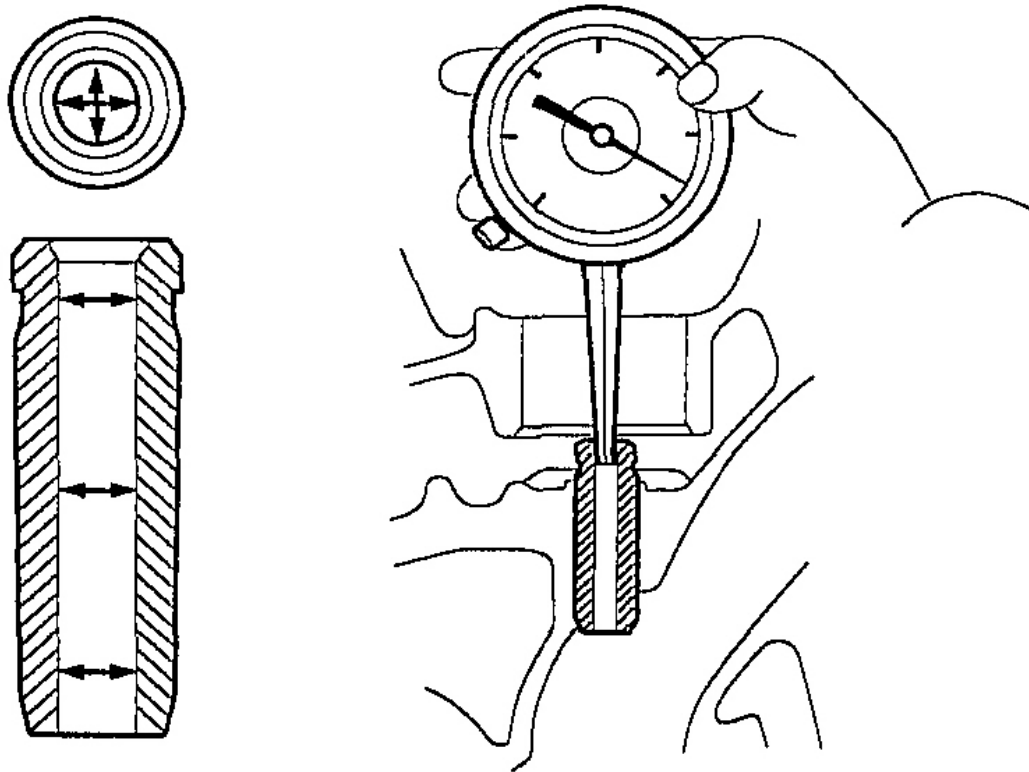
**Fig. 106: Measuring Cylinder Head Flatness**  
Courtesy of KIA MOTORS AMERICA, INC.

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

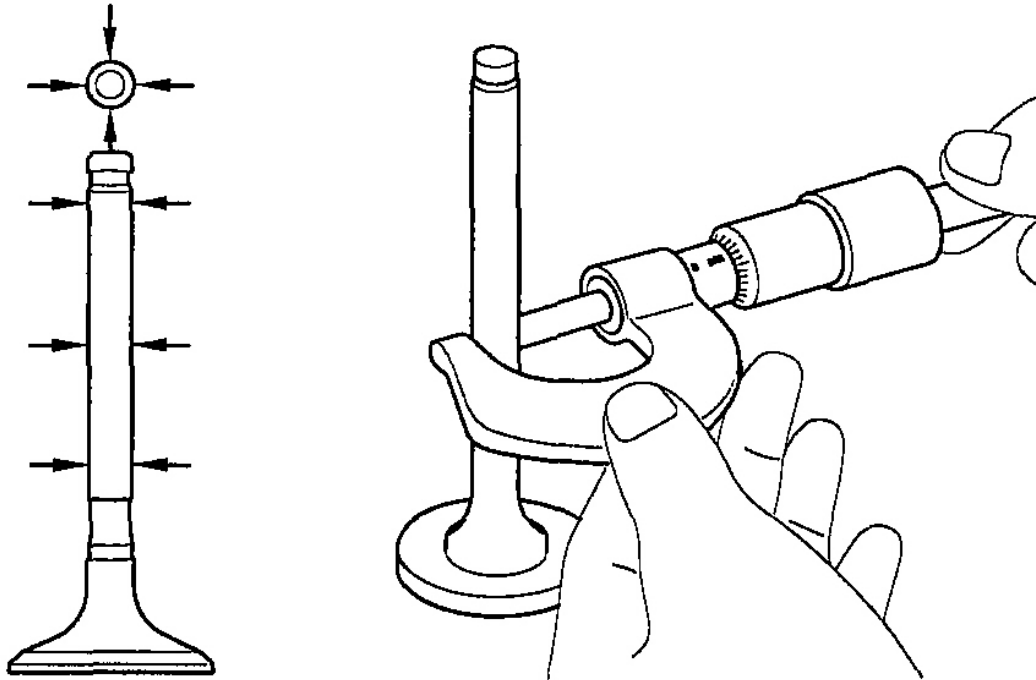
**Fig. 107: Measuring Valve Guide Clearance**  
Courtesy of KIA MOTORS AMERICA, INC.

- 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. 108: 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**

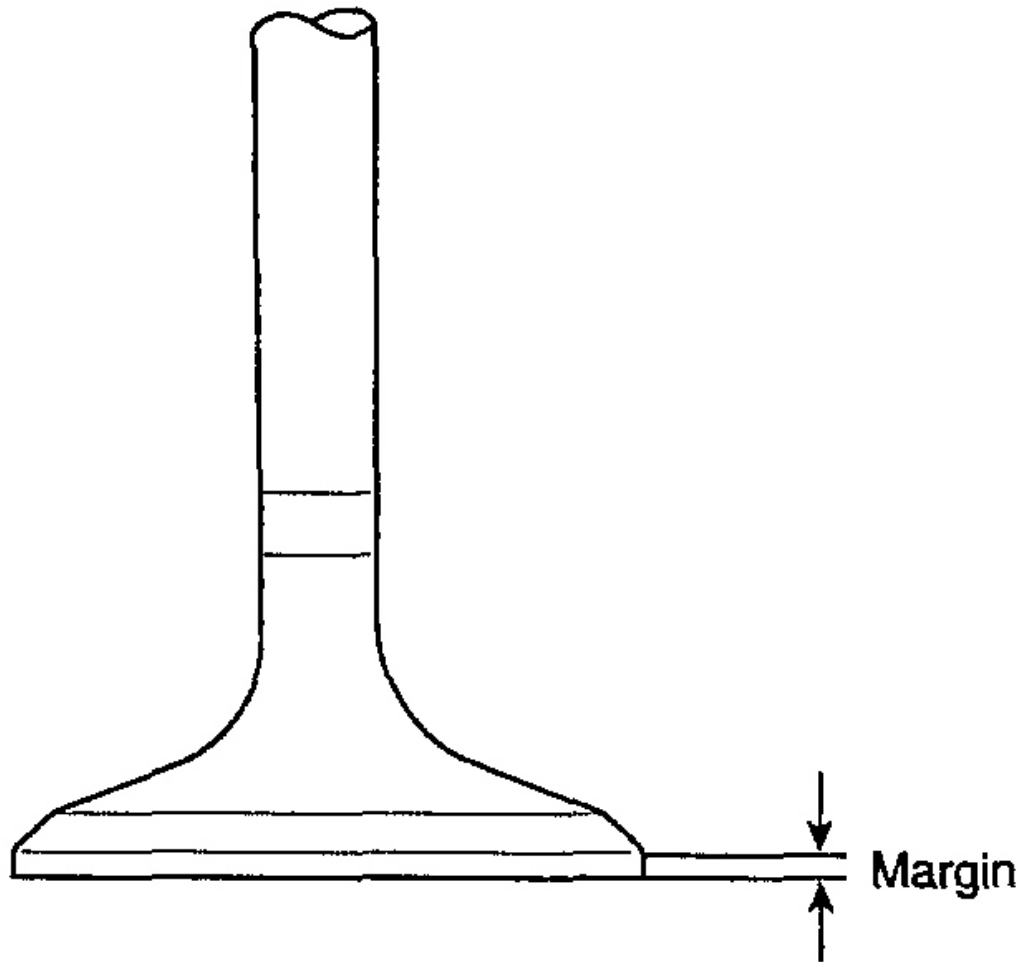
Intake: 1.15 mm (0.0453 in)

Exhaust: 1.35 mm (0.0531 in)

**Limit**

Intake: 0.8 mm (0.0315 in)

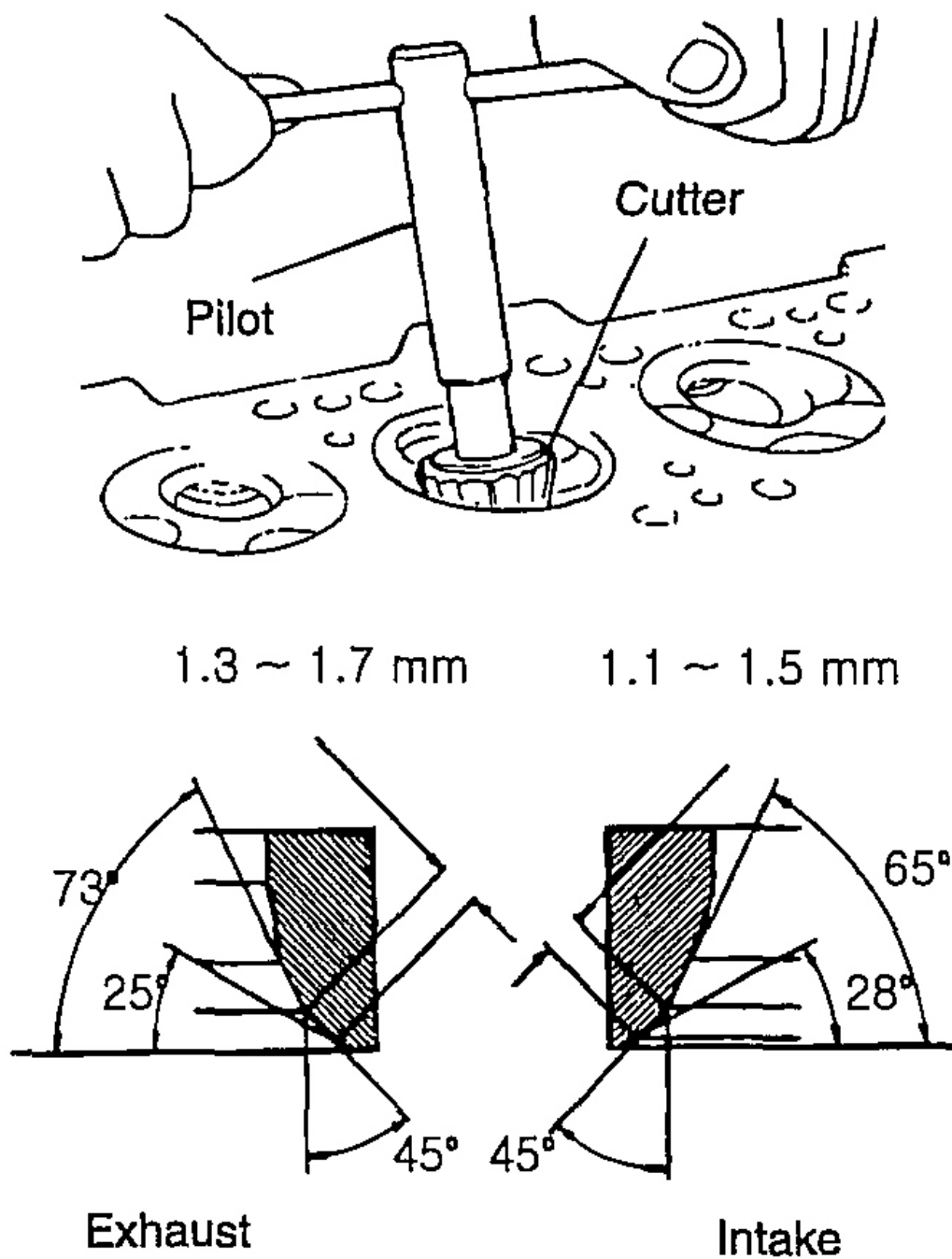
Exhaust: 1.0 mm (0.0394 in)



G00719043

**Fig. 109: 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. 110: 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.

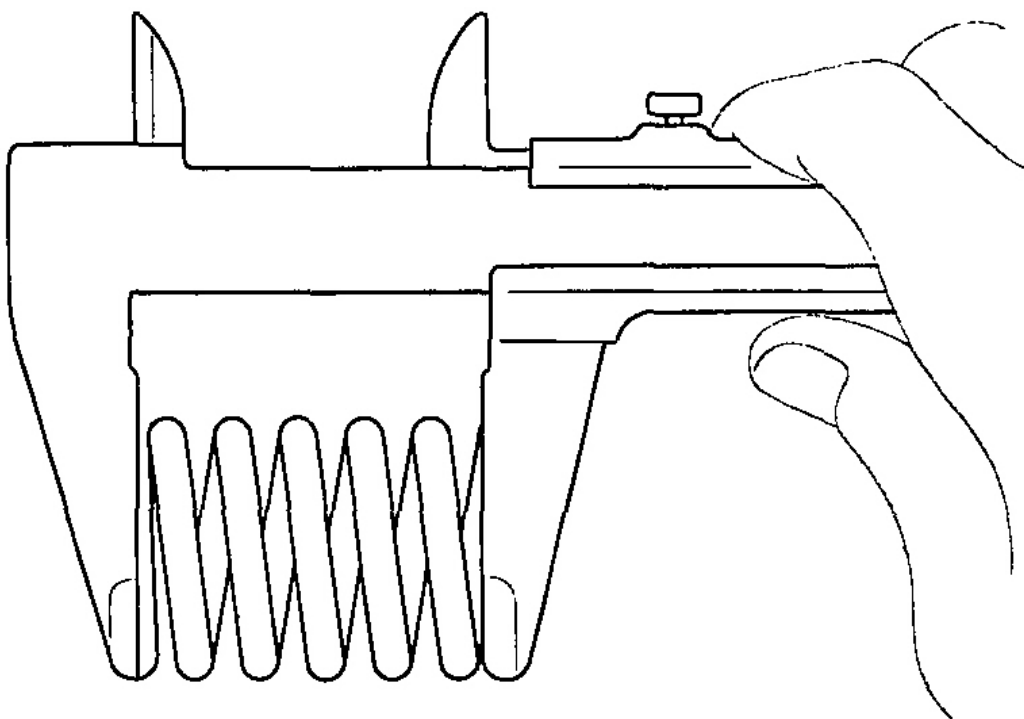
**Valve spring standard**

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. 111: Measuring Valve Springs**  
**Courtesy of KIA MOTORS AMERICA, INC.**

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

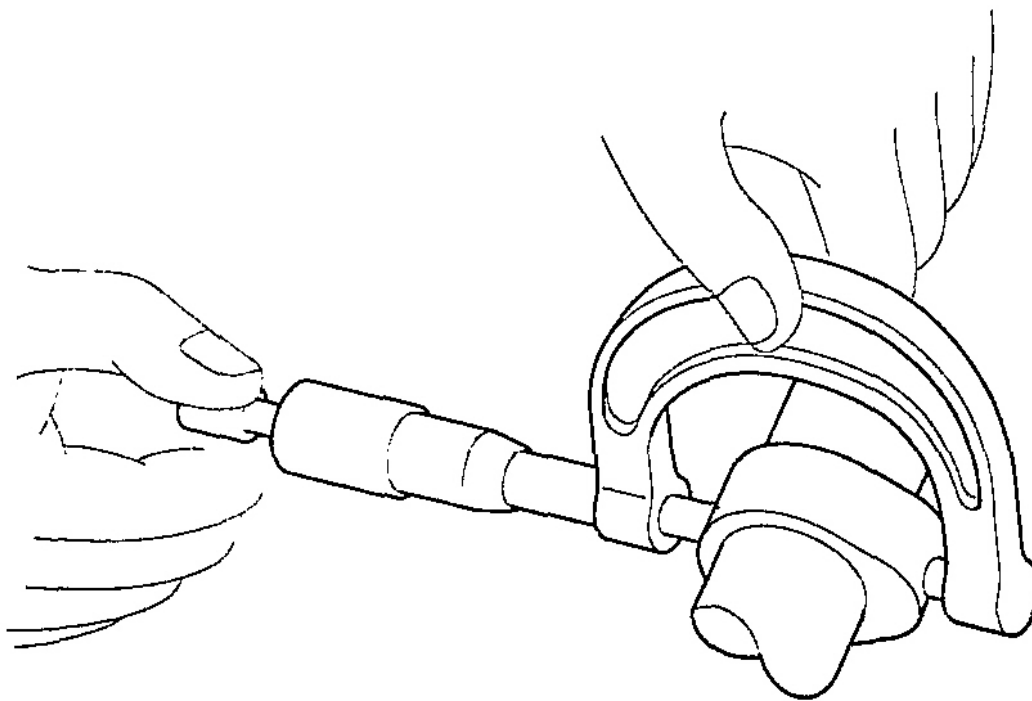
**CAMSHAFT**

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)



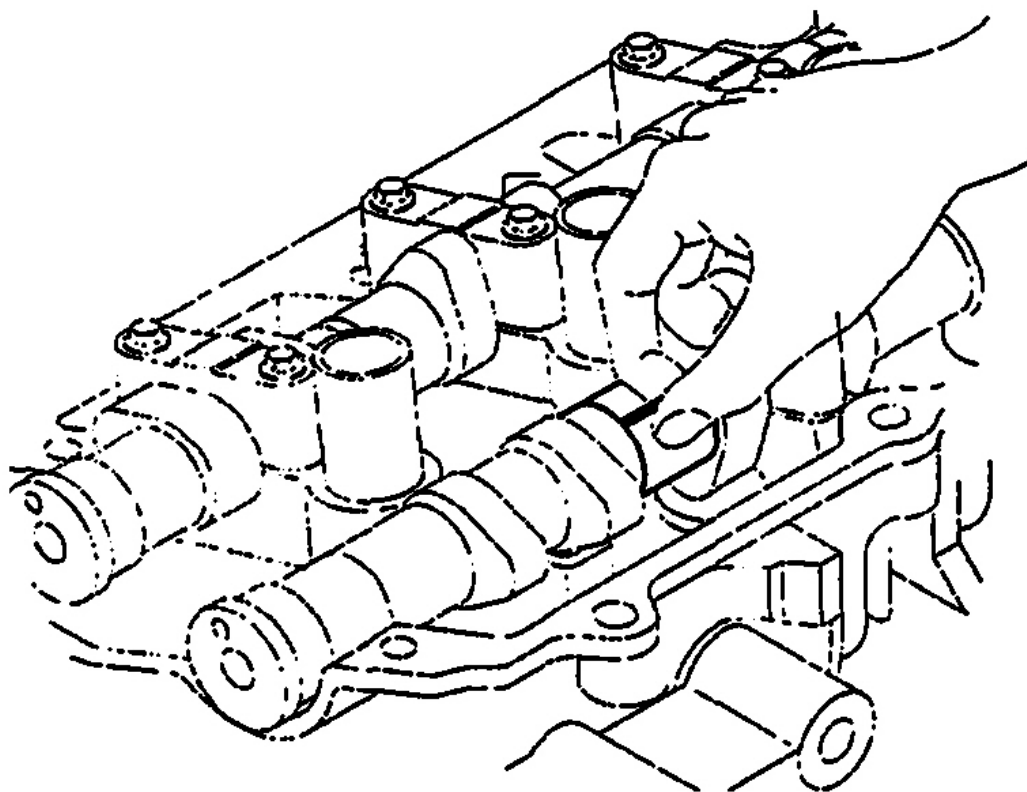
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**Fig. 112: Measuring Cam Lobe**

**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. 113: Applying Plastigage**  
Courtesy of KIA MOTORS AMERICA, INC.

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

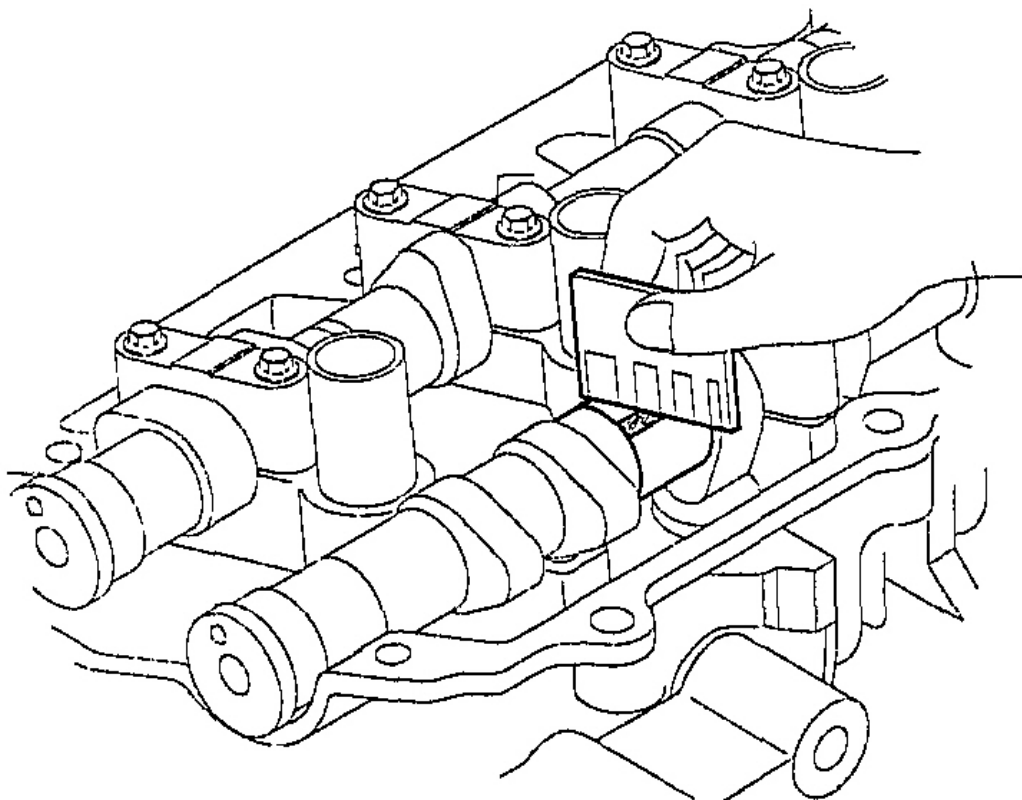
**CAUTION: Do not turn the camshaft.**

- 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)



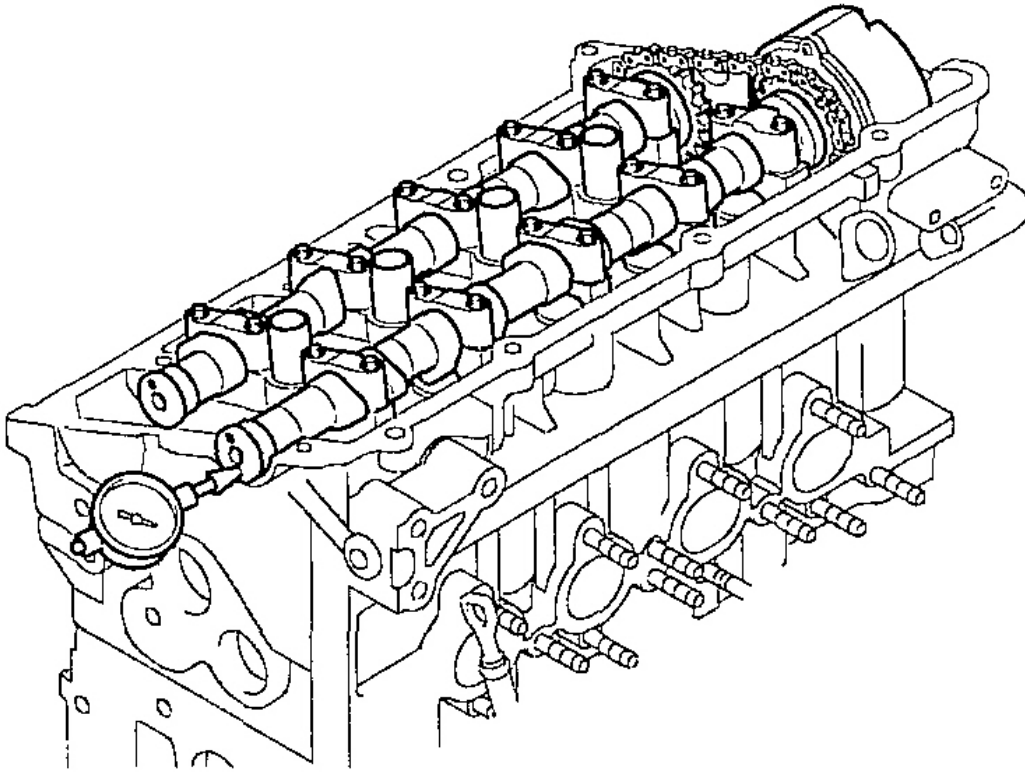
G00719048

**Fig. 114: 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. 115: Measuring Camshaft End Play**  
**Courtesy of KIA MOTORS AMERICA, INC.**

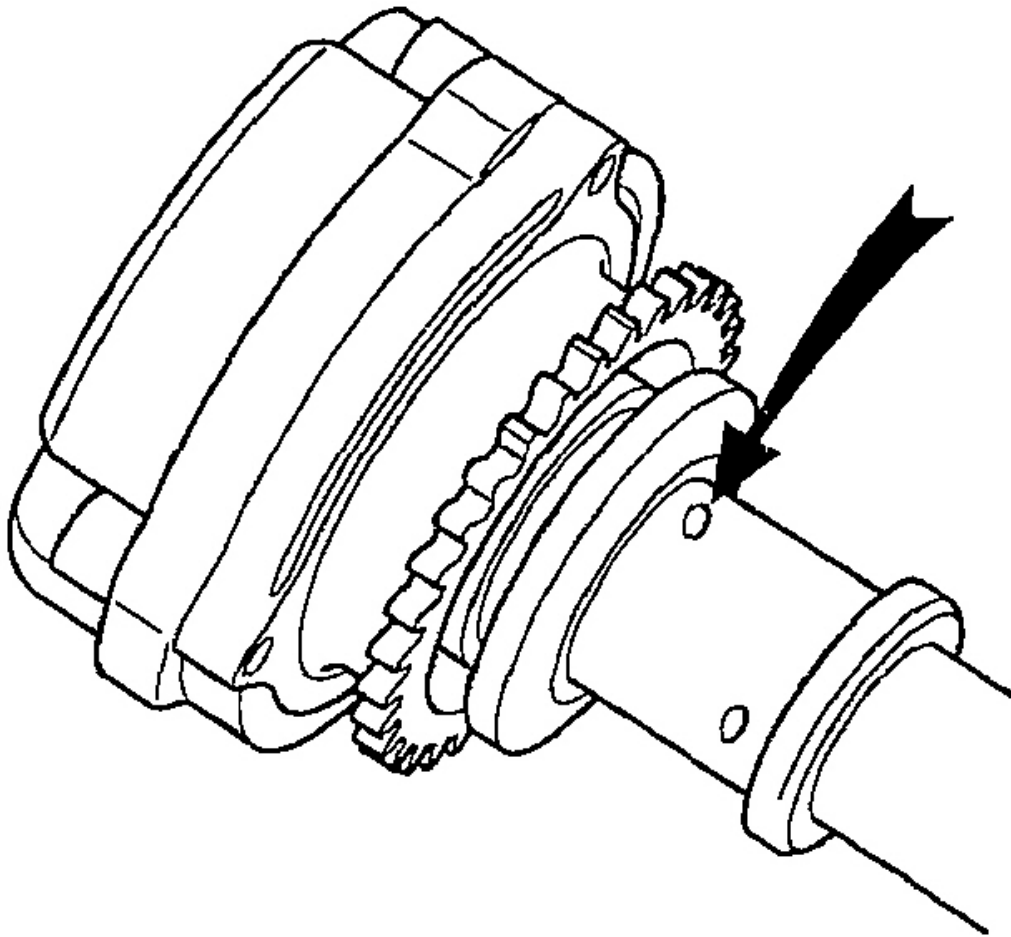
If the end play is greater than maximum, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.

- 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.





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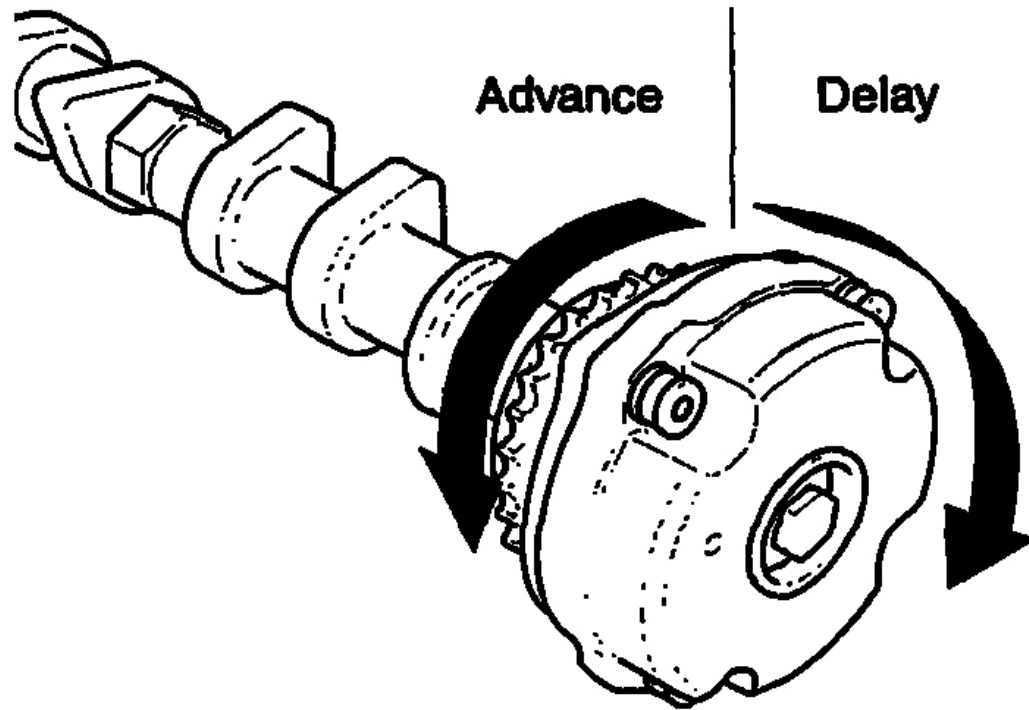
**Fig. 116: Vinyl Tape Application**  
Courtesy of KIA MOTORS AMERICA, INC.

- c. To release the CVVT lock pin, wrap some tape around the tip of an air pressure adapter and apply low air pressure (about 14 psi) to the exposed camshaft port.

**NOTE:**        **Wrap a shop towel or rag around the CVVT because residual oil may leak out of the unit when applying air pressure.**

- d. With low air pressure applied, turn the CVVT to the ADVANCE direction as indicated in the illustration.
- With the low air pressure applied, the CVVT should turn to the ADVANCE side.

- If too much air leaks when applying the low air pressure, the CVVT lock pin may not release and the CVVT may not turn.



G00719051

**Fig. 117: Illustrating CVVT Turning Direction**  
Courtesy of KIA MOTORS AMERICA, INC.

- e. Allow the CVVT assembly to move in the ADVANCE and DELAY directions to ensure there is no binding and that it moves freely.

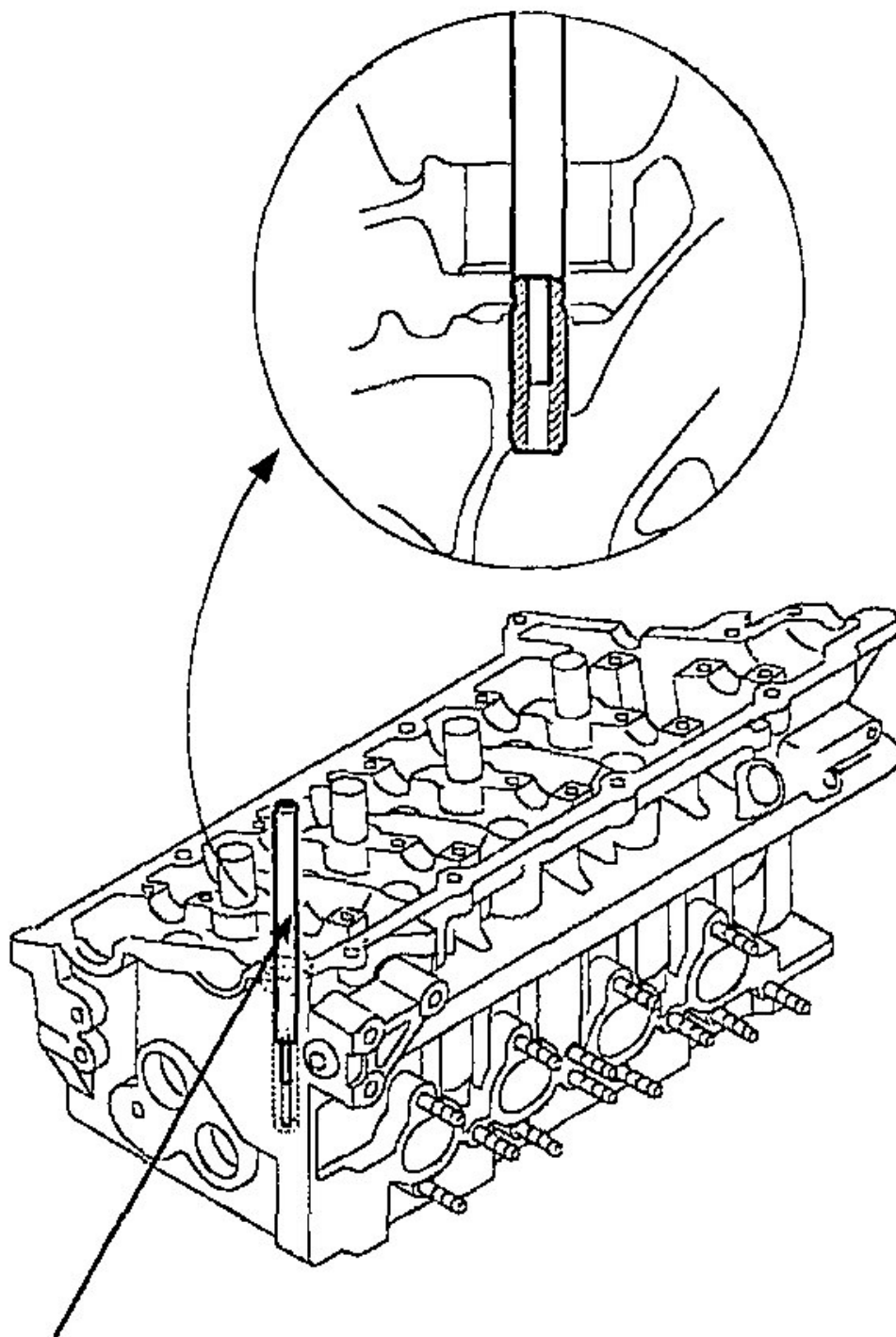
Standard: Movable smoothly in the range about 20°

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

## REPAIR

### VALVE GUIDE

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



**09221-3F100A**

G00719052

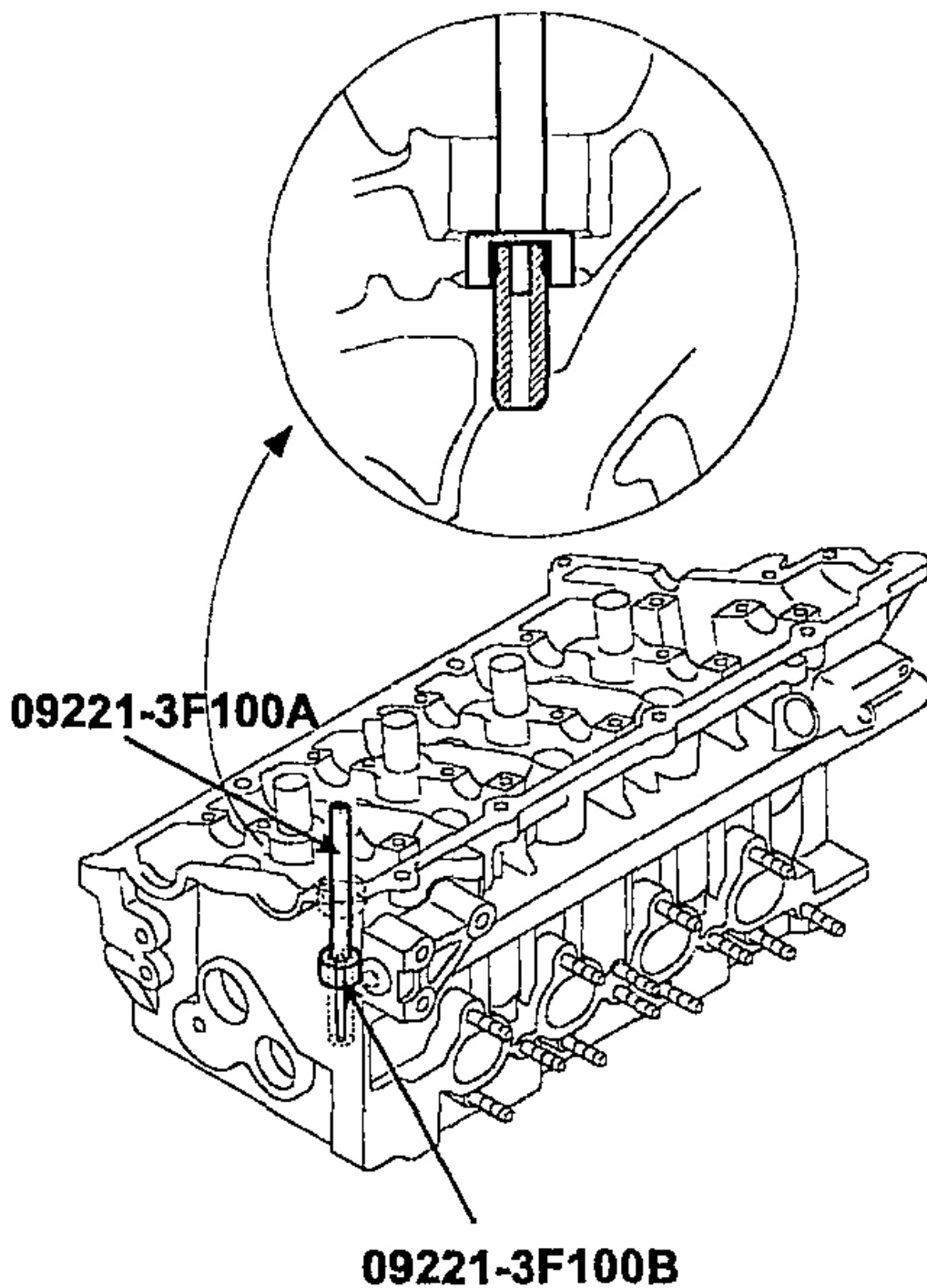
**Fig. 118: Removing Valve Guide****Courtesy of KIA MOTORS AMERICA, INC.**

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.

**Valve guide length**

Intake: 45.8-46.2 mm (1.8031-1.8189 in)

Exhaust: 54.3-54.7 mm (2.1378-2.1535 in)



G00719053

**Fig. 119: 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.

**VALVE GUIDE OVERSIZE**

| Item           | Oversize<br>[mm (in)] | Size<br>mark | Valve guide hole inner<br>diameter [mm (in)] | Valve guide outer diameter<br>[mm (in)] | Valve guide<br>protrusion height<br>[mm (in)] |
|----------------|-----------------------|--------------|----------------------------------------------|-----------------------------------------|-----------------------------------------------|
| Valve<br>guide | STD                   | -            | 11.000 ~ 11.018<br>(0.4331 ~ 0.4338)         | 11.040 ~ 11.050<br>(0.4346 ~ 0.4350)    | 14.000 (0.5512)                               |
|                | 0.05 (0.002) OS       | 5            | 11.050 ~ 11.068<br>(0.4350 ~ 0.4357)         | 11.090 ~ 11.100<br>(0.4366 ~ 0.4370)    |                                               |
|                | 0.25 (0.010) OS       | 25           | 11.250 ~ 11.268<br>(0.4429 ~ 0.4436)         | 11.290 ~ 11.300<br>(0.4445 ~ 0.4449)    |                                               |
|                | 0.50 (0.020) OS       | 50           | 11.500 ~ 11.518<br>(0.4528 ~ 0.4535)         | 11.540 ~ 11.550<br>(0.4543 ~ 0.4547)    |                                               |

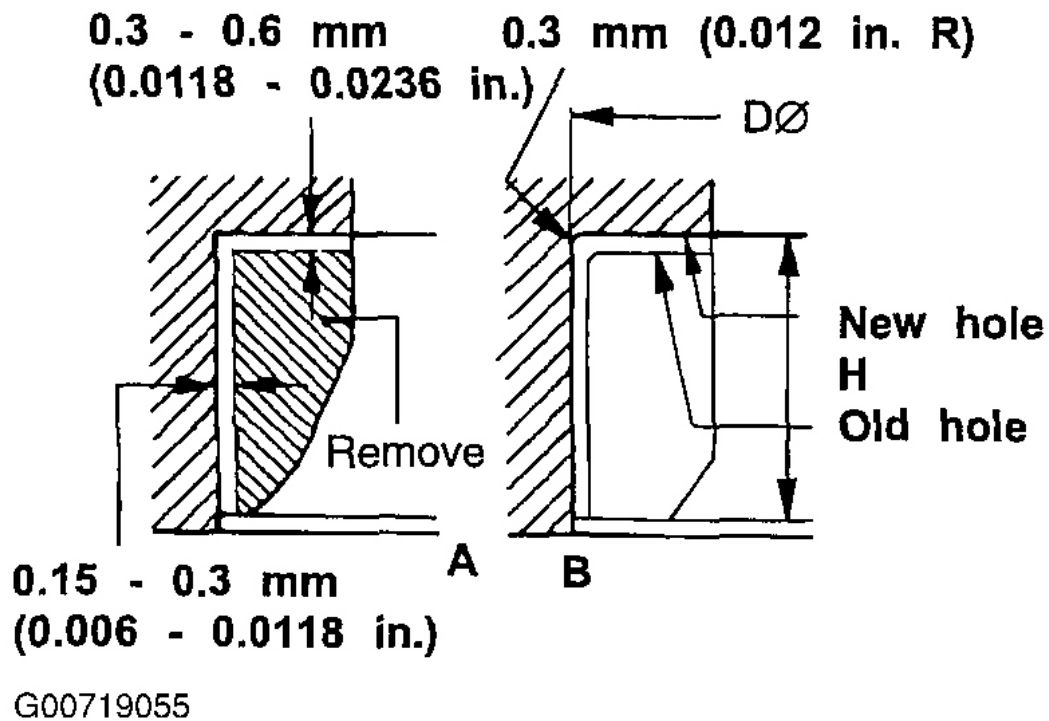
G00719054

**Fig. 120: Valve Guide Oversize Chart**

Courtesy of KIA MOTORS AMERICA, INC.

**VALVE SEAT RING**

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



**Fig. 121: Valve Seat Ring Cut Away Diagram**  
 Courtesy of KIA MOTORS AMERICA, INC.

2. Enlarge the seat ring hole of cylinder head so that matches the specified cylinder head hole inner diameter of new valve seat ring.
3. Heat the cylinder head to about 250°C (480°F) and press-fit an oversize seat ring for the cylinder head hole size.
4. Using lapping compound, lap the valve to the new seat.

#### VALVE SEAT RING OVERSIZE

## 2008 Kia Spectra EX

### 2008 ENGINES Engine Mechanical - Spectra & Spectra5

| Item                          | Over size<br>mm(in.) | Size<br>mark | Seat ring hole inner<br>diameter [mm(in)] | Seat ring outer diameter<br>[mm(in)] | Seat ring height<br>[mm(in)]       |
|-------------------------------|----------------------|--------------|-------------------------------------------|--------------------------------------|------------------------------------|
| Intake<br>valve<br>seat ring  | STD                  | -            | 33.000 ~ 33.025<br>(1.2992 ~ 1.3002)      | 33.090 ~ 33.105<br>(1.3028 ~ 1.3033) | 7.200 ~ 7.400<br>(0.2835 ~ 0.2913) |
|                               | 0.3(0.012)<br>OS     | 30           | 33.300 ~ 33.325<br>(1.3110 ~ 1.3120)      | 33.390 ~ 33.405<br>(1.3146 ~ 1.3152) | 7.500 ~ 7.700<br>(0.2953 ~ 0.3031) |
|                               | 0.6(0.024)<br>OS     | 60           | 33.600 ~ 33.625<br>(1.3228 ~ 1.3238)      | 33.690 ~ 33.705<br>(1.3264 ~ 1.3270) | 7.800 ~ 8.000<br>(0.3071 ~ 0.3150) |
| Exhaust<br>valve<br>seat ring | STD                  | -            | 28.500 ~ 28.521<br>(1.1220 ~ 1.1229)      | 28.590 ~ 28.605<br>(1.1256 ~ 1.1262) | 7.600 ~ 7.800<br>(0.3110 ~ 0.3189) |
|                               | 0.3(0.012)<br>OS     | 30           | 28.800 ~ 28.821<br>(1.1339 ~ 1.1347)      | 28.890 ~ 28.905<br>(1.1374 ~ 1.1380) | 7.900 ~ 8.100<br>(0.3110 ~ 0.3189) |
|                               | 0.6(0.024)<br>OS     | 60           | 29.100 ~ 29.121<br>(1.1457 ~ 1.1465)      | 29.190 ~ 29.205<br>(1.1492 ~ 1.1498) | 8.200 ~ 8.400<br>(0.3228 ~ 0.3307) |

G00719056

**Fig. 122: Valve Seat Ring Oversize Chart**  
Courtesy of KIA MOTORS AMERICA, INC.

#### 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.

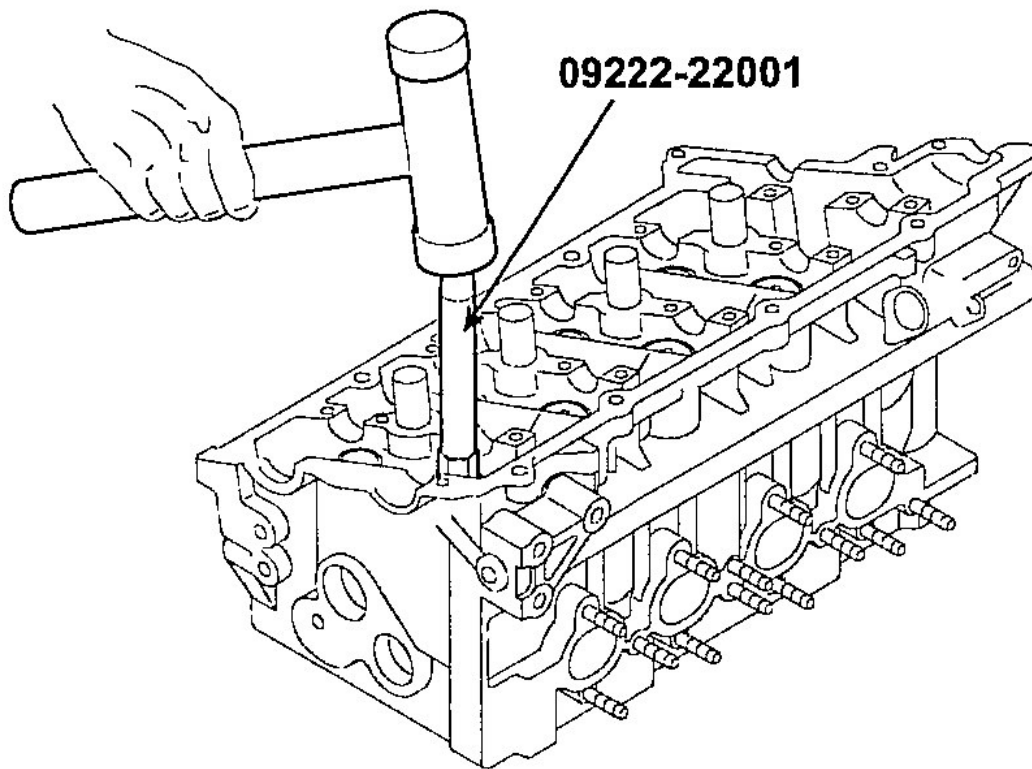
##### 1. Install the valves

- 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

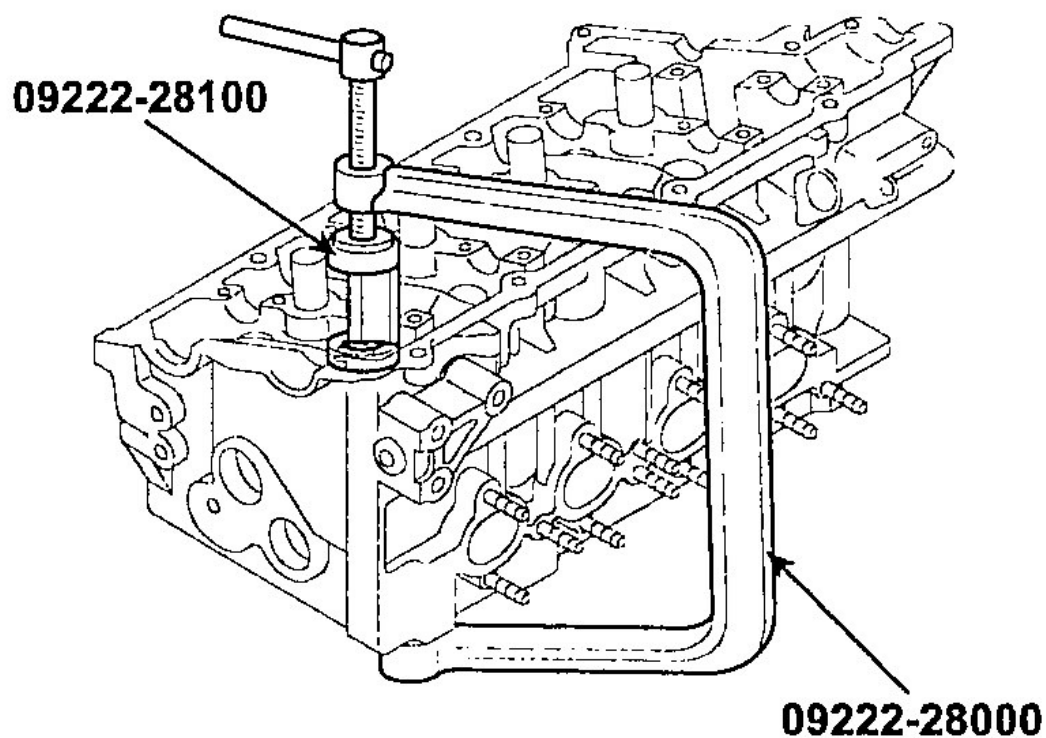
**Fig. 123: Installing Oil Seal**

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.

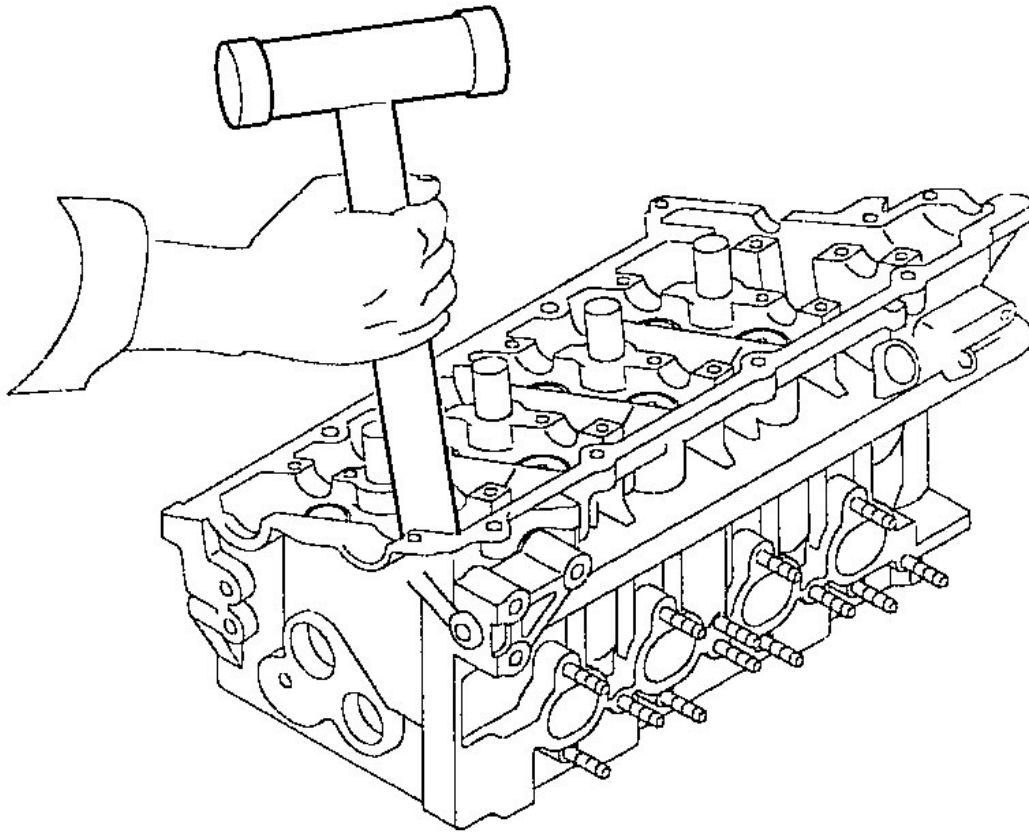
- d. Using the Service Tool (09222 - 28000, 09222 - 28100), compress the spring and install the retainer locks. After installing the valves, ensure that the retainer locks are correctly in place before releasing the valve spring compressor.



G00719058

**Fig. 124: Compressing Valve Spring**  
Courtesy of KIA MOTORS AMERICA, INC.

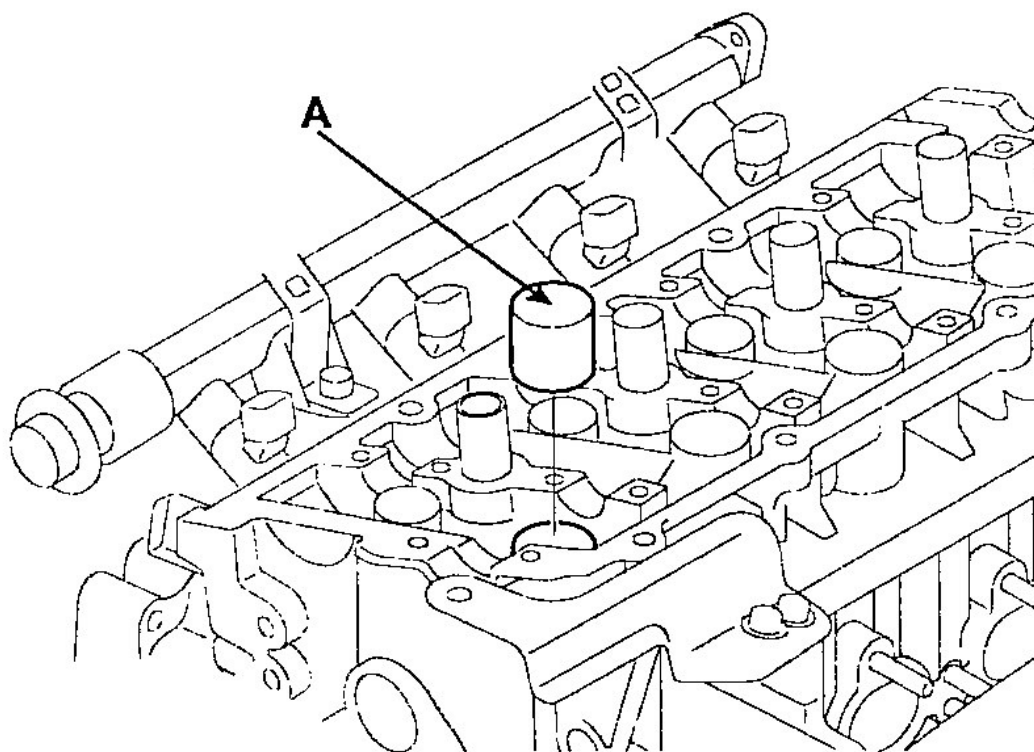
- e. Lightly tap the end of each valve stem two or three times with the wooden handle of a hammer to ensure proper seating of the valve and retainer lock.



G00719059

**Fig. 125: 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. 126: Installing Mechanical Lash Adjuster**  
Courtesy of KIA MOTORS AMERICA, INC.

## INSTALLATION

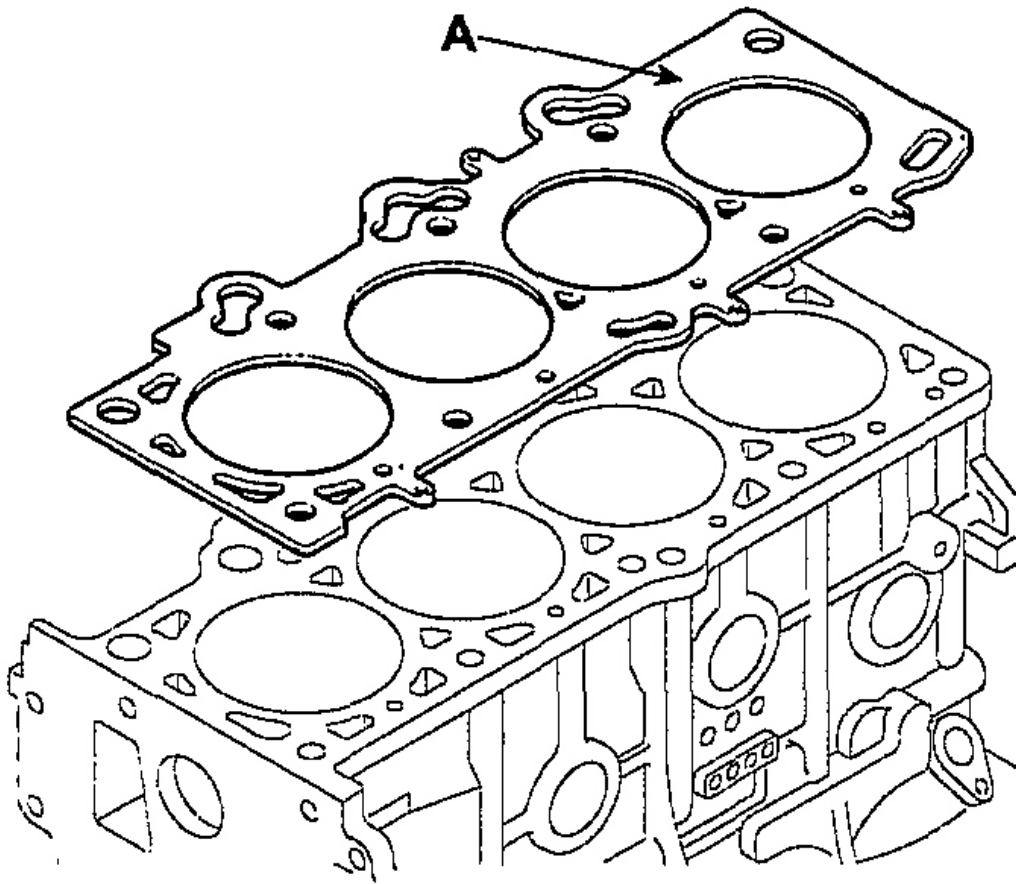
### NOTE:

- 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.**



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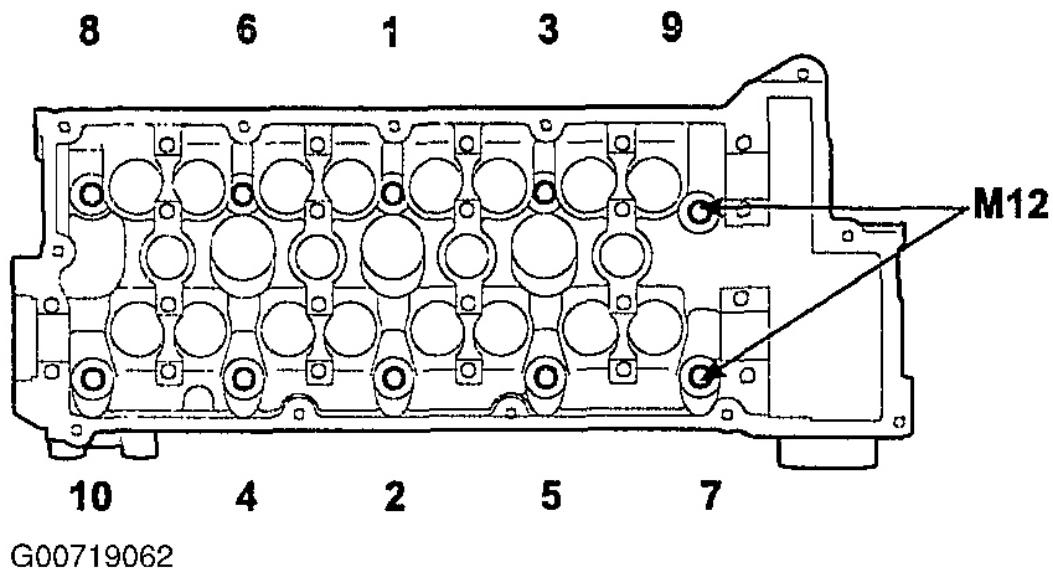
**Fig. 127: Illustrating Head Gasket Direction**  
Courtesy of KIA MOTORS AMERICA, INC.

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. 128**.

**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°)

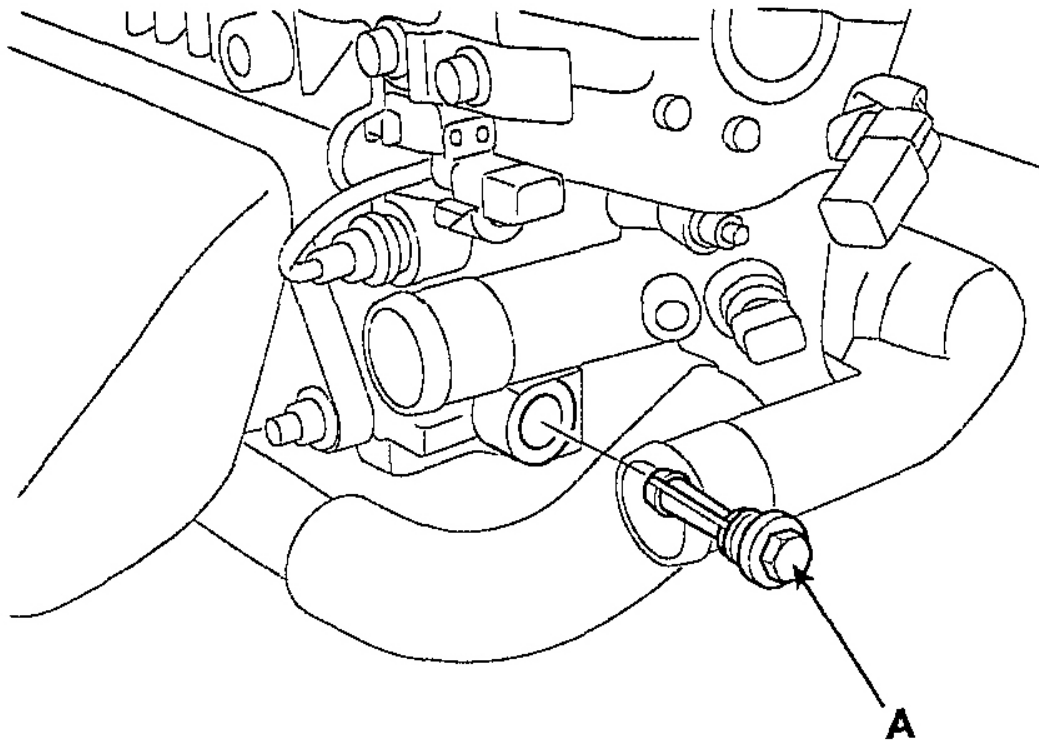
M12: 27.5-31.4 N.m (2.8-3.2 kg-m, 20.3-23.1 lb-ft) + (60°-65°) + (60°-65°)



**Fig. 128: 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

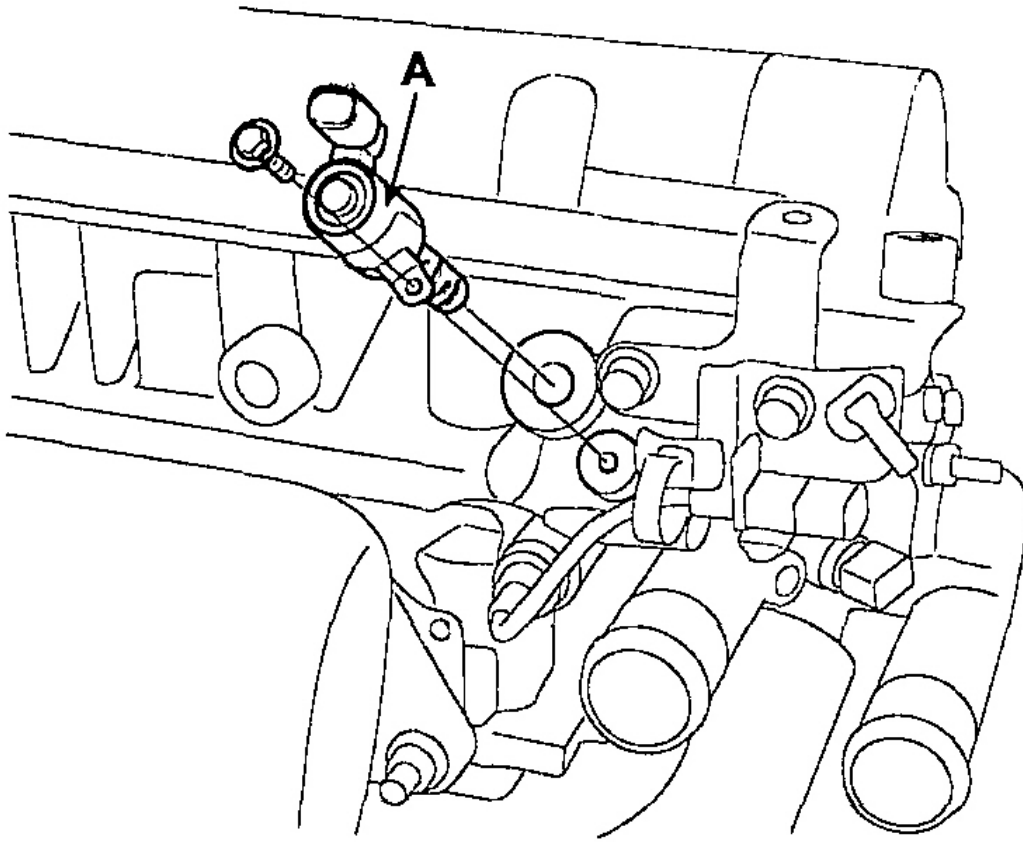
**Fig. 129: Installing Oil Control Valve Filter**  
**Courtesy of KIA MOTORS AMERICA, INC.**

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. 130: Installing Oil Control Valve**  
Courtesy of KIA MOTORS AMERICA, INC.

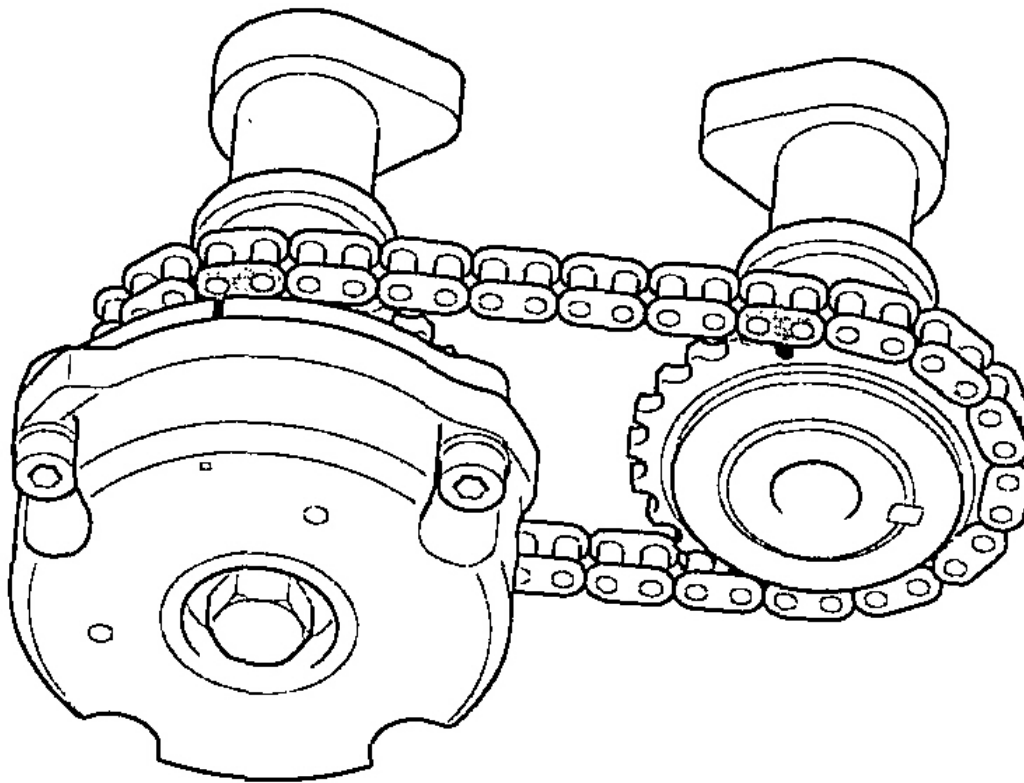
**CAUTION:**

- 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.





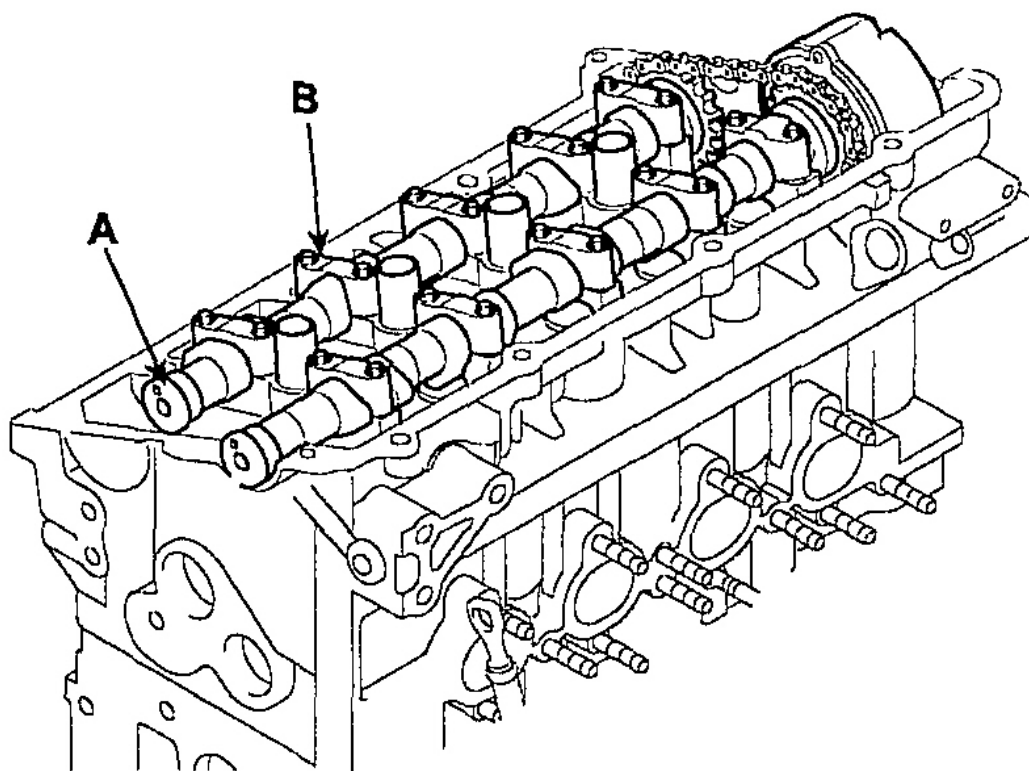
G00719065

**Fig. 131: 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)

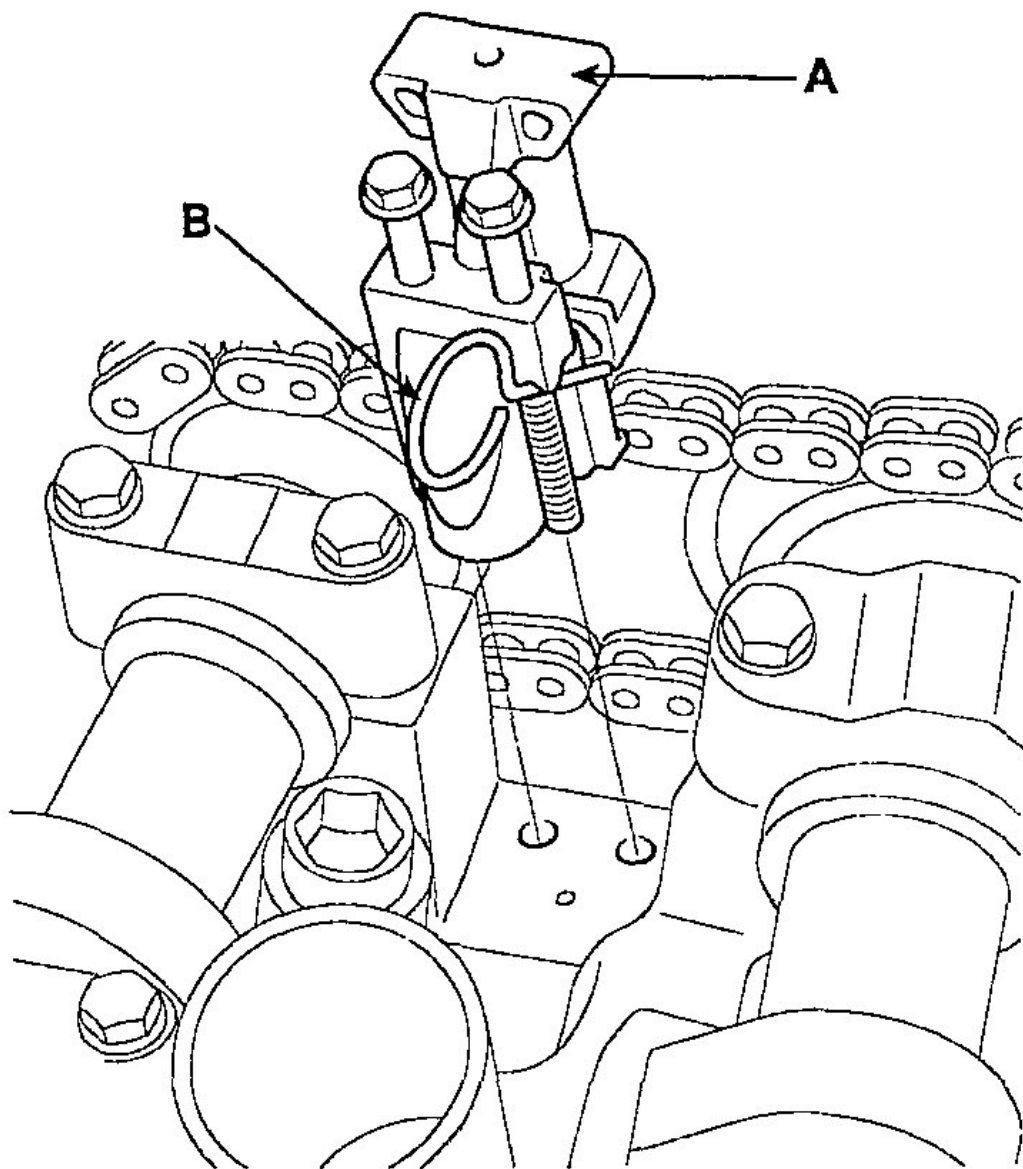


G00719066

**Fig. 132: Installing Camshaft Bearing Caps**  
Courtesy of KIA MOTORS AMERICA, INC.

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

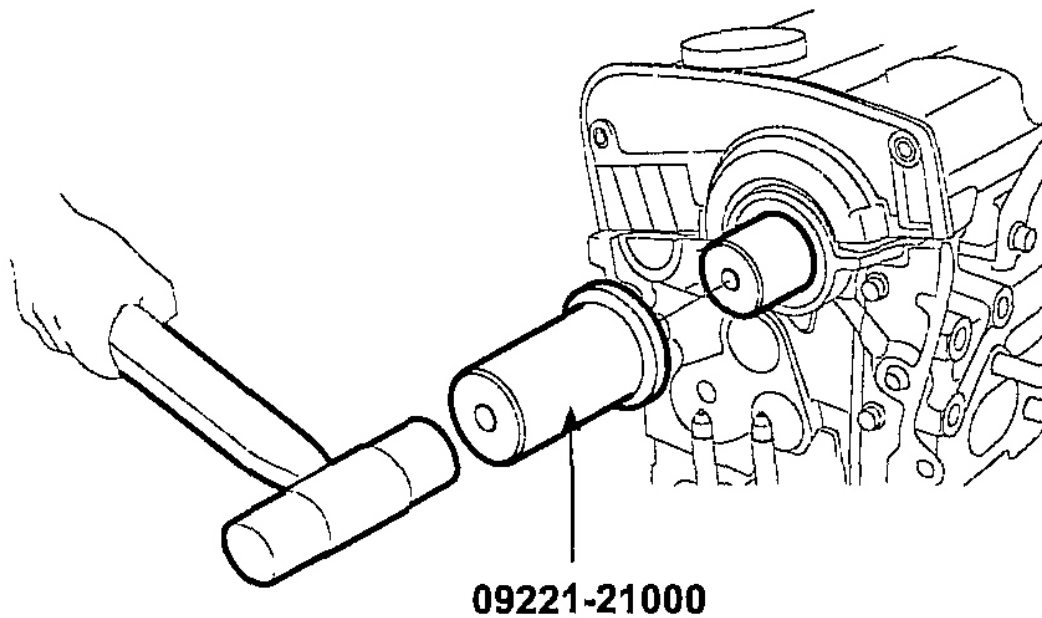
Tightening torque: 7.8-9.8 N.m (0.8-1.0 kg-m, 5.8-7.2 lb-ft)



G00719067

**Fig. 133: 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

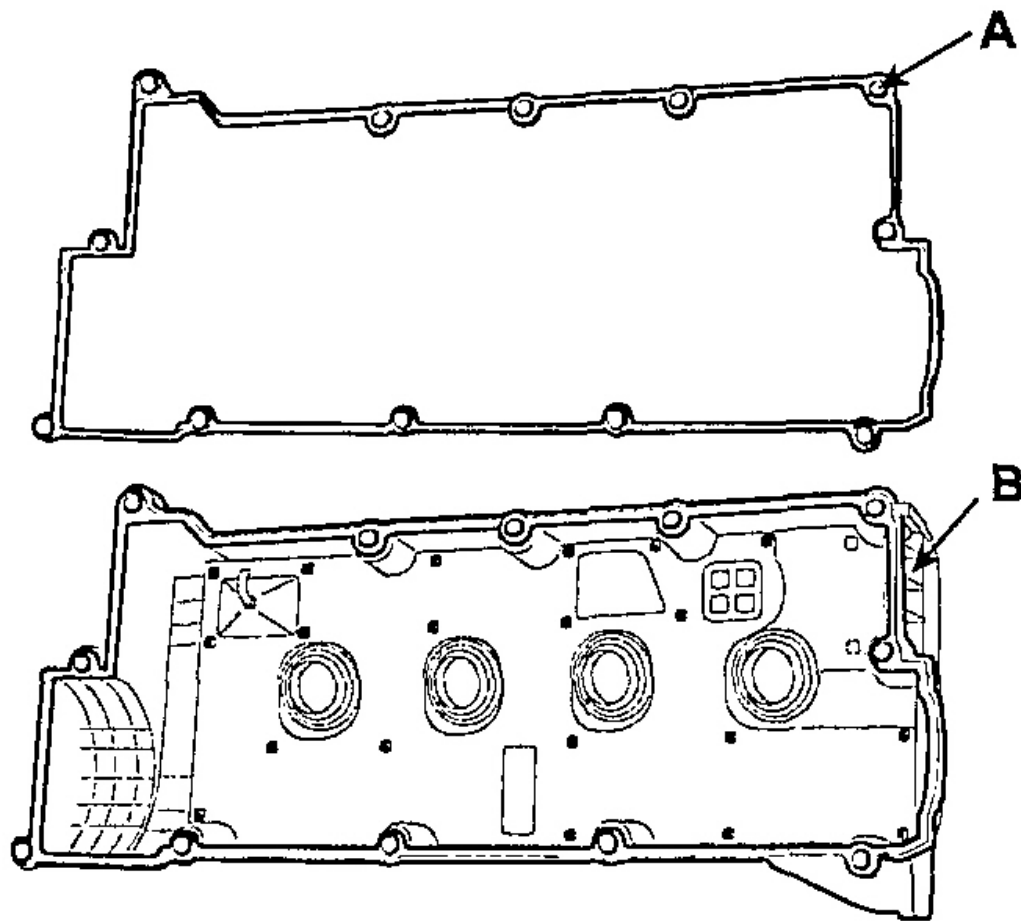
**Fig. 134: Installing Camshaft Bearing Oil Seal**  
Courtesy of KIA MOTORS AMERICA, INC.

9. Install the camshaft sprocket.

**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.

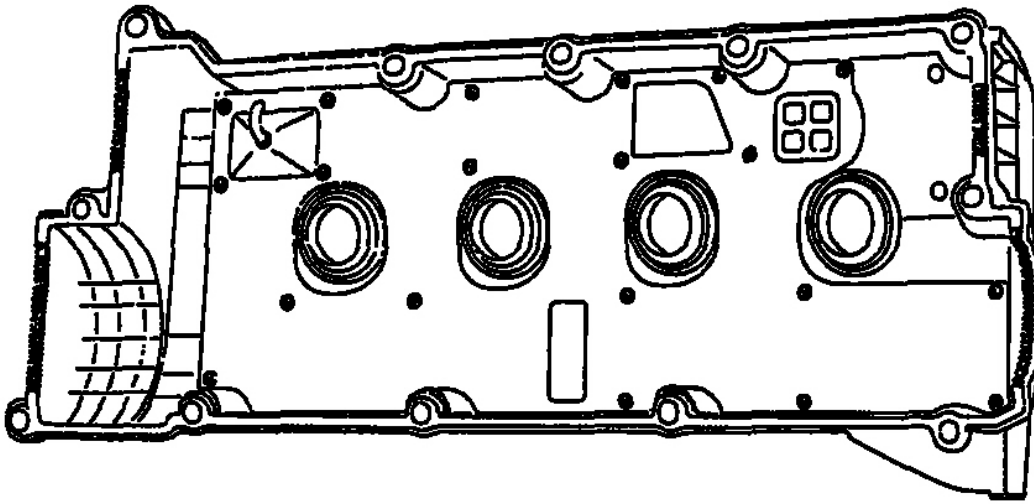
10. Install the cylinder head cover.
  - a. Install the cylinder head cover gasket (A) in the groove of the cylinder head cover (B).



G00719069

**Fig. 135: 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.



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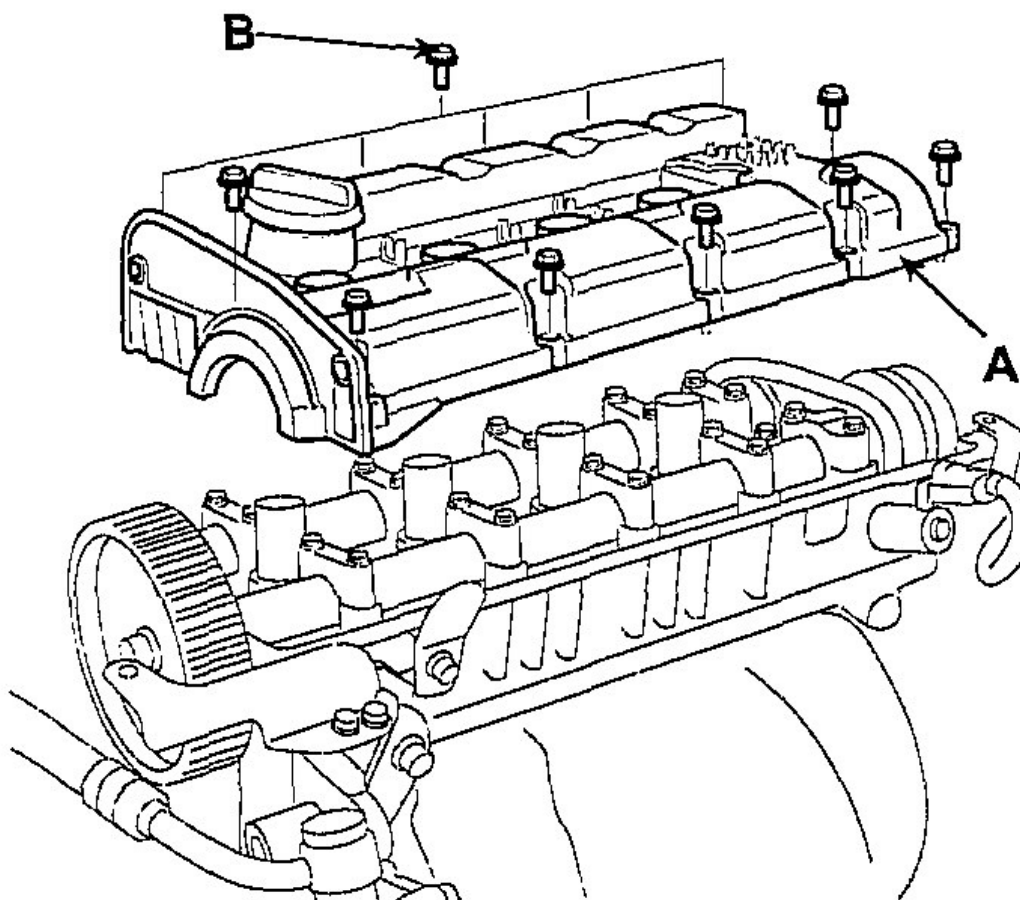
**Fig. 136: Applying Gasket Sealant**  
Courtesy of KIA MOTORS AMERICA, INC.

**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.

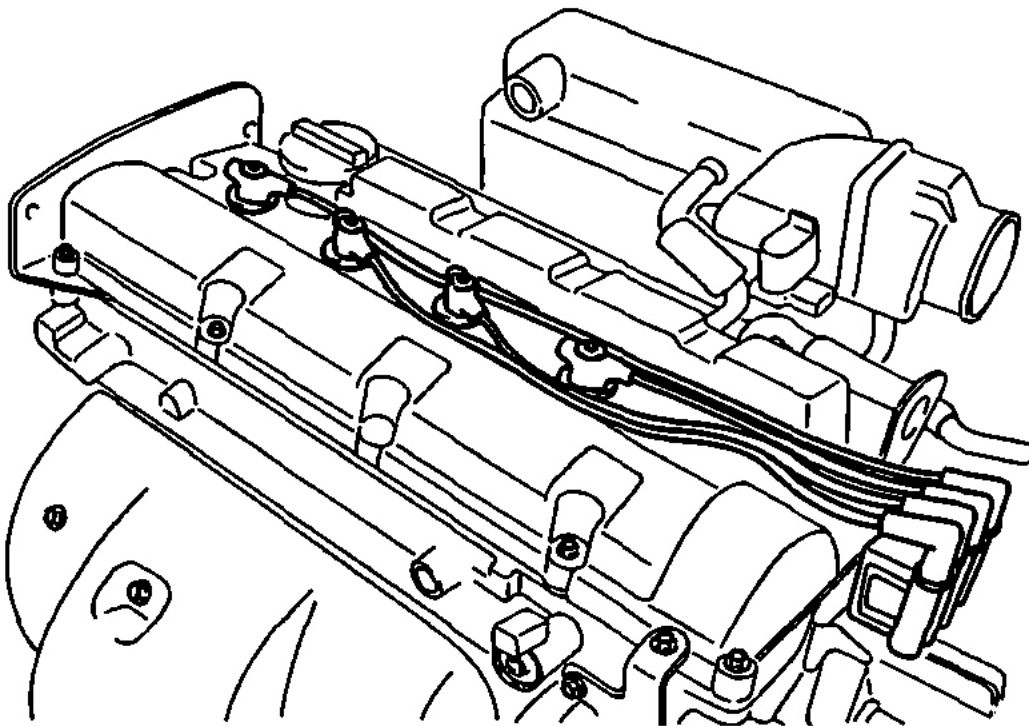
Tightening torque: 7.8-9.8 N.m (0.8-1.0 kg-m, 5.8-7.2 lb-ft)



G00719071

**Fig. 137: Installing Cylinder Head Cover**  
Courtesy of KIA MOTORS AMERICA, INC.

11. Install the PCV (Positive Crankcase Ventilation) hose.
12. Install the timing belt. See **TIMING BELT**.
13. Install the intake manifold. See **INTAKE AND EXHAUST SYSTEM**.
14. Install the exhaust manifold. See **INTAKE AND EXHAUST SYSTEM**.
15. Install the spark plug cables.



G00719072

**Fig. 138: Installing Spark Plug Cables**  
Courtesy of KIA MOTORS AMERICA, INC.

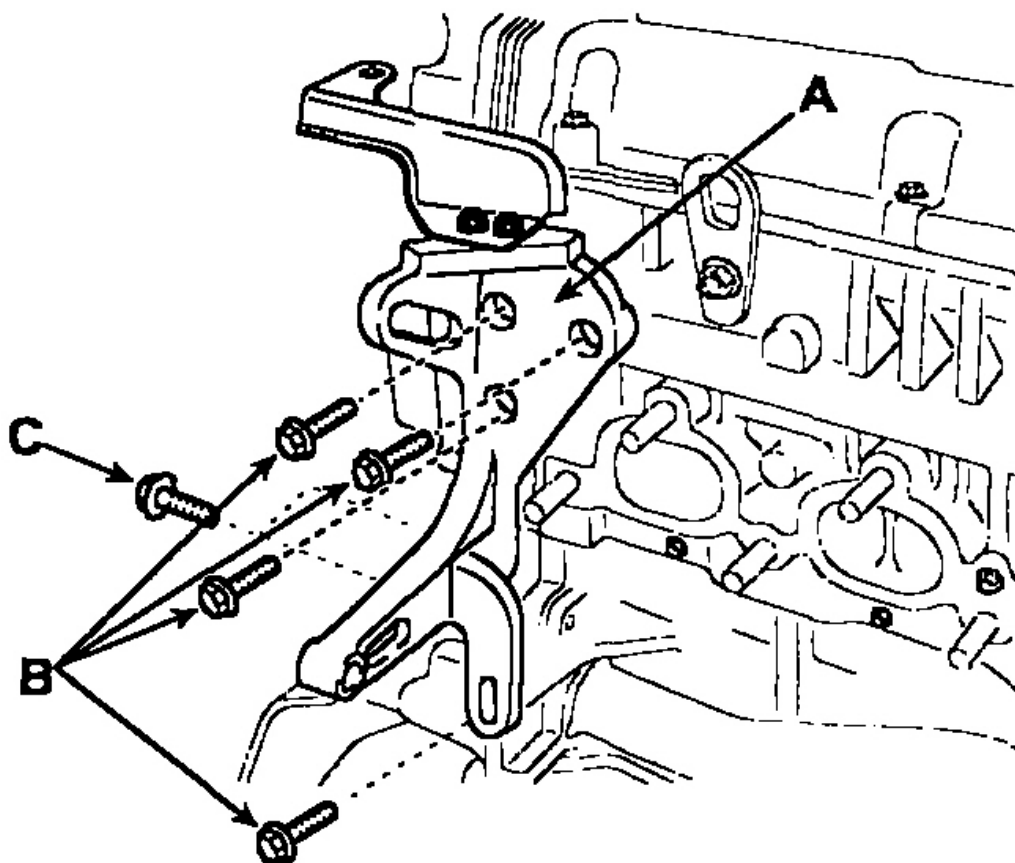
16. Install the power steering pump bracket (A) and bolts (B, C).

Tightening torque:

Bolt (B): 34.3-49.0 N.m (3.5-5.0 kg-m, 25.3-36.2 lb-ft)

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



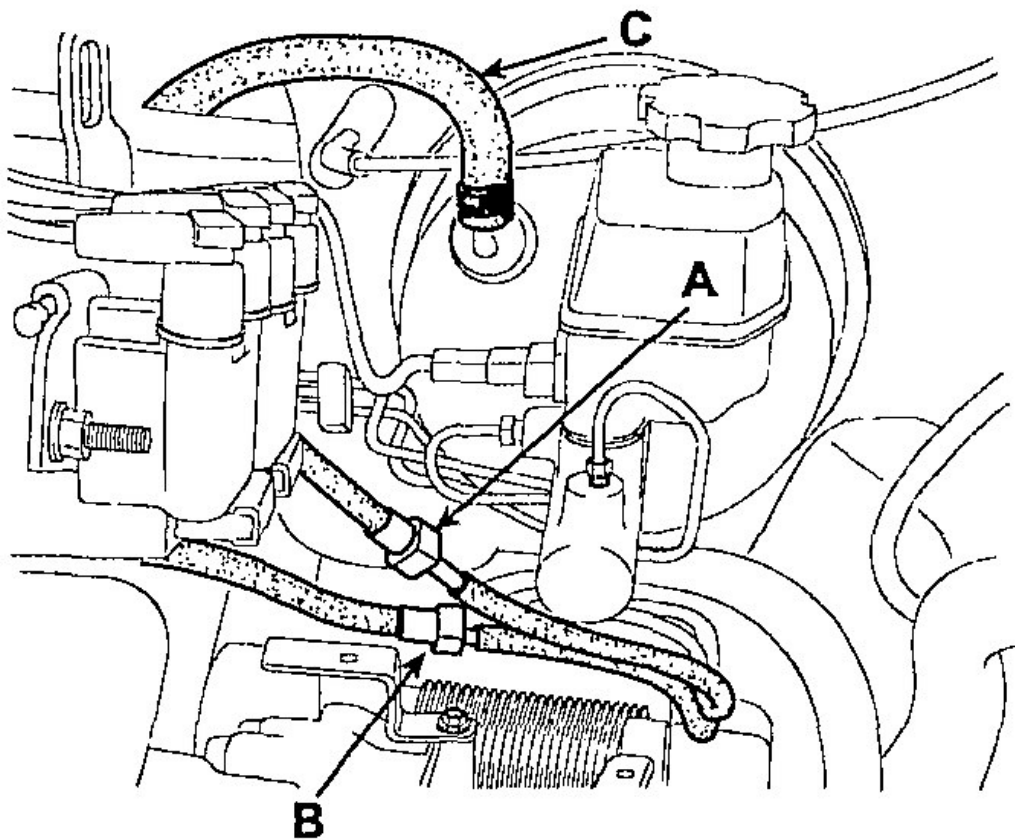


G00719073

**Fig. 139: Installing Power Steering Pump Bracket**

Courtesy of KIA MOTORS AMERICA, INC.

17. Install the power steering pump. See **CHECKING POWER STEERING BELT TENSION**.
18. Install the accelerator cable.
19. Install the brake booster hose (C).
20. Connect the hose (B) of the PCSV (Purge Control Solenoid Valve) side.
21. Connect the fuel inlet hose (A) of the delivery pipe side.

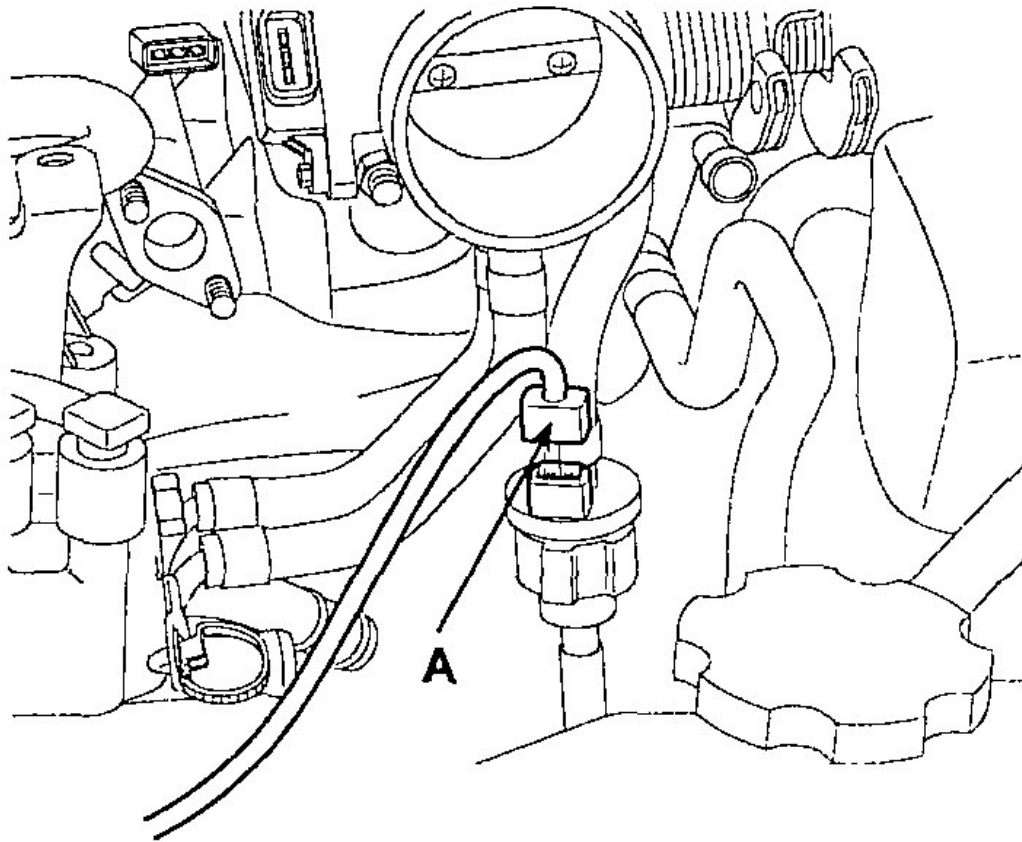


G00719074

**Fig. 140: Connecting Fuel Hoses**

Courtesy of KIA MOTORS AMERICA, INC.

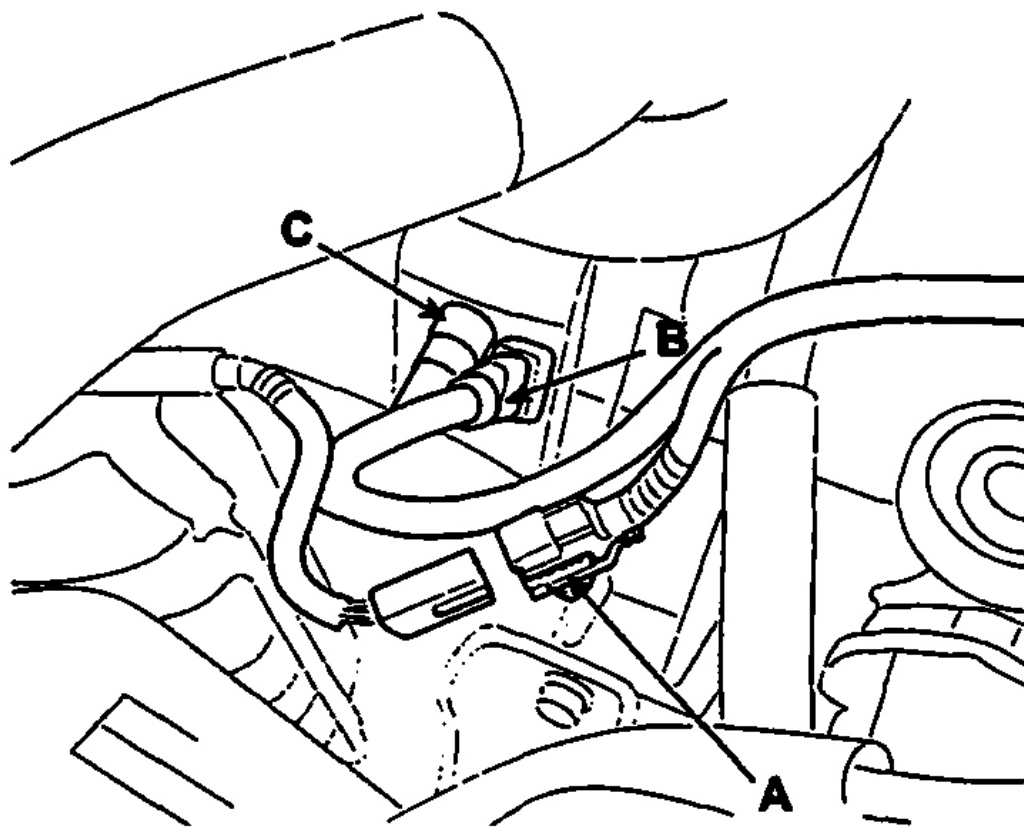
22. Install the engine wire harness connectors and wire harness clamps to the cylinder head and the intake manifold.
  - a. Connect the PCSV (Purge Control Solenoid Valve) connector (A).



G00719075

**Fig. 141: Connecting Purge Control Solenoid Valve**  
Courtesy of KIA MOTORS AMERICA, INC.

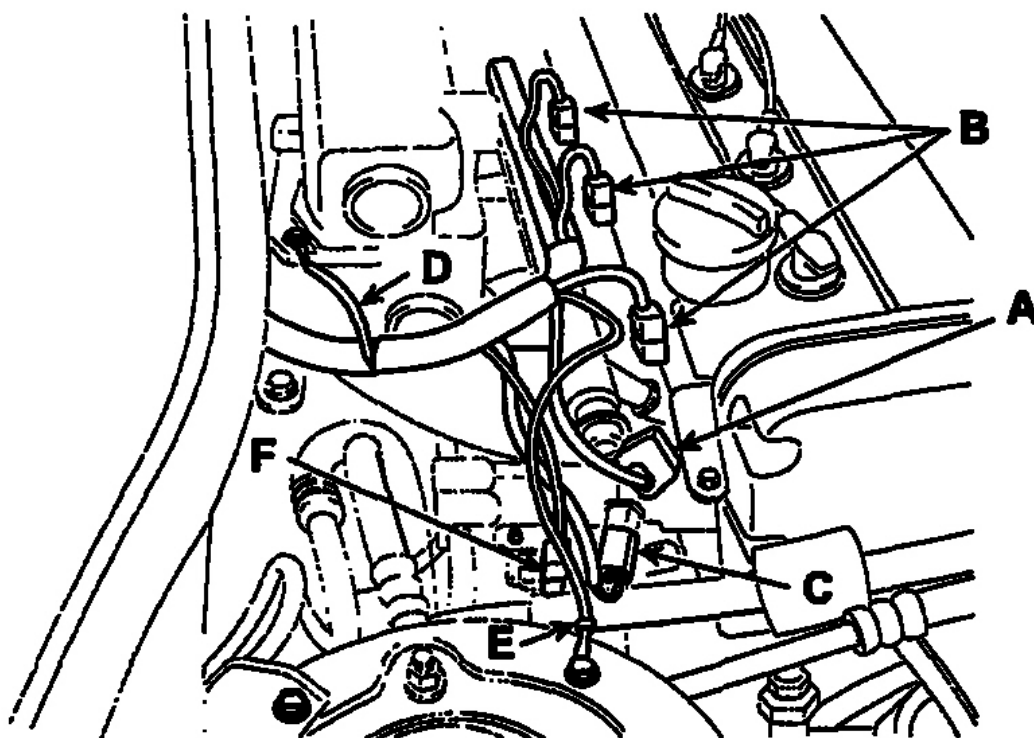
- b. Connect the front heated oxygen sensor connector (A).
- c. Connect the CKP (Crankshaft Position Sensor) connector (B).
- d. Connect the oil pressure switch connector (C).



G00719076

**Fig. 142: Connecting Oil Pressure Switch Connector**  
Courtesy of KIA MOTORS AMERICA, INC.

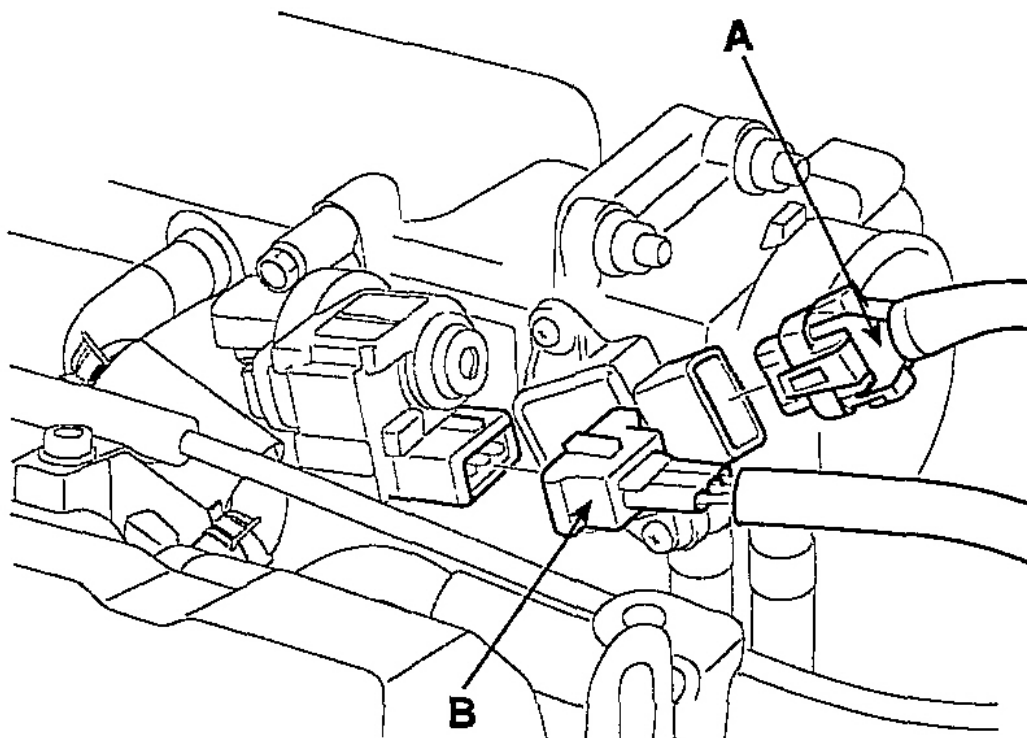
- e. Connect the air conditioner compressor switch connector (F).
- f. Connect the ground cables (D, E) to intake manifold and vehicle's body.
- g. Connect the knock sensor connector (C)
- h. Connect the fuel injector connectors (B)
- i. Connect the CMP (Camshaft position sensor) connector (A).



G00719077

**Fig. 143: Connecting Engine Sensors & Grounds**  
Courtesy of KIA MOTORS AMERICA, INC.

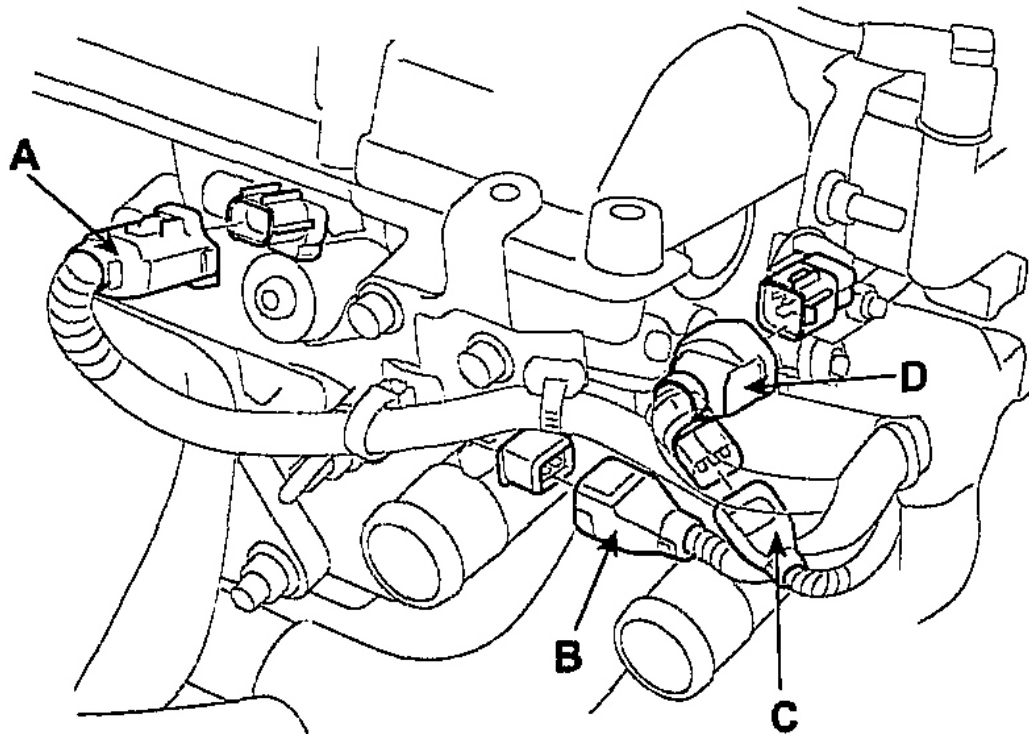
- j. Connect the ISA (Idle Speed Actuator) connector (B).
- k. Connect the TPS (Throttle Position Sensor) connector (A).



G00719078

**Fig. 144: Connecting ISA & TPS Connectors**  
Courtesy of KIA MOTORS AMERICA, INC.

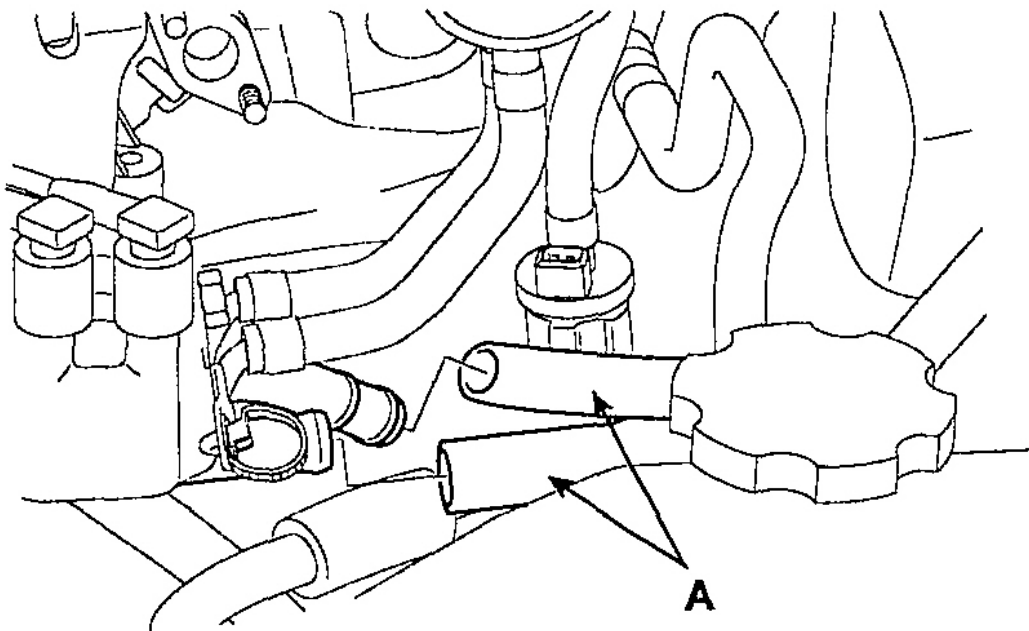
- l. Connect the ignition coil connector (D).
- m. Connect the ECT (Engine Coolant Temperature Sensor) connector (C).
- n. Connect the oil temperature sensor connector (B).
- o. Connect the OCV (Oil Control Valve) connector (A).



G00719079

**Fig. 145: Connecting Oil Control Valve**  
Courtesy of KIA MOTORS AMERICA, INC.

23. Install the heater hose (A).



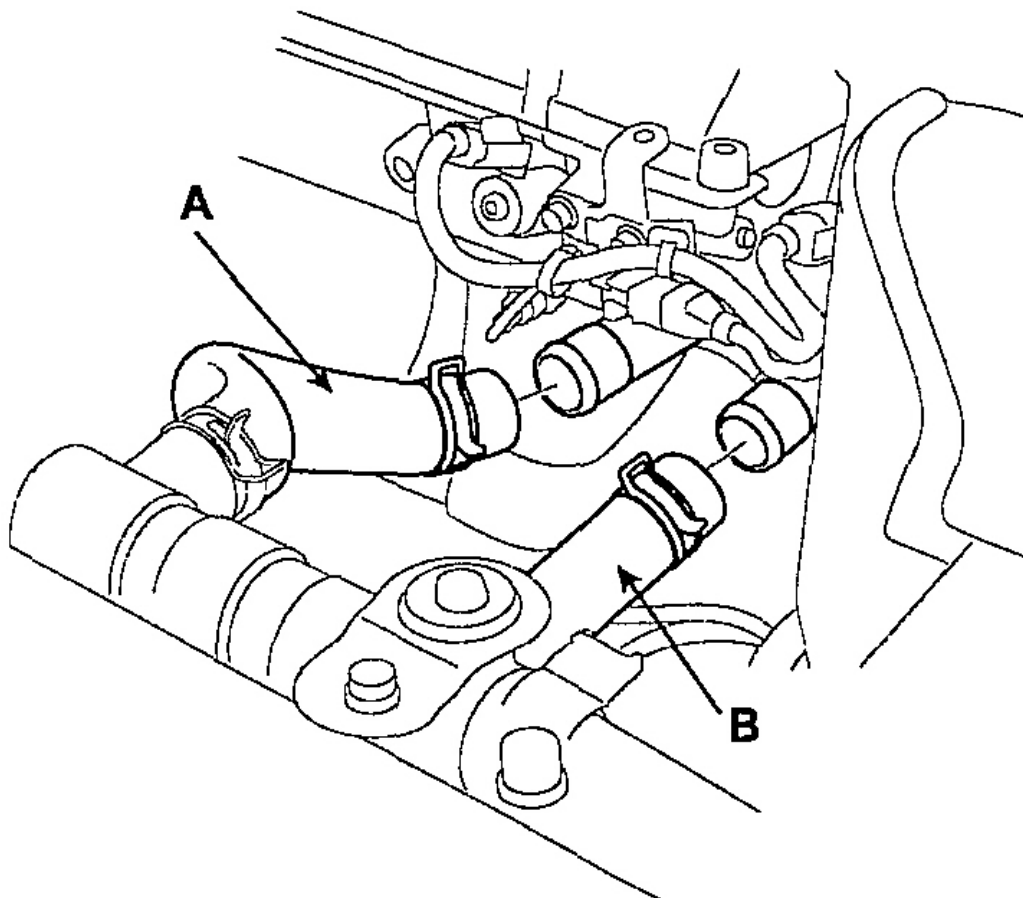
G00719080

**Fig. 146: Installing Heater Hose**

Courtesy of KIA MOTORS AMERICA, INC.

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



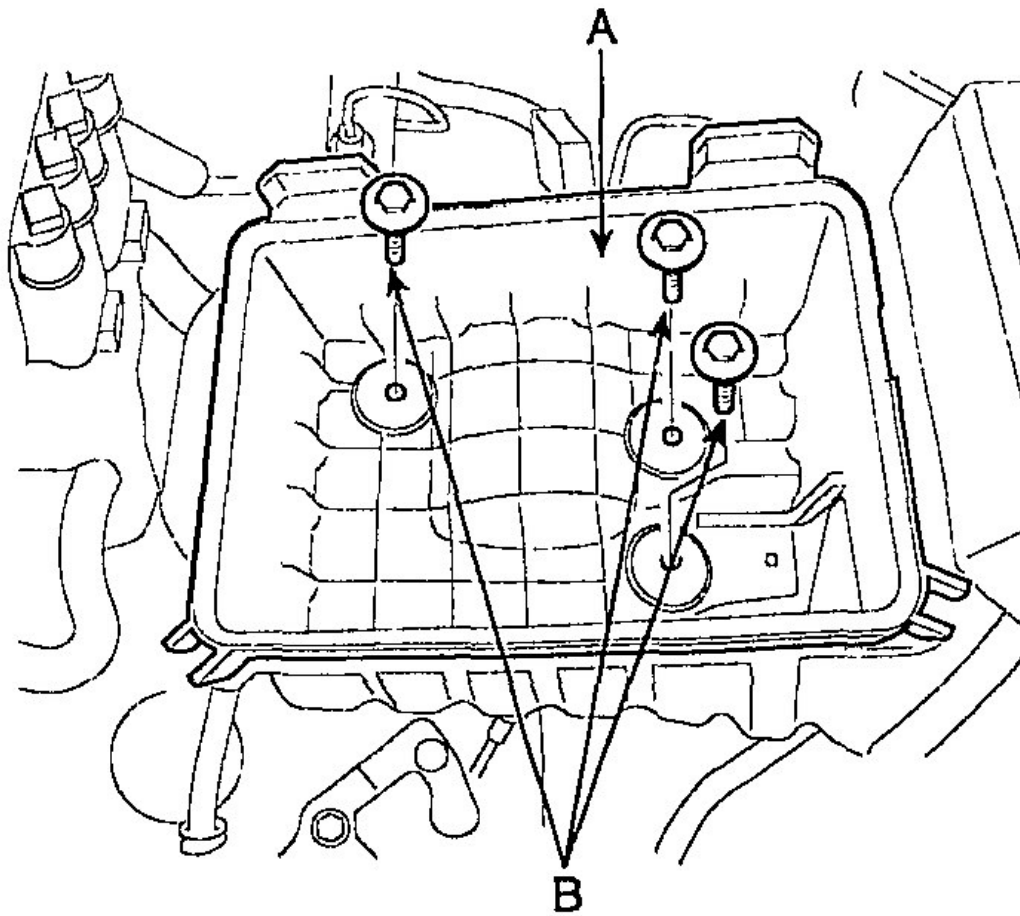


G00719081

**Fig. 147: Installing Upper & Lower Radiator Hose**  
Courtesy of KIA MOTORS AMERICA, INC.

25. Install the intake air hose and air cleaner assembly.
  - a. Install the air cleaner lower cover (A) and bolts (B).

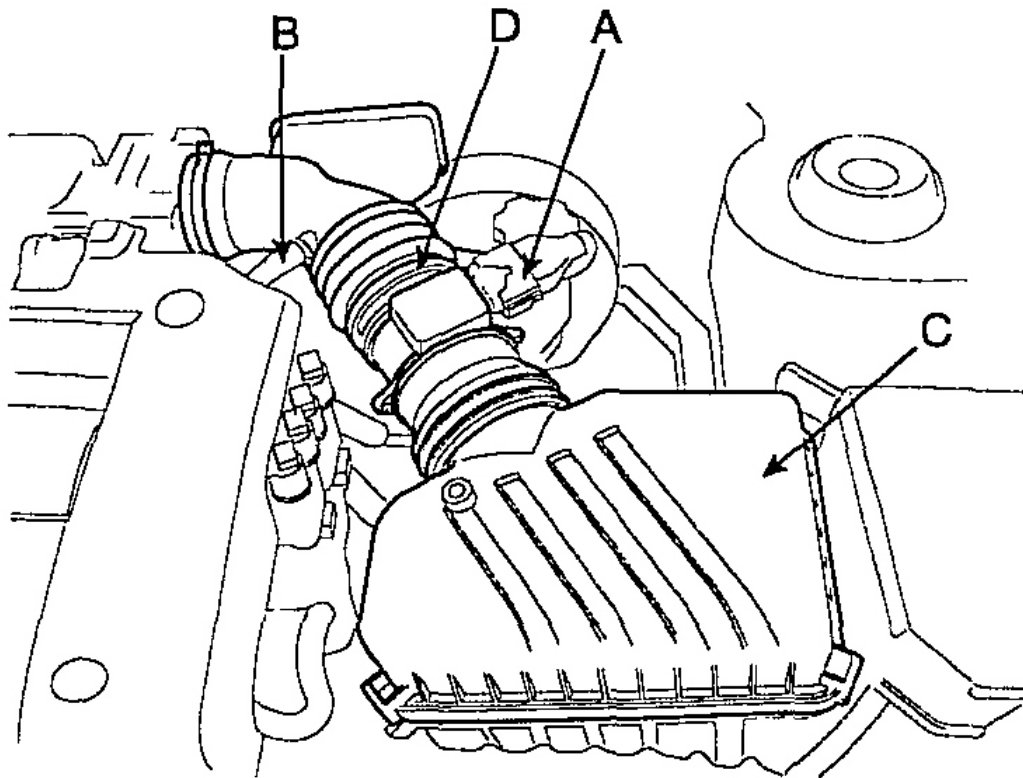
Tightening torque: 7.8-9.8 N.m (0.8-1.0 kg-m, 5.8-7.2 lb-ft)



G00719082

**Fig. 148: Installing Air Cleaner Lower Cover**  
Courtesy of KIA MOTORS AMERICA, INC.

- b. Install the air cleaner element.
- c. Install the intake air hose (D) and air cleaner upper cover (C).
- d. Install the breather hose (B) to intake air hose (D).
- e. Connect the AFS (Air Flow Sensor) connector (A).

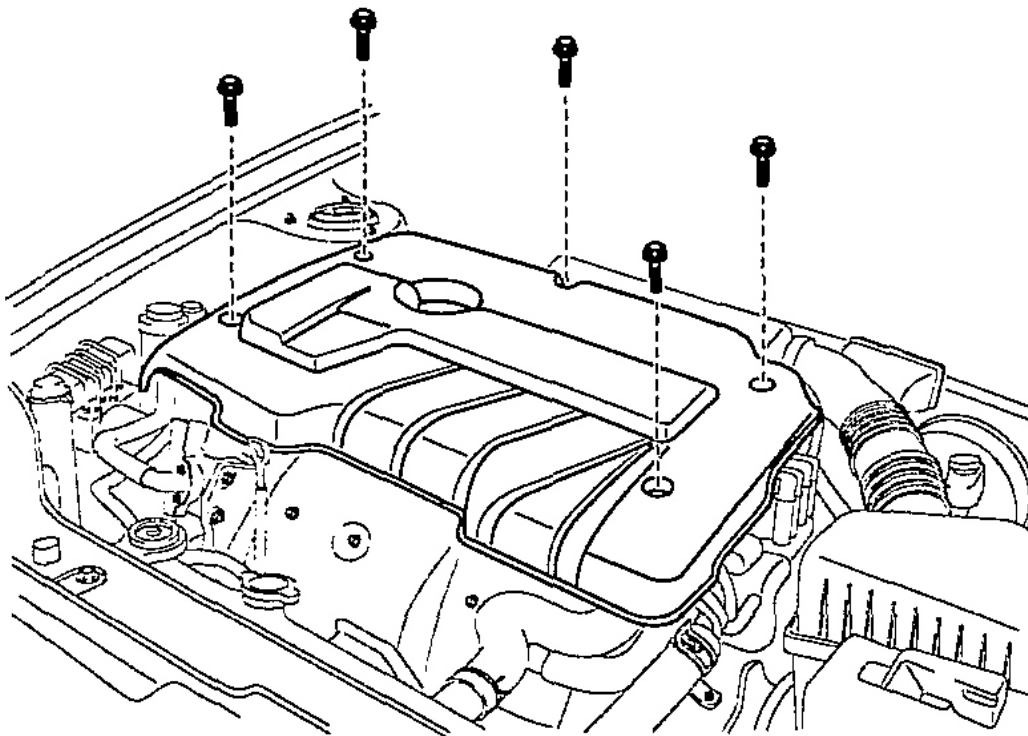


G00719083

**Fig. 149: Installing Intake Air Hose & AFS Connector**  
Courtesy of KIA MOTORS AMERICA, INC.

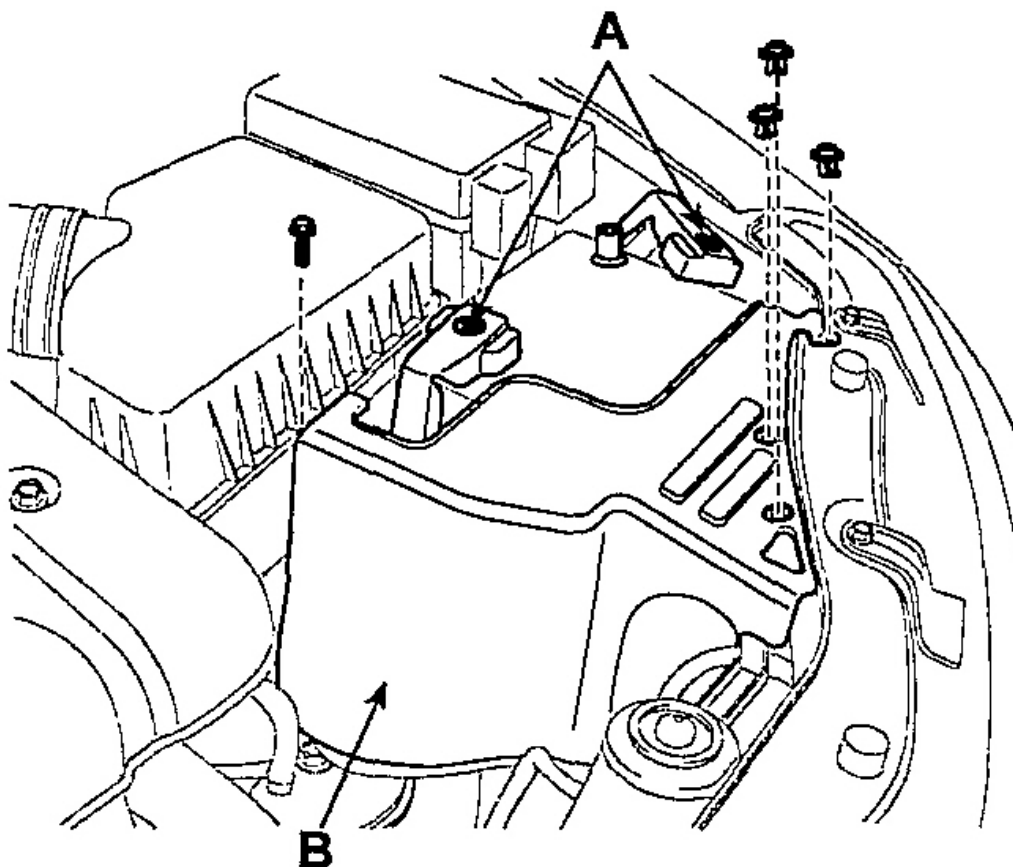
26. Install the engine cover.

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



**Fig. 150: Installing Engine Cover**  
**Courtesy of KIA MOTORS AMERICA, INC.**

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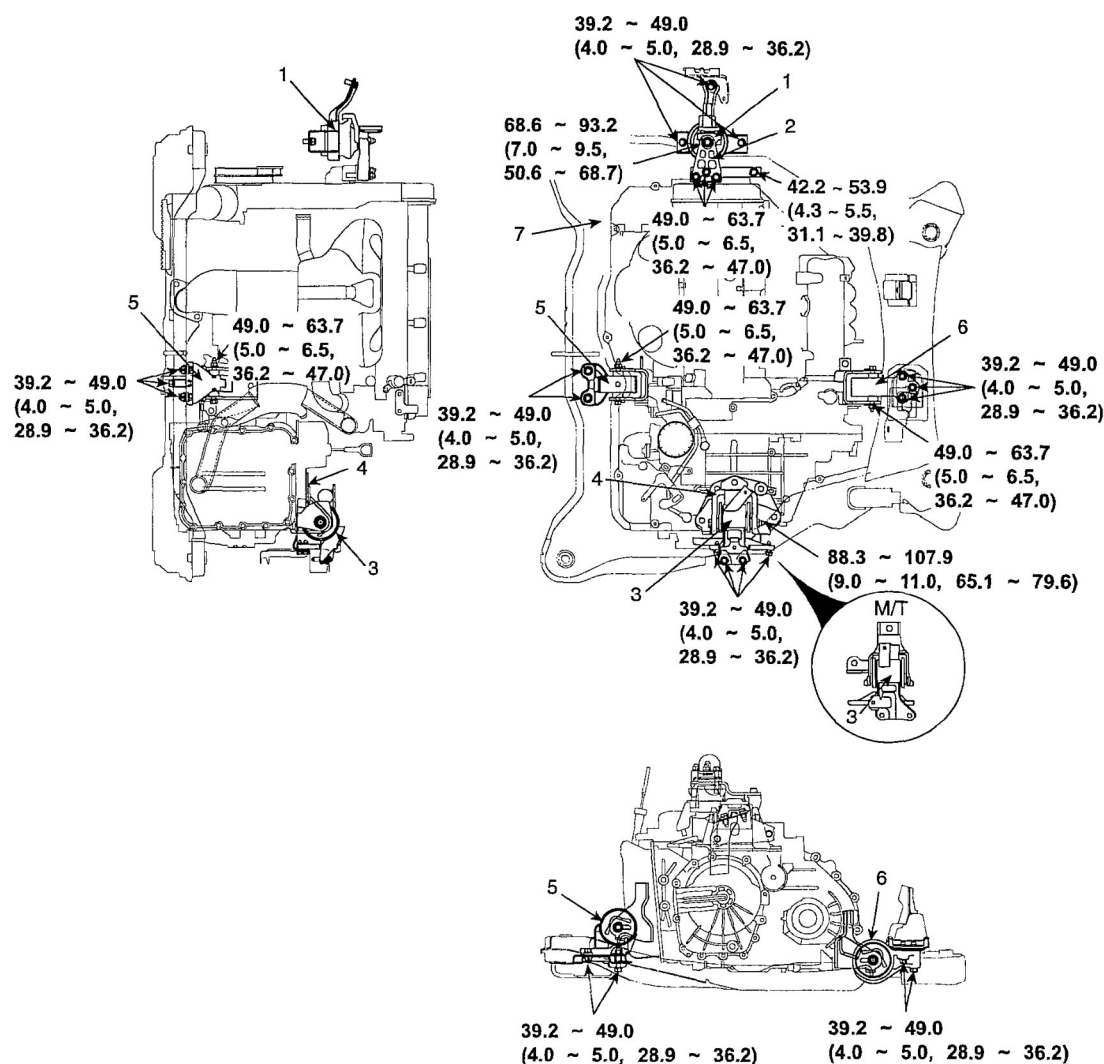
G00719085

**Fig. 151: Installing Heat Shield & Battery Terminals**  
Courtesy of KIA MOTORS AMERICA, INC.

28. Fill with engine coolant.
29. Start the engine and check for leaks.
30. Recheck engine coolant level and oil level.

## ENGINE & TRANSAXLE ASSEMBLY

### COMPONENT



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

1. Engine mounting bracket
2. Engine mounting support bracket
3. Transaxle mounting bracket
4. Transaxle support bracket

5. Front roll stopper
6. Rear roll stopper
7. Sub frame

G00719086

**Fig. 152: Identifying Engine & Transaxle Mounts With Torque Specifications**  
 Courtesy of KIA MOTORS AMERICA, INC.

## REMOVAL

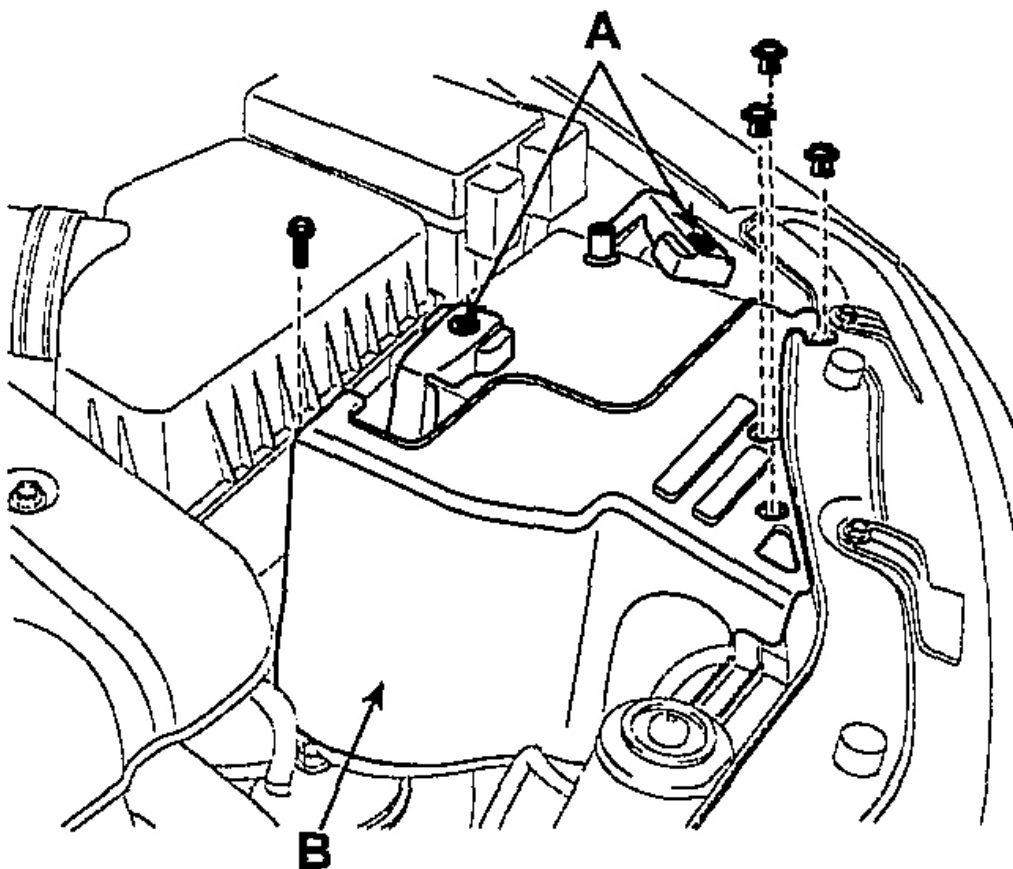
### CAUTION:

- 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.

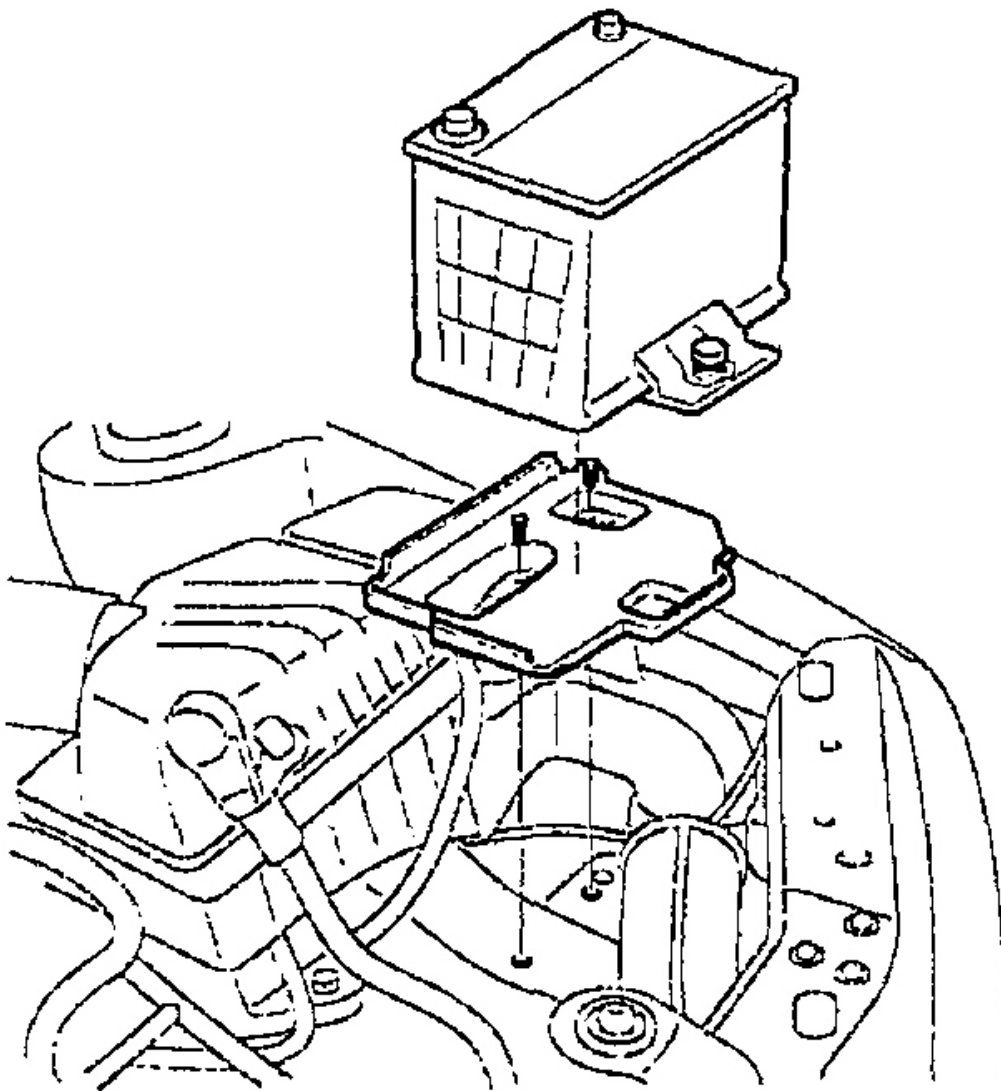
1. Disconnect the battery terminals (A) and remove the heat shield (B).



G00719087

**Fig. 153: Disconnecting Battery Terminals & Removing Heat Shield**  
Courtesy of KIA MOTORS AMERICA, INC.

2. Remove the battery and battery tray.

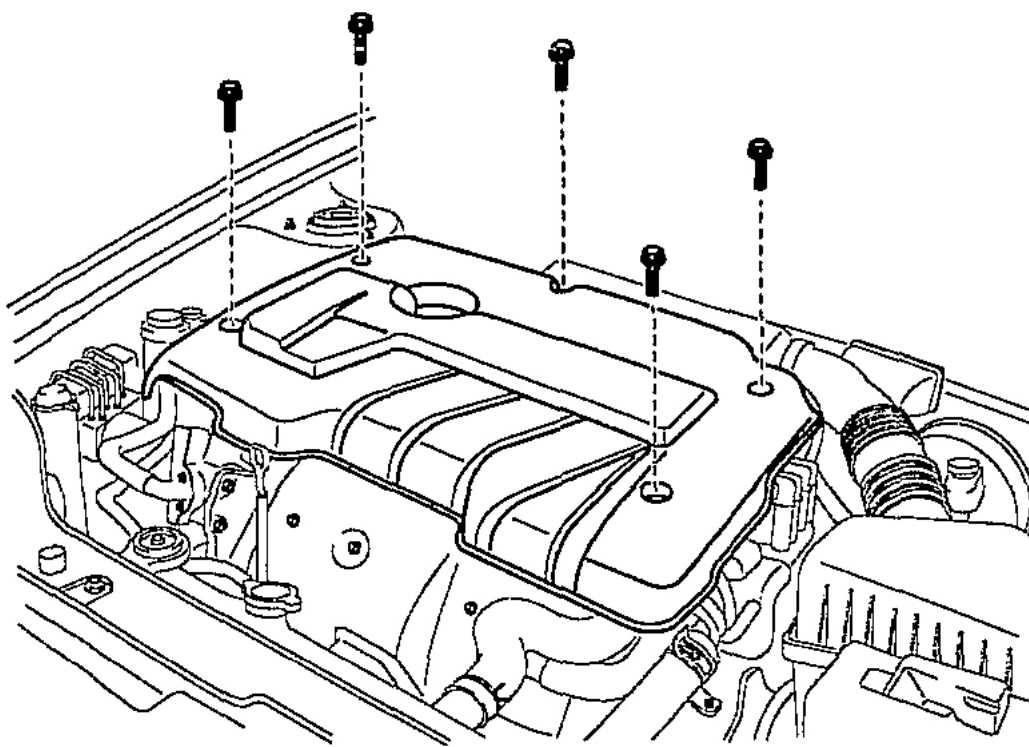


G00719088

**Fig. 154: Removing Battery & Battery Tray**  
Courtesy of KIA MOTORS AMERICA, INC.

3. Remove the engine cover.

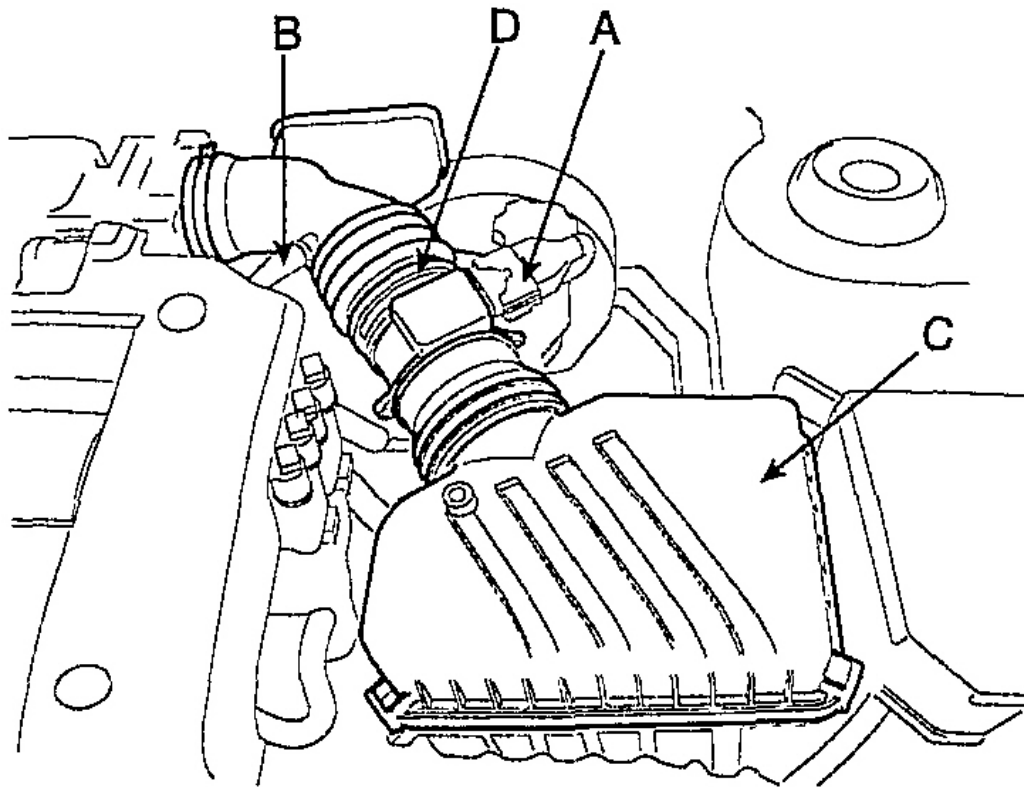




G00719089

**Fig. 155: Removing Engine Cover**  
Courtesy of KIA MOTORS AMERICA, INC.

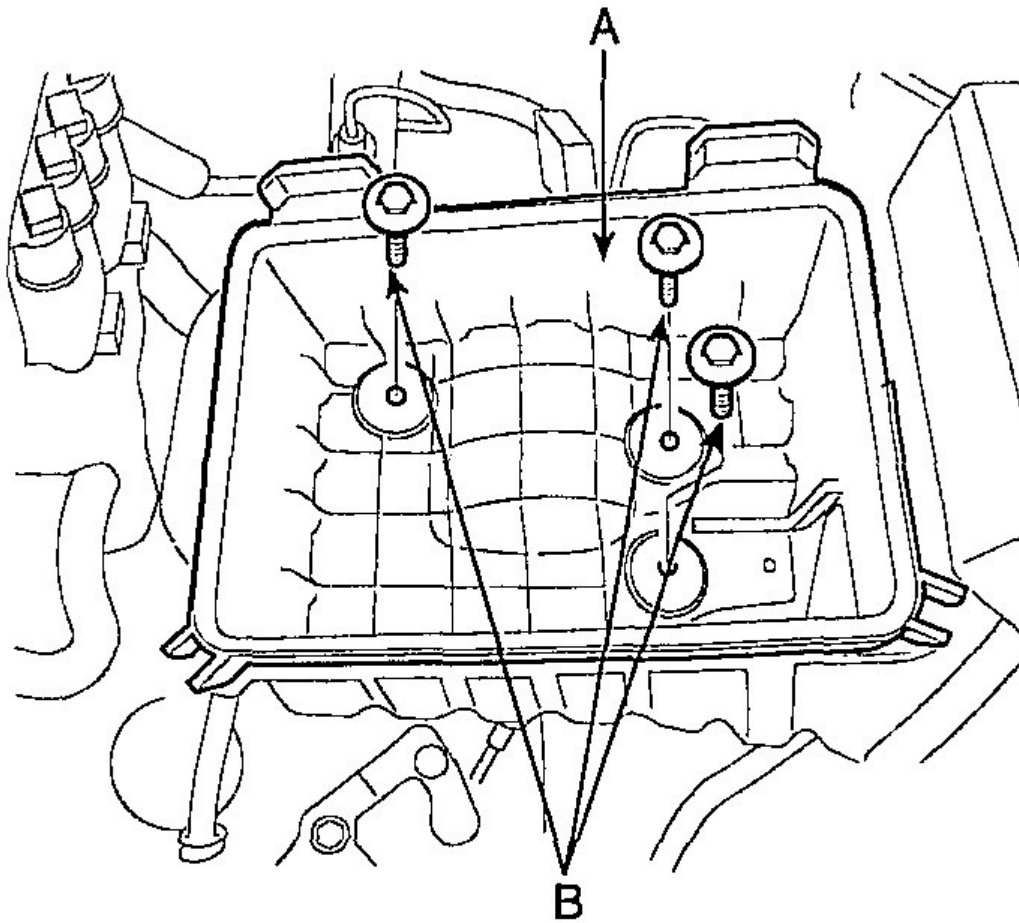
4. Drain the engine coolant. Remove the radiator cap to speed draining.
5. Remove the intake air hose and air cleaner assembly.
  - a. Disconnect the AFS (Air Flow Sensor) connector (A).
  - b. Disconnect the breather hose (B) from intake air hose (D).
  - c. Remove the intake air hose (D) and air cleaner upper cover (C).



G00719090

**Fig. 156: Removing Intake Air Hose & AFS Connector**  
Courtesy of KIA MOTORS AMERICA, INC.

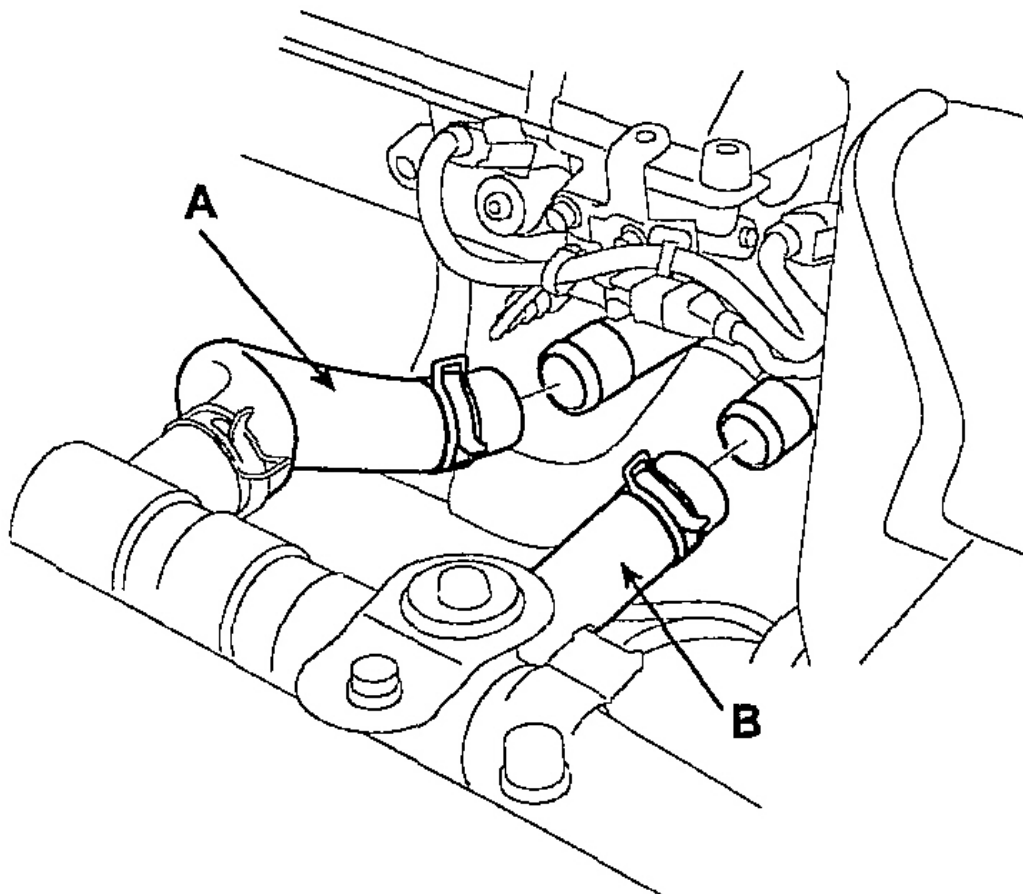
- d. Remove the air cleaner element.
- e. Remove the bolts (B) and air cleaner lower cover (A).



G00719091

**Fig. 157: Removing Air Cleaner Lower Cover**  
Courtesy of KIA MOTORS AMERICA, INC.

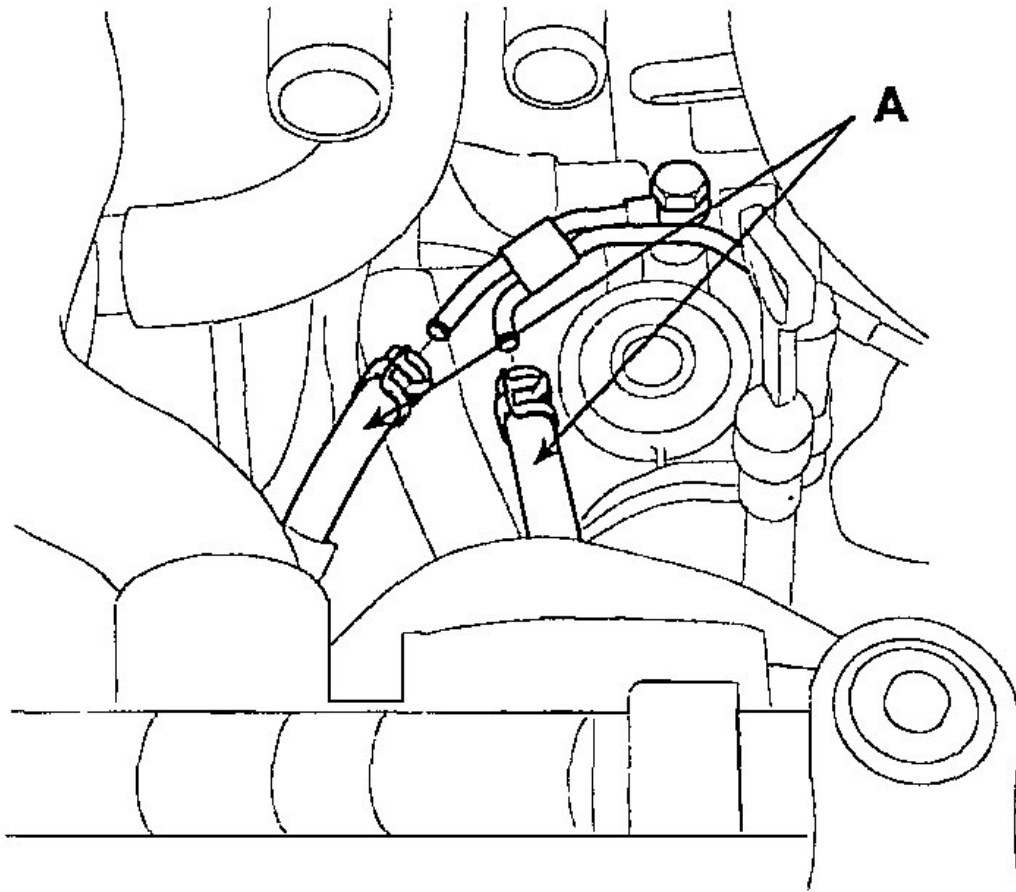
6. Remove the upper radiator hose (A) and lower radiator hose (B).



G00719092

**Fig. 158: Removing Upper & Lower Radiator Hose**  
Courtesy of KIA MOTORS AMERICA, INC.

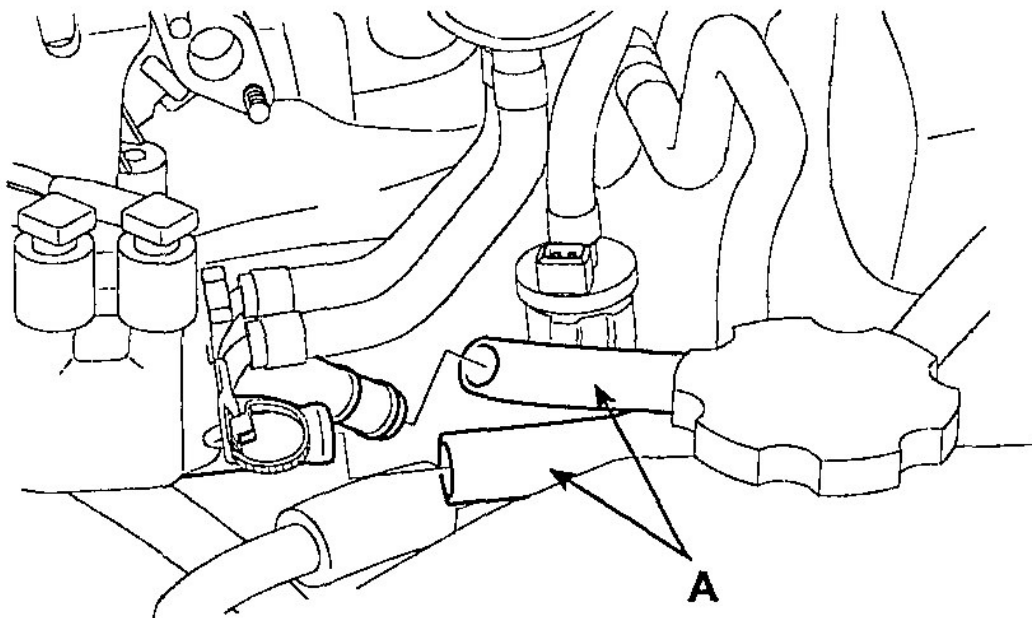
7. Remove the ATF (Automatic transaxle fluid) cooler hose (A).



G00719093

**Fig. 159: Removing ATF Cooler Hoses**  
Courtesy of KIA MOTORS AMERICA, INC.

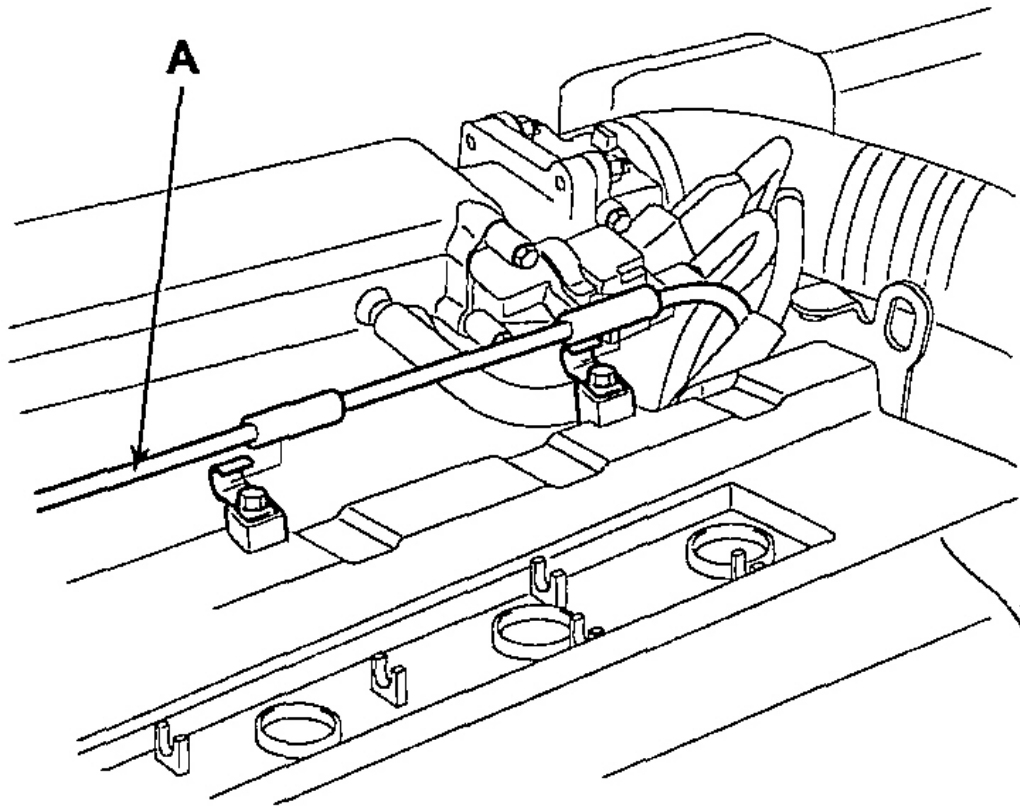
8. Remove the radiator. See **COOLING SYSTEM**.
9. Remove the heater hose (A).



G00719094

**Fig. 160: Removing Heater Hose**  
Courtesy of KIA MOTORS AMERICA, INC.

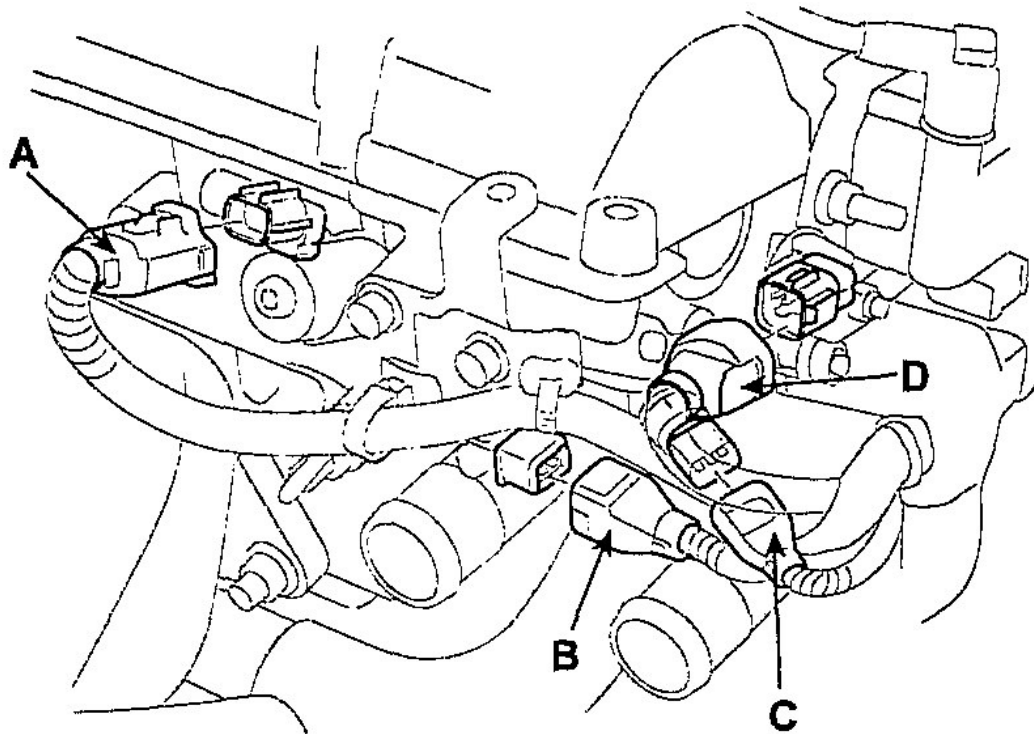
10. Remove the accelerator cable (A).



G00719095

**Fig. 161: 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).

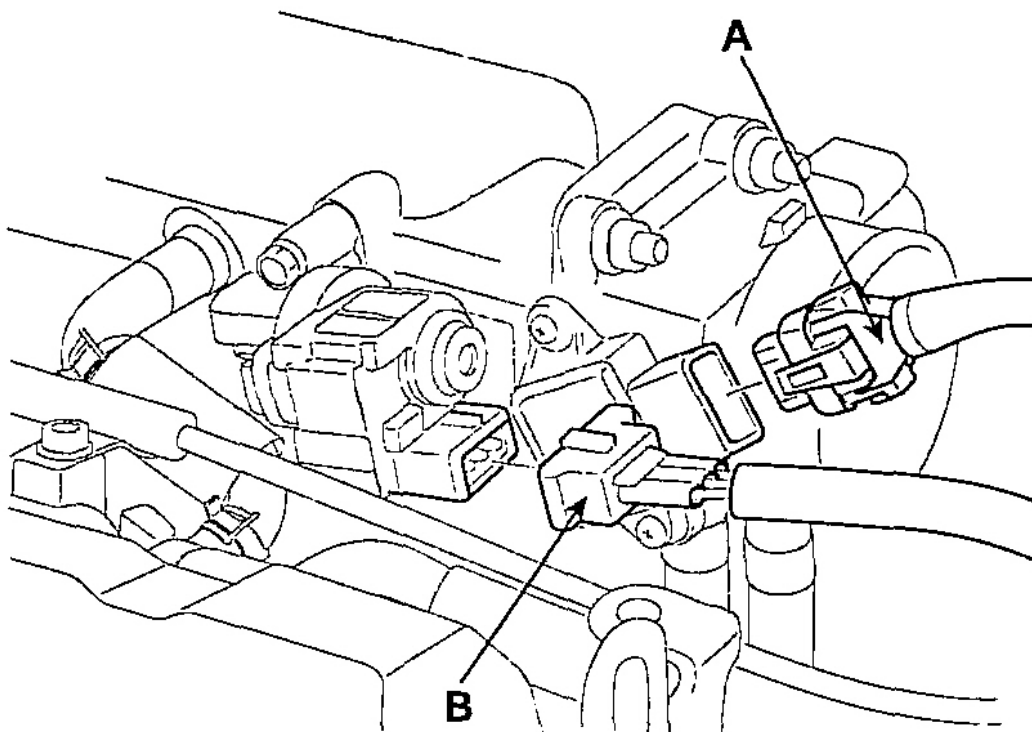


G00719096

**Fig. 162: 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).

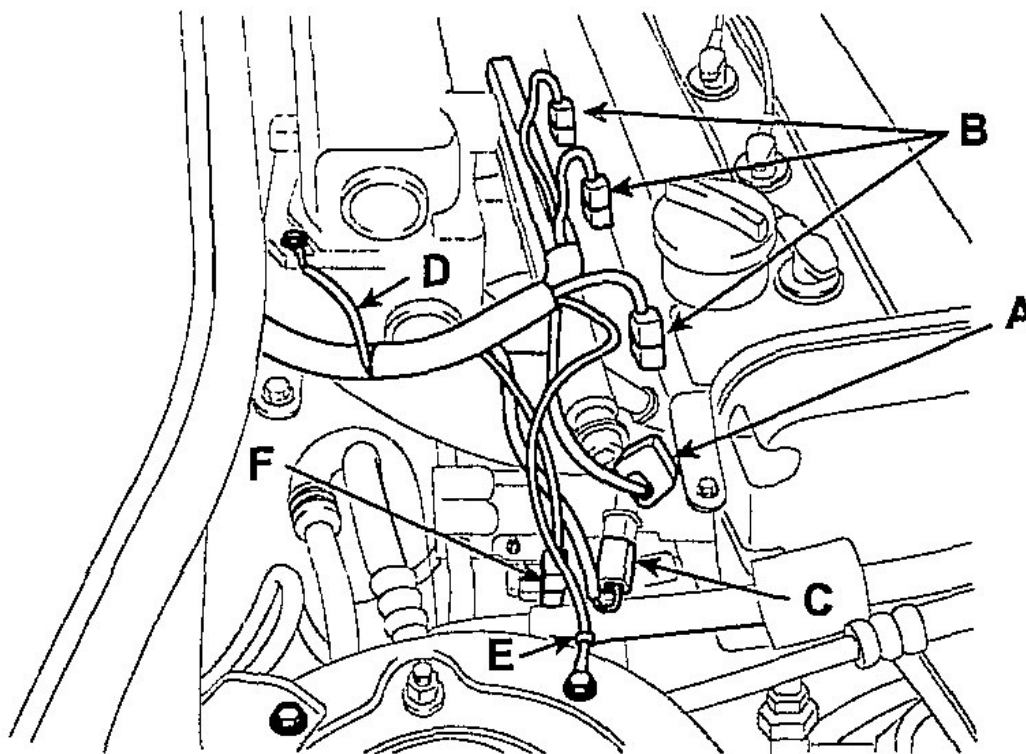




G00719097

**Fig. 163: Disconnecting the TPS & ISA Connectors**  
Courtesy of KIA MOTORS AMERICA, INC.

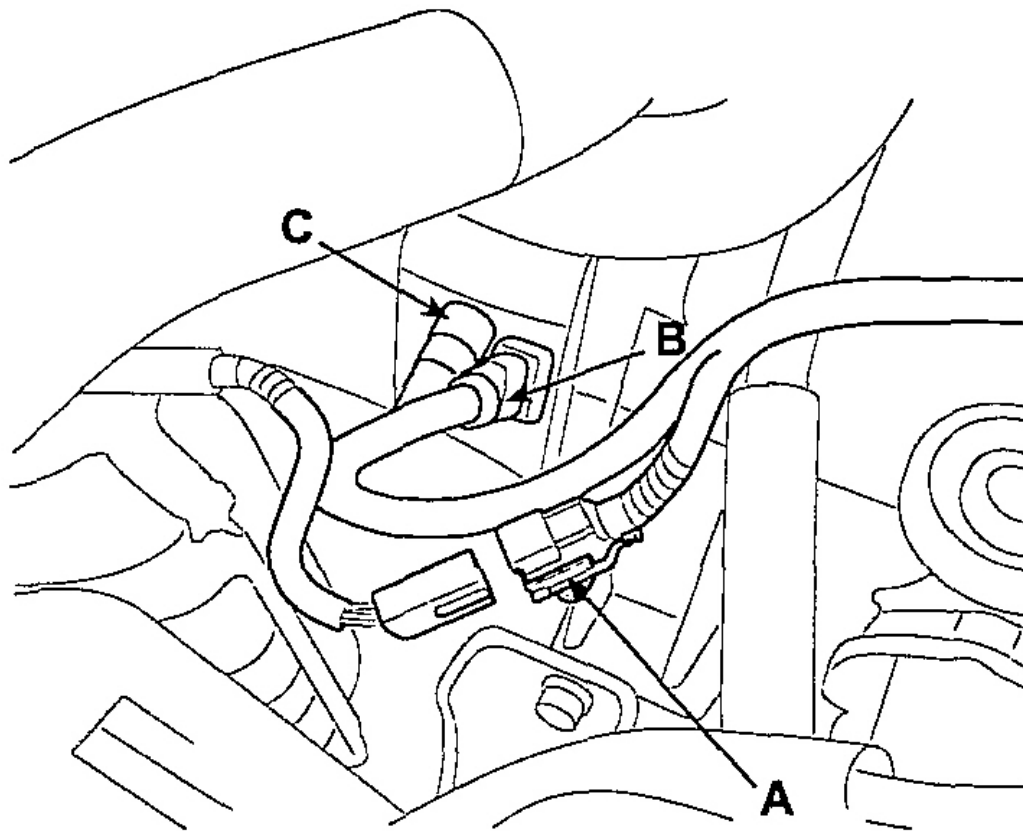
- g. Disconnect the CMP (Camshaft Position Sensor) connector (A).
- h. Disconnect the four fuel injector connectors (B).
- i. Disconnect the knock sensor connector (C).
- j. Disconnect the ground cables (D, E) from the intake manifold and vehicle's body.
- k. Disconnect the air conditioner compressor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



G00719098

**Fig. 164: Disconnecting Engine Sensors & Grounds**  
Courtesy of KIA MOTORS AMERICA, INC.

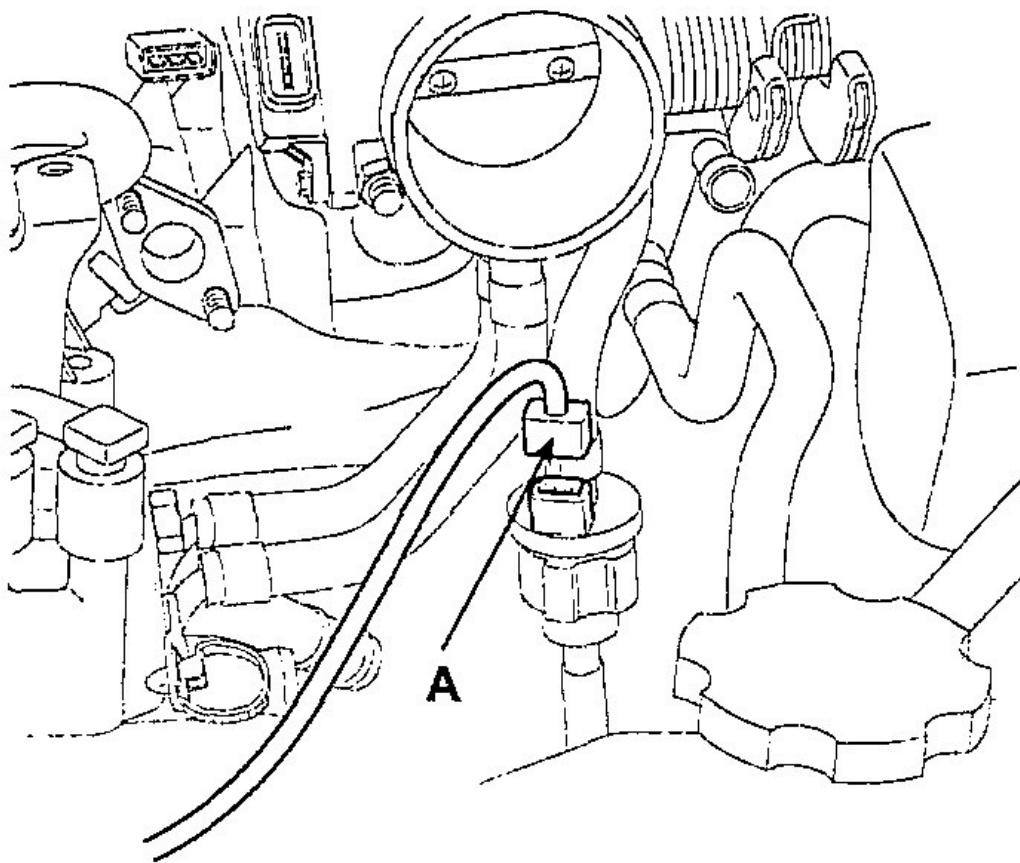
- l. Disconnect the front heated oxygen sensor connector (A).
- m. Disconnect the CKP (Crankshaft Position Sensor) connector (B).
- n. Disconnect the oil pressure switch connector (C).



G00719099

**Fig. 165: Disconnecting Oil Pressure Switch Connector**  
Courtesy of KIA MOTORS AMERICA, INC.

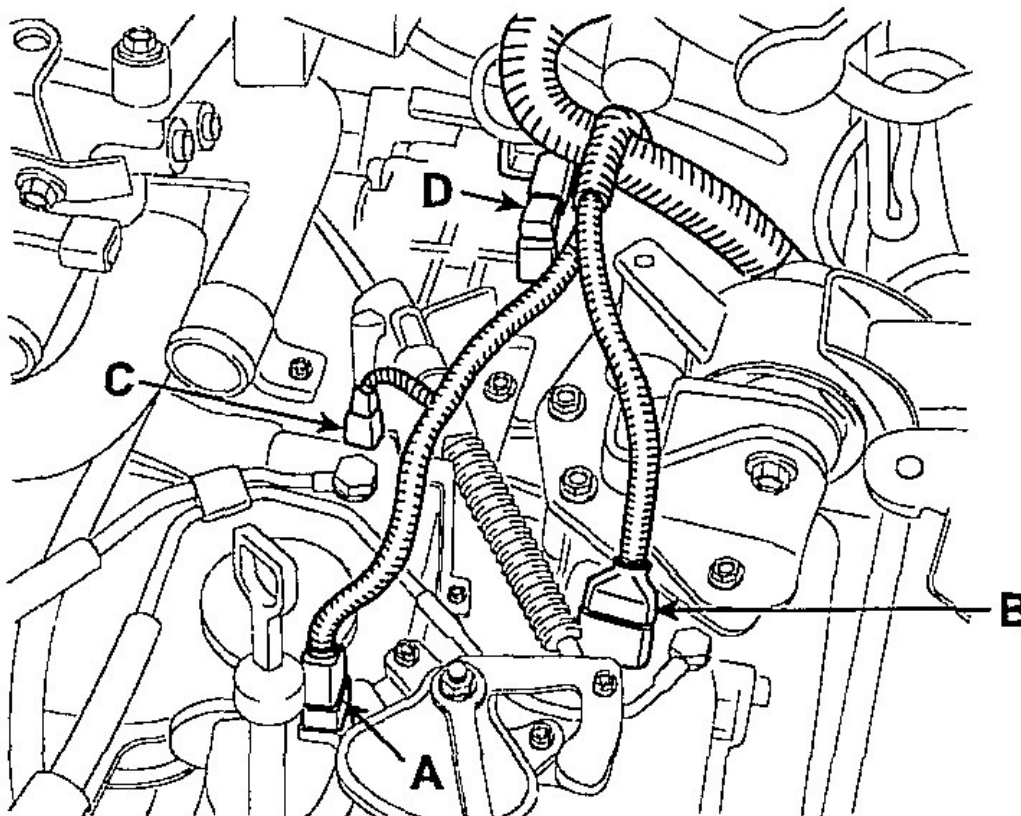
- o. Disconnect the PCSV (Purge Control Solenoid Valve) connector (A).



G00719100

**Fig. 166: Disconnecting PCSV Connector**  
Courtesy of KIA MOTORS AMERICA, INC.

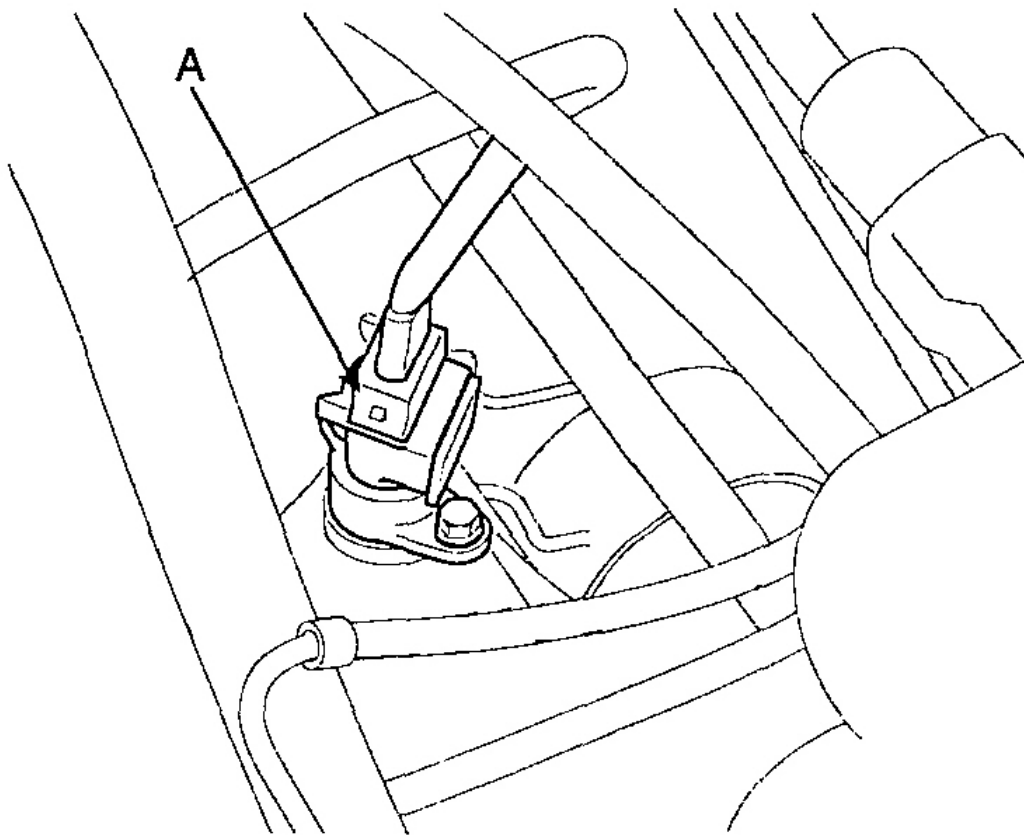
12. Remove the transaxle wire harness connectors and control cable from transaxle (A/T).
  - a. Disconnect the transaxle range switch connector (A).
  - b. Disconnect the solenoid valve connector (B).
  - c. Disconnect the input shaft speed sensor connector (C).
  - d. Disconnect the output shaft speed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



G00719101

**Fig. 167: Disconnecting Input & Output Shaft Speed Sensor Connectors**  
Courtesy of KIA MOTORS AMERICA, INC.

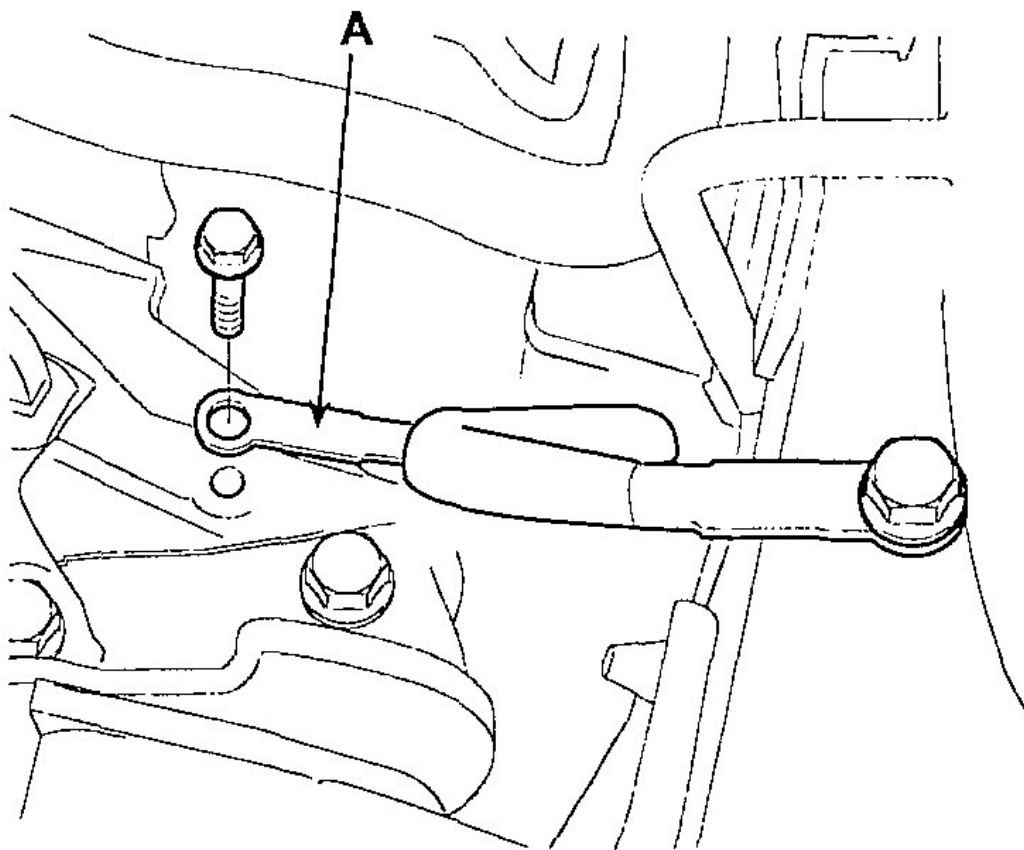
- e. Disconnect the vehicle speed sensor connector (A).



G00719102

**Fig. 168: Disconnecting Vehicle Speed Sensor Connector**  
Courtesy of KIA MOTORS AMERICA, INC.

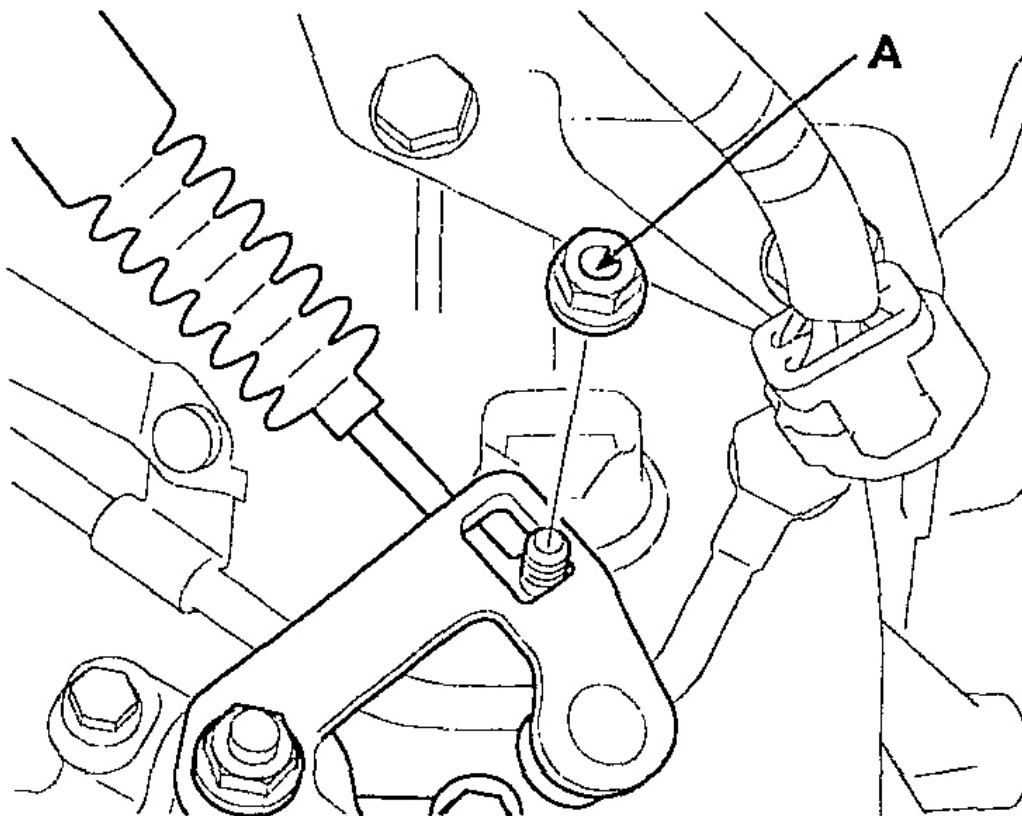
- f. Remove the transaxle ground cable (A).



G00719103

**Fig. 169: Removing Transaxle Ground Cable**  
Courtesy of KIA MOTORS AMERICA, INC.

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

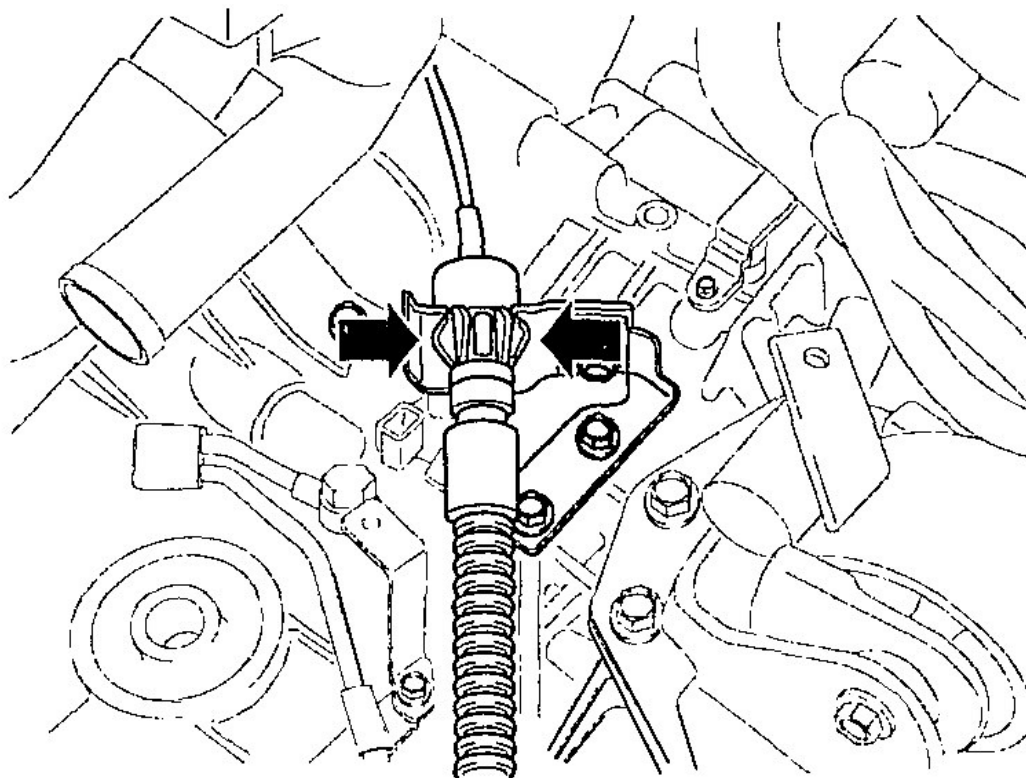


G00719104

**Fig. 170: Removing Control Cable Nut**  
Courtesy of KIA MOTORS AMERICA, INC.

- h. Remove the control cable.

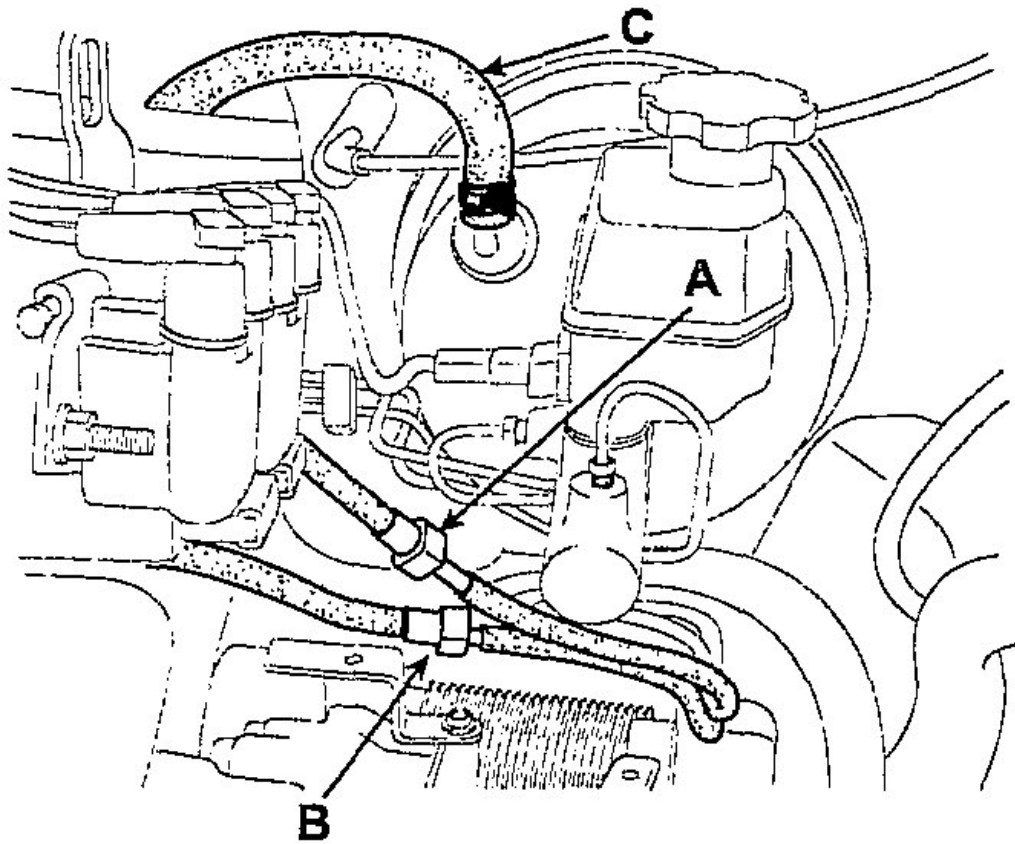




G00719105

**Fig. 171: Removing Control Cable**  
Courtesy of KIA MOTORS AMERICA, INC.

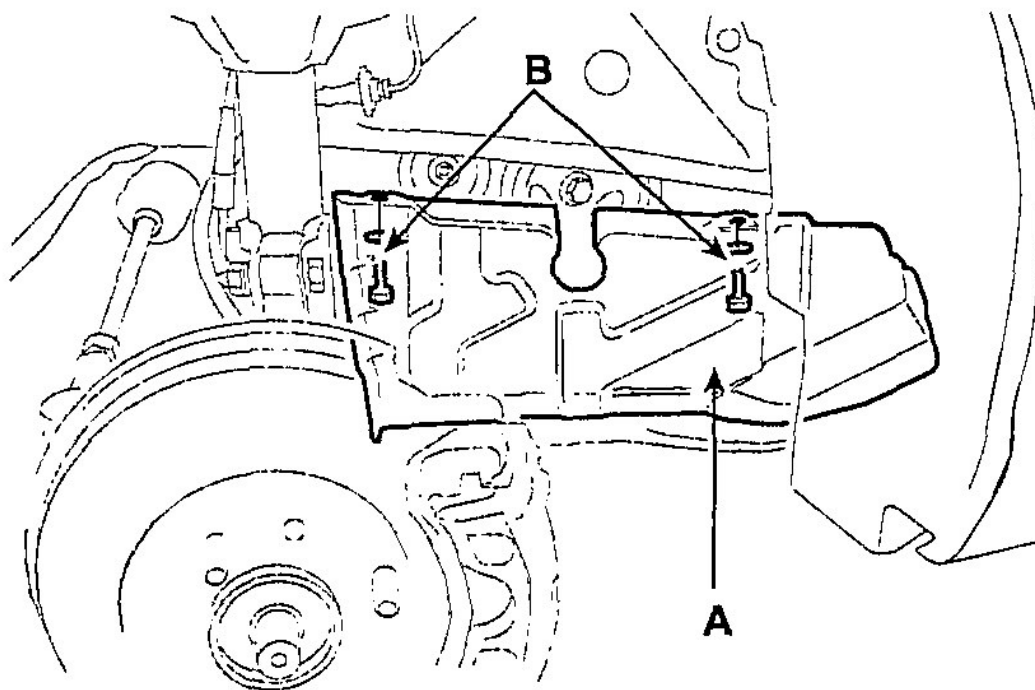
13. Disconnect the fuel inlet hose (A) of the delivery pipe side.
14. Disconnect the hose (B) of the PCSV (Purge Control Solenoid Valve) side.
15. Remove the brake booster vacuum hose (C).



G00719106

**Fig. 172: Removing Brake Booster Vacuum Hose**  
Courtesy of KIA MOTORS AMERICA, INC.

16. Remove the power steering pump drive belt.
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 front wheel (RH, LH).
19. Remove the bolts (B) and RH side cover (A).

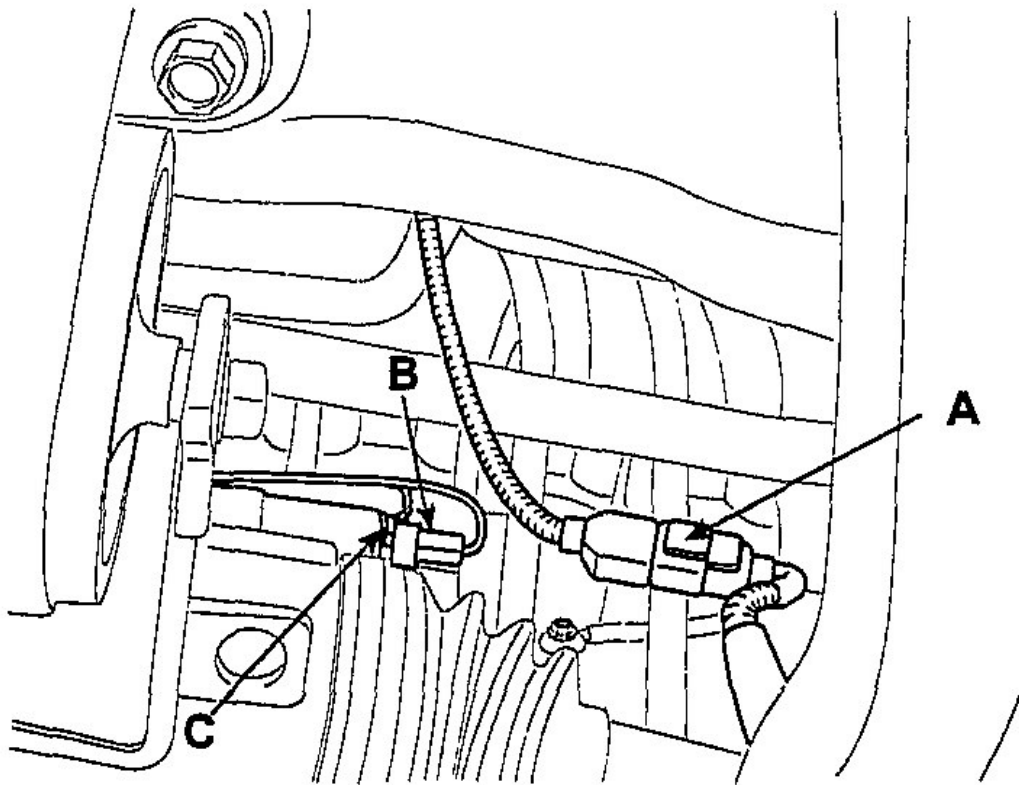


G00719107

**Fig. 173: Removing Side Cover**

Courtesy of KIA MOTORS AMERICA, INC.

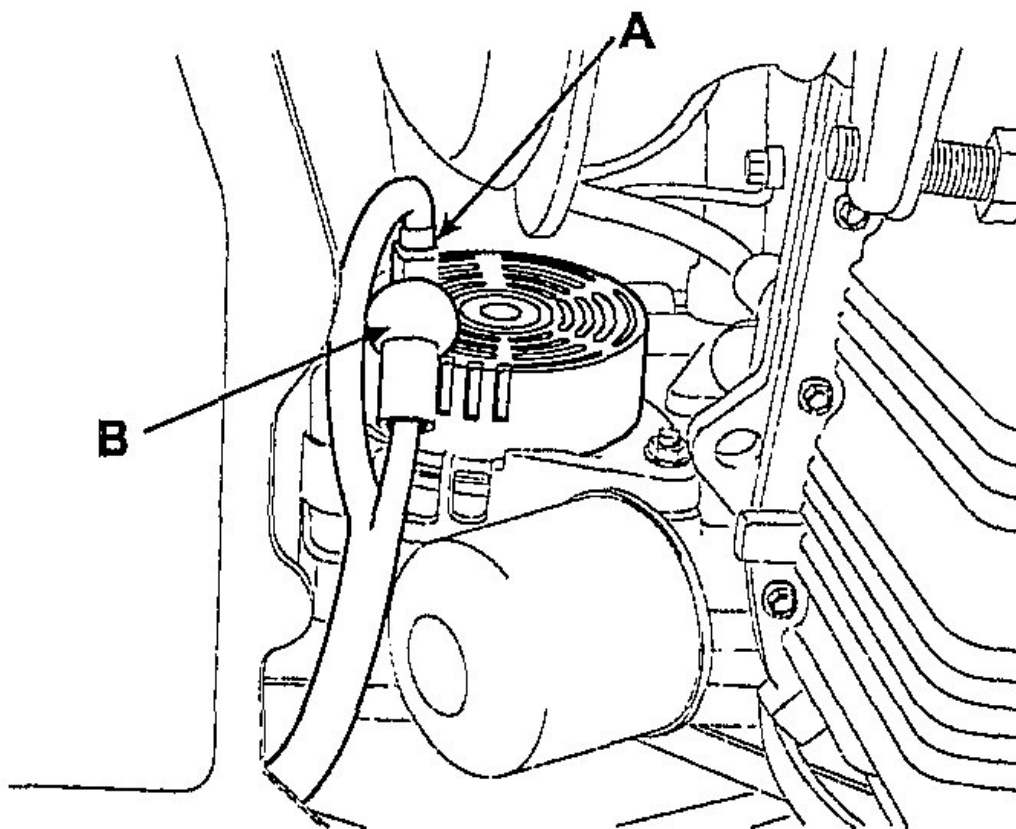
20. Remove the air conditioner compressor drive belt. See **DRIVE BELT** .
21. Remove the air conditioner compressor and fix the compressor to vehicle with a wire.
22. Remove the rear oxygen sensor connector (A) and clamp.
23. Disconnect the starter motor connector (B) and terminal (C).



G00719108

**Fig. 174: Disconnecting Starter Motor Connector**  
Courtesy of KIA MOTORS AMERICA, INC.

24. Remove the mounting clip of the starter cable.
25. Remove the alternator connector (A) and terminal (B).



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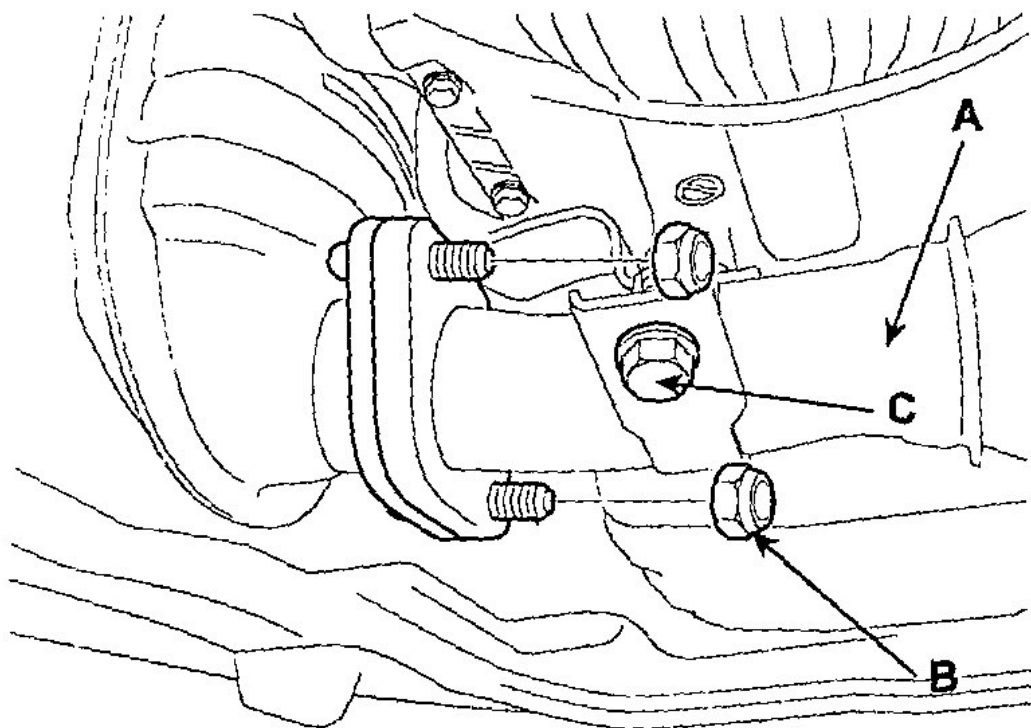
**Fig. 175: Removing Alternator Connector**  
Courtesy of KIA MOTORS AMERICA, INC.

26. Remove the front muffler (A).

Tightening torque:

Nut (B): 39.2-58.8 N.m (4.0- 6.0 kg-m, 28.9-43.4 lb-ft)

Bolt (C): 29.4-39.2 N.m (3.0-4.0 kg-m, 21.7-28.9 lb-ft)

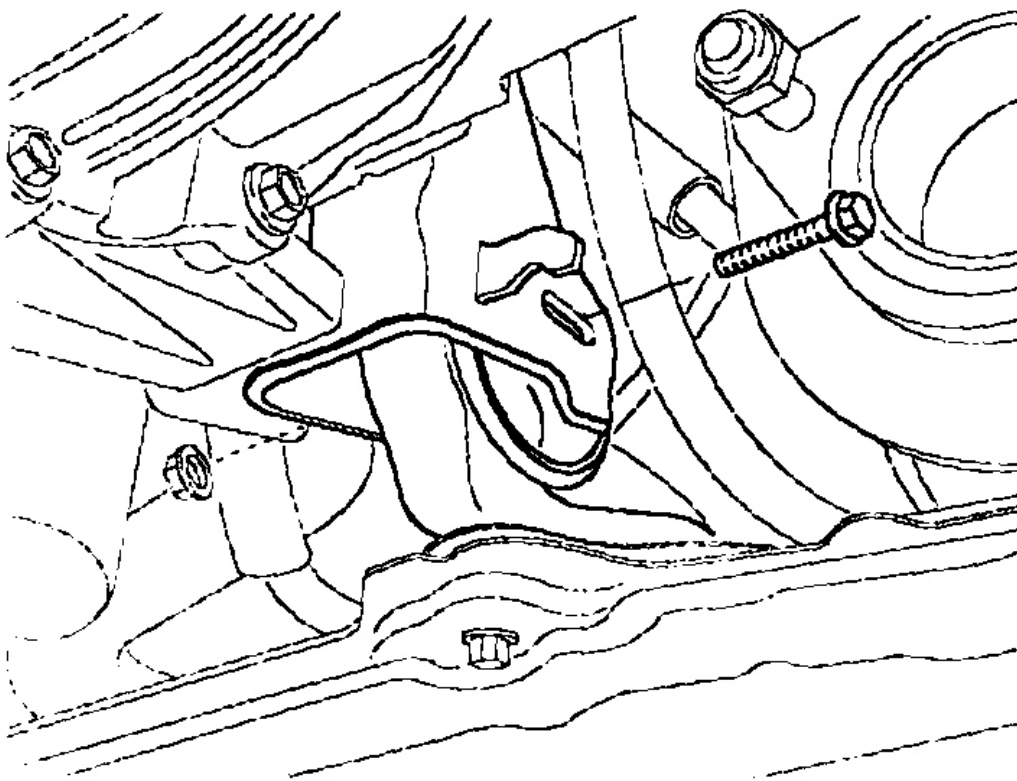


G00719110

**Fig. 176: Removing Front Muffler**  
Courtesy of KIA MOTORS AMERICA, INC.

27. Remove the drive shaft.
28. Remove the front roll stopper.

Tightening torque: 49.0-63.7 N.m (5.0-6.5 kg-m, 36.2-47.0 lb-ft)

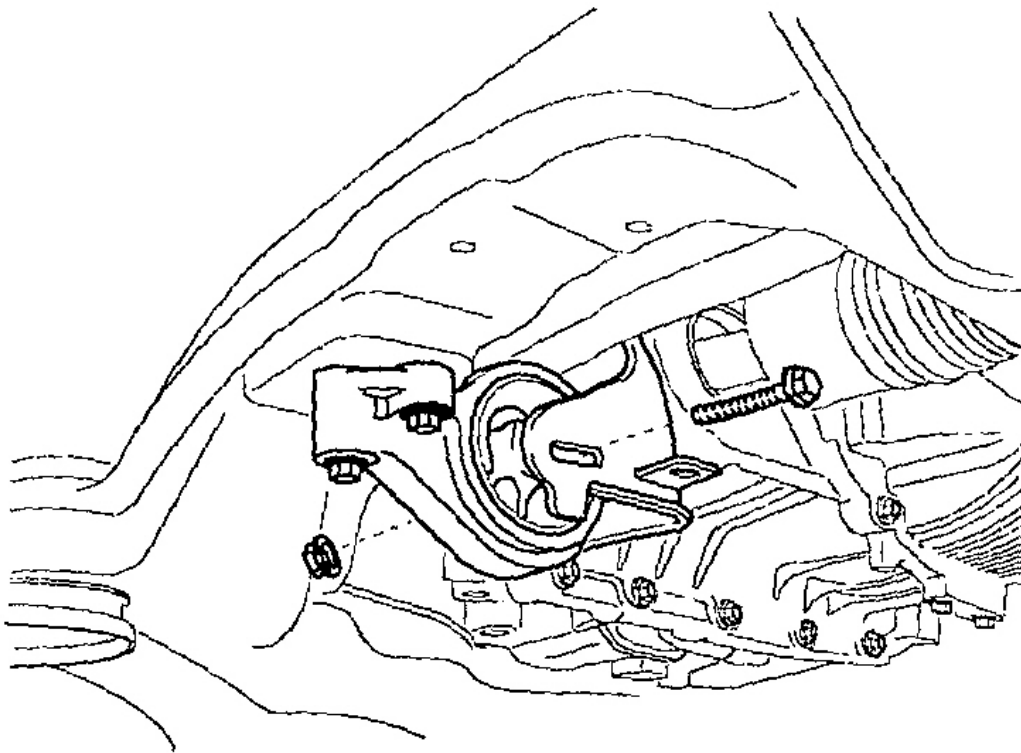


G00719111

**Fig. 177: Removing Front Roll Stopper**  
Courtesy of KIA MOTORS AMERICA, INC.

29. Remove the rear roll stopper.

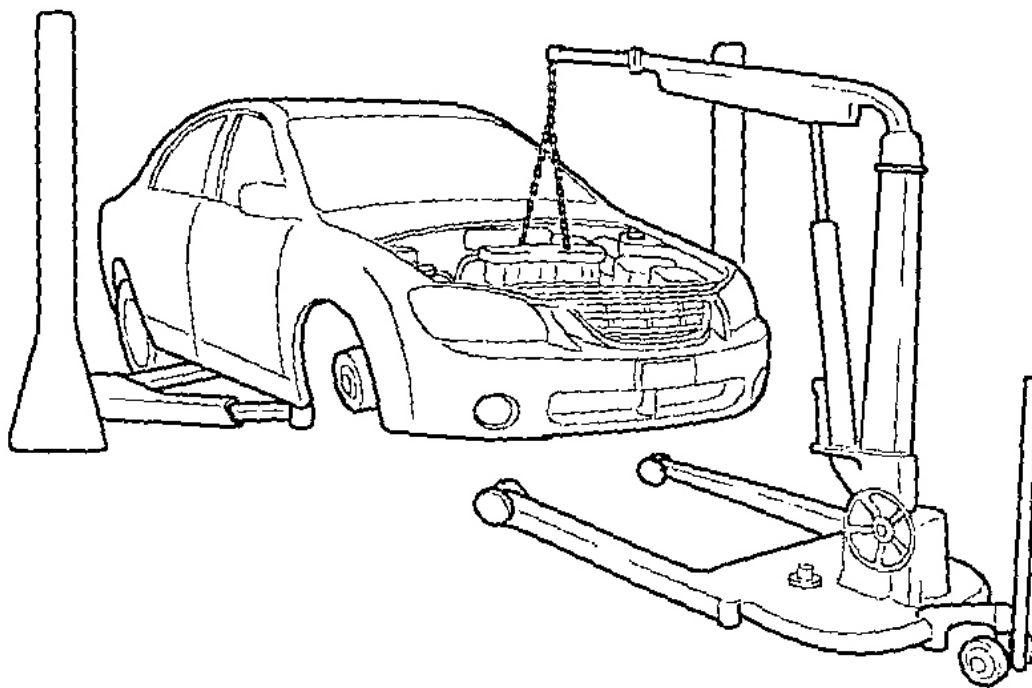
Tightening torque: 49.0-63.7 N.m (5.0-6.5 kg-m, 36.2-47.0 lb-ft)



**Fig. 178: Removing Rear Roll Stopper**  
**Courtesy of KIA MOTORS AMERICA, INC.**

- sábado, 6 de febrero de 2021 10:34:21 p. m.





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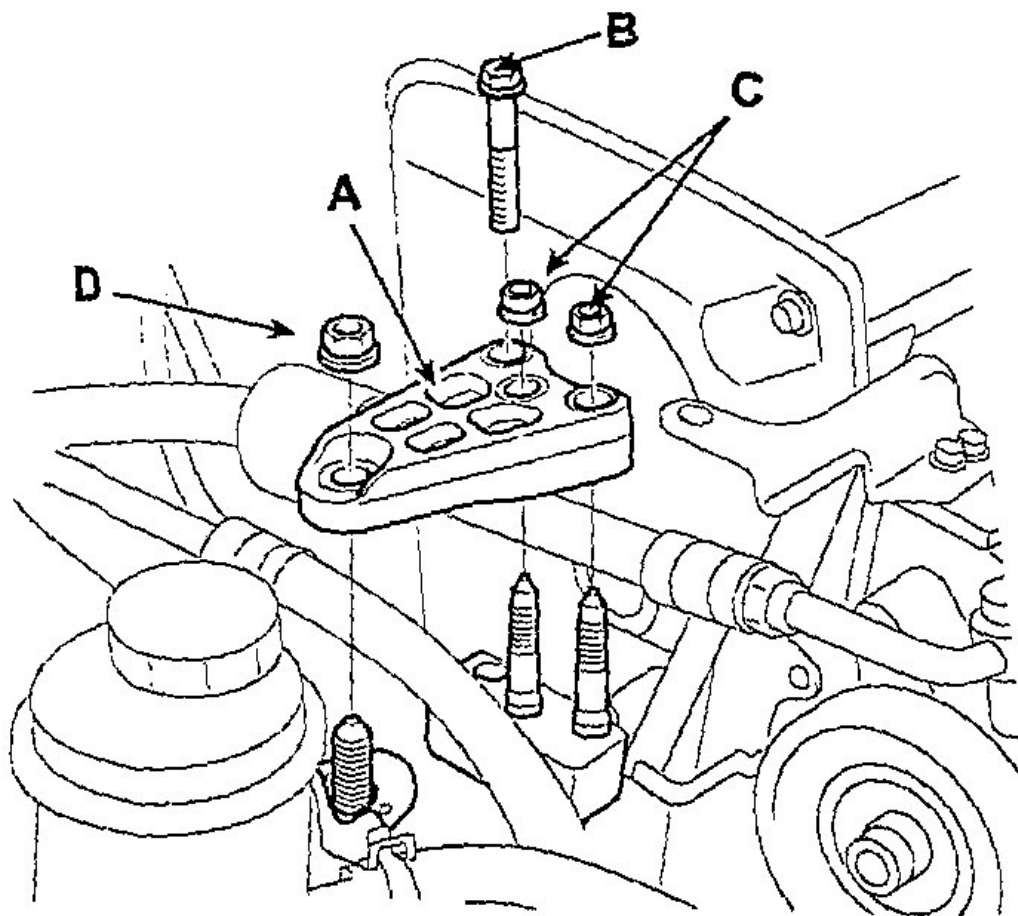
**Fig. 179: Installing Engine Hanger Lift To Engine And Transaxle Assembly**  
Courtesy of KIA MOTORS AMERICA, INC.

31. Remove the bolt (B), nuts (C, D) and engine mounting support bracket (A).

Tightening torque:

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

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



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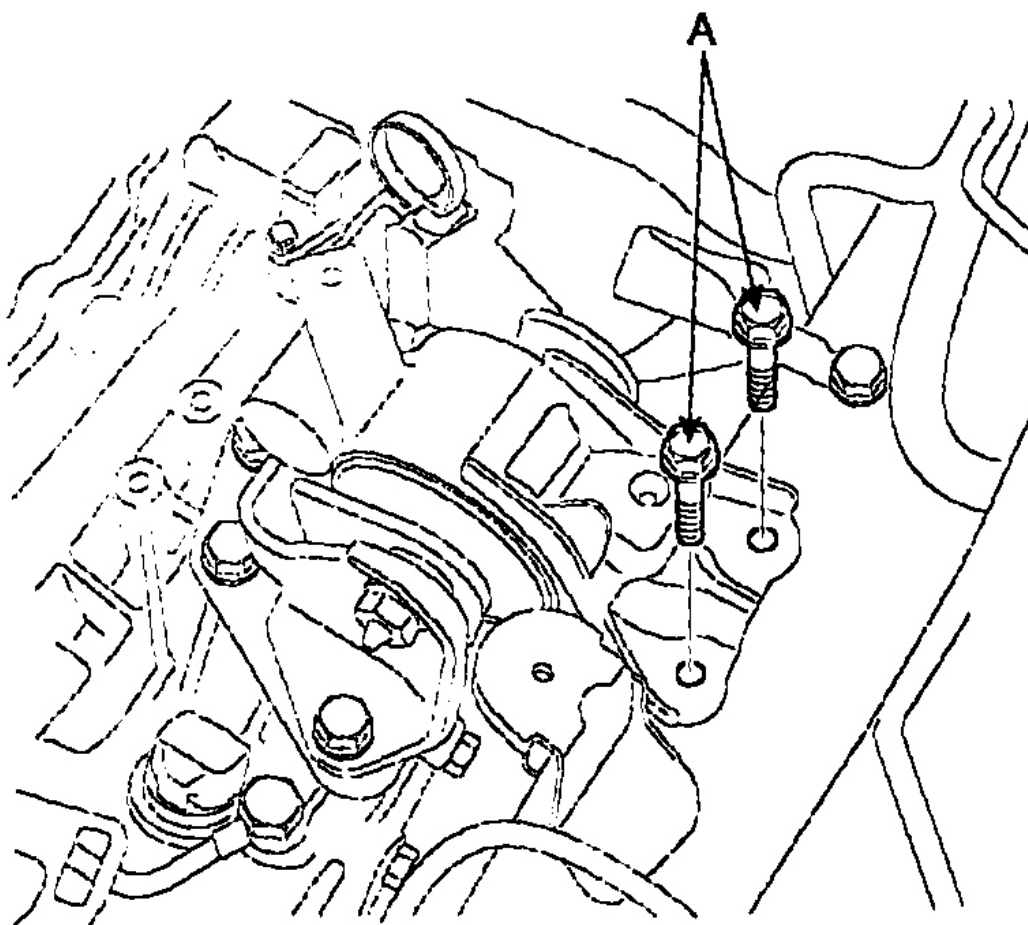
**Fig. 180: Removing Engine Mounting Support Bracket**  
Courtesy of KIA MOTORS AMERICA, INC.

32. Remove the transaxle mounting bracket.

Tightening torque:

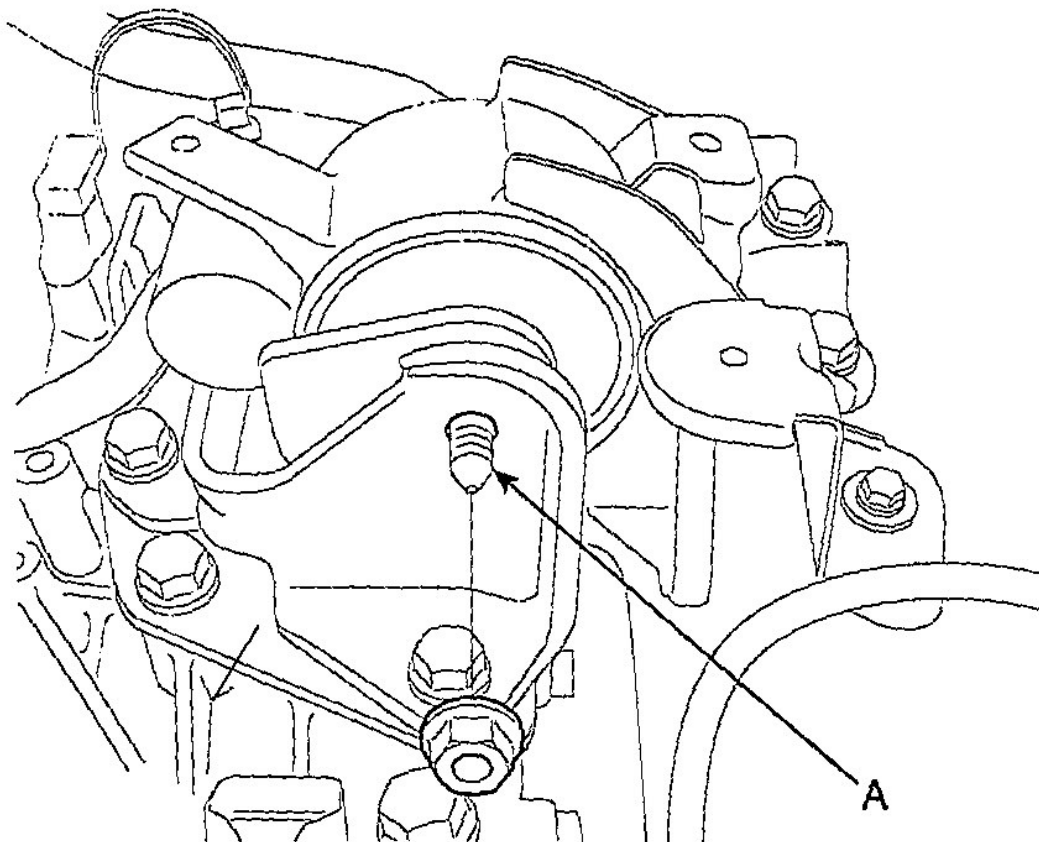
Bolt (A, C): 39.2-49.0 N.m (4.0-5.0 kg-m, 28.9-36.2 lb-ft)

Nut (B): 88.3-107.9 N.m (9.0-11.0 kg-m, 65.1-79.6 lb-ft)



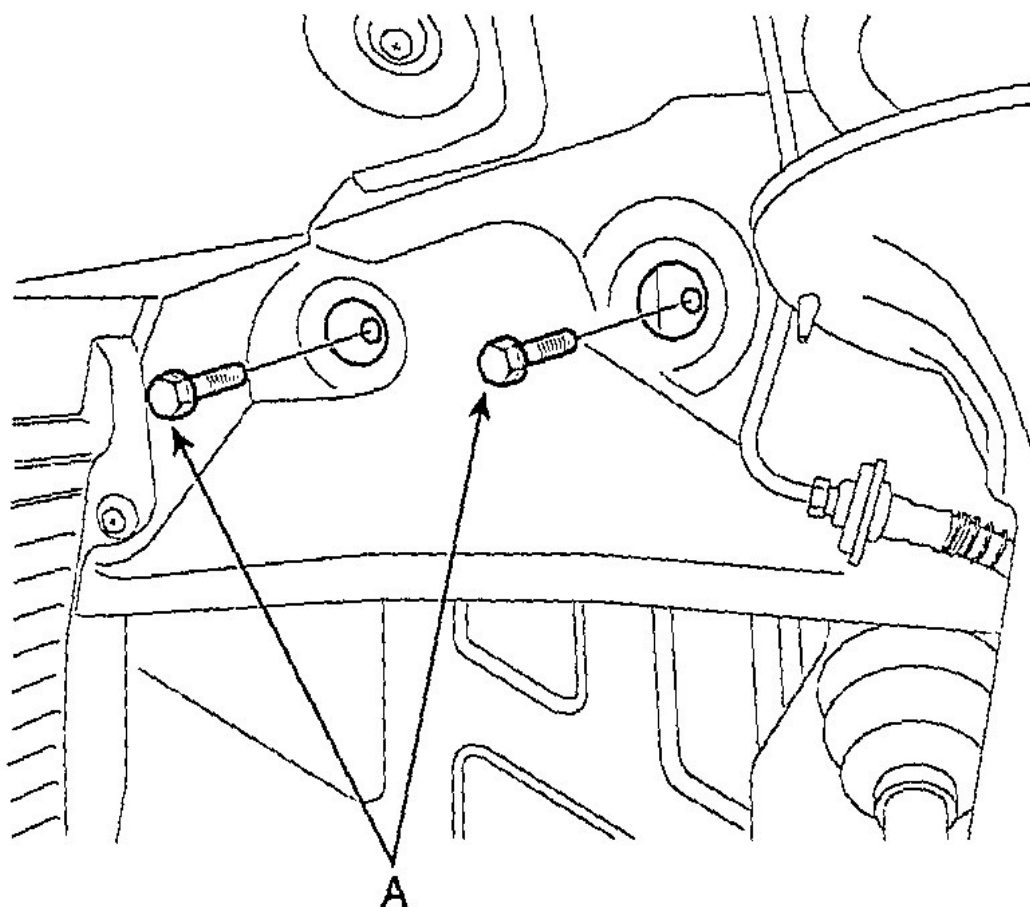
G00719115

**Fig. 181: Removing Transaxle Mounting Brackets (1 Of 3)**  
Courtesy of KIA MOTORS AMERICA, INC.



G00719116

**Fig. 182: Removing Transaxle Mounting Brackets (2 Of 3)**  
Courtesy of KIA MOTORS AMERICA, INC.



G00719117

**Fig. 183: Removing Transaxle Mounting Brackets (3 Of 3)**

Courtesy of KIA MOTORS AMERICA, INC.

33. Using engine hanger lift, remove the engine and transaxle assembly from vehicle.

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

## INSTALLATION

Installation is in the reverse order of removal.

Perform the following:

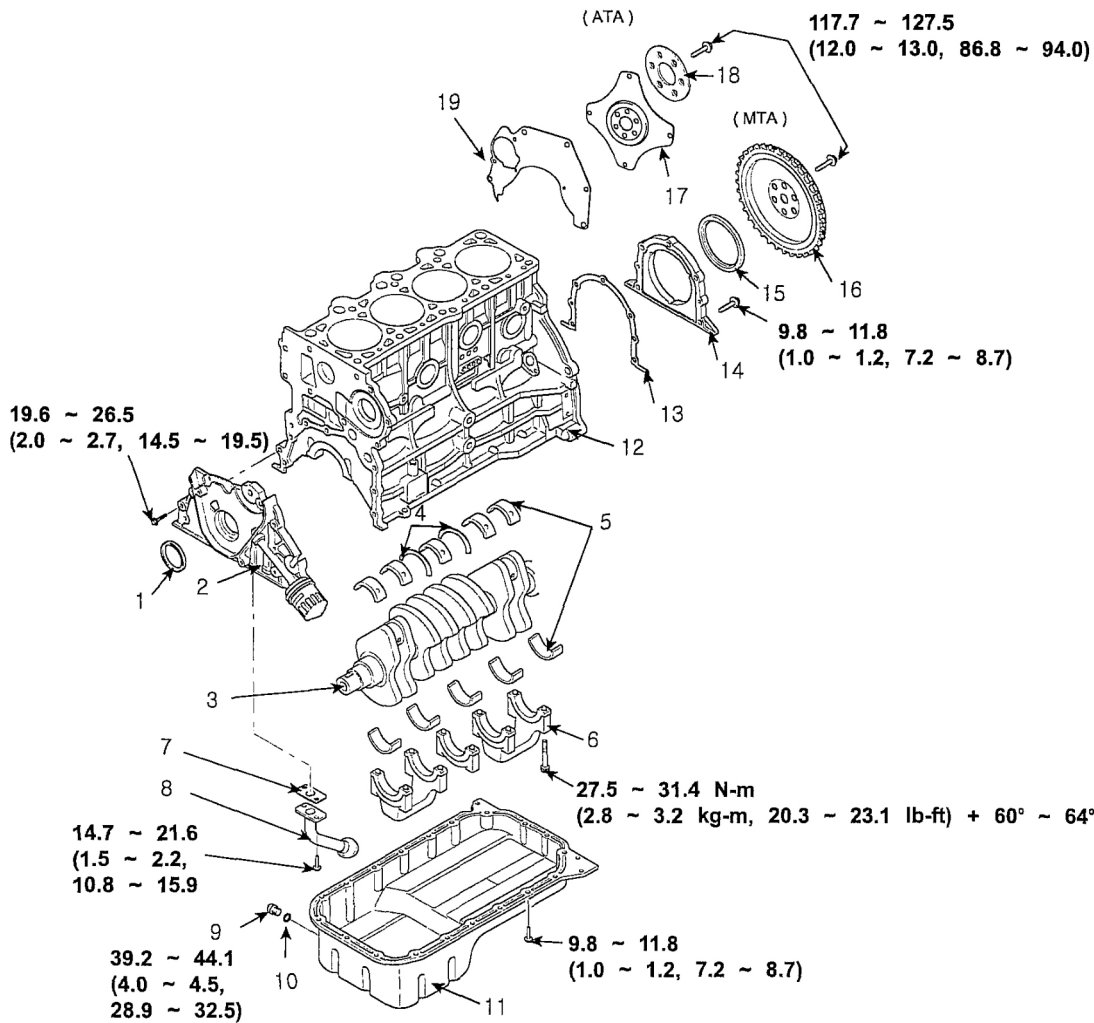
1. Adjust the shift cable.
2. Adjust the throttle cable.
3. Refill the engine with engine oil.
4. Refill the transaxle with fluid.
5. Refill the radiator and reservoir tank with engine coolant.
6. Place the heater control knob on "HOT" position.
7. Bleed air from the cooling system
  - a. Start engine and let it run until it warms up (until radiator fan operates 3 or 4 times).
  - b. Turn Off the engine. Check the level in the radiator, add coolant if needed. This will allow trapped air to be removed from the cooling system.
  - c. Put the radiator cap on tightly, then run the engine again and check for leaks.
8. Clean the battery posts and cable terminals with sandpaper assemble them, then apply grease to prevent corrosion.
9. Inspect for fuel leakage.

**NOTE:**        **After assemble 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.**

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

## **ENGINE BLOCK**

### **COMPONENT**

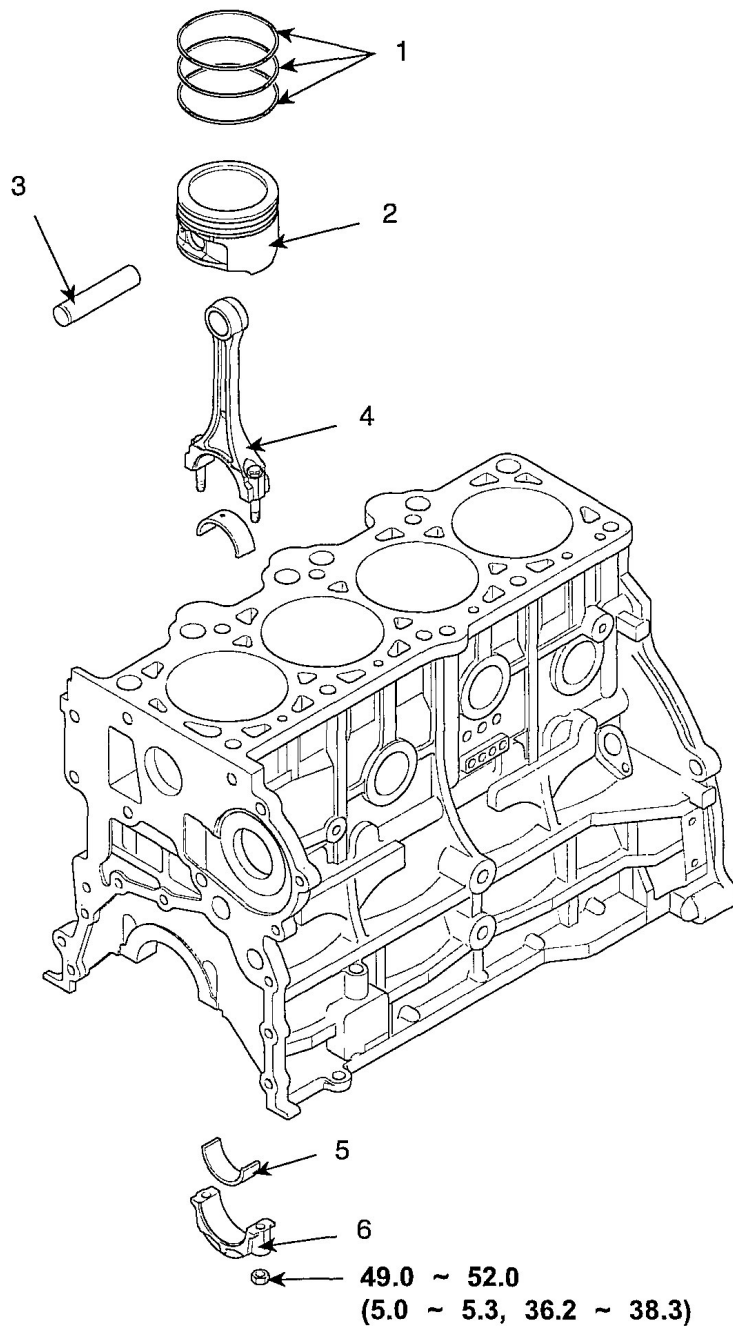


**TORQUE : N-m (kg-m, lb-ft)**

- |                     |                        |
|---------------------|------------------------|
| 1. Oil seal         | 11. Oil pan            |
| 2. Front case       | 12. Cylinder block     |
| 3. Crank shaft      | 13. Gasket             |
| 4. Thrust bearing   | 14. Rear oil seal case |
| 5. Main bearing     | 15. Oil seal           |
| 6. main bearing cap | 16. Fly wheel          |
| 7. Gasket           | 17. Drive plate        |
| 8. Oil screen       | 18. Washer             |
| 9. Drain plug       | 19. Rear plate         |
| 10. Gasket          |                        |

G00719118

**Fig. 184: 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

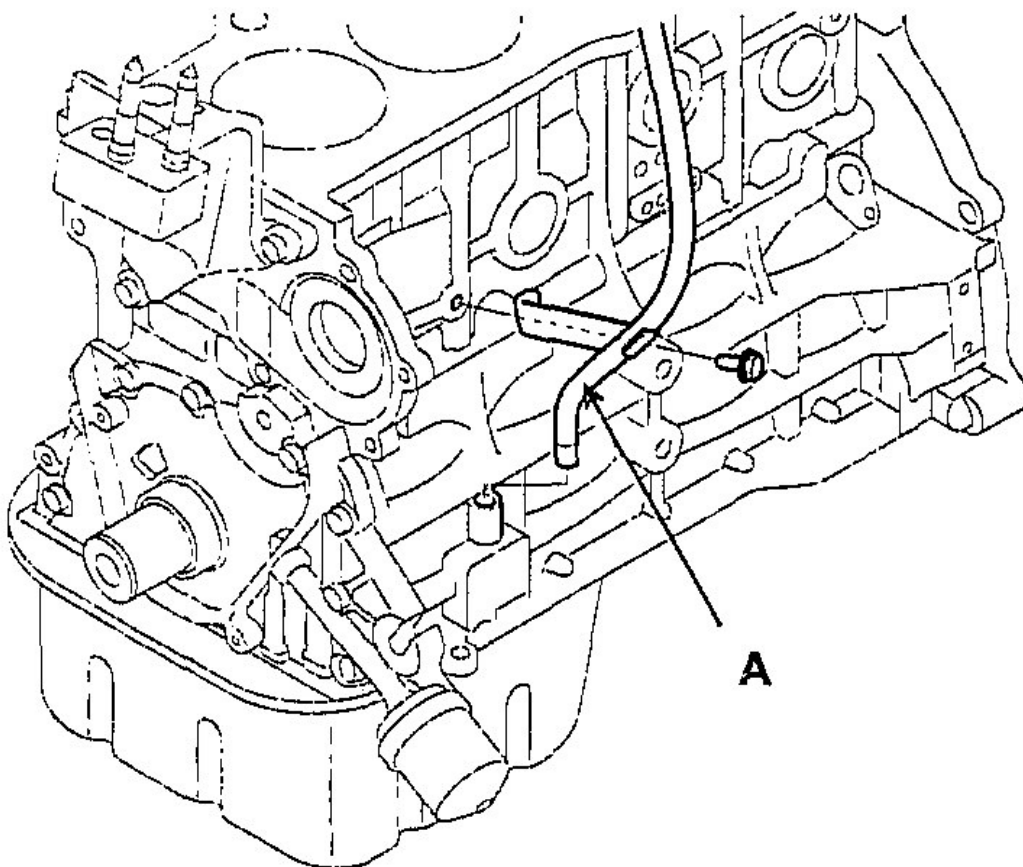
G00719119

**Fig. 185: Exploded View Of Block Assembly With Torque Specifications (2 Of 2)**  
 Courtesy of KIA MOTORS AMERICA, INC.



**DISASSEMBLY**

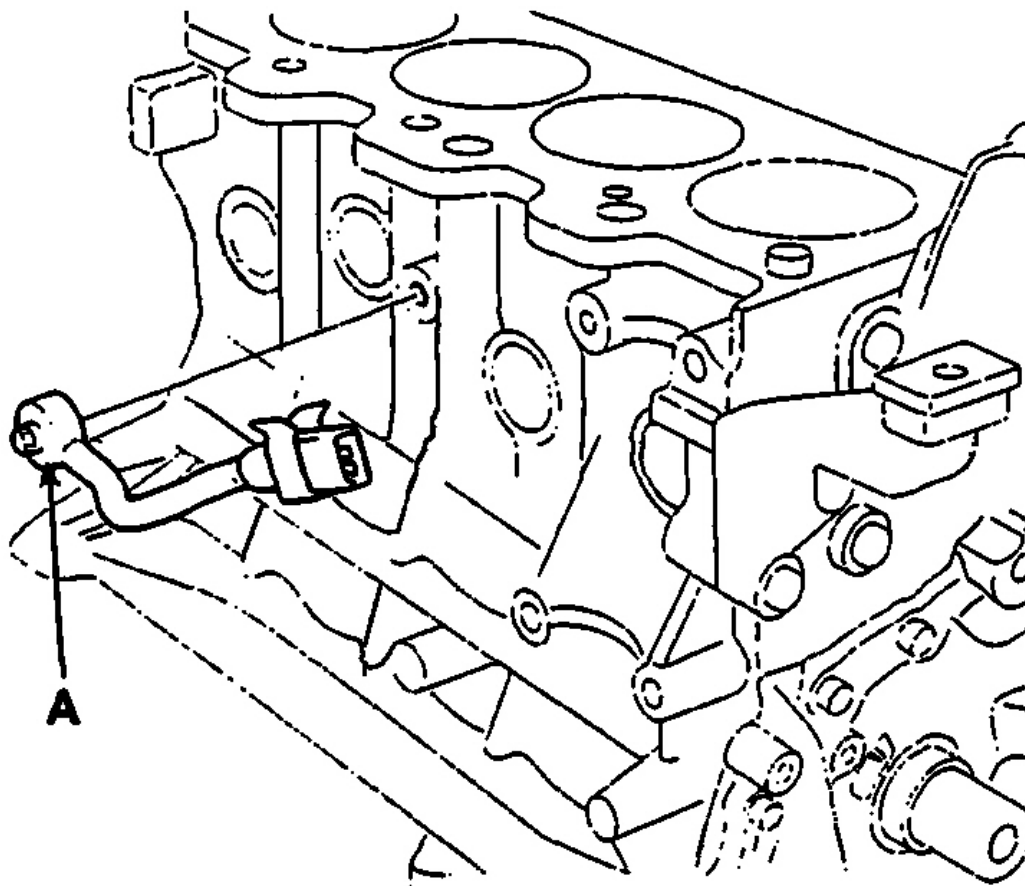
1. M/T: Remove the flywheel.
2. A/T: Remove the driveplate.
3. Install the engine block onto an engine stand for disassembly.
4. Remove the timing belt. See **REMOVAL**.
5. Remove the cylinder head. See **REMOVAL**.
6. Remove the oil level gauge tube (A).



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**Fig. 186: Removing Oil Level Gauge Tube**  
Courtesy of KIA MOTORS AMERICA, INC.

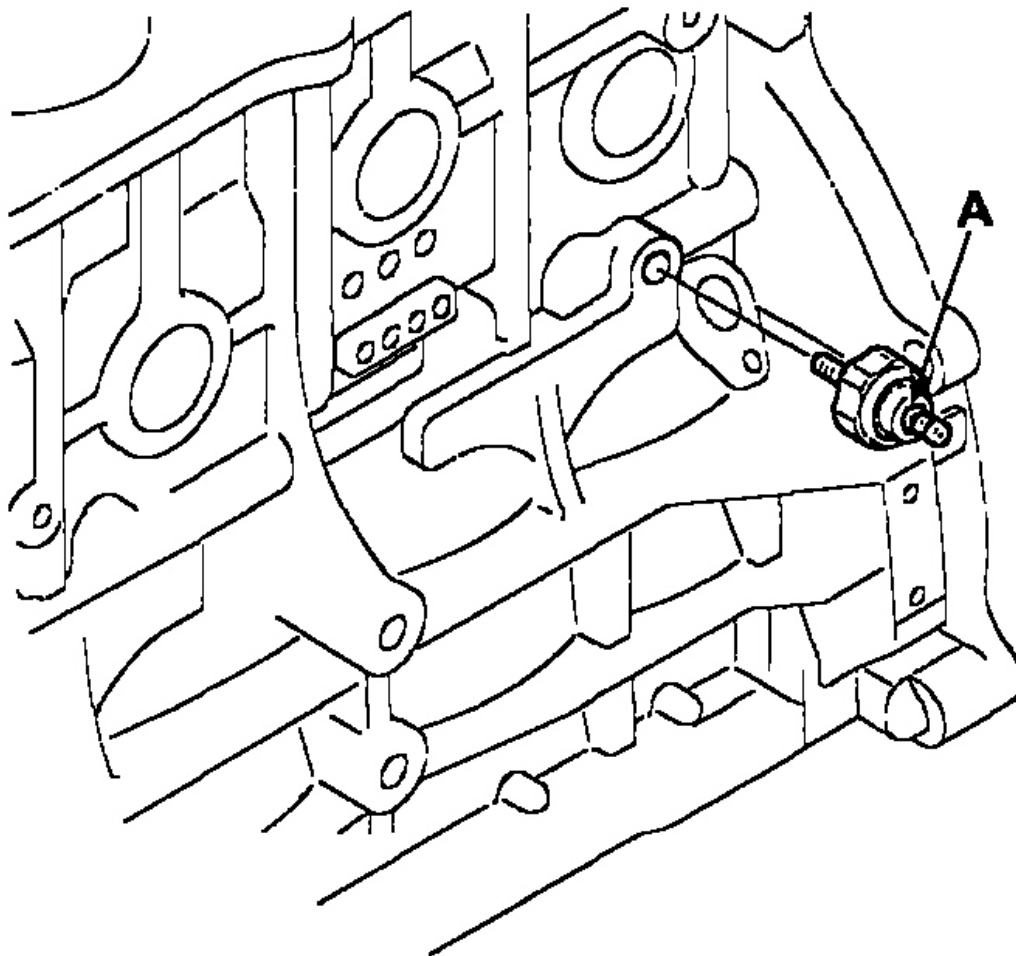
7. Remove the knock sensor (A).



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**Fig. 187: Removing Knock Sensor**  
Courtesy of KIA MOTORS AMERICA, INC.

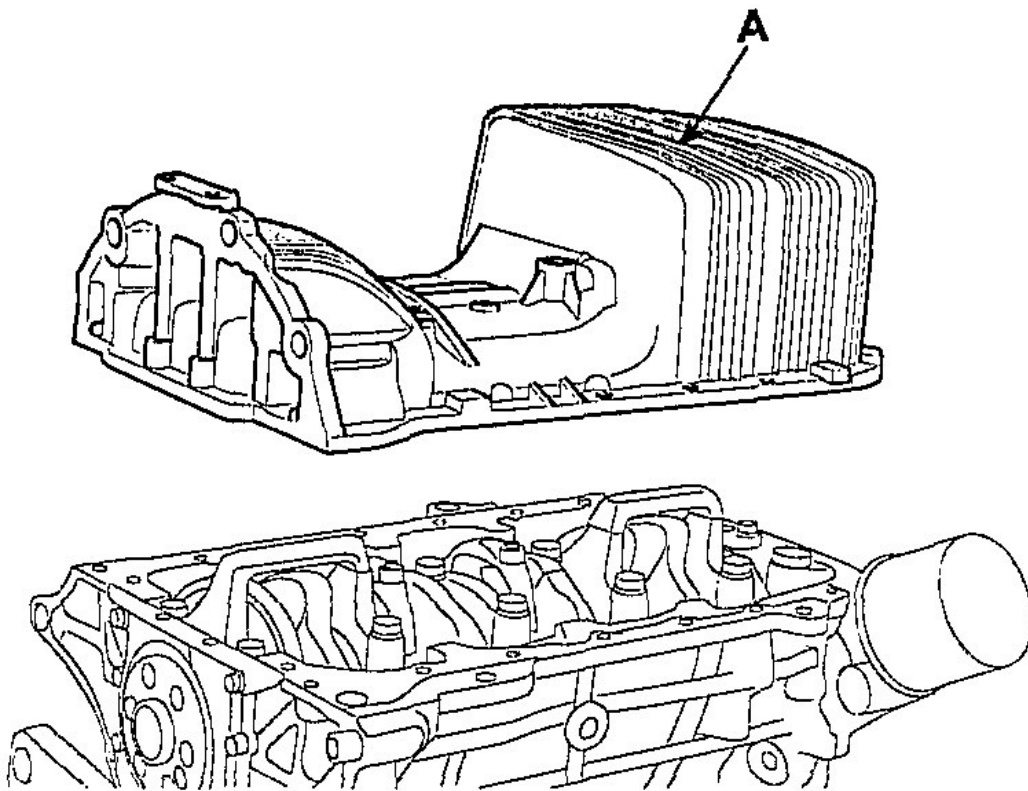
8. Remove the oil pressure switch (A).



G00719122

**Fig. 188: Removing Oil Pressure Switch**  
Courtesy of KIA MOTORS AMERICA, INC.

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



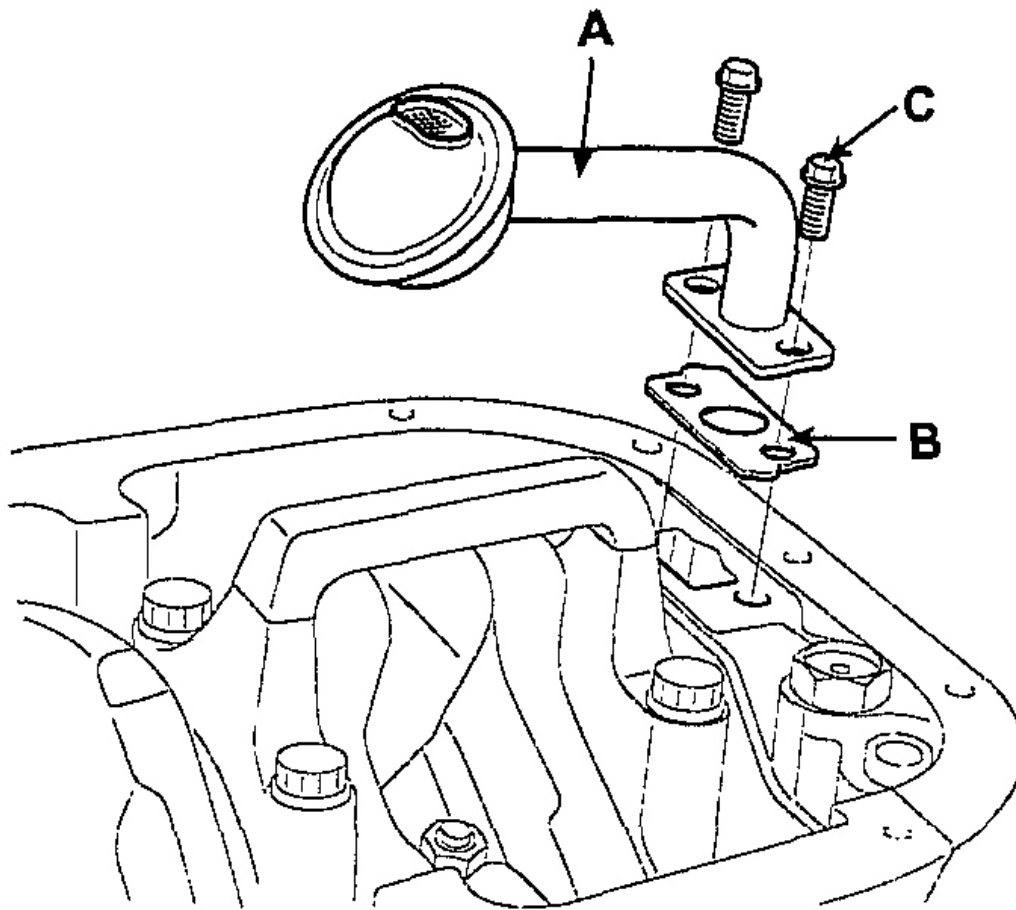
G00719123

**Fig. 189: Removing Oil Pan**

Courtesy of KIA MOTORS AMERICA, INC.

11. Remove the oil screen.

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



G00719124

**Fig. 190: Removing Oil Screen**

Courtesy of KIA MOTORS AMERICA, INC.

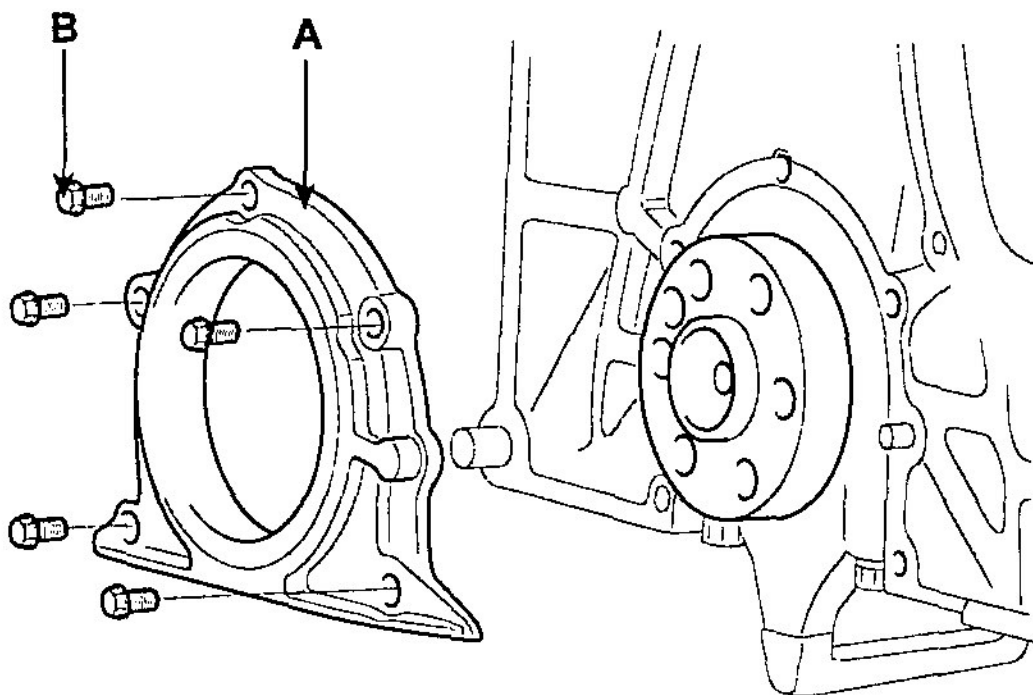
12. Check the connecting rod end play.
13. Remove the connecting rod caps and check oil clearance.
14. Remove the piston and connecting rod assemblies.
  - a. Using a ridge reamer, remove all the carbon from the top of the cylinder.
  - b. Push the piston, connecting rod assembly and upper bearing through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

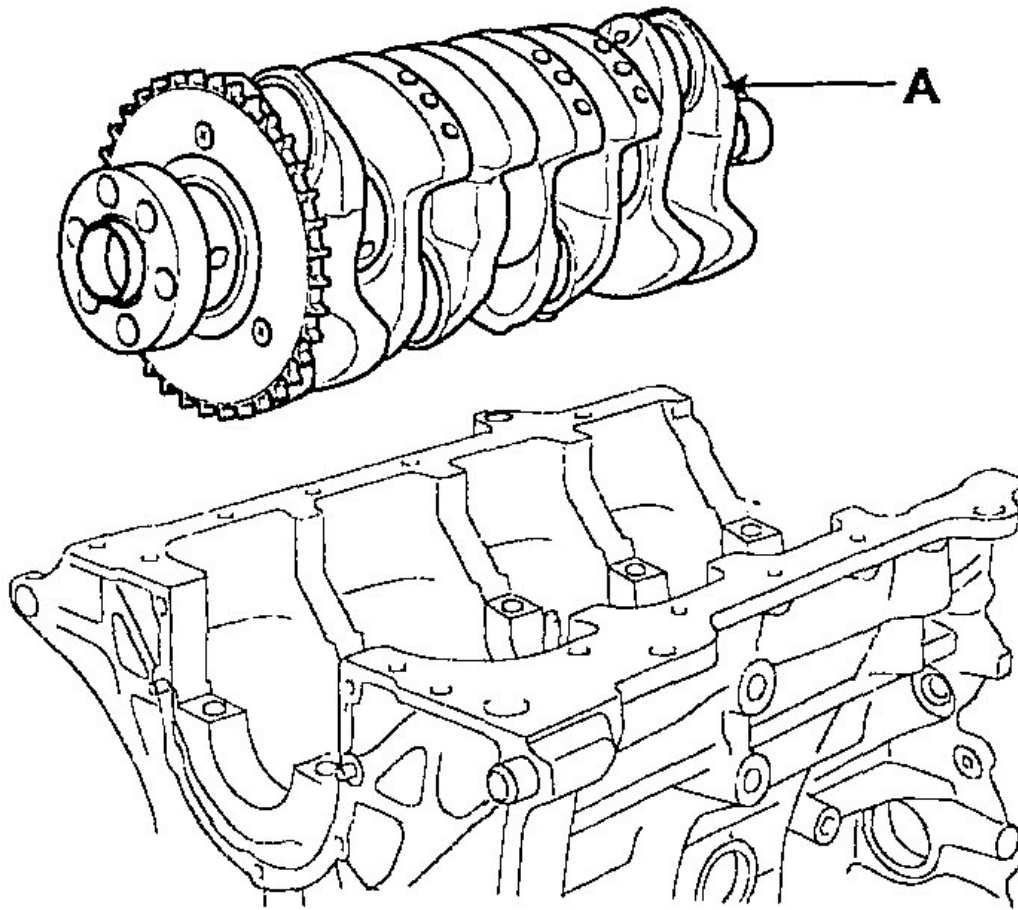


G00719125

**Fig. 191: 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. 192: 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. Remove the connecting rod from the piston.

Using a press, remove the piston pin from piston. Press-in load: 350-1,350 kg (772-2,976 lbs.)

## INSPECTION & REPAIR

### CONNECTING ROD AND CRANKSHAFT

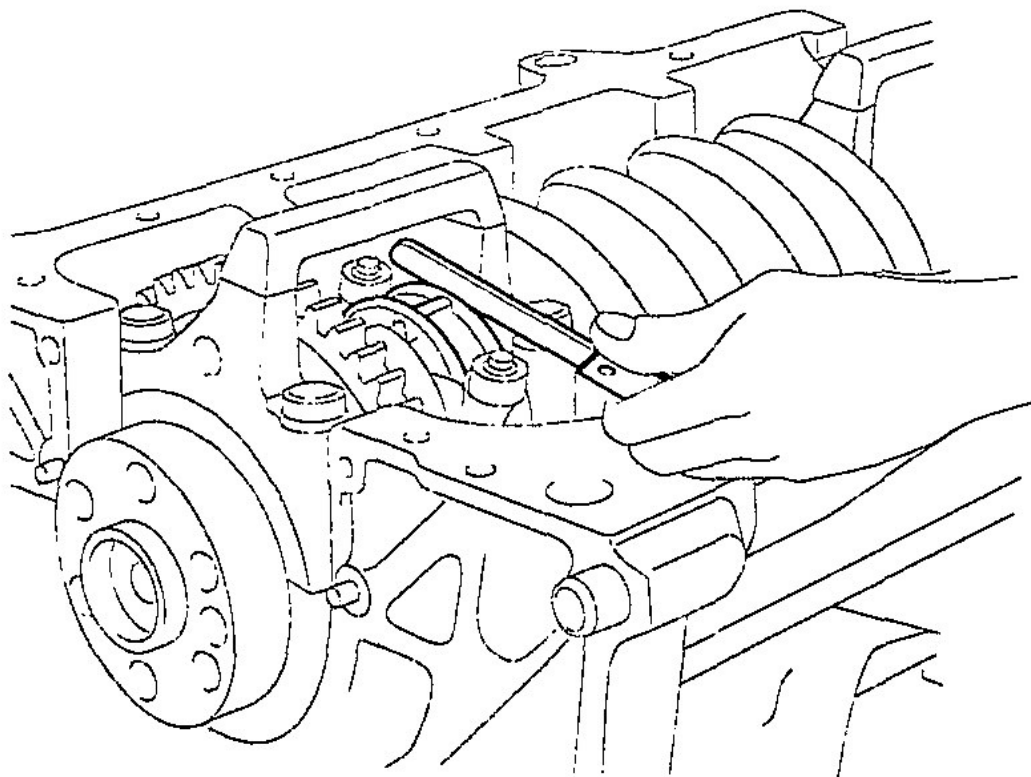
1. Check the connecting rod end play.

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. 193: Measuring Connecting Rod End Play**  
Courtesy of KIA MOTORS AMERICA, INC.



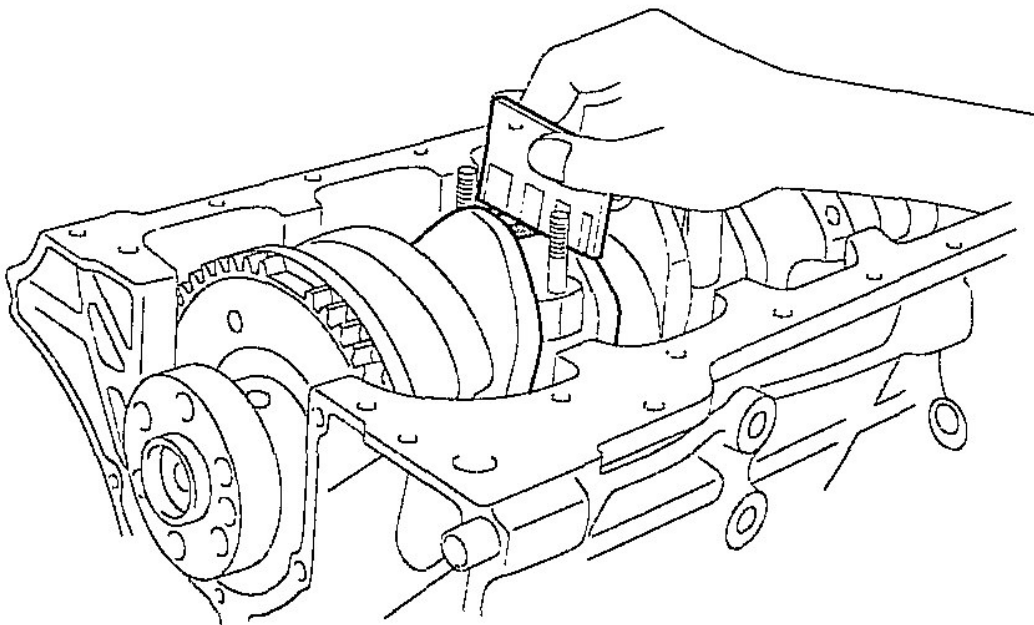
- If out-of-tolerance, install a new connecting rod.
  - If still out-of-tolerance, replace the crankshaft.
2. Check the connecting rod bearing oil clearance.
- a. Check that the match marks on the connecting rod and cap are aligned to ensure correct reassembly.
  - b. Remove the 2 connecting rod cap 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. 194: Measuring Connecting Rod Bearing Clearance****Courtesy of KIA MOTORS AMERICA, INC.**

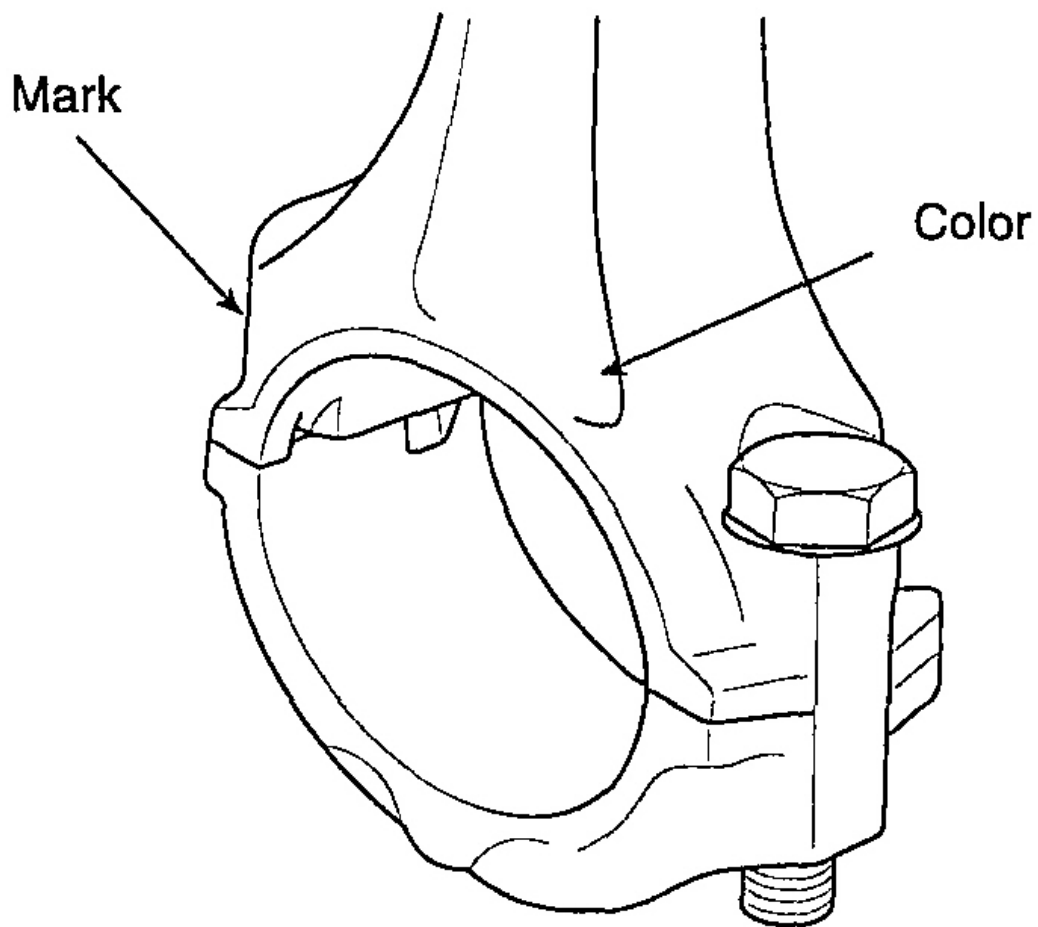
- i. If the plastigage measures too wide or too narrow, remove the upper and lower bearing and then install a new bearings with the same color mark. Recheck the oil clearance.

**CAUTION: Do not file, shim, of 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.



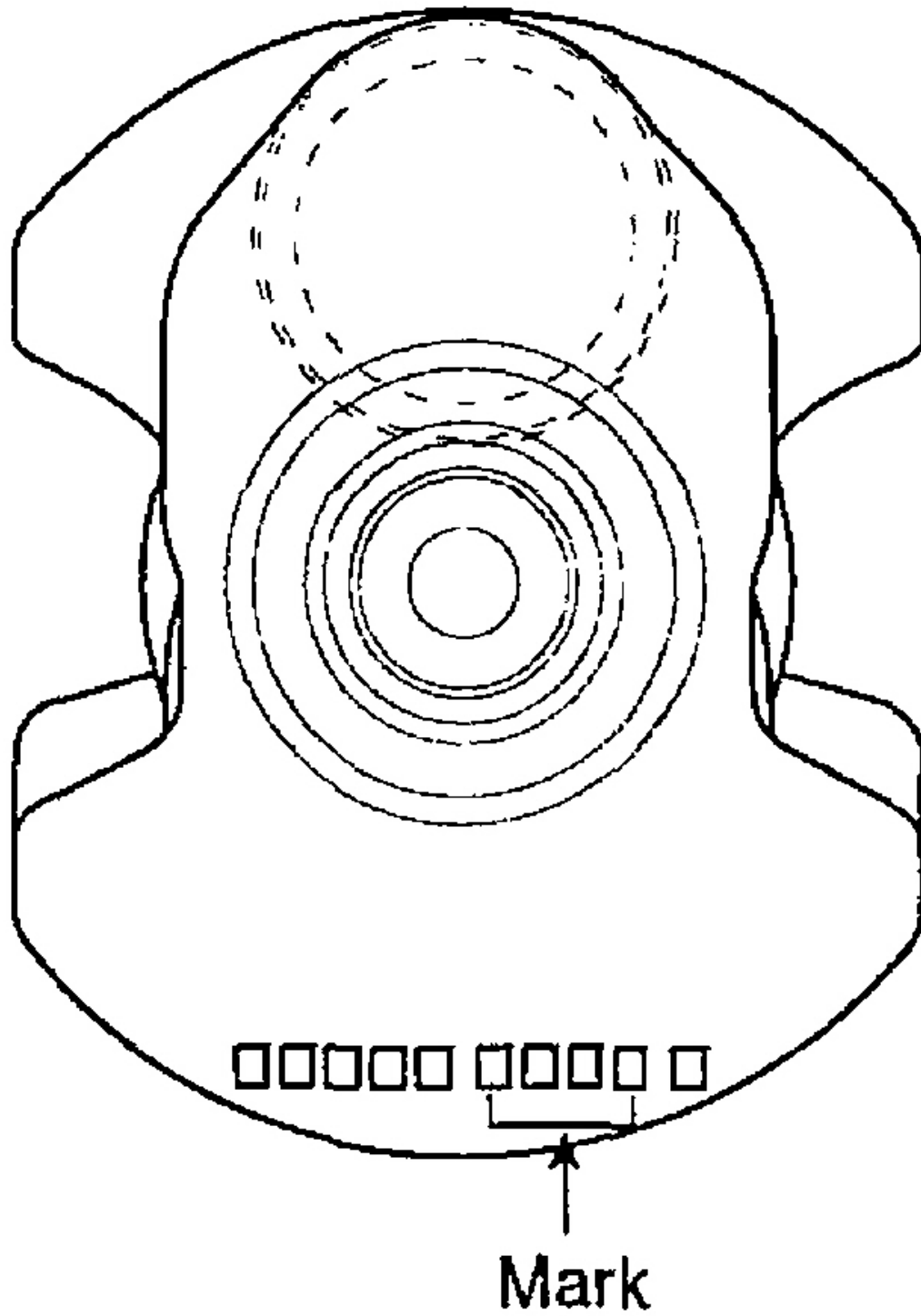
G00719129

**Fig. 195: 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<br>(1.8898 ~ 1.8900in) |
| B    | None   | 48.006 ~ 48.012mm<br>(1.8900 ~ 1.8902in) |
| C    | Yellow | 48.012 ~ 48.018mm<br>(1.8902 ~ 1.8905in) |

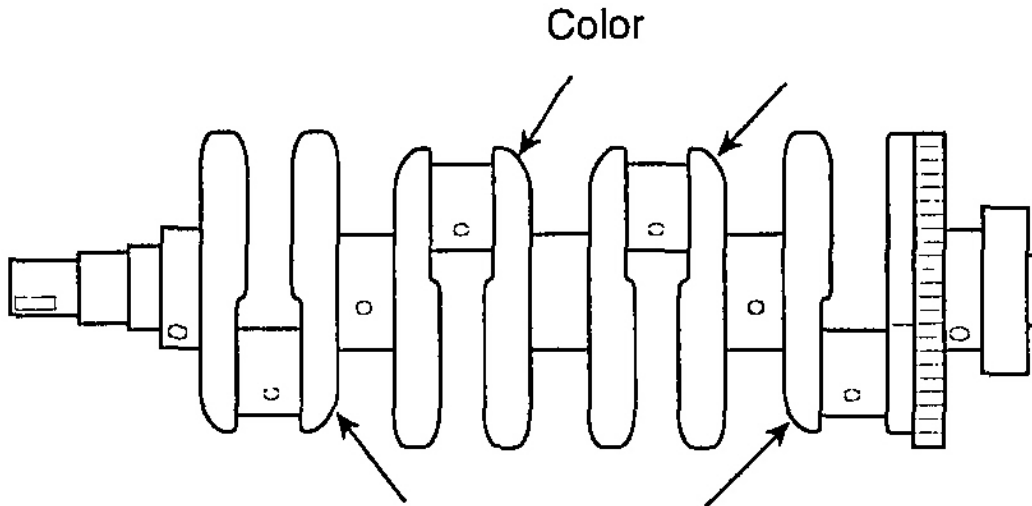
G00719130

**Fig. 196: Identifying Connecting Rod Chart**  
Courtesy of KIA MOTORS AMERICA, INC.



G00719131

**Fig. 197: Identifying Crankshaft Pin Journal Mark Location**  
 Courtesy of KIA MOTORS AMERICA, INC.



G00719132

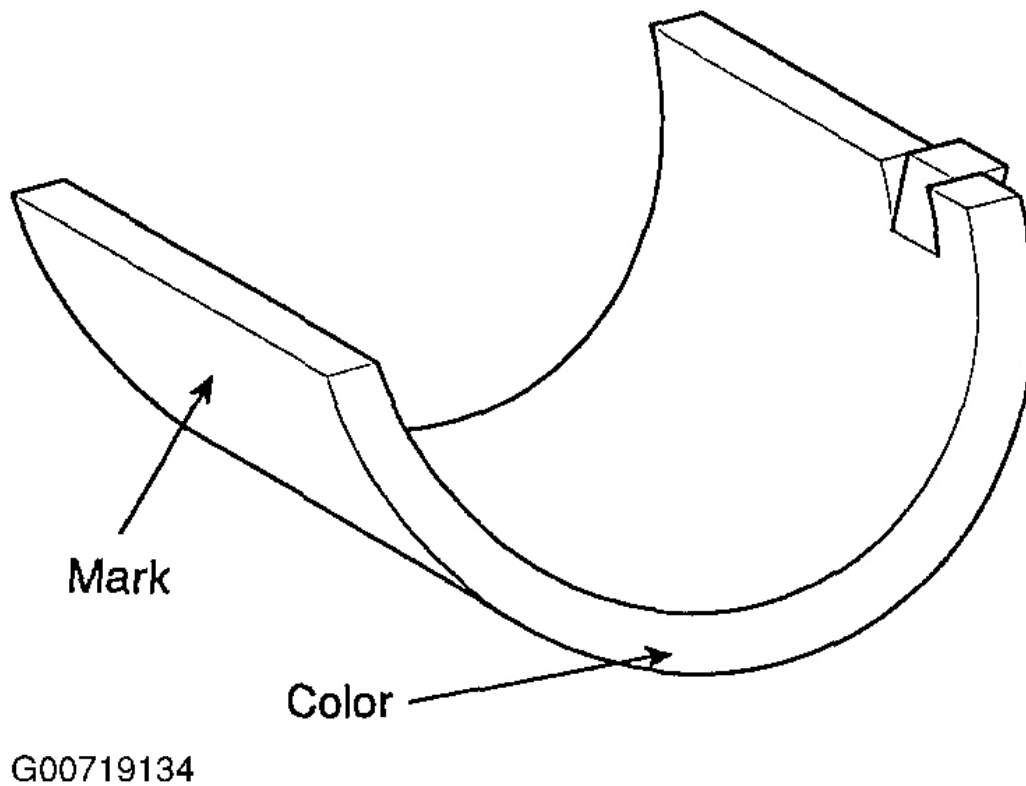
**Fig. 198: Identifying Crankshaft Color Location**  
 Courtesy of KIA MOTORS AMERICA, INC.

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

G00719133

**Fig. 199: Identifying Crankshaft Pin Journal Chart**

Courtesy of KIA MOTORS AMERICA, INC.



**Fig. 200: Identifying Connecting Rod Bearing Mark Location**  
Courtesy of KIA MOTORS AMERICA, INC.

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

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**Fig. 201: Identifying Connecting Rod Bearing Chart**  
 Courtesy of KIA MOTORS AMERICA, INC.

- k. Select the bearing by using selection table.



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

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**Fig. 202: Identifying Rod Bearing Selection Table**  
 Courtesy of KIA MOTORS AMERICA, INC.

3. Check the connecting rods.
  - a. 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.
  - b. 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.
  - c. 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 with a press. Any connecting rod that has been severely bent or distorted should be replaced.

Allowable bend of connecting rod: 0.05 mm/100 mm (0.0020 in/3.94 in ) or less

Allowable twist of connecting rod: 0.1 mm/100 mm (0.0039 in/3.94 in) or less

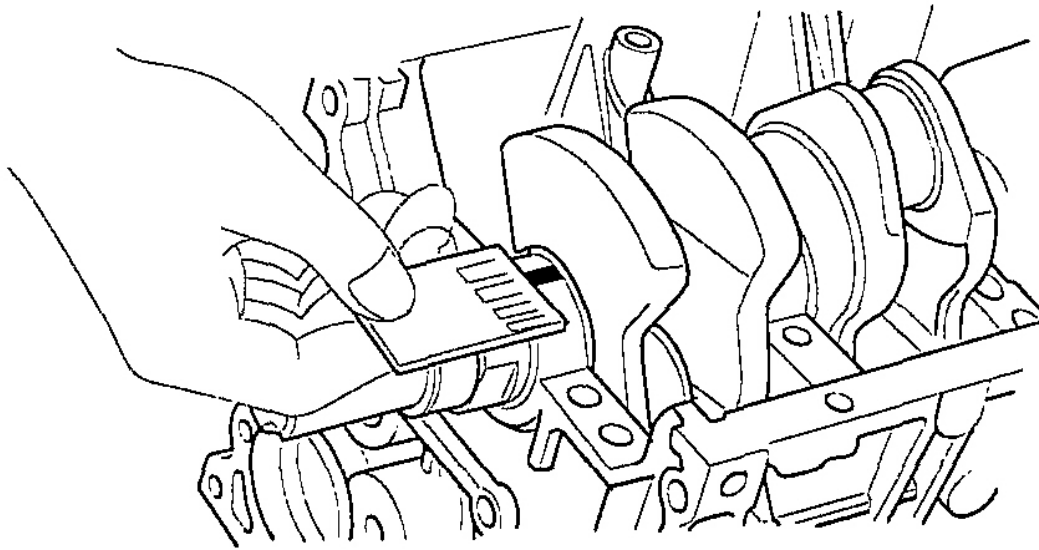
4. Check the crankshaft bearing oil clearance.
  - a. To check main bearing-to-journal oil clearance, remove the main bearing caps and lower bearings.
  - b. Clean each main journal and lower bearing with a clean shop towel.
  - c. Place one strip of plastigage across each main journal.
  - d. Reinstall 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. 203: 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.

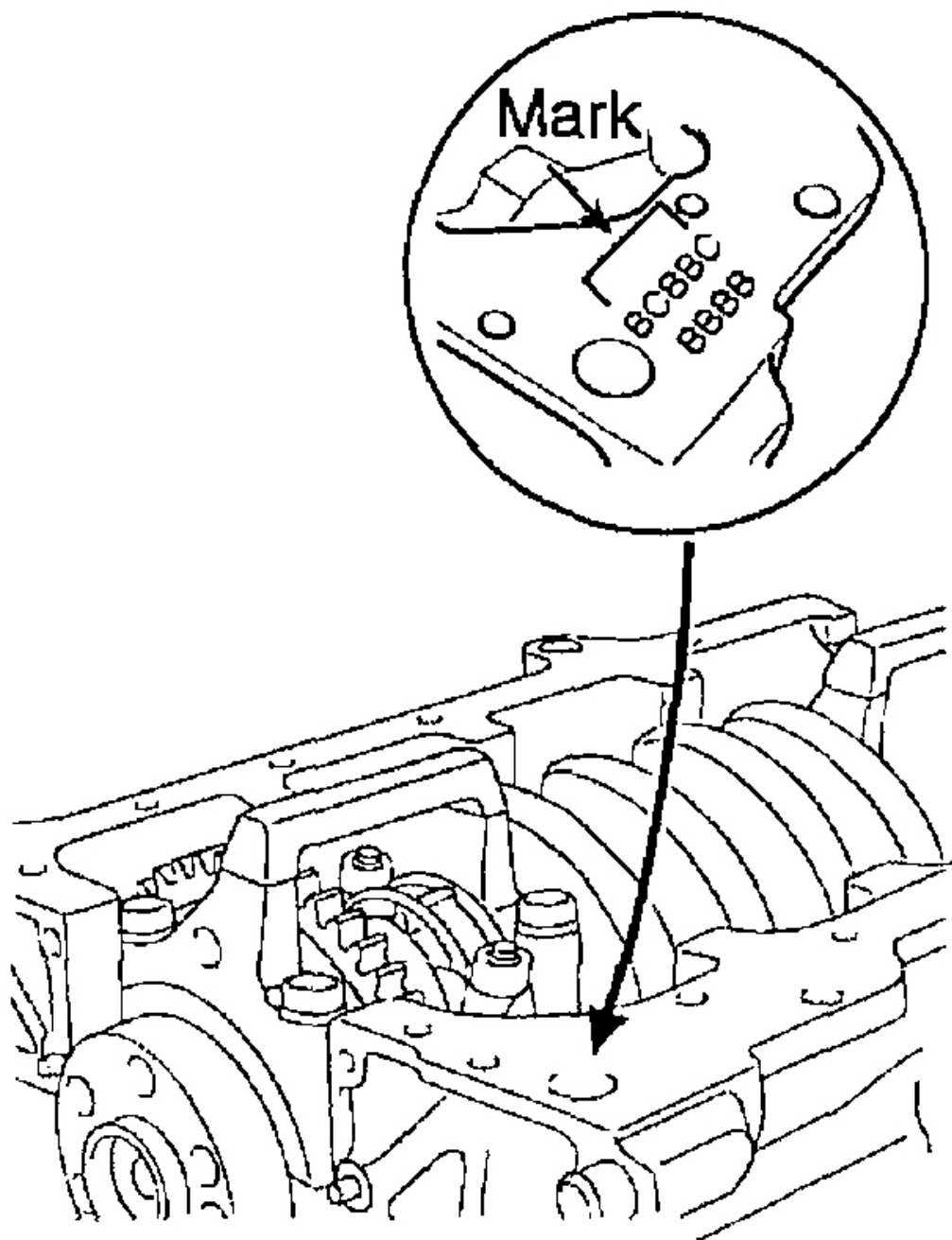
- g. If the plastigage shows the clearance is still incorrect, try the next larger or smaller bearing.

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.**

For cylinder block crankshaft journal bore mark location, see letters stamped on the end of the block as a mark for the size of each of the 5 main journal bores. Use them, and the numbers or letters stamped on the crank (marks for main journal size), to choose the correct bearings.



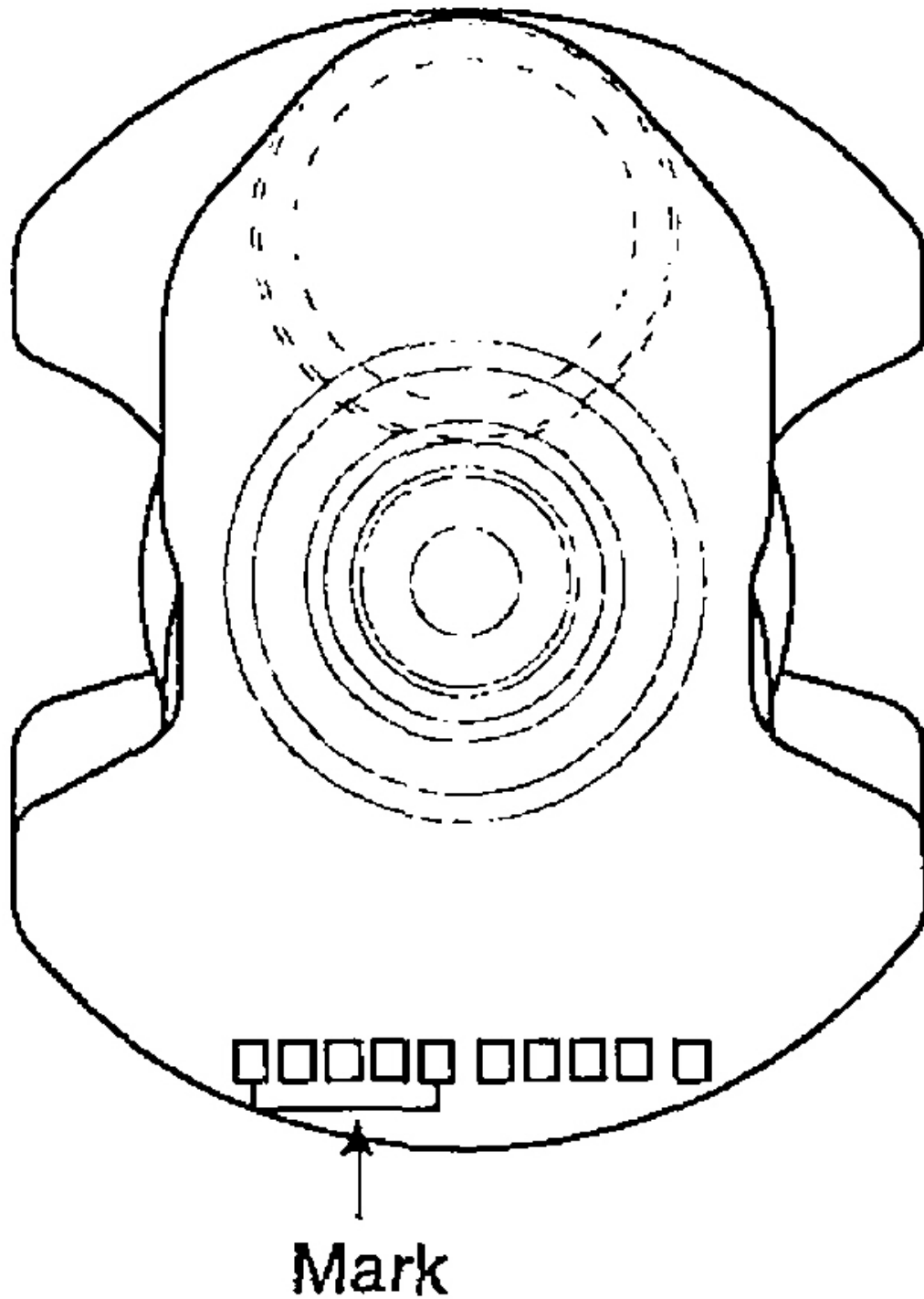
G00719138

**Fig. 204: Identifying Crankshaft Journal Bore Mark Location**  
Courtesy of KIA MOTORS AMERICA, INC.

| Mark | Cylinder block crankshaft journal<br>bore inner diameter |
|------|----------------------------------------------------------|
| A    | 61.000 ~ 61.006mm<br>(2.4016 ~ 2.4018in)                 |
| B    | 61.006 ~ 61.012mm<br>(2.4018 ~ 2.4020in)                 |
| C    | 61.012 ~ 61.018mm<br>(2.4020 ~ 2.4023in)                 |

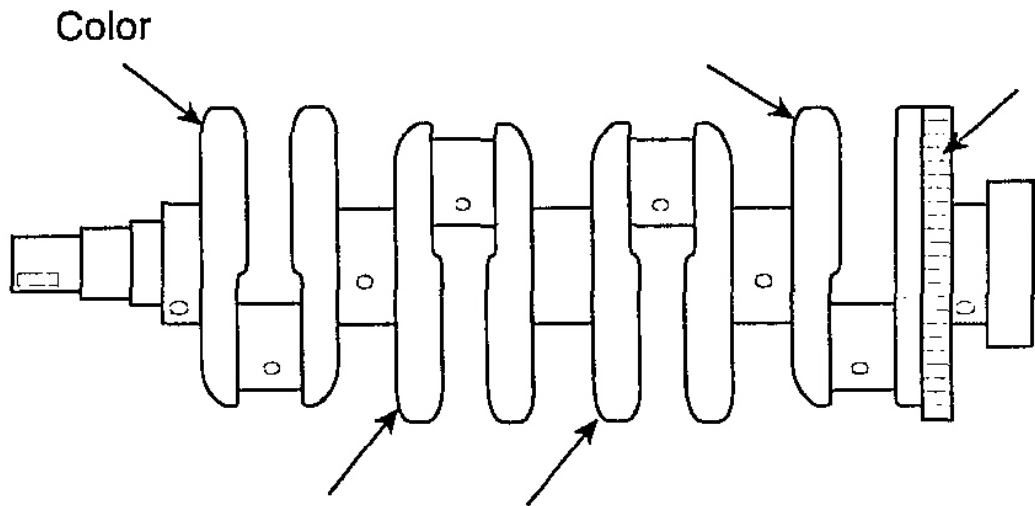
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**Fig. 205: Identifying Cylinder Block Crankshaft Journal Bore Chart**  
Courtesy of KIA MOTORS AMERICA, INC.



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**Fig. 206: Identifying Crankshaft Main Journal Mark Location**  
 Courtesy of KIA MOTORS AMERICA, INC.



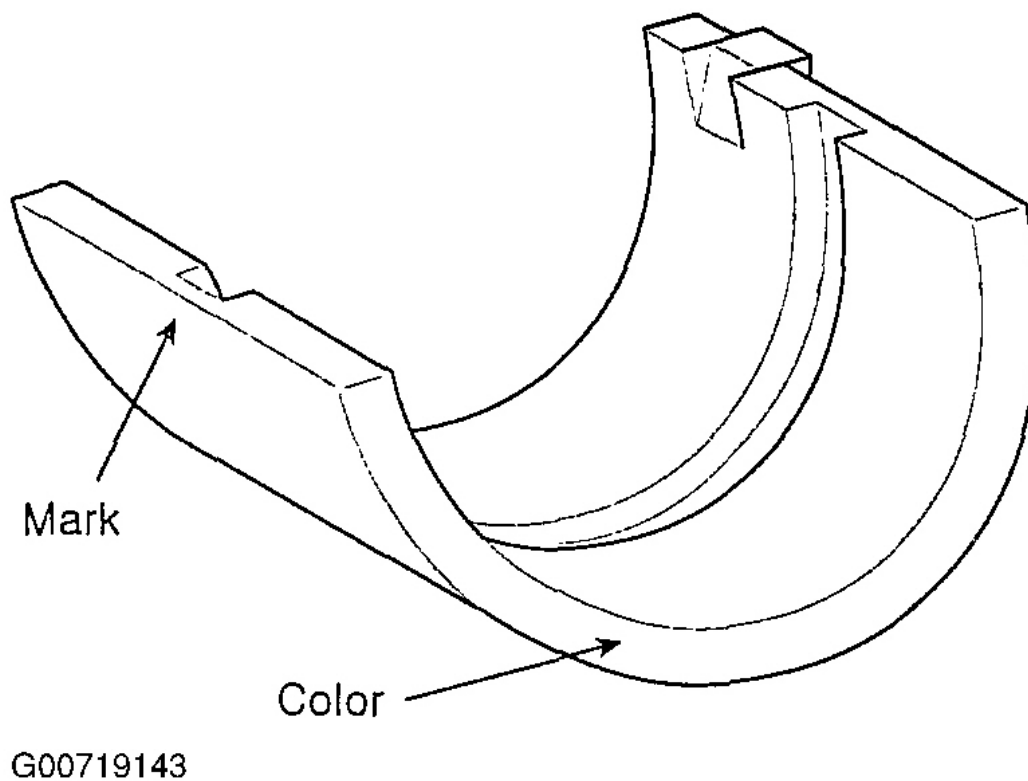
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**Fig. 207: Identifying Crankshaft Color Location**  
 Courtesy of KIA MOTORS AMERICA, INC.

| Mark | Color  | Crankshaft main journal<br>outer diameter |
|------|--------|-------------------------------------------|
| 1    | Yellow | 56.956 ~ 56.962mm<br>(2.2424 ~ 2.2426in)  |
| 2    | None   | 56.948 ~ 56.956mm<br>(2.2420 ~ 2.2424in)  |
| 3    | White  | 56.942 ~ 56.948mm<br>(2.2418 ~ 2.2420in)  |

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**Fig. 208: Identifying Crankshaft Main Journal Chart**  
 Courtesy of KIA MOTORS AMERICA, INC.



**Fig. 209: Identifying Crankshaft Main Bearing Mark Location**  
Courtesy of KIA MOTORS AMERICA, INC.



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

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**Fig. 210: Identifying Crankshaft Main Bearing Chart**  
 Courtesy of KIA MOTORS AMERICA, INC.

- h. Select the bearing by using selection table.

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

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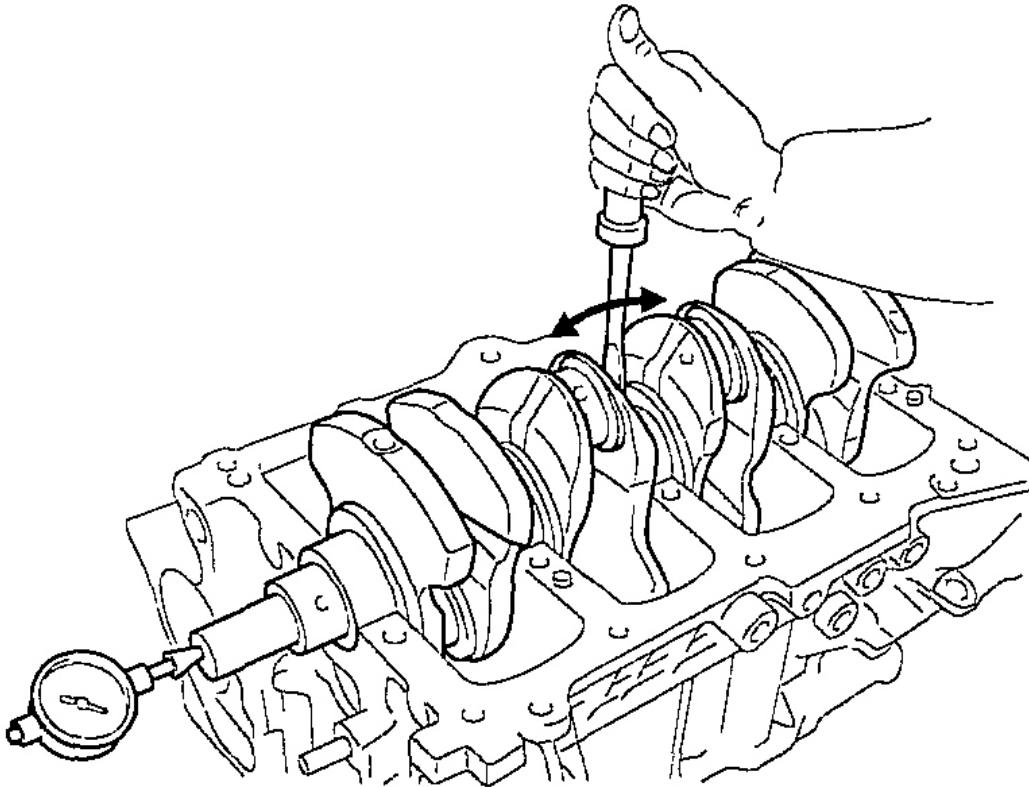
**Fig. 211: Identifying Crankshaft Main Bearing Selection Table**  
 Courtesy of KIA MOTORS AMERICA, INC.

5. 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)



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**Fig. 212: Measuring Crankshaft End Play**  
Courtesy of KIA MOTORS AMERICA, INC.

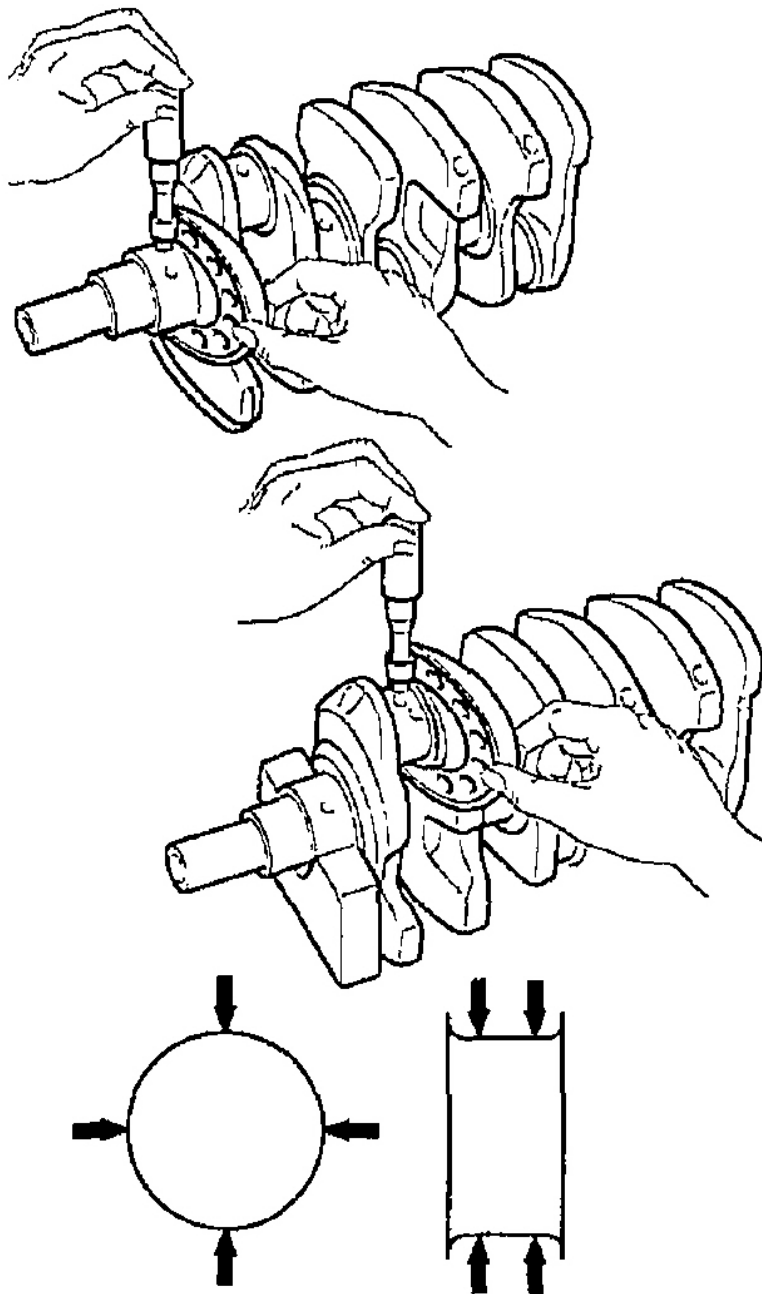
If the end play is greater than maximum, replace the thrust bearings as a set.

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

6. 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. 213: Measuring Crankshaft Journal Diameter**  
 Courtesy of KIA MOTORS AMERICA, INC.

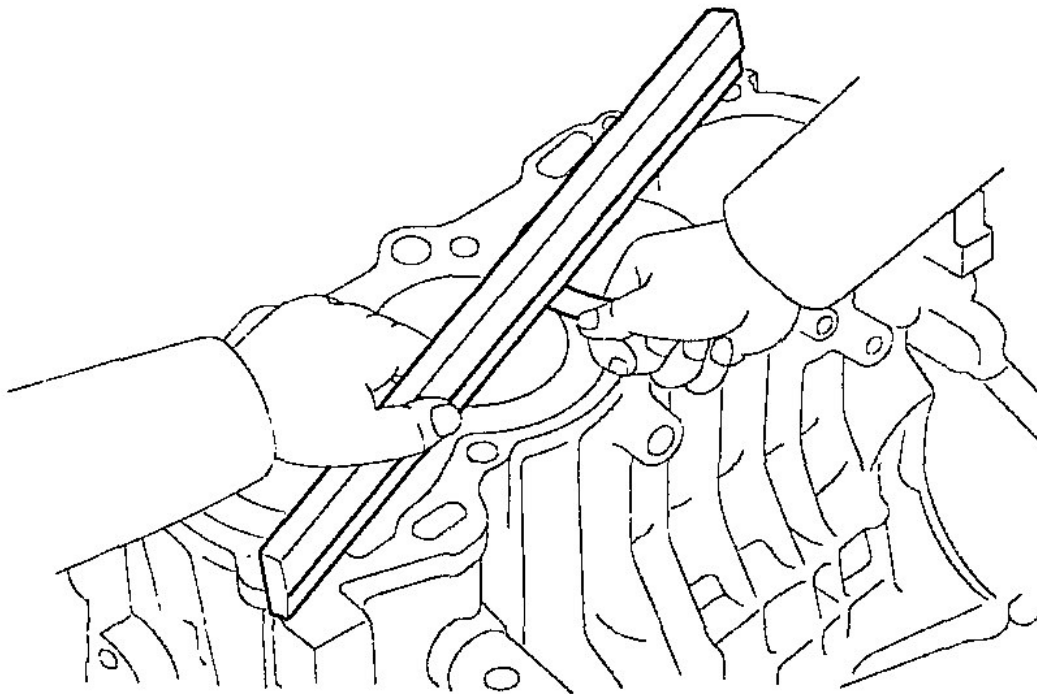
CYLINDER BLOCK

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

Total: Less than 0.05 mm (0.0020 in)

Bore to bore: Less than 0.03 mm (0.0012 in)

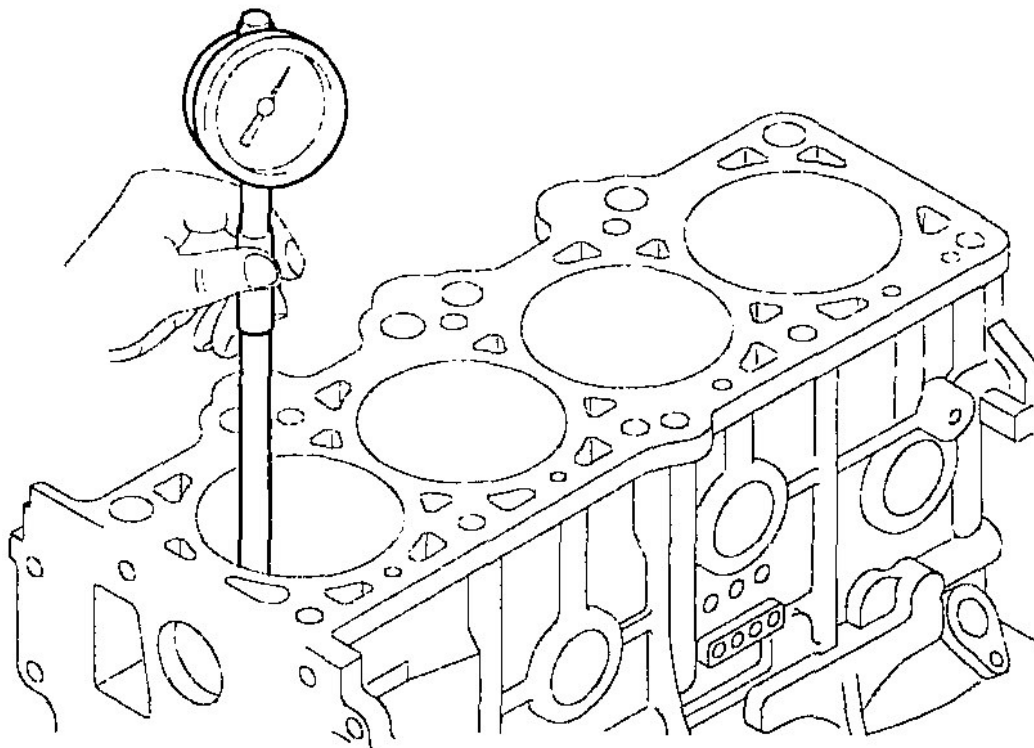


G00719148

**Fig. 214: 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.

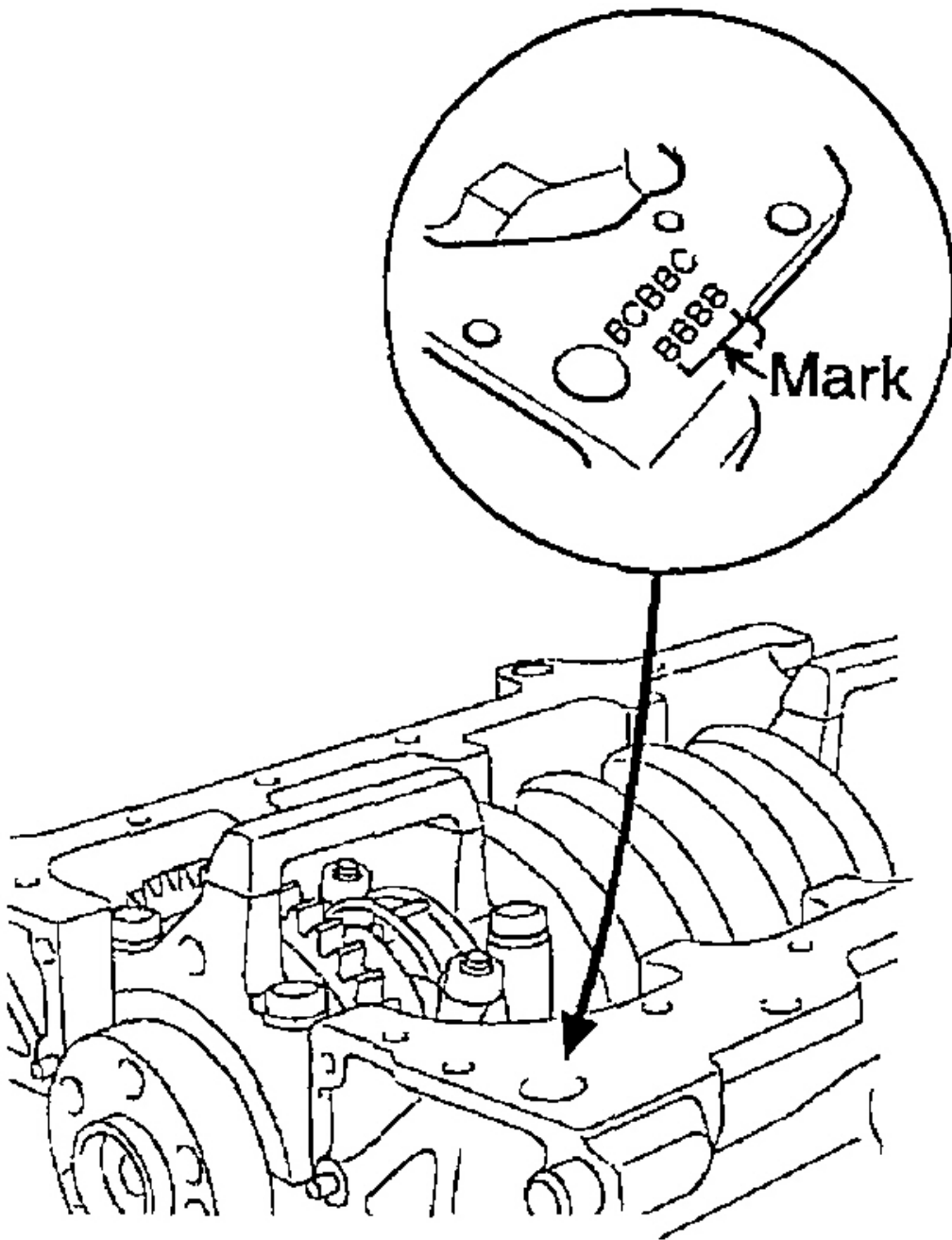
Standard diameter: 82.00-82.03 mm (3.2283-3.2295 in)



G00719149

**Fig. 215: 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. 216: Identifying Cylinder Bore Size Code**  
Courtesy of KIA MOTORS AMERICA, INC.

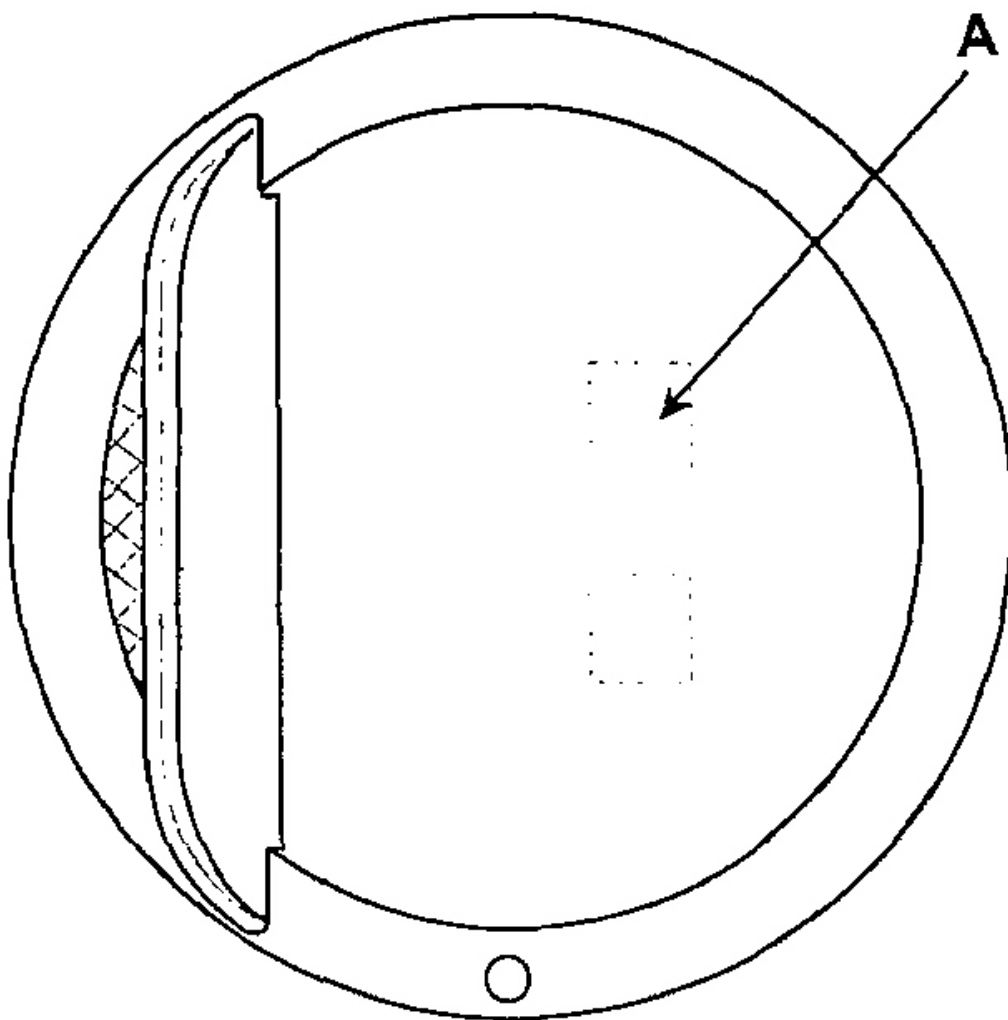
| Mark | Cylinder bore inner diameter           |
|------|----------------------------------------|
| A    | 82.00 ~ 82.01mm<br>(3.2283 ~ 3.2287in) |
| B    | 82.01 ~ 82.02mm<br>(3.2287 ~ 3.2291in) |
| C    | 82.02 ~ 82.03mm<br>(3.2291 ~ 3.2295in) |

G00719151

**Fig. 217: 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. 218: Identifying Piston Size Location**  
Courtesy of KIA MOTORS AMERICA, INC.

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

G00719153

**Fig. 219: 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.

**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.

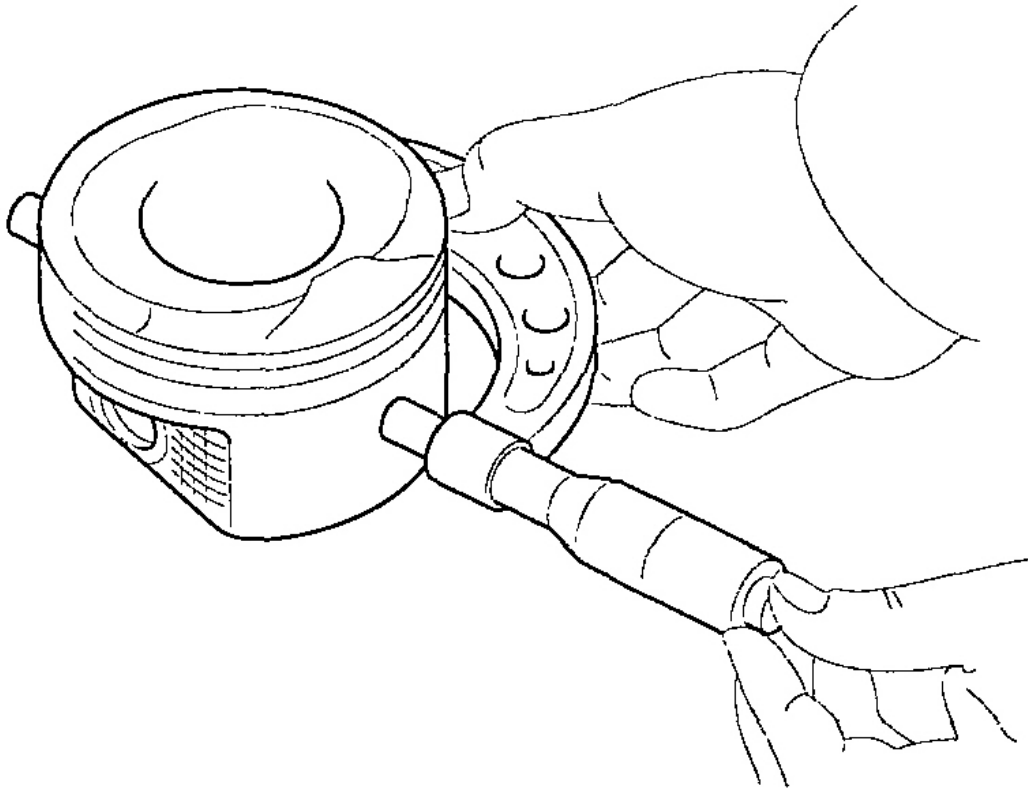
#### PISTON AND PISTON RINGS

- 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. 220: 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)

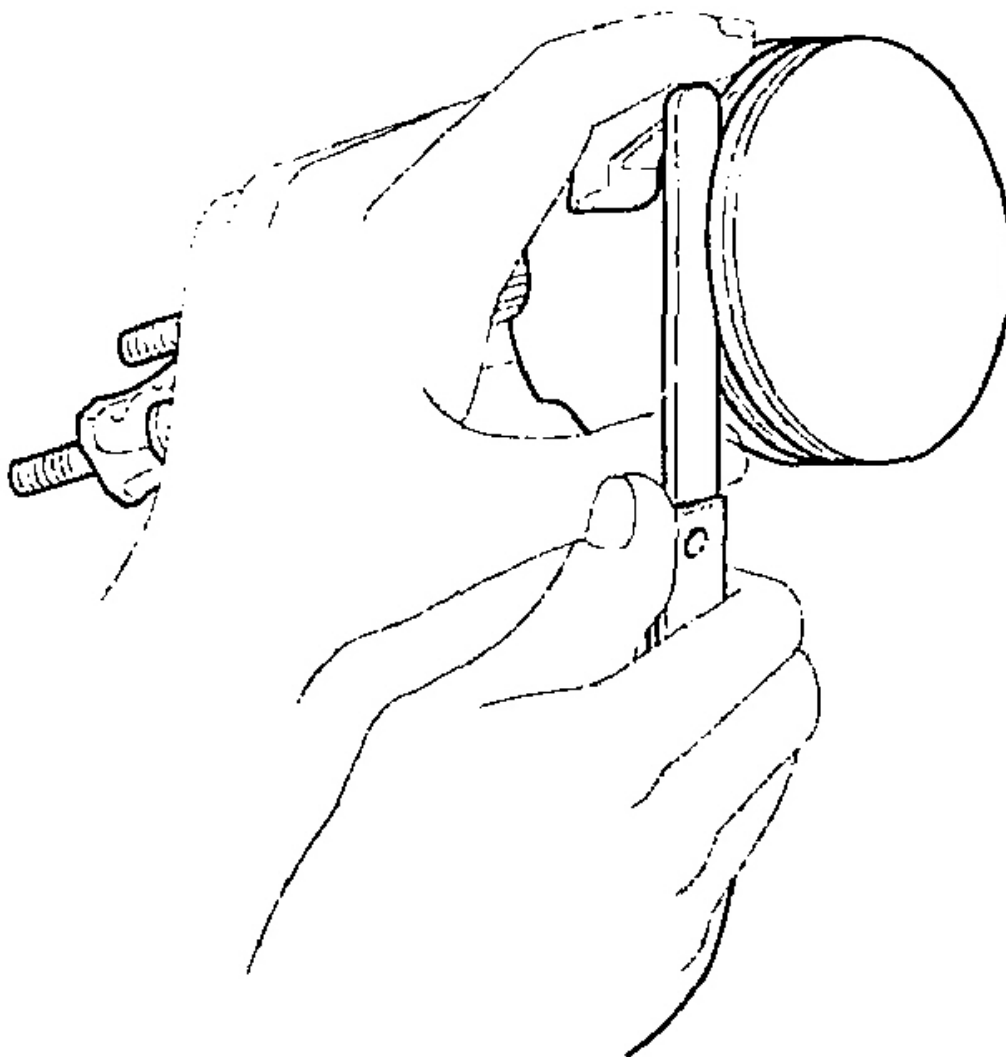
Oil ring: 0.06-0.15 mm (0.0024-0.0059 in)

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. 221: 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:

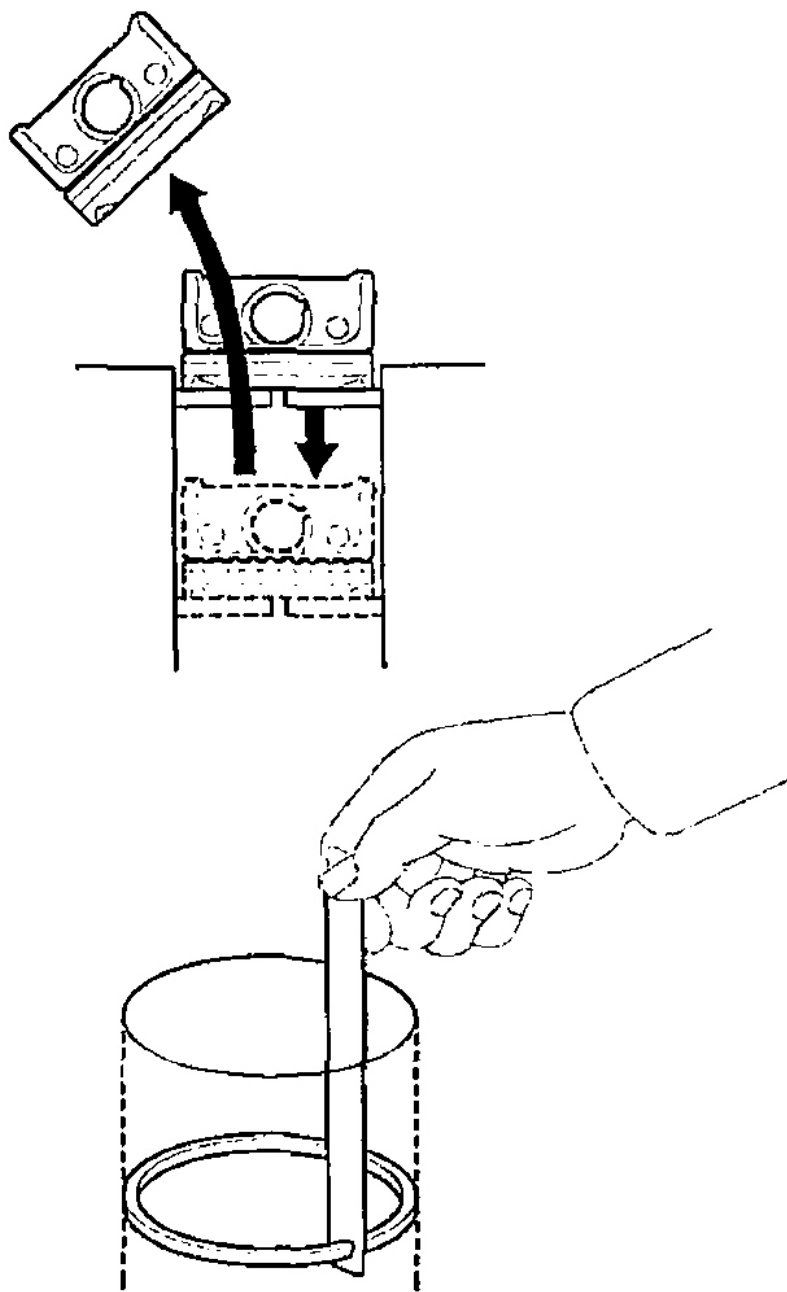
No.1: 0.23-0.38 mm (0.0091-0.0150 in)

No.2: 0.33-0.48 mm (0.0130-0.0189 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)



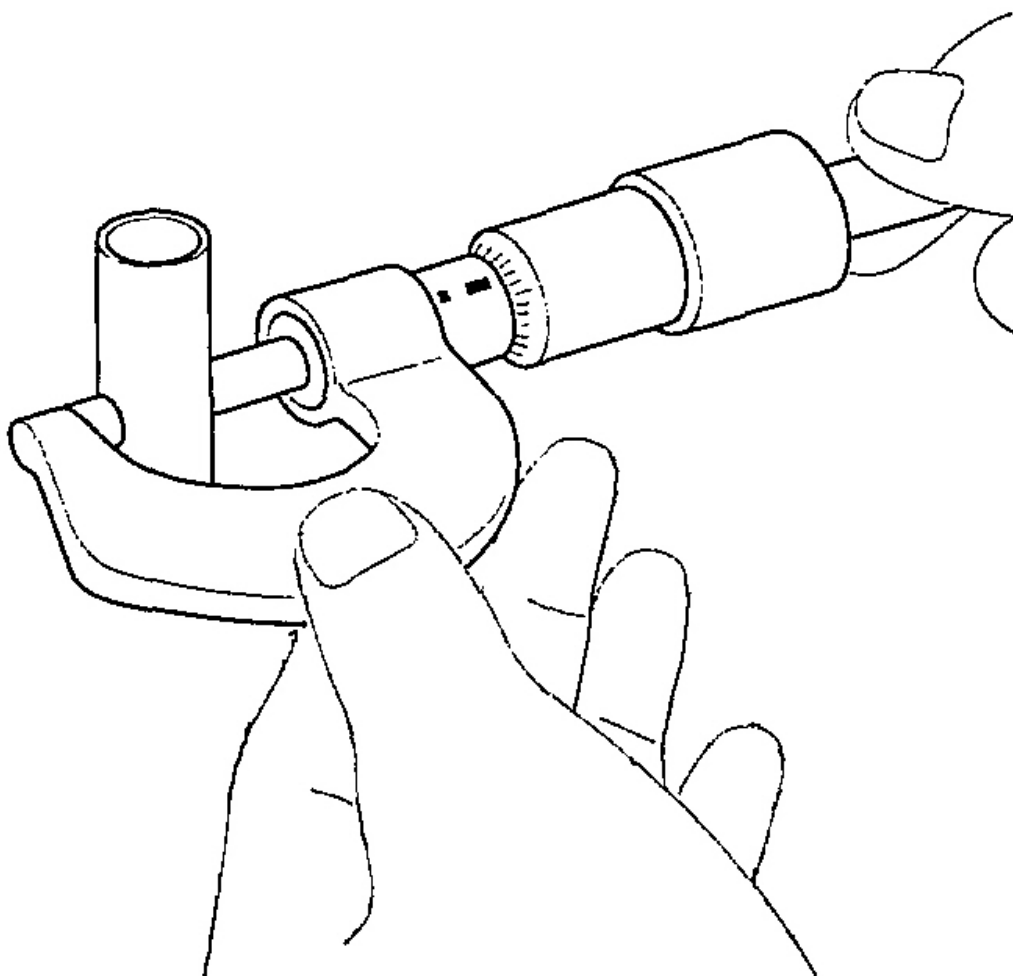
G00719156

**Fig. 222: 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. 223: 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

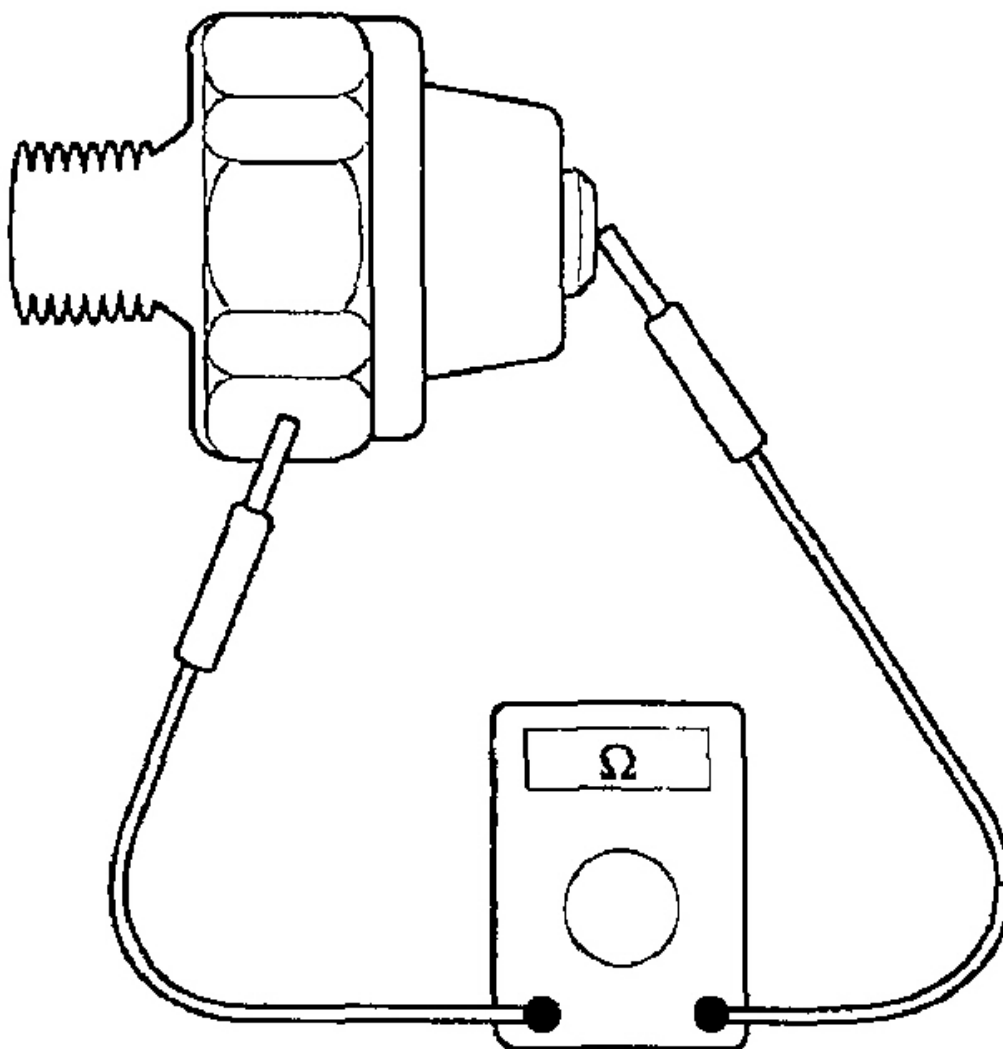


diameter.

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. 224: Measuring Oil Pressure Switch Continuity**  
Courtesy of KIA MOTORS AMERICA, INC.

3. If there is no continuity when a 49.0 kPa (0.5 kg/cm<sup>2</sup>, 7.1 psi) vacuum is applied through the oil hole, the switch is operating properly.

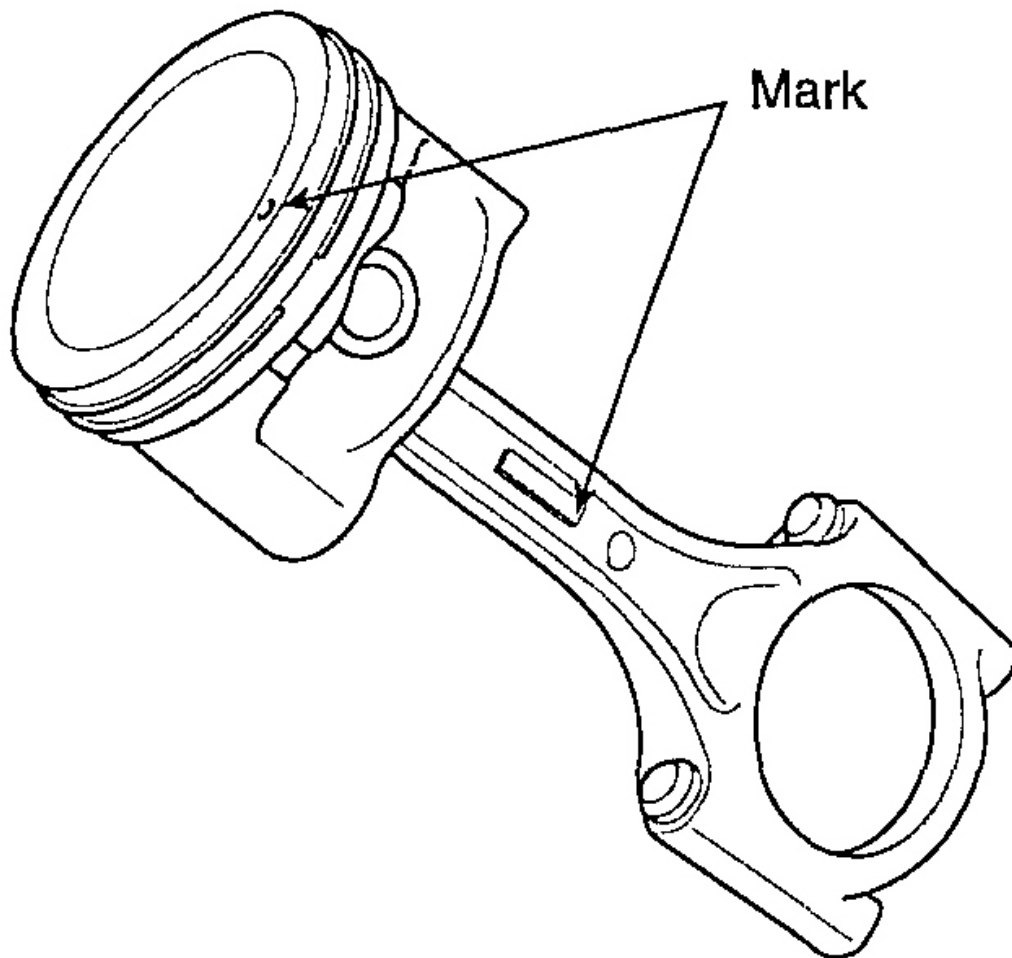
Check for air leakage. If air leaks, the diaphragm is broken. Replace it.

## 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.

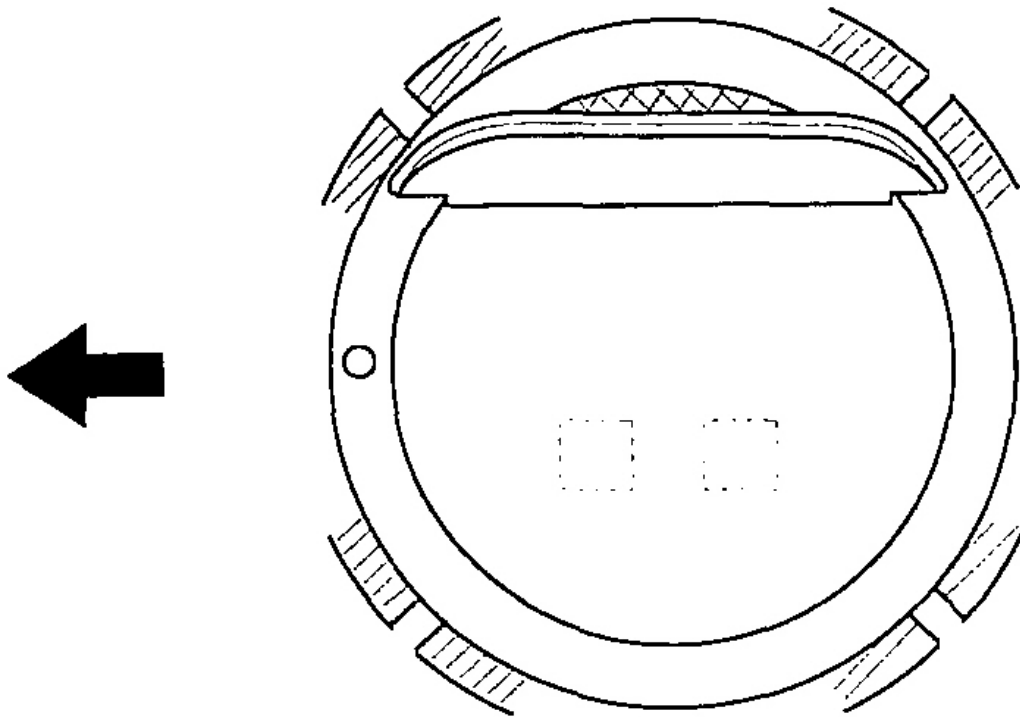
1. Assemble the piston and connecting rod.
  - a. Use a hydraulic press for installation
  - b. The piston front mark and the connecting rod front mark must face the timing belt side of the engine.



G00719160

**Fig. 225: Positioning Piston-To-Connecting Rod**  
Courtesy of KIA MOTORS AMERICA, INC.

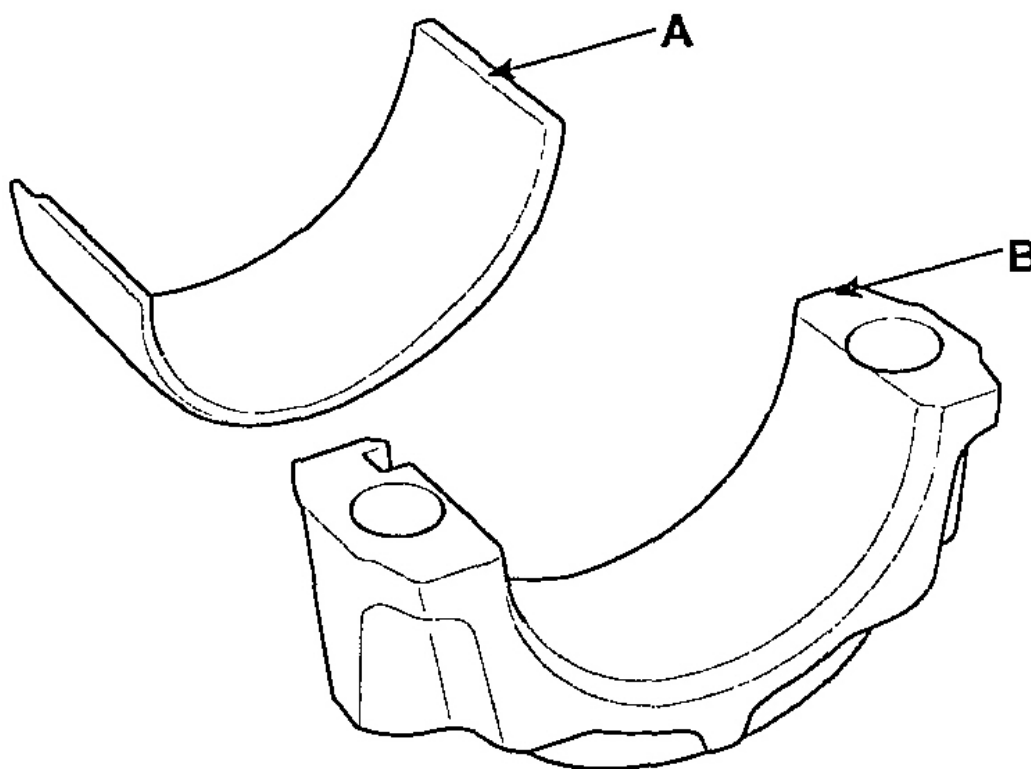
2. Install the piston rings.
  - a. Install the oil ring expander and 2 side rails by hand.
  - b. Using a piston ring expander, install the 2 compression rings with the code mark facing upward.
  - c. Position the piston rings so that the ring ends are as shown. See **Fig. 226**.



G00719161

**Fig. 226: 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).



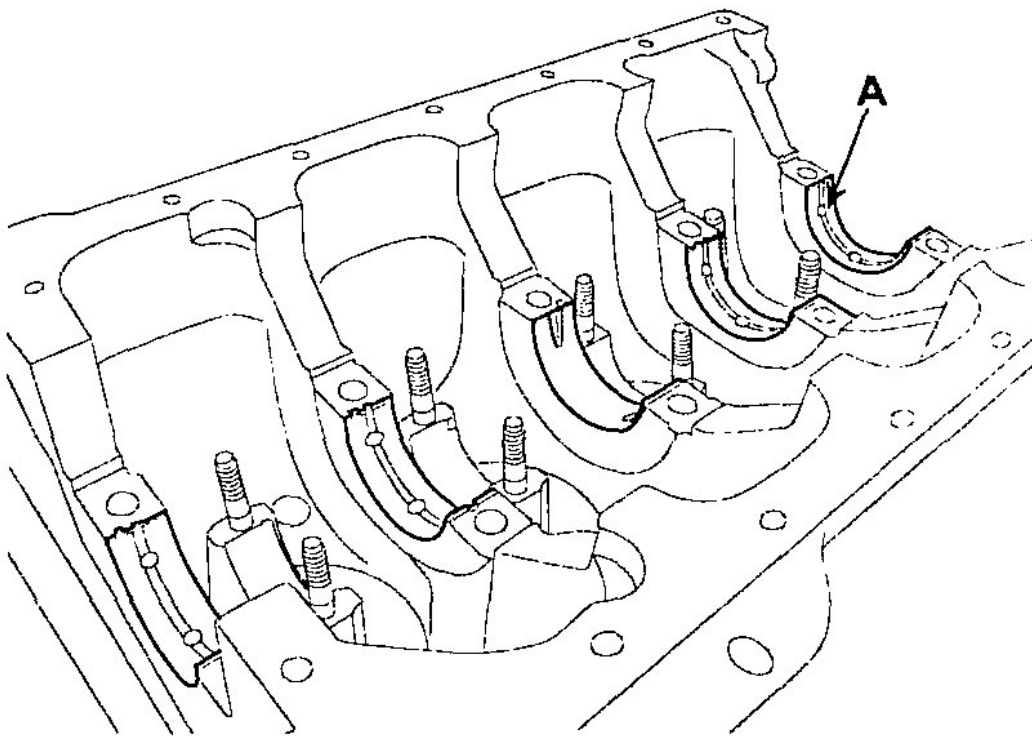
G00719162

**Fig. 227: 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).

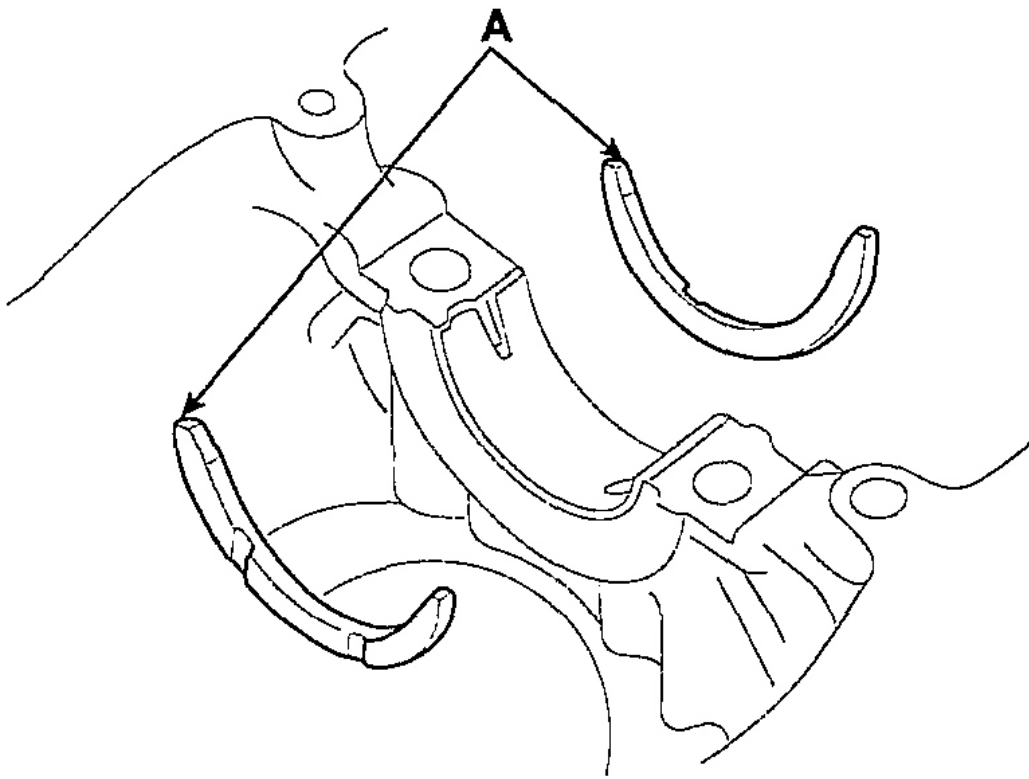


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**Fig. 228: Installing Upper Main Bearings**  
Courtesy of KIA MOTORS AMERICA, INC.

- 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.



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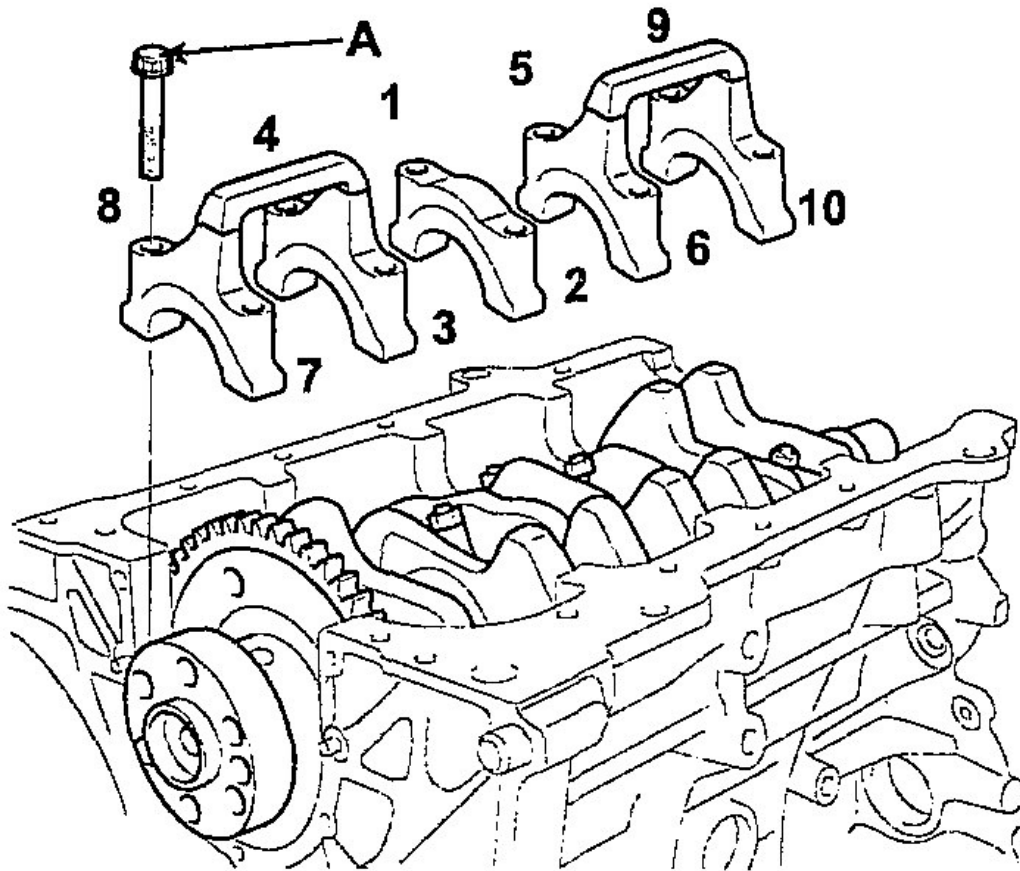
**Fig. 229: Installing Thrust Bearing**  
Courtesy of KIA MOTORS AMERICA, INC.

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. 230**.

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



G00719165

**Fig. 230: 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.

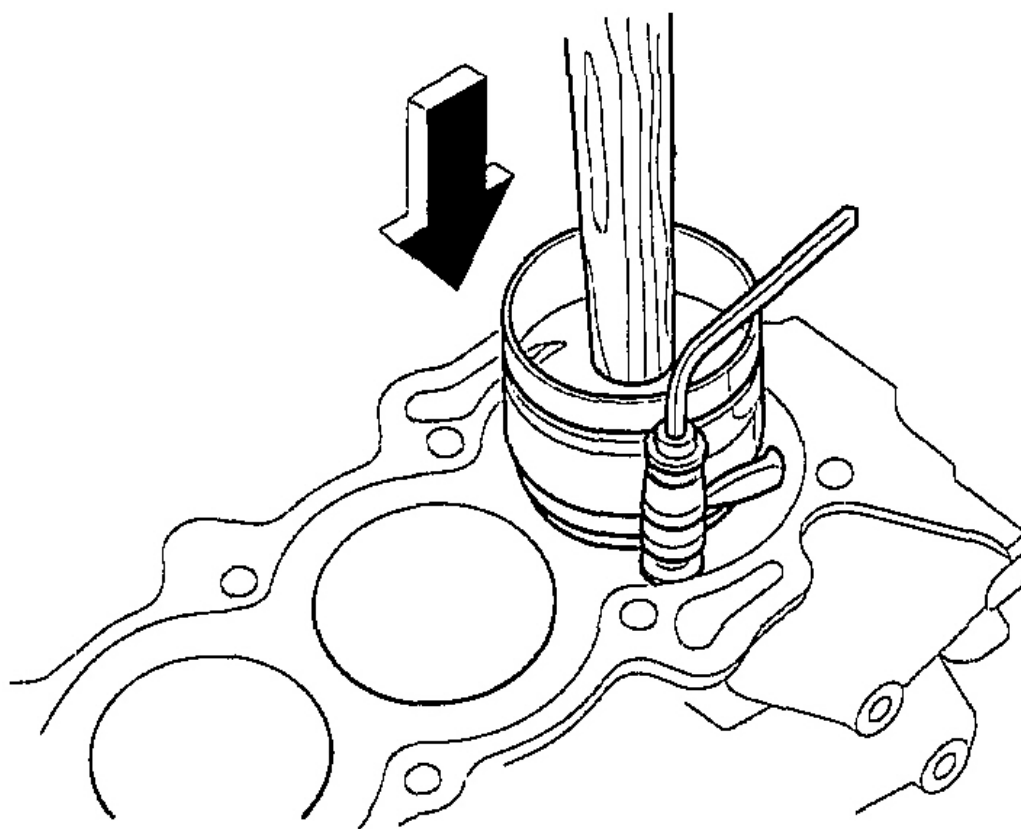
**NOTE:** Maintain downward force on the ring compressor to prevent



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)**



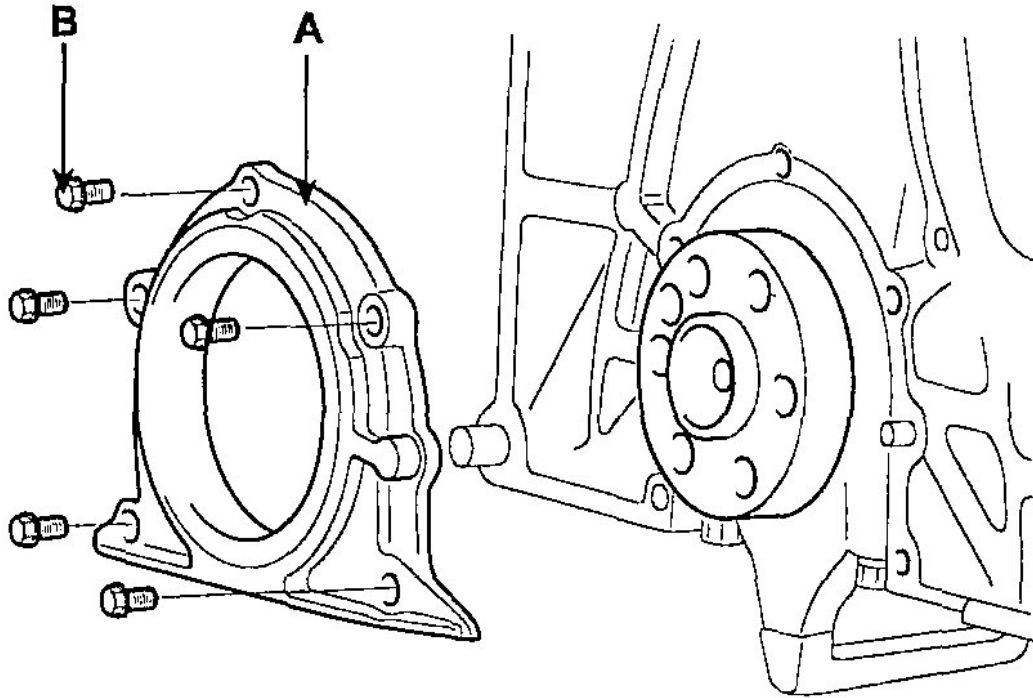
G00719166

**Fig. 231: 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)

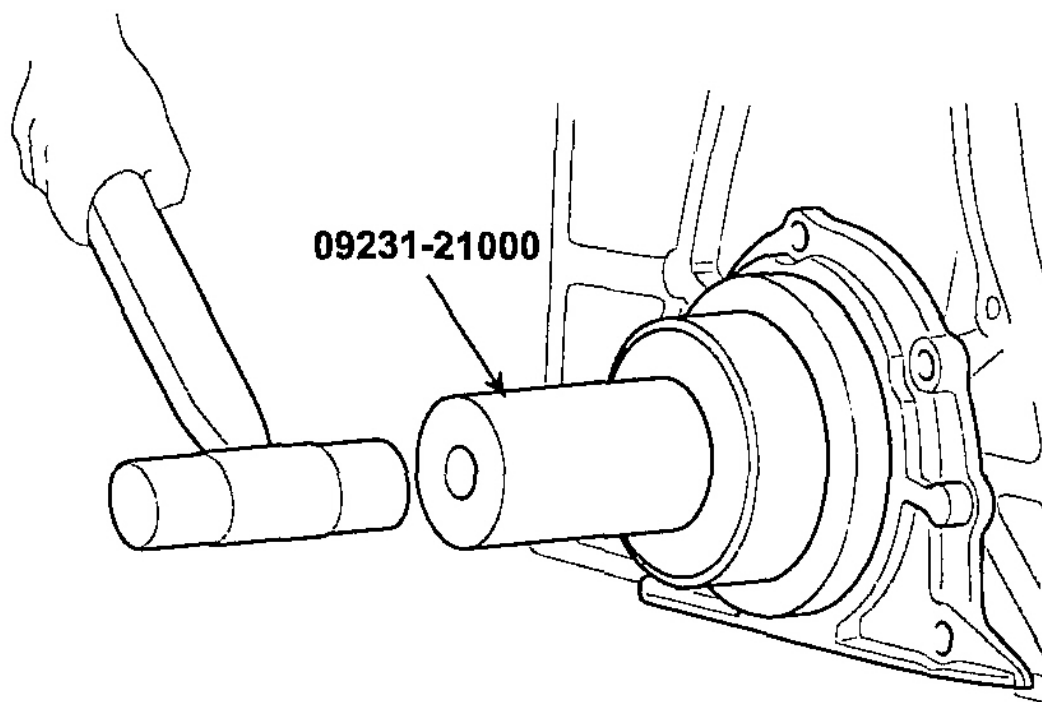


G00719167

**Fig. 232: 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.



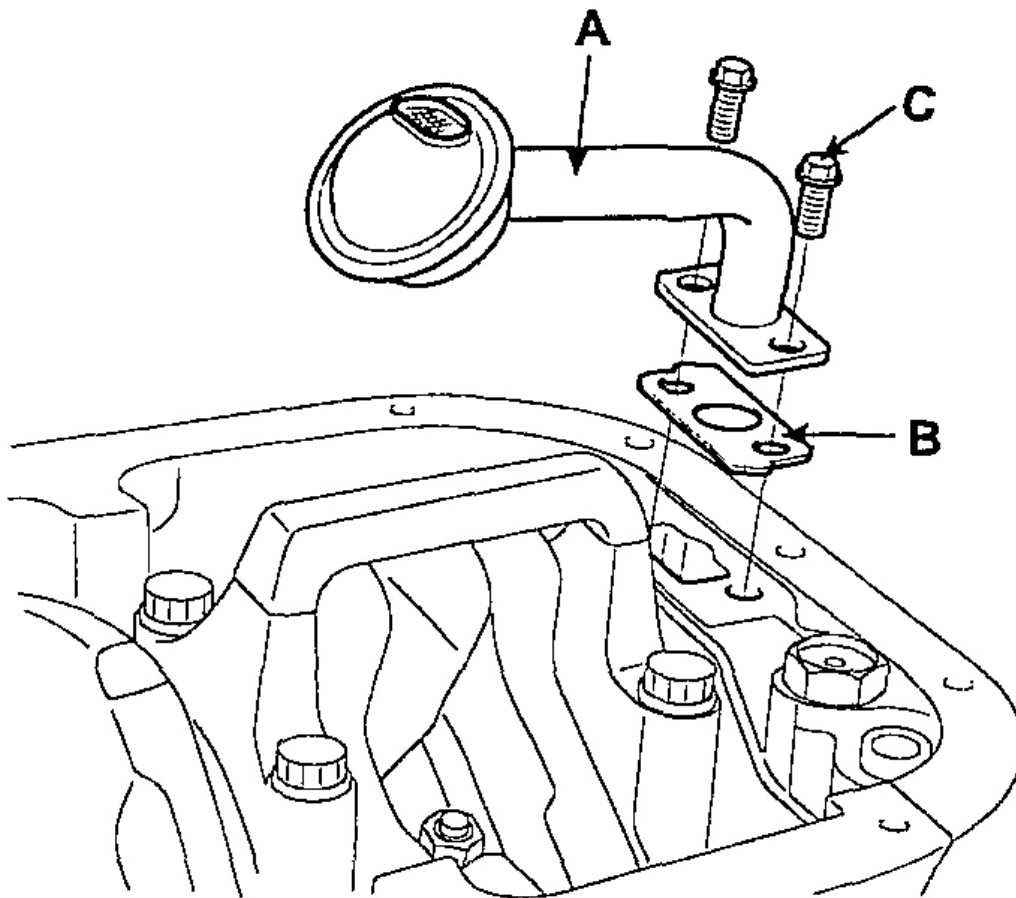
G00719168

**Fig. 233: 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. 234: 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.

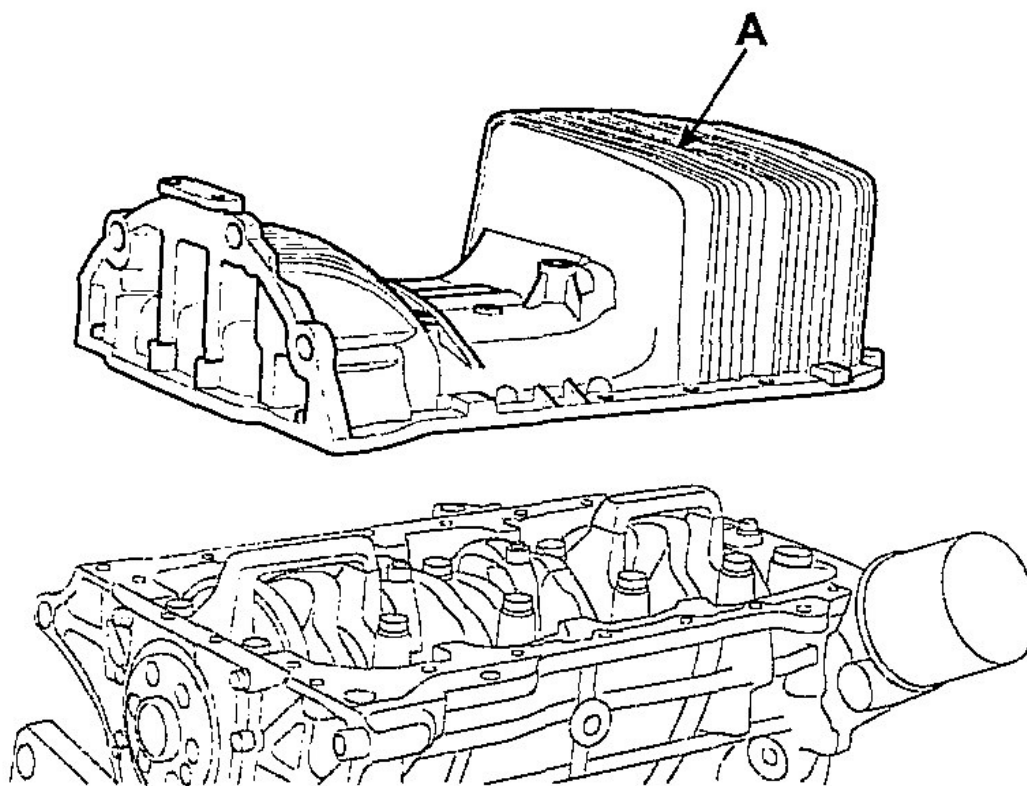
- b. Apply liquid gasket as an even bead, centered between the edges of the mating surface. Liquid gasket: MS 721-40A or equivalent.

**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)



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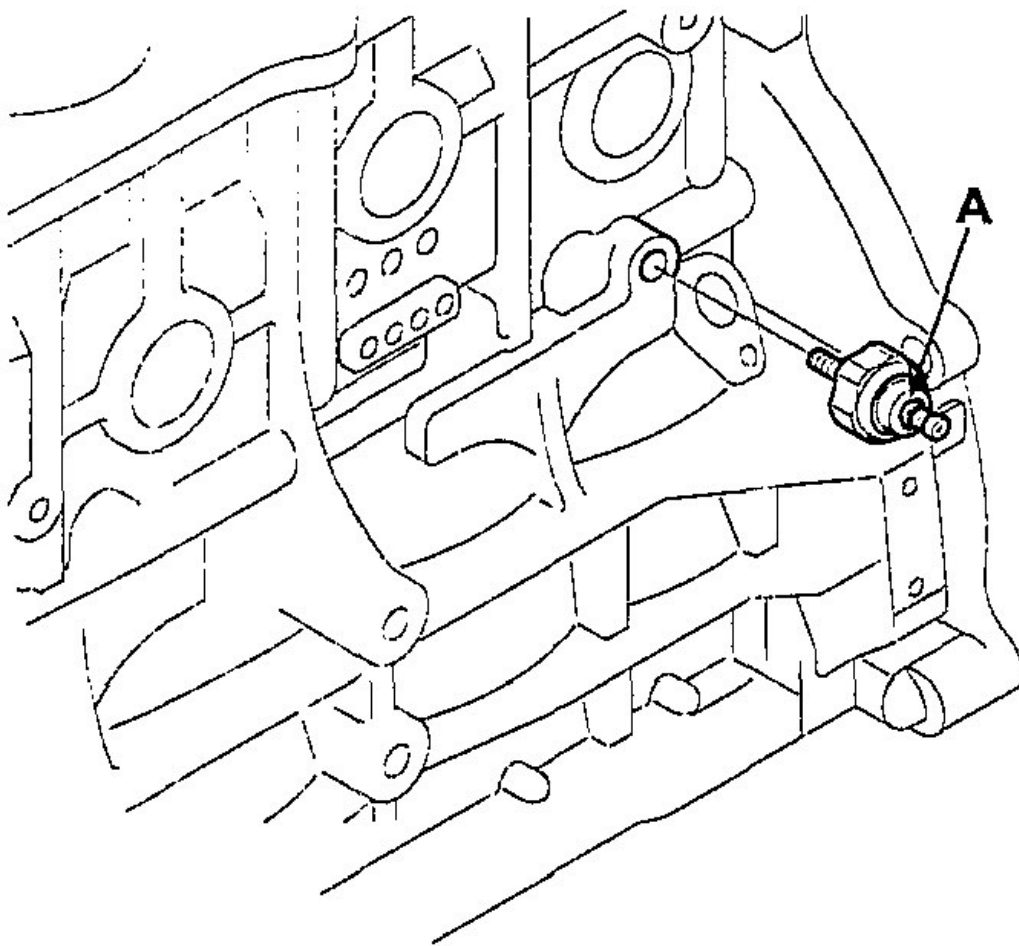
**Fig. 235: Installing Oil Pan**

Courtesy of KIA MOTORS AMERICA, INC.

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)

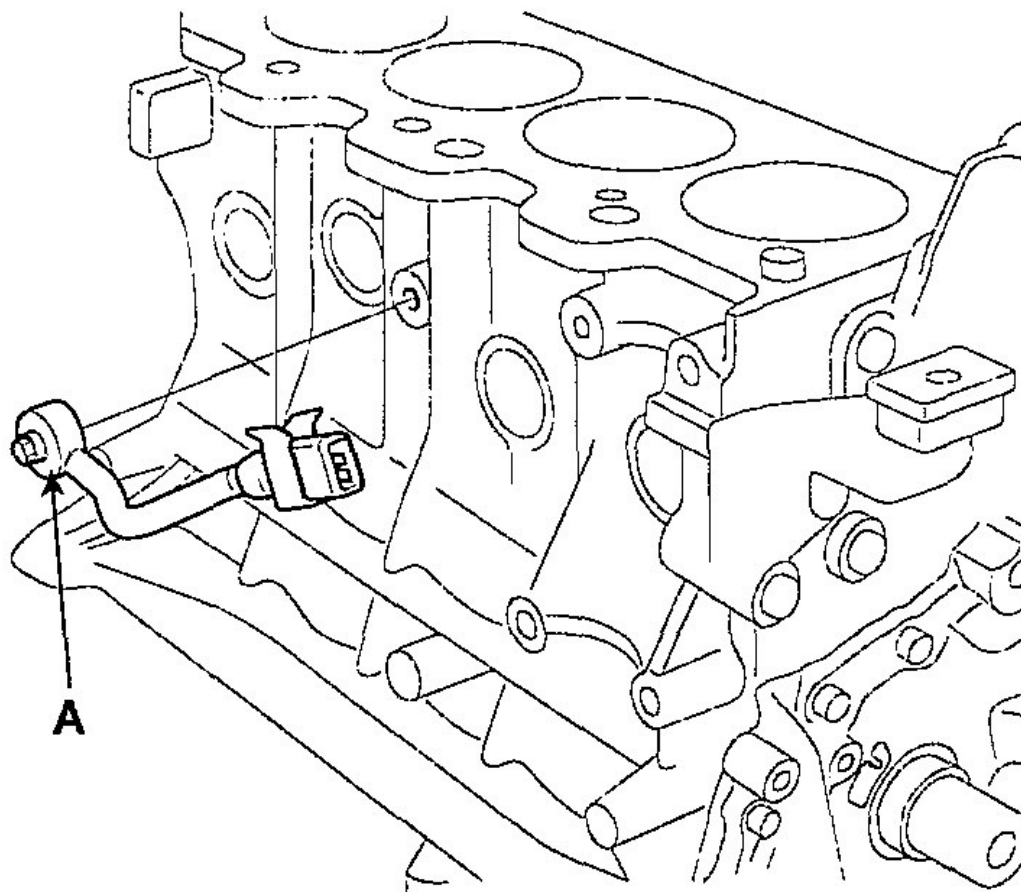


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**Fig. 236: Installing Oil Pressure Switch**  
Courtesy of KIA MOTORS AMERICA, INC.

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)



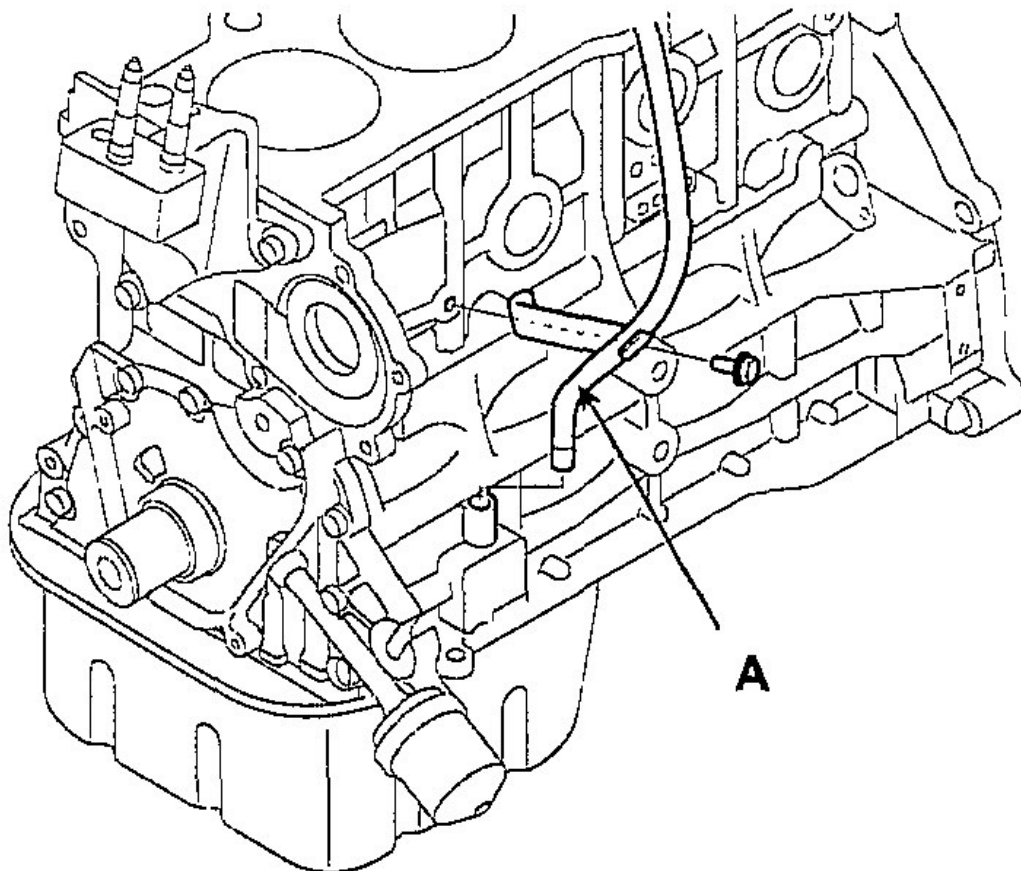
G00719172

**Fig. 237: Installing Knock Sensor**

Courtesy of KIA MOTORS AMERICA, INC.

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



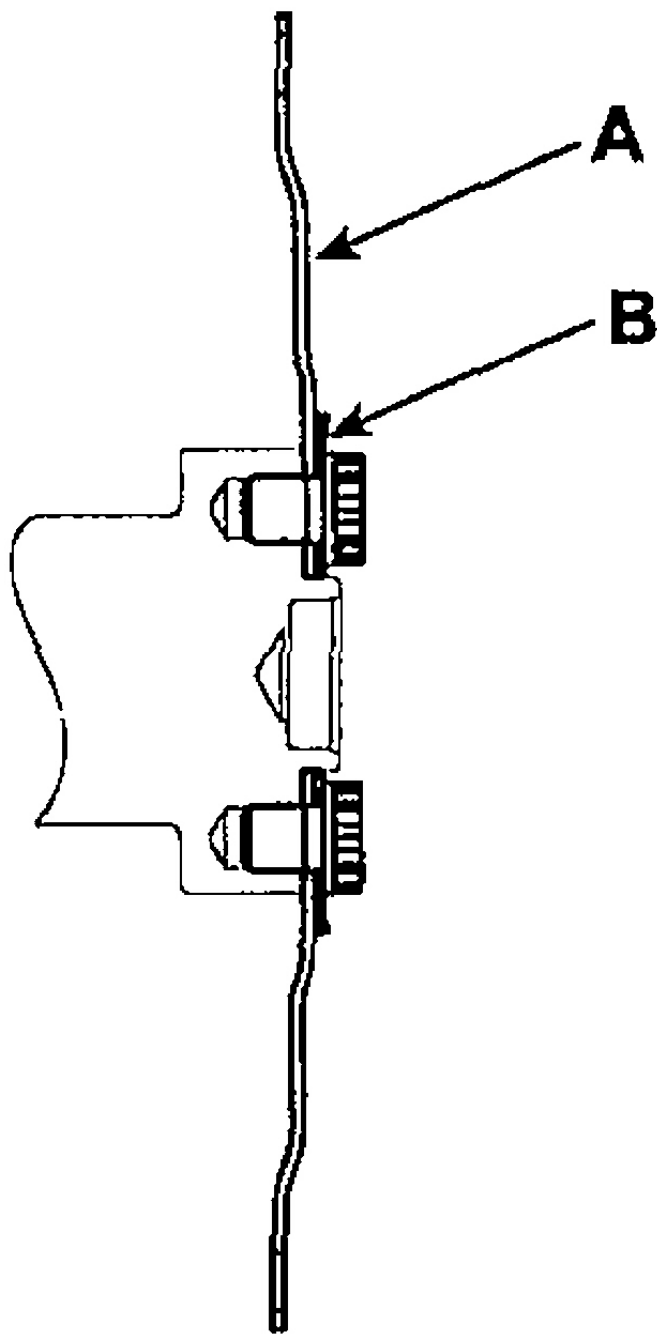
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**Fig. 238: Installing Oil Level Gauge Tube**  
Courtesy of KIA MOTORS AMERICA, INC.

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)





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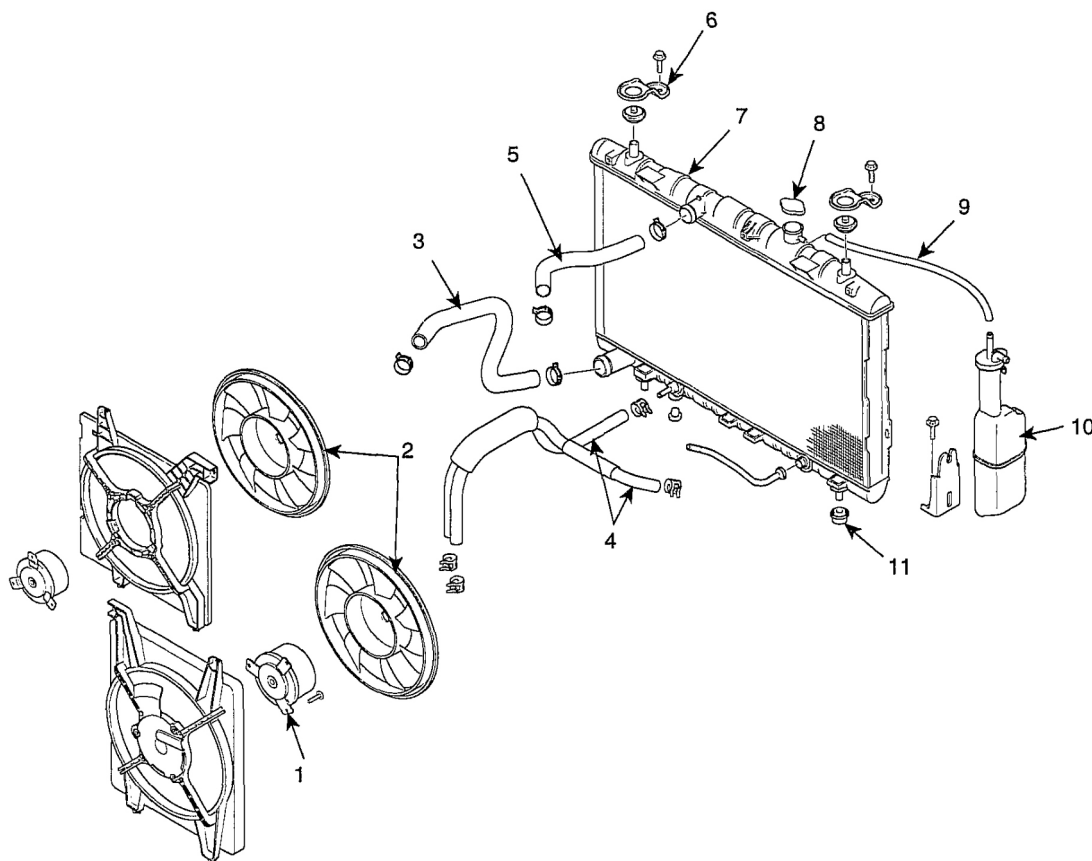
**Fig. 239: Installing Drive Plate**  
Courtesy of KIA MOTORS AMERICA, INC.

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

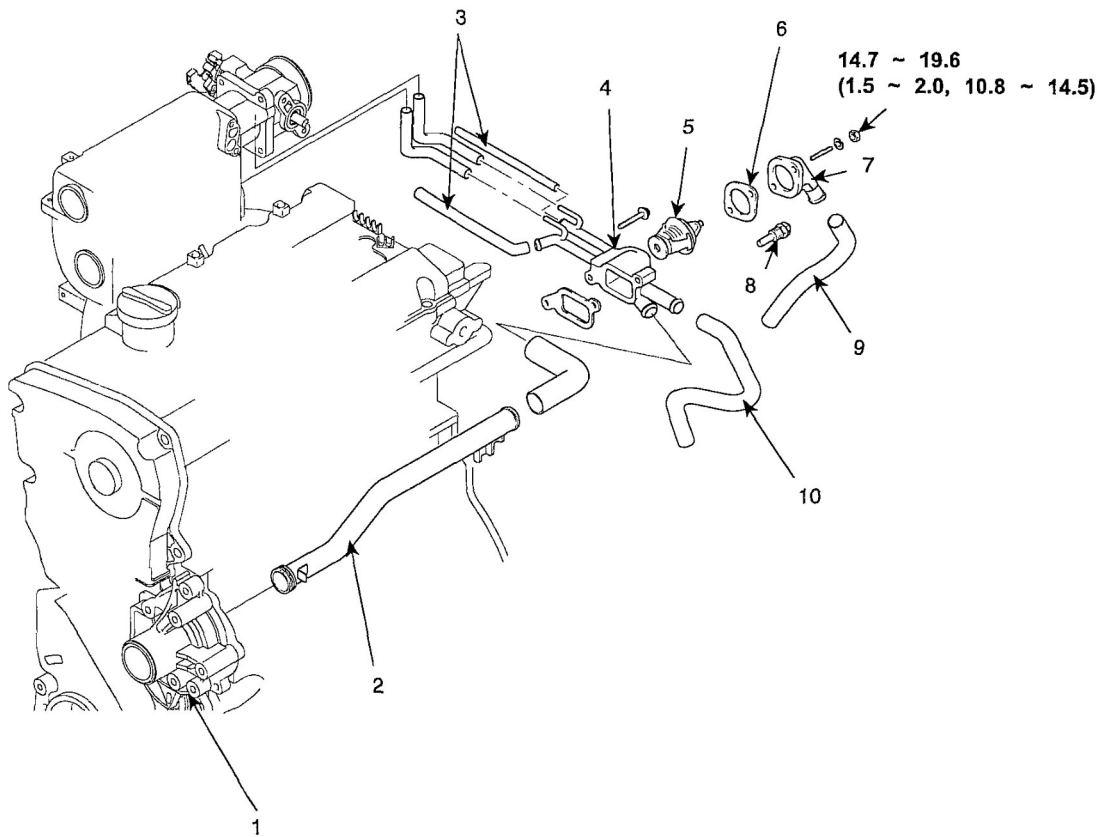
### COMPONENT



- |                          |                     |
|--------------------------|---------------------|
| 1. Fan motor             | 7. Radiator         |
| 2. Fan                   | 8. Radiator cap     |
| 3. Radiator lower hose   | 9. Over flow hose   |
| 4. Oil cooler hose (A/T) | 10. Reservoir tank  |
| 5. Radiator upper hose   | 11. Lower insulator |
| 6. Upper bracket         |                     |

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**Fig. 240: Identifying Cooling System Components (1 Of 2)**  
 Courtesy of KIA MOTORS AMERICA, INC.



**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     |

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**Fig. 241: Identifying Cooling System Components With Torque Specifications (2 Of 2)**  
Courtesy of KIA MOTORS AMERICA, INC.

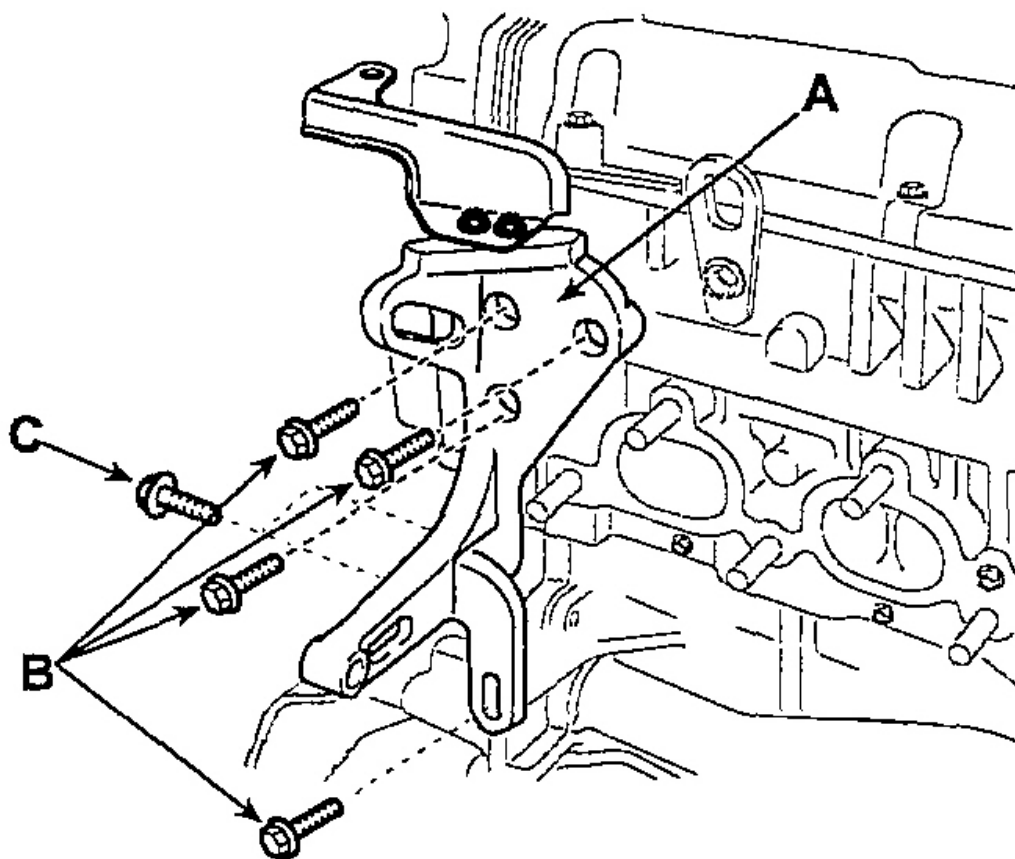
**REMOVAL**

**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. See **TIMING BELT**.
4. Remove the timing belt idler.
5. Remove the power steering pump and use a wire to secure the pump to the vehicle so that it is out of the way.
6. Remove the bolts (B, C) and power steering pump bracket (A).

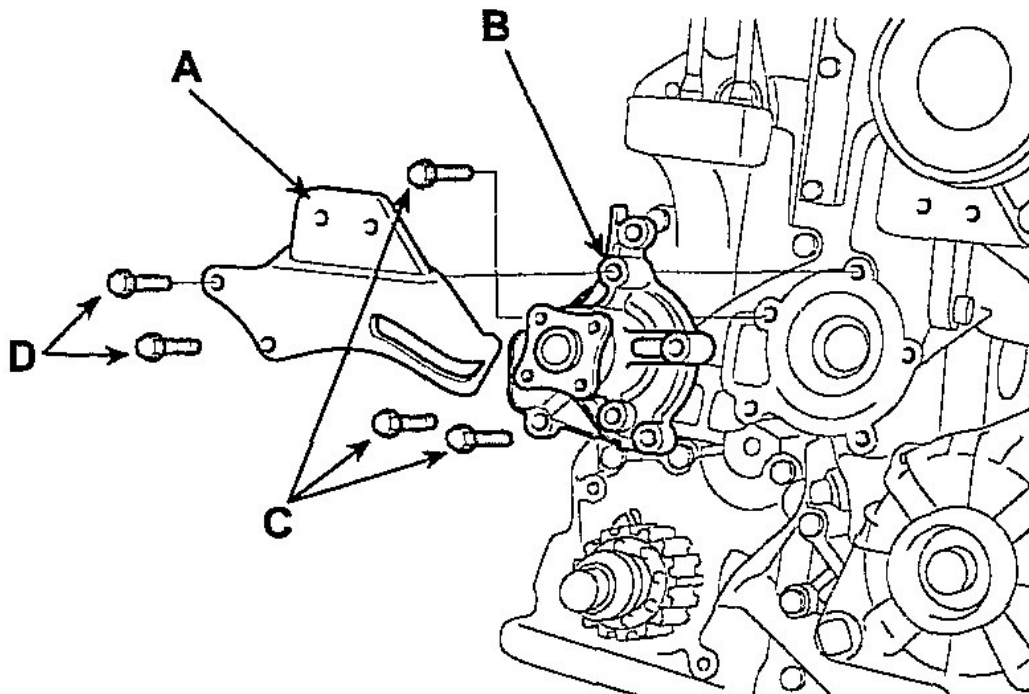


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**Fig. 242: Removing Power Steering Pump Bracket**  
Courtesy of KIA MOTORS AMERICA, INC.

7. Remove the alternator. See **ALTERNATOR BELT INSPECTION & ADJUSTMENT**.
8. Remove the water pump.
  - a. Remove the 2 bolts (D) and alternator brace (A).

- b. Remove the 3 bolts (C) and remove the water pump (B) and gasket.



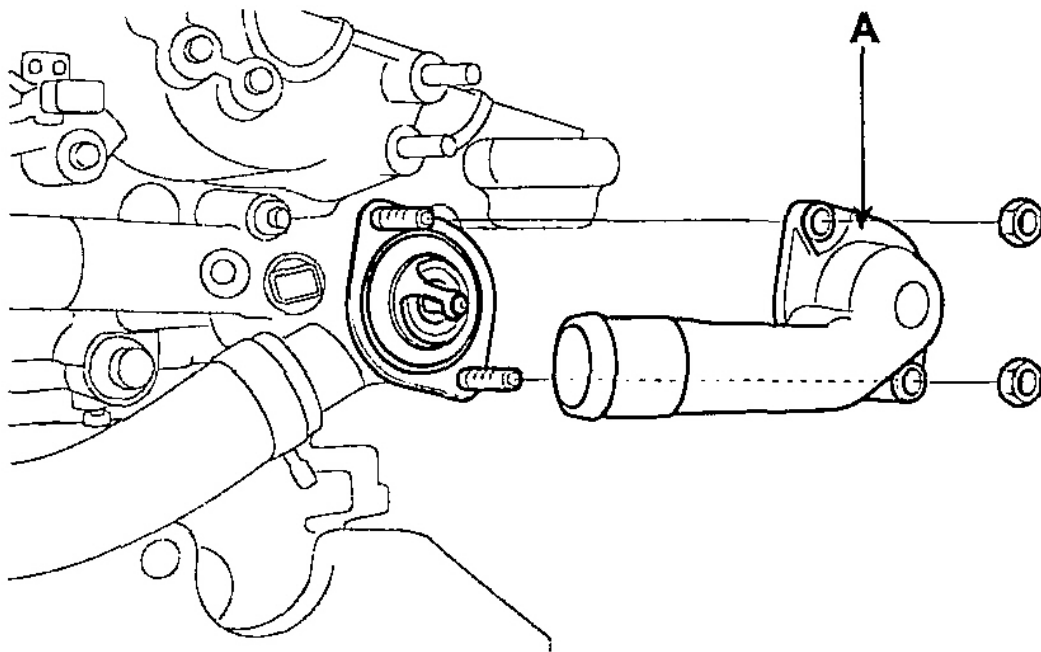
G00719182

**Fig. 243: 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.

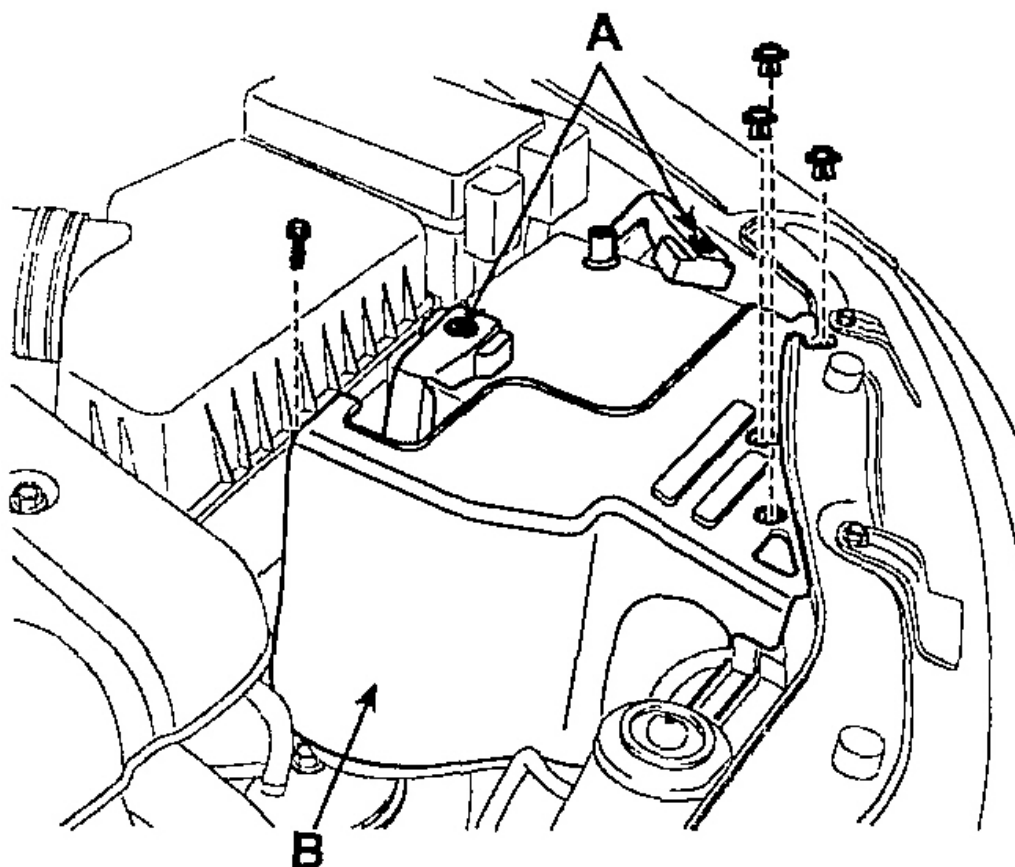


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**Fig. 244: Removing Thermostat**  
 Courtesy of KIA MOTORS AMERICA, INC.

#### RADIATOR

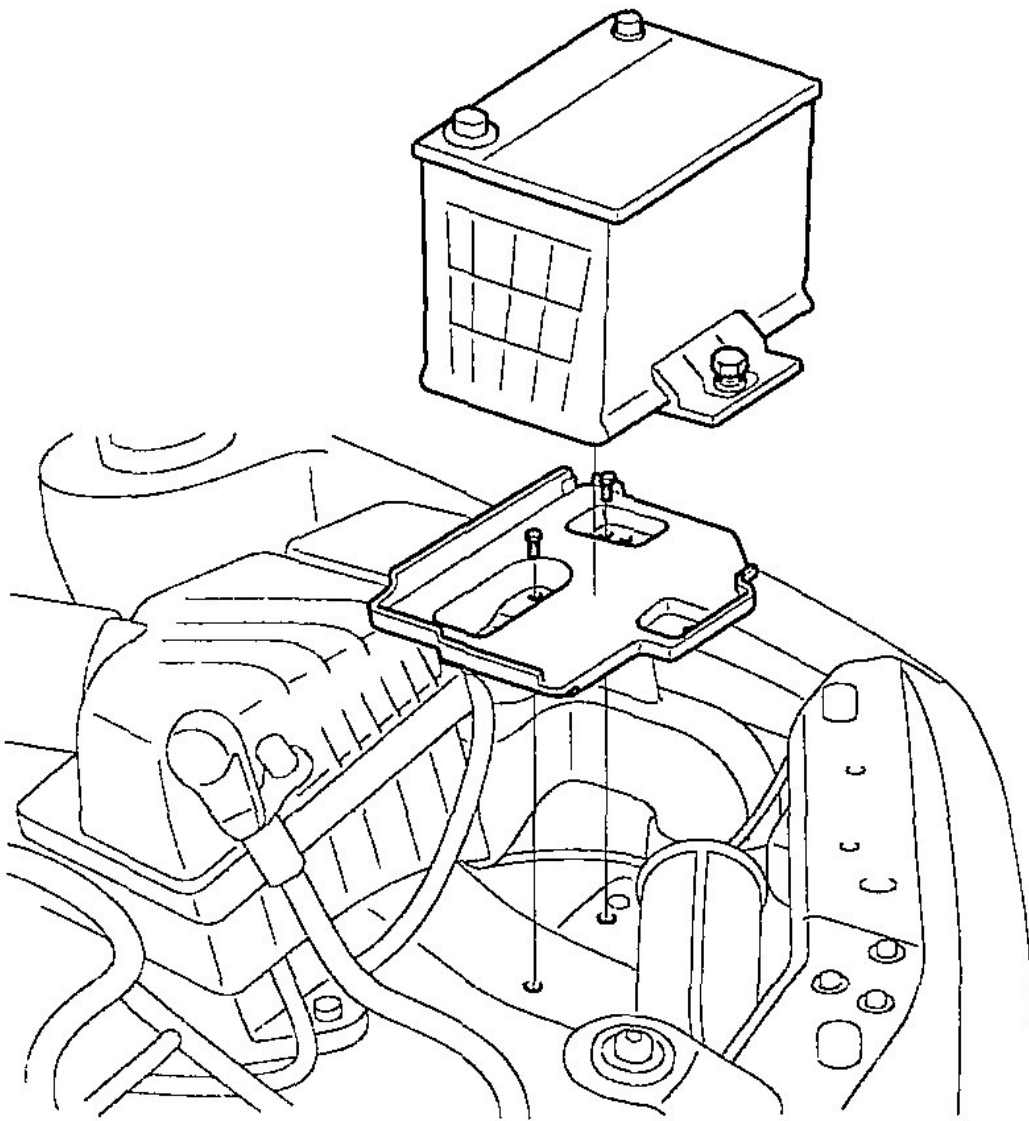
1. Drain the engine coolant.
2. Remove the battery terminals (A) and heat shield (B).



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**Fig. 245: Removing Battery Terminals**  
Courtesy of KIA MOTORS AMERICA, INC.

3. Remove the battery and battery tray.

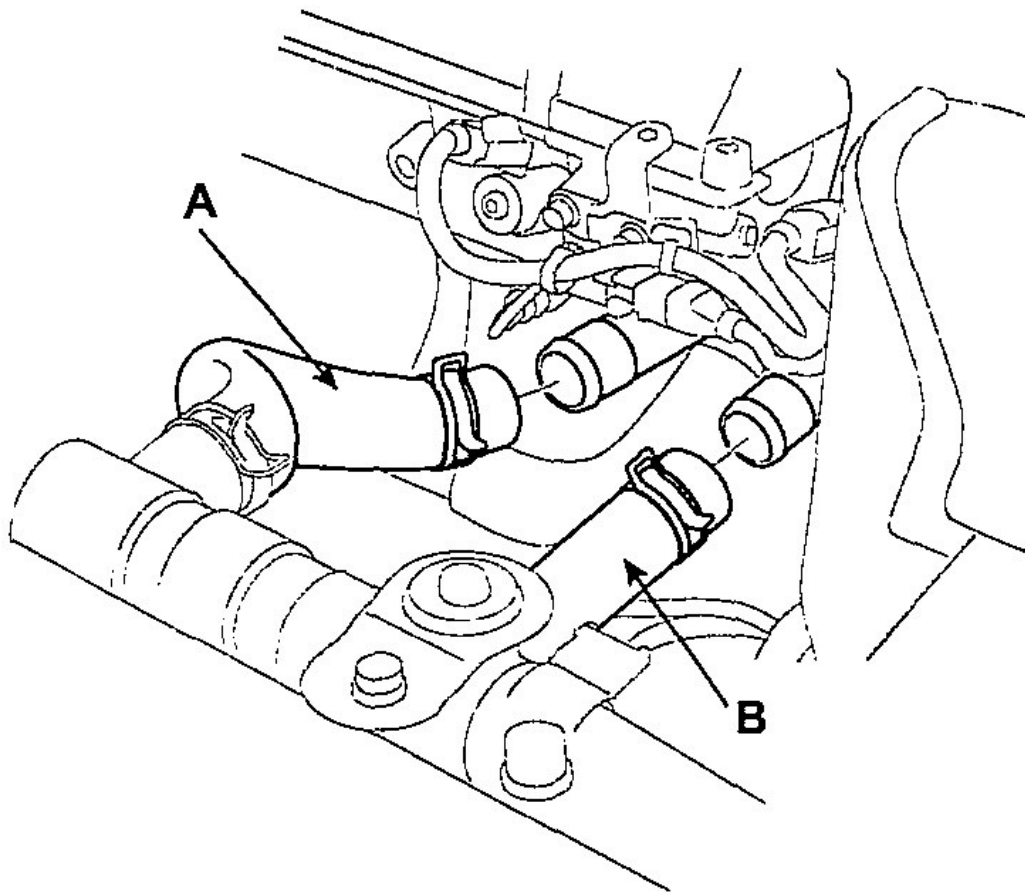


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**Fig. 246: Removing Battery & Battery Tray**  
Courtesy of KIA MOTORS AMERICA, INC.

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

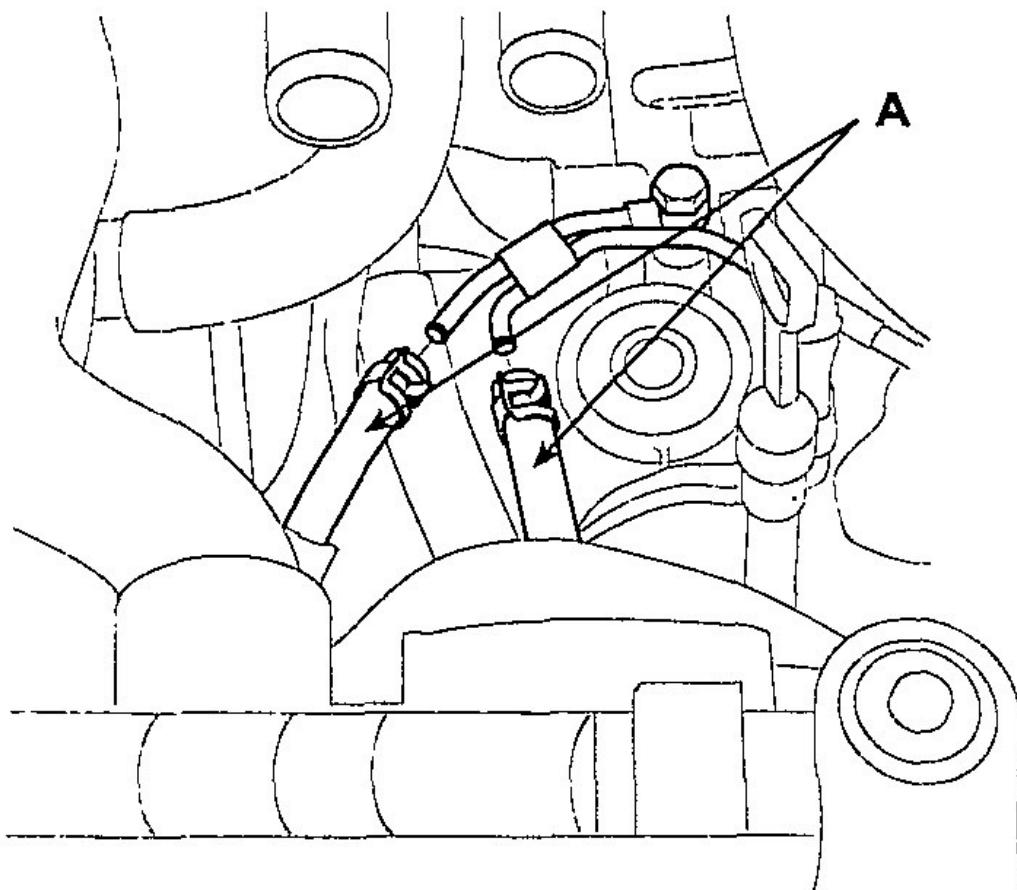




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**Fig. 247: Removing Upper & Lower Radiator Hose**  
Courtesy of KIA MOTORS AMERICA, INC.

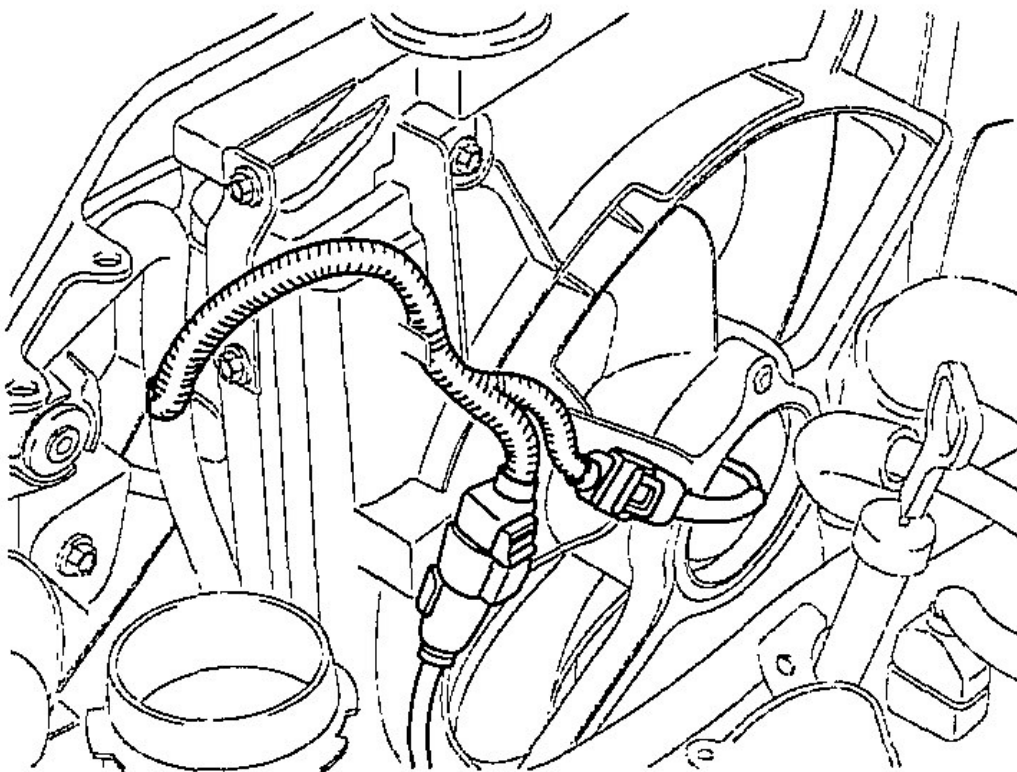
5. Remove the ATF (Automatic Transaxle Fluid) cooler hose (A).



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**Fig. 248: Removing Automatic Transaxle Fluid Cooler Hose**  
Courtesy of KIA MOTORS AMERICA, INC.

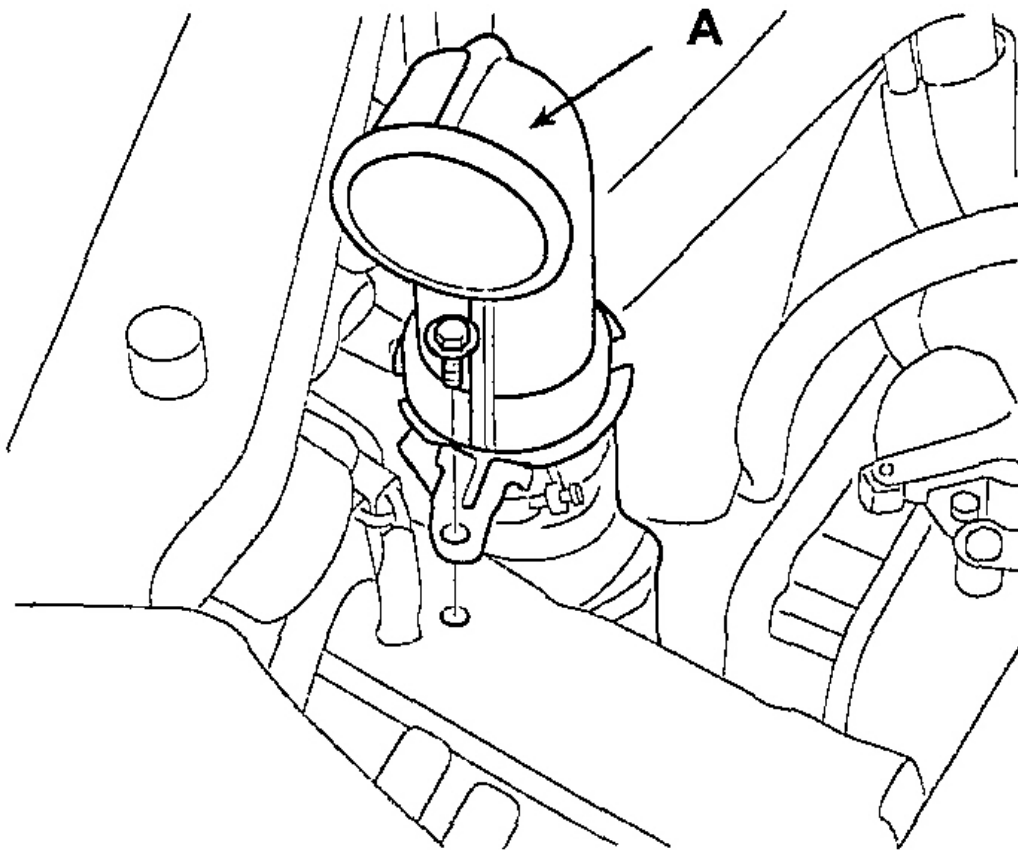
6. Disconnect the fan motor connector.



G00719188

**Fig. 249: Disconnecting Fan Motor Connector**  
Courtesy of KIA MOTORS AMERICA, INC.

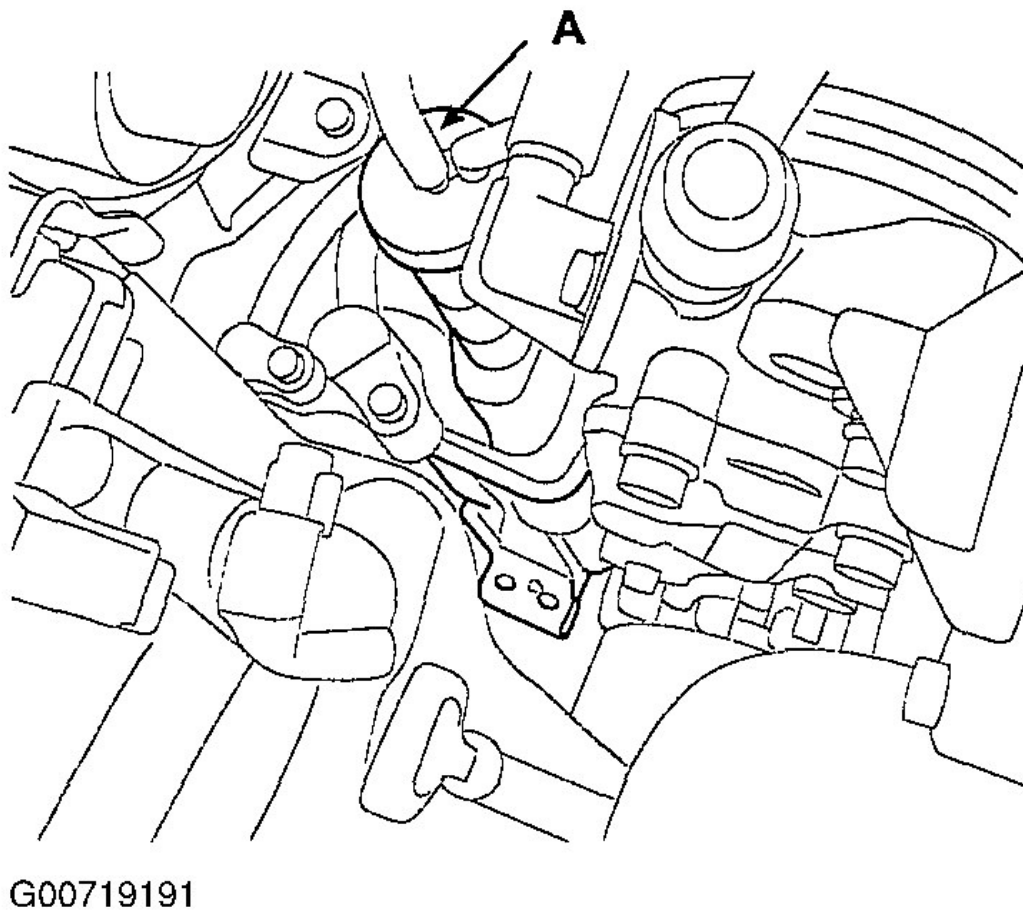
7. Remove the radiator.
  - a. Remove the air duct (A) to allow for radiator removal.



G00719190

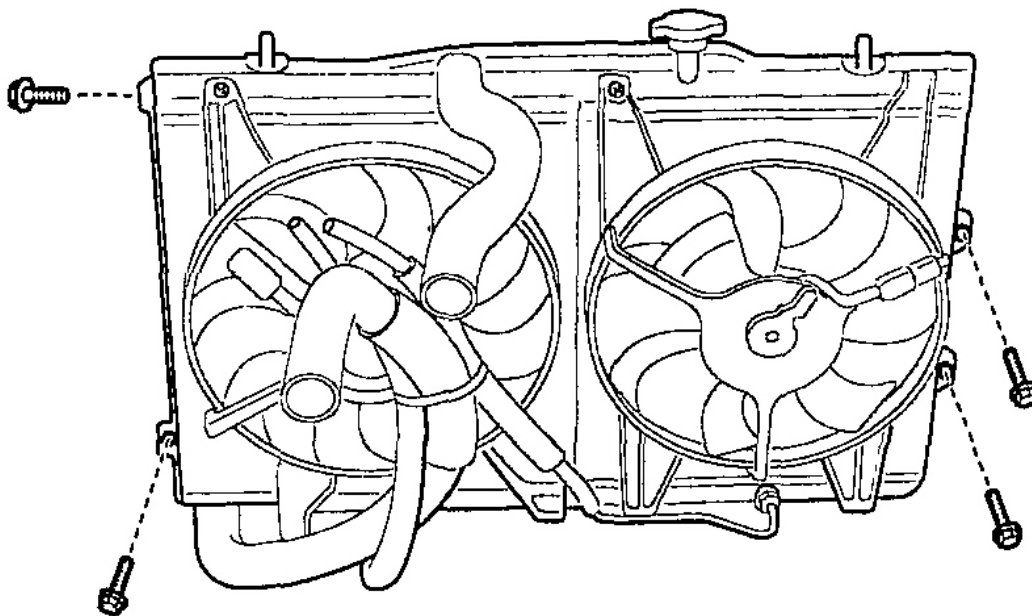
**Fig. 250: Removing Air Duct**  
Courtesy of KIA MOTORS AMERICA, INC.

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



**Fig. 251: Removing Reservoir Tank**  
Courtesy of KIA MOTORS AMERICA, INC.

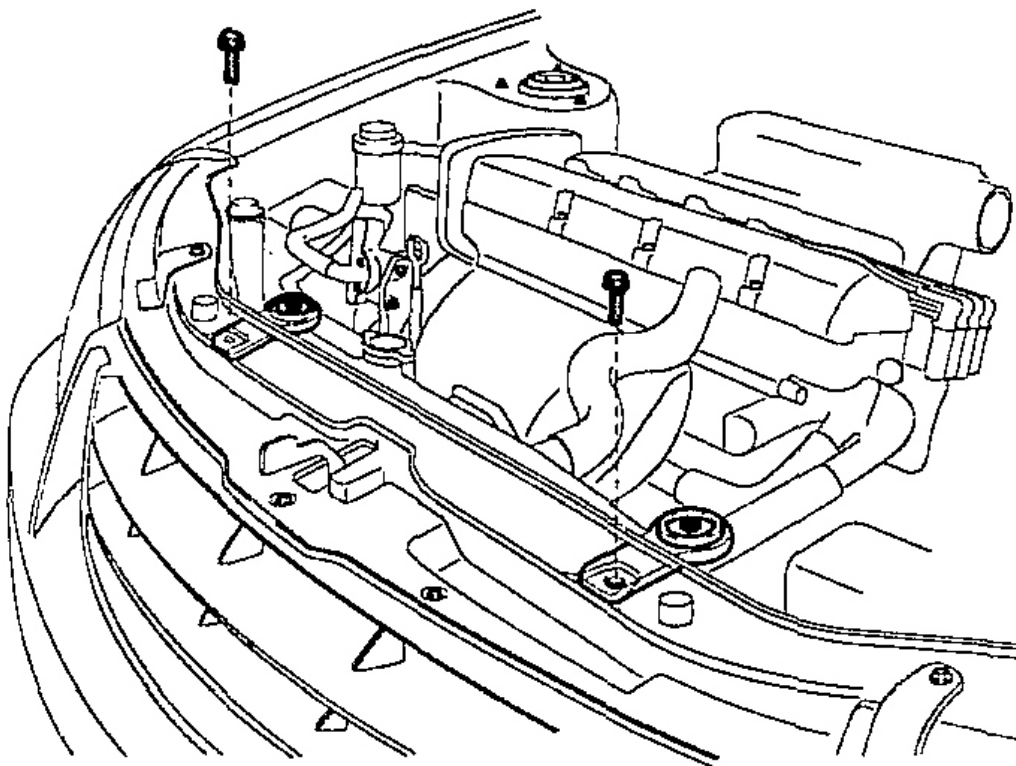
- c. Remove the radiator mounting bolts and remove the radiator from condenser.



G00719192

**Fig. 252: Removing Radiator From Condenser**  
Courtesy of KIA MOTORS AMERICA, INC.

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



G00719193

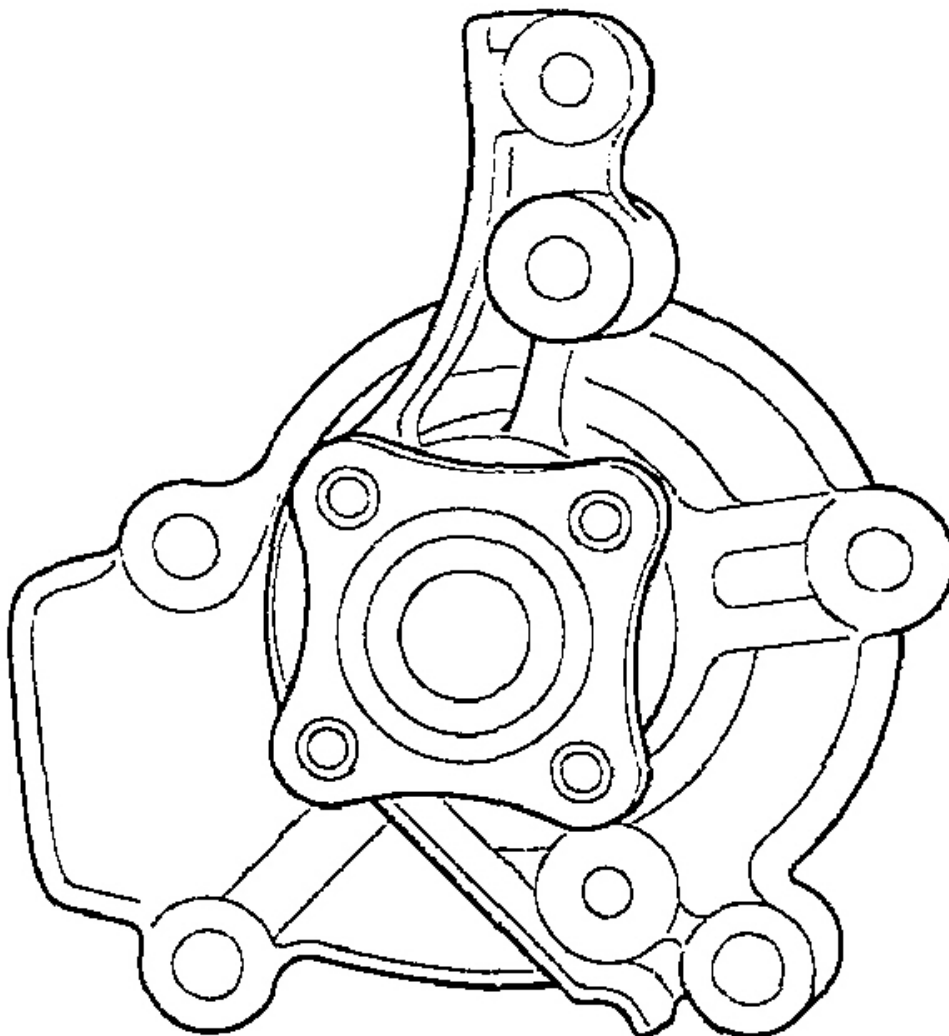
**Fig. 253: Removing Radiator Upper Bracket**  
Courtesy of KIA MOTORS AMERICA, INC.

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. 254: Inspecting Coolant Pump**  
Courtesy of KIA MOTORS AMERICA, INC.

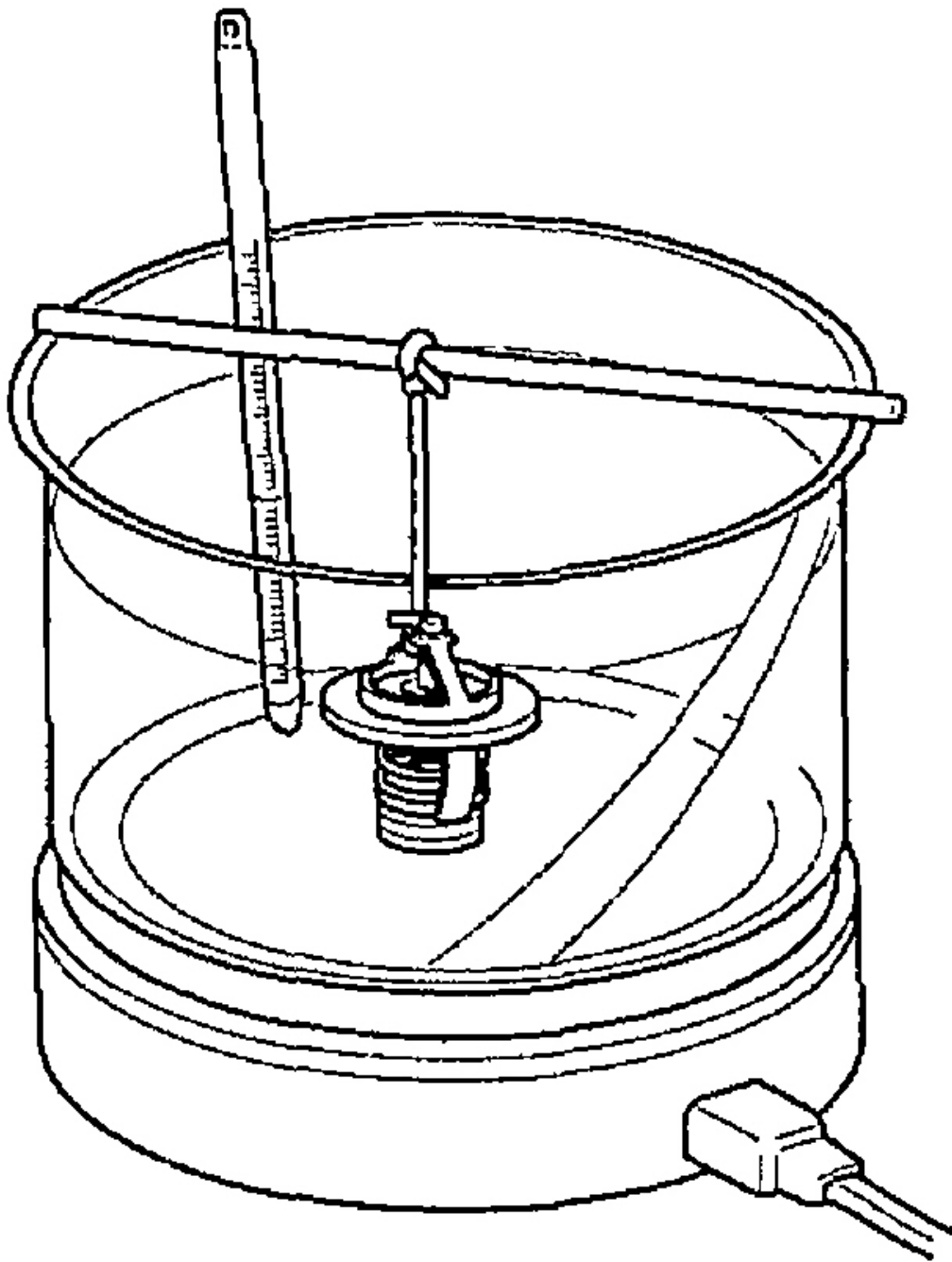
3. Check for coolant leakage. If coolant leaks from hole, the seal is defective. Replace the coolant pump assembly.

**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. 255: Testing Thermostat**  
Courtesy of KIA MOTORS AMERICA, INC.

2. Check the valve opening temperature.

Valve opening temperature: 82+/-1.5°C (179.6+/-2.7°F)

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

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)

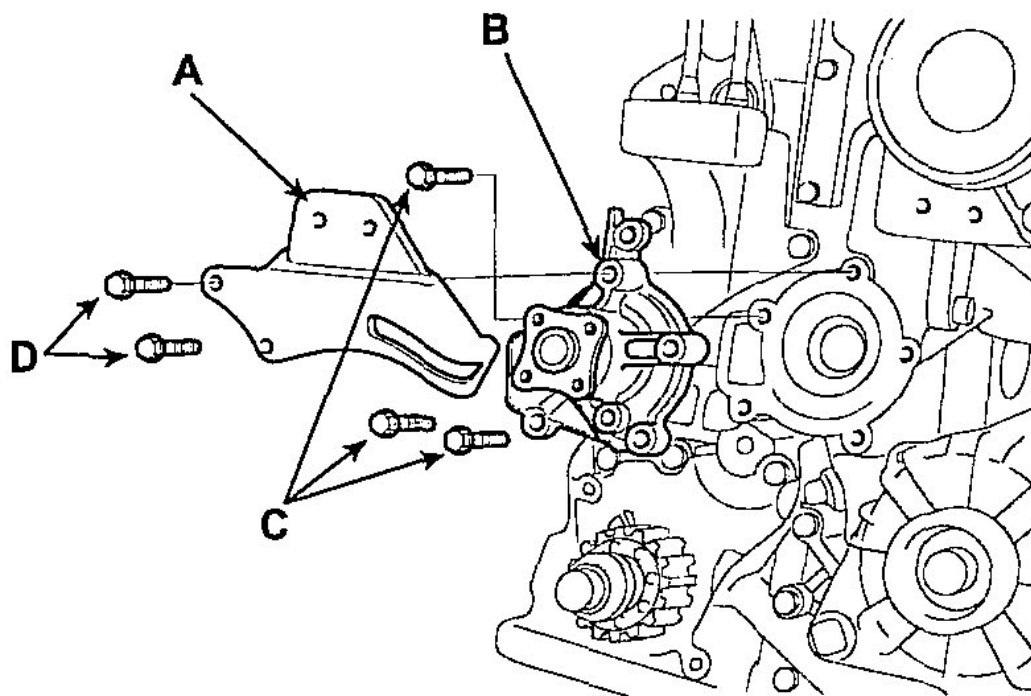
If the valve lift is not as specified, replace the thermostat.

## **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. 256: Installing Water Pump**  
Courtesy of KIA MOTORS AMERICA, INC.

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

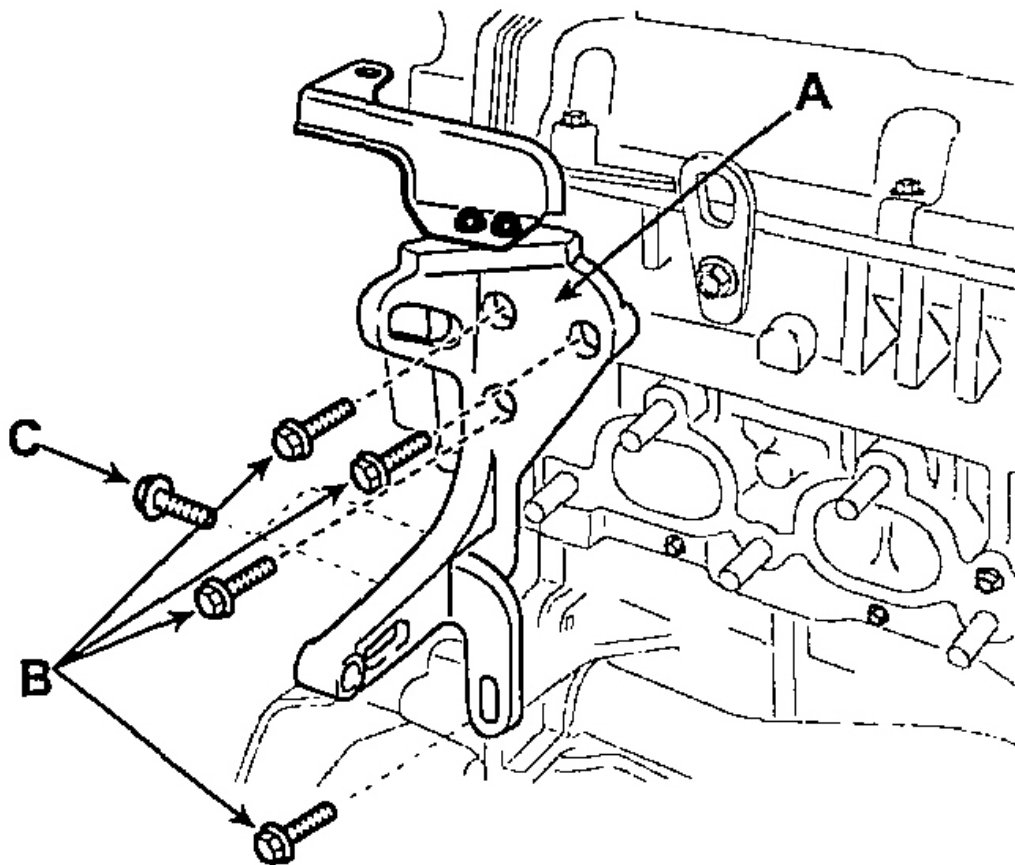
Tightening torque: 19.6-26.5 N.m (2.0-2.7 kg-m, 14.5-19.5 lb-ft)

2. Install the power steering pump bracket (A) and bolts (B, C).

Tightening torque:

Bolts (B): 34.3-49.0 N.m (3.5-5.0 kg-m, 25.3-36.2 lb-ft)

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



G00719197

**Fig. 257: Installing Power Steering Pump Bracket**  
Courtesy of KIA MOTORS AMERICA, INC.

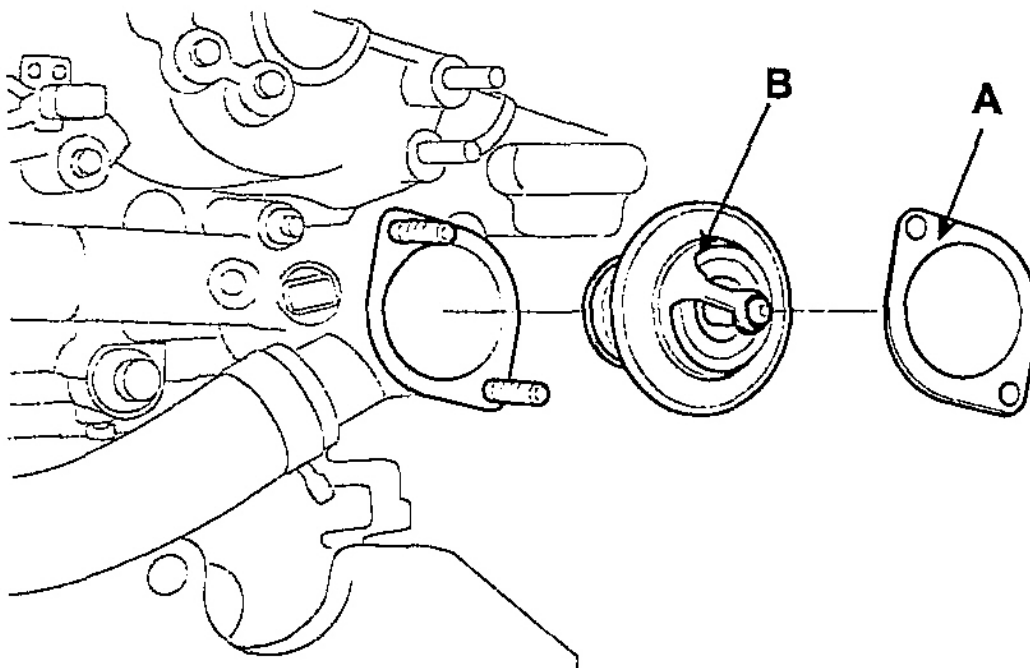
3. Install the alternator. See ALTERNATOR BELT INSPECTION & ADJUSTMENT .
4. Install the power steering pump. See CHECKING POWER STEERING BELT TENSION .
5. Install the timing belt idler.
6. Install the timing belt. See INSTALLATION.
7. Install the water pump pulley.
8. Install the drive belts.
9. Tighten the water pump pulley bolts.

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

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

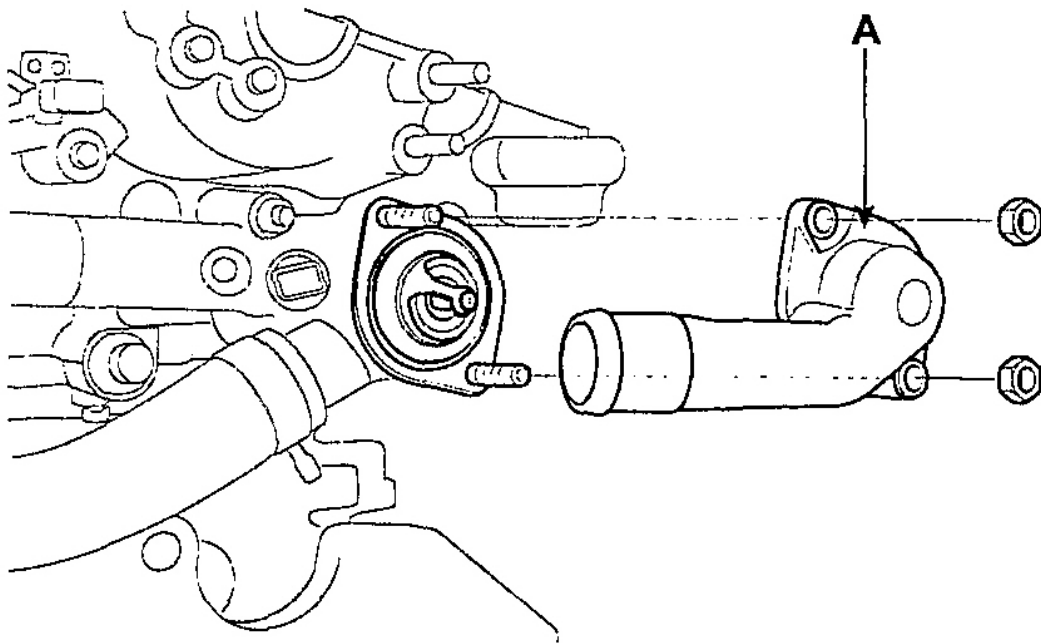


G00719198

**Fig. 258: 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. 259: 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 onto the radiator.
2. Install the radiator onto the air conditioner condenser on the vehicle.

**NOTE:** The next installation procedures are in the reverse order of radiator removal.

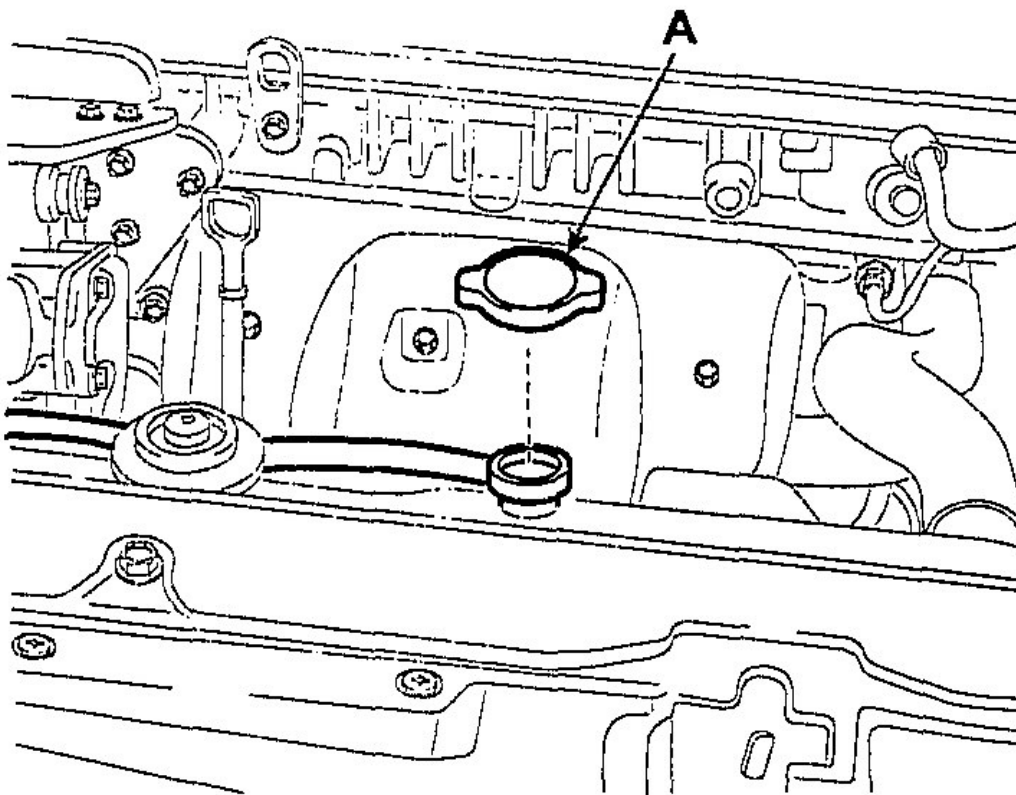
3. Connect the fan motor connector.
4. Install the upper and lower radiator hoses, and ATF cooler hoses.
5. Fill with engine coolant.
6. Start engine and check for leaks.

#### SERVICE & TESTING

## COOLANT SERVICE

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

1. Slide the heater temperature control lever to maximum heat. Make sure the engine and radiator are cool to the touch.
2. Remove the radiator cap (A).

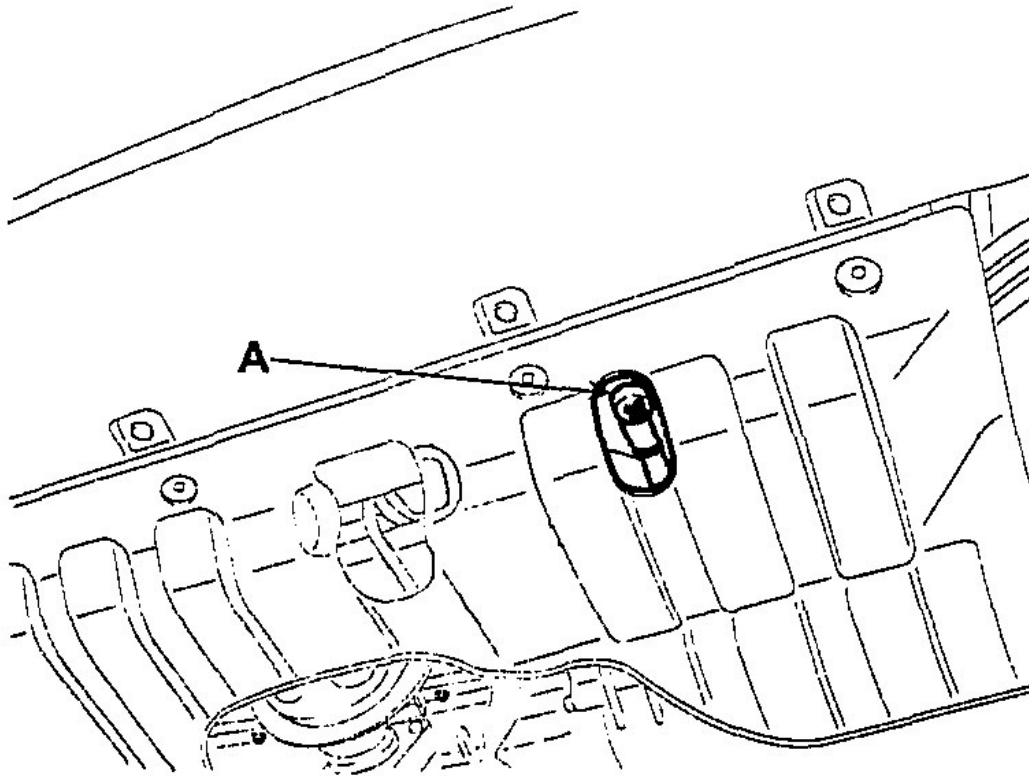


G00719177

**Fig. 260: Removing Radiator Cap**  
Courtesy of KIA MOTORS AMERICA, INC.

3. Loosen the drain plug (A), and drain the coolant.





G00719178

**Fig. 261: Loosening Cooling System Drain Plug**  
Courtesy of KIA MOTORS AMERICA, INC.

4. Tighten the radiator drain plug (A) securely.
5. Remove the coolant reservoir tank. Drain the coolant and reinstall the coolant reservoir tank. Fill the coolant reservoir tank to the MAX mark with the coolant.
6. Mix the recommended antifreeze with an equal amount of water in a clean container.

**NOTE:**

- Use only genuine antifreeze/coolant.
- For best corrosion protection, the coolant concentration must be maintained year-round at 50% minimum. Coolant concentrations less than 50% may not provide sufficient protection against corrosion of freezing.
- Coolant concentrations greater than 60% will impair cooling efficiency and are not recommended.

**CAUTION:**

- **Do not mix different brands of antifreeze/coolants.**
- **Do not use additional rust inhibitors or antirust products; they may not be compatible with the coolant.**

7. Pour the coolant into the radiator to the base of the filler neck, and install the radiator cap loosely.

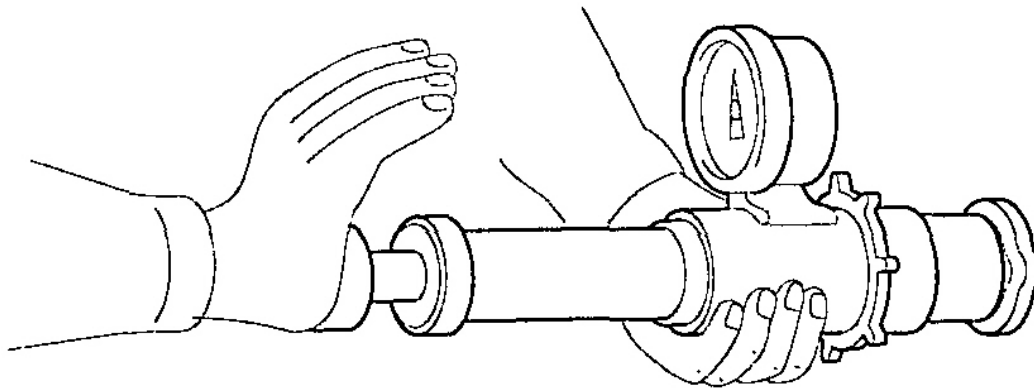
Coolant capacity: 8.14 liters (8.60 US qt, 7.16 Imp qt)

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

## TESTING

### RADIATOR CAP TESTING

1. Remove the radiator cap, wet its seal with engine coolant, then install into pressure tester.



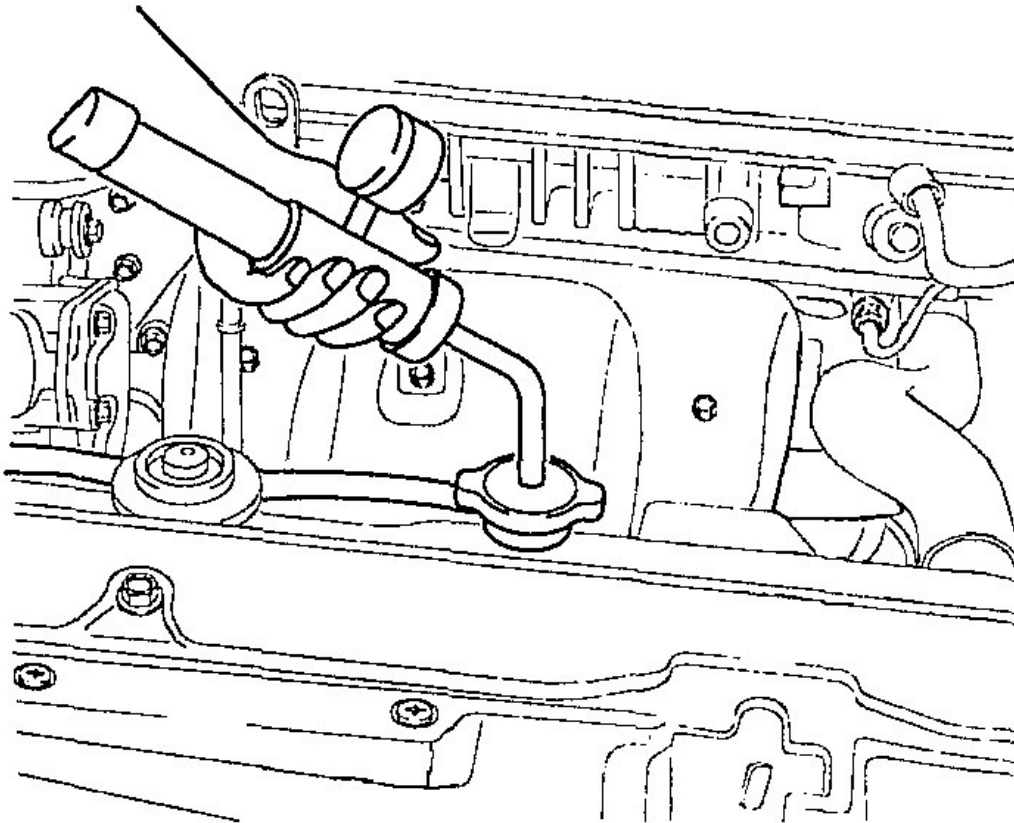
G00719179

**Fig. 262: Testing Radiator Cap**  
Courtesy of KIA MOTORS AMERICA, INC.

2. Apply a pressure of 93.16-122.58 kPa (0.95-1.25 kg/cm<sup>2</sup>, 13.51-17.78 psi).
3. Check for a drop in pressure.
4. If the pressure drops, replace the cap.

### RADIATOR LEAKAGE TEST

1. Wait until engine is cool, then carefully remove the radiator cap and fill the radiator with engine coolant, then install pressure tester to radiator.
2. Apply pressure of 93.16-122.58 kPa (0.95-1.25 kg/cm<sup>2</sup> , 13.51-17.78 psi).



G00719180

**Fig. 263: Testing Radiator**

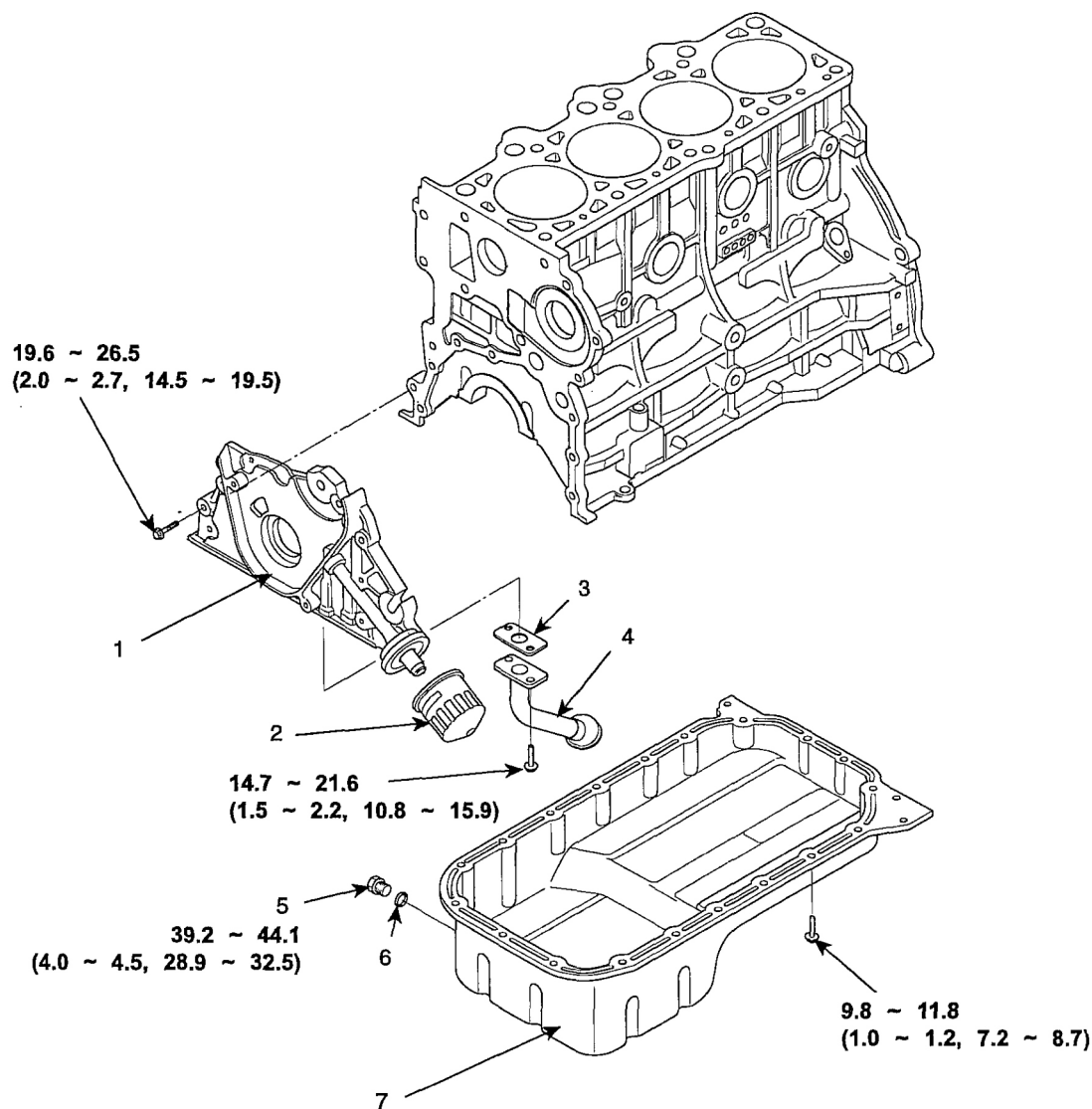
Courtesy of KIA MOTORS AMERICA, INC.

3. Inspect for engine coolant leaks and a drop in pressure.
4. Remove tester and reinstall radiator cap.

**NOTE:** Check for engine oil in coolant and/or coolant in engine oil.

## LUBRICATION SYSTEM

### COMPONENT



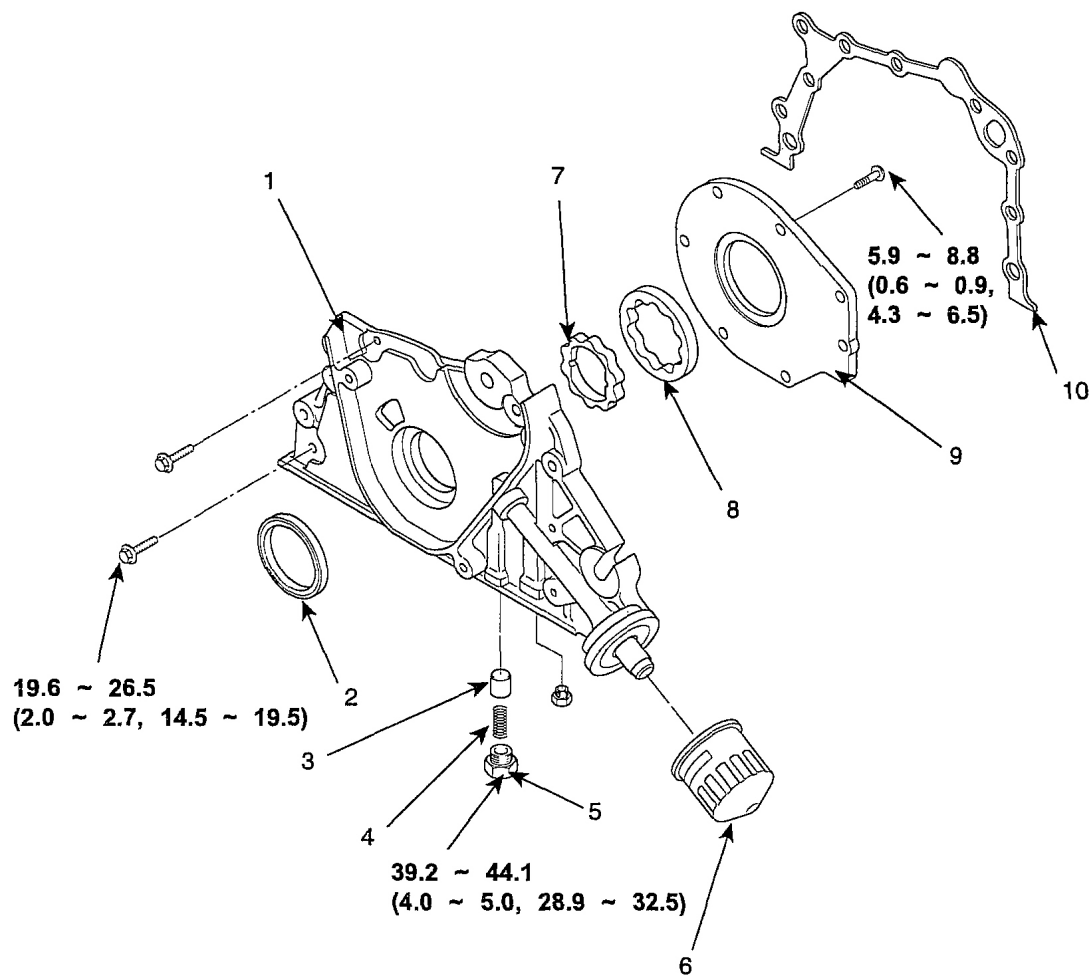
### TORQUE : N-m (kg-m, lb-ft)

1. Front case
2. Filter
3. Gasket
4. Oil screen

5. Drain plug
6. Gasket
7. Oil pan

G00719200

**Fig. 264: Identifying Lubrication System Components With Torque Specifications (1 Of 2)**  
Courtesy of KIA MOTORS AMERICA, INC.



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

- 1. Front case
- 2. Oil seal
- 3. Relief plunger
- 4. Relief spring
- 5. Plug

- 6. Oil filter
- 7. Inner rotor
- 8. Outer rotor
- 9. Pump cover
- 10. Gasket

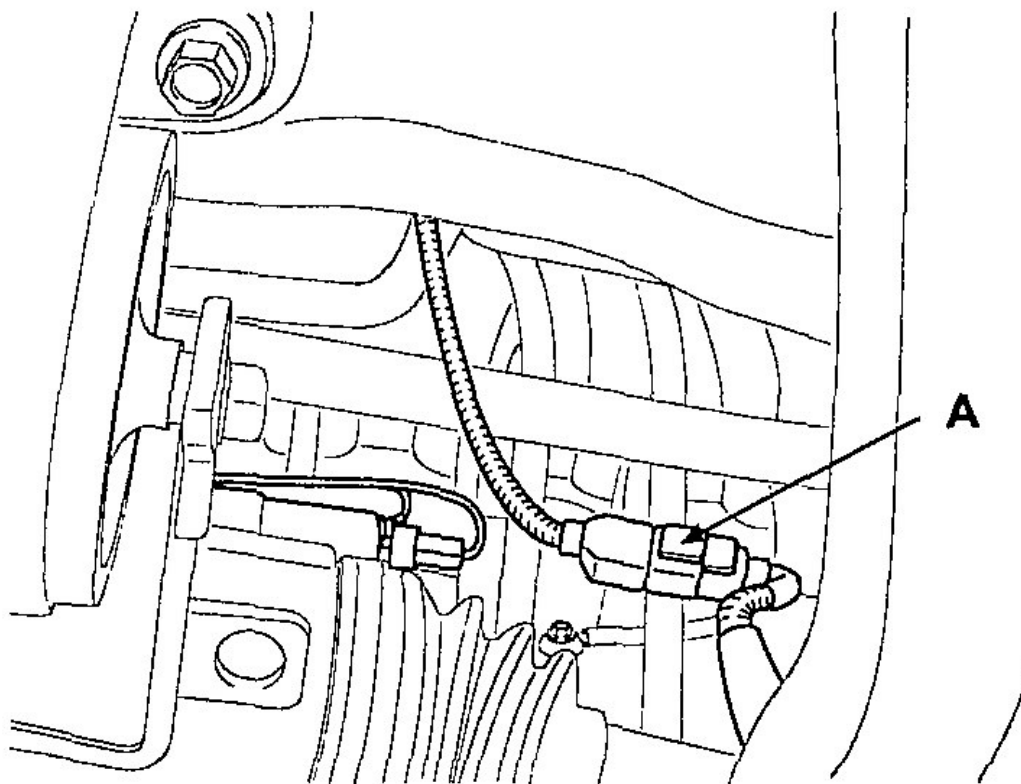
G00719201

**Fig. 265: Identifying Lubrication System Components With Torque Specifications (2 Of 2)**  
Courtesy of KIA MOTORS AMERICA, INC.

**REMOVAL**

**OIL PAN**

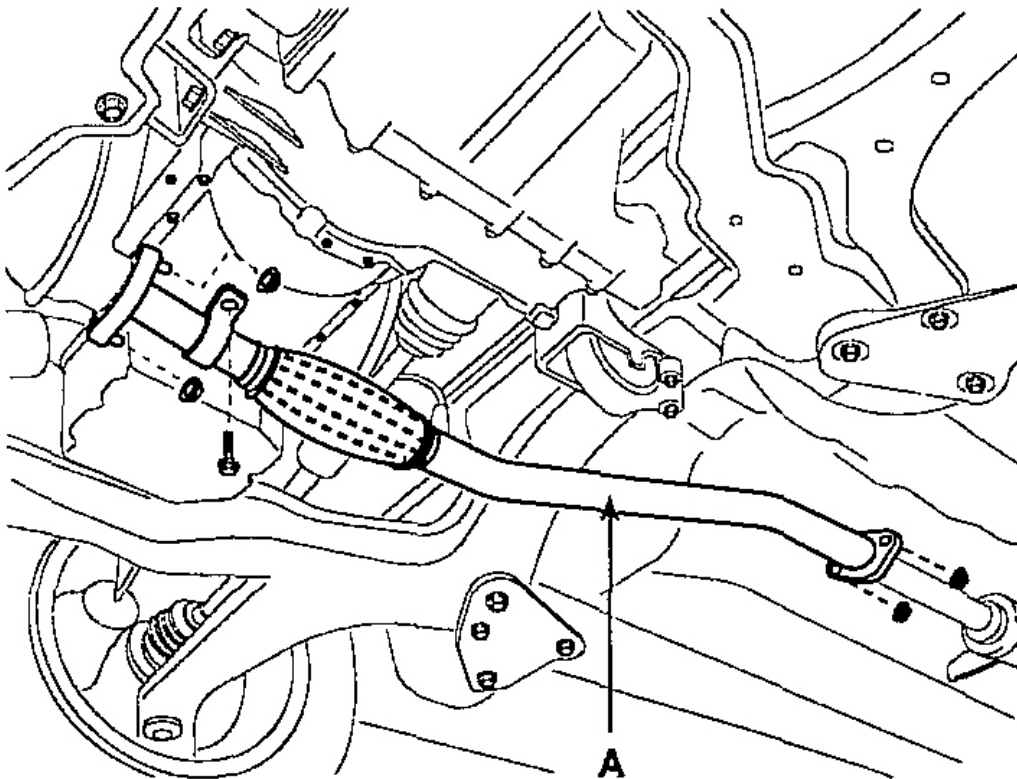
1. Drain the engine oil.
2. Disconnect the rear oxygen sensor connector (A).



G00719203

**Fig. 266: Disconnecting Rear Oxygen Sensor Connector**  
Courtesy of KIA MOTORS AMERICA, INC.

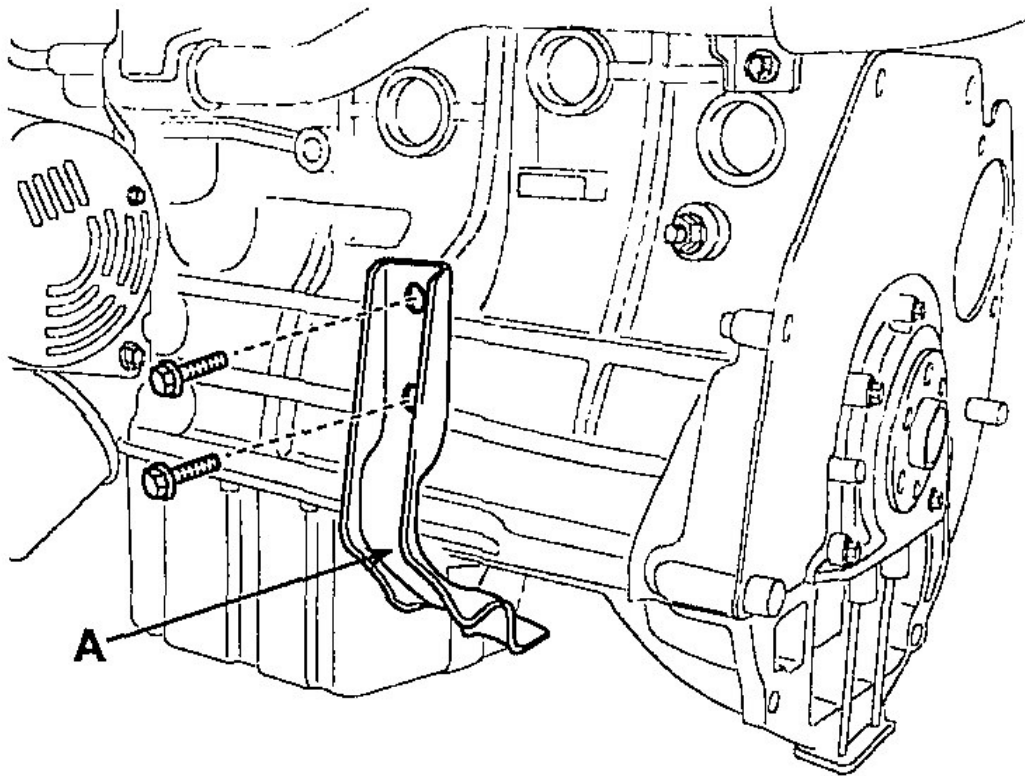
3. Remove the front muffler (A).



G00719204

**Fig. 267: Removing Front Muffler**  
Courtesy of KIA MOTORS AMERICA, INC.

4. Remove the exhaust manifold.
5. Remove the front muffler bracket (A).

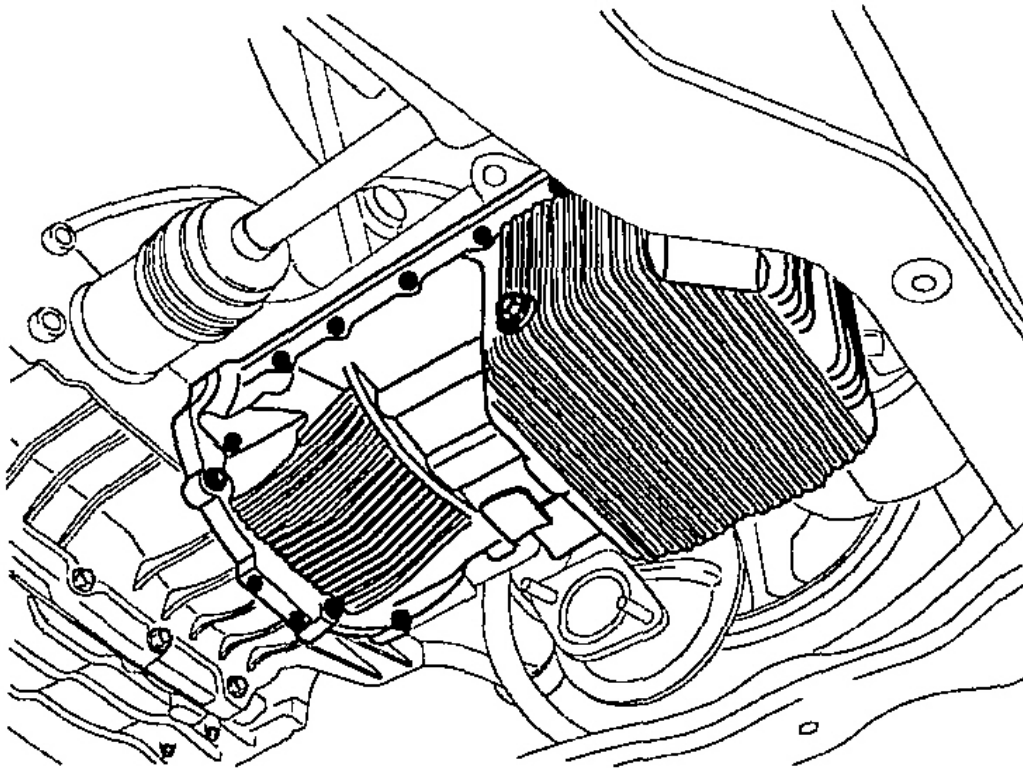


G00719205

**Fig. 268: Removing Front Muffler Bracket**  
Courtesy of KIA MOTORS AMERICA, INC.

6. Remove the oil pan.





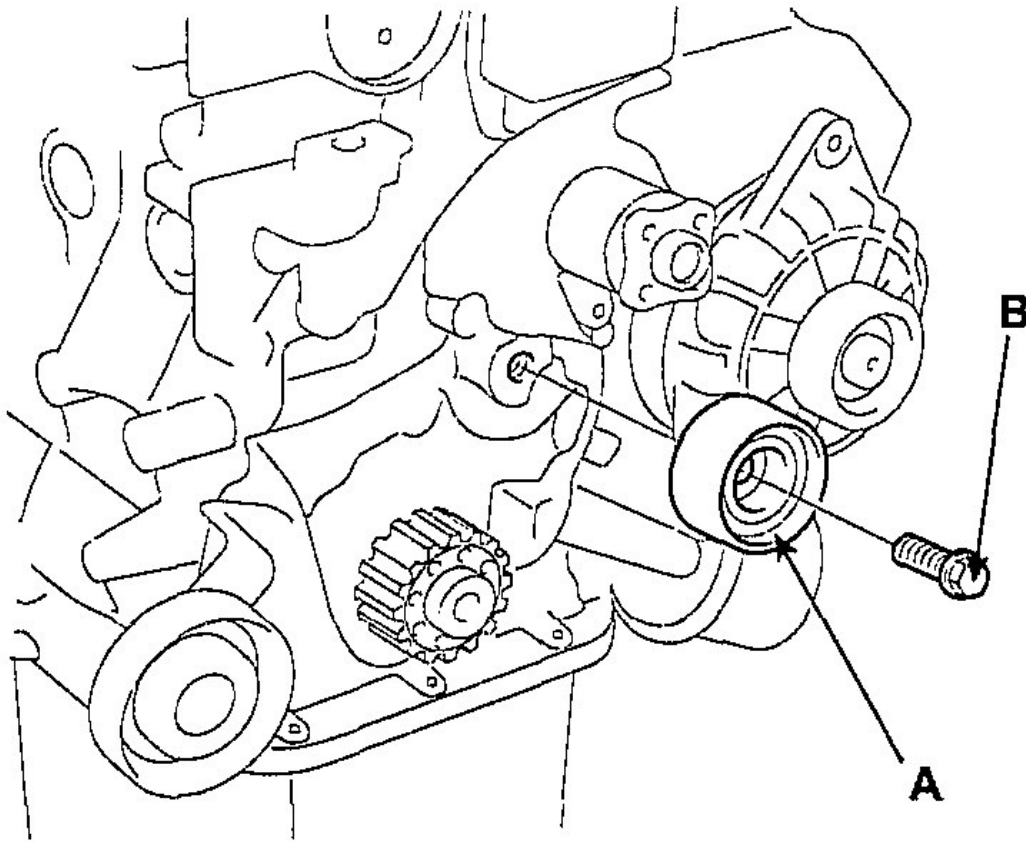
G00719206

**Fig. 269: Removing Oil Pan**

Courtesy of KIA MOTORS AMERICA, INC.

**OIL PUMP**

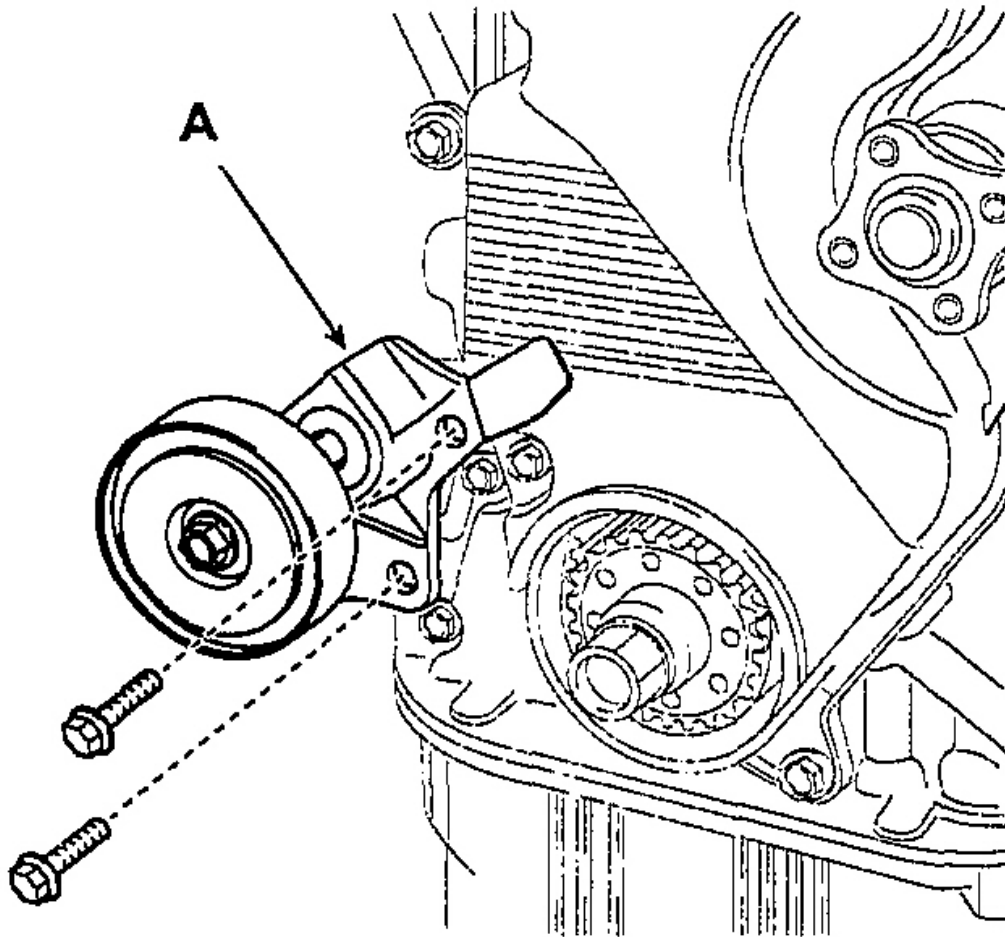
1. Drain the engine oil.
2. Remove the drive belts.
3. Turn the crankshaft pulley, and align its groove with timing mark "T" of the timing belt cover.
4. Remove the timing belt. See **REMOVAL**.
5. Remove the bolt (B) and timing belt idler (A).



G00719207

**Fig. 270: Removing Timing Belt Idler**  
Courtesy of KIA MOTORS AMERICA, INC.

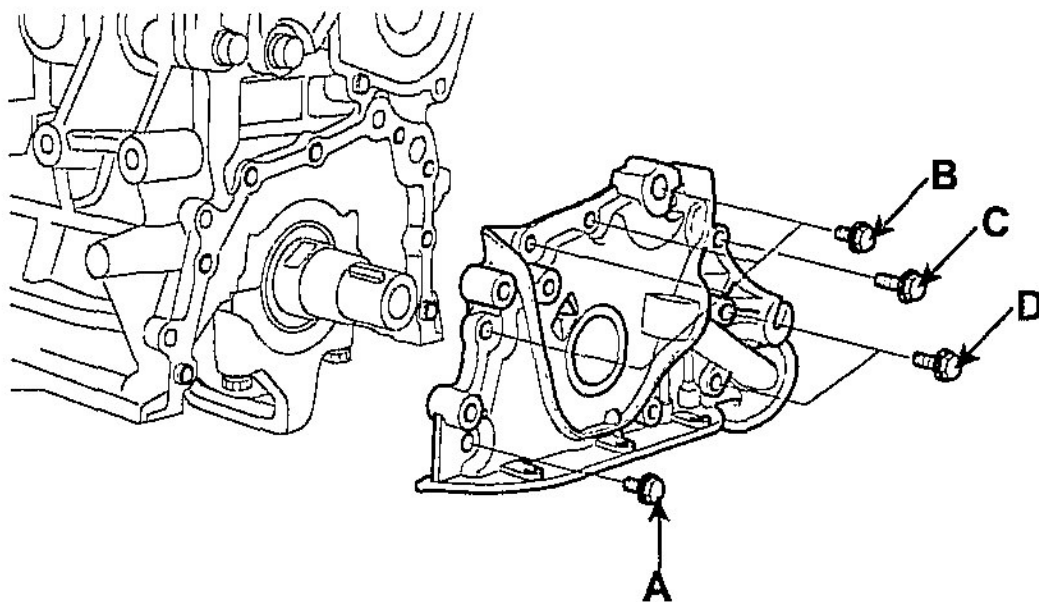
6. Remove the oil pan and oil screen.
7. Remove the alternator.
8. Remove the air conditioner compressor tensioner bracket (A).



G00719208

**Fig. 271: Removing Air Conditioner Compressor Tensioner Bracket**  
Courtesy of KIA MOTORS AMERICA, INC.

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

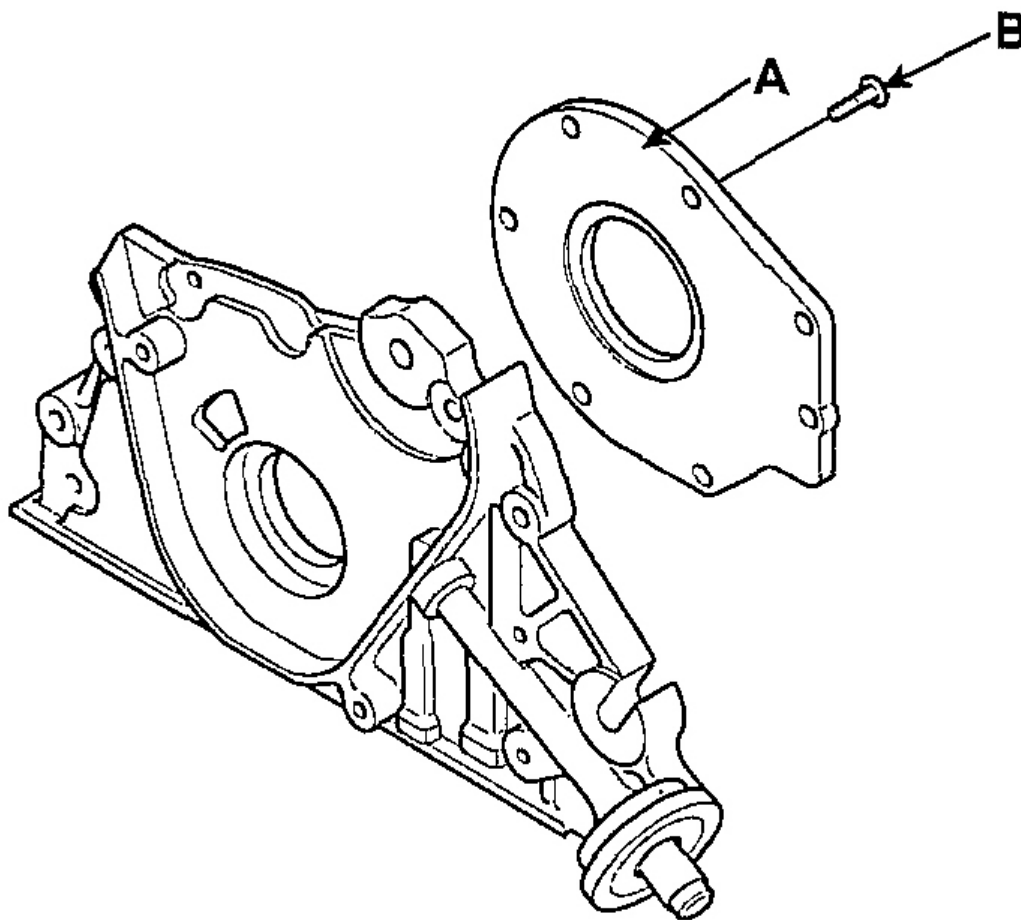


G00719209

**Fig. 272: Removing Front Case**

Courtesy of KIA MOTORS AMERICA, INC.

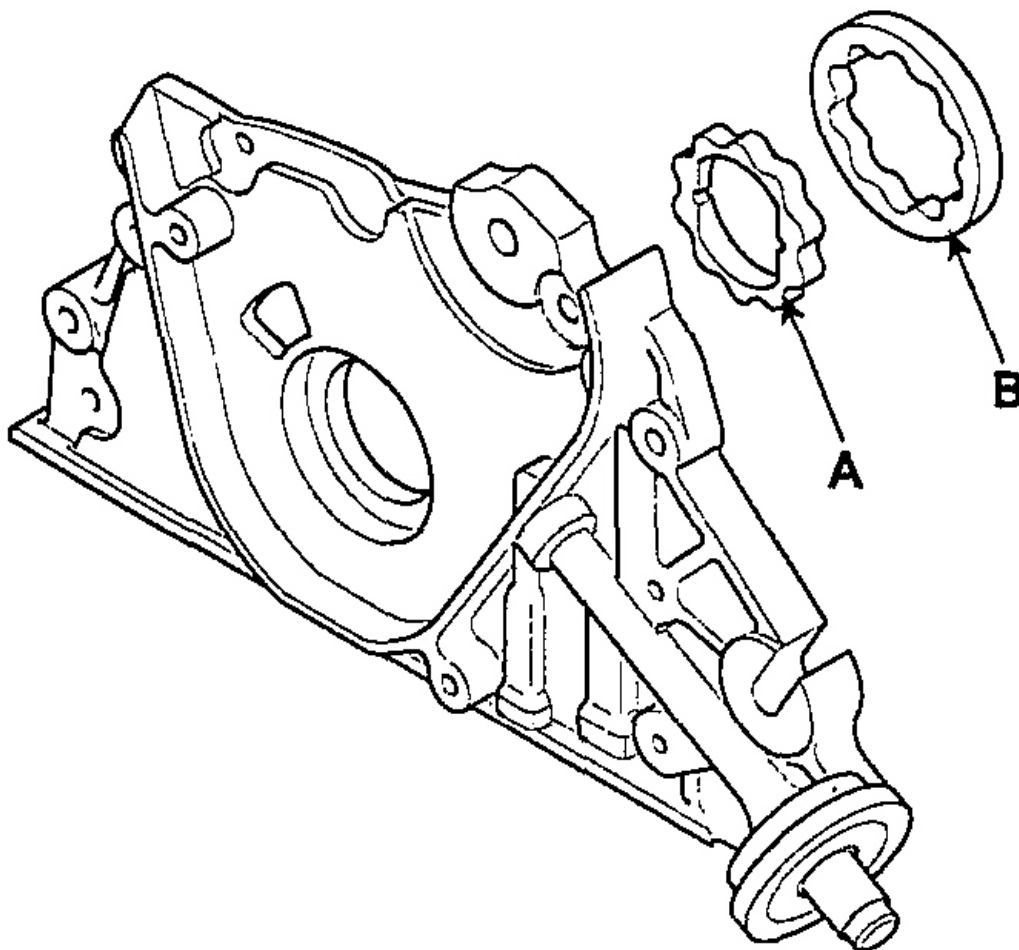
- a. Remove the screw (B) from the pump housing, then separate the housing and cover (A).



G00719210

**Fig. 273: Separating Housing & Cover**  
Courtesy of KIA MOTORS AMERICA, INC.

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



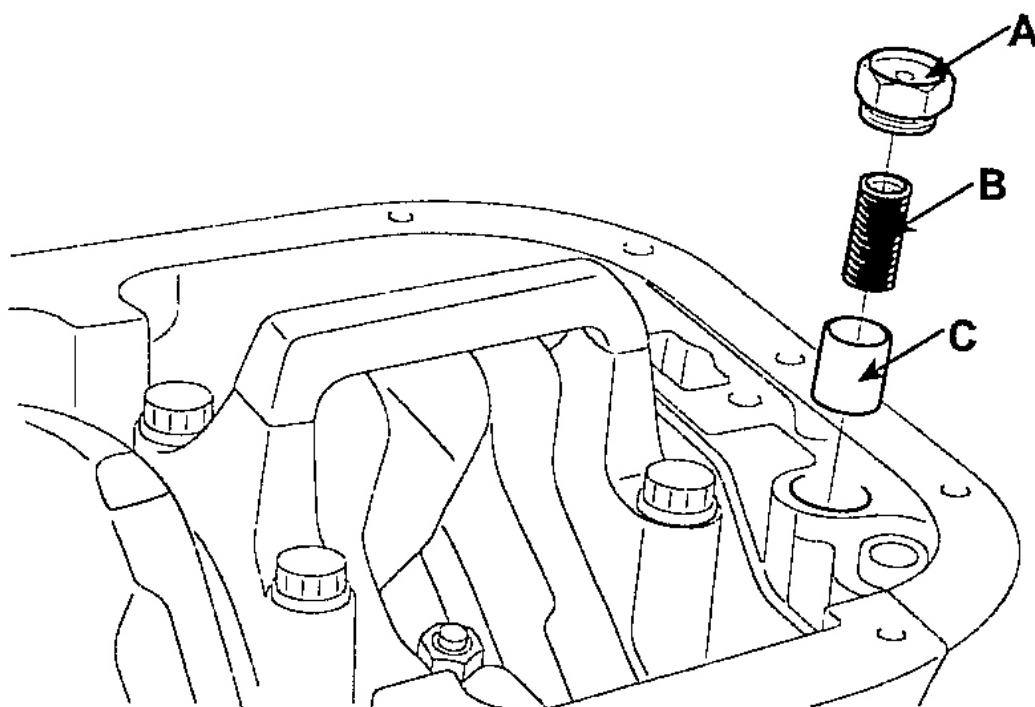
G00719211

**Fig. 274: Removing Inner & Outer Rotor**  
Courtesy of KIA MOTORS AMERICA, INC.

## DISASSEMBLY

### RELIEF PLUNGER

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



G00719212

**Fig. 275: 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.

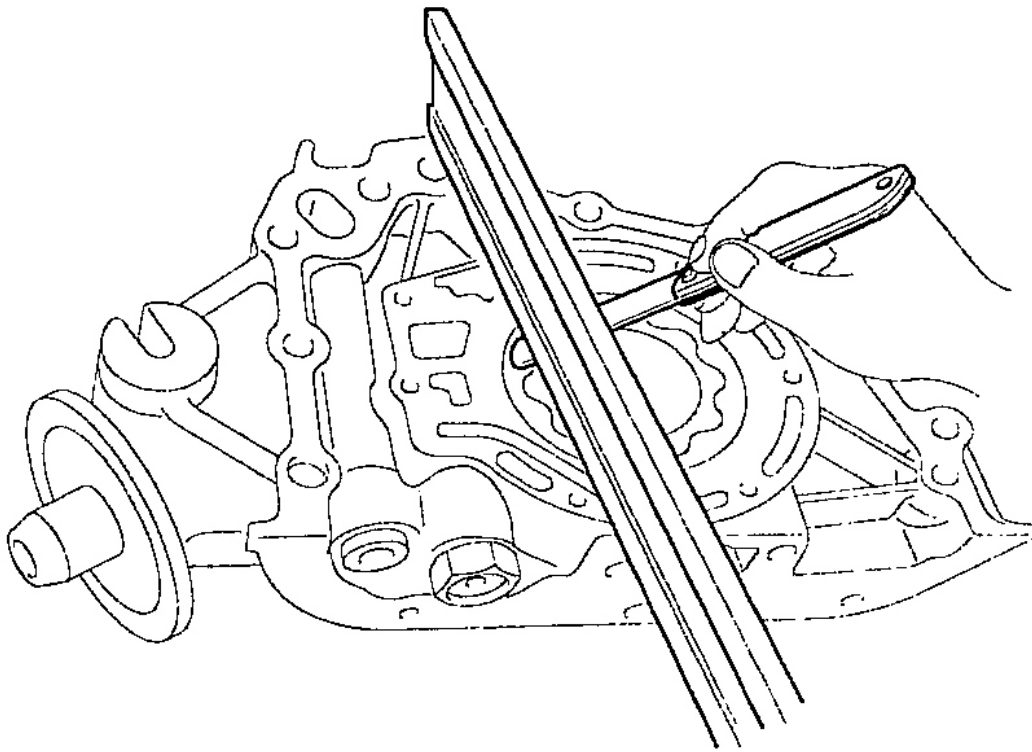
2. Inspect the relief valve spring. Inspect for distorted or broken relief valve spring.

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. 276: Measuring Rotor Side Clearance**  
 Courtesy of KIA MOTORS AMERICA, INC.

|                |             |                                       |
|----------------|-------------|---------------------------------------|
| Side clearance | Outer rotor | 0.04 ~ 0.09mm<br>(0.0016 ~ 0.0035in)  |
|                | Inner rotor | 0.04 ~ 0.085mm<br>(0.0016 ~ 0.0033in) |

G00719213

**Fig. 277: Identifying Rotor Side Clearance Specification Chart**  
 Courtesy of KIA MOTORS AMERICA, INC.

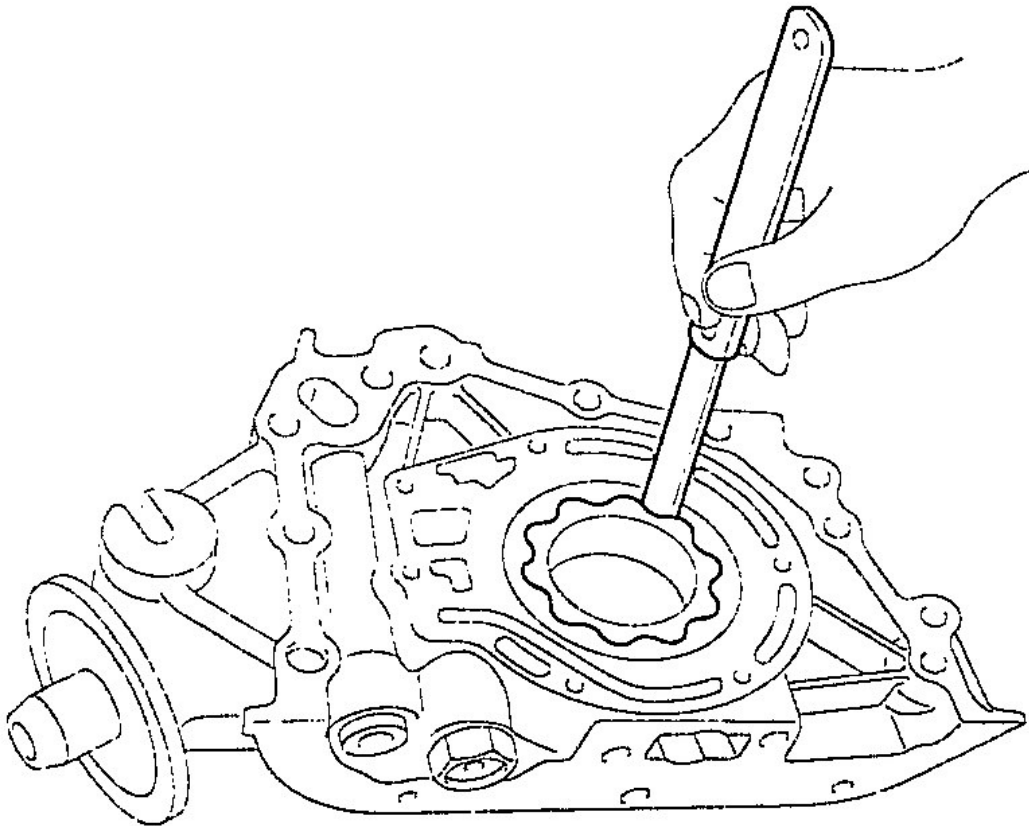
If the side clearance is greater than maximum, replace the rotors as a set. If necessary, replace the front



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)



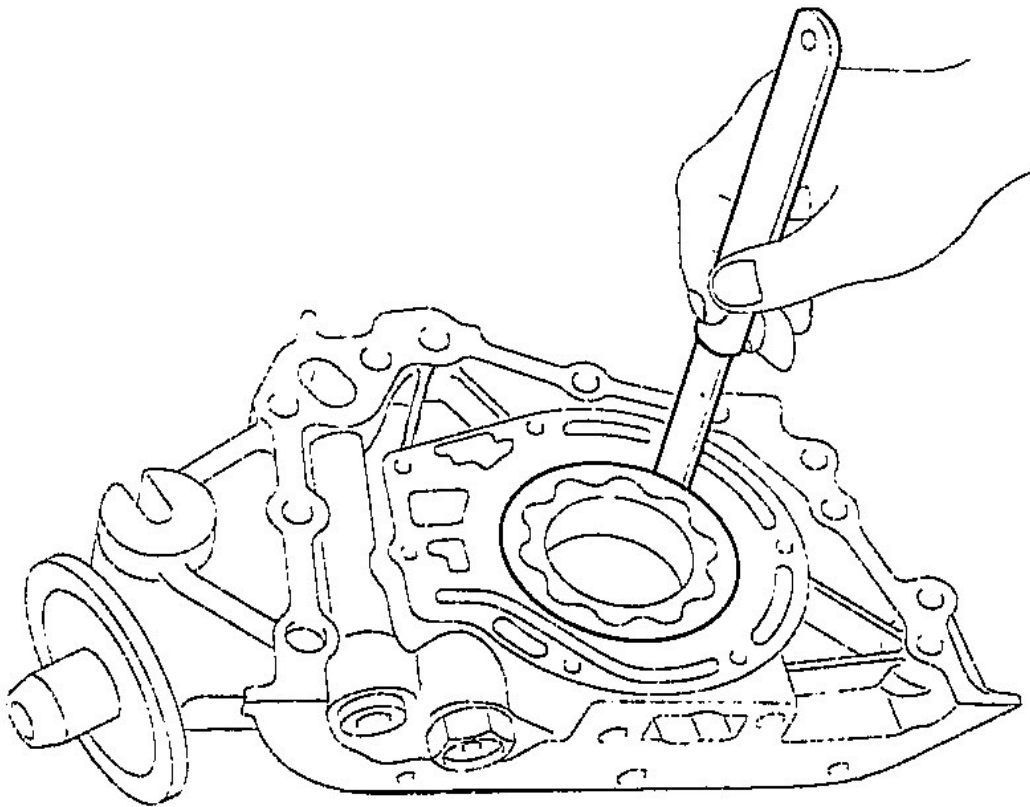
G00719215

**Fig. 278: 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. 279: Measuring Rotor Body Clearance**  
Courtesy of KIA MOTORS AMERICA, INC.

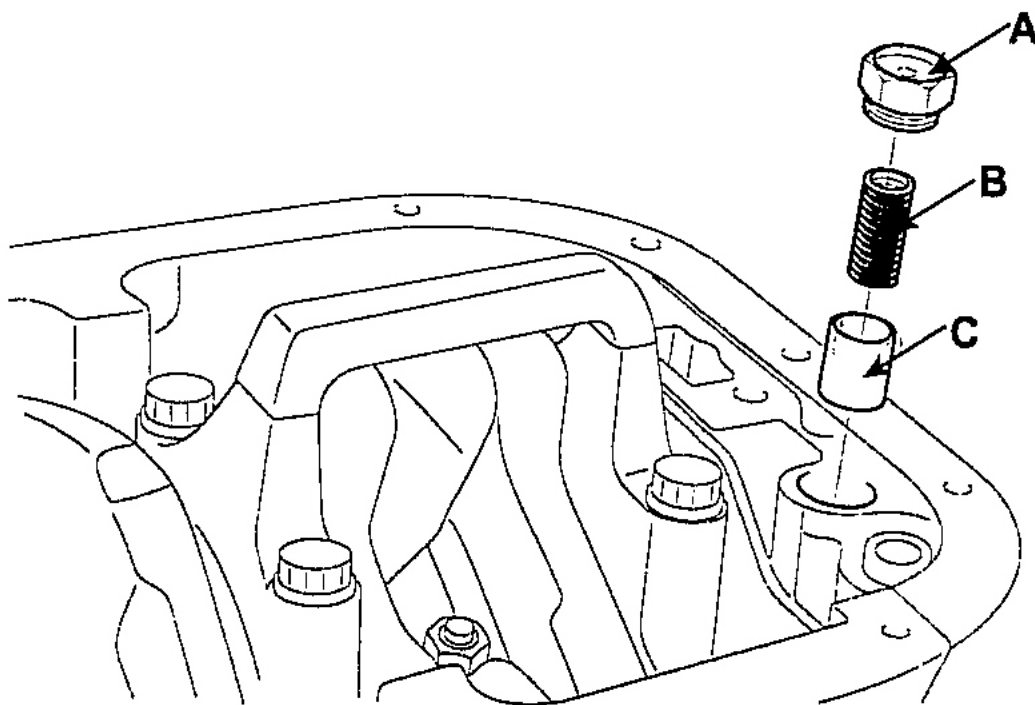
If the body clearance is greater than maximum, replace the rotors as a set. If necessary, replace the front case.

## 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)



G00719217

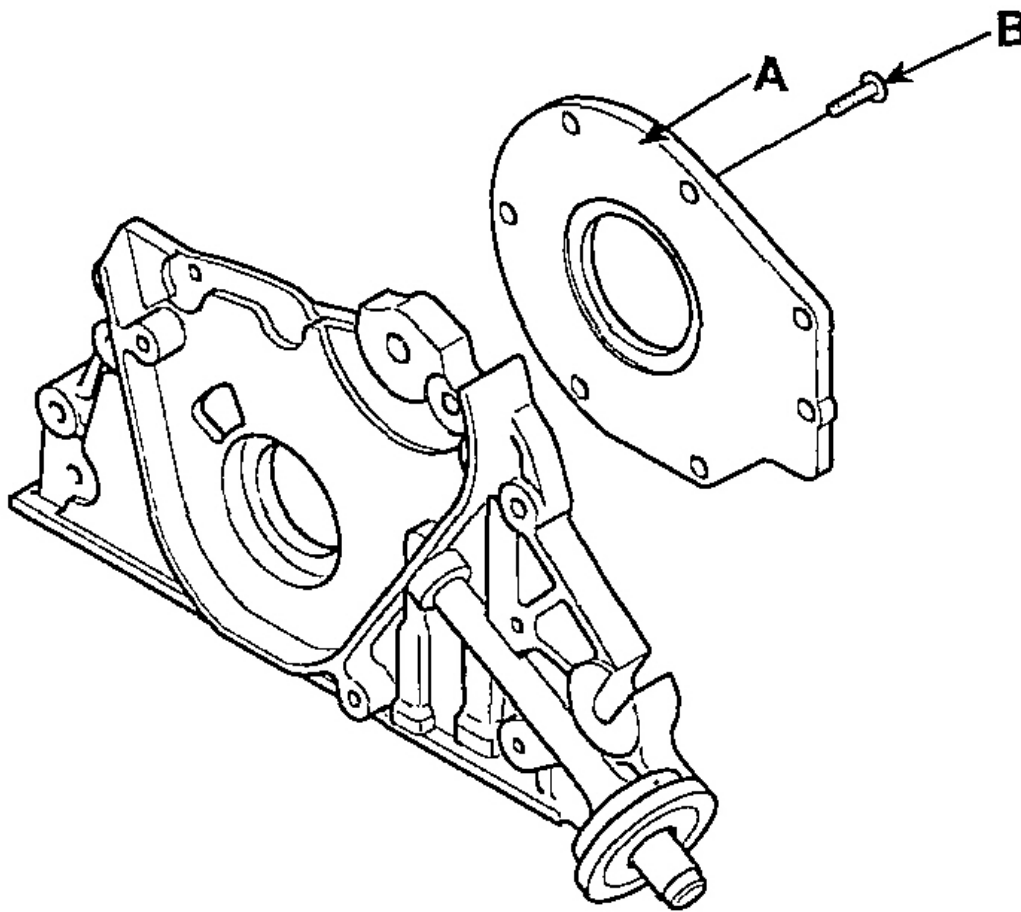
**Fig. 280: Installing Relief Plunger**

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).

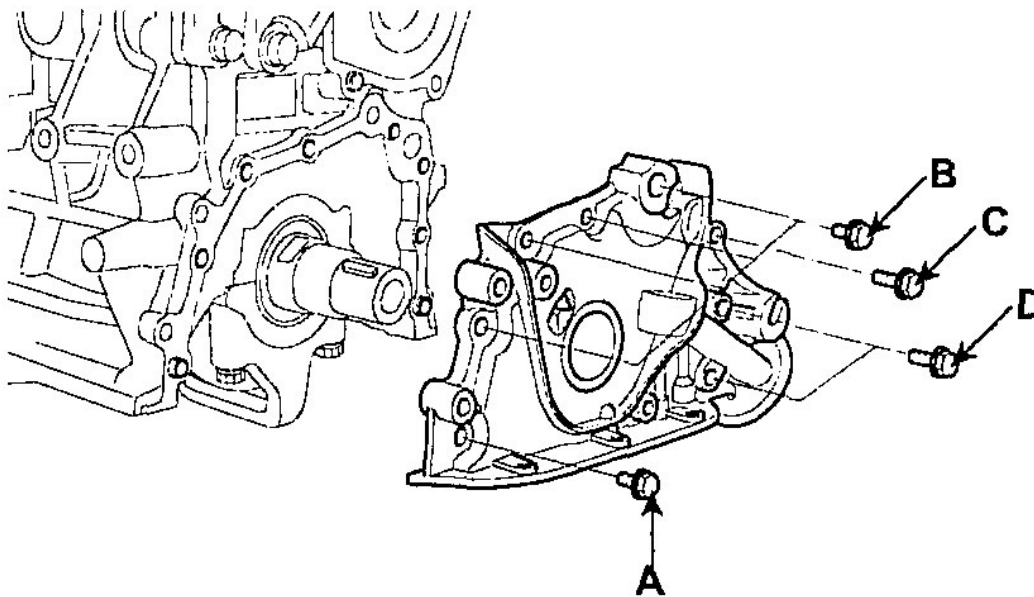
Tightening torque: 5.9-8.8 N.m (0.6-0.9 kg-m, 4.3-6.5 lb-ft)



G00719218

**Fig. 281: 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

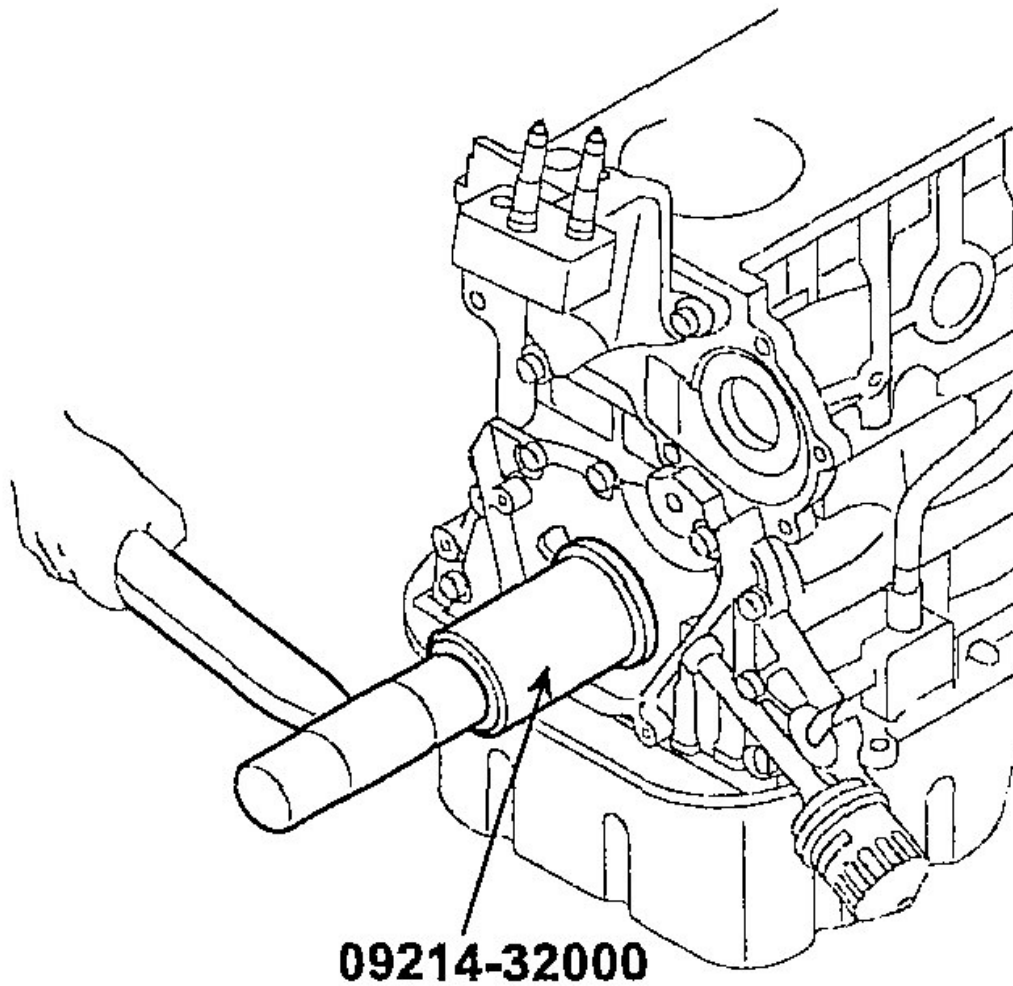
**Fig. 282: Identifying Oil Pump Bolts**  
Courtesy of KIA MOTORS AMERICA, INC.

Bolt length:

(A): 25 mm (0.984 in), (B): 30 mm (1.181 in), (C): 38 mm (1.496 in), (D): 45 mm (1.772 in)

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

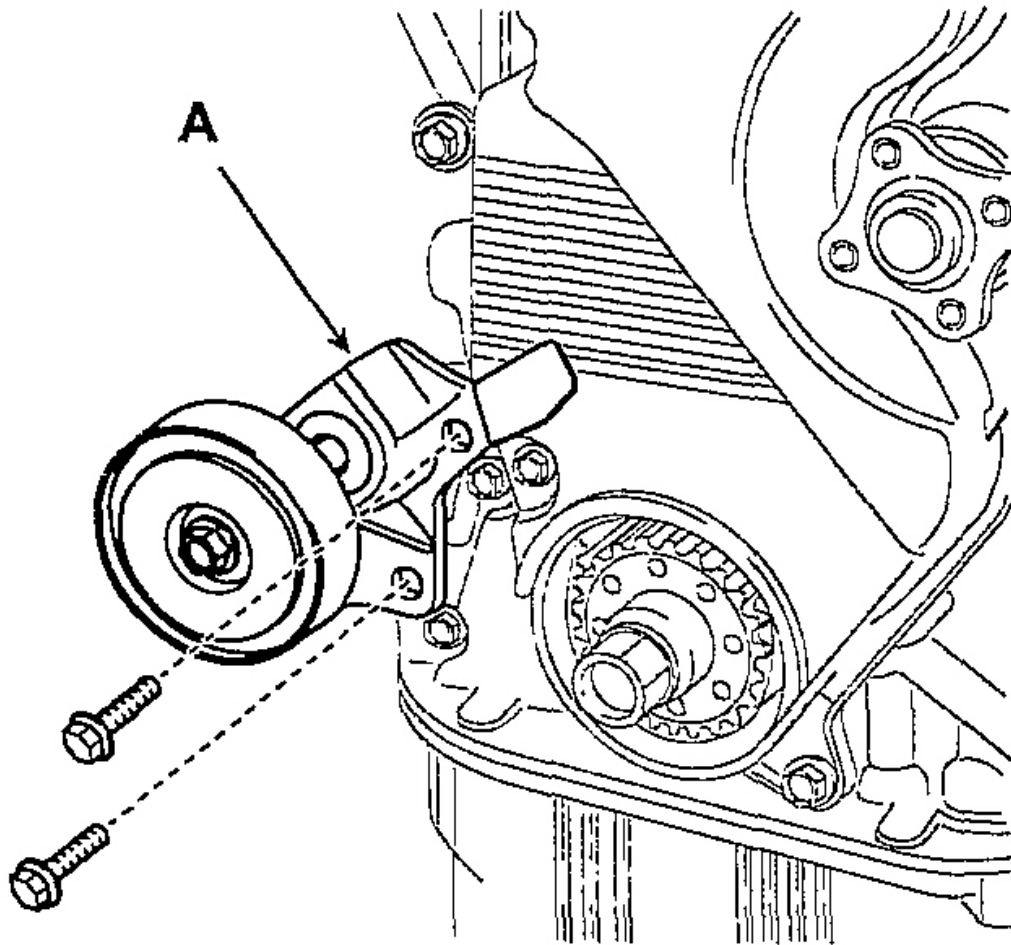
4. Apply a light coat of oil to the front case oil seal lip.
5. Using the Service Tool (09214-32000), install the front case oil seal.



G00719220

**Fig. 283: Installing Front Case Oil Seal**  
Courtesy of KIA MOTORS AMERICA, INC.

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



G00719221

**Fig. 284: 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

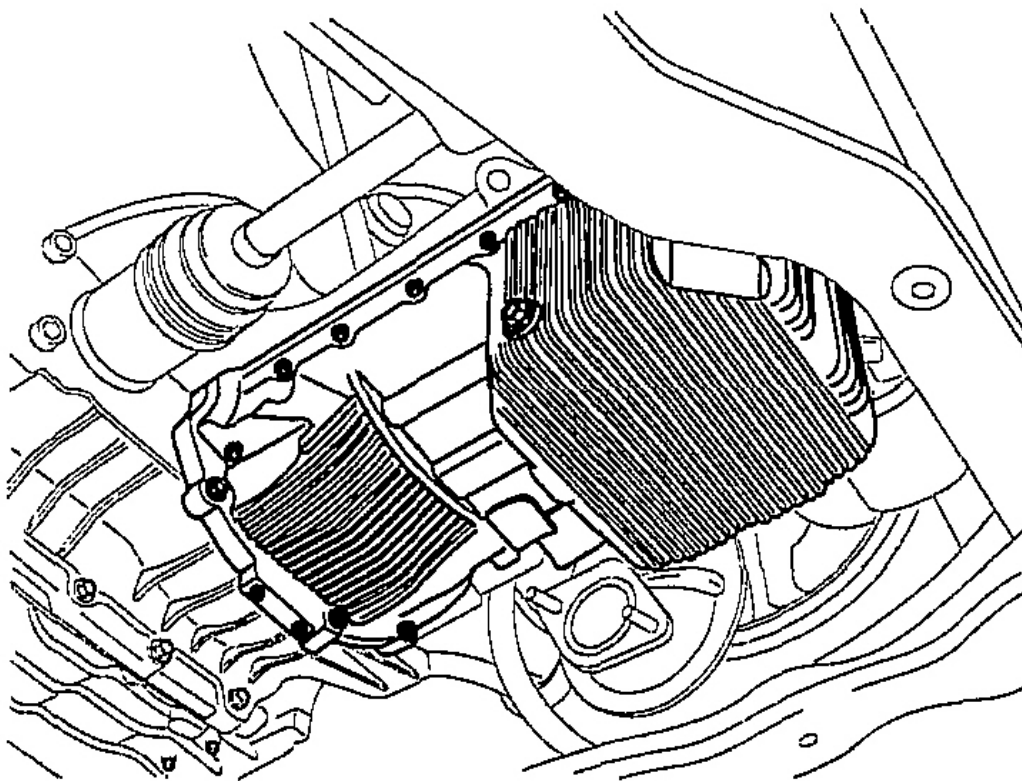
- NOTE:**
- To prevent leakage of oil, apply liquid gasket to the inner threads of the bolt holes.
  - Do not install the parts if five minutes or more have elapsed since applying the liquid gasket.
  - Instead, reapply liquid gasket after removing the residue.
  - After assembly, wait at least 30 minutes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

- c. Install the oil pan 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)

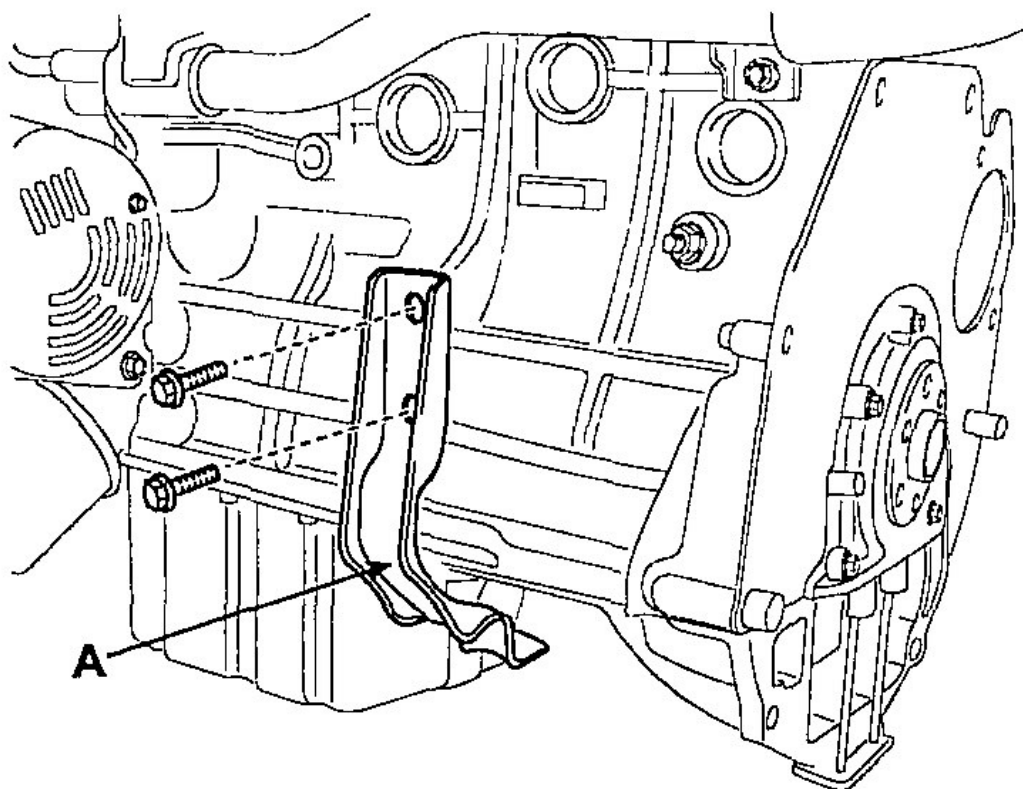




G00719222

**Fig. 285: Installing Oil Pan**  
Courtesy of KIA MOTORS AMERICA, INC.

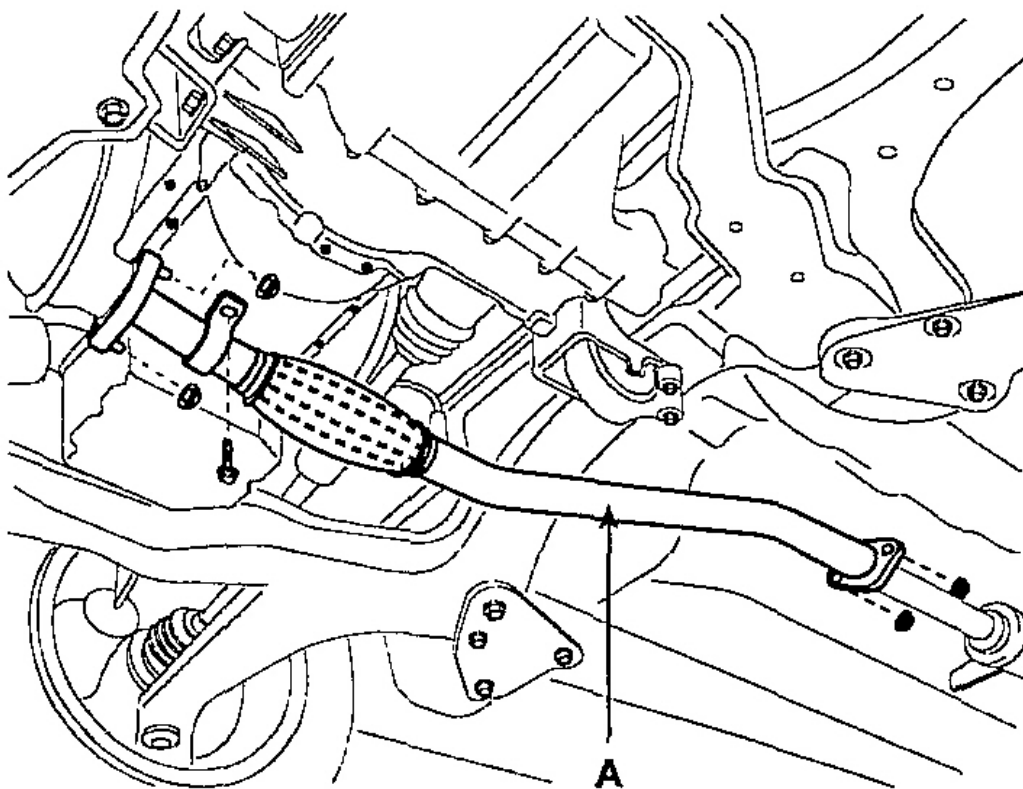
2. Install the front muffler bracket (A).



G00719223

**Fig. 286: Installing Front Muffler Bracket**  
Courtesy of KIA MOTORS AMERICA, INC.

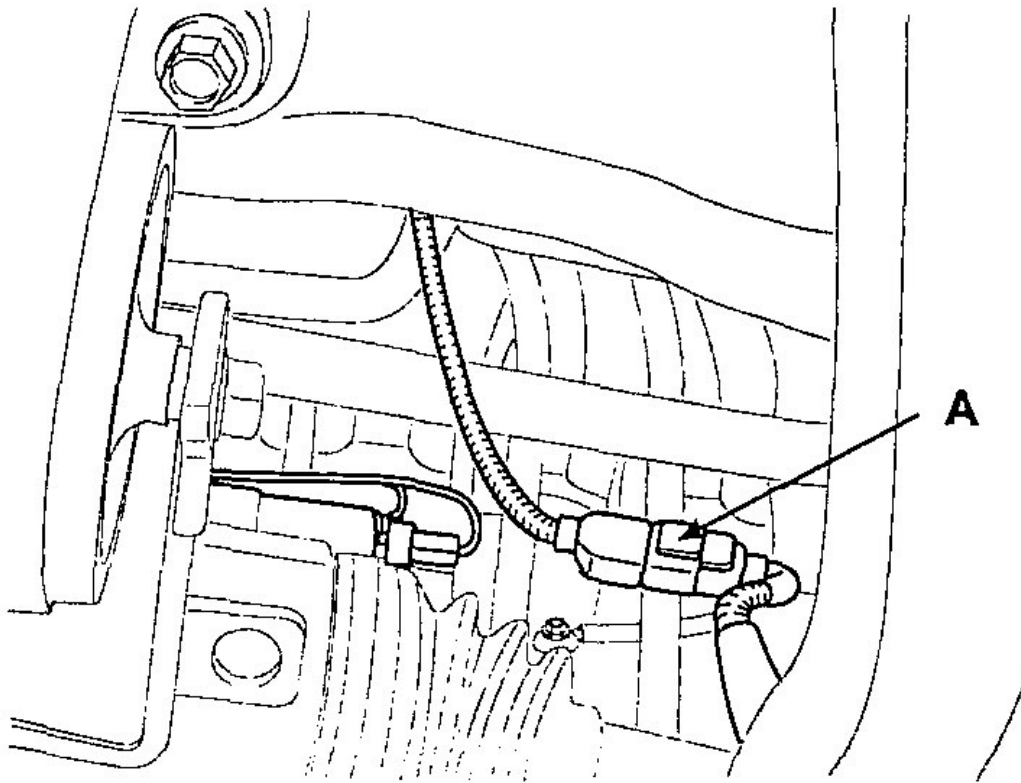
3. Install the exhaust manifold.
4. Install the front muffler (A).



G00719224

**Fig. 287: Installing Front Muffler**  
Courtesy of KIA MOTORS AMERICA, INC.

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



G00719225

**Fig. 288: Connecting Rear Oxygen Sensor Connector**  
Courtesy of KIA MOTORS AMERICA, INC.

6. Fill with engine oil

## SERVICE & INSPECTION

### 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)

- 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)

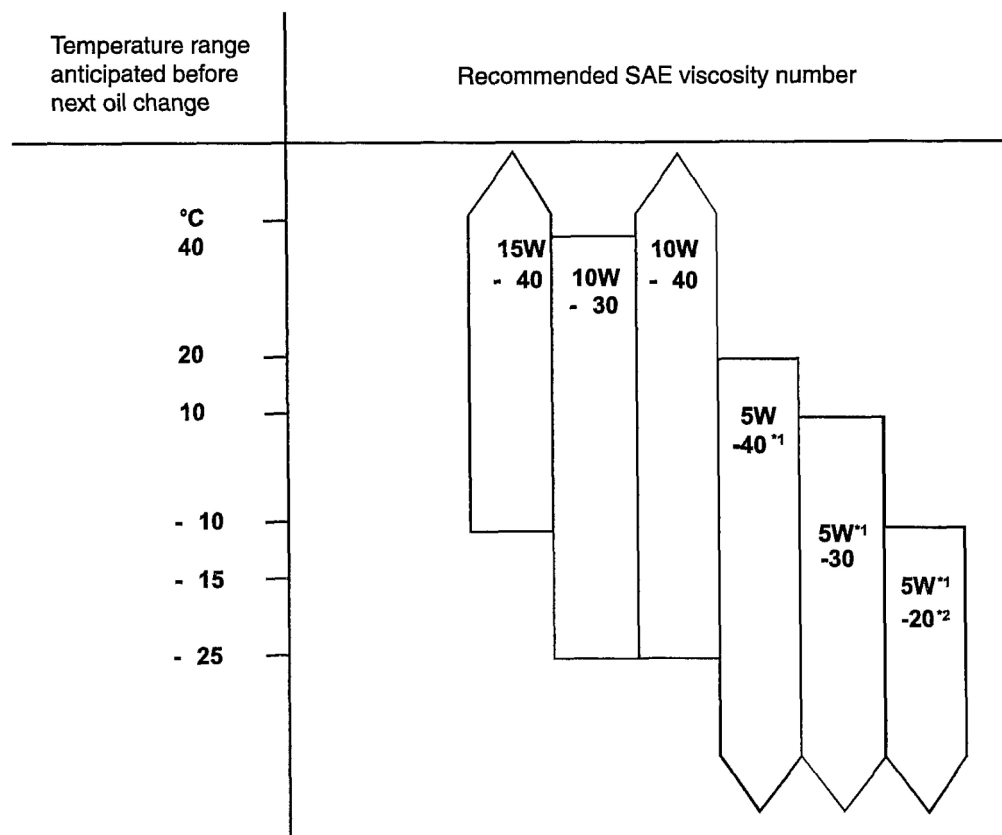
- c. Install the oil filler cap.
4. Start engine and check for oil leaks.
  5. Recheck the engine oil level.

#### **SELECTION OF ENGINE OIL**

Recommended ILSAC classification: GF1 OR ABOVE

Recommended API classification: SH OR ABOVE

Recommended SAE viscosity grades:



\*1 Restricted by driving condition and environment.

\*2 Not recommended for sustained high speed vehicle operation.

G00719202

**Fig. 289: Identifying Recommended Engine Oil**  
Courtesy of KIA MOTORS AMERICA, INC.

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

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

#### INSPECTION

1. Check the engine oil quality. Check for oil deterioration, entry of water, discoloring or thinning. If the quality is visibly poor, replace the oil.
2. Check the engine oil level.

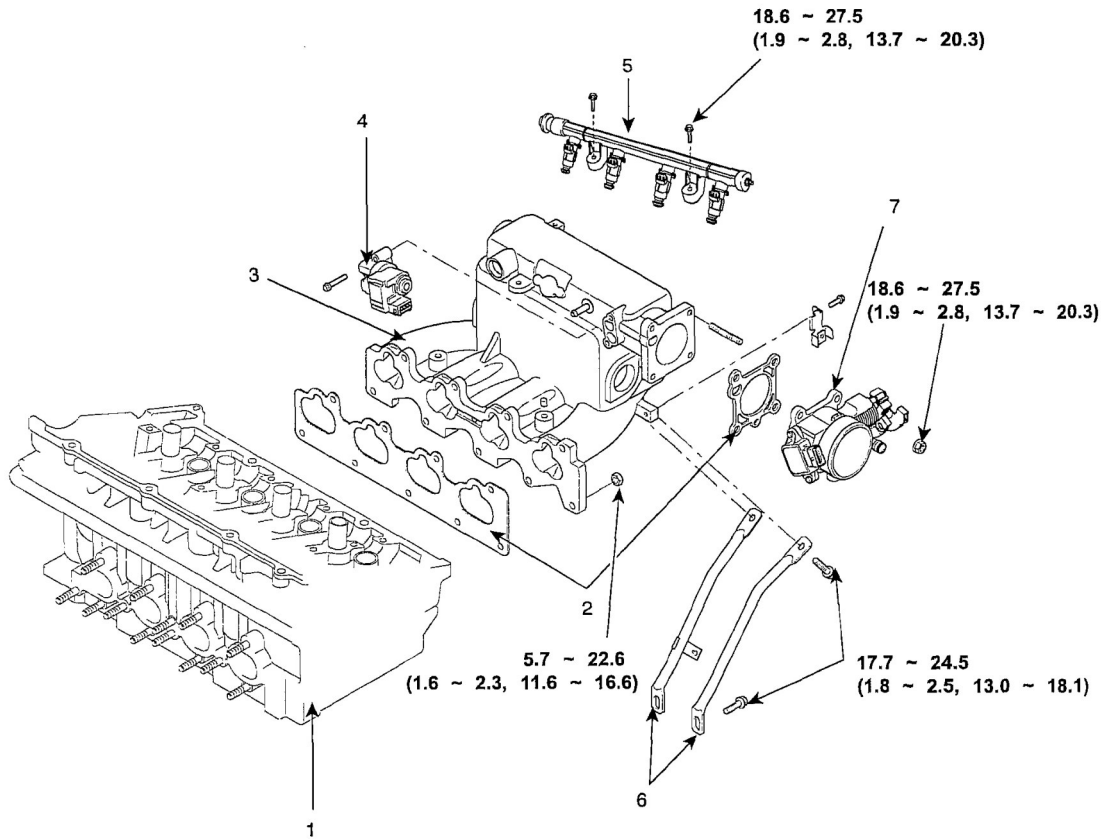
After warming up the engine for five minutes, stop the engine and check the oil level. The level should be between the "L" and "F" marks on the dipstick. If low, check for oil leakage and add oil up to the "F" mark on the dipstick

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

## **INTAKE AND EXHAUST SYSTEM**

### **INTAKE MANIFOLD**

#### **COMPONENT**



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

- |                                |                           |
|--------------------------------|---------------------------|
| 1. Cylinder head               | 5. Delivery pipe assembly |
| 2. Gasket                      | 6. Intake manifold stay   |
| 3. Intake manifold             | 7. Throttle body          |
| 4. I.S.A (Idle Speed Actuator) |                           |

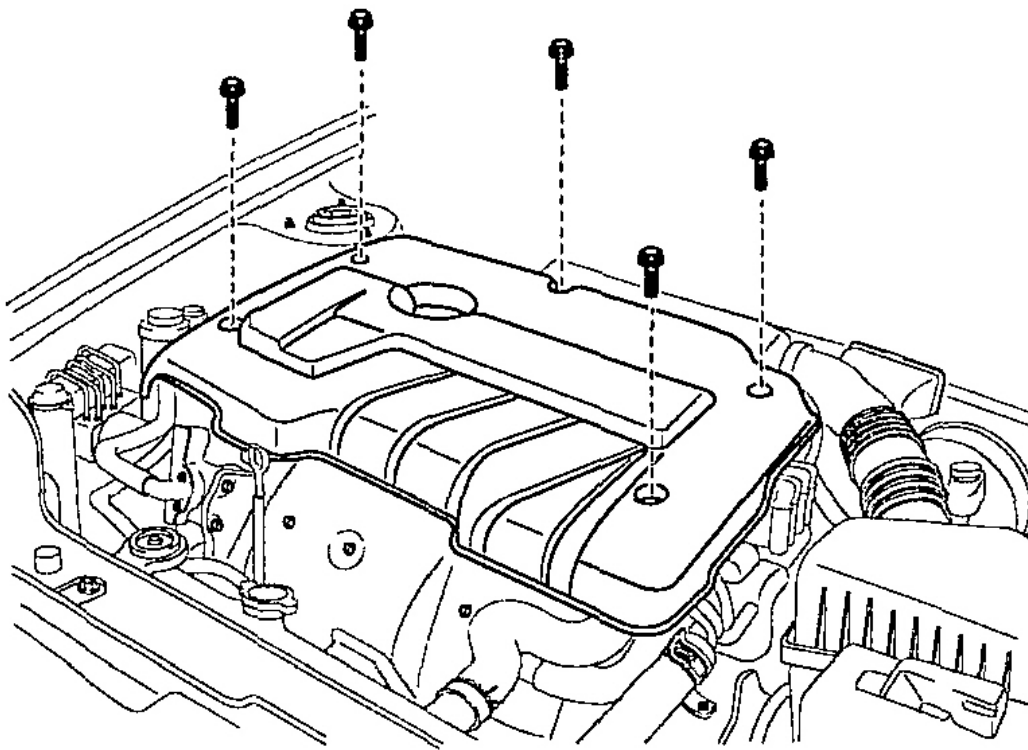
G00719226

**Fig. 290: Identifying Intake Manifold Components With Torque Specifications**  
 Courtesy of KIA MOTORS AMERICA, INC.

**REMOVAL**

1. Remove the engine cover.

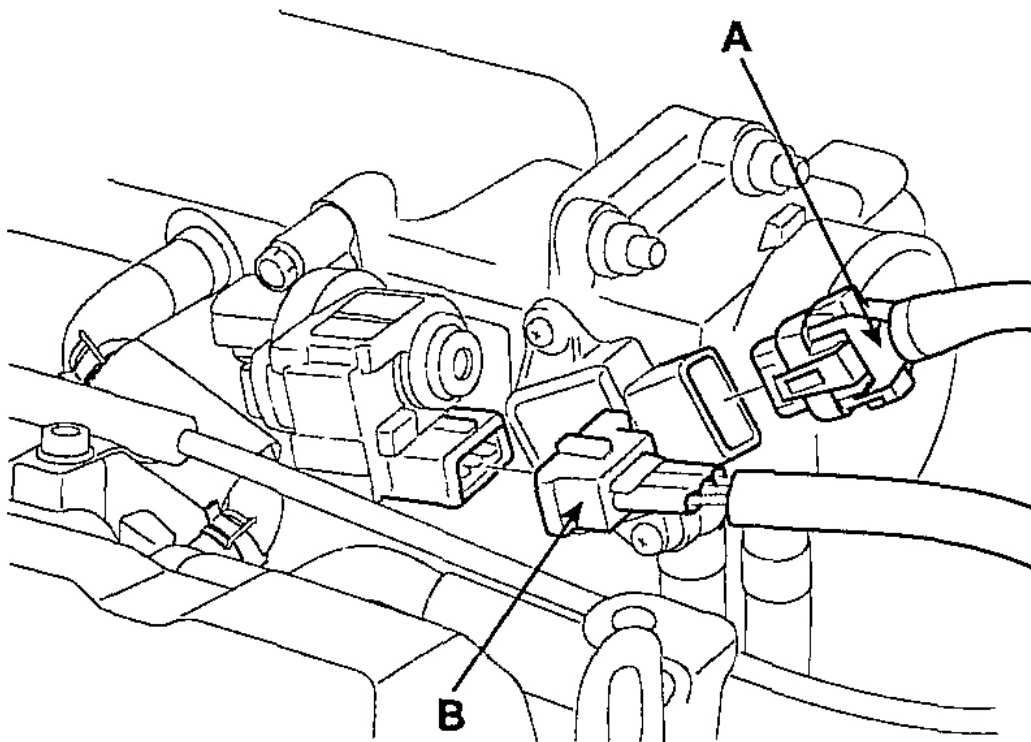




G00719227

**Fig. 291: Removing Engine Cover**  
Courtesy of KIA MOTORS AMERICA, INC.

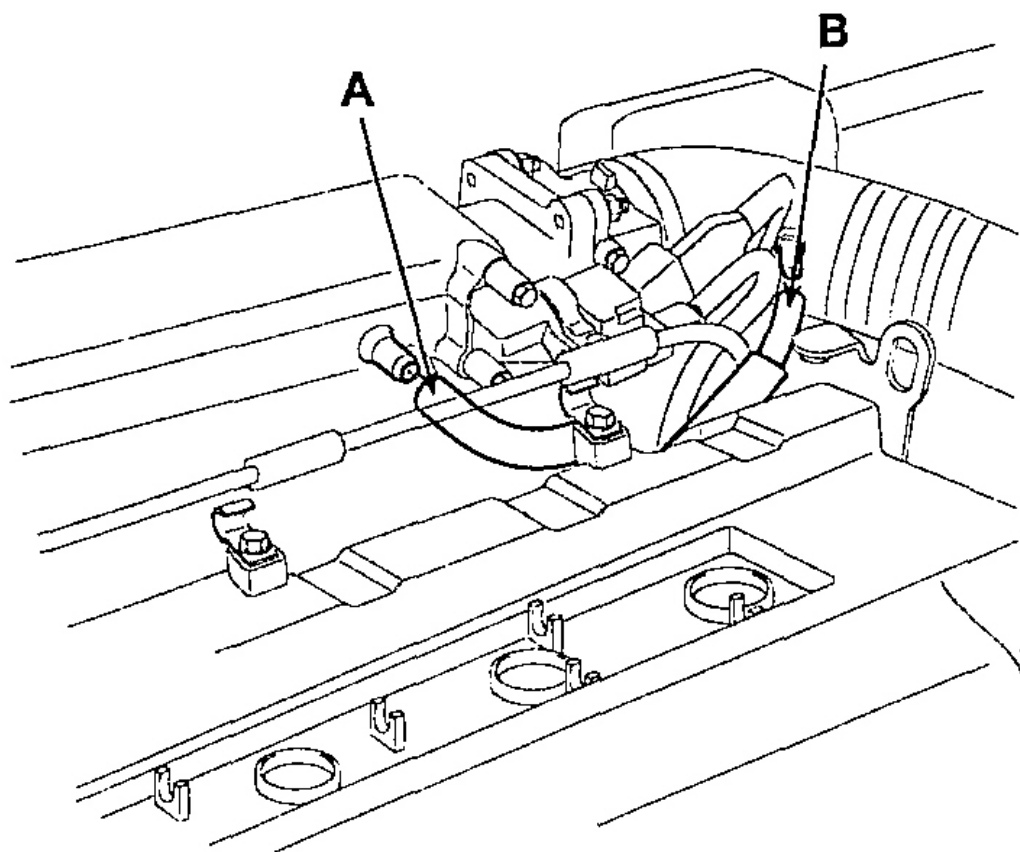
2. Disconnect the TPS (Throttle Position Sensor) connector (A) and ISA (Idle Speed Actuator) connector (B).



G00719228

**Fig. 292: Disconnect TPS & ISA Connector**  
Courtesy of KIA MOTORS AMERICA, INC.

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

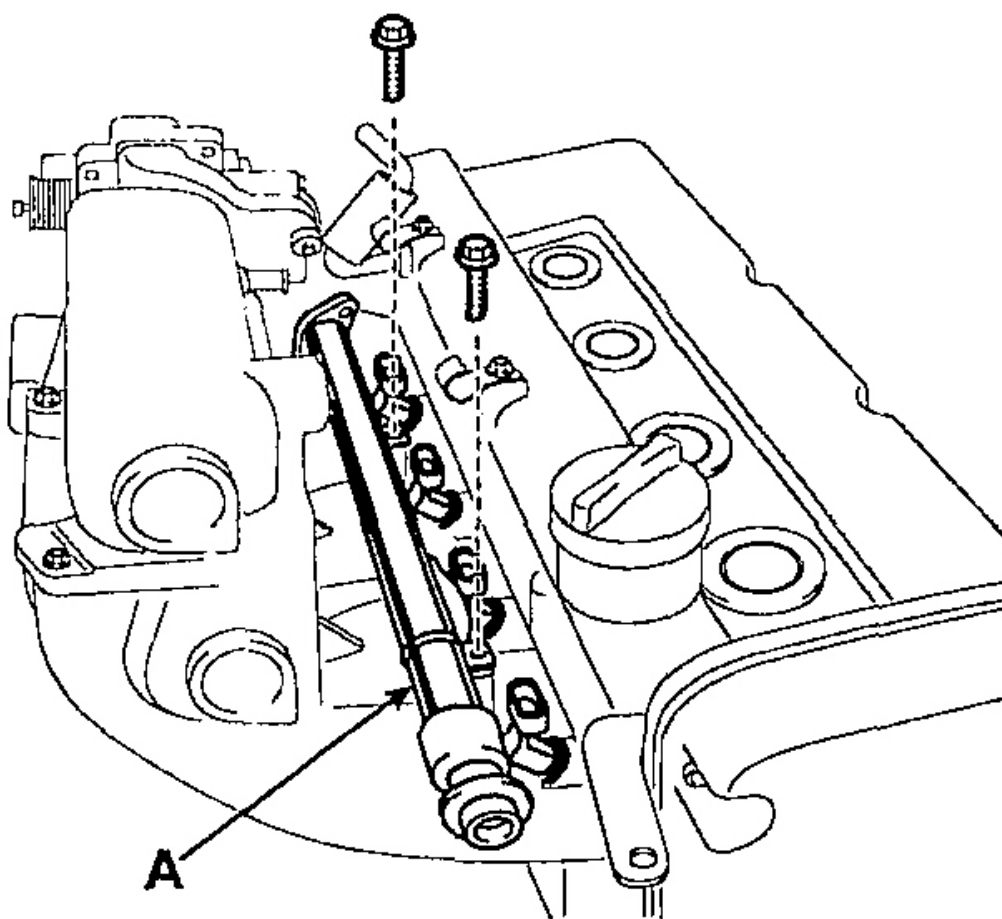


G00719229

**Fig. 293: Disconnect PCV Hose & Breather Hose**  
Courtesy of KIA MOTORS AMERICA, INC.

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

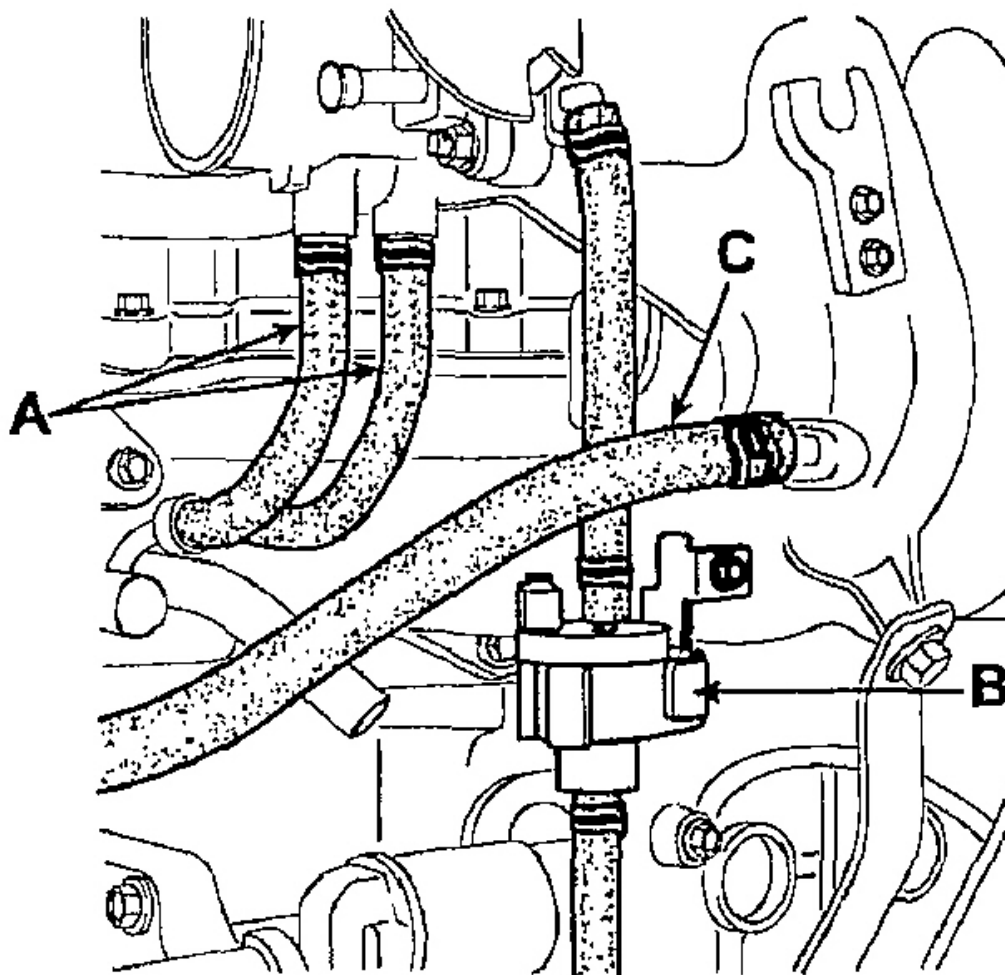
Tightening torque: 18.6-27.5 N.m (1.9-2.8 kg-m, 13.7-20.3 lb-ft)



G00719230

**Fig. 294: 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.

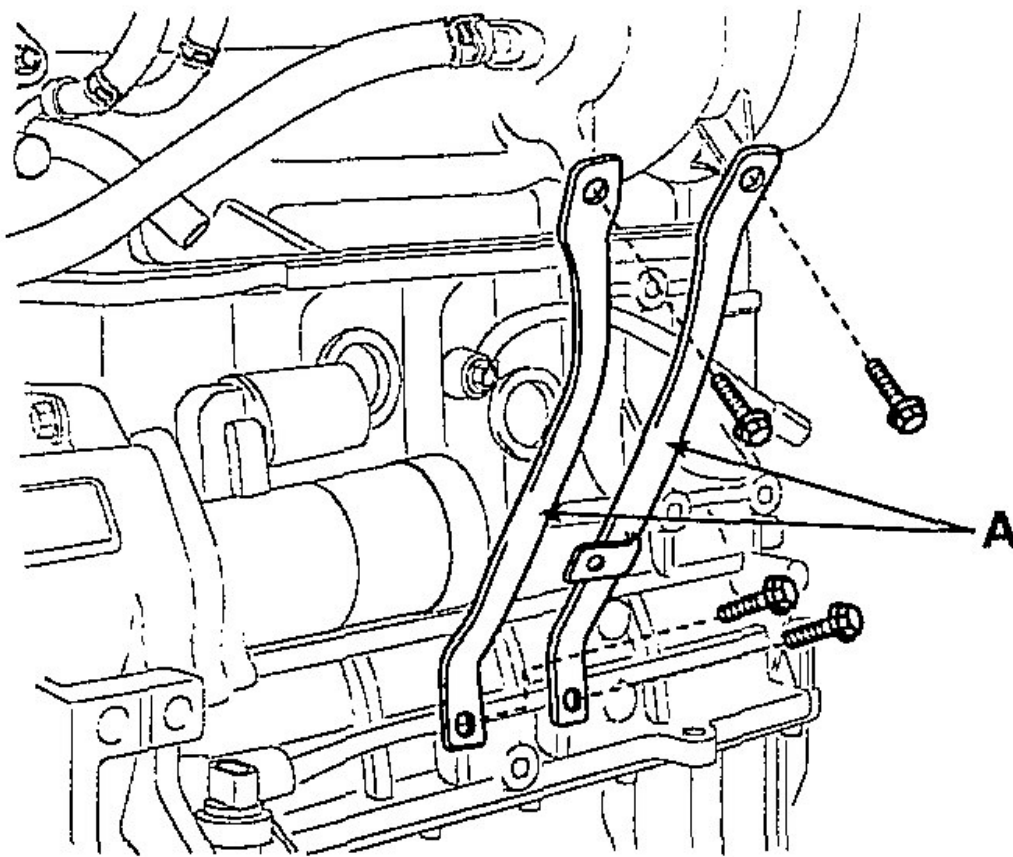


G00719231

**Fig. 295: 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)

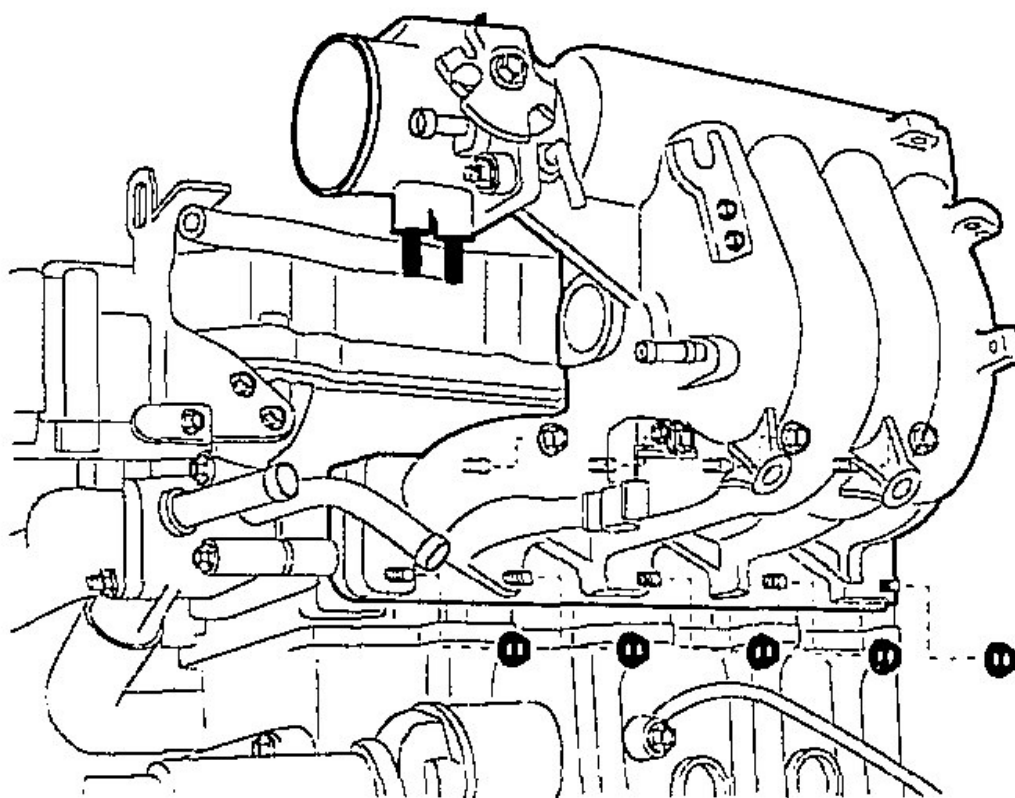


G00719232

**Fig. 296: 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)



G00719233

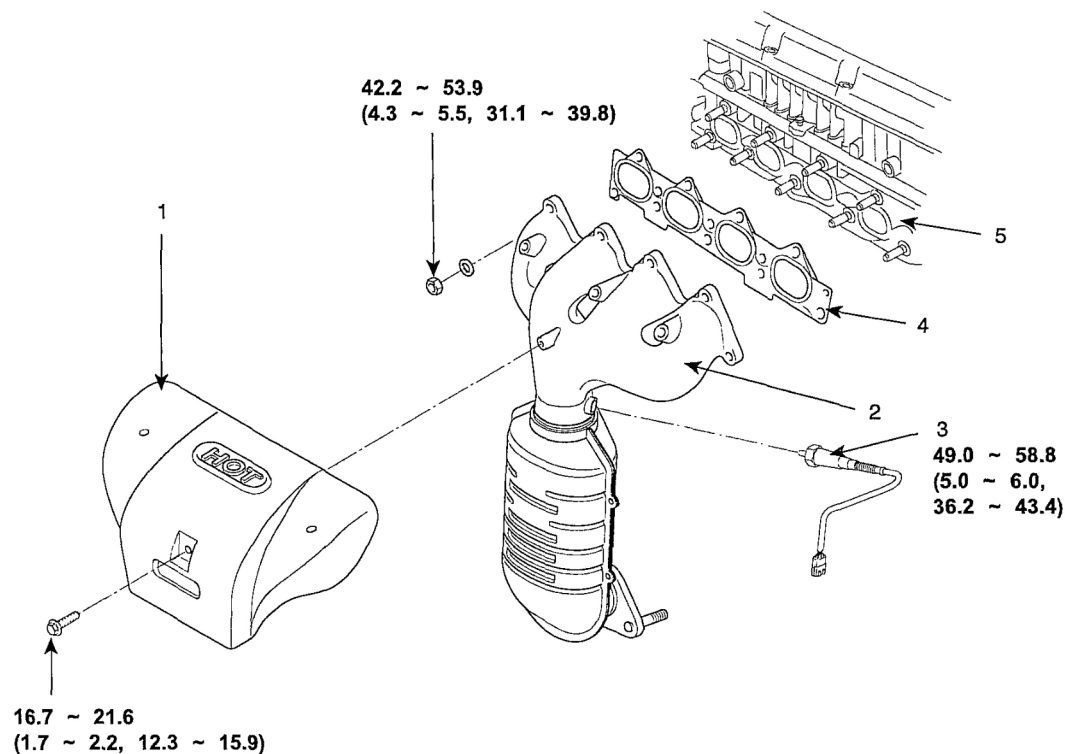
**Fig. 297: Removing Intake Manifold**  
Courtesy of KIA MOTORS AMERICA, INC.

#### INSTALLATION

Installation is in the reverse order of removal with new gasket.

#### 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

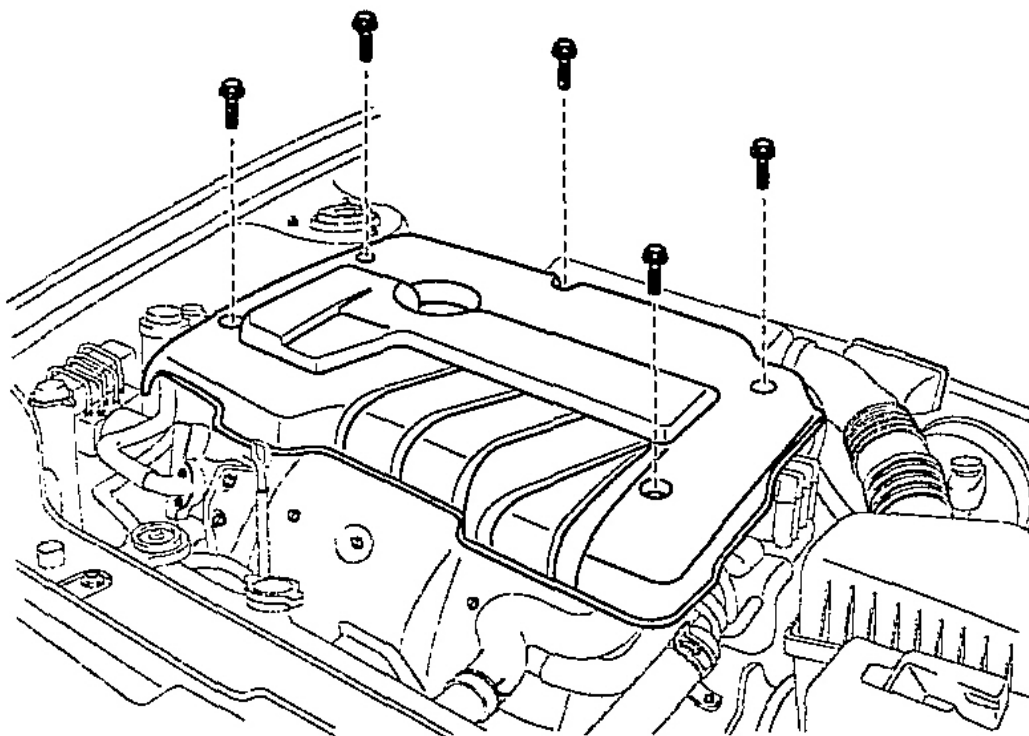
G00719234

**Fig. 298: Identifying Exhaust Manifold Components With Torque Specifications**  
Courtesy of KIA MOTORS AMERICA, INC.

**REMOVAL**

1. Remove the engine cover.





G00719235

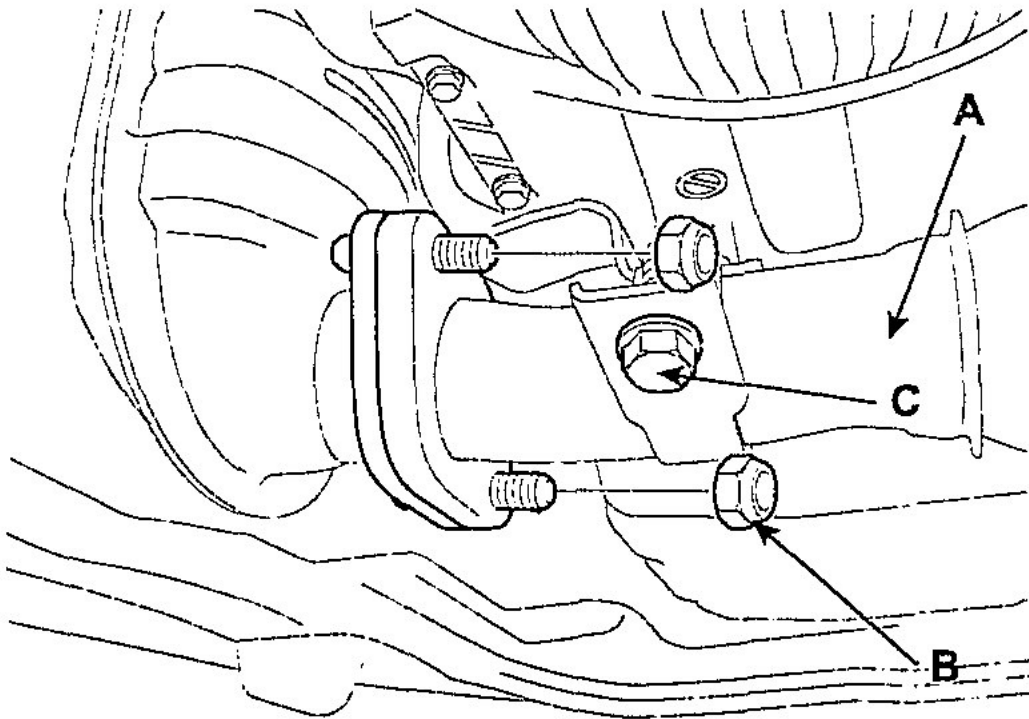
**Fig. 299: Removing Engine Cover**  
Courtesy of KIA MOTORS AMERICA, INC.

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

Tightening torque:

Nut (B): 39.2-58.8 N.m (4.0-6.0 kg-m, 28.9-43.4 lb-ft)

Bolt (C): 29.4-39.2 N.m (3.0-4.0 kg-m, 21.7-28.9 lb-ft)

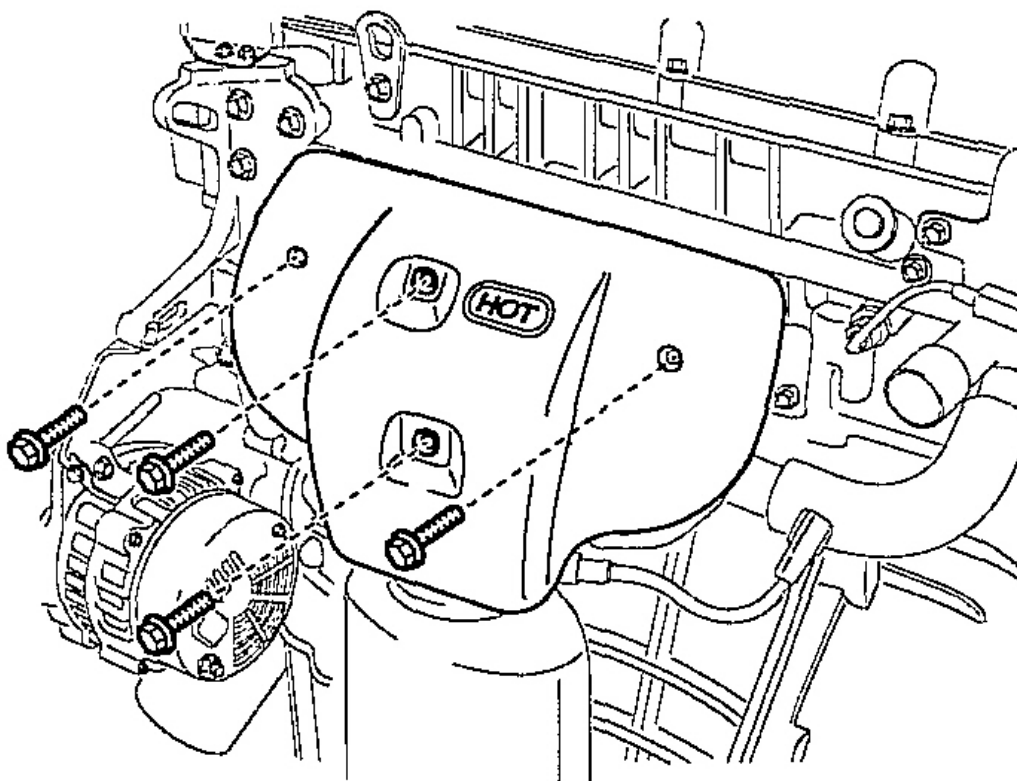


G00719236

**Fig. 300: Removing Front Muffler**  
Courtesy of KIA MOTORS AMERICA, INC.

4. Remove the heat protector.

Tightening torque: 16.7-21.6 N.m (1.7-2.2 kg-m, 12.3-15.9 lb-ft)

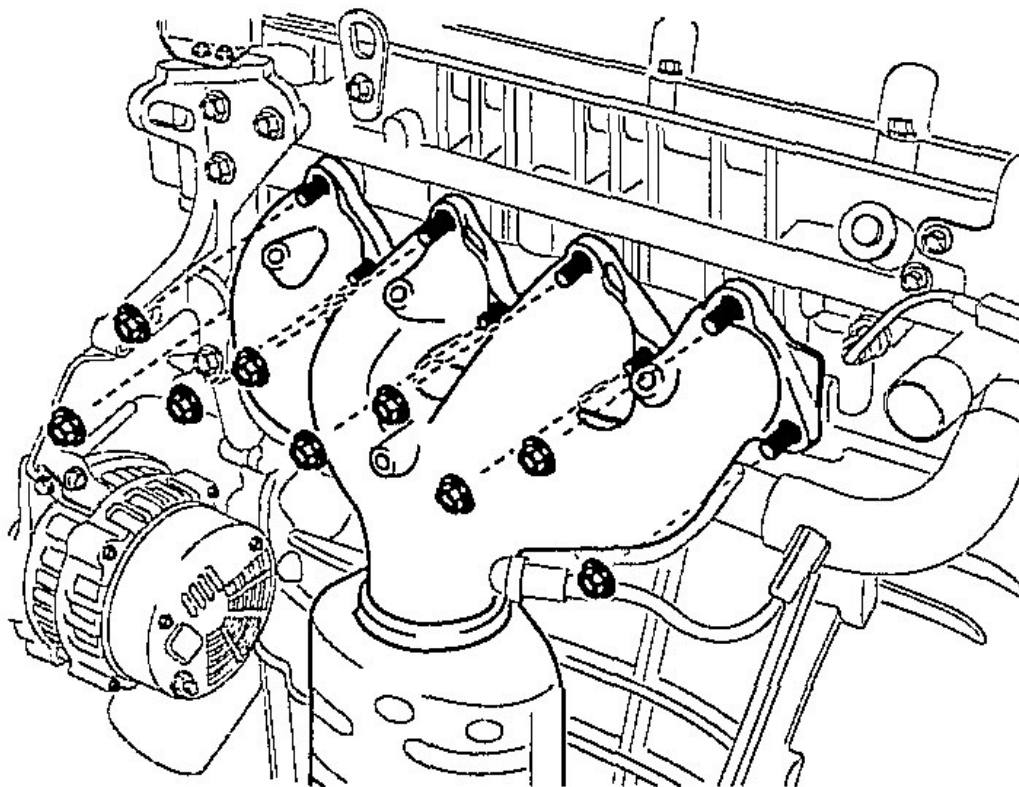


G00719237

**Fig. 301: Removing Heat Protector**  
Courtesy of KIA MOTORS AMERICA, INC.

5. Remove the exhaust manifold and catalytic converter assembly.

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



G00719238

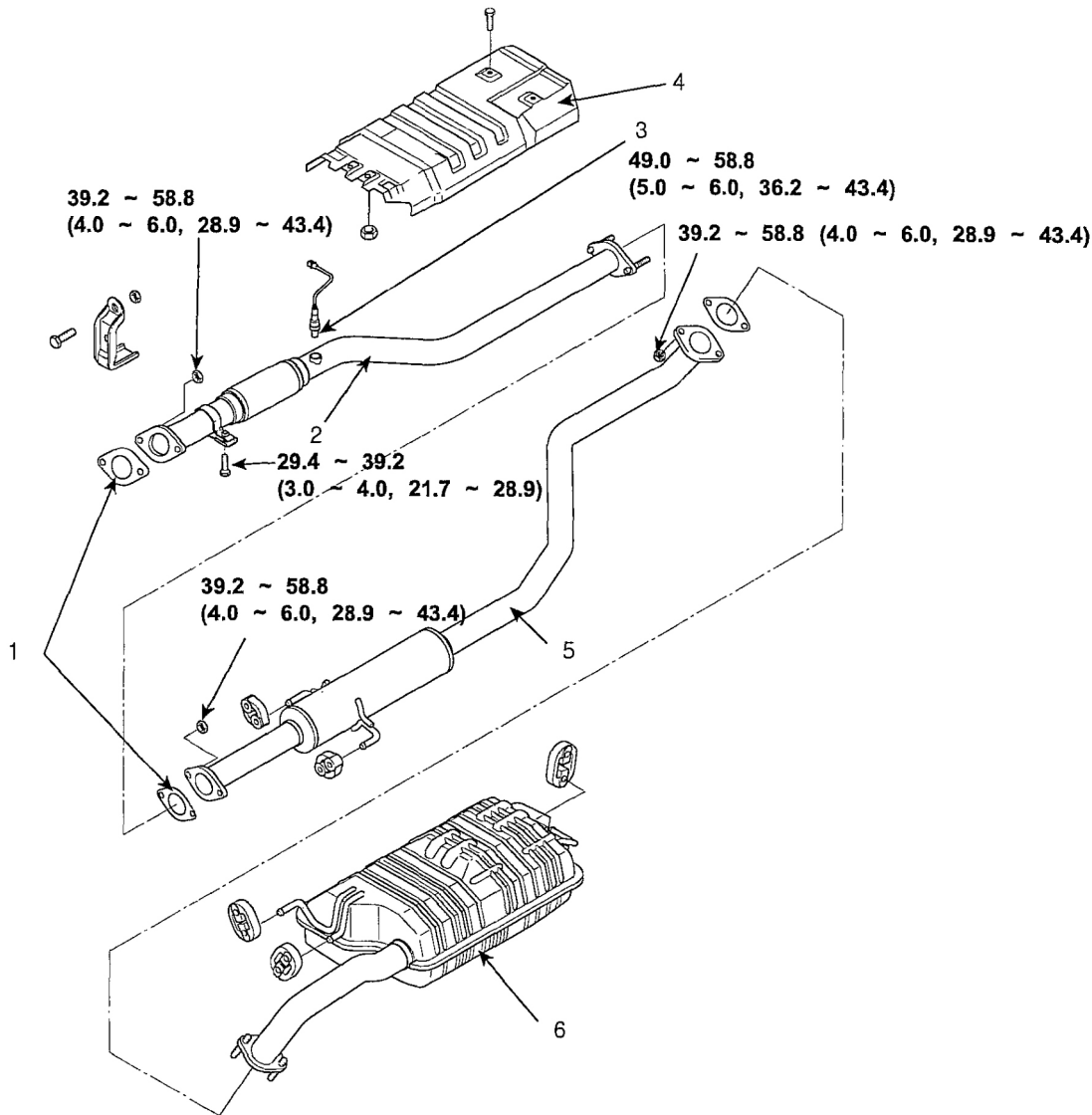
**Fig. 302: Removing Exhaust Manifold & Catalytic Converter Assembly**  
Courtesy of KIA MOTORS AMERICA, INC.

#### INSTALLATION

Installation is in the reverse order of removal

#### EXHAUST PIPE

#### COMPONENT



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

- 1. Gasket
- 2. Front muffler
- 3. Rear oxygen sensor

- 4. Heat protector
- 5. Center muffler
- 6. Main muffler

G00719239

**Fig. 303: Identifying Exhaust Pipe Components With Torque Specifications**  
Courtesy of KIA MOTORS AMERICA, INC.

## TORQUE SPECIFICATIONS

### TORQUE SPECIFICATIONS

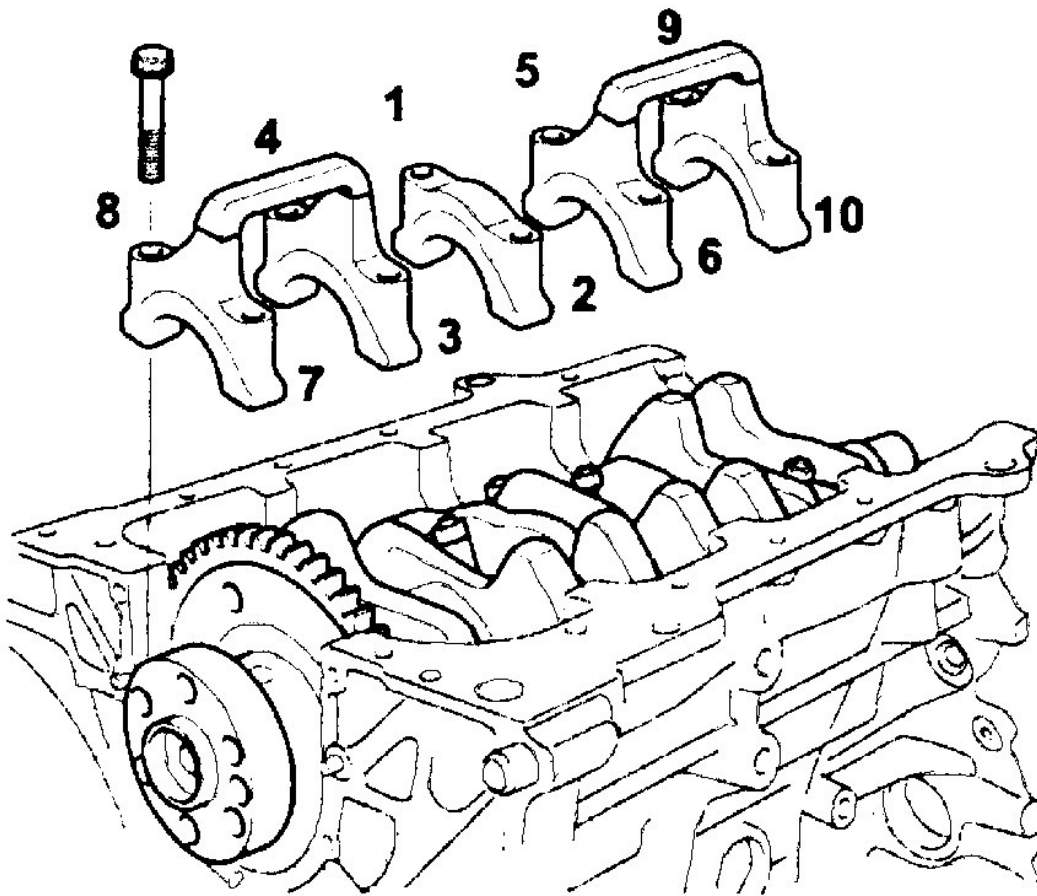
**2008 Kia Spectra EX**

2008 ENGINES Engine Mechanical - Spectra &amp; Spectra5

| <b>Application</b>                                                                 | <b>Ft. Lbs. (N.m)</b> |
|------------------------------------------------------------------------------------|-----------------------|
| 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 <sup>(1)</sup>                                    | 20-23 (27-31)         |
| Crankshaft Pulley Bolt                                                             | 123-130 (167-177)     |
| Crankshaft Sprocket Bolt                                                           | 72-87 (98-118)        |
| Cylinder Head Bolts <sup>(2)</sup>                                                 |                       |
| 10 x 99                                                                            | 17-20 (23-27)         |
| 12 x 15                                                                            | 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)         |

**2008 Kia Spectra EX****2008 ENGINES Engine Mechanical - Spectra & Spectra5**

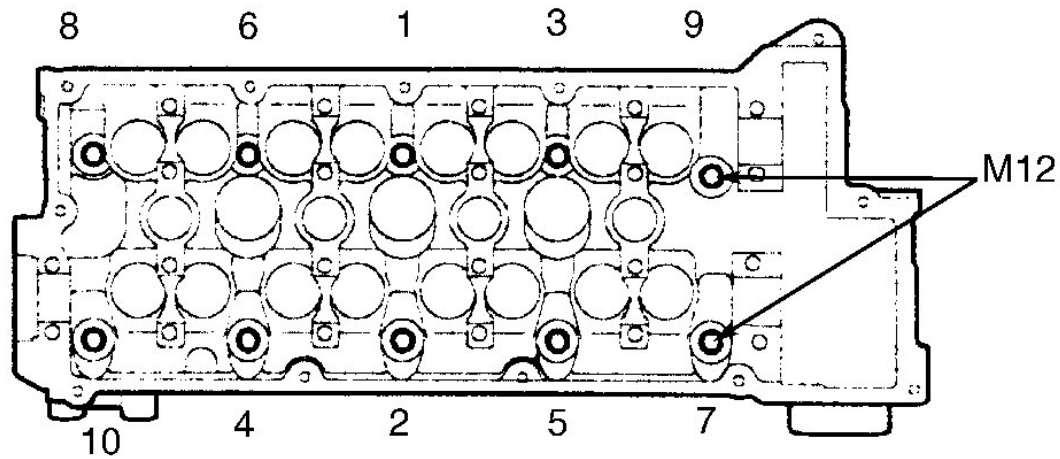
|                                                                      |                |
|----------------------------------------------------------------------|----------------|
| Timing Belt Tensioner & Idler Bolt                                   | 31-40 (42-54)  |
| Transaxle Mounting Bracket & 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)   |
| Water Pump Bolts                                                     | 9-11 (12-15)   |
| <b>INCH Lbs. (N.m)</b>                                               |                |
| 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 <b>Fig. 304</b> .    |                |
| (2) Tighten in several passes, in sequence. See <b>Fig. 305</b> .    |                |



G00351837

**Fig. 304: Main Bearing Cap Bolt Tightening Sequence**  
 Courtesy of KIA MOTORS AMERICA, INC.





G00351838

**Fig. 305: Cylinder Head Bolt Tightening Sequence**  
Courtesy of KIA MOTORS AMERICA, INC.