

**2008 Kia Magentis LX**

2008 ENGINE Mechanical (G4KC-GSL 2.4L) - Optima &amp; Magentis (Canadian)

**2008 ENGINE****Mechanical (G4KC-GSL 2.4L) - Optima & Magentis (Canadian)****GENERAL****SPECIFICATIONS****GENERAL SPECIFICATION**

| Description                              |                   | Specifications                                                                         | Limit                |
|------------------------------------------|-------------------|----------------------------------------------------------------------------------------|----------------------|
| <b>General</b>                           |                   |                                                                                        |                      |
| Type                                     |                   | In-line, Double Overhead Camshaft                                                      |                      |
| Number of cylinders                      |                   | 4                                                                                      |                      |
| Bore                                     |                   | 88 mm (3.464 in.)                                                                      |                      |
| Stroke                                   |                   | 97 mm (3.819 in.)                                                                      |                      |
| Total displacement                       |                   | 2359cc (143.90 cu. in.)                                                                |                      |
| Compression ratio                        |                   | 10.5: 1                                                                                |                      |
| Firing order                             |                   | 1-3-4-2                                                                                |                      |
| <b>Valve timing</b>                      |                   |                                                                                        |                      |
| Intake valve                             | Opens (ATDC/BBDC) | 11°-34°                                                                                |                      |
|                                          | Closes (ABDC)     | 22°-67°                                                                                |                      |
| Exhaust valve                            | Opens (BBDC)      | 34°                                                                                    |                      |
|                                          | Closes (ATDC)     | 10°                                                                                    |                      |
| <b>Cylinder head</b>                     |                   |                                                                                        |                      |
| Flatness of gasket surface               |                   | Less than 0.05 mm (0.0020 in.) (0.02 mm (0.0008 in.)/100 x 100)                        |                      |
| Flatness of manifold mounting surface    | Intake            | Less than 0.10 mm (0.0039 in.)                                                         |                      |
|                                          | Exhaust           | Less than 0.10 mm (0.0039 in.)                                                         |                      |
| <b>Camshaft</b>                          |                   |                                                                                        |                      |
| Cam height                               | Intake            | 43.80 mm (1.7244 in.)                                                                  |                      |
|                                          | Exhaust           | 45.00 mm (1.7716 in.)                                                                  |                      |
| Journal outer Diameter (Intake, Exhaust) |                   | No.1: 30 mm (1.1811 in.) (Intake) No. 2, 3, 4, 5: 24 mm (0.9449 in.) (Intake, Exhaust) |                      |
|                                          |                   | No.1: 40 mm (1.5748 in.) (Exhaust)                                                     |                      |
| Bearing oil clearance                    | Intake            | No.1: 0.020-0.057 mm (0.00078-0.00224 in.)                                             | 0.09 mm (0.0035 in.) |
|                                          |                   | No. 2, 3, 4, 5: 0.045-0.082 mm (0.00177-0.00323 in.)                                   | 0.12 mm (0.0047 in.) |
|                                          | Exhaust           | No.1, 2, 3, 4, 5: 0.045-0.082 mm (0.00177-0.00323 in.)                                 | 0.12 mm (0.0047 in.) |
| End play                                 |                   | 0.1-0.22 mm (0.0039-0.0086 in.)                                                        | 0.24 mm (0.0094 in.) |

## 2008 Kia Magentis LX

2008 ENGINE Mechanical (G4KC-GSL 2.4L) - Optima & Magentis (Canadian)

|                                          |         |                                                   |                                  |
|------------------------------------------|---------|---------------------------------------------------|----------------------------------|
|                                          |         |                                                   | in.)                             |
| <b>MLA</b>                               |         |                                                   |                                  |
| MLA outer Diameter                       |         | 31.964-31.980 mm (1.2584-1.2591 in.)              |                                  |
| Cylinder head tappet bore inner diameter |         | 32.000-32.025 mm (1.2598-1.2608 in.)              |                                  |
| MLA to tappet bore clearance             |         | 0.020-0.061 mm (0.0008-0.0024 in.)                | 0.7 mm (0.0276 in.)              |
| <b>Valve</b>                             |         |                                                   |                                  |
| Valve length                             | Intake  | 113.18 mm (4.4559 in.)                            | 112.93 mm (4.4460 in.)           |
|                                          | Exhaust | 105.89 mm (4.1689 in.)                            | 105.74 mm (4.1629 in.)           |
| Stem outer diameter                      | Intake  | 5.465-5.480 mm (0.2151-0.2157 in.)                |                                  |
|                                          | Exhaust | 5.458-5.470 mm (0.2149-0.2153 in.)                |                                  |
| Face angle                               |         | 45.25°-45.75°                                     |                                  |
| Thickness of valve head (margin)         | Intake  | 1.02 mm (0.0401 in.)                              |                                  |
|                                          | Exhaust | 1.09 mm (0.0429 in.)                              |                                  |
| Valve stem to valve guide clearance      | Intake  | 0.020-0.047 mm (0.00078-0.00185 in.)              | 0.07 mm (0.00275 in.)            |
|                                          | Exhaust | 0.030-0.054 mm (0.00118-0.00212 in.)              | 0.09 mm (0.00354 in.)            |
| <b>Valve guide</b>                       |         |                                                   |                                  |
| Length                                   |         | 43.8-44.2 mm (1.7244-1.7401 in.)                  |                                  |
| Inner diameter                           |         | 5.500-5.512 mm (0.2165-0.2170 in.)                |                                  |
| <b>Valve seat</b>                        |         |                                                   |                                  |
| Width of seat contact                    | Intake  | 1.16-1.46 mm (0.0457-0.0575 in.)                  |                                  |
|                                          | Exhaust | 1.35-1.65 mm (0.0531-0.0649 in.)                  |                                  |
| Seat angle                               |         | 44.75°-45.10°                                     |                                  |
| Valve spring                             |         |                                                   |                                  |
| Free length                              |         | 47.44 mm (1.8677 in.)                             |                                  |
| Load                                     |         | 19.0 ± 0.6kg/35.0 mm (41.88±1.32 lb/1.3779 in.)   |                                  |
| Squareness                               |         | 39.8 ± 1.2kg/26.0 mm (87.74 ± 2.64 lb/1.0236 in.) |                                  |
| Out of squareness                        |         | Less than 1.5°                                    |                                  |
| <b>Valve clearance</b>                   |         |                                                   |                                  |
| Cold (20°C [68°F])                       | Intake  | 0.17-0.23 mm (0.0067-0.0090 in.)                  | 0.10-0.30 mm (0.0039-0.0118 in.) |
|                                          | Exhaust | 0.27-0.33 mm (0.0106-0.0129 in.)                  | 0.20-0.40 mm (0.0078-0.0157 in.) |
| <b>Cylinder block</b>                    |         |                                                   |                                  |
| Cylinder bore                            |         | 88.00-88.03 mm (3.4645-3.4657 in.)                |                                  |

## 2008 Kia Magentis LX

2008 ENGINE Mechanical (G4KC-GSL 2.4L) - Optima & Magentis (Canadian)

|                                         |                   |                                                                |                      |
|-----------------------------------------|-------------------|----------------------------------------------------------------|----------------------|
| Flatness of gasket surface              |                   | Less than 0.05 mm (0.0020 in.) (0.02 mm (0.0008 in.)/100 x100) |                      |
| <b>Piston</b>                           |                   |                                                                |                      |
| Piston outer diameter                   |                   | 87.975-88.005 mm (3.4636-3.4648 in.)                           |                      |
| Piston to cylinder clearance            |                   | 0.015-0.035 mm (0.0028-0.0014 in.)                             |                      |
| Ring groove width                       | No. 1 ring groove | 1.22-1.24 mm (0.0006-0.0488 in.)                               | 1.26 mm (0.0496 in.) |
|                                         | No. 2 ring groove | 1.22-1.24 mm (0.0480-0.0488 in.)                               | 1.26 mm (0.0496 in.) |
|                                         | Oil ring groove   | 2.01-2.03 mm (0.0791-0.0799 in.)                               | 2.05 mm (0.0807 in.) |
| <b>Piston ring</b>                      |                   |                                                                |                      |
| Side clearance                          | No. 1 ring        | 0.03-0.07 mm (0.0012-0.0028 in.)                               | 0.1 mm (0.004 in.)   |
|                                         | No. 2 ring        | 0.03-0.07 mm (0.0012-0.0028 in.)                               | 0.1 mm (0.004 in.)   |
|                                         | Oil ring          | 0.06-0.15 mm (0.0024-0.0059 in.)                               | 0.2 mm (0.008 in.)   |
| End gap                                 | No. 1 ring        | 0.15-0.30 mm (0.0059-0.0118 in.)                               | 0.6 mm (0.0236 in.)  |
|                                         | No. 2 ring        | 0.30-0.45 mm (0.0118-0.0177 in.)                               | 0.7 mm (0.0275 in.)  |
|                                         | Oil ring          | 0.20-0.70 mm (0.0078-0.0275 in.)                               | 0.8 mm (0.0315 in.)  |
| <b>Piston pin</b>                       |                   |                                                                |                      |
| Piston pin outer diameter               |                   | 21.001-21.006 mm (0.8268-0.8270 in.)                           |                      |
| Piston pin hole inner diameter          |                   | 21.016-21.021 mm (0.8274-0.8276 in.)                           |                      |
| Piston pin hole clearance               |                   | 0.010-0.020 mm (0.0004-0.0008 in.)                             |                      |
| Connecting rod small end inner diameter |                   | 20.974-20.985 mm (0.8257-0.8262 in.)                           |                      |
| Piston pin press-fit load               |                   | 2451.7-12258.3 N (250-1250 kg, 551.2-2755.8 lbs)               |                      |
| <b>Connecting rod</b>                   |                   |                                                                |                      |
| Connecting rod big end inner diameter   |                   | 51.000-51.018 mm (2.0079-2.0086 in.)                           |                      |
| Connecting rod bearing oil clearance    |                   | 0.028-0.046 mm (0.0011-0.0018 in.)                             | 0.05 mm (0.0019 in.) |
| Side clearance                          |                   | 0.10-0.25 mm (0.0039-0.0098 in.)                               | 0.35 mm (0.0138 in.) |
| <b>Crankshaft</b>                       |                   |                                                                |                      |
| Main journal outer diameter             |                   | 51.942-51.960 mm (2.0449-2.0456 in.)                           |                      |
| Pin journal outer diameter              |                   | 47.954-47.972 mm (1.8879-1.8886 in.)                           |                      |
| Main bearing oil clearance              |                   | 0.026-0.049 mm (0.0010-0.0019 in.)                             | 0.1 mm (0.004 in.)   |
| End play                                |                   | 00.07-0.25 mm (0.0027-0.0098 in.)                              |                      |

**2008 Kia Magentis LX**

2008 ENGINE Mechanical (G4KC-GSL 2.4L) - Optima &amp; Magentis (Canadian)

**Engine oil**

|                                     |                                 |  |
|-------------------------------------|---------------------------------|--|
| Oil quantity (Total)                | 5.1L (5.39 US qt, 4.49 Imp. qt) |  |
| Oil quantity (Excluding oil filter) | 4.0L (4.23 US qt, 3.52 Imp qt)  |  |
| Oil quantity (Including oil filter) | 4.3L (4.54 US qt, 3.78 Imp. qt) |  |
| Oil type                            | 5W-20 (SL/GF-3)                 |  |

**Cooling system**

|                 |                                                     |                                                                   |
|-----------------|-----------------------------------------------------|-------------------------------------------------------------------|
| Cooling method  | Forced circulation with cooling fan                 |                                                                   |
| Coolant quality | 6.4-6.9L (6.76288-7.29 US qt, 5.63136-6.07 Imp. qt) |                                                                   |
| Thermostat      | Type                                                | Wax pellet type                                                   |
|                 | Opening temperature                                 | 82±1.5°C (179.6±34.7°F)                                           |
|                 | Closing temperature                                 | 77° (176.9°F)                                                     |
|                 | Pull opening temperature                            | 95°C (201°F)                                                      |
| Radiator cap    | Main valve opening pressure                         | 93.16-122.58 kPa (0.95-1.25 kg/cm <sup>2</sup> , 13.51-17.78 psi) |
|                 | Vacuum valve opening pressure                       | 6.86 kPa (1 psi, 0.07kg/cm <sup>2</sup> ) or less                 |

**Water temperature sensor**

|            |                 |                  |
|------------|-----------------|------------------|
| Type       | Thermistor type |                  |
| Resistance | 20°C (68°F)     | 2.45 ± 0.14kohms |
|            | 80°C (176°F)    | 0.3222 kohms     |

**TIGHTENING TORQUE****TIGHTENING TORQUE SPECIFICATION**

| Item                                    | Quantity | N.m               | kgf.m           | lb-ft             |
|-----------------------------------------|----------|-------------------|-----------------|-------------------|
| Ladder frame bolts                      | 10       | 23.52-27.44       | 2.4-2.8         | 17.35-20.24       |
| Oil pump & balance shaft module bolts   | 4        | 16.66 + 60° + 60° | 1.7 + 60° + 60° | 12.29 + 60° + 60° |
| Timing chain cover bolts (M8)           | 6        | 18.62-22.54       | 1.9-2.3         | 13.74-16.63       |
| Timing chain cover bolts (M6)           | 7        | 7.84-9.8          | 0.8-1.0         | 5.78-7.23         |
| Oil pan bolts (M6 x 10)                 | 16       | 9.8-11.76         | 1.0-1.2         | 7.23-8.67         |
| Oil pan bolts (M8 x 103)                | 2        | 26.46-30.38       | 2.7-3.1         | 19.52-22.41       |
| Engine support bracket bolt (M10 x 40)  | 1        | 39.2-44.1         | 4.0-4.5         | 28.92-32.53       |
| Engine support bracket bolts (M10 x 45) | 2        | 39.2-44.1         | 4.0-4.5         | 28.92-32.53       |
| Engine support bracket bolt (M8 x 30)   | 1        | 19.6-24.5         | 2.0-2.5         | 14.46-18.07       |
| Camshaft bearing cap bolts (M6)         | 16       | 10.78-12.74       | 1.1-1.3         | 7.95-9.39         |
| Camshaft bearing cap bolts (M8)         | 4        | 27.44-31.36       | 2.8-3.2         | 20.24-23.14       |
| Cylinder head bolts                     | 10       | 34.3 + 90° + 90°  | 3.5 + 90° + 90° | 25.3 + 90° + 90°  |
| Engine hanger bolts                     | 2        | 19.6-26.46        | 2.0-2.7         | 14.46-19.52       |
| Cylinder head cover bolts               | 18       | 7.84-9.8          | 0.8-1.0         | 5.78-7.23         |
| Crankshaft pulley bolt                  | 1        | 166.6-176.4       | 17-18           | 122.9-130.13      |

**2008 Kia Magentis LX**

2008 ENGINE Mechanical (G4KC-GSL 2.4L) - Optima &amp; Magentis (Canadian)

|                                         |    |             |           |             |
|-----------------------------------------|----|-------------|-----------|-------------|
| Flywheel bolts                          | 7  | 117.6-127.4 | 12-13     | 86.75-93.98 |
| Drive plate bolts                       | 7  | 117.6-127.4 | 12-13     | 86.75-93.98 |
| Timing chain tensioner bolts            | 2  | 9.8-11.76   | 1.0-1.2   | 7.23-8.67   |
| Timing chain tensioner arm bolt         | 1  | 9.8-11.76   | 1.0-1.2   | 7.23-8.67   |
| Timing chain guide bolts                | 3  | 9.8-11.76   | 1.0-1.2   | 7.23-8.67   |
| OCV bolt                                | 1  | 9.8-11.76   | 1.0-1.2   | 7.23-8.67   |
| CVVT & camshaft sprocket bolt           | 1  | 53.9-63.7   | 5.5-6.5   | 39.7-47.0   |
| Balance shaft chain tensioner arm bolt  | 1  | 9.8-11.76   | 1.0-1.2   | 7.23-8.67   |
| Balance shaft chain guide bolts         | 2  | 9.8-11.76   | 1.0-1.2   | 7.23-8.67   |
| Balance shaft chain tensioner bolts     | 2  | 9.8-11.76   | 1.0-1.2   | 7.23-8.67   |
| Water pump bolts                        | 5  | 19.6-26.46  | 2.0-2.7   | 14.46-19.52 |
| A/C bracket bolts                       | 4  | 19.6-33.0   | 2.0-3.36  | 14.46-24.3  |
| P/S bracket bolts                       | 2  | 44.1-53.9   | 4.5-5.5   | 32.53-39.70 |
| Tensioner & idler bracket bolts         | 7  | 39.2-44.1   | 4.0-4.5   | 28.92-32.53 |
| Water temp. control bolts               | 2  | 14.7-21.56  | 1.5-2.2   | 10.84-15.90 |
| Water temp. control nut                 | 1  | 19.6-26.46  | 2.0-2.7   | 14.46-19.52 |
| Water inlet pipe bolts                  | 2  | 19.6-26.46  | 2.0-2.7   | 14.46-19.52 |
| Oil level gauge assembly bolt           | 1  | 7.84-11.76  | 0.8-1.2   | 5.78-8.67   |
| Ignition coil bolts                     | 4  | 3.92-5.88   | 0.4-0.6   | 2.89-4.34   |
| Intake manifold bolts                   | 3  | 18.62-27.44 | 1.9-2.8   | 13.73-20.24 |
| Intake manifold nuts                    | 2  | 18.62-27.44 | 1.9-2.8   | 13.73-20.24 |
| Intake manifold stay bolts              | 4  | 18.62-27.44 | 1.9-2.8   | 13.73-20.24 |
| Exhaust manifold heat protector bolts   | 4  | 18.62-27.44 | 1.9-2.8   | 13.73-20.24 |
| Exhaust manifold nuts                   | 7  | 39.2-44.1   | 4.0-4.5   | 28.92-32.53 |
| Exhaust manifold stay bolts (M8)        | 2  | 18.62-27.44 | 1.9-2.8   | 13.74-20.24 |
| Exhaust manifold stay bolt (M10)        | 1  | 42.2-53.9   | 4.3-5.5   | 31.1-39.8   |
| Front muffler bolts                     | 2  | 39.2-58.8   | 4.0-6.0   | 28.92-43.37 |
| Engine cover nuts                       | 2  | 3.92-5.88   | 0.4-0.6   | 2.89-4.34   |
| Engine cover mounting bracket bolts     | 2  | 7.84-11.76  | 0.8-1.2   | 5.78-8.67   |
| Crankshaft position sensor & cover bolt | 1  | 3.92-5.88   | 0.4-0.6   | 2.89-4.34   |
| Oxygen sensor                           | 1  | 34.3-44.1   | 3.5-4.5   | 25.30-32.53 |
| Knock sensor                            | 1  | 16.66-25.48 | 1.7-2.6   | 12.29-18.79 |
| Oil temperature sensor                  | 1  | 19.6-39.2   | 2.0-4.0   | 14.46-28.92 |
| Camshaft position sensor                | 1  | 3.92-5.88   | 0.4-0.6   | 2.89-4.34   |
| Oil pressure switch                     | 1  | 7.84-11.76  | 0.8-1.2   | 5.78-8.67   |
| Main bearing cap bolts                  | 10 | 26.46 + 45° | 2.7 + 45° | 19.52 + 45° |
| Oil filter                              | 1  | 11.76-15.68 | 1.2-1.6   | 8.67-11.57  |
| Connecting rod bearing cap bolts        | 8  | 19.6 + 90°  | 2.0 + 90° | 14.46 + 90° |
| Engine mounting nut (M12 x 1.25 6T)     | 3  | 63.7-83.4   | 6.5-8.5   | 47.0-61.5   |
| Engine mounting bolts (M12 x 1.25 10T)  | 1  | 63.7-83.4   | 6.5-8.5   | 47.0-61.5   |

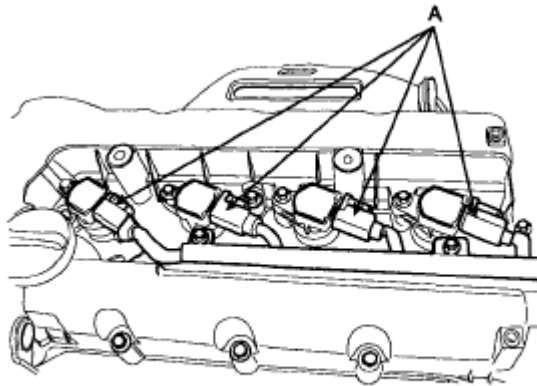
**COMPRESSION**

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

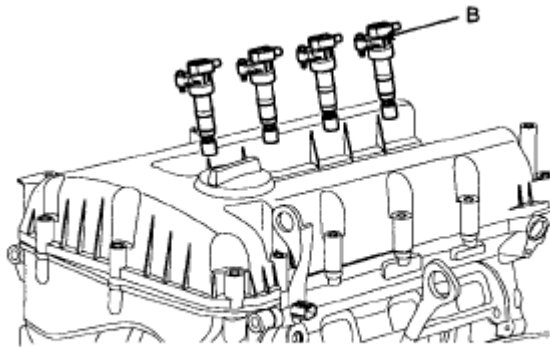
1. Warm up and stop engine.

Allow the engine to warm up to normal operating temperature.

2. Remove ignition coils connects (A), ignition coils (B). Refer to **IGNITION SYSTEM (ENGINE ELECTRICAL SYSTEM - G4KC-GSL 2.4L)**.



**Fig. 1: Identifying Ignition Coil Connector**  
Courtesy of KIA MOTORS AMERICA, INC.

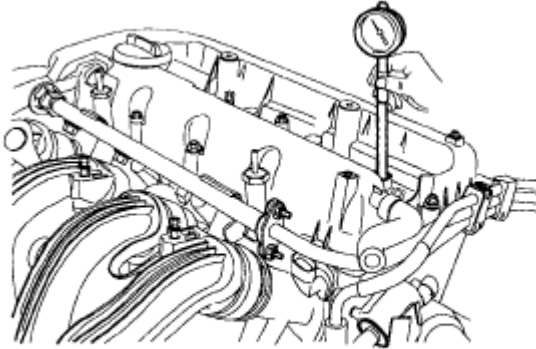


**Fig. 2: Identifying Ignition Coils**  
Courtesy of KIA MOTORS AMERICA, INC.

3. Remove spark plugs.

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

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



KCRF134B

**Fig. 3: Checking Engine Compression**  
Courtesy of KIA MOTORS AMERICA, INC.

2. Fully open the throttle.
3. While cranking the engine, measure the compression pressure.

**NOTE:** Always use a fully charged battery to obtain engine speed of 200 RPM or more.

4. Repeat steps (1) through (3) for each cylinder.

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

Compression pressure:

1,283 kPa (13.0 kgf/cm<sup>2</sup> , 185 psi) (200-250 RPM)

Minimum pressure:

1,135 kPa (11.5 kgf/cm<sup>2</sup> , 164 psi)

Difference between each cylinder:

100 kPa (1.0 kgf/cm<sup>2</sup> , 15 psi) or less

5. 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 steps (1) through (3) for cylinders with low compression.
  - If adding oil helps the compression, it is likely that the piston rings and/or cylinder bore are

worn or damaged.

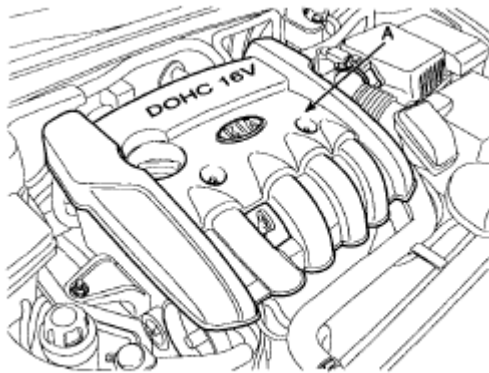
- If pressure stays low, a valve may be sticking or seating is improper, or there may be leakage past the gasket.
5. Reinstall spark plugs.
  6. Install ignition coils, ignition coil connects. Refer to **IGNITION SYSTEM (ENGINE ELECTRICAL SYSTEM (G4KC - GSL 2.4))**.

## **VALVE CLEARANCE INSPECTION AND ADJUSTMENT**

### **MLA (MECHANICAL LASH ADJUSTER)**

**NOTE:**        **Inspect and adjust the valve clearance when the engine is cold (Engine coolant temperature: 20°C) and cylinder head is installed on the cylinder block.**

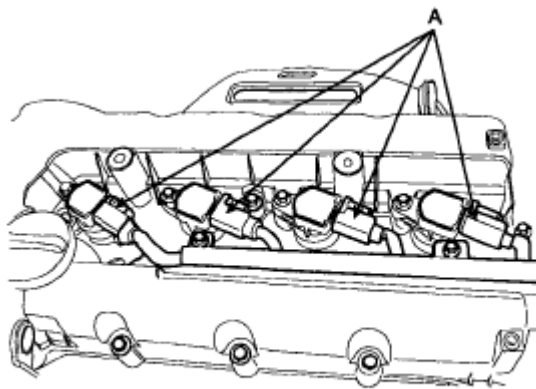
1. Remove the engine cover (A).



ACLG001A

**Fig. 4: Identifying Engine Cover**  
**Courtesy of KIA MOTORS AMERICA, INC.**

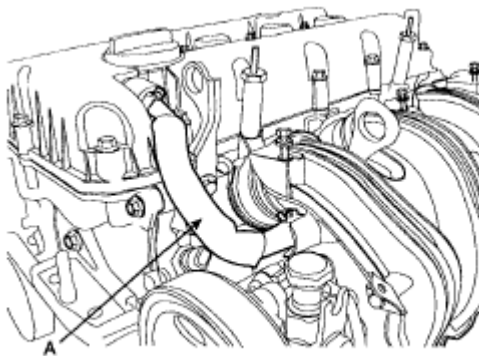
2. Remove the cylinder head cover.
  1. Disconnect the ignition coil connector (A) and remove the ignition coil.



KCRF131A

**Fig. 5: Identifying Ignition Coil Connector**  
Courtesy of KIA MOTORS AMERICA, INC.

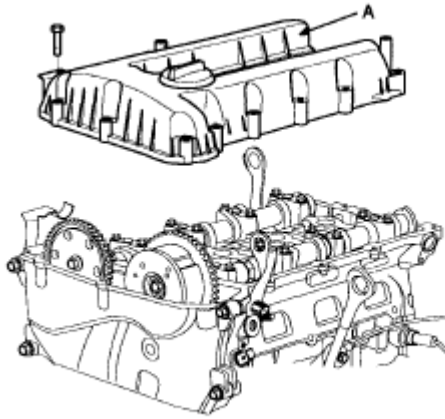
2. Disconnect the PCV hose (A) and the breather hose from the cylinder head cover.



KCRF141E

**Fig. 6: Identifying PCV Hose & Breather Hose From Cylinder Head Cover**  
Courtesy of KIA MOTORS AMERICA, INC.

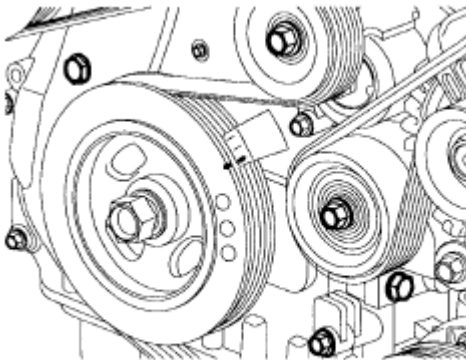
3. Loosen the cylinder head cover bolts and then remove the cover (A) and gasket.



KCRF115A

**Fig. 7: Identifying Cylinder Head Cover Bolts And Gasket**  
Courtesy of KIA MOTORS AMERICA, INC.

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

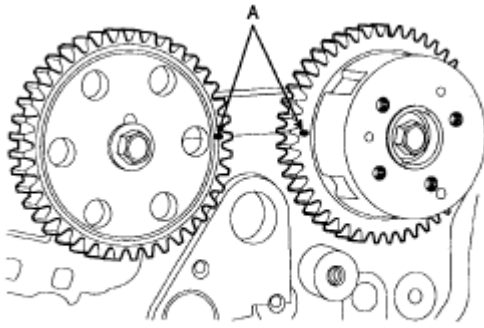


KCRF107A

**Fig. 8: Identifying Timing Marks**  
Courtesy of KIA MOTORS AMERICA, INC.

2. Check that the mark (A) of the camshaft timing sprockets are in straight line on the cylinder head surface as shown in the illustration.

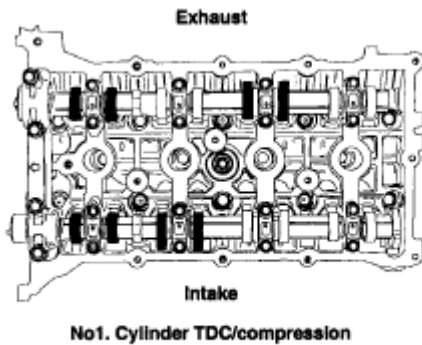
If not, turn the crankshaft one revolution (360°)



ACRF007A

**Fig. 9: Identifying Camshaft Sprocket Timing Marks**  
 Courtesy of KIA MOTORS AMERICA, INC.

4. Inspect the valve clearance.
  1. Check only the valve indicated as shown in illustration. [No. 1 cylinder: TDC/Compression] measure the valve clearance.



ECRF001A

**Fig. 10: Identifying Cylinder No. 1 At TDC/Compression**  
 Courtesy of KIA MOTORS AMERICA, INC.

- Using a thickness gauge, measure the clearance between the tappet 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 tappet.

### Valve clearance

#### Specification

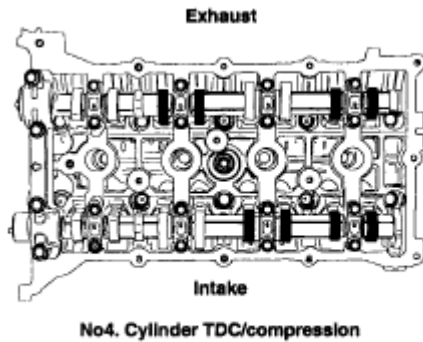
Engine coolant temperature: 20°C [68°F]

#### Limit

Intake: 0.10-0.30 mm (0.0039-0.0118 in.)

Exhaust: 0.20-0.40 mm (0.0079-0.0157 in.)

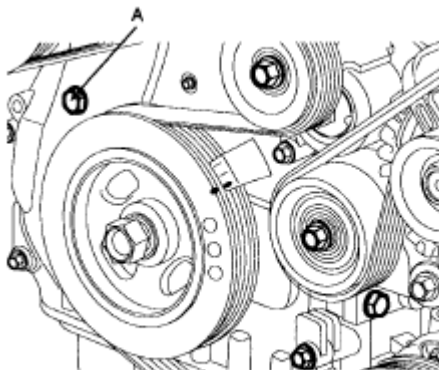
2. Turn the crankshaft pulley one revolution (360°) and align the groove with timing mark "T" of the lower timing chain cover.
3. Check only valves indicated as shown in illustration. [NO. 4 cylinder: TDC/compression]. Measure the valve clearance.



ECRF002A

**Fig. 11: Identifying Cylinder No. 4 At TDC/Compression**  
Courtesy of KIA MOTORS AMERICA, INC.

5. Adjust the intake and exhaust valve clearance.
  1. Set the No.1 cylinder to the TDC/compression.
  2. Marks on the timing chain and camshaft timing sprockets.
  3. Turn the crankshaft pulley 15° clockwise.
  4. Remove the service hole bolt (A) of the timing chain cover.

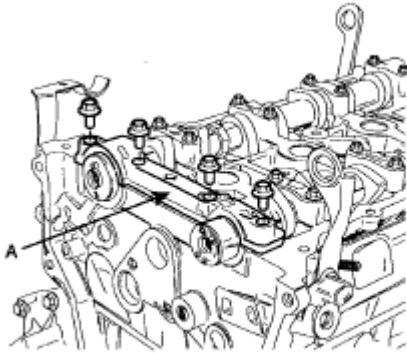


ACRF004A

**Fig. 12: Identifying Service Hole Bolt Of Timing Chain Cover**  
Courtesy of KIA MOTORS AMERICA, INC.

**CAUTION:** The bolt must not be reused once it has been assembled.

5. Insert a thin rod in the service hole of the timing chain cover and release the ratchet.
6. Remove the front camshaft bearing cap (A).



KCRF103A

**Fig. 13: Front Camshaft Bearing Cap**  
Courtesy of KIA MOTORS AMERICA, INC.

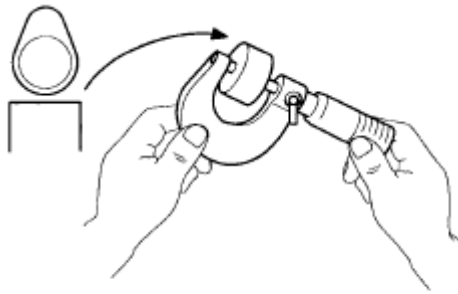
7. Remove the exhaust camshaft sprocket.
8. Remove the exhaust camshaft bearing cap and exhaust camshaft.
9. Remove the intake camshaft bearing cap and intake camshaft.

**CAUTION: When disconnect the timing chain from the camshaft timing sprocket, hold the timing chain.**

10. Secure the timing chain.

**CAUTION: Be careful not to drop anything inside timing chain cover.**

11. Measure the thickness of the removed tappet using a micrometer.



EDKE0000D

**Fig. 14: Measuring Tappet Thickness Using Micrometer**  
 Courtesy of KIA MOTORS AMERICA, INC.

12. Calculate the thickness of a new tappet so that the valve clearance comes within the specified value.

**Valve clearance (Engine coolant temperature: 20°C)**

T: Thickness of removed tappet

A: Measured valve clearance

N: Thickness of new tappet

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

Exhaust:  $N = T + [A - 0.30 \text{ mm (0.0118 in.)}]$

13. Select a new tappet with a thickness as close as possible to the calculated value.

**NOTE:** Tappets are available in 47 size increments of 0.015 mm (0.0006 in.) from 3.00 mm (0.118 in.) to 3.690 mm (0.1452 in.)

14. Place a new tappet on the cylinder head.
15. Hold the timing chain, and install the intake camshaft and timing sprocket assembly.
16. Align the matchmarks on the timing chain and camshaft timing sprocket.
17. Install the intake and exhaust camshaft.
18. Install the front bearing cap.
19. Install the service hole bolt.

**Tightening torque**

12-15 N.m (1.2-1.5 kgf.m, 8.8-11.0 lb-ft)

20. Turn the crankshaft two turns in the operating direction (clockwise) and realign crankshaft sprocket and camshaft sprocket timing marks.
21. Recheck the valve clearance.

**Valve clearance (Engine coolant temperature: 20°C)**

[Specification]

Intake: 0.17-0.23 mm (0.0067-0.0090 in.)

Exhaust: 0.27-0.33 mm (0.0106-0.0129 in.)

**TROUBLESHOOTING**

**TROUBLESHOOTING CHART**

| Symptom                                                    | Suspect area                                                                                                                                                                                                                                  | Remedy                                                                                                                                                                                               |
|------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Engine misfire with abnormal internal lower engine noises. | Worn crankshaft bearings Loose or improperly engine flywheel                                                                                                                                                                                  | Replace the crankshaft and bearings as required.<br>Repair or replace the flywheel as required.                                                                                                      |
|                                                            | Worn piston rings (Oil consumption may or may not cause the engine to misfire).                                                                                                                                                               | Inspect the cylinder for a loss of compression. Repair or replace as required.                                                                                                                       |
|                                                            | Worn crankshaft thrust bearings                                                                                                                                                                                                               | Replace the crankshaft and bearings as required                                                                                                                                                      |
| Engine misfire with abnormal valve train noise.            | Stuck valves (Carbon buildup on the valve stem)                                                                                                                                                                                               | 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 cranking 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, guides and/or valve stem oil seals.                                                                                                                                                                                              | Repair or replace as required.                                                                                                                                                                       |
|                                                            | Worn piston rings (Oil consumption may or may not cause the engine to misfire)                                                                                                                                                                | <ul style="list-style-type: none"> <li>Inspect the cylinder for a loss of compression.</li> <li>Repair or replace as required.</li> </ul>                                                            |
|                                                            | Incorrect oil viscosity                                                                                                                                                                                                                       | <ul style="list-style-type: none"> <li>Drain the oil.</li> <li>Install the correct viscosity oil.</li> </ul>                                                                                         |

## 2008 Kia Magentis LX

2008 ENGINE Mechanical (G4KC-GSL 2.4L) - Optima & Magentis (Canadian)

|                                                           |                                                                                         |                                                                                                                                                                                                                    |
|-----------------------------------------------------------|-----------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Engine noise on start-up, but only lasting a few seconds. | Worn crankshaft thrust bearing.                                                         | <ul style="list-style-type: none"> <li>Inspect the thrust bearing and crankshaft.</li> <li>Repair or replace as required.</li> </ul>                                                                               |
| 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.                                                                    | <ul style="list-style-type: none"> <li>Inspect the camshaft lobes.</li> <li>Replace the timing camshaft and valve lifters as required.</li> </ul>                                                                  |
|                                                           | 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.                                                                                                                                                      |
| Lower engine noise, regardless of engine speed            | Worn drive belt, idler, tensioner and bearing.                                          | Replace as required                                                                                                                                                                                                |
|                                                           | Low oil pressure                                                                        | Repair or required.                                                                                                                                                                                                |
|                                                           | Loose or damaged flywheel.                                                              | Repair or replace the flywheel.                                                                                                                                                                                    |
|                                                           | Damaged oil pan, contacting the oil pump screen.                                        | <ul style="list-style-type: none"> <li>Inspect the oil pan.</li> <li>Inspect the oil pump screen.</li> <li>Repair or replace as required.</li> </ul>                                                               |
|                                                           | Oil pump screen loose, damaged or restricted.                                           | <ul style="list-style-type: none"> <li>Inspect the oil pump screen.</li> <li>Repair or replace as required.</li> </ul>                                                                                             |
|                                                           | Excessive piston-to-cylinder bore clearance.                                            | <ul style="list-style-type: none"> <li>Inspect the piston, piston pin and cylinder bore.</li> <li>Repair as required.</li> </ul>                                                                                   |
|                                                           | Excessive piston pin-to-piston clearance                                                | <ul style="list-style-type: none"> <li>Inspect the piston, piston pin and the connecting rod.</li> <li>Repair or replace as required.</li> </ul>                                                                   |
|                                                           | Excessive connecting rod bearing clearance                                              | <p>Inspect the following components and repair as required.</p> <ul style="list-style-type: none"> <li>The connecting rod bearings.</li> <li>The connecting rods.</li> <li>The crankshaft pin journals.</li> </ul> |
|                                                           |                                                                                         | Inspect the following components, and repair as required.                                                                                                                                                          |

## 2008 Kia Magentis LX

2008 ENGINE Mechanical (G4KC-GSL 2.4L) - Optima & Magentis (Canadian)

|                                                  |                                                                                                                                                                           |                                                                                                                                                                                                                                                                                         |
|--------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                  | Excessive crankshaft bearing clearance                                                                                                                                    | <ul style="list-style-type: none"> <li>• The crankshaft bearings.</li> <li>• The crankshaft main journals.</li> <li>• The cylinder block</li> </ul>                                                                                                                                     |
|                                                  | Incorrect piston, piston pin and connecting rod installation                                                                                                              | <ul style="list-style-type: none"> <li>• Verify the piston pins and connecting rods are installed correctly.</li> <li>• Repair as required.</li> </ul>                                                                                                                                  |
| 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 main journals.</li> <li>• The cylinder block.</li> </ul>                                                                          |
| Engine will not crank-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> | <ol style="list-style-type: none"> <li>1. Remove spark plugs and check for fluid.</li> <li>2. Inspect for broken head gasket.</li> <li>3. Inspect for cracked engine block or cylinder head.</li> <li>4. Inspect for a sticking fuel injector and/or leaking fuel regulator.</li> </ol> |
|                                                  | Broken timing chain and/or timing chain and/or timing chain gears.                                                                                                        | <ol style="list-style-type: none"> <li>1. Inspect timing chain and gears.</li> <li>2. Repair as required.</li> </ol>                                                                                                                                                                    |
|                                                  | Material in cylinder <ul style="list-style-type: none"> <li>• Broken valve</li> <li>• Piston material</li> <li>• Foreign material</li> </ul>                              | <ol style="list-style-type: none"> <li>1. Inspect cylinder for damaged components and/or foreign materials.</li> <li>2. Repair or replace as required.</li> </ol>                                                                                                                       |
|                                                  | Seized crankshaft or connecting rod bearings.                                                                                                                             | <ol style="list-style-type: none"> <li>1. Inspect crankshaft and connecting rod bearing.</li> <li>2. Repair as required.</li> </ol>                                                                                                                                                     |
|                                                  | Bent or broken connecting rod.                                                                                                                                            | <ol style="list-style-type: none"> <li>1. Inspect connecting rods.</li> <li>2. Repair as required.</li> </ol>                                                                                                                                                                           |

# 2008 Kia Magentis LX

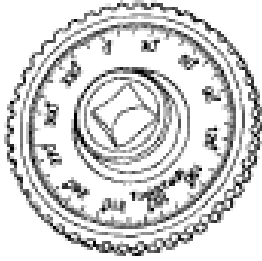
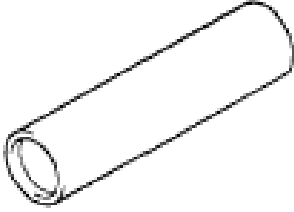
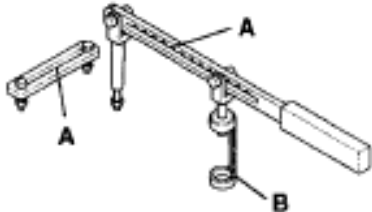
2008 ENGINE Mechanical (G4KC-GSL 2.4L) - Optima & Magentis (Canadian)

Broken crankshaft

1. Inspect crankshaft.
2. Repair as required.

## SPECIAL SERVICE TOOLS

## SPECIAL SERVICE TOOLS

| Tool (Number and name)                                              | Illustration                                                                                    | Use                                                                                                        |
|---------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| Torque angle adapter (09221-4A000)                                  | <br>LGAC030A   | Installation of bolts & nuts needing an angular method                                                     |
| Valve stem oil seal installer (09222-4A000)                         | <br>LGAC030D  | Installation of the valve stem oil seal                                                                    |
| Valve spring compressor & holder (09222-3K000) (09222-3K100)        | <br>ECRF003A | Removal and installation of the intake or exhaust valve<br>A. A: 09222-3K000<br>B. B: 09222-3K100 (holder) |
| Crankshaft front oil seal installer (09214 - 3K000) (09231 - H1100) |                                                                                                 | Installation of the front oil seal<br>A. A: 09214 - 3K000<br>B. B: 09231 - H1100                           |

## 2008 Kia Magentis LX

2008 ENGINE Mechanical (G4KC-GSL 2.4L) - Optima & Magentis (Canadian)



ACRF002A

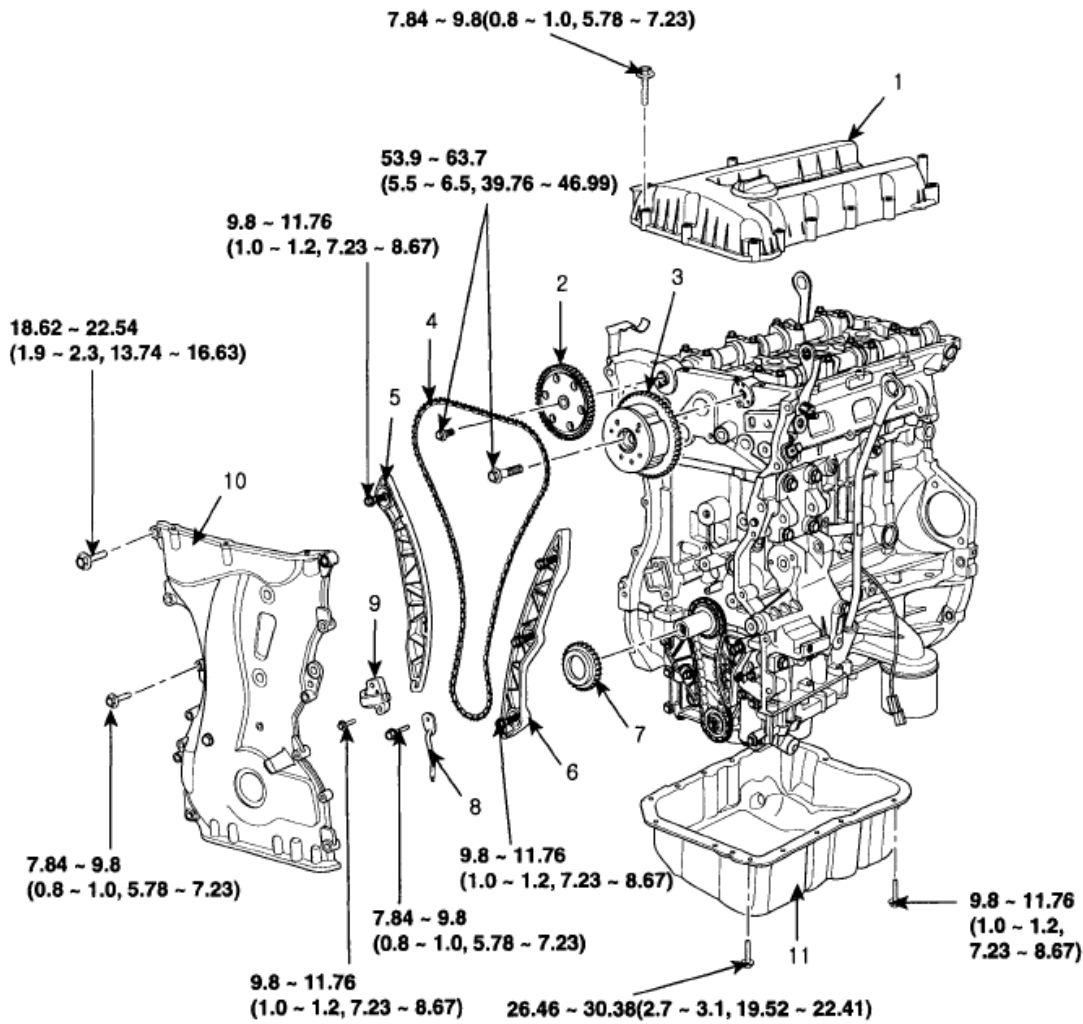
## TIMING SYSTEM

### TIMING CHAIN

#### COMPONENTS

## 2008 Kia Magentis LX

2008 ENGINE Mechanical (G4KC-GSL 2.4L) - Optima & Magentis (Canadian)

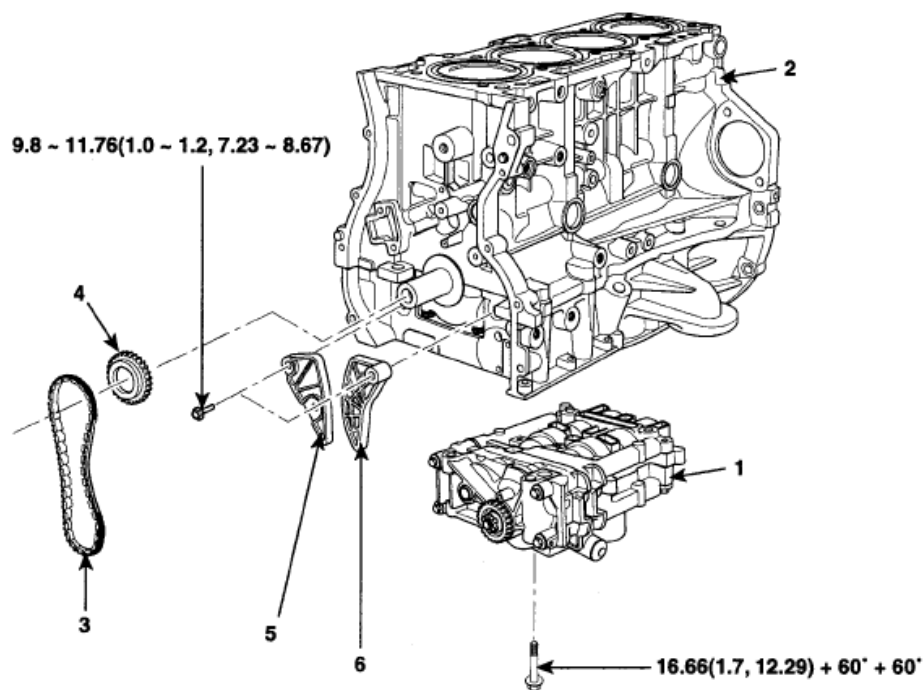


### TORQUE : N.m (kgf.m, lb-ft)

- |                               |                           |
|-------------------------------|---------------------------|
| 1. Cylinder head cover        | 7. Crankshaft sprocket    |
| 2. Exhaust camshaft sprocket  | 8. Oil jet                |
| 3. CVVT assembly              | 9. Timing chain tensioner |
| 4. Timing chain               | 10. Timing chain cover    |
| 5. Timing chain tensioner arm | 11. Oil pan               |
| 6. Timing chain guide         |                           |

SMGEM6012N

**Fig. 15: Identifying Timing System Components With Torque Specifications (1 Of 2)**  
Courtesy of KIA MOTORS AMERICA, INC.



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

- |                         |                                      |
|-------------------------|--------------------------------------|
| 1. Balance shaft module | 4. Balance shaft chain sprocket      |
| 2. Cylinder block       | 5. Balance shaft chain guide         |
| 3. Balance shaft chain  | 6. Balance shaft chain tensioner arm |

SMGEM6013N

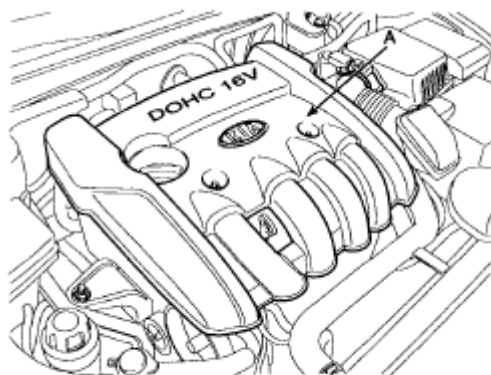
**Fig. 16: Identifying Timing System Components With Torque Specifications (2 Of 2)**  
 Courtesy of KIA MOTORS AMERICA, INC.

**REMOVAL**

Engine removal is not required for this procedure.

**TIMING CHAIN**

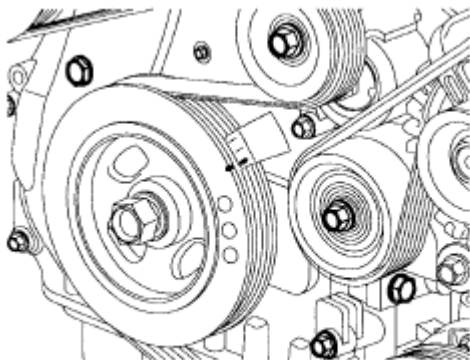
1. Remove the engine cover (A).



ACLG001A

**Fig. 17: Identifying Engine Cover**  
Courtesy of KIA MOTORS AMERICA, INC.

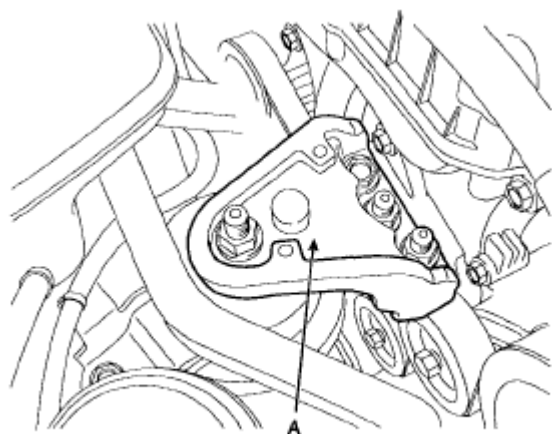
2. Remove RH front wheel.
3. Remove RH side cover.
4. Set No.1 cylinder to TDC/compression



KCRF107A

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

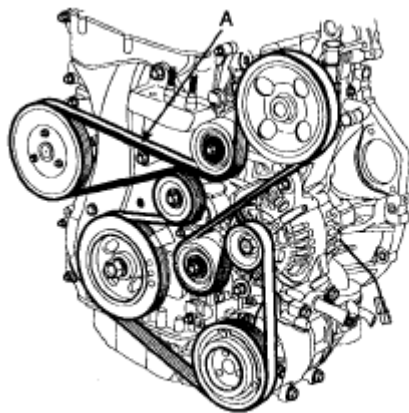
5. Remove the engine mount bracket (A).



SMGEM8010N

**Fig. 19: Identifying Engine Mount Bracket**  
Courtesy of KIA MOTORS AMERICA, INC.

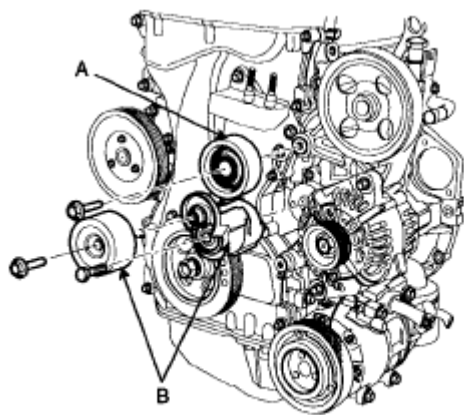
6. Remove drive belt (A).



ACLG031A

**Fig. 20: Identifying Drive Belt Routing**  
Courtesy of KIA MOTORS AMERICA, INC.

7. Remove the idler pulley (A).



ACLG032A

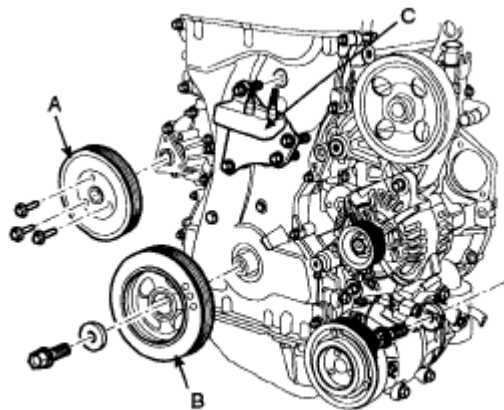
**Fig. 21: Identifying Idler Pulley**

Courtesy of KIA MOTORS AMERICA, INC.

8. Remove the drive belt tensioner (B).

**NOTE:** Tensioner pulley bolt is left-handed screw.

9. Remove the water pump pulley (A).

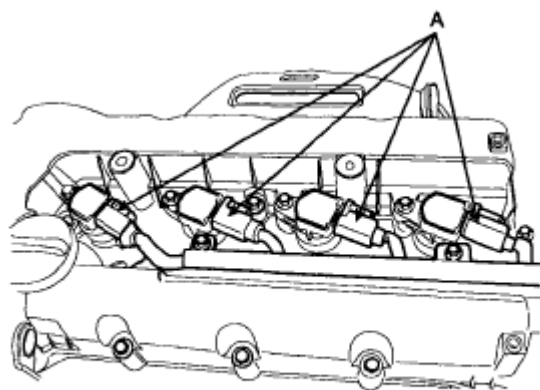


ACLG033A

**Fig. 22: Identifying Water Pump Pulley**

Courtesy of KIA MOTORS AMERICA, INC.

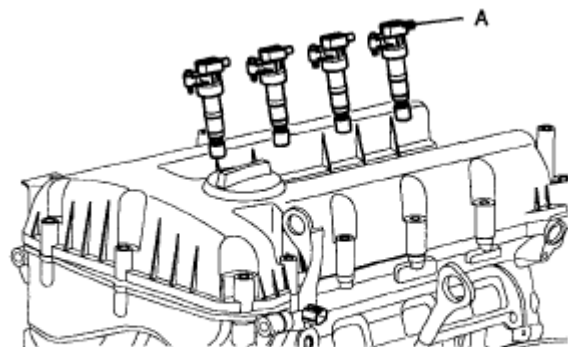
10. Remove the crankshaft pulley (B).
11. Remove the engine support bracket (C).
12. Disconnect the ignition coil connector (A).



KCRF131A

**Fig. 23: Identifying Ignition Coil Connector**  
Courtesy of KIA MOTORS AMERICA, INC.

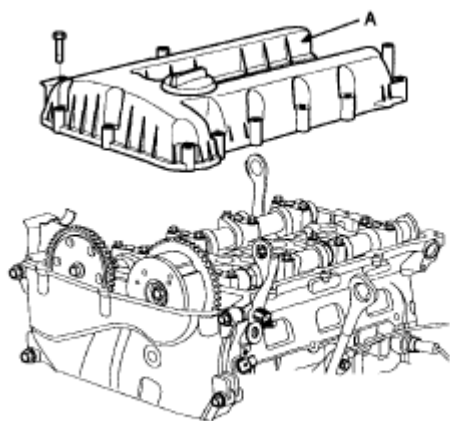
13. Remove the ignition coil (A).



KCRF111A

**Fig. 24: Identifying Ignition Coil**  
Courtesy of KIA MOTORS AMERICA, INC.

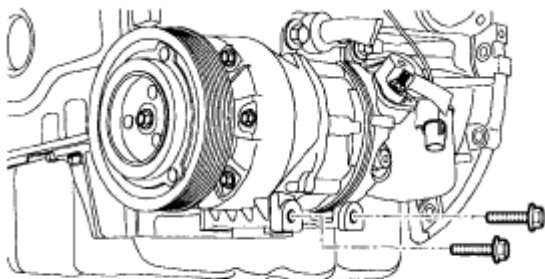
14. Remove the PCV hose and breather hose from the cylinder head cover.
15. Loosen the cylinder head cover bolts and then remove the cylinder head cover (A) and gasket.



KCRF115A

**Fig. 25: Identifying Cylinder Head Cover Bolts And Gasket**  
Courtesy of KIA MOTORS AMERICA, INC.

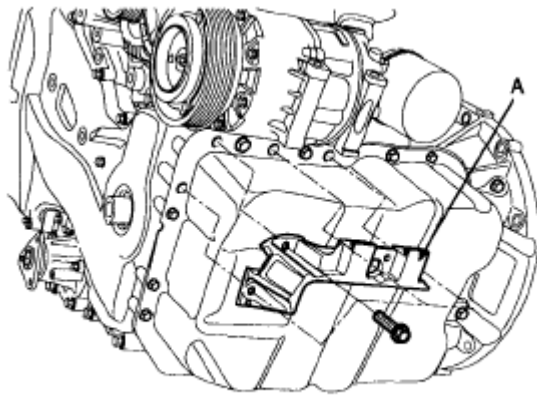
16. Remove the compressor lower bolts.



KCRF112A

**Fig. 26: Identifying Compressor Lower Bolts**  
Courtesy of KIA MOTORS AMERICA, INC.

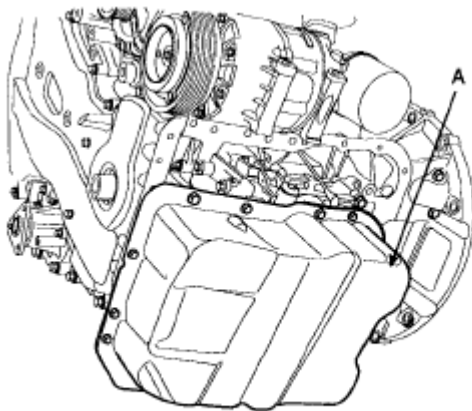
17. Remove the compressor bracket (A).



KCRF113A

**Fig. 27: Identifying Compressor Bracket**  
Courtesy of KIA MOTORS AMERICA, INC.

18. Drain the engine oil.
19. Remove the oil pan (A).

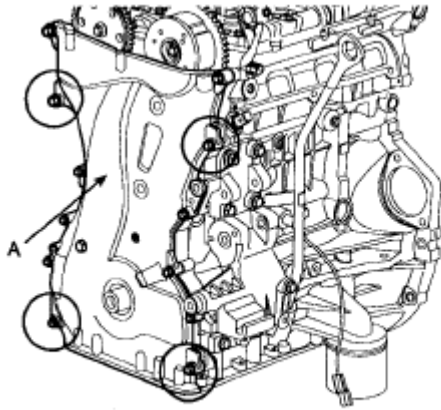


KCRF114A

**Fig. 28: Identifying Oil Pan**  
Courtesy of KIA MOTORS AMERICA, INC.

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

20. Remove the timing chain cover (A) by prying the portions between the cylinder head and cylinder block with a screwdriver.

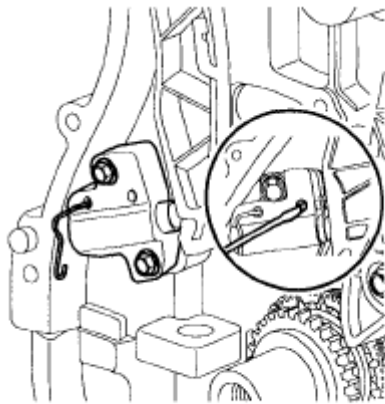


KCRF106A

**Fig. 29: Identifying Timing Chain Cover**  
Courtesy of KIA MOTORS AMERICA, INC.

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

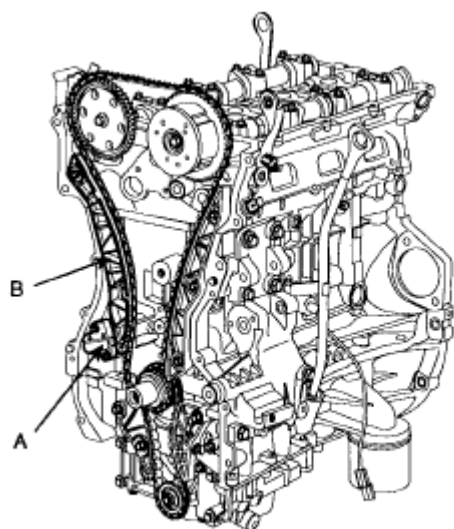
21. The key of crankshaft should be aligned with the mating face of main bearing cap. As a result of this, the piston of No.1 cylinder is placed at the top dead center on compression stroke.
22. Install a set pin after compressing the timing chain tensioner.



KCRF105A

**Fig. 30: Identifying Timing Chain Tensioner Set Pin**  
Courtesy of KIA MOTORS AMERICA, INC.

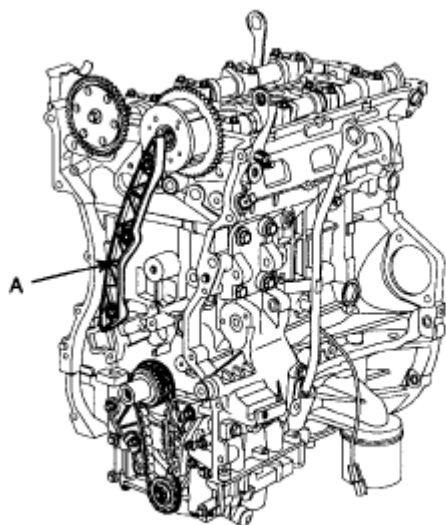
23. Remove the timing chain tensioner (A).



ACLG023A

**Fig. 31: Identifying Timing Chain Tensioner**  
Courtesy of KIA MOTORS AMERICA, INC.

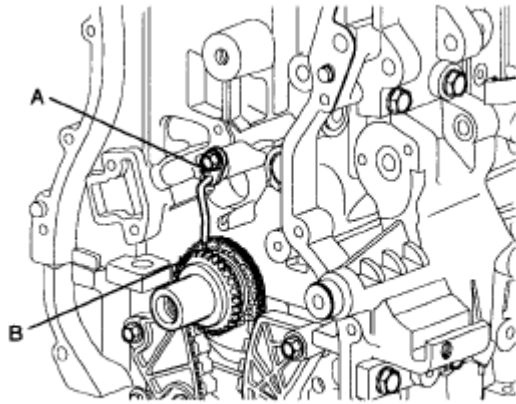
24. Remove the timing chain tensioner arm (B).
25. Remove the timing chain.
26. Remove the timing chain guide (A).



ACLG024A

**Fig. 32: Identifying Timing Chain Guide**  
Courtesy of KIA MOTORS AMERICA, INC.

27. Remove the timing chain oil jet (A).



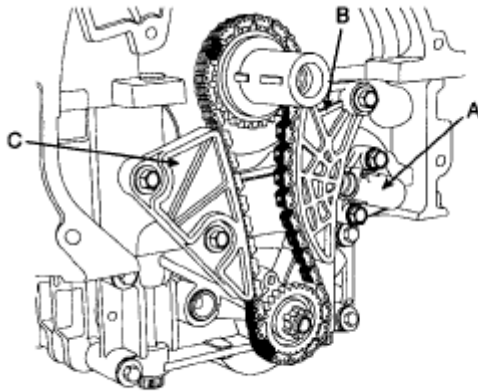
KCRF101A

**Fig. 33: Identifying Timing Chain Oil Jet**  
Courtesy of KIA MOTORS AMERICA, INC.

28. Remove the crankshaft chain sprocket (B).

#### BALANCE SHAFT CHAIN

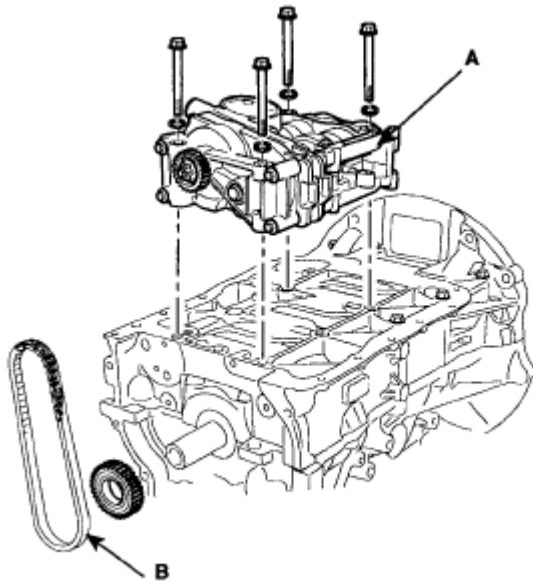
1. Remove the timing chain.
2. Install a set pin after compressing the balance shaft chain tensioner.
3. Remove the balance shaft chain tensioner (A).



KCRF117A

**Fig. 34: Identifying Balance Shaft Chain Tensioner**  
Courtesy of KIA MOTORS AMERICA, INC.

4. Remove the balance shaft chain tensioner arm (B).
5. Remove the balance shaft chain guide (C).
6. Remove the balance shaft module (A) and balance shaft chain (B).



ACLG034A

**Fig. 35: Identifying Balance Shaft Module And Balance Shaft Chain**  
Courtesy of KIA MOTORS AMERICA, INC.

## INSPECTION

### SPROCKETS, CHAIN TENSIONER, CHAIN GUIDE, CHAIN TENSIONER ARM

1. Check the camshaft sprocket and crankshaft sprocket for abnormal wear, cracks, or damage. Replace as necessary.
2. Inspect the tensioner arm and chain guide for abnormal wear, cracks, or damage.

Replace as necessary.

3. Check that the tensioner piston moves smoothly when the ratchet pawl is released with thin rod.

### BELT, IDLER, BELT TENSIONER, PULLEY

1. Check the belt for oil or dust deposits.

Replace, if necessary.

Small deposits 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 of the following flaws are evident, replace the belt.

#### NOTE:

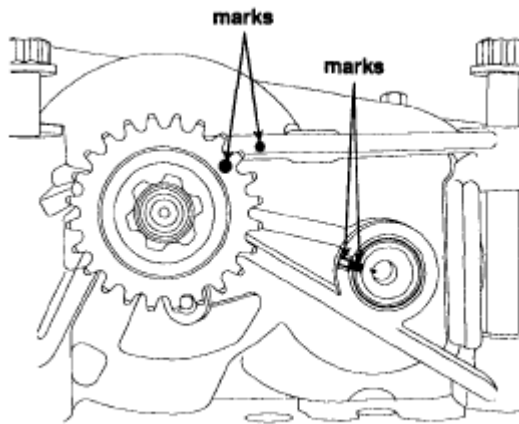
- Do not bend, twist or turn the timing belt inside out.
- Do not allow the timing belt to come into contact with oil, water and steam.

3. Inspect the idler for easy and smooth rotation and check for play or noise.

## INSTALLATION

### BALANCE SHAFT CHAIN

1. The key of crankshaft should be aligned with the mating face of main bearing cap. As a result of this, the piston of No.1 cylinder is placed at the top dead center on compression stroke.
2. Confirm the balance shaft module timing mark. Timing marks to be visually aligned with centers of adjacent cast timing notches.



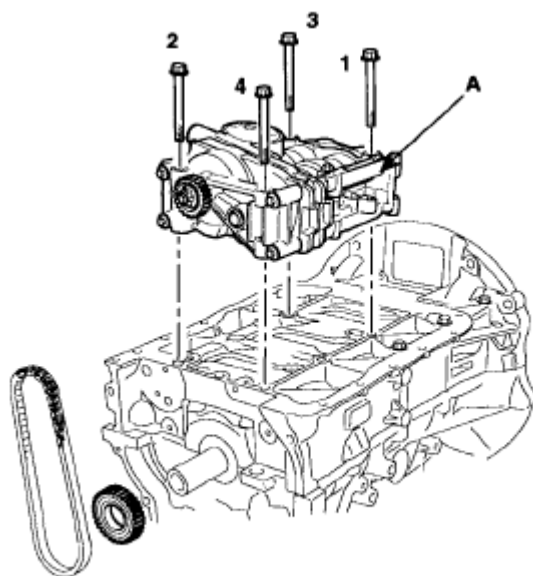
ECRF006A

**Fig. 36: Identifying Balance Shaft Module Timing Mark**  
Courtesy of KIA MOTORS AMERICA, INC.

3. Install balance shaft module (A) that the timing mark of balance shaft module sprocket should be matched with the timing mark (color link) of balance shaft chain.

### Tightening torque

16.66 N.m (1.7 kgf.m, 12.3 lb-ft) + 60° + 60°



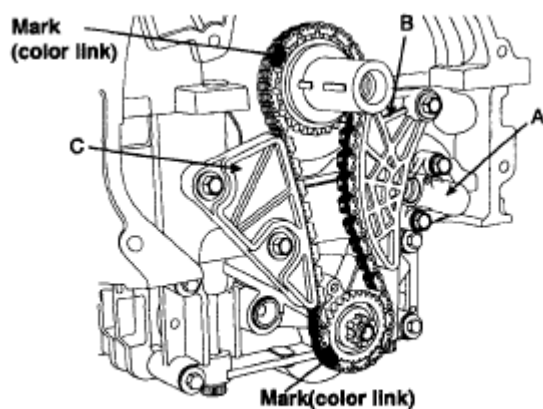
KCRF165B

**Fig. 37: Identifying Balance Shaft Module**  
Courtesy of KIA MOTORS AMERICA, INC.

4. Install the balance shaft chain guide (C).

**Tightening torque**

9.8-11.76 N.m (1.0-1.2 kgf.m, 7.23-8.67 lb-ft)



ECRF007A

**Fig. 38: Identifying Balance Shaft Chain Guide**  
Courtesy of KIA MOTORS AMERICA, INC.

5. Install the balance shaft tensioner arm (B).

**Tightening torque**

9.8-11.76 N.m (1.0-1.2 kgf.m, 7.23-8.67 lb-ft)

6. Install the balance shaft tensioner (A) and remove the set pin.

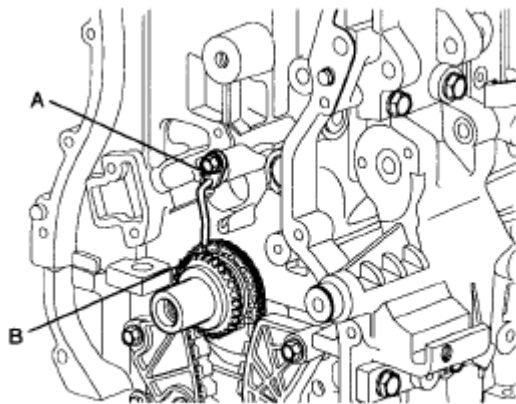
**Tightening torque**

9.8-11.76 N.m (1.0-1.2 kgf.m, 7.23-8.67 lb-ft)

7. Confirm the timing marks.

**TIMING CHAIN**

1. Install crankshaft chain sprocket (B).



KCRF101A

**Fig. 39: Identifying Timing Chain Oil Jet**  
Courtesy of KIA MOTORS AMERICA, INC.

2. Install timing chain oil jet (A).

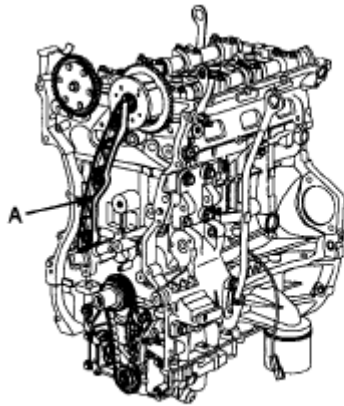
**Tightening torque**

7.84-9.8 N.m (0.8-1.0 kgf.m, 5.78-7.23 lb-ft)

3. Set crankshaft that the key of crankshaft should be aligned with the mating surface of main bearing cap. Put the intake, exhaust camshaft assembly that the TDC mark of intake sprocket and exhaust sprocket should be aligned with the top surface of cylinder head. As a result of this, place the piston on No.1 cylinder at the top dead center on compression stroke.
4. install timing chain guide (A).

**Tightening torque**

9.8-11.6 N.m (1.0-1.2 kgf.m, 7.23-8.67 lb-ft)



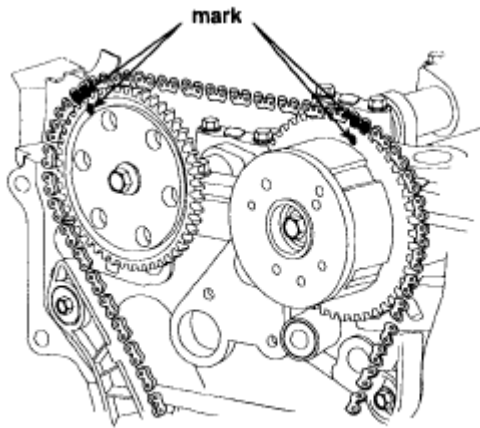
KCRF103A

**Fig. 40: Identifying Timing Chain Guide**  
Courtesy of KIA MOTORS AMERICA, INC.

5. Install timing chain.

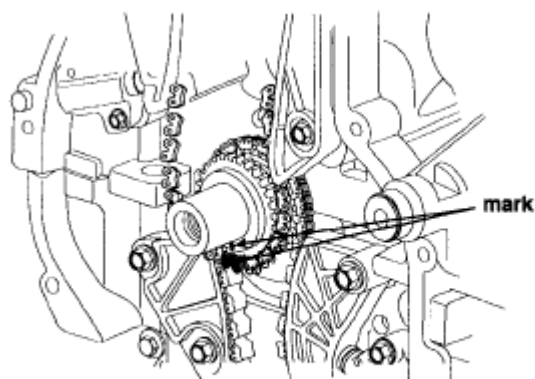
To install the timing chain with no slack between each shaft (cam, crank), follow the below procedure. Crankshaft sprocket (A) -> Timing chain guide (B) -> Intake camshaft sprocket (C) -> Exhaust camshaft sprocket (D).

The timing mark of each sprockets should be matched with timing mark (color link) of timing chain at installing timing chain.



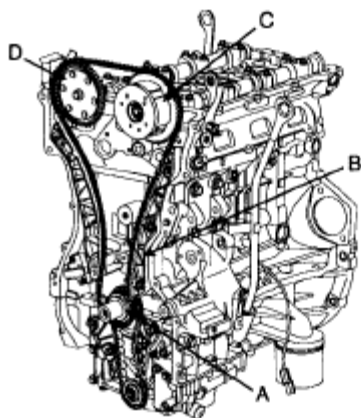
ECRF030A

**Fig. 41: Identifying Timing Mark, Crankshaft Sprocket And Timing Chain Guide**  
Courtesy of KIA MOTORS AMERICA, INC.



ECRF031A

**Fig. 42: Identifying Timing Mark, Crankshaft Sprocket And Timing Chain Guide**  
Courtesy of KIA MOTORS AMERICA, INC.



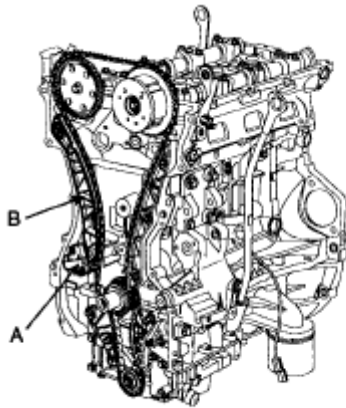
KCRF104B

**Fig. 43: Identifying Camshaft Sprocket, Crankshaft Sprocket And Timing Chain Guide**  
Courtesy of KIA MOTORS AMERICA, INC.

6. Install timing chain tensioner arm (B).

**Tightening torque**

9.8-11.76 N.m (1.0-1.2 kgf.m, 7.23-8.67 lb-ft)



KCRF104A

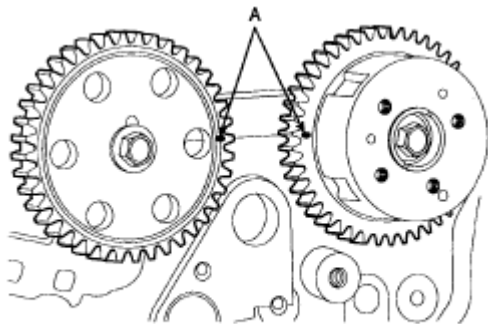
**Fig. 44: Identifying Timing Chain Tensioner Arm**  
Courtesy of KIA MOTORS AMERICA, INC.

7. Install timing chain auto tensioner (A) and remove set p in.

#### **Tightening torque**

9.8-11.76 N.m (1.0-1.2 kgf.m, 7.23-8.67 lb-ft)

8. After rotating crankshaft 2 revolutions in regular direction (clockwise viewed from front), confirm the timing mark.



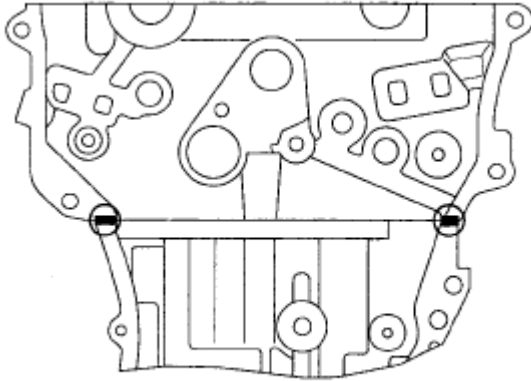
ACRF007A

**Fig. 45: Identifying Mark Of Camshaft Timing Sprockets On Cylinder Head Surface**  
Courtesy of KIA MOTORS AMERICA, INC.

9. Install timing chain cover.
  1. The sealant locations on chain cover and on counter parts (cylinder head, cylinder block, and ladder frame) must be free of engine oil and ETC.
  2. Before assembling the timing chain cover, the liquid sealant Loctite 5900 should be applied on the gap between cylinder head and cylinder block.

The part must be assembled within 5 minutes after sealant was applied.

Bead width: 2.5 mm (0.1 in.)



ECRF008A

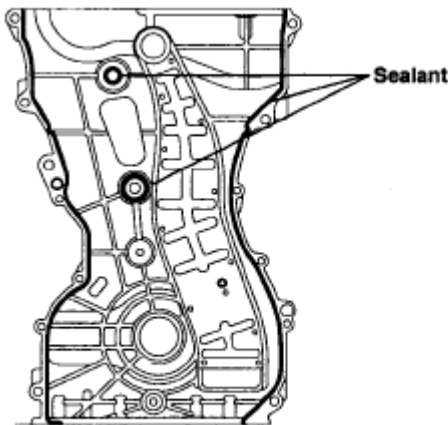
**Fig. 46: Identifying Sealant Area Between Cylinder Head And Cylinder Block**  
Courtesy of KIA MOTORS AMERICA, INC.

3. After applying liquid sealant Loctite 5900 on timing chain cover.

The part must be assembled within 5 minutes after sealant was applied.

Sealant should be applied without discontinuity.

Bead width: 2.5 mm (0.1 in.)



ECRF008A

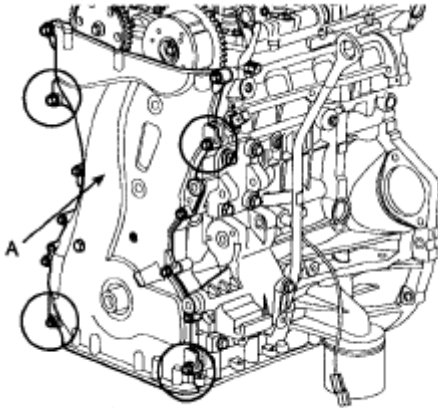
**Fig. 47: Identifying Sealant On Timing Chain Cover**  
Courtesy of KIA MOTORS AMERICA, INC.

4. The dowel pins on the cylinder block and holes on the timing chain cover should be used as a reference in order to assemble the timing chain cover (A) to be in exact position.

**Tightening torque**

M6: 7.84-9.8 N.m (0.8-1.0 kgf.m, 5.78-7.23 lb-ft)

M8: 18.62-22.54 N.m (1.9-2.3 kgf.m, 13.74-16.63 lb-ft)



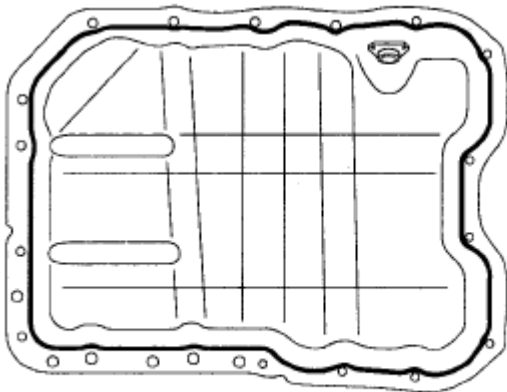
KCRF106A

**Fig. 48: Identifying Timing Chain Cover**  
Courtesy of KIA MOTORS AMERICA, INC.

5. The firing and/or blow out test should not be performed within 30 minutes after the timing chain cover was assembled.
10. Install oil pan.
  1. Using a gasket scraper, remove all the old packing material from the gasket surfaces.
  2. Before assembling the oil pan, the liquid sealant Loctite 5900 should be applied on oil pan.

The part must be assembled within 5 minutes after the sealant was applied.

Sealant: Loctite 5900 or equivalent



KCRF179A

**Fig. 49: Applying Sealant On Oil Pan**

Courtesy of KIA MOTORS AMERICA, INC.

**CAUTION:**

- When applying sealant gasket, sealant must not be protruded into the inside of oil pan.
- To prevent leakage of oil, apply sealant gasket to the inner threads of the bolt holes.

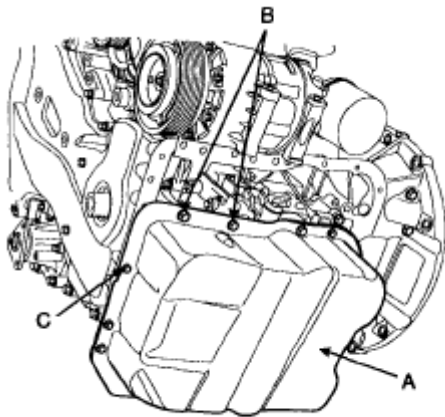
3. Install oil pan (A).

Uniformly tighten the bolts in several passes.

**Tightening torque**

M8 (B): 26.46-30.38 N.m (2.7-3.1 kgf.m, 19.52-22.41 lb-ft)

M6 (C): 9.8-11.76 N.m (1.0-1.2 kgf.m, 7.23-8.67 lb-ft)



KCRF114B

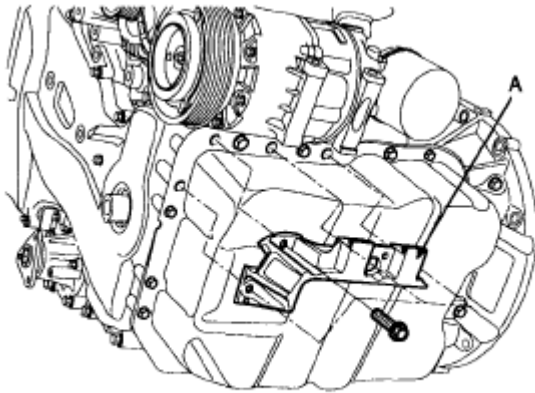
**Fig. 50: Identifying Oil Pan Mounting Bolts**

Courtesy of KIA MOTORS AMERICA, INC.

4. After assembly, wait at least 30 minutes before filling the engine with oil.
11. Install air compressor bracket (A).

**Tightening torque**

19.6-23.52 N.m (2.0-2.4 kgf.m, 14.46-17.35 lb-ft)



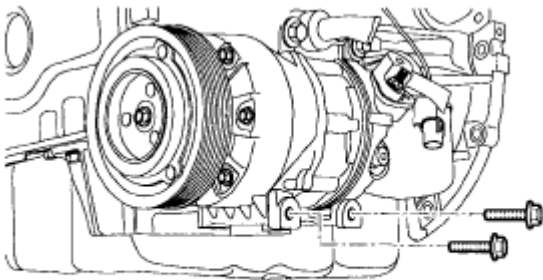
KCRF113A

**Fig. 51: Identifying Compressor Bracket**  
Courtesy of KIA MOTORS AMERICA, INC.

12. Install air compressor bolt

**Tightening torque**

19.6-24.5 N.m (2.0-2.5 kgf.m, 14.46-18.07 lb-ft)

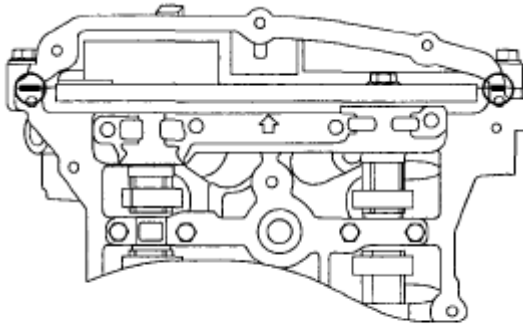


KCRF112A

**Fig. 52: Identifying Compressor Lower Bolts**  
Courtesy of KIA MOTORS AMERICA, INC.

13. Install cylinder head cover.
1. The hardening sealant located on the upper area between timing chain cover and cylinder head should be removed before assembling cylinder head cover.
  2. After applying sealant, it should be assembled within 5 minutes.

Bead width: 2.5 mm (0.1 in.)



ECRF011A

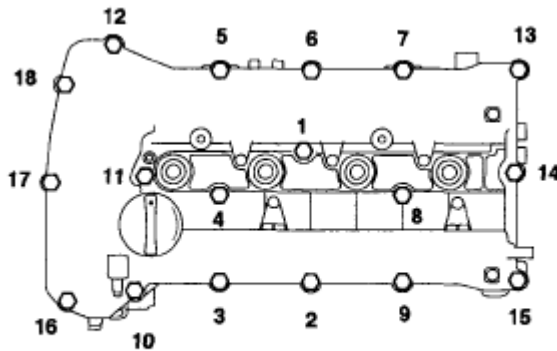
**Fig. 53: Identifying Upper Area Between Timing Chain Cover And Cylinder Head**  
Courtesy of KIA MOTORS AMERICA, INC.

3. The firing and/or blow out test should not be performed within 30 minutes after the cylinder head cover was assembled.
4. Install the cylinder head cover bolts as following method.

**Tightening torque**

1st step: 3.92-5.88 N.m (0.4-0.6 kgf.m, 2.89-4.34 lb-ft)

2st step: 7.84-9.8 N.m (0.8-1.0 kgf.m, 5.78-7.23 lb-ft)

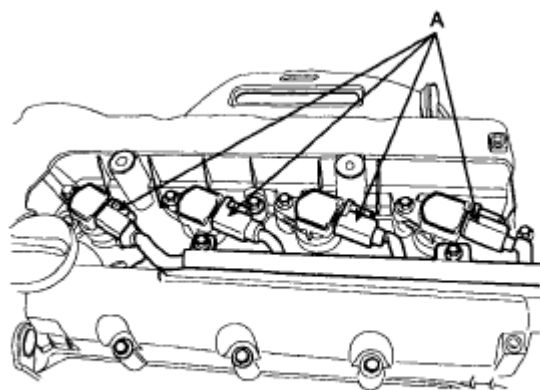


KCRF180A

**Fig. 54: Identifying Cylinder Head Cover Bolt Tightening Sequence**  
Courtesy of KIA MOTORS AMERICA, INC.

**CAUTION: Do not reuse cylinder head cover gasket.**

14. Install ignition coil.
15. Connect ignition coil connector (A).



KCRF131A

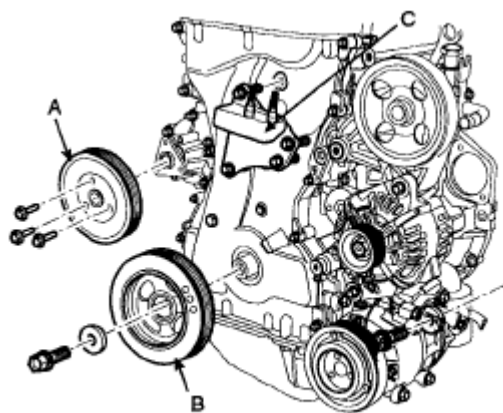
**Fig. 55: Identifying Ignition Coil Connector**  
Courtesy of KIA MOTORS AMERICA, INC.

16. Install engine support bracket (C).

**Tightening torque**

M10: 39.2-44.1 N.m (4.0-4.5 kgf.m, 28.92-32.53 lb-ft)

M8: 19.6-24.5 N.m (2.0-2.5 kgf.m, 14.46-18.07 lb-ft)



ACLG033A

**Fig. 56: Identifying Water Pump Pulley**  
Courtesy of KIA MOTORS AMERICA, INC.

17. Using flywheel stopper, install crankshaft pulley (B).

**Tightening torque**

166.6-176.4 N.m (17-18 kgf.m, 122.9-130.13 lb-ft)

18. Install water pump pulley (A).

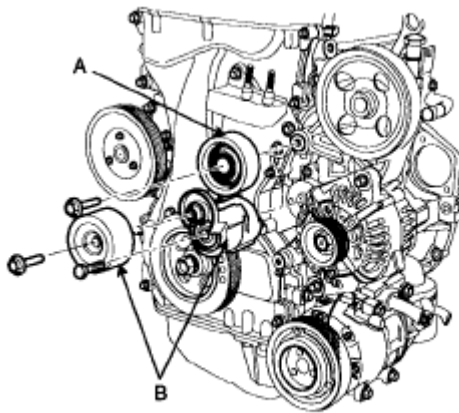
**Tightening torque**

7.84-9.8 N.m (0.8-1.0 kgf.m, 5.78-7.23 lb-ft)

19. Install drive belt tensioner (B) and tensioner pulley.

**Tightening torque**

53.9-63.7 N.m (5.5-6.5 kgf.m, 39.7-47.0 lb-ft)



ACLG032A

**Fig. 57: Identifying Idler Pulley**  
Courtesy of KIA MOTORS AMERICA, INC.

**NOTE:** Tensioner pulley bolt is left-hand screw.

20. Install idler pulley (A)

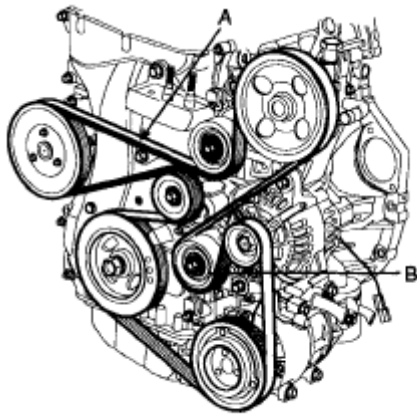
**Tightening torque**

53.9-63.7 N.m (5.5-6.5 kgf.m, 39.7-47.0 lb-ft)

21. Install drive belt (A)

Crankshaft pulley --> A/C pulley --> alternator pulley --> idler pulley --> P/C pump pulley --> idler pulley --> water pump pulley --> tensioner pulley.

Rotate auto tensioner arm in the counter - clockwise moving auto tensioner pulley bolt with wrench. After putting belt on auto tensioner pulley, release the auto tensioner pulley slowly.



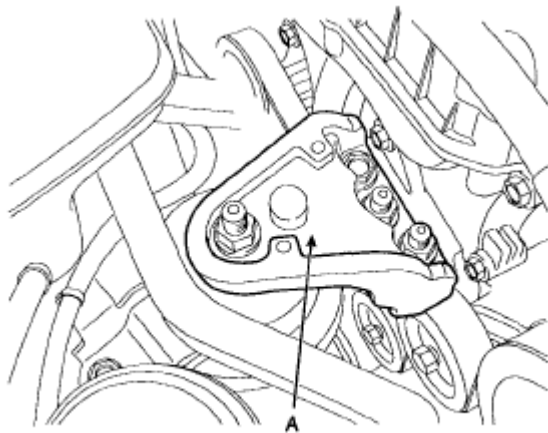
ACLG035A

**Fig. 58: Identifying Drive Belt Routing**  
Courtesy of KIA MOTORS AMERICA, INC.

22. Install engine mounting bracket (A).

**Tightening torque**

63.7-83.3 N.m (6.5-8.5 kgf.m, 47.0-61.4 lb-ft)



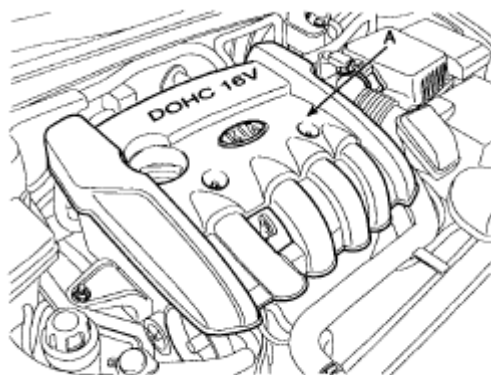
SMGEM6010N

**Fig. 59: Identifying Engine Mount Bracket**  
Courtesy of KIA MOTORS AMERICA, INC.

23. Install RH side cover.  
24. Install RH front wheel.  
25. Install engine cover (A).

**Tightening torque**

3.92-5.88 N.m (0.4-0.6 kgf.m, 2.89-4.34 lb-ft)

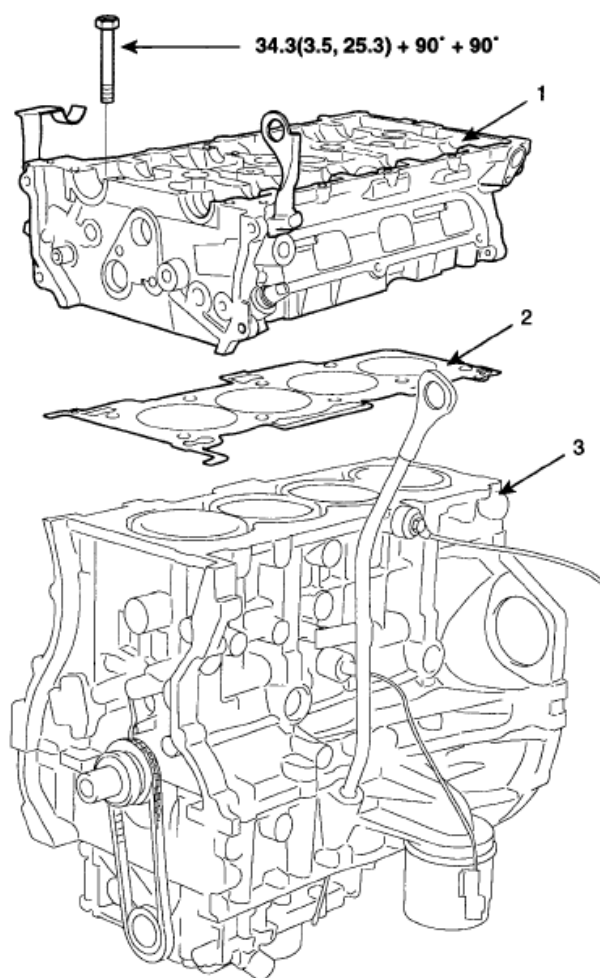


ACLG001A

**Fig. 60: Identifying Engine Cover**  
Courtesy of KIA MOTORS AMERICA, INC.

## **CYLINDER HEAD ASSEMBLY**

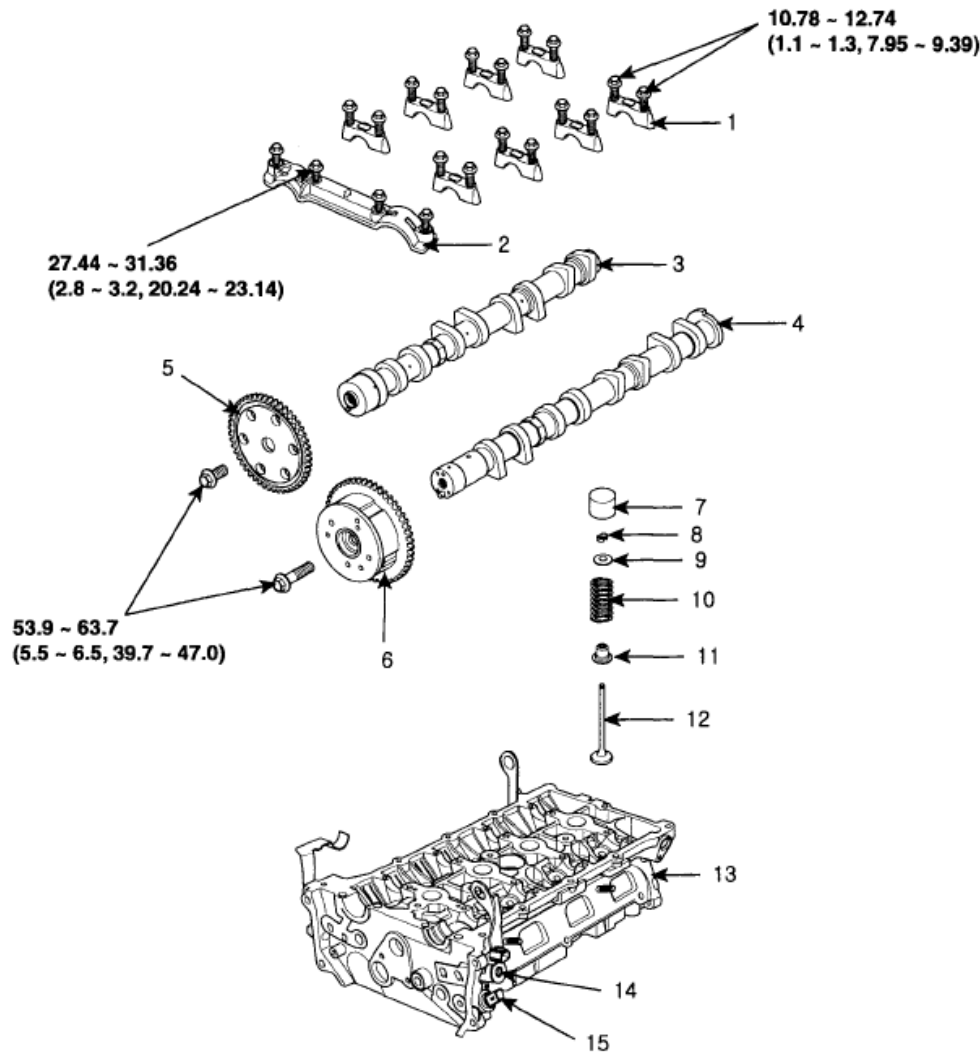
### **COMPONENTS**

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

- 1. Cylinder head
- 2. Cylinder head gasket
- 3. Cylinder block

SMGEM0014N

**Fig. 61: Identifying Cylinder Head Assembly Components & Torque Specification (1 Of 2)**  
Courtesy of KIA MOTORS AMERICA, INC.



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

- |                               |                  |                     |
|-------------------------------|------------------|---------------------|
| 1. Camshaft bearing cap       | 6. CVVT assembly | 11. Valve stem seal |
| 2. Camshaft front bearing cap | 7. MLA           | 12. Valve           |
| 3. Exhaust camshaft           | 8. Retainer lock | 13. Cylinder head   |
| 4. Intake camshaft            | 9. Retainer      | 14. OCV             |
| 5. Exhaust camshaft sprocket  | 10. Valve spring | 15. OTS             |

SMGEM6015N

**Fig. 62: Identifying Cylinder Head Assembly Components & Torque Specification (2 Of 2)**  
Courtesy of KIA MOTORS AMERICA, INC.

**REMOVAL**

Engine removal is not required for this procedure.

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

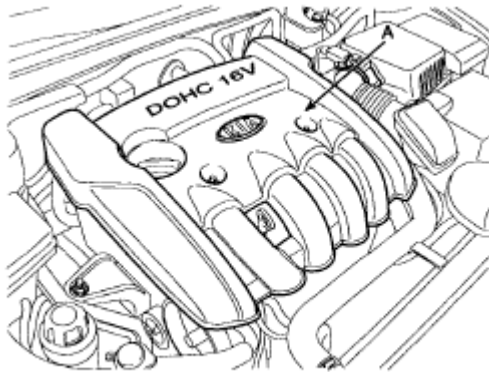
temperature drops below normal temperature before removing it.

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

**NOTE:**

- Mark all wiring and hoses to avoid mis-connection.
- Turn the crankshaft pulley so that the No. 1 piston is at top dead center.

1. Disconnect the negative terminal from the battery.
2. Remove engine cover (A).

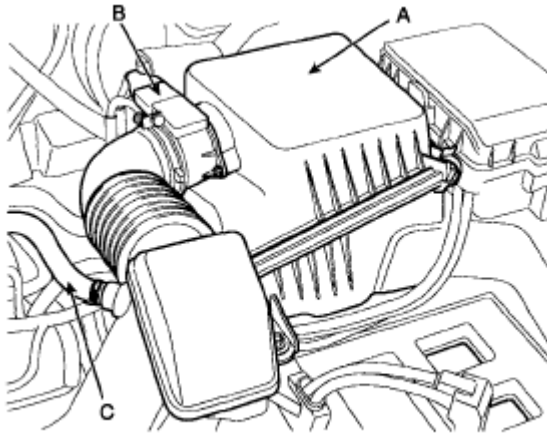


ACLG001A

**Fig. 63: Identifying Engine Cover**

Courtesy of KIA MOTORS AMERICA, INC.

3. Remove air duct.
4. Remove the intake air hose and air cleaner assembly.
  1. Disconnect the AFS (B) connector.
  2. Disconnect the breather hose (C) from air cleaner hose.
  3. Disconnect the ECU connector. Refer to **FUEL DELIVERY SYSTEM (FUEL SYSTEM - G4KC-GSL 2.4L)** .
  4. Remove the intake air hose and air cleaner (A).



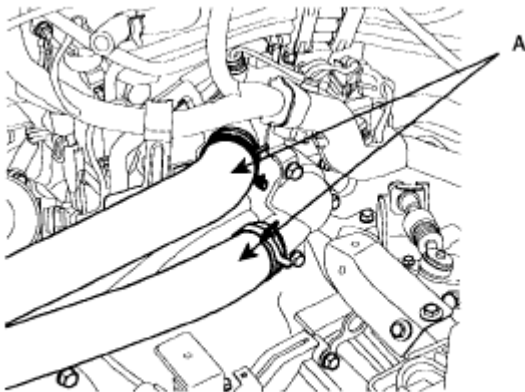
ACLG020A

**Fig. 64: Identifying Intake Air Hose And Air Cleaner**  
Courtesy of KIA MOTORS AMERICA, INC.

5. Remove front wheels.
6. Remove under cover.
7. Drain the engine coolant.

Remove the radiator cap to speed draining.

8. Remove the upper and lower radiator hose (A).



KCRF124A

**Fig. 65: Identifying Upper Radiator Hose And Lower Radiator Hose**  
Courtesy of KIA MOTORS AMERICA, INC.

9. Remove the heater hoses (A).

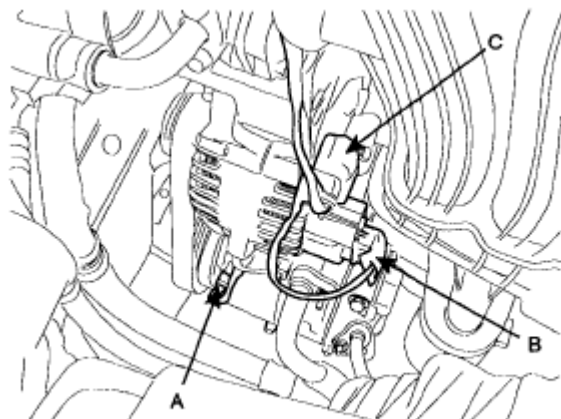


ACLG003A

**Fig. 66: Identifying Heater Hoses**

Courtesy of KIA MOTORS AMERICA, INC.

10. Disconnect A/C switch (A), alternator connector (B), and oil pressure switch (C).

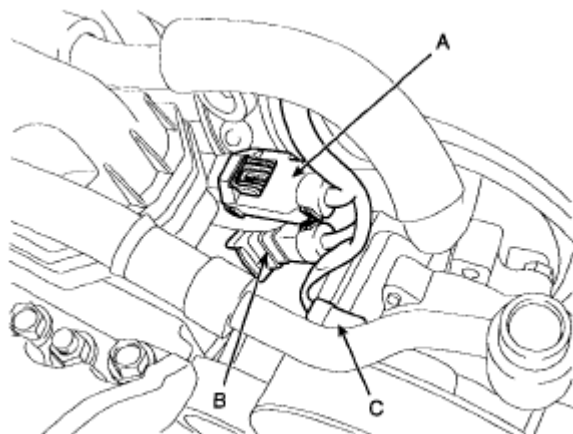


KCRF126A

**Fig. 67: Identifying A/C Switch, Alternator Connector And Oil Pressure Switch**

Courtesy of KIA MOTORS AMERICA, INC.

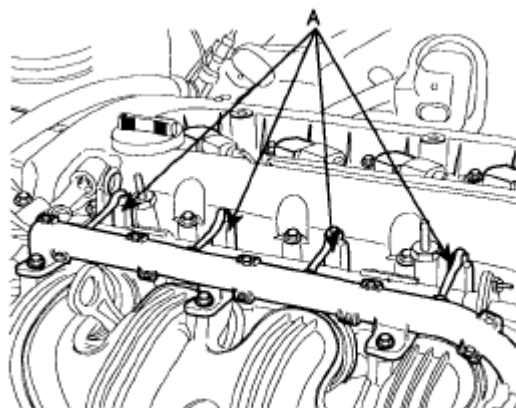
11. Disconnect OCV connector (A), OTS connector (B) and P/S switch connector (C).



ACLG004A

**Fig. 68: Identifying OCV Connector, OTS Connector And P/S Switch Connector**  
Courtesy of KIA MOTORS AMERICA, INC.

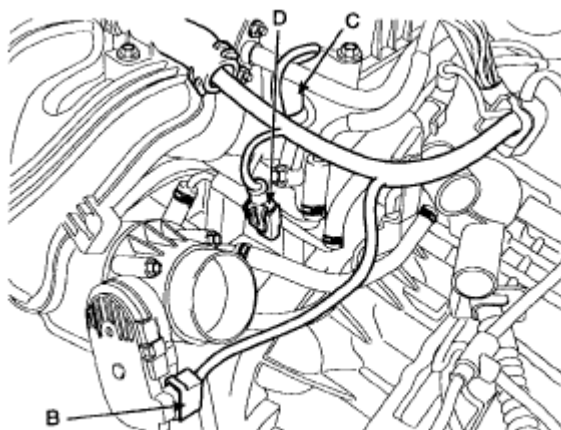
12. Disconnect injector connectors (A).



KCRF128A

**Fig. 69: Identifying Injector Connectors**  
Courtesy of KIA MOTORS AMERICA, INC.

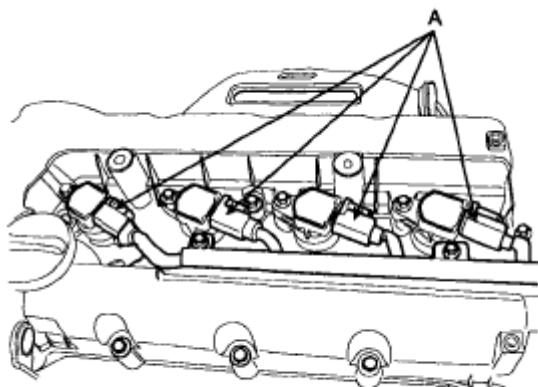
13. Disconnect the engine wire harness connectors.
  1. Remove the ETC connector (B), CMP connector (C), knock sensor connector (D).



ACLG005A

**Fig. 70: Identifying ETC Connector, CMP Connector And Knock Sensor Connector**  
Courtesy of KIA MOTORS AMERICA, INC.

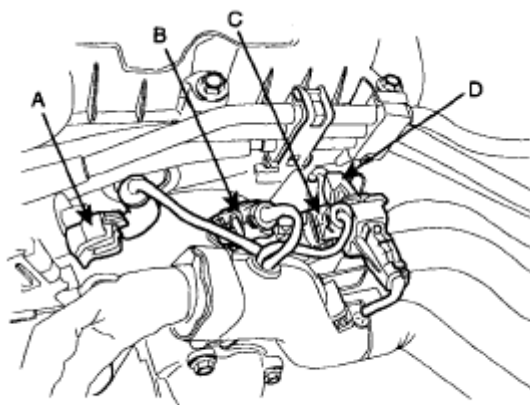
14. Disconnect ignition coil connectors (A).



KCRF131A

**Fig. 71: Identifying Ignition Coil Connector**  
Courtesy of KIA MOTORS AMERICA, INC.

15. Disconnect PCSV connector (A), WTS connector (B), condenser connector (C), and CKP sensor connector (D).

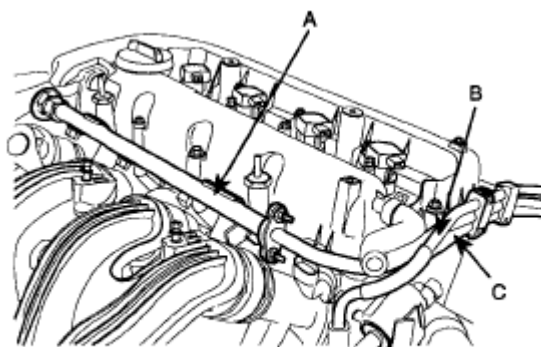


ACLG028A

**Fig. 72: Identifying PCSV Connector, WTS Connector, Condenser Connector And CKP Sensor Connector**

Courtesy of KIA MOTORS AMERICA, INC.

16. Remove delivery pipe (A), brake vacuum hose (B), and PCSV hose (C).

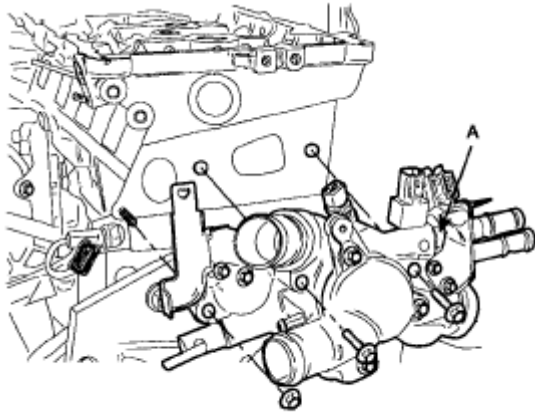


KCRF134A

**Fig. 73: Identifying Delivery Pipe, Brake Vacuum Hose And PCSV Hose**

Courtesy of KIA MOTORS AMERICA, INC.

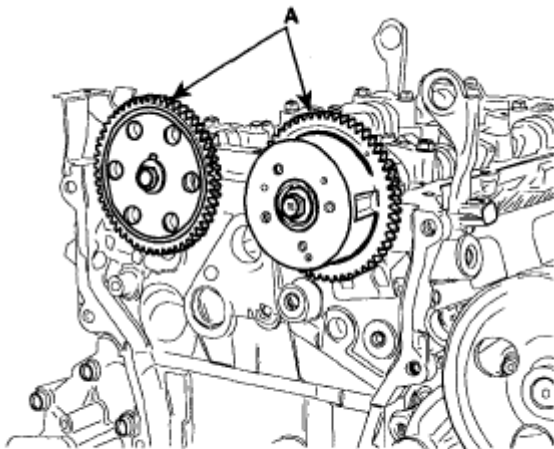
17. Remove water temp control assembly (A).



ACRF012A

**Fig. 74: Identifying Water Temp Control Assembly**  
Courtesy of KIA MOTORS AMERICA, INC.

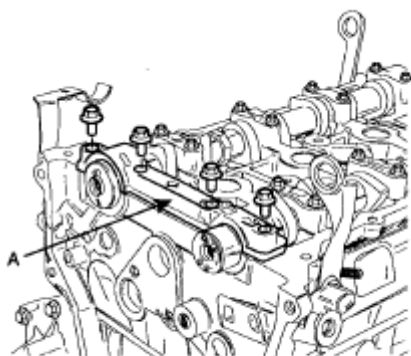
18. Remove intake manifold.
19. Remove exhaust manifold.
20. Remove timing chain.
21. Remove CVVT assembly and camshaft sprocket (A).



KCRF151A

**Fig. 75: Identifying CVVT Assembly And Camshaft Sprocket**  
Courtesy of KIA MOTORS AMERICA, INC.

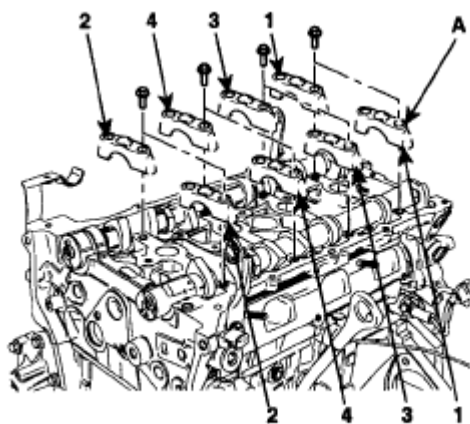
22. Remove camshaft.
  1. Remove front camshaft bearing cap (A).



KCRF153A

**Fig. 76: Identifying Front Camshaft Bearing Cap**  
Courtesy of KIA MOTORS AMERICA, INC.

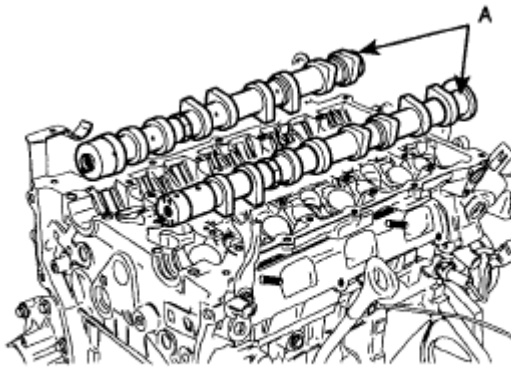
2. Remove camshaft bearing cap (A), in the sequence shown in illustration.



ACRF020A

**Fig. 77: Identifying Camshaft Bearing Cap In Sequence**  
Courtesy of KIA MOTORS AMERICA, INC.

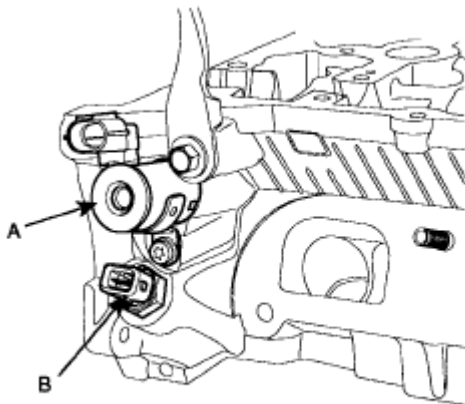
3. Remove camshafts (A)



KCRF155A

**Fig. 78: Identifying Camshafts**  
Courtesy of KIA MOTORS AMERICA, INC.

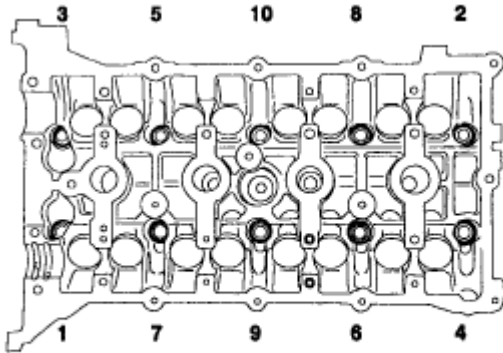
23. Remove OCV (A) and OTS (B).



KCRF119A

**Fig. 79: Identifying OCV And OTS**  
Courtesy of KIA MOTORS AMERICA, INC.

24. Remove the cylinder head bolts, then remove the cylinder head.
1. Using triple square 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.



KCRF182A

**Fig. 80: Cylinder Head Bolt Tightening Sequence**  
Courtesy of KIA MOTORS AMERICA, INC.

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

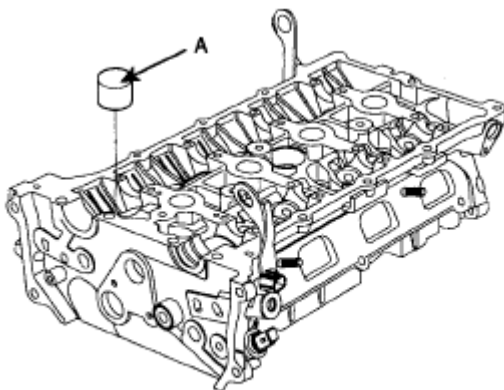
2. Lift the cylinder head from the dowels on the cylinder block and place the cylinder head on wooden blocks on a bench.

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

## DISASSEMBLY

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

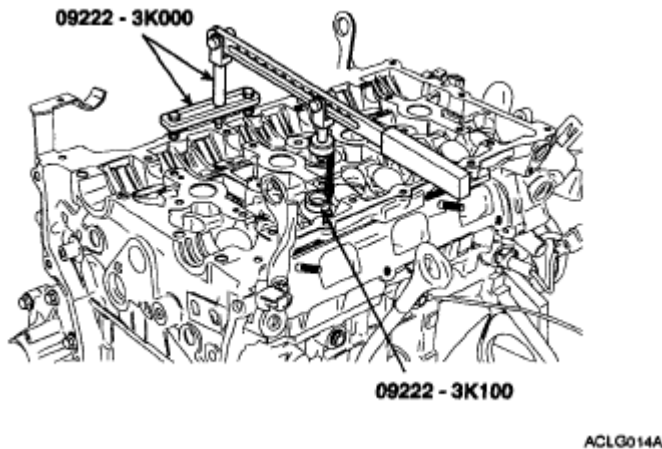
1. Remove MLAs (A).



KCRF125A

**Fig. 81: Identifying MLAs****Courtesy of KIA MOTORS AMERICA, INC.**

2. Remove valves.
  1. Using SST (09222-3K000, 09222-3K100), compress the valve spring and remove retainer lock.

**Fig. 82: Identifying SST (09222-3K000, 09222-3K100), Compress Valve Spring And Retainer Lock****Courtesy of KIA MOTORS AMERICA, INC.**

2. Remove the spring retainer.
3. Remove the valve spring.
4. Remove the valve.
5. Using needle-nose pliers, remove the valve stem seal.

**INSPECTION****CYLINDER HEAD**

1. Inspect for flatness.

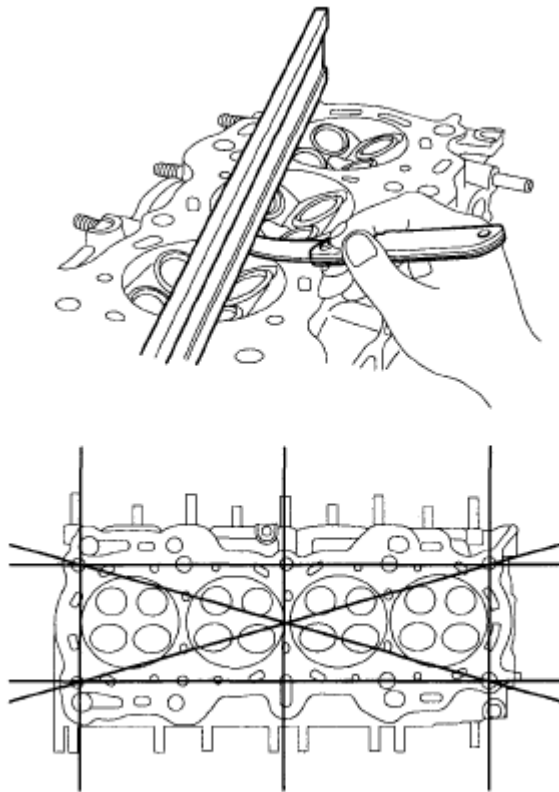
Using a precision straight edge and feeler gauge, measure the surface the contacting the cylinder block and the manifolds for warpage.

**Flatness of cylinder head gasket surface**

Standard: Less than 0.05 mm (0.002 in.) (0.02 mm (0.0008 in.)/100x100)

**Flatness of manifold mounting surface**

Standard: Less than 0.1 mm (0.0039 in.)



ECKD001H

**Fig. 83: Measuring Surface Cylinder Block And Manifolds For Warpage**  
Courtesy of KIA MOTORS AMERICA, INC.

2. Inspect for cracks.

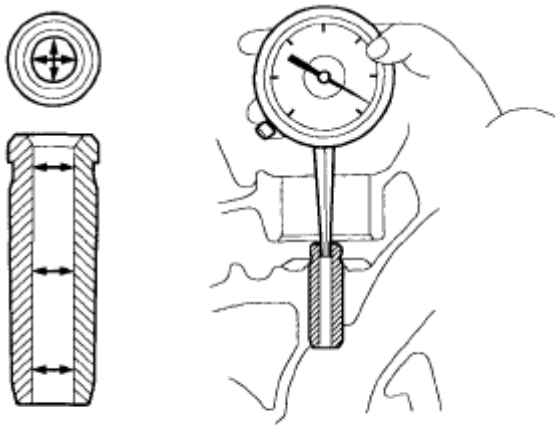
Check the combustion chamber, intake ports, exhaust ports and cylinder block surface for cracks. If cracked, replace the cylinder head.

#### **VALVE AND VALVE SPRING**

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

##### **Valve guide I.D.**

Intake/Exhaust: 5.500-5.512 mm (0.216-0.217 in.)



ECKD219A

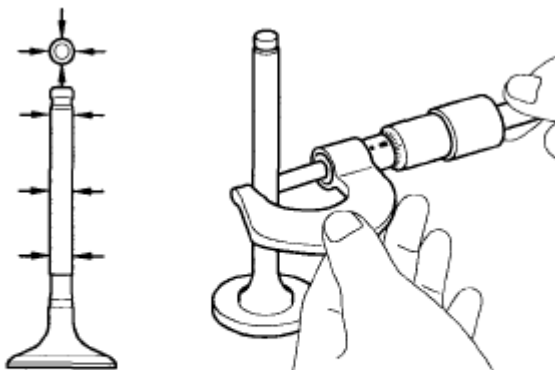
**Fig. 84: Measuring Inside Diameter Of Valve Guide**  
Courtesy of KIA MOTORS AMERICA, INC.

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

**Valve stem O.D.**

Intake: 5.465-5.480 mm (0.2151-0.2157 in.)

Exhaust: 5.458-5.470 mm (0.2149-0.2153 in.)



ECKD220A

**Fig. 85: Measuring Diameter Of Valve Stem**  
Courtesy of KIA MOTORS AMERICA, INC.

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

**Valve stem-to-guide clearance**

[Standard]

Intake: 0.020-0.047 mm (0.0008-0.0018 in.)

Exhaust: 0.030-0.054 mm (0.0012-0.0021 in.)

[Limit]

Intake: 0.07 mm (0.0027 in.)

Exhaust: 0.09 mm (0.0035 in.)

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

**2. Inspect valves.**

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

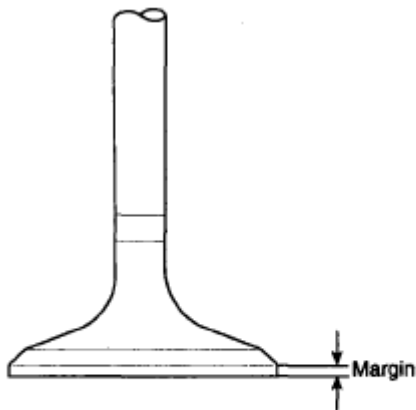
If the margin thickness is less than minimum, replace the valve.

**Margin**

[Standard]

Intake: 1.02 mm (0.0401 in.)

Exhaust: 1.09 mm (0.0429 in.)



ECKD221A

**Fig. 86: Identifying Valve Head Margin Thickness**  
**Courtesy of KIA MOTORS AMERICA, INC.**

4. Check the valve length.

**Valve length.**

[Standard]

Intake: 113.18 mm (4.4559 in.)

Exhaust: 105.89 mm (4.1689 in.)

[Limit]

Intake: 112.93 mm (4.4461 in.)

Exhaust: 105.74 mm (4.1630 in.)

5. Check the surface of the valve stem tip for wear.

If the valve stem tip is worn, replace the valve.

3. Inspect valve seats

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

Replace the seat if necessary.

Before reconditioning the seat, check the valve guide for wear. If the valve guide is worn, replace it, then recondition the seat. Recondition the valve seat with a valve seat grinder or cutter. The valve seat contact width should be within specifications and centered on the valve face.

4. Inspect valve springs.

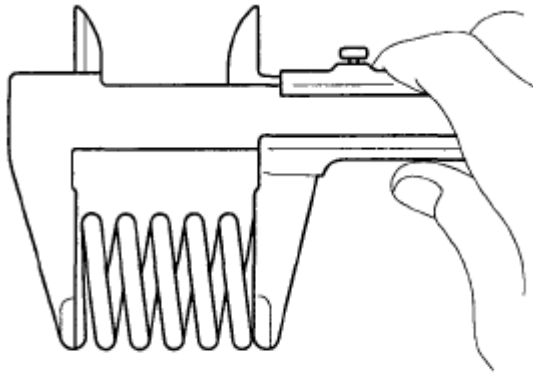
1. Using a steel square, measure the out-of-square of the valve spring.
2. Using a vernier calipers, measure the free length of the valve spring.

**Valve spring**

[Standard]

Free height: 47.44 mm (1.8677 in.)

Out-of-square: 1.5°



ECKD222A

**Fig. 87: Measuring Free Length Of Valve Spring**  
Courtesy of KIA MOTORS AMERICA, INC.

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

#### **MLA**

1. Inspect MLA.

Using a micrometer, measure the MLA outside diameter.

#### **MLA O.D.**

Intake/Exhaust: 31.964-31.980 mm (1.2584-1.2590 in.)

2. Using a caliper gauge, measure MLA tappet bore inner diameter of cylinder head.

#### **Tappet bore I.D.**

Intake/Exhaust: 32.000-32.025 mm (1.2598-1.2608 in.)

3. Subtract MLA outside diameter measurement from tappet bore inside diameter measurement.

#### **MLA to tappet bore clearance**

[Standard]

Intake/Exhaust: 0.020-0.061 mm (0.0008-0.0024 in.)

[Limit]

Intake/Exhaust: 0.07 mm (0.0027 in.)

**CAMSHAFT**

1. Inspect cam lobes.

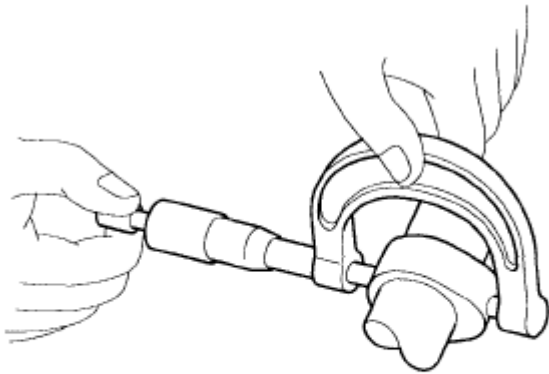
Using a micrometer, measure the cam lobe height.

**Cam height**

[Standard value]

Intake: 43.70-43.80 mm (1.7204-1.7244 in.)

Exhaust: 44.90-45.10 mm (1.7677-1.7756 in.)

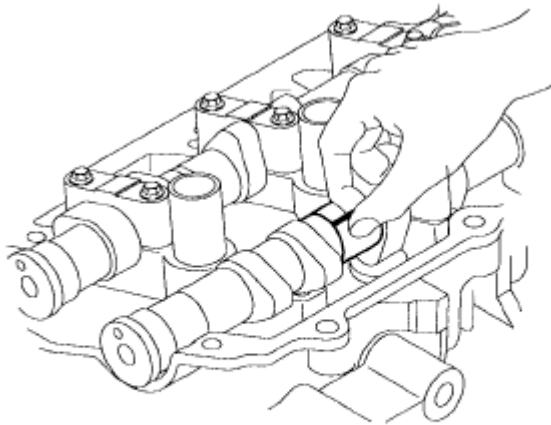


ECKD223A

**Fig. 88: Measuring Cam Lobe Height**  
**Courtesy of KIA MOTORS AMERICA, INC.**

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

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



ECKD224A

**Fig. 89: Identifying Camshafts On Cylinder Head**  
Courtesy of KIA MOTORS AMERICA, INC.

4. Install the bearing caps.

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

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

#### **Bearing oil clearance**

[Standard value]

Intake:

No. 1 journal: 0.020-0.057 mm (0.00078-0.00224in)

No. 2, 3, 4, 5: 0.045-0.082 mm (0.00177-0.00323in)

Exhaust:

No. 1, 2, 3, 4, 5: 0.045-0.082 mm (0.00177-0.00323in)

[Limit]

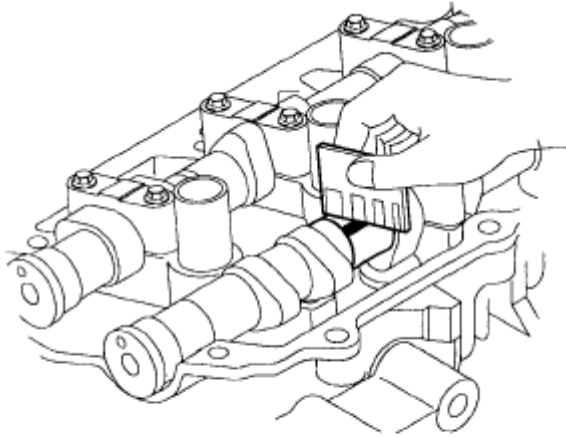
Intake:

No. 1 journal: 0.09 mm (0.0035in)

No. 2, 3, 4, 5: 0.12 mm (0.0047in)

Exhaust:

No. 1, 2, 3, 4, 5: 0.12 mm (0.0047in)



ECKD225A

**Fig. 90: Using Plastigage To Measure Widest Point**  
Courtesy of KIA MOTORS AMERICA, INC.

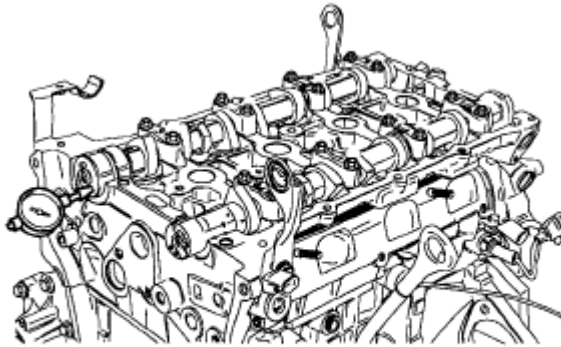
If the oil clearance is greater than maximum, replace the camshaft. If necessary, replace cylinder head.

7. Completely remove the plastigage.
8. Remove the camshafts.
3. Inspect camshaft end play.
  1. Install the camshafts.
  2. Using a dial indicator, measure the end play while moving the camshaft back and forth.

### **Camshaft end play**

[Standard value]: 0.10-0.22 mm (0.004-0.0087 in.)

[Limit]: 0.24 mm (0.0094 in.)



KCRF151B

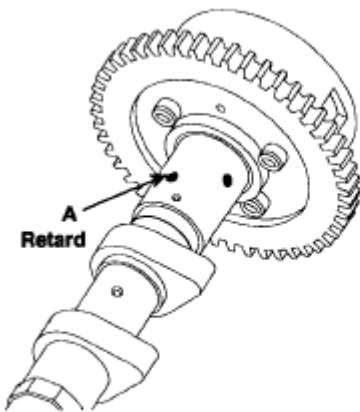
**Fig. 91: Measuring End Play Camshaft Back And Forth**  
Courtesy of KIA MOTORS AMERICA, INC.

If the end play is greater than maximum, replace the camshaft. If necessary, replace cylinder head.

3. Remove the camshafts.

#### CVVT ASSEMBLY

1. Inspect CVVT assembly.
  1. Check that the CVVT assembly will not turn.
  2. Apply vinyl tape to the retard hole (A) except the one indicated by the arrow in the illustration.



ECRF015A

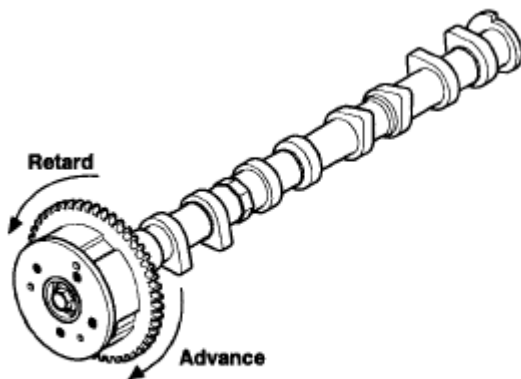
**Fig. 92: Applying Vinyl Tape To Retard Hole**  
Courtesy of KIA MOTORS AMERICA, INC.

3. Wind tape around the tip of the air gun and apply air of approx. 150 kPa (1.5 kgf/cm<sup>2</sup>, 21 psi) to the port of the camshaft.

(Perform this order to release the lock pin for the maximum delay angle locking.)

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

4. Under the condition of (3), turn the CVVT assembly to the advance angle side (the arrow marked direction in the illustration) with your hand. Depending on the air pressure, the CVVT assembly will turn to the advance side without applying force by hand. Also, under the condition that the pressure can be hardly applied because of the air leakage from the port, there may be the case that the lock pin could be hardly released.



ECRF016A

**Fig. 93: Identifying Retard And Advance Angle**  
Courtesy of KIA MOTORS AMERICA, INC.

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

Standard: Movable smoothly in the range about 22.5°

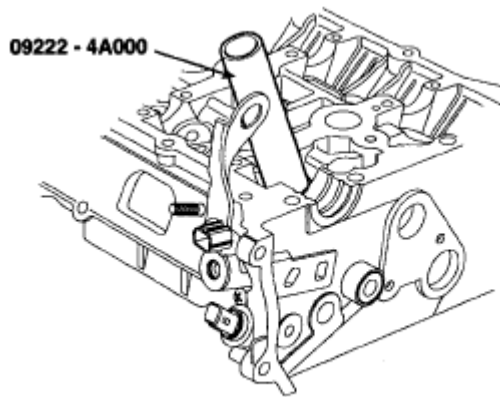
6. Turn the CVVT assembly with your hand and lock it at the maximum delay angle position (counter clockwise).

## REASSEMBLY

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

1. Install valves.
  1. Using SST (09222-4A000), push in a new oil seal.

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



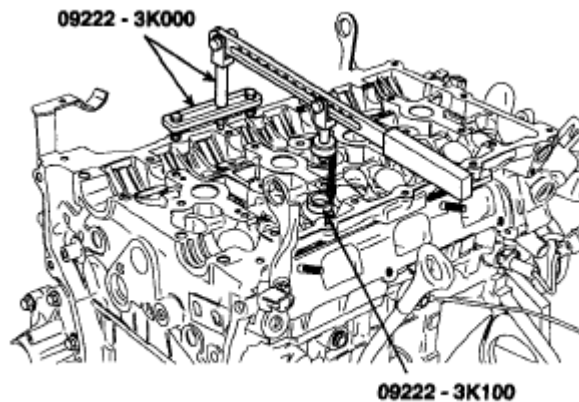
ACLG015A

**Fig. 94: Identifying SST (09222-4A000) And Oil Seal**  
Courtesy of KIA MOTORS AMERICA, INC.

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

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

3. Using the SST (09222-3K000, 09222-3K100), 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.

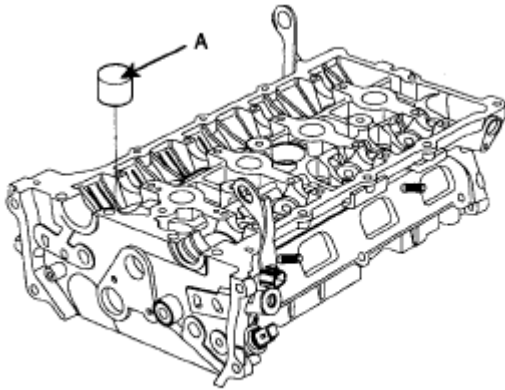


ACLG014A

**Fig. 95: Identifying SST (09222-3K000, 09222-3K100), Compress Valve Spring And Retainer Lock**  
Courtesy of KIA MOTORS AMERICA, INC.

4. 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.
2. Install MLAs.

Check that the MLA rotates smoothly by hand.



KCRF125A

**Fig. 96: Identifying MLAs**

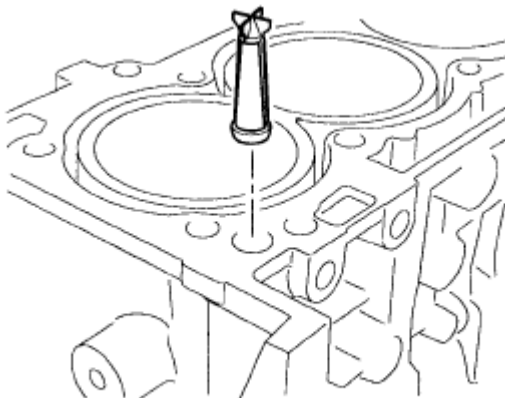
Courtesy of KIA MOTORS AMERICA, INC.

**NOTE:** MLA can be reinstalled in its original position.

## INSTALLATION

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

1. Install OCV filter.



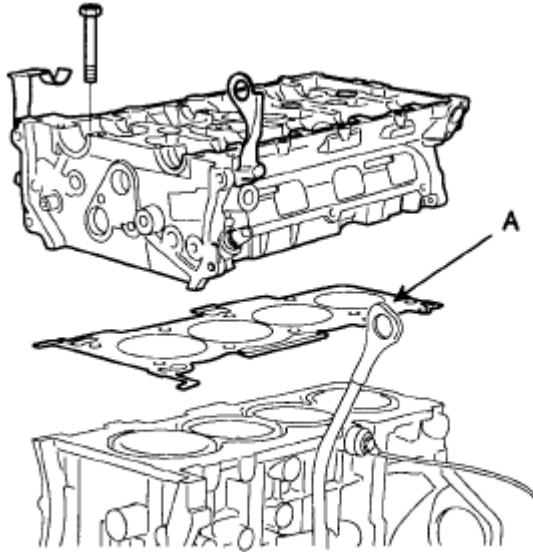
KCRF176A

**Fig. 97: Identifying OCV Filter**

Courtesy of KIA MOTORS AMERICA, INC.

**NOTE:** Keep the OCV filter clean.

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



KCRF163A

**Fig. 98: Positioning Cylinder Head Gasket On Cylinder Block**  
Courtesy of KIA MOTORS AMERICA, INC.

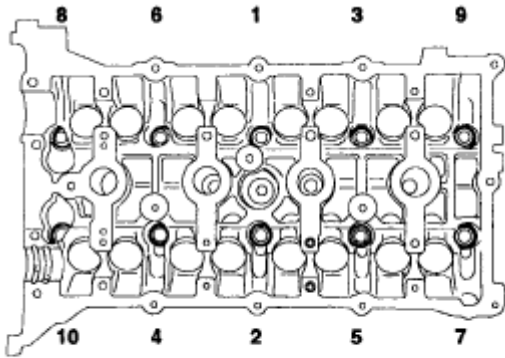
**NOTE:** Be careful of the installation direction.

3. Place the cylinder head carefully in order not to damage the gasket with the bottom part of the end.
4. Install cylinder head bolts.
  1. Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.
  2. Using triple square hexagon wrench, install and tighten the 10 cylinder head bolts and plate washers, in several passes, in the sequence shown in illustration.

#### **Tightening torque**

34.3 N.m (3.5 kgf.m, 25.3 lb-ft) + 90° + 90°

**NOTE:** Always use new cylinder head bolt.



KCRF102B

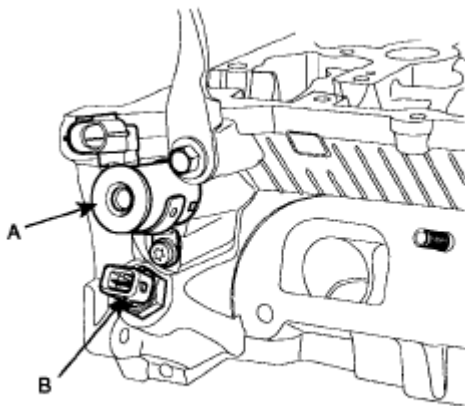
**Fig. 99: Identifying Cylinder Head Bolt Tightening Sequence**  
Courtesy of KIA MOTORS AMERICA, INC.

5. Install OCV (A) and OTS (B).

**Tightening torque**

OCV: 9.8-11.76 N.m (1.0-1.2 kgf.m, 7.23-8.67 lb-ft)

OTS: 19.6-23.52 N.m (2.0-2.4 kgf.m, 14.46-17.35 lb-ft)



KCRF119A

**Fig. 100: Identifying OCV And OTS**  
Courtesy of KIA MOTORS AMERICA, INC.

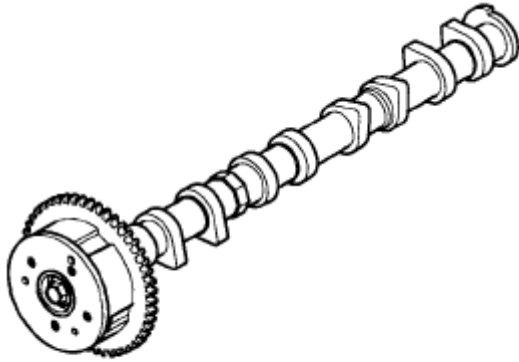
**CAUTION:**

- Do not reuse the OCV when dropped.
- Keep clean the OCV.
- Do not hold the OCV sleeve during servicing.
- When the OCV is installed on the engine, do not move the engine with holding the OCV yoke.

6. Install the CVVT and camshaft sprocket.

**Tightening torque**

53.9-63.7 N.m (5.5-6.5 kgf.m, 39.7-47.0 lb-ft)

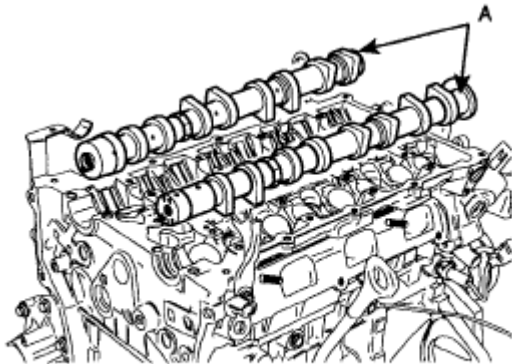


KCRF122A

**Fig. 101: Identifying CVVT And Camshaft Sprocket**  
Courtesy of KIA MOTORS AMERICA, INC.

**NOTE:** Hold the hexagonal head wrench portion of the camshaft with a vise, and install the bolt and CVVT assembly.

7. Install camshafts (A).



KCRF155A

**Fig. 102: Identifying Camshafts**  
Courtesy of KIA MOTORS AMERICA, INC.

**NOTE:** Apply a light coat of engine oil on camshaft journals.

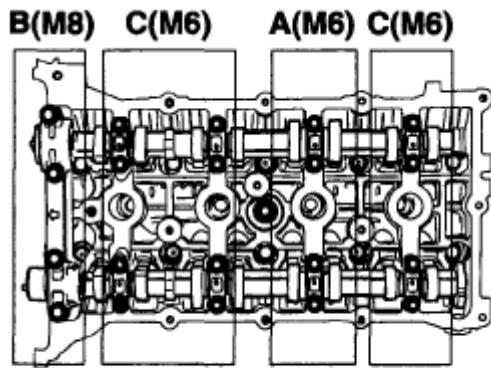
8. Install camshaft bearing caps in their proper locations. Tightening order.

Group A --> Group B --> Group C.

**Tightening torque**

M6: 10.78-12.74 N.m (1.1-1.3 kgf.m, 7.95-9.39 lb-ft)

M8: 27.44-31.36 N.m (2.8-3.2 kgf.m, 20.24-23.14 lb-ft)



ECRF017A

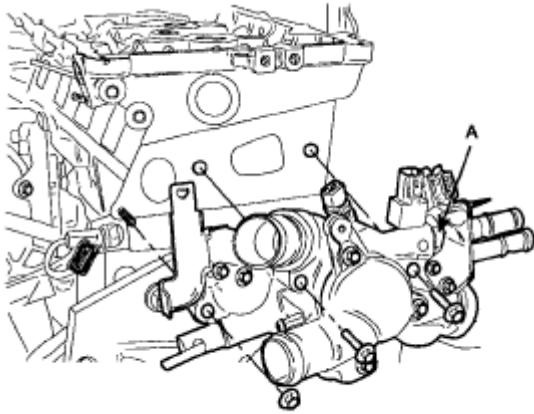
**Fig. 103: Identifying Camshaft Bearing Caps (Group A, Group B, Group C)**  
Courtesy of KIA MOTORS AMERICA, INC.

9. Install timing chain.
10. Check and adjust valve clearance.
11. Install the exhaust manifold.
12. Install the intake manifold.
13. Install water temp control assembly (A).

**Tightening torque**

Bolt: 14.7-21.56 N.m (1.5-2.2 kgf.m, 10.84-15.90 lb-ft)

Nut: 19.6-26.46 N.m (2.0-2.7 kgf.m, 14.46-19.52 lb-ft)



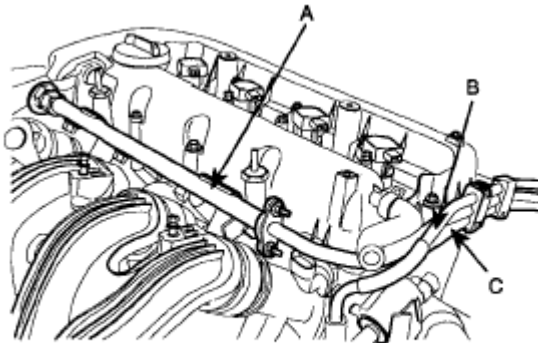
ACRF012A

**Fig. 104: Identifying Water Temp Control Assembly**  
 Courtesy of KIA MOTORS AMERICA, INC.

**NOTE:**

- Assemble water temp control assembly and water inlet pipe to water pump assembly before nuts for assembling of water inlet pipe to be tightened.
- Insert after wetting O-ring or inner surface of thermostat housing.
- Always use a new O-ring.

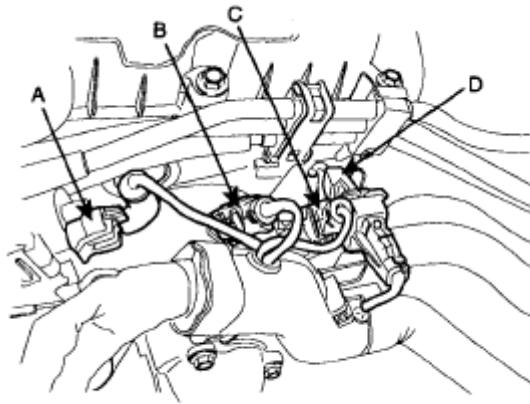
14. Install delivery pipe (A), brake hose (B), and PCSV hose (C).



KCRF134A

**Fig. 105: Identifying Delivery Pipe, Brake Vacuum Hose And PCSV Hose**  
 Courtesy of KIA MOTORS AMERICA, INC.

15. Install the PCSV connector (A), WTS connector (B), condenser connector (C), and CKP sensor connector (D).

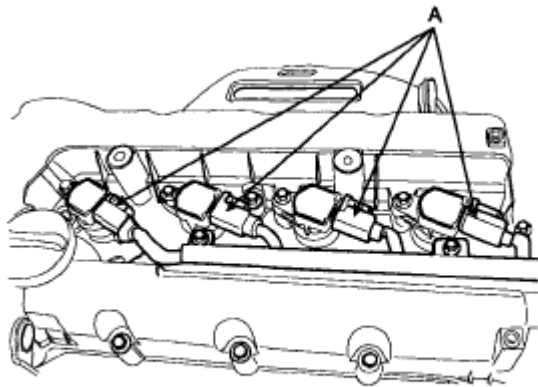


ACLG028A

**Fig. 106: Identifying PCSV Connector, WTS Connector, Condenser Connector And CKP Sensor Connector**

Courtesy of KIA MOTORS AMERICA, INC.

16. Install ignition coil connector (A).

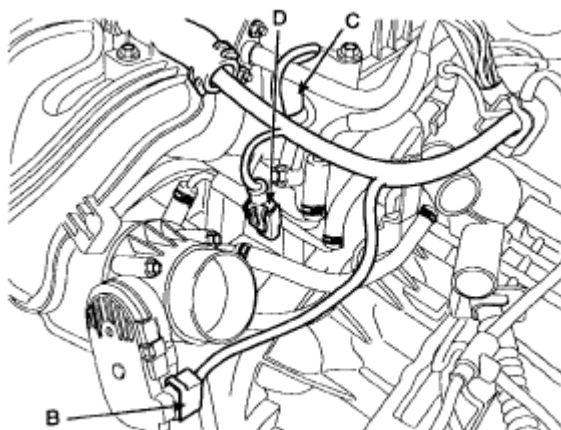


KCRF131A

**Fig. 107: Identifying Ignition Coil Connector**

Courtesy of KIA MOTORS AMERICA, INC.

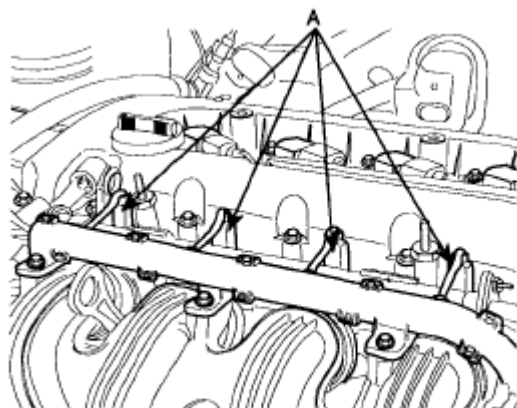
17. Install the engine wire harness connectors.
  1. Install the ETC connector (B), CMP connector (C), knock sensor connector (D).



ACLG005A

**Fig. 108: Identifying ETC Connector, CMP Connector And Knock Sensor Connector**  
Courtesy of KIA MOTORS AMERICA, INC.

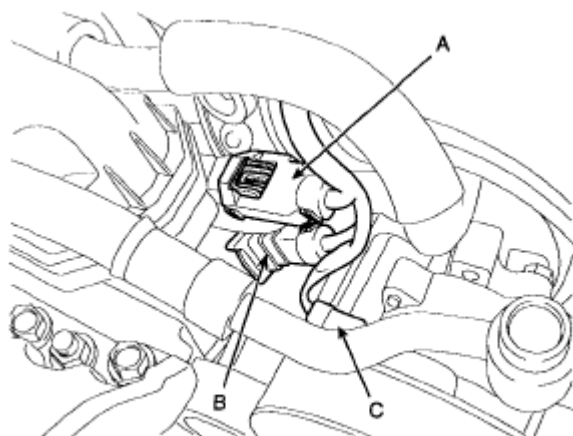
18. Install the injector connectors (A).



KCRF128A

**Fig. 109: Identifying Injector Connectors**  
Courtesy of KIA MOTORS AMERICA, INC.

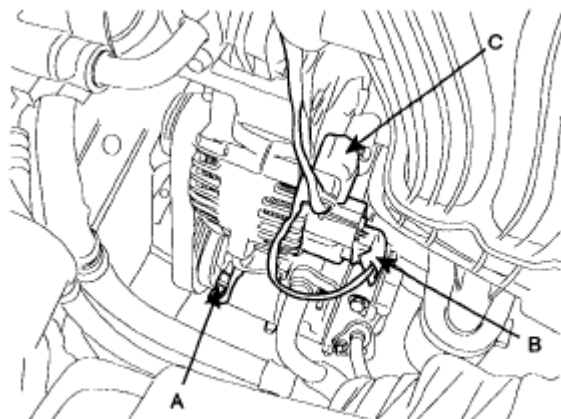
19. Install the OCV connector (A), OTS connector (B), P/S switch connector (C).



ACLG004A

**Fig. 110: Identifying OCV Connector, OTS Connector And P/S Switch Connector**  
Courtesy of KIA MOTORS AMERICA, INC.

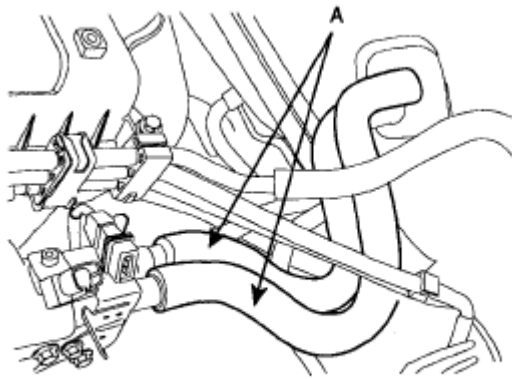
20. Install the A/C switch (A), alternator connect (B), and oil pressure switch (C).



KCRF126A

**Fig. 111: Identifying A/C Switch, Alternator Connector And Oil Pressure Switch**  
Courtesy of KIA MOTORS AMERICA, INC.

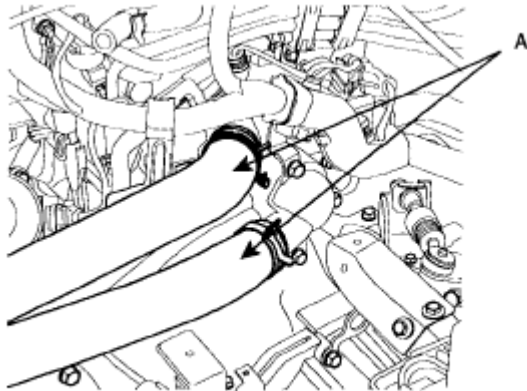
21. Install heater hoses (A).



KCRF133A

**Fig. 112: Identifying Heater Hoses**  
Courtesy of KIA MOTORS AMERICA, INC.

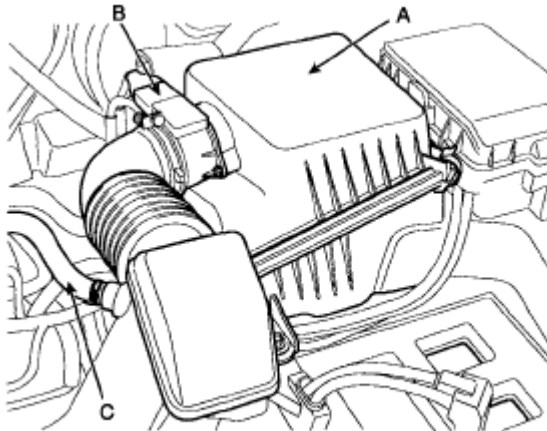
22. Install the upper radiator hose and lower radiator hose (A).



KCRF124A

**Fig. 113: Identifying Upper Radiator Hose And Lower Radiator Hose**  
Courtesy of KIA MOTORS AMERICA, INC.

23. Install under cover.
24. Install the intake air hose and air cleaner assembly.
1. Install the AFS (B) connector.
  2. Install the breather hose (C) from air cleaner hose.
  3. Install the ECU connector.
  4. Install the intake air hose and air cleaner (A).



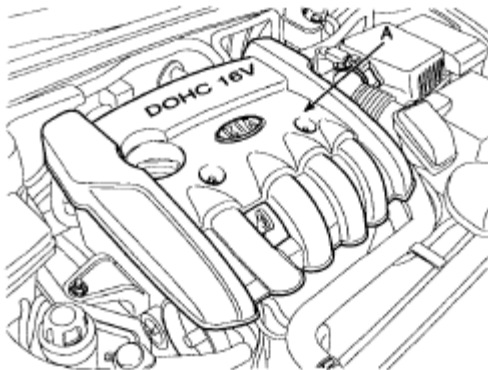
**Fig. 114: Identifying Intake Air Hose And Air Cleaner**  
Courtesy of KIA MOTORS AMERICA, INC.

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

## ENGINE AND TRANSAXLE ASSEMBLY

### REMOVAL

1. Remove the engine cover (A).



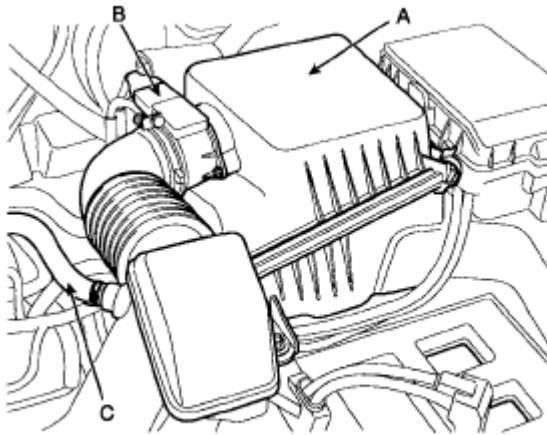
**Fig. 115: Identifying Engine Cover**  
Courtesy of KIA MOTORS AMERICA, INC.

2. Recovering refrigerant.

3. Remove the air duct.
4. Disconnect the negative terminal first, then the positive terminal.

Remove the battery.

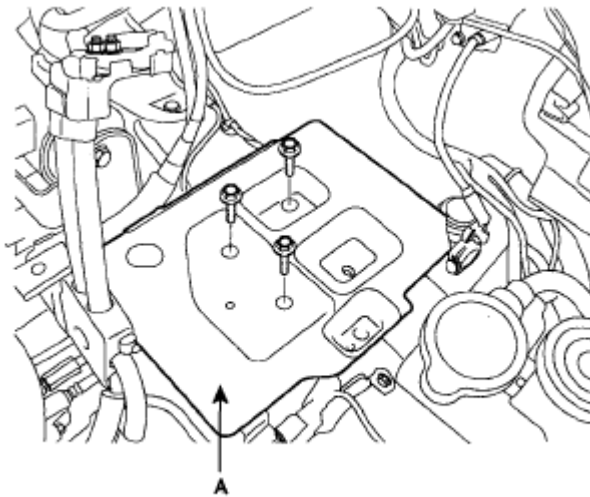
5. Remove the intake air hose and air cleaner assembly.
  1. Disconnect the AFS (B) connector.
  2. Disconnect the breather hose (C) from air cleaner hose.
  3. Disconnect the ECU connector. Refer to **FUEL DELIVERY SYSTEM (FUEL SYSTEM - G4KC-GSL 2.4LL)** .
  4. Remove the intake air hose and air cleaner (A).



ACLG020A

**Fig. 116: Identifying Intake Air Hose And Air Cleaner**  
Courtesy of KIA MOTORS AMERICA, INC.

6. Remove the battery bracket (A).



KMRE006B

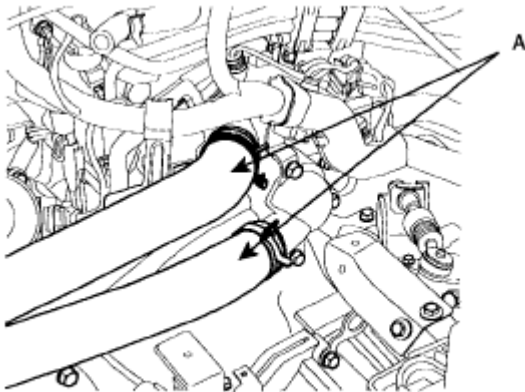
**Fig. 117: Identifying Battery Bracket**

Courtesy of KIA MOTORS AMERICA, INC.

7. Remove under cover.
8. Drain the engine coolant.

Remove the radiator cap to speed draining.

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

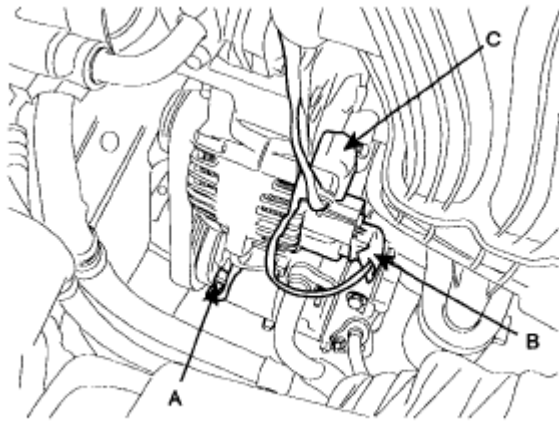


KCRF124A

**Fig. 118: Identifying Upper Radiator Hose And Lower Radiator Hose**

Courtesy of KIA MOTORS AMERICA, INC.

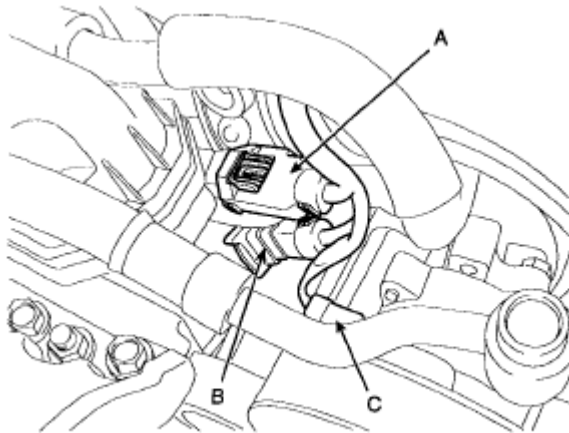
10. Remove the A/C switch (A), alternator connector (B) and pressure switch (C).



KCRF126A

**Fig. 119: Identifying A/C Switch, Alternator Connector And Oil Pressure Switch**  
Courtesy of KIA MOTORS AMERICA, INC.

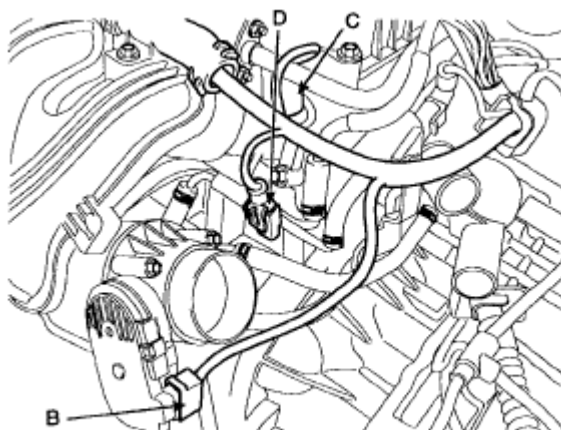
11. Remove the OCV connector (A), OTS connector (B), P/S switch connector (C).



ACLG004A

**Fig. 120: Identifying OCV Connector, OTS Connector And P/S Switch Connector**  
Courtesy of KIA MOTORS AMERICA, INC.

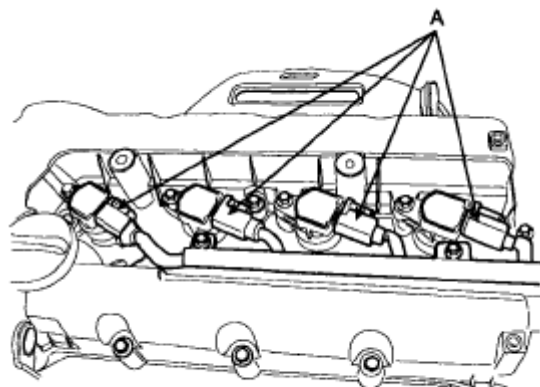
12. Remove the injector connectors (A).
13. Disconnect the engine wire harness connectors.
  1. Remove the ETC connector (B), CMP connector (C), knock sensor connector (D).



ACLG005A

**Fig. 121: Identifying ETC Connector, CMP Connector And Knock Sensor Connector**  
Courtesy of KIA MOTORS AMERICA, INC.

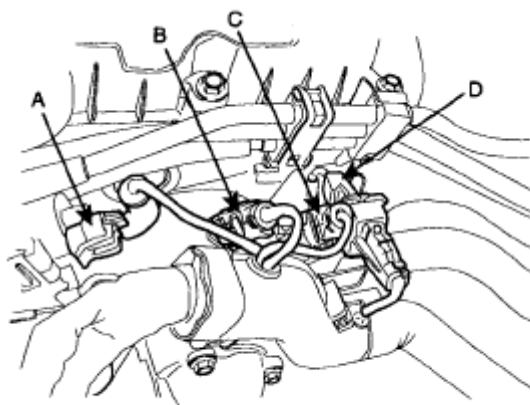
14. Remove the ignition coil connectors (A).



KCRF131A

**Fig. 122: Identifying Ignition Coil Connector**  
Courtesy of KIA MOTORS AMERICA, INC.

15. Remove the PCSV connector (A), WTS connector (B), condenser connector (C), and CKP sensor connector (D).

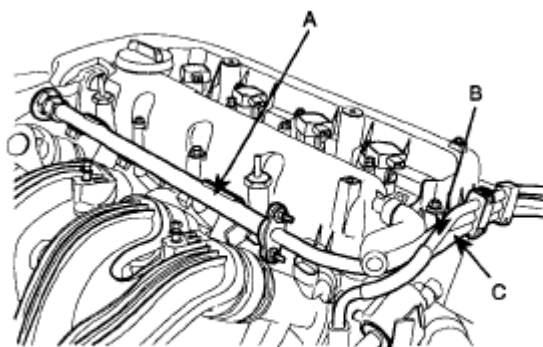


ACLG028A

**Fig. 123: Identifying PCSV Connector, WTS Connector, Condenser Connector And CKP Sensor Connector**

Courtesy of KIA MOTORS AMERICA, INC.

16. Remove delivery pipe (A), brake vacuum hose (B), and PCSV hose (C).



KCRF134A

**Fig. 124: Identifying Delivery Pipe, Brake Vacuum Hose And PCSV Hose**

Courtesy of KIA MOTORS AMERICA, INC.

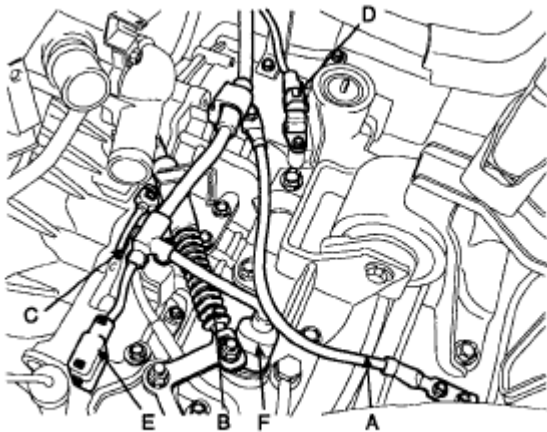
17. Remove the heater hoses (A).



ACLG003A

**Fig. 125: Identifying Heater Hoses**  
 Courtesy of KIA MOTORS AMERICA, INC.

18. Disconnect the transaxle wire harness connector and control cable.
  1. Remove the ground cable (A) from the transaxle.
  2. Remove the vehicle speed sensor connector.
  3. Remove the shaft cable assembly (B).
  4. Remove the input shaft speed connector (C).
  5. Remove the output shaft speed connector (D).
  6. Remove the inhibitor switch connector (E).
  7. Remove the solenoid valve connector (F).

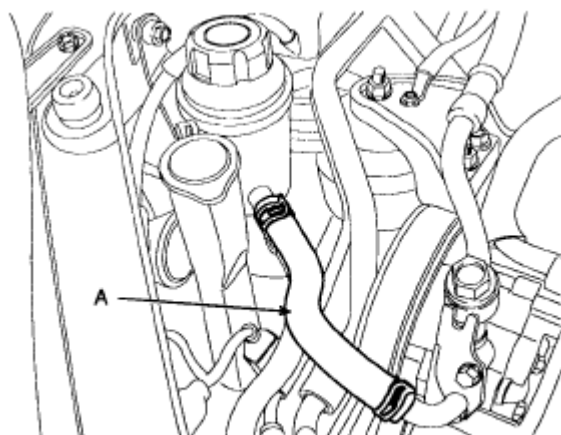


ACLG007A

**Fig. 126: Identifying Input Shaft Speed Connector And Shaft Cable Assembly**  
 Courtesy of KIA MOTORS AMERICA, INC.

8. Remove the hose from the A/T oil cooler tube.
19. Remove the steering u-joint mounting bolt. Refer to **STEERING COLUMN AND SHAFT** .

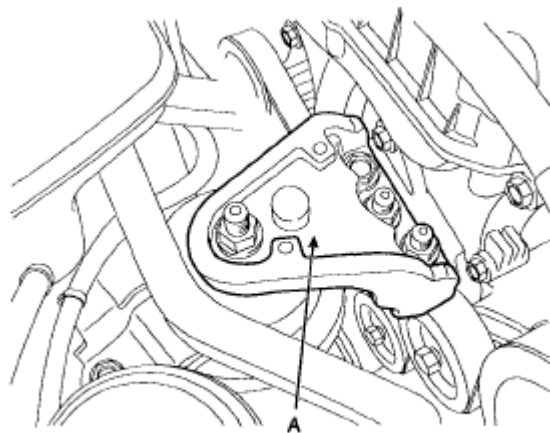
20. Remove the power steering oil hose (A).



ACLG006A

**Fig. 127: Identifying Power Steering Oil Hose**  
Courtesy of KIA MOTORS AMERICA, INC.

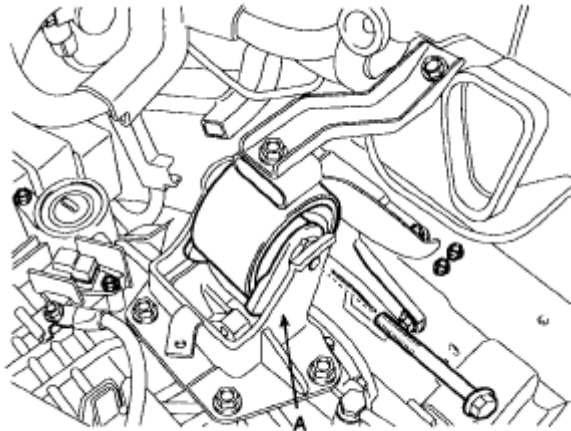
21. Remove the engine mounting bracket (A).



SMGEM6010N

**Fig. 128: Identifying Engine Mount Bracket**  
Courtesy of KIA MOTORS AMERICA, INC.

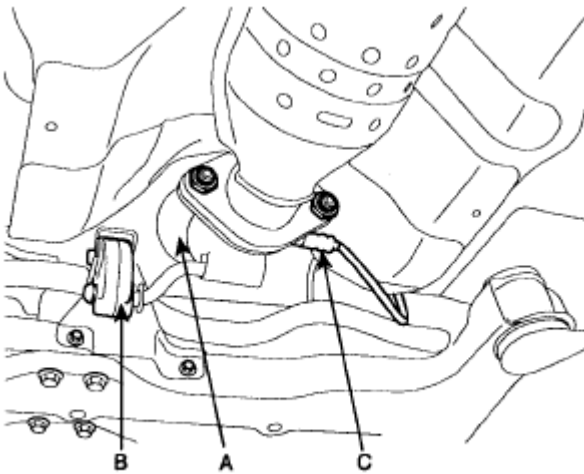
22. Remove the A/C pipe.
23. Remove the transaxle mounting bracket (A).



ACLG010A

**Fig. 129: Identifying Transaxle Mounting Bracket**  
Courtesy of KIA MOTORS AMERICA, INC.

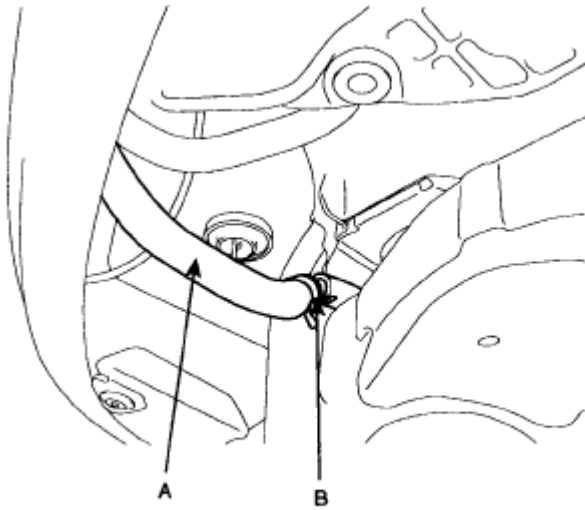
24. Remove the front tires.
25. Disconnect the wheel speed sensors (A) from both front knuckles. Refer to **DRIVESHAFT** .
26. Remove the caliper and hang the caliper assembly (A). Refer to **DRIVESHAFT** .
27. Remove the front strut lower mounting bolts and nuts. Refer to **FRONT SUSPENSION SYSTEM** .
28. Remove the drive shaft cover, heat protector. Refer to **DRIVESHAFT** .
29. Remove the exhaust pipe (A), hanger (B), and oxygen sensor (C).



KCRF031A

**Fig. 130: Identifying Exhaust Pipe, Hanger And Oxygen Sensor**  
Courtesy of KIA MOTORS AMERICA, INC.

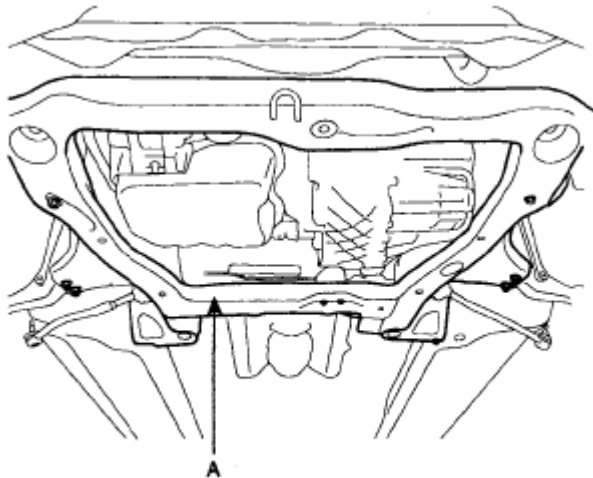
30. Remove power steering return hose (A) and drain power steering oil.



KMRE006J

**Fig. 131: Identifying Power Steering Return Hose And Drain Power Steering Oil**  
 Courtesy of KIA MOTORS AMERICA, INC.

31. Remove the EPS connector. Refer to **MECHANICAL POWER STEERING SYSTEM** .
32. Install jack and remove sub-frame (A).



KMRE006R

**Fig. 132: Identifying Jack And Sub-Frame**  
 Courtesy of KIA MOTORS AMERICA, INC.

33. Remove drive shaft from transaxle. Refer to **DRIVESHAFT** .
34. Separate the engine from the transaxle assembly by loosening mounting bolts.

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

## INSTALLATION

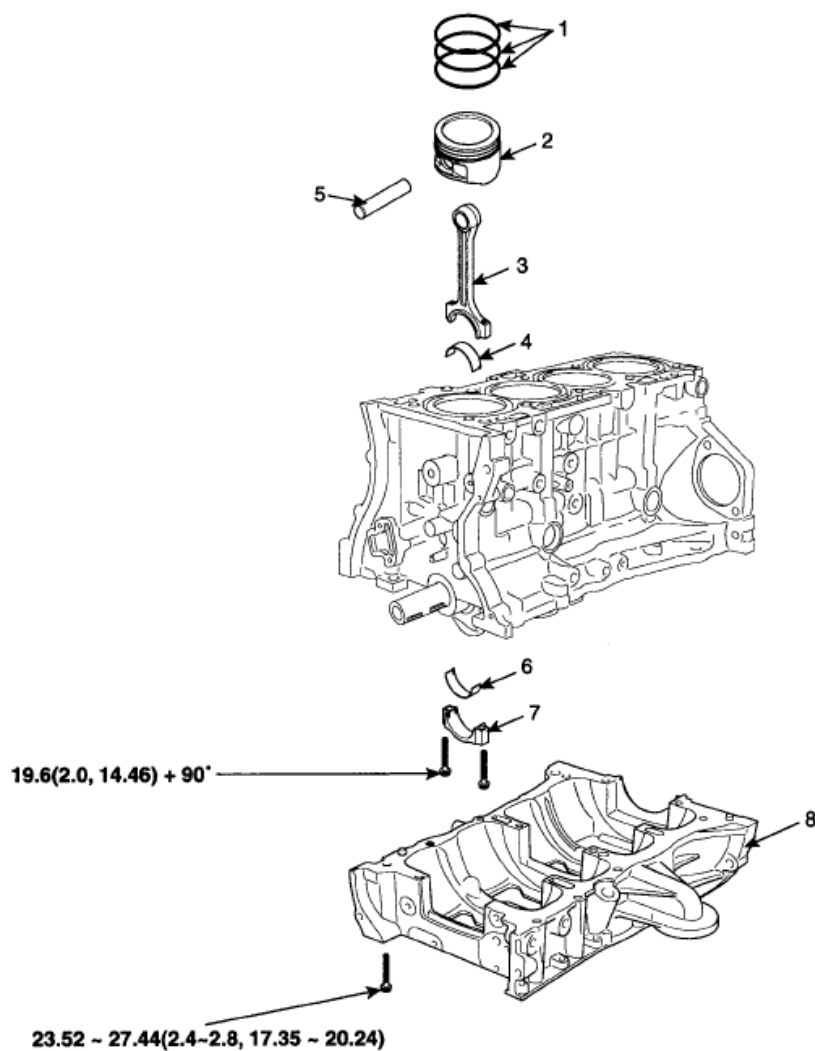
Installation is in the reverse order of removal.

Perform the following:

- Adjust the shift cable.
- Adjust the throttle cable.
- Refill the engine with engine oil.
- Refill the transaxle with fluid.
- Refill the radiator with engine coolant.
- Place the heater control knob on "HOT" position.
- Bleed air from the cooling system.
  - Start engine and let it run until it warms up. (until the radiator fan operates 3 or 4 times.)
  - 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.
  - Put the radiator cap on tightly, then run the engine again and check for leaks.
- Clean the battery posts and cable terminals with sandpaper assemble them, then apply grease to prevent corrosion.
- Inspect for fuel leakage.
  - After assembling the fuel line, turn on the ignition switch (do not operate the starter) so that the fuel pump runs for approximately two seconds and fuel line pressurizes.
  - Repeat this operation two or three times, then check for fuel leakage at any point in the fuel line.

## ENGINE BLOCK

### COMPONENTS

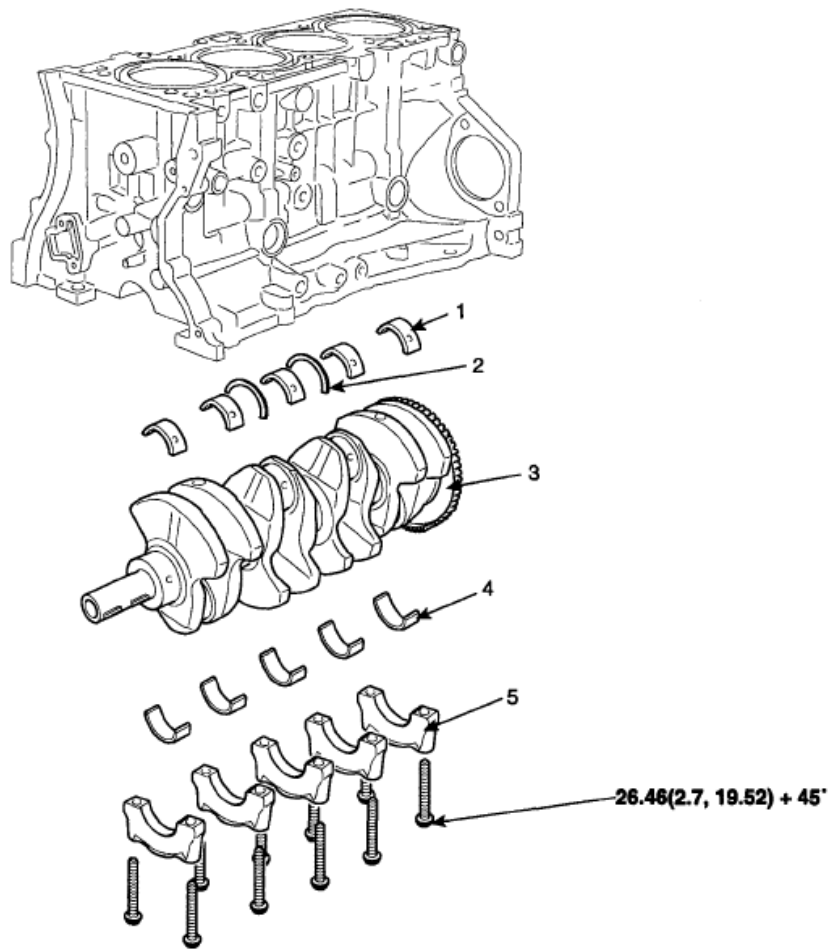


### TORQUE : N.m (kgf.m, lb-ft)

- |                                 |                                 |
|---------------------------------|---------------------------------|
| 1. Piston ring                  | 5. Piston pin                   |
| 2. Piston                       | 6. Connecting rod lower bearing |
| 3. Connecting rod               | 7. Connecting rod bearing cap   |
| 4. Connecting rod upper bearing | 8. Ladder frame                 |

SMGEM8016N

**Fig. 133: Identifying Engine Block Components & Torque Specifications (1 Of 2)**  
 Courtesy of KIA MOTORS AMERICA, INC.



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

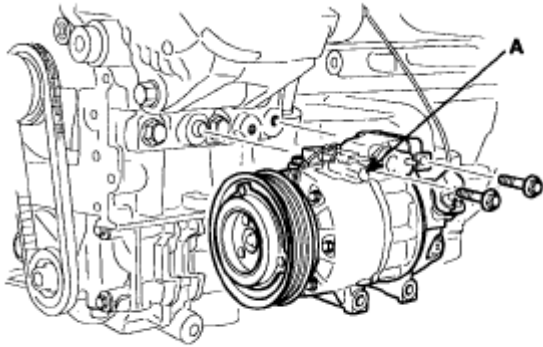
- |                             |                             |
|-----------------------------|-----------------------------|
| 1. Crankshaft upper bearing | 4. Crankshaft lower bearing |
| 2. Thrust bearing           | 5. Main bearing cap         |
| 3. Crankshaft               |                             |

SMGEM8017N

**Fig. 134: Identifying Engine Block Components & Torque Specifications (2 Of 2)**  
Courtesy of KIA MOTORS AMERICA, INC.

**DISASSEMBLY**

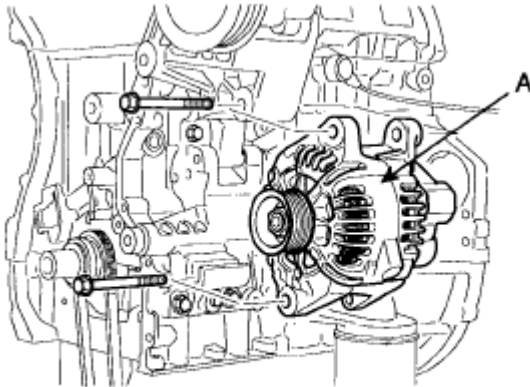
1. M/T: remove flywheel.
2. A/T: remove drive plate.
3. Install engine to engine stand for disassembly.
4. Remove timing chain.
5. Remove cylinder head.
6. Remove A/C compressor (A) from engine. Refer to **AIR CONDITIONING SYSTEM** .



KCRF158A

**Fig. 135: Identifying A/C Compressor From Engine**  
Courtesy of KIA MOTORS AMERICA, INC.

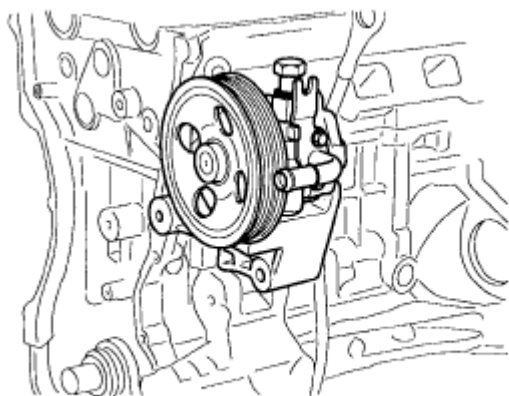
7. Remove alternator (A) from engine. Refer to **CHARGING SYSTEM (ENGINE ELECTRICAL SYSTEM (G4KC - GSL 2.4))** .



KCRF158A

**Fig. 136: Identifying Alternator From Engine**  
Courtesy of KIA MOTORS AMERICA, INC.

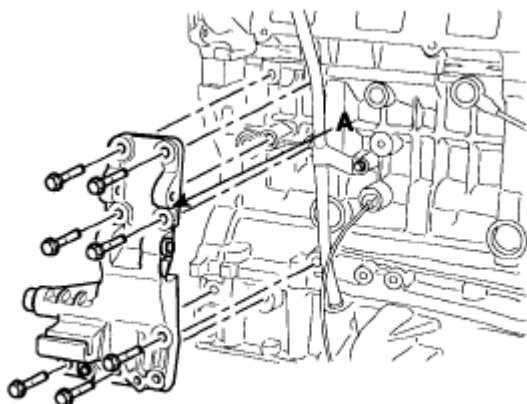
8. Remove power steering pump and bracket. Refer to **MECHANICAL POWER STEERING SYSTEM** .



KCRF160A

**Fig. 137: Identifying Power Steering Pump And Bracket**  
Courtesy of KIA MOTORS AMERICA, INC.

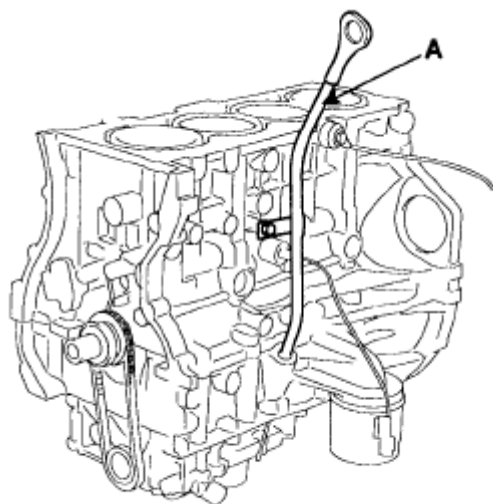
9. Remove tensioner assembly integrated bracket (A).



KCRF161A

**Fig. 138: Identifying Tensioner Assembly Integrated Bracket**  
Courtesy of KIA MOTORS AMERICA, INC.

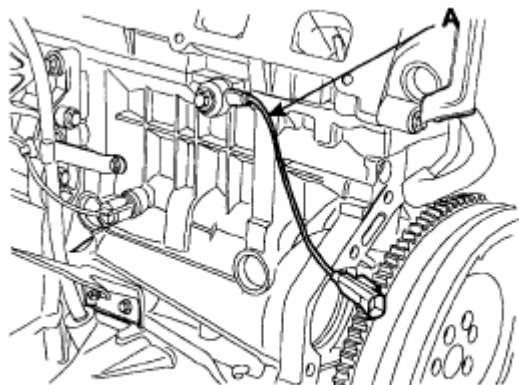
10. Remove oil level gauge assembly (A).



KCRF163B

**Fig. 139: Identifying Oil Level Dipstick/Gauge**  
Courtesy of KIA MOTORS AMERICA, INC.

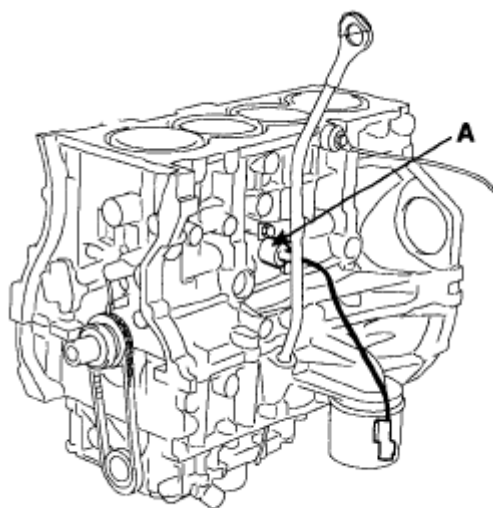
11. Remove knock sensor (A).



KCRF143A

**Fig. 140: Identifying Knock Sensor**  
Courtesy of KIA MOTORS AMERICA, INC.

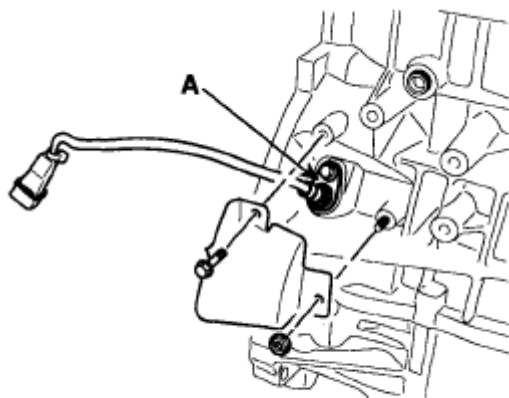
12. Remove oil pressure sensor (A).



KCRF183C

**Fig. 141: Identifying Oil Pressure Sensor**  
Courtesy of KIA MOTORS AMERICA, INC.

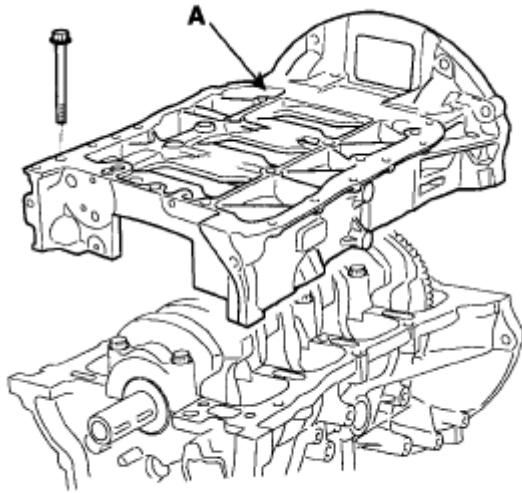
13. Remove CKP sensor (A).



KCRF184A

**Fig. 142: Identifying CKP Sensor**  
Courtesy of KIA MOTORS AMERICA, INC.

14. Remove water pump.
15. Remove balance shaft module.
16. Remove ladder frame (A).



KCRF167A

**Fig. 143: Identifying Ladder Frame**  
Courtesy of KIA MOTORS AMERICA, INC.

17. Check the connecting rod end play.
18. Remove the connecting rod caps and check oil clearance.
19. Remove piston and connecting rod assemblies.
  1. Using a ridge reamer, remove all the carbon from the top of the cylinder.
  2. Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.

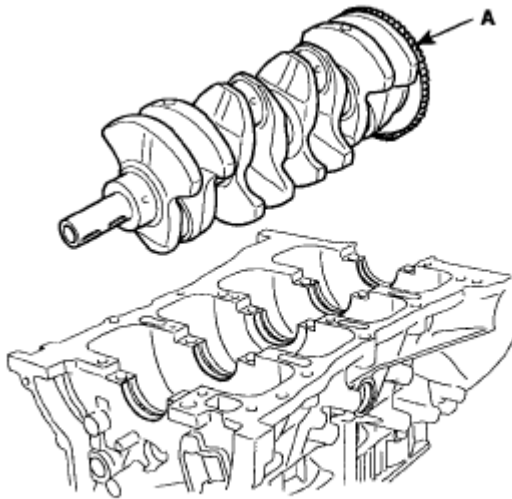
**NOTE:**

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

20. Remove crankshaft bearing cap and check oil clearance.
21. Check the crankshaft end play.
22. 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.**



KCRF172A

**Fig. 144: Identifying Crankshaft On Cylinder Block**  
Courtesy of KIA MOTORS AMERICA, INC.

23. 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.

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

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

25. Disconnect connecting rod from piston.

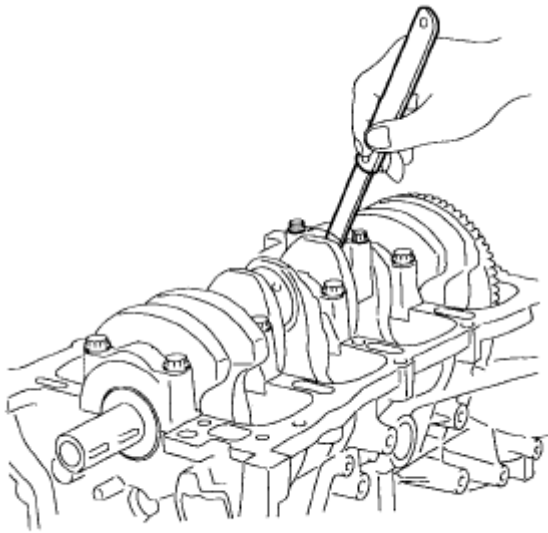
## INSPECTION

### CONNECTING ROD AND CRANKSHAFT

1. Check the connecting rod end play.

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

Standard end play: 0.1-0.25 mm (0.004-0.010 in.) Maximum end play: 0.35 mm (0.0138 in.)



KCRF169B

**Fig. 145: 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.
    1. Check the matchmarks on the connecting rod and cap are aligned to ensure correct reassembly.
    2. Remove 2 connecting rod cap bolts.
    3. Remove the connecting rod cap and bearing half.
    4. Clean the crank pin and bearing.
    5. Place plastigage across the crank pin.
    6. Reinstall the bearing half and cap, and torque the bolts.

#### **Tightening torque**

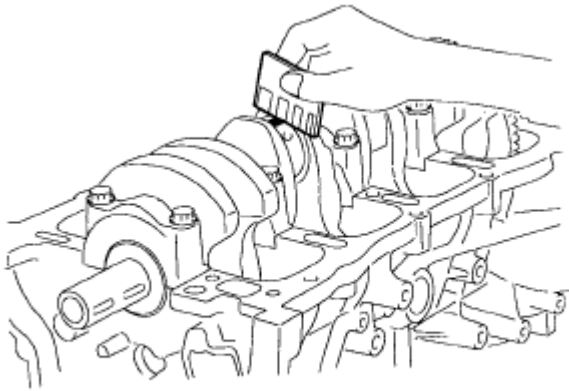
19.6 N.m (2.0 kgf.m, 14.46 lb-ft) + 90°

**NOTE: Do not turn the crankshaft.**

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

#### **Standard oil clearance**

0.028-0.046 mm (0.0011-0.0018 in.)



KCRF169A

**Fig. 146: Measuring Bearing Clearance Using Plastigage**  
Courtesy of KIA MOTORS AMERICA, INC.

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

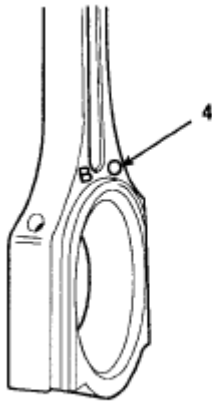
**CAUTION: Do not file, shim, or scrape the bearings or the caps to adjust clearance.**

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

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

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

#### CONNECTING ROD MARK LOCATION



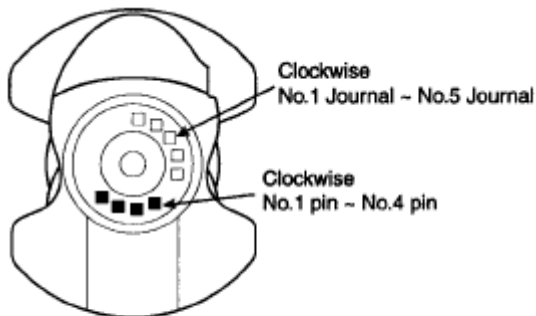
SMGEM6001N

**Fig. 147: Identifying Rod Mark Location**  
Courtesy of KIA MOTORS AMERICA, INC.

**DISCRIMINATION OF CONNECTING ROD**

| CLASS | MARK | INSIDE DIAMETER                      |
|-------|------|--------------------------------------|
| a     | A    | 51.000-51.006 mm (2.0079-2.0081 in.) |
| b     | B    | 51.006-51.012 mm (2.0081-2.0083 in.) |
| c     | C    | 51.012-51.018 mm (2.0083-2.0085 in.) |

**CRANKSHAFT PIN MARK LOCATION DISCRIMINATION OF CRANKSHAFT**



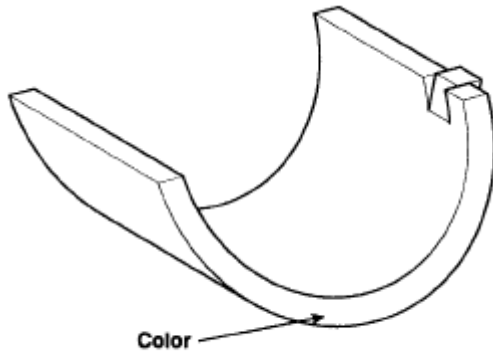
LCLG002A

**Fig. 148: Identifying Crankshaft Pin Mark Location**  
Courtesy of KIA MOTORS AMERICA, INC.

**DISCRIMINATION OF CRANKSHAFT**

| CLASS | MARK | OUTSIDE DIAMETER OF PIN              |
|-------|------|--------------------------------------|
| I     | 1    | 47.966-47.972 mm (1.8884-1.8886 in.) |
| II    | 2    | 47.960-47.966 mm (1.8881-1.8884 in.) |
| III   | 3    | 47.954-47.960 mm (1.8879-1.8881 in.) |

### PLACE OF IDENTIFICATION MARK (CONNECTING ROD BEARING) DISCRIMINATION OF CONNECTING ROD BEARING



ECRF021A

**Fig. 149: Identifying Connecting Rod Bearing Color**  
Courtesy of KIA MOTORS AMERICA, INC.

### DISCRIMINATION OF CONNECTING ROD BEARING

| CLASS | MARK   | THICKNESS OF BEARING               |
|-------|--------|------------------------------------|
| AA    | BLUE   | 1.514-1.517 mm (0.0596-0.0597 in.) |
| A     | BLACK  | 1.511-1.514 mm (0.0595-0.0596 in.) |
| B     | NONE   | 1.508-1.511 mm (0.0594-0.0595 in.) |
| C     | GREEN  | 1.505-1.508 mm (0.0593-0.0594 in.) |
| D     | YELLOW | 1.502-1.505 mm (0.0591-0.0593in)   |

### 11. Selection

#### REFERENCE CHART

| CRANKSHAFT IDENTIFICATION MARK | CONNECTING ROD IDENTIFICATION MARK | ASSEMBLING CLASSIFICATION OF BEARING |
|--------------------------------|------------------------------------|--------------------------------------|
| I (1)                          | a (A)                              | D (YELLOW)                           |
|                                | b (B)                              | C (GREEN)                            |
|                                | c (C)                              | B (NONE)                             |
| II (2)                         | a (A)                              | C (GREEN)                            |
|                                | b (B)                              | B (NONE)                             |
|                                | c (C)                              | A (BLACK)                            |
| III (3)                        | a (A)                              | B (NONE)                             |
|                                | b (B)                              | A (BLACK)                            |
|                                | c (C)                              | AA (BLUE)                            |

### 3. Check the connecting rods.

1. When reinstalling, make sure that cylinder numbers put on the connecting rod and cap at

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

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

Allowable bend of connecting rod:

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

Allowable twist of connecting rod:

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

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

### **Tightening torque**

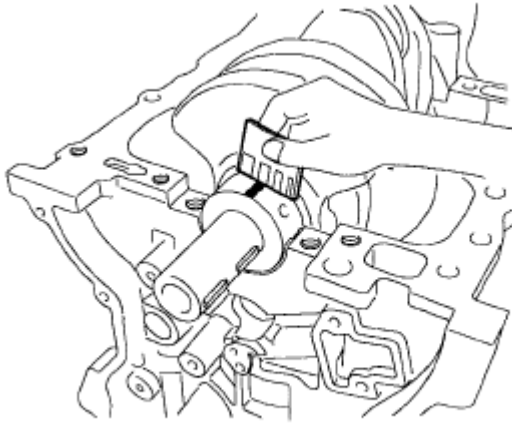
26.46 N.m (2.7 kgf.m, 19.52 lb-ft) + 45°

**NOTE:**        **Do not turn the crankshaft.**

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

### **Standard oil clearance**

0.026-0.048 mm (0.0010-0.0019 in.)



KCRF170A

**Fig. 150: Measuring Bearing Cap Clearance Using Plastigage**  
Courtesy of KIA MOTORS AMERICA, INC.

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

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

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

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

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

## CONNECTING RODS

1. When reinstalling, make sure that cylinder numbers put on the connecting rod and cap at disassembly match. When a new connecting rod is installed, make sure that the notches for holding the bearing in place are on the same side.
2. Replace the connecting rod if it is damaged on the thrust faces at either end. Also if step wear or a severely rough surface of the inside diameter of the small end is apparent, the rod must be replaced as well.
3. Using a connecting rod aligning tool, check the rod for bend and twist. If the measured value is close to the repair limit, correct the rod by a press. Any connecting rod that has been severely bent or distorted should be replaced.

Allowable bend of connecting rod:

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

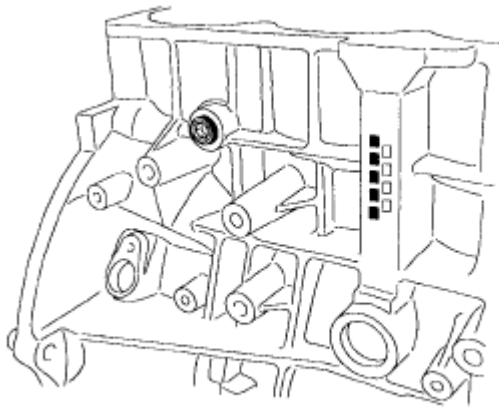
Allowable twist of connecting rod:

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

### **Crankshaft bore mark location**

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

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



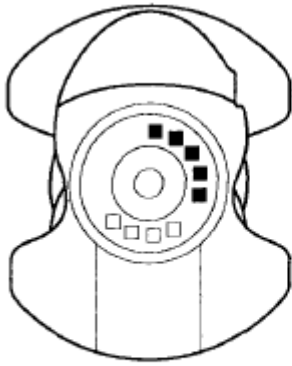
KCRF175C

**Fig. 151: Identifying Crankshaft Bore Mark Location**  
Courtesy of KIA MOTORS AMERICA, INC.

### **DISCRIMINATION OF CYLINDER BLOCK**

| CLASS | MARK | INSIDE DIAMETER                      |
|-------|------|--------------------------------------|
| a     | A    | 56.000-56.006 mm (2.2047-2.2049 in.) |
| b     | B    | 56.006-56.012 mm (2.2049-2.2052 in.) |
| c     | C    | 56.012-56.018 mm (2.2052-2.2054 in.) |

### **CRANKSHAFT JOURNAL MARK LOCATION DISCRIMINATION OF CRANKSHAFT**



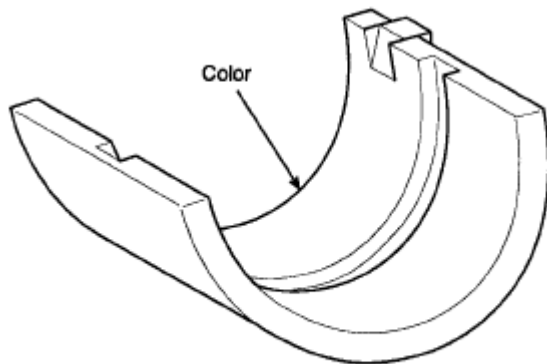
ACGE084Z

**Fig. 152: Identifying Crankshaft Journal Mark Location**  
Courtesy of KIA MOTORS AMERICA, INC.

**DISCRIMINATION OF CRANKSHAFT**

| CLASS | MARK | OUTSIDE DIAMETER OF JOURNAL          |
|-------|------|--------------------------------------|
| I     | 1    | 51.954-51.960 mm (2.0454-2.0456 in.) |
| II    | 2    | 51.948-51.954 mm (2.0452-2.0454.)    |
| III   | 3    | 51.942-51.948 mm (2.0449-2.0452 in.) |

**PLACE OF IDENTIFICATION MARK (CRANKSHAFT BEARING) DISCRIMINATION OF CRANKSHAFT BEARING**



ECRF022A

**Fig. 153: Identifying Crankshaft Bearing Color**  
Courtesy of KIA MOTORS AMERICA, INC.

**DISCRIMINATION OF CRANKSHAFT BEARING**

| CLASS | MARK  | THICKNESS OF BEARING               |
|-------|-------|------------------------------------|
| AA    | BLUE  | 2.026-2.029 mm (0.0797-0.0798 in.) |
| A     | BLACK | 2.023-2.026 mm (0.0796-0.0797 in.) |

## 2008 Kia Magentis LX

2008 ENGINE Mechanical (G4KC-GSL 2.4L) - Optima & Magentis (Canadian)

|   |        |                                    |
|---|--------|------------------------------------|
| B | NONE   | 2.020-2.023 mm (0.0795-0.0796 in.) |
| C | GREEN  | 2.017-2.020 mm (0.0794-0.795 in.)  |
| D | YELLOW | 2.014-2.017 mm (0.0793-0.0794 in.) |

### REFERENCE CHART

| CRANKSHAFT IDENTIFICATION MARK | CRANKSHAFT BORE IDENTIFICATION MARK | ASSEMBLING CLASSIFICATION OF BEARING |
|--------------------------------|-------------------------------------|--------------------------------------|
| I (1)                          | a (A)                               | D (YELLOW)                           |
|                                | b (B)                               | C (GREEN)                            |
|                                | c (C)                               | B (NONE)                             |
| II (2)                         | a (A)                               | C (GREEN)                            |
|                                | b (B)                               | B (NONE)                             |
|                                | c (C)                               | A (BLACK)                            |
| III (3)                        | a (A)                               | B (NONE)                             |
|                                | b (B)                               | A (BLACK)                            |
|                                | c (C)                               | AA (BLUE)                            |

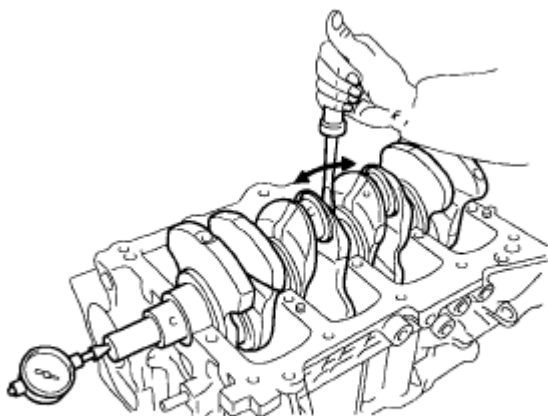
#### 4. Check crankshaft end play.

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

#### Standard end play

0.07-0.25 mm (0.0027-0.0098 in.)

Limit: 0.30 mm (0.0118 in.)



ECKD001B

**Fig. 154: Measuring Crankshaft Thrust Clearance**  
Courtesy of KIA MOTORS AMERICA, INC.

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

**Thrust bearing thickness**

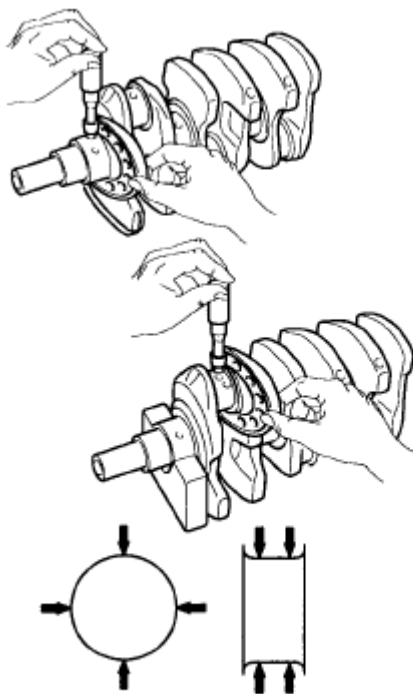
1.925-1.965 mm (0.0758-0.07736 in.)

**5. Inspect main journals and crank pins**

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

Main journal diameter: 51.942-51.960 mm (2.0449-2.0456 in.)

Crank pin diameter: 47.954-47.972 mm (1.8879-1.8886 in.)



ECKD001E

**Fig. 155: Measuring Diameter Of Main Journal And Crank Pin**  
Courtesy of KIA MOTORS AMERICA, INC.

**CYLINDER BLOCK**

**1. Remove gasket material.**

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

**2. Clean cylinder block**

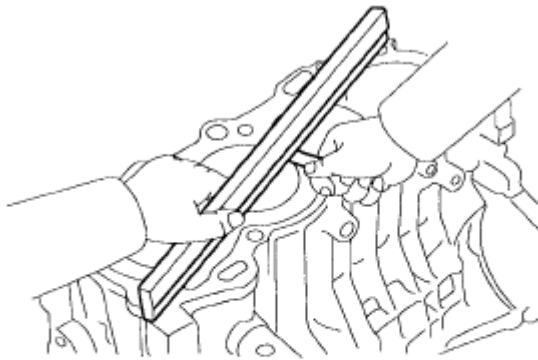
Using a soft brush and solvent, thoroughly clean the cylinder block.

**3. Inspect top surface of cylinder block for flatness.**

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

**Flatness of cylinder block gasket surface**

Standard: Less than 0.05 mm (0.0020 in.)



ECKD001L

**Fig. 156: Checking Flatness Of Cylinder Block Gasket Surface**  
Courtesy of KIA MOTORS AMERICA, INC.

**4. Inspect cylinder bore diameter**

Visually check the cylinder for vertical scratches.

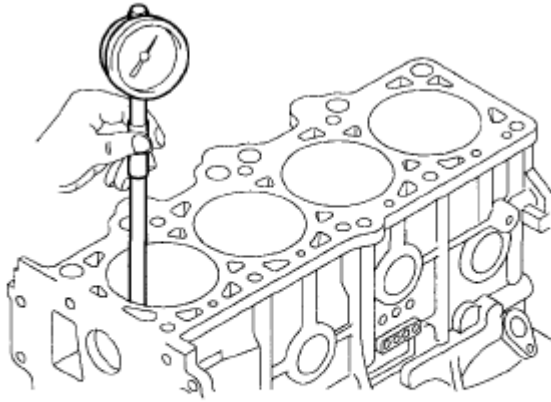
If deep scratches are present, replace the cylinder block.

**5. Inspect cylinder bore diameter**

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

**Standard diameter**

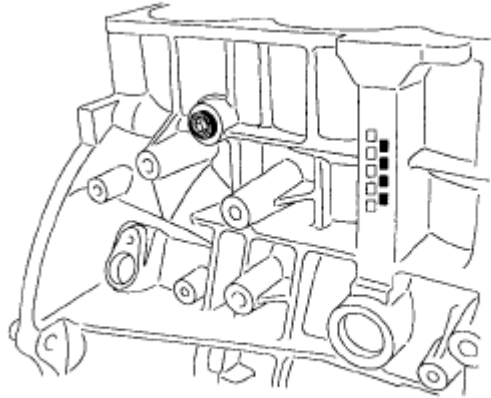
88.00-88.03 mm (3.4645-3.4657 in.)



ECKD318A

**Fig. 157: Checking Cylinder Bore Diameter**  
 Courtesy of KIA MOTORS AMERICA, INC.

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



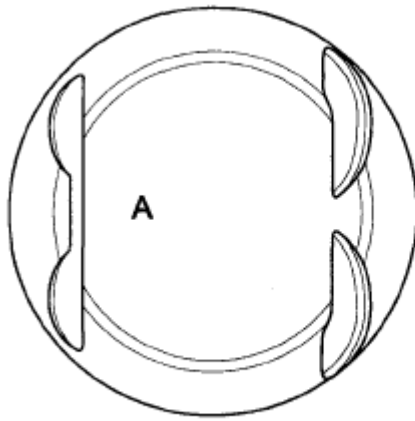
KCRF175B

**Fig. 158: Identifying Cylinder Bore Size Code On Cylinder Block**  
 Courtesy of KIA MOTORS AMERICA, INC.

**CYLINDER BORE INNER DIAMETER**

| Make | Cylinder bore inner diameter       |
|------|------------------------------------|
|      | 2.4L                               |
| A    | 88.00-88.01 mm (3.4645-3.4649 in.) |
| B    | 88.01-88.02 mm (3.4649-3.4653 in.) |
| C    | 88.02-88.03 mm (3.4653-3.4657 in.) |

7. Check the piston size code on the piston top face.



ECKE320B

**Fig. 159: Identifying Piston Size Code On Piston Top Face**  
 Courtesy of KIA MOTORS AMERICA, INC.

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

#### CYLINDER BORE INNER DIAMETER

| Make | Cylinder bore inner diameter         |
|------|--------------------------------------|
|      | 2.4L                                 |
| A    | 87.975-87.985 mm (3.4636-3.4640 in.) |
| None | 87.985-87.995 mm (3.4640-3.4644 in.) |
| C    | 87.995-88.005 mm (3.4644-3.4648 in.) |

8. Select the piston related to cylinder bore class.

Clearance: 0.015-0.035 mm (0.0006-0.0014 in.)

#### BORING CYLINDER

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.

New bore size = piston O.D. + 0.015 to 0.035 mm (0.0006 to 0.0014in) (clearance between piston and cylinder) - 0.01 mm (0.0004in) (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: 0.015-0.035 mm (0.0006-0.0014in)

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

**PISTON AND RINGS**

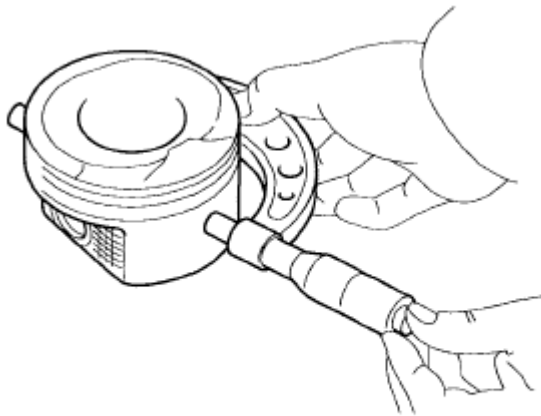
1. Clean piston
  1. Using a gasket scraper, remove the carbon from the piston top.
  2. Using a groove cleaning tool or broken ring, clean the piston ring grooves.
  3. Using solvent and a brush, thoroughly clean the piston.

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

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

**Standard diameter**

87.975-88.005 mm (3.4636-3.4648 in.)



ECKD001D

**Fig. 160: Measuring Piston Outside Diameter**  
**Courtesy of KIA MOTORS AMERICA, INC.**

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

**Piston-to-cylinder clearance**

0.015-0.035 mm (0.0006-0.0014 in.)

4. Inspect the piston ring side clearance.

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

**Piston ring side clearance**

Standard

No. 1: 0.03-0.07 mm (0.0012-0.0027 in.)

No. 2: 0.03-0.07 mm (0.0012-0.0027 in.)

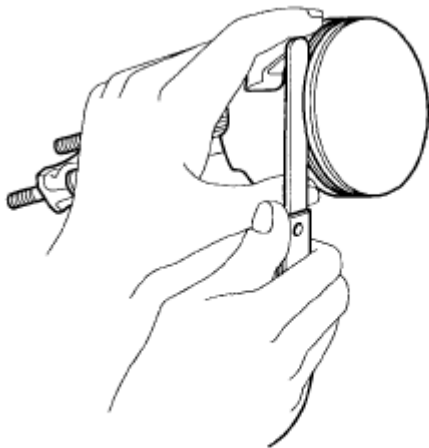
Oil ring: 0.06-0.15 mm (0.0024-0.0059 in.)

Limit

No. 1: 0.1 mm (0.004 in.)

No. 2: 0.1 mm (0.004 in.)

Oil ring: 0.2 mm (0.008 in.)



ECKD001G

**Fig. 161: Measuring Clearance Between Piston Ring And Wall Of Ring Groove**  
**Courtesy of KIA MOTORS AMERICA, INC.**

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

**5. Inspect piston ring end gap.**

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

**Piston ring end gap****Standard**

No. 1: 0.15-0.30 mm (0.0059-0.0118 in.)

No. 2: 0.30-0.45m (0.0118-0.0177 in.)

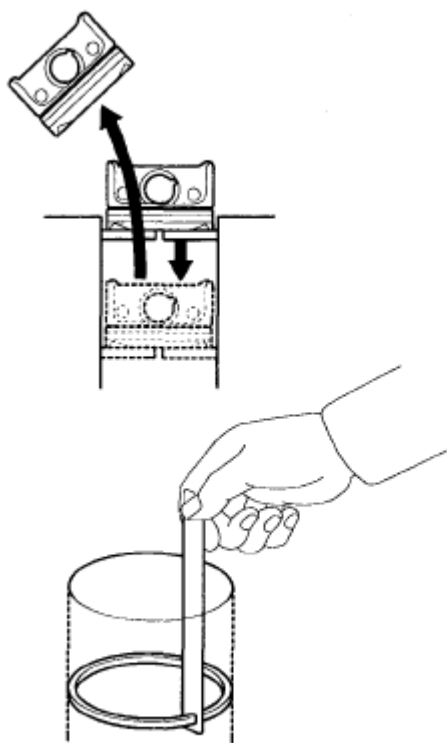
Oil ring: 0.20-0.70 mm (0.0079-0.0275 in.)

**Limit**

No. 1: 0.6 mm (0.0236 in.)

No. 2: 0.7 mm (0.0275 in.)

Oil ring: 0.8 mm (0.0315 in.)



ECKD001K

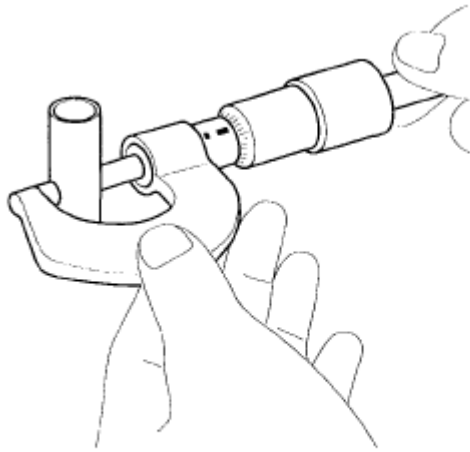
**Fig. 162: Measuring Piston Ring End Gap**  
Courtesy of KIA MOTORS AMERICA, INC.

#### PISTON PINS

1. Measure the diameter of the piston pin.

##### **Piston pin diameter**

21.001-21.006 mm (0.8268-0.8270 in.)



ECKD001Z

**Fig. 163: Measuring 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 diameter and the connecting rod small end diameter.

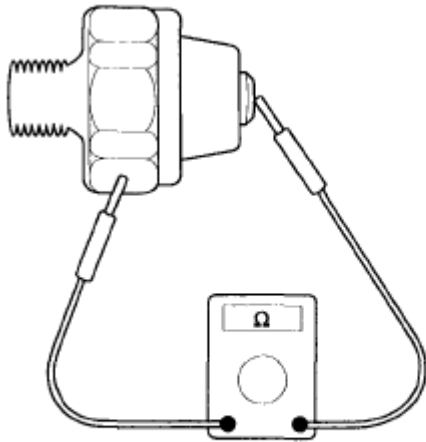
**Piston pin-to-connecting rod interference**

-0.032 to -0.016 mm (-0.0013 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.

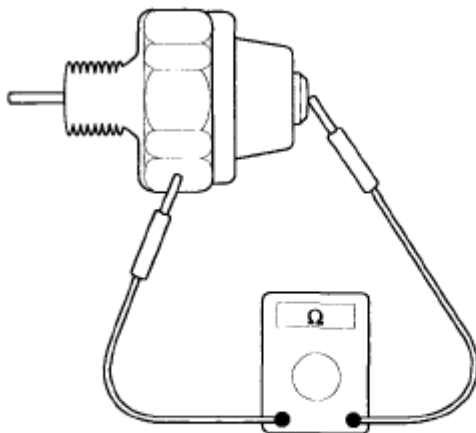


ECKD001W

**Fig. 164: Checking Continuity Between Terminal And Body**  
Courtesy of KIA MOTORS AMERICA, INC.

2. Check the continuity between the terminal and the body when the fine wire is pushed. If there is continuity even when the fine wire is pushed, replace the switch.
3. If there is no continuity when a 50 kPa (0.5 kg/cm<sup>2</sup>, 7 psi) vacuum is applied through the oil hole, the switch is operating properly.

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



ECKD001Y

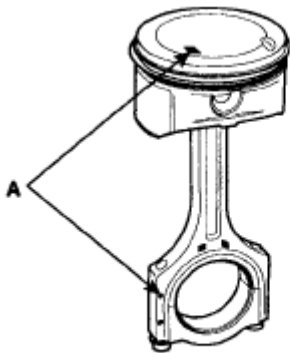
**Fig. 165: Checking Continuity Between Terminal And Body**  
Courtesy of KIA MOTORS AMERICA, INC.

## REASSEMBLY

**NOTE:**

- Thoroughly clean all parts to assembled.
- Before installing the parts, apply fresh engine oil to all sliding and rotating surfaces.
- Replace all gaskets, O-rings and oil seals with new parts.

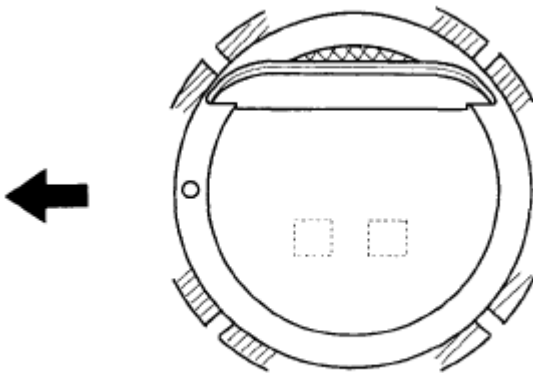
1. Assemble piston and connecting rod.
  1. Use a hydraulic press for installation.
  2. The piston front mark and the connecting rod front mark must face the timing belt side of the engine.



KCRF168A

**Fig. 166: Identifying Piston Front Mark And Rod**  
Courtesy of KIA MOTORS AMERICA, INC.

2. Install piston rings.
  1. Install the oil ring spacer and 2 side rails by hand.
  2. Using a piston ring expander, install the 2 compression rings with the code mark facing upward.
  3. Position the piston rings so that the ring ends are as shown. See **Fig. 167**.

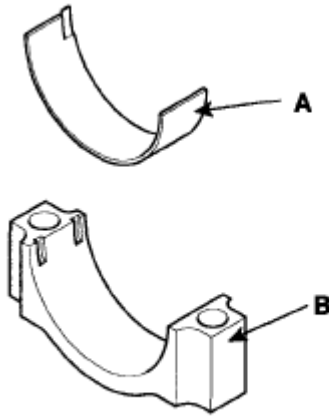


ECKD321A

**Fig. 167: Identifying Piston Ring Positions**  
Courtesy of KIA MOTORS AMERICA, INC.

## 3. Install connecting rod bearings.

1. Align the bearing claw with the groove of the connecting rod or connecting rod cap.
2. Install the bearings (A) in the connecting rod and connecting rod cap (B).



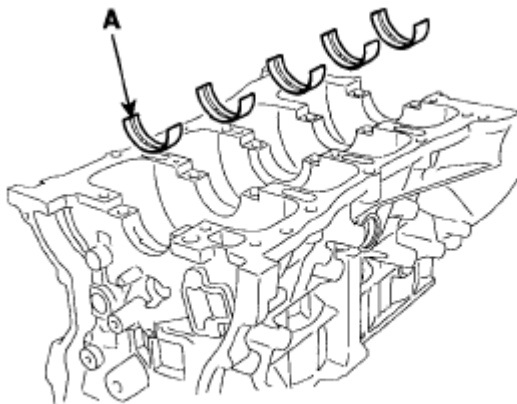
KCRF118B

**Fig. 168: Identifying Bearings And Rod Cap**  
Courtesy of KIA MOTORS AMERICA, INC.

## 4. Install main bearings.

**NOTE:** Upper bearings have an oil groove of oil holes; Lower bearings do not.

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



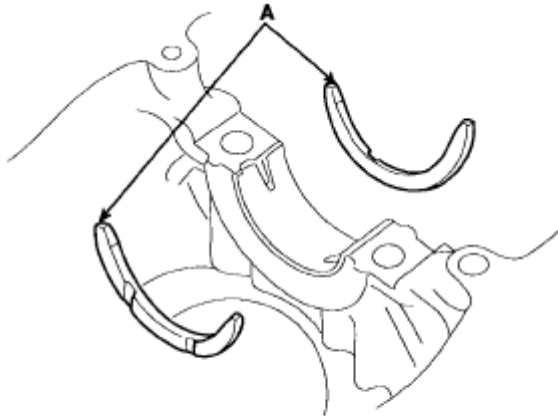
KCRF173A

**Fig. 169: Identifying Upper Bearings Oil Groove**  
Courtesy of KIA MOTORS AMERICA, INC.

2. Align the bearing claw with the claw groove of the main bearing cap, and push in the 5 lower bearings.

5. Install thrust bearings.

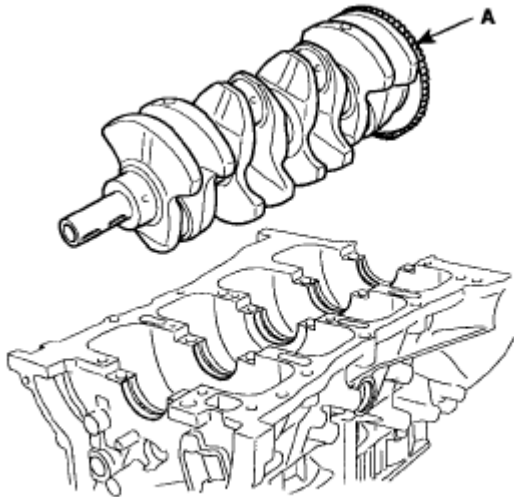
Install the 2 thrust bearings (A) under the No. 3 journal position of the cylinder block with the oil grooves facing outward.



ECKD324A

**Fig. 170: Identifying Thrust Bearings**  
Courtesy of KIA MOTORS AMERICA, INC.

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



KCRF172A

**Fig. 171: Identifying Crankshaft On Cylinder Block**  
Courtesy of KIA MOTORS AMERICA, INC.

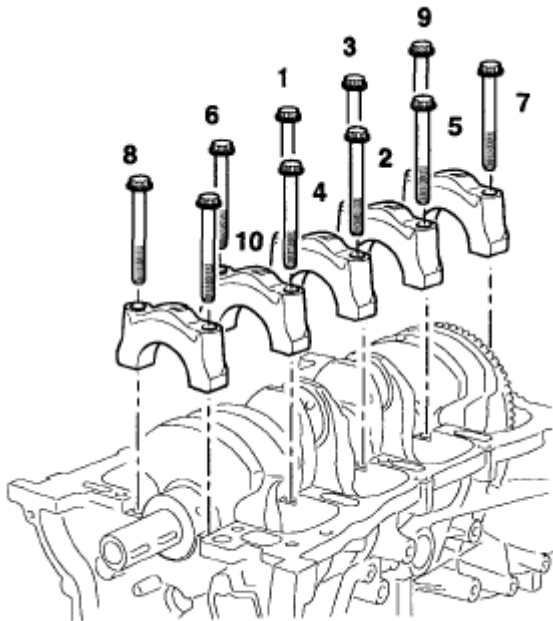
7. Place main bearing caps on cylinder block.
8. Install main bearing cap bolts.

**NOTE:**

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

1. Apply a light coat of engine oil on the threads and under the bearing cap bolts.
2. Install and uniformly tighten the 10 bearing cap bolts (A), in several passes, in the sequence shown in illustration.

**Tightening torque:** 26.46 N.m (2.7 kgf.m, 19.52 lb-ft) + 45°



KCRF171A

**Fig. 172: Identifying Bearing Cap Bolts & Tightening Sequence**  
Courtesy of KIA MOTORS AMERICA, INC.

3. Retighten the bearing cap bolts by 45° in the numerical order shown in illustration.
4. Check that the crankshaft turns smoothly.
9. Check crankshaft end play.
10. Install piston and connecting rod assemblies.

**NOTE:**

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

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

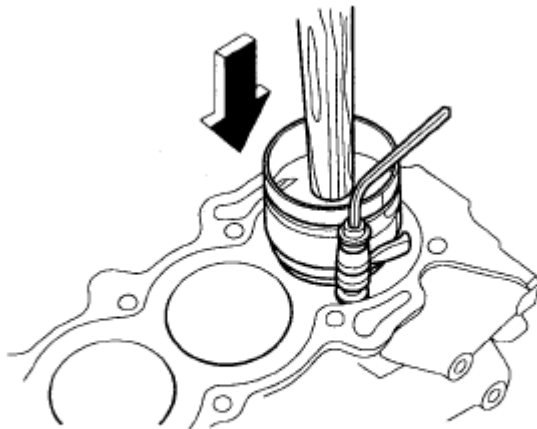
before pushing the piston into place.

4. Apply engine oil to the bolt threads. Install the rod caps with bearings, and torque the bolts.

#### Tightening torque

19.6 N.m (2.0 kgf.m, 14.46 lb-ft) + 90°

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



ECKD001F

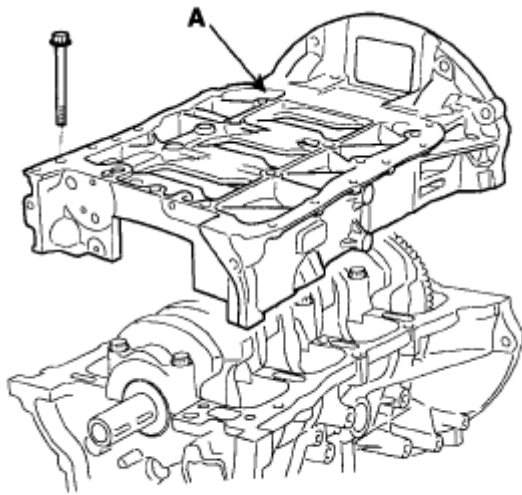
**Fig. 173: Installing Pistons**

Courtesy of KIA MOTORS AMERICA, INC.

11. Install ladder frame (A) with 10 bolts.

#### Tightening torque

23.52-27.44 N.m (2.4-2.8 kgf.m, 17.35-20.24 lb-ft)

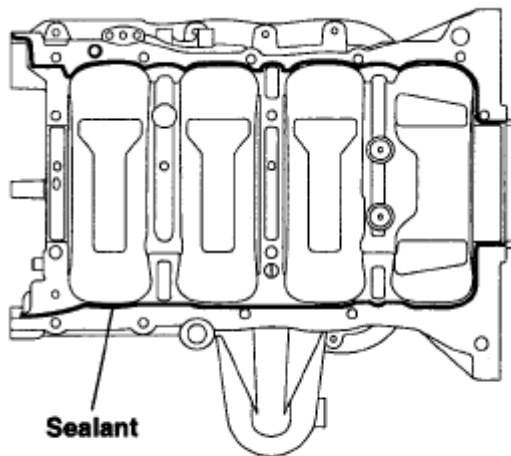


KCRF167A

**Fig. 174: Installing Ladder Frame**  
Courtesy of KIA MOTORS AMERICA, INC.

**NOTE:**

- Be assembling ladder frame, the liquid sealant Loctite 5900 should be applied ladder frame.
- The part must be assembled within 5 minutes after sealant was applied.
- Apply sealant to the inner threads of the bolt holes.



ECRF023A

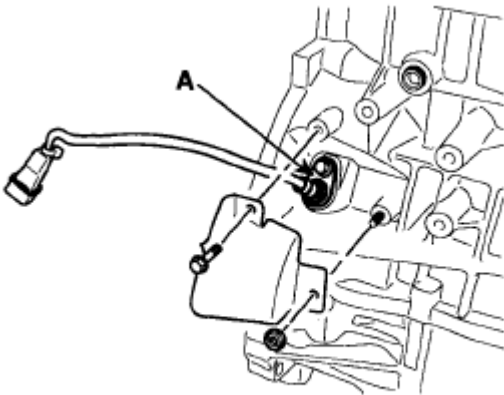
**Fig. 175: Identifying Sealant Application**  
Courtesy of KIA MOTORS AMERICA, INC.

12. Install rear oil seal.
  1. Apply engine oil to a new oil seal lip.

2. Using SST (09231-H1100, 09214-3K100) and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.
13. Install balance shaft module.
14. Install water pump.
15. Install CKP sensor (A) and sensor cover.

**Tightening torque**

3.92-5.88 N.m (0.4-0.6 kgf.m, 2.89-4.34 lb-ft)



KCRF184A

**Fig. 176: Identifying CKP Sensor**

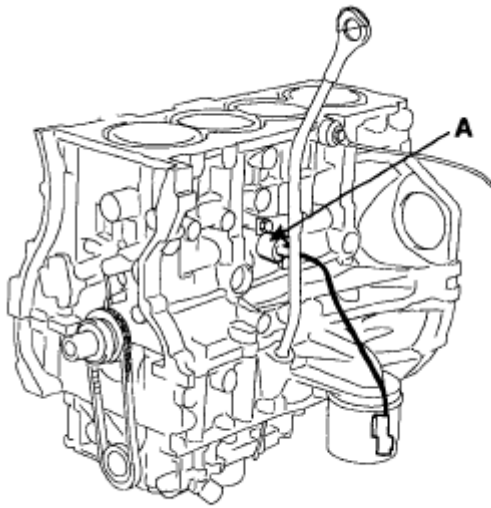
Courtesy of KIA MOTORS AMERICA, INC.

16. Install oil pressure sensor.
  1. Apply adhesive to 2 or 3 threads.

Adhesive: Three Bond 2310/2350 or equivalent.
  2. Install the oil pressure sensor (A).

**Tightening torque**

7.84-11.76 N.m (0.8-1.2 kgf.m, 5.78-8.67 lb-ft)



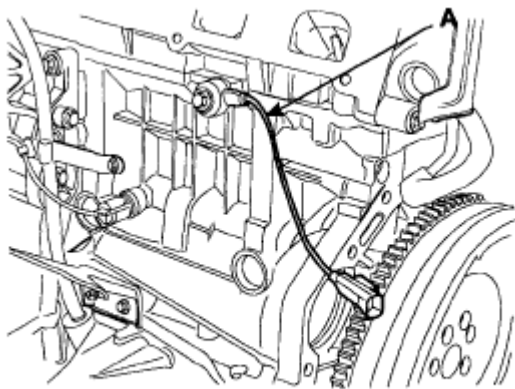
KCRF183C

**Fig. 177: Identifying Oil Pressure Sensor**  
Courtesy of KIA MOTORS AMERICA, INC.

17. Install knock sensor (A).

**Tightening torque**

16.66-25.48 N.m (1.7-2.6 kgf.m, 12.29-18.78 lb-ft)



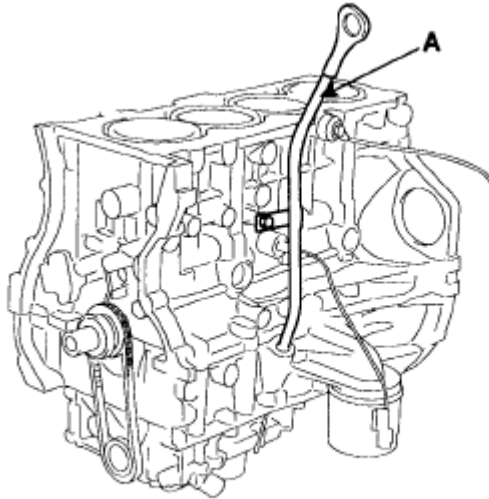
KCRF143A

**Fig. 178: Identifying Knock Sensor**  
Courtesy of KIA MOTORS AMERICA, INC.

18. Install oil level gauge assembly.
1. Install a new O-ring on the oil level gauge.
  2. Apply engine oil on the O-ring.
  3. Install the oil level gauge assembly (A) with the bolt.

### Tightening torque

7.84-11.76 N.m (0.8-1.2 kgf.m, 5.78-8.67 lb-ft)



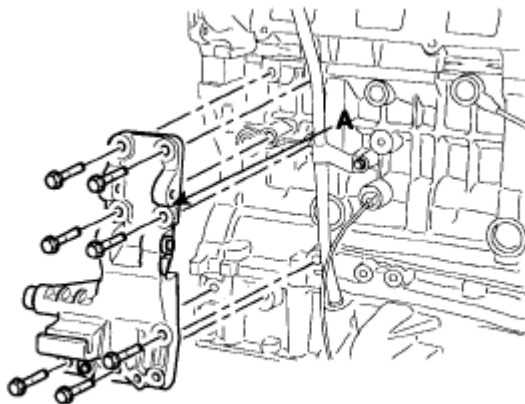
KCRF163B

**Fig. 179: Identifying Oil Level Dipstick/Gauge**  
Courtesy of KIA MOTORS AMERICA, INC.

19. Install tensioner assembly integrated bracket (A).

### Tightening torque

39.2-44.1 N.m (4.0-4.5 kgf.m, 28.92-32.53 lb-ft)



KCRF161A

**Fig. 180: Identifying Tensioner Assembly Integrated Bracket**  
Courtesy of KIA MOTORS AMERICA, INC.

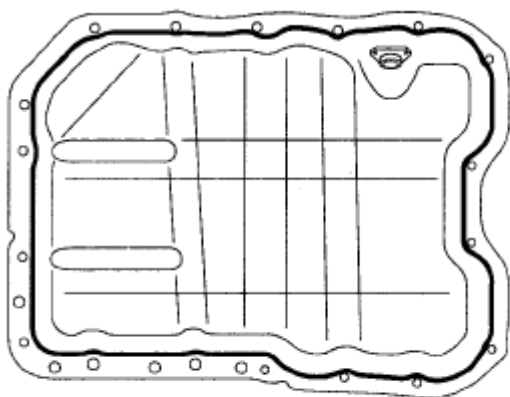
20. Install power steering pump bracket and power steering pump. Refer to **MECHANICAL POWER**

**STEERING SYSTEM** .

21. Install alternator. Refer to **CHARGING SYSTEM (ENGINE ELECTRICAL SYSTEM (G4KC - GSL 2.4))** .
22. Install A/C compressor. Refer to **AIR CONDITIONING SYSTEM** .
23. Install cylinder head.
24. Install timing chain.
25. Install oil pan.
  1. Using a razor blade and gasket scraper, remove all the old packing material from the gasket surfaces.

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

2. Apply liquid gasket as an even bead, centered between the edges of the mating surface. Use liquid gasket LOCTITE5900 or equivalent.



KCRF179A

**Fig. 181: Applying Sealant/Liquid Gasket On Oil Pan**  
Courtesy of KIA MOTORS AMERICA, INC.

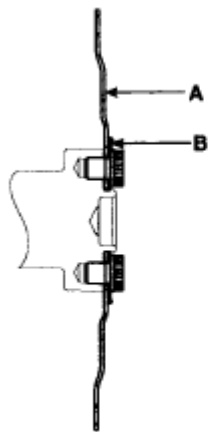
**NOTE:**

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

26. Remove engine stand.
27. A/T: Install drive plate (A).

**Tightening torque**

117.6-127.4 N.m (12-13 kgf.m, 86.75-93.98 lb-ft)



KCRF224A

**Fig. 182: Identifying Drive Plate**  
Courtesy of KIA MOTORS AMERICA, INC.

28. M/T: Install flywheel.

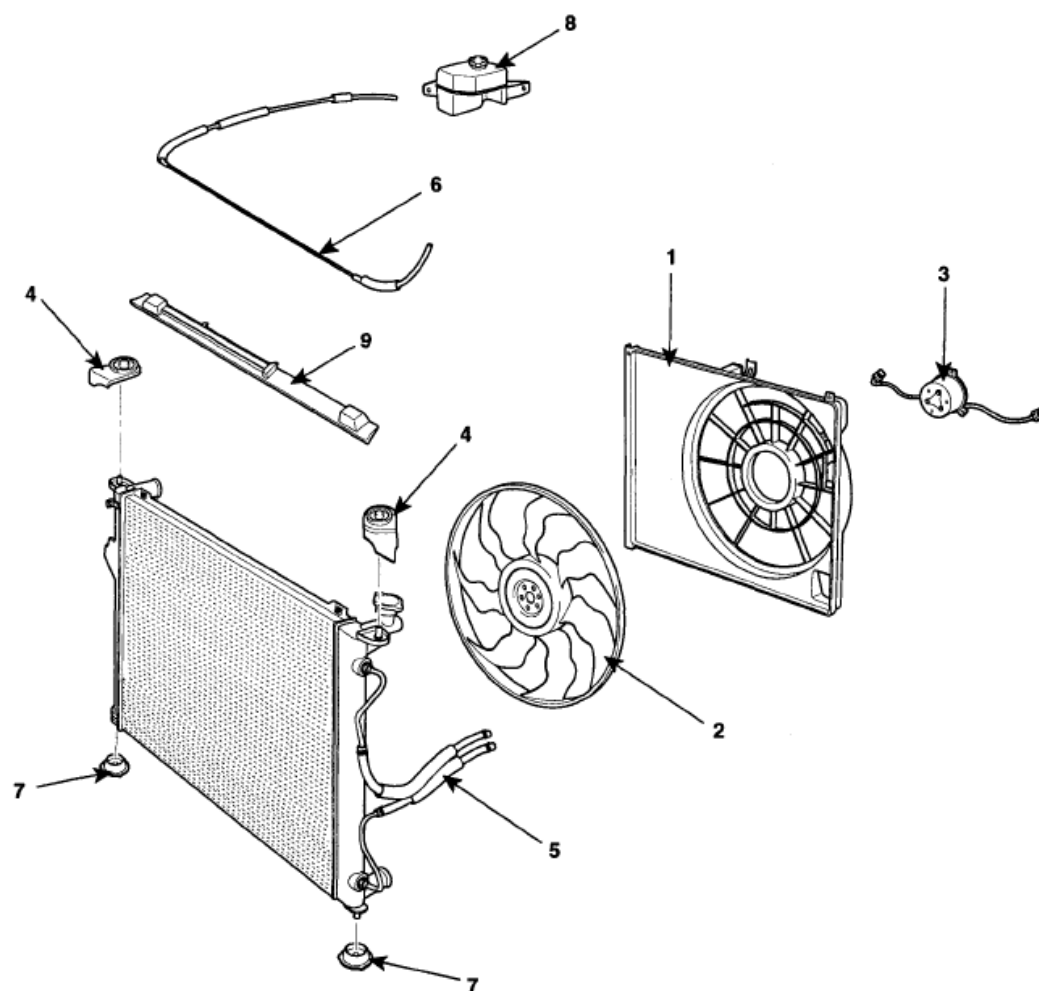
**Tightening torque**

117.6-127.4 N.m (12-13 kgf.m, 86.75-93.98 lb-ft)

**NOTE:**

- Always use new flywheel (drive plate) bolts.
- Install and uniformly tighten the 7 bolts, in several passes.

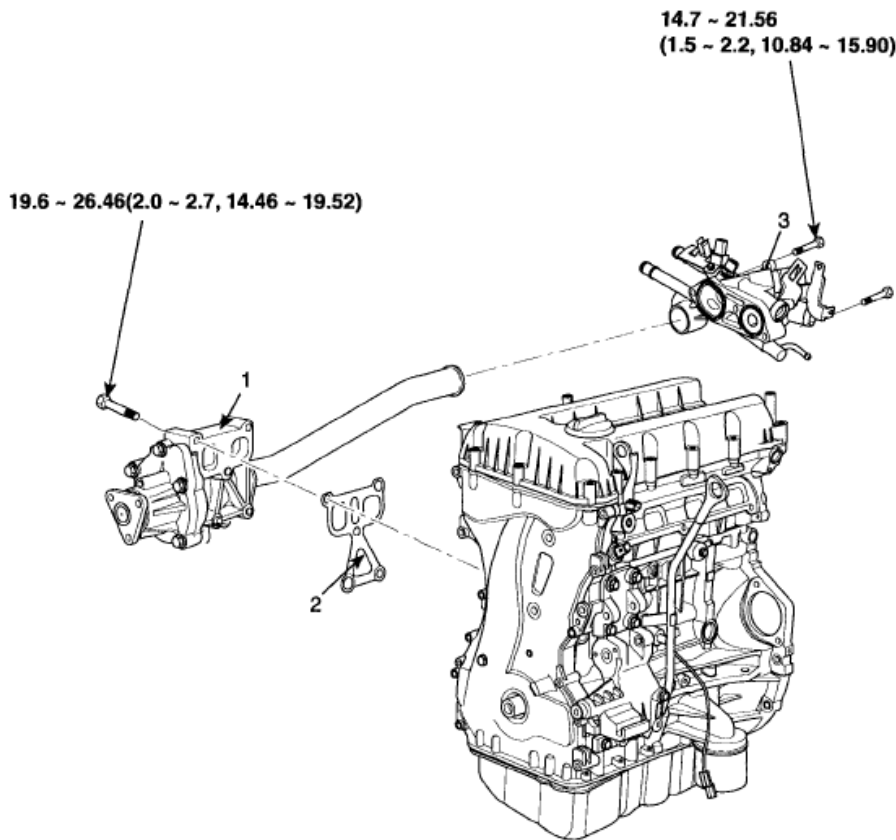
**COOLING SYSTEM****COMPONENTS**



- |                                    |                                      |
|------------------------------------|--------------------------------------|
| 1. Pan shroud                      | 6. Water pipe assembly               |
| 2. Fan                             | 7. Radiator lower mounting insulator |
| 3. Motor assembly                  | 8. Radiator reservoir                |
| 4. Radiator upper mounting bracket | 9. Cover                             |
| 5. Oil cooler assembly             |                                      |

SMGEM6011N

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



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

- 1. Water pump
- 2. Water pump gasket
- 3. Water temp control assembly

SMOEM6016N

**Fig. 184: Identifying Water Pump, Water Temperature Control Assembly & Torque Specifications**  
Courtesy of KIA MOTORS AMERICA, INC.

## ENGINE COOLANT REFILLING AND BLEEDING

**WARNING:** Never remove the radiator cap when the engine is hot. Serious scalding could be caused by hot fluid under high pressure escaping from the radiator.

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

1. Make sure the engine and radiator are cool to the touch.

2. Remove radiator cap.
3. Loosen the drain plug, and drain the coolant.
4. Tighten the radiator drain plug securely.
5. Remove, drain and reinstall the reservoir. Fill the tank halfway to the MAX mark with water, then up to the MAX mark with antifreeze.
6. Fill fluid mixture with coolant and water (4:6) slowly through the radiator cap. Push the upper/lower hoses of the radiator so as bleed air easily.

**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 or 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. Start the engine and run coolant circulates.

When the cooling fan operates and coolant circulates, refill coolant through the radiator cap.

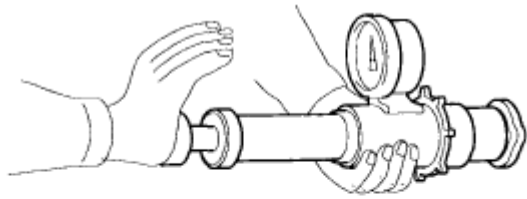
8. Repeat 7 until the cooling fan 3-5times and bleed air sufficiently out of the cooling system.
9. Install the radiator cap and fill the reservoir tank to the "MAX" line with coolant.
10. Run the vehicle under idle until the cooling fan operates 2-3 times.
11. Stop the engine and wait coolant gets cool.
12. Repeat 6 to 11 until the coolant level doesn't fall any more, bleed air out of the cooling system.

**NOTE:**

**As it is to bleed air out to the cooling system and refill coolant when coolant gets cool completely, recheck the coolant level in the reservoir tank for 2-3 days after replacing coolant.**

**RADIATOR CAP TESTING**

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



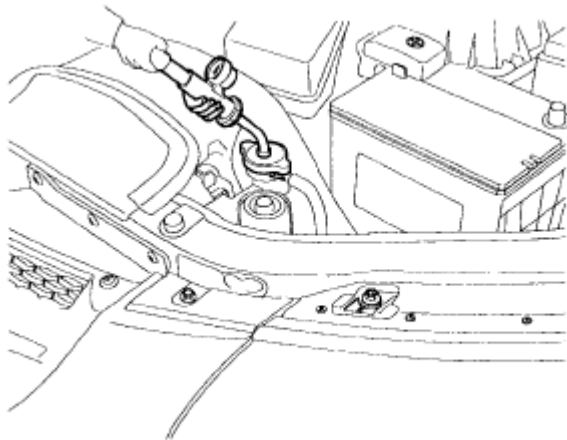
ECKD501X

**Fig. 185: Testing Radiator Cap Using Pressure Tester**  
 Courtesy of KIA MOTORS AMERICA, INC.

2. Apply a pressure of 93-123 kPa (0.95-1.25 kgf/cm<sup>2</sup> , 14-19 psi)
3. Check for a drop in pressure.
4. If the pressure drops, replace the cap.

#### **RADIATOR LEAKAGE TESTING**

1. Wait until engine is cool, then carefully remove the radiator cap and fill the radiator with engine coolant, then install it on the pressure tester.



KCRF184A

**Fig. 186: Checking Cooling system Using Pressure Tester**  
 Courtesy of KIA MOTORS AMERICA, INC.

2. Apply a pressure tester to the radiator and apply a pressure of 93-123 kPa (0.95-1.25 kgf/cm<sup>2</sup> 14-18 psi).
3. Inspect for engine coolant leaks and a drop in pressure.
4. Remove the tester and reinstall the radiator cap.

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

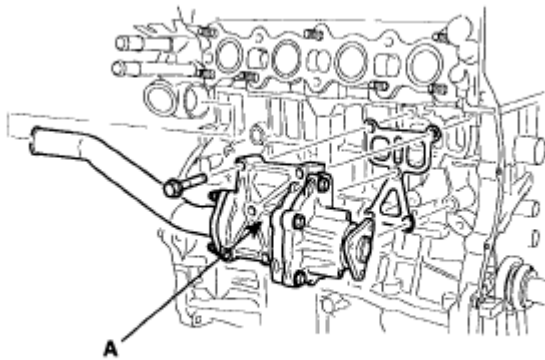
## REMOVAL

### 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 drive belt.
3. Remove exhaust manifold.
4. Remove water inlet pipe nut.
5. Remove the water pump (A).



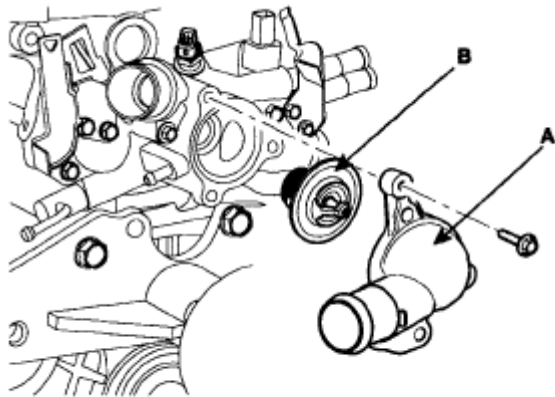
KCRF157A

**Fig. 187: Identifying Water Pump**  
Courtesy of KIA MOTORS AMERICA, INC.

### THERMOSTAT

**NOTE:** Removal of the thermostat would have an adverse effect, causing a lowering of cooling efficiency. Do not remove the thermostat, even if the engine tends to overheat.

1. Drain engine coolant so its level is below thermostat.
2. Remove water inlet (A) and thermostat (B).



KCRF123A

**Fig. 188: Identifying Water Inlet And Thermostat**  
Courtesy of KIA MOTORS AMERICA, INC.

## INSPECTION

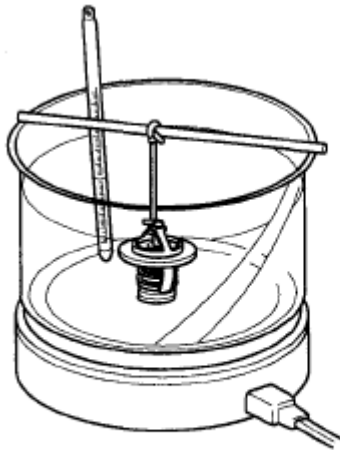
### WATER PUMP

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.
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.



ECKD503B

**Fig. 189: Testing Thermostat**  
**Courtesy of KIA MOTORS AMERICA, INC.**

2. Check the valve opening temperature.

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

Full opening temperature: 95°C (205°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 (205°F)

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

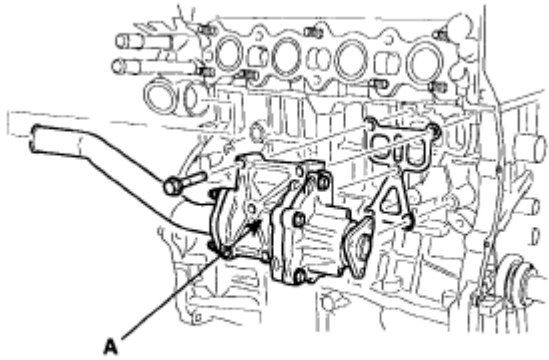
## INSTALLATION

### WATER PUMP

1. Install the water pump.
  1. Install the water pump (A) and a new gasket with the 5 bolts.

Tightening torque

19.6-26.46 N.m (2.0-2.7 kgf.m, 14.46-19.52 lb-ft)



KCRF157A

**Fig. 190: Identifying Water Pump**

Courtesy of KIA MOTORS AMERICA, INC.

2. Install water inlet pipe nut.

**Tightening torque**

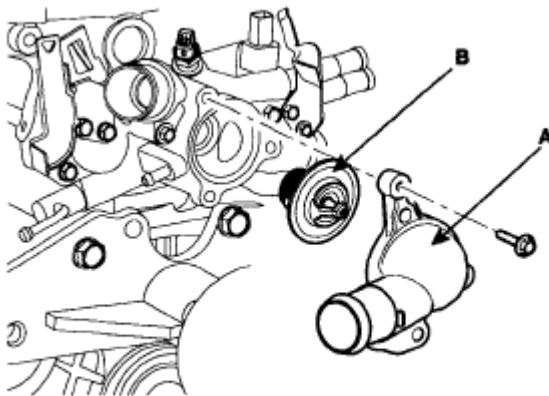
19.6-26.46 N.m (2.0-2.7 kgf.m, 14.46-19.52 lb-ft)

3. Install exhaust manifold.
4. Install drive belt.
5. Fill with engine coolant.
6. Start engine and check for leaks.
7. Recheck engine coolant level.

**THERMOSTAT**

1. Place thermostat (B) in thermostat housing (A).

1. Install the thermostat with the jiggle valve upward.



KCRF123A

**Fig. 191: Identifying Water Inlet And Thermostat**  
Courtesy of KIA MOTORS AMERICA, INC.

2. Install water inlet.

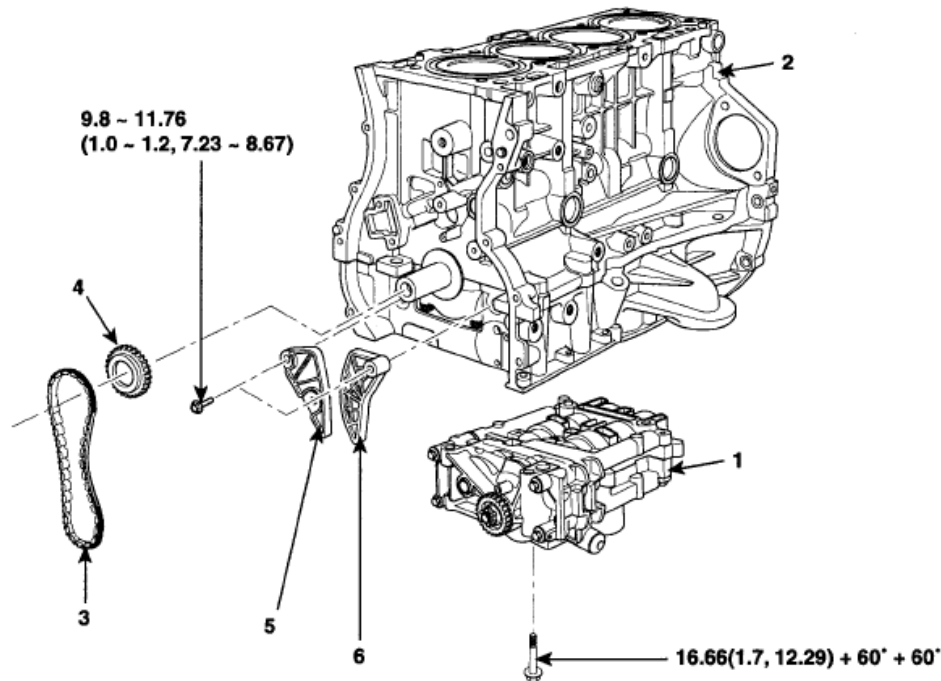
**Tightening torque**

14.7-21.56 N.m (1.5-2.2 kgf.m, 10.84-15.90 lb-ft)

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

## LUBRICATION SYSTEM

### COMPONENTS



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

- |                         |                                      |
|-------------------------|--------------------------------------|
| 1. Balance shaft module | 4. Balance shaft chain sprocket      |
| 2. Cylinder block       | 5. Balance shaft chain guide         |
| 3. Balance shaft chain  | 6. Balance shaft chain tensioner arm |

SMGEM6019N

**Fig. 192: Identifying Balance Shaft Components With Torque Specifications**  
Courtesy of KIA MOTORS AMERICA, INC.

**OIL AND FILTER****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 engine oil.
  1. Remove the oil filter cap.
  2. Remove the oil drain plug, and drain the oil into a container.
2. Replace oil filter.
  1. Remove the oil filter.
  2. Check and clean the oil filter installation surface.
  3. Check the part number of the new oil filter is as same as old one.
  4. Apply clean engine oil to the gasket of a new oil filter.
  5. Lightly screw the oil filter into place, and tighten it until the gasket contacts the seat.

**Tightening torque**

11.76-15.68 N.m (1.2-1.6 kgf.m, 8.67-11.57 lb-ft)

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

**Tightening torque**

39.2-44.1 N.m (4.0-4.5 kgf.m, 28.9-32.5 lb-ft)

2. Fill with fresh engine oil

**Capacity**

Total: 5.1L (5.39 US qt, 4.49 Imp. qt)

Excluding oil filter: 4.0L (4.23 US qt, 3.52 Imp. qts)

Including oil filter: 4.3L (4.54 US qt, 3.78 Imp. qts)

4. Start engine and check for oil leaks.
5. Recheck engine oil level.

**INSPECTION**

1. Check engine oil quality

Check the oil for deterioration, entry of water, discoloring or thinning.

If the quality is visibly poor, replace the oil.

2. Check engine oil level.

After warming up the engine and then 5 minutes after the engine stop, oil level should be between the "L" and "F" marks on the dipstick.

If low, check for leakage and add oil up to the "F" mark.

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

**SELECTION OF ENGINE OIL**

Recommended API classification: SJ OR SL ABOVE

Recommended SAE viscosity grades: 5W-20

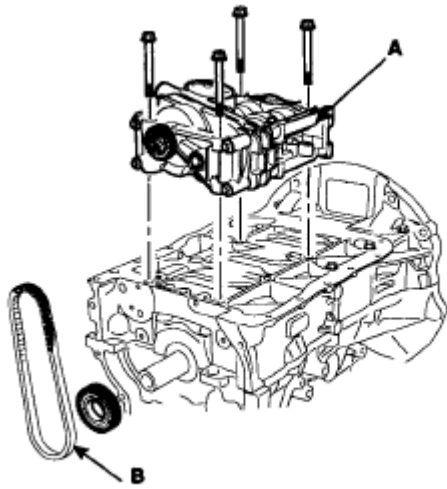
**NOTE: For best performance and maximum protection of all types of operation, select only those lubricants which:**

- Satisfy the requirement of the API classification.
- Have proper SAE grade number for expected ambient temperature range.

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

**REMOVAL**

1. Drain engine oil.
2. Remove the drive belt.
3. Turn the crankshaft and align the white groove on the crankshaft pulley with the pointer on the lower cover.
4. Remove the oil pan.
5. Remove the timing chain.
6. Remove balance shaft chain (B) and balance shaft module (A).



KCRF165A

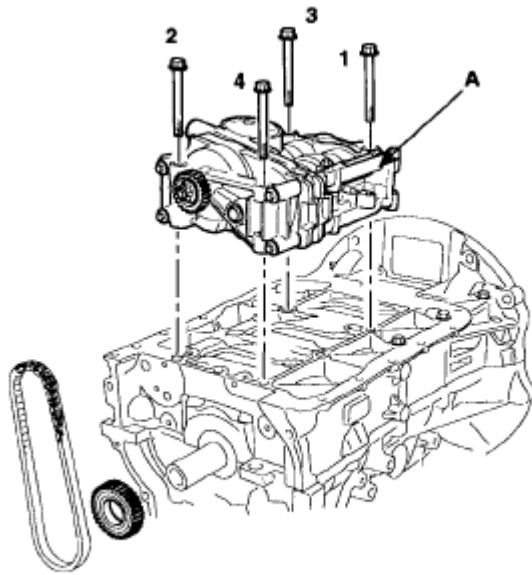
**Fig. 193: Identifying Balance Shaft Chain And Balance Shaft Module**  
Courtesy of KIA MOTORS AMERICA, INC.

## INSTALLATION

1. The key of crankshaft should be aligned with the mating face of main bearing cap. As a result of this, the piston of No.1 cylinder is placed at the top dead center on compression stroke.
2. Confirm the balance shaft module timing mark. Timing marks to be visually aligned with centers of adjacent cast timing notches.
3. Install balance shaft module (A) that the timing mark of balance shaft module sprocket should be matched with the timing mark (color link) of balance shaft chain.

### Tightening torque

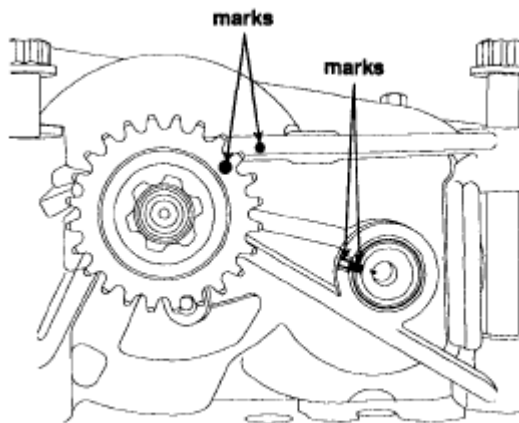
16.66 N.m (1.7 kgf.m, 12.3 lb-ft) + 60° + 60°



KCRF165B

**Fig. 194: Balance Shaft Module Mounting Bolts & Tightening Sequence**  
Courtesy of KIA MOTORS AMERICA, INC.

4. Install the balance shaft chain guide.
5. Install the balance shaft tensioner arm.
6. Install the balance shaft tensioner and remove the set pin.
7. Install the timing set pin from the balance shaft module.
8. Confirm the timing marks.



ECRF006A

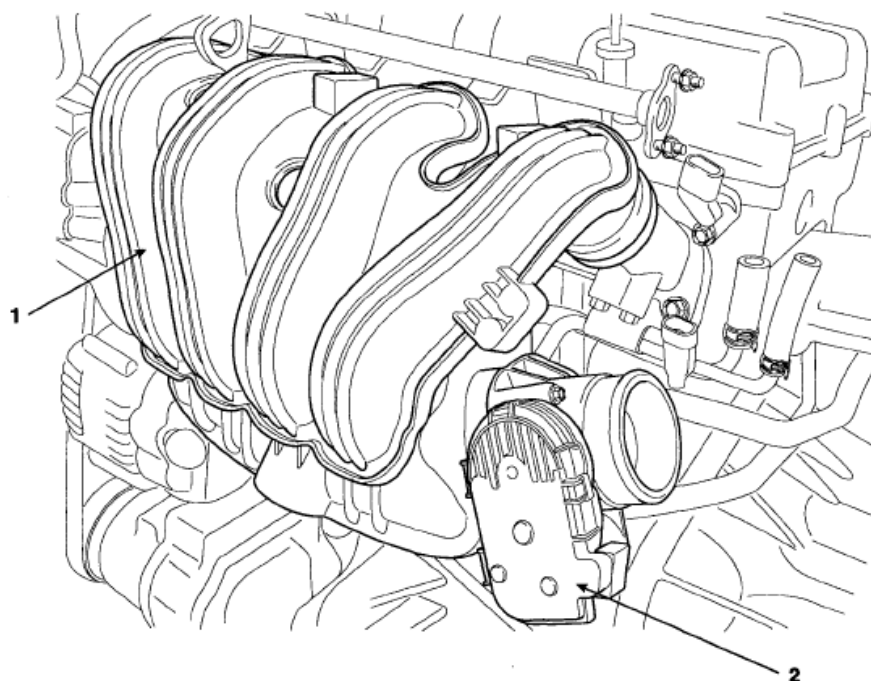
**Fig. 195: Identifying Balance Shaft Module Timing Marks**  
Courtesy of KIA MOTORS AMERICA, INC.

9. Install oil pan.
10. Fill with engine oil.

## INTAKE AND EXHAUST SYSTEM

### COMPONENTS

#### INTAKE MANIFOLD

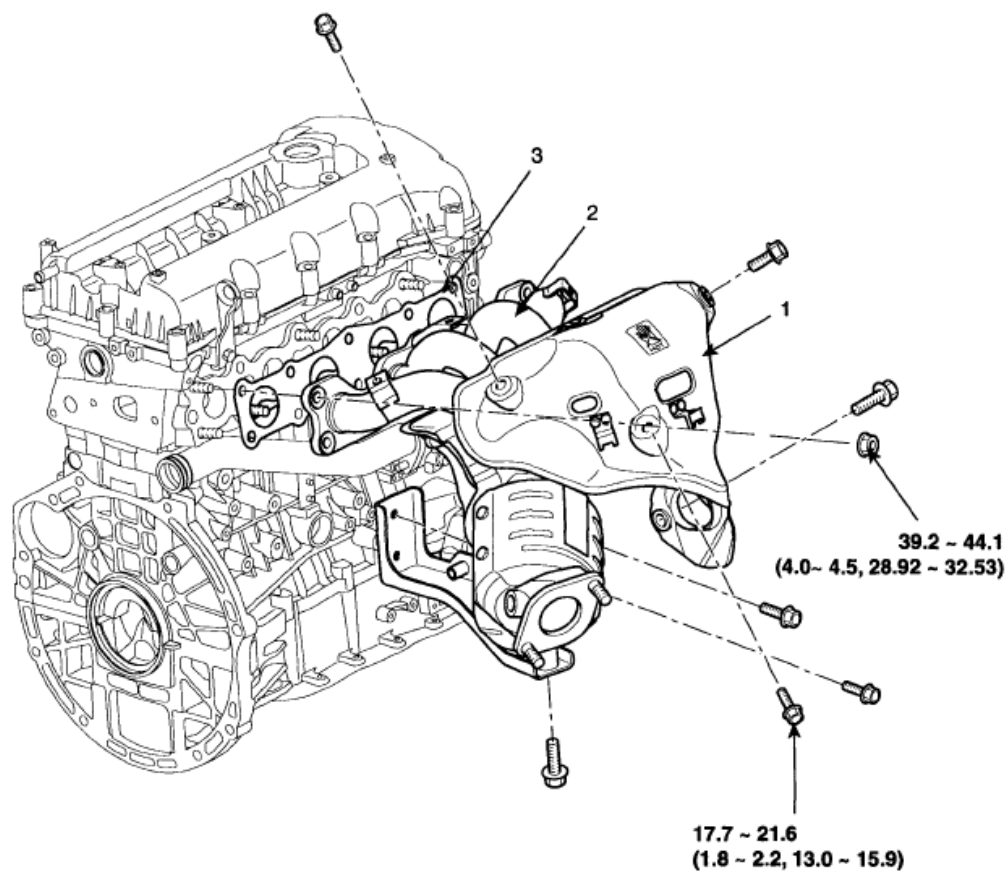


- 1. Intake manifold gasket
- 2. Electronic throttle body

SMGEM6002N

**Fig. 196: Identifying Intake Manifold Components**  
Courtesy of KIA MOTORS AMERICA, INC.

#### EXHAUST MANIFOLD



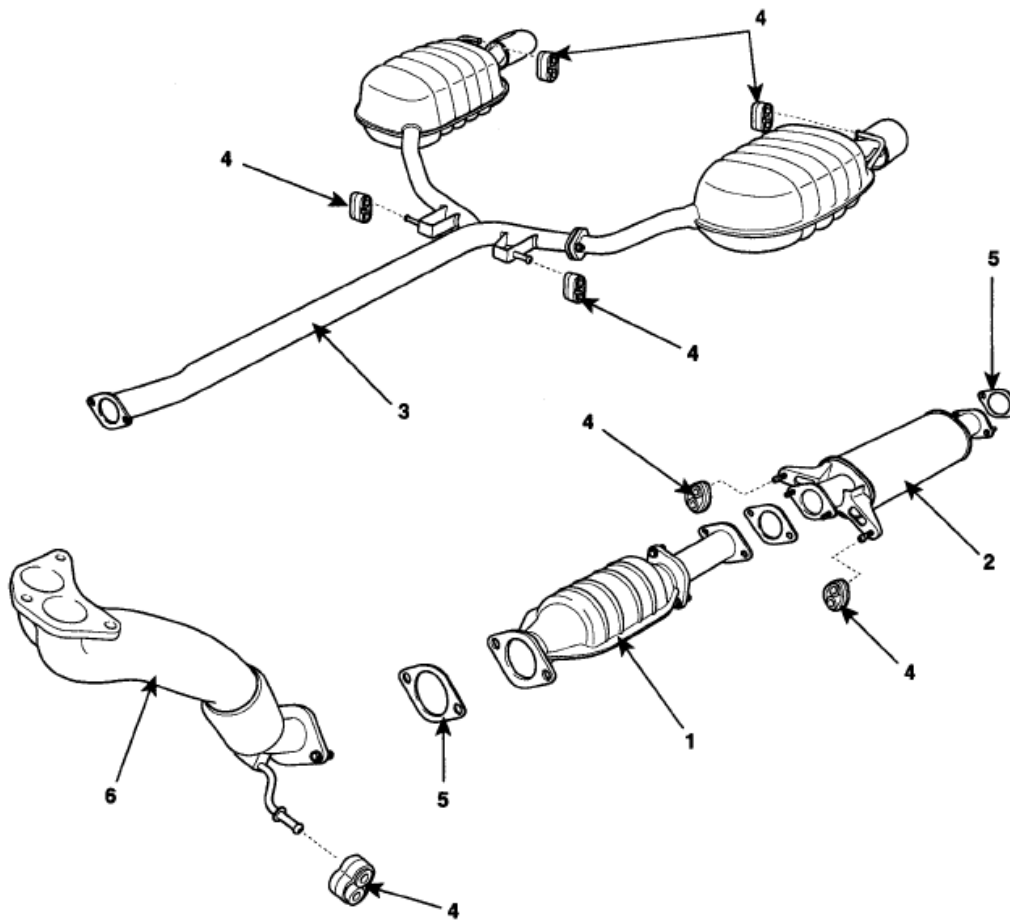
**TORQUE : N.m (kgf.m, lb-ft)**

1. Heat protector
2. Exhaust manifold
3. Exhaust manifold gasket

SMGEM6003N

**Fig. 197: Identifying Exhaust Manifold Components With Torque Specifications**  
Courtesy of KIA MOTORS AMERICA, INC.

**MUFFLER**



- 1. Catalytic converter
- 2. Center muffler
- 3. Main muffler

- 4. Rubber hanger
- 5. Gasket
- 6. Front muffler

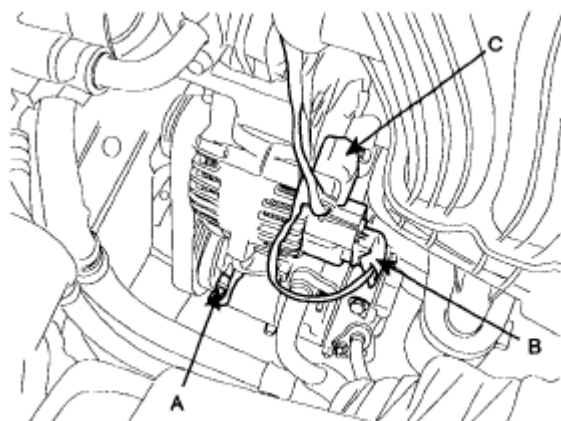
SMGEM6004N

**Fig. 198: Identifying Catalytic Converter & Muffler Components**  
Courtesy of KIA MOTORS AMERICA, INC.

## REMOVAL

### INTAKE MANIFOLD

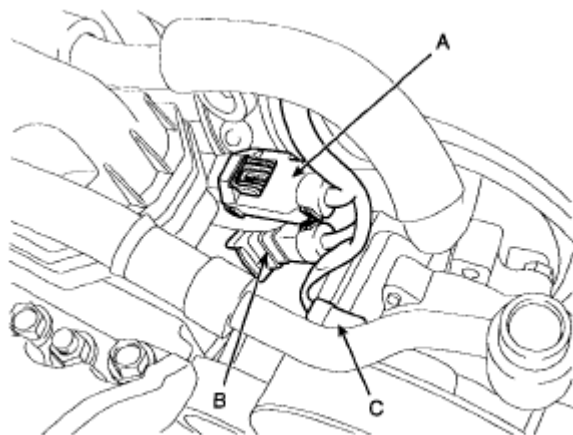
1. Remove the engine cover.
2. Remove the air cleaner assembly.
3. Remove the A/C switch connector (A), alternator connector (B) and oil pressure switch connector (C).



KCRF126A

**Fig. 199: Identifying A/C Switch, Alternator Connector And Oil Pressure Switch**  
Courtesy of KIA MOTORS AMERICA, INC.

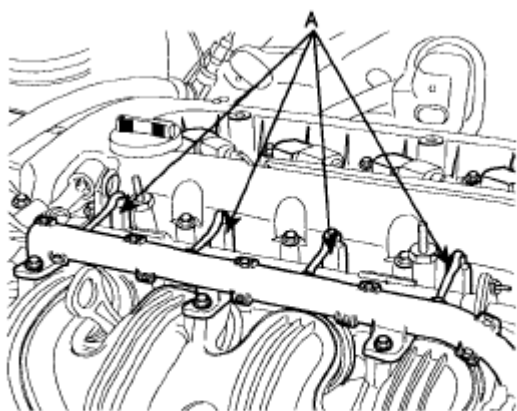
4. Remove the OCV connector (A), OTS connector (B), P/S switch connector (C).



ACLG004A

**Fig. 200: Identifying OCV Connector, OTS Connector And P/S Switch Connector**  
Courtesy of KIA MOTORS AMERICA, INC.

5. Remove the injector connector (A).

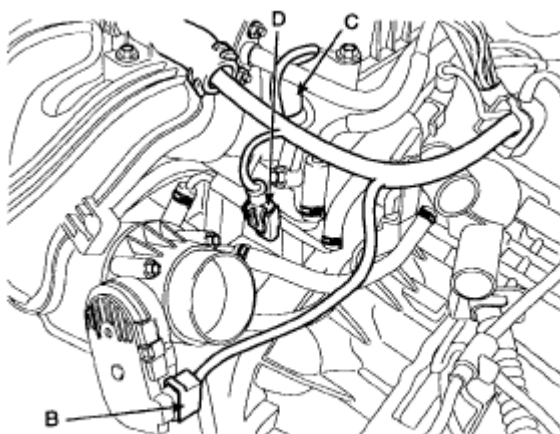


KCRF128A

**Fig. 201: Identifying Injector Connectors**

Courtesy of KIA MOTORS AMERICA, INC.

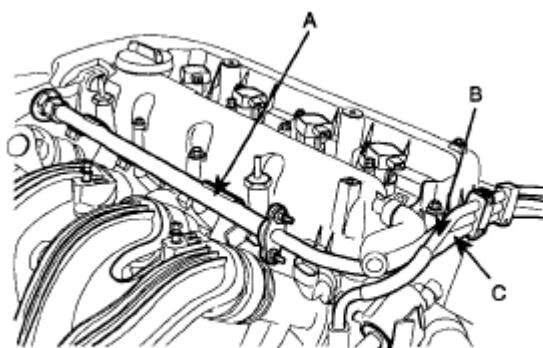
6. Disconnect the engine wire harness connectors.
  1. Remove the ETC connector (B), CMP connector (C), knock sensor connector (D).



ACLG005A

**Fig. 202: Identifying ETC Connector, CMP Connector And Knock Sensor Connector**  
Courtesy of KIA MOTORS AMERICA, INC.

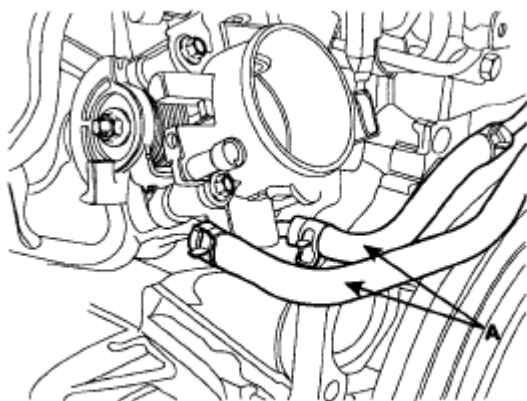
7. Remove the delivery pipe (A).



KCRF134A

**Fig. 203: Identifying Delivery Pipe, Brake Vacuum Hose And PCSV Hose**  
Courtesy of KIA MOTORS AMERICA, INC.

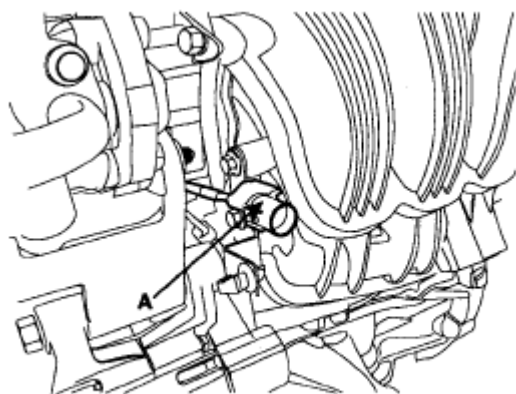
8. Remove the coolant hoses (A) from the throttle body.



KCRF141B

**Fig. 204: Identifying Coolant Hoses From Throttle Body**  
Courtesy of KIA MOTORS AMERICA, INC.

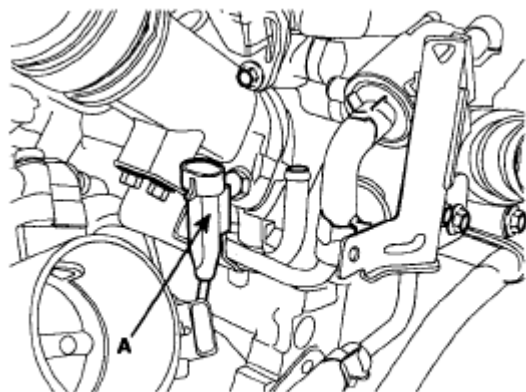
9. Remove the oil pressure switch connector (A) from the bracket.



KCRF141A

**Fig. 205: Identifying Oil Pressure Switch Connector From Bracket**  
Courtesy of KIA MOTORS AMERICA, INC.

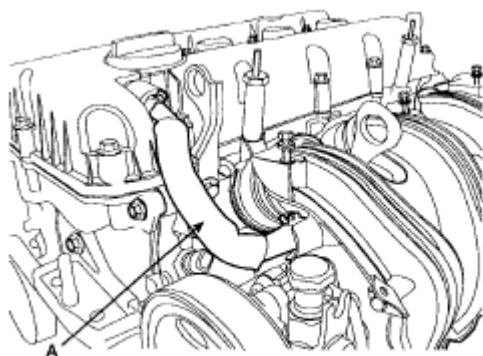
10. Remove the knock sensor connector (A) from the bracket.



KCRF141C

**Fig. 206: Identifying Knock Sensor Connector From Bracket**  
Courtesy of KIA MOTORS AMERICA, INC.

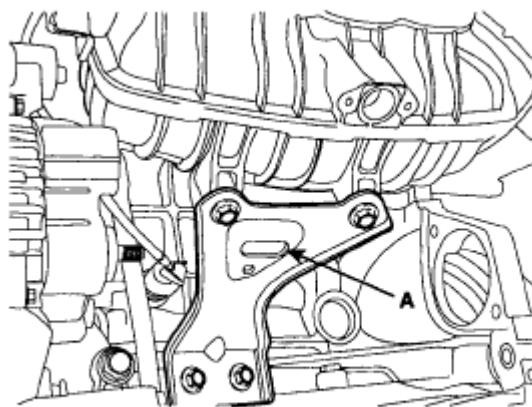
11. Remove the PCSV vacuum hose, brake vacuum hose.
12. Remove the PCV hose (A).



KCRF141E

**Fig. 207: Identifying PCV Hose And Breather Hose From Cylinder Head Cover**  
Courtesy of KIA MOTORS AMERICA, INC.

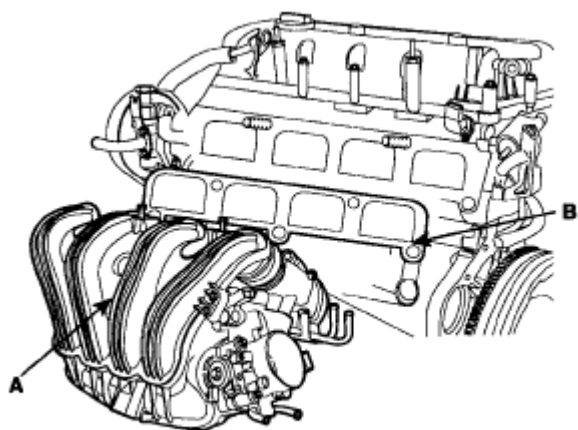
13. Remove the intake manifold stay (A).



KCRF141D

**Fig. 208: Identifying Intake Manifold Stay**  
Courtesy of KIA MOTORS AMERICA, INC.

14. Remove the oil level gauge.
15. Remove the intake manifold (A) and gasket.

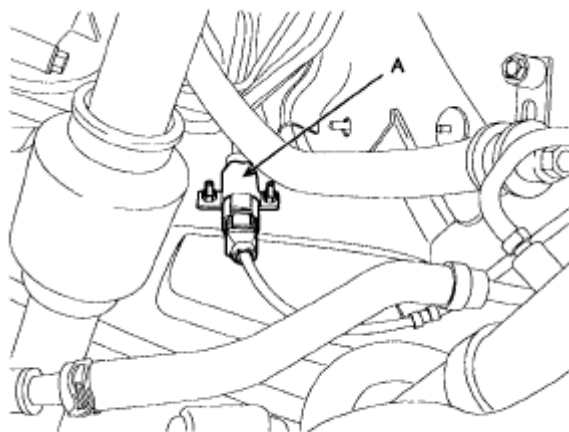


KCRF142A

**Fig. 209: Identifying Intake Manifold And Gasket**  
Courtesy of KIA MOTORS AMERICA, INC.

#### EXHAUST MANIFOLD

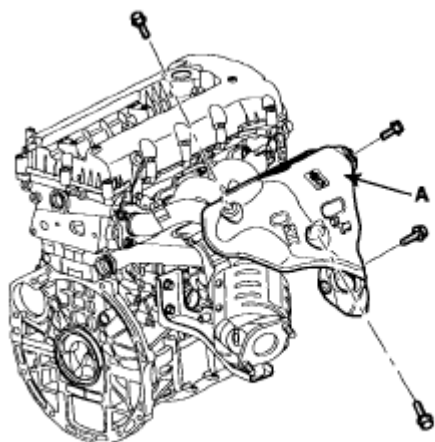
1. Remove the oxygen sensor connector (A).



ACLG008A

**Fig. 210: Identifying Oxygen Sensor Connector**  
Courtesy of KIA MOTORS AMERICA, INC.

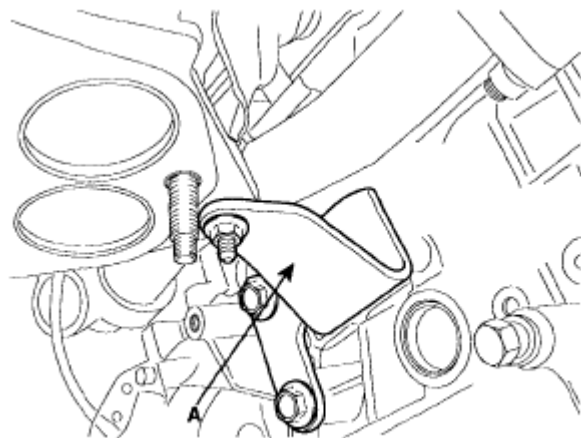
2. Remove the front muffler (A).
3. Remove the heat protector (A).



LCLG008A

**Fig. 211: Identifying Exhaust Heat Protector**  
Courtesy of KIA MOTORS AMERICA, INC.

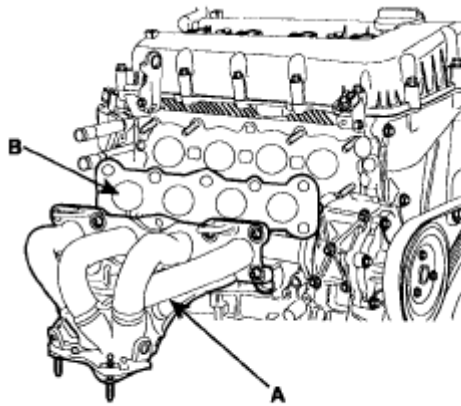
4. Remove the exhaust manifold stay (A).



ACRF019A

**Fig. 212: Identifying Exhaust Manifold Stay**  
Courtesy of KIA MOTORS AMERICA, INC.

5. Remove the exhaust manifold (A) and gasket.



KCRF140A

**Fig. 213: Identifying Exhaust Manifold And Gasket**  
Courtesy of KIA MOTORS AMERICA, INC.

## INSTALLATION

### INTAKE MANIFOLD

1. Install the intake manifold and gasket.

#### **Tightening torque:**

18.6-27.44 N.m (1.9-2.8 kgf.m, 13.7-20.2 lb-ft)

2. Install the intake manifold stay.

#### **Tightening torque:**

18.6-27.44 N.m (1.9-2.8 kgf.m, 13.7-20.2 lb-ft)

3. Install the PCV hose.
4. Install the PCSV vacuum hose, brake vacuum hose.
5. Install the knock sensor connector from the bracket.
6. Install the oil pressure switch connector from the bracket.
7. Install the coolant hoses from the throttle body.
8. Install the delivery pipe.
9. Install the engine wire harness connectors.
  1. Install the ETC connector, CMP connector, knock sensor connector.
10. Install the injector connector.
11. Install Remove the OCV connector, OTS connector, P/S switch connector.
12. Install the A/C switch connector, alternator connector and oil pressure switch connector.
13. Install the air cleaner assembly.

14. Install the engine cover.

**EXHAUST MANIFOLD**

1. Install the exhaust manifold.

**Tightening torque:**

39.2-44.1 N.m (4.0-4.5 kgf.m, 28.92-32.53 lb-ft)

2. Install the exhaust manifold stay.

**Tightening torque:**

Bolts: 18.6-27.44 N.m (1.9-2.8 kgf.m, 13.7-20.2 lb-ft)

Nut: 42.2-52.0 N.m (4.0-4.5 kgf.m, 31.1-38.3 lb-ft)

3. Install the heat protector.

**Tightening torque:**

17.7-21.6 N.m (1.8-2.2 kgf.m, 13.0-15.9 lb-ft)

4. Install the front muffler.

**Tightening torque:**

39.2-58.8 N.m (4.0-6.0 kg-m, 28.92-43.37 lb-ft)

5. Install the oxygen sensor connector