# Engine Mechanical - 1.0L

## Specifications

*SIE-ID = 1292078 Owner = prober01 LMD = 16-may-2003 LMB = kwalla01*

### Fastener Tightening Specifications

| Application | Specification | |
|---|---|---|
| | Metric | English |
| A/C Compressor Mounting Bracket Bolts | 35–45 N·m | 25–33 lb ft |
| A/C Compressor Mounting Lower Bolts | 20–24 N·m | 15–18 lb ft |
| A/C Compressor Mounting Upper Bolts | 18–22 N·m | 13–16 lb ft |
| Air Filter Housing Nuts | 5–7 N·m | 44–62 lb in |
| Air Filter Snorkel Bolt | 7–9 N·m | 62–80 lb in |
| Camshaft Gear Bolt | 50–60 N·m | 36–44 lb ft |
| Camshaft Plate Screw | 9–12 N·m | 80–106 lb in |
| Clutch Housing Lower Plate Bolts | 4–7 N·m | 35–62 lb in |
| Connecting Rod Bearing Cap Nuts | 31–35 N·m | 23–25 lb ft |
| Crankshaft Main Bearing Cap Bolts | 55–60 N·m | 41–44 lb ft |
| Crankshaft Pulley Bolt | 65–75 N·m | 48–55 lb ft |
| Crankshaft Rear Oil Seal Housing Bolts | 9–12 N·m | 80–106 lb in |
| Cylinder Head Bolts | 65–70 N·m | 48–52 lb ft |
| Cylinder Head Cover Hexagon Bolts | 9–12 N·m | 80–106 lb in |
| Distributor Housing Bolts/Nuts | 9–12 N·m | 80–106 lb in |
| Engine Mount Brace Bracket Bolts | 35–45 N·m | 25–33 lb ft |
| Engine Mount Brace Bracket Nuts | 18–22 N·m | 13–16 lb ft |
| Engine Mount Damping Block Bolts | 45–55 N·m | 33–41 lb ft |
| Engine Mount Front Bracket-to-Engine Mount Bolt | 35–41 N·m | 25–30 lb ft |
| Engine Mount Front Damping Bush Bolt – Crossmember Side | 35–41 N·m | 25–30 lb ft |
| Engine Mount Front Damping Bush Bolt/Nut – Bracket Side | 68–83 N·m | 50–62 lb ft |
| Engine Mount Front Damping Bush Bolts – Crossmember Side | 45–55 N·m | 33–41 lb ft |
| Engine Mount Intermediate Bracket Bolts | 72–88 N·m | 53–65 lb ft |
| Engine Mount Intermediate Bracket Upper Nuts | 60–70 N·m | 44–52 lb ft |
| Engine Mount Lower Bracket Bolts | 35–41 N·m | 25–30 lb ft |
| Engine Mount Reaction Rod-to-Body Bolts | 68–83 N·m | 50–61 lb ft |
| Engine Mount Reaction Rod-to-Engine Mount Bolts/Nuts | 68–83 N·m | 50–61 lb ft |
| Engine Mount Upper Bracket Bolts | 35–41 N·m | 25–30 lb ft |
| Exhaust Manifold Bolts/Nuts | 17–27 N·m | 13–20 lb ft |
| Exhaust Manifold Heat Shield Bolts | 8–12 N·m | 71–106 lb in |
| Flywheel Bolts | 40–45 N·m | 30–33 lb ft |
| Intake Manifold Main Bracket Bolts – 10M | 9–12 N·m | 80–106 lb in |
| Intake Manifold Main Bracket Nuts | 9–12 N·m | 80–106 lb in |
| Intake Manifold Nuts | 15–19 N·m | 11–14 lb ft |
| Intake Manifold Subsidiary Bracket Bolt | 9–12 N·m | 80–106 lb in |
| Intake Manifold Subsidiary Bracket Nut | 15–19 N·m | 11–14 lb ft |
| Oil Filter | 12–16 N·m | 106–140 lb in |
| Oil Filter Stud | 20–25 N·m | 15–18 lb ft |
| Oil Level Gage Guide Tube Bolt | 9–12 N·m | 80–106 lb in |
| Oil Pan Bolts/Nuts | 9–12 N·m | 80–106 lb in |
| Oil Pan Drain Plug | 30–40 N·m | 22–30 lb ft |

### Fastener Tightening Specifications (cont'd)

| Application | Specification | |
|---|---|---|
| | Metric | English |
| Oil Pressure Switch | 12–16 N·m | 106–140 lb in |
| Oil Pump Cover Bolts | 9–12 N·m | 80–106 lb in |
| Oil Pump Strainer Bolt | 9–12 N·m | 80–106 lb in |
| Power Steering Pump Bolt | 20–24 N·m | 15–18 lb ft |
| Power Steering Pump Front Bracket Bolt | 20–24 N·m | 15–18 lb ft |
| Power Steering Pump Rear Bracket Adjust Bolt | 20–24 N·m | 15–18 lb ft |
| Power Steering Pump Rear Bracket Bolt | 18–22 N·m | 13–16 lb ft |
| Power Steering Pump Rear Bracket Nut | 20–24 N·m | 15–18 lb ft |
| Rocker Arm Shaft Bolts | 9–12 N·m | 80–106 lb in |
| Spark Plug | 20–30 N·m | 15–22 lb ft |
| Timing Belt Front Lower Cover Bolts | 9–12 N·m | 80–106 lb in |
| Timing Belt Front Upper Cover Bolts | 9–12 N·m | 80–106 lb in |
| Timing Belt Rear Cover Bolts | 9–12 N·m | 80–106 lb in |
| Timing Belt Tensioner Bolt | 15–23 N·m | 11–17 lb ft |
| Valve Adjusting Lock Nuts | 15–20 N·m | 11–15 lb ft |

## Engine Mechanical Specifications

*SIE-ID = 1273077 Owner = prober01 LMD = 27-jul-2004 LMB = hinks*

### General Specifications

| Application | Specification | |
|---|---|---|
| | Metric | English |
| Engine Information | | |
| Engine Type | Overhead Cam L-4 | |
| Bore | 68.5 mm | 2.70 in |
| Compression Ratio | 9.3:1 | |
| Lubricating Type | Forced Feed | |
| Maximum Power at 5,400 RPM | 46.5 kW | 62.3 HP |
| Maximum Torque at 4,200 RPM | 87.3 N·m | 64.4 lb ft |
| Oil Pump Type | Trocboid Rotor | |
| Oil Filter Type | Cartridge (Full Flow) | |
| Oil Pan Capacity Including Oil Filter | 3.2 liter | 3.4 quarts |
| Stroke | 67.5 mm | 2.66 in |
| Total Displacement | 995 $cm^3$ | |
| Coolant | 4.2 L | 4.44 qt |
| Battery | 12V – 45 AH, 330 CCA | |

### Cylinder Compression Check Specifications

| Condition | Cylinder Number | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Compression top dead center of No. 1 cylinder | | | | |
| Intake | O | O | — | — |
| Exhaust | O | — | O | — |
| Exhaust top dead center of No. 1 cylinder | | | | |
| Intake | — | — | O | O |
| Exhaust | — | O | — | O |
| * O marks indicate the place where the valve clearance can be checked and adjusted. | | | | |

## Valve Clearance Specifications

| Application | Specification | |
|---|---|---|
| | Metric | English |
| Cold | | |
| Intake | 0.15 +/– 0.02 mm | 0.0059 +/– 0.0008 in |
| Exhaust | 0.2 +/– 0.02 mm | 0.00787 +/– 0.0008 in |
| Hot | | |
| Intake | 0.25 +/– 0.02 mm | 0.0098 +/– 0.0008 in |
| Exhaust | 0.3 +/– 0.02 mm | 0.0118 +/– 0.0008 in |

## Engine Mechanical Specifications

| Application | Specification | |
|---|---|---|
| | Metric | English |
| Camshaft | | |
| Bearing Outside Diameter, Head Journal I D, No. 1 | 43.5000–43.516 mm | 1.713–1.7132 in |
| Bearing Outside Diameter, Head Journal I D, No. 2 | 43.700–43.716 mm | 1.720–1.7211 in |
| Bearing Outside Diameter, Head Journal I D, No. 3 | 43.900–43.916 mm | 1.728–1.7290 in |
| Bearing Outside Diameter, Head Journal I D, No. 4 | 44.100–44.116 mm | 1.736–1.7369 in |
| Bearing Outside Diameter, Head Journal I D, No. 5 | 44.300–44.316 mm | 1.744–1.745 in |
| End Play | | |
| Journal Outside Diameter No. 1 | 43.425–43.450 mm | 1.710–1.711 in |
| Journal Outside Diameter No. 2 | 43.625–43.650 mm | 1.718–1.719 in |
| Journal Outside Diameter No. 3 | 43.825–43.850 mm | 1.725–1.726 in |
| Journal Outside Diameter No. 4 | 44.025–44.050 mm | 1.733 1.734 in |
| Journal Outside Diameter No. 5 | 44.225–44.250 mm | 1.741–1.742 in |
| Lift Exhaust | 5.38 mm | 0.212 in |
| Lift Intake | 5.42 mm | 0.213 in |
| Crankshaft | | |
| Connecting Rod Journal Diameter, All | 37.982–38.000 mm | 1.495–1.496 in |
| Main Journal Crankshaft End Play | 0.11–0.31 mm | 0.004–0.012 in |
| Main Journal Diameter, All | 43.982–44.000 mm | 1.7316–1.7323 in |
| Main Journal Main Bearing Clearance, All | 0.020–0.040 mm | 0.0008–0.0016 in |
| Main Journal Out of Round, Maximum | 0.005 mm | 0.0002 in |
| Main Journal Taper, Maximum | 0.005 mm | 0.0002 in |
| Out of Round, Maximum | 0.005 mm | 0.0002 in |
| Rod Bearing Clearance, All | 0.020–0.040 mm | 0.0008–0.0016 in |
| Rod Sode Clearance | 0.10–0.25 mm | 0.004–0.010 in |
| Taper, Maximum | 0.005 mm | 0.0002 in |
| Cylinder Bore | | |
| Diameter | 68.5 mm | 2.70 in |
| Out of Round, Maximum | 0.005 mm | 0.00020 in |
| Taper, Maximum | 0.005 mm | 0.00020 in |
| General Data | | |
| Bore Stroke | 68.5 x 67.5 mm | 2.70 x 2.66 in |
| Compression Ratio | 9.1–9.5:1 | |
| Displacement | 995 $cm^3$ | |
| Engine Type | 4 Cylinder, In-Line | |
| Firing Order | 1–3–4–2 | |
| Oil Pump | | |
| Gap Between Oil Pump Body and Outer Rotor | 0.10–0.17 mm | 0.0039–0.0067 in |

## Engine Mechanical Specifications (cont'd)

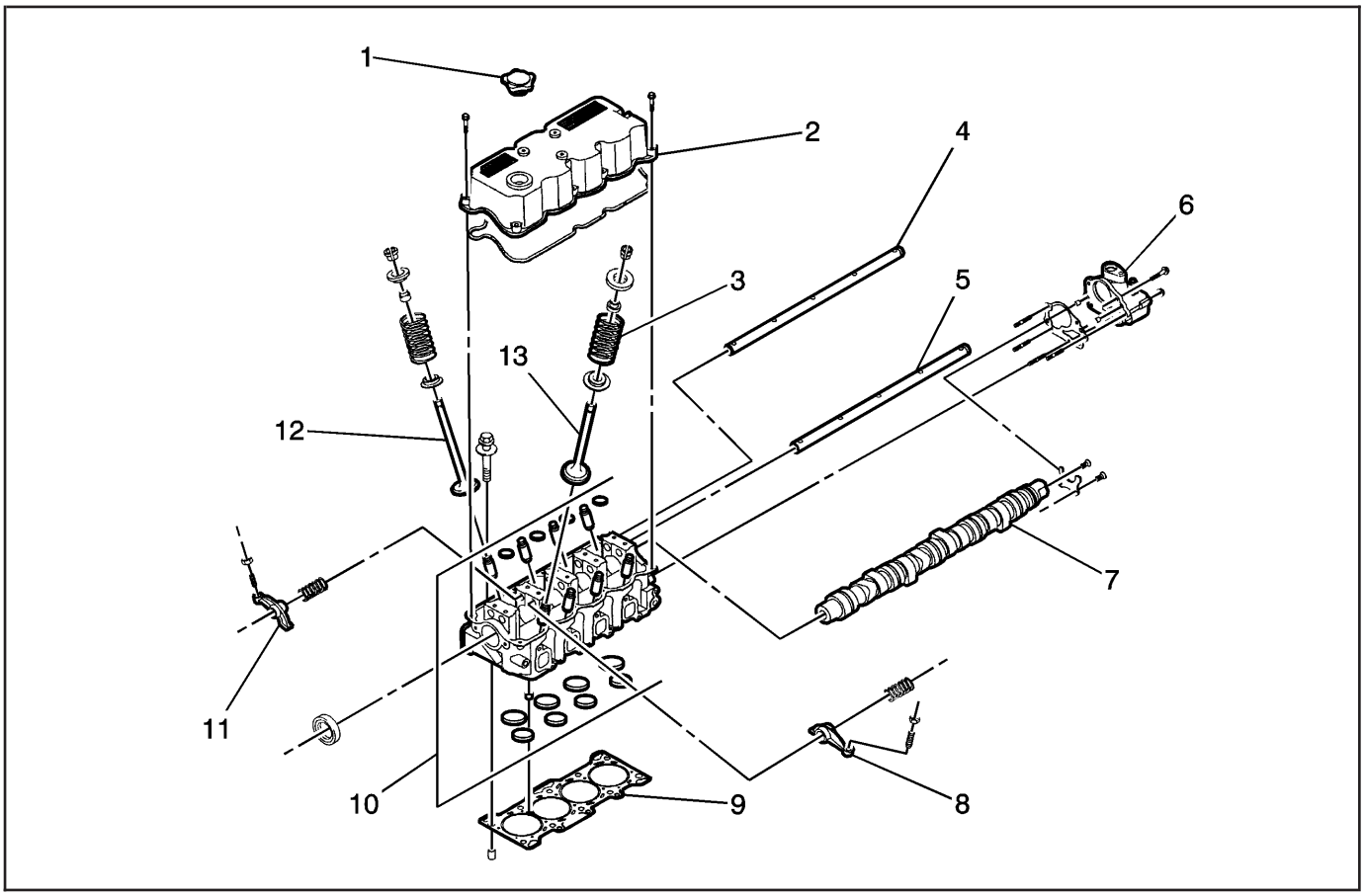
| Application | Specification | |
|---|---|---|
| | Metric | English |
| Inner Rotor Side Clearance | 0.065–0.115 mm | 0.0026–0.0045 in |
| Outer Rotor Side Clearance | 0.065–0.115 mm | 0.0026–0.0045 in |
| Relief Valve Spring Free Length | 52.4 mm | 2.06 in |
| Piston | | |
| Clearance to Bore | 0.025–0.045 mm | 0.0010–0.0018 in |
| Diameter | 68.465–68.485 mm | 2.695–2.696 in |
| Piston Pin | | |
| Diameter | 16.995–17.000 mm | 0.6691–0.6693 in |
| Pin Off-Set | 0.4–0.6 mm | 0.016–0.024 in |
| Piston Rings, End Gap | | |
| Top Compression | 0.15–0.30 mm | 0.006–0.012 in |
| 2nd Compression | 0.30–0.45 mm | 0.012–0.0.18 in |
| Piston Rings, Groove Clearance | | |
| Top Impression | 0.02–0.06 mm | 0.0008–0.002 in |
| 2nd Impression | 0.02–0.06 mm | 0.0008–0.002 in |
| Valve System | | |
| Face Angle, All | 45 degrees | |
| Face Runout, Maximum, All | 0.045 mm | 0.0018 in |
| Seat Angle, All | 45 degrees | |
| Seat Runout, Maximum, All | 0.05 mm | 0.0019 in |
| Seat Width, Exhaust | 1.56 mm | 0.061 in |
| Seat Width, Intake | 1.56 mm | 0.061 in |
| Valve Diameter, All, Exhaust | 31.7–31.9 mm | 1.248–1.256 in |
| Valve Diameter, All, Intake | 35.5–35.7 mm | 1.398–1.406 in |
| Valve Guide Inside Diameter | 5.500–5.512 mm | 0.2165–0.2170 in |
| Valve Lash Compensators | Mechanical | |
| Valve Spring Loads, Valve Closed | 23.4–27 Kgf 44.2 mm | 51.59–59.53 lbs 1.740 in |
| Valve Spring Loads, Valve Open | 51.7–58.3 Kgf 36.2 mm | 113.97–128.53 lbs 1.425 in |
| Valve Stem Diameter, Exhaust | 5.440–5.455 mm | 0.214–0.215 in |
| Valve Stem Diameter, Intake | 5.465–5.480 mm | 0.215–0.216 in |

# Component Locator

## Disassembled Views

*SIE-ID = 1283864 Owner = prober01 LMD = 02-apr-2003 LMB = aspenc01*

### Cylinder Head SIO-ID = 1241347 LMD = 21-jul-2004

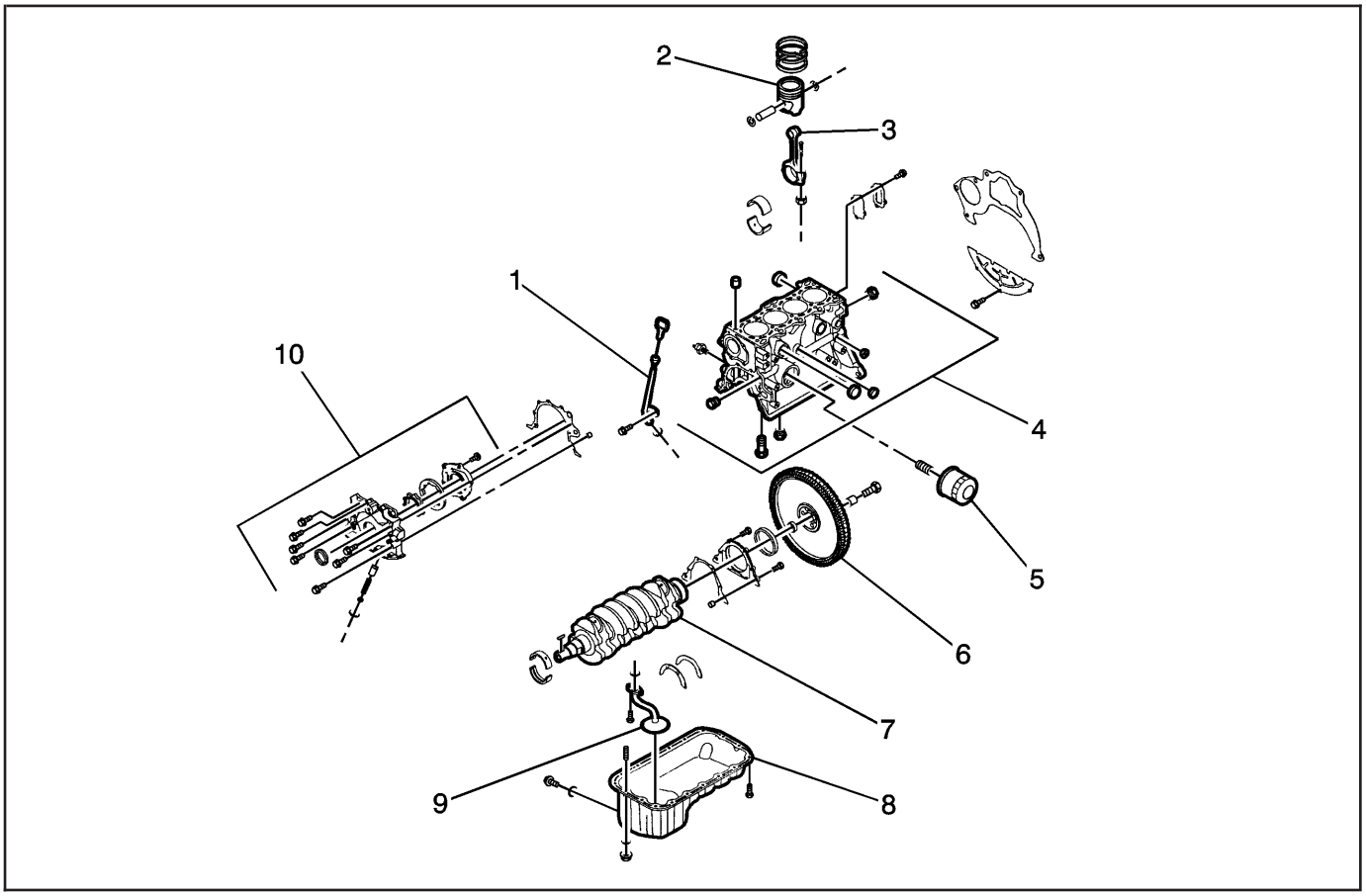



1241297

**Legend**

(1) Oil Filter Cap
(2) Cylinder Head Cover
(3) Valve Spring
(4) Intake Rocker Arm Shaft
(5) Exhaust Rocker Arm Shaft
(6) Water Outlet Case
(7) Camshaft
(8) Rocker Arm
(9) Cylinder Head Gasket
(10) Cylinder Head
(11) Rocker Arm
(12) Intake Valve
(13) Exhaust Valve

## Engine Block SIO-ID = 1241349 LMD = 21-jul-2004

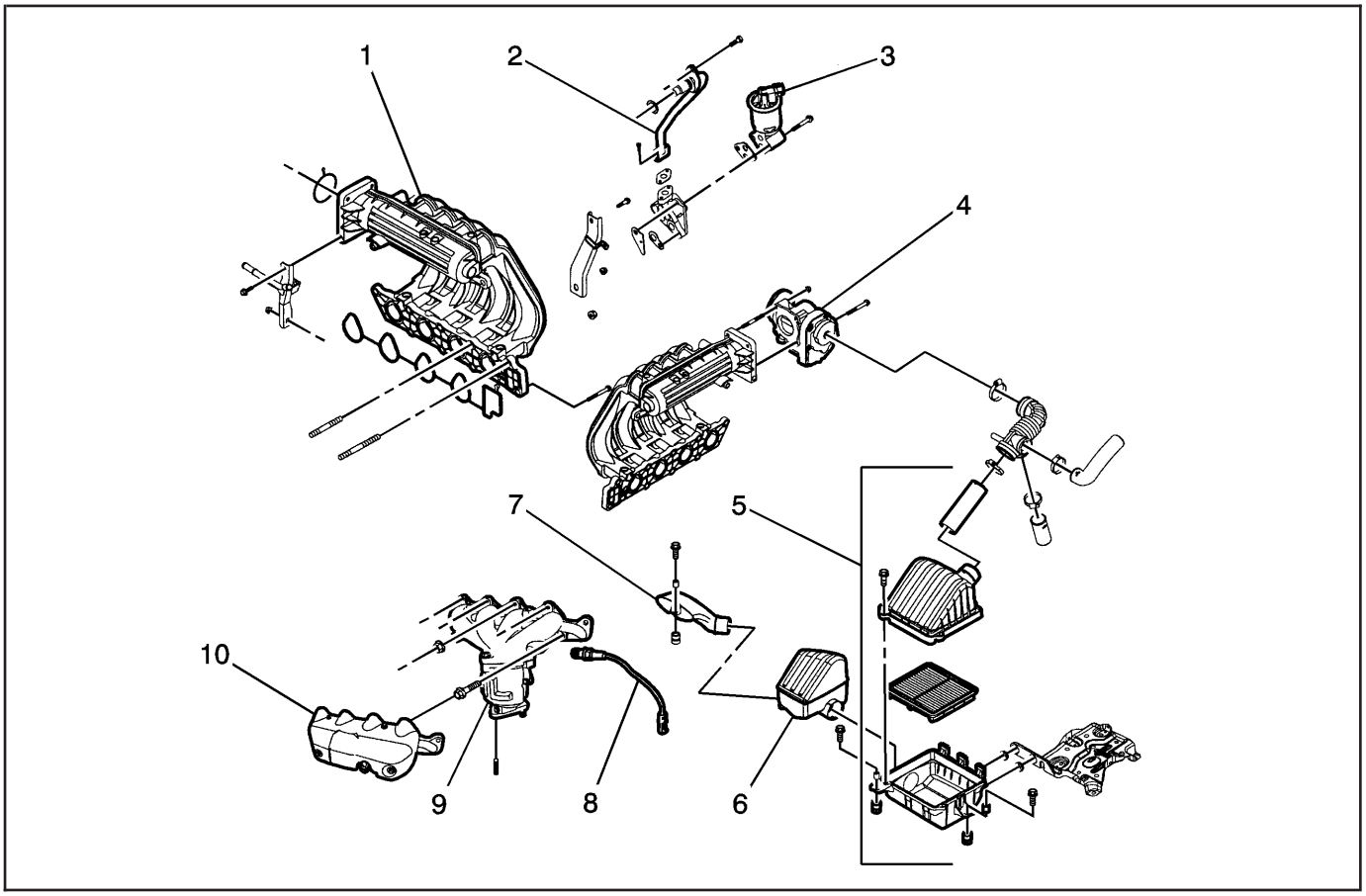



1241299

**Legend**

(1) Oil Level Gage Stick
(2) Piston
(3) Connecting Rod
(4) Engine Block
(5) Oil Filter
(6) Flywheel
(7) Crankshaft
(8) Oil Pan
(9) Oil Pump Strainer
(10) Oil Pump Assembly

## Manifold and Air Flow System SIO-ID = 1241350 LMD = 21-jul-2004

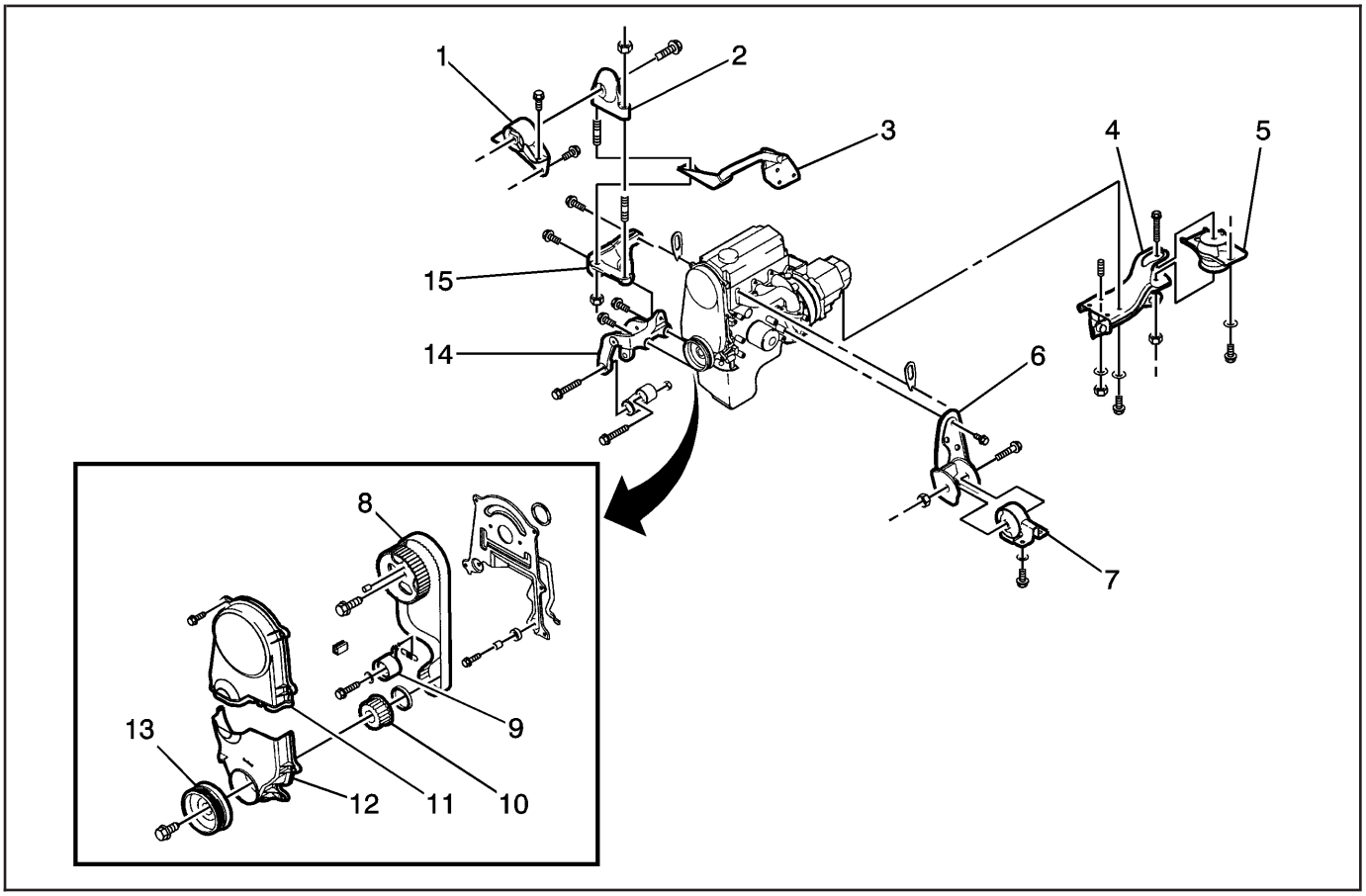



1241301

**Legend**

(1) Intake Manifold
(2) Exhaust Gas Recirculation (EGR) Pipe
(3) Exhaust Gas Recirculation (EGR) Valve
(4) Throttle Body Assembly
(5) Air Filter Assembly
(6) Resonator
(7) Snorkel
(8) Oxygen Sensor
(9) Exhaust Manifold
(10) Exhaust Manifold Heat Shield

## Timing Belt and Engine Mount SIO-ID = 1241351 LMD = 21-jul-2004




1241302

**Legend**

(1) Engine Mount Damping Block
(2) Engine Mount Intermediate Bracket
(3) Engine Mount Bracket
(4) Transaxle Mount Bracket
(5) Transaxle Mount Damping Block
(6) Engine Mount Front Bracket
(7) Engine Mount Front Damping Bush
(8) Timing Belt
(9) Timing Belt Tensioner
(10) Crankshaft Gear
(11) Timing Belt Upper Front Cover
(12) Timing Belt Lower Front Cover
(13) Crankshaft Pulley
(14) Engine Mount Lower Bracket
(15) Engine Mount Upper Bracket

# Diagnostic Information and Procedures

## Diagnostic Starting Point - Engine Mechanical

*SIE-ID = 1326881 Owner = prober01 LMD = 07-may-2003 LMB = jbowm01*

Begin the system diagnosis by reviewing *Symptoms - Engine Mechanical on page 6-4*. Reviewing the description and operation information will help you determine the correct symptom diagnostic procedure when a malfunction exists. Reviewing the description and operation information will also help you determine if the condition described by the customer is normal operation. Refer to *Engine Component Description on page 6-110* in order to identify the correct procedure for diagnosing the system and where the procedure is located.

## Symptoms - Engine Mechanical

*SIE-ID = 1645558 Owner = dcobb01 LMD = 30-jun-2005 LMB = jwatki01*

### Hard Start

| Checks | Actions |
|---|---|
| Malfunction of Ignition System | |
| Faulty fuse | Replace the fuse. |
| Faulty spark plug | Clean and adjust the plug gap or replace. |
| Electric leakage at the high tension cable | Replace the cable. |
| Poor connection of the high tension cable or lead wires | Replace the cable or wires. |
| Improper ignition timing | Adjust the ignition timing. |
| Faulty ignition coil | Replace the ignition coil. |
| Malfunction of Fuel System | |
| Lock of fuel in the fuel tank | Feed the fuel. |
| Dirty or clogged fuel filter | Replace the filter. |
| Clogged fuel pipe | Clean the fuel pipe. |
| Malfunction of the fuel pump | Replace the fuel pump. |
| Malfunction of the fuel injector | Replace the injector. |
| The foreign material in the fuel tank | Clean the fuel tank. |
| Decline of Compression Pressure | |
| Poor tightening spark plug | Tighten to the specified torque. Refer to *Fastener Tightening Specifications on page 6-1*. |
| Cracked cylinder head gasket | Replace the gasket. |
| Inadequate valve clearance | Adjust the clearance. |
| Leakage of the valve clearance | Repair the valve. |
| Interference of the valve stem | Replace the valve or the valve guide. |
| Low elasticity or damage of the valve spring | Replace the valve spring. |
| Abnormal interference of pistons and cylinders | Replace the piston ring. |
| Excessive wear of pistons, rings, or cylinders | Replace the ring or the piston and boring, or replace the cylinder. |
| Others | |
| Broken timing belt | Replace the belt. |
| Malfunction of positive crankcase ventilation (PCV) valve | Check and replace the PCV valve, if needed. |
| Loosening, damage, or leakage of the vacuum hose | Connect the hose correctly or replace it. |
| Leakage of the intake system | Replace the intake system. |

## Lack of Power, Sluggishness, or Sponginess

| Checks | Actions |
|---|---|
| Decline of Compression Pressure | Refer to *Symptoms - Engine Controls on page 6-94*. |
| Malfunction of Ignition System | |
| Improper ignition timing | Adjust the ignition timing. |
| Faulty spark plug | Adjust or replace the spark plug. |
| Electric leakage or poor connection of the high tension cable | Connect the cable correctly or replace it. |
| Malfunction of Fuel System | |
| Clogged fuel pipe | Clean the pipe. |
| Clogged or contaminated fuel filter | Replace the filter. |
| Others | |
| Clogged exhaust system | Check and repair the system. |
| Clogged or contaminated air cleaner element | Clean or replace the air cleaner element. |
| Leak of the intake manifold gasket | Replace the gasket. |
| Dragging brakes | Repair or replace the brakes. |
| Slipping clutch | Adjust or replace the clutch. |

## Rough, Unstable, or Incorrect Idle and Stalling

| Checks | Actions |
|---|---|
| Decline of Compression Pressure | Refer to *Symptoms - Engine Controls on page 6-94*. |
| Malfunction of Fuel System | |
| Clogged fuel pipe | Clean the pipe. |
| Clogged or contaminated fuel filter | Replace the filter. |
| Malfunction of the fuel pressure regulator | Replace the regulator. |
| Malfunction of Ignition System | |
| Malfunction of the spark plug | Adjust or replace the spark plug. |
| Electric leakage or poor connection of the high tension cable | Connect the cable correctly or replace it. |
| Poor ignition timing | Adjust the ignition timing. |
| Malfunction of the ignition coil | Replace the ignition coil. |
| Others | |
| Clogged or contaminated air cleaner element | Clean or replace the air cleaner element. |
| Leak of the intake manifold gasket | Replace the gasket. |
| Malfunction of positive crankcase ventilation (PCV) valve | Check the valve or replace it, if needed. |
| Poor connection or damage or leakage of the vacuum hose | Connect the hose correctly or replace it. |

## Hesitation, Sag, Stumble

| Checks | Actions |
|---|---|
| Decline of Compression Pressure | Refer to *Symptoms - Engine Controls on page 6-94*. |
| Malfunction of Ignition System | |
| Poor ignition timing | Adjust the ignition timing. |
| Poor spark plug or poor adjustment of the plug gap | Replace the plug or adjust the gap. |
| Electric leakage or poor connection of the high tension cable | Connect the cable correctly or replace it. |
| Others | |
| Malfunction of the air cleaner system | Clean or replace the air cleaner system. |
| Leak of the intake manifold gasket | Replace the gasket. |

## Surges/Chuggles

| Checks | Actions |
|---|---|
| Decline of Compression Pressure | Refer to *Symptoms - Engine Controls on page 6-94*. |
| Malfunction of Fuel System | |
| Clogged fuel pipe | Clean the pipe. |
| Clogged or contaminated fuel filter | Replace the filter. |
| Malfunction of the fuel pressure regulator | Replace the fuel pressure regulator. |
| Malfunction of Ignition System | |
| Malfunction of the spark plug | Adjust or replace the spark plug. |
| Electric leakage or poor connection of the high tension cable | Connect the cable correctly or replace it. |
| Poor ignition timing | Adjust the ignition timing. |
| Others | |
| Leak of the intake manifold gasket | Clean or replace the gasket. |
| Leakage of the vacuum hose | Connect the hose correctly or replace it. |

## Detonation/Spark Knock

| Checks | Actions |
|---|---|
| Overheated Engine | Refer to *Engine Overheating on page 6-13*. |
| Malfunction of Ignition System | |
| Abnormal spark plug | Replace the spark plug. |
| Poor ignition timing | Adjust the ignition timing. |
| Electric leakage or poor connection of the high tension cable | Connect the cable correctly or replace it. |
| Malfunction of Fuel System | |
| Clogged or contaminated fuel filter and fuel pipe | Clean or replace the fuel filter and the fuel pipe. |
| Others | |
| Leak of the intake manifold gasket | Replace the gasket. |
| Excessive carbon deposit due to abnormal combustion | Remove the carbon. |

### Engine Overheating

| Checks | Actions |
|---|---|
| Malfunction of Cooling System | |
| Lack of coolant | Refill the coolant. |
| Malfunction of the thermostat | Replace the thermostat. |
| Malfunction of the cooling fan | Check or replace the cooling fan. |
| Poor water pump performance | Replace the pump. |
| Clogged or leaky radiator | Clean, repair, or replace the radiator. |
| Malfunction of Lubrication System | |
| Poor engine oil | Replace the engine oil with the specified one. |
| Blocking oil filter or strainer | Clean or replace the oil filter or the strainer. |
| Lack of engine oil | Refill the oil. |
| Poor oil pump performance | Replace or repair the pump. |
| Leakage of oil | Repair the leak. |
| Other | |
| Damaged cylinder head gasket | Replace the gasket. |

### Poor Fuel Economy

| Checks | Actions |
|---|---|
| Decline of Compression Pressure | Refer to *Symptoms - Engine Controls on page 6-94*. |
| Malfunction of Fuel System | |
| Leakage of the fuel tank or the fuel pipe | Repair or replace the fuel tank or the fuel pipe. |
| Malfunction of Ignition System | |
| Improper ignition timing | Adjust the ignition timing. |
| Abnormal spark plug – Excessive carbon deposit, inadequate gap, burnt electrode | Replace the plug. |
| Electric leakage or poor connection of the high tension cable | Connect the cable normally or replace it. |
| Malfunction of Cooling System | |
| Malfunction of the thermostat | Replace the thermostat. |
| Others | |
| Improperly installed valve | Repair or replace the valve. |
| Slipping clutch | Repair or replace the clutch. |
| Low pressure of tires | Adjust the pressure of the tires. |

## Oil Pressure Diagnosis and Testing

*SIE-ID = 1283871 Owner = prober01 LMD = 19-may-2005 LMB = kmicak01*

### Tools Required

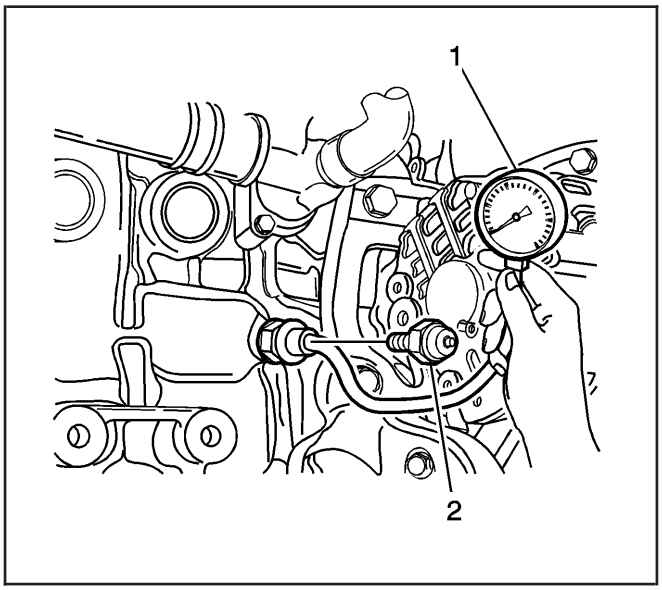
*J 21867* (09915–64510) Oil Pressure Gage or equivalent

Prior to checking the oil pressure, check the following:

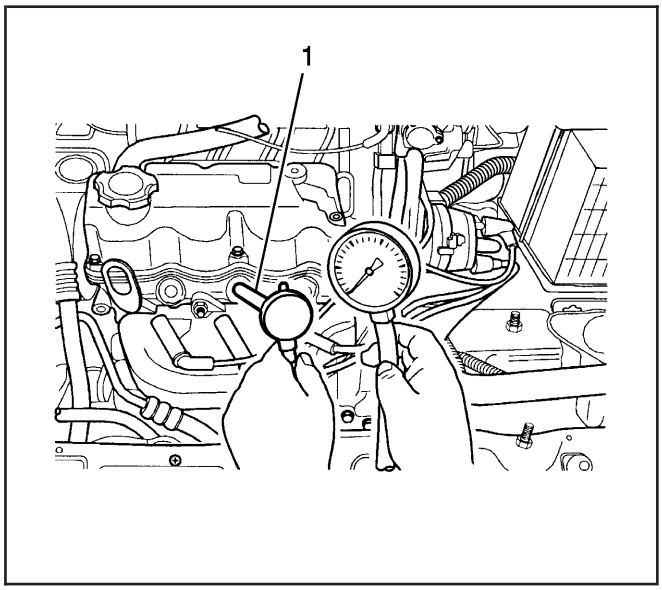
- Check the oil level and add if required.
- Replace the discolored, deteriorated, or diluted oil.
- Check any oil leakage and repair the defective parts.

Check the compression pressure in the following procedures:

1. Remove the oil pressure switch (2) from the cylinder block.




1224535




1224533

2. Install *J 21867* (1) to the mounting place of the oil pressure switch.
3. Start the engine and warm up to the normal operating temperature.
4. Raise the engine speed up to 2,000 RPM; then read the oil pressure.

   **Specification**

   At 2,000 RPM the oil pressure should read between 294.2–343.2 kPa (42.67–49.78 psi).

***Notice:*** Refer to *Fastener Notice on page P-7* in Cautions and Notices.

5. After checking, wrap the threads of the oil pressure switch with seal tape and tighten it to the specified torque.

   **Tighten**

   Tighten the oil pressure switch to 12–16 N·m (106–144 lb in).

6. Start the engine and check oil pressure switch for oil leakage.

## Engine Compression Test

*SIE-ID = 1283868 Owner = prober01 LMD = 09-sep-2003 LMB = pbiele01*

### Tools Required

*09915-64510* Compression Pressure Gage or equivalent

1. Warm up the engine to the normal operating temperature (cooling temperature: 80–90°C (176–194°F).
2. Stop the engine; then remove the high tension cable and the spark plug.
3. Disconnect the distributor optical sensor connector.
4. Install *09915-64510* (1) in the hole of the spark plug.
5. Disengage the clutch in Neutral, to lighten starting load engine upon cranking, and press the accelerator all the way down to make the throttle fully open.
6. Crank the engine with the starting motor and read the highest pressure on the compression pressure gage.
   - The difference of measured value between cylinders is 98.06 kPa (14.22 psi) and less.
   - On checking, make the connection perfectly air tight between the hole of the spark plug and the compression pressure gage.

     **Specification**

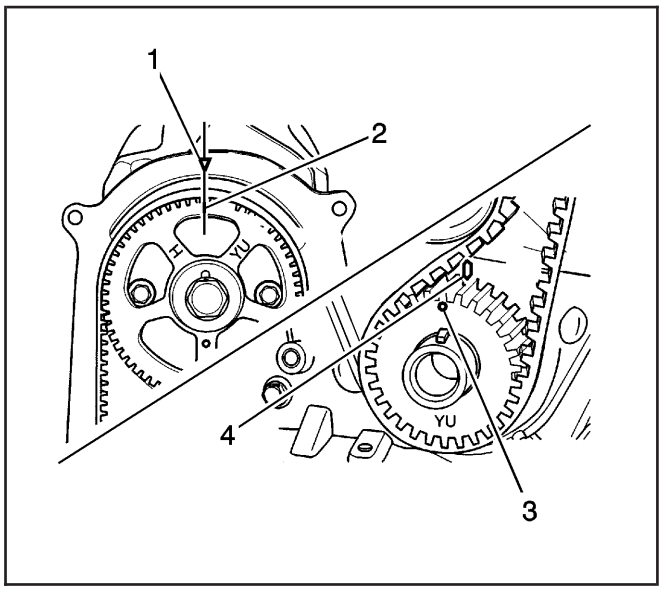
     - Compression pressure–400 RPM: the standard is 1,274.87 kPa (184.9 psi).
     - Compression pressure–400 RPM: the limit is 177.8 kPa (192.1 psi).
7. After checking, remove the gage and install the removed parts.

# Repair Instructions

## Valve Timing Inspection and Adjustment

*SIE-ID = 1283888 Owner = prober01 LMD = 16-may-2003 LMB = kwalla01*

Adjust the valve clearance in the following procedures:

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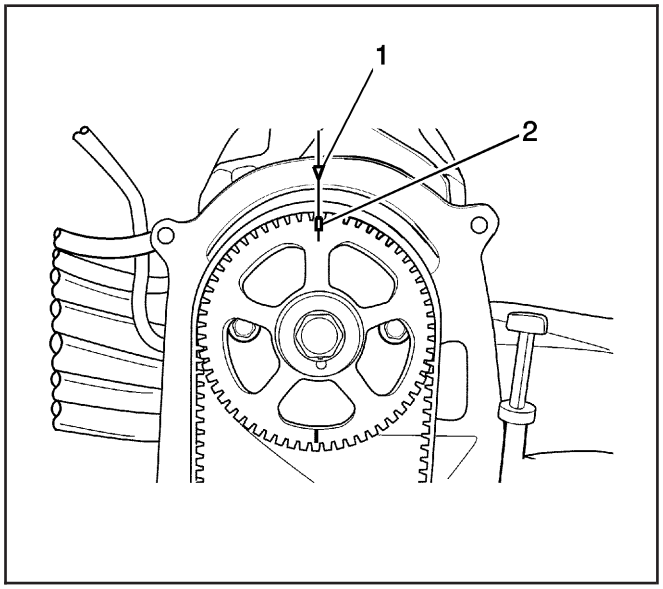
1. Remove the air filter/resonator assembly and the relevant parts installed on the cylinder head cover.
2. Remove the cylinder head cover hexagon bolts and remove the cover.
3. Turn over the crankshaft to make No. 1 cylinder match with the compression top dead center. When the camshaft sprocket notch (2) is aligned with the timing belt rear cover triangle pointer (1), and the crankshaft sprocket point (3) is aligned with the oil pump housing point (4), the compression top dead center is on the ignition sequence for No. 1 cylinder.
4. Check the valve clearance for No. 1 cylinder compression top dead center. Refer to Cylinder Compression Check Specifications in *Engine Mechanical Specifications on page 6-2*.

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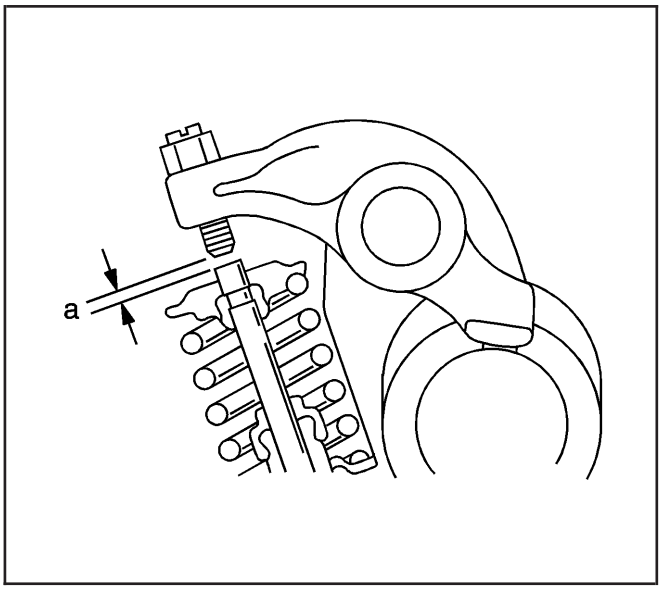
5. When the valve clearance check of No. 1 cylinder compression top dead center is complete, position No. 1 cylinder on the exhaust, top dead center, while rotating the crankshaft in a 360-degree arc. When the camshaft sprocket point (2) is aligned with the timing belt rear cover triangle pointer (1), the exhaust top dead center is on the ignition sequence for No. 1 cylinder.
6. Check the valve clearance for the No. 1 cylinder exhaust top dead center. Refer to Cylinder Compression Check Specifications in *Engine Mechanical Specifications on page 6-2*.

7. Check and adjust the valve clearance (a) using thickness gage.

   The measured value of valve clearance should meet the specified value. If not, adjust the valve clearance.

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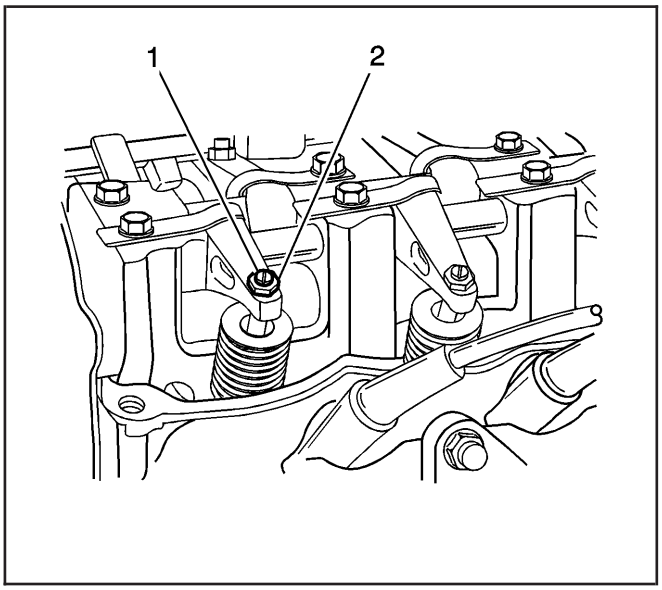
**Important:** In case of a hot engine, warm up the engine until the electric cooling fan begins to work and stop the engine to adjust the clearance with 20–30 minutes from there.

8. When adjusting the valve clearance, loosen the adjust nut (2) and tighten or loosen the adjust rod (1) properly. Refer to Valve Clearance Specifications in *Engine Mechanical Specifications on page 6-2*.

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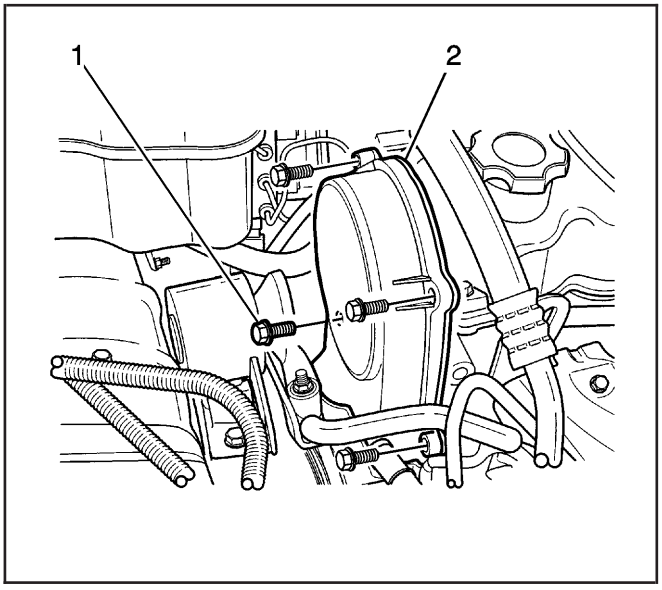
## Valve Timing Procedure

1. Check the valve timing.
2. After removing the high headlamp, loosen the bolts (1) and remove the timing belt front upper cover (2).

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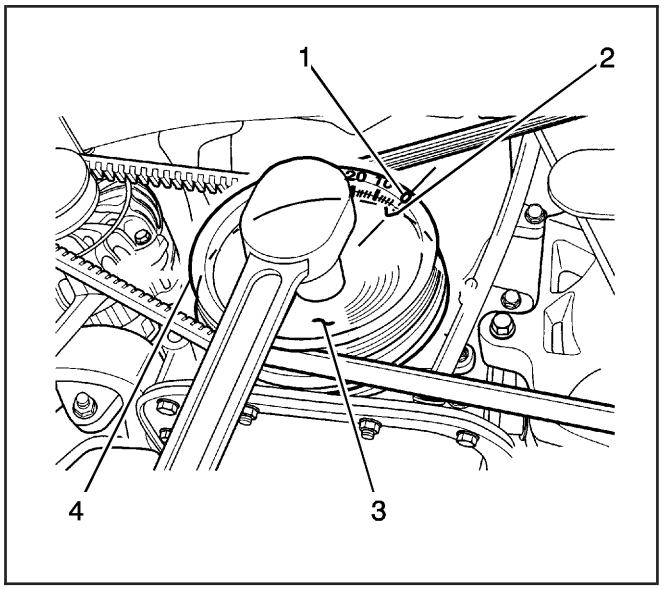


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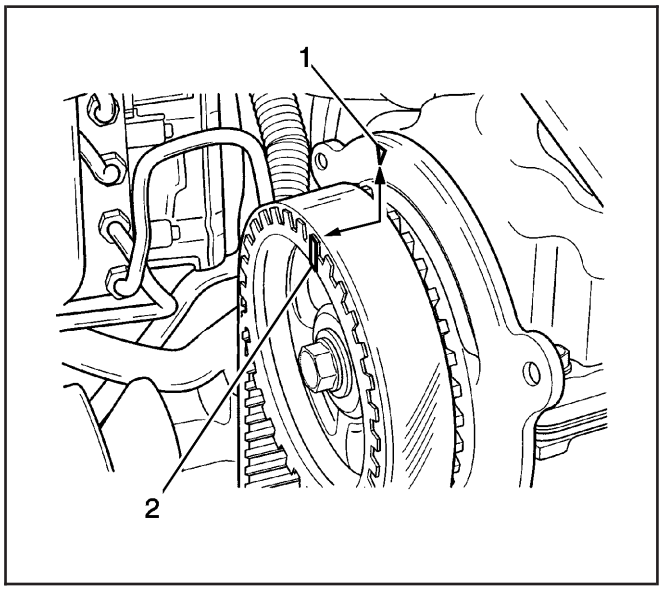
3. Turning the crankshaft clockwise twice, align the notch (2) on the crankshaft pulley (1), marked 0, for the timing check on the timing belt front lower cover.

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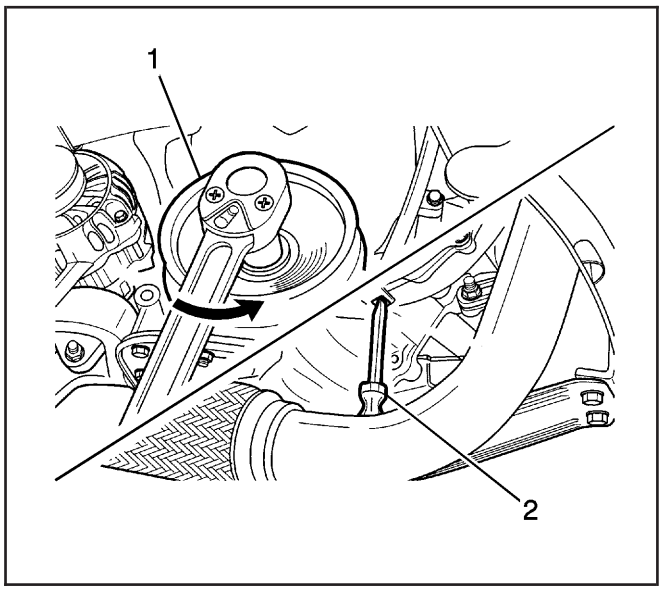
**Important:** Notch (2) should be aligned with pointer (1) to set the valve timing normally.

4. Check if the notch (2) on the camshaft sprocket is aligned with the triangle pointer (1) on the timing belt rear cover.

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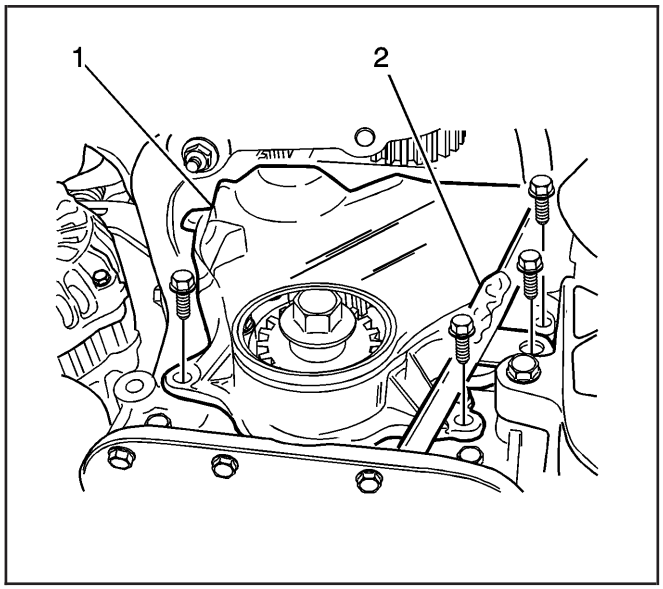
## Valve Timing Adjustment Procedure

1. Adjust the valve timing.
2. Loosen the bolt and remove the timing belt pulley (1). In loosening the bolt, use the driver (2) in the picture as shown.

3. Remove the oil level gage guide tube (2) and the timing belt front lower cover (1).

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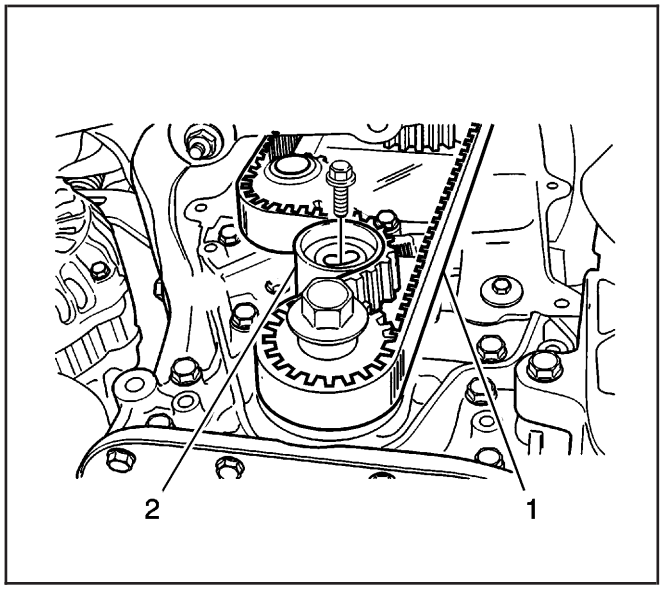
4. Remove the timing belt tensioner (2) and the timing belt (1).

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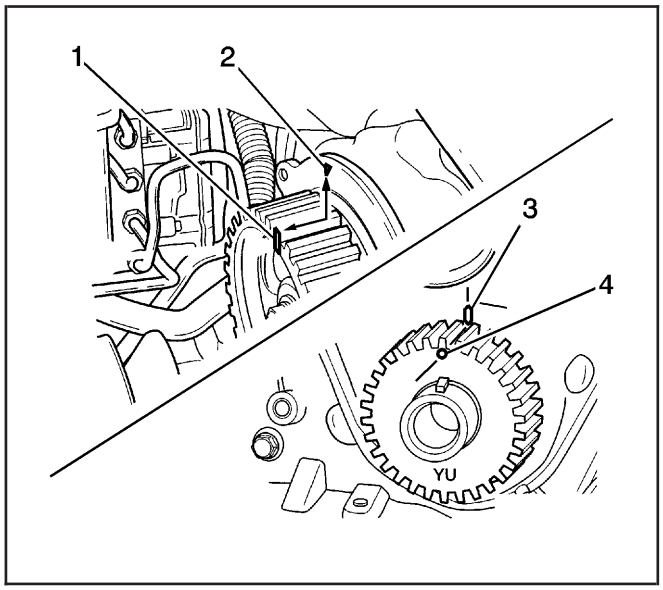
5. Using the bolt, turn the crankshaft clockwise to align the mark (4) on the crankshaft sprocket with the pointer (3) on the oil pump housing. Then, turn the camshaft to align the notch (1) with the pointer (2).

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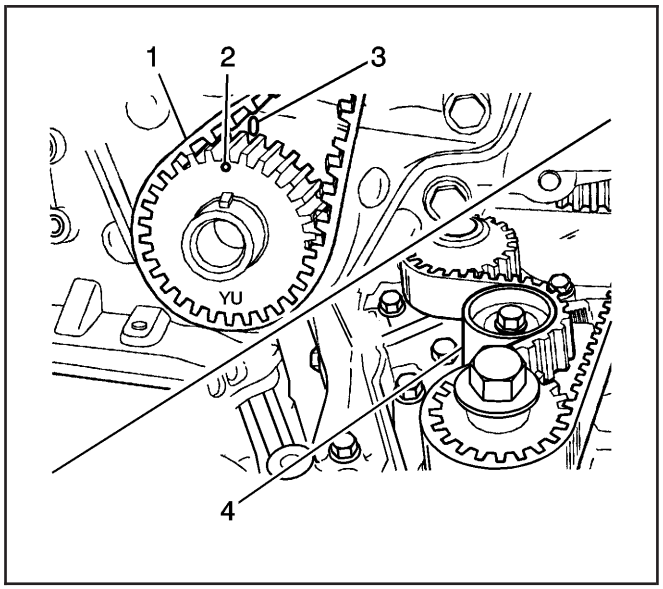


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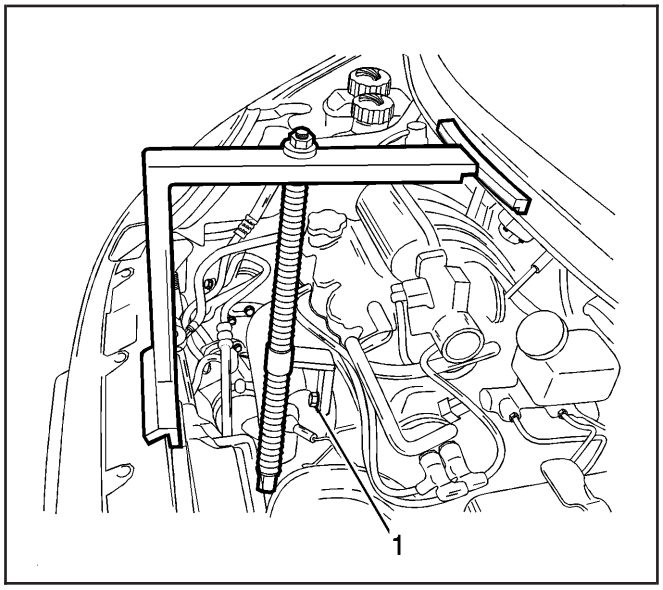
***Notice:*** Refer to *Fastener Notice on page P-7* in Cautions and Notices.

**Important:** Do not tighten the tensioner bolt completely.

6. Install the timing belt (1) and the tensioner (2).
7. Turn the crankshaft twice clockwise; align the mark (3) with the pointer (4) and tighten the tensioner bolt to 15–23 N·m (11–17 lb ft).
8. Install all removed parts.




1202885

## Engine Mount Damping Block Replacement

*SIE-ID = 1277762 Owner = prober01 LMD = 19-may-2005 LMB = kmicak01*

### Tools Required

*EN46567* (DW 110–020–A) Engine Assembly Support Fixture

## Removal Procedure

***Notice:*** SIO-ID = 2774 LMD = 18-oct-1995 Broken engine mountings can cause misalignment of certain drive-train components. Misalignment of drive-train components causes eventual destruction of the drive-train components.

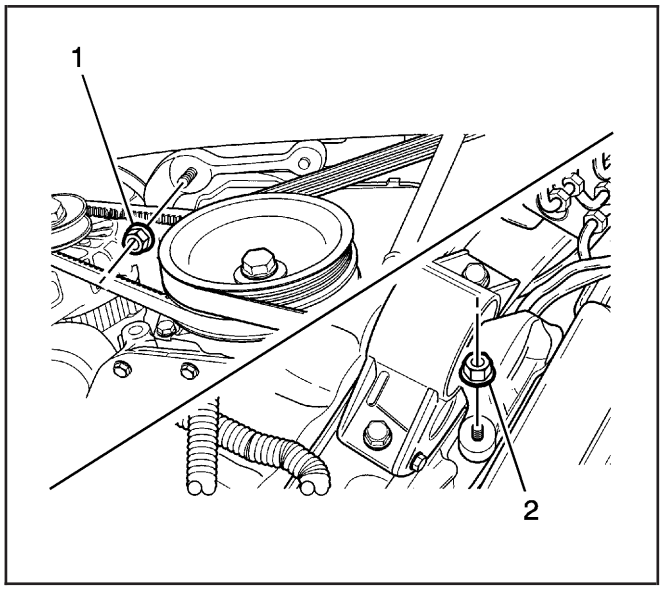
If one engine mount breaks, the rest of the engine mounts will have increased stress put on them. This could cause the rest of the engine mounts to break.

1. Install *EN46567* (1).
2. Remove the air inlet grille panel weatherstrip.
3. Remove the exhaust manifold heat shield.

***Notice:*** SIO-ID = 221323 LMD = 25-mar-1997 When raising or supporting the engine for any reason, do not use a jack under the oil pan, any sheet metal, or the crankshaft pulley. Lifting the engine in an unapproved manner may cause component damage.

4. Position *EN46567* (1) on the air inlet grille panel and the front upper panel on the center.

5. Tighten the engine fixture joint with a bolt after removing exhaust manifold bolt.
6. Remove the coolant surge tank. Refer to *Surge Tank Replacement on page 6-20* in Engine Cooling.
7. Remove the right headlamp. Refer to *Headlamp Replacement on page 8-51* in Lighting Systems.
8. Remove the intermediate bracket nut from the lower vehicle (1).
9. Remove the intermediate bracket nut from the upper vehicle (2).

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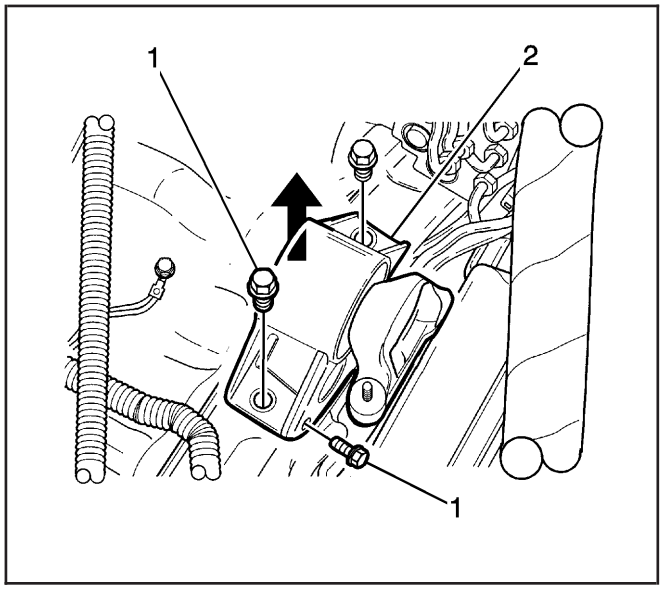
10. Remove the engine mount damping block assembly (1) with the intermediate bracket attached.

***Notice:*** SIO-ID = 1307936 LMD = 22-apr-2003 Loosen the engine support fixture bolt in order to lower the engine slightly and allow the engine mount damping block bolts to be removed. If the engine mount damping block bolts are loosened without lowering the engine assembly support fixture, the engine mount damping block bolts could be damaged.

11. Remove the engine mount damping block assembly from the wheel house and engine mount upper bracket (2).

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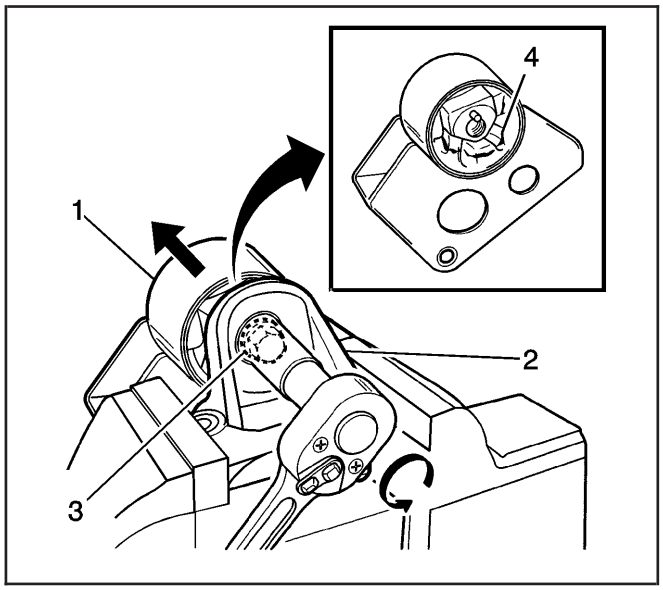
12. Vice the intermediate bracket (2).
13. Remove the intermediate bracket bolt (3).
14. Remove the engine mount damping block from the intermediate bracket (1).
15. Inspect the damping block for cracks, hardening or damages.

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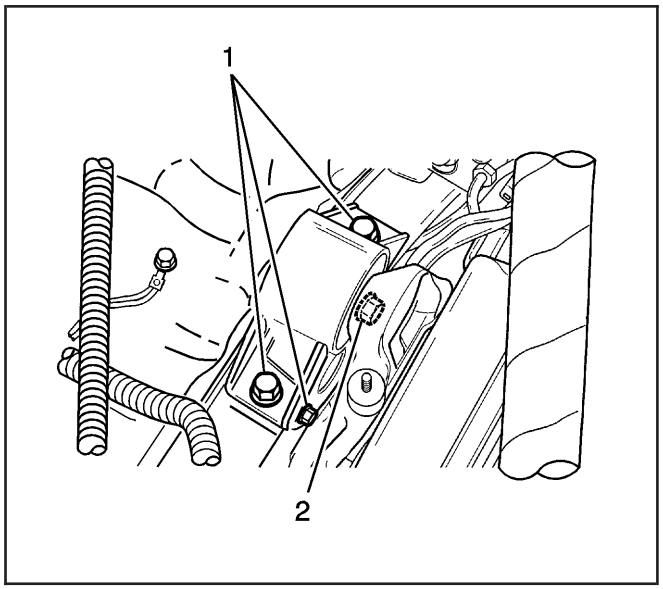



1230432

## Installation Procedure

***Notice:*** Refer to *Fastener Notice on page P-7* in Cautions and Notices.

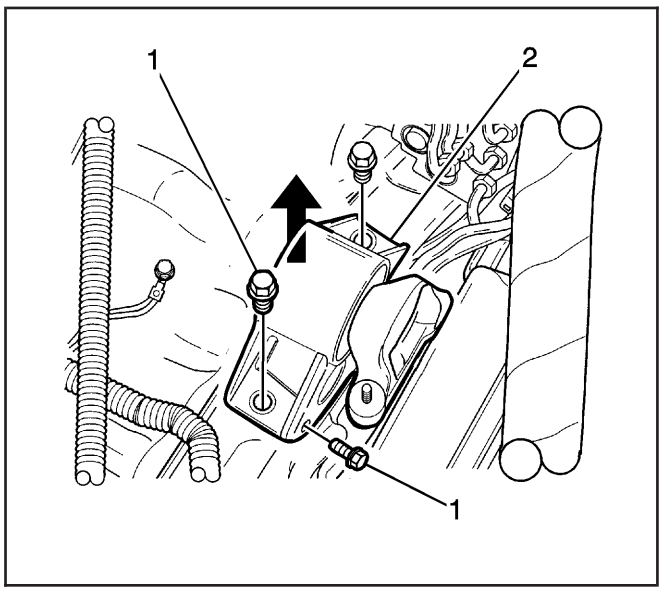
1. Install the engine mount dampering block to the intermediate bracket with bolts (1).

   **Tighten**

   Tighten the engine mount dampering block bolts to 45–55 N·m (33–41 lb ft).
2. Install the intermediate bracket with bolt (2).

   **Tighten**

   Tighten the intermediate bracket to 72–88 N·m (53–65 lb ft).

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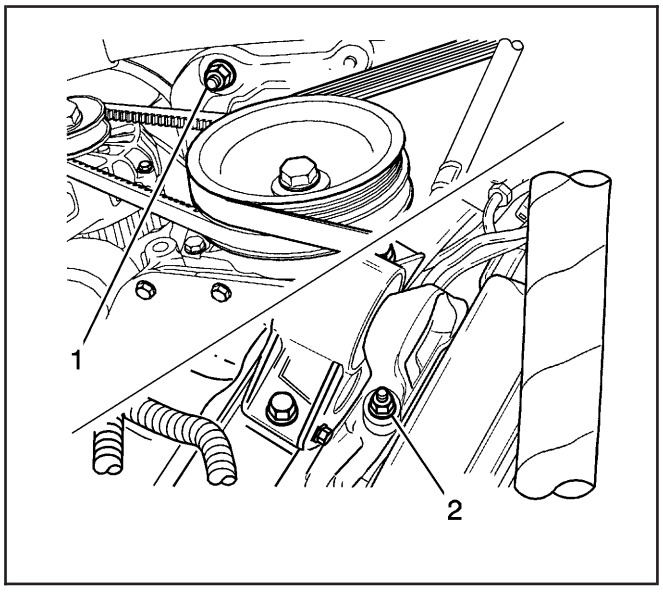
3. Install the engine mount damping block assembly to the wheelhouse and engine mount upper bracket (2).
4. Remove the engine mount damping block assembly (1) with the intermediate bracket attached.

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5. Install the intermediate bracket nuts (1, 2) to the upper and lower vehicle.

   **Tighten**

   Tighten the lower/upper engine mount intermediate bracket nuts to 60–70 N·m (44–52 lb ft).
6. Install the right headlamp. Refer to *Headlamp Replacement on page 8-51* in Lighting Systems.
7. Install the coolant surge tank. Refer to *Surge Tank Replacement on page 6-20* in Engine Cooling.
8. Install the exhaust manifold heat shield.
9. Install the air inlet grille panel weatherstrip.
10. Remove engine support fixture.

# Engine Mount Front Damping Bush Replacement

*SIE-ID = 1277828 Owner = prober01 LMD = 06-may-2003 LMB = dostre01*

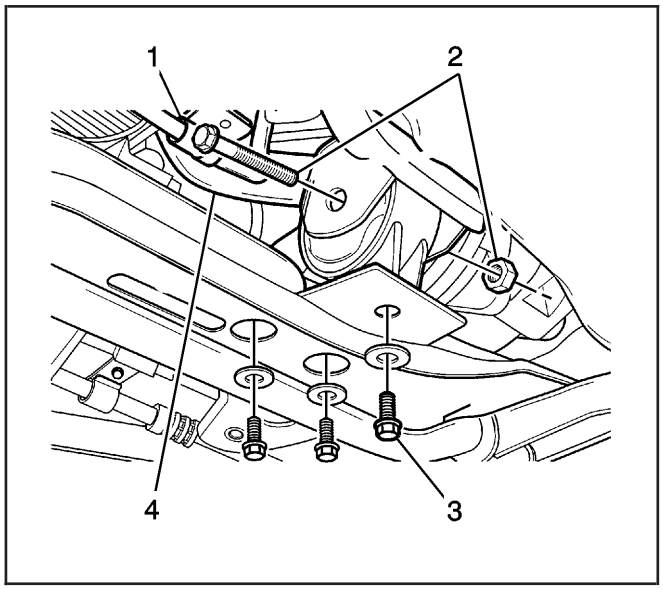
## Removal Procedure

***Caution: Refer to Exhaust Service Caution on page P-3 in Cautions and Notices.***

***Notice:*** SIO-ID = 2774 LMD = 18-oct-1995 Broken engine mountings can cause misalignment of certain drive-train components. Misalignment of drive-train components causes eventual destruction of the drive-train components.

If one engine mount breaks, the rest of the engine mounts will have increased stress put on them. This could cause the rest of the engine mounts to break.

1. Remove the exhaust manifold. Refer to *Exhaust Manifold Removal (Typical) on page 6-73* or *Exhaust Manifold Removal (Euro III) on page 6-74*.
2. Remove the stabilizer. Refer to *Stabilizer Shaft Replacement on page 3-8* in Front Suspension.
3. Remove the front damping bush bolt and nut on the bracket side (2).
4. Remove the front damping bush bolts on the crossmember side (3).
5. Remove the front bracket bolts on the engine block side (1).

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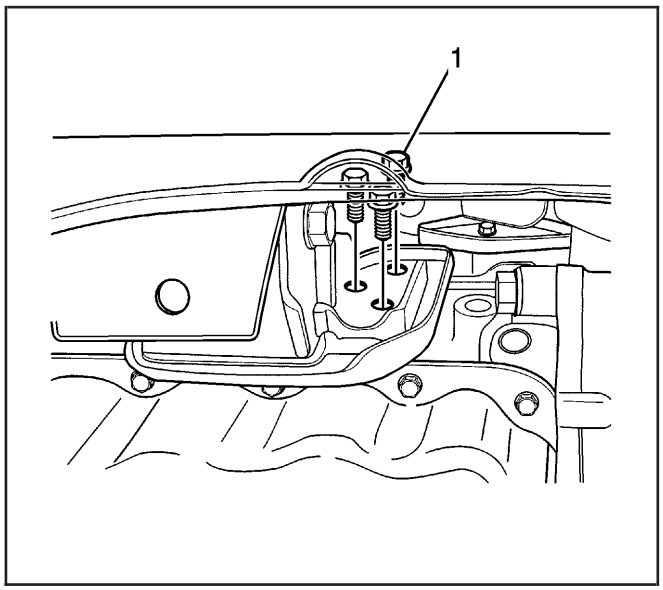


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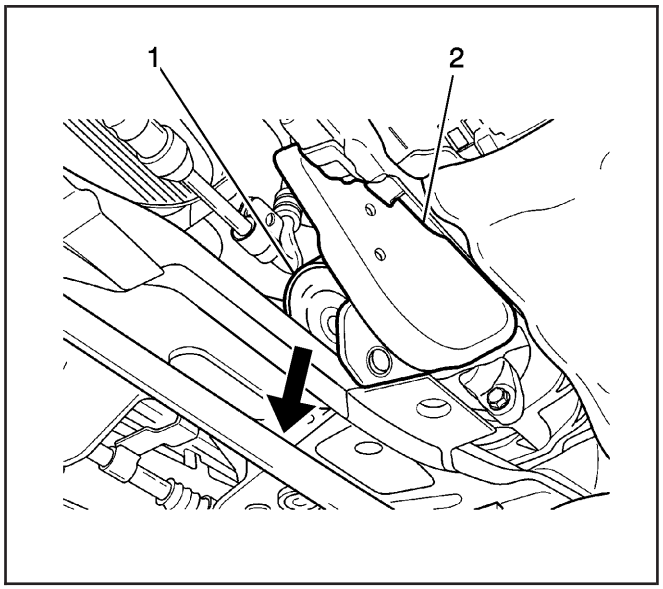


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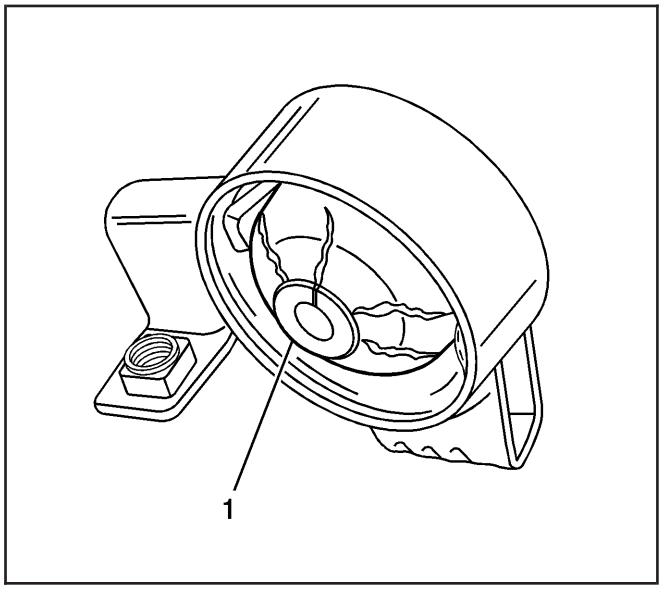
6. Remove the engine mount front damping bush assembly and the front bracket (2).

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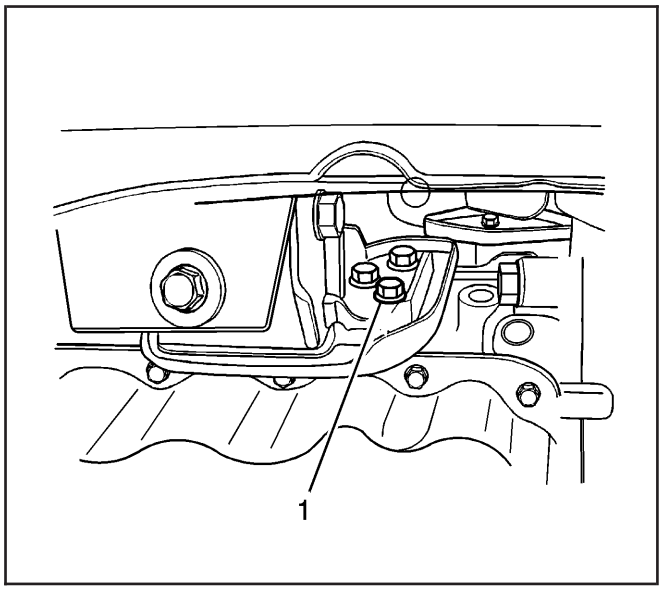
7. Inspect the engine mount damping bush assembly for crack and damage (1).

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## Installation Procedure

***Notice:*** Refer to *Fastener Notice on page P-7* in Cautions and Notices.

1. Install the front bracket bolts (1).

   **Tighten**

   Tighten the front bracket bolts on the cylinder block side to 35–41 N·m (25–30 lb ft).

2. Install the front damping bush bolts on the inner crossmember side (3).

   **Tighten**

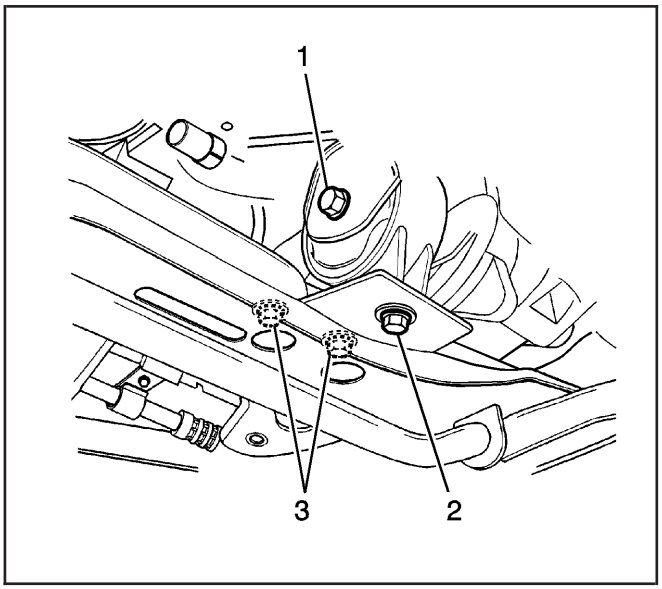
   Tighten the front damping bush bolt on the inner crossmember side to 45–55 N·m (33–41 lb ft).
3. Install the front damping bush bolts on the outer crossmember side (2).

   **Tighten**

   Tighten the front damping bush bolt on the inner crossmember side to 45–55 N·m (33–41 lb ft).
4. Install the front damping bush bolt and nut on the bracket side (1).

   **Tighten**

   Tighten the front damping bush bolt on the bracket side to 68–83 N·m (50–62 lb ft).
5. Install the stabilizer. Refer to *Stabilizer Shaft Replacement on page 3-8* in Front Suspension.
6. Install the exhaust manifold. Refer to *Exhaust Manifold Removal (Typical) on page 6-73* or *Exhaust Manifold Removal (Euro III) on page 6-74*.



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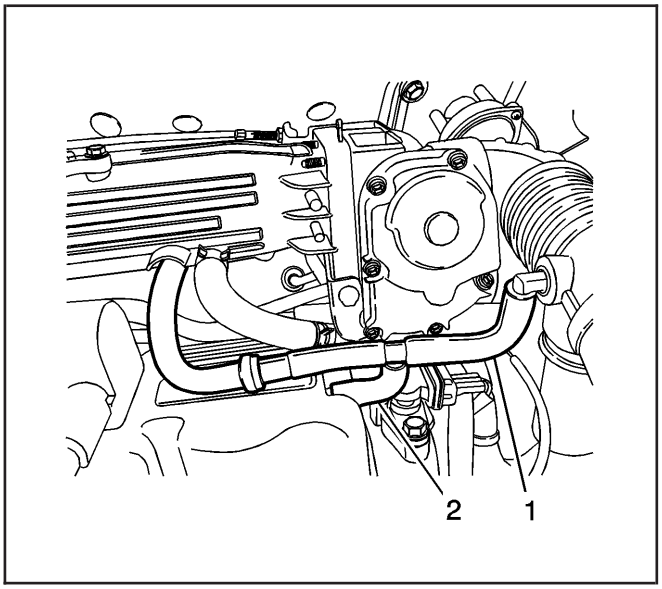
## Positive Crankcase Ventilation (PCV) Valve Replacement

*SIE-ID = 1277336 Owner = prober01 LMD = 06-may-2003 LMB = dostre01*

### Removal Procedure

1. Disconnect the positive crankcase ventilation (PCV) hose from the intake tube (1).
2. Disconnect the PCV hose from the cylinder head cover (2).
3. Disconnect the PCV hose from the lower intake manifold (3).
4. Remove the PCV hose with valve.



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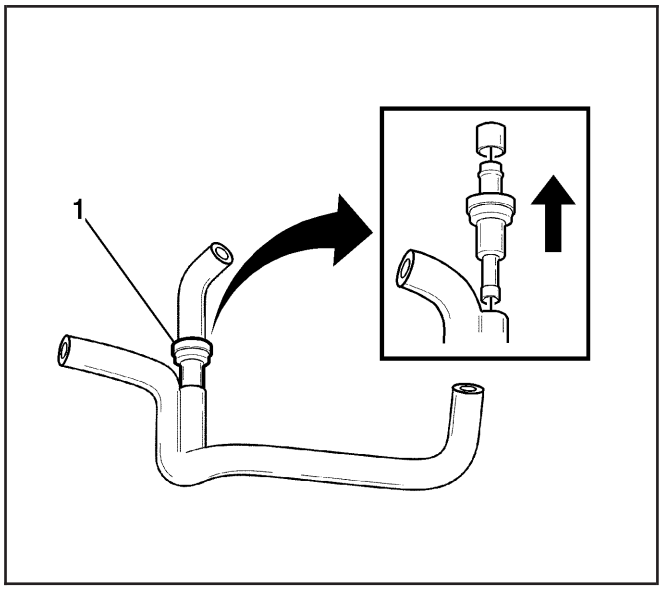


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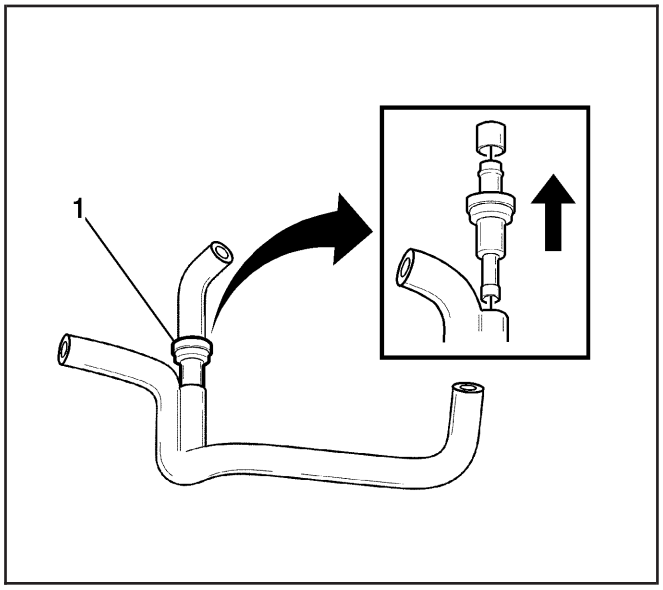
5. Remove the PCV valve (1).

**Important:** Blow air into valve only in the direction of the arrow shown on valve.

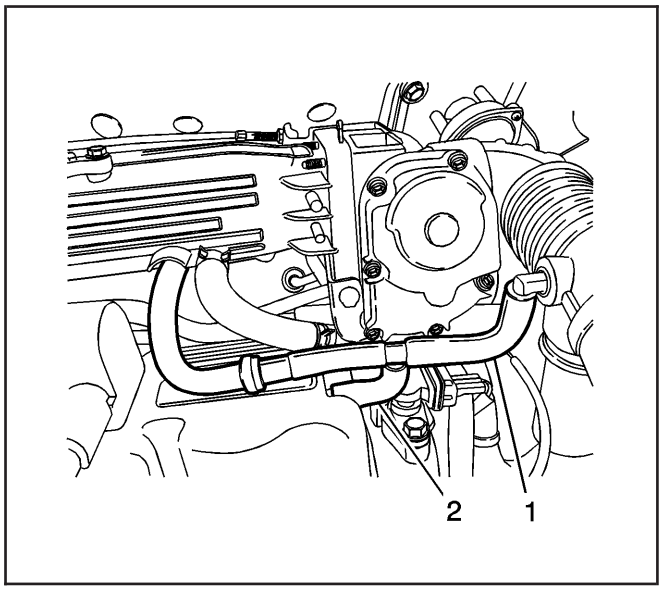
6. Inspect the tube for cracks, swelling or damage.
7. Inspect the PCV valve orifice for damage.




1222975

## Installation Procedure

1. Install the PCV valve (1).

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2. Install the PCV hose with valve.
3. Connect the PCV hose to the lower intake manifold.
4. Connect the PCV hose to the cylinder head cover (2).
5. Connect the PCV hose to the intake tube (1).

# Intake Manifold Replacement

*SIE-ID = 1277344 Owner = prober01 LMD = 12-may-2003 LMB = dostre01*

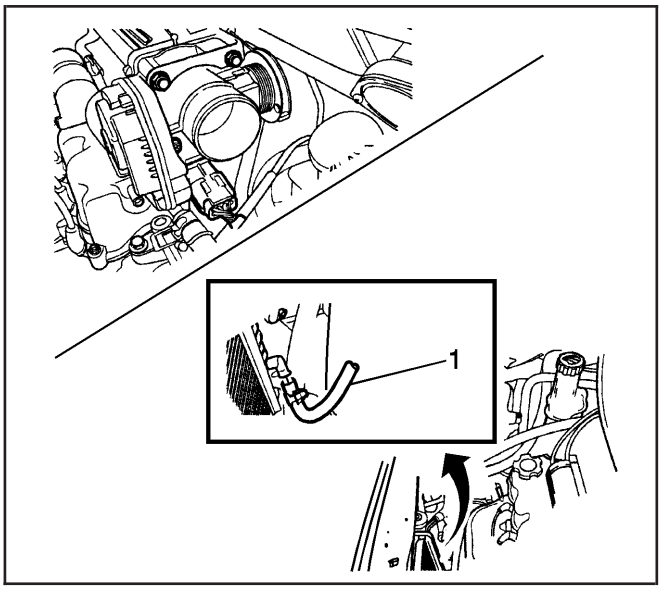
## Removal Procedure

***Caution:*** ***SIO-ID = 5004 LMD = 08-nov-2000*** ***Remove the fuel tank cap and relieve the fuel system pressure before servicing the fuel system in order to reduce the risk of personal injury. After you relieve the fuel system pressure, a small amount of fuel may be released when servicing the fuel lines, the fuel injection pump, or the connections. In order to reduce the risk of personal injury, cover the fuel system components with a shop towel before disconnection. This will catch any fuel that may leak out. Place the towel in an approved container when the disconnection is complete.***

1. Relieve the fuel system pressure. Refer to *Fuel Pressure Relief Procedure on page 6-115* in Engine Controls – 1.0L.

***Caution: Refer to Battery Disconnect Caution on page P-2 in Cautions and Notices.***

2. Disconnect the negative battery cable.
3. Remove the air filter, resonator, and snorkel assembly. Refer to *Air Cleaner Assembly Replacement on page 6-139* in Engine Controls – 1.0L.
4. Disconnect the radiator lower hose and drain coolant (1). Refer to *Radiator Replacement on page 6-24* in Engine Cooling.
5. Remove the throttle body assembly. Refer to *Throttle Body Assembly Replacement on page 6-114* in Engine Controls – 1.0L.
6. Disconnect the PCV hose and valve. Refer to *Positive Crankcase Ventilation (PCV) Valve Replacement on page 6-23*.
7. Remove the fuel rail and injector (1). Refer to *Fuel Injector Replacement on page 6-126* in Engine Controls – 1.0L.
8. Remove the exhaust gas recirculation (EGR) valve. Refer to *Exhaust Gas Recirculation (EGR) Valve Replacement on page 6-138* in Engine Controls – 1.0L.

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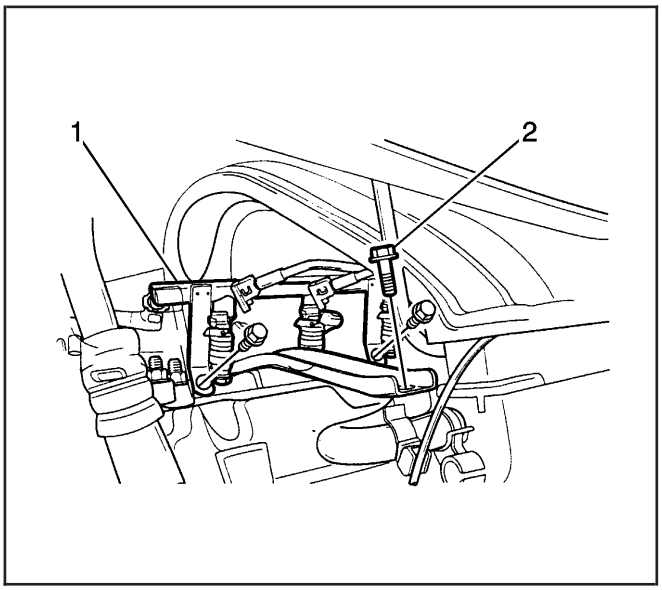


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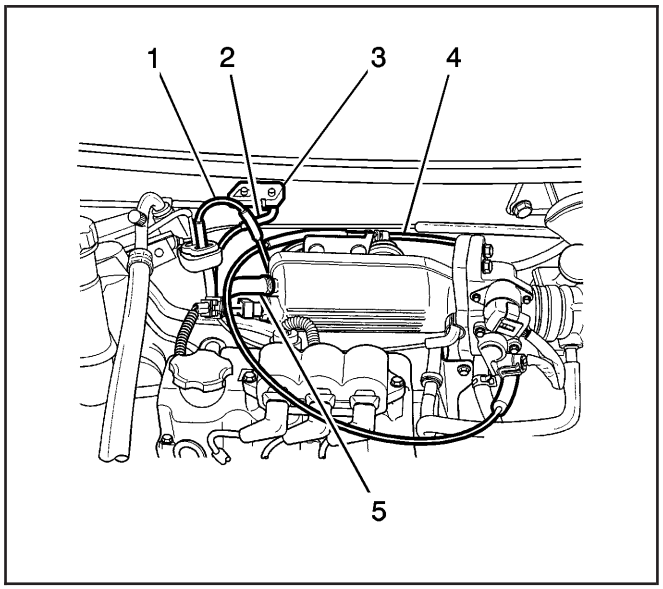


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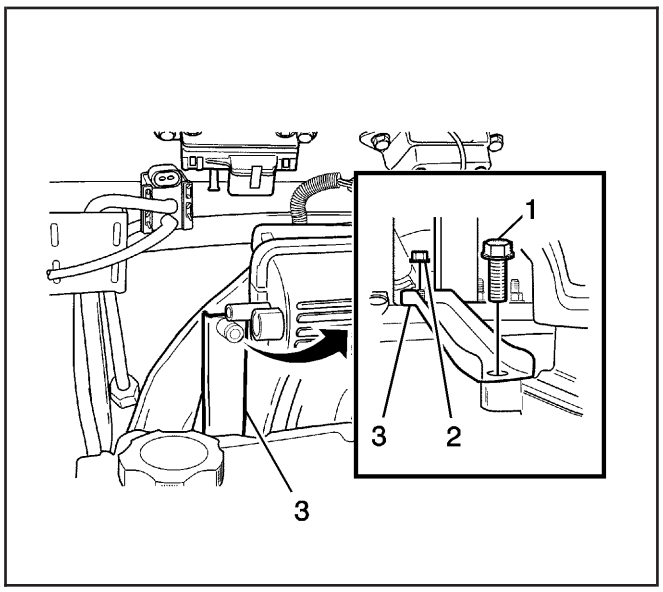
9. Loosen the lock nut and disconnect the throttle cable (4).
10. Disconnect the manifold absolute pressure (MAP) sensor connector (2).
11. Disconnect the evaporative emission canister solenoid connector (1).
12. Disconnect the brake vacuum tube (5).
13. Disconnect the intake air temperature (IAT) sensor connector.
14. Remove the intake manifold main bracket bolts, only upper two.

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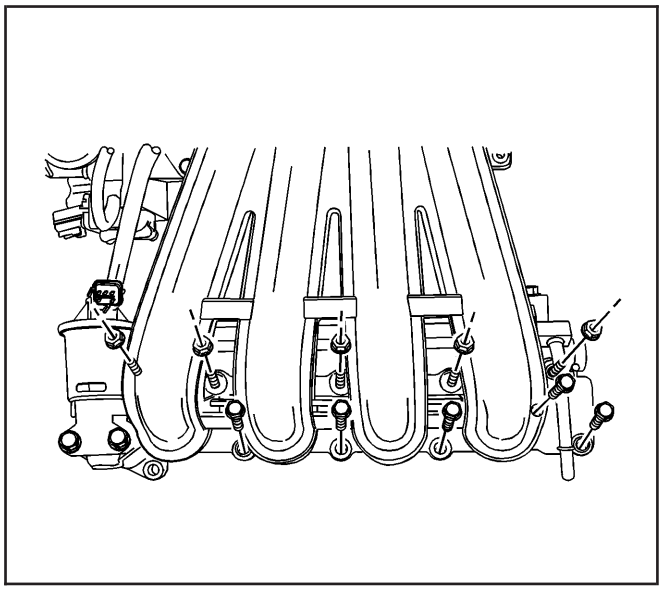
15. Remove the intake manifold upper bolt (1), lower nut (2) and subsidiary bracket (3).



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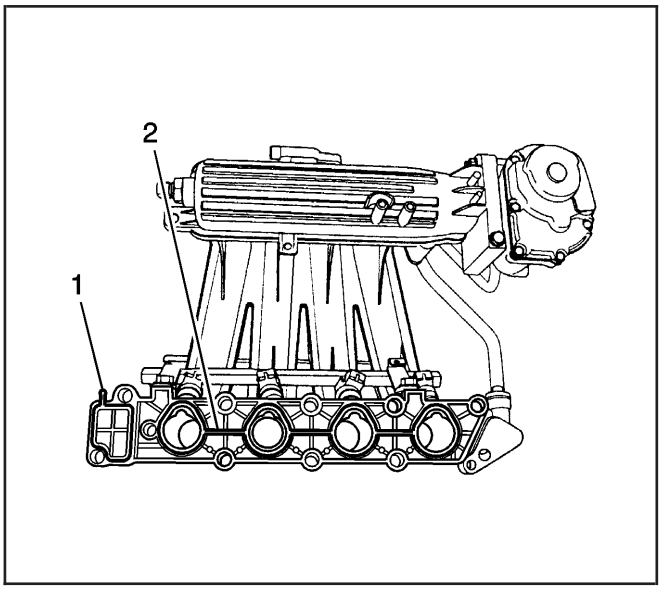
16. Remove the intake manifold nuts and bolts.
17. Remove the intake manifold from the cylinder head.

18. Disconnect the intake manifold gasket from the intake manifold (2).

**Important:** Carefully remove the gasket pulling the gasket upper position (1).

19. Inspect the gasket for cracks, hardening, swelling or damage.

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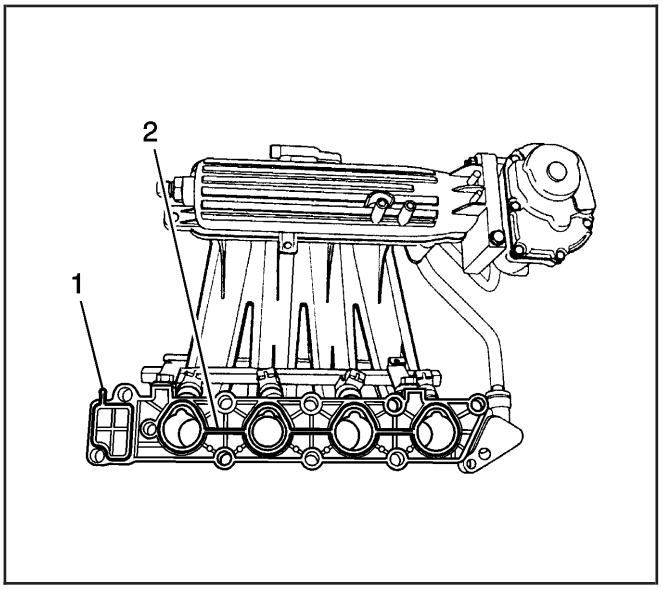
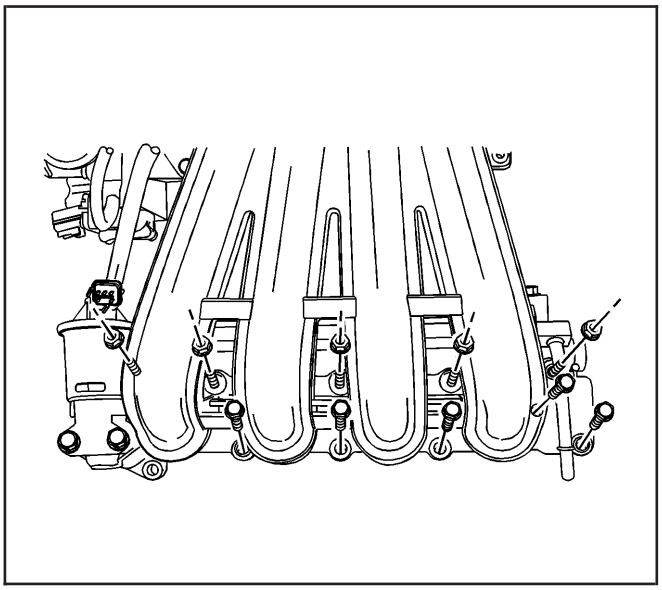
## Installation Procedure

1. Connect the intake manifold gasket to the intake manifold (2).

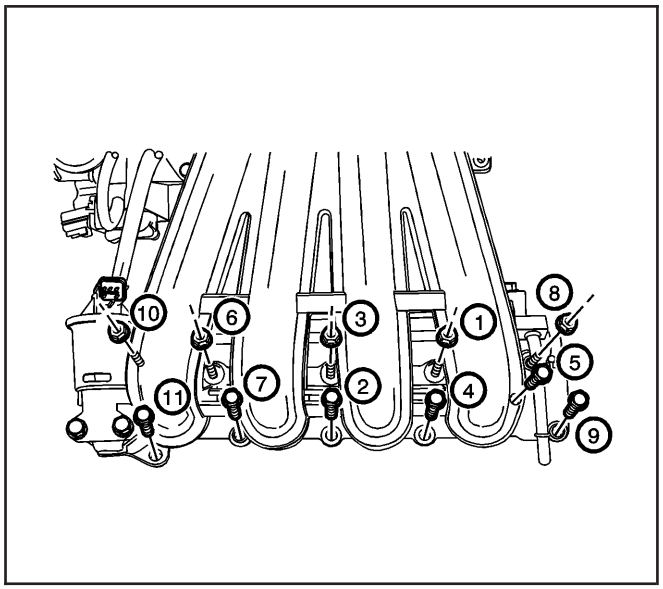



1240378

2. Install the intake manifold to the cylinder head.



1240376



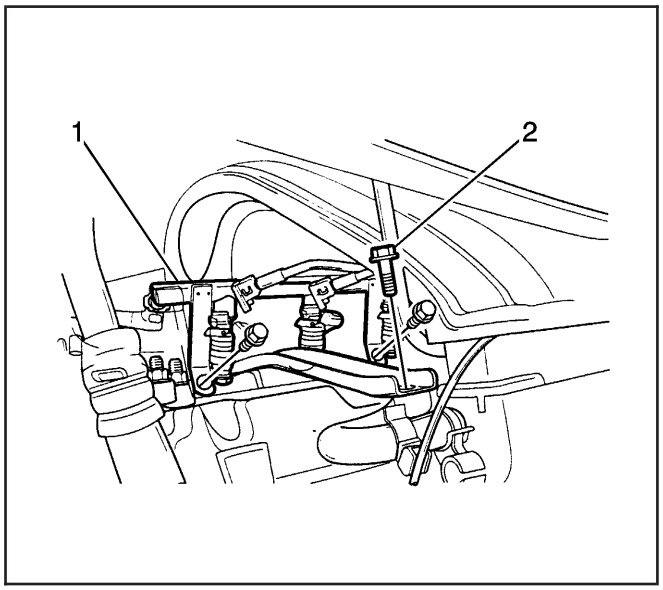

1240380

***Notice:*** Refer to *Fastener Notice on page P-7* in Cautions and Notices.

3. Install the intake manifold nuts and bolts in numerical order.

   **Tighten**

   Tighten the nuts to 15–19 N·m (11–14 lb ft).




1240375

**Important:** Tighten the bracket nut before all other nuts.

4. Install the intake manifold subsidiary bracket, lower nut (1) and upper bolt (2).

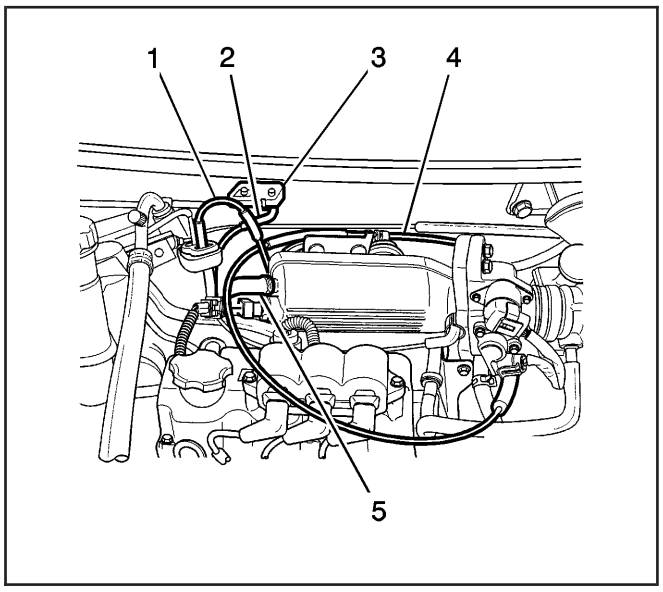
   **Tighten**

   - Tighten the intake manifold subsidiary bracket nut to 15–19 N·m (11–14 lb ft).
   - Tighten the intake manifold subsidiary bracket bolt to 9–12 N·m (80–106 lb in).

5. Install the upper two intake manifold main bracket bolts.

   **Tighten**

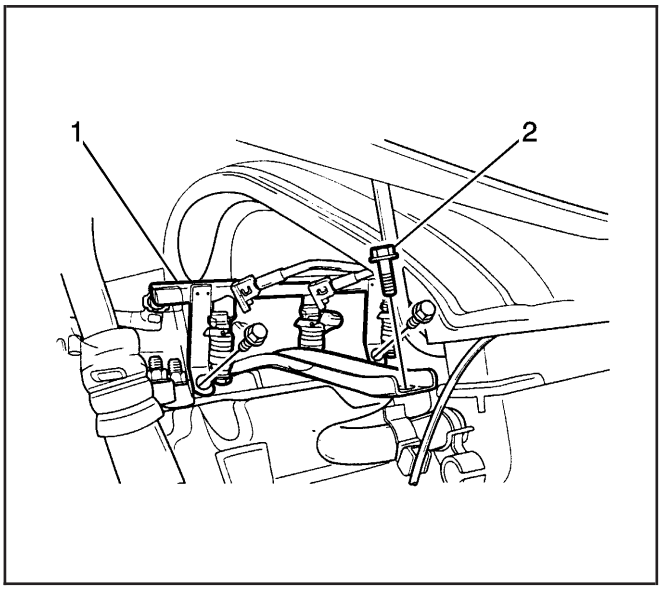
   Tighten the nuts to 15–19 N·m (11–14 lb ft).




1202840

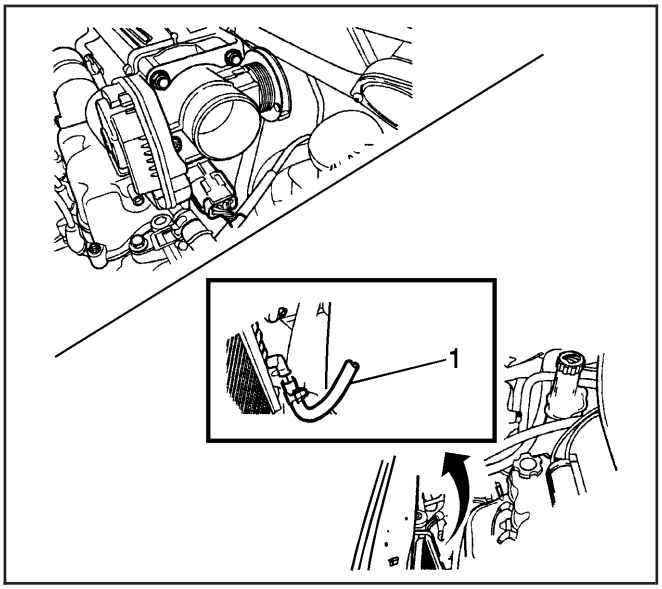
6. Connect the IAT sensor connector.
7. Connect the brake vacuum tube (5).
8. Connect the evaporative emission canister solenoid connector (1).
9. Connect the MAP sensor connector (2).
10. Connect the throttle cable and tighten the lock nut (4).

11. Install the EGR valve. Refer to *Exhaust Gas Recirculation (EGR) Valve Replacement on page 6-138* in Engine Controls – 1.0L.
12. Install the fuel rail and injector (1). Refer to *Fuel Rail Assembly Replacement on page 6-123* in Engine Controls – 1.0L.




1240375

13. Connect the PCV hose and valve. Refer to *Positive Crankcase Ventilation (PCV) Valve Replacement on page 6-23*.
14. Install the throttle body assembly. Refer to *Throttle Body Assembly Replacement on page 6-114* in Engine Controls – 1.0L.
15. Connect the radiator lower hose and fill radiator with coolant (1). Refer to *Radiator Replacement on page 6-24* in Engine Controls – 1.0L.
16. Install the snorkel assembly, resonator, and air filter. Refer to *Air Cleaner Assembly Replacement on page 6-139* in Engine Controls – 1.0L.




1240373

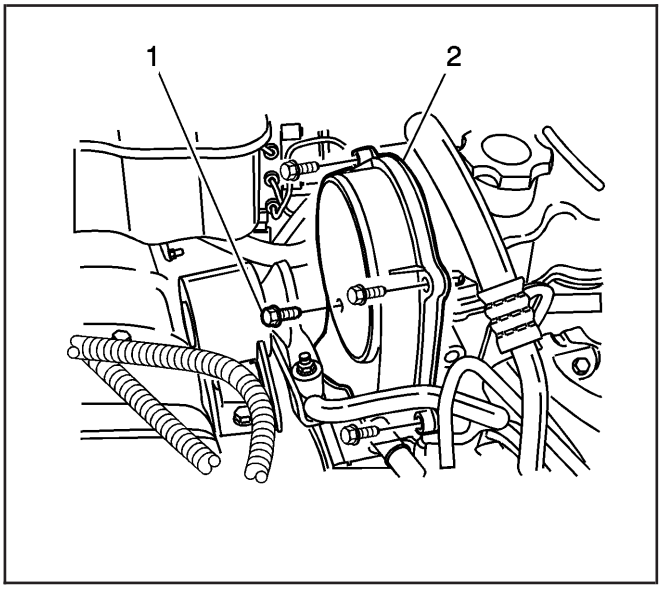
## Timing Belt Replacement

*SIE-ID = 1277354 Owner = prober01 LMD = 21-may-2003 LMB = jreich01*

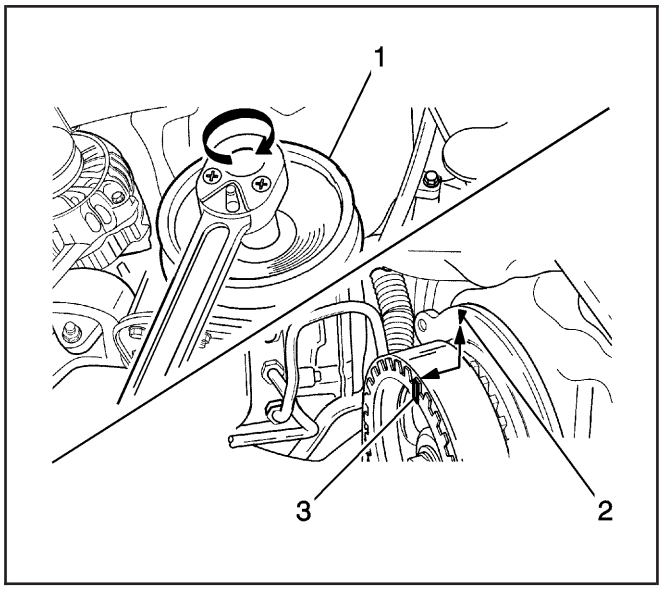
### Removal Procedure

***Caution: Refer to Battery Disconnect Caution on page P-2 in Cautions and Notices.***

1. Disconnect the negative battery cable.
2. Remove the right headlamp. Refer to *Headlamp Replacement on page 8-51* in Lighting Systems.
3. Remove the generator driver belt, A/C compressor drive belt and power steering drive belt, if equipped.
4. Remove the timing belt front upper cover (2) and bolts (1).

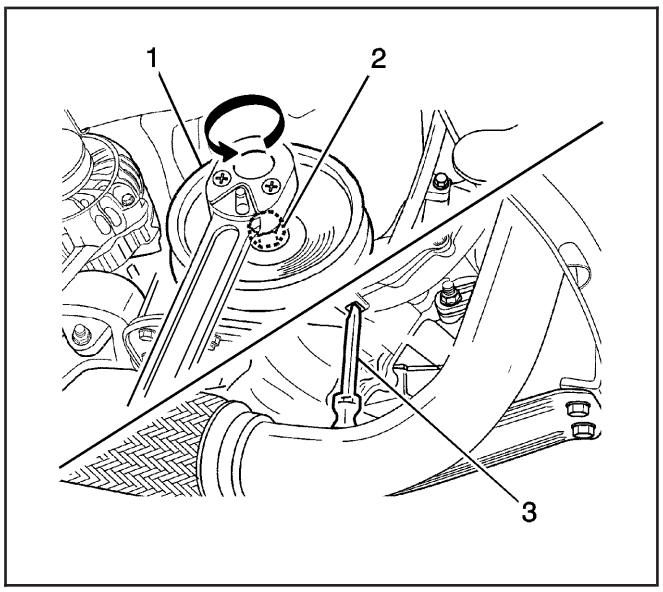



1230398



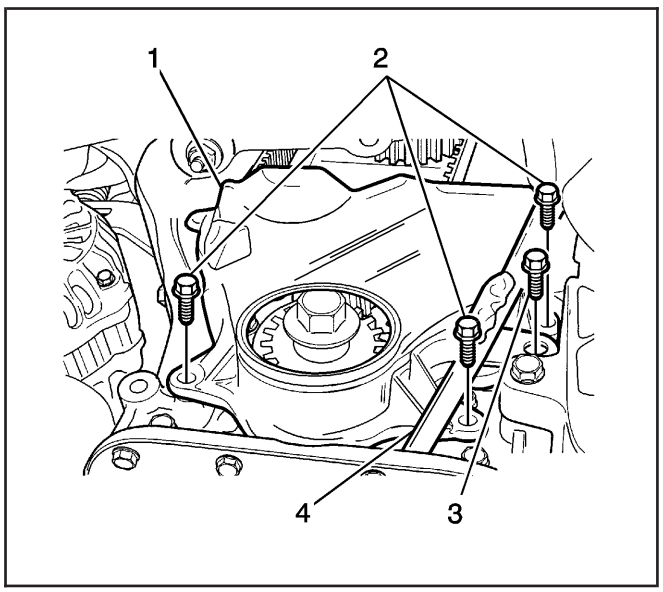

1230414

5. Remove the right wheel. Refer to *Tire and Wheel Removal and Installation on page 3-3* in Tires and Wheels.
6. Using the crankshaft pulley bolt, rotate the crankshaft clockwise until the mark on the camshaft gear (3) is aligned with the notch at the bottom of the rear timing belt cover (1).




1230416

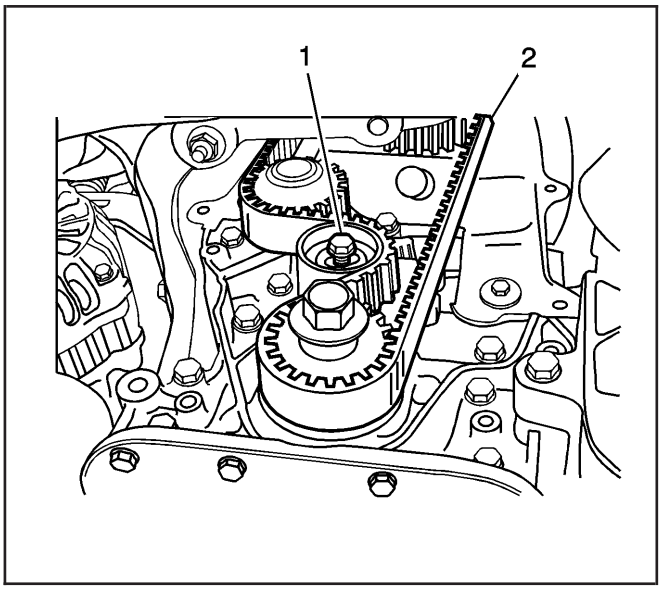
7. Remove the crankshaft pulley bolt (2).
8. To remove the bolt, use a driver, as shown (3).
9. Remove the crankshaft pulley (1).




1224163

10. Remove the oil level gage tube bolt (3).
11. Remove the oil level gage guide tube (4).
12. Remove the timing belt front lower cover bolts (2).
13. Remove the timing belt front lower cover (1).

14. Loosen the timing belt tensioner bolt (1).
15. Remove the timing belt (2).




1224164

## Installation Procedure

**Important:** If the camshaft or crankshaft rotates in the process of installing the timing belt, perform the valve timing adjustment, setting as necessary. Refer to *Valve Timing Inspection and Adjustment on page 6-14*.

1. Install the timing belt.

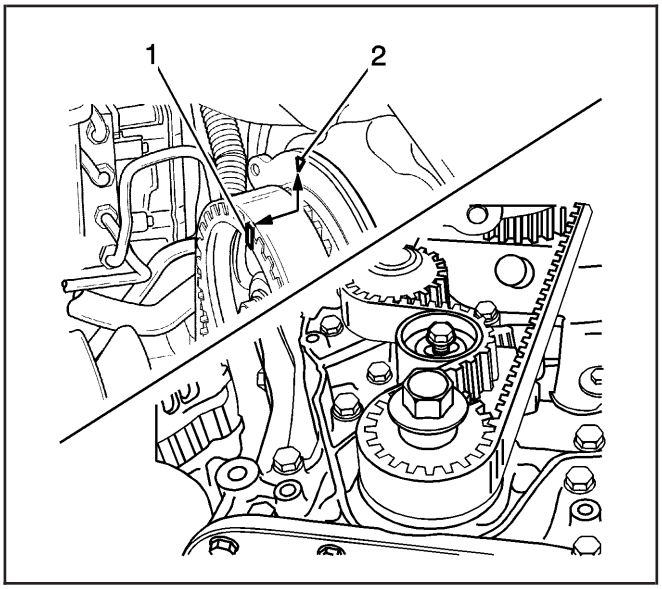
***Notice:*** Refer to *Fastener Notice on page P-7* in Cautions and Notices.

2. Install the timing belt tensioner bolt.

   **Tighten**

   Tighten the tensioner bolt to 15–23 N·m (11–17 lb ft).

3. Turn the crankshaft twice to align the notch on the camshaft (1) with the pointer on the rear cover (2) and tighten the bolt.




1224166

4. Install the timing belt front lower cover bolts (2).

   **Tighten**

   Tighten the timing belt front lower cover bolts to 9–12 N·m (80–106 lb in).

5. Install the oil level gage guide tube bolts (1).

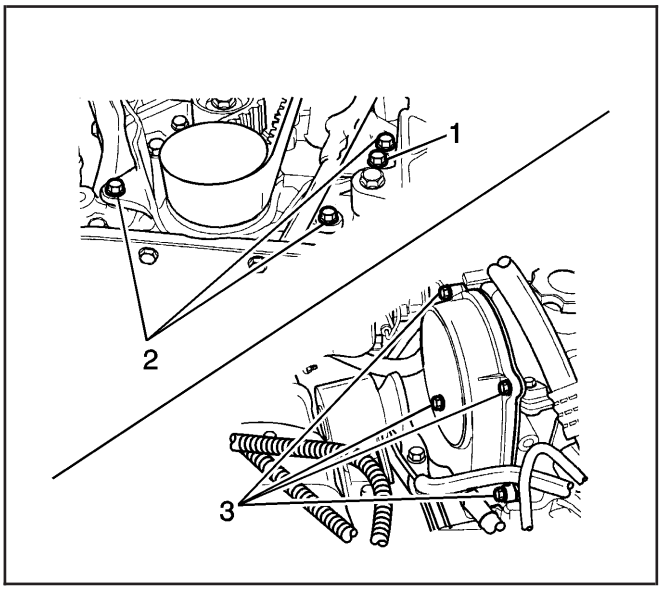
   **Tighten**

   Tighten the oil level gage guide tube bolts to 9–12 N·m (80–106 lb in).

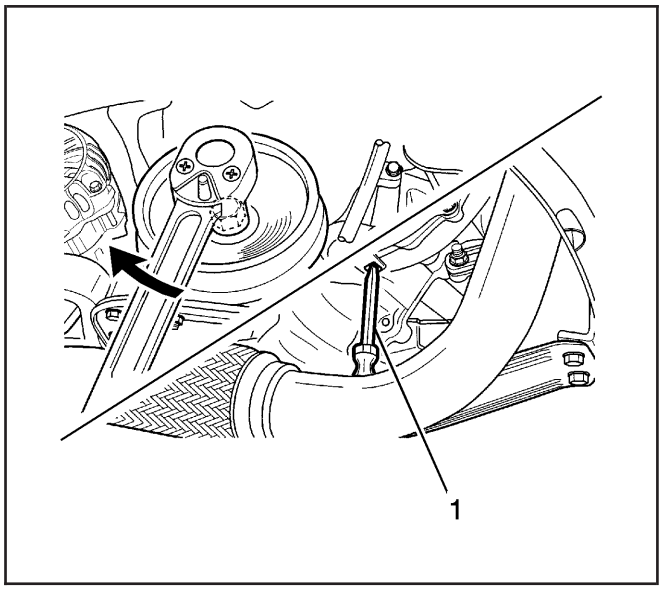
6. Install the timing belt front upper cover bolts (3).

   **Tighten**

   Tighten the timing belt front upper cover bolts to 9–12 N·m (80–106 lb in).




1224168

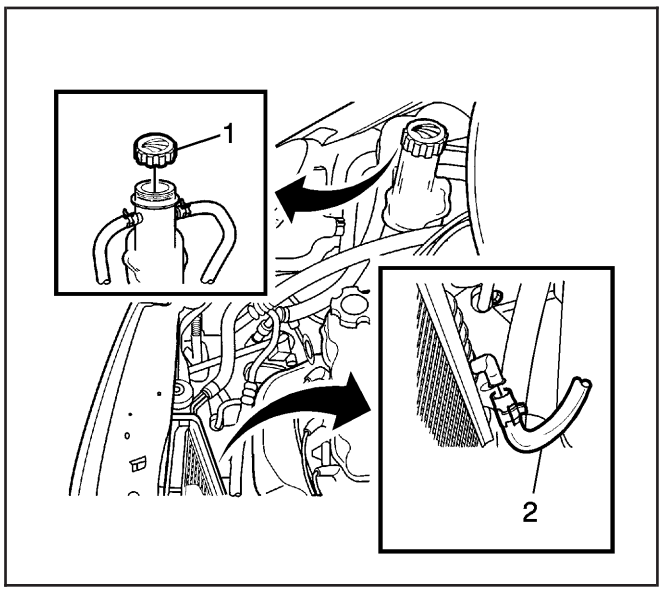



1224171

7. Install the crankshaft pulley bolt (1) using the driver, as shown.

   **Tighten**

   Tighten the crankshaft pulley bolt to 65–75 N·m (48–55 lb ft).
8. Install the power steering drive belt, the A/C compressor drive belt, and the generator drive belt, if equipped.
9. Install the right headlamp. Refer to *Headlamp Replacement on page 8-51* in Lighting Systems.
10. Connect the negative battery cable.




1222941

## Cylinder Head Replacement

*SIE-ID = 1277490 Owner = prober01 LMD = 19-may-2005 LMB = kmicak01*

### Removal Procedure

***Caution: Refer to Safety Glasses Caution on page P-4 in Cautions and Notices.***

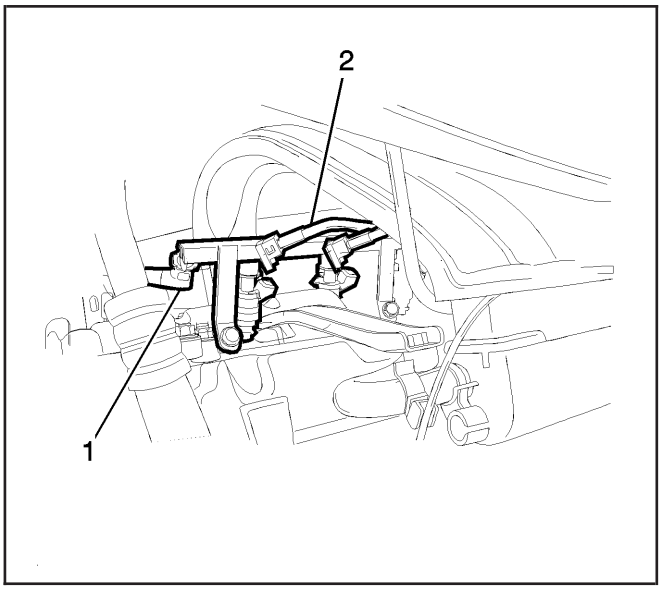
***Caution:*** *SIO-ID = 5004 LMD = 08-nov-2000* ***Remove the fuel tank cap and relieve the fuel system pressure before servicing the fuel system in order to reduce the risk of personal injury. After you relieve the fuel system pressure, a small amount of fuel may be released when servicing the fuel lines, the fuel injection pump, or the connections. In order to reduce the risk of personal injury, cover the fuel system components with a shop towel before disconnection. This will catch any fuel that may leak out. Place the towel in an approved container when the disconnection is complete.***

1. Relieve the fuel system pressure. Refer to *Fuel Pressure Relief Procedure on page 6-115* in Engine Controls.

***Caution: Refer to Battery Disconnect Caution on page P-2 in Cautions and Notices.***

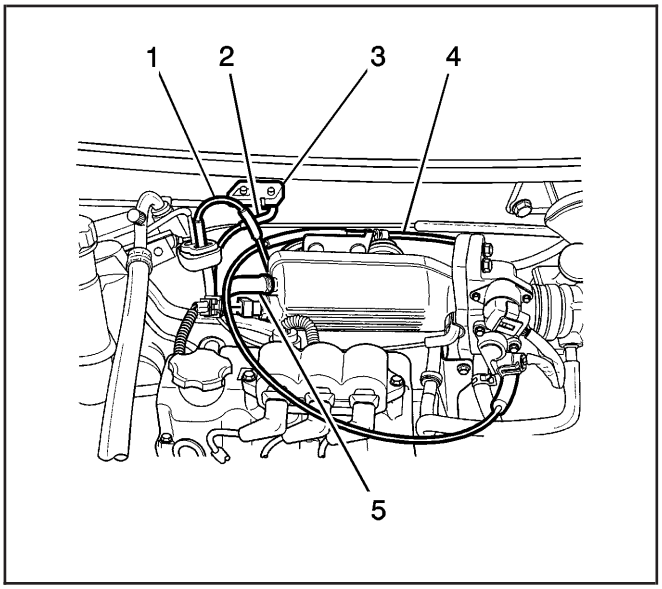
2. Disconnect the negative battery cable.
3. Remove the air filter, resonator, and the snorkel assembly. Refer to *Air Cleaner Assembly Replacement on page 6-139* in Engine Controls.
4. Remove the surge tank cap (1).
5. Disconnect the radiator lower hose and drain the coolant (2). Refer to *Draining and Filling Cooling System on page 6-17* in Engine Cooling.

6. Disconnect the fuel injector wire connectors and fuel line inlet hose. (2)



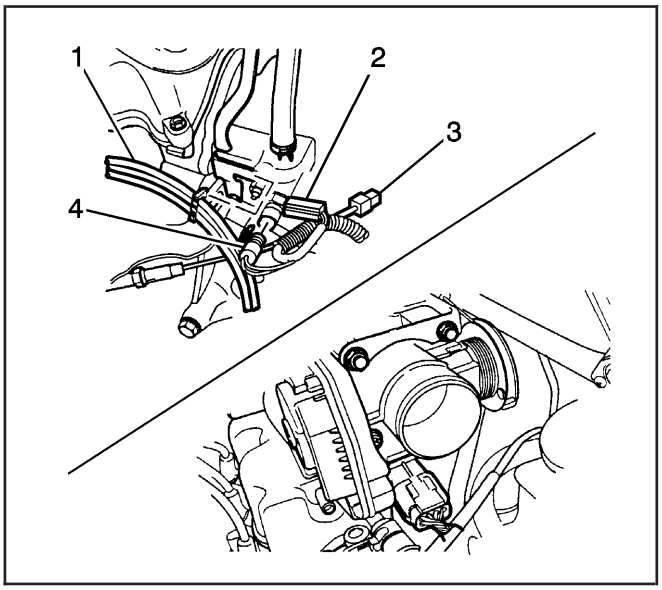

1202812

7. Disconnect the throttle cable (4).
8. Disconnect the manifold absolute pressure (MAP) sensor connector (3).
9. Disconnect the canister solenoid connector (1).
10. Disconnect the brake booster vacuum hose (5).

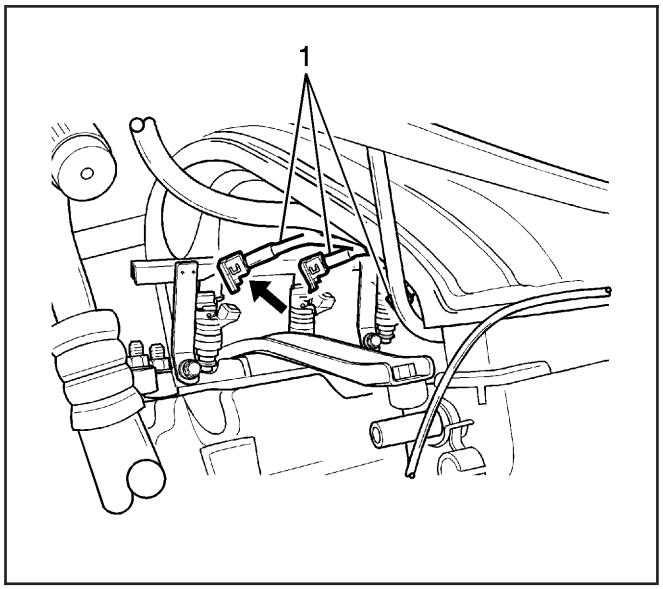



1202840

11. Disconnect the ignition wires (1) from the spark plugs.
12. Disconnect the engine coolant temperature sensor connector (2).
13. Disconnect the coolant temperature sensor connector (4).
14. Disconnect the oxygen sensor connector (3).

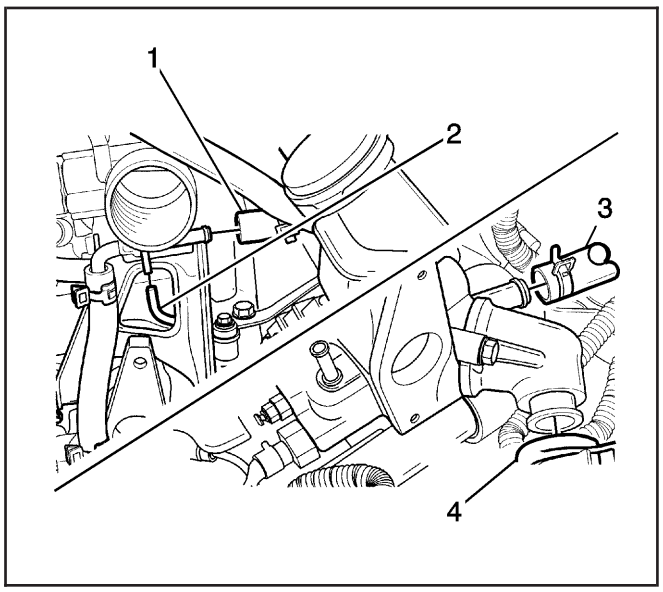



1240465



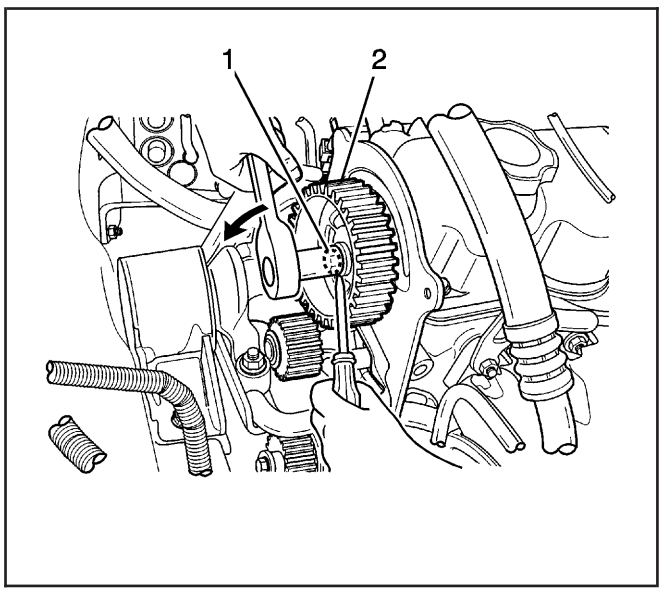

1230417

15. Disconnect the fuel injector wire connector (1).
16. Disconnect the distributor optical sensor connector.
17. Remove the exhaust gas recirculation (EGR) solenoid.




1230418

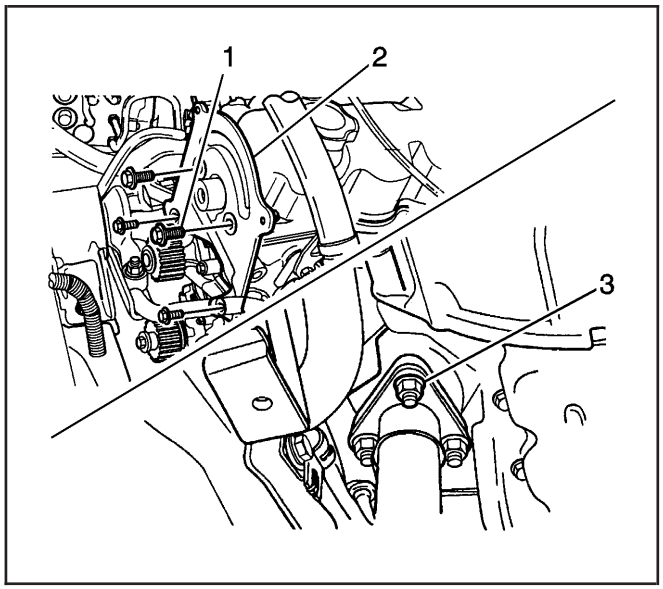
18. Disconnect the evaporative emission canister vacuum tube (2).
19. Disconnect the radiator upper hose from the thermostat housing (3).
20. Disconnect the heat core inlet hose from the thermostat housing (4).




1224181

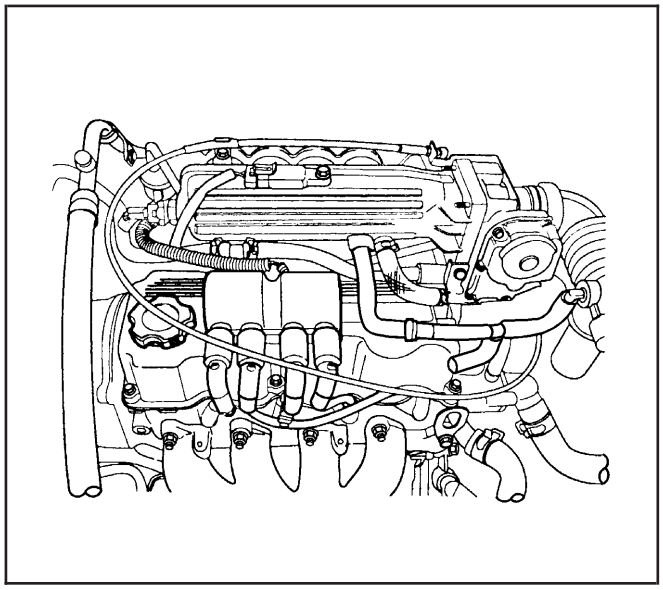
21. Remove the timing belt. Refer to *Timing Belt Replacement on page 6-29*.
22. Remove the camshaft gear bolt (1).
23. Remove the camshaft gear from the camshaft (2).

24. Remove the timing belt rear cover bolts (1).
25. Remove the rear cover from the cylinder head and block (2).
26. Remove front exhaust pipe nuts and gasket.
27. Remove front exhaust pipe.



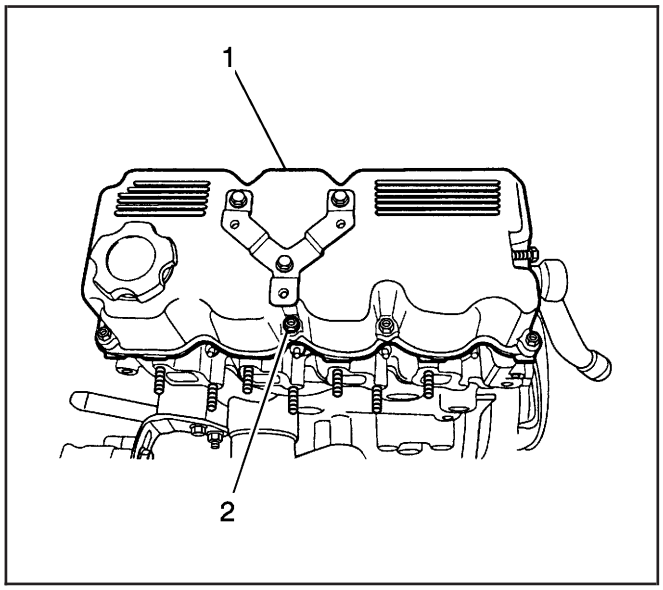

1240499

28. Disconnect the MAP sensor vacuum tube.
29. Disconnect the positive crankcase ventilation (PCV) hose and valve.
30. Remove the oil filter cap.
31. Remove the ignition coil.

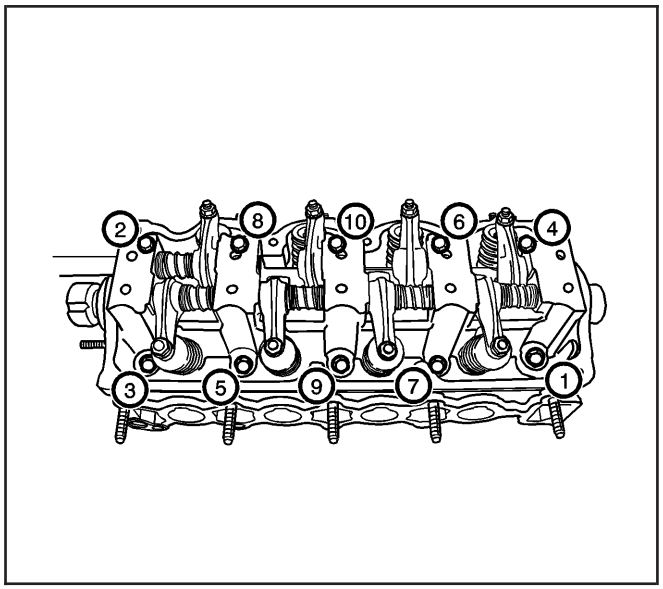


1240515

32. Remove the cylinder head cover hexagon bolts (2).
33. Remove the cylinder head cover with gasket (1).

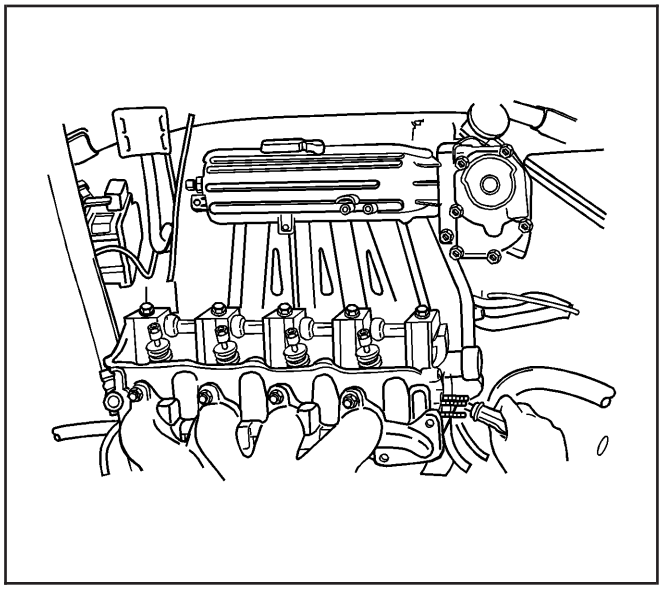



1240529




1240550

34. Gradually loosen all of the cylinder head bolts in the sequence shown.



1240563

35. Remove the cylinder head bolts (1).
36. Remove the cylinder head assembly from the engine block, with the intake/exhaust manifold, throttle body, distributor housing cylinder head gasket (2).
37. Inspect the cylinder head for damage.
38. Clean the gasket surfaces of the cylinder head and engine block.
39. Clean the cylinder head bolts.

## Installation Procedure

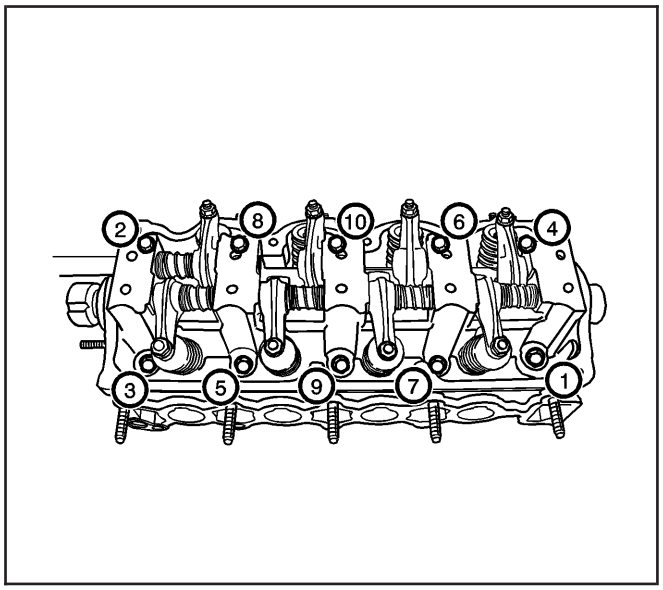
1. Install new cylinder head gasket.

***Notice:*** Refer to *Fastener Notice on page P-7* in Cautions and Notices.

2. Install the cylinder head bolts in the sequence shown.

   **Tighten**

   Tighten the cylinder head bolts to 65–70 N·m (48–52 lb ft).

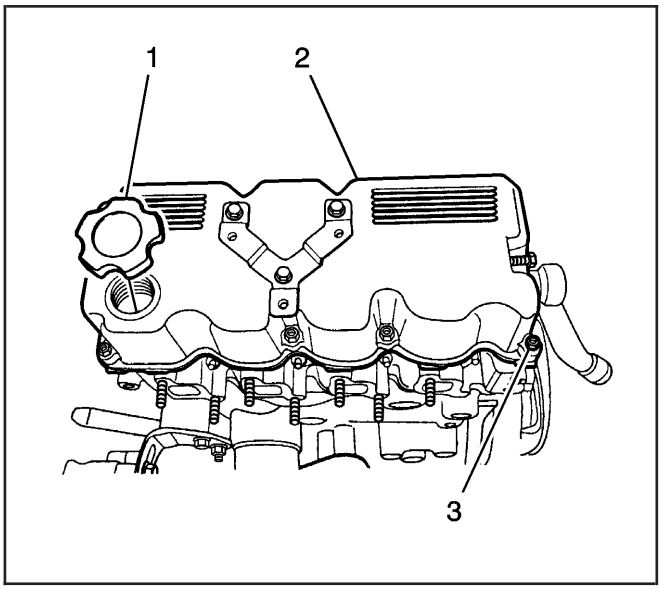



1240550

3. Install cylinder head assembly to engine block.
4. Install the cylinder head hexagon bolts (3).

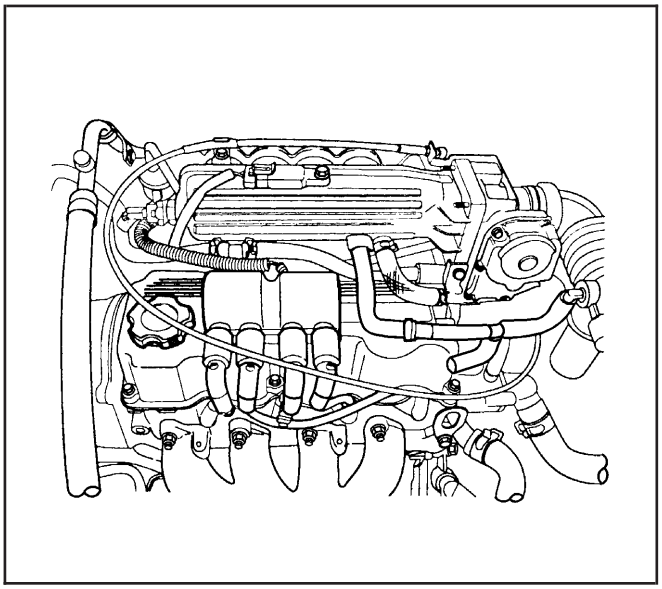
   **Tighten**

   Tighten the cylinder head bolts to 9–12 N·m (80–106 lb in).




1240580

5. Install the ignition coil.
6. Install the oil filter and cap.
7. Connect the PCV hose and valve.



1240515

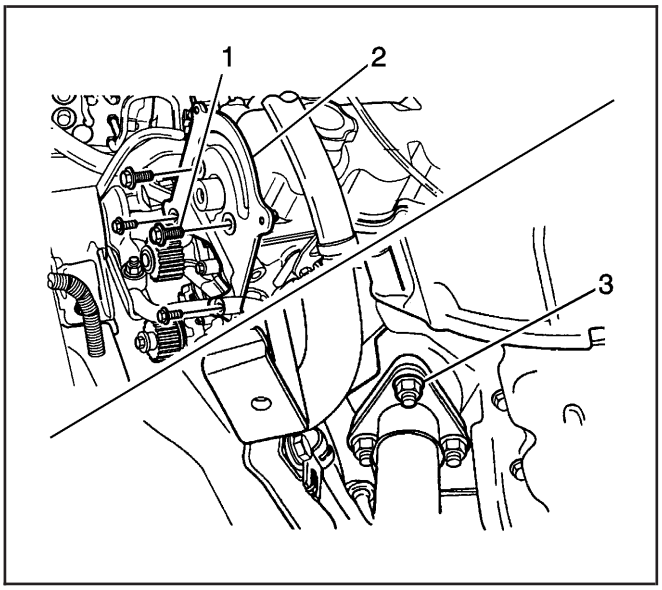
8. Install front exhaust pipe, gasket, and nuts (3).

   **Tighten**

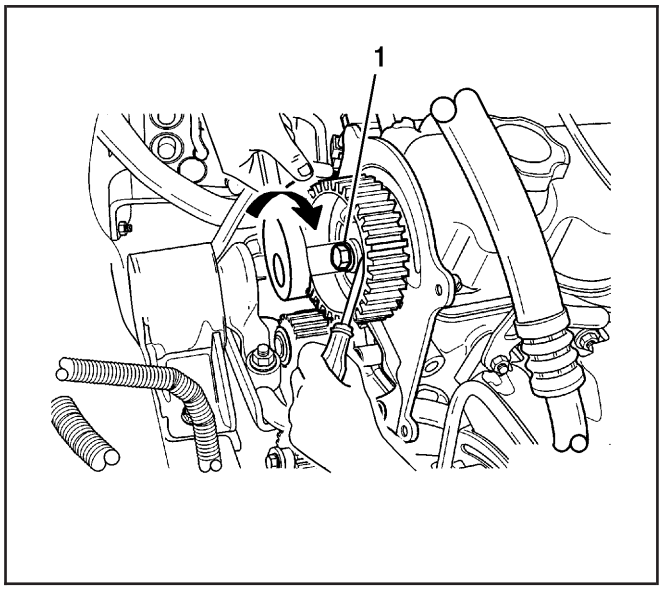
   Tighten the front exhaust pipe nuts to 25–35 N·m (18–25 lb ft).
9. Install timing belt rear cover to the cylinder head and block bolts (1).

   **Tighten**

   Tighten the timing belt rear cover bolts to 9–12 N·m (80–106 lb in).




1240499



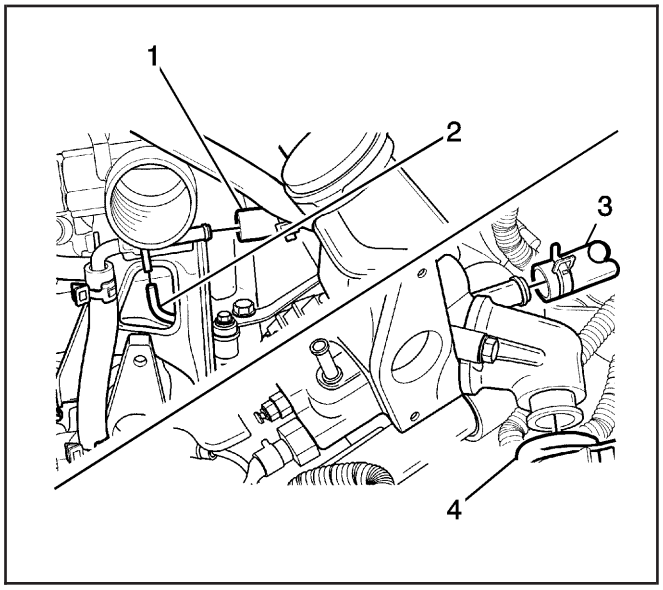

1230429

10. Install the camshaft gear to the camshaft with bolts (1).

    **Tighten**

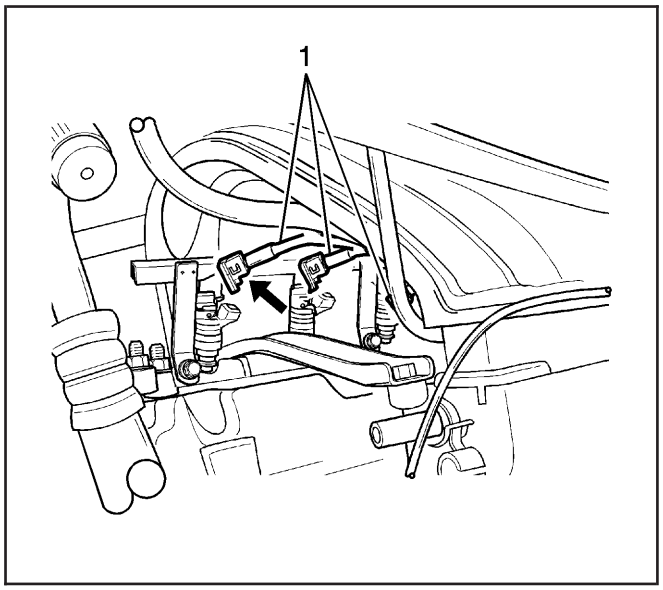
    Tighten the camshaft gear bolt to 50–60 N·m (36–44 lb ft).

11. Install the timing belt. Refer to *Timing Belt Replacement on page 6-29*.




1230418

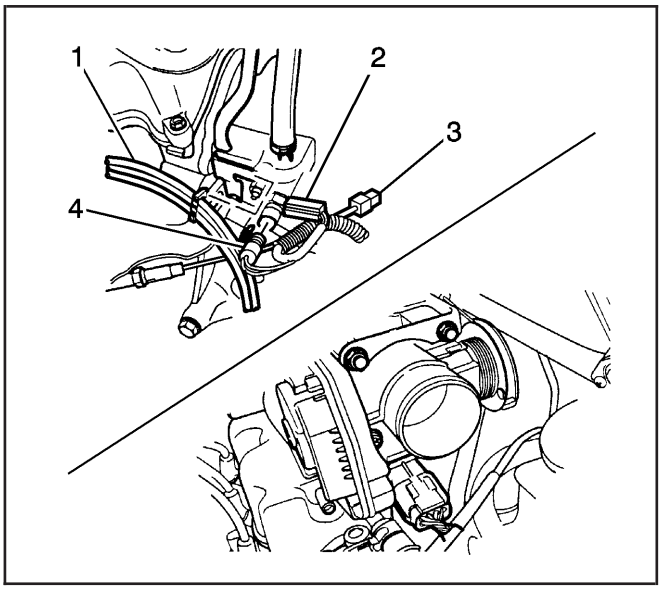
12. Connect the heat core inlet hose to the thermostat housing (4).
13. Connect the radiator upper hose to the thermostat housing (3).
14. Connect the evaporative emission canister vacuum tube (2).




1230417

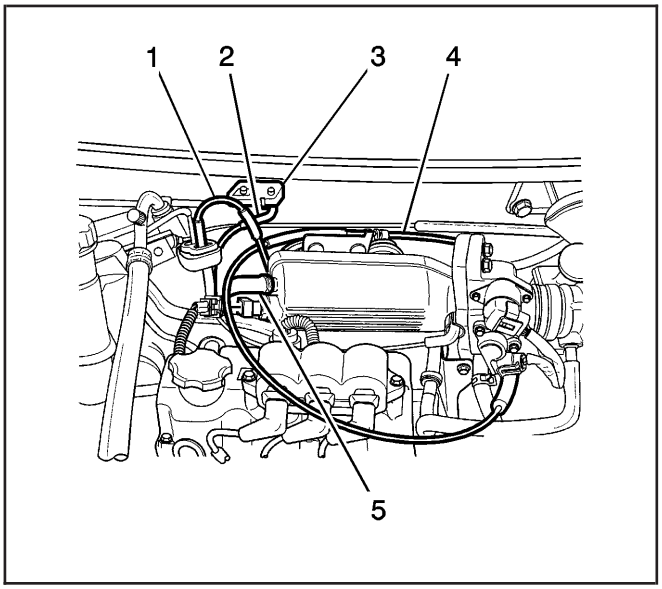
15. Install the EGR solenoid.
16. Connect the distributor optical sensor connector.
17. Connect the fuel injector wire connector (1).

18. Connect the oxygen sensor connector (3).
19. Connect the coolant temperature sensor connector (4).
20. Connect the engine coolant temperature sensor connector (2).
21. Connect the ignition wires to the spark plugs.



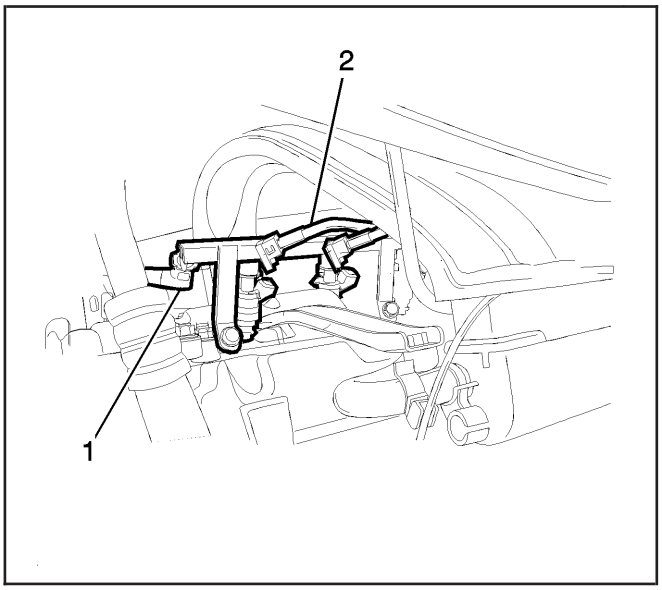

1240465

22. Connect the brake booster vacuum hose (5).
23. Connect the canister solenoid connector (1).
24. Connect the MAP sensor connector (3).
25. Connect the throttle cable (4).

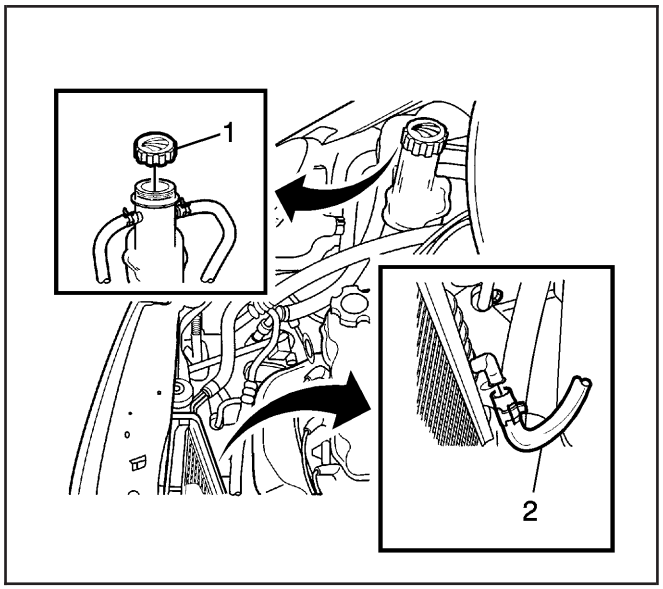



1202840

26. Connect the fuel line inlet hose (2) and the fuel injector wire connector (1).

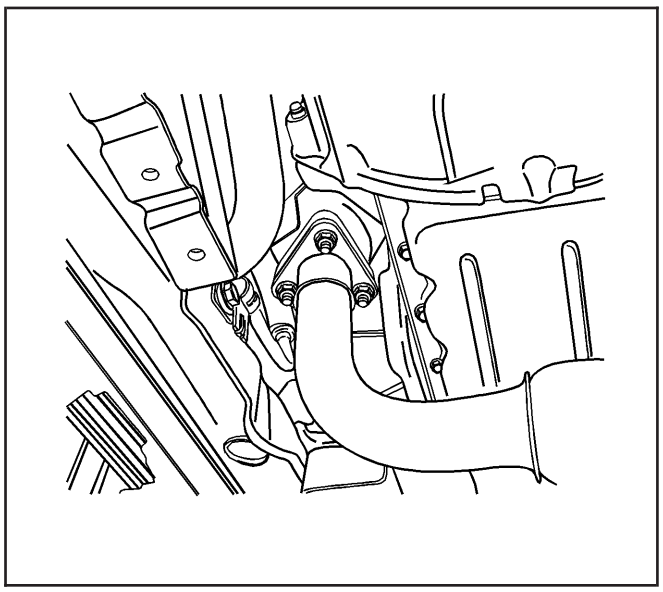



1202812




1222941

27. Connect radiator lower hose (2) and fill coolant. Refer to *Draining and Filling Cooling System on page 6-17* in Engine Cooling.
28. Install the surge tank cap (1).
29. Install the snorkel assembly, resonator and air filter. Refer to *Air Cleaner Assembly Replacement on page 6-139* in Engine Controls.
30. Connect the negative battery cable.



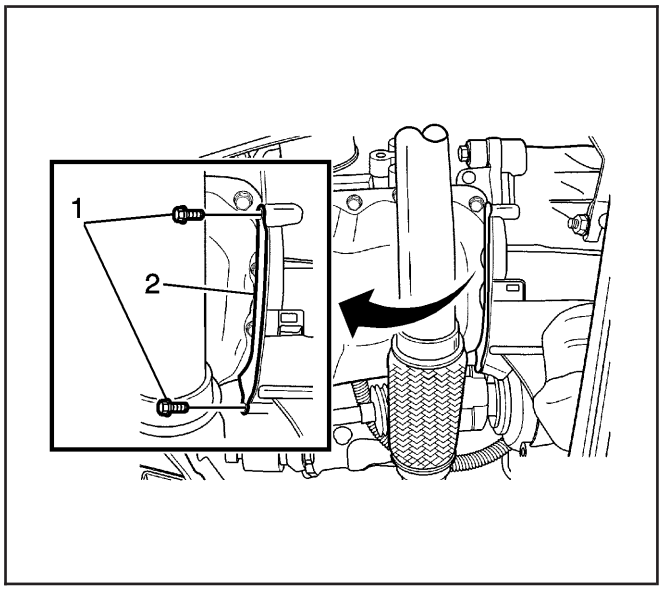
1240405

## Oil Pan Replacement

*SIE-ID = 1277357 Owner = prober01 LMD = 04-may-2005 LMB = kneved01*

### Removal Procedure

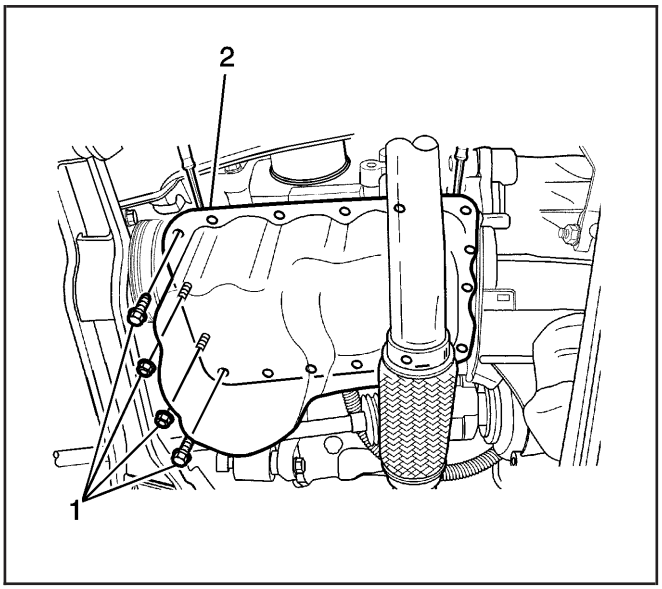
1. Drain the engine oil from the engine crankcase.
2. Remove the front exhaust pipe from the exhaust manifold.
3. Remove the exhaust manifold nuts and gaskets.
4. Remove the clutch housing lower plate bolts.




1224172

5. Remove the clutch housing lower plate (2).

6. Remove the oil pan bolts and nuts (1).
7. Remove the oil pan from the engine block (2).
8. Clean the oil pan and engine block sealing surfaces.
9. Clean the oil pan bolts.
10. Clean the oil pan bolt holes in the engine block.




1224174

## Installation Procedure

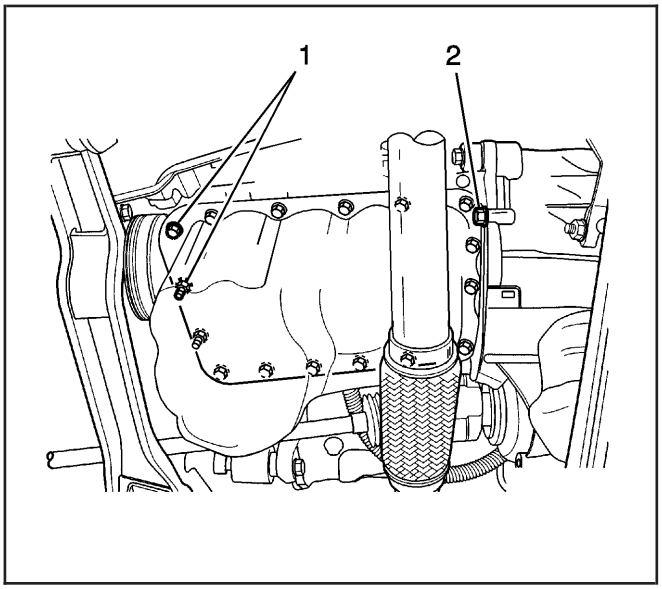
***Notice:*** Refer to *Fastener Notice on page P-7* in Cautions and Notices.

**Important:** Install the oil pan within 5 minutes after applying liquid gasket to the oil pan.

1. Install the oil pan with the bolts (2) and nuts (1).

   **Tighten**

   Tighten the oil pan bolts and nuts to 9–12 N·m (80–106 lb in).
2. Discard the used oil pan drain plug washer and replace it with a new one.

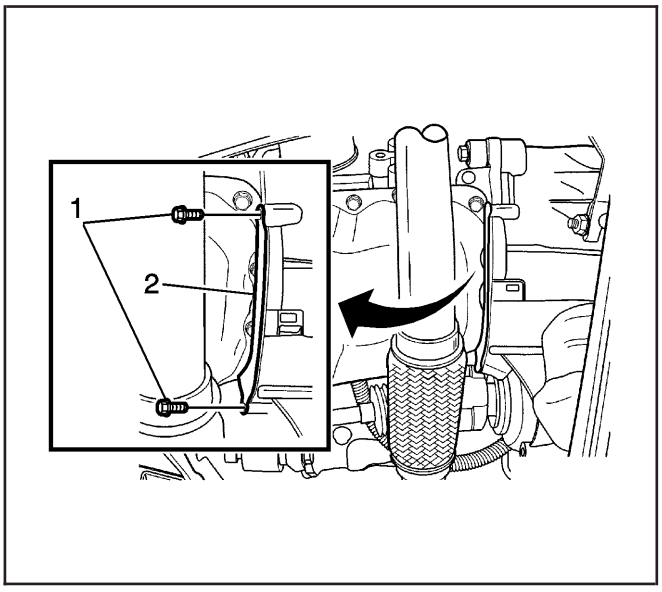



1224177

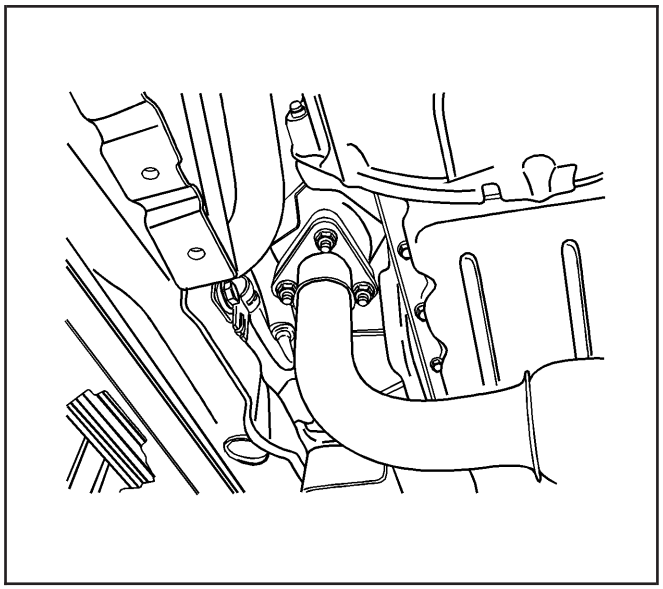
3. Install the clutch housing lower plate (2) with bolts (1).

   **Tighten**

   Tighten the clutch housing lower plate bolts to 4–7 N·m (35–62 lb in).




1224172

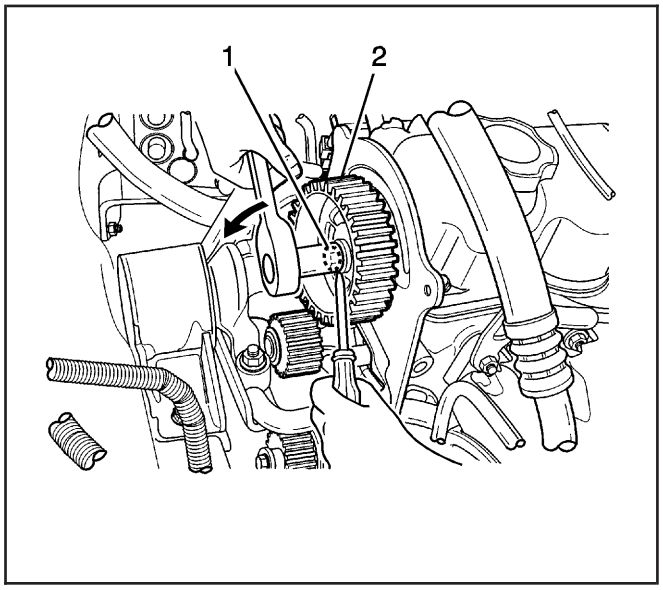


1240405

4. Install the front exhaust pipe with nuts.

   **Tighten**

   Tighten the front exhaust pipe nuts to 25–35 N·m (18–25 lb ft).
5. Check and fill engine oil.




1224181

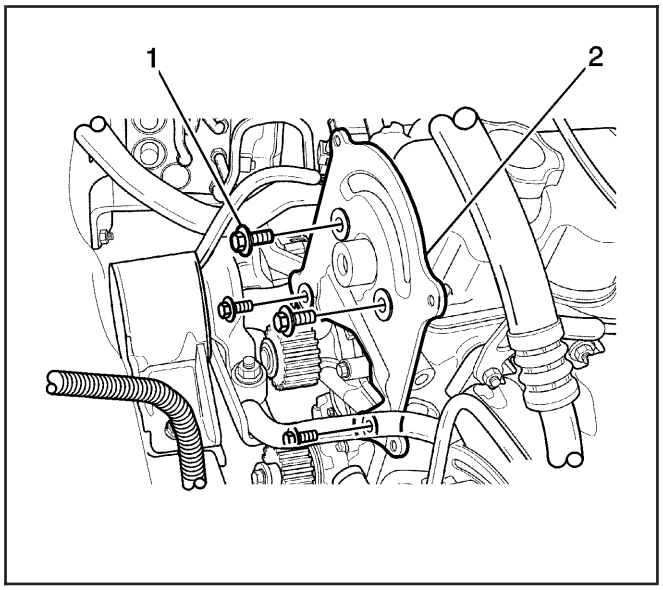
## Oil Pump Replacement

*SIE-ID = 1277379 Owner = prober01 LMD = 07-may-2003 LMB = dostre01*

### Removal Procedure

***Caution: Refer to Battery Disconnect Caution on page P-2 in Cautions and Notices.***

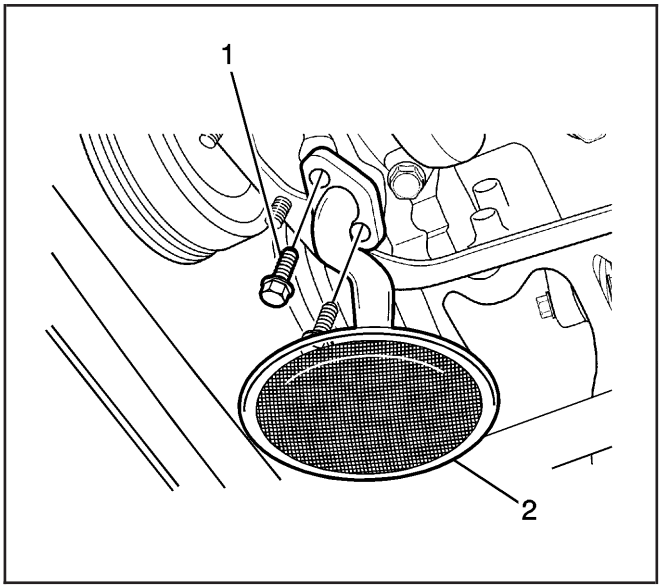
1. Disconnect the negative battery cable.
2. Remove the timing belt and timing belt tensioner. Refer to *Timing Belt Replacement on page 6-29*.
3. Remove the camshaft gear bolt (1).
4. Remove the camshaft gear from the camshaft (2).




1222960

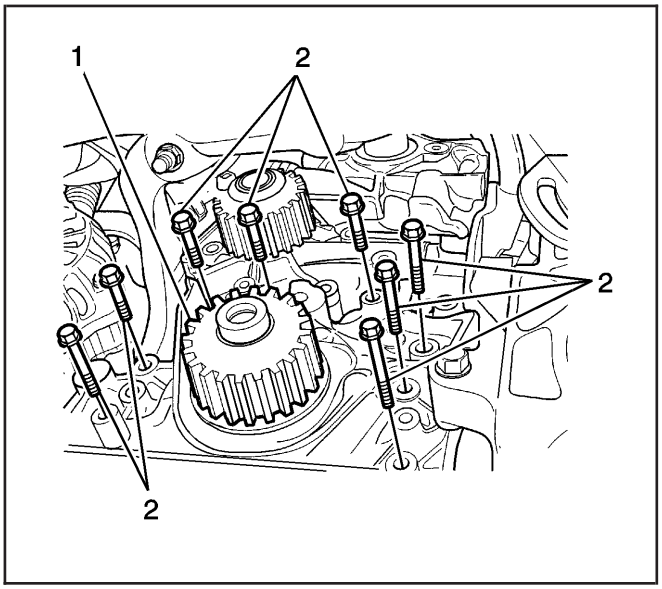
5. Remove the timing belt rear cover bolt (1).
6. Remove the timing belt rear cover (2).

7. Remove the oil pan. Refer to *Oil Pan Replacement on page 6-40*.
8. Remove the oil pump strainer bolts (1).
9. Remove the oil pump strainer with oil seal (2).



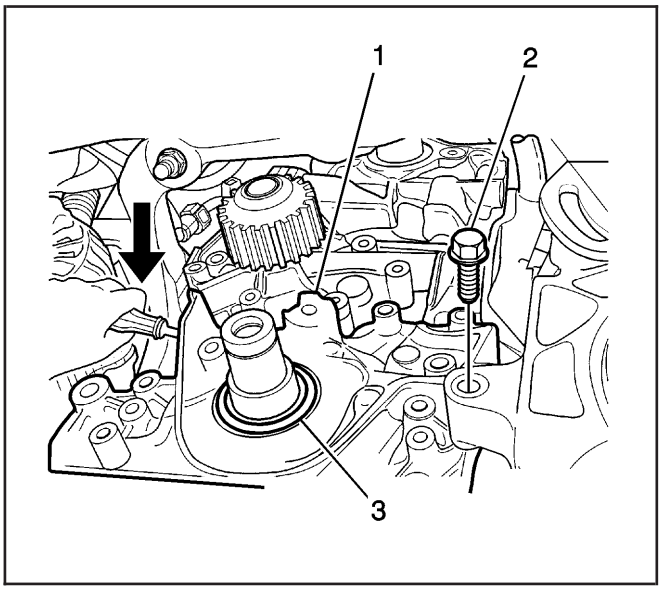

1224184

10. Remove the crankshaft gear from the crankshaft (1).
11. Remove the oil pump bolts (2).

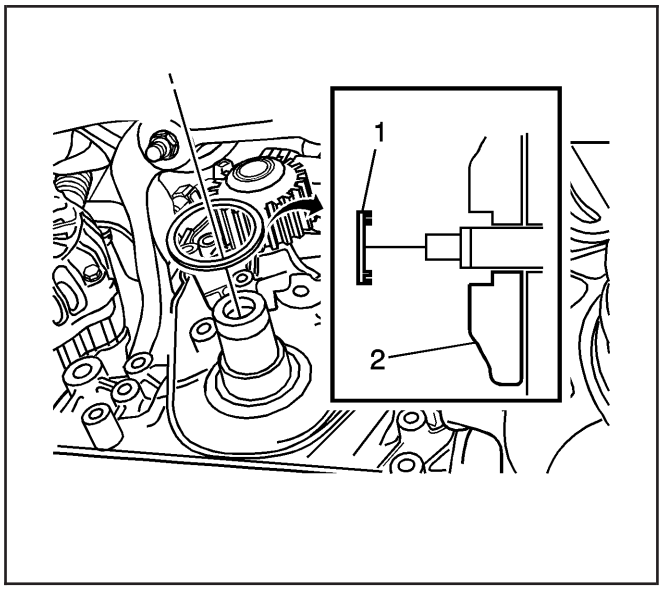



1224185

12. Remove the A/C compressor bracket bolt (2).
13. Remove the A/C compressor bracket.
14. Remove the oil pump (1).
15. Clean the oil pump and engine block gasket mating surfaces.
16. Remove the oil seal from the oil pump (3).
17. Inspect the oil seal for damage.




1224186



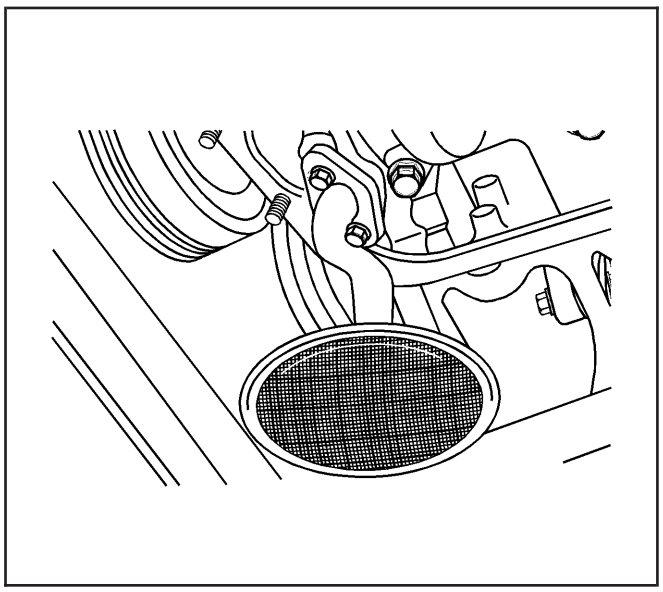

1222934

## Installation Procedure

1. Install a new oil pump gasket.

**Important:** If the crankshaft front oil seal is damaged, replace it with new oil seal.

2. When installing the crankshaft front oil seal to the oil pump, face the oil seal groove (1) toward the oil pump case contact surface (2) as shown.



1222935

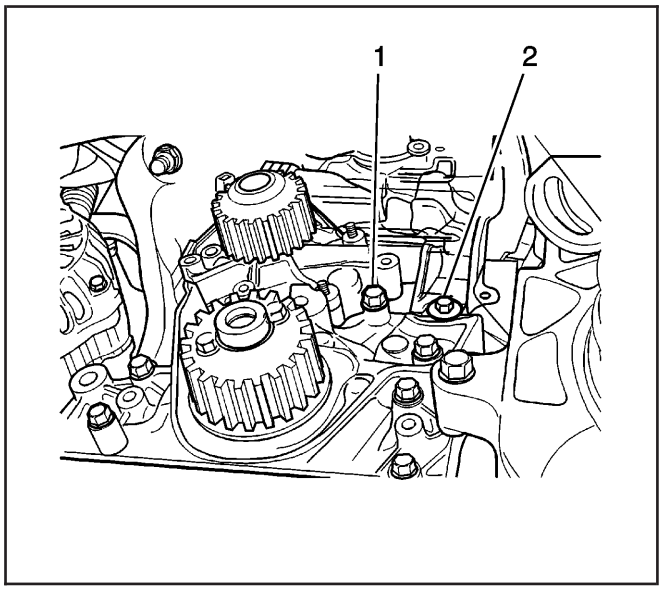
***Notice:*** Refer to *Fastener Notice on page P-7* in Cautions and Notices.

3. Install oil pump strainer and bolts.

   **Tighten**

   Tighten the oil pump strainer bolt to 9–12 N·m (80–106 lb in).

4. Install the oil pan. Refer to *Oil Pan Replacement on page 6-40*.




1222937

5. Install the oil pump, oil pump cover bolts (1), and timing belt rear cover bolts (3).

   **Tighten**

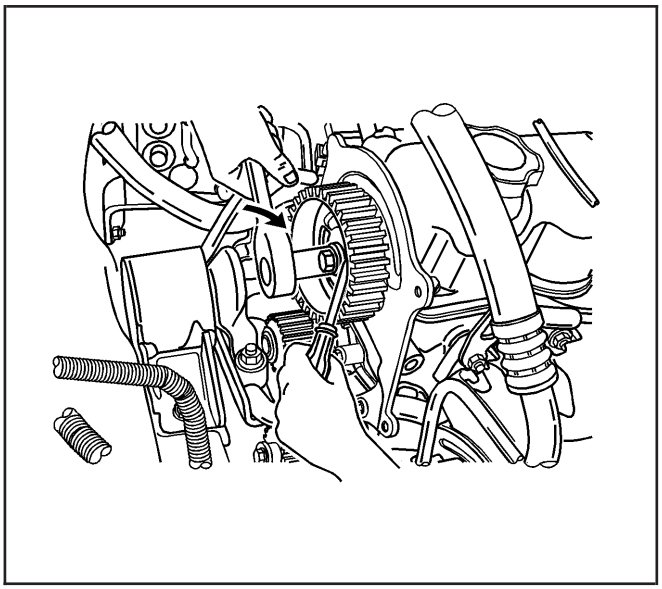
   Tighten the oil pump cover bolts and the timing belt rear cover bolts to 9–12 N·m (80–106 lb in).

6. Install the A/C compressor with bolt.
7. Install the crankshaft gear to crankshaft.

8. Install the camshaft gear and bolt.

   **Tighten**

   Tighten the camshaft gear bolt to 50–60 N·m (36–44 lb ft).
9. Install the timing belt and timing belt tensioner. Refer to *Timing Belt Replacement on page 6-29*.
10. Connect negative battery cable.



1222939

## Engine Replacement

*SIE-ID = 1649027 Owner = dcobb01 LMD = 19-may-2005 LMB = kmicak01*

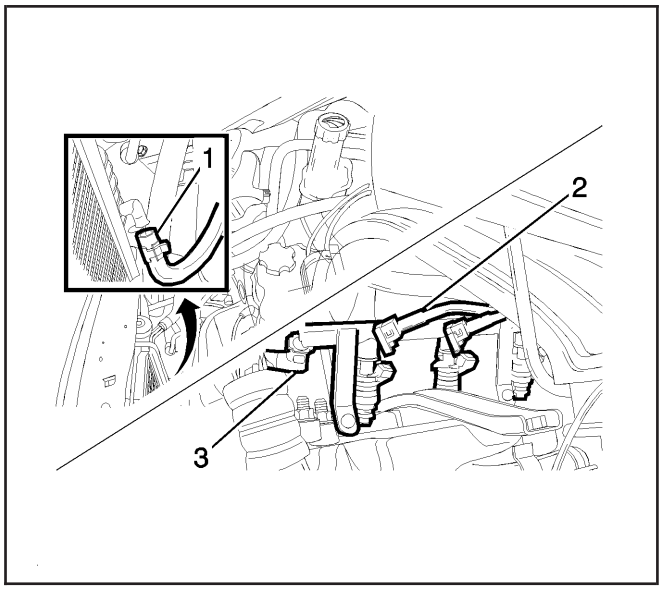
### Tools Required

*J 39580* (DW 010-010) Power Pack Engine and Transaxle Assembly Support Remover/Installer

## Removal Procedure

***Caution:*** *SIO-ID = 103381 LMD = 23-jul-1996* ***Avoid breathing the A/C Refrigerant 134a (R-134a) and the lubricant vapor or the mist. Exposure may irritate the eyes, nose, and throat. Work in a well ventilated area. In order to remove R-134a from the A/C system, use service equipment that is certified to meet the requirements of SAE J 2210 (R-134a recycling equipment). If an accidental system discharge occurs, ventilate the work area before continuing service. Additional health and safety information may be obtained from the refrigerant and lubricant manufacturers.***

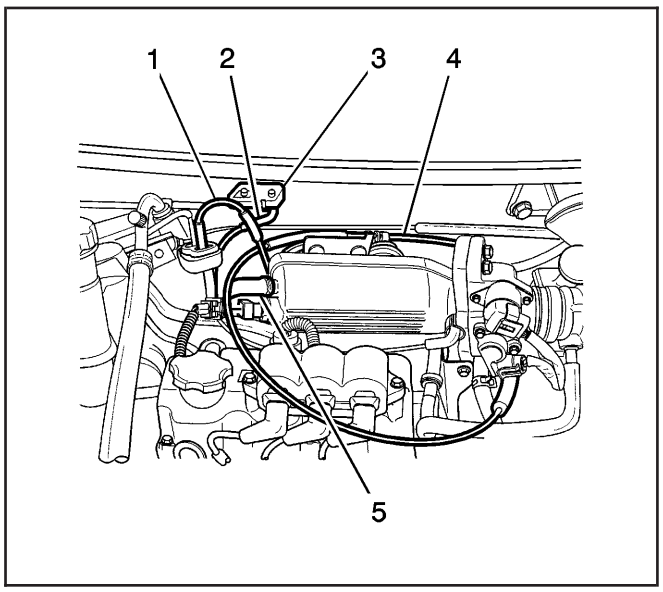
1. Discharge the air conditioning (A/C) system, if equipped.
2. Drain the power steering oil, if equipped.
3. Relieve the fuel system pressure. Refer to *Fuel Pressure Relief Procedure on page 6-115* for the 1.0L engine.




1203004

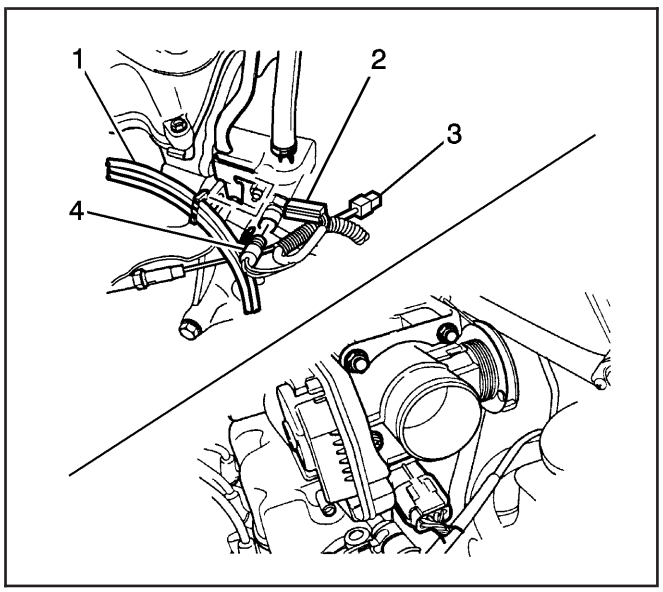
***Caution: Refer to Battery Disconnect Caution on page P-2.***

4. Disconnect the negative battery cable.
5. Remove the air filter, resonator with snorkel assembly (a). Refer to *Air Cleaner Assembly Replacement on page 6-139* for the 1.0L engine.
6. Disconnect the radiator lower hose and drain the coolant (1). Refer to *Draining and Filling Cooling System on page 6-17*.
7. Disconnect the fuel line inlet hose and the fuel injector wire connectors from the fuel rail (2, 3).




1202840

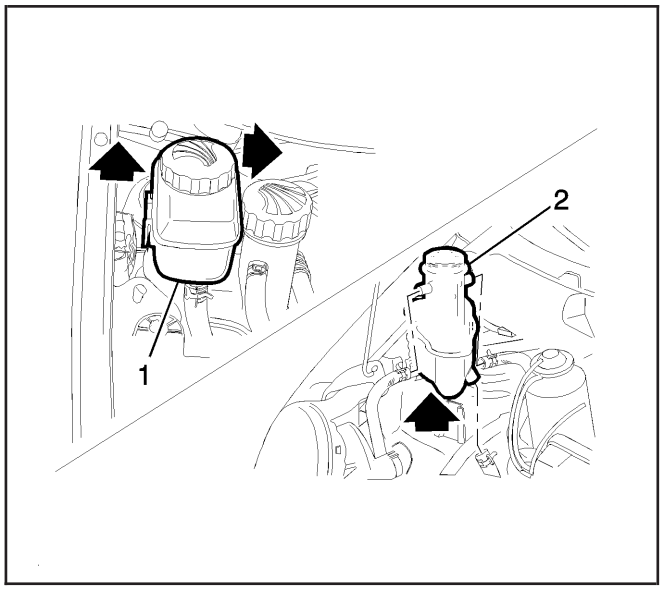
8. Disconnect the throttle cable (4).
9. Disconnect manifold absolute pressure (MAP) sensor connector (3).
10. Disconnect the canister solenoid connector (1).
11. Disconnect the brake booster vacuum hose (5).
12. Disconnect the evaporative emission (EVAP) canister vacuum hose.
13. Disconnect intake air temperature (IAT) sensor connector.




1240465

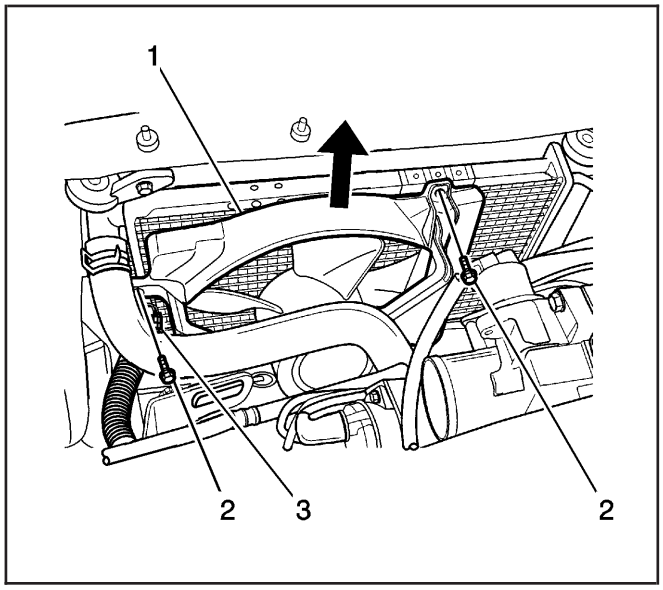
14. Disconnect the engine coolant temperature (ECT) sensor connector (4).
15. Disconnect the coolant temperature sensor connector (2).
16. Disconnect the oxygen sensor connector (3).
17. Disconnect camshaft position (CMP) sensor connector and crankshaft position (CKP) sensor connector.
18. Disconnect the heat core inlet hose.
19. Disconnect the throttle body coolant outlet hose.

20. Remove the power steering oil tank (2), if equipped. Refer to *Power Steering Fluid Reservoir Replacement on page 2-13*.
21. Remove the coolant surge tank (2).



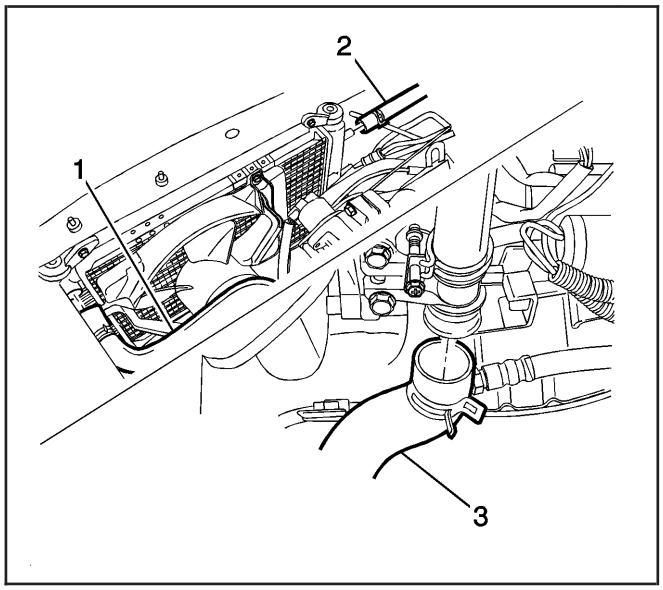

1203169

22. Disconnect the electrical connector (3).
23. Loosen the bolts (2).
24. Take out the coolant fan assembly as shown in the picture (1).

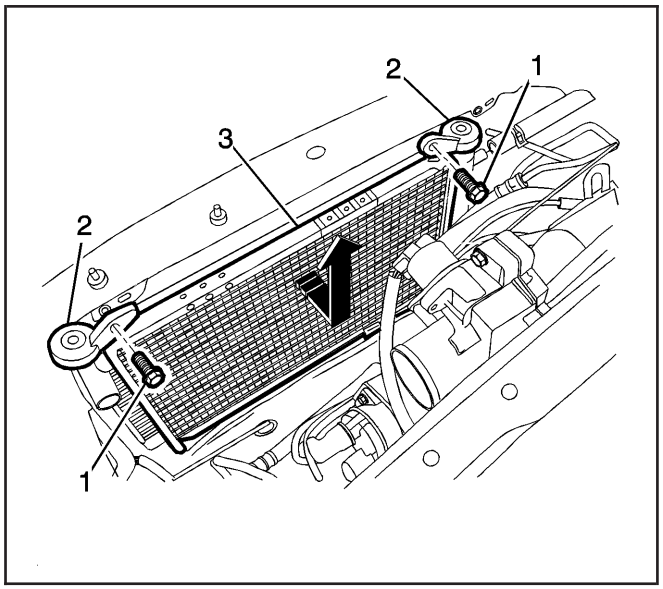



1224216

25. Disconnect and remove the radiator upper hose (1).
26. Disconnect and remove the radiator surge tank hose (2).
27. Disconnect and remove the radiator lower hose (3).

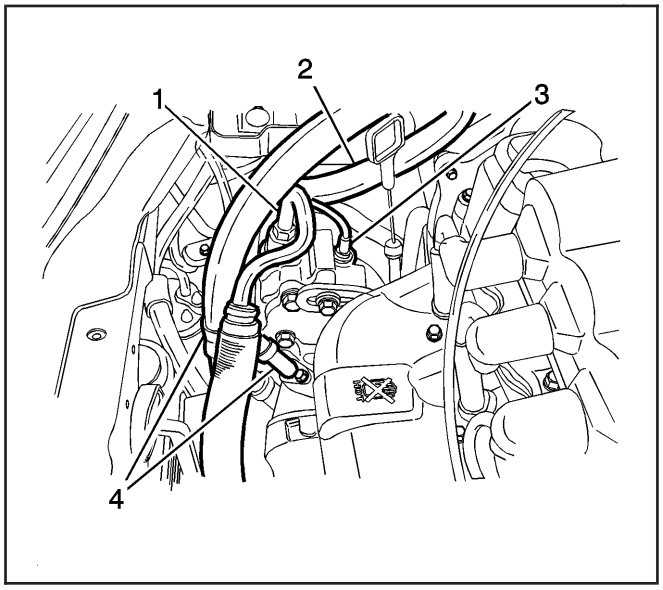



1204030



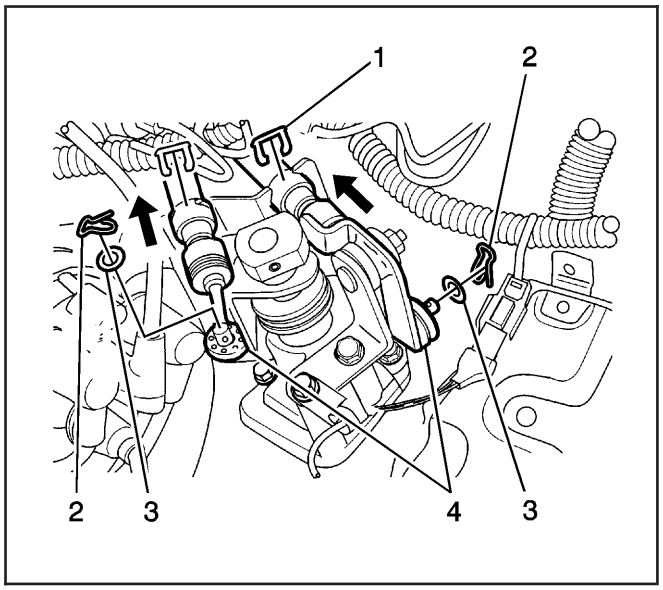

1204172

28. Loosen the bolts (2).
29. Remove the radiator mounting brackets (1).
30. Take out the radiator as shown in the picture (3).




1203579

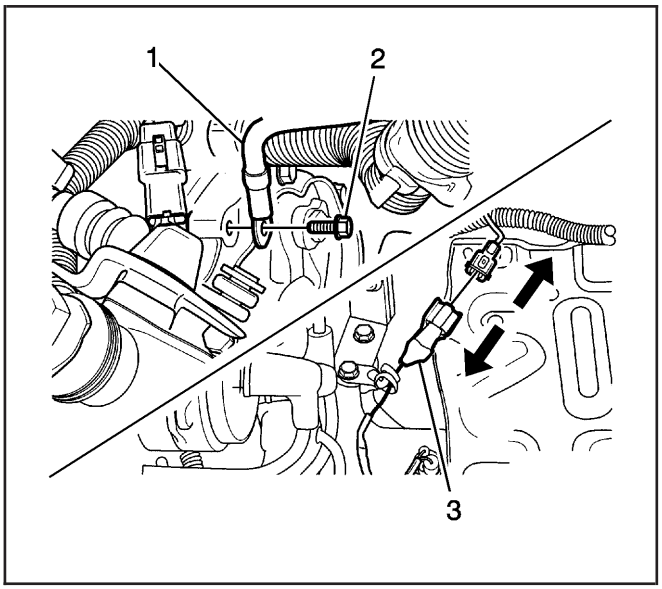
31. Disconnect the connectors, the pipes, and the hoses, if equipped, with the A/C system and power steering.
32. Disconnect the power steering pump (2).
33. Disconnect the hose from the power steering pump (1).
34. Disconnect the pipe from the power steering pump (1).
35. Disconnect the air conditioning low and high pressure pipes (4).
36. Disconnect the power steering hose.




1224503

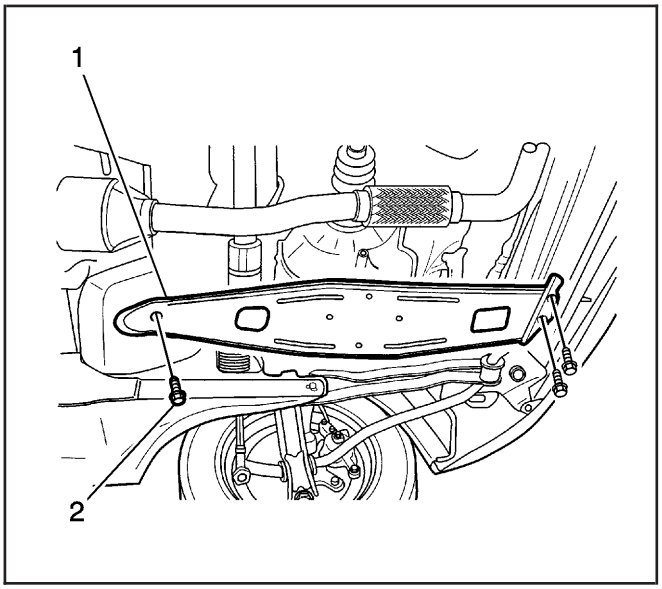
37. Remove the select and shift cable pin (2).
38. Remove the select and shift cable washer (3).
39. Disconnect the select and shift cable (4).
40. Remove the E-ring (1).

41. Remove the engine electrical wire bending strap.
42. Loosen the transaxle case ground connection line bolt (2).
43. Disconnect the transaxle case ground connection line (1).
44. Disconnect the backup lamp switch electrical connector (3).
45. Disconnect the gear position sensor electrical connector.



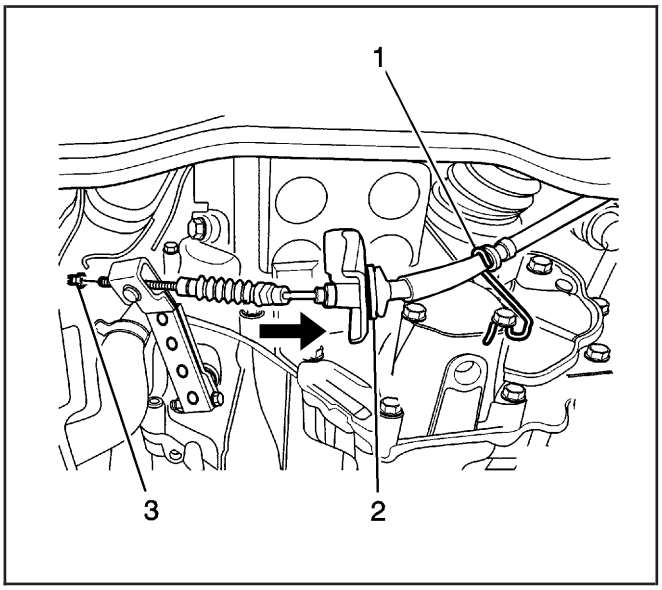

1224507

46. Remove the transaxle under cover (1) and bolts (2).

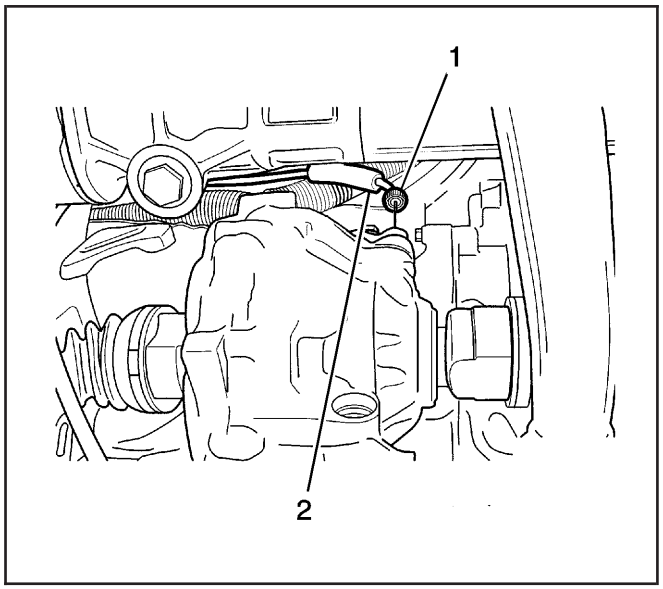



1224508

47. Remove the oil drain plug to drain transaxle oil.
48. Loosen the cable adjusting nuts (3).
49. Disconnect the cable from the wire clip (1).
50. Disconnect the cable from the transaxle mount hole (2).

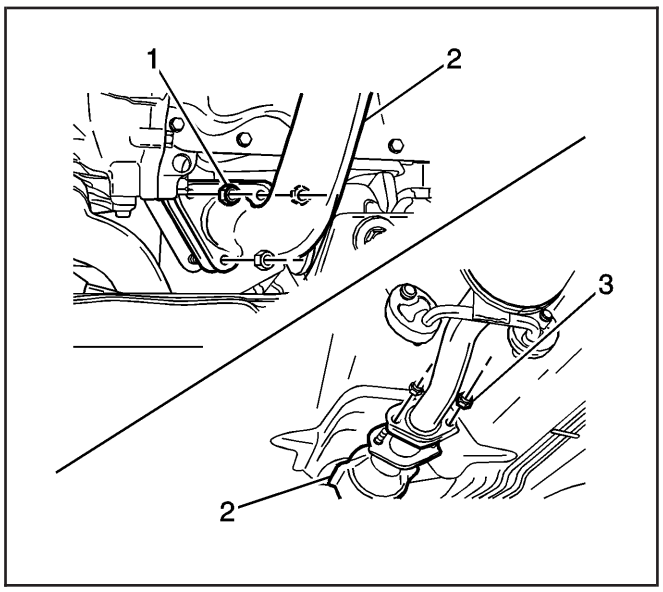



1224509



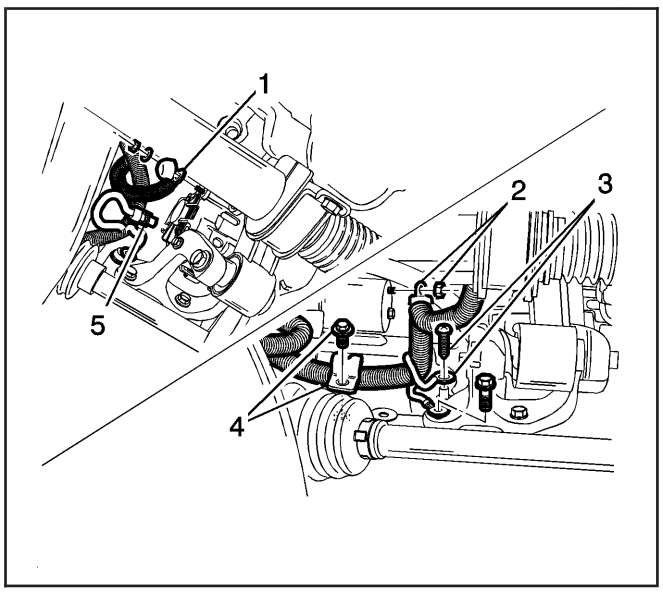

1224511

51. Loosen the speedometer cable nut (1).
52. Disconnect the speedometer cable (2).
53. Disconnect the vehicle speed sensor electrical connector, if equipped.




1224510

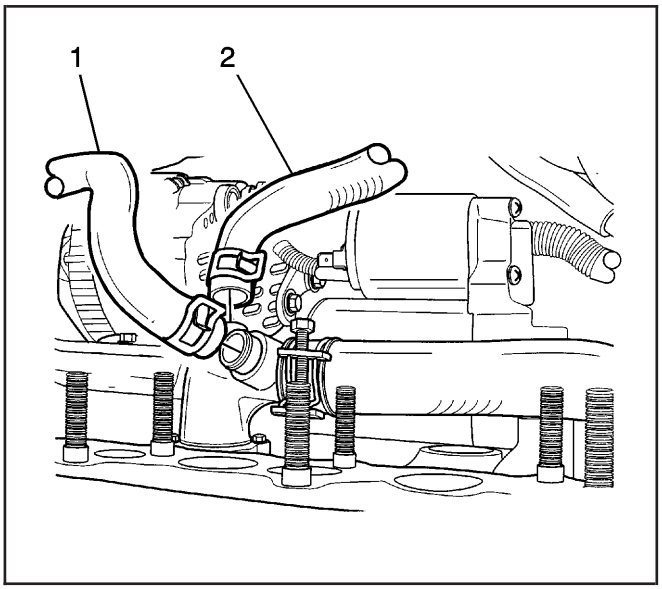
54. Loosen the exhaust pipe nuts (1).
55. Remove the gasket and disconnect the pipe (4).
56. Loosen the front exhaust pipe nuts (3).
57. Remove the front exhaust pipe (2).




1204807

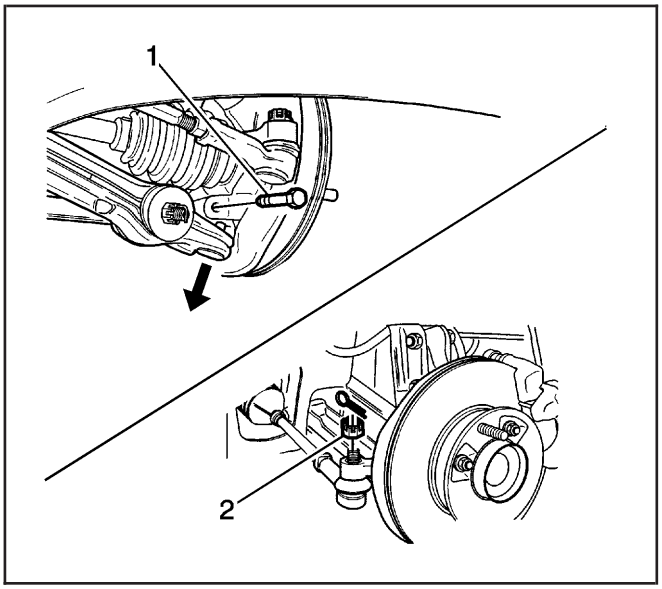
58. Disconnect the oil pressure switch electrical connector (3).
59. Disconnect the generator B+ terminal (1).
60. Disconnect the generator electrical connector (5).
61. Disconnect the starter electrical connector (2).
62. Disconnect the electrical wire strap (4).

63. Disconnect the surge tank coolant return hose (1) and the heater outlet hose (2).



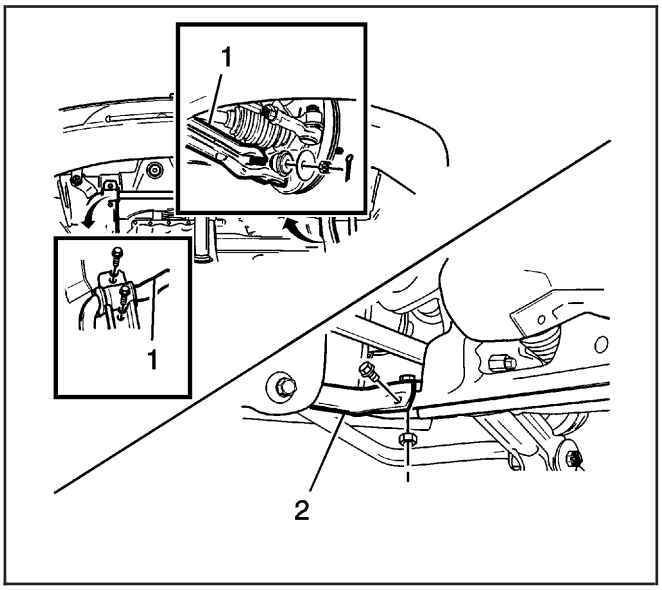

1224512

64. Remove both of the front tires. Refer to *Tire and Wheel Removal and Installation on page 3-3*.
65. Remove the control arm stud bolt (1).
66. Tie rod end castellated nut (2).
67. Remove both of the front wheels. Refer to *Control Arm Replacement on page 3-13*.

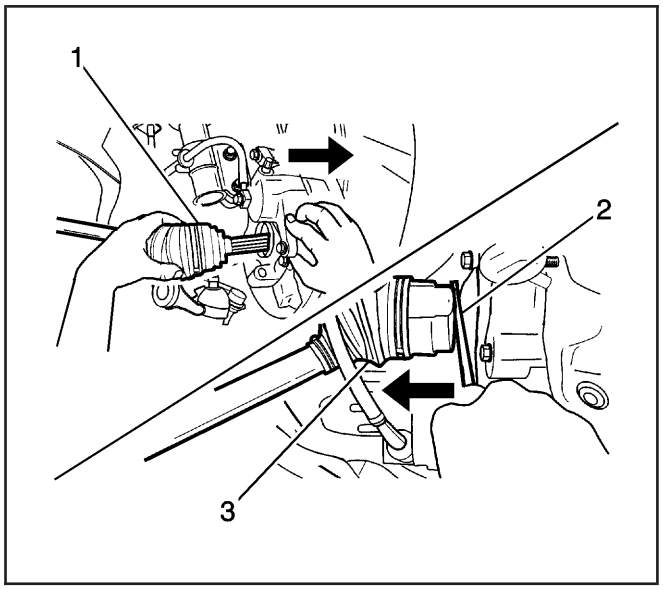



1224513

68. Remove the left/right front longitudinal member (2) and stabilizer bar (1). Refer to *Stabilizer Shaft Replacement on page 3-8*.



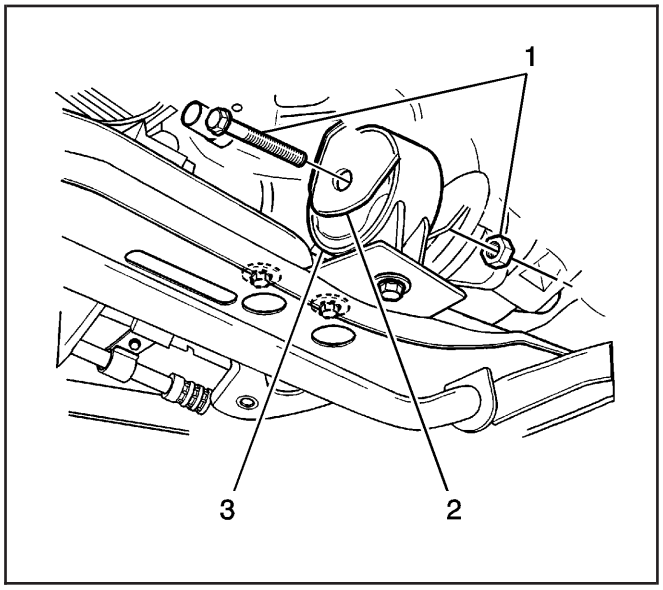

1224514




1224517

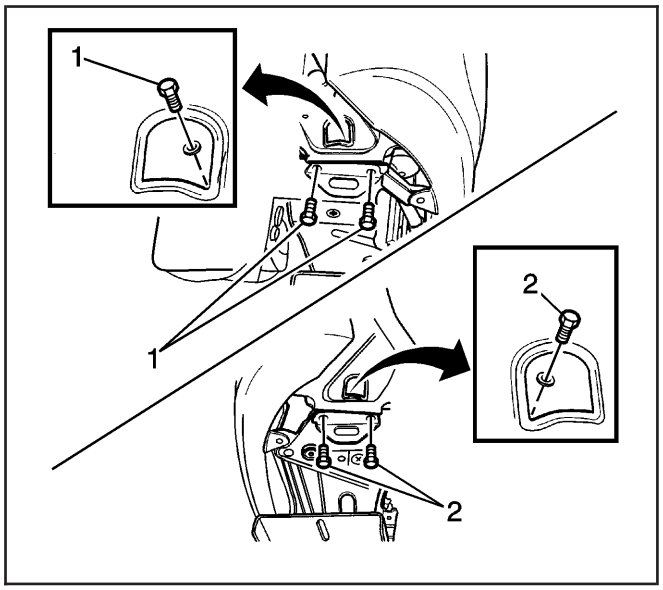
***Notice:*** SIO-ID = 1307894 LMD = 22-apr-2003 When removing the drive axle, use extreme care not to nick or cut the drive axle oil seal.

69. Loosen the caulking nut.
70. Remove the drive axle on the wheel side (1).
71. Insert a driver between the transaxle case and the drive axle joint case (2).
72. Remove the drive axle on the differential side as shown (3). Refer to *Diagnostic Starting Point - Front Drive Axle on page 4-3*.




1224520

73. Remove the damping bush assembly bolt and nut (1).
74. Remove the engine mount front bracket and the damping bush assembly (2, 3).

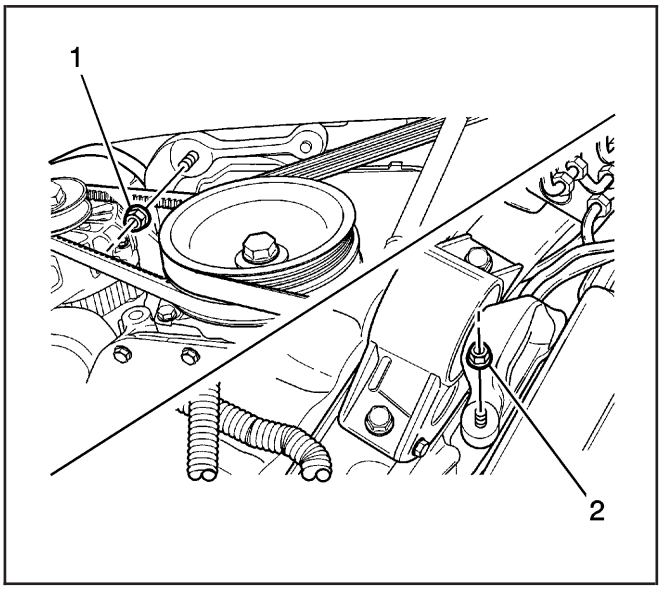



1223106

75. Remove the right and left crossmember (1, 2). Refer to *Crossmember Replacement - Front Suspension on page 3-6*.
76. Remove the left crossmember (2).

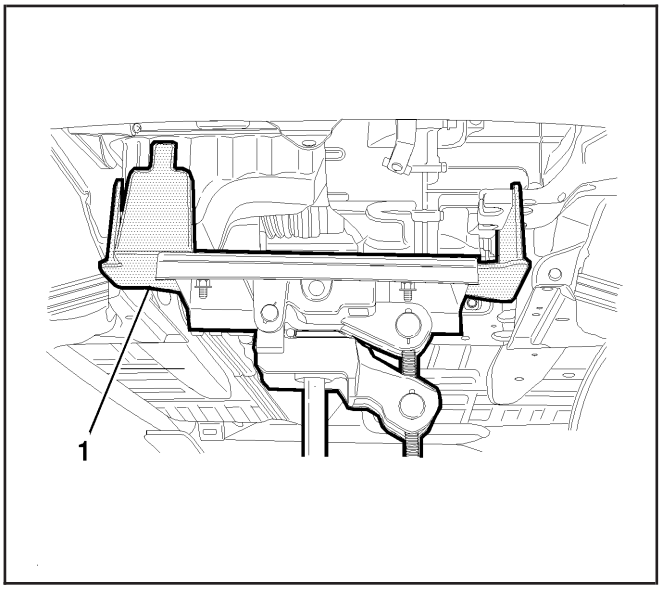
**Important:** Before loosening the engine mount intermediate bracket nut, the oil pan should be supported by the *J 39580*.

77. Loosen the engine mount intermediate bracket nut (2).
78. Loosen the engine mount intermediate bracket nut (1).



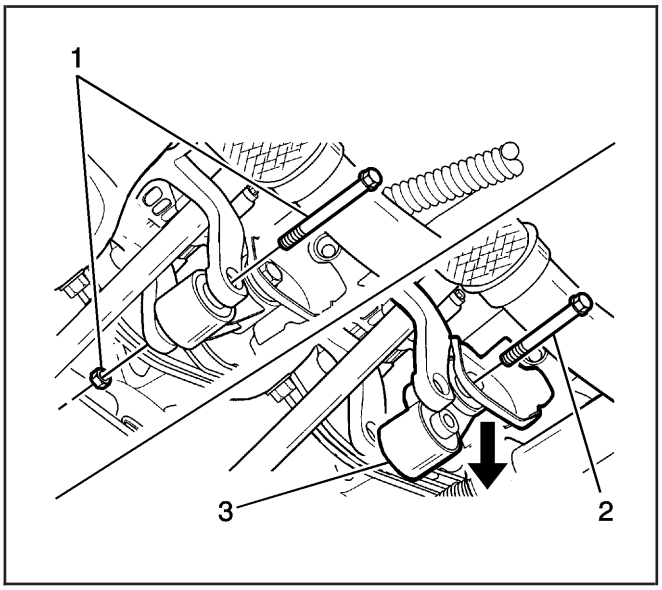

1223107

79. Support the oil pan with *J 39580* (1).

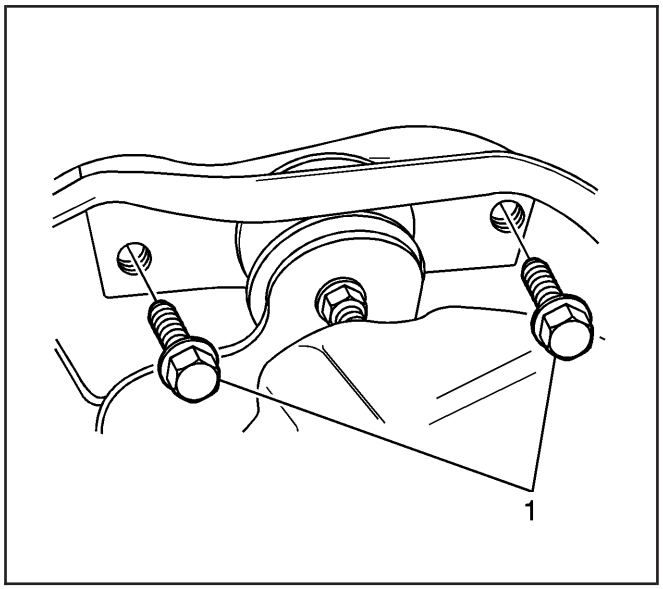



1203549

80. Loosen the bolt and nut from the engine mount lower bracket (1).
81. Loosen the bolt from the body bracket (2).
82. Remove the engine mount reaction rod (3).

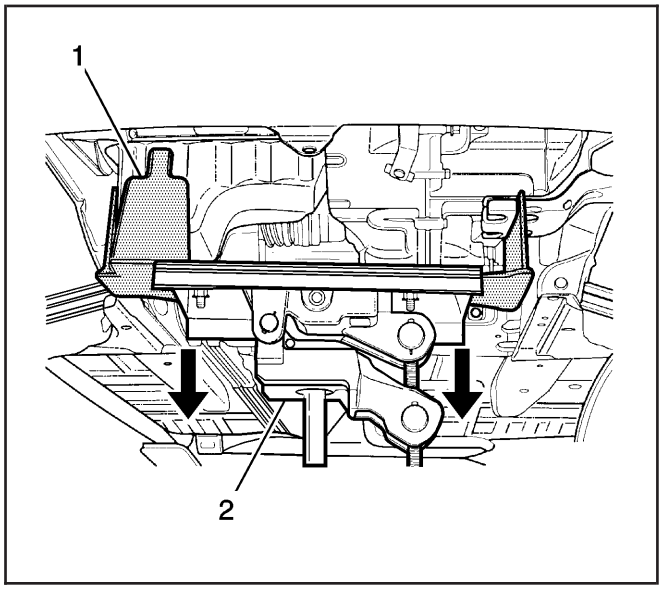



1223082



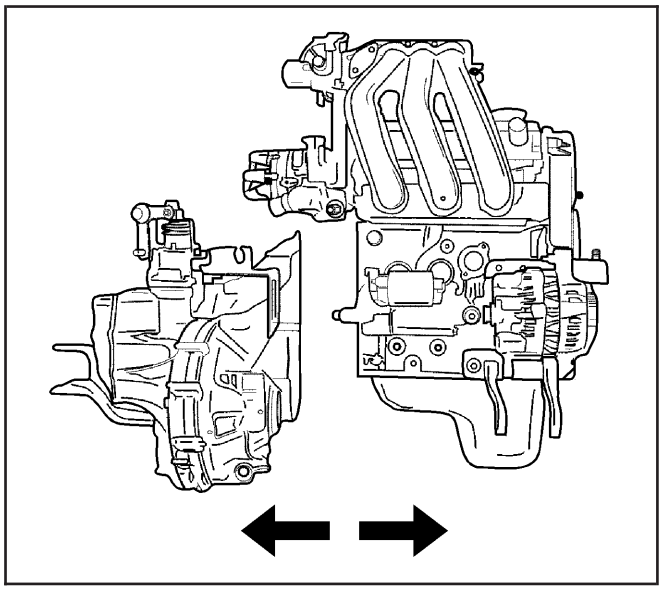

1240582

83. Loosen the transaxle mount bolts (1) and remove the mount.




1223108

84. Remove the engine/transaxle assembly by slowly lowering the special tool (1).



1223109

85. Remove the transaxle from the engine/transaxle assembly. Refer to *Transmission Replacement on page 7-23* for the Y4M transmission.
86. Remove some parts to be equipped with the engine assembly. Refer to *Crankshaft Replacement on page 6-61*.

## Installation Procedure

1. Install parts removed from the engine assembly. Refer to *Crankshaft Replacement on page 6-61*.
2. Connect the transaxle assembly to the engine assembly. Refer to *Transmission Replacement on page 7-23* for the Y4M transmission.

***Notice:*** Refer to *Fastener Notice on page P-7*.

3. Install the transaxle mount bolts (1).

   **Tighten**

   Tighten the transaxle mount bolt to 45–55 N·m (33–41 lb ft).

4. Install the engine mount reaction rod bolt on the body bracket side (3).

   **Tighten**

   Tighten the reaction rod bolt on the body bracket side to 68–83 N·m (50–61 lb ft).

5. Install the engine mount reaction rod bolt/nut on the lower bracket side (2).

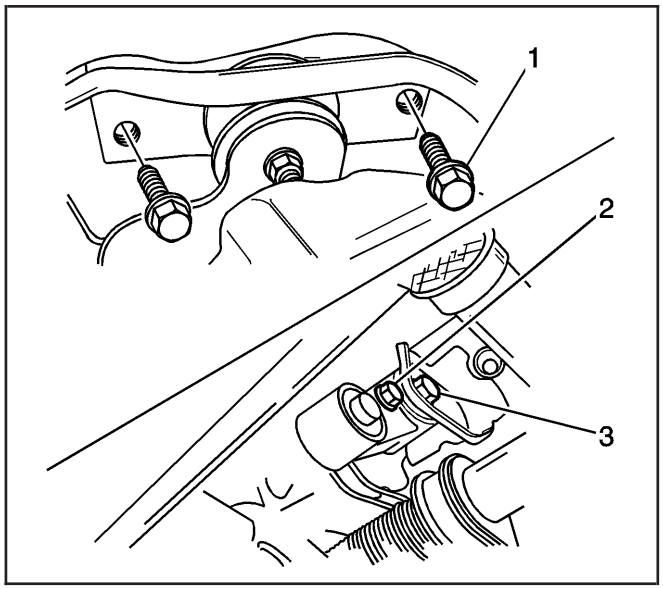
   **Tighten**

   Tighten the reaction rod/bolt nut on the lower bracket side to 68–83 N·m (50–61 lb ft).

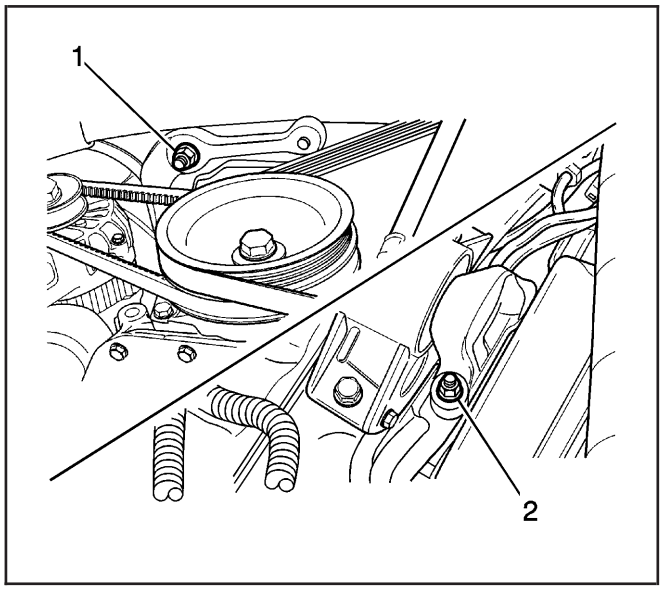
6. Install the engine mount intermediate bracket (1, 2).

   **Tighten**

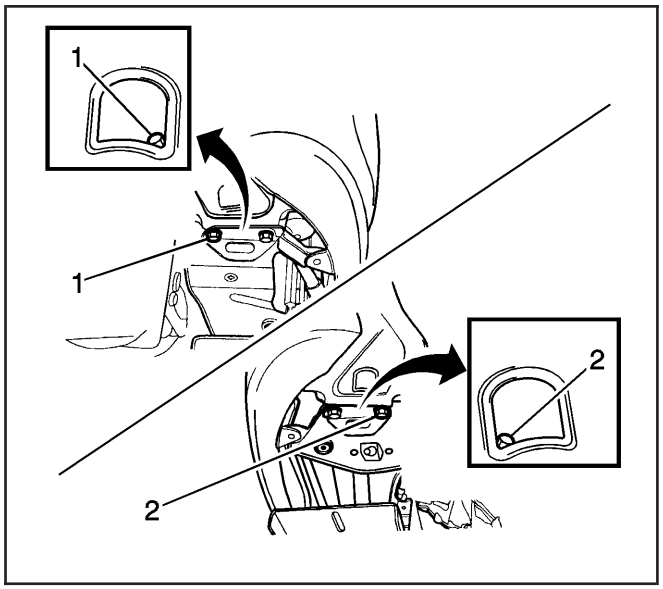
   Tighten the engine mount intermediate bracket upper/lower nut to 60–870 N·m (44–52 lb ft).




1240585




1223112

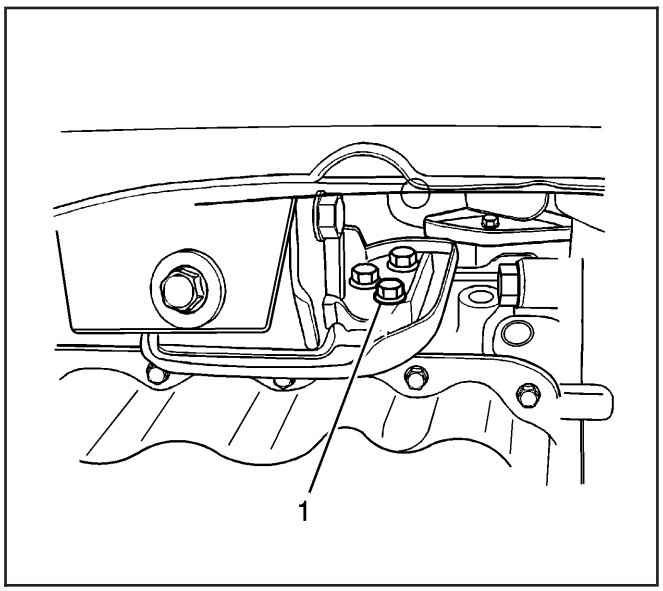



1223113

7. Install the left and right crossmember (1, 2).

   **Tighten**

   Tighten the left/right crossmember rear side bolts to 17–27 N·m (13–20 lb ft).

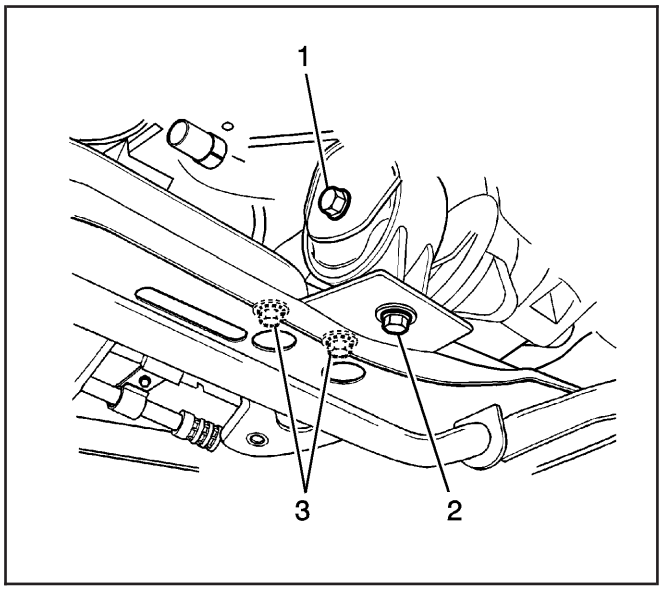



1230439

8. Install the front bracket bolts (1).

   **Tighten**

   Tighten the front bracket bolts on the cylinder block side to 35–41 N·m (25–30 lb ft).




1230441

9. Install the front damping bush bolts on the inner crossmember side (3).

   **Tighten**

   Tighten the front damping bush bolt on the inner crossmember side to 45–55 N·m (33–41 lb ft).

10. Install the damping bush bolts on the outer crossmember side (2).

    **Tighten**

    Tighten the front damping bush bolt on the outer crossmember side to 35–41 N·m (25–30 lb ft).

11. Install the front damping bush bolt and nut on the bracket side (1).

    **Tighten**

    Tighten the front damping bush bolt and nut on the bracket side to 68–83 N·m (50–61 lb ft).

12. Install the stabilizer bar (2).

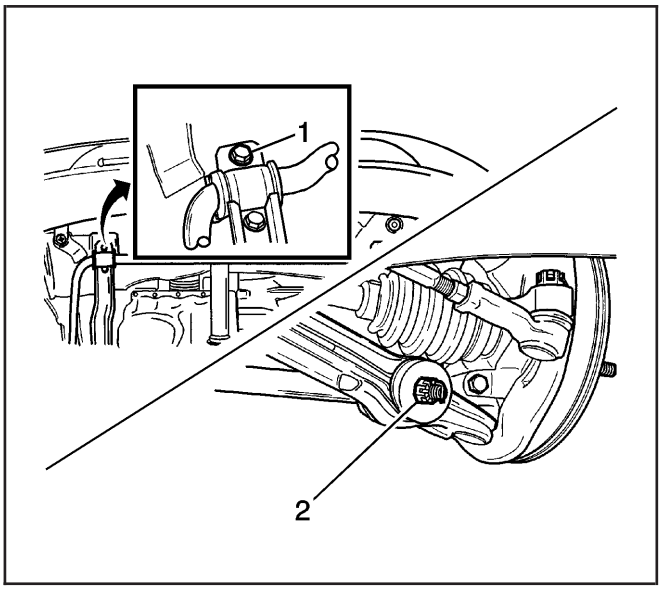
    **Tighten**

    Tighten the stabilizer bar castellated nut to 40–50 N·m (30–36 lb ft).

13. Install the stabilizer bar mounting bolt (1).

    **Tighten**

    Tighten the stabilizer bar mounting bar to 33–53 N·m (24–39 lb ft).

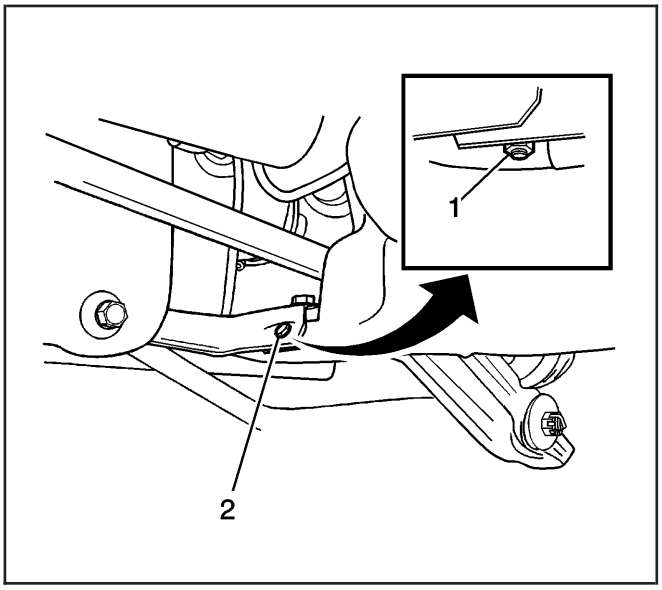



1223119

14. Install the front longitudinal member with the bolt (2) and nut (1).

    **Tighten**

    Tighten the front longitudinal member bolt to 10–14 N·m (7–10.5 lb ft).




1223120

15. Install the control arm stud and nut (2).

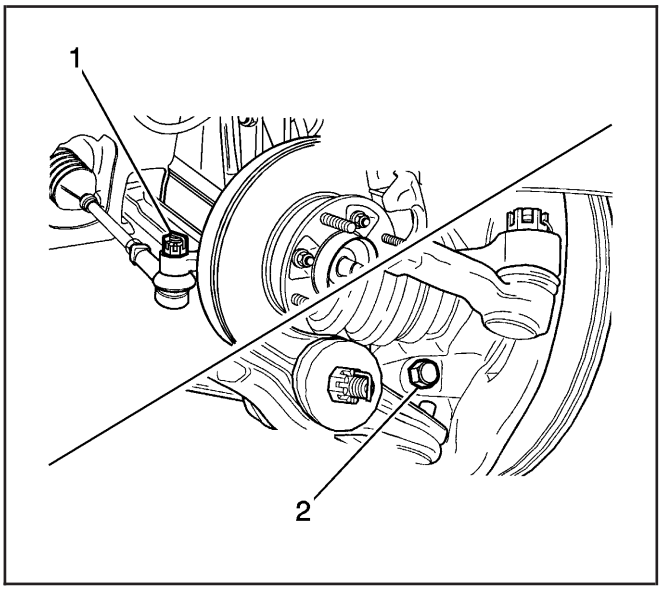
    **Tighten**

    Tighten the control arm stud nut to 50–870 N·m (36–52 lb ft).

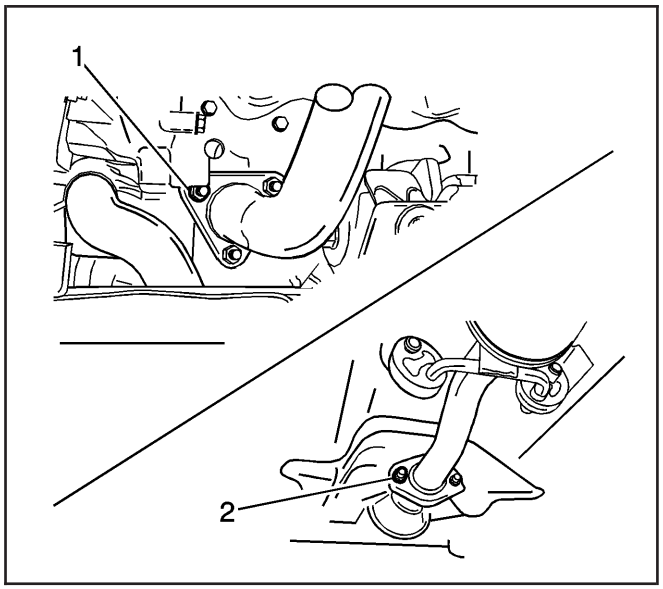
16. Install the tie rod end (1).

    **Tighten**

    Tighten the tie rod end castellated nut to 35–55 N·m (25–41 lb ft).




1223122

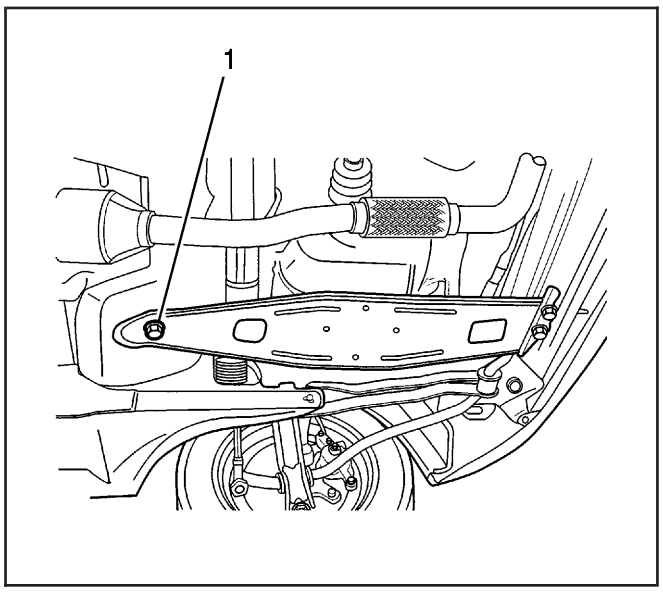



1223123

17. Install the front exhaust pipe with nuts (1, 2).

    **Tighten**

    Tighten the front exhaust pipe nuts on the muffler pipe side/exhaust manifold side to 25–35 N·m (18–25 lb ft).

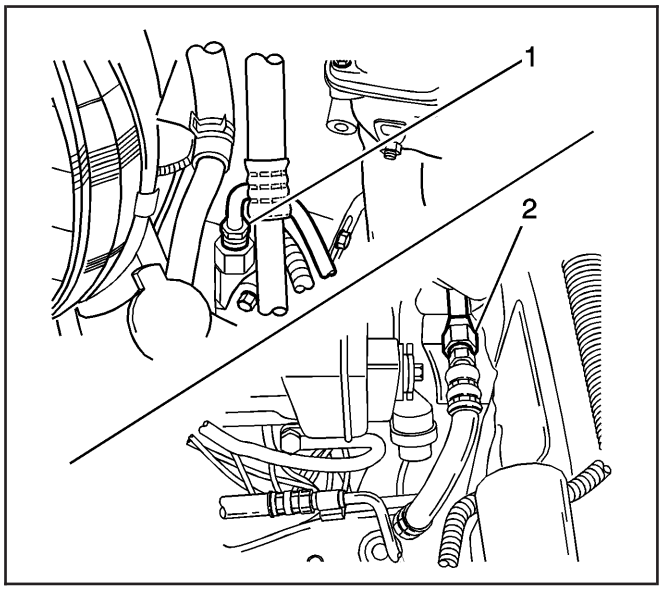



1224630

18. Install the transaxle under cover with bolts (1).

    **Tighten**

    Tighten the transaxle under cover bolts to 35–55 N·m (25–41 lb ft).




1224631

19. Install the power steering pump pressure pipe with nut (2) and fitting (1).

    **Tighten**

    - Tighten the power steering pump pressure pipe nut to 36–50 N·m (26–36 lb ft).
    - Tighten the power steering pump pressure pipe fitting to 21–35 N·m (15–25 lb ft).

20. Install air conditioning low/high pressure pipe (1).

    **Tighten**

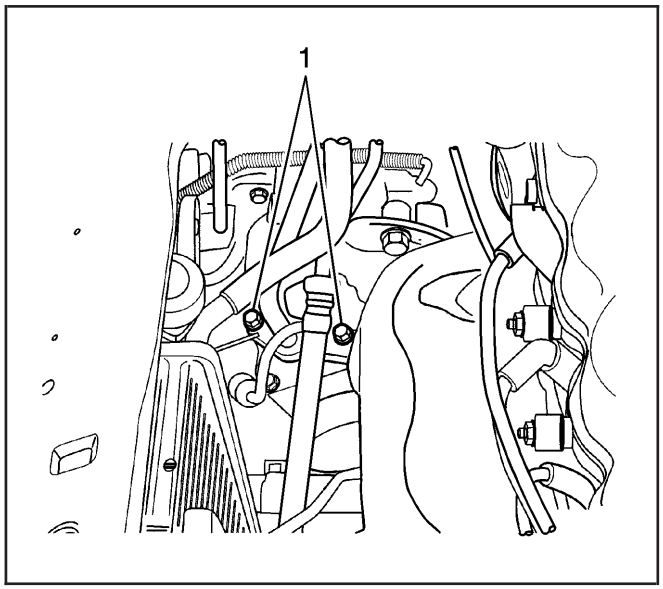
    Tighten the air conditioning low/high pressure pipe bolts to 23 N·m (17 lb ft).
21. Install the radiator (1).

    **Tighten**

    Tighten the radiator bolt to 4–5 N·m (35–44 lb in).
22. Install the cooling fan.

    **Tighten**

    Tighten the cooling fan bolt to 4–5 N·m (35–44 lb in).

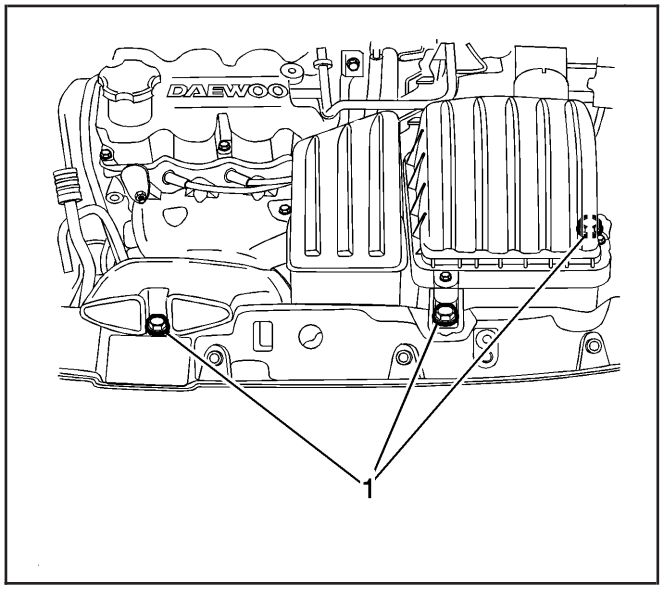



1224632

23. Install the snorkel with bolts (1).

    **Tighten**

    Tighten the snorkel bolt to 7–9 N·m (62–80 lb ft).
24. Check the air conditioning low/high pressure pipe O-ring seal, select/shift cable pin/washer/E-ring, the tie end joint castellated nut cotter pin, and the stabilizer castellated nut cotter pin for loss.
25. Refill transaxle oil, power steering oil, and coolant after finishing all installation procedures.
26. Check if the fuel inlet hose is connected with the fuel correctly.
27. Connect the negative battery cable.
28. Reset the engine control module (ECM). Refer to *Engine Control Module (ECM) Replacement on page 6-105* for the 1.0L engine.
29. Start the engine and check the engine for the normal operation.
30. Recharge the air conditioning gas and check the oil coolant level.
31. Check the vacuum hose, the coolant hose, the exhaust pipe, the air conditioning/power steering pipe and hose for leakage. Check if the electrical connectors are connected correctly.




1202810

# Engine Oil and Oil Filter Replacement

*SIE-ID = 1645617 Owner = dcobb01 LMD = 11-apr-2005 LMB = dcobb01*

## Removal Procedure

1. Raise and properly support the vehicle. Refer to *Lifting and Jacking the Vehicle on page 0-9* in General Information.
2. Position an appropriate drain pan under the engine.
3. Remove the oil pan drain plug bolt.
4. Remove the oil filter.

## Installation Procedure

***Notice:*** Refer to *Fastener Notice on page P-7*.

1. Install the oil filter.

   **Tighten**

   Tighten the oil filter to 12–16 N·m (106–140 lb in).
2. Discard the used oil pan drain plug washer and replace with a new oil pan drain plug washer.
3. Install the oil pan drain plug bolt.

   **Tighten**

   Tighten the oil pan drain plug bolt to 30–40 N·m (22–30 lb ft).
4. Lower the vehicle.
5. Fill the engine with oil to the appropriate mark.
6. Start engine and inspect for leaks.

# Crankshaft Replacement

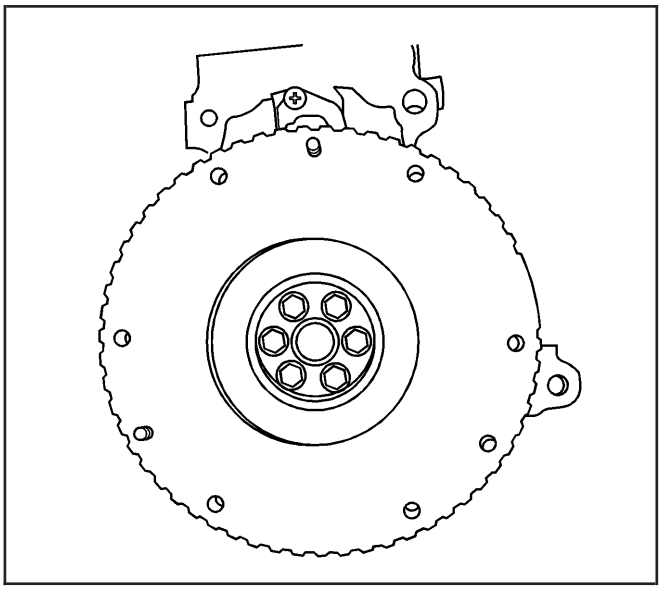
*SIE-ID = 1292074 Owner = prober01 LMD = 09-sep-2003 LMB = pbiele01*

### Tools Required

*OTC 1726* (KM-412) Engine Overhaul Stand

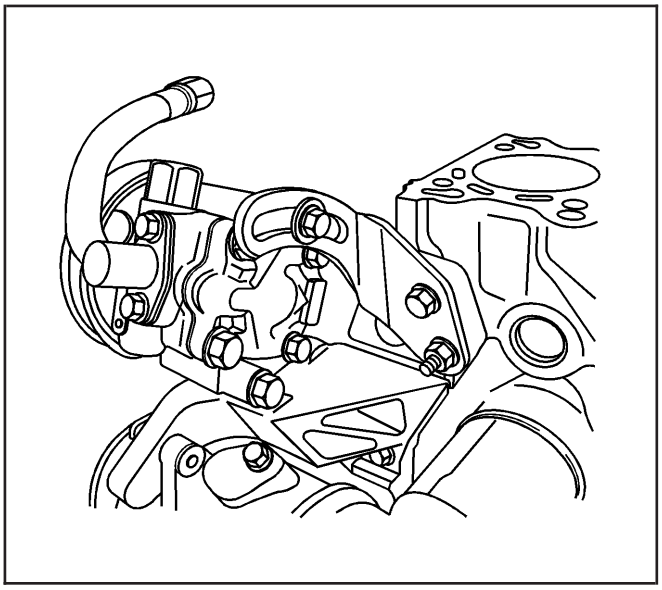
## Disassembly Procedure

1. Remove the engine. Refer to *Engine Replacement on page 6-45*.
2. Remove the transaxle from the engine. Refer to *Transmission Replacement on page 7-23* in Manual Transmission.
3. Remove the flywheel bolts.
4. Remove the flywheel.
5. Mount the engine assembly on the *OTC 1726*.



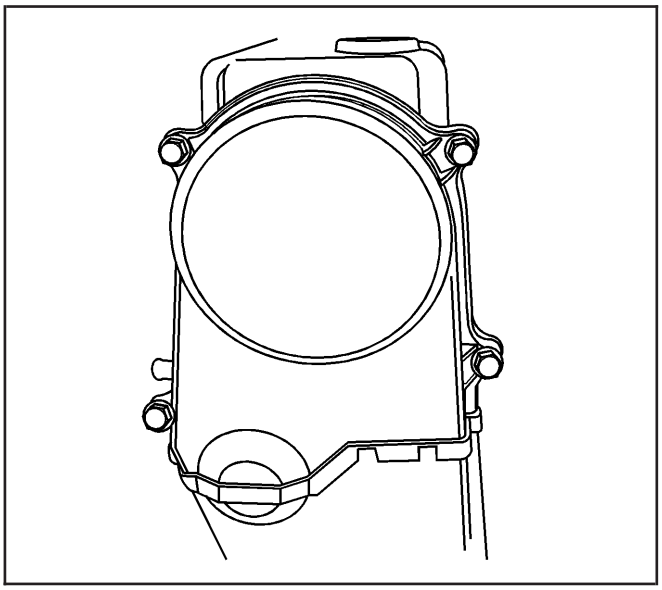
1240785

6. Remove the cylinder head. Refer to *Cylinder Head Replacement on page 6-32*.
7. Drain the engine oil from the engine.
8. Remove the power steering adjusting bolts.
9. Remove the power steering/air conditioning (A/C) belt.

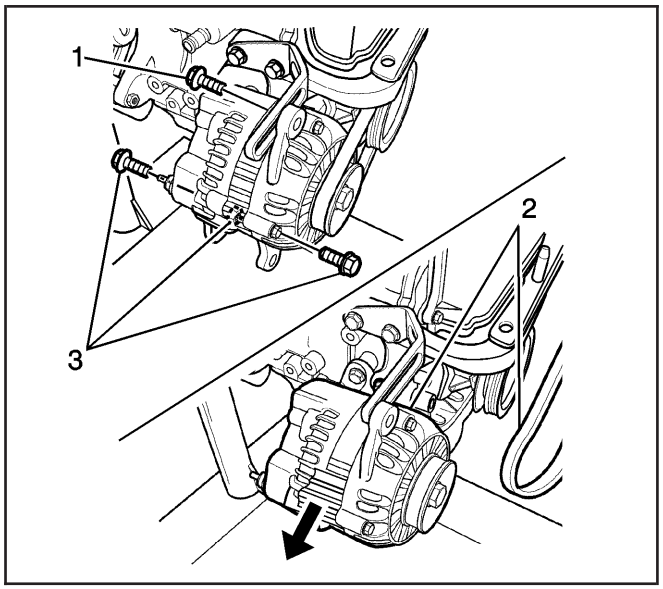


1240787

10. Turn the A/C compressor downward.
11. Remove the A/C compressor/power steering bracket bolts.
12. Remove the A/C compressor/power steering bracket.

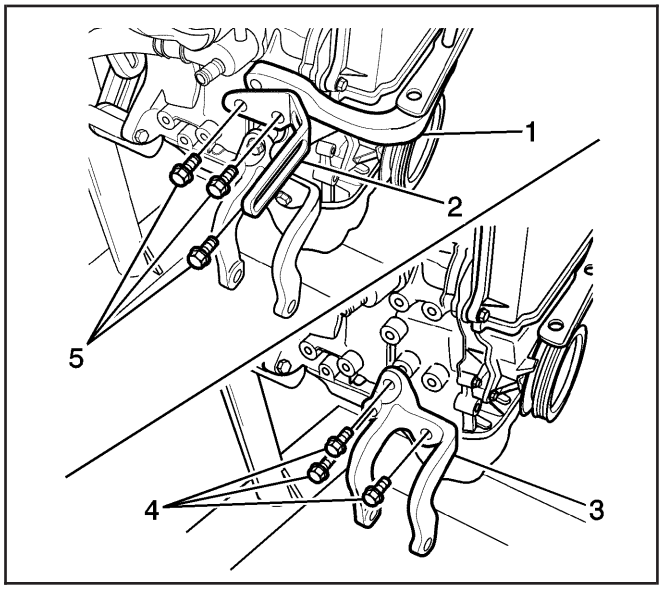


1240789



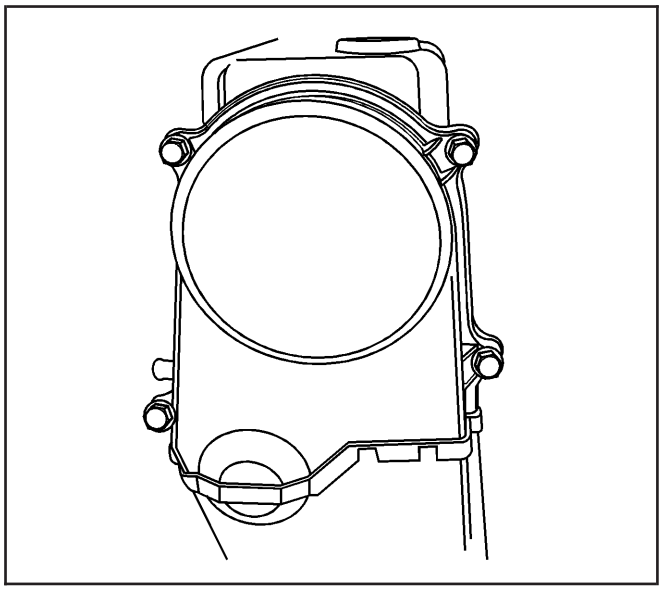

1230300

13. Loosen the generator bolt (1).
14. Loosen the generator lower bolts and the nut (3).
15. Remove the generator and belt (2).




1230302

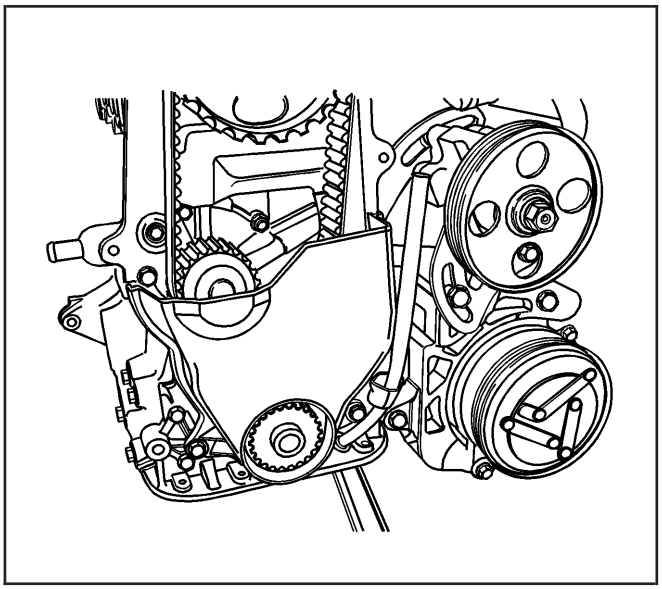
16. Loosen the engine mount upper bracket bolts (5).
17. Remove the generator shackle (2).
18. Remove the upper bracket (1).
19. Loosen the engine mount lower bracket bolts (4).
20. Remove the lower bracket (3).



1240789

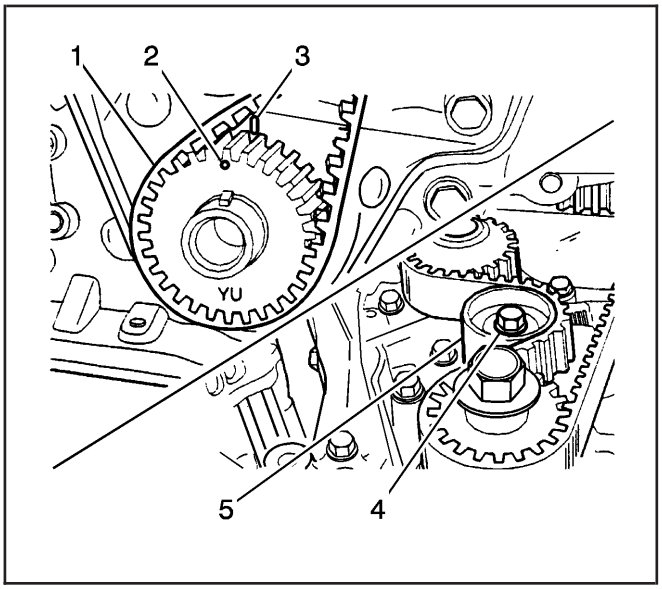
21. Remove the upper timing belt cover bolts.
22. Remove the upper timing belt cover.

23. Remove the lower timing belt cover bolts.
24. Remove the lower timing belt cover.



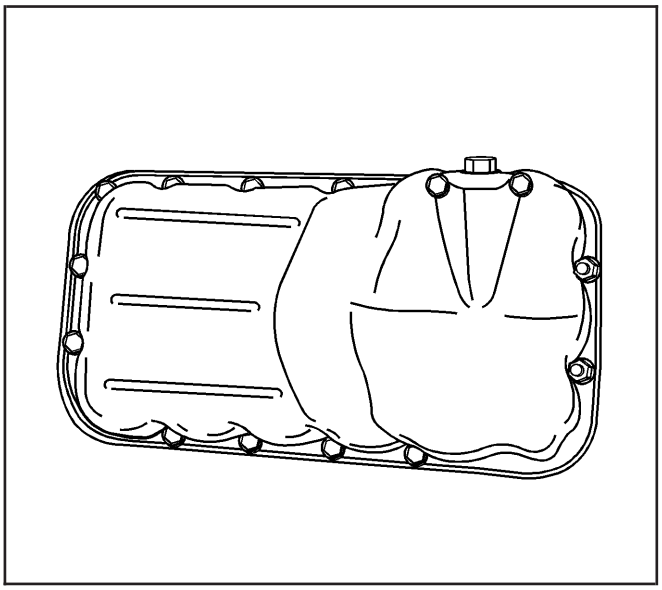
1240792

25. Loosen the timing belt automatic tensioner (3) bolt.
26. Remove the automatic tensioner from the timing belt (1).
27. Remove the timing belt.

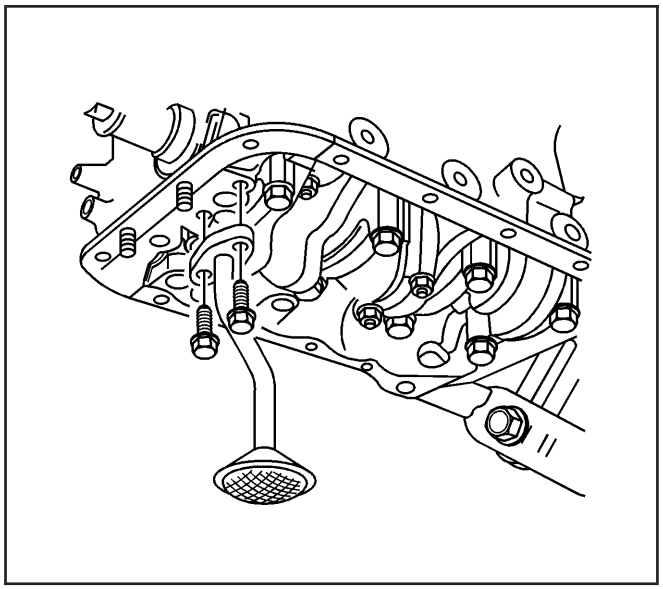



1240793

28. Rotate the engine on the *OTC 1726*.
29. Remove the oil pan retaining bolts and the nuts.
30. Remove the oil pan.

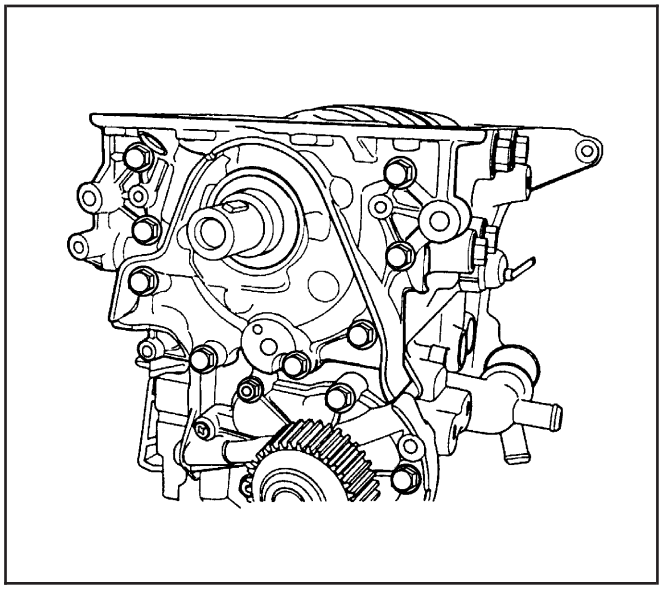


1240794



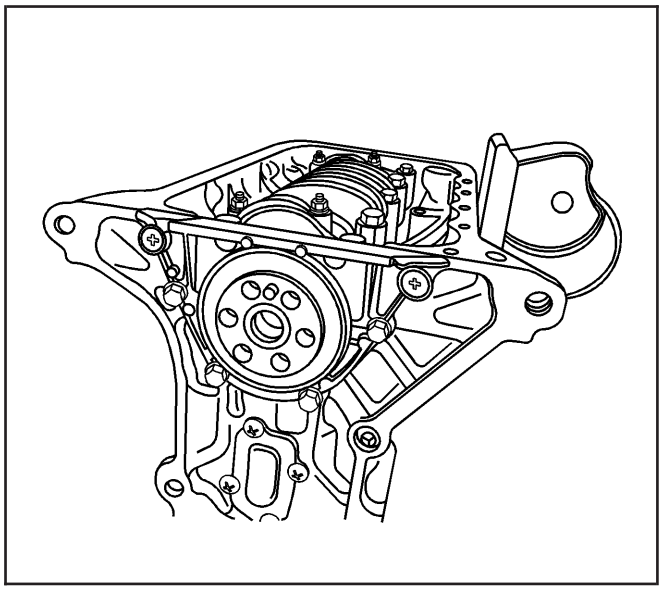
1240795

31. Remove the oil pan pickup tube bolts.
32. Remove the oil pan pickup tube.



1240796

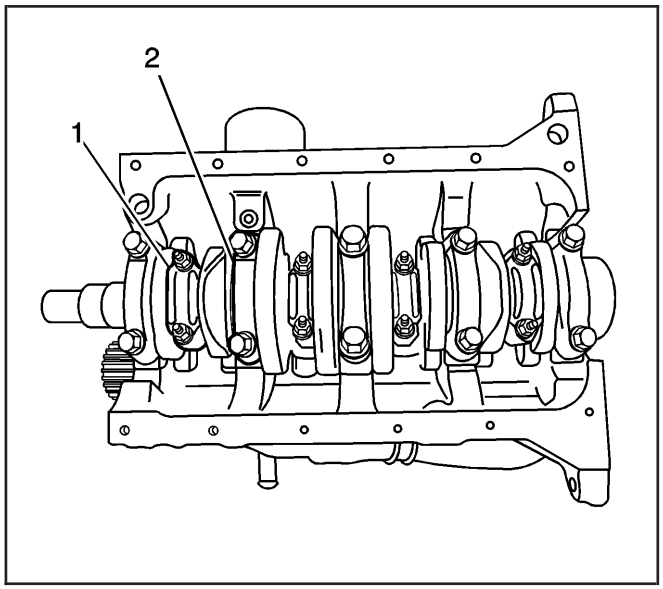
33. Remove the oil pump retaining bolts.
34. Remove the oil pump.



1240798

35. Remove the crankshaft rear oil seal housing screws and bolts.
36. Remove the gasket and the oil seal housing.

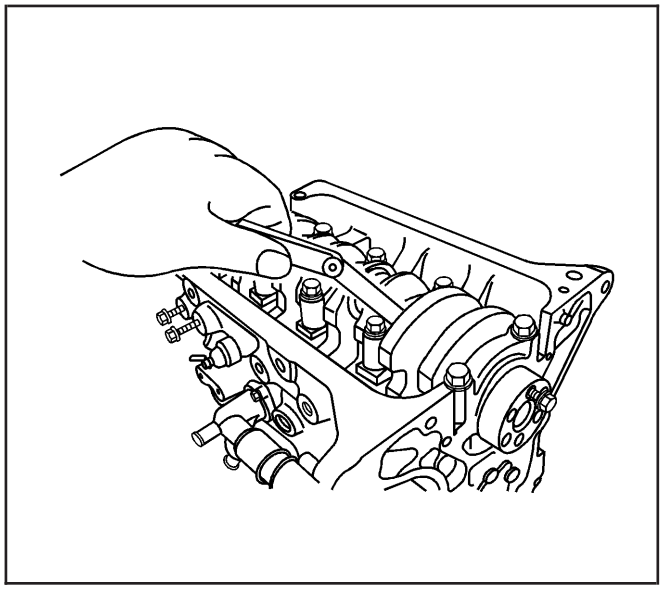
37. Mark the order of the rod bearing caps.
38. Remove the connecting rod cap nuts (1) for all of the pistons.
39. Remove the connecting rod bearing caps and the lower connecting rod bearing.
40. Remove the upper connecting rod bearing.
41. Mark the order of the crankshaft bearing caps.
42. Remove the crankshaft bearing cap bolts (2).
43. Remove the crankshaft bearing cap.
44. Remove the crankshaft bearings from the crankshaft bearing caps.
45. Remove the crankshaft.
46. Remove the crankshaft bearings from the engine block.
47. Clean the parts, as necessary.



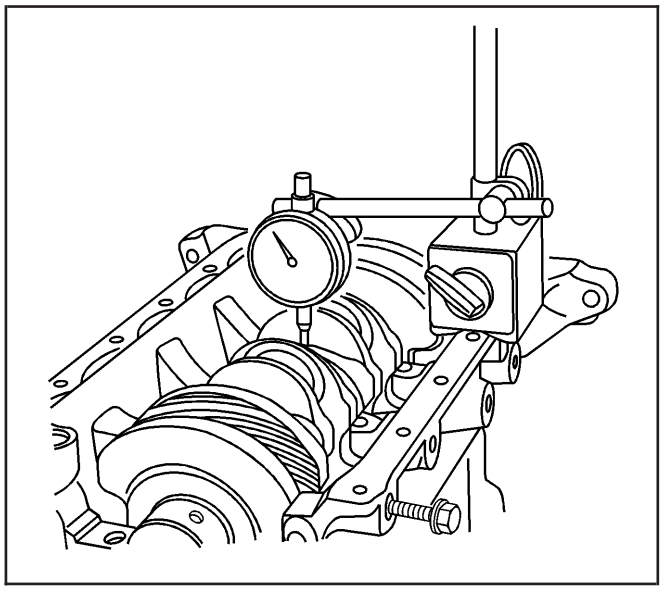
1240799

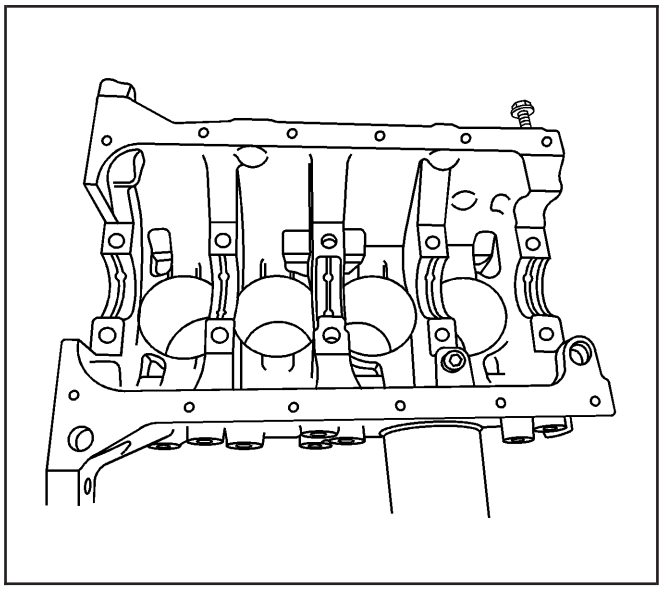
## Assembly Procedure

1. With the crankshaft and the bearings in place, plastic gage all bearing clearances. Refer to *Piston, Connecting Rod, and Bearings Cleaning and Inspection on page 6-68*.
2. Inspect the crankshaft end play with the crankshaft bearings installed.
3. Check the permissible crankshaft end play. Refer to *Engine Mechanical Specifications on page 6-2*.


1240800

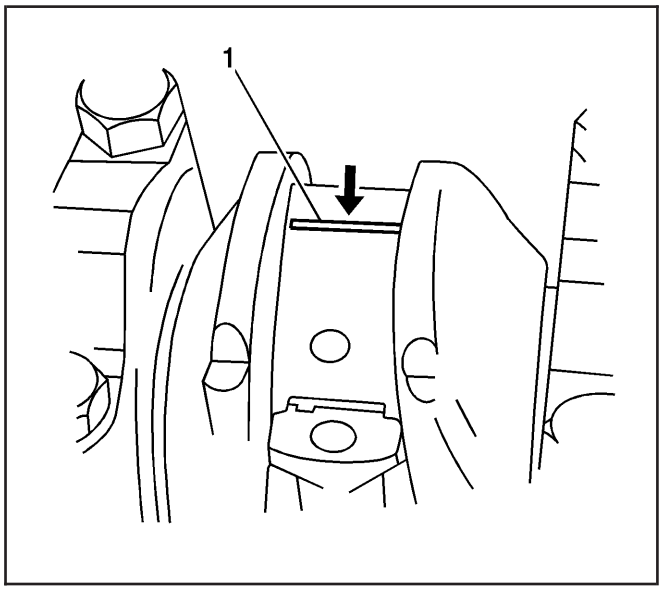
4. With the crankshaft mounted on the front and the rear crankshaft bearings, inspect the middle crankshaft journal for permissible out-of-round, runout. Refer to *Engine Mechanical Specifications on page 6-2*.


1240801



1240813

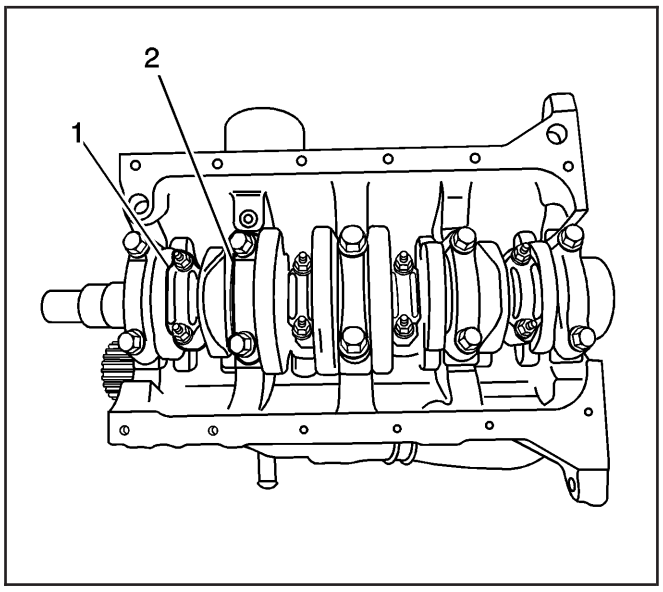
5. Coat the crankshaft bearings with engine oil.
6. Apply a bead of adhesive sealing compound to the grooves of the rear crankshaft bearing cap.
7. Install the crankshaft bearings in the engine block.
8. Install the crankshaft.




1241455

**Important:** Grease the crankshaft journals and lubricate the crankshaft bearings slightly so that the plastic gaging thread does not tear when the crankshaft bearings are removed.

9. Inspect all of the crankshaft bearing clearances using a commercially available plastic gaging—ductile plastic threads.
10. Cut the plastic gaging threads to the length of the bearing width. Lay them between the crankshaft journals and the crankshaft bearings.




1240799

***Notice:*** SIO-ID = 1307849 LMD = 22-apr-2003 Do not reuse crankshaft bearing cap bolts. Failure to replace the crankshaft bearing cap bolts can lead to crankshaft bearing cap bolt breakage or crankshaft bearing failure. A broken crankshaft bearing bolt can lead to extensive engine damage.

11. Install the crankshaft bearings to the crankshaft bearing caps.

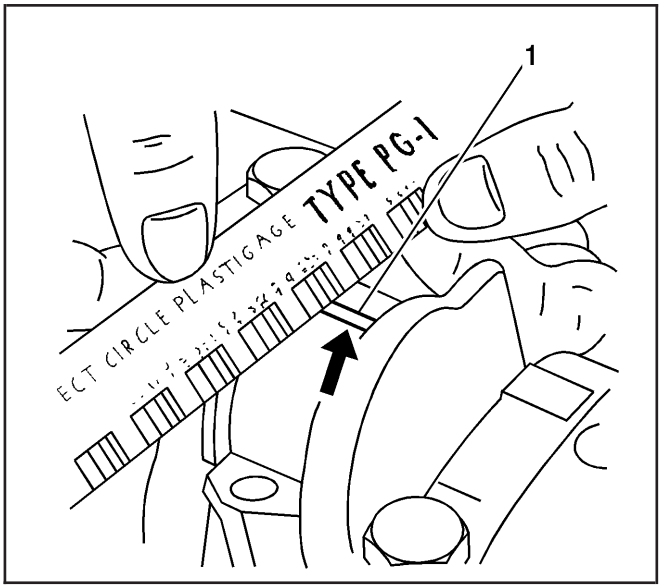
***Notice:*** Refer to *Fastener Notice on page P-7* in Cautions and Notices.

12. Install the crankshaft bearing caps bolts (2).

    **Tighten**

    Tighten the crankshaft bearing cap bolts to 57 N·m (42 lb ft).

13. Remove the crankshaft bearing caps.
14. Using a ruler, measure the width of the flattened plastic thread of the plastic gaging. Plastic gaging is available for different tolerance ranges.
15. Inspect the bearing clearances for permissible tolerance ranges. Refer to *Engine Mechanical Specifications on page 6-2*.



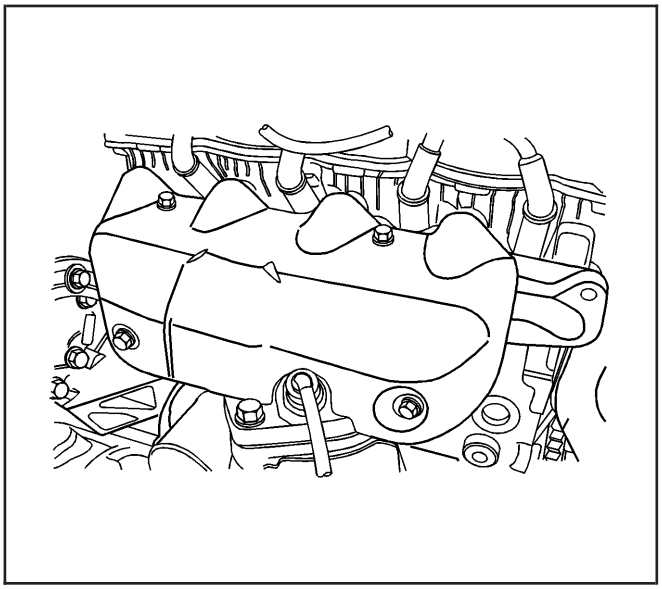

1241457

## Exhaust Manifold Removal

*SIE-ID = 1277349 Owner = prober01 LMD = 16-may-2003 LMB = kwalla01*

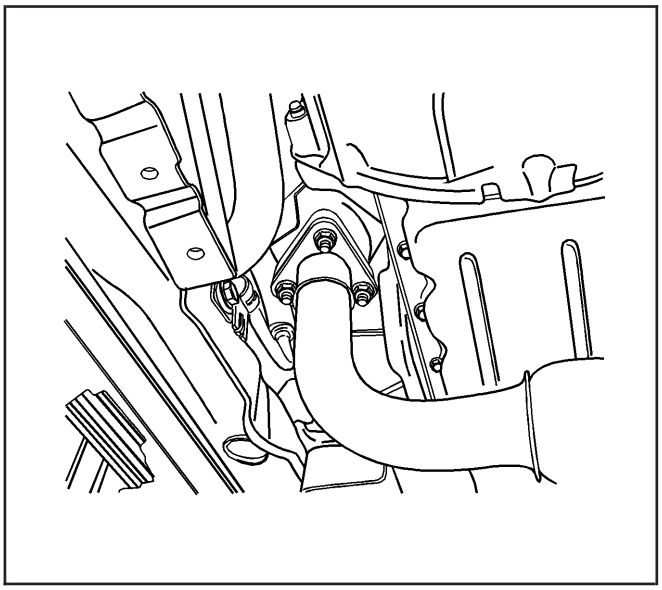
***Caution: Refer to Exhaust Service Caution on page P-3 in Cautions and Notices.***

1. Remove the air filter resonator, and snorkel assembly. Refer to *Air Cleaner Assembly Replacement on page 6-139* in Engine Controls–1.0L.
2. Disconnect the ignition wire and oxygen sensor (O2S) connector.
3. Remove exhaust manifold heat shield.

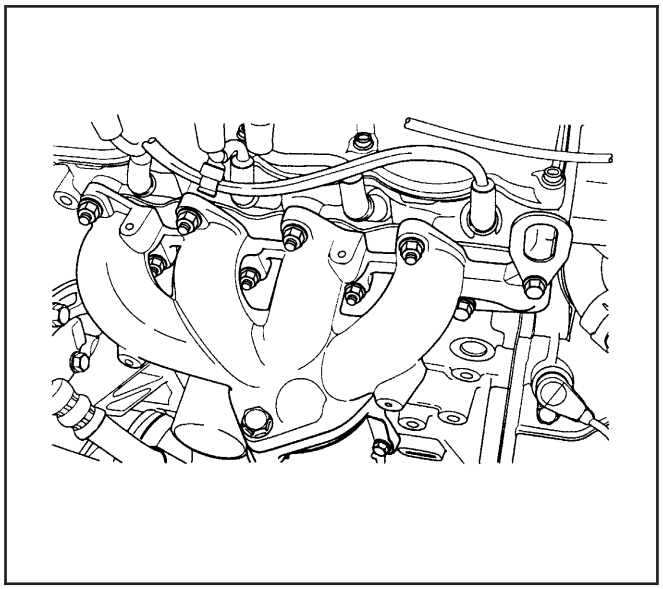


1240389

4. Remove the exhaust pipe from the pup–up catalytic converter.

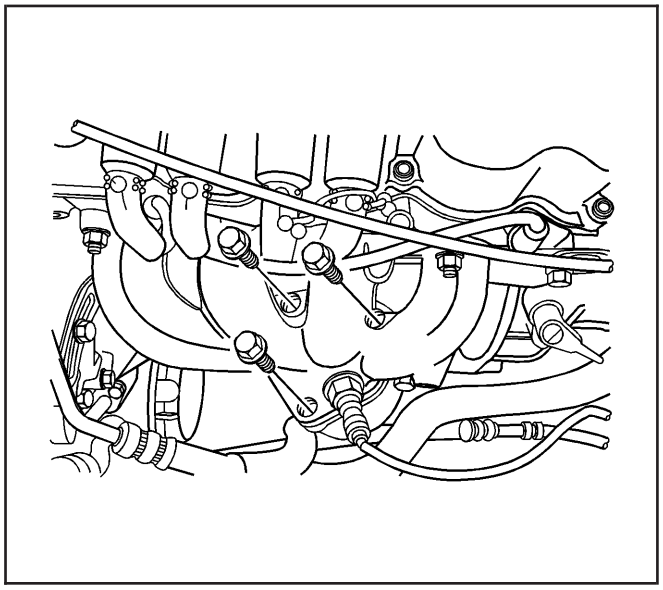


1240405



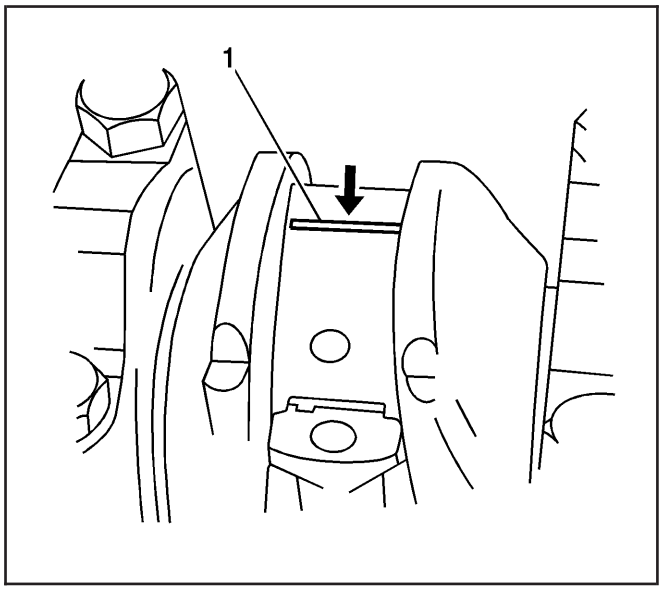
1240422

5. Remove the exhaust manifold with pup–up catalytic converter.



1240438

6. Remove the exhaust manifold from pup-up catalytic converter.




1241455

## Piston, Connecting Rod, and Bearings Cleaning and Inspection

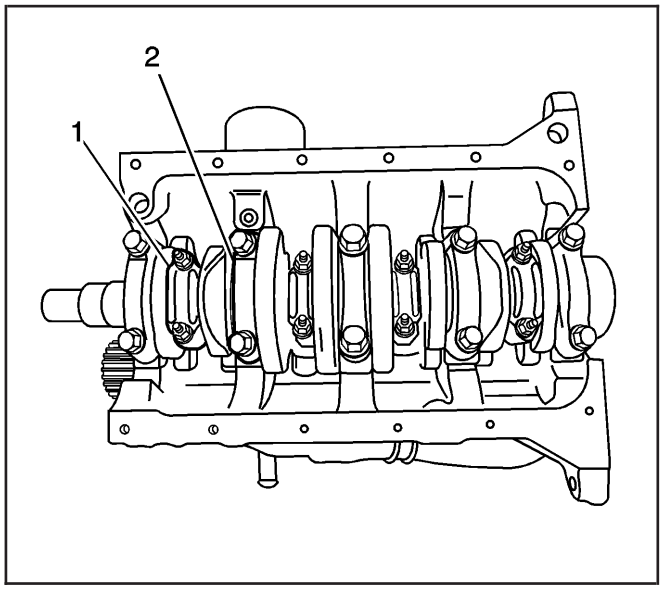
*SIE-ID = 1292077 Owner = prober01 LMD = 07-may-2003 LMB = dostre01*

### Connecting Rods Inspection

**Important:** Grease the connecting rod journals and lubricate the connecting rod bearings slightly so that the plastic gaging thread does not tear when the connecting rod bearing caps are removed.

1. Coat the connecting rod bearings with engine oil.
2. Install the upper connecting rod bearings into the connecting rod journals.
3. Install the lower connecting rod bearings into the connecting rod bearing caps.

4. Inspect all of the connecting rod bearing clearances using a commercially available plastic gaging, ductile plastic threads.
5. Cut the plastic gaging threads to the length of the bearing width. Lay them axially between the connecting rod journals and the connecting rod bearing.



1240799

***Notice:*** SIO-ID = 751951 LMD = 03-oct-2000 Avoid installing the bearing caps incorrectly. Cylinder head and camshaft damage may result.

6. Install the connecting rod bearing caps (1).

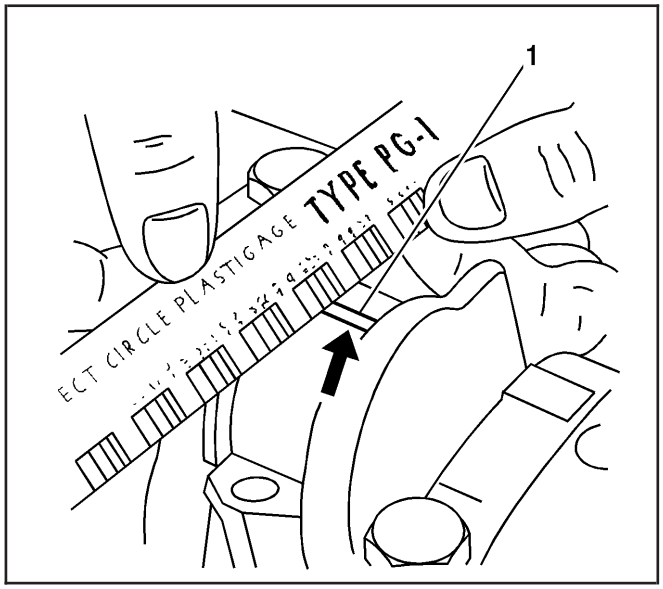
***Notice:*** Refer to *Fastener Notice on page P-7* in Cautions and Notices.

7. Install the connecting rod bearing cap nuts.

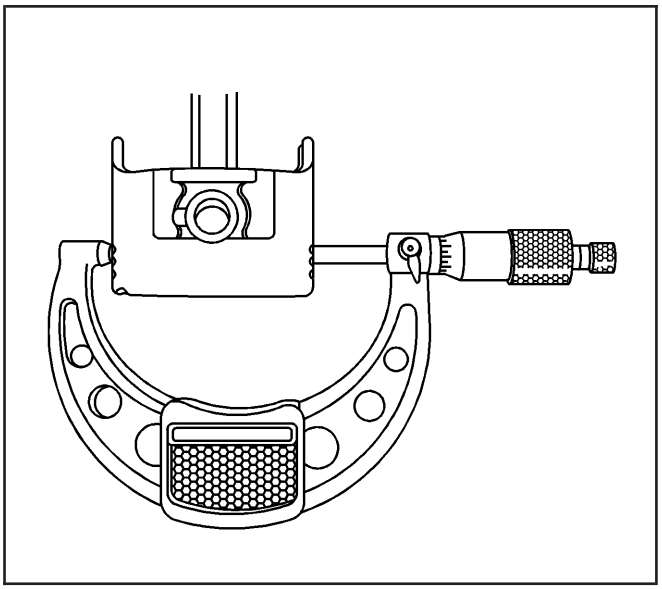
   **Tighten**

   Tighten the connecting rod bearing cap nuts to 33 N·m (24 lb ft).

8. Remove the connecting rod bearing caps.
9. Using a ruler, measure the width of the flattened plastic thread of the plastic gaging. Plastic gaging is available for different tolerance ranges.
10. Inspect the bearing clearance for permissible tolerance ranges. Refer to *Engine Mechanical Specifications on page 6-2*.



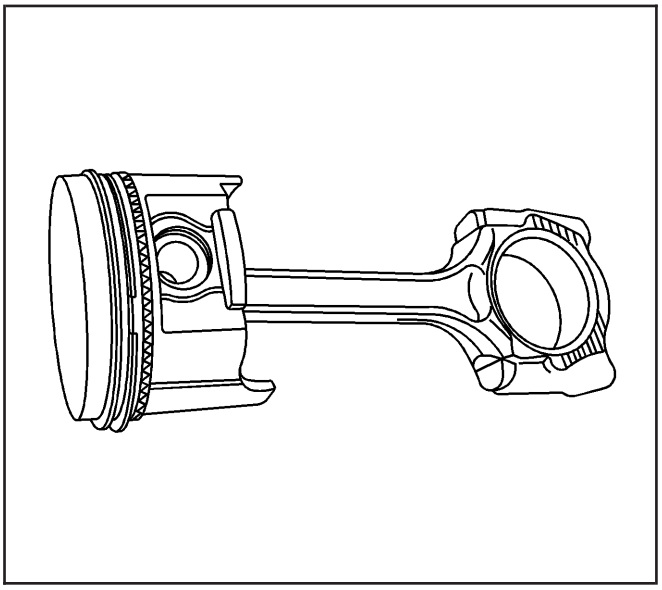
1241457



1240819

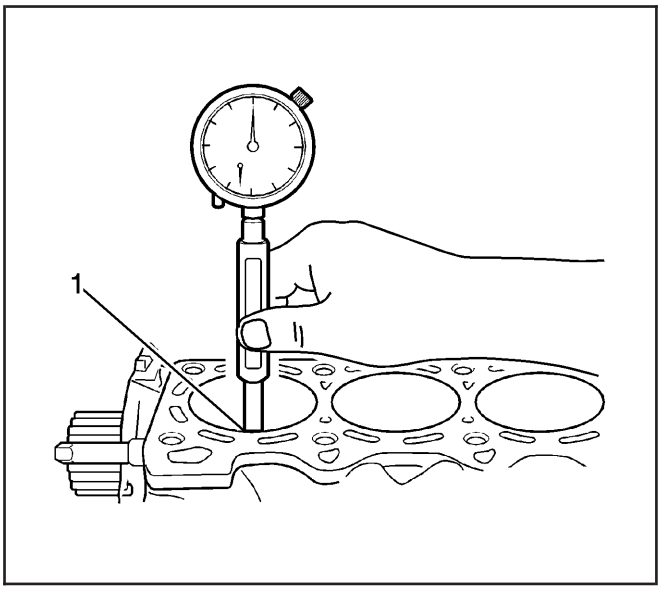
## Piston Inspection Procedure

1. Inspect the connecting rod for bending or twisting. If the connecting rod is bent or twisted, replace the connecting rod.
2. Inspect the connecting rod bearings.
3. Inspect the connecting rod lower end for wear.
4. Inspect the connecting rod upper end for scoring.
5. Inspect the piston for scoring, cracks, and wear.
6. Using a micrometer, inspect the piston for taper.



1240821

7. Inspect the fit of the piston to the connecting rod.

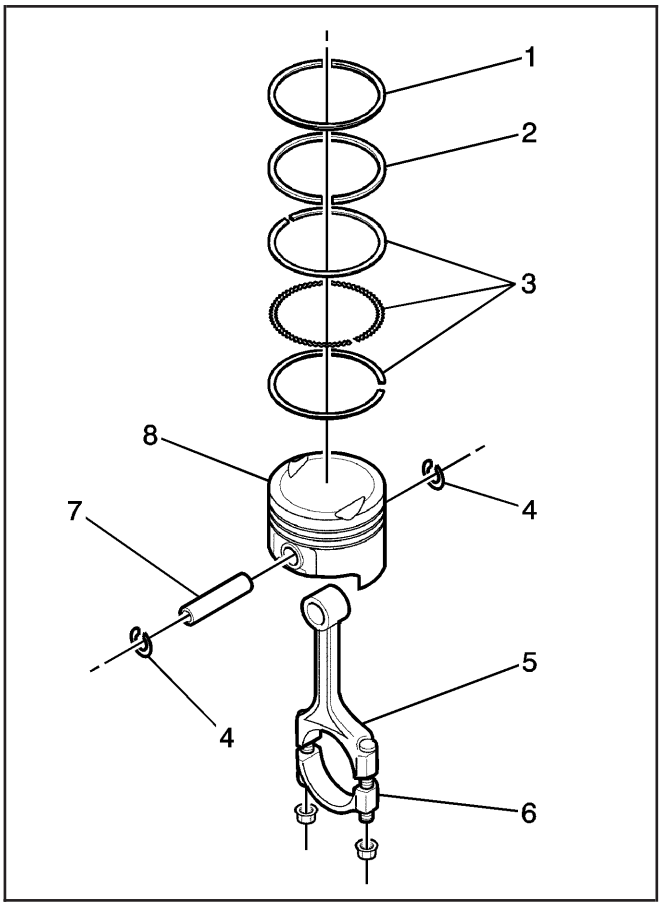



1230386

8. Inspect the engine block deck surface for flatness using a straight edge and a feeler gage. Refer to *Engine Mechanical Specifications on page 6-2*.
9. Inspect the bearing bore for concentricity and alignment using a bore gage (1). Refer to *Engine Mechanical Specifications on page 6-2*.
10. Inspect the engine block cylinder bore for wear, runout ridging and taper using a bore gage. Refer to *Engine Mechanical Specifications on page 6-2*.
11. Inspect the engine block cylinder bore for glazing. Lightly hone the cylinder bore, as necessary.

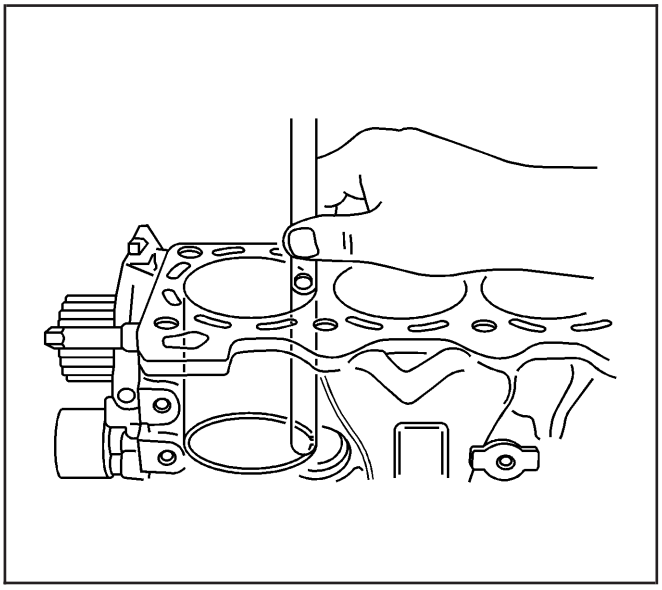
## Installation Procedure

1. Align the notch on the piston and the connecting rod so that the proper sides will be facing the front of the engine.
2. Install the piston pin guide (7) through the piston (8) and the connecting rod (5).
3. Coat the piston pin with clean oil.
4. Install the piston pin into the opposite side of the piston.
5. Install the piston pin into the piston and connecting rod assembly.

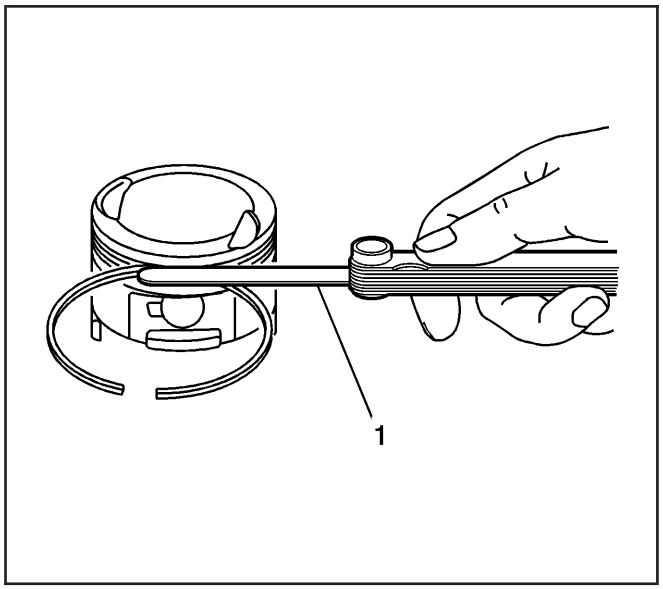



1225561

6. Select a set of new piston rings.
7. Measure the piston ring gap using a feeler gage.
8. If the piston ring gap is below specifications, increase the piston ring gap by carefully filing off excess material.

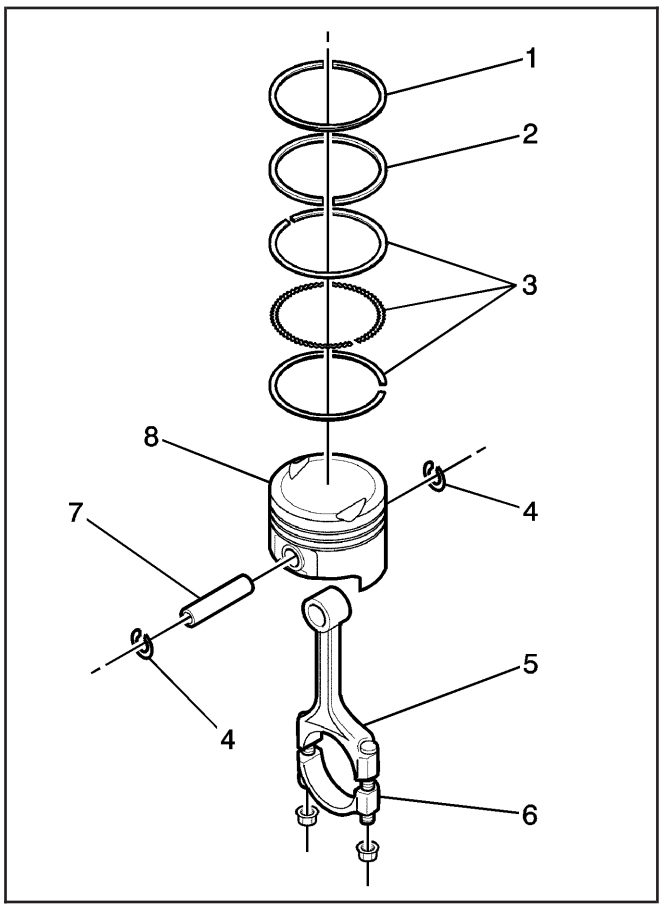


1240583




1224591

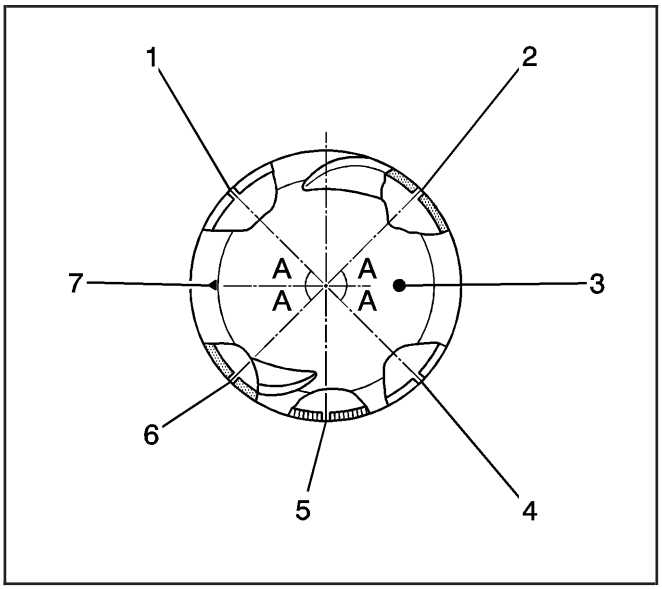
9. Measure the piston ring side clearance (1) using a feeler gage. Refer to *Engine Mechanical Specifications on page 6-2*.
10. If the piston ring is too thick, try another piston ring.
11. If no piston ring that fits to specifications can be found, the piston ring may be ground to size using emery paper placed on a sheet of glass.




1225561

12. Install a piston oil ring, the expander, and the second piston oil ring (3) to the bottom ring groove of the piston.
13. Install the second compression ring (2) to the middle ring groove of the piston.
14. Install the top compression ring (1) to the top ring groove of the piston.

15. Use a piston ring expander to install the piston rings. Do not expand the piston rings beyond the expansion necessary for installation.
16. Stagger the piston oil rings (1, 4), the oil ring rail (5) gaps, the second compression ring (6), and the top compression ring (2) in relation to the notch on the top of the piston.

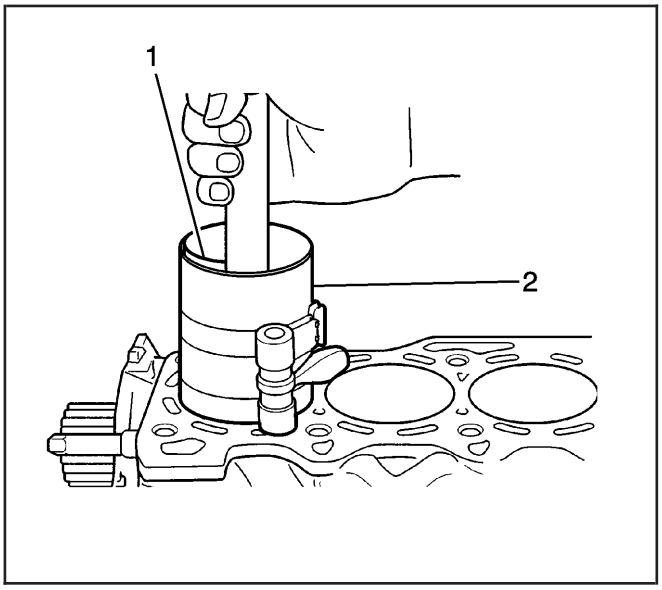



1224583

17. Lubricate the cylinder wall and the piston rings with clean engine oil.
18. Install the piston using a ring compressor (1) and a wood handle. Guide the lower connecting rod end to prevent damaging the crankshaft journal.

***Notice:*** SIO-ID = 751951 LMD = 03-oct-2000 Avoid installing the bearing caps incorrectly. Cylinder head and camshaft damage may result.

19. Install the connecting rod cap and the bearing. Refer to *Piston, Connecting Rod, and Bearings Cleaning and Inspection on page 6-68*.



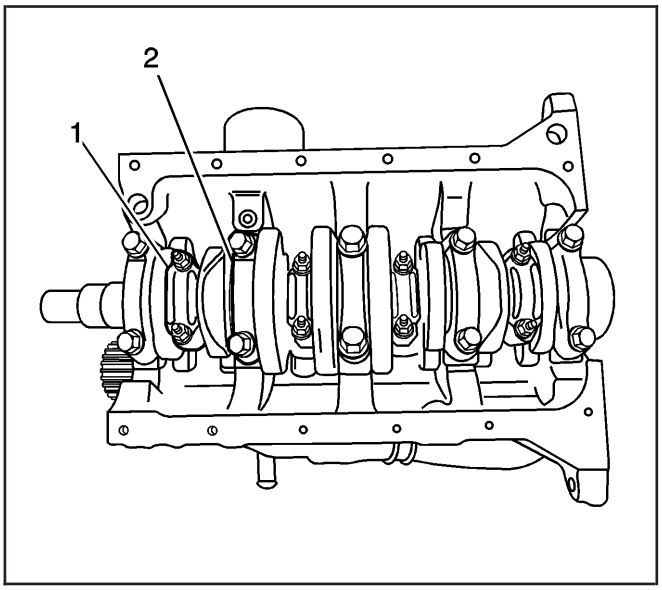

1224586

***Notice:*** Refer to *Fastener Notice on page P-7* in Cautions and Notices.

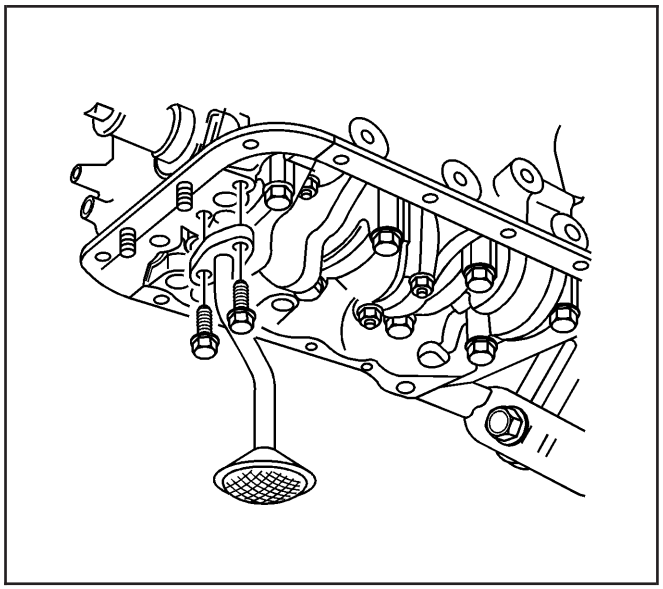
20. Install the connecting rod bearing cap nuts (1).

**Tighten**

Tighten the connecting rod bearing cap nuts to 33 N·m (24 lb ft).




1240799

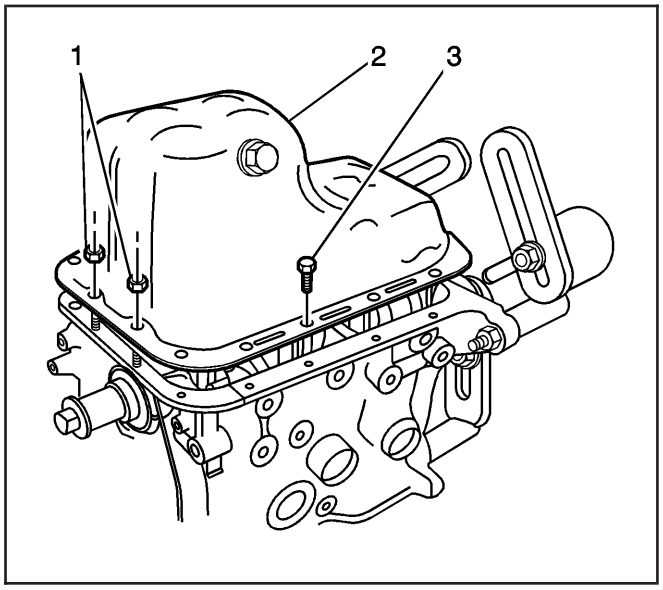


1240795

21. Install the oil pump/pickup tube.
22. Install the oil pump pickup tube bolts.

**Tighten**

Tighten the oil pump pickup tube bolts to 10 N·m (89 lb in).

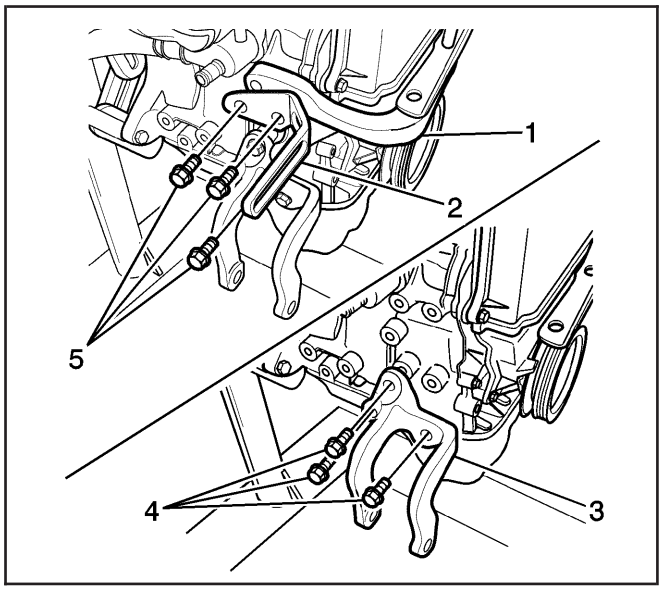



1240822

23. Install the oil pan (2).
24. Install the oil pan bolts (3) and nuts (1).

**Tighten**

Tighten the oil pan bolts and nuts to 10 N·m (89 lb in).




1230302

25. Install the lower engine mount bracket and the generator with the bolts (4).

**Tighten**

Tighten the lower engine mount bracket bolts to 38 N·m (28 lb ft).

26. Install the upper engine mount bracket and the generator shackle with the bolts (5).

**Tighten**

Tighten the upper engine mount bracket and generator shackle bolts to 38 N·m (28 lb ft).

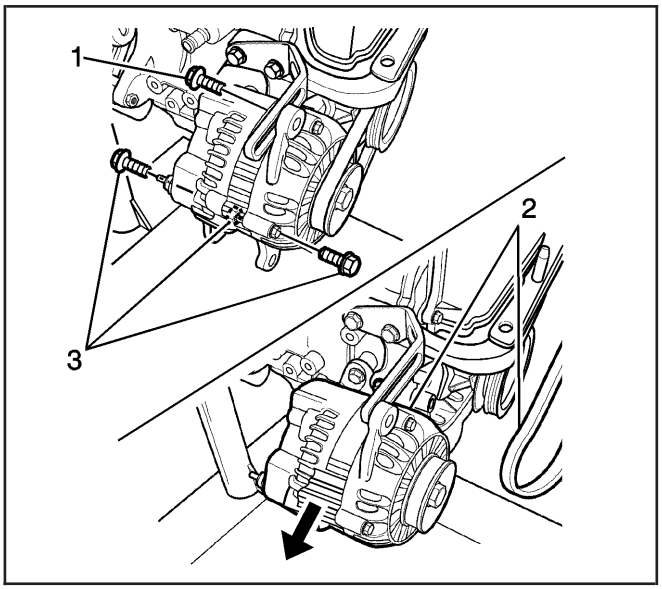
27. Install the generator with the bolts and the nut (3).

    **Tighten**

    Tighten the generator lower bolts and the nut to 23 N·m (17 lb ft).
28. Install the generator belt (2).

    **Tighten**

    Tighten the generator belt tension adjusting bolt to 23 N·m (17 lb ft).

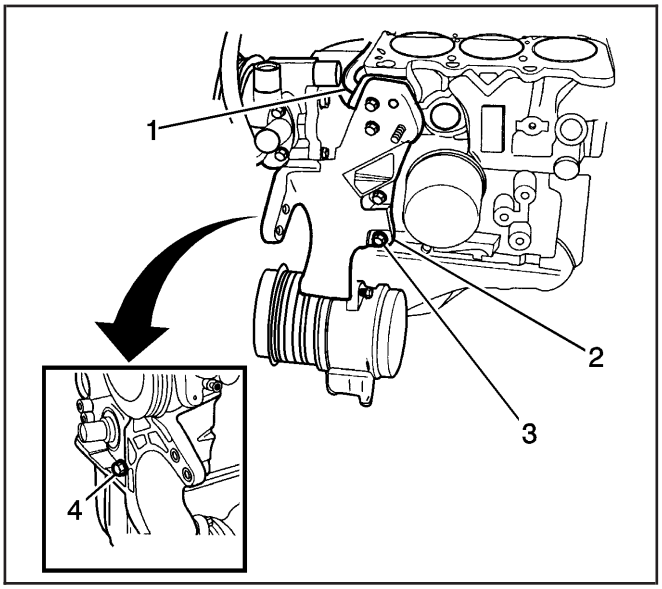



1230300

29. Install the engine mount bracket.
30. Install the air conditioning (A/C) compressor/power steering pump and the bracket with the bolts (2).

    **Tighten**

    - Tighten the engine mount bracket bolts to 20 N·m (15 lb ft).
    - Tighten the A/C compressor/power steering pump bracket bolts to 38 N·m (28 lb ft).

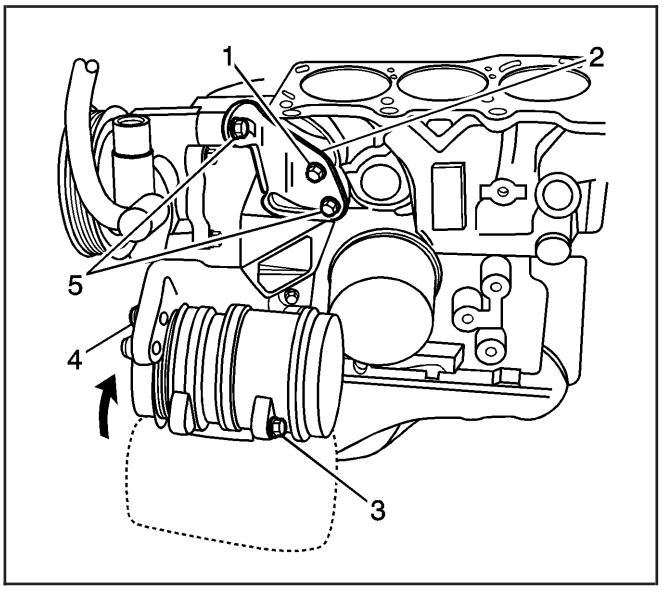



1222968

31. Install the power steering pump bracket with the bracket bolt/nut and adjusting bolt (1).

    **Tighten**

    Tighten the adjusting bolt and the power steering rear bracket nut to 22 N·m (16 lb ft).
32. Install the power steering/air conditioning belt.
33. Install the cylinder head with the intake manifold, the exhaust manifold, and distributor/adaptor attached. Refer to *Cylinder Head Replacement on page 6-32*.
34. Install the timing belt and component. Refer to *Timing Belt Replacement on page 6-29*.
35. Install the clutch and the transaxle to the engine.
36. Install the engine assembly to the engine compartment. Refer to *Engine Replacement on page 6-45*.
37. Refill the engine coolant system. Refer to *Draining and Filling Cooling System on page 6-17*.




1222970

38. Bleed the power steering system, as necessary. Refer to *Bleeding the Power Steering System on page 2-12*.
39. Refill the A/C refrigerant system, as necessary. Refer to *Refrigerant Recovery and Recharging on page 1-9* in HVAC.
40. Refill the transaxle oil, as necessary.
41. Connect the negative battery cable.
42. Start the engine and operate all systems.
43. Operate the idle air control valve reset procedure, as necessary.

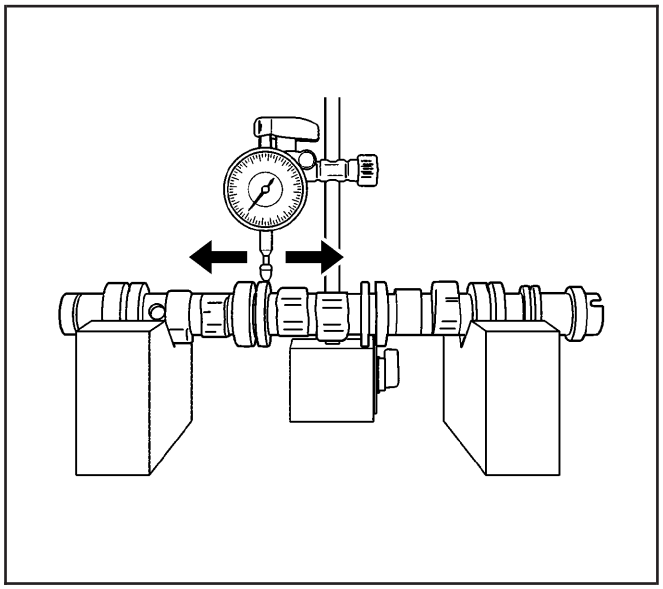
## Camshaft Cleaning and Inspection

*SIE-ID = 1292001 Owner = prober01 LMD = 19-may-2005 LMB = kmicak01*

1. Measure the bending of the camshaft using a dial gage.
2. Replace the camshaft if the measured value is over the specified limit.

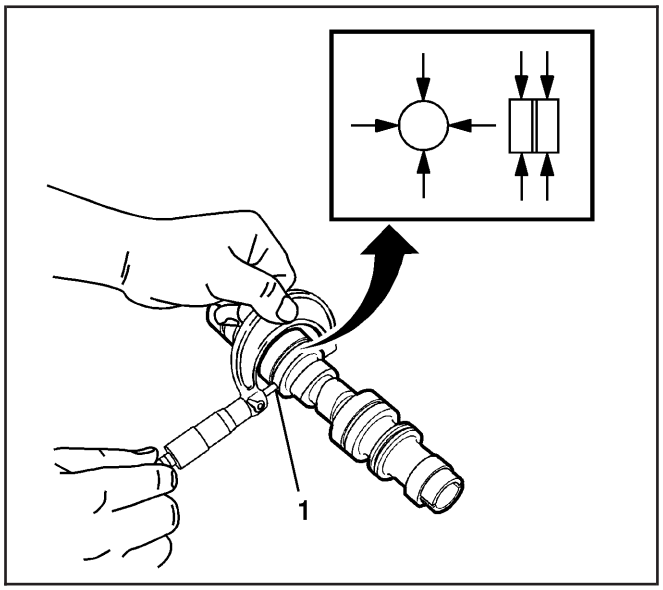
   **Specification**

   The specification limit is 0.03 mm (0.0012 in).



1224655

3. Measure the outer diameter of each journal at the 5 different places to check the abrasion of the camshaft journal (1).

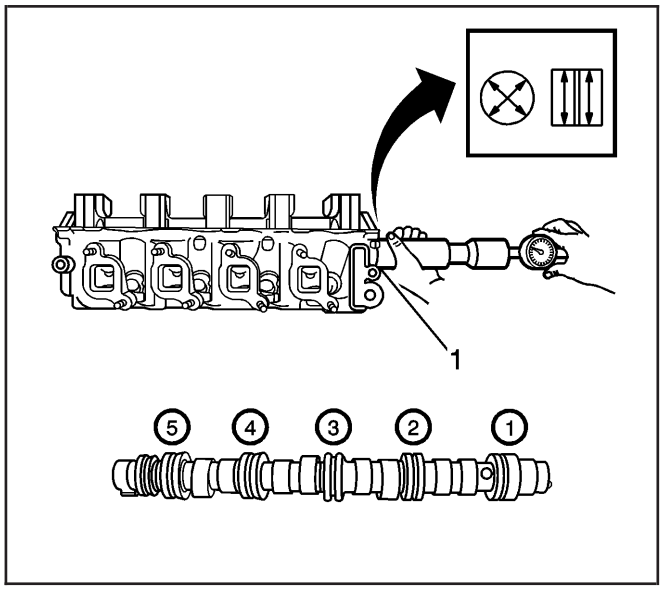



1224657

4. Using a bore gage (1), measure the inner diameter of the cylinder head journal at the 5 places. The clearance of the journal is measured by the difference between the outer diameter of the camshaft the inner diameter of the cylinder head journal part.

   **Specifications**

   - The journal clearance standard is 0.05–0.091 mm (0.0020–0.0036 in).
   - The journal clearance limit is 0.15 mm (0.0059 in).
   - The camshaft journal outer diameter (1) is 43.425–43.450 mm (1.7096–1.7106 in).
   - The inner diameter cylinder head journal part (1) is 43.500–43.516 mm (1.7126–1.7132 in).
   - The camshaft journal outer diameter (2) is 43.625–43.650 mm (1.7175–1.7185 mm).
   - The inner diameter cylinder head journal part (2) is 43.700–43.716 mm (1.7205–1.7211 in).
   - The camshaft journal outer diameter (3) is 43.825–43.850 mm (1.7254–1.7264 in).
   - The inner diameter cylinder head journal part (3) is 43.900–43.916 mm (1.7283–1.7290 in).
   - The camshaft journal outer diameter (4) is 44.025–44.050 mm (1.7333–1.7343 in).
   - The inner diameter cylinder head journal part (4) is 44.100–44.116 mm (1.7362–1.7369 in).
   - The camshaft journal outer diameter (5) is 44.225–44.250 mm (1.741–1.742 in).
   - The inner diameter cylinder head journal part (5) is 44.300–44.316 mm (1.744–1.745 in).
5. If necessary, replace the camshaft or cylinder head of which the limit is over the specified limit.



1240651

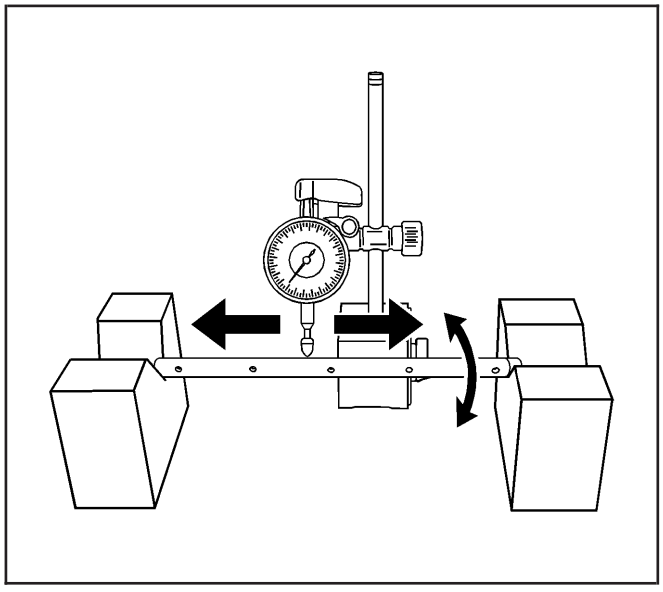
## Valve Rocker Arms Cleaning and Inspection

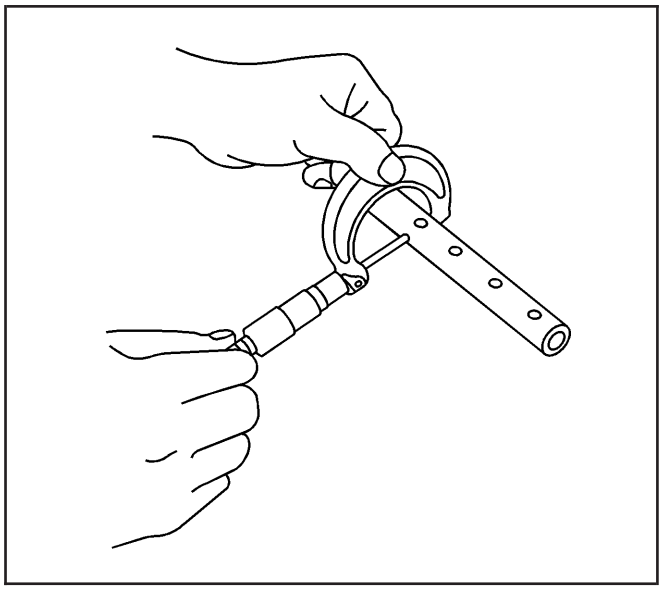
*SIE-ID = 1292018 Owner = prober01 LMD = 09-apr-2003 LMB = sryan01*

1. Check the bending of the rocker arm shaft by using the V block and the dial gage.
2. Replace the rocker arm shaft of which the bending is over the specification.

   **Specification**

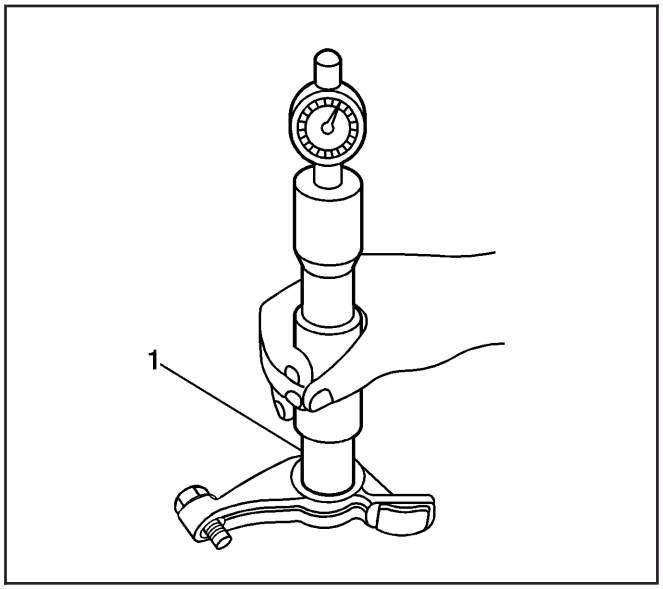
   The bending of the rocker arm shaft is 0.10 mm (0.0039 in).


1240664



1240677

3. Check the outer diameter of the rocker arm shaft using a micrometer to check the clearance between the rocker arm and the rocker arm shaft.

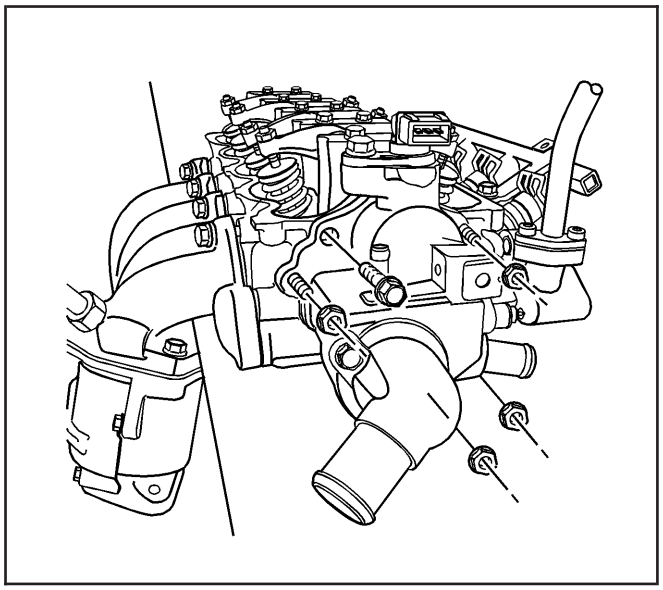



1240693

4. Check the inner diameter of the rocker arm using a bore gage (1).
5. If the difference is over the limit between the outer diameter and the inner diameter, replace the shaft or the rocker arm, or both if necessary.

**Specification**

The limit is 0.005–0.040 mm (0.0002–0.0016 in).



1240586

## Cylinder Head Disassemble

*SIE-ID = 1291218 Owner = prober01 LMD = 20-may-2005 LMB = kmicak01*

### Tools Required

- *EN 46569* (09916–14510) Valve Spring Compressor
- *EN 46571* (09916–44910) Valve Guide Remover

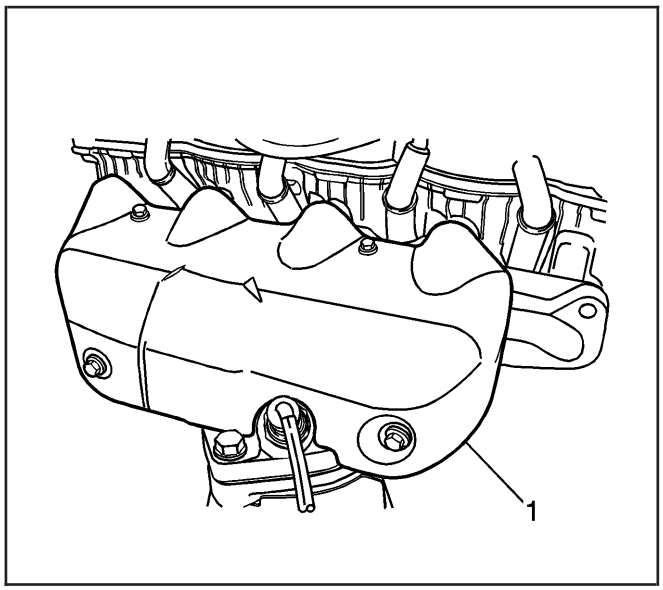
***Caution: Refer to Safety Glasses Caution on page P-4 in Cautions and Notices.***

***Caution:*** *SIO-ID = 26083 LMD = 26-jan-1996* ***Valve springs can be tightly compressed. Use care when removing retainers and plugs. Personal injury could result.***

***Caution: Refer to Exhaust Service Caution on page P-3 in Cautions and Notices.***

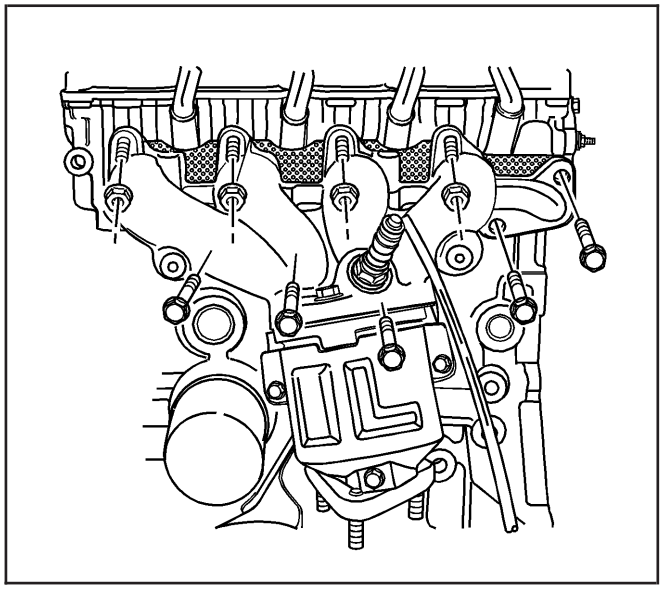
1. Remove the cylinder head with the intake manifold and the exhaust manifold attached. Refer to *Cylinder Head Replacement on page 6-32*.

2. Remove the bolt and the nuts in the water outlet case.
3. Remove the water outlet case.
4. Remove the exhaust manifold heat shield bolts.
5. Remove the exhaust manifold heat shield (1).

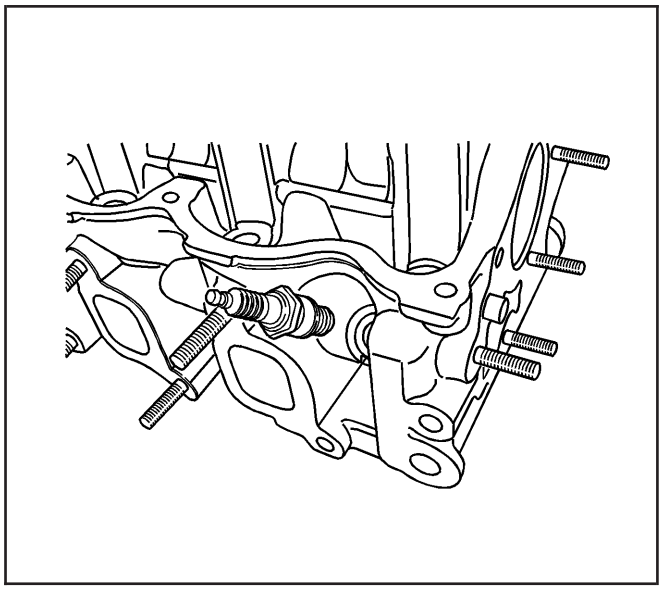



1240588

6. Remove the exhaust manifold nuts and the bolts.
7. Remove the exhaust manifold gasket.
8. Remove the exhaust manifold studs.

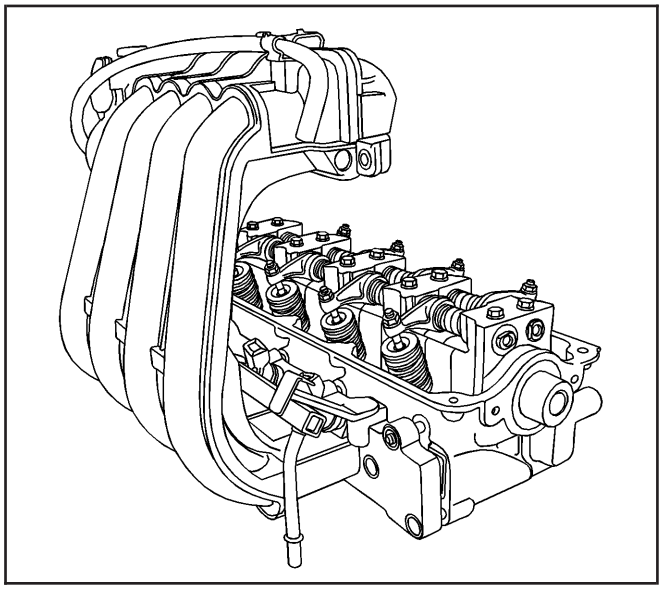


1240589



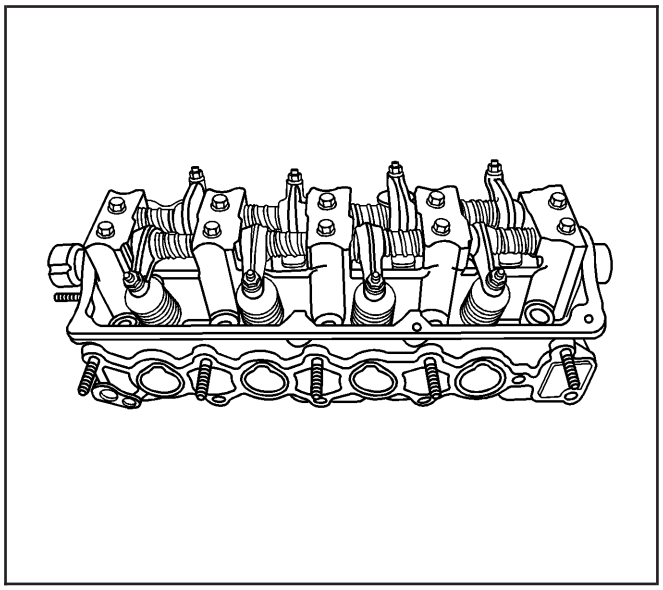
1240591

9. Remove the spark plugs.



1240593

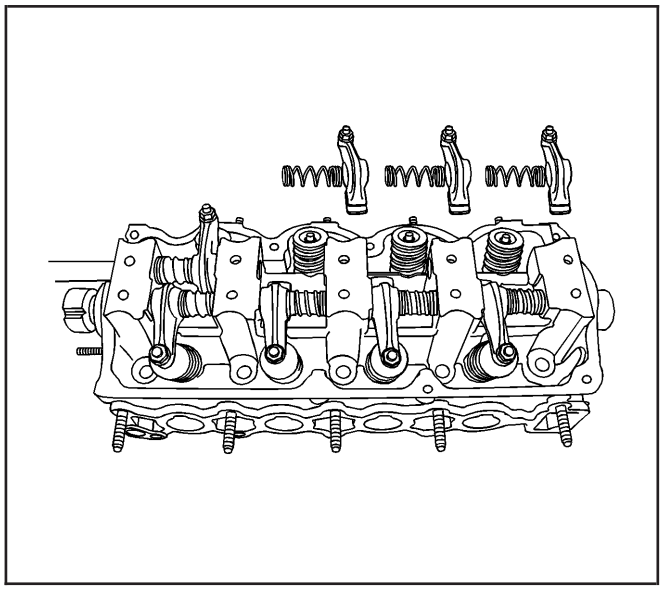
10. Remove the intake manifold retaining bolts and the nuts.
11. Remove the intake manifold with the gasket.
12. Remove the intake manifold studs.



1240595

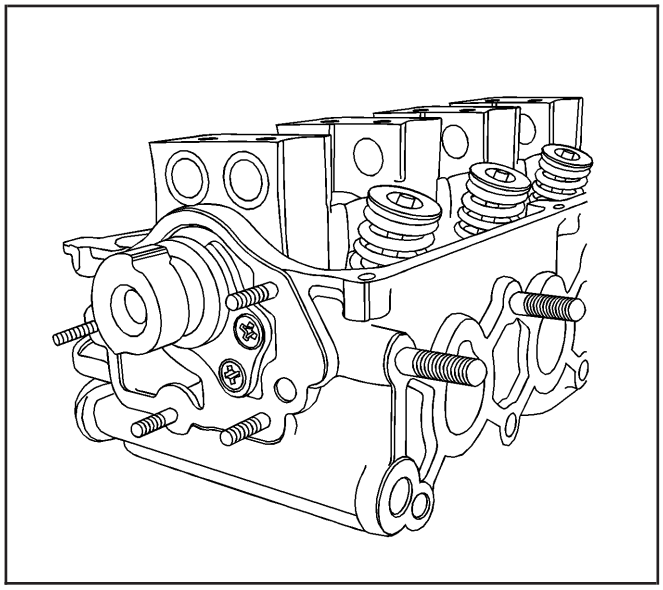
13. Remove the rocker arm shaft mounting bolts.

14. Remove the rocker arm spring and the rocker arm.



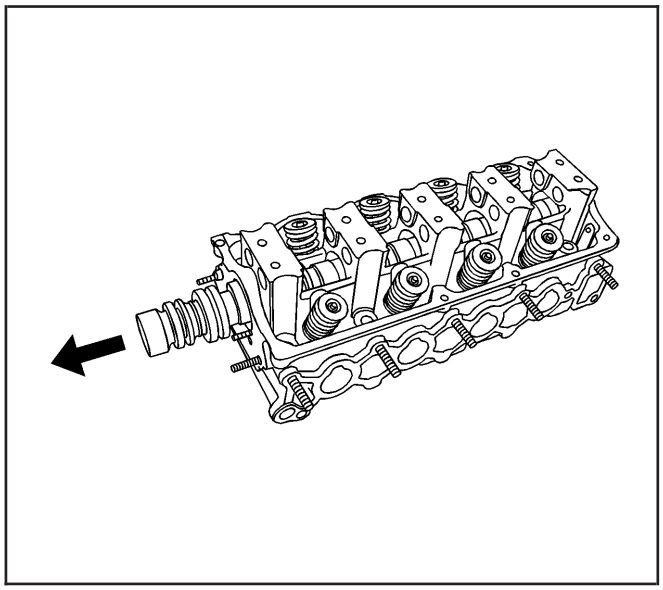
1240596

15. Remove the screws with the camshaft thrust plate.

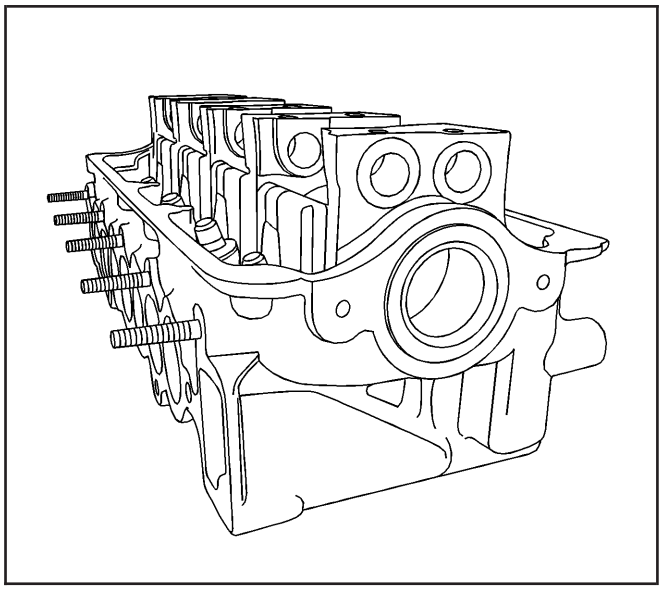


1240598

16. Remove the camshaft.

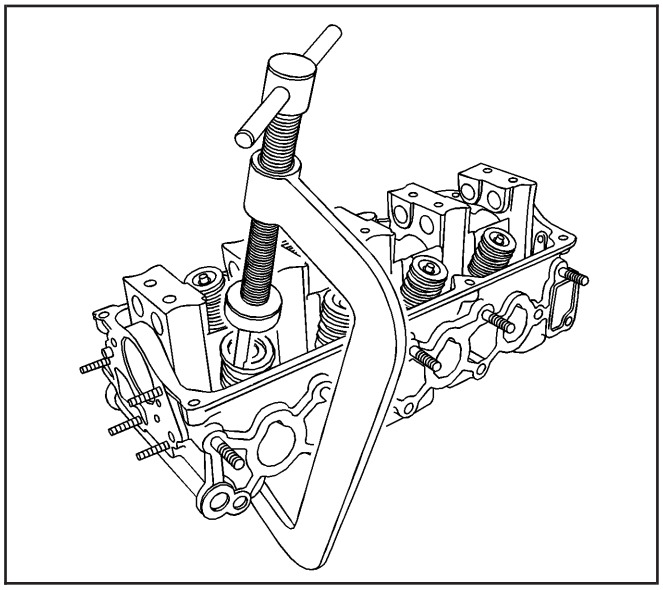


1240599



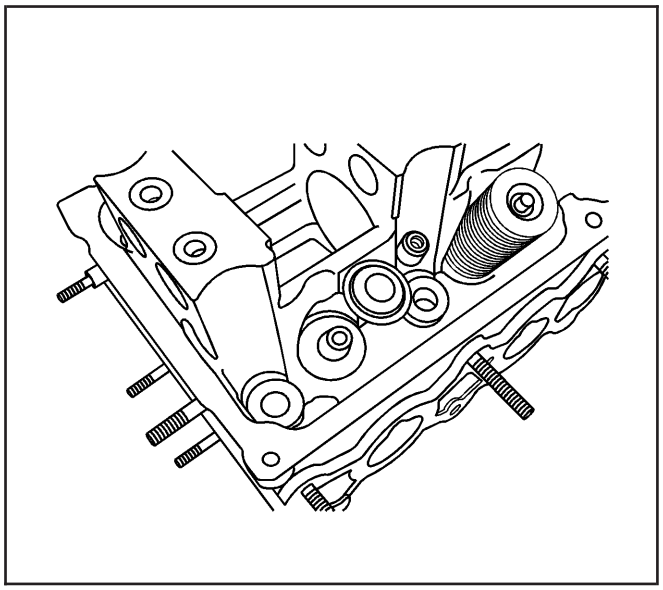
1240602

17. Remove the camshaft front oil seal from the housing hole.



1240603

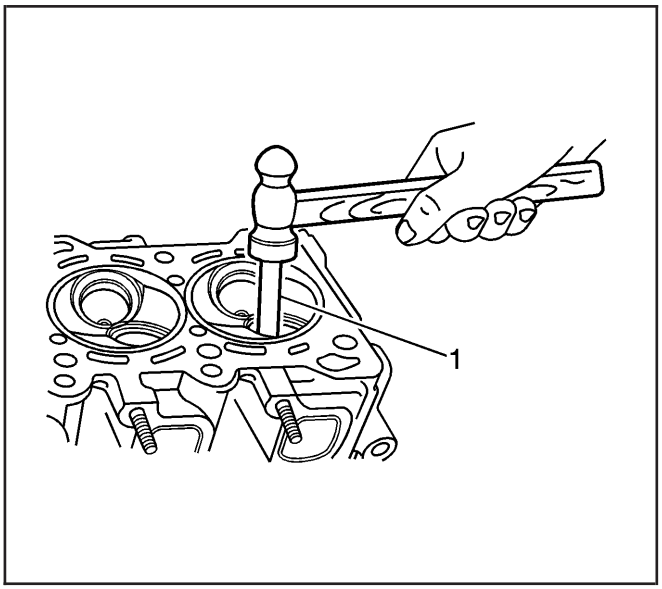
18. Using *EN 46569* with the *EN 47518* compress the valve spring.
19. Remove the valve keepers.
20. Remove the valve spring retainer and valve spring.
21. Remove the valves.



1240605

22. Remove the valve stem oil seals.
23. Remove the valve spring seat.

24. Position the *EN 46571* (1) on the valve guide.
25. Hammer and remove the valve guide from the combustion chamber to the direction of the installed valve spring using the *EN 46571* (1).
26. Remove the valve guide.

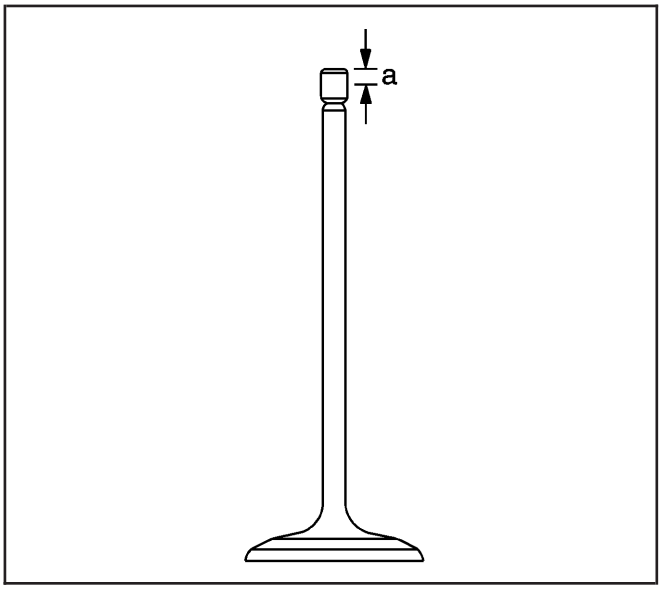



1240607

## Valve Guides Cleaning and Inspection

*SIE-ID = 1292071 Owner = prober01 LMD = 21-may-2003 LMB = jreich01*

1. Inspect the valve.
2. Inspect the valve or stem for abrasion, burn, or bending. Replace as necessary.
3. Inspect the edge of each valve for abrasion. Some uneven abrasion would be made on the edge because the rocker arm gets contacted at this surface when operating.
4. Repair the section within 0.05 mm (0.002 in) as required, or replace the valve if more modification is required (a).

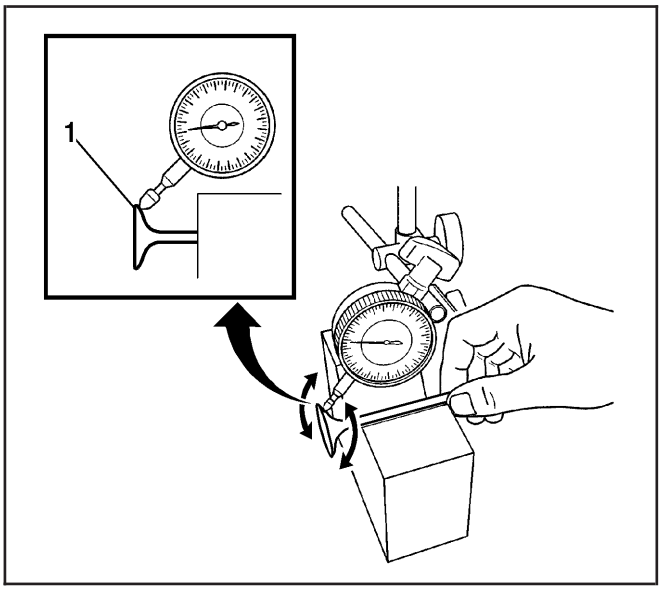



1224666

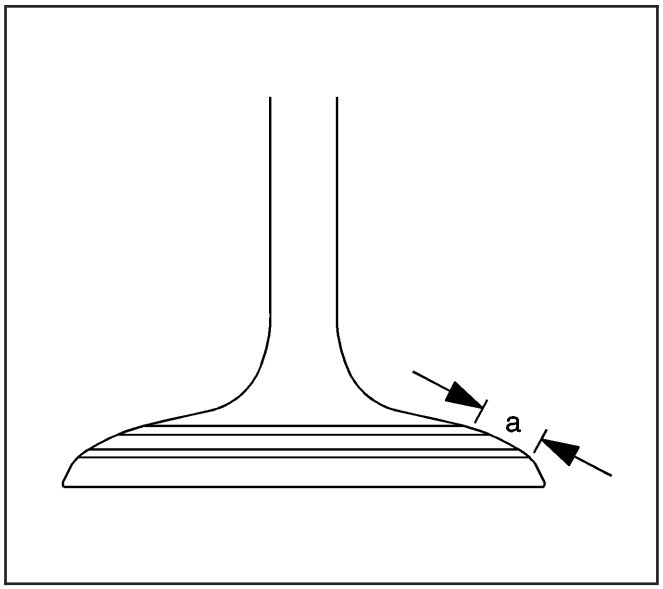
5. Measure the deviation to the rotating direction (1) using a dial gage and the V block by turning the valve slowly.

   **Specification**

   The deviation limit of the valve head to the rotating direction is within 0.08 mm (0.0031 in).
6. If the measured valve exceeds the limit, replace the valve.




1224667



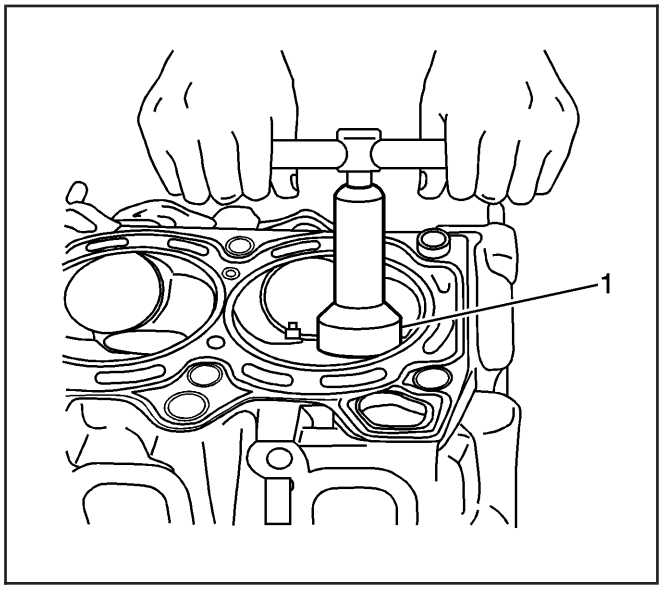

1240700

***Caution: Refer to Safety Glasses Caution on page P-4 in Cautions and Notices.***

7. Clean the valve and the valve seat. Apply red stamping ink thinly to the contacting surface of the valve seat. Inspect the fitting after installing the valve unit.
8. Inspect the contact width (a) on the surface of the valve seat.

### Specifications

- The intake is 1.46–1.66 mm (0.0575–0.0654 in).
- The exhaust is 1.46–1.66 mm (0.0575–0.0654 in).

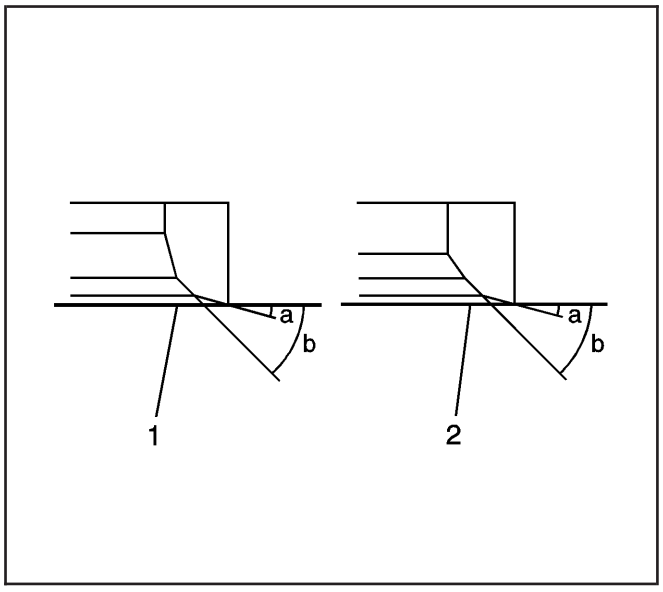



1224670

9. Repair by grinding and cutting off the valve seat. Lap it if the contacting width is uneven or out of the specified range (1).

**Important:** Upon cutting, take care of the contact width. Finish the cutting by gradually reducing the power so that there is no cutting mark on the surface.

10. When applying a seat cutter, use one with a smaller angle first. Increase the angle of the cutter up to the light and final modification of the contact. Finish the contact surface with the cutter at 45 degrees.




1224671

11. Lap both intake (1) and the exhaust (2) sides in 2 stages:
    - First stage – normal lap
    - Second stage – fine lap

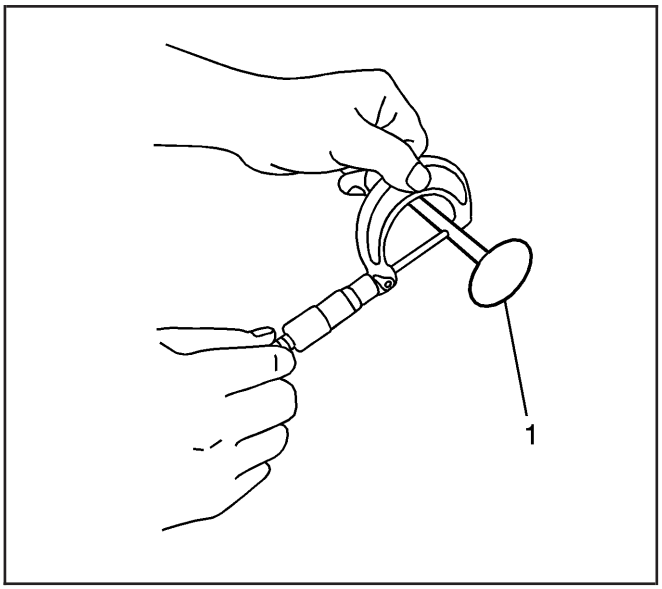
## Valve Stem and Valve Guide Clearance Inspection

*SIE-ID = 1292053 Owner = prober01 LMD = 21-may-2003 LMB = jreich01*

1. Inspect the diameter of the valve stem using a micrometer to check the clearance between the valve stem and the valve guide.

**Specifications**

- The intake outer diameter is 5.465–5.480 mm (0.2152–0.2157 in).
- The exhaust outer diameter is 5.440–5.455 mm (0.2142–0.2148 in).




1240694

2. Inspect the inner diameter of the valve guide using a bore gage (1), at least 1 place in the direction to the valve length.

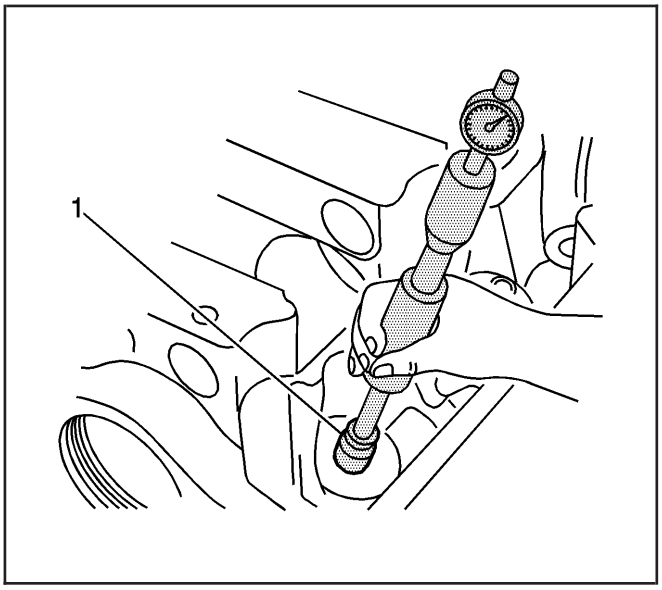
**Specifications**

- The intake inner diameter is 5.500–5.512 mm (0.2165–0.2170 in).
- The exhaust inner diameter is 5.500–5.512 mm (0.2165–0.2170 in).

3. Inspect the clearance between the valve stem and the valve guide.

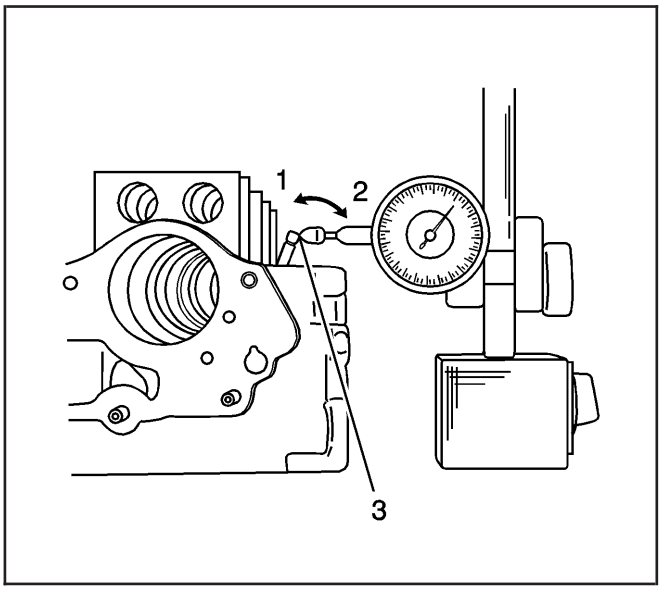
**Specifications**

- The intake clearance is 0.020–0.047 mm (0.0008–0.0019 in).
- The exhaust clearance is 0.0045–0.072 mm (0.0018–0.0028 in).

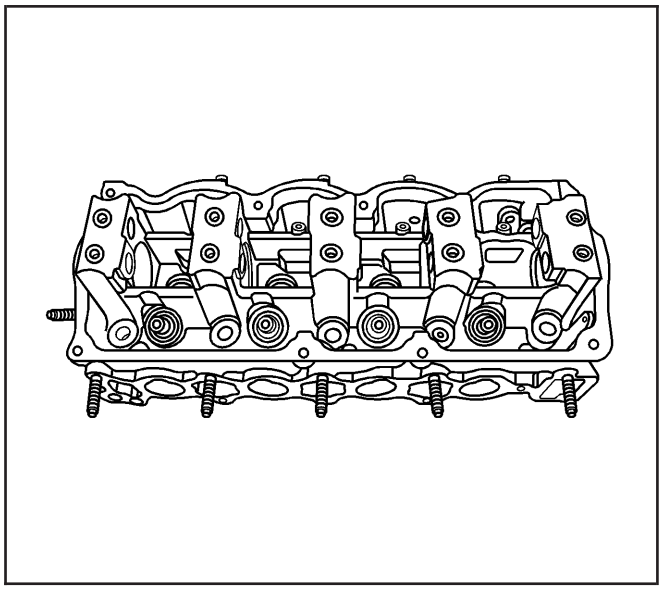



1240696

4. If a bore gage is not available, measure the clearance using a dial gage by moving the edge of the stem to the directions of (1, 2, 3).
   - The intake clearance is 0.14 mm (0.0055 in).
   - The exhaust clearance is 0.18 mm (0.0071 in).
5. If the measured value is over the limit, replace the valve stem or valve guide.




1240699



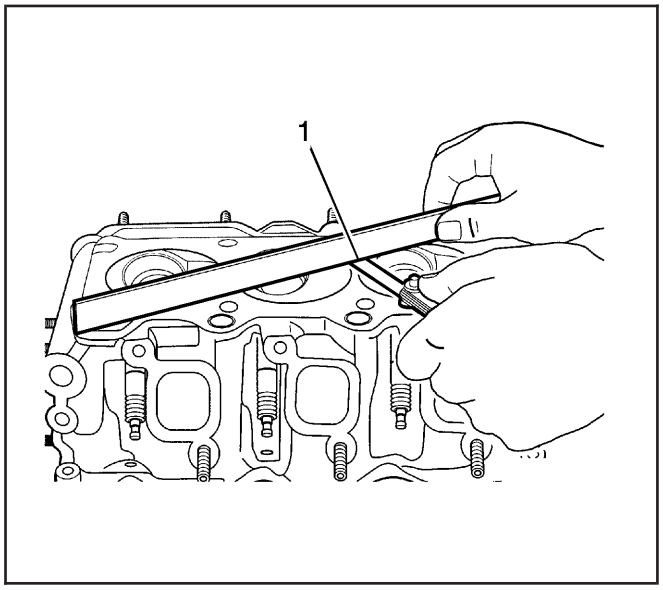
1240636

# Cylinder Head Cleaning and Inspection

*SIE-ID = 1291970 Owner = prober01 LMD = 09-apr-2003 LMB = sryan01*

## Cleaning Procedure

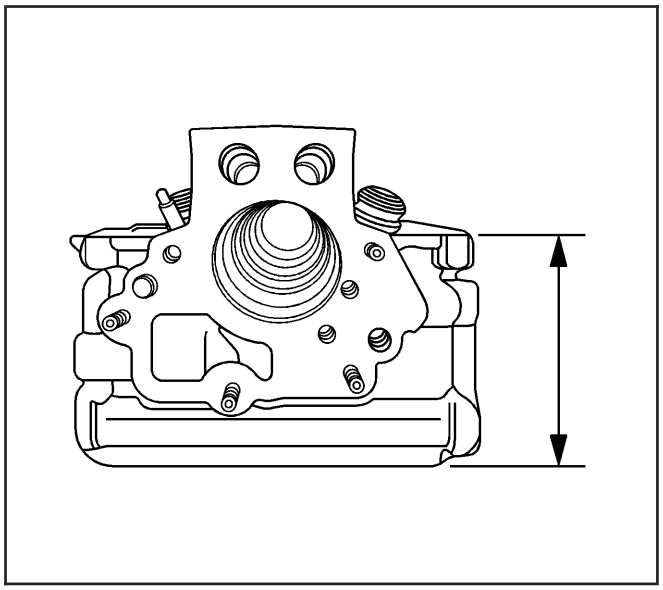
1. Clean the cylinder head.
2. Clean the valve guides.
3. Clean all of the threaded holes.
4. Clean the valves of carbon, oil, and varnish.




1224672

## Inspection Procedure

1. Clean the sealing surfaces.
2. Inspect the cylinder head gasket and the mating surfaces for leaks, corrosion, and blowby.
3. Inspect the cylinder head for cracks.
4. Inspect the length and the width of the cylinder head using a feeler gage and a straight edge (1).
5. Inspect the sealing surfaces for damage and warping. The cylinder head sealing surfaces must be flat within 0.05 mm (0.0020 in) maximum.



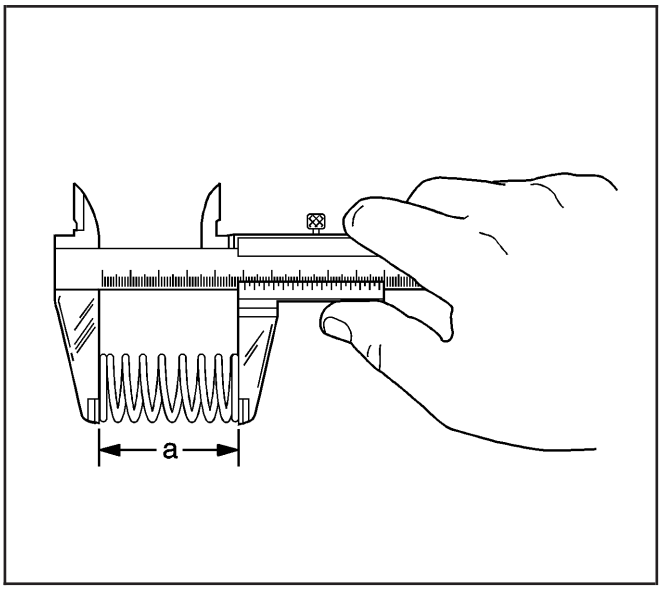
1240624

6. Inspect all threaded holes for damage.
7. Inspect the valve seats for excessive wear and burned spots.

## Valve Spring Inspection and Measurement

*SIE-ID = 1291980 Owner = prober01 LMD = 09-apr-2003 LMB = sryan01*

1. Inspect the valve spring. If the valve spring ends are not parallel, replace the valve spring.
2. Measure the valve spring height. Refer to *Engine Mechanical Specifications on page 6-2*. If the valve spring height does not match the specifications, replace the valve spring.
3. Inspect the valve spring seating surface of the valve rotators for wear or gouges. Replace as required.




1224677

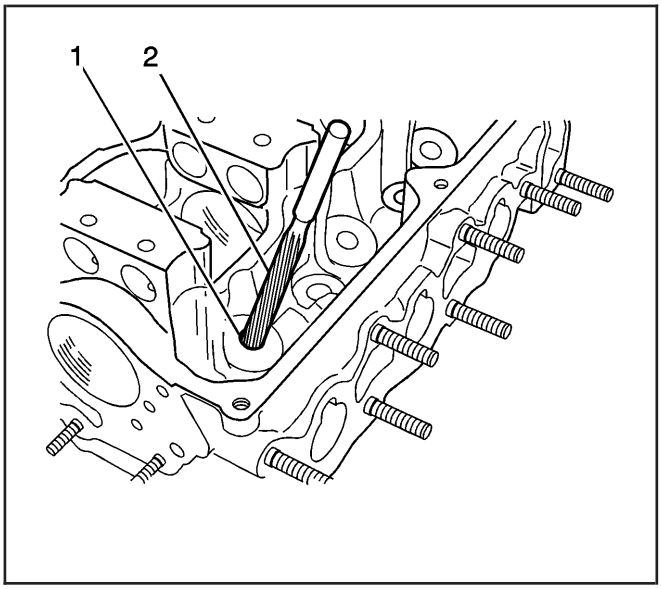
## Cylinder Head Assemble

*SIE-ID = 1292073 Owner = prober01 LMD = 20-may-2005 LMB = kmicak01*

### Tools Required

- *EN 46597* (09916-37320) Valve Guide Reamer (5 mm or 0.1969 in)
- *EN 46570* (09916-38210) Valve Guide Reamer (11 mm or 0.4331 in)
- *EN 46569* (09916–14510) Valve Spring Compressor
- *EN 46573* (09917-88220) Valve Guide Installer Attachment

1. Make the valve guide hole using *EN 46570* (2). Before installing the new valve guide into the cylinder head, ream the guide hole with the 11 mm reamer to remove burrs. Make sure the guide hole cones to a complete roundness (1).




1224683

***Notice:*** SIO-ID = 1307952 LMD = 22-apr-2003 Heat the cylinder head uniformly at a temperature 80-100°C (176-212°F) in order not to deform the cylinder head. Drive the new valve guide completely into the cylinder head with the valve guide installer.

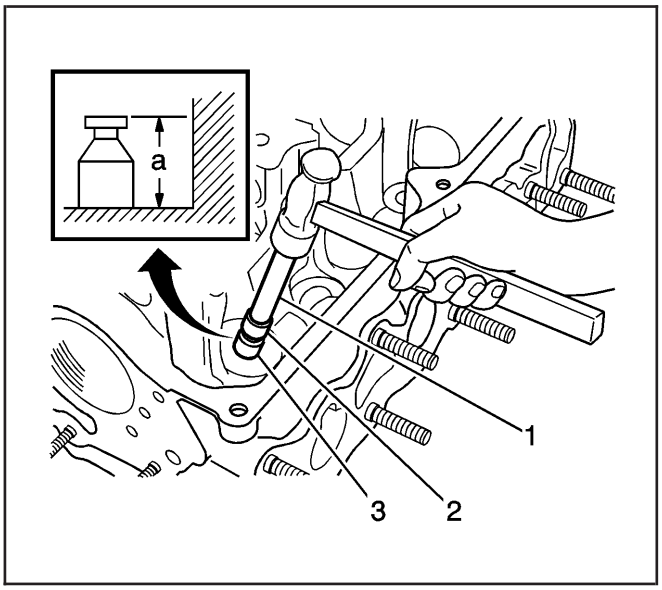
2. Peen and install the new valve guide using the *EN 46573* (2).

**Important:** Once disassembled, do not reuse the valve guide. Replace it with the new oversized valve guide.

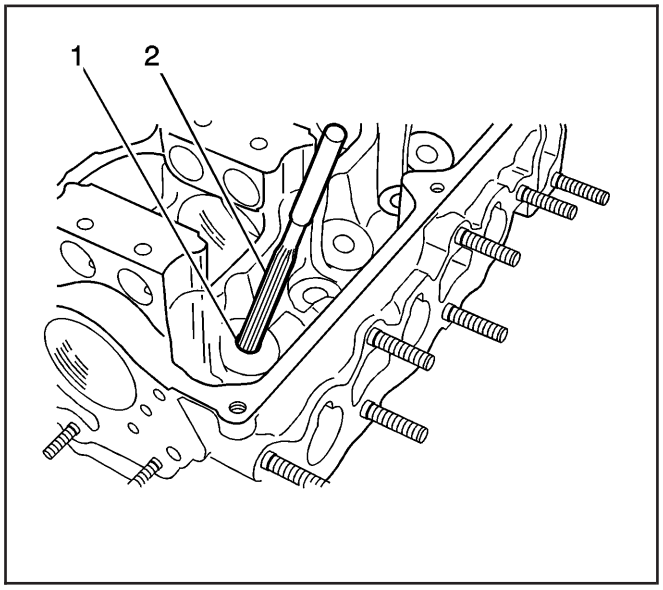
3. Inspect the protruded part of the guide from the cylinder head (a).

### Specifications

- The valve guide oversize is 0.03 mm (0.0012 in).




1230281




1230282

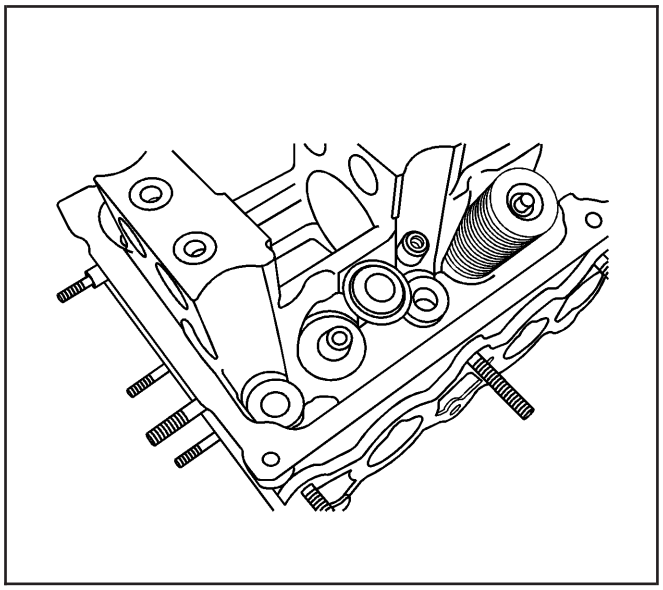
- The valve guide protrusion is 14 mm (0.5512 in).

4. Repair the valve guide bore with the *EN 46597* (2).

**Specification**

The valve guide bore width is 5 mm (0.1969 in).

5. Remove any debris from the hole.



1240605

6. Install the valve spring seats.

***Notice:*** SIO-ID = 1333163 LMD = 16-may-2003 Tapping or hitting the tool may cause damage to the seal.

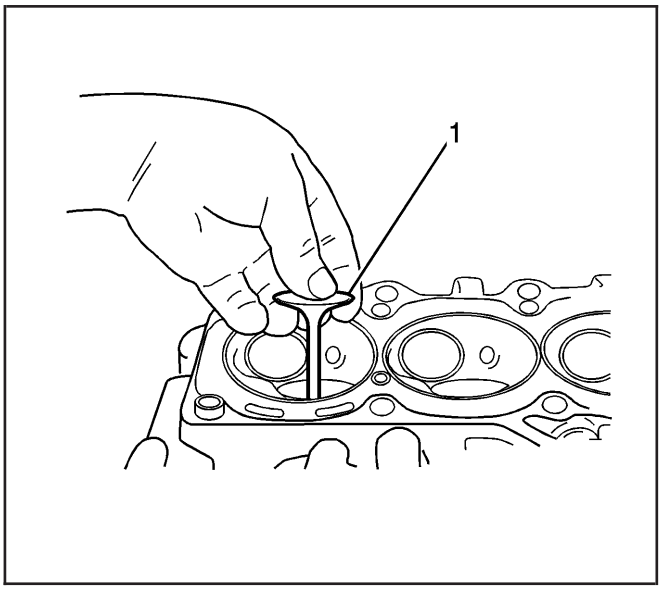
**Important:** Do not reuse the disassembled oil seal. Replace the disassembled oil seal with a new one.

**Important:** When installing the new oil seal, knee tap or hit the tool with a hammer.

7. Install the seal to the guide only by pushing the special tool by hand.
8. Install the valve stem oil seal to the valve guide. After applying engine oil to the seal and installing the seal to the valve guide, make sure the seal is properly fixed to the valve guide.

**Important:** Before installing the valve, coat the stem seal, valve guide, and valve stem with engine oil.

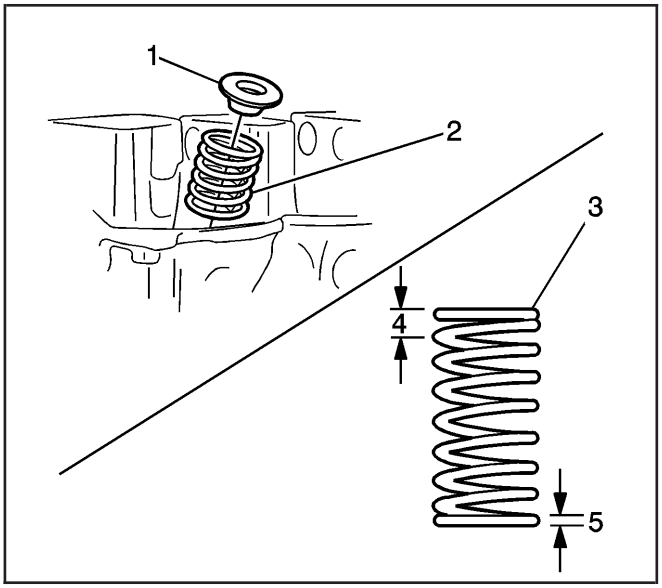
9. Install the valve (1) to the valve guide.




1230285

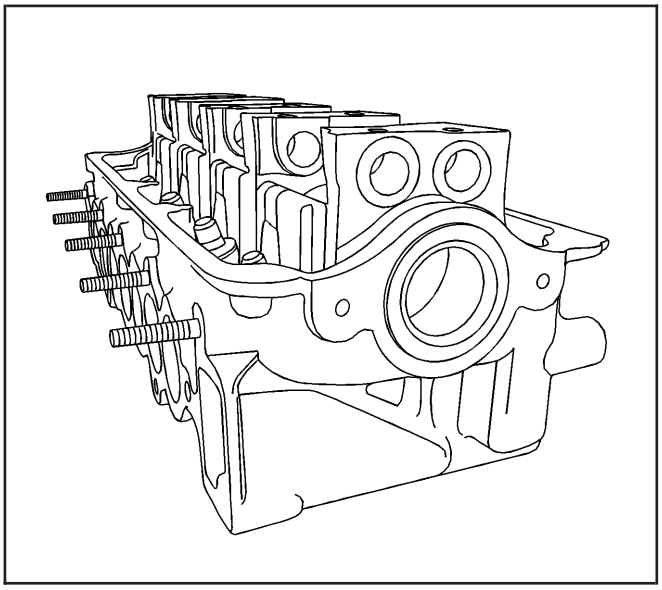
***Caution:*** *SIO-ID = 902671 LMD = 24-jul-2002* ***Valve springs can be tightly compressed. Use care when removing the retainers and plugs. Personal injury could result.***

10. Install the valve springs (2) and the spring retainers (1).
11. Using the *EN 46569* and *EN 46353*, compress the valve spring.
12. Install the valve keepers.

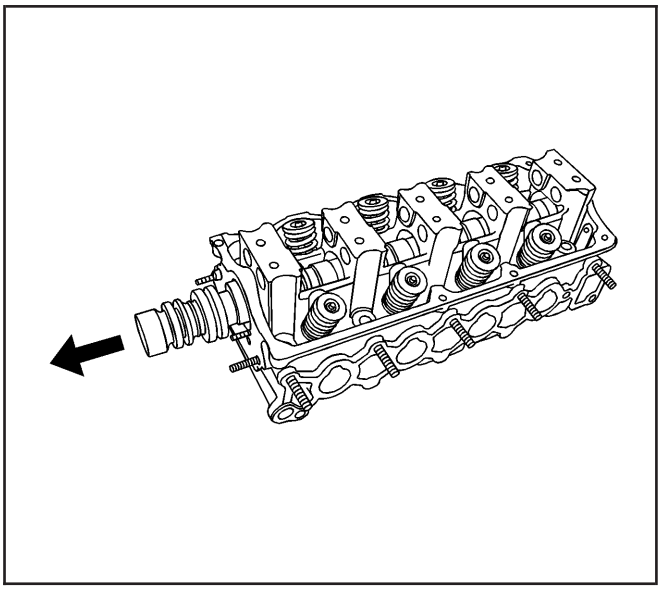



1230286

13. Install the camshaft front oil seal from the housing hole.



1240602

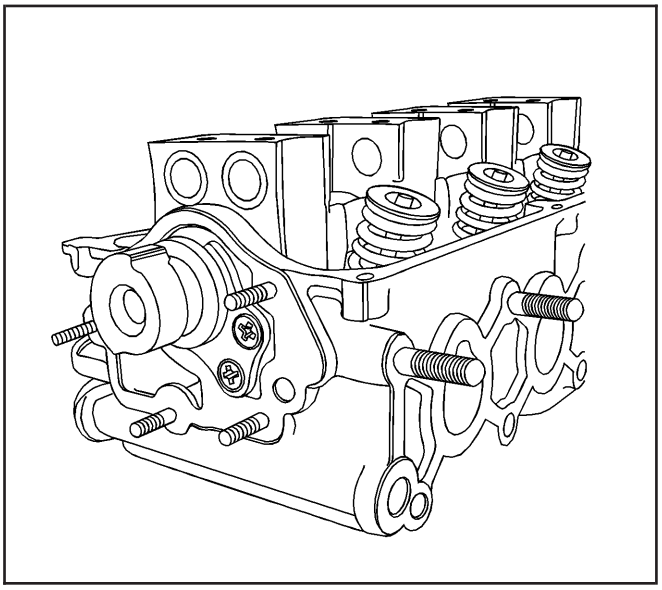


1240599

14. Coat the camshaft front oil seal, the cam, and the camshaft journal with the engine oil.
15. Install the camshaft front oil seal to the housing hole.

***Notice:*** SIO-ID = 1307788 LMD = 22-apr-2003 Use extreme care when installing the camshaft not to nick, scratch, or damage the camshaft lobes or bearing surfaces.

16. Install the camshaft to the cylinder head.



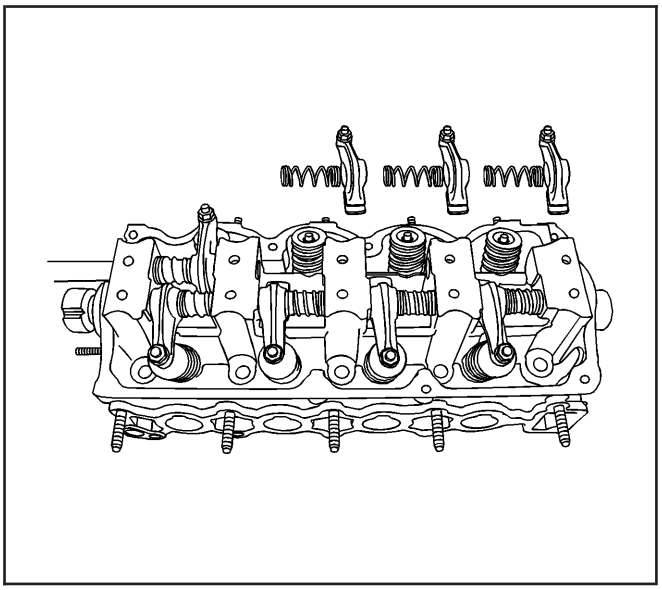
1240598

***Notice:*** Refer to *Fastener Notice on page P-7* in Cautions and Notices.

17. Install the screws with the camshaft thrust plate.

    **Tighten**

    Tighten the screws to 10 N·m (89 lb in).



1240596

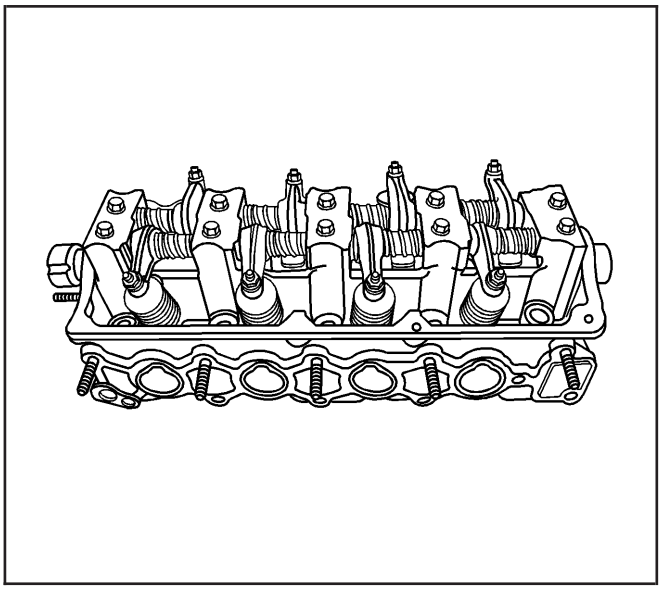
18. Coat the rocker arms and the rocker arm shafts with the engine oil.
19. Install the rocker arm spring and the rocker arm.

**Important:** The rocker arm shaft for the intake valves and the exhaust valves are different and their directions of installation are different.

20. Install the rocker arm shaft mounting bolts.

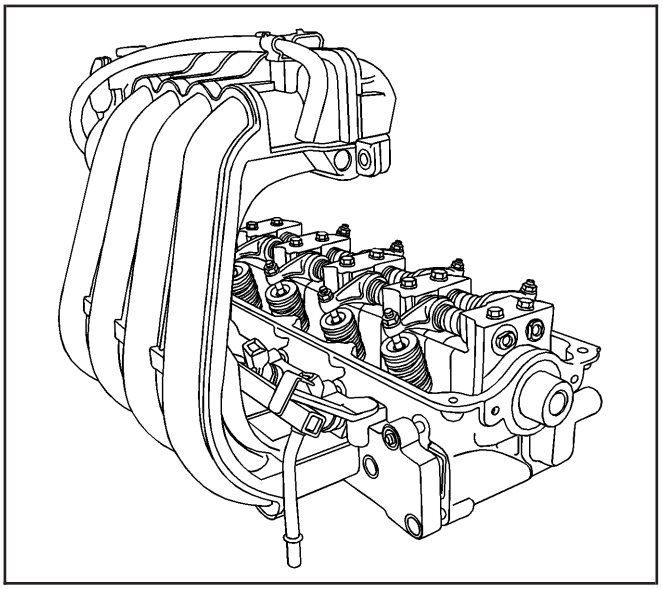
    **Tighten**

    Tighten the bolts to 10 N·m (89 lb in).



1240595

21. Install the intake manifold studs.
22. Install the intake manifold with the gasket.
23. Install the intake manifold.



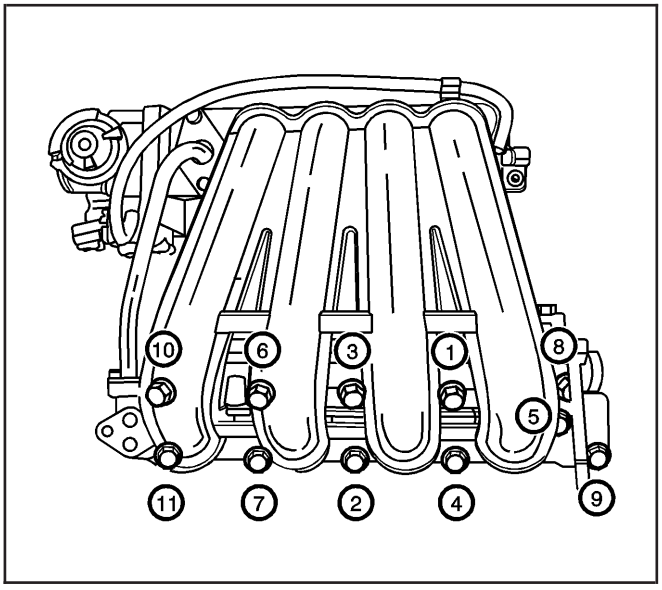
1240593

**Important:** Before tightening the intake manifold nuts, tighten the intake manifold support bracket nut.

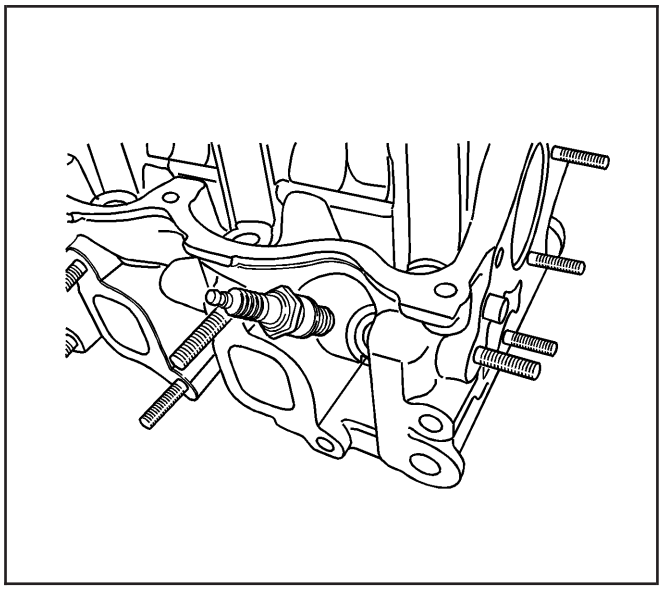
24. Install the intake manifold nuts in the sequential order shown.

    **Tighten**

    - Tighten the intake manifold nuts and the bolts to 17 N·m (13 lb ft).
    - Tighten the intake manifold bracket bolt to 10 N·m (89 lb in).

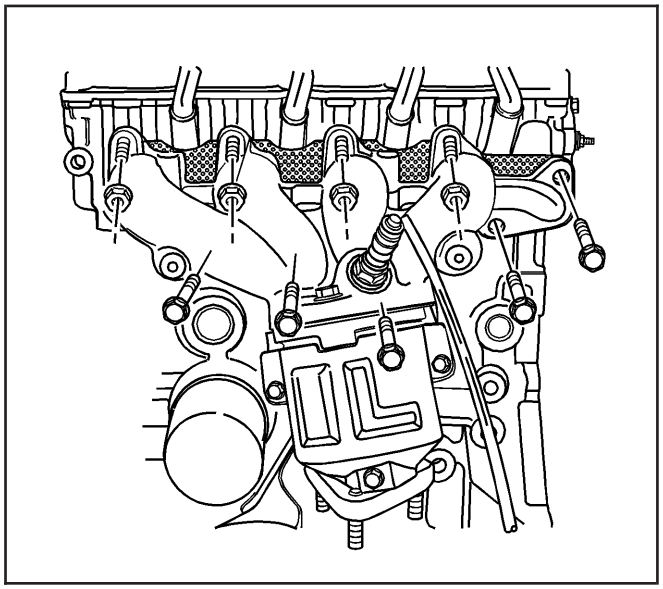



1240782



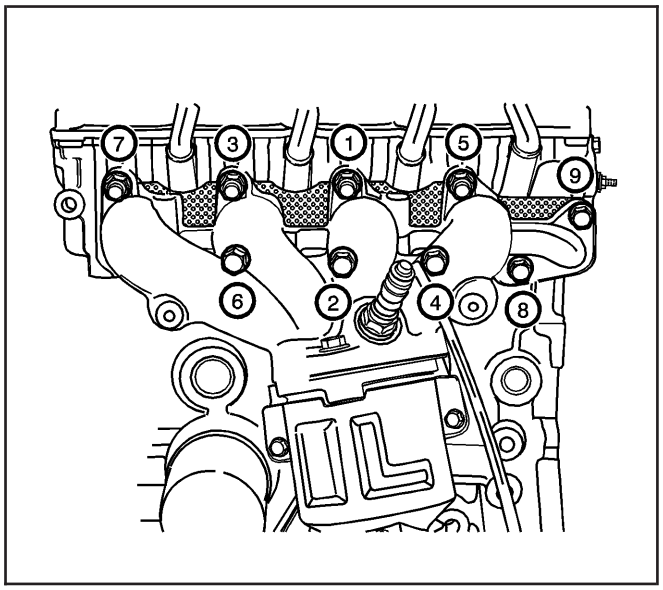
1240591

25. Install the spark plugs.



1240589

26. Install the exhaust manifold gasket and the exhaust manifold.




1240784

27. Install the bolts and nuts in the sequential order shown.

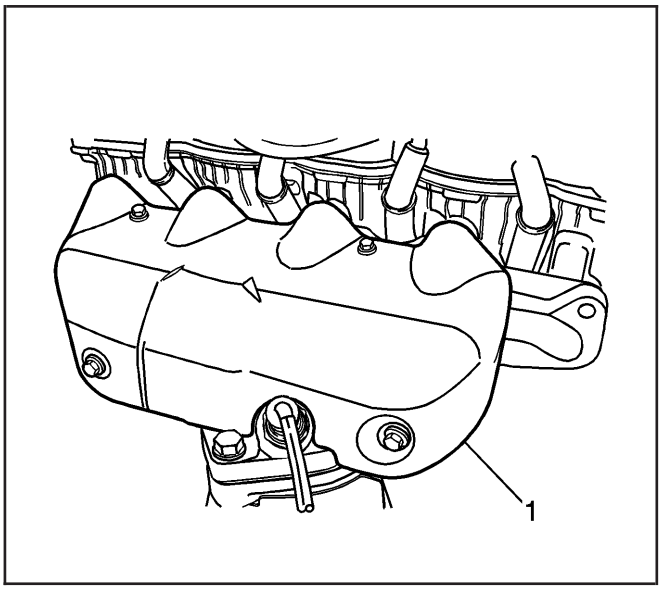
**Tighten**

Tighten the exhaust manifold nuts and bolts to 22 N·m (16 lb ft).

28. Install the exhaust manifold heat shield (1).
29. Install the exhaust manifold heat shield bolts.

    **Tighten**

    Tighten the exhaust manifold heat shield bolts to 10 N·m (89 lb in).

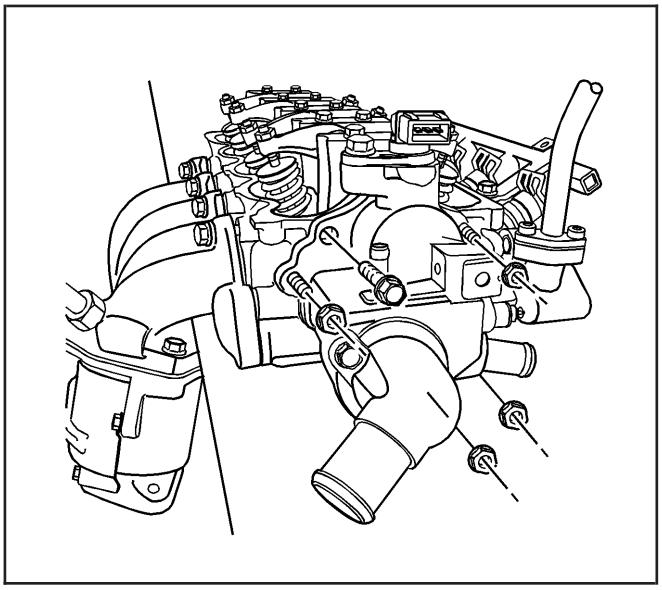



1240588

30. Install the water outlet case.
31. Install the water outlet case mounting bolts.

    **Tighten**

    Tighten the water outlet case mounting bolts to 10.5 N·m (93 lb in).
32. Install the cylinder head with the intake manifold and exhaust manifold attached. Refer to *Cylinder Head Replacement on page 6-32*.



1240586

## Exhaust Manifold Installation

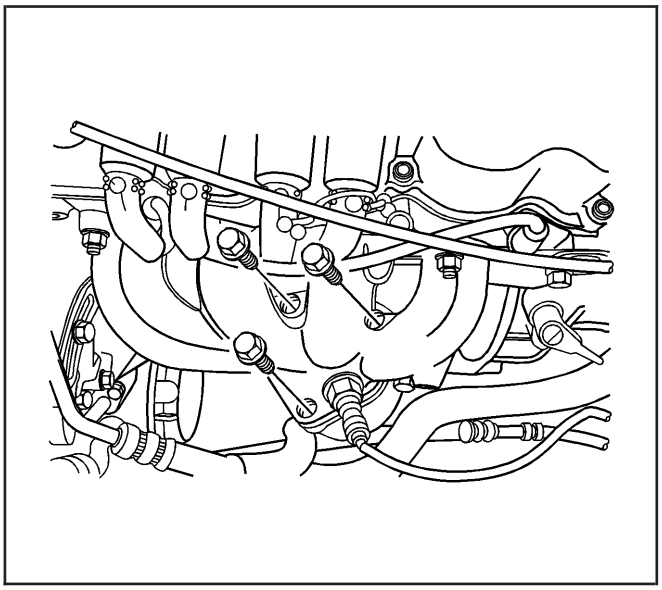
*SIE-ID = 1277987 Owner = prober01 LMD = 16-may-2003 LMB = kwalla01*

***Notice:*** Refer to *Fastener Notice on page P-7* in Cautions and Notices.

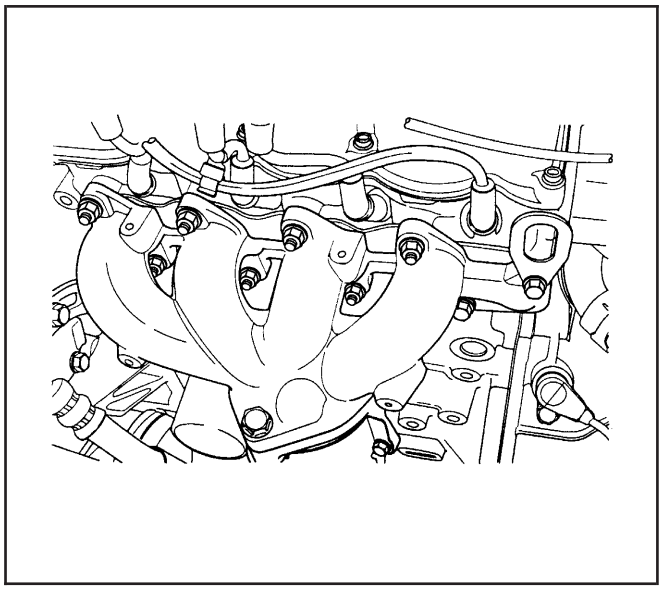
1. Install the exhaust manifold to the pup-up catalytic converter bolts.

   **Tighten**

   Tighten the exhaust manifold to the pup-up catalytic converter bolts to 50–60 N·m (36–43 lb ft).



1240438

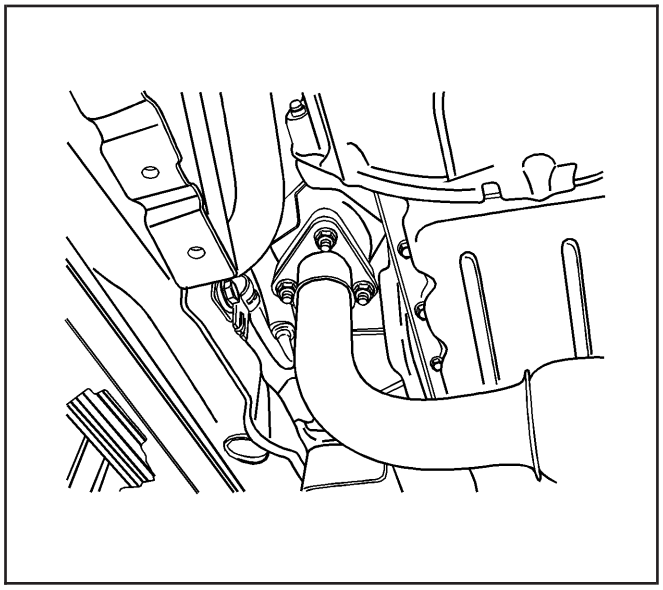


1240422

2. Install the exhaust manifold with pup-up catalytic converter.

   **Tighten**

   Tighten the exhaust manifold bolts and nuts to 17–27 N·m (13–20 lb ft).

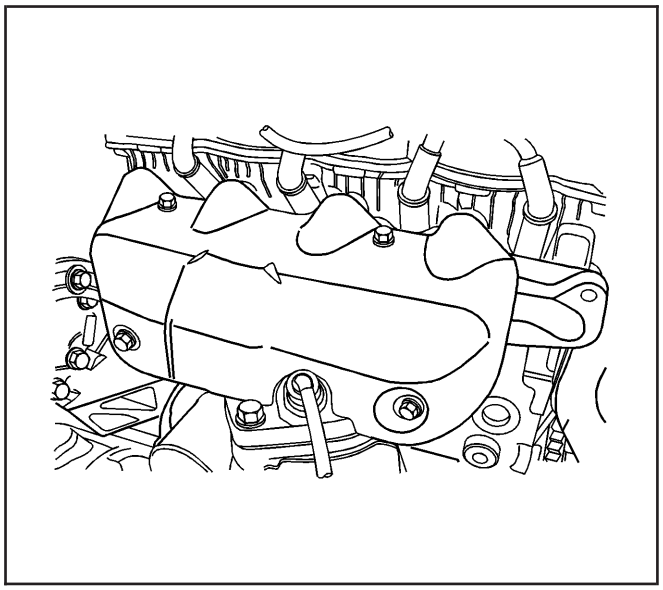


1240405

3. Install the exhaust pipe to the pup-up catalytic converter.

   **Tighten**

   Tighten the exhaust pipe to the pup-up catalytic converter nuts to 25–35 N·m (18–25 lb ft).



1240389

4. Install the exhaust manifold heat shield.

   **Tighten**

   Tighten the exhaust manifold heat shield bolts to 8–12 N·m (71–106 lb in).

5. Connect the O2S sensor connector and ignition wire.
6. Install snorkel assembly, resonator and filter. Refer to *Air Cleaner Assembly Replacement on page 6-139* in Engine Controls.

# Description and Operation

## Engine Component Description

*SIE-ID = 1283863 Owner = prober01 LMD = 02-apr-2003 LMB = aspenc01*

### Engine Lubrication

The engine lubrication is of the wetsump method to draw up the oil forced by the oil pump. The oil pump is of a trochoid type, and mounted on crankshaft at crankshaft pulley side. Oil is drawn up through oil pump pickup tube and passed through pump to oil filter. The filtered oil flows into two paths in engine block. In one path, oil reaches crankshaft journal bearings. Oil from crankshaft journal bearings is supplied to connecting rod bearings by means of intersecting passages drilled in crankshaft, and then injected from a small hole provided on big end of connecting rod to lubricate piston, rings, and cylinder wall. In another path, oil goes up to cylinder head and lubricates rocker arm, valve, camshaft, etc. through the oil hole provided on the rocker arm shaft.

### Cylinder Head and Valve Train

The cylinder head is made of cast aluminium alloy for better strength in hardness with lightweight, and camshaft and rocker arm shaft arranged in – line support.

The combustion chambers are formed into the manifold combustion chambers with increased squish parts for better combustion efficiency and its intake and exhaust parts are installed in the cross flow arrangement. The rocker arm operates in seesaw motion to close and open the intake and exhaust valves with camshaft by turning the rocker arm shaft of each intake and exhaust part.

### Engine Block

As the largest part of the engine components, the block has all the necessary parts attached to outer surface of it.

On the inside surface of block, there are bore surfaces by horning, which are cylinders, and on the periphery of the cylinders, there are the passages to prevent the overheated and to lubricate the engine block.

### Crankshaft

The crankshaft is to convert the rectilinear motion into the rotation motion through the connecting rod which transmits the power generated by combustion.

On the one side of it, oil pump, crankshaft pulley and timing belt pulley are attached, and oil seal housing and flywheel are on the other side.

A special steel of high grade cast iron is used for the material to stand the bending load and distortion. The material of the main bearing is aluminum alloy. The split thrust bearings are inserted in the journal bearing part.

### Connecting Rod

The connecting rods are made of forged steel, and its section is typed “T” with its big end connected to crankshaft and its small end to piston pin to transmit the power.

The big end is detachable, and its upper and lower parts are fastened by bolting after the metal bearings are inserted.

### Piston, Piston Ring and Piston Pin

#### Piston

The piston is of the open skirt type and its crown is exposed in the combustion chamber to generate power. its land and skirt parts are made of coat aluminium alloy which is light and has excellent heat conductivity in order to meet it continuous and high speed reciprocation movement.

#### Piston Ring

It is composed of two compression rings and one oil ring and installed between the grooves of the piston to make the high speed reciprocating movement maintaining a remarkable air tightness as well as cylinders. It is a critical parts to affect the compression pressure, oil consumption, compression, blow by pressure and engine performance.

#### Piston Pin

The pin is not fixed to the piston on connecting rod and its both ends are assembled by the circlip in the full floating type. The pin is used to transmit the power from the crown part of piston to connecting rod.

### Timing Belt and Pulley

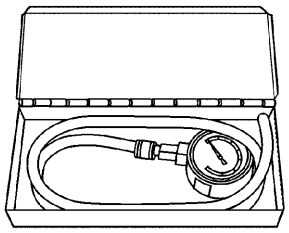
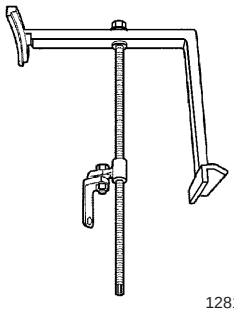
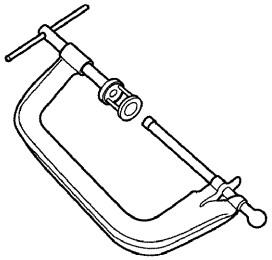
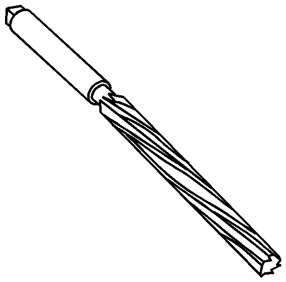
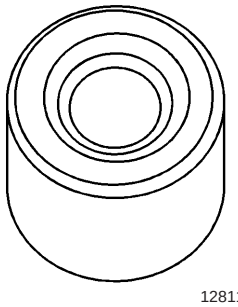
The timing belt connects the camshaft timing pulley and the crankshaft timing pulley. The timing belt coordinates the crankshaft and the camshaft and keeps them synchronized. The timing belt also turns the coolant pump. The timing belt and the pulleys are toothed so there is no slippage between them. There is a tension pulley that maintains the correct timing belt tension. The timing belt is made of a tough reinforced rubber similar to that used on the serpentine drive belt. The timing belt requires no lubrication.

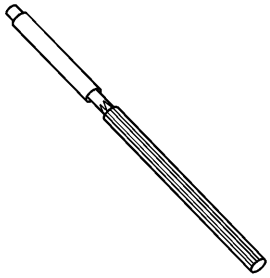
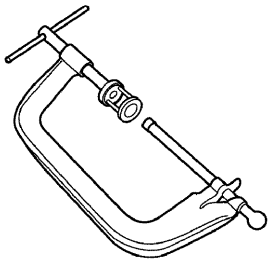
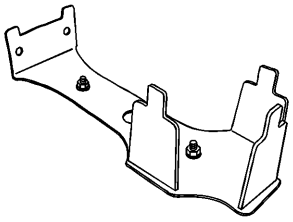
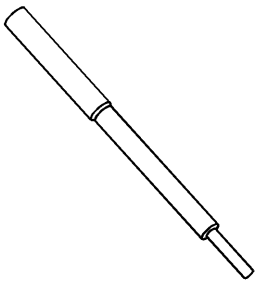
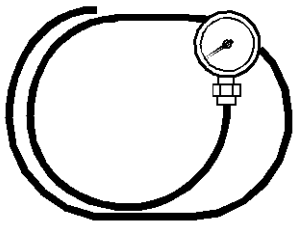
### Engine Mount

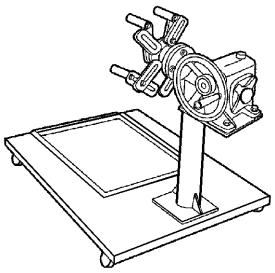
This is to absorb or reduce the engine vibration and impact from the wheeled road. Engine mount is attached to the engine-front side, the engine-right side and the engine–rear side one transaxle mount is attached to the transaxle side.

# Special Tools and Equipment

*SIE-ID = 1658958 Owner = dcobb01 LMD = 20-may-2005 LMB = kmicak01*

| Illustration | Tool Number/ Description |
|---|---|
|  1281150 | 09915-64510 Compression Pressure Gage |
|  1281164 | EN 46567 (DW 110-020-A) Engine Assembly Support Fixture |
|  1356142 | EN 46569 (09916-14510) Valve Spring Compressor |
|  1281159 | EN 46570 (09916-38210) Valve Guide Reamer (11 mm or 0.4331 in) |
|  1281163 | EN 46573 (09917-88220) Valve Guide Installer Attachment |

| Illustration | Tool Number/ Description |
|---|---|
|  1281158 | EN 46597 (09916–37320) Valve Guide Reamer (5 mm or 0.1969 in) |
|  1281157 | EN 47518 Valve Spring compressor |
|  1641095 | EN 47936 Engine Support Fixture – 1.0L |
|  1281160 | EN 48571 Valve Guide Remover |
|  29339 | J 21867 (09915-64510) Oil Pressure Gage |

| Illustration | Tool Number/ Description |
|---|---|
|  1281167 | OTC 1726<br>(KM-412)<br>Engine Overhaul Stand |