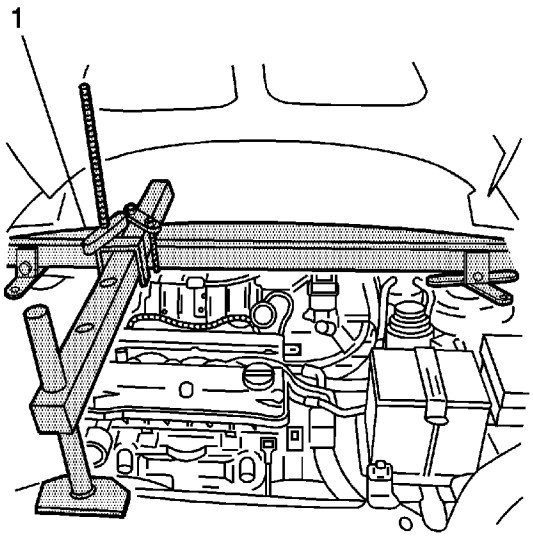
Engine Mount Replacement

Special Tools

J 28467-B (DW-117) Universal Engine Support Fixture

Removal Procedure

Warning: Refer to Battery Disconnect Warning in the Preface section.



1. Disconnect the negative battery cable.
2. Remove the upper radiator cover.
3. Remove the right front splash shield.
4. Support the engine assembly using the J 28467-B (1).

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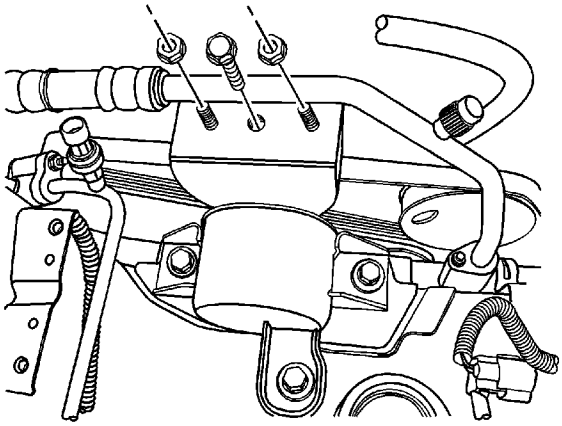
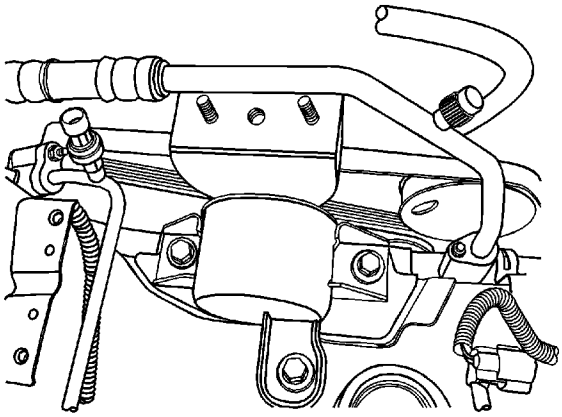
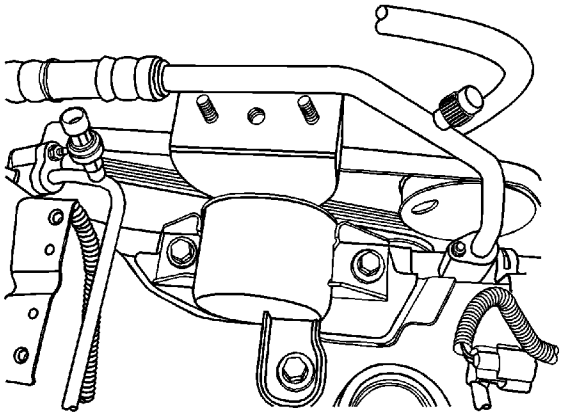


5. Remove the engine mount bracket retaining bolts.



6. Remove the engine mount retaining nuts.
7. Lower the engine.
8. Remove the engine mount.

Installation Procedure

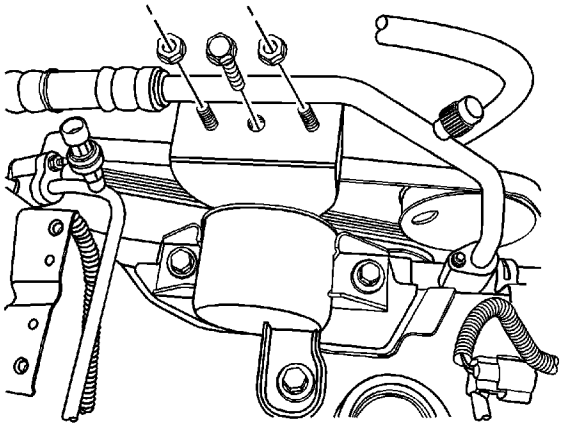


1. Install the engine mount.
2. Raise the engine.

Caution: Refer to Fastener Caution in the Preface section.

3. Install the engine mount retaining nuts.

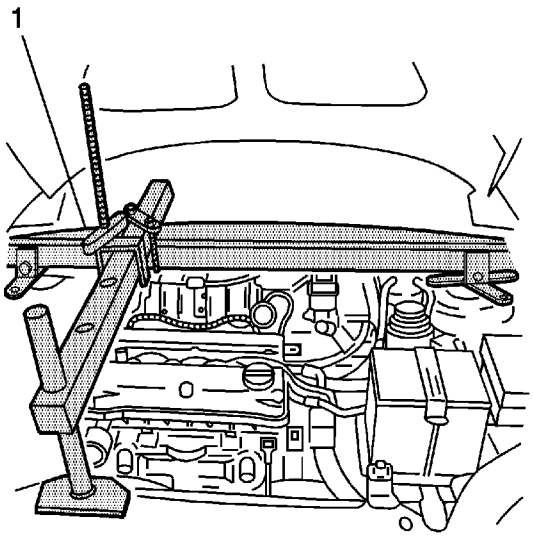
Tighten
Tighten the engine mount retaining nuts to 40 N·m (30 lb ft).



4. Install the engine mount bracket retaining bolts.

Tighten

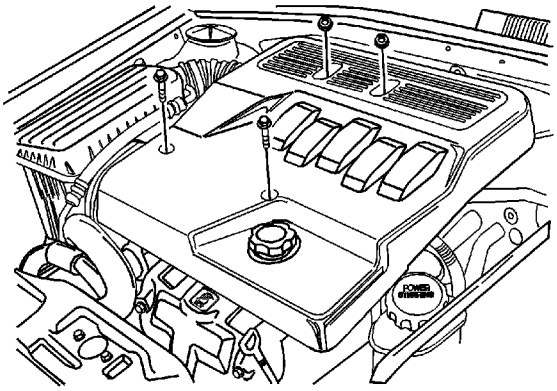
Tighten the engine mount bracket retaining bolts to 55 N·m (41 lb ft).



5. Remove J 28467-B (1).
6. Install the right front splash shield.
7. Install the upper radiator cover.
8. Connect the negative battery cable.

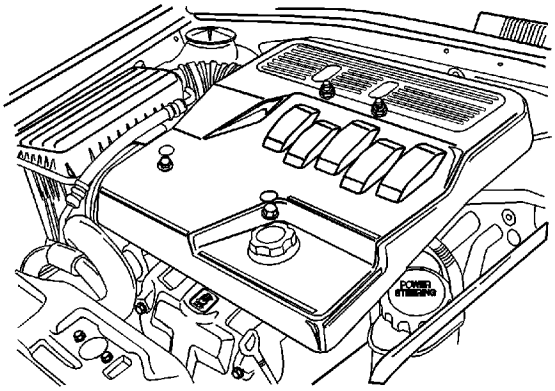
Engine Cover Replacement

Removal Procedure



1. Remove the bolts and nuts from the engine cover.
2. Remove the engine cover.

Installation Procedure



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1. Position the engine cover on the engine.

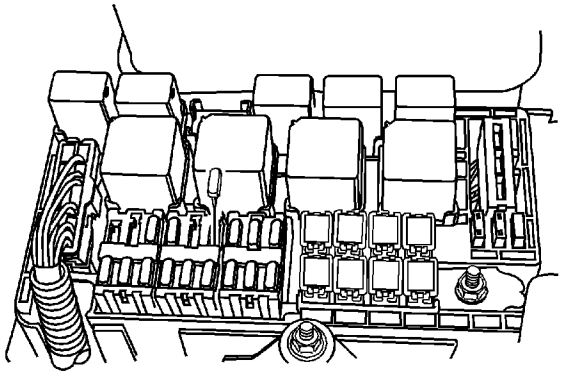
   Caution: Refer to Fastener Caution in the Preface section.

2. Install the engine cover bolts and nuts.

   Tighten
   Tighten the engine cover bolts and nuts to 10 N·m (89 lb ft).

Intake Manifold Replacement

Removal Procedure



1. Remove the fuel pump fuse.
2. Start the engine. After it stalls, crank the engine for 10 seconds to rid the fuel system of fuel pressure.

   Warning: Refer to Battery Disconnect Warning in the Preface section.

3. Disconnect the negative battery cable.

   Warning: Refer to Safety Glasses Warning in the Preface section.

4. Drain the engine coolant. Refer to Cooling System Draining and Filling.

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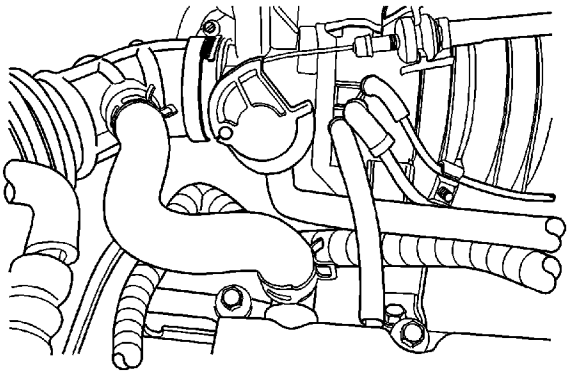
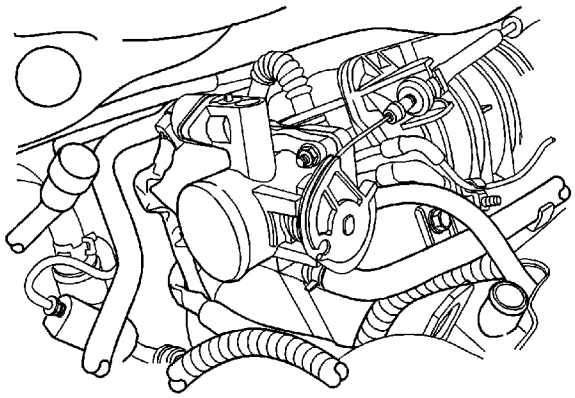
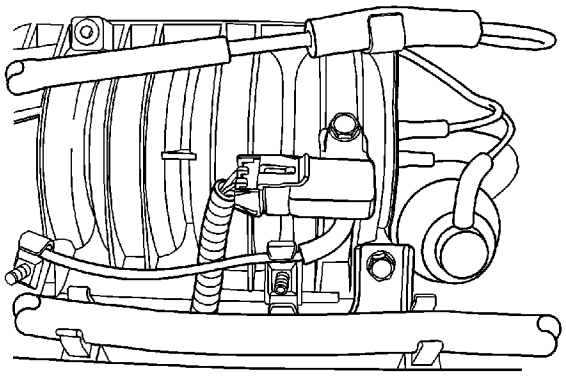


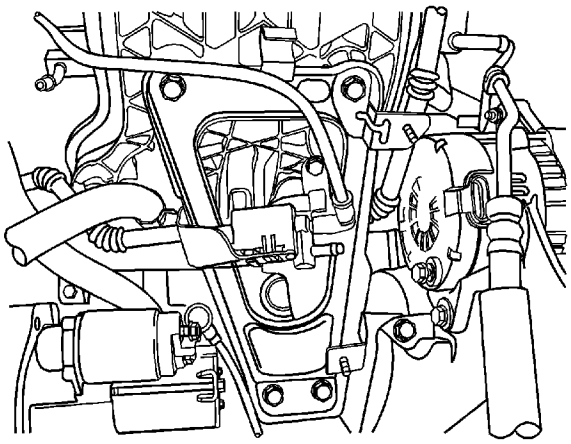
5. Disconnect the intake air temperature (IAT) sensor connector.
6. Disconnect the air intake tube from the throttle body.



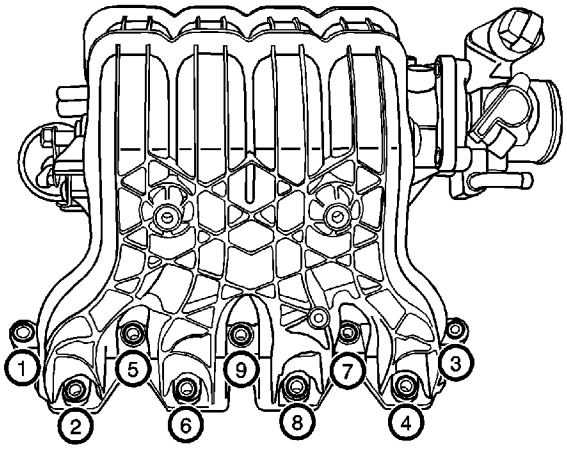
7. Disconnect the idle air control (IAC) valve connector.
8. Disconnect the throttle position sensor (TPS) connector.
9. Remove the alternator adjusting bolt and the alternator drive belt.
10. Disconnect the engine coolant temperature (ECT) sensor connector.
11. Disconnect the heater inlet hose from the cylinder head.
12. Disconnect the surge tank coolant hose at the throttle body.



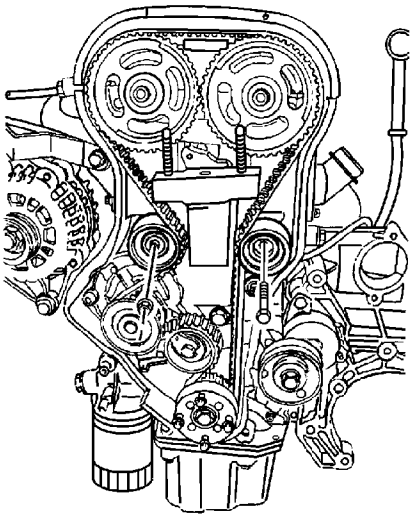
13. Disconnect all of the necessary vacuum hoses, including the vacuum hose at the fuel pressure regulator and the brake boaster vacuum hose at the intake manifold.
14. Disconnect the throttle body cable from the throttle body and the intake manifold.



15. Remove the fuel injector rail and fuel injectors as an assembly.
16. Remove the alternator adjusting bracket bolt from the intake manifold.
17. Remove the alternator adjusting bracket.
18. Remove the intake manifold support bracket bolts and the intake manifold.
19. Remove the intake manifold support bracket.

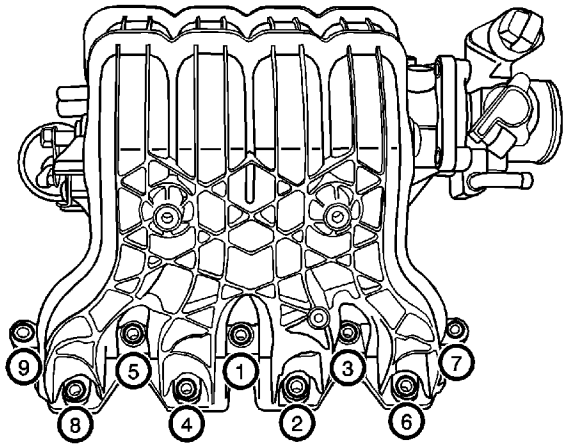


20. Remove the intake manifold retaining nuts/bolts in the sequence shown.
21. Remove the intake manifold.
22. Remove the intake manifold gasket.
23. Clean the sealing surfaces of the intake manifold and the cylinder head.



24. Remove the alternator. Refer to Generator Replacement.
25. Remove the intake manifold support bracket.

Installation Procedure

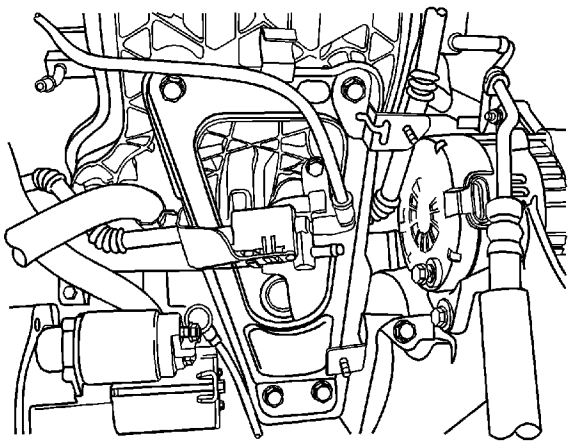


1. Install the intake manifold gasket.
2. Install the intake manifold.

Caution: Refer to Fastener Caution in the Preface section.

3. Install the intake manifold retaining nuts/bolts in the sequence shown.

Tighten
Tighten the intake manifold retaining nuts/bolts to 25 N·m (18 lb ft).

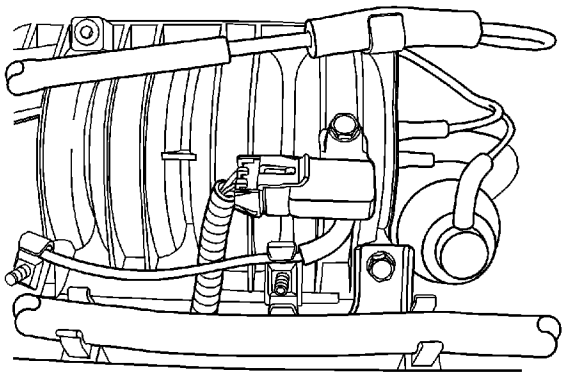


4. Install the intake manifold support bracket.
5. Install the intake manifold support bracket upper bolts to the intake manifold.

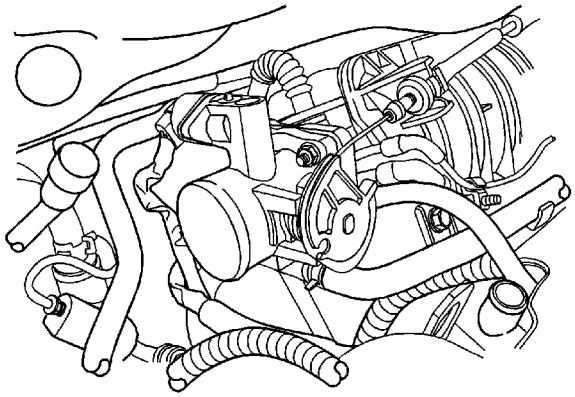
Tighten
Tighten the intake manifold support bracket upper bolts to 25 N·m (18 lb ft).

6. Install the intake manifold support bracket lower bolt-to-engine block.

Tighten
Tighten the intake manifold support bracket lower bolt-to-engine block to 40 N·m (30 lb ft).



7. Install the fuel rail and fuel injectors as an assembly.
8. Connect the throttle cable to the intake manifold and the throttle body.
9. Connect all of the necessary vacuum lines that were previously disconnected.
10. Connect the heater inlet hose to the cylinder head.
11. Connect the surge tank coolant hose to the throttle body.
12. Install the alternator adjusting bracket at the intake manifold.



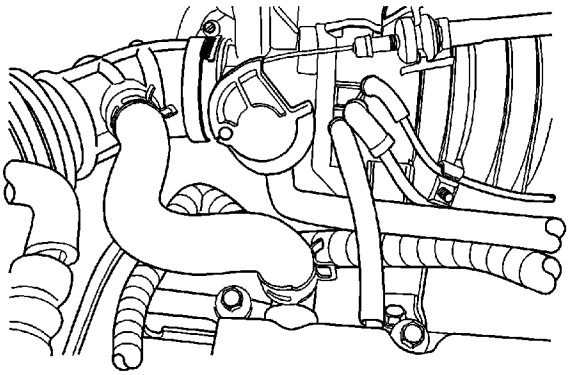
13. Install the alternator adjusting bracket bold.

    Tighten
    Tighten the alternator adjusting bracket bolts to 15 N·m (11 lb ft).

14. Install the alternator adjusting bolt and the alternator drive belt.

    Tighten
    Tighten the alternator adjusting bolts to 15 N·m (11 lb ft).

15. Connect the ECT sensor connector.
16. Connect the IAC valve connector.
17. Connect the TPS connector.



18. Connect the air intake tube to the throttle body.
19. Connect the IAT sensor connector.
20. Connect the powertrain control module (PCM)/engine control module (ECM) ground terminal to the intake manifold.
21. Install the fuel pump fuse.
22. Connect the negative battery cable.
23. Refill the engine cooling system. Refer to Cooling System Draining and Filling.

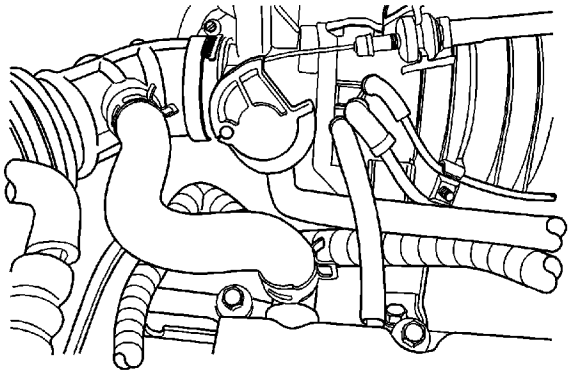
Timing Belt Replacement

Special Tools

- J 42492-A (KM-421-A) Timing Belt Adjuster
- J 45059 Angle Meter
- KM-470-B Angular Torque Gage

Removal Procedure

Warning: Refer to Battery Disconnect Warning in the Preface section.



1. Disconnect the negative battery cable.
2. Disconnect the intake air temperature (IAT) sensor connector.
3. Disconnect the air intake tube from the throttle body.
4. Disconnect the breather tube from the valve cover.

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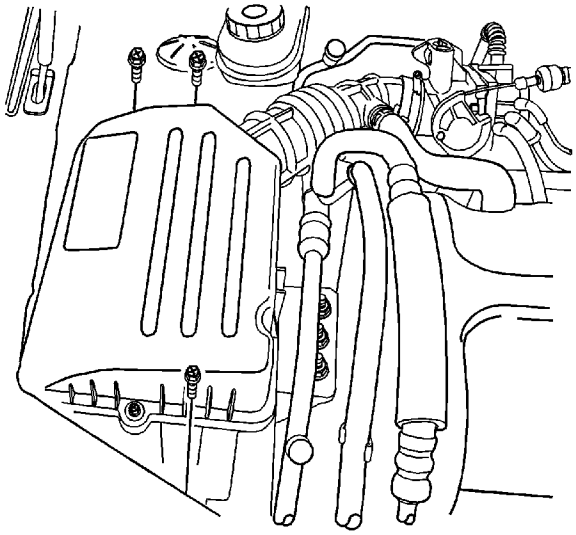
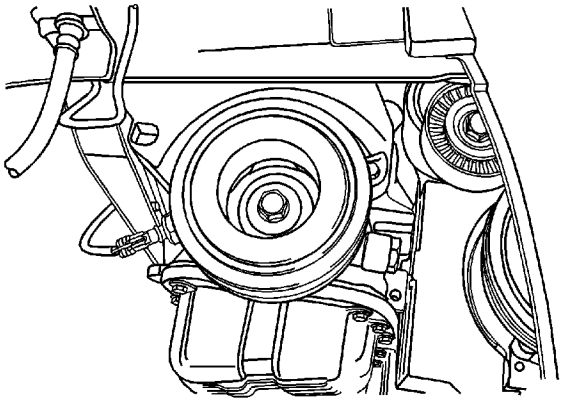
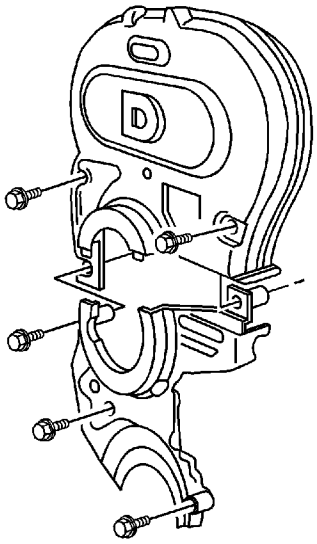


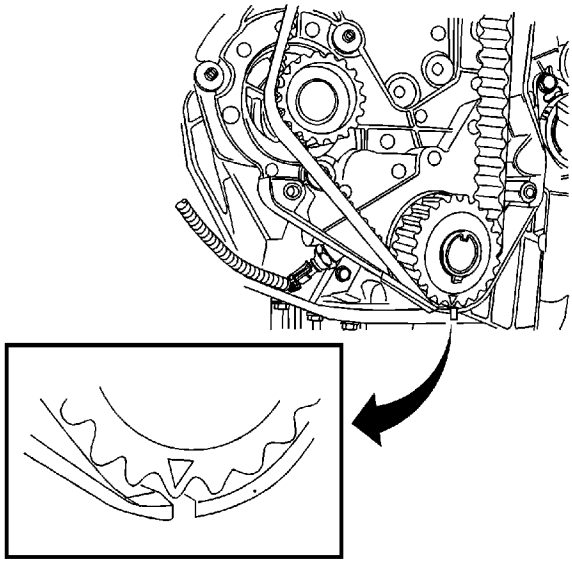
5. Remove the air filter housing bolts.
6. Remove the air filter housing.
7. Remove the right front wheel. Refer to Tire and Wheel Removal and Installation
8. Remove the right front splash shield.



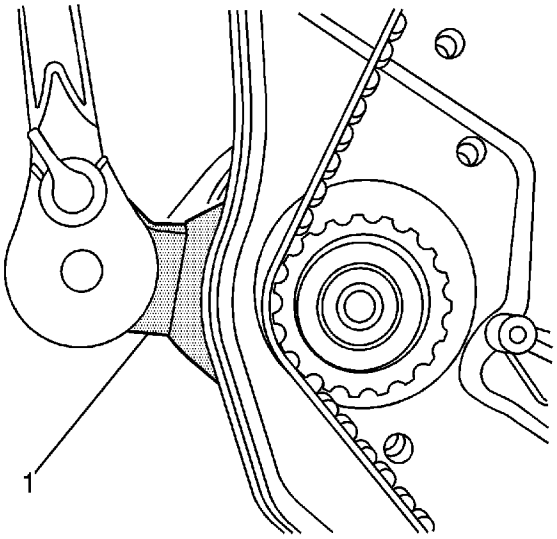
9. Remove the accessory drive belt.
10. Remove the crankshaft pulley bolt.
11. Remove the crankshaft pulley.



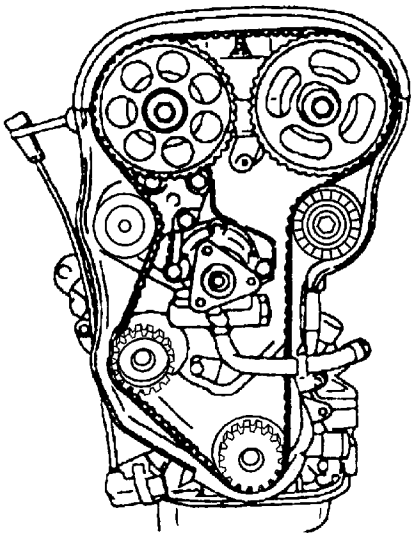
12. Remove the upper front timing belt cover bolts.
13. Remove the upper front timing belt cover by prying on the two tabs located on each side of the cover.
14. Remove the lower front timing belt cover bolts.
15. Remove the lower front timing belt cover.
16. Remove the power steering pump mounting bolts, if equipped.
17. Install the crankshaft pulley bolt.



18. Using the crankshaft pulley bolt, rotate the crankshaft clockwise until the timing mark on the crankshaft gear is aligned with the timing mark at the bottom of the rear timing belt cover.



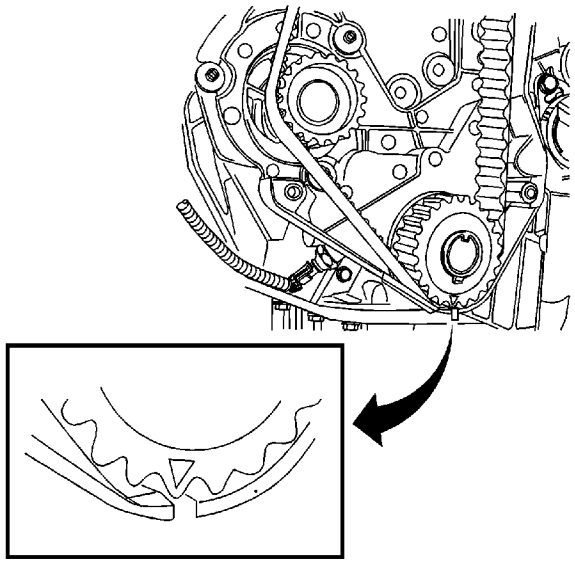
19. Slightly loosen the coolant pump retaining bolts.
20. Using the J 42492-A



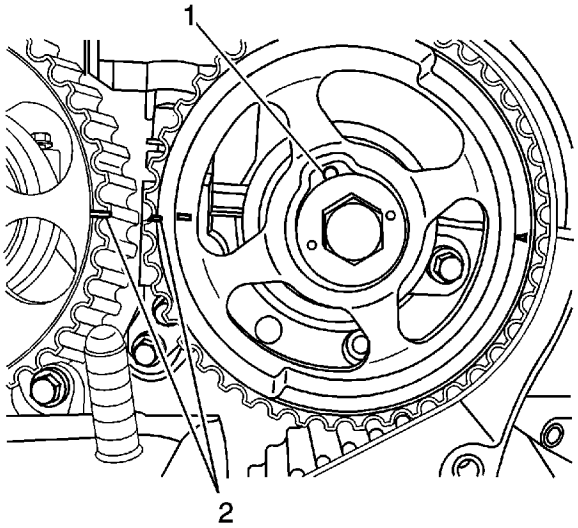
Note: Remove the timing belt behind the power steering pump.

21. Remove the timing belt.

Installation Procedure

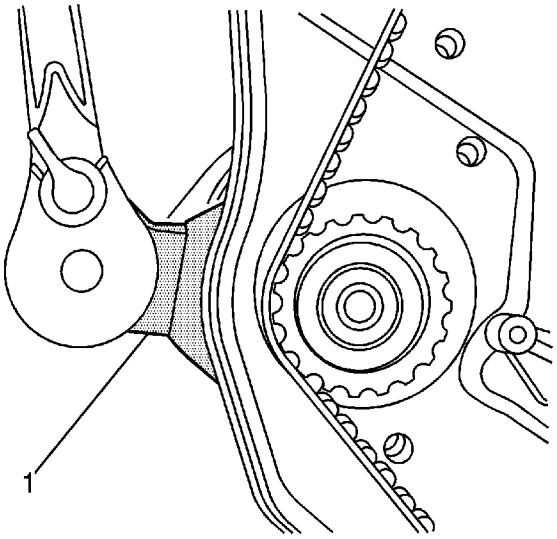


1. Align the timing mark on the crankshaft gear to the timing mark on the bottom of the rear timing belt cover.

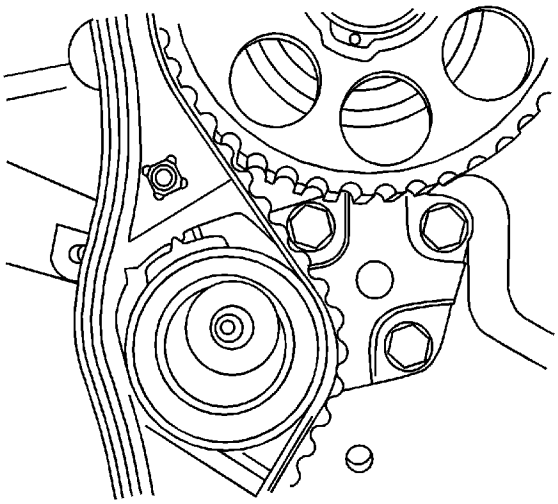


Note: Ensure that the exhaust camshaft gear dowel pin is approximately in the 11 o'clock position.

2. Align the timing marks on the camshaft gears.
3. Install the timing belt.

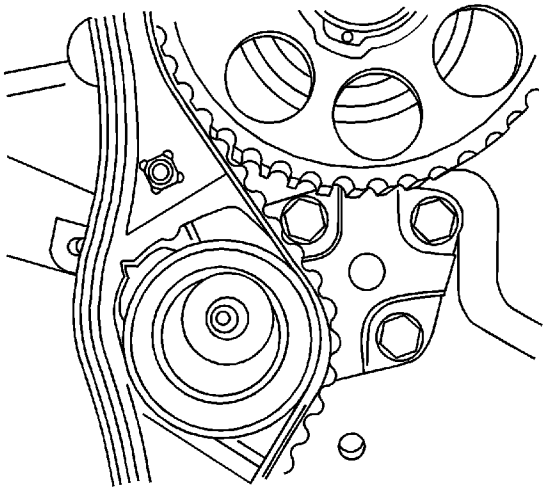


4. Rotate the coolant pump clockwise using the J 42492-A

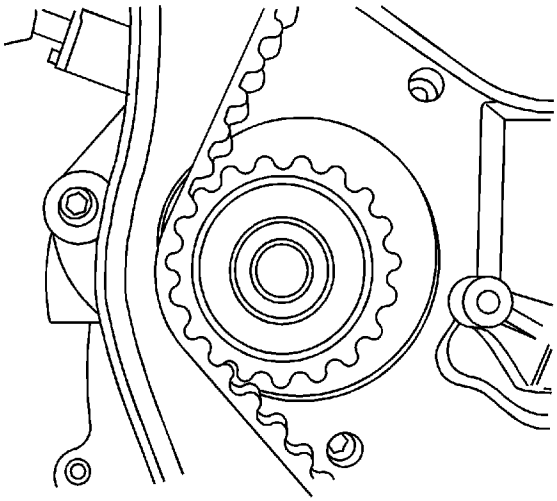


5. Rotate the coolant pump clockwise until the adjust arm pointer of the timing belt automatic tensioner is aligned to the notch in the timing belt automatic tensioner bracket.

Caution: Refer to Fastener Caution in the Preface section.

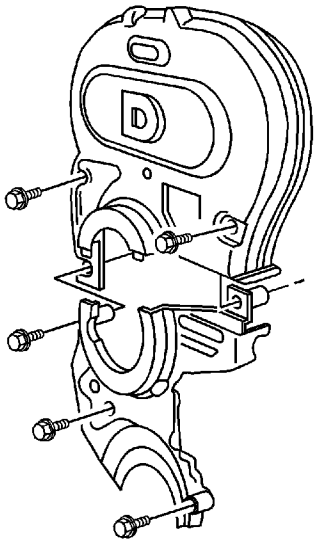


6. Tighten the coolant pump retaining bolts.
7. Rotate the crankshaft 2 full turns clockwise using the crankshaft pulley bolt.
8. Loosen the coolant pump retaining bolts.
9. Rotate the coolant pump until the adjust arm pointer of the timing belt automatic tensioner is aligned with the pointer on the timing belt automatic tensioner bracket.



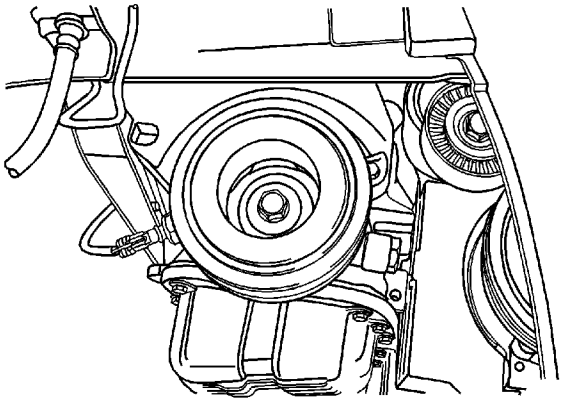
10. Tighten the coolant pump retaining bolts.

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



11. Remove the crankshaft pulley bolt.
12. Install the upper and lower front timing belt cover.
13. Install the upper and lower front timing belt cover bolts.

Tighten
Tighten the upper and lower front timing belt cover bolts to 10 N·m (89 lb in).

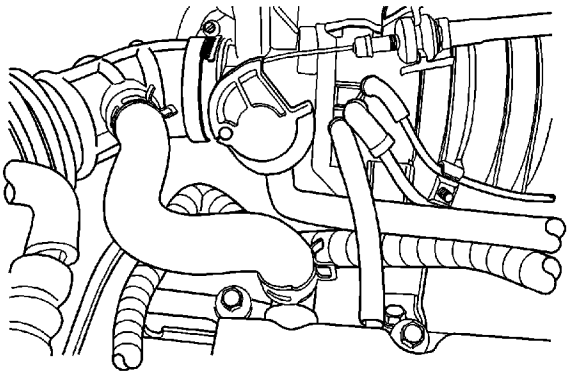


14. Install the crankshaft pulley.
15. Install the crankshaft pulley bolt.

Tighten
Tighten the crankshaft pulley bolt to 95 N·m (70 lb ft) using a torque wrench. Using the J

45059 or the KM-470-B , tighten the crankshaft pulley bolt 30 degrees plus 15 degrees.

16. Install the accessory drive belt, if equipped.
17. Install the right front splash shield.
18. Install the right front wheel. Refer to Tire and Wheel Removal and Installation



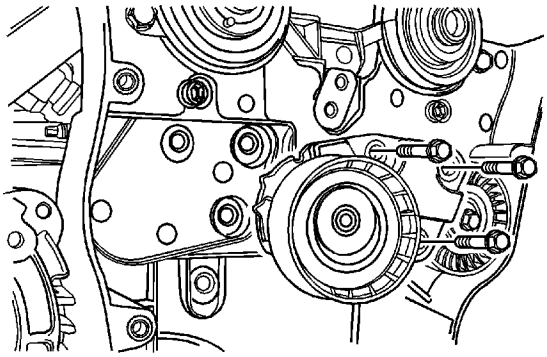
19. Install the air filter housing.
20. Install the air filter housing bolts.

Tighten
Tighten the air filter housing bolts to 8 N·m (71 lb in).

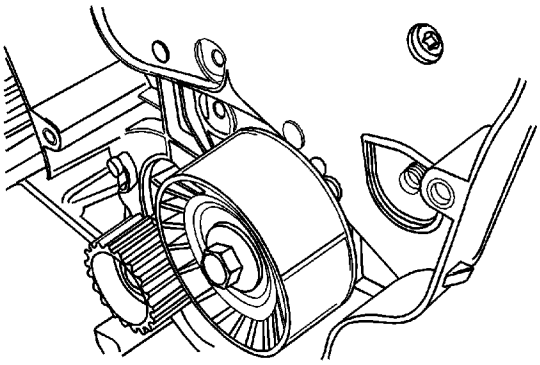
21. Connect the air intake tube to the throttle body.
22. Connect the breather tube to the throttle body.
23. Connect the IAT sensor connector.
24. Connect the negative battery cable.

Timing Belt Cover Replacement

Removal Procedure



1. Remove the timing belt. Refer to Timing Belt Replacement
2. Remove the camshaft gears. Refer to Camshaft Gear Replacement
3. Remove the crankshaft gear.
4. Remove the timing belt automatic tensioner bolts.
5. Remove the timing belt automatic tensioner.



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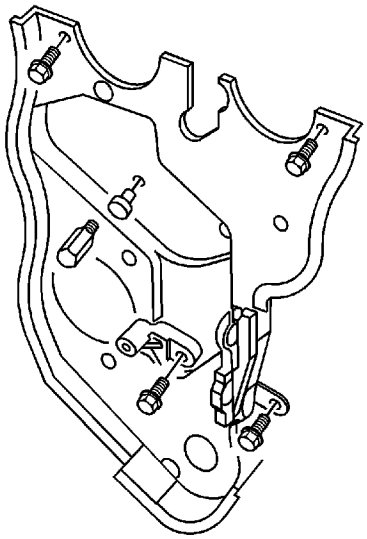
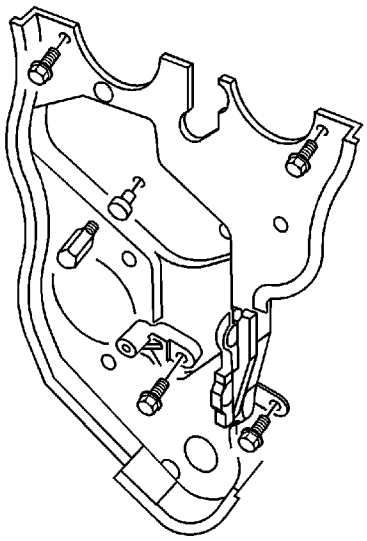
6. Remove the timing belt idler pulley bolt.
7. Remove the timing belt idler pulley.



8. Remove the rear timing belt cover bolts.
9. Remove the rear timing belt cover.

Installation Procedure

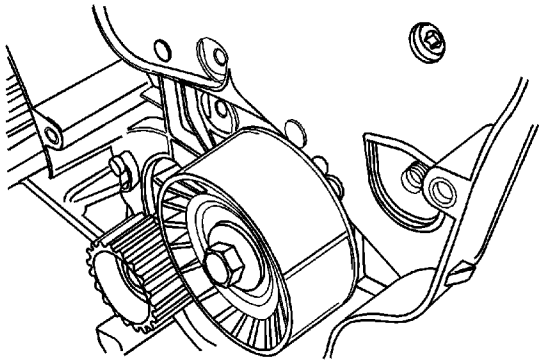


1. Install the rear timing belt cover.

   Caution: Refer to Fastener Caution in the Preface section.

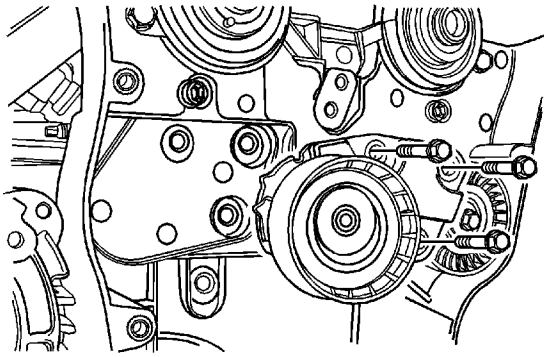
2. Install the rear timing belt cover bolts.

Tighten
Tighten the rear timing belt cover bolts to 10 N·m (89 lb in).



3. Install the timing belt idler pulley.
4. Install the timing belt idler pulley bolt.

Tighten
Tighten the timing belt idler pulley bolt to 40 N·m (30 lb ft).



5. Install the timing belt automatic tensioner.
6. Install the timing belt automatic tensioner bolts.

Tighten
Tighten the timing belt automatic tensioner bolts to 25 N·m (18 lb ft).

7. Install the crankshaft gear.

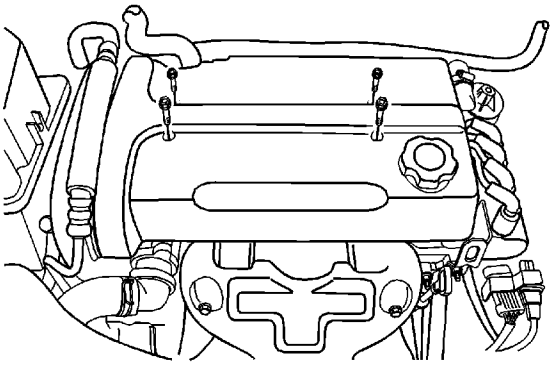
Note: Take extreme care to prevent any scratches, nicks or damage to the camshafts.

8. Install the camshaft gears. Refer to Camshaft Gear Replacement
9. Install the timing belt. Refer to Timing Belt Replacement

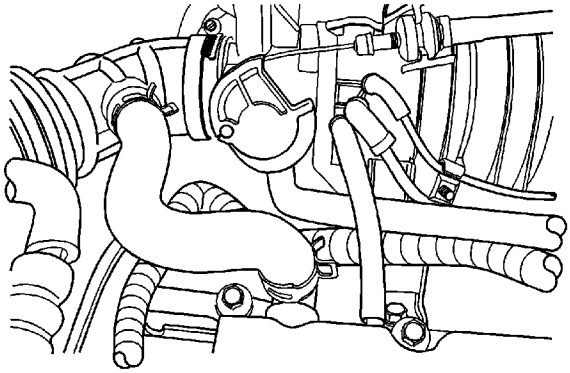
Valve Rocker Arm Cover Replacement

Removal Procedure

Warning: Refer to Battery Disconnect Warning in the Preface section.



1. Disconnect the negative battery cable.
2. Remove the engine cover bolts and cover.



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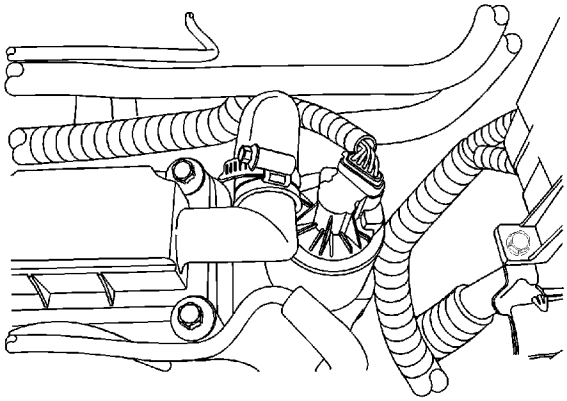
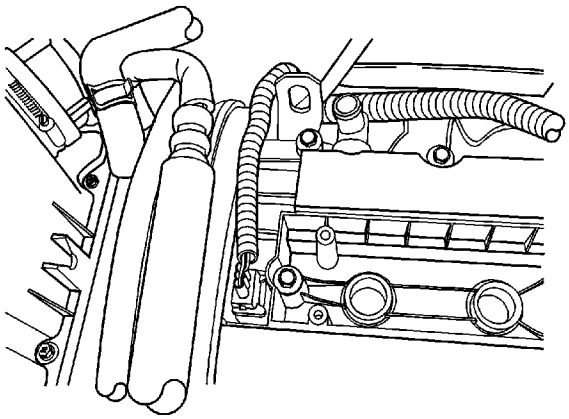
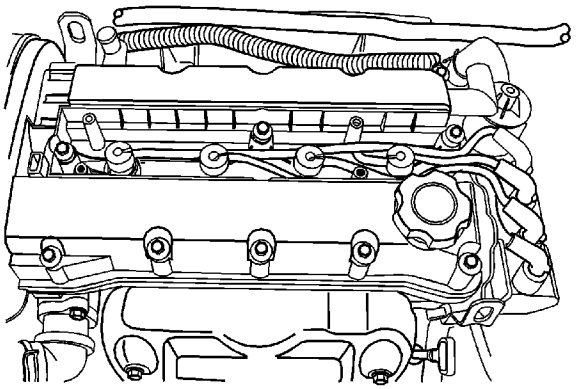
3. Disconnect the breather tube from the valve cover.



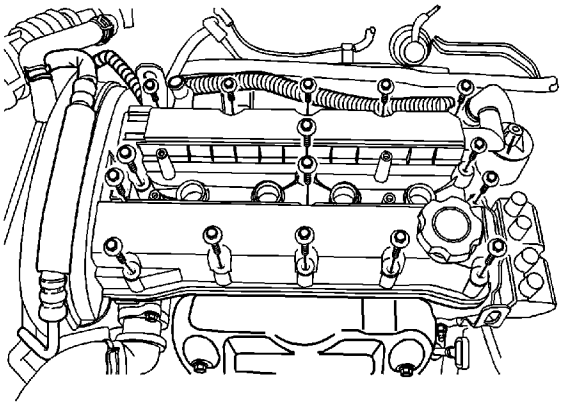
4. Disconnect the crankcase ventilation tube from the valve cover.



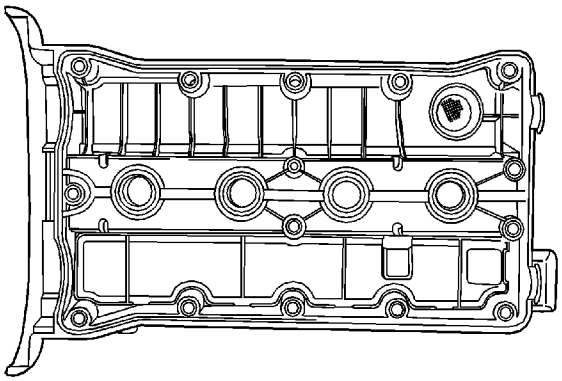
5. Disconnect the camshaft position (CMP) sensor connect.



6. Disconnect all of the necessary vacuum lines.
7. Disconnect the ignition wires from the spark plugs.

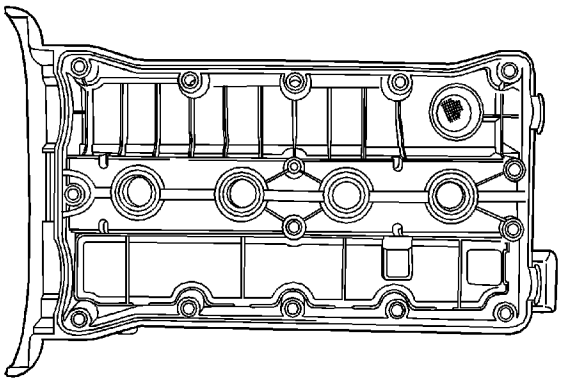


8. Remove the valve cover bolts.
9. Remove the valve cover.

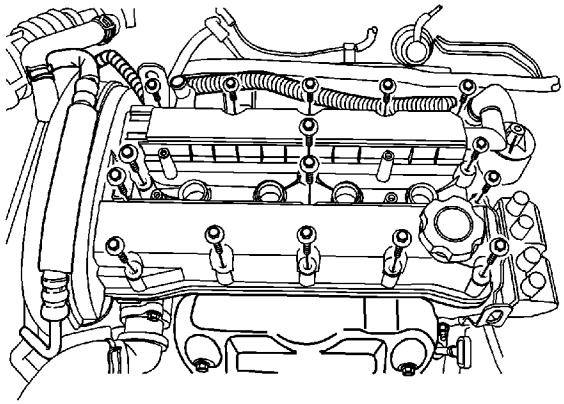


10. Remove the valve cover gasket from the valve cover.

Installation Procedure



1. Apply a small amount of gasket sealant to the corners of the front camshaft caps and the top of the rear valve cover to cylinder head seal.
2. Install the new valve cover gasket to the valve cover.

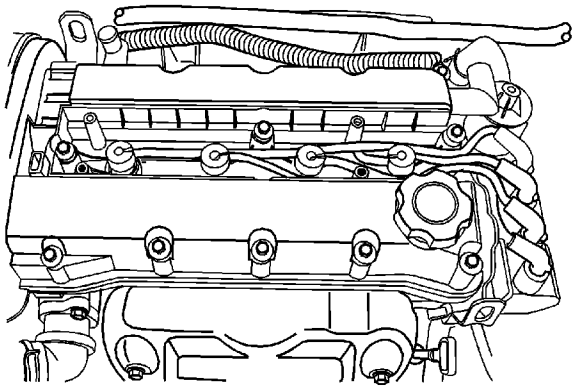


3. Install the valve cover.

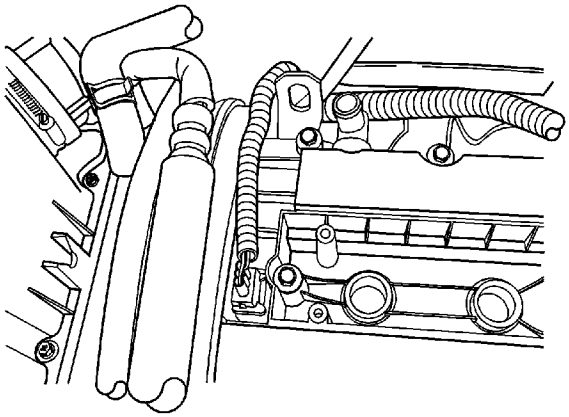
Caution: Refer to Fastener Caution in the Preface section.

4. Install the valve cover bolts.

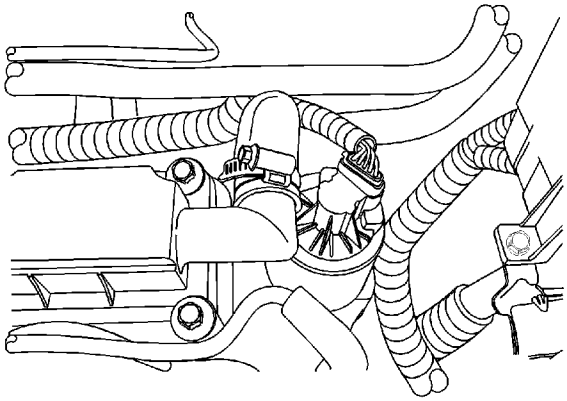
Tighten
Tighten the valve cover bolts to 10 N·m (89 lb in).



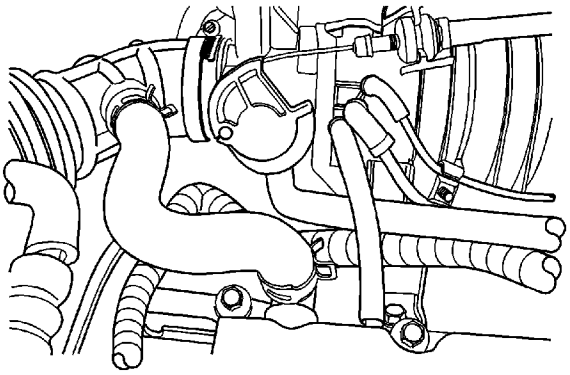
5. Connect the ignition wires from the spark plugs.
6. Connect all of the necessary vacuum lines.



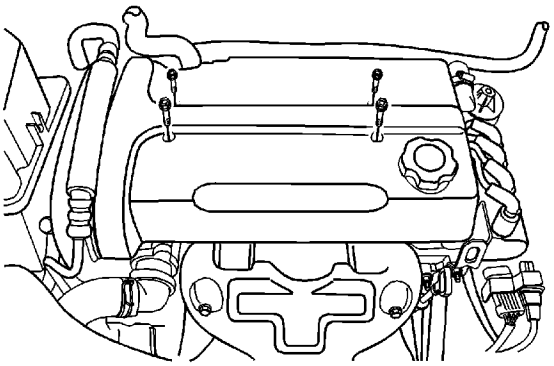
7. Connect the CMP sensor connector.



8. Connect the crankcase ventilation tube from the valve cover.



9. Connect the breather tube from the valve cover.



10. Install the spark plug cover.
11. Install the spark plug cover bolts.

Tighten
Tighten the engine cover bolts to 3 N·m (27 lb in).

12. Connect the negative battery cable.

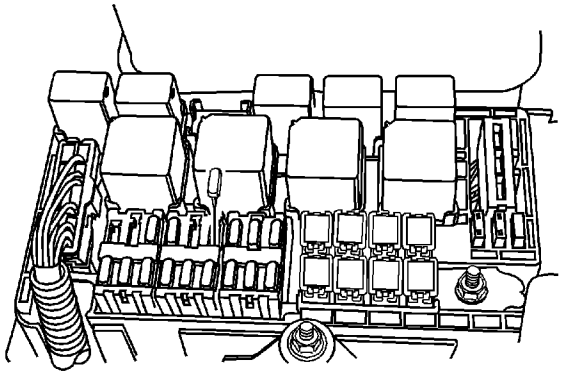
Cylinder Head Replacement

Special Tools

- *J-45059* Angle Meter
- *KM-470-B* Angular Torque Gage
- *J 42492-A* Timing Belt Adjuster

Removal Procedure

Warning: Refer to Safety Glasses Warning in the Preface section.



1. Remove the fuel pump fuse.
2. Start the engine. Crank the engine after the engine stalls for 10 seconds to rid the fuel system of fuel pressure.
3. Drain the engine coolant. Refer to Cooling System Draining and Filling.

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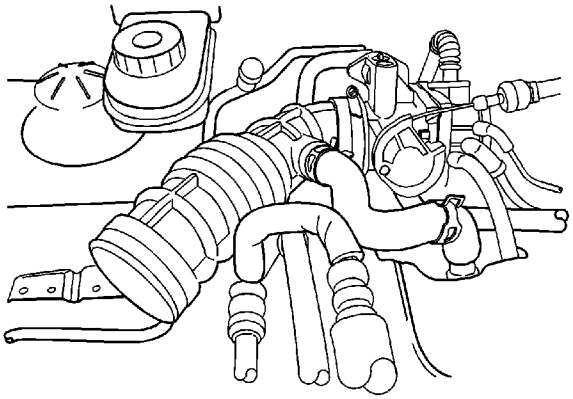
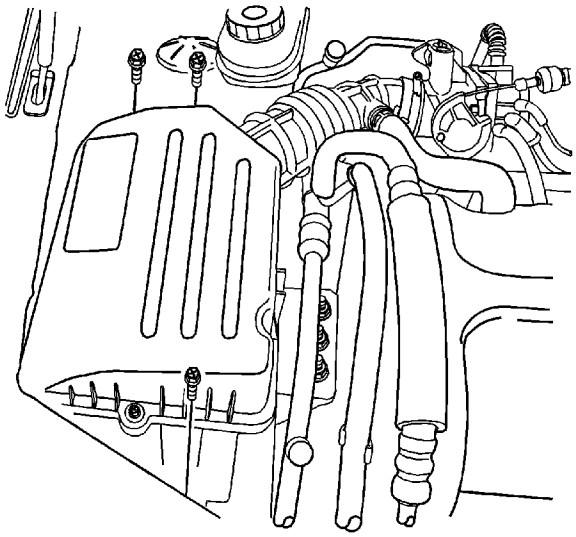
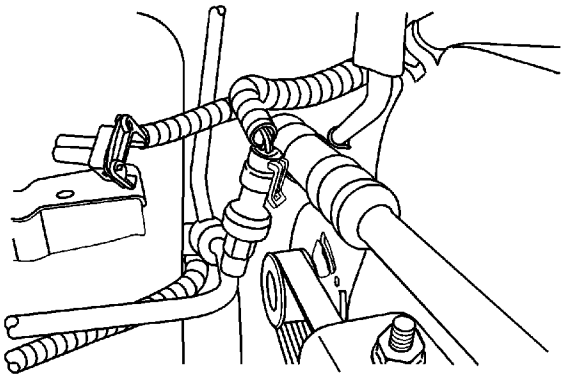


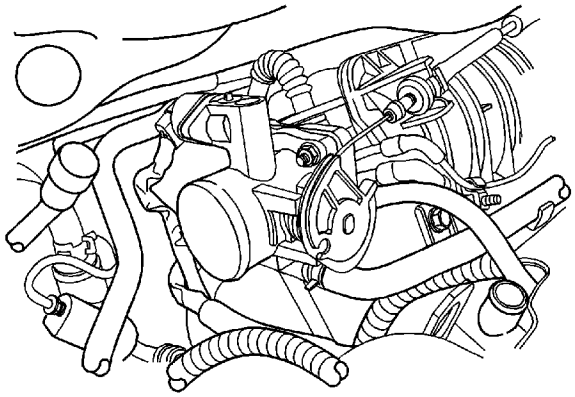
4. Disconnect the breather tube from the valve cover.
5. Disconnect the intake air temperature (IAT) sensor connector.
6. Disconnect the air intake tube from the throttle body.



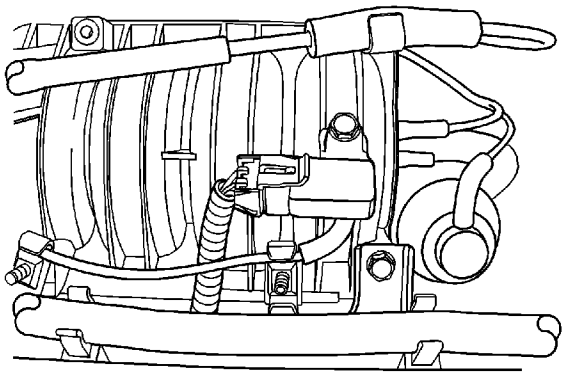
7. Remove the air filter housing bolts.
8. Remove the air filter housing.



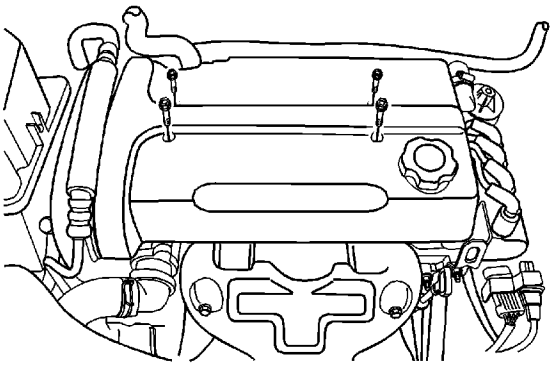
9. Disconnect the A/C pressure (ACP) transducer connector.



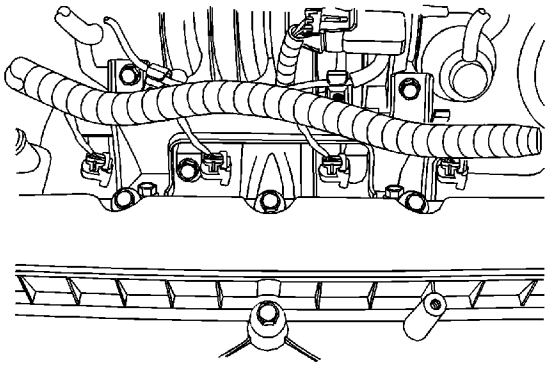
10. Disconnect the idle air control (IAC) valve connector.
11. Disconnect the throttle position (TP) sensor connector.
12. Disconnect the throttle cable from the throttle body and the intake manifold.
13. Disconnect the engine coolant inlet/outlet hose at the throttle body.



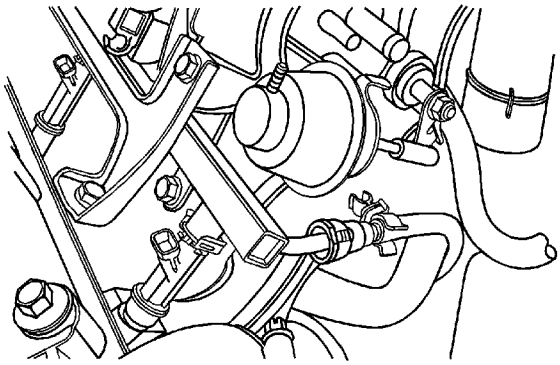
14. Disconnect the manifold absolute pressure (MAP) sensor connector.
15. Disconnect the brake booster vacuum hose.
16. Disconnect the variable geometry induction solenoid (VGIS) connector.
17. Disconnect the VGIS vacuum tank hose.



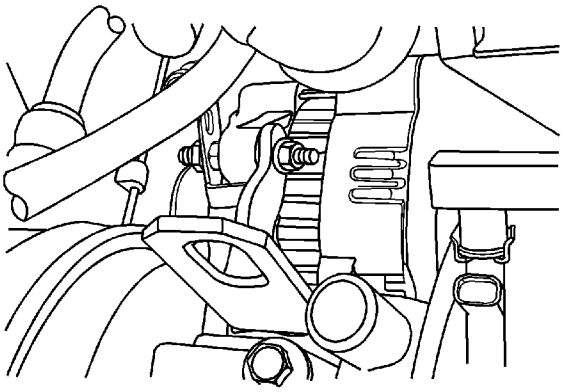
18. Remove the engine cover bolts and the cover.
19. Disconnect the breather tube from the valve cover.
20. Disconnect the crankcase ventilation tube from the valve cover.



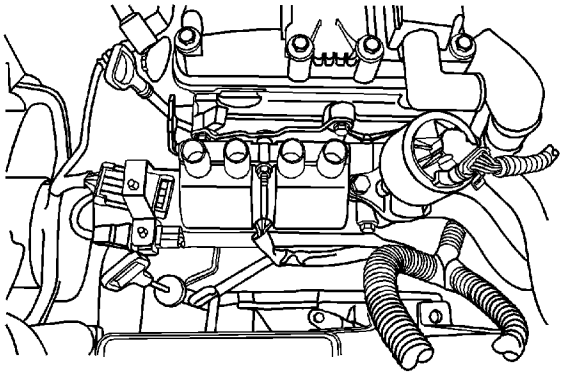
21. Disconnect the camshaft position (CMP) sensor connector.
22. Disconnect the ignition wires from the spark plugs.
23. Disconnect the fuel injector harness connectors.



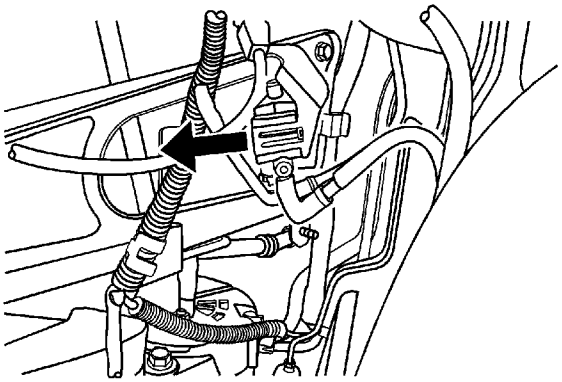
24. Disconnect the fuel line.



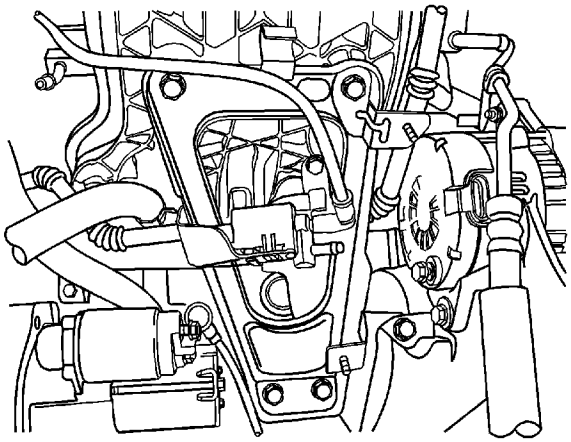
25. Remove the bracket nut from the power steering pressure pipe.
26. Remove the power steering pressure pipe.
27. Remove the alternator adjusting nut.



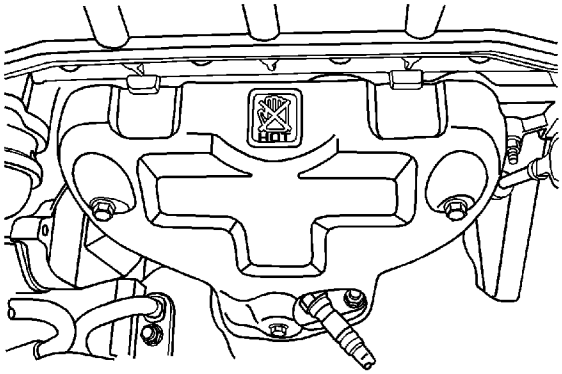
28. Remove the accessory drive bolt.
29. Disconnect the exhaust gas recirculation (EGR) valve connector.
30. Disconnect the ignition coil connector from the electronic ignition (EI) system.
31. Disconnect the front heated oxygen sensor (HO2S) connector.



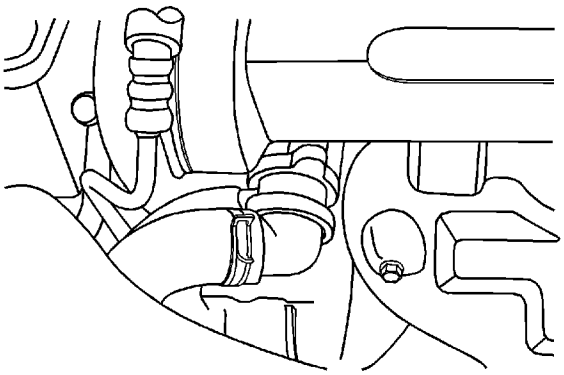
32. Remove the right front wheel. Refer to Tire and Wheel Removal and Installation.
33. Remove the engine under-cover bolt and the nuts.
34. Remove the engine under-cover.
35. Remove the canister purge solenoid valve at the intake manifold support bracket.



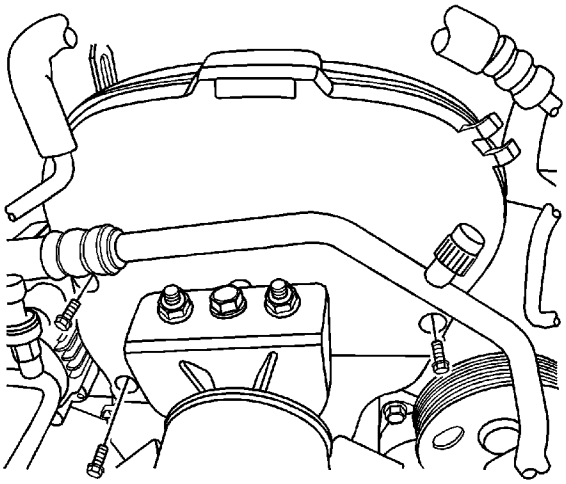
36. Remove the bracket bolts from the upper intake manifold support.
37. Remove the bracket bolts from the lower intake manifold support.
38. Disconnect the connector from the engine coolant temperature (ECT) sensor.



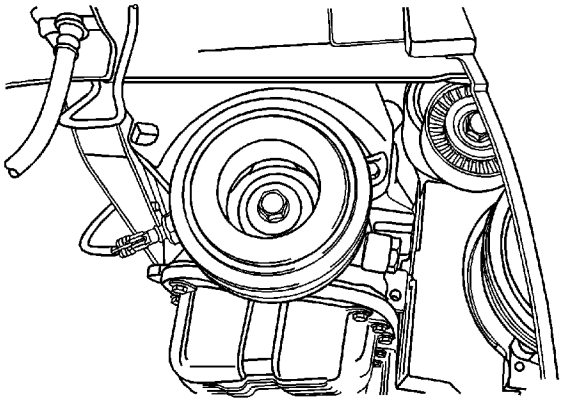
39. Remove the exhaust manifold heat shield bolts.
40. Remove the exhaust manifold heat shield.
41. Remove the catalytic converter. Refer to Catalytic Converter Replacement.



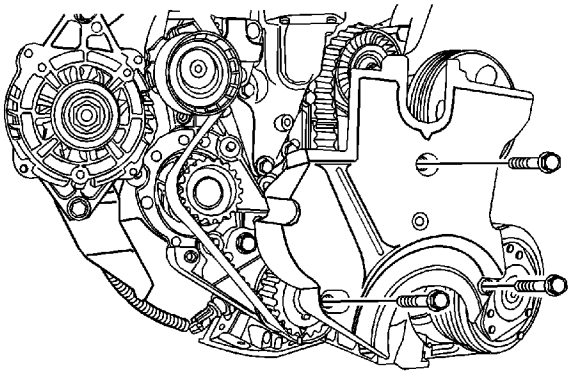
42. Loosen the hose clamp on the upper radiator hose at the thermostat housing.
43. Disconnect the upper radiator hose from the thermostat housing.



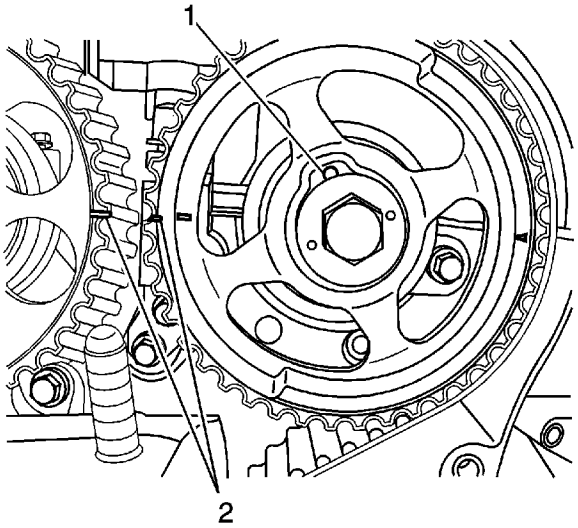
44. Remove the cover bolts from the upper front timing belt.
45. Remove the cover from the upper front timing belt.



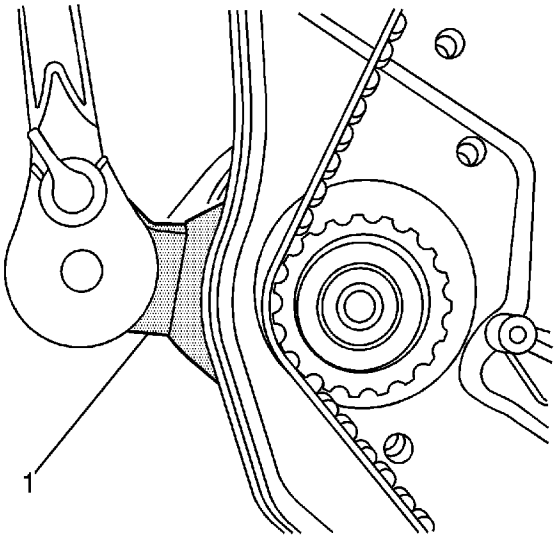
46. Remove the crankshaft pulley bolt.
47. Remove the crankshaft pulley.



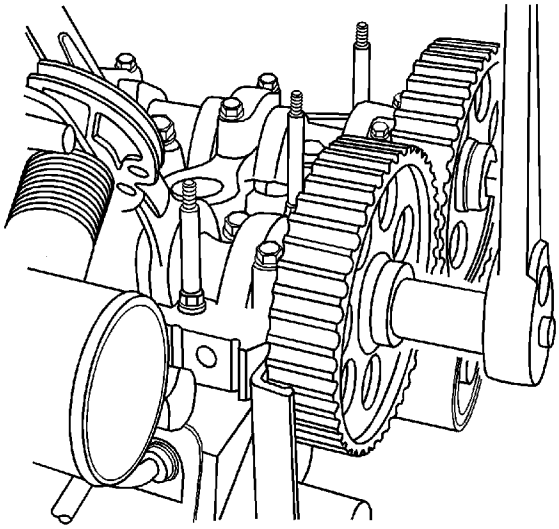
48. Remove the cover bolts from the lower front timing belt.
49. Remove the cover from the lower front timing belt.



50. Align the camshaft gear timing marks.



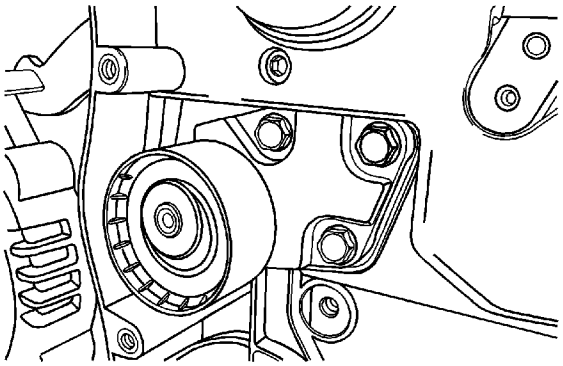
51. Slightly loosen the coolant pump retaining bolts.
52. Rotate the coolant pump counterclockwise using J 42492-A .
53. Remove the timing belt. Refer to Timing Belt Replacement.



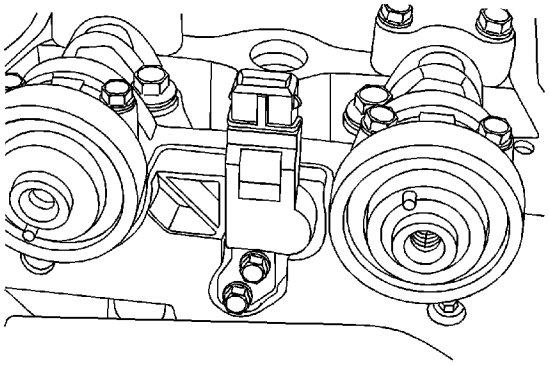
54. Remove the valve cover. Refer to Valve Rocker Arm Cover Replacement.

Caution: Use extreme care when installing the camshaft not to nick, scratch, or damage the camshaft lobes or bearing surfaces.

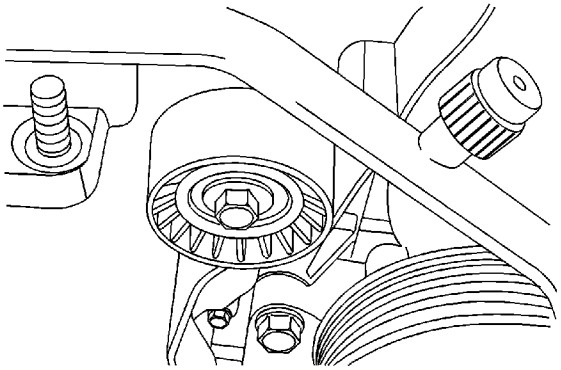
55. While holding the intake camshaft firmly in place, remove the intake camshaft gear bolt.
56. Remove the intake camshaft gear.
57. While holding the exhaust camshaft firmly in place, remove the exhaust camshaft gear bolt.
58. Remove the exhaust camshaft gear.



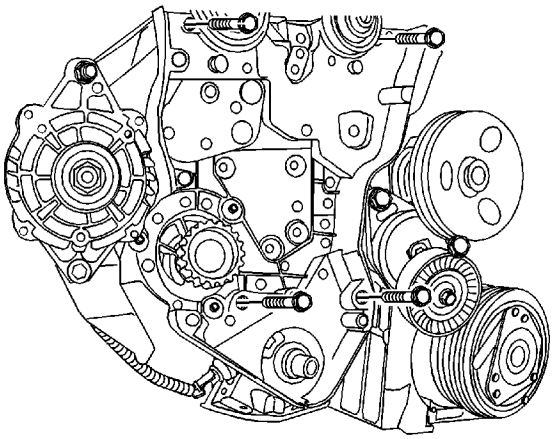
59. Remove the bolts from the timing belt automatic tensioner.
60. Remove the timing belt automatic tensioner.



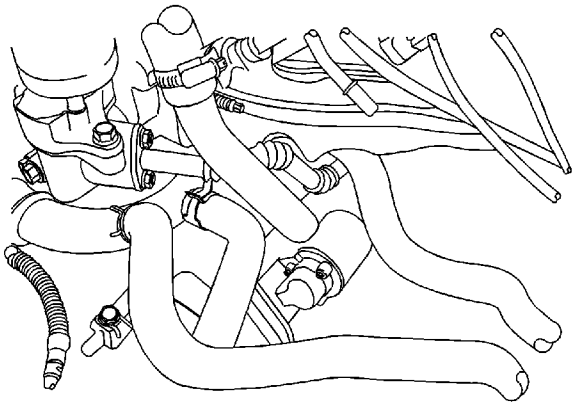
61. Remove the camshaft position (CMP) sensor bolts.
62. Remove the CMP sensor.



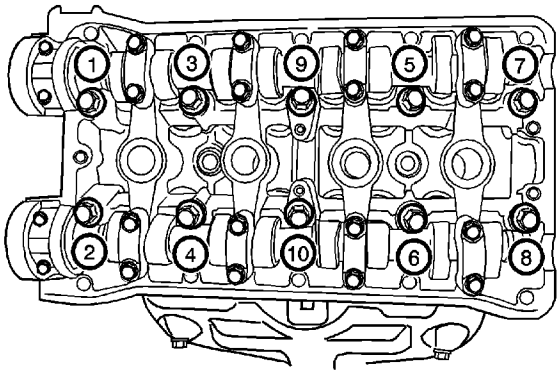
63. Remove the bolt from the timing belt idler pulley.
64. Remove the timing belt idler pulley.



65. Remove the bolts from the rear timing belt cover.
66. Remove the rear timing belt cover.



67. Disconnect the heater outlet hose from the coolant pipe.



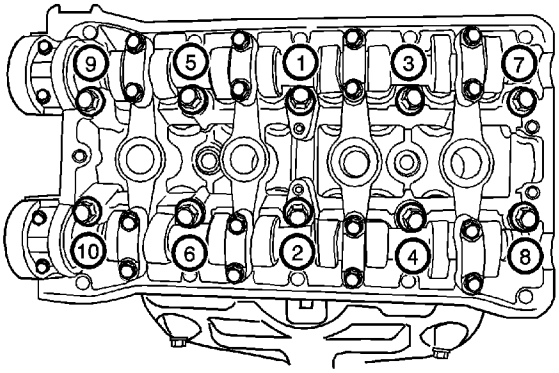
68. Loosen all of the cylinder head bolts gradually and in the sequence shown.
69. Remove and discard the cylinder head bolts.
70. Remove the cylinder head with the intake manifold and the exhaust manifold attached.

Caution: Use extreme care when removing the cylinder head to prevent any engine oil , dirt, or coolant from entering the engine. Damage to the engine could result.

71. Remove the cylinder head gasket.
72. Disassembly the cylinder head, if applicable. Refer to Cylinder Head Disassemble.
73. Clean and inspect the cylinder head as necessary. Refer to Cylinder Head Cleaning and Inspection.

Installation Procedure

1. Assemble the cylinder head, if applicable. Refer to Cylinder Head Assemble.

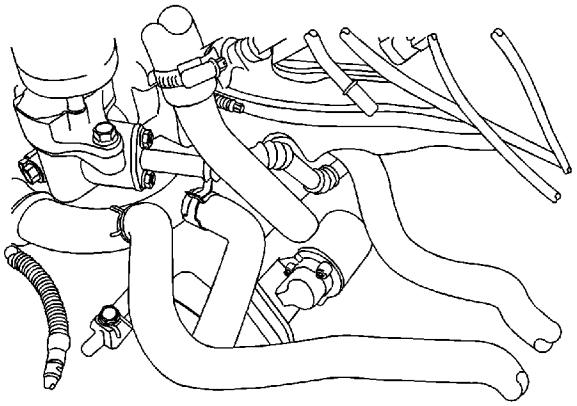


2. Install the cylinder head gasket.
3. Install the cylinder head with the intake manifold and the exhaust manifold attached.
4. Install new cylinder head bolts.

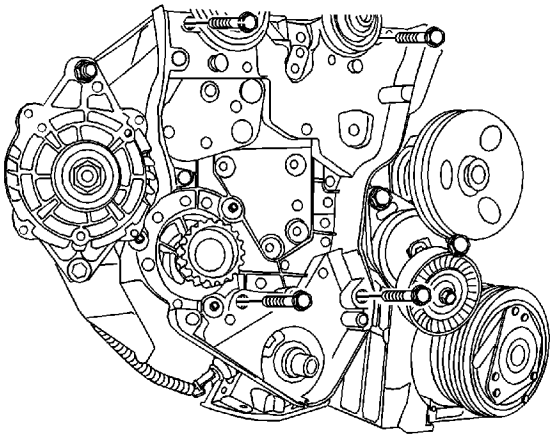
Caution: Refer to Fastener Caution in the Preface section.

5. Tighten the cylinder head bolts gradually and in the sequence shown.

Tighten
Tighten the bolts to 25 N·m (18 lb ft). Adjust the bolts to 60 degrees plus 60 degrees plus 60 degrees plus 10 degrees using J 45059 or KM-470-B .

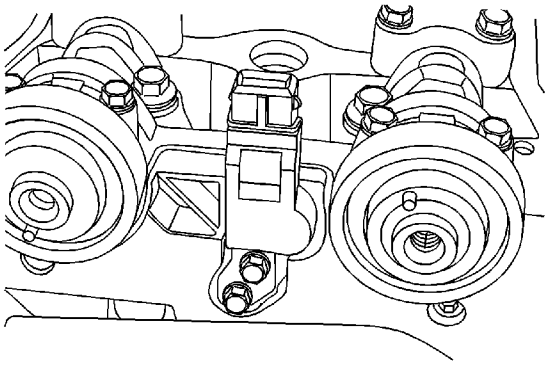


6. Connect the heater outlet hose to the coolant pipe.



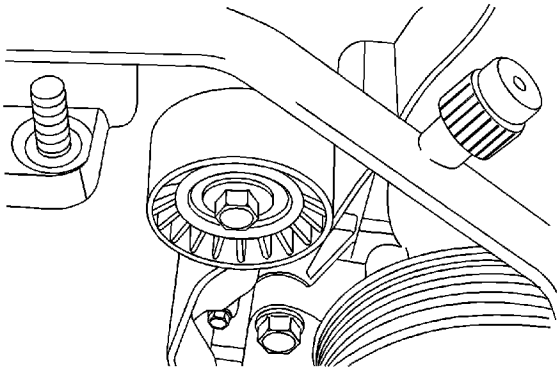
7. Install the rear timing belt cover.
8. Install the bolts to the rear timing belt cover.

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



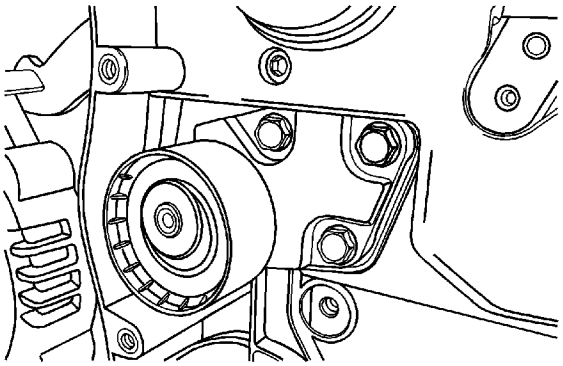
9. Install the CMP sensor. Install the CMP sensor bolts.

Tighten
Tighten the bolts to 12 N·m (106 lb in).



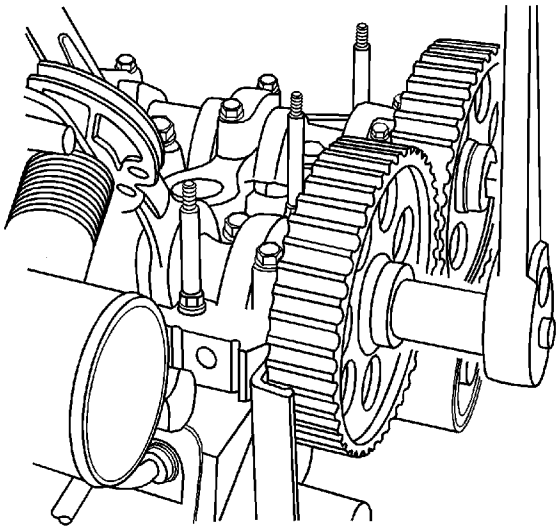
10. Install the timing belt idler pulley. Install the bolt to the timing belt idler pulley.

Tighten
Tighten the bolt to 40 N·m (30 lb ft).



11. Install the timing belt automatic tensioner. Install the bolts to the timing belt automatic tensioner.

Tighten
Tighten the bolts to 25 N·m (18 lb ft).



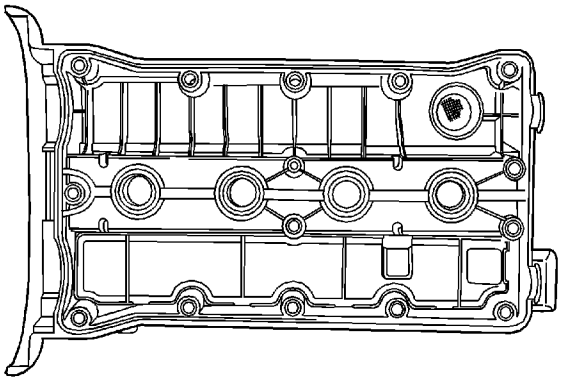
Caution: Use extreme care when installing the camshaft not to nick, scratch, or damage the camshaft lobes or bearing surfaces.

12. Install the intake camshaft gear.
13. While holding the intake camshaft firmly in place, install the intake camshaft gear bolt.

Tighten
Tighten the bolt to 67.5 N·m (49 lb ft).

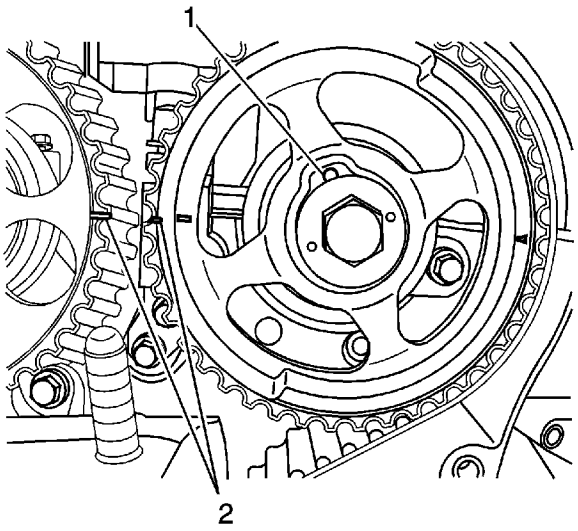
14. Install the exhaust camshaft gear.
15. While holding the exhaust camshaft firmly in place, install the exhaust camshaft gear bolt.

Tighten
Tighten the bolt to 67.5 N·m (49 lb ft).



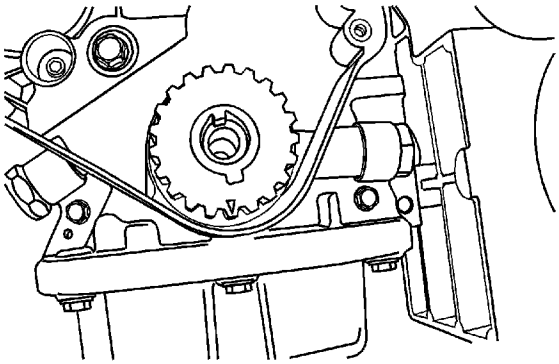
16. Apply a small amount of gasket sealant to the corners of the front camshaft caps and to the top of the seal between the rear valve cover and the cylinder head.
17. Install the valve cover and the valve cover gasket.
18. Install the valve cover bolts.

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

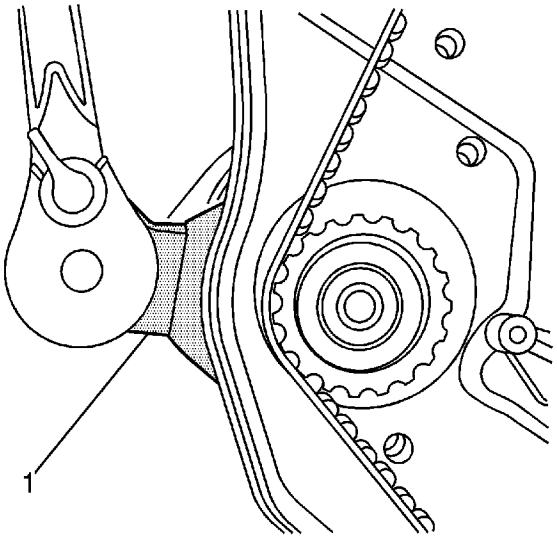


Note: Ensure that the exhaust camshaft gear dowel pin is approximately in the 11 o'clock position.

19. Align the timing marks on the camshaft gear.

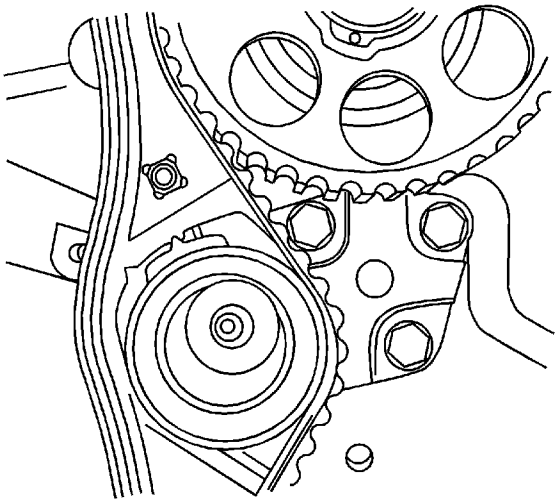


20. Align the mark on the crankshaft gear to the notch at the bottom of the rear timing belt cover.

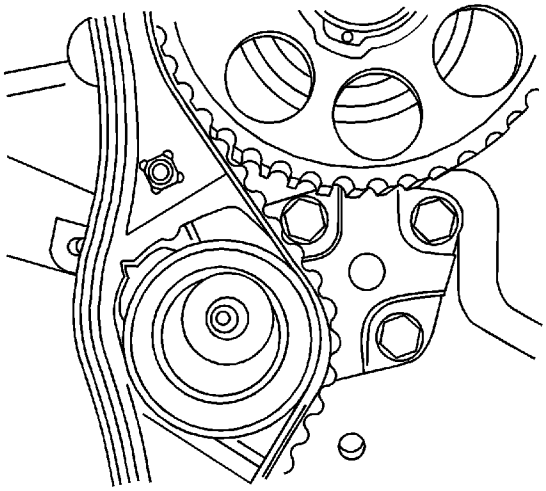


Caution: Do not use belt dressing on the drive belt. Belt dressing causes the breakdown of the composition of the drive belt. Failure to follow this recommendation will damage the drive belt.

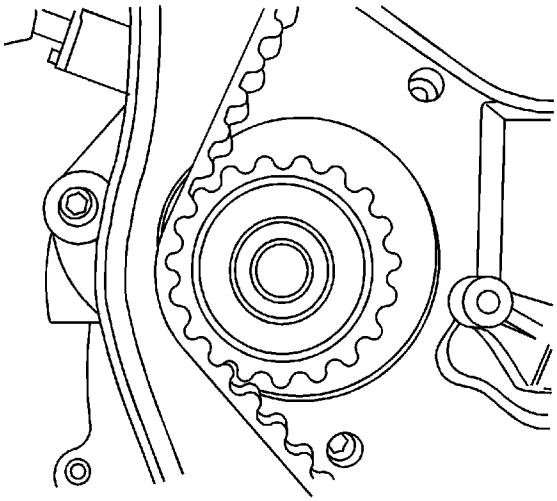
21. Inspect the timing belt. Refer to Timing Belt Inspection.



22. Rotate the coolant pump clockwise until the adjust arm pointer of the timing belt automatic tensioner is aligned to the notch in the timing belt automatic tensioner bracket.

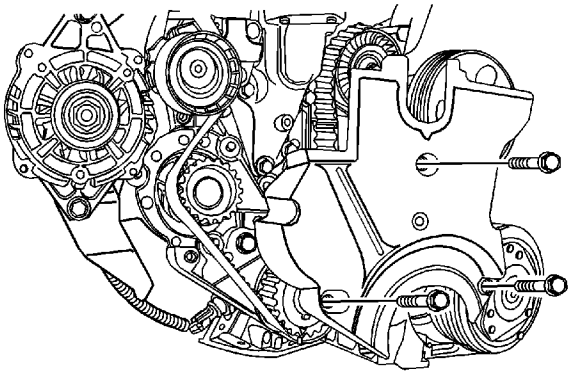


23. Tighten the coolant pump retaining bolts.
24. Rotate the crankshaft 2 full turns clockwise using the crankshaft pulley bolt.
25. Loosen the coolant pump retaining bolts.
26. Rotate the coolant pump until the adjust arm pointer of the timing belt automatic tensioner is aligned with the pointer on the timing belt automatic tensioner bracket.



27. Tighten the coolant pump retaining bolts.

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

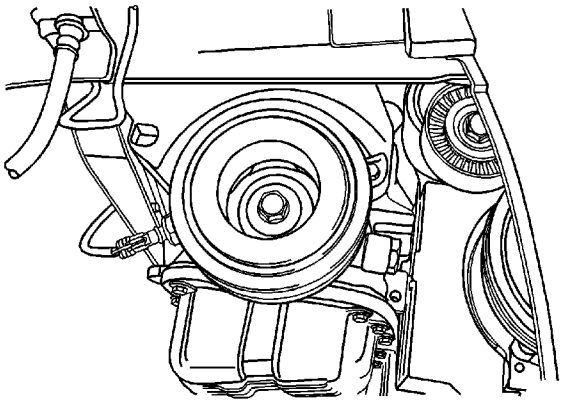


28. Install the retaining bolts that secure the engine mount to the engine mount bracket.

Tighten
Tighten the retaining bolts to 60 N·m (44 lb ft).

29. Install the lower front timing belt cover.
30. Install the bolts to the lower front timing belt cover.

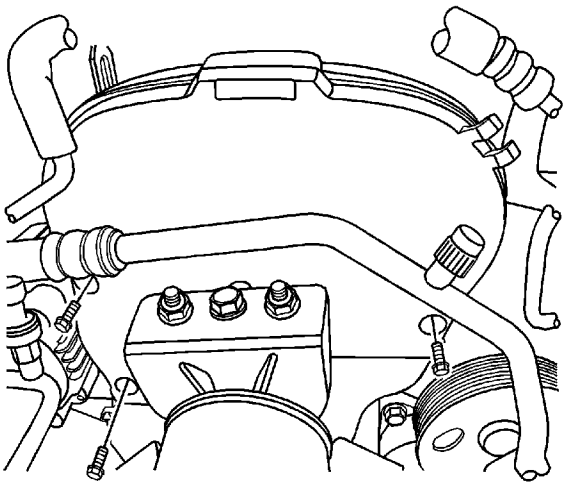
Tighten
Tighten the bolts to 10 N·m (89 lb in).



31. Install the crankshaft pulley.

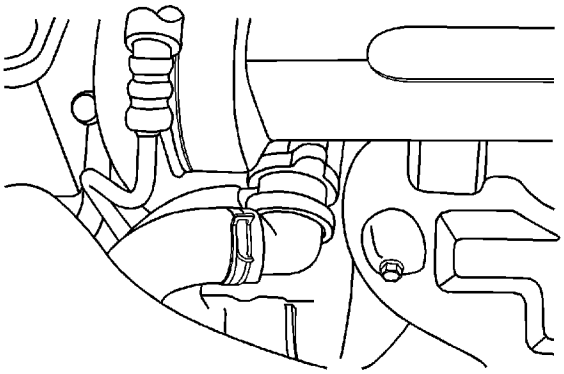
32. Install the crankshaft pulley bolt.

Tighten
Tighten the bolt to 95 N·m (70 lb ft) using a torque wrench. Using J 45059 or KM-470-B , tighten the crankshaft pulley bolt to 30 degrees plus 15 degrees.

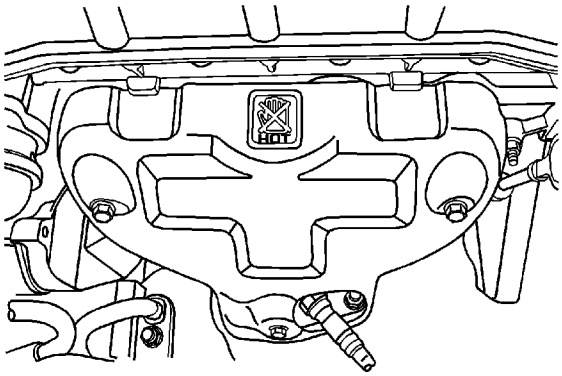


33. Install the upper front timing belt cover.
34. Install the bolts to the upper front timing belt cover.

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

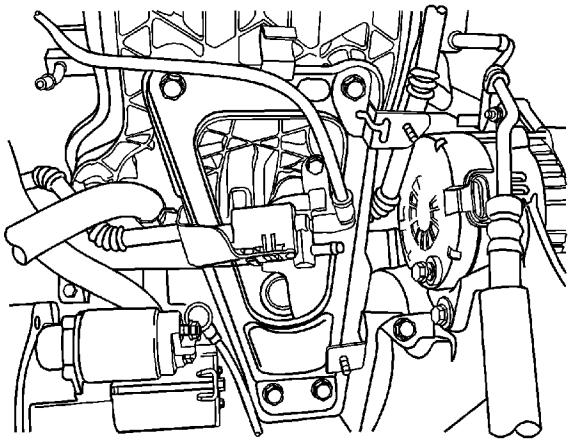


35. Connect the upper radiator hose to the thermostat housing.
36. Connect the throttle body coolant hose to the thermostat housing.
37. Install the catalytic converter. Refer to Catalytic Converter Replacement.



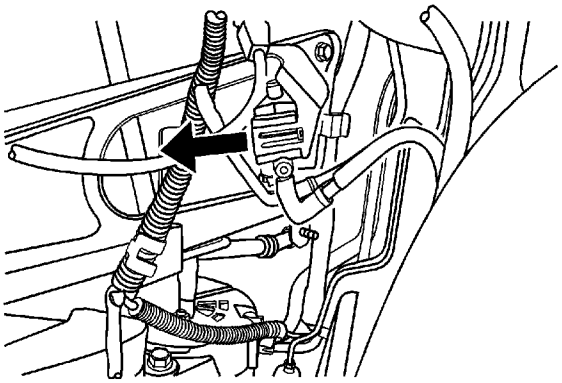
38. Install the exhaust manifold heat shield. Install the bolts to the exhaust manifold heat shield.

Tighten
Tighten the bolts to 15 N·m (11 lb ft).

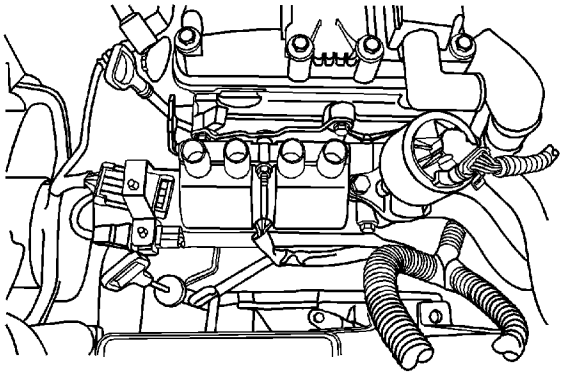


39. Connect the ECT sensor connector.
40. Install the upper bolts to the intake manifold support bracket.

Tighten
Tighten the bolts to 25 N·m (18 lb ft).



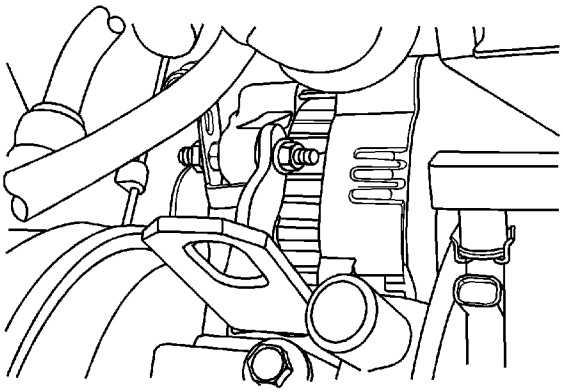
41. Install the canister purge solenoid valve at the intake manifold support bracket.
42. Install the engine under-cover.



43. Connect the front HO2S connector.
44. Connect the EI system ignition coil connector.
45. Connect the EGR valve connector.

Caution: Do not use belt dressing on the drive belt. Belt dressing causes the breakdown of the composition of the drive belt. Failure to follow this recommendation will damage the drive belt.

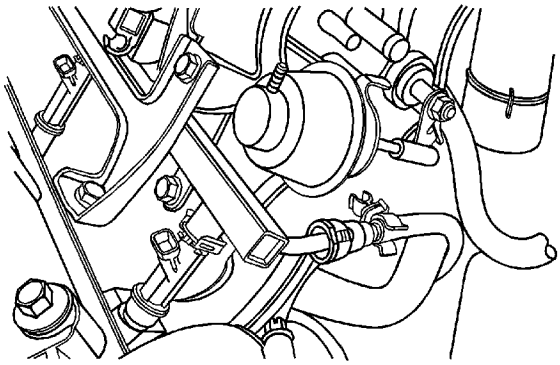
46. Install the accessory drive belt.



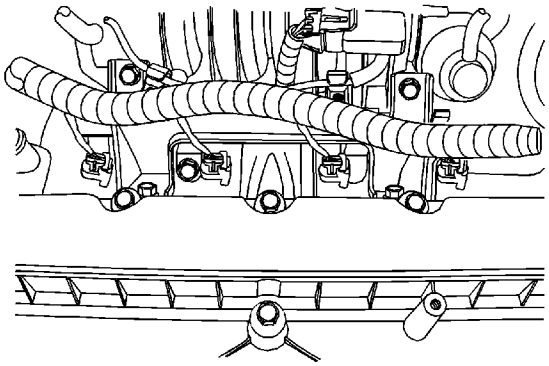
47. Install the alternator bracket retaining nut.

Tighten
Tighten the nut to 25 N·m (18 lb ft).

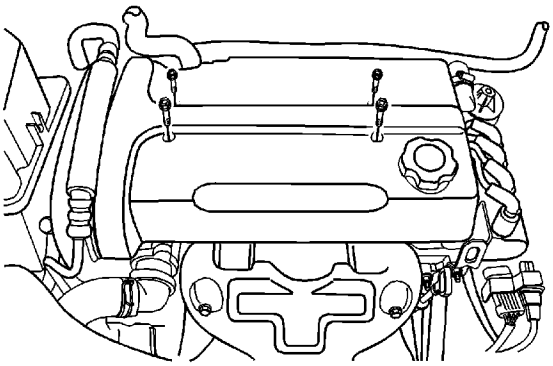
48. Install the alternator nut. Do NOT tighten.



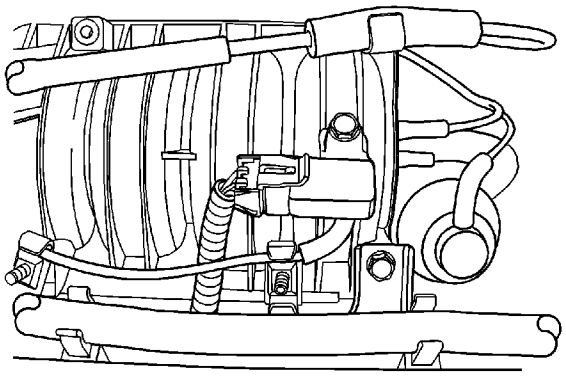
49. Connect the fuel line at the fuel rail.



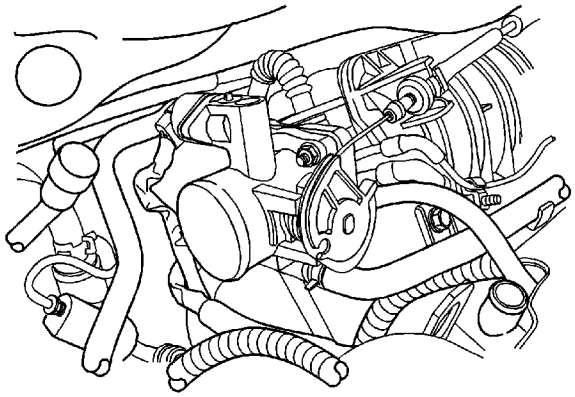
50. Connect the fuel injector harness connectors.
51. Connect the ignition wires from the spark plugs.
52. Connect the CMP sensor connector.



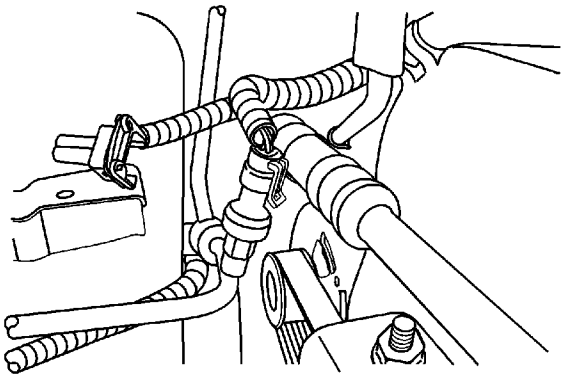
53. Connect the crankcase ventilation tube to the valve cover.
54. Connect the breather tube to the valve cover.
55. Install the engine cover.
56. Install the engine cover bolts.



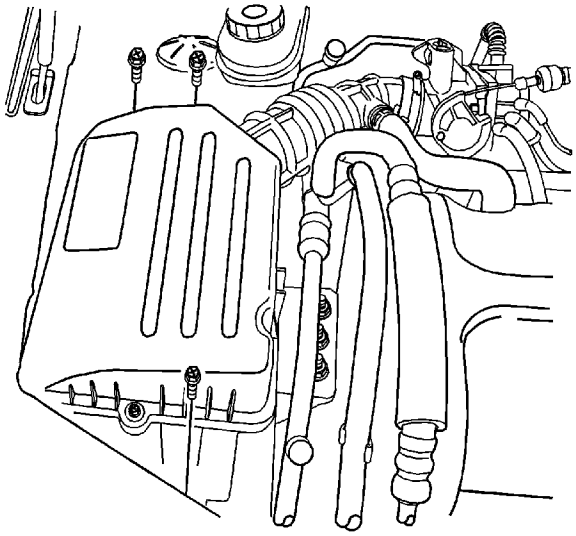
57. Connect the VGIS vacuum tank hose.
58. Connect the VGIS connector.
59. Connect the brake booster vacuum hose.
60. Connect the MAP sensor connector.



61. Connect the engine coolant inlet/outlet hose to the throttle body.
62. Connect the throttle cable to the throttle body and the intake manifold.
63. Connect the TP sensor connector.
64. Connect the IAC valve connector.

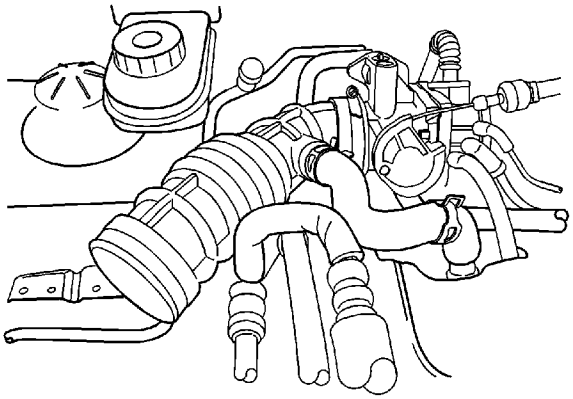


65. Connect the A/C pressure transducer connector.



66. Install the air filter housing. Install the air filter housing bolts.

Tighten
Tighten the bolts to 8 N·m (71 lb in).



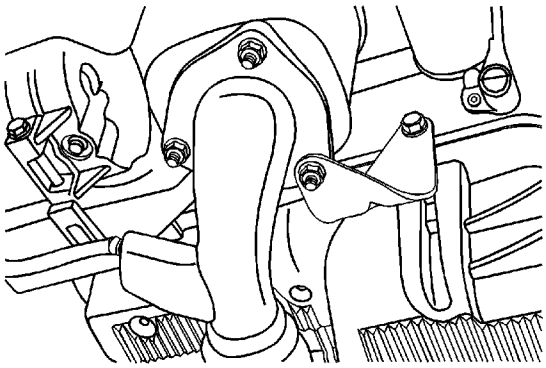
67. Connect the air intake tube to the throttle body.
68. Connect the IAT sensor connector.
69. Connect the breather tube to the valve cover.
70. Install the fuel pump fuse.
71. Connect the negative battery cable.
72. Fill the engine cooling system. Refer to Cooling System Draining and Filling.

Oil Pan Replacement

Removal Procedure

Warning: Refer to Battery Disconnect Warning in the Preface section.

Warning: Refer to Safety Glasses Warning in the Preface section.



1. Disconnect the negative battery cable.
2. Remove the right front wheel. Refer to Tire and Wheel Removal and Installation
3. Remove the right front splash shield.
4. Drain the engine oil from the engine crankcase.
5. Disconnect the heated oxygen sensor (HO2S).
6. Remove the catalytic lower flange nuts from the exhaust manifold and remover the bolts at the bracket.

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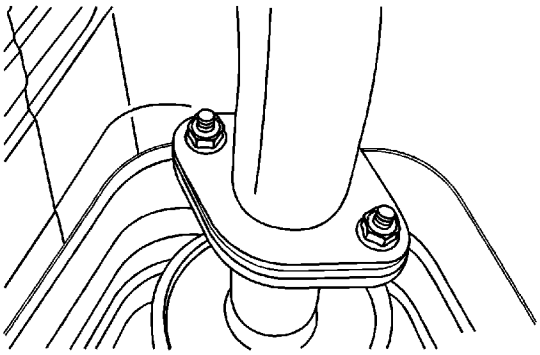
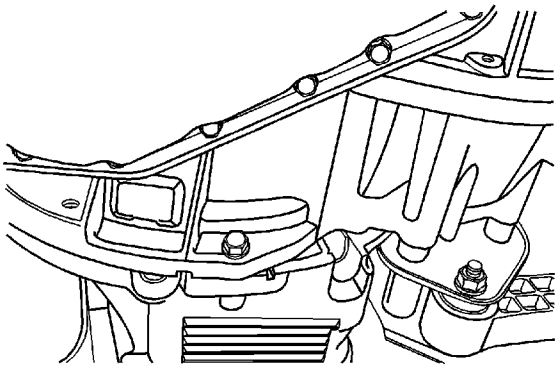
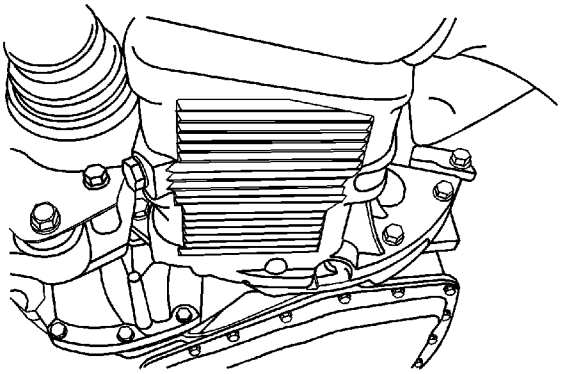


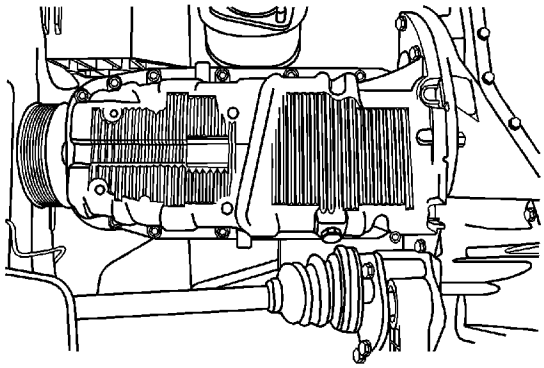
7. Remove the nuts that secure the front pipe.
8. Remove the catalytic converter and the exhaust pipe as a unit.



9. Remove the bolts that secure the oil pan to the transaxle housing.

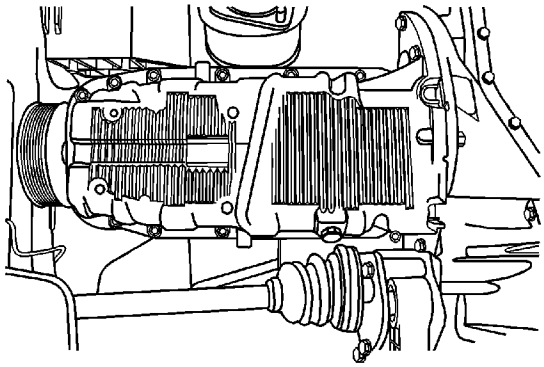


10. Remove the bolt that secures the transaxle housing to the oil pan.



11. Remove the grommet.
12. Remove the oil pan retaining bolts.
13. Remove the oil pan from the engine block.
14. Remove the gasket from the oil pan.

Installation Procedure



1. Install the gasket to the oil pan.

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

2. Install the oil pan to the engine block.

   Caution: Refer to Fastener Caution in the Preface section.

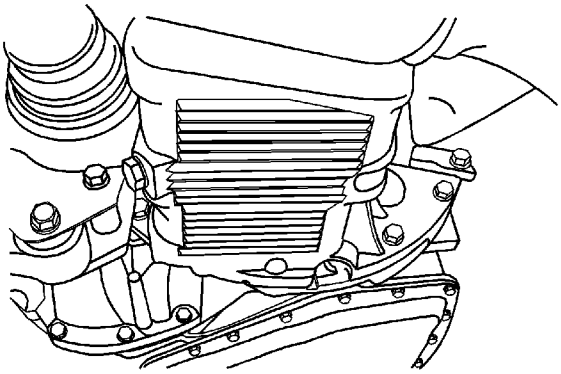
3. Install the oil pan retaining bolts.

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

4. Discard the used oil pan drain plug washer and replace it with a new one.

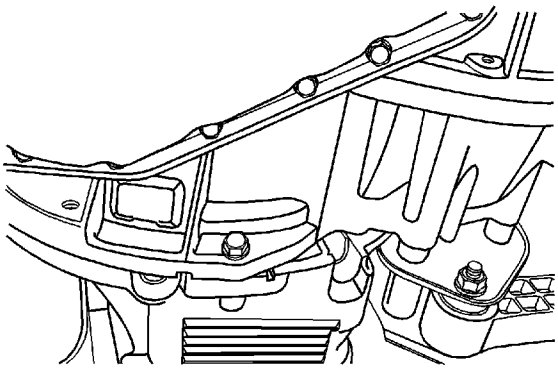
   Tighten
   Tighten the oil pan drain plug to 55 N·m (40 lb ft).

5. Install the grommet.



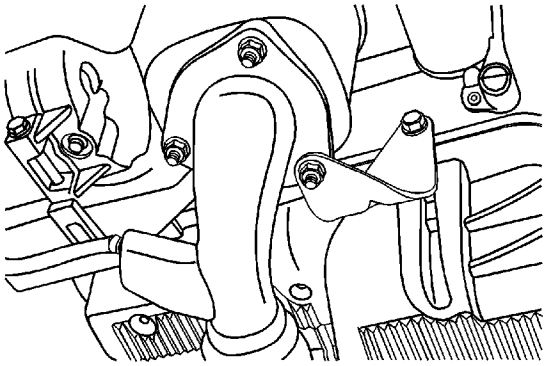
6. Install the bolt that secures the transaxle housing to the oil pan.

Tighten
Tighten the bolt to 25 N·m (18 lb ft).



7. Install the bolts that secure the oil pan to the transaxle housing.

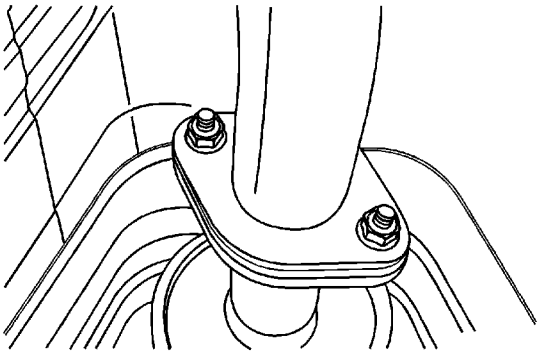
Tighten
Tighten the bolts to 25 N·m (18 lb ft).



8. Install the catalytic converters and the exhaust pipe as a unit.

Tighten

- Tighten the nuts that secure the catalytic converter to the exhaust manifold to 50 N·m (37 lb ft).
- Tighten the exhaust pipe bracket bolts to 50 N·m (37 lb ft).
- Tighten the front muffler nuts to 30 N·m (22 lb ft).



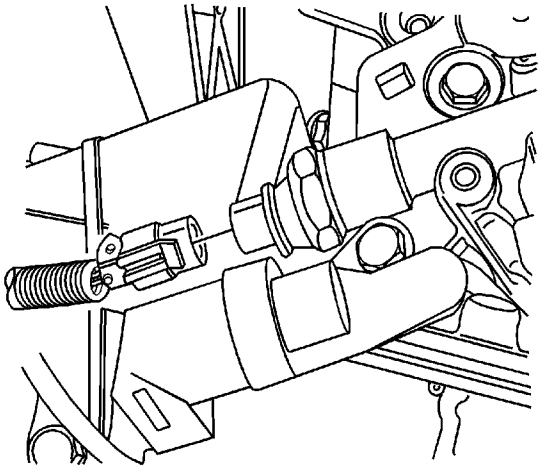
9. Connect the HO2S.
10. Install the right front splash shield.
11. Install the right front wheel. Refer to Tire and Wheel Removal and Installation
12. Connect the negative battery cable.

13. Refill the engine crankcase with engine oil.

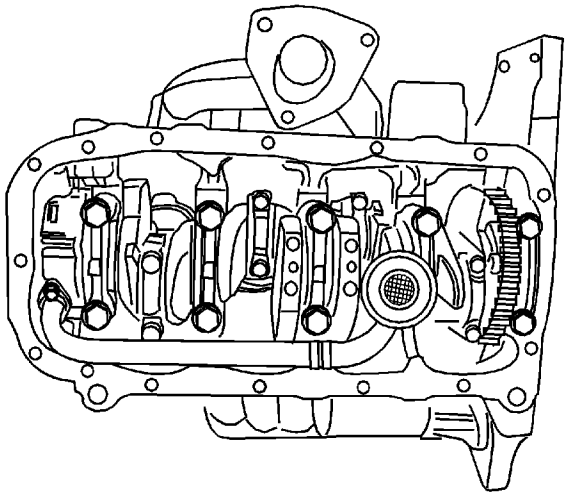
Oil Pump Replacement

Removal Procedure

Warning: Refer to Battery Disconnect Warning in the Preface section.



1. Disconnect the negative battery cable.
2. Remove the timing belt. Refer to Timing Belt Replacement.
3. Remove the rear timing belt cover. Refer to Timing Belt Cover Replacement.
4. Disconnect the oil pressure switch connector.



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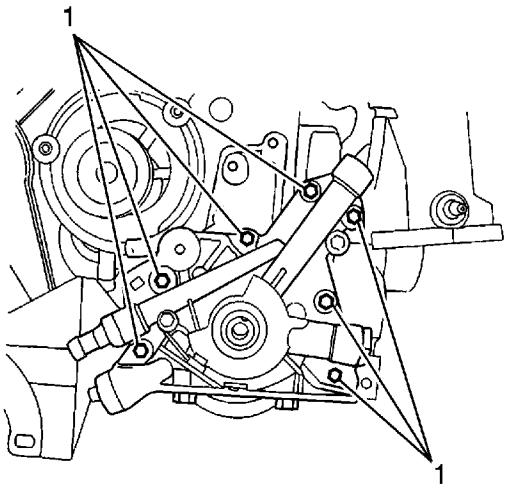
5. Remove the crankshaft position (CKP) sensor bolt.
6. Remove the CKP sensor.
7. Remove the oil pan. Refer to Oil Pan Replacement.
8. Remove the oil pump pickup tube and the support bracket bolts.
9. Remove the oil pump pickup tube.

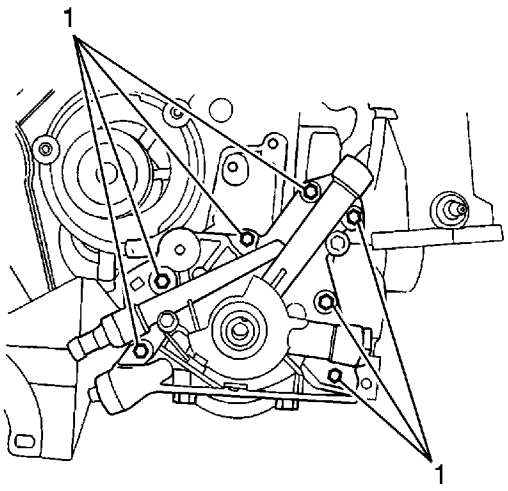


10. Remove the oil pump retaining bolts (1).

Warning: Refer to Safety Glasses Warning in the Preface section.

11. Carefully separate the oil pump and the gasket from the engine block and the oil pan.
12. Remove the oil pump.

Installation Procedure

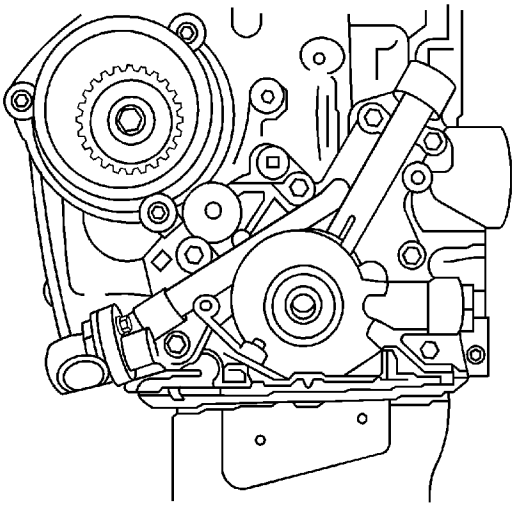


1. Install a new oil pump gasket to the oil pump.
2. Coat the threads of the oil pump bolts with LOCTITE® 242.

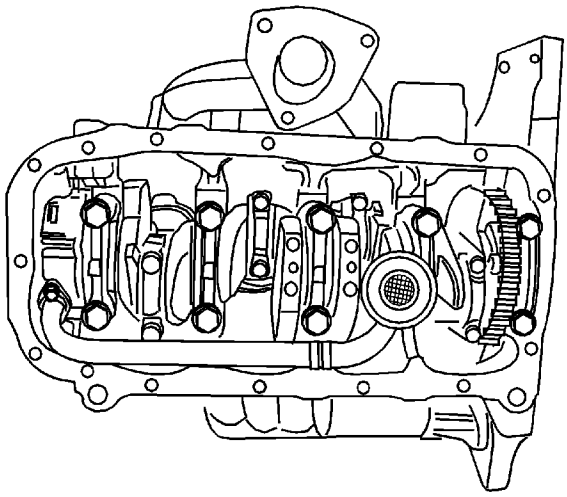
Caution: Refer to Fastener Caution in the Preface section.

3. Install the oil pump to the engine block with the bolts (1).

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

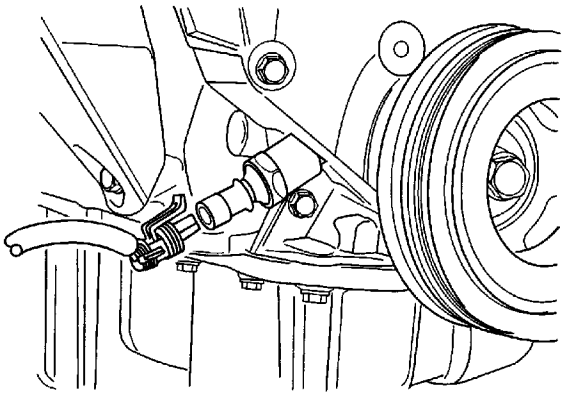


4. Install a new oil pump to the crankshaft shaft seal.
5. Coat the lip of the seal with a thin coat of grease.



6. Coat the threads of the oil pump pickup tube and the support bracket bolts with LOCTITE ®242.
7. Install the oil pump pickup tube and the bolts.

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



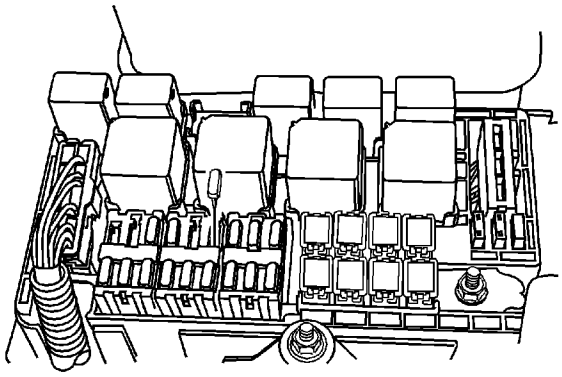
8. Install the oil pan. Refer to Oil Pan Replacement.
9. Install the CKP sensor and the bolt.

Tighten
Tighten the crankshaft position sensor retaining bolt to 10 N·m (89 lb in).

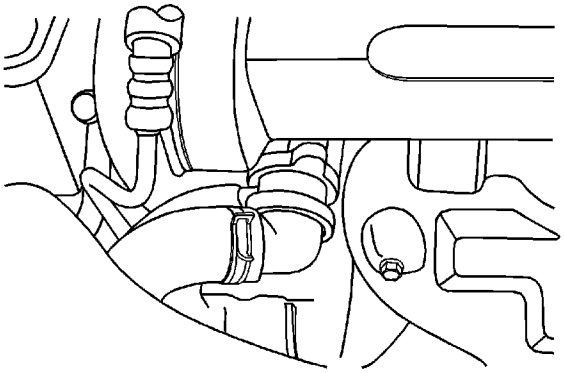
10. Connect the oil pressure switch connector.
11. Install the timing belt cover. Refer to Timing Belt Cover Replacement.
12. Install the timing belt. Refer to Timing Belt Replacement.
13. Connect the negative battery cable.

Engine Replacement

Removal Procedure



1. Remove the fuel pump fuse.
2. Start the engine. Crank the engine for 10 seconds after stalling to rid the fuel system of fuel pressure.
3. Drain the engine oil.
4. Remove the battery and the battery tray. Refer to Battery Tray Replacement



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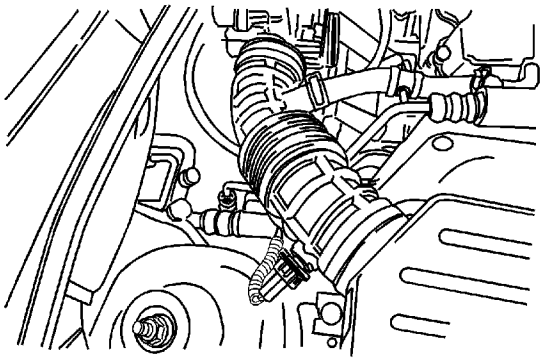
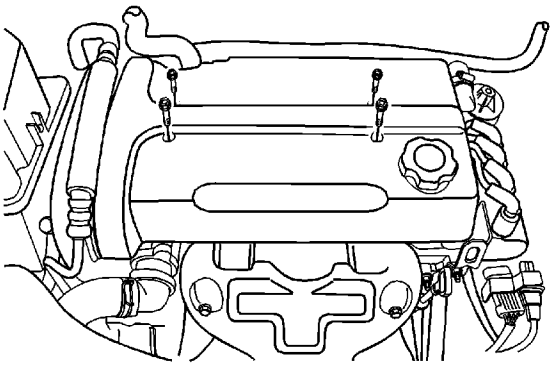
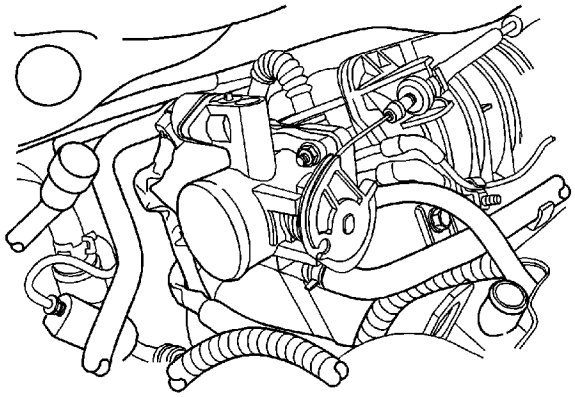
5. Discharge the air conditioning (A/C) system, if equipped. Refer to Refrigerant Recovery and Recharging
6. Drain the engine coolant. Refer to Cooling System Draining and Filling
7. Remove the cooling system radiator and the engine cooling fans. Refer to Radiator Replacement
8. Disconnect the upper radiator hose from the thermostat housing.
9. If the vehicle is equipped with a power steering pump, perform the following procedures:
   9.1. Disconnect the power steering return hose from the power steering pump.
   9.2. Remove the union nut from the power steering pressure hose.
   9.3. Disconnect the power steering pressure hose from the power steering pump.



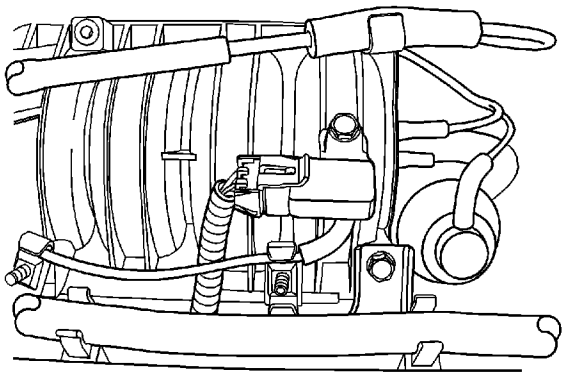
10. Disconnect the intake air temperature (IAT) sensor connector.
11. Disconnect the breather tube from the valve cover.
12. Disconnect the air intake tube from the throttle body.
13. Remove the air cleaner assembly. Refer to Air Cleaner Assembly Replacement



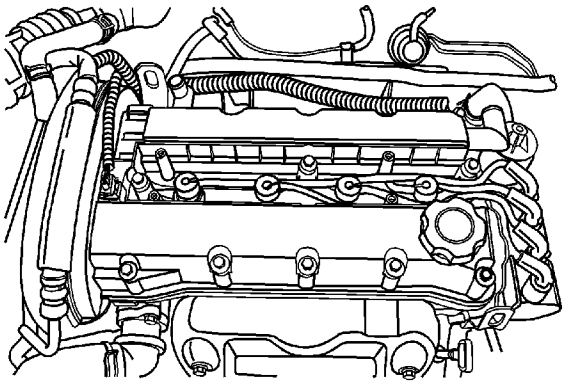
14. Remove the bolts from the spark plug cover.
15. Remove the spark plug cover.



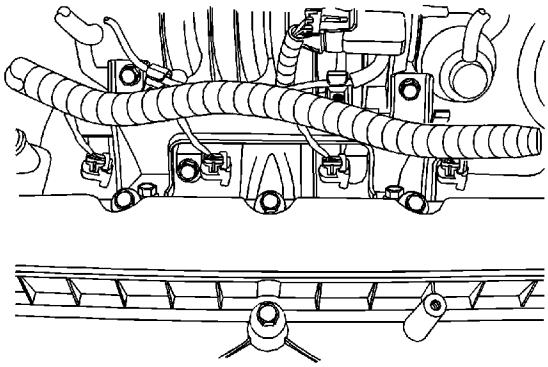
16. Disconnect the connector from the idle air control (IAC) valve.
17. Disconnect the connector from the throttle position sensor (TPS).
18. Disconnect the connector from the A/C pressure (ACP) transducer, if equipped.
19. Disconnect the camshaft position (CMP) sensor.
20. Disconnect the throttle cable from the throttle body and from the intake manifold bracket.



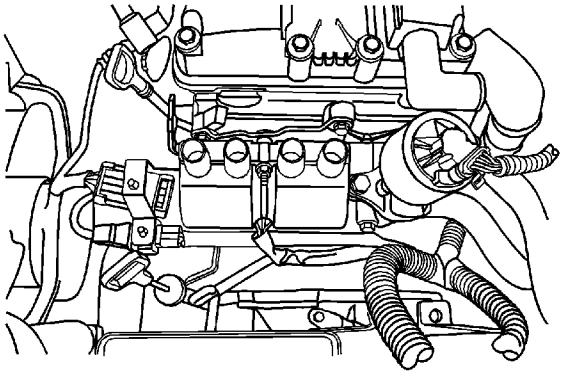
21. Disconnect the connector from the manifold absolute pressure (MAP) sensor.



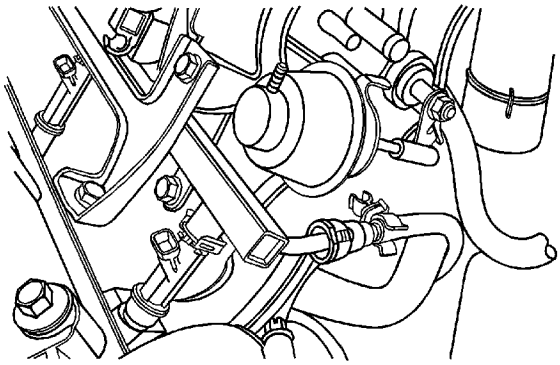
22. Disconnect the ignition wires from the spark plugs.



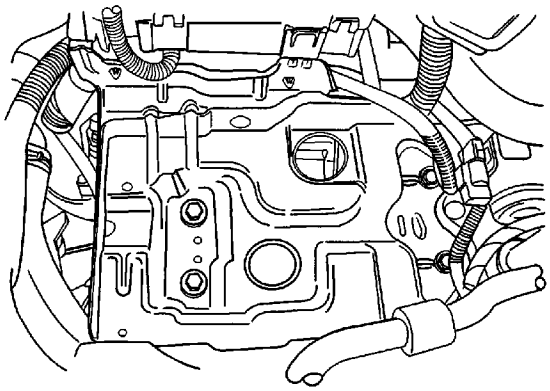
23. Disconnect the surge tank coolant hose at the throttle body.
24. Disconnect the fuel injector connectors.



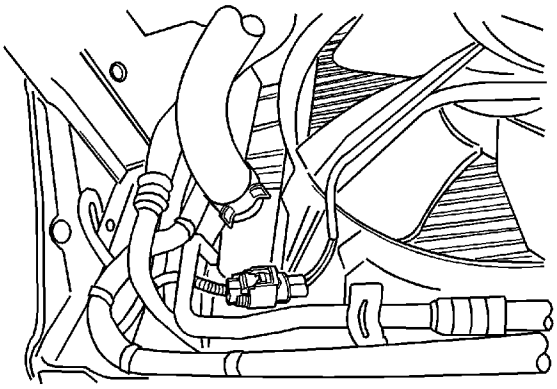
25. Disconnect the connector from the exhaust gas recirculation (EGR) valve.
26. Disconnect the electrical connector at the electronic ignition (EI) system ignition coil.
27. Disconnect the oxygen sensor connector.
28. Disconnect the connector from the crankshaft position sensor (CPS).



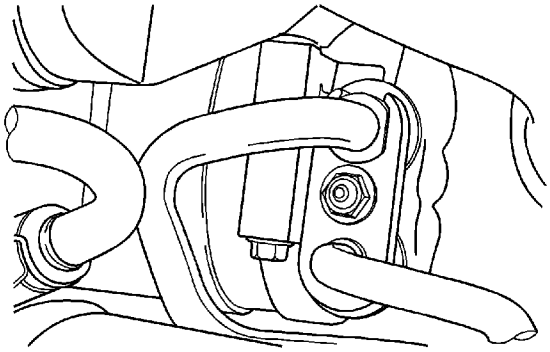
29. Disconnect all of the necessary vacuum lines. Disconnect the brake booster vacuum hose at the intake manifold.
30. Disconnect the fuel feed line at the fuel rail.



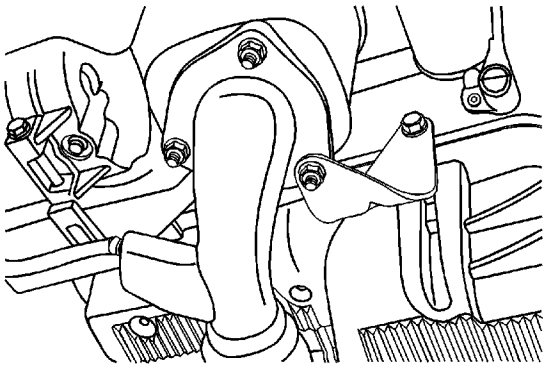
31. Remove the bolts from the battery tray support.
32. Remove the battery tray support.



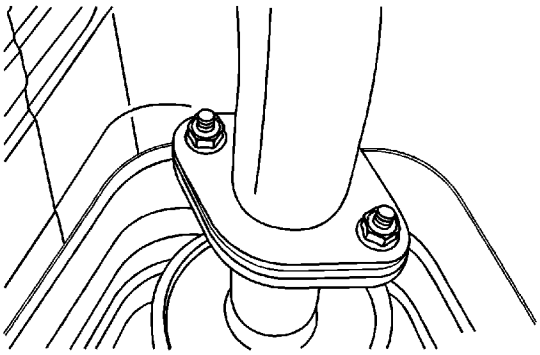
33. Disconnect the lower radiator hose from the coolant pipe.



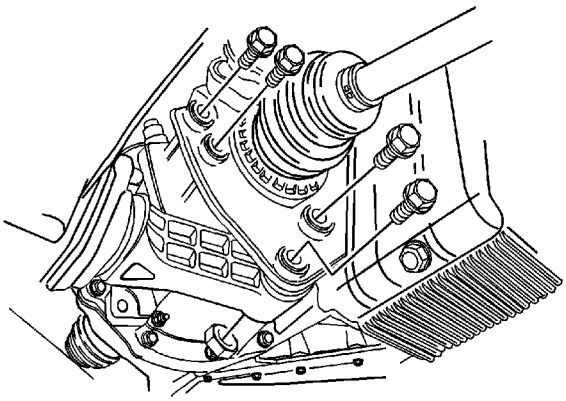
34. Remove the bolt from the A/C compressor pipe and hose assembly, if equipped.
35. Remove the A/C compressor pipe and hose assembly from the compressor.
36. Remove the front tire and wheel assemblies. Refer to Tire and Wheel Removal and Installation
37. Remove the front splash shield and the engine undercover.
38. Disconnect the A/T oil cooler inlet/outlet pipe, if equipped. Refer to Transmission Cooler Pipes and Hoses Replacement
39. Disconnect the A/T shift control cable, if equipped. Refer to Floor Shift Control Cable Replacement
40. Disconnect all of the A/T electrical connectors, if equipped.
41. Disconnect the electrical connector at the A/C compressor coil, if equipped.
42. Disconnect the connector from the rear heat oxygen sensor (HO2S).



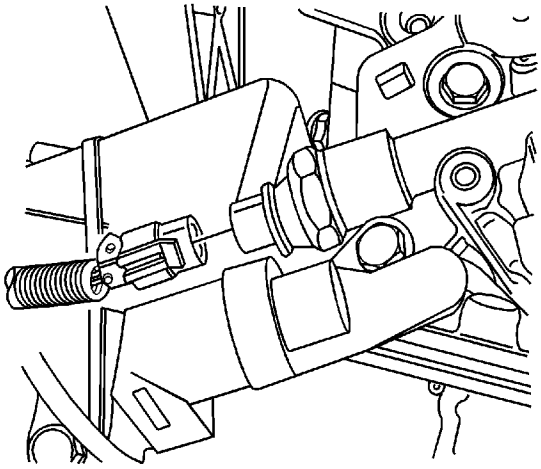
43. Remove the lower flange nuts from the exhaust manifold studs. Retain the gasket.
44. Remove the bolts at the bracket.



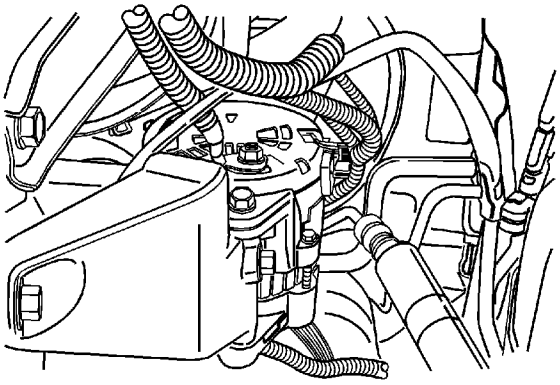
45. Remove the nuts that secure the front muffler pipe. Retain the gasket.
46. Remove the front exhaust pipe as a unit.



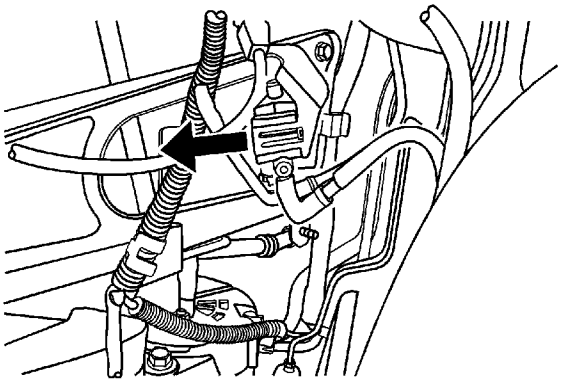
47. Remove the nut and bolt from the damping block connection.
48. Remove bolts from the rear mounting bracket. Remove the bracket.
49. Remove the A/T drive axle, if equipped. Refer to Front Drive Axle Inner Shaft and Inner Shaft Housing Replacement



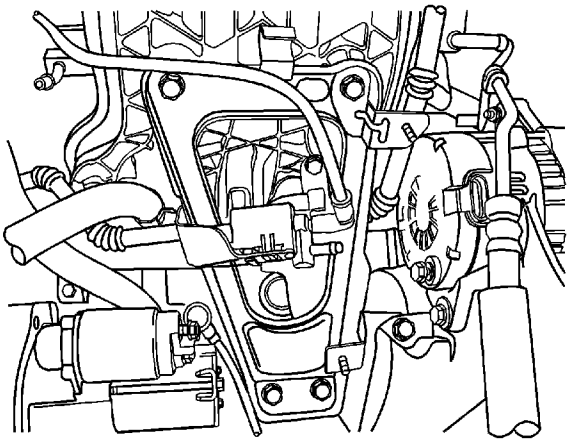
50. Disconnect the electrical connector at the oil pressure switch.



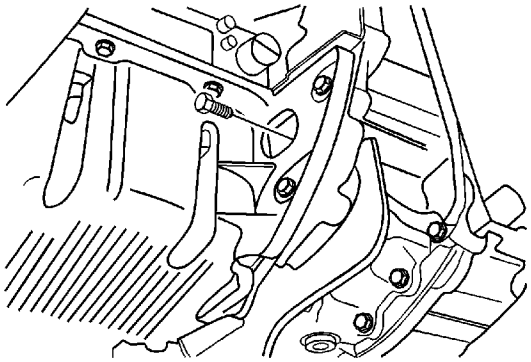
51. Remove the battery harness connector nut from the generator.
52. Disconnect the connector from the generator voltage regulator.



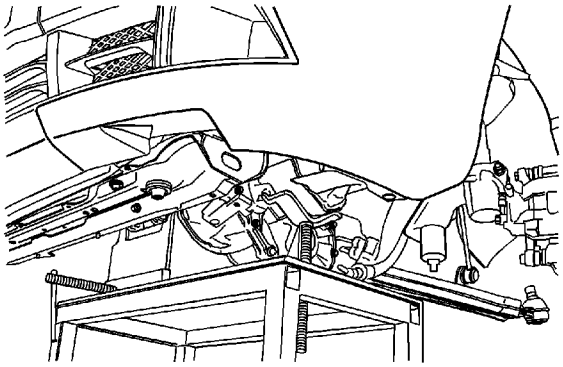
53. Disconnect the electrical connector from the evaporative (EVAP) emission canister purge solenoid.



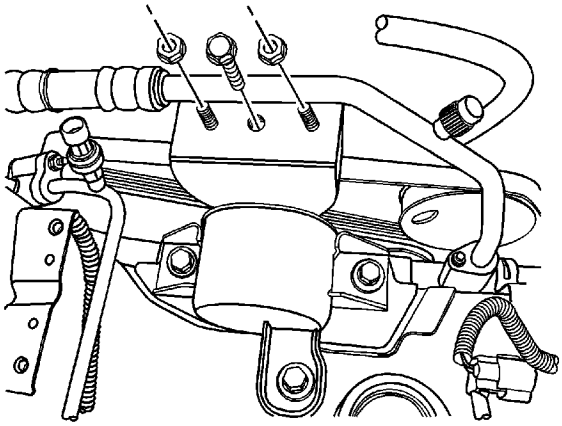
54. Remove the bolts from the intake manifold support bracket.
55. Remove the intake manifold support bracket.
56. Disconnect the connector from the engine coolant temperature (ECT) sensor.
57. Remove the lower starter mounting bolt.
58. Remove the starter solenoid nuts in order to disconnect the electrical cable.
59. Remove the lower engine wire harness.



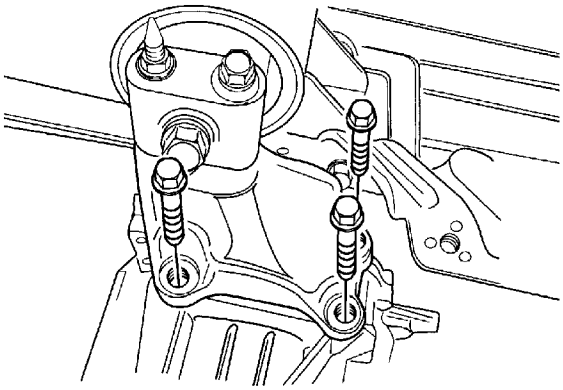
60. Remove the rubber from the oil pan.
61. Remove the torque converter service cover and the bolts.



62. Install the engine lifting device.



63. Remove the retaining bolts from the engine mount bracket.
64. Remove the bracket from the engine block.

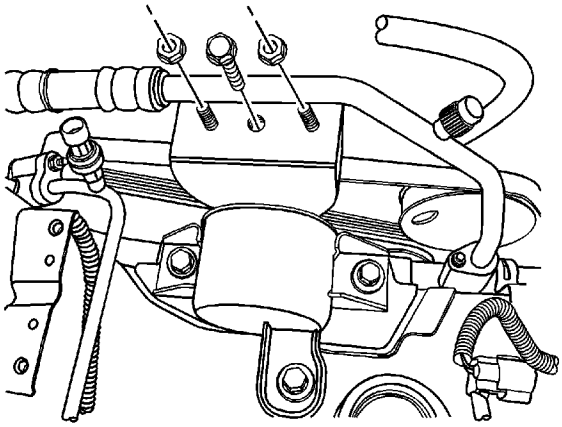


65. Remove the 3 bolts from the upper transaxle mounting bracket.

Note: Verify that the engine and transaxle assembly is not attached to the vehicle.

66. Lift up the vehicle slowly to separate the engine and transaxle assembly from the vehicle. Refer to Lifting and Jacking the Vehicle
67. Separate the engine block from the transaxle.
68. Remove the engine.

Installation Procedure



1. Install the engine and transaxle assembly into the engine compartment.
2. Install the right engine mount bracket to the engine block.

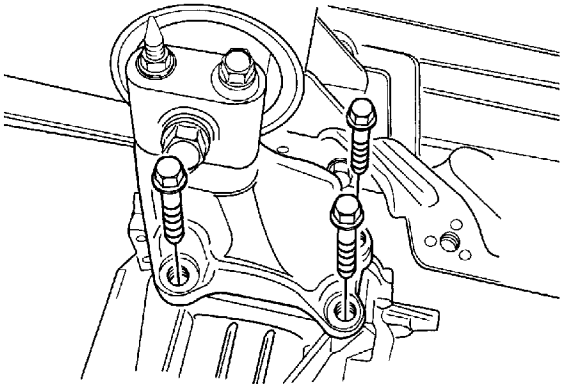
Caution: Refer to Fastener Caution in the Preface section.

3. Install the mounting bolts to the bracket.

Tighten
Tighten the bolts to 60 N·m (44 lb ft).

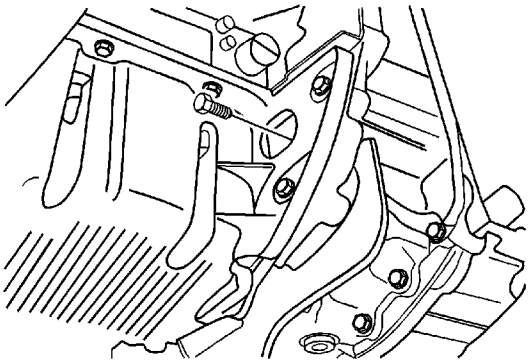
4. Install the bracket to the engine mount with 2 retaining bolts.

Tighten
Tighten the bolts to 60 N·m (44 lb ft).



5. Install the upper transaxle mounting bracket with 3 bolts.

Tighten
Tighten the bolts to 60 N·m (44 lb ft).



6. Install the service cover to the transaxle torque converter with bolts.

Tighten
Tighten the bolts to 65 N·m (48 lb ft).

7. Install the rubber to the oil pan.
8. Position the starter electrical wire on the solenoid terminal.

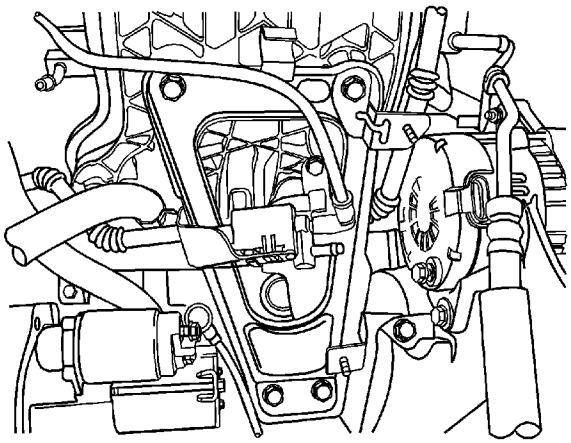
9. Install the starter solenoid nuts.

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

10. Install the lower mounting bolts to the starter.

Tighten
Tighten the bolt to 43 N·m (32 lb ft).

11. Connect the ECT sensor connector.

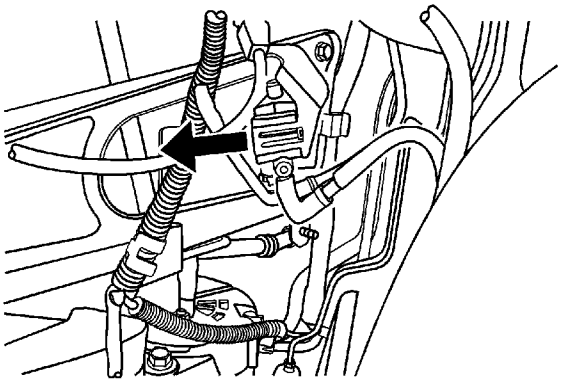


12. Install the intake manifold support bracket.
    12.1. Install the upper bracket bolts to the intake manifold.

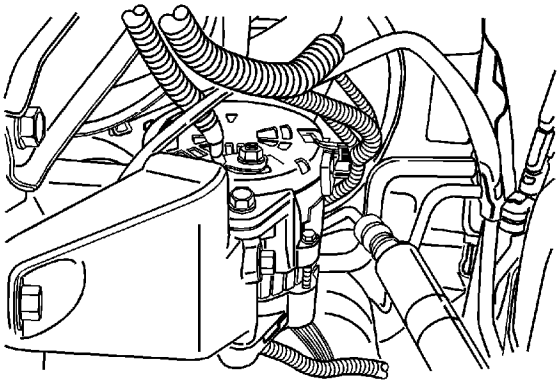
Tighten
Tighten the bolts to 25 N·m (18 lb ft).

    12.2. Install the lower bracket bolts to the engine block.

Tighten
Tighten the bolts to 40 N·m (30 lb ft).

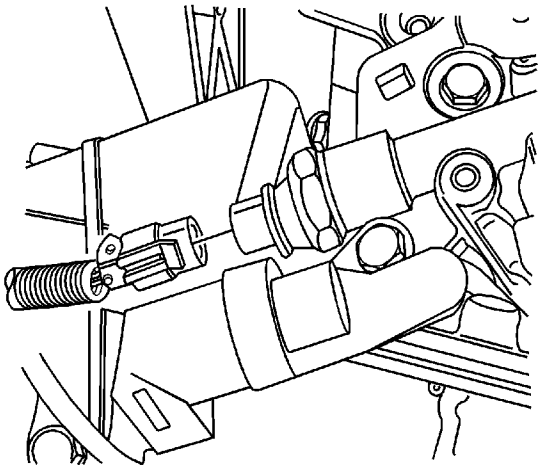


13. Connect the electrical connector to the EVAP canister purge solenoid.

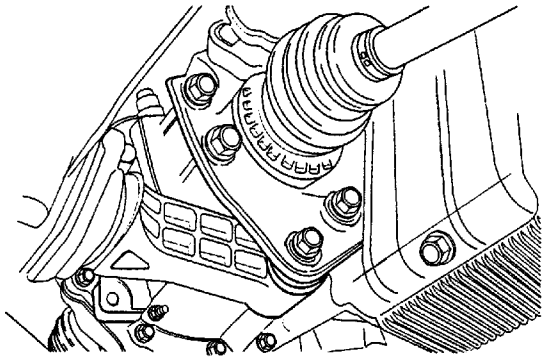


14. Connect the voltage regulator connector to the generator.
15. Install the battery harness connector to the generator using a nut.

Tighten
Tighten the nut to 15 N·m (11 lb ft).



16. Connect the electrical connector to the oil pressure switch.

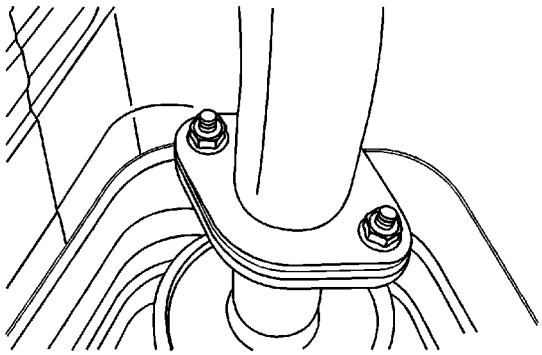


17. Install the A/T drive axle. Refer to Front Drive Axle Inner Shaft and Inner Shaft Housing Replacement
18. Install the rear mounting bracket and the bracket bolts.

    Tighten
    Tighten the bolts to 60 N·m (44 lb ft).

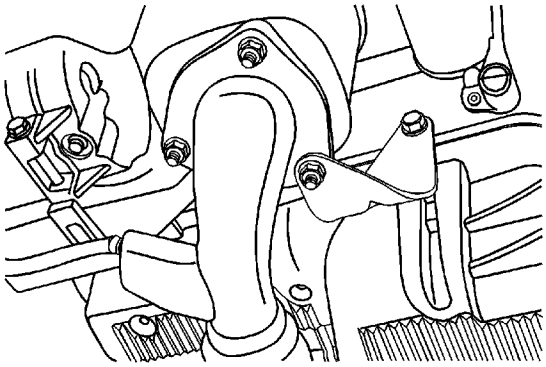
19. Install the damping block connection bolt and nut.

    Tighten
    Tighten the bolt and the nut to 80 N·m (59 lb ft).



20. Install the front exhaust pipe and the gasket.
21. Install the nuts to the front exhaust pipe.

Tighten
Tighten the nuts to 30 N·m (22 lb ft).



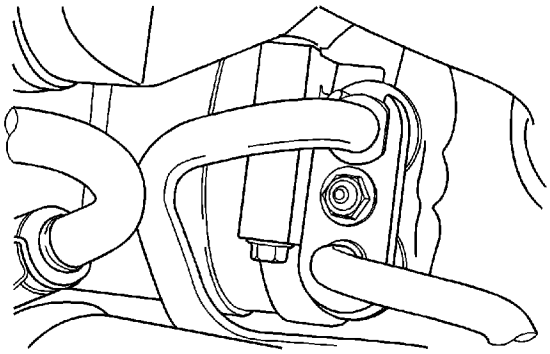
22. Install the exhaust front pipe and gasket to the catalytic converter. Secure with the retaining nuts.

Tighten
Tighten the nuts to 40 N·m (30 lb ft).

23. Secure the exhaust front pipe to the bracket with a bolt.

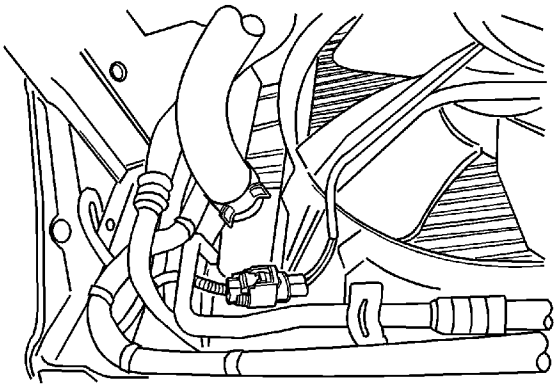
Tighten
Tighten the bolt to 40 N·m (30 lb ft).

24. Connect the rear HO2S connector.
25. Connect the A/C compressor coil connector, if equipped.
26. If the vehicle is equipped with automatic transmission, perform the following procedures:
    26.1. Connect all of the A/T electrical connectors.
    26.2. Connect the A/T shift control cable. Refer to Floor Shift Control Cable Replacement
    26.3. Connect the A/T oil cooler inlet/outlet pipe. Refer to Transmission Cooler Pipes and Hoses Replacement

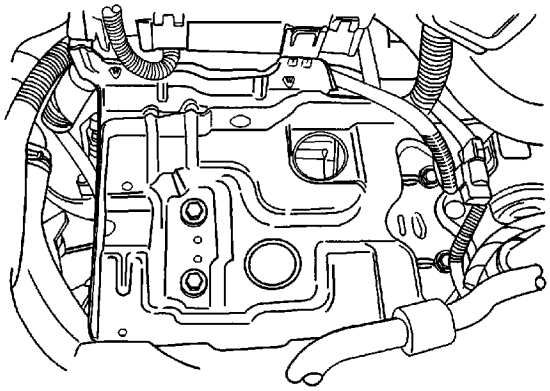


27. Install the front splash shield and the engine undercover.
28. Install the front tire and wheel assemblies. Refer to Tire and Wheel Removal and Installation
29. Install the pipe and hose assembly to the A/C compressor, if equipped. Secure with a retaining bolt.

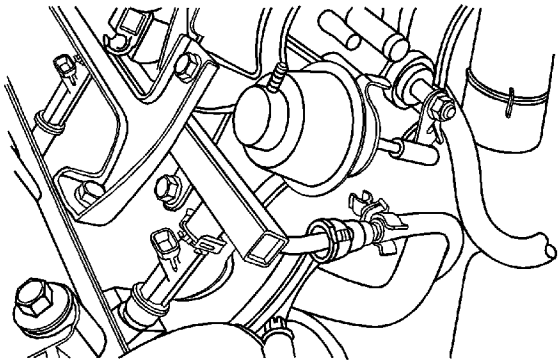
Tighten
Tighten the bolt to 33 N·m (24 lb ft).



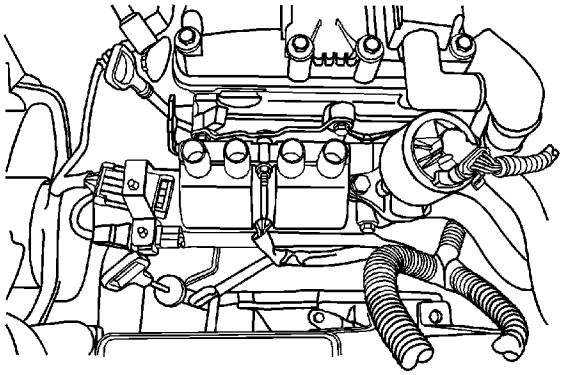
30. Connect the lower radiator hose to the coolant pipe.



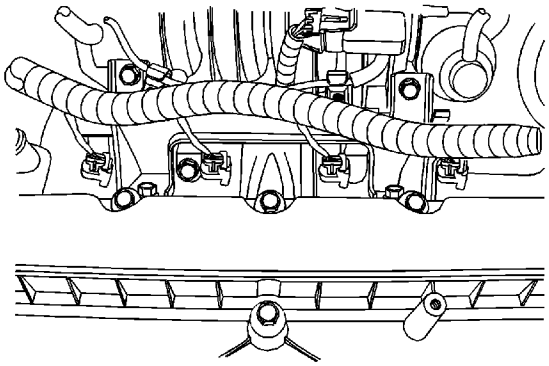
31. Install the battery tray support. Secure the support with a bolt.



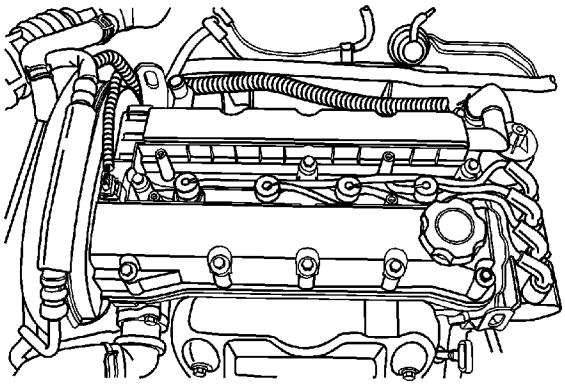
32. Connect the brake booster vacuum hose at the intake manifold. Connect all of the necessary vacuum lines.
33. Connect the fuel feed line at the fuel rail.



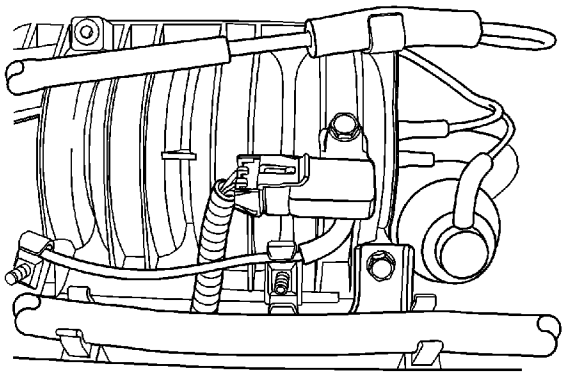
34. Connect the CPS connector.
35. Connect the oxygen sensor connector.
36. Connect the electrical connector at the EI system ignition coil
37. Connect the EGR valve connector.



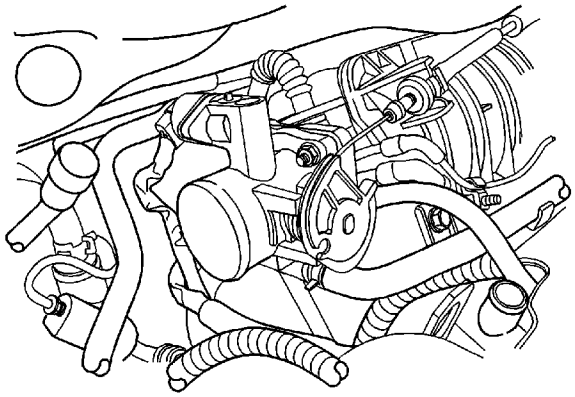
38. Connect the fuel injector connectors.
39. Connect the surge tank coolant hose at the throttle body.



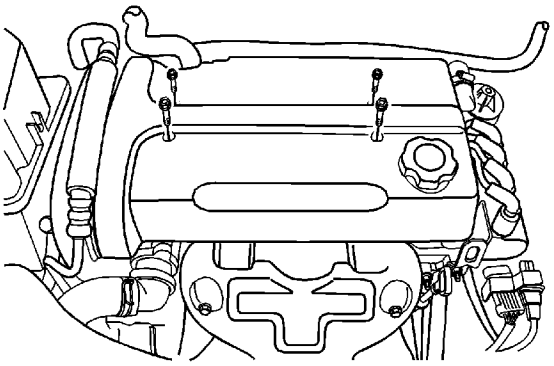
40. Connect the ignition wires to the spark plugs.



41. Connect the MAP sensor connector.



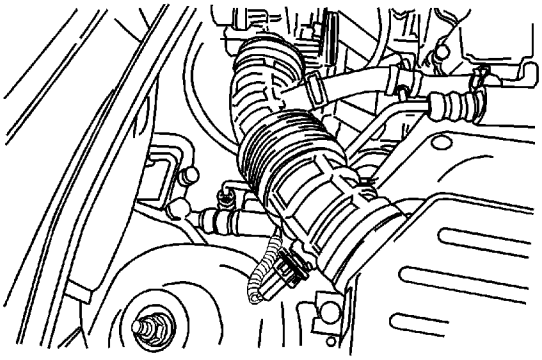
42. Connect the throttle cable to the throttle body and to the intake manifold bracket.
43. Connect the CMP sensor.
44. Connect the ACP transducer connector, if equipped.
45. Connect the TPS connector.
46. Connect the IAC valve connector.



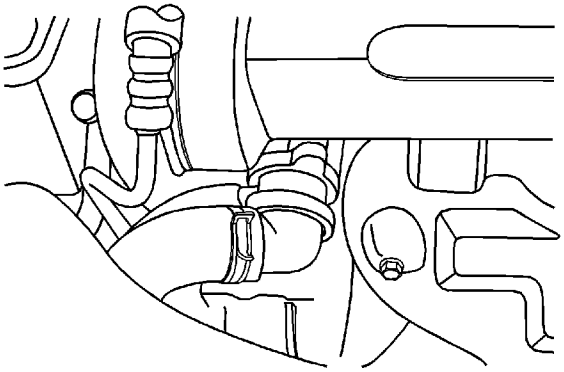
47. Install the spark plug cover. Install the bolts to the spark plug cover.

Tighten
Tighten the bolts to 3 N·m (27 lb in).

48. Install the air cleaner assembly. Refer to Air Cleaner Assembly Replacement



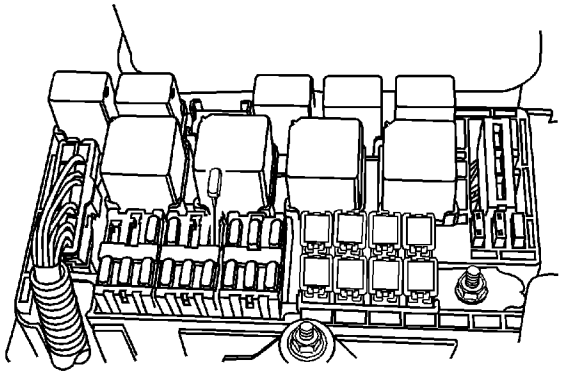
49. Connect the air intake tube to the throttle body.
50. Connect the breather tube to the valve cover.
51. Connect the IAT sensor connector.



52. If the vehicle is equipped with a power steering pump, perform the following procedures:
    52.1. Connect the power steering pressure hose to the power steering pump.
    52.2. Install the union nut to the power steering pump.

    Tighten
    Tighten the nut to 28 N·m (21 lb ft).

    52.3. Connect the power steering return hose to the power steering pump.
53. Connect the upper radiator hose to the thermostat housing.
54. Install the cooling system radiator and the engine cooling fans. Refer to Radiator Replacement
55. Install the battery and the battery tray. Refer to Battery Tray Replacement



56. Install the fuel pump fuse.
57. Fill the engine crankcase with engine oil.
58. Fill the engine coolant system. Refer to Cooling System Draining and Filling
59. Bleed the power steering system, if equipped. Refer to Power Steering System Bleeding
60. Fill the A/C refrigerant system, if equipped. Refer to Refrigerant Recovery and Recharging

Engine Oil and Oil Filter Replacement

Removal Procedure

1. Raise and properly support the vehicle. Refer to Lifting and Jacking the Vehicle.
2. Position an appropriate drain pan under the engine.
3. Remove the oil pan drain plug bolt.
4. Remove the oil filter.

Installation Procedure

Caution: Refer to Fastener Caution in the Preface section.

1. Install the oil filter.

   Tighten
   Tighten the oil filter to 14 N·m (10 lb ft).

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 55 N·m (40 lb ft).

4. Lower the vehicle.
5. Fill the engine with oil to the appropriate mark.
6. Start engine and inspect for leaks.

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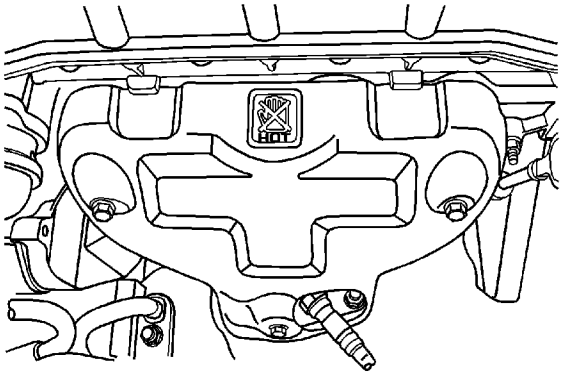
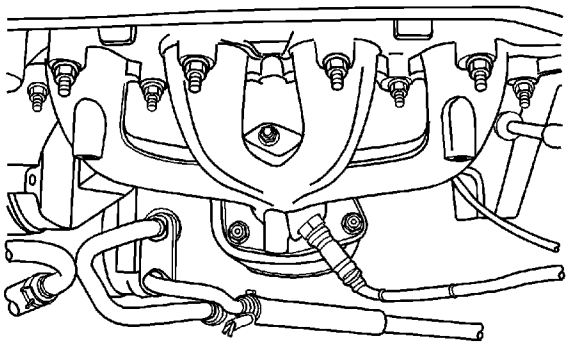
Exhaust Manifold Replacement

Removal Procedure

Warning: Refer to Battery Disconnect Warning in the Preface section.



1. Disconnect the negative battery cable.
2. Disconnect the pre-converter oxygen sensor connector.
3. Remove the exhaust manifold heat shield bolts.
4. Remove the exhaust manifold heat shield.



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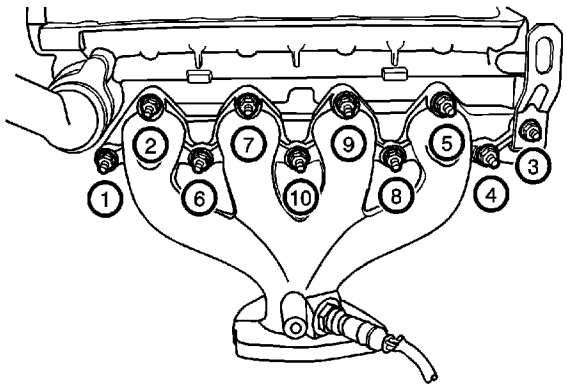
5. Remove the auxiliary catalytic converter nuts from the exhaust manifold.

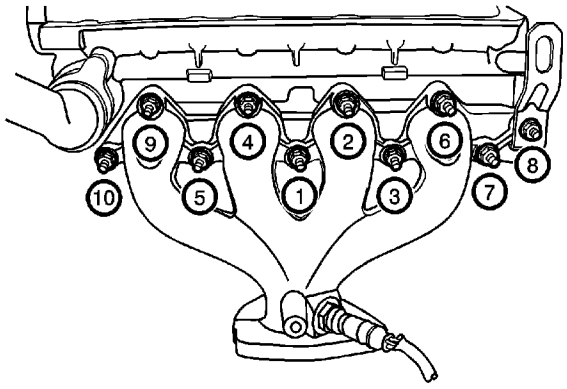


6. Remove the exhaust manifold retaining nuts in the sequence shown.
7. Remove the exhaust manifold.
8. Remove the exhaust manifold gasket.

Warning: Refer to Safety Glasses Warning in the Preface section.

9. Clean the sealing surfaces of the exhaust manifold and the cylinder head.

Installation Procedure

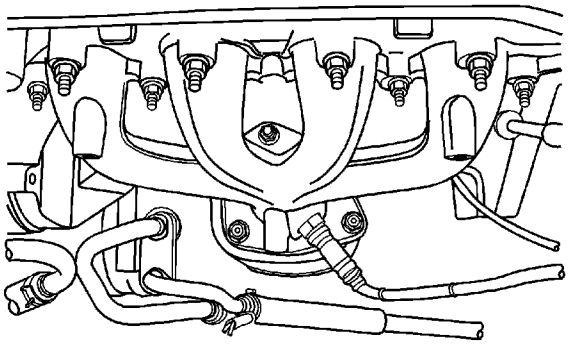


1. Install the exhaust manifold gasket.
2. Install the exhaust manifold.

Caution: Refer to Fastener Caution in the Preface section.

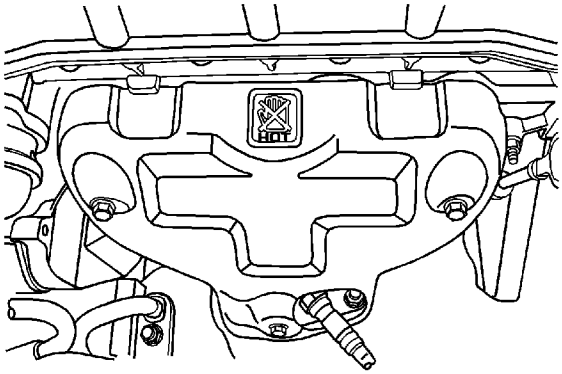
3. Install the exhaust manifold retaining nuts and tighten them in the sequence shown.

Tighten
Tighten the exhaust manifold retaining nuts 25 N·m (18 lb ft).



4. Install the auxiliary catalytic converter nuts to the exhaust manifold.

Tighten
Tighten the auxiliary catalytic converter-to-exhaust manifold nuts to 40 N·m (30 lb ft).



5. Install the exhaust manifold heat shield.
6. Install the exhaust manifold heat shield bolts.

Tighten
Tighten the exhaust manifold heat shield bolts to 15 N·m (11 lb ft).

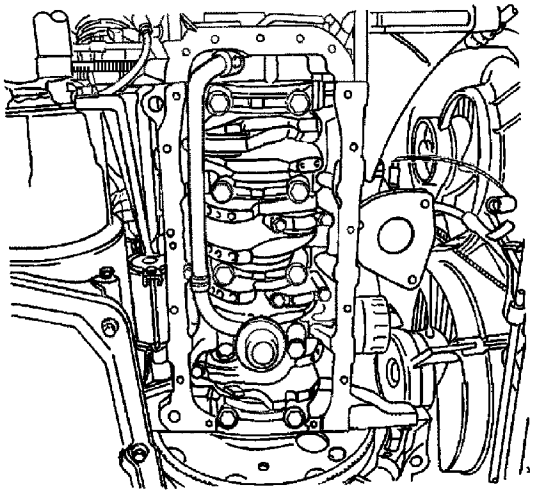
7. Connect the pre-converter oxygen sensor connector.
8. Connect the negative battery cable.

Piston, Connecting Rod, and Bearing Replacement

Special Tools

- J 24086-B (KM 427) Piston Pin Remover/Installer Set
- J 45059 Angle Meter
- KM-470-B Angular Torque Gage

Removal Procedure



1. Remove the cylinder head with the intake manifold and the exhaust manifold attached. Refer to Cylinder Head Replacement.
2. Remove the oil pan. Refer to Oil Pan Replacement.
3. Remove the oil suction pipe bolts.
4. Remove the oil suction pipe.

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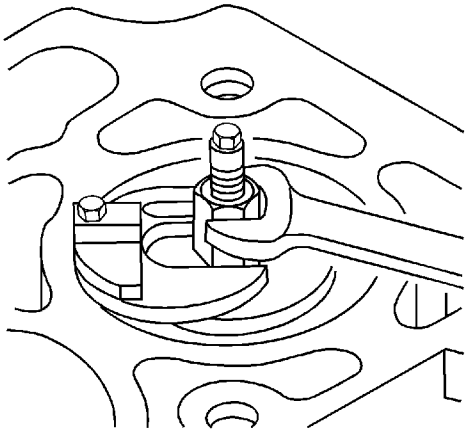
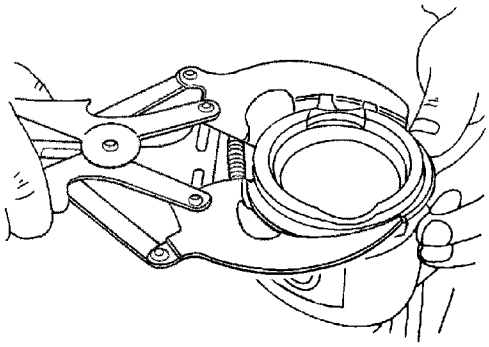
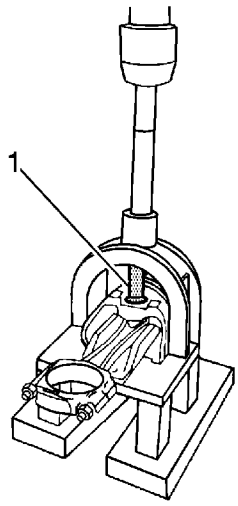


5. Move the piston to the bottom of the piston stroke.
6. Mark the connecting rod cap for position.
7. Remove the connecting rod cap bolts.
8. Remove the connecting rod cap and the lower connecting rod bearing.
9. Remove the upper piston connecting rod bearing.
10. Ridge ream the cylinder wall.



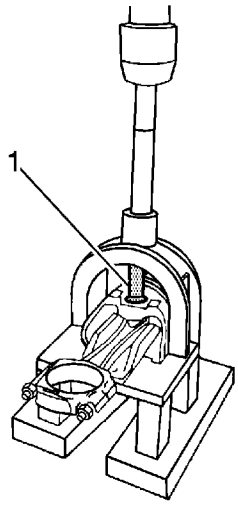
Warning: Handle the piston carefully. Worn piston rings are sharp and may cause bodily injury.

11. Remove the piston.
12. Use a piston ring expander tool to expand the piston rings.
13. Remove the piston rings.



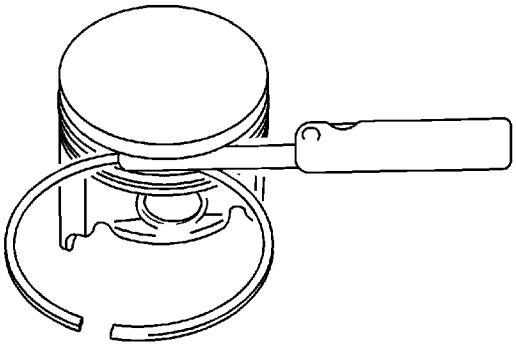
14. Remove the piston pin from the piston and connecting rod assembly using J 24086-B (1).
15. Separate the piston from the connecting rod.

Installation Procedure

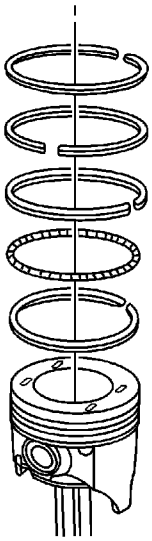


1. Align the notch on the piston and the connecting rod so that the proper sides will be facing the front of the engine.
2. Install the piston pin guide through the piston and the connecting rod.
3. Coat the piston pin with clean oil.
4. Install the piston pin into the opposite side of the piston.
5. Install the piston pin into the piston and connecting rod assembly using J 24086-B (1).
6. Select a set of new piston rings.

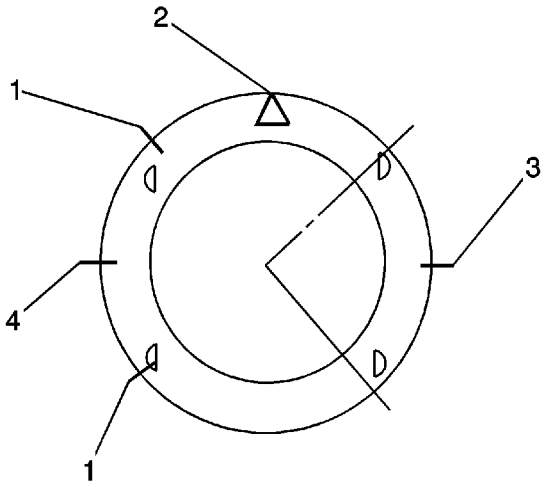
7. Measure the piston ring gap using a feeler gage. Refer to Engine Mechanical Specifications.
8. Increase the piston ring gap by carefully filing off excess material if the piston ring gap is below specifications.



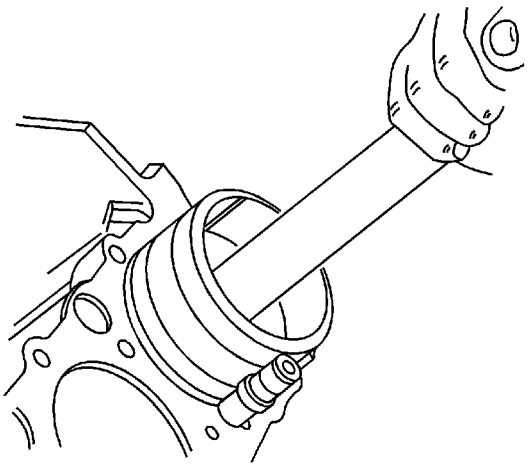
9. Measure the piston ring side clearance using a feeler gage. Refer to Engine Mechanical Specifications.
10. If the piston ring is too thick, try another piston ring.
11. If no piston ring can be found that fits to specifications, the piston ring may be ground to size with emery paper placed on a sheet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



12. Install a piston oil ring, the expander, then the second piston oil ring to the bottom ring groove of the piston.
13. Install the second compression ring to the middle ring groove of the piston.
14. Install the top compression ring to the top ring groove of the piston.

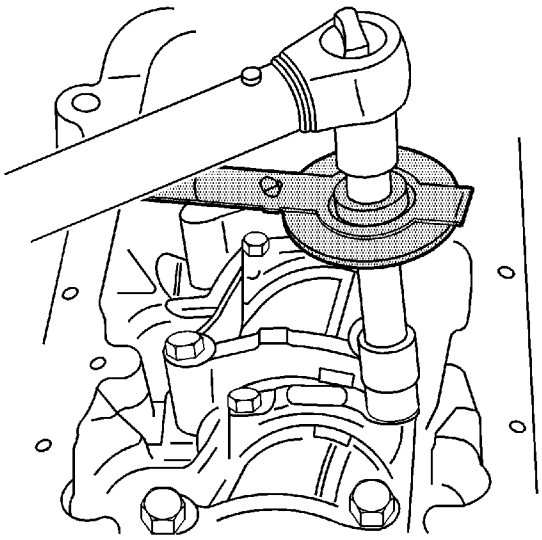


15. Use a piston ring expander to install the piston rings. Do not expand the piston rings beyond the expansion necessary for installation.
16. Stagger the piston oil rings (3) , the oil ring rail gaps (1), the second compression ring (4), and the top compression ring (3) in relation to the notch on the top of the piston (2).



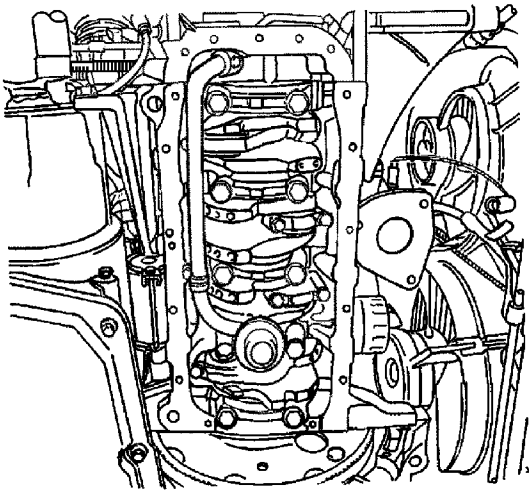
17. Lubricate the cylinder wall and the piston rings with clean engine oil.
18. Install the piston using a ring compressor and a wood handle. Guide the lower connecting rod end to prevent damaging the crankshaft journal.
19. Install the connecting rod cap and bearings. Refer to Crankshaft and Bearing Cleaning and Inspection.

Caution: Refer to Fastener Caution in the Preface section.



20. Install the connecting rod cap bolts.

Tighten
Tighten the connecting rod bearing cap bolts to 25 N·m (18 lb ft). Using the J 45059 , tighten the bolts one turn of 30 degrees plus one turn of 15 degrees.



21. Install the oil suction pipe.
22. Install the oil suction pipe bolts.

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

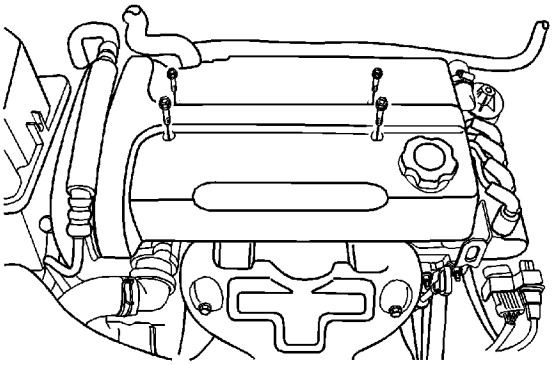
23. Install the oil pan. Refer to Oil Pan Replacement.
24. Install the cylinder head with the intake manifold and the exhaust manifold attached. Refer to Cylinder Head Replacement.

Camshaft Replacement

Special Tools

EN-48803 Camshaft Seal Installer

Removal Procedure



1. Remove the timing belt. Refer to Timing Belt Replacement.
2. Remove the engine cover bolts.
3. Remove the engine cover.

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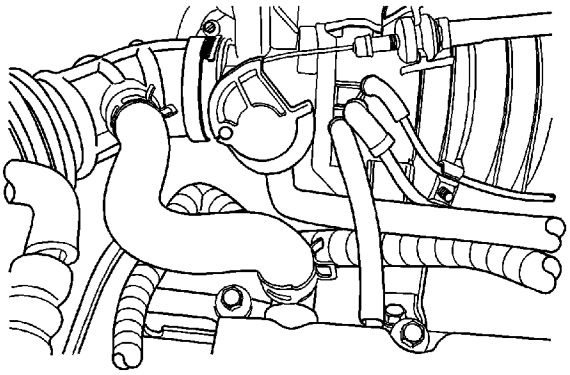
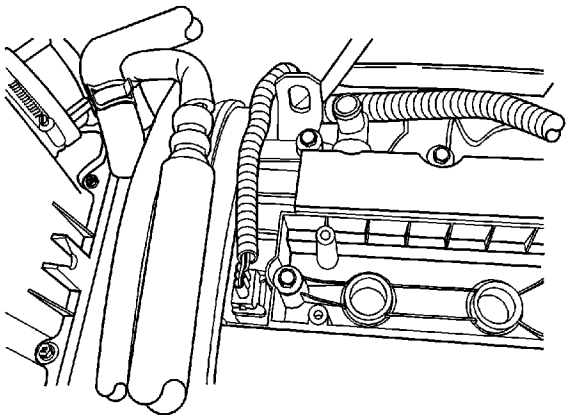
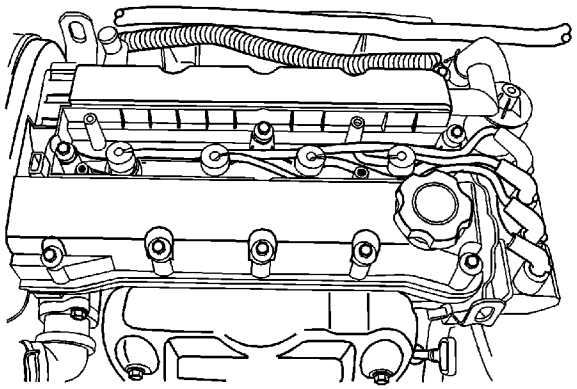


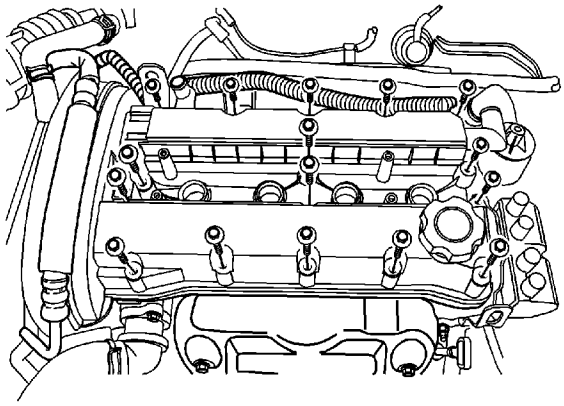
4. Disconnect the breather tube form the valve cover.
5. Disconnect the crankcase ventilation tube from the valve cover.



6. Disconnect the camshaft position (CMP) sensor connector.



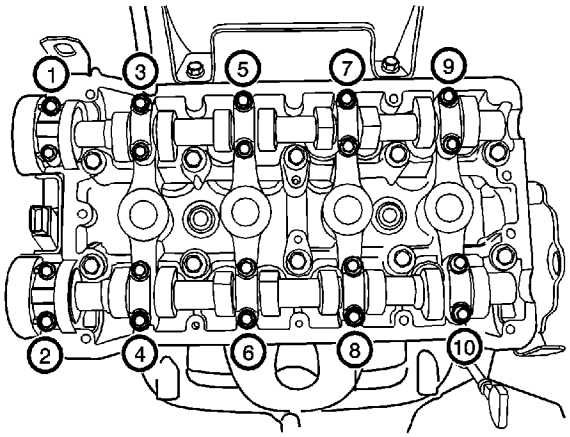
7. Disconnect the ignition wires from the spark plugs.



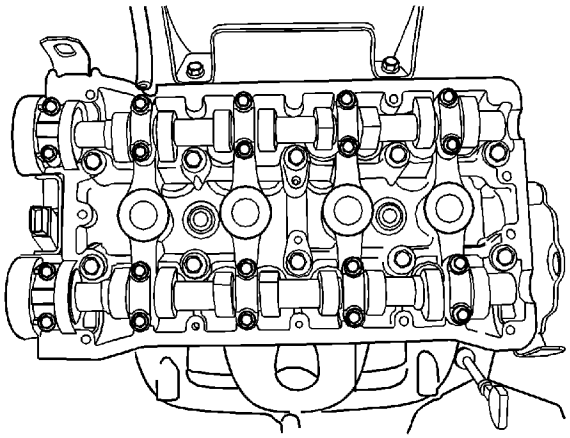
8. Remove the valve cover bolts.
9. Remove the valve cover and gasket.

Note: Use extreme care when removing the camshaft not to nick, scratch, or damage the camshaft lobes or bearing surfaces.

10. While holding the intake camshaft firmly in place, remove the intake camshaft gear bolt.
11. Remove the intake camshaft gear.
12. While holding the exhaust camshaft firmly in place, remove the exhaust camshaft gear bolt.
13. Remove the exhaust camshaft gear.

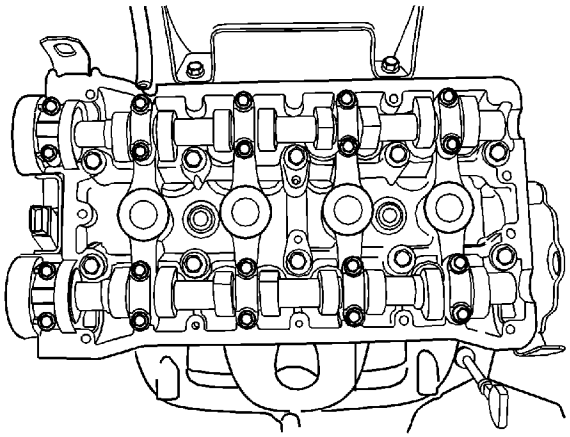


14. Remove the camshaft cap bolts gradually and in the sequence shown for each camshaft cap.



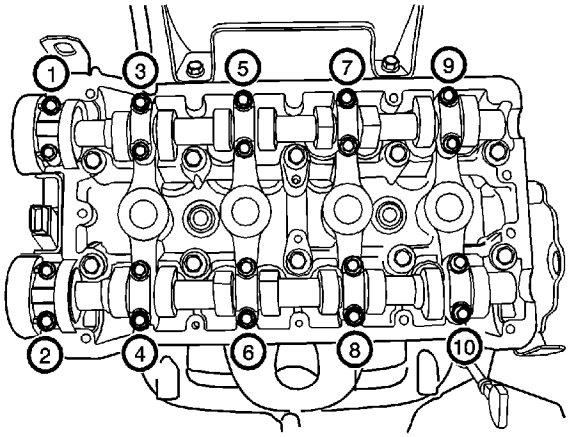
15. Remove the intake camshaft caps. Maintain the correct positions for installation.
16. Remove the intake camshaft.
17. Remove the exhaust camshaft caps. Maintain the correct positions for installation.
18. Remove the exhaust camshaft.
19. Remove the camshaft seals.

Installation Procedure



Note: Use extreme care when installing the camshaft not to nick, scratch, or damage the camshaft lobes or bearing surfaces.

1. Lubricate the camshaft journals and the camshaft caps with engine oil.
2. Install the intake camshaft.
3. Install the intake camshaft caps in their original positions.
4. Install the intake camshaft cap bolts.
5. Install the exhaust camshaft.
6. Install the exhaust camshaft caps in their original positions.

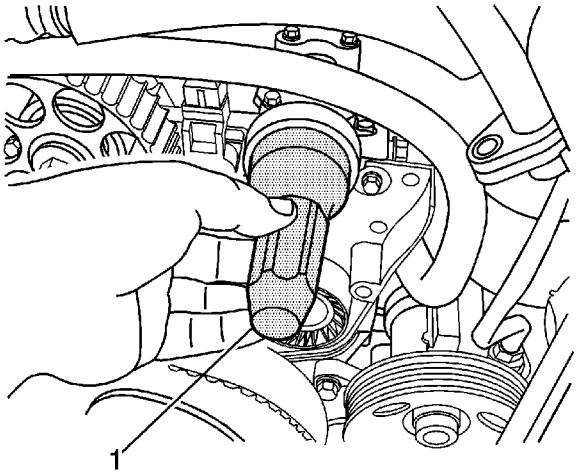


7. Install the exhaust camshaft cap bolts.

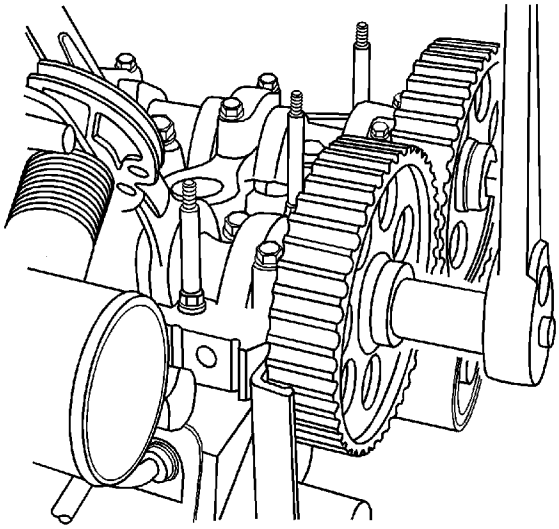
Caution: Refer to Fastener Caution in the Preface section.

8. Tighten the camshaft cap bolts gradually and in the sequence shown for each camshaft cap.

   Tighten
   Tighten the camshaft cap bolts to 16 N·m (12 lb ft).



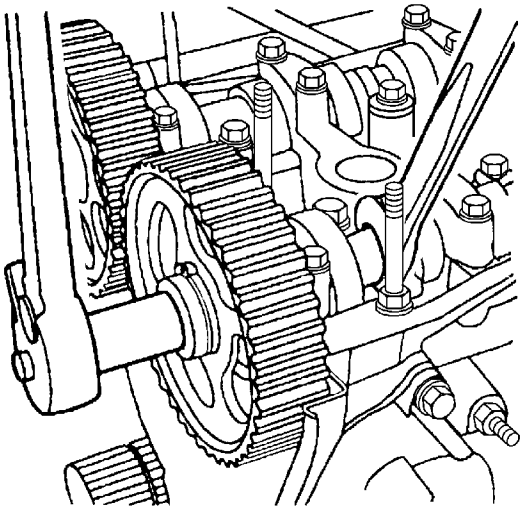
9. Install new camshaft seals by using EN-48803 .



10. Measure the intake camshaft end play and the exhaust camshaft end play. Refer to Engine Mechanical Specifications.
11. Install the intake camshaft gear.
12. While holding the intake camshaft firmly in place, install the intake camshaft gear bolt.

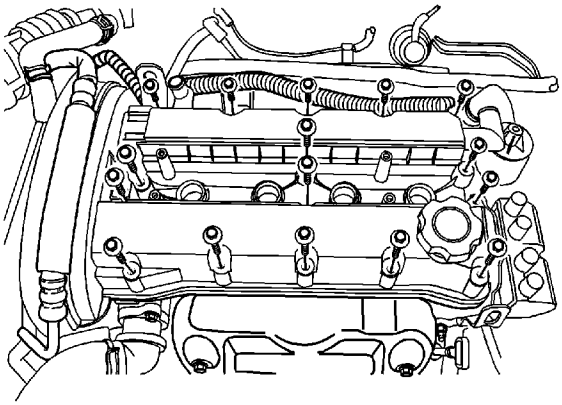
    Tighten

Tighten the intake camshaft gear bolt to 67.5 N·m (49 lb ft).



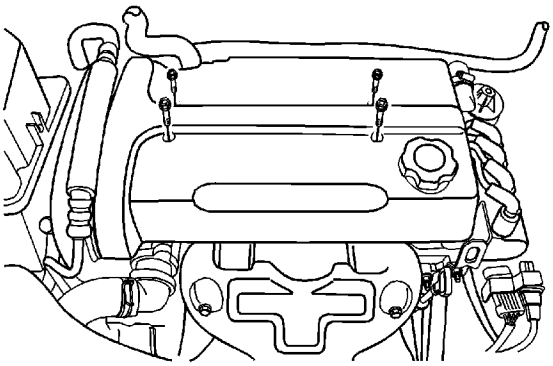
13. Install the exhaust camshaft gear.
14. While holding the exhaust camshaft firmly in place, install the exhaust camshaft gear bolt.

Tighten
Tighten the exhaust camshaft bolt to 67.5 N·m (49 lb ft).



15. Install the valve cover and the valve cover gasket.
16. Install the valve cover washers.
17. Install the valve cover nuts.

Tighten
Tighten the valve cover nuts to 9 N·m (80 lb in).



18. Connect the ignition wires to the spark plugs.
19. Connect the CMP sensor.
20. Install the engine cover.
21. Install the engine cover bolts.

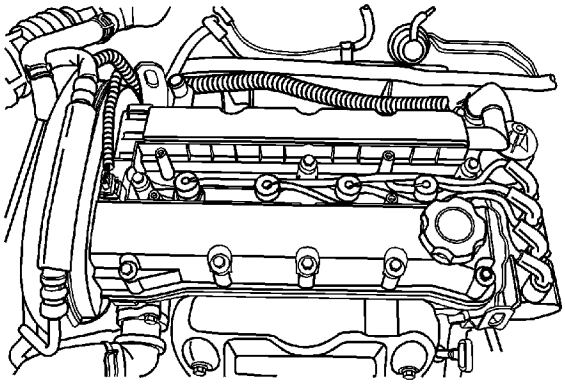
Tighten
Tighten the spark plug cover bolts to 3 N·m (27 lb in).

22. Install the oil filler cap.
23. Connect the vacuum line.
24. Connect the air breather tube to the valve cover.
25. Install the timing belt. Refer to Timing Belt Replacement.

Camshaft Gear Replacement

Removal Procedure

Warning: Refer to Battery Disconnect Warning in the Preface section.



1. Disconnect the negative battery cable.
2. Remove the timing belt. Refer to Timing Belt Replacement.
3. Remove the engine cover bolts.
4. Remove the engine cover.
5. Disconnect the ignition wires from the spark plugs.
6. Disconnect the crankcase ventilation tubes from the valve cover.
7. Disconnect the camshaft position (CMP) sensor.

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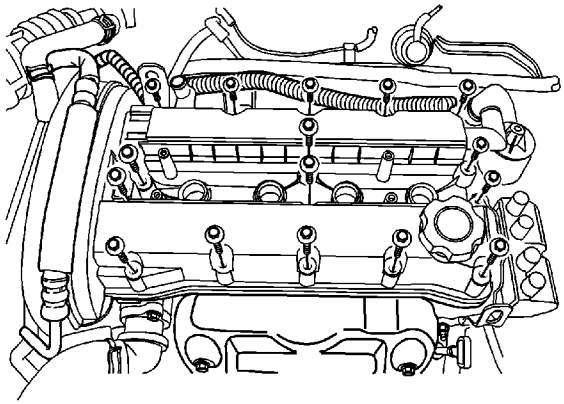
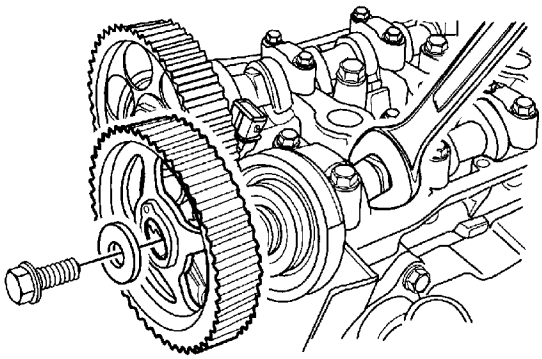


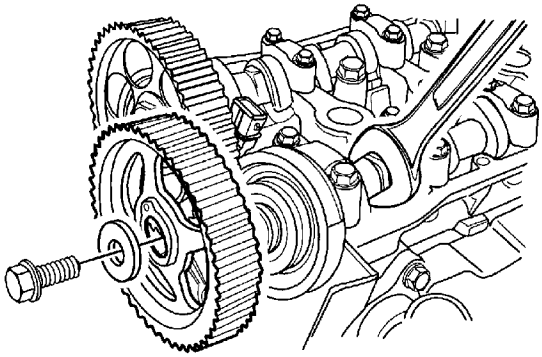
8. Remove the valve cover nuts.
9. Remove the valve cover washers.
10. Remove the valve cover and the valve cover gasket.



Caution: Use extreme care when installing the camshaft not to nick, scratch, or damage the camshaft lobes or bearing surfaces.

11. While holding the intake camshaft firmly in place, remove the intake camshaft gear bolt.
12. Remove the intake camshaft gear.
13. While holding the exhaust camshaft firmly in place, remove the exhaust camshaft gear bolt.
14. Remove the exhaust camshaft gear.

Installation Procedure



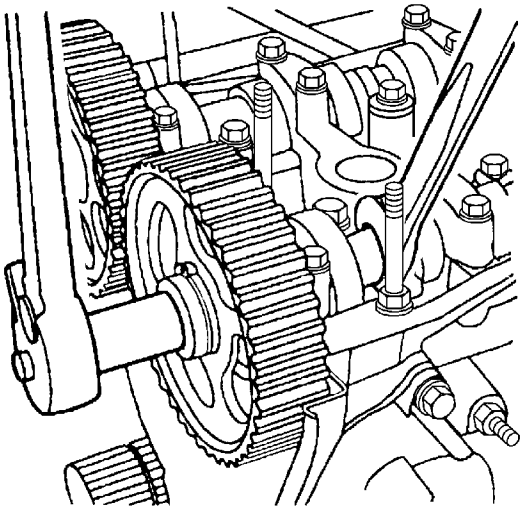
Caution: Use extreme care when installing the camshaft not to nick, scratch, or damage the camshaft lobes or bearing surfaces.

1. Install the intake camshaft gear.

   Caution: Refer to Fastener Caution in the Preface section.

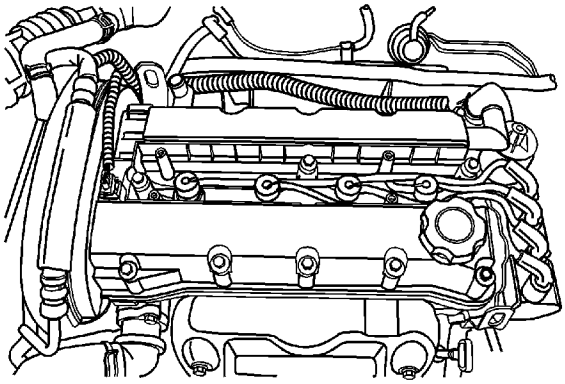
2. While holding the intake camshaft firmly in place, install the intake camshaft gear bolt.

   Tighten
   Tighten the intake camshaft gear bolt to 67.5 N·m (49 lb ft).



3. Install the exhaust camshaft gear.
4. While holding the exhaust camshaft firmly in place, install the exhaust camshaft gear bolt.

Tighten
Tighten the exhaust camshaft gear bolt to 67.5 N·m (49 lb ft).



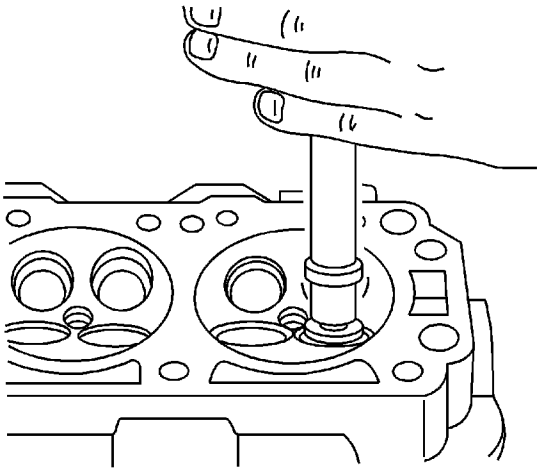
5. Connect the engine ventilation crankcase ventilation tubes to the valve cover.
6. Connect the ignition wires to the spark plugs.
7. Install the timing belt. Refer to Timing Belt Replacement.
8. Install the engine cover.
9. Connect the negative battery cable.

Valve Guide Reaming, and Valve and Seat Grinding

Tools Required

- KM-571-B Gage or equivalent
- KM-805 Valve Guide Reamer
- KM-340-1-C Cutter Set

Valve Grind-In



1. Lubricate the valve stem using a fine-grained paste.
2. Lift the valve rhythmically from the seat with a commercially available valve grinding tool in order to distribute the paste.

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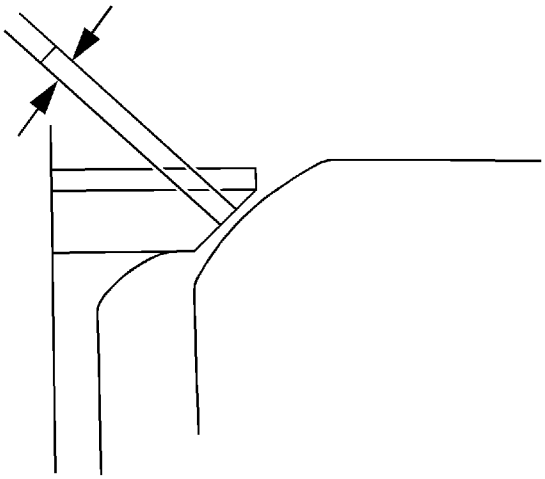
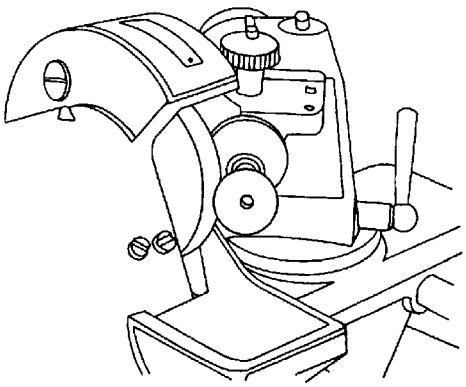


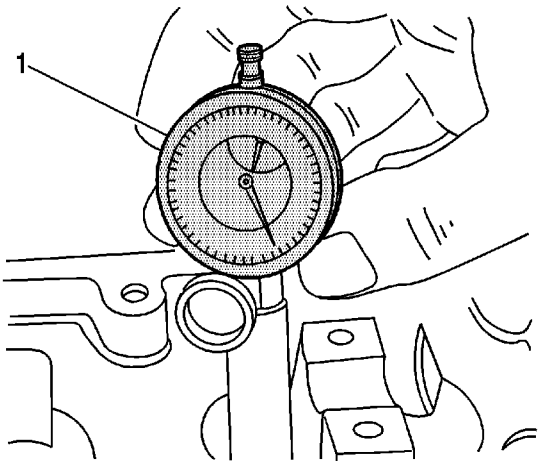
3. Check the contact pattern on the valve head and in the cylinder head.
4. Clean the valves, the valve guides, and the cylinder head.

Valve Grind

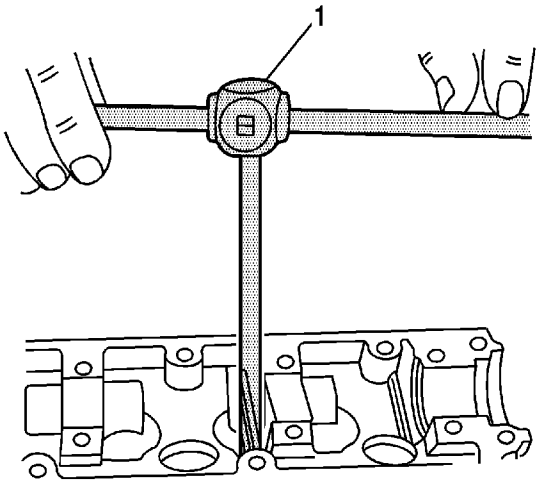


1. Ensure there are no crater line burns on the valve cone.
2. The valve may be reground only 2 times. Do not grind the valve stem end.
3. The angle at the valve face is 45 degrees.
4. Inspect the assembly height of the intake valves and the exhaust valves.

Valve Guide - Ream



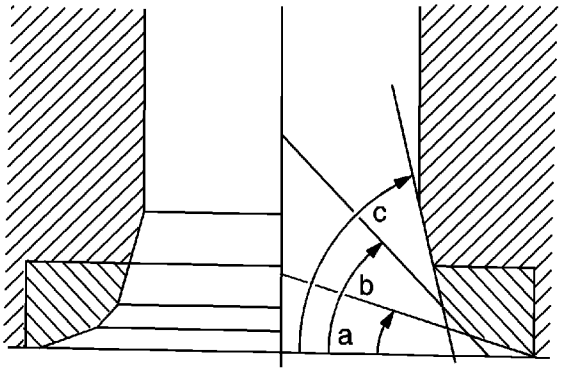
1. Measure the diameter of the valve guide using the KM-571-B (1) and a commercially available inside micrometer.



Important: Valve oversizes may already have been fitted in production.

2. An oversize service code is on the valve guide and the valve stem end. The Valve Guide Reaming Table give the correct size, reamer, and production codes for each service. Refer to Engine Mechanical Specifications .
3. Ream the valve guide using the KM-805 (1) from the upper side of the cylinder head to the next oversize.
4. After reaming, cross out the code and emboss the valve guide with the new code.

Valve Seat - Cut



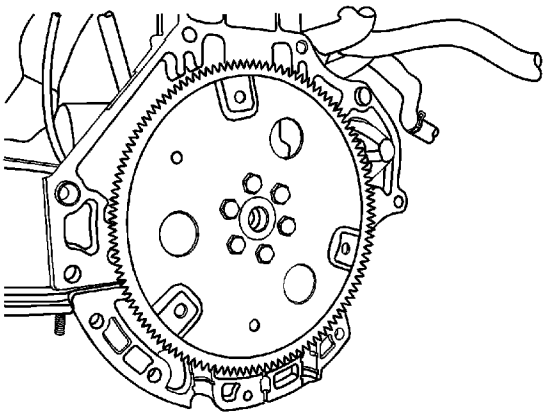
1. Place the cylinder head on wooden blocks.
2. Cut the intake and exhaust valve seats using the KM-340-7 included in the KM-340-1-C as follows:
   - Valve seat: A 44.5-45 degree side (b) using the KM-340-13 included in the KM-340-1-C
   - Upper correction angle: A 30 degree side (a) using the KM-340-13 included in the KM-340-1-C
   - Lower correction angle: A 60 degree side (c) using the KM-340-26 included in the KM-340-1-C
3. Clean the chippings from the cylinder head.
4. Inspect the dimensions to make sure the valve seat width is as follows:
   - Intake: 1.17-1.57 mm (0.046-0.062 in)
   - Exhaust: 1.4-1.8 mm (0.055-0.071 in)

Crankshaft Replacement

Special Tools

- KM 412 Engine Overhaul Stand
- J 42492-A (KM 421-A) Timing Belt Adjuster
- J 45059 Angle Meter
- KM-470-B Angular Torque Gage
- J-36792 (KM 635) Crankshaft Rear Oil Seal Installer

Removal Procedure



Note: Take extreme care to prevent any scratches, nicks, or damage to the camshafts.

1. Remove the engine. Refer to Engine Replacement.
2. Remove the flywheel bolts.
3. Remove the flywheel.

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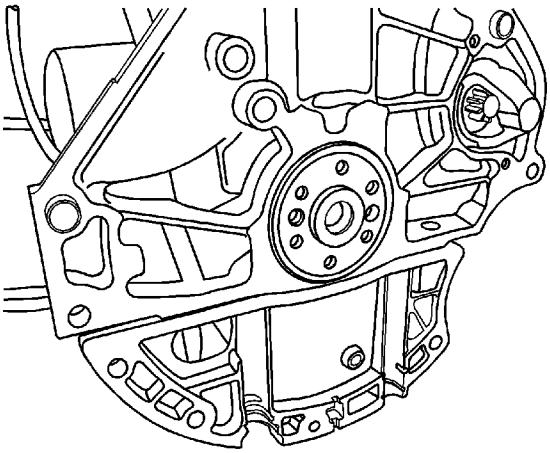
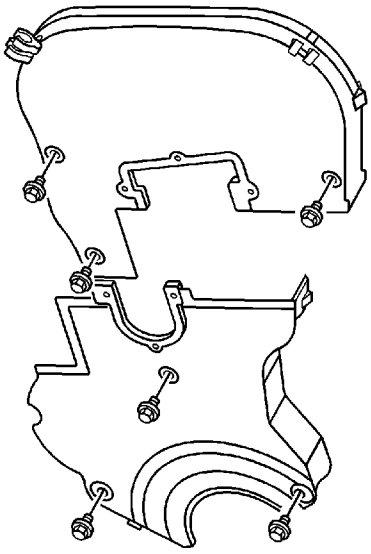
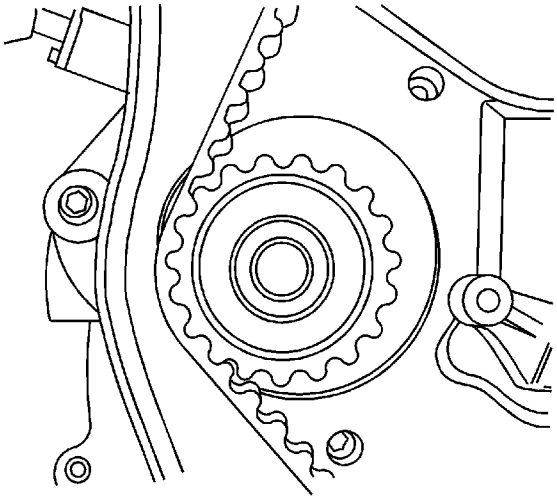


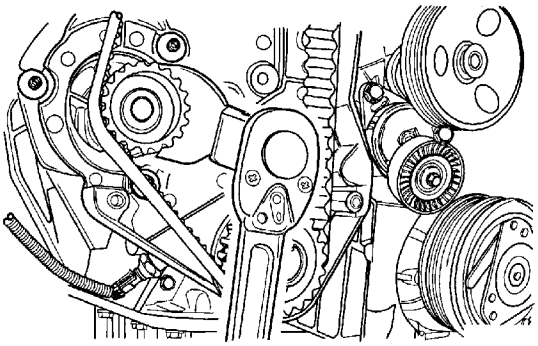
4. Remove the crankshaft rear oil seal.
5. Mount the engine assembly on the KM 412.



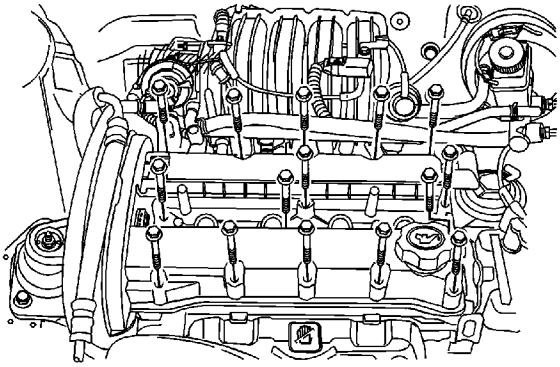
6. Remove the upper and the lower front timing belt cover bolts.
7. Remove the upper and the lower front timing belt cover.



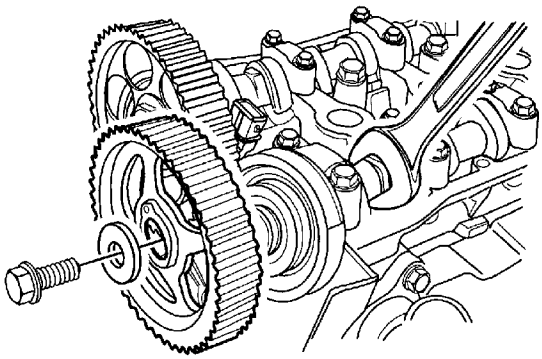
8. Slightly loosen the water pump retaining bolts.



9. Rotate the water pump using J 42492-A to remove the tension from the timing belt.
10. Remove the timing belt.



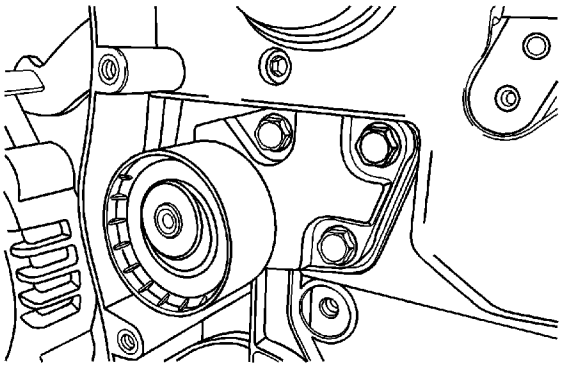
11. Disconnect the crankcase ventilation tubes from the valve cover.
12. Remove the engine cover bolts.
13. Remove the engine cover.
14. Disconnect the ignition wires from the spark plugs.
15. Remove the valve cover nuts.
16. Remove the valve cover washers.
17. Remove the valve cover and the valve cover gasket.



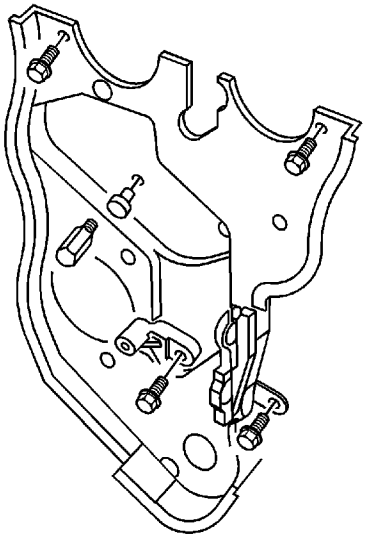
Note: Take extreme care to prevent any scratches, nicks, or damage to the camshafts.

18. While holding the intake camshaft firmly in place, remove the intake camshaft bolt.
19. Remove the intake camshaft gear.
20. While holding the exhaust camshaft firmly in place, remove the exhaust camshaft bolt.

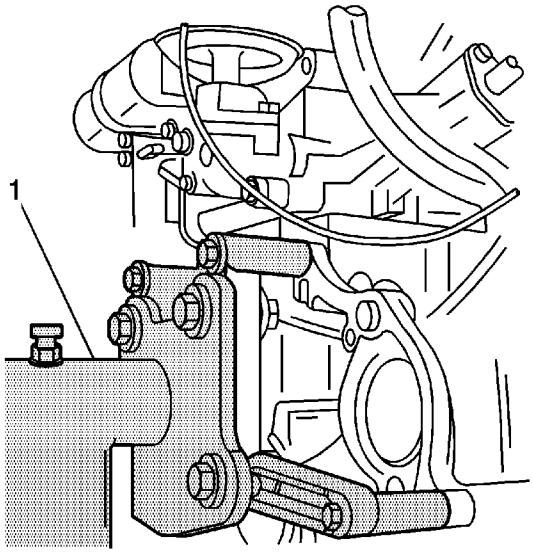
21. Remove the exhaust camshaft gear.



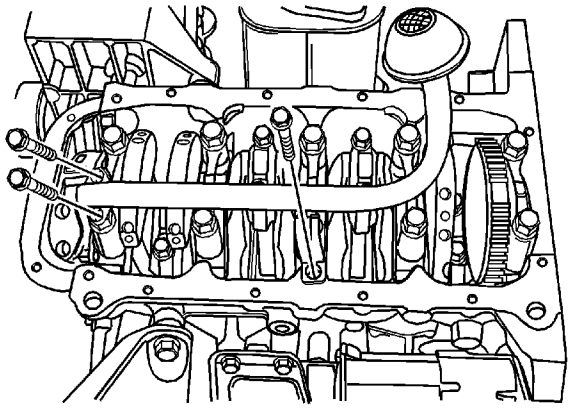
22. Remove the timing belt automatic tensioner bolts.
23. Remove the timing belt automatic tensioner.
24. Remove the timing belt idler pulley bolt.
25. Remove the timing belt idler pulley.



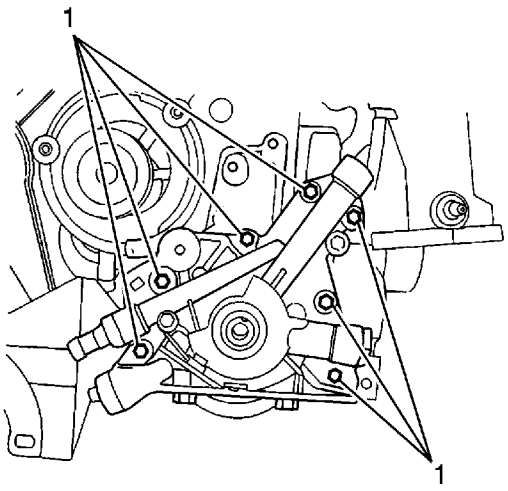
26. Remove the crankshaft timing belt gear.
27. Remove the rear timing belt cover bolts.
28. Remove the rear timing belt cover.



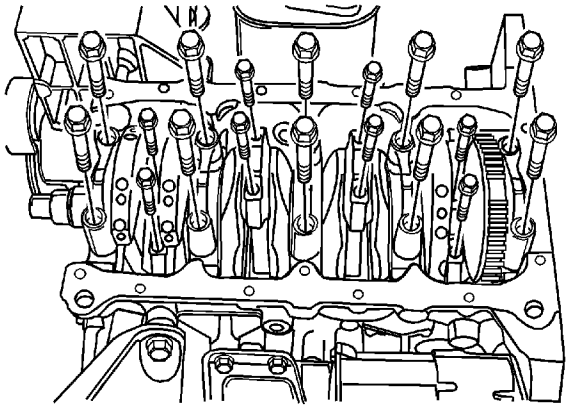
29. Rotate the engine on the KM 412 (1).



30. Remove the oil pan retaining bolts.
31. Remove the oil pan.
32. Remove the oil pickup tube bolts.
33. Remove the oil pickup tube.



34. Remove the oil pump retaining bolts (1).
35. Remove the oil pump.

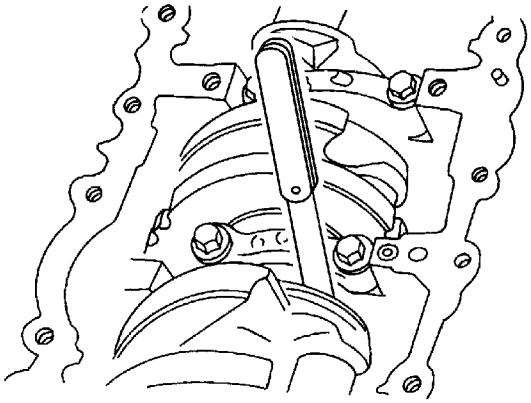


36. Mark the order of the connecting rod bearing caps.
37. Remove the connecting rod bearing cap bolts for all of the pistons.
38. Remove the connecting rod bearing caps and the lower connecting rod bearings.
39. Remove the upper connecting rod bearings.
40. Mark the order of the crankshaft bearing caps.
41. Remove the crankshaft bearing cap bolts.
42. Remove the crankshaft bearing caps and the lower crankshaft bearings.
43. Remove the crankshaft.
44. Remove the upper crankshaft bearings.

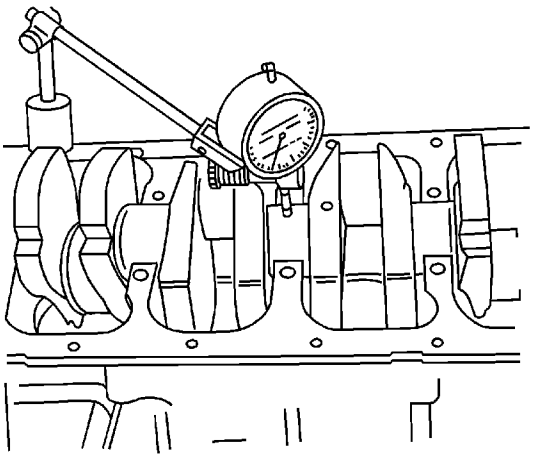
Warning: Refer to Safety Glasses Warning in the Preface section.

45. Clean the parts, as needed.

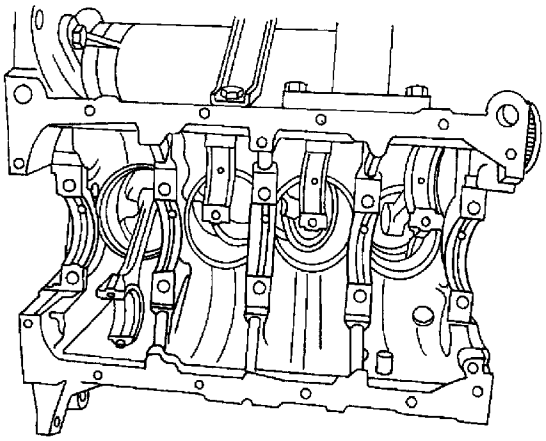
Installation Procedure



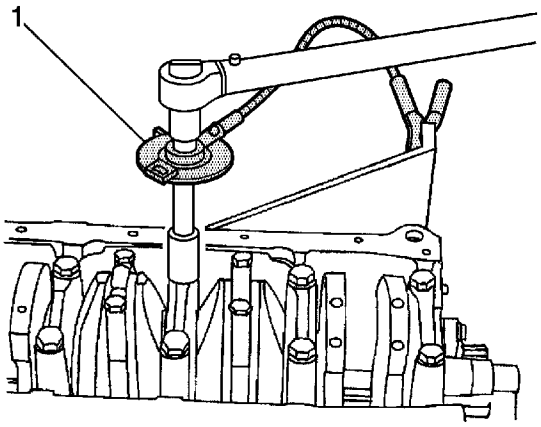
1. With the crankshaft and bearings in place, plastic gage all bearing clearances. Refer to Crankshaft and Bearing Cleaning and Inspection.
2. Inspect the crankshaft end play with the crankshaft bearings installed.
3. Inspect for permissible crankshaft end play. Refer to Crankshaft and Bearing Cleaning and Inspection.



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



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 he engine block.
8. Install the crankshaft.



9. Install the crankshaft bearings to the crankshaft bearing caps.
10. Install the crankshaft bearing caps.

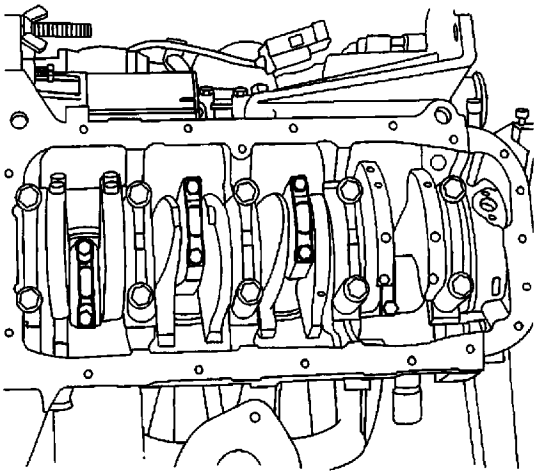
Caution: Refer to Fastener Caution in the Preface section.

Caution: 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 new crankshaft bearing bolt.

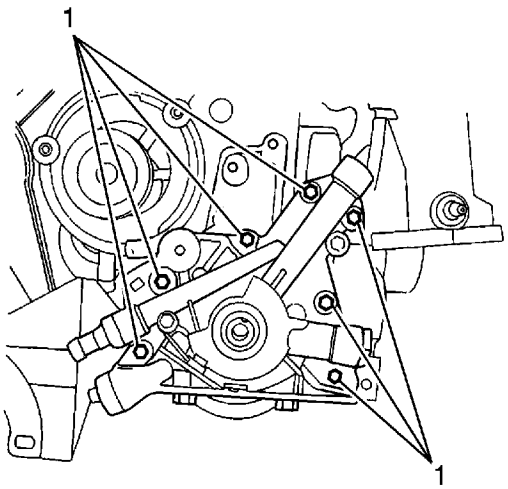
Tighten
Tighten the crankshaft bearing cap bolts to 50 N·m (37 lb ft). Using the J 45059 (1) or the KM-470-B , tighten the crankshaft bearing cap bolts 45 degrees and another 15 degrees.

12. Install the upper connecting rod bearings to the connecting rods.
13. Install the lower connecting rod bearings to the connecting rod bearing caps.



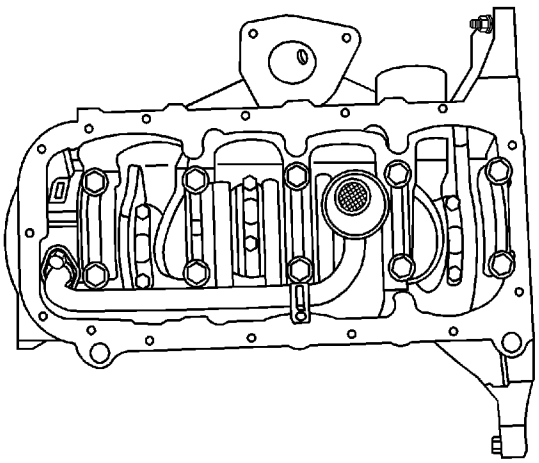
14. Install the connecting rod bearing caps to the connecting rods.
15. Install the new connecting rod bearing cap bolts.

Tighten
Tighten the connecting rod bearing cap bolts to 25 N·m (18 lb ft). Using the J 45059 or the KM-470-B , tighten the connecting rod bearing cap bolts another 30 degrees plus 15 degrees.



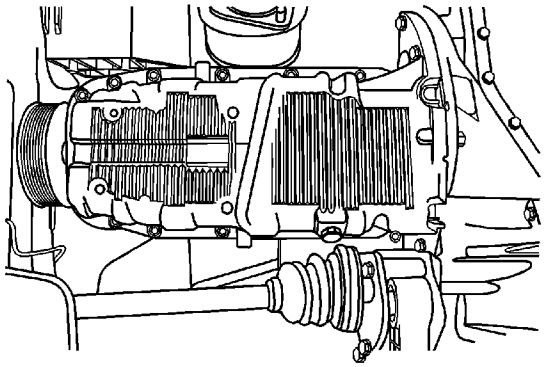
16. Install the oil pump.
17. Install the oil pump retaining bolts (1).

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



18. Install the oil pump pickup tube.
19. Install the oil pump pickup tube bolts.

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



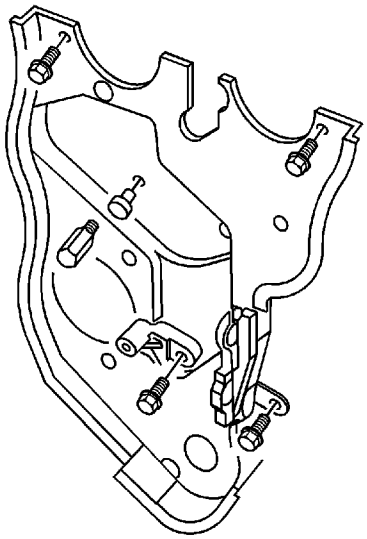
20. Install the oil pan gasket to the oil pan.
21. Install the oil pan.

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

22. Install the oil pan retaining bolts.

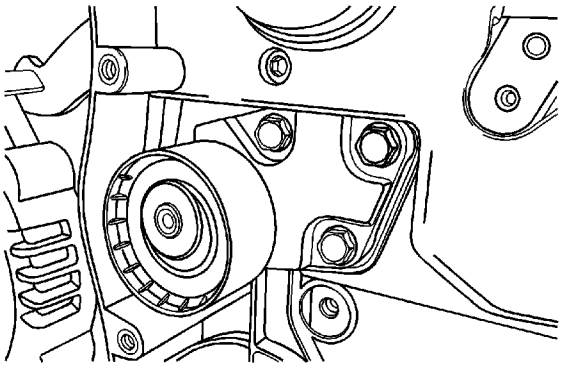
Tighten
Tighten the oil pan retaining bolts to 10 N·m (89 lb in).

23. Rotate the engine on the KM 412.



24. Install the rear timing belt cover.
25. Install the rear timing belt cover bolts.

Tighten
Tighten the rear timing belt cover bolts to 10 N·m (89 lb in).

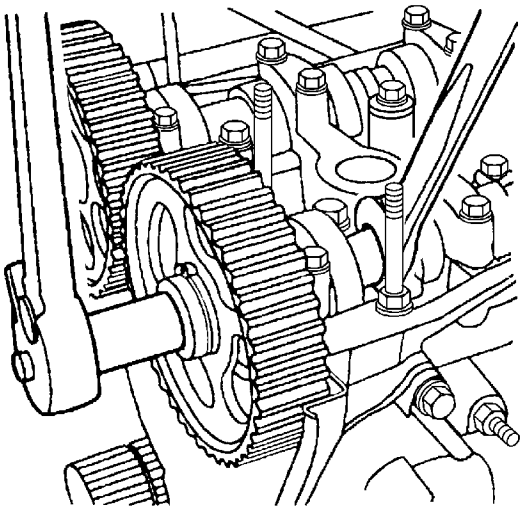


26. Install the crankshaft timing belt gear.
27. Install the timing belt automatic tensioner.
28. Install the timing belt automatic tensioner bolts.

Tighten
Tighten the timing belt automatic tensioner bolts to 25 N·m (18 lb ft).

29. Install the timing belt idler pulley.
30. Install the timing belt idler pulley bolt.

Tighten
Tighten the timing belt idler pulley bolt to 40 N·m (30 lb ft).



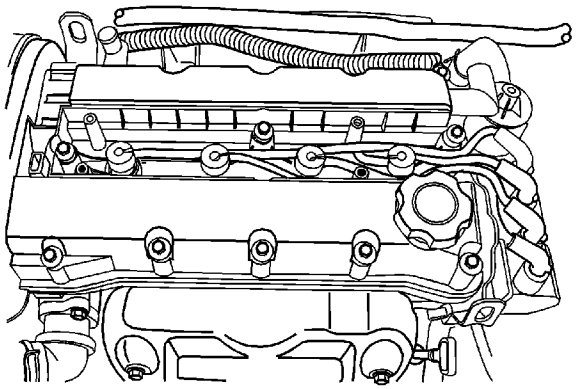
Caution: Use extreme care when installing the camshaft not to nick, scratch, or damage the camshaft lobes or bearing surfaces.

31. Install the intake camshaft gear.
32. Install the intake camshaft gear bolt while holding the intake camshaft firmly in place.

Tighten
Tighten the intake camshaft gear bolt to 67.5 N·m (49 lb ft).

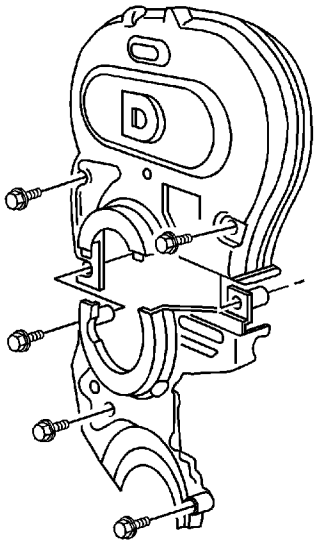
33. Install the exhaust camshaft gear.
34. Install the exhaust camshaft gear bolt while holding the exhaust camshaft firmly in place.

Tighten
Tighten the exhaust camshaft bolt to 67.5 N·m (49 lb ft).



35. Install the timing belt. Refer to Timing Belt Replacement.
36. Adjust the timing belt tension. Refer to Timing Belt Inspection.
37. Apply a small amount of gasket sealant to the corners of the front camshaft caps and to the top of the rear valve cover-to-cylinder head seal.
38. Install the valve cover and the valve cover gasket.
39. Install the valve cover washers.
40. Install the valve cover nuts.

Tighten
Tighten the valve cover nuts to 9 N·m (80 lb in).



41. Connect the ignition wires to the spark plugs.

42. Install the engine cover.
43. Install the engine cover bolts.

Tighten
Tighten the engine cover bolts to 3 N·m (27 lb in).

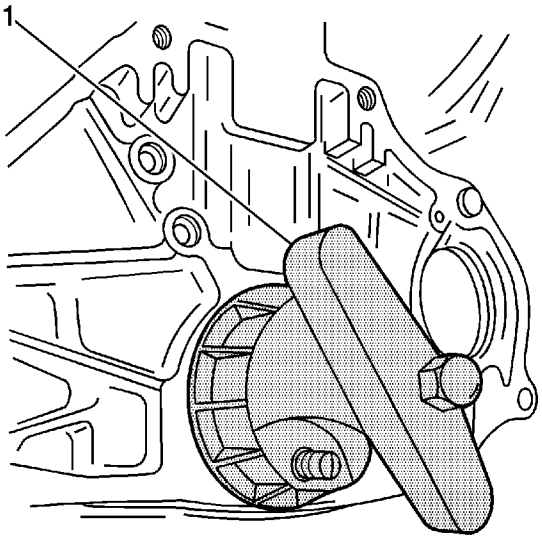
44. Connect the crankcase ventilation tube to the valve cover.
45. Install the upper and lower front timing belt cover.
46. Install the upper and lower front timing belt cover bolts.

Tighten
Tighten the upper and lower front timing belt cover bolts to 10 N·m (89 lb in).

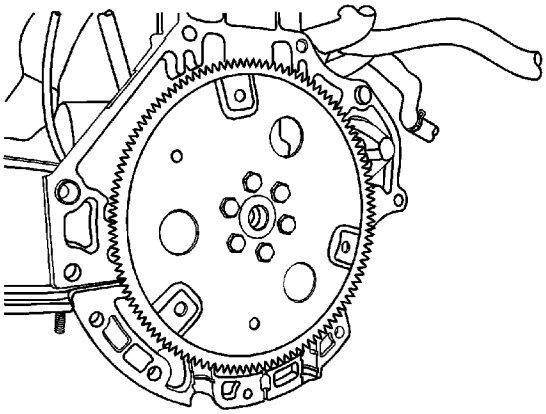
47. Install the power steering pump, if equipped.
48. Install the power steering pump mounting bolts.

Tighten
Tighten the power steering pump mounting bolts to 25 N·m (18 lb in).

49. Install the engine lifting device.
50. Remove the engine from the KM 412.



51. Install a new crankshaft rear oil seal using the J-36792 (1) or KM-635 .



52. Install the flywheel.
53. Install the flywheel or flexible plate bolts.

Tighten

For Manual transaxles, tighten the flywheel bolts to 35 N·m (25 lb ft). Use the J 45059 or KM-470-B to tighten the flywheel bolts 30 degrees plus 15 degrees. For the automatic transaxle, tighten the flexible plate bolts to 60 N·m (44 lb ft).

54. Install the engine. Refer to Engine Replacement.