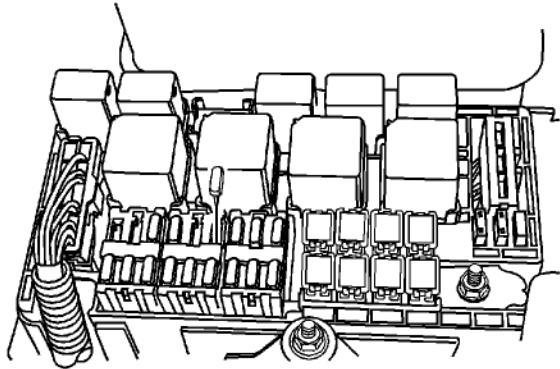


Intake Manifold Replacement

Removal Procedure



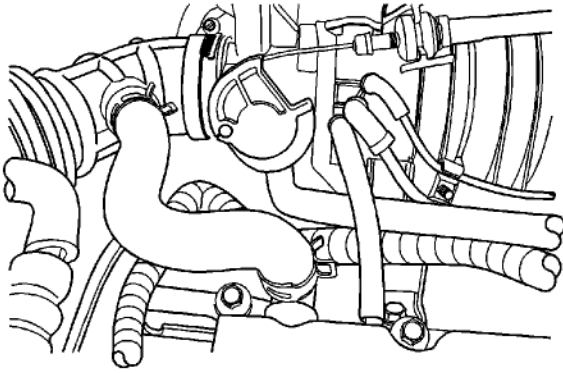
1. Remove the fuel pump fuse.
2. Start the engine. Crank the engine for 10 seconds after it stalls to rid the fuel system of fuel pressure.

Warning: Refer to [Battery Disconnect Warning](#) in the Preface section.

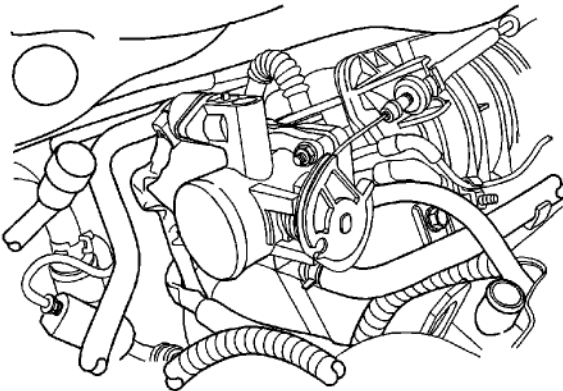
3. Disconnect the negative battery cable.

Warning: Refer to [Safety Glasses Warning](#) in the Preface section.

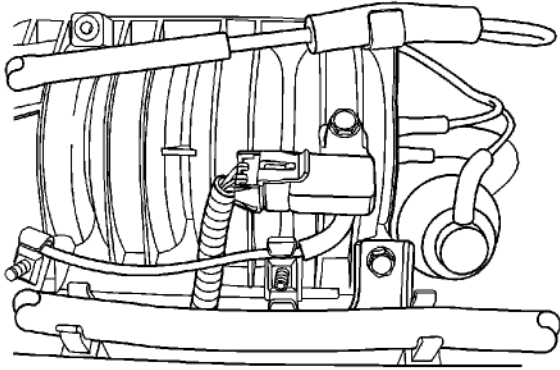
4. Drain the engine coolant. Refer to [Cooling System Draining and Filling](#).



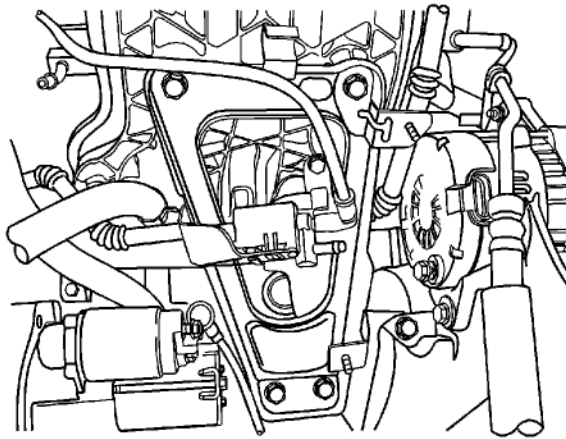
5. Disconnect the intake air temperature (IAT) sensor connector.
6. Disconnect the air intake tube from the throttle body.



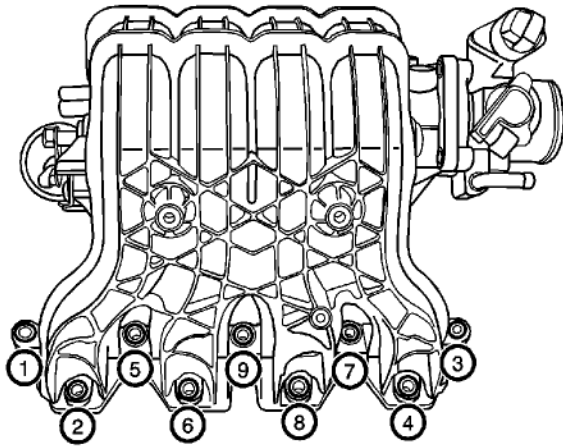
7. Disconnect the idle air control (IAC) valve connector.
8. Disconnect the throttle position sensor (TPS) connector.
9. Remove the alternator adjusting bolt and the alternator drive belt.
10. Disconnect the engine coolant temperature (ECT) sensor connector.
11. Disconnect the heater inlet hose from 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 booster vacuum hose at the intake manifold.
14. Disconnect the throttle cable from the throttle body and the intake manifold.

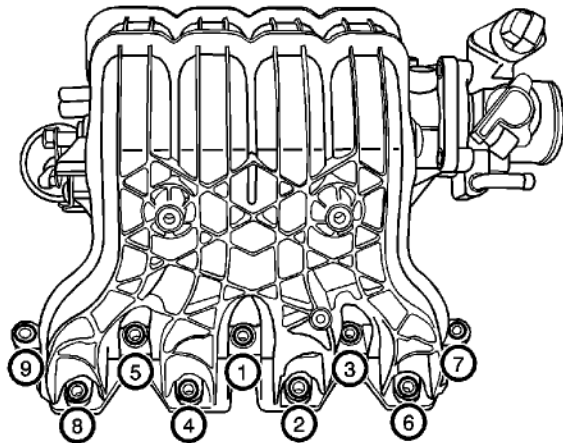


15. Remove the fuel injector rail and fuel injectors as an assembly.
16. Remove the alternator adjusting bracket bolt from the intake manifold.
17. Remove the alternator adjusting bracket.
18. Remove the intake manifold support bracket bolts and the intake manifold.
19. Remove the intake manifold support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

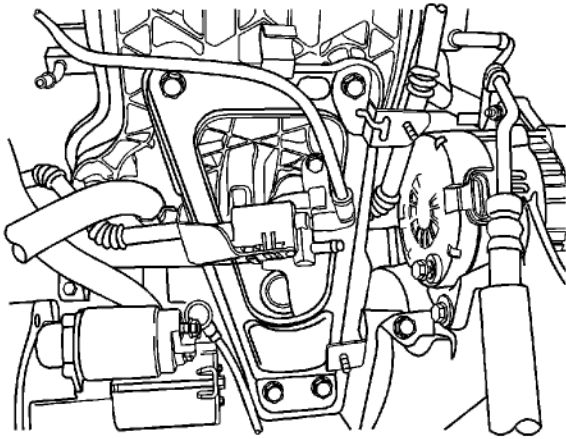
Installation Procedure



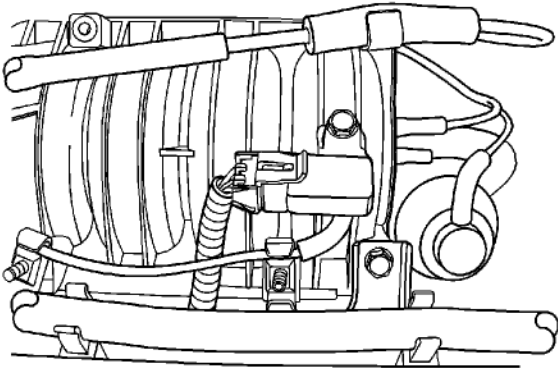
1. Install the intake manifold gasket.
2. Install the intake manifold.

Caution: Refer to [Fastener Caution](#) in the Preface section.

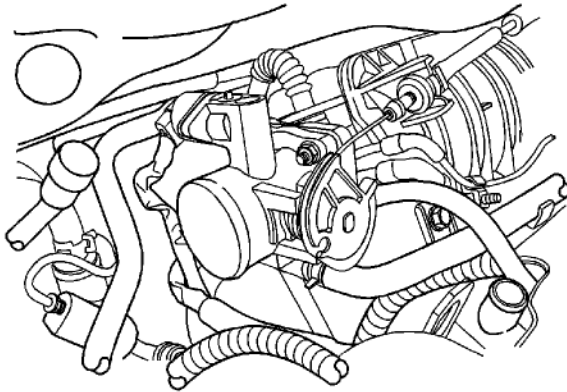
3. Install the intake manifold retaining nuts/bolts in the sequence shown and tighten to **25 N·m (18 lb ft)**.



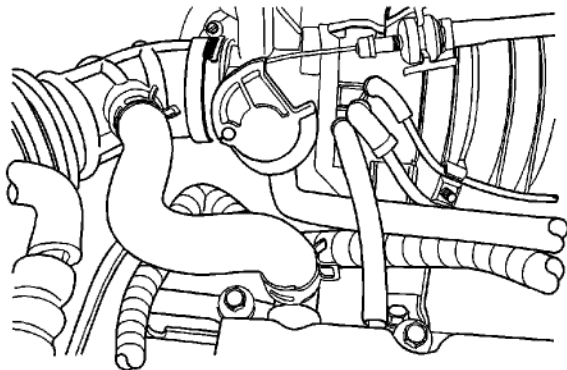
4. Install the intake manifold support bracket.
5. Install the intake manifold support bracket upper bolts to the intake manifold and tighten to **25 N·m (18 lb ft)**.
6. Install the intake manifold support bracket lower bolt-to-engine block and tighten to **40 N·m (30 lb ft)**.



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 bolt and tighten to **15 N·m (11 lb ft)**.
14. Install the alternator adjusting bolt and the alternator driver belt and tighten to **15 N·m (11 lb ft)**.
15. Connect the ECT sensor connector.
16. Connect the IAC valve connector.
17. Install the throttle body and engine cover. Refer to [Throttle Body Assembly Replacement](#).
18. Connect the TPS connector.



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

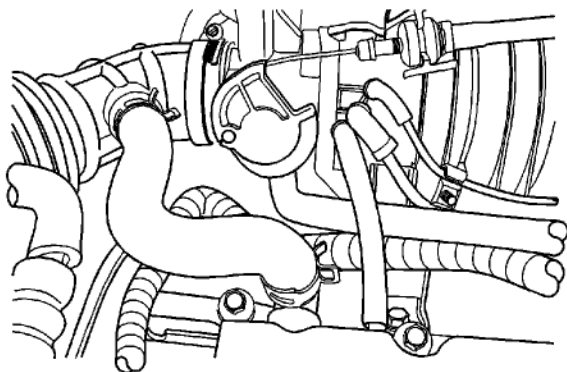
Timing Belt Replacement

Special Tools

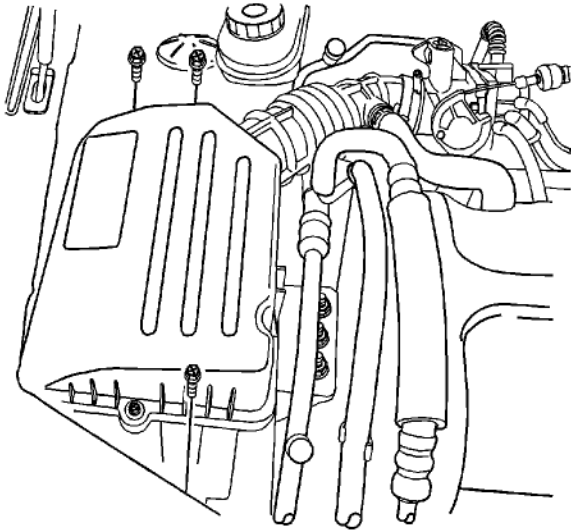
- [J 42492-A](#) (KM-421-A) Timing Belt Adjuster
- [J 45059](#) Angle Meter
- [KM-470-B](#) Angular Torque Gage

Removal Procedure

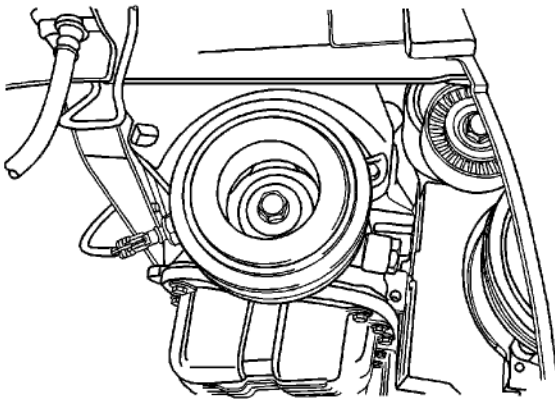
Warning: Refer to [Battery Disconnect Warning](#) in the Preface section.



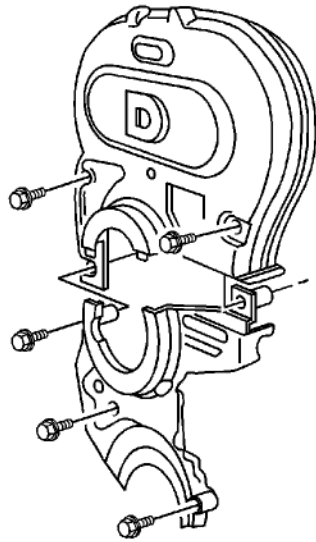
1. Disconnect the negative battery cable.
2. Disconnect the intake air temperature (IAT) sensor connector.
3. Disconnect the air intake tube from the throttle body.
4. Disconnect the breather tube from the valve cover.



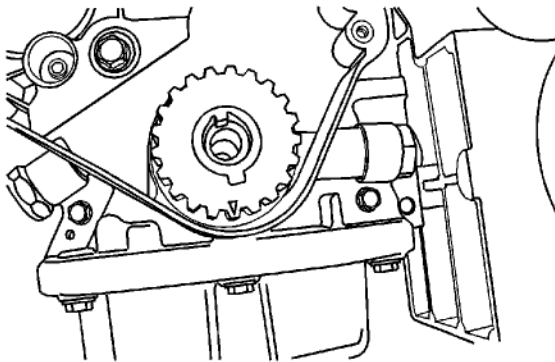
5. Remove the air filter housing bolts.
6. Remove the air filter housing.
7. Remove the right front wheel. Refer to [Tire and Wheel Removal and Installation](#).
8. Remove the right front splash shield.



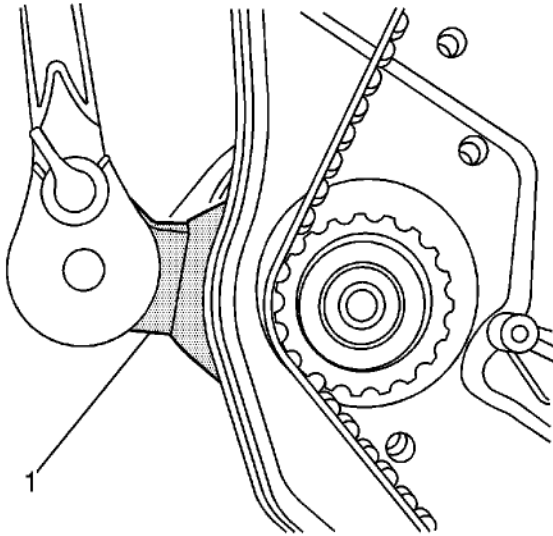
9. Remove the accessory drive belt.
10. Remove the crankshaft pulley bolt.
11. Remove the crankshaft pulley.



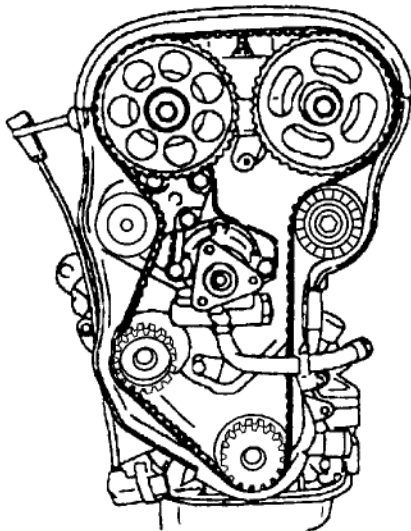
12. Remove the upper front timing belt cover bolts.
13. Remove the upper front timing belt cover.
14. Remove the lower front timing belt cover bolts.
15. Remove the lower front timing belt cover.
16. Remove the power steering pump mounting bolts, if equipped.
17. Install the crankshaft pulley bolt.



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



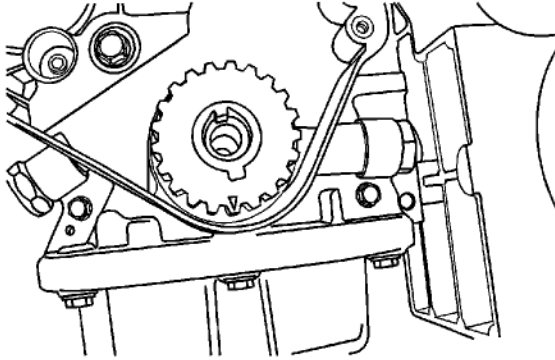
19. Slightly loosen the coolant pump retaining bolts.
20. Using the [J 42492-A](#) (1), rotate the coolant pump counterclockwise to release the tension on the timing belt.



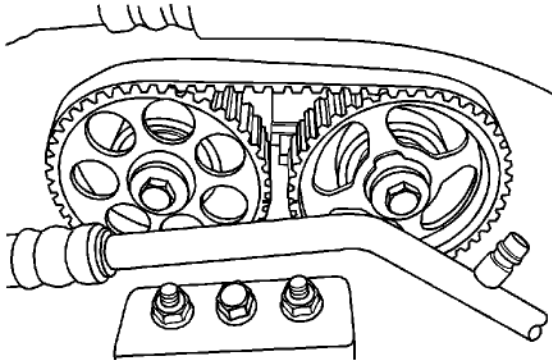
Note: Remove the timing belt behind the power steering pump.

21. Remove the timing belt.

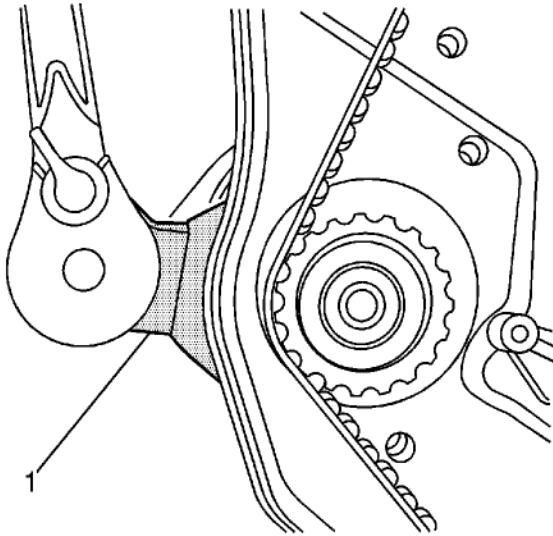
Installation Procedure



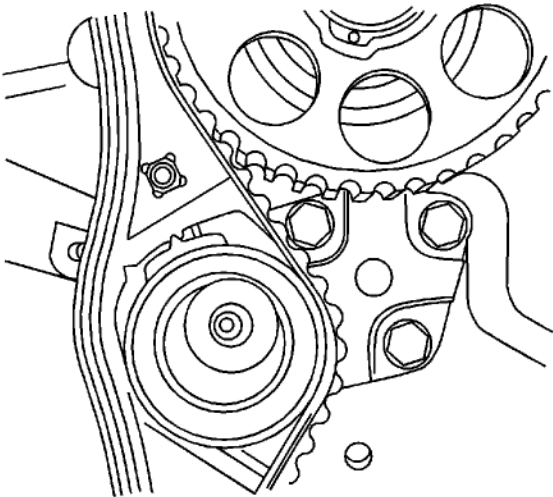
1. Align the timing mark on the crankshaft gear to the notch on the bottom of the rear timing belt cover.



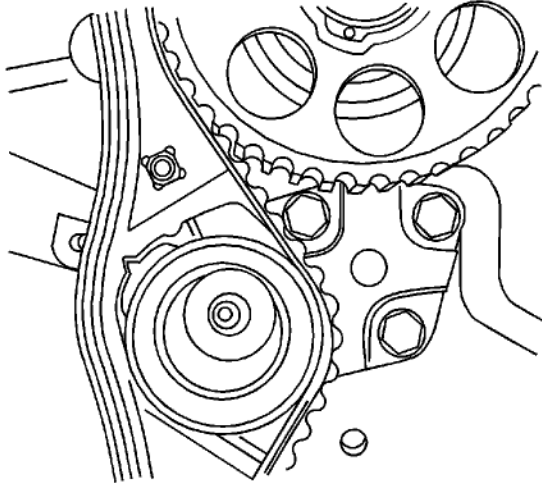
2. Align the timing marks on the camshaft gears.
3. Install the timing belt.



4. Rotate the coolant pump clockwise using the [J 42492-A](#) (1).

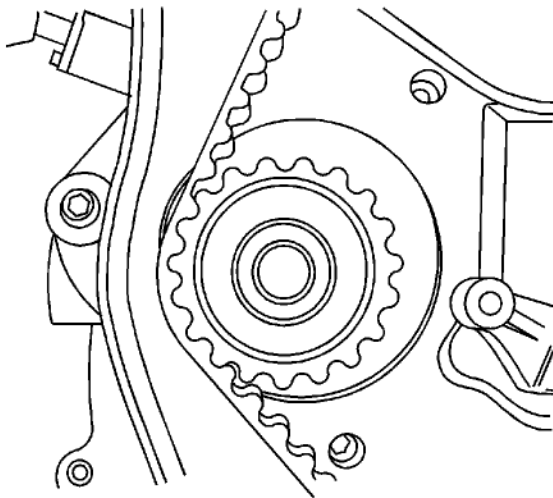


5. Rotate the coolant pump clockwise until the adjust arm pointer of the timing belt automatic tensioner is aligned to the notch in the timing belt automatic tensioner bracket.

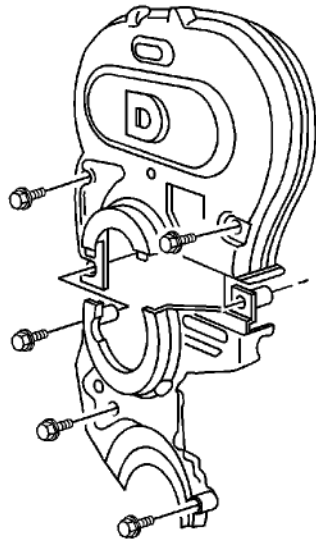


6. Tighten the coolant pump retaining bolts.
7. Rotate the crankshaft 2 full turns clockwise using the crankshaft pulley bolt.
8. Loosen the coolant pump retaining bolts.
9. Rotate the coolant pump until the adjust arm pointer of the timing belt automatic tensioner is aligned with the pointer on the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

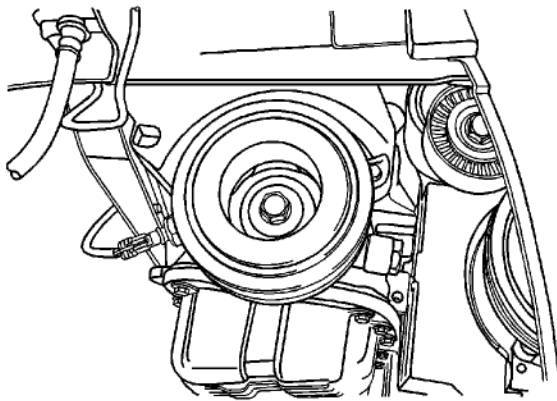
Caution: Refer to [Fastener Caution](#) in the Preface section.



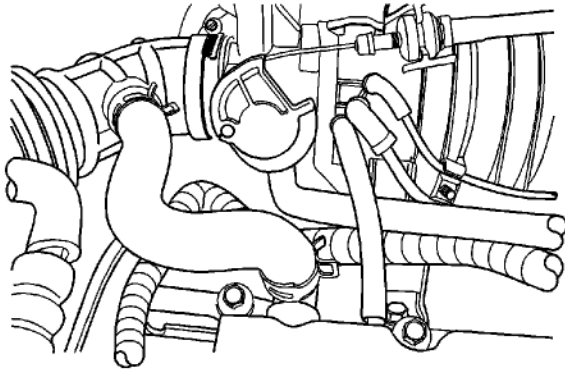
10. Tighten the coolant pump retaining bolts to **10 N·m (89 lb in)**.



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 and tighten to **10 N·m (89 lb in)**.



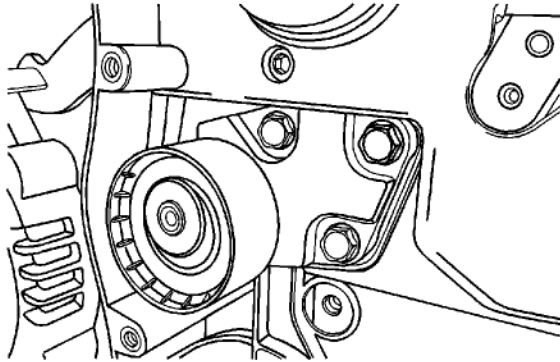
14. Install the crankshaft pulley.
15. Install the crankshaft pulley bolt. Tighten the crankshaft pulley bolt to **95 N·m (70 lb ft)** using a torque wrench. Using the [J 45059](#) or the [KM-470-B](#), tighten the crankshaft pulley bolt **15 degrees plus**.
16. Install the accessory drive belt, if equipped.
17. Install the right front splash shield.
18. Install the right front wheel. Refer to [Tire and Wheel Removal and Installation](#).



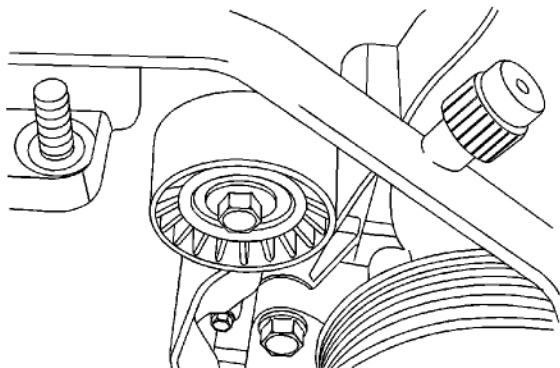
19. Install the air filter housing.
20. Install the air filter housing bolts and tighten to **8 N·m (71 lb in)**.
21. Connect the air intake tube to the throttle body.
22. Connect the breather tube to the throttle body.
23. Connect the IAT sensor connector.
24. Connect the negative battery cable.

Timing Belt Cover Replacement

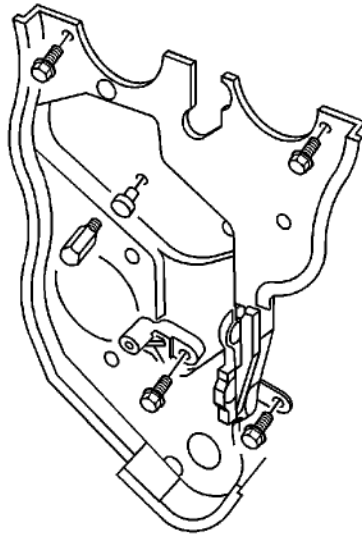
Removal Procedure



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.

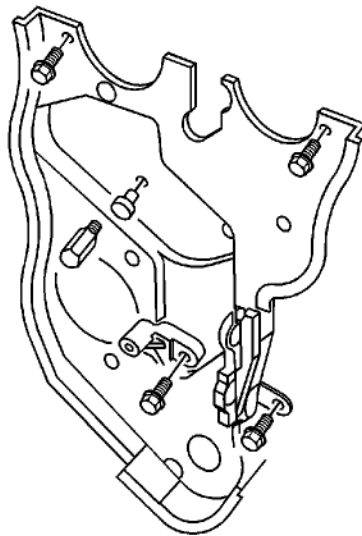


6. Remove the timing belt idler pulley bolt.
7. Remove the timing belt idler pulley.



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

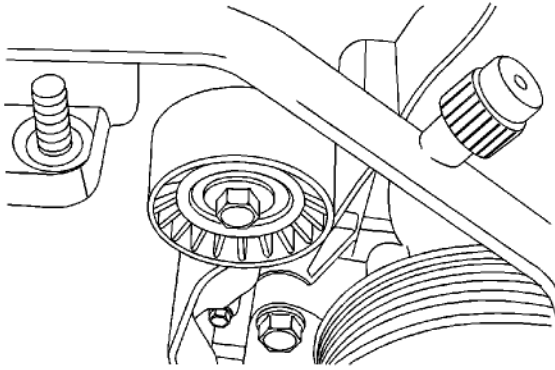
Installation Procedure



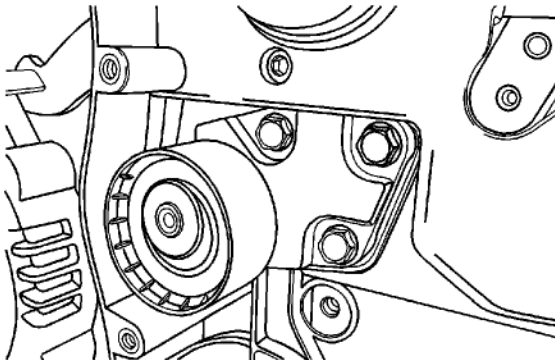
1. Install the rear timing belt cover.

Caution: Refer to [Fastener Caution](#) in the Preface section.

2. Install the rear timing belt cover bolts and tighten to **10 N·m (89 lb in)**.



3. Install the timing belt idler pulley.
4. Install the timing belt idler pulley bolt and tighten to **40 N·m (30 lb ft)**.

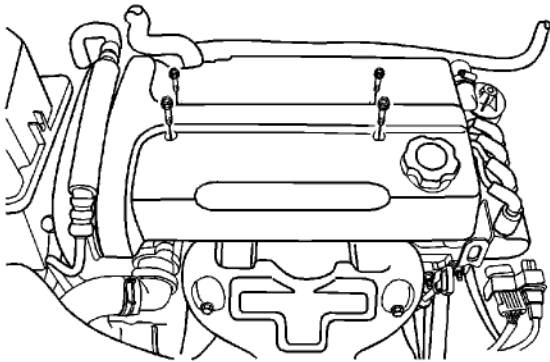


5. Install the timing belt automatic tensioner.
6. Install the timing belt automatic tensioner bolts and tighten to **25 N·m (18 lb ft)**.
7. Install the crankshaft gear.
8. Install the camshaft gears. Refer to [Camshaft Gear Replacement](#).
9. Install the timing belt and timing belt cover. Refer to [Timing Belt Replacement](#).

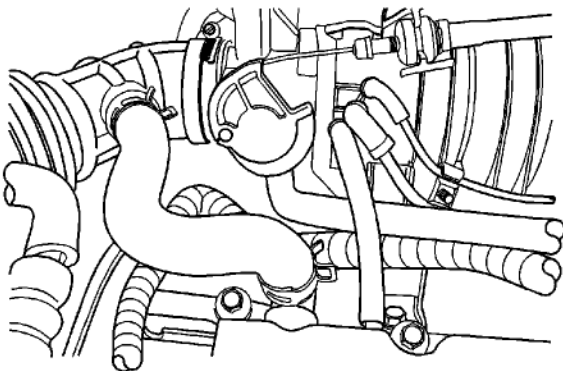
Valve Rocker Arm Cover Replacement

Removal Procedure

Warning: Refer to [Battery Disconnect Warning](#) in the Preface section.

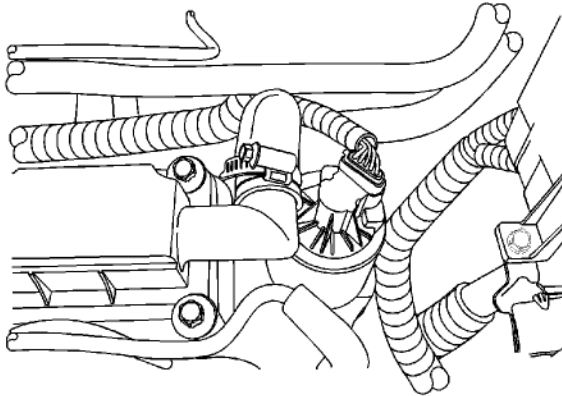


1. Disconnect the negative battery cable.
2. Remove the engine cover bolts and cover.

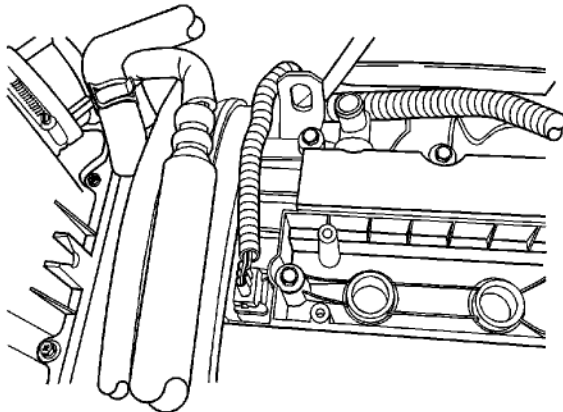


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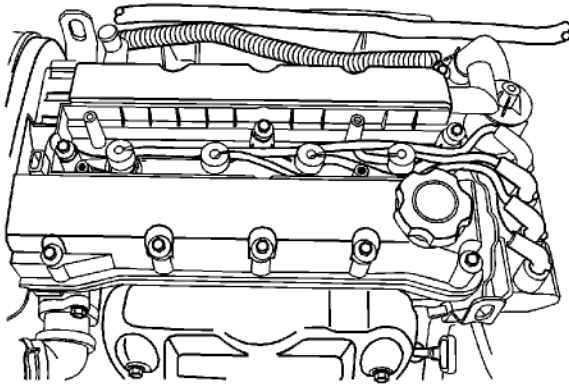
3. Disconnect the breather tube from the valve cover.



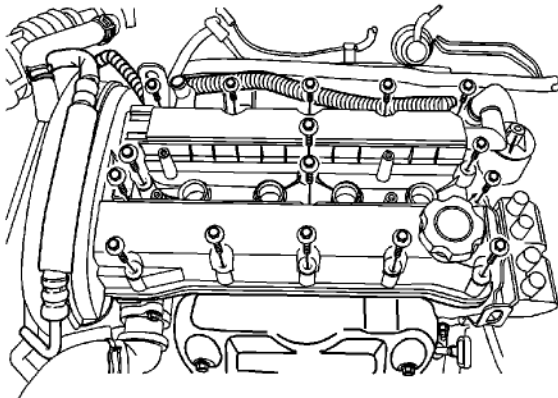
4. Disconnect the crankcase ventilation tube from the valve cover.



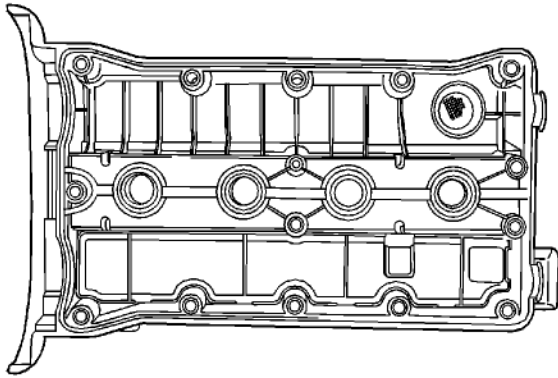
5. Disconnect the camshaft position (CMP) sensor connector.



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

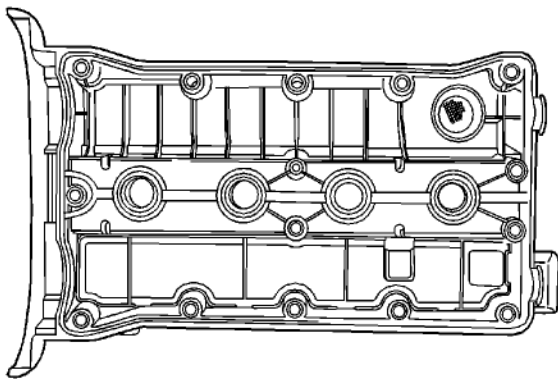


8. Remove the valve cover bolts.
9. Remove the valve cover.

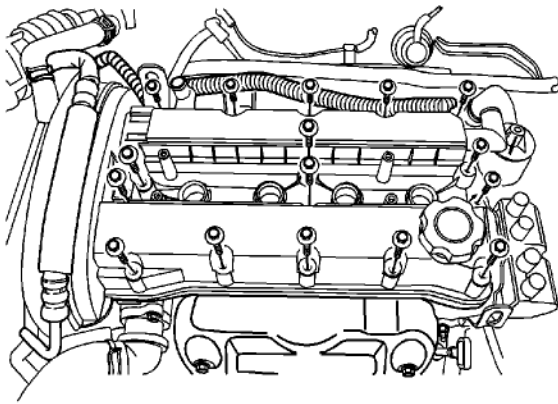


10. Remove the valve cover gasket from the valve cover.

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.



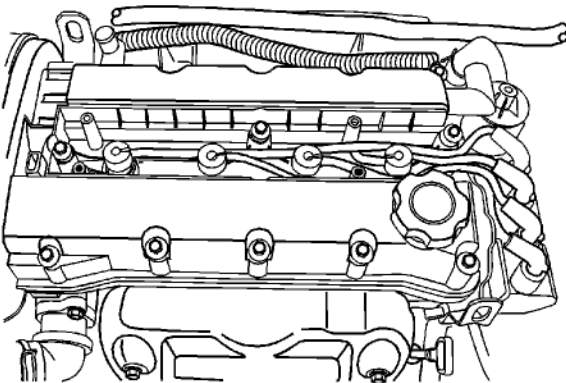
3. Install the valve cover.

Caution: Refer to [Fastener Caution](#) in the Preface section.

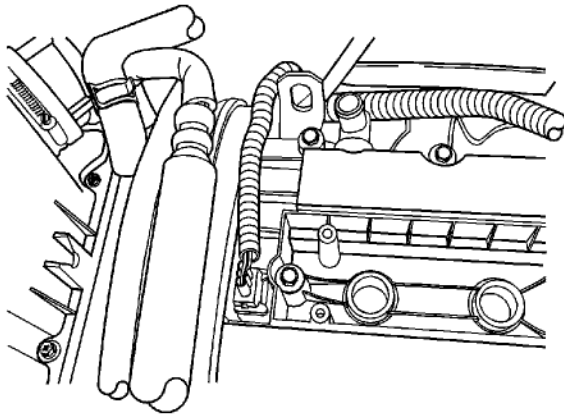
4. Install the valve cover bolts.

Tighten

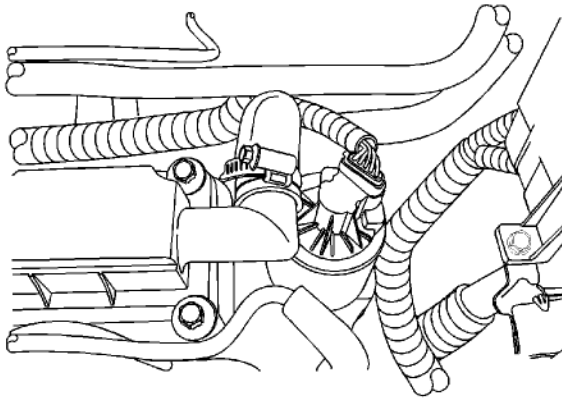
Tighten the valve cover bolts to 10 N·m (89 lb in).



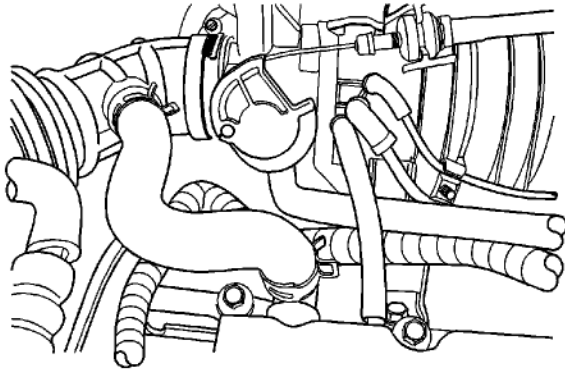
5. Connect the ignition wires from the spark plugs.
6. Connect all of the necessary vacuum lines.



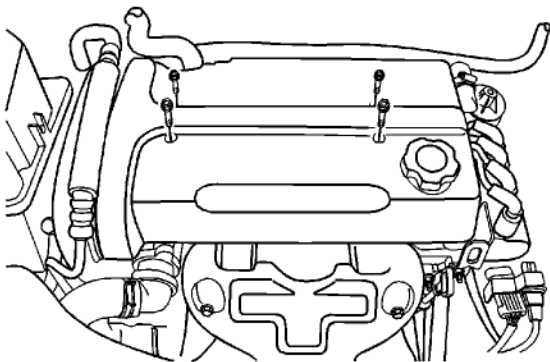
7. Connect the CMP sensor connector.



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



9. Connect the breather tube from the valve cover.



10. Install the engine cover.
11. Install the engine cover bolts.

Tighten

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

12. Connect the negative battery cable.

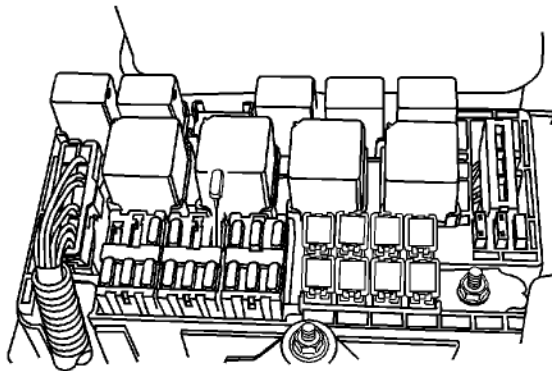
Cylinder Head Replacement

Special Tools

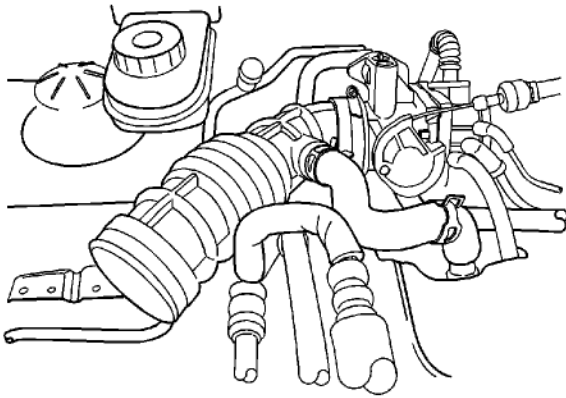
- [J 42492-A](#) (KM-421-A) Timing Belt Adjuster
- [J 45059](#) Angle Meter
- [KM-470-B](#) Angular Torque Gage

Removal Procedure

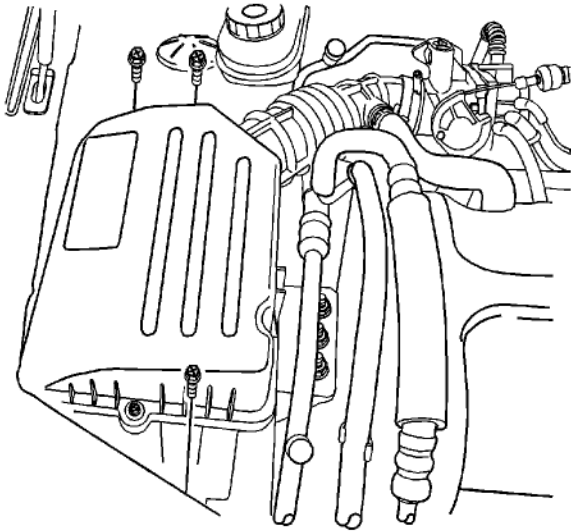
Warning: Refer to [Safety Glasses Warning](#) in the Preface section.



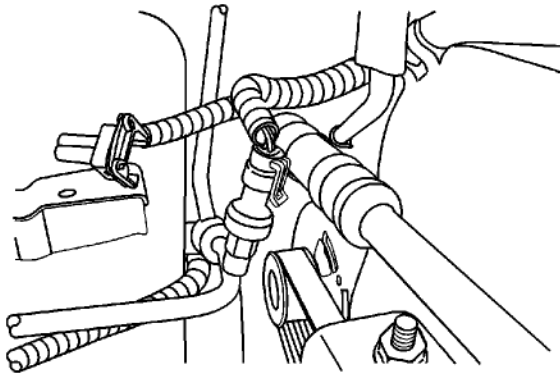
1. Remove the fuel pump fuse.
2. Start the engine. After it stalls, crank the engine after it stalls for 10 seconds to rid the fuel system of fuel pressure.
3. Drain the engine coolant. Refer to [Cooling System Draining and Filling](#).



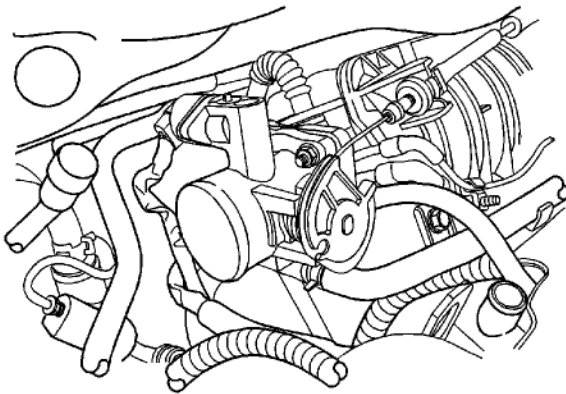
4. Disconnect the breather tube from the valve cover.
5. Disconnect the intake air temperature (IAT) sensor connector.
6. Disconnect the air intake tube from the throttle body.



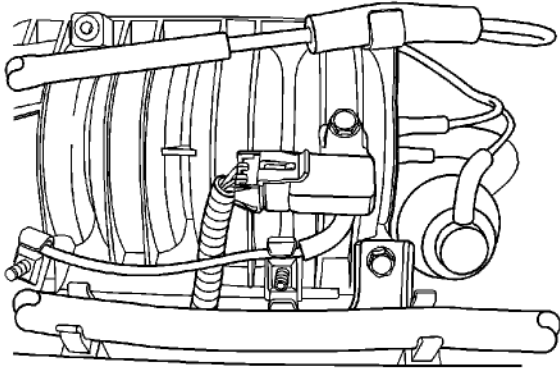
7. Remove the air filter housing bolts.
8. Remove the air filter housing.



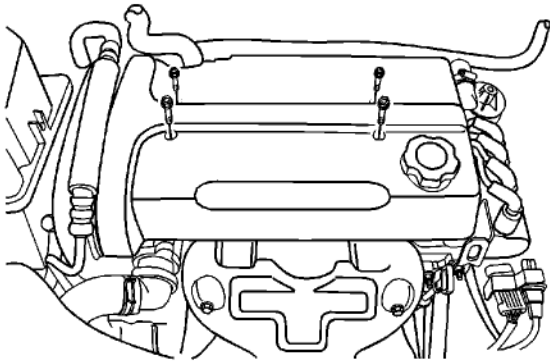
9. Disconnect the A/C pressure transducer (ACP) connector.



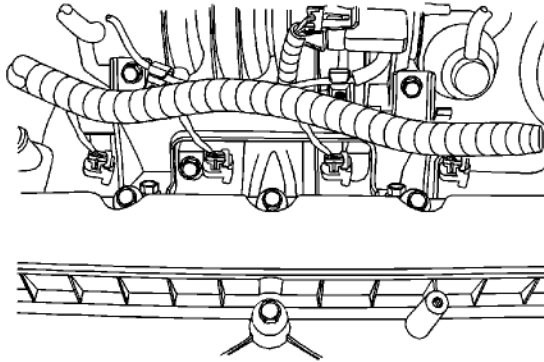
10. Disconnect the idle air control (IAC) valve connector.
11. Disconnect the throttle position (TP) sensor connector.
12. Disconnect the throttle cable from the throttle body and the intake manifold.
13. Disconnect the engine coolant inlet/outlet hose at the throttle body.



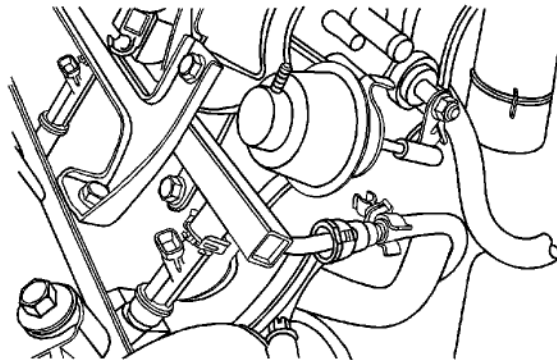
14. Disconnect the manifold absolute pressure (MAP) sensor connector.
15. Disconnect the brake booster vacuum hose.
16. Disconnect the variable geometry induction solenoid (VGIS) connector.
17. Disconnect the VGIS vacuum tank hose.



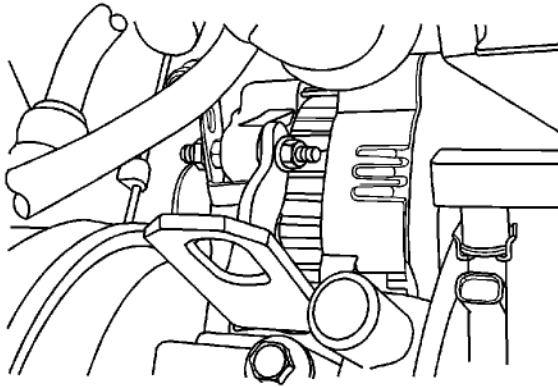
18. Remove the engine cover bolts and cover.
19. Disconnect the breather tube from the valve cover.
20. Disconnect the crankcase ventilation tube from the valve cover.



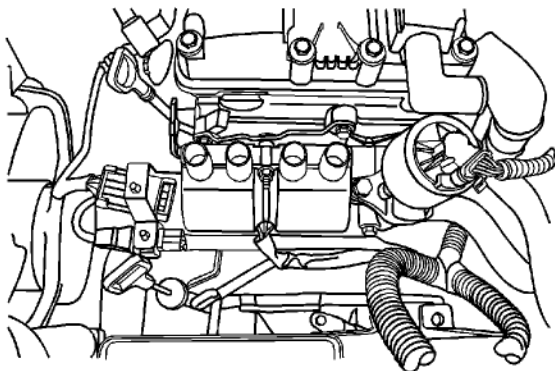
21. Disconnect the camshaft position (CMP) sensor connector.
22. Disconnect the ignition wires from the spark plugs.
23. Disconnect the fuel injector harness connectors.



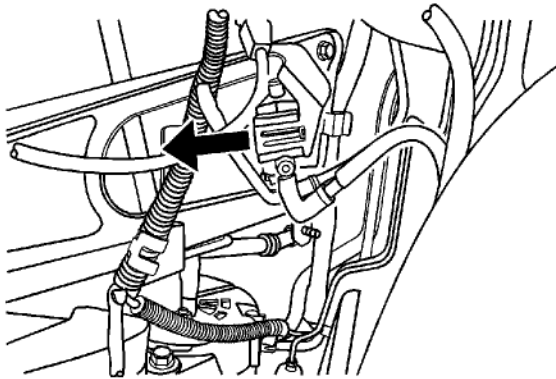
24. Disconnect the fuel line.



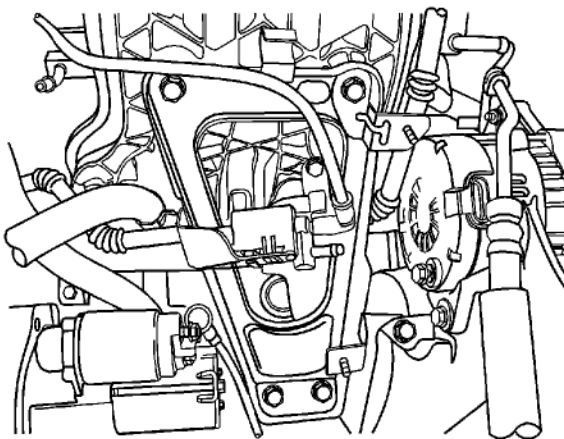
25. Remove the power steering pressure pipe bracket nut.
26. Remove the power steering pressure pipe.
27. Remove the alternator adjusting nut.



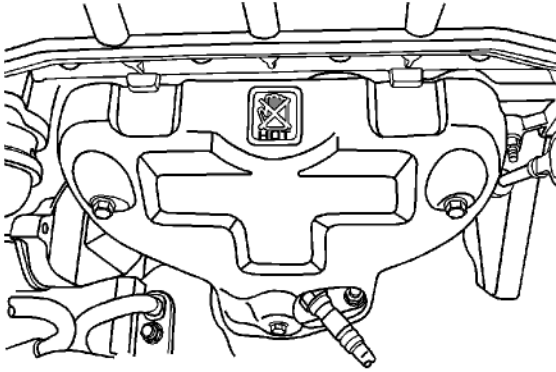
28. Remove the accessory drive bolt.
29. Disconnect the exhaust gas recirculation (EGR) valve connector.
30. Disconnect the electronic ignition (EI) system ignition coil connector.
31. Disconnect the front heated oxygen sensor (HO2S) connector.



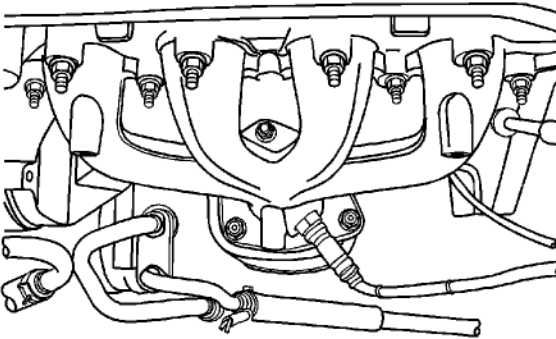
32. Remove the right front wheel. Refer to [Tire and Wheel Removal and Installation](#).
33. Remove the engine under cover bolt and the nuts.
34. Remove the engine under cover.
35. Remove the canister purge solenoid valve at the intake manifold support bracket.



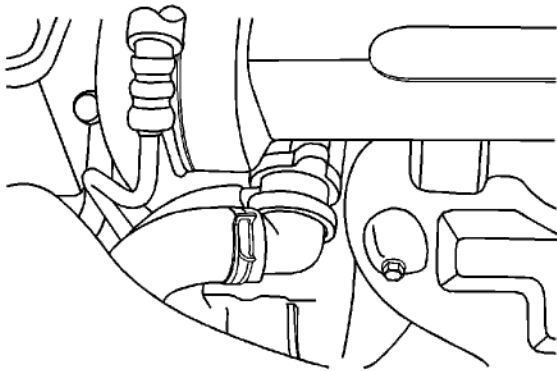
36. Remove the upper intake manifold support bracket bolts.
37. Remove the lower intake manifold support bracket bolts.
38. Disconnect the engine coolant temperature (ECT) sensor connector.



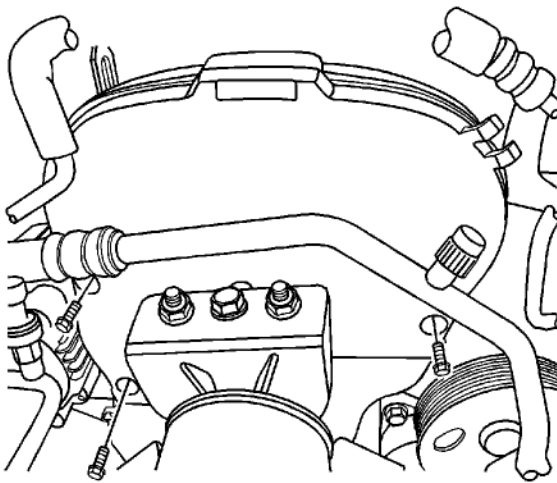
39. Remove the exhaust manifold heat shield bolts.
40. Remove the exhaust manifold heat shield.



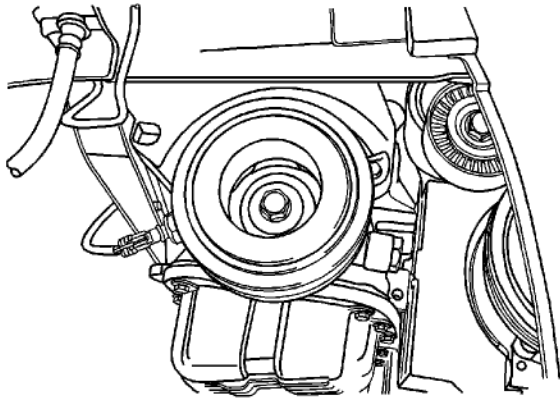
41. Remove the catalytic converter retaining nuts at the exhaust manifold.



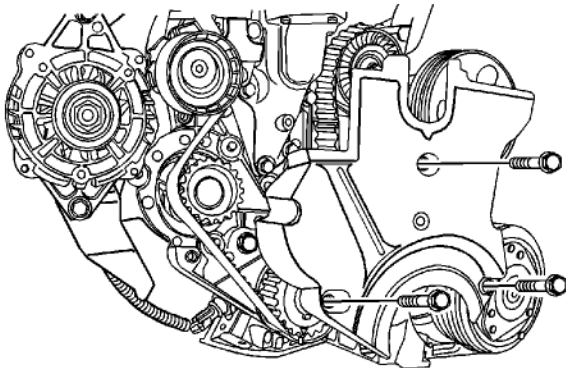
42. Loosen the hose clamp on the upper radiator hose at the thermostat housing.
43. Disconnect the upper radiator hose from the thermostat housing.



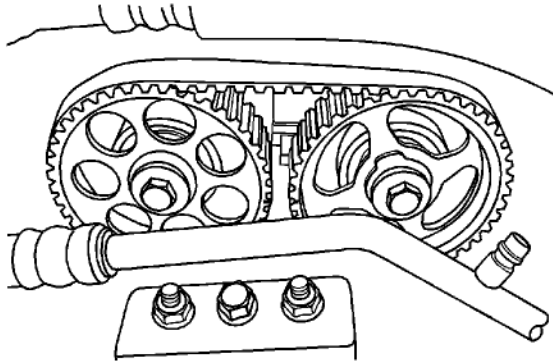
44. Remove the upper front timing belt cover bolts.
45. Remove the upper front timing belt cover.



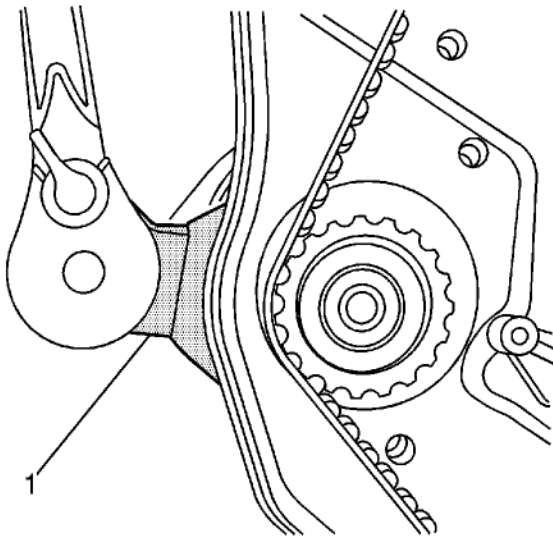
46. Remove the crankshaft pulley bolt.
47. Remove the crankshaft pulley.



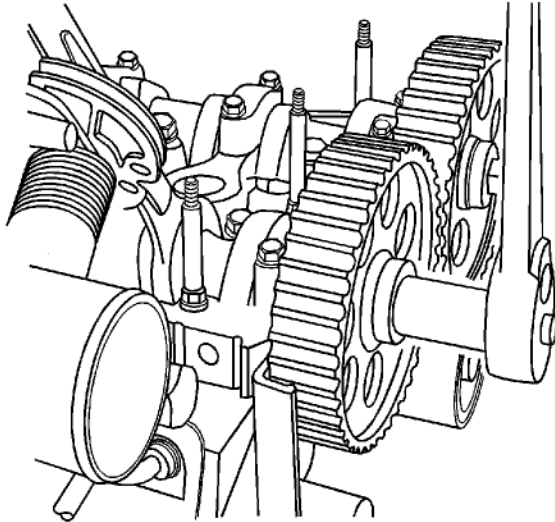
48. Remove the lower front timing belt cover bolts.
49. Remove the lower front timing belt cover.



50. Align the camshaft gear timing marks.



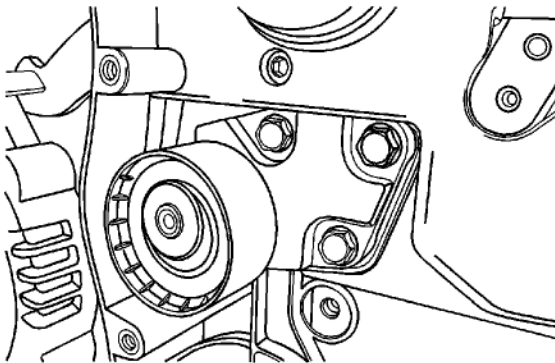
51. Slightly loosen the coolant pump retaining bolts.
52. Rotate the coolant pump counterclockwise using the [J 42492-A](#) (1) to relieve the timing belt tension.
53. Remove the timing belt. Refer to [Timing Belt Replacement](#).



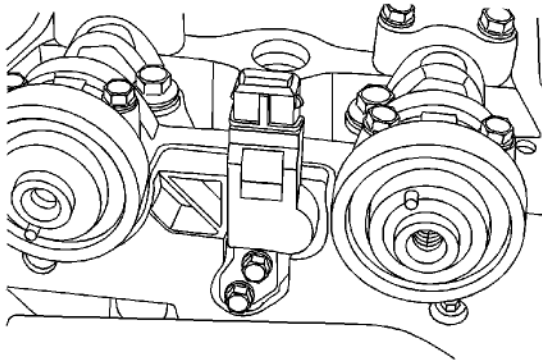
54. Remove the valve cover. Refer to [Valve Rocker Arm Cover Replacement](#).

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

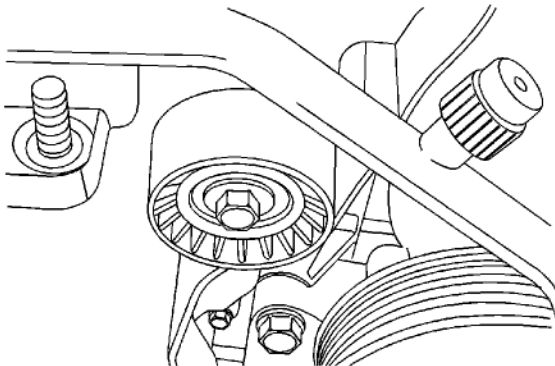
55. While holding the intake camshaft firmly in place, remove the intake camshaft gear bolt.
56. Remove the intake camshaft gear.
57. While holding the exhaust camshaft firmly in place, remove the exhaust camshaft gear bolt.
58. Remove the exhaust camshaft gear.



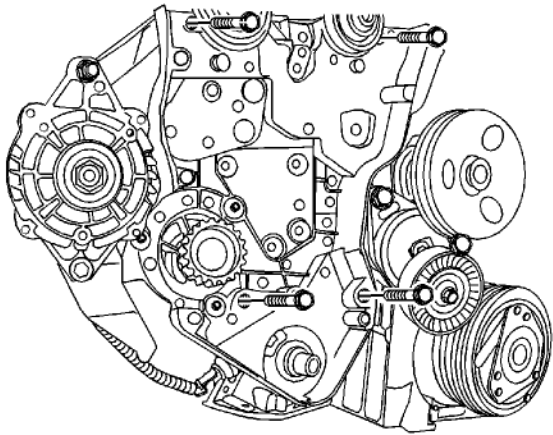
59. Remove the timing belt automatic tensioner bolts.
60. Remove the timing belt automatic tensioner.



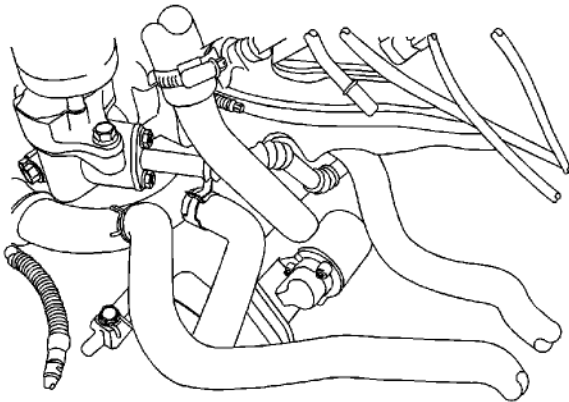
61. Remove the camshaft position (CMP) sensor bolts.
62. Remove the CMP sensor.



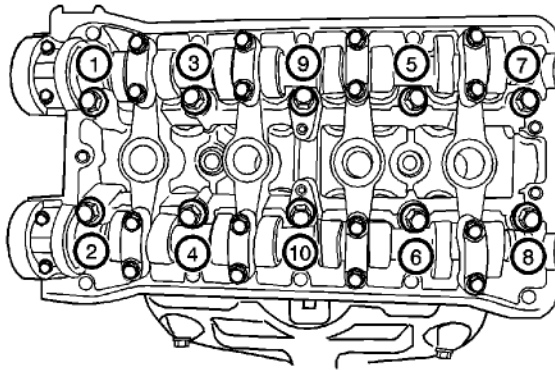
63. Remove the timing belt idler pulley bolt.
64. Remove the timing belt idler pulley.



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



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

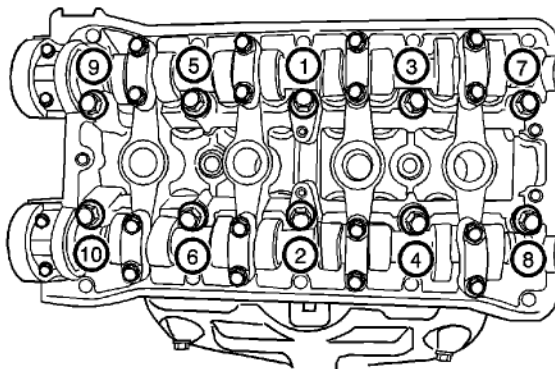


68. Loosen all of the cylinder head bolts gradually and in the sequence shown.
69. Remove the cylinder head bolts.
70. Remove the cylinder head with the intake manifold and the exhaust manifold attached.

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.

Installation Procedure



1. Install the cylinder head gasket.

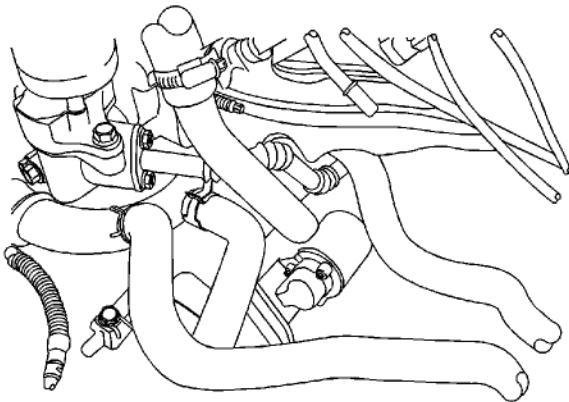
2. Install the cylinder head with the intake manifold and the exhaust manifold attached.
3. Install the cylinder head bolts.

Caution: Refer to [Fastener Caution](#) in the Preface section.

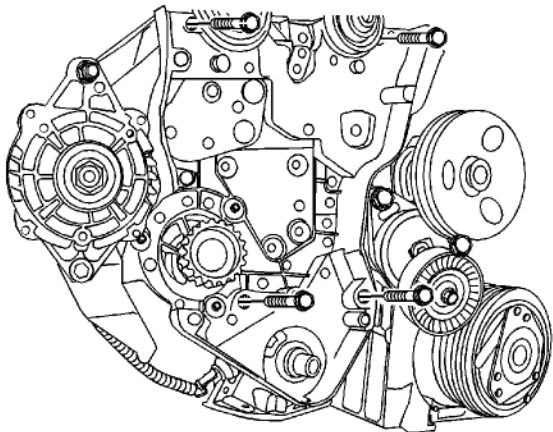
4. Tighten the cylinder head bolts gradually and in the sequence shown.

Tighten

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



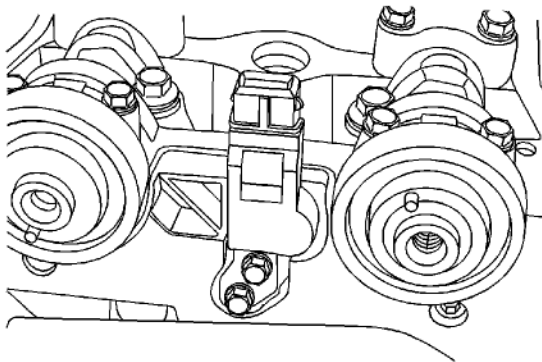
5. Connect the heater outlet hose from the coolant pipe.



6. Install the rear timing belt cover.
7. Install the rear timing belt cover bolts.

Tighten

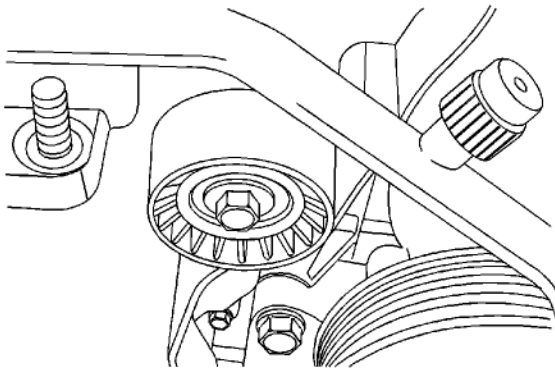
Tighten the rear timing belt cover bolts to 10 N·m (89 lb in).



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

Tighten

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

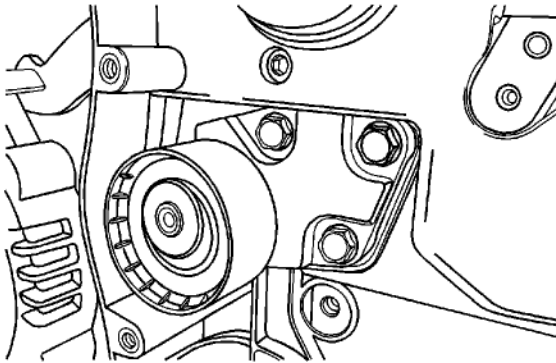




10. Install the timing belt idler pulley.
11. Install the timing belt idler pulley bolt.

Tighten

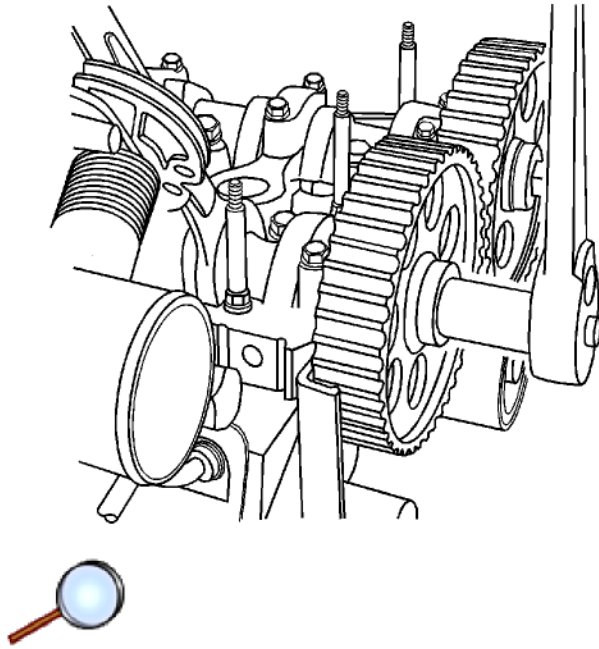
Tighten the timing belt idler pulley bolt to 40 N·m (30 lb ft).



12. Install the timing belt automatic tensioner.
13. Install the timing belt automatic tensioner bolts.

Tighten

Tighten the timing automatic tensioner 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.

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

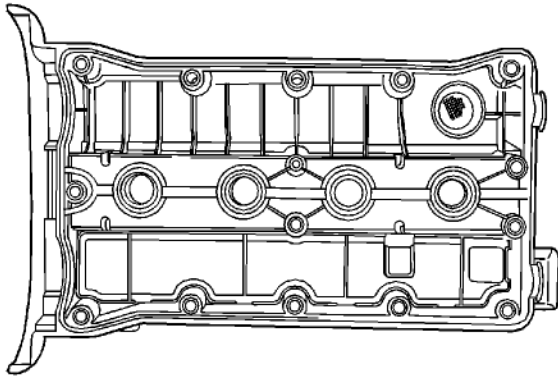
Tighten

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

16. Install the exhaust camshaft gear.
17. While holding the exhaust camshaft firmly in place, install the exhaust camshaft gear bolt.

Tighten

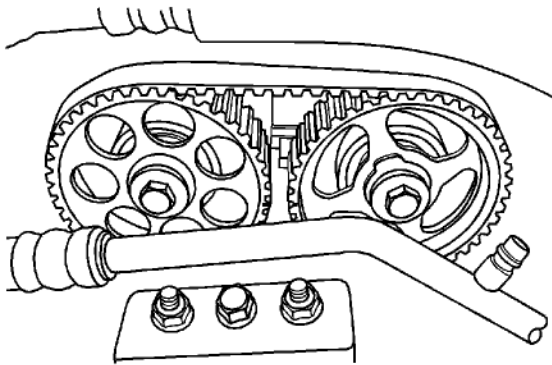
Tighten the exhaust camshaft gear bolt to 67.5 N·m (49 lb ft).



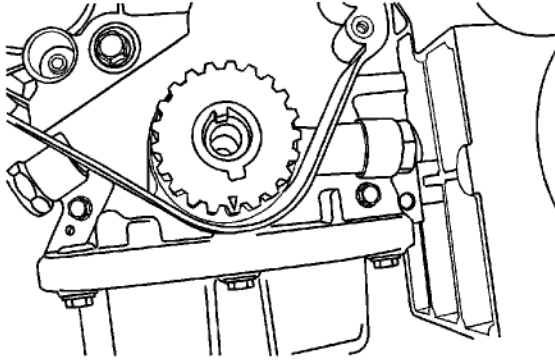
18. Apply a small amount of gasket sealant to the corners of the front camshaft caps, and the top of the rear valve cover to cylinder head seal.
19. Install the valve cover and the valve cover gasket.
20. Install the valve cover bolts.

Tighten

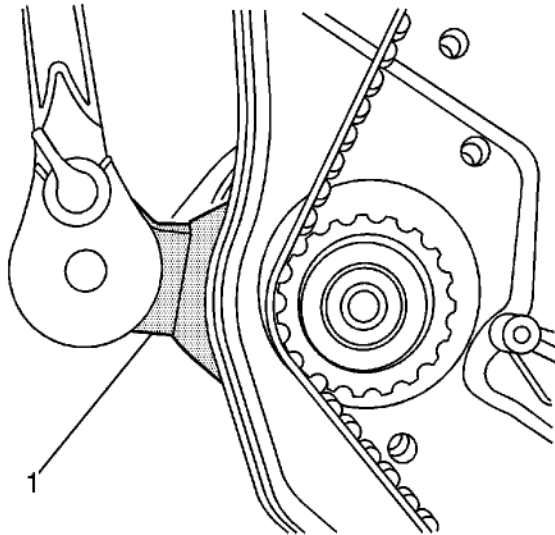
Tighten the valve cover bolts to 10 N·m (89 lb in).



21. Align the timing marks on the camshaft gear.



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



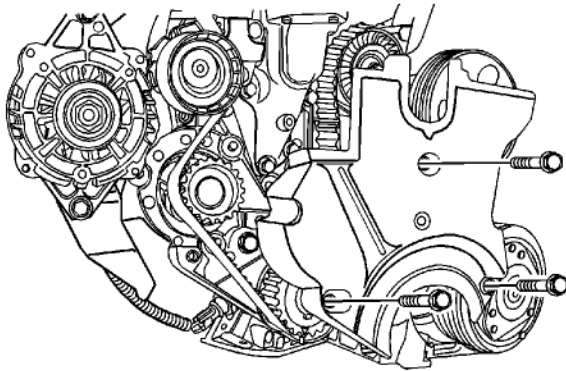
Caution: Do not use belt dressing on the drive belt. Belt dressing causes the breakdown of the composition of the drive belt. Failure to follow this recommendation will damage the drive belt.

23. Install the timing belt.
24. Rotate the coolant pump clockwise using the [J 42492-A](#) (1) to apply tension to the timing belt.

Tighten

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

25. Check and adjust the timing belt tension. Refer to [Timing Belt Inspection](#).



26. Install the engine mount-to-engine mount bracket retaining bolts.

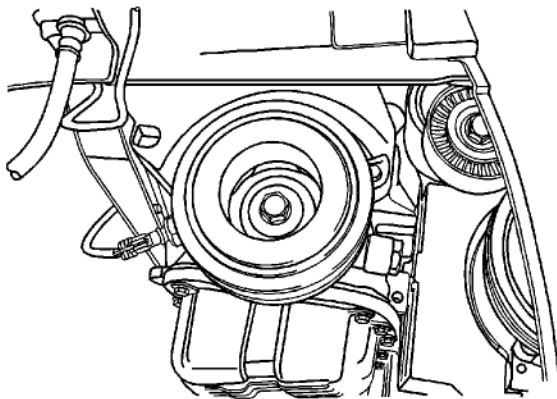
Tighten

Tighten the engine mount-to-engine mount bracket retaining bolts to 60 N·m (44 lb ft).

27. Install the lower front timing belt cover.
28. Install the lower front timing belt cover bolts.

Tighten

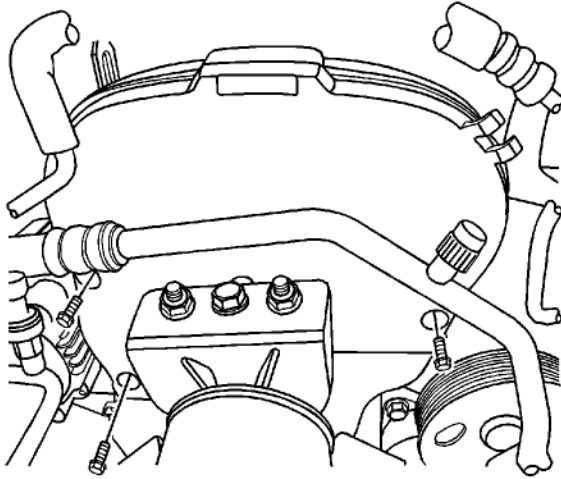
Tighten the lower front timing belt cover bolts to 10 N·m (89 lb in).



29. Install the crankshaft pulley.
30. Install the crankshaft pulley bolt.

Tighten

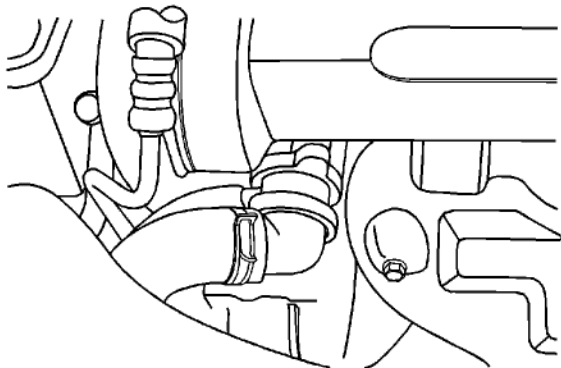
Tighten the crankshaft pulley bolt to 95 N·m (70 lb ft) using a torque wrench. Using the [J 45059](#) or [KM-470-B](#), tighten the crankshaft pulley bolt to 30 degrees plus 15 degrees.



31. Install the upper front timing belt cover.
32. Install the upper front timing belt cover bolts.

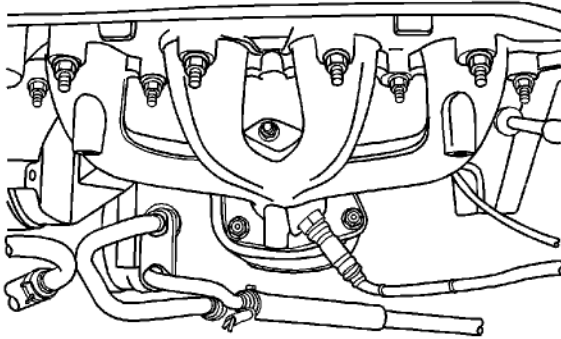
Tighten

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





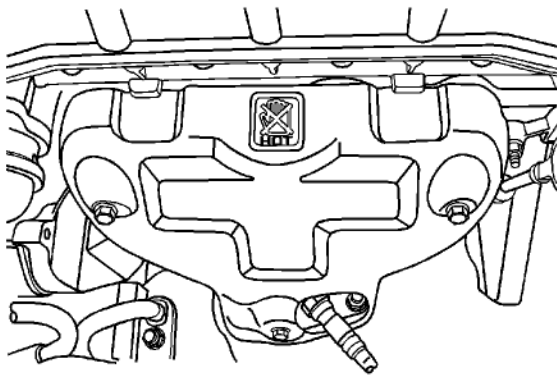
- 33. Connect the upper radiator hose from the thermostat housing.
- 34. Connect the throttle body coolant hose at the thermostat housing.



- 35. Install the catalytic converter retaining nuts at the exhaust manifold flange.

Tighten

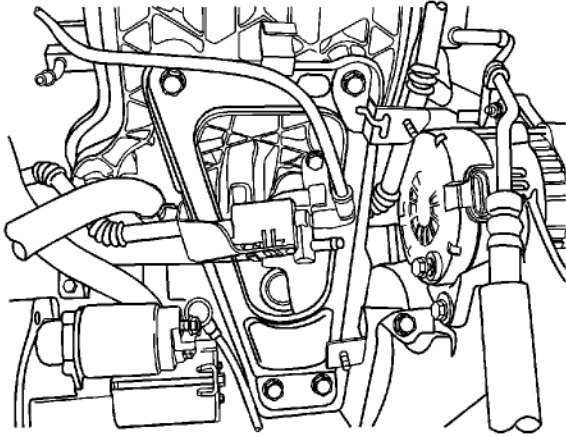
Tighten the catalytic converter retaining nuts to 40 N·m (30 lb ft).



- 36. Install the exhaust manifold heat shield.
- 37. Install the exhaust manifold heat shield bolts.

Tighten

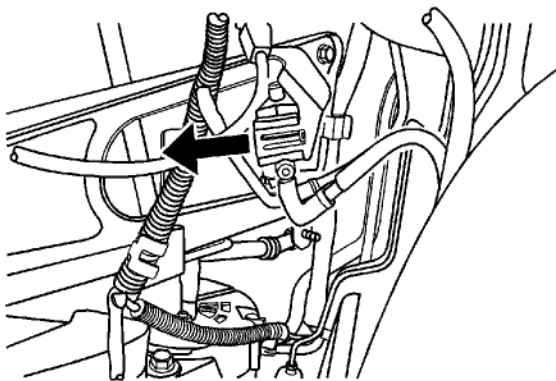
Tighten the exhaust manifold heat shield bolts to 15 N·m (11 lb ft).



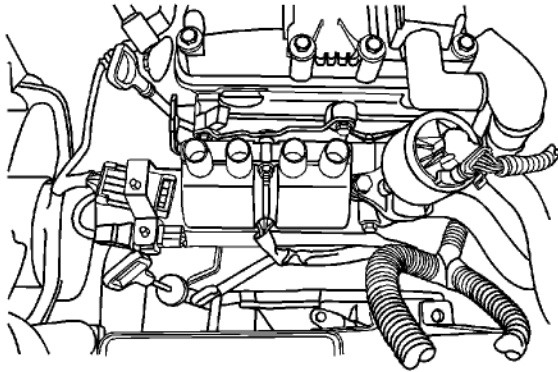
- 38. Connect the ECT sensor connector.
- 39. Install the intake manifold support bracket upper bolts.

Tighten

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



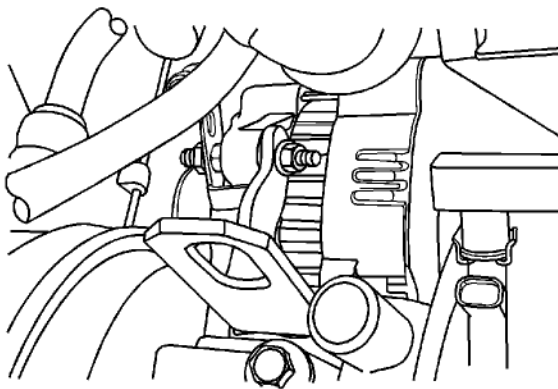
- 40. Install the canister purge solenoid valve at the intake manifold support bracket.
- 41. Install the engine under cover.



42. Connect the front HO2S connector.
43. Connect the EI system ignition coil connector.
44. 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.

45. Install the accessory drive belt.

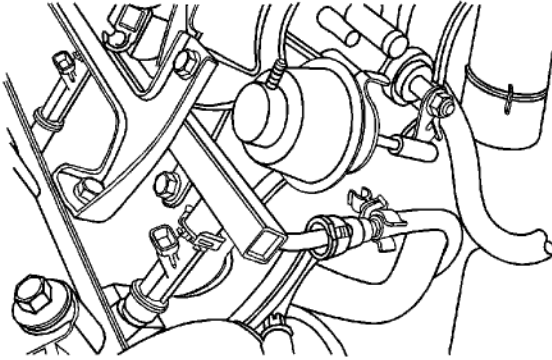


46. Install the alternator bracket retaining nut.

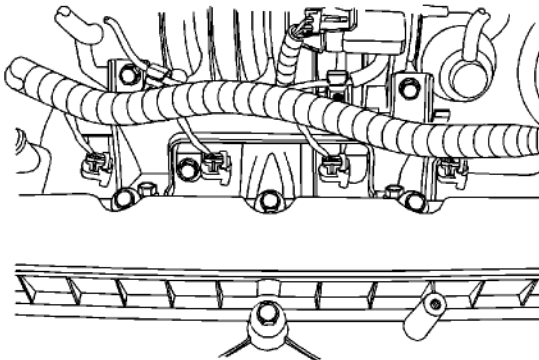
Tighten

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

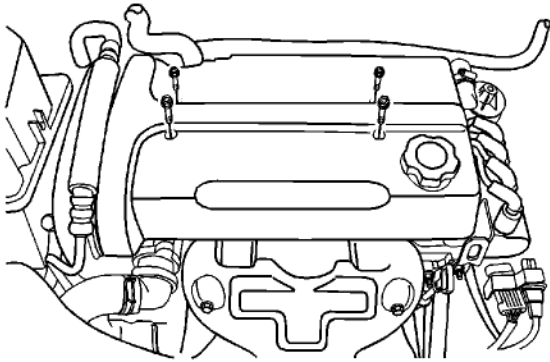
47. Install the alternator nut. Do not tighten.



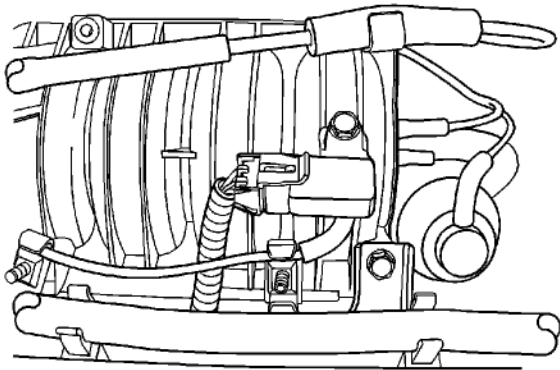
48. Connect the fuel line at the fuel rail.



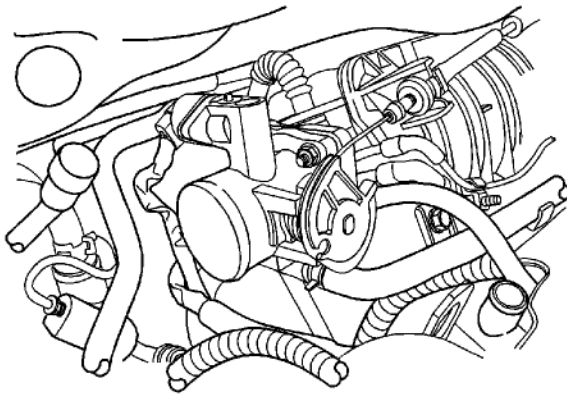
- 49. Connect the fuel injector harness connectors.
- 50. Connect the ignition wires from the spark plugs.
- 51. Connect the CMP sensor connector.



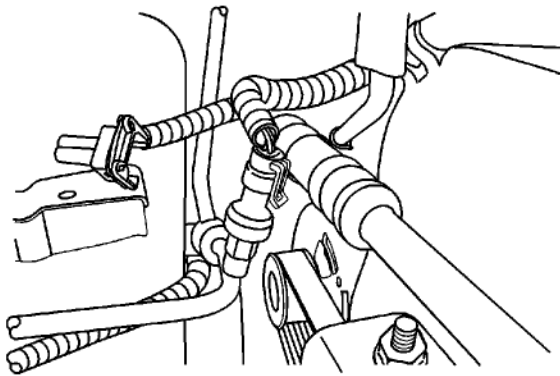
52. Connect the crankcase ventilation tube from the valve cover.
53. Connect the breather tube from the valve cover.
54. Install the engine cover.
55. Install the engine cover bolts.



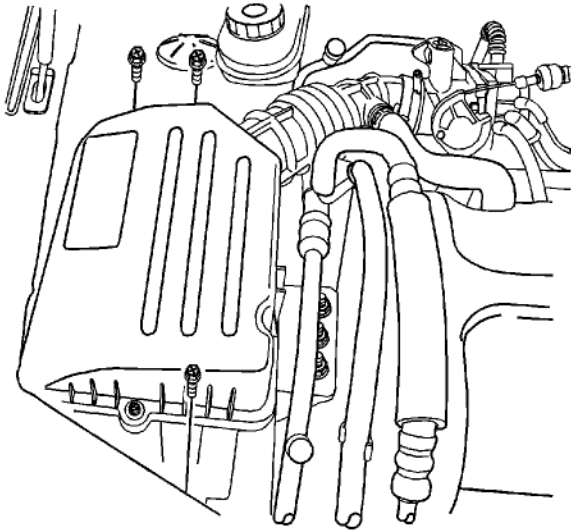
56. Connect the VGIS vacuum tank hose.
57. Connect the VGIS connector.
58. Connect the brake booster vacuum hose.
59. Connect the MAP sensor connector.



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



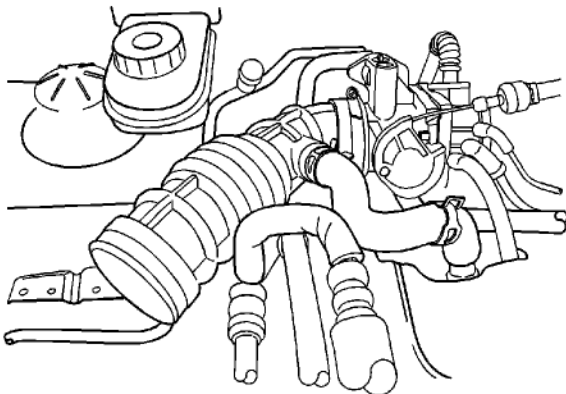
64. Connect the A/C pressure transducer connector.



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

Tighten

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

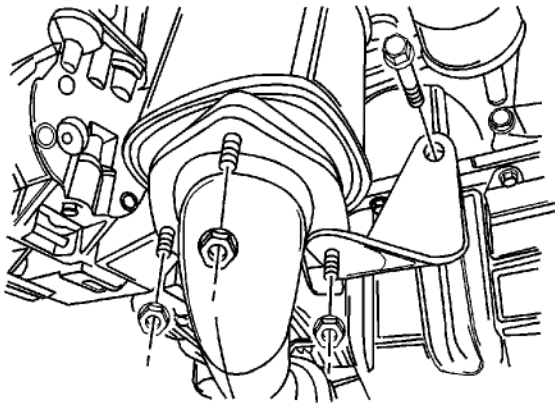


67. Connect the air intake tube from the throttle body.
68. Connect the IAT sensor connector.
69. Connect the breather tube from the valve cover.
70. Install the fuel pump fuse.
71. Connect the negative battery cable.
72. Fill the engine cooling system. Refer to [Cooling System Draining and Filling](#).

Oil Pan Replacement

Removal Procedure

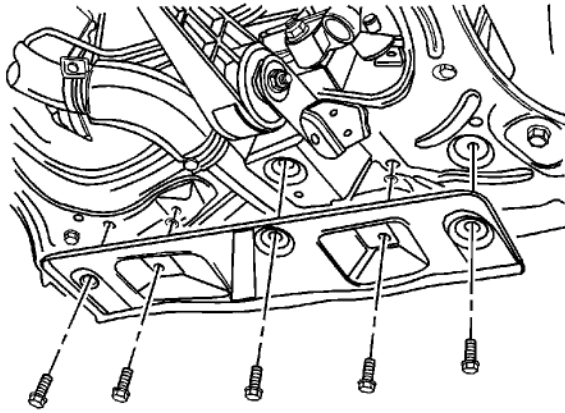
Warning: Refer to [Battery Disconnect Warning](#) in the Preface section.



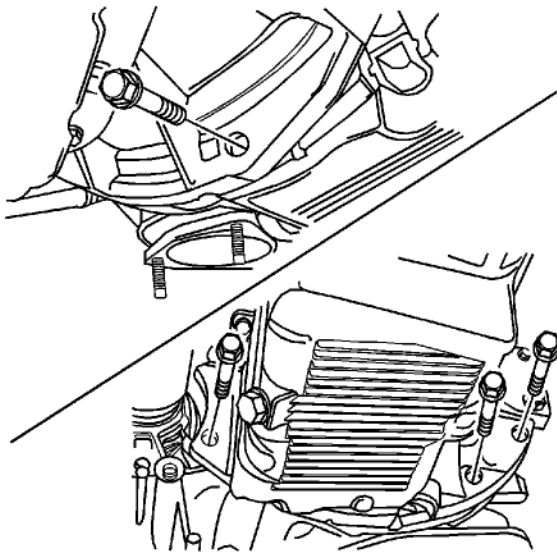
1. Disconnect the negative battery cable.

Warning: Refer to [Safety Glasses Warning](#) in the Preface section.

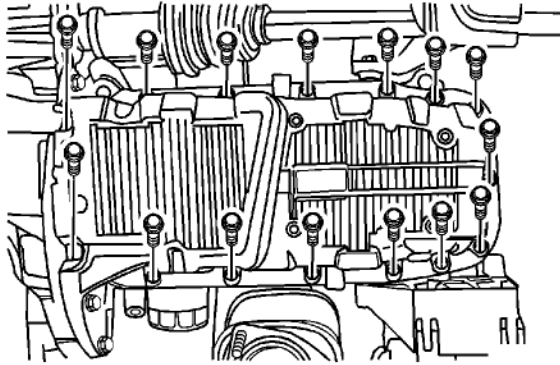
2. Drain the engine oil from the engine crankcase.
3. Remove the catalytic converter retaining nuts from the exhaust pipe.



4. Remove the lower crossmember bracket.
5. Remove the exhaust connecting pipe.

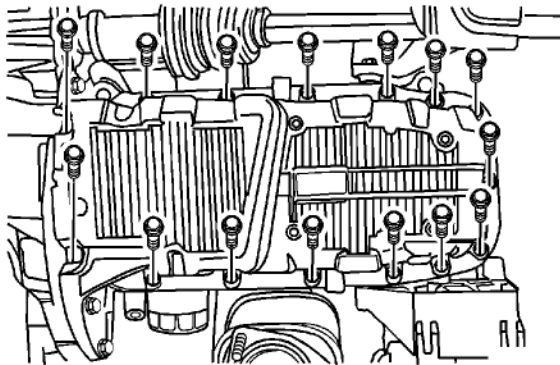


6. Remove the oil pan bolts to the transaxle case.



7. Remove the oil pan retaining bolts to the engine block.
8. Remove the oil pan from the engine block.
9. Clean the gasket surfaces on the oil pan and the engine block. Refer to [Oil Pan Cleaning and Inspection](#).

Installation Procedure



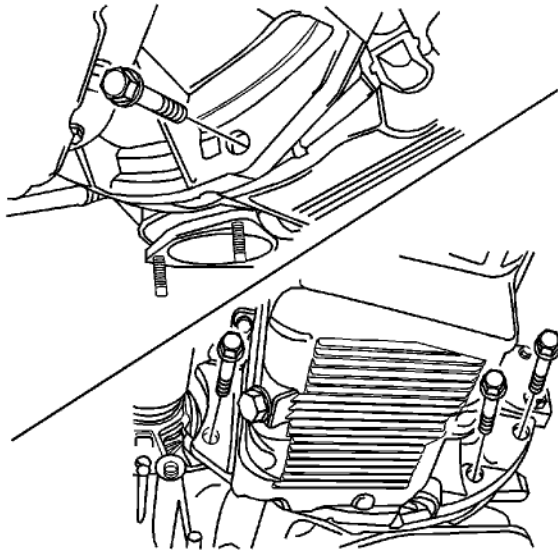
1. Coat the new oil pan gasket with sealant.

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

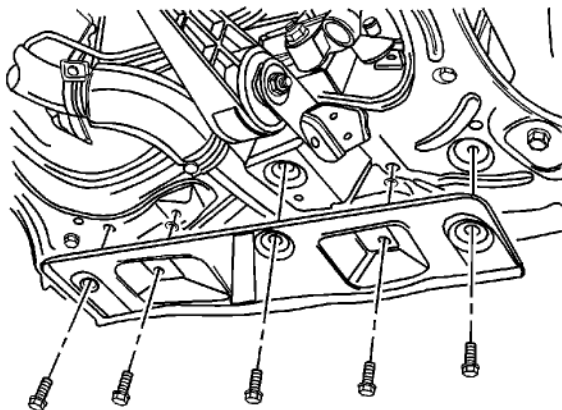
2. Install the oil pan to the engine block.

Caution: Refer to [Fastener Caution](#) in the Preface section.

3. Install the oil pan retaining bolts and tighten to **10 N·m (89 lb in)**.



4. Install the oil pan bolts to the transaxle case and tighten to **31 N·m (23 lb ft)**.

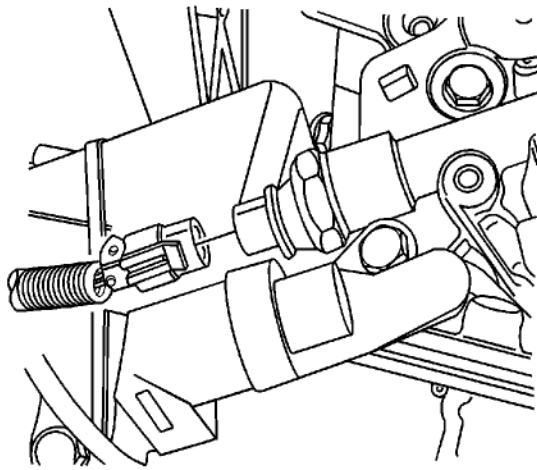


5. Install the exhaust connecting pipe.
6. Install the catalytic converter retaining nuts to the exhaust pipe and tighten to **40 N·m (30 lb ft)**.
7. Install the lower crossmember bracket.
8. Connect the negative battery cable.
9. Discard the used oil pan drain plug washer and replace it with a new one.
10. Install the oil pan drain plug and tighten to **55 N·m (40 lb ft)**.
11. Refill the engine crankcase with engine oil.

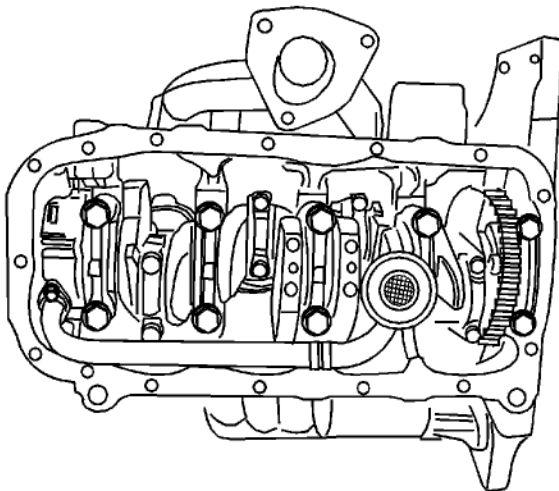
Oil Pump Replacement

Removal Procedure

Warning: Refer to [Battery Disconnect Warning](#) in the Preface section.

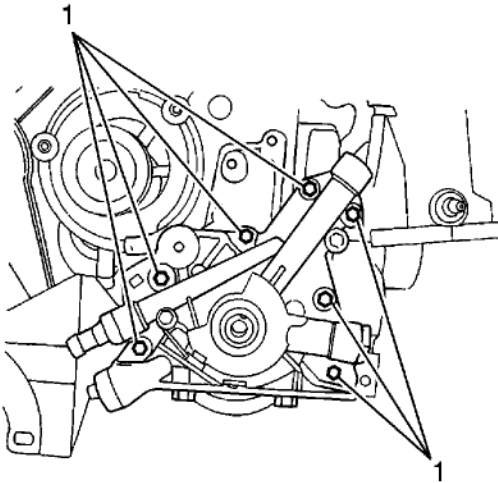


1. Disconnect the negative battery cable.
2. Remove the timing belt. Refer to [Timing Belt Replacement](#).
3. Remove the rear timing belt cover. Refer to [Timing Belt Cover Replacement](#).
4. Disconnect the oil pressure switch connector.





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.

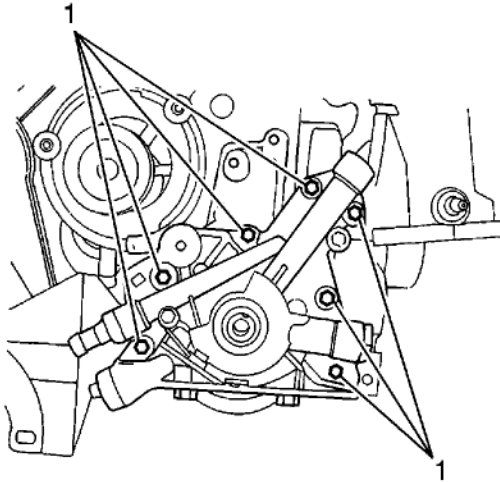


10. Remove the oil pump retaining bolts (1).

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.

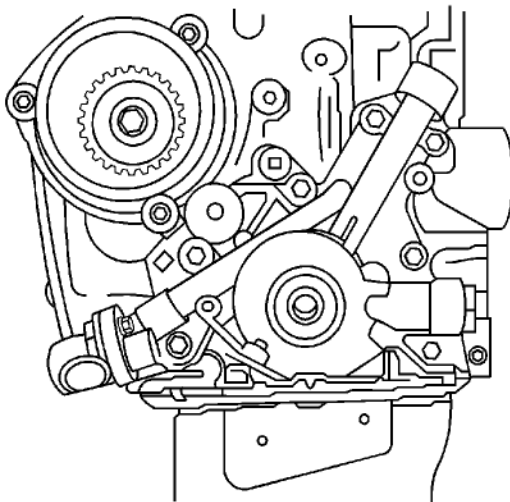
Installation Procedure



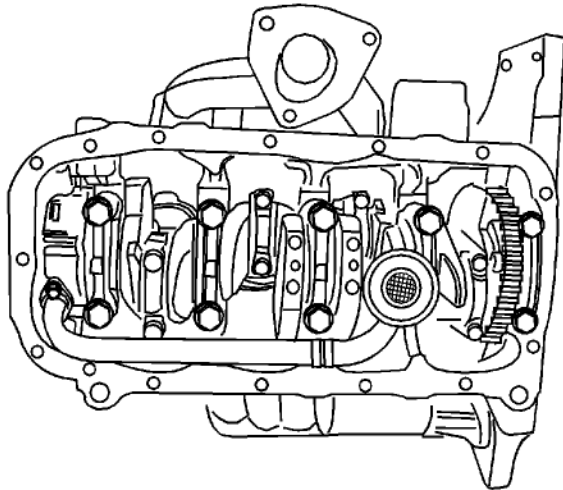
1. Apply a bead of room temperature vulcanizing (RTV) sealer to the oil pump gasket.
2. Install a new oil pump gasket to the oil pump.
3. Coat the threads of the oil pump bolts with LOCTITE® 242.

Caution: Refer to [Fastener Caution](#) in the Preface section.

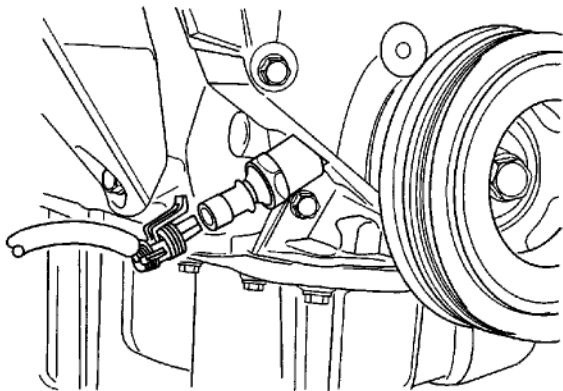
4. Install the oil pump to the engine block with the bolts (1) and tighten to **10 N·m (89 lb in)**.



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



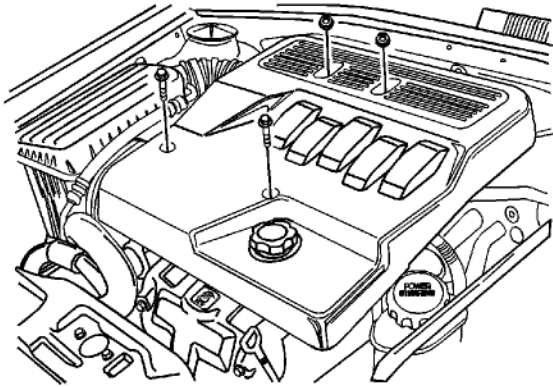
7. Coat the threads of the oil pump pickup tube and the support bracket bolts with LOCTITE® 242.
8. Install the oil pump pickup tube and the bolts and tighten to **10 N·m (89 lb in)**.



9. Install the oil pan. Refer to [Oil Pan Replacement](#).
10. Install the CKP sensor and the bolt and tighten to **10 N·m (89 lb in)**.
11. Connect the oil pressure switch connector.
12. Install the rear timing belt cover. Refer to [Timing Belt Cover Replacement](#).
13. Install the timing belt. Refer to [Timing Belt Replacement](#).
14. Connect the negative battery cable.

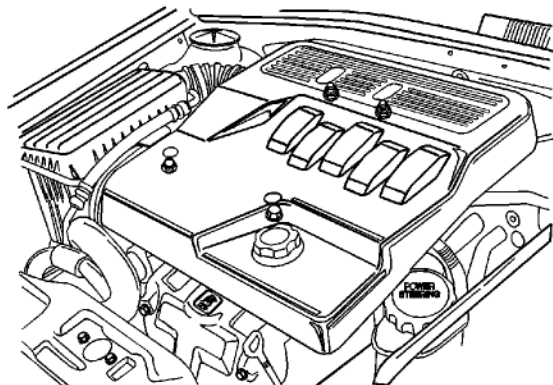
Engine Cover Replacement

Removal Procedure



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

Installation Procedure





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).

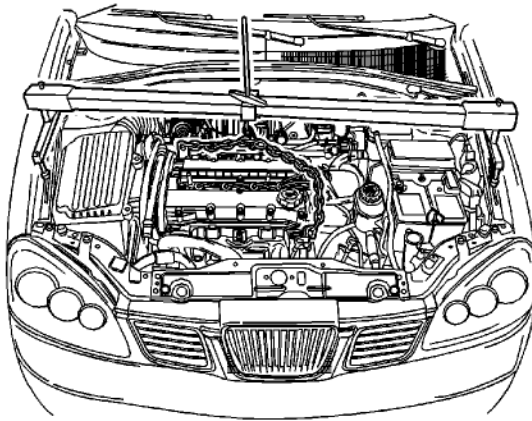
Engine Mount Replacement

Special Tools

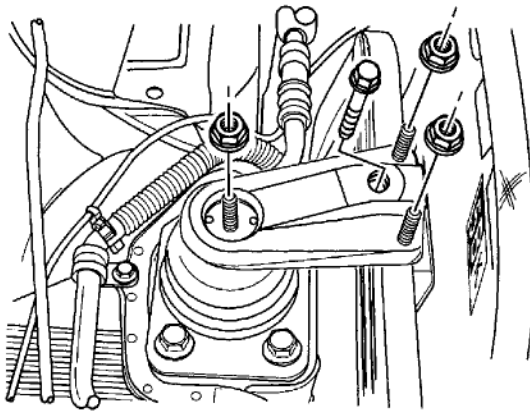
[J 28467-B](#) (DW-117) Universal Engine Support Fixture

Removal Procedure

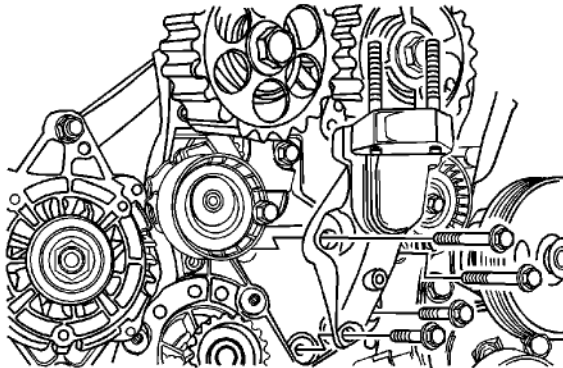
Warning: Refer to [Battery Disconnect Warning](#) in the Preface section.



1. Disconnect the negative battery cable.
2. Support the engine assembly using the [J 28467-B](#).

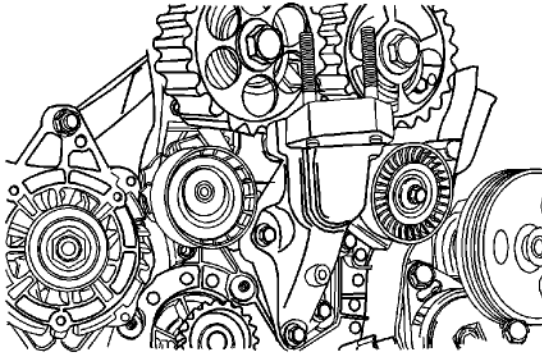


3. Remove the engine mount bracket attaching bolts/nuts.
4. Remove the front timing belt cover. Refer to [Timing Belt Cover Replacement](#).



5. Remove the engine mount attaching bolts/nuts.
6. Remove the engine mount.

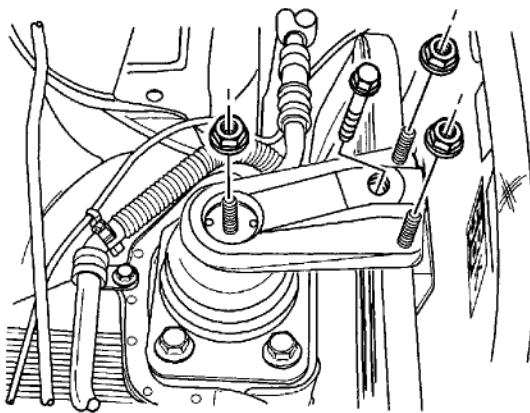
Installation Procedure



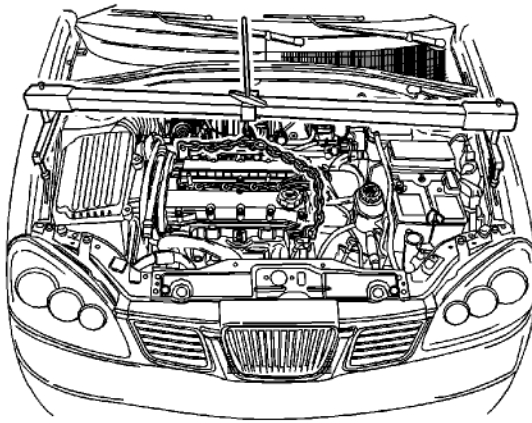
1. Install the engine mount.

Caution: Refer to [Fastener Caution](#) in the Preface section.

2. Install the engine mount retaining bolts and tighten to 30 N·m (22 lb ft).
3. Install the front timing belt cover. Refer to [Timing Belt Cover Replacement](#).



4. Install the engine mount bracket attaching bolts/nuts and tighten to 55 N·m (41 lb ft).



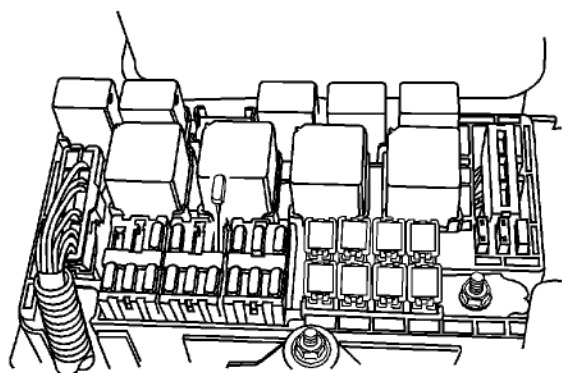
5. Remove the [J 28467-B](#) .
6. Connect the negative battery cable.

Engine Replacement

Special Tools

- [J 45059](#) Angle Meter
- [KM-470-B](#) Angular Torque Gage

Removal Procedure



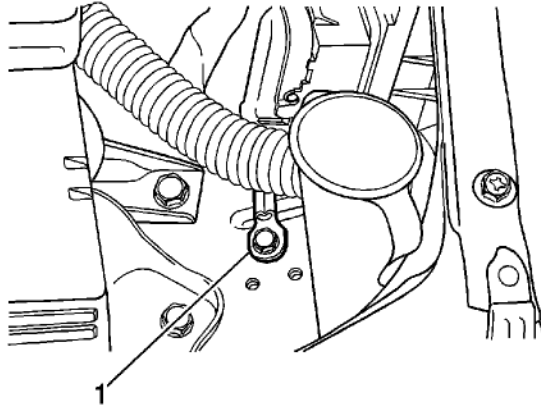
Note: On vehicles equipped with a manual transaxle, the manual transaxle must be removed before the engine is removed.

1. Remove the fuel pump fuse.
2. Start the engine. Crank the engine for 10 seconds after it stalls to rid the fuel system of fuel pressure.
3. Remove the hood. Refer to [Hood Replacement](#).

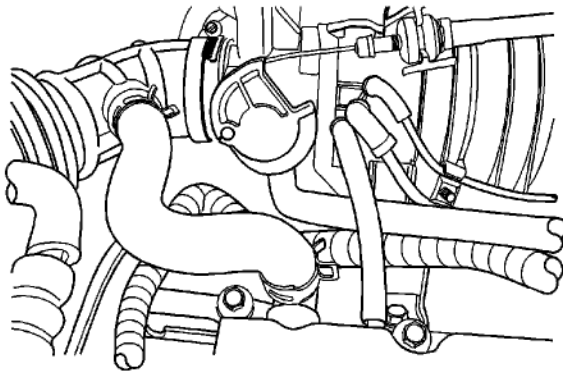
Warning: Refer to [Safety Glasses Warning](#) in the Preface section.

4. Drain the engine oil.

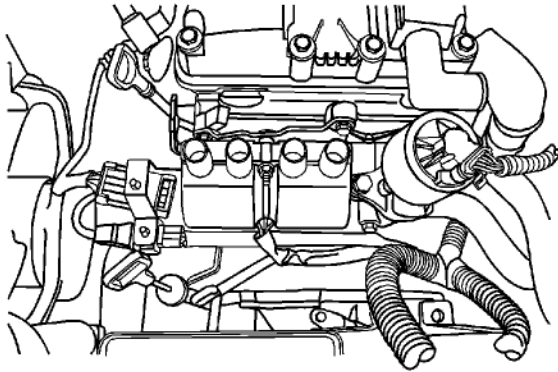
Warning: Refer to [Battery Disconnect Warning](#) in the Preface section.



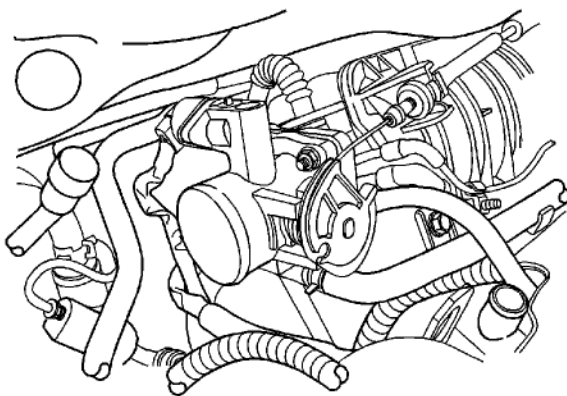
5. Disconnect the negative battery cable.
6. Disconnect and separate the positive battery cable.
7. Disconnect the negative battery cable (1) from the vehicle frame.



8. Discharge the air conditioning (A/C) system, if equipped. Refer to [Refrigerant Recovery and Recharging](#).
9. Disconnect the intake air temperature (IAT) sensor connector.
10. Remove the air intake tube from the throttle body and air filter housing.
11. Disconnect the breather tubes from the valve cover.
12. Remove the right front wheel. Refer to [Tire and Wheel Removal and Installation](#).
13. Remove the right front splash shield.
14. Remove the accessory drive belt, if equipped.
15. Remove the alternator adjusting bolt.

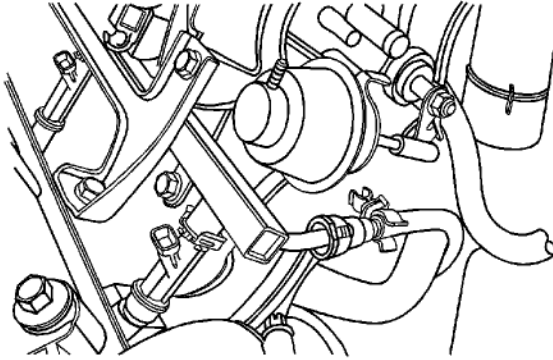


16. Drain the engine coolant. Refer to [Cooling System Draining and Filling](#).
17. Remove the cooling system radiator and the engine cooling fans. Refer to [Radiator Replacement](#).
18. Disconnect the upper radiator hose from the thermostat housing.
19. Disconnect the power steering return hose from the power steering pump, if equipped. Refer to [Power Steering Return Hose Replacement](#).
20. Disconnect the power steering pressure hose from the power steering pump, if equipped. Refer to [Power Steering Pump Hoses and Pipes Replacement](#).
21. Disconnect the electrical connector at the electronic ignition (EI) system ignition coil and the powertrain control module (PCM)/engine control module (ECM) ground terminal at the intake manifold and at the starter motor.

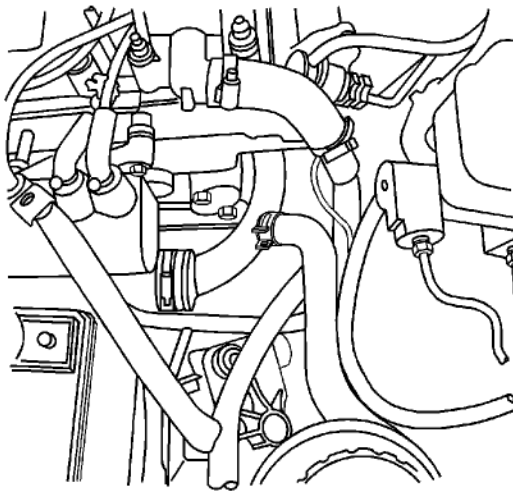


22. Disconnect the oxygen sensor connector.
23. Disconnect the fuel injector harness connectors.
24. Disconnect the idle air control (IAC) valve connector.

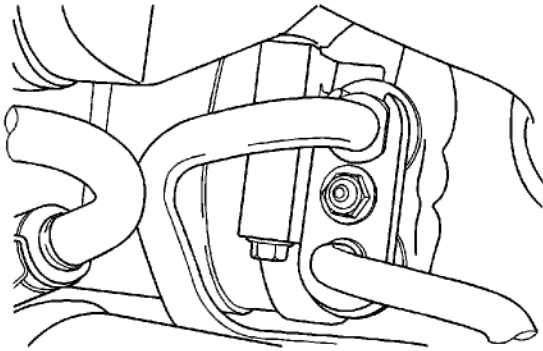
25. Disconnect the throttle position (TP) sensor connector.
26. Disconnect the engine coolant temperature (ECT) sensor connector.
27. Disconnect the alternator voltage regulator connector.
28. Remove the engine cover bolts.
29. Remove the engine cover.
30. Disconnect the camshaft position (CMP) sensor.



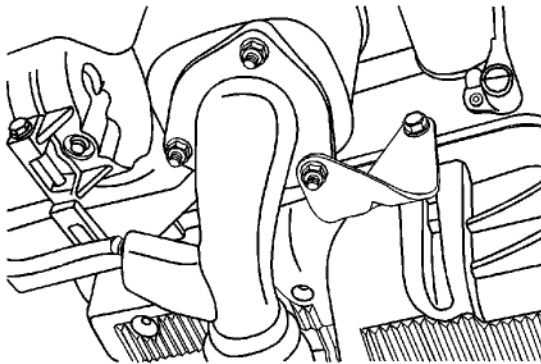
31. Disconnect all of the necessary vacuum lines including the brake booster vacuum hose.
32. Disconnect the fuel feed line at the fuel rail.



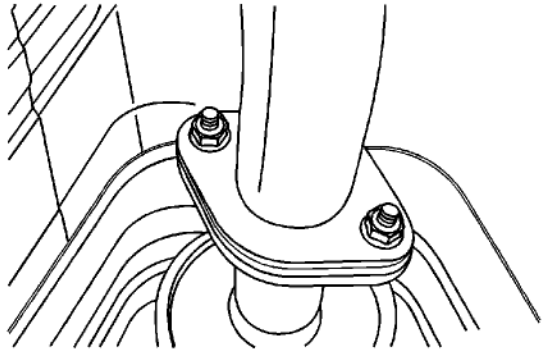
33. Disconnect the throttle cable from the throttle body and the intake manifold bracket.
34. Disconnect the surge tank coolant hose at the throttle body.
35. Disconnect the heater outlet hose at the coolant pipe.
36. Disconnect the heater inlet hose from the cylinder head.
37. Disconnect the surge tank coolant hose from the coolant pipe.
38. Disconnect the lower radiator hose from the coolant pipe.



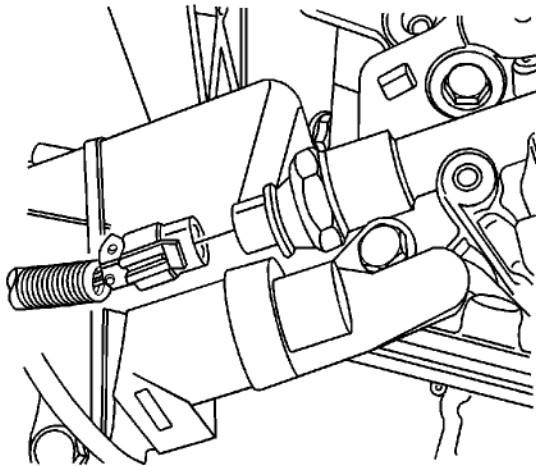
39. Disconnect the starter solenoid S terminal wire.
40. Remove the A/C compressor hose assembly retaining bolt.
41. Disconnect the A/C compressor hose assembly from the compressor.
42. Disconnect the electrical connector at the A/C compressor coil.
43. Remove the power steering hose from the power steering pump.



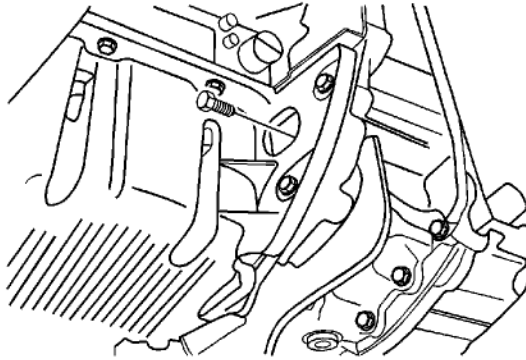
44. Remove the catalytic converter lower flange nuts from the exhaust manifold studs and the bolts at the bracket.



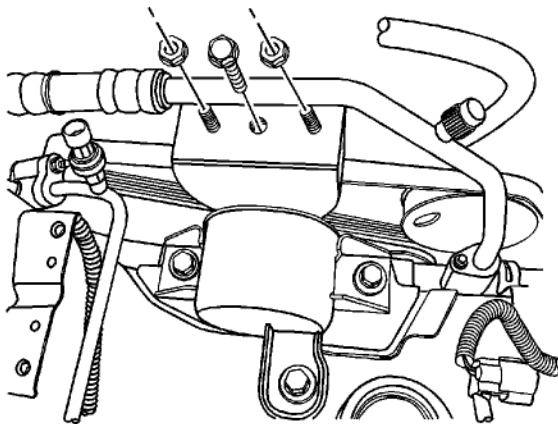
45. Remove the nuts that secure the front muffler pipe.
46. Remove the front exhaust pipe as a unit.



47. Remove the crankshaft pulley bolt.
48. Remove the crankshaft pulley.
49. Disconnect the vacuum lines at the evaporative emission (EVAP) canister purge solenoid.
50. Disconnect the electrical connector at the EVAP emissions charcoal canister purge solenoid.
51. Disconnect the electrical connector at the oil pressure switch.
52. Disconnect the crankshaft position (CKP) sensor and the knock sensor connectors.
53. Remove the CKP sensor retaining bolt.
54. Remove the CKP sensor.

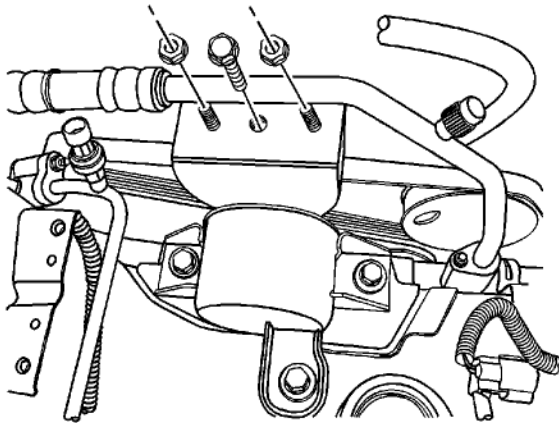


55. Install the engine lifting device.
56. Remove the service hole cover.
57. Remove the torque converter bolts. Refer to [Transmission Replacement](#).



58. Remove the power steering hoses and pipes. Refer to [Power Steering Pump Hoses and Pipes Replacement](#).
59. Remove the cross member by removing the nuts and the bolts to underbody.
60. Disconnect the right engine mount bracket from the engine mount by removing the retaining bolts.
61. Remove the right engine mount bracket from the engine block.
62. Separate the engine block from the transaxle.
63. Remove the engine.

Installation Procedure



1. Install the engine 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 right engine mount bracket retaining bolts.

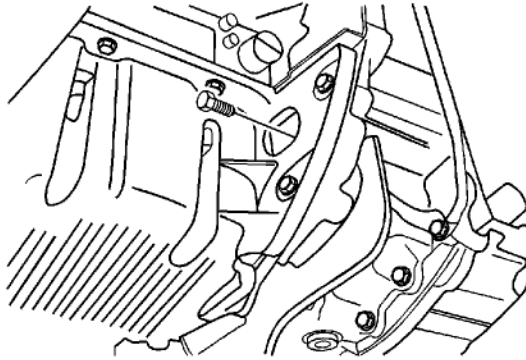
Tighten

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

4. Connect the right engine mount bracket to the engine mount by installing the 2 retaining bolts.

Tighten

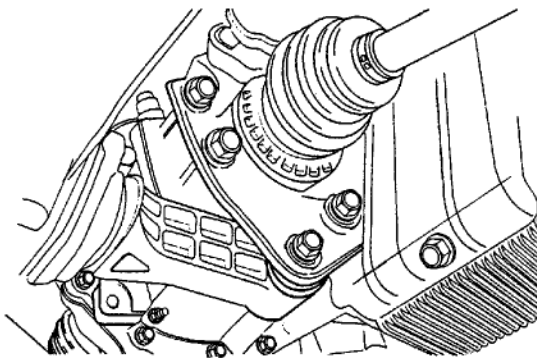
Tighten the engine mount-to-engine mount bracket retaining bolts to 60 N·m (44 lb ft).



5. Remove the floor jack used for support of the transaxle.
6. Remove the engine lifting device.
7. Install the transaxle torque converter bolts on vehicles equipped with an automatic transaxle.

Tighten

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

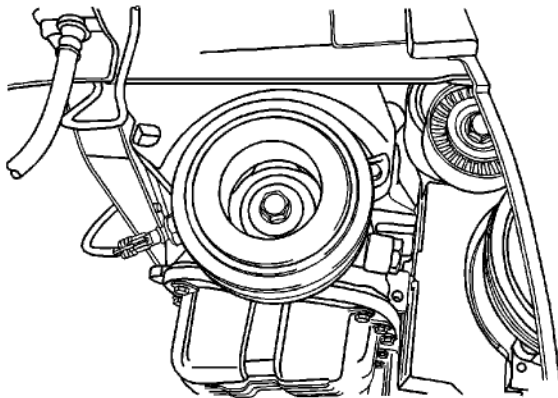


8. Install the rear mounting bracket bolts and the bracket.

Tighten

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

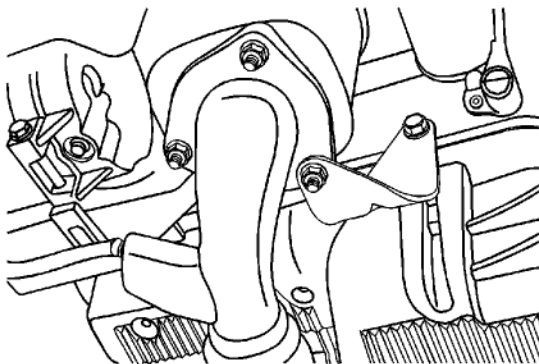
9. Install the damping block connection nut and bolt.



10. Connect the vacuum lines at the EVAP charcoal canister purge solenoid.
11. Connect the electrical connector to the EVAP canister purge solenoid.
12. Connect the oil pressure switch connector.
13. Install the crankshaft pulley.
14. 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 [KM-470-B](#), tighten the crankshaft pulley bolt 30 degrees plus 15 degrees.



15. Install the CKP sensor and the CKP sensor retaining bolt.

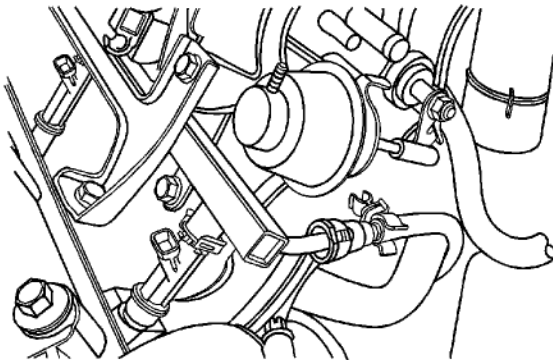
Tighten

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

16. Connect the CKP sensor and the knock sensor connectors.
17. Install the catalytic converter and the exhaust pipe as a unit.

Tighten

- Tighten the catalytic converter-to-exhaust manifold nuts and the bolts at the bracket to 40 N·m (30 lb ft).
 - Tighten the front muffler nuts to 30 N·m (22 lb ft).
18. Connect the power steering pressure hose, if equipped. Refer to [Power Steering Return Hose Replacement](#).

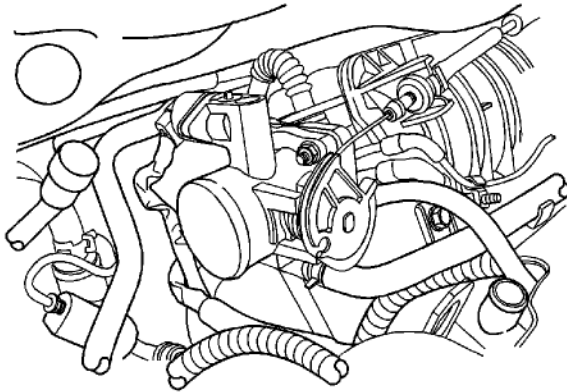


19. Connect the A/C compressor coil connector, if equipped.
20. Connect the ECT sensor connector.
21. Install the alternator adjusting bolt.
22. Install the accessory drive belt, if equipped.
23. Connect the A/C compressor hose assembly and the A/C compressor hose assembly retaining bolt, if equipped.

Tighten

Tighten the A/C compressor hose assembly retaining bolt to 33 N·m (24 lb ft).

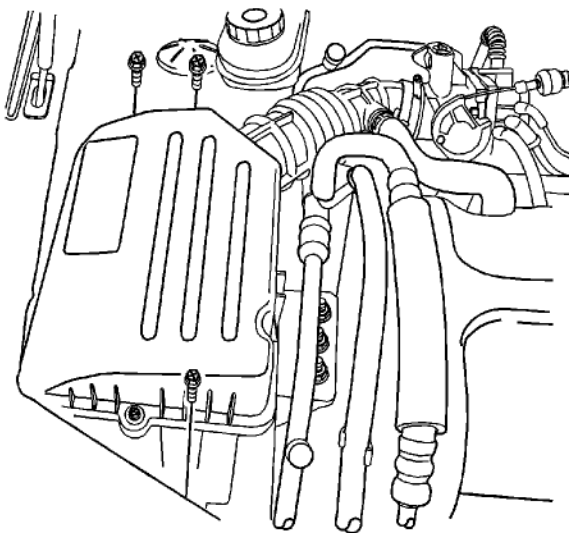
24. Install the right front splash shield.
25. Install the right front wheel. Refer to [Tire and Wheel Removal and Installation](#).
26. Connect the fuel feed line to the fuel rail.



27. Connect all of the necessary vacuum lines including the brake booster vacuum hose.
28. Connect the oxygen sensor connector.
29. Connect the starter solenoid S terminal wire.
30. Connect the alternator voltage regulator connector.
31. Connect the TP sensor connector.
32. Connect the IAC valve connector.
33. Connect the CMP sensor.
34. Install the engine cover.
35. Install the engine cover bolts.

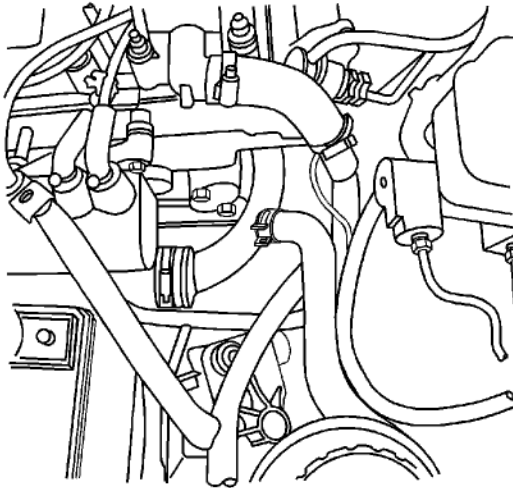
Tighten

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





36. Connect the fuel injector harness connectors.
37. Connect the electrical connector at the EI system ignition coil and the PCM/ECM ground terminal at the intake manifold and the starter motor.
38. Install the air intake tube between the throttle body and the air filter housing.
39. Connect the breather tubes to the valve cover.
40. Connect the IAT sensor connector.
41. Install the cooling system radiator and the engine cooling fans. Refer to [Radiator Replacement](#).



42. Connect the lower radiator hose to the coolant pipe.
43. Connect the upper radiator hose to the thermostat housing.
44. Connect the heater inlet hose to the cylinder head.
45. Connect the heater outlet hose to the coolant pipe.
46. Connect the coolant surge tank hose to the coolant pipe.
47. Connect the surge tank coolant hose to the throttle body.
48. Connect the throttle cable to the throttle body and the intake manifold bracket.
49. Install the fuel pump fuse.
50. Connect the negative battery cable to the vehicle frame.
51. Connect the negative battery cable.
52. Connect and assemble the positive battery cable.
53. Refill the engine crankcase with engine oil.
54. Refill the engine coolant system. Refer to [Cooling System Draining and Filling](#).
55. Bleed the power steering system, if equipped. Refer to [Power Steering System Bleeding](#).
56. Refill the A/C refrigerant system, if equipped. Refer to [Refrigerant Recovery and Recharging](#).
57. Install the hood. Refer to [Hood Replacement](#).

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

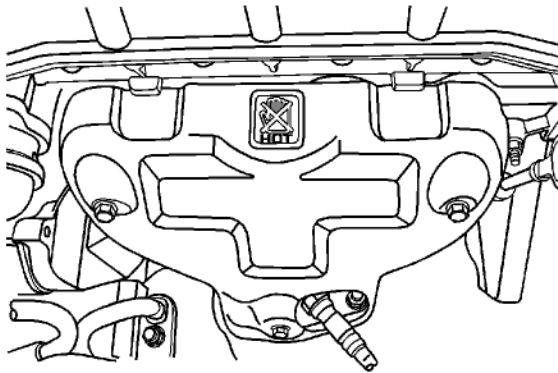
Tighten the oil pan drain plug bolt to 35 N·m (26 lb ft).

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

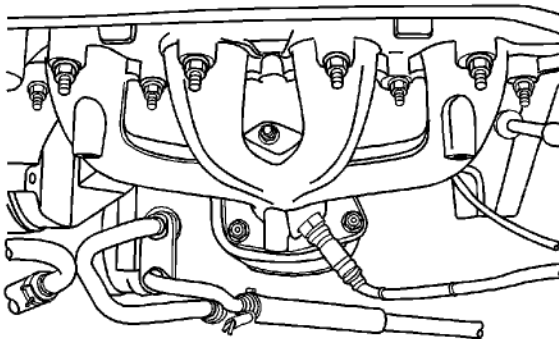
Exhaust Manifold Replacement

Removal Procedure

Warning: Refer to [Battery Disconnect Warning](#) in the Preface section.

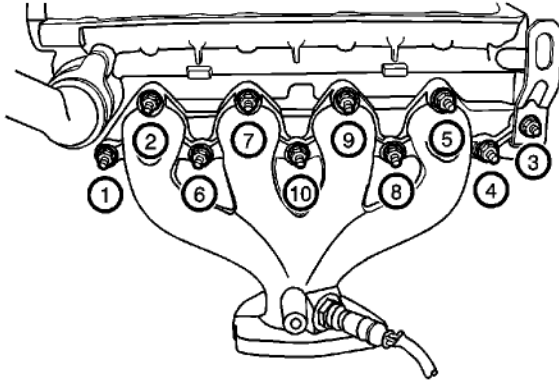


1. Disconnect the negative battery cable.
2. Disconnect the pre-converter oxygen sensor connector.
3. Remove the exhaust manifold heat shield bolts.
4. Remove the exhaust manifold heat shield.





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

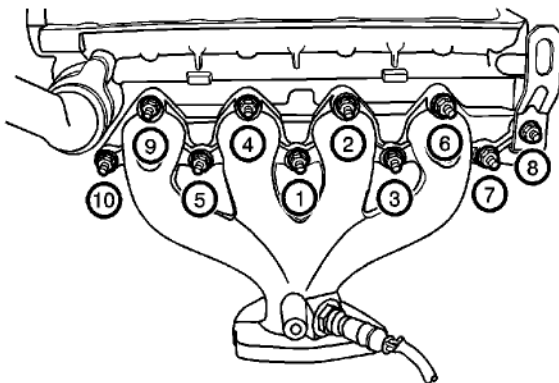


6. Remove the exhaust manifold retaining nuts in the sequence shown.
7. Remove the exhaust manifold.
8. Remove the exhaust manifold gasket.

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





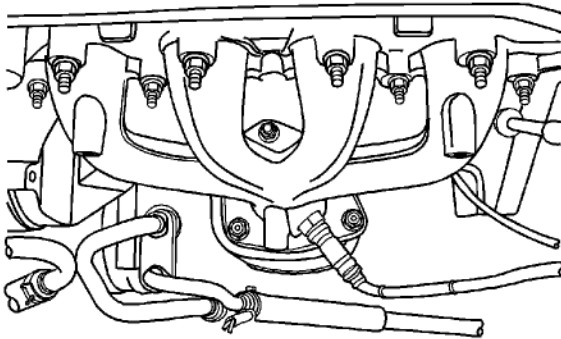
1. Install the exhaust manifold gasket.
2. Install the exhaust manifold.

Caution: Refer to [Fastener Caution](#) in the Preface section.

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

Tighten

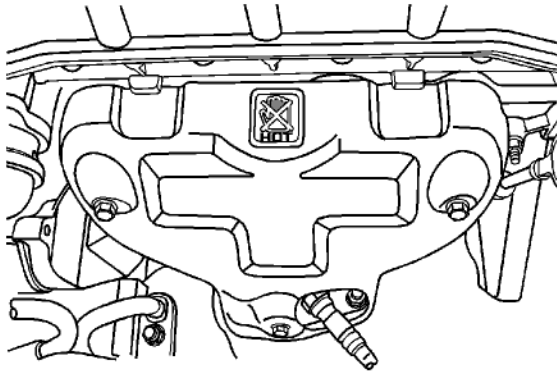
Tighten the exhaust manifold retaining nuts 25 N·m (18 lb ft).



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).

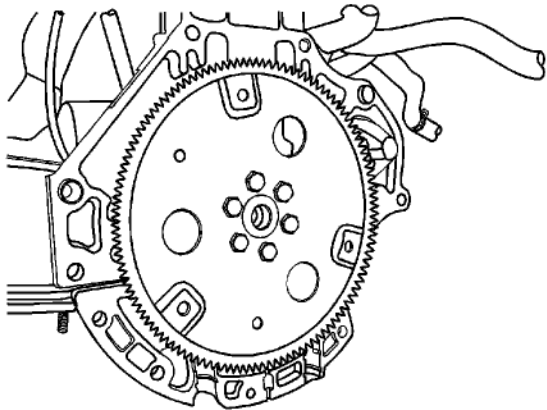
7. Connect the pre-converter oxygen sensor connector.
8. Connect the negative battery cable.

Crankshaft Replacement

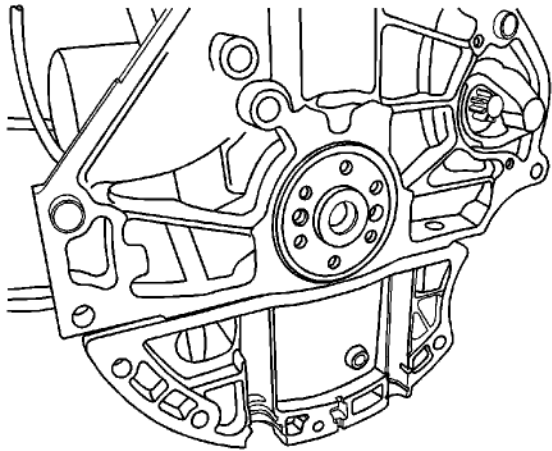
Special Tools

- [J 36972](#) Crankshaft Rear Oil Seal Installer
- [J 42492-A](#) (KM-421-A) Timing Belt Adjuster
- [J 45059](#) Angle Meter
- KM-412 Engine Overhaul Stand or equivalent
- [KM-470-B](#) Angular Torque Gage
- [KM-635](#) Crankshaft Rear Oil Seal Installer

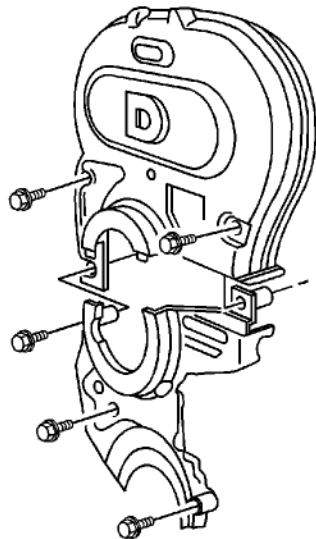
Disassembly Procedure



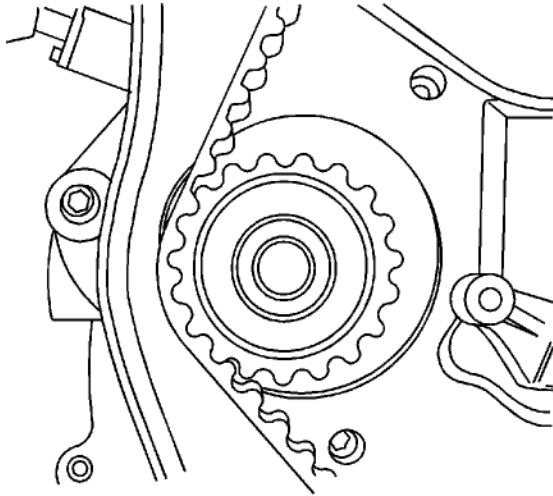
1. Remove the engine. Refer to [Engine Replacement](#).
2. Remove the flywheel bolts.
3. Remove the flywheel.



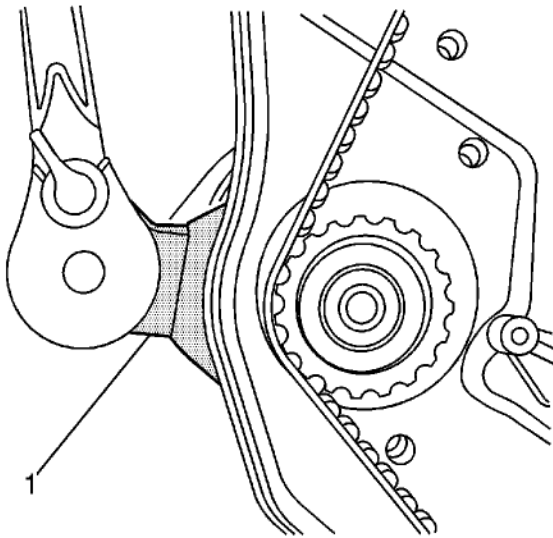
4. Remove the crankshaft rear oil seal.
5. Mount the engine assembly on the KM-412.



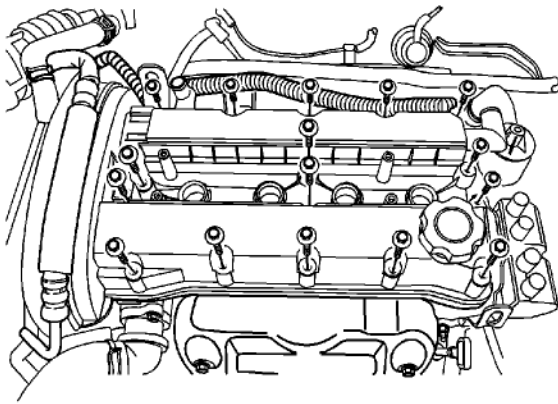
6. Remove the upper and lower front timing belt cover bolts.
7. Remove the upper and lower front timing belt cover.



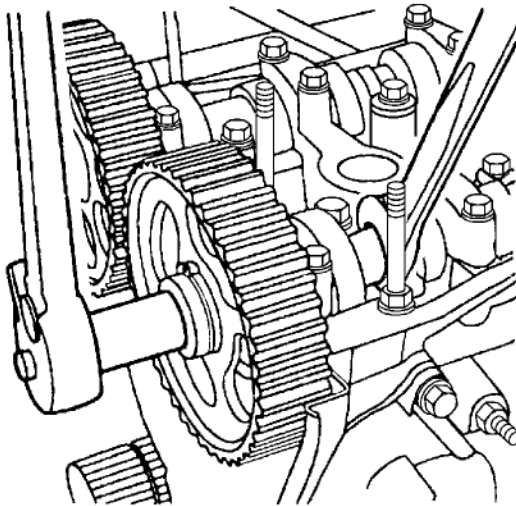
8. Slightly loosen the coolant pump retaining bolts.



9. Rotate the coolant pump using the [J 42492-A](#) (1) to remove the tension from the timing belt.
10. Remove the timing belt.



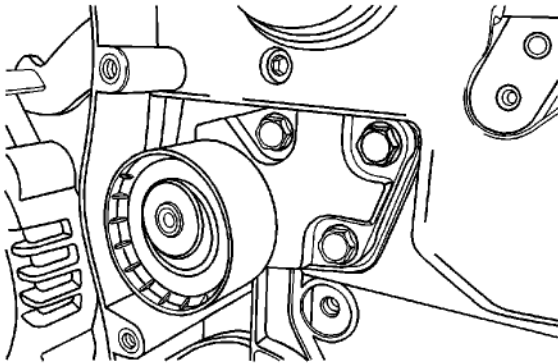
11. Disconnect the crankcase ventilation tubes from the valve cover.
12. Remove the engine cover bolts.
13. Remove the engine cover.
14. Disconnect the ignition wires from the spark plugs.
15. Remove the valve cover nuts.
16. Remove the valve cover washers.
17. Remove the valve cover and the valve cover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



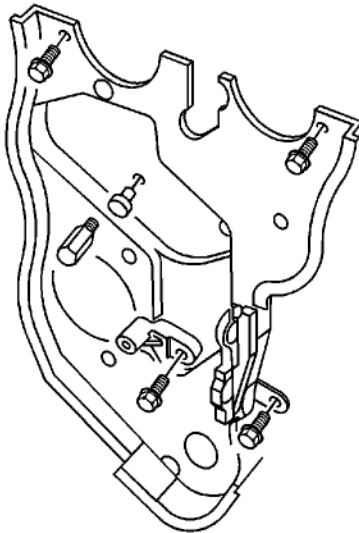
Caution: Use extreme care when installing the camshaft not to nick, scratch, or damage the camshaft lobes or bearing surfaces.

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

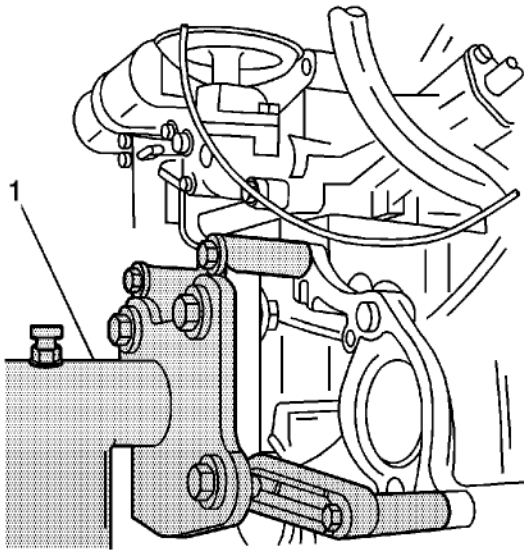
20. While holding the exhaust camshaft firmly in place, remove the exhaust camshaft bolt.
21. Remove the exhaust camshaft gear.



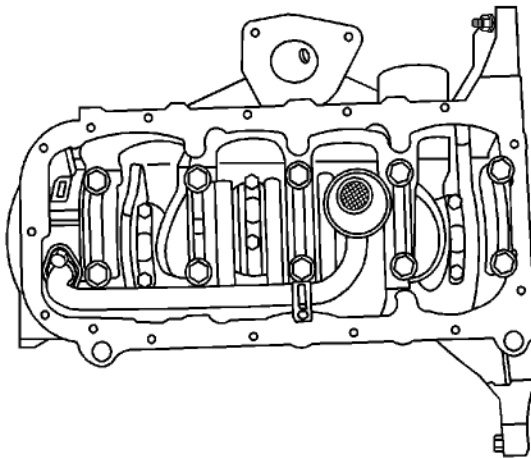
22. Remove the timing belt automatic tensioner bolts.
23. Remove the timing belt automatic tensioner.
24. Remove the timing belt idler pulley bolt.
25. Remove the timing belt idler pulley.



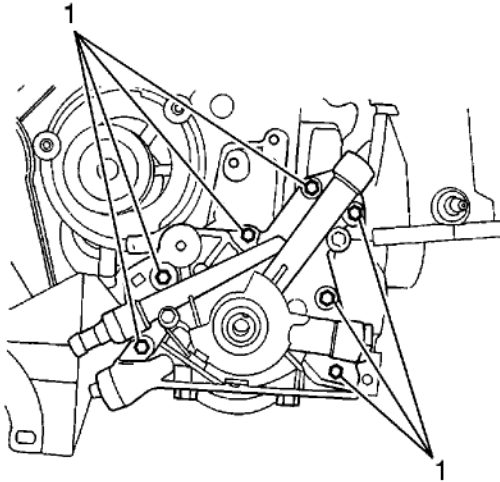
26. Remove the crankshaft timing belt gear.
27. Remove the rear timing belt cover bolts.
28. Remove the rear timing belt cover.



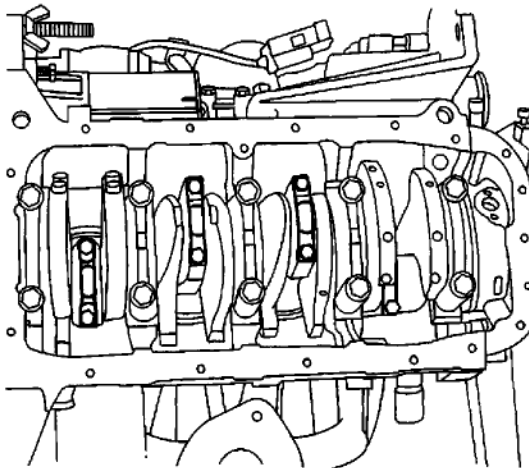
29. Rotate the engine of the KM-412 (1).



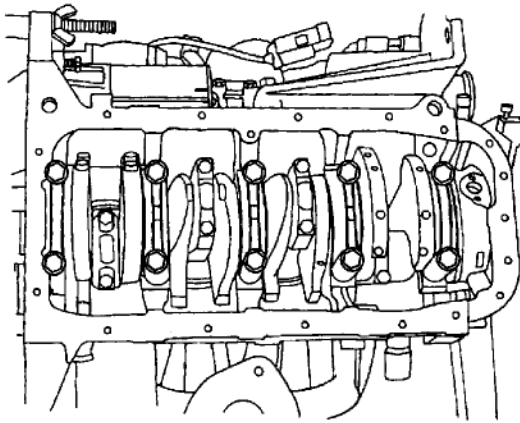
- 30. Remove the oil pan retaining bolts.
- 31. Remove the oil pan.
- 32. Remove the oil pickup tube bolts.
- 33. Remove the oil pickup tube.



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.

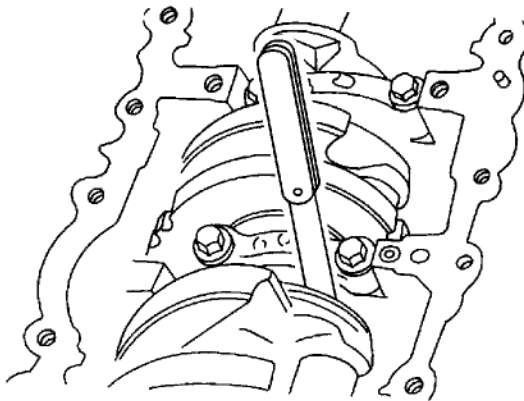


40. Mark the order of the crankshaft bearing caps.
41. Remove the crankshaft bearing cap bolts.
42. Remove the crankshaft bearing caps and the lower crankshaft bearings.
43. Remove the crankshaft.
44. Remove the upper crankshaft bearings.

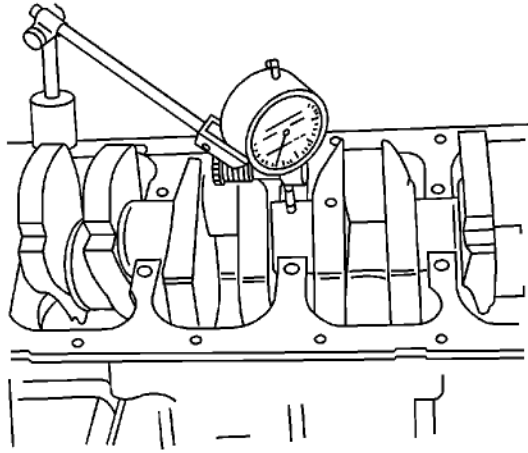
Warning: Refer to [Safety Glasses Warning](#) in the Preface section.

45. Clean any parts that need it.

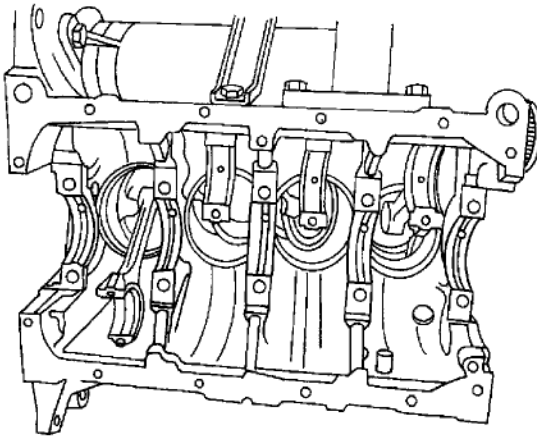
Assembly Procedure



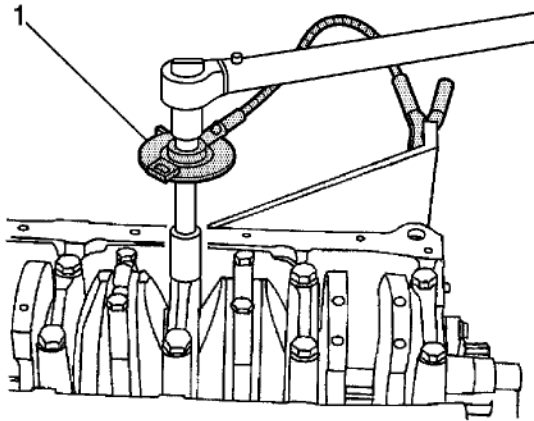
1. With the crankshaft and bearings in place, plastic gage all bearing clearances. Refer to [Crankshaft and Bearing Cleaning and Inspection](#).
2. Inspect the crankshaft end play with the crankshaft bearings installed.
3. Inspect for permissible crankshaft end play. Refer to [Engine Mechanical Specifications](#).



4. With the crankshaft mounted on the front and the rear crankshaft bearings, check the middle crankshaft bearings, check 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 the 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.

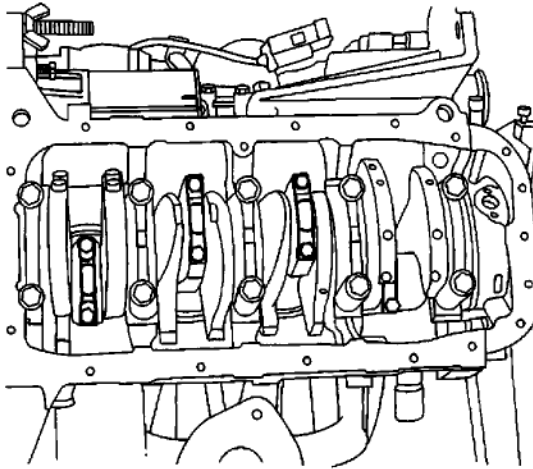
Caution: Do not reuse crankshaft bearing cap bolts. Failure to replace the crankshaft bearing cap bolts can lead to crankshaft bearing cap bolt breakage or crankshaft bearing failure. A broken crankshaft bearing bolt can lead to extensive engine damage.

11. Install the new crankshaft bearing cap bolts.

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 another 45 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.



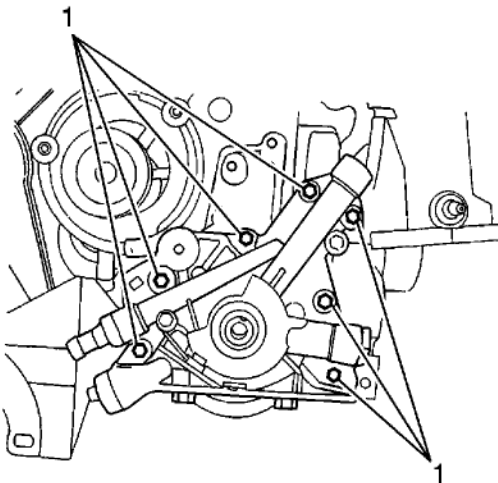
14. Install the connecting rod bearing caps to the connecting rods.

Caution: Do not reuse connecting rod bearing cap bolts. Failure to replace the connecting rod bearing cap bolts can lead to connecting rod bearing cap bolt breakage or connecting rod or bearing failure. A broken connecting rod bearing cap bolt can lead to extensive engine damage.

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.

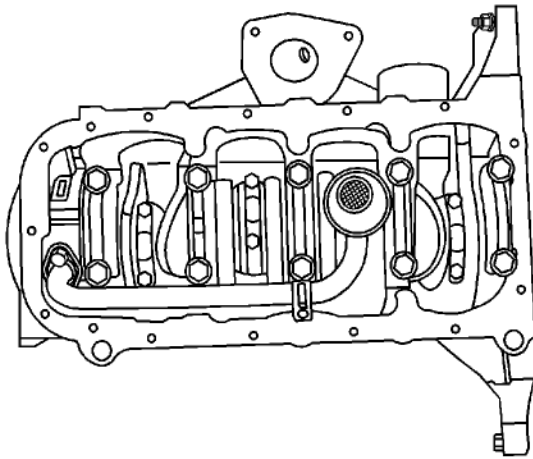




16. Install the oil pump.
17. Install the oil pump retaining bolts (1).

Tighten

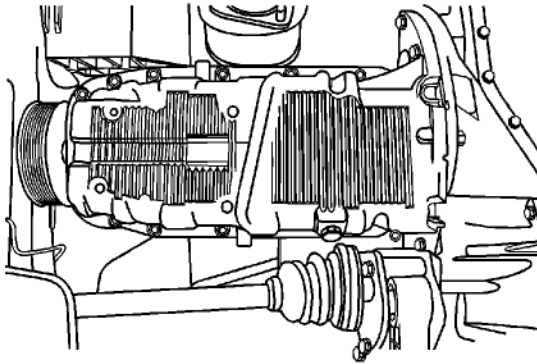
Tighten the oil pump retaining bolts to 10 N·m (89 lb in).



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).



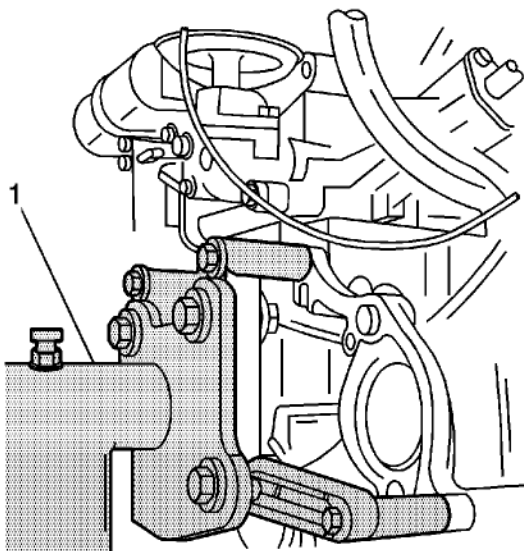
20. Install the oil pan gasket to the oil pan.
21. Install the oil pan.

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

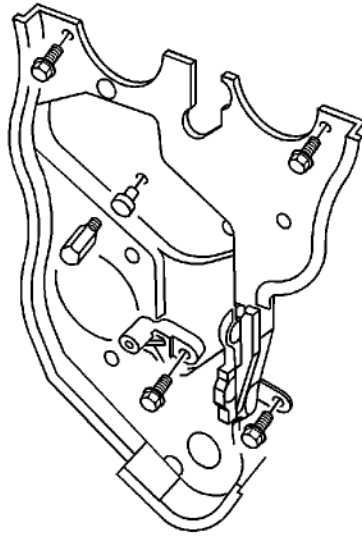
22. Install the oil pan retaining bolts.

Tighten

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



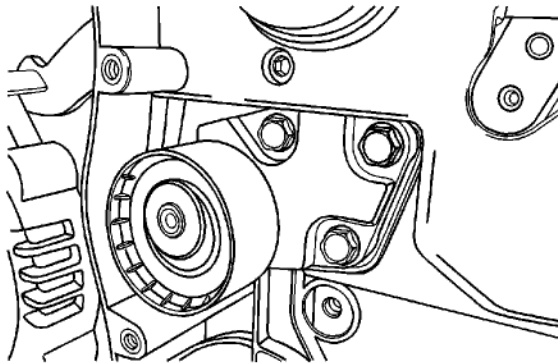
23. Rotate the engine on the KM-412 (1).



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.

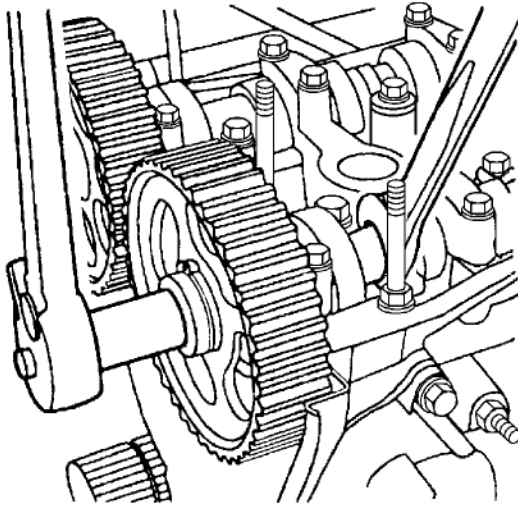
Tighten

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.

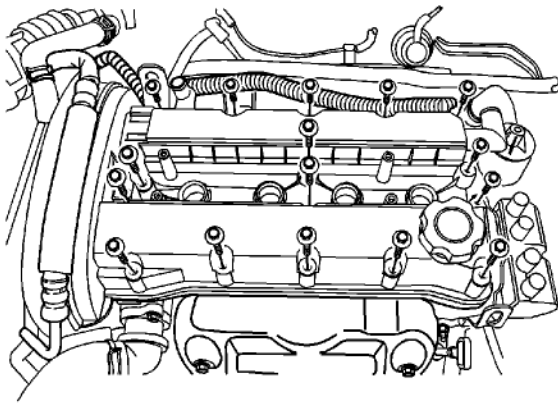
Tighten

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

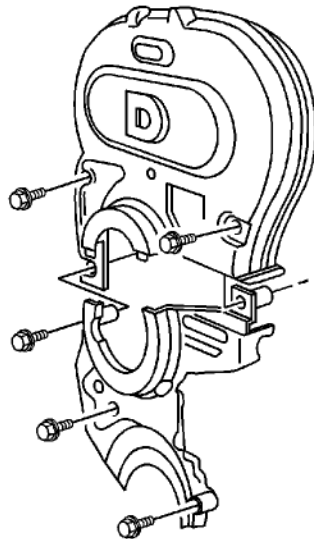
Tighten the exhaust camshaft bolt to 67.5 N·m (49 lb ft).



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 spark plug 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

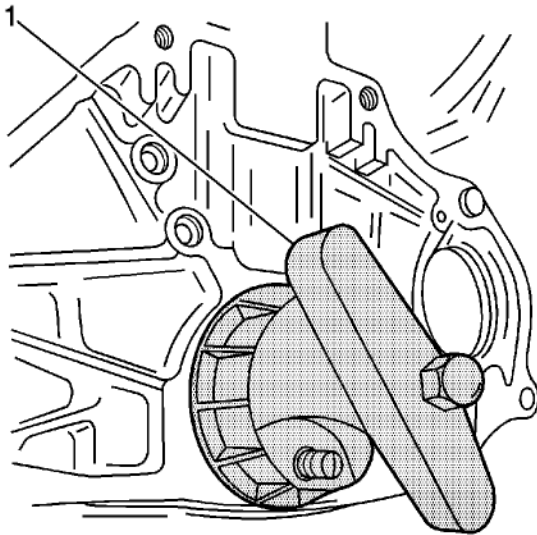
Tighten the upper and lower front timing belt cover bolts to 10 N·m (89 lb in).

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

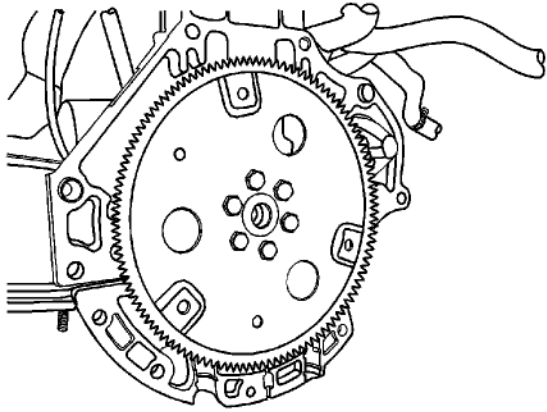
Tighten

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

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 36972](#) (1) or [KM-635](#).



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

Tighten

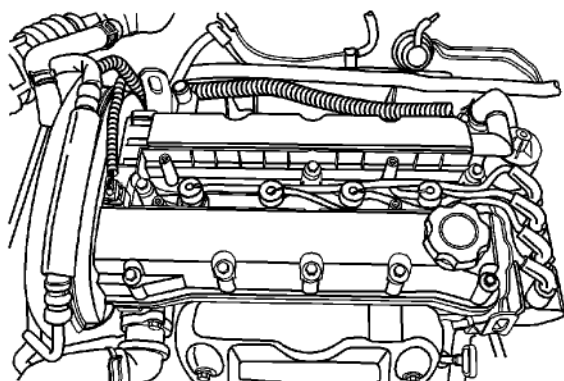
Tighten the flywheel bolts to 35 N·m (25 lb ft). Use the [J 45059](#) or the [KM-470-B](#) to tighten the flywheel bolts 30 degrees plus 15 degrees. For the manual transaxle, tighten the flexible plate bolts to 60 N·m (44 lb ft).

54. Install the engine. Refer to [Engine Replacement](#).

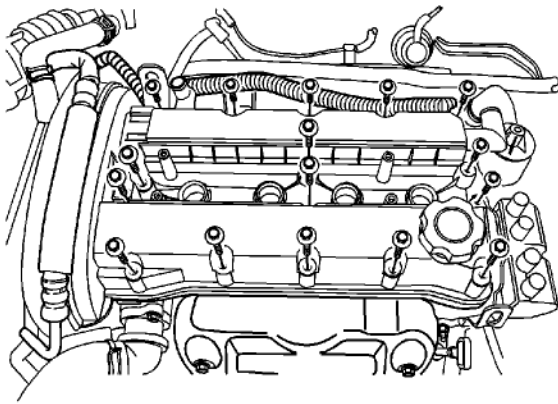
Camshaft Gear Replacement

Removal Procedure

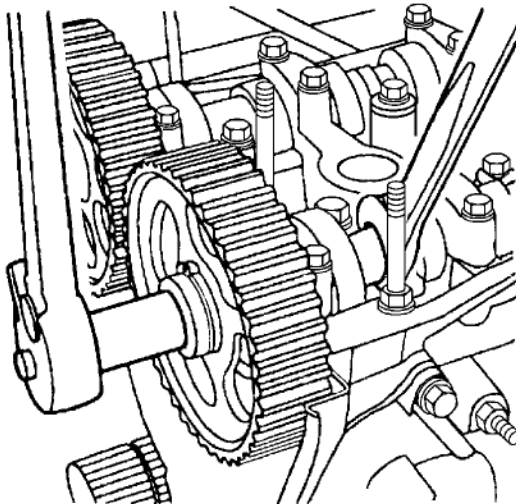
Warning: Refer to [Battery Disconnect Warning](#) in the Preface section.



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.



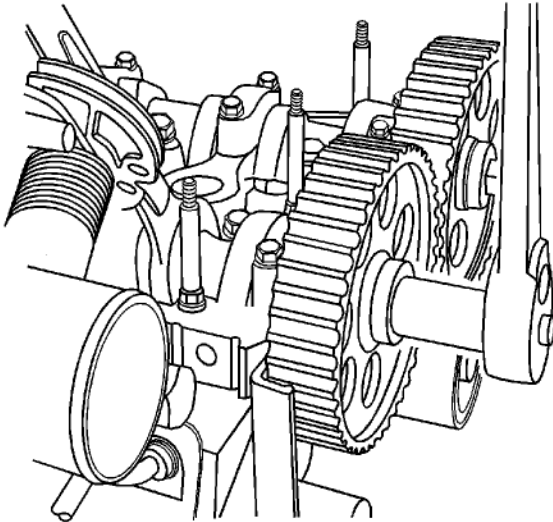
8. Remove the valve cover nuts.
9. Remove the valve cover washers.
10. Remove the valve cover and the valve cover gasket.



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.

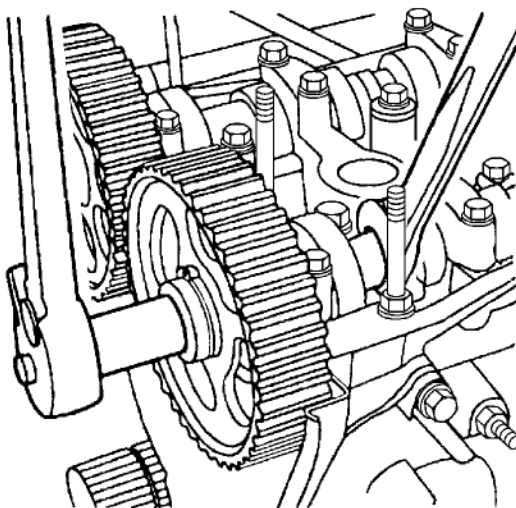
1. Install the intake camshaft gear.

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).

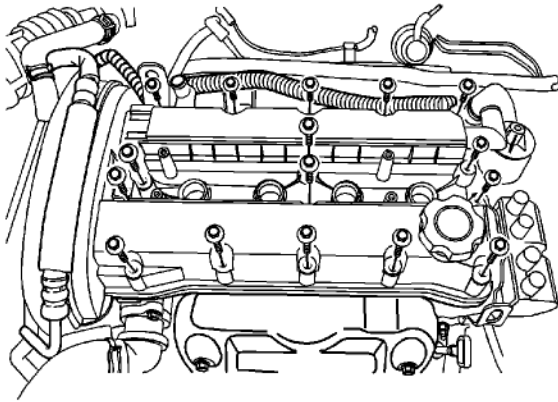




3. Install the exhaust camshaft gear.
4. While holding the exhaust camshaft firmly in place, install the exhaust camshaft gear bolt.

Tighten

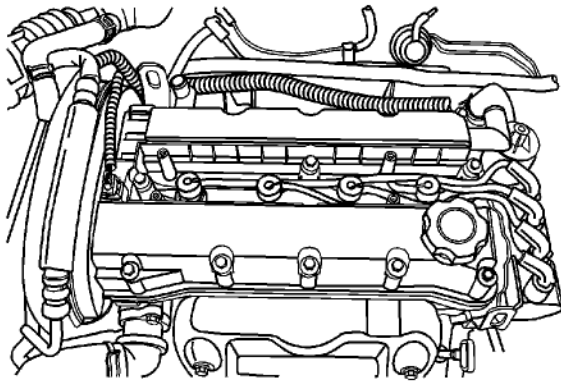
Tighten the exhaust camshaft gear bolt to 67.5 N·m (49 lb ft).



5. 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.
6. Install the valve cover and the valve cover gasket.
7. Install the valve cover washers.
8. Install the valve cover nuts.

Tighten

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



9. Connect the crankcase ventilation tubes to the valve cover.
10. Connect the ignition wires to the spark plugs.
11. Install the engine cover.
12. Install the engine cover bolts.

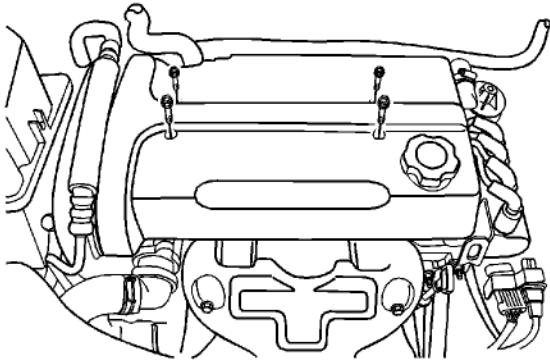
Tighten

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

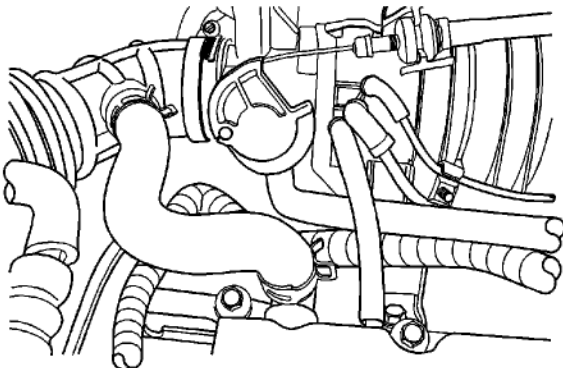
13. Install the timing belt. Refer to [Timing Belt Replacement](#).
14. Connect the CMP.
15. Connect the negative battery cable.

Camshaft Replacement

Removal Procedure



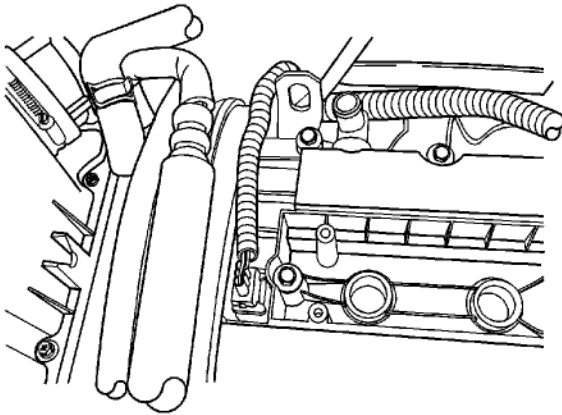
1. Remove the timing belt. Refer to [Timing Belt Replacement](#).
2. Remove the engine cover bolts.
3. Remove the engine cover.



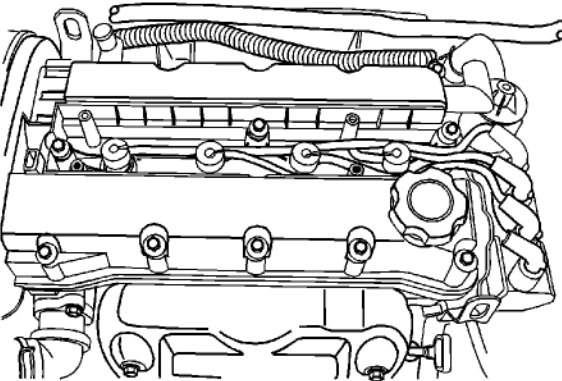
4. Disconnect the breather tube from the valve cover.

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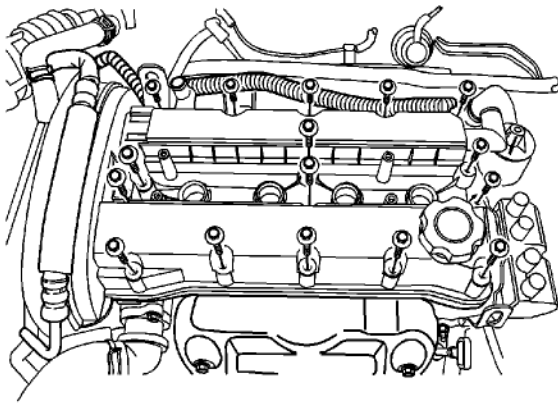
5. Disconnect the crankcase ventilation tube from the valve cover.



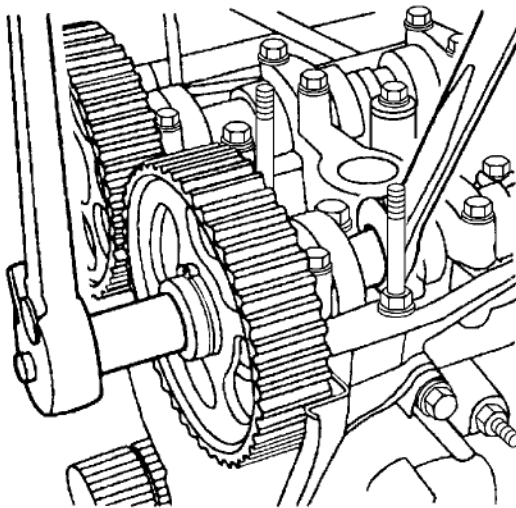
6. Disconnect the camshaft position (CMP) sensor connector.



7. Disconnect the ignition wires from the spark plugs.

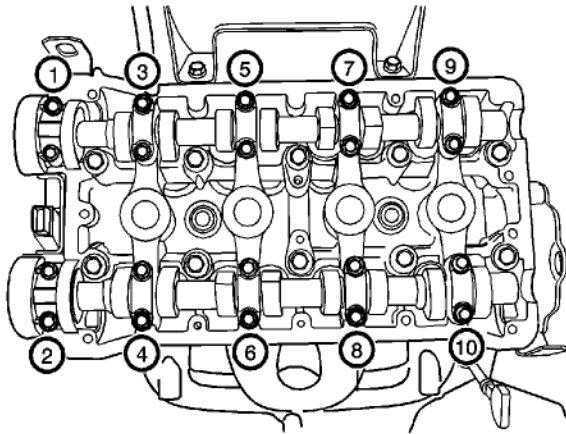


8. Remove the valve cover bolts.
9. Remove the valve cover and gasket.

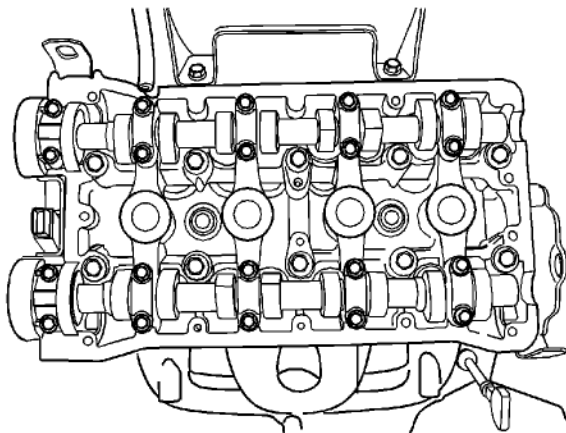


Caution: Use extreme care when removing the camshaft not to nick, scratch, or damage the camshaft lobes or bearing surfaces.

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.

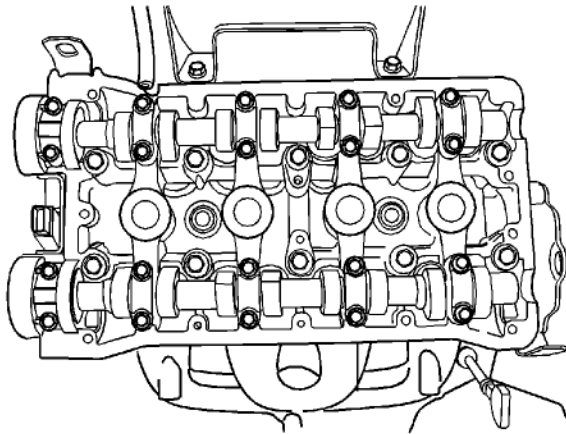


14. Remove the camshaft cap bolts gradually and in the sequence shown for each camshaft cap.



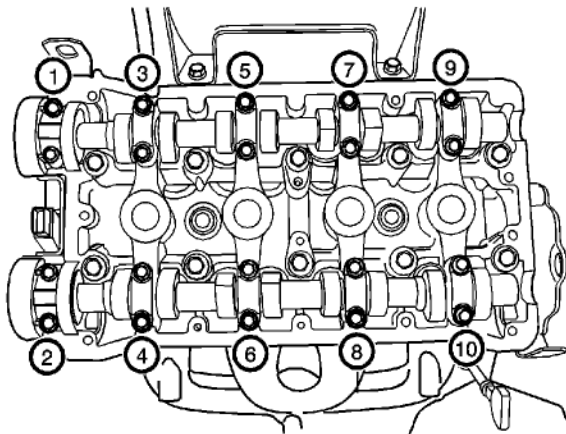
15. Remove the intake camshaft caps. Maintain the correct positions for installation.
16. Remove the intake camshaft.
17. Remove the exhaust camshaft caps. Maintaining the correct positions for installation.
18. Remove the exhaust camshaft.

Installation Procedure



Caution: 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.



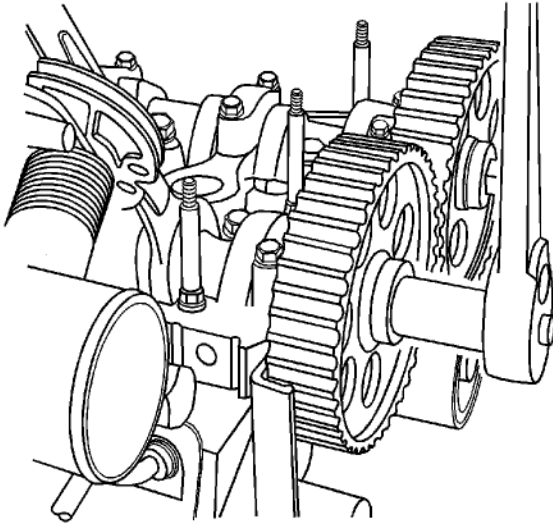
7. Install the exhaust camshaft cap bolts.

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

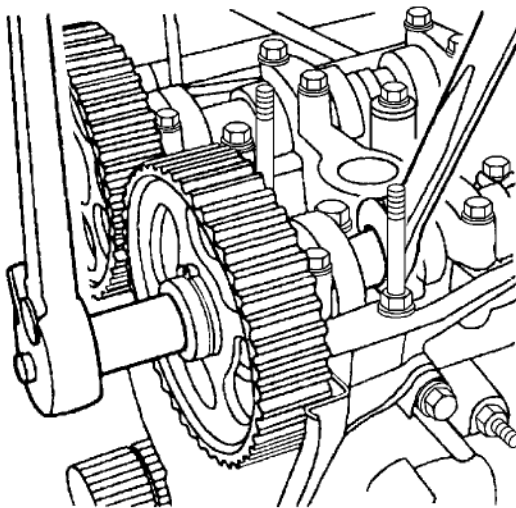
Tighten the camshaft cap bolts to 16 N·m (12 lb ft).



9. Measure the intake camshaft end play and the exhaust camshaft end play. Refer to [Engine Mechanical Specifications](#).
10. Install the intake camshaft gear.
11. 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).

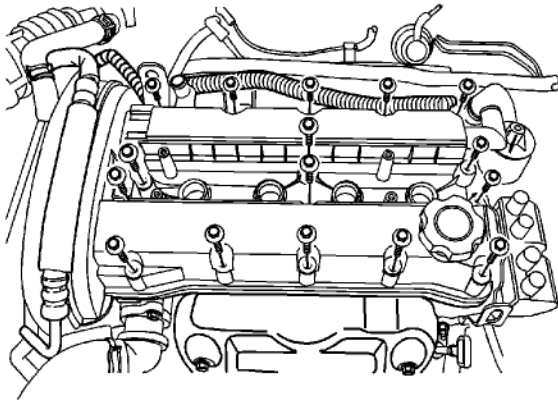




12. Install the exhaust camshaft gear.
13. While holding the exhaust camshaft firmly in place, install the exhaust camshaft gear bolt.

Tighten

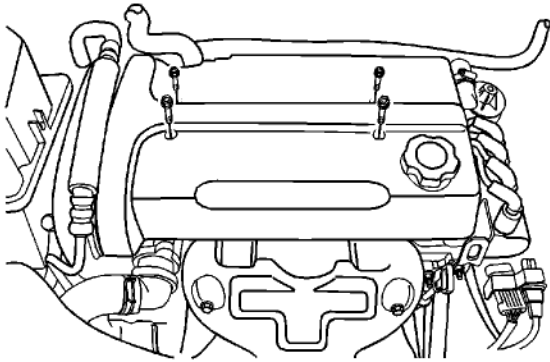
Tighten the exhaust camshaft gear bolt to 67.5 N·m (49 lb ft).



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

Tighten

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



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

Tighten

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

21. Install the oil filler cap.
22. Connect the vacuum line.
23. Connect the air breather tube to the valve cover.
24. Install the timing belt. Refer to [Timing Belt Replacement](#).

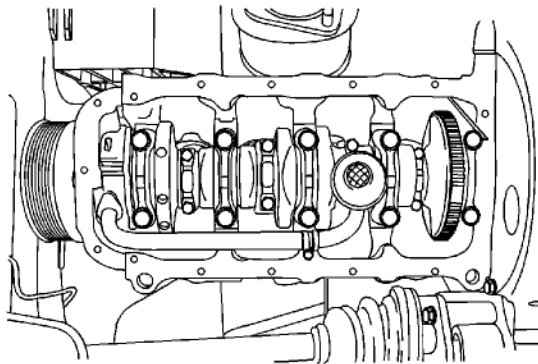
Piston, Connecting Rod, and Bearing Replacement

Special Tools

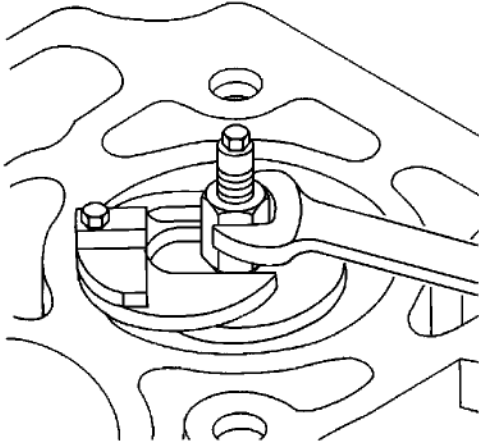
- [J 24086-B](#) (KM-427) Piston Pin Remover/Installer
- [J 45059](#) Angle Meter
- [KM-470-B](#) Angular Torque Gage

Removal Procedure

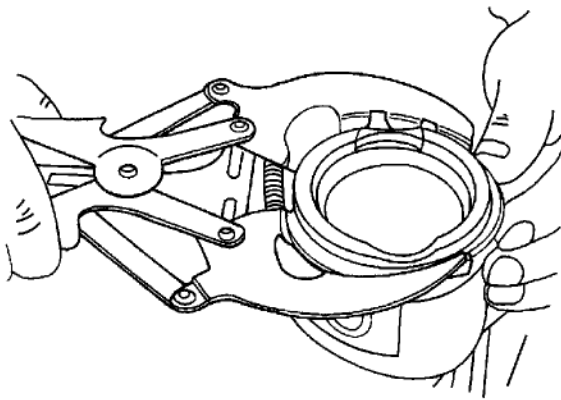
Warning: Refer to [Safety Glasses Warning](#) in the Preface section.



1. Remove the cylinder head with the intake manifold and exhaust manifold attached. Refer to [Cylinder Head Replacement](#).
2. Remove the oil pan. Refer to [Oil Pan Replacement](#).
3. Remove the oil pump/pickup tube bolts.
4. Remove the oil pump/pickup tube.

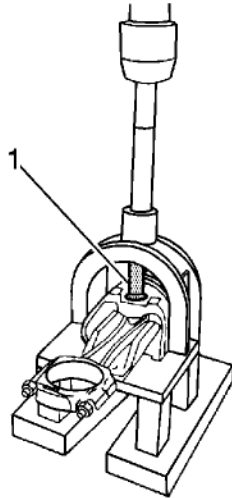


5. Move the piston to the bottom of the piston stroke.
6. Mark the connecting rod cap.
7. Remove the connecting rod cap bolts.
8. Remove the connecting rod cap and lower connecting rod bearing.
9. Remove the upper piston connecting rod bearing.
10. Ridge ream the cylinder wall.



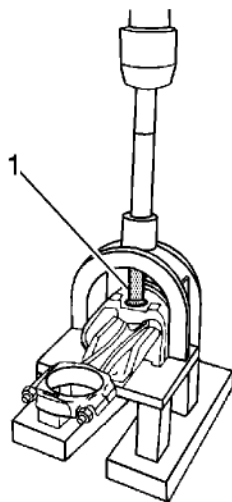
Warning: Handle the piston carefully. Worn piston rings are sharp and may cause bodily injury.

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 the [J 24086-B](#) (1).
15. Separate the piston from the connecting rod.

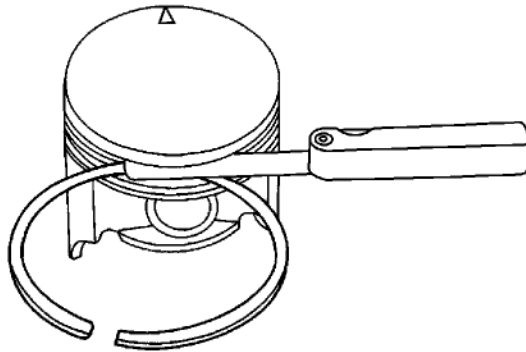
Installation Procedure



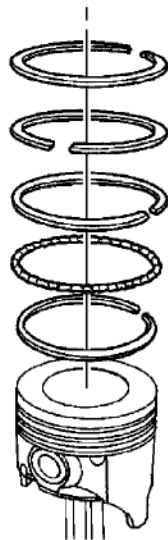
Warning: Avoid contact with moving parts and hot surfaces while working around a running engine in order to prevent physical injury.

1. Align the notch on the piston and 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 the [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.



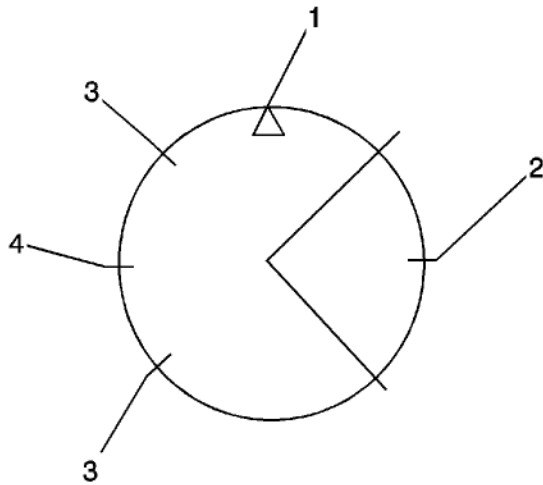
9. Measure the piston ring side clearance using a feeler gage. Refer to [Engine Mechanical Specifications](#).
10. If the piston ring is too thick, try another piston ring.
11. If no piston ring can be found that fits to specifications, the piston ring may be ground to size with emery paper placed on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



12. Install a piston oil ring, the expander, then the 2nd piston oil ring to the bottom ring groove

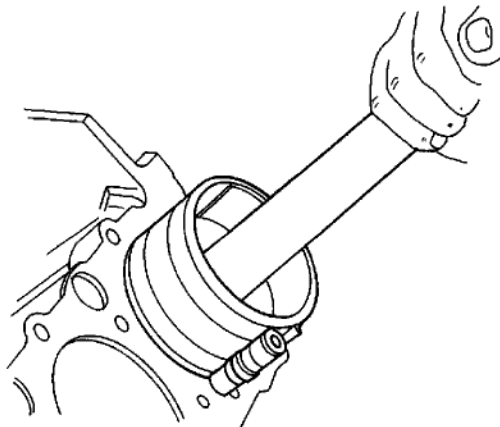
of the piston.

13. Install the 2nd compression ring to the middle ring groove of the piston.
14. Install the top compression ring to the top ring groove of the piston.



Caution: Use a piston ring expander to install the piston rings. The rings may be damaged if expanded more than necessary.

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 (2), the oil ring rail gaps (3), the 2nd compression ring (4), and the top compression ring in relation to the notch on the top of the piston (1).

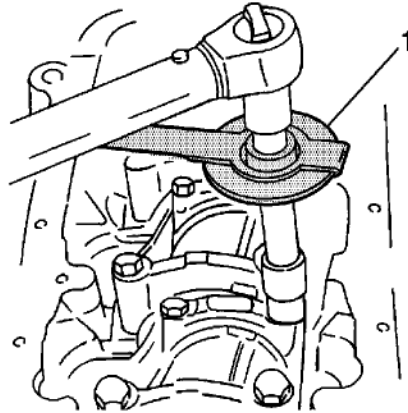


17. Lubricate the cylinder wall and the piston rings with clean engine oil.
18. Install the piston using a ring compressor and a wood handle. Guide the lower connecting rod

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 bearing bolts.

Tighten

Tighten the connecting rod bearing cap bolts to 25 N·m (18 lb ft). Using the [J 45059](#) or [KM-470-B](#) (1), tighten one turn of 30 degrees plus 15 degrees.

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

Tighten

Tighten the oil pump/pickup tube and support bracket 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](#).