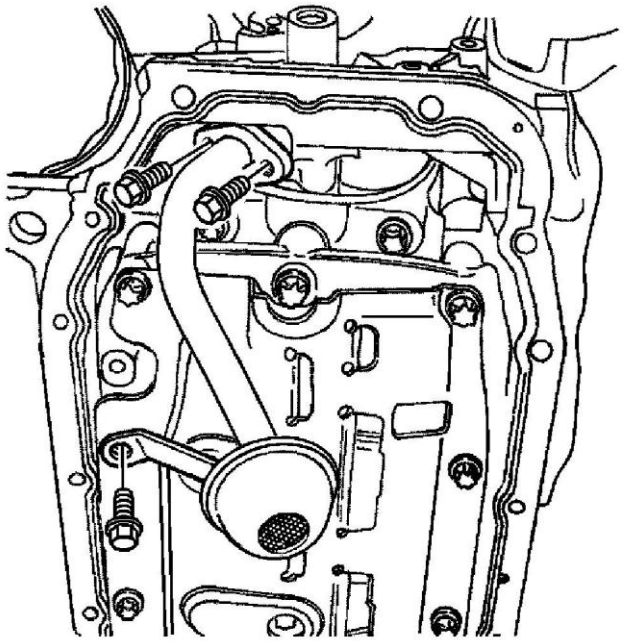
Connecting Rod Bearing: Service and Repair

Piston, Connecting Rod, and Bearing Replacement

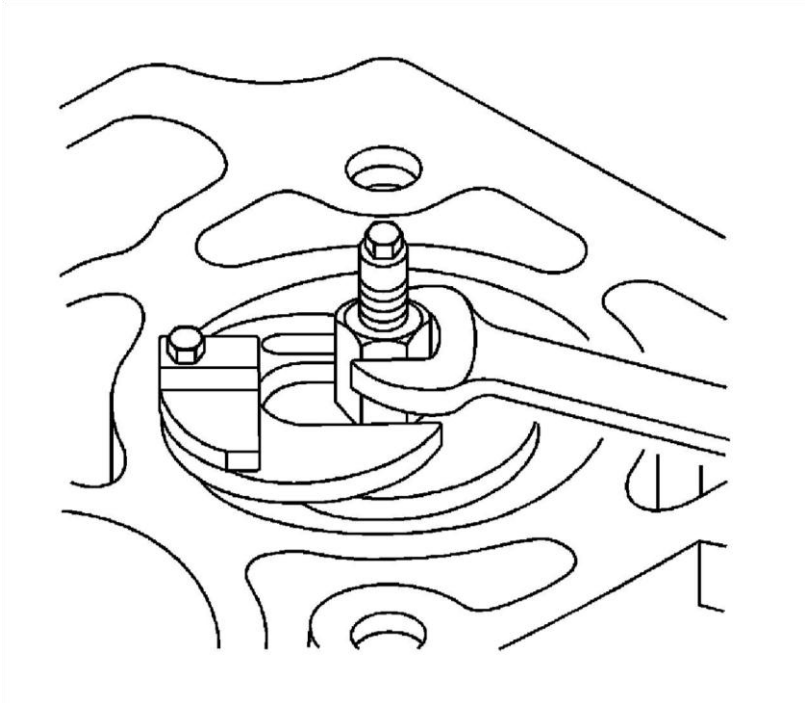
Tools Required

* J 24086-B Piston Pin Remover/Installer Set
* J 45059 Angle Meter
* J 8037 Ring Compressor or equivalent
* J 8087 Cylinder Bore Gage or equivalent
* KM-470-B Angular Torque Gage Removal Procedure

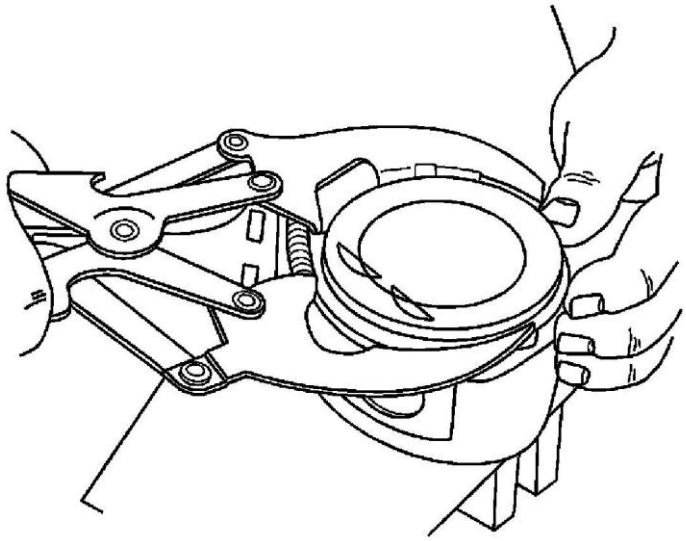


Caution: Refer to Safety Glasses Caution See: Service Precautions/Technician Safety Information/Safety Glasses Caution.

1. Remove the cylinder head with the intake manifold and the exhaust manifold attached. Refer to Cylinder Head Replacement See: Cylinder Head Assembly/Service and Repair.
2. Remove the oil pan. Refer to Oil Pan Replacement See: Engine Lubrication/Oil Pan/Service and Repair.
3. Remove the oil pump/pickup tube bolts.
4. Remove the oil pump/pickup tube.
5. Remove the engine block lower support and the splash shield bolts.
6. Remove the engine block lower support and the splash shield.

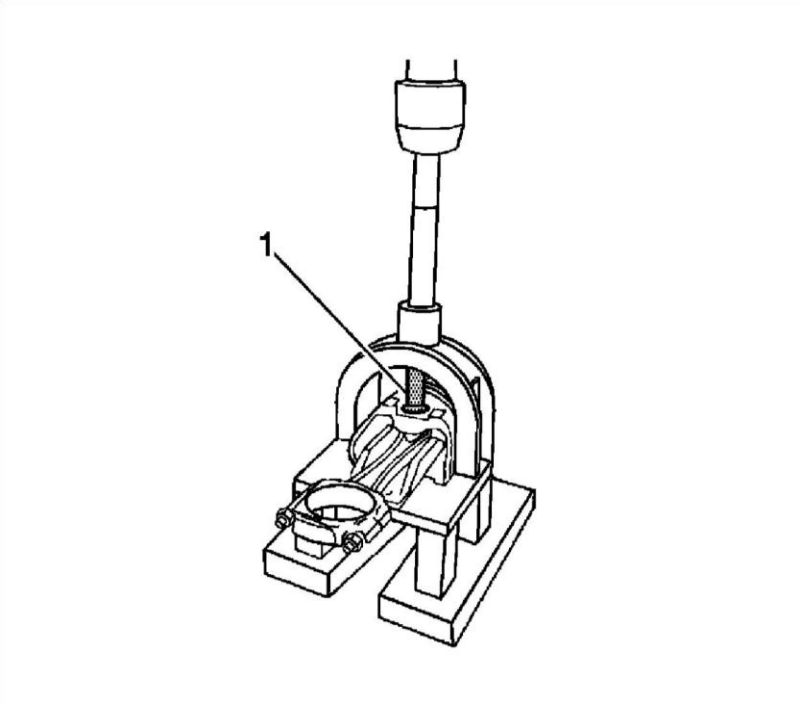


7. Move the piston to the bottom of the piston stroke.
8. Mark the connecting rod cap for position.
9. Remove the connecting rod cap bolts.
10. Remove the connecting rod cap and the lower connecting rod bearing.
11. Remove the upper piston connecting rod bearing.
12. Ridge ream the cylinder wall.

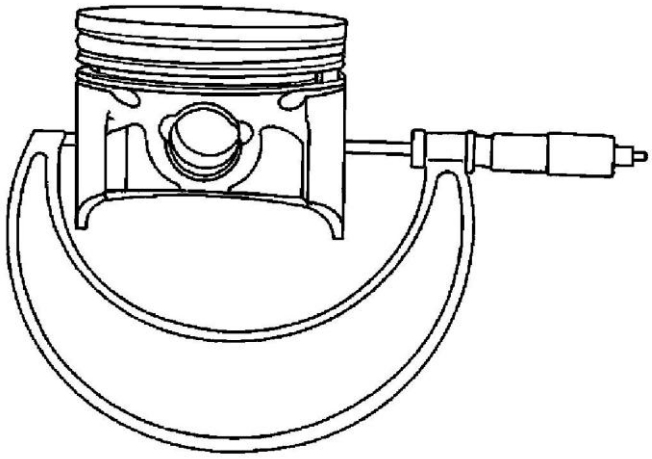


Caution: Handle the piston carefully. Worn piston rings are sharp and may cause bodily injury.

13. Remove the piston.
14. Use a piston ring expander tool to expand the piston rings.
15. Remove the piston rings.

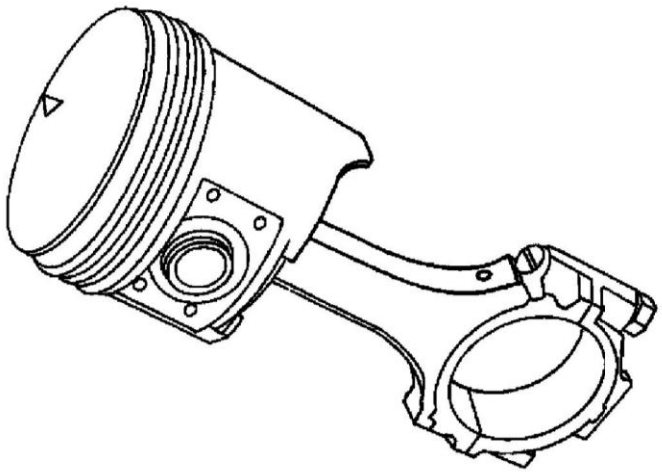


16. Remove the piston pin from the piston and connecting rod assembly using the J 24086-B (1).
17. Separate the piston from the connecting rod. Inspection Procedure

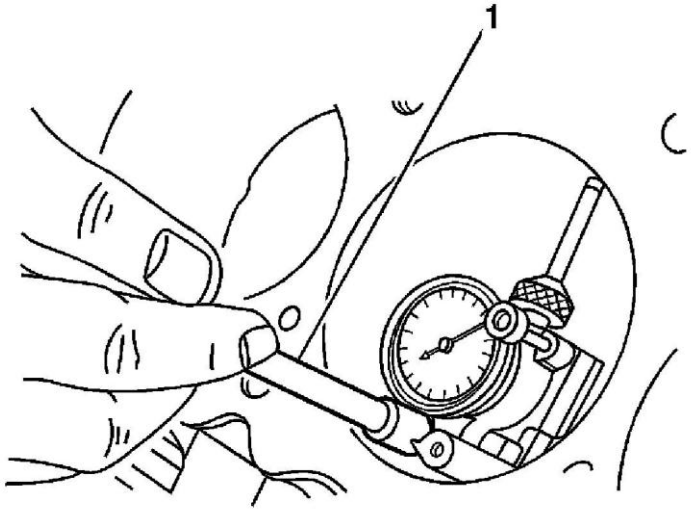


Caution: Refer to Safety Glasses Caution See: Service Precautions/Technician Safety Information/Safety Glasses Caution.

1. Inspect the connecting rod for bending or twisting. If the connecting rod is bent or twisted, replace the connecting rod.
2. Inspect the connecting rod bearings.
3. Inspect the connecting rod lower end for wear.
4. Inspect the connecting rod upper end for scoring.
5. Inspect the crankshaft rod bearing journal for wear. Refer to Engine Mechanical Specifications See: Specifications/Service Limits & General Specifications.
6. Inspect the piston for scoring, cracks, and wear.
7. Inspect the piston for taper using a micrometer.

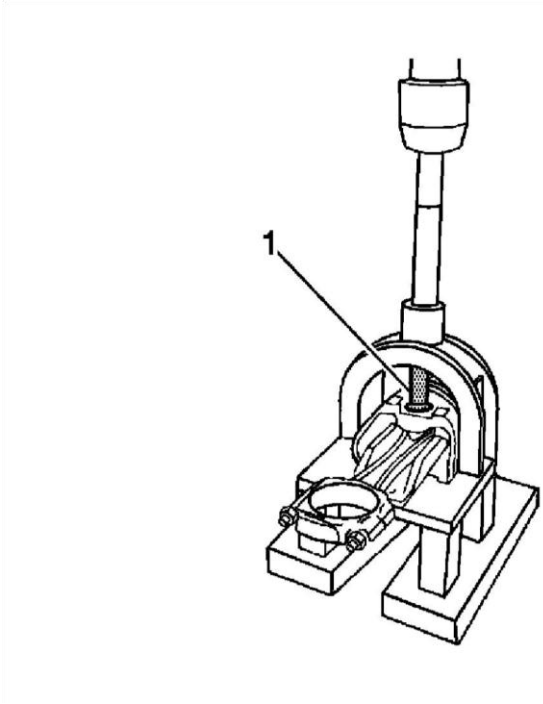


8. Inspect the piston for fit to the connecting rod.



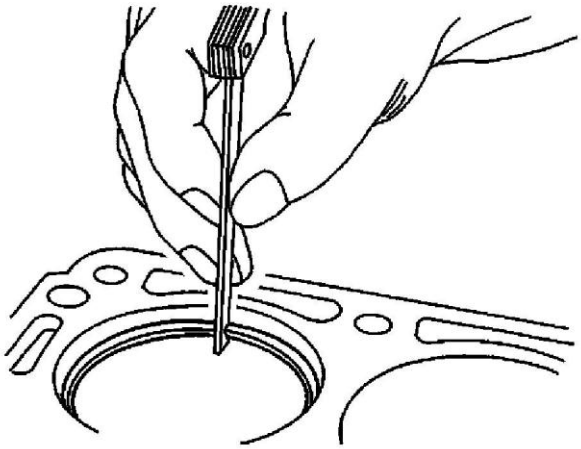
9. Inspect the engine block deck surface for flatness using a straight edge and a feeler gage. Refer to Engine Mechanical Specifications See: Specifications/Service Limits & General Specifications.
10. Inspect the bearing bore for concentricity and alignment using the J 8087 (1). Refer to Engine Mechanical Specifications See: Specifications/Service Limits & General Specifications.
11. If the bearing bore is beyond specifications, replace the engine block.
12. Inspect the engine block cylinder bore for wear, runout, ridging and taper using the J 8087 . Refer to Engine Mechanical Specifications See:
    Specifications/Service Limits & General Specifications.
13. Inspect the engine block cylinder bore for glazing.
14. Lightly hone the cylinder bore as necessary.

Installation Procedure



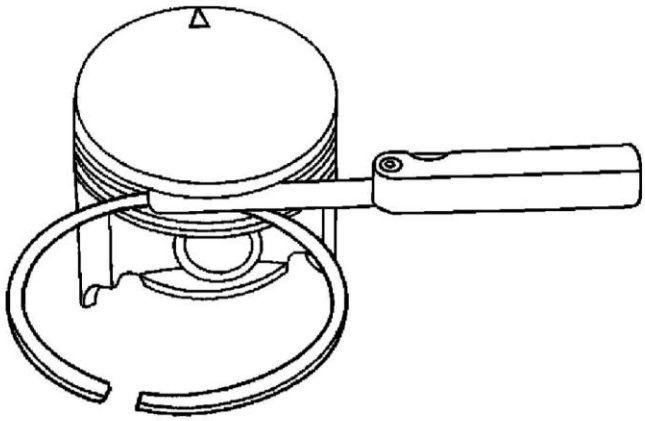
Important: For ease of installation of the piston pin, the connecting rod should be heated to 280°C (536°F). Heat the upper connecting rod only. Use commercial thermocolor material to determine the correct temperature. When the thermocolor material changes from black to green, the temperature is correct for installation.

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 the connecting rod assembly using the J 24086-B (1).

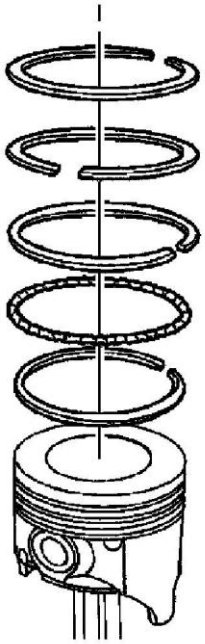


6. Select the set of new piston rings.
7. Measure the piston ring gap using a feeler gage. Refer to Engine Mechanical Specifications See: Specifications/Service Limits & General Specifications.

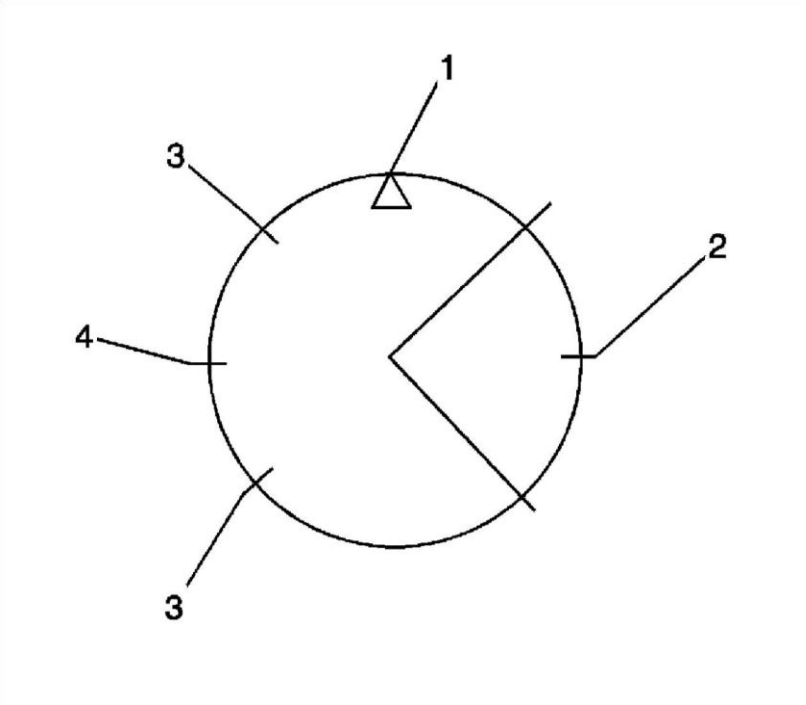
8. Increase the piston ring gap by carefully filing off excess material if the piston ring gap is below specifications.



9. Measure the piston ring side clearance using a feeler gage. Refer to Engine Mechanical Specifications See: Specifications/Service Limits & General 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.

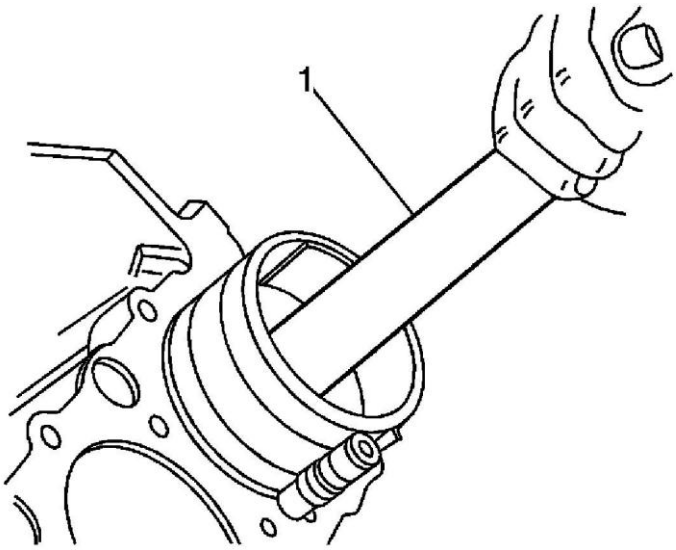


12. Install a piston oil ring, the expander, then the second piston oil ring to the bottom ring groove of the piston.
13. Install the second compression ring to the middle ring groove of the piston.
14. Install the top compression ring to the top ring groove of the piston.

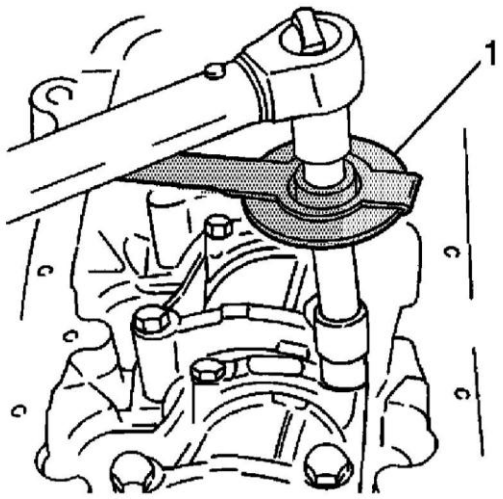


Notice: Use a piston ring expander to install the piston rings. The rings may be damaged if expanded more than necessary.

15. Install the piston rings.
16. Stagger the piston oil rings (2), the oil ring rail gaps (4), the second compression ring (5), and the top compression ring in relation to the notch
    (1) on the top of the piston.



17. Lubricate the cylinder wall and the piston rings with clean engine oil.
18. Install the piston using the J 8037 (1) 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 See: Service and Repair/Overhaul/5. Crankshaft and Bearing Cleaning and Inspection.



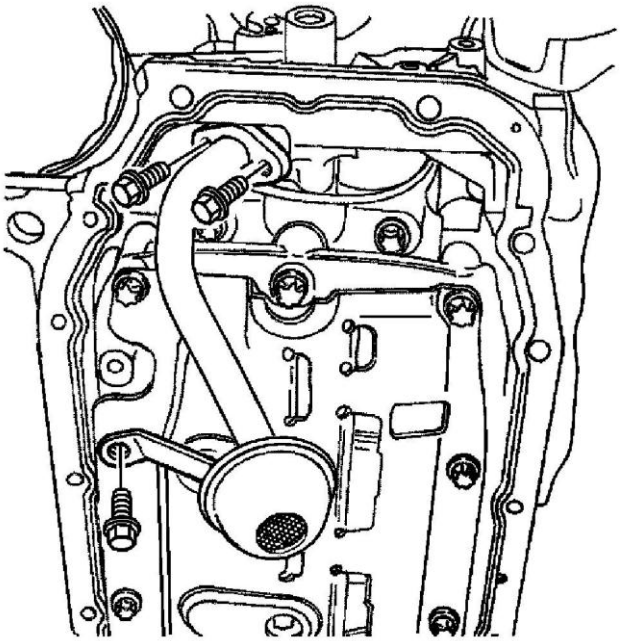
Notice: Refer to Fastener Notice See: Service Precautions/Vehicle Damage Warnings/Fastener Notice.

20. Install the connecting rod cap bearing bolts.

    Tighten the connecting rod cap bearing bolts to 35 Nm (26 lb ft). Using the J 45059 or the KM-470-B (1), tighten the bolts 1 turn of 45 degrees plus 15 degrees.

21. Install the engine block lower support bracket/splash shield bolts.

    Tighten the engine block lower support bracket/splash shield bolts to 35 Nm (26 lb ft).



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

Tighten the oil pump/pickup tube bolts to 8 Nm (71 lb in).

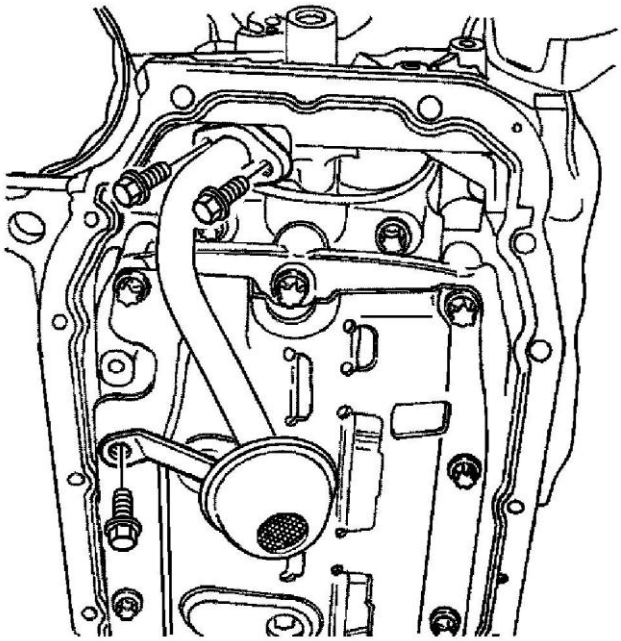
24. Install the oil pan. Refer to Oil Pan Replacement See: Engine Lubrication/Oil Pan/Service and Repair.
25. Install the cylinder head with the intake manifold and exhaust manifold attached. Refer to Cylinder Head Replacement See: Cylinder Head Assembly/Service and Repair.

Connecting Rod: Service and Repair

Piston, Connecting Rod, and Bearing Replacement

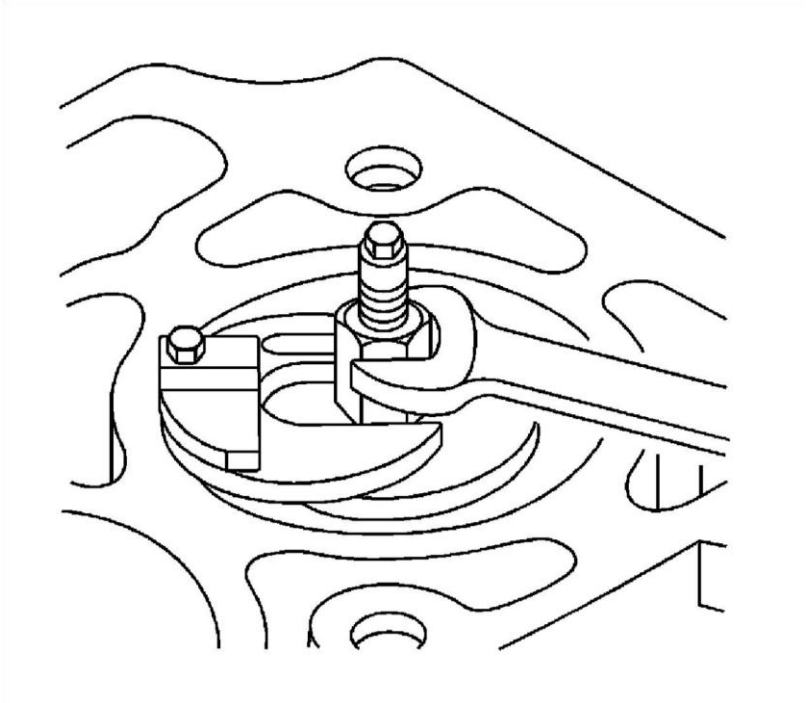
Tools Required

* J 24086-B Piston Pin Remover/Installer Set
* J 45059 Angle Meter
* J 8037 Ring Compressor or equivalent
* J 8087 Cylinder Bore Gage or equivalent
* KM-470-B Angular Torque Gage Removal Procedure

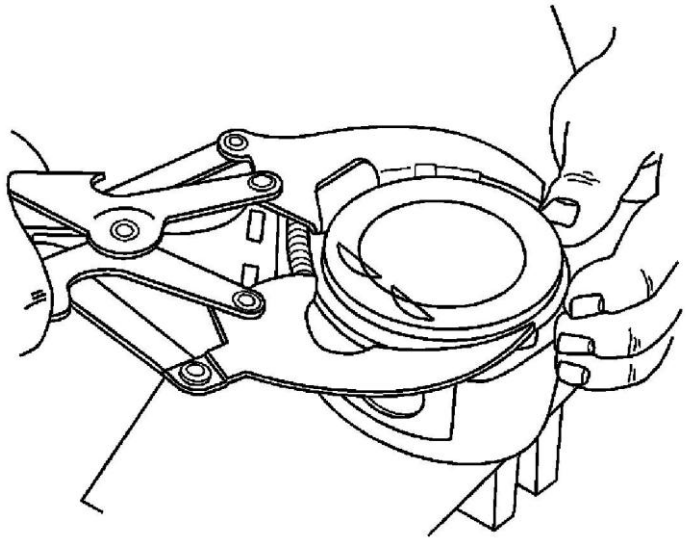


Caution: Refer to Safety Glasses Caution See: Service Precautions/Technician Safety Information/Safety Glasses Caution.

1. Remove the cylinder head with the intake manifold and the exhaust manifold attached. Refer to Cylinder Head Replacement See: Cylinder Head Assembly/Service and Repair.
2. Remove the oil pan. Refer to Oil Pan Replacement See: Engine Lubrication/Oil Pan/Service and Repair.
3. Remove the oil pump/pickup tube bolts.
4. Remove the oil pump/pickup tube.
5. Remove the engine block lower support and the splash shield bolts.
6. Remove the engine block lower support and the splash shield.

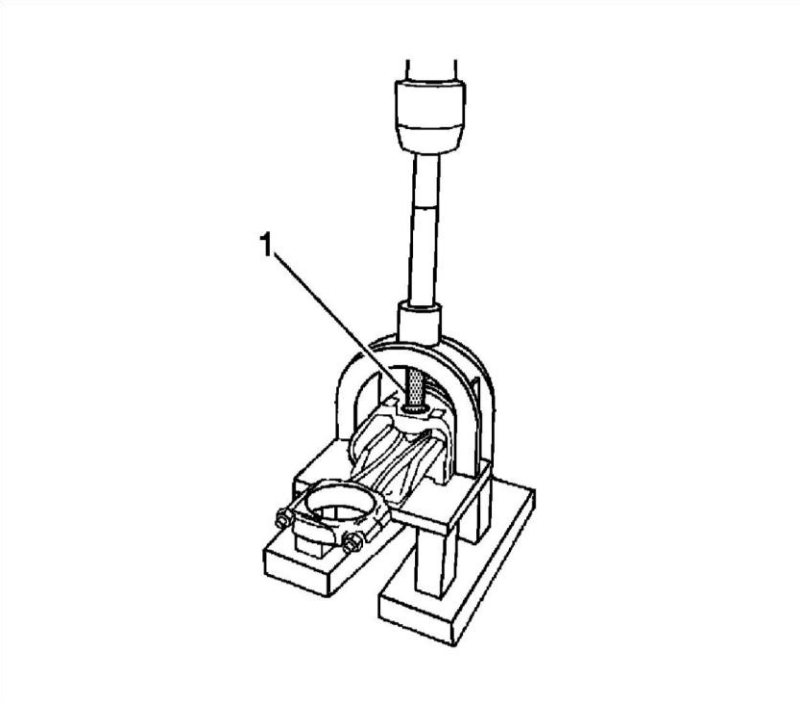


7. Move the piston to the bottom of the piston stroke.
8. Mark the connecting rod cap for position.
9. Remove the connecting rod cap bolts.
10. Remove the connecting rod cap and the lower connecting rod bearing.
11. Remove the upper piston connecting rod bearing.
12. Ridge ream the cylinder wall.

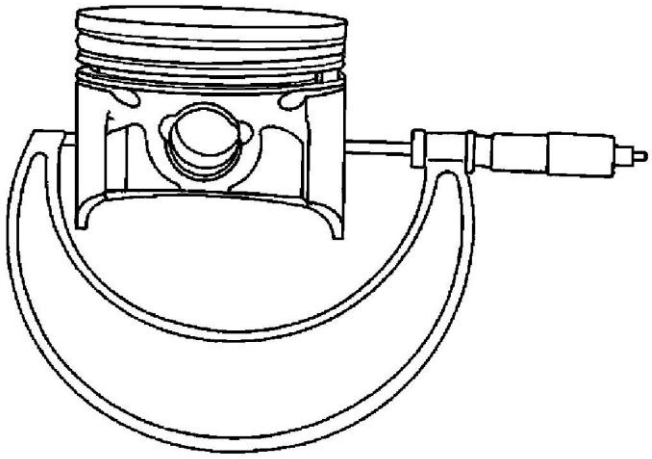


Caution: Handle the piston carefully. Worn piston rings are sharp and may cause bodily injury.

13. Remove the piston.
14. Use a piston ring expander tool to expand the piston rings.
15. Remove the piston rings.

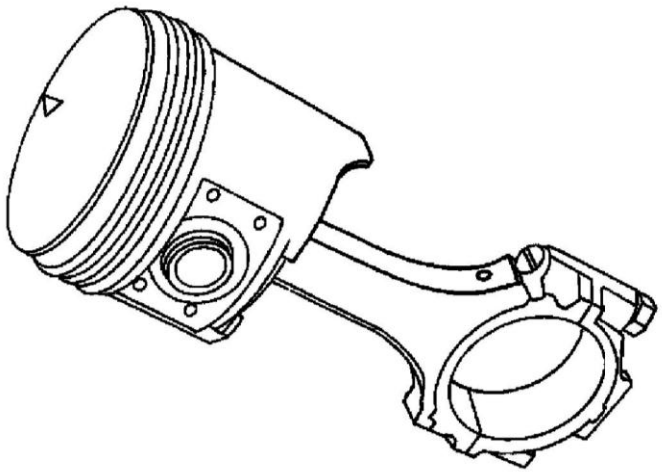


16. Remove the piston pin from the piston and connecting rod assembly using the J 24086-B (1).
17. Separate the piston from the connecting rod. Inspection Procedure

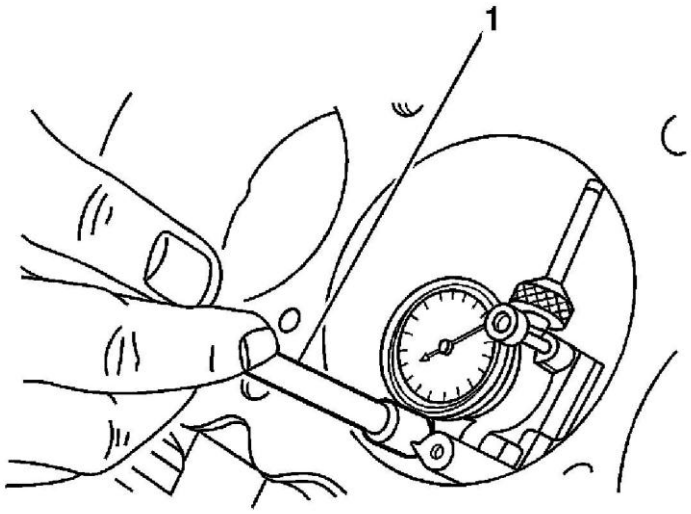


Caution: Refer to Safety Glasses Caution See: Service Precautions/Technician Safety Information/Safety Glasses Caution.

1. Inspect the connecting rod for bending or twisting. If the connecting rod is bent or twisted, replace the connecting rod.
2. Inspect the connecting rod bearings.
3. Inspect the connecting rod lower end for wear.
4. Inspect the connecting rod upper end for scoring.
5. Inspect the crankshaft rod bearing journal for wear. Refer to Engine Mechanical Specifications See: Specifications/Service Limits & General Specifications.
6. Inspect the piston for scoring, cracks, and wear.
7. Inspect the piston for taper using a micrometer.

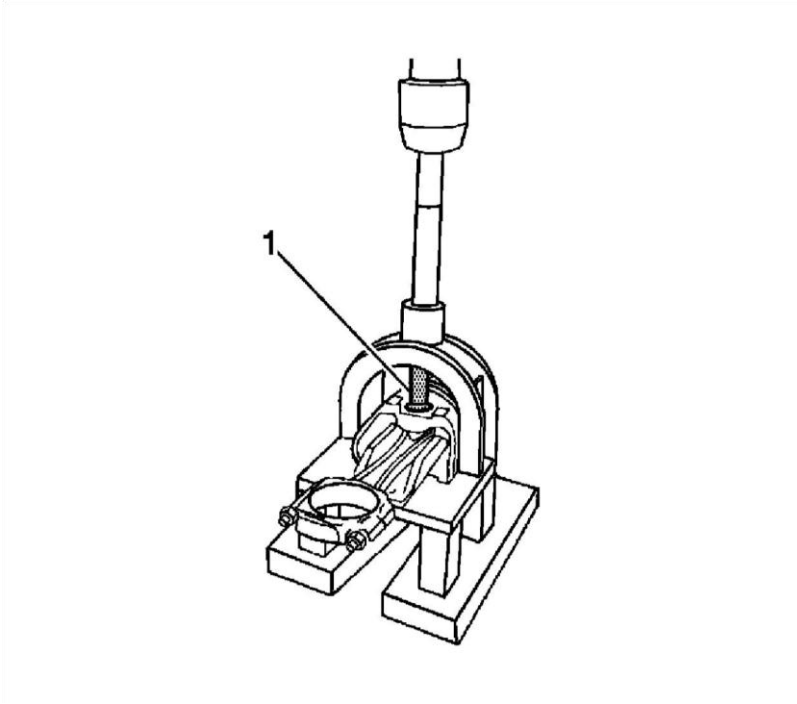


8. Inspect the piston for fit to the connecting rod.



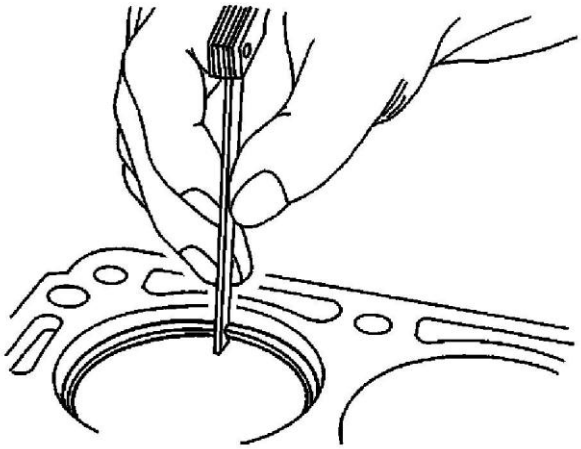
9. Inspect the engine block deck surface for flatness using a straight edge and a feeler gage. Refer to Engine Mechanical Specifications See: Specifications/Service Limits & General Specifications.
10. Inspect the bearing bore for concentricity and alignment using the J 8087 (1). Refer to Engine Mechanical Specifications See: Specifications/Service Limits & General Specifications.
11. If the bearing bore is beyond specifications, replace the engine block.
12. Inspect the engine block cylinder bore for wear, runout, ridging and taper using the J 8087 . Refer to Engine Mechanical Specifications See:
    Specifications/Service Limits & General Specifications.
13. Inspect the engine block cylinder bore for glazing.
14. Lightly hone the cylinder bore as necessary.

Installation Procedure



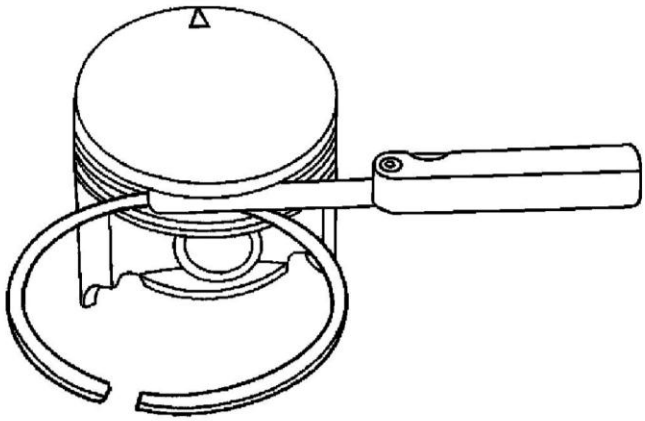
Important: For ease of installation of the piston pin, the connecting rod should be heated to 280°C (536°F). Heat the upper connecting rod only. Use commercial thermocolor material to determine the correct temperature. When the thermocolor material changes from black to green, the temperature is correct for installation.

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 the connecting rod assembly using the J 24086-B (1).

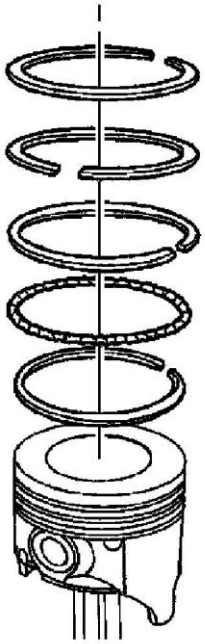


6. Select the set of new piston rings.
7. Measure the piston ring gap using a feeler gage. Refer to Engine Mechanical Specifications See: Specifications/Service Limits & General Specifications.

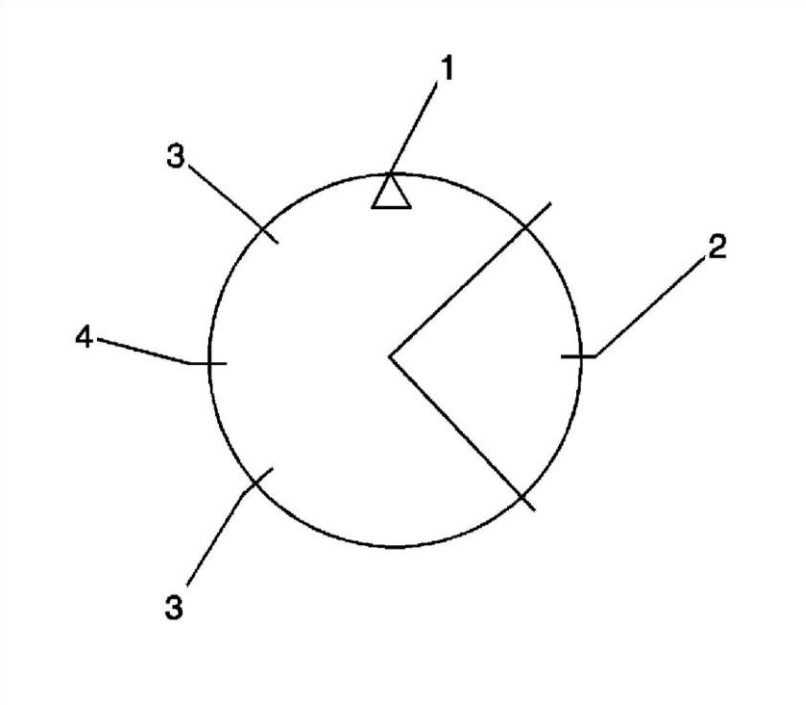
8. Increase the piston ring gap by carefully filing off excess material if the piston ring gap is below specifications.



9. Measure the piston ring side clearance using a feeler gage. Refer to Engine Mechanical Specifications See: Specifications/Service Limits & General 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.

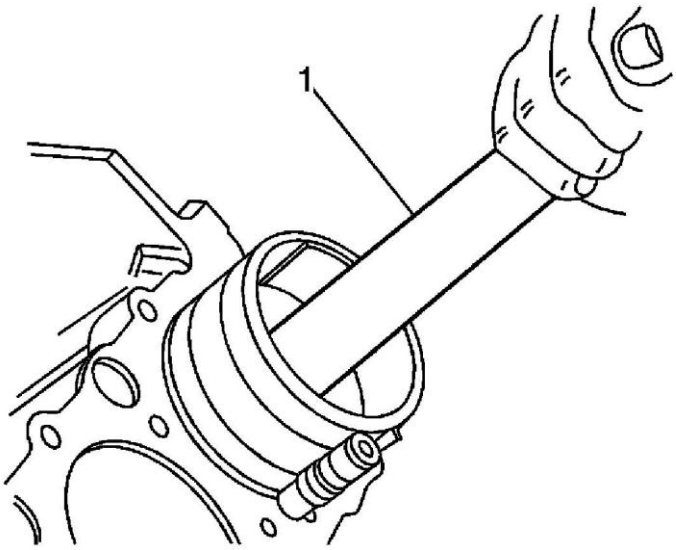


12. Install a piston oil ring, the expander, then the second piston oil ring to the bottom ring groove of the piston.
13. Install the second compression ring to the middle ring groove of the piston.
14. Install the top compression ring to the top ring groove of the piston.

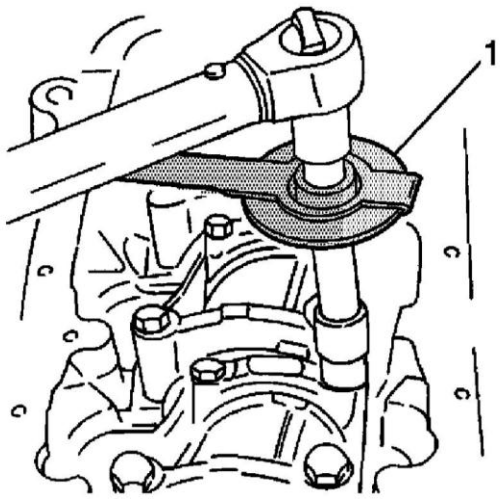


Notice: Use a piston ring expander to install the piston rings. The rings may be damaged if expanded more than necessary.

15. Install the piston rings.
16. Stagger the piston oil rings (2), the oil ring rail gaps (4), the second compression ring (5), and the top compression ring in relation to the notch
    (1) on the top of the piston.



17. Lubricate the cylinder wall and the piston rings with clean engine oil.
18. Install the piston using the J 8037 (1) 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 See: Service and Repair/Overhaul/5. Crankshaft and Bearing Cleaning and Inspection.



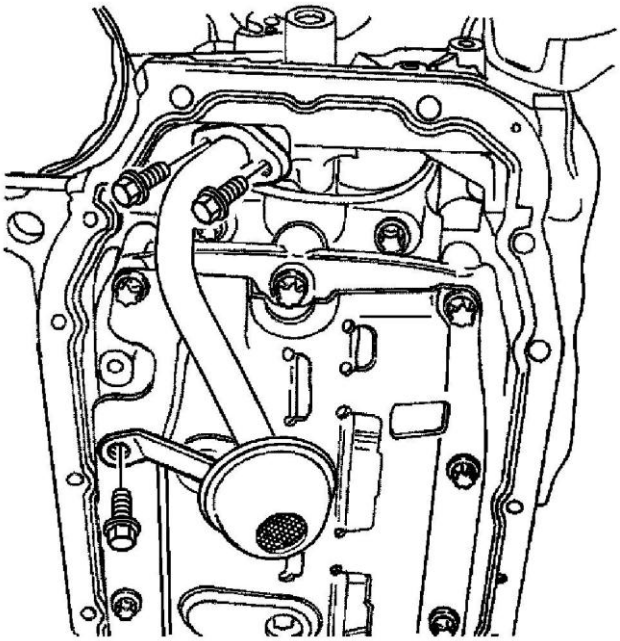
Notice: Refer to Fastener Notice See: Service Precautions/Vehicle Damage Warnings/Fastener Notice.

20. Install the connecting rod cap bearing bolts.

    Tighten the connecting rod cap bearing bolts to 35 Nm (26 lb ft). Using the J 45059 or the KM-470-B (1), tighten the bolts 1 turn of 45 degrees plus 15 degrees.

21. Install the engine block lower support bracket/splash shield bolts.

    Tighten the engine block lower support bracket/splash shield bolts to 35 Nm (26 lb ft).



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

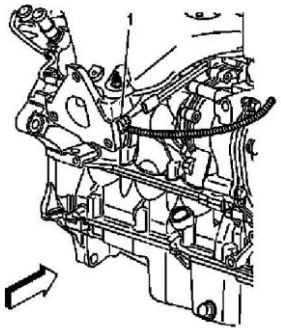
Tighten the oil pump/pickup tube bolts to 8 Nm (71 lb in).

24. Install the oil pan. Refer to Oil Pan Replacement See: Engine Lubrication/Oil Pan/Service and Repair.
25. Install the cylinder head with the intake manifold and exhaust manifold attached. Refer to Cylinder Head Replacement See: Cylinder Head Assembly/Service and Repair.

Engine Block Heater: Service and Repair
Coolant Heater Cord Replacement

Coolant Heater Cord Replacement

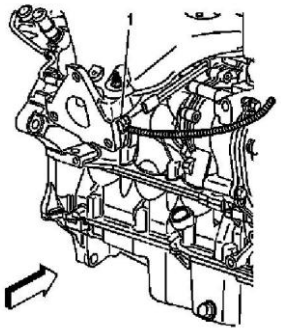
Removal Procedure



1. Disconnect the engine coolant heater cord (1).
2. Remove the clips from the engine mount and surge tank.

Installation Procedure

1. Install the clips from the engine mount and surge tank.



2. Connect the engine coolant heater cord (1). 2004 Chevrolet Optra (CANADA) L4-2.0L 10.52SS

Crankshaft: Service and Repair

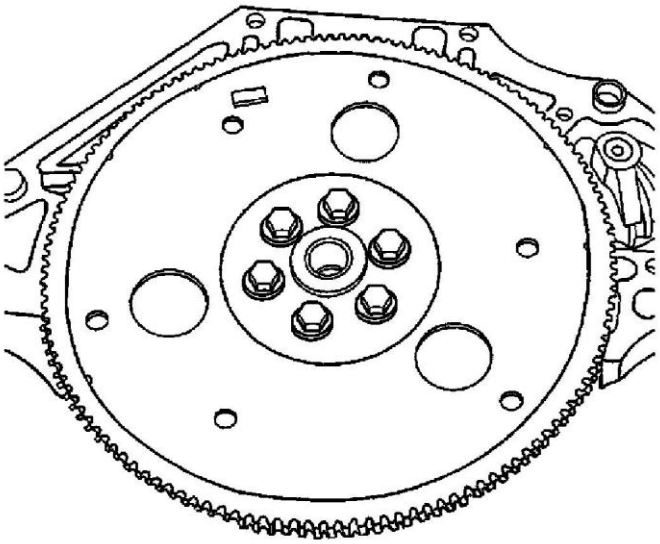
Crankshaft Replacement

Tools Required

* J-36792 or KM-635 Crankshaft Rear Oil Seal Installer
* J 45059 Angle Meter or

* KM-470-B Angular Torque Gage
* OTC 1726 (KM-412) Engine Overhaul
  Stand or equivalent

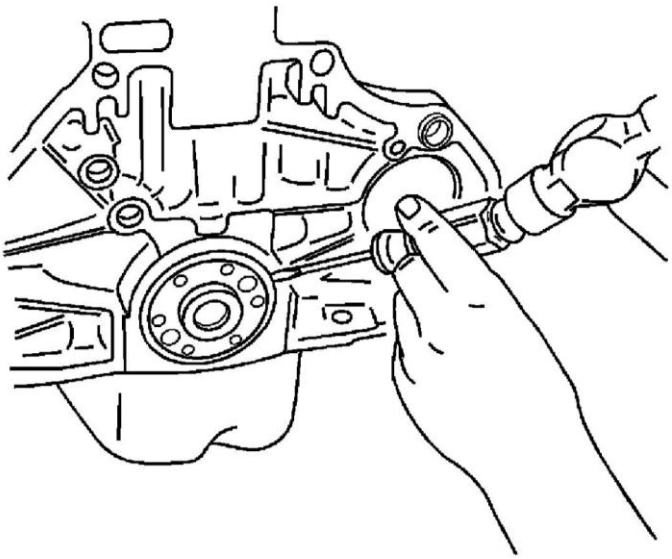
Disassembly Procedure



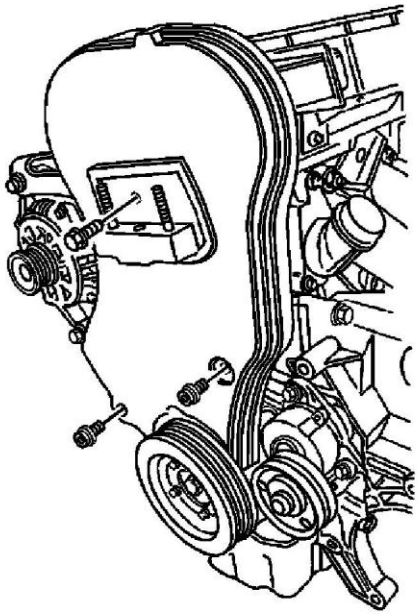
Caution: Refer to Safety Glasses Caution See: Service Precautions/Technician Safety Information/Safety Glasses Caution.

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

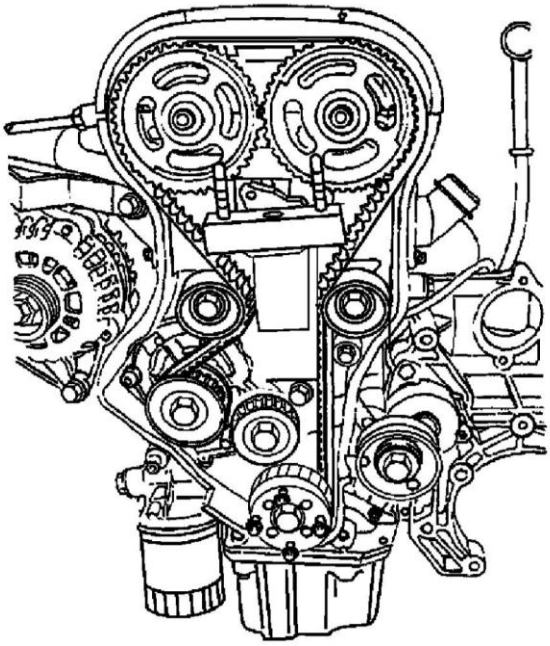
1. Remove the engine. Refer to Engine Replacement See: Service and Repair/Removal and Replacement.
2. Remove the flywheel or the flexible plate bolts.
3. Remove the flywheel or the flexible plate.



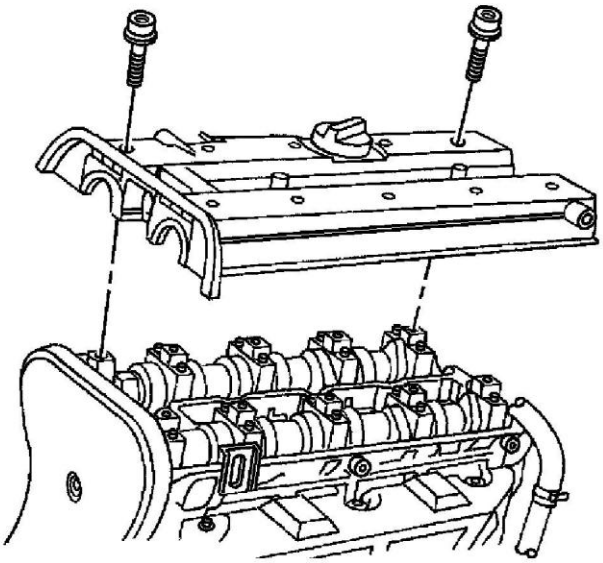
4. Remove the crankshaft rear oil seal.
5. Mount the engine assembly on the OTC 1726 .



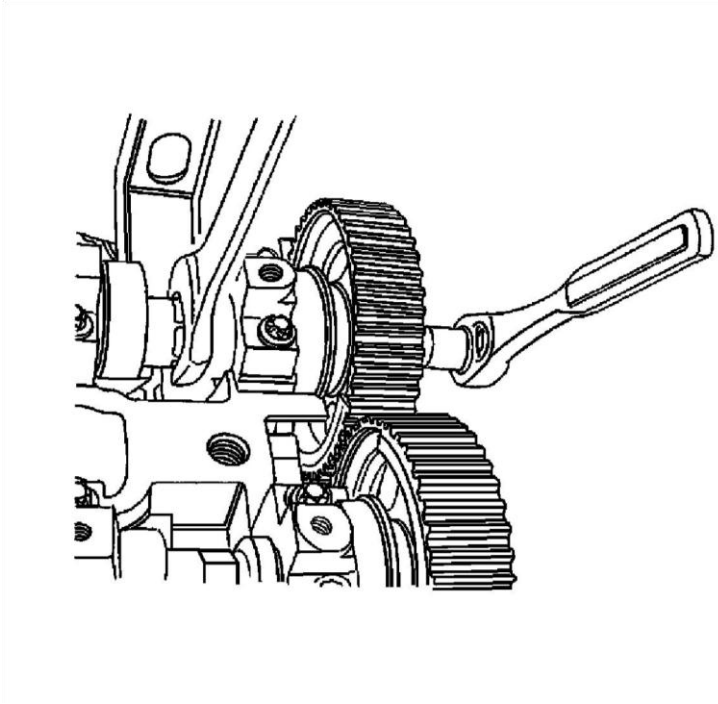
6. Remove the front timing belt cover bolts.
7. Remove the front timing belt cover. 8. Remove the crankshaft pulley bolts.
9. Remove the crankshaft pulley.



10. Loosen the timing belt automatic tensioner bolt.
11. Rotate the timing belt automatic tensioner hex-key clockwise to release the tension.
12. Remove the timing belt idler pulley bolt and nut.
13. Remove the timing belt idler pulleys.
14. Remove the timing belt.
15. Remove the engine mount retaining bolt.
16. Remove the engine mount.

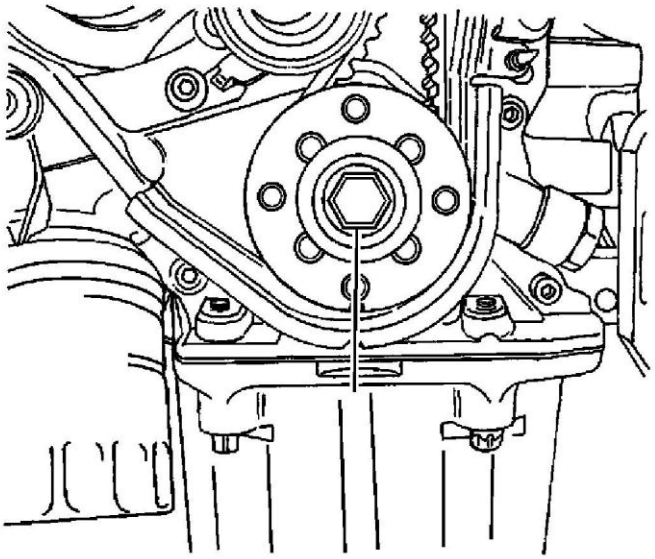


17. Disconnect the crankcase breather tubes from the valve cover.
18. Remove the spark plug cover bolts.
19. Remove the spark plug cover.
20. Disconnect the ignition wires from the spark plugs.
21. Remove the valve cover bolts.
22. Remove the valve cover and the valve cover gasket.

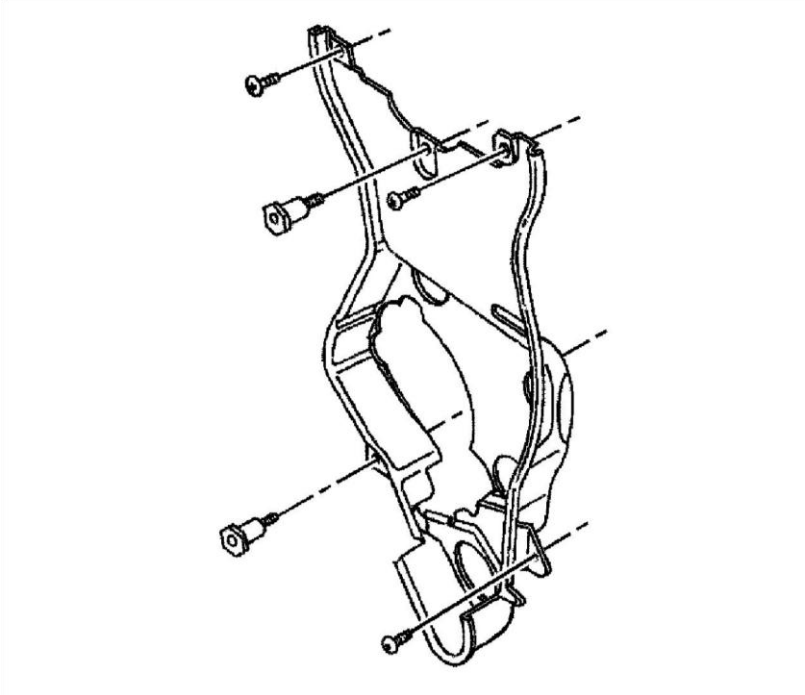


Notice: Use extreme care when installing the camshaft not to nick, scratch, or damage the camshaft lobes or bearing surfaces.

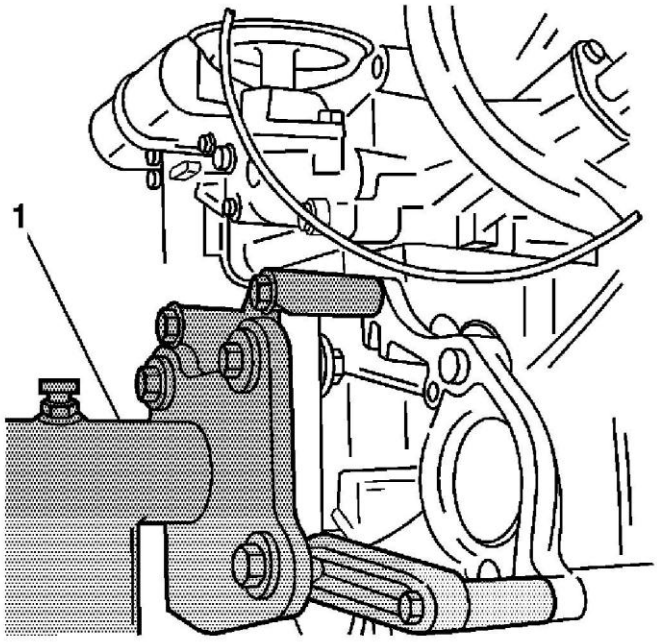
23. While holding the intake camshaft firmly in place, remove the intake camshaft bolt.
24. Remove the intake camshaft gear.
25. While holding the exhaust camshaft firmly in place, remove the exhaust camshaft bolt.
26. Remove the exhaust camshaft gear.



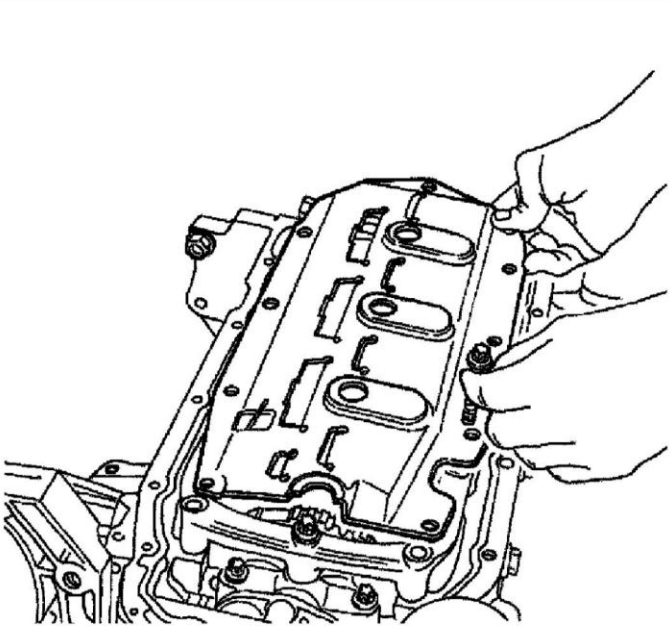
27. Remove the crankshaft timing belt gear.



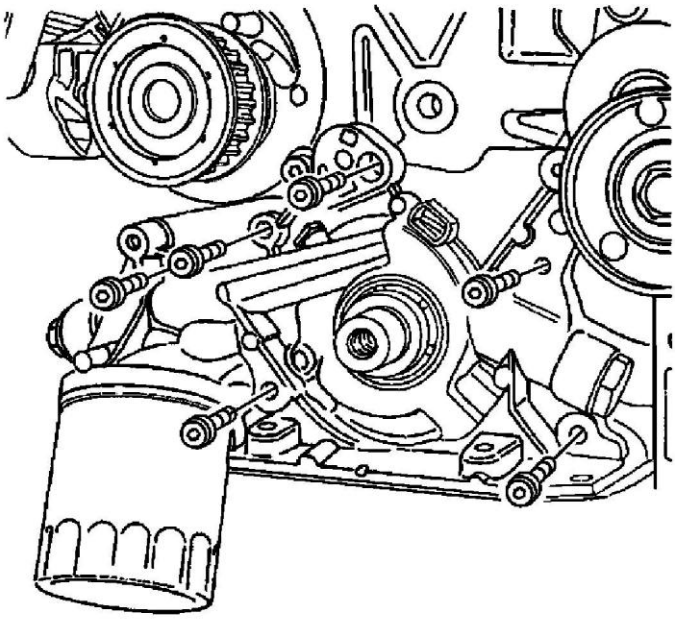
28. Remove the rear timing belt cover bolts and cover.



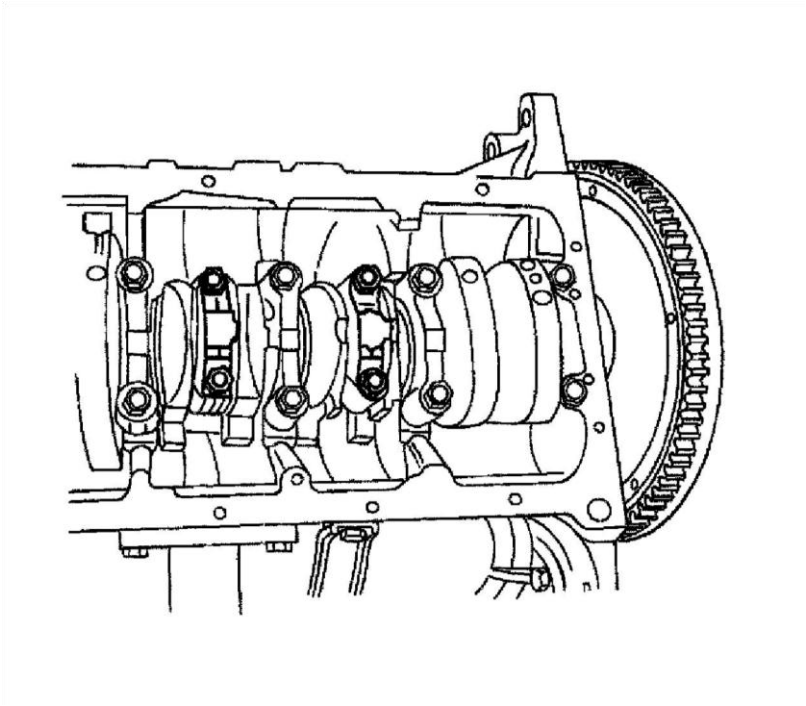
29. Rotate the engine on the OTC 1726 (1).



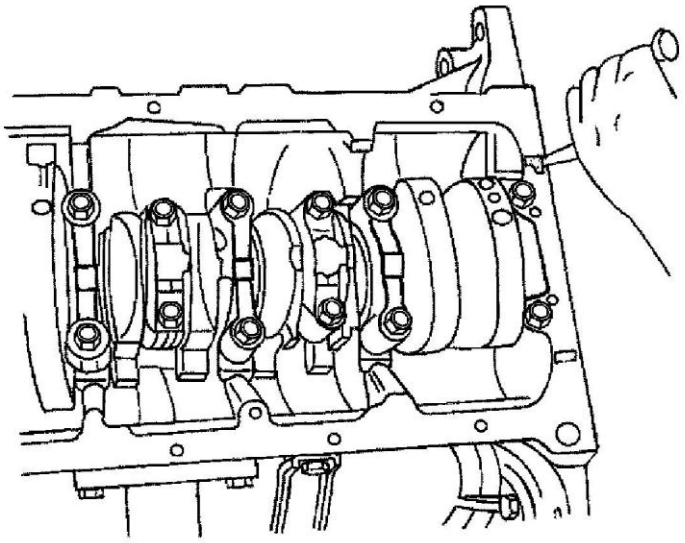
30. Remove the oil pan retaining bolts.
31. Remove the oil pan.
32. Remove the oil pump/pickup tube bolts.
33. Remove the oil pump/pickup tube.
34. Remove the lower block support bracket/splash shield bolts.
35. Remove the splash shield.
36. Remove the lower block support bracket bolts.
37. Remove the lower block support bracket.



38. Remove the oil pump retaining bolts.
39. Remove the oil pump.



40. Mark the order of the connecting rod bearing caps.
41. Remove the connecting rod bearing cap bolts for all of the pistons.
42. Remove the connecting rod bearing caps and the lower connecting rod bearings.

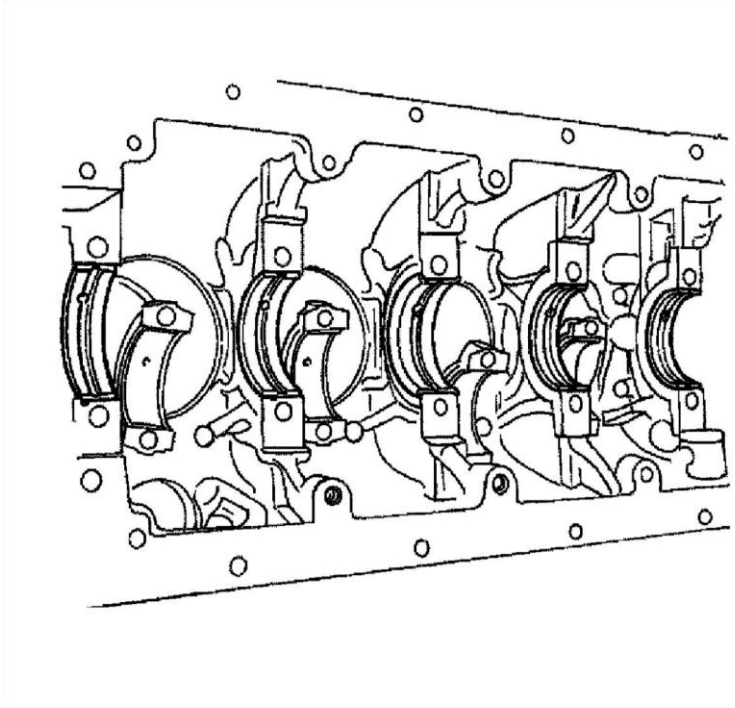


43. Mark the order of the crankshaft bearing caps.
44. Remove the crankshaft bearing cap bolts.
45. Remove the crankshaft bearing caps and the lower crankshaft bearings.
46. Remove the crankshaft.

Caution: Refer to Safety Glasses Caution See: Service Precautions/Technician Safety Information/Safety Glasses Caution.

47. Clean any necessary parts.

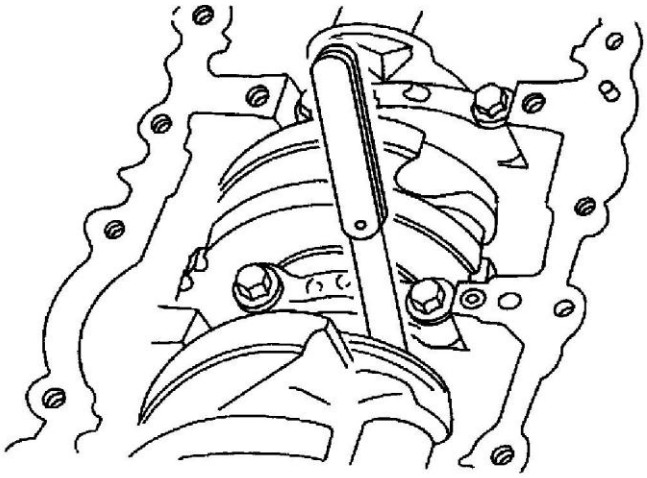
Assembly Procedure



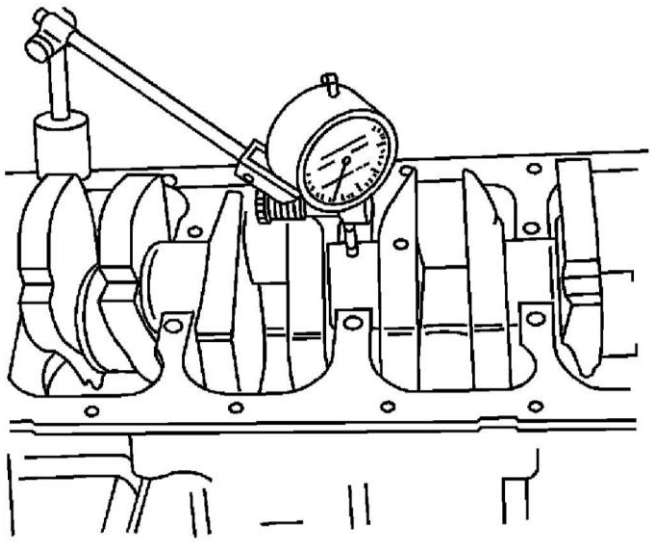
1. Coat the crankshaft bearings with engine oil.
   Notice: Refer to Fastener Notice See: Service Precautions/Vehicle Damage Warnings/Fastener Notice.

2. If replacing the crankshaft, transfer the pulse pickup sensor disc to the new crankshaft.

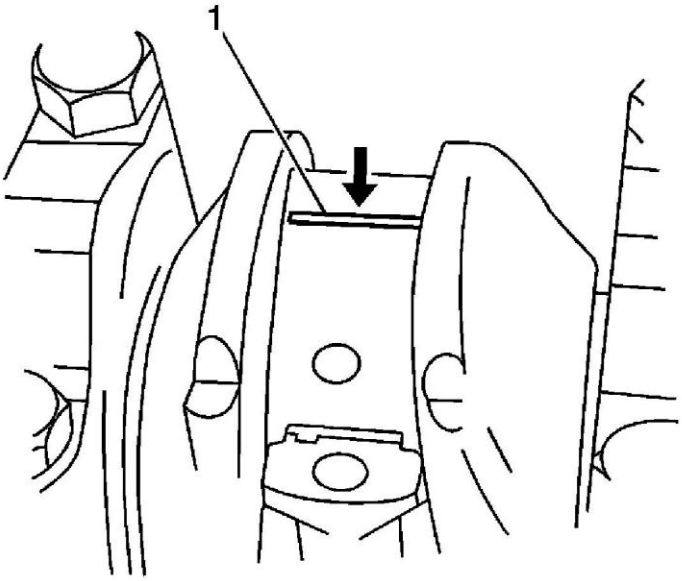
   Tighten the pulse pickup sensor disc to 13 Nm (115 lb in).



3. Install the crankshaft.
4. Install the lower crankshaft bearings in the bearing caps.
5. Inspect the crankshaft end play with the crankshaft bearings installed.
6. Check for permissible crankshaft end play. Refer to Engine Mechanical Specifications See: Specifications/Service Limits & General Specifications.



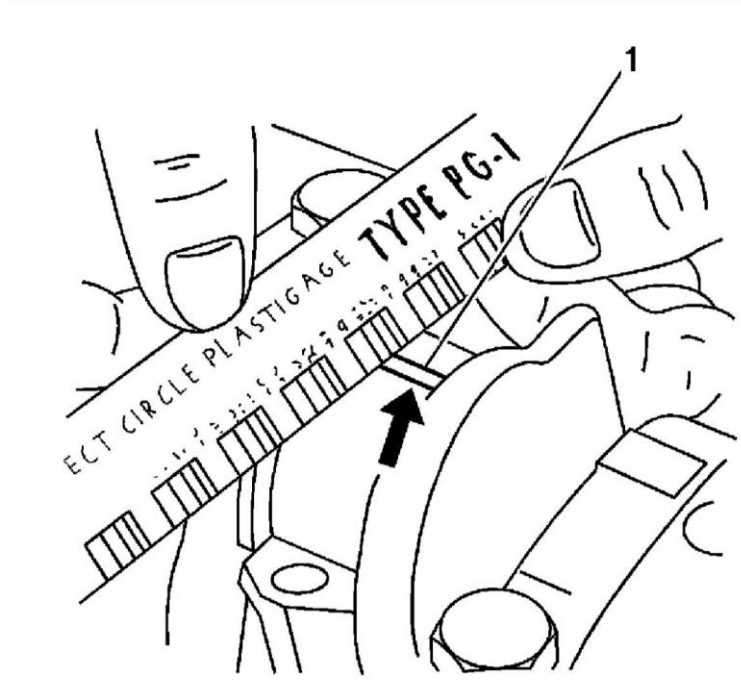
7. With the crankshaft mounted on the front and rear crankshaft bearings, check the middle crankshaft journal for permissible out-of-round, runout. Refer toEngine Mechanical Specifications See: Specifications/Service Limits & General Specifications.



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

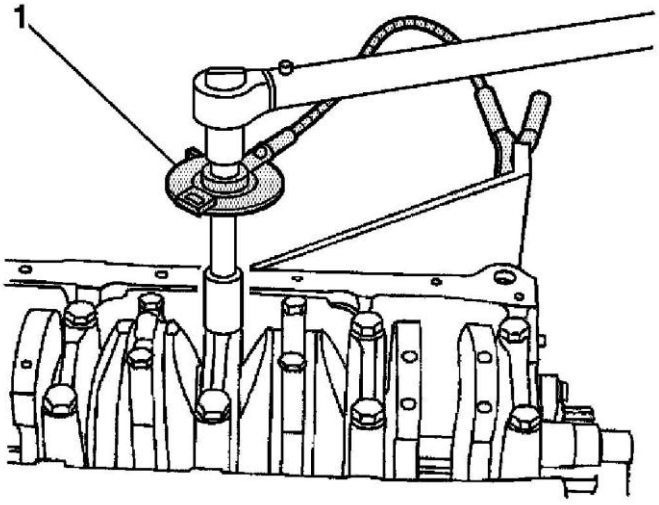
8. Measure all of the crankshaft bearing clearances using a commercially available plastic gaging, ductile plastic threads.
9. Cut the plastic gaging threads (1) to the length of the bearing width. Lay them axially between the crankshaft journals and the crankshaft bearings.
10. Install the crankshaft bearing caps and the bolts.

    Tighten the crankshaft bearing cap bolts to 50 Nm (37 lb ft). Using the J 45059 or the KM-470-B (1), tighten the bolt an additional turn of 45 degrees plus 15 degrees.



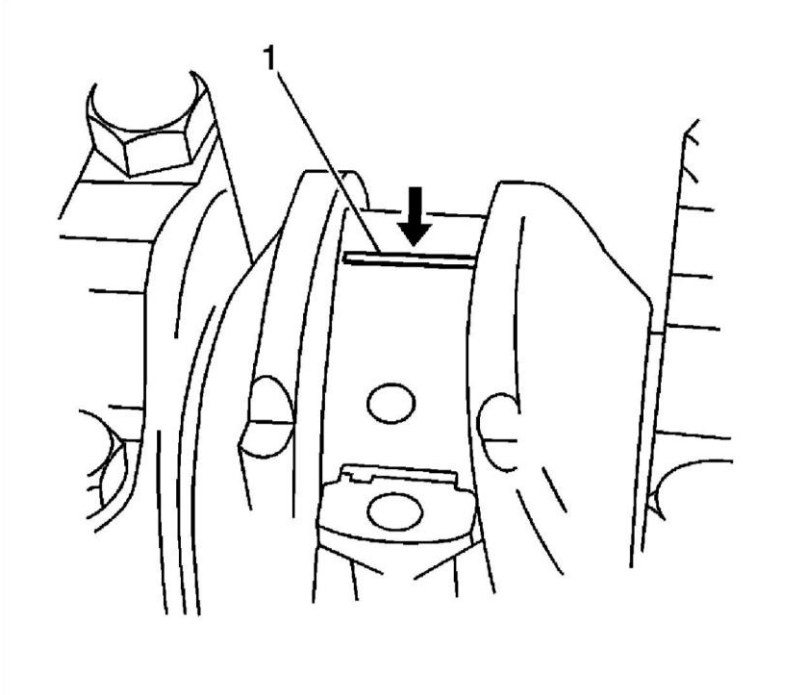
11. Remove the crankshaft bearing cap bolts and the caps.
12. Measure the width of the flattened plastic thread (1) of the plastic gaging using the scale printed on the plastic gaging package. Plastic gaging is available for different tolerance ranges.

13. Inspect the bearing clearance for permissible tolerance ranges. Refer to Engine Mechanical Specifications See: Specifications/Service Limits & General Specifications.



14. Apply a bead of adhesive sealing compound to the grooves of the crankshaft bearing caps.
15. Install the crankshaft bearing caps to the engine block.
16. Tighten the crankshaft bearing caps using new bolts.

    Tighten the crankshaft bearing cap bolts to 50 Nm (37 lb ft) using a torque wrench. Using the J 45059 or the KM-470-B (1) , tighten the bolts an additional turn of 45 degrees, plus another turn of 15 degrees.

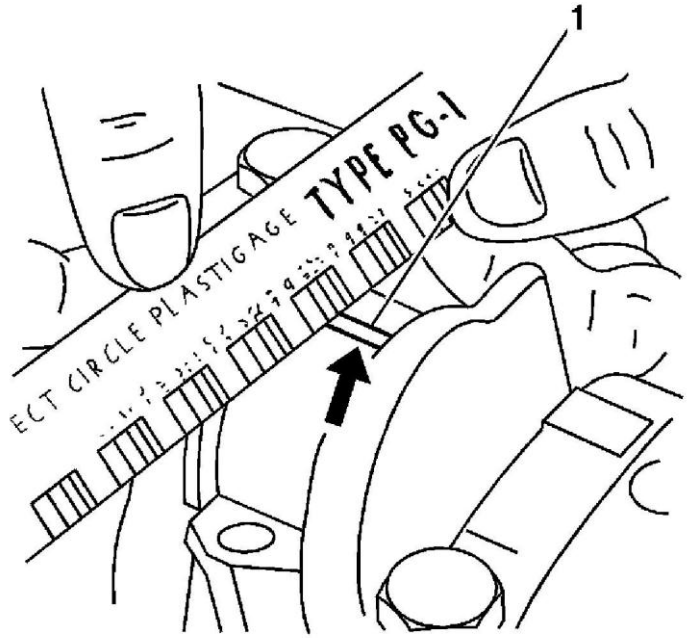


Important: Grease the connecting rod journals and lubricate the connecting rod bearings slightly so that the plastic gaging thread does not tear when the connecting rod bearing caps are removed.

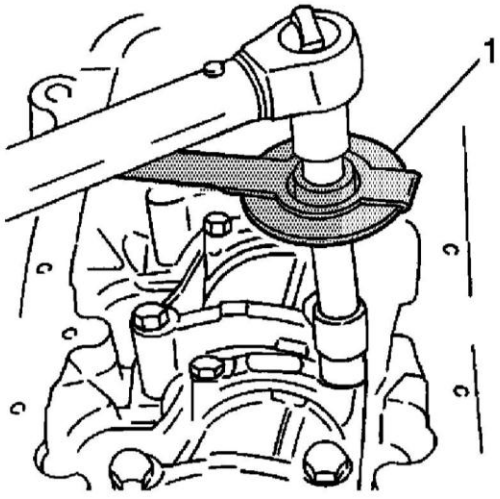
17. Measure all of the connecting rod bearing clearances using a commercially available plastic gaging, ductile plastic threads.

18. Cut the plastic gaging threads (1) to the length of the connecting rod bearing width. Lay them axially between the connecting rod journals and the connecting rod bearings.
19. Install the connecting rod bearing caps.

    Tighten the connecting rod bearing cap bolts to 35 Nm (26 lb ft) using a torque wrench. Use the J 45059 or the KM-470-B to tighten the connecting rod bearing cap bolts to plus 45 degrees plus 15 degrees.



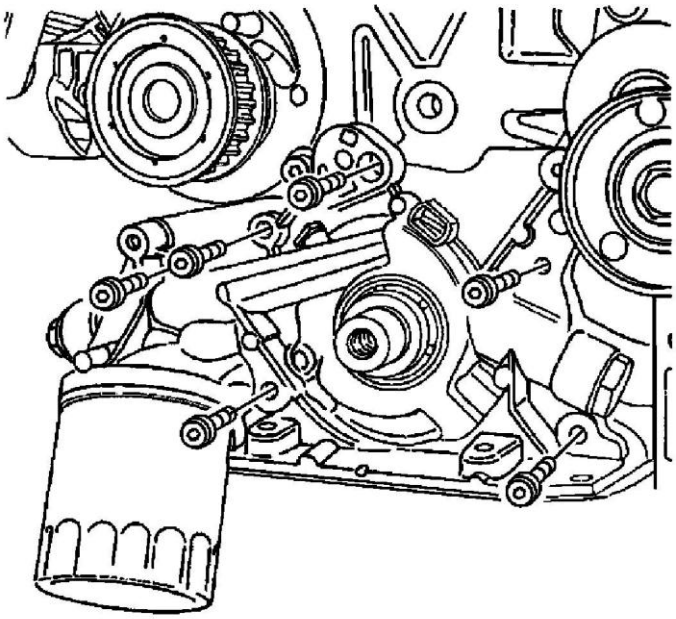
20. Remove the connecting rod bearing caps.
21. Measure the width of the flattened plastic thread (1) of the plastic gaging using the scale printed on the plastic gaging package. Plastic gaging is available for different tolerance ranges.
22. Inspect the bearing clearance for permissible tolerance ranges. Refer to Engine Mechanical Specifications See: Specifications/Service Limits & General Specifications.



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

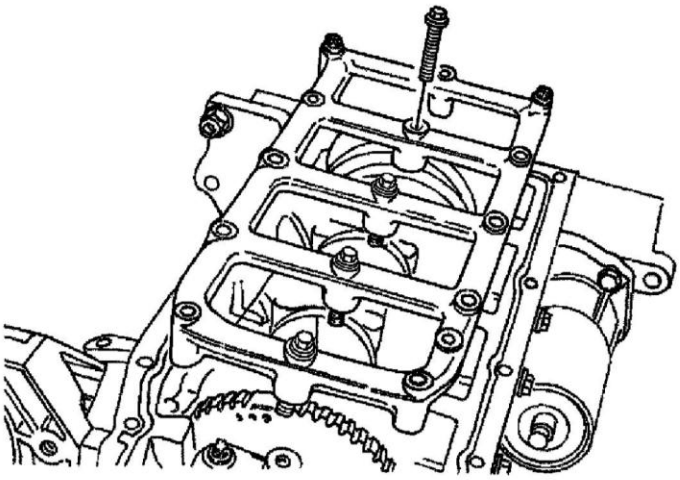
24. Tighten the connecting rod bearing caps using new bolts.

    Tighten the connecting rod bearing cap bolts to 35 Nm (26 lb ft) using a torque wrench. Use the J 45059 or the KM-470-B (1) to tighten the connecting rod cap bolts plus 45 degrees plus 15 degrees.



25. Install the oil pump.
26. Install the oil pump retaining bolts.

    Tighten the oil pump retaining bolts to 10 Nm (89 lb in).



27. Install engine block lower support bracket and the bolts.

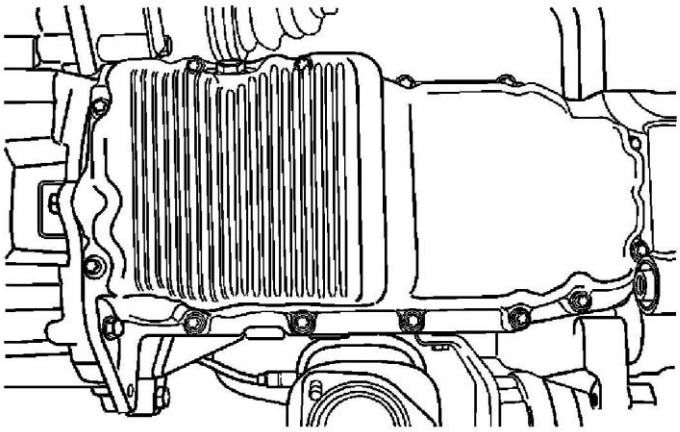
Tighten the engine block lower support bracket bolts to 20 Nm (15 lb in) plus 45 degrees using the J 45059 or the KM-470-B .

28. Install the lower block support bracket splash shield and the bolts.

    Tighten the lower block support bracket splash shield bolts to 35 Nm (26 lb ft).

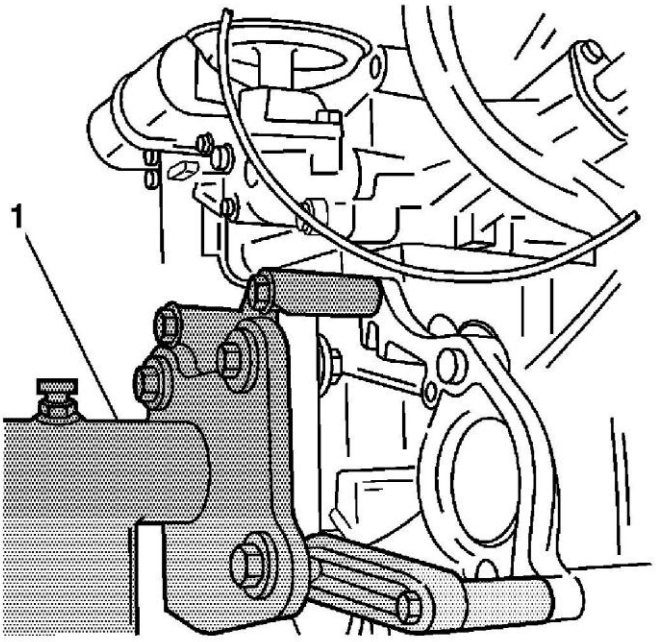
29. Install the oil pump/pickup tube.
30. Install the oil pump/pickup tube bolts.

    Tighten the oil pump/pickup tube bolts to 8 Nm (71 lb in).

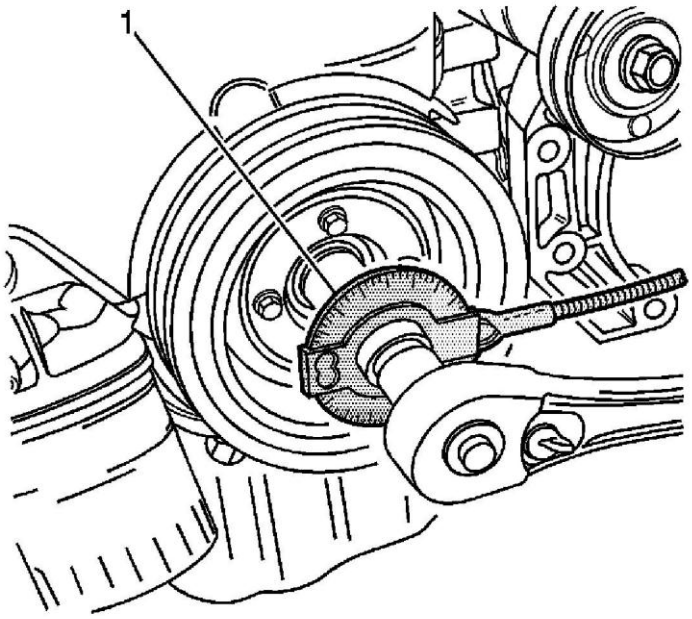


31. Coat the new oil pan gasket with the sealant.
32. Install the oil pan gasket to the oil pan.
33. Install the oil pan.
34. Install the oil pan retaining bolts.

    Tighten the oil pan retaining bolts to 10 Nm (89 lb in).



35. Rotate the engine on the OTC 1726 (1).



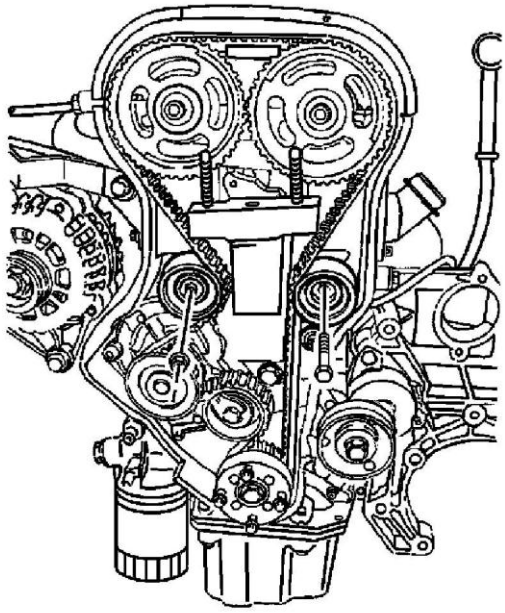
36. Install the rear timing belt cover.
37. Install the rear timing belt cover bolts.

    Tighten the rear timing belt cover bolts to 7 Nm (62 lb in).

38. Install the crankshaft timing belt drive gear and the bolt.

    Tighten the crankshaft timing belt drive gear bolt to 145 Nm (107 lb ft) plus 30 degrees plus 15 degrees using the J 45059 or theKM-470-B (1).
39. Install the engine mount and the retaining bolts.

Tighten the engine mount retaining bolts to 45 Nm (33 lb ft).

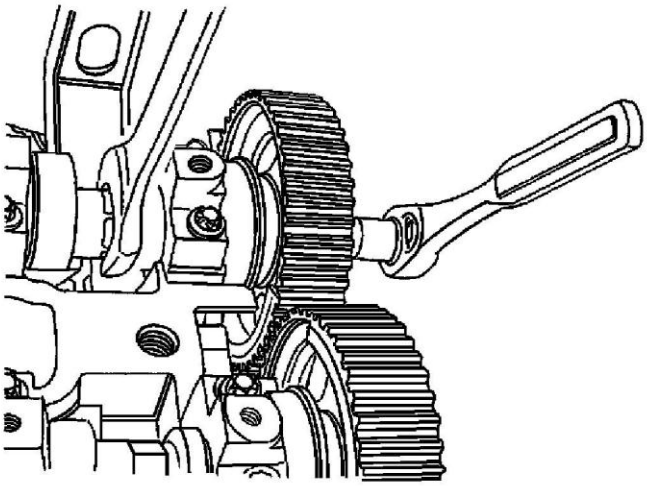


40. Install the timing belt automatic tensioner.
41. Install the timing belt automatic tensioner bolts.

Tighten the timing belt automatic tensioner bolts to 25 Nm (18 lb ft).

42. Install the timing belt idler pulley.
43. Install the timing belt idler pulley bolt and nut.

* Tighten the timing belt idler pulley bolt to 25 Nm (18 lb ft). * Tighten the timing belt idler pulley nut to 25 Nm (18 lb ft).



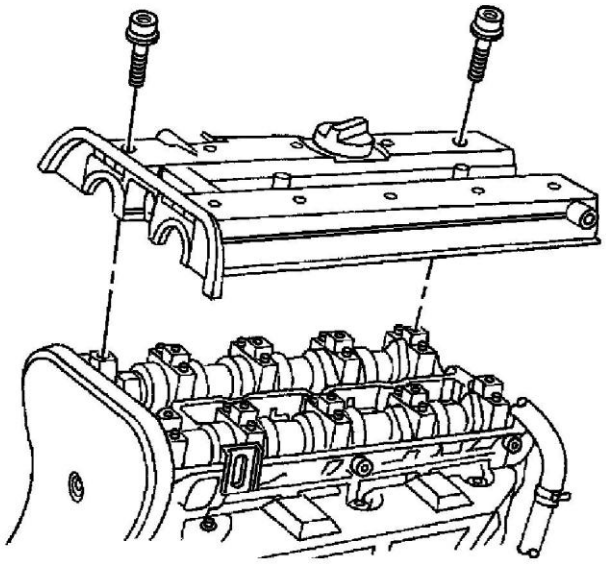
Notice: Use extreme care when installing the camshaft not to nick, scratch, or damage the camshaft lobes or bearing surfaces.

44. Install the intake camshaft gear.
45. Install the intake camshaft gear bolt while holding the intake camshaft firmly in place.

    Tighten the intake camshaft gear bolt to 50 Nm (37 lb ft) plus 60 degrees and 15 degrees.

46. Install the exhaust camshaft gear.
47. Install the exhaust camshaft gear bolt while holding the exhaust camshaft firmly in place.

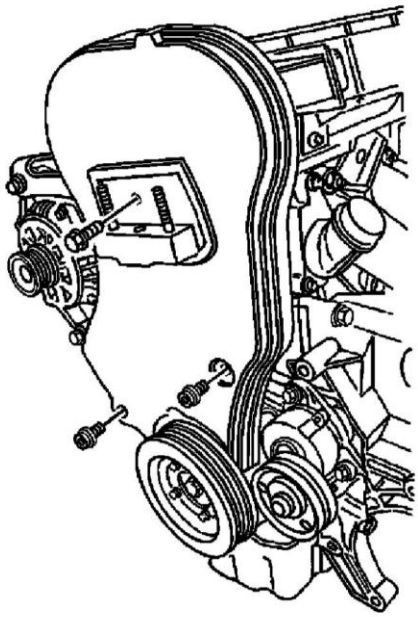
    Tighten the exhaust camshaft gear bolt to 50 Nm (37 lb ft) plus 60 degrees and 15 degrees.



48. Install the timing belt. Refer to Timing Belt Replacement See: Timing Components/Timing Belt/Service and Repair.

49. Adjust the timing belt tension. Refer to Timing Belt Inspection See: Service and Repair/Overhaul/2. Timing Belt Inspection.
50. 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 the cylinder head seal.
51. Install the valve cover and the valve cover gasket.
52. Install the valve cover bolts.

    Tighten the valve cover bolts to 8 Nm (71 lb in).



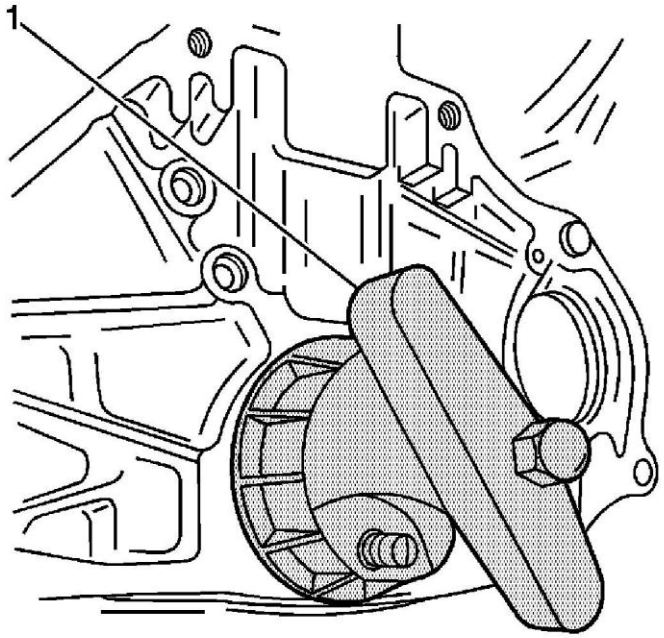
53. Connect the ignition wires to the spark plugs.
54. Install the spark plug cover.
55. Install the spark plug cover bolts.

    Tighten the spark plug cover bolts to 8 Nm (71 lb in).

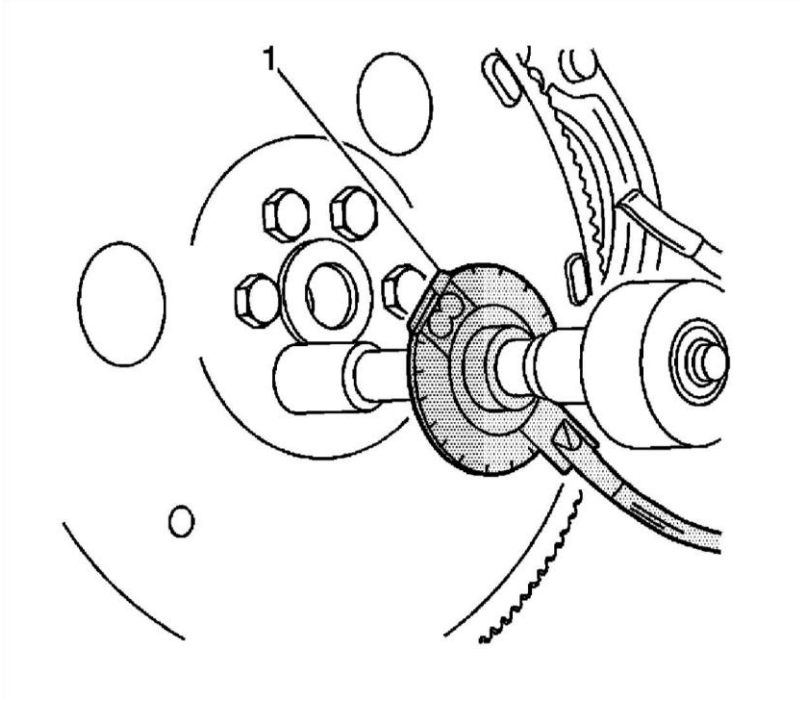
56. Connect the crankcase breather tube to the valve cover.
57. Install the front timing belt cover.
58. Install the front timing belt cover bolts.

    Tighten the front timing belt cover bolts to 8 Nm (71 lb in).

59. Install the engine lifting device.
60. Remove the engine from the OTC 1726 .



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



62. Install the flywheel or flexible plate.
63. Install the flywheel or the flexible plate bolts.

    Tighten the flywheel bolt to 65 Nm (48 lb ft). Use the J 45059 or the KM-470-B (1) to tighten the flywheel bolts another 30 degrees plus 15 degrees. For the automatic transaxle, tighten the flexible plate bolts to 45 Nm (33 lb ft).

64. Install the engine. Refer to Engine Replacement See: Service and Repair/Removal and Replacement.

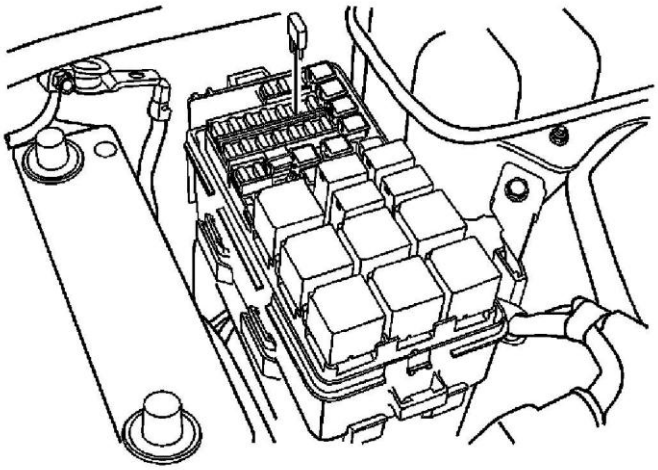
Cylinder Head Assembly: Service and Repair

Cylinder Head Replacement

Tools Required

* J 28467-B (DW-117) Universal Engine Support Fixture
* J 45059 Angle Meter or
* KM-470-B Angular Torque Gage

Removal Procedure



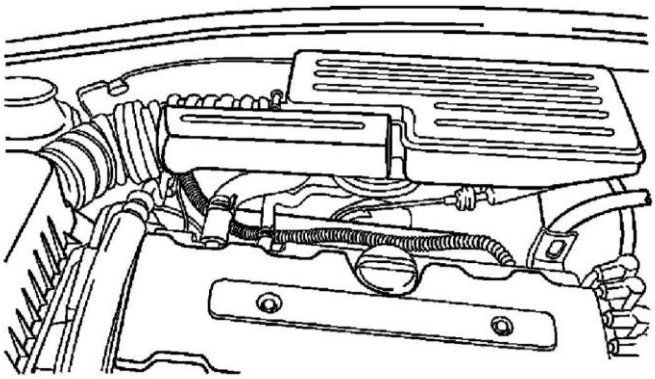
Caution: Refer to Compressed Valve Spring Caution See: Service Precautions/Technician Safety Information in Cautions and Notices.

Caution: Refer to Safety Glasses Caution See: Service Precautions/Technician Safety Information/Safety Glasses Caution in Cautions and Notices.

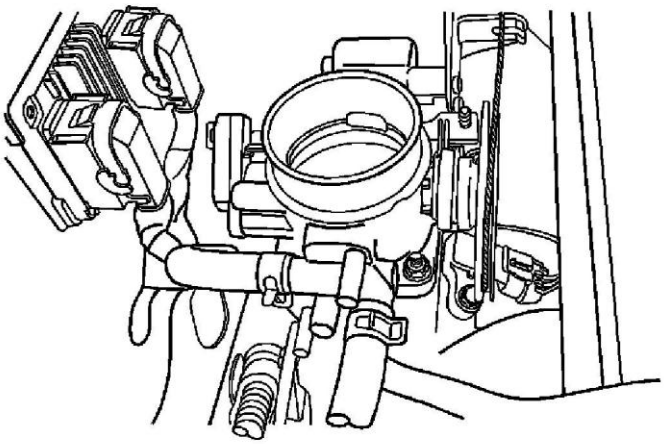
1. Remove the fuel pump fuse.
2. Start the engine and wait for it to stall.
3. Crank the engine for 10 seconds to rid the fuel system of fuel pressure.

Caution: Refer to Battery Disconnect Caution See: Starting and Charging/Battery/Service Precautions/Technician Safety Information/
Battery
Disconnect Caution in Cautions and Notices.

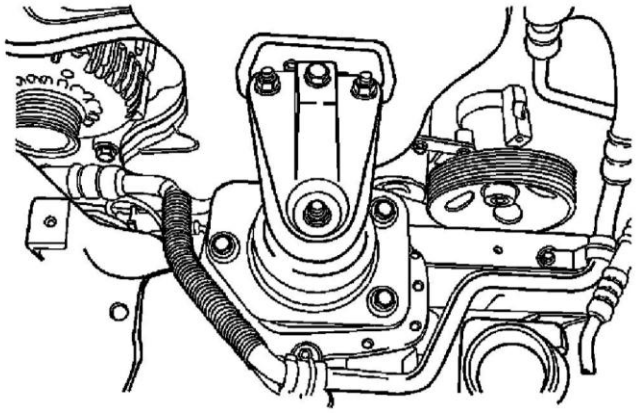
4. Disconnect the negative battery cable.
5. Disconnect the engine control module (ECM) ground terminal.
6. Drain the engine coolant. Refer to Cooling System Draining and Filling (Gasoline Engines) See: Cooling System/Service and Repair in Engine Cooling.



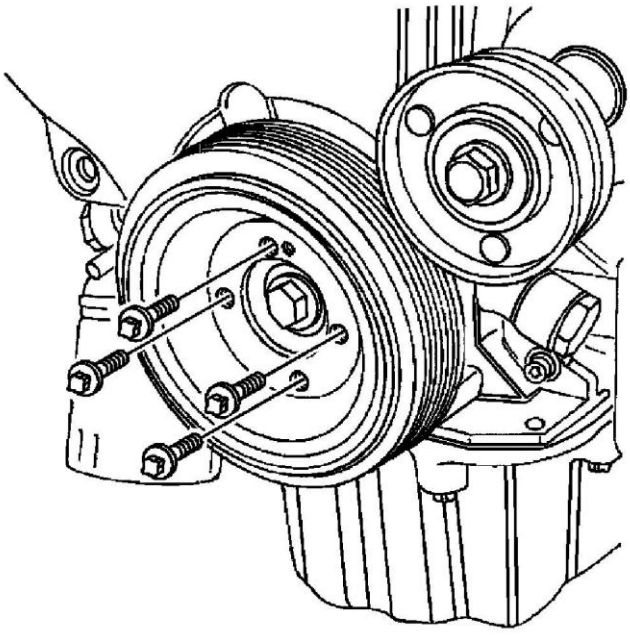
7. Disconnect the manifold air temperature (MAT) sensor connector.
8. Disconnect the breather tube from the valve cover.
9. Remove the air intake tube from the throttle body.



10. Disconnect the ignition coil connector.
11. Disconnect the oxygen sensor connector.
12. Disconnect the idle air control (IAC) valve connector.
13. Disconnect the throttle position (TP) sensor connector.
14. Disconnect the engine coolant temperature (ECT) sensor connector.
15. Disconnect the coolant temperature sensor (CTS) connector.
16. Disconnect the camshaft position (CMP) sensor connector.



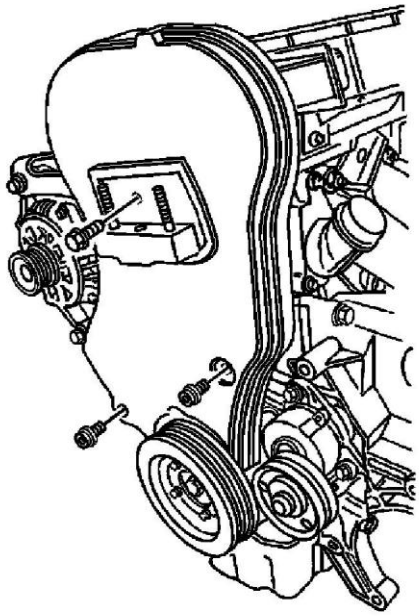
17. Remove the air cleaner housing bolts.
18. Remove the air cleaner housing.
19. Remove the right front wheel. Refer to Tire and Wheel Removal and Installation See: Maintenance/Wheels and Tires/Service and Repair in Tires and Wheels.
20. Remove the right front wheel well splash shield. Refer to Wheelhouse Splash Shield Replacement See: Body and Frame/Splash Guard/Service and Repair in Body Front End.
21. Install the J 28467-B .
22. Remove the right engine mount bracket and the retaining bolt and nuts. Refer to Engine Mount Replacement See: Drive Belts, Mounts, Brackets and Accessories/Engine Mount/Service and Repair.



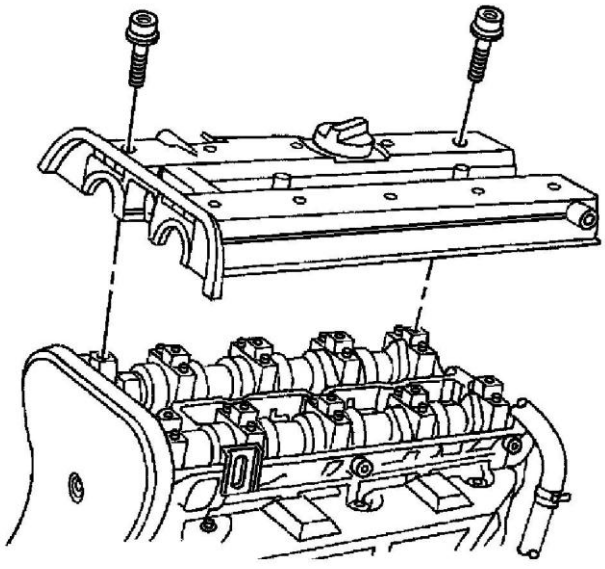
23. Disconnect the upper radiator hose at the thermostat housing.

Caution: Refer to Belt Dressing Notice See: Drive Belts, Mounts, Brackets and Accessories/Drive Belt/Service Precautions in Cautions and Notices.

24. Remove the power steering pump drive belt. Refer to Power Steering Pump Belt Replacement See: Drive Belts, Mounts, Brackets and Accessories/Drive Belt/Service and Repair in Power Steering System.
25. Remove the crankshaft pulley bolts.
26. Remove the crankshaft pulley.

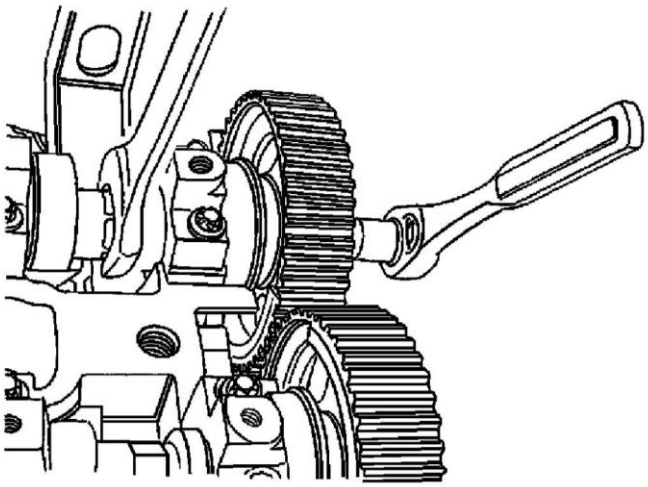


27. Remove the front timing belt cover bolts.
28. Remove the front timing belt cover.



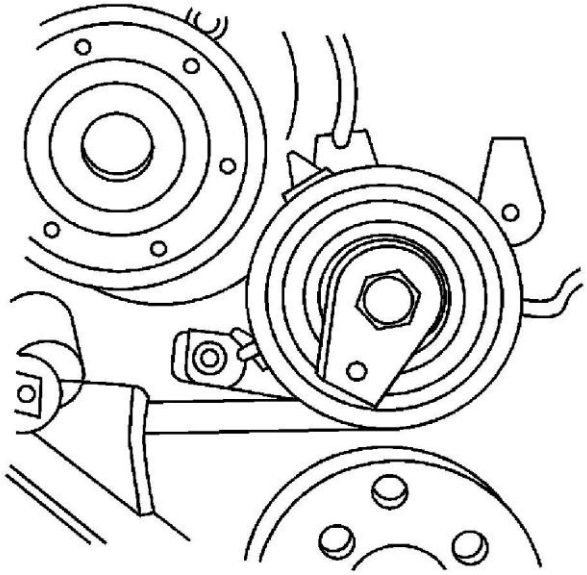
29. Remove the timing belt. Refer to Timing Belt Replacement See: Timing Components/Timing Belt/Service and Repair.
30. Disconnect the breather tube at the camshaft cover.
31. Remove the spark plug cover bolts.
32. Remove the spark plug cover.
33. Disconnect the ignition wires from the spark plugs.

34. Remove the valve cover bolts.
35. Remove the valve cover and the valve cover gasket.

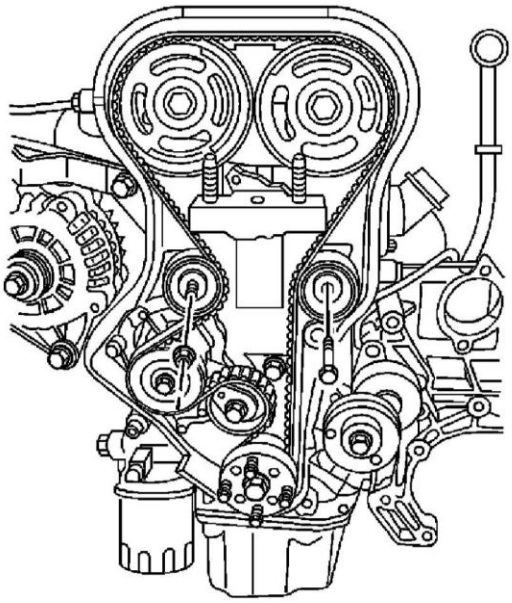


Notice: Use extreme care when installing the camshaft not to nick, scratch, or damage the camshaft lobes or bearing surfaces.

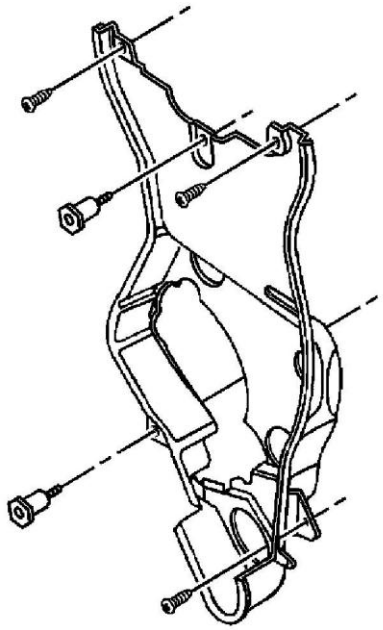
36. While holding the intake camshaft firmly in place, remove the intake camshaft gear bolt.
37. Remove the intake camshaft gear.
38. While holding the exhaust camshaft firmly in place, remove the exhaust camshaft gear bolt.
39. Remove the exhaust camshaft gear.



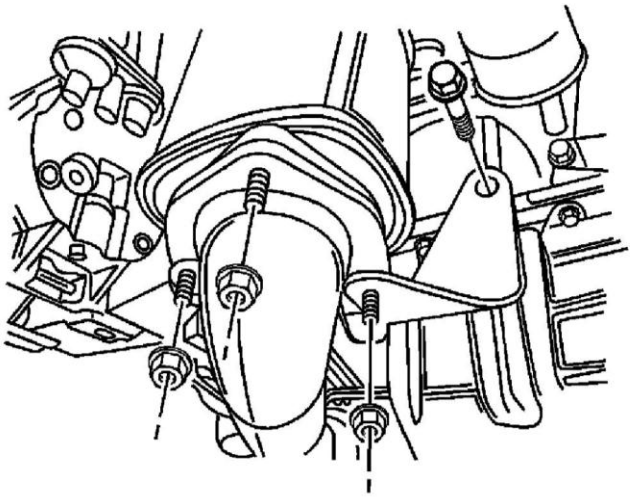
40. Remove the timing belt tensioner bolts.
41. Remove the timing belt tensioner.



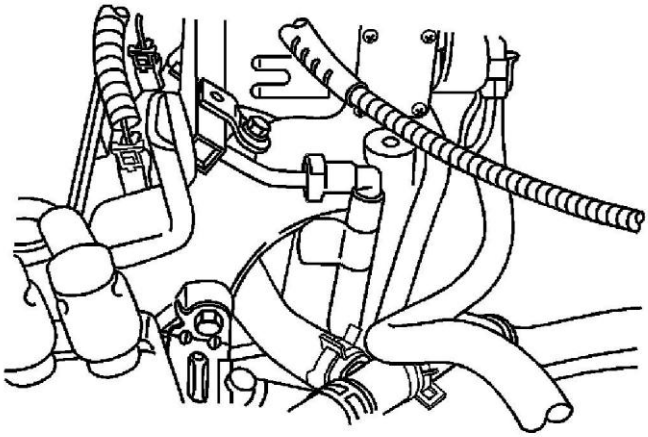
42. Remove the timing belt idler pulley bolt and nut.
43. Remove the timing belt idler pulleys.
44. Remove the engine mount bolts.
45. Remove the engine mount.
46. Remove the crankshaft gear.
47. Remove the camshaft position CMP sensor.
48. Remove the water pump. Refer to Coolant Pump Replacement (Gasoline Engines) See: Water Pump/Service and Repair/Removal and Replacement in Engine Cooling.



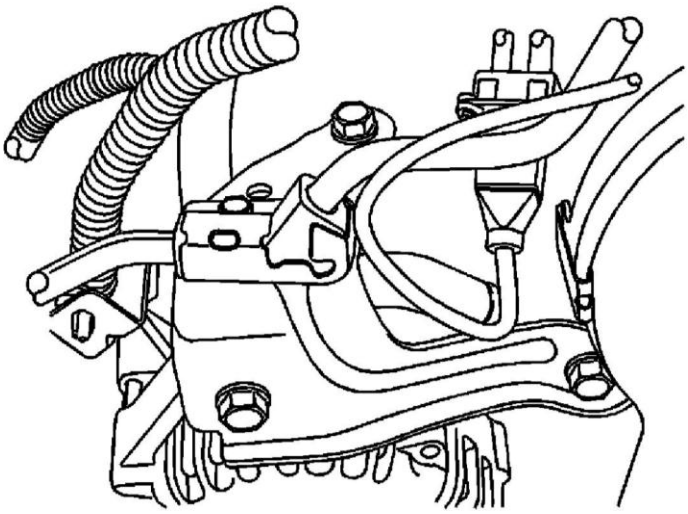
49. Remove the rear timing belt cover bolts.



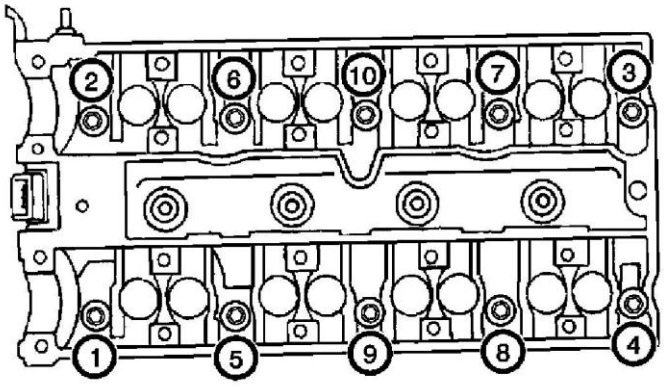
50. Remove the exhaust flex pipe retaining nuts from the exhaust manifold studs.
51. Disconnect the vacuum hoses, as needed.



52. Disconnect the fuel return line at the fuel pressure regulator.
53. Remove the alternator adjusting bracket retaining bolt and bracket.
54. Disconnect the fuel feed line at the fuel rail.
55. Disconnect the coolant hose at the rear cylinder head and ignition coil exhaust gas recirculation (EGR) bracket.
56. Disconnect the surge tank coolant hose at the throttle body.
57. Remove the fuel rail assembly. Refer to Fuel Injection Fuel Rail Assembly Replacement See: Powertrain Management/Fuel Delivery and Air Induction/Fuel Rail/Service and Repair In Engine Controls - 2.0L.



58. Remove the alternator-to-intake manifold support bracket bolts at the cylinder head coolant bypass and the intake manifold.
59. Remove the alternator support bracket.
60. Remove the intake manifold-to-alternator strap bracket bolt and loosen the bolt on the alternator.
61. Move the strap clear of the intake manifold.
62. Remove the canister purge solenoid bracket bolt and move the bracket clear, if equipped.

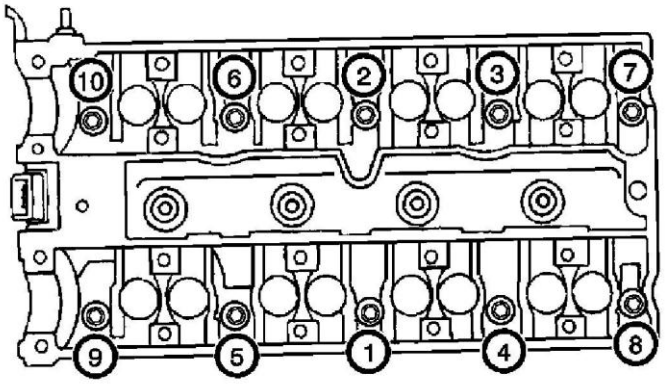


63. Disconnect the throttle cable at the throttle body and the intake manifold.
64. Loosen all of the cylinder head bolts gradually and in the sequence shown.
65. Remove the camshaft.
66. Remove and discard the cylinder head bolts.
67. Remove the cylinder head with the intake manifold and the exhaust manifold attached.

Important: Prevent any engine oil or coolant from entering the cylinders when removing the cylinder head.

68. Remove the cylinder head gasket.
69. Clean the gasket surfaces of the cylinder head and the engine block. Refer to Cylinder Head Cleaning and Inspection See: Service and Repair/Overhaul/10. Cylinder Head Cleaning and Inspection.

Installation Procedure



Caution: Refer to Compressed Valve Spring Caution See: Service Precautions/Technician Safety Information in Cautions and Notices.

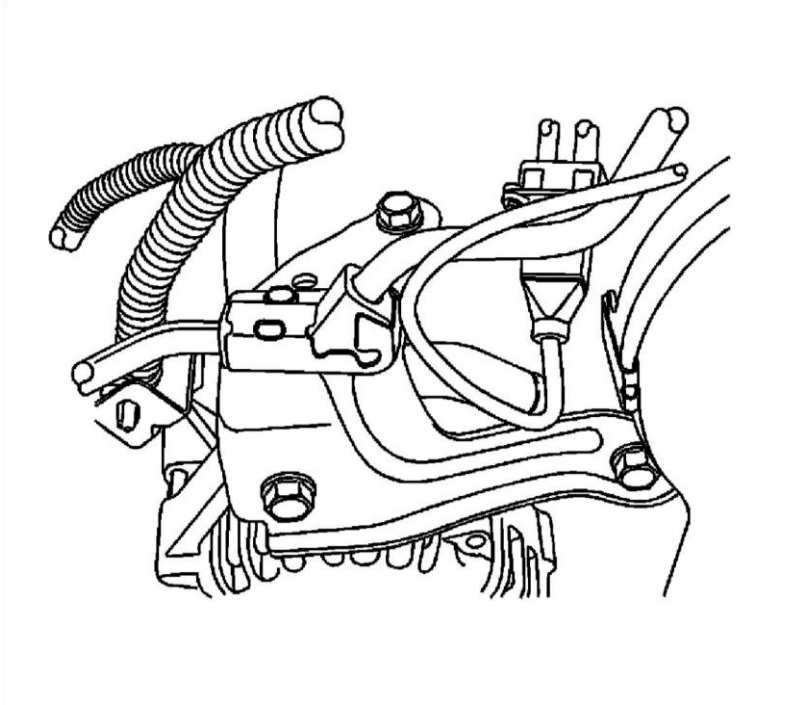
1. Install the cylinder head gasket.
2. Install the cylinder head with the intake manifold and the exhaust manifold attached.
3. Install new cylinder head bolts.

   Notice: Refer to Fastener Notice See: Service Precautions/Vehicle Damage Warnings/Fastener Notice in Cautions and Notices.

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

Tighten the cylinder head bolts to 25 Nm (18 lb ft) and turn the bolts another 3 turns of 90 degrees using J 45059 or the KM-470-B .

5. Install the camshaft.



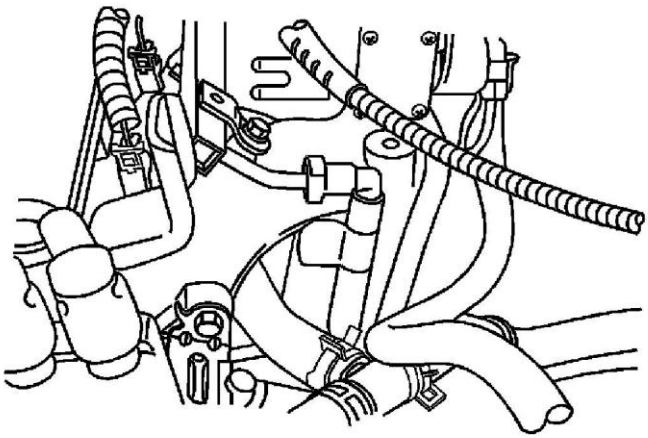
6. Connect the throttle cable at the throttle body and the intake manifold.
7. Install the alternator-to-intake manifold support bracket.
8. Install the alternator-to-manifold support bracket bolts.

Tighten the alternator-to-intake manifold support bracket bolts at the intake manifold to 37 Nm (27 lb ft).

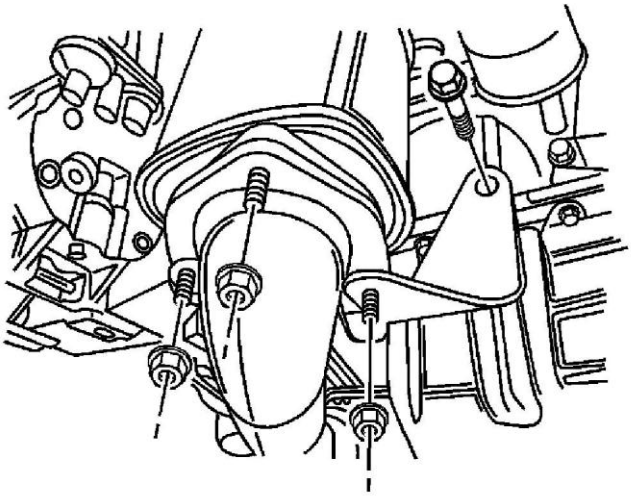
9. Install the intake manifold support bracket bolts to the alternator.

    Tighten the alternator-to-intake manifold support bracket bolts at the alternator to 22 Nm (16 lb ft).

10. Connect the surge tank coolant hose at the throttle body.
11. Connect the coolant hose to the rear cylinder head and ignition coil EGR bracket.

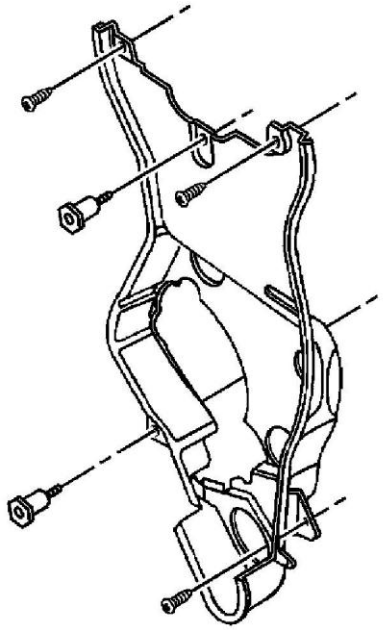


12. Connect the fuel feed line at the fuel rail.
13. Connect the fuel return line at the fuel rail.
14. Connect all of the necessary vacuum hoses.
15. Install the fuel rail assembly. Refer to Fuel Injection Fuel Rail Assembly Replacement See: Powertrain Management/Fuel Delivery and Air Induction/Fuel Rail/Service and Repair in Engine Controls - 2.0L.



16. Install the exhaust flex pipe retaining nuts to the exhaust manifold studs.

    Tighten the exhaust flex pipe retaining nuts to 35 Nm (26 lb ft).



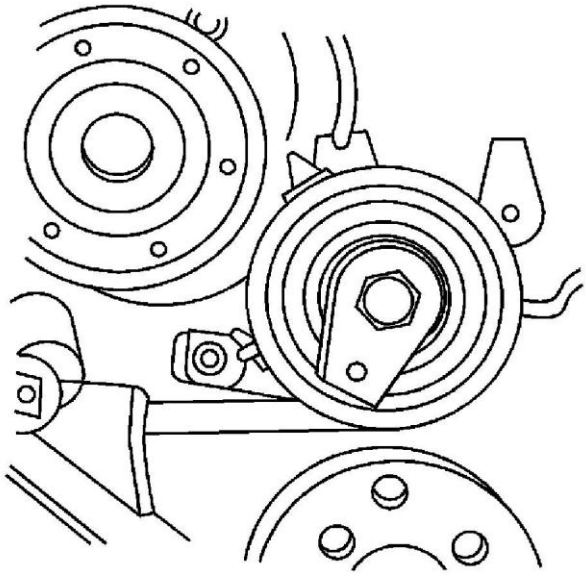
17. Install the rear timing belt cover bolts.

Tighten the rear timing belt cover bolts to 7 Nm (62 lb in).

18. Install the engine mount and engine mount bolts.

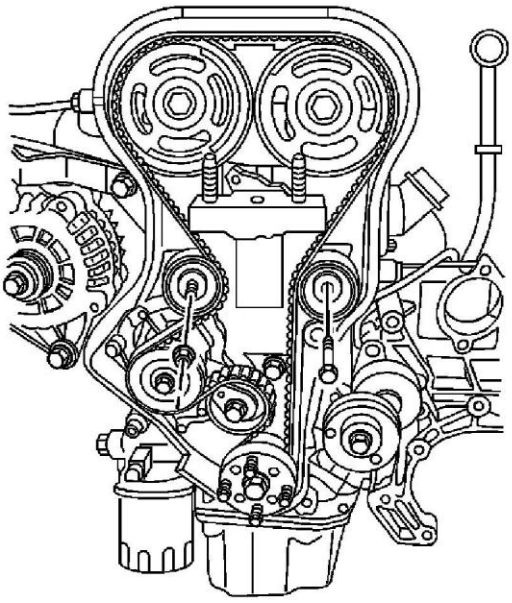
    Tighten the engine mount bolts to 45 Nm (33 lb ft).

19. Install the camshaft position CMP sensor.
20. Install the crankshaft gear.
21. Install the water pump. Refer to Coolant Pump Replacement (Gasoline Engines) See: Water Pump/Service and Repair/Removal and Replacement in Engine Cooling.



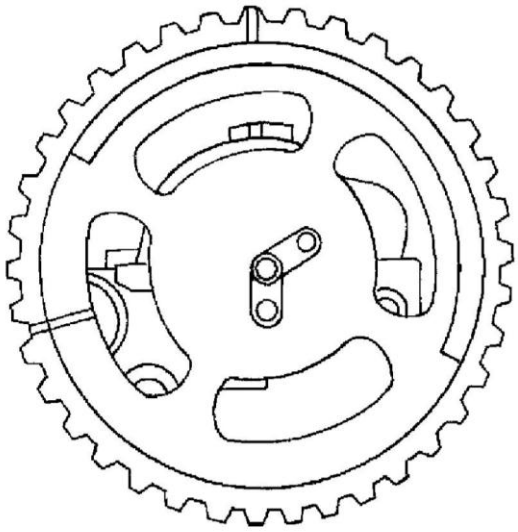
22. Install the tensioner.
23. Install the tensioner bolt.

    Tighten the tensioner bolt to 25 Nm (18 lb ft).

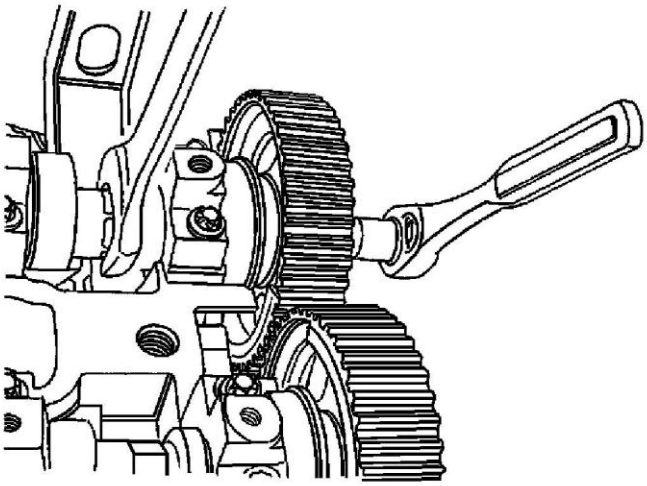


24. Install the timing belt idler pulleys.
25. Install the timing belt idler pulley bolt and nut.

    Tighten the idler pulley bolt to 25 Nm (18 lb ft).



26. Install the camshaft gears with the timing marks at the front.
27. Insert the guide pin of the intake camshaft into the IN bore.
28. Insert the guide pin of the exhaust camshaft into the EX bore.

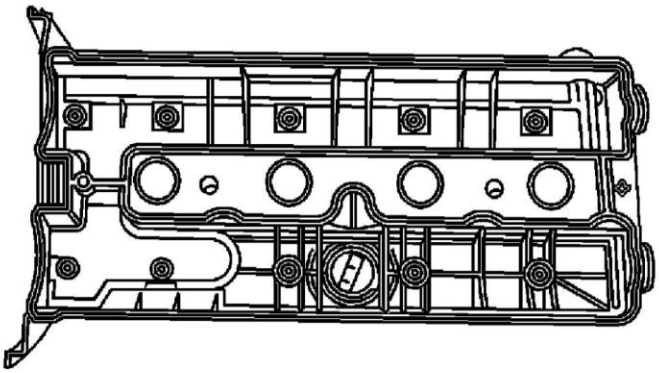


29. Install the camshaft gears by counterholding on the hex of the camshaft with an open-ended wrench.
30. Install the intake camshaft gear with a new bolt to the camshaft.

    Tighten the intake camshaft gear bolt to 50 Nm (37 lb ft), turn the bolt another 60 degrees and 15 degrees using the J 45059 or the KM-470-B .

31. While holding the exhaust camshaft firmly in place, install the exhaust camshaft gear bolt.

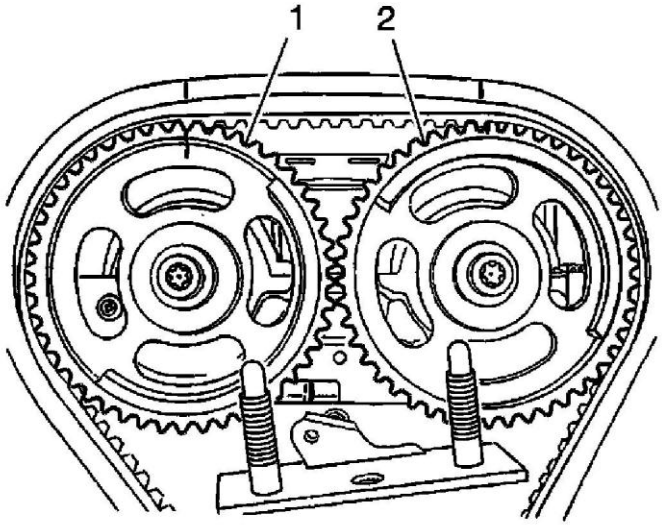
    Tighten the exhaust camshaft gear bolt to 50 Nm (37 lb ft), turn the bolt another 60 degrees and 15 degrees using the J 45059 or the KM-470-B .



32. 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.
33. Install the valve cover and the valve cover gasket.

34. Install the valve cover washers.
35. Install the valve cover bolts.

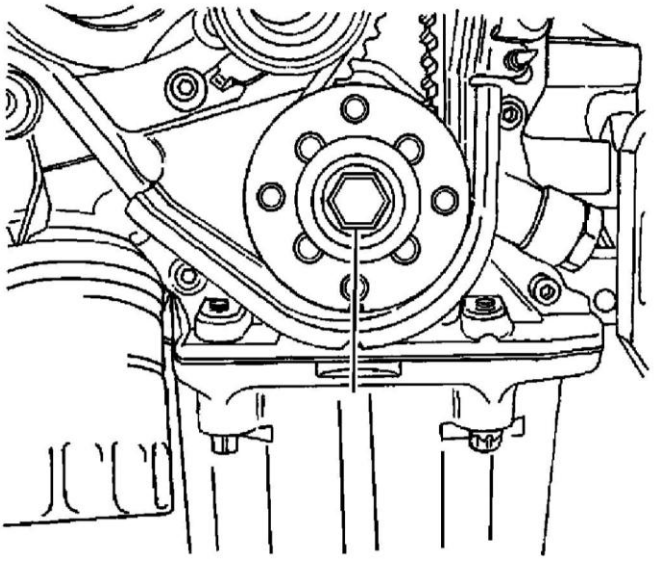
    Tighten the valve cover bolts to 8 Nm (71 lb in).



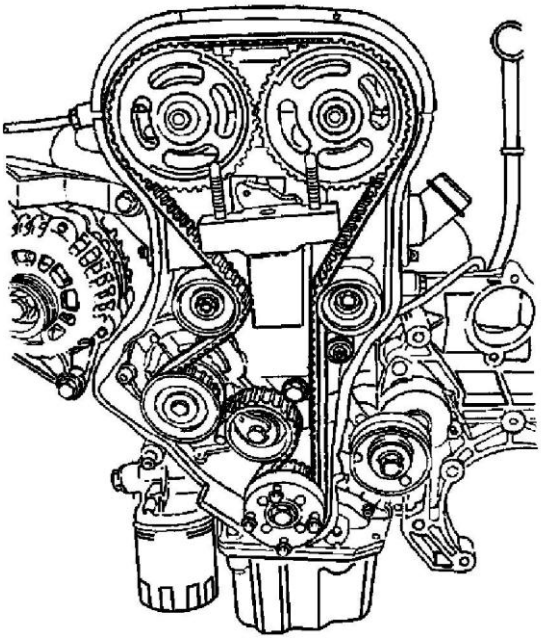
36. Connect the ignition wires to the spark plugs.
37. Install the spark plug cover.
38. Install the spark plug cover bolts.

    Tighten the spark plug cover bolts to 8 Nm (71 lb in).

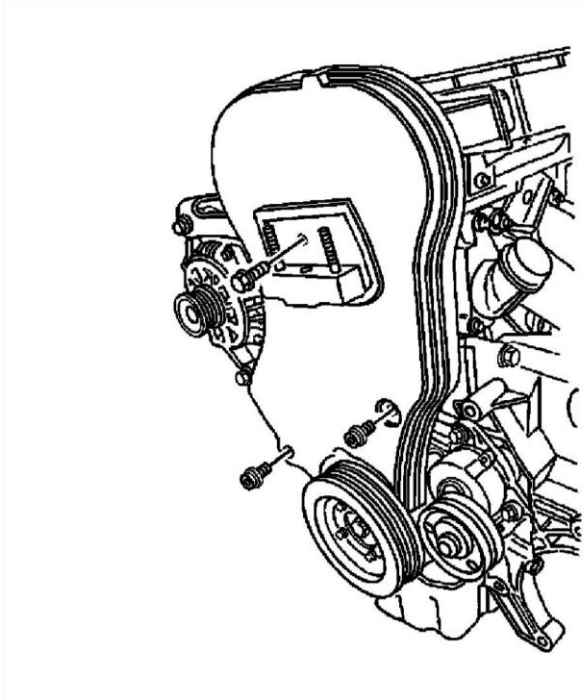
39. Connect the breather tube to the valve cover.
40. Align the timing marks on the camshaft gears to the notches on the valve cover, using the intake gear (1) mark for the intake gear and the exhaust gear mark for the exhaust gear (2).



41. Align the mark on the crankshaft gear with the notch at the bottom of the rear timing belt cover.



42. Install the timing belt. Refer to Timing Belt Replacement See: Timing Components/Timing Belt/Service and Repair.
43. Check and adjust the timing belt tension. Refer to Timing Belt Inspection See: Service and Repair/Overhaul/2. Timing Belt Inspection.

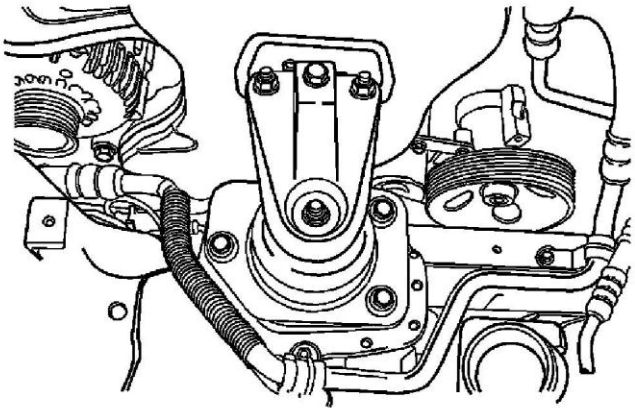


44. Install the front timing belt cover.
45. Install the front timing belt cover bolts.

Tighten the upper and lower front timing belt cover bolts to 6 Nm (53 lb in).

46. Install the crankshaft pulley.
47. Install the crankshaft pulley bolts.

Tighten the crankshaft pulley bolts to 12 Nm (106 lb in).

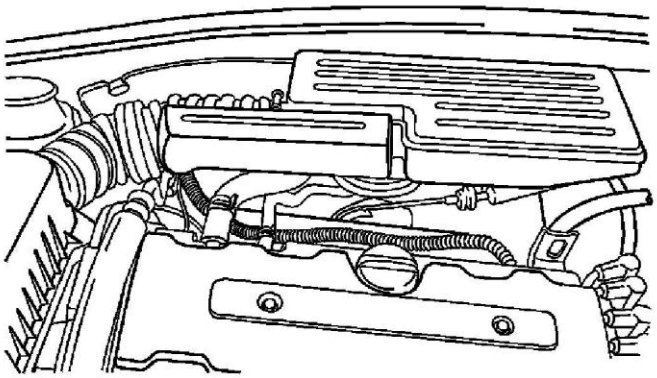


48. Install the right engine mount bracket, the retaining bolts, and the nut.

Tighten the right engine mount bracket retaining bolt and nuts to 55 Nm (41 lb ft).

49. Remove the J 28467-B .
    Notice: Refer to Belt Dressing Notice See: Drive Belts, Mounts, Brackets and Accessories/Drive Belt/Service Precautions in Cautions and Notices.

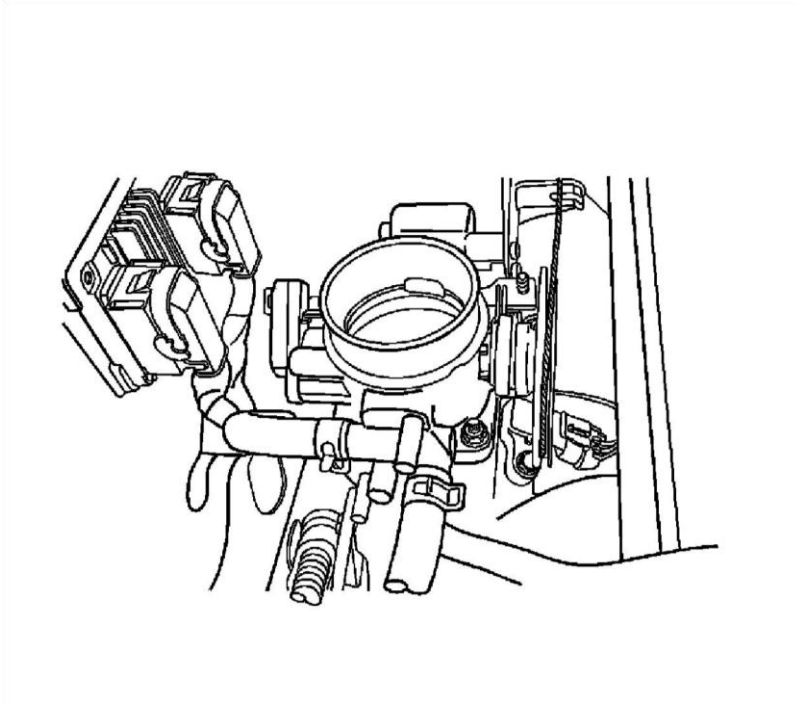
50. Install the power steering pump. Refer to Power Steering Pump Belt Replacement See: Drive Belts, Mounts, Brackets and Accessories/Drive Belt/Service and Repair in Power Steering System.
51. Connect the upper radiator hose to the thermostat housing.
52. Install the front wheel well splash shield. Refer to Wheelhouse Splash Shield Replacement See: Body and Frame/Splash Guard/Service and Repair in Body Front End.
53. Install the right front wheel. Refer to Tire and Wheel Removal and Installation See: Maintenance/Wheels and Tires/Service and Repair in Tires and Wheels.



54. Install the air cleaner housing.
55. Install the air cleaner housing bolts.

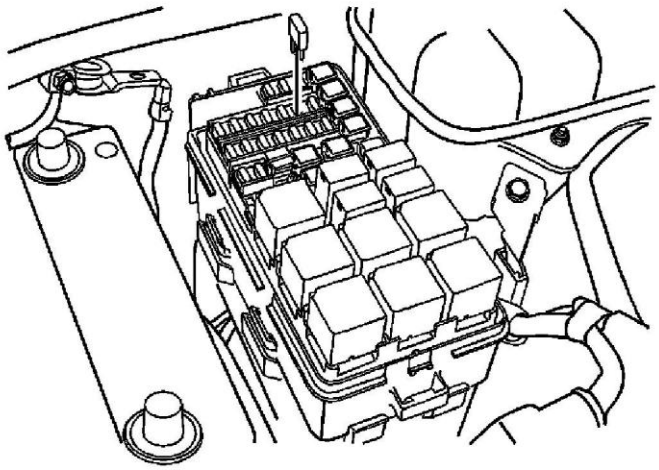
    Tighten the air cleaner housing bolts to 10 Nm (89 lb in).

56. Connect the air intake tube to the throttle body.
57. Connect the breather tube to the valve cover.
58. Connect the MAT sensor connector.



59. Connect the CTS connector.
60. Connect the engine CTS connector.
61. Connect the IAC valve connector.
62. Connect the TP sensor connector.
63. Install the canister purge solenoid bracket bolt.

Tighten the canister purge solenoid bracket bolt to 5 Nm (44 lb in).

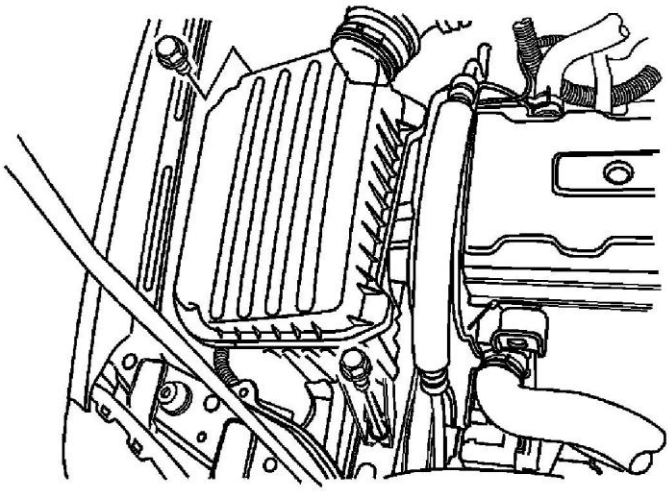


64. Connect the ignition coil connector.
65. Connect the oxygen sensor connector.
66. Connect the ECM ground terminal.
67. Install the fuel pump fuse.
68. Connect the negative battery ground cable.
69. Refill the engine cooling system. Refer to Cooling System Draining and Filling (Gasoline Engines) See: Cooling System/Service and Repair in Engine Cooling.

Drive Belt: Service and Repair

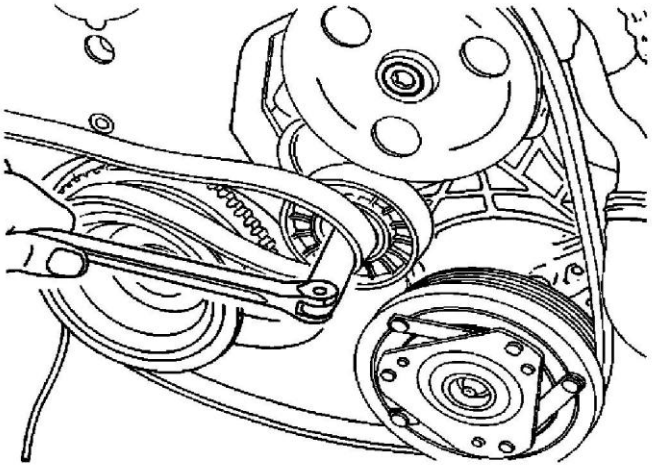
Power Steering Pump Belt Replacement

Removal Procedure

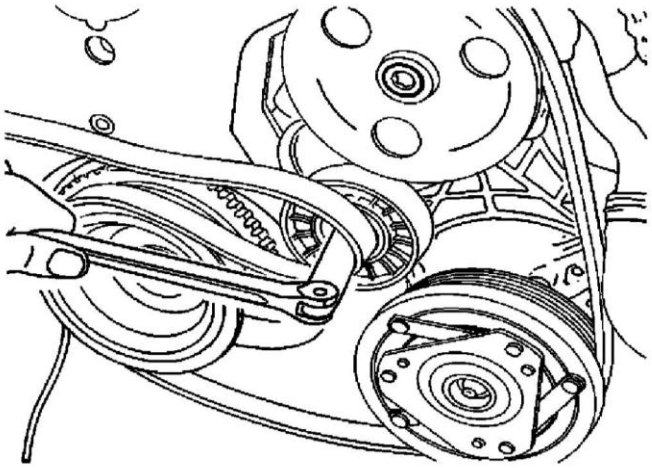


Notice: Refer to Belt Dressing Notice See: Service Precautions.

1. Remove the air filter housing assembly bolts and the air intake tube.
2. Remove the air filter housing assembly from the vehicle.

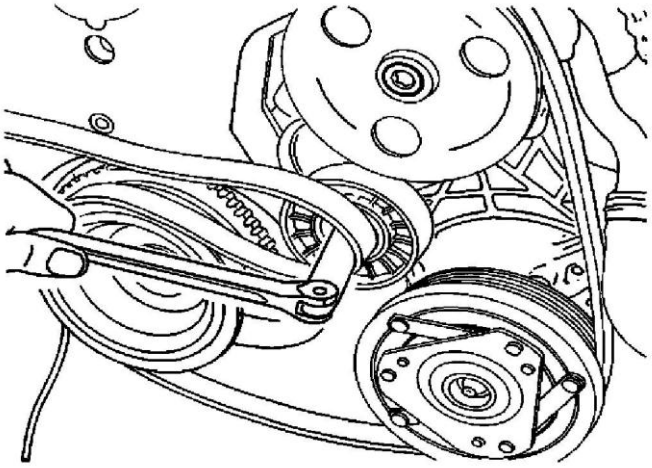


3. Use a wrench to turn the tensioner bolt clockwise, compressing the tensioner and releasing the tension on the serpentine accessory drive belt.

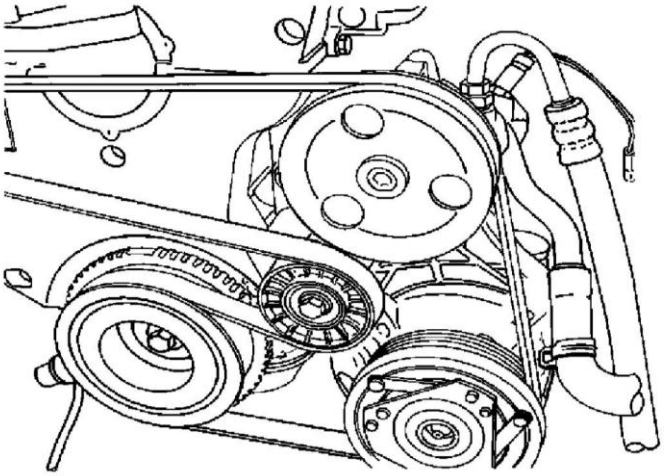


4. Remove the serpentine accessory drive belt.

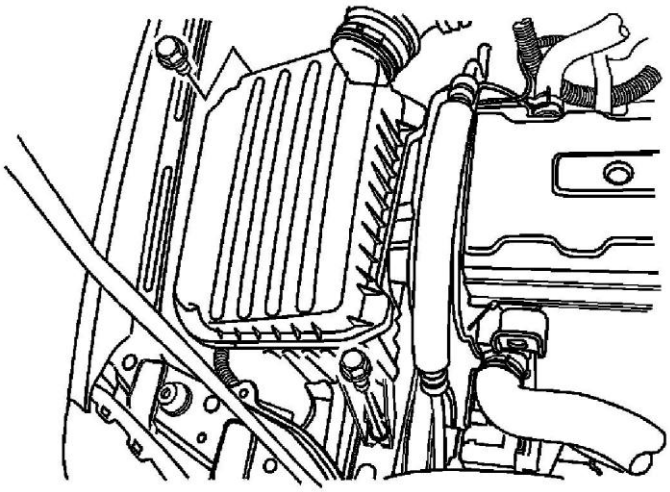
Installation Procedure



1. Use a wrench to turn the tensioner bolt clockwise, compressing the tensioner and releasing the tension on the serpentine accessory drive belt.
2. With the wrench in place on the tensioner bolt, loop the serpentine accessory drive belt loosely over the pulleys.



3. Slip the belt over the tensioner.
4. Remove the wrench from the tensioner bolt and the belt will tighten itself.



5. Install the air filter housing assembly into the vehicle

Notice: Refer to Fastener Notice See: Service Precautions/Vehicle Damage Warnings/Fastener Notice.

6. Install the air intake tube and the air filter housing assembly bolts.

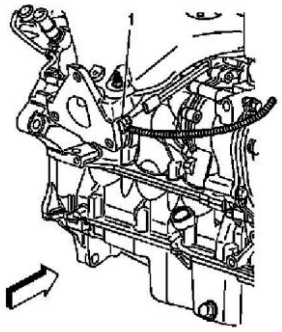
Tighten the air filter housing assembly bolts to 6 Nm (53 lb in).

Engine Block Heater: Service and Repair

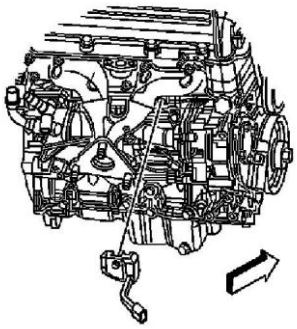
Coolant Heater Replacement

Coolant Heater Replacement

Removal Procedure

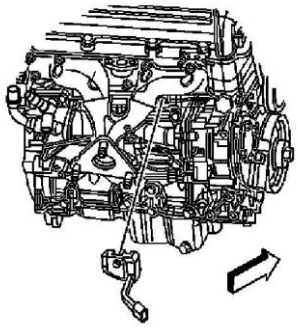


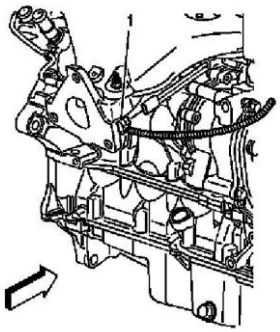
1. Disconnect the coolant heater cord (1).



2. Remove the coolant heater bolt.
3. Remove the coolant heater.

Installation Procedure





1. Install the coolant heater.

   Notice: Refer to Fastener Notice .

2. Install the coolant heater bolt.

   Tighten the bolt to 10 Nm (89 lb in).
3. Connect the coolant heater cord (1).

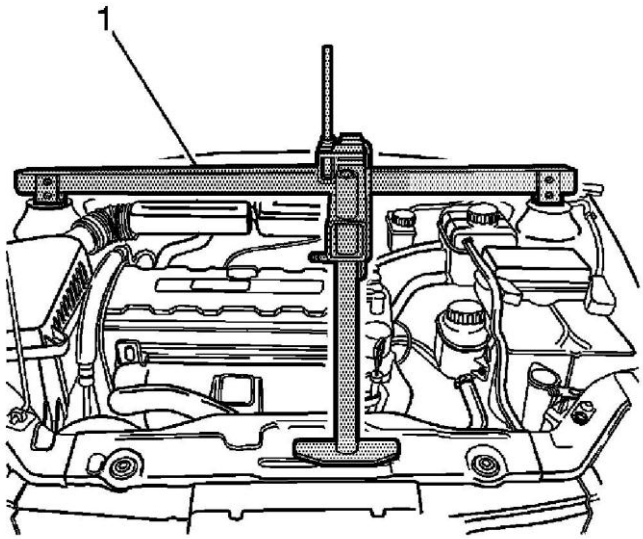
Engine Mount: Service and Repair

Engine Mount Replacement

Tools Required

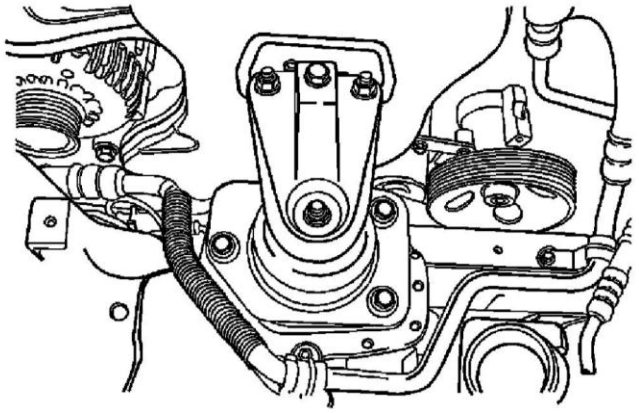
J 28467-B Universal Engine Support Fixture

Removal Procedure

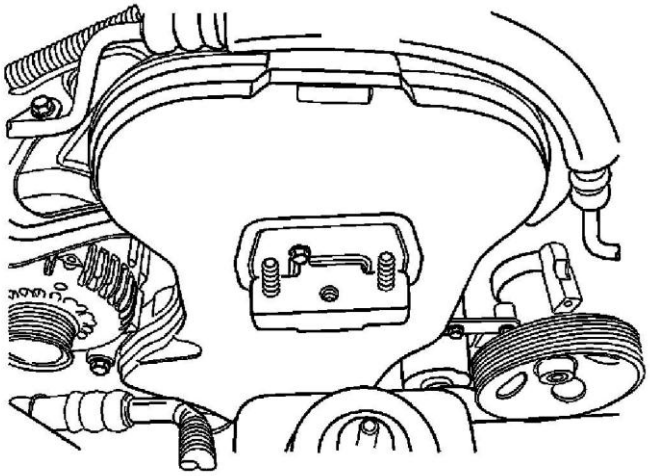


Caution: Refer to Battery Disconnect Caution See: Starting and Charging/Battery/Service Precautions/Technician Safety Information/ Battery Disconnect Caution in Cautions and Notices.

1. Disconnect the negative battery cable.
2. Support the engine assembly using J 28467-B (1).
3. Disconnect the intake air temperature (IAT) sensor connector.
4. Disconnect the air cleaner outlet hose from the throttle body.
5. Remove the air cleaner housing bolts.
6. Remove the air cleaner housing.



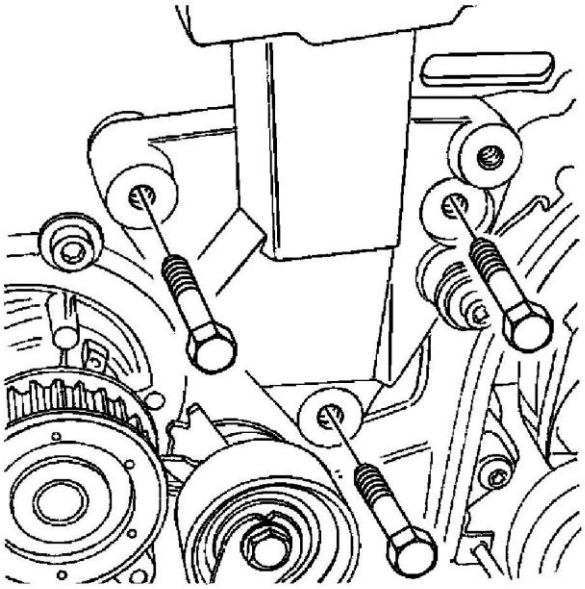
7. Remove the right front splash shield. Refer to Wheelhouse Splash Shield Replacement See: Body and Frame/Splash Guard/Service and Repair in Body Front End.
8. Remove the engine mount bracket retaining bolts.
9. Remove the engine mount bracket.
10. Remove the serpentine accessory drive belt. Refer to Power Steering Pump Belt Replacement See: Drive Belt/Service and Repair in Power Steering System.



11. Remove the front timing belt cover bolts.
12. Align the crankshaft pulley timing mark with the pointer, and the camshaft gears with the timing marks on the rear cover, by turning the crankshaft gear bolt.
13. Loosen the timing belt automatic tensioner bolt.
14. Turn the hex-key tab to relieve belt tension.
15. Remove the timing belt idler pulley bolt and nut.
16. Remove the timing belt idler pulley.

17. Remove the engine mount retaining bolts.
18. Remove the engine mount.

Installation Procedure

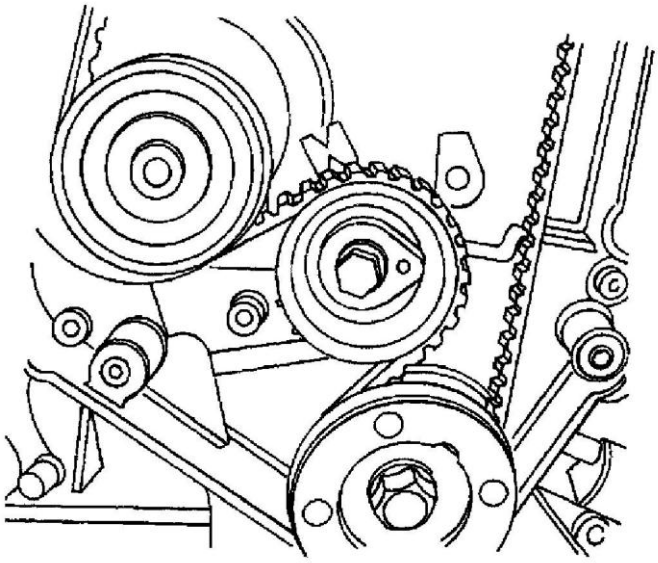


1. Install the engine mount.

Notice: Refer to Fastener Notice See: Service Precautions/Vehicle Damage Warnings/Fastener Notice in Cautions and Notices.

2. Install the engine mount retaining bolts.

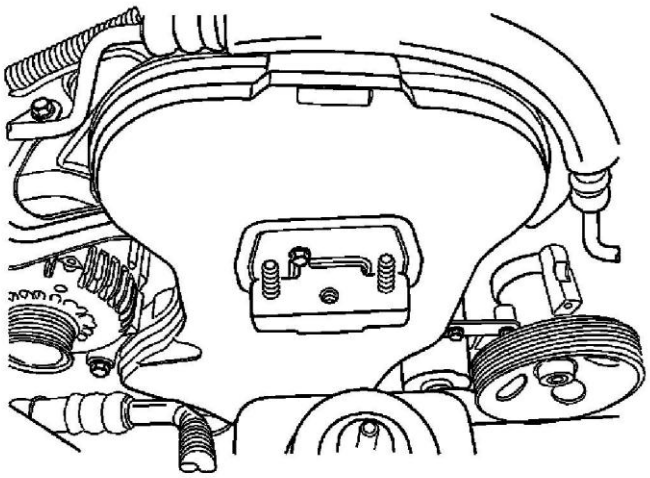
Tighten the engine mount retaining bolts to 45 Nm (33 lb ft).



3. Install the timing belt idler pulleys.
4. Install the timing belt idler pulley bolt and nut.

   Tighten the timing belt idler pulley bolt and nut to 25 Nm (18 lb ft).
5. Tension the timing belt by turning the timing belt automatic tensioner hex-key tab counterclockwise until the pointer is aligned to the indicator.

   Tighten the timing belt automatic tensioner bolt to 25 Nm (18 lb ft).



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

   Tighten the front timing belt cover bolts to 6 Nm (53 lb in).

8. Install the engine mount bracket and retaining bolts.

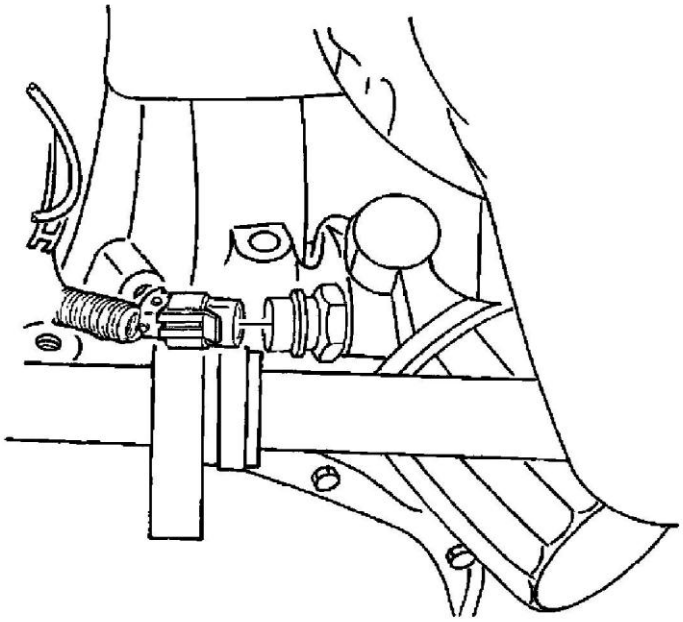
   Tighten the engine mount bracket retaining bolts to 55 Nm (41 lb ft).

9. Remove the J 28467-B .
10. Install the serpentine accessory drive belt. Refer to Power Steering Pump Belt Replacement See: Drive Belt/Service and Repair in Power Steering System.
11. Connect the negative battery cable.

Oil Pump: Service and Repair

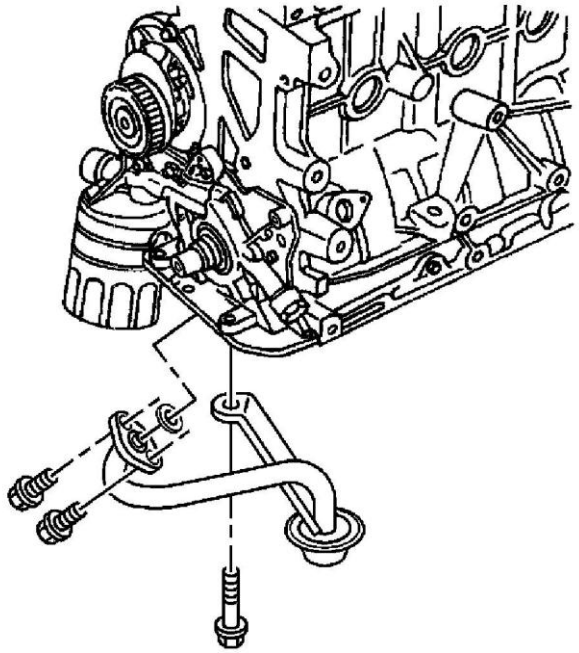
Oil Pump Replacement

Removal Procedure

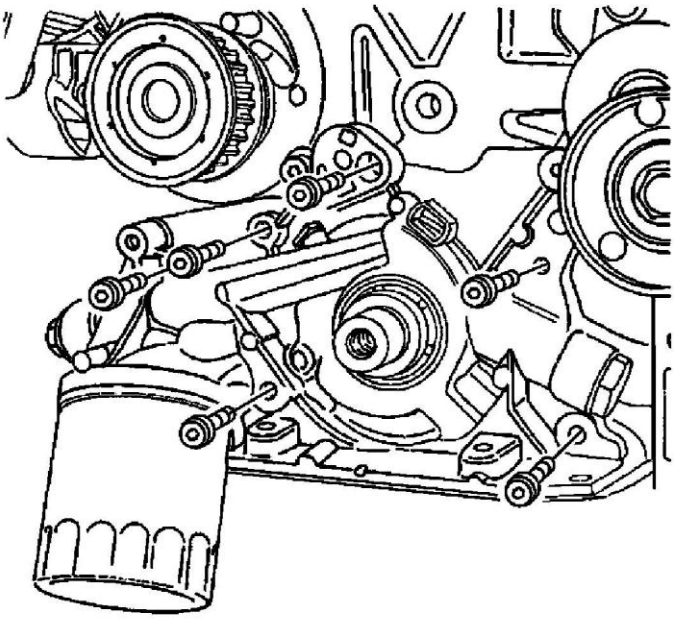


Caution: Refer to Battery Disconnect Caution See: Starting and Charging/Battery/Service Precautions/Technician Safety Information/Battery Disconnect Caution.

1. Disconnect the negative battery cable.
2. Remove the timing belt. Refer to Timing Belt Replacement See: Timing Components/Timing Belt/Service and Repair.
3. Remove the rear timing belt cover. Refer to Timing Belt Cover Replacement See: Timing Components/Timing Cover/Service and Repair.
4. Disconnect the oil pressure switch connector.

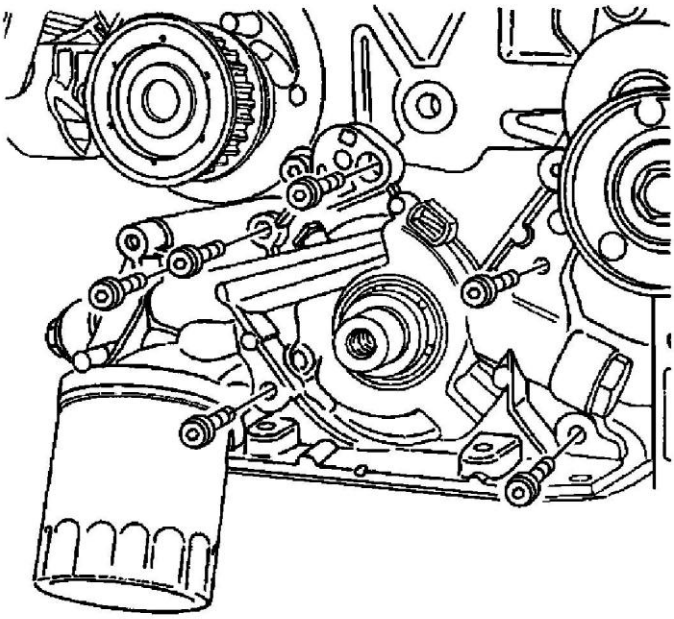


5. Remove the oil pan. Refer to Oil Pan Replacement See: Oil Pan/Service and Repair.
6. Remove the oil pump pickup tube and support the bracket bolts.
7. Remove the oil pump pickup tube.



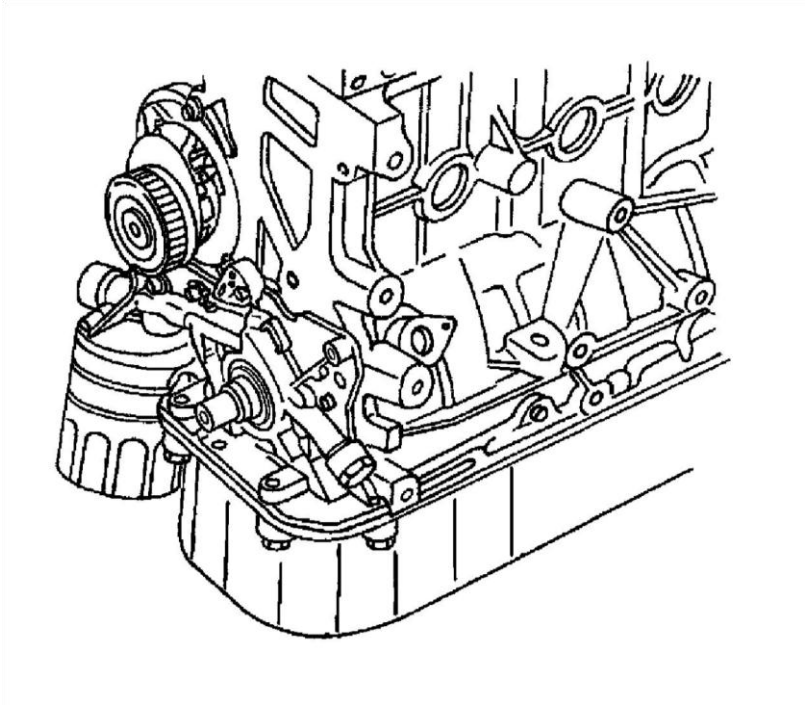
Caution: Refer to Safety Glasses Caution See: Service Precautions/Technician Safety Information/Safety Glasses Caution.

8. Remove the oil pump retaining bolts.
9. Carefully separate the oil pump and the gasket from the engine block and the oil pan.
10. Remove the oil pump. Installation Procedure

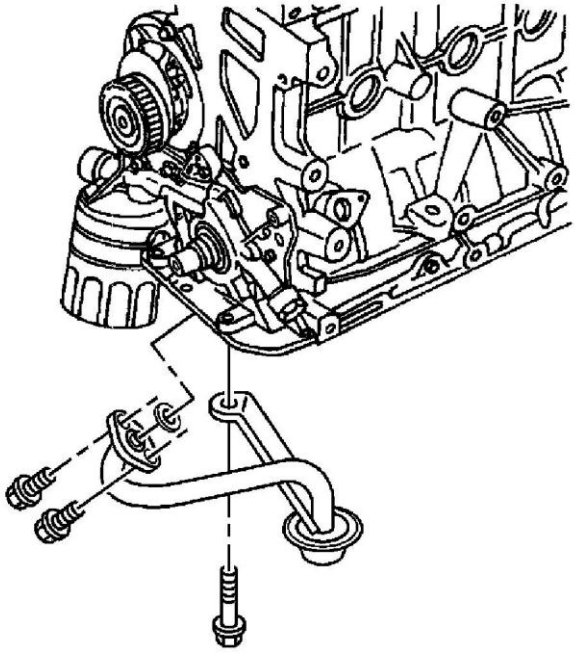


1. Apply LOCTITE(R) 242 to the oil pump bolts and RTV sealant to the new oil pump gasket.
2. Install the gasket to the oil pump and install the oil pump to the engine block with the bolts.

Tighten the oil pump retaining bolts to 10 Nm (89 lb in).

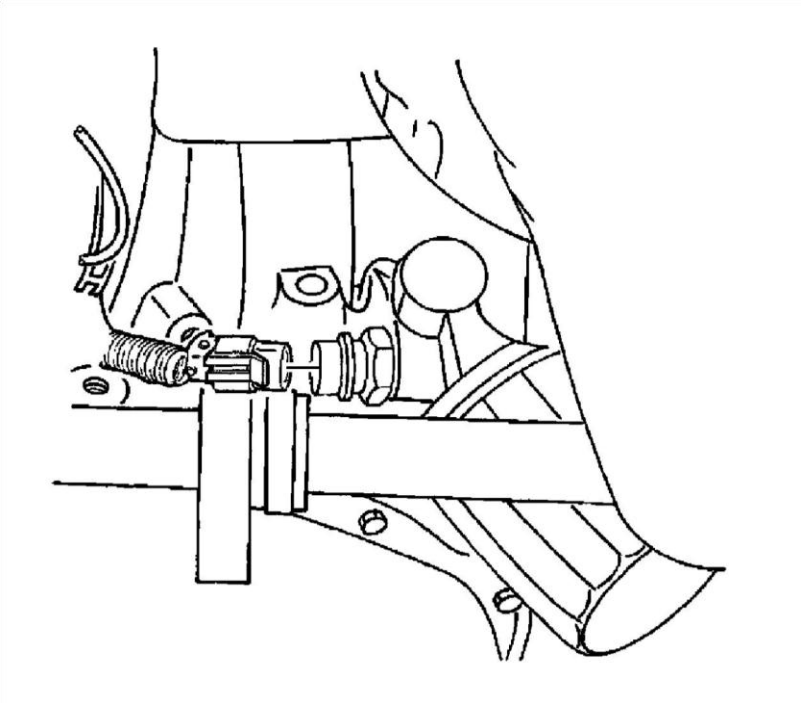


3. Install a new oil pump-to-cranshaft seal. Coat the lip of the seal with a thin coat of grease.



4. Coat the threads of the oil pump pickup tube and the support bracket bolts with LOCTITE(R) 242.
5. Install the oil pump tube and the bolts.

    * Tighten the oil pump pickup tube bolts to 8 Nm (71 lb in).
    * Tighten the oil pump pickup tube support bracket bolt to 10 Nm (89 lb in).



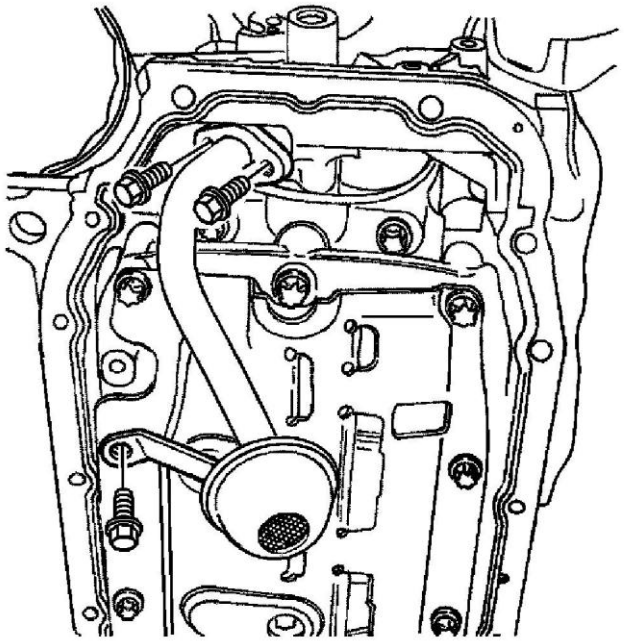
6. Install the oil pan. Refer to Oil Pan Replacement See: Oil Pan/Service and Repair.
7. Connect the oil pressure switch connector.
8. Install the rear timing belt cover. Refer to Timing Belt Cover Replacement See: Timing Components/Timing Cover/Service and Repair.
9. Install the timing belt. Refer to Timing Belt Replacement See: Timing Components/Timing Belt/Service and Repair.
10. Connect the negative battery cable.

Piston: Service and Repair

Piston, Connecting Rod, and Bearing Replacement

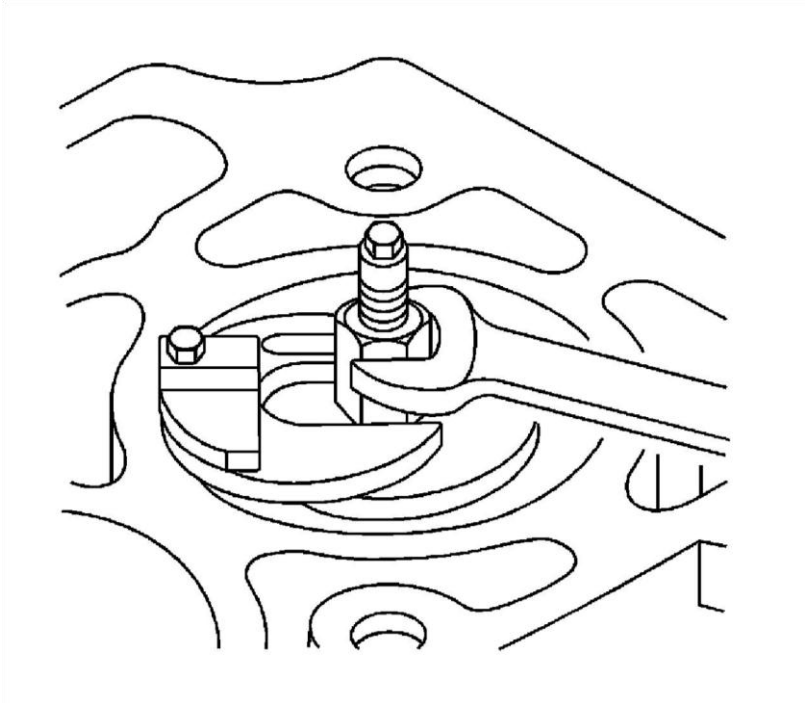
Tools Required

* J 24086-B Piston Pin Remover/Installer Set
* J 45059 Angle Meter
* J 8037 Ring Compressor or equivalent
* J 8087 Cylinder Bore Gage or equivalent
* KM-470-B Angular Torque Gage Removal Procedure

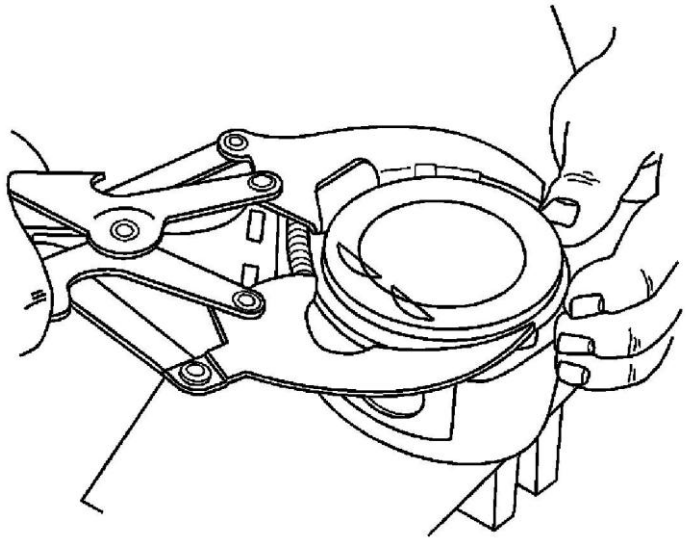


Caution: Refer to Safety Glasses Caution See: Service Precautions/Technician Safety Information/Safety Glasses Caution.

1. Remove the cylinder head with the intake manifold and the exhaust manifold attached. Refer to Cylinder Head Replacement See: Cylinder Head Assembly/Service and Repair.
2. Remove the oil pan. Refer to Oil Pan Replacement See: Engine Lubrication/Oil Pan/Service and Repair.
3. Remove the oil pump/pickup tube bolts.
4. Remove the oil pump/pickup tube.
5. Remove the engine block lower support and the splash shield bolts.
6. Remove the engine block lower support and the splash shield.

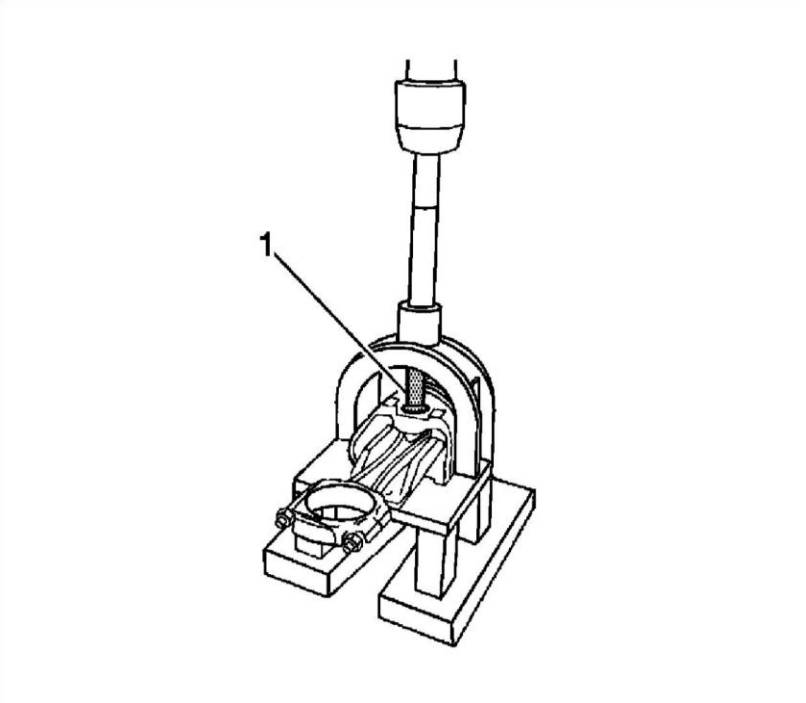


7. Move the piston to the bottom of the piston stroke.
8. Mark the connecting rod cap for position.
9. Remove the connecting rod cap bolts.
10. Remove the connecting rod cap and the lower connecting rod bearing.
11. Remove the upper piston connecting rod bearing.
12. Ridge ream the cylinder wall.

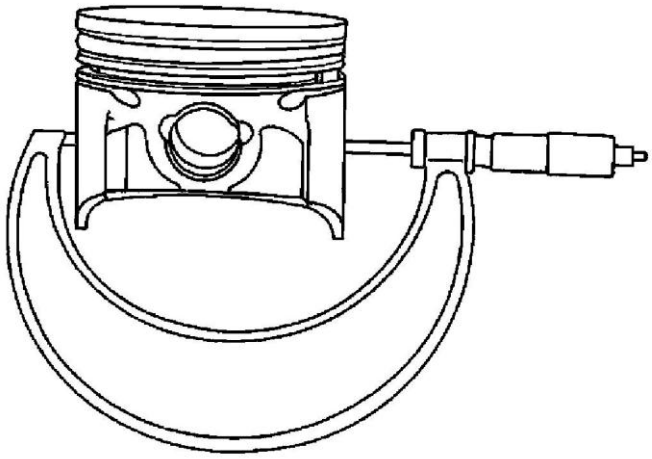


Caution: Handle the piston carefully. Worn piston rings are sharp and may cause bodily injury.

13. Remove the piston.
14. Use a piston ring expander tool to expand the piston rings.
15. Remove the piston rings.

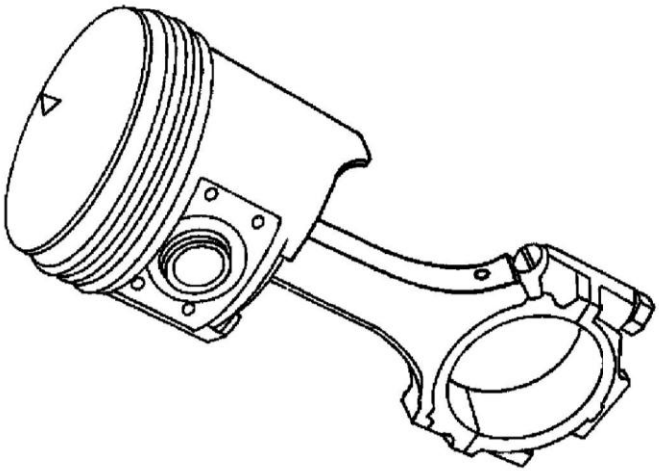


16. Remove the piston pin from the piston and connecting rod assembly using the J 24086-B (1).
17. Separate the piston from the connecting rod. Inspection Procedure

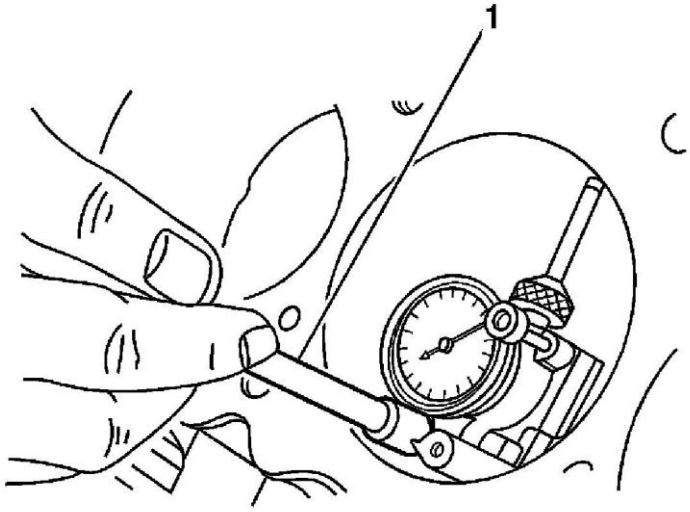


Caution: Refer to Safety Glasses Caution See: Service Precautions/Technician Safety Information/Safety Glasses Caution.

1. Inspect the connecting rod for bending or twisting. If the connecting rod is bent or twisted, replace the connecting rod.
2. Inspect the connecting rod bearings.
3. Inspect the connecting rod lower end for wear.
4. Inspect the connecting rod upper end for scoring.
5. Inspect the crankshaft rod bearing journal for wear. Refer to Engine Mechanical Specifications See: Specifications/Service Limits & General Specifications.
6. Inspect the piston for scoring, cracks, and wear.
7. Inspect the piston for taper using a micrometer.

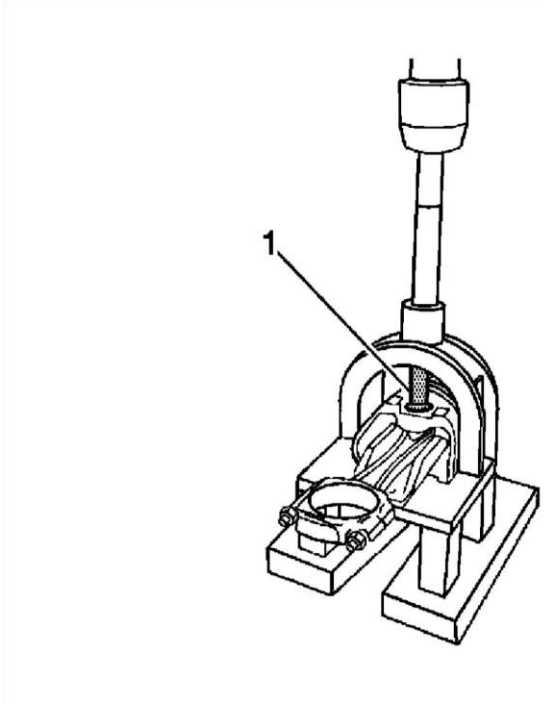


8. Inspect the piston for fit to the connecting rod.



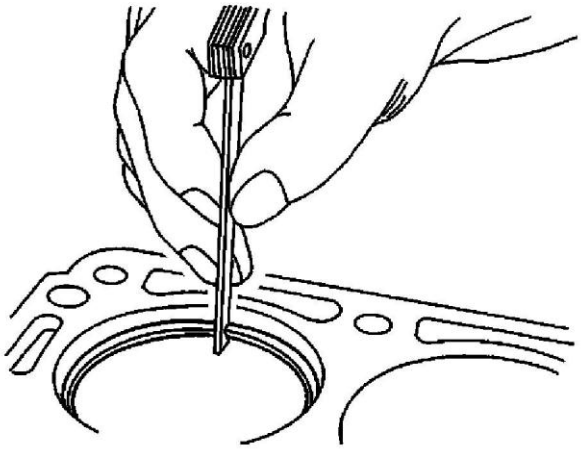
9. Inspect the engine block deck surface for flatness using a straight edge and a feeler gage. Refer to Engine Mechanical Specifications See: Specifications/Service Limits & General Specifications.
10. Inspect the bearing bore for concentricity and alignment using the J 8087 (1). Refer to Engine Mechanical Specifications See: Specifications/Service Limits & General Specifications.
11. If the bearing bore is beyond specifications, replace the engine block.
12. Inspect the engine block cylinder bore for wear, runout, ridging and taper using the J 8087 . Refer to Engine Mechanical Specifications See:
    Specifications/Service Limits & General Specifications.
13. Inspect the engine block cylinder bore for glazing.
14. Lightly hone the cylinder bore as necessary.

Installation Procedure



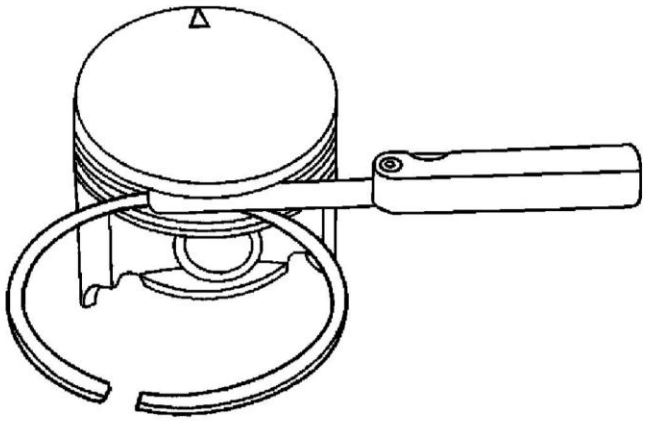
Important: For ease of installation of the piston pin, the connecting rod should be heated to 280°C (536°F). Heat the upper connecting rod only. Use commercial thermocolor material to determine the correct temperature. When the thermocolor material changes from black to green, the temperature is correct for installation.

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 the connecting rod assembly using the J 24086-B (1).

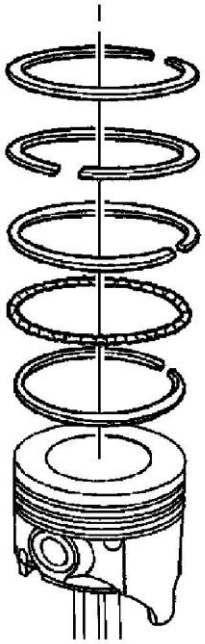


6. Select the set of new piston rings.
7. Measure the piston ring gap using a feeler gage. Refer to Engine Mechanical Specifications See: Specifications/Service Limits & General Specifications.

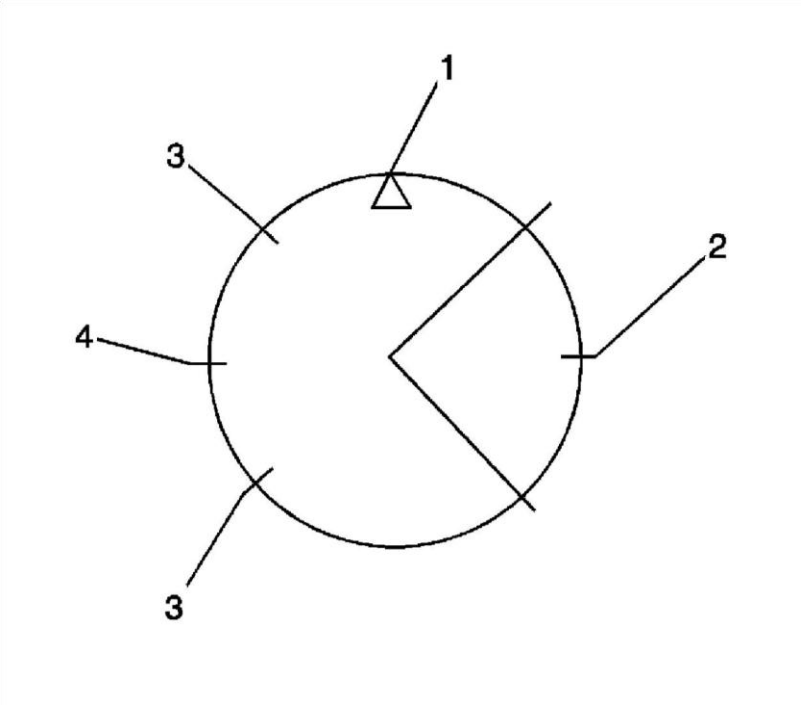
8. Increase the piston ring gap by carefully filing off excess material if the piston ring gap is below specifications.



9. Measure the piston ring side clearance using a feeler gage. Refer to Engine Mechanical Specifications See: Specifications/Service Limits & General 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.

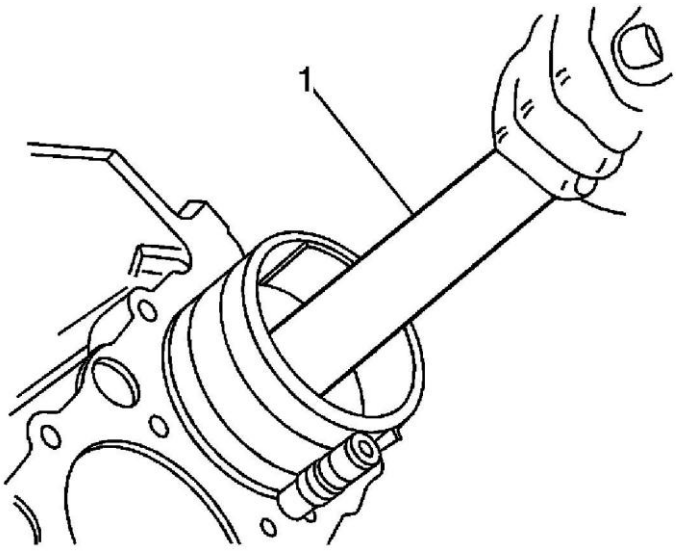


12. Install a piston oil ring, the expander, then the second piston oil ring to the bottom ring groove of the piston.
13. Install the second compression ring to the middle ring groove of the piston.
14. Install the top compression ring to the top ring groove of the piston.

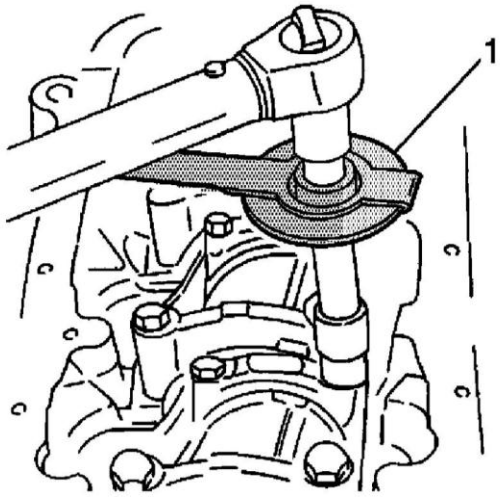


Notice: Use a piston ring expander to install the piston rings. The rings may be damaged if expanded more than necessary.

15. Install the piston rings.
16. Stagger the piston oil rings (2), the oil ring rail gaps (4), the second compression ring (5), and the top compression ring in relation to the notch
    (1) on the top of the piston.



17. Lubricate the cylinder wall and the piston rings with clean engine oil.
18. Install the piston using the J 8037 (1) 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 See: Service and Repair/Overhaul/5. Crankshaft and Bearing Cleaning and Inspection.



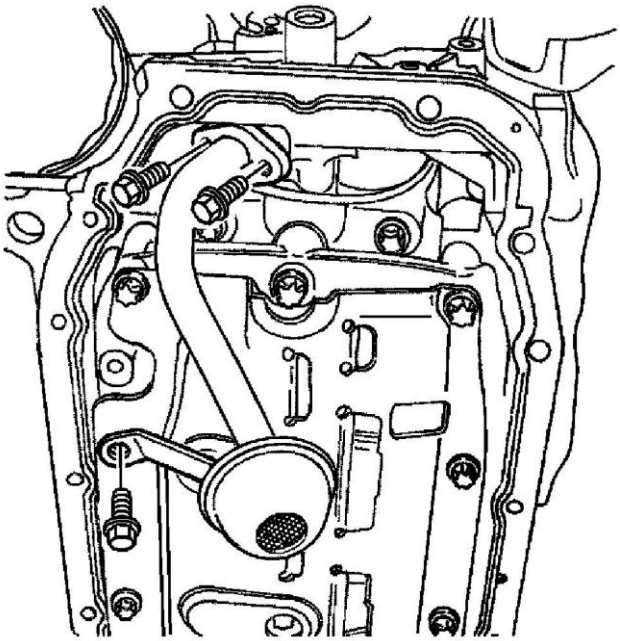
Notice: Refer to Fastener Notice See: Service Precautions/Vehicle Damage Warnings/Fastener Notice.

20. Install the connecting rod cap bearing bolts.

    Tighten the connecting rod cap bearing bolts to 35 Nm (26 lb ft). Using the J 45059 or the KM-470-B (1), tighten the bolts 1 turn of 45 degrees plus 15 degrees.

21. Install the engine block lower support bracket/splash shield bolts.

    Tighten the engine block lower support bracket/splash shield bolts to 35 Nm (26 lb ft).



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

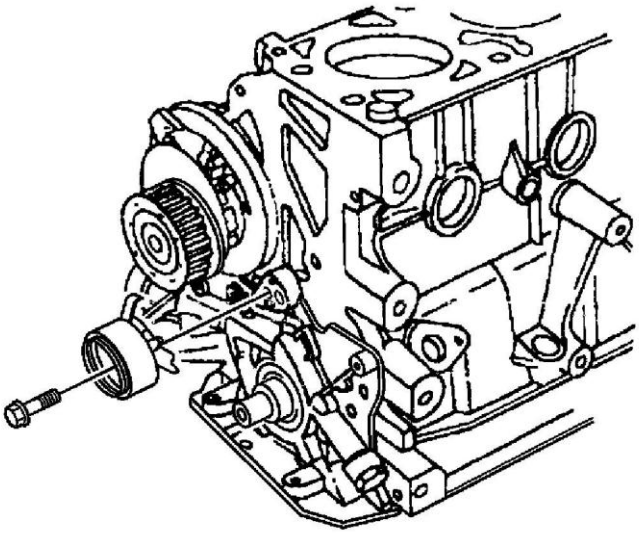
Tighten the oil pump/pickup tube bolts to 8 Nm (71 lb in).

24. Install the oil pan. Refer to Oil Pan Replacement See: Engine Lubrication/Oil Pan/Service and Repair.
25. Install the cylinder head with the intake manifold and exhaust manifold attached. Refer to Cylinder Head Replacement See: Cylinder Head Assembly/Service and Repair.

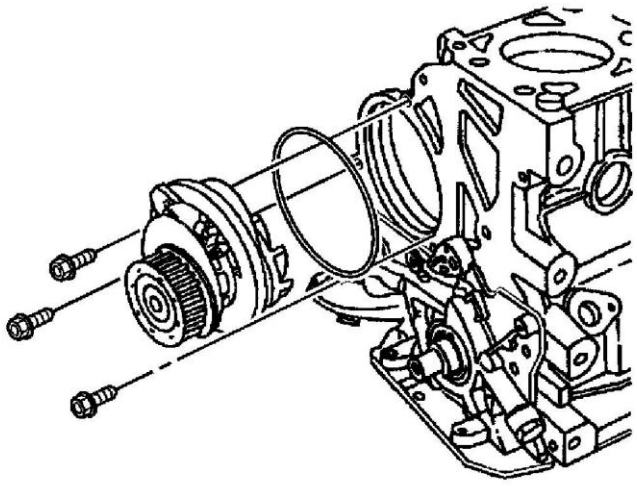
Water Pump: Removal and Replacement

Coolant Pump Replacement (Gasoline Engines)

Removal Procedure

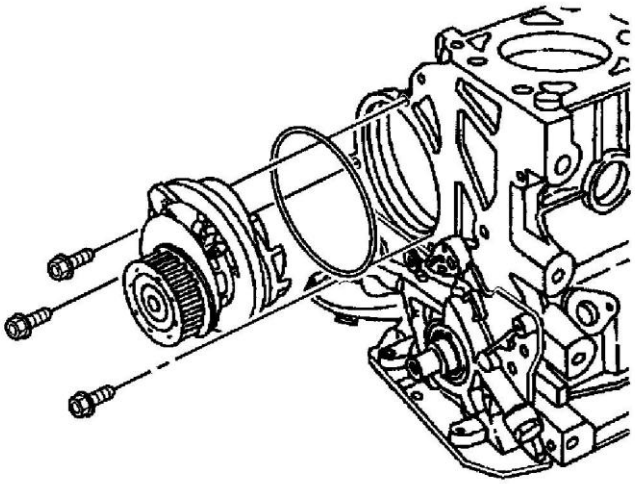


1. Drain the engine cooling system to a level below the thermostat housing. Refer to Cooling System Draining and Filling (Gasoline Engines) See: Cooling System/Service and Repair.
2. Remove the timing belt. Refer to Timing Belt Replacement for the 1.4L engine, Timing Belt Replacement for the 1.6L engine, Timing Belt Replacement for the 1.8L engine or Timing Belt Replacement See: Timing Components/Timing Belt/Service and Repair for the 2.0L engine.
3. Remove the timing belt tension roller retaining bolt.
4. Remove the timing belt tension roller.



5. Remove the water pump mounting bolts.
6. Remove the water pump from the engine block.
7. Remove the ring seal from the water pump.

Installation Procedure

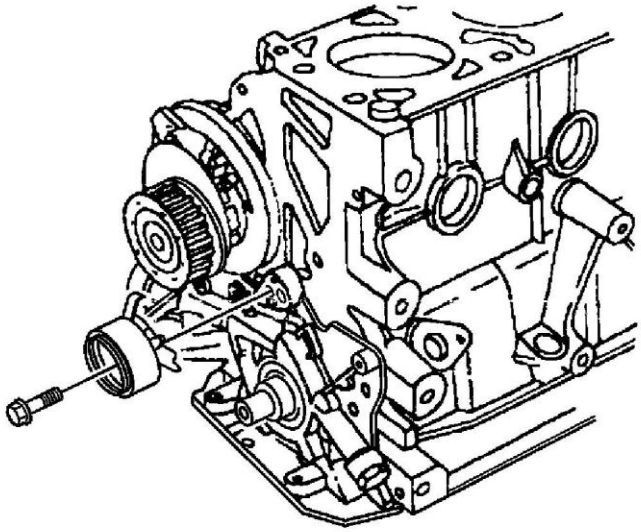


1. Install a new ring seal to the water pump.
2. Coat the sealing surface of the ring seal with Lubriplate(R).
3. Install the water pump to the engine block with the flange aligned with the recess of the rear timing belt cover.

Notice: Refer to Fastener Notice See: Service Precautions/Vehicle Damage Warnings/Fastener Notice.

4. Secure the water pump to the engine block with the mounting bolts.

* On 18L L79 and 2.0L DOHC engines, tighten the water pump mounting bolts to 25 Nm (18 lb ft).
* On 1.6L engine, tighten the water pump mounting bolts to 10 Nm (89 lb in).
* On 1.8L LDA engine, tighten the water pump mounting bolts to 8 Nm (71 lb in).

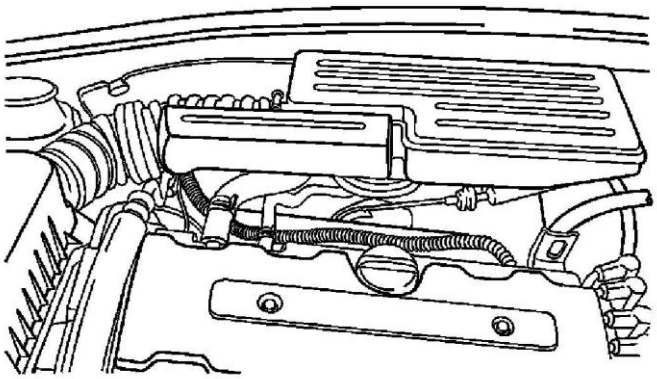


5. Install the timing belt tension roller to the oil pump with the flange inserted into the recess of the oil pump.
6. Install the timing belt tension roller bolt. Do not tighten the bolt at this time.
7. Install the timing belt. Refer to Timing Belt Replacement for the 1.4L engine, Timing Belt Replacement for the 1.6L engine, Timing Belt Replacement for the 1.8L engine or Timing Belt Replacement See: Timing Components/Timing Belt/Service and Repair for the 2.0L engine.
8. Refill the engine cooling system. Refer to Cooling System Draining and Filling (Gasoline Engines) See: Cooling System/Service and Repair.

Timing Belt: Service and Repair

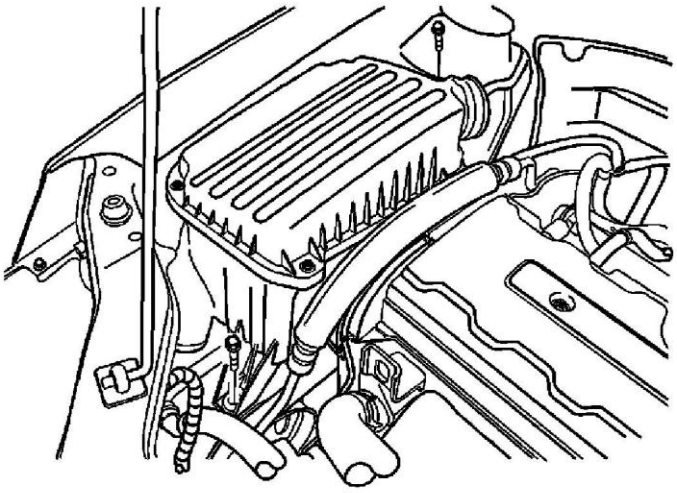
Timing Belt Replacement

Removal Procedure

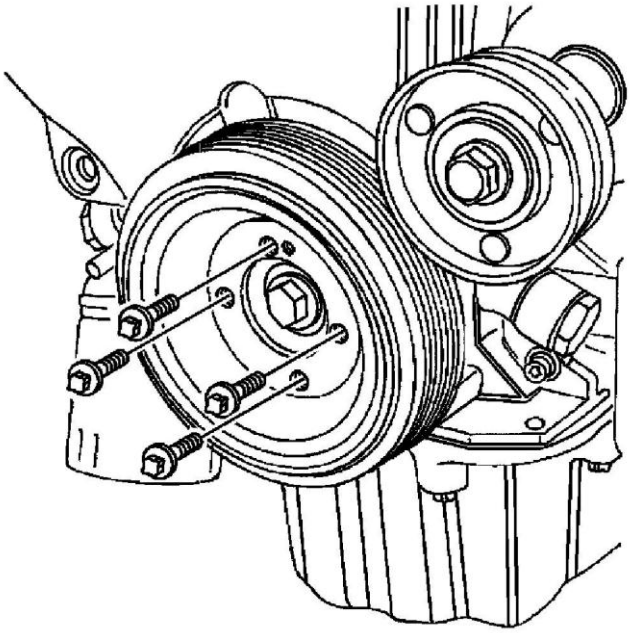


Caution: Refer to Battery Disconnect Caution See: Starting and Charging/Battery/Service Precautions/Technician Safety Information/ Battery Disconnect Caution in Cautions and Notices.

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



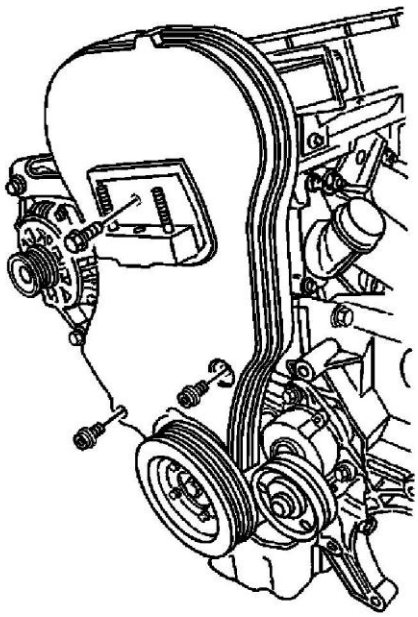
5. Remove the air cleaner housing bolts.
6. Remove the air cleaner.
7. Remove the right front wheel. Refer to Tire and Wheel Removal and Installation See: Maintenance/Wheels and Tires/Service and Repair in Tires and Wheels.
8. Remove the right front wheel well splash shield. Refer to Wheelhouse Splash Shield Replacement See: Body and Frame/Splash Guard/Service and Repair in Body Front End.



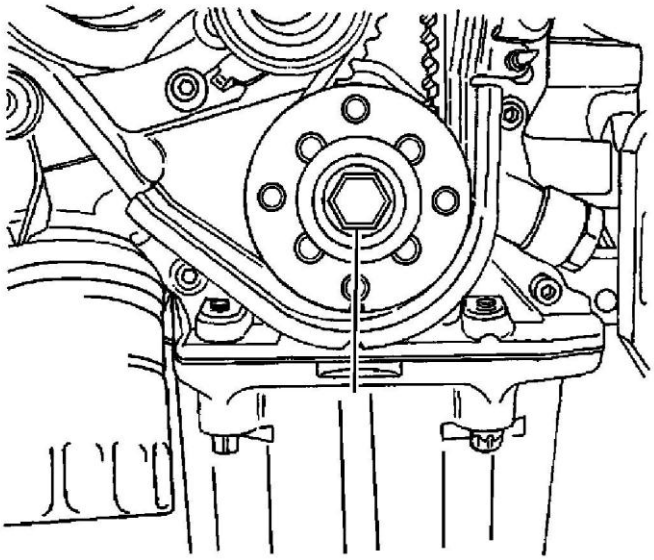
Notice: Refer to Belt Dressing Notice See: Drive Belts, Mounts, Brackets and Accessories/Drive Belt/Service Precautions in Cautions and Notices.

9. Remove the power steering pump drive belt. Refer to Power Steering Pump Belt Replacement See: Drive Belts, Mounts, Brackets and Accessories/Drive Belt/Service and Repair in Power Steering System.

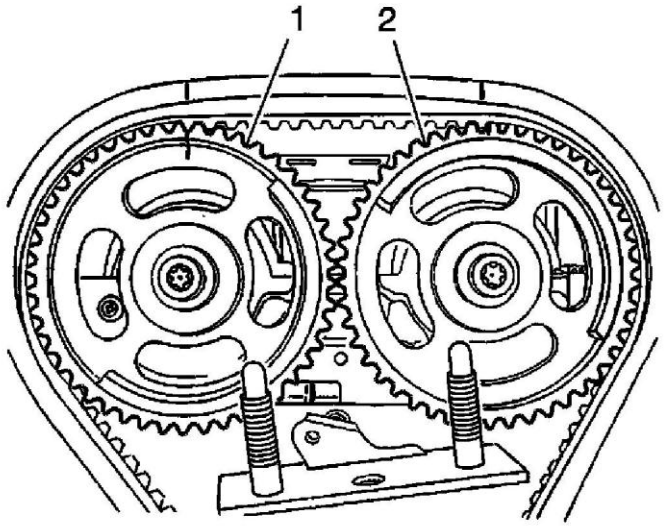
10. Remove the crankshaft pulley bolts.
11. Remove the crankshaft pulley.
12. Remove the right engine mount bracket. Refer to Engine Mount Replacement See: Drive Belts, Mounts, Brackets and Accessories/Engine Mount/Service and Repair.



13. Remove the front timing cover bolts.
14. Remove the front timing belt cover.



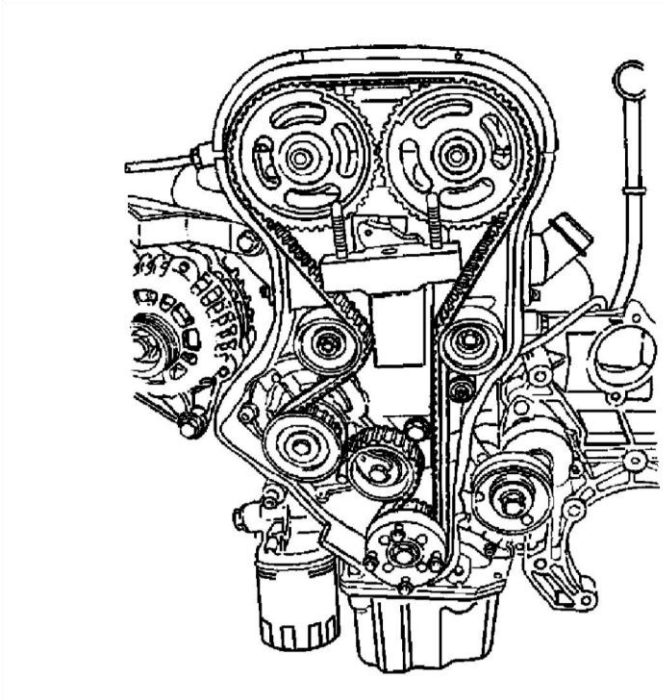
15. Using the crankshaft gear bolt, rotate the crankshaft clockwise until the timing mark on the crankshaft gear is aligned with the notch at the bottom of the rear timing belt cover.



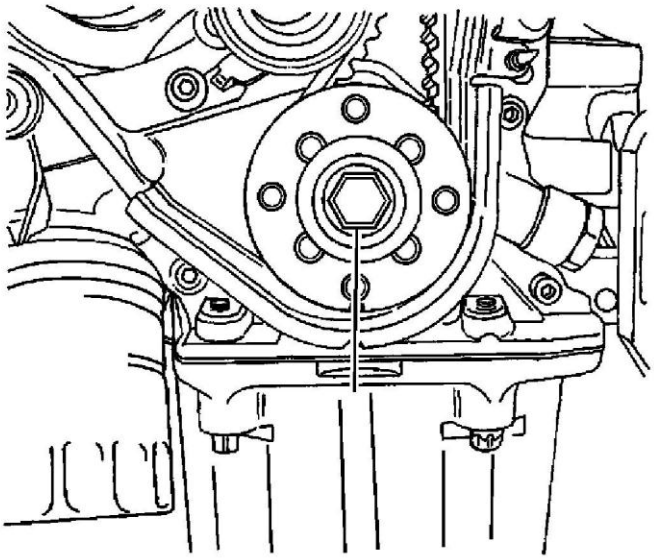
Important: The camshaft gears must align with the notch on the valve cover or damage to the engine could result.

Important: Use the intake gear mark for the intake camshaft gear and the exhaust gear (1) mark for the exhaust camshaft gear (2) since both gears are interchangeable.

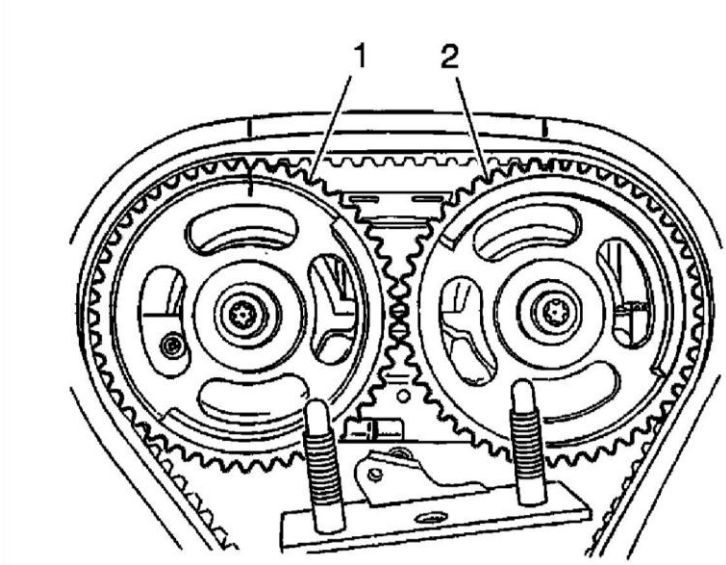
16. Align the camshaft gears with the notch on the valve cover.



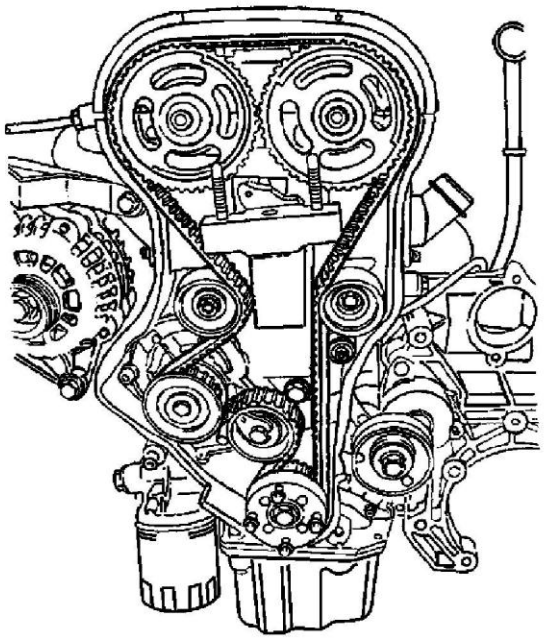
17. Loosen the automatic tensioner bolt. Turn the hex key tab to relieve the belt tension.
18. Remove the timing belt. Installation Procedure



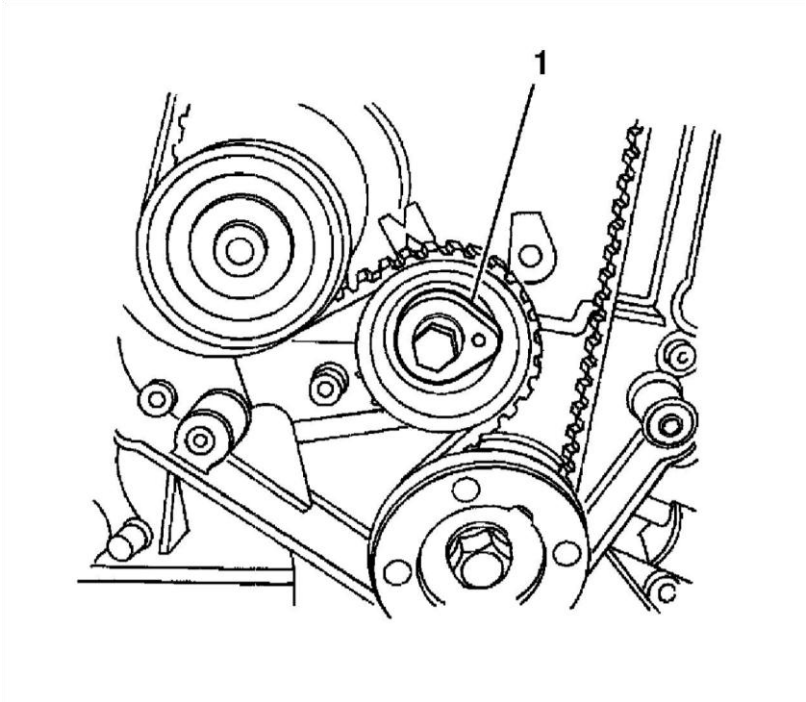
1. Align the timing mark on the crankshaft gear with the notch on the bottom of the rear timing belt cover.



2. Align the timing marks on the camshaft gears, using the intake gear mark for the intake gear (1) and the exhaust gear mark for the exhaust gear (2).



3. Install the timing belt.



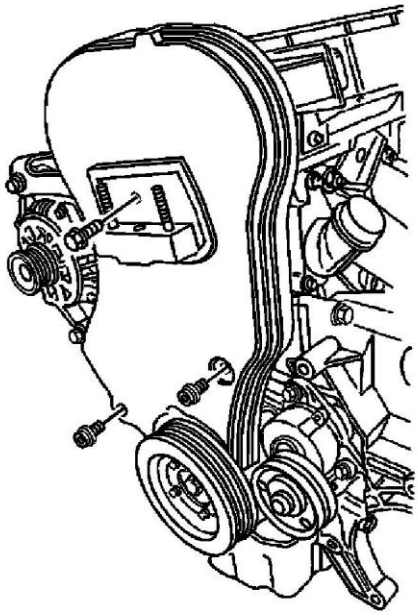
4. Turn the hex-key tab in a counterclockwise direction to tension the belt. Turn until the pointer aligns with the notch.

Notice: Refer to Fastener Notice See: Service Precautions/Vehicle Damage Warnings/Fastener Notice in Cautions and Notices.

5. Install the automatic tensioner bolt.

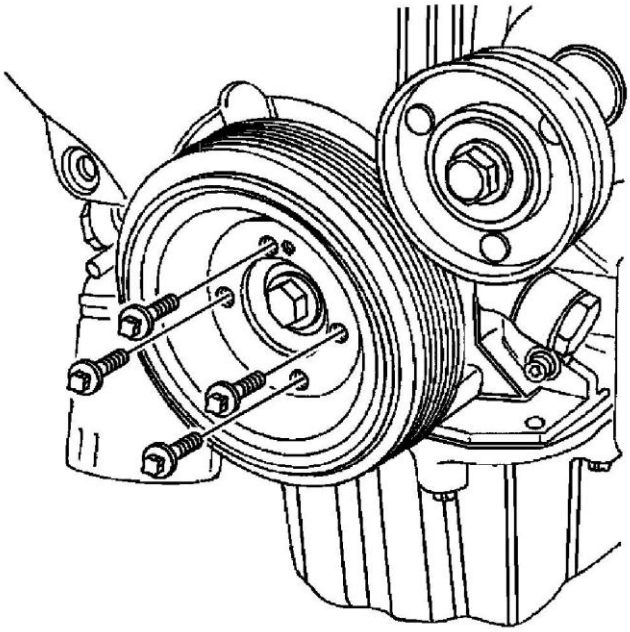
   Tighten the automatic tensioner bolt to 25 Nm (18 lb ft).

6. Rotate the crankshaft 2 full turns clockwise using the crankshaft gear bolt.
7. Inspect the automatic tensioner pointer.



8. Install the front timing belt cover.
9. Install the front timing belt cover bolts.

   Tighten the front timing belt cover bolts to 6 Nm (53 lb in).
10. Install the right engine mount bracket. Refer to Engine Mount Replacement See: Drive Belts, Mounts, Brackets and Accessories/ Engine Mount/Service and Repair.

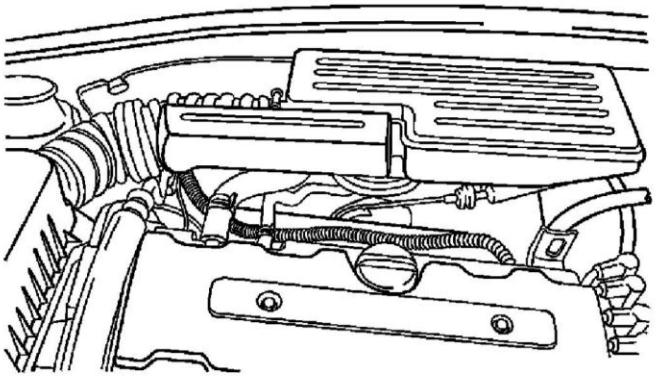


11. Install the crankshaft pulley.
12. Install the crankshaft pulley bolts

    Tighten the crankshaft pulley bolts to 20 Nm (15 lb ft).

Notice: Refer to Belt Dressing Notice See: Drive Belts, Mounts, Brackets and Accessories/Drive Belt/Service Precautions in Cautions and Notices.

13. Install the power steering pump drive belt. Refer to Power Steering Pump Belt Replacement See: Drive Belts, Mounts, Brackets and Accessories/Drive Belt/Service and Repair in Power Steering System.
14. Install the right front wheel well splash shield. Refer to Wheelhouse Splash Shield Replacement See: Body and Frame/Splash Guard/Service and Repair in Body Front End.
15. Install the right front wheel. Refer to Tire and Wheel Removal and Installation See: Maintenance/Wheels and Tires/Service and Repair in Tires and Wheels.



16. Install the air filter housing.
17. Install the air filter housing bolts.

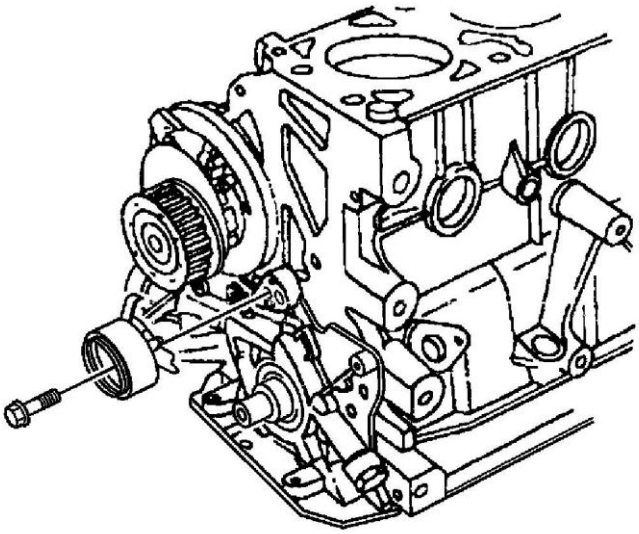
Tighten the air filter housing bolts to 10 Nm (89 lb in).

18. Connect the air intake tube to the throttle body.
19. Connect the breather tube to the valve cover.
20. Connect the IAT sensor connector.
21. Connect the negative battery cable.

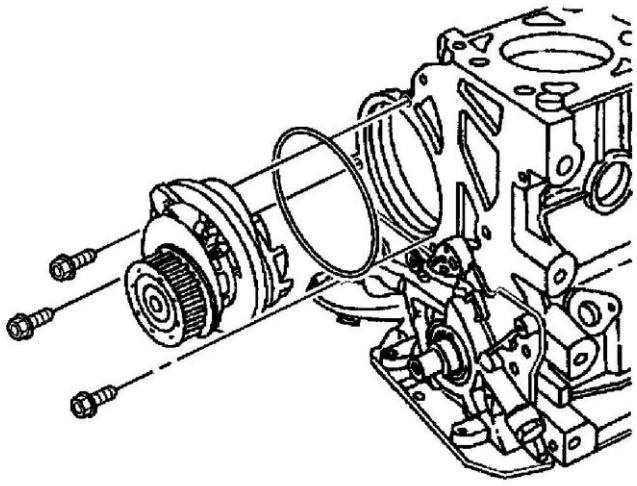
Water Pump: Removal and Replacement

Coolant Pump Replacement (Gasoline Engines)

Removal Procedure

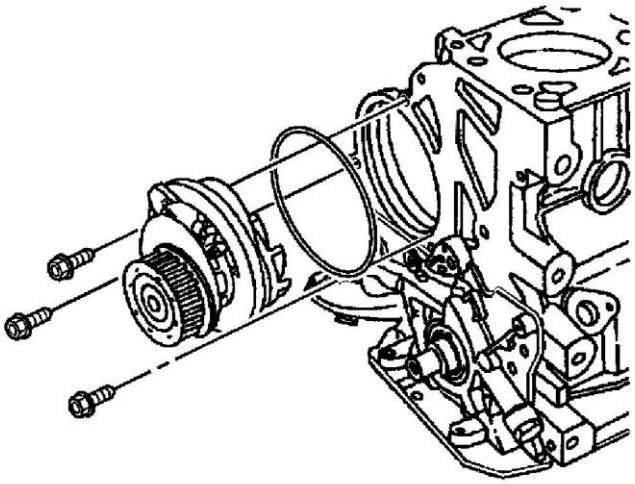


1. Drain the engine cooling system to a level below the thermostat housing. Refer to Cooling System Draining and Filling (Gasoline Engines) See: Cooling System/Service and Repair.
2. Remove the timing belt. Refer to Timing Belt Replacement for the 1.4L engine, Timing Belt Replacement for the 1.6L engine, Timing Belt Replacement for the 1.8L engine or Timing Belt Replacement See: Timing Components/Timing Belt/Service and Repair for the 2.0L engine.
3. Remove the timing belt tension roller retaining bolt.
4. Remove the timing belt tension roller.



5. Remove the water pump mounting bolts.
6. Remove the water pump from the engine block.
7. Remove the ring seal from the water pump.

Installation Procedure

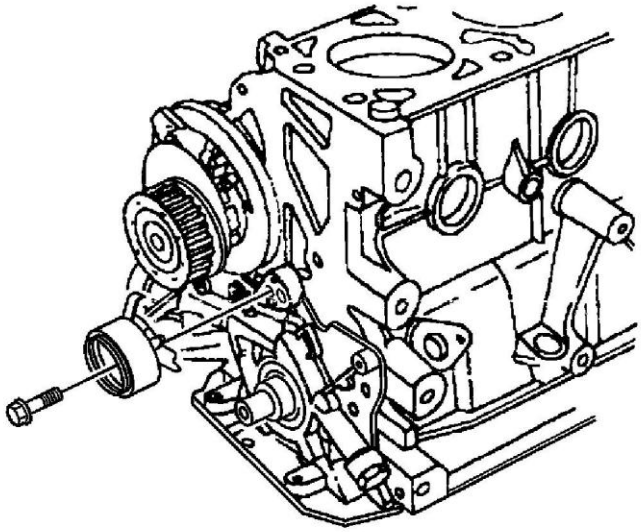


1. Install a new ring seal to the water pump.
2. Coat the sealing surface of the ring seal with Lubriplate(R).
3. Install the water pump to the engine block with the flange aligned with the recess of the rear timing belt cover.

Notice: Refer to Fastener Notice See: Service Precautions/Vehicle Damage Warnings/Fastener Notice.

4. Secure the water pump to the engine block with the mounting bolts.

* On 18L L79 and 2.0L DOHC engines, tighten the water pump mounting bolts to 25 Nm (18 lb ft).
* On 1.6L engine, tighten the water pump mounting bolts to 10 Nm (89 lb in).
* On 1.8L LDA engine, tighten the water pump mounting bolts to 8 Nm (71 lb in).



5. Install the timing belt tension roller to the oil pump with the flange inserted into the recess of the oil pump.
6. Install the timing belt tension roller bolt. Do not tighten the bolt at this time.
7. Install the timing belt. Refer to Timing Belt Replacement for the 1.4L engine, Timing Belt Replacement for the 1.6L engine, Timing Belt Replacement for the 1.8L engine or Timing Belt Replacement See: Timing Components/Timing Belt/Service and Repair for the 2.0L engine.
8. Refill the engine cooling system. Refer to Cooling System Draining and Filling (Gasoline Engines) See: Cooling System/Service and Repair.