

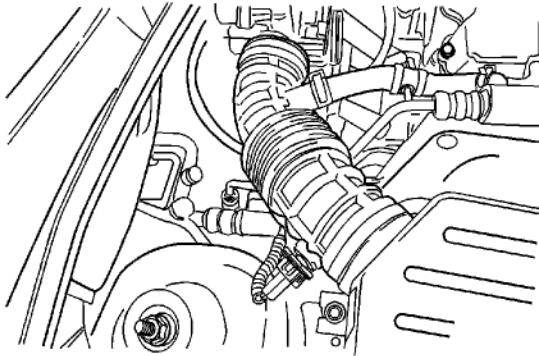
Timing Belt Inspection

Special Tools

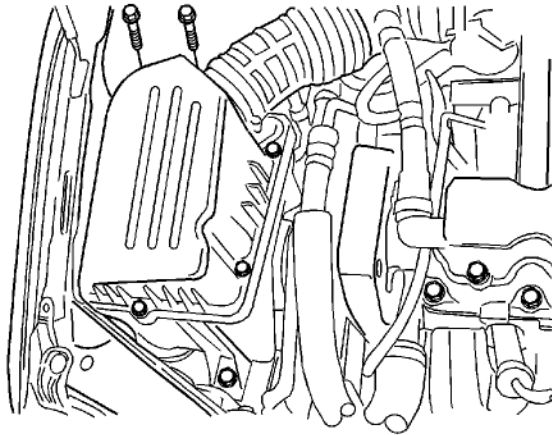
- [J 42492-A](#) Timing Belt Adjuster
- [KM-470-B](#) Angular Torque Gage
- [J 45059](#) Angle Meter

Adjustment Procedure

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

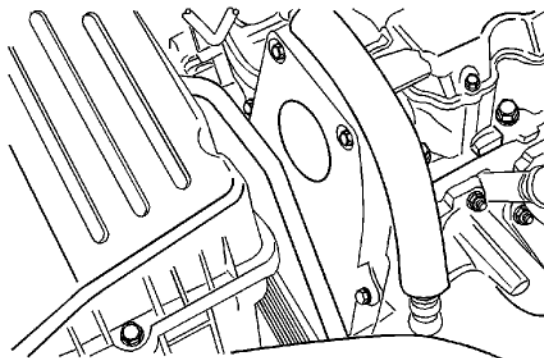


1. Disconnect the negative battery cable.
2. Disconnect the intake air temperature (IAT) sensor connector.
3. Disconnect the air intake tube from the throttle body.
4. Disconnect the breather tube from the valve cover.

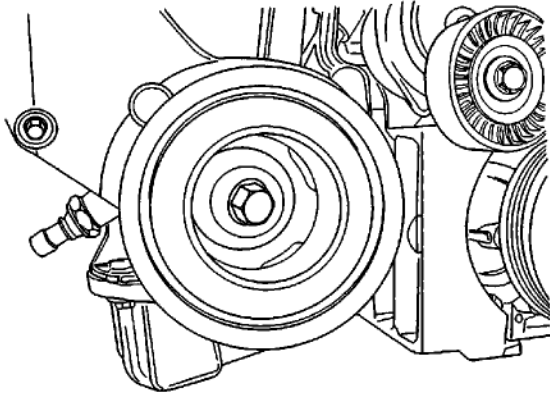


5. Remove the air cleaner housing bolts.
6. Remove the air cleaner housing.
7. Remove the right front wheel. Refer to [Tire and Wheel Removal and Installation](#).
8. Remove the right front wheel well splash shield.

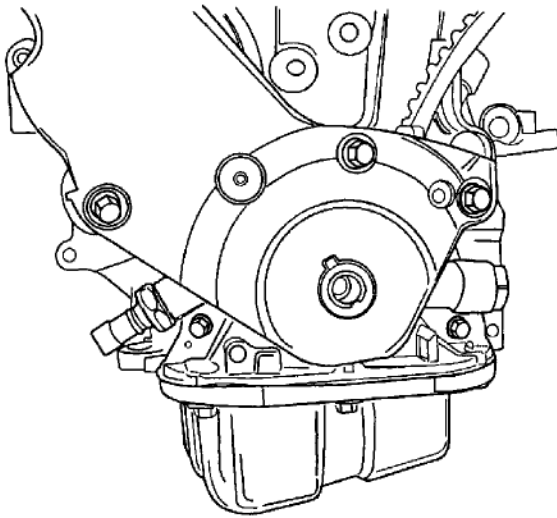
Caution: Refer to [Belt Dressing Caution](#) in the Preface section.



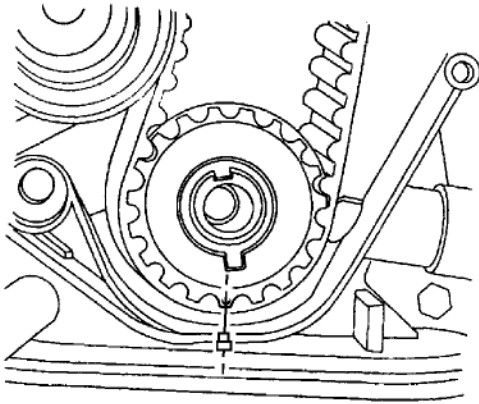
9. Remove the serpentine accessory drive belt. Refer to [Power Steering Pump Hoses and Pipes Replacement](#).
10. Remove the upper timing belt cover bolts.
11. Remove the upper timing belt cover.



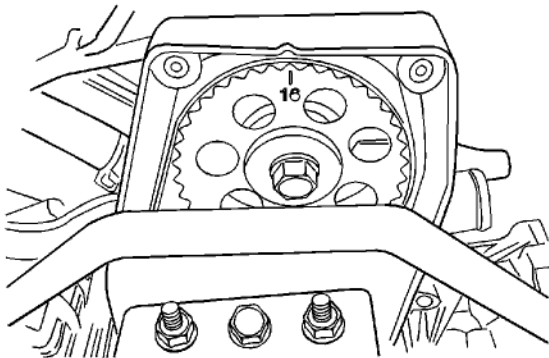
12. Remove the crankshaft pulley bolt.
13. Remove the crankshaft pulley.



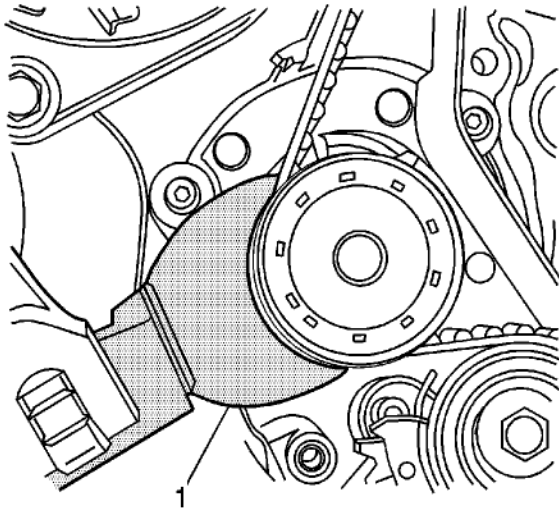
14. Remove the lower timing belt cover bolts.
15. Remove the lower timing belt cover.



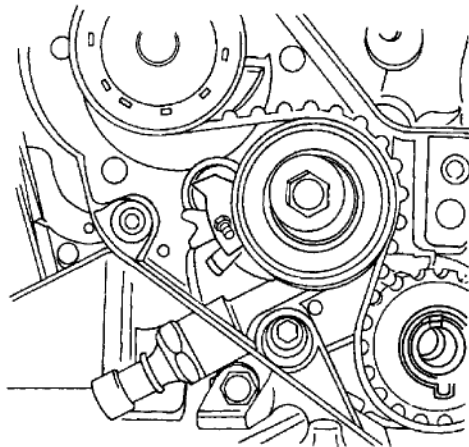
16. Install the crankshaft pulley bolt.
17. Rotate the crankshaft at least 1 full turn clockwise using the crankshaft pulley bolt.
18. Align the dot on the crankshaft gear to the notch at the bottom of the rear timing belt cover.



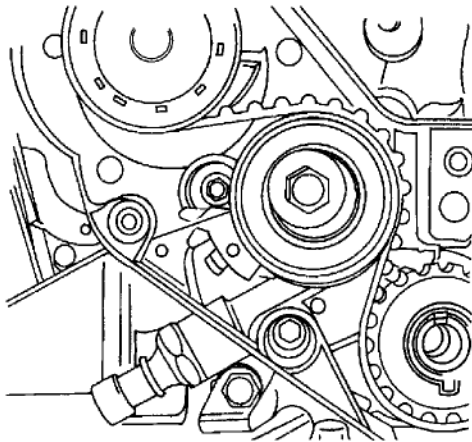
19. Align the camshaft gear timing mark to the notch at the top of the rear timing belt cover.



20. Slightly loosen the 3 coolant pump retaining bolts.
21. Using the [J 42492-A](#) (1), rotate the coolant pump clockwise to add the highest tension to the timing belt.
22. Tighten the coolant pump retaining bolts loosely.



23. Align the adjust arm hole of the timing belt automatic tensioner to the hole in the timing belt automatic tensioner bracket.
24. Insert a 4.5 mm driver through the adjust arm hole and the tensioner bracket hole.
25. Rotate the crankshaft 2 full turns clockwise using the crankshaft pulley bolt.
26. Rotate the crankshaft at least 1 full turn clockwise using the crankshaft pulley bolt.
27. Remove the driver from the timing belt automatic tensioner.
28. Loosen the coolant pump retaining bolts.



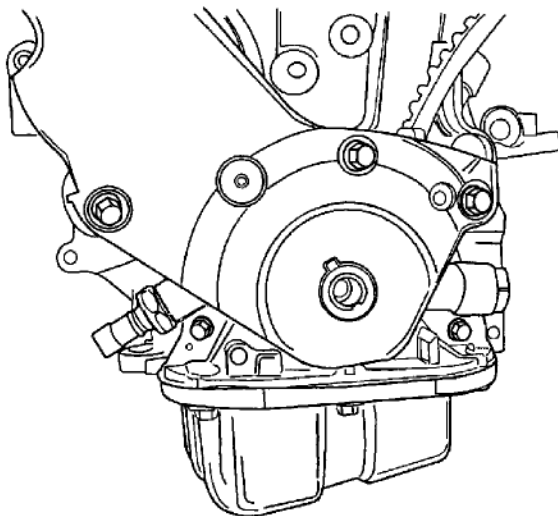
29. Rotate the coolant pump until the adjust arm pointer of the timing belt automatic tensioner is aligned with the notch in the timing belt automatic tensioner bracket.

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

30. Tighten the coolant pump retaining bolts.

Tighten

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

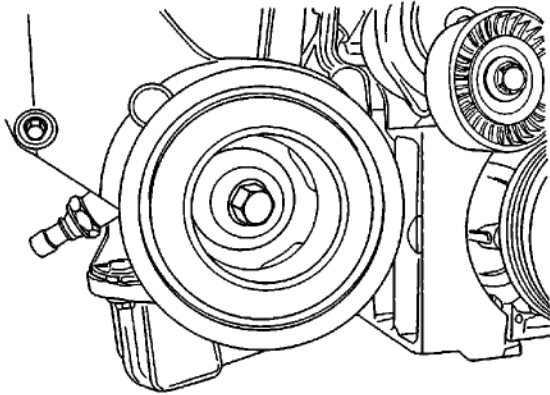


31. Remove the crankshaft pulley bolt.
32. Install the lower timing belt cover.

33. Install the lower timing belt cover bolts.

Tighten

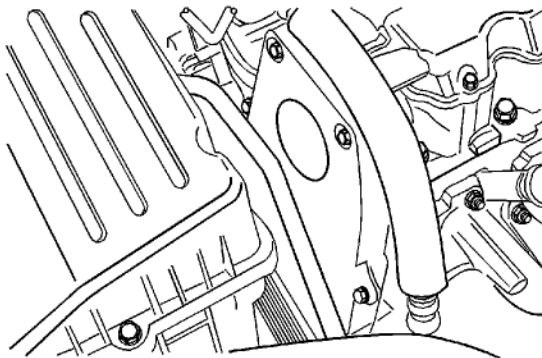
Tighten the lower timing belt cover bolts to 10 N·m (89 lb in).



34. Install the crankshaft pulley.
35. Install the crankshaft pulley bolt.

Tighten

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





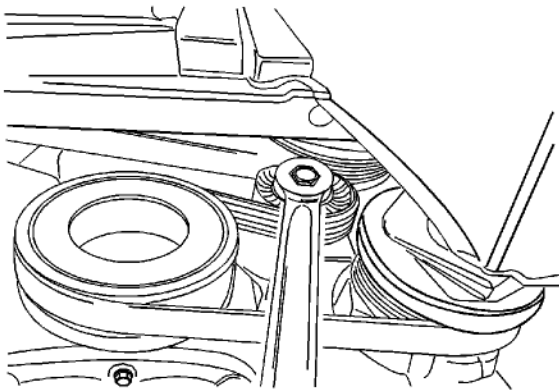
36. Install the upper timing belt cover.
37. Install the upper timing belt cover bolts.

Tighten

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

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

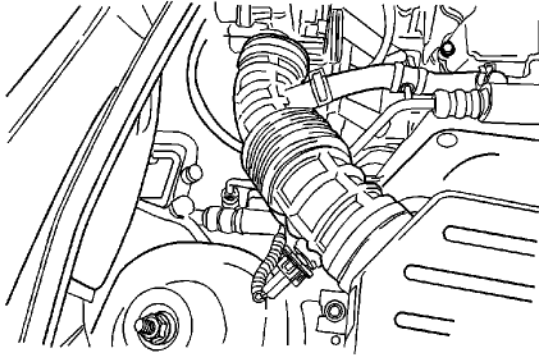
38. Install the serpentine accessory drive belt. Refer to [Power Steering Pump Hoses and Pipes Replacement](#).



39. Install the right front wheel well splash shield.
40. Install the right front wheel. Refer to [Tire and Wheel Removal and Installation](#).
41. Install the air cleaner housing.
42. Install the air cleaner housing bolts.

Tighten

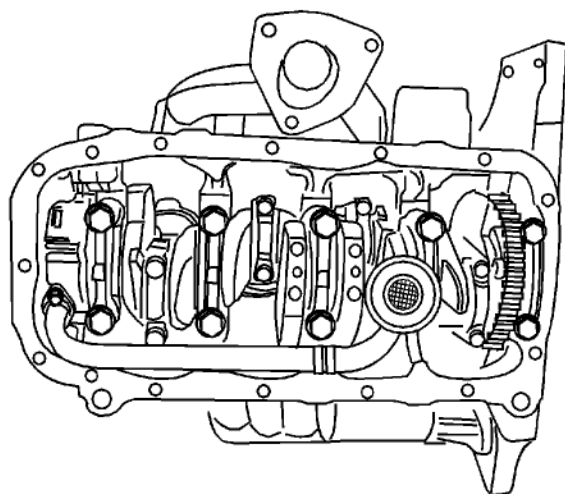
Tighten the air filter housing bolts to 12 N·m (106 lb in).



43. Connect the air intake tube to the throttle body.
44. Connect the breather tube to the valve cover.
45. Connect the IAT sensor connector.
46. Connect the negative battery cable.

Oil Pan Cleaning and Inspection

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

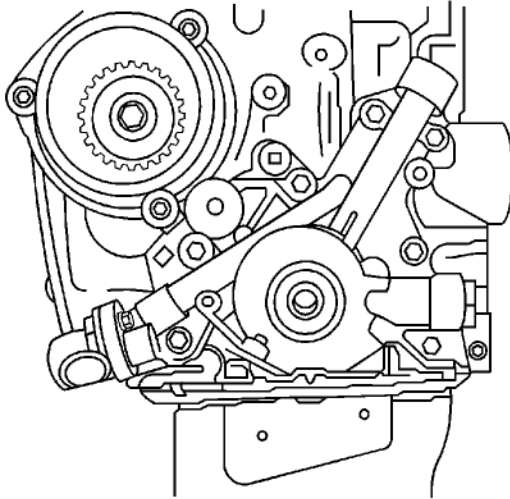


1. Clean the oil pan sealing surface.
2. Clean the engine block sealing surface.
3. Clean the oil pan retaining bolts.
4. Clean the oil pan retaining bolt holes in the engine block.

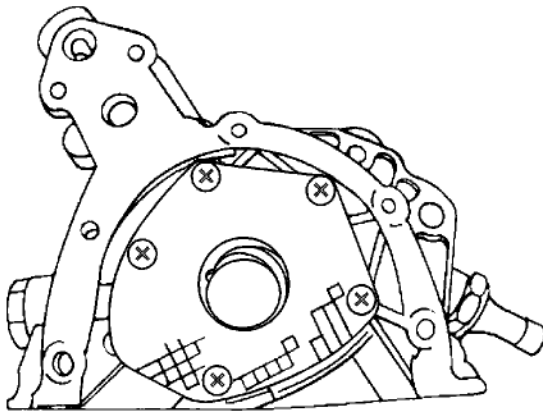
Oil Pump Cleaning and Inspection

Inspection Procedure

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



1. Clean the oil pump and the engine block gasket mating surfaces.
2. Remove the safety relief valve bolt.
3. Remove the safety relief valve and the spring.
4. Remove the oil pump-to-crankshaft seal.





5. Remove the oil pump rear cover bolts.
6. Remove the rear cover.
7. Clean the oil pump housing and all of the parts.
8. Inspect all of the parts for signs of wear. Refer to [Engine Mechanical Specifications](#).
9. Coat all of the oil pump parts with clean engine oil.
10. Reinstall all of the oil pump parts.

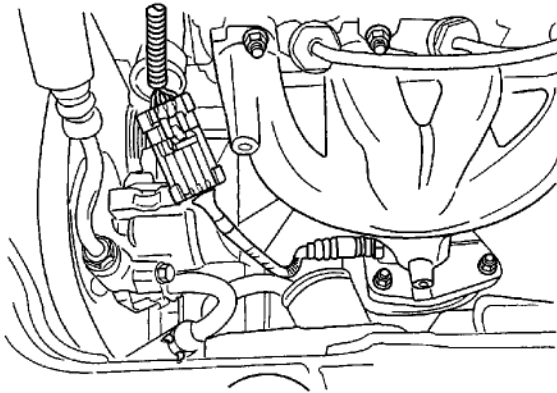
Caution: Fill oil pump cavities with petroleum jelly prior to installation. This will ensure that there is oil pressure immediately on start-up and will prevent engine damage.

11. Install the oil pump rear cover and the bolts. Tighten the bolts to **8 N·m (71 lb in)**.
12. Install the safety relief valve, the spring, the washer, and the bolt. Tighten the bolt to **40 N·m (30 lb ft)**.

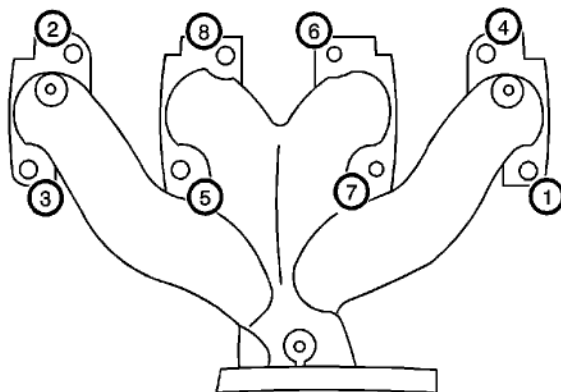
Exhaust Manifold Removal

Removal Procedure

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



1. Disconnect the negative battery cable.
2. Disconnect the ignition wires from the spark plugs.
3. Disconnect the oxygen (O2) sensor.
4. Remove the exhaust manifold heat shield bolts.
5. Remove the exhaust manifold heat shield.
6. Remove the auxiliary catalytic converter upper flange nuts.





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

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

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

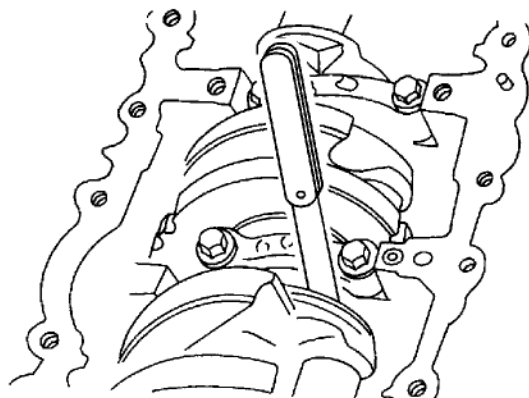
Crankshaft and Bearing Cleaning and Inspection

Special Tools

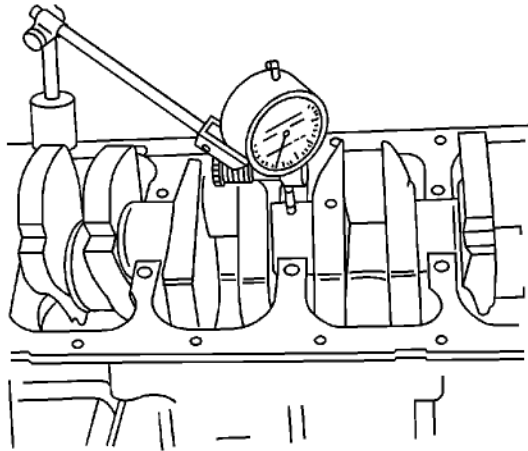
- [KM-470-B](#) Angular Torque Gage
- [J 45059](#) Angle Meter

Inspection Procedure

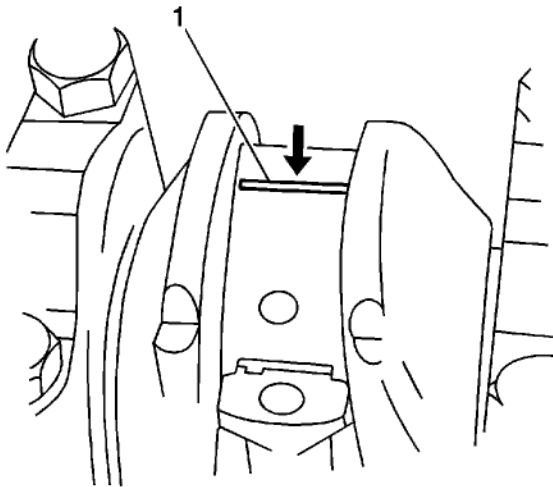
Warning: Refer to [Safety Glasses Warning](#) in the Preface section.



1. Coat the crankshaft bearings with engine oil.
2. Install the upper crankshaft bearings into the engine block crankshaft journals.
3. Install the lower crankshaft bearings into the crankshaft bearing caps.
4. Install the crankshaft.
5. Inspect the crankshaft end play with the crankshaft bearings installed.
6. Check for permissible crankshaft end play. Refer to [Engine Mechanical Specifications](#).

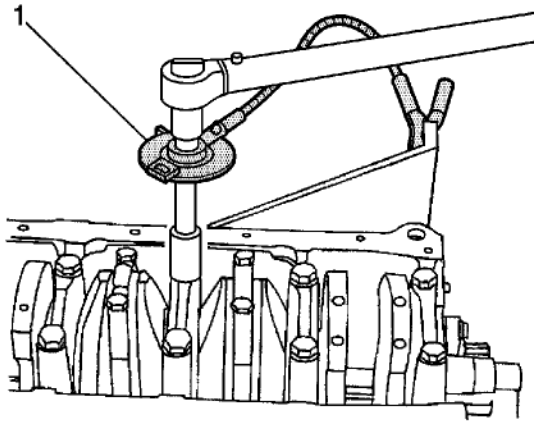


7. With the crankshaft mounted on the front and the rear crankshaft bearings, check the middle crankshaft journal for permissible out-of-round, runout. Refer to [Engine Mechanical Specifications](#).



Note: 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 to the length of the bearing width. Lay them axially (1) between the crankshaft journals and the crankshaft bearings (1).



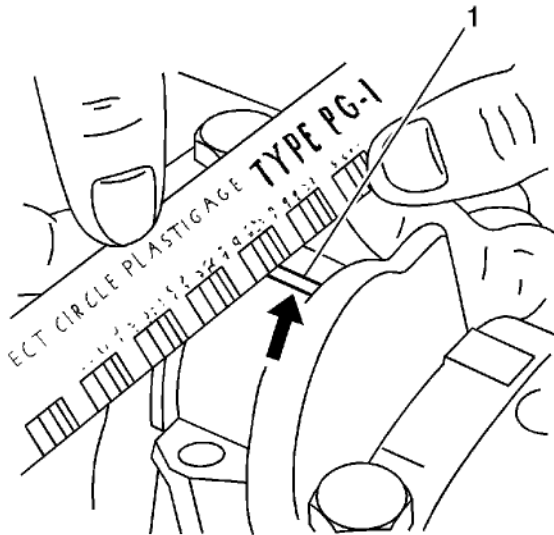
10. Install the crankshaft bearing caps.

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

11. Install the crankshaft bearing cap bolts.

Tighten

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



12. Remove the crankshaft bearing caps.

13. 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.
14. Inspect the bearing clearances for permissible tolerance ranges. Refer to [Engine Mechanical Specifications](#).

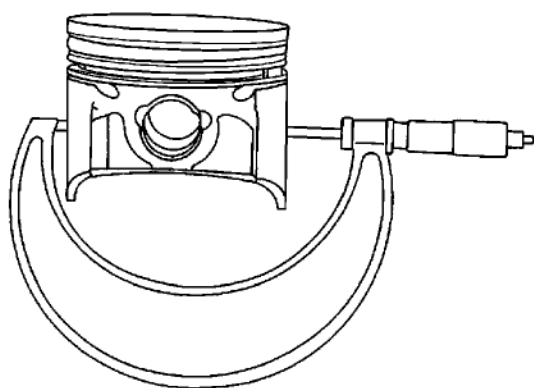
Piston, Connecting Rod, and Bearing Cleaning and Inspection

Special Tools

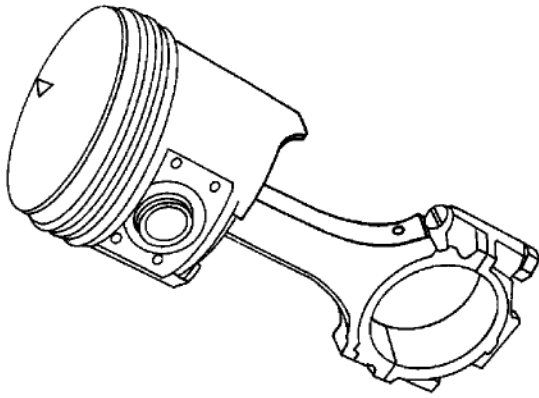
- [KM-470-B](#) Angular Torque Gage
- [J 45059](#) Angle Meter

Piston Inspection

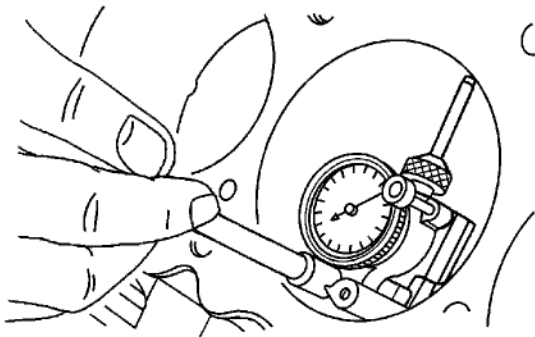
Warning: Refer to [Safety Glasses Warning](#) in the Preface section.



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](#).
6. Inspect the piston for scoring, cracks, and wear.
7. Inspect the piston for taper using a micrometer.



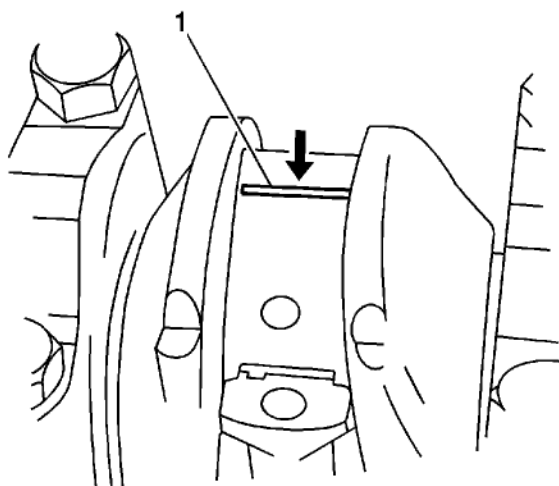
8. Inspect the piston for fit to the connecting rod.



9. Inspect the engine block deck surface for flatness using a straight edge and a feeler gage. Refer to [Engine Mechanical Specifications](#).
10. Inspect the bearing bore for concentricity and alignment using a bore gage. Refer to [Engine Mechanical Specifications](#). If beyond specifications, replace the engine block.
11. Inspect the engine block cylinder bore for wear, runout, ridging, and taper using a bore gage. Refer to [Engine Mechanical Specifications](#).
12. Inspect the engine block cylinder bore for glazing.

Connecting Rod Inspection

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



1. Coat the connecting rod bearings with engine oil.

Note: 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.

2. Install the upper connecting rod bearings into the connecting rod journals.
3. Install the lower connecting rod bearings into the connecting rod bearing caps.
4. Measure all of the connecting rod bearing clearances using a commercial available plastic gaging, ductile plastic threads.
5. Cut the plastic gaging threads (1) to the length of the bearing width. Lay them axially between the connecting rod journals and the connecting rod bearings.
6. Install the connecting rod bearing caps.

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

7. Install the connecting rod bearing cap bolts.

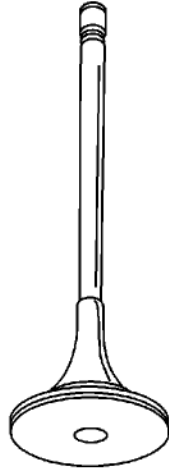
Tighten

- Tighten the connecting rod bearing cap bolts to 25 N·m (18 lb ft).
 - Using the [KM-470-B](#) (1), tighten the connecting rod bearing cap bolts another 30 degrees plus 15 degrees.
8. Remove the connecting rod bearing caps.
 9. Measure the width of the flattened plastic thread of the plastic gaging (1) using the scale printed on the plastic gaging package. Plastic gaging is available for different tolerance ranges.
 10. Inspect the bearing clearance for permissible tolerance ranges. Refer to [Engine Mechanical Specifications](#).

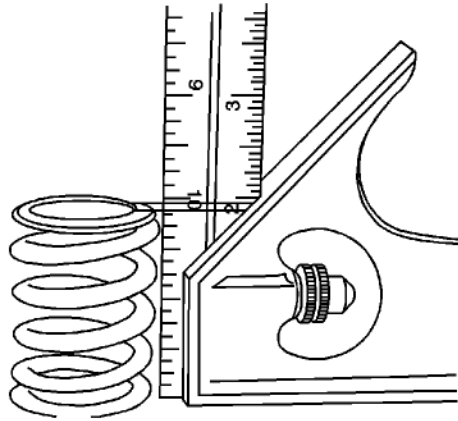
Valve Rocker Arm Cleaning and Inspection

Inspection Procedure

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



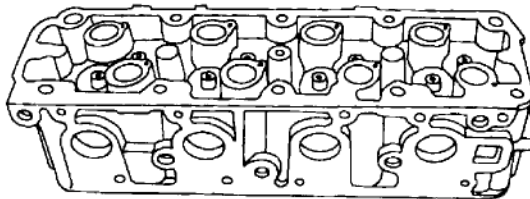
1. Inspect valve stem tip wear.
2. Inspect the valve keeper grooves and oil seal grooves for chips and wear.
3. Inspect the valves for burns or cracks.
4. Inspect the valve stem for burrs and scratches.
5. Inspect the valve stem. The valve stem must be straight.
6. Inspect the valve face for grooving. If the groove is so deep the refacing would result in a sharp edge, replace the valve.



7. Inspect the valve spring. If the valve spring ends are not parallel, replace the valve spring.
8. Measure the valve spring height. Refer to [Engine Mechanical Specifications](#). If the valve spring height does not match the specifications, replace the valve spring.

Cleaning Procedure

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



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

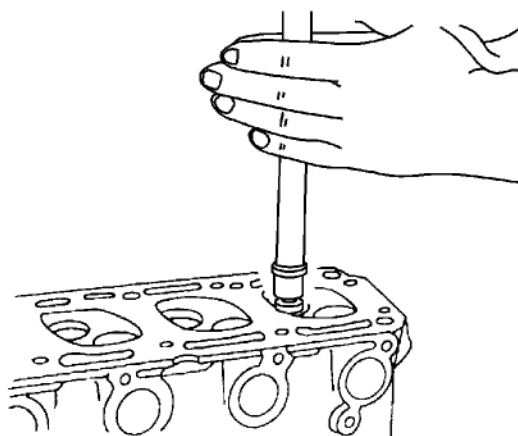
Valve Guide Reaming, and Valve and Seat Grinding

Special Tools

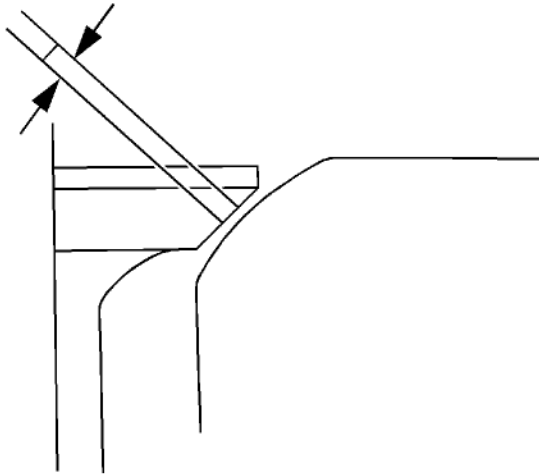
- [KM-253](#) Valve Guide Reamer
- [KM-254](#) Valve Guide Reamer
- [KM-255](#) Valve Guide Reamer
- [KM-340-1-C](#) Cutter Set (KM-340-7, KM-340-13 and KM-340-26 all part of this kit)
- [KM-419](#) Distance Gage
- [KM-571-B](#) Gage or Equivalent

Valve Grind-In

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



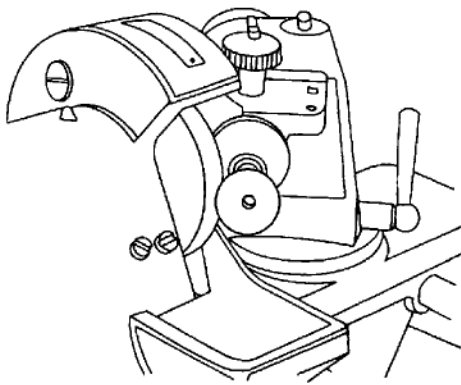
1. Lubricate the valve stem using a fine-grained paste.
2. Lift the valve rhythmically from the seat with a commercially available valve grinding tool in order to distribute the paste.



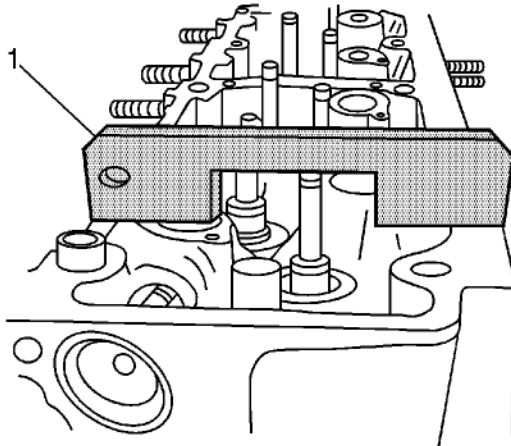
3. Check the contact pattern on the valve head and in the cylinder head.
4. Clean the valves, the valve guides, and the cylinder head.

Valve Grind

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



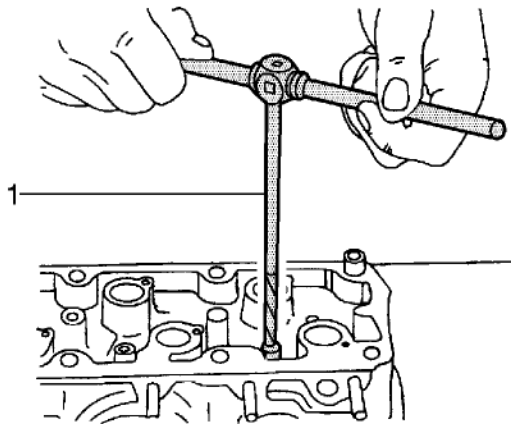
1. Ensure that there are no crater line burns on the valve cone.
2. The valve may be reground only 2 times. Do not grind the valve stem end.
3. The angle at the valve face angle is 46 degrees.



4. Check the valve stem projection using the [KM-419](#) (1).

Valve Guide Ream

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



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

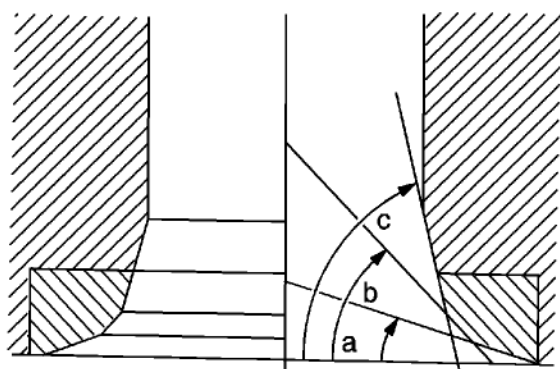
Note: Valve oversizes may already have been fitted in production.

Note: An oversize code is on the valve guide and the valve stem end.

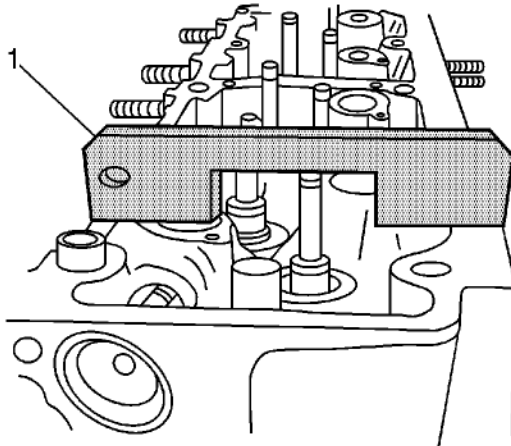
2. An oversize code is on the valve guide and the valve stem end. The valve guide reaming table gives the correct size, reamer (1), and production code for each service code. Refer to the Valve Guide Reaming Table in [Engine Mechanical Specifications](#).
3. Ream the valve guide from the upper side of the cylinder head to the next oversize. After reaming, cross out the code and emboss the valve guide with the new code.

Valve Seat - Cut

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



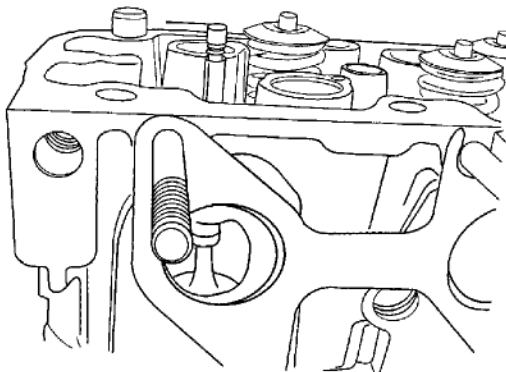
1. Place the cylinder head on wooden blocks.
2. Cut the intake and the exhaust valve seats using the KM-340-7 as follows:
 - The valve seat is a 45-degree (b) side using the KM-340-13.
 - The upper correction angle is a 30-degree (a) side using the KM-340-13.
 - The lower correction angle is a 60-degree (c) side using the KM-340-26.



3. Clean the chippings from the cylinder head.
4. Inspect the dimension for the proper valve seat width.

Specifications

- The intake equals 1.3-1.5 mm (0.051-0.059 in).
 - The exhaust equals 1.6-1.8 mm (0.063-0.071 in).
5. Inspect the valve stem projection using the [KM-419](#) (1).



6. If the dimension is exceeded, install new valves and then check the valve stem projection again. Refer to Valve Grind and Valve Grind-In in the previous supporting text.
7. If the valve stem projection is still too large despite replacing the valves, replace the cylinder head.

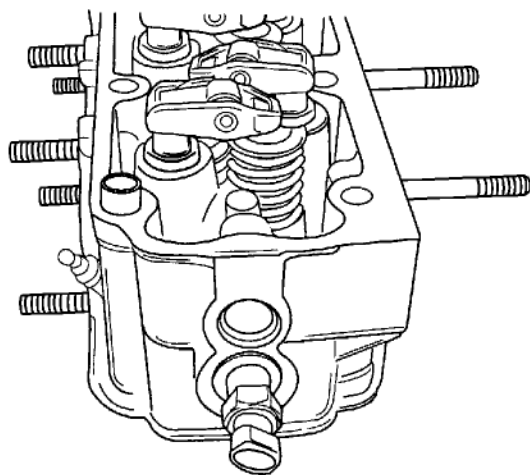
Cylinder Head Disassemble

Special Tools

[J 8062](#) (KM-348) Valve Spring Compressor - Head Off

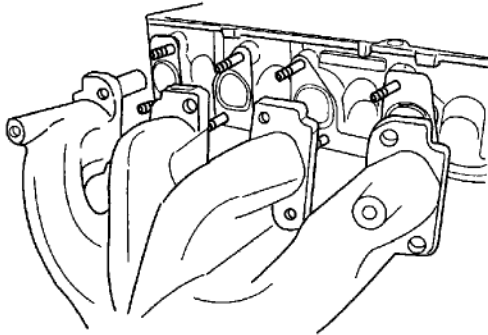
Disassembly Procedure

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

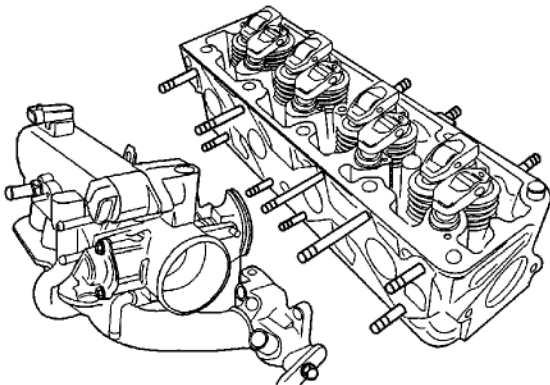


Warning: Valve springs can be tightly compressed. Use care when removing the retainers and plugs. Personal injury could result.

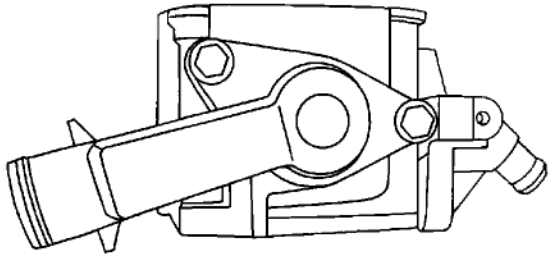
1. Remove the cylinder head with the intake manifold and the exhaust manifold attached. Refer to [Cylinder Head Replacement](#).
2. Remove the coolant temperature sensor.



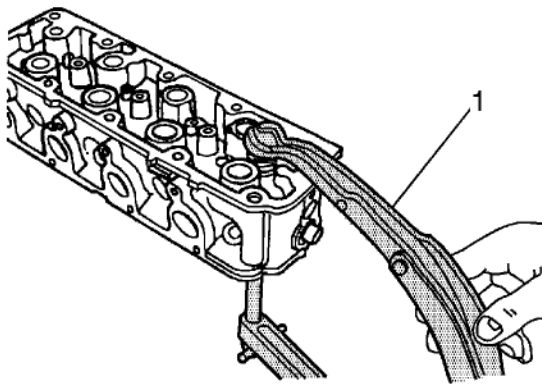
3. Remove the exhaust manifold heat shield bolts.
4. Remove the exhaust manifold heat shield.
5. Remove the exhaust manifold nuts.
6. Remove the exhaust manifold.
7. Remove the exhaust manifold gasket.
8. Remove the exhaust manifold studs.
9. Remove the spark plugs.



10. Remove the intake manifold retaining nuts.
11. Remove the intake manifold.
12. Remove the intake manifold gasket.
13. Remove the intake manifold studs.



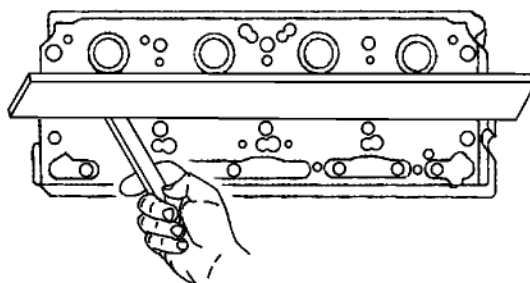
14. Remove the thermostat housing mounting bolts.
15. Remove the thermostat housing.
16. Remove the thermostat and thermostat gasket.



17. Using the [18062](#) (1), compress the valve springs.
18. Remove the valve keys.
19. Remove the valve spring plates.
20. Remove the valve springs.
21. Remove the valves.
22. Remove the valve stem oil seals.
23. Remove camshaft carrier alignment pins.

Cylinder Head Cleaning and Inspection

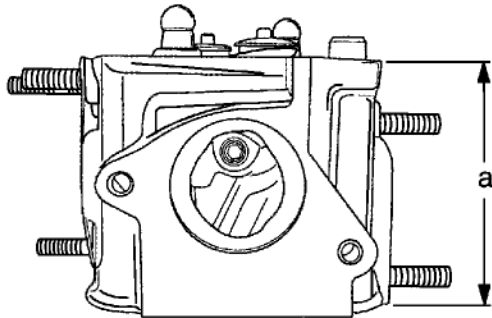
Warning: Refer to [Safety Glasses Warning](#) in the Preface section.



1. Clean the sealing surfaces.
2. Inspect the cylinder head gasket and the mating surfaces for leaks, corrosion, and blowby.
3. Inspect the cylinder head for cracks.
4. Inspect the length and the width of the cylinder head using a feeler gage and a straight edge.
5. Check the sealing surfaces for damage.

Specification

The cylinder head sealing surfaces must be flat within 0.15 mm (0.0059 in) maximum.



6. Measure the height of the cylinder head from sealing surface to sealing surface. The cylinder head height should be 95.9-96.1 mm (3.775-3.783 in) (A). If the cylinder head height is less than 95.9 mm (3.775 in), replace the cylinder head.
7. Inspect all threaded holes for damage.
8. Inspect the valve seats for excessive wear and burned spots.

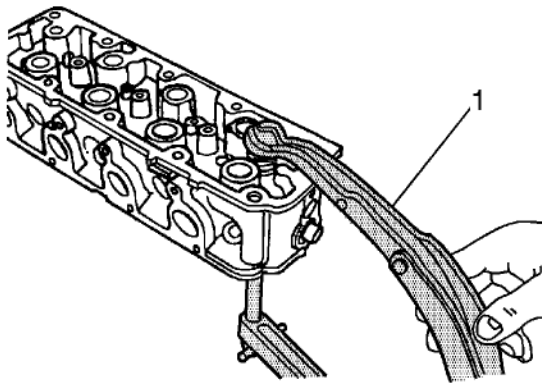
Cylinder Head Assemble

Special Tools

[J 8062](#) (KM-348) Valve Spring Compressor - Head Off

Assembly Procedure

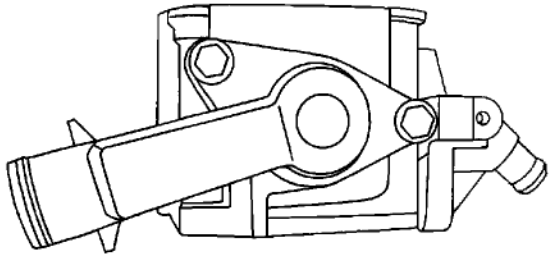
Warning: Refer to [Safety Glasses Warning](#) in the Preface section.



1. Install the camshaft carrier alignment pins.
2. Install new valve stem oil seals.
3. Coat the valves with engine oil.
4. Install the valves.
5. Install the valve springs.

Warning: Valve springs can be tightly compressed. Use care when removing the retainers and plugs. Personal injury could result.

6. Using the [J 8062](#) (1), compress the valve springs.
7. Install the valve keys.
8. Install the valve spring plate.



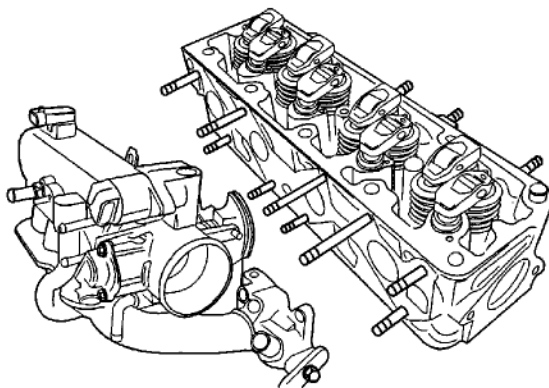
9. Install the thermostat and the gasket.
10. Install the thermostat housing.

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

11. Install the thermostat housing mounting bolts.

Tighten

Tighten the thermostat housing mounting bolts to 20 N·m (15 lb ft).

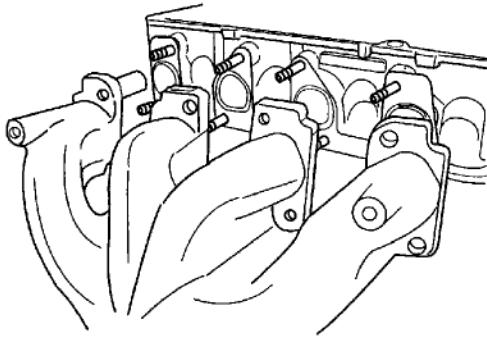


12. Install the intake manifold studs.
13. Install the intake manifold gasket.

14. Install the intake manifold.
15. Install the intake manifold retaining nuts.

Tighten

Tighten the intake manifold retaining nuts to 22 N·m (16 lb ft).



16. Install the spark plugs.

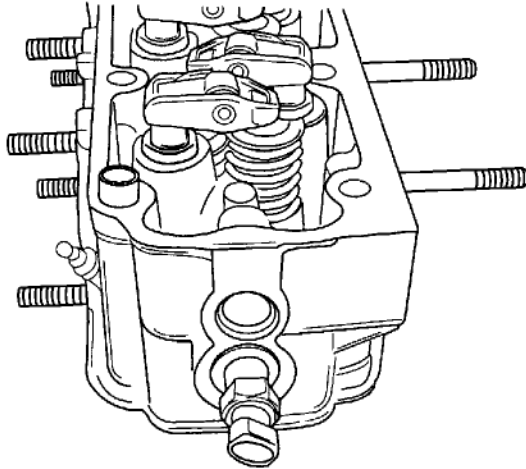
Tighten

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

17. Install the exhaust manifold studs.
18. Install the exhaust manifold gasket.
19. Install the exhaust manifold.
20. Install the exhaust manifold nuts.

Tighten

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



21. Install the exhaust manifold heat shield.
22. Install the exhaust manifold heat shield bolts.

Tighten

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

23. Install the coolant temperature sensor.

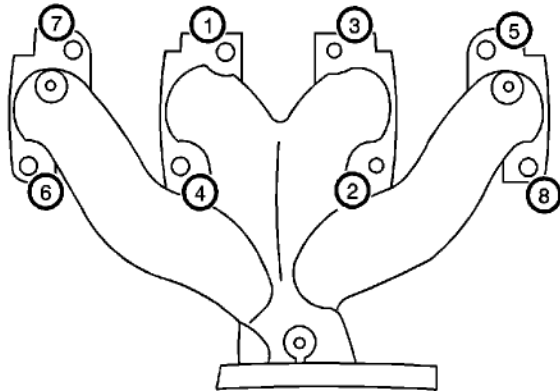
Tighten

Tighten the coolant temperature sensor to 20 N·m (15 lb ft).

24. Install the cylinder head with the intake manifold and the exhaust manifold attached. Refer to [Cylinder Head Replacement](#).

Exhaust Manifold Installation

Installation Procedure



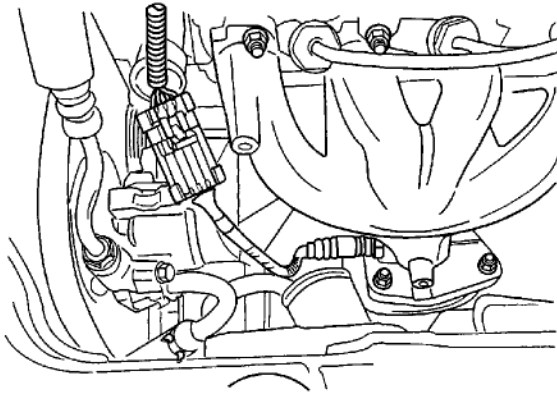
1. Install the exhaust manifold gasket.
2. Install the exhaust manifold.

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

3. Install the 8 exhaust manifold nuts and torque in the sequence shown.

Tighten

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



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

Tighten

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

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

Tighten

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

7. Connect the O2 sensor.
8. Connect the ignition wires to the spark plugs.
9. Connect the negative battery cable.