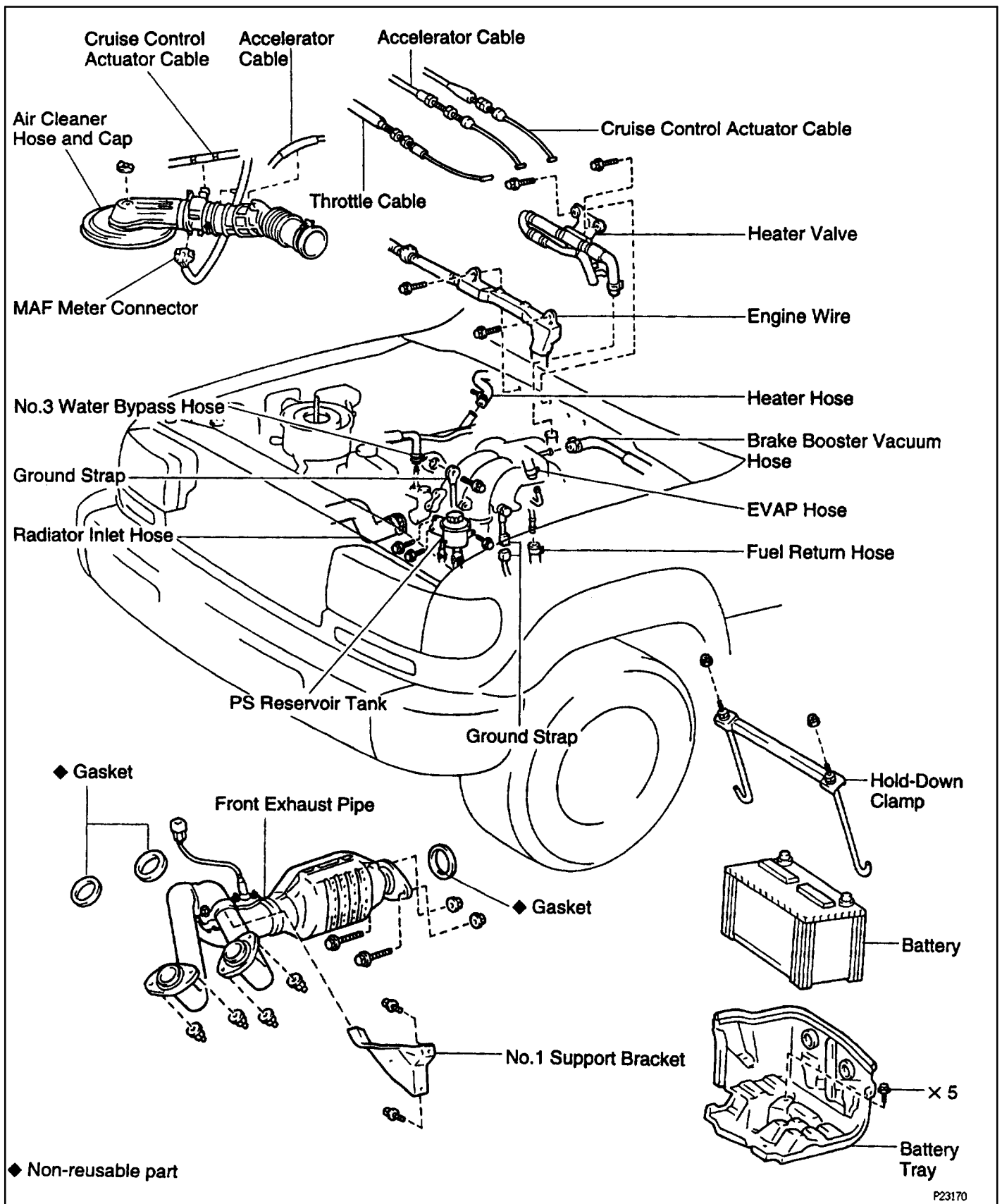
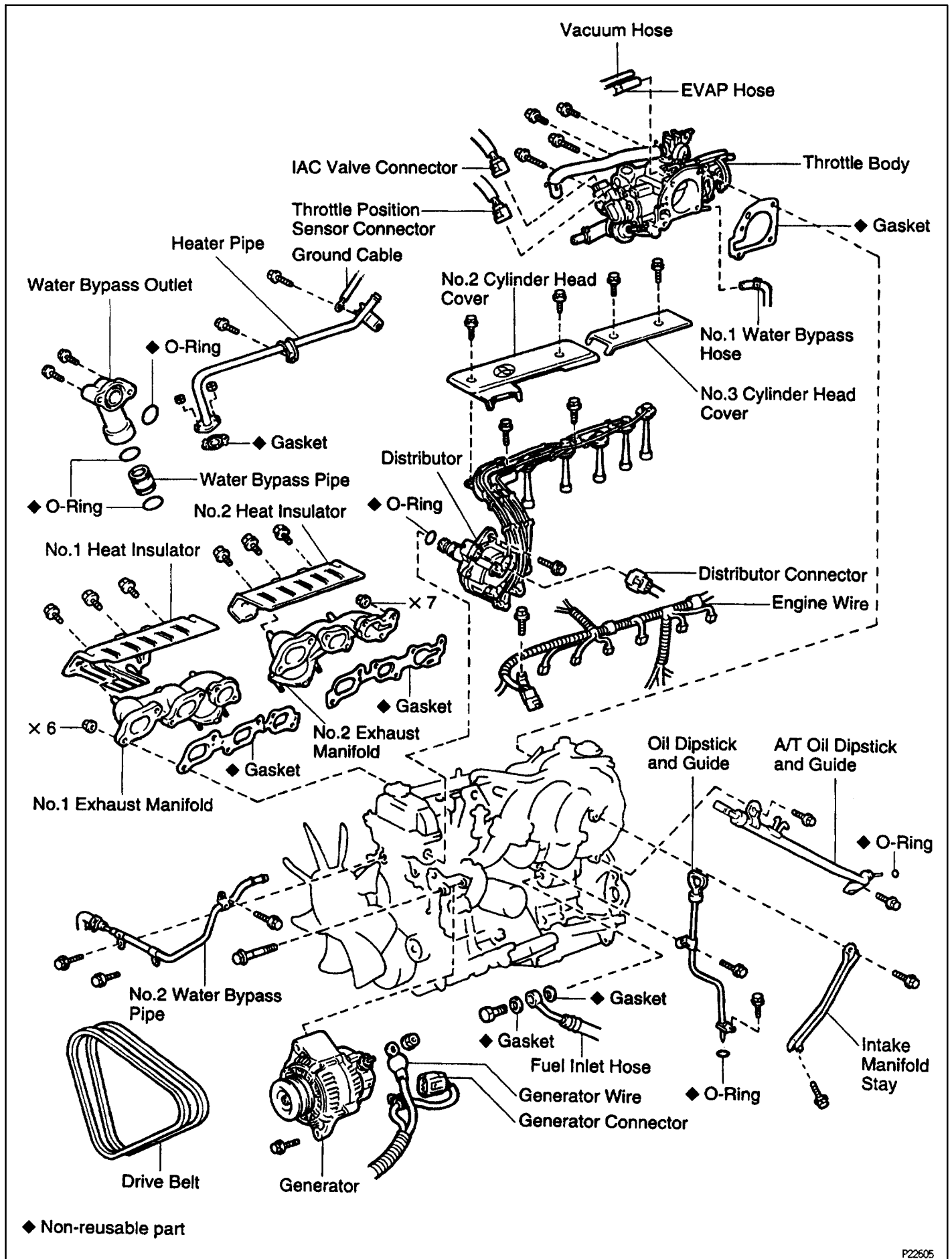
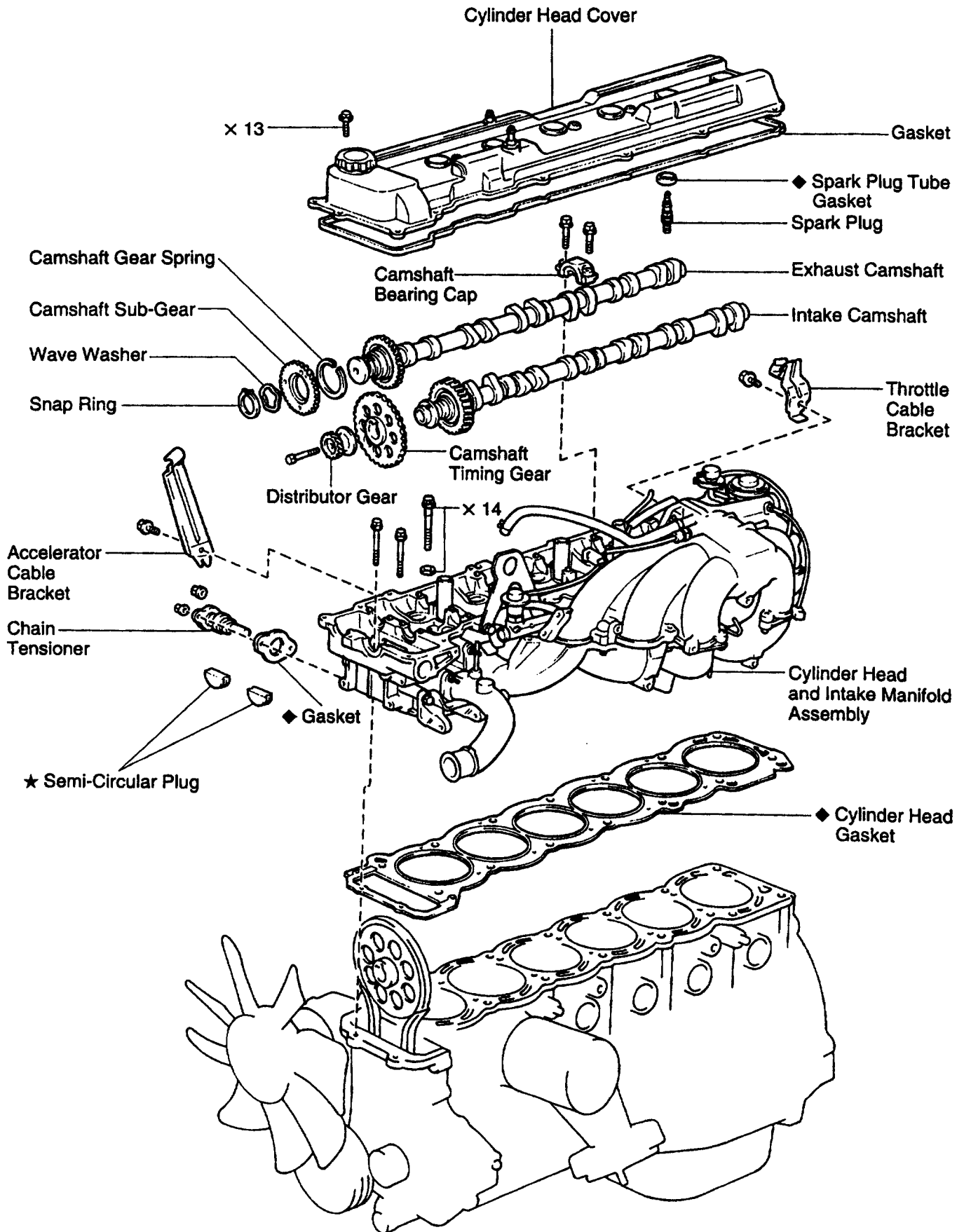
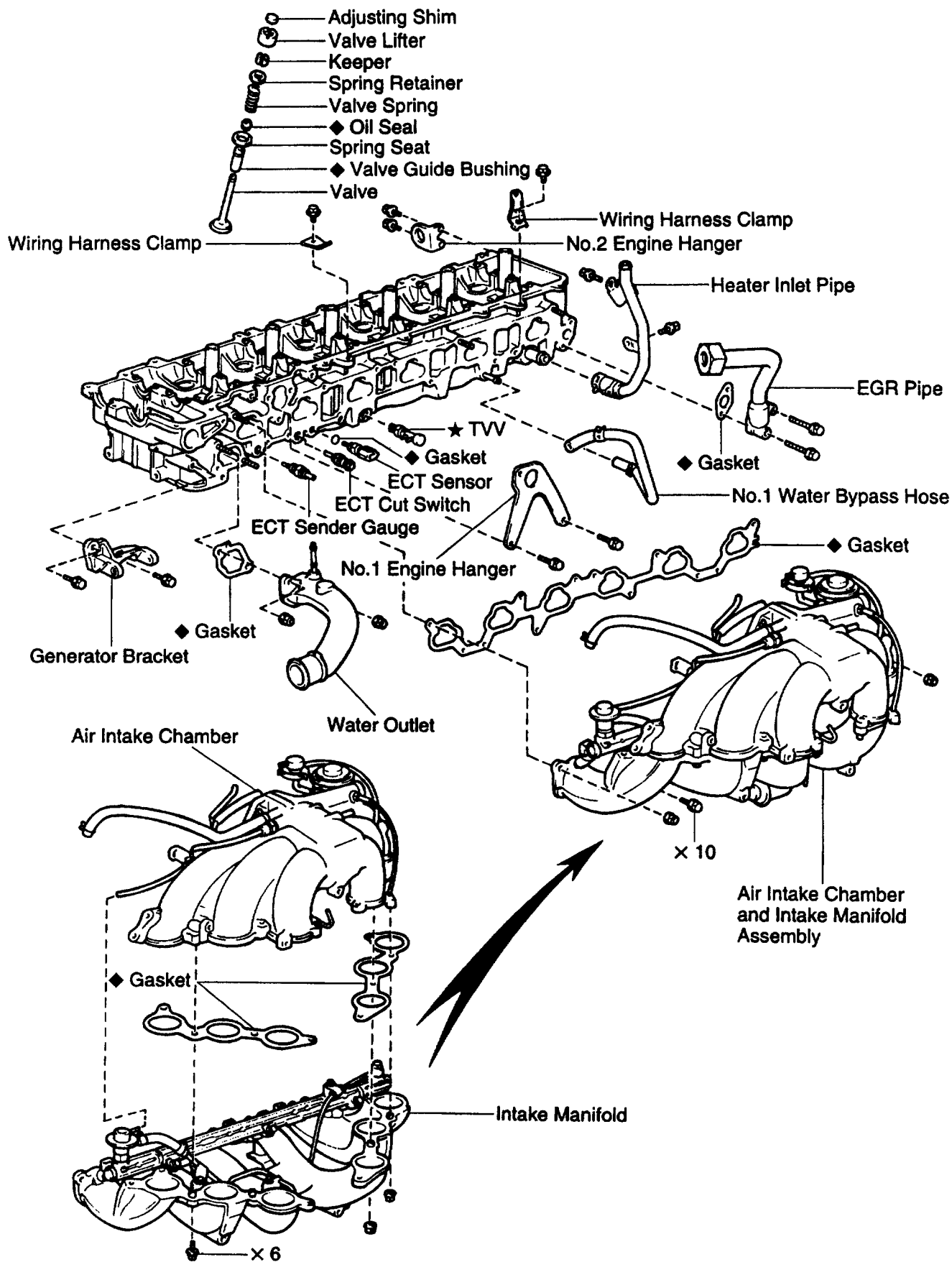


CYLINDER HEAD COMPONENTS FOR REMOVAL AND INSTALLATION

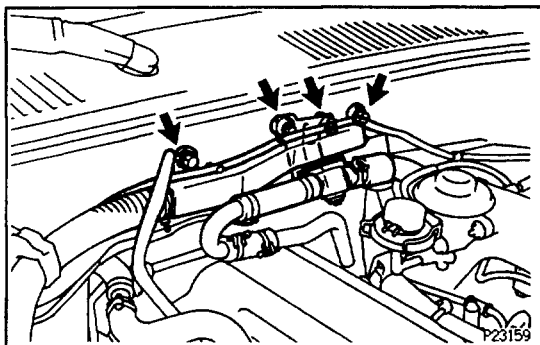
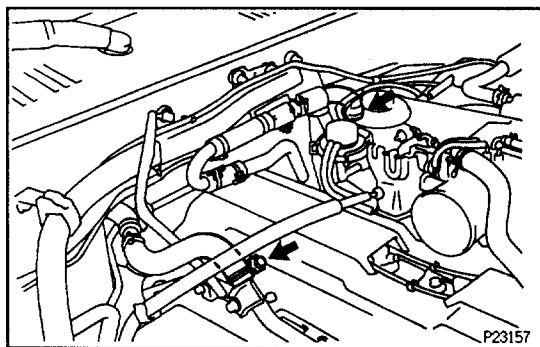
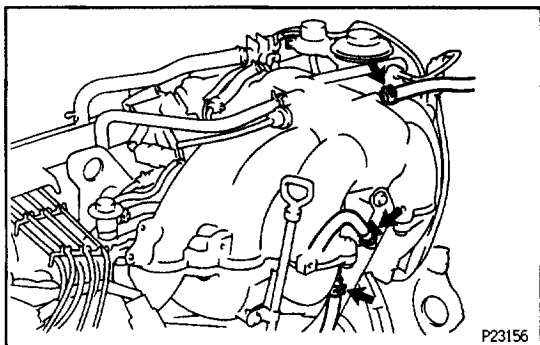
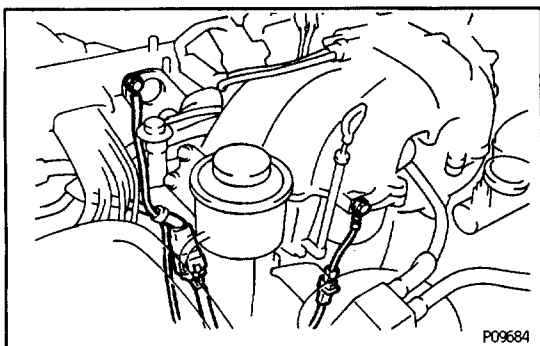
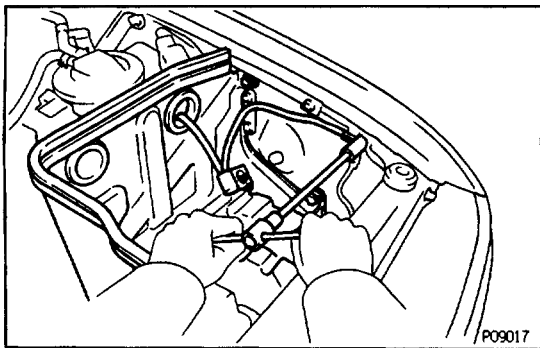






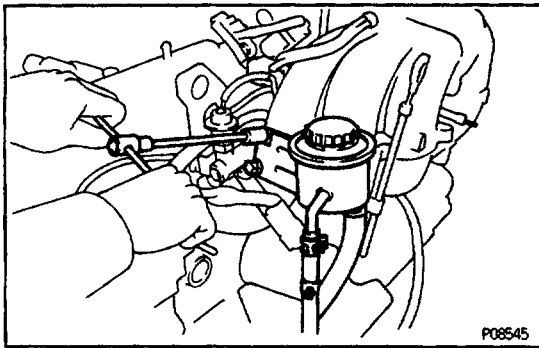


◆ Non-reusable part
★ Precoated part



CYLINDER HEAD REMOVAL

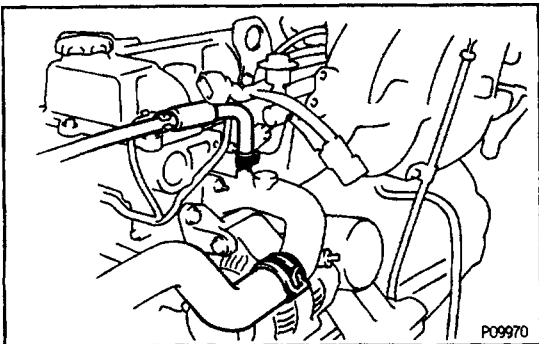
1. **DRAIN ENGINE COOLANT**
2. **REMOVE BATTERY AND BATTERY TRAY**
 - (a) Disconnect the battery cables.
 - (b) Remove the nuts, hold-down clamp and battery.
 - (c) Remove the bolt and disconnect the ground strap.
 - (d) Remove the 5 bolts and battery tray.
3. **REMOVE AIR CLEANER HOSE AND CAP**
4. **DISCONNECT CRUISE CONTROL ACTUATOR CABLE FROM THROTTLE BODY**
5. **DISCONNECT ACCELERATOR CABLE FROM THROTTLE BODY**
6. **DISCONNECT THROTTLE CABLE FROM THROTTLE BODY**
7. **DISCONNECT ENGINE GROUND STRAPS**
Disconnect the following ground straps:
 - Ground strap from No.1 engine hanger
 - Ground strap from air intake chamber
8. **DISCONNECT CONNECTOR ON INTAKE MANIFOLD FROM LH FENDER APRON**
9. **DISCONNECT BRAKE BOOSTER VACUUM HOSE**
10. **DISCONNECT EVAP HOSE**
11. **DISCONNECT FUEL RETURN HOSE**
12. **DISCONNECT HEATER HOSES**
13. **DISCONNECT ENGINE WIRE AND HEATER VALVE FROM COWL PANEL**
 - (a) Remove the 2 bolts and disconnect the engine wire and ground strap.
 - (b) Remove the 2 bolts and disconnect the heater valve.
14. **REMOVE NO.2 AND NO.3 CYLINDER HEAD COVERS**
Remove the 4 bolts and head covers.

**15. REMOVE DISTRIBUTOR**

(See distributor removal in Ignition System)

16. DISCONNECT PS RESERVOIR TANK

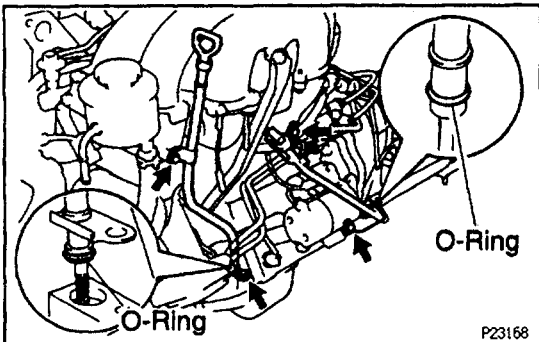
Remove the 3 bolts and disconnect the reservoir tank.

**17. DISCONNECT RADIATOR INLET HOSE****18. DISCONNECT NO.3 WATER BYPASS HOSE****19. REMOVE GENERATOR**

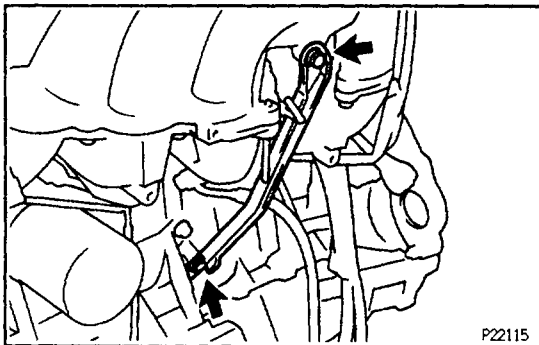
(See generator removal in Charging System)

20. REMOVE THROTTLE BODY

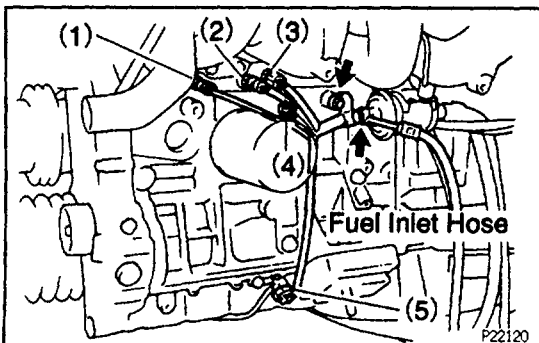
(See throttle body removal in SFI System)

**21. REMOVE OIL DIPSTICKS AND GUIDES FOR ENGINE AND TRANSMISSION**

- (a) Remove the 2 mounting bolts.
- (b) Pull out the dipstick together with dipstick guide.
- (c) Remove the O-ring from the dipstick guide.

**22. REMOVE INTAKE MANIFOLD STAY**

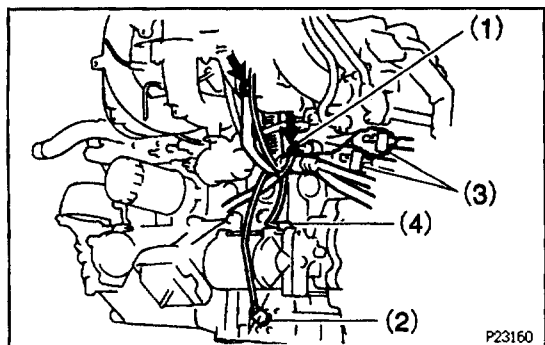
Remove the 2 bolts and intake manifold stay.

**23. DISCONNECT FUEL INLET HOSE**

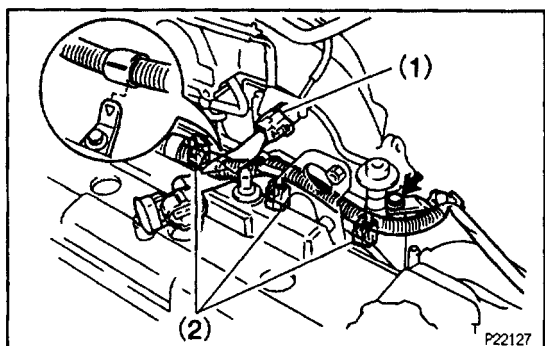
Remove the union bolt and 2 gaskets, and disconnect the fuel inlet hose from the fuel filter.

24. DISCONNECT ENGINE WIRE

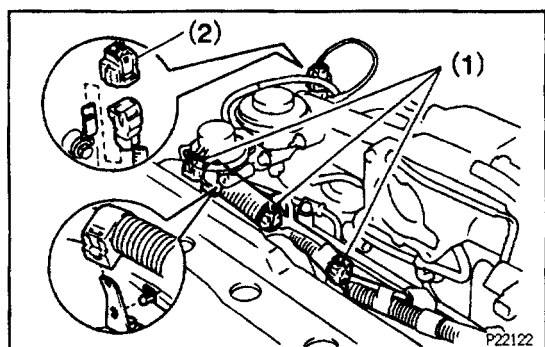
- (a) Disconnect these connectors:
 - (1) ECT sender gauge connector
 - (2) ECT cut switch connector
 - (3) ECT sensor connector
 - (4) Knock sensor connector
 - (5) Crankshaft position sensor connector
- (b) Remove the bolt and disconnect the engine wire from the cylinder block.



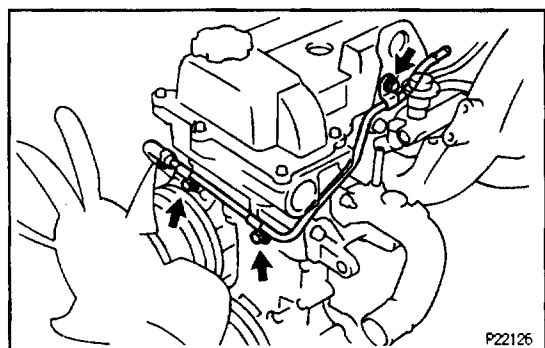
- (c) Disconnect these connectors:
 - (1) Knock sensor connector
 - (2) Oil level sensor connector
 - (3) 2 connectors from transmission
 - (4) Starter connector
- (d) Disconnect the 2 heated oxygen sensor connectors.
- (e) Disconnect the PNP switch connector.
- (f) Remove the 2 bolts and disconnect the engine wire from the intake manifold and cylinder block.



- (g) Disconnect the PCV hose from the PCV valve.
- (h) Remove the bolt holding the engine wire to the intake manifold.
- (i) Disconnect these connectors:
 - (1) Connector for emission control valve set assembly
 - (2) 3 injector connectors
- (j) Disconnect the engine wire clamp.

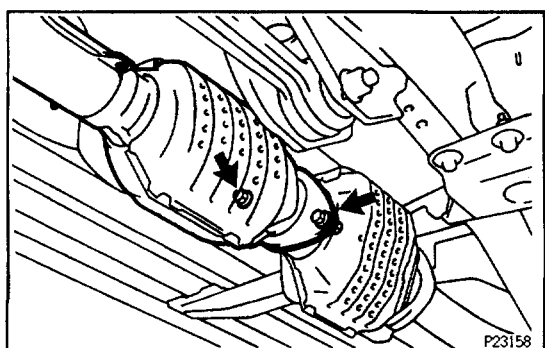


- (k) Disconnect the engine wire clamp.
- (l) Disconnect these connectors:
 - (1) 3 injector connectors
 - (2) EGR gas temp. sensor connector
- (m) Disconnect the clamp of the No.6 injector wire from the bracket.
- (n) Disconnect the engine wire from the cylinder head and intake manifold.



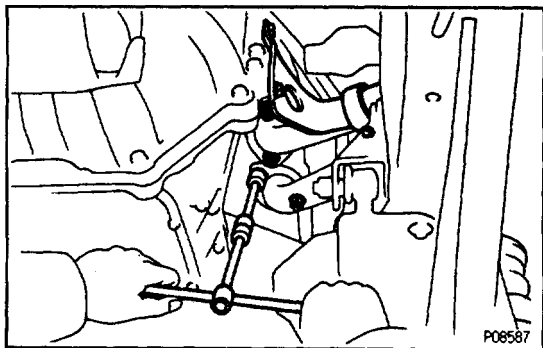
25. DISCONNECT NO.2 WATER BYPASS PIPE

Remove the 3 bolts, and disconnect the bypass pipe from the cylinder head.

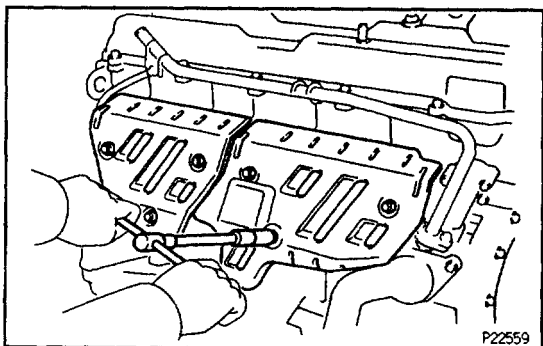


26. REMOVE FRONT EXHAUST PIPE

- (a) Disconnect the heated oxygen sensor connector.
- (b) Remove the 2 nuts and 2 bolts holding the front exhaust pipe to the rear TWC.
- (c) Disconnect the front exhaust pipe, and remove the gasket.

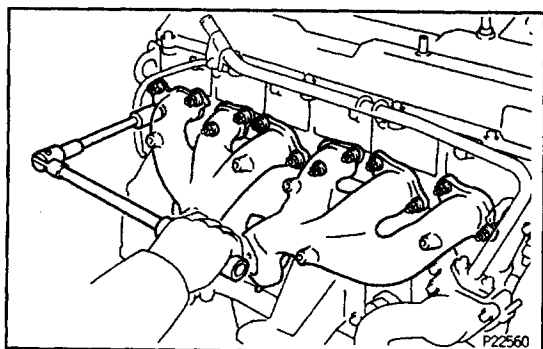


- (d) Loosen the clamp bolt and disconnect the clamp from the No.1 support bracket.
- (e) Remove the 2 bolts and No.1 support bracket.
- (f) Remove the 4 nuts, front exhaust pipe and 2 gaskets.

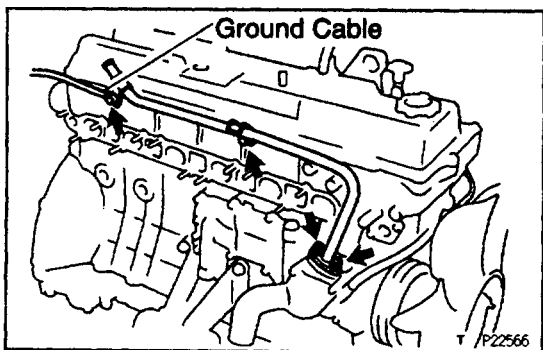


27. REMOVE NO.1 AND NO.2 EXHAUST MANIFOLDS

- (a) Remove the 6 bolts, No.1 heat insulator and No.2 heat insulator.

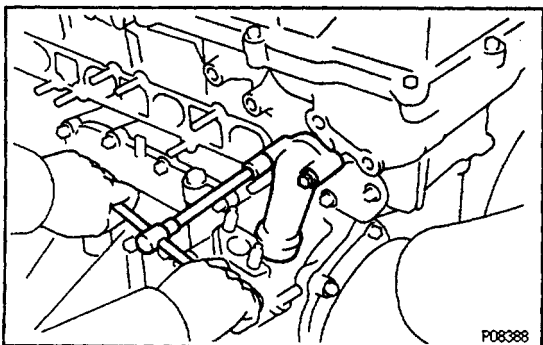


- (b) Remove the 13 nuts, No.1 exhaust manifold, No.2 exhaust manifold and 2 gaskets.



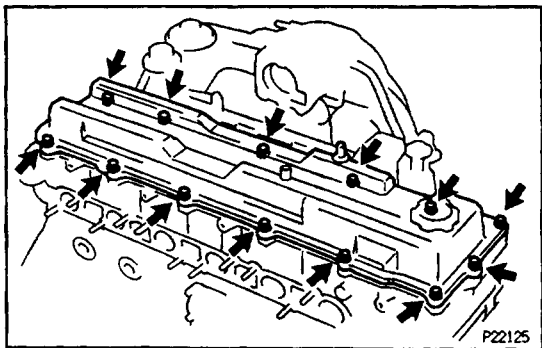
28. REMOVE HEATER PIPE

Remove the 2 bolts, 2 nuts, ground cable, heater pipe and gasket.

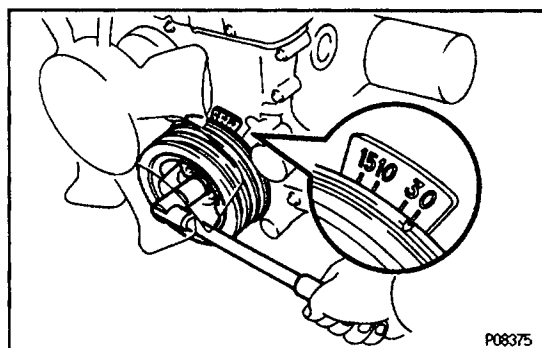


29. REMOVE WATER BYPASS OUTLET AND PIPE

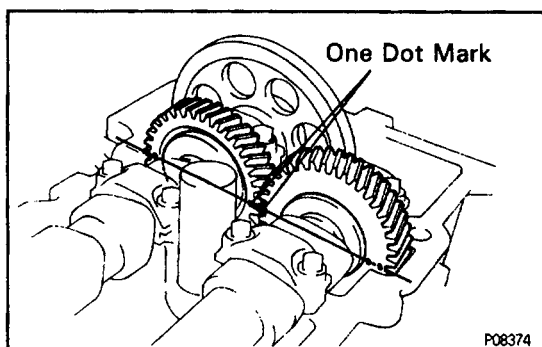
- (a) Remove the 2 bolts and water bypass outlet and pipe.
- (b) Remove the 3 O-rings from the water bypass outlet and pipe.

**30. REMOVE CYLINDER HEAD COVER**

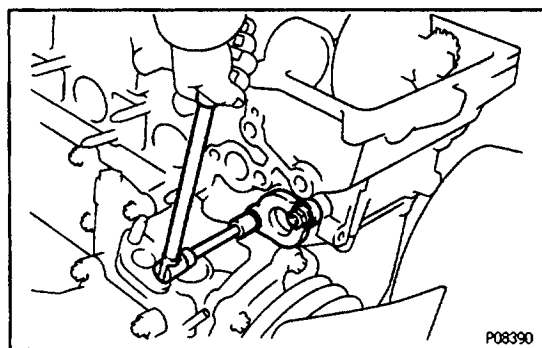
Remove the 13 bolts, cylinder head cover and gasket.

31. REMOVE SPARK PLUGS**32. SET NO.1 CYLINDER TO TDC/COMPRESSION**

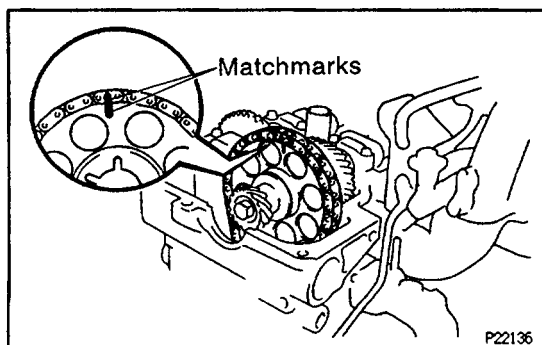
- (a) Turn the crankshaft pulley and align its groove with the "0" mark on the timing chain cover.



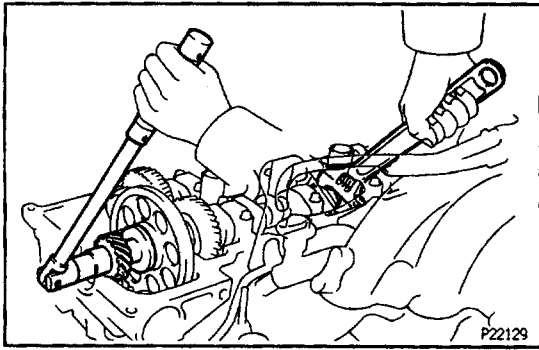
- (b) Check that the timing marks (one and two dots) of the camshaft drive and driven gears are in straight line on the cylinder head surface as shown in the illustration. If not, turn the crankshaft 1 revolution (360°) and align the marks as above.

**33. REMOVE CHAIN TENSIONER**

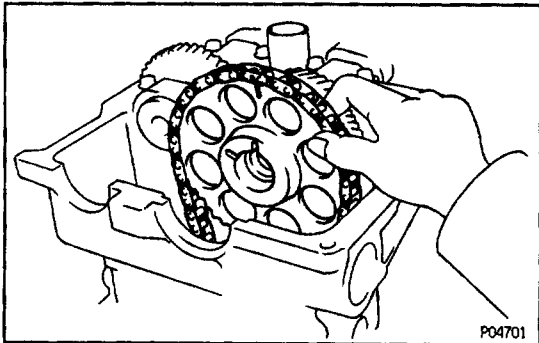
Remove the 2 nuts, chain tensioner and gasket.

**34. REMOVE CAMSHAFT TIMING GEAR**

- (a) Remove the semi-circular plug.
 (b) Place the matchmarks on the camshaft timing gear and timing chain.



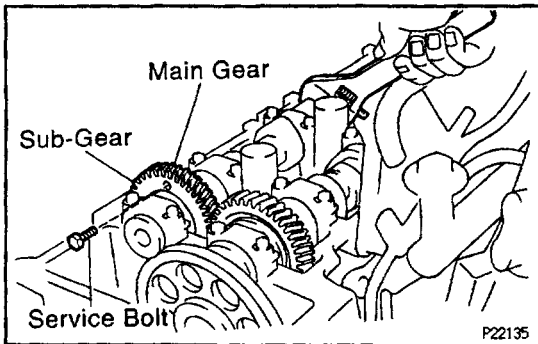
- (c) Hold the intake camshaft with a wrench, remove the bolt and distributor gear.



- (d) Remove the camshaft timing gear and chain from the intake camshaft and leave on the slipper and damper.

35. REMOVE CAMSHAFTS

NOTICE: Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being removed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.



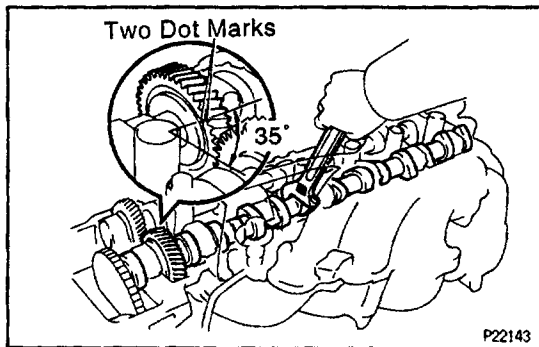
A. Remove exhaust camshaft

- (a) Bring the service bolt hole of the driven sub-gear upward by turning the hexagon wrench head portion of the exhaust camshaft with a wrench.
- (b) Secure the exhaust camshaft sub-gear to the main gear with a service bolt.

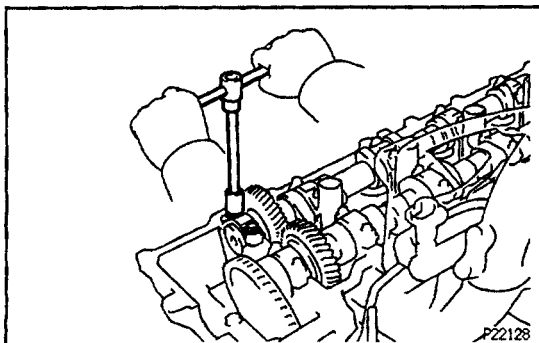
Recommended service bolt:

Thread diameter	6 mm
Thread pitch	1.0 mm
Bolt length	16 – 20 mm (0.63–0.79 in.)

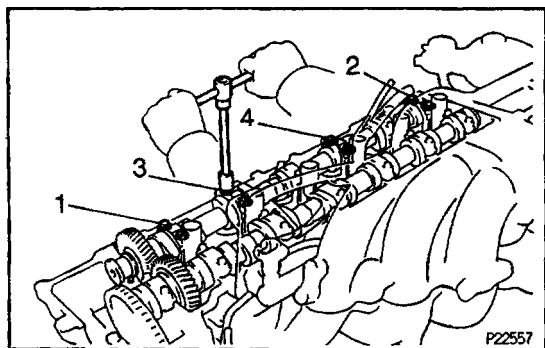
HINT: When removing the camshaft, make sure that the torsional spring force of the sub-gear has been eliminated by the above operation.



- (c) Set the timing mark (two dot marks) of the camshaft driven gear at approx. 35° angle by turning the hexagon wrench head portion of the intake camshaft with a wrench.



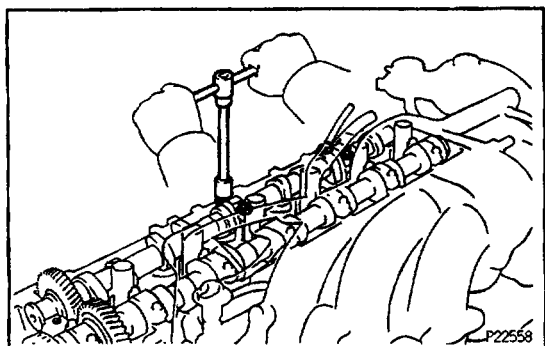
- (d) Lightly push the camshaft towards the rear without applying excessive force.
- (e) Loosen and remove the No.1 bearing cap bolts, alternately loosening the left and right bolts uniformly.



- (f) Loosen and remove the No.2, No.3, No.5 and No.7 bearing cap bolts, alternately loosening the left and right bolts uniformly in several passes, in the sequence shown.

NOTICE: Do not remove the No.4 and No.6 bearing cap bolts at this stage.

- (g) Remove the 4 bearing caps.

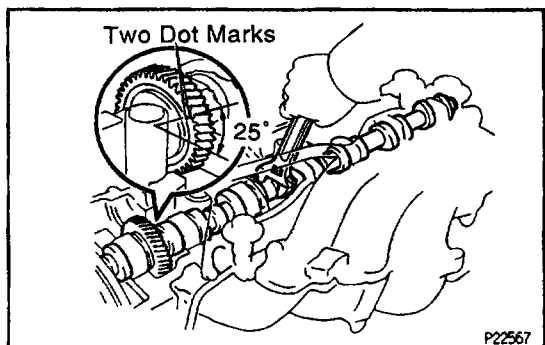


- (h) Alternately and uniformly loosen and remove the No.4 and No.6 bearing cap bolts.

HINT:

- As the 4 No.4 and No.6 bearing cap bolts are loosened, make sure that the camshaft is lifted out straight and level.
- If the camshaft is not being lifted out straight and level, retighten the 4 No.4 and No.6 bearing cap bolts. Then reverse the order of above steps from (g) to (e) and repeat steps from (c) to (h) once again.

NOTICE: Do not pry on or attempt to force the camshaft with a tool or other object.



- (i) Remove the 2 bearing caps and exhaust camshaft.

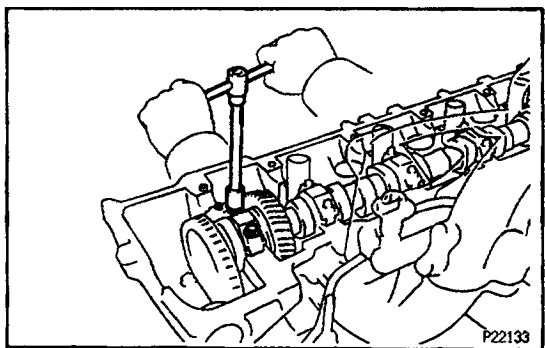
B. Remove intake camshaft

- (a) Set the timing mark (two dot marks) of the camshaft drive gear at approx. 25° angle by turning the hexagon wrench head portion of the intake camshaft with a wrench.

HINT: The above angle arrows the No.1 and No.4 cylinder cam lobes of the intake camshaft to push their valve lifters evenly.

- (b) Lightly push the intake camshaft towards the front without applying excessive force.

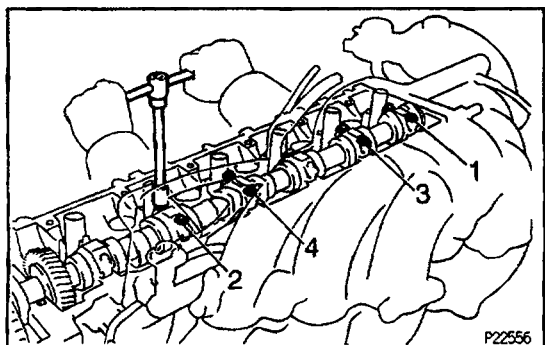
- (c) Loosen and remove the No.1 bearing cap bolts, alternately loosening the left and right bolts uniformly.

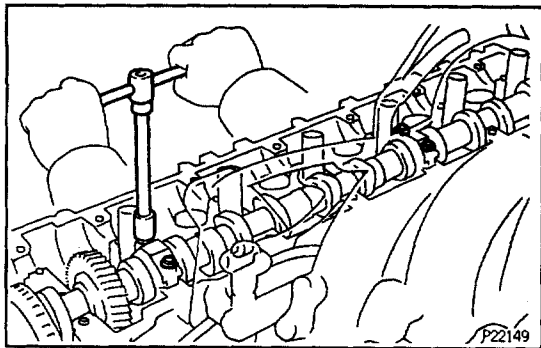


- (d) Loosen and remove the No.3, No.4, No.6 and No.7 bearing cap bolts, alternately loosening the left and right bolts uniformly in several passes, in the sequence shown.

NOTICE: Do not remove the No.2 and No.5 bearing cap bolts at this stage.

- (e) Remove the 4 bearing caps.





- (f) Alternately and uniformly loosen and remove the No.2 and No.5 bearing cap bolts.

HINT:

- As the 4 No.2 and No.5 bearing cap bolts are loosened, make sure that the camshaft is lifted out straight and level.
- If the camshaft is not being lifted out straight and level, retighten the 4 No.2 and No.5 bearing cap bolts. Then reverse the order of above steps from (e) to (c) and repeat steps from (a) to (f) once again.

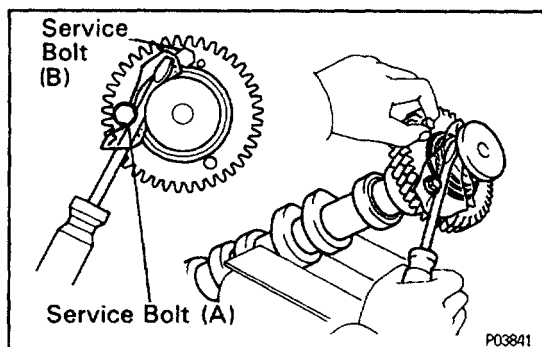
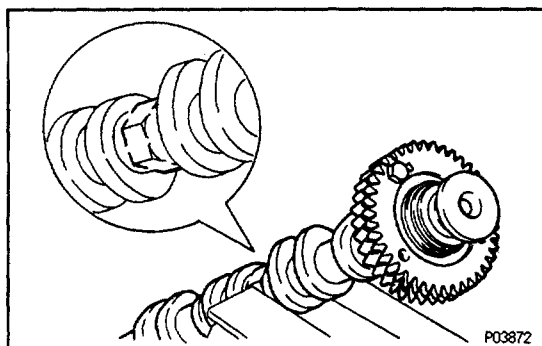
NOTICE: Do not pry on or attempt to force the camshaft with a tool or other object.

- (g) Remove the 2 bearing caps and exhaust camshaft.

36. DISASSEMBLE EXHAUST CAMSHAFT

- (a) Mount the hexagon wrench head portion of the camshaft in a vise.

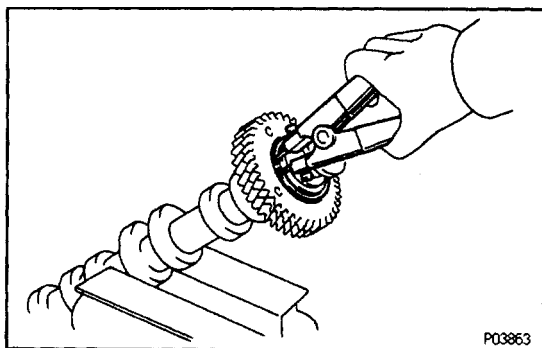
NOTICE: Be careful not to damage the camshaft.



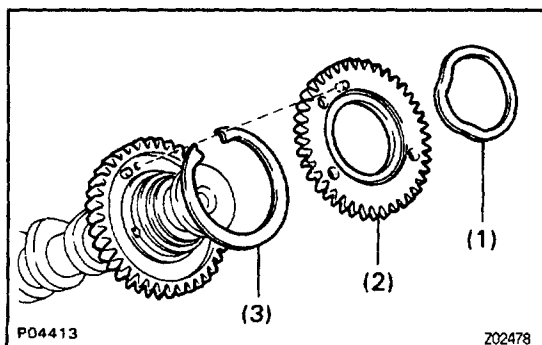
- (b) Insert a service bolt (A) into the service hole of the camshaft sub-gear.

- (c) Using a screwdriver, turn the sub-gear clockwise, and remove the service bolt (B).

NOTICE: Be careful not to damage the camshaft.

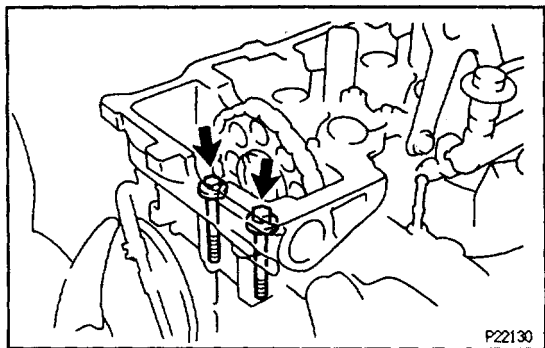


- (d) Using snap ring pliers, remove the snap ring.



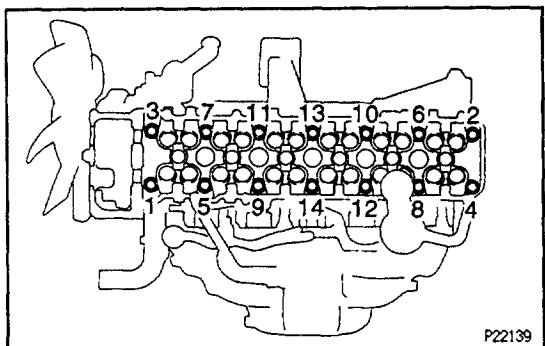
- (e) Remove the following parts:

- (1) Wave washer
- (2) Camshaft sub-gear
- (3) Camshaft gear spring



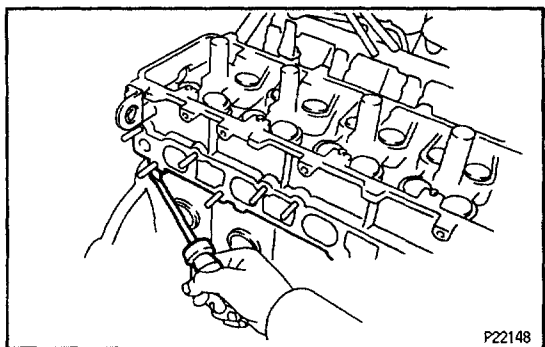
37. REMOVE CYLINDER HEAD AND INTAKE MANIFOLD ASSEMBLY

- (a) Remove the 2 bolts in front of the head before the other head bolts are removed.



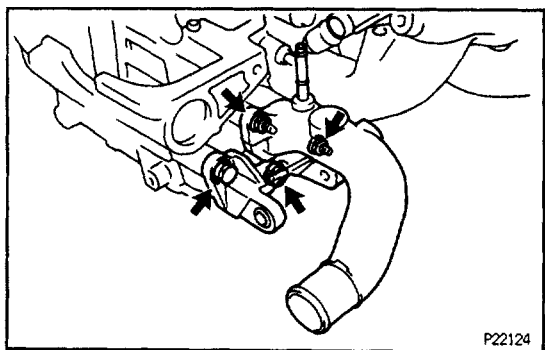
- (b) Uniformly loosen and remove the 14 cylinder head bolts, in several passes, in the sequence shown.

NOTICE: Cylinder head warpage or cracking could result from removing bolts in incorrect order.



- (c) Lift the cylinder head from the dowels on the cylinder block, and place the cylinder head on wooden blocks on a bench. HINT: If the cylinder head is difficult to lift off, pry between the cylinder head and cylinder block with a screwdriver.

NOTICE: Be careful not to damage the contact surfaces of the cylinder head and cylinder block.

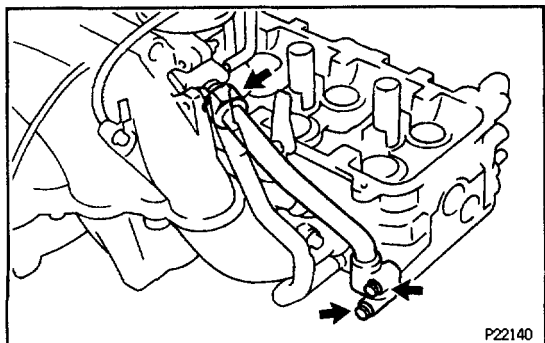


38. REMOVE GENERATOR BRACKET

Remove the 2 bolts and generator bracket.

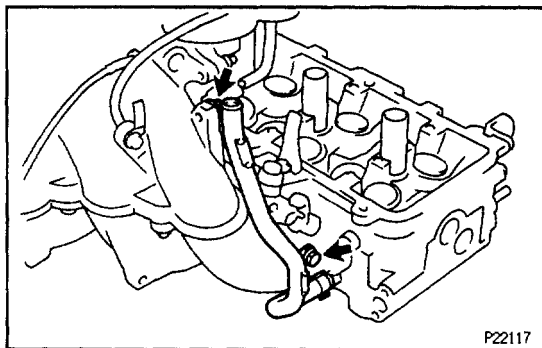
39. REMOVE WATER OUTLET

Remove the 2 nuts, water outlet and gasket.

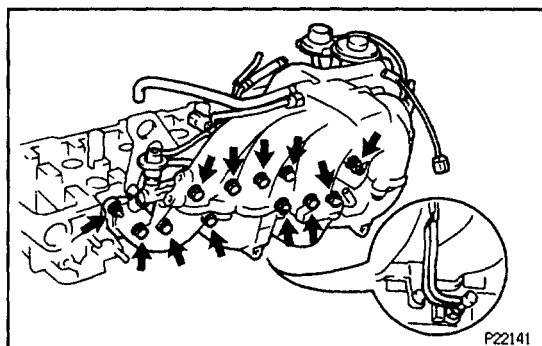


40. REMOVE EGR PIPE

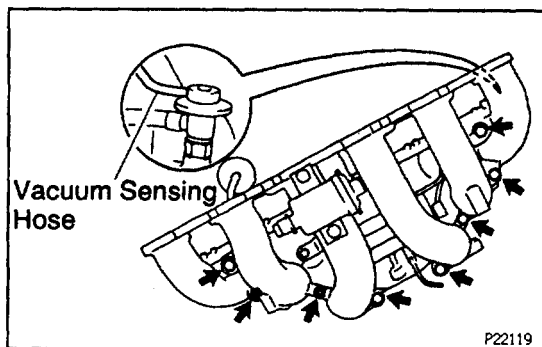
- (a) Loosen the union nut.
(b) Remove the 2 bolts, EGR pipe and gasket.

**41. REMOVE HEATER INLET PIPE AND HOSE**

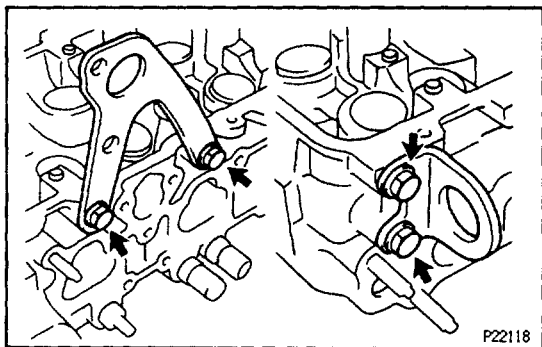
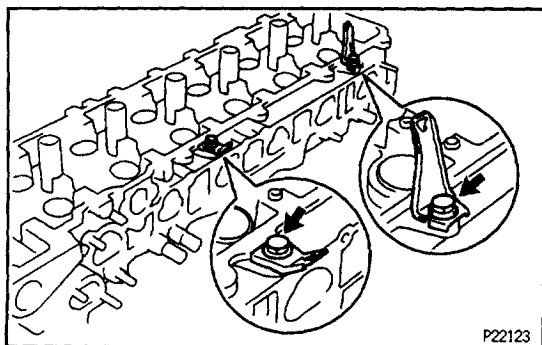
Remove the 2 bolts, and disconnect the pipe and hose.

**42. REMOVE AIR INTAKE CHAMBER AND INTAKE MANIFOLD ASSEMBLY**

- (a) Disconnect the 2 vacuum hoses from the TVV.
- (b) Remove the 10 bolts, 2 nuts, intake manifold and gasket.

**43. DISASSEMBLE AIR INTAKE CHAMBER AND INTAKE MANIFOLD ASSEMBLY**

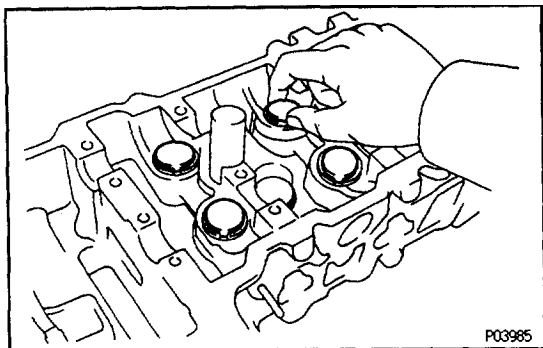
- (a) Disconnect the vacuum sensing hose from the fuel pressure regulator.
- (b) Remove the 6 bolts, 2 nuts, air intake chamber and 2 gaskets from the intake manifold.

44. REMOVE NO.1 WATER BYPASS HOSE**45. REMOVE NO.1 AND NO.2 ENGINE HANGERS****46. REMOVE 2 ENGINE WIRE CLAMP BRACKETS**

Remove the 2 bolts and 2 wire clamp brackets.

47. REMOVE ACCELERATOR CABLE BRACKET AND THROTTLE CABLE BRACKET

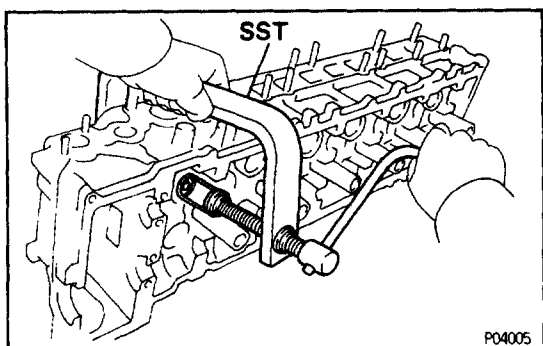
Remove the 2 bolts and 2 cable brackets.



CYLINDER HEAD DISASSEMBLY

1. REMOVE VALVE LIFTERS AND SHIMS

HINT: Arrange the valve lifters and shims in correct order.

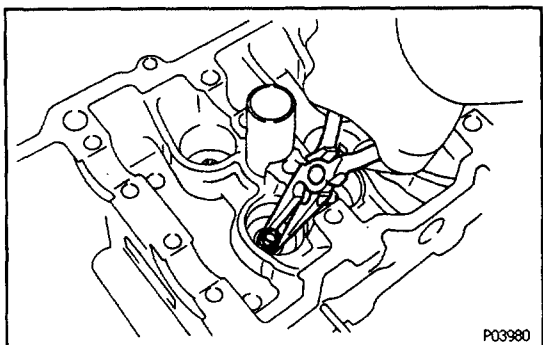


2. REMOVE VALVES

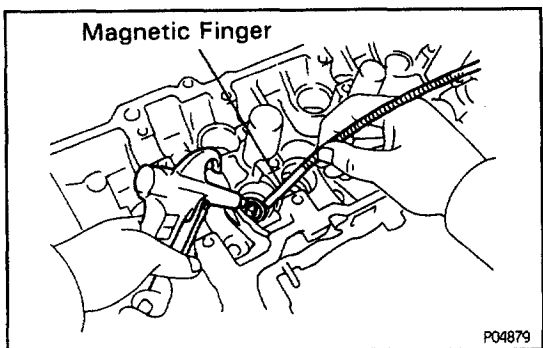
- (a) Using SST, compress the valve spring and remove the 2 keepers.

SST 09202-70020 (09202-00010)

- (b) Remove the spring retainer, valve spring and valve.

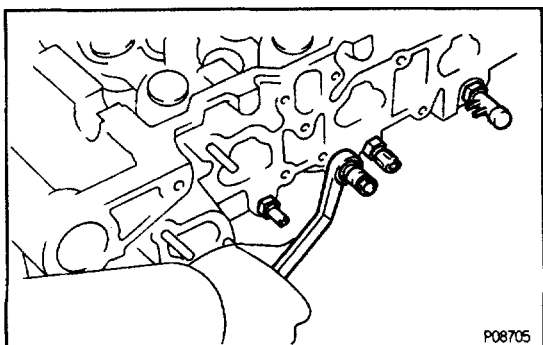


- (c) Using needle-nose pliers, remove the oil seal.



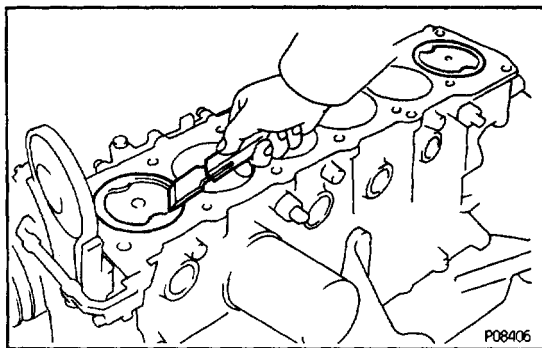
- (d) Using compressed air and a magnetic finger, remove the spring seat by blowing air.

HINT: Arrange the valves, valve springs, spring seats and spring retainers in correct order.



3. REMOVE FOLLOWING PARTS:

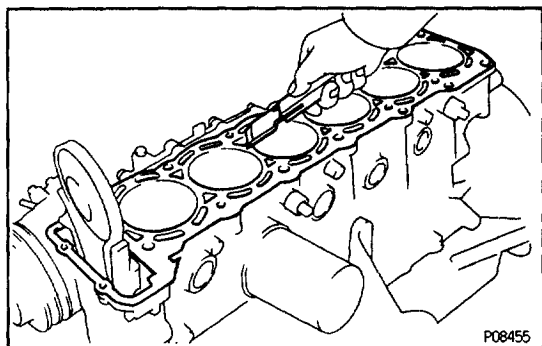
- (a) ECT sender gauge
- (b) ECT cut switch
- (c) ECT sensor
- (d) TVV



CYLINDER HEAD COMPONENTS INSPECTION, CLEANING AND REPAIR

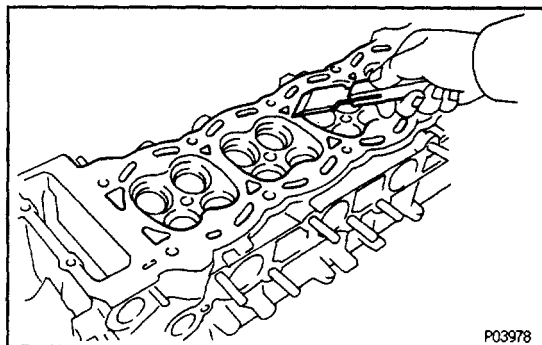
1. CLEAN TOP SURFACES OF PISTONS AND CYLINDER BLOCK

- (a) Turn the crankshaft, and bring each piston to top dead center (TDC). Using a gasket scraper, remove all the carbon from the piston top surface.



- (b) Using a gasket scraper, remove all the gasket material from the cylinder block surface.
- (c) Using compressed air, blow carbon and oil from the bolt holes.

CAUTION: Protect your eyes when using high-compressed air.

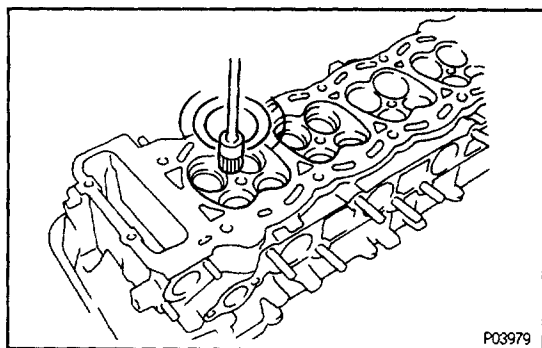


2. CLEAN CYLINDER HEAD

A. Remove gasket material

Using a gasket scraper, remove all the gasket material from the cylinder block contact surface.

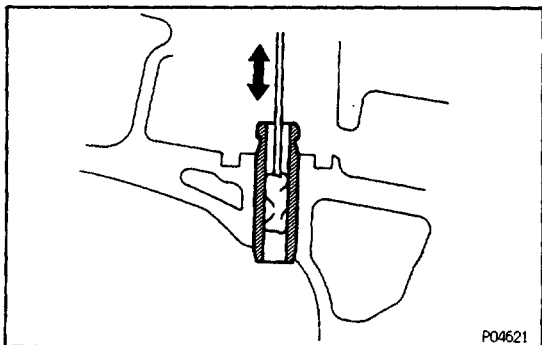
NOTICE: Be careful not to scratch the cylinder block contact surface.



B. Clean combustion chambers

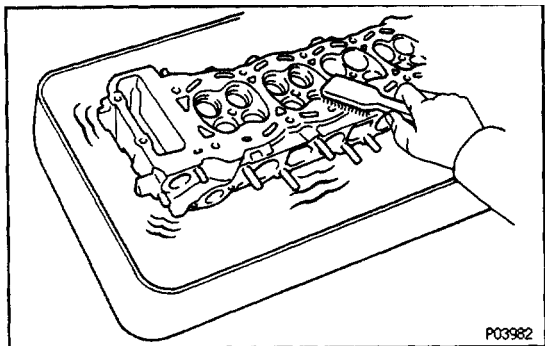
Using a wire brush, remove all the carbon from the combustion chambers.

NOTICE: Be careful not to scratch the cylinder block contact surface.



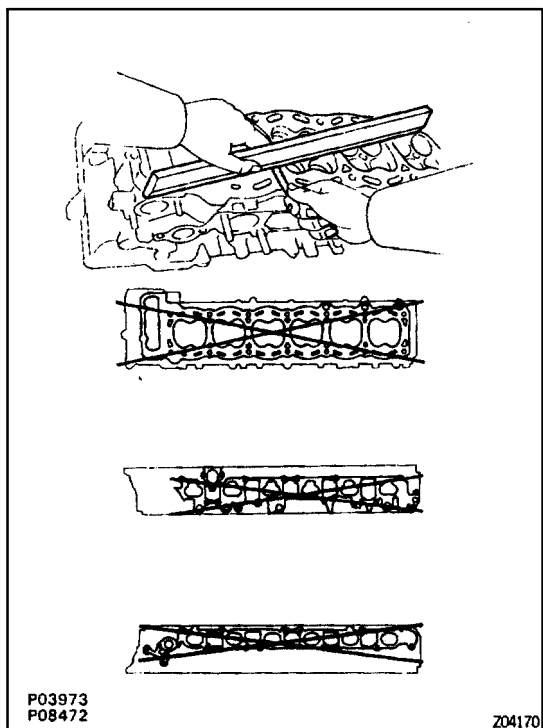
C. Clean valve guide bushings

Using a valve guide bushing brush and solvent, clean all the guide bushings.



D. Clean cylinder head

Using a soft brush and solvent, thoroughly clean the cylinder head.



3. INSPECT CYLINDER HEAD

A. Inspect for flatness

Using a precision straight edge and thickness gauge, measure the surfaces contacting the cylinder block and the manifolds for warpage.

Maximum warpage:

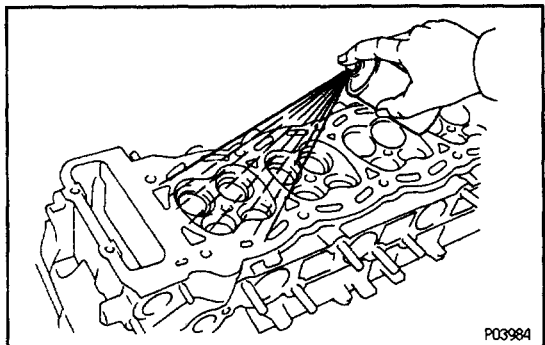
Cylinder block side

0.15 mm (0.0059 in.)

Manifold side

0.10 mm (0.0039 in.)

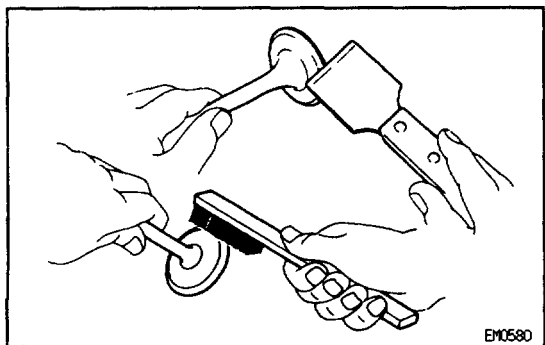
If warpage is greater than maximum, replace the cylinder head.



B. Inspect for cracks

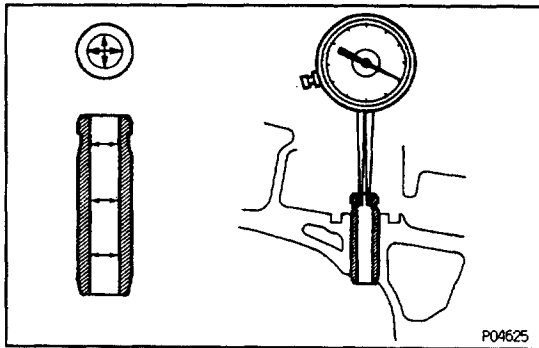
Using a dye penetrant, check the combustion chambers, intake ports, exhaust ports and cylinder block surface for cracks.

If cracked, replace the cylinder head.



4. CLEAN VALVES

- (a) Using a gasket scraper, chip off any carbon from the valve head.
- (b) Using a wire brush, thoroughly clean the valve.



5. INSPECT VALVE STEMS AND GUIDE BUSHINGS

- (a) Using a caliper gauge, measure the inside diameter of the guide bushing.

Bushing inside diameter:

7.010 – 7.030 mm (0.2760 – 0.2768 in.)

- (b) Using a micrometer, measure the diameter of the valve stem.

Valve stem diameter:

Intake

6.970 – 6.985 mm (0.2744 – 0.2750 in.)

Exhaust

6.965 – 6.980 mm (0.2742 – 0.2748 in.)

- (c) Subtract the valve stem diameter measurement from the guide bushing inside diameter measurement.

Standard oil clearance:

Intake

0.025 – 0.060 mm (0.0010 – 0.0024 in.)

Exhaust

0.030 – 0.065 mm (0.0012 – 0.0026 in.)

Maximum oil clearance:

Intake

0.08 mm (0.0031 in.)

Exhaust

0.10 mm (0.0039 in.)

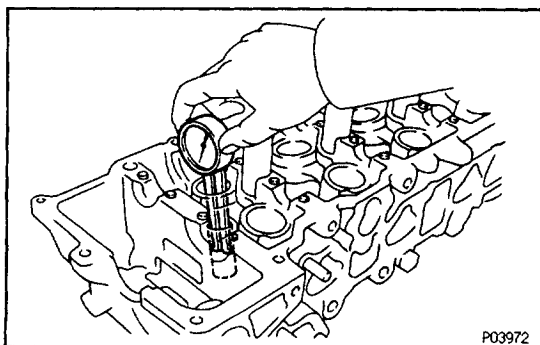
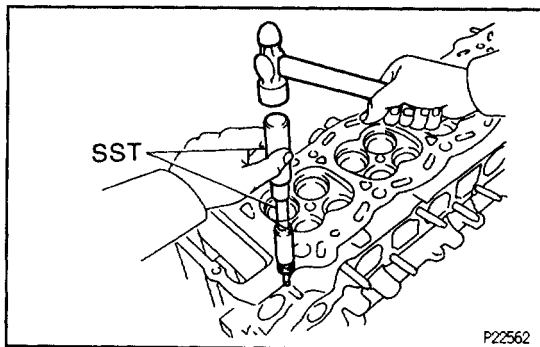
If the clearance is greater than maximum, replace the valve and guide bushing.

6. IF NECESSARY, REPLACE VALVE GUIDE BUSHINGS

- (a) Gradually heat the cylinder head to 80–100°C (176–212°F).
- (b) Using SST and a hammer, tap out the guide bushing.

SST 09201-10000 (09201-01070),

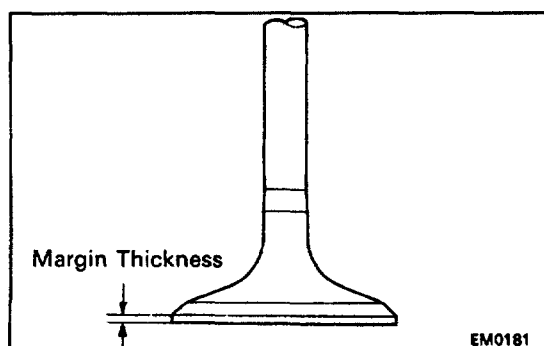
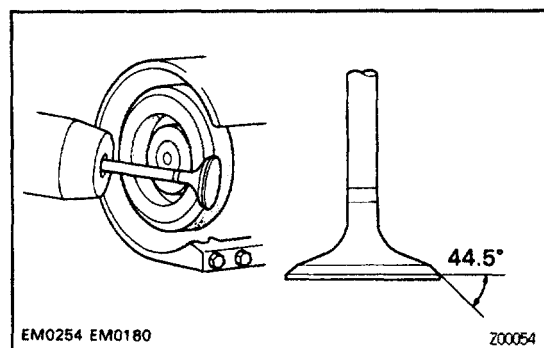
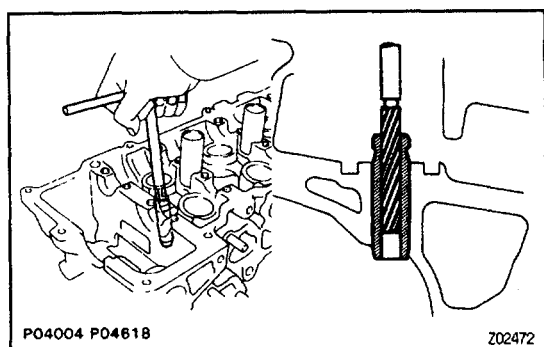
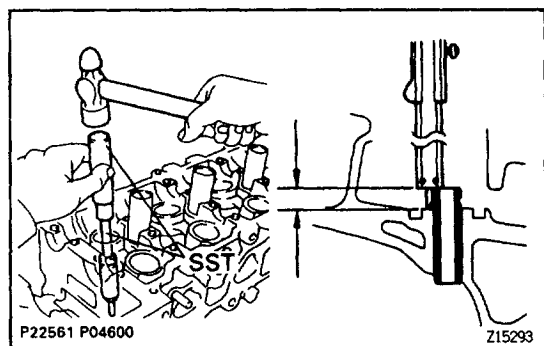
09950-70010 (09951-07100)



- (c) Using a caliper gauge, measure the bushing bore diameter of the cylinder head.

Both intake and exhaust

Bushing bore diameter mm (in.)	Bushing size
11.492 – 11.513 (0.4524 – 0.4533)	Use STD
11.542 – 11.563 (0.4544 – 0.4552)	Use O/S 0.05



- (d) Select a new guide bushing (STD size or O/S 0.05).
If the bushing bore diameter of the cylinder head is greater than 11.513 mm (0.4533 in.), machine the bushing bore to the following dimension:
11.542 – 11.563 mm (0.4544 – 0.4552 in.)
If the bushing bore diameter of the cylinder head is greater than 11.563 mm (0.4552 in.), replace the cylinder head.
- (e) Gradually heat the cylinder head to 80–100°C (176 –212°F).
- (f) Using SST and a hammer, tap in a new guide bushing until it protrudes 8.2 – 8.6 mm (0.323 – 0.339 in.) from the cylinder head.
SST 09201–10000 (09201–01070),
09950–70010 (09951–07100)
- (g) Using a sharp 7 mm reamer, ream the guide bushing to obtain the standard specified clearance (See page [EG-34](#)) between the guide bushing and valve stem.

7. INSPECT AND GRIND VALVES

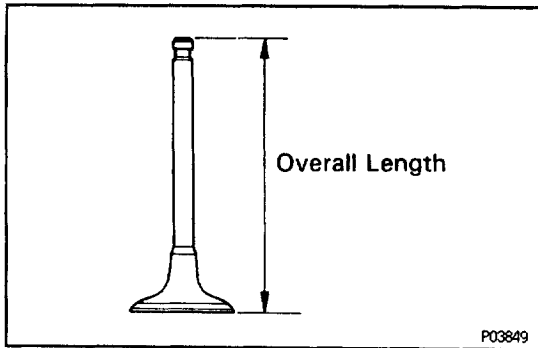
- (a) Grind the valve enough to remove pits and carbon.
(b) Check that the valve is ground to the correct valve face angle.

Valve face angle:**44.5°**

- (c) Check the valve head margin thickness.

Standard margin thickness:**1.2 mm (0.047 in.)****Minimum margin thickness:****1.0 mm (0.039 in.)**

If the margin thickness is less than minimum, replace the valve.



- (d) Check the valve overall length.

Standard overall length:

Intake

98.4 mm (3.874 in.)

Exhaust

97.9 mm (3.854 in.)

Minimum overall length:

Intake

97.9 mm (3.854 in.)

Exhaust

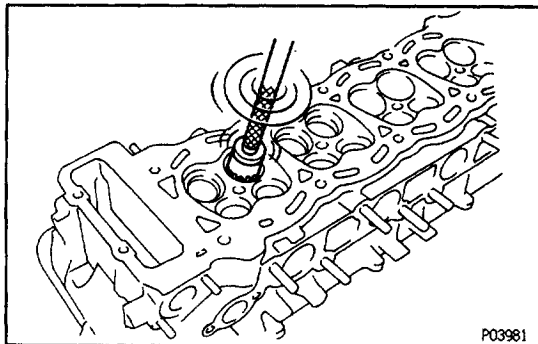
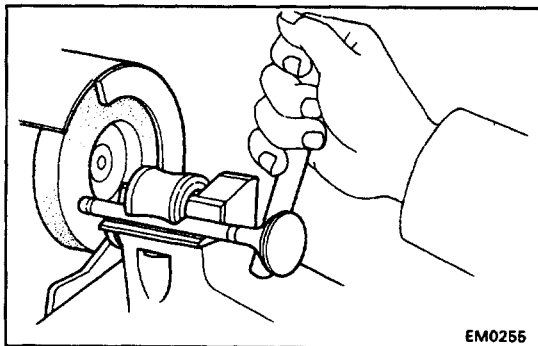
97.4 mm (3.835 in.)

If the overall length is less than minimum, replace the valve.

- (e) Check the surface of the valve stem tip for wear.

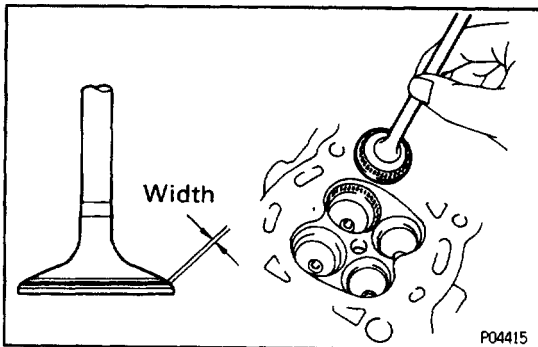
If the valve stem tip is worn, resurface the tip with a grinder or replace the valve.

NOTICE: Do not grind off more than minimum.



8. INSPECT AND CLEAN VALVE SEATS

- (a) Using a 45° carbide cutter, resurface the valve seats. Remove only enough metal to clean the seats.



- (b) Check the valve seating position.

Apply a light coat of prussian blue (or white lead) to the valve face. Lightly press the valve against the seat. Do not rotate valve.

- (c) Check the valve face and seat for the following:

- If blue appears 360° around the face, the valve is concentric. If not, replace the valve.
- If blue appears 360° around the valve seat, the guide and face are concentric. If not, resurface the seat.
- Check that the seat contact is in the middle of the valve face with the following width:

Intake

1.2 – 1.6 mm (0.047 – 0.063 in.)

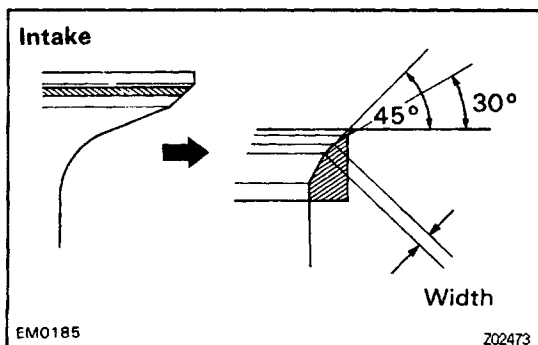
Exhaust

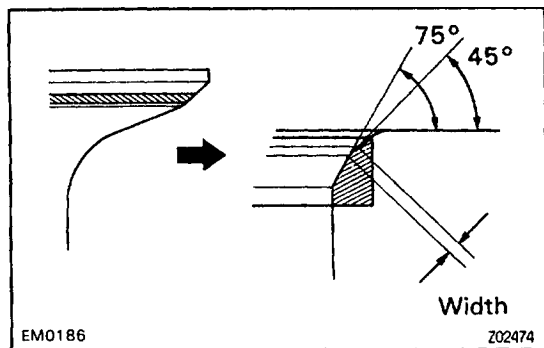
1.0 – 1.4 mm (0.039 – 0.055 in.)

If not, correct the valve seats as follows:

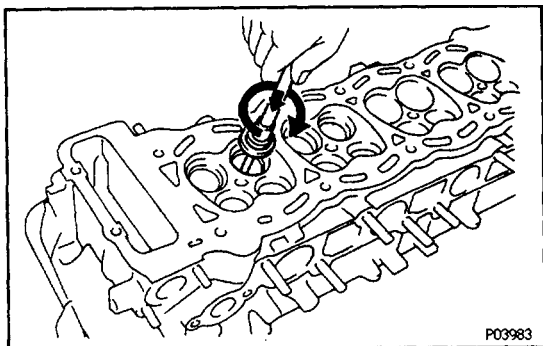
- (1) Intake:

If the seating is too high on the valve face, use 30° and 45° cutters to correct the seat.

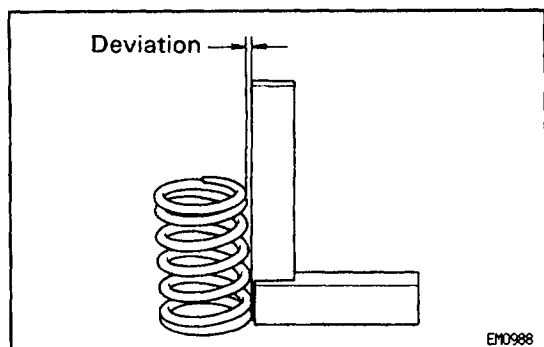




- (2) If the seating is too low on the valve face, use 75° and 45° cutters to correct the seat.



- (d) Hand-lap the valve and valve seat with an abrasive compound.
(e) After hand-lapping, clean the valve and valve seat.



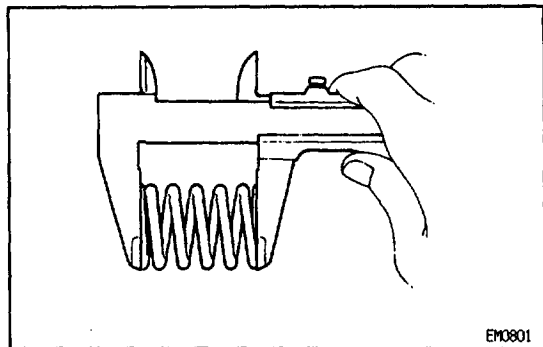
9. INSPECT VALVE SPRINGS

- (a) Using a steel square, measure the deviation of the valve spring.

Maximum deviation:

2.0 mm (0.079 in.)

If the deviation is greater than maximum, replace the valve spring.

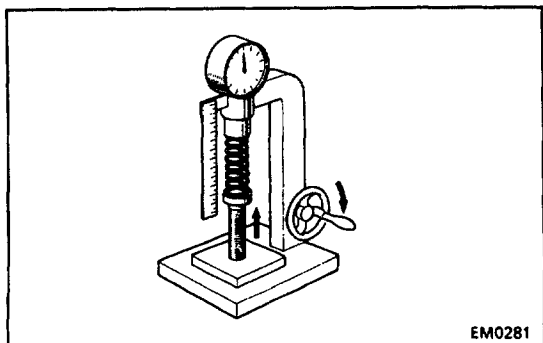


- (b) Using vernier calipers, measure the free length of the valve spring.

Free length:

43.94 – 45.06 mm (1.7299 – 1.7740 in.)

If the free length is not as specified, replace the valve spring.

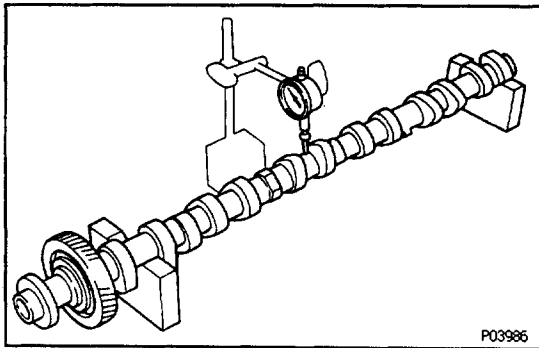


- (c) Using a spring tester, measure the tension of the valve spring at the specified installed length.

Installed tension:

214 – 238 N (21.8 – 24.2 kgf, 48.1–53.4 lbf) at 36.5 mm (1.437 in.)

If the installed tension is not as specified, replace the valve spring.



10. INSPECT CAMSHAFTS AND BEARINGS

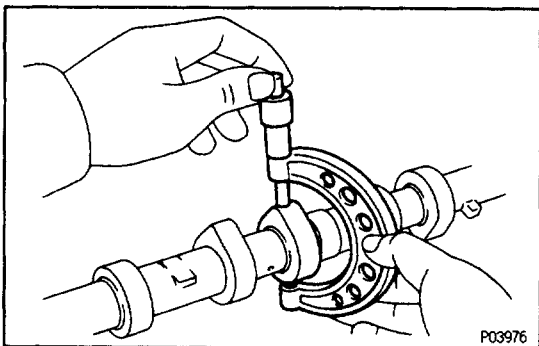
A. Inspect camshaft for runout

- (a) Place the camshaft on V-blocks.
- (b) Using a dial indicator, measure the circle runout at the center journal.

Maximum circle runout:

0.06 mm (0.0024 in.)

If the circle runout is greater than maximum, replace the camshaft.



B. Inspect cam lobes

Using a micrometer, measure the cam lobe height.

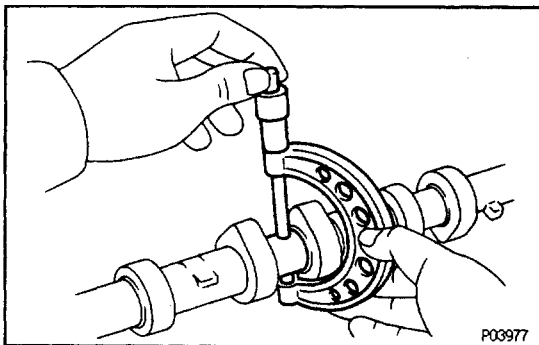
Standard cam lobe height:

50.61 – 50.71 mm (1.9925 – 1.9965 in.)

Minimum cam lobe height:

50.51 mm (1.9886 in.)

If the cam lobe height is less than minimum, replace the camshaft.



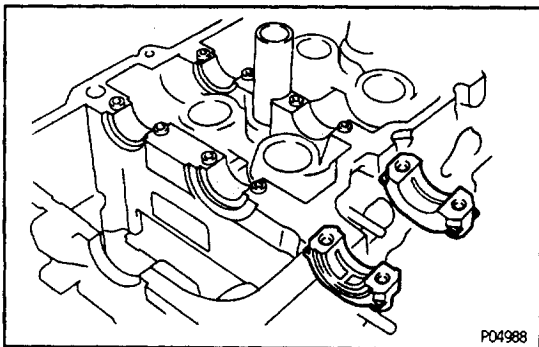
C. Inspect camshaft journals

Using a micrometer, measure the journal diameter.

Journal diameter:

26.959 – 26.975 mm (1.0614 – 1.0620 in.)

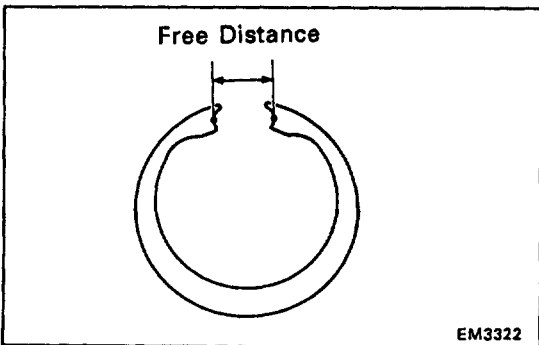
If the journal diameter is not as specified, check the oil clearance.



D. Inspect camshaft bearings

Check that bearings for flaking and scoring.

If the bearings are damaged, replace the bearing caps and cylinder head as a set.



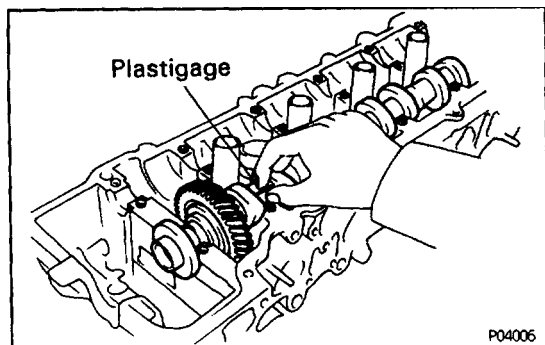
E. Inspect camshaft gear spring

Using vernier calipers, measure the free distance between the spring ends.

Free distance:

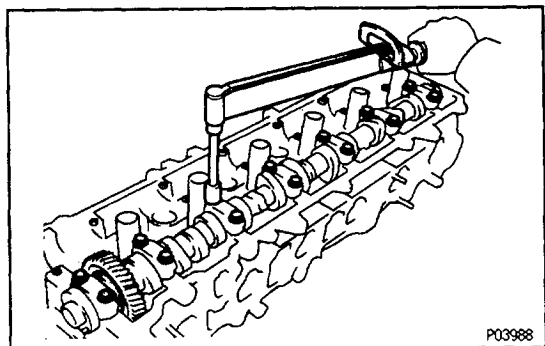
18.2 – 18.8 mm (0.717 – 0.740 in.)

If the free distance is not as specified, replace the gear spring.

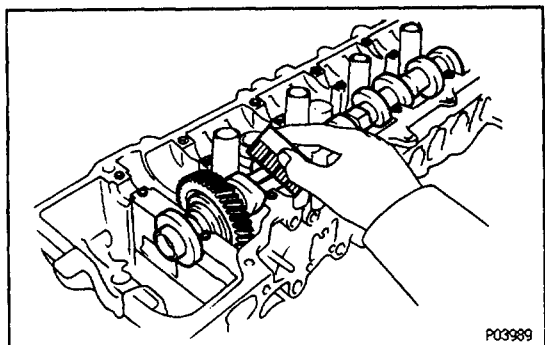


F. Inspect camshaft journal oil clearance

- (a) Clean the bearing caps and camshaft journals.
- (b) Place the camshafts on the cylinder head.
- (c) Lay a strip of Plastigage across each of the camshaft journals.



- (d) Install the bearing caps.
(See step 13 on pages [EG-47](#) to 49)
Torque: 16 N·m (160 kgf·cm, 12 ft·lbf)
NOTICE: Do not turn the camshaft.
- (e) Remove the bearing caps.



- (f) Measure the Plastigage at its widest point.

Standard oil clearance:

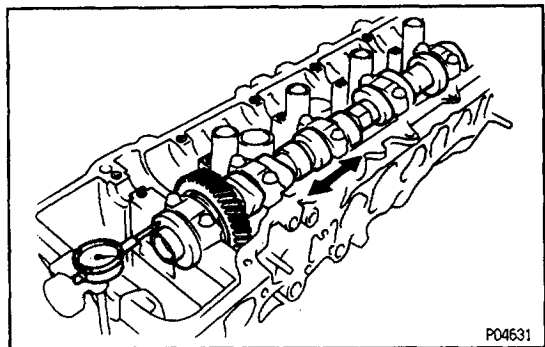
0.025 – 0.062 mm (0.0010 – 0.0024 in.)

Maximum oil clearance:

0.10 mm (0.0039 in.)

If the oil clearance is greater than maximum, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.

- (g) Completely remove the Plastigage.



G. Inspect camshaft thrust clearance

- (a) Install the camshaft.
(See step 13 on pages [EG-47](#) to 49)
- (b) Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

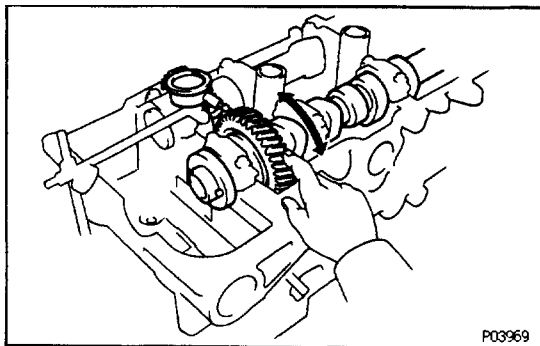
Standard thrust clearance:

0.030 – 0.080 mm (0.0012 – 0.0031 in.)

Maximum thrust clearance:

0.10 mm (0.0039 in.)

If the thrust clearance is greater than maximum, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.



H. Inspect camshaft gear backlash

- (a) Install the camshafts without installing the exhaust cam sub-gear.

(See step 13 on pages [EG-47](#) to 49)

- (b) Using a dial indicator, measure the backlash.

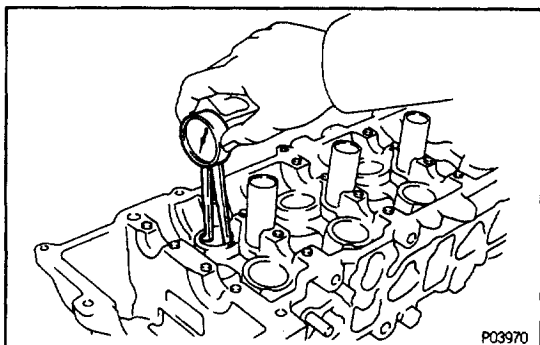
Standard backlash:

0.020 – 0.200 mm (0.0008 – 0.0079 in.)

Maximum backlash:

0.30 mm (0.0188 in.)

If the backlash is greater than maximum, replace the camshafts.



11. INSPECT VALVE LIFTERS AND LIFTER BORES

- (a) Using a caliper gauge, measure the lifter bore diameter of the cylinder head.

Lifter bore diameter:

34.000 – 34.021 mm (1.3386 – 1.3394 in.)

- (b) Using a micrometer, measure the lifter diameter.

Lifter diameter:

33.966 – 33.976 mm (1.3372 – 1.3376 in.)

- (c) Subtract the lifter diameter measurement from the lifter bore diameter measurement.

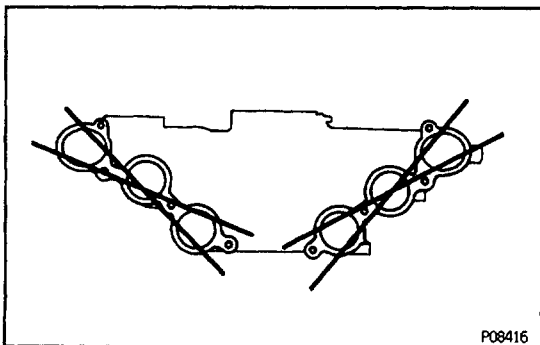
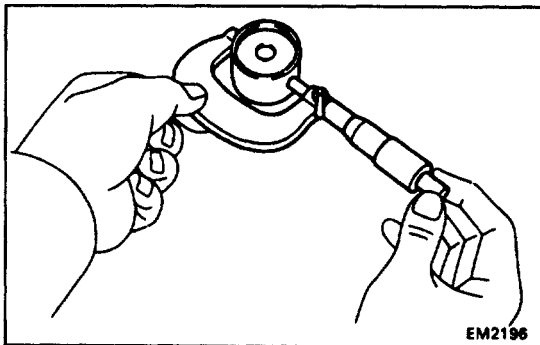
Standard oil clearance:

0.024 – 0.055 mm (0.0009–0.0022 in.)

Maximum oil clearance:

0.07 mm (0.0028 in.)

If the oil clearance is greater than maximum, replace the lifter. If necessary, replace the cylinder head.



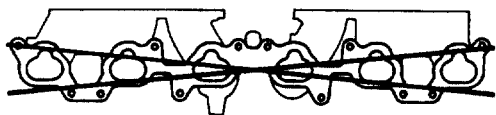
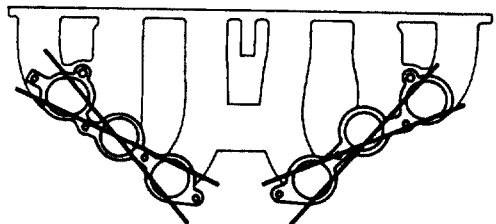
12. INSPECT AIR INTAKE CHAMBER

Using a precision straight edge and thickness gauge. measure the surface contacting the intake manifold for warpage.

Maximum warpage:

0.30 mm (0.0118 in.)

If warpage is greater than maximum, replace the air intake chamber.

Cylinder Head Side**Air Intake Chamber Side**P08414
P08415

Z04171

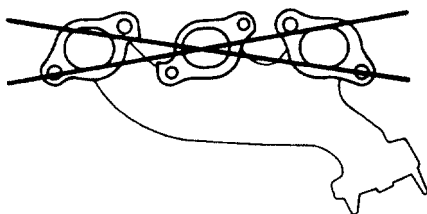
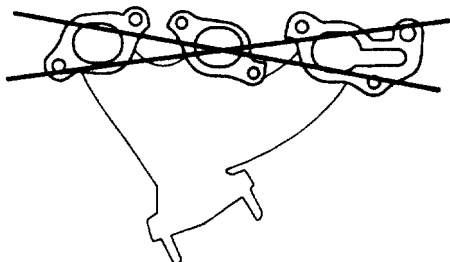
13. INSPECT INTAKE MANIFOLD

Using a precision straight edge and thickness gauge, measure the surface contacting the cylinder head and air intake chamber for warpage.

Maximum warpage:

0.30 mm (0.0118 in.)

If warpage is greater than maximum, replace the manifold.

No.1 Exhaust Manifold**No.2 Exhaust Manifold**

P08250

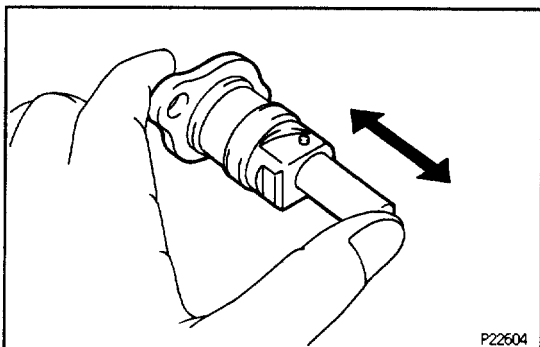
14. INSPECT EXHAUST MANIFOLDS

Using a precision straight edge and thickness gauge, measure the surface contacting the cylinder head for warpage.

Maximum warpage:

0.30 mm (0.0118 in.)

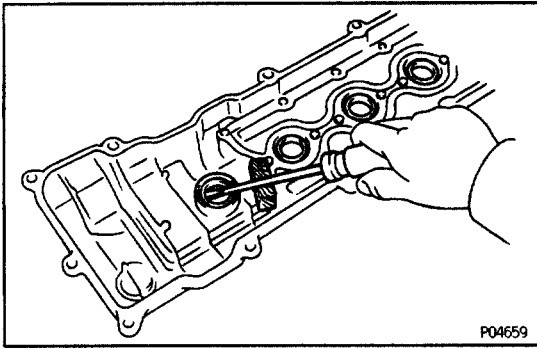
If warpage is greater than maximum, replace the manifold.



P22604

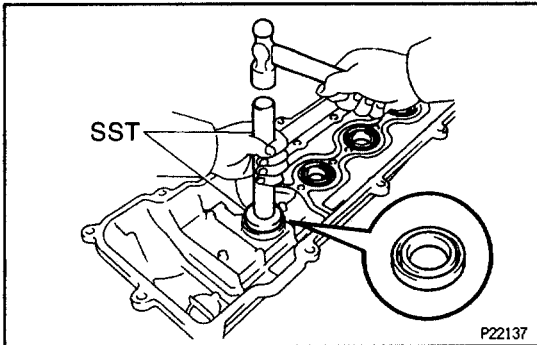
15. INSPECT CHAIN TENSIONER

Check that the plunger moves smoothly.



16. IF NECESSARY, REPLACE SPARK PLUG TUBE GASKETS

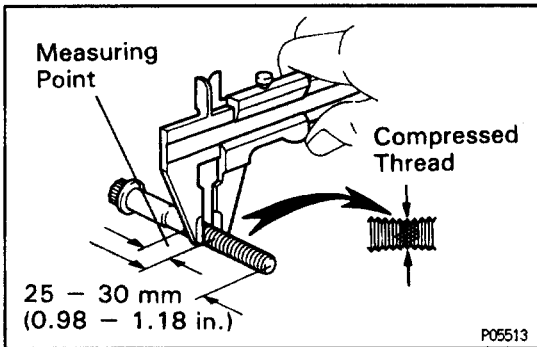
- (a) Using a screwdriver, pry off the tube gasket.



- (b) Using SST and a hammer, tap in a new tube gasket as shown in the illustration.

SST 09950-60010 (09951-00480),
09950-70010 (09951-07150)

- (c) Apply a light coat of MP grease to the gasket lip.



17. INSPECT CYLINDER HEAD BOLTS

Using vernier calipers, measure the thread outside diameter of the bolt.

Standard outside diameter:

10.85 – 11.00 mm (0.4272 – 0.4331 in.)

Minimum outside diameter:

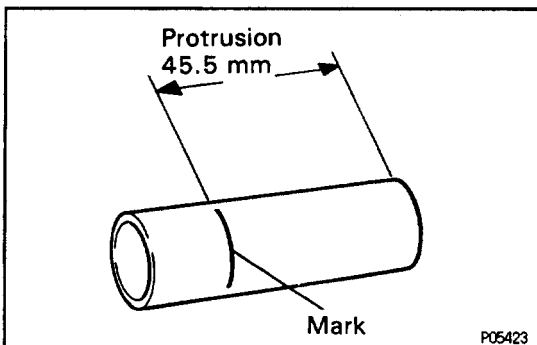
10.6 mm (0.417 in.)

If the diameter is less than minimum, replace the bolt.

CYLINDER HEAD ASSEMBLY

HINT:

- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- Replace all gaskets and oil seals with new ones.



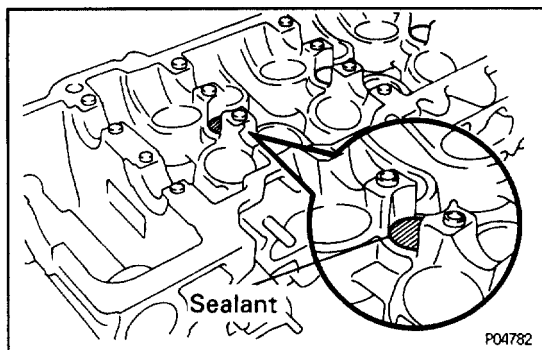
1. INSTALL SPARK PLUG TUBES

HINT: When using a new cylinder head, spark plug tubes must be installed.

- (a) Mark the standard position away from the edge, onto the spark plug tube.

Standard protrusion:

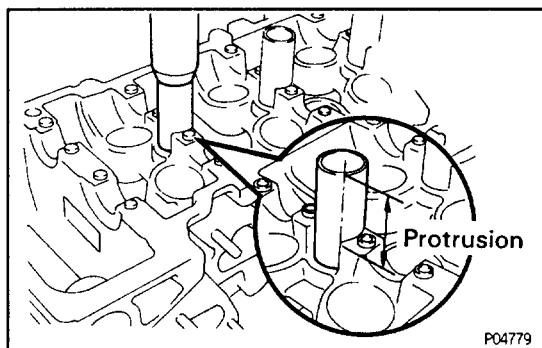
45.5 mm (1.791 in.)



- (b) Apply adhesive to the spark plug tube hole of the cylinder head.

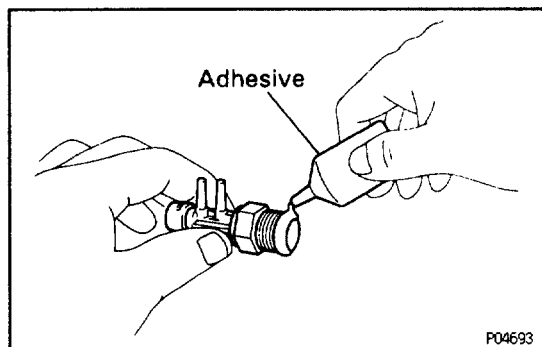
Sealant:

Part No. 08833-00070, Adhesive 1324, THREE BOND 1324 or equivalent



- (c) Using a press, press in a new spark plug tube until there is 45.5 mm (1.791 in.) protruding from the camshaft bearing cap installation surface of the cylinder head.

NOTICE: Avoid pressing a new spark plug tube in too far by measuring the amount of protrusion while pressing.

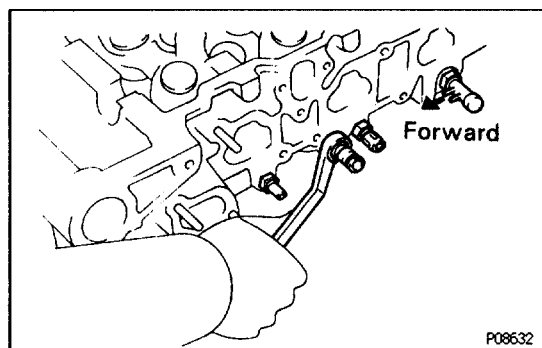


2. INSTALL FOLLOWING PARTS:

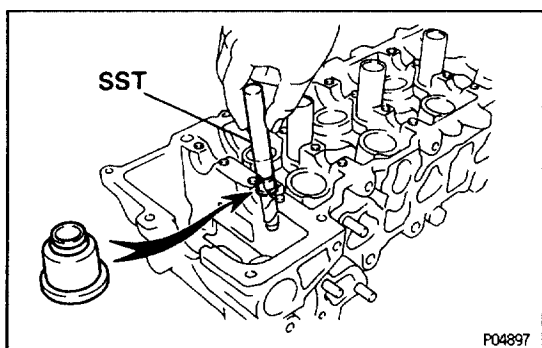
HINT: Apply adhesive to 2 or 3 threads of the TVV.

Adhesive:

Part No.08833-00080, THREE BOND 1344, LOCTITE 242 or equivalent

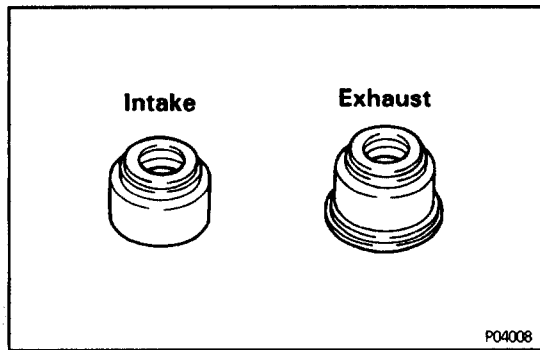


- (a) ECT sender gauge
- (b) ECT cut switch
- (c) ECT sensor
- (d) TVV

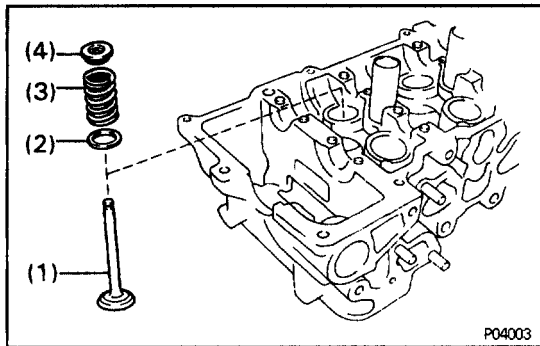


3. INSTALL VALVES

- (a) Using SST, push in a new oil seal.
SST 09236-00101 (09236-15010)

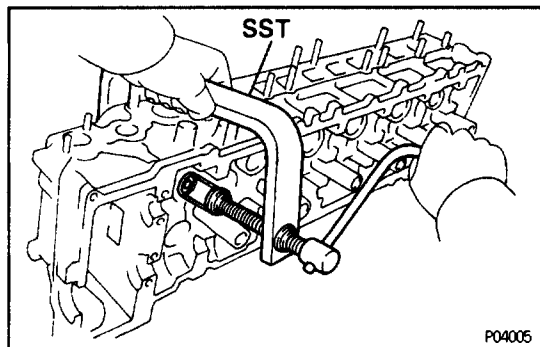


HINT: Different oil seals are used for the intake and exhaust.



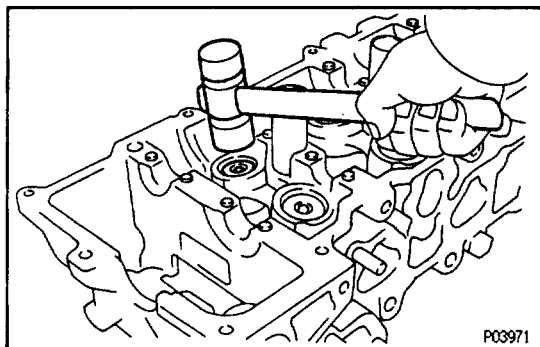
(b) Install the following parts:

- (1) Valve
- (2) Spring seat
- (3) Valve spring
- (4) Spring retainer



(c) Using SST, compress the valve spring and place the 2 keepers around the valve stem.

SST 09202-70020 (09202-00010)

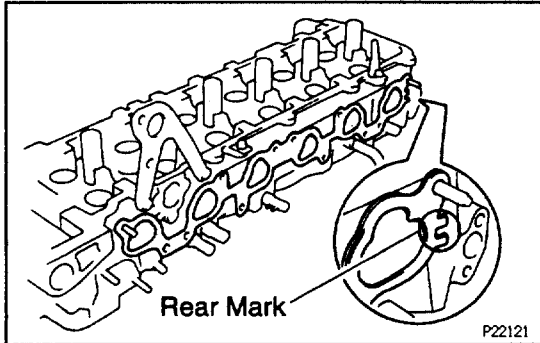


(d) Using a plastic-faced hammer, lightly tap the valve stem tip to ensure a proper fit.

4. INSTALL VALVE LIFTERS AND SHIMS

- (a) Install the valve lifter and shim.
- (b) Check that the valve lifter rotates smoothly by hand.

CYLINDER HEAD INSTALLATION



1. **INSTALL ACCELERATOR CABLE BRACKET AND THROTTLE CABLE BRACKET**
2. **INSTALL 2 ENGINE WIRE CLAMP BRACKETS**
3. **INSTALL NO.1 AND NO.2 ENGINE HANGERS**
Torque: 41 N·m (420 kgf·cm, 30 ft·lbf)
4. **INSTALL NO.1 WATER BYPASS HOSE**
5. **ASSEMBLE AIR INTAKE CHAMBER AND INTAKE MANIFOLD ASSEMBLY**

- (a) Install 2 new gaskets and the air intake chamber with the 6 bolts and 2 nuts.
Torque: 21 N·m (210 kgf·cm, 15 ft·lbf)
- (b) Connect the vacuum sensing hose to the fuel pressure regulator.

6. **INSTALL AIR INTAKE CHAMBER AND INTAKE MANIFOLD ASSEMBLY**

- (a) Place a new gasket so that the rear mark is toward the rear side.
- (b) Install the intake manifold with the 10 bolts and 2 nuts.
Torque: 21 N·m (210 kgf·cm, 15 ft·lbf)
- (c) Connect the 2 vacuum hoses to the TVV.

7. **INSTALL HEATER INLET PIPE AND HOSE**

Install the heater hose to the cylinder head, and connect the pipe to the intake manifold with the 2 bolts.

Torque: 21 N·m (210 kgf·cm, 15 ft·lbf)

8. **INSTALL EGR PIPE**

- (a) Temporarily install the union nut to the EGR valve.
- (b) Install a new gasket and the EGR pipe to the cylinder head with the 2 bolts.

Torque: 21 N·m (210 kgf·cm, 15 ft·lbf)

- (c) Tighten the union nut.

Torque: 78 N·m (800 kgf·cm, 58 ft·lbf)

9. **INSTALL WATER OUTLET**

Install a new gasket and the water outlet with the 2 nuts.

Torque: 21 N·m (210 kgf·cm, 15 ft·lbf)

10. **INSTALL GENERATOR BRACKET**

Install the generator bracket with the 2 bolts.

Torque: 43 N·m (440 kgf·cm, 32 ft·lbf)

11. **INSTALL CYLINDER HEAD AND INTAKE MANIFOLD ASSEMBLY**

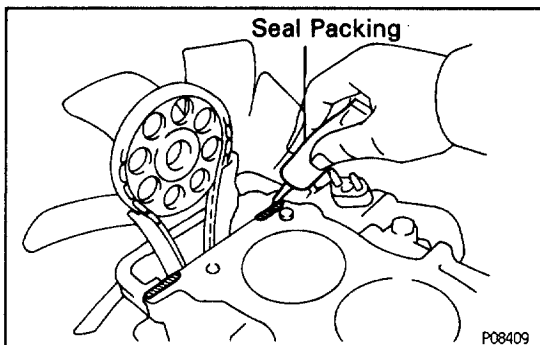
A. **Place cylinder head on cylinder block**

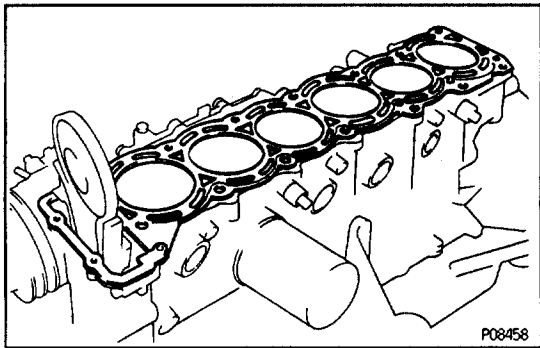
- (a) Apply seal packing to the 2 locations as shown.

Seal packing:

Part No. 08826-00080 or equivalent

NOTICE: Do not apply too much seal packing

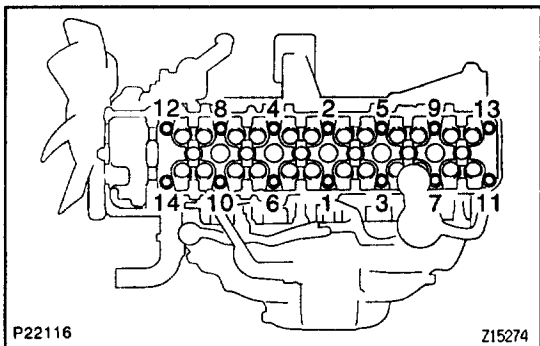




- (b) Place a new cylinder head gasket in position on the cylinder block.

NOTICE: Be careful of the installation direction.

- (c) Place the cylinder head in position on the cylinder head gasket.



B. Install cylinder head bolts

HINT:

- The cylinder head bolts are tightened in 3 progressive steps (steps (b), (d) and (e)).
- If any cylinder head bolt is broken or deformed, replace it.

- (a) Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.

- (b) Install and uniformly tighten the 14 cylinder head bolts and plate washers in several passes, in the sequence shown.

Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)

If any of the cylinder head bolts does not meet the torque specification, replace the cylinder head bolt.

- (c) Mark the front of the cylinder head bolt head with paint.

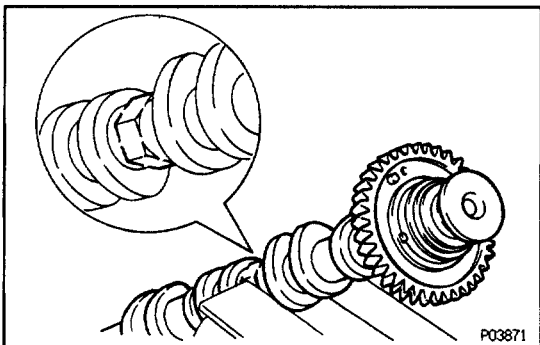
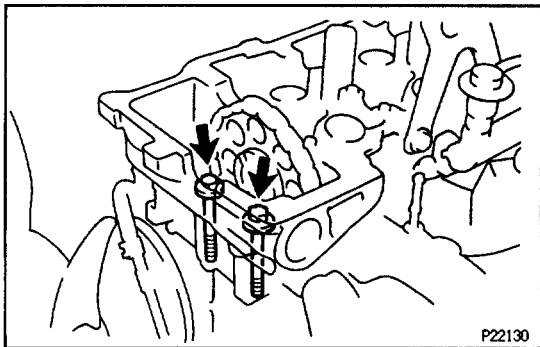
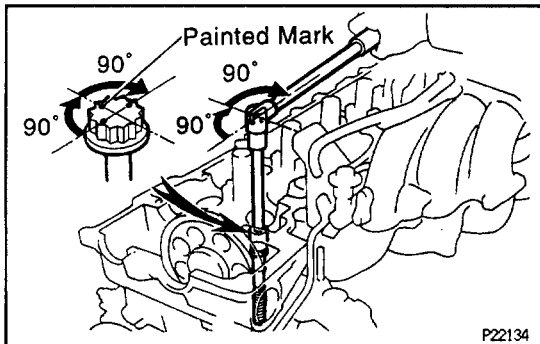
- (d) Retighten the cylinder head bolts by 90° in the numerical order shown.

- (e) Retighten the cylinder head bolts by an additional 90°.

- (f) Check that the painted mark is now facing rearward.

- (g) Install and torque the 2 mounting bolts.

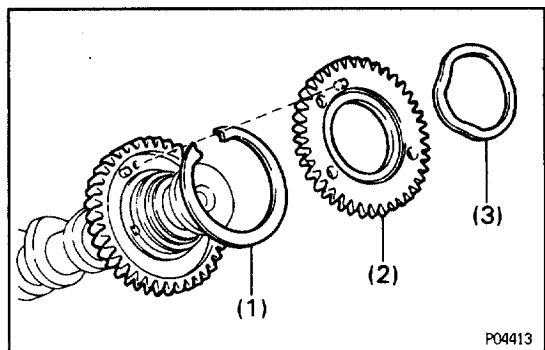
Torque: 21 N·m (210 kgf·cm, 15 ft·lbf)



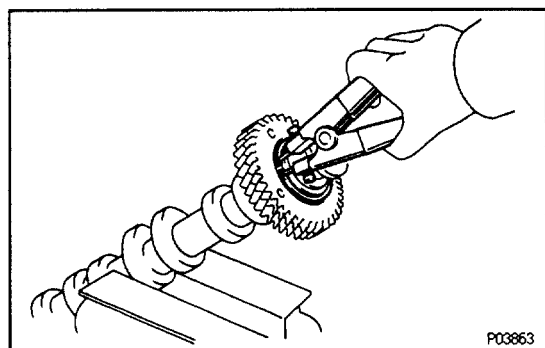
12. ASSEMBLE EXHAUST CAMSHAFT

- (a) Mount the hexagon wrench head portion of the camshaft in a vise.

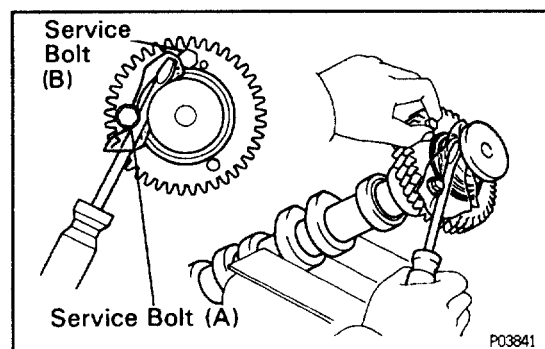
NOTICE: Be careful not to damage the camshaft.



- (b) Install the following parts:
- (1) Camshaft gear spring
 - (2) Camshaft sub-gear
 - (3) Wave washer
- HINT: Align the pins on the gears with the spring ends.



- (c) Using snap ring pliers, install the snap ring.



- (d) Insert a service bolt (A) into the service hole of the camshaft sub-gear.
- (e) Using a screwdriver, align the holes of the camshaft main gear and sub-gear by turning camshaft sub-gear clockwise, and install a service bolt (B).

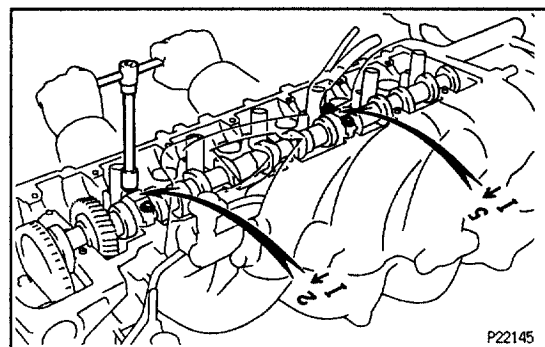
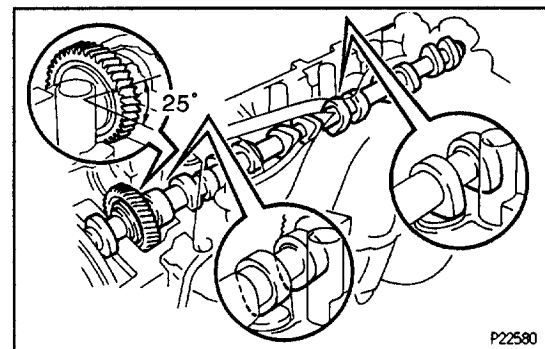
NOTICE: Be careful not to damage the camshaft.

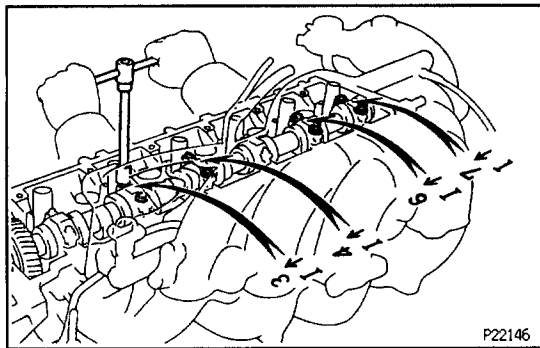
13. INSTALL CAMSHAFTS

NOTICE: Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being installed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.

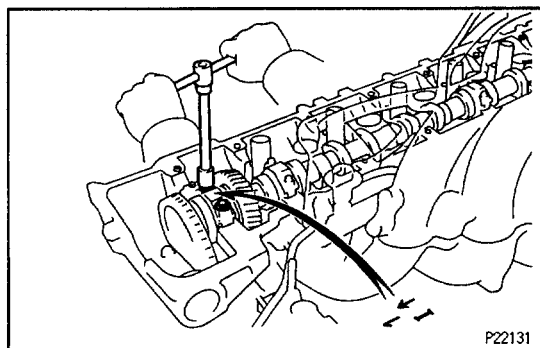
A. Install intake camshaft

- (a) Apply engine oil to the thrust portion of the intake camshaft.
- (b) Lightly place the intake camshaft on top of the cylinder head as shown in the illustration so that the No.1 and No.4 cylinder cam lobes face downward.
- (c) Lightly push the camshaft towards the front without applying excessive force.
- (d) Place the No.2 and No.5 bearing caps in their proper location.
- (e) Temporarily tighten these bearing cap bolts uniformly and alternately in several passes until the bearing caps are snug with the cylinder head.

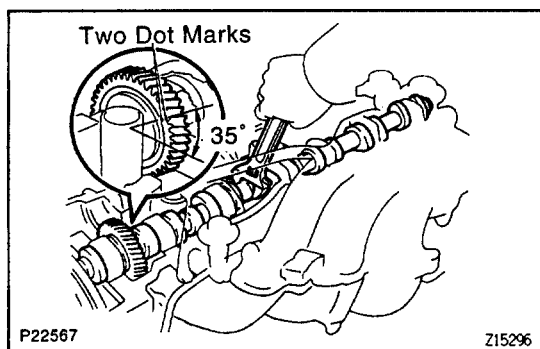




- (f) Place the No.3, No.4, No.6 and No.7 bearing caps in their proper location.
- (g) Temporarily tighten these bearing cap bolts, alternately tightening the left and right bolts uniformly.

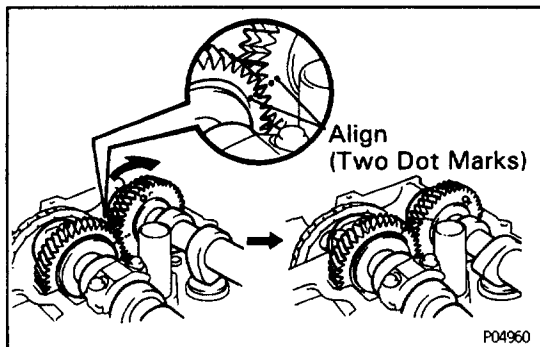


- (h) Place the No.1 bearing cap in its proper location. When doing this, check that there is no gap between the cylinder head and the contact surface of bearing cap.
- (i) Temporarily tighten the bearing cap bolts, alternately tightening the left and right bolts uniformly.
- (j) Uniformly tighten the 14 bearing cap bolts in several passes.
Torque: 16 N·m (160 kgf·cm, 12 ft·lbf)

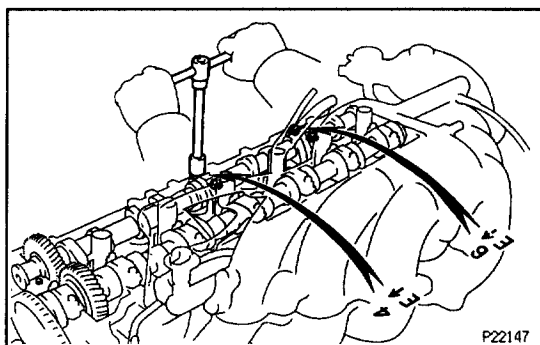


B. Install exhaust camshaft

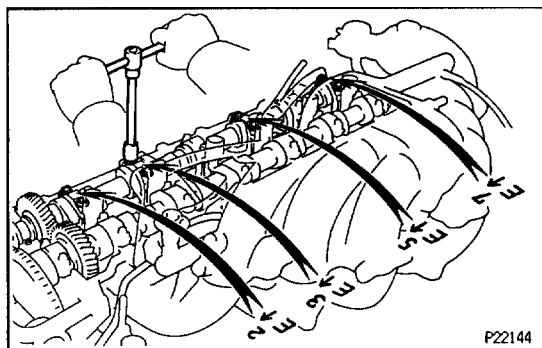
- (a) Set the timing mark (two dot marks) of the camshaft drive gear at approx. 35° angle by turning the hexagon wrench head portion of the intake camshaft with a wrench.



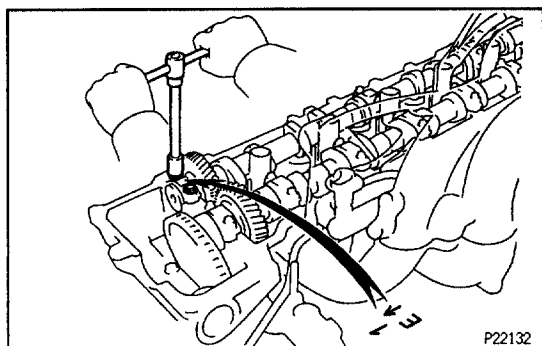
- (b) Apply engine oil to thrust portion of the exhaust camshaft.
- (c) Engage the exhaust camshaft gear to the intake camshaft gear by matching the timing marks (two dot marks) on each gear.
- (d) Roll down the exhaust camshaft onto the bearing journals while engaging gears with each other.
- (e) Lightly push the intake camshaft towards the front without applying excessive force.



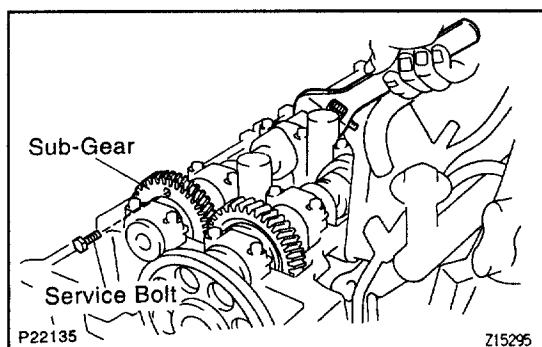
- (f) Install the No.4 and No.6 bearing caps in their proper location.
- (g) Temporarily tighten the bearing cap bolts uniformly and alternately in several passes until the bearing caps are snug with the cylinder head.



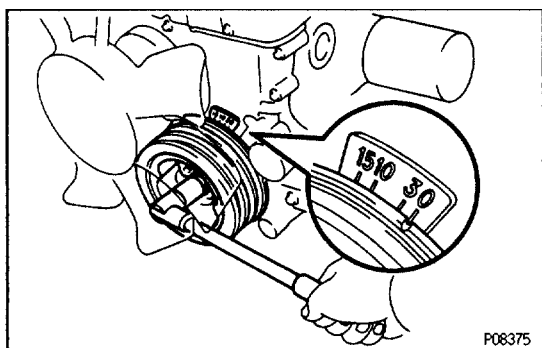
- (h) Place the No.2, No.3, No.5 and No.7 bearing caps in their proper location.
- (i) Temporarily tighten these bearing cap bolts, alternately tightening the left and right bolts uniformly.



- (j) Place the No.1 bearing cap in its proper location. When doing this, check that there is no gap between the cylinder head and the contact surface of bearing cap.
- (k) Temporarily tighten the bearing cap bolts, alternately tightening the left and right bolts uniformly.
- (l) Uniformly tighten the 14 bearing cap bolts in several passes.
Torque: 16 N·m (160 kgf·cm, 12 ft·lbf)

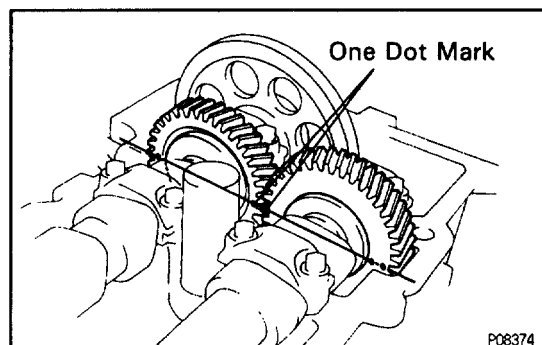


- (m) Bring the service bolt installed in the driven sub-gear upward by turning the hexagon wrench head portion of the camshaft with a wrench.
- (n) Remove the service bolt.
- (o) Check that the intake and exhaust camshafts turn smoothly.

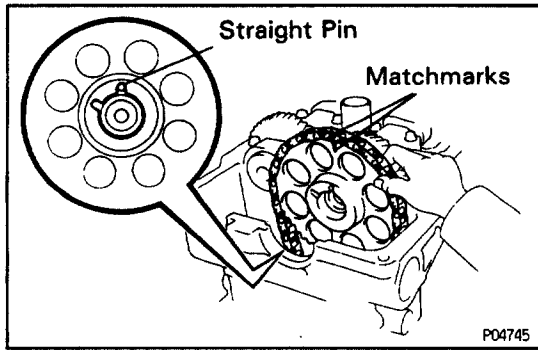


14. SET NO.1 CYLINDER TO TDC/COMPRESSION

- (a) Turn the crankshaft pulley, and align its groove with the timing mark "O" of the timing chain cover.



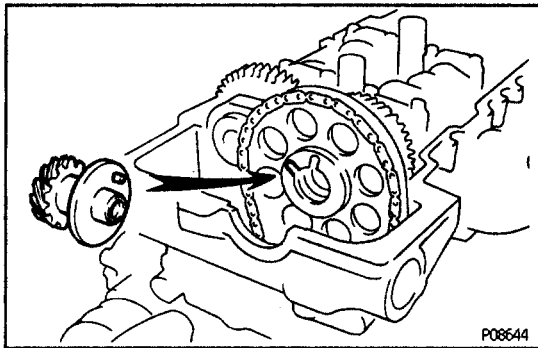
- (b) Turn the camshafts so that the timing marks with one and two dots will be in straight line on the cylinder head surface as shown in the illustration.



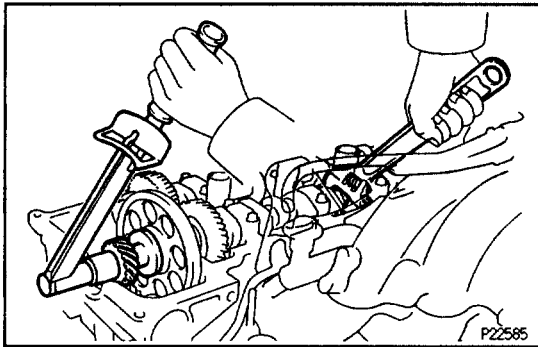
15. INSTALL CAMSHAFT TIMING GEAR

HINT: Check that the matchmarks on the camshaft timing gear and timing chain are aligned.

- (a) Place the gear over the straight pin of the intake camshaft.

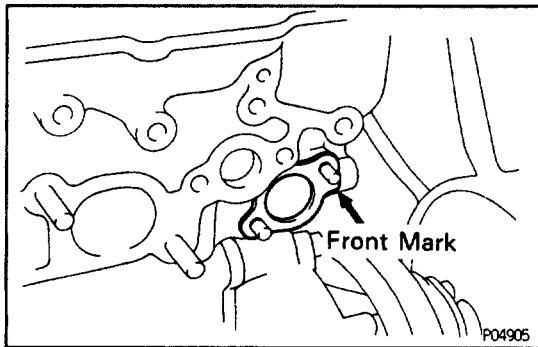


- (b) Align the straight pin of distributor gear with the straight pin groove of the intake camshaft gear as shown.



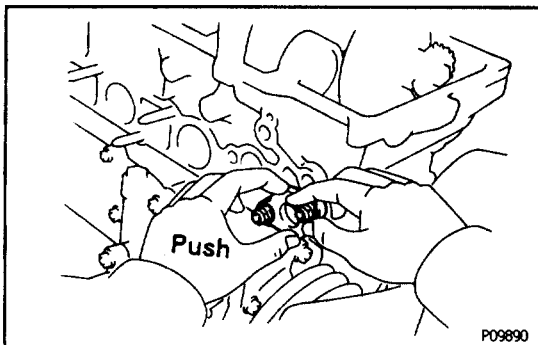
- (c) Hold the intake camshaft with a wrench, install and torque the bolt.

Torque: 74 N·m (750 kgf·cm, 54 ft·lbf)



16. INSTALL CHAIN TENSIONER

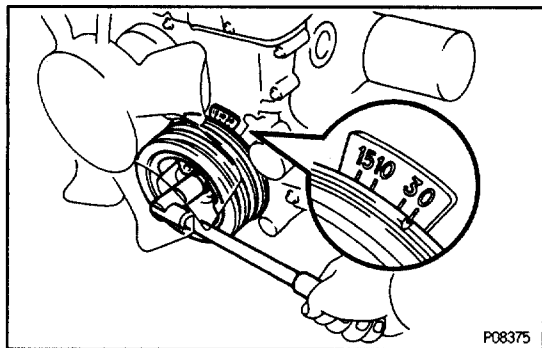
- (a) Place a new gasket so that the front mark is toward the front side.



- (b) Push the tensioner by hand until it touches the head installation surface, then install the 2 nuts.

- (c) Tighten the 2 nuts.

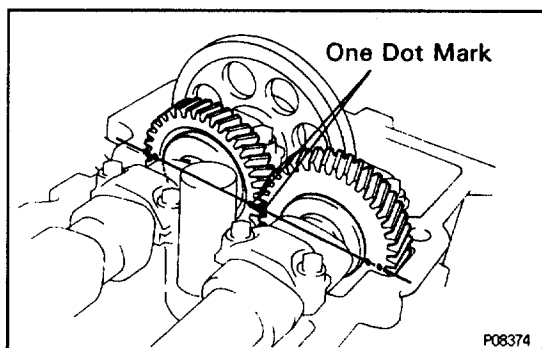
Torque: 21 N·m (210 kgf·cm, 15 ft·lbf)



17. CHECK VALVE TIMING

- (a) Turn the crankshaft pulley, and align its groove with the timing mark "0" of the timing chain cover.

NOTICE: Always turn the crankshaft clockwise.



- (b) Check that the timing marks (one and two dots) of the camshaft drive and driven gears are in straight line on the cylinder head surface as shown in the illustration. If not, turn the crankshaft 1 revolution (360°) and align the marks as above.

18. CHECK AND ADJUST VALVE CLEARANCE

(See steps 6 to 8 in valve clearance inspection and adjustment)

Turn the camshaft and position the cam lobe upward and check and adjust the valve clearance.

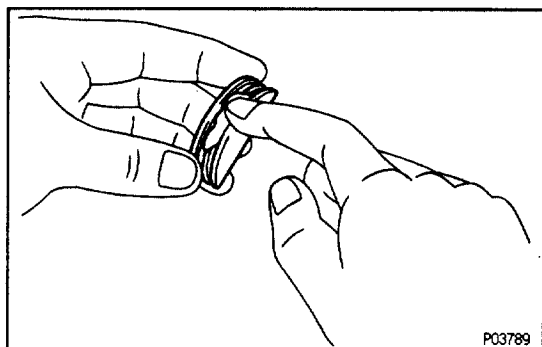
Valve clearance (Cold):

Intake

0.15 – 0.25 mm (0.006 – 0.010 in.)

Exhaust

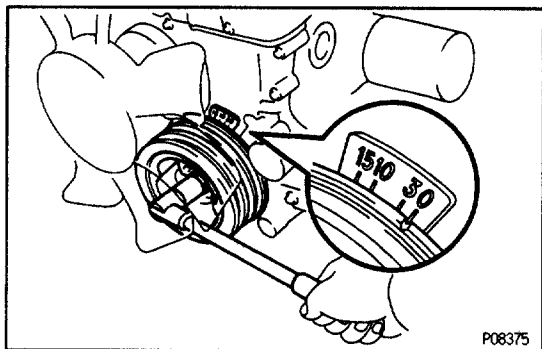
0.25 – 0.35 mm (0.010 – 0.014 in.)



19. INSTALL SPARK PLUGS

20. INSTALL SEMI-CIRCULAR PLUG

- (a) Remove any old packing (FIPG) material.



- (b) Apply seal packing to the cylinder head installation surface of the semi-circular plug.

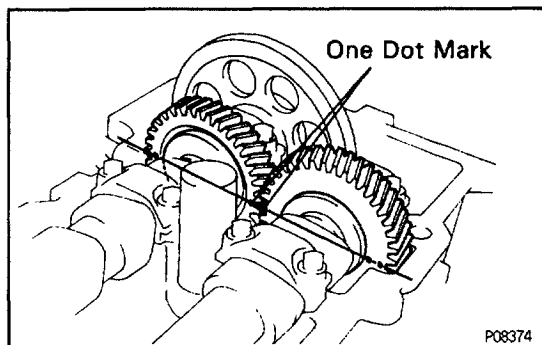
Seal packing:

Part No. 08826 – 00080 or equivalent

- (c) Install the semi-circular plug to the cylinder head.

21. SET NO.1 CYLINDER TO TDC/COMPRESSION

- (a) Turn the crankshaft pulley, and align its groove with the timing mark "0" of the timing chain cover.

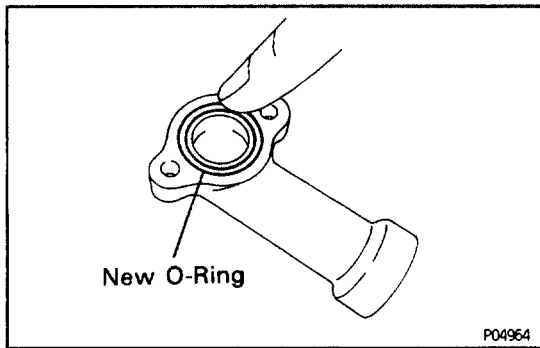


- (b) Check that the timing marks with one and two dots are in straight line on the cylinder head surface as shown in the illustration.

If not, turn the crankshaft 1 revolution (360°) and align the mark as above.

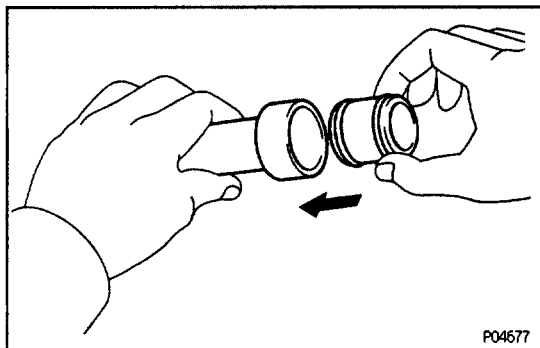
22. INSTALL CYLINDER HEAD COVER

- (a) Install the gasket to the cylinder head cover.
(b) Install the cylinder head cover with the 13 bolts.



23. INSTALL WATER BYPASS OUTLET AND PIPE

- (a) Install a new O-ring to the water bypass outlet.



- (b) Install 2 new O-rings to the water bypass pipe.
 (c) Apply soapy water to the O-rings.
 (d) Assemble the water bypass outlet and pipe.
 (e) Install the water bypass outlet and pipe with the 2 bolts.

Torque: 21 N·m (210 kgf·cm, 15 ft·lbf)

24. INSTALL HEATER PIPE

Install a new gasket, the heater pipe and ground cable with the 2 bolts and 2 nuts.

Torque:

Bolt: 20 N·m (200 kgf·cm, 14 ft·lbf)

Nut: 21 N·m (210 kgf·cm, 15 ft·lbf)

25. INSTALL NO.1 AND NO.2 EXHAUST MANIFOLDS

- (a) Install 2 new gaskets, No.1 exhaust manifold and No. 2 exhaust manifold with the 13 nuts.

Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)

- (b) Install the No.1 heat insulator and No.2 heat insulator with the 6 bolts.

Torque: 19 N·m (195 kgf·cm, 14 ft·lbf)

26. INSTALL FRONT EXHAUST PIPE

- (a) Install 2 new gaskets and the front exhaust pipe with the 4 nuts.

Torque: 63 N·m (630 kgf·cm, 46 ft·lbf)

- (b) Install the No.1 support bracket with the 2 bolts.

Torque: 24 N·m (240 kgf·cm, 17 ft·lbf)

- (c) Connect the clamp and tighten the clamp bolt.

Torque: 19.5 N·m (195 kgf·cm, 14 ft·lbf)

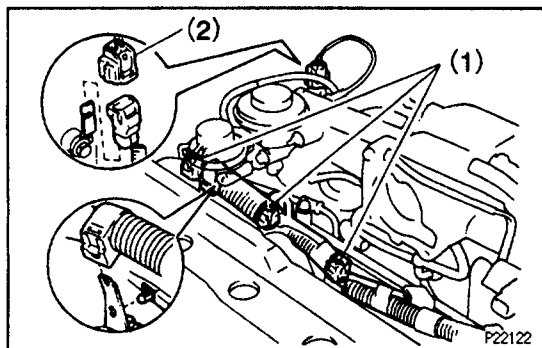
- (d) Connect the front exhaust pipe to the rear TWC with a new gasket, 2 bolts and 2 nuts.

Torque: 46 N·m (470 kgf·cm, 34 ft·lbf)

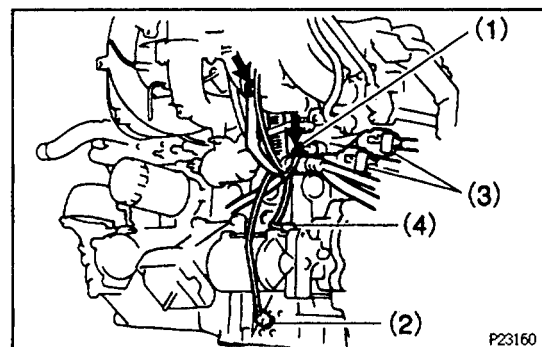
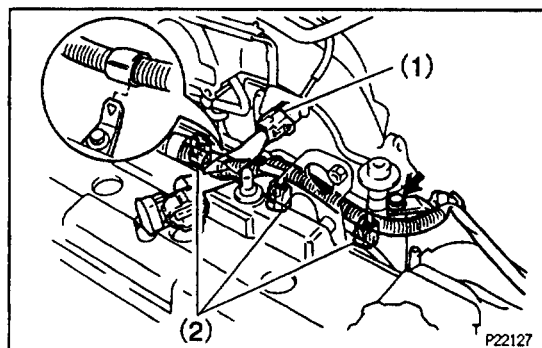
27. CONNECT NO.2 WATER BYPASS PIPE

Connect the bypass pipe to the cylinder head with the 3 bolts.

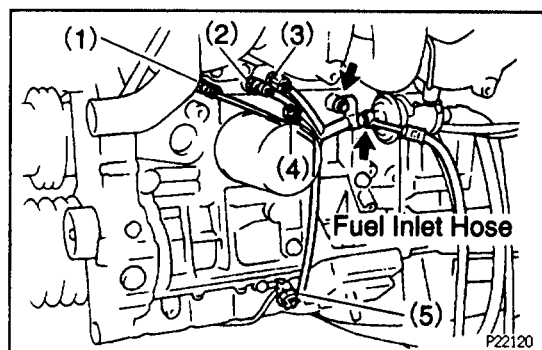
Torque: 20 N·m (200 kgf·cm, 14 ft·lbf)

**28. CONNECT ENGINE WIRE**

- (a) Place the engine wire on the intake manifold.
- (b) Connect these connectors:
 - (1) 3 injector connectors
 - (2) EGR gas temp. sensor connector
- (c) Connect the clamp of the No.6 injector wire to the bracket.
- (d) Connect the engine wire clamp.
- (e) Connect the engine wire clamp.
- (f) Connect these connectors:
 - (1) Connector for emission control valve set assembly
 - (2) 3 injector connectors
- (g) Install the bolt holding the engine wire to the intake manifold.



- (h) Connect the engine wire to the intake manifold and cylinder block with the 2 bolts.
- (i) Connect the PNP switch connector.
- (j) Connect the 2 heated oxygen sensor connectors.
- (k) Connect these connectors:
 - (1) Knock sensor connector
 - (2) Oil level sensor connector
 - (3) 2 connectors to transmission
 - (4) Starter connector



- (l) Connect the engine wire to the cylinder block with the bolt.
- (m) Connect these connectors:
 - (1) ECT sender gauge connector
 - (2) ECT cut switch connector
 - (3) ECT sensor connector
 - (4) Knock sensor connector
 - (5) Crankshaft position sensor connector

29. CONNECT FUEL INLET HOSE

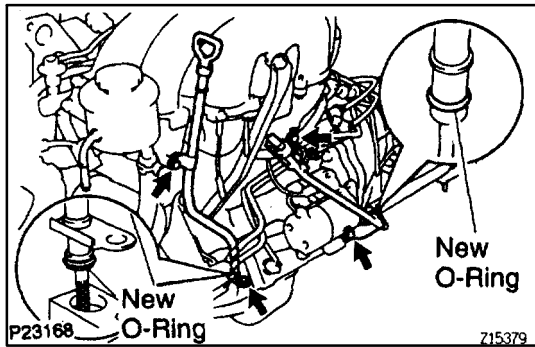
Connect the fuel inlet hose to the fuel filter with 2 new gaskets and the union bolt.

Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)

30. INSTALL INTAKE MANIFOLD STAY

Install the intake manifold stay with the 2 bolts.

Torque: 36 N·m (360 kgf·cm, 26 ft·lbf)

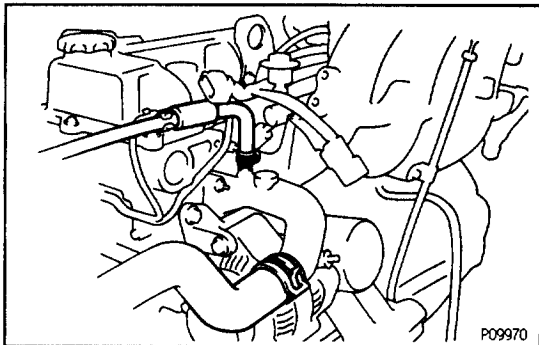


31. INSTALL OIL DIPSTICKS AND GUIDES FOR ENGINE AND TRANSMISSION

- Install a new O-ring to the dipstick guide.
 - Apply a light coat of engine oil on the O-ring.
 - Push in the dipstick guide into the guide hole of the oil pan.
 - Install the dipstick guide with the 2 bolts.
- Torque: 20 N·m (200 kgf·cm, 14 ft·lbf)

32. INSTALL THROTTLE BODY

(See throttle body installation in SFI System)



33. INSTALL GENERATOR AND DRIVE BELTS

(See generator installation in Charging System)

34. CONNECT NO.3 WATER BYPASS HOSE

35. CONNECT RADIATOR INLET HOSE

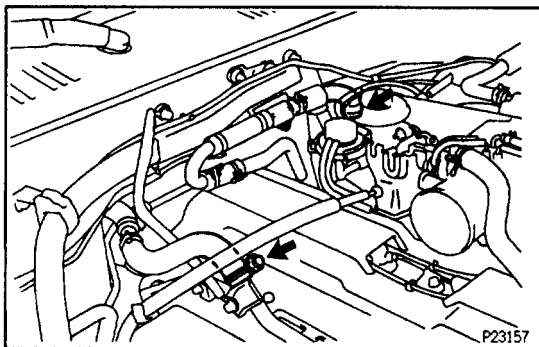
36. CONNECT PS RESERVOIR TANK

Connect the reservoir tank with the 3 bolts.

Torque: 20 N·m (200 kgf·cm, 14 ft·lbf)

37. INSTALL DISTRIBUTOR

(See distributor installation in Ignition System)



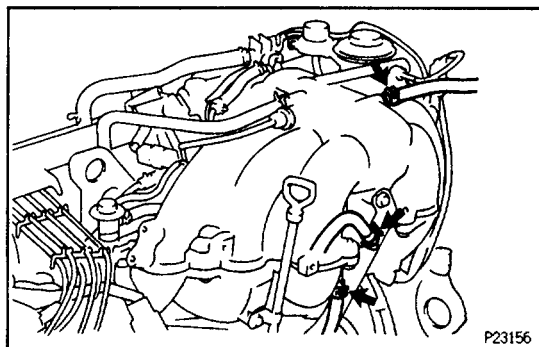
38. INSTALL NO.2 AND NO.3 CYLINDER HEAD COVERS

Install the head covers with the 4 bolts.

39. CONNECT HEATER VALVE AND ENGINE WIRE TO COWL PANEL

- Connect the heater valve with the 2 bolts.
- Connect the engine wire and ground strap with the 2 bolts.

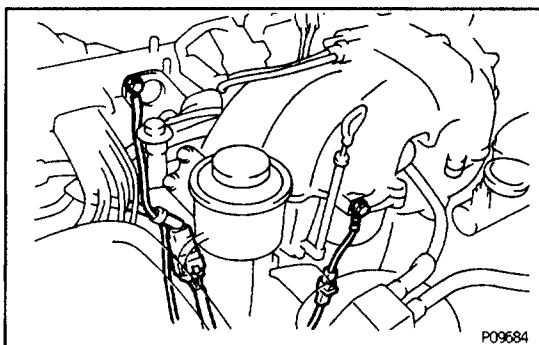
40. CONNECT HEATER HOSES



41. CONNECT FUEL RETURN HOSE

42. CONNECT EVAP HOSE

43. CONNECT BRAKE BOOSTER VACUUM HOSE



44. CONNECT CONNECTOR ON INTAKE MANIFOLD TO LH FENDER APRON

45. CONNECT ENGINE GROUND STRAPS

Connect the following ground straps:

- Ground strap to No.1 engine hanger
- Ground strap to air intake chamber

46. CONNECT THROTTLE CABLE TO THROTTLE BODY

47. CONNECT ACCELERATOR CABLE TO THROTTLE BODY

- 48. CONNECT CRUISE CONTROL ACTUATOR CABLE TO THROTTLE BODY**
- 49. INSTALL AIR CLEANER HOSE AND CAP**
- 50. INSTALL BATTERY TRAY AND BATTERY**
 - (a) Install the battery tray with the 5 bolts.
 - (b) Connect the ground strap with the bolt.
 - (c) Install the battery and hold-down clamp with the nuts.
 - (d) Connect the battery cables.
- 51. FILL RADIATOR WITH ENGINE COOLANT**
- 52. START ENGINE AND CHECK FOR LEAKS**
- 53. ADJUST IGNITION TIMING**
(See ignition timing inspection and adjustment)
- 54. PERFORM ROAD TEST**
Check for abnormal noise, shock, slippage, correct shift points and smooth operation.
- 55. RECHECK ENGINE COOLANT LEVEL**