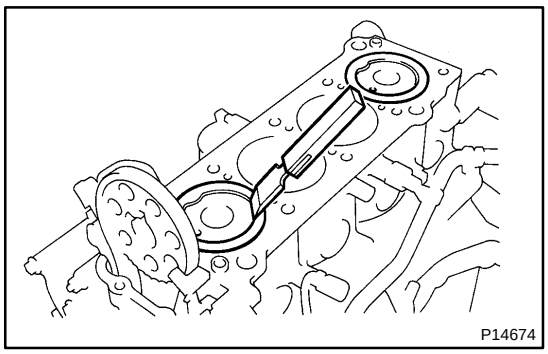
EM16R–02

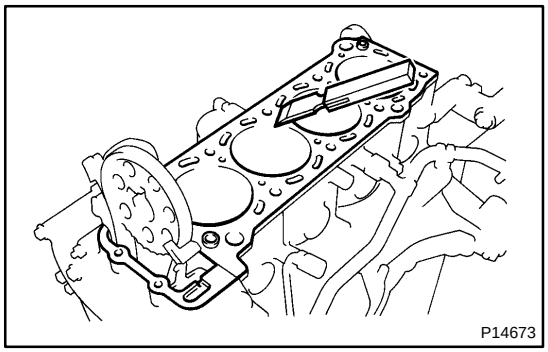
INSPECTION



1. CLEAN TOP SURFACES OF PISTONS AND CYLINDER BLOCK

(a) Turn the crankshaft, and bring each piston to top dead center (TDC).

(b) Using a gasket scraper, remove all the carbon from the piston top surface.

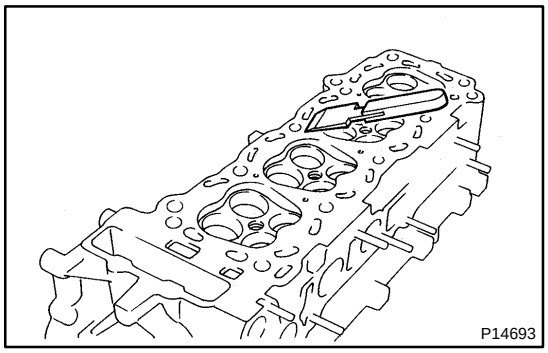


(c) Using a gasket scraper, remove all the gasket material from the cylinder block surface.

(d) Using compressed air, blow carbon and oil from the bolt holes.

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

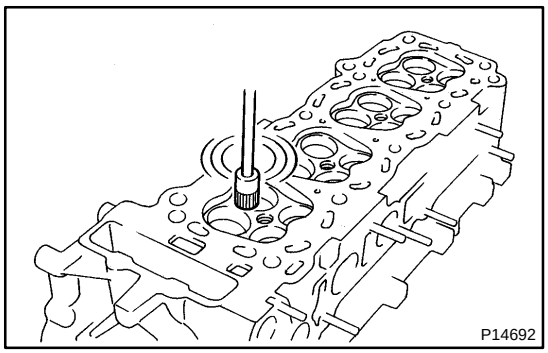
2. INSPECT SURFACES OF CYLINDER BLOCK FOR FLATNESS (See page EM–91)



3. CLEAN CYLIDER HEAD

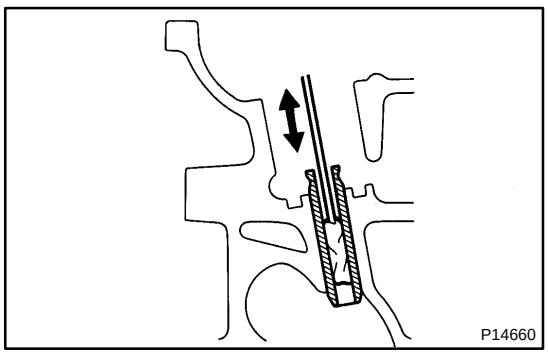
(a) Using a gasket scraper, remove all the gasket material from the cylinder block contact surface.

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

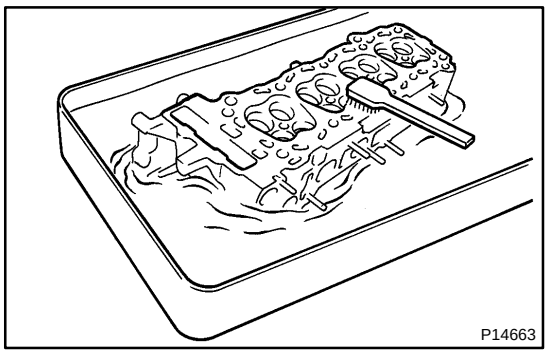


(b) Using a wire brush, remove all the carbon from the combustion chambers.

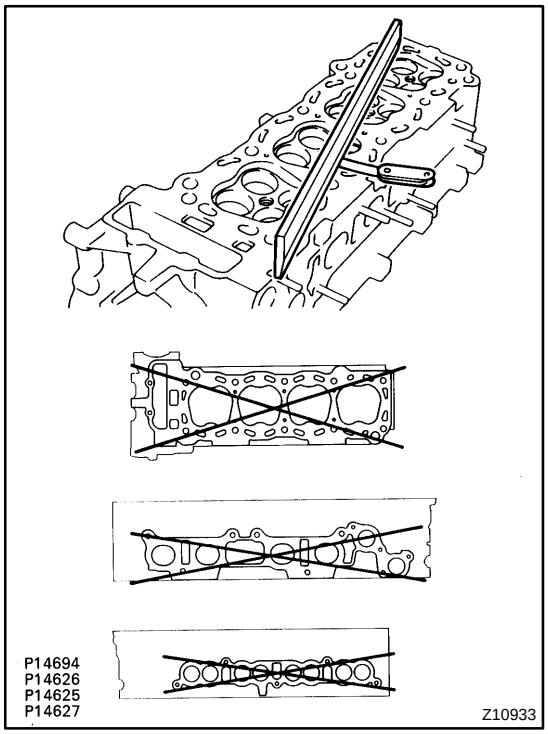
NOTICE:
Be careful not to scratch the cylinder block contact surface.



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



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



4. INSPECT CYLINDER HEAD

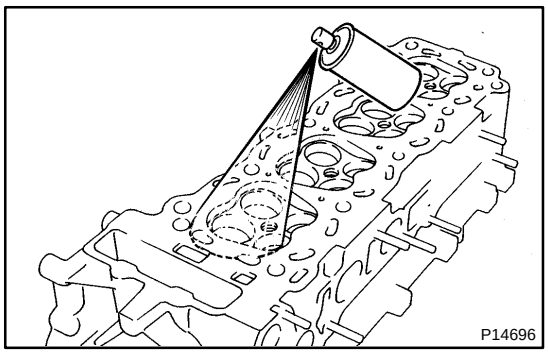
(a) Inspect for flatness.

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	0.05 mm (0.0020 in.)
Manifold side	0.10 mm (0.0039 in.)

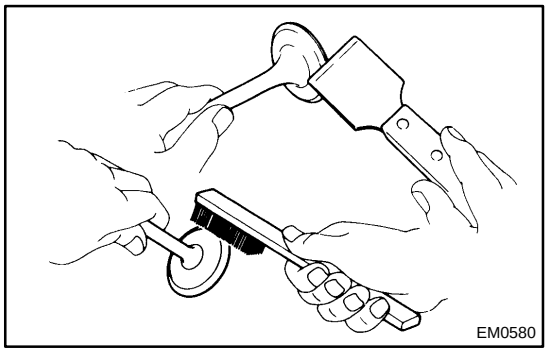
If warpage is greater than maximum, replace the cylinder head.



(b) Inspect for cracks.

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

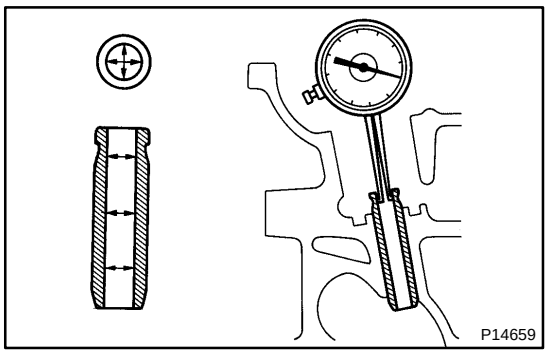
If cracked, replace the cylinder head.



5. CLEAN VALVES

(a) Using a gasket scraper, chip off any carbon from the valve head.

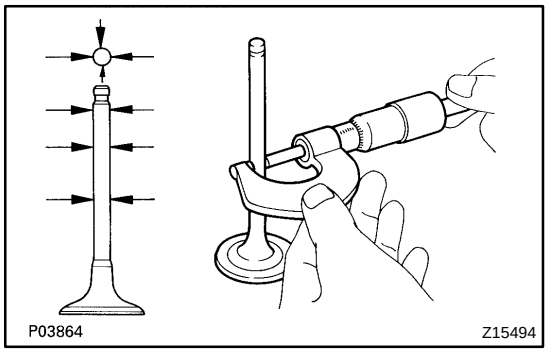
(b) Using a wire brush, thoroughly clean the valve.



6. INSPECT VALVE STEMS AND GUIDE BUSHINGS

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

Bushing inside diameter:
6.010 – 6.030 mm (0.2366 – 0.2374 in.)



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

Valve stem diameter:

Intake	5.970 – 5.985 mm (0.2350 – 0.2356 in.)
Exhaust	5.965 – 5.980 mm (0.2348 – 0.2354 in.)

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

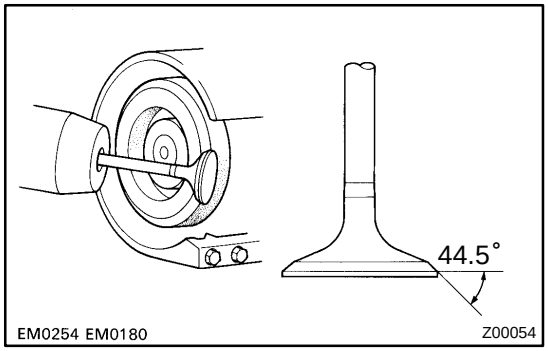
Standard oil clearance:

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 (See page EM–53).

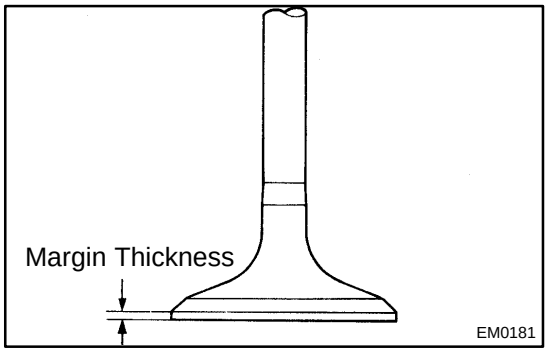


7. INSPECT AND GRIND VALVES

(a) Grind the valve enough to remove pits and carbon.

(b) Check that the valve is ground to the correct valve face angle.

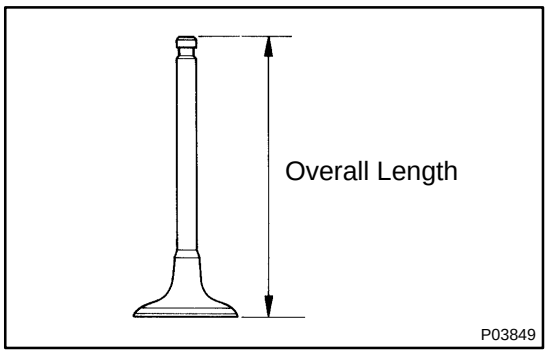
Valve face angle: 44.5°



(c) Check the valve head margin thickness.

Standard margin thickness: 1.0 mm (0.039 in.)
Minimum margin thickness: 0.5 mm (0.020 in.)

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



(d) Check the valve overall length.

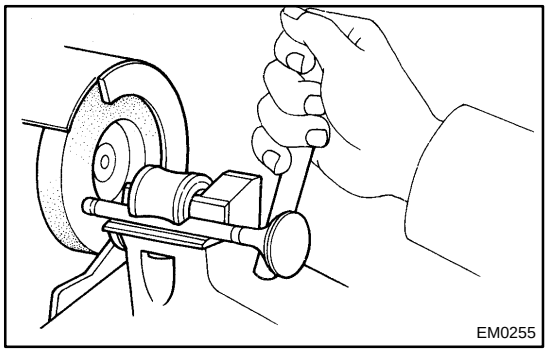
Standard overall length:

Intake	103.45 mm (4.0728 in.)
Exhaust	103.60 mm (4.0787 in.)

Minimum overall length:

Intake	102.95 mm (4.0531 in.)
Exhaust	103.10 mm (4.0590 in.)

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

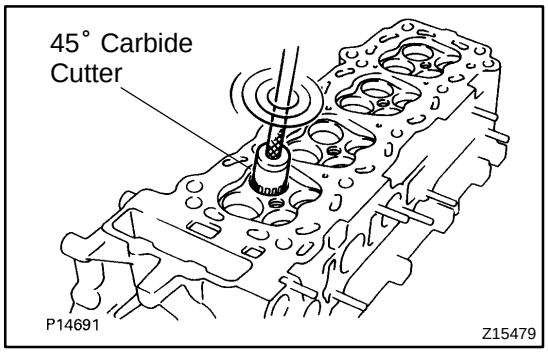


(e) Check the surface of the valve stem tip for wear.

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.

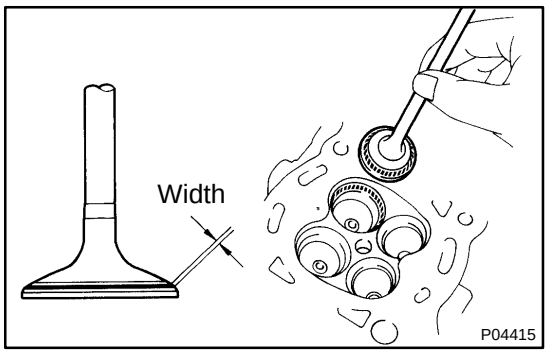


8. INSPECT AND CLEAN VALVE SEATS

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

(b) Check the valve seating position.

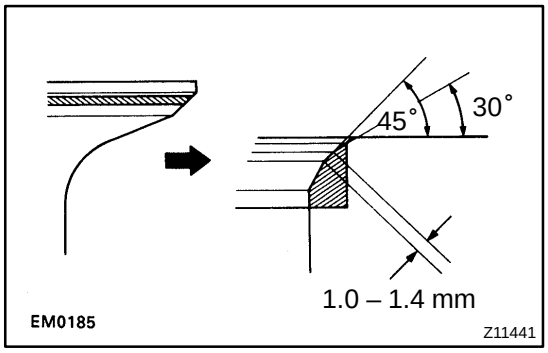
Apply a light coat of prussian blue (or white lead) to the valve face. Lightly press the valve against the seat. Do not rotate valve.



(c) Check the valve face and seat for these:

- 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 these width:

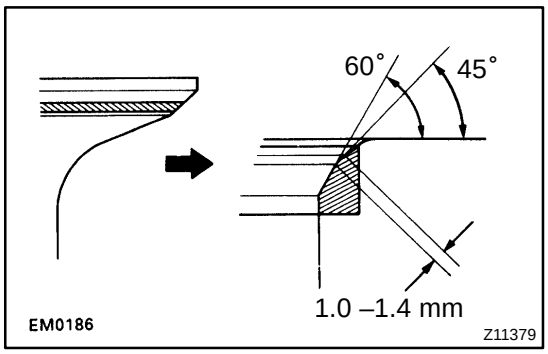
1.0 – 1.4 mm (0.039 – 0.055 in.)



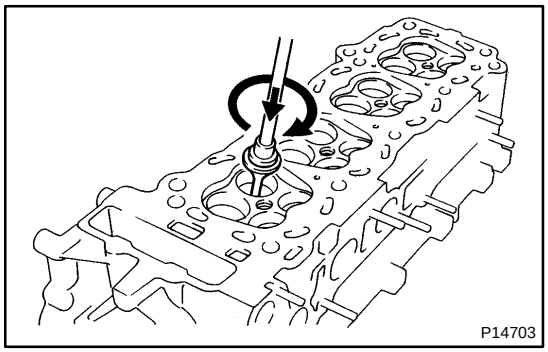
If not, correct the valve seats as follows:

(1) Intake valve seat:

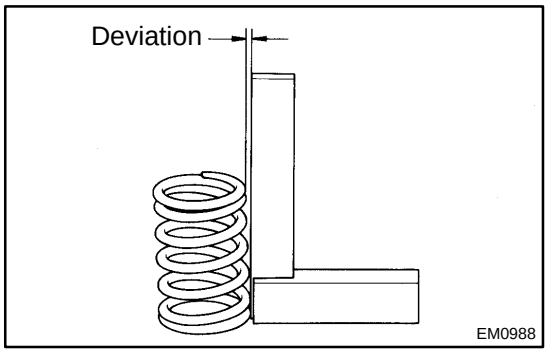
If the seating is too high on the valve face, use 30˚ and 45˚ cutters to correct the seat.



(2) Exhaust valve seat:
If the seating is too low on the valve face, use 60° and 45° cutters to correct the seat.



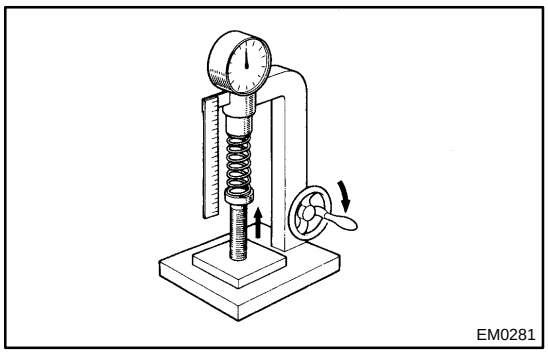
(d) Hand–lap the valve and valve seat with an abrasive compound.
(e) After hand–lapping, clean the valve and valve seat.



9. INSPECT VALVE SPRINGS

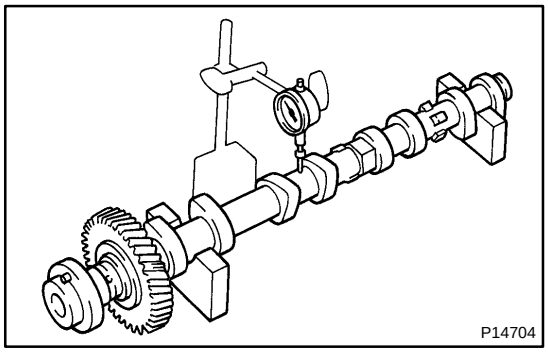
(a) Using a steel square, measure the deviation of the valve spring.
Maximum deviation: 2.0 mm (0.079 in.)

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



(b) Using a spring tester, measure the tension of the valve spring at the specified installed length.
Installed tension:
177 – 204 N (18.0 – 20.8 kgf, 39.7 – 45.9 lbf) at 35.7 mm (1.406 in.)

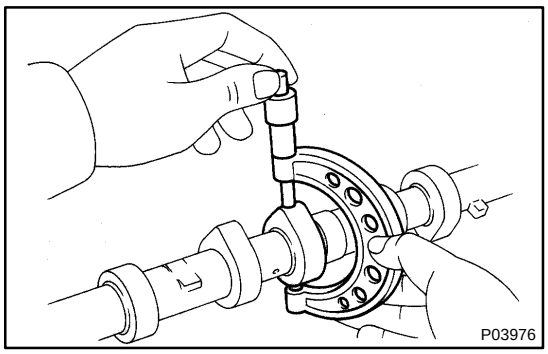
If the installed tension is not as specified, replace the valve spring.



10. INSPECT CAMSHAFT

(a) Inspect the runout.
(1) Place the camshaft on V–blocks.
(2) 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.

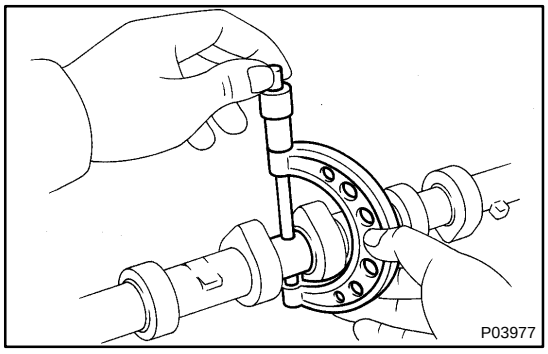


(b) Using a micrometer, measure the cam lobe height.

Standard cam lobe height:

Intake	45.31 – 45.41 mm (1.7839 – 1.7878 in.)
Exhaust	45.06 – 45.16 mm (1.7740 – 1.7779 in.)

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

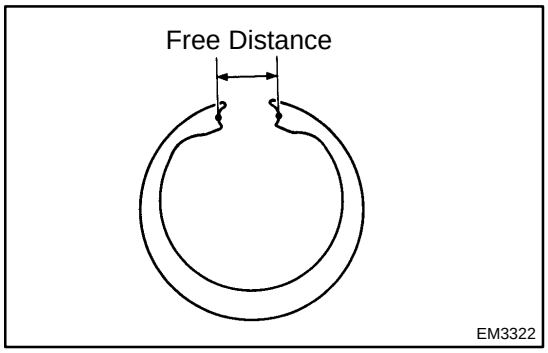


(c) Using a micrometer, measure the journal diameter.

Journal diameter:

26.959 – 26.975 mm (1.0614 – 1.0620 in.)

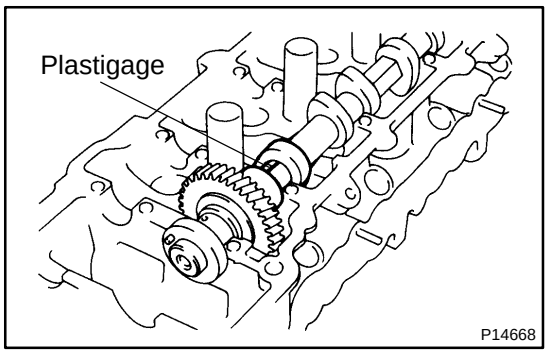
If the journal diameter is not as specified, check the oil clearance.



(d) Using a vernier caliper, measure the free distance between the gear spring ends.

Free distance: 22.5 – 22.9 mm (0.886 – 0.902 in.)

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



(e) Inspect the camshaft journal oil clearance.

(1) Clean the bearing caps and camshaft journals.

(2) Check the bearings for flaking and scoring.

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

(3) Place the camshafts on the cylinder head.

(4) Lay a strip of Plastigage across each of the journals.

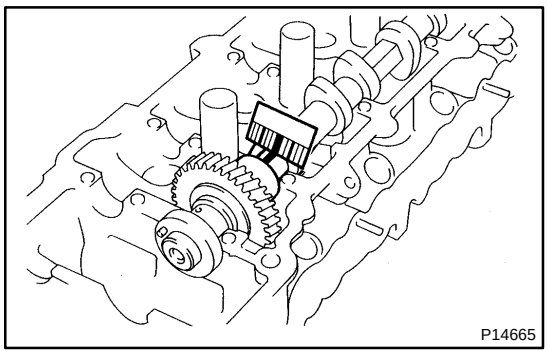
(5) Install the bearing caps (See page EM–55).

Torque: 15.5 N·m (160 kgf·cm, 12 ft·lbf)

NOTICE:

Do not turn the camshaft.

(6) Remove the bearing caps.

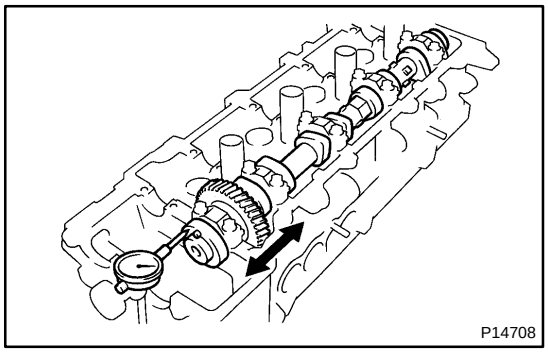

P14665

(7) Measure the Plastigage at its widest point.

Standard oil clearance:
0.025 – 0.062 mm (0.0010 – 0.0024 in.)
Maximum oil clearance: 0.08 mm (0.0031 in.)

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

(8) Completely remove the Plastigage.


P14708

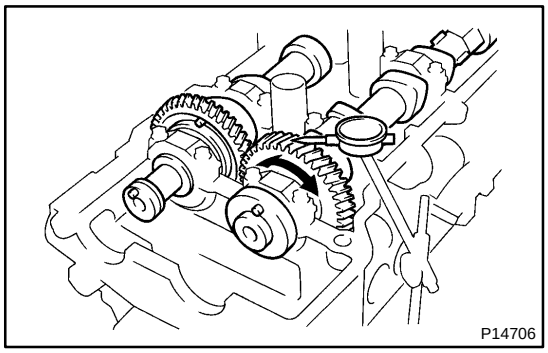
(f) Inspect the camshaft thrust clearance.

(1) Install the camshaft (See page EM–55).

(2) Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

Standard thrust clearance:
0.040 – 0.095 mm (0.0016 – 0.0037 in.)
Maximum thrust clearance: 0.12 mm (0.0047 in.)

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


P14706

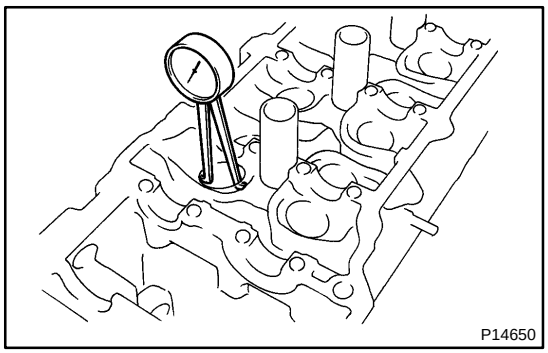
(g) Inspect the camshaft gear backlash.

(1) Install the camshafts without installing the exhaust cam sub–gear (See page EM–55).

(2) 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.)

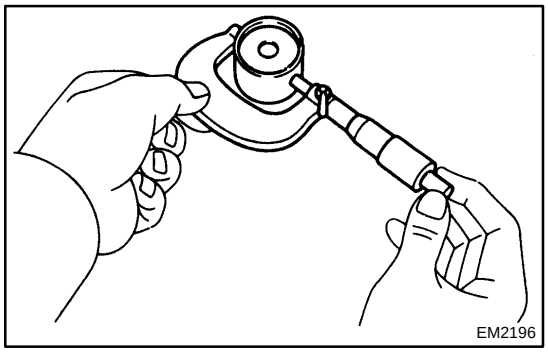
If the backlash is greater than maximum, replace the camshafts.


P14650

11. INSPECT VALVE LIFTERS AND LIFTER BORES

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

Lifter bore diameter:
31.000 – 31.016 mm (1.2205 – 1.2211 in.)


EM2196

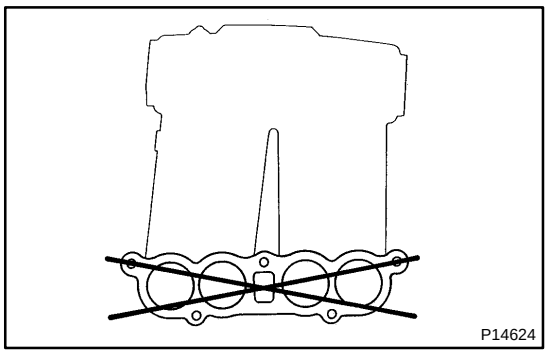
(b) Using a micrometer, measure the lifter diameter.

Lifter diameter:
30.966 – 30.976 mm (1.1578 – 1.2195 in.)

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

Standard oil clearance:
0.024 – 0.050 mm (0.0009 – 0.0020 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.

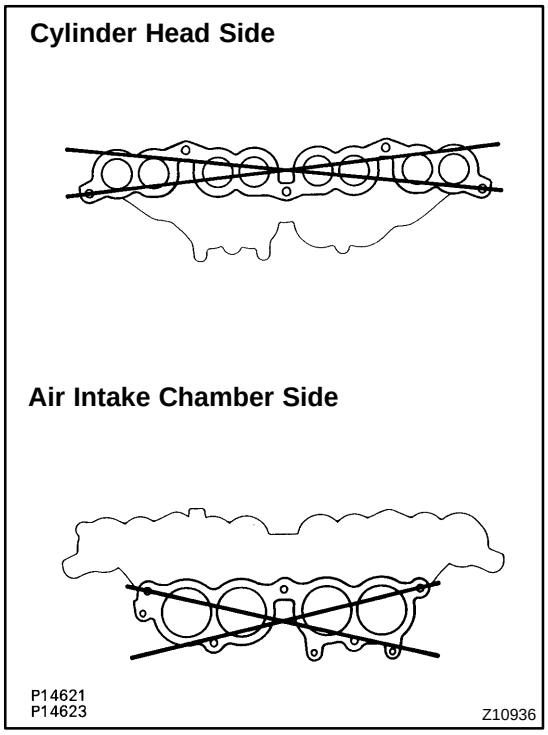


12. INSPECT AIR INTAKE CHAMBER

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

Maximum warpage: 0.20 mm (0.0078 in.)

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

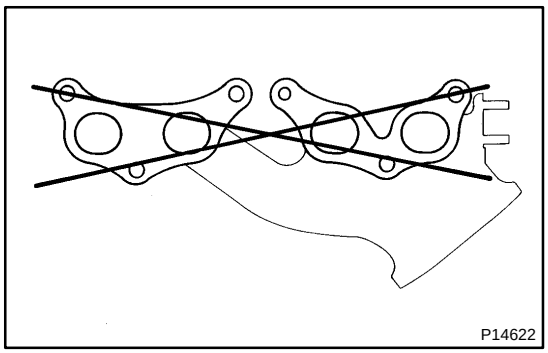


13. INSPECT INTAKE MANIFOLD

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

Maximum warpage: 0.20 mm (0.0078 in.)

If warpage is greater than maximum, replace the manifold.

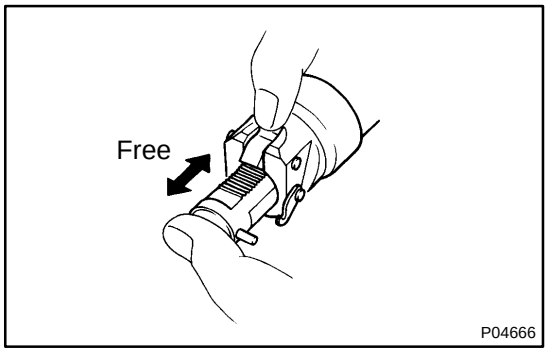


14. INSPECT EXHAUST MANIFOLD

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

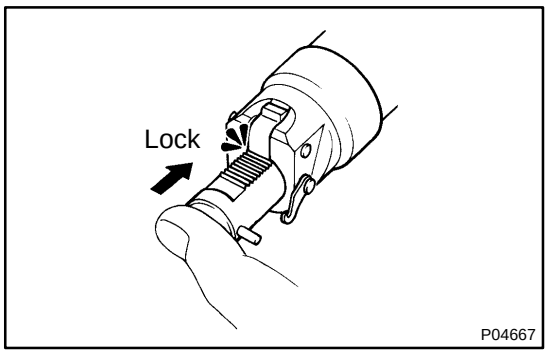
Maximum warpage: 0.50 mm (0.0197 in.)

If warpage is greater than maximum, replace the manifold.

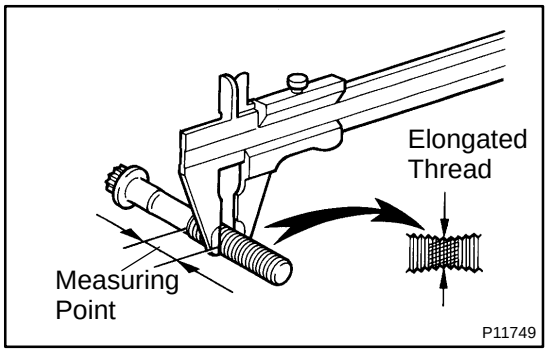


15. INSPECT CHAIN TENSIONER

(a) Check that the plunger moves smoothly when the ratchet pawl is raised with your finger.



(b) Released the ratchet pawl and check that the plunger is locked in place by the ratchet pawl and does not move when pushed with your finger.



16. INSPECT CYLINDER HEAD BOLTS

Using vernier calipers, measure the minimum diameter of the elongated thread at the measuring point.

Standard outside diameter:
10.76 – 10.97 mm (0.4236 – 0.4319 in.)
Minimum outside diameter: 10.40 mm (0.4094 in.)

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