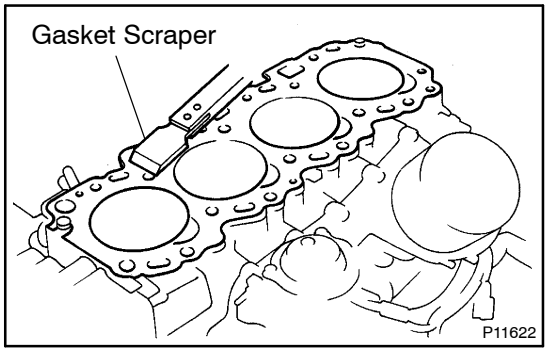
EM15F–01

INSPECTION



1. CLEAN TOP SURFACES OF PISTONS AND CYLINDER BLOCK

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

(b) Remove all the gasket material from the top of the cylinder block.

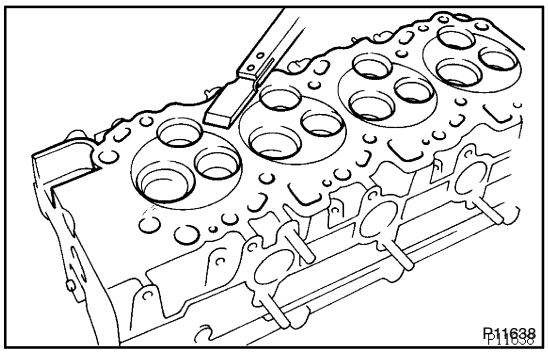
NOTICE:

Be careful not to scratch the surfaces.

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

CAUTION:

Protect your eyes when using high–compressed air.

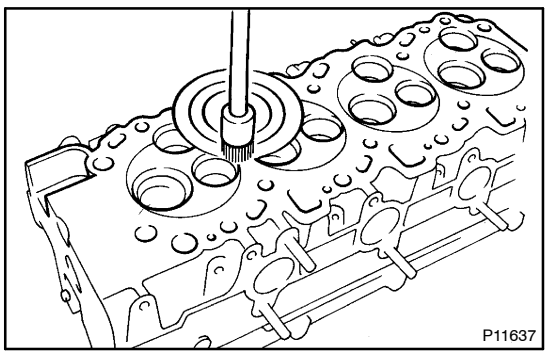


2. REMOVE GASKET MATERIAL

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.

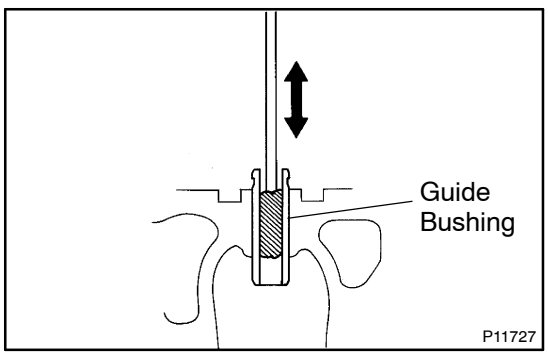


3. CLEAN COMBUSTION CHAMBERS

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

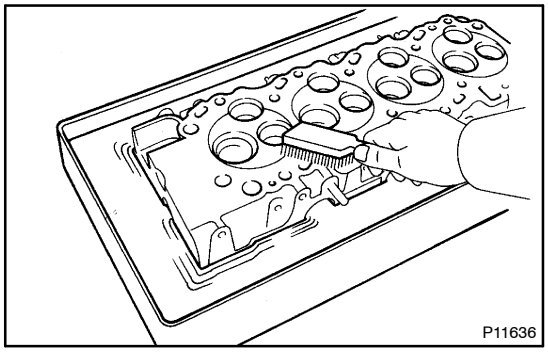
NOTICE:

Be careful not to scratch the cylinder block contact surface.



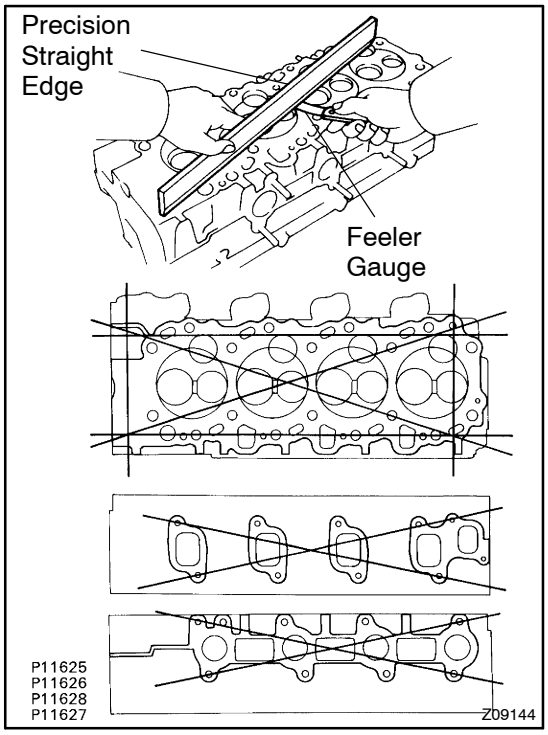
4. CLEAN VALVE GUIDE BUSHINGS

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



5. CLEAN CYLINDER HEAD

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

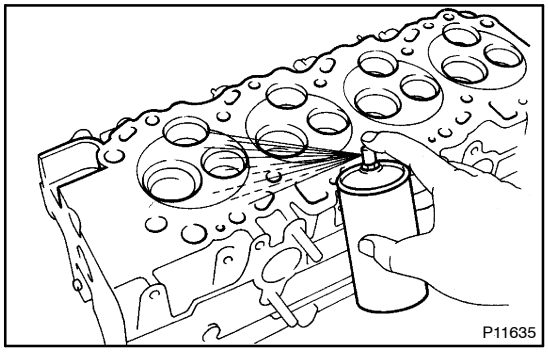


6. INSPECT FOR FLATNESS

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

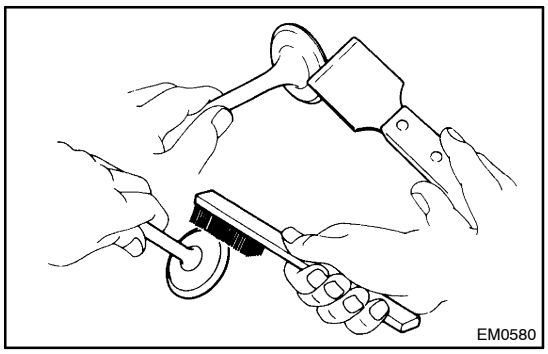
Maximum warpage: 0.15 mm (0.0059 in.)

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



7. INSPECT FOR CRACKS

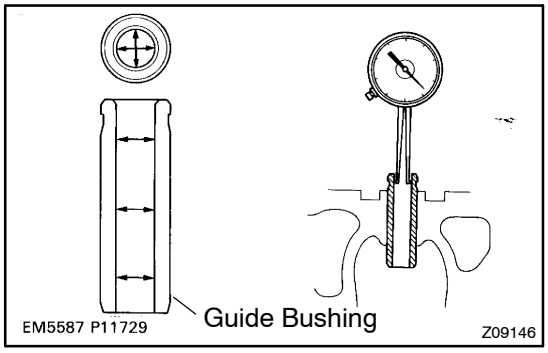
Using a dye penetrant, check the combustion chambers, intake ports, exhaust ports and surface contacting the cylinder block. If cracked, replace the cylinder head.



8. CLEAN VALVES

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

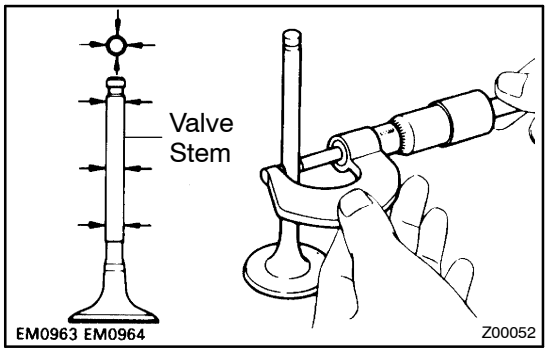
(b) Using a wire brush, thoroughly clean the valve.



9. INSPECT VALVE STEMS AND GUIDE BUSHINGS

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

Bushing inside diameter:
8.010 – 8.030 mm (0.3154 – 0.3161 in.)



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

Valve stem diameter:

Intake	7.975 – 7.990 mm (0.3140 – 0.3146 in.)
Exhaust	7.960 – 7.975 mm (0.3134 – 0.3140 in.)

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

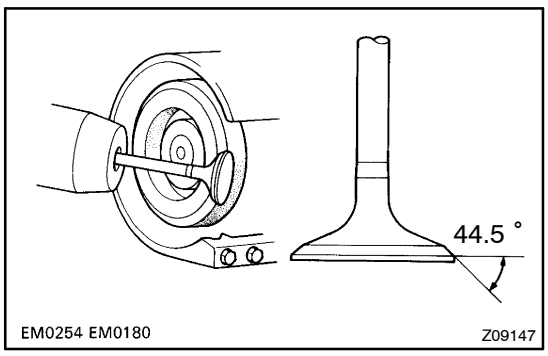
Standard oil clearance:

Intake	0.020 – 0.055 mm (0.0008 – 0.0022 in.)
Exhaust	0.035 – 0.070 mm (0.0014 – 0.0028 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–59)

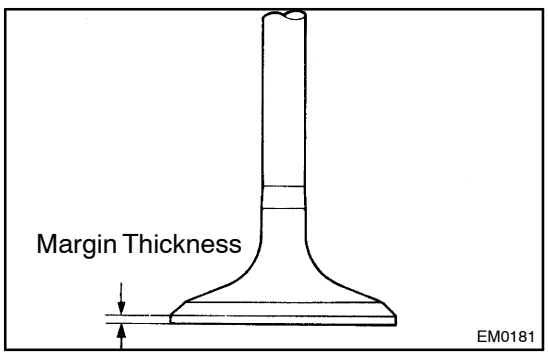


10. INSPECT AND GRIND VALVES

(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.

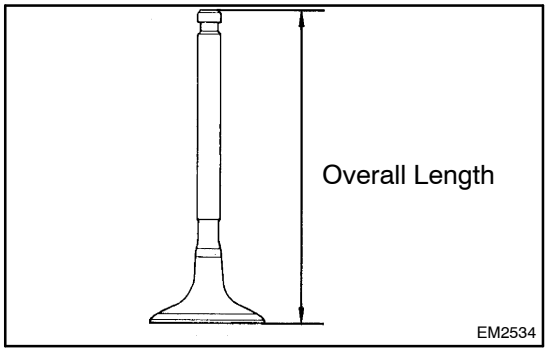
Standard margin thickness:

Intake	1.6 mm (0.063 in.)
Exhaust	1.7 mm (0.067 in.)

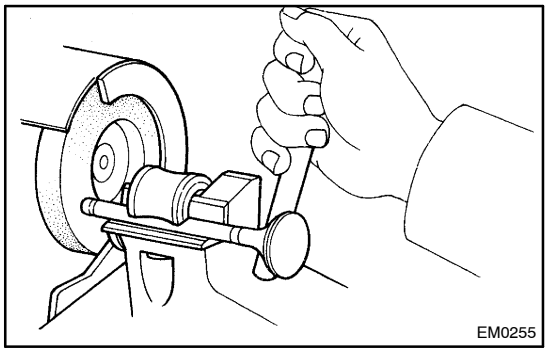
Minimum margin thickness:

Intake	1.1 mm (0.043 in.)
Exhaust	1.2 mm (0.047 in.)

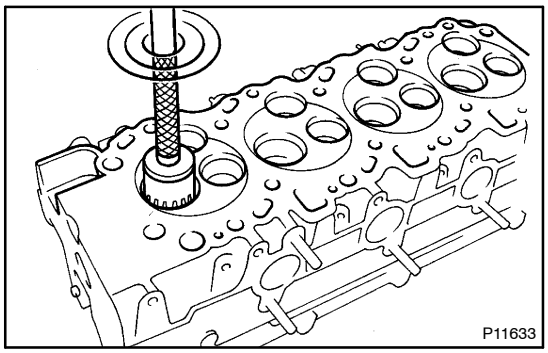
If the margin thickness is less than minimum, replace the valve.



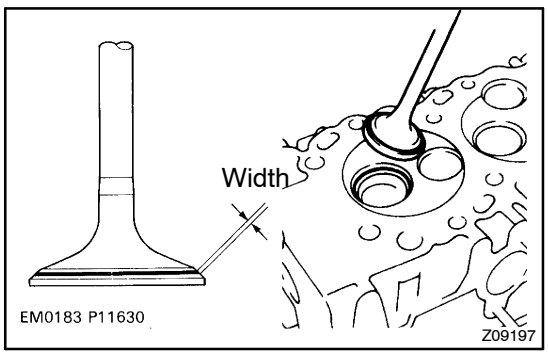
(d) Check the valve overall length.
Standard overall length:
103.29 – 103.69 mm (4.0665 – 4.0823 in.)
Minimum overall length: 102.79 mm (4.0468 in.)
If the overall length is less than minimum, replace the valve.



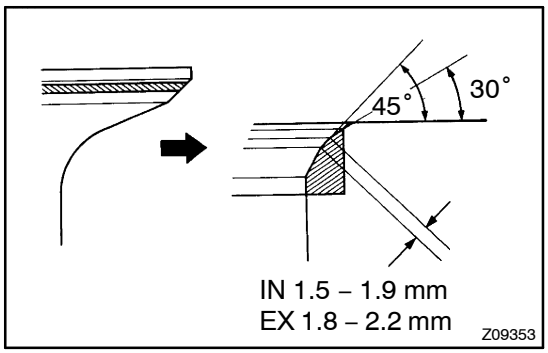
(e) Check the surface of the valve stem tip for wear.
If the valve stem tip is worn, resurface the tip with a grinder or replace the valve.
NOTICE:
Do not grind off more than minimum overall length.



11. INSPECT AND CLEAN VALVE SEATS
(a) Using a 45° carbide cutter, resurface the valve seats. Remove only enough metal to clean the seats.

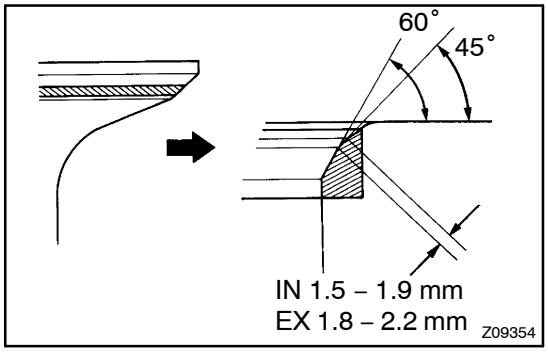


(b) Check the valve seating position.
Apply a light coat of prussian blue (or white lead) to the valve face. Lightly press the valve against the seat. Do not rotate valve.
(c) Check the valve face and seat for the following:
- If blue appears 360° around the valve face, the valve is concentric. If not, 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:

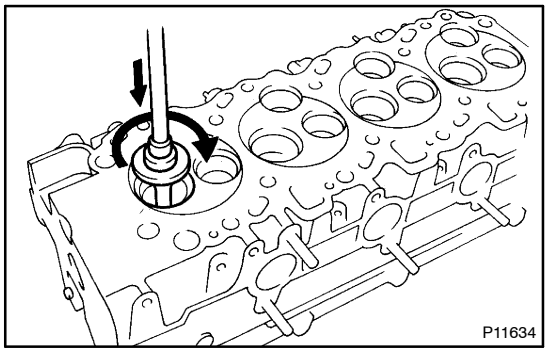


Intake	1.5 – 1.9 mm (0.059 – 0.075 in.)
Exhaust	1.8 – 2.2 mm (0.071 – 0.087 in.)

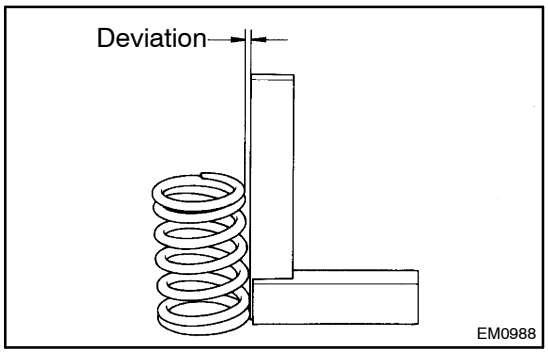
If not, correct the valve seats as follows:
(1) If the seating is too high on the valve face, use 30° and 45° cutters to correct the seat.



(2) If the seating is too low on the valve face, use 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.

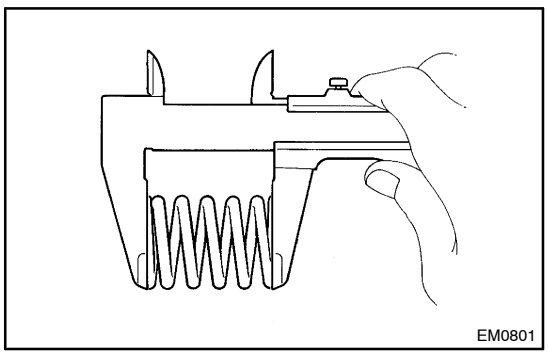


12. INSPECT VALVE SPRINGS

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

Maximum deviation: 2.0 mm (0.079 in.)

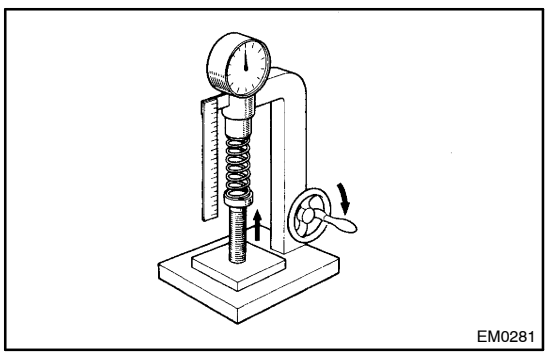
If the deviation is greater than maximum, replace the valve spring.



(b) Using a vernier caliper, measure the free length of the valve spring.

Free length: 48.54 mm (1.9110 in.)

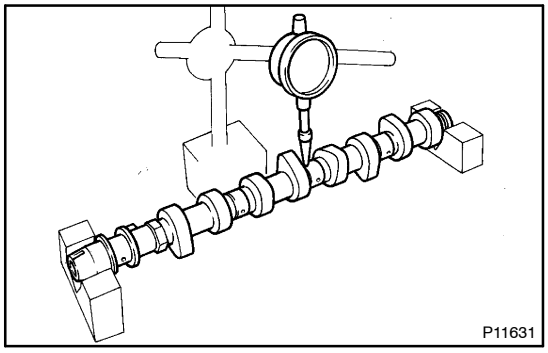
If the free length is not as specified, replace the valve spring.



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

Installed tension:
301 – 332 N (30.7 – 33.9 kgf, 67.7 – 74.7 lbf)
at 37.0 mm (1.457 in.)

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



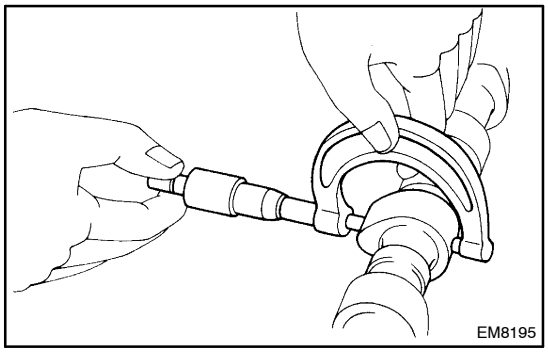
13. INSPECT CAMSHAFT FOR RUNOUT

(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.



14. INSPECT CAM LOBES

Using a micrometer, measure the cam lobe height.

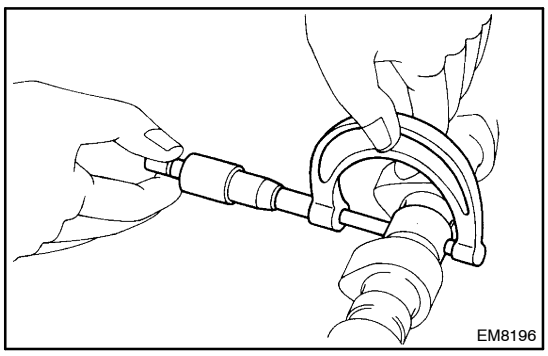
Standard cam lobe height:

Intake	54.810 – 54.910 mm (2.1579 – 2.1618 in.)
Exhaust	56.140 – 56.240 mm (2.2102 – 2.2142 in.)

Minimum cam lobe height:

Intake	54.39 mm (2.1413 in.)
Exhaust	55.72 mm (2.1937 in.)

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



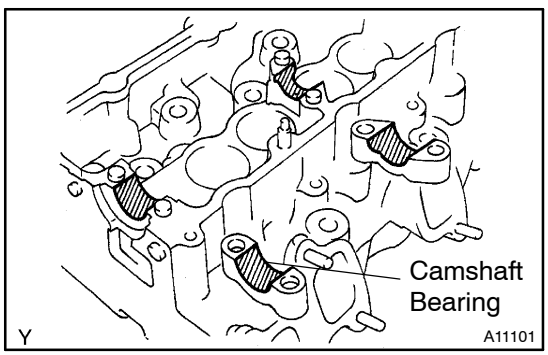
15. INSPECT CAMSHAFT JOURNALS

Using a micrometer, measure the journal diameter.

Journal diameter:

27.969 – 27.985 mm (1.1011 – 1.1018 in.)

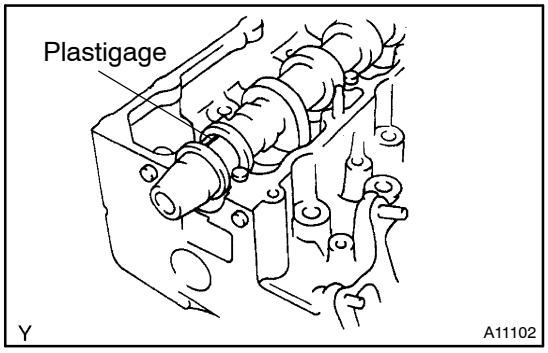
If the journal diameter is not as specified, check the oil clearance.

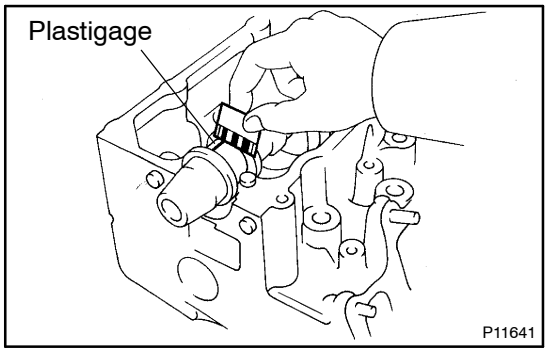


16. INSPECT CAMSHAFT BEARINGS

Check the bearings for flaking and scoring.

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





17. INSPECT CAMSHAFT JOURNAL OIL CLEARANCE

(a) Clean the bearing caps and camshaft journals.

(b) Place the camshaft on the cylinder head.

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

(d) Install the bearing caps. (See page EM–64)

Torque: 18 N·m (185 kgf·cm, 13 ft·lbf)

NOTICE:

Do not turn the camshaft.

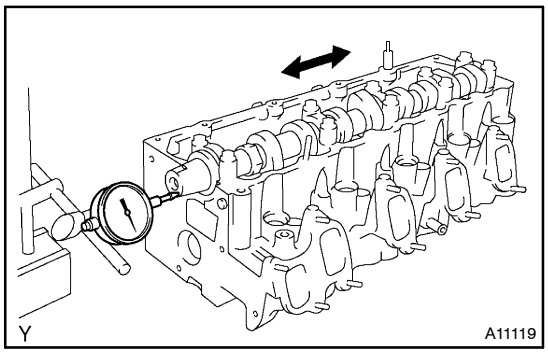
(e) Remove the bearing caps.

(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 (0.039 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.



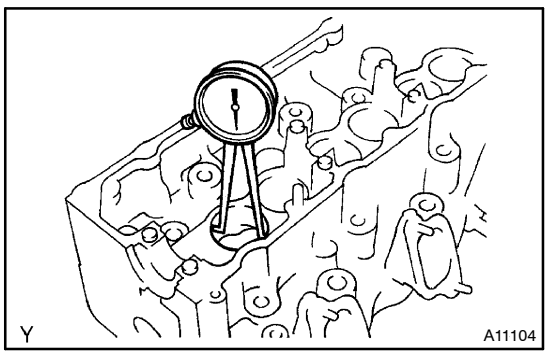
18. INSPECT CAMSHAFT THRUST CLEARANCE

(a) Install the camshaft. (See page EM–64)

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

Standard thrust clearance:
0.08 – 0.18 mm (0.0031 – 0.0071 in.)
Maximum thrust clearance: 0.25 mm (0.0098 in.)

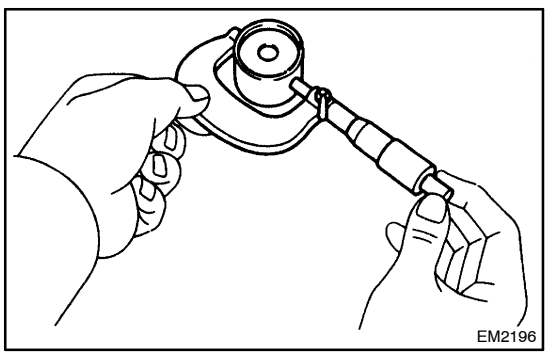
If the thrust clearance is greater than maximum, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.



19. INSPECT VALVE LIFTERS AND LIFTER BORES

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

Lifter bore diameter:
40.930 – 40.950 mm (1.6114 – 1.6122 in.)



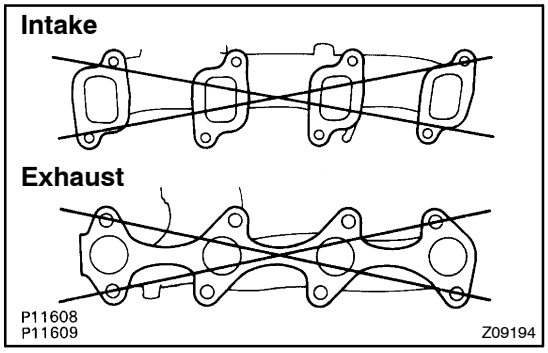
(b) Using a micrometer, measure the lifter diameter.

Lifter diameter:
40.892 – 40.902 mm (1.6099 – 1.6103 in.)

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

Standard oil clearance:
0.038 – 0.063 mm (0.0015 – 0.0025 in.)
Maximum oil clearance: 0.08 mm (0.0031 in.)

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

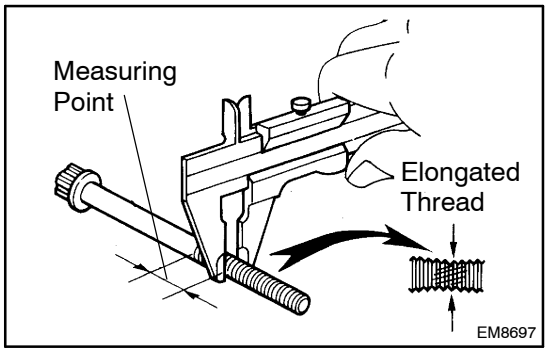


20. INSPECT INTAKE AND EXHAUST MANIFOLDS

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

Maximum warpage: 0.40 mm (0.0157 in.)

If warpage is greater than maximum, replace the manifold.



21. INSPECT CYLINDER HEAD BOLTS

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

Standard outer diameter:
11.8 – 12.0 mm (0.465 – 0.472 in.)

Minimum outer diameter: 11.6 mm (0.457 in.)

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