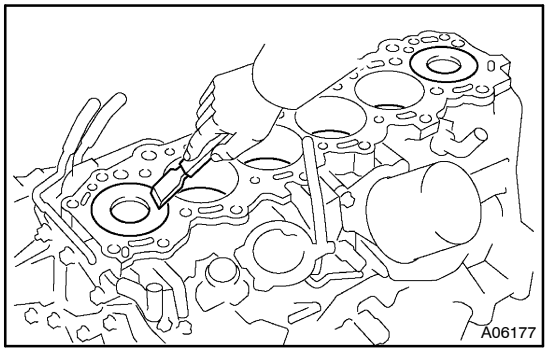
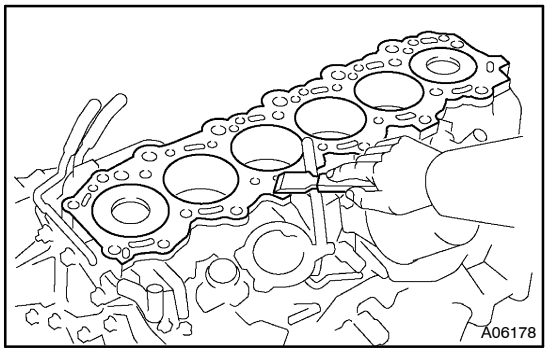
EM0WO–02

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.

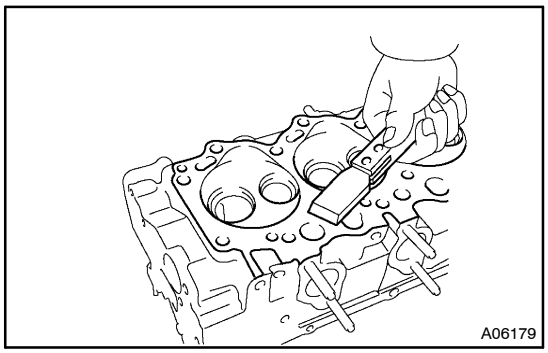
2. CLEAN CYLINDER HEAD

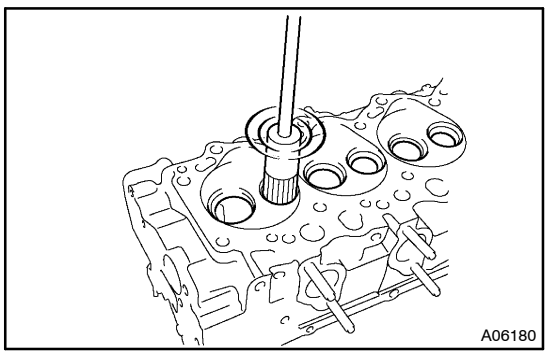
(a) Remove gasket material

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.



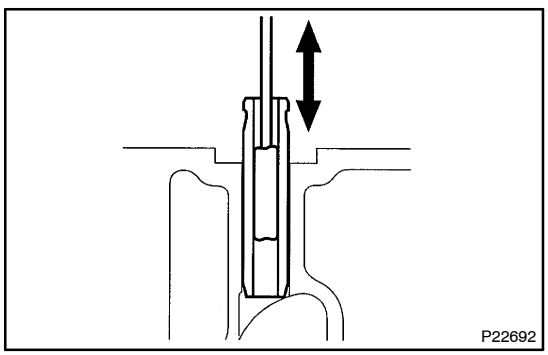


(b) Clean intake and exhaust ports

Using a wire brush, remove all the carbon from the intake and exhaust ports.

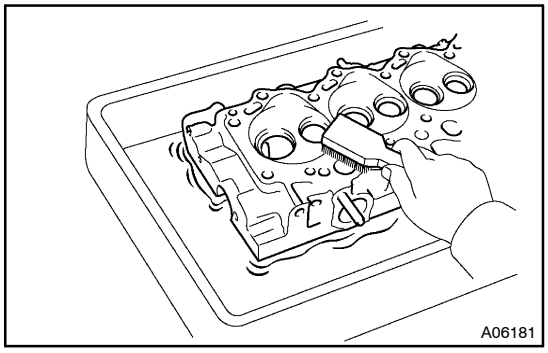
NOTICE:

Be careful not to scratch the valve contact surface.

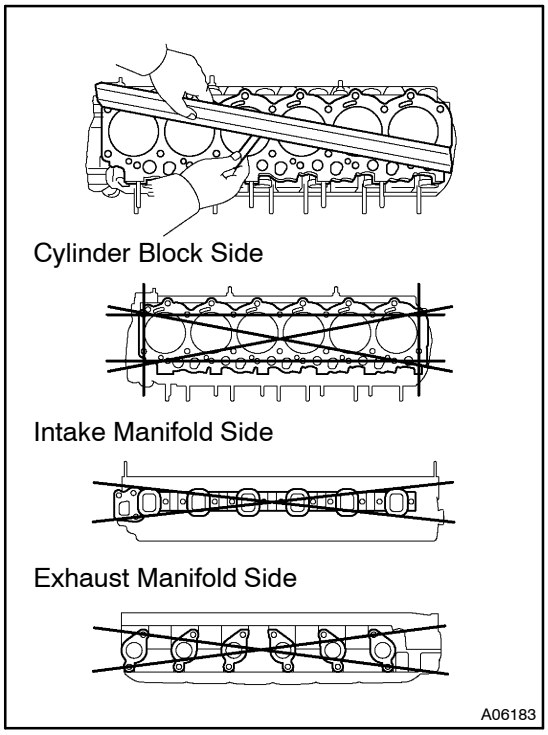


(c) Clean valve guide bushings

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



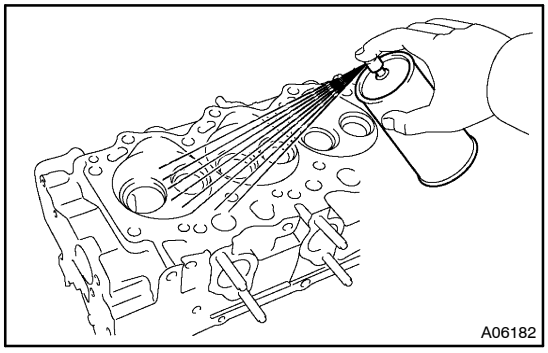
(d) Clean cylinder head
Using a soft brush and solvent, thoroughly clean the cylinder head.



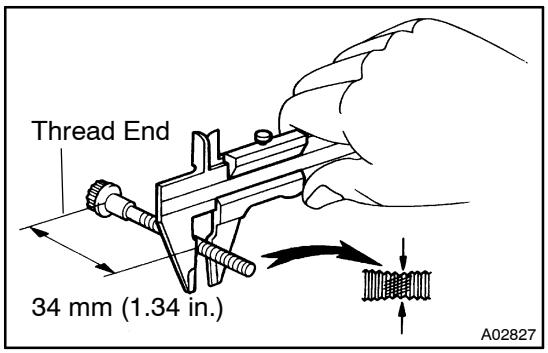
3. INSPECT CYLINDER HEAD

(a) Inspect for flatness
Using a precision straight edge an thickness gauge, measure the surfaces contacting the cylinder block and the manifolds for warpage.
Maximum warpage: 0.20 mm (0.0079 in.)

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

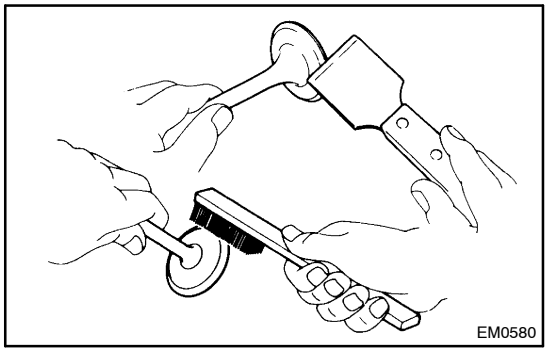


(b) Inspect for cracks
Using a dye penetrate, check the intake ports, exhaust ports and surface contacting the cylinder block.
If cracked, replace the cylinder head.



(c) Inspect cylinder head bolts
Using vernier calipers, measure the minimum outer diameter of the compressed thread at the measuring point.
Standard outer diameter:
10.800 – 11.000 mm (0.4252 – 0.4331 in.)
Minimum outer diameter: 10.55 mm (0.4154 in.)

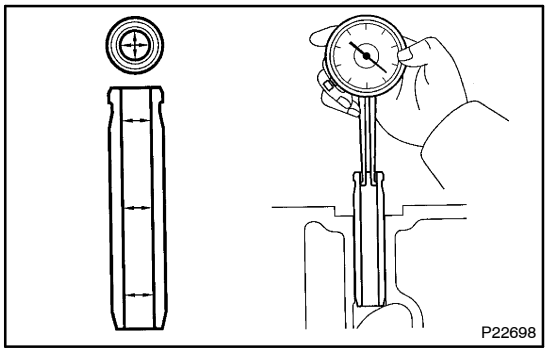
If the outer diameter is less than minimum, replace the bolt.



4. CLEAN VALVES

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

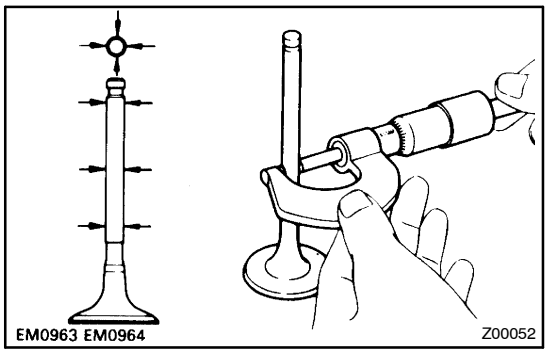
(b) Using a wire brush, thoroughly clean the valve.



5. INSPECT VALVE STEMS AND GUIDE BUSHINGS

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

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



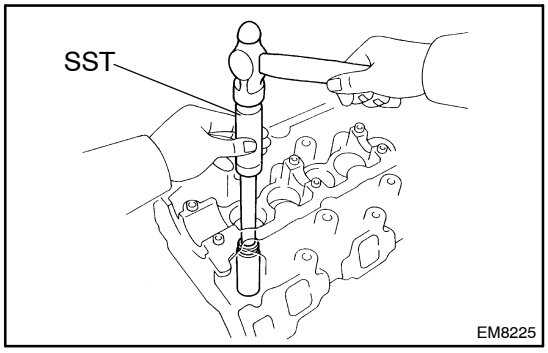
(b) Using a micrometer, measure the diameter of the valve stem.

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 busing inside diameter measurement.

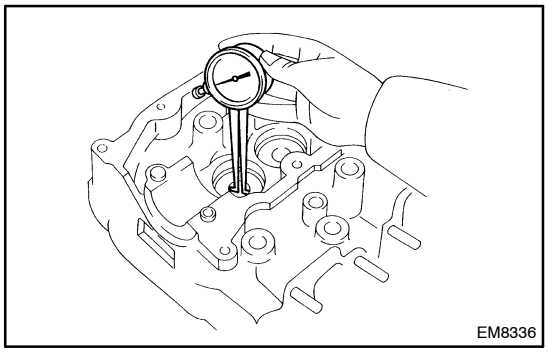
Standard oil clearance:
Intake
0.020 – 0.055 mm (0.0008 in.)
Exhaust
0.035 – 0.070 mm (0.0014 – 0.0028 in.)
Maximum oil clearance:
Intake
0.08 mm (0.0031 in.)
Exhaust
0.10 mm (0.0039 in.)

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



6. IF NECESSARY, REPLACE VALVE GUIDE BUSHINGS

(a) Using SST and a hammer, tap out the guide bushing.
SST 09201–10000 (09201–01060)



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

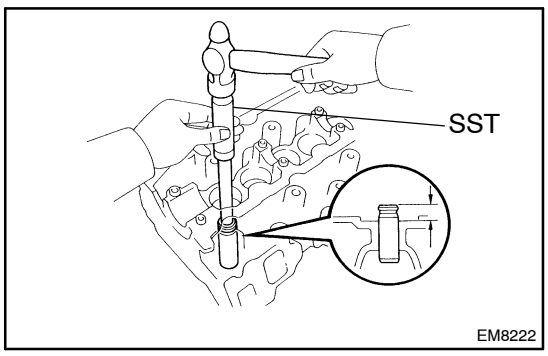
Bushing bore diameter mm (in.)	Bushing size
13.004 – 13.025 (0.5112 – 0.5128)	Use STD
13.054 – 13.075 (0.5139 – 0.5148)	Use O/S 0.05

(c) Select a new guide bushing (STD size or O/S 0.05).

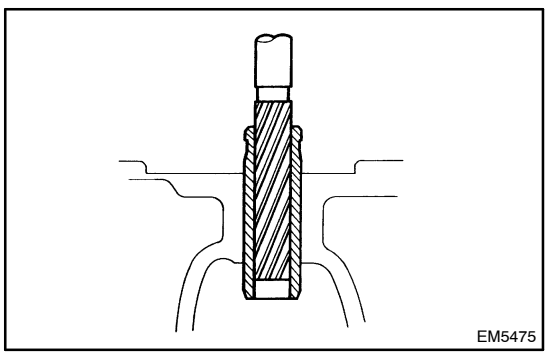
If the bushing bore diameter of the cylinder head is greater than 13.025 mm (0.5128 in.), machine the bushing bore to the following dimension:

Rebored cylinder head bushing bore dimension:
13.054 – 13.075 mm (0.5139–0.5148 in.)

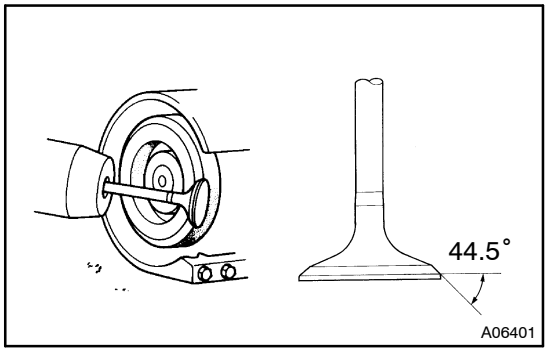
If the bushing bore diameter of the cylinder head is greater than 13.075 mm (0.5148 in.), replace the cylinder head.



(d) Using SST and a hammer, tap in a new guide bushing to where there is 11.8 – 12.2 mm (0.465 – 0.480 in.) protruding from the cylinder head.
SST 09201–10000 (09201–01060)



(e) Using a sharp 8 mm reamer, ream the guide bushing to obtain the standard specified clearance between the guide bushing and valve stem.

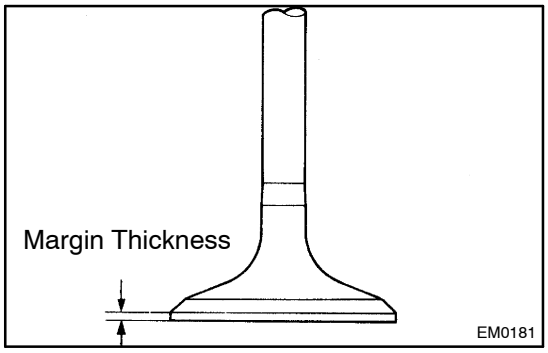


7. INSPECT AND GRIND VALVES

(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 face for wear.

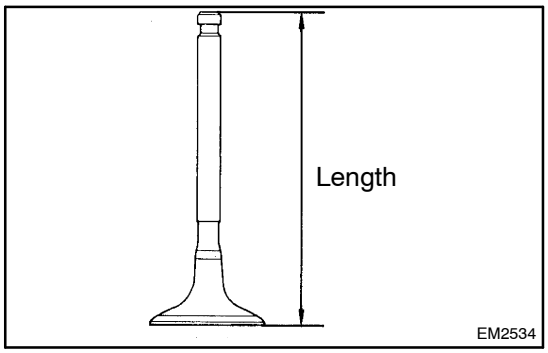
If the valve face is worn, replace the valve.

(d) Check the valve head margin thickness.

Standard margin thickness: 1.00 mm (0.0394 in.)

Minimum margin thickness: 0.83 mm (0.0327 in.)

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



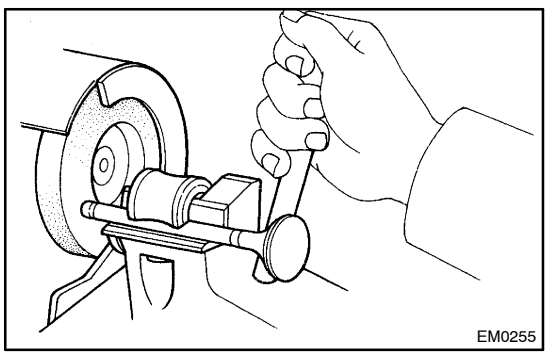
(e) Check the valve overall length.

Standard overall length:
Intake
103.49 mm (4.0744 in.)
Exhaust
103.34 mm (4.0685 in.)
Minimum overall length:
Intake
102.79 mm (4.0468 in.)
Exhaust
102.64 mm (4.0409 in.)

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

(f) Check the valve stem tip for wear.

If the valve stem tip is worn, replace the valve.

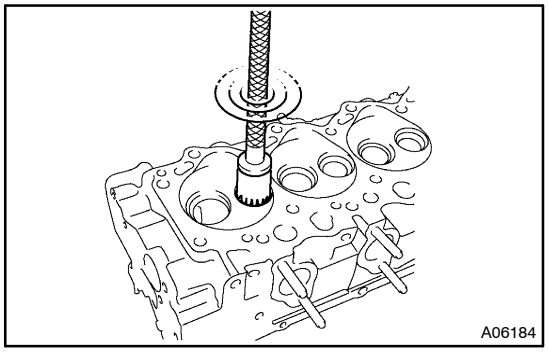


(g) Check the surface of the valve stem tip for wear.

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

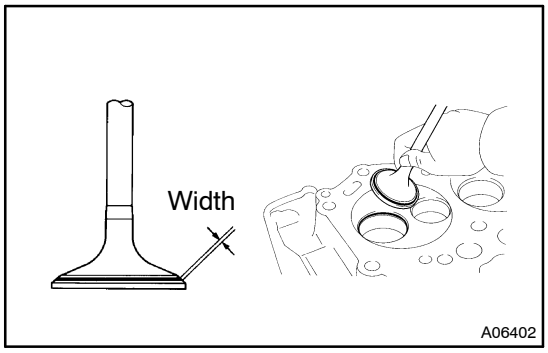
NOTICE:

Do not grind off more than the minimum overall length.



8. INSPECT AND CLEAN VALVE SEATS

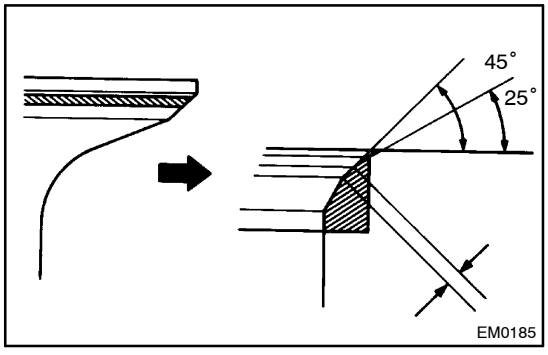
(a) Using a 45˚ carbide cutter, resurface the valve seats. Remove only enough metal to clean the seats.



(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.

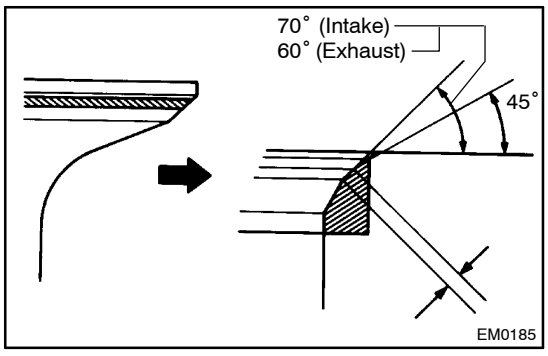
(c) Check the valve face and seat for the following:
- If blue appears 360˚ around the valve face, the valve is concentric. If not, replace the valve.
- If blue appears 360˚ around the valve seat,the guide and face are concentric. If not, resurface the seat.
- Check that the seat contact is in the middle 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.)



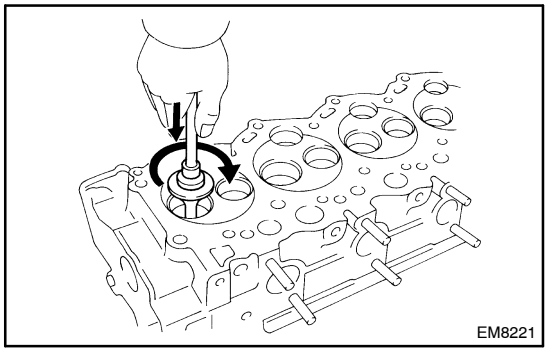
If not, correct the valve seats as follows:

(1) If the seating is too high on the valve face, use 25˚ and 45˚ cutters to correct the seat.

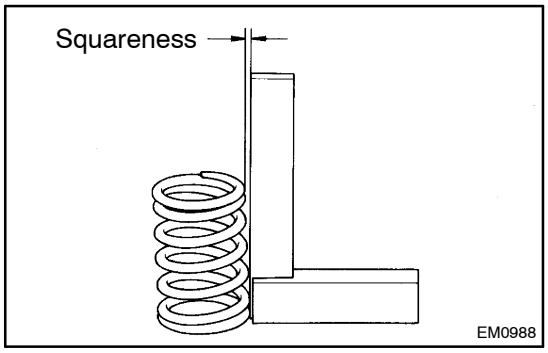


(2) (Intake)
If the seating is too low on the valve face, use 70˚ and 45˚ cutters to correct the seat.

(3) (Exhaust)
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.

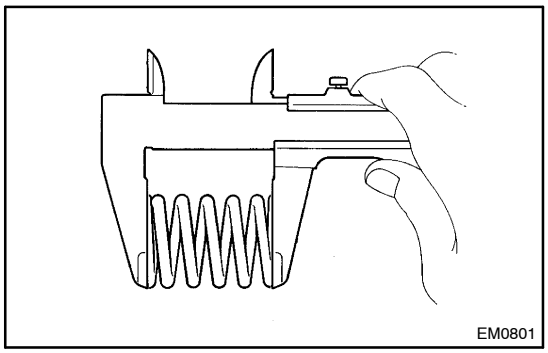


9. INSPECT VALVE SPRINGS

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

Maximum deviation: 2.0 mm (0.079 in.)

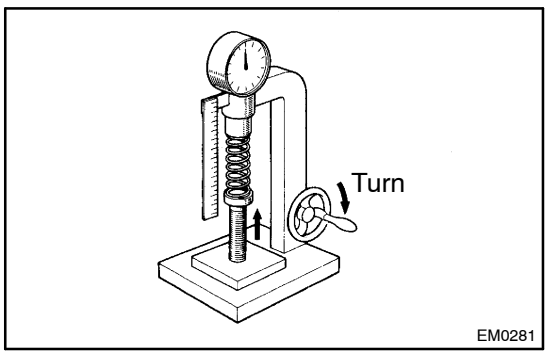
If the deviation is greater than maximum, replace the valve spring.



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

Free length: 46.20 mm (1.8189 in.)

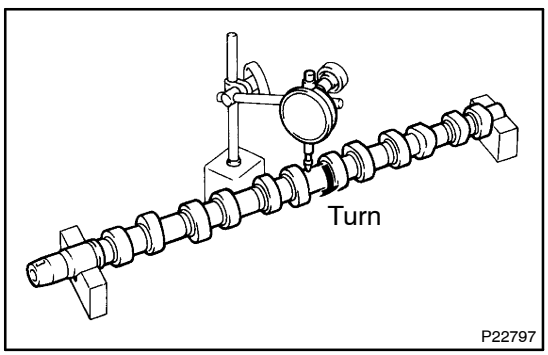
If the free length is not as specified, replace the valve spring.



(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.

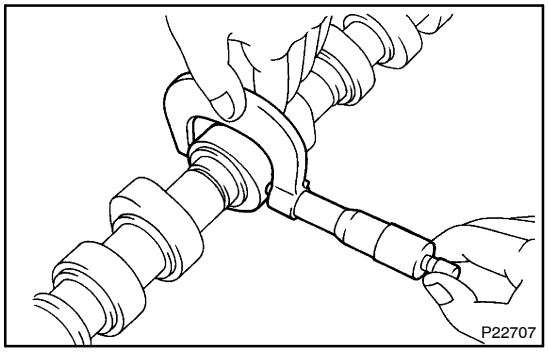


10. INSPECT CAMSHAFTS AND BEARINGS

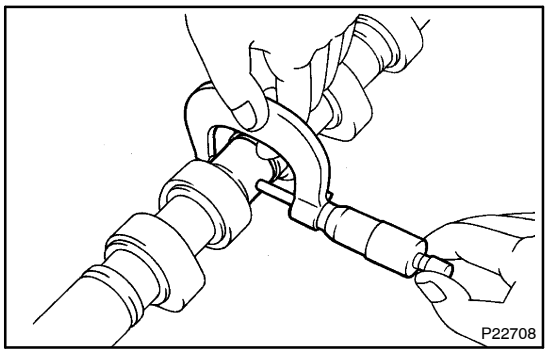
(a) Inspect camshaft for runout
  (1) Place the camshaft on V–blocks.
  (2) Using a dial indicator, measure the circle runout at the center journal.

Maximum circle runout: 0.10 mm (0.0039 in.)

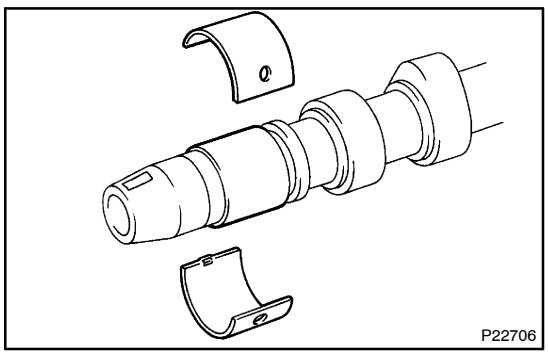
If the circle runout is greater than maximum, replace the camshaft.



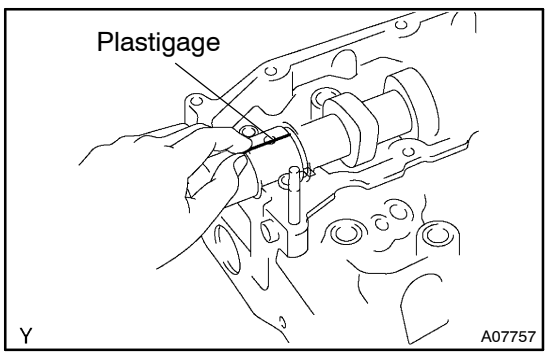
(b) Inspect cam lobes
Using a micrometer, measure the cam lobe height.
Standard cam lobe height:
Intake:
1HZ:
55.090 – 55.110 mm (2.1689 – 2.1697 in.)
1HD–T:
54.440 – 54.460 mm (2.1433 – 2.1441 in.)
Exhaust:
55.940 – 55.960 mm (2.2024 – 2.2031 in.)
Minimum cam lobe height:
Intake
1HZ:
54.59 mm (2.1492 in.)
1HD–T:
53.94 mm (2.1236 in.)
Exhaust
55.44 mm (2.1827 in.)
If the cam lobe height is less than minimum, replace the camshaft.



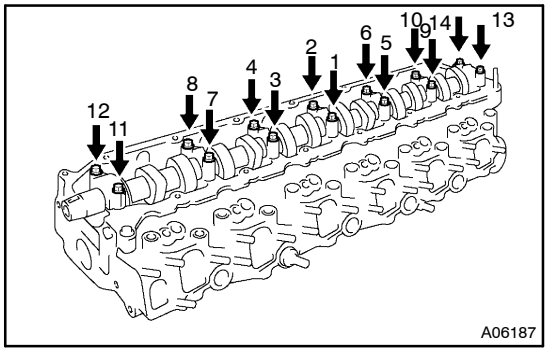
(c) Inspect camshaft journals
Using a micrometer, measure the journal diameter.
Journal diameter:
No.1
34.969 – 34.985 mm (1.3767 – 1.3774 in.)
others
27.986 – 28.002 mm (1.1018 – 1.1024 in.)
If the journal diameter is not as specified, check the oil clearance.



(d) 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.



(e) Inspect camshaft journal oil clearance
(1) Clean the bearing caps and camshaft journals.
(2) Place the camshaft on the cylinder head.
(3) Lay a strip of Plastigage across each of the camshaft journals.

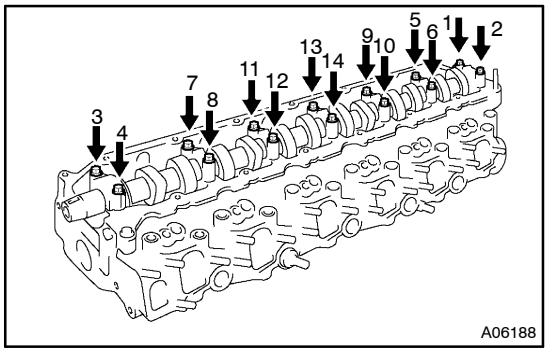


(4) Install the 7 bearing caps with the 14 bolts. Uniformly tighten the bolts in several passes, in the sequence shown.

Torque: 25 N·m (250 kgf·cm, 18 ft·lbf)

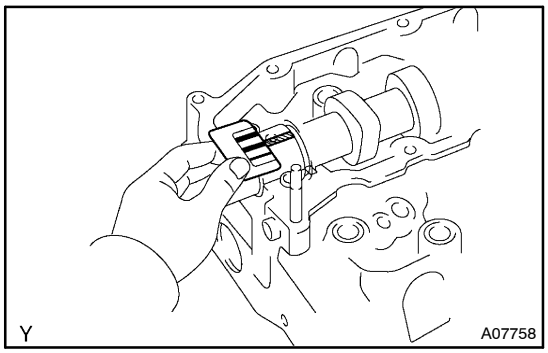
NOTICE:

Do not turn the camshaft.



(5) Uniformly loosen and remove the 14 bolts in several passes, in the sequence shown.

(6) Remove the 7 bearing caps.



(7) Measure the Plastigage at its widest point.

Standard oil clearance:

No.1

0.022 – 0.074 mm (0.0009 – 0.0029 in.)

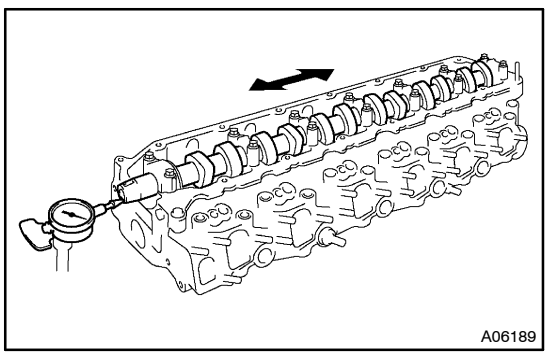
Others

0.030 – 0.066 mm (0.0012 – 0.0026 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.

(8) Completely remove the Plastigage.



(f) Inspect camshaft thrust clearance

(1) Install the camshaft.
(See procedure in item (4) above)

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

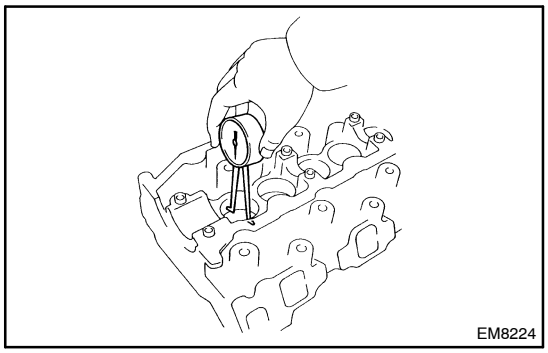
Standard thrust clearance:

0.10 – 0.20 mm (0.0039 – 0.0079 in.)

Maximum thrust clearance: 0.30 mm (0.0118 in.)

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

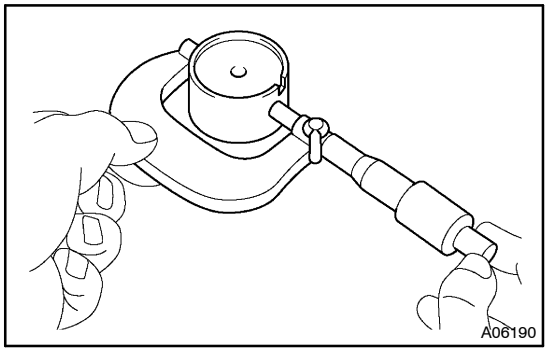
(3) Remove the camshaft.



11. INSPECT VALVE LIFTERS AND LIFTER BORES

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

Lifter bore diameter:
40.960 – 40.980 mm (1.6126 – 1.6134 in.)



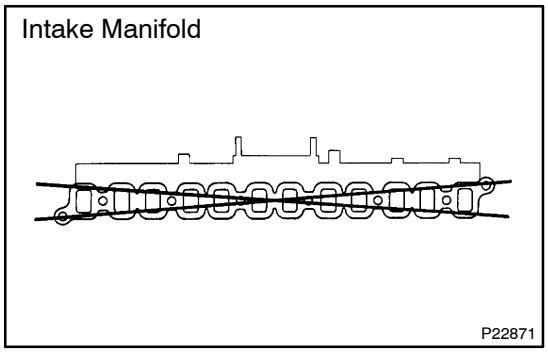
(b) Using a micrometer, measure the lifter diameter.

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:
0.058 – 0.083 mm (0.0023 – 0.0033 in.)
Maximum oil clearance: 0.10 mm (0.0039 in.)

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

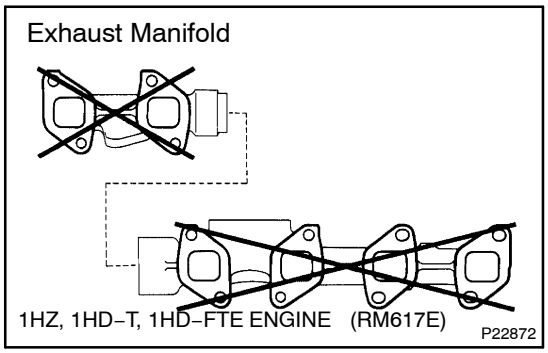


12. INSPECT INTAKE MANIFOLD

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.



13. INSPECT EXHAUST MANIFOLD

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.