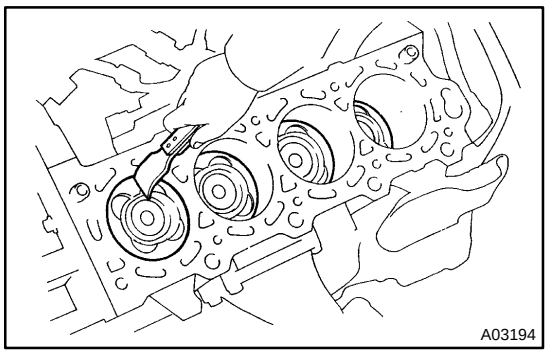
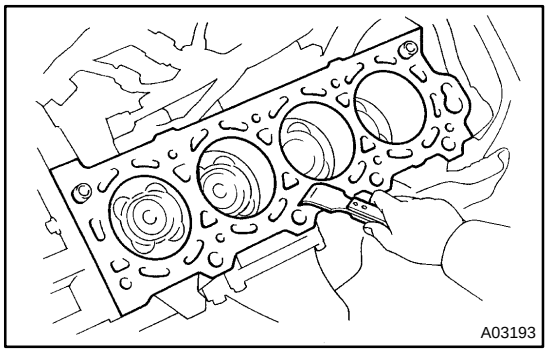
EM1X1−02

INSPECTION



1. CLEAN TOP SURFACES OF PISTONS AND CYLINDER BLOCK

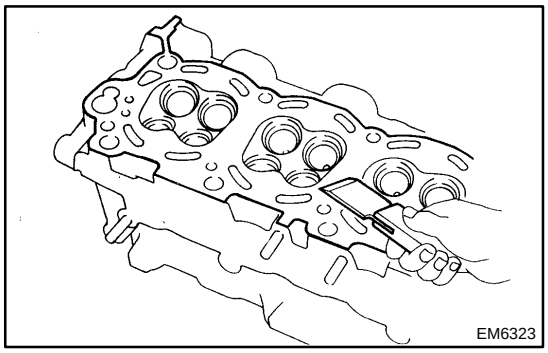
(a) Turn the crankshaft, and bring each piston to top dead center (TDC). Using a gasket scraper, remove all the carbon from the piston top surface.



(b) Using a surface contacting gasket scraper, remove all the gasket materials from the cylinder block.

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

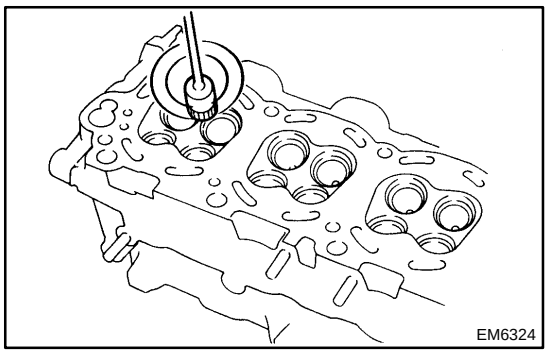
CAUTION:
Protect your eyes when using high pressure compressed air.



2. REMOVE GASKET MATERIAL

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

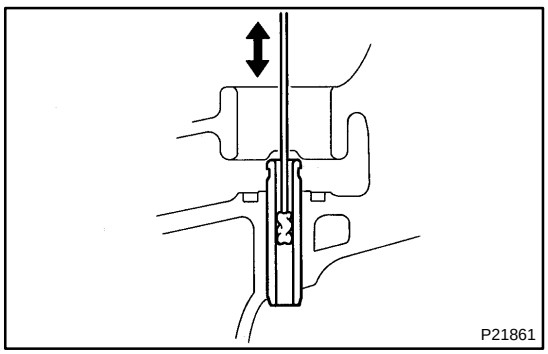
NOTICE:
Be careful not to scratch the surface contacting the cylinder block.



3. CLEAN COMBUSTION CHAMBERS

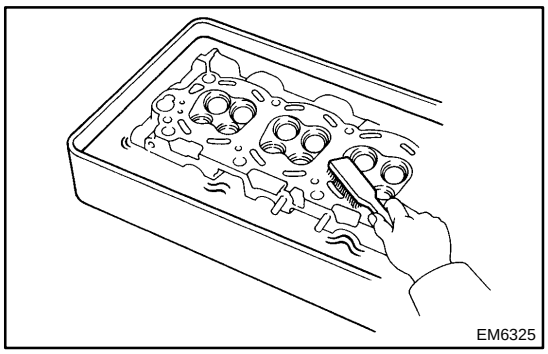
Using a wire brush, remove all the carbon from the combustion chambers.

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



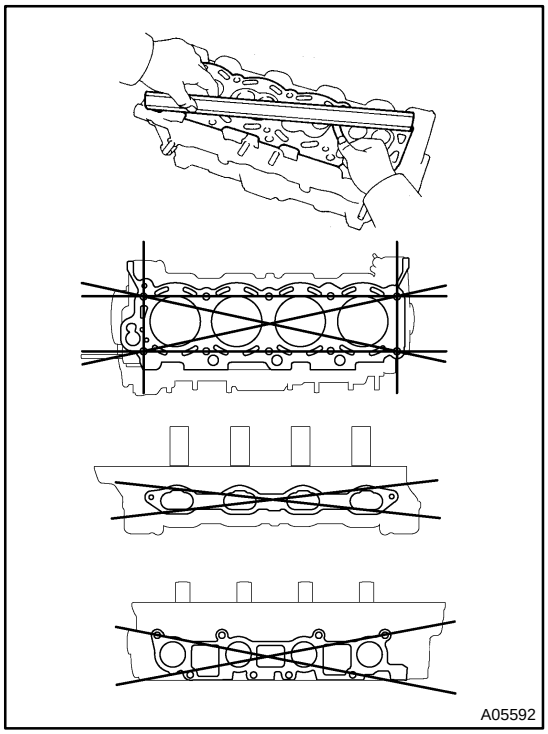
4. CLEAN VALVE GUIDE BUSHINGS

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



5. CLEAN CYLINDER HEAD

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

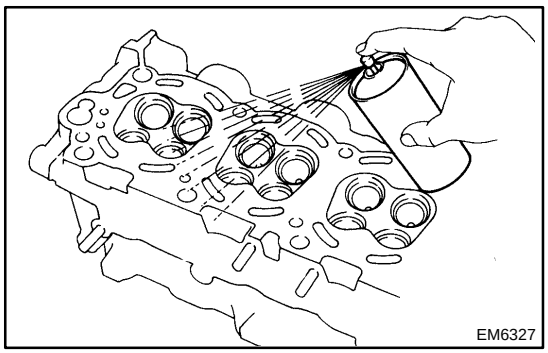


6. INSPECT FOR FLATNESS

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

Maximum warpage: 0.10 mm (0.0039 in.)

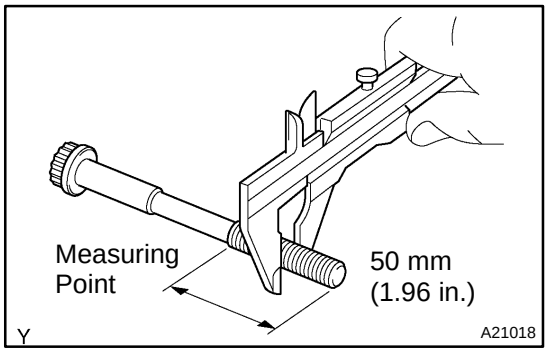
If warpage is greater than maximum, replace the cylinder head.



7. INSPECT FOR CRACKS

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

If cracked, replace the cylinder head.



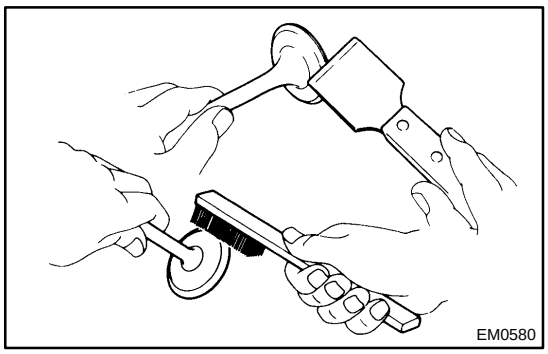
8. INSPECT CYLINDER HEAD BOLT

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

Standard outside diameter:
9.810 to 9.960 mm (0.3862 to 0.3921 in.)

Minimum outside diameter: 9.70 mm (0.3819 in.)

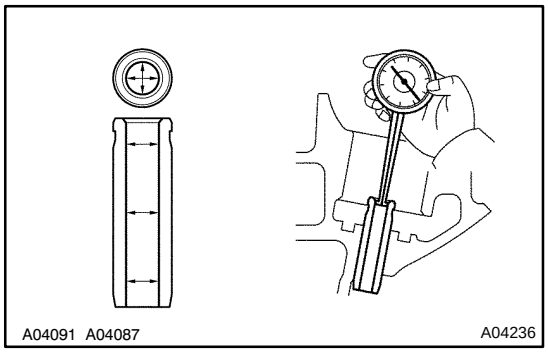
If the diameter is less than minimum, replace the bolt.


EM0580

9. CLEAN VALVES

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

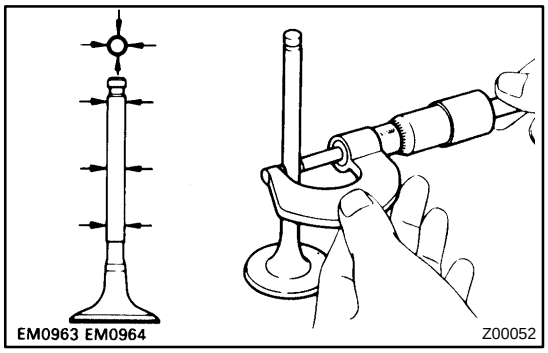
(b) Using a wire brush, thoroughly clean the valve.


A04091 A04087 A04236

10. INSPECT VALVE STEMS AND GUIDE BUSHINGS

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

Bushing inside diameter:
5.510 to 5.530 mm (0.2169 to 0.2177 in.)


EM0963 EM0964 Z00052

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

Valve stem diameter:

Intake	5.470 to 5.485 mm (0.2154 to 0.2159 in.)
Exhaust	5.465 to 5.480 mm (0.2152 to 0.2157 in.)

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

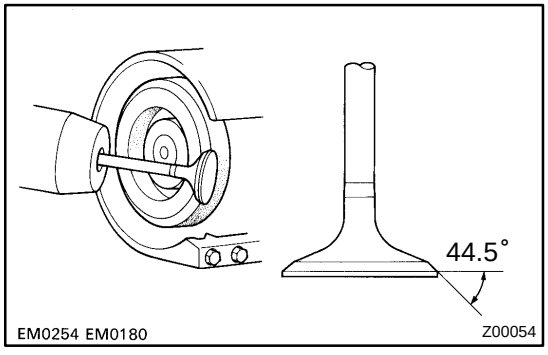
Standard oil clearance:

Intake	0.025 to 0.060 mm (0.0010 to 0.0024 in.)
Exhaust	0.030 to 0.065 mm (0.0012 to 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−56)



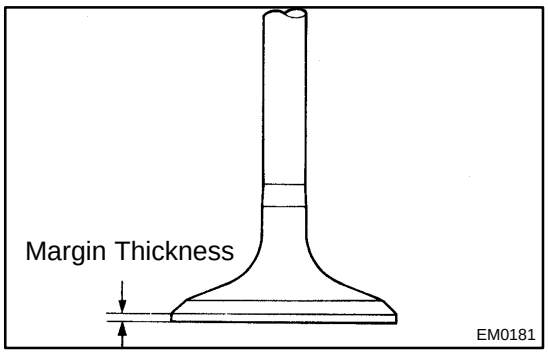
EM0254 EM0180 Z00054

11. INSPECT AND GRIND VALVES

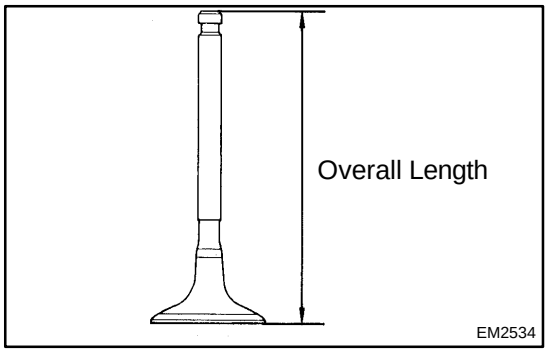
(a) Grind the valve enough to remove pits and carbon.

(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.



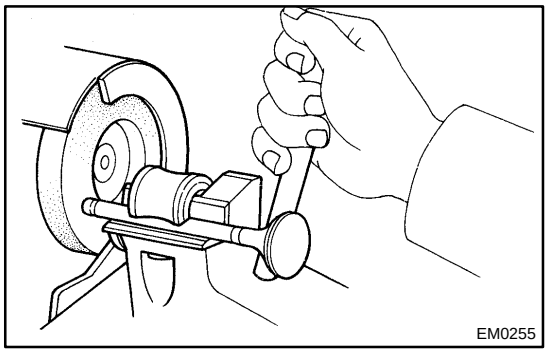
(d) Check the valve overall length.
Standard overall length:

Intake	95.05 mm (3.7421 in.)
Exhaust	95.10 mm (3.7441 in.)

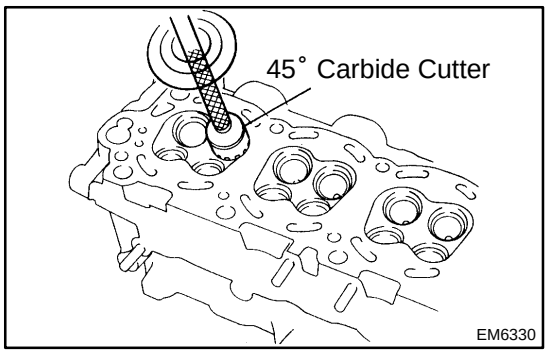
Minimum overall length:

Intake	94.55 mm (3.7224 in.)
Exhaust	94.60 mm (3.7244 in.)

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

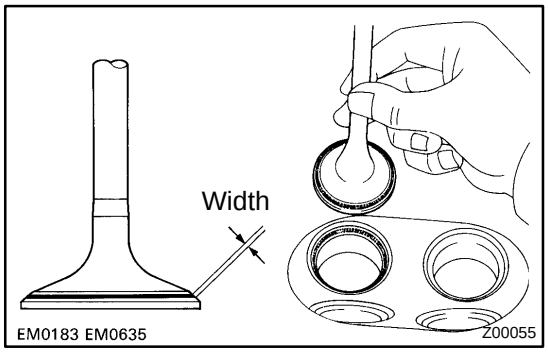


(e) Check the surface of the valve stem tip for wear.
If the valve stem tip is worn, resurface the tip with a grinder or replace the valve.
NOTICE:
Do not grind off more than minimum.

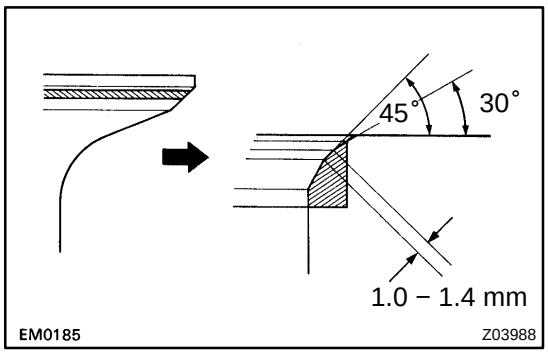


12. INSPECT AND CLEAN VALVE SEATS

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



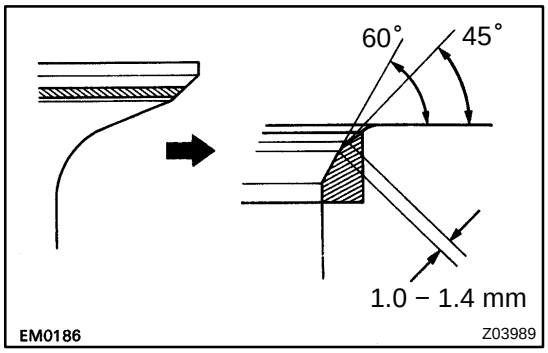
(b) Check the valve seating position.
Apply a light coat of Prussian blue (or white lead) to the valve face. Lightly press the valve against the seat. Do not rotate the valve.



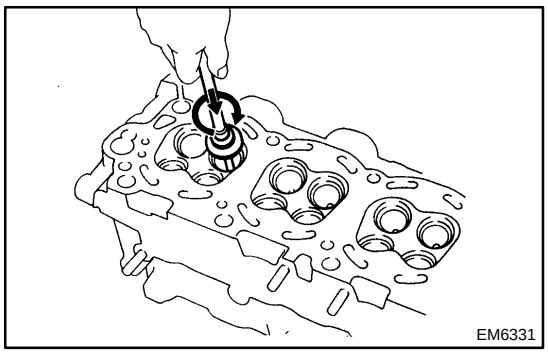
(c) Check the valve face and seat for the following:
- If blue appears 360° around the face, the valve is concentric. If not, replace the valve.
- If blue appears 360° around the valve seat, the guide and face are concentric. If not, resurface the seat.
- Check that the seat contact is in the middle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

1.0 to 1.4 mm (0.039 to 0.055 in.)

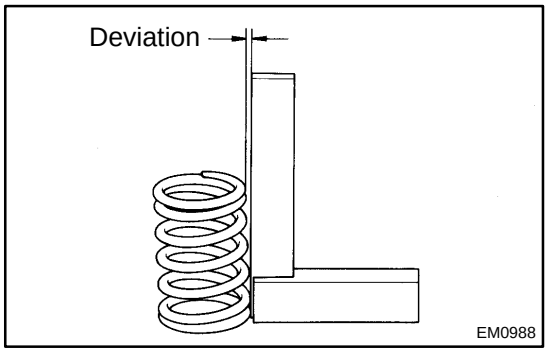
If not, correct the valve seats as follows:
- If the seating is too high on the valve face, use 30° and 45° cutters to correct the seat.



- 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.

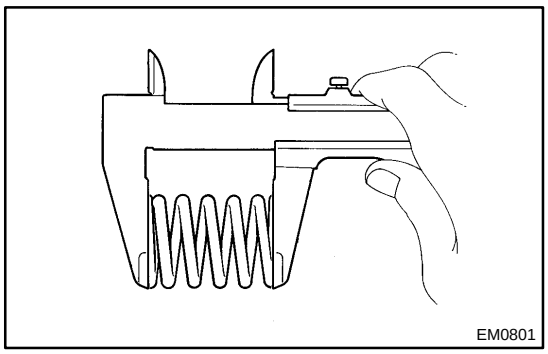


13. INSPECT VALVE SPRINGS

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

Maximum deviation: 2.0 mm (0.079 in.)

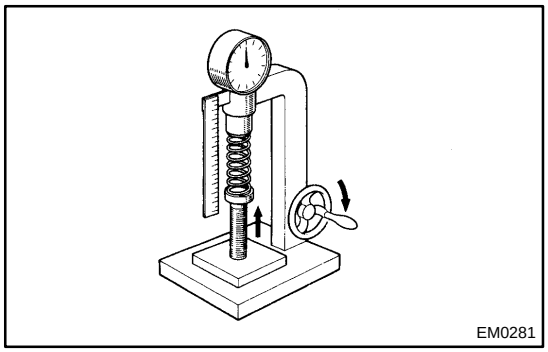
If the deviation is greater than maximum, replace the valve spring.


EM0801

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

Free length: 54.1 mm (2.130 in.)

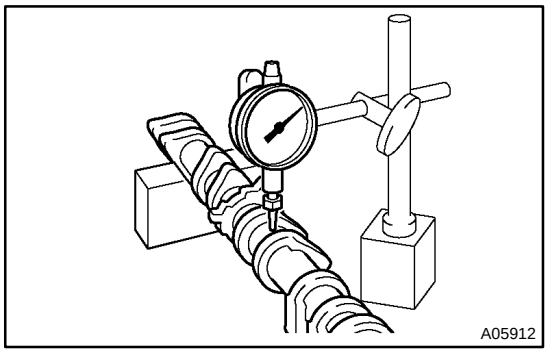
If the free length is not as specified, replace the valve spring.


EM0281

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

Installed tension:
210 to 226 N (21.4 to 23.0 kgf, 47.2 to 50.7 lbf)
at 35.0 mm (1.378 in.)

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


A05912

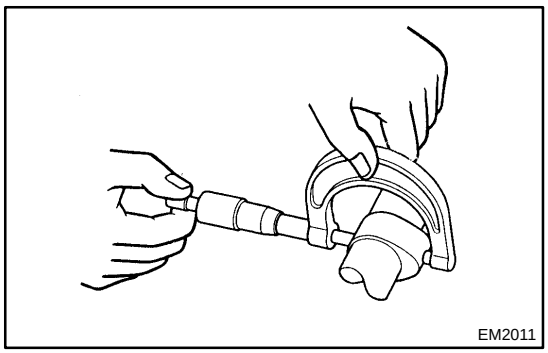
14. INSPECT CAMSHAFT FOR RUNOUT

(a) Place the camshaft on V−blocks.

(b) Using a dial indicator, measure the circle runout at the center journal.

Maximum circle runout: 0.03 mm (0.0012 in.)

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


EM2011

15. INSPECT CAM LOBES

Using a micrometer, measure the cam lobe height.

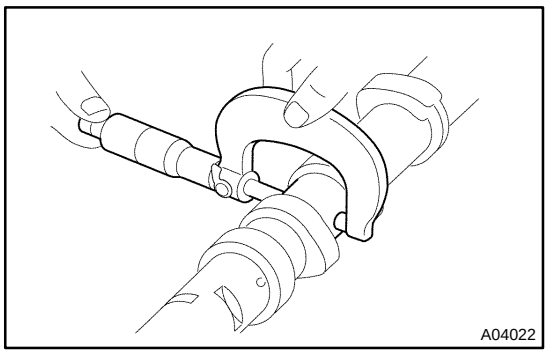
Standard cam lobe height:

Intake	42.61 to 42.71 mm (1.6776 to 1.6815 in.)
Exhaust	42.63 to 42.73 mm (1.6783 to 1.6823 in.)

Minimum cam lobe height:

Intake	42.46 mm (1.6717 in.)
Exhaust	42.48 mm (1.6724 in.)

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



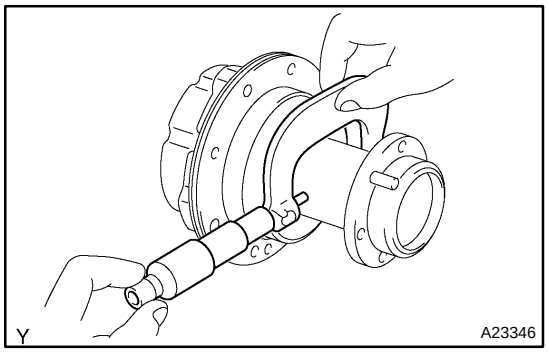
16. INSPECT CAMSHAFT JOURNALS

Using a micrometer, measure the journal diameter.

Journal diameter:

26.954 to 26.970 mm (1.0612 to 1.0618 in.)

If the journal diameter is not as specified, check the oil clearance (see step 20).



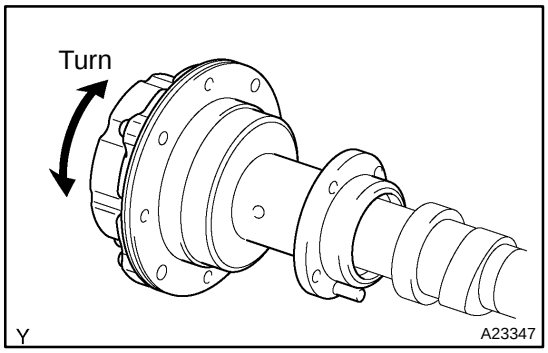
17. INSPECT CAMSHAFT TIMING TUBE

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

Journal diameter:

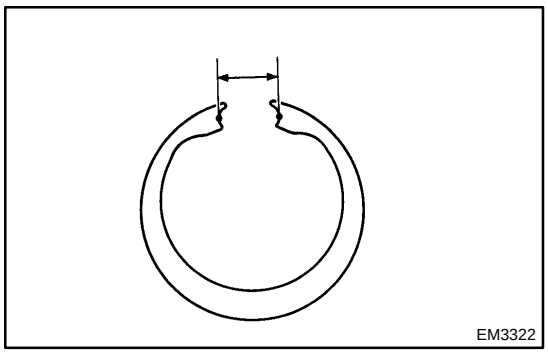
39.955 to 39.964 mm (1.5730 to 1.5734 in.)

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



(b) Install the timing tube to the intake camshaft, and check the timing tube turns smoothly.

If necessary, replace the timing tube and intake camshaft.



18. INSPECT CAMSHAFT GEAR SPRING

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

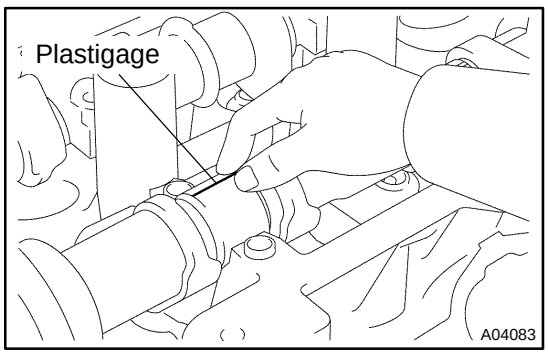
Free distance: 18.2 to 18.8 mm (0.717 to 0.740 in.)

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

19. 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.



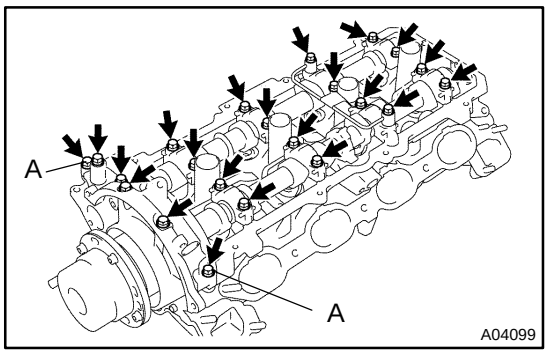
20. INSPECT CAMSHAFT JOURNAL OIL CLEARANCE

(a) Install the camshaft timing tube to the intake camshaft (see page EM−58).

(b) Clean the bearing caps and camshaft journals.

(c) Place the camshafts on the cylinder head.

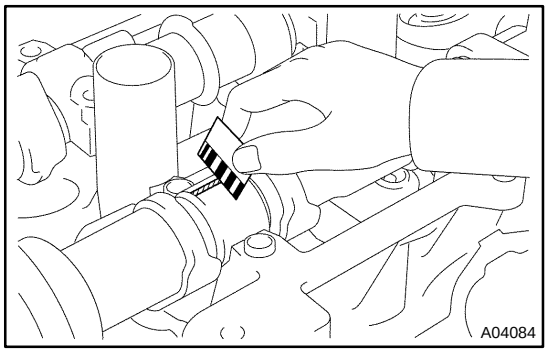
(d) Lay a strip of Plastigage across each of the camshaft journals.



(e) Install the bearing caps (see page EM−60).
Torque:
7.5 N·m (76 kgf·cm, 66 in.·lbf) for bolt A
16 N·m (160 kgf·cm, 12 ft·lbf) for others

NOTICE:
Do not turn the camshaft.

(f) Remove the bearing caps.



(g) Measure the Plastigage at its widest point.
Standard oil clearance:

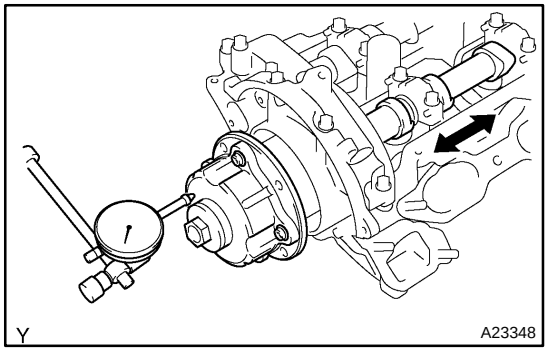
Camshaft journal	0.030 to 0.071 mm (0.0012 to 0.0028 in.)
Camshaft timing tube journal	0.036 to 0.057 mm (0.0014 to 0.0022 in.)

Maximum oil clearance:

Camshaft journal	0.100 mm (0.0039 in.)
Camshaft timing tube journal	0.075 mm (0.0030 in.)

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

(h) Completely remove the Plastigage.
(i) Remove the camshafts.
(j) Remove the camshaft timing tube from the intake camshaft.



21. INSPECT CAMSHAFT THRUST CLEARANCE

(a) Install the camshaft timing tube to the intake camshaft (see page EM−58).
(b) Install the camshaft (see page EM−58).
(c) Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.
Standard thrust clearance:

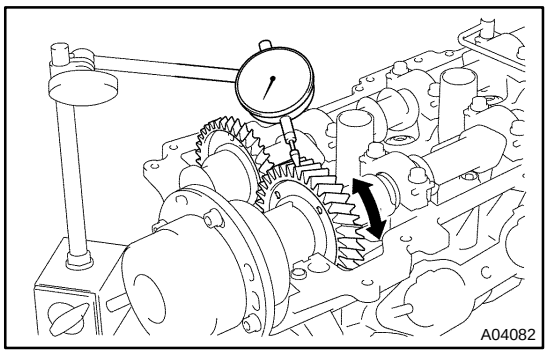
Intake	0 to 0.040 mm (0 to 0.0016 in.)
Exhaust	0.030 to 0.070 mm (0.0012 to 0.0028 in.)

Maximum thrust clearance:

Intake	0.12 mm (0.0047 in.)
Exhaust	0.10 mm (0.0039 in.)

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

(d) Remove the camshafts.
(e) Remove the camshaft timing tube from the intake camshaft.



22. INSPECT CAMSHAFT GEAR BACKLASH

(a) Install the drive gear to the camshaft timing tube (See page EM−58).

(b) Install the camshaft timing tube to the intake camshaft (See page EM−58).

(c) Install the camshafts without installing the exhaust camshaft sub−gear and front bearing cap (See page EM−58).

(d) Using a dial indicator, measure the backlash.

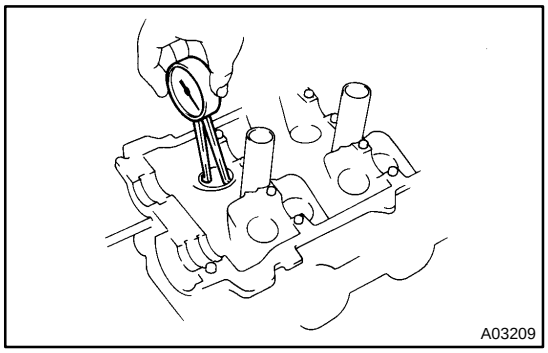
Standard backlash:
0.020 to 0.200 mm (0.0008 to 0.0079 in.)
Maximum backlash: 0.30 mm (0.0118 in.)

If the backlash is greater than the maximum, replace the intake camshaft drive gear and exhaust camshaft.

(e) Remove the camshafts.

(f) Remove the camshaft timing tube from the intake camshaft.

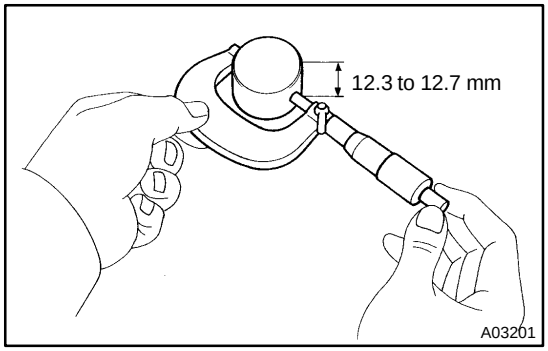
(g) Remove the drive gear from the camshaft timing tube.



23. 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 to 31.016 mm (1.2205 to 1.2211 in.)



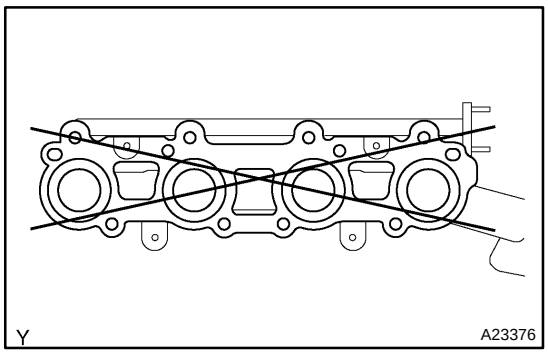
(b) Using a micrometer, measure the lifter diameter at the valve lifter center line, 12.3 to 12.7 mm (0.484 to 0.500 in.) from the valve lifter head.

Lifter diameter:
30.968 to 30.976 mm (1.2192 to 1.2195 in.)

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

Standard oil clearance:
0.024 to 0.050 mm (0.0009 to 0.0020 in.)
Maximum oil clearance:
0.07 mm (0.0028 in.)

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



24. INSPECT EXHAUST MANIFOLDS

Using a precision straight edge and feeler gauge, measure the warapage of the surface that is in contact with the cylinder head.

Maximum warpage: 0.10 mm (0.0394 in.)

If warpage is greater than maximum, replace the manifold.