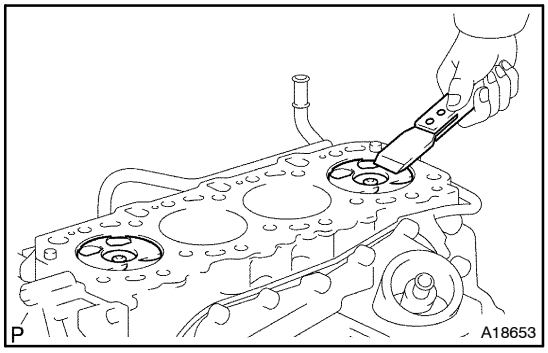
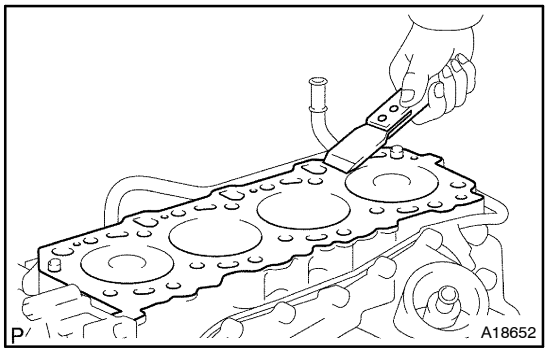
EM1TT–01

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.





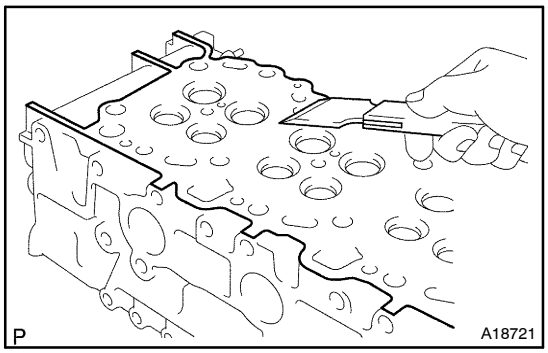
(b) Using a gasket scraper, remove all the gasket material from the cylinder block surface.

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

CAUTION:

Protect your eyes when using high–pressure compressed air.

2. INSPECT TOP SURFACE OF CYLINDER BLOCK FOR FLATNESS (See page EM–73)

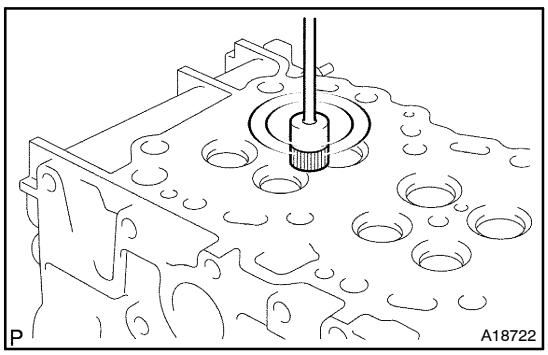


3. CLEAN CYLINDER HEAD

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

NOTICE:

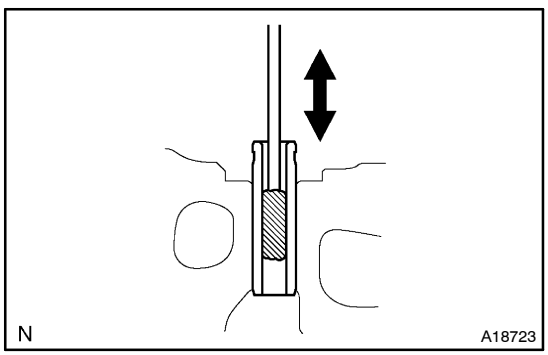
Be careful not to scratch the cylinder block contact surface.



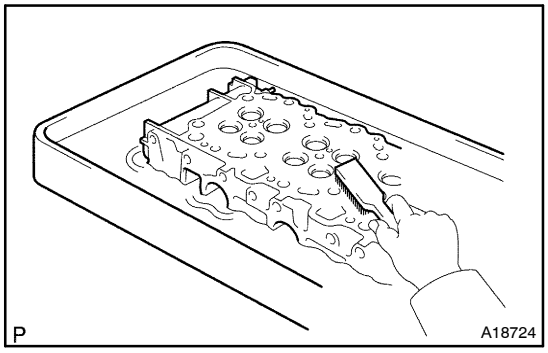
(b) Using a wire brush, remove all the carbon from the combustion chamber.

NOTICE:

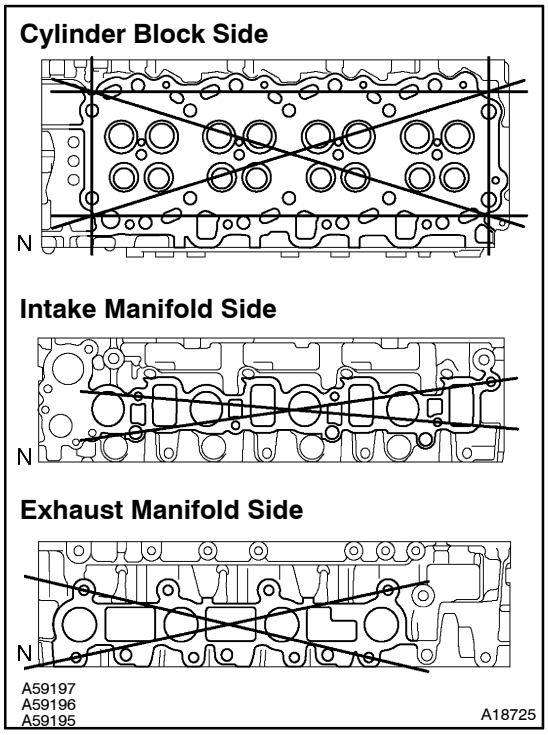
Be careful not to scratch the cylinder block contact surface.



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



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



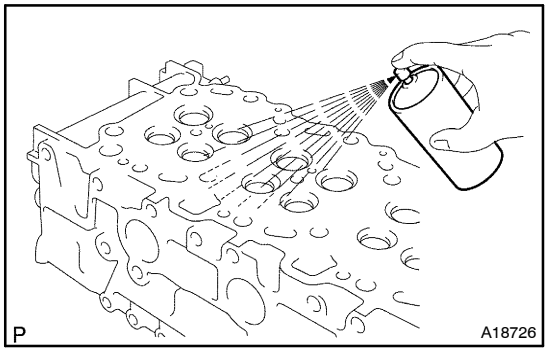
4. INSPECT CYLINDER HEAD

(a) Inspect for flatness.

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

Maximum warpage: 0.15 mm (0.0059 in.)

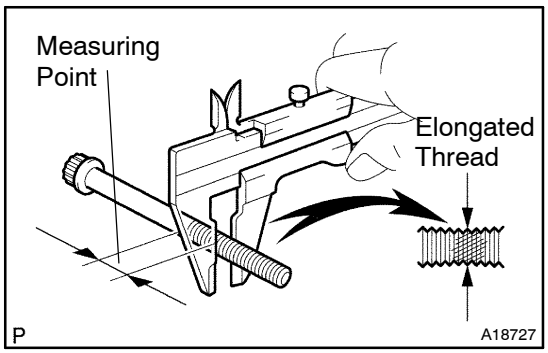
If warpage is greater than maximum, replace the cylinder head.



(b) Inspect for cracks.

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

If cracked, replace the cylinder head.



5. INSPECT CYLINDER HEAD BOLTS

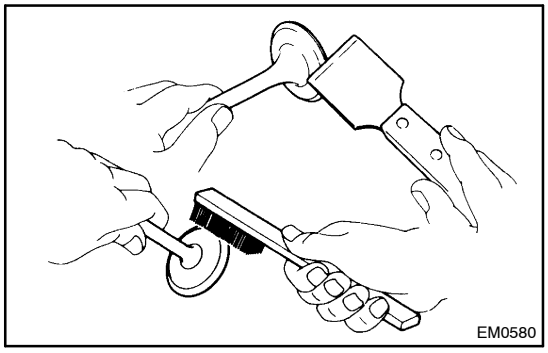
Using vernier calipers, measure the minimum outer diameter of the compressed thread at the measuring point.

Standard outer diameter:

11.8 – 12.0 mm (0.465 – 0.472 in.)

Minimum outer diameter: 11.6 mm (0.457 in.)

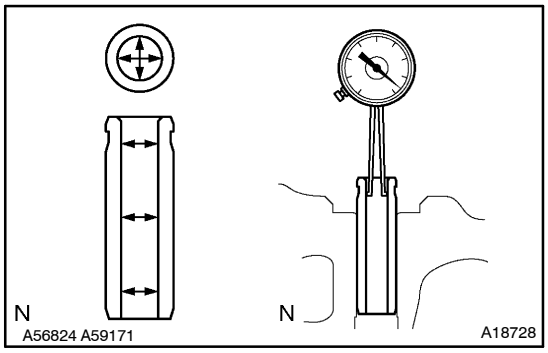
If the outer diameter is less than minimum, replace the bolt.



6. CLEAN VALVES

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

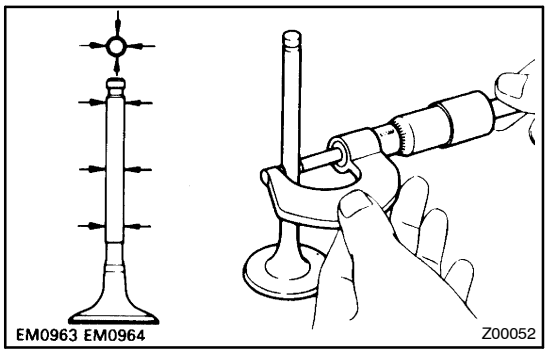
(b) Using a wire brush, thoroughly clean the valve.



7. 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	5.960 – 5.975 mm (0.2346 – 0.2352 in.)

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

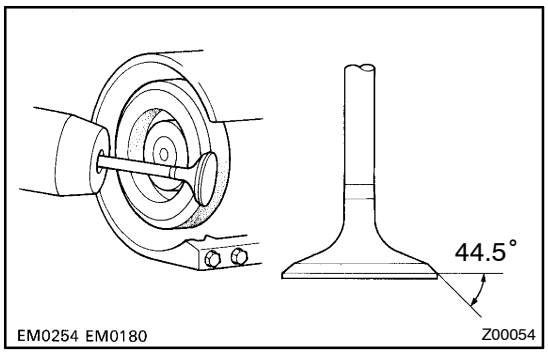
Standard oil clearance:

Intake	0.025 – 0.060 mm (0.0010 – 0.0024 in.)
Exhaust	0.035 – 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–54).

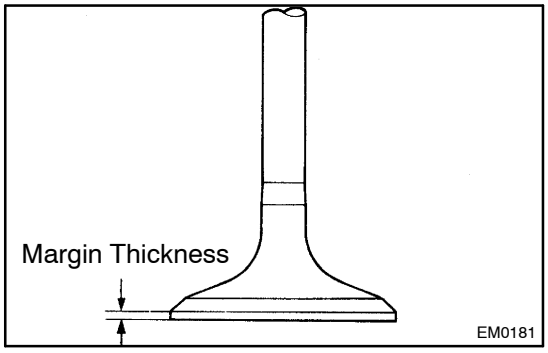


8. INSPECT AND GRIND VALVES

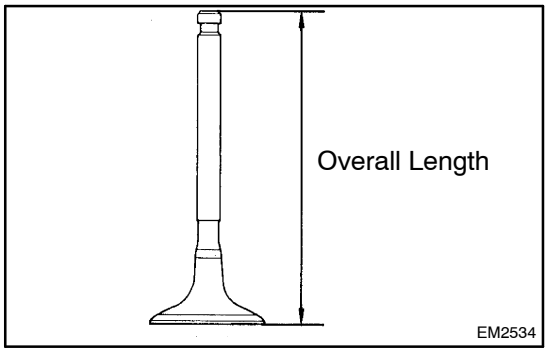
(a) Grind the valve enough to remove pits and carbon.

(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: 1.1 mm (0.043 in.)
Minimum margin thickness: 0.6 mm (0.024 in.)
If the margin thickness is less than minimum, replace the valve.



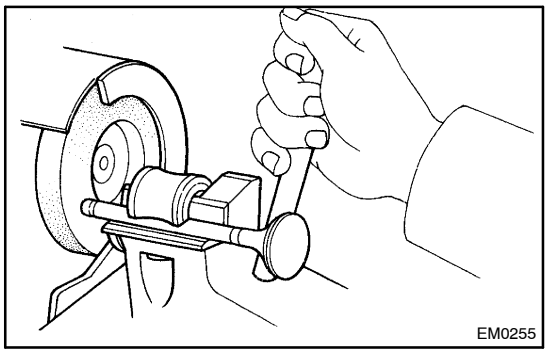
(d) Check the valve overall length.
Standard overall length:

Intake	105.38 – 105.78 mm (4.1488 – 4.1646 in.)
Exhaust	105.57 – 105.97 mm (4.1563 – 4.1720 in.)

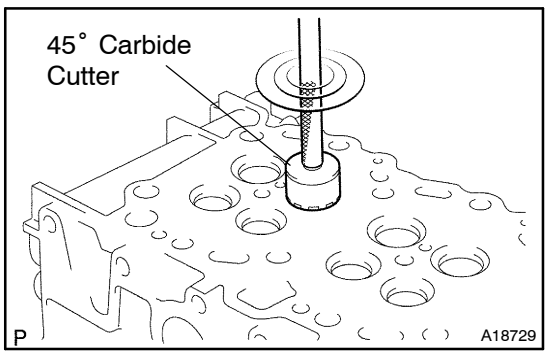
Minimum overall length:

Intake	104.88 mm (4.1646 in.)
Exhaust	105.07 mm (4.1366 in.)

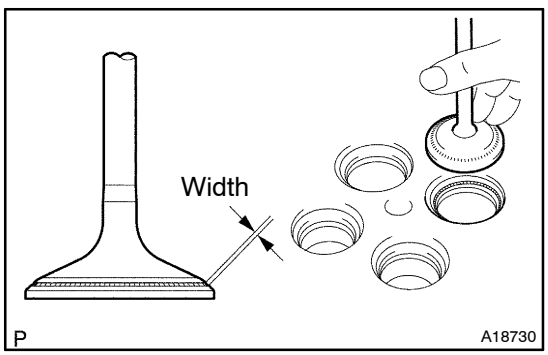
If the overall length is less than minimum, replace the valve.



(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 the minimum length.



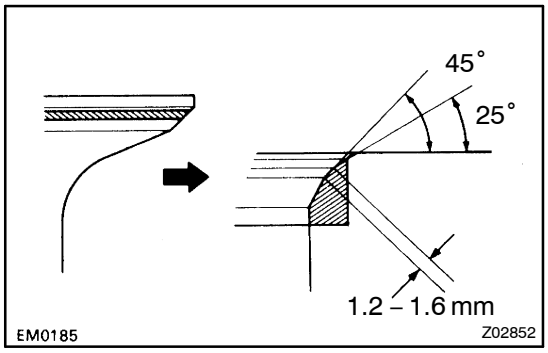
9. INSPECT AND CLEAN VALVE SEATS
(a) Using a 45° carbide cutter, resurface the valve seats. Remove only enough metal to clean the seats.



(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:

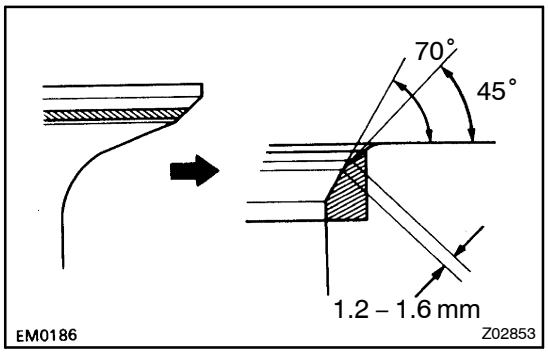
Intake	1.2 – 1.6 mm (0.047 – 0.063 in.)
Exhaust	1.6 – 2.0 mm (0.063 – 0.097 in.)



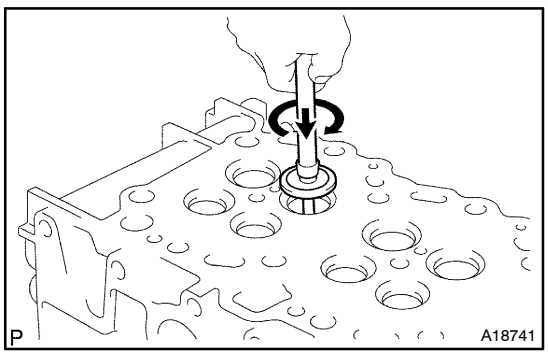
Intake:

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.

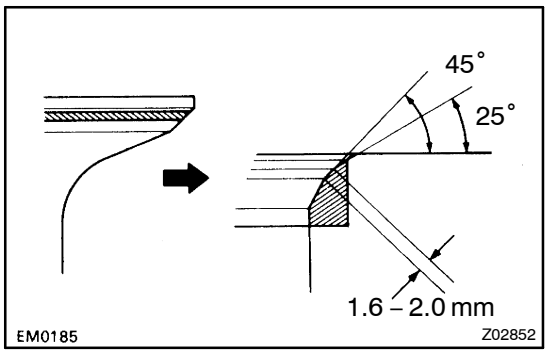


(2) If the seating is too low on the valve face, use 70° and 45° cutters to correct the seat.



(d) Hand–lap the valve and valve seat with an abrasive compound.

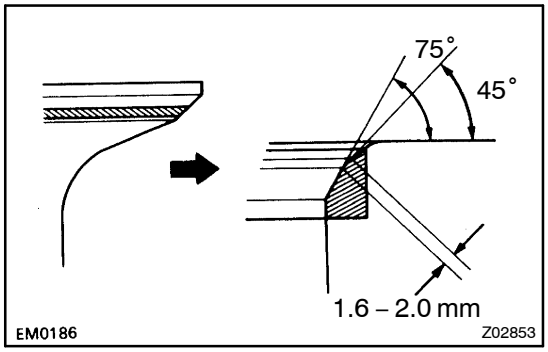
(e) After hand–lapping, clean the valve and valve seat.



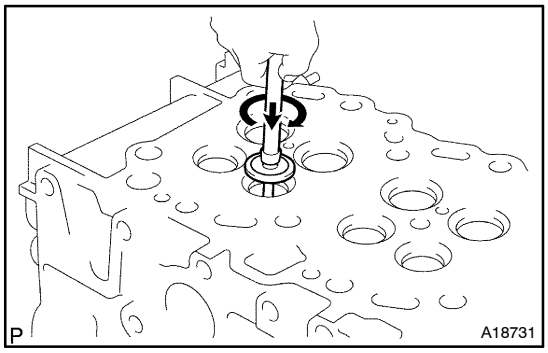
Exhaust:

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.

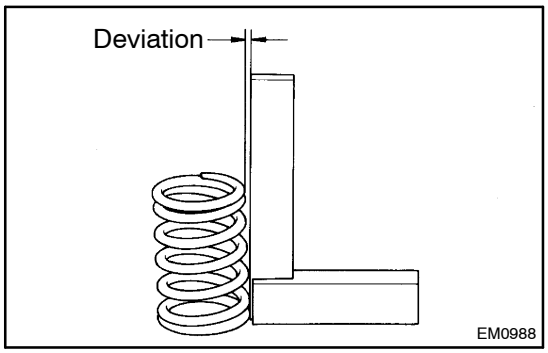


(2) If the seating is too low on the valve face, use 75° and 45° cutters to correct the seat.



(f) Hand–lap the valve and valve seat with an abrasive compound.

(g) After hand–lapping, clean the valve and valve seat.

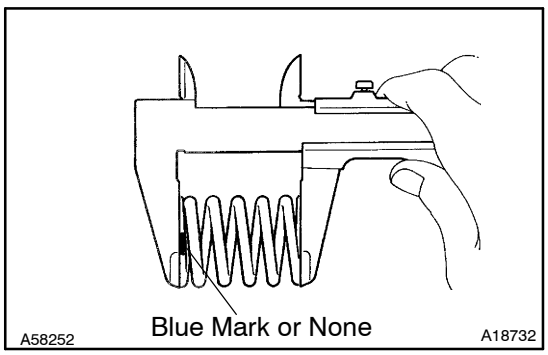


10. INSPECT VALVE SPRINGS

(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.

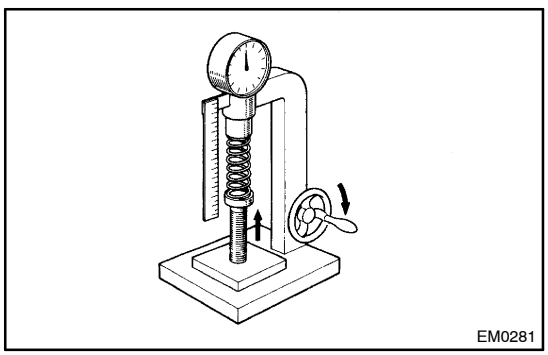


(b) Using vernier calipers, measure the free length of the spring.

Free length:

Blue mark	46.8 mm (1.843 in.)
None	46.5 mm (1.831 in.)

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

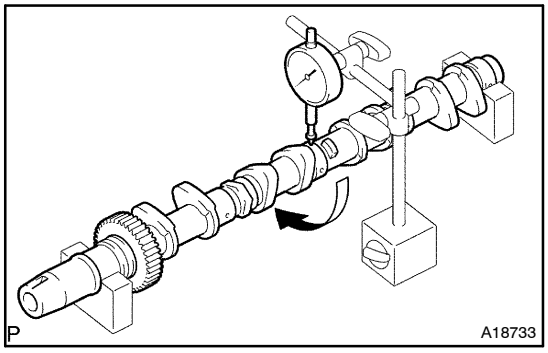


(c) Using a spring tester, measure the tension of the valve spring at the specified installed length.

Installed tension (at 33.1 mm (1.303 in.)):

Blue mark	149.9 – 166.1 N (15.3 – 16.9 kgf, 33.7 – 37.3 ibf)
None	150.2 – 165.8 N (15.3 – 16.9 kgf, 33.7 – 37.3 ibf)

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



11. INSPECT INTAKE CAMSHAFT

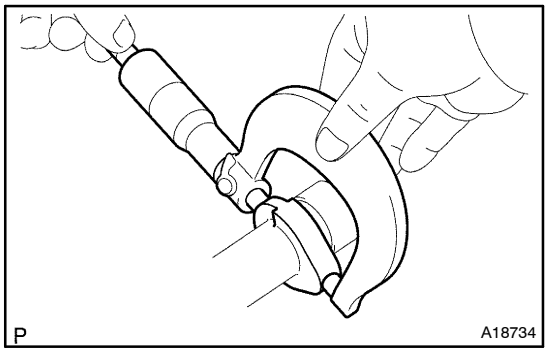
(a) Inspect the circle runout.

(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)

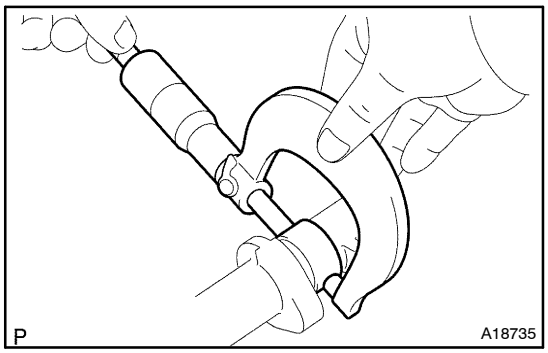
If the circle runout is greater than maximum, replace the camshaft.



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

Standard cam lobe height:
46.830 – 46.930 mm (1.8437 – 1.8476 in.)
Minimum cam lobe height: 46.68 mm (1.8378 in.)

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

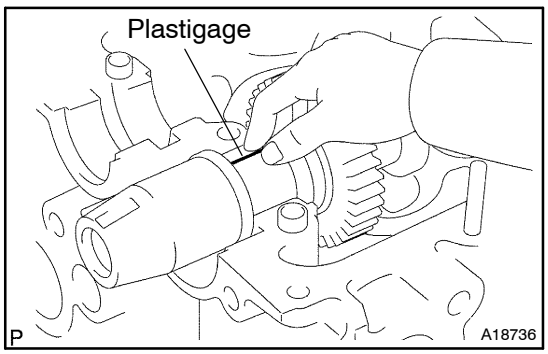


(c) Inspect the journal diameter of the camshaft.

(1) Using a micrometer, measure the journal diameter of the camshaft for the camshaft bearing.

Journal diameter:
27.969 – 27.985 mm (1.1011 – 1.1018 in.)

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



(d) Check the oil clearance.

(1) Clean the bearing caps and journals.

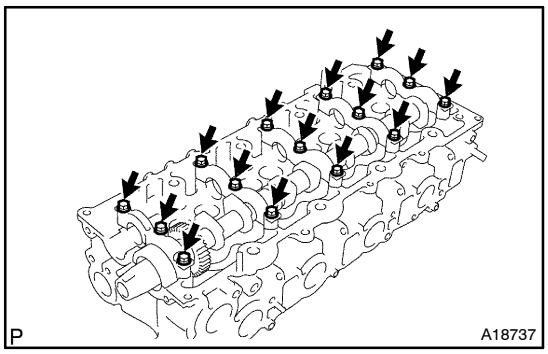
(2) Check that bearings for flaking and scoring.

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

(3) Install the bearings to the bearing caps and cylinder head.

(4) Place the camshaft on the cylinder head.

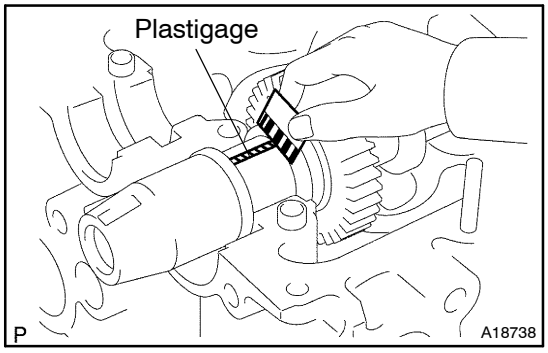
(5) Lay a strip of Plastigage across each of the journals.



(6) Install the bearing caps (See page EM–57).

NOTICE:
Do not turn the camshaft.

(7) Remove the bearing caps.



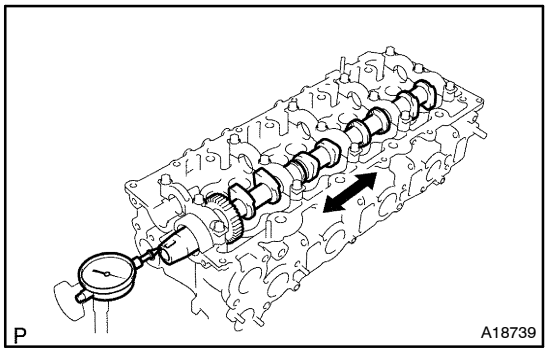
(8) Measure the Plastigage at its widest point.

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 cap and cylinder head as a set.

(9) Completely remove the Plastigage.

(10) Remove the camshaft.



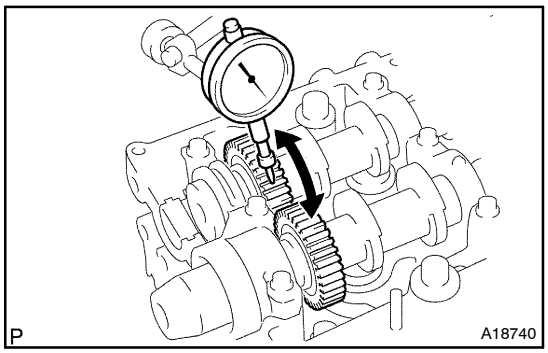
(e) Check the thrust clearance.

(1) Install the camshaft (See page EM–57).

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

Standard thrust clearance:
0.035 – 0.185 mm (0.0014 – 0.0073 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 cap and cylinder head as a set.



(f) Check the gear backlash.

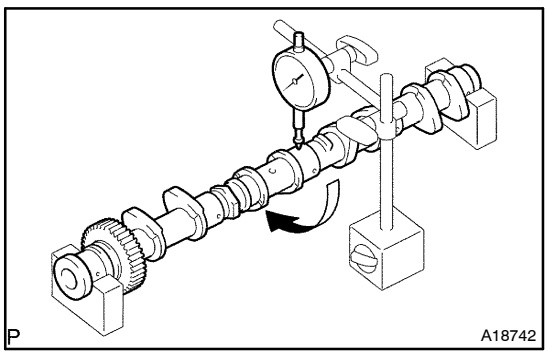
(1) Install the 2 camshafts (See page EM–57).

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

Standard backlash:
0.035 – 0.145 mm (0.0014 – 0.0057 in.)
Maximum backlash: 0.189 mm (0.0074 in.)

If the backlash is greater than maximum, replace the 2 camshafts.

(3) Remove the 2 camshafts.



12. INSPECT EXHAUST CAMSHAFT

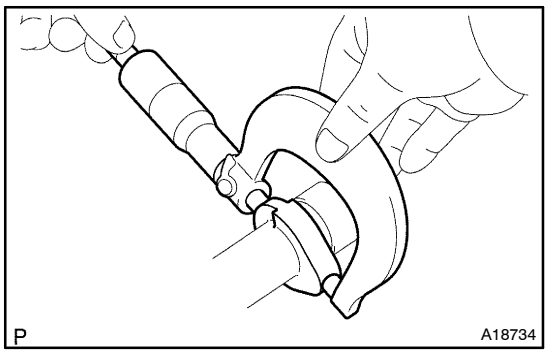
(a) Inspect the circle runout.

(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)

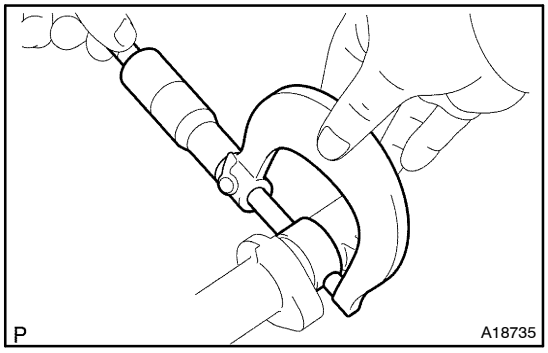
If the circle runout is greater than maximum, replace the camshaft.



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

Standard cam lobe height:
46.870 – 46.970 mm (1.8453 – 1.8492 in.)
Minimum cam lobe height: 46.72 mm (1.8394 in.)

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



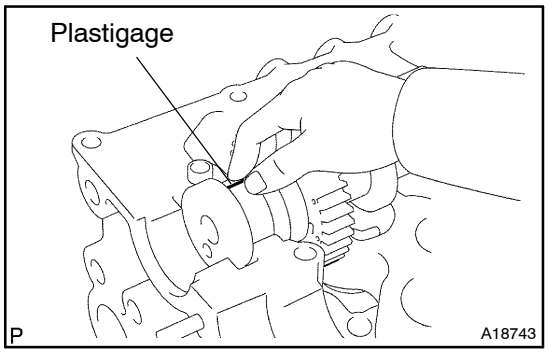
(c) Inspect the journal diameter of the camshaft.

(1) Using a micrometer, measure the journal diameter of the camshaft for the camshaft bearing.

Journal diameter:

27.969 – 27.985 mm (1.1011 – 1.1018 in.)

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



(d) Check the oil clearance.

(1) Clean the bearing caps and journals.

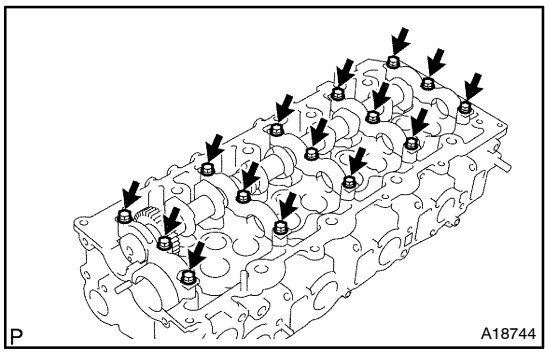
(2) Check that bearings for flaking and scoring.

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

(3) Install the bearings to the bearing caps and cylinder head.

(4) Place the camshaft on the cylinder head.

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

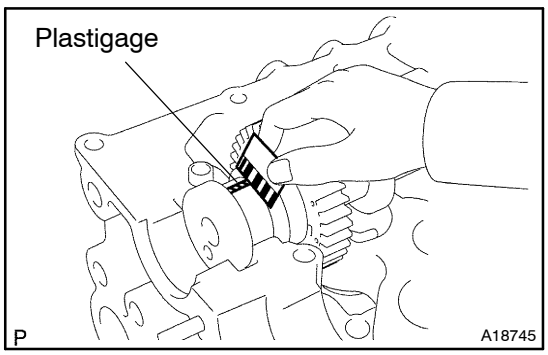


(6) Install the bearing caps (See page EM–57).

NOTICE:

Do not turn the camshaft.

(7) Remove the bearing caps.



(8) Measure the Plastigage at its widest point.

Standard oil clearance:

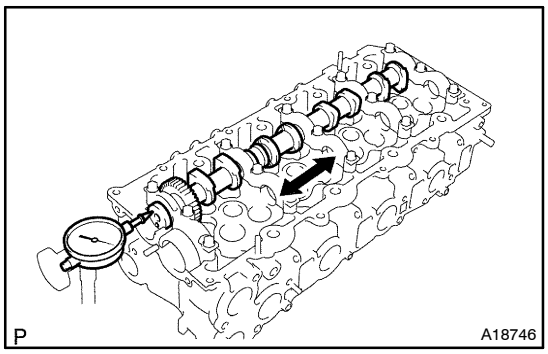
0.025 – 0.062 mm (0.0010 – 0.0024 in.)

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 cap and cylinder head as a set.

(9) Completely remove the Plastigage.

(10) Remove the camshaft.



(e) Check the thrust clearance.

(1) Install the camshaft (See page EM–57).

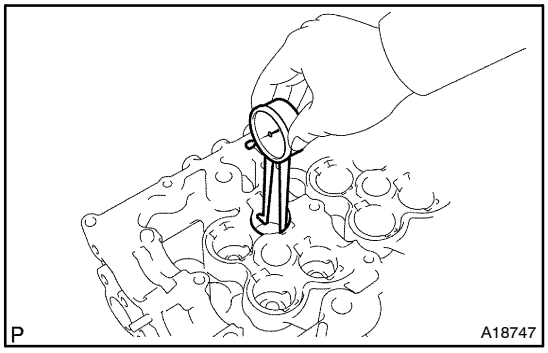
(2) Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

Standard thrust clearance:

0.035 – 0.185 mm (0.0014 – 0.0073 in.)

Maximum thrust clearance: 0.25 mm (0.0098 in.)

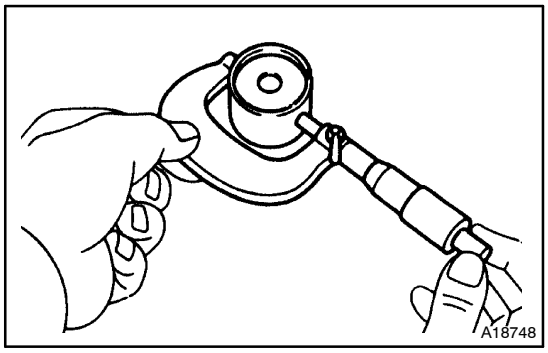
If the thrust clearance is greater than maximum, replace the camshaft. If necessary, replace the bearing cap and cylinder head as a set.



13. 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 – 31.021 mm (1.2205 – 1.2213 in.)



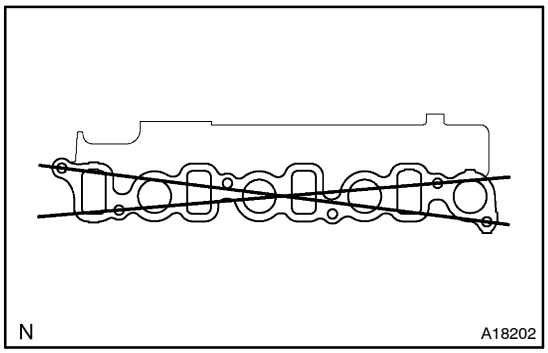
(b) Using a micrometer, measure the lifter diameter.

Lifter diameter:
30.966 – 30.976 mm (1.2191 – 1.2195 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: 0.075 mm (0.0030 in.)

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

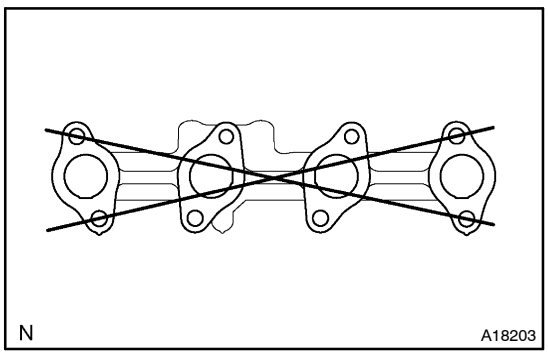


14. INSPECT INTAKE MANIFOLD

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.



15. 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.