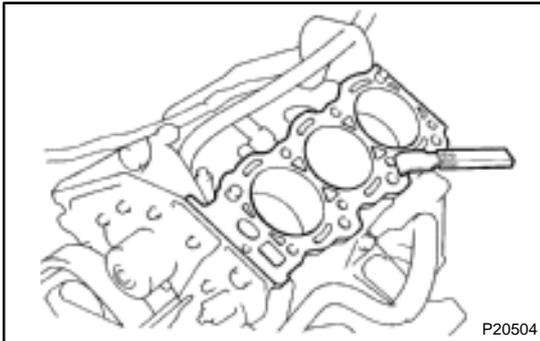


INSPECTION

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 surfaces.



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

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

CAUTION:

Protect your eyes when using high-compressed air.

2. INSPECT TOP SURFACE OF CYLINDER BLOCK FOR FLATNESS (See page EM-90)

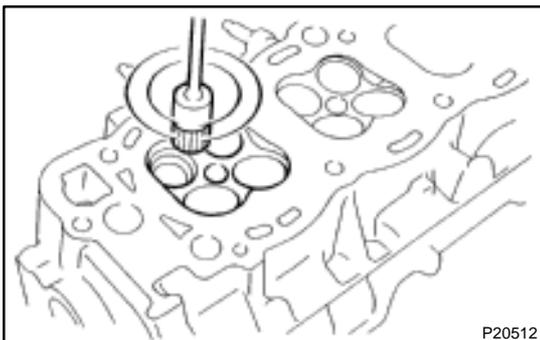


3. CLEAN CYLINDER HEAD

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

NOTICE:

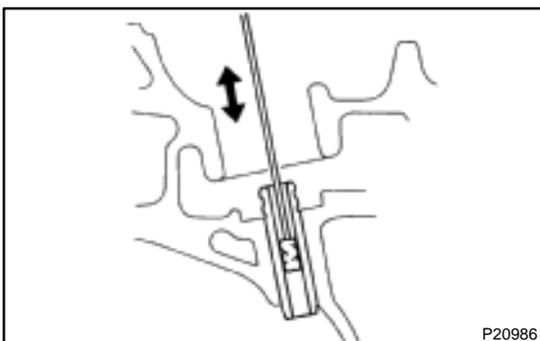
Be careful not to scratch the cylinder block contact surfaces.



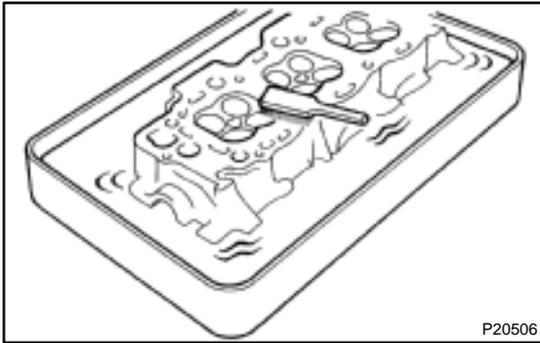
- (b) Using a wire brush, remove all the carbon from the combustion chambers.

NOTICE:

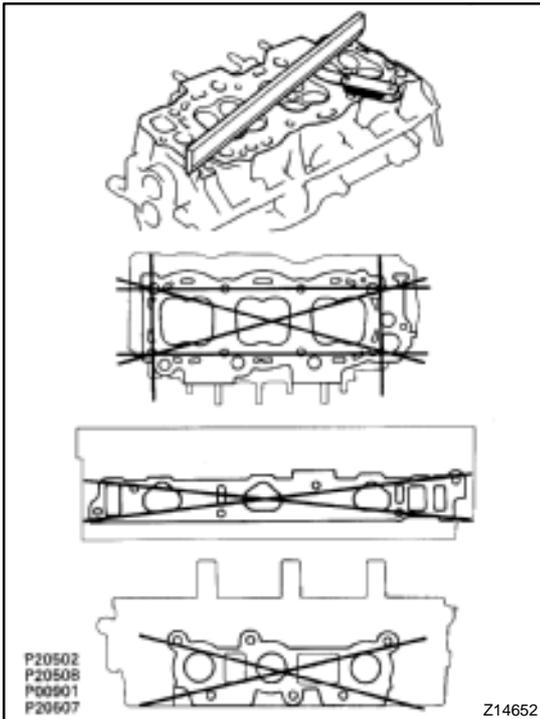
Be careful not to scratch the cylinder block contact surfaces.



- (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 heads.



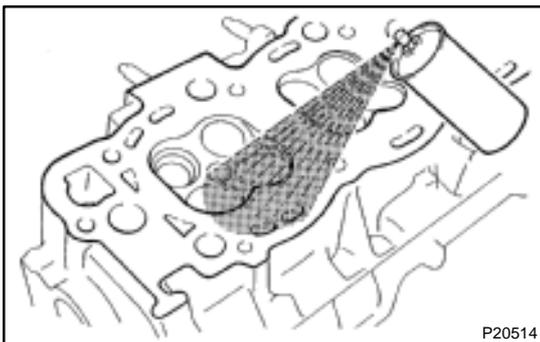
4. INSPECT CYLINDER HEAD

- (a) Inspect for flatness.

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

Maximum warpage: 0.10 mm (0.0039 in.)

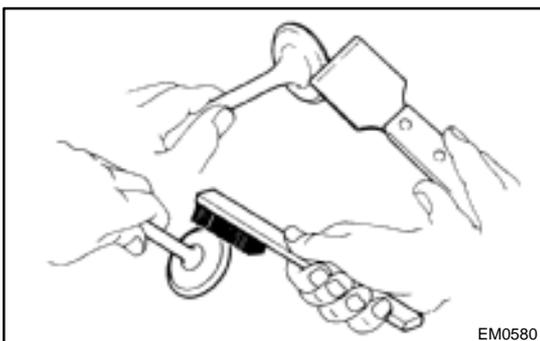
If warpage is greater than maximum, replace the cylinder head.



- (b) Inspect for cracks.

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

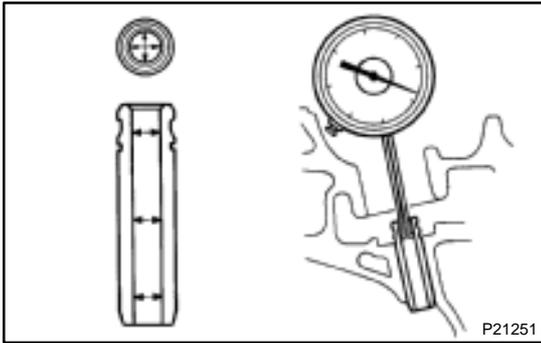
If cracked, replace the cylinder head.



5. CLEAN VALVES

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

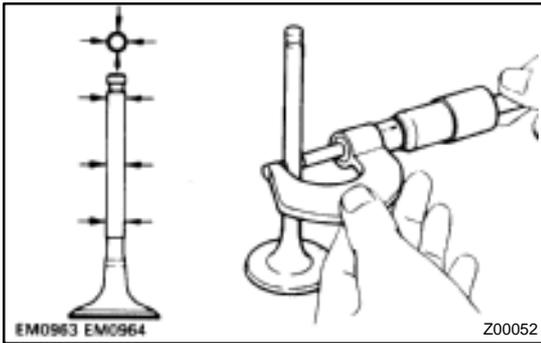
- (b) Using a wire brush, thoroughly clean the valve.



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.

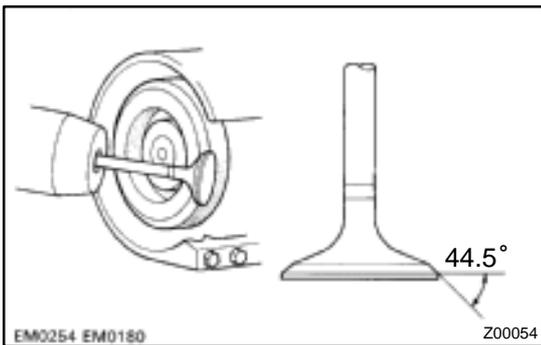
Standard oil clearance:

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.)

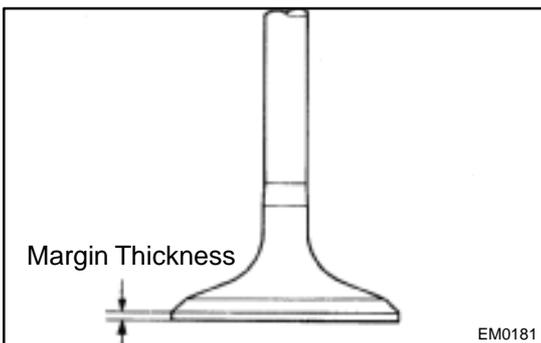
If the clearance is greater than maximum, replace the valve and guide bushing. (See page EM-48)



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.

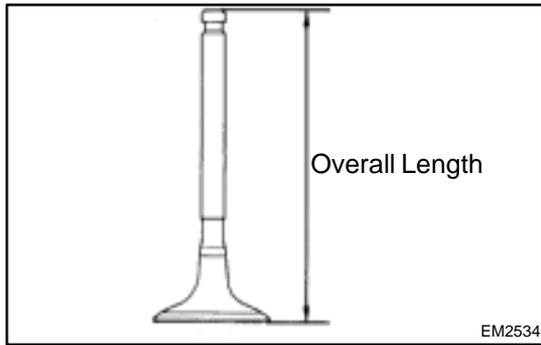
Valve face angle: 44.5°



- (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 the minimum, replace the valve.



(d) Check the valve overall length.

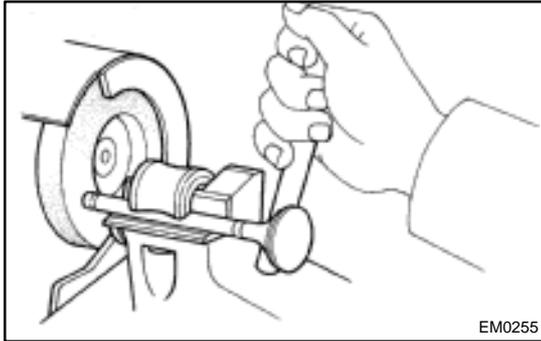
Standard overall length:

Intake	95.15 mm (3.7461 in.)
Exhaust	94.90 mm (3.7362 in.)

Minimum overall length:

Intake	94.60 mm (3.7244 in.)
Exhaust	94.40 mm (3.7165 in.)

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

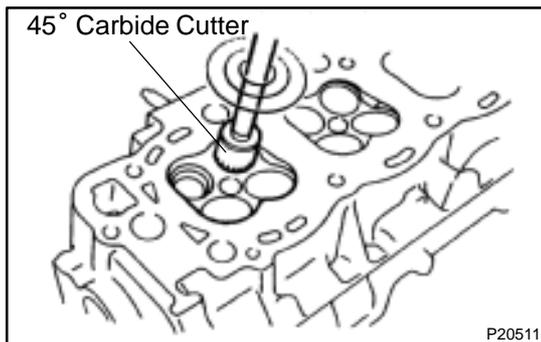


(e) Check the surface of the valve stem tip for wear.

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.

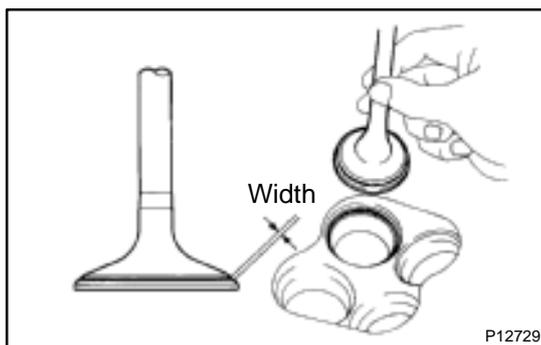


8. INSPECT AND CLEAN VALVE SEATS

(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 the valve.



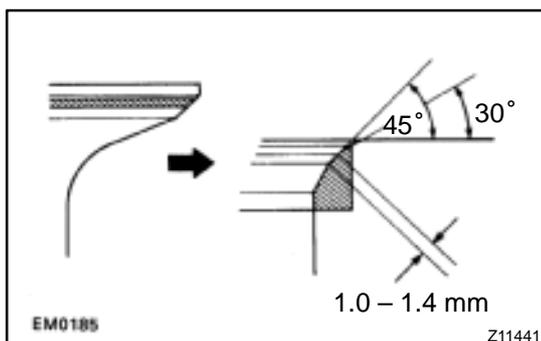
(c) Check the valve face and seat for the following:

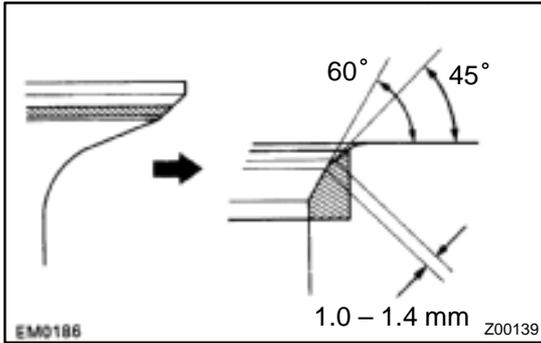
- If blue appears 360° around the face, the valve is concentric. If not, replace the valve.
- If blue appears 360° around the valve seat, the guide and face are concentric. If not, resurface the seat.
- Check that the seat contact is in the middle of the valve face with these width.

1.0 – 1.4 mm (0.039 – 0.055 in.)

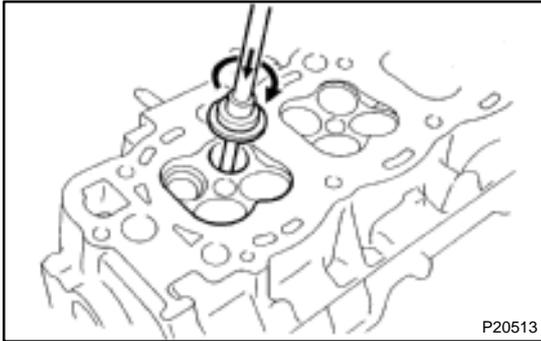
If not, correct the valve seats as follows:

- (1) If the seating is too high on the valve face, use 30° and 45° cutters to correct the seat.

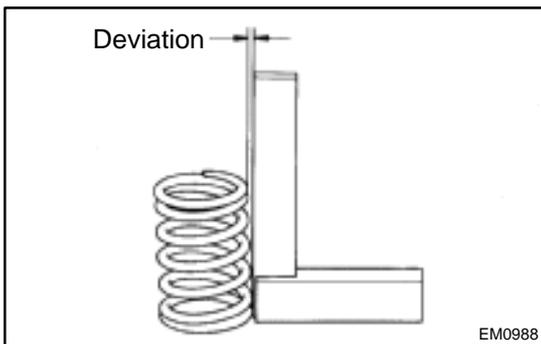




- (2) If the seating is too low on the valve face, use 60° and 45° cutters to correct the seat.



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

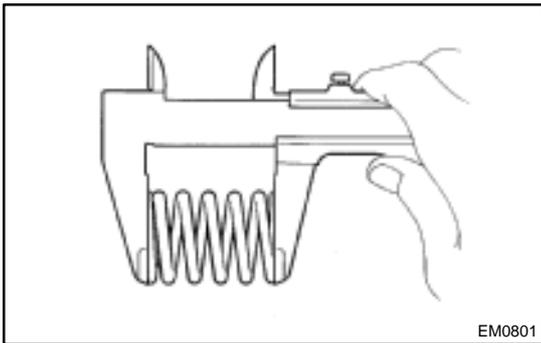


9. INSPECT VALVE SPRINGS

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

Maximum deviation: 2.0 mm (0.079 in.)

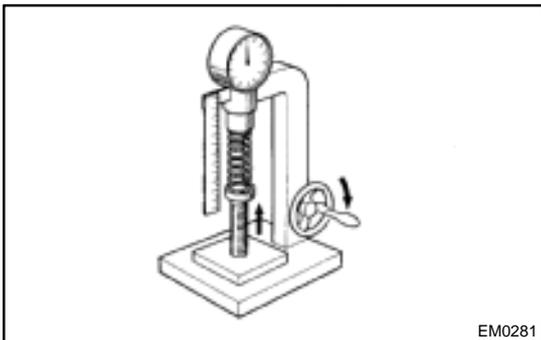
If deviation is greater than maximum, replace the valve spring.



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

Free length: 44.78 mm (1.7630 in.)

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



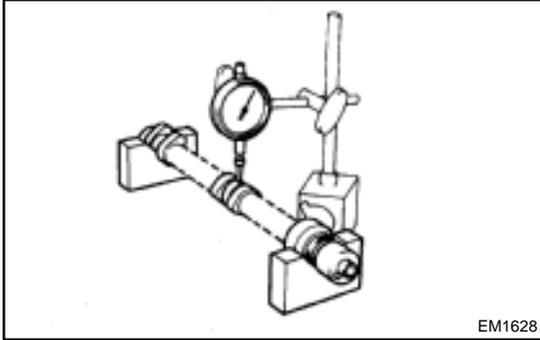
- (c) Using a spring tester, measure the tension of the valve spring at the specified installed length.

Installed tension:

186 – 206 N (19.0 – 21.0 kgf, 41.9 – 46.3 lbf)

at 33.3 mm (1.311 in.)

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



EM1628

10. INSPECT CAMSHAFTS

(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.

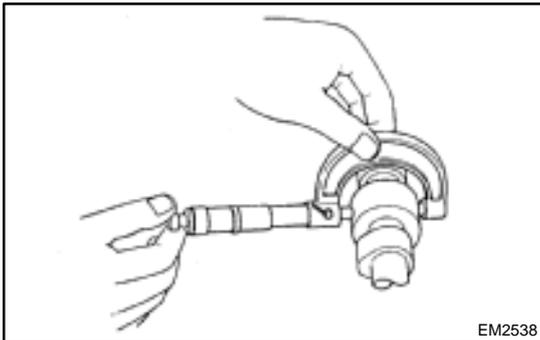
Standard cam lobe height:

Intake	42.31 – 42.41 mm (1.6657 – 1.6697 in.)
Exhaust	41.96 – 42.06 mm (1.6520 – 1.6559 in.)

Minimum cam lobe height:

Intake	42.16 mm (1.6598 in.)
Exhaust	41.81 mm (1.6461 in.)

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



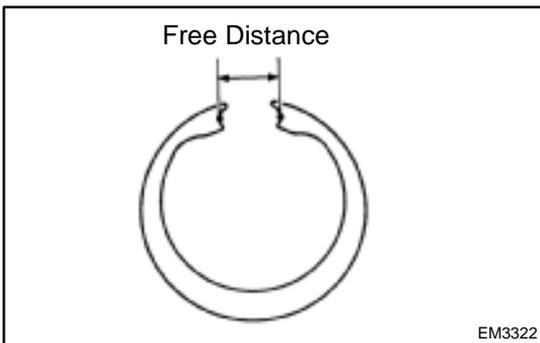
EM2538

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

Journal diameter:

26.949 – 26.965 mm (1.0610 – 1.0616 in.)

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

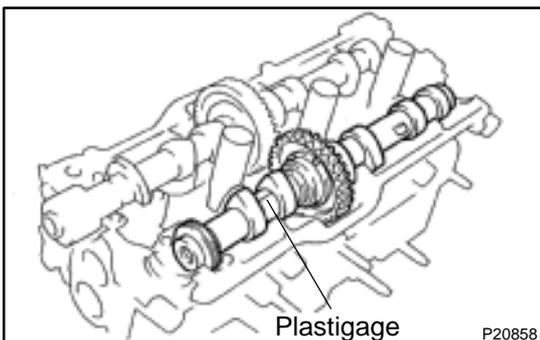


EM3322

(c) Using vernier calipers, measure the free distance between the spring end.

Free distance: 18.2 – 18.8 mm (0.712 – 0.740 in.)

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



P20858

(d) Inspect the camshaft journal oil clearance.

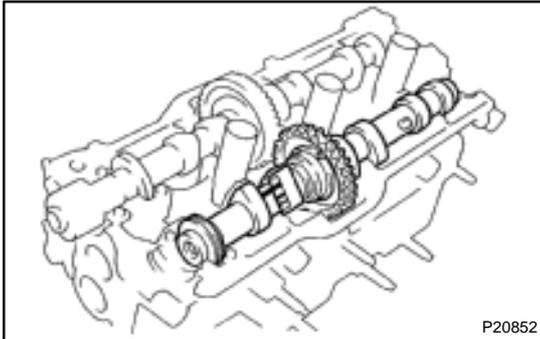
- (1) Clean the bearing caps and camshaft journals.
- (2) Check the bearings for flaking and scoring.

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 camshaft journals.
- (5) Install the bearing caps. (See page [EM-53](#))

NOTICE:**Do not turn the camshaft.**

- (6) Remove the bearing caps.

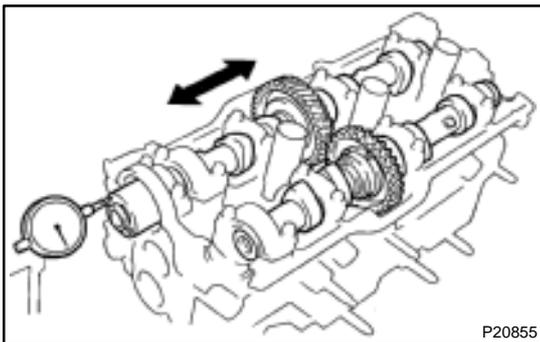


- (7) Measure the Plastigage at its widest point.

Standard oil clearance:**0.035 – 0.072 mm (0.0014 – 0.0028 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.



- (e) Inspect the camshaft thrust clearance.

- (1) Install the camshafts. (See page [EM-4](#))

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

Standard thrust clearance:**0.033 – 0.080 mm (0.0013 – 0.0031 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.

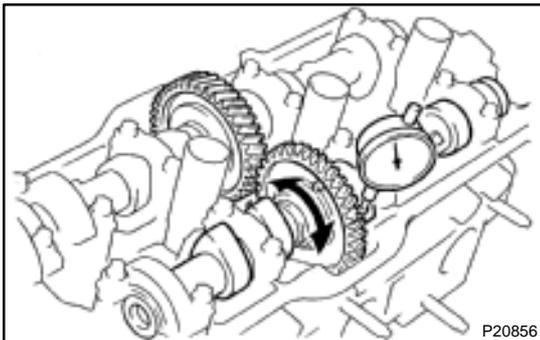
- (f) Inspect the camshaft gear backlash.

- (1) Install the camshafts without installing the exhaust camshaft sub-gear. (See page [EM-4](#))

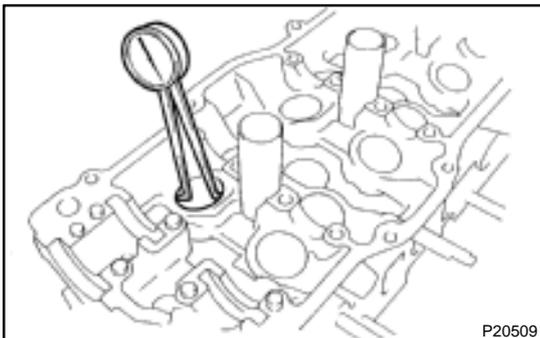
- (2) Using a dial indicator, measure the backlash.

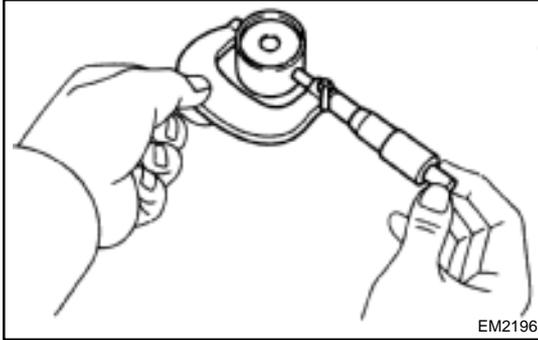
Standard backlash:**0.020 – 0.200 mm (0.0008 – 0.0079 in.)****Maximum backlash: 0.30 mm (0.0188 in.)**

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

**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 – 31.018 mm (1.2205 – 1.2212 in.)**



EM2196

- (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.

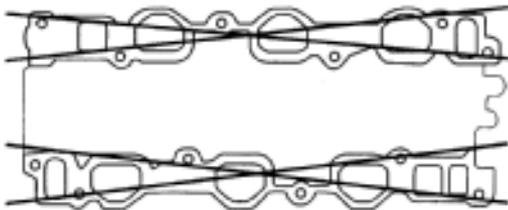
Standard oil clearance:

0.024 – 0.052 mm (0.0009 – 0.0020 in.)

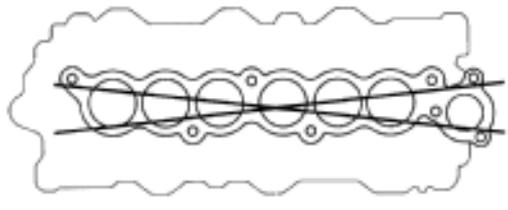
Maximum oil clearance: 0.08 mm (0.0031 in.)

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

Cylinder Head Side



Intake Air Connector Side

P21620
P21618

Z14655

12. INSPECT INTAKE MANIFOLD

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

Maximum warpage: 0.10 mm (0.0039 in.)

If warpage is greater than maximum, replace the intake manifold.

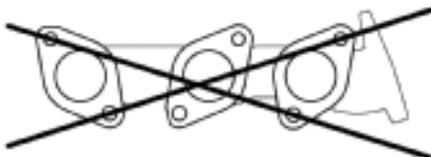
13. INSPECT EXHAUST MANIFOLDS

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

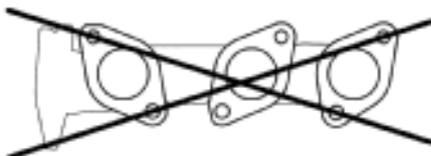
Maximum warpage: 1.00 mm (0.0394 in.)

If warpage is greater than maximum, replace the exhaust manifold.

LH Side

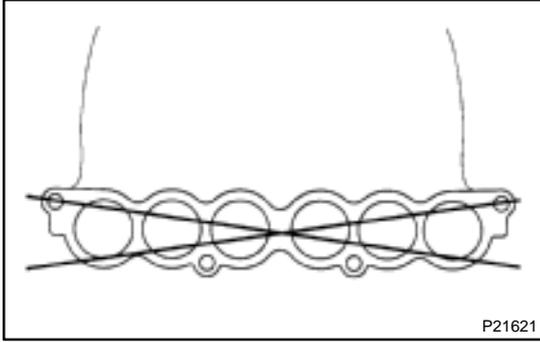


RH Side



P

A11027



14. INSPECT AIR INTAKE CHAMBER AND INTAKE AIR CONNECTOR

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

Maximum warpage: 0.10 mm (0.0039 in.)

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