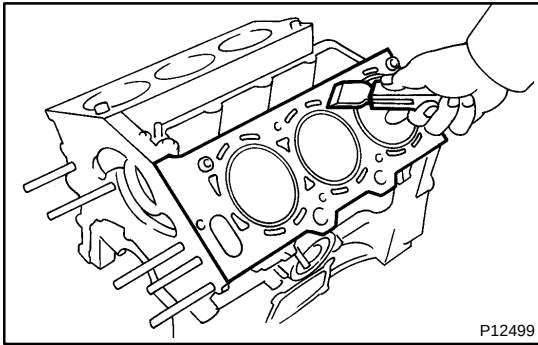




INSPECTION

1. REMOVE GASKET MATERIAL

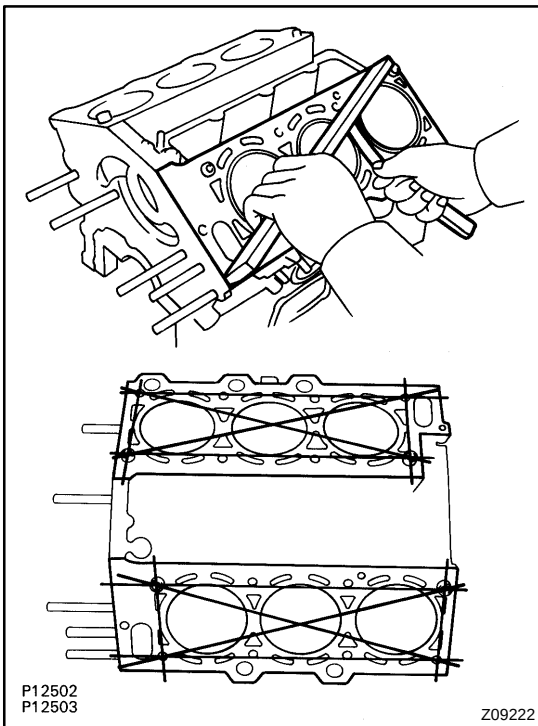
Using a gasket scraper, remove all the gasket material from the top surface of the cylinder block.

2. CLEAN CYLINDER BLOCK

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

NOTICE:

If the cylinder is washed at high temperatures, the cylinder liner sticks out beyond the cylinder block, so always wash the cylinder block at a temperature of 45°C (113°F) or less.

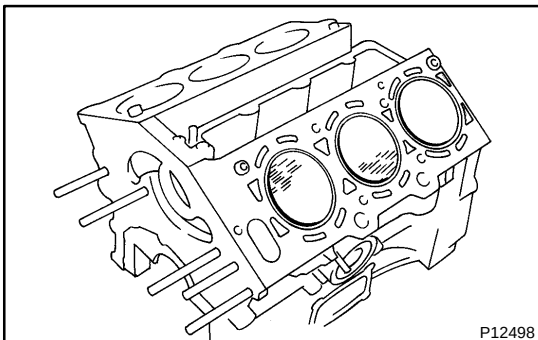


3. INSPECT TOP SURFACE OF CYLINDER BLOCK FOR FLATNESS

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

Maximum warpage: 0.07 mm (0.0028 in.)

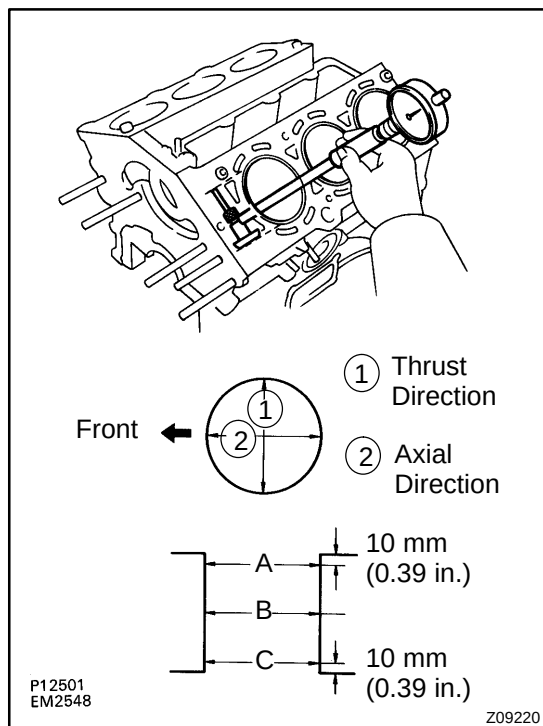
If warpage is greater than maximum, replace the cylinder block.



4. INSPECT CYLINDER FOR VERTICAL SCRATCHES

Visually check the cylinder for vertical scratches.

If deep scratches are present, replace the cylinder block.



5. INSPECT CYLINDER BORE DIAMETER

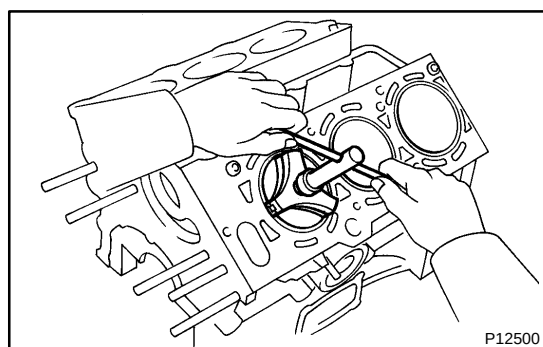
Using a cylinder gauge, measure the cylinder bore diameter at positions A, B and C in the thrust and axial directions.

Standard diameter:

87.500 - 87.512 mm (3.4449 - 3.4453 in.)

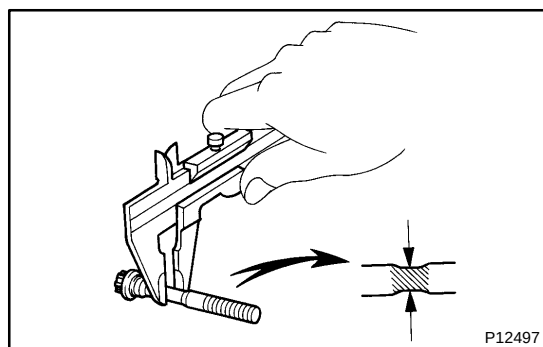
Maximum diameter: 87.52 mm (3.4457 in.)

If the diameter is greater than maximum, replace the cylinder block.



6. REMOVE CYLINDER RIDGE

If the wear is less than 0.2 mm (0.008 in.), using a ridge reamer, grind the top of the cylinder.



7. INSPECT 12 POINTED HEAD MAIN BEARING CAP BOLTS

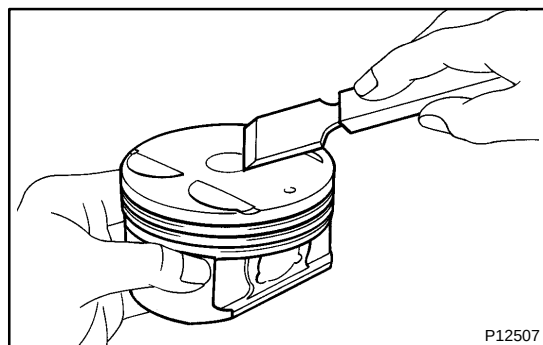
Using vernier calipers, measure the tension portion diameter of the bolt.

Standard diameter:

7.500 - 7.600 mm (0.2953 - 0.2992 in.)

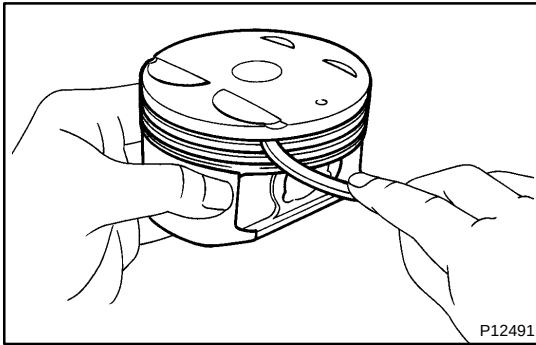
Minimum diameter: 7.20 mm (0.2835 in.)

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

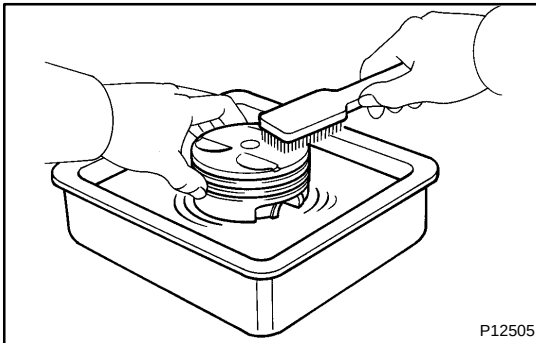


8. CLEAN PISTON

- (a) Using a gasket scraper, remove the carbon from the piston top.



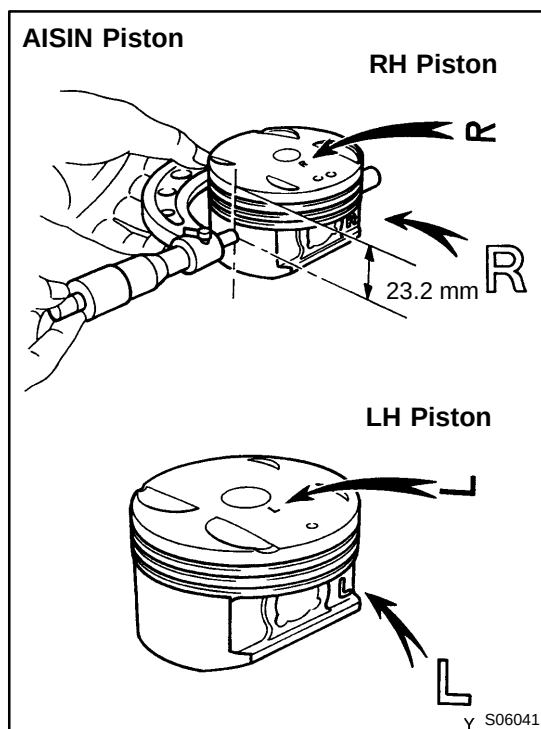
- (b) Using a groove cleaning tool or broken ring, clean the piston ring grooves.



- (c) Using solvent and a brush, thoroughly clean the piston.

NOTICE:

Do not use a wire brush.



9. INSPECT PISTON OIL CLEARANCE (AISIN Piton)

- (a) Using a micrometer, measure the piston diameter at right angles to the piston pin center line, 23.2 mm (0.913 in.) from the piston head.

Piston diameter:

87.406 - 87.416 mm (3.4412 - 3.4416 in.)

- (b) Measure the cylinder bore diameter in the thrust directions. (See step 5.)
- (c) Subtract the piston diameter measurement from the cylinder bore diameter measurement.

Standard oil clearance:

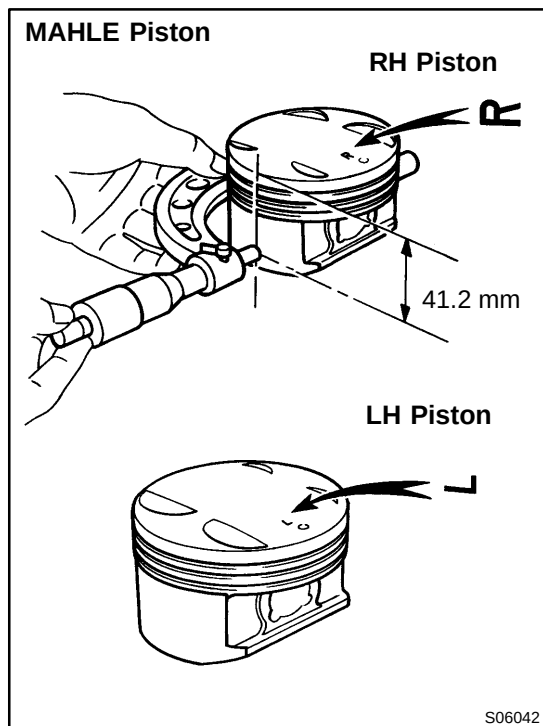
0.084 - 0.106 mm (0.0033 - 0.0042 in.)

Maximum oil clearance: 0.13 mm (0.0051 in.)

If the oil clearance is greater than maximum, replace all the 6 pistons. If necessary, replace the cylinder block.

HINT:

The shape of the piston varies for the RH and LH banks. The RH piston is marked with "R", the LH piston with "L".

**10. INSPECT PISTON OIL CLEARANCE (MAHLE Piston)**

- (a) Using a micrometer, measure the piston diameter at right angles to the piston pin center line, 41.2 mm (1.622 in.) from the piston head.

Piston diameter:

87.453 - 87.467 mm (3.4430 - 3.4436 in.)

- (b) Measure the cylinder bore diameter in the thrust directions. (See step 5.)
- (c) Subtract the piston diameter measurement from the cylinder bore diameter measurement.

Standard oil clearance:

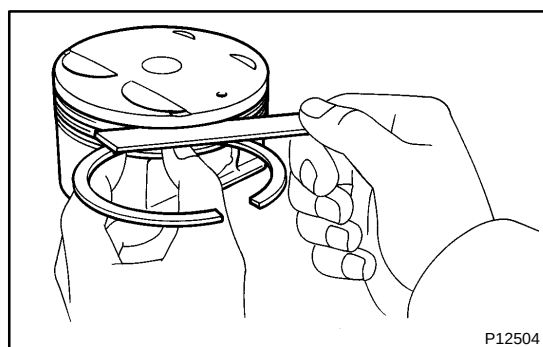
0.033 - 0.059 mm (0.0013 - 0.0023 in.)

Maximum oil clearance: 0.13 mm (0.0051 in.)

If the oil clearance is greater than maximum, replace all the 6 pistons. If necessary, replace the cylinder block.

HINT:

The shape of the piston varies for the RH and LH banks. The RH piston is marked with "R", the LH piston with "L".

**11. INSPECT PISTON RING GROOVE CLEARANCE**

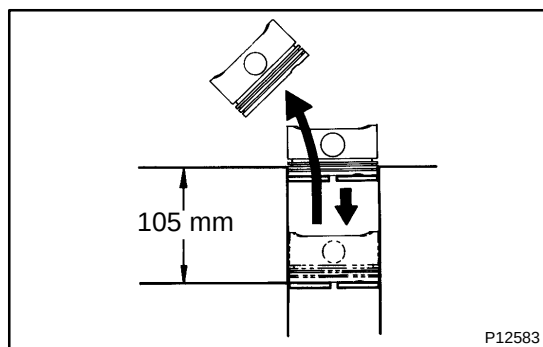
Using a feeler gauge, measure the clearance between new piston ring and the wall of the ring groove.

Ring groove clearance:

No.1: 0.020 - 0.070 mm (0.0008 - 0.0028 in.)

No.2: 0.020 - 0.060 mm (0.0008 - 0.0024 in.)

If the clearance is not as specified, replace the piston.

**12. INSPECT PISTON RING END GAP**

- (a) Insert the piston ring into the cylinder bore.
- (b) Using a piston, push the piston ring a little beyond the bottom of the ring travel, 105 mm (4.13 in.) from the top of the cylinder block.

- (c) Using a feeler gauge, measure the end gap.

Standard end gap:

No.1: 0.25 - 0.35 mm (0.0098 - 0.0138 in.)

No.2: 0.35 - 0.45 mm (0.0138 - 0.0177 in.)

Oil (Side rail): 0.15 - 0.40 mm (0.0059 - 0.0157 in.)

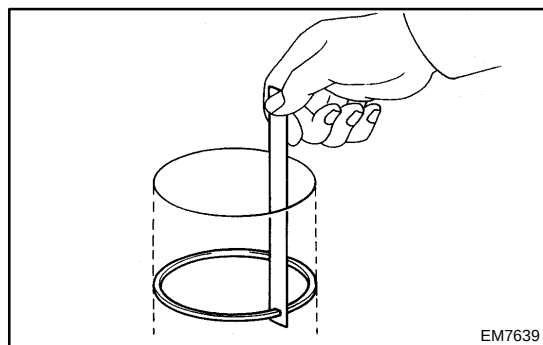
Maximum end gap:

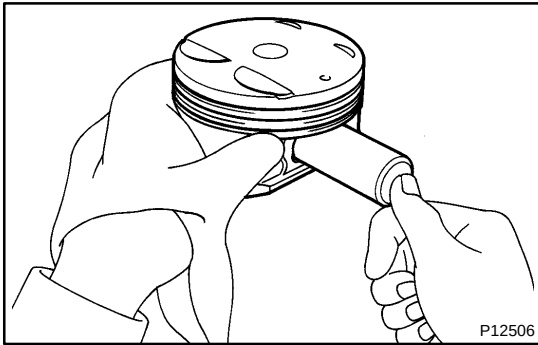
No.1: 0.95 mm (0.0374 in.)

No.2: 1.05 mm (0.0413 in.)

Oil (Side rail): 1.00 mm (0.0394 in.)

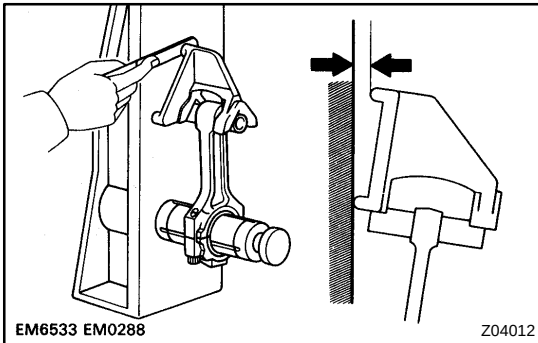
If the end gap is greater than maximum, replace the piston ring. If the end gap is greater than maximum, even with a new piston ring, replace the cylinder block.





13. INSPECT PISTON PIN FIT

At 60°C (140°F), you should be able to push the piston pin into the piston pin hole with your thumb.



14. INSPECT CONNECTING ROD ALIGNMENT

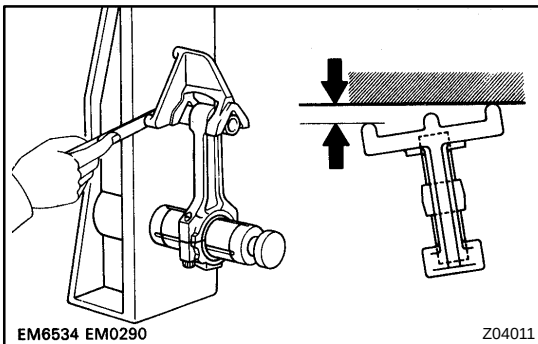
Using a rod aligner and feeler gauge, check the connecting rod alignment.

- Check for out-of-alignment.

Maximum out-of-alignment:

0.05 mm (0.0020 in.) per 100 mm (3.94 in.)

If out-of-alignment is greater than maximum, replace the connecting rod assembly.

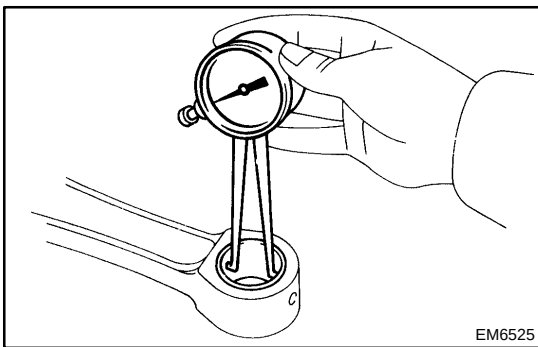


- Check for twist

Maximum twist:

0.15 mm (0.0059 in.) per 100 mm (3.94 in.)

If twist is greater than maximum, replace the connecting rod assembly.

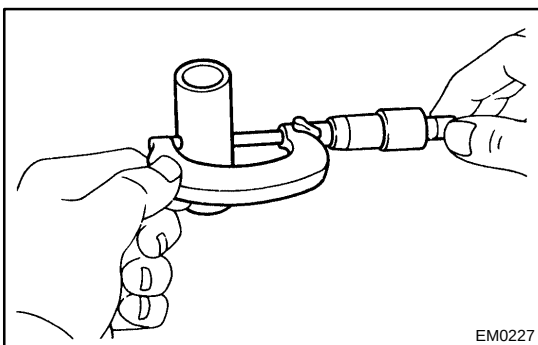


15. INSPECT PISTON PIN OIL CLEARANCE

- (a) Using a caliper gauge, measure the inside diameter of the connecting rod bushing.

Bushing inside diameter:

22.005 - 22.014 mm (0.8663 - 0.8667 in.)



- (b) Using a micrometer, measure the piston pin diameter.

Piston pin diameter:

21.997 - 22.006 mm (0.8660 - 0.8664 in.)

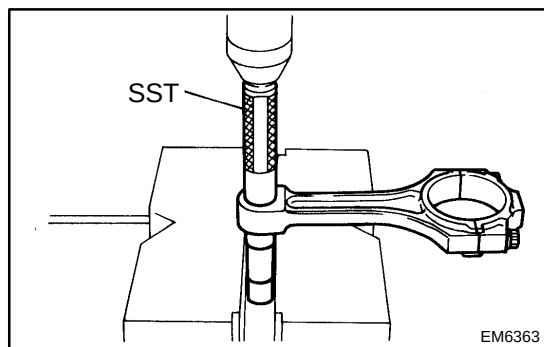
- (c) Subtract the piston pin diameter measurement from the bushing inside diameter measurement.

Standard oil clearance:

0.005 - 0.011 mm (0.0002 - 0.0004 in.)

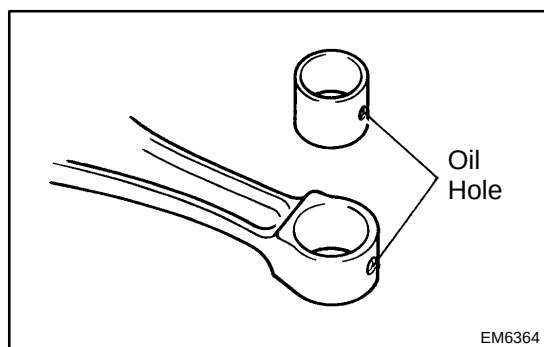
Maximum oil clearance: 0.05 mm (0.0020 in.)

If the oil clearance is greater than maximum, replace the bushing. If necessary, replace the piston and piston pin as a set.



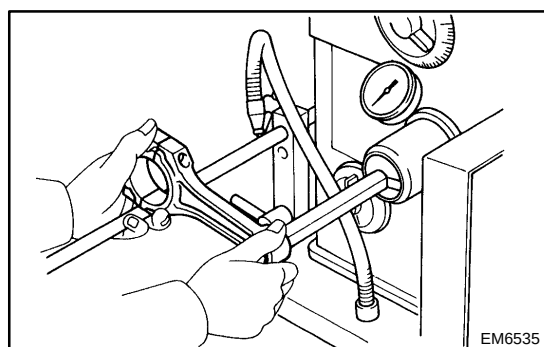
16. IF NECESSARY, REPLACE CONNECTING ROD BUSHING

- (a) Using SST and a press, press out the bushing.
SST 09222-30010

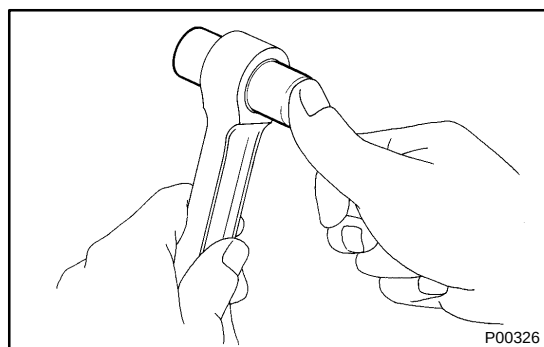


- (b) Align the oil holes of a new bushing and the connecting rod.

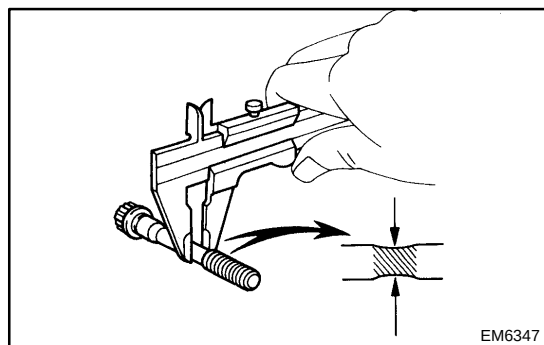
- (c) Using SST and a press, press in the bushing.
SST 09222-30010



- (d) Using a pin hole grinder, hone the bushing to obtain the standard specified clearance (see step 15 above) between the bushing and piston pin.



- (e) Check the piston pin fit at normal room temperature. Coat the piston pin with engine oil, and push it into the connecting rod with your thumb.



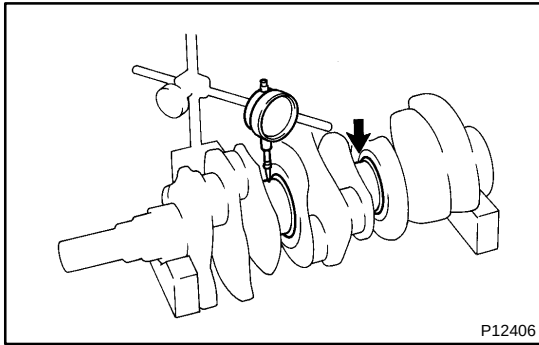
17. INSPECT CONNECTING ROD BOLTS

Using vernier calipers, measure the tension portion diameter of the bolt.

Standard diameter: 7.2 - 7.3 mm (0.284 - 0.287 in.)

Minimum diameter: 7.0 mm (0.276 in.)

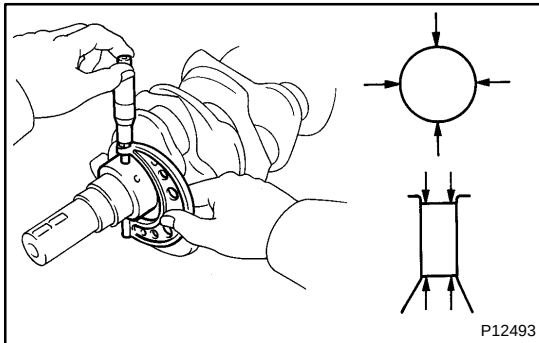
If the diameter is less than minimum, replace the bolt.

**18. INSPECT CRANKSHAFT FOR CIRCLE RUNOUT**

- (a) Place the crankshaft on V-blocks.
- (b) Using a dial indicator, measure the circle runout, as shown in the illustration.

Maximum circle runout: 0.06 mm (0.0024 in.)

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

**19. INSPECT MAIN JOURNALS AND CRANK PINS**

- (a) Using a micrometer, measure the diameter of each main journal and crank pin.

Main journal diameter:

60.988 - 61.000 mm (2.4011 - 2.4016 in.)

Crank pin diameter:

52.992 - 53.000 mm (2.0862 - 2.0866 in.)

If the diameter is not as specified, check the oil clearance. (See disassembly in cylinder block)

If necessary, replace the crankshaft.

- (b) Check each main journal and crank pin for taper and out-of-round as shown.

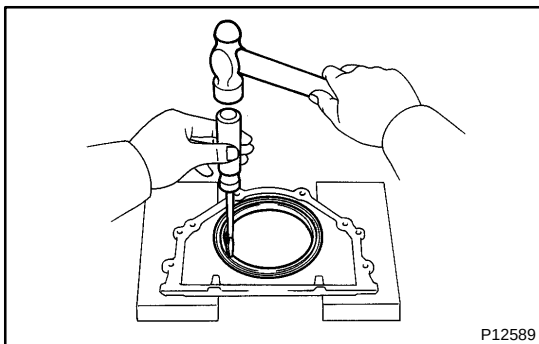
Maximum taper and out-of-round:

0.02 mm (0.0008 in.)

If the taper and out-of-round is greater than maximum, replace the crankshaft.

20. REPLACE CRANKSHAFT FRONT OIL SEAL

(See page [LU-14](#))

**21. REPLACE CRANKSHAFT REAR OIL SEAL**

HINT:

There are 2 methods ((a) and (b)) to replace the oil seal which are as follows:

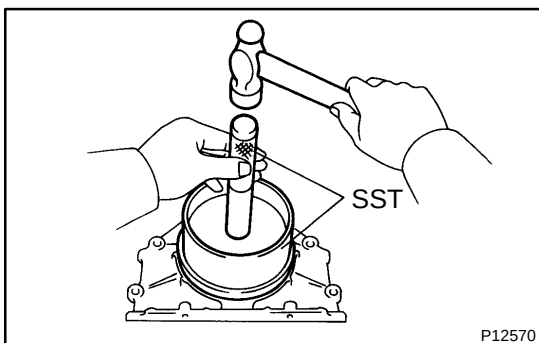
- (a) If the rear oil seal retainer is removed from the cylinder block.

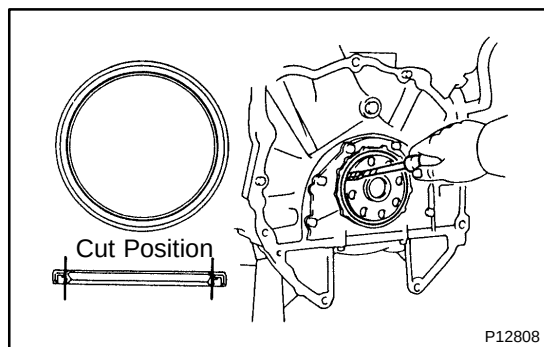
- (1) Using a screwdriver and hammer, tap out the oil seal.

- (2) Using SST and a hammer, tap in a new oil seal until its surface is flush with the rear oil seal retainer edge.

SST 09223-15030, 09950-70010 (09951-07100)

- (3) Apply MP grease to the oil seal lip.

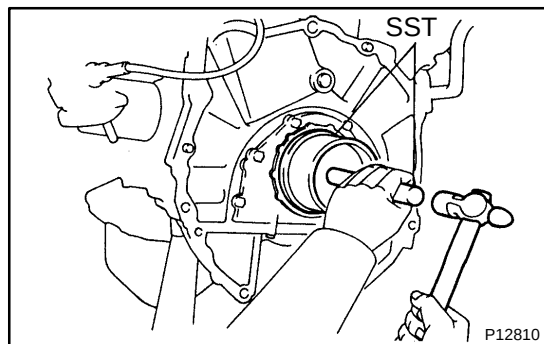




- (b) If the rear oil seal retainer is installed to the cylinder block.
- (1) Using a knife, cut off the oil seal lip.
 - (2) Using a screwdriver, pry out the oil seal.

NOTICE:

Be careful not to damage the crankshaft. Tape the screwdriver tip.



- (3) Apply MP grease to a new oil seal lip.
 - (4) Using SST and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.
- SST 09223-15030, 09950-70010 (09951-07100)