

EM6413

INSPECTION

1. REMOVE GASKET MATERIAL

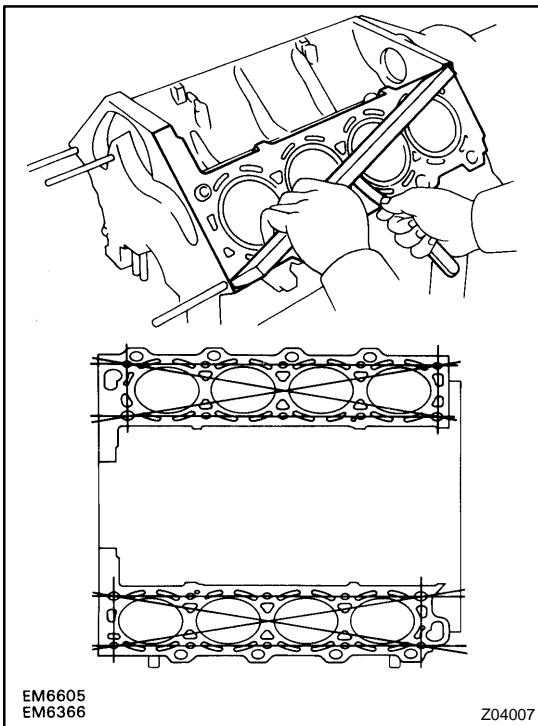
Using a gasket scraper, remove all the gasket material from the top surface of the cylinder block.

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° or less.

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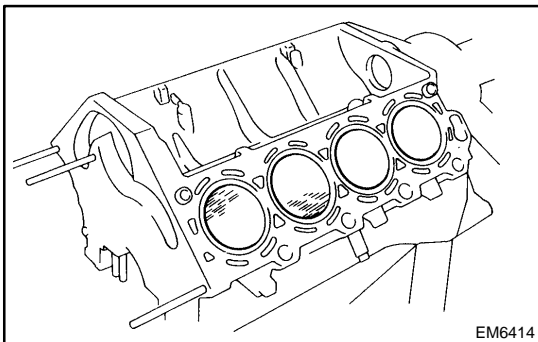
Z04007

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.

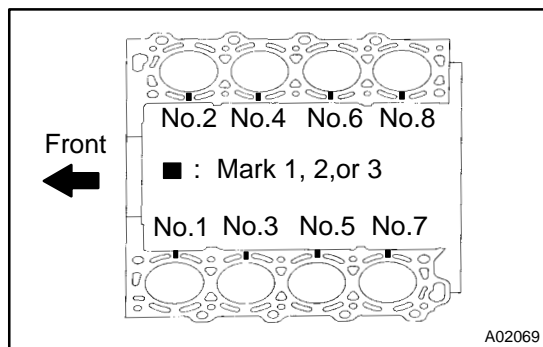


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4. INSPECT CYLINDER FOR VERTICAL SCRATCHES

Visually check the cylinder for vertical scratches.

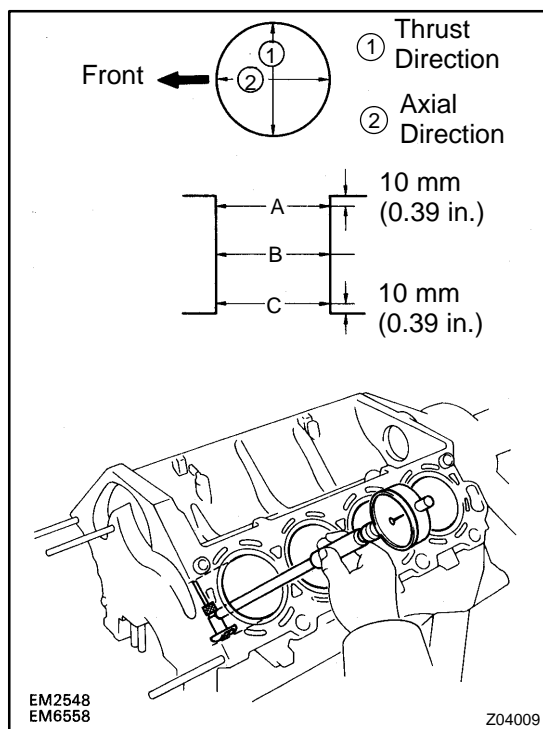
If deep scratches are present, replace the cylinder block.



5. INSPECT CYLINDER BORE DIAMETER

HINT:

There are 3 sizes of the standard cylinder bore diameter, marked "1", "2" and "3" accordingly. The mark is stamped on the top of the cylinder block.



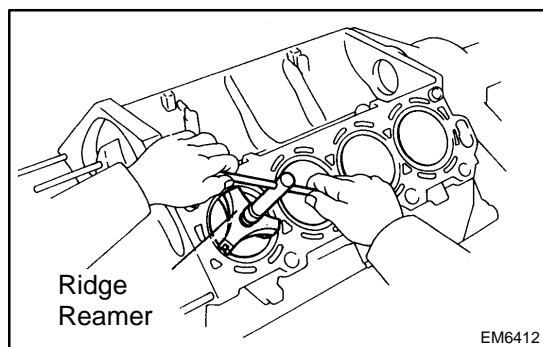
Using a cylinder gauge, measure the cylinder bore diameter at positions A, B and C in the thrust and axial directions.

Standard diameter:

Mark "1"	87.500 – 87.510 mm (3.4449 – 3.4453 in.)
Mark "2"	87.510 – 87.520 mm (3.4453 – 3.4457 in.)
Mark "3"	87.520 – 87.530 mm (3.4457 – 3.4461 in.)

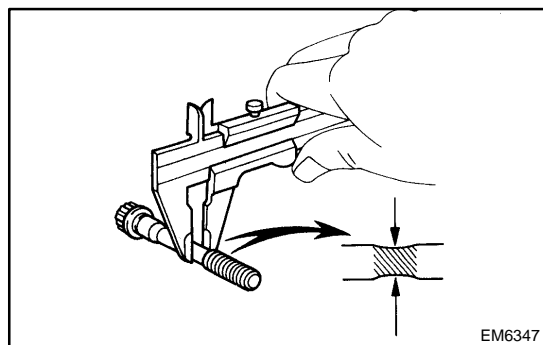
Maximum diameter: 87.73 mm (3.4539 in.)

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.



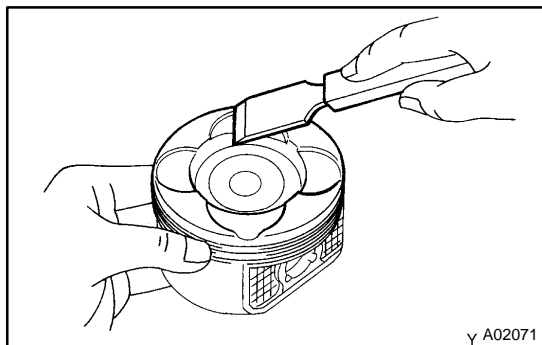
7. INSPECT MAIN BEARING CAP BOLTS

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

Diameter:

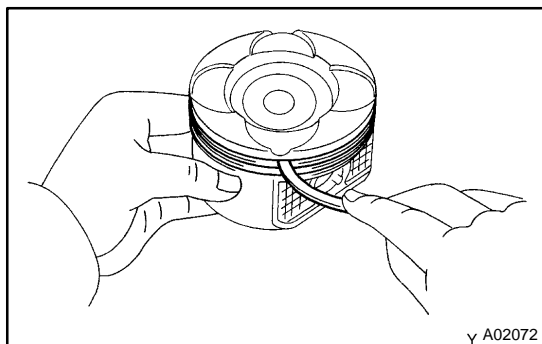
Standard	7.500 – 7.600 mm (0.2953 – 0.2992 in.)
Minimum	7.20 mm (0.2835 in.)

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

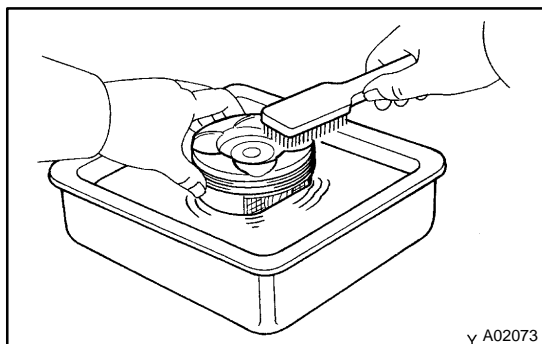


8. CLEAN PISTON

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



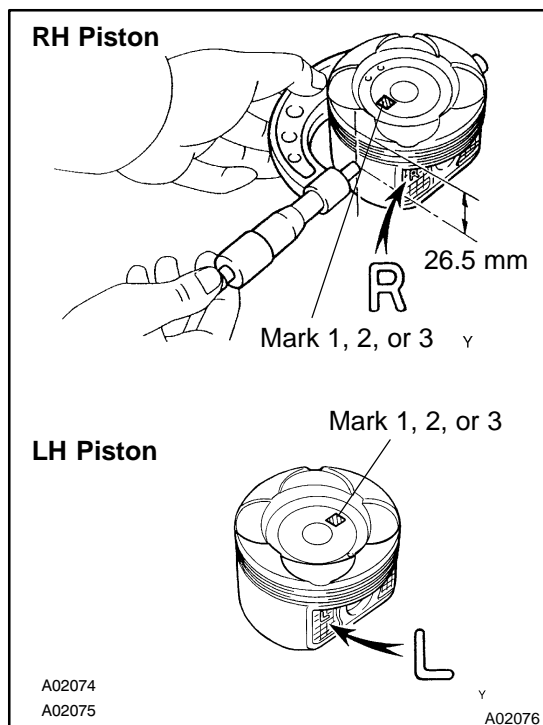
- (b) Using a groove cleaning tool or broken ring, clean the piston ring grooves.



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

NOTICE:

Do not use a wire brush.



9. INSPECT PISTON OIL CLEARANCE

HINT:

There are 3 sizes of the standard piston diameter, marked "1", "2" and "3" accordingly. The mark is stamped on the piston top.

- (a) Using a micrometer, measure the piston diameter at right angles to the piston pin center line, 26.5 mm (1.04 in.) from the piston head.

Piston diameter:

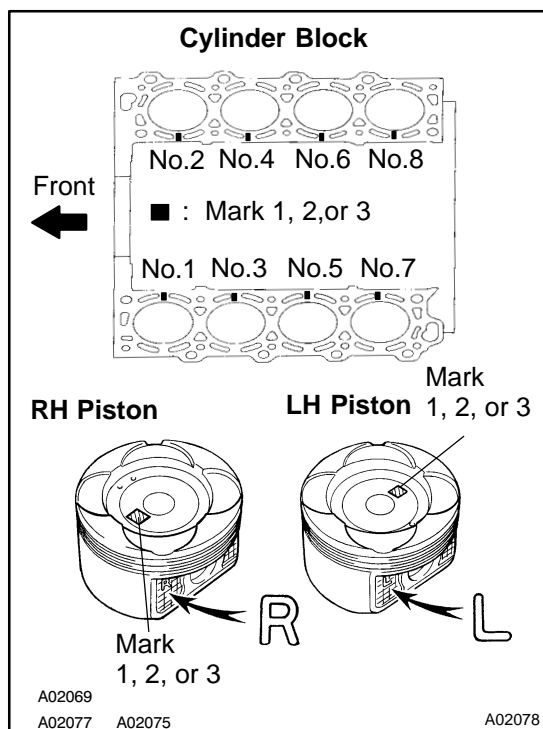
Mark "1"	87.406 – 87.416 mm (3.4411 – 3.4416 in.)
Mark "2"	87.416 – 87.426 mm (3.4416 – 3.4420 in.)
Mark "3"	87.426 – 87.436 mm (3.4420 – 3.4424 in.)

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

Oil clearance:

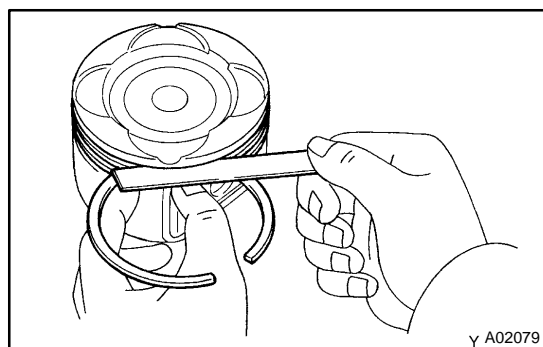
Standard	0.084 – 0.104 mm (0.0033 – 0.0041 in.)
Maximum	0.124 mm (0.0049 in.)

If the oil clearance is greater than maximum, replace all the 8 pistons. If necessary, replace the cylinder block.

**HINT**

Use new cylinder block:

- Use a piston with the same number mark as the cylinder diameter marked on the cylinder block.
- The shape of the piston varies for the RH and LH banks. The RH piston is marked with "R", the LH piston with "L".

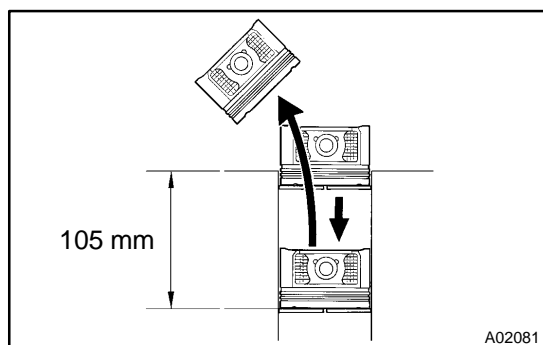
**10. INSPECT PISTON RING GROOVE CLEARANCE**

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

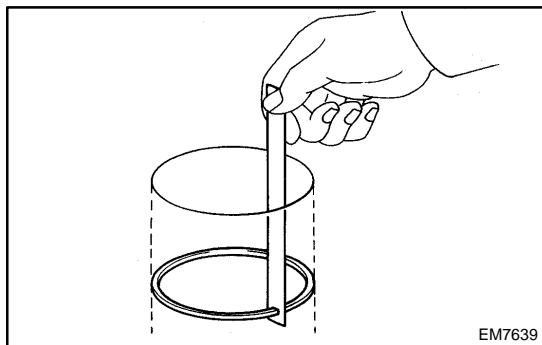
Ring groove clearance:

No.1	0.020 – 0.070 mm (0.0008 – 0.0028 in.)
No.2	0.010 – 0.050 mm (0.0004 – 0.0020 in.)

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

**11. INSPECT PISTON RING END GAP**

- Insert the piston ring into the cylinder bore.
- 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.

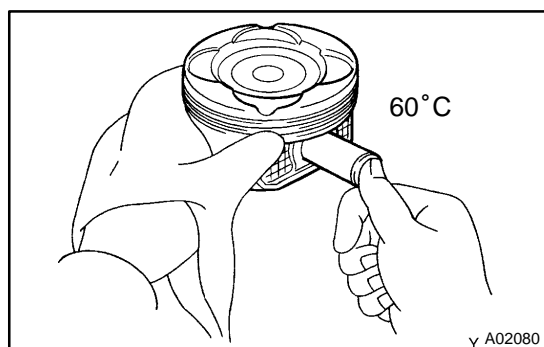
Standard end gap:

No.1	0.250 – 0.450 mm (0.0098 – 0.0177 in.)
No.2	0.500 – 0.700 mm (0.0197 – 0.0276 in.)
Oil (Side rail)	0.150 – 0.500 mm (0.0059 – 0.0197 in.)

Maximum end gap:

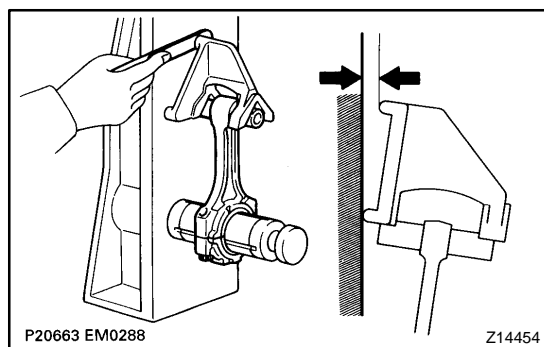
No.1	1.05 mm (0.0413 in.)
No.2	1.30 mm (0.0512 in.)
Oil (Side rail)	1.10 mm (0.0433 in.)

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.



12. 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.



13. INSPECT CONNECTING ROD ALIGNMENT

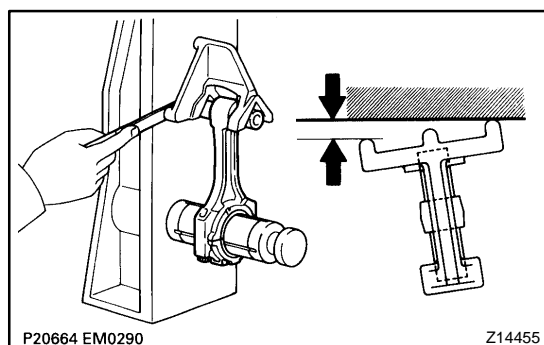
Using a rod aligner and feeler gauge, check the connecting rod alignment.

- Check for bend.

Maximum bend:

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

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

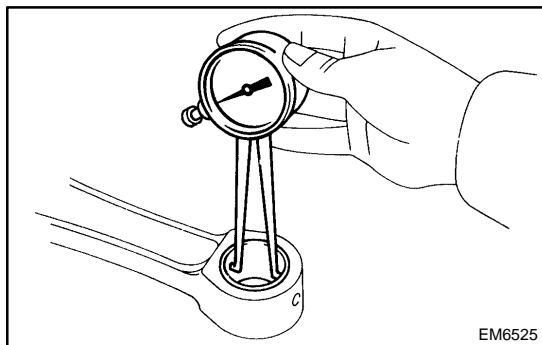


- Check for twist

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.



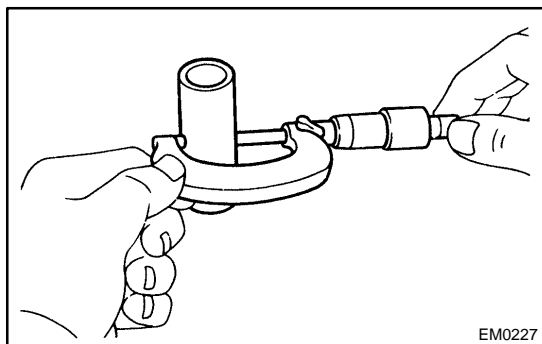
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14. INSPECT PISTON PIN OIL CLEARANCE

- (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.)



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

Piston pin diameter:

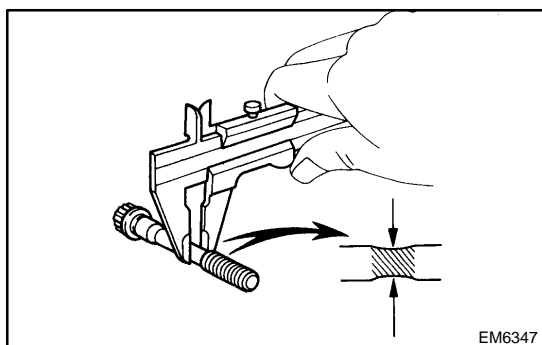
21.997 – 22.006 mm (0.8660 – 0.8664 in.)

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

Oil clearance:

Standard	0.005 – 0.011 mm (0.0002 – 0.0004 in.)
Maximum	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.



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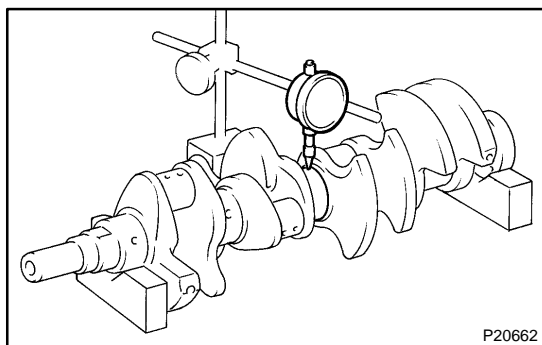
15. INSPECT CONNECTING ROD BOLTS

Using vernier calipers, measure the tension portion of the connecting rod bolt.

Diameter:

Standard	7.200 – 7.300 mm (0.2835 – 0.2874 in.)
Minimum	7.00 mm (0.2756 in.)

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



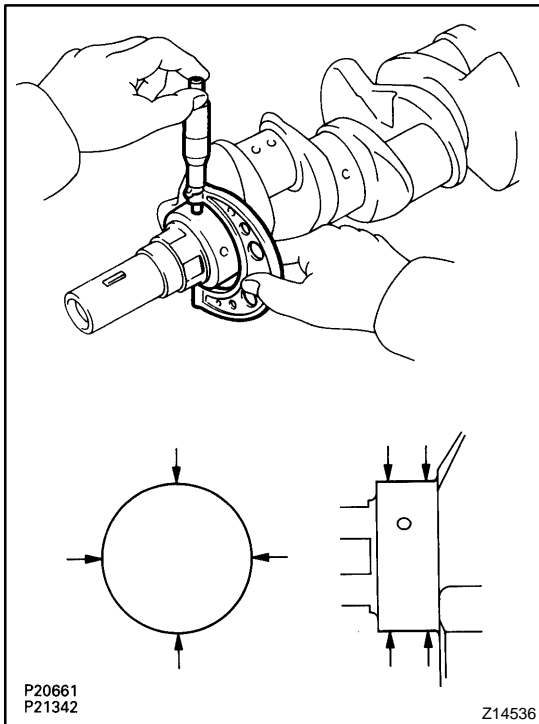
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16. INSPECT CRANKSHAFT FOR CIRCLE RUNOUT

- (a) Place the crankshaft on V-blocks.
 (b) Using a dial indicator, measure the circle runout at the center journal.

Maximum circle runout: 0.08 mm (0.0031 in.)

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

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

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

Diameter:

Main journal	66.988 – 67.000mm (2.6373 – 2.6378 in.)
Crank pin	51.982 – 52.000 mm (2.0465 – 2.0472 in.)

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