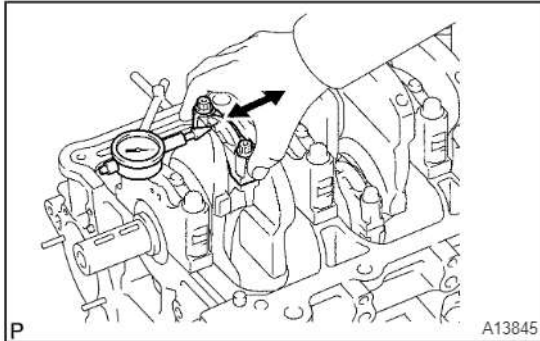


OVERHAUL



1. **INSPECT CONNECTING ROD THRUST CLEARANCE**
 - (a) Using a dial indicator, measure the thrust clearance while moving the connecting rod back and forth.

Standard thrust clearance:

0.160 to 0.362 mm (0.0063 to 0.0143 in.)

Maximum thrust clearance: 0.362 mm (0.0143 in.)

- (b) If the thrust clearance is greater than maximum, replace the connecting rod assembly(s). If necessary, replace the crankshaft.

2. **INSPECT CONNECTING ROD OIL CLEARANCE**

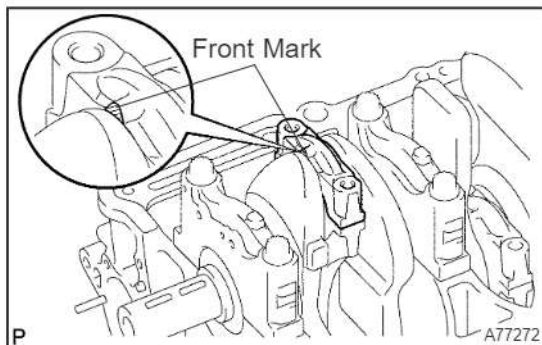
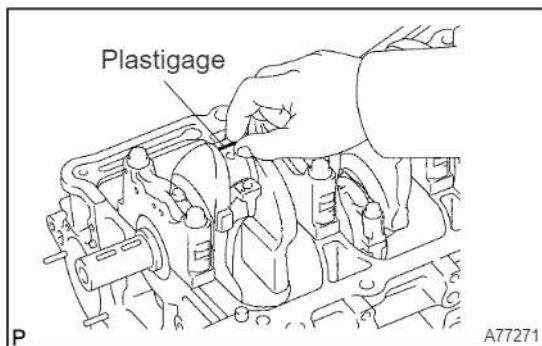
HINT:

The connecting rod cap bolts are tightened in 2 successive steps.

- (a) Check that the matchmarks on the connecting rod and cap are aligned to ensure correct reassembly.
 - (b) Using a 12 mm socket wrench, remove the 2 connecting rod cap bolts.

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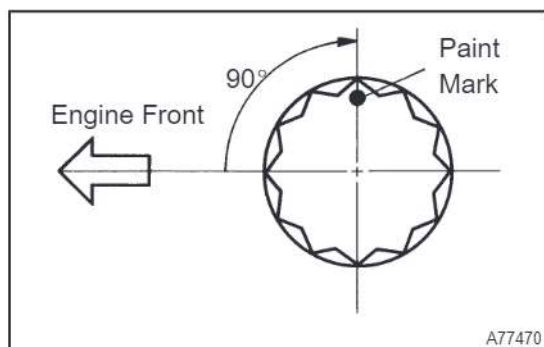
- (c) Clean the crank pin and bearing.
 - (d) Check the crank pin and bearing for pitting and scratches.
 - (e) Lay a strip of Plastigage on the crank pin.



- (f) Check that the front mark of the connecting rod cap is facing the correct direction.
 - (g) Apply a light coat of engine oil on the threads of the connecting rod cap bolts.
 - (h) Using a 12 mm socket wrench, tighten the bolts in several steps with the specified torque.

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Torque: 25 N·m (250 kgf·cm, 18 ft·lbf)

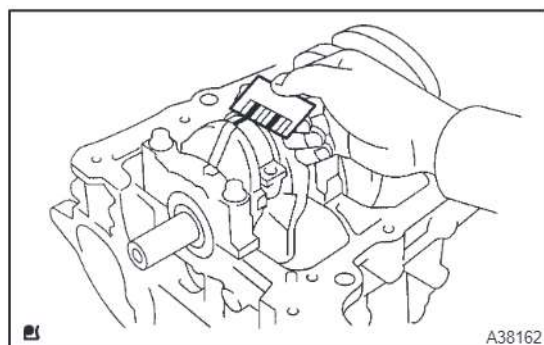


- (i) Place the front mark on each connecting rod cap bolt head with paint.
- (j) Retighten the cap bolts by 90° as shown in the illustration.

NOTICE:

Do not turn the crankshaft.

- (k) Remove the 2 bolts, connecting rod cap and lower bearing.



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

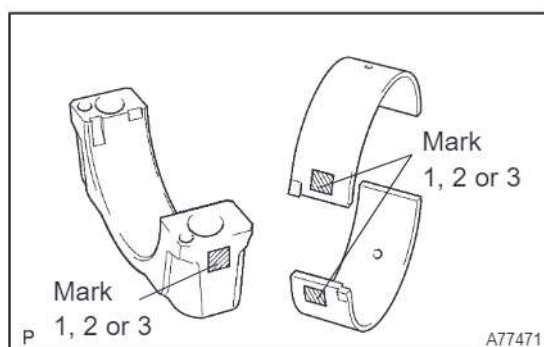
Standard oil clearance:

0.024 to 0.048 mm (0.0009 to 0.0019 in.)

Maximum oil clearance: 0.08 mm (0.0031 in.)

NOTICE:

Completely remove the Plastigage.

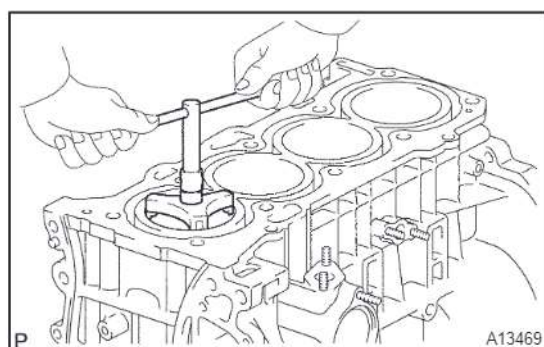


- (m) If replacing the bearing, replace it with one having the same number as marked on the connecting rod. There are 3 sizes of standard bearings, marked "1", "2" and "3" accordingly.

HINT:

Standard bearing center wall thickness.

Mark 1	1.485 to 1.488 mm (0.0585 to 0.0586 in.)
Mark 2	1.488 to 1.491 mm (0.0586 to 0.0587 in.)
Mark 3	1.491 to 1.494 mm (0.0587 to 0.0588 in.)

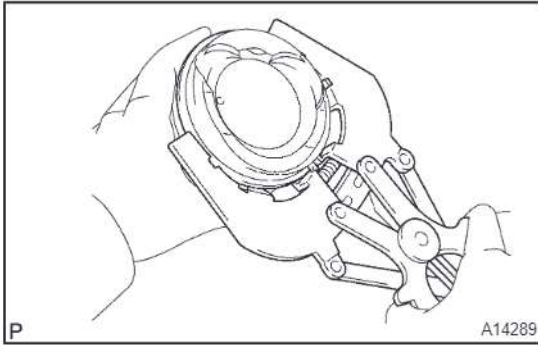
**3. REMOVE PISTON SUB-ASSY W/CONNECTING ROD**

- (a) Using a ridge reamer, remove all the carbon from the top of the cylinder.
- (b) Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.

HINT:

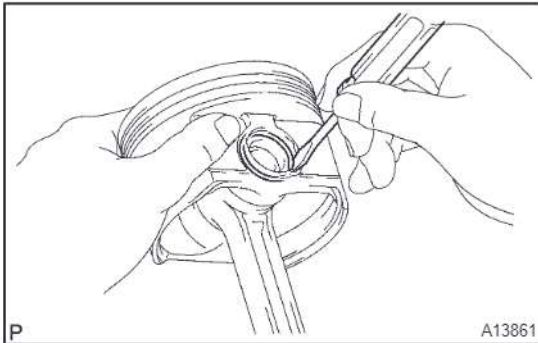
- Keep the bearing, connecting rod and cap together.
- Store the piston and connecting rod assemblies in correct order so they can be returned to the original locations when re-installing.

4. REMOVE CONNECTING ROD BEARING



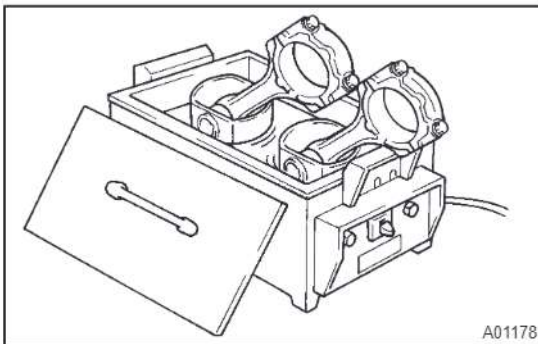
5. REMOVE PISTON RING SET

- (a) Using a piston ring expander, remove the 2 compression rings.
- (b) Remove the 2 side rails and oil ring by hand.

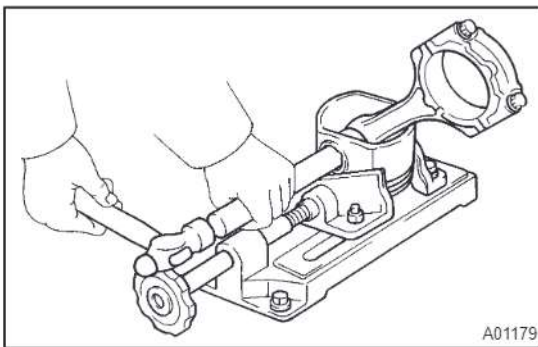


6. REMOVE PISTON

- (a) Using a small screwdriver, pry out the 2 snap rings.



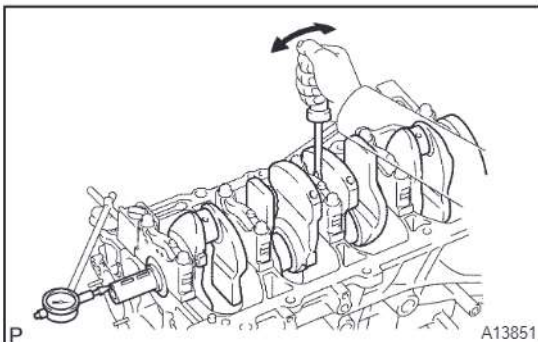
- (b) Gradually heat the piston to 80 to 90 °C (176 to 194 °F).



- (c) Using a plastic-faced hammer and brass bar, lightly tap out the piston pin and remove the connecting rod.

HINT:

- The piston and pin are a matched set.
- Store the pistons, pins, rings, connecting rods and bearings in correct order so that they can be returned to the original locations when re-assembling.



7. INSPECT CRANKSHAFT THRUST CLEARANCE

- (a) Using a dial indicator, measure the thrust clearance while prying the crankshaft back and forth with a screwdriver.

Standard thrust clearance:

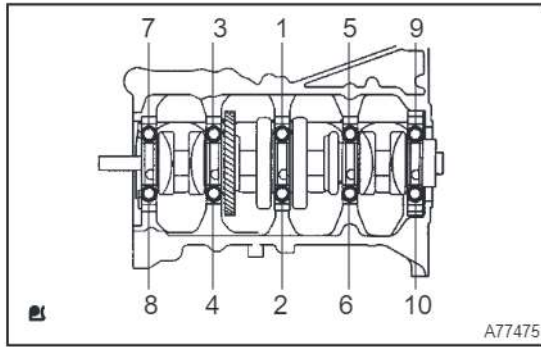
0.040 to 0.240 mm (0.0016 to 0.0094 in.)

Maximum thrust clearance: 0.30 mm (0.0118 in.)

- (b) If the thrust clearance is greater than maximum, replace the thrust washers as a set.

Thrust washer thickness:

1.930 to 1.980 mm (0.0760 to 0.0780 in.)

**8. REMOVE CRANKSHAFT**

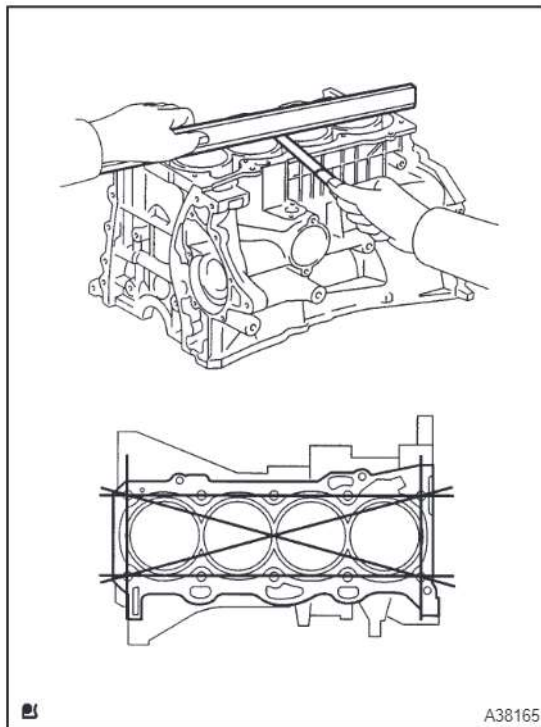
- (a) Using several steps, loosen and remove the 10 bearing cap sub-assembly bolts uniformly in the sequence shown.
- (b) Remove the bearing cap and the crankshaft.

9. REMOVE CRANKSHAFT THRUST WASHER UPPER**10. REMOVE CRANKSHAFT BEARING****NOTICE:**

Store the bearings in correct order so they can be returned to the original locations when re-assembling.

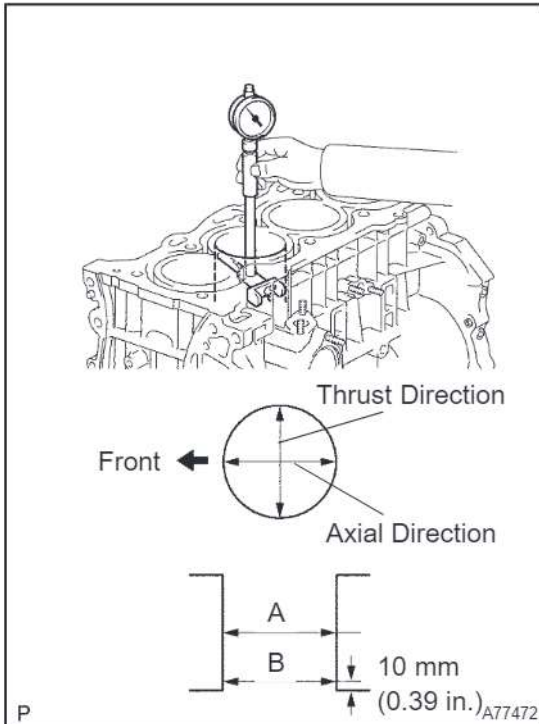
11. REMOVE CRANKSHAFT BEARING NO.2**NOTICE:**

Store the bearings in correct order so they can be returned to the original locations when re-assembling.

12. REMOVE STUD BOLT**13. INSPECT CYLINDER BLOCK FOR FLATNESS**

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

Maximum warpage: 0.05 mm (0.0020 in.)



14. INSPECT CYLINDER BORE

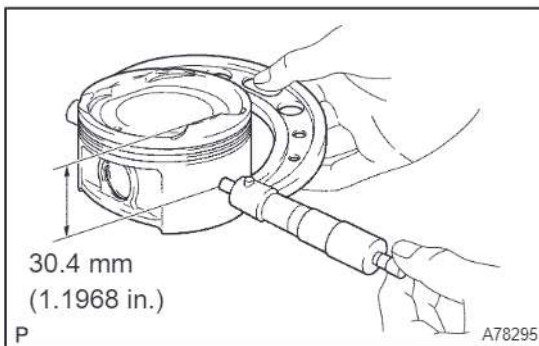
- (a) Using a cylinder gauge, measure the cylinder bore diameter at positions A, B and C in the thrust and axial directions.

Standard diameter:

86.000 to 86.013 mm (3.3858 to 3.3863 in.)

Maximum diameter: 86.013 mm (3.3863 in.)

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



15. INSPECT PISTON DIAMETER

- (a) Using a micrometer, measure the piston diameter at right angles to the piston pin center line, 30.4 mm (1.1968 in.) from the piston head.

Piston diameter:

85.927 to 85.937 mm (3.3829 to 3.3833 in.)

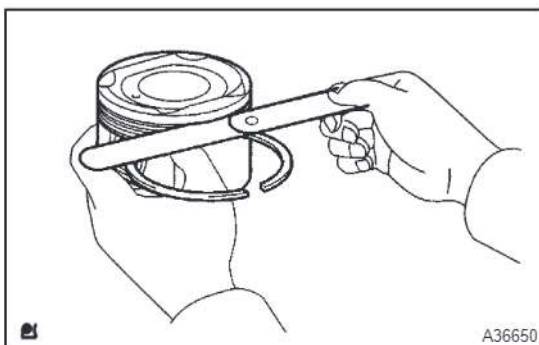
16. INSPECT PISTON CLEARANCE

- (a) Subtract the piston diameter measurement from the cylinder bore diameter measurement.

Standard oil clearance: 0.063 to 0.086 mm (0.0025 to 0.0034 in.)

Maximum oil clearance: 0.1 mm (0.0039 in.)

- (b) If the clearance is greater than maximum, replace all the 4 pistons. If necessary, replace the cylinder block.

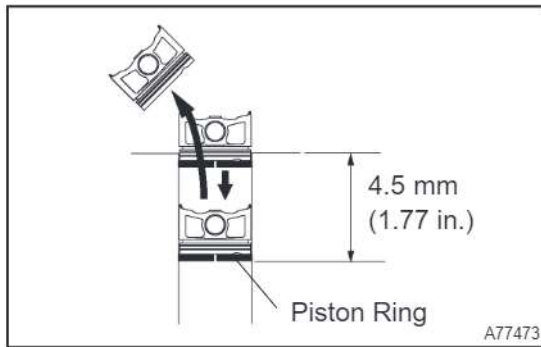


17. INSPECT RING GROOVE CLEARANCE

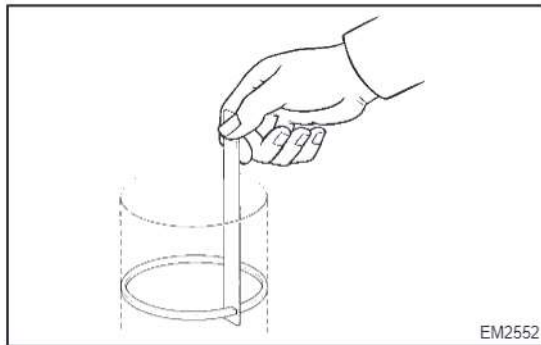
- (a) Using a feeler gauge, measure the clearance between the piston ring and the wall of the ring groove.

Ring groove clearance:

Piston Ring	mm (in.)
No. 1	0.020 to 0.007 (0.0008 to 0.0028)
No. 2	0.020 to 0.006 (0.0008 to 0.0024)
Oil ring (Side rail)	0.070 to 0.150 (0.0028 to 0.0059)

**18. INSPECT PISTON RING END GAP**

- (a) Using a piston, push the piston ring a little beyond the bottom of the ring travel, 4.5 mm (1.77 in.) from the top of the cylinder block.



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

Standard end gap:

No. 1 0.30 to 0.40 mm (0.0118 to 0.0157 in.)

No. 2 0.47 to 0.62 mm (0.0185 to 0.0244 in.)

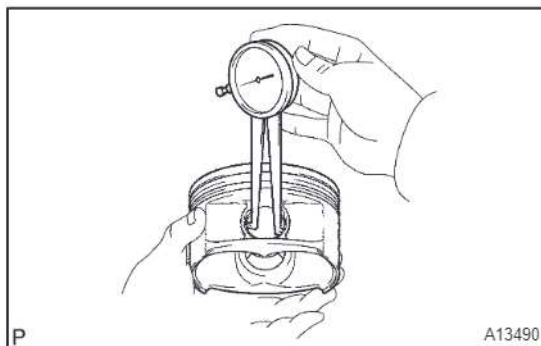
Oil (side rail) 0.10 to 0.35 mm (0.0039 to 0.0138 in.)

Maximum end gap:

No. 1 0.89 mm (0.0350 in.)

No. 2 1.37 mm (0.0539 in.)

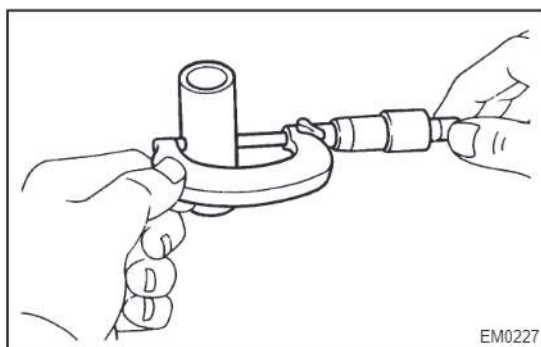
Oil (side rail) 0.73 mm (0.0287 in.)

**19. INSPECT PISTON PIN OIL CLEARANCE**

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

Bushing inside diameter:

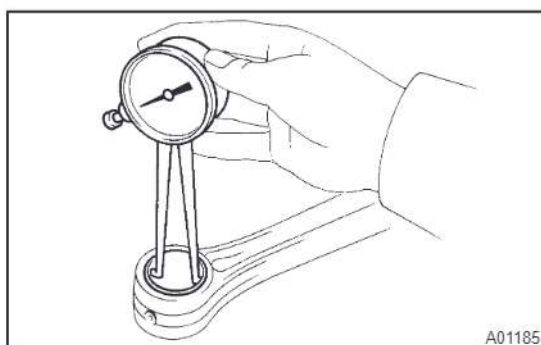
22.005 to 22.014 mm (0.8663 to 0.8667 in.)



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

Piston pin diameter:

21.997 to 22.009 mm (0.8660 to 0.8665 in.)



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

Bushing inside diameter:

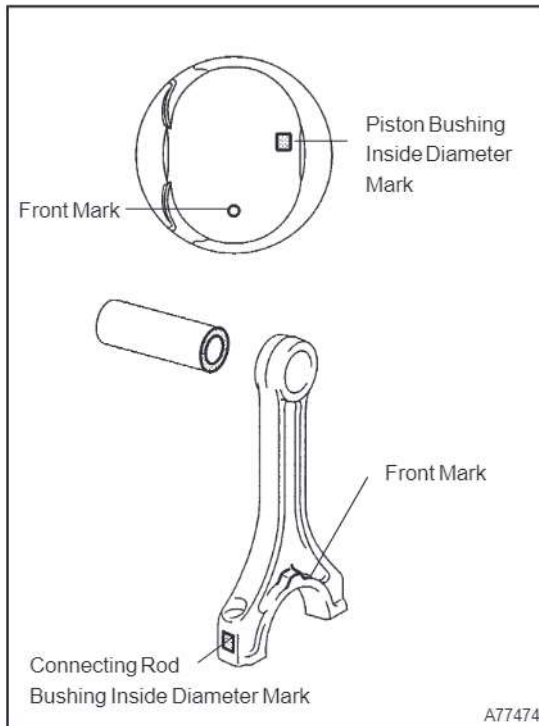
22.005 to 22.014 mm (0.8663 to 0.8667 in.)

- (d) Subtract the piston pin diameter measurement from the piston pin hole diameter measurement.

Standard oil clearance:

0.005 to 0.011 mm (0.0002 to 0.0004 in.)

Maximum oil clearance: 0.05 mm (0.0020 in.)



- (e) If the oil clearance is greater than maximum, replace the connecting rod. If necessary, replace the piston and piston pin as a set.

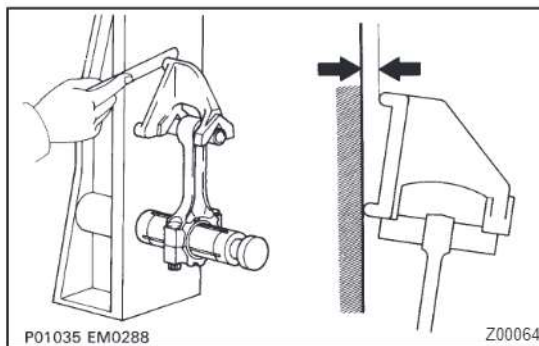
- (f) Subtract the piston pin diameter measurement from the bushing inside diameter measurement.

Standard oil clearance:

0.005 to 0.011 mm (0.0002 to 0.0004 in.)

Maximum oil clearance: 0.05 mm (0.0020 in.)

- (g) If the oil clearance is greater than maximum, replace the connecting rod. If necessary, replace the connecting rod and piston pin as a set.



20. INSPECT CONNECTING ROD SUB-ASSY

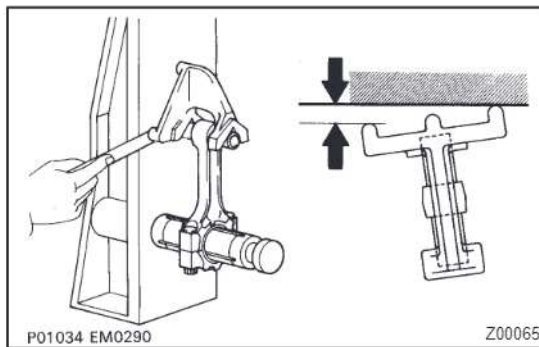
- (a) Using a rod aligner and feeler gauge, check the connecting rod alignment.

- (1) Check for misalignment.

Maximum misalignment:

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

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

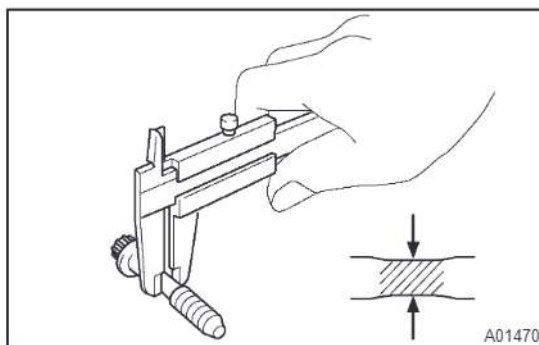


- (1) Check for twist.

Maximum twist:

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

- (c) If twist is greater than maximum, replace the connecting rod assembly.



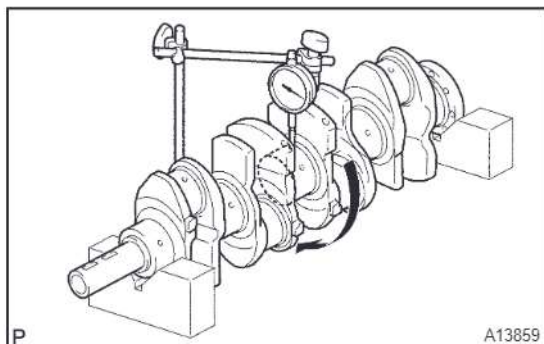
21. INSPECT CONNECTING ROD BOLT

- (a) Using a vernier calipers, measure the tension portion diameter of the bolt.

Standard diameter: 7.2 to 7.3 mm (0.283 to 0.287 in.)

Minimum diameter: 7.0 mm (0.276 in.)

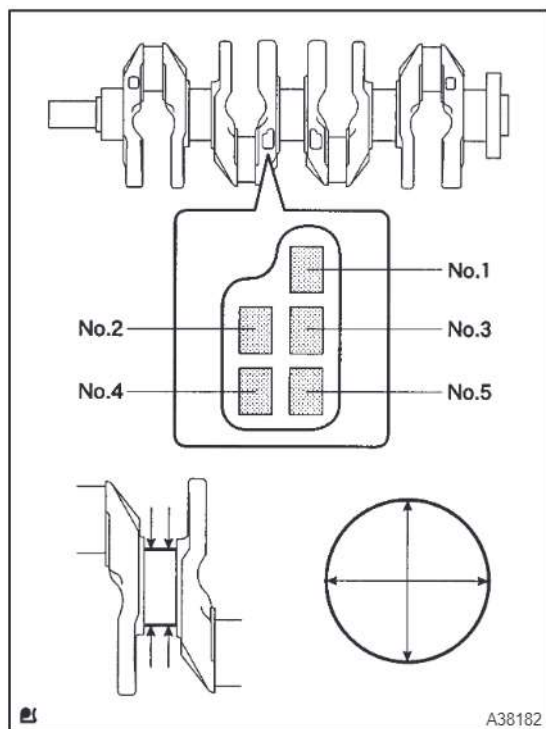
- (b) If the diameter is less than minimum, replace the bolt.



22. INSPECT CRANKSHAFT

- (a) Using a dial indicator and V-blocks, measure the circle runout as shown in the illustration.

Maximum circle runout: 0.03 mm (0.0012 in.)



- (b) Using a micrometer, measure the diameter of each main journal.

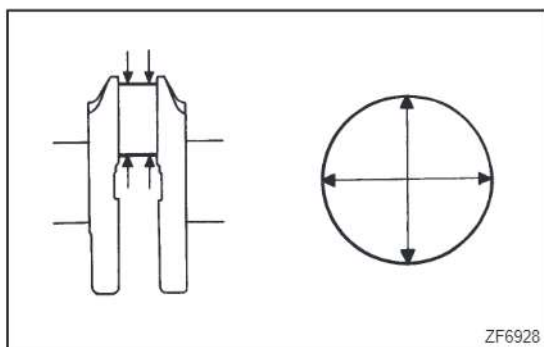
Diameter: 54.988 to 55.000 (2.1648 to 2.06535 in.)

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

Maximum taper and out-of-round: 0.003 mm (0.0001 in.)

HINT:

Mark	mm (in.)
0	54.998 to 55.000 (2.16528 to 2.16535)
1	54.996 to 54.998 (2.16520 to 2.16528)
2	54.994 to 54.996 (2.16512 to 2.16520)
3	54.992 to 54.994 (2.16504 to 2.16512)
4	54.990 to 54.992 (2.16496 to 2.16504)
5	54.988 to 54.990 (2.16490 to 2.16496)

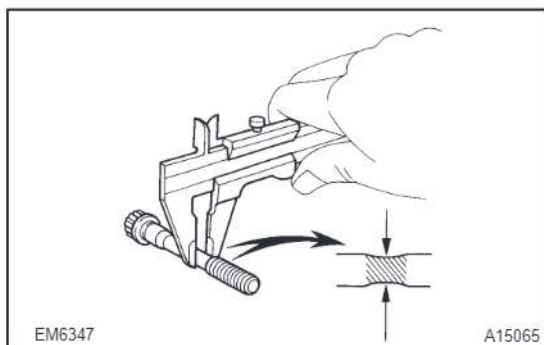


- (d) Using a micrometer, measure the diameter of each crank pin.

Diameter: 47.990 to 48.000 mm (1.8894 to 1.8898 in.)

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

Maximum taper and out-of-round: 0.003 mm (0.0001 in.)



23. INSPECT CRANKSHAFT BEARING CAP SET BOLT

- (a) Using vernier calipers, measure the tension portion diameter of the bolt.

Standard diameter: 7.5 to 7.6 mm (0.295 to 0.299 in.)

Minimum diameter: 7.2 mm (0.283 in.)

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

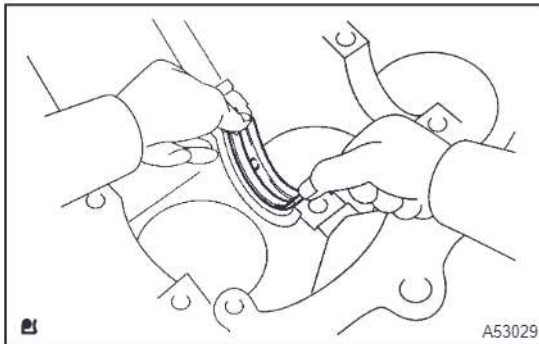
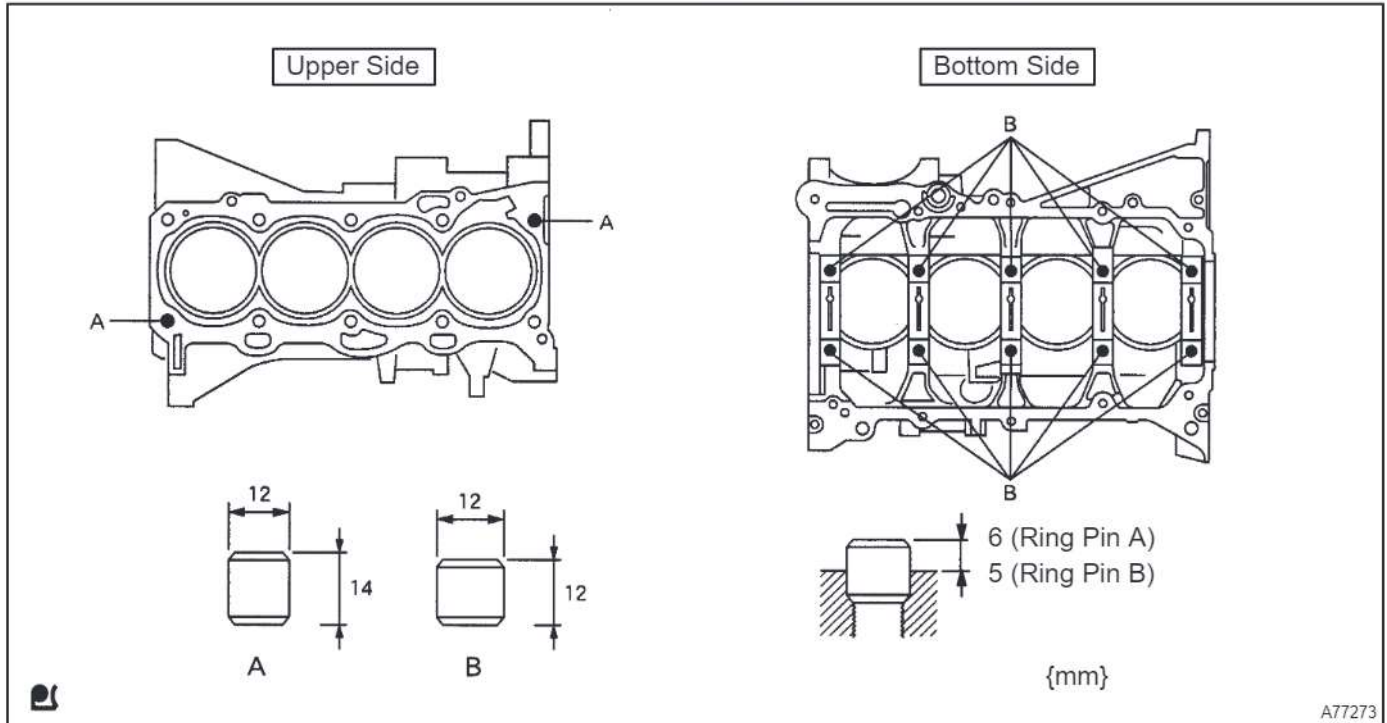
24. INSTALL RING PIN

- (a) Using a plastic-faced hammer, tap into the ring pin.

Standard protrusion:

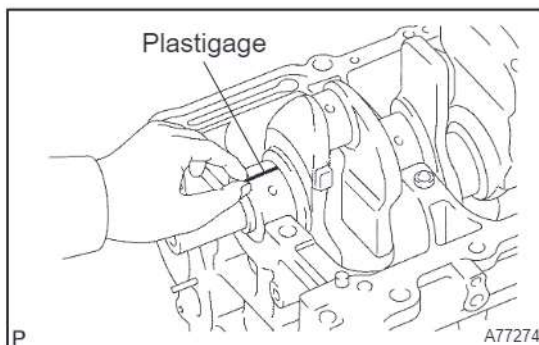
Ring pin A 6 mm (0.236 in.)

Ring pin B 5 mm (0.197 in.)

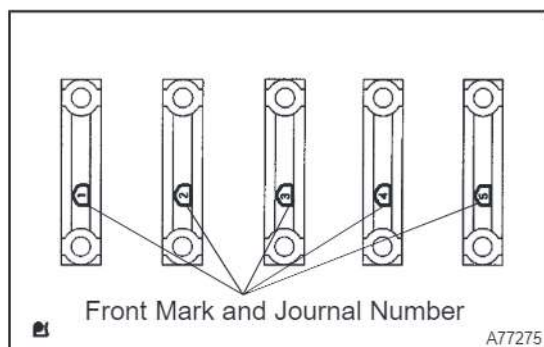
**25. INSPECT CRANKSHAFT OIL CLEARANCE****NOTICE:**

- Clean the backside of the bearing and the bearing surface of the bearing cap and keep them free of oils.
- The bearing cap bolts are tightened in 2 progressive steps.

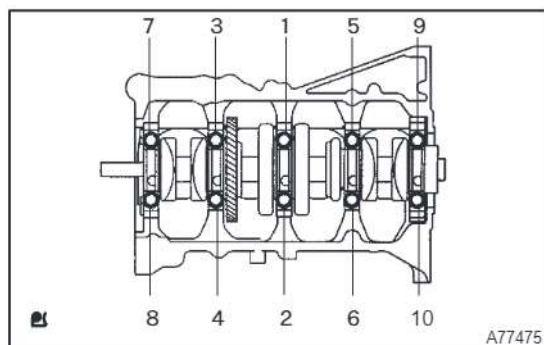
- (a) Clean each main journal and bearing.
- (b) Install the upper bearing with an oil groove on cylinder block.
- (c) Install the lower bearing on the bearing cap sub assembly.
- (d) Place the crankshaft on the cylinder block.



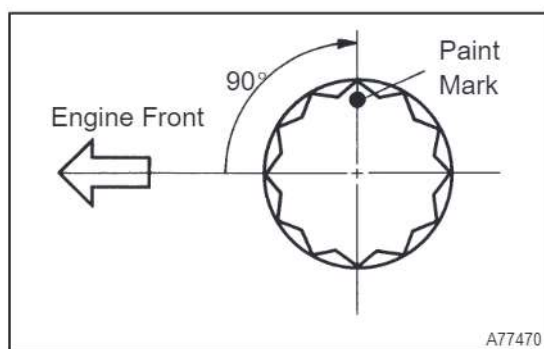
- (e) Lay a strip of Plastigage across each journal.
SST 09011-38121



- (f) Examine the front marks and install the bearing caps on the cylinder block.
- (g) Apply a light coat of engine oil on the threads and under the bearing cap bolts.



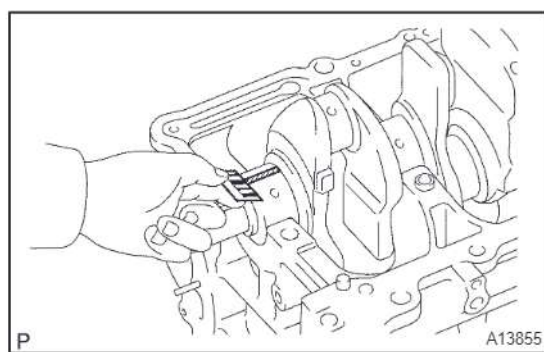
- (h) Using several steps, tighten the bolts with the specified torque in the sequence shown in the illustration.
 - (i) Retighten the bolts in the same way as above with the specified torque.
- Torque: 40 N·m (408 kgf·cm, 29 ft·lbf)



- (j) Place the front mark on each bearing cap bolt head with paint.
- (k) Retighten the bearing cap bolts by 90° in the same sequence as step (h).
- (l) Check that each painted mark is now at a 90° angle to the front.

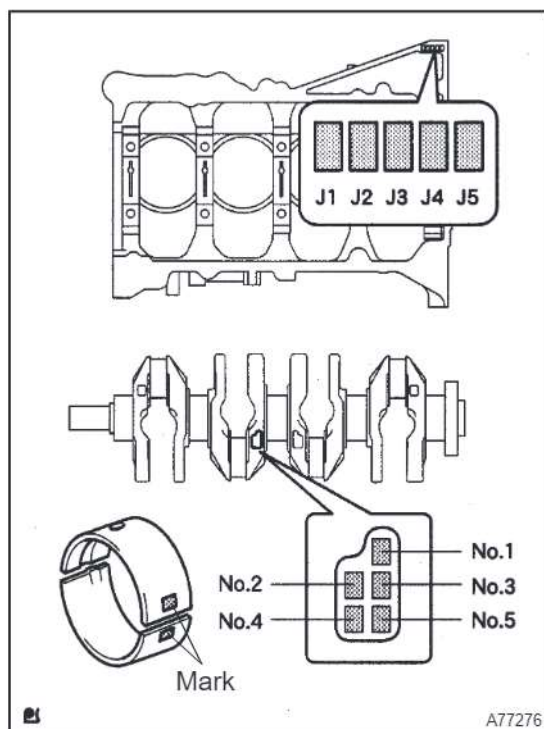
NOTICE:**Do not turn the crankshaft.**

- (m) Remove the bearing caps.



- (n) Measure the Plastigage at its widest point.
- Standard oil clearance:**
0.017 to 0.040 mm (0.0007 to 0.0016 in.)
Maximum oil clearance: 0.07 mm (0.0028 in.)

NOTICE:**Completely remove the Plastigage.**



- (o) If using a standard bearing, replace it with one having the same number as old one. If the number of the bearing cannot be determined, select a proper bearing by putting together the numbers imprinted on the cylinder block and the crankshaft. The total number of this will determine an applicable bearing among the 4 standard bearings, marked "1", "2", "3" and "4". For the details about selection, refer to the table and hint below.

Cylinder block + Crankshaft	0 to 2	3 to 5	6 to 8	9 to 11
Replacement bearing number	"1"	"2"	"3"	"4"

HINT:

EXAMPLE

Cylinder block with imprinted number "4"

Crankshaft with imprinted number "3"

"4" + "3" = "7"

Select the bearing with marked "3"

Reference:

Item	Mark	mm (in.)
Cylinder block main journal bore diameter (A)	0	59.000 to 59.002 (2.08683 to 2.32291)
	1	59.003 to 59.004 (2.08694 to 2.32299)
	2	59.005 to 59.006 (2.08701 to 2.32307)
	3	59.007 to 59.009 (2.08708 to 2.32318)
	4	59.010 to 59.011 (2.08718 to 2.32326)
	5	59.012 to 59.013 (2.08725 to 2.32334)
	6	59.014 to 59.016 (2.08733 to 2.32346)
Crankshaft main journal diameter (B)	0	54.998 to 55.000 (1.94528 to 2.16535)
	1	54.996 to 54.998 (1.94521 to 2.16527)
	2	54.994 to 54.996 (1.94514 to 2.16519)
	3	54.992 to 54.994 (1.94507 to 2.16511)
	4	54.990 to 54.992 (1.94500 to 2.16504)
	5	54.988 to 54.990 (1.94493 to 2.16496)
Standard bearing center wall thickness	1	1.993 to 1.996 (0.07846 to 0.07858)
	2	1.996 to 1.999 (0.07858 to 0.07870)
	3	1.999 to 2.002 (0.07870 to 0.07882)
	4	2.002 to 2.005 (0.07882 to 0.07894)

26. INSTALL TIGHT PLUG

- (a) Apply adhesive around tight plugs.

Adhesive: Part No. 08833-00070, THREE BOND 1324 or equivalent.

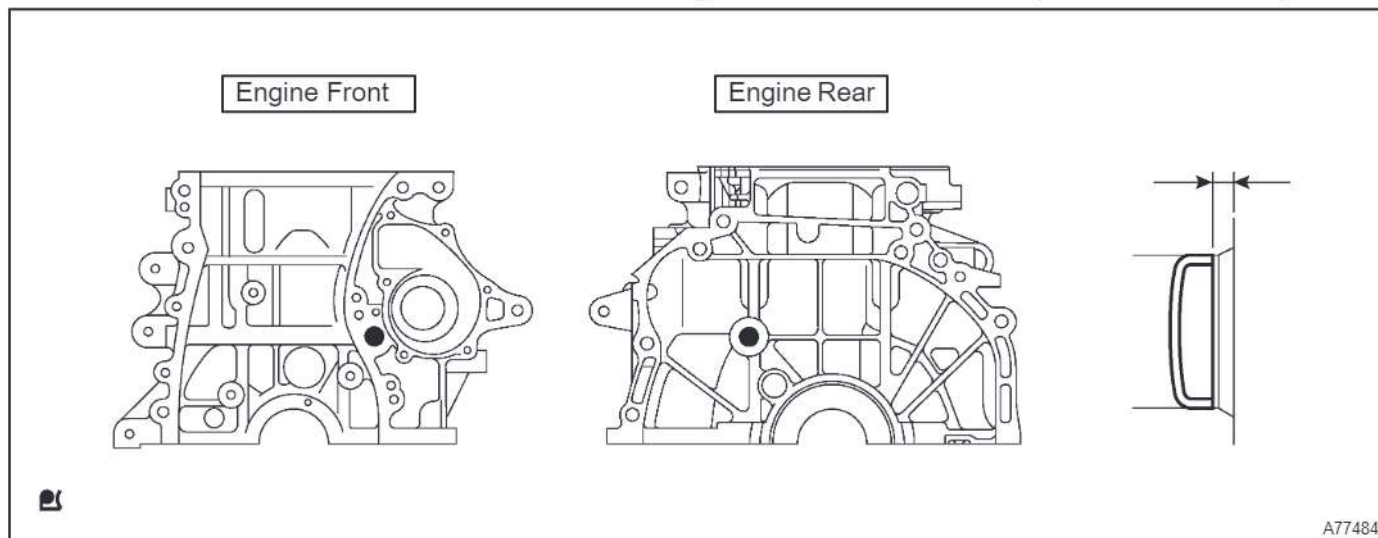
- (b) Using SST, push in the tight plugs as shown in the illustration.

SST 09950-60010 (09951-00200), 09950-70010 (09951-07100)

Standard depth:

Engine front 1.7 to 2.7 mm (0.067 to 0.106 in.)

Engine rear 2.2 to 3.2 mm (0.087 to 0.126 in.)



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27. INSTALL STUD BOLT

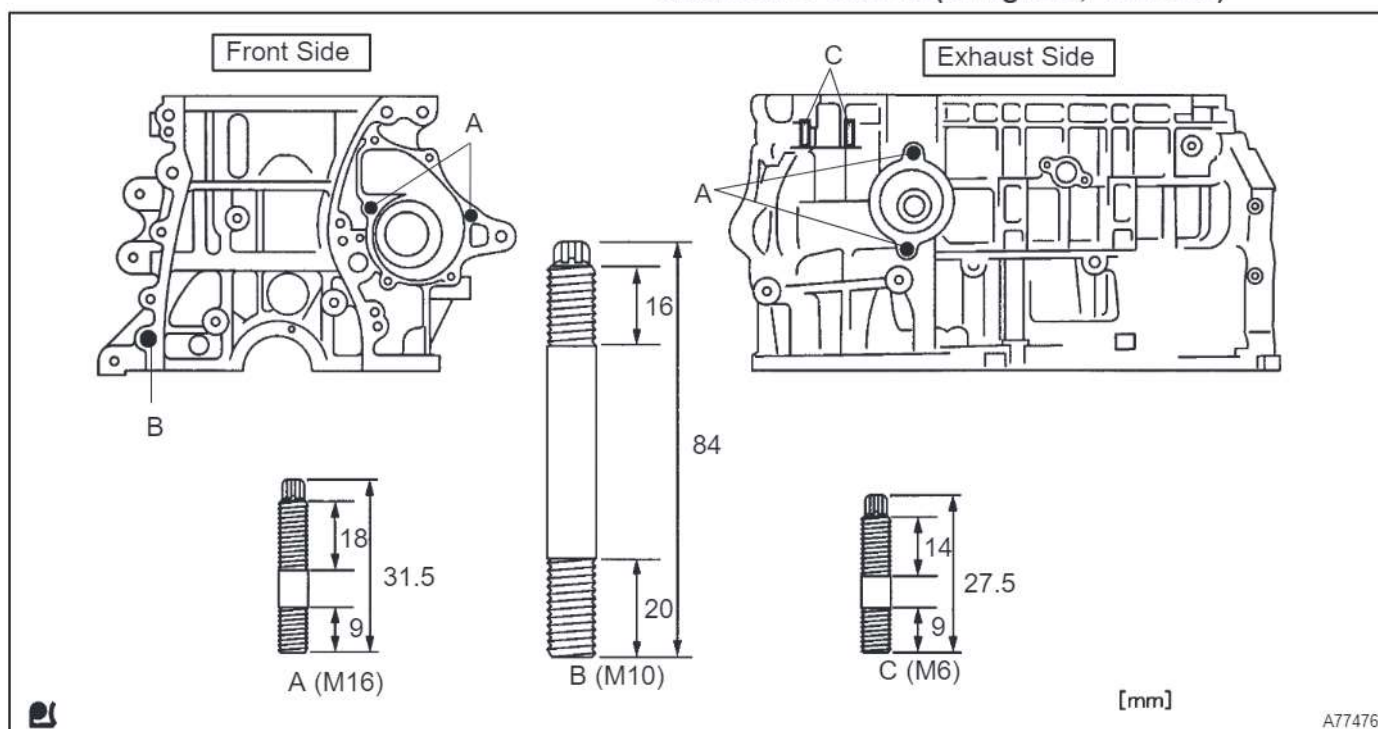
- (a) Install the stud bolts as shown in the illustration.

Torque:

Stud bolt A 5.0 N·m (51 kgf·cm, 44 in.·lbf)

Stud bolt B 10N·m (97 kgf·cm, 84 in.·lbf)

Stud bolt C 5.0N·m (51 kgf·cm, 44 in.·lbf)



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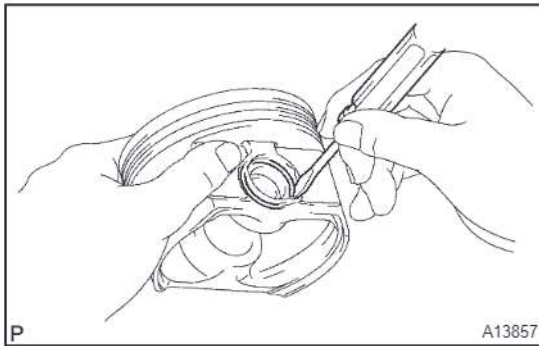
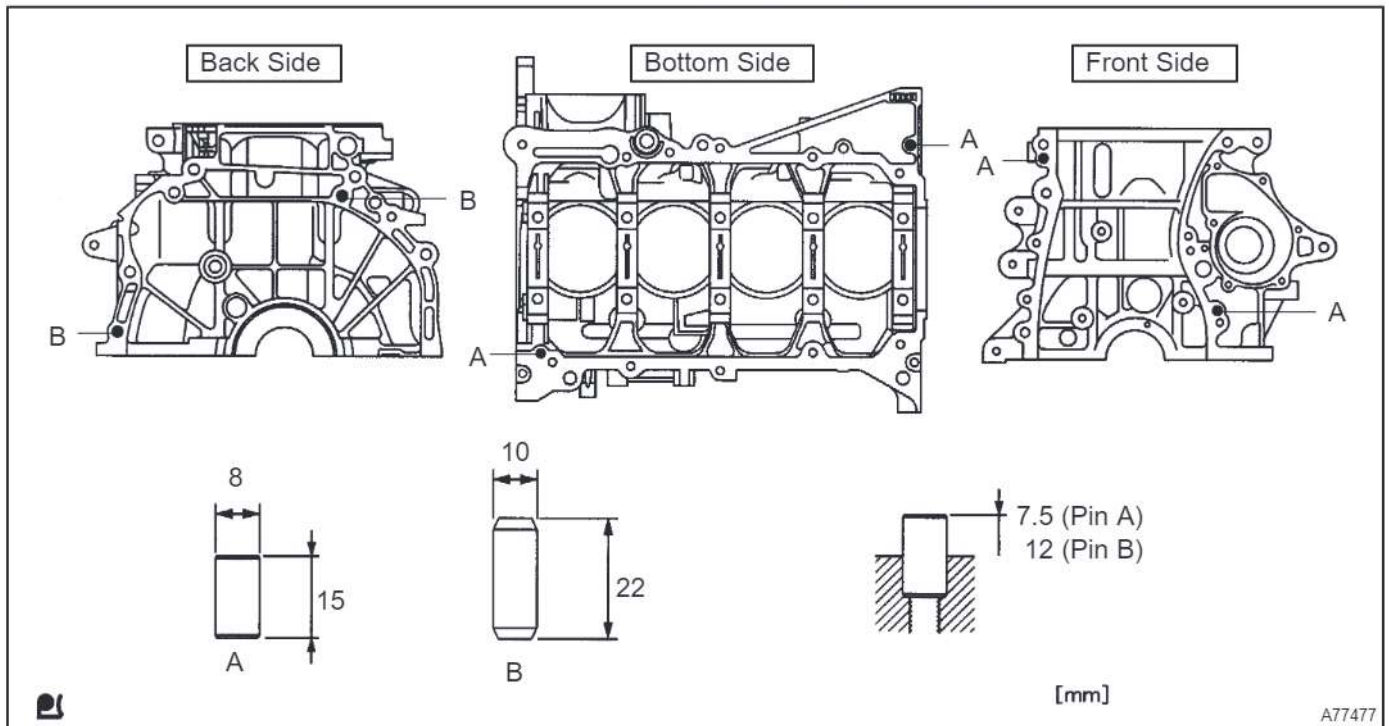
28. INSTALL STRAIGHT PIN

- (a) Using a plastic-faced hammer, tap into the straight pin.

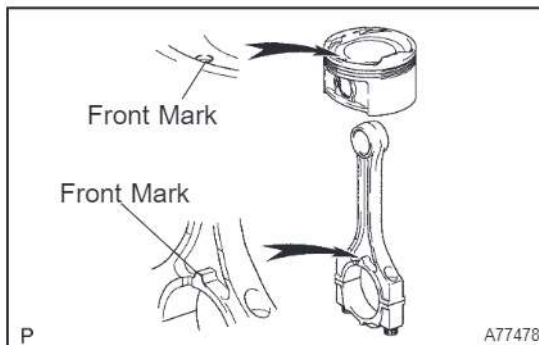
Standard protrusion

Pin A 7.5 mm (0.295 in.)

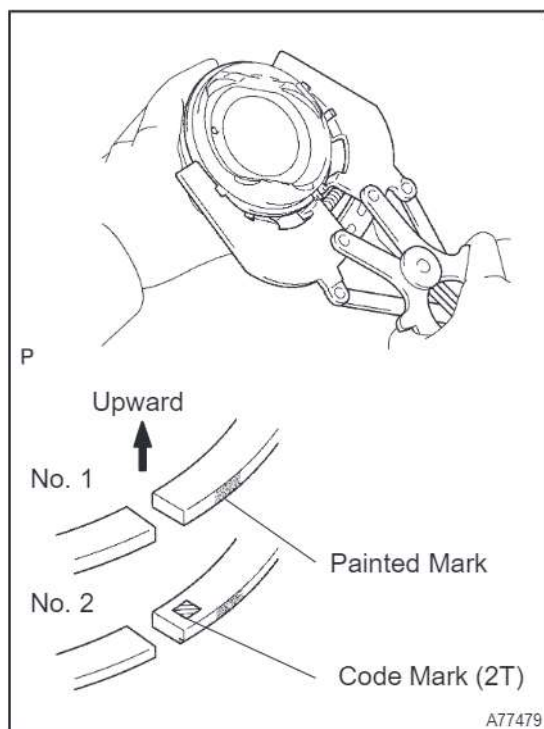
Pin B 12 mm (0.472 in.)

**29. INSTALL PISTON**

- (a) Using a small screwdriver, install a new snap ring at one end of the piston pin hole.
- (b) Gradually heat the piston to 80 to 90°C (176 to 194°F).



- (c) Align the front mark of the piston with the front mark located on the connecting rod, and push in the piston with your thumb.
- (d) Using a small screwdriver, install a new snap ring on the other end of the piston pin hole.

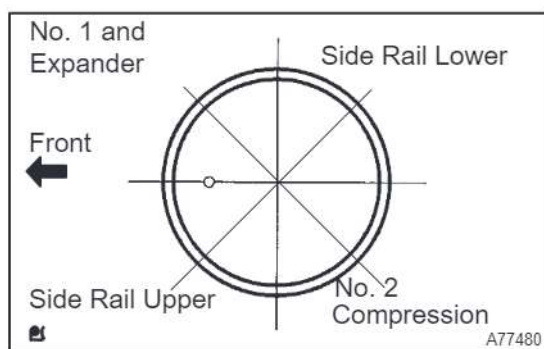


30. INSTALL PISTON RING SET

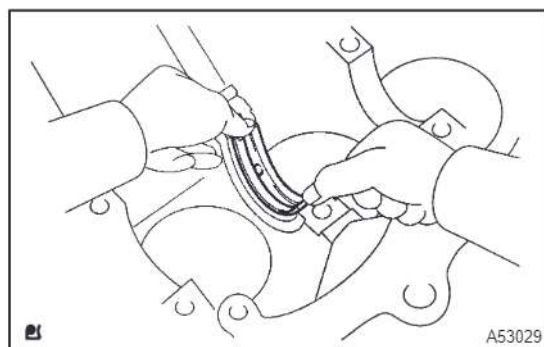
- Install the oil ring expander and 2 side rails by hand.
- Using a piston ring expander, install the 2 compression rings with the painted mark facing right side.

NOTICE:

Install the compression ring No. 2 with the code mark (2T) upward.



- Position the piston rings so that the ring ends are as shown.

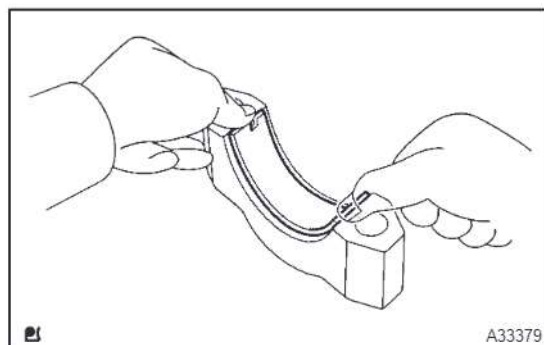


31. INSTALL CRANKSHAFT BEARING

- Install the upper bearing with an oil groove on cylinder block.

NOTICE:

Clean the back side of the bearing and the bearing surface of the cylinder block and keep them free of oils.

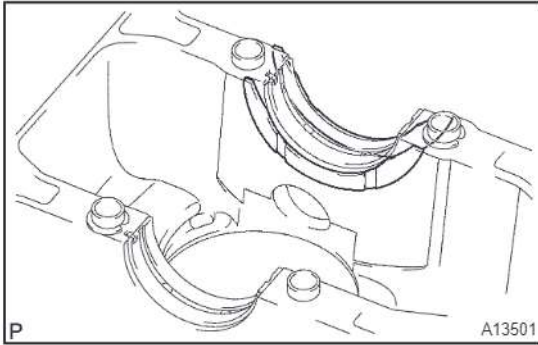


32. INSTALL CRANKSHAFT BEARING NO.2

- Install the lower bearing on bearing cap.

NOTICE:

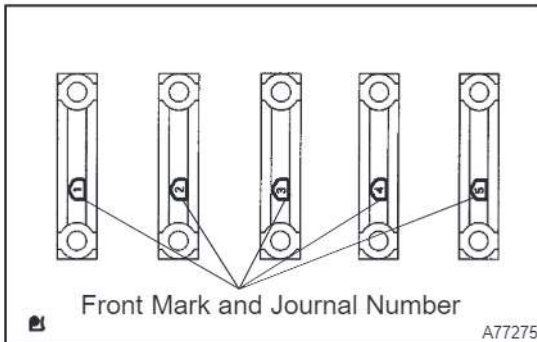
Clean the back side of the bearing and the bearing surface of the cylinder block and keep them free of oils.

**33. INSTALL CRANKSHAFT THRUST WASHER UPPER**

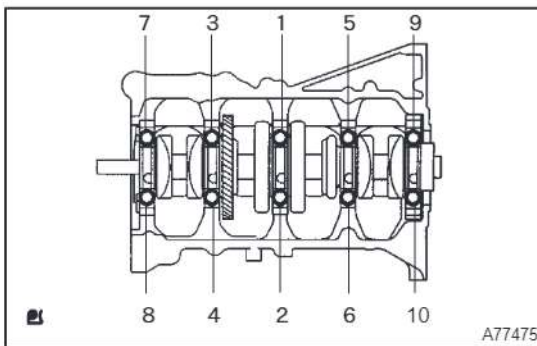
- (a) Install the 2 thrust washers under the No. 3 journal position of the cylinder block with the oil grooves facing outward.

34. INSTALL CRANKSHAFT

- (a) Apply engine oil on the upper bearing and install the crankshaft on the cylinder block.
(b) Apply engine oil on the lower bearing.



- (c) Examine the front marks and install the bearing caps to the cylinder block.
(d) Apply a light coat of engine oil on the threads of the bearing cap bolts.

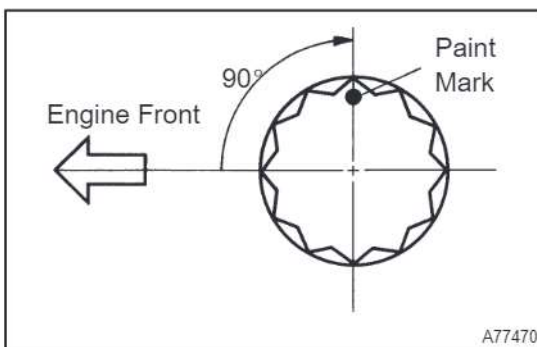


- (e) Using several steps, tighten the bolts with the specified torque in the sequence shown in the illustration.

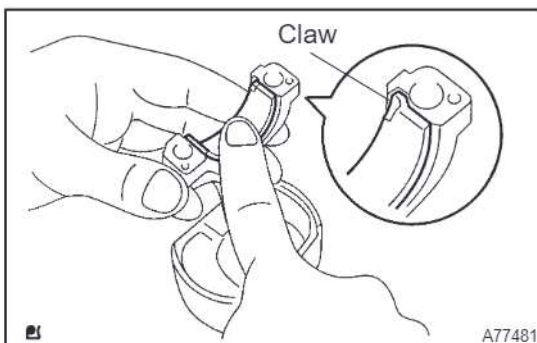
Torque: 20 N·m (204 kgf·cm, 15 ft·lbf)

- (f) Retighten the bolts in the same way as above with the specified torque.

Torque: 40 N·m (408 kgf·cm, 29 ft·lbf)



- (g) Place the front mark on each bearing cap bolt head with paint.
(h) Retighten the bearing cap bolts by 90° in the same sequence as step (e).
(i) Check that each painted mark is now at a 90° angle to the front.
(j) Check that the crankshaft turns smoothly.

**35. INSTALL CONNECTING ROD BEARING**

- (a) Align the bearing claw with the groove of the connecting rod or connecting cap.

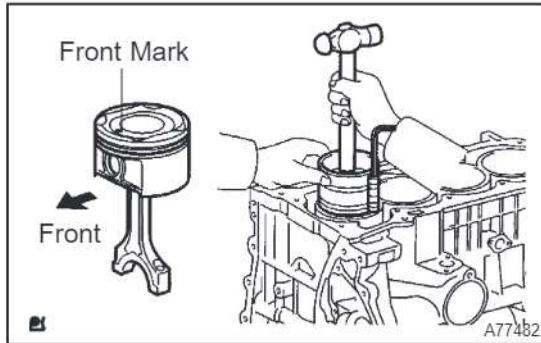
NOTICE:

Clean the back side of the bearing and the bearing surface of the bearing cap and keep them free of oils.

36. INSTALL PISTON SUB-ASSY W/CONNECTING ROD**NOTICE:**

The connecting rod cap bolts are tightened in 2 progressive steps.

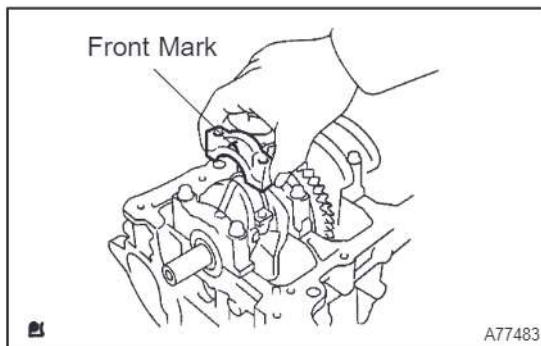
- (a) Apply engine oil on the cylinder walls, the pistons, and the surfaces of connecting rod bearings.
- (b) Check the position of the piston ring ends.



- (c) Using a piston ring compressor, push the correctly numbered piston and connecting rod assemblies into each cylinder with the front mark of the piston facing forward.

NOTICE:

Match the numbered connecting rod cap with the connecting rod.



- (d) Check that the protrusion of the connecting rod cap is facing the correct direction.
- (e) Apply a light coat of engine oil on the threads of the connecting rod cap bolts.
- (f) Using a 12 mm socket wrench, tighten the bolts in several steps with the specified torque.

Torque: 25 N·m (250 kgf·cm, 18 ft·lbf)

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- (g) Place the front mark on each connecting cap bolt head with paint.
- (h) Retighten the cap bolts by 90° as shown in the illustration.
- (i) Check that each painted mark is at a 90° angle to the front.
- (j) Check that the crankshaft turns smoothly.

