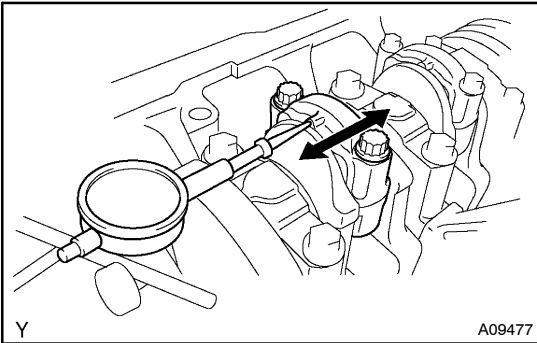


# CYLINDER BLOCK (1CD-FTV) OVERHAUL

140DS-01



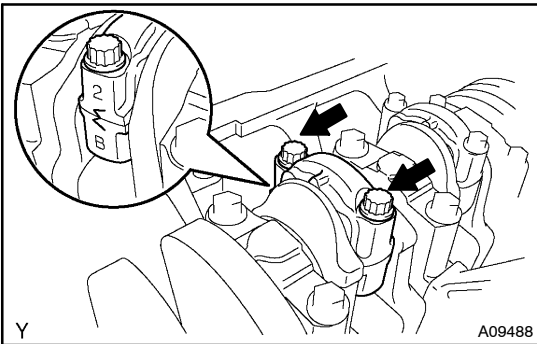
1. **INSPECT CONNECTING ROD THRUST CLEARANCE**
  - (a) Using a dial indicator, measure the thrust clearance while moving the connecting rod back and forth.

**Standard thrust clearance:**

**0.08 – 0.30 mm (0.0031 – 0.0118 in.)**

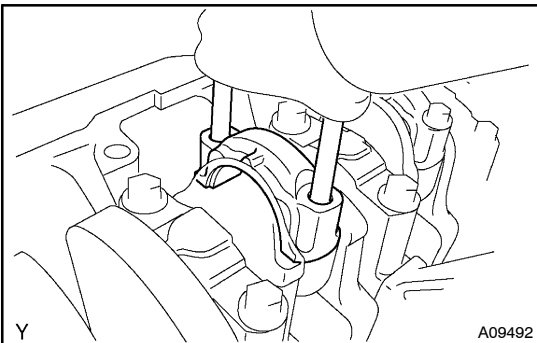
**Maximum thrust clearance: 0.40 mm (0.0157 in.)**

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**

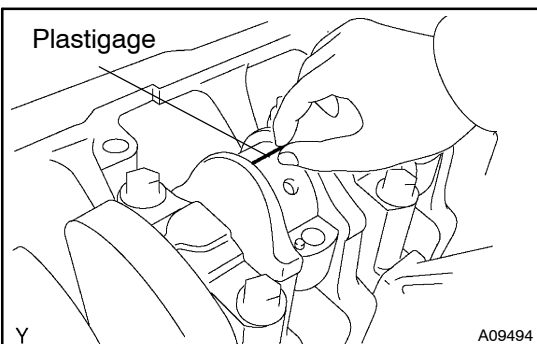
- (a) Check the matchmarks on the connecting rod and cap to ensure correct reassembly.
- (b) Remove the 2 connecting rod cap bolts.



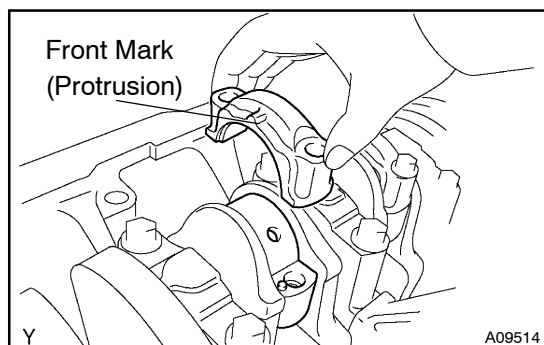
- (c) Using 2 removed connecting rod cap bolts, remove the connecting rod cap and lower bearing by wiggling the connecting rod cap right and left.

**HINT:**

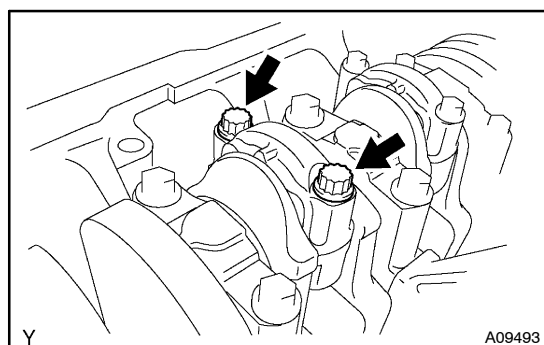
Keep the lower bearing inserted with the connecting rod cap.



- (d) Clean the crank pin and bearing.
- (e) Check the crank pin and bearing for pitting and scratches. If the crank pin or bearing is damaged, replace the bearings. If necessary, replace the crankshaft.
- (f) Lay a strip of plastigage the crank pin.



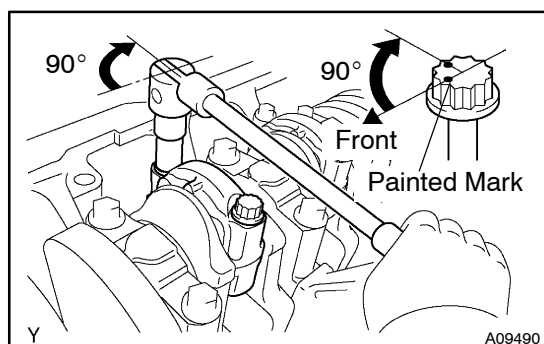
- (g) Match the numbered connecting rod cap with the connecting rod.
- (h) Install the connecting rod cap with the front mark facing forward.
- (i) Apply a light coat of engine oil on the threads and under the heads of the connecting rod cap bolts.



- (j) Install and alternately tighten the 2 cap bolts in several passes.

**Torque: 30 N·m (300 kgf·cm, 22 ft·lbf)**

If any of the cap bolts does not meet the torque specification, replace the connecting rod cap bolts.

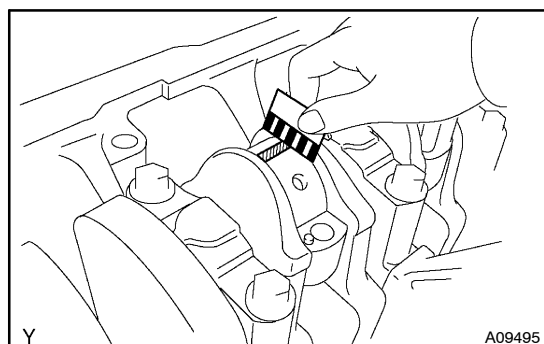


- (k) Mark the front of the cap bolt with the paint.
- (l) Relight the cap bolts 90° as shown.
- (m) Check that the painted mark is now at a 90° angle to the front.

**NOTICE:**

**Do not turn the crankshaft.**

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



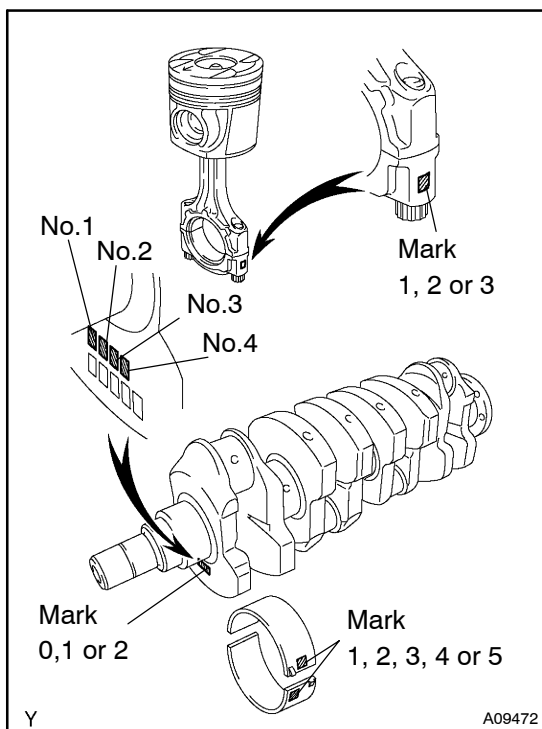
- (o) Measure the Plastigage at its widest point.

**Standard oil clearance:**

**0.038 – 0.056 mm (0.0015 – 0.0022 in.)**

**Maximum oil clearance: 0.10 mm (0.0039 in.)**

If the oil clearance is greater than maximum, replace the bearings. If necessary, replace the crankshaft.



- (p) If using a standard bearing, replace it with one having the same number. If the number of the bearing cannot be determined, select the correct bearing by adding together the numbers imprinted on the crankshaft and connecting rod cap, then selecting the bearing with the same number as the total. There are 5 sizes of standard bearings, marked "1", "2", "3", "4" and "5" accordingly.

Connecting rod cap	Crankshaft	Use bearing
1	0	1
1	1	2
1	2	3
2	0	2
2	1	3
2	2	4
3	0	3
3	1	4
3	2	5

HINT:

EXAMPLE: Connecting rod cap "2" + Crankshaft "1"  
= total number 3 (Use bearing "3")

#### Connecting rod big end inside diameter:

Mark "1"	53.500 – 53.506 mm (2.1063 – 2.1065 in.)
Mark "2"	53.506 – 53.512 mm (2.1065 – 2.1068 in.)
Mark "3"	53.512 – 53.518 mm (2.1068 – 2.1070 in.)

#### Crankshaft crank pin diameter:

Mark "0"	50.494 – 50.500 mm (1.9880 – 1.9882 in.)
Mark "1"	53.488 – 53.494 mm (1.9877 – 1.9880 in.)
Mark "2"	50.482 – 50.488 mm (1.9875 – 1.9877 in.)

#### Standard sized bearing center wall thickness:

Mark "1"	1.478 – 1.481 mm (0.0582 – 0.0583 in.)
Mark "2"	1.481 – 1.484 mm (0.0583 – 0.0584 in.)
Mark "3"	1.484 – 1.487 mm (0.0584 – 0.0585 in.)
Mark "4"	1.487 – 1.490 mm (0.0585 – 0.0587 in.)
Mark "5"	1.490 – 1.493 mm (0.0587 – 0.0588 in.)

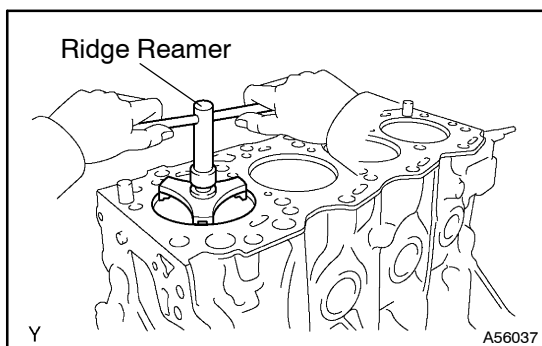
- (q) Completely remove the Plastigage.

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

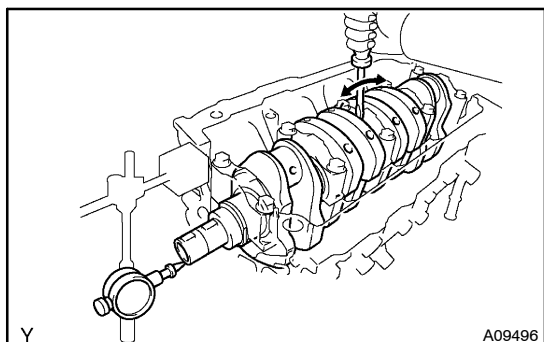
- (a) Using a ridge reamer, remove all the carbon from the top of the cylinder.
- (b) Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.

HINT:

- Keep the bearing, connecting rod and cap together.
- Arrange the piston and connecting rod assemblies in the correct order.



#### 4. REMOVE CONNECTING ROD BEARING



#### 5. 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:**

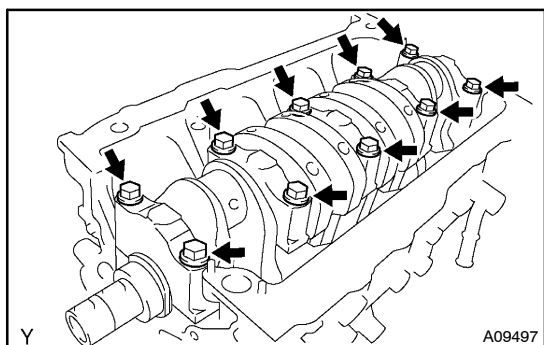
**0.040 – 0.024 mm (0.0016 – 0.0094 in.)**

**Maximum thrust clearance: 0.30 mm(0.0118 in.)**

If the thrust clearance is greater than maximum, replace the thrust washer as a set.

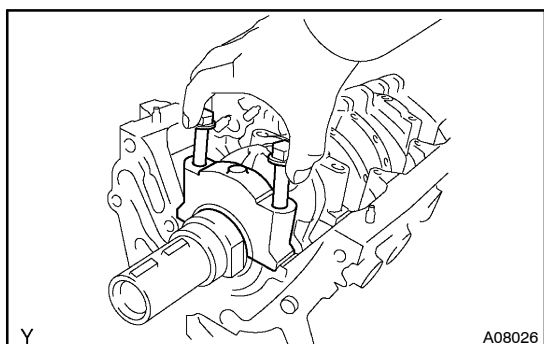
**Thrust washer thickness:**

STD	2.680 – 2.730 mm (0.1055 – 0.1075 in.)
O/S 0.125	2.743 – 2.793 mm (0.1080 – 0.1100 in.)
O/S 0.250	2.805 – 2.855 mm (0.1104 – 0.1124 in.)



#### 6. REMOVE CRANKSHAFT

- (a) Uniformly loosen and remove the 10 main bearing cap bolts.



- (b) Using the removed main bearing cap bolts, wiggle the cap back and forth, and remove the 5 main bearing caps, 5 lower bearings and 2 lower thrust washers (No. 3 main bearing cap only).

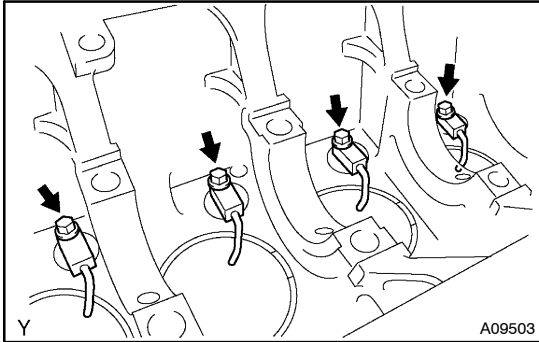
**HINT:**

- Keep the lower bearing and main bearing cap together.
- Arrange the main bearing caps and lower thrust washers in the correct order.

- (c) Lift out the crankshaft.

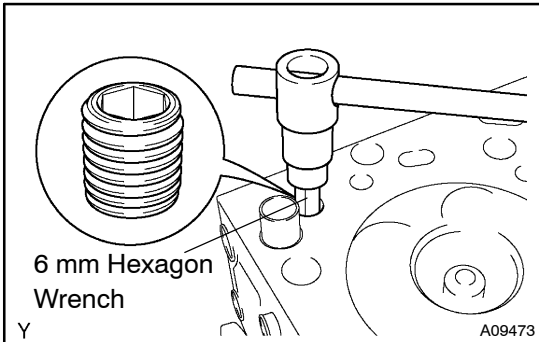
**HINT:**

Keep the upper bearing and upper thrust washers together with the cylinder block.



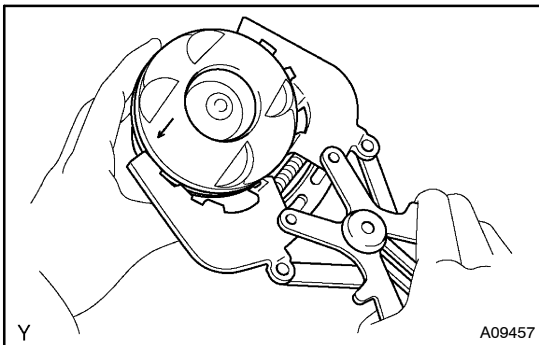
## 7. REMOVE SUB-ASSY OIL NOZZLE NO.1

- (a) Remove the bolt and 4 oil nozzles.



## 8. REMOVE CYLINDER BLOCK OIL ORIFICE

- (a) Using a 6 mm hexagon wrench, remove the oil orifice.



## 9. REMOVE PISTON RING SET

- (a) Using a piston ring expander, remove the No. 1 piston ring, No. 2 piston ring and oil ring.

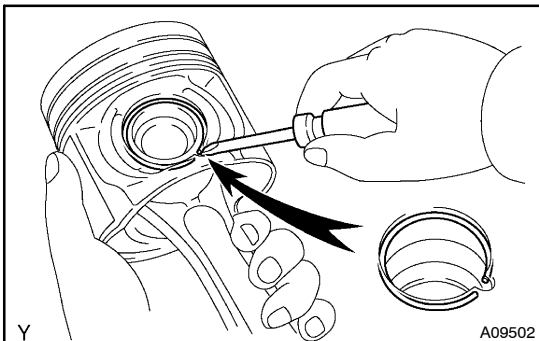
### NOTICE:

**Make the expansion of the piston ring as small as necessary.**

- (b) Remove the coil by hand.

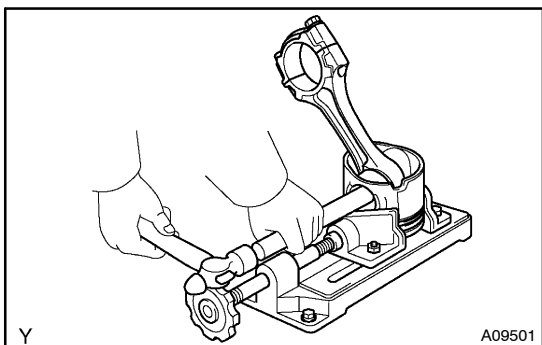
### HINT:

Arrange the piston rings in correct order only.



## 10. REMOVE W/PIN PISTON SUB-ASSY

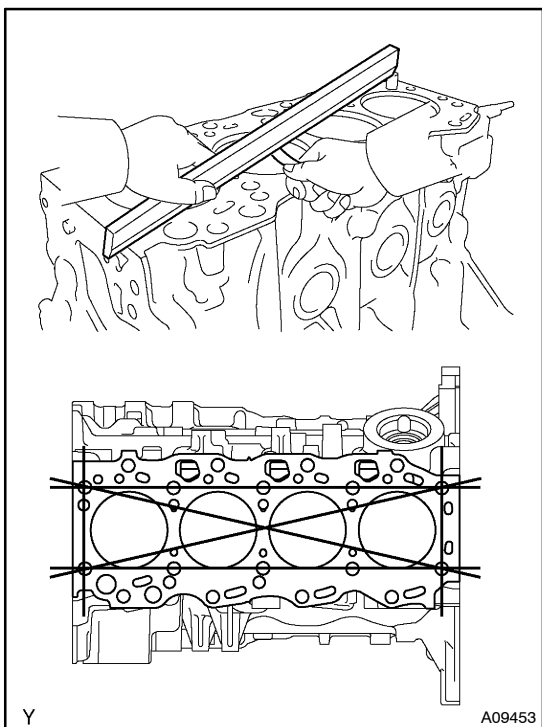
- (a) Using a small screwdriver, pry off the snap rings from the piston.
- (b) Gradually heat the piston to approx. 60°C (140°F).



- (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.
- Arrange the pistons, pins, rings, connecting rods and bearings in the correct order.

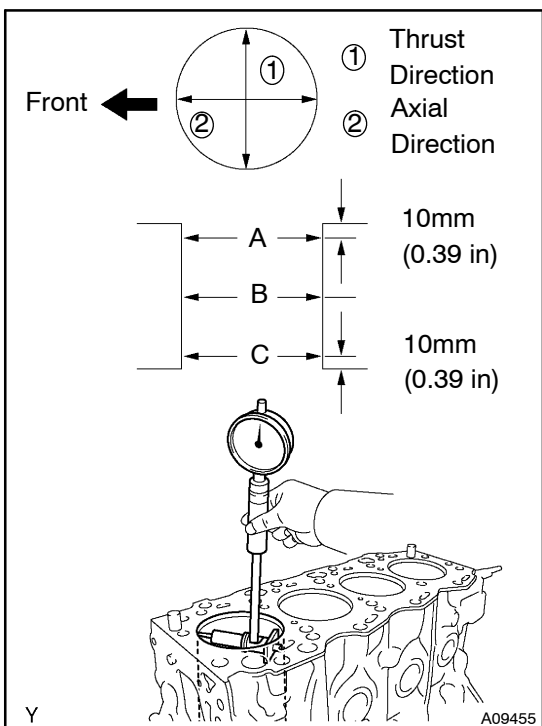


**11. INSPECT CYLINDER BLOCK FOR FLATNESS**

- (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.)**

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



**12. INSPECT CYLINDER BORE**

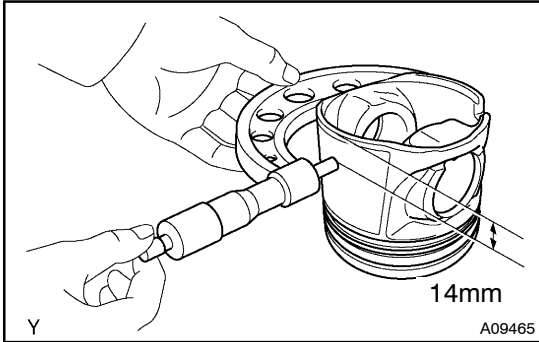
- (a) Using a cylinder gauge, measure the cylinder bore diameter at the positions A, B and C in the thrust and axial directions.

**Standard diameter:**

**82.200 – 82.213 mm (3.2362 – 3.2367 in.)**

**Maximum diameter: 82.400 mm (3.2441 in.)**

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



### 13. INSPECT W/PIN PISTON SUB-ASSY

- (a) Using a micrometer, measure the piston diameter at a right angles to the piston pin center line, 14 mm (0.55 in.) below the skirt bottom edge.

**Piston diameter:**

**82.148 – 82.182 mm (3.2341 – 3.2355 in.)**

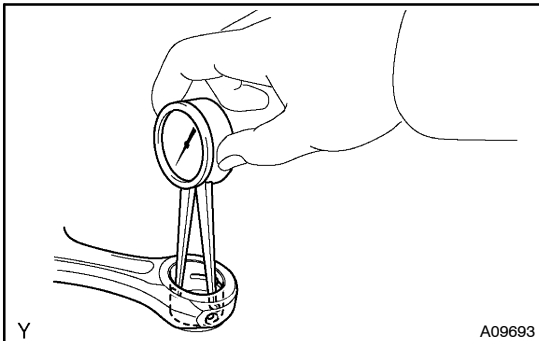
- (b) Subtract the piston diameter measurement from the cylinder bore diameter measurement.

**Standard oil clearance:**

**0.018 – 0.065 mm (0.0007 – 0.0026 in.)**

**Maximum oil clearance: 0.14 mm (0.0055 in.)**

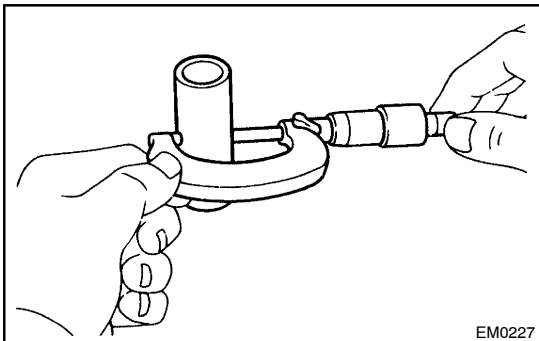
If the oil clearance is greater than maximum, replace all the 4 pistons. If necessary, replace the cylinder block.



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

**Bushing inside diameter:**

**31.015 – 31.027 mm (1.2211 – 1.2215 in.)**



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

**Piston pin diameter:**

**31.000 – 31.012 mm (1.2205 – 1.2209 in.)**

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

**Standard oil clearance:**

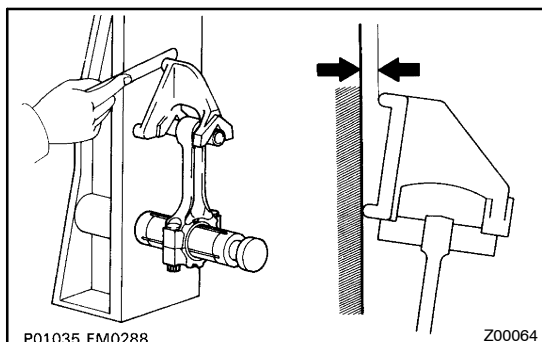
**0.011 – 0.019 mm (0.0004 – 0.0007 in.)**

**Maximum oil clearance: 0.025 mm (0.0010 in.)**

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

**14. INSPECT CONNECTING ROD SUB-ASSY**

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

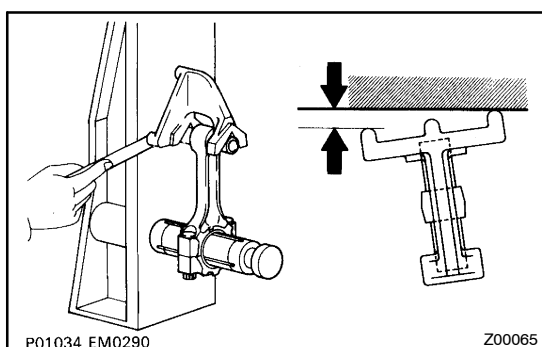


- (1) check for out-of-alignment.

**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.

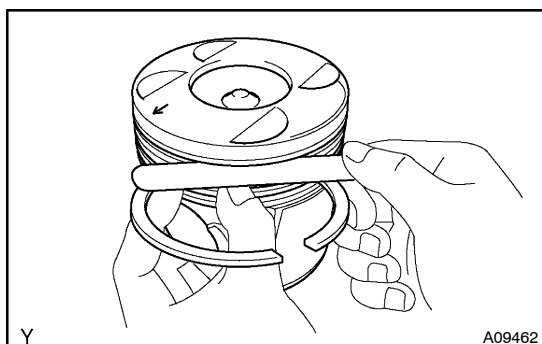


- (2) Check for twist.

**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.

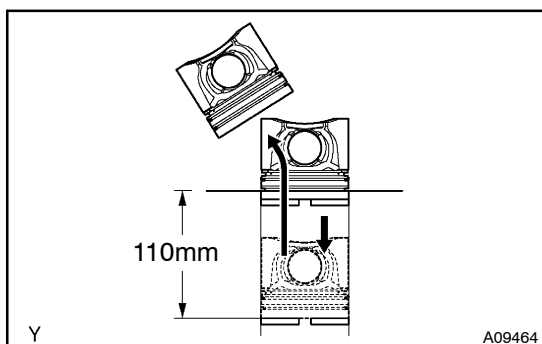
**15. INSPECT RING GROOVE CLEARANCE**

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

**Ring groove clearance:**

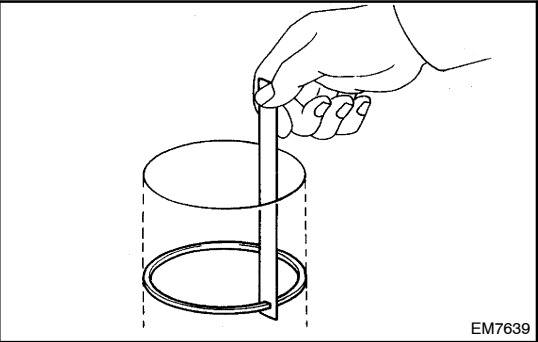
No. 1	0.08 – 0.12 mm (0.0031 – 0.0047 in.)
No. 2	0.06 – 0.10 mm (0.0024 – 0.0039 in.)
Oil	0.03 – 0.07 mm (0.0012 – 0.0028 in.)

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

**16. INSPECT PISTON RING END GAP**

- (a) Using a piston, push the piston ring a little beyond the bottom of the ring travel, 110 mm (4.33 in.) from the top of the cylinder block.





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

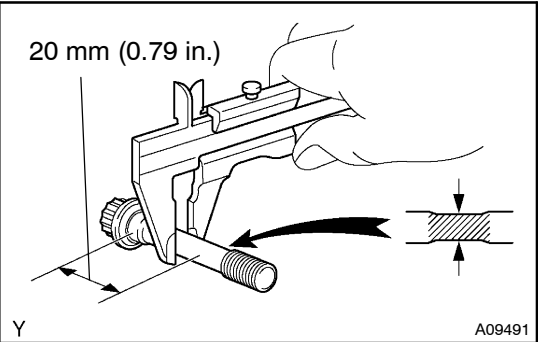
**Standard end gap:**

No. 1	0.27 – 0.43 mm (0.0106 – 0.0169 in.)
No. 2	0.39 – 0.58 mm (0.0154 – 0.0228 in.)
Oil	0.20 – 0.44 mm (0.0079 – 0.0173 in.)

**Maximum end gap:**

No. 1	0.82 mm (0.0323 in.)
No. 2	1.00 mm (0.0394 in.)
Oil	0.90 mm (0.0354 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.



**17. INSPECT CONNECTING ROD BOLT**

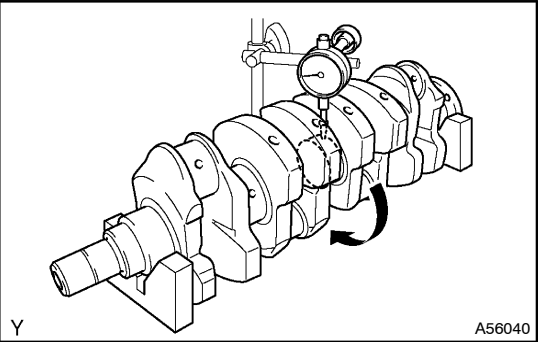
(a) Using vernier calipers, measure the tension portion diameter.

**Standard diameter:**

**8.2 – 8.3 mm (0.323 – 0.327 in.)**

**Minimum diameter: 8.0 mm (0.315 in.)**

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



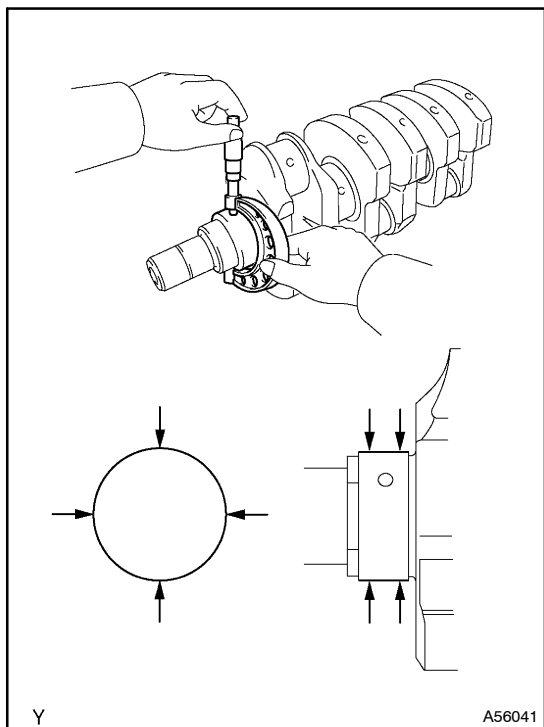
**18. INSPECT CRANKSHAFT**

(a) Place the crankshaft on V-blocks.

(b) Using a dial indicator, measure the circle runout at the center journal.

**Maximum circle runout: 0.025 mm (0.0010 in.)**

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



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

**Main journal diameter:**

**56.992 – 57.010 mm (2.2438 – 2.2445 in.)**

**Crank pin diameter:**

**50.482 – 50.500 mm (1.9875 – 1.9882 in.)**

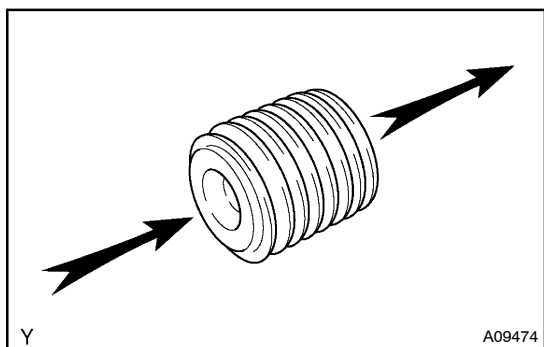
If the diameter is not as specified, replace the crankshaft.

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

**Maximum taper and out-of-round:**

**0.01 mm (0.0004 in.)**

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

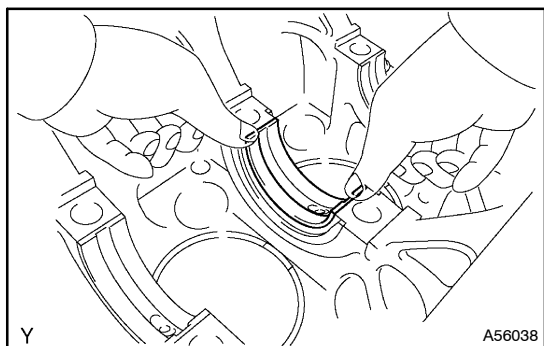


## 19. INSPECT CYLINDER BLOCK OIL ORIFICE

- (a) Check the oil orifice for clogging.  
If necessary, replace the oil orifice.

## 20. INSPECT CRANKSHAFT OIL CLEARANCE

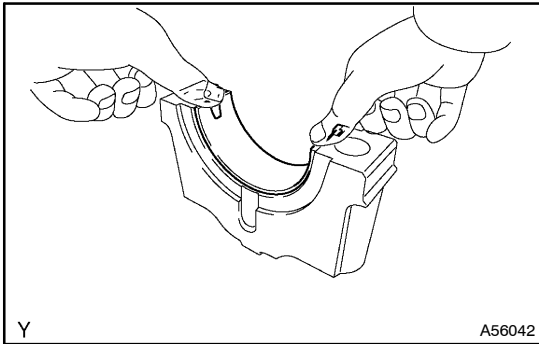
- (a) Clean each main journal and bearing.



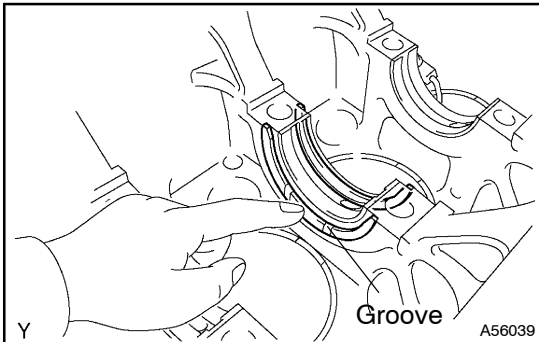
- (b) Install the bearing on the cylinder block and bearing cap.  
**HINT:**

Upper bearings have an oil groove and oil holes; lower bearings do not.

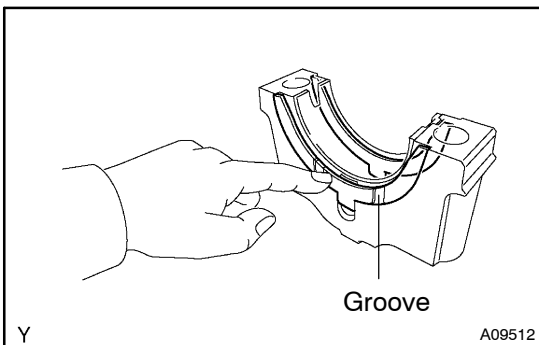
- (1) Align the bearing claw with the claw groove of the cylinder block, and push in the 5 upper bearings.



- (2) Align the bearing claw with the claw groove of the main bearing cap, and push in the 5 lower bearings.

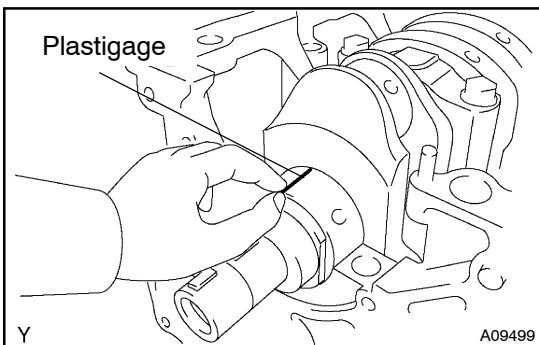


- (c) Install the 2 thrust washers under the No. 3 journal position of the cylinder block with the oil grooves facing outward.

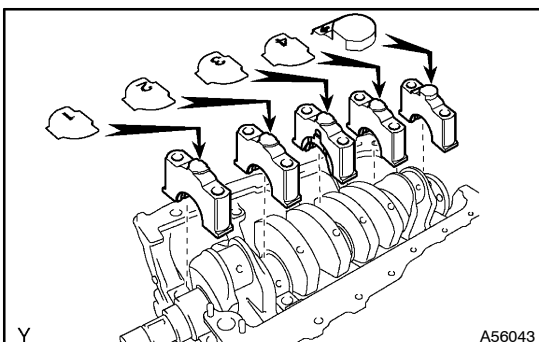


- (d) Install the 2 thrust washers on the No. 3 bearing cap with the oil grooves facing outward.

- (e) Place the crankshaft on the cylinder block.



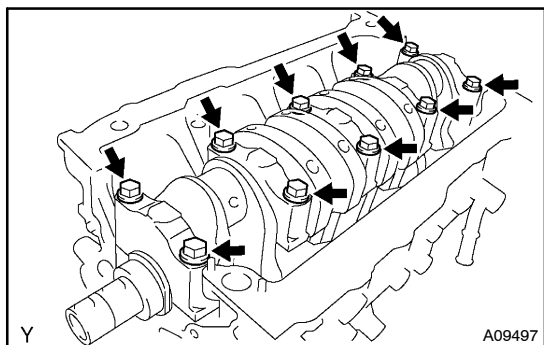
- (f) Lay a strip of Plastigage across each journal.



- (g) Install the 5 main bearing caps in their proper locations.

HINT:

Each bearing cap as a number and a front mark.



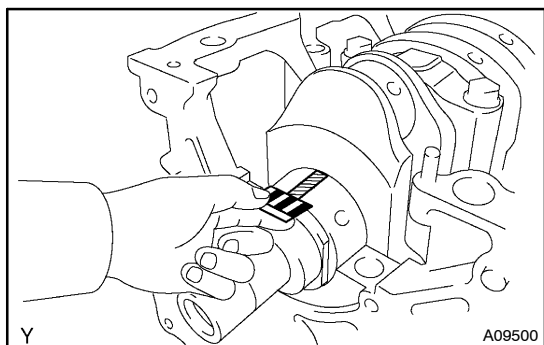
- (h) Apply a light coat of engine oil on the threads and under the heads of the main bearing cap bolts.
- (i) Install and uniformly tighten the 10 bolts of the main bearing cap in several passes.

**Torque: 115 N·m (1,150 kgf·cm, 85 ft·lbf)**

**NOTICE:**

**Do not turn the crankshaft**

- (j) Remove the bearing cap.



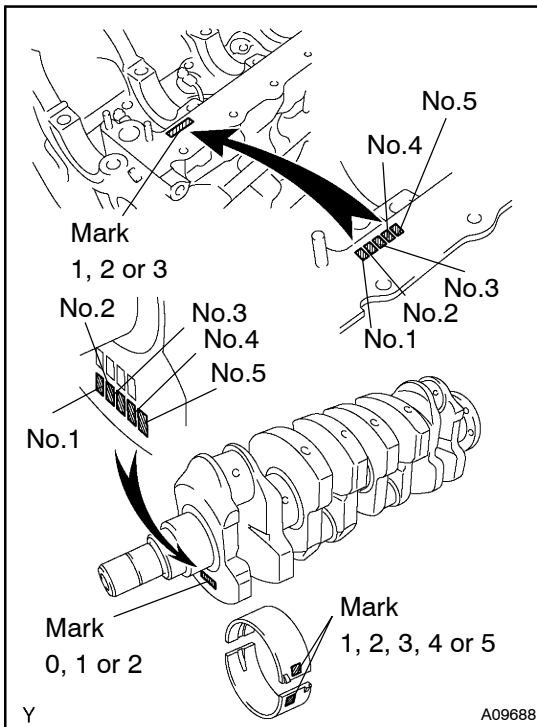
- (k) Measure the Plastigage at its widest point.

**Standard oil clearance:**

**0.032 – 0.050 mm (0.0013 – 0.0020 in.)**

**Maximum oil Clearance: 0.10 mm (0.0039 in.)**

If the oil clearance is greater than maximum, replace the bearings. If necessary, replace the crankshaft.



- (l) If using a standard bearing, replace it with one having the same number. If the number of the bearing cannot be determined, select the correct bearing by adding together the numbers imprinted on the cylinder block and crankshaft, then selecting the bearing with the same number as the total. There are 5 sizes of standard bearings, marked "1", "2", "3", "4" and "5" accordingly.

#### Number Marked

Cylinder block	Crankshaft	Use bearing
1	0	1
1	1	2
1	2	3
2	0	2
2	1	3
2	2	4
3	0	3
3	1	4
3	2	5

HINT:

#### EXAMPLE

Cylinder block "2" + Crankshaft "1" = Total number 3 (Use bearing "3")

#### Cylinder block main journal bore diameter:

Mark "1"	61.000 – 61.006 mm (2.4016 – 2.4018 in.)
Mark "2"	61.006 – 61.012 mm (2.4018 – 2.4020 in.)
Mark "3"	61.012 – 61.018 mm (2.4020 – 2.4023 in.)

#### Crankshaft main journal diameter:

Mark "0"	57.004 – 57.010 mm (2.2442 – 2.2445 in.)
Mark "1"	56.998 – 57.004 mm (2.2440 – 2.2442 in.)
Mark "2"	56.992 – 56.998 mm (2.2438 – 2.2440 in.)

#### Standard sized bearing center wall thickness:

Mark "1"	1.976 – 1.979 mm (0.0778 – 0.0779 in.)
Mark "2"	1.979 – 1.982 mm (0.0779 – 0.0780 in.)
Mark "3"	1.982 – 1.985 mm (0.0780 – 0.0781 in.)
Mark "4"	1.985 – 1.988 mm (0.0781 – 0.0783 in.)
Mark "5"	1.988 – 1.991 mm (0.0783 – 0.0784 in.)

- (m) Completely remove the Plastigage.

**21. INSTALL TIGHT PLUG**

- (a) Apply adhesive around tight plugs.

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

- (b) Using SST, into the tight plugs as shown in the illustration.  
SST 09950-60010 (09951-00350), 09950-70010  
(09951-07100)

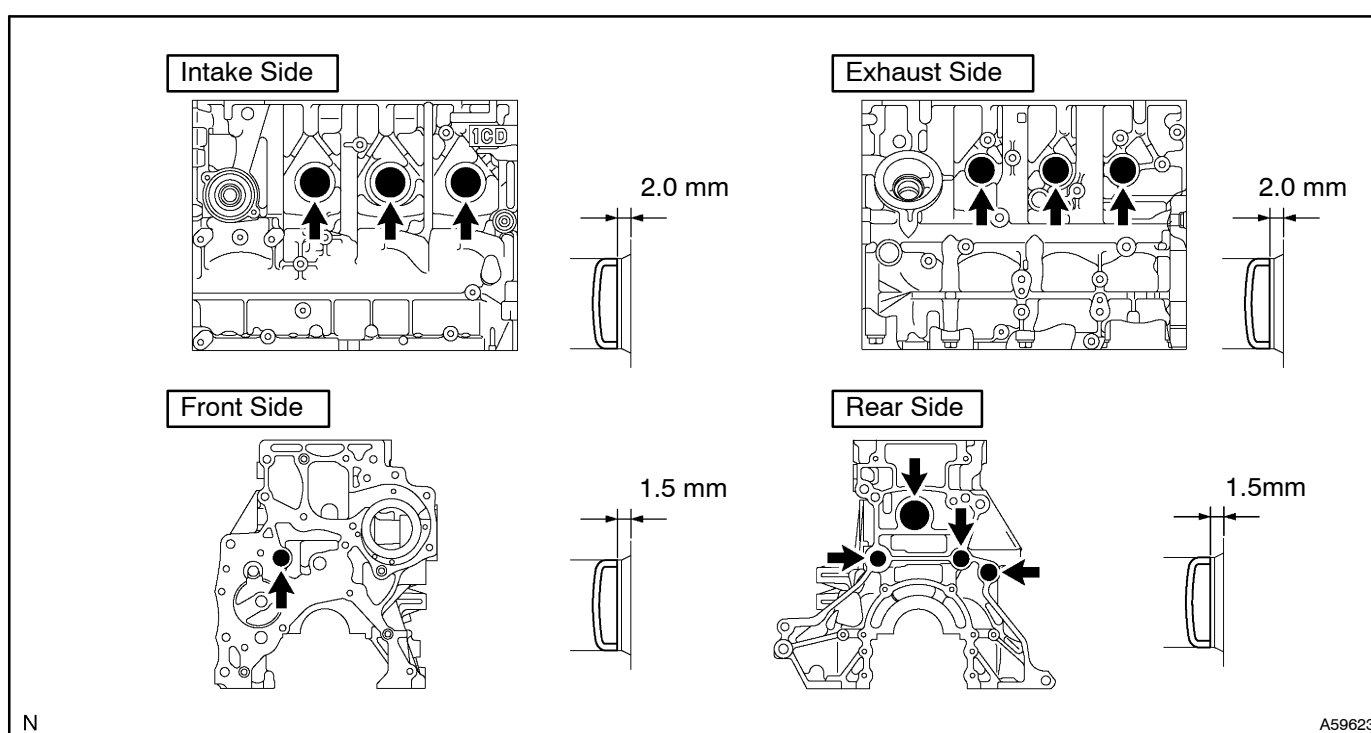
**Standard depth:**

**Intake side 2.0 mm (0.0787 in.)**

**Exhaust side 2.0 mm (0.0787 in.)**

**Front side 1.5 mm (0.0590 in.)**

**Rear side 1.5 mm (0.0590 in.)**



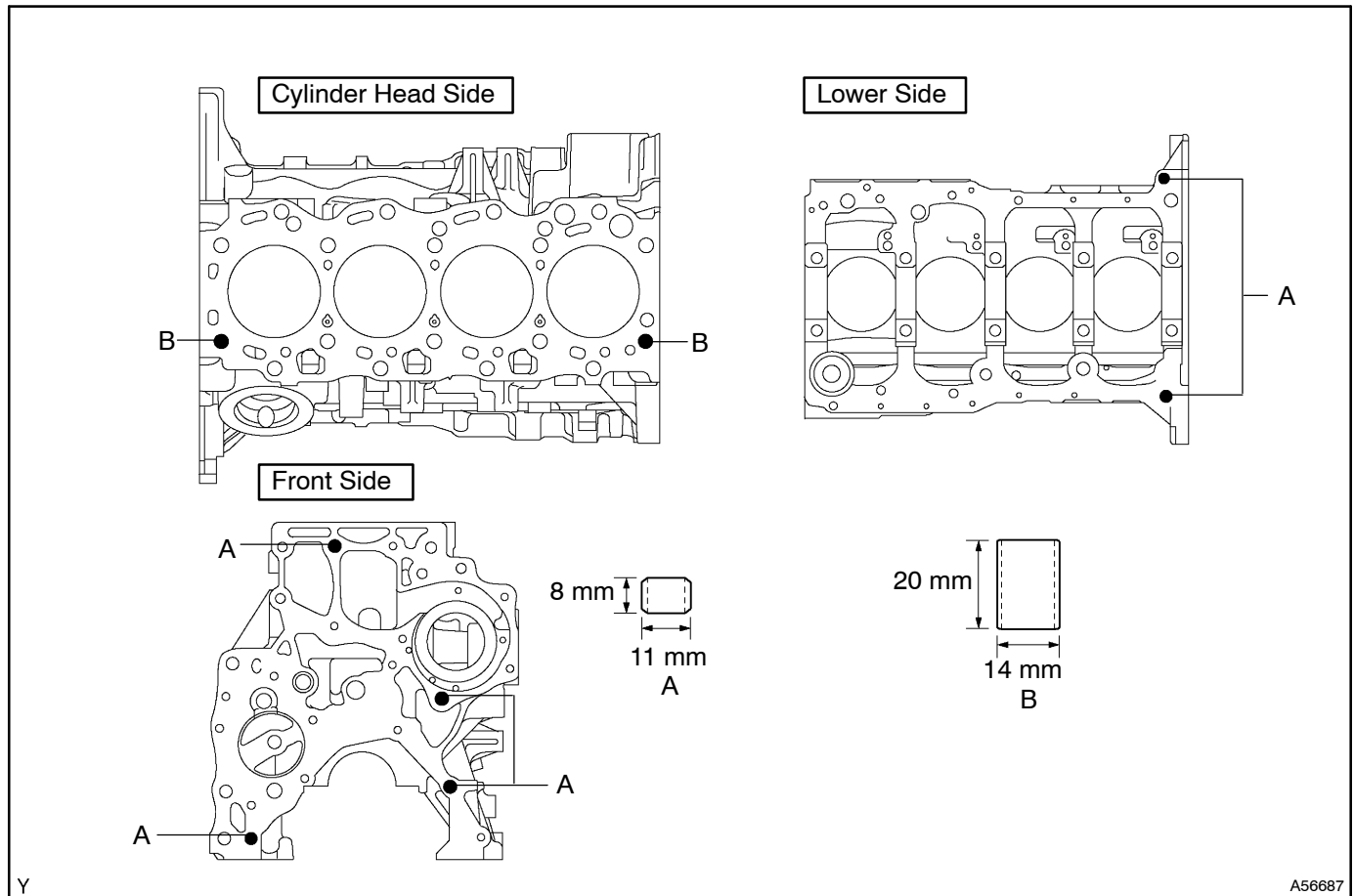
**22. INSTALL RING PIN**

- (a) Using a plastic-faced hammer, tap in new ring pin to the specified protrusion height.

**Protrusion height:**

**A 7.0 mm (0.2755 in.)**

**B 13 mm (0.5118 in.)**



**23. INSTALL STRAIGHT PIN**

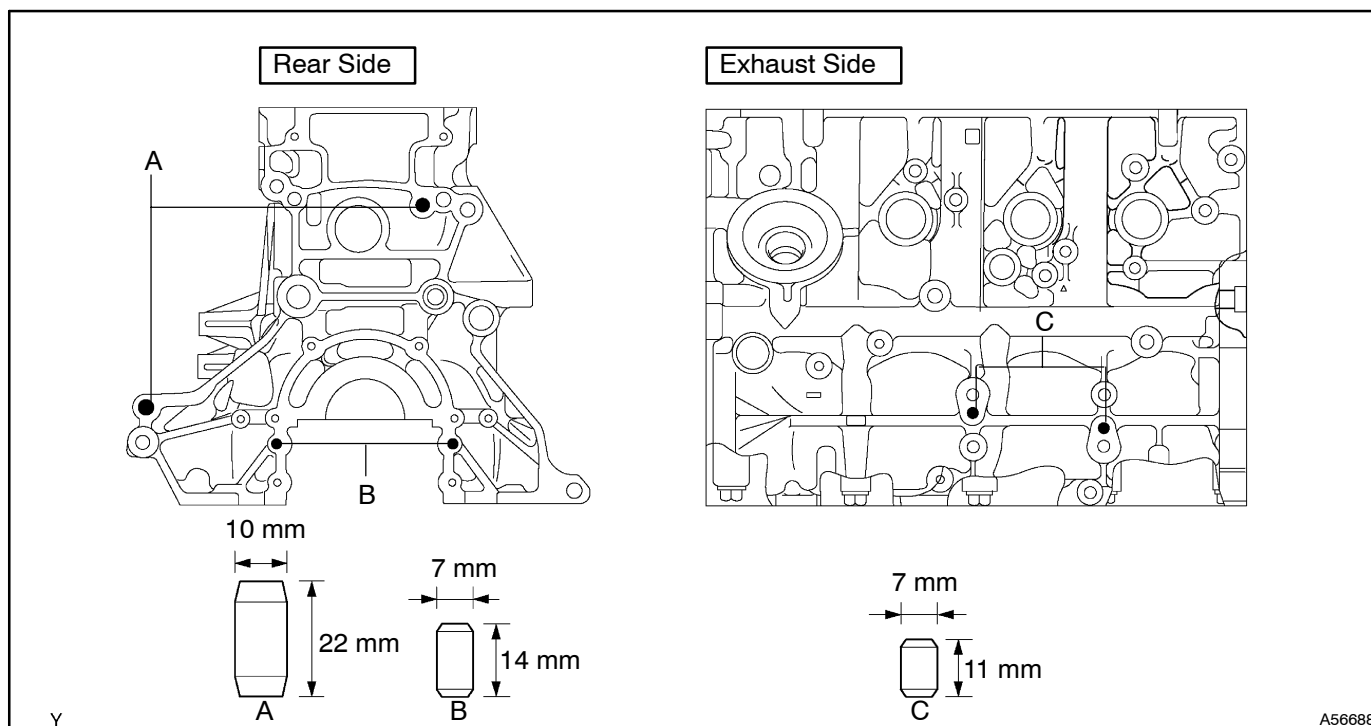
- (a) Using a plastic-faced hammer, tap into the straight pin.

**Standard protrusion:**

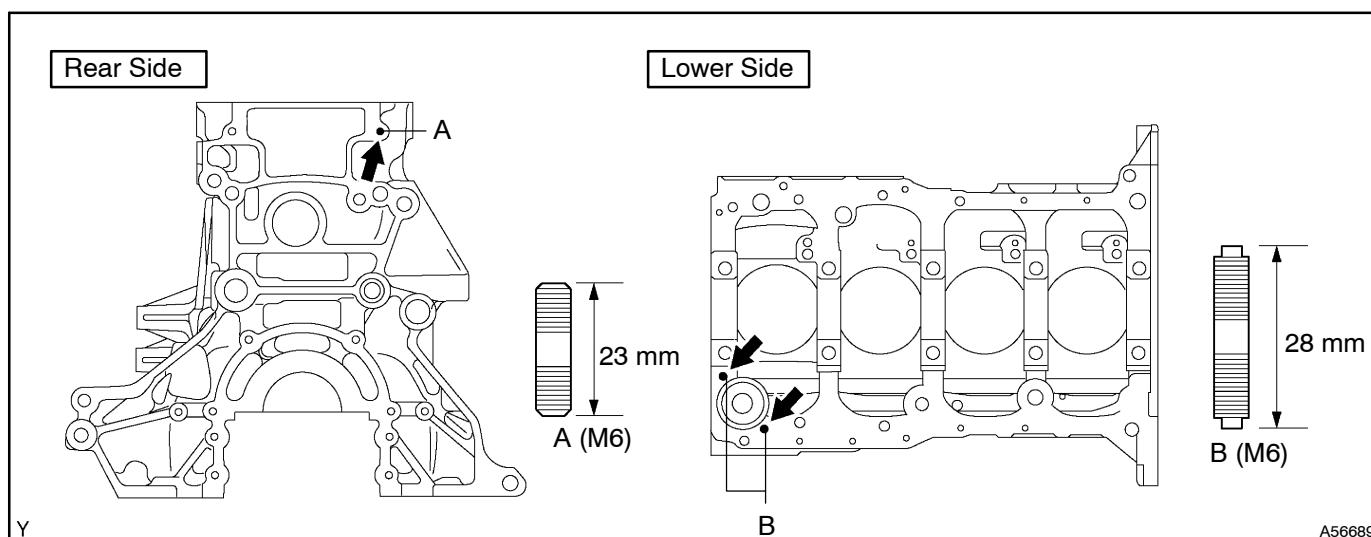
**A 13 mm (0.5118 in.)**

**B 7.0 mm (0.2755 in.)**

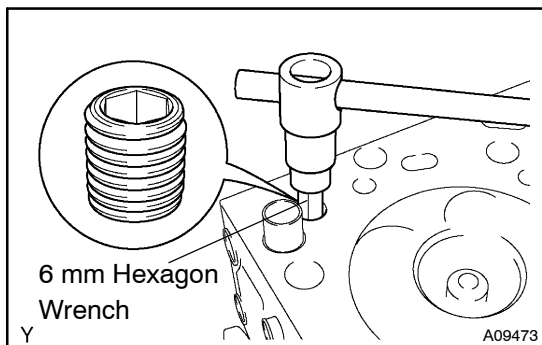
**C 5.0 mm (0.1968 in.)**

**24. INSTALL STUD BOLT**

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

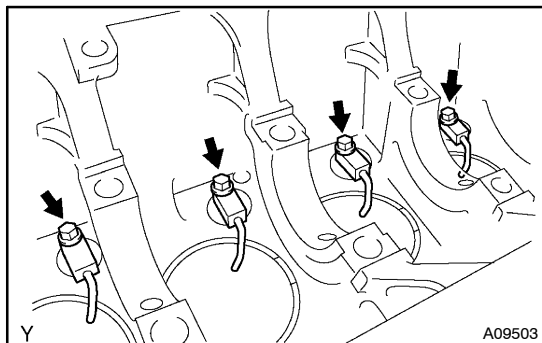






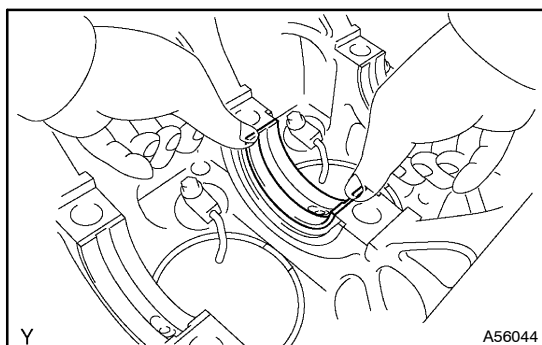
## 25. INSTALL CYLINDER BLOCK OIL ORIFICE

- (a) Using a 6 mm hexagon wrench, install the oil orifice.  
**Torque: 9.0 N·m (90 kgf·cm, 78 in·lbf)**



## 26. INSTALL SUB-ASSY OIL NOZZLE NO.1

- (a) Install the oil nozzle with the bolt. Install the 4 oil nozzles.  
**Torque: 7.4 N·m (75 kgf·cm, 65 in·lbf)**

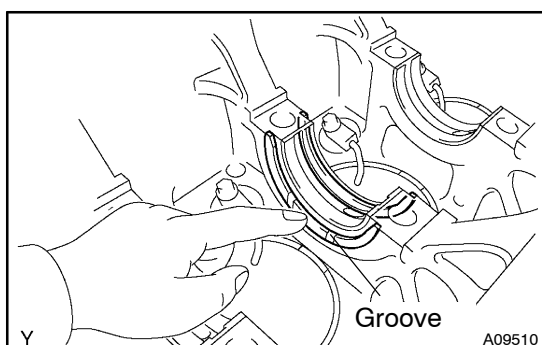
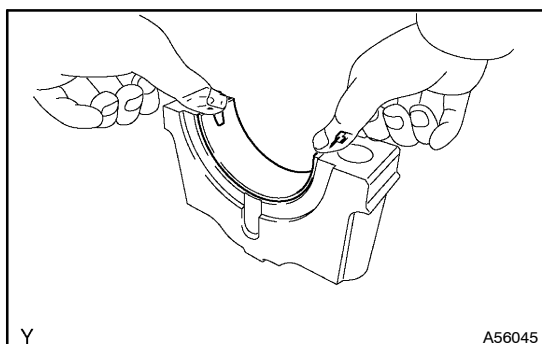


## 27. INSTALL CRANKSHAFT

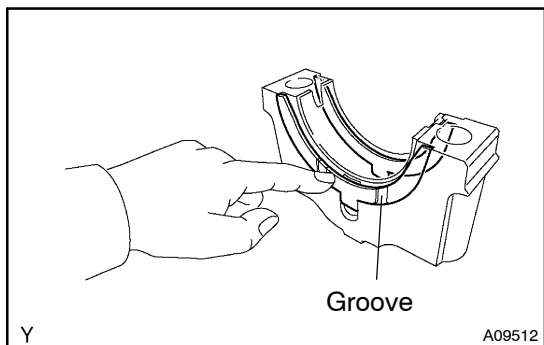
- (a) Install the bearing on the cylinder block and bearing cap.  
**HINT:**

Upper bearings have an oil groove and oil holes; lower bearings do not.

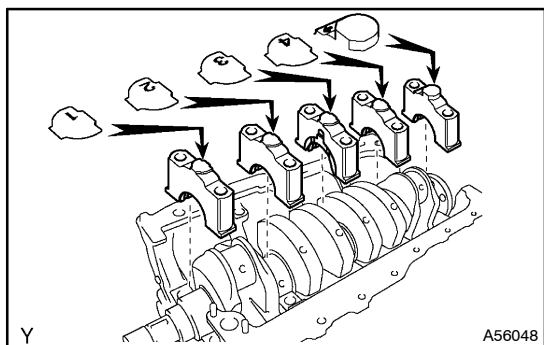
- (1) Align the bearing claw with the claw groove of the cylinder block, and push in the 5 upper bearings.
- (2) Align the bearing claw with the claw groove of the main bearing cap, and push in the 5 lower bearings.



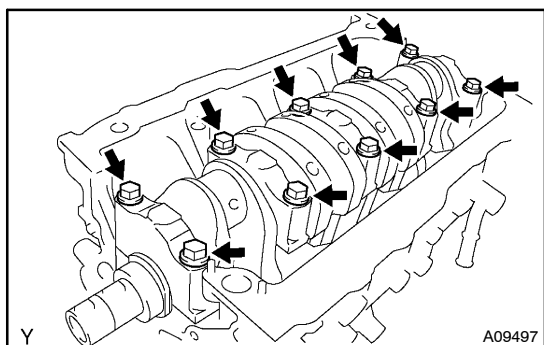
- (b) Install the 2 thrust washers under the No. 3 journal position of the cylinder block with the oil grooves facing outward.



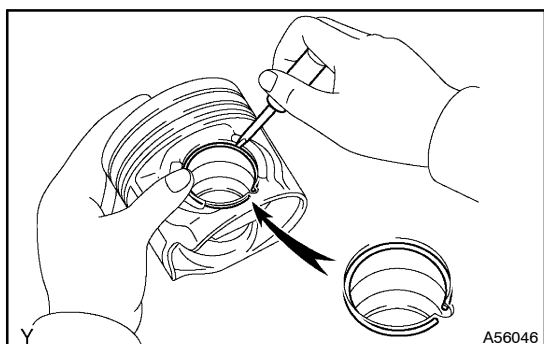
- (c) Install the 2 thrust washers on the No. 3 bearing cap with the oil grooves facing outward.



- (d) Install the 5 main bearing caps in their proper locations.  
HINT:  
Each bearing cap has a number and a font mark.



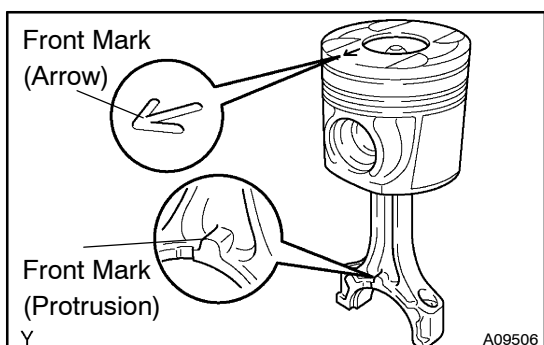
- (e) Apply a light coat of engine oil on the threads and under the heads of the main bearing cap bolts.  
(f) Install and uniformly tighten the 10 bolts of the main bearing cap in several passes.  
**Torque: 115 N·m (1,150 kgf·cm, 85 ft·lbf)**  
(g) Check that the crankshaft turns smoothly.



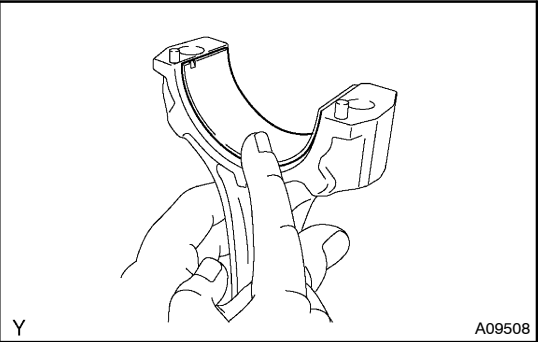
## 28. INSTALL W/PIN PISTON SUB-ASSY

SST 09011-38121

- (a) Install a new snap ring on one side of the piston pin hole.  
(b) Gradually heat the piston to 60°C (140°F).  
(c) Coat the piston pin and piston hole of the piston with engine oil.



- (d) Align the front marks of the piston and connecting rod, and push in the piston pin with your thumb.  
(e) Install a new snap ring on the other side of the piston pin hole.

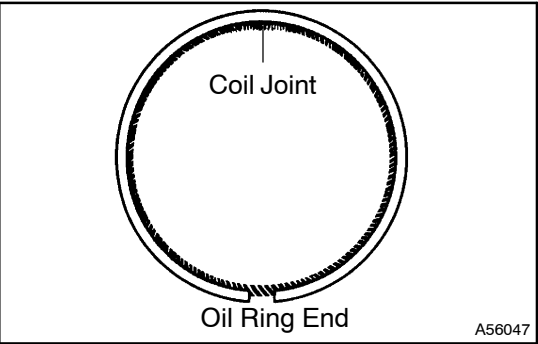


29. INSTALL CONNECTING ROD BEARING

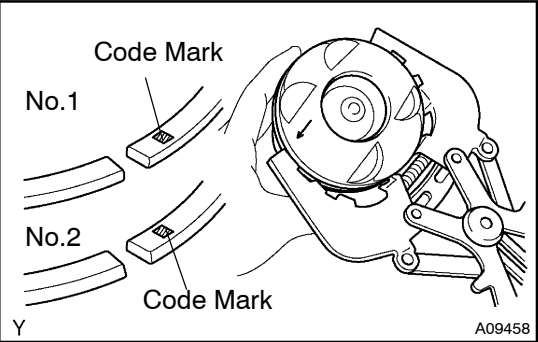
- (a) Align the bearing claw with the groove of the connecting rod or connecting cap.
- (b) Install the bearings in the connecting rod and connecting rod cap.

30. INSTALL PISTON RING SET

- (a) Install the coil by hand.



- (b) Using a piston ring expander, install the oil ring.
- HINT:  
Face the end gap of the oil ring in the opposite direction coil joint.

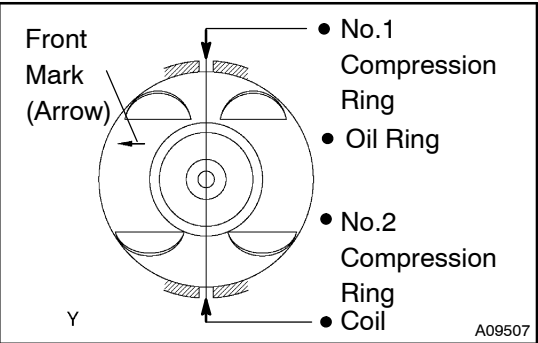


- (c) Using a piston ring expander, install the No.2 and No.1 piston rings with the code mark facing upward.

Code mark:

No.1	1T
No.2	2T

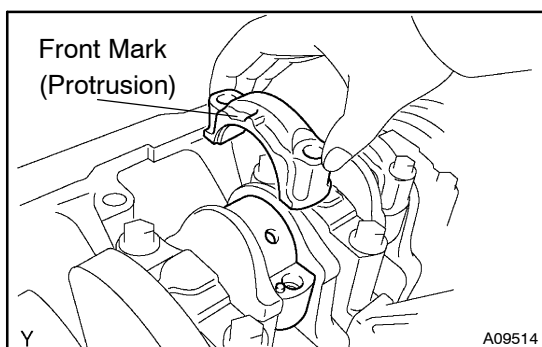
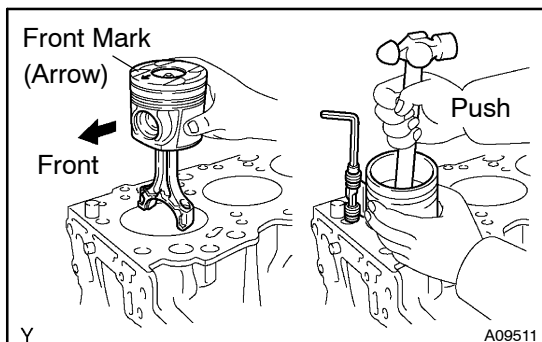
**NOTICE:**  
Make the expansion of the piston ring as small as necessary.



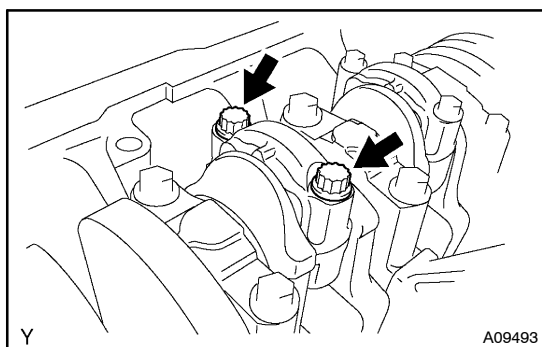
- (d) Position the piston rings so that the ring ends are as shown.

**31. INSTALL PISTON SUB-ASSY W/CONNECTING ROD**

- (a) Apply engine oil to 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.



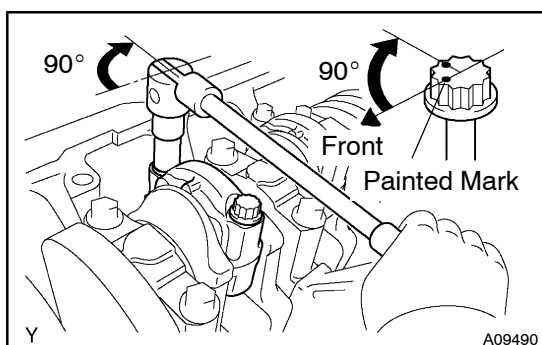
- (d) Match the numbered connecting rod cap with the connecting rod.
- (e) Install the connecting rod cap with the front mark facing forward.
- (f) Apply a light coat of engine oil on the threads and under the heads of the connecting rod cap bolts.



- (g) Install and alternately tighten the 2 cap bolts in several passes.

**Torque: 30 N·m (300 kgf·cm, 22 ft·lbf)**

If any of the cap bolts does not meet the torque specification, replace the connecting rod cap bolts.



- (h) Mark the front of the cap bolt with the paint.
- (i) Relight the cap bolts 90° as shown.
- (j) Check that the painted mark is now at a 90° angle to the front.
- (k) Check that the crankshaft turns smoothly.