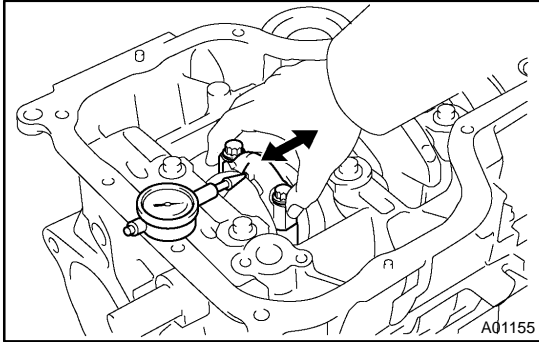
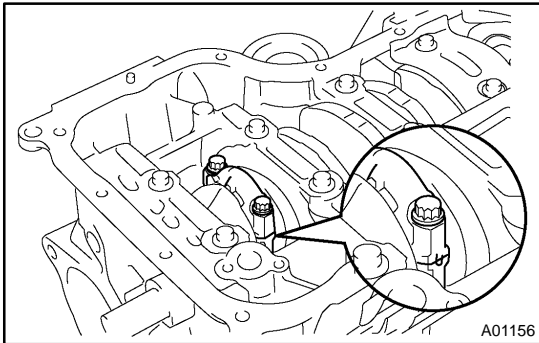


OVERHAUL

1. REMOVE CYLINDER BLOCK WATER DRAIN COCK SUB-ASSY



2. **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 – 0.342 mm (0.0063 – 0.0135 in.)
- Maximum thrust clearance: 0.342 mm (0.0135 in.)**



3. INSPECT CONNECTING ROD BEARING OIL CLEARANCE

NOTICE:

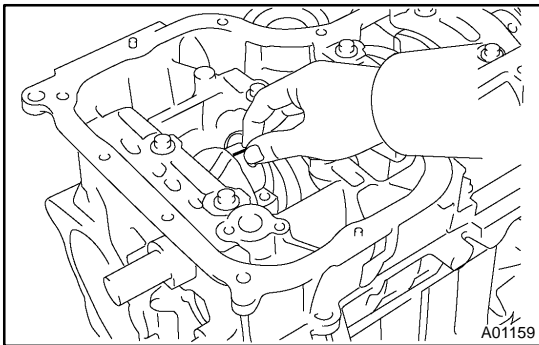
Do not turn the crankshaft.

- (a) Using marking paint, write the matched cylinder number on each connecting rod and cap.

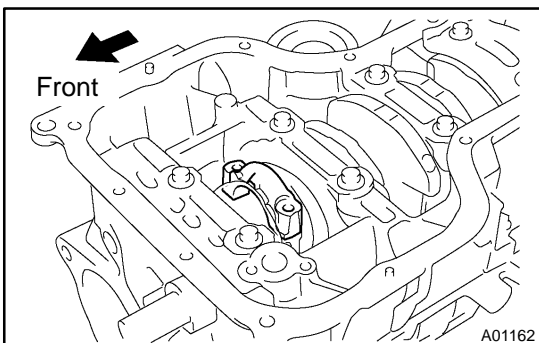
HINT:

The match marks on the connecting rods and caps are for ensuring correct reassembly.

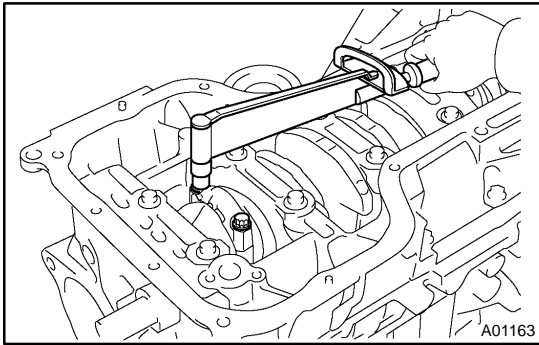
- (b) Using SST, remove the 2 connecting rod cap bolts.
 SST 09205-16010
- (c) Clean the crank pin and bearing.
- (d) Check the crank pin and bearing for pitting and scratches.



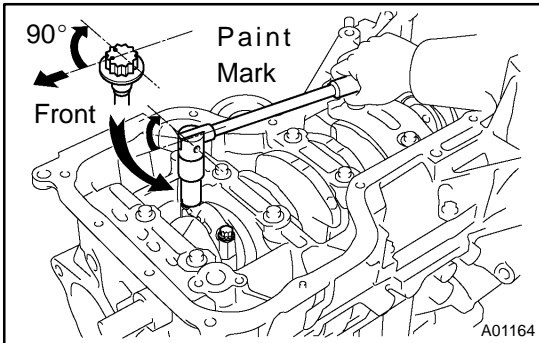
- (e) Lay a strip of plastigage across the crank pin.



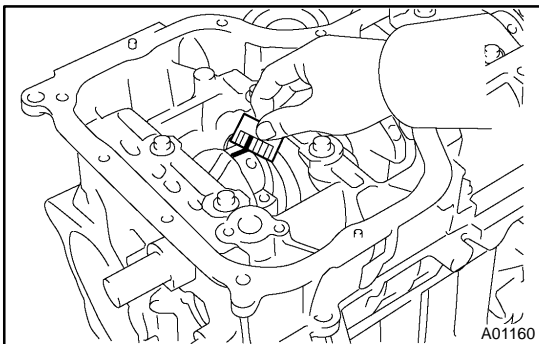
- (f) Check that the protrusion of the connecting rod cap is facing in the correct direction.



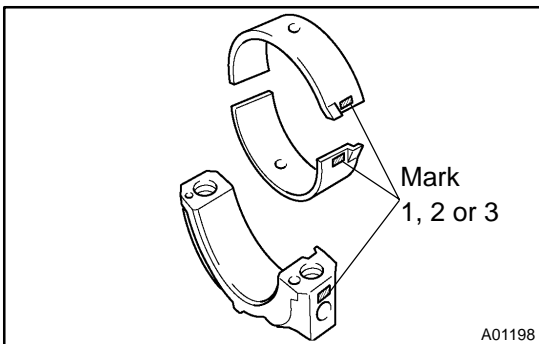
- (g) Apply a light coat of engine oil on the threads and under the heads of the connecting rod cap bolts.
- (h) Using SST, tighten the bolts in several passes by the specified torque.
SST 09205-16010
Torque: 30 N·m (306 kgf·cm, 22 ft·lbf)



- (i) Mark the front of the connecting cap bolts with paint.
- (j) Retighten the cap bolts by 90 ° as shown in the illustration.
- (k) Check that the crankshaft turns smoothly.
- (l) Remove the 2 bolts, connecting rod cap and lower bearing.

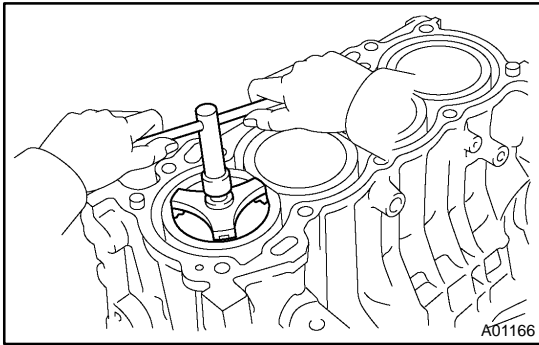


- (m) Measure the plastigage at its widest point.
Standard oil clearance:
0.028 – 0.052 mm (0.0011 – 0.0020 in.)
Maximum oil clearance: 0.080 mm (0.0031 in.)
NOTICE:
Remove the plastigage completely after the measurement.



- (n) If replacing a bearing, select a new one having the same number as marked on the connecting rod. There are 3 sizes of standard bearings, marked "1", "2" and "3" accordingly.
Reference:
Standard bearing center wall thickness

Item	Mark	mm (in.)
Connecting rod large end bore diameter	1	48.000 – 48.008 (1.8898 – 1.8901)
	2	48.008 – 48.016 (1.8901 – 1.8904)
	3	48.016 – 48.024 (1.8904 – 1.8907)
Connecting rod bearing thickness	1	1.482 – 1.486 (0.0583 – 0.0585)
	2	1.486 – 1.490 (0.0585 – 0.0587)
	3	1.490 – 1.494 (0.0587 – 0.0588)
Crankshaft pin outer diameter	–	44.992 – 45.000 (1.7713 – 1.7717)



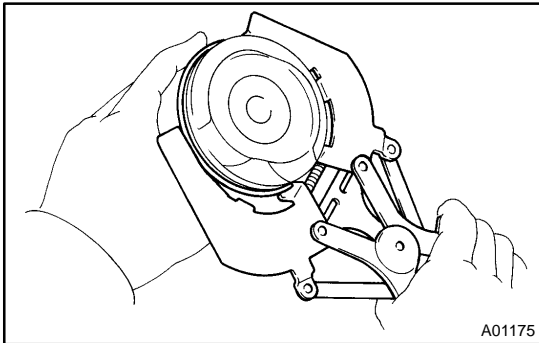
4. REMOVE PISTON SUB-ASSY W/CONNECTING ROD

- (a) 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.

5. REMOVE CONNECTING ROD BEARING

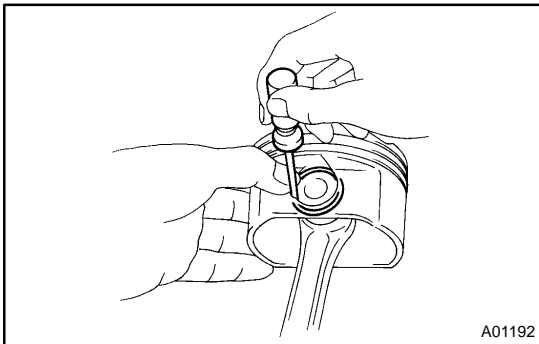


6. REMOVE PISTON RING SET

HINT:

Take care not to misplace the piston rings on both the match with the piston and the direction of the rings.

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

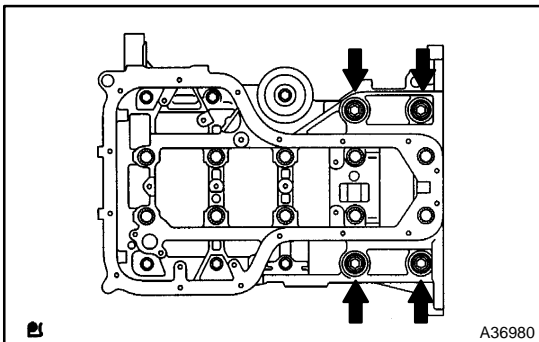


7. REMOVE PISTON PIN HOLE SNAP RING

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

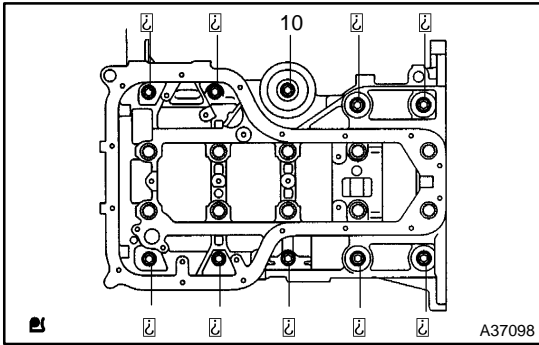
8. REMOVE W/PIN PISTON SUB-ASSY

- (a) Remove the pin and connecting rod from the piston.

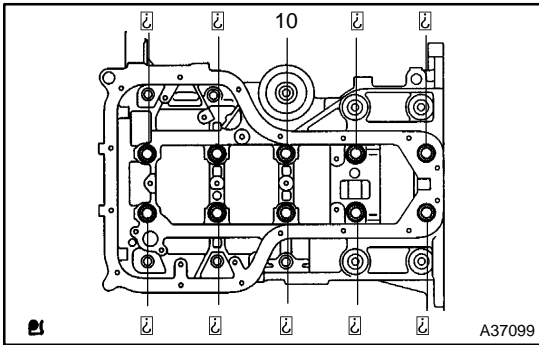


9. REMOVE CRANKSHAFT BEARING CAP SUB-ASSY

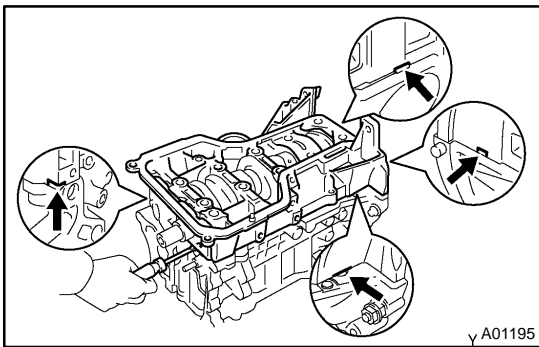
- (a) Remove the 4 screws plugs from the bearing cap sub-assembly.



(b) Remove the 10 hexagon head bearing cap sub-assembly bolts.



(c) Uniformly loosen the 10 bearing cap sub-assembly bolts, in several passes, in the sequence shown in the illustration.

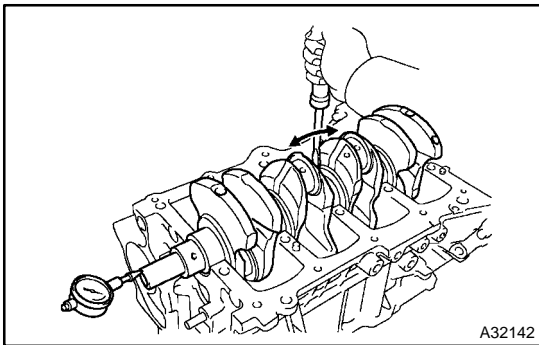


(d) Using a screwdriver, remove the bearing cap sub-assembly by prying the indicated portions between the cylinder block and bearing cap sub-assembly. Remove the 5 lower main bearings.

NOTICE:

Be careful not to damage the contact surfaces of the cylinder block and bearing cap sub-assembly.

SST 09011-38121



10. 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:

0.04 - 0.24 mm (0.0016 - 0.0094 in.)

Maximum thrust clearance: 0.24 mm (0.0094 in.)

(b) If the thrust clearance is greater than maximum, measure the thrust washer thickness. If the thickness is not specified, replace the thrust washer.

Thrust washer thickness:

2.430 - 2.480 mm (0.0957 - 0.0976 in.)

11. REMOVE CRANKSHAFT

12. REMOVE CRANKSHAFT THRUST WASHER UPPER

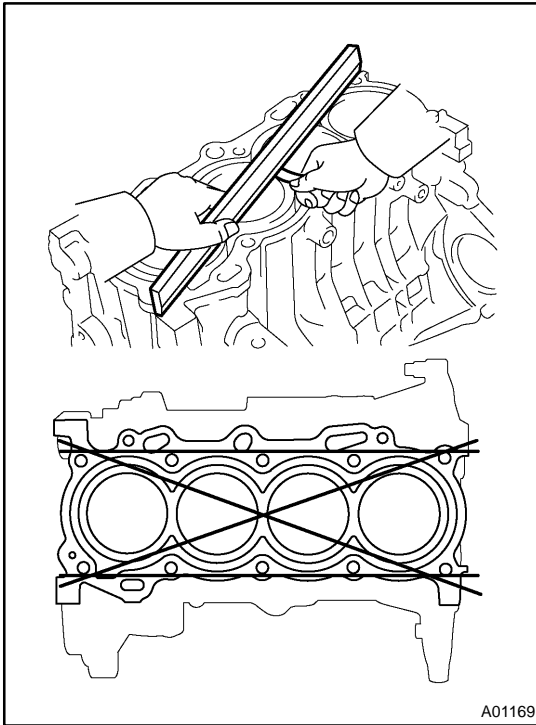
13. REMOVE CRANKSHAFT BEARING

NOTICE:

Arrange the main bearings and thrust washers in the correct order.

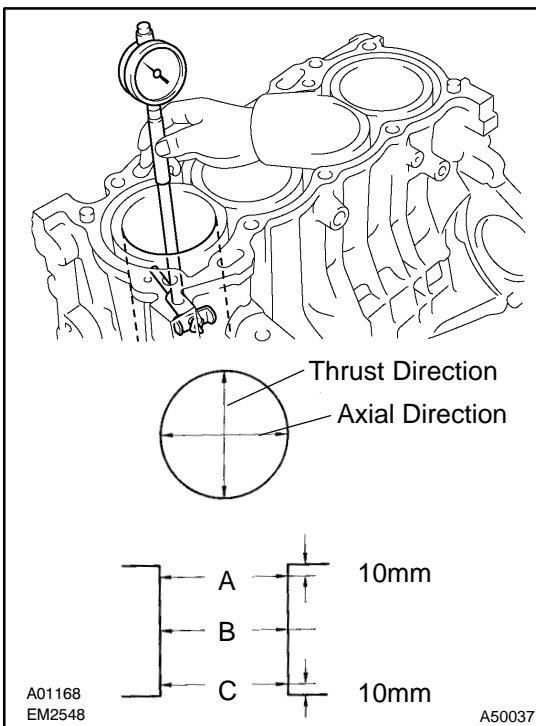
14. REMOVE STUD BOLT

15. REMOVE SUB-ASSY OIL NOZZLE NO.1

**16. 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.)

**17. INSPECT CYLINDER BORE**

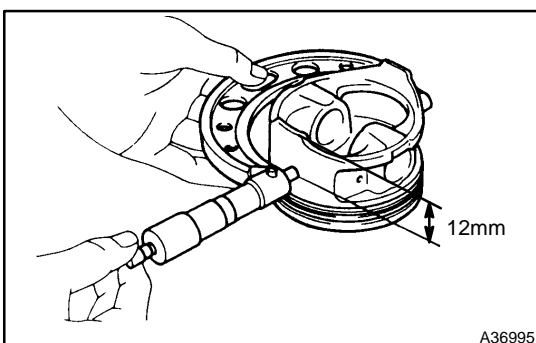
- (a) Using a cylinder gauge, measure the cylinder bore diameter at positions A, B and C in the thrust and axial directions.

Standard diameter:

82.000 – 82.013 mm (3.2283 – 3.2289 in.)

Maximum diameter: 82.013 mm (3.2289 in.)

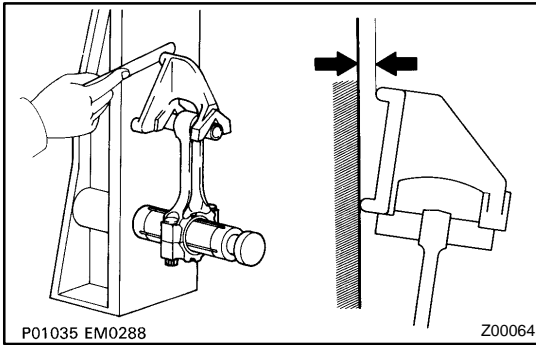
- (b) If the diameter is greater than the maximum, replace the cylinder block.

**18. INSPECT PISTON DIAMETER**

- (a) Using a micrometer, measure the piston diameter at a right angle to the piston pin hole, and at the piston of 12 mm (0.472 in.) from the piston skirt.

Piston diameter:

81.975 – 81.993 mm (3.2274 – 3.2281 in.)

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

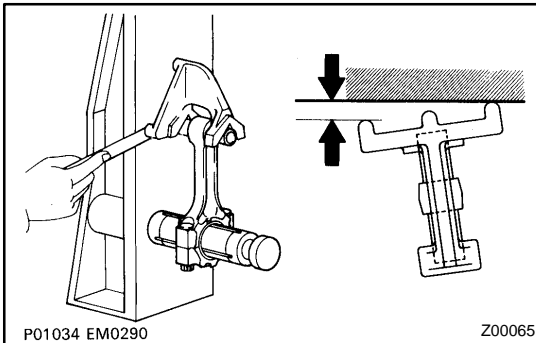
(a) Using a rod aligner and feeler gauge, check the connecting rod alignment.

(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:

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

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

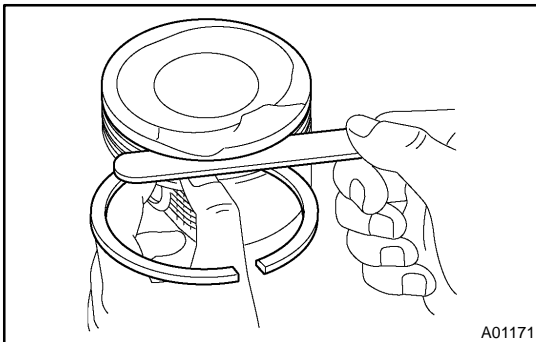
20. INSPECT PISTON CLEARANCE

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

Standard oil clearance: 0.007 – 0.038 mm (0.0003 – 0.0015 in.)

Maximum oil clearance: 0.10 mm (0.0039 in.)

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

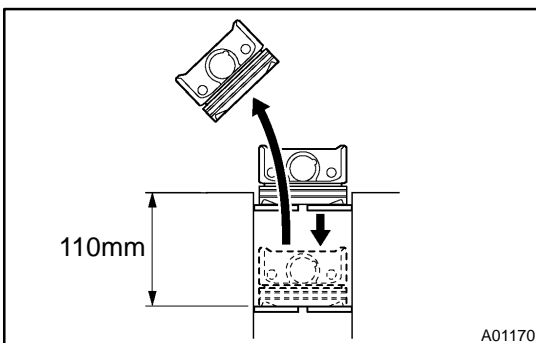
**21. INSPECT RING GROOVE CLEARANCE**

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

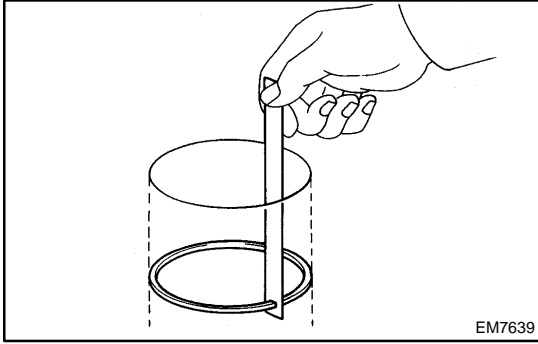
Ring groove clearance:

No.1: 0.020 – 0.070 mm (0.0009 – 0.0028 in.)

No.2: 0.030 – 0.070 mm (0.0012 – 0.0028 in.)

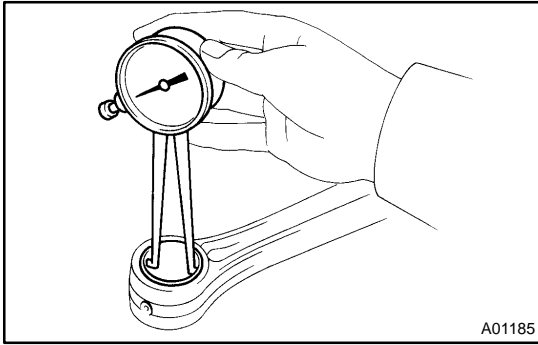
**22. INSPECT PISTON RING END GAP**

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



EM7639

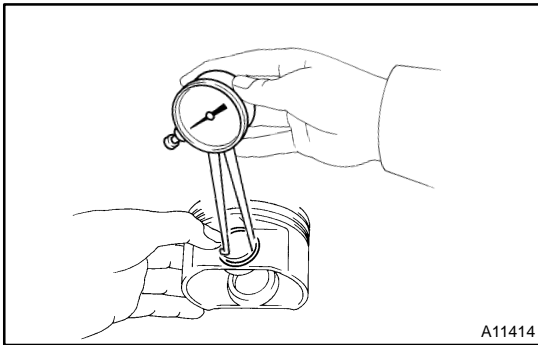
- (b) Using a feeler gauge, measure the end gap.
Standard end gap:
No. 1: 0.25 – 0.35 mm (0.0098 – 0.0138 in.)
No. 2: 0.35 – 0.50 mm (0.0138 – 0.0197 in.)
Oil (side rail): 0.15 – 0.40 mm (0.0059 – 0.0157 in.)
Maximum end gap:
No. 1: 1.05 mm (0.0413 in.)
No. 2: 1.20 mm (0.0472 in.)
Oil (side rail): 1.05mm (0.0413 in.)



A01185

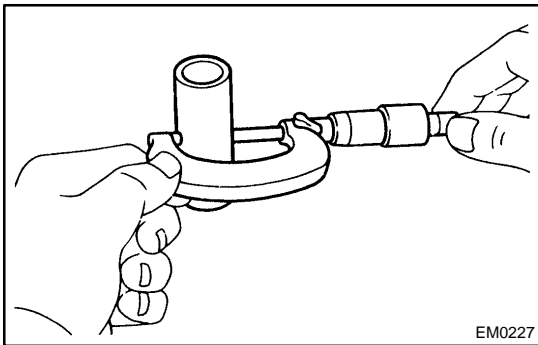
23. INSPECT PISTON PIN

- (a) Using a caliper gauge, measure the inside diameter of the connecting rod bushing.
Bushing inside diameter:
20.011–20.023 mm (0.7878 – 0.7883 in.)



A11414

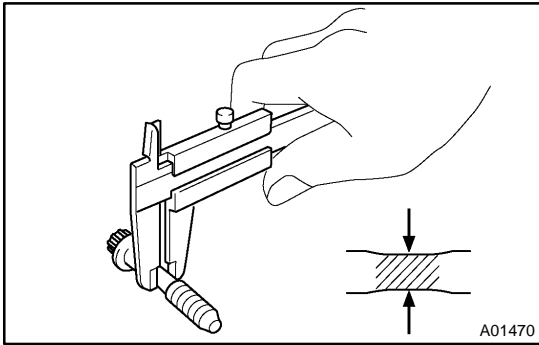
- (b) Using a caliper gauge, measure the inside diameter of the piston bushing.
Bushing inside diameter:
20.013–20.025 mm (0.7879 – 0.7884 in.)



EM0227

- (c) Using a micrometer, measure the piston pin diameter.
Piston pin diameter:
20.004 – 20.016 mm (0.7876 – 0.7880 in.)
 (d) Subtract the piston pin diameter measurement from the bushing inside diameter measurement.
Standard oil clearance:
Piston x Piston pin
0.005 – 0.013 mm (0.0002 – 0.0005 in.)
Piston x Connecting rod
0.005 – 0.009 mm (0.0002 – 0.0004 in.)

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



24. INSPECT CONNECTING ROD BOLT

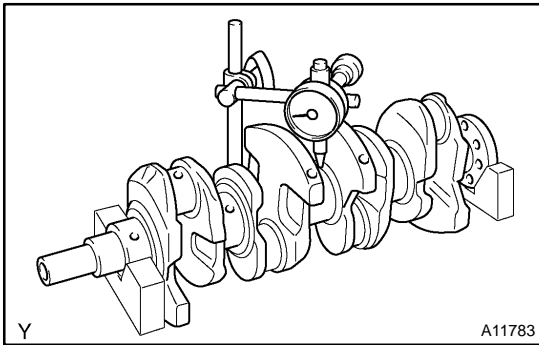
- (a) Using a vernier caliper, measure the tension portion diameter of the bolts.

Standard diameter:

6.6 – 6.7 mm (0.260 – 0.264 in.)

Maximum diameter: 6.7 mm (0.263 in.)

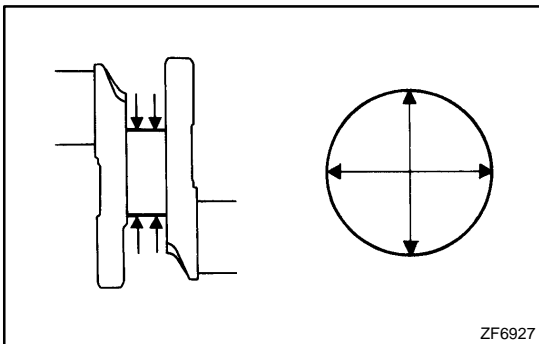
- (b) If the diameter is less than minimum, replace the bolt.



25. 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.)

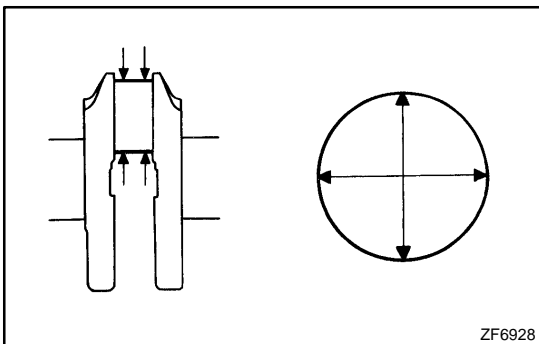


- (b) Using a micrometer, measure the diameter of each main journal at the points shown in the illustration.

Diameter: 47.988 – 48.000 mm (1.8893 – 1.8898 in.)

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

**Maximum taper and out-of-round:
0.02 mm (0.0008 in.)**

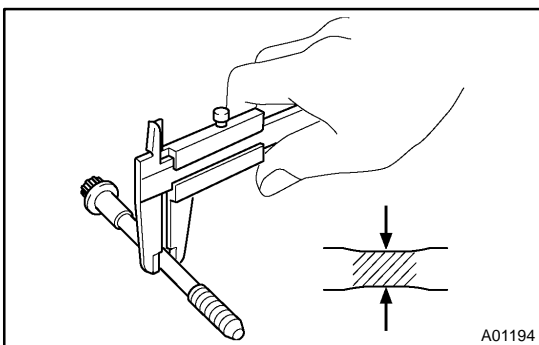


- (d) Using a micrometer, measure the diameter of each crank pin at the points shown in the illustration.

Diameter: 44.992 – 45.000 mm (1.7713 – 1.7717 in.)

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

**Maximum taper and out-of-round:
0.02 mm (0.0008 in.)**



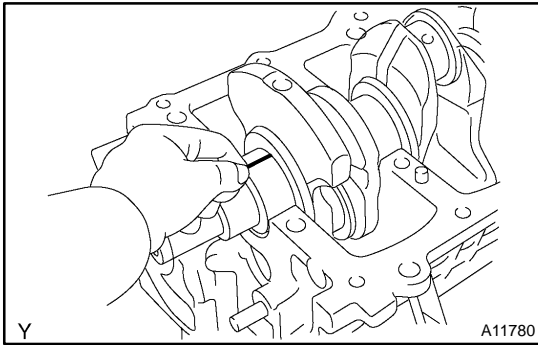
26. INSPECT CRANKSHAFT BEARING CAP BOLT

- (a) Using vernier caliper, measure the tension portion diameter of the bolts.

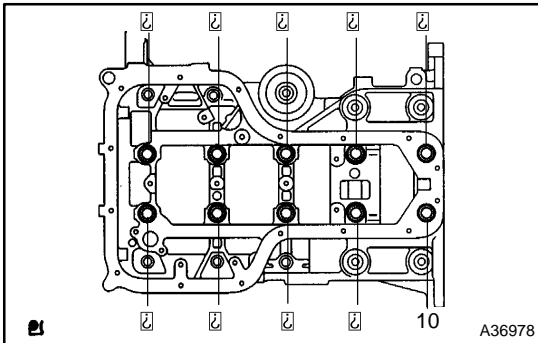
Standard diameter: 7.3 – 7.5 mm (0.287 – 0.295 in.)

Minimum diameter: 7.3 mm (0.287 in.)

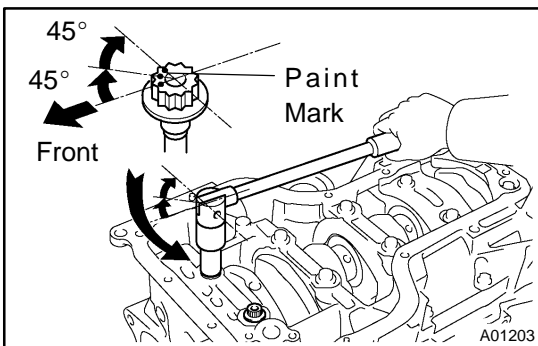
- (b) If the diameter is less than minimum, replace the bolt.

**27. INSPECT CRANKSHAFT OIL CLEARANCE**

- (a) Clean each main journal and bearing.
- (b) Place the crankshaft on the cylinder block.
- (c) Lay a strip of plastigage across each journal.



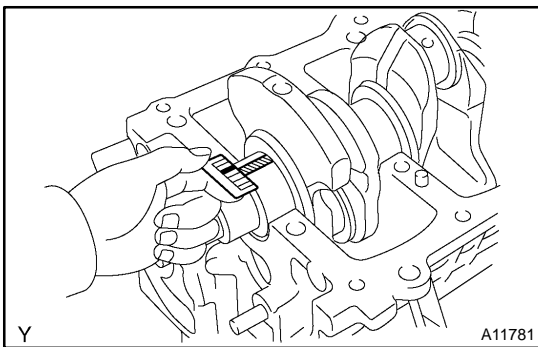
- (d) Using socket wrench (12), tighten the bolts in several passes, in the sequence shown, by the specified torque.
Torque: 22 N·m (224 kgf·cm, 16 ft·lbf)
- (e) Using socket wrench (12), retighten the bolts in several passes, in the sequence shown, by the specified torque.
Torque: 44 N·m (449 kgf·cm, 32 ft·lbf)
- (f) Mark the front of the bearing cap sub-assembly bolts with paint.



- (g) Retighten the bearing cap sub-assembly bolts by 45 ° twice, in the numerical order shown.
- (h) Check that the painted mark is now at a 90 ° angle to the front.

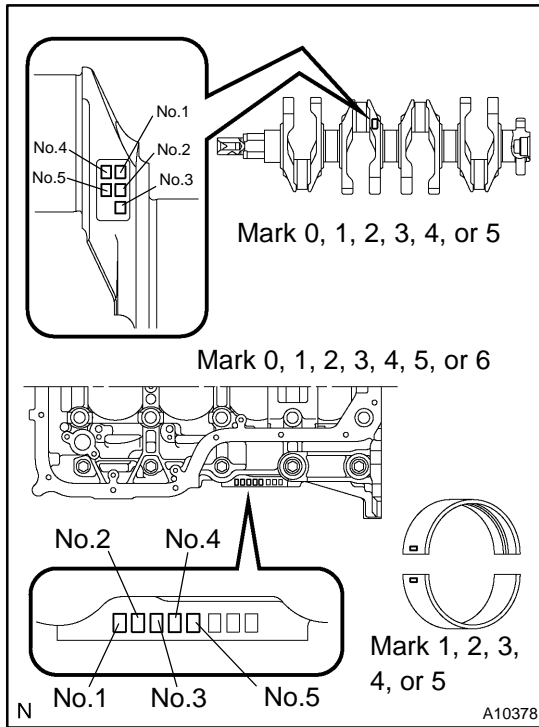
NOTICE:**Do not turn the crankshaft.**

- (i) Remove the bearing cap sub-assembly.



- (j) Measure the plastigage at its widest point.
Standard oil clearance:
0.016 – 0.032 mm (0.0006 – 0.0013 in.)
Maximum oil clearance: 0.08 mm (0.0031 in.)

NOTICE:**Completely remove the plastigage**



(k) If using standard bearing, replace it with one having the same number. If the number of the bearing cannot be determined, refer to the following table to select bearing.

Standard bearings selection chart

Cylinder block Number mark	Crank shaft number mark					
	0	1	2	3	4	5
0	1	1	1	2	2	2
1	1	1	2	2	2	3
2	1	2	2	2	3	3
3	2	2	2	3	3	3
4	2	3	3	3	4	4
5	3	3	3	4	4	4
6	3	3	4	4	4	5

HINT:

Cylinder block "4", Crank shaft "3", Use bearing "3"

Item	Mark	mm (in.)
Cylinder block main journal bore diameter	"0"	52.000 - 52.003 (2.0472 - 2.0473)
	"1"	52.003 - 52.005 (2.0473 - 2.0474)
	"2"	52.005 - 52.007 (2.0474 - 2.0475)
	"3"	52.007 - 52.010 (2.0475 - 2.0476)
	"4"	52.010 - 52.012 (2.0476 - 2.0477)
	"5"	52.012 - 52.014 (2.0477 - 2.0478)
	"6"	52.014 - 52.016 (2.0478 - 2.0479)
Crankshaft main journal diameter	"0"	47.998 - 48.000 (1.8897 - 1.8898)
	"1"	47.996 - 47.998 (1.8896 - 1.8897)
	"2"	47.994 - 47.996 (1.8895 - 1.8896)
	"3"	47.992 - 47.994 (1.8894 - 1.8895)
	"4"	47.990 - 47.992 (1.8893 - 1.8894)
	"5"	47.988 - 47.990 (1.8892 - 1.8893)
Standard bearing center wall thickness	"1"	1.989 - 1.992 (0.0783 - 0.0784)
	"2"	1.992 - 1.995 (0.0784 - 0.0785)
	"3"	1.995 - 1.998 (0.0785 - 0.0787)
	"4"	1.998 - 2.001 (0.0787 - 0.0788)
	"5"	2.001 - 2.004 (0.0788 - 0.0789)

28. INSTALL STUD BOLT

Torque:

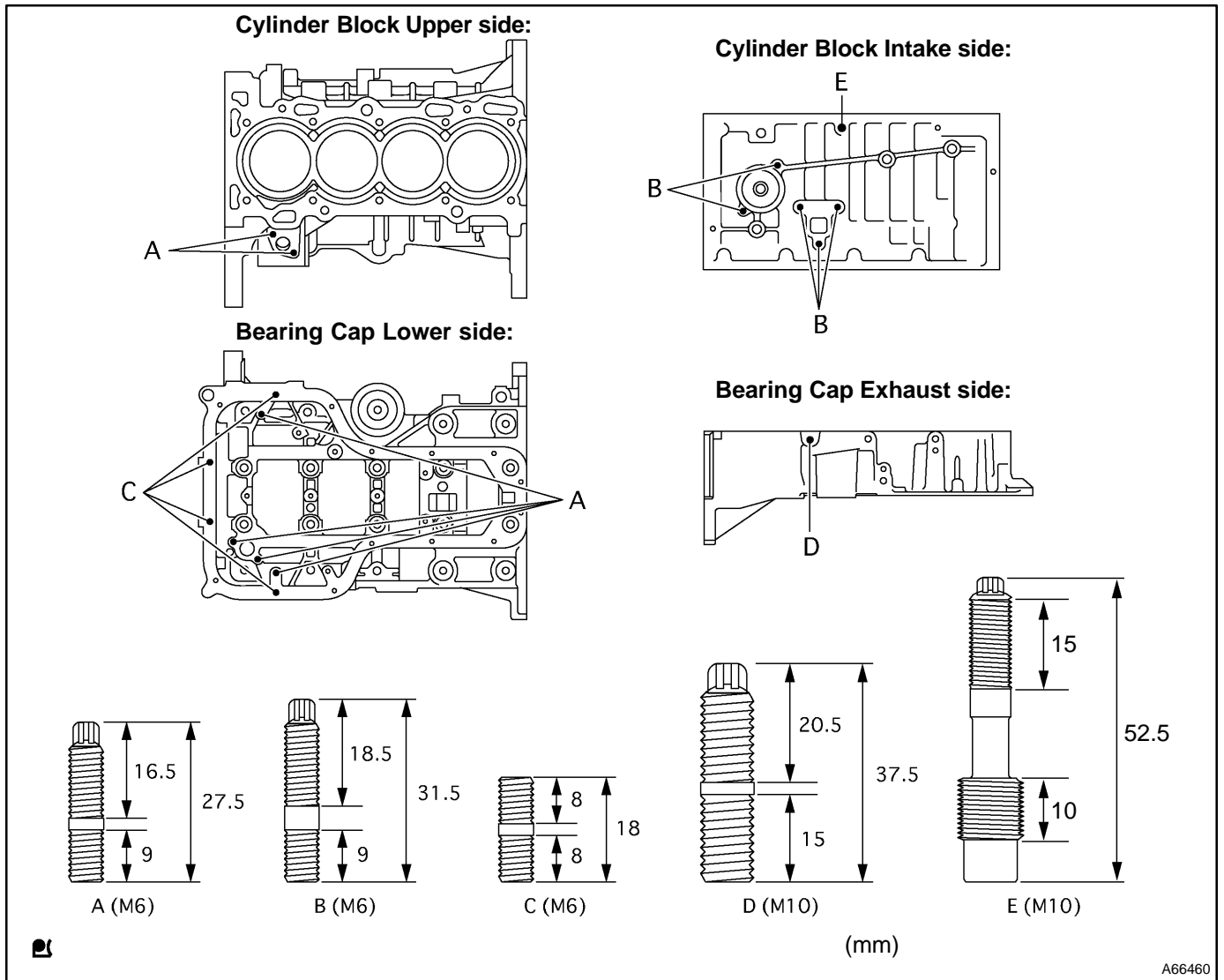
A 5.0 N·m (51 kgf·cm, 44 in·lbf)

B 5.0 N·m (51 kgf·cm, 44 in·lbf)

C 5.0 N·m (51 kgf·cm, 44 in·lbf)

D 19.0 N·m (194 kgf·cm, 14 ft·lbf)

E 11N·m (112 kgf·cm, 8 ft·lbf)



A66460

29. INSTALL RING PIN

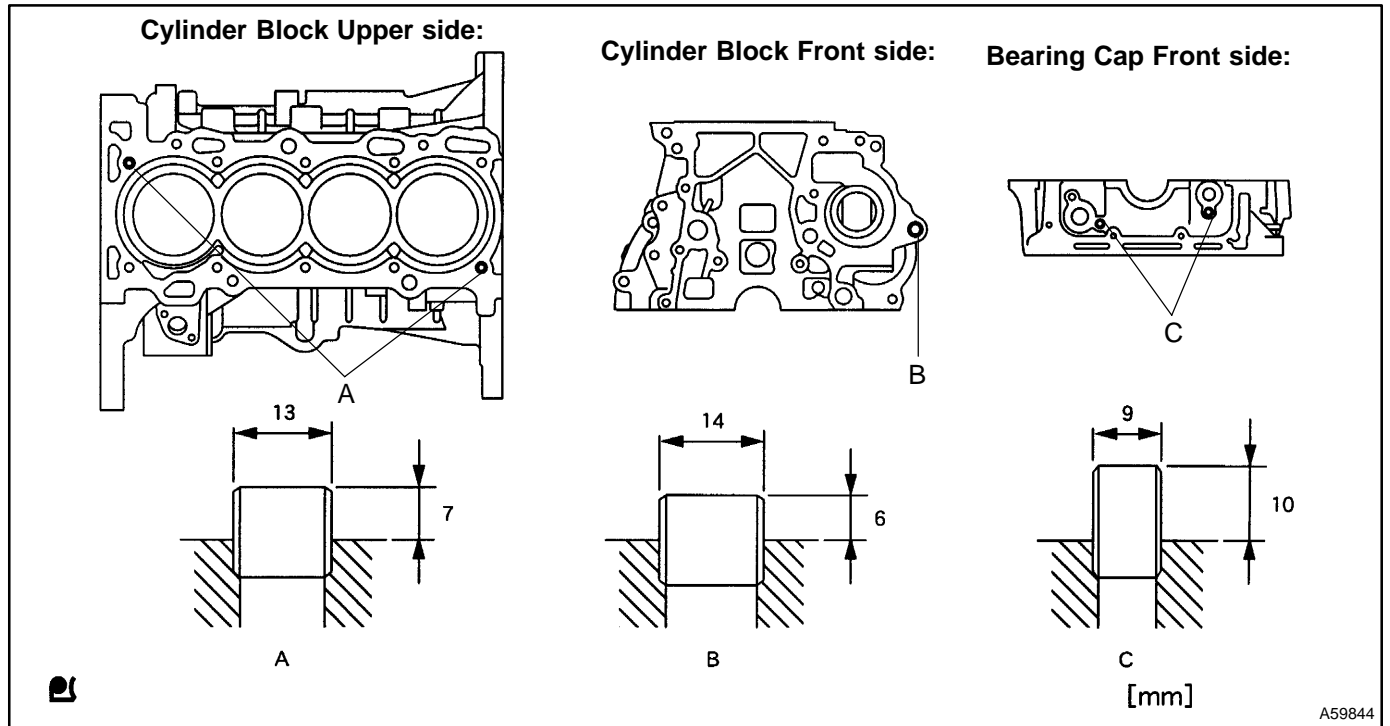
- (a) Using a plastic-faced hammer, tap in the new ring pins to the specified protrusion height.

Protrusion height:

A 7 mm (0.2756 in.)

B 6 mm (0.2362 in.)

C 10 mm (0.3973 in.)



30. INSTALL STRAIGHT PIN

(a) Using a plastic-faced hammer, tap in the straight pins to the specified protrusion height.

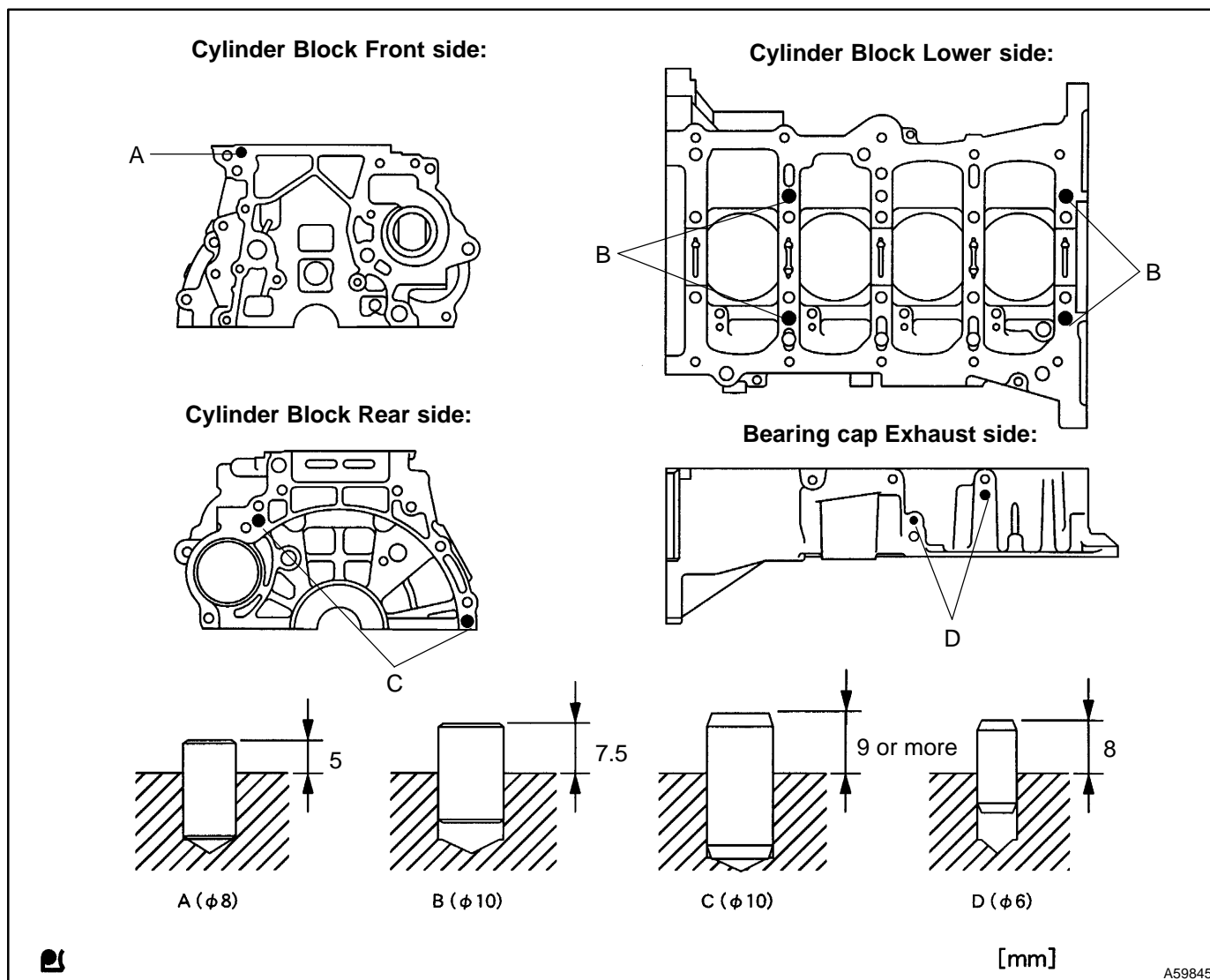
Protrusion height:

A 5 mm (0.1969 in.)

B 7.5 mm (0.2953 in.)

C 9 mm (0.3543 in.) or more

D 8 mm (0.3150 in.)



31. INSTALL TIGHT PLUG

- (a) Apply adhesive around tight plugs.

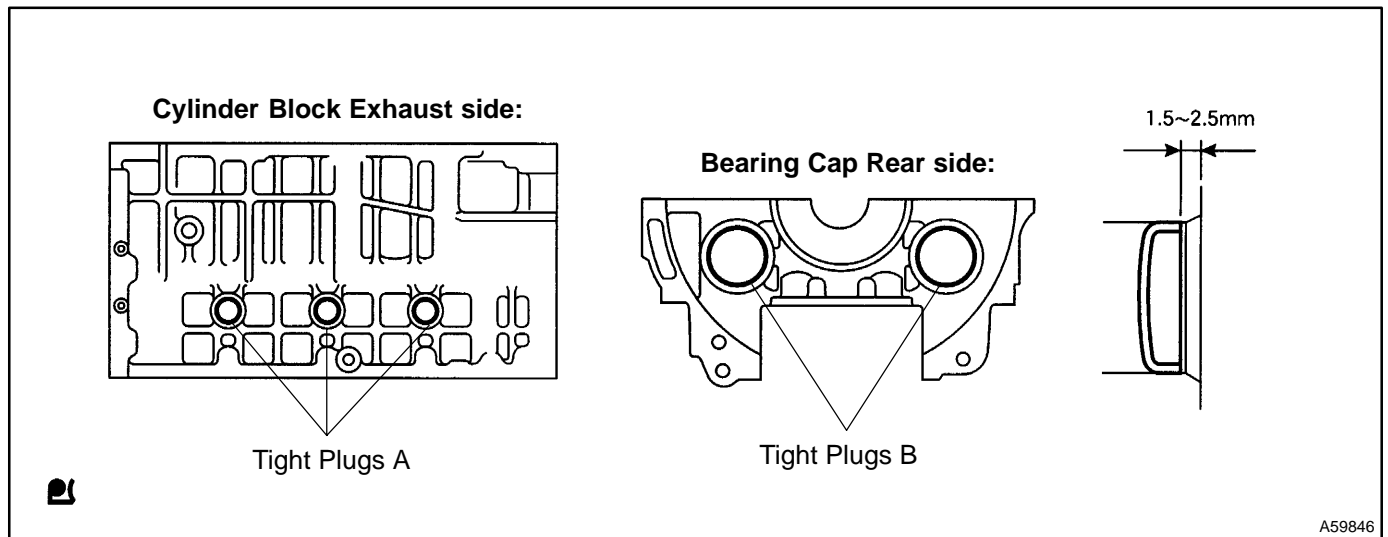
Adhesive: Part No. 08833-00070, THREE BOND 1324 or equivalent

- (b) Using SST, tap in the tight plugs A until its surface is flush with the cylinder block.

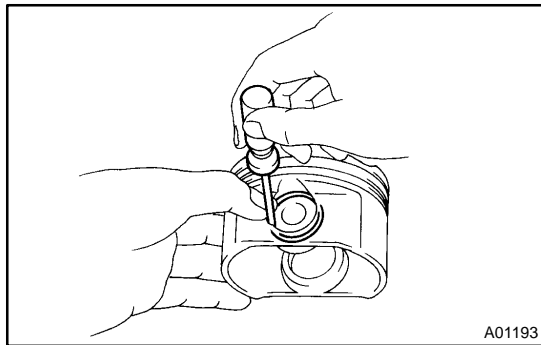
- (c) Using SST, tap in the tight plugs B to the specified protrusion height.

Protrusion height:**B 1.5 - 2.5 mm(0.0591 - 0.0984 in.)**

SST 09950-60010 (09951-00250), 09950-70010 (09951-07100, 09951-00450)

**32. INSTALL SUB-ASSY OIL NOZZLE NO.1**

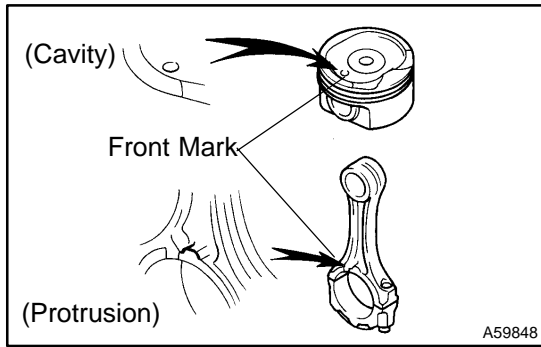
- (a) Using a bi-hexagon wrench (5), install the oil nozzle No.1.

Torque: 9.0 N·m (92 kgf·cm, 80 in·lbf)**33. INSTALL PISTON PIN HOLE SNAP RING**

- (a) Using a small screwdriver, install a new snap ring at one end of the piston pin hole.

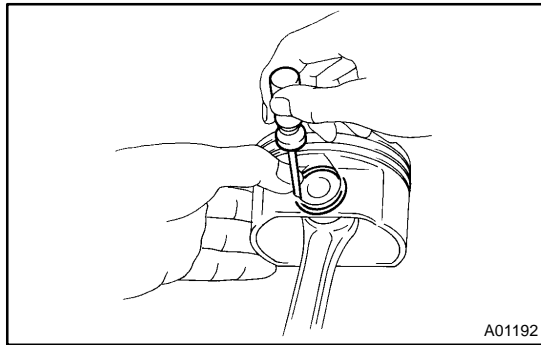
HINT:

Be sure that end gap of the snap ring is aligned with the pin hole cutout portion of the piston.



34. INSTALL W/PIN PISTON SUB-ASSY

- (a) Coat the piston pin with engine oil.
- (b) Align the front marks on the piston and connecting rod, and push in the piston with your thumb.

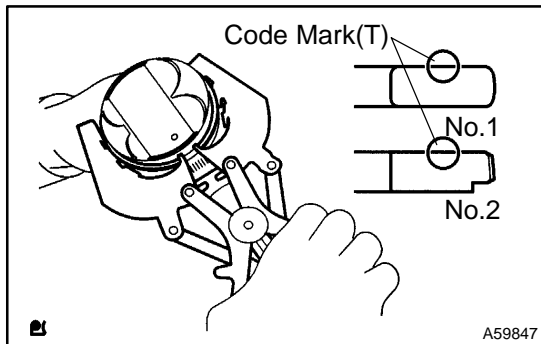


35. INSTALL PISTON PIN HOLE SNAP RING

- (a) Using a small screwdriver, install a new snap ring on the other end of the piston pin hole.

HINT:

Be sure that end gap of the snap ring is not as aligned with the pin hole cutout portion of the piston.



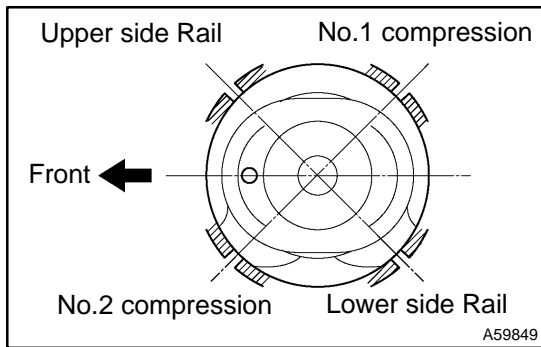
36. INSTALL PISTON RING SET

HINT:

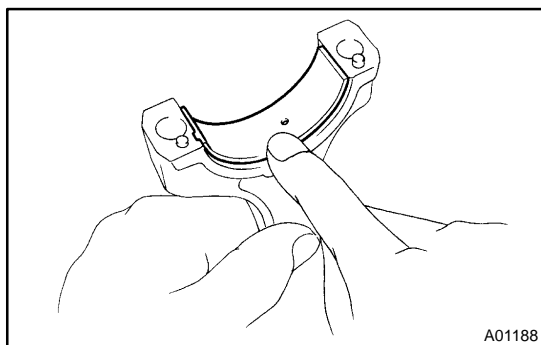
In case of reusing the piston rings, install them to the matched pistons with the surfaces faced correctly.

- (a) Install the oil ring expander and 2 side rails by hand.
- (b) Using a piston ring expander, install the 2 compression rings with the code mark facing upward.

Code mark : T



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

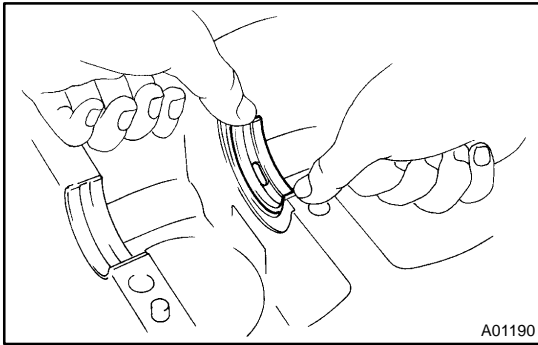


37. INSTALL CONNECTING ROD BEARING

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

NOTICE:

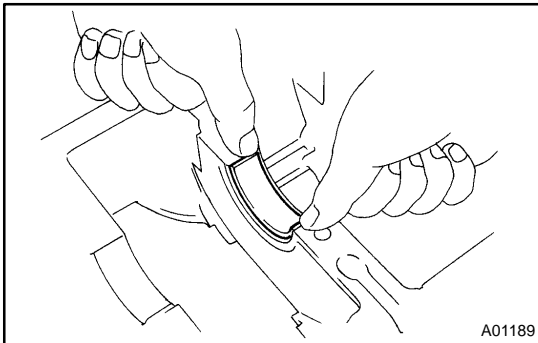
Clean the backside of the bearing and the bearing surface of the connecting rod and let not stick the oils and fats.

**38. INSTALL CRANKSHAFT**

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

NOTICE:

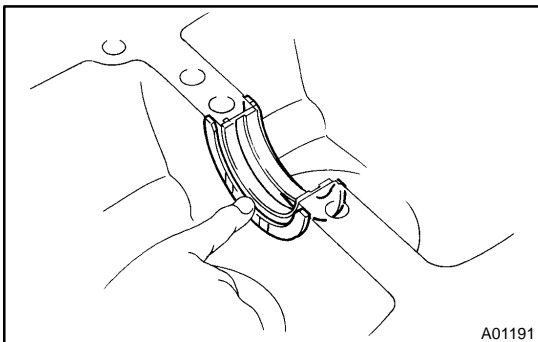
Clean the backside of the bearing and the bearing surface of the bearing cap and let not stick the oils and fats.



- (b) Install the lower bearing on the bearing cap sub assembly.

NOTICE:

Clean the backside of the bearing and the bearing surface of the bearing cap and let not stick the oils and fats.



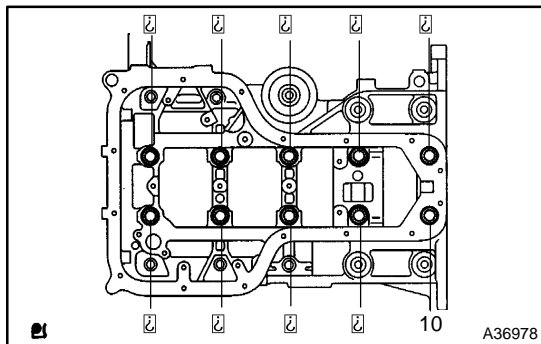
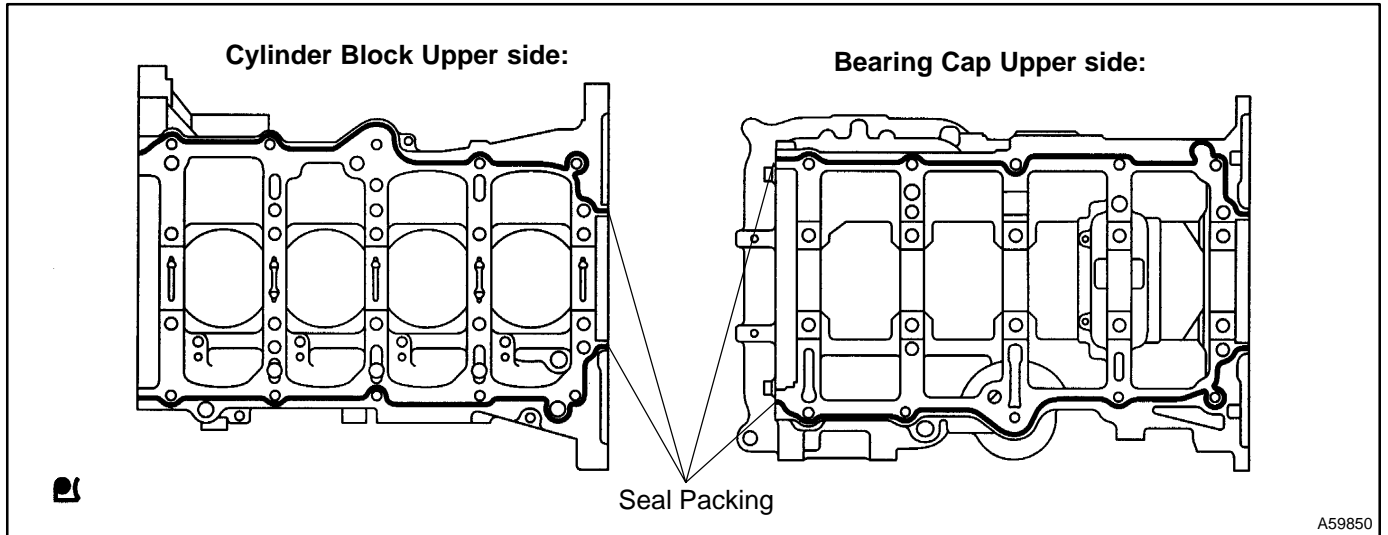
- (c) Install the 2 thrust washers upper the No. 3 journal position of the cylinder block with the oil grooves facing outward.
- (d) Apply engine oil to upper bearing and install the crankshaft on the cylinder block.
- (e) Apply a light coat of engine oil on the bolt threads, the bolt seats, and the bearings of the bearing cap sub assembly.

- (f) Apply seal packing in the shape of bead (Diameter 2.5 – 3.5 mm (0.08 – 0.12 in.) consequently as shown in the illustration.

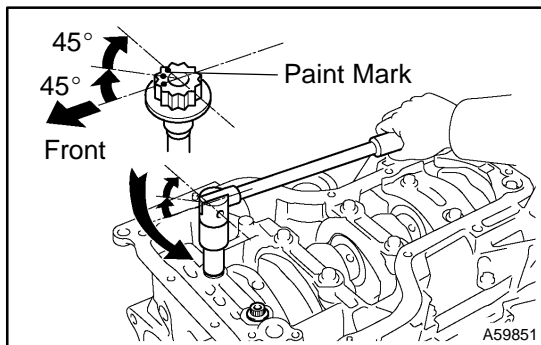
Seal packing: Part No. 08826-00080 or equivalent

NOTICE:

- Remove any oil from the contact surface.
- Install the bearing cap sub-assembly within 3 minutes after applying seal packing.
- Do not put into engine oil within 2 hours after the installation.



- (g) Using socket wrench (12), tighten the bolts in several passes, in the sequence shown, by the specified torque.
Torque: 22 N·m (224 kgf·cm, 16 ft·lbf)
- (h) Using socket wrench (12), retighten the bolts in several passes, in the sequence shown, by the specified torque.
Torque: 44 N·m (449 kgf·cm, 32 ft·lbf)
- (i) Mark the front of the bearing cap sub-assembly bolts with paint.

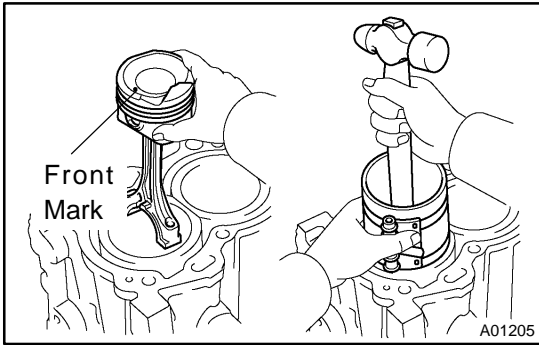


- (j) Retighten the bearing cap sub-assembly bolts by 45 ° twice, in the numerical order shown.
- (k) Check that the painted mark is now at a 90 ° angle to the front.
- (l) Tighten 10 other bolts for the bearing cap.
Torque: 18 N·m (184 kgf·cm, 13 ft·lbf)
- (m) apply adhesive to 2 or 3 threads, and install the 4 screw plugs.

Adhesive:

Part No. 08833-0070, THREE BOND 1324, or equivalent

Torque: 43 N·m (438 kgf·cm, 32 ft·lbf)

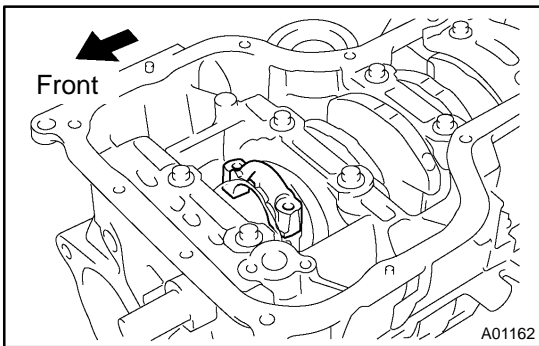


39. INSTALL CONNECTING ROD SUB-ASSY

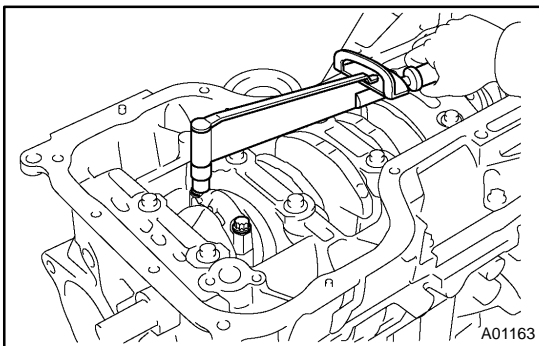
- (a) Apply engine oil to the cylinder walls, the pistons, and the surfaces of connecting rod bearings.
- (b) Check the position of the piston ring ends.
- (c) Using a piston ring compressor, push the correctly numbered piston and connecting rod assemblies into each cylinder with the front mark of the piston facing forward.
- (d) Align the pin dowels of the connecting rod cap with the pins of the connecting rod, and install the connecting rod.

NOTICE:

- **Clean the backside and the surface of the connecting rod cap bearing and let not stick the oils and fats.**
- **Match the numbered connecting rod cap with the same numbered connecting rod.**



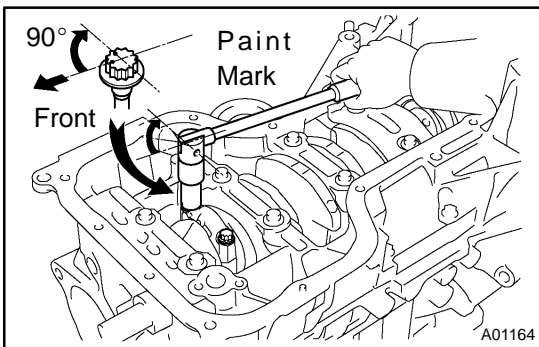
- (e) Check that the protrusion of the connecting rod cap is facing in the correct direction.



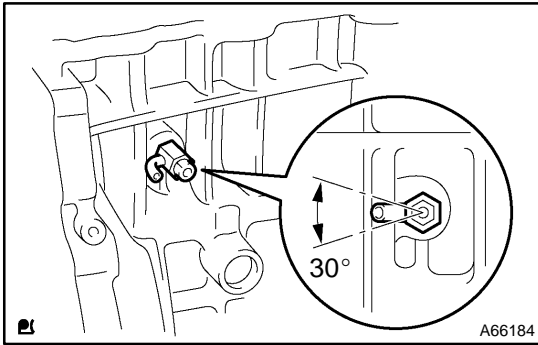
- (f) Apply a light coat of engine oil on the threads and under the heads of the connecting rod cap bolts.
- (g) Using SST, tighten the bolts in several passes by the specified torque.

SST 09205-16010

Torque: 30 N·m (306 kgf·cm, 22 ft·lbf)



- (h) Mark the front of the connecting cap bolts with paint.
- (i) Retighten the cap bolts by 90 ° as shown in the illustration.
- (j) Check that the crankshaft turns smoothly.



40. INSTALL CYLINDER BLOCK WATER DRAIN COCK SUB-ASSY

- (a) Apply two or three threads of adhesive to the drain union, and install it within 3 minutes.

Torque: 25 N·m (255 kgf·cm 18 ft·lbf)

- (b) After applying the specified torque, rotate the drain union clockwise until its drain port faces downward.

NOTICE:

- Do not put into coolant in an hour after the installation.
- Do not rotate the drain union more than 360 ° in (b), and never loosen it after setting the union correctly.