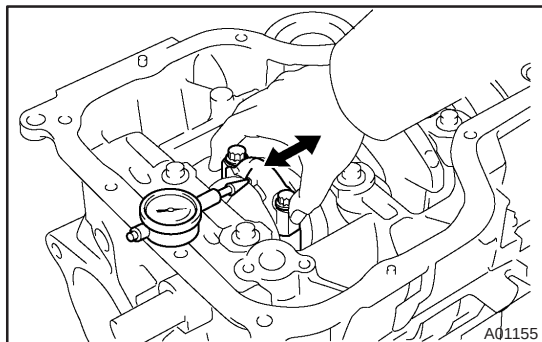
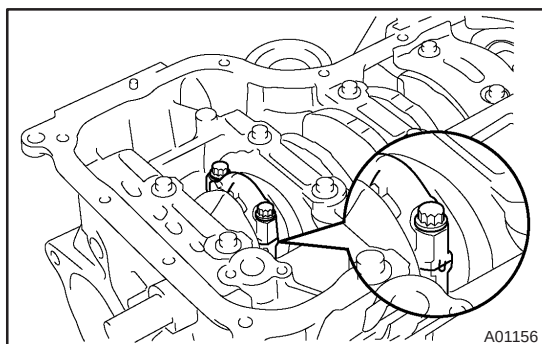


OVERHAUL



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 – 0.342 mm (0.063 – 0.0135 in.)
Maximum thrust clearance: 0.342 mm (0.0135 in.)



2. **INSPECT CONNECTING ROD BEARING OIL CLEARANCE**

NOTICE:

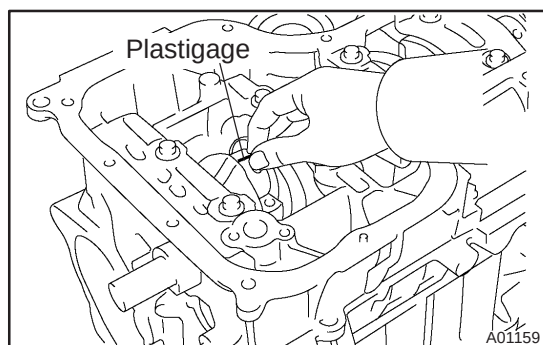
Do not turn the crankshaft.

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

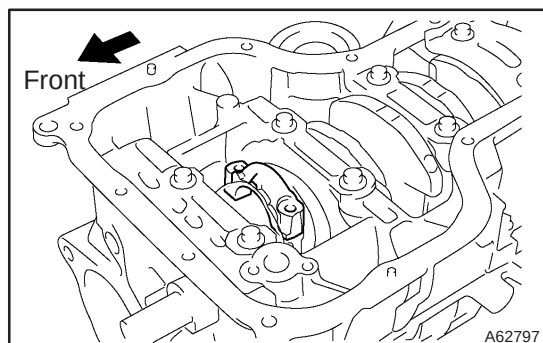
HINT:

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

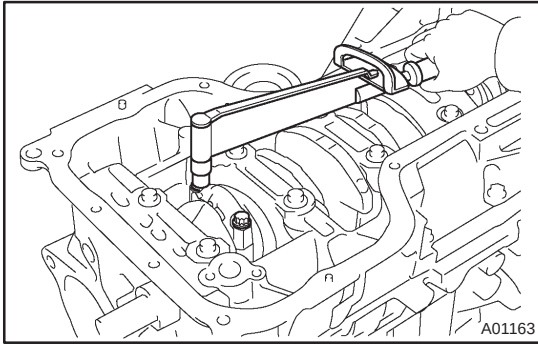
- (b) Using SST, remove the 2 connecting rod cap bolts.
 SST 09205-16010
- (c) Clean the crank pin and bearing.
- (d) Check the crank pin and bearing for pitting and scratches.



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



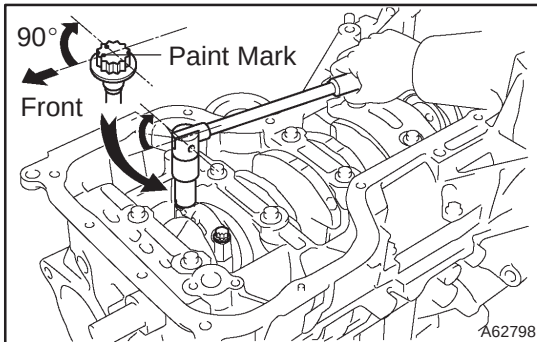
- (f) Check that the protrusion of the connecting rod cap is facing in the correct direction.



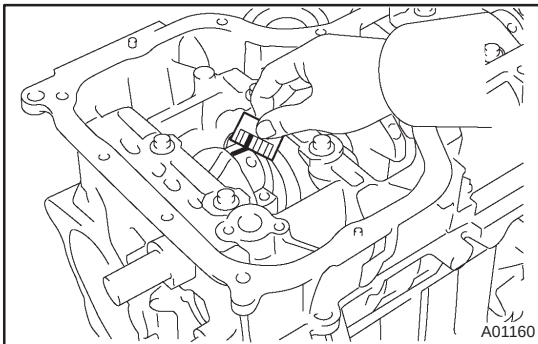
- (g) Apply a light coat of engine oil on the threads and under the heads of the connecting rod cap bolts.
- (h) Using SST, tighten the bolts in several passes by the specified torque.

SST 09205-16010

Torque: 20 N·m (204 kgf·cm, 15 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.

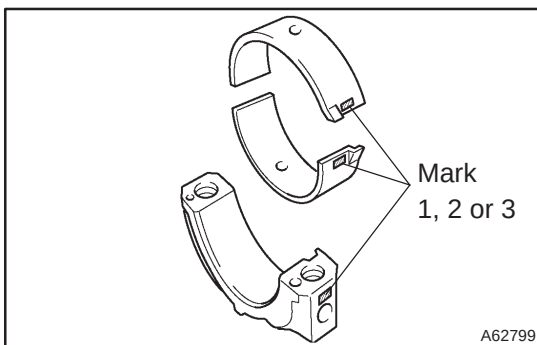
Standard oil clearance:

0.028 – 0.060 mm (0.0011 – 0.0024 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

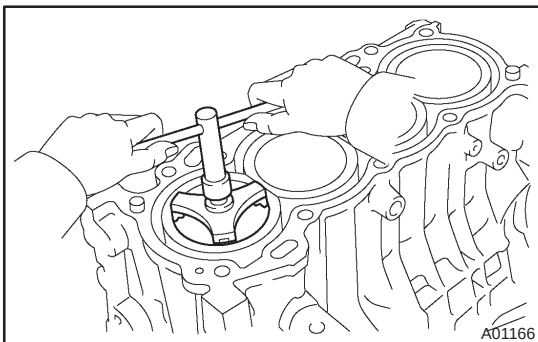
Mark	mm (in.)
1	1.486 – 1.490 (0.0585 – 0.0587)
2	1.490 – 1.494 (0.0587 – 0.0588)
3	1.494 – 1.498 (0.0588 – 0.0590)

3. REMOVE PISTON SUB-ASSY W/CONNECTING ROD

- (a) Using a ride 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.

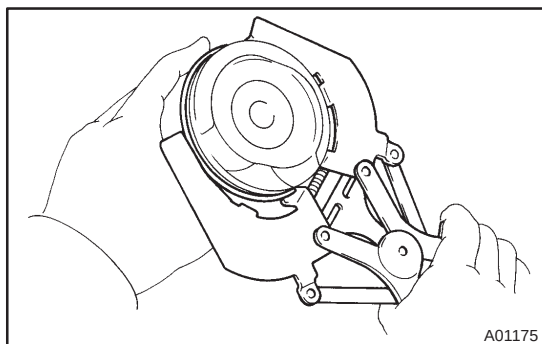
HINT:

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



4. REMOVE CONNECTING ROD BEARING

- (a) Remove the connecting rod bearing from the connecting rod and crankshaft.

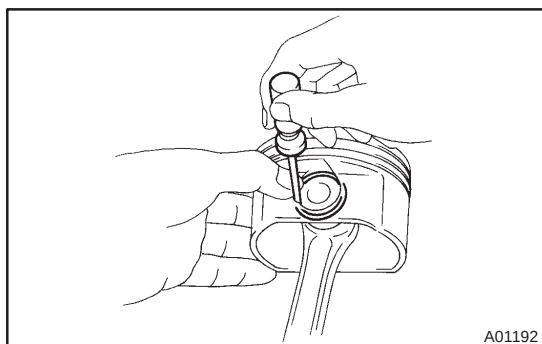


5. REMOVE PISTON RING SET

HINT:

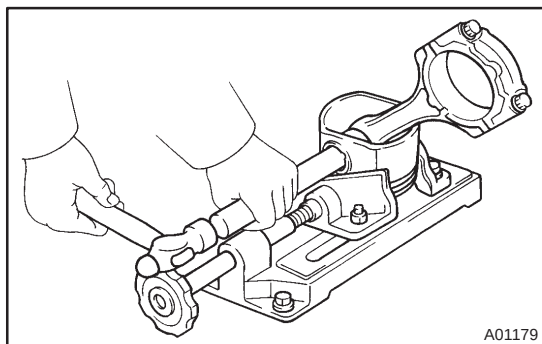
Take care not to misplace the piston rings on both the match with the piston and the direction of the rings.

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



6. REMOVE PISTON PIN HOLE SNAP RING

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



7. REMOVE W/PIN PISTON SUB-ASSY

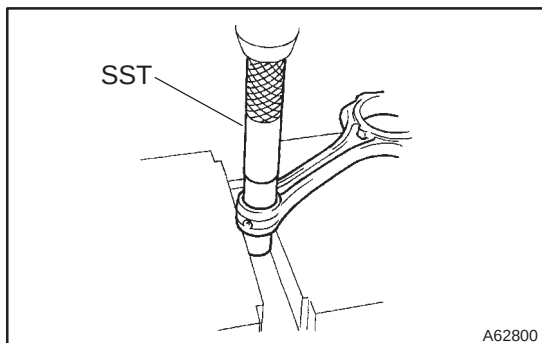
- (a) Gradually heat the piston to 80 – 90°C (176 – 194°F).
- (b) Using a plastic hammer and brass bar, lightly tap out the piston pin and remove the connecting rod.

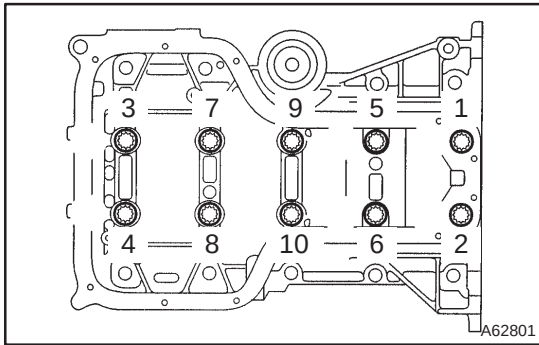
HINT:

- The piston and pin are a matched set.
- Arrange the piston, pins, ring, connecting rod and bearings in the correct order.

8. REMOVE CONNECTING ROD SMALL END BUSH

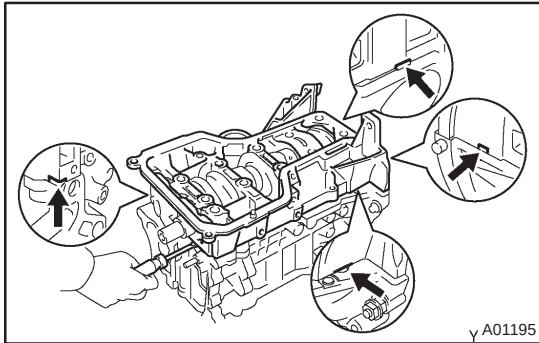
- (a) Using SST and a press, press out the bushing.
SST 09222-30010





9. REMOVE CRANKSHAFT BEARING CAP SUB ASSY

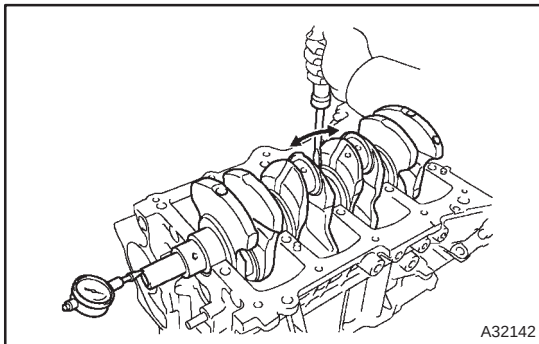
- (a) Remove the 10 bearing cap bolts.
- (b) Uniformly loosen the 10 bearing cap sub-assy bolts, in several passes, in the sequence shown in the illustration.
SST 09011-38121



- (c) 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.



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: 0.30 mm (0.0118 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 THRUST WASHER UPPER

- (a) Remove the crankshaft thrust washer from the cylinder block.

12. REMOVE CRANKSHAFT

- (a) Lift out the crankshaft.
- (b) Remove the 5 upper main bearings and 2 thrust washers from the cylinder block.

NOTICE:

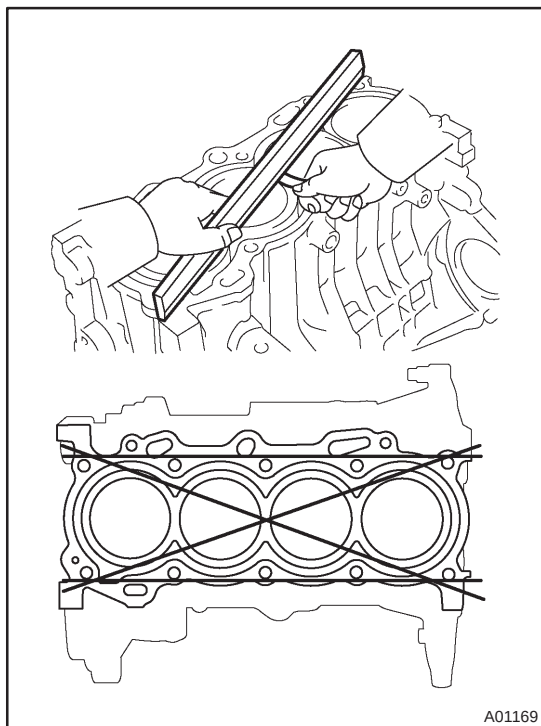
Arrange the main bearings and thrust washers in the correct order.

13. REMOVE CRANKSHAFT BEARING

- (a) Remove the crankshaft bearing from the cylinder block.

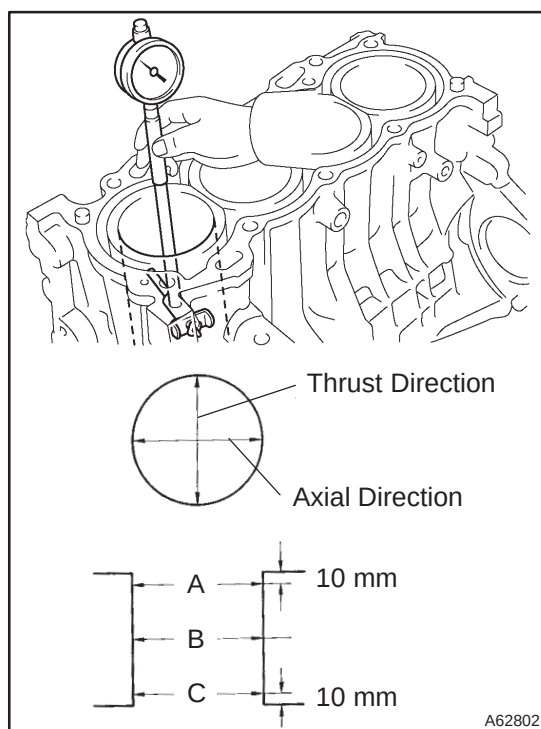
14. REMOVE STUD BOLT

- (a) Remove the 9 stud bolts from the cylinder block.

**15. 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.)

**16. INSPECT CYLINDER BORE**

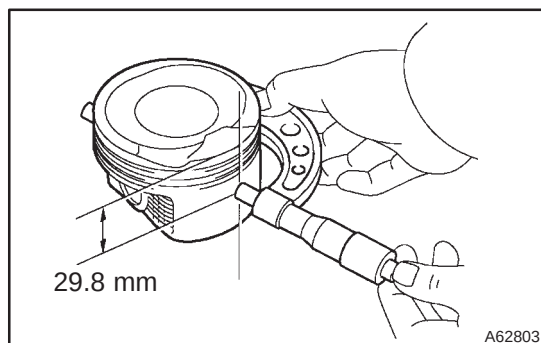
- (a) Using a cylinder gauge, measure the cylinder bore diameter at positions A, B and C in the thrust and axial directions.

Standard diameter:

79.000 – 79.013 mm (3.1102 – 3.1108 in.)

Maximum diameter: 79.013 mm (3.1108 in.)

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

**17. 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 29.8 mm (1.173 in.) from the piston head.

Piston diameter:

1ZZ-FE 78.925 – 78.935 mm (3.1073 – 3.1077 in.)

3ZZ-FE 78.955 – 78.965 mm (3.1085 – 3.1089 in.)

18. INSPECT PISTON OIL CLEARANCE

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

Standard oil clearance:

1ZZ-FE 0.065 – 0.088 mm (0.0026 – 0.0035 in.)

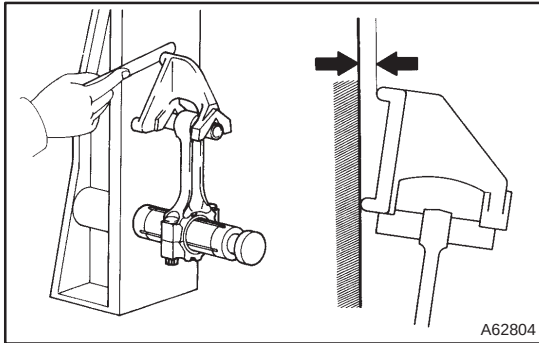
3ZZ-FE 0.035 – 0.058 mm (0.0014 – 0.0023 in.)

Maximum oil clearance:

1ZZ-FE 0.088 mm (0.0035 in.)

3ZZ-FE 0.058 mm (0.0023 in.)

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

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

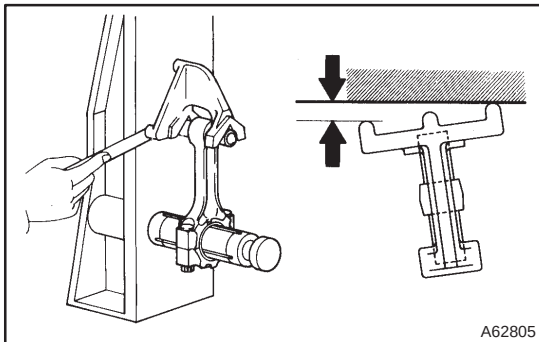
- (a) Using a connecting rod aligner and feeler gauge, check the connecting rod alignment.

(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.

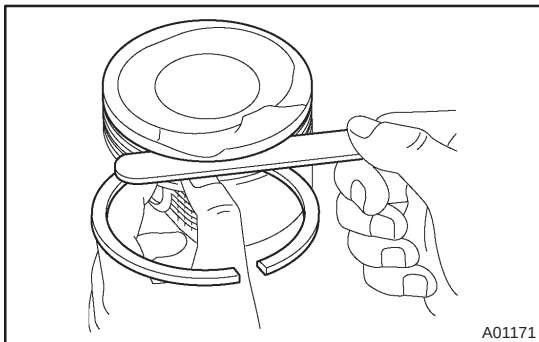


(2) Check for twist.

Maximum twist:

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

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

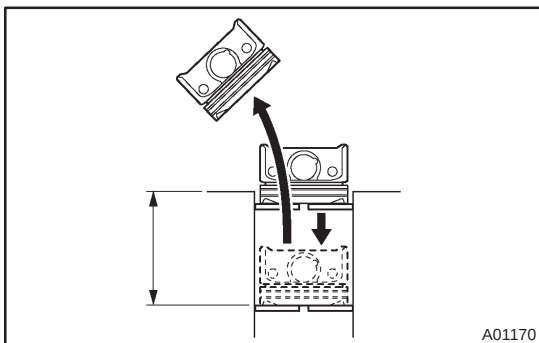
**20. INSPECT RING GROOVE CLEARANCE**

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

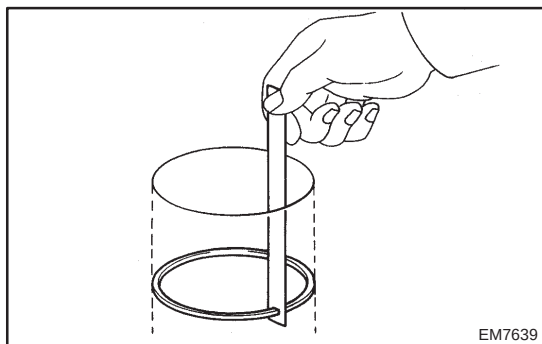
Ring groove clearance:

No. 1 0.020 – 0.070 mm (0.0008 – 0.0028 in.)

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

**21. INSPECT PISTON RING END GAP**

- (a) Using a piston, push the piston ring a little beyond the bottom of the ring travel, that means 100 mm (3.94 in.) from the top of the cylinder block.



EM7639

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

Standard end gap:

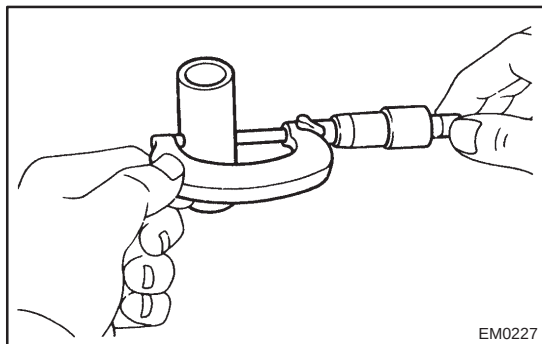
No. 1 0.25 – 0.35 mm (0.0098 – 0.0138 in.)

No. 2 0.35 – 0.50 mm (0.0138 – 0.0197 in.)

Maximum end gap:

No. 1 0.74 mm (0.029 in.)

No. 2 0.89 mm (0.035 in.)



EM0227

22. INSPECT PISTON PIN

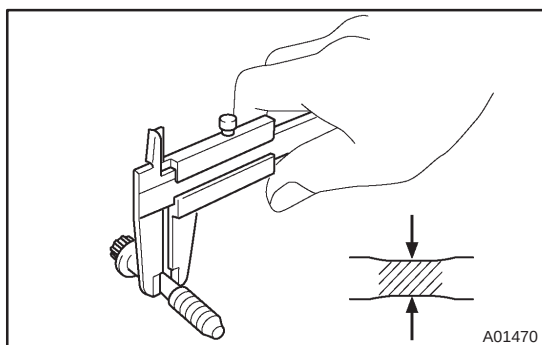
- (a) Using a micrometer, measure the piston pin diameter.

Piston pin diameter:

20.004 – 20.013 mm (0.7876 – 0.7879 in.)

NOTICE:

Push the piston pin into the matched piston.



A01470

23. INSPECT CONNECTING ROD BOLT

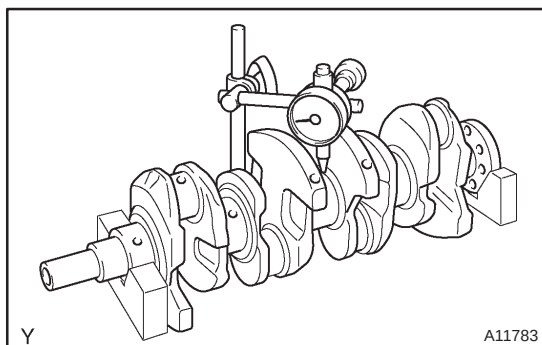
- (a) Using a vernier caliper, measure the tension portion diameter of the bolts.

Standard diameter:

6.6 – 6.7 mm (0.260 – 0.264 in.)

Maximum diameter: 6.4 mm (0.252 in.)

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



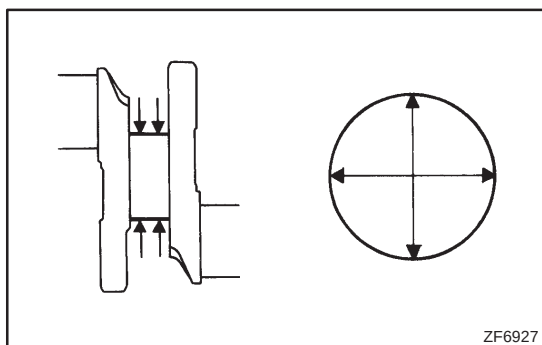
Y

A11783

24. 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.)



ZF6927

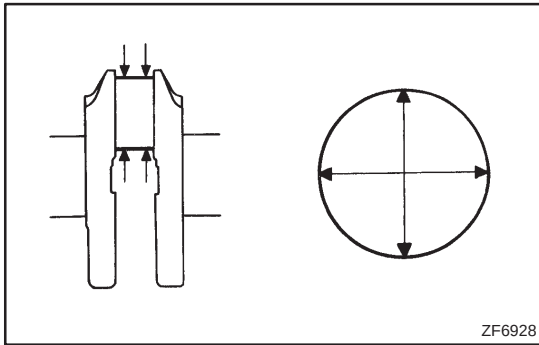
- (b) Using a micrometer, measure the diameter of each main journal at the points shown in the illustration.

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.)

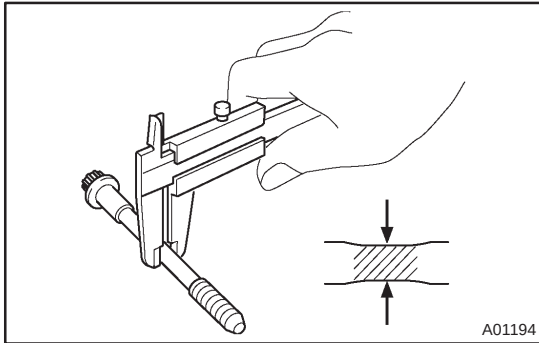


- (d) Using a micrometer, measure the diameter of each crank pin at the points shown in the illustration.

Diameter: 43.992 – 44.000 mm (1.7320 – 1.7323 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.)**

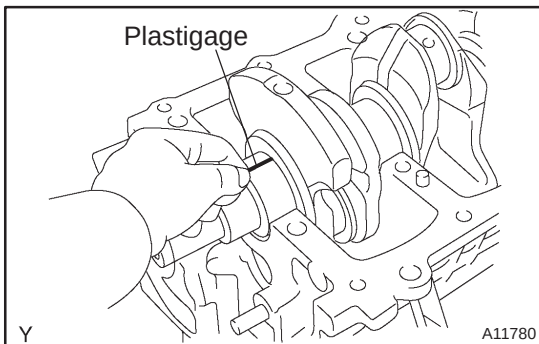


25. INSPECT CRANKSHAFT BEARING CAP SET BOLT

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

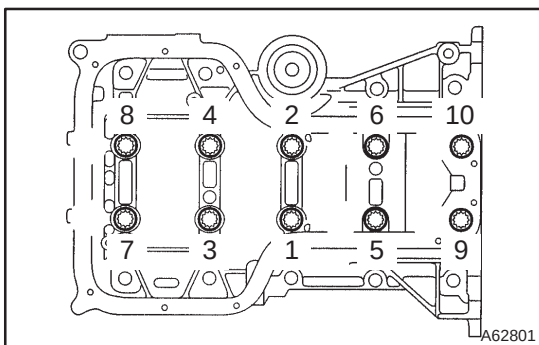
Standard diameter: 7.3 – 7.5 mm (0.287 – 0.295 in.)

Minimum diameter: 7.2 mm (0.283 in.)



26. INSPECT CRANKSHAFT OIL CLEARANCE

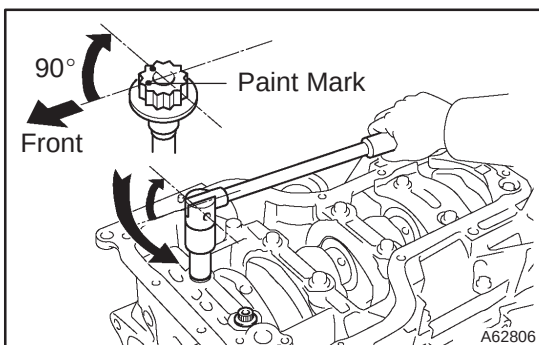
- (a) Clean each main journal and bearing.
(b) Place the crankshaft on the cylinder block.
(c) Lay a strip of Plastigage across each journal.



- (d) Using SST, tighten the bolts in several passes, in the sequence shown, by the specified torque.

SST 09011-38121

Torque: 44 N·m (449 kgf·cm, 33 ft·lbf)

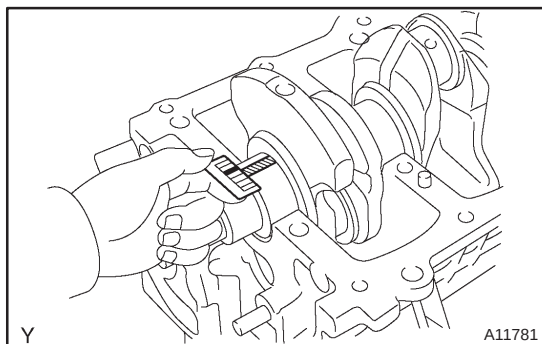


- (e) Mark the front of the bearing cap sub-assembly bolts with paint.
(f) Retighten the bearing cap sub-assy bolts by 90° as shown in the illustration.
(g) Check that the painted mark is now at a 90° angle to the front.

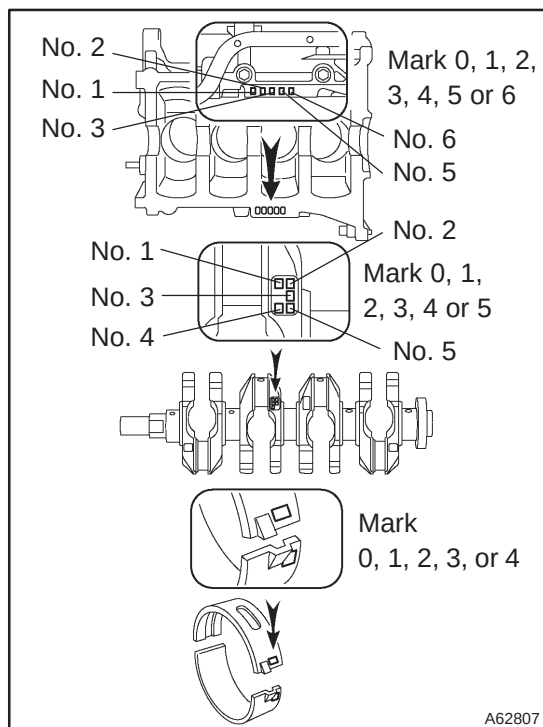
NOTICE:

Do not turn the crankshaft.

- (h) Remove the bearing cap sub-assy.



- (i) Measure the Plastigage at its widest point.
Standard oil clearance:
0.013 – 0.030 mm (0.0005 – 0.0012 in.)
Minimum oil clearance: 0.05 mm (0.0020 in.)

NOTICE:**Completely remove the plastigage**

- (j) If replacing a bearing, select a new one having the same number. If the number of the bearing cannot be determined, calculate the correct use bearing number by adding together the numbers imprinted on the cylinder block and crankshaft, then select a new bearing having the calculated number. There are 4 sizes of standard bearings, marked "1", "2", "3" and "4" accordingly.

Cylinder block (A) +				
Crankshaft (B)	0-2	3-5	6-8	9-11
Use bearing	"1"	"2"	"3"	"4"

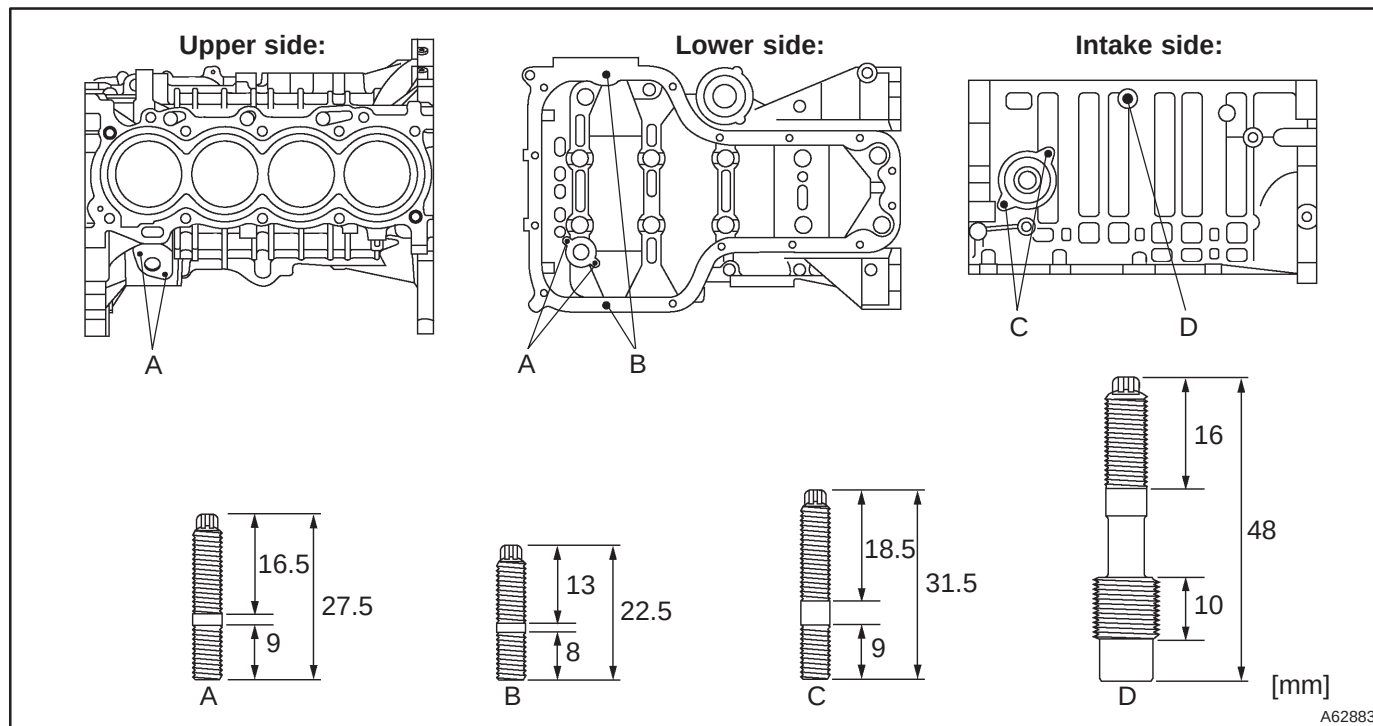
HINT:**EXAMPLE:**

Cylinder block "4" (A) + Crankshaft "3" (B) = Total number 7 (Use bearing "3")

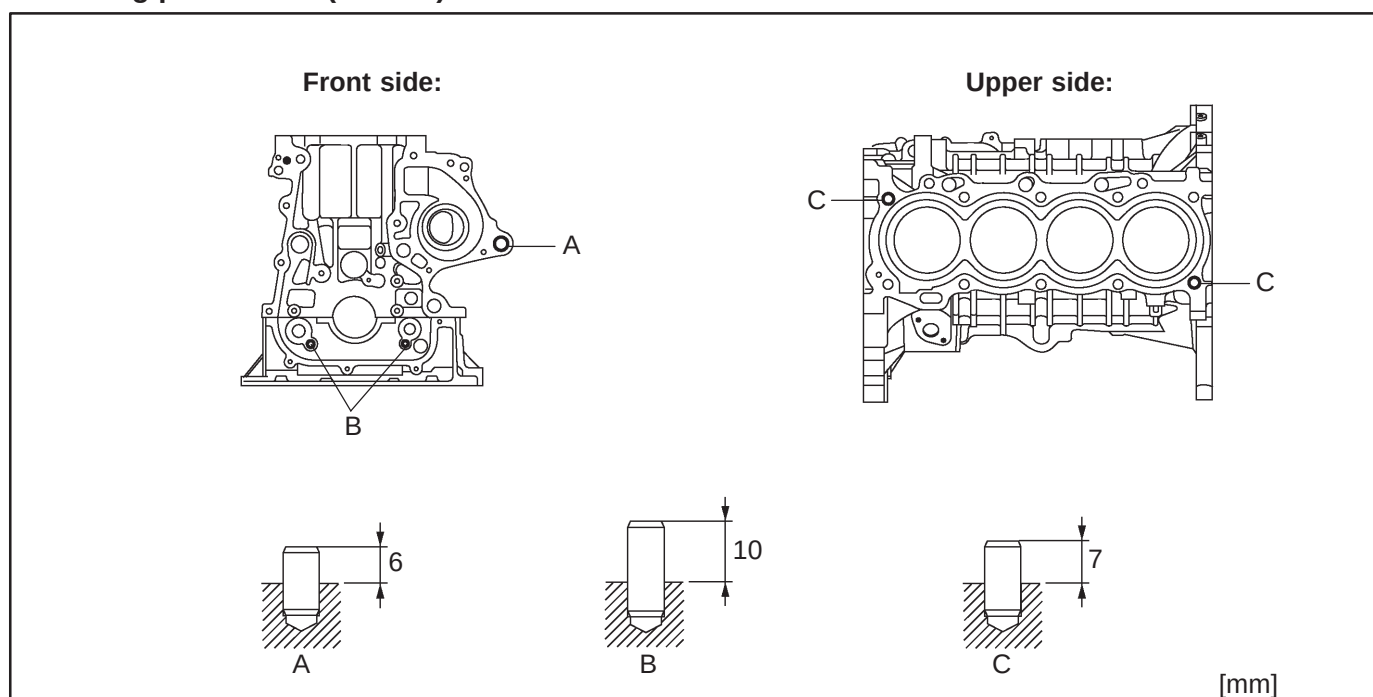
Item	Mark	mm (in.)
Cylinder block main journal bore diameter (A)	"0"	52.000 – 52.003 (2.0472 – 2.0473)
	"1"	52.003 – 52.005 (2.0473 – 2.0474)
	"2"	52.005 – 52.007 (2.0474 – 2.0475)
	"3"	52.007 – 52.010 (2.0475 – 2.0476)
	"4"	52.010 – 52.012 (2.0476 – 2.0477)
	"5"	52.012 – 52.014 (2.0477 – 2.0478)
	"6"	52.014 – 52.016 (2.0478 – 2.0479)
Crankshaft main journal diameter (B)	"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"	1.994 – 1.997 (0.0785 – 0.0786)
	"2"	1.997 – 2.000 (0.0786 – 0.0787)
	"3"	2.000 – 2.003 (0.0787 – 0.0789)
	"4"	2.003 – 2.006 (0.0789 – 0.0790)

27. INSTALL STUD BOLT

- (a) Install the 9 stud bolt to the cylinder block.

Torque:**Stud bolt A, B and C 5.0 N·m (51 kgf·cm, 44 in.·lbf)****Stud bolt D 11 N·m (112 kgf·cm, 8 ft·lbf)****28. INSTALL RING PIN**

- (a) Using a plastic hammer, install the 5 ring pins to the cylinder block.

Standard protrusion:**Ring pin A 6 mm (0.24 in.)****Ring pin B 10 mm (0.39 in.)****Ring pin C 7 mm (0.28 in.)**

29. INSTALL STRAIGHT PIN

- (a) Using a plastic hammer, install the 9 straight pins to the cylinder block.

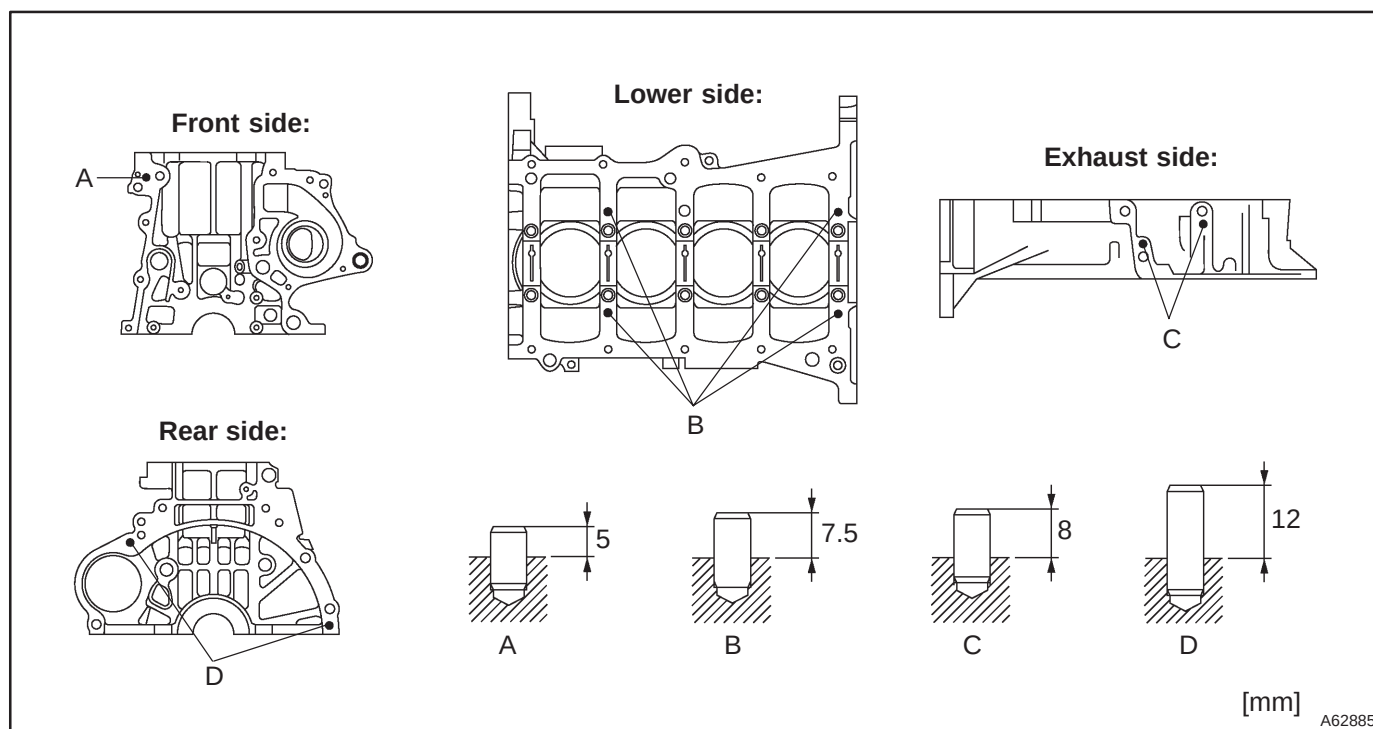
Standard protrusion:

Straight pin A 5 mm (0.20 in.)

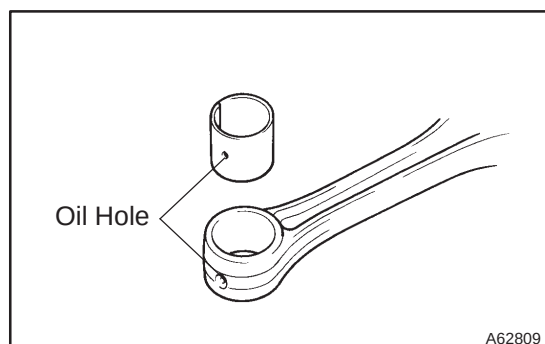
Straight pin B 7.5 mm (0.30 in.)

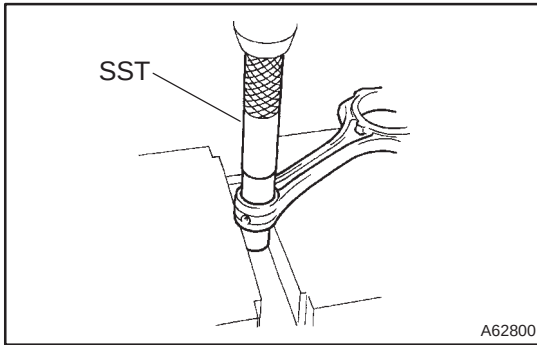
Straight pin C 8 mm (0.31 in.)

Straight pin D 12 mm (0.47 in.)

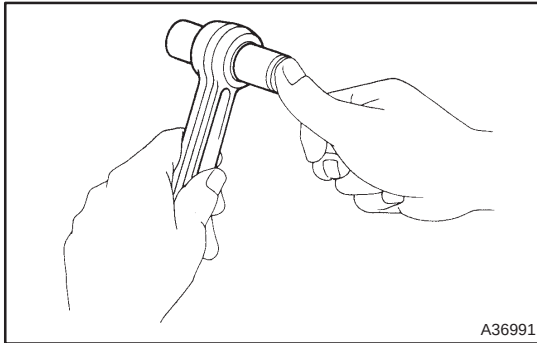
**30. INSTALL CONNECTING ROD SMALL END BUSH**

- (a) Align the oil hole of a new bushing with the one of the connecting rod.





- (b) Using SST and a press, press into the small end bushing. SST 09222-30010
- (c) After installing the bushing, check that the oil hole of the connecting rod is aligned with the hole of the small end bushing and that the oil clearance measured on both sides of connecting rod are equal.

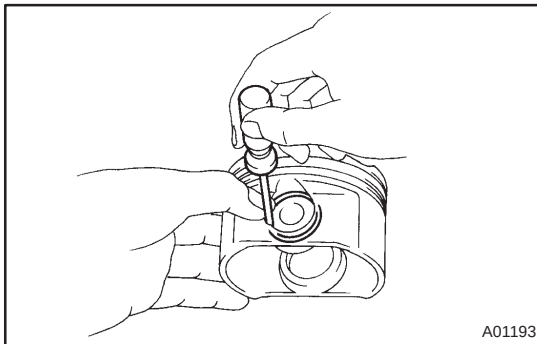


- (d) Horn the connecting rod end bushing to obtain the standard specified oil clearance.

Oil clearance: 0.005 – 0.011 mm (0.0002 – 0.0004 in.)

HINT:

When pushing the piston pin with engine oil applied into the connecting rod with thumb, the piston pin is supposed to have a little resistance to insert at normal room temperature.

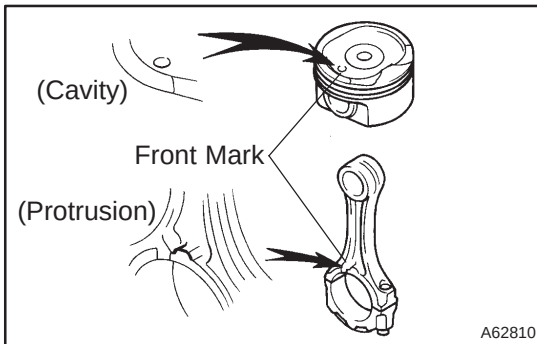


31. INSTALL PISTON PIN HOLE SNAP RING

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

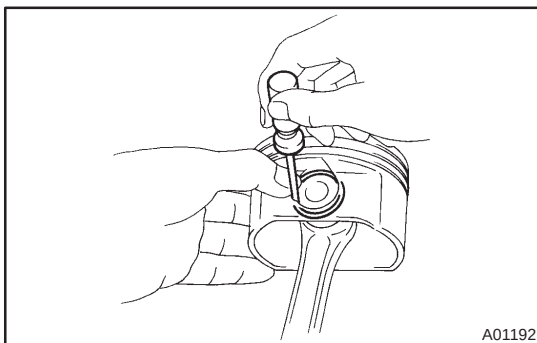
HINT:

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



32. INSTALL W/PIN PISTON SUB-ASSY

- (a) Gradually heat the piston to 80 – 90°C (176–194°F).
- (b) Align the front marks on the piston with connecting rod, and push in the piston with your thumb.

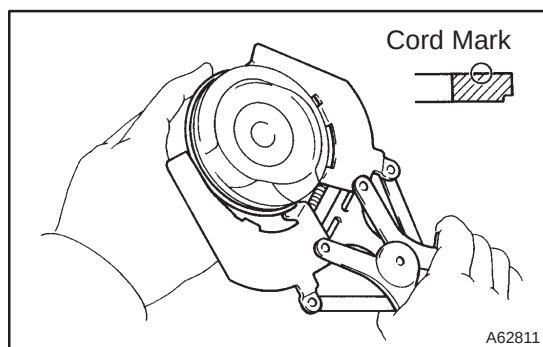


33. INSTALL PISTON PIN HOLE SNAP RING

- (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 aligned with the pin hole cutout portion of the piston.



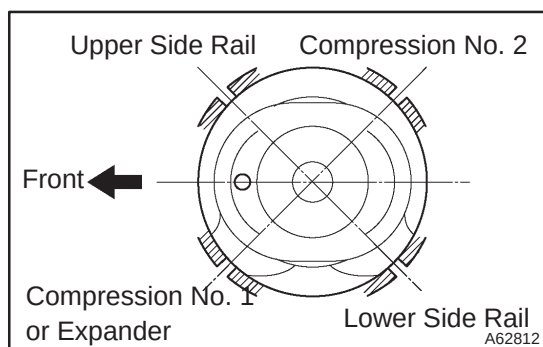
34. INSTALL PISTON RING SET

HINT:

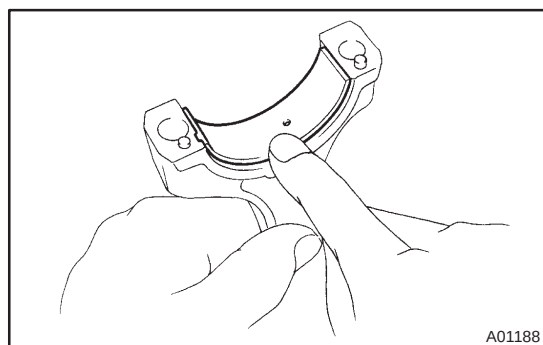
In case of reusing the piston rings, install them to the matched pistons with the surfaces faced correctly.

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

Code mark (No.2 only): T or 2R



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

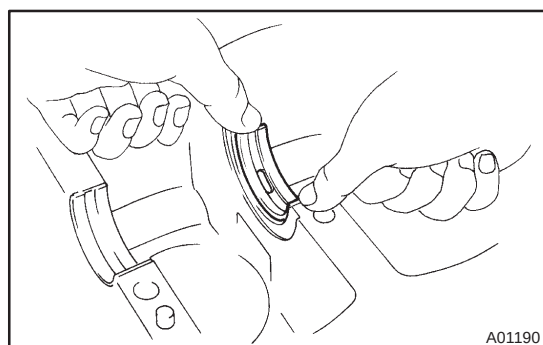


35. INSTALL CONNECTING ROD BEARING

- 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.

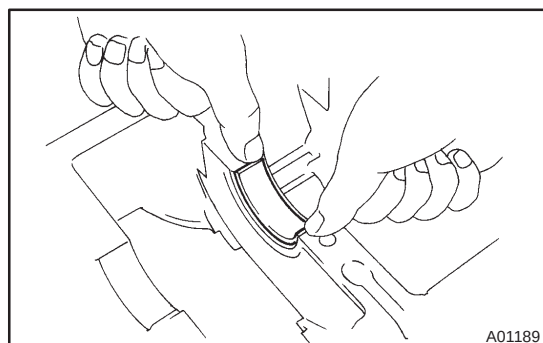


36. INSTALL CRANKSHAFT

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

NOTICE:

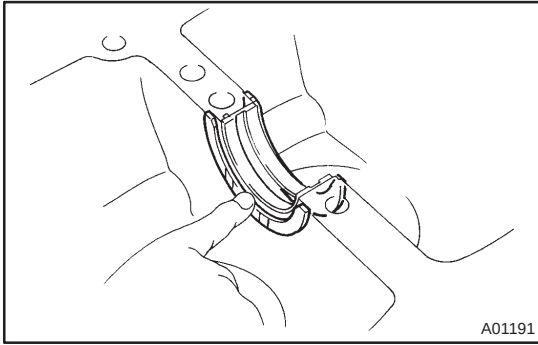
Clean the backside of the bearing and the bearing surface of the bearing cap and let not stick the oils and fats.



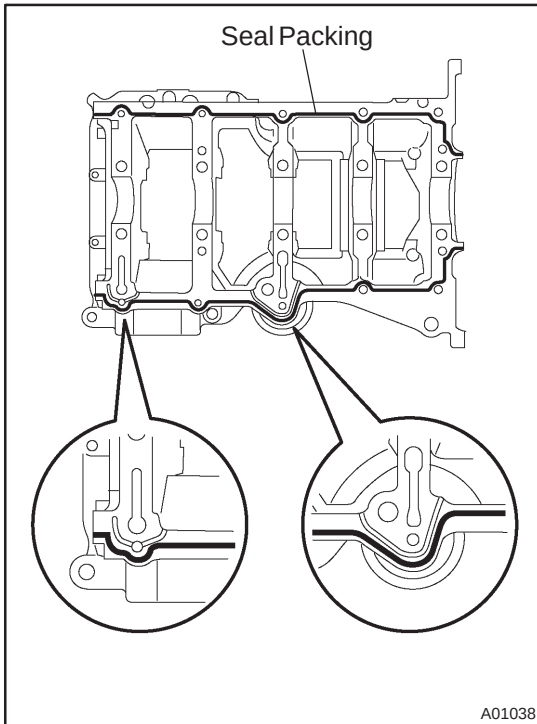
- Install the lower bearing on the bearing cap sub-assy.

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 under 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-assy.

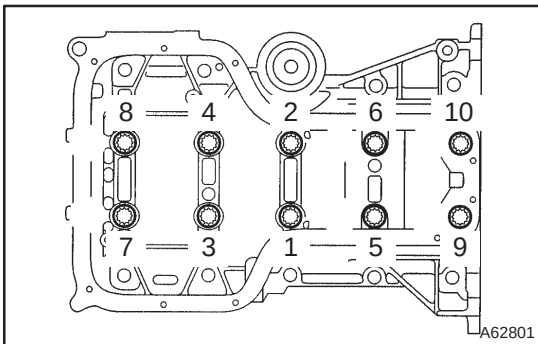


- (f) Apply seal packing in the shape of bead (Diameter 2.5 – 3.5 mm (0.08 – 0.12 in.) consequently as shown in the illustration.

Seal packing: Part No. 08826-00080 or equivalent

NOTICE:

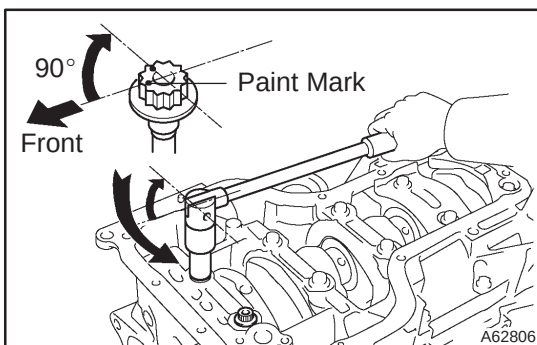
- Remove any oil from the contact surface.
- Install the bearing cap sub-assembly within 3 minutes after applying seal packing.
- Do not put into engine oil within 2 hours after the installation.



- (g) Using SST, tighten the bolts in several passes, in the sequence shown, by the specified torque.

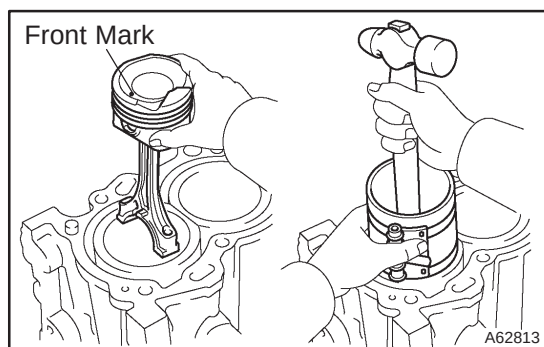
SST 09011-38121

Torque: 44 N·m (449 kgf·cm, 33 ft·lbf)



- (h) Mark the front of the bearing cap sub-assy bolts with paint.
- (i) Retighten the bearing cap sub-assy bolts by 90° as shown in the illustration.
- (j) Check that the painted mark is now at a 90° angle to the front.
- (k) Tighten 10 other bolts for the bearing cap.

Torque: 19 N·m (194 kgf·cm, 14 ft·lbf)

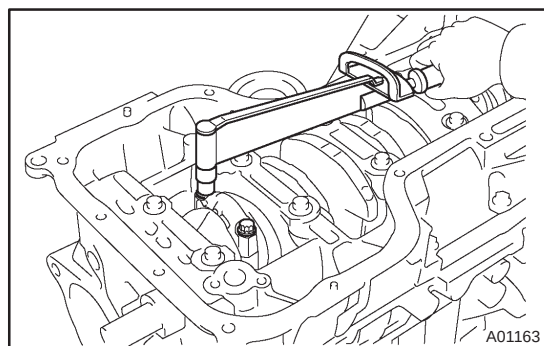
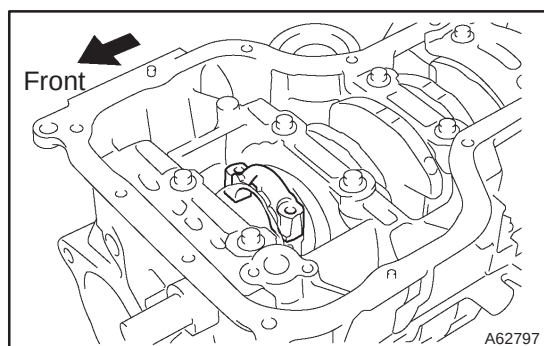


37. INSTALL CONNECTING ROD SUB-ASSY

- Apply engine oil to the cylinder walls, the pistons, and the surfaces of connecting rod bearings.
- Check the position of the piston ring ends.
- 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.
- Align the pin dowels of the connecting rod cap with the pins of the connecting rod, and install the connecting rod.

NOTICE:

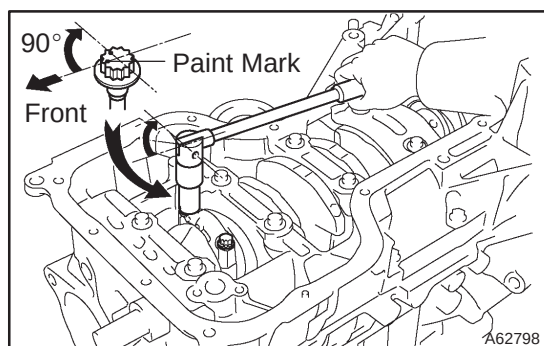
- **Clean the backside and the surface of the connecting rod cap bearing and let not stick the oils and fats.**
 - **Match the numbered connecting rod cap with the same numbered connecting rod.**
- Check that the protrusion of the connecting rod cap is facing in the correct direction.



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

SST 09205-16010

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



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